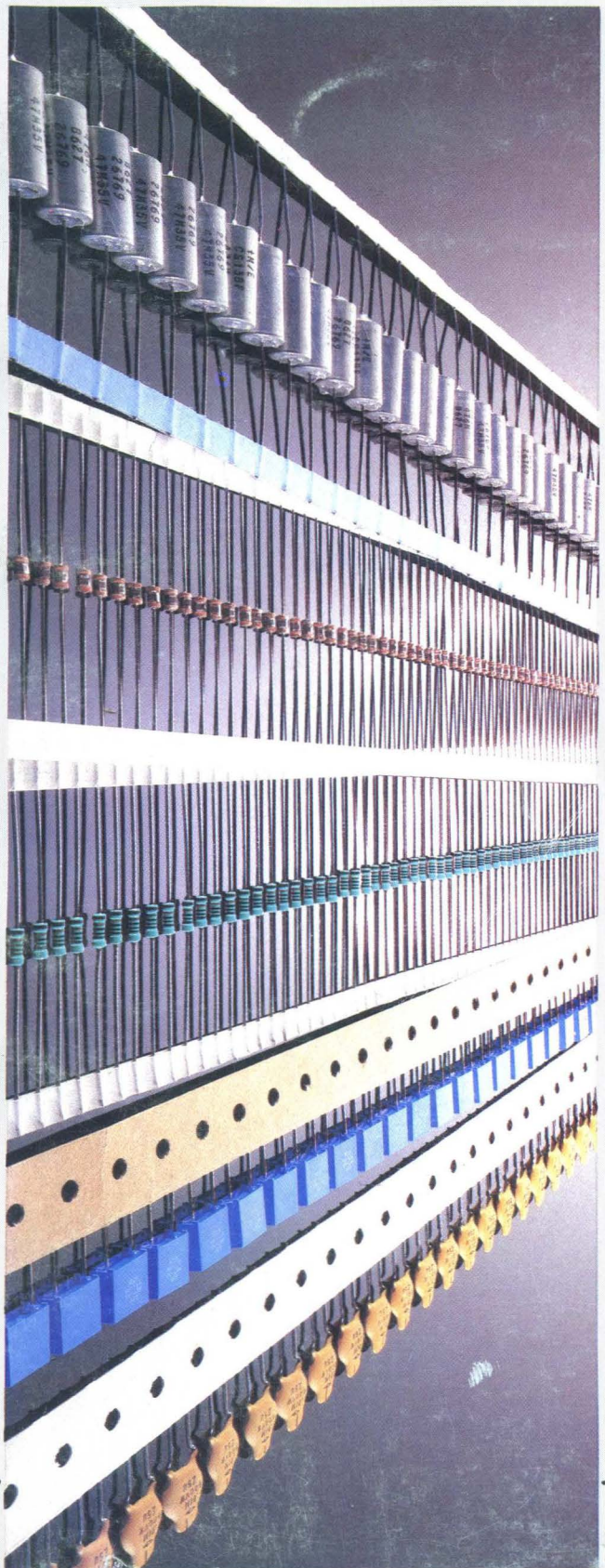
MEPCO/CENTRALAB

A NORTH AMERICAN PHILIPS COMPANY

PHILIPS



1988-89
Resistor/Capacitor Data Book

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Resistor/Capacitor Data Book

SALES OFFICES AND REPRESENTATIVES

AL	Huntsville, Over & Over, Inc.	(205) 837-7105
AZ	Tempe, Mepco/Centralab	(602) 820-2225
CA	Anaheim, Mepco/Centralab	(714) 441-0385
CA	*Harbor City, Refrigeration Comp., Inc.	(213) 325-3420
CA	Mission Hills, Mepco/Centralab	(818) 891-6299
CA	Mountain View, Brooks Technical Group	(415) 960-3880
CA	San Diego, Mepco/Centralab	(619) 453-0332
CA	Sunnyvale, Mepco/Centralab	(408) 746-2066
CO	Englewood, Mepco/Centralab	(303) 779-9696
FL	Altamonte Springs, Mepco/Centralab	(407) 339-5073
FL	Ft. Lauderdale, Mepco/Centralab	(305) 485-0115
GA	Norcross, Over & Over, Inc.	(404) 449-6205
GA	Norcross, Mepco/Centralab	(404) 662-1580
IA	Cedar Rapids, Lorenz Sales, Inc.	(319) 377-4666
IL	Bannockburn, GMR Sales, Inc.	(312) 295-8440
IL	Des Plaines, Mepco/Centralab	(312) 827-4487
IN	Fort Wayne, Corrao Marsh, Inc.	(219) 482-2725
IN	Green Field, Corrao Marsh, Inc.	(317) 462-4446
IN	Indianapolis, Leslie M. Devoe Company	(317) 842-3245
KS	Merriam, Lorenz Sales, Inc.	(913) 384-6556
MA	Woburn, Mepco/Centralab	(617) 932-4748
MD	Columbia, Delta III Associates	(301) 730-4700
MI	Farmington Hills, Mepco/Centralab	(313) 553-6010
MN	Minneapolis, Electric Component Sales, Inc.	(612) 933-2594
MO	University City, Lorenz Sales, Inc.	(314) 997-4558
NC	Charlotte, Over & Over, Inc.	(704) 542-9111
NC	Raleigh, Over & Over, Inc.	(919) 782-9111
NE	Lincoln, Lorenz Sales, Inc.	(402) 475-4660
NJ	Englewood Cliff, Ed Glass Associates	(201) 592-0200
NJ	Mendham, Mepco/Centralab	(201) 543-2556
NY	Binghamton, Empire Technical Assoc., Inc.	(607) 772-0651
NY	East Rochester, Empire Technical Assoc., Inc.	(716) 381-8500
NY	Skaneateles, Empire Technical Assoc., Inc.	(315) 685-5703
OH	Dayton, Mepco/Centralab	(513) 436-0066
OH	Wickliffe, Mepco/Centralab	(216) 731-7721
OR	Beaverton, Eclipse Marketing Group	(503) 642-1661
PA	Narberth, Bresson Associates, Inc.	(215) 664-6460
PR	Hato Rey, M. Anderson Company, Inc.	(809) 751-2026
TX	Austin, Mepco/Centralab	(512) 331-8828
TX	Richardson, Mepco/Centralab	(214) 231-8274
WA	Redmond, Eclipse Marketing Group	(206) 885-6991
WA	Spokane, Eclipse Marketing Group	(509) 922-3972
WI	Milwaukee, Mepco/Centralab	(414) 228-4244

*Motor Start Products Only

ALPHA NUMERIC INDEX

Aluminum Electrolytic Capacitors

QUICK REFERENCE INDEX

STANDARD DC PRODUCT

Series	Description	Capacitance Range (μF)	Working Voltage Range (Volts)	Operating Temperature Range (°C)	Nominal Case Size D x L	Page
AXIAL LEAD						
3070	Miniature Long Life	1.0-15,000	6.3-385	−40 to +85	0.177 in. x 0.394 in. to 0.827 in. x 1.575 in.	5
COMPUTER GRADE						
3120	High Performance Ultra Long Life	310 to 870,000	6.0-250	−40 to +105	1⅜ in. x 2⅛ in. to 3 in. x 8⅝ in.	11
3186	Standard Computer Grade	160-1,000,000	6.5-450	−40 to +85	1⅜ in. x 2⅛ in to 3 in. x 8⅝ in.	24
3188	Long Life	160-920,000	6.0-400	−40 to +85	1⅜ in x 2⅛ in to 3 in. x 3⅝ in.	36
3191	Symmetrical Tolerance SMPS Output	2800-200,000	5.0-55	−40 to +85	1⅜ in. x 2⅛ in. to 2 in. x 5⅝ in.	48

MINIATURE, RADIAL, DC PRODUCT

Series	Description	Capacitance Range (μF)	Working Voltage Range (Volts)	Operating Temperature Range (°C)	Nominal Case Size D x L	Page
3476	General Purpose	0.47-10,000	6.3-450	−40 to +85 for 100V or less −25 to +85 for 160V or greater	5 x 11 mm to 18 x 40 mm	56
3477	Very Low Leakage	0.1-4,700	6.3-100	−40 to +85	5 x 11 mm to 18 x 40 mm	62
3478	Minimized Leakage Epoxy End Seal	0.1-100	6.3-50	−40 to +85	5 x 14 mm to 10 x 15 mm	66
3479	Small Size High Capacitance	470-22,000	10-100	−40 to +85	22 x 30 mm to 30 x 50 mm	69
3480	Low Leakage Extended Temperature	0.47-10,000	6.3-250	−55 to +105 6.3 – 100V −40 to +105 160–250V	5 x 11 mm to 18 x 40 mm	72
3481	Low Impedance and ESR	2.2-1,000	10-100	−55 to +105	8 x 11.5 mm to 12.5 x 42.5 mm	77
3482	Low ESR, High Capacitance	15-16,500	7.5-250	−55 to +105 7.5–100V −25 to +105 150–250V	19.1 x 31.8 mm to 25.4 x 92.1 mm	81

NEW, HIGH CV, DC PRODUCT

Series	Description	Capacitance Range (μF)	Working Voltage Range (Volts)	Operating Temperature Range (°C)	Nominal Case Size D x L	Page
RADIAL-TUBULAR						
Super-Snap™ 3487	Printed Circuit Board Snap-In	22-100,000	6.3-250	−40 to +85	22 x 25 mm to 35 x 80 mm	89
Super Snap™ 3489	High CV Product For Off Line SMPS	270-2700	200-250	−40 to +85	25 x 35 mm 35 x 80 mm	98

Aluminum Electrolytic Capacitors

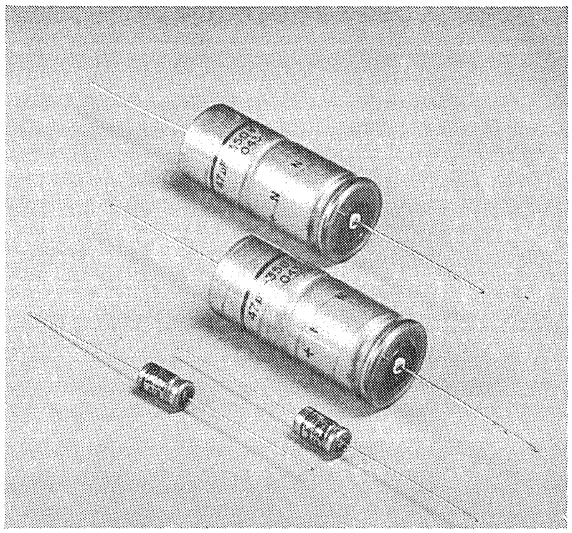
QUICK REFERENCE INDEX

STANDARD AC PRODUCT

Series	Description	Capacitance Range (μF)	Working Voltage Range (Volts)	Operating Temperature Range (°C)	Nominal Case Size D x L	Page
3500	AC Motor Start	21-1,200	110-330	−20 to +65	1.438 x 2.750 in. to 2.562 x 4.375 in.	103

TECHNICAL INFORMATION

Miniature Axial-Leaded Aluminum Electrolytic Capacitors



DESCRIPTION

Mepco/Centralab's Series 3070 Aluminum Electrolytic Capacitors are mainly used for filtering, coupling and decoupling.

They are also suitable for higher-voltage, moderate-capacitance applications in power supplies, instrumentation and controls. The taped and reeled versions are excellent for automatic insertion and for cutting and forming equipment.

These capacitors feature extremely low leakage current, low impedance, exceptional reliability, and wide operating temperature, at a very low cost.

In construction, the capacitor has etched-aluminum-foil electrodes rolled up with a porous paper spacer which separates the anode and the cathode. The spacer is impregnated with an electrolyte which is the electrical connection between the dielectric and the cathode foil. The electrolyte used offers excellent electrical characteristics over a wide temperature range. The capacitor is housed in an aluminum case covered with a transparent blue sleeve.

FEATURES

- High CV Design.
- Wide ranges of capacitances and voltages: 1.0 to 15,000μF, 6.3 to 385WVDC.
- Very low ESR
- High ripple current capability.
- Capacitance tolerance: −10 to +50%.
- Case Sizes: 0.177 in. by 0.394 in. to 0.827 in. by 1.575 in.

SERIES 3070

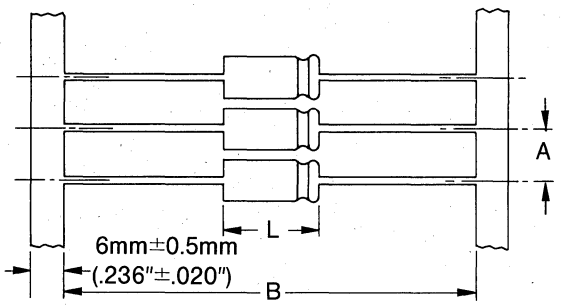
Miniature Axial-Leaded Aluminum Electrolytic Capacitors

DIMENSIONS

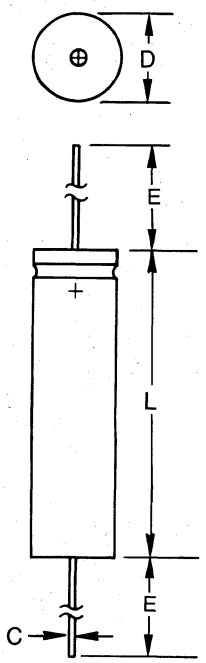
CASE CODE	UNINSULATED CASE DIMENSION*					
	Dimensions in Inches			Dimensions in Millimeters		
	D nom	L nom	C	D nom	L nom	C
BA	.177	.394	.024	4.5	10.0	0.6
DA	.236	.394	.024	6.0	10.0	0.6
EE	.256	.709	.032	6.5	18.0	0.8
FE	.315	.709	.032	8.0	18.0	0.8
GE	.394	.709	.032	10.0	18.0	0.8
GG	.394	.984	.032	10.0	25.0	0.8
GH	.394	1.181	.032	10.0	30.0	0.8
HH	.492	1.181	.032	12.5	30.0	0.8
JH	.591	1.181	.032	15.0	30.0	0.8
LH	.709	1.181	.032	18.0	30.0	0.8
LK	.709	1.575	.032	18.0	40.0	0.8
MK	.827	1.575	.032	21.0	40.0	0.8

*Insulated unit = D nom + .5mm. L nom + 5mm max.

TAPE & REEL SPECIFICATIONS



CASE OUTLINE DRAWING



Series 3070 capacitors are marked with:

- nominal capacitance
- tolerance on nominal capacitance (where case size permits)
- rated voltage
- group number (ex. 030)
- origin code
- name of manufacturer (where case size permits)
- band to identify the negative terminal
- + sign to identify the positive terminal (where case size permits)

Case Size	Component Pitch "A" = .016" (0.4mm)	Inside Taping Spacing "B" = .069" (1.5mm)	Distance Between Reel Flanges	Quantity Per Reel (Pieces)	Capacitor Length "L" Max.	Wire Length "E" Min.
BA	.197" (5mm)	2.50" (63.50mm)	3.33" (84.5mm)	3,000	.413" (10.5mm)	.984" (25.0mm)
DA	.394" (10mm)	2.50" (63.50mm)	3.33" (84.5mm)	1,000	.413" (10.5mm)	.984" (25.0mm)
EE	.394" (10mm)	2.874" (73.00mm)	3.46" (88.0mm)	1,000	.728" (18.5mm)	1.04" (26.4mm)
FE	.394" (10mm)	2.874" (73.00mm)	3.46" (88.0mm)	500	.728" (18.5mm)	1.04" (26.4mm)
GE	.591" (15mm)	2.874" (73.00mm)	3.46" (88.0mm)	500	.728" (18.5mm)	1.04" (26.4mm)
GG	.591" (15mm)	2.874" (73.00mm)	3.48" (88.0mm)	500	1.003" (25.4mm)	.913" (23.2mm)

HOW TO SPECIFY

Mepco/Centralab Series 3070 Capacitors can be completely specified using the following designation:

307 — **Mepco/Centralab Product Series** (See Physical spec)

FE — **Case Size Code**

331 — **Capacitance** XX = Significant Digits, X = Multiplier, i.e. 331 = 330μF, 330 = 33μF, 339 = 3.3μF, 338 = .33μF

T — **Tolerance** T = −10+50%

010 — **Voltage** 010 = 10VDC, 100 = 100VDC, 6P3 = 6.3VDC

J — **Mechanical Characteristics** J = No Epoxy

P — **Insulation** P = Standard Polycarbonate

B — **Packaging** B = Standard Bulk, T = Tape and Reel*, A = Ammo Pack

*Available for sizes BA, DA, EE, FE, GE & GG ONLY.

SERIES 3070

Miniature Axial-Leaded Aluminum Electrolytic Capacitors

PERFORMANCE CHARACTERISTICS

- **CAPACITANCE at 120Hz, 25°C**
  Rated values: 1.0μF to 15,000μF
  Tolerances: −10+50% Tolerance is stated in each part number.
- **VOLTAGE**
  Rated values: (DC + peak AC) 6.3V to 385V
  Surge voltage: 1.15 X rated voltage ≤ 250 WVDC
  1.10 X rated voltage ≥ 350 WVDC
- **LEAKAGE CURRENT**
  See Std. Cap. Values
  Capacitor is conditioned for 30 minutes at rated voltage; 24 hours later, rated voltage is applied for 5 minutes.
- **ESR (TYPICAL)**
  See Std. Cap. Values
  Measured at 120 Hz, 25°C
- **RIPPLE CURRENT**
  See Std. Cap. Values
  Maximum allowable ripple current at 85°C, 120Hz.
- **TEMPERATURE RANGE**
  Operating: −40°C to +85°C
- **LOW TEMPERATURE PEFORMANCE (SERIES 3073, 3074, 3075 and 3076):** When measured at −40°C and a frequency of 120Hz, the impedance of these capacitors will not be greater than the value determined below. Reference measurements are made at 20°C and 120Hz.

RATED DC VOLTAGE	20°C IMPEDANCE MULTIPLIER
6.3	7
10	5
16	5
25–160	4
>160	7

LIFE TEST

Capacitor Series	A Ambient Temp. (°C ±3°C)	B Test Period (Hours ±8 hrs.) DC Voltage	D Capacitance Mni. (%)*	E ESR Max. (%)*	F Leakage Current Max. (%)**
3073					
6.4V	85	2000	75	130	100
10–100V	85	2000	85	130	100
3074					
6.3V	85	5000	70	130	100
10–100V	85	5000	85	130	100
3075					
160V	85	2000	70	150	100
250–385V	85	2000	85	150	100
3076					
≤160V	85	5000	85	130	100
250–385V	85	5000	90	130	100

*Referenced to measured initial value.
**Referenced to initial specified limit.

STANDARD CAPACITANCE VALUES

6.3 VDC WORKING/SURGE = 1.15 X RATED VDC

Capacitance uF	Mepco/Centralab Part Number	Case Code	Max. ESR (OHMS) 120 Hz 25°	Max. RMS Ripple Current AMPS @ 120 Hz 85°	Max. Leakage After 1 Min. uA
33	3073BA330T6P3JPA	BA	12.1	.042	11
68	3073BA680T6P3JPA	BA	5.86	.053	22
150	3073DA151T6P3JPA	DA	2.66	.087	10
470	3073FE471T6P3JPA	FE	0.85	.220	22
680	3073GE681T6P3JPA	GE	0.59	.350	30
1000	3073GG102T6P3JPA	GG	0.40	.480	42
1500	3074GH152T6P3JPB	GH	.300	.450	61
2200	3074HH222T6P3JPB	HH	.210	.610	88
3300	3074JH332T6P3JPB	JH	.150	.790	129
4700	3074LH472T6P3JPB	LH	.120	1.000	182
6800	3074LK682T6P3JPB	LK	.090	1.280	261
10000	3074MK103T6P3JPB	MK	.070	1.570	382
15000	3074MK153T6P3JPB	MK	.070	1.600	571

10 VDC WORKING/SURGE = 1.15 X RATED VDC

Capacitance uF	Mepco/Centralab Part Number	Case Code	Max. ESR (OHMS) 120 Hz 25°	Max. RMS Ripple Current AMPS @ 120 Hz 85°	Max. Leakage After 1 Min. uA
22	3073BA220T010JPA	BA	14.5	.042	11
47	3073BA470T010JPA	BA	6.78	.053	24
100	3073DA101T010JPA	DA	3.19	.087	10
220	3073EE221T010JPA	EE	1.45	.150	18
330	3073FE331T010JPA	FE	0.97	.220	24
470	3073GE471T010JPA	GE	0.68	.350	33
680	3073GG681T010JPA	GG	0.47	.480	45
1000	3074GH102T010JPB	GH	.320	.430	64
1500	3074HH152T010JPB	HH	.250	.570	94
2200	3074JH222T010JPB	JH	.180	.740	136
3300	3074LH332T010JPB	LH	.130	.950	202
4700	3074LK472T010JPB	LK	.100	1.220	286
6800	3074MK682T010JPB	MK	.080	1.500	412
10000	3074MK103T010JPB	MK	.080	1.520	604

16 VDC WORKING/SURGE = 1.15 X RATED VDC

Capacitance uF	Mepco/Centralab Part Number	Case Code	Max. ESR (OHMS) 120 Hz 25°	Max. RMS Ripple Current AMPS @ 120 Hz 85°	Max. Leakage After 1 Min. uA
15	3073BA150T016JPA	BA	17.0	.042	12
33	3073BA330T016JPA	BA	7.72	.053	27
68	3073DA680T016JPA	DA	3.75	.087	11
150	3073EE151T016JPA	EE	1.70	.150	19
220	3073FE221T016JPA	FE	1.16	.220	26
330	3073GE331T016JPA	GE	.78	.350	36
470	3073GG471T016JPA	GG	.55	.480	49
680	3074GH681T016JPB	GH	.380	.400	70
1000	3074HH102T016JPB	HH	.260	.550	100
1500	3074JH152T016JPB	JH	.210	.680	148
2200	3074LH222T016JPB	LH	.150	.880	216
3300	3074LK332T016JPB	LK	.110	1.160	321
4700	3074MK472T016JPB	MK	.090	1.430	455
6800	3074MK682T016JPB	MK	.080	1.460	657

25 VDC WORKING/SURGE = 1.15 X RATED VDC

Capacitance uF	Mepco/Centralab Part Number	Case Code	Max. ESR (OHMS) 120 Hz 25°	Max. RMS Ripple Current AMPS @ 120 Hz 85°	Max. Leakage After 1 Min. uA
10	3073BA100T025JPA	BA	22.3	.036	13
22	3073BA220T025JPA	BA	10.2	.043	28
47	3073DA470T025JPA	DA	4.80	.083	12
100	3073EE101T025JPA	EE	2.23	.120	19
150	3073FE151T025JPA	FE	1.49	.190	27
220	3073GE221T025JPA	GE	1.02	.280	37
330	3073GG331T025JPA	GG	.680	.350	54
470	3074GH471T025JPB	GH	.470	.360	75
680	3074HH681T025JPB	HH	.320	.500	106
1000	3074JH102T025JPB	JH	.220	.660	154
1500	3074LH152T025JPB	LH	.180	.810	229
2200	3074LK222T025JPB	LK	.130	1.060	334
3300	3074MK332T025JPB	MK	.100	1.340	499
4700	3074MK472T025JPB	MK	.100	1.370	709

SERIES 3070

Miniature Axial-Leaded Aluminum Electrolytic Capacitors

STANDARD CAPACITANCE VALUES

40 VDC WORKING/SURGE = 1.15 X RATED VDC

Capacitance uF	Mepco/Centralab Part Number	Case Code	Max. ESR (OHMS) 120 Hz 25°	Max. RMS Ripple Current AMPS @ 120 Hz 85°	Max. Leakage After 1 Min. uA
6.8	3073BA689T040JPA	BA	25.8	.036	14
10	3073BA100T040JPA	BA	17.6	.038	20
15	3073BA150T040JPA	BA	11.7	.043	30
22	3073DA220T040JPA	DA	8.00	.061	9
33	3073DA330T040JPA	DA	5.31	.083	12
47	3073EE470T040JPA	EE	3.73	.120	16
100	3073FE101T040JPA	FE	1.75	.190	28
150	3073GE151T040JPA	GE	1.17	.280	40
220	3073GG221T040JPA	GG	.800	.430	57
220	3074GH221T040JPB	GH	.860	.260	57
330	3074HH331T040JPB	HH	.580	.370	84
470	3074HH471T040JPB	HH	.400	.440	117
680	3074JH681T040JPB	JH	.280	.580	167
1000	3074LH102T040JPB	LH	.190	.780	244
1500	3074LK152T040JPB	LK	.160	.970	364
2200	3074MK222T040JPB	MK	.120	1.220	532
3300	3074MK332T040JPB	MK	.110	1.284	796

63 VDC WORKING/SURGE = 1.15 X RATED VDC

Capacitance uF	Mepco/Centralab Part Number	Case Code	Max. ESR (OHMS) 120 Hz 25°	Max. RMS Ripple Current AMPS @ 120 Hz 85°	Max. Leakage After 1 Min. uA
.33	3073BA338T063JPA	BA	435	.005	5
.47	3073BA478T063JPA	BA	305	.008	5
.68	3073BA688T063JPA	BA	211	.010	5
1.0	3073BA109T063JPA	BA	143	.012	5
1.5	3073BA159T063JPA	BA	95.6	.012	5
2.2	3073BA229T063JPA	BA	65.2	.021	7
3.3	3073BA339T063JPA	BA	46.5	.025	11
4.7	3073BA479T063JPA	BA	30.5	.031	15
6.8	3073BA689T063JPA	BA	21.1	.035	22
10	3073DA100T063JPA	DA	12.8	.051	7
15	3073DA150T063JPA	DA	8.50	.061	10
22	3073EE220T063JPA	EE	5.79	.090	13
47	3073FE470T063JPA	FE	2.71	.120	22
68	3073GE680T063JPA	GE	1.88	.200	30
100	3073GG101T063JPA	GG	1.28	.260	42
150	3074GH151T063JPB	GH	.900	.260	61
220	3074HH221T063JPB	HH	.614	.350	88
330	3074JH331T063JPB	JH	.410	.480	129
470	3074JH471T063JPB	JH	.290	.570	182
680	3074LH681T063JPB	LH	.200	.770	261
1000	3074MK102T063JPB	MK	.140	1.140	382
1500	3074MK152T063JPB	MK	.150	1.110	571

100 VDC WORKING/SURGE = 1.15 X RATED VDC

Capacitance uF	Mepco/Centralab Part Number	Case Code	Max. ESR (OHMS) 120 Hz 25°	Max. RMS Ripple Current AMPS @ 120 Hz 85°	Max. Leakage After 1 Min. uA
1.0	3073BA109T100JPA	BA	128	.014	5
2.2	3073BA229T100JPA	BA	57.9	.025	11
3.3	3073BA339T100JPA	BA	38.6	.035	17
4.7	3073DA479T100JPA	DA	23.7	.038	22
6.8	3073DA689T100JPA	DA	16.4	.061	34
10	3073EE100T100JPA	EE	11.2	.090	50
22	3073FE220T100JPA	FE	5.07	.120	80
33	3073GE330T100JPA	GE	3.38	.200	119
47	3073GG470T100JPA	GG	2.37	.260	33
68	3074GH680T100JPB	GH	3.53	.130	45
100	3074HH101T100JPB	HH	2.40	.190	64
150	3074JH151T100JPB	JH	1.60	.250	94
220	3074LH221T100JPB	LH	1.09	.330	136
330	3074LK331T100JPB	LK	.730	.460	202
470	3074MK471T100JPB	MK	.510	.600	286
680	3074MK681T100JPB	MK	.420	.650	412

160 VDC WORKING/SURGE = 1.15 X RATED VDC

Capacitance uF	Mepco/Centralab Part Number	Case Code	Max. ESR (OHMS) 120 Hz 25°	Max. RMS Ripple Current AMPS @ 120 Hz 85°	Max. Leakage After 1 Min. uA
4.7	3075EE479T160JPA	EE	53.2	.026	38
10	3075FE100T160JPA	FE	25.0	.041	68
22	3075GG220T160JPA	GG	11.4	.077	126
22	3076GH220T160JPB	GH	6.80	.106	42
33	3076HH330T160JPB	HH	4.50	.146	58
47	3076JH470T160JPB	JH	3.20	.194	78
68	3076JH680T160JPB	JH	2.20	.233	108
100	3076LH101T160JPB	LH	1.50	.313	154
150	3076LK151T160JPB	LK	1.00	.433	226
220	3076MK221T160JPB	MK	.070	.571	327

250 VDC WORKING/SURGE = 1.15 X RATED VDC

Capacitance uF	Mepco/Centralab Part Number	Case Code	Max. ESR (OHMS) 120 Hz 25°	Max. RMS Ripple Current AMPS @ 120 Hz 85°	Max. Leakage After 1 Min. uA
2.2	3075EE229T250JPA	EE	132	.018	28
4.7	3075FE479T250JPA	FE	61.7	.029	55
10	3075GG100T250JPA	GG	29.0	.055	95
10	3076GH100T250JPB	GH	15.0	.072	33
15	3076HH150T250JPB	HH	10.0	.100	44
22	3076HH220T250JPB	HH	6.80	.120	60
33	3076JH330T250JPB	JH	4.50	.162	84
47	3076LH470T250JPB	LH	3.20	.215	116
68	3076LK680T250JPB	LK	2.20	.291	163
100	3076MK101T250JPB	MK	1.50	.385	235

350 VDC WORKING/SURGE = 1.1 X RATED VDC

Capacitance uF	Mepco/Centralab Part Number	Case Code	Max. ESR (OHMS) 120 Hz 25°	Max. RMS Ripple Current AMPS @ 120 Hz 85°	Max. Leakage After 1 Min. uA
4.7	3075GE479T350JPA	GE	68.1	.032	69
6.8	3076GH689T350JPB	GH	22.0	.060	32
10	3076HH100T350JPB	HH	15.0	.081	42
15	3076HH150T350JPB	HH	10.0	.100	57
22	3076JH220T350JPB	JH	6.80	.133	79
33	3076LH330T350JPB	LH	4.50	.162	114
47	3076LK470T350JPB	LK	3.20	.242	158
68	3076MK680T350JPB	MK	2.20	.317	224

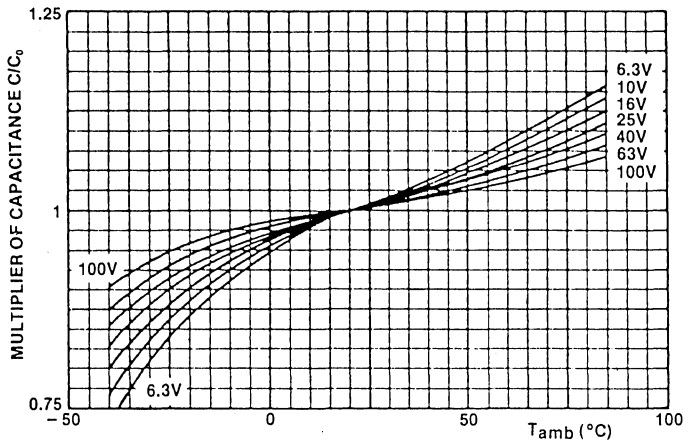
385 VDC WORKING/SURGE = 1.1 X RATED VDC

Capacitance uF	Mepco/Centralab Part Number	Case Code	Max. ESR (OHMS) 120 Hz 25°	Max. RMS Ripple Current AMPS @ 120 Hz 85°	Max. Leakage After 1 Min. uA
1.0	3075EE109T385JPA	EE	335	.012	19
2.2	3075FE229T385JPA	FE	152	.023	42
4.7	3075GG479T385JPA	GG	71.3	.043	71
6.8	3076GH689T385JPB	GH	22.0	.060	34
10	3076HH100T385JPB	HH	15.0	.081	45
15	3076HH150T385JPB	HH	10.0	.110	62
22	3076LH220T385JPB	LH	6.80	.147	86
33	3076LK330T385JPB	LK	4.50	.203	124
47	3076LK470T385JPB	LK	3.20	.242	173
68	3076MK680T385JPB	MK	2.20	.317	246

TYPICAL PERFORMANCE

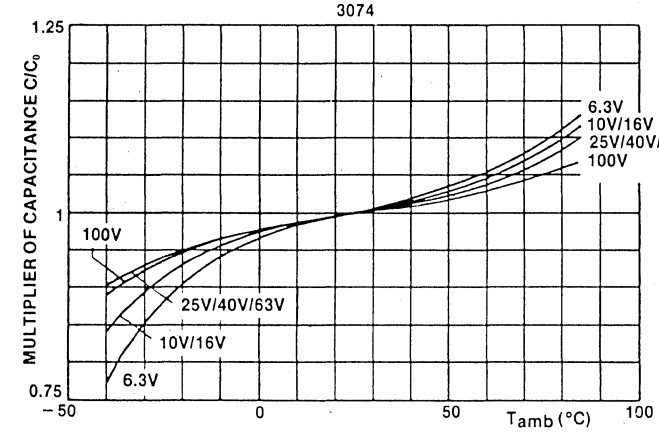
CAPACITANCE vs. TEMPERATURE

3073



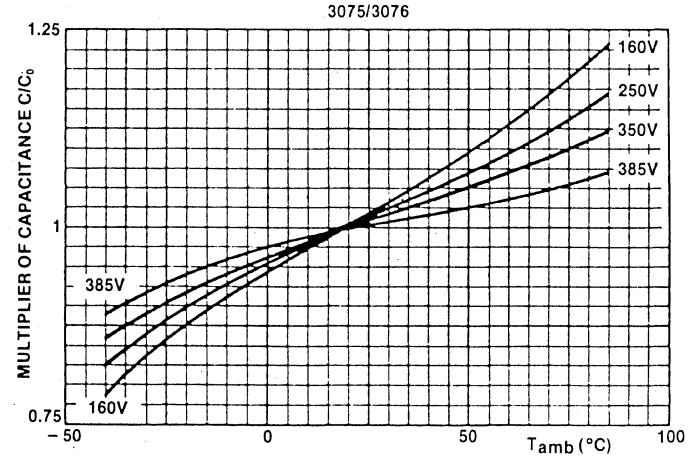
Typical capacitance as a function of ambient temperature
C_0 = capacitance at 20°C, 120Hz

3074



Typical capacitance as a function of ambient temperature
C_0 = capacitance at 25°C, 120Hz

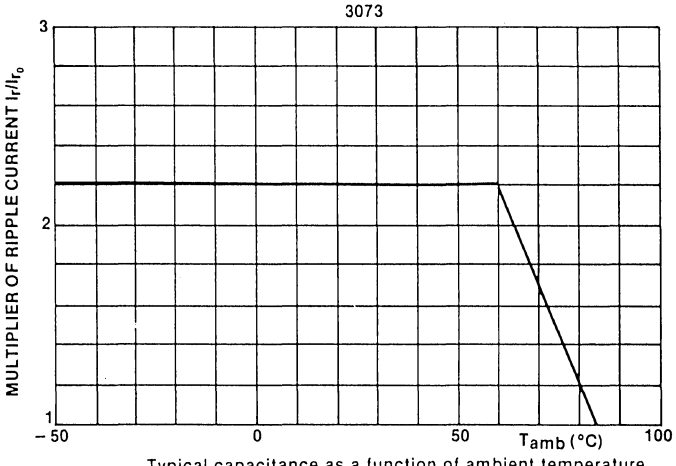
3075/3076



Typical capacitance as a function of ambient temperature
C_0 = capacitance at 20°C, 120Hz

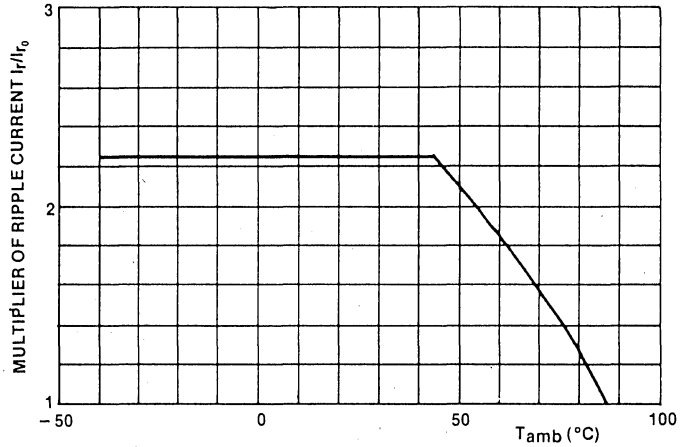
RIPPLE CURRENT vs. TEMPERATURE

3073



Typical capacitance as a function of ambient temperature
I_{r_0} = ripple current at 85°C, 120Hz

3074/3075/3076



Typical ripple current as a function of ambient temperature
I_{r_0} = ripple current at 85°C, 120Hz

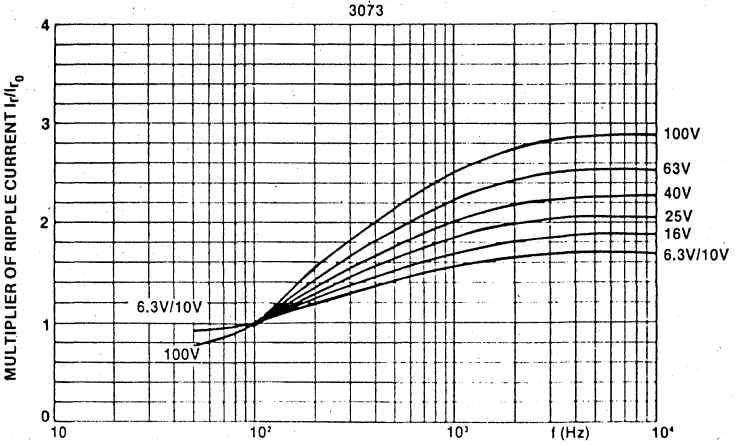
SERIES 3070

Miniature Axial-Leaded Aluminum Electrolytic Capacitors

TYPICAL PERFORMANCE

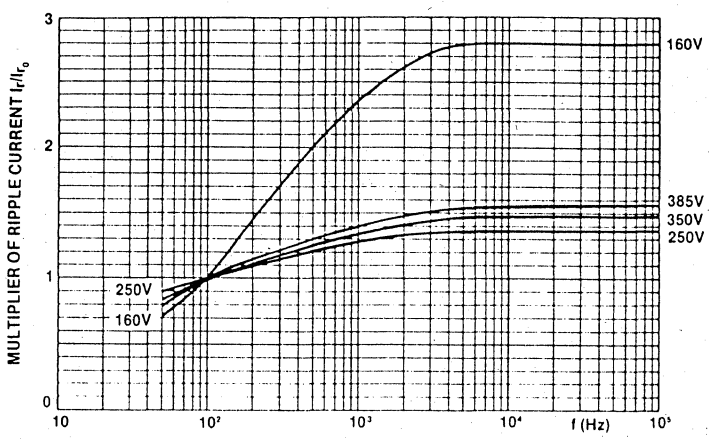
RIPPLE CURRENT vs. FREQUENCY

3073



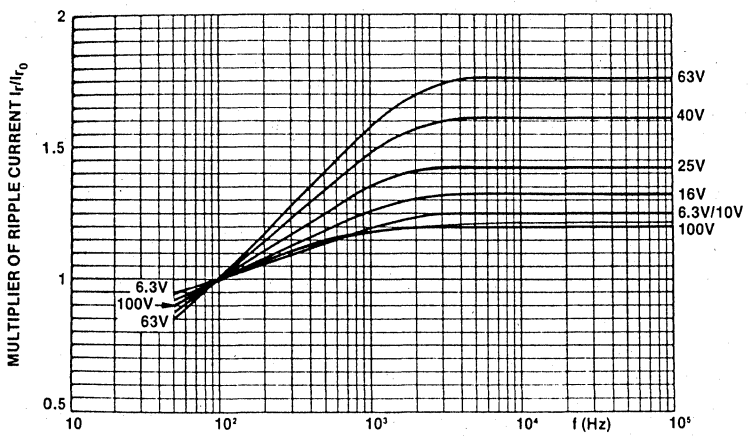
Typical ripple current as a function of frequency
I_{r_0} = ripple current at 85°C, 120 Hz

3075



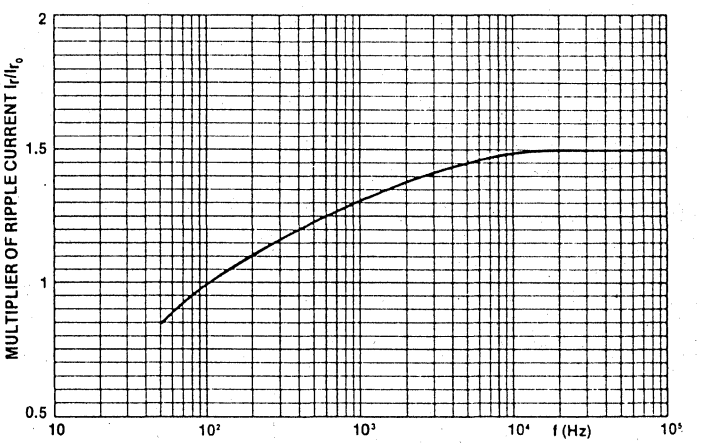
Typical ripple current as a function of frequency
I_{r_0} = ripple current at 85°C, 120Hz

3074 (CASES GH—LH)



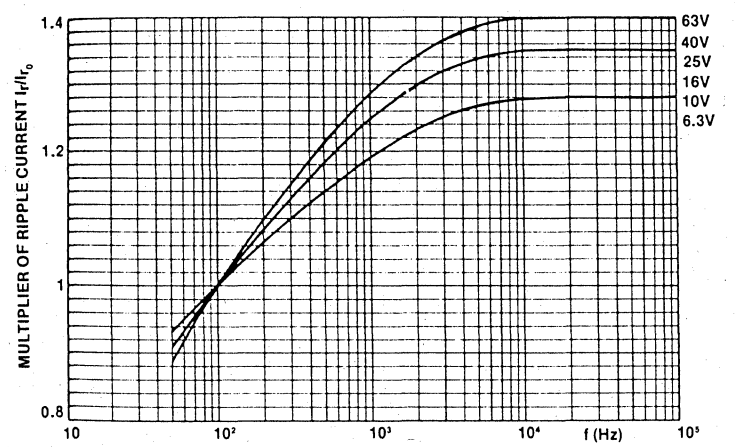
Typical ripple current as a function of frequency
I_{r_0} = ripple current at 85°C, 120 Hz

3076



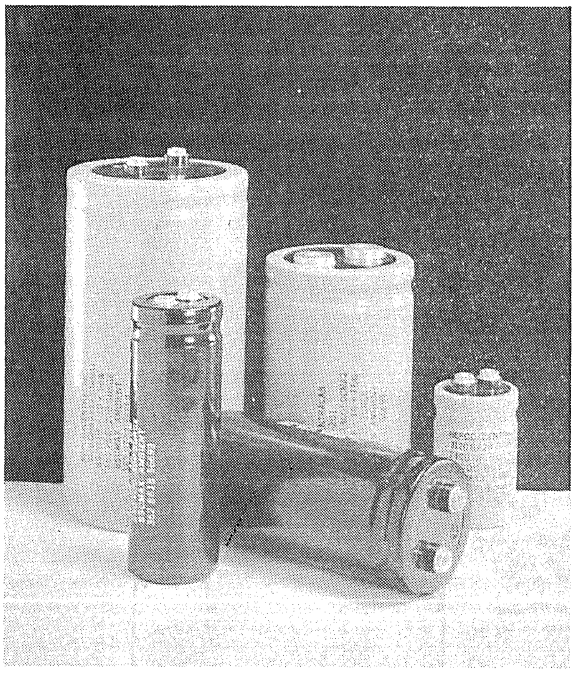
Typical ripple current as a function of frequency
I_{r_0} = ripple current at 85°C, 120 Hz.

3074 (CASES LK—MK)



Typical ripple current as a function of frequency
I_{r_0} = ripple current at 85°C, 120H.

High-Performance Computer-Grade Aluminum Electrolytic Capacitors



Extended Operating Temperature Range (+105°C) Long Operating Life (3000 hrs.) with Rated DC Voltage and Ripple Current. (+85°C)

DESCRIPTION:

Series 3120 computer-grade offer performance suited to applications where high CV, wide operating temperature range, and low ESR are critical. They employ a newly developed non-aqueous environmentally acceptable glycol based electrolyte, permitting good operational characteristics at 105°C. Carefully controlled and highly optimized etching and anodizing processes result in exceptionally high CV per unit volume. Special computer controlled symmetrical multiple tabbing techniques minimize ESR and ESL. Custom designed and patented case construction anchors the element and eliminates the need for potting compound. This results in a uniform space for gas expansion with more reliable operation of the safety vent. The combination of all these features result in longer operating and storage life. In addition to the above, these advanced materials and manufacturing processes provide Series 3120 capacitors with high ripple-current ratings and low impedance and DC leakage.

FEATURES:

- Operating temperature range: −40°C to +105°C.
- Excellent temperature stability during 3000 hours of life-test with rated ripple current, at 85°C and during 500 hours at 105°C shelf-life test.
- Very low ESR and impedance in the frequency range of 120 Hz to 100 kHz.
- High ripple-current ratings in the 120 Hz to 100 kHz frequency range.
- Voltage range: 6 to 250 WVDC.
- Custom designed case construction* eliminates potting compound.

*Patent pending

SERIES 3120
Computer Grade Capacitors

DIMENSIONS

Case Code	UNINSULATED CASE DIMENSIONS					
	Dimensions in Inches			Dimensions in Millimeters		
	D	L	S	D	L	S
BA	1.375	2.125	.500	34.92	53.97	12.70
BB	1.375	2.625	.500	34.92	66.67	12.70
BC	1.375	3.125	.500	34.92	79.37	12.70
BD	1.375	3.625	.500	34.92	92.07	12.70
BE	1.375	4.125	.500	34.92	104.77	12.70
BF	1.375	4.625	.500	34.92	117.47	12.70
BG	1.375	5.125	.500	34.92	130.17	12.70
BH	1.375	5.625	.500	34.92	142.87	12.70
DA	1.750	2.125	.750	44.45	53.97	19.05
DB	1.750	2.625	.750	44.45	66.67	19.05
DC	1.750	3.125	.750	44.45	79.37	19.05
DD	1.750	3.625	.750	44.45	92.07	19.05
DE	1.750	4.125	.750	44.45	104.77	19.05
DF	1.750	4.625	.750	44.45	117.47	19.05
DG	1.750	5.125	.750	44.45	130.17	19.05
DH	1.750	5.625	.750	44.45	142.87	19.05
EA	2.000	2.125	.875	50.80	53.97	22.22
EB	2.000	2.625	.875	50.80	66.67	22.22
EC	2.000	3.125	.875	50.80	79.37	22.22
ED	2.000	3.625	.875	50.80	92.07	22.22
EE	2.000	4.125	.875	50.80	104.77	22.22
EF	2.000	4.625	.875	50.80	117.47	22.22
EG	2.000	5.125	.875	50.80	130.17	22.22
EH	2.000	5.625	.875	50.80	142.87	22.22
FB	2.500	2.625	1.125	63.50	66.67	28.57
FC	2.500	3.125	1.125	63.50	79.37	28.57
FD	2.500	3.625	1.125	63.50	92.07	28.57
FE	2.500	4.125	1.125	63.50	104.77	28.57
FF	2.500	4.625	1.125	63.50	117.47	28.57
FG	2.500	5.125	1.125	63.50	130.17	28.57
FH	2.500	5.625	1.125	63.50	142.87	28.57
GC	3.000	3.125	1.250	76.20	79.37	31.75
GD	3.000	3.625	1.250	76.20	92.07	31.75
GE	3.000	4.125	1.250	76.20	104.77	31.75
GF	3.000	4.625	1.250	76.20	117.47	31.75
GG	3.000	5.125	1.250	76.20	130.17	31.75
GH	3.000	5.625	1.250	76.20	142.87	31.75
GN	3.000	8.625	1.250	76.20	219.07	31.75

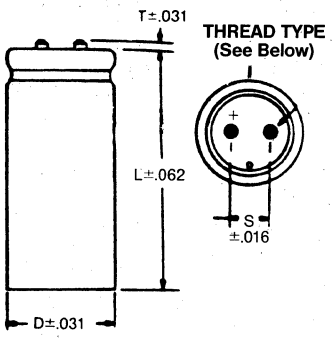
PC MOUNT OVERALL HEIGHT (INCHES)

Case Length	H		
	D = 1.375	D = 1.750	D = 2.000
2.125	2.26	2.31	2.31
2.625	2.76	2.81	2.81
3.125	3.26	3.31	3.31
3.625	3.76	3.81	3.81
4.125	4.26	4.31	4.31
4.625	4.76	4.81	4.81
5.125	5.26	5.31	5.31
5.625	5.76	5.81	5.81

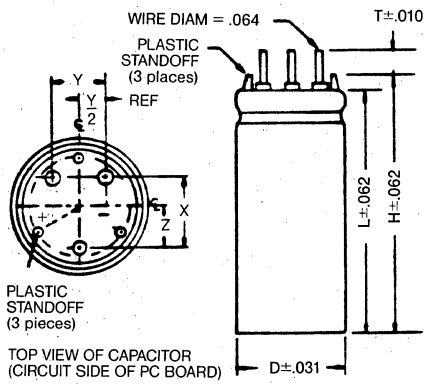
PC MOUNT TERMINAL SPACING (INCHES)

Case Diameter	X	Y	Z
1.375	.550	.600	.375
1.750	.900	.700	.525
2.000	1.000	.800	.575

CASE OUTLINE DRAWING



CASE OUTLINE DRAWING
PRINTED CIRCUIT BOARD MOUNT



INSULATED CASE DIMENSION ADDER AND BRACKET CODES

INSULATION TYPE	INCHES			MM			BRACKET CODE	
	D	L	H	D	L	H	without	with
.004 inch Polymeric	.010	.015	.010	.25	.38	.25	M	L
.008 inch Polymeric	.020	.032	.024	.508	.813	.61	P	R
.012 inch Polymeric	.025	.062	.045	.63	1.58	1.14	H	J
Uninsulated	–	–	–	–	–	–	N	X

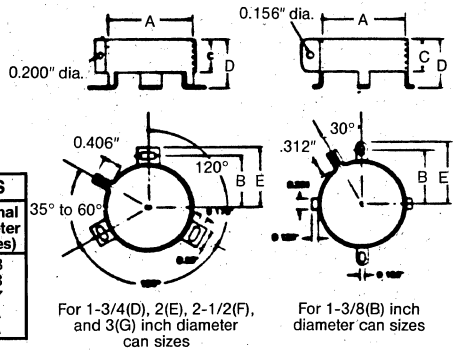
The capacitors are marked with:
- nominal capacitance
- rated voltage
- EIA source and date code
- maximum ambient temperature
- polarity
- name of manufacturer
- part number
- capacitance tolerance

BRACKET DIMENSIONS

Case Diameters	Dimensions in Inches				
	A ±0.005	B ±0.031	C ±0.016	D ±0.031	E ±0.031
1.375	1.375	0.906	0.562	0.750	1.156
1.750	1.750	1.125	0.750	1.125	1.313
2.000	2.000	1.250	0.750	1.125	1.438
2.500	2.500	1.500	0.750	1.125	1.688
3.000	3.000	1.750	0.750	1.125	1.938
Case Diameters	**Dimension in Millimeters**				
	A ±0.13	B ±0.79	C ±0.40	D ±0.79	E ±0.79
34.92	34.92	23.01	14.25	19.05	29.36
44.45	44.45	28.57	19.05	28.57	33.35
50.80	50.80	31.75	19.05	28.57	36.51
63.50	63.50	38.10	19.05	28.57	42.87
76.20	76.20	44.45	19.05	28.57	49.22

Note: All brackets are zinc/iridite plated.

BRACKET OUTLINE DRAWING



For 1-3/4(D), 2(E), 2-1/2(F), and 3(G) inch diameter can sizes

For 1-3/8(B) inch diameter can sizes

TERMINAL STYLES, DIMENSIONS, AND CODES

Terminal Style	T (inches)	T (mm)	Code	Thread Type	Terminal Diameter (inches)
High Post	.250	6.4	A	10-32	.313
Low Post	.063	1.6	B	10-32	.313
High Current*	.125	3.2	D	16-28	.687
Solder Lug	.468	11.9	C	N/A	N/A
PC Mount	.250	8.6	H	N/A	N/A

*Available in 2½" and 3" diameter cans only. Recommended for applications where ripple current exceeds 30 Amperes.

HOW TO SPECIFY

Mepco/Centralab series 3120 capacitors can be completely specified using the following designation:

3120 — **M/C Series Number**

GH — **Case Size Code**

114 — **Rated Capacitance**
First two digits are significant figures. Third digit is power of 10 multiplier
114 = 110000μF

U — **Capacitance Tolerance**
U = −10%+75%
T = −10%+50%

025 — **Rated Voltage**
025 = 25VDC
005 = 5VDC
100 = 100VDC

A — **Terminal Type**
A-Standard High Post Terminal.
B-Standard Low Post Terminal.
D-High Current Terminal.
H-PC Mount

M — **Insultation and Hardware**
See Physical Specifications

A-1 — **Factory Assigned Number**

PERFORMANCE SPECIFICATIONS

1. TEMPERATURE.
1.1 OPERATING. These capacitors are designed to operate within the temperature range of −40°C to +105°C.

1.2 STORAGE. These capacitors may be subjected, without permanent damage, to conditions in transit where temperatures range from −55°C to +105°C at altitudes up to 200,000 feet.

1.3 TOLERANCE. Unless otherwise specified, temperature tolerance shall be ±3°C.

2. DC WORKING VOLTAGE. The dc working voltage is the maximum operating voltage for continuous operation at maximum rated temperature.

3. SURGE VOLTAGE. The surge voltage is the maximum non-recurrent voltage to which the capacitor should be subjected.

3.1 The surge voltage shall not exceed the value specified in the rating table.

3.2 SURGE TEST

3.2.1 Capacitors shall be connected in series with a resistor. The value of the resistor is:

CAPACITRANCE (μF)	RESISTOR (ohms)
0-2500	1000
2501-25000	100
25001-250000	10
250001-UP	3

The series combination is then subjected to rated surge voltage for 30 seconds at 85°C and the capacitor allowed to discharge thru the resistor. This sequence is repeated 10 times per hour at 6 minute intervals for 1000 cycles.

3.2.2 Leakage current when measured per paragraph 6.2, not sooner than four (4) hours after completion of the test, shall not exceed the initial leakage current limit. There shall be no leaking of electrolyte and no mechanical damage.

4. CAPACITANCE. Capacitance shall be measured on a capacitance bridge having a maximum rms signal voltage of 1 volt at 120 Hz. Capacitance shall be within these specified tolerances when measured at 25°C.

WVDC	TOLERANCE
50	−10% +75%
51-250	−10% +50%

5. EQUIVALENT SERIES RESISTANCE (ESR) Measurement shall be made by the bridge method at 120 Hz and 25°C. The equivalent series resistance shall not exceed the value shown in the rating table.

6. DC LEAKAGE CURRENT.
6.1 PRE-CONDITIONING. In the period 24 to 48 hours prior to test, rated working voltage shall be applied to the capacitor for a minimum of 30 minutes.

6.2 MEASUREMENT. Measurement shall be made at 25°C ±5°C. Voltage shall be applied to the capacitor thru a current limiting resistor. The leakage current shall be measured 5 minutes after the capacitor reaches rated voltage. Leakage current shall not exceed the value calculated as shown:

6-100V $I_L = .001\sqrt{CV}$

101-250V $I_L = .003\sqrt{CV}$

C—Rated Capacitance (uf)
V—Rated Voltage (volts)
I_L = Leakage Current (mA)

7. LOW TEMPERATURE PERFORMANCE
7.1 CAPACITANCE. Capacitance, when measured at −40°C and a frequency of 120 Hz, shall not be less than the following percentages of the 25°C capacitance.

TEMPERATURE—40 DEGREES C

RATED DC VOLTAGE	% of 25°C CAPACITANCE	25°C IMPEDANCE MULTIPLIER
0-9	50	5.5
10-75	60	4.5
76-250	85	2.0

8. LIFE TEST.
8.1 Capacitors shall be placed in a circulating air oven at an ambient temperature of 85°C. Spacing between capacitors must be at least 1" and capacitors must not be subjected to direct radiation from heating elements. Circulation of air shall be sufficient to keep the temperature within (6) inches of the capacitor below 88°C.

SERIES 3120
Computer Grade Capacitors

PERFORMANCE SPECIFICATIONS

8.1.1 Rated voltage and rated ripple current shall be applied for a period of 3000 ± 8 hours. Following this test, the capacitors shall meet the requirements of paragraph 8.2.

8.1.2 Alternate life test:
Rated DC voltage shall be applied to the capacitors for a period of 4000 ± 8 hours. Following this test the capacitors shall meet the requirements of paragraph 8.2.

8.1.3 Alternate life test:
At an ambient of 105°C rated voltage with 25% of rated ripple current applied for a period of 1000 ± 8 hours. Following this test the capacitors shall meet the requirements of paragraph 8.2.

8.2 Upon completion of the life test, the capacitors shall be returned to room ambient for a minimum of 24 hours. The capacitors shall then meet the following requirements:

8.2.1 Capacitance, when measured per paragraph 4., shall not be less than 85% of the initial measured value.

8.2.2 The equivalent series resistance, when measured per paragraph 5., shall not be greater than 175% of the specified = value.

8.2.3 The leakage current, when measured and determined paragraph 6.2, shall not exceed the initial specification limit.

8.2.4 There shall be no evidence of mechanical damage or excessive electrolyte leakage.

9. SHELF TEST. Capacitors shall be placed in a circulating air oven at 105°C for a period of 500 ± 8 hours with no voltage applied. The units shall then be allowed to cool in an ambient of 25°C for a minimum of 24 hours.

9.1 The capacitance and equivalent series resistance shall meet initial specifications.

9.2 The leakage current when measured per paragraph 6.2 shall not exceed 200% of the initial specification.

10. VIBRATION. Capacitors shall be clamped rigidly to a vibration platform and subjected to a simple harmonic motion having a maximum peak-to-peak amplitude of .06 inches and a maximum acceleration of 10g. The frequency of vibration shall be varied linearly between 10 and 55 cycles per second. The entire frequency range, 10 to 55 to 10 cps, shall be traversed in one minute. Capacitors shall be vibrated for 1½ hours with the direction of motion being parallel to the axis of the capacitor. The capacitors shall then be placed so that the direction of motion is perpendicular to the axis and the vibration continued for 1½ hours. During the last ½ hour of the test, the capacitor shall be connected to a bridge and observed for a 3 minute period. A capacitor failing the vibration test is defined as one failing to meet the requirements of paragraph 9.1.

9.1 There shall be no evidence of loosening of the capacitor element within the container, when shaken by hand following the test. There shall be no indication of intermittent contact during the 3 minute observation period. Capacitors shall not be open or shorted.

HIGH VIBRATION
UPON SPECIAL REQUEST a 3120 type capacitor is available to meet the following test. Capacitors shall be clamped rigidly to a vibration platform and subjected to a simple harmonic motion having a maximum peak-to-peak amplitude of .06 inches and a maximum acceleration of 20g. The frequency of vibration shall be varied logarithmically between 10 and 2000 cycles per second. The entire frequency range, 10 to 2000 to 10 cps, shall be traversed in 20 minutes. This cycle may be repeated two times in each of three mutually perpendicular directions, the first being such that the direction of motion is parallel to the axis of their containers.

At some time during the last half hour of the test each component on test shall be connected for capacitance measurement and its capacitance shall be observed for a period of approximately three (3) minutes.

There shall be no evidence of loosening of the capacitor element within the container as evidenced by shaking. There shall be no indication of intermittent connection during the three (3) minute observation period. Capacitors shall not be open or shorted.

PERFORMANCE SPECIFICATIONS

11. CONTAINER SEAL. Following the vibration test, each capacitor shall be tested for seal tightness in accordance with paragraphs 11.1 and 11.2.

11.1 Capacitors shall be subjected to two successive temperature cycles in circulating air as follows:

ONE TEMPERATURE CYCLE

A. 85°C—15 min.
B. 25°C—15 min.
C. −40°C—15 min.
D. 25°C—15 min.

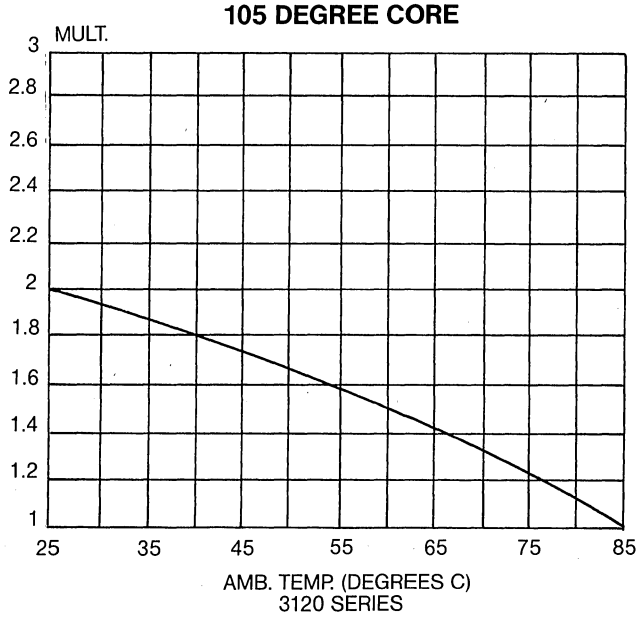
11.2 Following the second cycle, the capacitors shall be placed in 90-95°C water for 5 minutes. A failure is defined as a unit exhibiting a continuous chain of bubbles when immersed.

12. RIPPLE CURRENT. Capacitors will withstand the 85°C rms ripple current stated in the rating tables for the duration of the life test as specified in paragraph 8. of the Performance Specifications. Any reduction in ambient temperature and/or ripple current will extend the operating life of the capacitor. See application guidelines for method for determining extended life at derated conditions.

12.1. Ripple Current values are specified at an ambient temperature of 85°C and a frequency of 120 Hz. Ripple current (I_R) at other frequencies and temperatures can be calculated

$$I_R = I_{85} \cdot \text{RIPPLE MULTIPLIER}$$

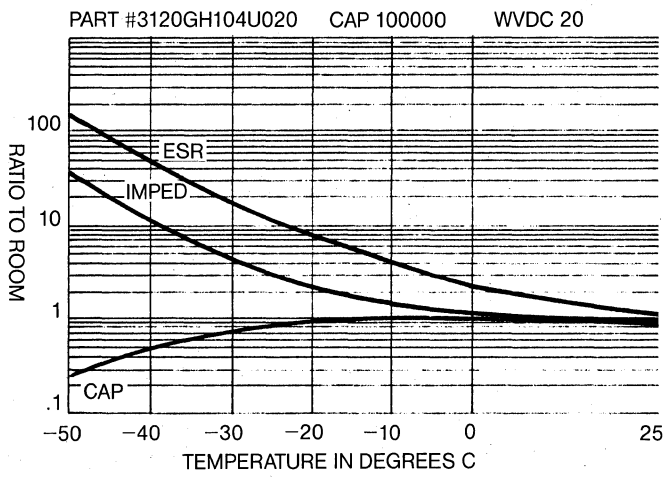
RIPPLE MULTIPLIER
105 DEGREE CORE

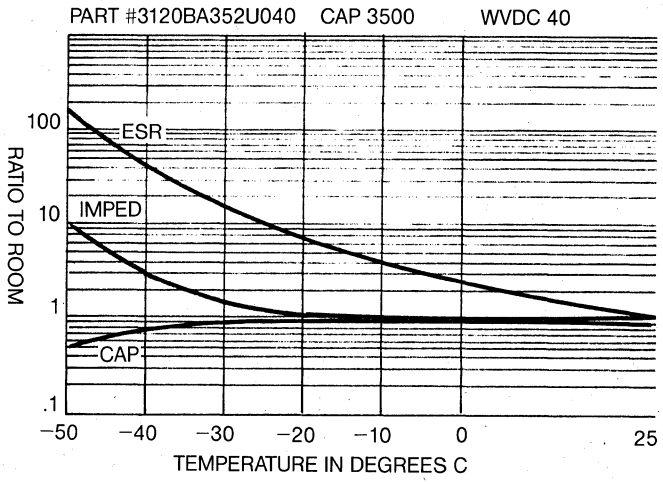


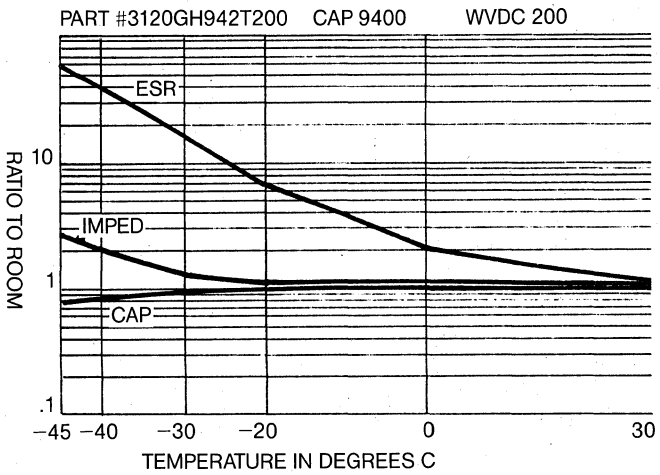
12.2 For ripple currents at other frequencies, see application guidelines.

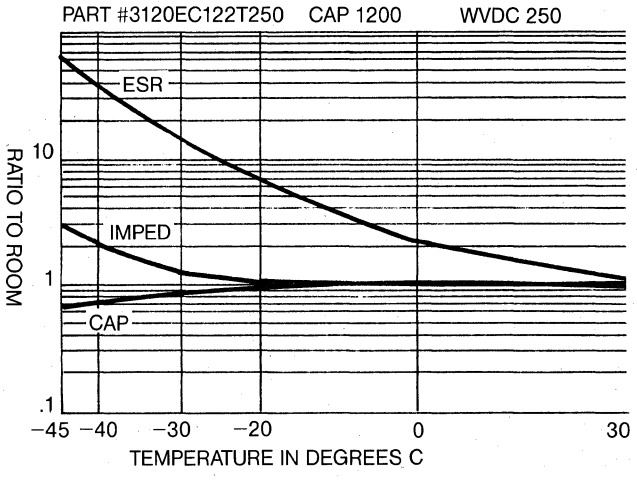
SERIES 3120
Computer Grade Capacitors

TYPICAL PERFORMANCE CURVES
Electrical Characteristics vs. Temperature

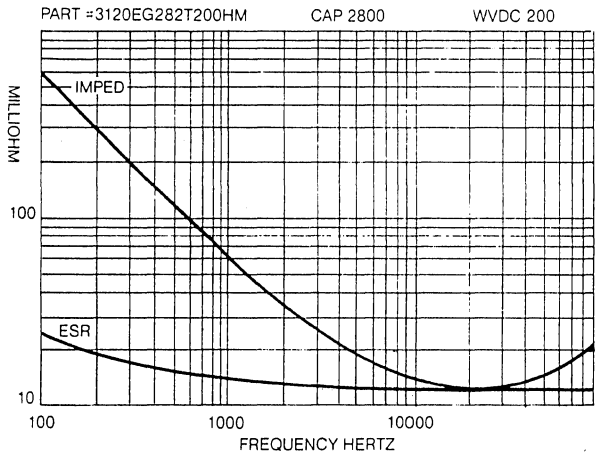


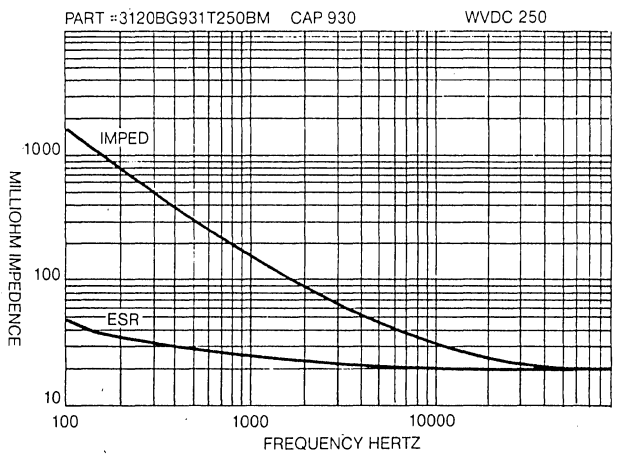




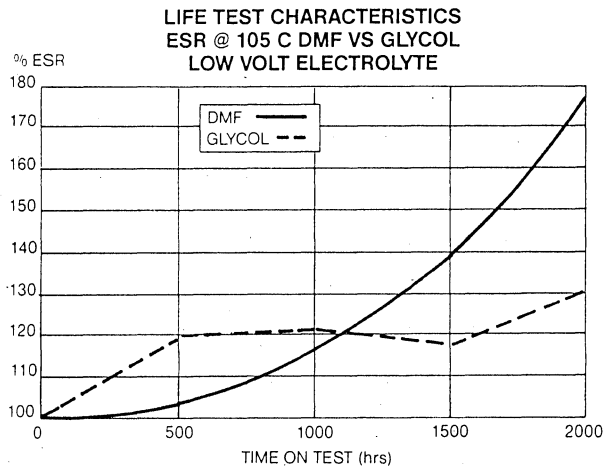


TYPICAL PERFORMANCE CURVES
Impedance vs. Frequency





LIFE PERFORMANCE.
The newly developed non-aqueous, glycol based electrolyte exhibits some deficiencies at very low temperatures. This deficiency is more than compensated by superior performance at very high temperatures. This is illustrated on the life test characteristic curve shown below. Note the E.S.R. stability of the Mepco/Centralab glycol vs DMF based electrolyte. This E.S.R. stability is one of the major factors responsible for the long life characteristic of the 3120 capacitor series.



SERIES 3120

Computer Grade Capacitors

STANDARD CAPACITANCE VALUES

6.0 VDC WORKING, 10.0 SURGE

Capacitance μF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
42000	3120BA423U006AM	BA	0.0145	10.0
51000	3120BB513U006AM	BB	0.0125	11.7
68000	3120BC683U006AM	BC	0.0102	13.9
85000	3120BD853U006AM	BD	0.0089	15.9
100000	3120BE104U006AM	BE	0.0080	17.6
120000	3120BF124U006AM	BF	0.0074	19.3
130000	3120BG134U006AM	BG	0.0070	20.7
150000	3120BH154U006AM	BH	0.0067	22.2
76000	3120DA763U006AM	DA	0.0144	11.7
91000	3120DB913U006AM	DB	0.0126	13.6
120000	3120DC124U006AM	DC	0.0103	16.0
150000	3120DD154U006AM	DD	0.0090	18.2
180000	3120DE184U006AM	DE	0.0081	20.2
210000	3120DF214U006AM	DF	0.0075	22.0
240000	3120DG244U006AM	DG	0.0071	23.6
270000	3120DH274U006AM	DH	0.0068	25.1
79000	3120EA793U006AM	EA	0.0116	14.3
110000	3120EB114U006AM	EB	0.0087	17.8
150000	3120EC154U006AM	EC	0.0072	20.8

6.0 VDC WORKING, 10.0 SURGE

Capacitance μF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
190000	3120ED194U006AM	ED	0.0063	23.5
230000	3120EE234U006AM	EE	0.0057	25.9
270000	3120EF274U006AM	EF	0.0054	28.1
310000	3120EG314U006AM	EG	0.0051	30.0
350000	3120EH354U006AM	EH	0.0049	30.0
190000	3120FB194U006AM	FB	0.0071	22.6
260000	3120FC264U006AM	FC	0.0060	26.3
320000	3120FD324U006AM	FD	0.0053	29.5
390000	3120FE394U006AM	FE	0.0048	30.0
460000	3120FF464U006AM	FF	0.0045	30.0
520000	3120FG524U006AM	FG	0.0043	30.0
590000	3120FH594U006AM	FH	0.0042	30.0
380000	3120GC384U006AM	GC	0.0067	27.9
480000	3120GD484U006AM	GD	0.0059	30.0
580000	3120GE584U006AM	GE	0.0054	30.0
680000	3120GF684U006AM	GF	0.0050	30.0
770000	3120GG774U006AM	GG	0.0047	30.0
870000	3120GH874U006DM	GH	0.0045	42.1

7.5 VDC WORKING, 12.0 SURGE

Capacitance μF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
38000	3120BA383U7P5AM	BA	0.0146	10.0
46000	3120BB463U7P5AM	BB	0.0127	11.6
62000	3120BC623U7P5AM	BC	0.0103	13.9
77000	3120BD773U7P5AM	BD	0.0089	15.8
93000	3120BE933U7P5AM	BE	0.0080	17.6
100000	3120BF104U7P5AM	BF	0.0076	19.1
120000	3120BG124U7P5AM	BG	0.0070	20.7
130000	3120BH134U7P5AM	BH	0.0068	22.0
68000	3120DA683U7P5AM	DA	0.0145	11.7
82000	3120DB823U7P5AM	DB	0.0126	13.5
110000	3120DC114U7P5AM	DC	0.0103	16.0
130000	3120DD134U7P5AM	DD	0.0090	18.1
160000	3120DE164U7P5AM	DE	0.0082	20.1
190000	3120DF194U7P5AM	DF	0.0076	21.9
220000	3120DG224U7P5AM	DG	0.0071	23.6
240000	3120DH244U7P5AM	DH	0.0068	25.1
71000	3120EA713U7P5AM	EA	0.0116	14.2
100000	3120EB104U7P5AM	EB	0.0087	17.7
140000	3120EC144U7P5AM	EC	0.0072	20.8

7.5 VDC WORKING, 12.0 SURGE

Capacitance μF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
170000	3120ED174U7P5AM	ED	0.0063	23.5
210000	3120EE214U7P5AM	EE	0.0058	25.9
250000	3120EF254U7P5AM	EF	0.0054	28.1
280000	3120EG284U7P5AM	EG	0.0051	30.0
320000	3120EH324U7P5AM	EH	0.0049	30.0
170000	3120FB174U7P5AM	FB	0.0072	22.6
230000	3120FC234U7P5AM	FC	0.0060	26.2
290000	3120FD294U7P5AM	FD	0.0053	29.4
350000	3120FE354U7P5AM	FE	0.0049	30.0
410000	3120FF414U7P5AM	FF	0.0046	30.0
470000	3120FG474U7P5AM	FG	0.0043	30.0
530000	3120FH534U7P5AM	FH	0.0042	30.0
350000	3120GC354U7P5AM	GC	0.0068	27.8
430000	3120GD434U7P5AM	GD	0.0059	30.0
520000	3120GE524U7P5AM	GE	0.0054	30.0
610000	3120GF614U7P5AM	GF	0.0050	30.0
700000	3120GG704U7P5AM	GG	0.0048	30.0
790000	3120GH794U7P5DM	GH	0.0046	42.1

10.0 VDC WORKING, 15.0 SURGE

Capacitance μF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
29000	3120BA293U010AM	BA	0.0149	9.9
35000	3120BB353U010AM	BB	0.0130	11.5
46000	3120BC463U010AM	BC	0.0106	13.7
58000	3120BD583U010AM	BD	0.0091	15.7
70000	3120BE703U010AM	BE	0.0082	17.5
82000	3120BF823U010AM	BF	0.0075	19.1
93000	3120BG933U010AM	BG	0.0071	20.6
100000	3120BH104U010AM	BH	0.0068	21.9
52000	3120DA523U010AM	DA	0.0147	11.6
62000	3120DB623U010AM	DB	0.0128	13.4
83000	3120DC833U010AM	DC	0.0105	15.9
100000	3120DD104U010AM	DD	0.0091	18.0
120000	3120DE124U010AM	DE	0.0083	20.0
140000	3120DF144U010AM	DF	0.0076	21.8
160000	3120DG164U010AM	DG	0.0072	23.4
180000	3120DH184U010AM	DH	0.0069	25.0
54000	3120EA543U010AM	EA	0.0118	14.1
81000	3120EB813U010AM	EB	0.0088	17.7
100000	3120EC104U010AM	EC	0.0073	20.6

10.0 VDC WORKING, 15.0 SURGE

Capacitance μF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
130000	3120ED134U010AM	ED	0.0064	23.3
160000	3120EE164U010AM	EE	0.0058	25.7
180000	3120EF184U010AM	EF	0.0054	27.9
210000	3120EG214U010AM	EG	0.0052	29.9
240000	3120EH244U010AM	EH	0.0050	30.0
130000	3120FB134U010AM	FB	0.0073	22.4
180000	3120FC184U010AM	FC	0.0061	26.1
220000	3120FD224U010AM	FD	0.0054	29.3
270000	3120FE274U010AM	FE	0.0049	30.0
310000	3120FF314U010AM	FF	0.0046	30.0
360000	3120FG364U010AM	FG	0.0044	30.0
400000	3120FH404U010AM	FH	0.0042	30.0
260000	3120GC264U010AM	GC	0.0069	27.6
330000	3120GD334U010AM	GD	0.0060	30.0
390000	3120GE394U010AM	GE	0.0055	30.0
460000	3120GF464U010AM	GF	0.0051	30.0
530000	3120GG534U010AM	GG	0.0048	30.0
590000	3120GH594U010DM	GH	0.0046	41.8
650000	3120GN654U010DM	GN	0.0052	45.0

STANDARD CAPACITANCE VALUES

16.0 VDC WORKING, 20.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
21000	3120BA213U016AM	BA	0.0154	9.7
25000	3120BB253U016AM	BB	0.0134	11.3
33000	3120BC333U016AM	BC	0.0109	13.4
42000	3120BD423U016AM	BD	0.0094	15.4
50000	3120BE503U016AM	BE	0.0084	17.2
59000	3120BF593U016AM	BF	0.0077	18.9
67000	3120BG673U016AM	BG	0.0073	20.4
76000	3120BH763U016AM	BH	0.0069	21.8
37000	3120DA373U016AM	DA	0.0150	11.5
45000	3120DB453U016AM	DB	0.0130	13.3
60000	3120DC603U016AM	DC	0.0107	15.7
75000	3120DD753U016AM	DD	0.0093	17.9
90000	3120DE903U016AM	DE	0.0083	19.9
100000	3120DF104U016AM	DF	0.0078	21.6
120000	3120DG124U016AM	DG	0.0073	23.3
130000	3120DH134U016AM	DH	0.0070	24.8
39000	3120EA393U016AM	EA	0.0121	14.0
58000	3120EB583U016AM	EB	0.0089	17.5
78000	3120EC783U016AM	EC	0.0074	20.5

16.0 VDC WORKING, 20.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
97000	3120ED973U016AM	ED	0.0065	23.2
110000	3120EE114U016AM	EE	0.0059	25.5
130000	3120EF134U016AM	EF	0.0055	27.7
150000	3120EG154U016AM	EG	0.0052	29.7
170000	3120EH174U016AM	EH	0.0050	30.0
97000	3120FB973U016AM	FB	0.0074	22.3
130000	3120FC134U016AM	FC	0.0061	25.9
160000	3120FD164U016AM	FD	0.0054	29.1
190000	3120FE194U016AM	FE	0.0050	30.0
220000	3120FF224U016AM	FF	0.0046	30.0
260000	3120FG264U016AM	FG	0.0044	30.0
290000	3120FH294U016AM	FH	0.0042	30.0
190000	3120GC194U016AM	GC	0.0070	27.4
240000	3120GD244U016AM	GD	0.0061	30.0
280000	3120GE284U016AM	GE	0.0055	30.0
330000	3120GF334U016AM	GF	0.0052	30.0
380000	3120GG384U016AM	GG	0.0049	30.0
430000	3120GH434U016DM	GH	0.0047	41.6
650000	3120GN654U016DM	GN	0.0054	45.0

20.0 VDC WORKING, 24.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
15000	3120BA153U020AM	BA	0.0186	8.8
18000	3120BB183U020AM	BB	0.0160	10.3
24000	3120BC243U020AM	BC	0.0128	12.4
30000	3120BD303U020AM	BD	0.0110	14.3
36000	3120BE363U020AM	BE	0.0097	16.0
42000	3120BF423U020AM	BF	0.0089	17.6
48000	3120BG483U020AM	BG	0.0083	19.1
54000	3120BH543U020AM	BH	0.0078	20.5
26000	3120DA263U020AM	DA	0.0221	9.5
31000	3120DB313U020AM	DB	0.0190	11.0
42000	3120DC423U020AM	DC	0.0151	13.2
53000	3120DD533U020AM	DD	0.0128	15.2
63000	3120DE633U020AM	DE	0.0113	17.1
74000	3120DF743U020AM	DF	0.0103	18.8
85000	3120DG853U020AM	DG	0.0095	20.4
95000	3120DH953U020AM	DH	0.0089	21.9
27000	3120EA273U020AM	EA	0.0172	11.7
41000	3120EB413U020AM	EB	0.0123	14.9
55000	3120EC553U020AM	EC	0.0099	17.7

20.0 VDC WORKING, 24.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
68000	3120ED683U020AM	ED	0.0085	20.2
82000	3120EE823U020AM	EE	0.0076	22.5
96000	3120EF963U020AM	EF	0.0070	24.7
110000	3120EG114U020AM	EG	0.0065	26.7
120000	3120EH124U020AM	EH	0.0061	28.5
68000	3120FB683U020AM	FB	0.0106	18.6
91000	3120FC913U020AM	FC	0.0085	22.0
110000	3120FD114U020AM	FD	0.0074	25.0
130000	3120FE134U020AM	FE	0.0066	27.7
160000	3120FF164U020AM	FF	0.0060	30.0
180000	3120FG184U020AM	FG	0.0056	30.0
200000	3120FH204U020AM	FH	0.0053	30.0
130000	3120GC134U020AM	GC	0.0105	22.4
160000	3120GD164U020AM	GD	0.0089	25.5
200000	3120GE204U020AM	GE	0.0079	28.4
230000	3120GF234U020AM	GF	0.0071	30.0
270000	3120GG274U020AM	GG	0.0066	30.0
300000	3120GH304U020DM	GH	0.0062	36.0
490000	3120GN494U020DM	GH	0.0070	40.5

25.0 VDC WORKING, 40.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
11000	3120BA113U025AM	BA	0.0194	8.7
13000	3120BB133U025AM	BB	0.0167	10.1
18000	3120BC183U025AM	BC	0.0133	12.2
22000	3120BD223U025AM	BD	0.0113	14.0
27000	3120BE273U025AM	BE	0.0100	15.8
31000	3120BF313U025AM	BF	0.0091	17.4
36000	3120BG363U025AM	BG	0.0085	18.9
41000	3120BH413U025AM	BH	0.0080	20.3
20000	3120DA203U025AM	DA	0.0225	9.4
24000	3120DB243U025AM	DB	0.0193	10.9
32000	3120DC323U025AM	DC	0.0154	13.1
40000	3120DD403U025AM	DD	0.0130	15.1
48000	3120DE483U025AM	DE	0.0115	16.9
56000	3120DF563U025AM	DF	0.0104	18.7
64000	3120DG643U025AM	DG	0.0096	20.3
72000	3120DH723U025AM	DH	0.0090	21.8
20000	3120EA203U025AM	EA	0.0176	11.6
31000	3120EB313U025AM	EB	0.0126	14.7
41000	3120EC413U025AM	EC	0.0101	17.5

25.0 VDC WORKING, 40.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
52000	3120ED523U025AM	ED	0.0087	20.0
62000	3120EE623U025AM	EE	0.0077	22.4
73000	3120EF733U025AM	EF	0.0071	24.5
83000	3120EG833U025AM	EG	0.0066	26.5
94000	3120EH943U025AM	EH	0.0062	28.3
52000	3120FB523U025AM	FB	0.0107	18.5
69000	3120FC693U025AM	FC	0.0087	21.8
87000	3120FD873U025AM	FD	0.0074	24.8
100000	3120FE104U025AM	FE	0.0067	27.6
120000	3120FF124U025AM	FF	0.0061	30.0
130000	3120FG134U025AM	FG	0.0057	30.0
150000	3120FH154U025AM	FH	0.0054	30.0
100000	3120GC104U025AM	GC	0.0106	22.2
120000	3120GD124U025AM	GD	0.0090	25.3
150000	3120GE154U025AM	GE	0.0080	28.3
170000	3120GF174U025AM	GF	0.0072	30.0
200000	3120GG204U025AM	GG	0.0067	30.0
230000	3120GH234U025DM	GH	0.0063	35.9
370000	3120GN374U025DM	GN	0.0071	40.1

SERIES 3120
Computer Grade Capacitors

STANDARD CAPACITANCE VALUES

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
30.0 VDC WORKING, 45.0 SURGE				
9700	3120BA972U030AM	BA	0.0197	8.6
11000	3120BB113U030AM	BB	0.0171	10.0
15000	3120BC153U030AM	BC	0.0136	12.1
19000	3120BD193U030AM	BD	0.0115	13.9
23000	3120BE233U030AM	BE	0.0102	15.6
27000	3120BF273U030AM	BF	0.0093	17.2
31000	3120BG313U030AM	BG	0.0086	18.7
35000	3120BH353U030AM	BH	0.0081	20.1
17000	3120DA173U030AM	DA	0.0228	9.3
20000	3120DB203U030AM	DB	0.0196	10.9
27000	3120DC273U030AM	DC	0.0155	13.0
34000	3120DD343U030AM	DD	0.0132	15.0
41000	3120DE413U030AM	DE	0.0116	16.9
48000	3120DF483U030AM	DF	0.0105	18.6
55000	3120DG553U030AM	DG	0.0097	20.2
62000	3120DH623U030AM	DH	0.0091	21.7
17000	3120EA173U030AM	EA	0.0179	11.5
26000	3120EB263U030AM	EB	0.0128	14.6
35000	3120EC353U030AM	EC	0.0103	17.4
35.0 VDC WORKING, 50.0 SURGE				
6900	3120BA692U035AM	BA	0.0477	5.5
8200	3120BB822U035AM	BB	0.0406	6.5
11000	3120BC113U035AM	BC	0.0317	7.9
13000	3120BD133U035AM	BD	0.0267	9.2
16000	3120BE163U035AM	BE	0.0231	10.4
19000	3120BF193U035AM	BF	0.0207	11.5
22000	3120BG223U035AM	BG	0.0189	12.6
24000	3120BH243U035AM	BH	0.0176	13.6
12000	3120DA123U035AM	DA	0.0692	5.3
14000	3120DB143U035AM	DB	0.0587	6.3
19000	3120DC193U035AM	DC	0.0454	7.6
24000	3120DD243U035AM	DD	0.0375	8.9
29000	3120DE293U035AM	DE	0.0323	10.1
34000	3120DF343U035AM	DF	0.0286	11.3
39000	3120DG393U035AM	DG	0.0259	12.4
43000	3120DH433U035AM	DH	0.0239	13.4
12000	3120EA123U035AM	EA	0.0325	8.5
19000	3120EB193U035AM	EB	0.0227	11.0
25000	3120EC253U035AM	EC	0.0179	13.2
40.0 VDC WORKING, 60.0 SURGE				
5800	3120BA582U040AM	BA	0.0485	5.5
6900	3120BB692U040AM	BB	0.0413	6.5
9300	3120BC932U040AM	BC	0.0322	7.8
11000	3120BD113U040AM	BD	0.0271	9.1
13000	3120BE133U040AM	BE	0.0236	10.3
16000	3120BF163U040AM	BF	0.0210	11.5
18000	3120BG183U040AM	BG	0.0192	12.5
20000	3120BH203U040AM	BH	0.0178	13.5
10000	3120DA103U040AM	DA	0.0700	5.3
12000	3120DB123U040AM	DB	0.0592	6.2
16000	3120DC163U040AM	DC	0.0458	7.6
20000	3120DD203U040AM	DD	0.0379	8.9
24000	3120DE243U040AM	DE	0.0326	10.1
28000	3120DF283U040AM	DF	0.0289	11.2
32000	3120DG323U040AM	DG	0.0262	12.3
37000	3120DH373U040AM	DH	0.0240	13.4
10000	3120EA103U040AM	EA	0.0330	8.4
16000	3120EB163U040AM	EB	0.0230	10.9
21000	3120EC213U040AM	EC	0.0181	13.1

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
30.0 VDC WORKING, 45.0 SURGE				
44000	3120ED443U030AM	ED	0.0088	19.9
53000	3120EE533U030AM	EE	0.0078	22.2
62000	3120EF623U030AM	EF	0.0071	24.4
71000	3120EG713U030AM	EG	0.0066	26.4
80000	3120EH803U030AM	EH	0.0063	28.2
44000	3120FB443U030AM	FB	0.0108	18.4
59000	3120FC593U030AM	FC	0.0087	21.7
74000	3120FD743U030AM	FD	0.0075	24.7
89000	3120FE893U030AM	FE	0.0067	27.5
100000	3120FF104U030AM	FF	0.0061	30.0
110000	3120FG114U030AM	FG	0.0057	30.0
130000	3120FH134U030AM	FH	0.0054	30.0
87000	3120GC873U030AM	GC	0.0107	22.1
100000	3120GD104U030AM	GD	0.0091	25.2
130000	3120GE134U030AM	GE	0.0080	28.2
150000	3120GF154U030AM	GF	0.0073	30.0
170000	3120GG174U030AM	GG	0.0067	30.0
190000	3120GH194U030DM	GH	0.0063	35.7
320000	3120GN324U030DM	GN	0.0072	40.0
35.0 VDC WORKING, 50.0 SURGE				
31000	3120ED313U035AM	ED	0.0151	15.2
38000	3120EE383U035AM	EE	0.0132	17.1
44000	3120EF443U035AM	EF	0.0119	18.9
50000	3120EG503U035AM	EG	0.0109	20.6
57000	3120EH573U035AM	EH	0.0102	22.2
31000	3120FB313U035AM	FB	0.0166	14.8
42000	3120FC423U035AM	FC	0.0132	17.7
52000	3120FD523U035AM	FD	0.0111	20.3
63000	3120FE633U035AM	FE	0.0098	22.7
73000	3120FF733U035AM	FF	0.0089	25.0
84000	3120FG843U035AM	FG	0.0082	27.1
94000	3120FH943U035AM	FH	0.0076	29.1
62000	3120GC623U035AM	GC	0.0168	17.6
77000	3120GD773U035AM	GD	0.0141	20.3
93000	3120GE933U035AM	GE	0.0123	22.8
100000	3120GF104U035AM	GF	0.0110	25.1
120000	3120GG124U035AM	GG	0.0100	27.3
130000	3120GH134U035DM	GH	0.0093	29.4
220000	3120GN224U035DM	GN	0.0073	39.7
40.0 VDC WORKING, 60.0 SURGE				
26000	3120ED263U040AM	ED	0.0153	15.1
32000	3120EE323U040AM	EE	0.0133	17.0
37000	3120EF373U040AM	EF	0.0120	18.8
42000	3120EG423U040AM	EG	0.0110	20.5
48000	3120EH483U040AM	EH	0.0103	22.1
26000	3120FB263U040AM	FB	0.0168	14.7
35000	3120FC353U040AM	FC	0.0133	17.6
44000	3120FD443U040AM	FD	0.0112	20.2
53000	3120FE533U040AM	FE	0.0099	22.6
62000	3120FF623U040AM	FF	0.0089	24.9
71000	3120FG713U040AM	FG	0.0082	27.0
79000	3120FH793U040AM	FH	0.0077	29.0
52000	3120GC523U040AM	GC	0.0170	17.6
65000	3120GD653U040AM	GD	0.0142	20.2
78000	3120GE783U040AM	GE	0.0124	22.7
91000	3120GF913U040AM	GF	0.0111	25.0
100000	3120GG104U040AM	GG	0.0101	27.2
110000	3120GH114U040DM	GH	0.0094	29.3
190000	3120GN194U040DM	GN	0.0073	39.6

STANDARD CAPACITANCE VALUES

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
50.0 VDC WORKING, 75.0 SURGE				
4700	3120BA472U050AM	BA	0.0497	5.4
5700	3120BB572U050AM	BB	0.0422	6.4
7600	3120BC762U050AM	BC	0.0329	7.7
9500	3120BD952U050AM	BD	0.0275	9.0
11000	3120BE113U050AM	BE	0.0240	10.2
13000	3120BF133U050AM	BF	0.0214	11.3
15000	3120BG153U050AM	BG	0.0195	12.4
17000	3120BH173U050AM	BH	0.0181	13.4
8400	3120DA842U050AM	DA	0.0707	5.3
10000	3120DB103U050AM	DB	0.0598	6.2
13000	3120DC133U050AM	DC	0.0464	7.5
16000	3120DD163U050AM	DD	0.0384	8.8
20000	3120DE203U050AM	DE	0.0329	10.0
23000	3120DF233U050AM	DF	0.0292	11.1
27000	3120DG273U050AM	DG	0.0264	12.2
30000	3120DH303U050AM	DH	0.0243	13.3
8700	3120EA872U050AM	EA	0.0335	8.4
13000	3120EB133U050AM	EB	0.0234	10.8
17000	3120EC173U050AM	EC	0.0185	13.0
60.0 VDC WORKING, 90.0 SURGE				
4200	3120BA422T060AM	BA	0.0503	5.4
5000	3120BB502T060AM	BB	0.0428	6.3
6700	3120BC672T060AM	BC	0.0334	7.7
8400	3120BD842T060AM	BD	0.0278	9.0
10000	3120BE103T060AM	BE	0.0242	10.2
11000	3120BF113T060AM	BF	0.0218	11.2
13000	3120BG133T060AM	BG	0.0198	12.3
15000	3120BH153T060AM	BH	0.0183	13.4
7500	3120DA752T060AM	DA	0.0711	5.3
9000	3120DB902T060AM	DB	0.0602	6.2
12000	3120DC123T060AM	DC	0.0466	7.5
15000	3120DD153T060AM	DD	0.0385	8.8
18000	3120DE183T060AM	DE	0.0331	10.0
21000	3120DF213T060AM	DF	0.0293	11.1
24000	3120DG243T060AM	DG	0.0265	12.2
27000	3120DH273T060AM	DH	0.0244	13.3
7700	3120EA772T060AM	EA	0.0339	8.3
11000	3120EB113T060AM	EB	0.0238	10.7
15000	3120EC153T060AM	EC	0.0187	12.9
75.0 VDC WORKING, 100.0 SURGE				
2700	3120BA272T075AM	BA	0.0541	5.2
3300	3120BB332T075AM	BB	0.0458	6.1
4400	3120BC442T075AM	BC	0.0356	7.4
5500	3120BD552T075AM	BD	0.0296	8.7
6600	3120BE662T075AM	BE	0.0257	9.9
7700	3120BF772T075AM	BF	0.0229	11.0
8800	3120BG882T075AM	BG	0.0208	12.0
9900	3120BH992T075AM	BH	0.0193	13.0
4800	3120DA482T075AM	DA	0.0735	5.2
5800	3120DB582T075AM	DB	0.0621	6.1
7800	3120DC782T075AM	DC	0.0480	7.4
9700	3120DD972T075AM	DD	0.0396	8.7
11000	3120DE113T075AM	DE	0.0342	9.8
13000	3120DF133T075AM	DF	0.0303	11.0
15000	3120DG153T075AM	DG	0.0273	12.0
17000	3120DH173T075AM	DH	0.0251	13.1
5000	3120EA502T075AM	EA	0.0359	8.1
7600	3120EB762T075AM	EB	0.0250	10.5
10000	3120EC103T075AM	EC	0.0197	12.6

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
50.0 VDC WORKING, 75.0 SURGE				
21000	3120ED213U050AM	ED	0.0155	15.0
26000	3120EE263U050AM	EE	0.0135	16.9
30000	3120EF303U050AM	EF	0.0122	18.6
35000	3120EG353U050AM	EG	0.0112	20.3
39000	3120EH393U050AM	EH	0.0104	21.9
21000	3120FB213U050AM	FB	0.0171	14.6
29000	3120FC293U050AM	FC	0.0135	17.5
36000	3120FD363U050AM	FD	0.0114	20.1
43000	3120FE433U050AM	FE	0.0100	22.5
51000	3120FF513U050AM	FF	0.0090	24.8
58000	3120FG583U050AM	FG	0.0083	26.9
65000	3120FH653U050AM	FH	0.0078	28.9
43000	3120GC433U050AM	GC	0.0171	17.5
53000	3120GD533U050AM	GD	0.0143	20.1
64000	3120GE643U050AM	GE	0.0125	22.6
75000	3120GF753U050AM	GF	0.0112	24.9
86000	3120GG863U050AM	GG	0.0102	27.1
96000	3120GH963U050DM	GH	0.0095	29.2
150000	3120GN154U050DM	GN	0.0074	39.4
60.0 VDC WORKING, 90.0 SURGE				
19000	3120ED193T060AM	ED	0.0157	14.9
23000	3120EE233T060AM	EE	0.0137	16.8
27000	3120EF273T060AM	EF	0.0123	18.6
31000	3120EG313T060AM	EG	0.0113	20.2
35000	3120EH353T060AM	EH	0.0105	21.8
15000	3120FB153T060AM	FB	0.0162	15.0
20000	3120FC203T060AM	FC	0.0129	17.9
26000	3120FD263T060AM	FD	0.0108	20.6
31000	3120FE313T060AM	FE	0.0096	23.0
36000	3120FF363T060AM	FF	0.0086	25.3
41000	3120FG413T060AM	FG	0.0080	27.4
47000	3120FH473T060AM	FH	0.0075	29.5
30000	3120GC303T060AM	GC	0.0154	18.4
38000	3120GD383T060AM	GD	0.0129	21.2
46000	3120GE463T060AM	GE	0.0113	23.7
53000	3120GF533T060AM	GF	0.0102	26.1
61000	3120GG613T060AM	GG	0.0093	28.4
69000	3120GH693T060DM	GH	0.0087	30.5
110000	3120GN114T060DM	GH	0.0069	40.9
75.0 VDC WORKING, 100.0 SURGE				
12000	3120ED123T075AM	ED	0.0166	14.5
15000	3120EE153T075AM	EE	0.0143	16.4
17000	3120EF173T075AM	EF	0.0129	18.1
20000	3120EG203T075AM	EG	0.0118	19.8
22000	3120EH223T075AM	EH	0.0110	21.3
10000	3120FB103T075AM	FB	0.0171	14.6
13000	3120FC133T075AM	FC	0.0136	17.4
17000	3120FD173T075AM	FD	0.0114	20.1
20000	3120FE203T075AM	FE	0.0101	22.4
23000	3120FF233T075AM	FF	0.0091	24.7
27000	3120FG273T075AM	FG	0.0083	26.8
30000	3120FH303T075AM	FH	0.0078	28.8
20000	3120GC203T075AM	GC	0.0159	18.1
25000	3120GD253T075AM	GD	0.0133	20.9
30000	3120GE303T075AM	GE	0.0116	23.4
35000	3120GF353T075AM	GF	0.0104	25.7
40000	3120GG403T075AM	GG	0.0096	28.0
45000	3120GH453T075DM	GH	0.0089	30.1
73000	3120GN733T075DM	GN	0.0070	40.5

SERIES 3120
Computer Grade Capacitors

STANDARD CAPACITANCE VALUES

Capacitance μF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
85.0 VDC WORKING, 105.0 SURGE				
1400	3120BA142T085AM	BA	0.1017	3.8
1700	3120BB172T085AM	BB	0.0851	4.5
2300	3120BC232T085AM	BC	0.0648	5.5
2900	3120BD292T085AM	BD	0.0528	6.5
3500	3120BE352T085AM	BE	0.0449	7.5
4100	3120BF412T085AM	BF	0.0394	8.4
4700	3120BG472T085AM	BG	0.0353	9.2
5300	3120BH532T085AM	BH	0.0321	10.1
2600	3120DA262T085AM	DA	0.0927	4.6
3100	3120DB312T085AM	DB	0.0783	5.4
4200	3120DC422T085AM	DC	0.0601	6.6
5200	3120DD522T085AM	DD	0.0495	7.7
6300	3120DE632T085AM	DE	0.0423	8.8
7400	3120DF742T085AM	DF	0.0372	9.9
8400	3120DG842T085AM	DG	0.0335	10.9
9500	3120DH952T085AM	DH	0.0307	11.8
2700	3120EA272T085AM	EA	0.0586	6.3
4100	3120EB412T085AM	EB	0.0401	8.3
5400	3120EC542T085AM	EC	0.0312	10.0
100.0 VDC WORKING, 150.0 SURGE				
830	3120BA831T100AM	BA	0.1067	3.7
1000	3120BB102T100AM	BB	0.0896	4.4
1300	3120BC132T100AM	BC	0.0696	5.3
1600	3120BD162T100AM	BD	0.0573	6.2
2000	3120BE202T100AM	BE	0.0478	7.2
2300	3120BF232T100AM	BF	0.0422	8.1
2600	3120BG262T100AM	BG	0.0380	8.9
3000	3120BH302T100AM	BH	0.0342	9.8
1400	3120DA142T100AM	DA	0.0995	4.5
1700	3120DB172T100AM	DB	0.0836	5.3
2300	3120DC232T100AM	DC	0.0640	6.4
2900	3120DD292T100AM	DD	0.0523	7.5
3500	3120DE352T100AM	DE	0.0447	8.6
4100	3120DF412T100AM	DF	0.0393	9.6
4700	3120DG472T100AM	DG	0.0353	10.6
5300	3120DH532T100AM	DH	0.0322	11.5
1500	3120EA152T100AM	EA	0.0640	6.1
2300	3120EB232T100AM	EB	0.0434	7.9
3000	3120EC302T100AM	EC	0.0338	9.6
125.0 VDC WORKING, 150.0 SURGE				
740	3120BA741T125AM	BA	0.1152	3.6
890	3120BB891T125AM	BB	0.0967	4.2
1100	3120BC112T125AM	BC	0.0775	5.1
1400	3120BD142T125AM	BD	0.0625	6.0
1700	3120BE172T125AM	BE	0.0528	6.9
2000	3120BF202T125AM	BF	0.0459	7.7
2300	3120BG232T125AM	BG	0.0409	8.6
2600	3120BH262T125AM	BH	0.0371	9.4
1300	3120DA132T125AM	DA	0.0991	4.5
1500	3120DB152T125AM	DB	0.0846	5.2
2100	3120DC212T125AM	DC	0.0640	6.4
2600	3120DD262T125AM	DD	0.0527	7.5
3100	3120DE312T125AM	DE	0.0451	8.6
3700	3120DF372T125AM	DF	0.0394	9.6
4200	3120DG422T125AM	DG	0.0355	10.6
4700	3120DH472T125AM	DH	0.0325	11.5
1300	3120EA132T125AM	EA	0.0685	5.9
2000	3120EB202T125AM	EB	0.0462	7.7
2700	3120EC272T125AM	EC	0.0354	9.4

Capacitance μF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
85.0 VDC WORKING, 105.0 SURGE				
6800	3120ED682T085AM	ED	0.0257	11.7
8200	3120EE822T085AM	EE	0.0220	13.2
9600	3120EF962T085AM	EF	0.0195	14.8
10000	3120EG103T085AM	EG	0.0181	16.0
12000	3120EH123T085AM	EH	0.0163	17.5
6800	3120FB682T085AM	FB	0.0269	11.7
9100	3120FC912T085AM	FC	0.0209	14.0
11000	3120FD113T085AM	FD	0.0176	16.2
13000	3120FE133T085AM	FE	0.0152	18.2
16000	3120FF163T085AM	FF	0.0134	20.4
18000	3120FG183T085AM	FG	0.0122	22.2
20000	3120FH203T085AM	FH	0.0113	24.0
13000	3120GC133T085AM	GC	0.0216	15.6
16000	3120GD163T085AM	GD	0.0180	18.0
20000	3120GE203T085AM	GE	0.0154	20.3
23000	3120GF233T085AM	GF	0.0138	22.4
27000	3120GG273T085AM	GG	0.0124	24.5
30000	3120GH303T085DM	GH	0.0115	26.5
49000	3120GN493T085DM	GN	0.0087	36.3
100.0 VDC WORKING, 150.0 SURGE				
3800	3120ED382T100AM	ED	0.0277	11.2
4600	3120EE462T100AM	EE	0.0237	12.8
5400	3120EF542T100AM	EF	0.0209	14.3
6100	3120EG612T100AM	EG	0.0189	15.6
6900	3120EH692T100AM	EH	0.0173	17.0
3800	3120FB382T100AM	FB	0.0290	11.2
5100	3120FC512T100AM	FC	0.0224	13.6
6400	3120FD642T100AM	FD	0.0186	15.7
7700	3120FE772T100AM	FE	0.0160	17.8
9000	3120FF902T100AM	FF	0.0142	19.7
10000	3120FG103T100AM	FG	0.0130	21.5
11000	3120FH113T100AM	FH	0.0120	23.2
7600	3120GC762T100AM	GC	0.0225	15.3
9500	3120GD952T100AM	GD	0.0186	17.6
11000	3120GE113T100AM	GE	0.0162	19.8
13000	3120GF133T100AM	GF	0.0144	21.9
15000	3120GG153T100AM	GG	0.0130	24.0
17000	3120GH173T100DM	GH	0.0120	25.9
27000	3120GN273T100DM	GN	0.0090	35.6
125.0 VDC WORKING, 150.0 SURGE				
3400	3120ED342T125AM	ED	0.0290	11.0
4100	3120EE412T125AM	EE	0.0248	12.5
4800	3120EF482T125AM	EF	0.0218	13.9
5500	3120EG552T125AM	EG	0.0196	15.3
6100	3120EH612T125AM	EH	0.0181	16.6
3400	3120FB342T125AM	FB	0.0300	11.0
4500	3120FC452T125AM	FC	0.0233	13.3
5700	3120FD572T125AM	FD	0.0192	15.5
6800	3120FE682T125AM	FE	0.0166	17.5
8000	3120FF802T125AM	FF	0.0147	19.4
9100	3120FG912T125AM	FG	0.0133	21.3
10000	3120FH103T125AM	FH	0.0123	22.9
6700	3120GC672T125AM	GC	0.0226	15.2
8400	3120GD842T125AM	GD	0.0187	17.6
10000	3120GE103T125AM	GE	0.0162	19.8
11000	3120GF113T125AM	GF	0.0146	21.8
13000	3120GG133T125AM	GG	0.0131	23.9
15000	3120GH153T125DM	GH	0.0120	25.9
24000	3120GN243T125DM	GN	0.0091	35.5

STANDARD CAPACITANCE VALUES

150.0 VDC WORKING, 200.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
560	3120BA561T150AM	BA	0.1272	3.4
670	3120BB671T150AM	BB	0.1071	4.0
900	3120BC901T150AM	BC	0.0813	4.9
1100	3120BD112T150AM	BD	0.0672	5.8
1300	3120BE132T150AM	BE	0.0576	6.6
1500	3120BF152T150AM	BF	0.0507	7.4
1800	3120BG182T150AM	BG	0.0439	8.3
2000	3120BH202T150AM	BH	0.0401	9.0
1000	3120DA102T150AM	DA	0.1058	4.3
1200	3120DB122T150AM	DB	0.0891	5.1
1600	3120DC162T150AM	DC	0.0684	6.2
2000	3120DD202T150AM	DD	0.0560	7.3
2400	3120DE242T150AM	DE	0.0478	8.3
2800	3120DF282T150AM	DF	0.0420	9.3
3200	3120DG322T150AM	DG	0.0377	10.2
3600	3120DH362T150AM	DH	0.0344	11.2
1000	3120EA102T150AM	EA	0.0746	5.6
1500	3120EB152T150AM	EB	0.0509	7.3
2000	3120EC202T150AM	EC	0.0391	8.9

150.0 VDC WORKING, 200.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
2600	3120ED262T150AM	ED	0.0315	10.5
3100	3120EE312T150AM	EE	0.0270	12.0
3600	3120EF362T150AM	EF	0.0238	13.3
4100	3120EG412T150AM	EG	0.0214	14.7
4600	3120EH462T150AM	EH	0.0196	16.0
2600	3120FB262T150AM	FB	0.0326	10.6
3400	3120FC342T150AM	FC	0.0255	12.7
4300	3120FD432T150AM	FD	0.0209	14.8
5200	3120FE522T150AM	FE	0.0179	16.8
6000	3120FF602T150AM	FF	0.0159	18.7
6900	3120FG692T150AM	FG	0.0143	20.5
7800	3120FH782T150AM	FH	0.0131	22.2
5100	3120GC512T150AM	GC	0.0240	14.8
6400	3120GD642T150AM	GD	0.0198	17.1
7700	3120GE772T150AM	GE	0.0171	19.3
8900	3120GF892T150AM	GF	0.0152	21.4
10000	3120GG103T150AM	GG	0.0138	23.3
11000	3120GH113U150DM	GH	0.0128	25.1
18000	3120GN183T150DM	GN	0.0095	34.7

200.0 VDC WORKING, 250.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
440	3120BA441T200AM	BA	0.1233	3.4
530	3120BB531T200AM	BB	0.1034	4.1
710	3120BC711T200AM	BC	0.0787	5.0
890	3120BD891T200AM	BD	0.0641	5.9
1000	3120BE102T200AM	BE	0.0567	6.6
1200	3120BF122T200AM	BF	0.0487	7.5
1400	3120BG142T200AM	BG	0.0430	8.4
1600	3120BH162T200AM	BH	0.0387	9.2
790	3120DA791T200AM	DA	0.1032	4.4
950	3120DB951T200AM	DB	0.0869	5.2
1200	3120DC122T200AM	DC	0.0680	6.2
1500	3120DD152T200AM	DD	0.0557	7.3
1900	3120DE192T200AM	DE	0.0467	8.4
2200	3120DF222T200AM	DF	0.0412	9.4
2500	3120DG252T200AM	DG	0.0370	10.3
2800	3120DH282T200AM	DH	0.0338	11.3
820	3120EA821T200AM	EA	0.0707	5.8
1200	3120EB122T200AM	EB	0.0490	7.5
1600	3120EC162T200AM	EC	0.0377	9.1

200.0 VDC WORKING, 250.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
2000	3120ED202T200AM	ED	0.0309	10.6
2400	3120EE242T200AM	EE	0.0265	12.1
2800	3120EF282T200AM	EF	0.0233	13.5
3200	3120EG322T200AM	EG	0.0209	14.9
3700	3120EH372T200AM	EH	0.0189	16.3
2000	3120FB202T200AM	FB	0.0320	10.7
2700	3120FC272T200AM	FC	0.0246	12.9
3400	3120FD342T200AM	FD	0.0203	15.0
4100	3120FE412T200AM	FE	0.0174	17.0
4800	3120FF482T200AM	FF	0.0154	19.0
5500	3120FG552T200AM	FG	0.0139	20.8
6100	3120FH612T200AM	FH	0.0128	22.5
4000	3120GC402T200AM	GC	0.0235	14.9
5000	3120GD502T200AM	GD	0.0195	17.2
6000	3120GE602T200AM	GE	0.0168	19.5
7100	3120GF712T200AM	GF	0.0149	21.6
8100	3120GG812T200AM	GG	0.0135	23.6
9100	3120GH912T200DM	GH	0.0124	25.5
14000	3120GN143T200DM	GN	0.0094	34.9

250.0 VDC WORKING, 300.0 SURGE

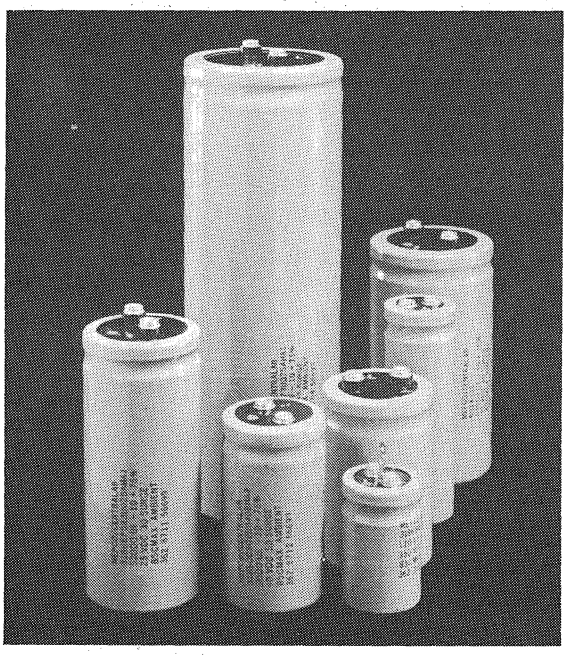
Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
310	3120BA311T250AM	BA	0.1438	3.2
370	3120BB371T250AM	BB	0.1212	3.8
500	3120BC501T250AM	BC	0.0915	4.6
630	3120BD631T250AM	BD	0.0740	5.5
750	3120BE751T250AM	BE	0.0630	6.3
880	3120BF881T250AM	BF	0.0548	7.1
1000	3120BG102T250AM	BG	0.0490	7.8
1100	3120BH112T250AM	BH	0.0450	8.5
560	3120DA561T250AM	DA	0.1153	4.1
670	3120DB671T250AM	DB	0.0972	4.9
900	3120DC901T250AM	DC	0.0742	6.0
1100	3120DD112T250AM	DD	0.0613	7.0
1300	3120DE132T250AM	DE	0.0526	7.9
1500	3120DF152T250AM	DF	0.0463	8.9
1800	3120DG182T250AM	DG	0.0406	9.9
2000	3120DH202T250AM	DH	0.0372	10.7
580	3120EA581T250AM	EA	0.0824	5.3
870	3120EB871T250AM	EB	0.0562	7.0
1100	3120EC112T250AM	EC	0.0445	8.4

250.0 VDC WORKING, 300.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
1400	3120ED142T250AM	ED	0.0360	9.8
1700	3120EE172T250AM	EE	0.0305	11.3
2000	3120EF202T250AM	EF	0.0266	12.6
2300	3120EG232T250AM	EG	0.0237	13.9
2600	3120EH262T250AM	EH	0.0216	15.2
1400	3120FB142T250AM	FB	0.0371	9.9
1900	3120FC192T250AM	FC	0.0283	12.1
2400	3120FD242T250AM	FD	0.0232	14.1
2900	3120FE292T250AM	FE	0.0198	16.0
3400	3120FF342T250AM	FF	0.0174	17.8
3900	3120FG392T250AM	FG	0.0157	19.6
4400	3120FH442T250AM	FH	0.0143	21.3
2800	3120GC282T250AM	GC	0.0261	14.2
3600	3120GD362T250AM	GD	0.0213	16.5
4300	3120GE432T250AM	GE	0.0183	18.6
5000	3120GF502T250AM	GF	0.0162	20.7
5700	3120GG572T250AM	GG	0.0147	22.6
6400	3120GH642T250DM	GH	0.0135	24.4
10000	3120GN103T250DM	GN	0.0100	33.8

SERIES 3186
Computer Grade Capacitors

Computer-Grade Aluminum Electrolytic Capacitors



DESCRIPTION:

Mepco/Centralab's Series 3186 Computer-Grade Aluminum Electrolytic Capacitors are designed for use in the most demanding data-system and industrial-control applications. They provide the highest attainable reliability in this class of capacitors, with generous safety margins insured by computer designing and painstaking manufacturing control.

This family of capacitors offers the widest range of capacity/voltage combinations ever offered in heavy-duty computer-grade electrolytics. Combined with 38 standard case sizes and five terminal options, the Series 3186 Capacitors can provide a suitable standard product for nearly every application. In addition, the ripple-current ratings for these units meet or exceed all industry requirements for similar products. These capacitors are suitable for all applications where long life at high operating temperatures without derating is required in a standard computer-grade product.

FEATURES:

- 1000 Hours Operating Life at 85°C with ripple.
- Highest Capacitance per case size.
- Meets or exceeds all requirements for EIA-RS395 for type II capacitors.
- Computer-designed for optimum performance.
- Three Standard Insulation Thicknesses.
- 38 Standard Case Sizes.
- Pressure-Sensitive Safety Vent.

DIMENSIONS

Case Code	UNINSULATED CASE DIMENSIONS					
	Dimensions in Inches			Dimensions in Millimeters		
	D	L	S	D	L	S
BA	1.375	2.125	.500	34.92	53.97	12.70
BB	1.375	2.625	.500	34.92	66.67	12.70
BC	1.375	3.125	.500	34.92	79.37	12.70
BD	1.375	3.625	.500	34.92	92.07	12.70
BE	1.375	4.125	.500	34.92	104.77	12.70
BF	1.375	4.625	.500	34.92	117.47	12.70
BG	1.375	5.125	.500	34.92	130.17	12.70
BH	1.375	5.625	.500	34.92	142.87	12.70
DA	1.750	2.125	.750	44.45	53.97	19.05
DB	1.750	2.625	.750	44.45	66.67	19.05
DC	1.750	3.125	.750	44.45	79.37	19.05
DD	1.750	3.625	.750	44.45	92.07	19.05
DE	1.750	4.125	.750	44.45	104.77	19.05
DF	1.750	4.625	.750	44.45	117.47	19.05
DG	1.750	5.125	.750	44.45	130.17	19.05
DH	1.750	5.625	.750	44.45	142.87	19.05
EA	2.000	2.125	.875	50.80	53.97	22.22
EB	2.000	2.625	.875	50.80	66.67	22.22
EC	2.000	3.125	.875	50.80	79.37	22.22
ED	2.000	3.625	.875	50.80	92.07	22.22
EE	2.000	4.125	.875	50.80	104.77	22.22
EF	2.000	4.625	.875	50.80	117.47	22.22
EG	2.000	5.125	.875	50.80	130.17	22.22
EH	2.000	5.625	.875	50.80	142.87	22.22
FB	2.500	2.625	1.125	63.50	66.67	28.57
FC	2.500	3.125	1.125	63.50	79.37	28.57
FD	2.500	3.625	1.125	63.50	92.07	28.57
FE	2.500	4.125	1.125	63.50	104.77	28.57
FF	2.500	4.625	1.125	63.50	117.47	28.57
FG	2.500	5.125	1.125	63.50	130.17	28.57
FH	2.500	5.625	1.125	63.50	142.87	28.57
GC	3.000	3.125	1.250	76.20	79.37	31.75
GD	3.000	3.625	1.250	76.20	92.07	31.75
GE	3.000	4.125	1.250	76.20	104.77	31.75
GF	3.000	4.625	1.250	76.20	117.47	31.75
GG	3.000	5.125	1.250	76.20	130.17	31.75
GH	3.000	5.625	1.250	76.20	142.87	31.75
GN	3.000	8.625	1.250	76.20	219.07	31.75

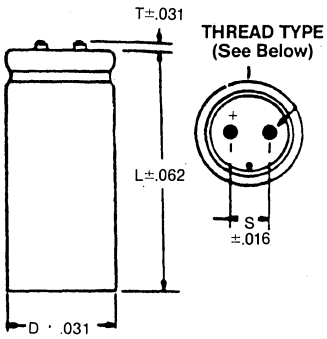
PC MOUNT OVERALL HEIGHT (INCHES)

Case Length	H		
	D = 1.375	D = 1.750	D = 2.000
2.125	2.26	2.31	2.31
2.625	2.76	2.81	2.81
3.125	3.26	3.31	3.31
3.625	3.76	3.81	3.81
4.125	4.26	4.31	4.31
4.625	4.76	4.81	4.81
5.125	5.26	5.31	5.31
5.625	5.76	5.81	5.81

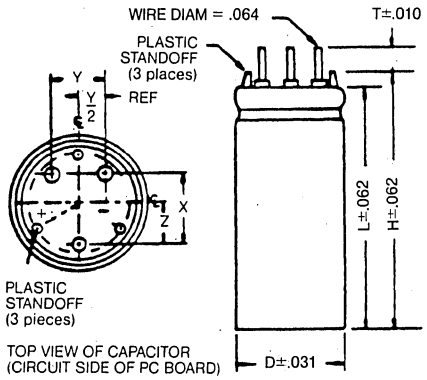
PC MOUNT TERMINAL SPACING (INCHES)

Case Diameter	X	Y	Z
1.375	.550	.600	.375
1.750	.900	.700	.525
2.000	1.000	.800	.575

CASE OUTLINE DRAWING



CASE OUTLINE DRAWING
PRINTED CIRCUIT BOARD MOUNT



INSULATED CASE DIMENSION ADDER AND BRACKET CODES

INSULATION TYPE	INCHES			MM			BRACKET CODE	
	D	L	H	D	L	H	without	with
.004 inch Polymeric	.010	.015	.010	.25	.38	.25	M	L
.008 inch Polymeric	.020	.032	.024	.508	.813	.61	P	R
.012 inch Polymeric	.025	.062	.045	.63	1.58	1.14	H	J
Uninsulated	–	–	–	–	–	–	N	X

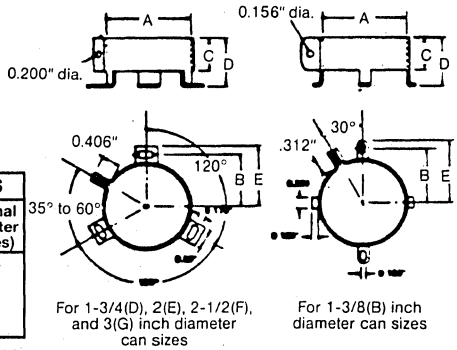
The capacitors are marked with:
- nominal capacitance
- rated voltage
- EIA source and date code
- maximum ambient temperature
- polarity
- name of manufacturer
- part number
- capacitance tolerance

BRACKET DIMENSIONS

Case Diameters	Dimensions in Inches				
	A ±0.005	B ±0.031	C ±0.016	D ±0.031	E ±0.031
1.375	1.375	0.906	0.562	0.750	1.156
1.750	1.750	1.125	0.750	1.125	1.313
2.000	2.000	1.250	0.750	1.125	1.438
2.500	2.500	1.500	0.750	1.125	1.688
3.000	3.000	1.750	0.750	1.125	1.938
Case Diameters	**Dimension in Millimeters**				
	A ±0.13	**B ±0.79**	**C ±0.40**	**D ±0.79**	**E ±0.79**
34.92	34.92	23.01	14.25	19.05	29.36
44.45	44.45	28.57	19.05	28.57	33.35
50.80	50.80	31.75	19.05	28.57	36.51
63.50	63.50	38.10	19.05	28.57	42.87
76.20	76.20	44.45	19.05	28.57	49.22

Note: All brackets are zinc/iridite plated.

BRACKET OUTLINE DRAWING



TERMINAL STYLES, DIMENSIONS, AND CODES

Terminal Style	T (inches)	T (mm)	Code	Thread Type	Terminal Diameter (inches)
High Post	.250	6.4	A	10-32	.313
Low Post	.063	1.6	B	10-32	.313
High Current*	.125	3.2	D	16-28	.687
Solder Lug	.468	11.9	C	N/A	N/A
PC Mount	.250	8.6	H	N/A	N/A

*Available in 2½" and 3" diameter cans only. Recommended for applications where ripple current exceeds 30 Amperes.

HOW TO SPECIFY

Mepco/Centralab Series 3186 capacitors can be completely specified using the following designation:

3186 — **Mepco/Centralab Product Series**

BA — **Case Size Code**

942 — **Capacitance**
XX = Significant Digits
X = Multiplier
i.e. 942 = 9400μF

U — **Tolerance**
U = −10%+75%
T = −10%+50%

005 — **Voltage**
005 = 5VDC
050 = 50VDC

A — **Terminal Style**
A=High Post
B=Low Post
C=Solder Lug
D=High Current
H=PC Mount

M — **Insulation & Bracket Code** (see physical spec)

A-1 — **Factory Assigned Number**

SERIES 3186
Computer Grade Capacitors

PERFORMANCE SPECIFICATIONS

1. TEMPERATURE.
1.1 OPERATING. These capacitors are designed to operate within the temperature range of −40°C to +85°C.

1.2 STORAGE. These capacitors may be subjected, without permanent damage, to conditions in transit where temperatures range from −55°C to +85°C at altitudes up to 80,000 feet.

1.3 TOLERANCE. Unless otherwise specified, temperature tolerance shall be ±3°C.

2. DC WORKING VOLTAGE. The dc working voltage is the maximum operating voltage for continuous operation at maximum rated temperature.

3. SURGE VOLTAGE. The surge voltage is the maximum non-recurrent voltage to which the capacitor should be subjected.

3.1 The surge voltage shall not exceed the value specified in the rating table.

3.2 SURGE TEST

3.2.1 Capacitors shall be connected in series with a resistor. The value of the resistor is:

CAPACITANCE (μF)	RESISTOR (ohms)
0-2500	1000
2501-25000	100
25001-250000	10
250001-UP	3

The series combination is then subjected to rated surge voltage for 30 seconds at room temperature and the capacitor allowed to discharge thru the resistor. This sequence is repeated 6 times per hour at 10 minute intervals for 24 hours.

3.2.2 Leakage current when measured per paragraph 6.2, not sooner than four (4) hours after completion of the test, shall not exceed the initial leakage current limit. There shall be no leaking of electrolyte and no mechanical damage.

4. CAPACITANCE. Capacitance shall be measured on a capacitance bridge having a maximum rms signal voltage of 1 volt at 120 Hz. Capacitance shall be within these specified tolerances when measured at 25°C.

WVDC	TOLERANCE
≤100	−10%, +75%
101-450	−10%, +50%

5. EQUIVALENT SERIES RESISTANCE (ESR) Measurement shall be made by the bridge method at 120 Hz and 25°C. The equivalent series resistance shall not exceed the value shown in the rating table.

6. DC LEAKAGE CURRENT.
6.1 PRE-CONDITIONING. In the period 24 to 48 hours prior to test, rated working voltage shall be applied to the capacitor for a minimum of 30 minutes.

6.2 MEASUREMENT. Measurement shall be made at 25°C ±5°C. Voltage shall be applied to the capacitor thru a current limiting resistor. The leakage current shall be measured 5 minutes after the capacitor reaches rated voltage. Leakage current shall not exceed the value calculated as shown: $I_L = .006\sqrt{CV}$

C—Rated Capacitance (μf)
V—Rated Voltage (volts)
I_L—Leakage Current (mA)

6.2.1 In no case, however, shall the dc leakage current limit exceed 6.0 mA.

7. LIFE TESTS.
7.1 Capacitors shall be placed in a circulating air oven at an ambient temperature of 85°C. Spacing between capacitors must be at least 1" and capacitors must not be subjected to direct radiation from heating elements. Circulation of air shall be sufficient to keep the temperature within six (6) inches of the capacitor below 88°C.

7.1.1 Rated DC voltage shall be applied to the capacitors for a period of 2000 ± 8 hours. Following this test the capacitors shall meet the requirements of paragraph 7.2.

7.1.2 Alternate life test: Rated voltage and rated ripple current shall be applied for a period of 1000 ± 8 hours. Following this test the capacitors shall meet the requirements of paragraph 7.2.

7.2 Upon completion of the life test, the capacitors shall be returned to room ambient for a minimum of 24 hours. The capacitors shall then meet the following requirements:

7.2.1 Capacitance, when measured per paragraph 4., shall not be less than 90% of the initial measured value.

PERFORMANCE SPECIFICATIONS

7.2.2 The equivalent series resistance, when measured per paragraph 5., shall not be greater than 175% of the initial measured value.

7.2.3 The leakage current, when measured and determined per paragraph 6.2, shall not exceed the initial specification limit.

7.2.4 There shall be no evidence of mechanical damage or excessive electrolyte leakage.

8. SHELF TEST. Capacitors shall be placed in a circulating air oven at 85°C for a period of 100 ± 4 hours with no voltage applied. The units shall then be allowed to cool in an ambient of 25°C for a minimum of 16 hours.

8.1 The capacitance and equivalent series resistance shall meet initial specifications.

8.2 The leakage current when measured per paragraph 6.2 shall not exceed 200% of the initial specification.

9. VIBRATION. Capacitors shall be clamped rigidly to a vibration platform and subjected to a simple harmonic motion having a maximum peak-to-peak amplitude of .06 inches and a maximum acceleration of 10g. The frequency of vibration shall be varied linearly between 10 and 55 cycles per second. The entire frequency range, 10 to 55 to 10 cps, shall be traversed in one minute. Capacitors shall be vibrated for 1½ hours with the direction of motion being parallel to the axis of the capacitor. The capacitors shall then be placed so that the direction of motion is perpendicular to the axis and the vibration continued for 1½ hours. During the last ½ hour of the test, the capacitor shall be connected to a bridge and observed for a 3 minute period. A capacitor failing the vibration test is defined as one failing to meet the requirements of paragraph 9.1.

9.1 There shall be no evidence of loosening of the capacitor element within the container, when shaken by hand following the test. There shall be no indication of intermittent contact during the 3 minute observation period. Capacitors shall not be open or shorted.

10. CONTAINER SEAL. Following the vibration test each capacitor shall be tested for seal tightness in accordance with paragraphs 10.1 and 10.2.

10.1 Capacitors shall be subjected to two successive temperature cycles in circulating air as follows:

ONE TEMPERATURE CYCLE

A. 85°C-30 min.
B. 25°C-30 min.
C. −40°C-30 min.
D. 25°C-30 min.

10.2 Following the second cycle, the capacitors shall be placed in 90-95°C water for 5 minutes. A failure is defined as a unit exhibiting a continuous chain of bubbles when immersed.

11. LOW-TEMPERATURE PERFORMANCE

When measured at the temperature indicated in Table and at a frequency of 120 Hz the typical capacitance of these capacitors shall be the percentages of the 25 degrees C capacitance and the typical impedance shall be the value when multiplied as shown.

TEMPERATURE −40 DEGREES C

RATED DC VOLTAGE	% of 25°C CAPACITANCE	25°C IMPEDANCE MULTIPLIER
0-9	35	6.0
10-75	55	5.0
76-250	70	2.75

TEMPERATURE −25 DEGREES C

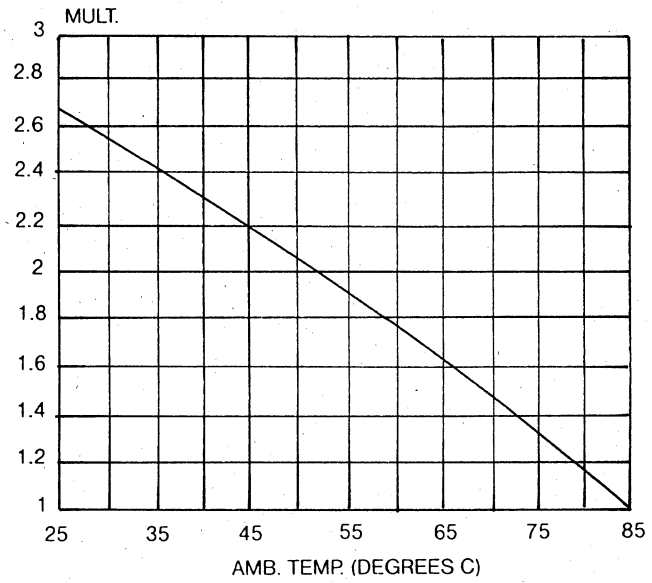
RATED DC VOLTAGE	% of 25°C CAPACITANCE	25°C IMPEDANCE MULTIPLIER
251-400	70	3.00

12. RIPPLE CURRENT. Capacitors will withstand the 85°C rms ripple current stated in the rating tables for the duration of the life test as specified in paragraph 7 of the Performance Specifications. Any reduction in ambient temperature and/or ripple current will extend the operating life of the capacitor. See application guidelines for method for determining extended life at derated conditions.

12.1. Ripple Current values are specified at an ambient temperature of 85°C and a frequency of 120 Hz. Ripple current (I_R) at other frequencies and temperatures can be calculated.

$$I_R = I_{85} \cdot \text{RIPPLE MULTIPLIER}$$

RIPPLE MULTIPLIER
95 DEGREE CORE



12.2 For ripple currents at other frequencies, see application guidelines.

STANDARD CAPACITANCE VALUES

6.5 VDC WORKING, 9.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
46000	3186BA463U6P5AM	BA	0.0270	5.2
55000	3186BB553U6P5AM	BB	0.0234	6.1
73000	3186BC733U6P5AM	BC	0.0188	7.2
92000	3186BD923U6P5AM	BD	0.0162	8.3
110000	3186BE114U6P5AM	BE	0.0145	9.3
120000	3186BF124U6P5AM	BF	0.0133	10.2
140000	3186BG144U6P5AM	BG	0.0125	11.0
160000	3186BH164U6P5AM	BH	0.0118	11.8
85000	3186DA853U6P5AM	DA	0.0141	8.4
100000	3186DB104U6P5AM	DB	0.0124	9.7
130000	3186DC134U6P5AM	DC	0.0102	11.4
170000	3186DD174U6P5AM	DD	0.0088	13.0
200000	3186DE204U6P5AM	DE	0.0080	14.3
230000	3186DF234U6P5AM	DF	0.0074	15.6
270000	3186DG274U6P5AM	DG	0.0070	16.8
300000	3186DH304U6P5AM	DH	0.0067	17.9
110000	3186EA114U6P5AM	EA	0.0154	8.7
130000	3186EB134U6P5AM	EB	0.0134	10.1
180000	3186EC184U6P5AM	EC	0.0109	11.9

6.5 VDC WORKING, 9.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
230000	3186ED234U6P5AM	ED	0.0095	13.6
270000	3186EE274U6P5AM	EE	0.0085	15.1
320000	3186EF324U6P5AM	EF	0.0079	16.4
360000	3186EG364U6P5AM	EG	0.0074	17.6
410000	3186EH414U6P5AM	EH	0.0071	18.8
230000	3186FB234U6P5AM	FB	0.0159	10.7
300000	3186FC304U6P5AM	FC	0.0129	12.6
380000	3186FD384U6P5AM	FD	0.0110	14.4
460000	3186FE464U6P5AM	FE	0.0099	16.0
530000	3186FF534U6P5AM	FF	0.0091	17.5
610000	3186FG614U6P5AM	FG	0.0085	18.9
690000	3186FH694U6P5AM	FH	0.0080	20.1
450000	3186GC454U6P5AM	GC	0.0091	17.0
560000	3186GD564U6P5AM	GD	0.0079	19.2
680000	3186GE684U6P5AM	GE	0.0071	21.2
790000	3186GF794U6P5AM	GF	0.0065	23.0
900000	3186GG904U6P5AM	GG	0.0062	24.7
1000000	3186GH105U6P5AM	GH	0.0059	26.2

7.5 VDC WORKING, 9.0 SURGE

41000	3186BA413U7P5AM	BA	0.0272	5.2
50000	3186BB503U7P5AM	BB	0.0235	6.0
66000	3186BC663U7P5AM	BC	0.0190	7.2
83000	3186BD833U7P5AM	BD	0.0163	8.3
100000	3186BE104U7P5AM	BE	0.0145	9.3
110000	3186BF114U7P5AM	BF	0.0134	10.1
130000	3186BG134U7P5AM	BG	0.0125	11.0
150000	3186BH154U7P5AM	BH	0.0119	11.7
77000	3186DA773U7P5AM	DA	0.0142	8.3
92000	3186DB923U7P5AM	DB	0.0124	9.6
120000	3186DC124U7P5AM	DC	0.0102	11.4
150000	3186DD154U7P5AM	DD	0.0089	12.9
180000	3186DE184U7P5AM	DE	0.0081	14.3
210000	3186DF214U7P5AM	DF	0.0075	15.6
240000	3186DG244U7P5AM	DG	0.0071	16.7
270000	3186DH274U7P5AM	DH	0.0068	17.8
100000	3186EA104U7P5AM	EA	0.0155	8.7
120000	3186EB124U7P5AM	EB	0.0135	10.1
160000	3186EC164U7P5AM	EC	0.0110	11.9

7.5 VDC WORKING, 9.0 SURGE

200000	3186ED204U7P5AM	ED	0.0095	13.5
250000	3186EE254U7P5AM	EE	0.0086	15.0
290000	3186EF294U7P5AM	EF	0.0079	16.4
330000	3186EG334U7P5AM	EG	0.0074	17.6
370000	3186EH374U7P5AM	EH	0.0071	18.8
200000	3186FB204U7P5AM	FB	0.0163	10.6
270000	3186FC274U7P5AM	FC	0.0131	12.5
340000	3186FD344U7P5AM	FD	0.0113	14.3
410000	3186FE414U7P5AM	FE	0.0100	15.9
480000	3186FF484U7P5AM	FF	0.0092	17.4
550000	3186FG554U7P5AM	FG	0.0086	18.7
620000	3186FH624U7P5AM	FH	0.0081	20.0
410000	3186GC414U7P5AM	GC	0.0092	16.8
510000	3186GD514U7P5AM	GD	0.0080	19.0
610000	3186GE614U7P5AM	GE	0.0072	21.0
710000	3186GF714U7P5AM	GF	0.0066	22.8
820000	3186GG824U7P5AM	GG	0.0062	24.5
920000	3186GH924U7P5AM	GH	0.0059	26.1

10.0 VDC WORKING, 12.0 SURGE

35000	3186BA353U010AM	BA	0.0274	5.2
42000	3186BB423U010AM	BB	0.0237	6.0
57000	3186BC573U010AM	BC	0.0191	7.2
71000	3186BD713U010AM	BD	0.0164	8.3
85000	3186BE853U010AM	BE	0.0146	9.2
100000	3186BF104U010AM	BF	0.0134	10.1
110000	3186BG114U010AM	BG	0.0126	10.9
120000	3186BH124U010AM	BH	0.0120	11.7
65000	3186DA653U010AM	DA	0.0143	8.3
79000	3186DB793U010AM	DB	0.0125	9.6
100000	3186DC104U010AM	DC	0.0103	11.3
130000	3186DD134U010AM	DD	0.0089	12.9
150000	3186DE154U010AM	DE	0.0081	14.3
180000	3186DF184U010AM	DF	0.0075	15.5
210000	3186DG214U010AM	DG	0.0071	16.7
230000	3186DH234U010AM	DH	0.0068	17.8
89000	3186EA893U010AM	EA	0.0156	8.7
100000	3186EB104U010AM	EB	0.0137	10.0
140000	3186EC144U010AM	EC	0.0111	11.8

10.0 VDC WORKING, 12.0 SURGE

170000	3186ED174U010AM	ED	0.0096	13.5
210000	3186EE214U010AM	EE	0.0086	15.0
250000	3186EF254U010AM	EF	0.0080	16.3
280000	3186EG284U010AM	EG	0.0075	17.6
320000	3186EH324U010AM	EH	0.0071	18.7
170000	3186FB174U010AM	FB	0.0168	10.4
230000	3186FC234U010AM	FC	0.0135	12.4
290000	3186FD294U010AM	FD	0.0115	14.1
350000	3186FE354U010AM	FE	0.0103	15.7
410000	3186FF414U010AM	FF	0.0094	17.2
470000	3186FG474U010AM	FG	0.0087	18.5
530000	3186FH534U010AM	FH	0.0083	19.8
350000	3186GC354U010AM	GC	0.0094	16.7
430000	3186GD434U010AM	GD	0.0082	18.8
520000	3186GE524U010AM	GE	0.0073	20.8
610000	3186GF614U010AM	GF	0.0068	22.6
700000	3186GG704U010AM	GG	0.0063	24.3
790000	3186GH794U010AM	GH	0.0060	25.9

SERIES 3186
Computer Grade Capacitors

STANDARD CAPACITANCE VALUES

15.0 VDC WORKING, 18.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
27000	3186BA273U015AM	BA	0.0278	5.1
32000	3186BB323U015AM	BB	0.0241	6.0
43000	3186BC433U015AM	BC	0.0193	7.1
54000	3186BD543U015AM	BD	0.0166	8.2
64000	3186BE643U015AM	BE	0.0148	9.2
75000	3186BF753U015AM	BF	0.0136	10.1
86000	3186BG863U015AM	BG	0.0127	10.9
97000	3186BH973U015AM	BH	0.0120	11.7
49000	3186DA493U015AM	DA	0.0146	8.2
59000	3186DB593U015AM	DB	0.0127	9.5
79000	3186DC793U015AM	DC	0.0104	11.3
99000	3186DD993U015AM	DD	0.0091	12.8
110000	3186DE114U015AM	DE	0.0082	14.2
130000	3186DF134U015AM	DF	0.0076	15.4
150000	3186DG154U015AM	DG	0.0072	16.6
170000	3186DH174U015AM	DH	0.0069	17.7
67000	3186EA673U015AM	EA	0.0159	8.6
81000	3186EB813U015AM	EB	0.0138	10.0
100000	3186EC104U015AM	EC	0.0113	11.7

15.0 VDC WORKING, 18.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
130000	3186ED134U015AM	ED	0.0097	13.4
160000	3186EE164U015AM	EE	0.0087	14.9
180000	3186EF184U015AM	EF	0.0081	16.2
210000	3186EG214U015AM	EG	0.0076	17.5
240000	3186EH244U015AM	EH	0.0072	18.6
130000	3186FB134U015AM	FB	0.0174	10.2
180000	3186FC184U015AM	FC	0.0139	12.2
220000	3186FD224U015AM	FD	0.0119	13.9
270000	3186FE274U015AM	FE	0.0106	15.5
310000	3186FF314U015AM	FF	0.0097	16.9
360000	3186FG364U015AM	FG	0.0090	18.3
400000	3186FH404U015AM	FH	0.0085	19.5
260000	3186GC264U015AM	GC	0.0098	16.4
330000	3186GD334U015AM	GD	0.0084	18.5
390000	3186GE394U015AM	GE	0.0076	20.5
460000	3186GF464U015AM	GF	0.0070	22.3
530000	3186GG534U015AM	GG	0.0065	24.0
590000	3186GH594U015AM	GH	0.0062	25.5
650000	3186GN654U015AM	GN	0.0052	30.0

20.0 VDC WORKING, 24.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
23000	3186BA233U020AM	BA	0.0281	5.1
27000	3186BB273U020AM	BB	0.0243	5.9
36000	3186BC363U020AM	BC	0.0195	7.1
46000	3186BD463U020AM	BD	0.0167	8.2
55000	3186BE553U020AM	BE	0.0149	9.2
64000	3186BF643U020AM	BF	0.0137	10.0
73000	3186BG733U020AM	BG	0.0128	10.9
82000	3186BH823U020AM	BH	0.0121	11.6
42000	3186DA423U020AM	DA	0.0147	8.2
50000	3186DB503U020AM	DB	0.0128	9.5
67000	3186DC673U020AM	DC	0.0105	11.2
84000	3186DD843U020AM	DD	0.0091	12.8
100000	3186DE104U020AM	DE	0.0082	14.1
110000	3186DF114U020AM	DF	0.0077	15.4
130000	3186DG134U020AM	DG	0.0072	16.6
150000	3186DH154U020AM	DH	0.0069	17.7
57000	3186EA573U020AM	EA	0.0160	8.6
69000	3186EB693U020AM	EB	0.0139	9.9
92000	3186EC923U020AM	EC	0.0113	11.7

20.0 VDC WORKING, 24.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
110000	3186ED114U020AM	ED	0.0098	13.3
130000	3186EE134U020AM	EE	0.0088	14.8
160000	3186EF164U020AM	EF	0.0081	16.2
180000	3186EG184U020AM	EG	0.0076	17.4
200000	3186EH204U020AM	EH	0.0072	18.6
110000	3186FB114U020AM	FB	0.0177	10.1
150000	3186FC154U020AM	FC	0.0142	12.1
190000	3186FD194U020AM	FD	0.0121	13.8
230000	3186FE234U020AM	FE	0.0107	15.4
260000	3186FF264U020AM	FF	0.0098	16.8
300000	3186FG304U020AM	FG	0.0091	18.1
340000	3186FH344U020AM	FH	0.0086	19.4
220000	3186GC224U020AM	GC	0.0099	16.2
280000	3186GD284U020AM	GD	0.0085	18.4
330000	3186GE334U020AM	GE	0.0077	20.4
390000	3186GF394U020AM	GF	0.0070	22.2
450000	3186GG454U020AM	GG	0.0066	23.9
500000	3186GH504U020AM	GH	0.0062	25.4
650000	3186GN654U020AM	GN	0.0054	30.0

25.0 VDC WORKING, 30.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
13000	3186BA133U025AM	BA	0.0436	4.1
16000	3186BB163U025AM	BB	0.0371	4.8
22000	3186BC223U025AM	BC	0.0290	5.8
27000	3186BD273U025AM	BD	0.0244	6.8
33000	3186BE333U025AM	BE	0.0213	7.7
38000	3186BF383U025AM	BF	0.0191	8.5
44000	3186BG443U025AM	BG	0.0175	9.3
49000	3186BH493U025AM	BH	0.0164	10.0
25000	3186DA253U025AM	DA	0.0217	6.8
30000	3186DB303U025AM	DB	0.0186	7.9
40000	3186DC403U025AM	DC	0.0148	9.4
50000	3186DD503U025AM	DD	0.0126	10.8
61000	3186DE613U025AM	DE	0.0111	12.2
71000	3186DF713U025AM	DF	0.0101	13.4
81000	3186DG813U025AM	DG	0.0094	14.5
91000	3186DH913U025AM	DH	0.0088	15.6
34000	3186EA343U025AM	EA	0.0254	6.8
41000	3186EB413U025AM	EB	0.0217	7.9
55000	3186EC553U025AM	EC	0.0172	9.5

25.0 VDC WORKING, 30.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
68000	3186ED683U025AM	ED	0.0145	11.0
82000	3186EE823U025AM	EE	0.0127	12.3
96000	3186EF963U025AM	EF	0.0114	13.6
110000	3186EG114U025AM	EG	0.0105	14.8
120000	3186EH124U025AM	EH	0.0099	15.9
68000	3186FB683U025AM	FB	0.0297	7.8
91000	3186FC913U025AM	FC	0.0232	9.4
110000	3186FD114U025AM	FD	0.0194	10.9
130000	3186FE134U025AM	FE	0.0169	12.3
160000	3186FF164U025AM	FF	0.0150	13.6
180000	3186FG184U025AM	FG	0.0136	14.8
200000	3186FH204U025AM	FH	0.0126	16.0
130000	3186GC134U025AM	GC	0.0159	12.8
160000	3186GD164U025AM	GD	0.0134	14.7
200000	3186GE204U025AM	GE	0.0116	16.5
230000	3186GF234U025AM	GF	0.0104	18.2
270000	3186GG274U025AM	GG	0.0095	19.8
300000	3186GH304U025AM	GH	0.0089	21.3
480000	3186GN484U025AM	GN	0.0070	28.6

STANDARD CAPACITANCE VALUES

30.0 VDC WORKING, 40.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
11000	3186BA113U030AM	BA	0.0440	4.1
14000	3186BB143U030AM	BB	0.0374	4.8
19000	3186BC193U030AM	BC	0.0293	5.8
23000	3186BD233U030AM	BD	0.0246	6.7
28000	3186BE283U030AM	BE	0.0215	7.6
33000	3186BF333U030AM	BF	0.0193	8.5
38000	3186BG383U030AM	BG	0.0177	9.2
43000	3186BH433U030AM	BH	0.0165	10.0
21000	3186DA213U030AM	DA	0.0645	3.9
26000	3186DB263U030AM	DB	0.0545	4.6
35000	3186DC353U030AM	DC	0.0423	5.6
43000	3186DD433U030AM	DD	0.0351	6.5
52000	3186DE523U030AM	DE	0.0303	7.4
61000	3186DF613U030AM	DF	0.0269	8.2
70000	3186DG703U030AM	DG	0.0244	9.0
79000	3186DH793U030AM	DH	0.0225	9.8
29000	3186EA293U030AM	EA	0.0776	3.9
35000	3186EB353U030AM	EB	0.0655	4.6
47000	3186EC473U030AM	EC	0.0505	5.5

30.0 VDC WORKING, 40.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
59000	3186ED593U030AM	ED	0.0416	6.5
71000	3186EE713U030AM	EE	0.0357	7.4
83000	3186EF833U030AM	EF	0.0315	8.2
95000	3186EG953U030AM	EG	0.0285	9.0
100000	3186EH104U030AM	EH	0.0264	9.7
59000	3186FB593U030AM	FB	0.0302	7.8
79000	3186FC793U030AM	FC	0.0236	9.4
98000	3186FD983U030AM	FD	0.0196	10.8
110000	3186FE114U030AM	FE	0.0171	12.2
130000	3186FF134U030AM	FF	0.0153	13.5
150000	3186FG154U030AM	FG	0.0139	14.7
170000	3186FH174U030AM	FH	0.0128	15.9
110000	3186GC114U030AM	GC	0.0287	9.5
140000	3186GD144U030AM	GD	0.0237	11.1
170000	3186GE174U030AM	GE	0.0204	12.5
200000	3186GF204U030AM	GF	0.0180	13.9
230000	3186GG234U030AM	GG	0.0163	15.2
260000	3186GH264U030AM	GH	0.0150	16.4
420000	3186GN424U030AM	GN	0.0113	22.6

35.0 VDC WORKING, 45.0 SURGE

52000	3186ED523U035AM	ED	0.0424	6.4
62000	3186EE623U035AM	EE	0.0364	7.3
73000	3186EF733U035AM	EF	0.0321	8.1
83000	3186EG833U035AM	EG	0.0290	8.9
94000	3186EH943U035AM	EH	0.0266	9.7
52000	3186FB523U035AM	FB	0.0306	7.7
69000	3186FC693U035AM	FC	0.0239	9.3
87000	3186FD873U035AM	FD	0.0199	10.8
100000	3186FE104U035AM	FE	0.0173	12.1
120000	3186FF124U035AM	FF	0.0154	13.4
130000	3186FG134U035AM	FG	0.0140	14.6
150000	3186FH154U035AM	FH	0.0130	15.8
100000	3186GC104U035AM	GC	0.0294	9.4
120000	3186GD124U035AM	GD	0.0246	10.9
150000	3186GE154U035AM	GE	0.0210	12.3
170000	3186GF174U035AM	GF	0.0187	13.6
200000	3186GG204U035AM	GG	0.0168	14.9
230000	3186GH234U035AM	GH	0.0154	16.2
370000	3186GN374U035AM	GN	0.0115	22.3

35.0 VDC WORKING, 45.0 SURGE

10000	3186BA103U035AM	BA	0.0443	4.1
12000	3186BB123U035AM	BB	0.0378	4.8
16000	3186BC163U035AM	BC	0.0296	5.8
21000	3186BD213U035AM	BD	0.0247	6.7
25000	3186BE253U035AM	BE	0.0216	7.6
29000	3186BF293U035AM	BF	0.0194	8.4
33000	3186BG333U035AM	BG	0.0178	9.2
37000	3186BH373U035AM	BH	0.0166	9.9
19000	3186DA193U035AM	DA	0.0650	3.9
23000	3186DB233U035AM	DB	0.0551	4.6
30000	3186DC303U035AM	DC	0.0428	5.6
38000	3186DD383U035AM	DD	0.0354	6.5
46000	3186DE463U035AM	DE	0.0306	7.3
54000	3186DF543U035AM	DF	0.0271	8.2
61000	3186DG613U035AM	DG	0.0246	9.0
69000	3186DH693U035AM	DH	0.0227	9.7
26000	3186EA263U035AM	EA	0.0790	3.9
31000	3186EB313U035AM	EB	0.0668	4.5
41000	3186EC413U035AM	EC	0.0516	5.5

40.0 VDC WORKING, 50.0 SURGE

44000	3186ED443U040AM	ED	0.0434	6.3
53000	3186EE533U040AM	EE	0.0372	7.2
62000	3186EF623U040AM	EF	0.0328	8.0
71000	3186EG713U040AM	EG	0.0296	8.8
80000	3186EH803U040AM	EH	0.0271	9.6
44000	3186FB443U040AM	FB	0.0310	7.7
59000	3186FC593U040AM	FC	0.0242	9.2
74000	3186FD743U040AM	FD	0.0201	10.7
89000	3186FE893U040AM	FE	0.0174	12.1
100000	3186FF104U040AM	FF	0.0156	13.3
110000	3186FG114U040AM	FG	0.0142	14.5
130000	3186FH134U040AM	FH	0.0131	15.7
87000	3186GC873U040AM	GC	0.0304	9.3
100000	3186GD104U040AM	GD	0.0255	10.7
130000	3186GE134U040AM	GE	0.0216	12.1
150000	3186GF154U040AM	GF	0.0192	13.4
170000	3186GG174U040AM	GG	0.0174	14.7
190000	3186GH194U040AM	GH	0.0160	15.9
310000	3186GN314U040AM	GN	0.0118	22.0

40.0 VDC WORKING, 50.0 SURGE

9000	3186BA902U040AM	BA	0.0446	4.0
10000	3186BB103U040AM	BB	0.0383	4.7
14000	3186BC143U040AM	BC	0.0299	5.8
18000	3186BD183U040AM	BD	0.0250	6.7
21000	3186BE213U040AM	BE	0.0218	7.6
25000	3186BF253U040AM	BF	0.0196	8.4
28000	3186BG283U040AM	BG	0.0180	9.2
32000	3186BH323U040AM	BH	0.0167	9.9
16000	3186DA163U040AM	DA	0.0658	3.9
19000	3186DB193U040AM	DB	0.0558	4.5
26000	3186DC263U040AM	DC	0.0432	5.5
33000	3186DD333U040AM	DD	0.0357	6.4
39000	3186DE393U040AM	DE	0.0309	7.3
46000	3186DF463U040AM	DF	0.0274	8.1
52000	3186DG523U040AM	DG	0.0249	8.9
59000	3186DH593U040AM	DH	0.0229	9.7
22000	3186EA223U040AM	EA	0.0809	3.8
26000	3186EB263U040AM	EB	0.0685	4.5
35000	3186EC353U040AM	EC	0.0527	5.4

SERIES 3186
Computer Grade Capacitors

STANDARD CAPACITANCE VALUES

50.0 VDC WORKING, 65.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
6800	3186BA682U050AM	BA	0.0457	4.0
8200	3186BB822U050AM	BB	0.0389	4.7
10000	3186BC103U050AM	BC	0.0308	5.7
13000	3186BD133U050AM	BD	0.0256	6.6
16000	3186BE163U050AM	BE	0.0223	7.5
19000	3186BF193U050AM	BF	0.0199	8.3
21000	3186BG213U050AM	BG	0.0183	9.1
24000	3186BH243U050AM	BH	0.0170	9.8
12000	3186DA123U050AM	DA	0.0669	3.8
15000	3186DB153U050AM	DB	0.0566	4.5
20000	3186DC203U050AM	DC	0.0438	5.5
25000	3186DD253U050AM	DD	0.0363	6.4
30000	3186DE303U050AM	DE	0.0313	7.3
35000	3186DF353U050AM	DF	0.0278	8.1
40000	3186DG403U050AM	DG	0.0252	8.9
45000	3186DH453U050AM	DH	0.0232	9.6
16000	3186EA163U050AM	EA	0.0836	3.8
20000	3186EB203U050AM	EB	0.0703	4.4
27000	3186EC273U050AM	EC	0.0541	5.4

50.0 VDC WORKING, 65.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
33000	3186ED333U050AM	ED	0.0446	6.3
40000	3186EE403U050AM	EE	0.0382	7.1
47000	3186EF473U050AM	EF	0.0337	7.9
54000	3186EG543U050AM	EG	0.0303	8.7
61000	3186EH613U050AM	EH	0.0278	9.5
33000	3186FB333U050AM	FB	0.0317	7.6
45000	3186FC453U050AM	FC	0.0246	9.2
56000	3186FD563U050AM	FD	0.0205	10.6
67000	3186FE673U050AM	FE	0.0177	12.0
79000	3186FF793U050AM	FF	0.0158	13.2
90000	3186FG903U050AM	FG	0.0143	14.5
100000	3186FH104U050AM	FH	0.0133	15.6
66000	3186GC663U050AM	GC	0.0318	9.1
83000	3186GD833U050AM	GD	0.0262	10.5
99000	3186GE993U050AM	GE	0.0226	11.9
110000	3186GF114U050AM	GF	0.0201	13.1
130000	3186GG134U050AM	GG	0.0181	14.4
140000	3186GH144U050AM	GH	0.0167	15.6
240000	3186GN244U050AM	GN	0.0122	21.7

63.0 VDC WORKING, 85.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
4400	3186BA442U063AM	BA	0.0480	3.9
5300	3186BB532U063AM	BB	0.0408	4.6
7000	3186BC702U063AM	BC	0.0319	5.6
8800	3186BD882U063AM	BD	0.0266	6.5
10000	3186BE103U063AM	BE	0.0234	7.3
12000	3186BF123U063AM	BF	0.0208	8.1
14000	3186BG143U063AM	BG	0.0190	8.9
15000	3186BH153U063AM	BH	0.0177	9.6
8100	3186DA812U063AM	DA	0.0684	3.8
9700	3186DB972U063AM	DB	0.0580	4.5
12000	3186DC123U063AM	DC	0.0451	5.4
16000	3186DD163U063AM	DD	0.0372	6.3
19000	3186DE193U063AM	DE	0.0320	7.2
22000	3186DF223U063AM	DF	0.0284	8.0
25000	3186DG253U063AM	DG	0.0258	8.8
29000	3186DH293U063AM	DH	0.0237	9.5
10000	3186EA103U063AM	EA	0.0864	3.7
13000	3186EB133U063AM	EB	0.0725	4.3
17000	3186EC173U063AM	EC	0.0559	5.3

63.0 VDC WORKING, 85.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
21000	3186ED213U063AM	ED	0.0459	6.2
26000	3186EE263U063AM	EE	0.0393	7.0
30000	3186EF303U063AM	EF	0.0346	7.8
35000	3186EG353U063AM	EG	0.0311	8.6
39000	3186EH393U063AM	EH	0.0285	9.4
17000	3186FB173U063AM	FB	0.0286	8.0
23000	3186FC233U063AM	FC	0.0223	9.6
29000	3186FD293U063AM	FD	0.0186	11.1
35000	3186FE353U063AM	FE	0.0162	12.5
41000	3186FF413U063AM	FF	0.0145	13.8
47000	3186FG473U063AM	FG	0.0132	15.1
53000	3186FH533U063AM	FH	0.0122	16.3
34000	3186GC343U063AM	GC	0.0290	9.5
43000	3186GD433U063AM	GD	0.0239	11.0
52000	3186GE523U063AM	GE	0.0206	12.4
60000	3186GF603U063AM	GF	0.0183	13.8
69000	3186GG693U063AM	GG	0.0166	15.0
78000	3186GH783U063AM	GH	0.0152	16.3
120000	3186GN124U063AM	GN	0.0114	22.4

75.0 VDC WORKING, 95.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
3900	3186BA392U075AM	BA	0.0487	3.9
4700	3186BB472U075AM	BB	0.0414	4.6
6200	3186BC622U075AM	BC	0.0324	5.5
7800	3186BD782U075AM	BD	0.0270	6.4
9400	3186BE942U075AM	BE	0.0235	7.3
10000	3186BF103U075AM	BF	0.0213	8.0
12000	3186BG123U075AM	BG	0.0193	8.8
14000	3186BH143U075AM	BH	0.0178	9.6
7100	3186DA712U075AM	DA	0.0690	3.8
8600	3186DB862U075AM	DB	0.0584	4.4
11000	3186DC113U075AM	DC	0.0453	5.4
14000	3186DD143U075AM	DD	0.0374	6.3
17000	3186DE173U075AM	DE	0.0322	7.2
20000	3186DF203U075AM	DF	0.0286	8.0
23000	3186DG233U075AM	DG	0.0259	8.7
25000	3186DH253U075AM	DH	0.0238	9.5
9700	3186EA972U075AM	EA	0.0865	3.7
11000	3186EB113U075AM	EB	0.0732	4.3
15000	3186EC153U075AM	EC	0.0563	5.3

75.0 VDC WORKING, 95.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
19000	3186ED193U075AM	ED	0.0462	6.1
23000	3186EE233U075AM	EE	0.0395	7.0
27000	3186EF273U075AM	EF	0.0348	7.8
31000	3186EG313U075AM	EG	0.0313	8.6
35000	3186EH353U075AM	EH	0.0287	9.3
15000	3186FB153U075AM	FB	0.0288	8.0
20000	3186FC203U075AM	FC	0.0225	9.6
26000	3186FD263U075AM	FD	0.0187	11.1
31000	3186FE313U075AM	FE	0.0163	12.5
36000	3186FF363U075AM	FF	0.0146	13.8
41000	3186FG413U075AM	FG	0.0133	15.0
47000	3186FH473U075AM	FH	0.0123	16.2
30000	3186GC303U075AM	GC	0.0292	9.5
38000	3186GD383U075AM	GD	0.0241	11.0
46000	3186GE463U075AM	GE	0.0208	12.4
53000	3186GF533U075AM	GF	0.0184	13.7
61000	3186GG613U075AM	GG	0.0167	15.0
69000	3186GH693U075AM	GH	0.0153	16.2
110000	3186GN114U075AM	GN	0.0115	22.3

STANDARD CAPACITANCE VALUES

100.0 VDC WORKING, 125.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
2000	3186BA202U100AM	BA	0.0930	2.8
2400	3186BB242U100AM	BB	0.0784	3.3
3200	3186BC322U100AM	BC	0.0602	4.1
4000	3186BD402U100AM	BD	0.0494	4.8
4800	3186BE482U100AM	BE	0.0422	5.4
5600	3186BF562U100AM	BF	0.0371	6.1
6500	3186BG652U100AM	BG	0.0331	6.7
7300	3186BH732U100AM	BH	0.0303	7.3
3700	3186DA372U100AM	DA	0.0857	3.4
4500	3186DB452U100AM	DB	0.0722	4.0
6000	3186DC602U100AM	DC	0.0557	4.9
7500	3186DD752U100AM	DD	0.0459	5.7
9000	3186DE902U100AM	DE	0.0394	6.5
10000	3186DF103U100AM	DF	0.0350	7.2
12000	3186DG123U100AM	DG	0.0314	7.9
13000	3186DH133U100AM	DH	0.0289	8.6
5100	3186EA512U100AM	EA	0.0948	3.5
6100	3186EB612U100AM	EB	0.0800	4.1
8100	3186EC812U100AM	EC	0.0616	5.0

100.0 VDC WORKING, 125.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
10000	3186ED103U100AM	ED	0.0506	5.9
12000	3186EE123U100AM	EE	0.0433	6.7
14000	3186EF143U100AM	EF	0.0382	7.5
16000	3186EG163U100AM	EG	0.0343	8.2
18000	3186EH183U100AM	EH	0.0314	8.9
10000	3186FB103U100AM	FB	0.0383	6.9
13000	3186FC133U100AM	FC	0.0298	8.3
17000	3186FD173U100AM	FD	0.0245	9.7
20000	3186FE203U100AM	FE	0.0212	10.9
23000	3186FF233U100AM	FF	0.0189	12.1
27000	3186FG273U100AM	FG	0.0170	13.3
30000	3186FH303U100AM	FH	0.0157	14.4
20000	3186GC203U100AM	GC	0.0352	8.6
25000	3186GD253U100AM	GD	0.0290	10.0
30000	3186GE303U100AM	GE	0.0249	11.3
35000	3186GF353U100AM	GF	0.0220	12.5
40000	3186GG403U100AM	GG	0.0199	13.7
45000	3186GH453U100AM	GH	0.0182	14.9
72000	3186GN723U100AM	GN	0.0134	20.7

125.0 VDC WORKING, 150.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
1300	3186BA132T125AM	BA	0.1048	2.6
1600	3186BB162T125AM	BB	0.0870	3.1
2100	3186BC212T125AM	BC	0.0672	3.8
2700	3186BD272T125AM	BD	0.0541	4.5
3200	3186BE322T125AM	BE	0.0465	5.2
3800	3186BF382T125AM	BF	0.0404	5.8
4300	3186BG432T125AM	BG	0.0364	6.4
4900	3186BH492T125AM	BH	0.0330	7.0
2500	3186DA252T125AM	DA	0.0912	3.3
3000	3186DB302T125AM	DB	0.0770	3.9
4000	3186DC402T125AM	DC	0.0593	4.7
5000	3186DD502T125AM	DD	0.0487	5.5
6000	3186DE602T125AM	DE	0.0418	6.3
7000	3186DF702T125AM	DF	0.0368	7.0
8000	3186DG802T125AM	DG	0.0332	7.7
9000	3186DH902T125AM	DH	0.0304	8.4
3400	3186EA342T125AM	EA	0.0991	3.4
4100	3186EB412T125AM	EB	0.0835	4.0
5400	3186EC542T125AM	EC	0.0643	4.9

125.0 VDC WORKING, 150.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
6800	3186ED682T125AM	ED	0.0527	5.8
8200	3186EE822T125AM	EE	0.0450	6.6
9600	3186EF962T125AM	EF	0.0396	7.3
10000	3186EG103T125AM	EG	0.0361	8.0
12000	3186EH123T125AM	EH	0.0326	8.7
6800	3186FB682T125AM	FB	0.0403	6.7
9100	3186FC912T125AM	FC	0.0312	8.1
11000	3186FD113T125AM	FD	0.0260	9.4
13000	3186FE133T125AM	FE	0.0224	10.6
16000	3186FF163T125AM	FF	0.0197	11.9
18000	3186FG183T125AM	FG	0.0178	13.0
20000	3186FH203T125AM	FH	0.0164	14.0
13000	3186GC133T125AM	GC	0.0365	8.5
16000	3186GD163T125AM	GD	0.0301	9.8
20000	3186GE203T125AM	GE	0.0257	11.1
23000	3186GF233T125AM	GF	0.0227	12.3
27000	3186GG273T125AM	GG	0.0204	13.5
30000	3186GH303T125AM	GH	0.0187	14.7
49000	3186GN493T125AM	GN	0.0137	20.4

150.0 VDC WORKING, 175.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
760	3186BA761T150AM	BA	0.1096	2.6
920	3186BB921T150AM	BB	0.0917	3.1
1200	3186BC122T150AM	BC	0.0711	3.7
1500	3186BD152T150AM	BD	0.0581	4.4
1800	3186BE182T150AM	BE	0.0495	5.0
2100	3186BF212T150AM	BF	0.0434	5.6
2400	3186BG242T150AM	BG	0.0388	6.2
2700	3186BH272T150AM	BH	0.0353	6.8
1400	3186DA142T150AM	DA	0.0963	3.2
1700	3186DB172T150AM	DB	0.0809	3.8
2200	3186DC222T150AM	DC	0.0628	4.6
2800	3186DD282T150AM	DD	0.0513	5.4
3400	3186DE342T150AM	DE	0.0437	6.1
3900	3186DF392T150AM	DF	0.0387	6.8
4500	3186DG452T150AM	DG	0.0347	7.6
5100	3186DH512T150AM	DH	0.0317	8.2
1900	3186EA192T150AM	EA	0.1033	3.4
2300	3186EB232T150AM	EB	0.0869	4.0
3000	3186EC302T150AM	EC	0.0670	4.8

150.0 VDC WORKING, 175.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
3800	3186ED382T150AM	ED	0.0548	5.6
4600	3186EE462T150AM	EE	0.0467	6.4
5400	3186EF542T150AM	EF	0.0410	7.2
6100	3186EG612T150AM	EG	0.0369	7.9
6900	3186EH692T150AM	EH	0.0336	8.6
3800	3186FB382T150AM	FB	0.0423	6.6
5100	3186FC512T150AM	FC	0.0326	7.9
6400	3186FD642T150AM	FD	0.0269	9.2
7700	3186FE772T150AM	FE	0.0231	10.5
9000	3186FF902T150AM	FF	0.0205	11.6
10000	3186FG103T150AM	FG	0.0186	12.7
11000	3186FH113T150AM	FH	0.0171	13.7
7600	3186GC762T150AM	GC	0.0375	8.4
9500	3186GD952T150AM	GD	0.0308	9.7
11000	3186GE113T150AM	GE	0.0266	10.9
13000	3186GF133T150AM	GF	0.0234	12.2
15000	3186GG153T150AM	GG	0.0211	13.3
17000	3186GH173T150AM	GH	0.0193	14.5
27000	3186GN273T150AM	GN	0.0141	20.2

SERIES 3186
Computer Grade Capacitors

STANDARD CAPACITANCE VALUES

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
200.0 VDC WORKING, 250.0 SURGE				
510	3186BA511T200AM	BA	0.1203	2.5
620	3186BB621T200AM	BB	0.1003	2.9
820	3186BC821T200AM	BC	0.0770	3.6
1000	3186BD102T200AM	BD	0.0638	4.2
1200	3186BE122T200AM	BE	0.0542	4.8
1400	3186BF142T200AM	BF	0.0474	5.4
1600	3186BG162T200AM	BG	0.0424	6.0
1800	3186BH182T200AM	BH	0.0385	6.5
950	3186DA951T200AM	DA	0.0975	3.2
1100	3186DB112T200AM	DB	0.0832	3.7
1500	3186DC152T200AM	DC	0.0635	4.6
1900	3186DD192T200AM	DD	0.0519	5.3
2300	3186DE232T200AM	DE	0.0443	6.1
2600	3186DF262T200AM	DF	0.0393	6.8
3000	3186DG302T200AM	DG	0.0353	7.5
3400	3186DH342T200AM	DH	0.0321	8.2
1300	3186EA132T200AM	EA	0.1017	3.4
1500	3186EB152T200AM	EB	0.0865	4.0
2000	3186EC202T200AM	EC	0.0664	4.8
250.0 VDC WORKING, 300.0 SURGE				
400	3186BA401T250AM	BA	0.1314	2.4
490	3186BB491T250AM	BB	0.1088	2.8
650	3186BC651T250AM	BC	0.0833	3.4
810	3186BD811T250AM	BD	0.0680	4.1
980	3186BE981T250AM	BE	0.0574	4.7
1100	3186BF112T250AM	BF	0.0514	5.2
1300	3186BG132T250AM	BG	0.0449	5.8
1400	3186BH142T250AM	BH	0.0418	6.3
750	3186DA751T250AM	DA	0.1036	3.1
900	3186DB901T250AM	DB	0.0873	3.6
1200	3186DC122T250AM	DC	0.0670	4.4
1500	3186DD152T250AM	DD	0.0549	5.2
1800	3186DE182T250AM	DE	0.0469	5.9
2100	3186DF212T250AM	DF	0.0412	6.6
2400	3186DG242T250AM	DG	0.0370	7.3
2700	3186DH272T250AM	DH	0.0338	8.0
1000	3186EA102T250AM	EA	0.1069	3.3
1200	3186EB122T250AM	EB	0.0901	3.9
1600	3186EC162T250AM	EC	0.0691	4.7
300.0 VDC WORKING, 350.0 SURGE				
240	3186BA241T300AM	BA	0.3795	1.4
280	3186BB281T300AM	BB	0.3253	1.6
380	3186BC381T300AM	BC	0.2415	2.0
480	3186BD481T300AM	BD	0.1926	2.4
570	3186BE571T300AM	BE	0.1631	2.8
670	3186BF671T300AM	BF	0.1398	3.1
770	3186BG771T300AM	BG	0.1226	3.5
860	3186BH861T300AM	BH	0.1105	3.8
450	3186DA451T300AM	DA	0.2255	2.1
540	3186DB541T300AM	DB	0.1889	2.5
720	3186DC721T300AM	DC	0.1432	3.0
900	3186DD901T300AM	DD	0.1159	3.6
1000	3186DE102T300AM	DE	0.1032	4.0
1200	3186DF122T300AM	DF	0.0877	4.5
1400	3186DG142T300AM	DG	0.0766	5.1
1600	3186DH162T300AM	DH	0.0682	5.6
610	3186EA611T300AM	EA	0.1854	2.5
730	3186EB731T300AM	EB	0.1557	3.0
980	3186EC981T300AM	EC	0.1179	3.6

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
200.0 VDC WORKING, 250.0 SURGE				
2600	3186ED262T200AM	ED	0.0540	5.7
3100	3186EE312T200AM	EE	0.0462	6.5
3600	3186EF362T200AM	EF	0.0407	7.2
4100	3186EG412T200AM	EG	0.0365	7.9
4600	3186EH462T200AM	EH	0.0334	8.7
2600	3186FB262T200AM	FB	0.0423	6.6
3400	3186FC342T200AM	FC	0.0329	7.9
4300	3186FD432T200AM	FD	0.0270	9.2
5200	3186FE522T200AM	FE	0.0232	10.5
6000	3186FF602T200AM	FF	0.0206	11.6
6900	3186FG692T200AM	FG	0.0186	12.7
7800	3186FH782T200AM	FH	0.0170	13.8
5100	3186GC512T200AM	GC	0.0366	8.5
6400	3186GD642T200AM	GD	0.0301	9.8
7700	3186GE772T200AM	GE	0.0258	11.1
8900	3186GF892T200AM	GF	0.0228	12.3
10000	3186GG103T200AM	GG	0.0206	13.5
11000	3186GH113T200AM	GH	0.0189	14.6
18000	3186GN183T200AM	GN	0.0138	20.3
250.0 VDC WORKING, 300.0 SURGE				
2000	3186ED202T250AM	ED	0.0566	5.6
2400	3186EE242T250AM	EE	0.0483	6.3
2800	3186EF282T250AM	EF	0.0424	7.1
3200	3186EG322T250AM	EG	0.0380	7.8
3700	3186EH372T250AM	EH	0.0345	8.5
2000	3186FB202T250AM	FB	0.0448	6.4
2700	3186FC272T250AM	FC	0.0345	7.7
3400	3186FD342T250AM	FD	0.0283	9.0
4100	3186FE412T250AM	FE	0.0243	10.2
4800	3186FF482T250AM	FF	0.0214	11.4
5500	3186FG552T250AM	FG	0.0193	12.5
6100	3186FH612T250AM	FH	0.0178	13.5
4000	3186GC402T250AM	GC	0.0377	8.3
5000	3186GD502T250AM	GD	0.0310	9.7
6000	3186GE602T250AM	GE	0.0266	10.9
7100	3186GF712T250AM	GF	0.0234	12.2
8100	3186GG812T250AM	GG	0.0211	13.3
9100	3186GH912T250AM	GH	0.0193	14.4
14000	3186GN143T250AM	GN	0.0142	20.1
300.0 VDC WORKING, 350.0 SURGE				
1200	3186ED122T300AM	ED	0.0967	4.2
1400	3186EE142T300AM	EE	0.0830	4.8
1700	3186EF172T300AM	EF	0.0706	5.5
1900	3186EG192T300AM	EG	0.0635	6.0
2200	3186EH222T300AM	EH	0.0564	6.7
1200	3186FB122T300AM	FB	0.0887	4.5
1600	3186FC162T300AM	FC	0.0675	5.5
2000	3186FD202T300AM	FD	0.0548	6.5
2400	3186FE242T300AM	FE	0.0464	7.4
2800	3186FF282T300AM	FF	0.0404	8.3
3200	3186FG322T300AM	FG	0.0359	9.1
3700	3186FH372T300AM	FH	0.0319	10.1
2400	3186GC242T300AM	GC	0.0546	6.9
3000	3186GD302T300AM	GD	0.0446	8.1
3600	3186GE362T300AM	GE	0.0379	9.2
4200	3186GF422T300AM	GF	0.0331	10.2
4800	3186GG482T300AM	GG	0.0296	11.3
5400	3186GH542T300AM	GH	0.0269	12.2
8800	3186GN882T300AM	GN	0.0187	17.5

STANDARD CAPACITANCE VALUES

350.0 VDC WORKING, 400.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
210	3186BA211T350AM	BA	0.4025	1.3
260	3186BB261T350AM	BB	0.3269	1.6
340	3186BC341T350AM	BC	0.2509	2.0
430	3186BD431T350AM	BD	0.1998	2.4
520	3186BE521T350AM	BE	0.1664	2.7
600	3186BF601T350AM	BF	0.1450	3.1
690	3186BG691T350AM	BG	0.1271	3.4
780	3186BH781T350AM	BH	0.1133	3.8
400	3186DA401T350AM	DA	0.2344	2.1
480	3186DB481T350AM	DB	0.1963	2.4
650	3186DC651T350AM	DC	0.1471	3.0
810	3186DD811T350AM	DD	0.1193	3.5
970	3186DE971T350AM	DE	0.1007	4.0
1100	3186DF112T350AM	DF	0.0891	4.5
1300	3186DG132T350AM	DG	0.0771	5.1
1400	3186DH142T350AM	DH	0.0715	5.5
550	3186EA551T350AM	EA	0.1901	2.5
660	3186EB661T350AM	EB	0.1594	2.9
880	3186EC881T350AM	EC	0.1211	3.6

350.0 VDC WORKING, 400.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
1100	3186ED112T350AM	ED	0.0982	4.2
1300	3186EE132T350AM	EE	0.0836	4.8
1500	3186EF152T350AM	EF	0.0732	5.4
1700	3186EG172T350AM	EG	0.0653	5.9
1900	3186EH192T350AM	EH	0.0591	6.5
1100	3186FB112T350AM	FB	0.0901	4.5
1400	3186FC142T350AM	FC	0.0707	5.4
1800	3186FD182T350AM	FD	0.0563	6.4
2200	3186FE222T350AM	FE	0.0471	7.3
2600	3186FF262T350AM	FF	0.0407	8.2
2900	3186FG292T350AM	FG	0.0367	9.0
3300	3186FH332T350AM	FH	0.0329	9.9
2100	3186GC212T350AM	GC	0.0565	6.8
2700	3186GD272T350AM	GD	0.0455	8.0
3200	3186GE322T350AM	GE	0.0389	9.0
3800	3186GF382T350AM	GF	0.0338	10.1
4300	3186GG432T350AM	GG	0.0303	11.1
4900	3186GH492T350AM	GH	0.0273	12.1
7900	3186GN792T350AM	GN	0.0191	17.3

400.0 VDC WORKING, 450.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
180	3186BA181T400AM	BA	0.4277	1.3
220	3186BB221T400AM	BB	0.3513	1.6
300	3186BC301T400AM	BC	0.2596	2.0
370	3186BD371T400AM	BD	0.2114	2.3
450	3186BE451T400AM	BE	0.1751	2.7
530	3186BF531T400AM	BF	0.1497	3.0
600	3186BG601T400AM	BG	0.1330	3.4
680	3186BH681T400AM	BH	0.1183	3.7
350	3186DA351T400AM	DA	0.2435	2.0
420	3186DB421T400AM	DB	0.2039	2.4
560	3186DC561T400AM	DC	0.1544	2.9
700	3186DD701T400AM	DD	0.1249	3.4
850	3186DE851T400AM	DE	0.1043	4.0
990	3186DF991T400AM	DF	0.0905	4.5
1100	3186DG112T400AM	DG	0.0818	4.9
1200	3186DH122T400AM	DH	0.0752	5.3
480	3186EA481T400AM	EA	0.1970	2.4
580	3186EB581T400AM	EB	0.1645	2.9
770	3186EC771T400AM	EC	0.1252	3.5

400.0 VDC WORKING, 450.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
960	3186ED961T400AM	ED	0.1016	4.1
1100	3186EE112T400AM	EE	0.0881	4.7
1300	3186EF132T400AM	EF	0.0760	5.3
1500	3186EG152T400AM	EG	0.0671	5.9
1700	3186EH172T400AM	EH	0.0603	6.4
970	3186FB971T400AM	FB	0.0929	4.4
1200	3186FC122T400AM	FC	0.0743	5.3
1600	3186FD162T400AM	FD	0.0577	6.3
1900	3186FE192T400AM	FE	0.0492	7.2
2200	3186FF222T400AM	FF	0.0430	8.0
2500	3186FG252T400AM	FG	0.0383	8.9
2900	3186FH292T400AM	FH	0.0340	9.8
1900	3186GC192T400AM	GC	0.0576	6.7
2300	3186GD232T400AM	GD	0.0474	7.8
2800	3186GE282T400AM	GE	0.0401	8.9
3300	3186GF332T400AM	GF	0.0349	10.0
3800	3186GG382T400AM	GG	0.0311	11.0
4300	3186GH432T400AM	GH	0.0281	12.0
6900	3186GN692T400AM	GN	0.0196	17.1

450.0 VDC WORKING, 500.0 SURGE

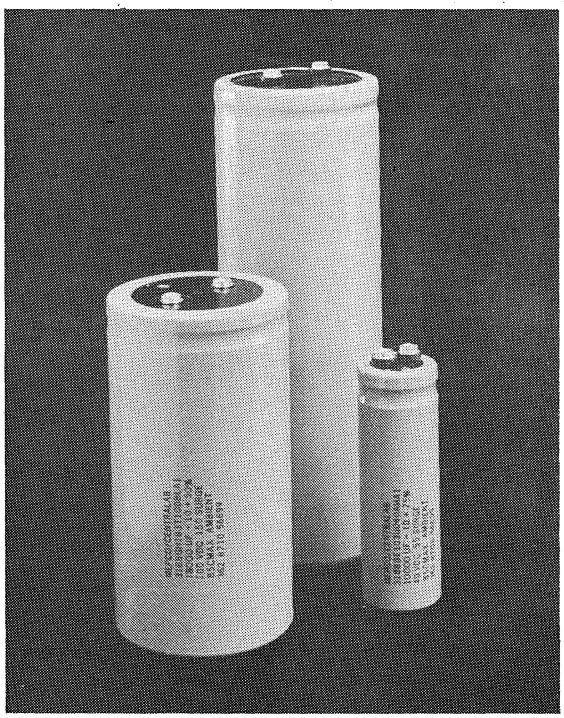
Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
160	3186BA161T450AM	BA	0.4380	1.3
190	3186BB191T450AM	BB	0.3694	1.5
260	3186BC261T450AM	BC	0.2720	1.9
320	3186BD321T450AM	BD	0.2219	2.2
390	3186BE391T450AM	BE	0.1834	2.6
450	3186BF451T450AM	BF	0.1597	2.9
520	3186BG521T450AM	BG	0.1392	3.3
580	3186BH581T450AM	BH	0.1255	3.6
300	3186DA301T450AM	DA	0.2565	2.0
360	3186DB361T450AM	DB	0.2147	2.3
480	3186DC481T450AM	DC	0.1626	2.8
600	3186DD601T450AM	DD	0.1313	3.4
730	3186DE731T450AM	DE	0.1095	3.9
850	3186DF851T450AM	DF	0.0950	4.4
970	3186DG971T450AM	DG	0.0842	4.8
1000	3186DH102T450AM	DH	0.0806	5.2
410	3186EA411T450AM	EA	0.2069	2.4
490	3186EB491T450AM	EB	0.1738	2.8
660	3186EC661T450AM	EC	0.1311	3.4

450.0 VDC WORKING, 500.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
820	3186ED821T450AM	ED	0.1066	4.0
990	3186EE991T450AM	EE	0.0896	4.6
1100	3186EF112T450AM	EF	0.0801	5.1
1300	3186EG132T450AM	EG	0.0697	5.8
1400	3186EH142T450AM	EH	0.0644	6.2
830	3186FB831T450AM	FB	0.0977	4.3
1100	3186FC112T450AM	FC	0.0746	5.3
1300	3186FD132T450AM	FD	0.0628	6.0
1600	3186FE162T450AM	FE	0.0522	7.0
1900	3186FF192T450AM	FF	0.0448	7.9
2200	3186FG222T450AM	FG	0.0395	8.7
2500	3186FH252T450AM	FH	0.0354	9.6
1600	3186GC162T450AM	GC	0.0606	6.6
2000	3186GD202T450AM	GD	0.0493	7.7
2400	3186GE242T450AM	GE	0.0419	8.7
2800	3186GF282T450AM	GF	0.0365	9.7
3200	3186GG322T450AM	GG	0.0326	10.7
3700	3186GH372T450AM	GH	0.0292	11.7
5900	3186GN592T450AM	GN	0.0203	16.8

SERIES 3188

Long-Life Computer-Grade Aluminum Electrolytic Capacitors



DESCRIPTION:

Series 3188 Long-Life Aluminum Electrolytic Capacitors are designed for those applications where a standard computer-grade product must operate under environmental and operational stresses more severe than those normally encountered. These units are constructed of the highest-quality materials and processed to achieve the low leakage current necessary for long shelf life and long operating life with high ripple currents. The Series 3188 features a 2000 hour operating life at 85°C with ripple current and DC working voltage applied. It is available in 38 standard case sizes with a choice of five terminal styles. Capacitance values up to 920,000μF are available in voltage ratings from 6WVDC to 400WVDC and are computer-designed for optimum performance.

FEATURES:

- 2000 hours operating life at 85°C with ripple.
- Up to 42A Ripple Current at 65°C 30A at 85°C.
- 38 Standard Case Sizes.
- Low Leakage Current.
- Computer-designed for optimum performance.
- Meets all requirements of EIA-RS-395 for type I capacitors.

DIMENSIONS

Case Code	UNINSULATED CASE DIMENSIONS					
	Dimensions in Inches			Dimensions in Millimeters		
	D	L	S	D	L	S
BA	1.375	2.125	.500	34.92	53.97	12.70
BB	1.375	2.625	.500	34.92	66.67	12.70
BC	1.375	3.125	.500	34.92	79.37	12.70
BD	1.375	3.625	.500	34.92	92.07	12.70
BE	1.375	4.125	.500	34.92	104.77	12.70
BF	1.375	4.625	.500	34.92	117.47	12.70
BG	1.375	5.125	.500	34.92	130.17	12.70
BH	1.375	5.625	.500	34.92	142.87	12.70
DA	1.750	2.125	.750	44.45	53.97	19.05
DB	1.750	2.625	.750	44.45	66.67	19.05
DC	1.750	3.125	.750	44.45	79.37	19.05
DD	1.750	3.625	.750	44.45	92.07	19.05
DE	1.750	4.125	.750	44.45	104.77	19.05
DF	1.750	4.625	.750	44.45	117.47	19.05
DG	1.750	5.125	.750	44.45	130.17	19.05
DH	1.750	5.625	.750	44.45	142.87	19.05
EA	2.000	2.125	.875	50.80	53.97	22.22
EB	2.000	2.625	.875	50.80	66.67	22.22
EC	2.000	3.125	.875	50.80	79.37	22.22
ED	2.000	3.625	.875	50.80	92.07	22.22
EE	2.000	4.125	.875	50.80	104.77	22.22
EF	2.000	4.625	.875	50.80	117.47	22.22
EG	2.000	5.125	.875	50.80	130.17	22.22
EH	2.000	5.625	.875	50.80	142.87	22.22
FB	2.500	2.625	1.125	63.50	66.67	28.57
FC	2.500	3.125	1.125	63.50	79.37	28.57
FD	2.500	3.625	1.125	63.50	92.07	28.57
FE	2.500	4.125	1.125	63.50	104.77	28.57
FF	2.500	4.625	1.125	63.50	117.47	28.57
FG	2.500	5.125	1.125	63.50	130.17	28.57
FH	2.500	5.625	1.125	63.50	142.87	28.57
GC	3.000	3.125	1.250	76.20	79.37	31.75
GD	3.000	3.625	1.250	76.20	92.07	31.75
GE	3.000	4.125	1.250	76.20	104.77	31.75
GF	3.000	4.625	1.250	76.20	117.47	31.75
GG	3.000	5.125	1.250	76.20	130.17	31.75
GH	3.000	5.625	1.250	76.20	142.87	31.75
GN	3.000	8.625	1.250	76.20	219.07	31.75

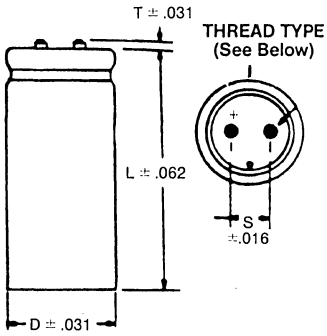
PC MOUNT OVERALL HEIGHT (INCHES)

Case Length	H		
	D = 1.375	D = 1.750	D = 2.000
2.125	2.26	2.31	2.31
2.625	2.76	2.81	2.81
3.125	3.26	3.31	3.31
3.625	3.76	3.81	3.81
4.125	4.26	4.31	4.31
4.625	4.76	4.81	4.81
5.125	5.26	5.31	5.31
5.625	5.76	5.81	5.81

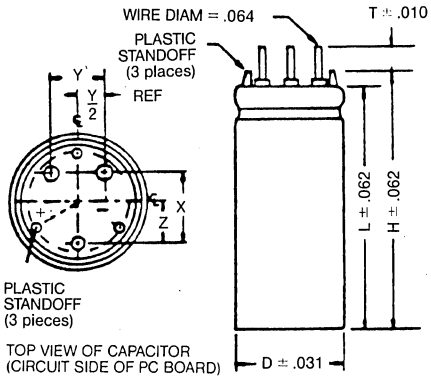
PC MOUNT TERMINAL SPACING (INCHES)

Case Diameter	X	Y	Z
1.375	.550	.600	.375
1.750	.900	.700	.525
2.000	1.000	.800	.575

CASE OUTLINE DRAWING



CASE OUTLINE DRAWING
PRINTED CIRCUIT BOARD MOUNT



INSULATED CASE DIMENSION ADDER AND BRACKET CODES

INSULATION TYPE	INCHES			MM			BRACKET CODE	
	D	L	H	D	L	H	without	with
.004 inch Polymeric	.010	.015	.010	.25	.38	.25	M	L
.008 inch Polymeric	.020	.032	.024	.508	.813	.61	P	R
.012 inch Polymeric	.025	.062	.045	.63	1.58	1.14	H	J
Uninsulated	–	–	–	–	–	–	N	X

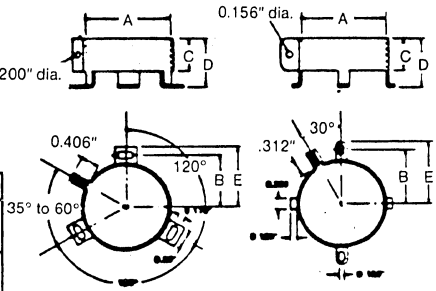
The capacitors are marked with:
- nominal capacitance
- rated voltage
- EIA source and date code
- maximum ambient temperature
- polarity
- name of manufacturer
- part number
- capacitance tolerance

BRACKET DIMENSIONS

Case Diameters	Dimensions in Inches				
	A ·0.005	B ·0.031	C ·0.016	D ·0.031	E ·0.031
1.375	1.375	0.906	0.562	0.750	1.156
1.750	1.750	1.125	0.750	1.125	1.313
2.000	2.000	1.250	0.750	1.125	1.438
2.500	2.500	1.500	0.750	1.125	1.688
3.000	3.000	1.750	0.750	1.125	1.938
Case Diameters	**Dimension in Millimeters**				
	A ·0.13	**B ·0.79**	**C ·0.40**	**D ·0.79**	**E ·0.79**
34.92	34.92	23.01	14.25	19.05	29.36
44.45	44.45	28.57	19.05	28.57	33.35
50.80	50.80	31.75	19.05	28.57	36.51
63.50	63.50	38.10	19.05	28.57	42.87
76.20	76.20	44.45	19.05	28.57	49.22

Note: All brackets are zinc/iridite plated.

BRACKET OUTLINE DRAWING



For 1-3/4(D), 2(E), 2-1/2(F), and 3(G) inch diameter can sizes

For 1-3/8(B) inch diameter can sizes

TERMINAL STYLES, DIMENSIONS, AND CODES

Terminal Style	T (inches)	T (mm)	Code	Thread Type	Terminal Diameter (inches)
High Post	.250	6.4	A	10-32	.313
Low Post	.063	1.6	B	10-32	.313
High Current*	.125	3.2	D	¼-28	.687
Solder Lug	.468	11.9	C	N/A	N/A
PC Mount	.250	8.6	H	N/A	N/A

*Available in 2½" and 3" diameter cans only. Recommended for applications where ripple current exceeds 30 Amperes.

HOW TO SPECIFY

Mepco/Centralab Series 3188 capacitors can be completely specified using the following designation:

3188 — **Mepco/Centralab Product Series**

BA — **Case Size Code**

802 — **Capacitance**
XX = Significant Digits
X = Multiplier
i.e. 802 = 8000μF

U — **Tolerance**
U = −10%+75%
T = −10%+50%

005 — **Voltage**
005 = 5VDC
050 = 50VDC

A — **Terminal Style**
A=High Post
B=Low Post
D=High Current
H=PC Mount

M — **Insulation & Bracket Code**
(see physical spec)

A-1 — **Factory Assigned Number**

SERIES 3188
Computer Grade Capacitors

PERFORMANCE SPECIFICATIONS

1. TEMPERATURE.
1.1 OPERATING. These capacitors are designed to operate within the temperature range of −40°C to +85°C.

1.2 STORAGE. These capacitors may be subjected, without permanent damage, to conditions in transit where temperatures range from −55°C to +85°C at altitudes up to 80,000 feet.

1.3 TOLERANCE. Unless otherwise specified, temperature tolerance shall be ±3°C.

2. DC WORKING VOLTAGE. The dc working voltage is the maximum operating voltage for continuous operation at maximum rated temperature.

3. SURGE VOLTAGE. The surge voltage is the maximum non-recurrent voltage to which the capacitor should be subjected.

3.1 The surge voltage shall not exceed the values specified in the rating table.

3.2 SURGE TEST

3.2.1 Capacitors shall be connected in series with a resistor. The value of the resistor is:

CAPACITANCE (μF)	RESISTOR (ohms)
0-2500	1000
2501-25000	100
25001-250000	10
250001-UP	3

The series combination is then subjected to rated surge voltage for 30 seconds at room temperature and the capacitor allowed to discharge thru the resistor. This sequence is repeated six times per hour at 10 minute intervals for 24 hours.

3.2.2 Leakage current when measured per paragraph 6.2, not sooner than four (4) hours after completion of the test, shall not exceed the initial leakage current limit. There shall be no leaking of electrolyte and no mechanical damage.

4. CAPACITANCE. Capacitance shall be measured on a capacitance bridge having a maximum rms signal voltage of 1 volt at 120 Hz. Capacitance shall be within the specified tolerance when measured at 25°C.

WVDC	TOLERANCE
≤75	−10%, +75%
>75	−10%, +50%

5. EQUIVALENT SERIES RESISTANCE (ESR) Measurement shall be made by the bridge method at 120 Hz and 25°C. The equivalent series resistance shall not exceed the value shown in the rating table.

6. DC LEAKAGE CURRENT.
6.1 PRE-CONDITIONING. In the period 24 to 48 hours prior to test, rated working voltage shall be applied to the capacitor for a minimum of 30 minutes.

6.2 MEASUREMENT. Measurement shall be made at 25°C. Voltage shall be applied to the capacitor thru a current limiting resistor. The leakage current shall be measured 5 minutes after the capacitor reaches rated voltage. Leakage current shall not exceed the value calculated as shown:

$I_L = .006\ CV$ • $CV \leq 250{,}000\ \mu F \cdot V$

$I_L = .003\ \sqrt{CV}$ $CV > 250{,}000\ \mu F \cdot V$

C—Rated Capacitance (μf)
V—Rated Voltage (volts)
I_L—Leakage Current (mA)

6.2.1 In no case, however, shall the dc leakage current limit exceed 4000μA.

7. LIFE TESTS.
7.1 Capacitors shall be placed in a circulating air oven at an ambient temperature of 85°C. Spacing between capacitors must be at least 1" and capacitors must not be subjected to direct radiation from heating elements. Circulation of air shall be sufficient to keep the temperature within six (6) inches of the capacitor below 88°C.

7.1.1 Rated DC voltage with rated ripple current shall be applied to the capacitors for a period of 2000 ± 8 hours. Following this test the capacitors shall meet the requirements of paragraph 7.2.

7.1.2 Alternate life test: Rated DC voltage for a period of 4000 ± 8 hours. Following this test the capacitors shall meet the requirements of paragraph 7.2.

7.2 Upon completion of the life test, the capacitors shall be returned to room ambient for a minimum of 24 hours. The capacitors shall then meet the following requirements:

7.2.1 Capacitance, when measured per paragraph 4., shall not be less than 85% of the initial measured value.

7.2.2 The equivalent series resistance (ESR), when measured per paragraph 5., shall not be greater than 175% of the initial measured value.

7.2.3 The leakage current, when measured and determined per paragraph 6.2, shall not exceed the initial specification.

7.2.4 There shall be no evidence of mechanical damage or excessive electrolyte leakage.

8. SHELF TEST. Capacitors shall be placed in a circulating air oven at 85°C for a period of 250 ± 4 hours with no voltage applied. The units shall then be allowed to cool to 25°C for a minimum of 16 hours.

8.1 The capacitance, equivalent series resistance and leakage current, when measured in accordance with paragraphs 4, 5, & 6.2 respectively, shall meet the initial specifications.

9. VIBRATION. Capacitors shall be clamped rigidly to a vibration platform and subjected to a simple harmonic motion having a maximum peak-to-peak amplitude of .06 inches and a maximum acceleration of 10g. The frequency of vibration shall be varied linearly between 10 and 55 cycles per second. The entire frequency range, 10 to 55 to 10 cps, shall be traversed in one minute. Capacitors shall be vibrated for 1½ hours with the direction of motion being parallel to the axis of the capacitor. The capacitors shall then be placed so that the direction of motion is perpendicular to the axis and the vibration continued for 1½ hours. During the last ½ hour of the test, the capacitor shall be connected to a bridge and observed for a 3 minute period. A capacitor failing the vibration test is defined as one failing to meet the requirements of paragraph 9.1.

9.1 There shall be no evidence of loosening of the capacitor element within the container, when shaken by hand following the test. There shall be no indication of intermittent contact during the 3 minute observation period. Capacitors shall not be open or shorted.

10. CONTAINER SEAL. Following the vibration test each capacitor shall be tested for seal tightness in accordance with paragraphs 10.1 and 10.2.

10.1 Capacitors shall be subjected to two successive temperature cycles in circulating air as follows:

ONE TEMPERATURE CYCLE

A. 85°C-30 min.
B. 25°C-30 min.
C. −40°C-30 min.
D. 25°C-30 min.

10.2 Following the second cycle, the capacitors shall be placed in 90-95°C water for 5 minutes. A failure is defined as a unit exhibiting a continuous chain of bubbles when immersed.

11. LOW-TEMPERATURE PERFORMANCE

When measured at the temperature indicated in Table and at a frequency of 120 Hz the typical capacitance of these capacitors shall be the percentages of the 25 degrees C capacitance and the typical impedance shall be the value when multiplied as shown.

TEMPERATURE −40 DEGREES C

RATED DC VOLTAGE	% of 25°C CAPACITANCE	25°C IMPEDANCE MULTIPLIER
0-9	35	6.0
10-75	55	5.0
76-250	70	2.75

TEMPERATURE −25 DEGREES C

RATED DC VOLTAGE	% of 25°C CAPACITANCE	25°C IMPEDANCE MULTIPLIER
251-400	70	3.00

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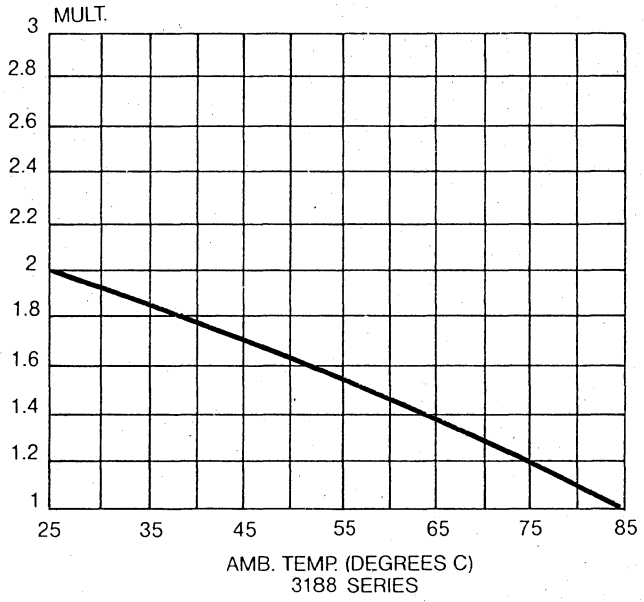
12. RIPPLE CURRENT. Capacitors will withstand the 85°C rms ripple current stated in the rating tables for the duration of the life test as specified in paragraph 7 of the Performance Specifications. Any reduction in ambient temperature and/or ripple current will extend the operating life of the capacitor. See application guidelines for method for determining extended life at derated conditions.

12.1. Ripple Current values are specified at an ambient temperature of 85°C and a frequency of 120 Hz. Ripple current (I_R) at other frequencies and temperatures can be calculated.

$$I_R = I_{85} \cdot \text{RIPPLE MULTIPLIER}$$

RIPPLE MULTIPLIER
105 DEGREE CORE



12.2 For ripple currents at other frequencies, see application guidelines.

STANDARD CAPACITANCE VALUES

6.0 VDC WORKING, 9.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
41000	3188BA413U006AM	BA	0.0272	7.3
50000	3188BB503U006AM	BB	0.0235	8.5
66000	3188BC663U006AM	BC	0.0190	10.2
83000	3188BD833U006AM	BD	0.0163	11.7
100000	3188BE104U006AM	BE	0.0145	13.1
110000	3188BF114U006AM	BF	0.0134	14.3
130000	3188BG134U006AM	BG	0.0125	15.5
150000	3188BH154U006AM	BH	0.0119	16.6
77000	3188DA773U006AM	DA	0.0142	11.8
92000	3188DB923U006AM	DB	0.0124	13.6
120000	3188DC124U006AM	DC	0.0102	16.1
150000	3188DD154U006AM	DD	0.0089	18.3
180000	3188DE184U006AM	DE	0.0081	20.2
210000	3188DF214U006AM	DF	0.0075	22.0
240000	3188DG244U006AM	DG	0.0071	23.7
270000	3188DH274U006AM	DH	0.0068	25.2
100000	3188EA104U006AM	EA	0.0155	12.3
120000	3188EB124U006AM	EB	0.0135	14.2
160000	3188EC164U006AM	EC	0.0110	16.8

6.0 VDC WORKING, 9.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
200000	3188ED204U006AM	ED	0.0095	19.1
250000	3188EE254U006AM	EE	0.0086	21.2
290000	3188EF294U006AM	EF	0.0079	23.1
330000	3188EG334U006AM	EG	0.0074	24.9
370000	3188EH374U006AM	EH	0.0071	26.5
200000	3188FB204U006AM	FB	0.0163	15.0
270000	3188FC274U006AM	FC	0.0131	17.7
340000	3188FD344U006AM	FD	0.0113	20.2
410000	3188FE414U006AM	FE	0.0100	22.5
480000	3188FF484U006AM	FF	0.0092	24.5
550000	3188FG554U006AM	FG	0.0086	26.5
620000	3188FH624U006AM	FH	0.0081	28.2
410000	3188GC414U006AM	GC	0.0092	23.8
510000	3188GD514U006AM	GD	0.0080	26.9
610000	3188GE614U006AM	GE	0.0072	29.7
710000	3188GF714U006AM	GF	0.0066	30.0
820000	3188GG824U006AM	GG	0.0062	30.0
920000	3188GH924U006AM	GH	0.0059	30.0

7.5 VDC WORKING, 10.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
39000	3188BA393U7P5AM	BA	0.0273	7.3
47000	3188BB473U7P5AM	BB	0.0235	8.5
63000	3188BC633U7P5AM	BC	0.0190	10.2
78000	3188BD783U7P5AM	BD	0.0163	11.7
94000	3188BE943U7P5AM	BE	0.0146	13.1
110000	3188BF114U7P5AM	BF	0.0134	14.4
120000	3188BG124U7P5AM	BG	0.0125	15.5
140000	3188BH144U7P5AM	BH	0.0119	16.6
72000	3188DA723U7P5AM	DA	0.0143	11.8
87000	3188DB873U7P5AM	DB	0.0124	13.6
110000	3188DC114U7P5AM	DC	0.0102	16.0
140000	3188DD144U7P5AM	DD	0.0089	18.2
170000	3188DE174U7P5AM	DE	0.0081	20.2
200000	3188DF204U7P5AM	DF	0.0075	22.0
230000	3188DG234U7P5AM	DG	0.0071	23.7
260000	3188DH264U7P5AM	DH	0.0068	25.2
98000	3188EA983U7P5AM	EA	0.0155	12.3
110000	3188EB114U7P5AM	EB	0.0136	14.2
150000	3188EC154U7P5AM	EC	0.0110	16.8

7.5 VDC WORKING, 10.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
190000	3188ED194U7P5AM	ED	0.0096	19.1
230000	3188EE234U7P5AM	EE	0.0086	21.2
270000	3188EF274U7P5AM	EF	0.0079	23.1
310000	3188EG314U7P5AM	EG	0.0075	24.9
350000	3188EH354U7P5AM	EH	0.0071	26.5
190000	3188FB194U7P5AM	FB	0.0165	14.9
260000	3188FC264U7P5AM	FC	0.0132	17.7
320000	3188FD324U7P5AM	FD	0.0114	20.1
390000	3188FE394U7P5AM	FE	0.0101	22.4
460000	3188FF464U7P5AM	FF	0.0092	24.5
520000	3188FG524U7P5AM	FG	0.0086	26.4
590000	3188FH594U7P5AM	FH	0.0082	28.2
380000	3188GC384U7P5AM	GC	0.0093	23.7
480000	3188GD484U7P5AM	GD	0.0081	26.8
580000	3188GE584U7P5AM	GE	0.0072	29.6
680000	3188GF684U7P5AM	GF	0.0067	30.0
770000	3188GG774U7P5AM	GG	0.0063	30.0
870000	3188GH874U7P5AM	GH	0.0060	30.0

10.0 VDC WORKING, 15.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
30000	3188BA303U010AM	BA	0.0277	7.3
37000	3188BB373U010AM	BB	0.0239	8.5
49000	3188BC493U010AM	BC	0.0192	10.1
61000	3188BD613U010AM	BD	0.0165	11.6
74000	3188BE743U010AM	BE	0.0147	13.0
86000	3188BF863U010AM	BF	0.0135	14.3
98000	3188BG983U010AM	BG	0.0126	15.4
110000	3188BH114U010AM	BH	0.0120	16.5
56000	3188DA563U010AM	DA	0.0145	11.7
68000	3188DB683U010AM	DB	0.0126	13.5
91000	3188DC913U010AM	DC	0.0103	16.0
110000	3188DD114U010AM	DD	0.0090	18.1
130000	3188DE134U010AM	DE	0.0082	20.1
150000	3188DF154U010AM	DF	0.0076	21.9
180000	3188DG184U010AM	DG	0.0071	23.6
200000	3188DH204U010AM	DH	0.0068	25.1
77000	3188EA773U010AM	EA	0.0158	12.2
92000	3188EB923U010AM	EB	0.0137	14.1
120000	3188EC124U010AM	EC	0.0112	16.7

10.0 VDC WORKING, 15.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
150000	3188ED154U010AM	ED	0.0097	19.0
180000	3188EE184U010AM	EE	0.0087	21.1
210000	3188EF214U010AM	EF	0.0080	23.0
240000	3188EG244U010AM	EG	0.0075	24.7
270000	3188EH274U010AM	EH	0.0072	26.4
150000	3188FB154U010AM	FB	0.0171	14.6
200000	3188FC204U010AM	FC	0.0138	17.3
250000	3188FD254U010AM	FD	0.0118	19.8
300000	3188FE304U010AM	FE	0.0105	22.0
360000	3188FF364U010AM	FF	0.0095	24.1
410000	3188FG414U010AM	FG	0.0089	26.0
460000	3188FH464U010AM	FH	0.0084	27.8
300000	3188GC304U010AM	GC	0.0096	23.3
370000	3188GD374U010AM	GD	0.0083	26.4
450000	3188GE454U010AM	GE	0.0075	29.2
530000	3188GF534U010AM	GF	0.0069	30.0
600000	3188GG604U010AM	GG	0.0064	30.0
680000	3188GH684U010AM	GH	0.0061	30.0

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STANDARD CAPACITANCE VALUES

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
15.0 VDC WORKING, 20.0 SURGE				
23000	3188BA233U015AM	BA	0.0281	7.2
27000	3188BB273U015AM	BB	0.0243	8.4
36000	3188BC363U015AM	BC	0.0195	10.1
46000	3188BD463U015AM	BD	0.0167	11.6
55000	3188BE553U015AM	BE	0.0149	12.9
64000	3188BF643U015AM	BF	0.0137	14.2
73000	3188BG733U015AM	BG	0.0128	15.4
82000	3188BH823U015AM	BH	0.0121	16.4
42000	3188DA423U015AM	DA	0.0147	11.6
50000	3188DB503U015AM	DB	0.0128	13.4
67000	3188DC673U015AM	DC	0.0105	15.9
84000	3188DD843U015AM	DD	0.0091	18.0
100000	3188DE104U015AM	DE	0.0082	20.0
110000	3188DF114U015AM	DF	0.0077	21.8
130000	3188DG134U015AM	DG	0.0072	23.4
150000	3188DH154U015AM	DH	0.0069	25.0
57000	3188EA573U015AM	EA	0.0160	12.1
69000	3188EB693U015AM	EB	0.0139	14.0
92000	3188EC923U015AM	EC	0.0113	16.6
20.0 VDC WORKING, 30.0 SURGE				
13000	3188BA133U020AM	BA	0.0436	5.8
16000	3188BB163U020AM	BB	0.0371	6.8
22000	3188BC223U020AM	BC	0.0290	8.2
27000	3188BD273U020AM	BD	0.0244	9.6
33000	3188BE333U020AM	BE	0.0213	10.8
38000	3188BF383U020AM	BF	0.0191	12.0
44000	3188BG443U020AM	BG	0.0175	13.1
49000	3188BH493U020AM	BH	0.0164	14.1
25000	3188DA253U020AM	DA	0.0217	9.6
30000	3188DB303U020AM	DB	0.0186	11.1
40000	3188DC403U020AM	DC	0.0148	13.3
50000	3188DD503U020AM	DD	0.0126	15.3
61000	3188DE613U020AM	DE	0.0111	17.2
71000	3188DF713U020AM	DF	0.0101	18.9
81000	3188DG813U020AM	DG	0.0094	20.6
91000	3188DH913U020AM	DH	0.0088	22.1
34000	3188EA343U020AM	EA	0.0254	9.6
41000	3188EB413U020AM	EB	0.0217	11.2
55000	3188EC553U020AM	EC	0.0172	13.5
25.0 VDC WORKING, 40.0 SURGE				
11000	3188BA113U025AM	BA	0.0440	5.8
14000	3188BB143U025AM	BB	0.0374	6.8
19000	3188BC193U025AM	BC	0.0293	8.2
23000	3188BD233U025AM	BD	0.0246	9.5
28000	3188BE283U025AM	BE	0.0215	10.8
33000	3188BF333U025AM	BF	0.0193	12.0
38000	3188BG383U025AM	BG	0.0177	13.1
43000	3188BH433U025AM	BH	0.0165	14.1
21000	3188DA213U025AM	DA	0.0219	9.5
26000	3188DB263U025AM	DB	0.0188	11.1
35000	3188DC353U025AM	DC	0.0150	13.3
43000	3188DD433U025AM	DD	0.0127	15.3
52000	3188DE523U025AM	DE	0.0112	17.1
61000	3188DF613U025AM	DF	0.0102	18.9
70000	3188DG703U025AM	DG	0.0094	20.5
79000	3188DH793U025AM	DH	0.0089	22.0
29000	3188EA293U025AM	EA	0.0256	9.6
35000	3188EB353U025AM	EB	0.0219	11.2
47000	3188EC473U025AM	EC	0.0173	13.4

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
15.0 VDC WORKING, 20.0 SURGE				
110000	3188ED114U015AM	ED	0.0098	18.9
130000	3188EE134U015AM	EE	0.0088	20.9
160000	3188EF164U015AM	EF	0.0081	22.9
180000	3188EG184U015AM	EG	0.0076	24.6
200000	3188EH204U015AM	EH	0.0072	26.3
110000	3188FB114U015AM	FB	0.0177	14.4
150000	3188FC154U015AM	FC	0.0142	17.0
190000	3188FD194U015AM	FD	0.0121	19.5
230000	3188FE234U015AM	FE	0.0107	21.7
260000	3188FF264U015AM	FF	0.0098	23.7
300000	3188FG304U015AM	FG	0.0091	25.7
340000	3188FH344U015AM	FH	0.0086	27.4
220000	3188GC224U015AM	GC	0.0099	23.0
280000	3188GD284U015AM	GD	0.0085	26.0
330000	3188GE334U015AM	GE	0.0077	28.8
390000	3188GF394U015AM	GF	0.0070	30.0
450000	3188GG454U015AM	GG	0.0066	30.0
500000	3188GH504U015AM	GH	0.0062	30.0
650000	3188GN654U015DM	GN	0.0054	45.0
20.0 VDC WORKING, 30.0 SURGE				
68000	3188ED683U020AM	ED	0.0145	15.5
82000	3188EE823U020AM	EE	0.0127	17.4
96000	3188EF963U020AM	EF	0.0114	19.2
110000	3188EG114U020AM	EG	0.0105	20.9
120000	3188EH124U020AM	EH	0.0099	22.5
68000	3188FB683U020AM	FB	0.0297	11.1
91000	3188FC913U020AM	FC	0.0232	13.3
110000	3188FD114U020AM	FD	0.0194	15.4
130000	3188FE134U020AM	FE	0.0169	17.3
160000	3188FF164U020AM	FF	0.0150	19.2
180000	3188FG184U020AM	FG	0.0136	21.0
200000	3188FH204U020AM	FH	0.0126	22.6
130000	3188GC134U020AM	GC	0.0159	18.1
160000	3188GD164U020AM	GD	0.0134	20.8
200000	3188GE204U020AM	GE	0.0116	23.4
230000	3188GF234U020AM	GF	0.0104	25.8
270000	3188GG274U020AM	GG	0.0095	28.0
300000	3188GH304U020AM	GH	0.0089	30.0
480000	3188GN484U020DM	GN	0.0070	40.5
25.0 VDC WORKING, 40.0 SURGE				
59000	3188ED593U025AM	ED	0.0146	15.5
71000	3188EE713U025AM	EE	0.0128	17.4
83000	3188EF833U025AM	EF	0.0115	19.2
95000	3188EG953U025AM	EG	0.0106	20.9
100000	3188EH104U025AM	EH	0.0099	22.4
59000	3188FB593U025AM	FB	0.0302	11.0
79000	3188FC793U025AM	FC	0.0236	13.2
98000	3188FD983U025AM	FD	0.0196	15.3
110000	3188FE114U025AM	FE	0.0171	17.2
130000	3188FF134U025AM	FF	0.0153	19.0
150000	3188FG154U025AM	FG	0.0139	20.8
170000	3188FH174U025AM	FH	0.0128	22.5
110000	3188GC114U025AM	GC	0.0162	18.0
140000	3188GD144U025AM	GD	0.0135	20.7
170000	3188GE174U025AM	GE	0.0118	23.2
200000	3188GF204U025AM	GF	0.0106	25.6
230000	3188GG234U025AM	GG	0.0097	27.8
260000	3188GH264U025AM	GH	0.0090	29.9
420000	3188GN424U025DM	GN	0.0070	40.3

STANDARD CAPACITANCE VALUES

30.0 VDC WORKING, 45.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
9000	3188BA902U030AM	BA	0.0446	5.7
10000	3188BB103U030AM	BB	0.0383	6.7
14000	3188BC143U030AM	BC	0.0299	8.1
18000	3188BD183U030AM	BD	0.0250	9.5
21000	3188BE213U030AM	BE	0.0218	10.7
25000	3188BF253U030AM	BF	0.0196	11.9
28000	3188BG283U030AM	BG	0.0180	13.0
32000	3188BH323U030AM	BH	0.0167	14.0
16000	3188DA163U030AM	DA	0.0658	5.5
19000	3188DB193U030AM	DB	0.0558	6.4
26000	3188DC263U030AM	DC	0.0432	7.8
33000	3188DD333U030AM	DD	0.0357	9.1
39000	3188DE393U030AM	DE	0.0309	10.3
46000	3188DF463U030AM	DF	0.0274	11.5
52000	3188DG523U030AM	DG	0.0249	12.6
59000	3188DH593U030AM	DH	0.0229	13.7
22000	3188EA223U030AM	EA	0.0809	5.4
26000	3188EB263U030AM	EB	0.0685	6.3
35000	3188EC353U030AM	EC	0.0527	7.7

30.0 VDC WORKING, 45.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
44000	3188ED443U030AM	ED	0.0434	9.0
53000	3188EE533U030AM	EE	0.0372	10.2
62000	3188EF623U030AM	EF	0.0328	11.4
71000	3188EG713U030AM	EG	0.0296	12.5
80000	3188EH803U030AM	EH	0.0271	13.6
44000	3188FB443U030AM	FB	0.0310	10.8
59000	3188FC593U030AM	FC	0.0242	13.1
74000	3188FD743U030AM	FD	0.0201	15.1
89000	3188FE893U030AM	FE	0.0174	17.1
100000	3188FF104U030AM	FF	0.0156	18.9
110000	3188FG114U030AM	FG	0.0142	20.6
130000	3188FH134U030AM	FH	0.0131	22.3
87000	3188GC873U030AM	GC	0.0304	13.1
100000	3188GD104U030AM	GD	0.0255	15.1
130000	3188GE134U030AM	GE	0.0216	17.2
150000	3188GF154U030AM	GF	0.0192	19.0
170000	3188GG174U030AM	GG	0.0174	20.8
190000	3188GH194U030AM	GH	0.0160	22.5
310000	3188GN314U030DM	GN	0.0118	31.1

40.0 VDC WORKING, 55.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
6800	3188BA682U040AM	BA	0.0457	5.7
8200	3188BB822U040AM	BB	0.0389	6.6
10000	3188BC103U040AM	BC	0.0308	8.0
13000	3188BD133U040AM	BD	0.0256	9.3
16000	3188BE163U040AM	BE	0.0223	10.6
19000	3188BF193U040AM	BF	0.0199	11.8
21000	3188BG213U040AM	BG	0.0183	12.8
24000	3188BH243U040AM	BH	0.0170	13.9
12000	3188DA123U040AM	DA	0.0669	5.4
15000	3188DB153U040AM	DB	0.0566	6.4
20000	3188DC203U040AM	DC	0.0438	7.8
25000	3188DD253U040AM	DD	0.0363	9.0
30000	3188DE303U040AM	DE	0.0313	10.3
35000	3188DF353U040AM	DF	0.0278	11.4
40000	3188DG403U040AM	DG	0.0252	12.5
45000	3188DH453U040AM	DH	0.0232	13.6
16000	3188EA163U040AM	EA	0.0836	5.3
20000	3188EB203U040AM	EB	0.0703	6.2
27000	3188EC273U040AM	EC	0.0541	7.6

40.0 VDC WORKING, 55.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
33000	3188ED333U040AM	ED	0.0446	8.8
40000	3188EE403U040AM	EE	0.0382	10.1
47000	3188EF473U040AM	EF	0.0337	11.2
54000	3188EG543U040AM	EG	0.0303	12.3
61000	3188EH613U040AM	EH	0.0278	13.4
33000	3188FB333U040AM	FB	0.0317	10.7
45000	3188FC453U040AM	FC	0.0246	12.9
56000	3188FD563U040AM	FD	0.0205	15.0
67000	3188FE673U040AM	FE	0.0177	16.9
79000	3188FF793U040AM	FF	0.0158	18.7
90000	3188FG903U040AM	FG	0.0143	20.5
100000	3188FH104U040AM	FH	0.0133	22.1
66000	3188GC663U040AM	GC	0.0318	12.8
83000	3188GD833U040AM	GD	0.0262	14.9
99000	3188GE993U040AM	GE	0.0226	16.8
110000	3188GF114U040AM	GF	0.0201	18.6
130000	3188GG134U040AM	GG	0.0181	20.4
140000	3188GH144U040AM	GH	0.0167	22.0
240000	3188GN244U040DM	GN	0.0122	30.6

50.0 VDC WORKING, 75.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
5300	3188BA532U050AM	BA	0.0468	5.6
6400	3188BB642U050AM	BB	0.0398	6.6
8600	3188BC862U050AM	BC	0.0312	8.0
10000	3188BD103U050AM	BD	0.0263	9.2
12000	3188BE123U050AM	BE	0.0229	10.4
15000	3188BF153U050AM	BF	0.0203	11.6
17000	3188BG173U050AM	BG	0.0186	12.7
19000	3188BH193U050AM	BH	0.0173	13.7
9800	3188DA982U050AM	DA	0.0677	5.4
11000	3188DB113U050AM	DB	0.0576	6.3
15000	3188DC153U050AM	DC	0.0445	7.7
19000	3188DD193U050AM	DD	0.0368	9.0
23000	3188DE233U050AM	DE	0.0317	10.2
27000	3188DF273U050AM	DF	0.0281	11.4
31000	3188DG313U050AM	DG	0.0255	12.5
35000	3188DH353U050AM	DH	0.0235	13.5
13000	3188EA133U050AM	EA	0.0849	5.3
16000	3188EB163U050AM	EB	0.0715	6.2
21000	3188EC213U050AM	EC	0.0551	7.5

50.0 VDC WORKING, 75.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
26000	3188ED263U050AM	ED	0.0454	8.8
32000	3188EE323U050AM	EE	0.0388	10.0
37000	3188EF373U050AM	EF	0.0342	11.1
42000	3188EG423U050AM	EG	0.0308	12.2
48000	3188EH483U050AM	EH	0.0282	13.3
26000	3188FB263U050AM	FB	0.0321	10.7
35000	3188FC353U050AM	FC	0.0250	12.9
44000	3188FD443U050AM	FD	0.0207	14.9
53000	3188FE533U050AM	FE	0.0179	16.8
62000	3188FF623U050AM	FF	0.0160	18.6
71000	3188FG713U050AM	FG	0.0145	20.4
79000	3188FH793U050AM	FH	0.0134	22.0
52000	3188GC523U050AM	GC	0.0328	12.6
65000	3188GD653U050AM	GD	0.0270	14.7
78000	3188GE783U050AM	GE	0.0232	16.6
91000	3188GF913U050AM	GF	0.0205	18.4
100000	3188GG104U050AM	GG	0.0186	20.1
110000	3188GH114U050AM	GH	0.0170	21.7
180000	3188GN184U050DM	GN	0.0125	30.3

SERIES 3188
Computer Grade Capacitors

STANDARD CAPACITANCE VALUES

60.0 VDC WORKING, 90.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
3900	3188BA392U060AM	BA	0.0487	5.5
4700	3188BB472U060AM	BB	0.0414	6.4
6200	3188BC622U060AM	BC	0.0324	7.8
7800	3188BD782U060AM	BD	0.0270	9.1
9400	3188BE942U060AM	BE	0.0235	10.3
10000	3188BF103U060AM	BF	0.0213	11.4
12000	3188BG123U060AM	BG	0.0193	12.5
14000	3188BH143U060AM	BH	0.0178	13.5
7100	3188DA712U060AM	DA	0.0690	5.4
8600	3188DB862U060AM	DB	0.0584	6.3
11000	3188DC113U060AM	DC	0.0453	7.6
14000	3188DD143U060AM	DD	0.0374	8.9
17000	3188DE173U060AM	DE	0.0322	10.1
20000	3188DF203U060AM	DF	0.0286	11.3
23000	3188DG233U060AM	DG	0.0259	12.4
25000	3188DH253U060AM	DH	0.0238	13.4
9700	3188EA972U060AM	EA	0.0865	5.2
11000	3188EB113U060AM	EB	0.0732	6.1
15000	3188EC153U060AM	EC	0.0563	7.4

60.0 VDC WORKING, 90.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
19000	3188ED193U060AM	ED	0.0462	8.7
23000	3188EE233U060AM	EE	0.0395	9.9
27000	3188EF273U060AM	EF	0.0348	11.0
31000	3188EG313U060AM	EG	0.0313	12.1
35000	3188EH353U060AM	EH	0.0287	13.2
15000	3188FB153U060AM	FB	0.0288	11.3
20000	3188FC203U060AM	FC	0.0225	13.5
26000	3188FD263U060AM	FD	0.0187	15.7
31000	3188FE313U060AM	FE	0.0163	17.6
36000	3188FF363U060AM	FF	0.0146	19.5
41000	3188FG413U060AM	FG	0.0133	21.3
47000	3188FH473U060AM	FH	0.0123	23.0
30000	3188GC303U060AM	GC	0.0292	13.4
38000	3188GD383U060AM	GD	0.0241	15.5
46000	3188GE463U060AM	GE	0.0208	17.5
53000	3188GF533U060AM	GF	0.0184	19.4
61000	3188GG613U060AM	GG	0.0167	21.2
69000	3188GH693U060AM	GH	0.0153	22.9
110000	3188GN114U060DM	GN	0.0115	31.6

75.0 VDC WORKING, 100.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
2900	3188BA292U075AM	BA	0.0512	5.3
3500	3188BB352U075AM	BB	0.0435	6.3
4700	3188BC472U075AM	BC	0.0339	7.6
5900	3188BD592U075AM	BD	0.0282	8.9
7100	3188BE712U075AM	BE	0.0245	10.1
8300	3188BF832U075AM	BF	0.0218	11.2
9500	3188BG952U075AM	BG	0.0199	12.3
10000	3188BH103U075AM	BH	0.0187	13.2
5400	3188DA542U075AM	DA	0.0704	5.3
6500	3188DB652U075AM	DB	0.0595	6.2
8700	3188DC872U075AM	DC	0.0461	7.6
10000	3188DD103U075AM	DD	0.0383	8.8
13000	3188DE133U075AM	DE	0.0328	10.0
15000	3188DF153U075AM	DF	0.0291	11.2
17000	3188DG173U075AM	DG	0.0263	12.3
19000	3188DH193U075AM	DH	0.0242	13.3
7400	3188EA742U075AM	EA	0.0878	5.2
8900	3188EB892U075AM	EB	0.0741	6.1
11000	3188EC113U075AM	EC	0.0573	7.4

75.0 VDC WORKING, 100.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
14000	3188ED143U075AM	ED	0.0470	8.6
17000	3188EE173U075AM	EE	0.0402	9.8
20000	3188EF203U075AM	EF	0.0354	11.0
23000	3188EG233U075AM	EG	0.0318	12.0
26000	3188EH263U075AM	EH	0.0291	13.1
11000	3188FB113U075AM	FB	0.0296	11.1
15000	3188FC153U075AM	FC	0.0230	13.4
19000	3188FD193U075AM	FD	0.0192	15.5
23000	3188FE233U075AM	FE	0.0166	17.5
27000	3188FF273U075AM	FF	0.0148	19.3
31000	3188FG313U075AM	FG	0.0135	21.1
35000	3188FH353U075AM	FH	0.0125	22.8
23000	3188GC233U075AM	GC	0.0296	13.3
29000	3188GD293U075AM	GD	0.0244	15.4
35000	3188GE353U075AM	GE	0.0211	17.4
41000	3188GF413U075AM	GF	0.0187	19.3
47000	3188GG473U075AM	GG	0.0169	21.1
52000	3188GH523U075AM	GH	0.0155	22.8
85000	3188GN853U075DM	GN	0.0116	31.4

100.0 VDC WORKING, 150.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
1300	3188BA132T100AM	BA	0.1062	3.7
1600	3188BB162T100AM	BB	0.0881	4.4
2100	3188BC212T100AM	BC	0.0681	5.4
2700	3188BD272T100AM	BD	0.0548	6.4
3200	3188BE322T100AM	BE	0.0470	7.3
3800	3188BF382T100AM	BF	0.0409	8.2
4300	3188BG432T100AM	BG	0.0368	9.0
4900	3188BH492T100AM	BH	0.0333	9.9
2500	3188DA252T100AM	DA	0.0919	4.6
3000	3188DB302T100AM	DB	0.0775	5.5
4000	3188DC402T100AM	DC	0.0597	6.6
5000	3188DD502T100AM	DD	0.0491	7.8
6000	3188DE602T100AM	DE	0.0420	8.9
7000	3188DF702T100AM	DF	0.0370	9.9
8000	3188DG802T100AM	DG	0.0334	10.9
9000	3188DH902T100AM	DH	0.0305	11.9
3400	3188EA342T100AM	EA	0.0996	4.9
4100	3188EB412T100AM	EB	0.0839	5.7
5400	3188EC542T100AM	EC	0.0646	6.9

100.0 VDC WORKING, 150.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
6800	3188ED682T100AM	ED	0.0529	8.1
8200	3188EE822T100AM	EE	0.0452	9.2
9600	3188EF962T100AM	EF	0.0397	10.3
10000	3188EG103T100AM	EG	0.0362	11.3
12000	3188EH123T100AM	EH	0.0328	12.3
6800	3188FB682T100AM	FB	0.0405	9.5
9100	3188FC912T100AM	FC	0.0314	11.5
11000	3188FD113T100AM	FD	0.0261	13.3
13000	3188FE133T100AM	FE	0.0225	15.0
16000	3188FF163T100AM	FF	0.0198	16.7
18000	3188FG183T100AM	FG	0.0179	18.3
20000	3188FH203T100AM	FH	0.0165	19.8
13000	3188GC133T100AM	GC	0.0366	12.0
16000	3188GD163T100AM	GD	0.0302	13.9
20000	3188GE203T100AM	GE	0.0258	15.7
23000	3188GF233T100AM	GF	0.0228	17.4
27000	3188GG273T100AM	GG	0.0205	19.1
30000	3188GH303T100AM	GH	0.0188	20.7
49000	3188GN493T100DM	GN	0.0137	28.9

STANDARD CAPACITANCE VALUES

125.0 VDC WORKING, 150.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
680	3188BA681T125AM	BA	0.1215	3.5
810	3188BB811T125AM	BB	0.1027	4.1
1000	3188BC102T125AM	BC	0.0825	4.9
1300	3188BD132T125AM	BD	0.0655	5.8
1600	3188BE162T125AM	BE	0.0547	6.8
1900	3188BF192T125AM	BF	0.0474	7.6
2100	3188BG212T125AM	BG	0.0432	8.4
2400	3188BH242T125AM	BH	0.0388	9.2
1200	3188DA122T125AM	DA	0.1002	4.4
1500	3188DB152T125AM	DB	0.0833	5.3
2000	3188DC202T125AM	DC	0.0640	6.4
2500	3188DD252T125AM	DD	0.0525	7.5
3000	3188DE302T125AM	DE	0.0449	8.6
3500	3188DF352T125AM	DF	0.0395	9.6
4000	3188DG402T125AM	DG	0.0355	10.6
4500	3188DH452T125AM	DH	0.0324	11.5
1700	3188EA172T125AM	EA	0.1028	4.8
2000	3188EB202T125AM	EB	0.0870	5.6
2700	3188EC272T125AM	EC	0.0666	6.8

125.0 VDC WORKING, 150.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
3400	3188ED342T125AM	ED	0.0545	8.0
4100	3188EE412T125AM	EE	0.0465	9.1
4800	3188EF482T125AM	EF	0.0409	10.2
5500	3188EG552T125AM	EG	0.0367	11.2
6100	3188EH612T125AM	EH	0.0336	12.2
3400	3188FB342T125AM	FB	0.0428	9.2
4500	3188FC452T125AM	FC	0.0331	11.2
5700	3188FD572T125AM	FD	0.0272	13.0
6800	3188FE682T125AM	FE	0.0235	14.7
8000	3188FF802T125AM	FF	0.0207	16.4
9100	3188FG912T125AM	FG	0.0187	17.9
10000	3188FH103T125AM	FH	0.0173	19.4
6700	3188GC672T125AM	GC	0.0368	11.9
8400	3188GD842T125AM	GD	0.0303	13.8
10000	3188GE103T125AM	GE	0.0260	15.6
11000	3188GF113T125AM	GF	0.0232	17.3
13000	3188GG133T125AM	GG	0.0208	19.0
15000	3188GH153T125AM	GH	0.0189	20.6
24000	3188GN243T125AM	GN	0.0139	28.7

150.0 VDC WORKING, 200.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
570	3188BA571T150AM	BA	0.1293	3.4
680	3188BB681T150AM	BB	0.1091	4.0
910	3188BC911T150AM	BC	0.0831	4.9
1100	3188BD112T150AM	BD	0.0692	5.7
1300	3188BE132T150AM	BE	0.0593	6.5
1600	3188BF162T150AM	BF	0.0500	7.4
1800	3188BG182T150AM	BG	0.0451	8.2
2000	3188BH202T150AM	BH	0.0412	8.9
1000	3188DA102T150AM	DA	0.1052	4.3
1200	3188DB122T150AM	DB	0.0887	5.1
1600	3188DC162T150AM	DC	0.0680	6.2
2100	3188DD212T150AM	DD	0.0548	7.4
2500	3188DE252T150AM	DE	0.0469	8.4
2900	3188DF292T150AM	DF	0.0413	9.4
3300	3188DG332T150AM	DG	0.0371	10.3
3800	3188DH382T150AM	DH	0.0336	11.3
1400	3188EA142T150AM	EA	0.1066	4.7
1700	3188EB172T150AM	EB	0.0896	5.5
2300	3188EC232T150AM	EC	0.0685	6.7

150.0 VDC WORKING, 200.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
2800	3188ED282T150AM	ED	0.0564	7.9
3400	3188EE342T150AM	EE	0.0480	9.0
4000	3188EF402T150AM	EF	0.0421	10.0
4600	3188EG462T150AM	EG	0.0377	11.1
5100	3188EH512T150AM	EH	0.0345	12.0
2800	3188FB282T150AM	FB	0.0447	9.0
3800	3188FC382T150AM	FC	0.0343	11.0
4800	3188FD482T150AM	FD	0.0282	12.8
5700	3188FE572T150AM	FE	0.0243	14.4
6700	3188FF672T150AM	FF	0.0214	16.1
7700	3188FG772T150AM	FG	0.0193	17.6
8600	3188FH862T150AM	FH	0.0177	19.1
5600	3188GC562T150AM	GC	0.0377	11.8
7100	3188GD712T150AM	GD	0.0309	13.7
8500	3188GE852T150AM	GE	0.0265	15.5
9900	3188GF992T150AM	GF	0.0234	17.2
11000	3188GG113T150AM	GG	0.0212	18.8
12000	3188GH123T150AM	GH	0.0195	20.3
20000	3188GN203T150AM	GN	0.0141	28.5

200.0 VDC WORKING, 250.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
400	3188BA401T200AM	BA	0.1314	3.3
490	3188BB491T200AM	BB	0.1088	4.0
650	3188BC651T200AM	BC	0.0833	4.9
810	3188BD811T200AM	BD	0.0680	5.7
980	3188BE981T200AM	BE	0.0574	6.6
1100	3188BF112T200AM	BF	0.0514	7.3
1300	3188BG132T200AM	BG	0.0449	8.2
1400	3188BH142T200AM	BH	0.0418	8.8
750	3188DA751T200AM	DA	0.1036	4.4
900	3188DB901T200AM	DB	0.0873	5.1
1200	3188DC122T200AM	DC	0.0670	6.3
1500	3188DD152T200AM	DD	0.0549	7.4
1800	3188DE182T200AM	DE	0.0469	8.4
2100	3188DF212T200AM	DF	0.0412	9.4
2400	3188DG242T200AM	DG	0.0370	10.3
2700	3188DH272T200AM	DH	0.0338	11.3
1000	3188EA102T200AM	EA	0.1069	4.7
1200	3188EB122T200AM	EB	0.0901	5.5
1600	3188EC162T200AM	EC	0.0691	6.7

200.0 VDC WORKING, 250.0 SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
2000	3188ED202T200AM	ED	0.0566	7.9
2400	3188EE242T200AM	EE	0.0483	8.9
2800	3188EF282T200AM	EF	0.0424	10.0
3200	3188EG322T200AM	EG	0.0380	11.0
3700	3188EH372T200AM	EH	0.0345	12.0
2000	3188FB202T200AM	FB	0.0448	9.0
2700	3188FC272T200AM	FC	0.0345	10.9
3400	3188FD342T200AM	FD	0.0283	12.7
4100	3188FE412T200AM	FE	0.0243	14.4
4800	3188FF482T200AM	FF	0.0214	16.1
5500	3188FG552T200AM	FG	0.0193	17.6
6100	3188FH612T200AM	FH	0.0178	19.1
4000	3188GC402T200AM	GC	0.0377	11.8
5000	3188GD502T200AM	GD	0.0310	13.7
6000	3188GE602T200AM	GE	0.0266	15.5
7100	3188GF712T200AM	GF	0.0234	17.2
8100	3188GG812T200AM	GG	0.0211	18.8
9100	3188GH912T200AM	GH	0.0193	20.4
14000	3188GN143T200AM	GN	0.0142	28.4

SERIES 3188
Computer Grade Capacitors

STANDARD CAPACITANCE VALUES

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
250.0 VDC WORKING, 300.0 SURGE				
290	3188BA291T250AM	BA	0.1508	3.1
340	3188BB341T250AM	BB	0.1287	3.7
460	3188BC461T250AM	BC	0.0969	4.5
580	3188BD581T250AM	BD	0.0783	5.3
690	3188BE691T250AM	BE	0.0667	6.1
810	3188BF811T250AM	BF	0.0579	6.9
920	3188BG921T250AM	BG	0.0517	7.6
1000	3188BH102T250AM	BH	0.0479	8.3
530	3188DA531T250AM	DA	0.1165	4.1
640	3188DB641T250AM	DB	0.0978	4.9
860	3188DC861T250AM	DC	0.0746	5.9
1000	3188DD102T250AM	DD	0.0631	6.9
1200	3188DE122T250AM	DE	0.0537	7.8
1500	3188DF152T250AM	DF	0.0456	8.9
1700	3188DG172T250AM	DG	0.0410	9.8
1900	3188DH192T250AM	DH	0.0374	10.7
730	3188EA731T250AM	EA	0.1153	4.5
870	3188EB871T250AM	EB	0.0973	5.3
1100	3188EC112T250AM	EC	0.0759	6.4
300.0 VDC WORKING, 350.0 SURGE				
210	3188BA211T300AM	BA	0.4025	1.9
260	3188BB261T300AM	BB	0.3269	2.3
340	3188BC341T300AM	BC	0.2509	2.8
430	3188BD431T300AM	BD	0.1998	3.3
520	3188BE521T300AM	BE	0.1664	3.9
600	3188BF601T300AM	BF	0.1450	4.4
690	3188BG691T300AM	BG	0.1271	4.9
780	3188BH781T300AM	BH	0.1133	5.4
400	3188DA401T300AM	DA	0.2344	2.9
480	3188DB481T300AM	DB	0.1963	3.4
650	3188DC651T300AM	DC	0.1471	4.2
810	3188DD811T300AM	DD	0.1193	5.0
970	3188DE971T300AM	DE	0.1007	5.7
1100	3188DF112T300AM	DF	0.0891	6.4
1300	3188DG132T300AM	DG	0.0771	7.2
1400	3188DH142T300AM	DH	0.0715	7.7
550	3188EA551T300AM	EA	0.1901	3.5
660	3188EB661T300AM	EB	0.1594	4.1
880	3188EC881T300AM	EC	0.1211	5.1
350 VDC WORKING, 400.0 SURGE				
180	3188BA181T350AM	BA	0.4277	1.8
220	3188BB221T350AM	BB	0.3513	2.2
300	3188BC301T350AM	BC	0.2596	2.8
370	3188BD371T350AM	BD	0.2114	3.3
450	3188BE451T350AM	BE	0.1751	3.8
530	3188BF531T350AM	BF	0.1497	4.3
600	3188BG601T350AM	BG	0.1330	4.8
680	3188BH681T350AM	BH	0.1183	5.3
350	3188DA351T350AM	DA	0.2435	2.9
420	3188DB421T350AM	DB	0.2039	3.4
560	3188DC561T350AM	DC	0.1544	4.1
700	3188DD701T350AM	DD	0.1249	4.9
850	3188DE851T350AM	DE	0.1043	5.6
990	3188DF991T350AM	DF	0.0905	6.3
1100	3188DG112T350AM	DG	0.0818	7.0
1200	3188DH122T350AM	DH	0.0752	7.6
480	3188EA481T350AM	EA	0.1970	3.5
580	3188EB581T350AM	EB	0.1645	4.1
770	3188EC771T350AM	EC	0.1252	5.0

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
250.0 VDC WORKING, 300.0 SURGE				
1400	3188ED142T250AM	ED	0.0617	7.5
1700	3188EE172T250AM	EE	0.0523	8.6
2000	3188EF202T250AM	EF	0.0457	9.6
2300	3188EG232T250AM	EG	0.0409	10.6
2600	3188EH262T250AM	EH	0.0372	11.6
1400	3188FB142T250AM	FB	0.0499	8.6
1900	3188FC192T250AM	FC	0.0382	10.4
2400	3188FD242T250AM	FD	0.0312	12.1
2900	3188FE292T250AM	FE	0.0267	13.8
3400	3188FF342T250AM	FF	0.0234	15.4
3900	3188FG392T250AM	FG	0.0211	16.9
4400	3188FH442T250AM	FH	0.0192	18.4
2800	3188GC282T250AM	GC	0.0403	11.4
3600	3188GD362T250AM	GD	0.0328	13.3
4300	3188GE432T250AM	GE	0.0281	15.0
5000	3188GF502T250AM	GF	0.0248	16.7
5700	3188GG572T250AM	GG	0.0223	18.3
6400	3188GH642T250AM	GH	0.0204	19.9
10000	3188GN103T250AM	GN	0.0149	27.8
300.0 VDC WORKING, 350.0 SURGE				
1100	3188ED112T300AM	ED	0.0982	6.0
1300	3188EE132T300AM	EE	0.0836	6.8
1500	3188EF152T300AM	EF	0.0732	7.6
1700	3188EG172T300AM	EG	0.0653	8.4
1900	3188EH192T300AM	EH	0.0591	9.2
1100	3188FB112T300AM	FB	0.0901	6.4
1400	3188FC142T300AM	FC	0.0707	7.6
1800	3188FD182T300AM	FD	0.0563	9.0
2200	3188FE222T300AM	FE	0.0471	10.4
2600	3188FF262T300AM	FF	0.0407	11.7
2900	3188FG292T300AM	FG	0.0367	12.8
3300	3188FH332T300AM	FH	0.0329	14.0
2100	3188GC212T300AM	GC	0.0565	9.6
2700	3188GD272T300AM	GD	0.0455	11.3
3200	3188GE322T300AM	GE	0.0389	12.8
3800	3188GF382T300AM	GF	0.0338	14.3
4300	3188GG432T300AM	GG	0.0303	15.7
4900	3188GH492T300AM	GH	0.0273	17.2
7900	3188GN792T300AM	GN	0.0191	24.5
350.0 VDC WORKING, 400.0 SURGE				
960	3188ED961T350AM	ED	0.1016	5.9
1100	3188EE112T350AM	EE	0.0881	6.6
1300	3188EF132T350AM	EF	0.0760	7.5
1500	3188EG152T350AM	EG	0.0671	8.3
1700	3188EH172T350AM	EH	0.0603	9.1
970	3188FB971T350AM	FB	0.0929	6.3
1200	3188FC122T350AM	FC	0.0743	7.4
1600	3188FD163T350AM	FD	0.0577	8.9
1900	3188FE192T350AM	FE	0.0492	10.2
2200	3188FF222T350AM	FF	0.0430	11.3
2500	3188FG252T350AM	FG	0.0383	12.5
2900	3188FH292T350AM	FH	0.0340	13.8
1900	3188GC192T350AM	GC	0.0576	9.5
2300	3188GD232T350AM	GD	0.0474	11.1
2800	3188GE282T350AM	GE	0.0401	12.6
3300	3188GF332T350AM	GF	0.0349	14.1
3800	3188GG382T350AM	GG	0.0311	15.5
4300	3188GH432T350AM	GH	0.0281	16.9
6900	3188GN692T350AM	GN	0.0196	24.2

STANDARD CAPACITANCE VALUES

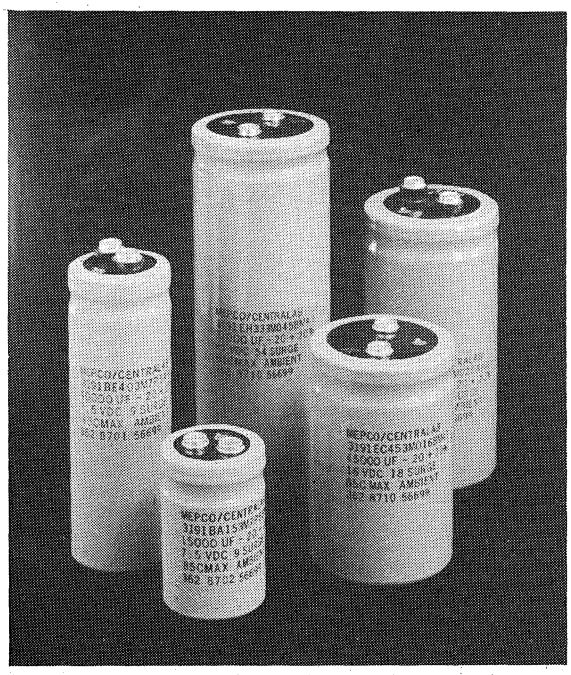
Capacitance μF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
400.0 VDC WORKING, 450.0 SURGE				
160	3188BA161T400AM	BA	0.4380	1.8
190	3188BB191T400AM	BB	0.3694	2.2
260	3188BC261T400AM	BC	0.2720	2.7
320	3188BD321T400AM	BD	0.2219	3.2
390	3188BE391T400AM	BE	0.1834	3.7
450	3188BF451T400AM	BF	0.1597	4.2
520	3188BG521T400AM	BG	0.1392	4.7
580	3188BH581T400AM	BH	0.1255	5.1
300	3188DA301T400AM	DA	0.2565	2.8
360	3188DB361T400AM	DB	0.2147	3.3
480	3188DC481T400AM	DC	0.1626	4.0
600	3188DD601T400AM	DD	0.1313	4.8
730	3188DE731T400AM	DE	0.1095	5.5
850	3188DF851T400AM	DF	0.0950	6.2
970	3188DG971T400AM	DG	0.0842	6.9
1000	3188DH102T400AM	DH	0.0806	7.3
410	3188EA411T400AM	EA	0.2069	3.4
490	3188EB491T400AM	EB	0.1738	4.0
660	3188EC661T400AM	EC	0.1311	4.9

Capacitance μF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
400.0 VDC WORKING, 450.0 SURGE				
820	3188ED821T400AM	ED	0.1066	5.7
990	3188EE991T400AM	EE	0.0896	6.6
1100	3188EF112T400AM	EF	0.0801	7.3
1300	3188EG132T400AM	EG	0.0697	8.1
1400	3188EH142T400AM	EH	0.0644	8.8
830	3188FB831T400AM	FB	0.0977	6.1
1100	3188FC112T400AM	FC	0.0746	7.4
1300	3188FD132T400AM	FD	0.0628	8.6
1600	3188FE162T400AM	FE	0.0522	9.9
1900	3188FF192T400AM	FF	0.0448	11.1
2200	3188FG222T400AM	FG	0.0395	12.3
2500	3188FH252T400AM	FH	0.0354	13.5
1600	3188GC162T400AM	GC	0.0606	9.3
2000	3188GD202T400AM	GD	0.0493	10.8
2400	3188GE242T400AM	GE	0.0419	12.3
2800	3188GF282T400AM	GF	0.0365	13.8
3200	3188GG322T400AM	GG	0.0326	15.2
3700	3188GH372T400AM	GH	0.0292	16.6
5900	3188GN592T400AM	GN	0.0203	23.8

SERIES 3191

Computer-Grade Aluminum Electrolytic Capacitors

Symmetrical-Tolerance Capacitors for Switch-Mode Power Supplies.



DESCRIPTION:

Series 3191 Computer-Grade Aluminum Electrolytic Capacitors are specifically designed for use in switch-mode power supplies. Their construction utilizes the most advanced multiple-tabbing techniques and a non-acqueous electrolyte system to attain extremely low ESR, high ripple-current capability and long life. These same attributes make them an excellent choice for any filtering application.

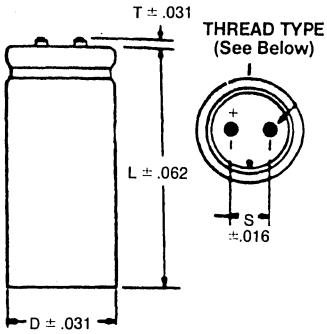
FEATURES:

- 5 VDC to 55 VDC ratings.
- Very Low ESR—2.4 milliohms at 20 kHz (200000 μF and 5 VDC).
- Symmetrical ESR Tolerance—$\pm$30%.
- Symmetrical Capacitance Tolerance—$\pm$20%.
- High Ripple Current Capability—up to 30 amps in a 2.0" x 5.625" case at 85°C.

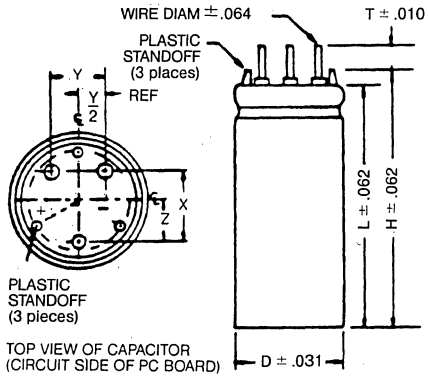
DIMENSIONS

Case Code	UNINSULATED CASE DIMENSIONS					
	Dimensions in Inches			Dimensions in Millimeters		
	D	L	S	D	L	S
BA	1.375	2.125	.500	34.92	53.97	12.70
BB	1.375	2.625	.500	34.92	66.67	12.70
BC	1.375	3.125	.500	34.92	79.37	12.70
BD	1.375	3.625	.500	34.92	92.07	12.70
BE	1.375	4.125	.500	34.92	104.77	12.70
BF	1.375	4.625	.500	34.92	117.47	12.70
BG	1.375	5.125	.500	34.92	130.17	12.70
BH	1.375	5.625	.500	34.92	142.87	12.70
DA	1.750	2.125	.750	44.45	53.97	19.05
DB	1.750	2.625	.750	44.45	66.67	19.05
DC	1.750	3.125	.750	44.45	79.37	19.05
DD	1.750	3.625	.750	44.45	92.07	19.05
DE	1.750	4.125	.750	44.45	104.77	19.05
DF	1.750	4.625	.750	44.45	117.47	19.05
DG	1.750	5.125	.750	44.45	130.17	19.05
DH	1.750	5.625	.750	44.45	142.87	19.05
EA	2.000	2.125	.875	50.80	53.97	22.22
EB	2.000	2.625	.875	50.80	66.67	22.22
EC	2.000	3.125	.875	50.80	79.37	22.22
ED	2.000	3.625	.875	50.80	92.07	22.22
EE	2.000	4.125	.875	50.80	104.77	22.22
EF	2.000	4.625	.875	50.80	117.47	22.22
EG	2.000	5.125	.875	50.80	130.17	22.22
EH	2.000	5.625	.875	50.80	142.87	22.22

CASE OUTLINE DRAWING



CASE OUTLINE DRAWING
PRINTED CIRCUIT BOARD MOUNT



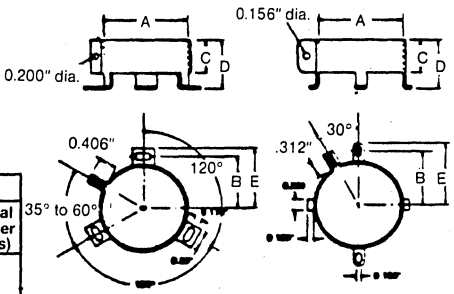
INSULATED CASE DIMENSION ADDER AND BRACKET CODES								
	INCHES			MM			BRACKET CODE	
INSULATION TYPE	D	L	H	D	L	H	without	with
.004 inch Polymeric	.010	.015	.010	.25	.38	.25	M	L
.008 inch Polymeric	.020	.032	.024	.508	.813	.61	P	R
.012 inch Polymeric	.025	.062	.045	.63	1.58	1.14	H	J
Uninsulated	–	–	–	–	–	–	N	X

The capacitors are marked with:
- nominal capacitance
- rated voltage
- EIA source and date code
- maximum ambient temperature
- polarity
- name of manufacturer
- part number
- capacitance tolerance

BRACKET DIMENSIONS					
	Dimensions in Inches				
Case Diameters	A 0.005	B 0.031	C 0.016	D 0.031	E 0.031
1.375	1.375	0.906	0.562	0.750	1.156
1.750	1.750	1.125	0.750	1.125	1.313
2.000	2.000	1.250	0.750	1.125	1.438
	Dimensions in Millimeters				
Case Diameters	A 0.13	B 0.79	C 0.40	D 0.79	E 0.79
34.92	34.92	23.01	14.25	19.05	29.36
44.45	44.45	28.57	19.05	28.57	33.35
50.80	50.80	31.75	19.05	28.57	36.51

Note: All brackets are zinc/iridite plated.

BRACKET OUTLINE DRAWING



For 1-3/4(D), 2(E), 2-1/2(F), and 3(G) inch diameter can sizes

For 1-3/8(B) inch diameter can sizes

PC MOUNT OVERALL HEIGHT (INCHES)

Case Length	H		
	D = 1.375	D = 1.750	D = 2.000
2.125	2.26	2.31	2.31
2.625	2.76	2.81	2.81
3.125	3.26	3.31	3.31
3.625	3.76	3.81	3.81
4.125	4.26	4.31	4.31
4.625	4.76	4.81	4.81
5.125	5.26	5.31	5.31
5.625	5.76	5.81	5.81

PC MOUNT TERMINAL SPACING (INCHES)

Case Diameter	X	Y	Z
1.375	.550	.600	.375
1.750	.900	.700	.525
2.000	1.000	.800	.575

TERMINAL STYLES, DIMENSIONS, AND CODES					
Terminal Style	T (inches)	T (mm)	Code	Thread Type	Terminal Diameter (inches)
High Post	.250	6.4	A	10-32	.313
Low Post	.063	1.6	B	10-32	.313
PC Mount	.250	8.6	H	N/A	N/A

HOW TO SPECIFY

Mepco/Centralab Series 3191 Capacitors can be completely specified using the following designation:

3191 — **Mepco/Centralab Product Series**

BA — **Case Size Code** (see physical spec)

183 — **Capacitance**
XX = Significant Digits
X = Multiplier
i.e. 183 = 18000μF

M — **Tolerance**
M = ±20%

005 — **Volts**
005 = 5VDC
050 = 50VDC

B — **Termination**
A=High Post
B=Low Post
H=PC Mount

M — **Insulation & Bracket Code** (see physical spec)

A-1 — **Factory Assigned Number**

SERIES 3191
Computer Grade Capacitors

PERFORMANCE SPECIFICATIONS

1. TEMPERATURE.

1.1 OPERATING. These capacitors are designed to operate within the temperature range of −40°C to +85°C.

1.2 STORAGE. These capacitors may be subjected, without permanent damage, to conditions in transit where temperatures range from −55°C to +85°C at altitudes up to 120,000 feet.

1.3 TOLERANCE. Unless otherwise specified, temperature tolerance shall be ±3°C.

2. DC WORKING VOLTAGE. The dc working voltage is the maximum operating voltage for continuous operation at maximum rated temperature.

3. SURGE VOLTAGE. The surge voltage is the maximum non-recurrent voltage to which the capacitor should be subjected.

3.1 The surge voltage shall not exceed the values specified in the rating table.

3.2 SURGE TEST

3.2.1 Capacitors shall be connected in series with a resistor. The value of the resistor is:

CAPACITANCE (μF)	RESISTOR (ohms)
0-2500	1000
2501-25000	100
25001-250000	10
250001-UP	3

The series combination is then subjected to rated surge voltage for 30 seconds at 85°C and the capacitor allowed to discharge thru the resistor. This sequence is repeated ten times per hour at 6 minute intervals for 1000 cycles.

3.2.2 Leakage current when measured per paragraph 6.2, not sooner than four (4) hours after completion of the test, shall not exceed the initial leakage current limit. There shall be no leaking of electrolyte and no mechanical damage.

4. CAPACITANCE. Capacitance shall be measured on a capacitance bridge having a maximum rms signal voltage of 1 volt at 120 Hz. Capacitance shall be within the specified tolerance when measured at 25°C.

5. EQUIVALENT SERIES RESISTANCE. The ESR, which is relatively constant between 5 kHz and 50 kHz, is determined by measuring the impedance at the capacitor's resonant frequency or by measuring it directly at 20 kKz. The resonant frequency may be approximated by the formula:

$$f = \frac{1350}{\sqrt{C}}$$

where

f=resonant frequency in kHz
C=Capacitance in μF

The ESR shall be within the specified tolerance.

6. DC LEAKAGE CURRENT.

6.1 PRE-CONDITIONING. In the period 24 to 48 hours prior to test, rated working voltage shall be applied to the capacitor for a minimum of 15 minutes.

6.2 MEASUREMENT. Measurement shall be made at 25°C. Voltage shall be applied to the capacitor thru a current limiting resistor. The leakage current shall be measured 5 minutes after the capacitor reaches rated voltage. Leakage current shall not exceed the value calculated as shown:

$$I = .0015\sqrt{CV}$$

C—Rated Capacitance (μf)
V—Rated Voltage (volts)
I—Leakage Current (mA)

7. LOW TEMPERATURE PERFORMANCE.

7.1 CAPACITANCE. Capacitance, when measured at −40°C and a frequency of 120 Hz, shall not be less than the following percentages of the 25°C capacitance.

TEMPERATURE −40 DEGREES C

RATED DC VOLTAGE	% OF 25°C CAPACITANCE	25°C IMPEDANCE MULTIPLIER
0-9	50	5.5
10-55	60	4.5

8. LIFE TEST.

8.1 Capacitors shall be placed in a circulating air oven at an ambient temperature of 85°C. Spacing between capacitors must be at least 1" and capacitors must not be subjected to direct radiation from heating elements. Circulation of air shall be sufficient to keep the temperature within six (6) inches of the capacitor below 88°C.

8.1.1 Rated dc voltage with rated ripple current shall be applied to the capacitors for a period of 1500 hours. Following this test the capacitors shall meet the requirements of paragraph 8.2.

8.2 Upon completion of the life test, the capacitors shall be returned to room ambient for a minimum of 24 hours. The capacitors shall then meet the following requirements:

8.2.1 Capacitance, when measured per paragraph 4., shall not be less than 85% of the initial measured value.

8.2.2 The ESR, when measured per paragraph 5., shall not be greater than 175% of the initial requirement.

8.2.3 The leakage current, when measured per paragraph 6.2, shall not exceed the initial specification.

8.2.4 There shall be no evidence of mechanical damage or excessive electrolyte leakage.

9. SHELF TEST. Capacitors shall be placed in a circulating air oven at 85°C for a period of 100 ± 4 hours with no voltage applied. The units shall then be allowed to cool to 25°C for a minimum of 16 hours.

9.1 The capacitance and equivalent series resistance, when measured in accordance with paragraphs 4 and 5, shall meet the initial specification. The leakage current shall not exceed 200% of the initial limit when measured per paragraph 6.2.

10. VIBRATION. Capacitors shall be clamped rigidly to a vibration platform and subjected to a simple harmonic motion having a maximum peak-to-peak amplitude of .06 inches and a maximum acceleration of 10g. The frequency of vibration shall be varied linearly between 10 and 55 cycles per second. The entire frequency range, 10 to 55 to 10 cps, shall be traversed in one minute. Capacitors shall be vibrated for 1½ hours with the direction of motion being parallel to the axis of the capacitor. The capacitors shall then be placed so that the direction of motion is perpendicular to the axis and the vibration continued for 1½ hours. During the last ½ hour of the test, the capacitor shall be connected to a bridge and observed for a 3 minute period. A capacitor failing the vibration test is defined as one failing to meet the requirements of paragraph 10.1.

9.1 There shall be no evidence of loosening of the capacitor element within the container, when shaken by hand following the test. There shall be no indication of intermittent contact during the 3 minute observation period. Capacitors shall not be open or shorted.

11. CONTAINER SEAL. Following the vibration test each capacitor shall be tested for seal tightness in accordance with paragraphs 11.1 and 11.2.

11.1 Capacitors shall be subjected to two successive temperature cycles in circulating air as follows:

ONE TEMPERATURE CYCLE

A. 85°C-30 min.
B. 25°C-30 min.
C. −40°C-30 min.
D. 25°C-30 min.

11.2 Following the second cycle, the capacitors shall be placed in 90-95°C water for 5 minutes. A failure is defined as a unit exhibiting a continuous chain of bubbles when immersed.

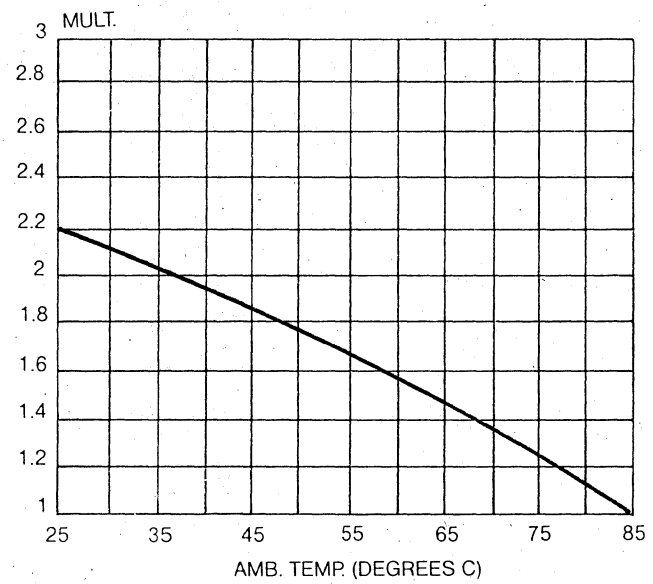
SERIES 3191
Computer Grade Capacitors

12. RIPPLE CURRENT. Capacitors will withstand the 85°C rms ripple current stated in the rating tables for the duration of the life test as specified in paragraph 8 of the Performance Specifications. Any reduction in ambient temperature and/or ripple current will extend the operating life of the capacitor. See application guidelines for method for determining extended life at derated conditions.

12.1. Ripple Current values are specified at an ambient temperature of 85°C and a frequency of 120 Hz. Ripple current (I_R) at other frequencies and temperatures can be calculated.

$$I_R = I_{85} \cdot \text{RIPPLE MULTIPLIER}$$

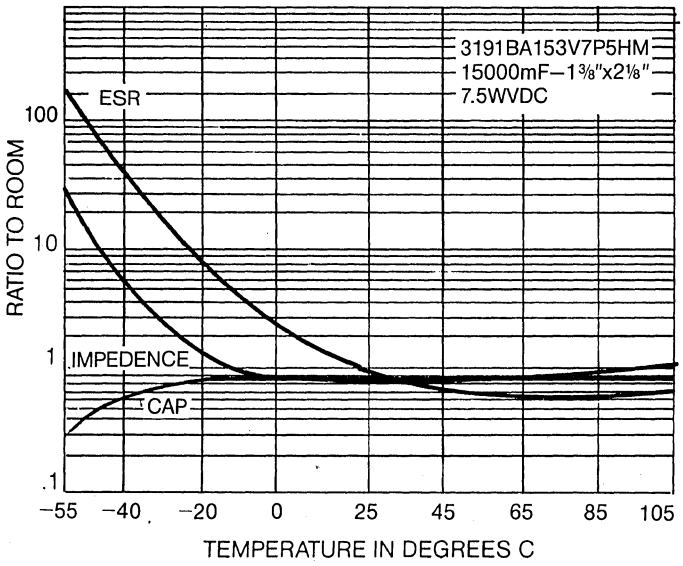
RIPPLE MULTIPLIER
100 DEGREE CORE

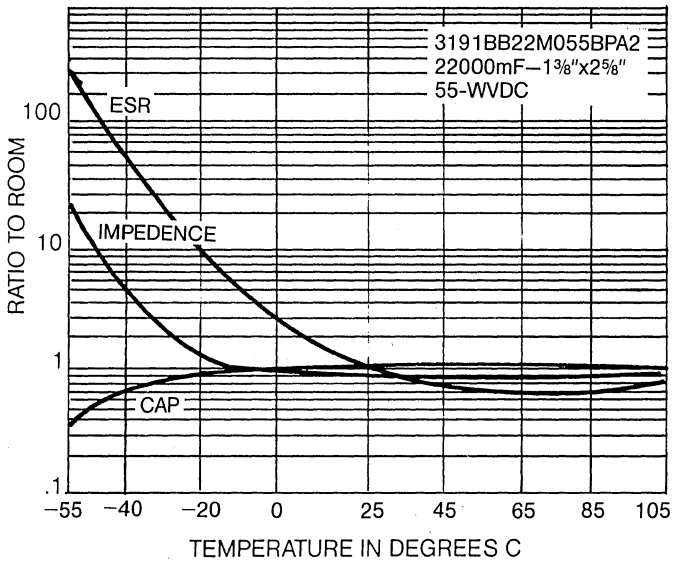


12.2 For ripple currents at other frequencies, see application guidelines.

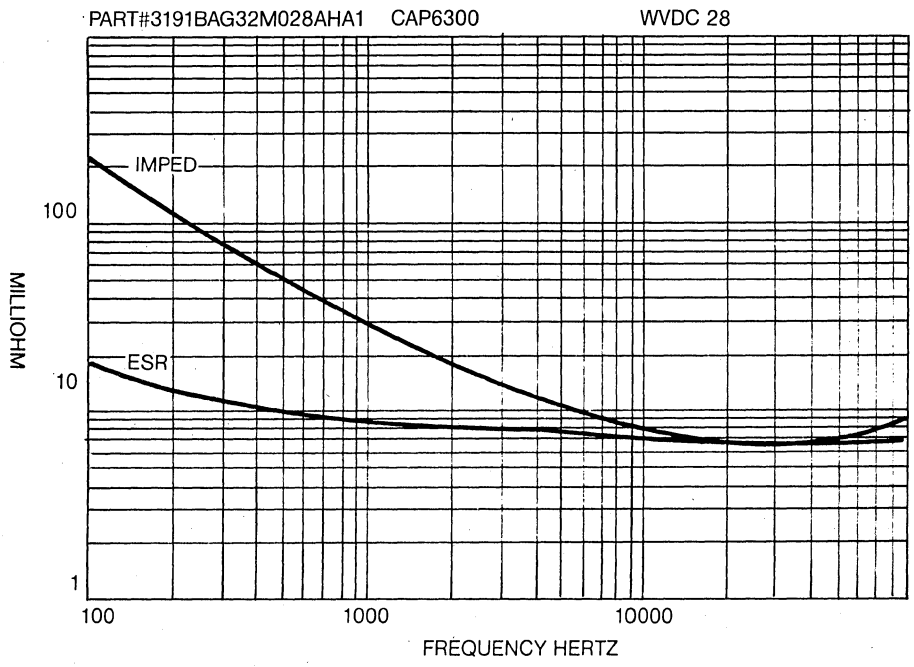
TYPICAL PERFORMANCE CURVES

CAPACITANCE, ESR & IMPEDENCE @ 120 Hz vs TEMPERATURE





Impedance vs. Frequency



SERIES 3191
Computer Grade Capacitors

STANDARD CAPACITANCE VALUES

5 VDC WORKING, 6 VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	ESR Max. at 120 HZ 25°C (OHMS)	ESR ±30% at 20KHZ 25°C (OHMS)	Max. RMS Ripple Current (AMPS) 20 KHZ 85°C
18000	3191BA183M005BM	BA	.01660	8.4	12.3
25000	3191BB253M005BM	BB	.01425	7.2	14.3
32000	3191BC323M005BM	BC	.01151	6.1	16.8
39000	3191BD393M005BM	BD	.00990	5.4	18.9
46000	3191BE463M005BM	BE	.00886	5.0	20.8
53000	3191BF533M005BM	BF	.00813	4.8	22.4
60000	3191BG603M005BM	BG	.00761	4.6	24.0
67000	3191BH673M005BM	BH	.00722	4.4	25.3
57000	3191EA573M005BM	EA	.01323	5.5	18.7
69000	3191EB693M005BM	EB	.01151	4.9	21.4
92000	3191EC923M005BM	EC	.00933	4.2	24.6
110000	3191ED114M005BM	ED	.00792	3.8	27.5
130000	3191EE134M005BM	EE	.00706	3.6	29.9
160000	3191EF164M005BM	EF	.00660	3.4	30.0
180000	3191EG184M005BM	EG	.00614	3.3	30.0
200000	3191EH204M005BM	EH	.00581	3.2	30.0

16 VDC WORKING, 18 VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	ESR Max at 120 HZ 25°C (OHMS)	ESR ±30% at 20 KHZ 25°C (OHMS)	Max. RMS Ripple Current (AMPS) 20 KHZ 85°C
10000	3191BA103M016BM	BA	.01845	8.6	12.1
14000	3191BB143M016BM	BB	.01522	5.5	14.1
18000	3191BC183M016BM	BC	.01227	6.1	16.5
22000	3191BD223M016BM	BD	.01053	5.5	18.7
26000	3191BE263M016BM	BE	.00941	5.0	20.5
30000	3191BF303M016BM	BF	.00863	4.8	22.2
34000	3191BG343M016BM	BG	.00806	4.6	23.7
38000	3191BH383M016BM	BH	.00763	4.5	25.1
26000	3191EA263M016BM	EA	.01271	5.6	18.6
32000	3191EB323M016BM	EB	.01110	5.0	21.2
43000	3191EC433M016BM	EC	.00904	4.3	24.5
53000	3191ED533M016BM	ED	.00778	3.9	27.3
64000	3191EE643M016BM	EE	.00699	3.6	29.8
75000	3191EF753M016BM	EF	.00644	3.5	30.0
86000	3191EG863M016BM	EG	.00604	3.3	30.0
96000	3191EH963M016BM	EH	.00573	3.3	30.0

7.5 VDC WORKING, 9 VDC SURGE

15000	3191BA153M7P5BM	BA	.01702	8.5	12.2
21000	3191BB213M7P5BM	BB	.01451	7.2	14.3
27000	3191BC273M7P5BM	BC	.01171	6.1	16.7
33000	3191BD333M7P5BM	BD	.01007	5.4	18.8
39000	3191BE393M7P5BM	BE	.00900	5.0	20.7
45000	3191BF453M7P5BM	BF	.00825	4.8	22.4
51000	3191BG513M7P5BM	BG	.00771	4.6	23.9
57000	3191BH573M7P5BM	BH	.00731	4.4	25.3
48000	3191EA483M7P5BM	EA	.01330	5.5	18.7
58000	3191EB583M7P5BM	EB	.01156	4.9	21.3
76000	3191EC763M7P5BM	EC	.00931	4.2	24.6
95000	3191ED953M7P5BM	ED	.00802	3.8	27.4
110000	3191EE114M7P5BM	EE	.00710	3.6	29.9
130000	3191EF134M7P5BM	EF	.00655	3.4	30.0
150000	3191EG154M7P5BM	EG	.00615	3.3	30.0
170000	3191EH174M7P5BM	EH	.00584	3.2	30.0

20 VDC WORKING, 22 VDC SURGE

8800	3191BA882M020BM	BA	.01921	8.9	12.0
12000	3191BB123M020BM	BB	.01563	7.4	14.0
16000	3191BC163M020BM	BC	.01254	6.2	16.5
20000	3191BD203M020BM	BD	.01072	5.5	18.6
22000	3191BE223M020BM	BE	.00983	5.1	20.4
27000	3191BF273M020BM	BF	.00881	4.8	22.2
30000	3191BG303M020BM	BG	.00827	4.6	23.7
34000	3191BH343M020BM	BH	.00778	4.5	25.1
23000	3191EA233M020BM	EA	.01269	5.7	18.5
27000	3191EB273M020BM	EB	.01098	5.1	21.1
37000	3191EC373M020BM	EC	.00897	4.3	24.4
46000	3191ED463M020BM	ED	.00774	3.9	27.2
55000	3191EE553M020BM	EE	.00695	3.6	29.7
64000	3191EF643M020BM	EF	.00639	3.5	30.0
74000	3191EG743M020BM	EG	.00600	3.4	30.0
83000	3191EH833M020BM	EH	.00570	3.3	30.0

10 VDC WORKING, 12 VDC SURGE

16000	3191BA163M010BM	BA	.01694	8.1	12.4
19000	3191BB193M010BM	BB	.01465	7.2	14.3
25000	3191BC253M010BM	BC	.01181	6.1	16.7
31000	3191BD313M010BM	BD	.01013	5.4	18.8
38000	3191BE383M010BM	BE	.00904	5.0	20.7
44000	3191BF443M010BM	BF	.00828	4.7	22.4
51000	3191BG513M010BM	BG	.00773	4.5	24.0
57000	3191BH573M010BM	BH	.00733	4.4	25.4
38000	3191EA383M010BM	EA	.01283	5.5	18.7
46000	3191EB463M010BM	EB	.01118	5.0	21.3
61000	3191EC613M010BM	EC	.00906	4.3	24.6
76000	3191ED763M010BM	ED	.00782	3.9	27.4
92000	3191EE923M010BM	EE	.00703	3.6	29.9
100000	3191EF104M010BM	EF	.00636	3.4	30.0
120000	3191EG124M010BM	EG	.00603	3.3	30.0
130000	3191EH134M010BM	EH	.00568	3.2	30.0

28 VDC WORKING, 32 VDC SURGE

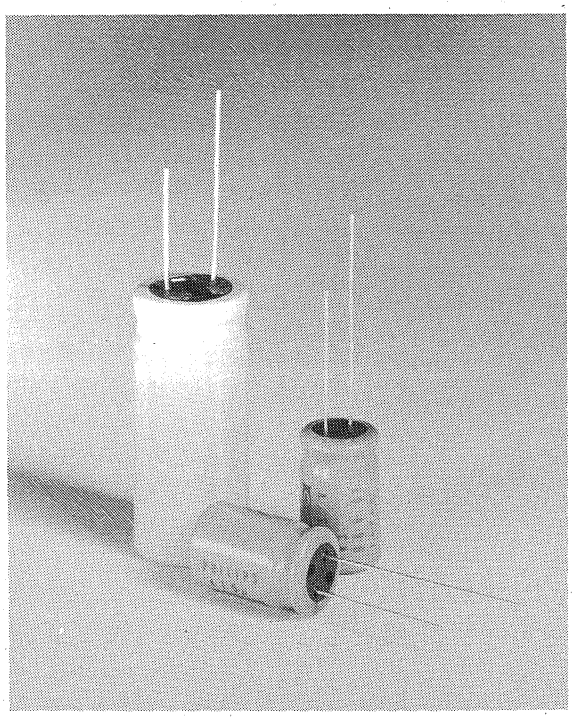
6300	3191BA632M028BM	BA	.02074	8.8	11.9
8800	3191BB882M028BM	BB	.01656	7.5	13.9
11000	3191BC113M028BM	BC	.01361	6.3	16.3
14000	3191BD143M028BM	BD	.01149	5.6	18.4
16000	3191BE163M028BM	BE	.01037	5.1	20.3
19000	3191BF193M028BM	BF	.00936	4.9	22.0
22000	3191BG223M028BM	BG	.00864	4.6	23.6
24000	3191BH243M028BM	BH	.00821	4.5	24.9
15000	3191EA153M028BM	EA	.01320	5.8	18.4
18000	3191EB183M028BM	EB	.01145	5.2	20.9
24000	3191EC243M028BM	EC	.00928	4.4	24.2
30000	3191ED303M028BM	ED	.00800	4.0	27.1
36000	3191EE363M028BM	EE	.00716	3.7	29.5
42000	3191EF423M028BM	EF	.00658	3.5	30.0
48000	3191EG483M028BM	EG	.00616	3.4	30.0
54000	3191EH543M028BM	EH	.00584	3.3	30.0

STANDARD CAPACITANCE VALUES

Capacitance µF	Mepco/Centralab Part Number	Case Code	ESR Max. at 120 HZ 25°C (OHMS)	ESR ±30% at 20 KHZ 25°C (OHMS)	Max. RMS Ripple Current (AMPS) 20 KHZ 85°C
35 VDC WORKING, 40 VDC SURGE					
4500	3191BA452M035BM	BA	.02337	9.2	11.6
6300	3191BB632M035BM	BB	.01835	7.7	13.7
8100	3191BC812M035BM	BC	.01485	6.4	16.1
10000	3191BD103M035BM	BD	.01264	5.7	18.2
12000	3191BE123M035BM	BE	.01113	5.2	20.1
14000	3191BF143M035BM	BF	.01008	5.0	21.8
16000	3191BG163M035BM	BG	.00931	4.7	23.3
17000	3191BH173M035BM	BH	.00893	4.6	24.6
11000	3191EA113M035BM	EA	.01388	5.9	18.2
13000	3191EB133M035BM	EB	.01202	5.3	20.7
17000	3191EC173M035BM	EC	.00971	4.5	24.0
22000	3191ED223M035BM	ED	.00834	4.0	26.9
26000	3191EE263M035BM	EE	.00745	3.7	29.3
31000	3191EF313M035BM	EF	.00683	3.6	30.0
35000	3191EG353M035BM	EG	.00637	3.4	30.0
40000	3191EH403M035BM	EH	.00603	3.3	30.0
45 VDC WORKING, 50 VDC SURGE					
3800	3191BA382M045BM	BA	.02724	11.3	11.8
4600	3191BB462M045BM	BB	.02310	9.8	13.8
6200	3191BC622M045BM	BC	.01803	7.9	16.4
7700	3191BD772M045BM	BD	.01516	6.9	18.7
9300	3191BE932M045BM	BE	.01319	6.2	20.8
10000	3191BF103M045BM	BF	.01237	5.9	22.5
12000	3191BG123M045BM	BG	.01103	5.5	24.4
14000	3191BH143M045BM	BH	.01008	5.2	26.1
9300	3191EA932M045BM	EA	.01548	7.0	17.8
11000	3191EB113M045BM	EB	.01336	6.2	20.4
14000	3191EC143M045BM	EC	.01074	5.2	23.7
18000	3191ED183M045BM	ED	.00915	4.6	26.7
22000	3191EE223M045BM	EE	.00812	4.2	29.4
26000	3191EF263M045BM	EF	.00740	3.9	30.0
29000	3191EG293M045BM	EG	.00688	3.8	30.0
33000	3191EH333M045BM	EH	.00648	3.6	30.0
55 VDC WORKING, 64 VDC SURGE					
2800	3191BA282M055BM	BA	.03098	11.8	9.5
3900	3191BB392M055BM	BB	.02385	9.7	11.3
5000	3191BC502M055BM	BC	.01916	8.0	13.4
6200	3191BD622M055BM	BD	.01609	7.0	15.2
7300	3191BE732M055BM	BE	.01416	6.3	16.9
8400	3191BF842M055BM	BF	.01277	5.8	18.5
9500	3191BG952M055BM	BG	.01173	5.5	19.9
10000	3191BH103M055BM	BH	.01127	5.5	21.0
7300	3191EA732M055BM	EA	.01639	7.1	15.4
8800	3191EB882M055BM	EB	.01410	6.2	17.7
11000	3191EC113M055BM	EC	.01135	5.3	20.6
14000	3191ED143M055BM	ED	.00963	4.6	23.2
17000	3191EE173M055BM	EE	.00851	4.2	25.5
20000	3191EF203M055BM	EF	.00773	4.0	27.6
23000	3191EG233M055BM	EG	.00716	3.8	29.5
26000	3191EH263M055BM	EH	.00673	3.7	30.0

SERIES 3476

Miniature Single-Ended Aluminum Electrolytic Capacitors



DESCRIPTION:

The Mepco/Centralab Series 3476 is a general purpose Single-Ended Aluminum Electrolytic Capacitor. These capacitors are suitable for use in timing and delay circuits as well as filtering, coupling, and decoupling.

Series 3476 capacitors are supplied as polar units available in 13 case sizes, ranging from 5x11mm to 18x40mm.

FEATURES:

- Capacitance tolerance ±20%.
- Smaller size allows wider choice of capacitance and voltage for automatic insertion.
- Low leakage current.
- With the exception of 5mm diameter cans, all capacitors have safety vents.
- Max Operating Temperature +85°C.
- Capacitance Range 0.47 to 10,000 μF.
- Rated Voltage Range 6.3 to 450V.
- Halogenated Solvent Proof Configuration available, 6.3 to 100V.

For Application Guidelines see pages 116-119.

SERIES 3476

Miniature Single-Ended Aluminum Electrolytic Capacitors

CHARACTERISTICS

Item	Characteristic	
Voltage Range	**100V, DC or less**	**160~450V, DC**
Operating Temperature Range	−40~+85°C	−25~85°C
Capacitance Tolerance	±20% (M) (−10~+30% (S)...Non-standard) (at 20°C, 120Hz)	
Leakage Current	The following specifications shall be satisfied when the rated voltage is applied for the required time. After 1 minute : 0.03CV (μA) or 4 μA, whichever is greater After 2 minutes: 0.01CV (μA) or 3 μA, whichever is greater Where C=Nominal capacitance (μF) V=Rated voltage (V) (at 20°C) After 1 minute : 0.1CV +40 (μA) (CV≦1000) 0.04CV + 100 (μA) (CV>1000) After 5 minutes: 0.03CV + 15 (μA) (CV≦1000) 0.02CV + 25 (μA) (CV>1000)	
Dissipation Factor (Tan δ)	See table below	
Surge Voltage	See table below	
Temperature Characteristics	See table below	
Load Life	The following specifications shall be satisfied when the capacitors are restored to 20°C after the rated voltage applied for 1,000 hours at 85°C. Capacitance change (%) from initial value Tan δ≦150% of initial specified value Leakage current ≦ initial specified value	The following specifications shall be satisfied when the capacitors are restored to 20°C after the rated voltage applied for 1,000 hours at 85°C. Capacitance change ≦±20% of initial value Dissipation factor ≦150% of initial specified value Leakage current ≦ initial specified value
Shelf Life	The following specifications shall be satisfied when the capacitors are restored to 20°C after exposing them at 85°C for 1,000 hours without voltage applied. Capacitance change value shall be within the specifications shown on the table of load life. Tan δ≦150% of initial specified value Leakage current ≦initial specified value	The following specifications shall be satisfied when the capacitors are restored to 20°C after exposing them at 85°C for 500 hours without voltage applied. Capacitance change ≦±20% of initial value Dissipation factor ≦150% of initial specified value Leakage current ≦200% of initial specified value
Others	Satisfies characteristic W of JIS C5141* Tested Methods per JIS 5102**	

Rated voltage (V)	6.3	10	16	25	35	50	63~80	100	160~315	350~450
Tan δ	0.24	0.20	0.16	0.14	0.12	0.10	0.08	0.07	0.20	0.24

For capacitors whose rated voltage is 100V or less and whose capacitance exceeds 1,000μF, the specification of tanδ is increased by 0.02 for every addition of 1,000μF. (at 20°C, 120Hz)

Rated voltage (V)	6.3	10	16	25	35	50	63	80	100	160	200	250	315	350	400	450
Surge voltage (V)	8	13	20	32	44	63	79	100	125	200	250	300	365	400	450	500

Impedance ratio at 120Hz

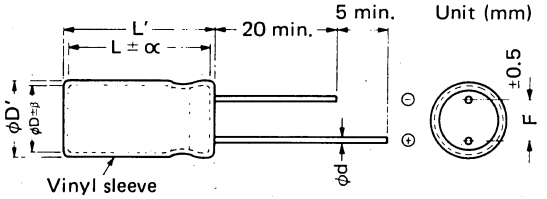
Rated voltage (V)	6.3	10	16	25	35	50	63	80	100	160	200, 250	315, 350	400, 450
Z-25°C/Z20°C	4	3	2	2	2	2	2	2	2	4	8	12	16
Z-40°C/Z20°C	10	8	6	4	3	3	3	3	3	—	—	—	—

V \ Case diameter	≦φ6.3	>φ6.3
6.3~16V	±20%	
25~100V	±20%	±15%

*May be ordered from American National Standards Institute. **A summary of these standards appears on page 122.

CASE OUTLINE DRAWING

D	F	d
5	2	0.5
6.3	2.5	0.6
8	3.5	0.6
10	5	0.6
12.5	5	0.6
16	7.5	0.8
18	7.5	0.8



When D≦12.5, D'≦D + 0.5 and L'≦L + 1.5
When D>12.5, D'≦D + 0.5 and L'≦L + 2.0
For L≦10, α = 1 For D≦10, β = 0.5
For L > 10, α = 2 For D > 10, β = 1

CASE DIMENSIONS

Case Code	Diameter (mm)	Length (mm)	Case Code	Diameter (mm)	Length (mm)
CB	5.0	11.0	HG	12.5	25.0
DB	6.3	11.0	KG	16.0	25.0
FC	8.0	11.5	KJ	16.0	31.5
GC	10.0	12.5	KL	16.0	35.5
GD	10.0	16.0	LL	18.0	35.5
GF	10.0	20.0	LK	18.0	40.0
HF	12.5	20.0			

See page 120 for mm to inches conversion table.

Note: With the exception of 5mm diameter cans, all 3476 capacitors have a safety vent.

SERIES 3476
Miniature Single-Ended Aluminum Electrolytic Capacitors

CASE SIZE OF STANDARD PRODUCTS

D x L (mm)

V / µF	6.3	10	16	25	35	50	63	80	100	160	200	250	350	450
0.47						5x11			5x11	6.3x11			10x16	
1						5x11			5x11	6.3x11		10x16	10x16	10x16
2.2						5x11	5x11		5x11	8x11.5		10x16	10x16	10x20
3.3						5x11	5x11		5x11	10x16	10x16	10x16	10x20	12.5x20
4.7				5x11	5x11	5x11	5x11		6.3x11	10x16	10x16	10x16	10x20	12.5x25
10			5x11	5x11	5x11	5x11	6.3x11		8x11.5	10x16	10x20	12.5x20	12.5x25	16x25
22		5x11	5x11	5x11	6.3x11	6.3x11	8x11.5	10x12.5	10x12.5	12.5x20	12.5x20	12.5x25	16x25	
33	5x11	5x11	5x11	6.3x11	6.3x11	8x11.5	8x11.5	10x16	10x16	12.5x25	16x25	16x25	16.35.5	
47	5x11	5x11	6.3x11	6.3x11	8x11.5	8x11.5	10x12.5	10x16	10x20	16x25	16x25	16x35.5		
100	6.3x11	6.3x11	8x11.5	8x11.5	10x12.5	10x16	10x20	12.5x20	12.5x20	16x35.5	18x40			
220	8x11.5	8x11.5	10x12.5	10x16	10x20	12.5x20	12.5x20	12.5x25	16x25					
330	10x12.5	10x12.5	10x16	10x20	12.5x20	12.5x20	12.5x25	16x31.5	16x31.5					
470	10x12.5	10x16	10x20	12.5x20	12.5x25	16x25	16x25	16x35.5	18x35.5					
1000	10x20	12.5x20	12.5x25	16x25	16x25	16x31.5	18x35.5							
2200	12.5x25	16x25	16x25	16x35.5	18x35.5									
3300	16x25	16x31.5	16x35.5	18x40										
4700	16x31.5	16x35.5	18x35.5											
6800	16x35.5	18x40												
10000	18x40													

STANDARD CAPACITANCE VALUES

6.3VDC WORKING, 8VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
33	3476CB330M6P3JMBS	CB	12.057	0.044
47	3476CB470M6P3JMBS	CB	8.466	0.054
100	3476DB101M6P3JMBS	DB	3.979	0.090
220	3476FC221M6P3JMBS	FC	1.809	0.155
330	3476GC331M6P3JMBS	GC	1.206	0.222
470	3476GC471M6P3JMBS	GC	.846	0.265
1000	3476GF102M6P3JMBS	GF	.396	0.460
2200	3476HG222M6P3JMBS	HG	.196	0.787
3300	3476KG332M6P3JMBS	KG	.141	1.027
4700	3476KJ472M6P3JMBS	KJ	.106	1.270
6800	3476KL682M6P3JMBS	KL	.088	1.674
10000	3476LK103M6P3JMBS	LK	.070	2.037

10VDC WORKING, 13VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
22	3476CB220M010JMBS	CB	15.071	0.051
33	3476CB330M010JMBS	CB	10.048	0.068
47	3476CB470M010JMBS	CB	7.055	0.084
100	3476DB101M010JMBS	DB	3.316	0.140
220	3476FC221M010JMBS	FC	1.508	0.240
330	3476GC331M010JMBS	GC	1.005	0.320
470	3476GD471M010JMBS	GD	.705	0.410
1000	3476HF102M010JMBS	HF	.331	0.640
2200	3476KG222M010JMBS	KG	.166	0.946
3300	3476KJ332M010JMBS	KJ	.120	1.189
4700	3476KL472M010JMBS	KL	.091	1.410
6800	3476LK682M6P3JMBS	LK	.078	1.959

16VDC WORKING, 20VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
10	3476CB100M016JMBS	CB	26.525	0.031
22	3476CB220M016JMBS	CB	12.062	0.055
33	3476CB330M016JMBS	CB	8.038	0.073
47	3476DB470M016JMBS	DB	5.650	0.094
100	3476FC101M016JMBS	FC	2.650	0.160
220	3476GC221M016JMBS	GC	1.213	0.285
330	3476GD331M016JMBS	GD	.800	0.385
470	3476GF471M016JMBS	GF	.563	0.480
1000	3476HG102M016JMBS	HG	.263	0.780
2200	3476KG222M016JMBS	KG	.138	1.120
3300	3476KL332M016JMBS	KL	.100	1.347
4700	3476LL472M016JMBS	LL	.078	1.585

25VDC WORKING, 32VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
4.7	3476CB479M025JMBS	CB	49.388	0.022
10	3476CB100M025JMBS	CB	23.213	0.040
22	3476CB220M025JMBS	CB	10.550	0.069
33	3476DB330M025JMBS	DB	7.038	0.090
47	3476DB470M025JMBS	DB	4.938	0.110
100	3476FC101M025JMBS	FC	2.325	0.170
220	3476GD221M025JMBS	GD	1.050	0.320
330	3476GF331M025JMBS	GF	.700	0.450
470	3476HF471M025JMBS	HF	.500	0.580
1000	3476KG102M025JMBS	KG	.238	0.920
2200	3476KL222M025JMBS	KL	.120	1.300
3300	3476LK332M025JMBS	LK	.090	1.560

STANDARD CAPACITANCE VALUES

35VDC WORKING, 44VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
4.7	3476CB479M035JMBS	CB	42.325	0.026
10	3476CB100M035JMBS	CB	19.900	0.044
22	3476DB220M035JMBS	DB	9.038	0.076
33	3476DB330M035JMBS	DB	6.025	0.100
47	3476FC470M035JMBS	FC	4.238	0.135
100	3476GC101M035JMBS	GC	1.988	0.230
220	3476GF221M035JMBS	GF	.900	0.400
330	3476HF331M035JMBS	HF	.600	0.520
470	3476HG471M035JMBS	HG	.425	0.760
1000	3476KG102M035JMBS	KG	.200	1.050
2200	3476LL222M035JMBS	LL	.105	1.359

50VDC WORKING, 63VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
0.47	3476CB478M050JMBS	CB	352.739	0.006
1	3476CB109M050JMBS	CB	165.788	0.013
2.2	3476CB229M050JMBS	CB	75.363	0.023
3.3	3476CB339M050JMBS	CB	50.238	0.029
4.7	3476CB479M050JMBS	CB	35.275	0.035
10	3476CB100M050JMBS	CB	16.575	0.051
22	3476DB220M050JMBS	DB	7.538	0.080
33	3476FC330M050JMBS	FC	5.025	0.105
47	3476FC470M050JMBS	FC	3.525	0.140
100	3476GD101M050JMBS	GD	1.663	0.250
220	3476HF221M050JMBS	HF	.750	0.450
330	3476HF331M050JMBS	HF	.500	0.600
470	3476KG471M050JMBS	KG	.350	0.800
1000	3476KJ102M050JMBS	JK	.166	1.350

63VDC WORKING, 79VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
2.2	3476CB229M063JMBS	CB	60.288	0.027
3.3	3476CB339M063JMBS	CB	40.188	0.035
4.7	3476CB479M063JMBS	CB	28.225	0.044
10	3476DB100M063JMBS	DB	13.263	0.070
22	3476FC220M063JMBS	FC	6.025	0.110
33	3476FC330M063JMBS	FC	4.025	0.140
47	3476GC470M063JMBS	GC	2.825	0.180
100	3476GF101M063JMBS	GF	1.325	0.300
220	3476HF221M063JMBS	HF	.600	0.520
330	3476HG331M063JMBS	HG	.400	0.700
470	3476KG471M063JMBS	KG	.288	0.920
1000	3476LL102M063JMBS	LL	.133	1.550

80VDC WORKING, 100VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
22	3476GC220M080JMBS	GC	6.025	0.130
33	3476GD330M080JMBS	GD	4.025	0.180
47	3476GD470M080JMBS	GD	2.825	0.195
100	3476HF101M080JMBS	HF	1.325	0.330
220	3476HG221M080JMBS	HG	.600	0.565
330	3476KJ331M080JMBS	KJ	.400	0.825
470	3476KL471M080JMBS	KL	.283	1.020

100VDC WORKING, 125VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
0.47	3476CB478M100JMBS	CB	246.66	0.010
1	3476CB109M100JMBS	CB	116.05	0.018
2.2	3476CB229M100JMBS	CB	52.75	0.031
3.3	3476CB339M100JMBS	CB	35.16	0.041
4.7	3476DB479M100JMBS	DB	24.68	0.052

100VDC WORKING, 125VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
10	3476FC100M100JMBS	FC	11.600	0.088
22	3476GC220M100JMBS	GC	5.275	0.145
33	3476GD330M100JMBS	GD	3.513	0.190
47	3476GF470M100JMBS	GF	2.475	0.235
100	3476HF101M100JMBS	HF	1.163	0.390
220	3476KG221M100JMBS	KG	.525	0.720
330	3476KJ331M100JMBS	KJ	.350	0.980
470	3476LL471M100JMBS	LL	.248	1.300

160VDC WORKING, 200VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
0.47	3476DB478M160JMBS	DB	705.47	0.0067
1	3476DB109M160JMBS	DB	331.57	0.0098
2.2	3476FC229M160JMBS	FC	150.71	0.016
3.3	3476GD339M160JMBS	GD	100.41	0.026
4.7	3476GD479M160JMBS	GD	70.55	0.031
10	3476GD100M160JMBS	GD	33.16	0.046
22	3476HF220M160JMBS	HF	15.07	0.082
33	3476HG330M160JMBS	HG	10.05	0.110
47	3476KG470M160JMBS	KG	7.05	0.145
100	3476KL101M160JMBS	KL	3.313	0.234

200VDC WORKING, 250VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
3.3	3476GD339M200JMBS	GD	100.47	0.026
4.7	3476GD479M200JMBS	GD	70.55	0.031
10	3476GF100M200JMBS	GF	33.16	0.050
22	3476HF220M200JMBS	HF	15.07	0.082
33	3476KG330M200JMBS	KG	10.05	0.122
47	3476KG470M200JMBS	KG	7.05	0.145
100	3476LK101M200JMBS	LK	3.313	0.248

250VDC WORKING, 300VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
1	3476GD109M250JMBS	GD	331.57	0.014
2.2	3476GD229M250JMBS	GD	150.71	0.021
3.3	3476GD339M250JMBS	GD	100.47	0.026
4.7	3476GD479M250JMBS	GD	70.56	0.031
10	3476HF100M250JMBS	HF	33.16	0.055
22	3476HG220M250JMBS	HG	15.07	0.090
33	3476KG330M250JMBS	KG	10.05	0.122
47	3476KJ470M250JMBS	KJ	7.05	0.156

350VDC WORKING, 400VDC SURGE

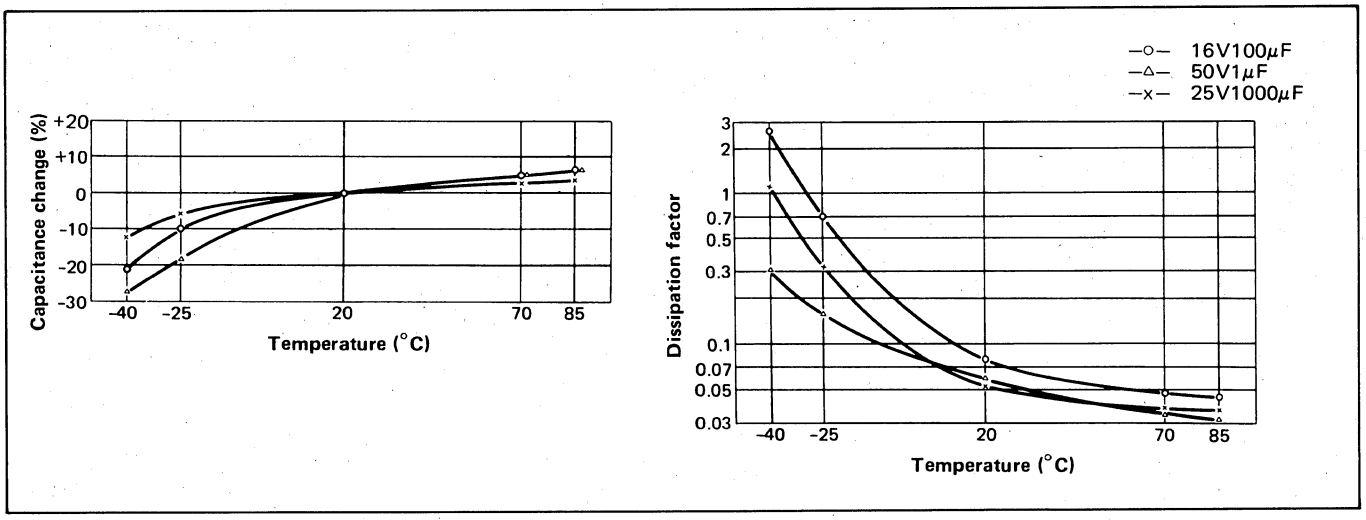
Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
0.47	3476GD478M350JMBS	GD	846.58	0.0092
1	3476GD109M350JMBS	GD	397.89	0.013
2.2	3476GD229M350JMBS	GD	180.86	0.019
3.3	3476GF339M350JMBS	GF	120.58	0.024
4.7	3476GF479M350JMBS	GF	84.66	0.031
10	3476HG100M350JMBS	HG	39.79	0.051
22	3476KG220M350JMBS	KG	18.09	0.091
33	3476KL330M350JMBS	KL	12.06	0.122

450VDC WORKING, 500VDC SURGE

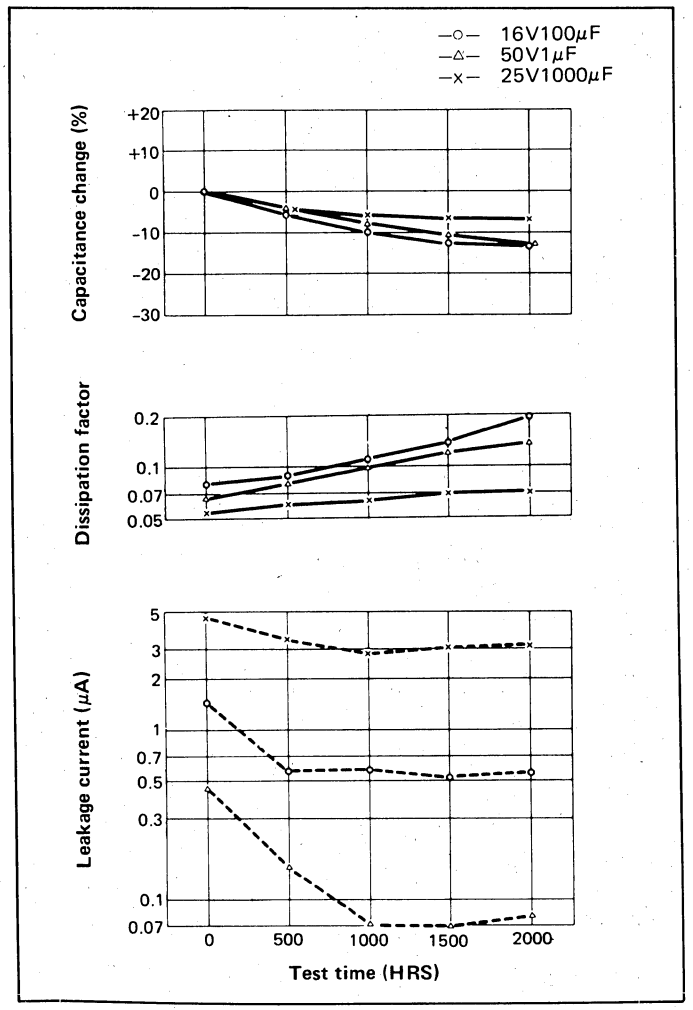
Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
1	3476GD109M450JMBS	GD	397.89	0.013
2.2	3476GF229M450JMBS	GF	180.86	0.021
3.3	3476HF339M450JMBS	HF	120.58	0.029
4.7	3476HG479M450JMBS	HG	84.66	0.038
10	3476KG100M450JMBS	KG	39.79	0.061

SERIES 3476
Miniature Single-Ended Aluminum Electrolytic Capacitors

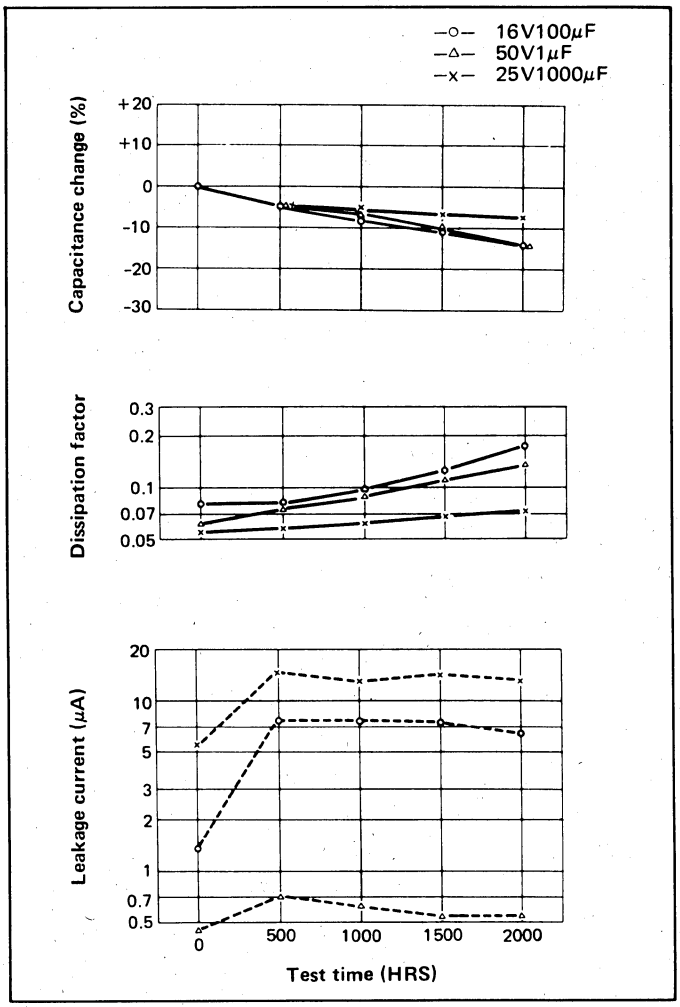
TEMPERATURE CHARACTERISTICS



85°C LOAD LIFE

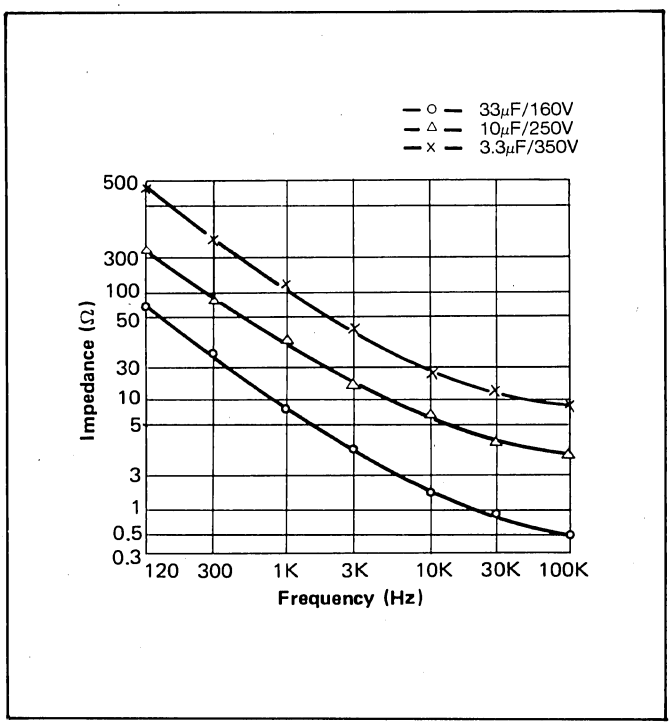


85°C SHELF LIFE

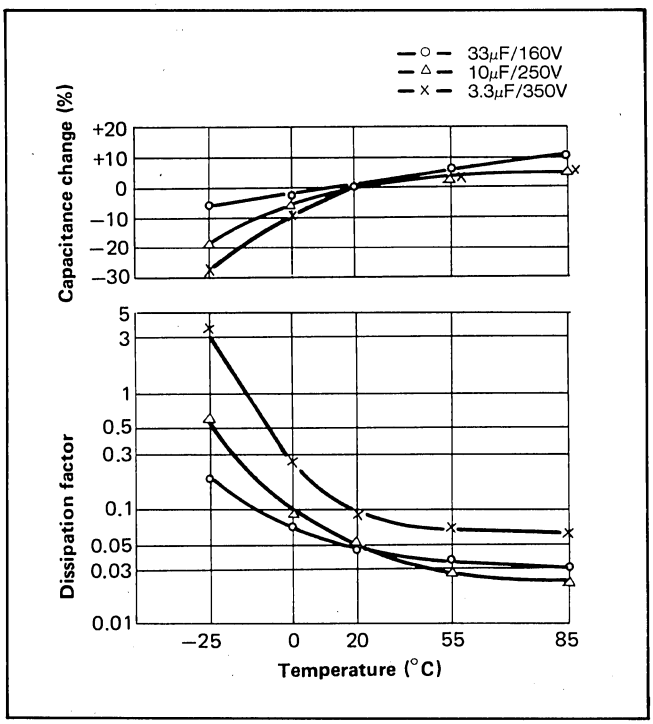


SERIES 3476
Miniature Single-Ended Aluminum Electrolytic Capacitors

TEMPERATURE CHARACTERISTICS



IMPEDANCE



HOW TO SPECIFY

Mepco/Centralab Series 3476 Capacitors can be completely specified using the following designation:

3476	GF	471	M	016	J	M	B	S

Mepco/Centralab Product Series

Case Size Code
(see physical spec)

Capacitance
XX=Significant Digits
X=Multiplier
i.e. 471=470μF
470= 47μF
478=.47μF

Tolerance
M=±20%
S=+30%
−10%

Voltage
016=16VDC
100=100VDC
6P3=6.3VDC

Mechanical Characteristics
J=Standard
*P=Solvent Resistant

Insulation
M=Standard PVC

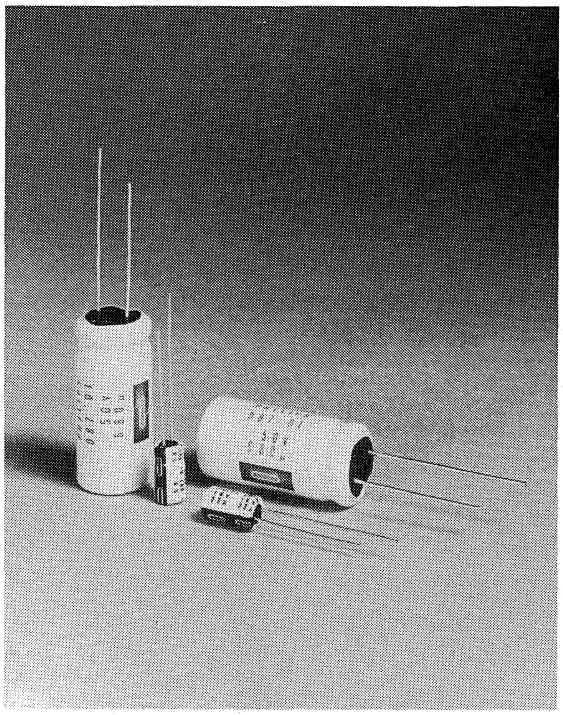
Packaging (pg. 32)
B=Standard Bulk
T=Tape and Reel
A=Ammo Pack

Lead Configuration
S=Standard
Options (see pg. 86)
C=Cut
D=Forming Cut
F=Snap in Forming Cut
M=Snap in Cut

*Available in voltages 6.3–100. (See "Application Guidelines" section page 117 for approved solvents and cleaning conditions.)

SERIES 3477

Miniature Single-Ended Aluminum Electrolytic Capacitors



DESCRIPTION:

Series 3477 are low-leakage, single-ended, miniature aluminum electrolytic capacitors.

Series 3477 capacitors have the same electrical characteristics as Series 3478, but are more cost effective because they do not have epoxy end seals.

Series 3477 capacitors, as well as Series 3478, may be used for copling of preamplifiers and for replacement of tantalum capacitors.

FEATURES:

- Extremely low leakage current.
- Excellent shelf life.
- Low cost as compared with tantalum capacitors.

For Application Guidelines see pages 116-119.

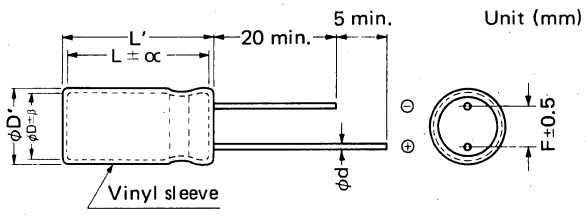
SERIES 3477
Miniature Single-Ended Aluminum Electrolytic Capacitors

CHARACTERISTICS

Item	Characteristic
Operating Temperature Range	−40~+85°C
Capacitance Tolerance	±20% (M) [−10% (K)...Non-standard] (at 20°C, 120Hz)
Leakage Current	DC voltage shall be applied through a 1,000 ohm series resistor in such a manner as to develop rated voltage across the capacitor in one minute. The leakage current, when measured one minute after DC voltage developed rated voltage, shall not exceed the following value: 0.002CV (μA) or 0.2μA, whichever is greater. (at 20°C)
Dissipation Factor (Tan δ)	<table><tr><td>Rated voltage (V)</td><td>6.3</td><td>10</td><td>16</td><td>25</td><td>35</td><td>50</td><td>63</td><td>80</td><td>100</td></tr><tr><td>Tan δ</td><td>0.24</td><td>0.20</td><td>0.16</td><td>0.14</td><td>0.12</td><td>0.10</td><td>0.10</td><td>0.08</td><td>0.07</td></tr></table> (at 20°C, 120Hz) For capacitors whose capacitance exceeds 1000μF, the specification of tanδ is increased by 0.02 for every addition of 1,000μF.
Temperature Characteristics	Impedance ratio at 120Hz Z−25°C/Z20°C: 4 max. Z−40°C/Z20°C: 8 max.
Load Life	The following specifications shall be satisfied when the capacitors are restored to 20°C after the rated voltage applied for 1,000 hours at 85°C. Capacitance change ≦±15% of initial value Tan δ ≦150% of initial specified value Leakage current ≦ initial specified value
Shelf Life	• The following specifications shall be satisfied when the capacitors are restored to 20°C after exposing them at 85°C for 500 hours without voltage applied. The rated voltage shall be applied to the capacitors for minimum of 30 minutes, at least 24 hours and not more than 48 hours before the measurements. Capacitance change ≦±15% of initial value Tan δ ≦150% of initial specified value Leakage current ≦ initial specified value • After exposing the capacitors at room temperature (−10 to +40°C) for 6 months without voltage applied, capacitance and tan δ shall be met the initial specified value and leakage current shall not exceed 150% of the initial specified value without preconditioning.
Others	Satisfies characteristic W of JIS C5141*—Tested Methods per JIS 5102**

*May be ordered from American National Standards Institute.
**A summary of these standards appears on page 122.

CASE OUTLINE DRAWING



D	φ5	φ6.3	φ8	φ10	φ12.5	φ16	φ18
L'	L+1.5					L+2.0	
D'	D+0.5					D+0.5	
d	0.5	0.6	0.6	0.6	0.6	0.8	0.8
F	2	2.5	3.5	5	5	7.5	7.5

For L≦10, α=1 For D≦10, β=0.5
For L>10, α=2 For D>10, β=1

See page 120 for mm to inches conversion table.

Note: With the exception of 8mm diameter cans, all 3477 capacitors have a safety vent.

CASE SIZE OF STANDARD PRODUCTS

D x L (mm)

V / μF	6.3	10	16	25	35	50	63	80	100
0.1						5x11			5x11
0.15						5x11			5x11
0.22						5x11			5x11
0.33						5x11			5x11
0.47						5x11			5x11
0.68						5x11			5x11
1						5x11			5x11
1.5						5x11			5x11
2.2						5x11		5x11	6.3x11
3.3						5x11		6.3x11	8x11.5
4.7				5x11	5x11	6.3x11		6.3x11	8x11.5
6.8				5x11	5x11	6.3x11	6.3x11	8x11.5	10x12.5
10			5x11	6.3x11	6.3x11	8x11.5	8x11.5	10x12.5	10x16
15			5x11	6.3x11	8x11.5	8x11.5	10x12.5	10x16	10x20
22		5x11	6.3x11	8x11.5	8x11.5	10x12.5	10x16	10x16	10x20
33		6.3x11	6.3x11	8x11.5	10x12.5	10x16	10x16	10x20	12.5x20
47		6.3x11	8x11.5	10x12.5	10x12.5	10x16	10x20	10x20	12.5x25
68		6.3x11	8x11.5	10x12.5	10x16	10x20	10x20	12.5x20	12.5x25
100		8x11.5	10x12.5	10x16	10x20	12.5x20	12.5x25	12.5x25	16.25
150		10x12.5	10x16	10x20	12.5x20	12.5x25	12.5x25	16x25	16x31.5
220	10x12.5	10x16	10x20	12.5x20	12.5x25	16x25	16x31.5	16x31.5	18x35.5
330	10x16	10x20	12.5x20	12.5x25	16x25	16x31.5	16x35.5	16x35.5	18x40
470	10x20	12.5x20	12.5x20	16x25	16x25	16x35.5	18x35.5	18x35.5	
680	12.5x20	12.5x20	12.5x25	16x31.5	16x31.5	16x35.5	18x35.5		
1000	12.5x25	12.5x25	16x25	16x35.5	18x35.5	18x40			
1500	12.5x25	16x25	16x31.5	16x35.5	18x40				
2200	16x25	16x31.5	18x35.5	18x40					
3300	16x35.5	16x35.5	18x40						
4700	18x35.5	18x40							

SERIES 3477
Miniature Single-Ended Aluminum Electrolytic Capacitors

STANDARD CAPACITANCE VALUES

6.3VDC WORKING, 8VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
220	3477GC221M6P3JMBS	GC	1.809	.180
330	3477GD331M6P3JMBS	GD	1.206	.244
470	3477GF471M6P3JMBS	GF	.846	.315
680	3477HF681M6P3JMBS	HF	.585	.421
1000	3477HG102M6P3JMBS	HG	.398	.554
1500	3477HG152M6P3JMBS	HG	.265	.679
2200	3477KG222M6P3JMBS	KG	.196	.910
3300	3477KL332M6P3JMBS	KL	.141	1.228
4700	3477LL472M6P3JMBS	LL	.106	1.529

10VDC WORKING, 13VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
22	3477CB220M010JMBS	CB	15.071	.040
33	3477DB330M010JMBS	DB	10.048	.056
47	3477DB470M010JMBS	DB	7.055	.067
68	3477DB680M010JMBS	DB	4.876	.081
100	3477FC101M010JMBS	FC	3.316	.113
150	3477GC151M010JMBS	GC	2.210	.163
220	3477GD221M010JMBS	GD	1.508	.218
330	3477GF331M010JMBS	GF	1.005	.289
470	3477HF471M010JMBS	HF	.705	.383
680	3477HF681M010JMBS	HF	.488	.461
1000	3477HG102M010JMBS	HG	.331	.607
1500	3477KG152M010JMBS	KG	.221	.823
2200	3477KJ222M010JMBS	KJ	.166	1.073
3300	3477KL332M010JMBS	KL	.120	1.345
4700	3477LK472M010JMBS	LK	.091	1.702

16VDC WORKING, 20VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
10	3477CB100M016JMBS	CB	26.526	.030
15	3477CB150M016JMBS	CB	17.684	.037
22	3477DB220M016JMBS	DB	12.056	.051
33	3477DB330M016JMBS	DB	8.039	.063
47	3477FC470M016JMBS	FC	5.644	.086
68	3477FC680M016JMBS	FC	3.901	.104
100	3477GC101M016JMBS	GC	2.653	.149
150	3477GD151M016JMBS	GD	1.769	.201
220	3477GF221M016JMBS	GF	1.206	.264
330	3477HF331M016JMBS	HF	.804	.359
470	3477HF471M016JMBS	HF	.565	.428
680	3477HG681M016JMBS	HG	.390	.515
1000	3477KG102M016JMBS	KG	.265	.751
1500	3477KJ152M016JMBS	KJ	.176	.991
2200	3477LL222M016JMBS	LL	.136	1.281
3300	3477LK332M016JMBS	LK	.100	1.594

25VDC WORKING, 32VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
4.7	3477CB479M025JMBS	CB	49.384	.022
6.8	3477CB689M025JMBS	CB	34.133	.027
10	3477DB100M025JMBS	DB	23.210	.037
15	3477DB150M025JMBS	DB	15.474	.045
22	3477FC220M025JMBS	FC	10.550	.063
33	3477FC330M025JMBS	FC	7.033	.077
47	3477GC470M025JMBS	GC	4.939	.109
68	3477GC680M025JMBS	GC	3.414	.131
100	3477GD101M025JMBS	GD	2.321	.175
150	3477GF151M025JMBS	GF	1.548	.233
220	3477HF221M025JMBS	HF	1.055	.313
330	3477HG331M025JMBS	HG	.704	.417

25VDC WORKING, 32VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
470	3477KG471M025JMBS	KG	.494	.551
680	3477KJ681M025JMBS	KJ	.341	.713
1000	3477KL102M025JMBS	KL	.233	.885
1500	3477KL152M025JMBS	KL	.155	1.084
2200	3477LK222M025JMBS	LK	.120	1.391

35VDC WORKING, 44VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
4.7	3477CB479M035JMBS	CB	42.329	.024
6.8	3477CB689M035JMBS	CB	29.256	.029
10	3477DB100M035JMBS	DB	19.895	.040
15	3477FC150M035JMBS	FC	13.263	.056
22	3477FC220M035JMBS	FC	9.043	.068
33	3477GC330M035JMBS	GC	6.029	.098
47	3477GC470M035JMBS	GC	4.233	.118
68	3477GD680M035JMBS	GD	2.926	.156
100	3477GF101M035JMBS	GF	1.990	.205
150	3477HF151M035JMBS	HF	1.326	.279
220	3477HG221M035JMBS	HG	.904	.368
330	3477KG331M035JMBS	KG	.603	.498
470	3477KG471M035JMBS	KG	.424	.595
680	3477KJ681M035JMBS	KJ	.293	.770
1000	3477LL102M035JMBS	LL	.199	.997
1500	3477LK152M035JMBS	LK	.133	1.241

50VDC WORKING, 63VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
0.1	3477CB108M050JMBS	CB	1657.865	.001
0.15	3477CB158M050JMBS	CB	1105.243	.0016
0.22	3477CB228M050JMBS	CB	753.575	.0024
0.33	3477CB338M050JMBS	CB	502.384	.0036
0.47	3477CB478M050JMBS	CB	352.738	.0051
0.68	3477CB688M050JMBS	CB	243.804	.0074
1.0	3477CB109M050JMBS	CB	165.786	.011
1.5	3477CB159M050JMBS	CB	110.524	.015
2.2	3477CB229M050JMBS	CB	75.358	.018
3.3	3477CB339M050JMBS	CB	50.239	.022
4.7	3477DB479M050JMBS	DB	35.274	.030
6.8	3477DB689M050JMBS	DB	24.380	.036
10	3477FC100M050JMBS	FC	16.579	.050
15	3477FC150M050JMBS	FC	11.053	.062
22	3477GC220M050JMBS	GC	7.536	.088
33	3477GD330M050JMBS	GD	5.024	.119
47	3477GD470M050JMBS	GD	3.527	.142
68	3477GF680M050JMBS	GF	2.438	.196
100	3477HF101M050JMBS	HF	1.658	.250
150	3477HG151M050JMBS	HG	1.105	.332
220	3477KG221M050JMBS	KG	.754	.446
330	3477KJ331M050JMBS	KJ	.503	.588
470	3477KL471M050JMBS	KL	.353	.718
680	3477KL681M050JMBS	KL	.244	.863
1000	3477LK102M050JMBS	LK	.166	1.110

63VDC WORKING, 79VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
6.8	3477DB689M063JMBS	DB	24.380	.036
10	3477FC100M063JMBS	FC	16.579	.050
15	3477GC150M063JMBS	GC	11.053	.073
22	3477GD220M063JMBS	GD	7.536	.097
33	3477GD330M063JMBS	GD	5.024	.119

SERIES 3477
Miniature Single-Ended Aluminum Electrolytic Capacitors

STANDARD CAPACITANCE VALUES

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
63VDC WORKING, 79VDC SURGE				
47	3477GF470M063JMBS	GF	3.528	.154
68	3477GF680M063JMBS	GF	2.438	.186
100	3477HG101M063JMBS	HG	1.658	.271
150	3477HG151M063JMBS	HG	1.105	.332
220	3477KJ221M063JMBS	KJ	0.754	.480
330	3477KL331M063JMBS	KL	0.503	.601
470	3477LL471M063JMBS	LL	0.353	.749
680	3477LL681M063JMBS	LL	0.244	.901
80VDC WORKING, 100VDC SURGE				
2.2	3477CB229M080JMBS	CB	60.286	.020
3.3	3477DB339M080JMBS	DB	40.191	.028
4.7	3477DB479M080JMBS	DB	28.219	.033
6.8	3477FC689M080JMBS	FC	19.504	.046
10	3477GC100M080JMBS	GC	13.263	.066
15	3477GD150M080JMBS	GD	8.843	.090
22	3477GD220M080JMBS	GD	6.029	.109
33	3477GF330M080JMBS	GF	4.019	.144
47	3477GF470M080JMBS	GF	2.823	.172
68	3477HF680M080JMBS	HF	1.950	.230
100	3477HG101M080JMBS	HG	1.326	.303
150	3477KG151M080JMBS	KG	0.884	.411
220	3477KJ221M080JMBS	KJ	0.603	.536
330	3477KL331M080JMBS	KL	0.403	.672
470	3477LL471M080JMBS	LL	0.283	.837

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
100VDC WORKING, 125VDC SURGE				
0.1	3477CB108M100JMBS	CB	1160.506	.0022
0.15	3477CB158M100JMBS	CB	773.67	.0033
0.22	3477CB228M100JMBS	CB	527.03	.0048
0.33	3477CB338M100JMBS	CB	351.66	.0072
0.47	3477CB478M100JMBS	CB	246.916	.010
0.68	3477CB688M100JMBS	CB	170.66	.012
1	3477CB109M100JMBS	CB	116.05	.014
1.5	3477CB159M100JMBS	CB	77.368	.017
2.2	3477DB229M100JMBS	DB	52.75	.024
3.3	3477FC339M100JMBS	FC	35.166	.034
4.7	3477FC479M100JMBS	FC	24.691	.041
6.8	3477GC689M100JMBS	GC	17.066	.058
10	3477GD100M100JMBS	GD	11.605	.078
15	3477GF150M100JMBS	GF	7.736	.104
22	3477GF220M100JMBS	GF	5.275	.126
33	3477HF330M100JMBS	HF	3.516	.171
47	3477HG470M100JMBS	HG	2.469	.222
68	3477HG680M100JMBS	HG	1.706	.267
100	3477KG101M100JMBS	KG	1.160	.359
150	3477KJ151M100JMBS	KJ	.774	.473
220	3477LL221M100JMBS	LL	.528	.612
330	3477LK331M100JMBS	LK	.351	.762

CASE DIMENSIONS

Case Code	Diameter (mm)	Length (mm)
CB	5	11
DB	6.3	11
FC	8	11.5
GC	10	12.5
GD	10	16
GF	10	20
HF	12.5	20

Case Code	Diameter (mm)	Length (mm)
HG	12.5	25
KG	16	25
KJ	16	31.5
KL	16	35.5
LL	18	35.5
LK	18	40

HOW TO SPECIFY

Mepco/Centralab Series 3477 Capacitors can be completely specified using the following designation:

3477 — **Mepco/Centralab Product Series**

HF — **Case Size Code** (see physical spec)

471 — **Capacitance**
XX=Significant Digits
X=Multiplier
i.e. 471=470µF
470= 47µF
478=.47µF

T — **Tolerance**
M=±20%
K=±10%

016 — **Voltage**
016=16VDC
100=100VDC
6P3=6.3VDC

J — **Mechanical Characteristics**
J=Standard

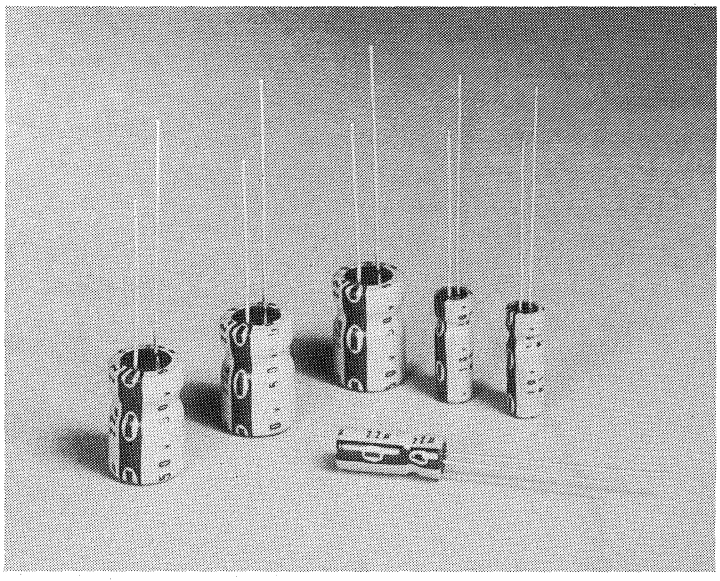
M — **Insulation**
M=Standard PVC

B — **Packaging**
B=Standard Bulk
T=Tape and Reel
A=Ammo Pack

S — **Lead Configuration**
S=Standard
Options (see pg. 86)
C=Cut
D=Forming Cut
F=Snap in Forming Cut
M=Snap in Cut
H=Cut–6.35mm

SERIES 3478

Miniature Single-Ended Aluminum Electrolytic Capacitors



DESCRIPTION:

Series 3478 capacitors are small-sized, single-ended low leakage aluminum electrolytic capacitors. Their standard leakage current is about one-twentieth of general-type aluminum electrolytic capacitors, making them suitable replacements for tantalum capacitors in many applications.

FEATURES:

- Extremely low leakage current.
- Low cost as compared with tantalum electrolytic capacitors.
- Case dimensions are almost identical to general-type, miniature aluminum electrolytic capacitors (only 3mm longer than general-type capacitors in terms of dimension L).
- Minimal mechanical stress is transmitted to internal elements, since the lead wire is sealed with epoxy resin.
- Excellent shelf life.
- Epoxy end seal standard.

For Application Guidelines see pages 116-119.

SERIES 3478

Miniature Single-Ended Aluminum Electrolytic Capacitors

CHARACTERISTICS

Item	Characteristic
Operating Temperature Range	−40~+85°C
Capacitance Tolerance	±20% (at 20°C, 120Hz)
Leakage Current	DC Voltage shall be applied through a 1,000 ohm series resistor in such a manner as to develop rated voltage across the capacitor in one minute. The leakage current, when measured 30 seconds after DC voltage developed rated voltage, shall not exceed the following value: 0.002CV(μA) or 0.2μA, whichever is greater. C: Nominal capacitance (μF) V: Rated Voltage (V) (at 20°C)
Dissipation Factor (Tan δ)	Rated voltage (V): 6.3 / 10 / 16 / 25 / 50 Tan δ: 0.24 / 0.20 / 0.16 / 0.14 / 0.10 (at 20°C, 120Hz)
Load Life	The following specifications shall be satisfied when the capacitors are restored to 20°C after the rated voltage applied for 1,000 hours at 85°C. Capacitance change ≦±15% of initial value Tan δ≦150% of initial specified value Leakage current ≦ initial specified value
Shelf Life	• The following specifications shall be satisfied when the capacitors are restored to 20°C after exposing them at 85°C for 500 hours without voltage applied. The rated voltage shall be applied to the capacitors for minimum of 30 minutes, at least 24 hours and not more than 48 hours before the measurements. Capacitance change ≦±15% of initial value Tan δ≦150% of initial specified value Leakage current ≦ initial specified value • After exposing the capacitors at room temperature for 6 months without voltage applied, the leakage current shall be met the initial specified value after 1 minute without preconditioning.
Others	Satisfies characteristics W of JIS C5141*—Test Methods per JIS 5102**

*May be ordered from American National Standards Institute.
**A summary of these standards appears on page 122.

CASE SIZE OF STANDARD PRODUCTS

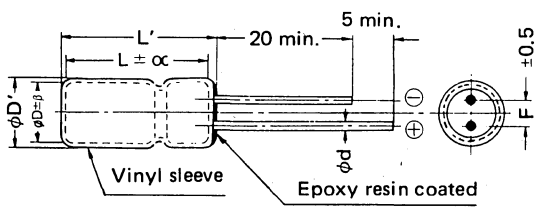
D x L (mm)

V / μF	6.3	10	16	25	50
0.1					5x14
0.22					5x14
0.33					5x14
0.47					5x14
1.0					5x14
2.2					5x14
3.3				5x14	6.3x14
4.7				5x14	6.3x14
10			5x14	6.3x14	8x14
22		5x14	6.3x14	8x14	10x15
33	5x14	6.3x14	6.3x14	8x14	
47	6.3x14	6.3x14	8x14	10x15	
100	8x14	8x14	10x15		

Note: With the exception of 8mm diameter cans, all 3478 capacitors have a safety vent.

CASE OUTLINE DRAWING

Unit (mm)



D'≦D+0.5
L'≦L+1

For L≦10, α=1 For D≦10, β=0.5
For L>10, α=2 For D>10, β=1

D	F	d
5	2	0.5
6.3	2.5	0.6
8	3.5	0.6
10	5	0.6

See page 120 for mm to inches conversion table.

SERIES 3478
Miniature Single-Ended Aluminum Electrolytic Capacitors

STANDARD CAPACITANCE VALUES

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
6.3VDC WORKING, 8VDC SURGE				
33	3478AA330M6P3PMBS	AA	12.058	.045
47	3478BA470M6P3PMBS	BA	8.466	.064
100	3478CA101M6P3PMBS	CA	3.989	.112
10VDC WORKING, 13VDC SURGE				
22	3478AA220M010PMBS	AA	15.071	.045
33	3478BA330M010PMBS	BA	10.048	.063
47	3478BA470M010PMBS	BA	7.055	.075
100	3478CA101M010PMBS	CA	3.316	.122
16VDC WORKING, 20VDC SURGE				
10	3478AA100M016PMBS	AA	26.526	.034
22	3478BA220M016PMBS	BA	12.058	.057
33	3478BA330M016PMBS	BA	8.039	.070
47	3478CA470M016PMBS	CA	5.644	.094
100	3478DB101M016PMBS	DB	2.653	.159

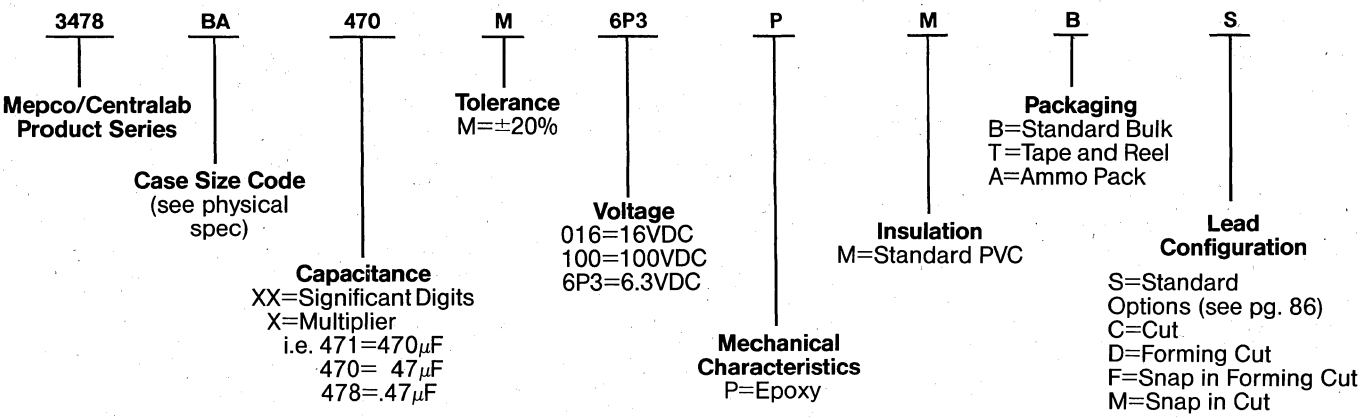
Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
25VDC WORKING, 32VDC SURGE				
3.3	3478AA339M025PMBS	AA	70.334	.018
4.7	3478AA479M025PMBS	AA	49.384	.025
10	3478BA100M025PMBS	BA	23.210	.041
22	3478CA220M025PMBS	CA	10.550	.068
33	3478CA330M025PMBS	CA	7.034	.084
47	3478DB470M025PMBS	DB	4.939	.116
50VDC WORKING, 63VDC SURGE				
0.1	3478AA108M050PMBS	AA	1657.865	.0011
0.22	3478AA228M050PMBS	AA	753.575	.0024
0.33	3478AA338M050PMBS	AA	502.384	.0036
0.47	3478AA478M050PMBS	AA	352.738	.0051
1.0	3478AA109M050PMBS	AA	165.786	.011
2.2	3478AA229M050PMBS	AA	75.358	.020
3.3	3478BA339M050PMBS	BA	50.238	.028
4.7	3478BA479M050PMBS	BA	35.738	.033
10	3478CA100M050PMBS	CA	16.788	.057
22	3478DB220M050PMBS	DB	7.536	.094

CASE DIMENSIONS

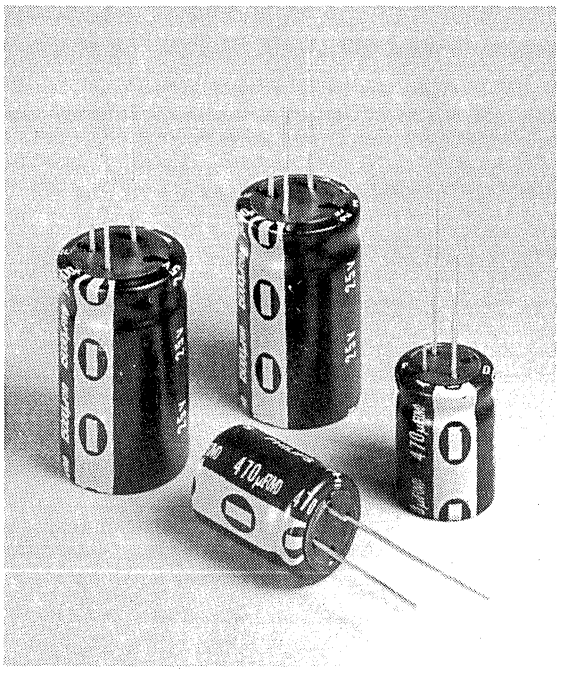
Case Code	Diameter (mm)	Length (mm)
AA	5	14
BA	6.3	14
CA	8	14
DB	10	15

HOW TO SPECIFY

Mepco/Centralab Series 3478 Capacitors can be completely specified using the following designation:



Miniature Single-Ended Aluminum Electrolytic Capacitors



DESCRIPTION:

Series 3479 capacitors are large capacitance, aluminum electrolytics with lead wire terminals. A newly developed, high magnification etched foil makes the Series 3479 smaller than ordinary capacitors of this type.

Capacitors in Series 3479 are ideal for small-sized light-weight, high performance electronic devices.

FEATURES:

- High C/V product.
- Capacitance tolerance ±20% or −10 to +30%.
- Leakage current 0.02CV.
- Free from polarity error.
- Low cost.

For Application Guidelines see pages 116-119.

SERIES 3479
Miniature Single-Ended Aluminum Electrolytic Capacitors

CHARACTERISTICS

Item	Characteristic
Operating Temperature Range	−40~+85°C
Capacitance Tolerance	±20% (−10~30% (Q)...Non-Standard) (at 20°C, 120Hz)
Leakage Current	0.02CV (μA) or 3,000μA, whichever is smaller. (After 5 minutes) (at 20°C)
Dissipation Factor (Tan δ)	Refer to the table. (at 20°C, 120Hz)
Temperature Characteristics	Impedance ratio at 120Hz
Load Life	The following specifications shall be satisfied when the capacitors are restored to 20°C after the rated voltage applied at 85°C for 1,000 hours. Capacitance change ≦±20% of initial value Tan δ≦150% of initial specified value Leakage current ≦ initial specified value
Shelf Life	The following specifications shall be satisfied when the capacitors are restored to 20°C after exposing them for 1,000 hours at 85°C without voltage applied. Capacitance change ≦±20% of initial value Tan δ≦150% of initial specified value Leakage current ≦ initial specified value
Others	Satisfies characteristics W of JIS C5141*—Test Methods per JIS 5102**

Rated voltage (V)	10	16	25	35	50	63	80	100
Z−25°C/Z20°C	3	3	3	3	3	3	3	3
Z−40°C/Z20°C	12	12	10	6	4	4	4	4

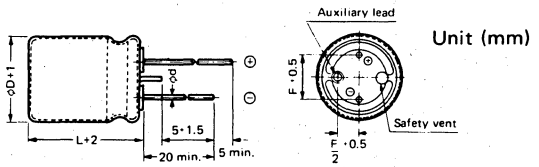
*May be ordered from American National Standards Institute. **A summary of these standards appears on page 122.

CASE SIZE OF STANDARD PRODUCTS

D x L (mm)

WV / μF	10	16	25	35	50	63	80	100
470								22x30
1000						22x30	22x40	25.4x40
2200				22x30	22x40	25.4x40	25.4x50	30x50
3300		22x30	22x30	22x40	25.4x40	25.4x50	30x50	
4700	22x30	22x30	22x40	25.4x40	25.4x50	30x50		
6800	22x30	22x40	25.4x40	25.4x50	30x50			
10000	22x40	25.4x40	25.4x50	30x50				
15000	25.4x50	30x50	30x50					
22000	30x50							

CASE OUTLINE DRAWING



Tolerance
D±1
L±2

D	22	25.4	30
F	10.0	12.5	15.0
d	1.0	1.0	1.2

(Note) Use auxiliary terminal independent of all other circuits.
See page 121 for mm to inches conversion table.

Note: All parts have safety vent.

STANDARD CAPACITANCE VALUES

Capacitance μF	Mepco/Centralab Part Number	Case Code	Dissipation Factor (Tan δ)	Maximum ESR (OHMS) 120Hz, at 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
10VDC WORKING, 13VDC SURGE					
4700	3479AA472M010JMBS	AA	.50	.176	1.0
6800	3479AA682M010JMBS	AA	.50	.123	1.3
10000	3479AB103M010JMBS	AB	.70	.116	1.6
15000	3479BC153M010JMBS	BC	.85	.094	2.0
22000	3479CC223M010JMBS	CC	.85	.064	2.8
16VDC WORKING, 20VDC SURGE					
3300	3479AA332M016JMBS	AA	.35	.176	1.0
4700	3479AA472M016JMBS	AA	.35	.124	1.3
6800	3479AB682M016JMBS	AB	.50	.123	1.6
10000	3479BB103M016JMBS	BB	.60	.100	2.0
15000	3479CC153M016JMBS	CC	.75	.083	2.7
25VDC WORKING, 32VDC SURGE					
3300	3479AA332M025JMBS	AA	.35	.176	1.1
4700	3479AB472M025JMBS	AB	.35	.124	1.3
6800	3479BB682M025JMBS	BB	.45	.110	1.7
10000	3479BC103M025JMBS	BC	.45	.075	2.1
15000	3479CC153M025JMBS	CC	.60	.066	2.7
35VDC WORKING, 44VDC SURGE					
2200	3479AA222M035JMBS	AA	.20	.151	1.0
3300	3479AB332M035JMBS	AB	.30	.151	1.3
4700	3479BB472M035JMBS	BB	.30	.106	1.6
6800	3479BC682M035JMBS	BC	.30	.074	2.0
10000	3479CC103M035JMBS	CC	.40	.066	2.6

SERIES 3479
Miniature Single-Ended Aluminum Electrolytic Capacitors

STANDARD CAPACITANCE VALUES

Capacitance μF	Mepco/Centralab Part Number	Case Code	Dissipation Factor (Tan δ)	Maximum ESR (OHMS) 120Hz, at 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
50VDC WORKING, 63VDC SURGE					
2200	3479AB222M050JMBS	AB	.20	.151	1.1
3300	3479BB332M050JMBS	BB	.25	.126	1.4
4700	3479BC472M050JMBS	BC	.25	.089	1.7
6800	3479CC682M050JMBS	CC	.30	.074	2.2
63VDC WORKING, 79VDC SURGE					
1100	3479AA102M063JMBS	AA	.20	.331	.7
2200	3479BB222M063JMBS	BB	.20	.151	1.2
3300	3479BC332M063JMBS	BC	.25	.126	1.4
4700	3479CC472M063JMBS	CC	.25	.089	1.8
80VDC WORKING, 100VDC SURGE					
1000	3479AB102M080JMBS	AB	.15	.249	.8
2200	3479BC222M080JMBS	BC	.20	.151	1.3
3300	3479CC332M080JMBS	CC	.20	.100	1.7
100VDC WORKING, 125VDC SURGE					
470	3479AA471M100JMBS	AA	.15	.529	.6
1000	3479BB102M100JMBS	BB	.15	.249	.9
2200	3479CC222M100JMBS	CC	.15	.113	1.4

CASE DIMENSIONS

Case Code	Diameter (mm)	Length (mm)
AA	22	30
AB	22	40
BB	25.4	40
BC	25.4	50
CC	30	50

HOW TO SPECIFY

Mepco/Centralab Series 3479 Capacitors can be completely specified using the following designation:

3479 — **Mepco/Centralab Product Series**

AA — **Case Size Code** (see physical spec)

470 — **Capacitance**
XX=Significant Digits
X=Multiplier
i.e. 471=470μF
470= 47μF
478=.47μF

M — **Tolerance**
M=±20%
S=+30%
−10%

100 — **Voltage**
016=16VDC
100=100VDC
6P3=6.3VDC

J — **Mechanical Characteristics**
J=Standard

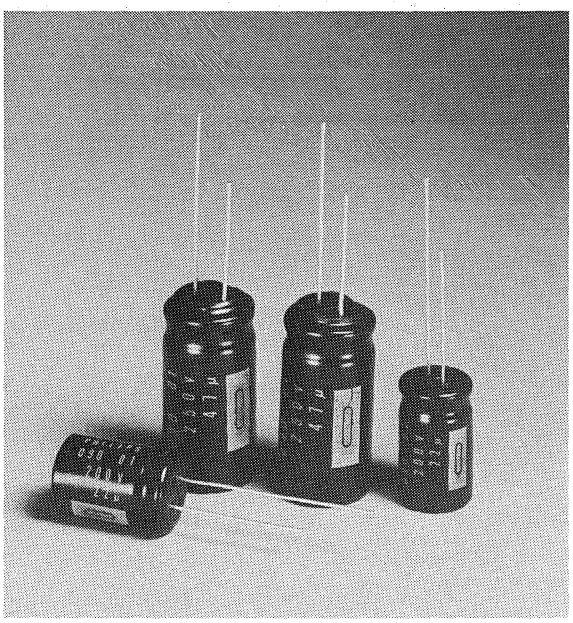
M — **Insulation**
M=Standard PVC

B — **Packaging**
B=Standard Bulk

S — **Lead Configuration**
S=Standard
Options (see pg. 86)
C=Cut

SERIES 3480

Miniature Single-Ended Aluminum Electrolytic Capacitors



DESCRIPTION:

Series 3480 capacitors are much smaller than conventional general-purpose miniature aluminum electrolytic capacitors. A newly developed, high-magnification etched foil is employed which allows the 3480 to be almost identical in case size to the 3476. A wide temperature range of −55 to +105°C and a long life of 1000 hours at 105°C is made possible by a newly developed, high-performance electrolyte and a special sealing material. Series 3480 employs the newest high-stability anode foil so that leakage current will change minimally even if the capacitors are left unused for a long period.

Series 3480 capacitors are useful in an extensive range of applications, both consumer and industrial. They are highly stable products suitable for time constant circuits.

FEATURES:

- Wide temperature range of (−55 to 105°C 6.3 to 100V; −40 to 105°C 160 to 250VDC.).
- Higher CV values compared to ordinary aluminum electrolytic capacitors.
- Load life of 1000 hours at 105°C with no voltage derating.
- Very low leakage current.
- Smaller size allows wider choice of capacitance and voltage for automatic insertion.
- Safety vents with the exception of 5mm diameter cans.
- Halogenated Solvent Proof Configuration available.

For Application Guidelines see pages 116-119.

SERIES 3480
Miniature Single-Ended Aluminum Electrolytic Capacitors

CHARACTERISTICS

Item	Characteristic	
Voltage Range	6.3~100V•DC	160~250V•DC
Operating Temperature Range	−55~+105°C	−40~+105°C
Capacitance Tolerance	±20% (M) (at 20°C, 120Hz)	
Leakage Current	The following specifications shall be satisfied when the rated voltage is applied for the required time. After 2 minutes: 0.002CV (μA) or 0.2μA, whichever is greater	After 1 minute : 0.1CV + 40 (μA) (CV≦1000) 0.04CV + 100 (μA) (CV>1000) After 5 minutes : 0.03CV + 15 (μA) (CV≦1000) 0.02CV + 25 (μA) (CV>1000) Where, C: Nominal capacitance (μF), V: Rated voltage (V) (at 20°C)
Dissipation Factor (Tan δ)	See table below	
Temperature Characteristics	(1) Capacitance change: Capacitance at −40°C is more than 80% of 20°C value. (2) Impedance ratio at 120Hz	(1) Capacitance change: Capacitance at −40°C is more than 70% of 20°C value.
Load Life	The following specifications shall be satisfied when the capacitors are restored to 20°C after the rated voltage applied for 1,000 hours at 105°C. Capacitance change from initial value: 6.3~16V ±25%; 25~100V ±20% Dissipation factor ≦200% of initial specified value Leakage current ≦ initial specified value	The following specifications shall be satisfied when the capacitors are restored to 20°C after the rated voltage applied for 1,000 hours at 105°C. Capacitance change ≦±20% of initial value Dissipation factor ≦200% of initial specified value Leakage current ≦ initial specified value
Shelf Life	The following specifications shall be satisfied when the capacitors are restored to 20°C after exposing them at 105°C for 1,000 hours without voltage applied. Capacitance change value shall be within the specifications shown on the table of load life. Dissipation factor ≦200% of initial specified value Leakage current ≦200% of initial specified value	The following specifications shall be satisfied when the capacitors are restored to 20°C after exposing them at 105°C for 1,000 hours without voltage applied. Capacitance change ≦±20% of initial value Dissipation factor ≦200% of initial specified value Leakage current ≦500% of initial specified value
Others	Satisfies characteristic W of JIS C5141*—Test Methods per JIS 5102**	

Rated voltage (V)	6.3	10	16	25	35	50	63, 80	100	160	200	250
Tan δ	0.22	0.19	0.16	0.14	0.12	0.10	0.08	0.07	0.15	0.12	0.10

For capacitors whose rated voltage is 100V or less and whose capacitance exceeds 1,000μF, the specification of tan δ is increased by 0.02 for every addition of 1,000μF. (at 20°C, 120Hz)

Rated voltage (V)	6.3	10	16	25	35	50	63	80	100	160	200	250
Z(−25°C)/Z(20°C)	3	2	2	2	2	2	2	2	2	3	3	3
Z(−40°C)/Z(20°C)	6	5	3	3	3	3	3	3	3	4	4	4

*May be ordered from American National Standards Institute.

**A summary of these standards appears on page 122.

SERIES 3480
Miniature Single-Ended Aluminum Electrolytic Capacitors

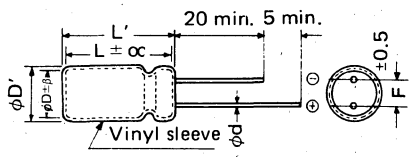
CASE SIZE OF STANDARD PRODUCTS

ΦD x L (mm)

V / μF	6.3	10	16	25	35	50	63	80	100	160	200	250
0.47						5x11			5x11	6.3x11		
1						5x11			5x11	6.3x11		10x16
2.2						5x11			5x11	8x11.5		10x16
3.3						5x11			5x11	10x16	10x16	10x16
4.7						5x11	5x11	6.3x11	6.3x11	10x16	10x16	10x16
10						5x11	6.3x11	8x11.5	8x11.5	10x16	10x20	12.5x20
22				5x11	6.3x11	6.3x11	8x11.5	10x12.5	10x12.5	12.5x20	12.5x20	12.5x25
33			5x11	6.3x11	6.3x11	8x11.5	8x11.5	10x16	10x16	12.5x25	16x25	16x25
47		5x11	6.3x11	6.3x11	8x11.5	8x11.5	10x12.5	10x16	10x20	16x25	16x25	16x31.5
100		6.3x11	8x11.5	8x11.5	10x12.5	10x16	10x20	12.5x20	12.5x20	16x35.5	18x40	
220	8x11.5	8x11.5	10x12.5	10x16	10x20	12.5x20	12.5x20	12.5x25	16x25			
330	10x12.5	10x12.5	10x16	10x20	12.5x20	12.5x20	12.5x25	16x31.5	16x31.5			
470	10x12.5	10x16	10x20	12.5x20	12.5x25	16x25	16x25	16x35.5	18x35.5			
1000	10x20	12.5x20	12.5x25	16x25	16x25	16x31.5	18x35.5					
2200	12.5x25	16x25	16x25	16x35.5	18x35.5							
3300	16x25	16x31.5	16x35.5	18x40								
4700	16x31.5	16x35.5	18x35.5									
10000	18x40											

CASE OUTLINE DRAWING

Unit (mm)



D	φ5	φ6.3	φ8	φ10	φ12.5	φ16	φ18
L'	L+1.5					L+2.0	
D'	D+0.5					D+0.5	
d	0.5	0.6	0.6	0.6	0.6	0.8	0.8
F	2	2.5	3.5	5	5	7.5	7.5

For L≦10, α=1 For D≦10, β=0.5
For L>10, α=2 For D>10, β=1

See page 120 for mm to inches conversion table.

Note: With the exception of 5mm diameter cans, all 3480 capacitors have a safety vent.

STANDARD CAPACITANCE VALUES

Capacitance μF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 105°C
6.3VDC WORKING, 8VDC SURGE				
220	3480FC221M6P3JMBS	FC	1.658	.155
330	3480GC331M6P3JMBS	GC	1.105	.222
470	3480GC471M6P3JMBS	GC	.776	.265
1000	3480GF102M6P3JMBS	GF	.365	.460
2200	3480HG222M6P3JMBS	HG	.181	.787
3300	3480KG332M6P3JMBS	KG	.115	1.027
4700	3480KJ472M6P3JMBS	KJ	.089	1.270
10000	3480LK103M6P3JMBS	LK	.061	2.037
10VDC WORKING, 13VDC SURGE				
47	3480CB470M010JMBS	CB	6.703	.060
100	3480DB101M010JMBS	DB	3.150	.099
220	3480FC221M010JMBS	FC	1.431	.170
330	3480GC331M010JMBS	GC	.955	.243
470	3480GD471M010JMBS	GD	.670	.317
1000	3480HF102M010JMBS	HF	.315	.560
2200	3480KG222M010JMBS	KG	.159	.946
3300	3480KJ332M010JMBS	KJ	.115	1.189
4700	3480KL472M010JMBS	KL	.089	1.410
16VDC WORKING, 20VDC SURGE				
33	3480CB330M016JMBS	CB	8.039	.056
47	3480DB470M016JMBS	DB	5.644	.076
100	3480FC101M016JMBS	FC	2.653	.128
220	3480GC221M016JMBS	GC	1.206	.222
330	3480GD331M016JMBS	GD	.804	.297
470	3480GF471M016JMBS	GF	.565	.386
1000	3480HG102M016JMBS	HG	.265	.676
2200	3480KG222M016JMBS	KG	.136	1.046
3300	3480KL332M016JMBS	KL	.100	1.582
4700	3480LL472M016JMBS	LL	.078	1.881
25VDC WORKING, 32VDC SURGE				
22	3480CB220M025JMBS	CB	10.550	.049
33	3480DB330M025JMBS	DB	7.034	.068
47	3480DB470M025JMBS	DB	4.939	.081
100	3480FC101M025JMBS	FC	2.321	.137
220	3480GD221M025JMBS	GD	1.055	.260
330	3480GF331M025JMBS	GF	.704	.346
470	3480HF471M025JMBS	HF	.494	.458
1000	3480KG102M025JMBS	KG	.233	.800
2200	3480KL222M025JMBS	KL	.120	1.230
3300	3480LK322M025JMBS	LK	.090	1.620
35VDC WORKING, 44VDC SURGE				
22	3480DB220M035JMBS	DB	9.043	.060
33	3480DB330M035JMBS	DB	6.029	.073
47	3480FC470M035JMBS	FC	4.233	.101
100	3480GC101M035JMBS	GC	1.990	.172
220	3480GF221M035JMBS	GF	.904	.305
330	3480HF331M035JMBS	HF	.603	.415
470	3480HG471M035JMBS	HG	.424	.535
1000	3480KG102M035JMBS	KG	.198	.864
2200	3480LL222M035JMBS	LL	.105	1.359

Capacitance μF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 105°C
50VDC WORKING, 63VDC SURGE				
.47	3480CB478M050JMBS	CB	352.738	.006
1	3480CB109M050JMBS	CB	165.786	.012
2.2	3480CB229M050JMBS	CB	75.358	.018
3.3	3480CB339M050JMBS	CB	50.239	.022
4.7	3480CB479M050JMBS	CB	35.274	.027
10	3480CB100M050JMBS	CB	16.579	.039
22	3480DB220M050JMBS	DB	7.536	.065
33	3480FC330M050JMBS	FC	5.024	.093
47	3480FC470M050JMBS	FC	3.528	.111
100	3480GD101M050JMBS	GD	1.658	.207
220	3480HF221M050JMBS	HF	.754	.371
330	3480HF331M050JMBS	HF	.503	.454
470	3480KG471M050JMBS	KG	.353	.649
1000	3480KJ102M050JMBS	KJ	.166	1.014
63VDC WORKING, 79VDC SURGE				
4.7	3480CB479M063JMBS	CB	28.219	.030
10	3480DB100M063JMBS	DB	13.263	.050
22	3480FC220M063JMBS	FC	6.029	.085
33	3480FC330M063JMBS	FC	4.019	.104
47	3480GC470M063JMBS	GC	2.823	.145
100	3480GF101M063JMBS	GF	1.326	.252
220	3480HF221M063JMBS	HF	.603	.414
330	3480HG331M063JMBS	HG	.403	.550
470	3480KG471M063JMBS	KG	.283	.725
1000	3480LL102M063JMBS	LL	.133	1.212
80VDC WORKING, 100VDC SURGE				
4.7	3480DB479M080JMBS	DB	28.219	.034
10	3480FC100M080JMBS	FC	13.263	.057
22	3480GC220M080JMBS	GC	6.029	.099
33	3480GD330M080JMBS	GD	4.019	.133
47	3480GD470M080JMBS	GD	2.823	.158
100	3480HF101M080JMBS	HF	1.326	.280
220	3480HG221M080JMBS	HG	.603	.449
330	3480KJ331M080JMBS	KJ	.403	.651
470	3480KL471M080JMBS	KL	.283	.804
100VDC WORKING, 125VDC SURGE				
0.47	3480CB478M100JMBS	CB	246.916	.010
1	3480CB109M100JMBS	CB	116.05	.015
2.2	3480CB229M100JMBS	CB	52.75	.022
3.3	3480CB339M100JMBS	CB	35.166	.027
4.7	3480DB479M100JMBS	DB	24.691	.036
10	3480FC100M100JMBS	FC	11.605	.061
22	3480GC220M100JMBS	GC	5.275	.106
33	3480GD330M100JMBS	GD	3.516	.142
47	3480GF470M100JMBS	GF	2.469	.184
100	3480HF101M100JMBS	HF	1.160	.298
220	3480KG221M100JMBS	KG	.528	.530
330	3480KJ331M100JMBS	KJ	.351	.699
470	3480LL471M100JMBS	LL	.248	.888

SERIES 3480
Miniature Single-Ended Aluminum Electrolytic Capacitors

STANDARD CAPACITANCE VALUES

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
160VDC WORKING, 200VDC SURGE				
0.47	3480DB478M160JMBS	DB	529.11	.007
1	3480DB109M160JMBS	DB	248.68	.011
2.2	3480FC229M160JMBS	FC	113.04	.019
3.3	3480GD339M160JMBS	GD	75.36	.030
4.7	3480GD479M160JMBS	GD	52.91	.036
10	3480GD100M160JMBS	GD	24.87	.053
22	3480HF220M160JMBS	HF	11.30	.095
33	3480HG330M160JMBS	HG	7.54	.127
47	3480KG470M160JMBS	KG	5.29	.168
100	3480KL101M160JMBS	KL	2.49	.270
200VDC WORKING, 250VDC SURGE				
3.3	3480GD339M200JMBS	GD	60.29	.034
4.7	3480GD479M200JMBS	GD	42.33	.041
10	3480GF100M200JMBS	GF	19.89	.065
22	3480HF220M200JMBS	HF	9.04	.107
33	3480KG330M200JMBS	KG	6.03	.157
47	3480KG470M200JMBS	KG	4.23	.188
100	3480LK101M200JMBS	LK	1.99	.320

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
250VDC WORKING, 300VDC SURGE				
1	3480GD109M250JMBS	GD	165.79	.020
2.2	3480GD229M250JMBS	GD	75.36	.030
3.3	3480GD339M250JMBS	GD	50.24	.037
4.7	3480GD479M250JMBS	GD	35.27	.045
10	3480HF100M250JMBS	HF	16.58	.079
22	3480HG220M250JMBS	HG	7.54	.127
33	3480KG330M250JMBS	KG	5.02	.172
47	3480KJ470M250JMBS	KJ	3.53	.221

CASE DIMENSIONS

Case Code	Diameter (mm)	Length (mm)
CB	5	11
DB	6.3	11
FC	8	11.5
GC	10	12.5
GD	10	16
GF	10	20
HF	12.5	20

Case Code	Diameter (mm)	Length (mm)
HG	12.5	25
KG	16	25
KJ	16	31.5
KL	16	35.5
LL	18	35.5
LK	18	40

HOW TO SPECIFY

Mepco/Centralab Series 3480 Capacitors can be completely specified using the following designation:

3480 — **Mepco/Centralab Product Series**

GF — **Case Size Code** (see physical spec)

471 — **Capacitance**
XX=Significant Digits
X=Multiplier
i.e. 471=470µF
470= 47µF
478=.47µF

M — **Tolerance**
M=±20%

016 — **Voltage**
016=16VDC
100=100VDC
6P3=6.3VDC

J — **Mechanical Characteristics**
J=Standard
P=Solvent Resistant*

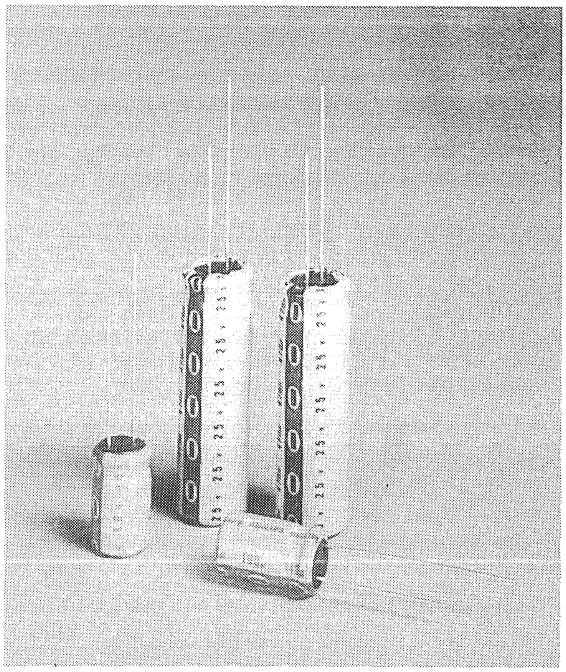
M — **Insulation**
M=Standard PVC

B — **Packaging**
B=Standard Bulk
T=Tape and Reel

S — **Lead Configuration**
S=Standard
Options (see pg. 86)
C=Cut
D=Forming Cut
F=Snap in Forming Cut
M=Snap in Cut
H=Cut–6.35mm

*See "Application Guidelines" section page 117 for approved solvents and cleaning conditions.

Miniature Single-Ended Aluminum Electrolytic Capacitors



DESCRIPTION:

Series 3481 capacitors exhibit long operating life (2000 hours at 105°C) and very low impedance and ESR. They have a higher ripple current rating than general purpose aluminum electrolytic capacitors and are suitable for use in switching power supplies.

FEATURES:

- Very low impedance and ESR.
- High permissible ripple current.
- Wide operating temperature range (−55 to +105°C).
- Long life and high reliability equivalent to 2000 hours at 105°C.
- Halogenated Solvent Proof Configuration available.

For Application Guidelines see pages 116-119.

SERIES 3481
Miniature Single-Ended Aluminum Electrolytic Capacitors

CHARACTERISTICS

Item	Characteristic
Operating Temperature Range	−55 ~ +105°C
Capacitance Tolerance	−10 ~ +100% (at 120Hz, 20°C)
Equivalent Series Resistance (ESR)	When measured at a temperature of 20°C and a frequency of 120 and 1000Hz, the ESR shall not exceed the specified values given in the tables on page 119.
Impedence	When measured at a temperature of 20°C and frequency of 100KHz, the impedance shall to exceed the specified values given in the table.
Equivalent Series Inductance	When measured at a frequency of 1MHz and within 3mm of the body of the capacitor, the ESL shall not exceed 20nH.
Leakage Current	0.002CV (μA) or 2μA, whichever is greater. (After 3 minutes) where C: Nominal capacitance (μF) V: Rated working voltage (V) (at 20°C)
Low Temperature Characteristics	Capacitance at −55°C shall not be less than 70% of the initial 20°C measured value and the ratio of impedance at 120Hz shall not exceed the following values.
Surge Voltage	
Load Life	The following specifications shall be satisfied when the capacitors are restored to 20°C after the rated voltage applied for 2,000 hours at 105°C. Capacitance change ≦±15% of initial value ESR at 120Hz and 1KHz ≦150% of initial specified value Leakage current ≦ initial specified value
Shelf Life	The following specifications shall be satisfied when the capacitors are restored to 20°C after exposing them at 105°C for 500 hours without voltage applied. Capacitance change ≦±10% of initial value ESR at 120Hz and 1KHz ≦150% of initial specified value Leakage current ≦ 200% of initial specified value
Permissible Ripple Current	Refer to tables on page 78. When the ambient temperature and frequency are different from 85°C and 100KHz respectively, the ripple current shall not exceed the value multiplied by the factor given in Fig. 1 and Fig. 2, page 80.
Others	Satisfies characteristics C of JIS C5141*—Test Methods per JIS 5102**

Rated voltage (V)	10	16	25	35	50	63	100
Z−55°C/Z20°C	4	3	2	2	2	2	2

Rated voltage (V)	10	16	25	35	50	63	100
Surge Voltage	13	20	32	44	63	79	125

*May be ordered from American National Standards Institute.
**A summary of these standards appears on page 122.

STANDARD CAPACITANCE VALUES

Capacitance μF	Mepco/Centralab Part Number	Case Code	ESR (Ω) at 20°C 120Hz	ESR (Ω) at 20°C 1KHz	Max. Ripple Current (A RMS) at 85°C & 100KHz
10VDC WORKING, 13VDC SURGE					
47	3481AA470V010JDBS	AA	3.5	1.9	0.26
100	3481BC101V010JDBS	BC	1.8	1.0	0.33
220	3481BD221V010JDBS	BD	1.0	0.58	0.48
330	3481CD331V010JDBS	CD	0.48	0.28	0.73
470	3481CE471V010JDBS	CE	0.24	0.16	1.42
1000	3481CF102V010JDBS	CF	0.12	0.076	2.87
16VDC WORKING, 20VDC SURGE					
33	3481AA330V016JDBS	AA	4.0	2.0	0.19
47	3481BB470V016JDBS	BB	2.8	1.4	0.26
100	3481BC101V016JDBS	BC	1.5	0.8	0.45
220	3481CD221V016JDBS	CD	0.61	0.35	0.71
330	3481CE331V016JDBS	CE	0.28	0.17	1.31
680	3481CF681V016JDBS	CF	0.14	0.09	2.44

SERIES 3481
Miniature Single-Ended Aluminum Electrolytic Capacitors

STANDARD CAPACITANCE VALUES

Capacitance µF	Mepco/Centralab Part Number	Case Code	ESR (Ω) at 20°C 120Hz	ESR (Ω) at 20°C 1KHz	Max. Ripple Current (A RMS) at 85°C & 100KHz
25VDC WORKING, 32VDC SURGE					
22	3481AA220V025JDBS	AA	5.0	2.0	0.15
33	3481BB330V025JDBS	BB	2.8	1.7	0.24
68	3481BC680V025JDBS	BC	1.5	0.85	0.40
100	3481BD101V025JDBS	BD	1.2	0.60	0.47
220	3481CE221V025JDBS	CE	0.40	0.27	1.02
470	3481CF471V025JDBS	CF	0.16	0.10	1.90
35VDC WORKING, 44VDC SURGE					
10	3481AA100V035JDBS	AA	7.0	2.0	0.13
22	3481BB220V035JDBS	BB	2.5	1.5	0.26
47	3481BC470V035JDBS	BC	2.2	1.0	0.31
68	3481BD680V035JDBS	BD	1.3	0.80	0.45
100	3481CE101V035JDBS	CE	0.80	0.40	1.00
330	3481CF331V035JDBS	CF	0.26	0.20	1.55
50VDC WORKING, 63VDC SURGE					
10	3481AA100V050JDBS	AA	10.0	4.5	0.10
33	3481BC330V050JDBS	BC	2.3	1.8	0.26
47	3481BD470V050JDBS	BD	2.0	1.0	0.34
100	3481CE101V050JDBS	CE	0.76	0.42	0.69
220	3481CF221V050JDBS	CF	0.40	0.25	1.28

Capacitance µF	Mepco/Centralab Part Number	Case Code	ESR (Ω) at 20°C 120Hz	ESR (Ω) at 20°C 1KHz	Max. Ripple Current (A RMS) at 85°C & 100KHz
63VDC WORKING, 79VDC SURGE					
6.8	3481AA689V063JDBS	AA	18.0	8.0	0.075
10	3481BB100V063JDBS	BB	10.0	5.0	0.10
22	3481BC220V063JDBS	BC	4.0	2.8	0.19
33	3481BD330V063JDBS	BD	3.5	2.0	0.24
68	3481CE680V063JDBS	CE	1.2	0.60	0.55
100	3481CF101V063JDBS	CF	0.60	0.30	1.18
100VDC WORKING, 125VDC SURGE					
2.2	3481AA229V100JDBS	AA	70.0	30.0	0.075
3.3	3481BB339V100JDBS	BB	48.3	20.0	0.081
6.8	3481BC689V100JDBS	BC	20.0	4.5	0.12
10	3481BD100V100JDBS	BD	13.3	3.0	0.17
22	3481CE220V100JDBS	CE	2.0	0.80	0.60
47	3481CF470V100JDBS	CF	0.88	0.35	1.10

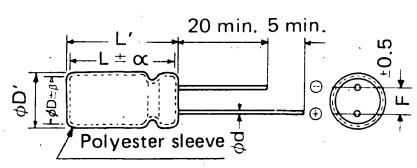
CASE SIZE OF STANDARD PRODUCTS

D x L (mm)

µF \ V	10	16	25	35	50	63	100
2.2							8x11.5
3.3							10x12.5
6.8						8x11.5	10x16.5
10				8x11.5	8x11.5	10x12.5	10x20.5
22			8x11.5	10x12.5		10x16.5	12.5x24.5
33.		8x11.5	10x12.5		10x16.5	10x20.5	
47	8x11.5	10x12.5		10x16.5	10x20.5		12.5x42.5
68			10x16.5	10x20.5		12.5x24.5	
100	10x16.5	10x16.5	10x20.5	12.5x24.5	12.5x24.5	12.5x42.5	
220	10x20.5	12.5x20.5	12.5x24.5		12.5x42.5		
330	12.5x20.5	12.5x24.5		12.5x42.5			
470	12.5x24.5		12.5x42.5				
680		12.5x42.5					
1000	12.5x42.5						

CASE OUTLINE DRAWING

Unit (mm)



For L≦10, α=1 For D≦10, β=0.5
For L>10, α=2 For D>10, β=1

D	D'	L'	F	d
8	D+0.5	L+2.0	3.5	0.6
10	D+1.0	L+2.0	5.0	0.6
12.5	D+1.0	L+2.0	5.0	0.6

See page 120 for mm to inches conversion table.
Note: All 3481 capacitors have a safety vent.

SERIES 3481
Miniature Single-Ended Aluminum Electrolytic Capacitors

RIPPLE CURRENT MULTIPLIERS

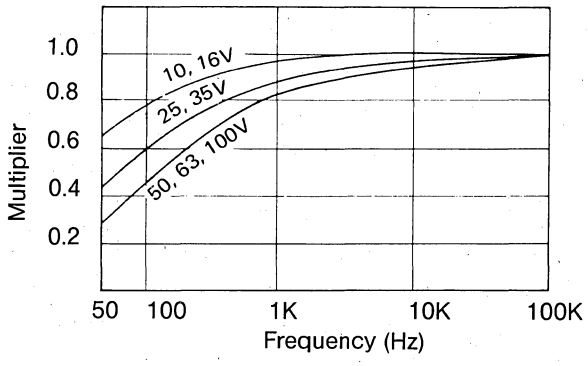


Fig. 1

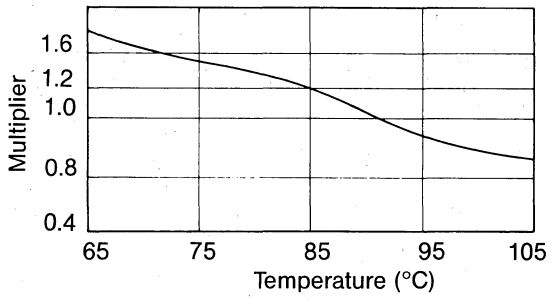


Fig. 2

CASE DIMENSIONS

Case Code	Diameter (mm)	Length (mm)
AA	8	11.5
BB	10	12.5
BC	10	16.5
BD	10	20.5
CD	12.5	20.5
CE	12.5	24.5
CF	12.5	42.5

HOW TO SPECIFY

Mepco/Centralab Series 3481 Capacitors can be completely specified using the following designation:

3481 — **Mepco/Centralab Product Series**

CE — **Case Size Code** (see physical spec)

471 — **Capacitance**
XX=Significant Digits
X=Multiplier
i.e. 471=470μF
470= 47μF
478=.47μF

V — **Tolerance**
V=−10+100%

010 — **Voltage**
016=16VDC
100=100VDC
6P3=6.3VDC

J — **Mechanical Characteristics**
J=Standard
P=Solvent Resistant

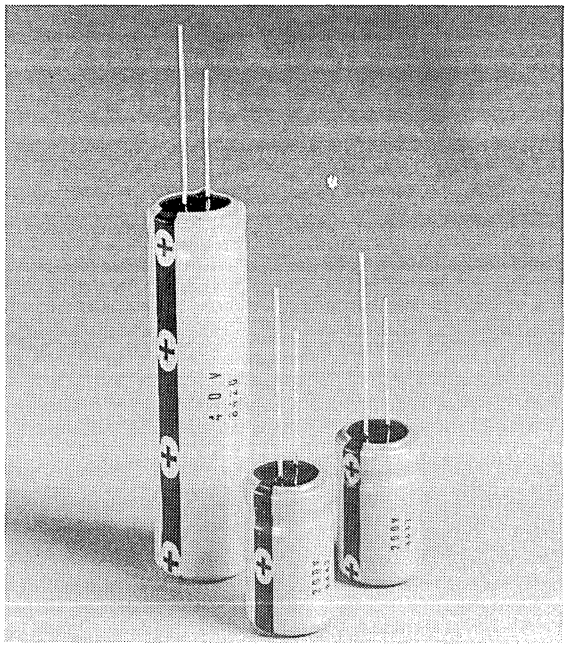
D — **Insulation**
D=Polyester

B — **Packaging**
B=Standard Bulk
T=Tape and Reel
A=Ammo Pack

S — **Lead Configuration**
S=Standard
Options (see pg. 86)
C=Cut
D=Forming Cut
F=Snap in Forming Cut
M=Snap in Cut

*See "Application Guidelines" section page 117 for approved solvents and cleaning conditions.

Miniature Single-Ended Aluminum Electrolytic Capacitors



DESCRIPTION:

Series 3482 capacitors are specially designed for switching regulators and other applications requiring low ESR and high frequency capabilities. These electrolytic capacitors feature the most advanced technology available and are suitable for high reliability data processing, industrial, and military applications. The life performance and low temperature characteristics far exceed those of conventional +85°C electrolytic capacitors. An epoxy end seal is supplied to protect the capacitor from halogenated and other cleaning solvents.

FEATURES:

- Wide operating temperature range (−55 to +105°C 7.5 to 100V, −25 to 105°C 150 to 250VDC).
- Very low ESR.
- Long life and high reliability equivalent to 2000 hours at 105°C.
- Epoxy end seal standard.

For Application Guidelines see pages 116-119.

SERIES 3482
Miniature Single-Ended Aluminum Electrolytic Capacitors

CHARACTERISTICS

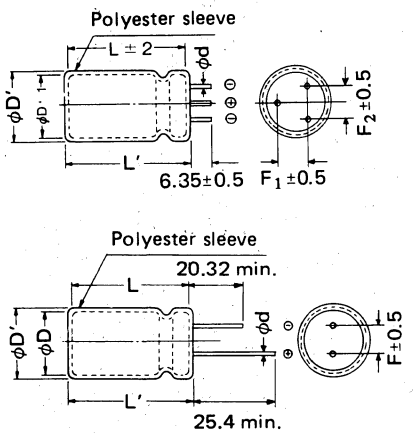
Item	Characteristic	
Voltage Range	7.5 ~ 100V·DC	150 ~ 250V·DC
Operating Temperature Range	−55~+105°C	−25°C~+105°C
Capacitance Tolerance	−10~+75% (U) (at 20°C, 120Hz)	
Leakage Current	½ $\sqrt{CV}$ (μA)...(7.5~ 40V) $\sqrt{CV}$ (μA)...(50 ~ 100V) (After 5 minute at 20°C)	0.02CV + 10 (μA)
Equivalent Series Resistance (ESR)	When measured at 20°C and 120Hz and 10KHz, ESR value shall not exceed the values given in the table on next two pages.	
Impedance	When measured at 20°C and 100KHz, impedance value shall not exceed the values given in the table on next two pages.	
Permissible Ripple Current	Refer to the table on next two pages. When the ambient temperature and frequency are different from 85°C and 120Hz, ripple current value shall not exceed the value multiplied by the factor given in fig. 1 and fig. 2.	
Surge Voltage	Capacitors, connected in series with 1,000 ohm resistors, shall withstand surge test voltage applied at the rate of ½ minute on, 4½ minutes off, for 1,000 successive test cycles at 20°C.	
Temperature Characteristics	• At −55°C (7.5~12V) Capacitance > 65% of the value at 20°C ESR ≦ 20 times the initial specified value Impedance ≦ 6 times the value at 20°C (16~100V) Capacitance ≧ 80% of the value at 20°C ESR ≦ 10 times the initial specified value Impedance ≦ 3 times the value at 20°C	• At −25°C (150~250V) Capacitance ≧ 70% of the value at 20°C ESR ≦ 10 times initial specified value Impedance ≦ 4 times the value at 20°C Leakage current ≦ initial value • At +105°C Capacitance ≦ 115% of the value at 25°C ESR ≦ initial specified value Impedance ≦ the value at 25°C Leakage current ≦ 5 times the initial specified value (at 120Hz)
Load Life	The following specifications shall be satisfied when the capacitors are restored to 20°C after the rated voltage applied for 2,000 hours at 105°C. Capacitance change ≦±15% of initial value (7.5~100V), ±20% of initial value (150~250V) Leakage current ≦ initial specified value ESR, Z ≦ 200% of initial specified value	
Shelf Life	The following specifications shall be satisfied when the capacitors are restored to 20°C after exposing them at 105°C for 500 hours without voltage applied. Capacitance change ≦±15% of initial value Leakage current ≦ 5 times the initial specified value ESR, Z ≦ 150% of initial specified value	
Others	Satisfies characteristic C of JIS C5141*—Test Methods per JIS 5102**	

Rated voltage (V)	7.5	12	16	25	40	50	75	100	150	200	250
Surge voltage (V)	10	18	20	35	55	75	100	150	200	250	300

*May be ordered from American National Standards Institute.

**A summary of these standards appears on page 122.

CASE OUTLINE DRAWING



RIPPLE CURRENT MULTIPLIERS

Unit (mm)

φD	19.1	22.2	25.4
φD'	φD + 0.78	φD + 0.78	φD + 0.78
L'	L+1.77	L+1.77	L+1.77
F	7.62	7.62	10.16
F_1	7.62	10.16	10.16
F_2	5.08	7.62	7.62
φd	1.0	1.0	1.0

See page 121 for mm to inches conversion table.

Fig. 1

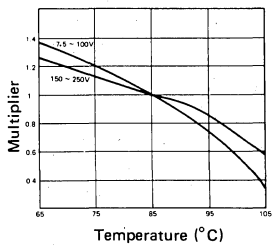
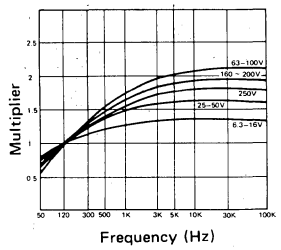


Fig. 2



STANDARD CAPACITANCE VALUES

7.5VDC WORKING, 10VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR Ohms at 25°C 120Hz	Maximum ESR Ohms at 25°C 10KHz	Maximum Impedance Ohms at 25°C 100KHz	Maximum RMS 85°C Ripple Current Amps 120Hz
1800	3482GG182U7P5RDBS	GG	.125	.062	.062	1.9
2200	3482GJ222U7P5RDBS	GJ	.067	.038	.041	2.8
2800	3482GJ282U7P5RDBS	GJ	.090	.045	.046	2.4
3300	3482GL332U7P5RDBS	GL	.045	.026	.031	3.7
3900	3482GL392U7P5RDBS	GL	.058	.029	.030	3.5
5200	3482GP522U7P5RDBS	GP	.046	.023	.025	4.3
5600	3482GP562U7P5RDBS	GP	.040	.021	.022	4.4
6800	3482GS682U7P5RDBS	GS	.033	.018	.020	5.4
2700	3482HG272U7P5RDBS	HG	.080	.047	.047	2.4
4100	3482HJ412U7P5RDBS	HJ	.063	.034	.035	2.9
5600	3482HL562U7P5RDBS	HL	.043	.023	.024	4.2
5900	3482HL592U7P5RDBS	HL	.042	.023	.024	4.1
6800	3482HP682U7P5RDBS	HP	.025	.016	.022	5.7
8200	3482HP822U7P5RDBS	HP	.029	.016	.018	5.5
10000	3482HS103U7P5RDBS	HS	.024	.013	.015	6.6
3500	3482JG352U7P5RDBS	JG	.058	.027	.032	3.2
4700	3482JJ472U7P5RDBS	JJ	.037	.024	.028	4.1
5600	3482JJ562U7P5RDBS	JJ	.047	.026	.028	3.9
8200	3482JL822U7P5RDBS	JL	.032	.018	.020	5.3
10000	3482JP392U7P5RDBS	JP	.020	.013	.021	7.3
11000	3482JP113U7P5RDBS	JP	.025	.015	.018	5.3
13500	3482JS143U7P5RDBS	JS	.021	.013	.016	6.3
16500	3482JT173U7P5RDBS	JT	.018	.012	.015	7.4

12VDC WORKING, 18VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR Ohms at 25°C 120Hz	Maximum ESR Ohms at 25°C 10KHz	Maximum Impedance Ohms at 25°C 100KHz	Maximum RMS 85°C Ripple Current Amps 120Hz
1200	3482GG122U012RDBS	GG	.144	.058	.058	1.8
1800	3482GJ182U012RDBS	GJ	.096	.039	.039	2.4
2500	3482GL252U012RDBS	GL	.070	.031	.032	3.5
3300	3482GP332U012RDBS	GP	.052	.023	.025	4.3
3600	3482GP362U012RDBS	GP	.042	.020	.022	4.3
4100	3482GS412U012RDBS	GS	.042	.019	.021	5.4
4700	3482GS472U012RDBS	GS	.037	.015	.017	5.4
1500	3482HG152U012RDBS	HG	.119	.053	.053	2.1
2600	3482HJ262U012RDBS	HJ	.058	.026	.028	3.2
2700	3482HJ272U012RDBS	HJ	.066	.029	.030	3.1
3900	3482HL392U012RDBS	HL	.038	.020	.025	4.6
4700	3482HP472U012RDBS	HP	.032	.017	.023	5.5
5100	3482HP512U012RDBS	HP	.036	.017	.019	5.1
6300	3482HS632U012RDBS	HS	.029	.014	.017	6.1
2200	3482JG222U012RDBS	JG	.084	.043	.044	2.7
3700	3482JJ372U012RDBS	JJ	.055	.029	.031	3.1
4700	3482JL472U012RDBS	JL	.036	.020	.022	4.8
5300	3482JL532U012RDBS	JL	.036	.020	.022	4.3
5600	3482JL562U012RDBS	JL	.027	.014	.019	5.7
6800	3482JP682U012RDBS	JP	.027	.014	.017	6.0
7200	3482JP722U012RDBS	JP	.028	.015	.018	5.3
8200	3482JS822U012RDBS	JS	.023	.013	.016	6.6
8800	3482JS882U012RDBS	JS	.023	.013	.016	6.3
10500	3482JT113U012RDBS	JT	.020	.012	.015	7.4
11000	3482JT113U012RDBS	JT	.020	.012	.015	8.6

16VDC WORKING, 20VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR Ohms at 25°C 120Hz	Maximum ESR Ohms at 25°C 10KHz	Maximum Impedance Ohms at 25°C 100KHz	Maximum RMS 85°C Ripple Current Amps 120Hz
1000	3482GG102U016RDBS	GG	.146	.064	.064	1.8
1500	3482GJ152U016RDBS	GJ	.097	.042	.042	2.4
2200	3482GL222U016RDBS	GL	.066	.029	.030	3.4
2700	3482GP272U016RDBS	GP	.047	.022	.027	4.4
2800	3482GP282U016RDBS	GP	.055	.023	.025	4.3
3200	3482GP322U016RDBS	GP	.042	.019	.021	4.3
3400	3482GS342U016RDBS	GS	.044	.019	.021	5.4
3900	3482GS392U016RDBS	GS	.037	.016	.018	5.4
1200	3482HE122U016RDBS	HE	.132	.060	.060	2.0
2200	3482HJ222U016RDBS	HJ	.072	.033	.034	3.0
3900	3482HL392U016RDBS	HL	.050	.023	.024	4.0
4300	3482HP432U016RDBS	HP	.038	.017	.019	5.1
5300	3482HS532U016RDBS	HS	.031	.014	.017	6.1
5600	3482HS562U016RDBS	HS	.028	.013	.015	6.1
1800	3482JG182U016RDBS	JG	.087	.044	.045	2.6
3100	3482JJ312U016RDBS	JJ	.057	.029	.031	3.0
3300	3482JJ332U016RDBS	JJ	.052	.024	.026	3.7
4500	3482JL452U016RDBS	JL	.039	.020	.022	4.2
4700	3482JL472U016RDBS	JL	.037	.017	.019	4.8
6000	3482JP602U016RDBS	JP	.029	.015	.018	5.3
6800	3482JP682U016RDBS	JP	.025	.013	.016	6.3
7400	3482JS742U016RDBS	JS	.024	.013	.016	6.3
8200	3482JS822U016RDBS	JS	.024	.013	.016	7.3
10000	3482JT103U016RDBS	JT	.017	.012	.015	8.2

25VDC WORKING, 35VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR Ohms at 25°C 120Hz	Maximum ESR Ohms at 25°C 10KHz	Maximum Impedance Ohms at 25°C 100KHz	Maximum RMS 85°C Ripple Current Amps 120Hz
680	3482GG681U025RDBS	GG	.156	.059	.059	1.7
1000	3482GJ102U025RDBS	GJ	.106	.040	.040	2.3
1200	3482GL122U025RDBS	GL	.073	.030	.033	3.4
1300	3482GL132U025RDBS	GL	.085	.032	.033	2.9
1500	3482GL152U025RDBS	GL	.071	.027	.028	3.0
2200	3482GP222U025RDBS	GP	.048	.019	.020	4.0
2700	3482GS272U025RDBS	GS	.039	.016	.020	4.9
1000	3482HG102U025RDBS	HG	.111	.046	.046	2.1
1500	3482HJ152U025RDBS	HJ	.074	.031	.032	2.9
2200	3482HL222U025RDBS	HL	.051	.021	.022	3.8
2800	3482HP282U025RDBS	HP	.043	.018	.020	4.7
3300	3482HS332U025RDBS	HS	.035	.015	.018	5.1
3900	3482HS392U025RDBS	HS	.029	.013	.015	6.0
1200	3482JG122U025RDBS	JG	.097	.044	.045	2.4
1800	3482JJ182U025RDBS	JJ	.054	.028	.029	4.0
1900	3482JJ192U025RDBS	JJ	.065	.030	.031	2.6
2200	3482JJ222U025RDBS	JJ	.053	.024	.025	3.6
2700	3482JL272U025RDBS	JL	.044	.020	.022	3.6
2800	3482JL282U025RDBS	JL	.042	.019	.021	4.7
3900	3482JP392U025RDBS	JP	.030	.015	.018	5.7
4600	3482JS462U025RDBS	JS	.027	.013	.016	5.5
4900	3482JS492U025RDBS	JS	.026	.013	.016	5.6
5900	3482JT592U025RDBS	JT	.023	.012	.015	6.5

40VDC WORKING, 55VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR Ohms at 25°C 120Hz	Maximum ESR Ohms at 25°C 10KHz	Maximum Impedance Ohms at 25°C 100KHz	Maximum RMS 85°C Ripple Current Amps 120Hz
390	3482GG391U040RDBS	GG	.170	.061	.061	1.6
560	3482GJ561U040RDBS	GJ	.118	.043	.043	2.1
850	3482GL851U040RDBS	GL	.071	.035	.033	3.0
1200	3482GP122U040RDBS	GP	.055	.025	.027	3.7
1500	3482GS152U040RDBS	GS	.044	.024	.023	4.6
560	3482HE561U040RDBS	HE	.118	.048	.048	2.1
820	3482HJ821U040RDBS	HJ	.081	.033	.034	2.8
1200	3482HL122U040RDBS	HL	.055	.023	.024	3.7
1800	3482HP182U040RDBS	HP	.037	.016	.018	4.9
2200	3482HS222U040RDBS	HS	.030	.013	.015	5.9
820	3482JG821U040RDBS	JG	.097	.039	.040	2.4
1200	3482JJ122U040RDBS	JJ	.066	.027	.028	3.3
1800	3482JL182U040RDBS	JL	.044	.018	.019	4.4
2200	3482JP222U040RDBS	JP	.066	.016	.016	5.2
2800	3482JS282U040RDBS	JS	.031	.013	.016	5.6
3300	3482JT332U040RDBS	JT	.024	.010	.015	7.3

SERIES 3482
Miniature Single-Ended Aluminum Electrolytic Capacitors

STANDARD CAPACITANCE VALUES

50VDC WORKING, 75VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR Ohms at 25°C 120Hz	Maximum ESR Ohms at 25°C 10KHz	Maximum Impedance Ohms at 25°C 100KHz	Maximum RMS 85°C Ripple Current Amps 120Hz
330	3482GG331U050RDBS	GG	.281	.145	.145	1.2
560	3482GJ561U050RDBS	GJ	.166	.085	.085	1.8
820	3482GL821U050RDBS	GL	.113	.058	.058	1.3
1200	3482GP122U050RDBS	GP	.077	.040	.041	3.0
1500	3482GS152U050RDBS	GS	.062	.032	.033	3.8
470	3482HG471U050RDBS	HG	.206	.112	.112	1.6
820	3482HJ821U050RDBS	HJ	.118	.064	.064	2.3
1200	3482HL122U050RDBS	HL	.081	.044	.044	3.0
1500	3482HP152U050RDBS	HP	.065	.035	.035	3.7
2200	3482HS222U050RDBS	HS	.044	.024	.025	4.8
680	3482JG681U050RDBS	JG	.146	.084	.084	1.9
1200	3482JJ122U050RDBS	JJ	.083	.048	.048	2.9
1500	3482JL152U050RDBS	JL	.086	.038	.038	3.5
2200	3482JP222U050RDBS	JP	.046	.026	.027	4.6
2700	3482JS272U050RDBS	JS	.037	.021	.022	5.6
3300	3482JT332U050RDBS	JT	.030	.017	.018	6.4

75VDC WORKING, 100VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR Ohms at 25°C 120Hz	Maximum ESR Ohms at 25°C 10KHz	Maximum Impedance Ohms at 25°C 100KHz	Maximum RMS 85°C Ripple Current Amps 120Hz
150	3482GG151U075RDBS	GG	.424	.102	.102	1.0
270	3482GJ271U075RDBS	GJ	.236	.071	.071	1.5
390	3482GL391U075RDBS	GL	.163	.049	.049	2.0
560	3482GP561U075RDBS	GP	.113	.036	.036	2.6
680	3482GS681U075RDBS	GS	.094	.030	.030	3.1
270	3482HG271U075RDBS	HG	.246	.083	.083	1.4
390	3482HJ391U075RDBS	HJ	.170	.057	.057	1.9
560	3482HL561U075RDBS	HL	.118	.040	.040	2.5
820	3482HP821U075RDBS	HP	.081	.030	.030	3.3
1000	3482HS102U075RDBS	HS	.066	.025	.026	4.0
340	3482JG341U075RDBS	JG	.176	.086	.084	1.8
560	3482JJ561U075RDBS	JJ	.126	.045	.045	2.3
820	3482JL821U075RDBS	JL	.086	.033	.033	3.1
1200	3482JP122U075RDBS	JP	.059	.025	.025	4.0
1500	3482JS152U075RDBS	JS	.047	.020	.021	4.9
1700	3482JT172U075RDBS	JT	.041	.017	.018	5.5

100VDC WORKING, 150VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR Ohms at 25°C 120Hz	Maximum ESR Ohms at 25°C 10KHz	Maximum Impedance Ohms at 25°C 100KHz	Maximum RMS 85°C Ripple Current Amps 120Hz
82	3482GG820U100RDBS	GG	.647	.213	.213	0.8
130	3482GJ131U100RDBS	GJ	.440	.142	.142	0.9
190	3482GL191U100RDBS	GL	.295	.105	.105	1.4
260	3482GP261U100RDBS	GP	.220	.078	.078	1.8
320	3482GS321U100RDBS	GS	.180	.064	.064	2.1
390	3482GS391U100RDBS	GS	.136	.045	.045	2.6
120	3482HG121U100RDBS	HG	.453	.159	.159	1.0
220	3482HJ221U100RDBS	HJ	.247	.087	.087	1.6
290	3482HL291U100RDBS	HL	.195	.071	.071	1.8
400	3482HP401U100RDBS	HP	.145	.053	.053	2.3
560	3482HS561U100RDBS	HS	.097	.034	.034	3.2
190	3482JG191U100RDBS	JG	.316	.155	.150	1.3
290	3482JJ291U100RDBS	JJ	.210	.071	.071	1.5
410	3482JL411U100RDBS	JL	.140	.053	.053	2.0
550	3482JP551U100RDBS	JP	.105	.040	.040	2.7
680	3482JS681U100RDBS	JS	.082	.030	.030	3.7
820	3482JT821U100RDBS	JT	.068	.025	.025	4.2

150VDC WORKING, 200VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR Ohms at 25°C 120Hz	Maximum ESR Ohms at 25°C 10KHz	Maximum Impedance Ohms at 25°C 100KHz	Maximum RMS 85°C Ripple Current Amps 120Hz
27	3482GG270U150RDBS	GG	3.240	.348	.882	0.36
33	3482GG330U150RDBS	GG	2.700	.750	.690	0.40
39	3482GG390U150RDBS	GG	2.160	.570	.553	0.44
47	3482GJ470U150RDBS	GJ	1.830	.448	.465	0.51
56	3482GJ560U150RDBS	GJ	1.570	.418	.406	0.56
68	3482GJ680U150RDBS	GJ	1.210	.318	.308	0.63
82	3482HJ820U150RDBS	HJ	1.050	.278	.207	0.71
100	3482JJ101U150RDBS	JJ	.849	.226	.221	0.83
120	3482JJ121U150RDBS	JJ	.693	.185	.180	0.92
150	3482JL151U150RDBS	JL	.562	.151	.147	1.07
180	3482JL181U150RDBS	JL	.457	.122	.120	1.18
220	3482JP221U150RDBS	JP	.378	.102	.101	1.36
270	3482JP271U150RDBS	JP	.312	.086	.085	1.50
330	3482JS331U150RDBS	JS	.251	.070	.069	1.80

200VDC WORKING, 250VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR Ohms at 25°C 120Hz	Maximum ESR Ohms at 25°C 10KHz	Maximum Impedance Ohms at 25°C 100KHz	Maximum RMS 85°C Ripple Current Amps 120Hz
18	3482GG180U200RDBS	GG	4.490	.924	.886	0.31
22	3482GG220U200RDBS	GG	3.720	.760	.740	0.34
27	3482GG270U200RDBS	GG	2.920	.606	.581	0.38
33	3482GJ330U200RDBS	GJ	2.500	.540	.500	0.44
39	3482GJ390U200RDBS	GJ	2.020	.418	.400	0.49
47	3482GJ470U200RDBS	GJ	1.550	.322	.309	0.56
56	3482HJ560U200RDBS	HJ	1.350	.282	.270	0.63
68	3482JJ680U200RDBS	JJ	1.130	.238	.229	0.72
82	3482JJ820U200RDBS	JJ	.934	.196	.189	0.79
100	3482JJ101U200RDBS	JJ	.775	.163	.157	0.87
120	3482JL121U200RDBS	JL	.647	.138	.134	0.99
150	3482JP151U200RDBS	JP	.501	.107	.104	1.18
180	3482JP181U200RDBS	JP	.430	.093	.090	1.28
220	3482JT221U200RDBS	JT	.346	.075	.074	1.59

250VDC WORKING, 300VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Code	Maximum ESR Ohms at 25°C 120Hz	Maximum ESR Ohms at 25°C 10KHz	Maximum Impedance Ohms at 25°C 100KHz	Maximum RMS 85°C Ripple Current Amps 120Hz
15	3482GG150U250RDBS	GG	5.470	.936	.887	0.28
18	3482GG180U250RDBS	GG	4.700	.760	.750	0.30
22	3482GG220U250RDBS	GG	3.750	.645	.611	0.34
27	3482GG270U250RDBS	GG	2.870	.492	.467	0.41
33	3482GJ330U250RDBS	GJ	2.460	.429	.408	0.44
39	3482HJ390U250RDBS	HJ	2.030	.350	.332	0.51
47	3482HJ470U250RDBS	HJ	1.620	.280	.266	0.57
56	3482JJ560U250RDBS	JJ	1.410	.244	.232	0.64
68	3482JJ680U250RDBS	JJ	1.140	.198	.189	0.71
82	3482JJ820U250RDBS	JJ	.940	.165	.158	0.78
100	3482JL101U250RDBS	JL	.795	.141	.141	0.89
120	3482JP121U250RDBS	JP	.632	.112	.108	1.05
150	3482JP151U250RDBS	JP	.524	.094	.090	1.15
180	3482JT181U250RDBS	JT	.437	.078	.076	1.42

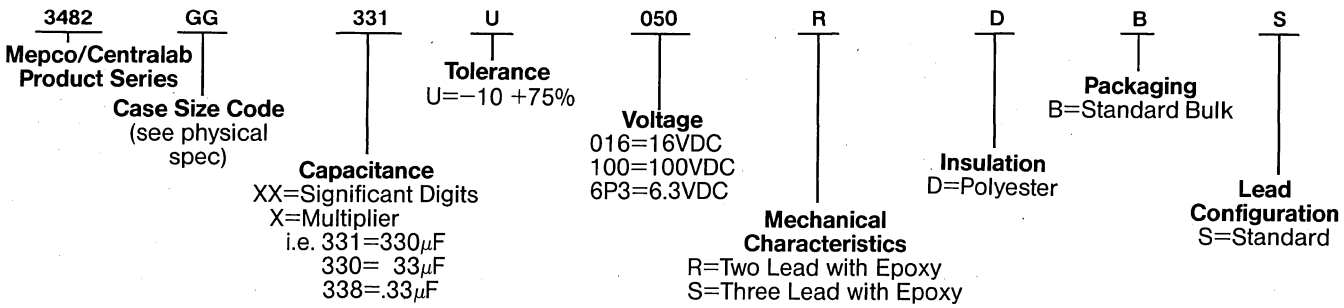
CASE DIMENSIONS

Case Code	Diameter (mm)	Length (mm)
GG	19.1	31.8
GJ	19.1	41.3
GL	19.1	54
GP	19.1	66.7
GS	19.1	81.3
HE	22.2	28.6
HG	22.2	31.8
HJ	22.2	41.3
HL	22.2	54

Case Code	Diameter (mm)	Length (mm)
HP	22.2	66.7
HS	22.2	81.3
JG	25.4	31.8
JJ	25.4	41.3
JL	25.4	54
JP	25.4	66.7
JS	25.4	81.3
JT	25.4	92.1

HOW TO SPECIFY

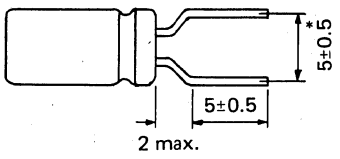
Mepco/Centralab Series 3482 Capacitors can be completely specified using the following designation:



LEAD CUT AND LEAD FORMING

Case dia. of ϕ5 to ϕ8 Unit (mm)

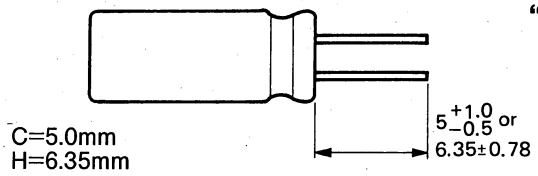
FC/Forming Cut "D"



*3.5±0.5 mm is available for case dia. ϕ4.

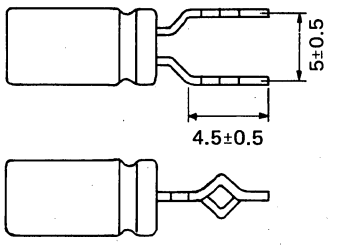
Case dia. of ϕ10 to ϕ18 and 3479 Type (ϕ22 to ϕ30) Unit (mm)

C/Cut "C" "H"



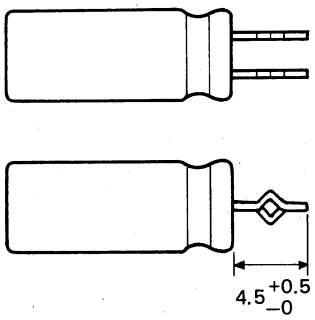
Case dia. of ϕ5 to ϕ8 Unit (mm)

FM/Snap-in Forming Cut "F"



Case dia. of ϕ10 to ϕ18 Unit (mm)

MC/Snap-in Cut "M"



PRODUCT LABEL SPECIFICATION

Mepco/Centralab Capacitors are marked with:

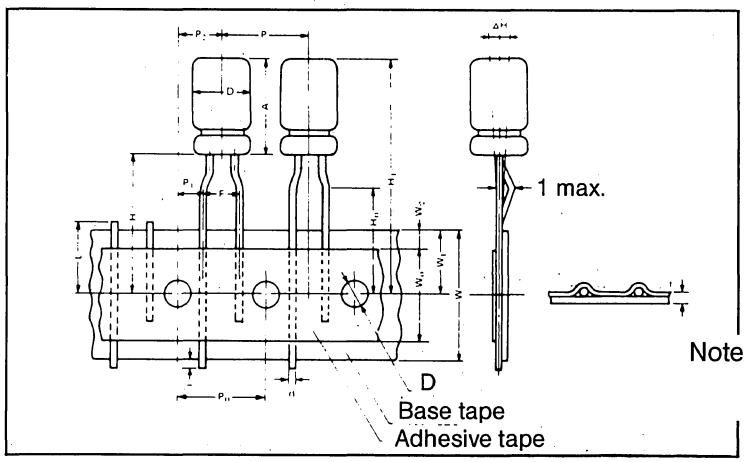
- Nominal Capacitance
- Rated Voltage
- Series Code Number
- Polarity
- PHILIPS
- Country of Origin
- Special Tolerances

Series Code Numbers and Sleeve/Marking Colors are as follows:

M/C SERIES	SERIES CODE	COLOR
3476—STD	035 01	Blue/Black
3476—Solvent Proof	086 01	Blue/Red
3477	087 01	Yellow/Black
3478	088 01	Orange/Black
3479	093 01	Black/White
3480	090 01	Dark Brown/White
3481	089 01	Orange/Black
3482	092 01	Orange/Black
3480—Solvent Proof	095 01	Dark Brown/Yellow (Green)
3481—Solvent Proof	094 01	Orange/Red

TAPING

(8mm diameter & smaller)



Note: The component can be oriented on the tape with either positive or negative lead leading. Customer must specify.

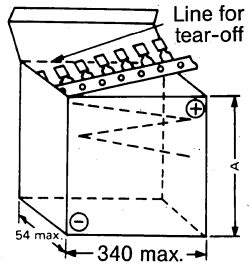
DIMENSIONS (mm)

Item	Symbol	Nominal value	Tolerance	Remarks
Body diameter	D	ϕ4 to ϕ8	±0.5	
Lead-wire diameter	d	0.45/0.5/0.6	±0.05	
Pitch of component	P	12.7	±1.0	
Feed hole pitch	P_0	12.7	±0.2	(Cumulative pitch error: 1mm/20 pitch)
Hole center to lead	P_1	3.85	±0.7	To be measured at bottom of clinch
Feed hole center to component center	P_2	6.35	±1.0	
Lead to lead distance	F	5.0	−0.2/+0.8	
Component alignment, F-R	ΔH	0	±2.0	
Tape width	W	18.0	−0.5	
Hole-down tape width	W_0	12.5	min.	
Hole position	W_1	9.0	−0.5/+0.75	
Hole-down tape position	W_2	1.5	max.	
Height of component from tape center	H	18.5 (ϕ5, ϕ6.3) 20.0 (ϕ8)	±0.75	$H + A \leqq H_1$
Lead-wire clinch height	H_0	16.0	±0.5	
Component height	H_1	32.25	max.	Applicable to reel pack box
Lead-wire protrusion	ℓ	1.0	max.	
Feed hole diameter	D_0	4.0	±0.3	
Total tape thickness	t	0.7	±0.2	
Length of snipped lead	L	11.0	max.	

*For D=8, H=20.0±0.75 is available. In this case, the dimension of H_1 is not specified.

PACKAGING

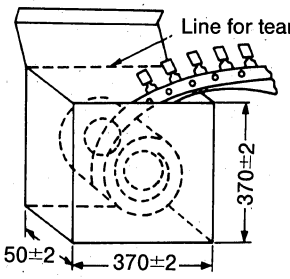
AMMO PACK BOX



Packaging quantity

Dia. of capacitor	Packaging quantity	Dimension "A"
5 mm	2000 pcs.	265
6.3	2000	305
8	1000	265

REEL PACK BOX

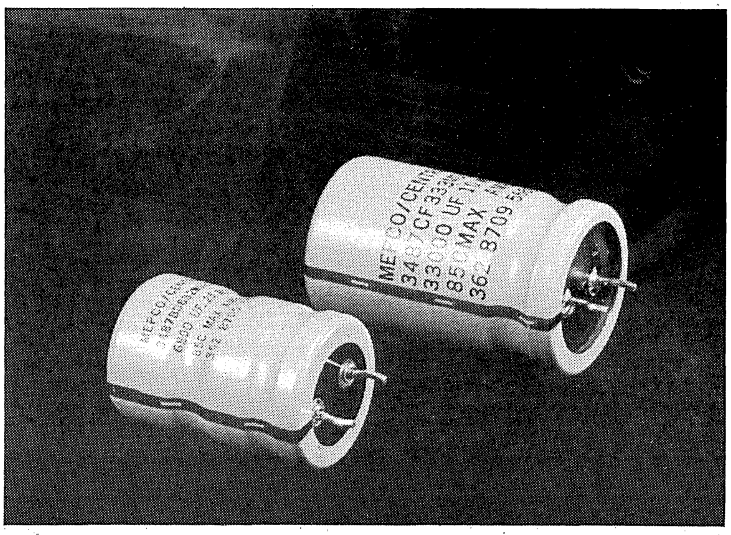


Packaging quantity

Dia. of capacitor	Packaging quantity
5 mm	1500 pcs.
6.3	1000
8	800

Note) The component shall be oriented on the tape so that the positive lead is leading or the negative lead is leading, whichever customer request.

Industrial/ Computer Grade Snap-In Aluminum Electrolytic Capacitors



DESCRIPTION:

The Series 3487 utilizes a new snap-in terminal configuration. This allows fast and easy mounting onto printed circuit boards, eliminating the need for mounting hardware and reducing assembly time.

State of the art etching and anodizing processes have resulted in CV products that are equivalent to, or better than, those of most presently available aluminum electrolytic capacitors (110,000 μF at 6.3 WVDC in a 35 x 80 mm case).

A newly designed safety vent is integrated into the top of the case, opposite from the terminal end. The possibility of printed circuit board spoilage is thereby reduced.

A plastic coating of the terminal header is available and provides excellent resistance to the entrance of most normally used printed circuit board cleaners.

All connections of the 3487 are welded to insure long-term electrical integrity.

FEATURES:

ELECTRICAL

- Extremely high CV density.
- Capacitance from 68 to 110,000 μF.
- Voltage range from 6.3 WVDC to 450 WVDC.
- 85°C ambient operating temperature.
- 2,000-hour life at 85°C with rated DC voltage applied.
- Standard capacitance tolerance ±20%.
- Excellent frequency response.

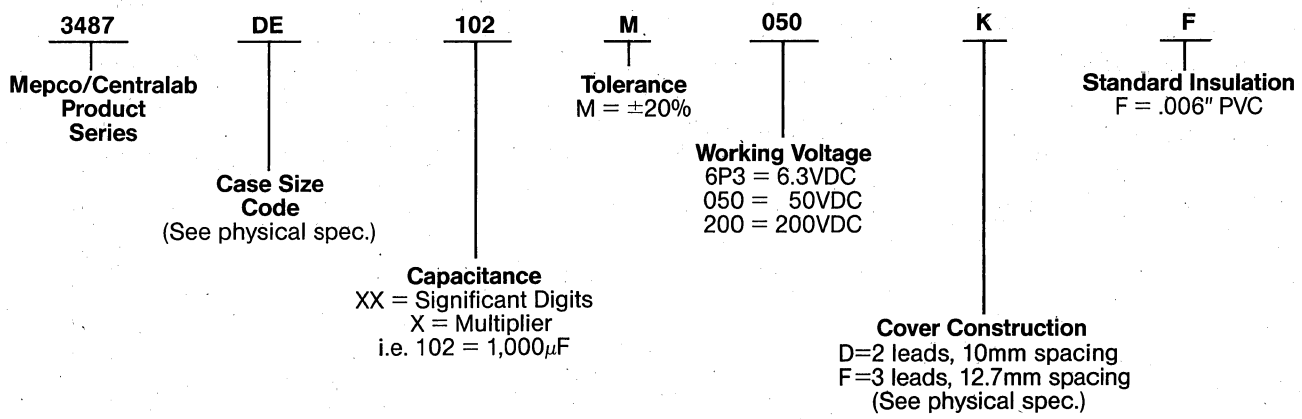
MECHANICAL

- Snap-in (self-mounting) terminals
- All welded construction
- Venting mechanism at the top of the case for better printed circuit board protection.
- Pitchless construction (no potting compound).
- Protective plastic end seal to allow on-board cleaning (upon request).
- Integral stand off feet on terminal cover for ease of board cleaning.

SERIES 3487
Snap-In Aluminum Electrolytic Capacitors

HOW TO SPECIFY

Mepco/Centralab Series 3487 Capacitors can be completely specified using the following designation:

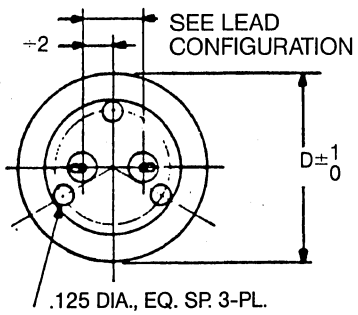


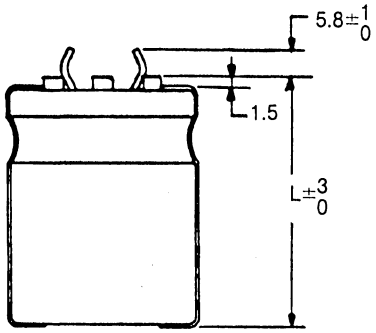
DIMENSIONS

Case Codes	INSULATED CASE DIMENSIONS			
	Dimensions (mm)		Dimensions (in.)	
	$D\pm^{1}_{0}$ mm	$L\pm^{3}_{0}$ mm	$D\pm^{.039}_{0}$	$L\pm^{.118}_{0}$
B D	25	35	.984	1.378
B E	25	40	.984	1.575
B F	25	50	.984	1.969
C C	30	30	1.181	1.181
C D	30	35	1.181	1.378
C E	30	40	1.181	1.575
C F	30	50	1.181	1.969
C G	30	63	1.181	2.480
C H	30	80	1.181	3.150
D C	35	30	1.378	1.181
D D	35	35	1.378	1.378
D E	35	40	1.378	1.575
D F	35	50	1.378	1.969
D G	35	63	1.378	2.480
D H	35	80	1.378	3.150

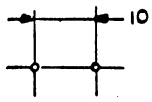
CASE OUTLINE DRAWINGS

P.C. BOARD LAYOUT
(AS SEEN FROM MOUNTING SIDE)

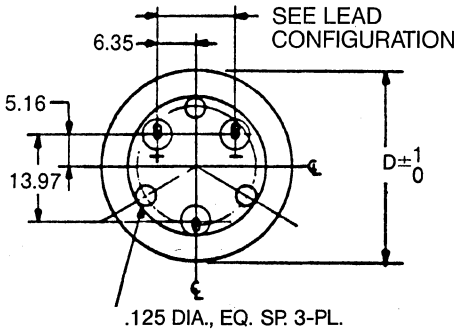


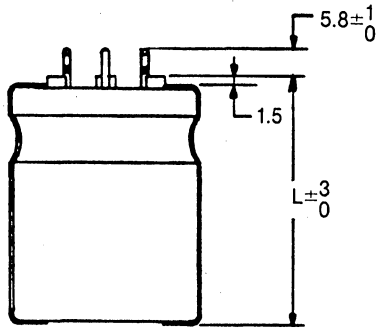


LEAD CONFIGURATIONS K AND J

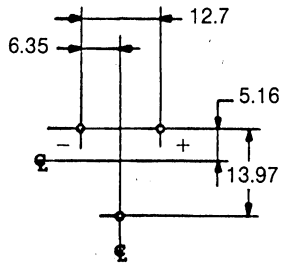


P.C. BOARD LAYOUT
(AS SEEN FROM MOUNTING SIDE)





LEAD CONFIGURATION R AND C



ALL DIMENSIONS ARE MM
ALL HOLE DIAMETERS ARE 2MM
LEADS ARE 16 GAUGE TINNED COPPER WIRE

SERIES 3487
Snap-In Aluminum Electrolytic Capacitors

PERFORMANCE SPECIFICATIONS

1. TEMPERATURE.

1.1 OPERATING. These capacitors are designed to operate within the temperature range of −40°C to +85°C.

1.2 STORAGE. These capacitors may be subjected, without permanent damage, to conditions in transit where temperatures range from −55°C to +85°C at altitudes up to 80,000 feet.

1.3 TOLERANCE. Unless otherwise specified, temperature tolerance shall be ±3°C.

2. DC WORKING VOLTAGE. The dc working voltage is the maximum operating voltage for continuous operation at maximum rated temperature.

3. SURGE VOLTAGE. The surge voltage is the maximum non-recurrent voltage to which the capacitor should be subjected.

3.1 The surge voltage shall not exceed the values specified in the rating table.

3.2 SURGE TEST.

3.2.1 Capacitors shall be connected in series with a resistor. The value of the resistor is:

CAPACITANCE (μF)	RESISTOR (ohms)
0-2500	1000
2501-25000	100
25001-250000	10

The series combination is then subjected to rated surge voltage for 30 seconds at room temperature and the capacitor allowed to discharge thru the resistor. This sequence is repeated six times per hour at 10 minute intervals for 24 hours.

3.2.2 Leakage current when measured per paragraph 6.2 not sooner than four (4) hours after completion of the test, shall not exceed the initial leakage current limit. There shall be no leaking of electrolyte and no mechanical damage.

4. CAPACITANCE. Capacitance shall be measured on a capacitance bridge having a maximum rms signal voltage of 1 volt at 120 Hz. Capacitance shall be within the −20% to +20% of the nominal value when measured at 25°C.

5. EQUIVALENT SERIES RESISTANCE (ESR). Measurement shall be made by the bridge method at 120 Hz and 25°C. The equivalent series resistance shall not exceed the value shown in the rating table.

6. DC LEAKAGE CURRENT.

6.1 PRE-CONDITIONING. In the period 24 to 48 hours prior to test, rated working voltage shall be applied to the capacitor for a minimum of 30 minutes.

6.2 MEASUREMENT. Measurement shall be made at 25°C. Voltage shall be applied to the capacitor thru a current limiting resistor. The leakage current shall be measured 5 minutes after the capacitor reaches rated voltage. Leakage current shall not exceed the value calculated as shown:

$I_L = .006\sqrt{CV}$ (mA)

C— Rated Capacitance (μf)

V— Rated Voltage (volts)

I_L= Leakage Current (mA)

7. LIFE TEST.

7.1 Capacitors shall be placed in a circulating air oven at an ambient temperature of 85°C. Spacing between capacitors must be at least 1" and capacitors must not be subjected to direct radiation from heating elements. Circulation of air shall be sufficient to keep the temperature within six (6) inches of the capacitor below 88°C.

7.1.1 Rated DC voltage shall be applied to the capacitors for a period of 2000 ±8 hours. Following this test the capacitors shall meet the requirements of paragraph 7.2.

7.1.2 Alternate life test: Rated voltage and rated ripple current shall be applied for a period of 1000 ±8 hours. Following this test the capacitors shall meet the requirements of paragraph 7.2.

7.2 Upon completion of the life test, the capacitors shall be returned to room ambient for a minimum of 24 hours. The capacitors shall then meet the following requirements:

7.2.1 Capacitance, when measured per paragraph 4., shall not be less than 85% of the initial measured value.

7.2.2 The equivalent series resistance (ESR), when measured per paragraph 5., shall not be greater than 150% of the initial specification.

7.2.3 The leakage current, when measured and determined per paragraph 6.2, shall not exceed the initial specification.

7.2.4 There shall be no evidence of mechanical damage or excessive electrolyte leakage.

8. SHELF TEST. Capacitors shall be placed in a circulating air oven at 85°C for a period of 500 ±4 hours with no voltage applied. The units shall then be allowed to cool to 25°C for a minimum of 16 hours.

8.1 The capacitance, when measured in accordance with paragraph 4, shall be within ±15% of the initial measured value.

8.2 The equivalent series resistance, when measured in accordance with paragraph 5, shall not exceed 130% of the initial specification.

8.3 The leakage current, when measured in accordance with paragraph 6.2, shall not exceed 200% of the initial specification.

9. VIBRATION. Capacitors shall be clamped rigidly to a vibration platform and subjected to a simple harmonic motion having a maximum peak-to-peak amplitude of .06 inches and a maximum acceleration of 10g. The frequency of vibration shall be varied linearly between 10 and 55 cycles per second. The entire frequency range, 10 to 55 cps, shall be traversed in one minute. Capacitors shall be vibrated for 1½ hours with the direction of motion being parallel to the axis of the capacitor. The capacitors shall then be placed so that the direction of motion is perpendicular to the axis and the vibration continued for 1½ hours. During the last ½ hour of the test, the capacitor shall be connected to a bridge and observed for a 3 minute period. A capacitor failing the vibration test is defined as one failing to meet the requirements of paragraph 9.1.

9.1 There shall be no evidence of loosening of the capacitor element within the container, when shaken by hand following the test. There shall be no indication of intermittent contact during the 3 minute observation period. Capacitors shall not be open or shorted.

10. CONTAINER SEAL. Following the vibration test each capacitor shall be tested for seal tightness in accordance with paragraphs 10.1 and 10.2.

10.1 Capacitors shall be subjected to two successive temperature cycles in circulating air as follows:

ONE TEMPERATURE CYCLE

A.	85°C-30 min.	C.	−40°C-30 min.
B.	25°C-30 min.	D.	25°C-30 min.

10.2 Following the second cycle, the capacitors shall be placed in 90-95°C water for 5 minutes. A failure is defined as a unit exhibiting a continuous chain of bubbles when immersed.

11. SAFETY VENT. A special vent—incorporated into the capacitor container—is designed to release dangerous internal pressure in the event of circuit malfunction or polarity reversal.

11.1 VENT TEST

11.1.1 The capacitor should be rigidly mounted in an explosion-proof container. The method of mounting should not physically restrict the radial ends of the capacitor case (the cover or opposite end from the cover).

11.1.2 Reverse DC voltage of sufficient magnitude to cause a 10 amp reverse current flow shall be applied to the capacitor.

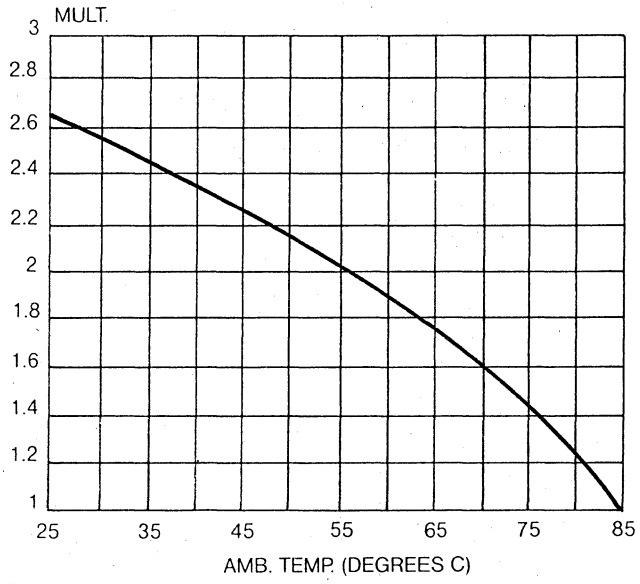
11.1.3 The safety vent shall operate without expulsion of the cover from the capacitor.

12. RIPPLE CURRENT. Capacitors will withstand the 85°C rms ripple current stated in the rating tables for the duration of the life test as specified in paragraph 7. of the Performance Specifications. Any reduction in ambient temperature and/or ripple current will extend the operating life of the capacitor. See application guidelines for method for determining extended life at derated conditions.

12.1. Ripple Current values are specified at an ambient temperature of 85°C and a frequency of 120 Hz. Ripple current (I_R) at other frequencies and temperatures can be calculated.

$$I_R = I_{85} \cdot \text{RIPPLE MULTIPLIER}$$

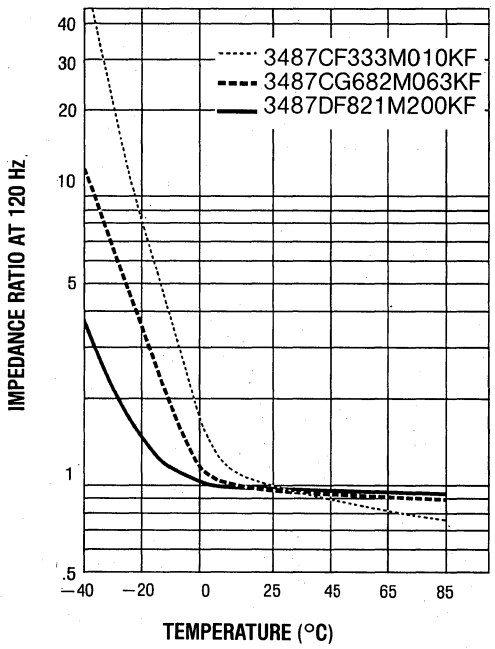
RIPPLE MULTIPLIER
95 DEGREE CORE



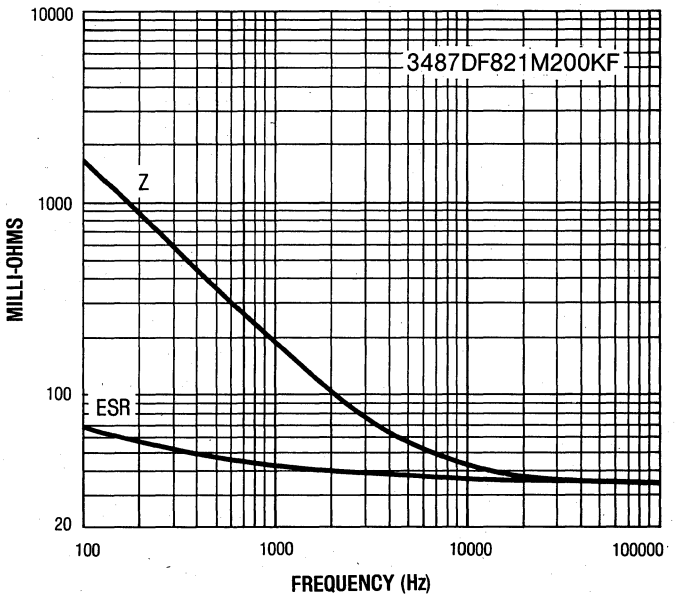
12.2 For ripple currents at other frequencies, see application guidelines.

SERIES 3487
Snap-In Aluminum Electrolytic Capacitors

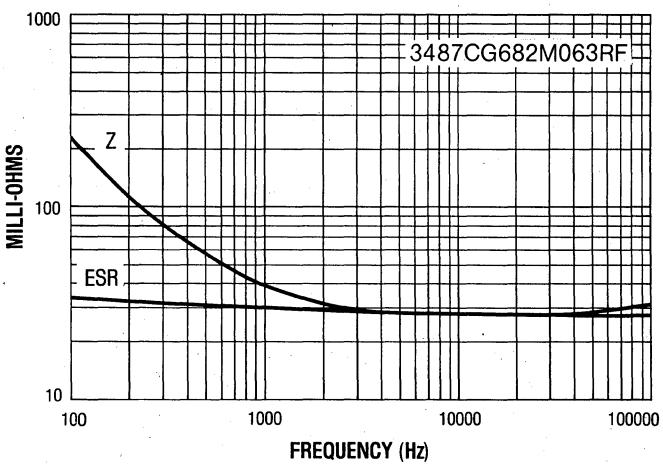
IMPEDANCE vs. TEMPERATURE



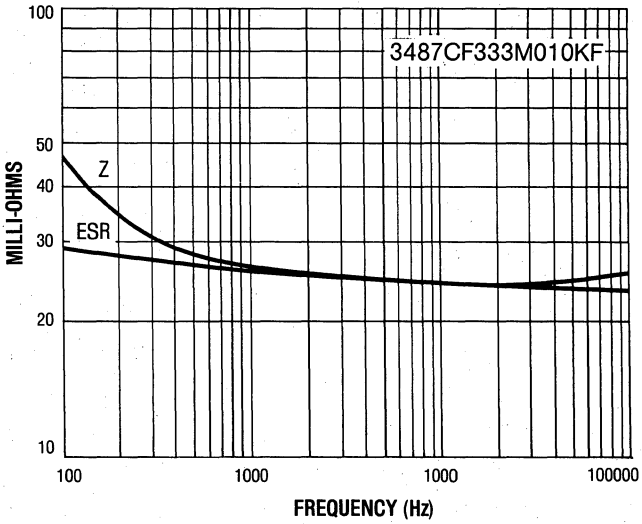
IMPEDANCE (Z) & EQUIVALENT SERIES RESISTANCE (ESR) vs. FREQUENCY (25°C)



IMPEDANCE (Z) & EQUIVALENT SERIES RESISTANCE (ESR) vs. FREQUENCY (25°C)



IMPEDANCE (Z) & EQUIVALENT SERIES RESISTANCE (ESR) vs FREQUENCY (25°C)



STANDARD CAPACITANCE VALUES

6.3VDC WORKING, 8VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Size	Maximum ESR (OHMS) 120Hz+25°C	Max. RMS Ripple Current AMPS at 120Hz+85°C
15000	3487BD153M6P3KF	25x35	0.068	2.9
18000	3487BE183M6P3KF	25x40	0.056	3.35
27000	3487BF273M6P3KF	25x50	0.041	4.3
18000	3487CC183M6P3KF	30x30	0.081	2.84
22000	3487CD223M6P3KF	30x35	0.062	3.42
27000	3487CE273M6P3KF	30x40	0.051	3.96
39000	3487CF393M6P3KF	30x50	0.038	4.99
56000	3487CG563M6P3RF	30x63	0.031	6.06
80000	3487CH803M6P3RF	30x80	0.023	7.62
27000	3487DC273M6P3KF	35x30	0.087	3.04
33000	3487DD333M6P3KF	35x35	0.065	3.69
39000	3487DE393M6P3KF	35x40	0.052	4.3
56000	3487DF563M6P3KF	35x50	0.039	5.39
81000	3487DG813M6P3RF	35x63	0.032	6.45
110000	3487DH114M6P3RF	35x80	0.025	8.14

10VDC WORKING, 13VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Size	Maximum ESR (OHMS) 120Hz+25°C	Max. RMS Ripple Current AMPS at 120Hz+85°C
12000	3487BD123M010KF	25x35	0.070	2.87
15000	3487BE153M010KF	25x40	0.057	3.35
22000	3487BF223M010KF	25x50	0.041	4.28
15000	3487CC153M010KF	30x30	0.082	2.82
18000	3487CD183M010KF	30x35	0.063	3.4
22000	3487CE223M010KF	30x40	0.051	3.94
33000	3487CF333M010KF	30x50	0.038	4.97
39000	3487CG393M010RF	30x63	0.031	6.04
56000	3487CH563M010RF	30x80	0.024	7.6
22000	3487DC223M010KF	35x30	0.089	3
27000	3487DD273M010KF	35x35	0.067	3.65
33000	3487DE333M010KF	35x40	0.054	4.24
47000	3487DF473M010KF	35x50	0.040	5.32
56000	3487DG563M010RF	35x63	0.032	6.51
82000	3487DH823M010RF	35x80	0.025	8.15

16VDC WORKING, 20VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Size	Maximum ESR (OHMS) 120Hz+25°C	Max. RMS Ripple Current AMPS at 120Hz+85°C
10000	3487BD103M016KF	25x35	0.068	2.91
12000	3487BE123M016KF	25x40	0.056	3.36
18000	3487BF183M016KF	25x50	0.041	4.31
10000	3487CC103M016KF	30x30	0.083	2.8
15000	3487CD153M016KF	30x35	0.064	3.36
18000	3487CE183M016KF	30x40	0.052	3.91
22000	3487CF223M016KF	30x50	0.039	4.92
33000	3487CG333M016RF	30x63	0.031	5.99
47000	3487CH473M016RF	30x80	0.024	7.54
15000	3487DC153M016KF	35x30	0.089	3.01
22000	3487DD223M016KF	35x35	0.070	3.56
27000	3487DE273M016KF	35x40	0.057	4.14
39000	3487DF393M016KF	35x50	0.042	5.18
47000	3487DG473M016RF	35x63	0.033	6.36
68000	3487DH683M016RF	35x80	0.026	7.97

25VDC WORKING, 32VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Size	Maximum ESR (OHMS) 120Hz+25°C	Max. RMS Ripple Current AMPS at 120Hz+85°C
6800	3487BD682M025KF	25x35	0.070	2.86
8200	3487BE822M025KF	25x40	0.058	3.31
12000	3487BF123M025KF	25x50	0.042	4.23
6800	3487CC682M025KF	30x30	0.085	2.77
10000	3487CD103M025KF	30x35	0.065	3.33
12000	3487CE123M025KF	30x40	0.053	3.87
18000	3487CF183M025KF	30x50	0.040	4.87
22000	3487CG223M025RF	30x63	0.032	5.93
33000	3487CH333M025RF	30x80	0.024	7.46
10000	3487DC103M025KF	35x30	0.090	2.98
15000	3487DD153M025KF	35x35	0.072	3.52
18000	3487DE183M025KF	35x40	0.058	4.11
22000	3487DF223M025KF	35x50	0.041	5.27
33000	3487DG333M025RF	35x63	0.034	6.26
47000	3487DH473M025RF	35x80	0.026	7.88

35VDC WORKING, 44VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Size	Maximum ESR (OHMS) 120Hz+25°C	Max. RMS Ripple Current AMPS at 120Hz+85°C
4700	3487BD472M035KF	25x35	0.076	2.75
6800	3487BE682M035KF	25x40	0.058	3.31
8200	3487BF822M035KF	25x50	0.046	4.06
5600	3487CC562M035KF	30x30	0.087	2.74
6800	3487CD682M035KF	30x35	0.067	3.29
10000	3487CE103M035KF	30x40	0.054	3.83
12000	3487CF123M035KF	30x50	0.040	4.83
18000	3487CG183M035RF	30x63	0.032	5.88
22000	3487CH223M035RF	30x80	0.025	7.41
8200	3487DC822M035KF	35x30	0.093	2.94
10000	3487DD103M035KF	35x35	0.069	3.58
12000	3487DE123M035KF	35x40	0.056	4.17
18000	3487DF183M035KF	35x50	0.042	5.2
22000	3487DG223M035RF	35x63	0.033	6.36
33000	3487DH333M035RF	35x80	0.026	7.94

50VDC WORKING, 63VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Size	Maximum ESR (OHMS) 120Hz+25°C	Max. RMS Ripple Current AMPS at 120Hz+85°C
3300	3487BD332M050KF	25x35	0.057	3.18
3900	3487BE392M050KF	25x40	0.047	3.68
5600	3487BF562M050KF	25x50	0.035	4.66
3300	3487CC332M050KF	30x30	0.074	2.97
4700	3487CD472M050KF	30x35	0.057	3.56
5600	3487CE562M050KF	30x40	0.046	4.14
8200	3487CF822M050KF	30x50	0.035	5.19
10000	3487CG103M050RF	30x63	0.028	6.31
15000	3487CH153M050RF	30x80	0.022	7.89
4700	3487DC472M050KF	35x30	0.082	3.14
6800	3487DD682M050KF	35x35	0.065	3.71
8200	3487DE822M050KF	35x40	0.052	4.33
12000	3487DF123M050KF	35x50	0.039	5.38
15000	3487DG153M050RF	35x63	0.031	6.57
22000	3487DH223M050RF	35x80	0.024	8.18

SERIES 3487
Snap-In Aluminum Electrolytic Capacitors

STANDARD CAPACITANCE VALUES

63VDC WORKING, 79VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Size	Maximum ESR (OHMS) 120Hz+25°C	Max. RMS Ripple Current AMPS at 120Hz+85°C
2200	3487BD222M063KF	25x35	0.062	3.04
2700	3487BE272M063KF	25x40	0.051	3.53
3900	3487BF392M063KF	25x50	0.037	4.47
2200	3487CC222M063KF	30x30	0.080	2.85
3300	3487CD332M063KF	30x35	0.062	3.41
3900	3487CE392M063KF	30x40	0.050	3.98
5600	3487CF562M063KF	30x50	0.037	5
6800	3487CG682M063RF	30x63	0.030	6.09
10000	3487CH103M063RF	30x80	0.023	7.65
3300	3487DC332M063KF	35x30	0.089	3.01
4700	3487DD472M063KF	35x35	0.070	3.57
5600	3487DE562M063KF	35x40	0.056	4.18
8200	3487DF822M063KF	35x50	0.042	5.21
10000	3487DG103M063RF	35x63	0.033	6.39
15000	3487DH153M063RF	35x80	0.026	7.95

80VDC WORKING, 100VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Size	Maximum ESR (OHMS) 120Hz+25°C	Max. RMS Ripple Current AMPS at 120Hz+85°C
1200	3487BD122M080KF	25x35	0.178	1.8
1800	3487BE182M080KF	25x40	0.128	2.23
2200	3487BF222M080KF	25x50	0.102	2.73
1500	3487CC152M080KF	30x30	0.181	1.9
1800	3487CD182M080KF	30x35	0.142	2.26
2700	3487CE272M080KF	30x40	0.110	2.7
3300	3487CF332M080KF	30x50	0.083	3.37
4700	3487CG472M080RF	30x63	0.065	4.16
6800	3487CH682M080RF	30x80	0.049	5.31
2200	3487DC222M080KF	35x30	0.177	2.13
2700	3487DD272M080KF	35x35	0.134	2.58
3300	3487DE332M080KF	35x40	0.109	3
4700	3487DF472M080KF	35x50	0.080	3.78
6800	3487DG682M080RF	35x63	0.065	4.59
8200	3487DH822M080RF	35x80	0.048	5.84

100VDC WORKING, 125VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Size	Maximum ESR (OHMS) 120Hz+25°C	Max. RMS Ripple Current AMPS at 120Hz+85°C
820	3487BD821M100KF	25x35	0.220	1.62
1200	3487BE122M100KF	25x40	0.158	2.01
1500	3487BF152M100KF	25x50	0.125	2.47
1000	3487CC102M100KF	30x30	0.21	1.77
1200	3487CD122M100KF	30x35	0.169	2.08
1800	3487CE182M100KF	30x40	0.124	2.54
2200	3487CF222M100KF	30x50	0.097	3.12
2700	3487CG272M100RF	30x63	0.080	3.77
3900	3487CH392M100RF	30x80	0.058	4.85
1500	3487DC152M100KF	35x30	0.185	2.09
1800	3487DD182M100KF	35x35	0.143	2.5
2200	3487DE222M100KF	35x40	0.116	2.9
3300	3487DF332M100KF	35x50	0.084	3.68
3900	3487DG392M100RF	35x63	0.069	4.46
5600	3487DH562M100RF	35x80	0.051	5.67

160VDC WORKING, 200VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Size	Maximum ESR (OHMS) 120Hz+25°C	Max. RMS Ripple Current AMPS at 120Hz+85°C
270	3487BD271M160KF	25x35	0.383	1.23
330	3487BE331M160KF	25x40	0.314	1.43
470	3487BF471M160KF	25x50	0.223	1.85
270	3487CC271M160KF	30x30	0.404	1.27
390	3487CD391M160KF	30x35	0.288	1.59
470	3487CE471M160KF	30x40	0.238	1.84
680	3487CF681M160KF	30x50	0.168	2.37
820	3487CG821M160RF	30x63	0.139	2.86
1200	3487CH122M160RF	30x80	0.099	3.74
330	3487DC331M160KF	35x30	0.352	1.52
560	3487DD561M160KF	35x35	0.233	1.96
680	3487DE681M160KF	35x40	0.191	2.27
1000	3487DF102M160KF	35x50	0.136	2.91
1200	3487DG122M160RF	35x63	0.110	3.52
1800	3487DH182M160RF	35x80	0.079	4.57

200VDC WORKING, 250VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Size	Maximum ESR (OHMS) 120Hz+25°C	Max. RMS Ripple Current AMPS at 120Hz+85°C
220	3487BD221M200KF	25x35	0.507	1.07
270	3487BE271M200KF	25x40	0.414	1.24
390	3487BF391M200KF	25x50	0.290	1.62
220	3487CC221M200KF	30x30	0.53	1.11
270	3487CC271M200KF	30x30	0.455	1.2
330	3487CD331M200KF	30x35	0.366	1.41
470	3487CE471M200KF	30x40	0.268	1.73
560	3487CF561M200KF	30x50	0.217	2.09
390	3487DC391M200KF	35x30	0.364	1.49
560	3487DD561M200KF	35x35	0.266	1.83
680	3487DE681M200KF	35x40	0.217	2.12
820	3487DF821M200KF	35x50	0.169	2.6
1000	3487DF102M200KF	35x50	0.154	2.73
1200	3487DG122M200RF	35x63	0.125	3.3
1500	3487DH152M200RF	35x80	0.097	4.13

250VDC WORKING, 300VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Size	Maximum ESR (OHMS) 120Hz+25°C	Max. RMS Ripple Current AMPS at 120Hz+85°C
180	3487BD181M250KF	25x35	0.533	1.04
220	3487BE221M250KF	25x40	0.436	1.21
330	3487BF331M250KF	25x50	0.296	1.6
220	3487CC221M250KF	30x30	0.477	1.17
270	3487CD271M250KF	30x35	0.383	1.38
330	3487CE331M250KF	30x40	0.313	1.6
470	3487CF471M250KF	30x50	0.223	2.06
560	3487CG561M250RF	30x63	0.186	2.47
330	3487DC331M250KF	35x30	0.375	1.47
390	3487DD391M250KF	35x35	0.301	1.72
470	3487DE471M250KF	35x40	0.247	1.99
680	3487DF681M250KF	35x50	0.176	2.55
820	3487DF821M250KF	35x50	0.161	2.67
1000	3487DG102M250RF	35x63	0.130	3.24
1200	3487DH122M250RF	35x80	0.102	4.02

STANDARD CAPACITANCE VALUES

300VDC WORKING, 350VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Size	Maximum ESR (OHMS) 120Hz+25°C	Max. RMS Ripple Current AMPS at 120Hz+85°C
100	3487BD101M300KF	25x35	1.37	.65
120	3487BE121M300KF	25x40	1.14	.75
180	3487BF181M300KF	25x50	.769	.99
120	3487CC121M300KF	30x30	1.17	.75
150	3487CD151M300KF	30x35	.942	.88
180	3487CE181M300KF	30x40	.782	1.01
270	3487CF271M300KF	30x50	.527	1.34
330	3487CG331M300RF	30x63	.432	1.62
470	3487CH471M300RF	30x80	.306	2.13
180	3487DC181M300KF	35x30	.830	.99
220	3487DD221M300KF	35x35	.669	1.16
270	3487DE271M300KF	35x40	.546	1.34
390	3487DF391M300KF	35x50	.382	1.73
470	3487DG471M300RF	35x63	.316	2.08
680	3487DH681M300RF	35x80	.222	2.73

400VDC WORKING, 450VDC SURGE

Capacitance µF	Mepco/Centralab Part Number	Case Size	Maximum ESR (OHMS) 120Hz+25°C	Max. RMS Ripple Current AMPS at 120Hz+85°C
82	3487BD820M400KF	25x35	1.44	.63
100	3487BE101M400KF	25x40	1.18	.73
150	3487BF151M400KF	25x50	.797	.98
100	3487CC101M400KF	30x30	1.21	.73
120	3487CD121M400KF	30x35	1.00	.85
150	3487CE151M400KF	30x40	.811	1
220	3487CF221M400KF	30x50	.555	1.31
270	3487CG271M400RF	30x63	.453	1.58
390	3487CH391M400RF	30x80	.317	2.09
120	3487DC121M400KF	35x30	1.03	.88
180	3487DD181M400KF	35x35	.704	1.13
220	3487DE221M400KF	35x40	.575	1.31
330	3487DF331M400KF	35x50	.391	1.71
390	3487DG391M400RF	35x63	.327	2.05
560	3487DH561M400RF	35x80	.232	2.68

350VDC WORKING, 400VDC SURGE

100	3487BD101M350KF	25x35	1.29	.67
120	3487BE121M350KF	25x40	1.07	.77
150	3487BF151M350KF	25x50	.863	.94
100	3487CC101M350KF	30x30	1.31	.71
150	3487CD151M350KF	30x35	.889	.91
180	3487CE181M350KF	30x40	.738	1.04
270	3487CF271M350KF	30x50	.497	1.38
330	3487CG331M350RF	30x63	.407	1.67
470	3487CH471M350RF	30x80	.288	2.19
150	3487DC151M350KF	35x30	.918	.94
220	3487DD221M350KF	35x35	.636	1.19
270	3487DE271M350KF	35x40	.519	1.37
330	3487DF331M350KF	35x50	.418	1.66
470	3487DG471M350RF	35x63	.300	2.14
680	3487DH681M350RF	35x80	.211	2.8

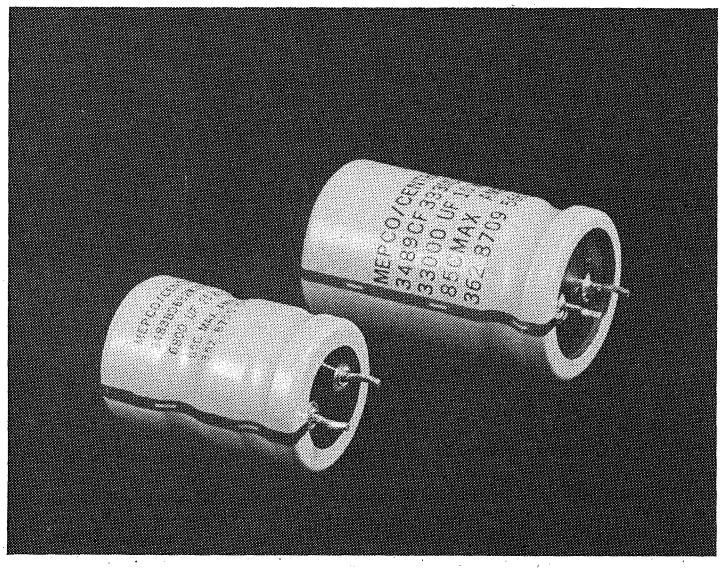
450VDC WORKING, 500VDC SURGE

68	3487BD680M450KF	25x35	1.60	.6
82	3487BE820M450KF	25x40	1.32	.7
120	3487BF121M450KF	25x50	.904	.92
82	3487CC820M450KF	30x30	1.35	.7
100	3487CD101M450KF	30x35	1.10	.81
120	3487CE121M450KF	30x40	.917	.94
180	3487CF181M450KF	30x50	.618	1.24
220	3487CG221M450RF	30x63	.505	1.5
330	3487CH331M450RF	30x80	.342	2.01
120	3487DC121M450KF	35x30	.963	.92
150	3487DD151M450KF	35x35	.769	1.08
180	3487DE181M450KF	35x40	.637	1.24
270	3487DF271M450KF	35x50	.431	1.63
330	3487DG331M450RF	35x63	.353	1.97
470	3487DH471M450RF	35x80	.250	2.57

SUPER SNAP™ SERIES 3489

Industrial/Computer Grade Snap-In Aluminum Electrolytic Capacitor

Special Design For "Off-Line" Switching Application



DESCRIPTION

The series 3489 is specially designed for input capacitor application in off line switching power supplies. It utilizes a new snap-in configuration with integral standoffs. This allows fast and easy mounting into circuit boards. The standoffs provide space between capacitor body and PWB for easy cleaning and preventing cleaning fluid entrapment.

State of the art etching and anodizing process results in extremely high CV product in the applicable 200 and 250 W.V. area. This combined with very low E.S.R. and ripple current capability produce a capacitor ideal for off line switch mode application.

The specially designed safety vent in the top of the can minimizes PWB damage by electrolyte spill in case of venting.

All internal and external connections of the 3489 are welded to ensure integrity of all contacts.

FEATURES

ELECTRICAL

- Very high CV density.
- Capacitance from 270 to 2700.
- Voltage range of 200 and 250 VDC.
- 85°C ambient operating temperature.
- 2000 hour life at 85°C with rated DC voltage applied.
- Standard capacitor tolerance of ±20%.
- Excellent high frequency response.
- Low E.S.R. with high ripple current ratings.

MECHANICAL

- Snap-in (self mounting) terminals.
- All welded connectors.
- Top mounted safety vent device for PWB protection.
- Pitchless construction (no potting compound)
- Integral standoff feet on terminal end for improved PWB cleaning.

SERIES 3489

Snap-In Aluminum Electrolytic Capacitors

HOW TO SPECIFY

Mepco/Centralab Series 3489 Capacitors can be completely specified using the following designation:

3489 — **Mepco/Centralab Product Series**

DE — **Case Size Code** (See physical spec.)

102 — **Capacitance**
xx = Significant Digits
x = Multiplier
i.e. 102 = 1,000 uf

M — **Tolerance**
M = ±20%

200 — **Working Voltage**

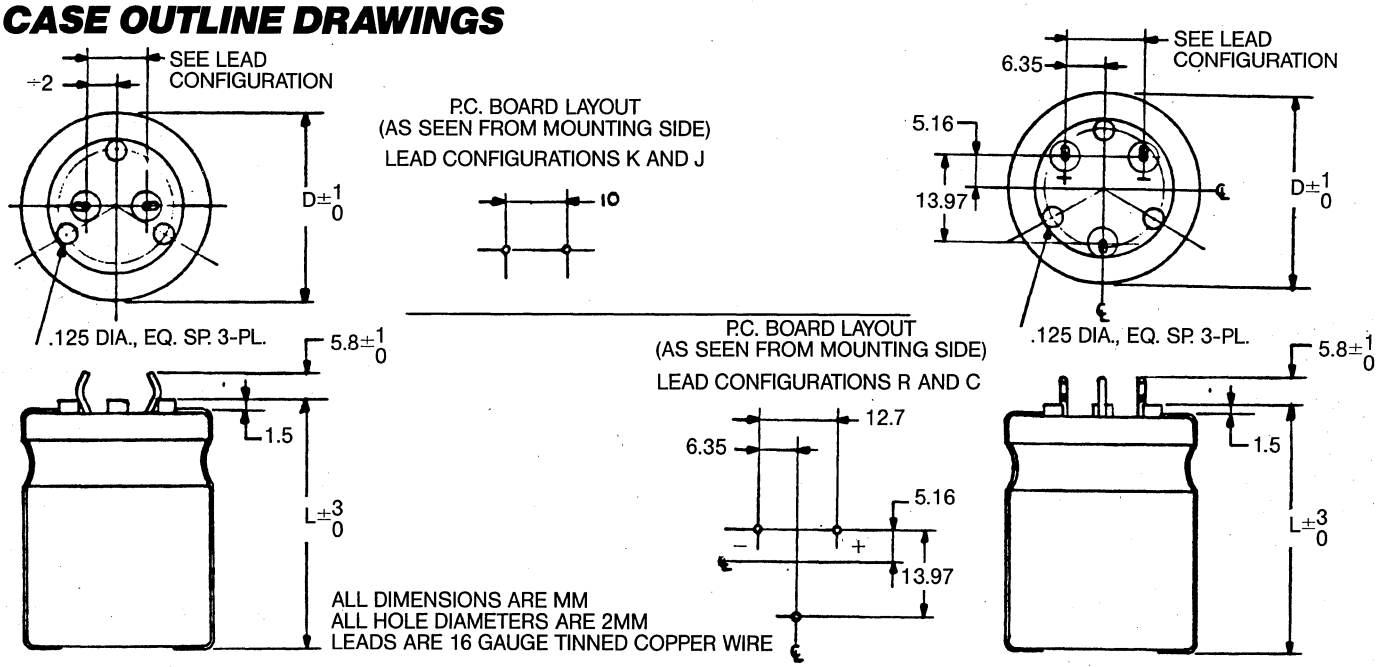
Cover Construction
D = Two leads 10.0mm spacing.
F = Three leads 12.7mm spacing.
(See physical spec.)

F — **Standard Insulation**
F = .006" PVC

DIMENSIONS

Case Codes	INSULATED CASE DIMENSIONS			
	Dimensions (mm)		Dimensions (in.)	
	$D\pm\frac{1}{0}$mm	$L\pm\frac{3}{0}$mm	$D\pm\frac{.039}{0}$	$L\pm\frac{.118}{0}$
BD	25	35	.984	1.378
BE	25	40	.984	1.575
BF	25	50	.984	1.969
CC	30	30	1.181	1.181
CD	30	35	1.181	1.378
CE	30	40	1.181	1.575
CF	30	50	1.181	1.969
CG	30	63	1.181	2.480
CH	30	80	1.181	3.150
DC	35	30	1.378	1.181
DD	35	35	1.378	1.378
DE	35	40	1.378	1.575
DF	35	50	1.378	1.969
DG	35	63	1.378	2.480
DH	35	80	1.378	3.150

CASE OUTLINE DRAWINGS



SERIES 3489

Snap-In Aluminum Electrolytic Capacitors

PERFORMANCE SPECIFICATIONS

1. TEMPERATURE.

1.1 OPERATING. These capacitors are designed to operate within the temperature range of −40°C to +85°C.

1.2 STORAGE. These capacitors may be subjected, without permanent damage, to conditions in transit where temperatures range from −55°C to +85°C at altitudes up to 80,000 feet.

1.3 TOLERANCE. Unless otherwise specified, temperature tolerance shall be ±3°C.

2. DC WORKING VOLTAGE. The dc working voltage is the maximum operating voltage for continuous operation at maximum rated temperature.

3. SURGE VOLTAGE. The surge voltage is the maximum non-recurrent voltage to which the capacitor should be subjected.

3.1 The surge voltage shall not exceed the values specified in the rating table.

3.2 SURGE TEST.

3.2.1 Capacitors shall be connected in series with a resistor. The value of the resistor is:

CAPACITANCE (μF)	RESISTOR (ohms)
0-2500	1000

The series combination is then subjected to rated surge voltage for 30 seconds at room temperature and the capacitor allowed to discharge thru the resistor. This sequence is repeated six times per hour at 10 minute intervals for 24 hours.

3.2.2 Leakage current, when measured per paragraph 6.2, not sooner than four (4) hours after completion of the test, shall not exceed the initial leakage current limit. There shall be no leaking of electrolyte and no mechanical damage.

4. CAPACITANCE. Capacitance shall be measured on a capacitance bridge having a maximum rms signal voltage of 1 volt at 120 Hz. Capacitance shall be within −20% to +20% of the nominal value when measured at 25°C.

5. EQUIVALENT SERIES RESISTANCE (ESR). Measurement shall be made by the bridge method at 120 Hz and 25°C. The equivalent series resistance shall not exceed the value shown in the rating table.

6. DC LEAKAGE CURRENT.

6.1 PRE-CONDITIONING. In the period 24 to 48 hours prior to test, rated working voltage shall be applied to the capacitor for a minimum of 30 minutes.

6.2 MEASUREMENT. Measurement shall be made at 25°C. Voltage shall be applied to the capacitor thru a current limiting resistor. The leakage current shall be measured 5 minutes after the capacitor reaches rated voltage. Leakage current shall not exceed the value calculated as shown:

$I_L = 6\sqrt{CV}\ (\mu A)$

C—Rated Capacitance (μf)

V—Rated Voltage (volts)

7. LIFE TESTS.

7.1 Capacitors shall be placed in a circulating air oven at an ambient temperature of 85°C. Spacing between capacitors must be at least 1" and capacitors must not be subjected to direct radiation from heating elements. Circulation of air shall be sufficient to keep the temperature within six (6) inches of the capacitor below 88°C.

7.1.1 Rated DC voltage shall be applied to the capacitors for a period of 2000 ± 8 hours. Following this test the capacitors shall meet the requirements of paragraph 7.2.

7.1.2 Alternate life test: Rated DC voltage and rated ripple current shall be applied for a period of 1000 ± 8 hours. Following this test the capacitors shall meet the requirements of paragraph 7.2.

7.2 Upon completion of the life test, the capacitors shall be returned to room ambient for a minimum of 24 hours. The capacitors shall then meet the following requirements:

7.2.1 Capacitance, when measured per paragraph 4., shall not be less than 85% of the initial measured value.

7.2.2 The equivalent series resistance (ESR), when measured per paragraph 5., shall not be greater than 150% of the initial specification.

7.2.3 The leakage current, when measured and determined per paragraph 6.2, shall not exceed the initial specification.

7.2.4 There shall be no evidence of mechanical damage or excessive electrolyte leakage.

8. SHELF TEST. Capacitors shall be placed in a circulating air oven at 85°C for a period of 500 ± 4 hours with no voltage applied. The units shall then be allowed to cool to 25°C for a minimum of 16 hours.

8.1 The capacitance, when measured in accordance with paragraph 4, shall be within ±15% of the initial measured value.

9. VIBRATION. Capacitors shall be clamped rigidly to a vibration platform and subjected to a simple harmonic motion having a maximum peak-to-peak amplitude of .06 inches and a maximum acceleration of 10g. The frequency of vibration shall be varied linearly between 10 and 55 cycles per second. The entire frequency range, 10 to 55 cps, shall be traversed in one minute. Capacitors shall be vibrated for 1½ hours with the direction of motion being parallel to the axis of the capacitor. The capacitors shall then be placed so that the direction of motion is perpendicular to the axis and the vibration continued for 1½ hours. During the last ½ hour of the test, the capacitor shall be connected to a bridge and observed for a 3 minute period. A capacitor failing the vibration test is defined as one failing to meet the requirements of paragraph 9.1.

9.1 There shall be no evidence of loosening of the capacitor element within the container, when shaken by hand following the test. There shall be no indication of intermittent contact during the 3 minute observation period. Capacitors shall not be open or shorted.

10. CONTAINER SEAL. Following the vibration test each capacitor shall be tested for seal tightness in accordance with paragraphs 10.1 and 10.2.

10.1 Capacitors shall be subjected to two successive temperature cycles in circulating air as follows:

ONE TEMPERATURE CYCLE

A. 85°C-30 min.
B. 25°C-30 min.
C. −40°C-30 min.
D. 25°C-30 min.

10.2 Following the second cycle, the capacitors shall be placed in 90-95°C water for 5 minutes. A failure is defined as a unit exhibiting a continuous chain of bubbles when immersed.

11. SAFETY VENT. A special relief vent—incorporated into the capacitor container—is designed to release dangerous internal pressure in the event of circuit malfunction or polarity reversal.

11.1 VENT TEST

11.1.1 The capacitor should be rigidly mounted in an explosion-proof container. The method of mounting should not physically restrict the radial ends of the capacitor case (the cover or opposite end from the cover).

11.1.2 Reverse DC voltage of sufficient magnitude to cause a 10 amp reverse current flow shall be applied to the capacitor.

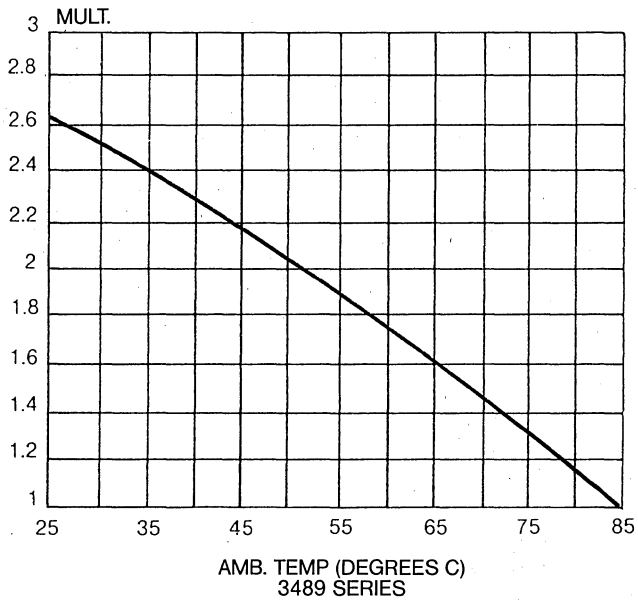
11.1.3 The safety vent shall operate without expulsion of the cover from the cequivtor.

12. RIPPLE CURRENT. Capacitors will withstand the 85°C rms ripple current stated in the rating tables for the duration of the life test as specified in paragraph 7 of the Performance Specifications. Any reduction in ambient temperature and/or ripple current will extend the operating life of the capacitor. See application guidelines for method for determining extended life at derated conditions.

12.1. Ripple Current values are specified at an ambient temperature of 85°C and a frequency of 120 Hz. Ripple current (I_R) at other frequencies and temperatures can be calculated.

$$I_R = I_{85} \cdot \text{RIPPLE MULTIPLIER}$$

RIPPLE MULTIPLIER
95 DEGREE CORE



12.2 For ripple currents at other frequencies, see application guidelines.

SERIES 3489

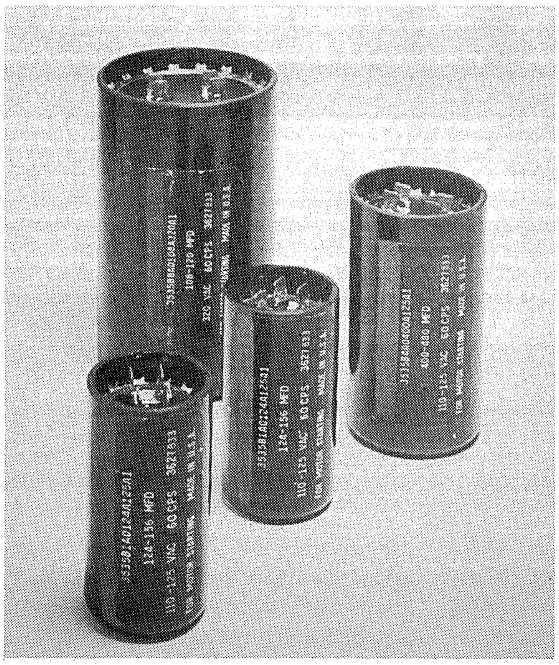
Snap-In Aluminum Electrolytic Capacitors

STANDARD CAPACITANCE VALUES

Capacitance μF	Mepco/Centralab Part Number	Case Code	Maximum ESR (OHMS) 120Hz, 25°C	Max. RMS Ripple Current AMPS at 120Hz, 85°C
200 VDC WORKING, 250 VDC SURGE				
330	3489BD331M200DF	25x35	.271	1.45
470	3489BE471M200DF	25x40	.199	1.79
680	3489BF681M200DF	25x50	.141	2.32
390	3489CC391M200DF	30x30	.268	1.56
560	3489CD561M200DF	30x35	.196	1.92
680	3489CE681M200DF	30x40	.160	2.23
1000	3489CF102M200DF	30x50	.114	2.87
1200	3489CG122M200DF	30x63	.094	3.48
1800	3489CH182M200DF	30x80	.066	4.58
560	3489DC561M200DF	35x30	.247	1.80
820	3489DD821M200DF	35x35	.182	2.21
1000	3489DE102M200DF	35x40	.148	2.56
1200	3489DF122M200DF	35x50	.113	3.18
1800	3489DG182M200DF	35x63	.086	3.98
2700	3489DH272M200DF	35x80	.061	5.21
250 VDC WORKING, 300 VDC SURGE				
270	3489BD271M250DF	25x35	.283	1.42
330	3489BE331M250DF	25x40	.232	1.65
470	3489BF471M250DF	25x50	.166	2.14
330	3489CC331M250DF	30x30	.278	1.53
390	3489CD391M250DF	30x35	.224	1.80
470	3489CE471M250DF	30x40	.184	2.08
680	3489CF681M250DF	30x50	.131	2.68
1000	3489CG102M250DF	30x63	.098	3.40
1200	3489CH122M250DF	30x80	.076	4.25
390	3489DC391M250DF	35x30	.275	1.71
560	3489DD561M250DF	35x35	.202	2.10
680	3489DE681M250DF	35x40	.165	2.43
1000	3489DF102M250DF	35x50	.118	3.12
1200	3489DG122M250DF	35x63	.096	3.77
1800	3489DH182M250DF	35x80	.067	4.95

SERIES 3500

A.C. Motor Start Capacitor



DESCRIPTION

Mepco/Centralab's Series 3500 A.C. motor-start capacitor is an electrochemical device consisting of compactly wound aluminum foil separated by layers of paper, which are impregnated with a conducting electrolyte. Etching of the foil prior to formation and winding increases both the effective foil surface area and the capacitance per unit volume of the finished capacitor. The entire assembly is housed in a molded plastic container.

Capacitors are rated for operation in ambient temperatures from −40°C to +65°C, and at a frequency of 50 Hz to 60 Hz.

Two case styles are available along with a choice of terminals and mounting methods. Four terminal types are available. All have a special metal to metal under cover connection for positive terminal contact with the capacitor roll tabs. On special order, units can be supplied with bleeder resistors soldered across the terminals.

FEATURES

- Plastic case requires no insulation.
- Stable electrical characteristics after 75,000 starts (110VAC and 125VAC).
- Type 3535 meets EIA Type I specifications.
- Type 3534 meets EIA Type II specifications.
- Longer life due to cooler operation.
- Four terminal types available.

SERIES 3500
A.C. Motor Start Capacitor

CASE DIMENSIONS AND STYLES

Dimensions in Inches

Case Size	D ±0.010	H ±0.020	Case Style A W (Max)	Case Style B W (Max)
1	1 7/16	2 3/4	0.250	0.032
2	1 7/16	3 3/8	.250	.032
3	1 7/16	4 3/8	.250	.032
4	1 13/16	3 3/8	.250	.032
5	1 13/16	4 3/8	.250	.032
6	2 1/16	3 3/8	.250	.032
7	2 1/16	4 3/8	.250	.032
8	2 9/16	4 3/8		.032

END CAPS

Bottom Lead Hole		Top Lead Hole	
Case Size	Catalog No.	Case Size	Catalog No.
1, 2, 3	614A766AAP1	1, 2, 3	614A766ABP1
4, 5	614A766AAP2	4, 5	614A766ABP2
6, 7	614A766AAP3	6, 7	614A766ABP3
8	614A766AAP4	8	614A766ABP4

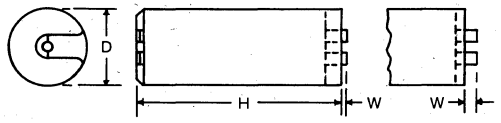
BRACKETS

Case Size	Catalog No.	A	B	C	D	E
3,5,7,8	614A765ABP1	5.015	4.656	2.0	—	2.078
2,4,6	614A765ABP2	4.015	3.650	1.703	.906	1.578
1	614A765ABP3	3.374	3.015	1.062	.586	1.258

LEADS AND TERMINALS

If required, leads (with or without terminals) can be supplied at extra cost. Standard lengths vary from 4 to 28 inches in 2-inch increments. Lead wire is #18 stranded copper conductor with 0.062" min. thickness thermoplastic insulation. Insulation is stripped ½" from ends, and bared lead is tinned. Upon request, leads can be supplied with terminals affixed to one end. Either eyelet or female quick-connect terminals are available.

CASE OUTLINE DRAWING

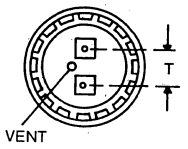


Style B (recessed cover depth)

Style A (Nonrecessed cover depth)

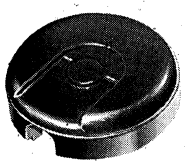
TERMINAL SPACING

CASE SIZE	T (in.) ± .062
1, 2, 3	0.500
4, 5	0.625
6, 7, 8	0.813

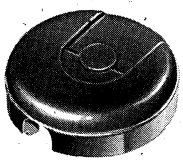


END CAPS

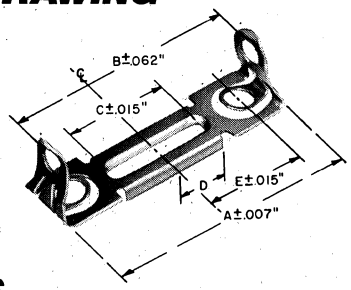
Bottom Lead Hole



Top Lead Hole



BRACKET DRAWING



TERMINALS

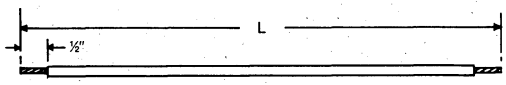
Type A Double QC

Type B Single QC

Type C Double QC with solder lug

Type D Solder lug

(Quick-connect terminals are also suitable for soldered connections).



Eyelet terminal

Female quick-connect terminal

STANDARD CAPACITANCE VALUES EIA TYPE I

110 VOLTS AC

UF Min-Max	Case Size	M/C Part Number
21-25	1	3535B1A0021A110**
25-30	1	3535B1A0025A110**
30-36	1	3535B1A0030A110**
36-43	1	3535B1A0036A110**
43-53	1	3535B1A0043A110**
47-56	1	3535B1A0047A110**
53-64	1	3535B1A0053A110**
64-77	1	3535B1A0064A110**
72-88	1	3535B1A0072A110**
88-108	1	3535B1A0088A110**
108-130	1	3535B1A0108A110**
124-149	1	3535B1A0124A110**
130-156	1	3535B1A0130A110**
145-175	1	3535B1A0145A110**
161-193	1	3535B1A0161A110**
189-227	2	3535B2A0189A110**
216-259	2	3535B2A0216A110**
233-280	2	3535B2A0233A110**
243-292	4	3535B4A0243A110**
270-324	4	3535B4A0270A110**
340-408	4	3535B4A0340A110**
378-440	4	3535B4A0378A110**
400-480	4	3535B4A0400A110**
430-516	4	3535B4A0430A110**
460-552	4	3535B4A0460A110**
540-648	7	3535B7A0540A110**
590-708	7	3535B7A0590A110**
710-850	8	3535B8A0710A110**

125 VOLTS AC

UF Min-Max	Case Size	M/C Part Number
21-25	1	3535B1A0021A125**
25-30	1	3535B1A0025A125**
30-36	1	3535B1A0030A125**
36-43	1	3535B1A0036A125**
43-53	1	3535B1A0043A125**
47-56	1	3535B1A0047A125**
53-64	1	3535B1A0053A125**
64-77	1	3535B1A0064A125**
72-88	1	3535B1A0072A125**
88-108	1	3535B1A0088A125**
108-130	1	3535B1A0108A125**
124-149	1	3535B1A0124A125**
130-156	1	3535B1A0130A125**
145-175	2	3535B2A0145A125**
161-193	2	3535B2A0161A125**
189-227	2	3535B2A0189A125**
216-259	4	3535B4A0216A125**
233-280	4	3535B4A0233A125**
243-292	4	3535B4A0243A125**
270-324	4	3535B4A0270A125**
340-408	5	3535B5A0340A125**
378-440	5	3535B5A0378A125**
400-480	5	3535B5A0400A125**
430-516	7	3535B7A0430A125**
460-552	7	3535B7A0460A125**
560-648	8	3535B8A0560A125**

165 VOLTS AC

UF Min-Max	Case Size	M/C Part Number
21-25	1	3535B1A0021A165**
25-30	1	3535B1A0025A165**
30-36	1	3535B1A0030A165**
36-43	1	3535B1A0036A165**
43-53	1	3535B1A0043A165**
47-56	1	3535B1A0047A165**

UF Min-Max	Case Size	M/C Part Number
53-64	1	3535B1A0053A165**
64-77	1	3535B1A0064A165**
72-88	1	3535B1A0072A165**
88-108	2	3535B2A0088A165**
108-130	2	3535B2A0108A165**
124-149	4	3535B4A0124A165**
130-156	4	3535B4A0130A165**
145-175	4	3535B4A0145A165**
161-193	4	3535B4A0161A165**
189-227	4	3535B4A0189A165**
216-259	5	3535B5A0216A165**
233-280	5	3535B5A0233A165**
243-292	5	3535B5A0243A165**
270-324	5	3535B5A0270A165**
340-408	7	3535B7A0340A165**
400-480	8	3535B8A0400A165**

220 VOLTS AC

UF Min-Max	Case Size	M/C Part Number
21-25	1	3535B1A0021A220**
25-30	1	3535B1A0025A220**
30-36	1	3535B1A0030A220**
36-43	2	3535B2A0036A220**
43-53	2	3535B2A0043A220**
47-56	2	3535B2A0047A220**
53-64	4	3535B4A0053A220**
64-77	4	3535B4A0064A220**
72-88	4	3535B4A0072A220**
88-108	4	3535B4A0088A220**
108-130	5	3535B5A0108A220**
124-149	5	3535B5A0124A220**
130-156	5	3535B5A0130A220**
145-175	7	3535B7A0145A220**
161-193	8	3535B8A0161A220**
189-227	8	3535B8A0189A220**

250 VOLTS AC

UF Min-Max	Case Size	M/C Part Number
21-25	1	3535B1A0021A250**
25-30	1	3535B1A0025A250**
30-36	2	3535B1A0030A250**
36-43	2	3535B2A0036A250**
43-53	4	3535B4A0043A250**
47-56	4	3535B4A0047A250**
53-64	4	3535B4A0053A250**
64-77	4	3535B4A0064A250**
72-88	4	3535B4A0072A250**
88-108	5	3535B5A0088A250**
108-130	5	3535B5A0108A250**
124-149	7	3535B7A0124A250**
130-156	8	3535B8A0130A250**
145-175	8	3535B8A0145A250**
161-193	8	3535B8A0161A250**

330 VOLTS AC

UF Min-Max	Case Size	M/C Part Number
21-25	2	3535B2A0021A330**
25-30	2	3535B2A0025A330**
30-36	4	3535B4A0030A330**
36-43	4	3535B4A0036A330**
43-53	4	3535B4A0043A330**
47-56	4	3535B4A0047A330**
53-64	5	3535B5A0053A330**
64-77	5	3535B5A0064A330**
72-88	5	3535B5A0072A330**
88-108	7	3535B7A0088A330**
108-130	8	3535B8A0108A330**

NOTE: **Last two digits of M/C part number to be assigned by the computer for individual customer identification. M/C part numbers shown are for standard parts. Recessed case, double quick connect terminals.

SERIES 3500
A.C. Motor Start Capacitor

STANDARD CAPACITANCE VALUES EIA. TYPE II

UF Min-Max	Case Size	M/C Part Number
110 VOLTS AC		
21-25	1	3534B1A0021A110**
25-30	1	3534B1A0025A110**
30-36	1	3534B1A0030A110**
36-43	1	3534B1A0036A110**
43-53	1	3534B1A0043A110**
47-56	1	3534B1A0047A110**
53-64	1	3534B1A0053A110**
64-77	1	3534B1A0064A110**
72-88	1	3534B1A0072A110**
88-108	1	3534B1A0088A110**
108-130	1	3534B1A0108A110**
124-149	1	3534B1A0124A110**
130-156	1	3534B1A0130A110**
145-175	1	3534B1A0145A110**
161-193	1	3534B1A0161A110**
189-227	1	3534B1A0189A110**
216-259	2	3534B2A0216A110**
233-280	2	3534B2A0233A110**
243-292	2	3534B2A0243A110**
270-324	2	3534B2A0270A110**
340-408	4	3534B4A0340A110**
378-440	4	3534B4A0378A110**
400-480	4	3534B4A0400A110**
430-516	4	3534B4A0430A110**
460-552	4	3534B4A0460A110**
540-648	5	3534B5A0540A110**
590-708	5	3534B5A0590A110**
710-850	7	3534B7A0710A110**
829-995	7	3534B7A0829A110**
1000-1200	8	3534B8A1000A110**
125 VOLTS AC		
21-25	1	3534B1A0021A125**
25-30	1	3534B1A0025A125**
30-36	1	3534B1A0030A125**
36-43	1	3534B1A0036A125**
43-53	1	3534B1A0043A125**
47-56	1	3534B1A0047A125**
53-64	1	3534B1A0053A125**
64-77	1	3534B1A0064A125**
72-88	1	3534B1A0072A125**
88-108	1	3534B1A0088A125**
108-130	1	3534B1A0108A125**
124-149	1	3534B1A0124A125**
130-156	1	3534B1A0130A125**
145-175	1	3534B1A0145A125**
161-193	1	3534B1A0161A125**
189-227	2	3534B2A0189A125**
216-259	2	3534B2A0216A125**
233-280	2	3534B2A0233A125**
243-292	3	3534B3A0243A125**
270-324	3	3534B3A0270A125**
340-408	4	3534B4A0340A125**
378-440	4	3534B4A0378A125**
400-480	4	3534B4A0400A125**
430-516	4	3534B4A0430A125**
460-552	4	3534B4A0460A125**
560-648	5	3534B5A0560A125**
645-774	7	3534B7A0645A125**
829-995	8	3534B8A0829A125**
165 VOLTS AC		
21-25	1	3534B1A0021A165**
25-30	1	3534B1A0025A165**
30-36	1	3534B1A0030A165**
36-43	1	3534B1A0036A165**
43-53	1	3534B1A0043A165**
47-56	1	3534B1A0047A165**
53-64	1	3534B1A0053A165**
64-77	1	3534B1A0064A165**

UF Min-Max	Case Size	M/C Part Number
165 VOLTS AC		
72-88	1	3534B1A0072A165**
88-108	1	3534B1A0088A165**
108-130	2	3534B2A0108A165**
124-149	2	3534B2A0124A165**
130-156	4	3534B4A0130A165**
145-175	4	3534B4A0145A165**
161-193	4	3534B4A0161A165**
189-227	4	3534B4A0189A165**
216-259	4	3534B4A0216A165**
233-280	5	3534B5A0233A165**
243-292	5	3534B5A0243A165**
270-324	5	3534B5A0270A165**
340-408	7	3534B7A0340A165**
400-480	7	3534B7A0400A165**
460-552	8	3534B8A0460A165**
220 VOLTS AC		
21-25	1	3534B1A0021A220**
25-30	1	3534B1A0025A220**
30-36	1	3534B1A0030A220**
36-43	1	3534B1A0036A220**
43-53	2	3534B2A0043A220**
47-56	2	3534B2A0047A220**
53-64	2	3534B2A0053A220**
64-77	4	3534B4A0064A220**
72-88	4	3534B4A0072A220**
88-108	4	3534B4A0088A220**
108-130	4	3534B4A0108A220**
124-149	5	3534B5A0124A220**
130-156	5	3534B5A0130A220**
145-175	7	3534B7A0145A220**
161-193	7	3534B7A0161A220**
189-227	7	3534B7A0189A220**
233-280	8	3534B8A0233A220**
270-324	8	3534B8A0270A220**
250 VOLTS AC		
21-25	1	3534B1A0021A250**
25-30	1	3534B1A0025A250**
30-36	2	3534B2A0030A250**
36-43	2	3534B2A0036A250**
43-53	2	3534B2A0043A250**
47-56	2	3534B2A0047A250**
53-64	4	3534B4A0053A250**
64-77	4	3534B4A0064A250**
72-88	4	3534B4A0072A250**
88-108	5	3534B5A0088A250**
108-130	5	3534B5A0108A250**
124-149	5	3534B5A0124A250**
130-156	5	3534B5A0130A250**
145-175	7	3534B7A0145A250**
161-193	7	3534B7A0161A250**
189-227	8	3534B8A0189A250**
233-280	8	3534B8A0233A250**
330 VOLTS AC		
21-25	2	3534B2A0021A330**
25-30	2	3534B2A0025A330**
30-36	4	3534B4A0030A330**
36-43	4	3534B4A0036A330**
43-53	4	3534B4A0043A330**
47-56	4	3534B4A0047A330**
53-64	5	3534B5A0053A330**
64-77	5	3534B5A0064A330**
72-88	5	3534B5A0072A330**
88-108	7	3534B7A0088A330**
108-130	8	3534B8A0108A330**
124-149	8	3534B8A0124A330**
145-174	8	3534B8A0145A330**

NOTE: **Last two digits of M/C part number to be assigned by the computer for individual customer identification. M/C part numbers shown are for standard parts. Recessed case, double quick connect terminals.

PERFORMANCE SPECIFICATIONS

1. **TEMPERATURE.**

1.1 Operating. These capacitors are designed to operate within the ambient temperature range of −40°C to 65°C.

1.2 Storage. These capacitors may be subjected, without permanent damage, to conditions in transit where temperatures range from −55°C to +95°C.

1.3 Tolerance. Unless otherwise specified, temperature tolerance shall be ±3°C.

2. **FREQUENCY.** Unless otherwise specified, frequency shall be 50-60 Hz.

3. **VOLTAGE RATING.** The rated voltage is the rms value of AC voltage at which the capacitor may be operated at its normal duty cycle and maximum ambient temperature.

4. **CAPACITANCE AND POWER FACTOR.**

4.1 Measurement. Using the circuit shown in Fig.1, apply rated voltage to the capacitor and measure current and power dissipated. Current shall be measured within 3 seconds, dissipated power within 4 seconds after application of rated voltage.

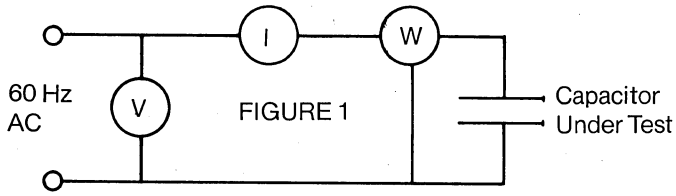


FIGURE 1

4.2 Temperature. Measurement shall be made at, or referred to, a temperature of 25°C.

4.3 Calculation of Capacitance and Power Factor.

$$C = \frac{I \times 10^6}{2\pi f V} \qquad \%PF = \frac{W}{VI} \times 100$$

Where C is capacitance in ufs
I is current in amperes
π is a constant (3.14)
f is frequency in hertz
V is applied voltage
PF is the power factor
W is power dissipated in watts

4.4 Requirements. Capacitance shall be within specified limits and the power factor shall not exceed 10%.

5. **LIFE TEST.***

5.1 Capacitors shall be placed in a circulating air oven at an ambient temperature of 65°C. Spacing between capacitors must be at least 1" and capacitors must not be subjected to direct radiation from heating elements. Circulation of air shall be sufficient to keep the temperature, within six (6) inches of the capacitor, below 68°C.

* Caution—Confine capacitor(s) under test to isolate all electrical connections for the safety of personnel.

5.1.1 A resistance equivalent to approximately 10% of the capacitor impedance shall be connected in series with each capacitor. A resistor of approximately 1000 ohms shall be connected in parallel with each capacitor.

5.1.2 Rated voltage shall be applied to the capacitor resistor combination for 3535 capacitors EIA Type I as specified below. Table is per EIA Standard RS-463.

Rated Voltage	Voltage Cycle	Duty Cycle	Minimum Number Starts
110, 115 and 125	2 times per minute ¾ sec. on; 29¼ sec. off.	0.0250	75,000
165, 220, 250 and 330	1 time per minute 1 sec. on; 59 sec. off.	0.0167	40,000

SERIES 3500
A.C. Motor Start Capacitor

5.1.3 Rated voltage shall be applied to the capacitor resistor combination for 3534 capacitors EIA Type II as specified below. Table is per EIA Standard RS-463.

Rated Voltage, Test Voltage as (rms)	Capacitance Rating (mfd)		Duty Cycle		Duration of Test* (Number of Starts)
	From	To	Seconds On	Seconds Off	
110	21-25	124-149	¾	29¼	50,000
	130-156	243-292	1	59	50,000
	270-324	378-454	1	89	33,500
	400-480	540-648	1	119	25,000
	590-708	850-1020	1	179	16,500
	1000-1200	1280-1546	1	239	12,500
115	21-25	108-130	¾	29¼	50,000
	124-149	189-227	1	59	50,000
	216-259	340-408	1	89	33,500
	378-454	460-552	1	119	25,000
	540-648	815-978	1	179	16,500
	829-995	1020-1224	1	239	12,500
125	21-25	88-106	¾	29¼	50,000
	108-130	145-174	1	59	50,000
	161-193	233-280	1	89	33,500
	243-292	378-454	1	119	25,000
	400-480	590-708	1	179	16,500
	645-774	800-960	1	239	12,500
165	21-25	88-106	1	59	33,500
	108-130	124-149	1	89	33,500
	130-156	216-259	1	119	25,000
	233-280	340-408	1	179	16,500
	378-454	590-708	1	239	12,500

* The number of starts shown in this column are reduced starts for accelerated testing so that test time does not exceed 35 days. Type 2 capacitors should be capable of 50,000 starts for ratings to 125 volts and 40,000 starts for higher voltages.

5.2 Upon completion of the life test, the capacitors shall be returned to room ambient for a minimum of 24 hours.The capacitors shall then meet the following requirements:

5.2.1 Capacitance, when measured per paragraph 4, shall not differ from the initial measured value by more than 25%.

5.2.2 The power factor, when measured per paragraph 4, shall not exceed 20%.

6. **OVERVOLTAGE TEST.** Capacitors shall withstand, without breakdown or visible mechanical damage, 140% of rated voltage for one second at room temperature (EIA Type I capacitors only).

7. **TERMINAL STRENGTH.** At the point of normal lead connection, terminals shall withstand a force of 5 pounds applied gradually in any direction for a period of one minute. There shall be no loosening of the terminals or damage to the terminal or seal.

8. **CASE INSULATION.** Capacitors are designed to withstand a 1500-volt rms 60-cycle voltage applied for 5 seconds between terminals and case without breakdown or flashover.

Rated Voltage, Test Voltage ac (rms)	Capacitance Rating (mfd)		Duty Cycle		Duration of Test * (Number of Starts)
	From	To	Seconds On	Seconds Off	
220	21-25	43-52	1	59	33,500
	37-56	72-86	1	89	33,500
	88-106	145-174	1	119	25,000
	161-193	243-292	1	179	16,500
	270-324	430-516	1	239	12,500
250	21-25	30-36	1	59	33,500
	36-43	64-77	1	89	33,500
	72-86	88-106	1	119	25,000
	108-130	189-227	1	179	16,500
	216-259	324-389	1	239	12,500
330	21-25	21-25	1	59	33,500
	25-30	30-36	1	89	33,500
	36-43	64-77	1	119	25,000
	72-86	88-106	1	179	16,500
	108-130	130-156	1	239	12,500

* The number of starts shown in this column are reduced starts for accelerated testing so that test time does not exceed 35 days. Type 2 capacitors should be capable of 50,000 starts for ratings to 125 volts and 40,000 starts for higher voltages.

9. **VIBRATION.** Capacitors shall be clamped rigidly to a vibration platform and subjected to a simple harmonic motion having a maximum peak-to-peak amplitude of .06 inches and a maximum acceleration of 10g. The frequency of vibration shall be varied linearly between 10 and 55 cycles per second. The entire frequency range, 10 to 55 to 10 cps, shall be traversed in one minute. Capacitors shall be vibrated for 1½ hours with the direction of motion being parallel to the axis of the capacitor. The capacitors shall then be placed so that the direction of motion is perpendicular to the axis and the vibration continued for 1½ hours. During the last ½ hour of the test, the capacitor shall be connected to a bridge and observed for a 3 minute period. A capacitor failing the vibration test is defined as one failing to meet the requirements of paragraph 9.1.

9.1 There shall be no evidence of loosening of the capacitor element within the container, when shaken by hand following the test. There shall be no indication of intermittent contact during the 3 minute observation period. Capacitors shall not be open or shorted.

10. **MARKING.** Capacitors will have the following minimum marking:

Manufacturer's Name And/Or Symbol
Manufacturer's Part Number
Capacitance (Min-Max Mfd)
Rated Voltage
Rated Frequency
EIA Source and Date Code

APPLICATION GUIDELINES

The Mepco/Centralab AC Motor Start capacitors are non-polar aluminum electrolytic capacitors designed for intermittent AC duty; more specifically, the starting of small AC motors. They are not suitable for most DC or continuous AC applications.

1. **DUTY CYCLE.** The duty cycle of an AC Motor Start capacitor may be determined by dividing the capacitor's on-time (energized time) by the sum of its on-time (energized time) and its off-time (de-energized time). For a given AC Motor Start capacitor, operating at a given voltage and ambient temperature; the time-averaged power dissipated by the capacitor, the internal operating temperature of the capacitor and, therefore, the life expectancy of the capacitor are all directly proportional to the capacitor's duty cycle.

1.1 Normal capacitor life may be realized (assuming voltage and temperature limits are not exceeded) when the on-time of a capacitor does not exceed 3 seconds and its duty cycle does not exceed 0.0167. Example: Twenty (20) three (3) second starts per hour yield a duty cycle of 0.0167 and does not exceed the three (3) second on-time limit.

1.2 Longer than 3 second on-times are not recommended as they will cause the capacitor's life to be shortened. Should they be unavoidable, there are certain things that can be done to minimize the degradation of the capacitor's life expectancy. For on-times up to 6 seconds:

- Reduce the duty cycle by increasing the off-time
- Reduce the ambient temperature
- Provide forced air cooling
- Use a capacitor with a higher voltage rating
- Series two capacitors each having twice the mfd value of the original.

2. **FREQUENCY.** These capacitors are designed for and are tested at 60 Hz. They are, however, suitable for use from 50 to 60 Hz.

3. **VOLTAGE.** Rated voltage and overvoltage (proof test) have been covered in the PERFORMANCE SPECIFICATIONS section and will not be reiterated here. However, there is a third voltage that should be considered in the application of AC Motor Start capacitors.

During the start cycle of a normal capacitor motor, the voltage impressed across the AC motor start capacitor does not remain constant. It should start close to the rated voltage, dip slightly and then begin to increase as the motor's RPM increases. Should the start switch fail to open, it is possible for the capacitor's voltage to increase to as much as 2 to 3 times the capacitor's rated voltage.

3.1 Normal capacitor life may be realized (assuming temperature and duty cycle limits are not exceeded) when, during the start cycle, the voltage impressed across the capacitor does not exceed 125% of its rated voltage.

4. **TEMPERATURE.** The storage and operating temperatures have been covered in the PERFORMANCE SPECIFICATIONS section. There has been some misunderstanding about the −40°C lower limit. As the temperature decreases from room temperature, capacitance starts to fall and % power factor (measurement of losses) starts to rise. Either one of these effects will cause a decrease in a motor's starting torque. The effects are such that below −40°C, a stalled rotor condition could occur. However, because the losses are so high, the internal capacitor temperature will rise rather quickly, thus restoring normal start torque. The total effect may just be a delay in the motor reaching switch out speed.

5. **SHELF LIFE.** The normal shelf life expectancy for these capacitors is typically in excess of 5 years when stored in ambient temperatures not exceeding 40°C.

6. **RESISTORS.** Some specialized applications require that the motor start capacitor be discharged prior to the closing of the start switch. This minimizes shock hazard, Switch Bounce noise, and peak contact currents. The resistor used to discharge the capacitor should be large enough so as not to significantly increase the power factor and small enough to insure discharging the capacitor within the time required. Normally, a 15K ohm ±20% 2-watt resistor is used. Consult factory for this option.

7. **MOUNTING.** Vertical mounting of the capacitor with the terminals up is recommended; however, horizontal mounting with the pressure relief vent up is acceptable. Vertical mounting with terminals down or horizontal mounting with a relief vent down is not recommended as they may reduce capacitor life and could impair the operation of the pressure relief vent.

8. **CLEANING SOLVENTS.** Recommended cleaning solvents are those free of halogens or halogen groups such as ethyl alcohol, butyl alcohol, methyl alcohol, propyl alcohol and deionized or distilled water.

Solvents that are NOT recommended are halogenated hydrocarbon solvents such as Freon TF,® Freon TMC,® carbon tetrachloride, chloroform, trichloroethylene, trichloroethane, and methylene chloride.

9. **SAFETY.** The watt-second capability of these capacitors is high enough that precautions should be taken during the testing and application of these devices. Normally, the DC series resistance of the main and auxiliary windings are such that the capacitor is completely discharged prior to the motor coming to a complete stop. However, if this is not the case, or if this is deemed inadequate, discharge resistors are available from the factory.

9.1 **Misapplication, such as exceeding design limits or applying continuous AC voltage, may result in destruction or explosion of capacitors.**

10. **GENERAL.** In the event that application requirements exceed the parameters expressed herein, it is often possible to use a standard capacitor, providing certain "tradeoffs" are acceptable. It is also possible that special designs and/or manufacturing techniques not normally included, could be applied to meet a special situation.

10.1 When consulting the factory about a special application or an application problem, the following minimum information should be available:

a. Capacitor nameplate information; MFD value, voltage, etc.
b. Case size (diameter x length)
c. Capacitor's worst case duty cycle
d. Maximum switch out voltage
e. Maximum ambient temperature
f. Any special or unusual application characteristic

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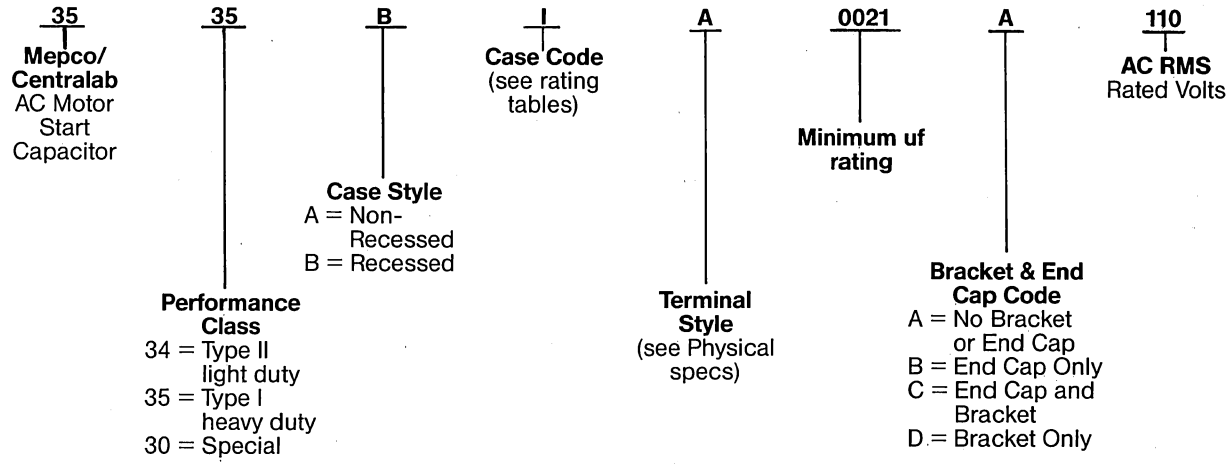
HOW TO SPECIFY

Mepco/Centralab A.C. Motor Start capacitors can be completely specified using the following designations:



APPLICATION GUIDELINES

Computer Grade & Snap-In

To determine the maximum allowable ripple current at 85°C at the above subject frequency the following procedure should be used. Obtain the power dissipation rating of the subject capacitor from the table listed within. This table lists the power dissipation capability at 85°C ambient of each case at 10°C and 20°C core rise temperature. The rated core rise temperature of each capacitor style are defined in their individual performance specifications.

The following mathematical formuli produce the maximum allowable 85°C ripple current.

ESR (hf) = ESR (120) X FACTOR (hf)

$$I\,(rhf) = \sqrt{\frac{P}{ESR\ (hf)}}$$

Where **ESR (120)** = ratio of ESR ohms from 120 Hz 25°C published listing.

ESR (hf) = ESR ohms desired 120 Hz to 100 KHz

Factor (hf) = ratio of ESR change from curves

P = Power dissipation from tabled listing

I (rhf) = Maximum allowable ripple current at 85°C at the selected frequency.

Maximum allowable ripple current at the desired frequency lower than 85°C ambient may be obtained by multiplying the result with the temperature multiplier that is listed in each individual product's performance specifications.

POWER DISSIPATION OF COMPUTER GRADE BY CASE SIZE

CASE	CASE DIA.	CASE LENGTH	P@10°C RISE	P@20°C RISE
BA	1.375	2.125	.730	1.460
BB	1.375	2.625	.860	1.720
BC	1.375	3.125	.990	1.980
BD	1.375	3.625	1.120	2.240
BE	1.375	4.125	1.250	2.500
BF	1.375	4.625	1.380	2.760
BG	1.375	5.125	1.510	3.020
BH	1.375	5.625	1.640	3.280
DA	1.750	2.125	.990	1.980
DB	1.750	2.625	1.120	2.240
DC	1.750	3.125	1.320	2.640
DD	1.750	3.625	1.480	2.960
DE	1.750	4.125	1.650	3.300
DF	1.750	4.625	1.810	3.620
DG	1.750	5.125	1.980	3.960
DH	1.750	5.625	2.140	4.280
EA	2.000	2.125	1.180	2.360
EB	2.000	2.625	1.370	2.740
EC	2.000	3.125	1.560	3.120
ED	2.000	3.625	1.740	3.480
EE	2.000	4.125	1.930	3.860
EF	2.000	4.625	2.120	4.240
EG	2.000	5.125	2.310	4.620
EH	2.000	5.625	2.500	5.000
FB	2.500	2.625	1.837	3.650
FC	2.500	3.125	2.060	4.120
FD	2.500	3.625	2.300	4.600
FE	2.500	4.125	2.530	5.060
FF	2.500	4.625	2.770	5.540
FG	2.500	5.125	3.000	6.000
FH	2.500	5.625	3.240	6.480
GC	3.000	3.125	3.760	5.230
GD	3.000	3.625	2.900	5.800
GE	3.000	4.125	3.180	6.360
GF	3.000	4.625	3.460	6.920
GG	3.000	5.125	3.760	7.520
GH	3.000	5.625	4.030	8.060
GN	3.000	8.625	5.730	11.460

CODE:
P = POWER DISSIPATION IN WATTS
P @ RISE = CORE TEMP. ABOVE AMBIENT

Power Dissipation of Snap-in

3487 SERIES

Case Code	Case Size(mm)	Power Dissipation
BD	25x35	.58
BE	25x40	.64
BF	25x50	.76
CC	30x30	.66
CD	30x35	.73
CE	30x40	.80
CF	30x50	.95
CG	30x63	1.14
CH	30x80	1.39
DC	35x30	.81
DD	35x35	.89
DE	35x40	.98
DF	35x50	1.15
DG	35x63	1.37
DH	35x80	1.66

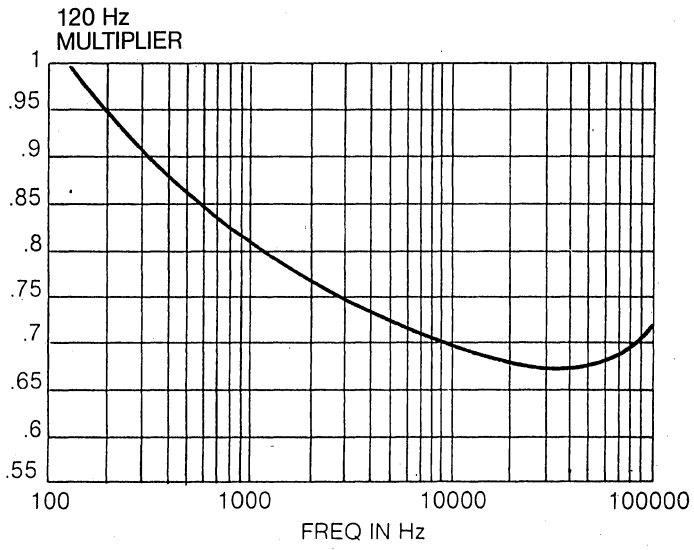
1. RIPPLE CURRENT

All capacitors will withstand the RMS ripple current stated in the Standard Rating tables, specified at an ambient temperature of 85°C and a frequency of 120Hz. Permissible ripple current at other temperatures and frequencies can be calculated as indicated below. Where capacitors are operated at both a temperature and a frequency other than rated, both the multiplying factors should be used.

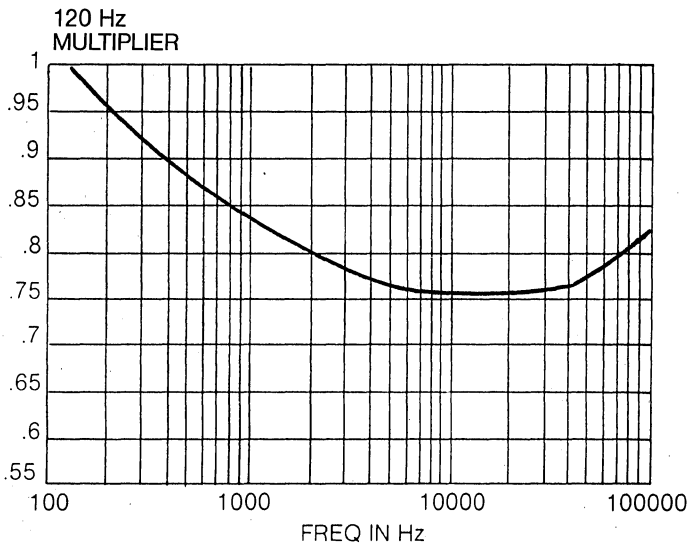
The ripple current multiplier factors for temperature are given for each individual capacitor style in their respective performance specifications. To obtain ripple current at frequencies above 120 Hz to 100 KHz the following procedure should be followed.

The three curves listed represent the ratio of ESR change from 120 Hz to 100 KHz. They are categorized into three voltage ranges and are valid for all the computer grade and snap-in type units. To obtain the ESR of a unit at a frequency above 120 Hz, find the ratio of change from the appropriate curve. Multiply the listed 120 Hz ESR of the subject unit by the ratio, the result is the ESR at the desired frequency.

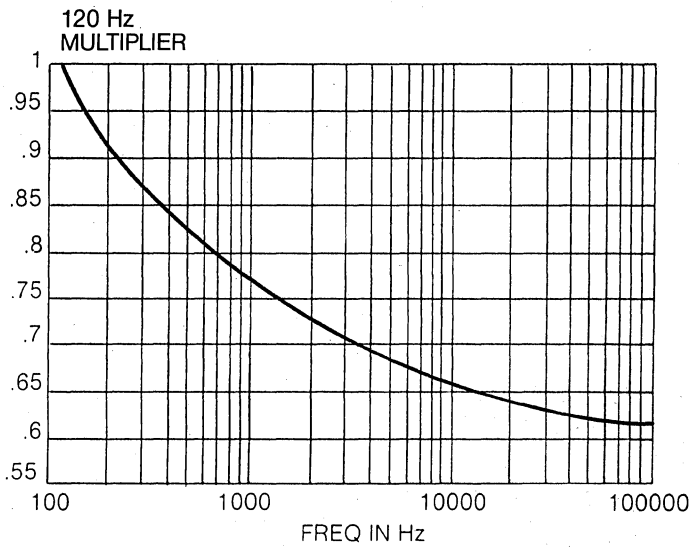
HI FREQ. ESR MULTIPLIER
76-250 VOLT



HI FREQ. ESR MULTIPLIER
0-75 VOLT



HI FREQ. ESR MULTIPLIER
251-450 VOLT



APPLICATION GUIDELINES

Computer Grade & Snap-In

1.1 TERMINAL HEAT RISE. To limit terminal heat rise, the 85°C ripple current should not exceed the following RMS values:

Standard Terminal: 30 amps
High-Current Terminal: 45 amps

When ripple currents greater than 10 amperes RMS are applied to these capacitors, the terminal screws should be torqued to a minimum of 20-inch-pounds (maximum, 25-inch-pounds) for standard terminals and 50-inch pounds (maximum, 60-inch-pounds) for high-current terminals to minimize I^2R losses at the terminals.

2. RIPPLE VOLTAGE AND VOLTAGE REVERSAL. The sum of the DC voltage and peak ripple voltage must not exceed the rated voltage of the capacitor.

To avoid polarity reversal on the capacitor, the peak AC voltage applied must not exceed the applied DC voltage. The following Series can withstand a voltage reversal for short periods of time as indicated, without any significant change in electrical characteristics:

Series	Max. Voltage Reversal
3120	1.5
3186	1.5
3188	1.5
3191	1.5
3487	1.5

3. INSULATION AND GROUNDING. These capacitors have an indeterminated resistance between the cathode terminal and the container. The container should be considered to be at the same potential as the cathode terminal with respect to ground. When a potential other than that of chassis ground is present on the cathode terminal, the container should be properly insulated.

3.1 INSULATING SLEEVE. These capacitors may be supplied with PVC insulation for 85°C ambient operation.

The insulation shall be tested in accordance with EIA specification RS-395 paragraph 2.19.

The typical insulation breakdown voltages measured between the cathode terminal or case and a 1" metallic band wrapped around the insulated container are as follows, at a relative humidity of 45%, ambient temperature of 25°C, and breakdown current of 1000μA:

PVC Insulation Thickness	.004"	.006"	.008"	.012"
Breakdown Voltage (VAC)	1600	2000	2400	3200

4. SAFETY VENT.

SERIES 3487

A unique vent is designed into the top of the aluminum can, so constructed that the end of the can will rupture and release dangerous internal pressure which could occur in the event of a circuit malfunction or polarity reversal.

SERIES 3120, 3186, 3188, 3191:

These capacitors are designed with a safety device incorporated in the header. This device prevents case rupture or cover damage in event of excess pressure build-up due to improper operation.

Vent Test: A reverse DC voltage shall be applied to the capacitor to cause a reverse current flow of 10 amperes. The capacitor should be securely mounted to a surface by wrap-around clamp during this test. The vent should operate before an explosion or the expulsion of any capacitor material occurs. A capacitor which does not vent within 20 minutes is considered to have passed the vent test.

5. MOUNTING

SERIES 3186, 3188, 3191: Vertical mounting of the capacitor with the terminals up is recommended; however, horizontal mounting with the pressure relief vent up is acceptable. Vertical mounting with the terminals down and horizontal mounting with the pressure relief vent down are not recommended, since this could impair the operation of the safety vent.

SERIES 3487, 3120: These capacitors may be mounted in any plane.

6. CLEANING SOLVENT WARNING AND DISCLAIMER. Industry standards such as EIA RS-395 and Military Specification MIL-C-39018 caution against the use of halogenated hydrocarbon solvents in cleaning boards containing aluminum electrolytic capacitors. The probability of failures in capacitors cleaned by halogenated hydrocarbon solvents is sufficient for Mepco/Centralab to disclaim any warranties, specific or implied, to our product if our capacitors are subjected in any manner or extent to these solvents.

Examples of these solvents are Freon TF,® Freon TMC,® carbon tetrachloride, chloroform, trichloroethylene, trichloroethane, methylene chloride and MEK. Recommended solvents are those free of halogens or halogen groups, such as ethyl alcohol, butyl alcohol, methyl alcohol, propyl alcohol, and water.

If halogenated hydrocarbon solvents must be used, the following alternatives exist:

a. The electrolytic capacitors should be inserted into the boards after the cleaning process has been completed.

b. Product Series is supplied with a protective end seal which permits on board cleaning using any of the above solvents. On special order, Mepco/Centralab can supply most tubular designs to meet the same requirements.

SAFETY

WITH CAPACITORS HAVING A HIGH WATT-SECOND CAPABILITY IT IS IMPORTANT THAT SUITABLE PRECAUTIONS BE OBSERVED IN THE TESTING AND APPLICATION OF THESE DEVICES. BLEEDER RESISTORS AND OTHER DISCHARGE CIRCUITRY SHOULD BE USED TO PROTECT SERVICEMEN AND USERS. WHEN USED IN LARGE BANKS, THE MECHANICAL STRUCTURE MUST BE DESIGNED SO AS TO WITHSTAND THE LARGE CURRENTS THAT MAY OCCUR IN THE EVENT OF A CAPACITOR SHORT CIRCUIT. THE MECHANICAL STRUCTURE SHOULD ALSO BE CONSTRUCTED SO THAT IT WILL CONTAIN THE CAPACITORS IF A CAPACITOR EXPLOSION SHOULD OCCUR.

MISAPPLICATIONS, SUCH AS EXCEEDING DESIGN LIMITS OR APPLYING REVERSE VOLTAGE TO POLAR UNITS, MAY RESULT IN DESTRUCTION OR EXPLOSION OF CAPACITORS.

PRECAUTIONS IN CASE OF VENT OPERATION. OPERATION OF THE VENT STRUCTURE INVOLVES EXPULSION OF HOT GASES AND/OR LIQUIDS UNDER HIGH PRESSURE. CONTACT WITH THIS MATERIAL COULD CAUSE PERSONAL INJURY OR PROPERTY DAMAGE AND THEREFORE SHOULD BE AVOIDED.

Shelf Life. The normal shelf life expectancy for these capacitors when stored at ambient temperatures of 40°C or below is indicated in TABLE 6, column G. When stored for longer periods, and/or at higher temperatures, their leakage current should be checked at room temperature in accordance with the original requirement, before placing the capacitors in service. If the leakage current exceeds the value calculated from the formulas, refer to Technical Note on Reform Procedures.

SHELF LIFE

Capacitor Series	Shelf Life Expectancy (years)
3076	3
3120	5
3186	3
3188	4
3191	3
3487	3

GENERAL

In the event that application requirements exceed the parameters of a particular Series, it is often possible to use a standard capacitor, providing certain "trade-offs" are acceptable. It is also possible that special designs and manufacturing techniques not normally included can be applied to meet a special situation. These include the following:

- Higher Vibration Limits
- Higher Ripple Current
- Lower ESR
- Non-Polar Construction
- Solder-Lug Terminals
- Metric Threaded Terminals
- Special Capacitance Tolerance
- Special Marking and Labeling
- Additional Case Sizes

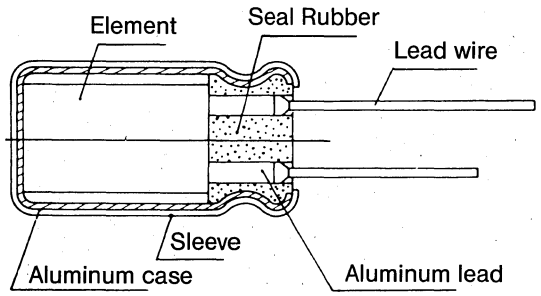
More specific device parameters can be obtained on request, these include:

- ESR at any Frequency (to 100kHz)
- Ripple Current Rating at any Frequency (to 100kHz)
- Impedance and ESR vs. Frequency Plots
- Inductance

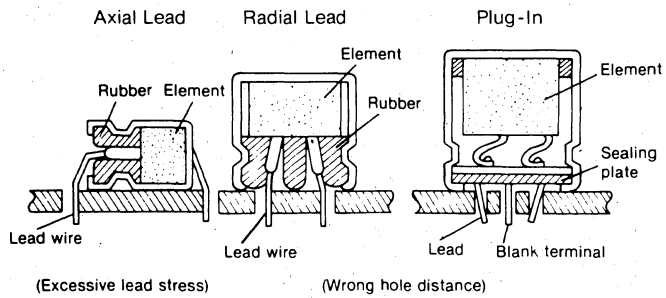
Application Guidelines
Plug-in Axial and Radial Lead Types

Proper handling of aluminum electrolytic capacitors in equipment assembly can insure good performance of the capacitors and a long life.

Insulation
General purpose types of aluminium electrolytic capacitors are covered with a sleeve made of vinyl chloride or the like. This sleeve is used for marking. When the internal element or the container needs to be electrically isolated, capacitors specially designed for insulation requirements should be used.



Mounting
The distance between the terminal holes on the circuit board should be the same as that between the lead wires or terminal of the capacitor. Excessive force in mounting on circuit boards should be avoided.



1. Axial and Radial Lead Types
Improper insertion of the lead wires in circuit boards may cause electrolyte leakage or break the lead wires or impair their connection with the internal elements. When the distance between the two terminal holes on the circuit board cannot be reduced to that between the lead wires, lead-formed capacitors are recommended.

Lead stress should not exceed 1.5 kg. When excessive stress is unavoidable, resin-sealed capacitors such as the 3478 Series are recommended.

2. Plug-in Type
Improper insertion of the terminals in circuit boards may break the terminals or impair their connection with the internal elements.

The blank terminal of a multi-terminal capacitor should be considered to be at the same potential as the electrolyte and should therefore be isolated from the circuit. When the blank terminal cannot be electrically isolated from the circuit, a capacitor with a blank terminal that is insulated from the capacitor element should be specified.

Soldering
Incorrect soldering may shrink or break the sleeve. Please read the following information carefully, before soldering.

1. Too high a soldering temperature or too long a soldering time may cause secondary shrinking of the sleeve which unnecessarily exposes the container. No problems will be observed at a soldering temperature of 260°C or below for no more than 10 seconds.

2. Soldering may melt or break the sleeve, if the sleeve is in contact with circuit patterns. To avoid this problem, the capacitors should be mounted slightly raised from the circuit board. (Lead-formed capacitors are recommended.)

3. Sleeve may be melted by solder which has migrated up through the terminal holes on the circuit board. To avoid this problem, the same application as stated in the foregoing paragraph is recommended.

4. When soldering, heated lead wires or terminals of adjacent components may tear the sleeve if contacted. Please mount carefully so as not to bring adjacent components' terminals or lead wires into contact with the sleeve, particularly when mounting on through-hole circuit boards.

Cleaning

Aluminum can be aggressively attacked by halide ions, particularly by chloride ions. Even small amounts of chloride ions inside of the capacitor will cause corrosion accidents—rapid capacitance drop and venting. Therefore, the prevention of chloride contamination is the most important check point for quality control in our production lines.

At present, chlorinated hydrocarbon organic solvents such as Trichlene,™ Chlorocene,™ and Freon™ are commonly used to remove soldering pastes from circuit boards. However, if general purpose types of aluminum electrolytic capacitors, whose seal constructions are not solvent-proof, are cleaned with such solvents, the solvents may gradually penetrate the seal portion and corrode the inside of the capacitor.

Accordingly, only alcohol base solvents are recommended for cleaning. Chlorinated hydrocarbons are not recommended.

The mechanism of corrosion of aluminum electrolytic capacitors by chloride ions can be explained as follows:

Chlorinated solvents are absorbed and diffuse through the polymer seal to enter the inside of the capacitor. Various chemical reactions may occur depending upon the particular solvent and electrolyte, but the final result is release of chloride ion.

Chloride ion can penetrate through imperfections and micro-cracks in the aluminum oxide dielectric layer to reach the underlying aluminum metal. At these points the metal is attacked with production of a soluble chloride in this anodic half-cell reaction:

$$Al + 3Cl^- \rightarrow AlCl_3 + 3e \quad \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

There is always at least 1-2% water in the electrolyte and this is sufficient to hydrolyze the $AlCl_3$:

$$AlCl_3 + 3H_2O \rightarrow Al(OH)_3 + 3H^+ + 3Cl^- \quad \ldots\ldots (9)$$

This reaction releases chloride ion for further attack of aluminum. The hydrogen ion increases the local acidity which causes oxide dielectric to dissolve.

Thus localized corrosion occurs at an accelerated pace with attack of both metal and dielectric.

Recommended cleaning solvents therefore are those free of halogen. When halogenated solvents must be used, solvent-proof capacitors, whose seal construction are specially designed, are recommended.

Some adhesives, dampproofing agents and dustproofing agents also contain halides and should be used with caution.

Cleaning of "Solvent Resistant" Capacitors

The load life test specifications shall be satisfied after the capacitors are subjected to the following cleaning conditions.

Freon TE® or **Freon TES®**
Max. cleaning time: 5 minutes
Cleaning method: Immersion, ultrasonic, or vapor

—Caution—

1. The capacitors can withstand the immersion cleaning with chlorothene for a maximum of 5 minutes at the normal temperature. However, PVC sleeve swells with chlorothene and then may shrink by heat at drying process. Consult for chlorothene cleaning.
2. When the lead spacing of the capacitor is different from the hole spacing to the PC board, use the lead forming type capacitor to prevent stress on seal.
3. Consult for flux to be used and other cleaning conditions.

(Freon TE and Freon TES are registered trademarks of Dupont, Inc.)

Storage

The characteristics of electrolytic capacitors depend on temperature; the higher the ambient temperature, the faster the deterioration proceeds (leakage current increase, tan δ increase and capacitance drop). Humidity is another deteriorating factor. Capacitors may have their lead wires/terminals oxidize, impairing solderability, when stored in humid places for long periods of time.

Aluminum electrolytic capacitors should be stored at room temperature in dry places out of direct sunlight.

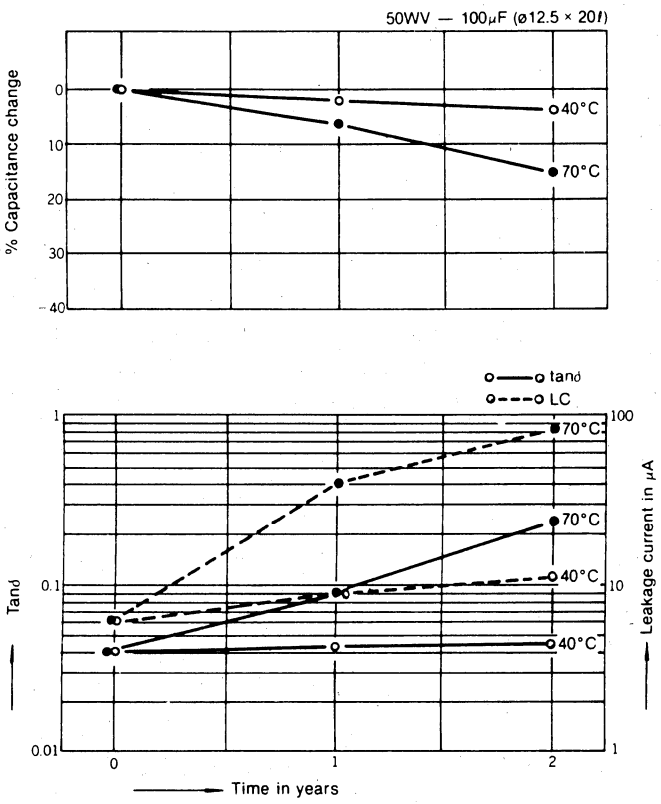
Capacitors stored at room temperature for not more than 2 to 3 years will show a negligible rise in the leakage current and will need no special treatment.

If aluminum electrolytic capacitors are stored above room temperature for long periods of time, the anode foil may react with the electrolyte to increase the leakage current. The application of even normal voltages gives such capacitors larger leakage currents, whereby the amount of gas

Application Guidelines
Plug-in Axial and Radial Lead Types

generated may cause the safety vent to open.
Capacitors stored for long periods of time should be subjected to a voltage treatment* which reforms the dielectric. By this reform process, leakage current is reduced to the initial level. Leakage current increase varies with working voltage of the capacitors, normally in the order:
Low voltage capacitors<Middle voltage capacitors<High voltage capacitors.

Effect of Storage Time and Temperature



***Note**
The voltage treatment is to gradually increase the applied voltage up to the rated value so that the current is set to the capacitor's specified leakage current value, and then keep the applied voltage at the rated value for 30 to 60 minutes.

General Guidelines For Using Electrolytic Capacitors

1. Electrolytic capacitors for DC application require polarization.
Confirm the polarity. If used in reversed polarity, the circuit life may be shortened or the capacitor may be damaged. For use in circuits whose polarity is occasionally reversed, or whose polarity is unknown, use bi-polar capacitors. Also, note that an electrolytic capacitor cannot be used for AC application.

2. Do not apply a voltage exceeding the capacitor's voltage rating.
If a voltage exceeding the capacitor's voltage rating is applied, the capacitor may be damaged as leakage current increases. When using the capacitor with AC voltage superimposed on DC voltage, care must be exercised that the peak value of AC voltage does not exceed the rated voltage.

3. Do not exceed ripple current specification.
Use the electrolytic capacitor at current values within the permissible ripple range. If the ripple current exceeds the specified value, request capacitors for high ripple current applications.

4. Determine the operating temperature range.
Use the electrolytic capacitors according to the specified operating temperature range. Usage at lower temperature will ensure longer life.

5. The standard electrolytic capacitor is not suitable for circuits in which charge and discharge are frequently repeated.
If used in circuits in which charge and discharge are frequently repeated, the capacitance value may drop, or the capacitor may be damaged. Please consult our engineering department for assistance in these applications.

6. Apply voltage treatment to the electrolytic capacitor which has been allowed to stand for a long time.
If the electrolytic capacitor is allowed to stand for a long time, its working voltage is liable to drop, resulting in increased leakage current. If the rated voltage is applied to such a product, a large leakage current occurs and this generates internal heat, which damages the capacitor. If the electrolytic capacitor is allowed to stand for more than 2-3 years, apply a voltage treatment (see note, page 37) before use.

7. Cleaning circuit boards after soldering.
Some solvents have adverse effects on capacitors. Ask our engineering department about suitable cleaning agents.

8. Do not place a soldering iron on the body of the capacitor.
The electrolytic capacitor is covered with a vinyl sleeve to insulate the case. If the soldering iron comes in contact with the electrolytic capacitor body during wiring, damage to the vinyl sleeve and/or case may result in defective insulation, or improper protection of the capacitor elements.

9. Be careful of temperature and time when soldering.
When soldering a printed circuit board with various components, care must be taken that the soldering temperature is not too high and that the dipping time is not too long. Otherwise, there will be adverse effects on the electrical characteristics and insulation sleeve of electrolytic capacitors. In the case of small-sized electrolytic capacitors, nothing abnormal will occur if dipping is performed at less than 260°C for less than 10 seconds.

10. Do not apply excessive force to the lead wires or terminals.
If excessive force is applied to the lead wires and terminals, they may be broken or their connections with the internal elements may be affected. (For strength of terminals, refer to JIS C5102, C5141 and C5142.)

11. Care should be used in selecting a storage area.
If electrolytic capacitors are exposed to high temperatures caused by such things as direct sunlight, the life of the capacitor may be adversely affected. Storage in a high humidity atmosphere may affect the solderability of lead wire and terminals.

12. Surge voltage.
The surge voltage rating is the maximum DC overvoltage to which the capacitor may be subjected for short periods not exceeding approximately 30 seconds at infrequent intervals of not more than five minutes. Unless otherwise specified, the rated surge voltages are as follows:

Rated Voltage (V)	6.3	10	16	25	35
Rated Surge Voltage (V)	8	13	20	32	44

Rated Voltage (V)	50	63	80	100	160	200
Rated Surge Voltage (V)	63	79	100	125	200	250

Rated Voltage (V)	250	315	350	400	450
Rated Surge Voltage (V)	300	365	400	450	500

13. Capacitor case sizes and other product standards specified in this catalog may be changed or modified without notice for improvement of quality.

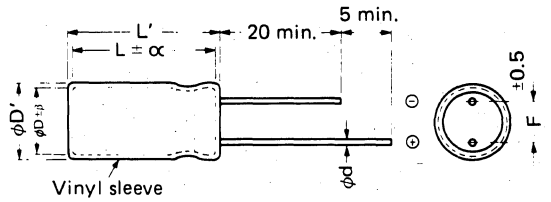
METRIC CONVERSION TABLE

UNINSULATED CASE DIMENSIONS

Case Dimensions		Fig. A	Lead Dia.	Case Dimensions		Fig. A	Lead Dia.
Dia. mm	Length mm	F mm	mm	Dia. Inches	Length Inches	F Inches	Inches
5	11	2	0.5	.197	.433	.079	.020
5	14	2	0.5	.197	.551	.079	.020
6.3	11	2.5	0.6	.248	.433	.098	.024
6.3	14	2.5	0.6	.248	.551	.098	.024
8	11.5	3.5	0.6	.315	.453	.138	.024
8	14	3.5	0.6	.315	.551	.138	.024
10	12.5	5.0	0.6	.394	.492	.197	.024
10	15	5.0	0.6	.394	.591	.197	.024
10	16	5.0	0.6	.394	.630	.197	.024
10	16.5	5.0	0.6	.394	.650	.197	.024
10	20	5.0	0.6	.394	.787	.197	.024
10	20.5	5.0	0.6	.394	.507	.197	.024
12.5	20	5.0	0.6	.492	.787	.197	.024
12.5	20.5	5.0	0.6	.492	.807	.197	.024
12.5	24.5	5.0	0.6	.492	.965	.197	.024
12.5	25	5.0	0.6	.492	.984	.197	.024
12.5	42.5	5.0	0.6	.492	1.673	.197	.024
16	25	7.5	0.8	.630	.984	.295	.032
16	31.5	7.5	0.8	.630	1.240	.295	.032
16	35.5	7.5	0.8	.630	1.398	.295	.032
18	35.5	7.5	0.8	.709	1.398	.295	.032
18	40	7.5	0.8	.709	1.575	.295	.032

CASE OUTLINE DRAWING DIMENSIONS (mm)

FIG. A



Series	D	ϕ5	ϕ6.3	ϕ8	ϕ10	ϕ12.5	ϕ16	ϕ18
3476 3477 3480	L'	L+1.5					L+2.0	
	D'	D+0.5					D+0.5	
	d	0.5	0.6	0.6	0.6	0.6	0.8	0.8
	F	2	2.5	3.5	5	5	7.5	7.5
3481	L'			L+2.0				
	D'			D+1.0				
3478	L'	L+1.0						
	D'	D+0.5						

Conversions of mm to inches for any dimensions not shown on the Conversion Table can be done by dividing mm by 25.4.

METRIC CONVERSION TABLE

METRIC CONVERSION TABLE

UNINSULATED CASE DIMENSIONS

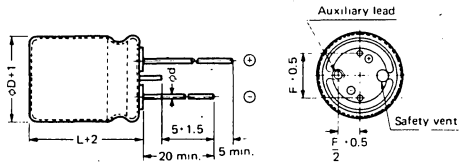
Case Dimensions		Fig. B		Fig. C			Lead Dia.
Dia.	Length	F	F/2	F	F1	F2	
mm	mm	mm	mm	mm	mm	mm	mm
19.1	31.8			7.62	7.62	5.08	1.0
19.1	31.8			7.62	7.62	5.08	1.0
19.1	54			7.62	7.62	5.08	1.0
19.1	66.7			7.62	7.62	5.08	1.0
19.1	81.3			7.62	7.62	5.08	1.0
22	30	10	5				1.0
22	40	10	5				1.0
22.2	28.6			7.62	10.16	7.62	1.0
22.2	31.8			7.62	10.16	7.62	1.0
22.2	41.3			7.62	10.16	7.62	1.0
22.2	54			7.62	10.16	7.62	1.0
22.2	66.7			7.62	10.16	7.62	1.0
22.2	81.3			7.62	10.16	7.62	1.0
25.4	31.8			10.16	10.16	7.62	1.0
25.4	40	12.5	6.25				1.0
25.4	41.3			10.16	10.16	7.62	1.0
25.4	51	12.5	6.25				1.0
25.4	54			10.16	10.16	7.62	1.0
25.4	66.7			10.16	10.16	7.62	1.0
25.4	81.3			10.16	10.16	7.62	1.0
25.4	92.1			10.16	10.16	7.62	1.0
30	50	15.0	7.5				1.2

Case Dimensions		Fig. B		Fig. C			Lead Dia.
Dia.	Length	F	F/2	F	F1	F2	
Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
.752	1.252			.3	.3	.2	.040
.752	1.626			.3	.3	.2	.040
.752	2.126			.3	.3	.2	.040
.752	2.626			.3	.3	.2	.040
.752	3.201			.3	.3	.2	.040
.866	1.181	.394	.197				.040
.866	1.399	.394	.197				.040
.874	1.126			.3	.4	.3	.040
.874	1.252			.3	.4	.3	.040
.874	1.626			.3	.4	.3	.040
.874	2.126			.3	.4	.3	.040
.874	2.626			.3	.4	.3	.040
.874	3.201			.3	.4	.3	.040
1.000	1.252			.4	.4	.3	.040
1.000	1.399	.492	.246				.040
1.000	1.626			.4	.4	.3	.040
1.000	1.968	.492	.246				.040
1.000	2.126			.4	.4	.3	.040
1.000	2.626			.4	.4	.3	.040
1.000	3.201			.4	.4	.3	.040
1.000	3.626			.4	.4	.3	.040
1.181	1.968	.591	.295				.047

CASE OUTLINE DRAWING DIMENSIONS (mm)

FIG. B

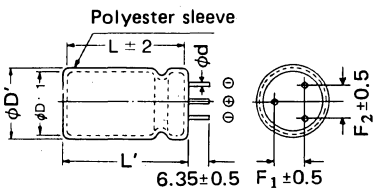
Series		22	25.4	30
3479	F	10.0	12.5	15.0
	d	1.0	1.0	1.2



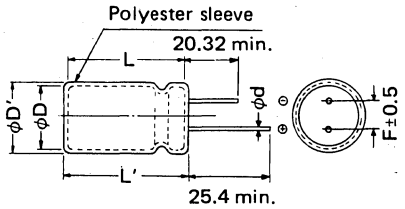
(Note) Use auxiliary terminal independent of all other circuits.

FIG. C

3 Leads Single Ended



2 Leads Single Ended



Series	φD	19.1	22.2	25.4
3482	φD'	φD+0.78	φD+0.78	φD+0.78
	L'	L+1.77	L+1.77	L+1.77
	F	7.62	7.62	10.16
	F1	7.62	10.16	10.16
	F2	5.08	7.62	7.62
	φd	1.0	1.0	1.0

Conversions of mm to inches for any dimensions not shown on the Conversion Table can be done by dividing mm by 25.4.

Summary of JIS C5141/C5102

Scope

This standard specifies the characteristics, ratings, and dimensions of polarized, aluminum-foil, dry-type electrolytic capacitors for electronic equipment, based on JIS C5140—General Rules for Electrolytic Capacitors, mainly to be used in DC circuits.

The testing method shall comply with JIS C5102—Methods for Testing of Fixed Capacitors for Electronic Equipment.

Table 1

No.	Item			Performance Characteristic					Testing method (JIS C5102)	Summary of testing method in JIS C5102
				C	B	E	A	W		
1	Range of operating temperature °C			−40 ~ +85	−25 ~ +85	−25 ~ +70	−10 ~ +85	−25 ~ +70		
2	Range of rated voltage V			6.3 ~ 450				100 ~ 450 / 63 ~ 100 (excl.)		
3	Construction and dimensions			To comply with Figs. and Tables					To comply with 6.1 and 6.3	Appearance by visual Dimensions by either caliper or micrometer
4	Marking		Marked items	To satisfy 3					To comply with 6.2	Marking by visual
			Solvent resistance	To be easily readable					To comply with 6.2.1 Reagent to be acetone	Immersed & stationary in reagent at 20 to 25°C for 30±5 seconds
5	Leakage Current μA	CV product 1000 or under	Grade X	0.05CV+10			N/A			Precondition for 30 minutes at rated voltage at 20-25°C, 24-48 hours prior to measurement. VOLTAGE: Rated Voltage TIME: 5 minutes after the voltage has reached the rated value. PROTECTIVE SERIES RESISTOR: About 1,000 ohms.
			Grade Y	0.1CV+60			0.1CV +160	0.06CV +10		
		CV product over 1000	Grade X	0.03CV+30			N/A			
			Grade Y	0.06CV+100			0.06CV +200	0.04CV +30		
6	Tolerance on capacitance %	Nominal capacitance 4.7 μF or under	Rated voltage 6.3V or over up to 100V (excl.)	−10 ~ +150					To comply with 7.4. Measuring circuit to comply with Fig. 6C Measuring frequency 120Hz=10% The peak of measuring voltage not to exceed the rated voltage.	
			Rated voltage 100V or over up to 350V (incl.)	−10 ~ +100						
			Rated voltage over 350V	−10 ~ +75						
		Nominal capacitance over 4.7 μF	Rated voltage 6.3V or over up to 100V (excl.)	−10 ~ +100			−10 ~ +150			
			Rated voltage 100V or over up to 350V (incl.)	−10 ~ +75			−10 ~ +100			
			Rated voltage over 350V	−10 ~ +50						
7	Tangent of loss angle[2]	Rated voltage up to 10V (incl.)		0.5 max.					To comply with 7.5. Test method of No. 6 applies.	
		Rated voltage over 10V up to 25V (incl.)		0.35 max.						
		Rated voltage over 25V up to 63V (incl.)		0.25 max.						
		Rated voltage 63V up to 315V (incl.)		0.2 max.						
		Rated voltage over 315V		0.25 max.						

Summary of JIS C5141/C5102

Table 1 Continued

No.	Item			Performance Characteristic C	B	E	A	W	Testing method (JIS C5102)	Summary of testing method in JIS C5102
8	Surge voltage	Leakage current		Not to exceed value given in No. 5					To comply with 7.10.[3] Testing temperature for characteristics C, B and E. maximum operating temperature ±2°C: for characteristics A and W. 15 to 35°C.	Precondition per No. 5 above prior to Surge Test. Test conditions are: VOLTAGE: Surge voltage specified in the individual standard. SERIES PROTECTIVE RESISTOR: About 1,000 ohms. Voltage applied 1,000 times for 30±5 seconds at intervals of 5±0.5 minutes without discharging.
		Capacitance		Not less than 85% of the value before test			Not less than 80% of the value before test			
		Tangent of loss angle		Not to exceed 175% of the value given in No. 7			Not to exceed 200% of the value given in No. 7			
		Appearance		No notable change to be found						
9	Withstand voltage[4]			No flashover, dielectric breakdown to take place					To comply with 7.1 To apply 1500V (1000V for rated voltage less than 300V) for 1 minute between the case and mounting fittings.	
10	Insulation resistance[4]			Not less than 10 MΩ					To comply with 7.2 Measurement to be made between the case and mounting fittings with a 500V insulation resistance tester.	
11	Terminal strength	Tensile strength		No breaking or loosening of terminal					To comply with 8.1. Test condition (A) Duration of load Application 10=1 sec.	Lead Wire Terminal Dm. (mm) / Load (kg): 0.3 thru 0.5 — 0.5; >0.5 thru 0.8 — 1.0; >0.8 thru 1.2 — 2.5; >1.2 — 4.5
		Bending strength								
12	Vibration resistance	Capacitance		Measured values to remain stable during measurement (when measured several times within 30 minutes before the end of the test)					To comply with 8.2. class (A). Vibration to be applied for 2 hours each in the directions parallel and perpendicular to the longitudinal axis of the capacitor. Total 4 hours.	VIBRATION FREQUENCIES. 10 to 55 to 10Hz. in 1 minute. Simple harmonic motion. TOTAL AMPLITUDE: 1.5mm
		Appearance		No notable change to be found						
13	Solder-dip heat resistance	Leakage current		Not more than value given in No. 5					To comply with 8.3. Temperature of solder 350±10°C, dipping time 3±0.5 seconds.	The depth of dipping the terminal in flux and solder shall be up to 4±0.8mm from the roof of the terminal, unless otherwise specified.
		Variation of capacitance		Within ±10% of the value before test						
		Tangent of loss angle		Not more than value given in No. 7						
		Appearance		No notable change to be found						
14	Solderability			A minimum of 75% of the terminal surface must be covered with solder.					To comply with 8.4. Temperature of solder 230±5°C. dipping time 2±0.5 seconds.	FLUX. Methanol and solution of rosin to be used OBSERVATION: It shall take place after dipping OBSERVATION INSTRUMENT. Projector or magnifying glass with the magnification of about 10.
15	Stability at low temperature and high temperature	Step 2	Impedence ratio	Ratio to value in Step 1 to be not more than value given in Table 2					To comply with 9.11. Measurement of impedance to comply with 7.7. Measuring frequency 120Hz±10%.	See Table 3
		Step 4	Variation of capacitance — Rated voltage 160V or under	Within±25% of value in Step 1						
			Variation of capacitance — Rated voltage over 160V	Within ±20% of value in Step 1						
			Tangent of loss angle	Not more than value given in No. 7						
		Step 5	Leakage current	Not more than value given in No. 5						
			Variation of capacitance	Within±11% of value in Step 1						
			Tangent of loss angle	Not more than value given in No. 7						

Summary of JIS C5141/C5102

Table 1 Continued

No.	Item			Performance Characteristic C	B	E	A	W	Testing method (JIS C5102)	Summary of testing method in JIS C5102
16	Temperature and immersion cycle	Leakage current		Not more than value given in No. 5			N/A		Temperature Cycle per 9.3 follow immediately by Immersion Test per 9.4. Wash with water, dry at room temperature for 1 to 4 hours. Voltage condition per No. 5 above. Make measurements.	IMMERSION CYCLE: (2) cycles in (2) baths First bath clean water at 65°±5°C for 15 minutes followed by 0°±3°C saturated salt water bath for 15 minutes.
		Variation of capacitance	Rated voltage 160V or under	Within ±15% of value before test						
			Rated voltage over 160V	Within±10% of value before test						
		Tangent of loss angle		Not more than value given in No. 7						
		Appearance		No notable change to be found						
17	Moisture resistance (steady state)	Leakage current		Not more than value given in No. 5					To comply with 9.5. Test conducted at no load Test time, characteristics C, B and E, Grade X 500±12 h Grade Y, 240±8 h A and W, 120±6 h After completion of test. voltage condition per No. 5 above. Then measurements to be made.	TEMPERATURE: 40±2°C RELATIVE HUMIDITY 90 to 95%. NO VOLTAGE SHALL BE APPLIED
		Variation of capacitance	Rated voltage 160V or under	Within±15% of value before test						
			Rated voltage over 160V	Within ±10% of value before test						
		Tangent of loss angle		Not more than value given in No. 7						
		Appearance		No notable change to be found						
18	Reduced pressure			No flash-over, dielectric breakdown, swelling or breaking of case, leakage of electrolyte to take place	N/A				To comply with 9.8. Air pressure 113±5 mbar. DC voltage equal to rated voltage to be applied for 1 minute.	
19	High temperature loading	Leakage current		Not more than value given in No. 5					To comply with 9.10[3] Test temperature maximum operating temperature ±2°C Test time: characteristics C, B and E, Grade X, 200±12 hours Grade Y, 1000±12 hours A and W, 500±12 hours Applied voltage DC voltage equal to rated voltage to be applied through series protective resistor (about 1000) For Grade X, maximum permissible ripple current to be passed through capacitor.	
		Capacitance		Not less than 85% of value before test			Not less than 80% of value before test			
		Tangent of loss angle		Not more than 175% of value given in No. 7			Not more than 200% of value given in No. 7			
		Appearance		No notable change to be found						

Table 2

Rated voltage V	Impedance ratio (Z_T /Z_{20}) Charactistic C	Characteristics B, E, A and W (less than 100V)	Characteristic W (100V to 450V)
3.15 to 6.3 (incle.)	60	8	–
6.13 to 315 (incle.)	16	4	12
315 to 350 (incle.)	40	8	24
350 to 450 (incle.)	80	20	60

Remarks 1. Z_T: impedance (Ω) at the lowest operating temperature
2. Z_{20}: impedance (Ω) at 120°C
3. Measuring frequency to be 120Hz±10%

Table 3

Step	Temperature °C	Time min.
1	Minimum working temperature $^{0}_{-3}$	30
2	Room temperature	10–15
3	Maximum working temperature $^{+3}_{0}$	30
4	Room temperature	10–15

MODERN ELECTROLYTIC CAPACITOR TECHNOLOGY

GENERAL

The ability of a capacitor to store electrical energy is a direct function of its mechanical geometry and its chemical composition. The amount of energy that it can store is given by the equation:

$$Q = CV$$

where Q = the magnitude of the stored charge
C = the capacitance in farads
V = the applied voltage

But the capacitance is determined by:

$$C + K\frac{a}{d}$$

where **a** is the directly opposing area of the plates, **d** is the distance between them (assumed to be uniform across the area), and **K** is the "dielectric constant" of the material separating them.

Engineers and scientists have been wrestling with these factors for generations, in the perennial effort to cram more and more capacitance into less and less space, in conformance with the unending trend of equipment miniaturization.

Obviously, increasing the area (**a**) of the capacitor plates will increase the capacitance of the device. This would tend to increase the size, but since only the area, not the thickness, of the plates is significant (in most applications) the plates could be made thinner to counteract the increase. Ways were developed to produce ever thinner metal foils, and eventually to deposit thin metallic films directly on both sides of a paper or plastic ribbon which can then be rolled up.

Reducing the thickness of the dielectric separator will also increase the capacitance of the device by reducing the distance (**d**) between the plates; this also reduces the size for a given capacitance, or allows more capacitance to be installed in a given space. Advancements in the production of high-quality, homogeneous plastic films of very thin gauges have enabled substantial reduction in capacitor size, combined with worthwhile increase in capacitance per unit volume.

Use of dielectric materials having higher dielectric constants will also increase the capacitance of the device, hopefully with a decrease (or at least no increase) in unit size. The search for better materials will continue.

One of the major breakthroughs in this field occurred about 85 years ago: the development of the electrolytic capacitor, a brilliantly ingenious expedient for obtaining high capacitance in a small space. Essentially, it consisted of an aluminum-foil ribbon, on the surface of which a thin film of aluminum oxide has been formed electrochemically, and a water-based electrolyte fluid which acts as the opposing plate. The oxide-coated foil, a second strip of aluminum foil, and a porous strip of paper interposed between them were rolled up together, and suspended in the liquid electrolyte, which penetrated the porous spacer. The physical relationship is diagrammed in Figure 1.

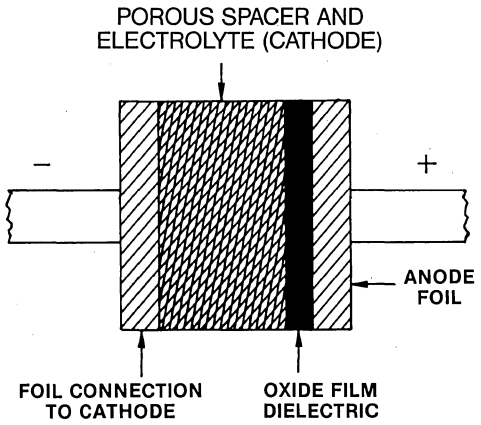


Figure 1. Polarized Electrolytic Capacitor.

The oxide-coated foil is the positive plate (anode), the aluminum oxide film is the dielectric, and the fluid electrolyte is the negative plate (cathode). The second strip of aluminum foil serves only as a connection in broad and intimate contact with the negative-plate electrolyte, and is usually bonded to the aluminum can that houses the capacitor. The porous strip prevents direct short-circuits between the two foil strips.

The oxide dielectric has a thickness on the order of 0.01 micron; thus the distance (**d**) between the "plates" has been reduced almost to the vanishing point. Furthermore, the dielectric constant (**K**) of this oxide is approximately 11. compared to 5

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for paper, or 3 for polycarbonate or Mylar® plastic film. As a result, the capacitance per cubic inch in an electrolytic capacitor is increased tremendously, compared to conventional capacitor designs, even in the original electrolytic versions.

Over the years since their inception, there have been continuous improvements in electrolytic capacitor designs, and advancements in their technology. One of the most significant was that of etching the anode plate. The etching action exposes the grain structure, enormously increasing the area of the surface for a given area of foil. Etching of a given area of aluminum foil results in a many fold increase in the actual surface area facing the electrolyte plate, in the finished capacitor. Two other notable advancements were the development of non-aqueous and solid electrolytes, and of practical manufacturing techniques for the production of high-purity aluminum foil. Both of these factors will be examined in detail later, in conjunction with capacitor fabrication.

While the energy storage capabilities of aluminum electrolytic capacitors are impressive, electrolytic construction has certain inherent limitations that affect the use and performance of these capacitors. Safe operating voltages are limited to about 450 volts. The oxide dielectric has rectifier properties, blocking current flow in one direction but offering low resistance in the opposite direction; it is therefore limited to DC applications, and a voltage reversal of more than a volt or two will cause breakdown of the film and destruction of the capacitor. (Non-polarized types for AC applications are available. Their construction is essentially the same as shown in Figure 1, but *both* foils are coated with oxide dielectric, constituting two capacitors connected back to back). The power factor of electrolytics is considerably higher than those of other capacitor types, and the broad plate area makes for appreciable leakage.

PRODUCTION TECHNOLOGY

The design and fabrication of an electrolytic capacitor is an extremely complex science. The physical principles involved, and their interlocking—and occasionally mutually exclusive—relationships have been the subject of continuous, heavy research for more than 80 years. Some of the developments that have evolved are discussed below.

The Anode (Positive Plate). Capacitance is directly proportional to the surface area of the capacitor plates. This factor has been uniquely exploited in electrolytic design by etching the surface of the anode foil, either *chemically,* by immersion in an acid bath such as hydrochloric acid, or *electrochemically* by immersion in a conductive, corrosive bath such as a solution of sodium chloride, and applying an electric current to the foil and solution. In both cases, the etching action exposes the grain structure of the metal, enormously increasing the area of the surface for a given area of foil. The degree of etch is controlled by immersion time in chemical etching, and by the regulation of current flow in electrochemical etching.

The presence of impurities (principally copper, silicon, magnesium, iron, and zinc), in the anode foil, can result in early failure of an electrolytic capacitor. Particles of other metals do not form an oxide barrier layer as aluminum does, hence constitute leakage paths. They also form galvanic couples with aluminum and will produce hydrogen gas in the presence of an electrolyte, besides reducing the efficiency of the oxide-layer barrier and causing generation of excessive heat. For these reasons, high-purity aluminum is used for foils, and the electrochemical etching process is the most suitable for use on this material. Lower-purity aluminum is used for the cathode foil.

In the electrochemical etching process, high etching-current density produces a fine etch pattern, with very high surface gain. However, when this surface is anodized (as discussed later) to voltages above 100 volts, the thickness of the oxide layer formed will bridge over some of the fine depressions of the etch pattern, reducing the surface gain, and the forming reaction will cause mechanical erosion of the peaks of the etch, further reducing the effective area.

Using the lower etching-current density produces a coarser surface, but the higher resistance to erosion and over-bridging results in a higher final capacity, when anodized at higher voltages. Thus, there is a trade-off relationship between etch coarseness and forming voltage in achieving maximum capacity at a selected working voltage, in a capacitor of given size. It is possible to custom-tailor the etch for optimum capacity at

a given voltage.

The foil is run as a continuous ribbon through the precleaning bath, then over a roller which supplies the current for etching, then down into the etching tank, then through a series of baths that remove the etch solution, neutralize residual salt, remove loose metal particles, and wash away any remaining materials carried over from the processing tanks. The foil is then dried and immediately rolled, and protected from the atmosphere to prevent formation of "non-barrier" oxide prior to its entry into the anodizing, or forming, process.

Two types of "anodized" films can be formed on aluminum. In contact with moist air, the surface layer of aluminum forms a porous oxide of regular structure and low resistance, known as non-barrier oxide. When immersed in certain electrolyte solutions and connected to a DC power source as an anode with the solution as a cathode, the surface layer of aluminum forms an impervious, amorphous film of aluminum oxide having the property of restricting the flow of current in one direction and permitting it to flow in the opposite direction. This barrier oxide layer has a thickness which is a function of the applied voltage—approximately 14 angstroms per volt, at room temperature. The forming voltage must be considerably higher than the proposed operating voltage, to provide adequate dielectric strength over a long operating life despite aging effects. Leakage current increases rapidly as the operating voltage approaches the forming voltage value, particularly in "wet" electrolytics.

Needless to say, the foil, the electrolyte, and the tanks and apparatus must all be of the highest purity, and cleanliness. The presence of impurities can result in porosity in the oxide film, and can cause some dissolving of the film in the electrolyte—an effect that can double for every 10°C rise in the temperature of the solution. Impurities remaining in the elements of a finished capacitor will cause reactions that will result in high leakage, early deterioration, and outright failure after a short operating life.

The Electrolyte. In an electrolytic capacitor the electrolyte constitutes the second electrode, or plate, separated from the anode, or positive plate by the barrier layer of oxide formed on the anode surface. Ideally, it must be chemically inert, and have good temperature stability, and the proper conductivity. If the conductivity is too low, a high ESR (equivalent series resistance) results, with consequent high loss factor. If the conductivity is too high for the rated operating voltage, electrolytic breakdown in the form of sparking occurs (known as "scintillation"), resulting in failure of the capacitor.

"Wet" electrolytic capacitors use a liquid electrolyte; the solvent (usually from the glycol family), some form of conductive salts, and a controlled amount of water. A porous ribbon of a nonconductive material such as a highly absorbent paper is wound as a separator between the two foils, and this ribbon is saturated with the electrolyte. The construction of such a capacitor is shown on Figure 2. The rolled element is installed in a cylindrical metal container which may be connected to the cathode foil. A plastic sleeve is provided on some types, to facilitate the use of off ground applications.

Limiting the amount of water in the electrolyte limits gassing and chemical activity, thereby increasing life expectancy. Low water levels in electrolytes also increase the shelf life. Using solvents less viscous than glycols, as an example amides, and more soluble salts, enables the electrolyte to penetrate into the fine etch structure of the foil more readily, thus contacting a greater surface area. This increases the ratio of unit capacitance to contact area and further reduces E.S.R.

Low viscosity electrolytes have additional desirable characteristics, they maintain more uniform conductivity at higher frequencies as shown in Figure 3, enhancing their utility as components in switching regulated power supplies. The lower E.S.R. also enables these units to handle higher ripple currents than previously permitted.

The resistivity of electrolytes particularly with high water content, varies with temperature especially below 25°C. This results in high loss of capacitance and increase in E.S.R. at temperatures below −10°C. The high water content in electrolytes also limits their use to a maximum temperature of +85°C. At these high temperatures they have limited life expectancy and shelf life. Local sites in the aluminum foil are activated by water, allowing exposure of bare metal. This results in high leakage current when a stored capacitor is subjected to applied voltage. If this leakage

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current can reach a sufficient magnitude from an unregulated source, the unit may go into thermal runaway, with subsequent failure.

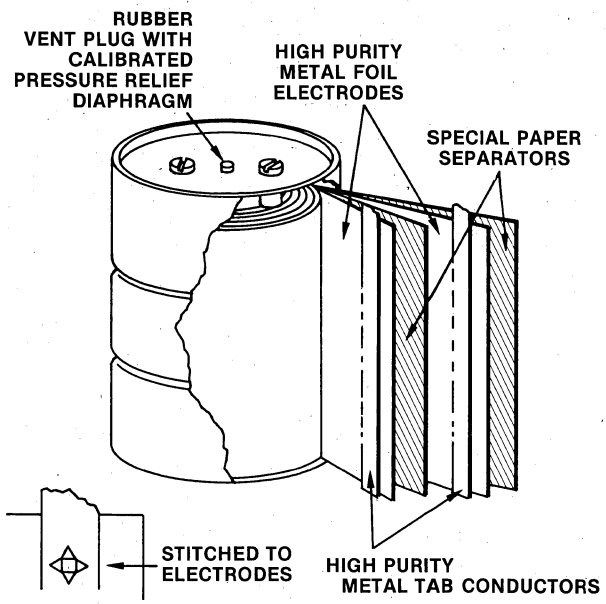


Figure 2. Basic construction of a concentrically wound computer grade electrolytic capacitor.

At extremely low temperatures, conventional glycol family electrolytics lose in excess of 35% of their capacitance, and increase their E.S.R. manyfold, in relation to their room temperature values. These effects are caused by the increase in resistivity of the electrolyte, due to increased viscosity or sometimes by crystalization, as well as its shrinkage from the etch pattern of the foil. This results in poor contact between the electrolyte and the foils. This type of capacitor becomes a practically pure resistive device at −60°C due to these effects.

While it is a fact that amide based electrolytes produce capacitors with superior low temperature characteristics, such as an 80% capacitance retention at −55°C, they have several undesirable characteristics. The vapor pressures of amide base electrolytes are much higher than for glycols, thereby requiring superior sealing characteristics, and special materials in their containers. The high vapor pressures effect the long term life at high temperature operation. The toxicity of the amides is also considerably greater than glycols and they may also have adverse ecological effects.

Mepco/Centralab has developed non-aqueous, glycol family, electrolytes that possess excellent E.S.R. characteristics and superior, long term, high temperature operation. This is illustrated in Figure 4. This shows the superior E.S.R. stability of the glycol electrolyte vs the amide based on at 105°C operation.

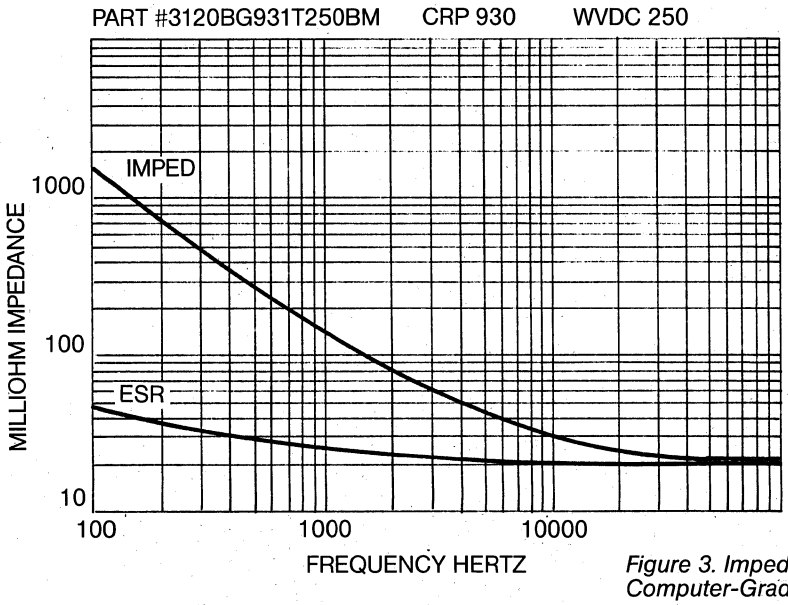


Figure 3. Impedance vs. Frequency Characteristic of Standard Computer-Grade Electrolytic Capacitors.

LIFE TEST CHARACTERISTICS ESR @ 105°C DMF VS GLYCOL LOW VOLT ELECTROLYTE

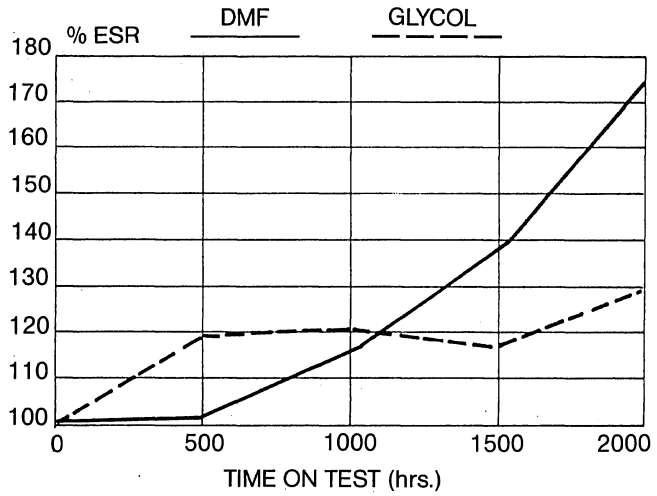
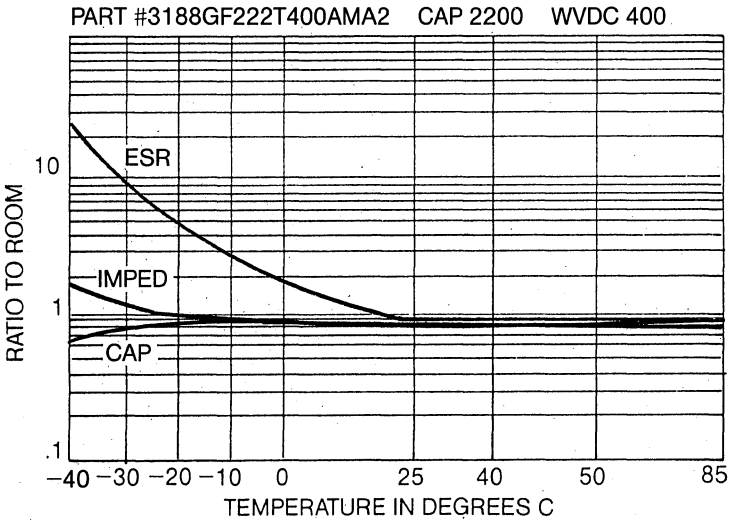
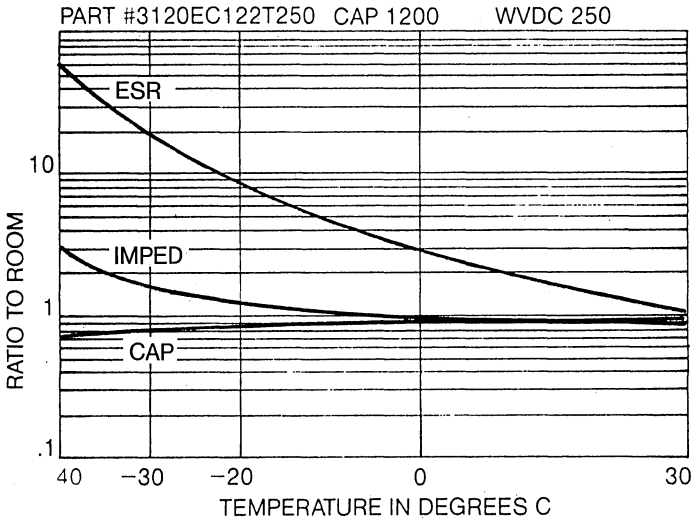


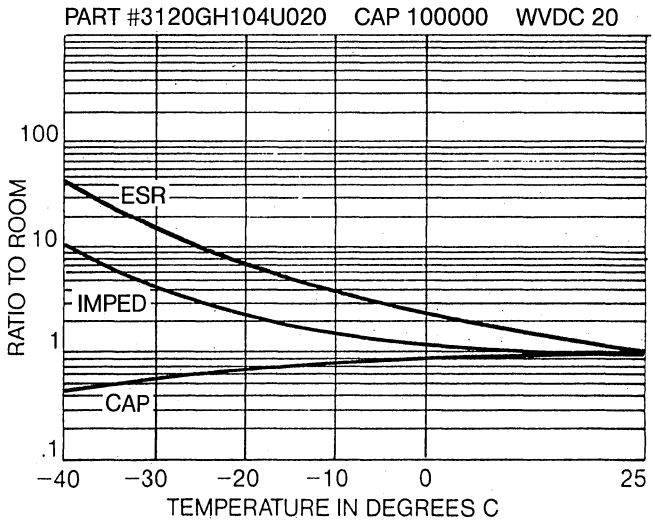
Figure 4. E.S.R. Stability comparison at high temperature of amide vs. glycol base electrolytes.

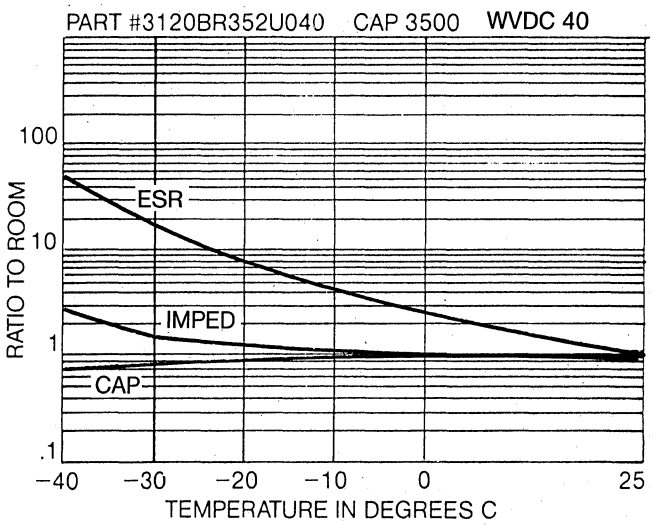
While the low temperature characteristics are somewhat inferior, the following curves should indicate that they are quite acceptable for all but the most critical military applications.

The following figures illustrate typical low temperature operating characteristics with the newly developed and utilized electrolytes.









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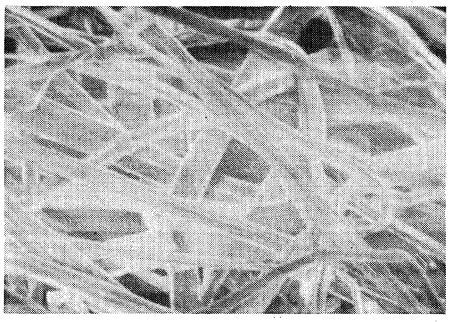
The Spacer. The characteristics of the spacer that separates the foil ribbons influence the ESR of the capacitor. Each type of spacer has a resistance factor dependent upon its density, type of fiber, and fiber shape. In the design of low-ESR capacitors, it is essential to use spacers with low resistance factors. At present, the lowest resistance-factor spacers are of the lowest-density types, and since this low density is associated with minimum mechanical strength, special equipment is required to utilize them effectively. Proper design sometimes involves use of more than one spacer for optimum electrical characteristics and ease of manufacture. Figure 9 presents microphotographs of various spacers, showing their fiber structure.

The Cathode. The cathode foil in an electrolytic capacitor serves as a means of making extended contact with the electrolyte throughout the length and breadth of the separator strip. However, it also effectively forms another capacitor with the electrolyte, in series with the anode capacitor. The total effective capacitance is:

$$\frac{1}{C_{total}} = \frac{1}{C_{anode}} + \frac{1}{C_{cathode}}$$

Theoretically, the cathode foil has no insulation or oxide coating; its capacitance therefore should be infinitely large, and the total capacitance would be governed by the anode alone. Actually, a thin oxide film of some sort forms on the metal through exposure to the atmosphere and to the electrolyte, reducing this capacitance, though in all but low-voltage electrolytics it is considerably higher than the anode capacitance because of the relative thinness of the cathode film.

Non-polar electrolytic capacitors are essentially two capacitors connected back to back. Both foils are anodized to form oxide barrier layers, and they share the electrolyte in common. The system is inefficient, having a high power factor due to the large ESR, but is an effective and economical device in such AC applications as motor-starting capacitors where the intermittent use allows time for dissipation of generated heat between operations. The capacitor manufacturer is well equipped to advise a customer on his specification, and his application, to maximize performance and life at minimum cost, and to adjust his processes to produce the idealized capacitor.



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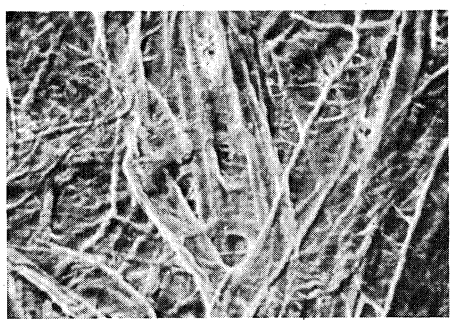

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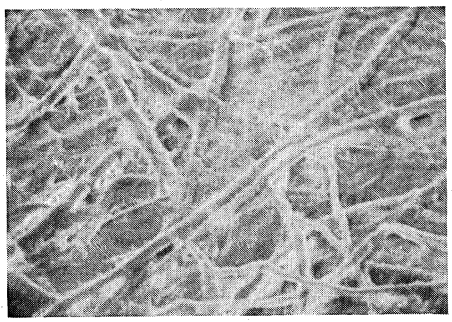

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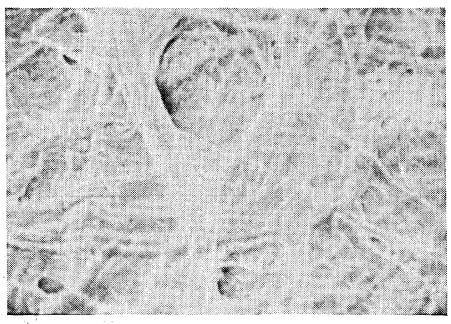

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Figure 9. Fiber Structures of Spacers.

ELECTRO-MECHANICAL CONSIDERATIONS

Several mechanical innovations have been incorporated into electrolytic capacitor design, aimed at improving the electrical performance as well as the efficiency of these components. A very significant one is the multi-tabbing of the foil windings. Since the foil cross-section is extremely small, the foil resistance can be appreciable, especially in the larger-diameter units. An effective method for minimizing this resistance is to install several connection tabs at equal distances along the length of the foils. This has the effect of connecting the resistance of the segments in parallel, thereby reducing the total resistance of the foil ribbon, and lowering the ESR.

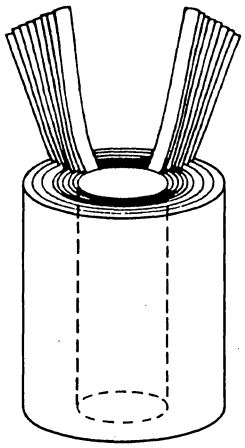

Figure 10. Multi-Tabbed Doughnut-Wound Capacitor.

The coiled helices of foil, being effectively in series with the conductive paths in the capacitor, also contribute some inductance to the ESL (equivalent series inductance) of the unit. But multi-tabbing reduces this effect significantly, not only by connecting the inductances of the segments in parallel, but also by the bifilar action of the centered tabs. For most effectively minimizing ESR and ESL, the tabs must be placed in the exact mathematical center of each segment; this placement is now accomplished by computerized techniques, which locate the tabs for optimum electrical performance, and for mechanical ease of assembly. Figure 10 shows this multi-tabbed construction, and Figure 11 shows typical characteristics achieved with this design. Capacitors of this construction can attain ESR values of less than 2 milliohms in the 120Hz-40kHz frequency range.

Another benefit of the multi-tabbing technique is greater realization of capacitance in high-capacitance, low-voltage units. Since the unit capacitance with its associated individual foil resistance is a strip-line network, reduction of this resistance increases the effective capacitance at the terminals of the device.

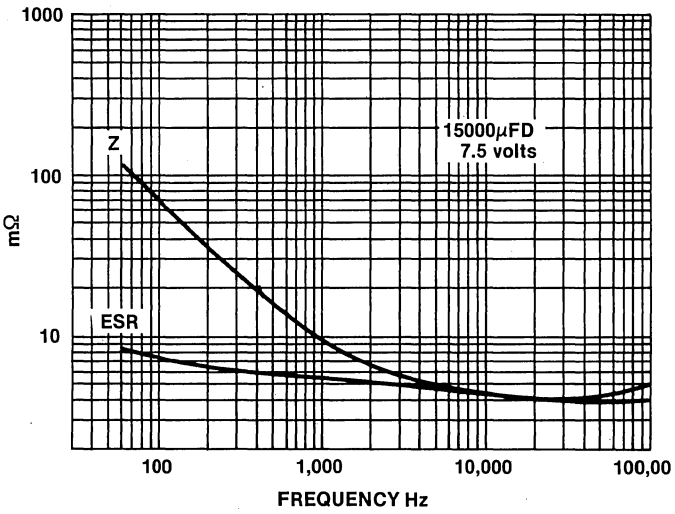

Figure 11. Impedance and ESR vs. Frequency, Mepco/Centralab High-Frequency Capacitor.

Another recent improvement is the elimination of potting compound. This is available on special order when a higher than standard vibration is a requirement. In previous designs, a bituminous compound was used to anchor the capacitor element in its metal case to prevent damage or failure due to mechanical vibration; this compound, being a poor thermal conductor, constituted a barrier to efficient heat dissipation from the element. Mepco/Centralab developed a method (patent pending) of crimping the sides of the case to achieve direct contact with the capacitor element as shown in Figure 12. This achieves a positive anchoring of the element, preventing its movement in any direction when subjected to vibration.

Direct and firm contact between case and element provides excellent thermal conductivity from the element to the ambient atmosphere and chassis or frame support, resulting in cooler operation of the capacitor. In addition, absence of potting material results in uniform gas expansion space in each unit, increasing the operating life of the capacitor. Units with this construction

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are the most suitable for mounting in any plane during operation.

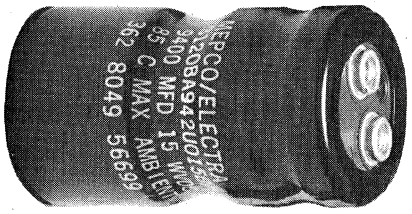

Figure 12. Crimped Case.

Further enhancement of the thermal efficiency of the unit is achieved by winding the capacitor element with a large core opening (see Figure 10). The development of foils with higher capacitance per unit area decreases the foil length required for a given capacitance rating. By keeping the outer diameter constant, for efficient roll contact with the case, and increasing the internal core size, a higher thermal efficiency is realized.

Thermal efficiency can also be boosted by judicious use of forced-air cooling in some applications. Occasionally, a power-supply designer will calculate the proper capacitance value for the filter, then find that the ripple-current requirements exceed the capability of the selected capacitor. The need for adding more capacitance in this situation can often be avoided if forced air is used to increase the ripple-current capability of the capacitor. As shown in Figure 13, the thermal resistance from the case of the capacitor to ambient can be reduced to less than 30% of the still air value. Another factor which is also shown is that the optimum air velocity is from 300 to 400 feet per minute. Air flow greater than 400 feet per minute causes very little decrease in thermal resistance.

The case to ambient thermal resistance in °C/watt can be approximated by:

$O_{ca} = K/A,$

where:

O_{ca} = Thermal resistance case to ambient (°C/watt)

A = Surface area of metal case (in^2)

K = 165 for still air

K = 64 for forced air at 300 ft./min. velocity

The graph in Figure 14 demonstrates how more power can be dissipated in the components when forced air is used. The ratio of the two curves is 2.6, which means that 2.6 times the still air power can be dissipated with 300 ft./min. forced air. In aluminum electrolytic capacitors this gives a 50% increase in ripple current capability.

DEFINITION OF CAPACITOR PARAMETERS

Electrically, an ideal capacitor exhibits only capacitance between its terminals—no resistance, no inductance—and when a varying voltage is applied, the current flowing in it will lead the voltage applied across it by 90°. In practical capacitors the situation is as shown in Figure 15, the lumped-parameter circuit for a capacitor. Because of its physical construction and composition, the capacitor unavoidably includes both inductance and resistance in series with the capacitance, and minute leakage paths through the dielectric add some resistance in parallel with the capacitance.

ESL, the "equivalent series inductance," is determined by the mechanical construction of the finished capacitor. ESR, the "equivalent series resistance," in an electrolytic capacitor is determined by the electrolyte, the spacer, the dielectric (barrier oxide), and the foil resistance. R_L, the DC resistance due to leakage current, is determined by the qualities of the dielectric. The actual values of these lumped parameters vary quite widely among electrolytic capacitors because of differences in size, and in forming techniques, as well as in construction and composition. In any given capacitor, they also vary with ambient conditions, and with applied voltage, waveform, and frequency. What is more, they often vary in a nonlinear manner. For these reasons, capacitor parameters must often be qualified by stating range limitations and conditions of operation. This has some significant influences on the equipment designer's choice of a capacitor, and its performance in a particular application, as indicated in the following discussions.

CAPACITANCE. The capacitance of an electrolytic capacitor is normally stated in microfarads, though the time is approaching when single units will offer one or more farads of capacitance in a container of practical size. The forming process used to establish operating voltage ratings is a precise science, but it is not yet exact. Therefore

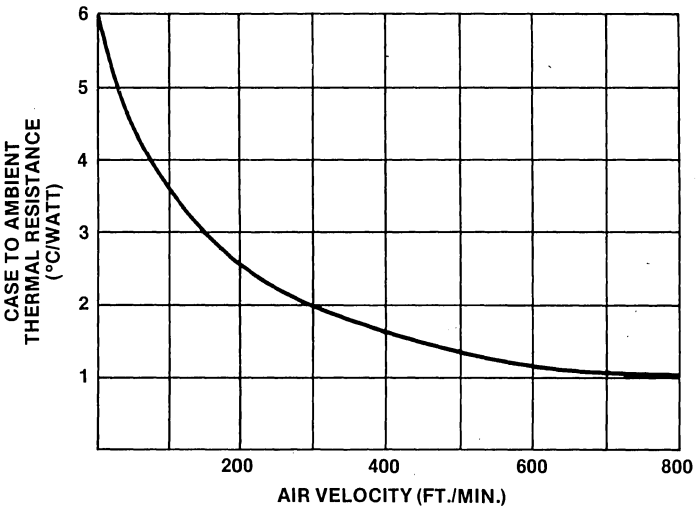

Figure 13. Thermal Resistance vs. Air Velocity. (2.00" x 4.125" cylindrical case)

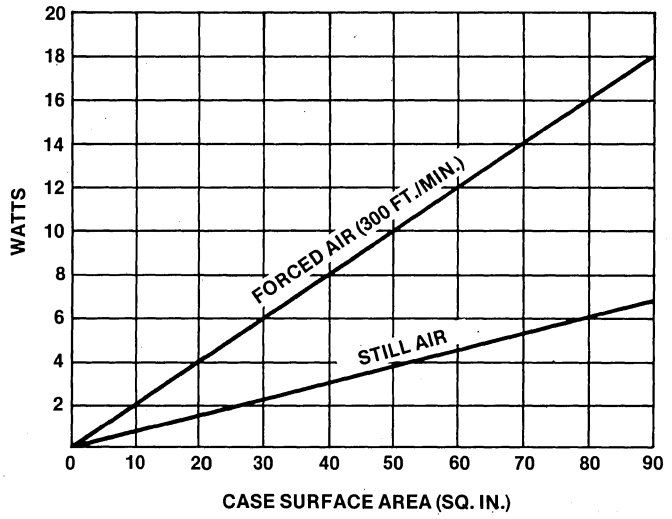

Figure 14. Power Dissipation vs. Case Surface Area. (for 10°C rise over ambient)

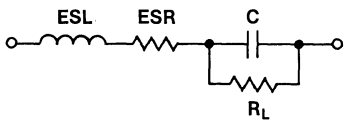

Figure 15. Equivalent Circuit of a Practical Capacitor.

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the actual capacitances achieved in capacitors of a particular production run will vary somewhat from unit to unit, and these units are cataloged within a liberal capacitance tolerance. Most applications for electrolytic capacitors are uncritical of exact capacitance values, and require only that the capacitance exceed a nominal minimum value.

CAPACITANCE TOLERANCE (ACCURACY). This tolerance is stated as the maximum positive and negative deviations of the capacitance from a rated nominal value, at a standard test temperature (usually 25° ±3°C), measured at a standard frequency (usually 120 Hz), at a negligibly low test voltage (usually 1 volt). It is usually expressed as a percentage of nominal capacitance. Common tolerances are −10% +50%, −10% +75%, and ±20%. Closer tolerances are available on special order, for critical applications.

Notes: Measurements at other than the standard test temperature *must* allow for the temperature characteristic (see blow) of the capacitor. "Negligibly low test voltage" means that the test voltage applied is not high enough to cause significant temperature rise due to losses and/or leakage. Usually at the standard test frequency, the test voltage is not critical.

TEMPERATURE CHARACTERISTIC (OF CAPACITANCE). The variation of capacitance with temperature, in electrolytic capacitors, is non-linear, particularly in the region below room temperature. To list an over-all average numerical temperature coefficient would be misleading, since the coefficient is quite small at conventional operating temperatures, and substantially larger at low temperatures. Electrolytics are not ordinarily utilized in thermal-compensation or stabilization schemes, but their performance over a specific temperature range is usually of interest to the circuit designer, and their temperature characteristics are customarily provided in graphic form (see Figures 5 and 8 for typical examples of glycol vs. amide electrolytics).

The temperature characteristic of capacitance for a given type or model electrolytic capacitor will vary with the nominal capacitance and voltage ratings.

Note: The temperature reference in this characteristic is that of the capacitor, not the ambient temperature.

DC WORKING VOLTAGE. This is the maximum voltage at which a capacitor may be operated continuously, over its rated operating temperature range. Voltages in electronic and electrical circuits are often DC with an additional AC component consisting of ripple or noise signals, fluctuations due to power-line variations, etc. The specified DC working voltage rating includes the *total* (DC plus peak AC) voltage that may be applied in continuous operation. The AC component must not be allowed to exceed the DC component, to avoid polarity reversal and possible destruction of the capacitor.

SURGE VOLTAGE. Electrolytic capacitors can usually withstand an occasional brief pulse or surge of voltage beyond their rated DC working voltage without being damaged. A surge rating is established for each type or model, which includes ripple, noise, power-line fluctuations and *all* transient occurrences. This rating is on a non-recurrent basis, and should never be exceeded, even momentarily.

EQUIVALENT SERIES RESISTANCE (ESR). The ESR of a capacitor is a standard characteristic, expressed in ohms, representing all energy losses in the "equivalent" series resistance of a capacitor, regardless of source: lead resistance, termination losses, dissipation in the dielectric material, foil resistance. It assumes that all losses can be represented by a single resistance in series with the idealized perfect capacitor. The power losses caused by it result in internal heating of the device, which in turn affects the useful expected life, the impedance (a major factor in applications), and the permissible ripple current.

ESR is strongly dependent upon the operating temperature of the capacitor, and varies inversely with it as can be seen in Figures 7 and 8. This variance is primarily the result of the contribution of the electrolyte—spacer combination to the total ESR of the capacitor.

An added source of ESR is found in the resistance of the aluminum foil itself, due to both the series resistance of the foil and the resistance of the oxide on the anode foil. The higher voltage ratings will have higher ESR values due to thicker anodic oxide films.

Since in large capacitors the length of the foil ribbon is considerable, and the actual cross-section of the foil is relatively thin due to the

etching of the surfaces, significant resistance exists. This resistance is further affected by the individual etch patterns used, but may be controlled to some extent by adjusting the foil area-to-capacitance ratios; that is, the higher the ratio of foil area to unit capacitance, the lower the ESR produced.

EFFECTIVE SERIES INDUCTANCE. The effective series inductance of a capacitor, which is a function of its mechanical construction, dominates the impedance of the device above the self resonant frequency. This can become a limiting factor in higher frequency applications such as switch mode power supplies. The self resonance of the capacitor is that frequency at which the inductive reactance and the capacitive reactance are equal in magnitude and opposite in phase. At this frequency the impedance of the device is equal to the ESR.

RIPPLE CURRENT. When a periodic (AC) voltage wave is superimposed on the DC voltage applied to an electrolytic capacitor—i.e., when the filter capacitor in a DC power supply is being charged by the rectifier and discharged by the external load—current flows into and out of the capacitor. This "ripple current" flows through the ESR of the capacitor, generating heat which increases the internal temperature of the unit.

Being an electrochemical device, the capacitor is subject to deterioration, including a shortened life, by temperature increases. The higher temperatures cause an increase in leakage current, and loss of electrolyte through the seals; the current flow initiates electrolysis of the electrolyte, generating gas, and decreasnig the quantity of electrolyte, which in turn causes a decrease in capacitance and an increase in ESR. The failure mode typically is a loss of capacitance to the point that the power supply ripple voltage will be beyond the specified limit.

Manufacturers of electrolytic capacitors usually offer several grades of capacitors, rated by their length of accelerated life under test. Generally, the essential differences between these grades are the level of leakage current allowed, the type of electrolyte used, and the quality of the sealing method used. Figures 16 and 17 illustrate the difference in operating life between two Mepco/Centralab types: the Series 3186 and Series 3120.

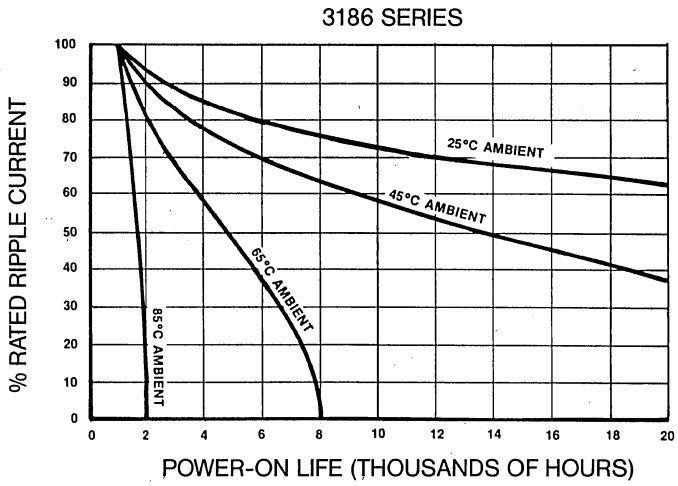

Figure 16. Series 3186—Life vs. % Rated Ripple Current and Ambient Temperature (at 100% Rated Voltage)

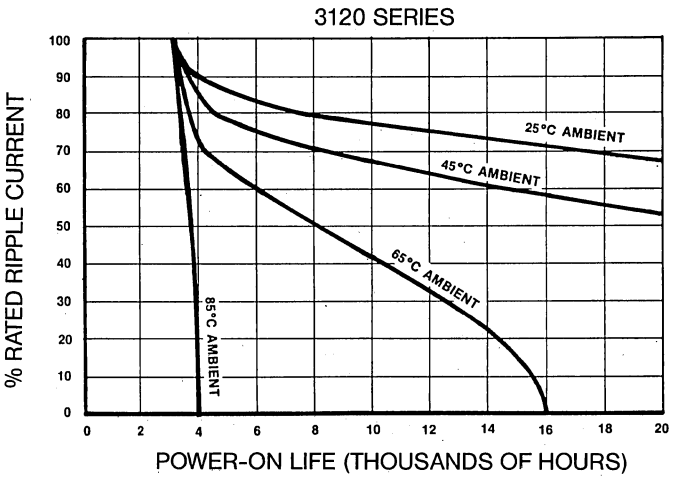

Figure 17. Series 3120—Life vs. % Rated Ripple Current and Ambient Temperature (at 100% Rated Voltage)

At a 45°C ambient temperature, and 50% of the rated ripple current at that temperature, the 3186 has an expected life of 14,000 power-on hours with 100% rated voltage applied. Under the same rated conditions, the 3120 will have a power-on life of 22,000 hours. The lifetime of both Series will be extended further if the applied voltage is reduced from the 100% value.

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Ripple current through the capacitor can be measured in several ways, some more accurate than others. Figure 18 illustrates three of these methods. The first method shown is the most accurate. The current is read directly from a True RMS current probe. The second method, reading the RMS voltage across a very-low-resistance shunt and using Ohm's Law to derive the current works very well, if the resistance of the shunt is less than 10% of the impedance of the capacitor. The third method is perhaps the easiest, but is the least accurate if the actual impedance of the capacitor is not known. The ripple current can be approximated by dividing the RMS voltage by the calculated impedance:

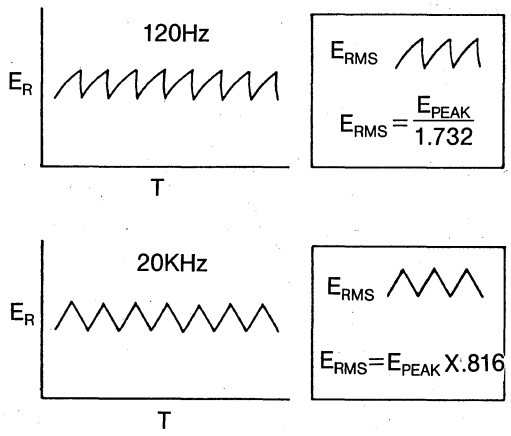
$$Z_C = \sqrt{ESR^2 + (X_L - X_C)^2}$$

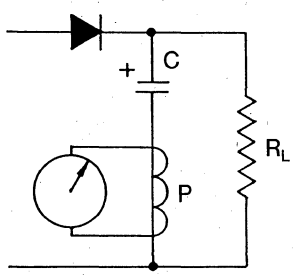
$$X_C = \frac{1}{2\pi fC}$$

$$X_L = 2\pi fL$$

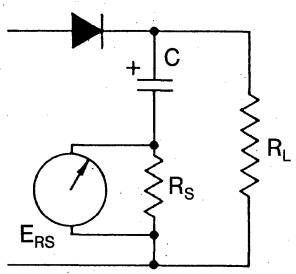
f = frequency, C = Farads, L = Henries

where the ESR, capacitance, and inductance are the values specified in the manufacturer's literature.



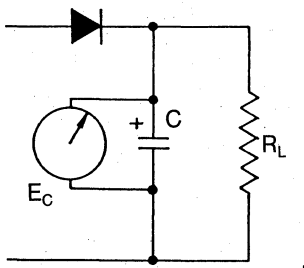


1. CURRENT PROBE.



2. VERY LOW RESISTANCE SHUNT.

$$I = \frac{E_{RS}}{R}$$



3. RMS VOLTAGE. $I = \frac{E_C}{Z_C}$

Figure 18. Measurement of Ripple Current.

QUALITY, DISSIPATION, AND POWER FACTORS. These three factors are discussed together because they are interrelated, and are sometimes misinterpreted when described individually. Quality Factor (or Q) is simply the ratio of the capacitor's reactance to its resistance (X_C/R) at a specified frequency. It should be as high as possible, since a lower ratio indicates higher power loss. Dissipation Factor (DF) is the reciprocal of Quality Factor: $DF = 1/Q = R/X_C$. It should be as low as possible, since high DF represents a high power loss. Power Factor (PF) is the ratio of resistance to impedance (R/Z) and represents the fraction of input voltamperes (or power) dissipated in the capacitor. Quality Factor and Dissipation Factor are terms associated with DC capacitors. Power Factor is primarily associated with AC motor start capacitors.

INSULATION RESISTANCE AND DC LEAKAGE CURRENT. I_R is a measure of the capacitor's ability to retain a charge with respect to time. It is the ratio of the DC test voltage impressed across to the current that flows through it (at a specified voltage and temperature). This current is measured 5 minutes after the capacitor has been charged to the test voltage. The capacitor then appears as a high resistance in parallel with an ideal (non-leaky) capacitor. Insulation resistance is sometimes expressed in megohms for small capacitors and as a time constant (the product of R and C in megohm-microfarads) for higher-value capacitors. It should not be confused with the equivalent series resistance.

1. CAPACITOR LIFE PREDICTION GUIDELINES

The following equations and tables can be used to predict the life of aluminum electrolytic capacitors at derated voltages and temperatures. Failures are defined as parameter drift beyond the limits outlined in the life test section of the Performance Specifications.

Based on DC aluminum electrolytic capacitor tests, the inherent relationships between temperature, voltage and life were established. A failure rate for each product was established from testing at maximum rated conditions. From this failure rate a base lifetime was established.

The multipliers found in the tables for each product type were derived from acceleration factors for voltage and temperature derating [equations (2), (3), and (4)].

The expected life for each product type is determinted by computing the capacitor hot-spot temperature [equation (1) ←————] and the ratio of use voltage to rated voltage. From this, the base life multiplier can be found in the appropriate table. The multiplier times the base life (found in Table 1) yields the expected life.

The computation of expected life assumes a constant or decreasing failure rate and that the wearout portion of the product life has not been reached. The expected life is the statistical time required to generate one failure in 25 units based on a 60% confidence level.

Multipliers resulting in expected lifetimes in excess of 10 years may not be valid due to secondary failure modes not considered in the construction of these tables.

*These life predictions do not apply due to the small physical size and ripple current limitation of these products. In the case of the 3487 styles, the procedure may be applied to the 35mm diameter units.

CALCULATION OF CORE TEMPERATURE

(1) $\text{Core Temp}^{*} = \text{Ambient Temp} + \dfrac{I^2 \text{ X E.S.R.}}{.006 \text{ X Area}}$

$$.006 = \frac{\dfrac{\text{WATTS}}{\text{Area/sq. inch}}}{\text{°C Temp Rise}}$$

AREA = Surface Area of Can = $\pi \text{ X } D_{IA} \text{ X } (L_E + (\frac{D_{IA}}{2})$

I = Ripple Current (Amps)
AMB = Ambient Temperture (°C)
ESR = Equivalent Series Resistance (ohms)

*Based on free convection in still air.

ACCELERATION FACTORS

(2) $A_1 = {}_X[(\text{Tmax} - \text{Tcore})/10]$

X = The space required for the explanation of this complex factor is unavailable here. If it is required, please contact Mepco/Centralab Engineering, and the information will be provided.

(3) $A_2 = \dfrac{I_L \text{ at Rated Voltage \& Temperature}}{I_L \text{ at Derated Voltage \& Temperature}}$

(4) $A = A_1 \text{ X } A_2$

Tmax = Design Core Temp. as listed in Table 1
Tcore = Actual Core Temp.

TABLE 1
TABLE BASE LIFE

TYPE	LOAD* LIFE HOURS	AMBIENT TEMP. °C	DESIGN CORE TEMP. °C	LIFE MULTIPLIER TABLE
3120	3000	85	105	2
3186	1000	85	95	1
3188	2000	85	105	3
3191	1500	85	100	4
3487*	1000	85	95	1

*Load Life=Max. rated amb. temp., voltage and ripple current.

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LIFE MULTIPLIER—TABLE 1

CORE TEMP.	% RATED VOLTAGE 75	80	85	90	95	100
95	2.6	2.2	1.8	1.5	1.2	1.0
94	2.7	2.2	1.8	1.6	1.3	1.1
93	2.9	2.4	2.0	1.6	1.3	1.2
92	3.3	2.8	2.4	1.9	1.5	1.2
91	3.6	2.9	2.4	2.0	1.6	1.3
90	3.8	3.2	2.6	2.2	1.8	1.4
89	4.2	3.4	2.8	2.3	1.9	1.5
88	4.2	3.5	2.9	2.4	1.9	1.6
87	4.6	3.9	3.2	2.6	2.1	1.7
86	5.0	4.2	3.4	2.9	2.4	1.9
85	5.3	4.4	3.6	3.0	2.4	2.0
84	5.8	4.9	4.0	3.2	2.6	2.1
83	6.2	5.2	4.2	3.5	2.8	2.3
82	6.6	5.5	4.4	3.7	3.0	2.5
81	7.3	6.1	5.0	4.1	3.3	2.6
80	7.9	6.5	5.4	4.4	3.5	2.8
79	8.3	6.8	5.6	4.5	3.7	3.0
78	9.1	7.5	6.1	5.0	4.0	3.3
77	9.6	7.9	6.4	5.3	4.2	3.5
76	10.5	8.6	7.1	5.7	4.7	3.7
75	11.3	9.2	7.5	6.1	5.0	4.0
74	12.2	10.0	8.1	6.6	5.3	4.3
73	12.9	10.6	8.6	7.0	5.6	4.6
72	14.1	11.4	9.4	7.6	6.1	4.9
71	15.1	12.4	10.0	8.1	6.6	5.3
70	16.3	13.3	10.6	8.8	7.1	5.7
69	17.3	14.2	11.5	9.3	7.5	6.1
68	18.8	15.4	12.4	10.1	8.1	6.5
67	20.0	16.3	13.2	10.7	8.6	7.0
66	21.7	17.6	14.3	11.6	9.3	7.5
65	23.3	18.9	15.3	12.4	10.0	8.0
64	25.2	20.4	16.5	13.3	10.7	8.6
63	27.0	21.9	17.6	14.2	11.4	9.2
62	29.1	23.5	19.0	15.3	12.4	9.8
61	31.2	25.3	20.4	16.4	13.2	10.6
60	33.4	26.9	21.7	17.5	14.1	11.3
59	35.9	29.0	23.3	18.7	15.1	12.1
58	38.8	31.3	25.2	20.3	16.2	13.0
57	41.5	33.5	26.9	21.6	17.3	13.9
56	44.7	36.0	28.9	23.2	18.6	14.9
55	48.0	38.6	31.0	24.9	19.9	16.0
54	51.5	41.4	33.4	26.6	21.3	17.2
53	55.6	44.6	35.8	28.7	23.0	18.4
52	59.6	47.9	38.4	30.7	24.6	19.7
51	64.1	51.3	41.1	32.9	26.4	21.1
50	68.8	55.2	44.2	35.4	28.3	22.6
49	74.0	59.2	47.4	37.9	30.3	24.2
48	79.6	63.7	51.0	40.7	32.5	26.0
47	85.6	68.3	54.6	43.7	34.9	27.9
46	91.8	73.3	58.5	46.8	37.4	29.9
45	98.5	78.6	62.8	50.2	40.0	32.0
44	105.9	84.4	67.3	53.8	42.9	34.3
43	113.9	90.8	72.4	57.7	46.1	36.8
42	122.3	97.4	77.6	61.9	49.4	39.4
41	131.3	104.5	83.3	66.3	52.9	42.2
40	141.1	112.2	89.3	71.2	56.8	45.3
39	151.3	120.4	95.7	76.3	60.8	48.5
38	162.7	129.2	102.8	81.9	65.2	52.0
37	174.7	138.7	110.3	87.8	69.9	55.7
36	187.6	148.9	118.3	94.1	75.0	59.7
35	201.4	159.7	126.8	100.9	80.3	64.0
34	216.2	171.4	136.1	108.2	86.1	68.6
33	232.5	184.2	146.1	116.1	92.4	73.5
32	249.4	197.5	156.7	124.4	99.0	78.8
31	267.9	212.0	168.1	133.5	106.1	84.5
30	287.5	227.4	180.2	143.1	113.8	90.5
29	308.6	244.0	193.3	153.4	121.9	97.0
28	331.3	261.8	207.3	164.5	130.7	104.0
27	355.6	280.8	222.3	176.3	140.1	111.4
26	382.0	301.6	238.6	189.2	150.3	119.4
25	409.9	323.4	255.8	202.8	161.0	128.0

LIFE MULTIPLIER–TABLE 2

CORE TEMP.	% RATED VOLTAGE 75	80	85	90	95	100
105	1.80	1.60	1.40	1.30	1.10	1.00
104	1.75	1.57	1.48	1.29	1.11	1.01
103	1.80	1.63	1.46	1.29	1.11	1.03
102	1.85	1.69	1.45	1.29	1.12	1.04
101	1.89	1.66	1.51	1.36	1.21	1.06
100	1.93	1.72	1.58	1.36	1.22	1.07
99	1.98	1.77	1.57	1.43	1.23	1.09
98	2.08	1.82	1.63	1.43	1.30	1.11
97	2.01	1.83	1.59	1.42	1.24	1.12
96	2.11	1.93	1.71	1.48	1.31	1.14
95	2.15	1.89	1.68	1.47	1.31	1.15
94	2.24	1.99	1.78	1.58	1.38	1.17
93	2.28	2.04	1.81	1.57	1.38	1.19
92	2.32	2.05	1.83	1.61	1.38	1.21
91	2.40	2.11	1.86	1.64	1.43	1.22
90	2.37	2.09	1.86	1.63	1.43	1.24
89	2.48	2.18	1.93	1.67	1.44	1.26
88	2.49	2.21	1.93	1.69	1.48	1.28
87	2.56	2.23	1.98	1.72	1.49	1.30
86	2.60	2.29	2.02	1.74	1.53	1.31
85	2.67	2.35	2.06	1.80	1.57	1.33
84	2.86	2.52	2.20	1.91	1.66	1.43
83	3.09	2.69	2.35	2.04	1.76	1.53
82	3.34	2.92	2.55	2.21	1.90	1.64
81	3.63	3.18	2.75	2.38	2.07	1.76
80	3.91	3.41	2.96	2.56	2.20	1.89
79	4.21	3.68	3.20	2.75	2.36	2.02
78	4.53	3.94	3.42	2.94	2.53	2.17
77	4.86	4.23	3.68	3.15	2.71	2.32
76	5.28	4.59	3.98	3.43	2.93	2.49
75	5.69	4.95	4.26	3.66	3.13	2.67
74	6.10	5.28	4.57	3.92	3.35	2.86
73	6.59	5.69	4.91	4.20	3.61	3.06
72	7.08	6.11	5.25	4.49	3.85	3.28
71	7.66	6.61	5.67	4.86	4.14	3.52
70	8.24	7.11	6.10	5.22	4.44	3.77
69	8.88	7.63	6.54	5.58	4.76	4.04
68	9.54	8.19	7.03	6.00	5.10	4.33
67	10.3	8.84	7.57	6.44	5.49	4.64
66	11.1	9.53	8.14	6.92	5.90	4.98
65	11.9	10.2	8.73	7.42	6.30	5.33
64	12.9	11.0	9.40	8.04	6.76	5.72
63	13.9	11.9	10.1	8.57	7.24	6.13
62	14.9	12.7	10.8	9.20	7.78	6.57
61	16.1	13.7	11.7	9.87	8.35	7.04
60	17.3	14.8	12.5	10.6	8.95	7.54
59	18.7	15.9	13.5	11.4	9.59	8.08
58	20.1	17.1	14.4	12.2	10.3	8.66
57	21.7	18.3	15.5	13.1	11.0	9.29
56	23.3	19.7	16.6	14.0	11.8	9.95
55	25.1	21.2	17.9	15.1	12.7	10.7
54	27.1	22.8	19.2	16.2	13.6	11.4
53	29.1	24.5	20.7	17.4	14.6	12.3
52	31.3	26.4	22.2	18.6	15.6	13.1
51	33.7	28.4	23.8	20.0	16.8	14.1
50	36.3	30.5	25.6	21.5	18.0	15.1
49	39.1	32.8	27.5	23.1	19.3	16.2
48	42.1	35.3	29.6	24.7	20.7	17.3
47	45.3	37.9	31.7	26.5	22.2	18.6
46	48.7	40.7	34.1	28.5	23.8	19.9
45	52.5	43.8	36.6	30.6	25.5	21.3
44	56.4	47.1	39.3	32.8	27.4	22.9
43	60.7	50.6	42.2	35.2	29.4	24.5
42	65.3	54.4	45.3	37.7	31.5	26.3
41	70.3	58.4	48.6	40.5	33.8	28.1
40	75.6	62.8	52.2	43.4	36.2	30.2
39	81.4	67.5	56.1	46.6	38.8	32.3
38	87.5	72.5	60.2	50.0	41.6	34.7
37	94.2	78.0	64.6	53.7	44.6	37.1
36	101.3	83.0	69.4	57.6	47.9	39.8
35	109.0	90.0	74.5	61.8	51.3	42.7
34	117.2	96.7	80.0	66.3	55.0	45.7
33	126.0	103.9	85.9	71.1	59.0	49.0
32	135.5	111.6	92.2	76.3	63.2	52.5
31	145.7	119.9	99.0	81.9	67.8	56.3
30	156.7	128.8	106.3	87.8	72.7	60.3
29	168.5	138.4	114.0	94.2	78.0	64.7
28	181.1	148.6	122.4	101.0	83.6	69.3
27	194.7	159.7	131.4	108.4	89.7	74.3
26	209.3	171.5	141.0	116.3	96.1	79.6
25	225.1	184.2	151.3	124.7	103.0	85.3

Aluminum Electrolytic Capacitors
TECHNICAL NOTES

LIFE MULTIPLIER—TABLE 3

CORE TEMP.	% RATED VOLTAGE 75	80	85	90	95	100
105	1.80	1.60	1.40	1.30	1.10	1.00
104	1.79	1.60	1.51	1.32	1.13	1.04
103	1.88	1.70	1.52	1.34	1.16	1.07
102	1.96	1.79	1.54	1.37	1.19	1.11
101	2.05	1.81	1.64	1.48	1.31	1.15
100	2.14	1.90	1.74	1.51	1.35	1.19
99	2.23	2.00	1.77	1.62	1.39	1.23
98	2.40	2.10	1.87	1.65	1.50	1.27
97	2.36	2.15	1.88	1.67	1.46	1.32
96	2.53	2.32	2.05	1.78	1.57	1.37
95	2.64	2.31	2.06	1.80	1.61	1.41
94	2.80	2.48	2.23	1.97	1.72	1.46
93	2.91	2.61	2.30	2.00	1.76	1.52
92	3.02	2.67	2.38	2.09	1.80	1.57
91	3.19	2.80	2.46	2.18	1.90	1.62
90	3.21	2.84	2.52	2.21	1.94	1.68
89	3.43	3.02	2.66	2.30	2.00	1.74
88	3.51	3.12	2.73	2.39	2.09	1.80
87	3.69	3.22	2.85	2.47	2.15	1.87
86	3.82	3.37	2.97	2.56	2.25	1.93
85	4.00	3.52	3.09	2.70	2.35	2.00
84	4.29	3.77	3.30	2.87	2.49	2.14
83	4.64	4.04	3.53	3.06	2.64	2.30
82	5.01	4.37	3.82	3.31	2.84	2.46
81	5.45	4.77	4.13	3.58	3.11	2.64
80	5.87	5.11	4.43	3.84	3.29	2.83
79	6.32	5.52	4.80	4.13	3.54	3.03
78	6.79	5.91	5.12	4.42	3.79	3.25
77	7.30	6.34	5.51	4.73	4.06	3.48
76	7.92	6.88	5.97	5.14	4.40	3.73
75	8.54	7.42	6.39	5.48	4.70	4.00
74	9.15	7.92	6.86	5.88	5.02	4.29
73	9.88	8.54	7.36	6.30	5.41	4.59
72	10.6	9.16	7.87	6.74	5.77	4.92
71	11.5	9.91	8.50	7.29	6.20	5.28
7	12.4	10.7	9.15	7.82	6.66	5.66
69	13.3	11.4	9.81	8.38	7.14	6.06
68	14.3	12.3	10.5	8.99	7.65	6.50
67	15.5	13.3	11.4	9.66	8.23	6.96
66	16.7	14.3	12.2	10.4	8.85	7.46
65	17.9	15.3	13.1	11.1	9.45	8.00
64	19.4	16.6	14.1	12.1	10.1	8.57
63	20.8	17.8	15.1	12.8	10.9	9.19
62	22.4	19.1	16.2	13.8	11.7	9.85
61	24.2	20.6	17.5	14.8	12.5	10.6
6	26.0	22.1	18.8	15.9	13.4	11.3
59	28.1	23.8	20.2	17.1	14.4	12.1
58	30.2	25.6	21.7	18.3	15.4	13.0
57	32.5	27.5	23.3	19.6	16.6	13.9
56	35.0	29.6	25.0	21.1	17.7	14.9
55	37.7	31.8	26.9	22.7	19.1	16.0
54	40.6	34.3	28.9	24.3	20.4	17.1
53	43.7	36.8	31.0	26.0	21.9	18.4
52	47.0	39.5	33.3	27.9	23.5	19.7
51	50.6	42.6	35.7	30.0	25.2	21.1
50	54.4	45.7	38.4	32.2	27.0	22.6
49	58.7	49.2	41.3	34.6	29.0	24.3
48	63.2	52.9	44.3	37.1	31.1	26.0
47	67.9	56.9	47.6	39.8	33.3	27.9
46	73.1	61.1	51.1	42.7	35.7	29.9
45	78.7	65.7	54.9	45.9	38.3	32.0
44	84.6	70.6	58.9	49.2	41.1	34.3
43	91.1	75.9	63.2	52.8	44.0	36.8
42	98.0	81.6	68.0	56.6	47.2	39.4
41	105.5	87.7	73.0	60.7	50.6	42.2
40	113.4	94.2	78.3	65.2	54.3	45.3
39	122.1	101.3	84.1	69.9	58.2	48.5
38	131.3	108.8	90.3	75.0	62.4	52.0
37	141.3	117.0	97.0	80.5	67.0	55.7
36	152.0	125.7	104.1	86.4	71.8	59.7
35	163.4	135.0	111.8	92.7	77.0	64.0
34	175.8	145.1	120.0	99.4	82.5	68.6
33	189.0	155.8	128.8	106.7	88.5	73.5
32	203.3	167.4	138.3	114.4	94.9	78.8
31	218.6	179.9	148.5	122.8	101.7	84.4
30	235.1	193.3	159.4	131.7	109.1	90.5
29	252.7	207.6	171.0	141.3	117.0	97.0
28	271.7	223.0	183.6	151.6	125.4	104.0
27	292.1	239.5	197.1	162.6	134.5	111.4
26	314.0	257.2	211.5	174.4	144.2	119.4
25	337.6	276.3	227.0	187.1	154.6	128.0

LIFE MULTIPLIER—TABLE 4

CORE TEMP.	% RATED VOLTAGE 75	80	85	90	95	100
100	2.50	2.10	1.80	1.50	1.20	1.00
99	2.54	2.16	1.79	1.51	1.22	1.04
98	2.59	2.23	1.88	1.52	1.25	1.07
97	2.96	2.50	2.03	1.66	1.39	1.11
96	3.00	2.56	2.12	1.77	1.41	1.15
95	3.14	2.63	2.21	1.78	1.53	1.19
94	3.28	2.79	2.30	1.89	1.56	1.23
93	3.22	2.70	2.25	1.87	1.50	1.27
92	3.45	2.86	2.35	1.98	1.61	1.32
91	3.59	3.02	2.52	2.08	1.73	1.37
90	3.64	3.03	2.56	2.09	1.68	1.41
89	3.93	3.26	2.73	2.20	1.80	1.46
88	3.98	3.35	2.78	2.27	1.83	1.52
87	4.16	3.44	2.84	2.35	1.93	1.57
86	4.29	3.54	2.96	2.44	1.97	1.62
85	5.33	4.40	3.67	3.00	2.40	2.00
84	5.76	4.76	3.95	3.22	2.61	2.14
83	6.28	5.20	4.26	3.51	2.84	2.30
82	6.65	5.52	4.53	3.73	2.99	2.46
81	7.31	6.02	4.94	4.06	3.32	2.64
80	7.88	6.46	5.32	4.31	3.50	2.83
79	8.30	6.85	5.60	4.55	3.69	3.03
78	9.02	7.43	6.10	4.97	4.04	3.25
77	9.66	7.95	6.50	5.26	4.27	3.48
76	10.5	8.66	7.06	5.73	4.67	3.73
75	11.2	9.18	7.48	6.10	4.92	4.00
74	12.1	9.96	8.11	6.60	5.34	4.29
73	13.0	10.6	8.66	7.02	5.71	4.59
72	14.1	11.5	9.32	7.55	6.11	4.92
71	15.0	12.3	9.97	8.08	6.52	5.28
70	16.1	13.2	10.7	8.65	7.02	5.66
69	17.5	14.2	11.5	9.32	7.56	6.06
68	18.7	15.3	12.3	10.0	8.06	6.50
67	20.2	16.5	13.3	10.7	8.66	6.96
66	21.7	17.7	14.3	11.6	9.28	7.46
65	23.3	12.5	15.3	12.3	9.94	8.00
64	25.0	20.3	16.4	13.2	10.6	8.57
63	26.9	21.8	17.6	14.2	11.4	9.19
62	29.0	23.5	18.9	15.3	12.3	9.85
61	31.2	25.2	20.3	16.4	13.2	10.6
60	33.6	27.1	21.9	17.6	14.1	11.3
59	36.1	29.1	23.5	18.9	15.1	12.1
58	38.8	31.2	25.2	20.2	16.2	13.0
57	41.7	33.5	27.0	21.7	17.4	13.9
56	44.8	36.0	29.0	23.2	18.6	14.9
55	48.1	38.7	31.1	24.9	20.0	16.0
54	51.6	41.5	33.3	26.7	21.4	17.1
53	55.6	44.6	35.8	28.7	23.0	18.4
52	59.6	47.8	38.3	30.7	24.6	19.7
51	64.2	51.5	41.2	33.0	26.4	21.1
50	68.8	55.2	44.2	35.3	28.3	22.6
49	74.0	59.2	47.4	37.9	30.3	24.3
48	79.6	63.6	50.8	40.7	32.5	26.0
47	85.5	68.3	54.6	43.6	34.9	27.9
46	91.9	73.4	58.6	46.8	37.4	29.9
45	98.6	78.7	62.9	50.2	40.0	32.0
44	106.0	84.5	67.5	53.8	43.0	34.3
43	113.8	90.7	72.3	57.7	46.0	36.0
42	122.2	97.3	77.5	61.9	49.4	39.4
41	131.4	104.6	83.3	66.4	52.9	42.2
40	141.0	112.1	89.3	71.1	56.7	45.3
39	151.5	120.4	95.9	76.4	60.9	48.5
38	162.6	129.2	102.8	81.8	65.2	52.0
37	174.8	138.8	110.4	87.8	69.9	55.7
36	187.7	149.0	118.4	94.2	75.0	59.7
35	201.5	159.8	126.9	100.9	80.4	64.0
34	216.3	171.5	136.1	108.2	86.1	68.6
33	232.3	184.0	146.0	116.1	92.3	73.5
32	249.4	197.5	156.7	124.4	99.0	78.8
31	267.9	212.0	168.1	133.5	106.1	84.4
30	287.5	227.4	180.3	143.1	113.8	90.5
29	308.7	244.1	193.3	153.4	122.0	97.0
28	296.1	233.9	185.3	147.0	116.8	104.0
27	355.7	280.9	222.4	176.4	140.1	111.4
26	381.8	301.4	238.5	189.1	150.1	119.4
25	409.9	323.4	255.8	202.8	161.0	128.0

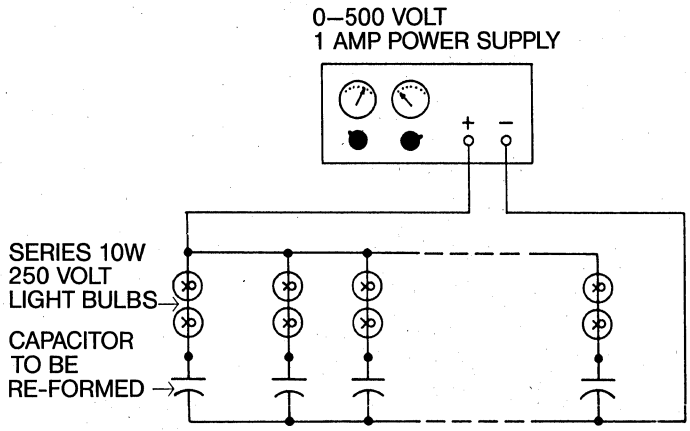
Aluminum Electrolytic Capacitors
TECHNICAL NOTES

2. FIELD RE-FORM PROCEDURE

DC aluminum electrolytic capacitors require re-forming when the leakage current exceeds the value calculated from the leakage current formulas in paragraph 3 below. The procedure for re-forming in the field is as follows:

1. Preheat capacitors to 85°C ±5°C for 4 hours ±.5 hour.
2. Remove capacitors from oven and apply 110% rated voltage in a room temperature ambient (25°C ±3°C) as per the diagram below. Remove and discard any units that are shorted or appear to draw a constant or increasing amount of current.
3. Remove units from the re-form set-up after the *average* unit current drawn from the power supply is ¼ of the leakage requirement for the unit type involved.
4. Condition units for 24 hours ±5 hours in a room-temperature ambient with no voltage applied. Then measure leakage current as outlined in Performance Specifications paragraph 6. Repeat steps 1 through 4 for units that do not meet this limit. Discard any units that have ruptured vent plugs or have evidence of leaking electrolyte.

   When units are re-formed by this procedure, they will have a shelf life of approximately one year, provided the storage ambient does not exceed 40°C.



3. CAPACITOR SHELF-CHARACTERISTICS

The graphs on the next page can be used to predict the shelf life of aluminum electrolytic capacitors stored in various ambient temperatures. The Specification Limit Line on the left of the graph indicates the length of time, at various temperatures for which the capacitors are expected to meet the leakage current limits calculated from the formulas shown below. The Practical Limit Line on the right of the graph defines the length of storage for which a user should expect acceptable performance from the capacitor in normal applications.

Capacitors that are to be used at operating temperatures which are at least 25°C less than the maximum operating temperature and have been in storage for a period longer than the Practical Limit should have their leakage current checked. Any unit whose leakage current exceeds the value calculated from the formulas shown below should be re-formed.

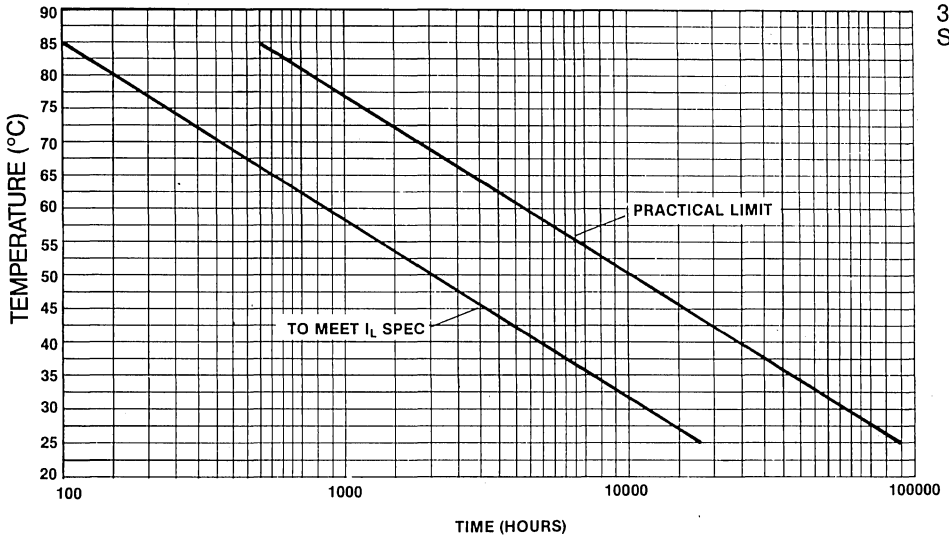
Capacitors that draw a constant or increasing amount of leakage should also be re-formed.

Leakage current after pre-conditioning or re-form is measured after five minutes of voltage application. The voltage is applied to the capacitor through a series resistor with a value such that the rated voltage will appear on the capacitor terminals within one minute.

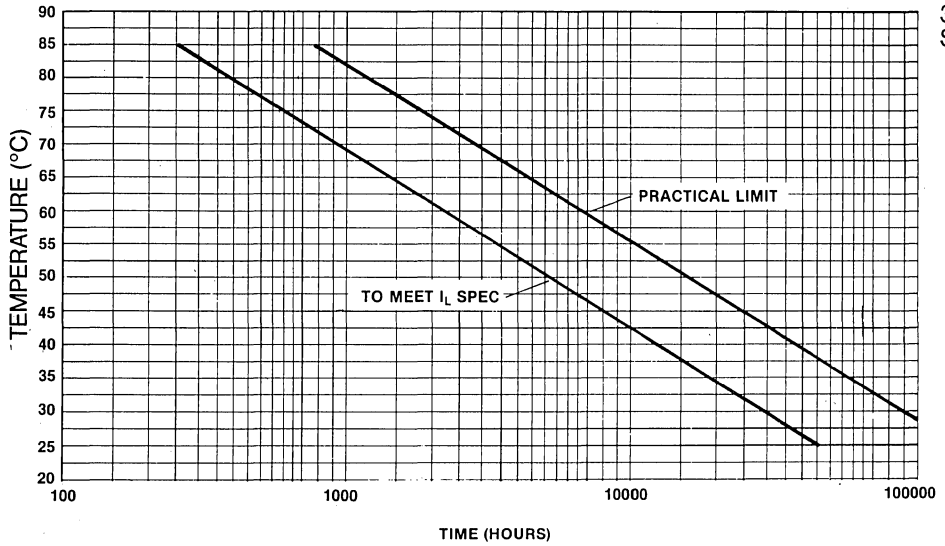
LEAKAGE CURRENT FORMULAS

TIME SERIES	PRE-CONDITIONING EQUATION (MINUTES)	EQUATION I – μA	MAX. VALUE (μA)
3073/3074* (CV≤1000) (CV>1000)	N/A	.01CV or 1μA whichever is greater .006CV + 4	N/A
3075 (CV≤1000) (CV>1000)	N/A	.05CV or 5μA whichever is greater .03CV + 20	N/A
3076	N/A	.009CV + 10μA	N/A
3120 6–100V)	30	$1\sqrt{CV}$	N/A
(101–250V)	30	$3\sqrt{CV}$	N/A
3186	30	$6\sqrt{CV}$	6000
3188 (CV≤250,000)	30	.006CV	4000
(CV>250,000)	30	$3\sqrt{CV}$	4000
3191	15	$1.5\sqrt{CV}$	N/A

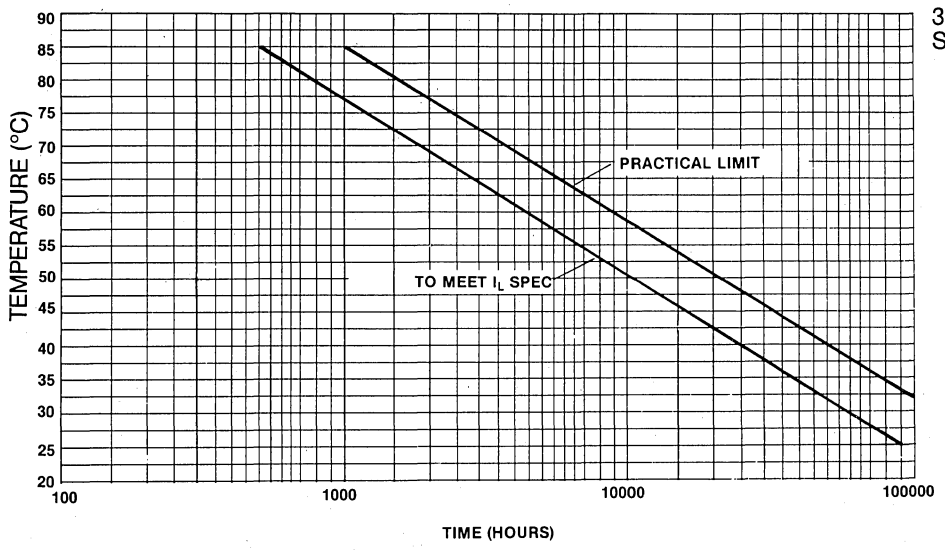
*BA case only I_L = .05CV or 5μA whichever is greater.



3186, 3191
SHELF CHARACTERISTICS



3188
SHELF CHARACTERISTICS



3120, 3428
SHELF CHARACTERISTICS

Aluminum Electrolytic Capacitors
DESIGN ENGINEERING NOTES

About This Section...
In these notes, we discuss and analyze the major design problems most frequently encountered in capacitor applications. The presentation assumes that the reader has: (1) read the immediately preceding sections entitled Modern Electrolytic Capacitor Technology and Technical Notes (pages 62-79); (2) acquired adequate experience in conventional circuit design; and (3) gained reasonable facility with the mathematics of linear-circuit computations. Where appropriate, an accesible bibliographic reference is given.

We have attempted to make this presentation mathematically rigorous and physically realistic. When a simplifying assumption *has* been made, it has been noted... and, if necessary, explained.

One final word: these are the design-engineering topics that we feel you are most likely to encounter; but there are many others that arise less frequently, yet are challenging, and can be critical to circuit performance and reliability. You are invited to consult us about any such engineering problem in the application or selection of aluminum electorlytic capacitors. Write or call:

Applications Engineering Department
Mepco/Centralab
6071 St. Andrews Rd.
Columbia, South Carolina 29210

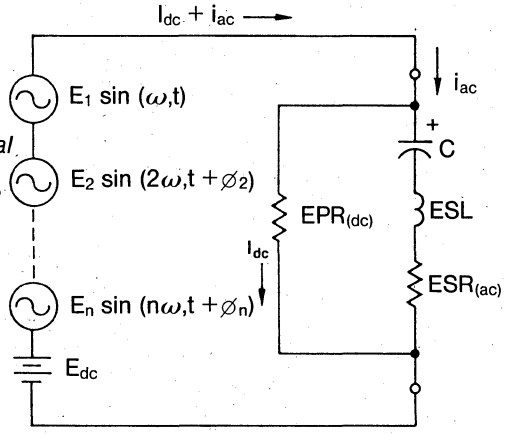


Figure 1. Equivalent circuit of an electrolytic capacitor and for non-sinusoidal (but periodic) AC ripple voltage with significant DC component.

Ripple Voltage and Current; Total Dissipation. Figure 1 shows the "general cases" for both the applied voltage and the parameters of the equivalent circuit of the capacitor. Note the following:

1. The applied voltage comprises the series combination of a dc voltage and a *periodic* ac waveform of unvarying shape and amplitude. By Fourier analysis,* it can be shown that any continuous, periodic waveform can be expressed as the sum of a set of sinewave signals of various relative amplitudes and phases. The lowest-frequency signal has a frequency $f_1 = 1/\tau$, where τ is the period of the original waveform. The other sinewave signals in the set occur at integral multiples of that lowest frequency (i.e., at $2/\tau$, $3/\tau$, $4/\tau \ldots n/\tau$), and are called the "second, third, fourth,... and nth *harmonic* components of the original waveform.

2. The amplitudes and phases of all harmonic components present can be computed from the Fourier integral and the geometry of the original ac ripple-voltage waveform. Although some waveforms have an *infinite number of harmonic components,* the amplitudes of the higher-order harmonics are negligibly small. In waveforms exhibiting "mirror symmetry" (between the geometries above and below E_{dc}), only the odd harmonics exist—i.e., the fundamental and the third, fifth, seventh, etc. The phase relationships are often restricted to 0° and 180° (plus or minus sinewave polarities). Figure 2 shows a number common periodic ac ripple waveforms and their Fourier expansions.

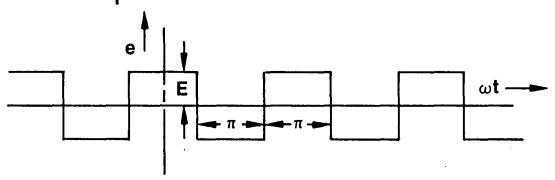
3. In precise ripple-current computations, the rms values of the individual harmonic current components may be individually determined, then summed by a formula that involves taking the square root of the sum of the squares of all significant harmonic current amplitudes, as shown in example #2, below.

4. There is one simpler case than that just described. It is illustrated in example #1, in which the ripple voltage is assumed to be a pure sine wave, at 120Hz; hence, there are no harmonic components. The ac impedance of the capacitor at 120Hz is known, from catalog data supplied, and need not be computed. *In this one special case,* the rms ripple current is computed simply by dividing the rms value of the applied ripple voltage by the (120-Hz) impedance of the capacitor. The dissipation due to ripple current is, then, (I ac rms)^2 X ESR. To this must be added the dissipation

*See any text dealing with spectral analysis. Publications like the ITT handbook (any edition) are also useful aids.

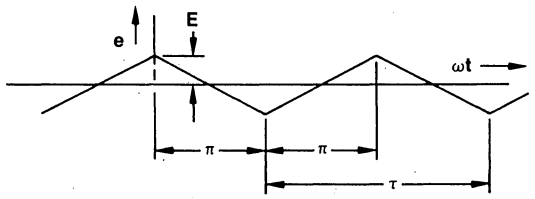
FOR ALL WAVEFORMS

τ = period $= \frac{1}{f}$ $\quad 2\pi f = \omega \quad 2\pi ft = \omega t$



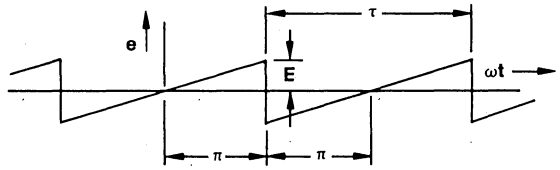
Square wave

$$e(t) = \frac{4}{\pi}E\left(\cos(\omega t - \frac{1}{3}\cos(3\omega t) + \frac{1}{5}\cos(5\omega t) - \frac{1}{7}\cos(7\omega t) + \ldots\right)$$



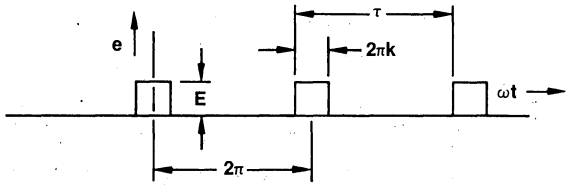
Triangular wave

$$e(t) = \frac{8}{\pi^2}E\left(\cos(\omega t + \frac{1}{9}\cos(3\omega t) + \frac{1}{25}\cos(5\omega t) + \ldots\right)$$



Sawtooth wave

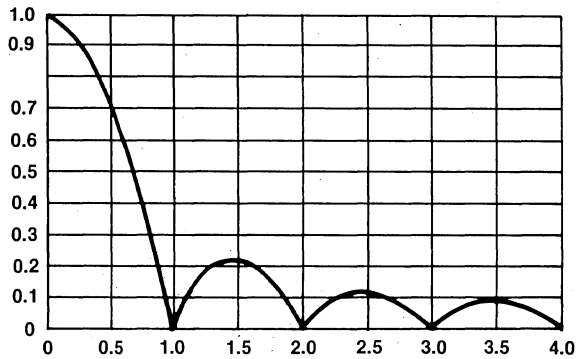
$$e(t) = \frac{2}{\pi}E\left(\sin(\omega t - \frac{1}{2}\sin(2\omega t) + \frac{1}{3}\sin(3\omega t) - \frac{1}{4}\sin(4\omega t) + \ldots\right)$$



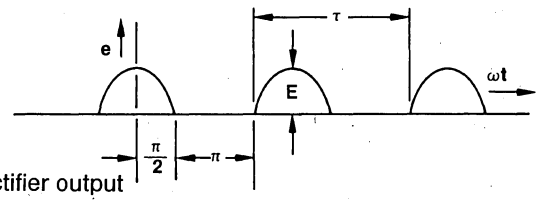
Short square pulse

$$e(t) = E\left[k + \frac{2}{\pi}\left(\sin k\pi\cos(\omega t + \frac{1}{2}\sin 2k\pi\cos(2\omega t) + \frac{1}{3}\sin 3k\pi\cos(3\omega t) \ldots + \frac{1}{n}\sin nk\pi\cos(n\omega t)\ldots\right)\right]$$

The relative values of the coefficients of cos nx are plotted below as a function of nk for the case $k \ll 1$, i.e., for short pulse. Under these conditions the coefficients of cos nx are proportional to $\sin nk\pi)/nk\pi$.

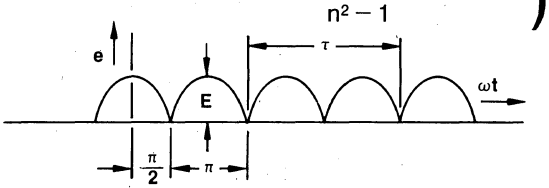


Relative amplitude of harmonics for $k \ll 1$.



Half-wave rectifier output

$$e(t) = \frac{1}{\pi}E\left(1 + \frac{\pi}{2}\cos(\omega t) + \frac{2}{3}\cos(\omega t) - \frac{2}{15}\cos(4\omega t) + \frac{2}{35}\cos(6\omega t) \ldots (-1)^{\frac{n}{2}+1}\frac{2}{n^2-1}\cos(n\omega t)\ldots\right)$$



Full-wave rectifier output

$$e(\omega t) = \frac{2}{\pi}E\left(1 + \frac{2}{3}\cos(2\omega t) - \frac{2}{15}\cos(4\omega t) + \frac{2}{35}\cos(6\omega t) \ldots (-1)^{\frac{n}{2}+1}\frac{2}{n^2-1}\cos(n\omega t)\ldots\right)$$

Figure 2.
Harmonic Composition of Some Common Periodic Waves.

Aluminum Electrolytic Capacitors
DESIGN ENGINEERING NOTES

due to leakage, which is Edc X Idc, where Idc is the rated maximum leakage current at the operating temperature.

5. In the generalized equivalent circuit of the capacitor shown in the right-hand side of figure 1, the leakage resistor is shown as EPR, the Equivalent Parallel Resistance. It is safely assumed to be constant and independent of both applied voltage and frequency, provided only that the applied Edc is at least 30% of the rated working voltage of the capacitor. It *is* temperature-dependent to some extent. The methods of measuring Idc and ESR are such as to separate them effectively. ERS is, however, sensitive to frequency, operating temperature, and (to a much lesser extent) to the applied dc and ac voltages.

Returning to Figure 1, it should be clear that the left-hand side of the diagram represents any applied ripple voltage, having any dc component, and any amplitude and wavefore of variation, provided only that the variations are truly periodic. Thus, figures 1 and 2 provide the basis for a generalized technique for computing ripple current from applied voltage (of any waveform or period) and from the parameters of the capacitor.

The capacitor parameters are shown on right-hand side of figure 1. Remember that the methods used for measuring ESR and EPR keep them separate and independent. Therefore, EPR is assumed to dissipate power *only* due to the dc leakage current (Idc); and ESR is assumed to dissipate power *only* due to the rms ac ripple currents (appropriately summed as Iac), caused by the individual Fourier ac voltage components.

Example No. 1. This example considers the simplest practical case of the application of the foregoing theory. In it, the applied voltage is the sum of a dc voltage and a single sine wave. Such a ripple waveform is applied across the capacitor when a full-wave rectifier drives the capacitor through a multi-section low-pass, "choke-input." LC filter having a fairly sharp cutoff just above the fundamental ripple frequency. (Even a single large inductance between the full-wave rectifier and the capacitor closely approaches the example.) Given the applied voltage values and the capacitor parameters listed below, what dissipation occurs in the capacitor?

Edc	=200V	C=400μF
Eac	=6 sin(ωt)	X_L at 120Hz=0.008Ω
ω	=2π(120)=754	ESR at 120Hz=0.1Ω
		EPR at 250Vdc=$10^6\Omega$

The dc leakage current is simply the ratio of Edc to EPR, or

$$Idc = 200/10^6 = 200\mu A = 0.2mA$$

and this dissipates a power equal to the product of EDC and Idc, or

$$Pdc = 200 \times 0.2 \times 10^{-3} = 40mW = 0.04W$$

The ac computation is slightly more difficult, but equally straightforward, since only a single frequency is involved.

$$Zac = ESR + j\omega ESL - j\frac{1}{\omega C} \text{ (a vector sum)}$$

In this example, both ESR and jωESL are negligibly small compared with 1/jωC *at 120 Hz,* so we may write:

$$Zac \cong 1/j\omega C$$

(Note that the normal data given for this capacitor includes its 120Hz impedence, which may be used in place of the 1/jωC computed for Zac) and we may ignore the j, since all it tells us is that the current Iac leads the applied ac voltage by 90°. Therefore,

$$Zac = 1/\omega C = 1/(400 \times 10^{-6} \times 754)$$

or $Zac = 3.32\Omega$

and we may the compute Iac

$$Iac = 6 \sin(754t)/3.32 = 1.81 \sin(754t).$$

In other words, Iac is a sine wave of current having a peak value of 1.81 amperes. For a sine wave, the rms value is 0.707 times the peak value, so

$$Iac - 0.707 \times 1.81A = 1.28A \text{ rms}$$

and the power dissipated in ESR is

$$Pac = (Iac\ rms)^2\ ESR = 0.16W$$

and the total power dissipated in the capacitor is

$$Pt = Pac + Pdc = 0.16W + 0.04W = 0.2W$$

Example No. 2. In this second example, we consider a 400μF capacitor with the same ESR and ESL, to which we apply a *sawtooth* ripple-voltage waveform, superimposed on a large Edc, as before. As we shall see later, this type of ripple waveform can occur when the rectangular-wave output of a switching regulator at, say, 95% duty cycle is fed to the capacitor through an inductor. Referring to figure 2, we find that the Fourier components of a sawtooth wave occur at both even and odd harmonics, diminishing in amplitude inversely as the order of the harmonic. If we assume a 3.14V peak-to-peak ripple amplitude superimposed on the 200V Edc, and $1/\tau$ = 400Hz, what dissipation occurs in the capacitor?

Edc=200V
Eac=3.14V p-p sawtooth
τ =1/400 seconds

C =400μF
ESL=10.6μH
X_L=0.008Ω at 120Hz
ESR=0.1Ω, assumed constant over the spectrum from 400Hz to 2,400Hz*

The dc leakage current at 25°C and rated voltage is given by:

$$Idc = 200/10^6 = 0.2mA,$$

which causes a dissipation in EPR of:

Pdc = 200 x 0.2mA = 0.04W.

*See typical DF-vs-frequency curve, figure 3. DF = (ESR X ωC).

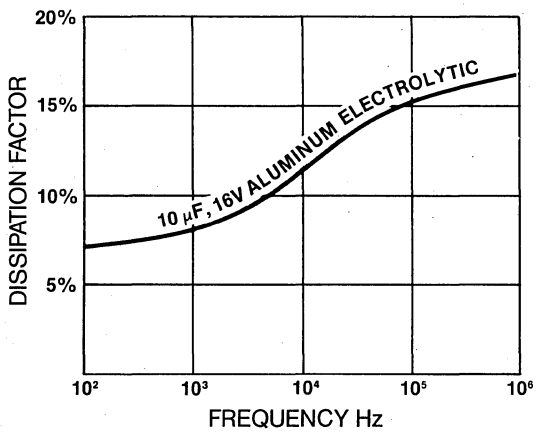


Figure 3. DF vs. Frequency for Electrolytic Capacitors.

The ac computation is best handled by a chart format, as shown below.

f	$\omega(2\tau f)$	E peak
400Hz	2,500	2V
800Hz	5,000	1V
1,200Hz	7,500	0.67V
1,600Hz	10,000	0.50V
2,000Hz	12,500	0.40V
2,400Hz	15,000	0.33V

$$e(t) = \frac{2}{\pi}(3.14)\sin(\omega t) - \frac{1}{2}\sin(2\omega t) + \frac{1}{3}(\sin 3\omega t) - \frac{1}{4}\sin(4\omega t) + \ldots$$

(The first six harmonics of sawtooth wave, from figure 2)

ω	$1/\omega C$	ωL	ESR	$1/\omega C - \omega L$
2,500	1.0 Ω	0.0264Ω	0.1Ω	0.974Ω
5,000	0.5 Ω	0.0528Ω	0.1Ω	0.447Ω
7,500	0.33Ω	0.0792Ω	0.1Ω	0.251Ω
10,000	0.25Ω	0.1056Ω	0.1Ω	0.144Ω
12,500	0.20Ω	0.132Ω	0.1Ω	0.068Ω
15,000	0.10Ω	0.264Ω	0.1Ω	0.164Ω

ω	Zac	Epeak	Ipeak	Irms
2,500	1.04Ω	2.0V	1.9A	1.4A
5,000	0.55Ω	1.0V	1.8A	1.3A
7,500	0.27Ω	0.67V	2.5A	1.8A
10,000	0.17Ω	0.5V	2.9A	2.1A
12,500	0.12Ω	0.4V	3.3A	2.3A
15,000	0.19Ω	0.33V	1.7A	1.2A

ω	Irms	I^2rms	Pac (=ESR X I^2rms)
2,500	1.4A	2.0A^2	0.2W
5,000	1.3A	1.7A^2	0.17W
7,500	1.8A	3.3A^2	0.33W
10,000	2.1A	4.4A^2	0.44W
12,500	2.3A	5.3A^2	0.53W
15,000	1.2A	1.4A^2	0.14W

Pac = 1.81W (Fundamental through 6th harmonic)

The total power dissipated is given by:

$$Pt = Pdc + Pac = 0.04 + 1.81 = 1.85W$$

A number of useful facts may be deduced by analyzing and comparing the results of examples 1 and 2.

Aluminum Electrolytic Capacitors
DESIGN ENGINEERING NOTES

- At low-frequencies—i.e., well below resonance—only the capacitance and ESR are significant. Even the ripple-voltage *waveform* is not very important, if most or all of the high-amplitude harmonics fall below resonance. In both examples we have used a capacitor that is resonant at about 2.5kHz:

$$f\,res = \frac{1}{2\pi\sqrt{LC}}$$

that is, the frequency at which

$$2\pi fL = \frac{1}{2\pi FC}$$

"L" in the above formula is the ESL of the capacitor. For L = 10.6μH and C = 400μF, f res = 2,445Hz.

- So great is the diffeence between signals falling well below resonance and those approaching resonance, that the 6V p-p ripple voltage of example 1 causes only about *one-tenth* the dissipation of the *smaller* signal (3.14V p-p) used in example 2...because the smaller signal has harmonic components near the capacitor's resonant frequency; in fact, the fifth harmonic falls just below resonance, and the sixth is just above it.
- In both examples, note that we have used as a starting point the ripple *voltage* across the capacitor, *not* the ripple current flowing through it. If we *had* known the rms ripple current, then it would only have been necessary to square that current, and multiply the result by ESR:

$$Pac = (Irms)^2\ ESR\ watts.$$

- If a number of rms ripple current (e.g., at different frequencies, as in example 2) are to pass through the same ESR, the dissipation may be computed by the principle of superposition, using the sum-of-squares formula:

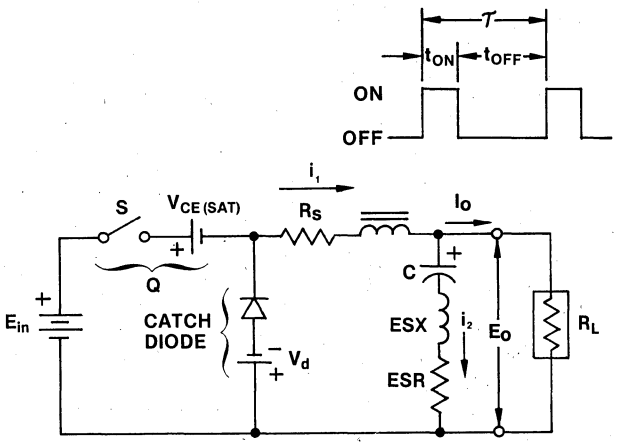
$Pac = [(I_1)^2 + (I_2)^2 + (I_3)^2 + ...(In)^2]$ ESR watts where I_1, I_2, I_3, etc. are each rms values.

Capacitor Calculations for Switching Regulator Output Circuits

For the specialist designer in motor controls and power supplies, this introductory treatment will, no doubt, convey very little new information. The technical literature of the past few years has piled up a mass of detailed analytical approaches, some of them involving complex mathematics.

For the engineer who wishes to make a good *start* on the design of the basic regulator (figure 4), and of many popular variations of this basic type, the following is well worth reading.

Figure 4. Equivalent circuit representative of many "constant-frequency," or duty-cycle-modulated switching regulators.



The circuit operates at a fixed frequency; that is, τ in figure 4 is a constant—say 100μsec for a 10 kHz regulator. The control of E_O is achieved by changing the duty cycle (α) of the control of the switching transistor.

$$\alpha = \left[1 - \frac{\tau on}{\tau}\right]$$

Figure 5 relates the various parameters around the circuit to critical currents and voltages that are established by the designer. Figure 5 presents a total of six sets of parametric curves, all synchronously related on a time "ladder," and the reader will find it possible, by moving from 5a to 5f, in various random sequences, to perform the three design tasks he must complete before the details of the electronics circuit can be attacked.

For example, figure 5f allows one to start with the required output voltage and the sum of the load and capacitor current (figure 5b) to read the product 2△VRC. From this computation, one can use figure 5d to determine the value of C.

One final note about figures 4 and 5. The results obtained from manipulations of figure 5 will not give completely valid results if the X_L shown in figure 4 is significant in magnitude to ESR. Furthermore, the results obtained in such a situation are "optimistic." Tending to yield smaller values of C and lower power dissipation. Using the new aluminum electrolytics with amide electrolytes, it is possible to obtain extremely large values of capacitance in which the X_L term is negligible compared to ESR.

It is obvious that we are not able to present the complete subject in this condensed summary. Two or three sample designs, however, treated as exercises, should serve to give the reader sufficient versatility with this rigorous and comprehensive view.

Figure 5. Relationships among parameters of Figure 4, assuming $X_L <<< ESR$.

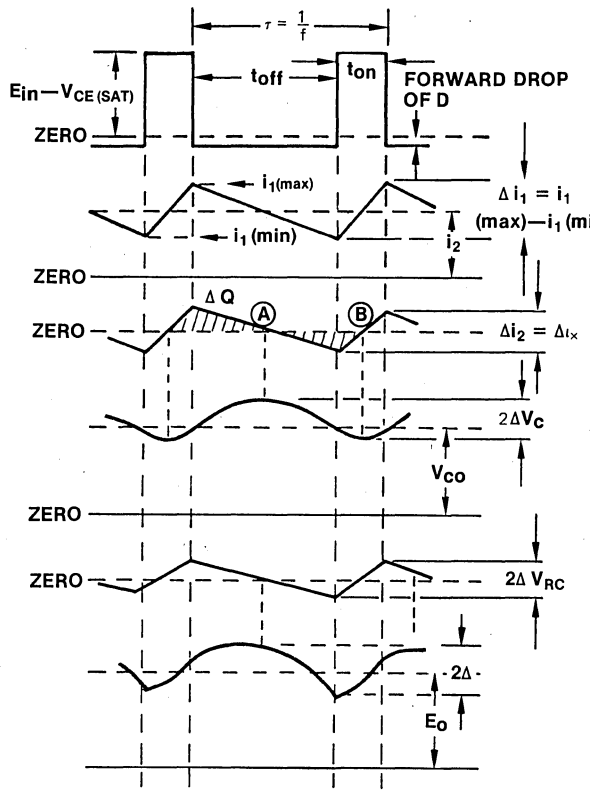


Figure 5a. Voltage across D.

Figure 5b. Current through L.(i_2).

Figure 5c. Current through C. (i_2).

Figure 5d. Voltage across capacitor c. (V_c).

Figure 5e. Voltage across R_C. (V_{RC}).

Figure 5f. Output voltage.

Ceramic Capacitors
QUICK REFERENCE INDEX

MULTILAYER LEADED CAPACITORS

Series	Description	Capacitance Range	Working Voltage Range (VDC)	Operating Temperature Range (°C)	Nominal Size	Page
CERAMIC CAPACITORS PART NUMBERING SYSTEM						**152**
A	Mono-Axial™; Conformal Coated Axial Leaded	10 pf to 1.0 μF	up to 200VDC	−55° to +125°C	.170" long x 100" dia to .400" long x .150 dia"	**153**
G	Mono-Glass™; Glass Encapsulated Axial Leaded	10 pf to .56 μF	up to 200VDC	−55° to +175°C	.170" long x 100" dia to .400" long x .150 dia"	**170**
K	Mono-Kap™; Radial Leaded	10 pf to 10 μF	up to 200VDC	−55° to +125°C	.150" Square x 100" Thick to .500" Square x .200 Thick"	**175**
P	Mono-Pak™; Dual In-Line Package	10 pf to .33 μF	up to 200VDC	−55° to +125°C	.170" long x 100" dia to .400" long x .150 dia"	**191**

CERAMIC DISC CAPACITORS

Series	Description	Capacitance Range	Working Voltage Range	Operating Temperature Range (°C)	Nominal Size	Page
D & S	General Purpose and Temperature Stable Class 1, 2 & 3	3.3 pf to .1 μF	50VDC to 6KVDC	−55°C to +125°C	.197" diameter to 1.0" diameter	**155**
D	Temperature Compensating Class 1	1.0 pf to 820 pF	50VDC to 6KVDC	−55°C to +125°C	.197" diameter to 1.0" diameter	**166**
S	Special Application GAP-KAP®	.75 pf to .02 μF	up to 3000VDC; up to 6KVDC Arc	−55°C to +85°C	.197" diameter to 1.0" diameter	**206**
S-UL	UL and CSA listed Across-the-Line Discs	100 pf to .01 μF	125VAC and 250VAC	−55°C to +125°C	.330" diameter to 1.0" diameter	**208**
U	Ultra-Kap® Class IV	.01 μF to 2.2 μF	3VDC to 100VDC	−55°C to +125°C	.197" diameter to 1.0" diameter	**193**

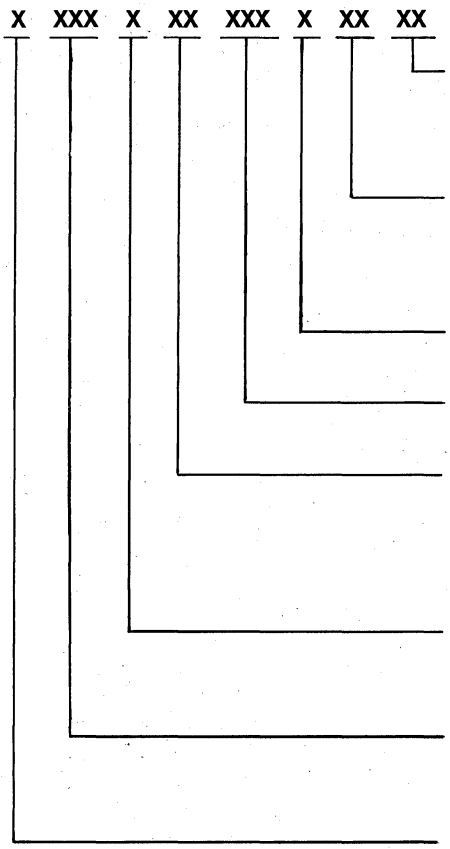
PLATE AND TRANSMITTING CAPACITORS

Series	Description	Capacitance Range	Working Voltage Range	Operating Temperature Range (°C)	Nominal Size	Page
R	General Purpose and Temperature Stable Plate Caps	.68 pf to .022 μF	50VDC and 100VDC	−55°C to +125°C	3.6mm x 6.3mm x 2.5mm to 6.2mm x 11.2mm x 2.5mm	**197**
T	RF Rated, Special Application Transmitting Capacitors	3.0 pf to .001 μF	5KV, 7.5KV, 15KV and 20KVDC	−55°C to +85°C	.250" diameter to 2.0" diameter	**202**

Part Numbering System

CERAMIC CAPACITOR PART NUMBER SYSTEM

PART NUMBER COMPOSED OF THE FOLLOWING SEGMENTS:



Electrical Detail Code;
Defines measurement method as well as limits.

Mechanical Detail Code;
Defines spacing, length, form and diameter of leads.

Voltage Code

EIA TC Code

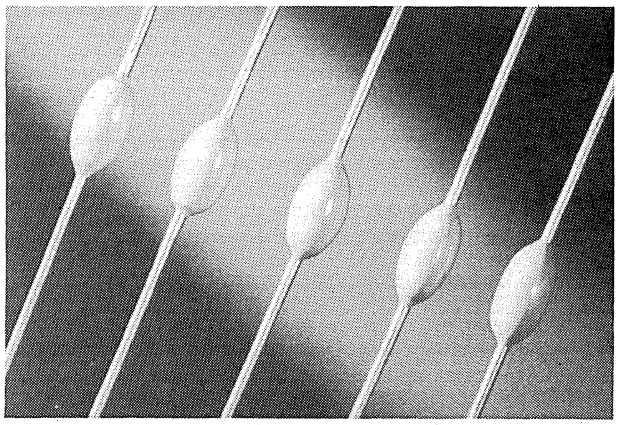
Size Code; Defines Diameter in discs. Length in Mono-Glass, Length and Height in Mono-Kap, Diagonal in Single Plates.

Capacitance Tolerance Code (Standard EIA Codes)

Capacitance Code, two significant digits, last digit is multiplier.

LEADED CAPACITORS IN THIS CATALOG:
A = MONO-AXIAL™
G = MONO-GLASS™
K = MONO-KAP®
P = MONO-PAK®
D = DISC (STD)
U = DISC (ULTRAKAP)
S = DISC (SPECIAL)
R = PLATE CAPACITORS
T = RF CAPACITORS

Mono-Axial™ Conformal Coated Ceramic Capacitors



DESCRIPTION

Industry requirements for components utilized in automated assembly and placement equipment have significantly expanded application opportunities for automatic insertion of multilayer ceramic capacitors. These devices enable the electronic manufacturer and assembler to increase the printed circuit board density and allow use of both sides of the board for greater productivity.

Class I dielectrics (C0G or NPO) have a stable, predictable, linear change over their operating temperature range and typically are neither Voltage nor Frequency sensitive. Class II and Class III dielectrics (X7R and Z5U, respectively) typically are used for bypass and coupling applications, where their sensitivity to Voltage and Frequency may be tolerated. Their Temperature Characteristics are non-linear and may best be described as a maximum tolerance envelope over a rated temperature range.

MECHANICAL PARAMETERS:

Terminal Strength: 2.2 Kg (5 lbs) Minimum pull to destruction, per Method B5 of RS-198-CII, Test Condition A.

Lead Materials: #24 AWG (.020" ±0.001") Tinned, Copper Clad Steel. 30% Conductivity. Temper: Soft; Tensile Strength: 65000 PSI Max.

Body: Conformally coated Epoxy.

ELECTRICAL PARAMETERS:

Capacitance: Measured @ 1Mhz @ 1.2VRMS max. @ 25°C for C0G types with C ≤ 1000pF. Measured @ 1Khz @ 1.2VRMS max. @ 25°C for C0G types with C > 1000 pF. Measured @ 1Khz @ 1.0VRMS ±.2VRMS @ 25°C for X7R types. Measured @ 1Khz @ 0.5VRMS±.1VRMS @ 25°C for Z5U types.

Dissipation Factor: .1% Maximum for C0G types, 2.5% Maximum for X7R types and 4.0% for Z5U types; Measurement conditions are the same as for Capacitance measurement.

Dielectric Strength: Parts are subjected for up to 5 seconds @ 25°C to 250% of Rated Voltage and will exhibit no evidence of breakdown.

Insulation Resistance: When measured @ 25°C and Rated Voltage, the following Minimum Values will be met: 100K MegΩ or 1000ΩF (whichever is less) for C0G and X7R types, 10K MegΩ or 1000 ΩF (whichever is less) for Z5U types.

Body Insulation: 500VDC Minimum, in accordance with RS-198-CII.

Operating Temperature Range: −55°C to +125°C for C0G, −55°C to +125°C for X7R, −55°C to +85°C for Z5U.

SERIES A

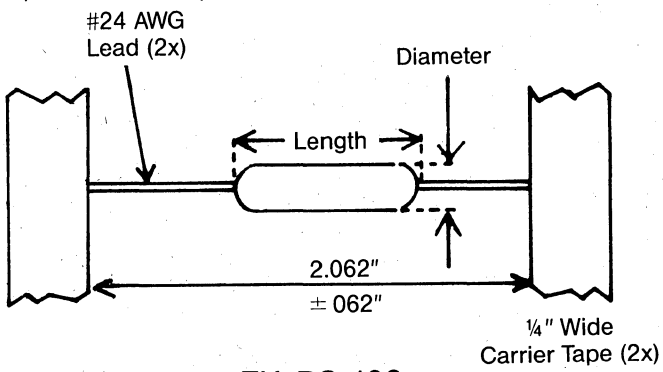
Mono-Axial™ Conformal Coated Ceramic Capacitors

MONO-AXIAL RANGE CHARTS

Material	C0G			X7R			Z5U	
Voltage	50V	100V	200V	50V	100V	200V	50V	100V
Cap. Value								
10 pF	17	17	17					
12 pF	17	17	17					
15 pF	17	17	17					
18 pF	17	17	17					
22 pF	17	17	17					
27 pF	17	17	17					
33 pF	17	17	17					
39 pF	17	17	17					
47 pF	17	17	17					
56 pF	17	17	17					
68 pF	17	17	17					
82 pF	17	17	17					
100 pF	17	17	17					
120 pF	17	17	17	17	17			
150 pF	17	17	17	17	17			
180 pF	17	17	17	17	17			
220 pF	17	17	17	17	17			
270 pF	17	17	26	17	17			
330 pF	17	17	26	17	17			
390 pF	17	17	26	17	17			
470 pF	17	17	26	17	17			
560 pF	17	17	26	17	17			
680 pF	17	26	18	17	17			
820 pF	26	26	29	17	17		17	17
.001 μF	26	26	29	17	17		17	17
.0012 μF	26	26	40	17	17		17	17
.0015 μF	26	18	40	17	17		17	17
.0018 μF	26	18	40	17	17		17	17
.0022 μF	26	18	40	17	17		17	17
.0027 μF	18	40		17	17		17	17
.0033 μF	29	40		17	17		17	17
.0039 μF	40	40		17	17		17	17
.0047 μF	40	40		17	17	29	17	17
.0056 μF	40			17	17	29	17	17
.0068 μF				17	17	29	17	17
.0082 μF				17	17	29	17	17

Material	C0G			X7R			Z5U	
Voltage	50V	100V	200V	50V	100V	200V	50V	100V
Cap. Value								
.01 μF				17	17	18	17	17
.012 μF				17	17	18	17	17
.015 μF				17	17	18	17	17
.018 μF				17	17	18	17	17
.022 μF				17	17	18	17	17
.027 μF				17	26	29	17	17
.033 μF				17	26	40	17	26
.039 μF				17	26	40	17	26
.047 μF				17	26	40	17	18
.056 μF				17	18		17	18
.068 μF				26	29		17	29
.082 μF				26	29		17	29
.1 μF				26	29		17	29
.12 μF				29	40		18	40
.15 μF				29	40		18	40
.18 μF				40			18	
.22 μF				40			18	
.27 μF				40			18	
.33 μF				40			18	
.39 μF							40	
.47 μF							40	
.56 μF							40	
.68 μF							40	
.82 μF							40	
1.0 μF							40	

Taped and Reeled per EIA RS-296E



Standard Tolerances:
C0G ±5%; ±10% also available
X7R ±10%; ±20% also available
Z5U +80/−20%; ±20% also available.

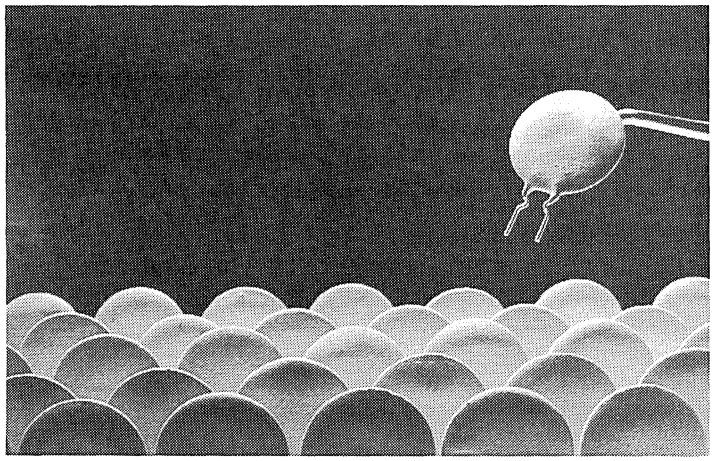
Dimensions per EIA RS-198:

Size	Length	Diameter
17	.170"Max	.100"Max
26	.260"Max	.100"Max
29	.290"Max	.150"Max
40	.400"Max	.150"Max

Note:
"Length is defined as "Clean Lead to Clean Lead" dimension.

SERIES D AND S

50VDC through 6KVDC, EIA Class I, II and III, General Purpose and Temperature Stable, Ceramic Disc Capacitors



DESCRIPTION:

Our General Purpose and Temperature Stable capacitors are available with DC Voltage ratings as high as 6KV. They may be subdivided into four different groupings of Standard Stock Items:

1. Low Voltage Standard Stock Items; This covers the range of 50VDC through 600VDC with Temperature Characteristics of Z5U and Z5V, they are typically used in non-critical bypass and coupling applications. Also included are Dual Capacitance units, which provide two capacitors within a single package, with a common center lead.
2. Temperature Stable Standard Stock Items: This covers a 100VDC X7R unit and a variety of 600VDC X5F and Z5P units. These items provide excellent temperature stability over a wide ambient temperature range.
3. 1 KDVC General Purpose Stock Items; This series provides a wide choice of 1000 Volt DC rated units for general purpose applications. These units are primarily designed for non-critical coupling, bypass and filter applications as found in all types of entertainment, industrial and medical equipment.
4. High Voltage Standard Stock Items: This series includes 1400VDC/150VAC units as well as 1600VDC, 3000VDC and 6000VDC units. These units are especially useful for filtering, blocking, voltage multiplier applications and for arc and noise suppression on switches, relays and motors.

ELECTRICAL PARAMETERS:

CAPACITANCE:

Measured @ 1MHz @ 1.2VRMS max. @ 25°C for S2L and S3N Temperature Characteristics

Measured @ 1KHz @ 1.0±0.1VRMS @ 25°C for all others.

DISSIPATION FACTOR:

.6% Max. when measured @ 1MHz @ 1.2VRMS Max. @ 25°C for S2L and S3N Temperature Characteristics.

2.5% Max. when measured @ 1KHz @ 1.0±0.1 VRMS @ 25°C for all others.

SERIES D AND S

50VDC through 6KVDC, EIA Class I, II and III, General Purpose and Temperature Stable, Ceramic Disc Capacitors

DIELECTRIC STRENGTH:
250% of Rated Voltage for units rated 500/600VDC or less, 200% of Rated Voltage for units rated 1KVDC, 175% of Rated Voltage for units rated over 1KVDC, with the test voltage being raised from zero to the specified value at a rate of approx. 500VDC per second and the maximum test voltage being maintained for 60 seconds; the limiting value of direct current shall be 50 milliAmps for both charging and discharging.

INSULATION RESISTANCE:
10,000 Meg Ω minimum when measured at rated Voltage or 500VDC, whichever is less, after 2 minutes, ±5 seconds charge time, with charging current limited to 50 milliAmps.

MARKING:
Mepco/Centralab Logo (Diamond Shape), Capacitance Value (in Micro-Farad or Pico-Farad), EIA Capacitance Tolerance Code, Rated Voltage (for Voltage ratings other than 500/600VDC), EIA Temperature Characteristic (In this order, as size permits); 50 Volt rated units may have capacitance value marking underlined to denote 50VDC rating.

ENCAPSULATION:
Phenolic Resin, Golden/Yellow colored for units less than 3000VDC, Epoxy, Golden colored for 3000VDC and higher, coating material is at Mepco/Centralab's option.

OPERATING TEMPERATURE RANGE
−55°C to +125°C.

PACKAGING:
Both Bulk and Radial Tape and Reel (per EIA RS-468) product is available. Taped and Reeled product available on 2000 pcs. Reels only.

LEADFORMS:
Bulk Product available in variety of Forms, Spacings, Lengths and Wire Diameters. Taped and Reeled Product available with 5MM (.197") Nominal Spacing, #24AWG CCS Wire, IKC (Standard), SOL or SLC Leads.

Use the following chart to determine which Ceramic to use in order to obtain the desired Temperature Characteristics.

EIA TC	Maximum Capacitance Change Allowed	*	Temp. Range	Use Ceramic	Standard Avail. Tol.
X5F	+/−7.5%	*	−55°C to +85°C	T27 only	+/−10, +/−20%
X5P	+/−10%		−55°C to +85°C	T4 or T27	+/−10, +/−20%
X5R	+/−15%		−55°C to +85°C	T4 or T27	+/−10, +/−20%
X5S	+/−22%		−55°C to +85°C	T4 or T27	+/−10, +/−20%
X5T	+22/−33%		−55°C to +85°C	T4 or T27	+/−10, +/−20%
X5U	+22/−56%		−55°C to +85°C	T4, T27 or T32	+/−20, +80-20%
X5V			−55°C to +85°C	T4, T27 or T32	+/−20, +80-20%
X7S	+/−22%		−55°C to +125°C	T27 only	+/−10, +/−20%
X7T	+22/−33%		−55°C to +125°C	T4 or T27	+/−20, +80-20%
X7U	+22/−56%		−55°C to +125°C	T4, T27 or T32	+/−20, +80-20%
X7V	+22/−82%		−55°C to +125°C	T4, T27 or T32	+/−20, +80-20%
Y5E	+/−4.7%		−30°C to +85°C	T27 only	+/−10, +/−20%
Y5F	+/−7.5%		−30°C to +85°C	T27 only	+/−10, +/−20%
Y5P	+/−10%	*	−30°C to +85°C	T4 or T27	+/−10, +/−20%
Y5R	+/−15%		−30°C to +85°C	T4 or T27	+/−10, +/−20%
Y5S	+/−22%		−30°C to +85°C	T4 or T27	+/−10, +/−20%
Y5T	+22/−33%		−30°C to +85°C	T4 or T27	+/−20, +80-20%
Y5U	+22/−56%		−30°C to +85°C	T4, T27 or T32	+/−20, +80-20%
Y5V	+22/−82%		−30°C to +85°C	T4, T27, T32 or T66	+/−20, +80-20%
Z5E	+/−4.7%		+10°C to +85°C	T27 only	+/−10, +/−20%
Z5F	+/−7.5%		+10°C to +85°C	T4 or T27	+/−10, +/−20%
Z5P	+/−10%	*	+10°C to +85°C	T4 or T27	+/−10, +/−20%
Z5R	+/−15%		+10°C to +85°C	T4 or T27	+/−10, +/−20%
Z5S	+/−22%		+10°C to +85°C	T4 or T27	+/−10, +/−20%
Z5T	+22/+33%		+10°C to +85°C	T4 or T27	+/−20, +80-20%
Z5U	+22/−56%	*	+10°C to +85°C	T4, T27, T32 or T66	+/−20, +80-20%
Z5V	+22/−82%	*	+10°C to +85°C	Any One Listed.	+/−20, +80-20%

* STANDARD Temperature Characteristics

50VDC through 6KVDC, EIA Class I, II and III, General Purpose and Temperature Stable, Ceramic Disc Capacitors

How to use the Class II and Class III Selector Chart:

1. Look up the EIA TC Code required, or look up the Maximum Change in Capacitance Value over a certain Temperature Range allowed by the Circuit.
2. This will provide one (or more) Ceramic(s).
3. Now use the range chart and find the intersection of the capacitance Value desired and the Voltage desired (within the previously selected Ceramic).
4. The number found is the smallest size on which this product may be supplied.

An Example:

Requirements: 2200 pF +/−10%, Y5S, 100VDC, no larger than .500". We find that for Y5S we can use either T4 or T27 Ceramic. In the Range Chart, we find at the intersection of EIA Cap Code 222 and T27 Ceramic/100V, that "40" is listed. (Nothing is listed under T4 for this Cap Code, so that the T27 Ceramic is the only choice.) This means that the above described part can be supplied on a diameter of .394" Maximum, well within the .500" requirement. Where multiple Ceramics meet the same TC requirements, typically the smallest sizes are found under the Ceramic with the highest number.

CLASS II AND CLASS III DISC CAPACITORS

CLASS II; TC tolerance < ±22% (E, F, P, R)
CLASS III; TC tolerance = > ±22% (S, T, U, V)

	EIA CLASS II						EIA CLASS III							
Common Electrical Detail	**T4 CERAMIC**			**T27 CERAMIC**			**T32 CERAMIC**			**T66 CERAMIC**			**T82 CER.**	
	EU	ED	EM	EU	ED	EM	EU	ED	EM	EU	ED	EM	EU	ED
Voltage	**100**	**500**	**1KV**	**100**	**500**	**1KV**	**100**	**500**	**1KV**	**100**	**500**	**1KV**	**100**	**500**
680	20	20	20											
820	20	20	20											
101	20	20	20											
121				20	20	20								
151				20	20	20								
181				20	20	20								
221				20	20	20								
271				20	20	20								
331				20	20	20								
391				20	20	20								
471				20	20	20								
561				20	29	29	20	20	20					
681				20	29	29	20	20	20					
821				29	29	29	20	29	29		20	20		
102				29	29	29	20	29	29		20	20		
122				29	40	40	20	29	29		20	29		
152				29	40	40	29	29	29	20	29	29		
182				40	40	40	29	40	40	20	29	29		
202				40	40	40	29	40	40	20	29	29		
222				40	40	40	29	40	40	20	29	40		
272				40	47	47	29	40	40	29	29	40	20	
302				40	47	47	29	40	40	29	40	40	20	
332				40	47	47	40	40	40	29	40	40	29	
392				40	59	59	40	47	47	29	40	40	29	
472				47	59	59	40	47	47	29	40	40	29	
502				47	59	59	40	47	47	29	40	47	29	
562				59	69	69	40	59	59	40	40	59	29	
682				59	69	69	40	59	59	40	40	59	40	

CODED CAPACITANCE VALUE

Continued

SERIES D AND S

50VDC through 6KVDC, EIA Class I, II and III, General Purpose and Temperature Stable, Ceramic Disc Capacitors

CLASS II; TC tolerance < ±22% (E, F, P, R)
CLASS III; TC tolerance = > ±22% (S, T, U, V)

		EIA CLASS II									EIA CLASS III				
Common Electrical Detail		T4 CERAMIC			T27 CERAMIC			T32 CERAMIC			T66 CERAMIC			T82 CER.	
		EU	ED	EM	EU	ED	EM	EU	ED	EM	EU	ED	EM	EU	ED
Voltage		100	500	1KV	100	500	1KV	100	500	1KV	100	500	1KV	100	500
CODED CAPACITANCE VALUE	822				59	82	82	47	69	69	40	47	59	40	
	103				69	82	82	47	69	69	40	47	59	40	
	123					93	93	59	82	82	40	59	69	40	59
	153							59	82	93	47	59	69	47	59
	183										47	69	82	47	69
	203										59	69	82	59	69
	223										59	69	82	59	69
	273										59	69	S72	59	69
	303										69	S72	S85	69	S72
	333										69	S72	S85	69	S72
	393										69	S72	S85	69	S72
	473										69	S72	S95	69	S72
	503										69	S72	S95	69	S72
	563										S62	S85		S62	S72
	683										S62	S85		S62	S85
	823										S72	S95		S72	S95
	104										S72	S95		S72	S95

Size Codes:

20 .197" dia, .156" thick
29 .290" dia, .156" thick
40 .394" dia, .156" thick
47 .472" dia, .156" thick
59 .590" dia, .156" thick
69 .690" dia, .156" thick
82 .820" dia, .156" thick
93 .930" dia, .156" thick

Special Sizes (Dual Disc Construction)

S62 .620" ida, .220" thick (Epoxy or Phenolic Coated, CRL option)

S72 .720" dia, .220" thick (Epoxy or Phenolic Coated, CRL option)

S85 .850" dia, .220" thick (Epoxy or Phenolic Coated, CRL option)

S95 .950" dia, .220" thick (Epoxy or Phenolic Coated, CRL option)

Note:
Voltages indicated are maximum operating voltages; use 100V column for 50V, etc.

50VDC through 6KVDC, EIA Class I, II and III, General Purpose and Temperature Stable, Ceramic Disc Capacitors

LOW VOLTAGE STANDARD STOCK ITEMS

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	TC CODE	MAX. DIA.	MAX. THICK.	LEAD SPACE	LEAD STYLE
50 Volt DCW								
.005 mf	D502Z29Z5VFAAEU	CK502	+80–20%	Z5V	.29"	.156"	.250"	SLL
.01	D103Z39Z5VFAAEU	CK103	+80–20%	Z5V	.39"	.156"	.250"	SLL
■.01	D103Z39Z5VFTHEU	—	+80–20%	Z5V	.39"	.140"	.200"	IKC*
.02	D203Z59Z5VFABEU	CK203	+80–20%	Z5V	.59"	.156"	.375"	SLL
.025	D253Z59Z5VFABEU	CK253	+80–20%	Z5V	.59"	.156"	.375"	SLL
.03	D303Z59Z5VFABEU	CK303	+80–20%	Z5V	.59"	.156"	.375"	SLL
.05	D503Z69Z5VFABEU	CK503	+80–20%	Z5V	.69"	.156"	.375"	SLL
.1	S104Z72Z5VFAZAA	CK104	+80–20%	Z5V	.72"	.171"	.375"	SLL
75 Volt DCW								
.05 mf	D503X69Z5VGAZAA	DDA503	+80–30%	Z5V	.69"	.156"	.375"	SLL
.1	S104X72Z5VGAZAA	DDA104	+80–30%	Z5V	.72"	.171"	.375"	SLL
100 Volt DCW								
.005 mf	D502M39Z5VHAAEU	DC502	±20%	Z5V	.39"	.156"	.250"	SLL
.005	D502M39Z5VHBEEU	XXDC502	±20%	Z5V	.39"	.156"	.250"	SLC
.01	D103M39Z5VHAAEU	DC103	±20%	Z5V	.39"	.156"	.250"	SLL
.01	D103M39Z5VHBEEU	XXDC103	±20%	Z5V	.39"	.156"	.250"	SLC
■.01	D103M39Z5VHTHEU	—	±20%	Z5V	.39"	.140"	.200"	IKC*
.02	D203M59Z5VHABEU	DC203	±20%	Z5V	.59"	.156"	.375"	SLL
.02	D203M59Z5VHBFEU	XXDC203	±20%	Z5V	.59"	.156"	.375"	SLC
.025	D253M59Z5VHABEU	DC253	±20%	Z5V	.59"	.156"	.375"	SLL
.025	D253M59Z5VHBFEU	XXDC253	±20%	Z5V	.59"	.156"	.375"	SLC
.05	D503M69Z5VHABEU	DC503	±20%	Z5V	.69"	.156"	.375"	SLL
.05	D503M69Z5VHBFEU	XXDC503	±20%	Z5V	.69"	.156"	.375"	SLC
.1	S104M72Z5VHAZAA	DC104	±20%	Z5V	.72"	.171"	.375"	SLL
.1	S104S72Z5VHAZAA	DC104S	±30%	Z5V	.72"	.171"	.375"	SLL
150 Volt DCW								
.005 uf	D502X39Z5VJAZAA	DDM502	+60–40%	Z5V	.39"	.156"	.250"	SLL
.01 uf	D103X39Z5VJAAEU	DDM103	+60–40%	Z5V	.39"	.156"	.250"	SLL
.02 uf	S203X40Z5VJAZAA	DDM203	+60–40%	Z5V	.40"	.171"	.250"	SLL
600 Volt DCW								
.01 mf	D103P59Z5ULABED	DD6103	GMV	Z5U	.59"	.156"	.375"	SLL
.015	D153Z69Z5ULABED	DD153	+80–20%	Z5U	.69"	.156"	.375"	SLL
.02	D203Z69Z5ULABED	DD203	+80–20%	Z5U	.69"	.156"	.375"	SLL
.02	D203Z69Z5ULBFED	XXDD203	+80–20%	Z5U	.69"	.156"	.375"	SLC
.03	S303Z72Z5ULAZAA	DD303	+80–20%	Z5U	.72"	.250"	.375"	SLL
.04	S403Z72Z5ULAZAA	DD403	+80–20%	Z5U	.72"	.250"	.375"	SLL
.05	S503Z85Z5ULAZAA	DD503	+80–20%	Z5U	.85"	.250"	.375"	SLL
.05	S503Z85Z5ULBFED	XXDD503	+80–20%	Z5U	.85"	.250"	.375"	SLC
.1	S104Z95Z5VLAZAB	DD104	+80–20%	Z5V	.95"	.250"	.375"	SLL
Dual Capacitance 600 Volt DCW								
.001 uf	S102P39Z5ULAZAA	DD3102	GMV	Z5U	.39"	.186"	.125"	SLL
.005 uf	S502P59Z5ULAZAA	DD3502	GMV	Z5U	.59"	.225"	.125"	SLL
.01 uf	S103P69Z5ULAZAA	DD3103	GMV	Z5U	.69"	.225"	.125"	SLL

*Tape and Reel Packaging

■ New Product

SERIES D AND S

50VDC through 6KVDC,EIA Class I, II and III, General Purpose and Temperature Stable, Ceramic Disc Capacitors

TEMPERATURE STABLE STANDARD STOCK ITEMS

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	MAX. DIA.	MAX. THICK.	LEAD SPACE	LEAD STYLE
100 Volt DCW X7R							
■.001 mf	D102K20X7RHPCEW	—	± 10%	.20"	.140"	.200"	SLF
600 Volt DCW X5F							
150 pf	D151K20X5FLAAEC	CE151	± 10%	.20"	.156"	.250"	SLL
220 pf	D221K20X5FLAAEC	CE221	± 10%	.20"	.156"	.250"	SLL
330 pf	D331K20X5FLAAEC	CE331	± 10%	.20"	.156"	.250"	SLL
470 pf	D471K20X5FLAAEC	CE471	± 10%	.20"	.156"	.250"	SLL
500 pf	D501K20X5FLAAEC	CE501	± 10%	.20"	.156"	.250"	SLL
560 pf	D561K29X5FLAAEA	CE561	± 10%	.29"	.156"	.250"	SLL
680 pf	D681K29X5FLAAEA	CE681	± 10%	.29"	.156"	.250"	SLL
750 pf	D751K29X5FLAAEA	CE751	± 10%	.29"	.156"	.250"	SLL
800 pf	D801K29X5FLAAEC	CE801	± 10%	.29"	.156"	.250"	SLL
820 pf	D821K29X5FLAAEC	CE821	± 10%	.29"	.156"	.250"	SLL
.001 uf	D102K29X5FLAAEC	CE102	± 10%	.29"	.156"	.250"	SLL
.0012 uf	D122K39X5FLAAEC	CE122	± 10%	.39"	.156"	.250"	SLL
.0015 uf	D152K39X5FLAAEC	CE152	± 10%	.39"	.156"	.250"	SLL
.0018 uf	D182K39X5FLAAEC	CE182	± 10%	.39"	.156"	.250"	SLL
.002 uf	D202K39X5FLAAEC	CE202	± 10%	.39"	.156"	.250"	SLL
.0022 uf	D222K39X5FLAAEC	CE222	± 10%	.39"	.156"	.250"	SLL
.0033 uf	D332K47X5FLABEC	CE332	± 10%	.47"	.156"	.375"	SLL
.0039 uf	D392K59X5FLABEC	CE392	± 10%	.59"	.156"	.375"	SLL
.0047 uf	D472K59X5FLABEC	CE472	± 10%	.59"	.156"	.375"	SLL
.005 uf	D502K69X5FLABED	CE502	± 10%	.69"	.156"	.375"	SLL
.0062 uf	D622K69X5FLABED	CE622	± 10%	.69"	.156"	.375"	SLL
.0082 uf	D822K82X5FLABEC	CE822	± 10%	.82"	.156"	.375"	SLL
.01 uf	D103K82X5FLABEA	CE103	± 10%	.82"	.156"	.375"	SLL
600 Volt DCW Z5P							
.0012 mf	D122K39Z5PLAAED	CF122	± 10%	.39"	.156"	.250"	SLL
.0015 mf	D152K39Z5PLAAED	CF152	± 10%	.39"	.156"	.250"	SLL
.0018 mf	D182K39Z5PLAAED	CF182	± 10%	.39"	.156"	.250"	SLL
.002 mf	D202K39Z5PLAAED	CF202	± 10%	.39"	.156"	.250"	SLL
.0022 mf	D222K39Z5PLAAEC	CF222	± 10%	.39"	.156"	.250"	SLL
.0033 mf	D332K47Z5PLAAED	CF332	± 10%	.47"	.156"	.250"	SLL
.0039 mf	D392K59Z5PLABED	CF392	± 10%	.59"	.156"	.375"	SLL
.0047 mf	D472K59Z5PLABED	CF472	± 10%	.59"	.156"	.375"	SLL
.005 mf	D502K59Z5PLABED	CF502	± 10%	.59"	.156"	.375"	SLL
.0062 mf	D622K69Z5PLABED	CF622	± 10%	.69"	.156"	.375"	SLL
.0082 mf	D822K82Z5PLABED	CF822	± 10%	.82"	.156"	.375"	SLL
.01 mf	D103K82Z5PLABED	CF103	± 10%	.82"	.156"	.375"	SLL

*Tape and Reel Packaging

■ New Product

50VDC through 6KVDC, EIA Class I, II and III, General Purpose and Temperature Stable, Ceramic Disc Capacitors

1KVDC GP STANDARD STOCK ITEMS

CAP. VALUE	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	TC CODE	MAX. DIA.	MAX. THICK.	LEAD SPACE	LEAD STYLE
1000 Volt DCW								
3.3 pf	D339D20S2LNAAAL	DD3R3	±0.5%	S2L	.20"	.156"	.250"	SLL
5 pf	D509K20S2LNAAAL	DD050	±10%	S2L	.20"	.156"	.250"	SLL
6 pf	D609K20S2LNAAAL	DD060	±10%	S2L	.20"	.156"	.250"	SLL
6.8 pf	D689K20S2LNAAAL	DD6R8	±10%	S2L	.20"	.156"	.250"	SLL
7 pf	D709K20S2LNAAAL	DD070	±10%	S2L	.20"	.156"	.250"	SLL
8 pf	D809K20S2LNAAAL	DD080	±10%	S2L	.20"	.156"	.250"	SLL
10 pf	D100K20S2LNAAAL	DD100	±10%	S2L	.20"	.156"	.250"	SLL
12 pf	D120K20S2LNAAAL	DD120	±10%	S2L	.20"	.156"	.250"	SLL
15 pf	D150K20S2LNAAAL	DD150	±10%	S2L	.20"	.156"	.250"	SLL
18 pf	D180K20S2LNAAAL	DD180	±10%	S2L	.20"	.156"	.250"	SLL
20 pf	D200K20S2LNAAAL	DD200	±10%	S2L	.20"	.156"	.250"	SLL
22 pf	D220K20S2LNAAAL	DD220	±10%	S2L	.20"	.156"	.250"	SLL
24 pf	D240K20S2LNAAAL	DD240	±10%	S2L	.20"	.156"	.250"	SLL
25 pf	D250K20S2LNAAAL	DD250	±10%	S2L	.20"	.156"	.250"	SLL
27 pf	D270K20S2LNAAAL	DD270	±10%	S2L	.20"	.156"	.250"	SLL
30 pff	D300K29S2LNAAAL	DD300	±10%	S2L	.29"	.156"	.250"	SLL
33 pf	D330K29S2LNAAAL	DD330	±10%	S2L	.29"	.156"	.250"	SLL
39 pf	D390K29S2LNAAAL	DD390	±10%	S2L	.29"	.156"	.250"	SLL
47 pf	D470K29S2LNAAAL	DD470	±10%	S2L	.29"	.156"	.250"	SLL
50 pf	D500K29S3NNAAAL	DD500	±10%	S3N	.29"	.156"	.250"	SLL
51 pf	D510K29S3NNAAAL	DD510	±10%	S3N	.29"	.156"	.250"	SLL
56 pf	D560K29S3NNAAAL	DD560	±10%	S3N	.29"	.156"	.250"	SLL
68 pf	D680K29S3NNAAAL	DD680	±10%	S3N	.29"	.156"	.250"	SLL
75 pf	D750K29S3NNAAAL	DD750	±10%	S3N	.29"	.156"	.250"	SLL
82 pf	D820K29S3NNAAAL	DD820	±10%	S3N	.29"	.156"	.250"	SLL
91 pf	D910K29S3NNAAAL	DD910	±10%	S3N	.29"	.156"	.250"	SLL
100 pf	D101K29S3NNAAAL	DD101	±10%	S3N	.29"	.156"	.250"	SLL
100 pf	D101K29S3NNBEAL	XXDD101	±10%	S3N	.29"	.156"	.250"	SLC
■100 pf	D101K29S3NNTHAL	—	±10%	S3N	.29"	.156"	.200"	IKC*
120 pf	D121K29S3NNAAAL	DD121	±10%	S3N	.29"	.156"	.250"	SLL
130 pf	D131K29S3NNAAAL	DD131	±10%	S3N	.29"	.156"	.250"	SLL
150 pf	D151K29S3NNAAAL	DD151	±10%	S3N	.29"	.156"	.250"	SLL
180 pf	D181K29S3NNAAAL	DD181	±10%	S3N	.29"	.156"	.250"	SLL
200 pf	D201K29S3NNAAAL	DD201	±10%	S3N	.29"	.156"	.250"	SLL
200 pf	D201K29S3NNBEAB	XXDD201	±10%	S3N	.29"	.156"	.250"	SLC
220 pf	D221K20Z5FNAAEM	DD221	±10%	Z5F	.20"	.156"	.250"	SLL
220 pf	D221K20Z5FNBEEM	XXDD221	±10%	Z5F	.20"	.156"	.250"	SLC
240 pf	D241K20Z5FNAAEM	DD241	±10%	Z5F	.20"	.156"	.250"	SLL
250 pf	D251K20Z5FNAAEM	DD251	±10%	Z5F	.20"	.156"	.250"	SLL
270 pf	D271K20Z5FNAAEM	DD271	±10%	Z5F	.20"	.156"	.250"	SLL
300 pf	D301K20Z5FNAAEM	DD301	±10%	Z5F	.20"	.156"	.250"	SLL
330 pf	D331K20Z5FNAAEM	DD331	±10%	Z5F	.20"	.156"	.250"	SLL
350 pf	D351K20Z5FNAAEM	DD351	±10%	Z5F	.20"	.156"	.250"	SLL
360 pf	D361K20Z5FNAAEM	DD361	±10%	Z5F	.20"	.156"	.250"	SLL
390 pf	D391K20Z5FNAAEM	DD391	±10%	Z5F	.20"	.156"	.250"	SLL
400 pf	D401K20Z5FNAAEM	DD401	±10%	Z5F	.20"	.156"	.250"	SLL

*Tape and Reel Packaging

■ New Product

SERIES D AND S

50VDC through 6KVDC, EIA Class I, II and III, General Purpose and Temperature Stable, Ceramic Disc Capacitors

1KVDC GP STANDARD STOCK ITEMS

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	TC CODE	MAX. DIA.	MAX. THICK.	LEAD SPACE	LEAD STYLE
470 pf	D471K20Z5FNAAEM	DD471	±10%	Z5F	.20"	.156"	.250"	SLL
470 pf	D471K20Z5FNBEEM	XXDD471	±10%	Z5F	.20"	.156"	.250"	SLC
500 pf	D501K29Z5FNAAEM	DD501	±10%	Z5F	.29"	.156"	.250"	SLL
500 pf	D501K29Z5FNBEEM	XXDD501	±10%	Z5F	.29"	.156"	.250"	SLC
510 pf	D511K29Z5FNAAEM	DD511	±10%	Z5F	.29"	.156"	.250"	SLL
560 pf	D561K29Z5FNAAEM	DD561	±10%	Z5F	.29"	.156"	.250"	SLL
600 pf	D601K29Z5RNAAEM	DD601	±10%	Z5R	.29"	.156"	.250"	SLL
680 pf	D681K29Z5RNAAEM	DD681	±10%	Z5R	.29"	.156"	.250"	SLL
750 pf	D751K29Z5RNAAEM	DD751	±10%	Z5R	.29"	.156"	.250"	SLL
820 pf	D821K29Z5FNAAEM	DD821	±10%	Z5F	.29"	.156"	.250"	SLL
910 pf	D911K29Z5RNAAEM	DD911	±10%	Z5R	.29"	.156"	.250"	SLL
.001 mf	D102K29Z5FNAAEM	DD102	±10%	Z5F	.29"	.156"	.250"	SLL
.001 mf	D102K29Z5FNBEEM	XXDD102	±10%	Z5F	.29"	.156"	.250"	SLC
■.001 mf	D102K29Z5FNTHEM	—	±10%	Z5F	.29"	.156"	.200"	IKC*
.001 mf	D102P29Z5UNAAEM	DD102G	GMV	Z5U	.29"	.156"	.250"	SLL
.001 mf	D102P29Z5UNBEEM	XXDD102G	GMV	Z5U	.29"	.156"	.250"	SLC
.0012 mf	D122K39Z5RNAAEM	DD122	+10%	Z5R	.39"	.156"	.250"	SLL
.0013 mf	D132K39Z5RNAAEM	DD132	±10%	Z5R	.39"	.156"	.250"	SLL
.0015 mf	D152K39Z5RNAAEM	DD152	±10%	Z5R	.39"	.156"	.250"	SLL
.0015 mf	D152P29Z5UNAAEM	DD152G	GMV	Z5U	.29"	.156"	.250"	SLL
.0016 mf	D162K39Z5RNAAEM	DD162	±10%	Z5R	.39"	.156"	.250"	SLL

GENERAL PURPOSE 1KVDC STANDARD STOCK ITEMS

CAP. VALUE	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	TC CODE	MAX. DIA.	MAX. THICK.	LEAD SPACE	LEAD STYLE
1000 Volt DCW								
.0018 mf	D182K39Z5RNAAEM	DD182	±10%	Z5R	.39"	.156"	.250"	SLL
.002 mf	D202M39Z5UNAAEM	DD202	±20%	Z5U	.39"	.156"	.250"	SLL
.002 mf	D202M39Z5UNBEEM	XXDD202	±20%	Z5U	.39"	.156"	.250"	SLC
.0022 mf	D222M39Z5UNAAEM	DD222	±20%	Z5U	.39"	.156"	.250"	SLL
.0025 mf	D252M39Z5UNAAEM	DD252	±20%	Z5U	.39"	.156"	.250"	SLL
.0027 mf	D272M39Z5UNAAEM	DD272	±20%	Z5U	.39"	.156"	.250"	SLL
.003 mf	D302M39Z5UNAAEM	DD302	±20%	Z5U	.39"	.156"	.250"	SLL
.0033 mf	D332M39Z5UNAAEM	DD332	±20%	Z5U	.39"	.156"	.250"	SLL
.0039 mf	D392M39Z5UNAAEM	DD392	±20%	Z5U	.39"	.156"	.250"	SLL
.004 mf	D402M39Z5UNAAEM	DD402	±20%	Z5U	.39"	.156"	.250"	SLL
.0043 mf	D432M47Z5UNAAEM	DD432	±20%	Z5U	.47"	.156"	.250"	SLL
.0047 mf	D472M47Z5UNAAEM	DD472	±20%	Z5U	.47"	.156"	.250"	SLL
.005 mf	D502M47Z5UNAAEM	DD5022	±20%	Z5U	.47"	.156"	.250"	SLL
.005 mf	D502P59Z5UNABEM	DD502	GMV	Z5U	.59"	.156"	.375"	SLL
.005 mf	D502P59Z5UNBFEM	XXDD502	GMV	Z5U	.59"	.156"	.375"	SLC
.0056 mf	D562M47Z5UNAAEM	DD562	±20%	Z5U	.47"	.156"	.250"	SLL
.0068 mf	D682M59Z5UNABEM	DD682	±20%	Z5U	.59"	.156"	.375"	SLL
.0075 mf	D752M59Z5UNABEM	DD752	±20%	Z5U	.59"	.156"	.375"	SLL
.0082 mf	D822M59Z5UNABEM	DD822	±20%	Z5U	.59"	.156"	.375"	SLL
.01 mf	D103M59Z5UNABEM	DD1032	±20%	Z5U	.59"	.156"	.375"	SLL
.01 mf	D103P69Z5UNABEM	DD103	GMV	Z5U	.69"	.156"	.375"	SLL
.01 mf	D103P69Z5UNBFEM	XXDD103	GMV	Z5U	.69"	.156"	.375"	SLC

*Tape and Reel Packaging

■ New Product

50VDC through 6KVDC, EIA Class I, II and III, General Purpose and Temperature Stable, Ceramic Disc Capacitors

HIGH VOLTAGE STANDARD STOCK ITEMS

CAP. VALUE	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	TC CODE	MAX. DIA.	MAX. THICK.	LEAD SPACE	LEAD STYLE
1400 Volt DCW / 150 Volt AC RMS, 60Hz								
.0047 mf	D472M82Z5UYAZAA	DI472	±20%	Z5U	.82"	.240"	.375"	SLL
.01 mf	D103M82Z5UYAZAA	DI103	±20%	Z5U	.82"	.180"	.375"	SLL
1600 Volt DCW								
.003 mf	D302P59Z5UXAZAA	DD16302	GMV	Z5U	.59"	.172"	.375"	SLL
.005 mf	D502P59Z5UXAZAA	DD16502	GMV	Z5U	.59"	.172"	.375"	SLL
.006 mf	D602P69Z5UXAZAA	DD16602	GMV	Z5U	.69"	.172"	.375"	SLL
.007 mf	D702P69Z5UXAZAA	DD16702	GMV	Z5U	.69"	.172"	.375"	SLL
.01 mf	D103P82Z5UXAZAA	DD16103	GMV	Z5U	.82"	.172"	.375"	SLL
.015 mf	D153Z93Z5UXAZAA	DD16153	+80 – 20%	Z5U	.93"	.172"	.375"	SLL
3000 Volt DCW								
4.7 pf	D479M33S2LRAAAL	DD304R7	±20%	S2L	.33"	.180"	.250"	SLL
10 pf	D100M33S2LRAAAL	DD30100	±20%	S2L	.33"	.180"	.250"	SLL
15 pf	D150M33S2LRAAAL	DD30150	±20%	S2L	.33"	.180"	.250"	SLL
22 pf	D220M33S3NRAAAL	DD30220	±20%	S3N	.33"	.180"	.250"	SLL
30 pf	D300M33S3NRAAAL	DD30300	±20%	S3N	.33"	.203"	.250"	SLL
33 pf	D330M33S3NRAAAL	DD30330	±20%	S3N	.33"	.203"	.250"	SLL
47 pf	D470M33S3NRAAAL	DD30470	±20%	S3N	.33"	.203"	.250"	SLL
50 pf	D500M33S3NRAAAL	DD30500	±20%	S3N	.33"	.203"	.250"	SLL
68 pf	D680M33S3NRAAAL	DD30680	±20%	S3N	.33"	.203"	.250"	SLL
82 pf	D820M33S3NRAAAL	DD30820	±20%	S3N	.33"	.203"	.250"	SLL
100 pf	D101M33Z5URAAEM	DD30101	±20%	Z5U	.33"	.203"	.250"	SLL
150 pf	D151M33Z5URAAEM	DD30151	±20%	Z5U	.33"	.203"	.250"	SLL
200 pf	D201M33Z5URAAEM	DD30201	±20%	Z5U	.33"	.203"	.250"	SLL
220 pf	D221M33Z5URAAEM	DD30221	±20%	Z5U	.33"	.203"	.250"	SLL
250 pf	D251M33Z5URAAEM	DD30251	±20%	Z5U	.33"	.203"	.250"	SLL
270 pf	D271M33Z5URAAEM	DD30271	±20%	Z5U	.33"	.203"	.250"	SLL
300 pf	D301M33Z5URAAEM	DD30301	±20%	Z5U	.33"	.203"	.250"	SLL
330 pf	D331M33Z5URAAEM	DD30331	±20%	Z5U	.33"	.203"	.250"	SLL
390 pf	D391M33Z5URAAEM	DD30391	±20%	Z5U	.33"	.203"	.250"	SLL
470 pf	D471M33Z5URAAEM	DD30471	±20%	Z5U	.33"	.203"	.250"	SLL
500 pf	D501M33Z5URAAEM	DD30501	±20%	Z5U	.33"	.203"	.250"	SLL
680 pf	D681M33Z5URAAEM	DD30681	±20%	Z5U	.33"	.203"	.250"	SLL
750 pf	D751M33Z5URAAEM	DD30751	±20%	Z5U	.33"	.203"	.250"	SLL
820 pf	D821M43Z5URAAEM	DD30821	±20%	Z5U	.43"	.203"	.250"	SLL
.001 mf	D102M43Z5URAAEM	DD30102	±20%	Z5U	.43"	.203"	.250"	SLL
.0012 mf	D122M43Z5URAAEM	DD30122	±20%	Z5U	.43"	.203"	.250"	SLL
.0015 mf	D152M63Z5URABEM	DD30152	±20%	Z5U	.63"	.203"	.375"	SLL
.002 mf	D202M63Z5URABEM	DD30202	±20%	Z5U	.63"	.203"	.375"	SLL
.0022 mf	D222M63Z5URABEM	DD30222	±20%	Z5U	.63"	.203"	.375"	SLL
.0027 mf	D272M63Z5URABEM	DD30272	±20%	Z5U	.63"	.203"	.375"	SLL
.003 mf	D302M63Z5URABEM	DD30302	±20%	Z5U	.63"	.203"	.375"	SLL
.0033 mf	D332M63Z5URABEM	DD30332	±20%	Z5U	.63"	.203"	.375"	SLL
.0039 mf	D392M73Z5URABEM	DD30392	±20%	Z5U	.73"	.203"	.375"	SLL
.0047 mf	D472M73Z5URABEM	DD30472	±20%	Z5U	.73"	.203"	.375"	SLL
.005 mf	D502M73Z5URABEM	DD30502	±20%	Z5U	.73"	.203"	.375"	SLL
.01 mf	D103M96Z5URABEM	DD30103	±20%	Z5U	.96"	.203"	.375"	SLL

SERIES D AND S

50VDC through 6KVDC, EIA Class I, II and III, General Purpose and Temperature Stable, Ceramic Disc Capacitors

HIGH VOLTAGE STANDARD STOCK ITEMS

CAP. VALUE	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	TC CODE	MAX. DIA.	MAX. THICK.	LEAD SPACE	LEAD STYLE
6000 Volt DCW								
10 pf	D100M66S2LUABAL	DD60100	±20%	S2L	.66"	.313"	.375"	SLL
15 pf	D150M66S2LUABAL	DD60150	±20%	S2L	.66"	.313"	.375"	SLL
30 pf	D300M66S3NUABAL	DD60300	±20%	S3N	.66"	.313"	.375"	SLL
39 pf	D390M66S3NUABAL	DD60390	±20%	S3N	.66"	.313"	.375"	SLL
47 pf	D470M66S3NUABAL	DD60470	±20%	S3N	.66"	.313"	.375"	SLL
50 pf	D500M66S3NUABAL	DD60500	±20%	S3N	.66"	.313"	.375"	SLL
75 pf	D750M66S3NUABAL	DD60750	±20%	S3N	.66"	.313"	.375"	SLL
82 pf	D820M66S3NUABAL	DD60820	±20%	S3N	.66"	.313"	.375"	SLL
100 pf	D101M66S3NUAZAA	DD60101	±20%	S3N	.66"	.313"	.375"	SLL
120 pf	D121M66S3NUABAL	DD60121	±20%	S3N	.66"	.313"	.375"	SLL
150 pf	D151M66S3NUABAL	DD60151	±20%	S3N	.66"	.313"	.375"	SLL
180 pf	D181M66Z5UUABEM	DD60181	±20%	Z5U	.66"	.313"	.375"	SLL
200 pf	D201M66Z5UUABEM	DD60201	±20%	Z5U	.66"	.313"	.375"	SLL
220 pf	D221M66Z5UUABEM	DD60221	±20%	Z5U	.66"	.313"	.375"	SLL
250 pf	D251M66Z5UUABEM	DD60251	±20%	Z5U	.66"	.313"	.375"	SLL
300 pf	D301M66Z5UUABEM	DD60301	±20%	Z5U	.66"	.313"	.375"	SLL
390 pf	D391M66Z5UUABEM	DD60391	±20%	Z5U	.66"	.313"	.375"	SLL
470 pf	D471M66Z5UUABEM	DD60471	±20%	Z5U	.66"	.313"	.375"	SLL
500 pf	D501M66Z5UUABEM	DD60501	±20%	Z5U	.66"	.313"	.375"	SLL
750 pf	D751M66Z5UUABEM	DD60751	±20%	Z5U	.66"	.313"	.375"	SLL
820 pf	D821M66Z5UUABEM	DD60821	±20%	Z5U	.66"	.313"	.375"	SLL
.001 mf	D102M66Z5UUABEM	DD60102	±20%	Z5U	.66"	.313"	.375"	SLL
.0012 mf	D122M66Z5UUABEM	DD60122	±20%	Z5U	.66"	.313"	.375"	SLL
.0015 mf	D152M66Z5UUABEM	DD60152	±20%	Z5U	.66"	.313"	.375"	SLL
.002 mf	D202M76Z5UUABEM	DD60202	±20%	Z5U	.76"	.313"	.375"	SLL
.0022 mf	D222M76Z5UUABEM	DD60222	±20%	Z5U	.76"	.313"	.375"	SLL

Standard Disc Leadforms

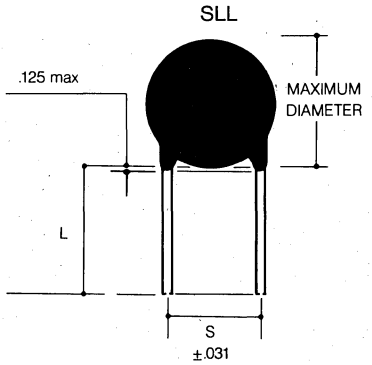


Fig 1 leadform available on all sizes and voltages, Bulk product only.

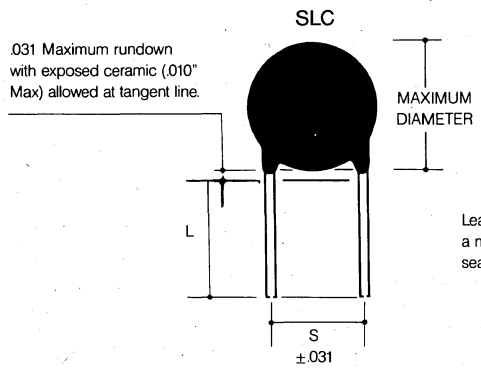


Fig 2 available on single disc construction, 1KV max rating, also avail. on Radial T & R.

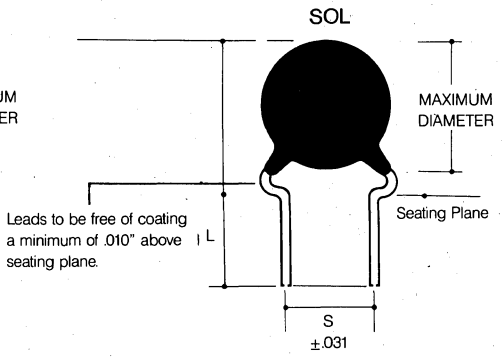


Fig 3 available on single disc construction, 1KV max rating, also avail. on Radial T & R.

SERIES D AND S

50VDC through 6KVDC, EIA Class I, II and III, General Purpose and Temperature Stable, Ceramic Disc Capacitors

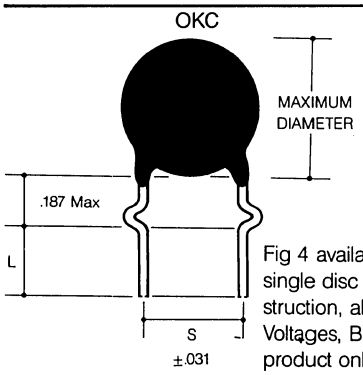


Fig 4 available on single disc construction, all Voltages, Bulk product only.

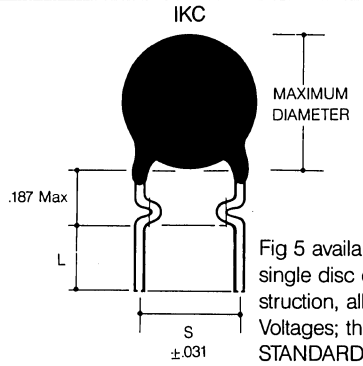


Fig 5 available on single disc construction, all Voltages; this is the STANDARD form for Radial T & R.

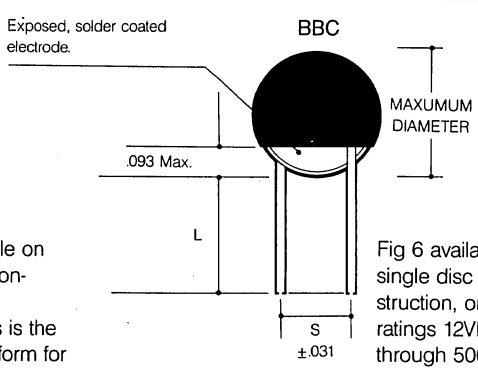


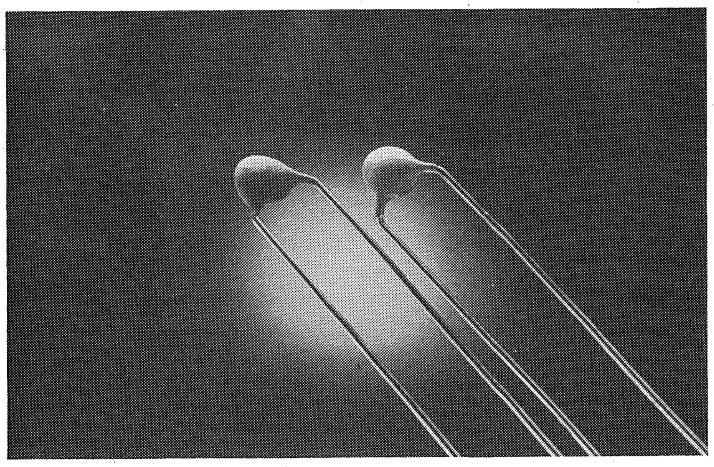
Fig 6 available on single disc construction, on Voltage ratings 12VDC through 500VDC, Bulk product only.

WIRE FORMS AND SPACINGS AVAILABLE BY DISC SIZE.

Product Form	LeadForm/ Figure	Spacing (S)	Length (L)	AWG/Dia	Available on Size	Mechanical Detail Code
	SLL/1	.197"	1.00 MIN	24/.020	20 thru 59	MB
BULK	SLL/1	.250"	1.00 MIN	22/.025	20 thru 59	AA
	SLL/1	.375"	1.00 MIN	22/.025	29 thru 96	AB
	SLC/2	.197"	1.00 MIN	24/.020	20 thru 59	MD
	SLC/2	.197"	.197+.031/−.016	24/.020	20 thru 47	MF
	SLC/2	.250"	1.00 MIN	22/.025	20 thru 59	BA
	SLC/2	.250"	.187+.031/−.016	22/.025	20 thru 47	BE
	SLC/2	.375"	1.00 MIN	22/.025	29 thru 93	BB
	SLC/2	.375"	.187+.031/−.016	22/.025	29 thru 93	BF
	SOL/3	.197"	.197+.031/−.016	24/.020	20 thru 47	MM
	SOL/3	.250"	1.00 MIN	22/.025	20 thru 47	EA
	SOL/3	.250"	.165+.031/−.016	22/.025	20 thru 47	EG
	SOL/3	.250"	.187+.031/−.016	22/.025	20 thru 47	EE
	SOL/3	.375"	1.00 MIN	22/.025	29 thru 93	AB
	SOL/3	.375"	.165+.031/−.016	22/.025	29 thru 47	EH
	SOL/3	.375"	.187+.031/−.016	22/.025	29 thru 93	EF
	OKC/4	.250"	1.00 MIN	22/.025	20 thru 47	GC
	OKC/4	.250"	.187+.031/−.016	22/.025	29 thru 47	GE
	OKC/4	.375"	1.00 MIN	22/.025	40 thru 93	GD
	OKC/4	.375"	187+.031/−.016	22/.025	59 thru 93	GF
	IKC/5	.197"	.197+.031/−.016	22/.025	20 thru 47	MT
	IKC/5	.250"	1.00 MIN	22/.025	20 thru 47	FC
	IKC/5	.250"	.187+.031/−.016	22/.025	20 thru 47	FE
	IKC/5	.375"	1.00 MIN	22/.025	59 thru 93	FD
	IKC/5	.375"	.187+.031/−.016	22/.025	59 thru 93	FF
	BBC/6	.250"	1.00 MIN	22/.025	20 thru 47	CA
	BBC/6	.250"	.165+.031/−.016	22/.025	20 thru 47	CN
	BBC/6	.250"	.187+.031/−.016	22/.025	20 thru 47	CE
	BBC/6	.375"	1.00 MIN	22/.025	59 thru 93	CB
	BBC/6	.375"	.165+.031/−.016	22/.025	59 thru 93	CP
	BBC/6	.375"	.187+.031/−.016	22/.025	20 thru 93	CF
RADIAL TAPE AND REEL	SLC/2	.197"	H IS 17 to 19.5MM	24/.020	20 thru 47	TM
	SOL/3	.197"	Ho IS 16±.5MM	24/.020	20 thru 47	TK
	IKC/5	.197"	Ho IS 16±.5MM	24/.020	20 thru 47	TH

SERIES D

50VDC through 1000VDC EIA Class I, Temperature Compensating, Ceramic Disc Capacitors



DESCRIPTION:

Mepco/Centralab's Temperature Compensating Capacitors provide an accurate predictable linear capacitance change with variations in ambient temperature. This change is called Temperature Coefficient of Capacitance (TCC or TC) and is expressed in Parts-per-million-per-degree-Centigrade (PPM/°C). The Temperature Coefficient is determined from a two point measurement of the capacitance at +25°C and +85°C.

The NPO capacitor typical application includes tuned circuits, RF networks and other critical applications where the drift free performance of a temperature compensating capacitor is mandatory.

Other types of temperature compensating capacitors, such as N330 (S2H), N750 (U2J), N1500 (P3K), are primarily used in circuits where compensation to offset positive drifting of wiring, coils, resistors, etc. is required.

ELECTRICAL PARAMETERS:

CAPACITANCE:
Measured @ 1MHz @ 1.2VRMS max. @ 25°C for values 1000 pF or less.
Measured @ 1KHz @ 1.2VRMS max. @ 25°C for values over 1000 pF.

DISSIPATION FACTOR:
For Class I capacitors, dissipation factor is typically expressed as Q (Quality) Factor and is measured under the same conditions as capacitance. Q = 1/DF or DF = 1/Q.

DIELECTRIC STRENGTH:
250% of Rated Voltage for units rated 500/600 VDC or less, 200% of Rated Voltage for units rated over 600VDC.

INSULATION RESISTANCE:
10,000 Meg Ω minimum when measured at rated Voltage or 500VDC, whichever is less, after 2 minutes, ±5 seconds charge time, with charging current limited to 50 milliAmps.

MARKING:
Mepco/Centralab Logo (Diamond Shape), Capacitance Value (in Micro-Farad), EIA Capacitance Tolerance Code, Rated Voltage (for Voltage ratings other than 500/600VDC), EIA Temperature Characteristic (In this order, as size permits), 50 Volt rated units may have capacitance value marking underlined to denote 50VDC rating.

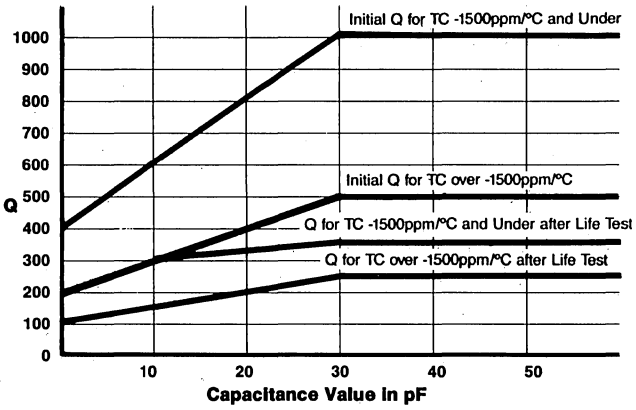
ENCAPSULATION:
Phenolic Resin, Golden/Yellow colored.

OPERATING TEMPERATURE RANGE
−55°C to +125°C.

50VDC through 1000VDC EIA Class I, Temperature Compensating, Ceramic Disc Capacitors

PACKAGING:
Both Bulk and Radial Tape and Reel (per EIA RS-468) product is available. Taped and Reeled product available on 2000 pcs. Reels only.

LEADFORMS:
Bulk Product available in variety of Forms, Spacings, Lengths and Wire Diameters. Taped and Reeled Product available with 5MM 9.197") Nominal Spacing, #24AWG CCS Wire, IKC (Standard), SOL or SLC Leads.



RANGE CHART

EIA Class I Disc Capacitors

Numbers reflect smallest STD Mepco/Centralab disc sizes.

		NPO			N150			N330			N470			N750			N1500			N3300			N4700		
Standard Tolerance		Tol. 5%, 10%			Tol. 5%, 10%			Tol. 5%, 10%			Tol. 5%, 10%			Tol. 5%, 10%			Tol. 5%, 10%			Tol. 10%, 20%			Tol. 10%, 20%		
Standard Elect. Code		AC	AA	AB	AC	AA	AB	AC	AA	AB	AC	AA	AB	AC	AA	AB	AC	AA	AB	AC	AA	AB	AC	AA	AB
Voltage		**100**	**500**	**1KV**	**100**	**500**	**1KV**	**100**	**500**	**1KV**	**100**	**500**	**1KV**	**100**	**500**	**1KV**	**100**	**500**	**1KV**	**100**	**500**	**1KV**	**100**	**500**	**1KV**
EIA CAPACITANCE VALUE CODE	159	20	20	20	20	20	20																		
	189	20	20	20	20	20	20																		
	229	20	20	20	20	20	20																		
	279	20	20	20	20	20	20																		
	339	20	20	20	20	20	20	20	20	20															
	399	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20									
	479	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20									
	569	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20									
	689	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20						
	829	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20						
	919	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20						
	100	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20						
	120	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20						
	150	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20						
	180	20	20	20	20	20	20	20	29	29	20	20	20	20	20	20	20	29	29						
	220	20	20	20	20	20	20	20	29	29	20	20	20	20	29	29	20	29	29						
	270	20	29	29	29	29	29	29	29	29	20	29	29	20	29	29	20	29	29						
	330	29	29	29	29	40	40	29	29	29	29	29	29	29	29	29	29	29	29	20	20	20			
	390	29	29	29	29	40	40	29	40	40	29	29	29	29	29	29	29	29	29	20	20	20			
	470	29	40	40	29	40	40	29	40	40	29	40	40	29	29	29	29	40	40	20	20	20			
	560	29	40	40	40	40	40	29	40	40	29	40	40	29	40	40	29	40	40	20	29	29			
	680	29	40	40	40	40	40	40	40	40	29	40	40	29	40	40	29	40	40	20	29	29	20	20	20
	820	40	40	40	40	40	40	40	40	40	40	40	40	29	40	40	29	40	40	20	29	29	20	20	20
	910	40	40	40	40	47	47	40	47	47	40	40	40	40	40	40	29	40	40	29	29	29	20	20	20
	101	40	40	40	40	59	59	40	47	47	40	47	47	40	40	40	29	40	40	29	29	29	20	29	29
	121	40	47	47	47	59	59	40	59	59	40	47	47	40	40	40	40	40	40	29	40	40	20	29	29
	151	40	59	59	47	69	69	40	59	59	40	59	59	40	47	47	40	47	47	29	40	40	20	29	29
	181	47	59	59	59	69	69	47	69	69	40	59	59	40	59	59	40	47	47	29	40	40	29	29	29
	221	47	59	59	59	82	82	59	69	69	47	69	69	47	59	59	40	59	59	40	40	40	29	40	40
	271	59	69	69	69	82	82		82	82	59	69	69	47	59	59	47	59	59	40	40	40	29	40	40
	331	59	82	82	82				82	82	59	82	82	59	69	69	47	69	69	40	47	47	29	40	40
	391	69	82	82	82							82	82		69	69	59	69	69	40	59	59	40	40	40
	471														82	82	59	82	82	40	59	59	40	47	47
	561														82	82		82	82	47	59	59	40	47	47
	681																			59	69	69	40	59	59
	821																			59	69	69	47	59	59

SERIES D

50VDC through 1000VDC EIA Class I, Temperature Compensating, Ceramic Disc Capacitors

STANDARD STOCK LISTING DISC CAPACITORS

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	TC CODE	MAX. DIA.	MAX. THICK.	LEAD SPACE	LEAD STYLE
100 Volt DCW C0G (NPO)								
■10 pf	D100J20C0GHMBAC	—	±5%	C0G	.20"	.138"	.200"	SLL
■22	D220J20C0GHMBAC	—	±5%	C0G	.20"	.138"	.200"	SLL
■27	D270J20C0GHMBAC	—	±5%	C0G	.20"	.138"	.200"	SLL
■33	D330J20C0GHMBAC	—	±5%	C0G	.20"	.138"	.200"	SLL
■47	D470J29C0GHMBAC	—	±5%	C0G	.29"	.138"	.200"	SLL
■68	D680J29C0GHMBAC	—	±5%	C0G	.29"	.138"	.200"	SLL
■82	D820J40C0GHMBAC	—	±5%	C0G	.40"	.138"	.200"	SLL
■100	D101J40C0GHMBAC	—	±5%	C0G	.40"	.138"	.200"	SLL
600 Volt DCW C0G (NPO)								
1.5 pF	D159D20C0KLAAAA	DTZ1R5	±0.5pF	C0K	.20"	.156"	.250"	SLL
2.2 pF	D229D20C0KLAAAA	DTZ2R2	±0.5pF	C0K	.20"	.156"	.250"	SLL
3.3 pF	D339D20C0JLAAAA	DTZ3R3	±0.5pF	C0J	.20"	.156"	.250"	SLL
4.7 pF	D479D20C0JLAAAA	DTZ4R7	±0.5pF	C0J	.20"	.156"	.250"	SLL
6.8 pF	D689D20C0HLAAAA	DTZ6R8	±0.5pF	C0H	.20"	.156"	.250"	SLL
10 pF	D100J20C0GLAAAA	DTZ10	±5%	C0G	.20"	.156"	.250"	SLL
15 pF	D150J20C0GLAAAA	DTZ15	±5%	C0G	.20"	.156"	.250"	SLL
■18 pF	D180J20C0GLAAAA	—	±5%	C0G	.20"	.156"	.250"	SLL
20 pF	D200J20C0GLAAAA	DTZ20	±5%	C0G	.20"	.156"	.250"	SLL
22 pF	D220J29C0GLAAAA	DTZ22	±5%	C0G	.29"	.156"	.250"	SLL
25 pF	D250J29C0GLAAAA	DTZ25	±5%	C0G	.29"	.156"	.250"	SLL
■27 pF	D270J29C0GLAAAA	—	±5%	C0G	.29"	.156"	.250"	SLL
33 pF	D330J29C0GLAAAA	DTZ33	±5%	C0G	.29"	.156"	.250"	SLL
47 pF	D470J40C0GLAAAA	DTZ47	±5%	C0G	.40"	.156"	.250"	SLL
50 pF	D500J40C0GLAAAA	DTZ50	±5%	C0G	.40"	.156"	.250"	SLL
68 pF	D680J40C0GLAAAA	DTZ68	±5%	C0G	.40"	.156"	.250"	SLL
75 pF	D750J40C0GLABAA	DTZ75	±5%	C0G	.40"	.156"	.375"	SLL
82 pF	D820J40C0GLABAA	DTZ82	±5%	C0G	.40"	.156"	.375"	SLL
100 pF	D101J40C0GLABAA	DTZ100	±5%	C0G	.40"	.156"	.375"	SLL
120 pF	D121J47C0GLABAA	DTZ120	±5%	C0G	.47"	.156"	.375"	SLL
150 pF	D151J59C0GLABAA	DTZ150	±5%	C0G	.59"	.156"	.375"	SLL
200 pF	D201J59C0GLABAA	DTZ200	±5%	C0G	.59"	.156"	.375"	SLL
220 pF	D221J59C0GLABAA	DTZ220	±5%	C0G	.59"	.156"	.375"	SLL
600 Volt DCW N750								
5 pF	D509D20U2JLAAAA	DTN5	±.5 pF	U2J	.20"	.156"	.250"	SLL
10 pF	D100J20U2JLAAAA	DTN10	±5%	U2J	.20"	.156"	.250"	SLL
15 pF	D150J20U2JLAAAA	DTN15	±5%	U2J	.20"	.156"	.250"	SLL
22 pF	D220J20U2JLAAAA	DTN22	±5%	U2J	.20"	.156"	.250"	SLL
25 pF	D250J20U2JLAAAA	DTN25	±5%	U2J	.20"	.156"	.250"	SLL
■27	D270J29U2JLAAAA	—	±5%	U2J	.29"	.156"	.250"	SLL
33	D330J29U2JLAAAA	DTN33	±5%	U2J	.29"	.156"	.250"	SLL
47	D470J29U2JLAAAA	DTN47	±5%	U2J	.29"	.156"	.250"	SLL
68	D680J39U2JLAAAA	DTN68	±5%	U2J	.39"	.156"	.250"	SLL
75	D750J39U2JLA7AA	DTN75	±5%	U2J	.39"	.156"	.250"	SLL
100	D101J39U2JLAAAA	DTN100	±5%	U2J	.39"	.156"	.250"	SLL
150	D151J47U2JLAAAA	DTN150	±5%	U2J	.47"	.156"	.250"	SLL
180	D181J59U2JLABAA	DTN180	±5%	U2J	.59"	.156"	.375"	SLL
330	D331J69U2JLABAA	DTN330	±5%	U2J	.69"	.156"	.375"	SLL
390	D391J69U2JLABAA	DTN390	±5%	U2J	.69"	.156"	.375"	SLL
470	D471J82U2JLABAA	DTN470	±5%	U2J	.82"	.156"	.375"	SLL
500	D501J82U2JLABAA	DTN500	±5%	U2J	.82"	.156"	.375"	SLL
620	D621J93U2JLABAA	DTN620	±5%	U2J	.93"	.156"	.375"	SLL

■ New Stock Item

50VDC through 1000VDC EIA Class I, Temperature Compensating, Ceramic Disc Capacitors

STANDARD STOCK LISTING DISC CAPACITORS

600 Volt DCW N1500

100 pf	D101J39P3KLAAAA	DTX101	±5%	P3K	.39"	.156"	.250"	SLL
120	D121J39P3KLAAAA	DTX121	±5%	P3K	.39"	.156"	.250"	SLL
150	D151J47P3KLAAAA	DTX151	±5%	P3K	.47"	.156"	.250"	SLL
180	D181J47P3KLAAAA	DTX181	±5%	P3K	.47"	.156"	.250"	SLL
200	D201J59P3KLABAA	DTX201	±5%	P3K	.59"	.156"	.375"	SLL
220	D221J59P3KLABAA	DTX221	±5%	P3K	.59"	.156"	.375"	SLL
330	D331J69P3KLABAA	DTX331	±5%	P3K	.69"	.156"	.375"	SLL
390	D391J69P3KLABAA	DTX391	±5%	P3K	.69"	.156"	.375"	SLL
470 pF	D471J75P3KLABAA	DTX471	±5%	P3K	.75"	.156"	.375"	SLL
500 pF	D501J75P3KLABAA	DTX501	±5%	P3K	.75"	.156"	.375"	SLL
620 pF	D621J82P3KLABAA	DTX621	±5%	P3K	.82"	.156"	.375"	SLL

■ New Stock Item

TEMPERATURE COMPENSATING DISCS.

TC Tolerances from +25°C to +85°C in PPM.

Capacitance in pF	NPO	N080	N150	N330	N470	N750	N1500	N3300
0.5 to 2.0	±250	±250	±250	±250	±250	±250	±250	±500
2.1 to 3.9	±120	±120	±120	±120	±120	±120	±250	±500
4.0 to 9.9	± 60	± 60	± 60	± 60	±120	±120	±250	±500
10 and Over	± 30	± 30	± 30	± 60	± 60	±120	±250	±500

TC Tolerances from -55°C to +25°C in PPM.

Capacitance in pF	NPO	N080	N150	N330	N470	N750	N1500	N3300
0.5 to 2.0	+250 −341	+250 −359	+250 −374	+250 −414	+250 −444	+250 −506	+250 −670	+500 −1400
2.1 to 3.9	+120 −182	+120 −200	+120 −215	+120 −255	+120 −286	+120 −330	+250 −670	+500 −1400
4.0 to 9.9	+ 60 −109	+ 60 −127	+ 60 −142	+ 60 −180	+120 −286	+120 −330	+250 −670	+500 −1400
10 and Over	+ 30 − 75	+ 30 − 90	+ 30 −105	+ 60 −180	+ 60 −210	+120 −274	+250 −670	+500 −1400

Note:

To determine the percent capacitance change when the temperature is varied from +25°C to any other temperature, use the following formula:

$$\triangle C = \frac{TC \times \triangle T}{10000}$$

where:

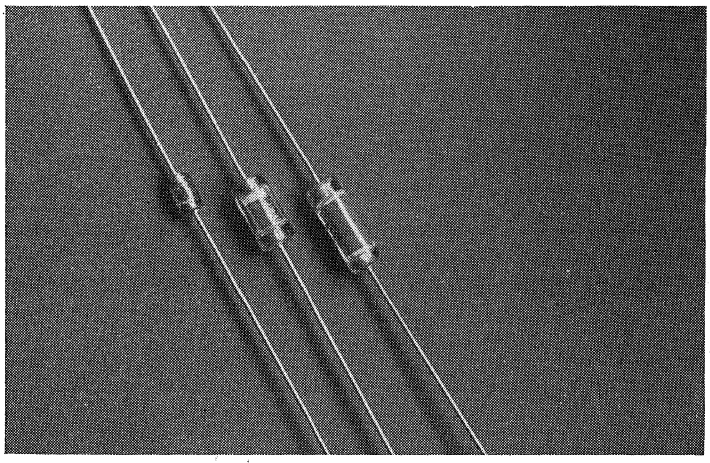
$\triangle C$ = percent change of capacitance from value at +25°C

TC = Temperature Coefficient in ppm/°C

$\triangle T$ = temperature change in °C from +25°C

SERIES G

Mono-glass™ 50VDC and 100VDC, Glass Encapsulated, Multilayer Capacitors



DESCRIPTION:

Mepco/Centralab Glass Encapsulated capacitors feature reliable hermetically sealed type, glass to metal construction. This durable construction prevents reflow of solderless internal contacts in the wave soldering process and prevents glass fracturing during lead forming.

The Glass Encapsulated capacitors are ideally suited for applications in communications equipment, navigation and guidance systems, computer business machines or where high volume, low price is required.

ELECTRICAL PARAMETERS

CAPACITANCE:
Measured @ 1Mhz @ 1.2VRMS max @ 25°C for C0G types with C≤ 1000pF.

Measured @ 1Khz @ 1.2VRMS max. @ 25°C for C0G types with C≥ 1000pF.

Measured @ 1Khz @ 1.0VRMS ±.2VRMS @ 25°C for X7R types.

Measured @ 1Khz @ .5VRMS ±.1VRMS @ 25°C for Z5U and Y5V types.

DISSIPATION FACTOR:
.1% Maximum for C0G types,
2.5% Maximum for X7R types and
4.0% Maximum for Z5U and Y5V types;
Measurements conditions are the same as for Capacitance measurement.

DIELECTRIC STRENGTH:
Parts are subjected for up to 5 seconds @ 25°C to : 250% of Rated Voltage

INSULATION RESISTANCE:
When measured @ 25°C and Rated Voltage, the following Minimum Values will be met:
100 Gig Ω or 1000 ΩF (whichever is less) for C0G and X7R types, 10 GigΩ or 1000 ΩF (whichever is less) for Z5U and Y5V types.

ENCAPSULATION:
Glass to Metal Seal

OPERATING TEMPERATURE RANGE
−55°C to +175°C for C0G
−55°C to +125°C for X7R
−55°C to +85C for Y5V and Z5U

Mono-glass™ 50VDC and 100VDC, Glass Encapsulated, Multilayer Capacitors

SIZE	VOLTAGE	C0G TOL 2%, 5%,10% MIN/MAX VAL.	X7R TOL 10%,20% MIN/MAX VAL.	Z5U TOL 20%,80/20% MIN/MAX VAL.
17	50V	10/470PF	100PF/.027MFD	.001/.1MFD
	100V	10/390PF	100PF/.012MFD	.001/.022MFD
20	50V	560/680PF	.033FMD	.056/.1MFD
	100V	470PF	.015MFD	.027MFD
25	50V	750/1000PF	.039/.056MFD	.1MFD
	100V	560/820PF	.018/.022MFD	.033/.047MFD
30	50V	1200/3300PF	.068/.18MFD	.12/.33MFD
	100V	1000/2700PF	.027/.082MFD	.056/.15MFD
40	50V	3900/6800PF	.22/.56MFD	.39/.56MFD
	100V	3300/4700PF	.1/.15MFD	.18/.27MFD

Note:Y5V available only in Values listed as Standard Stock Items

STANDARD MARKING (Minimum)

Capacitance Value:

10pF through 99pF: actual value in pF (2 digits only)

100pF and above: coded cap. value, same as used in P/N

Tolerance Code; Standard EIA Tolerance Code.

Material Code (EIA TC CODE): A = C0G, C = X7R, E = Z5U, Y = Y5V

Date Code: four digit code, first two digits denote year, last two the week of manufacture.

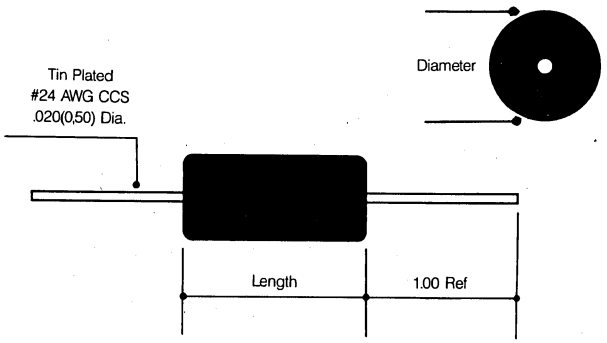
PACKAGING:

Standard Product of Size Code 17, 20 and 25 is Reel-packed per EIA RS-296; 5000 pcs per reel.

Standard Product of Size Code 30 and 40 is Reel-packed per EIA RS-296; 2500 pcs per reel.

BULK PRODUCT:

Bulk product may be ordered, in 1000 pcs/box, by specifying "VX" for the Mechanical Detail Code ("VV" denotes Taped and Reeled Product)



INCH **(MILLIMETER)**

INCH
MILLIMETER

Mechanical:

Size Code	Maximum Length Inches	Maximum Length Millimeters	Maximum Diameter Inches	Maximum Diameter Millimeters
17	.170	4,32	.100	2,54
20	.200	5,08	.100	2,54
25	.250	6,36	.100	2,54
30	.300	7,63	.150	3,81
40	.400	10,17	.150	3,81

SERIES G

Mono-glass™ 50VDC and 100VDC, Glass Encapsulated, Multilayer Capacitors

STANDARD STOCK LISTING

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	SIZE CODE
50 Volt DCW C0G (NPO)				
10 pf	G100J17C0GFVVWA	C40C100J	± 5%	17
10 pf	G100K17C0GFVVWA	C40C100K	± 10%	17
12 pf	G120J17C0GFVVWA	C40C120J	± 5%	17
15 pf	G150J17C0GFVVWA	C40C150J	± 5%	17
15 pf	G150K17C0GFVVWA	C40C150K	± 10%	17
18 pf	G180J17C0GFVVWA	C40C180J	± 5%	17
22 pf	G220J17C0GFVVWA	C40C220J	± 5%	17
22 pf	G220K17C0GFVVWA	C40C220K	± 10%	17
27 pf	G270J17C0GFVVWA	C40C270J	± 5%	17
33 pf	G330J17C0GFVVWA	C40C330J	± 5%	17
39 pf	G390J17C0GFVVWA	C40C390J	± 5%	17
47 pf	G470J17C0GFVVWA	C40C470J	± 5%	17
47 pf	G470K17C0GFVVWA	C40C470K	± 10%	17
56 pf	G560J17C0GFVVWA	C40C560J	± 5%	17
68 pf	G680J17C0GFVVWA	C40C680J	± 5%	17
68 pf	G680K17C0GFVVWA	C40C680K	± 10%	17
82 pf	G820J17C0GFVVWA	C40C820J	± 5%	17
82 pf	G820K17C0GFVVWA	C40C820K	± 10%	17
100 pf	G101J17C0GFVVWA	C40C101J	± 5%	17
100 pf	G101K17C0GFVVWA	C40C101K	± 10%	17
120 pf	G121J17C0GFVVWA	C40C121J	± 5%	17
150 pf	G151J17C0GFVVWA	C40C151J	± 5%	17
180 pf	G181J17C0GFVVWA	C40C181J	± 5%	17
220 pf	G221J17C0GFVVWA	C40C221J	± 5%	17
220 pf	G221K17C0GFVVWA	C40C221K	± 10%	17
270 pf	G271J17C0GFVVWA	C40C271J	± 5%	17
330 pf	G331J17C0GFVVWA	C40C331J	± 5%	17
390 pf	G391J17C0GFVVWA	C40C391J	± 5%	17
390 pf	G391K17C0GFVVWA	C40C391K	± 10%	17
470 pf	G471J17C0GFVVWA	C40C471J	± 5%	17
470 pf	G471K17C0GFVVWA	C40C471K	± 10%	17
560 pf	G561J17C0GFVVWA	C40C561J	± 5%	17
680 pf	G681J17C0GFVVWA	C40C681J	±5%	17
■820 pf	G821J25C0GFVVWA	–	±5%	25
■.001 mf	G102J25C0GFVVWA	–	±5%	25
■.001 mf	G102K25C0GFVVWA	–	±10%	25
■.0012 mf	G122J30C0GFVVWA	–	±5%	30
■.0015 mf	G152J30C0GFVVWA	–	±5%	30
.0018 mf	G182J30C0GFVVWA	C40C182J	±5%	30
.0022 mf	G222J30C0GFVVWA	C40C222J	±5%	30
.0027 mf	G272J30C0GFVVWA	C40C272J	±5%	30
.0027 mf	G272K30C0GFVVWA	C40C272K	±10%	30
.0033 mf	G332J30C0GFVVWA	C40C332J	±5%	30
.0033 mf	G332K30C0GFVVWA	C40C332K	±10%	30
■.0039 mf	G392J40C0GFVVWA	–	±5%	40
■.0047 mf	G472J40C0GFVVWA	–	±5%	40
.0056 mf	G562J40C0GFVVWA	C40C562J	±5%	40
.0068 mf	G682J40C0GFVVWA	C40C682J	±5%	40
.0068 mf	G682K40C0GFVVWA	C40C682K	±10%	40

■ New Product

Mono-glass™ 50VDC and 100VDC, Glass Encapsulated, Multilayer Capacitors

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	SIZE CODE
50 Volt DCW X7R				
100 pf	G101K17X7RFVVWA	C41C101K	±10%	17
100 pf	G101M17X7RFVVWA	C41C101M	±20%	17
120 pf	G121K17X7RFVVWA	C41C121K	±10%	17
150 pf	G151K17X7RFVVWA	C41C151K	±10%	17
150 pf	G151M17X7RFVVWA	C41C151M	±20%	17
180 pf	G181K17X7RFVVWA	C41C181K	±10%	17
220 pf	G221K17X7RFVVWA	C41C221K	±10%	17
220 pf	G221M17X7RFVVWA	C41C221M	±20%	17
270 pf	G271K17X7RFVVWA	C41C271K	±10%	17
330 pf	G331K17X7RFVVWA	C41C331K	±10%	17
330 pf	G331M17X7RFVVWA	C41C331M	±20%	17
390 pf	G391K17X7RFVVWA	C41C391K	±10%	17
470 pf	G471K17X7RFVVWA	C41C471K	±10%	17
470 pf	G471M17X7RFVVWA	C41C471M	±20%	17
560 pf	G561K17X7RFVVWA	C41C561K	±10%	17
680 pf	G681K17X7RFVVWA	C41C681K	±10%	17
680 pf	G681M17X7RFVVWA	C41C681M	±20%	17
820 pf	G821K17X7RFVVWA	C41C821K	±10%	17
.001 mf	G102K17X7RFVVWA	C41C102K	±10%	17
.001 mf	G102M17X7RFVVWA	C41C102M	±20%	17
.0012 mf	G122K17X7RFVVWA	C41C122K	±10%	17
.0015 mf	G152K17X7RFVVWA	C41C152K	±10%	17
.0015 mf	G152M17X7RFVVWA	C41C152M	±20%	17
.0018 mf	G182K17X7RFVVWA	C41C182K	±10%	17
.0022 mf	G222K17X7RFVVWA	C41C222K	±10%	17
.0022 mf	G222M17X7RFVVWA	C41C222M	±20%	17
.0027 mf	G272K17X7RFVVWA	C41C272K	±10%	17
.0033 mf	G332K17X7RFVVWA	C41C332K	±10%	17
.0039 mf	G392K17X7RFVVWA	C41C392K	±10%	17
.0047 mf	G472K17X7RFVVWA	C41C472K	±10%	17
.0047 mf	G472M17X7RFVVWA	C41C472M	±20%	17
.0056 mf	G562K17X7RFVVWA	C41C562K	±10%	17
.0068 mf	G682K17X7RFVVWA	C41C682K	±10%	17
.0082 mf	G822K17X7RFVVWA	C41C822K	±10%	17
.01 mf	G103K17X7RFVVWA	C41C103K	±10%	17
.01 mf	G103M17X7RFVVWA	C41C103M	±20%	17
.012 mf	G123K17X7RFVVWB	C41C123K	±10%	17
.015 mf	G153K17X7RFVVWC	C41C153K	±10%	17
.018 mf	G183K17X7RFVVWD	C41C183K	±10%	17
.022 mf	G223K20X7RFVVWE	C41C223K	±10%	20
.022 mf	G223M17X7RFVVWA	C41C223M	±20%	20
.027 mf	G273K20X7RFVVWF	C41C273K	±10%	20
.033 mf	G333K30X7RFVVWG	C41C333K	±10%	30
.039 mf	G393K30X7RFVVWH	C41C393K	±10%	30
.039 mf	G393M17X7RFVVWA	C41C393M	±20%	30
.047 mf	G473K30X7RFVVWJ	C41C473K	±10%	30
.047 mf	G473M17X7RFVVWA	C41C473M	±20%	30
.056 mf	G563K30X7RFVVWK	C41C563K	±10%	30
.068 mf	G683K30X7RFVVWL	C41C683K	±10%	30
.082 mf	G823K30X7RFVVWM	C41C823K	±10%	30
.1 mf	G104K30X7RFVVWN	C41C104K	±10%	30
.1 mf	G104M17X7RFVVWA	C41C104M	±20%	30
.12 mf	G124K40X7RFVVWP	C41C124K	±10%	40

■ New Product

SERIES G

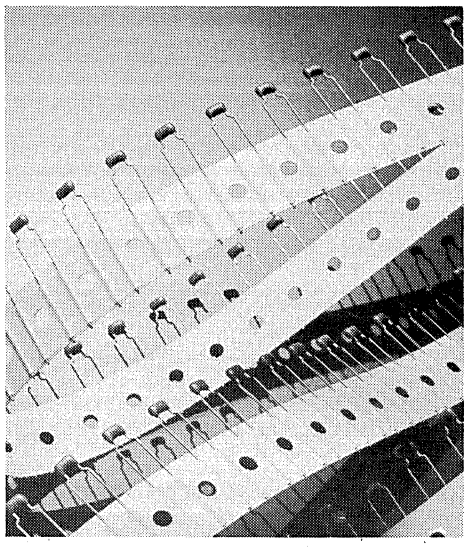
Mono-glass™ 50VDC and 100VDC, Glass Encapsulated, Multilayer Capacitors

STANDARD STOCK LISTING

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	SIZE CODE
50 Volt DCW X7R				
.15 mf	G154K40X7RFVVWR	C41C154K	±10%	40
.18 mf	G184K40X7RFVVWS	C41C184K	±10%	40
■.22 mf	G224K40X7RFVVWT	—	±10%	40
50 Volt DCW Z5U				
.001 mf	G102M17Z5UFVVWA	C43C102M	±20%	17
.001 mf	G102Z17Z5UFVVWA	C43C102Z	+80-20%	17
.0012 mf	G122M17Z5UFVVWA	C43C122M	±20%	17
.0015 mf	G152M17Z5UFVVWA	C43C152M	±20%	17
.0018 mf	G182M17Z5UFVVWA	C43C182M	±20%	17
.0022 mf	G222M17Z5UFVVWA	C43C222M	±20%	17
.0027 mf	G272M17Z5UFVVWA	C43C272M	±20%	17
.0033 mf	G332M17Z5UFVVWA	C43C332M	±20%	17
.0039 mf	G392M17Z5UFVVWA	C43C392M	±20%	17
.0047 mf	G472M17Z5UFVVWA	C43C472M	±20%	17
.0056 mf	G562M17Z5UFVVWA	C43C562M	±20%	17
.0068 mf	G682M17Z5UFVVWA	C43C682M	±20%	17
.0082 mf	G822M17Z5UFVVWA	C43C822M	±20%	17
.01 mf	G103M17Z5UFVVWA	C43C103M	±20%	17
.01 mf	G103Z17Z5UFVVWA	C43C103Z	+80-20%	17
.012 mf	G123M17Z5UFVVWB	C43C123M	±20%	17
.015 mf	G153M17Z5UFVVWC	C43C153M	±20%	17
.022 mf	G223M17Z5UFVVWE	C43C223M	±20%	17
.022 mf	G223Z17Z5UFVVWE	C43C223Z	+80-20%	17
.027 mf	G273M17Z5UFVVWF	C43C273M	±20%	17
.033 mf	G333M17Z5UFVVWG	C43C333M	±20%	17
.033 mf	G333Z17Z5UFVVWG	C43C333Z	+80-20%	17
.039 mf	G393M17Z5UFVVWH	C43C393M	±20%	17
.047 mf	G473M17Z5UFVVWJ	C43C473M	±20%	17
.047 mf	G473Z17Z5UFVVWJ	C43C473Z	+80-20%	17
.056 mf	G563M20Z5UFVVWK	C43C563M	±20%	20
.068 mf	G683M25Z5UFVVWL	C43C683M	±20%	25
.068 mf	G683Z25Z5UFVVWL	C43C683Z	+80-20%	25
.082 mf	G823M25Z5UFVVWM	C43C823M	±20%	25
■.1 mf	G104M17Z5UFVVWN	—	±20%	17
50 Volt DCW Z5U				
.1 mf	G104M25Z5UFVVWN	C43C104M	±20%	25
■.1 mf	G104Z17Z5UFVVWN	—	+80-20%	17
.1 mf	G104Z25Z5UFVVWN	C43C104Z	+80-20%	25
.12 mf	G124M30Z5UFVVWP	C43C124M	±20%	30
.15 mf	G154M30Z5UFVVWR	C43C154M	±20%	30
.18 mf	G184M30Z5UFVVWS	C43C184M	±20%	30
.22 mf	G224M30Z5UFVVWT	C43C224M	±20%	30
.22 mf	G224Z30Z5UFVVWT	C43C224Z	+80-20%	30
.27 mf	G274M30Z5UFVVWU	C43C274M	±20%	30
■.33 mf	G334M40Z5UFVVWW	—	±20%	40
■.39 mf	G394M40Z5UFVVWX	—	±20%	40
■.47 mf	G474M40Z5UFVVWY	—	±20%	40
■.47 mf	G474Z40Z5UFVVWY	—	+80-20%	40
50 Volt DCW Y5V				
.0047 mf	G472Z17Y5VFVVWA	C42C472Z	+80-20%	17
.01 mf	G103Z17Y5VFVVWA	C42C103Z	+80-20%	17
.047 mf	G473Z17Y5VFVVWJ	C42C473Z	+80-20%	17
.1 mf	G104Z25Y5VFVVWN	C42C104Z	+80-20%	25

■ New Product

Mono-Kap® C0G, X7R, Y5V and Z5U, 50VDC and 100VDC, Multilayer Capacitors



DESCRIPTION:

Mepco/Centralab Ultra-Stable capacitors provide maximum capacitance stability over a wide range of environmental conditions, applied voltages and frequencies. The ultra-stable C0G (NPO) temperature characteristic is maintained over the complete operating temperature range of −55°C to +125°C.

These capacitors are ideally suited for RC network, pulse and RF tuned circuit applications where extreme stability is of paramount importance.

Mepco/Centralab Temperature Stable capacitors are reliable temperature stable units with a high ratio of capacitance per unit volume. These miniature size units offer a rugged epoxy coating for environmental protection and radial leads for convenient printed circuit board installation.

These capacitors are designed to provide reliable temperature stable performance over an extremely wide temperature range in bypass, coupling and blocking operations.

Mepco/Centralab General Purpose capacitors offer high capacitance, miniature size units for general purpose applications. These miniature multilayer capacitors feature radial leads for convenient printed circuit board installation and a rugged epoxy coating for environmental protection.

These capacitors are ideally suited for a wide range of non-critical general purpose bypass, coupling and filtering applications.

ELECTRICAL PARAMETERS:

CAPACITANCE:
Measured @ 1MHz @ 1.2VRMS Max. @ 25°C for C0G types with C≤ 1000pF.
Measured @ 1KHz @ 1.2VRMS max. @ 25°C for C0G types with C> 1000pF.
Measured @ 1KHz @ 1.0VRMS ±.2VRMS @ 25°C for X7R types.
Measured @ 1KHz @ .5VRMS ± .1VRMS @ 25°C for Z5U and Y5V types.

DISSIPATION FACTOR:
.1% Maximum for C0G types,
2.5% Maximum for X7R types and
4.0% Maximum for Z5U and Y5V types;
Measurements conditions are the same as for Capacitance measurement.

DIELECTRIC STRENGTH:
Parts are subjected for up to 5 seconds @ 25°C to: 250% of Rated Voltage

INSULATION RESISTANCE:
When measured @ 25°C and Rated Voltage, the following Minimum Values will be met: 100 GigΩ or 1000 ΩF (whichever is less) for C0G and X7R types, 10 Gig Ω or 1000 ΩF (whichever is less) for Z5U and Y5V types.

ENCAPSULATION:
Conformal Epoxy

OPERATING TEMPERATURE RANGE:
−55°C to +125° for C0G and X7R
−55°C to +85°C for Y5V and Z5U

SERIES K

Mono-Kap® C0G, X7R, Y5V and Z5U, 50VDC and 100VDC, Multilayer Capacitors

MONO-KAP VALUES BY SIZE, VOLTAGE AND CERAMIC:

SIZE	VOLTAGE	C0G TOL 2%, 5%, 10% MIN/MAX VAL.	X7R TOL 10%, 20% MIN/MAX VAL.	Z5U TOL 20%, 80/20% MIN/MAX VAL.
	50V	10/470PF	100PF/.027MFD	.001/.047MFD
15*	100V	10/390PF	100PF/.012MFD	.01/.022MFD
	200V	10/180PF	100PF/2700PF	
	50V	560/3300PF	.033/.18MFD	.056/.33MFD
20	100V	470/2700PF	.012/.10MFD	.027/.18MFD
	200V	220/1500PF	.0033/.022MFD	
	50V	.0039/.15MFD	.22/.82MFD	.39/1.5MFD
30	100V	.0033/.012MFD	.12/.47MFD	.22/.82MFD
	200V	.0018/.0068MFD	.027/.12MFD	
	50V	.018/.039MFD	1.0/2.2MFD	1.8/4.7MFD
40	100V	.015/.039MFD	.56/1.5MFD	1.0/2.7MFD
	200V	.0082/.022MFD	.22/.33MFD	
	50V	.047/.082MFD	2.7/4.7MFD	5.6/10.0MFD
50	100V	.047/.068MFD	2.2MFD	3.3/5.6MFD
	200V	.027/.047MFD	.47/.68MFD	

STANDARD MARKING:

CAPACITANCE VALUE:
10pF through 99pF: actual value in pF (2 digits only)
100pF and above: coded cap. value, same as used in P/N on the Spec.

TOLERANCE CODE:
Standard EIA Tolerance Code.

VOLTAGE:
1 = 100VDC, 2 = 200VDC, 5 = 50VDC

MATERIAL CODE (EIA TC CODE):
A = C0G, C = X7R, E = Z5U, Y = Y5V

SIZE CHART:

Size Code	W (Max.)	H (Max.)	Thickness (Max.)
15	.150	.150	.100
20	.200	.200	.125
30	.300	.300	.150
40	.400	.400	.150
50	.500	.500	.200

*Note: 15 Size marked with Coded Capacitance Value ONLY

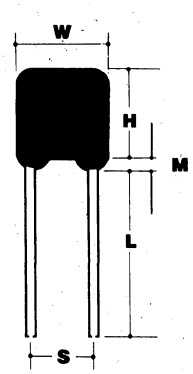


Fig 1 M = .062MAX

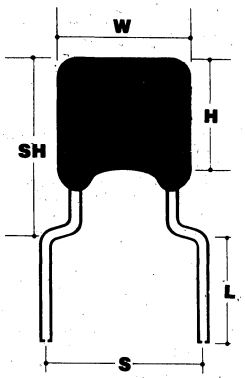


Fig 2, 3 & 4 SH = (H Max + .100) Max

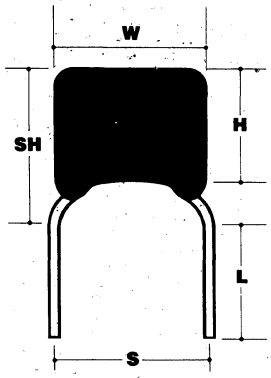


Fig 3

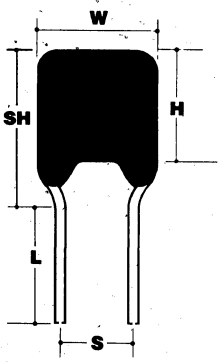


Fig 4

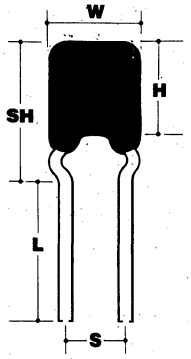


Fig 5 SH = (H Max + .125) Max

For Fig 2, 3, 4, & 5, the meniscus (rundown) will terminate a minimum of .015" above the Seating Plane (as formed by the wire preform).

Standard Leadlength for Mono-Kap is 1.00" Min. Cut lead versions available upon request.

.187±.031 recommended as Leadlength below Seating Plane as formed by either wire form or part bottom.

Mono-Kap® C0G, X7R, Y5V and Z5U, 50VDC and 100VDC, Multilayer Capacitors

BULK MONO-KAP MECHANICAL DETAIL CODES.

Size	Spacing	Wire Dia	Figure	Detail Code
15	.100	.016	1	VA
15	.100	.020	1	VB
15	.200	.020	2	VC
15	.100	.016	5	VJ
15	.100	.020	5	VK
20	.100	.020	1	VB
20	.200	.020	2	VC
20	.250	.020	4	VD
20	.300	.020	4	VE
20	.375	.020	4	VF
20	.375	.025	4	VG
20	.100	.020	5	VK
20	.200	.020	5	VL
30	.200	.020	1	VC
30	.300	.020	4	VE
30	.375	.020	4	VF
30	.375	.025	4	VG
30	.200	.020	5	VL
40	.200	.020	3	VC
40	.400	.025	1	VH
40	.200	.020	5	VL
50	.400	.025	1	VH
50	.400	.025	5	VM

ELECTRICAL DETAIL CODES FOR ALL MULTI-LAYER PRODUCTS

Cap Value In F	Min IR In M	Detail Code	Cap Value In F	Min IR In M	Detail Code
.01	100000	WA	.27	3700	WU
.012	84000	WB	.33	3100	WW
.015	67000	WC	.39	2600	WX
.018	56000	WD	.47	2200	WY
.022	46000	WE	.56	1800	XA
.027	37000	WF	.68	1500	XB
.033	31000	WG	.82	1200	XC
.039	26000	WH	1.0	1000	XD
.047	22000	WJ	1.5	670	XE
.056	18000	WK	2.2	460	XF
.068	15000	WL	2.7	370	XG
.082	12000	WM	3.3	310	XH
.100	10000	WN	4.7	220	XJ
.120	8400	WP	5.6	180	XK
.150	6700	WR	6.8	150	XL
.180	5600	WS	8.2	120	XM
.220	4600	WT	10	100	XN

RADIAL TAPE AND REEL MONO-KAP MECHANICAL DETAIL CODE

Size	Spacing	AWG/ Wire Dia	Fig	Code	H* (MM)
15	5MM(.200)	24/.020	2	TT	17/19.5
15	2.5MM(.100)	24/.020	5	TP	16+/–.5
20	5MM(.200)	24/.020	5	TR	16+/–.5
20	5MM(.200)	24/.020	2	TT	17/19.5
20	2.5MM(.100)	24/.020	5	TP	16+/–.5
30	5MM(.200)	24/.020	5	TR	16+/–.5
30	5MM(.200)	24/.020	1	TT	17/19.5
40	5MM(.200)	24/.020	4	TT	17/19.5

H *is the dimension from the centerline of the sprocket hole in the tape to the inserted seating plane*

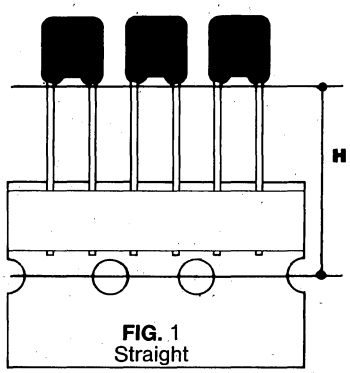


FIG. 1
Straight

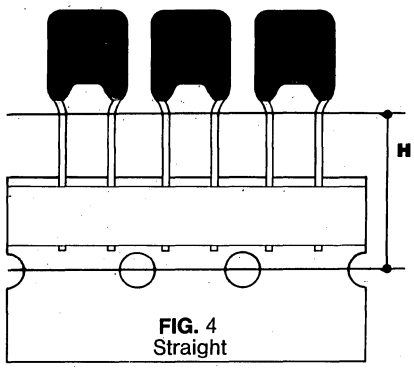


FIG. 4
Straight

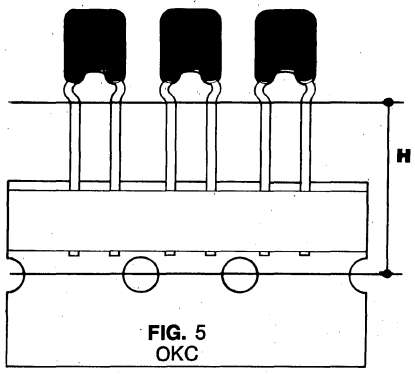


FIG. 5
OKC

SERIES K

Mono-Kap® C0G, X7R, Y5V and Z5U, 50VDC and 100VDC, Multilayer Capacitors

STANDARD STOCK LISTING

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	SIZE CODE	LEAD SPACE
50 Volt DCW C0G (NPO)					
10 pf	K100J15C0GFVAWA	CN15C100J	±5%	15	.100"
10 pf	K100K15C0GFVAWA	CN15C100K	±10%	15	.100"
12 pf	K120J15C0GFVAWA	CN15C120J	±5%	15	.100"
12 pf	K120K15C0GFVAWA	CN15C120K	±10%	15	.100"
15 pf	K150J15C0GFVAWA	CN15C150J	±5%	15	.100"
15 pf	K150K15C0GFVAWA	CN15C150K	±10%	15	.100"
18 pf	K180J15C0GFVAWA	CN15C180J	±5%	15	.100"
18 pf	K180K15C0GFVAWA	CN15C180K	±10%	15	.100"
22 pf	K220J15C0GFVAWA	CN15C220J	±5%	15	.100"
22 pf	K220K15C0GFVAWA	CN15C220K	±10%	15	.100"
27 pf	K270J15C0GFVAWA	CN15C270J	±5%	15	.100"
27 pf	K270K15C0GFVAWA	CN15C270K	±10%	15	.100"
33 pf	K330J15C0GFVAWA	CN15C330J	±5%	15	.100"
33 pf	K330K15C0GFVAWA	CN15C330K	±10%	15	.100"
39 pf	K390J15C0GFVAWA	CN15C390J	±5%	15	.100"
39 pf	K390K15C0GFVAWA	CN15C390K	±10%	15	.100"
47 pf	K470J15C0GFVAWA	CN15C470J	±5%	15	.100"
47 pf	K470K15C0GFVAWA	CN15C470K	±10%	15	.100"
56 pf	K560J15C0GFVAWA	CN15C560J	±5%	15	.100"
56 pf	K560K15C0GFVAWA	CN15C560K	±10%	15	.100"
68 pf	K680J15C0GFVAWA	CN15C680J	±5%	15	.100"
68 pf	K680K15C0GFVAWA	CN15C680K	±10%	15	.100"
82 pf	K820J15C0GFVAWA	CN15C820J	±5%	15	.100"
82 pf	K820K15C0GFVAWA	CN15C820K	±10%	15	.100"
100 pf	K101J15C0GFVAWA	CN15C101J	±5%	15	.100"
100 pf	K101K15C0GFVAWA	CN15C101K	±10%	15	.100"
120 pf	K121J15C0GFVAWA	CN15C121J	±5%	15	.100"
120 pf	K121K15C0GFVAWA	CN15C121K	±10%	15	.100"
150 pf	K151J15C0GFVAWA	CN15C151J	±5%	15	.100"
150 pf	K151K15C0GFVAWA	CN15C151K	±10%	15	.100"
180 pf	K181J15C0GFVAWA	CN15C181J	±5%	15	.100"
180 pf	K181K15C0GFVAWA	CN15C181K	±10%	15	.100"
220 pf	K221J15C0GFVAWA	CN15C221J	±5%	15	.100"
220 pf	K221K15C0GFVAWA	CN15C221K	±10%	15	.100"
270 pf	K271J15C0GFVAWA	CN15C271J	±5%	15	.100"

Mono-Kap® C0G, X7R, Y5V and Z5U, 50VDC and 100VDC, Multilayer Capacitors

STANDARD STOCK LISTING

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	SIZE CODE	LEAD SPACE
50 Volt DCW C0G (NPO)					
270 pf	K271K15C0GFVAWA	CN15C271K	±10%	15	.100"
330 pf	K331J15C0GFVAWA	CN15C331J	±5%	15	.100"
330 pf	K331K15C0GFVAWA	CN15C331K	±10%	15	.100"
390 pf	K391J15C0GFVAWA	CN15C391J	±5%	15	.100"
390 pf	K391K15C0GFVAWA	CN15C391K	±10%	15	.100"
470 pf	K471J15C0GFVAWA	CN15C471J	±5%	15	.100"
470 pf	K471K15C0GFVAWA	CN15C471K	±10%	15	.100"
560 pf	K561J20C0GFVBWA	—	±5%	20	.100"
560 pf	K561K20C0GFVBWA	—	±10%	20	.100"
680 pf	K681J20C0GFVBWA	CN20C681J	±5%	20	.100"
680 pf	K681K20C0GFVBWA	CN20C681K	±10%	20	.100"
820 pf	K821J20C0GFVBWA	CN20C821J	±5%	20	.100"
.001 mf	K102J20C0GFVBWA	CN20C102J	±5%	20	.100"
.001 mf	K102K20C0GFVBWA	CN20C102K	±10%	20	.100"
.0012 mf	K122K20C0GFVBWA	CN20C122K	±10%	20	.100"
.0015 mf	K152J20C0GFVBWA	CN20C152J	±5%	20	.100"
.0015 mf	K152K20C0GFVBWA	CN20C152K	±10%	20	.100"
.0018 mf	K182J20C0GFVBWA	CN20C182J	±5%	20	.100"
.0018 mf	K182K20C0GFVBWA	CN20C182K	±10%	20	.100"
.0022 mf	K222J20C0GFVBWA	CN20C222J	±5%	20	.100"
.0022 mf	K222K20C0GFVBWA	CN20C222K	±10%	20	.100"
.0027 mf	K272K20C0GFVBWA	CN20C272K	±10%	20	.100"
.0033 mf	K332J20C0GFVBWA	CN20C332J	±5%	20	.100"
.0033 mf	K332K20C0GFVBWA	CN20C332K	±10%	20	.100"
.0039 mf	K392J30C0GFVCWA	CN30C392J	±5%	30	.200"
.0047 mf	K472J30C0GFVCWA	CN30C472J	±5%	30	.200"
.0047 mf	K472K30C0GFVCWA	CN30C472K	±10%	30	.200"
.0056 mf	K562K30C0GFVCWA	CN30C562K	±10%	30	.200"
.0068 mf	K682J30C0GFVCWA	CN30C682J	±5%	30	.200"
.0068 mf	K682K30C0GFVCWA	CN30C682K	±10%	30	.200"
.0082 mf	K822K30C0GFVCWA	CN30C822K	±10%	30	.200"
.01 mf	K103J30C0GFVCWA	CN30C103J	±5%	30	.200"
.01 mf	K103K30C0GFVCWA	CN30C103K	±10%	30	.200"
.015 mf	K153J40C0GFVCWC	CN40C153J	±5%	40	.200"
.022 mf	K223J40C0GFVCWE	CN40C223J	±5%	40	.200"
100 Volt DCW C0G (NPO)					
10 pf	K100J15C0GHVAWA	CN15A100J	±5%	15	.100"
10 pf	K100K15C0GHVAWA	CN15A100K	±10%	15	.100"
12 pf	K120J15C0GHVAWA	CN15A120J	±5%	15	.100"
12 pf	K120K15C0GHVAWA	CN15A120K	±10%	15	.100"
15 pf	K150J15C0GHVAWA	CN15A150J	±5%	15	.100"
15 pf	K150K15C0GHVAWA	CN15A150K	±10%	15	.100"
18 pf	K180J15C0GHVAWA	CN15A180J	±5%	15	.100"
18 pf	K180K15C0GHVAWA	CN15A180K	±10%	15	.100"
22 pf	K220J15C0GHVAWA	CN15A220J	±5%	15	.100"
22 pf	K220K15C0GHVAWA	CN15A220K	±10%	15	.100"

SERIES K

Mono-Kap® C0G, X7R, Y5V and Z5U, 50VDC and 100VDC, Multilayer Capacitors

STANDARD STOCK LISTING

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	SIZE CODE	LEAD SPACE
100 Volt DCW COG (NPO)					
27 pf	K270J15C0GHVAWA	CN15A270J	±5%	15	.100"
27 pf	K270K15C0GHVAWA	CN15A270K	±10%	15	.100"
33 pf	K330J15C0GHVAWA	CN15A330J	±5%	15	.100"
33 pf	K330K15C0GHVAWA	CN15A330K	±10%	15	.100"
39 pf	K390J15C0GHVAWA	CN15A390J	±5%	15	.100"
39 pf	K390K15C0GHVAWA	CN15A390K	±10%	15	.100"
47 pf	K470J15C0GHVAWA	CN15A470J	±5%	15	.100"
47 pf	K470K15C0GHVAWA	CN15A470K	±10%	15	.100"
56 pf	K560J15C0GHVAWA	CN15A560J	±5%	15	.100"
56 pf	K560K15C0GHVAWA	CN15A560K	±10%	15	.100"
68 pf	K680J15C0GHVAWA	CN15A680J	±5%	15	.100"
68 pf	K680K15C0GHVAWA	CN15A680K	±10%	15	.100"
82 pf	K820J15C0GHVAWA	CN15A820J	±5%	15	.100"
82 pf	K820K15C0GHVAWA	CN15A820K	±10%	15	.100"
100 pf	K101J15C0GHVAWA	CN15A101J	±5%	15	.100"
100 pf	K101K15C0GHVAWA	CN15A101K	±10%	15	.100"
120 pf	K121J15C0GHVAWA	CN15A121J	±5%	15	.100"
120 pf	K121K15C0GHVAWA	CN15A121K	±10%	15	.100"
150 pf	K151J15C0GHVAWA	CN15A151J	±5%	15	.100"
150 pf	K151K15C0GHVAWA	CN15A151K	±10%	15	.100"
180 pf	K181J15C0GHVAWA	CN15A181J	±5%	15	.100"
180 pf	K181K15C0GHVAWA	CN15A181K	±10%	15	.100"
220 pf	K221J15C0GHVAWA	CN15A221J	±5%	15	.100"
220 pf	K221K15C0GHVAWA	CN15A221K	±10%	15	.100"
270 pf	K271J15C0GHVAWA	CN20A271J	±5%	15	.100"
270 pf	K271K15C0GHVAWA	CN20A271K	±10%	15	.100"
330 pf	K331J15C0GHVAWA	CN20A331J	±5%	15	.100"
330 pf	K331K15C0GHVAWA	CN20A331K	±10%	15	.100"
390 pf	K391J15C0GHVAWA	CN20A391J	±5%	15	.100"
390 pf	K391K15C0GHVAWA	CN20A391K	±10%	15	.100"
470 pf	K471J20C0GHVBWA	CN20A471J	±5%	20	.100"
470 pf	K471K20C0GHVBWA	CN20A471K	±10%	20	.100"
560 pf	K561J20C0GHVBWA	CN20A561J	±5%	20	.100"
560 pf	K561K20C0GHVBWA	CN20A561K	±10%	20	.100"
680 pf	K681J20C0GHVBWA	CN20A681J	±5%	20	.100"
680 pf	K681K20C0GHVBWA	CN20A681K	±10%	20	.100"
820 pf	K821J20C0GHVBWA	CN20A821J	±5%	20	.100"
820 pf	K821K20C0GHVBWA	CN20A821K	±10%	20	.100"
.001 mf	K102J20C0GHVBWA	CN20A102J	±5%	20	.100"
.001 mf	K102K20C0GHVBWA	CN20A102K	±10%	20	.100"
.0012 mf	K122J20C0GHVBWA	CN20A122J	±5%	20	.200"
.0015 mf	K152J20C0GHVBWA	CN20A152J	±5%	20	.100"
.0015 mf	K152K20C0GHVBWA	CN20A152K	±10%	20	.100"
.0018 mf	K182J30C0GHVCWA	CN30A182J	±5%	30	.200"
.0018 mf	K282K30C0GHVCWA	CN30A182K	±10%	30	.200"
.0022 mf	K222J30C0GHVCWA	CN30A222J	±5%	30	.200"
.0022 mf	K222K30C0GHVCWA	CN30A222K	±10%	30	.200"

Mono-Kap® C0G, X7R, Y5V and Z5U, 50VDC and 100VDC, Multilayer Capacitors

STANDARD STOCK LISTING

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	SIZE CODE	LEAD SPACE
100 Volt DCW COG (NPO)					
.0027 mf	K272J30C0GHVCWA	CN30A272J	±5%	30	.200"
.0027 mf	K272K30C0GHVCWA	CN30A272K	±10%	30	.200"
.0033 mf	K332J30C0GHVCWA	CN30A332J	±5%	30	.200"
.0033 mf	K332K30C0GHVCWA	CN30A332K	±10%	30	.200"
.0039 mf	K392J30C0GHVCWA	CN30A392J	±5%	30	.200"
.0047 mf	K472J30C0GHVCWA	CN30A472J	±5%	30	.200"
.0047 mf	K472K30C0GHVCWA	CN30A472K	±10%	30	.200"
.0068 mf	K682J30C0GHVCWA	CN30A682J	±5%	30	.200"
.01 mf	K103J40C0GHVCWA	CN40A103J	±5%	40	.200"
.01 mf	K103K40C0GHVCWA	CN40A103K	±10%	40	.200"
50 Volt DCW X7R					
150 pf	K151K15X7RFVAWA	CW15C151K	±10%	15	.100"
180 pf	K181K15X7RFVAWA	CW15C181K	±10%	15	.100"
180 pf	K181M15X7RFVAWA	CW15C181M	±20%	15	.100"
220 pf	K221K15X7RFVAWA	CW15C221K	±10%	15	.100"
270 pf	K271K15X7RFVAWA	CW15C271K	±10%	15	.100"
270 pf	K271M15X7RFVAWA	CW15C271M	±20%	15	.100"
330 pf	K331K15X7RFVAWA	CW15C331K	±10%	15	.100"
330 pf	K331M15X7RFVAWA	CW15C331M	±20%	15	.100"
390 pf	K391K15X7RFVAWA	CW15C391K	±10%	15	.100"
390 pf	K391M15X7RFVAWA	CW15C391M	±20%	15	.100"
470 pf	K471K15X7RFVAWA	CW15C471K	±10%	15	.100"
470 pf	K471M15X7RFVAWA	CW15C471M	±20%	15	.100"
560 pf	K561K15X7RFVAWA	CW15C561K	±10%	15	.100"
680 pf	K681K15X7RFVAWA	CW15C681K	±10%	15	.100"
680 pf	K681M15X7RFVAWA	CW15C681M	±20%	15	.100"
820 pf	K821K15X7RFVAWA	CW15C821K	±10%	15	.100"
820 pf	K821M15X7RFVAWA	CW15C321M	±20%	15	.100"
.001 mf	K102K15X7RFVAWA	CW15C102K	±10%	15	.100"
.001 mf	K102K15X7RFTTWA*	—	±10%	15	.200"
.001 mf	K102M15X7RFVAWA	CW15C102M	±20%	15	.100"
.001 mf	K102M15X7RFTTWA*	—	±20%	15	.200"
.0012 mf	K122K15X7RFVAWA	CW15C122K	±10%	15	.100"
.0015 mf	K152K15X7RFVAWA	CW15C152K	±10%	15	.100"
.0018 mf	K182K15X7RFVAWA	CW15C182K	±10%	15	.100"
.0022 mf	K222K15X7RFVAWA	CW15C222K	±10%	15	.100"
.0022 mf	K222M15X7RFVAWA	CW15C222M	±20%	15	.100"
.0027 mf	K272K15X7RFVAWA	CW15C272K	±10%	15	.100"
.0027 mf	K272M15X7RFVAWA	CW15C272M	±20%	15	.100"
.0033 mf	K332K15X7RFVAWA	CW15C332K	±10%	15	.100"
.0033 mf	K332M15X7RFVAWA	CW15C332M	±20%	15	.100"
.0039 mf	K392K15X7RFVAWA	CW15C392K	±10%	15	.100"
.0047 mf	K472K15X7RFVAWA	CW15C472K	±10%	15	.100"
.0047 mf	K472M15X7RFVAWA	CW15C472M	±20%	15	.100"
.0056 mf	K562K15X7RFVAWA	CW15C562K	±10%	15	.100"
.0056 mf	K562M15X7RFVAWA	CW15C562M	±20%	15	.100"
.0068 mf	K682K15X7RFVAWA	CW15C682K	±10%	15	.100"
.0068 mf	K682M15X7RFVAWA	CW15C682M	±20%	15	.100"

*NEW PRODUCT TAPE & REEL

SERIES K

Mono-Kap® C0G, X7R, Y5V and Z5U, 50VDC and 100VDC, Multilayer Capacitors

STANDARD STOCK LISTING

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	SIZE CODE	LEAD SPACE
50 Volt DCW X7R					
.0082 mf	K822K15X7RFVAWA	CW15C822K	±10%	15	.100"
.0082 mf	K822M15X7RFVAWA	CW15C822M	±20%	15	.100"
.01 mf	K103K15X7RFVAWA	CW15C103K	±10%	15	.100"
.01 mf	K103K15X7RFVCWA	CW20C103K244	±10%	15	.200"
.01 mf	K103K15X7RFTTWA*	—	±10%	15	.200"
.01 mf	K103M15X7RFVAWA	CW15C103M	±20%	15	.100"
.01 mf	K103M15X7RFVCWA	CW20C103M244	±20%	15	.200"
.01 mf	K103M15X7RFTTWA	—	±10%	15	.200"
.015 mf	K153K15X7RFVAWC	CW15C153K	±10%	15	.100"
.015 mf	K153M15X7RFVAWC	CW15C153M	±20%	15	.100"
.018 mf	K183K15X7RFVBWD	CW20C183K	±10%	20	.100"
.018 mf	K183M15X7RFVBWD	CW20C183M	±20%	20	.100"
.022 mf	K223K15X7RFVBWE	CW20C223K	±10%	20	.100"
.022 mf	K223K15X7RFVCWE	CW20C223K244	±10%	20	.200"
.022 mf	K223K15X7RFTTWE*	—	±10%	15	.200"
.022 mf	K223M15X7RFVBWE	CW20C223M	±20%	20	.100"
.022 mf	K223M15X7RFVCWE	CW20C223M244	±20%	20	.200"
.022 mf	K223M15X7RFTTWE*	—	±10%	15	.200"
.027 mf	K273K20X7RFVBWF	CW20C273K	±10%	20	.100"
.033 mf	K333K20X7RFVBWG	CW20C333K	±10%	20	.100"
.033 mf	K333M20X7RFVBWG	CW20C333M	±20%	20	.100"
.039 mf	K393K20X7RFVBWH	CW20C393K	±10%	20	.100"
.047 mf	K473K20X7RFVBWJ	CW20C473K	±10%	20	.100"
.047 mf	K473K20X7RFVCWJ	CW20C473K244	±10%	20	.200"
.047 mf	K473K20X7RFTTWJ*	—	±10%	20	.200"
.047 mf	K473M20X7RFVBWJ	CW20C473M	±20%	20	.100"
.047 mf	K473M20X7RFVCWJ	CW20C473M244	±20%	20	.200"
.047 mf	K473M20X7RFTTWJ*	—	±20%	20	.200"
.056 mf	K563K20X7RFVBWK	CW20C563K	±10%	20	.100"
.056 mf	K563M20X7RFVBWK	CW20C563M	±20%	20	.100"
.068 mf	K683K20X7RFVBWL	CW20C683K	±10%	20	.100"
.068 mf	K683M20X7RFVBWL	CW20C683M	±20%	20	.100"
.082 mf	K823K20X7RFVBWM	CW20C823K	±10%	20	.100"
.10 mf	K104K20X7RFVBWN	CW20C104K	±10%	20	.100"
.10 mf	K104K20X7RFVCWN	CW20C104K244	±10%	20	.200"
.10 mf	K104K20X7RFTTWN*	—	±10%	20	.200"
.10 mf	K104K30X7RFVCWN	CW30C104K	±10%	30	.200"
.10 mf	K104M20X7RFVBWN	CW20C104M	±20%	20	.100"
.10 mf	K104M20X7RFVCWN	CW20C104M244	±20%	20	.200"
.10 mf	K104M20X7RFTTWN*	—	±20%	20	.200"
.10 mf	K104M30X7RFVCWN	CW30C104M	±20%	30	.200"
.12 mf	K124K30X7RFVCWP	CW30C124K	±10%	30	.200"
.12 mf	K124M30X7RFVCWP	CW30C124M	±20%	30	.200"
.15 mf	K154K30X7RFVCWR	CW30C154K	±10%	30	.200"
.15 mf	K154M30X7RFVCWR	CW30C154M	±20%	30	.200"
.18 mf	K184K30X7RFVCWS	CW30C184K	±10%	30	.200"

*NEW PRODUCT TAPE & REEL

STANDARD STOCK LISTING

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	SIZE CODE	LEAD SPACE
50 Volt DCW X7R					
.18 mf	K184M30X7RFVCWS	CW30C184M	±20%	30	.200"
.22 mf	K224K30X7RFVCWT	CW30C224K	±10%	30	.200"
.22 mf	K224M30X7RFVCWT	CW30C224M	±20%	30	.200"
.27 mf	K274K30X7RFVCWU	CW30C274K	±10%	30	.200"
.27 mf	K274M30X7RFVCWU	CW30C274M	±20%	30	.200"
.33 mf	K334K30X7RFVCWW	CW30C334K	±10%	30	.200"
.33 mf	K334M30X7RFVCWW	CW30C334M	±20%	30	.200"
.39 mf	K394K30X7RFVCWX	CW40C394K	±10%	30	.200"
.47 mf	K474K30X7RFVCWY	CW40C474K	±10%	30	.200"
.47 mf	K474M30X7RFVCWY	CW40C474M	±20%	30	.200"
.56 mf	K564M40X7RFVCXA	CW40C564M	±20%	40	.200"
.68 mf	K684K40X7RFVCXB	CW40C684K	±10%	40	.200"
.82 mf	K824M40X7RFVHXC	CW50C824M	±20%	40	.400"
1.0 mf	K105K40X7RFVHXD	CW50C105K	±10%	40	.400"
1.0 mf	K105M40X7RFVHXD	CW50C105M	±20%	40	.400"
100 Volt DCW X7R					
150 pf	K151K15X7RHVAWA	CW15A151K	±10%	15	.100"
150 pf	K151M15X7RHVAWA	CW15A151M	±20%	15	.100"
180 pf	K181K15X7RHVAWA	CW15A181K	±10%	15	.100"
220 pf	K221K15X7RHVAWA	CW15A221K	±10%	15	.100"
220 pf	K221M15X7RHVAWA	CW15A221M	±20%	15	.100"
270 pf	K271K15X7RHVAWA	CW15A271K	±10%	15	.100"
330 pf	K331K15X7RHVAWA	CW15A331K	±10%	15	.100"
330 pf	K331M15X7RHVAWA	CW15A331M	±20%	15	.100"
390 pf	K391K15X7RHVAWA	CW15A391K	±10%	15	.100"
390 pf	K391M15X7RHVAWA	CW15A391M	±20%	15	.100"
470 pf	K471K15X7RHVAWA	CW15A471K	±10%	15	.100"
470 pf	K471M15X7RHVAWA	CW15A471M	±20%	15	.100"
560 pf	K561K15X7RHVAWA	CW15A561K	±10%	15	.100"
560 pf	K561M15X7RHVAWA	CW15A561M	±20%	15	.100"
680 pf	K681K15X7RHVAWA	CW15A681K	±10%	15	.100"
820 pf	K821K15X7RHVAWA	CW15A821K	±10%	15	.100"
.001 mf	K102K15X7RHVAWA	CW15A102K	±10%	15	.100"
.001 mf	K102M15X7RHVAWA	CW15A102M	±20%	15	.100"
.0012 mf	K122K15X7RHVAWA	CW15A122K	±10%	15	.100"
.0012 mf	K122M15X7RHVAWA	CW15A122M	±20%	15	.100"
.0015 mf	K152K15X7RHVAWA	CW15A152K	±10%	15	.100"
.0018 mf	K182K15X7RHVAWA	CW15A182K	±10%	15	.100"
.0022 mf	K222K15X7RHVAWA	CW15A222K	±10%	15	.100"
.0022 mf	K222M15X7RHVAWA	CW15A222M	±20%	15	.100"
.0027 mf	K272K15X7RHVAWA	CW15A272K	±10%	15	.100"
.0033 mf	K332K15X7RHVAWA	CW15A332K	±10%	15	.100"
.0033 mf	K332M15X7RHVAWA	CW15A332M	±20%	15	.100"
.0039 mf	K392K15X7RHVAWA	CW15A392K	±10%	15	.100"
.0047 mf	K472K15X7RHVAWA	CW15A472K	±10%	15	.100"
.0047 mf	K472M15X7RHVAWA	CW15A472M	±20%	15	.100"
.0056 mf	K562K15X7RHVAWA	CW15A562K	±10%	15	.100"

SERIES K

Mono-Kap® C0G, X7R, Y5V and Z5U, 50VDC and 100VDC, Multilayer Capacitors

STANDARD STOCK LISTING

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	SIZE CODE	LEAD SPACE
100 Volt DCW X7R					
.0068 mf	K682K15X7RHVBWA	CW20A682K	±10%	20	.100"
.0068 mf	K682M15X7RHVBWA	CW20A682M	±20%	20	.100"
.0082 mf	K822K15X7RHVBWA	CW20A822K	±10%	20	.100"
.01 mf	K103K15X7RHVBWA	CW20A103K	±10%	20	.100"
.01 mf	K103K15X7RHVCWA	CW20A103K244	±10%	20	.200"
.01 mf	K103M15X7RHVBWA	CW20A103M	±20%	20	.100"
.01 mf	K103M15X7RHVCWA	CW20A103M244	±20%	20	.200"
.012 mf	K123K15X7RHVBWB	CW20A123K	±10%	20	.100"
.015 mf	K153K20X7RHVBWC	CW20A153K	±10%	20	.100"
.015 mf	K153M20X7RHVBWC	CW20A153M	±20%	20	.100"
.018 mf	K183K20X7RHVBWD	CW20A183K	±10%	20	.100"
.022 mf	K223K20X7RHVBWE	CW20A223K	±10%	20	.100"
.022 mf	K223K20X7RHVCWE	CW20A223K244	±10%	20	.200"
.022 mf	K223M20X7RHVBWE	CW20A223M	±20%	20	.100"
.022 mf	K223M20X7RHVCWE	CW20A223M244	±20%	20	.200"
.027 mf	K273K20X7RHVBWF	CW20A273K	±10%	20	.100"
.027 mf	K273M20X7RHVBWF	CW20A273M	±20%	20	.100"
.033 mf	K333K20X7RHVCWG	CW30A333K	±10%	30	.200"
.033 mf	K333M20X7RHVCWG	CW30A333M	±20%	30	.200"
.039 mf	K393M20X7RHVCWH	CW30A393M	±20%	20	.200"
.047 mf	K473K20X7RHVCWJ	CW20A473K244	±10%	20	.200"
.047 mf	K473M20X7RHVCWJ	CW20A473M244	±20%	20	.200"
.056 mf	K563K20X7RHVCWK	CW30A563K	±10%	20	.200"
.068 mf	K683K20X7RHVCWL	CW30A683K	±10%	30	.200"
.068 mf	K683M20X7RHVCWL	CW30A683M	±20%	30	.200"
.082 mf	K823M20X7RHVCWM	CW30A823M	±20%	20	.200"
.10 mf	K104K20X7RHVCWN	CW30A104K	±10%	30	.200"
.10 mf	K104K20X7RHTTWN*	—	±10%	20	.200"
.10 mf	K104M20X7RHVCWN	CW30A104M	±20%	30	.200"
.12 mf	K124K30X7RHVCWP	CW30A124K	±10%	30	.200"
.12 mf	K124M30X7RHVCWP	CW30A124M	±20%	30	.200"
.22 mf	K224K30X7RHVCWT	CW40A224K	±10%	30	.200"
.22 mf	K224M30X7RHVCWT	CW40A224M	±20%	30	.200"
.33 mf	K334K30X7RHVCWW	CW40A334K	±10%	30	.200"
.39 mf	K394K50X7RHVHWX	CW50A394K	±10%	50	.400"
.47 mf	K474K50X7RHVHWY	CW50A474K	±10%	50	.400"
.47 mf	K474M50X7RHVHWY	CW50A474M	±20%	50	.400"
.56 mf	K564K50X7RHVHXA	CW50A564K	±10%	50	.400"
.56 mf	K564M50X74HVHXA	CW50A564M	±20%	50	.400"
50 Volt DCW Y5V					
270 pf	K271Z15Y5VFVAWA	CY15C271Z	+80-20%	15	.100"
330 pf	K331Z15Y5VFVAWA	CY15C331Z	+80-20%	15	.100"
390 pf	K391Z15Y5VFVAWA	CY15C391Z	+80-20%	15	.100"
680 pf	K681Z15Y5VFVAWA	CY15C681Z	+80-20%	15	.100"
.001 mf	K102M15Y5VFVAWA	CY15C102M	±20%	15	.100"
.0015 mf	K152Z15Y5VFVAWA	CY15C152Z	+80-20%	15	.100"
.0018 mf	K182Z15Y5VFVAWA	CY15C182Z	+80-20%	15	.100"

*NEW PRODUCT TAPE & REEL

Mono-Kap® C0G, X7R, Y5V and Z5U, 50VDC and 100VDC, Multilayer Capacitors

STANDARD STOCK LISTING

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	SIZE CODE	LEAD SPACE
50 Volt DCW Y5V					
.0022 mf	K222M15Y5VFVAWA	CY15C222M	±20%	15	.100"
.0027 mf	K272Z15Y5VFVAWA	CY15C272Z	+80-20%	15	.100"
.0033 mf	K332M15Y5VFVAWA	CY15C332M	±20%	15	.100"
.0039 mf	K392Z15Y5VFVAWA	CY15C392Z	+80-20%	15	.100"
.0047 mf	K472M15Y5VFVAWA	CY15C472M	±20%	15	.100"
.0056 mf	K562Z15Y5VFVAWA	CY15C562Z	+80-20%	15	.100"
.0068 mf	K682M15Y5VFVAWA	CY15C682M	±20%	15	.100"
.01 mf	K103M15Y5VFVAWA	CY15C103M	±20%	15	.100"
.01 mf	K103M15Y5VFVCWA	CY20C103M244	±20%	20	.200"
.01 mf	K103P15Y5VFVAWA	CY15C103P	GMV	15	.100"
.01 mf	K103Z15Y5VFVAWA	CY15C103Z	+80-20%	15	.100"
.01 mf	K103Z15Y5VFVCWA	CY20C103Z244	+80-20%	20	.200"
.015 mf	K153Z15Y5VFVAWC	CY15C153Z	+80-20%	15	.100"
.022 mf	K223M15Y5VFVAWE	CY15C223M	±20%	15	.100"
.022 mf	K223Z15Y5VFVAWE	CY15C223Z	+80-20%	15	100"
.022 mf	K223Z15Y5VFVCWE	CY20C223Z244	+80-20%	20	.200"
.047 mf	K473M20Y5VFVCWJ	CY20C473M244	±20%	20	.200"
.056 mf	K563Z20Y5VFVBWK	CY15C563Z	+80-20%	20	.100"
.10 mf	K104M20Y5VFVBWN	CY20C104M	±20%	20	.100"
.10 mf	K104M20Y5VFVCWN	CY20C104M244	±20%	20	.200"
.10 mf	K104P20Y5VFVBWN	CY20C104P	GMV	20	.100"
.10 mf	K104Z20Y5VFVBWN	CY20C104Z	+80-20%	20	.100"
.10 mf	K104Z20Y5VFVCWN	CY20C104Z244	+80-20%	20	.200"
.12 mf	K124Z20Y5VFVBWP	CY20C124Z	+80-20%	20	.100"
.15 mf	K154M20Y5VFVBWR	CY20C154M	±20%	20	.100"
.22 mf	K224M20Y5VFVBWT	CY20C224M	±20%	20	.100"
.22 mf	K224Z20Y5VFVCWT	CY20C224Z244	+80-20%	20	.200"
.27 mf	K274Z30Y5VFVCWU	—	+80-20%	30	.200"
.47 mf	K474Z30Y5VFVCWY	—	+80-20%	30	.200"
.68 mf	K684M30Y5VFVCXB	CY30C684M	±20%	30	.200"
1.0 mf	K105M30Y5VFVCXD	CY30C105M	±20%	30	.200"
1.0 mf	K105P30Y5VFVCXD	CY30C105P	GMV	30	.200"
1.0 mf	K105Z30Y5VFVCXD	CY30C105Z	+80-20%	30	.200"
100 Volt DCW Y5V					
330 pf	K331Z15Y5VHVAWA	CY15A331Z	+80-20%	15	.100"
390 pf	K391Z15Y5VHVAWA	CY15A391Z	+80-20%	15	.100"
470 pf	K471Z15Y5VHVAWA	CY15A471Z	+80-20%	15	.100"
560 pf	K561Z15Y5VHVAWA	CY15A561Z	+80-20%	15	.100"
680 pf	K681Z15Y5VHVAWA	CY15A681Z	+80-20%	15	.100"
.001 mf	K102Z15Y5VHVAWA	CY15A102Z	+80-20%	15	.100"
.0012 mf	K122Z15Y5VHVAWA	CY15C122Z	+80-20%	15	.100"
.0015 mf	K152Z15Y5VHVAWA	CY15A152Z	+80-20%	15	.100"
.0018 mf	K182Z15Y5VHVAWA	CY15A182Z	+80-20%	15	.100"
.0039 mf	K392Z15Y5VHVAWA	CY15A392Z	+80-20%	15	.100"
.0047 mf	K472Z15Y5VHVAWA	CY15A472Z	+80-20%	15	.100"
.0056 mf	K562Z15Y5VHVAWA	CY15A562Z	+80-20%	15	.100"
.0068 mf	K682Z15Y5VHVAWA	CY15A682Z	+80-20%	15	.100"

SERIES K

Mono-Kap® C0G, X7R, Y5V and Z5U, 50VDC and 100VDC, Multilayer Capacitors

STANDARD STOCK LISTING

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	SIZE CODE	LEAD SPACE
100 Volt DCW Y5V					
.01 mf	K103M15Y5VHVAWA	CY15A103M	±20%	15	.100"
.01 mf	K103M15Y5VHVCWA	CY20A103M244	±20%	15	.200"
.01 mf	K103P15Y5VHVAWA	CY15A103P	GMV	15	.100"
.01 mf	K103Z15Y5VHVAWA	CY15A103Z	+80-20%	15	.100"
.01 mf	K103Z15Y5VHVCWA	CY20A103Z244	+80-20%	15	.200"
.012 mf	K123Z15Y5VHVAWB	CY15A123Z	+80-20%	15	.100"
.015 mf	K153Z15Y5VHVAWC	CY15A153Z	+80-20%	15	.100"
.022 mf	K223M15Y5VHVCWE	CY20A223M244	±20%	20	.200"
.022 mf	K223Z15Y5VHVCWE	CY20A223Z244	+80-20%	20	.200"
.027 mf	K273Z15Y5VHVBWF	CY15A273Z	+80-20%	20	.100"
.047 mf	K473M15Y5VHVBWJ	CY20A473M	±20%	20	.100"
.10 mf	K104M20Y5VHVBWN	CY20A104M	±20%	20	.100"
.10 mf	K104M20Y5VHVCWN	CY20A104M244	±20%	20	.200"
.10 mf	K104P20Y5VHVBWN	CY20A104P	GMV	20	.100"
.10 mf	K104Z20Y5VHVBWN	CY20A104Z	+80-20%	20	.100"
.10 mf	K104Z20Y5VHVCWN	CY20A104Z244	+80-20%	20	.200"
.15 mf	K154Z20Y5VHVBWR	CY20A154Z	+80 – 20	20	.100"
.22 mf	K224Z30Y5VHVCWT	—	+80-20%	30	.200"
.27 mf	K274Z30Y5VHVCWU	CY30A274Z	+80-20%	30	.200"
.33 mf	K334M30Y5VHVCWW	CY30A334M	±20%	30	.200"
.47 mf	K474M30Y5VHVCWW	CY30A474M	±20%	30	.200"
.47 mf	K474Z30Y5VHVCWW	CY30A474Z	+80-20%	30	.200"
50 Volt DCW Z5U					
.001 mf	K102M15Z5UFVAWA	CZ15C102M	±20%	15	.100"
.0015 mf	K152M15Z5UFVAWA	CZ15C152M	±20%	15	.100"
.0018 mf	K182Z15Z5UFVAWA	CZ15C1822	+80 – 20%	15	.100"
.0022 mf	K222M15Z5UFVAWA	CZ15C222M	±20%	15	.100"
.0033 mf	K332Z15Z5UFVAWA	CZ15C332Z	+80-20%	15	.100"
.0039 mf	K392M15Z5UFVAWA	CZ15C392M	±20%	15	.100"
.0047 mf	K472Z15Z5UFVAWA	CZ15C472Z	+80-20%	15	.100"
.0068 mf	K682M15Z5UFVAWA	CZ15C682M	±20%	15	.100"
.0068 mf	K682Z15Z5UFVAWA	CZ15C682Z	+80-20%	15	.100"
.0082 mf	K822M15Z5UFVAWA	CZ15C822M	±20%	15	.100"
.01 mf	K103M15Z5UFVAWA	CZ15C103M	±20%	15	.100"
.01 mf	K103M15Z5UFVCWA	CZ20C103M244	±20%	20	.200"
.01 mf	K103M15Z5UFTTWA*	—	±20%	15	.200"
.01 mf	K103Z15Z5UFVAWA	CZ15C103Z	+80-20%	15	.100"
.01 mf	K103Z15Z5UFVCWA	CZ20C103Z244	+80-20%	20	.200"
.01 mf	K103Z15Z5UFTTWA*	—	+80-20%	15	.200"
.012 mf	K123M15Z5UFVAWB	CZ15C123M	±20%	15	.100"
.012 mf	K123Z15Z5UFVAWB	CZ15C123Z	+80-20%	15	.100"
.018 mf	K183M15Z5UFVAWD	CZ15C183M	±20%	15	.100"
.022 mf	K223M15Z5UFVAWE	CZ15C223M	±20%	15	.100"
.022 mf	K223M15Z5UFVCWE	CZ20C223M244	±20%	20	.200"
.022 mf	K223Z15Z5UFVAWE	CZ15C223Z	+80-20%	15	.100"
.022 mf	K223Z15Z5UFVCWE	CZ20C223Z244	+80-20%	20	.200"
.027 mf	K273M15Z5UFVAWF	CZ15C273M	±20%	15	.100"
.033 mf	K333M15Z5UFVAWG	CZ15C333M	±20%	15	.100"

*New Product Tape and Reel

Mono-Kap® C0G, X7R, Y5V and Z5U, 50VDC and 100VDC, Multilayer Capacitors

STANDARD STOCK LISTING

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	SIZE CODE	LEAD SPACE
50 Volt DCW Z5U					
.033 mf	K333Z15Z5UFVAWG	CZ15C333Z	+80-20%	15	.100"
.047 mf	K473M20Z5UFVBWJ	CZ20C473M	±20%	20	.100"
.047 mf	K473M20Z5UFVCWJ	CZ20C473M244	±20%	20	.200"
.047 mf	K473Z20Z5UFVBWJ	CZ20C473Z	+80-20%	20	.100"
.047 mf	K473Z20Z5UFVCWJ	CZ20C473Z244	+80-20%	20	.200"
.068 mf	K683M20Z5UFVBWL	CZ20C683M	±20%	20	.100"
.068 mf	K683Z20Z5UFVBWL	CZ20C683Z	+80-20%	20	.100"
.10 mf	K104M20Z5UFVBWN	CZ20C104M	±20%	20	.100"
.10 mf	K104M20Z5UFVCWN	CZ20C104M244	±20%	20	.200"
.10 mf	K104M20Z5UFTTWN*	—	±20%	20	.200"
.10 mf	K104Z20Z5UFVBWN	CZ20C104Z	+80-20%	20	.100"
.10 mf	K104Z20Z5UFVCWN	CZ20C104Z244	+80-20%	20	.200"
.10 mf	K104Z20Z5UFTTWN*	—	+80-20%	20	.200"
.12 mf	K124M20Z5UFVBWP	CZ20C124M	±20%	20	.100"
.15 mf	K154M20Z5UFVBWR	CZ20C154M	±20%	20	.100"
.15 mf	K154Z20Z5UFVBWR	CZ20C154Z	+80-20%	20	.100"
.18 mf	K184M20Z5UFVBWS	CZ20C184M	±20%	20	.100"
.22 mf	K224M20Z5UFVBWT	CZ20C224M	±20%	20	.100"
.22 mf	K224M20Z5UFVCWT	CZ20C224M244	±20%	20	.200"
.22 mf	K224M20Z5UFTTWT*	—	±20%	20	.200"
.22 mf	K224Z20Z5UFVBWT	CZ20C224Z	+80-20%	20	.100"
.22 mf	K224Z20Z5UFVCWT	CZ20C224Z244	+80-20%	20	.200"
.33 mf	K334M30Z5UFVCWW	CZ30C334M	±20%	30	.200"
.47 mf	K474M30Z5UFVCWY	CZ30C474M	±20%	30	.200
.47 mf	K474M30Z5UFTTWY*	—	±20%	30	.200"
.47 mf	K474Z30Z5UFVCWY	CZ30C474Z	+80-20%	30	.200"
.68 mf	K684M30Z5UFVCXB	CZ30C684M	±20%	30	.200"
.82 mf	K824M30Z5UFVCXC	CZ30C824M	±20%	30	.200"
1.0 mf	K105M30Z5UFVCXD	CZ30C105M	±20%	30	.200"
1.0 mf	K105M30Z5UFTTXD*	—	±20%	30	.200"
1.0 mf	K105Z30Z5UFVCXD	CZ30C105Z	+80-20%	30	.200"
1.5 mf	K155M40Z5UFVCXE	CZ40C155M	±20%	40	.200"
1.8 mf	K185M40Z5UFVCXF	CZ40C185M	±20%	40	.200"
2.2 mf	K225M40Z5UFVCXF	CZ40C225M	±20%	40	.200"
2.2 mf	K225Z40Z5UFVCXF	CZ40C225Z	+80-20%	40	.200"
3.3 mf	K335M50Z5UFVHXH	CZ50C335M	±20%	50	.400"
4.7 mf	K475M50Z5UFVHXJ	CZ50C475M	±20%	50	.400"
4.7 mf	K475Z50Z5UFVHXJ	CZ50C475Z	+80-20%	50	.400"
100 Volt DCW Z5U					
.001 mf	K102M15Z5UHVAWA	CZ15A102M	±20%	15	.100"
.001 mf	K102Z15Z5UHVAWA	CZ15A102Z	+80-20%	15	.100"
.0022 mf	K222M15Z5UHVAWA	CZ15A222M	±20%	15	.100"
.0033 mf	K332Z15Z5UHVAWA	CZ15A332M	±20%	15	.100"
.0039 mf	K392M15Z5UHVAWA	CZ15A392M	±20%	15	.100"
.0047 mf	K472M15Z5UHVAWA	CZ15A472M	±20%	15	.100"
.0047 mf	K472Z15Z5UHVAWA	CZ15A472Z	+80-20%	15	.100"
.0082 mf	K822M15Z5UHVAWA	CZ15A822M	±20%	15	.100"

*New Product Tape and Reel

SERIES K

Mono-Kap® C0G, X7R, Y5V and Z5U, 50VDC and 100VDC, Multilayer Capacitors

STANDARD STOCK LISTING

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	SIZE CODE	LEAD SPACE
.01 mf	K103M15Z5UHVAWA	CZ15A103M	±20%	15	.100"
.01 mf	K103M15Z5UHVCWA	CZ20A103M244	±20%	20	.200"
.01 mf	K103Z15Z5UHVAWA	CZ15A103Z	+80-20%	15	.100"
.01 mf	K103Z15Z5UHVCWA	CZ20A103Z244	+80-20%	20	.200"
.012 mf	K123M15Z5UHVAWB	CZ15A123M	±20%	15	.100"
.022 mf	K223M20Z5UHVBWE	CZ20A223M	±20%	20	.200"
.022 mf	K223M20Z5UHVCWE	CZ20A223ZM244	±20%	20	.200"
.022 mf	K223Z20Z5UHVCWE	CZ20A223Z244	+80-20%	20	.200"
.033 mf	K333M20Z5UHVBWG	CZ20A333M	±20%	20	.100"
.039 mf	K393M20Z5UHVBWH	CZ20A393M	±20%	20	.100"
.047 mf	K473M20Z5UHVBWJ	CZ20A473M	±20%	20	.100"
.047 mf	K473M20Z5UHVCWJ	CZ20A473M244	±20%	20	.200"
.068 mf	K683M20Z5UHVBWL	CZ20A683M	±20%	20	.100"
.10 mf	K104M20Z5UHVBWN	CZ20A104M	±20%	20	.100"
.10 mf	K104M20Z5UHVCWN	CZ20A104M244	±20%	20	.200"
.10 mf	K104Z20Z5UHVBWN	CZ20A104Z	+80-20%	20	.100"
.10 mf	K104Z20Z5UHVCWN	CZ20A104Z244	+80-20%	20	.200"
.12 mf	K124M20Z5UHVBWP	CZ20A124M	±20%	20	.100"
.15 mf	K154M20Z5UHVCWR	CZ20A154M	±20%	30	.200"
.22 mf	K224Z30Z5UHVCWT	CZ30A224M	+20	30	.200"
.33 mf	K334M30Z5UHVCWW	CZ30A334M	±20%	30	.200"
.47 mf	K474M30Z5UHVCWY	CZ30A474M	±20%	30	.200
.47 mf	K474Z30Z5UHVCWY	CZ30A474Z	+80-20%	30	.200"
1.0 mf	K105M40Z5UHVCXD	CZ40A105M	±20%	40	.200"
2.2 mf	K225M50Z5UHVHXF	CZ50A225M	±20%	50	.400"

MONO KAP® TAPE & REEL

DESCRIPTION	SYMBOL	METRIC DIMENSION	REFERENCE DIM'S IN INCHES
Body Dimensions (MK)	L x W	11.0 x 11.0 Max	.43 x .43ref
Body Thickness	T	4.0 Max	.157ref
Wire Lead Dia.	d	0.5+0.06/−0.05	#24 AWG CCS
Taping Pitch	P	12.7 Ref	.500ref
Feed Hole Pitch (Note 1)	Po	12.7±0.3 (Note)	.500ref
Feed Hole Off Alignment	P1/P2	3.85±0.7/6.35±1.3	.15ref/.25ref
Lead Spacing	F	5.0+0.8/−0.2 (or 2.54)	.197ref (.100)
Body Inclination	h	0±1.0	0±.039ref
Carrier Tape Width	W	18.0+1.0/−0.5	.709ref
Adhesive Tape Width	Wo	13.0 Ref	.512ref
Feed Hole Ht off Alignment	W1	9.0+0.75/−0.5	.354ref
Adhesive Tape Margin	W2	3.0+3.0	.118ref
Straight Lead Height	H	17.0Min./19.5Max	.67/.76ref
Lead Crimp Height	Ho	16.0±0.5	.63ref
Top of Component Height	H1	23.0Min/32.25Max	.91/1.27ref
Clean, Parallel Lead Length	H2	6.0ref	.236ref
Lead End Protusion	1	2.0 Max	.078ref
Feed Hole Diameter	Do	4.0±0.3	.157ref
Overall Tape Thickness	t	0.9 Max	.035ref
Rejected Component Cut Height	L	10.0Max	.394ref

Note: 1: Cumulative pitch tolerance over 20 consecutive units not to exceed ±1.0mm.
2: Dimensions meet requirements defined in EIA RS468.
3: "H2" defines the useable portion of the lead for insertion equipment purposes; the leads in this area to be straight and parallel. They shall be @ 90° ±3° to the top edge of the carrier tape and shall also be parallel to each other to within 3°.
Deformation, if any, shall not exceed 3°.
H2 is the straight lead portion of any formed wire and the "Free of coating" area of any non-formed wire.

MONOKAP TAPE & REEL

TAPE & REEL

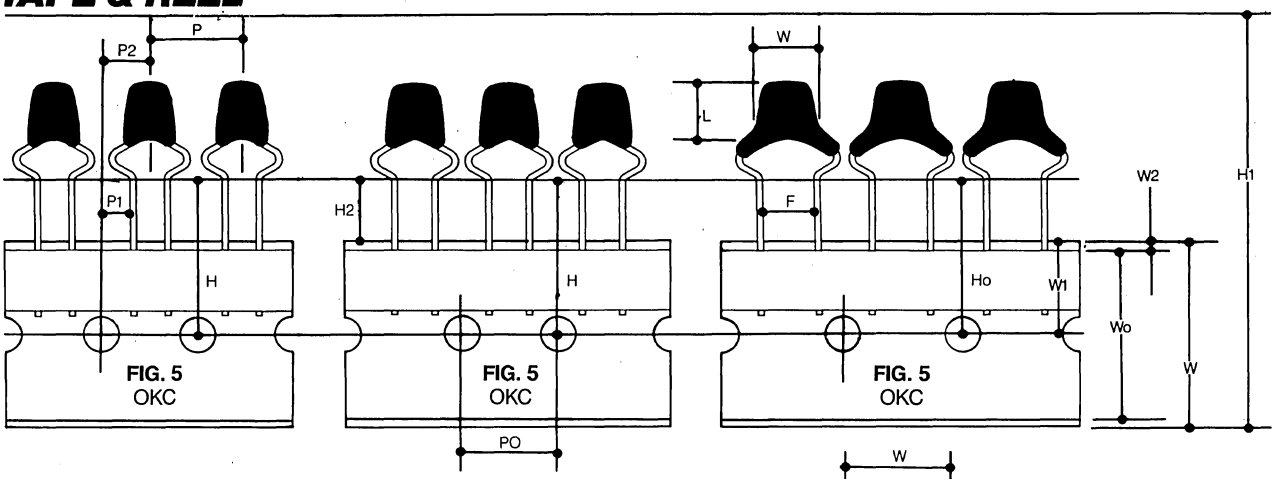


FIG. 5
OKC

FIG. 5
OKC

FIG. 5
OKC

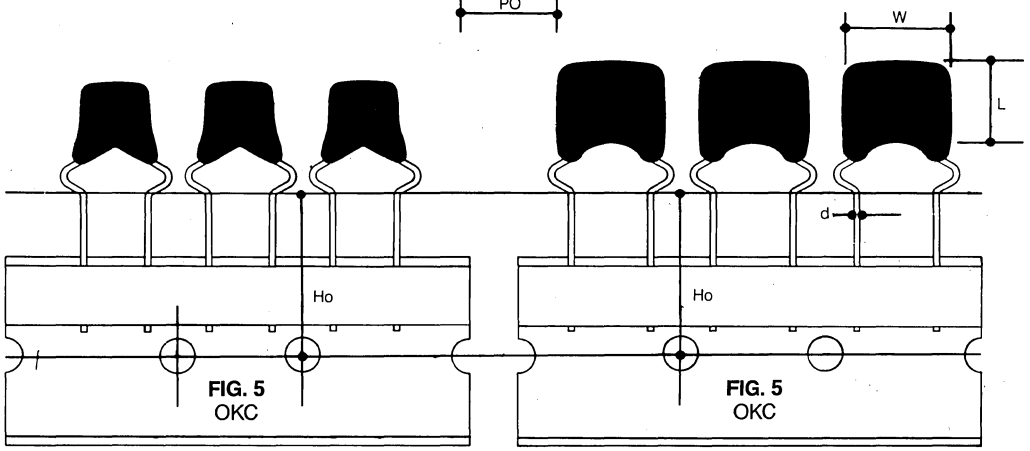


FIG. 5
OKC

FIG. 5
OKC

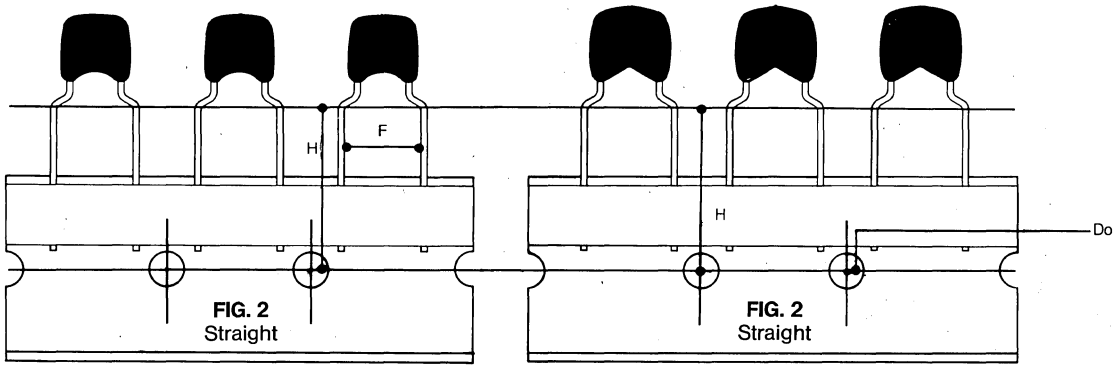


FIG. 2
Straight

FIG. 2
Straight

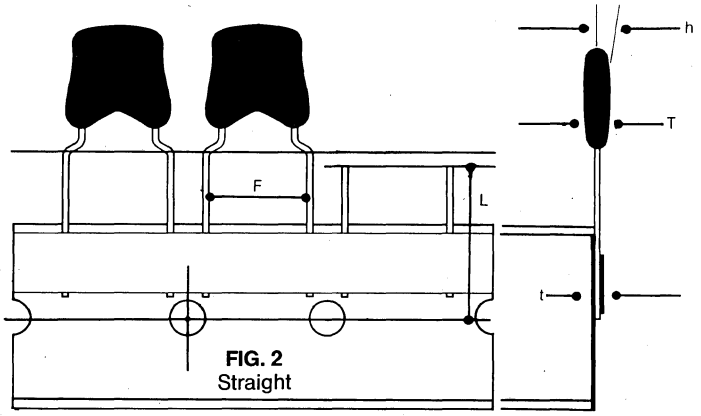


FIG. 2
Straight

Outside and inside crimped wire forms above; straight wire forms below.

DISC CAP TAPE & REEL

TAPE & REEL

DESCRIPTION	SYMBOL	METRIC DIMENSION	REFERENCE DIM'S IN INCHES
Body Diameter (Discs)	A	12,0Max	.476ref
Body Thickness	T	4,0 Max	.157ref
Wire Lead Dia.	d	.45/.65	#23 AWG Cu
Taping Pitch	P	12,7 Ref	.500ref
Feed Hole Pitch (Note 1)	Po	12,7±0,3 (Note 1)	.500ref
Feed Hole Off Alignment	P1/P2	3,85±0,7/6,35±1,3	.152ref/.25ref
Lead Spacing	F	5,0+0,8/−0,2	.197ref
Body Inclination	h	0±1,0	0±.039ref
Carrier Tape Width	W	18,0+1,0/−0,5	.709ref
Adhesive Tape Width	Wo	13,0 Ref	.512ref
Feed Hole Ht off Alignment	W1	9,0+0,75/−0,5	.354ref
Adhesive Tape Margin	W2	3,0±3,0	.118ref
Straight Lead Height	H	17,0Min./19,5Max	.67/.76ref
Lead Crimp Height	Ho	16,0±0,5	.63ref
Top of Component Height	H1	23,0Min/32,25Max	.91/1.27ref
Clean, Parallel Lead Length	H2	6,0ref	.236ref
Lead End Protrusion	1	2,0 Max	.078ref
Feed Hole Diameter	Do	4,0±0,3	.157ref
Overall Tape Thickness	t	0,9 Max	.035ref
Rejected Component Cut Height	L	10,0Max	.394ref

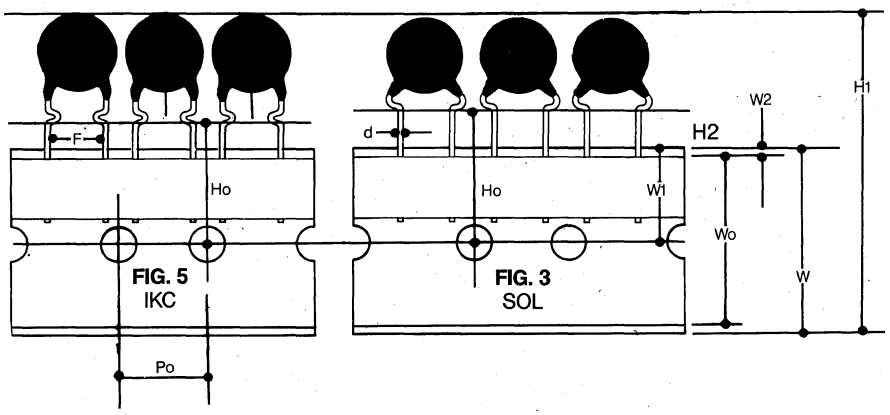


FIG. 5 IKC

FIG. 3 SOL

Note: 1: Cumulative pitch tolerance over 20 consecutive units not to exceed ±1.0mm.
2: Dimensions meet requirements defined in EIA RS468.
3: "H2" defines the useable portion of the lead for insertion equipment purposes; the leads in this area to be straight and parallel. They shall be @ 90° ±3° to the top edge of the carrier tape and shall also be parallel to each other to within 3°.
Deformation, if any, shall not exceed 3°.
H2 is the straight lead portion of any formed wire and the "Free of coating" area of any non-formed wire.

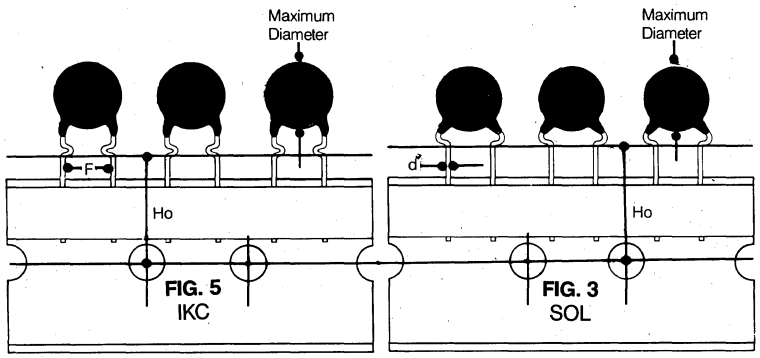


FIG. 5 IKC

FIG. 3 SOL

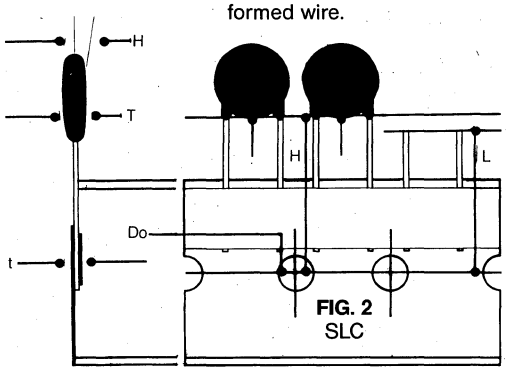
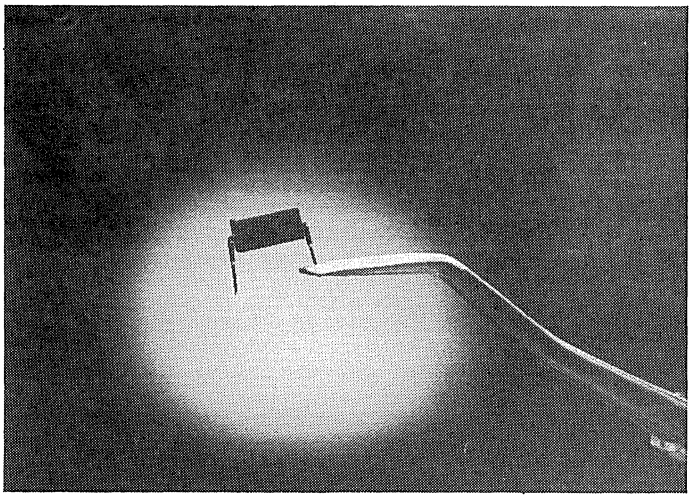


FIG. 2 SLC

SERIES P

Mono-Pak® Dual In-Line Ceramic Multilayer Capacitors



DESCRIPTION:

Mepco/Centralab's two pin, dual In-Line capacitors feature a .165" maximum inserted height, compatible with IC's and other DIP's. The units are packed for automatic insertion.

ELECTRICAL PARAMETERS:

CAPACITANCE:

Measured @ 1MHz @ 1.2VRMS Max. @ 25°C for C0G types with C≤ 1000pF.

Measured @ 1KHz @ 1.2VRMS max. @ 25°C for C0G types with C> 1000pF.

Measured @ 1Khz @ 1.0VRMS ± .2VRMS @ 25°C for X7R types.

Measured @ 1Khz @ .5VRMS ± .1VRMS @ 25°C for Z5U types.

DISSIPATION FACTOR:

.1% Maximum for C0G types,
2.5% Maximum for X7R types and
4.0% Maximum for Z5U types;
Measurements conditions are the same as for Capacitance measurement.

DIELECTRIC STRENGTH:

Parts are subjected for up to 5 seconds @ 25°C to: 250% of Rated Voltage'

INSULATION RESISTANCE:

When measured @ 25°C and Rated Voltage, the following Minimum Values will be met: 100 Gig Ω or 1000 Ω F (whichever is less) for C0G and X7R types, 10 Gig Ω or 1000 Ω F (whichever is less) for Z5U types.

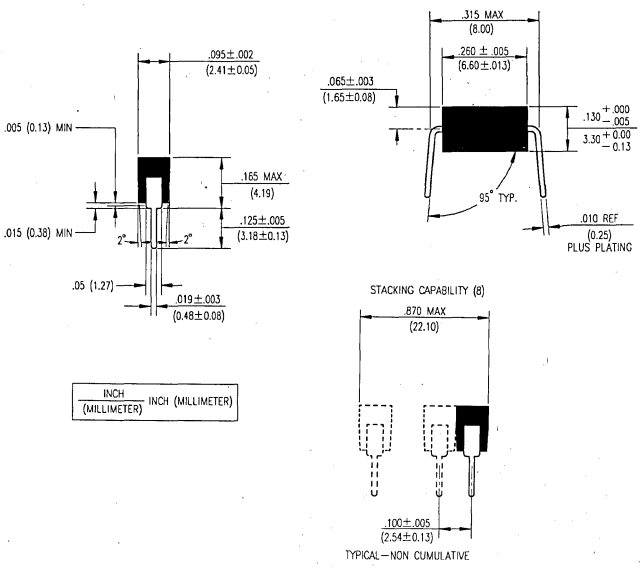
OPERATING TEMPERATURE RANGE

−55°C to +125°C for C0G and X7R
−55°C to +85°C for Z5U

ENCAPSULATION:

Molded Epoxy

DIMENSIONS:



SERIES P

Mono-Pak® Dual In-Line Ceramic Multilayer Capacitors

STANDARD STOCK LISTING

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	SIZE CODE	LEAD SPACING
50 Volt DCW C0G (NPO)					
10 pf	P100K26C0GFVPWA	CN80C100KM	±10	26	.300"
22	P220K26C0GFVPWA	CN80C220KM	±10	26	.300"
33	P330K26C0GFVPWA	CN80C330KM	±10	26	.300"
47	P470K26C0GFVPWA	CN80C470KM	±10	26	.300"
56	P560K26C0GFVPWA	CN80C560KM	±10	26	.300"
68	P680K26C0GFVPWA	CN80C680KM	±10	26	.300"
82	P820K26C0GFVPWA	CN80C820KM	±10	26	.300"
100	P101K26C0GFVPWA	CN80C101KM	±10	26	.300"
150	P151K26C0GFVPWA	CN80C151KM	±10	26	.300"
220	P221J26C0GFVPWA	CN80C221JM	±5	26	.300"
220	P221K26C0GFVPWA	CN80C221KM	±10	26	.300"
330	P331K26C0GFVPWA	CN80C331KM	±10	26	.300"
470	P471K26C0GFVPWA	CN80C471KM	±10	26	.300"
.001 mf	P102J26C0GFVPWA	CN80C102JM	±5	26	.300"
.001	P102K26C0GFVPWA	CN80C102KM	±10	26	.300"
.0022	P222K26C0GFVPWA	CN80C222KM	±10	26	.300"
50 Volt DCW X7R					
.0033	P332K26X7RFVPWA	CW80C332KM	±10	26	.300"
.0047	P472K26X7RFVPWA	CW80C472KM	±10	26	.300"
.01	P103K26X7RFVPWA	CW80C103KM	±10	26	.300"
.01	P103M26X7RFVPWA	CW80C103MM	±20	26	.300"
.022	P223K26X7RFVPWE	CW80C223KM	±10	26	.300"
.022	P223M26X7RFVPWE	CW80C223MM	±20	26	.300"
.047	P473K26X7RFVPWJ	CW80C473KM	±10	26	.300"
.047	P473M26X7RFVPWJ	CW80C473MM	±20	26	.300"
.1	P104K26X7RFVPWN	CW80C104KM	±10	26	.300"
.1	P104M26X7RFVPWN	CW80C104MM	±20	26	.300"
.22	P224K26X7RFVPWT	CW80C224KM	±10	26	.300"
.22	P224M26X7RFVPWT	CW80C224MM	±20	26	.300"
50 Volt DCW Z5U					
.01	P103M26Z5UFVPWA	CZ80C103MM	±20	26	.300"
.01	P103Z26Z5UFVPWA	CZ80C103ZM	+80-20	26	.300"
.022	P223M26Z5UFVPWE	CZ80C223MM	±20	26	.300"
.022	P223Z26Z5UFVPWE	CZ80C223ZM	+80-20	26	.300"
.047	P473M26Z5UFVPWJ	CZ80C473MM	±20	26	.300"
.047	P473Z26Z5UFVPWJ	CZ80C473ZM	+80-20	26	.300"
.1	P104M26Z5UFVPWN	CZ80C104MM	±20	26	.300"
.1	P104Z26Z5UFVPWN	CZ80C104ZM	+80-20	26	.300"
.22	P224M26Z5UFVPWT	CZ80C224MM	±20	26	.300"
.22	P224Z26Z5UFVPWT	CZ80C224ZM	+80-20	26	.300"
.33	P334Z26Z5UFVPWW	CZ80C334ZM	+80-20	26	.300"

STANDARD MARKING:

VMCCCT

V = VOLTAGE CODE
1 = 100V
2 = 200V
leave blank for 50V

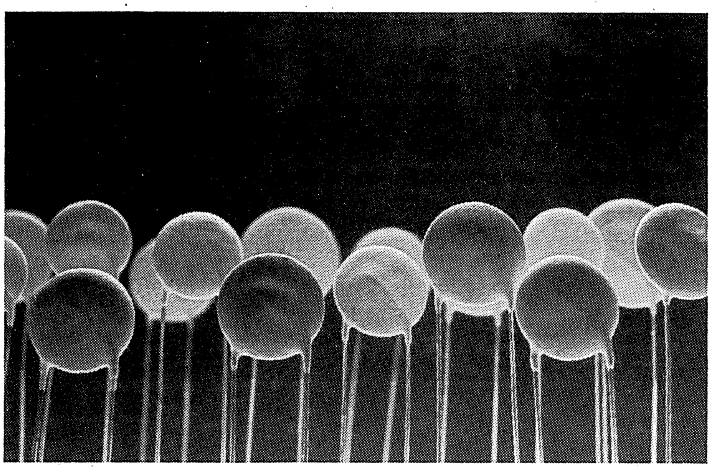
M = MATERIAL CODE (EIA TC CODE)
A = C0G (NPO)
C = X7R
E = Z5U

CCC = CODED CAPACITANCE VALUE
10pF through 99pF: actual value in pF (2 digits only)
100pF and above: coded cap. value, same as used in P/N on the Spec.

T = TOLERANCE CODE; SAME AS USED IN THE P/N
Use "VP" for Mechanical Detail Code for all Mono-Pak (they are packaged 200 to a Magazine).

Standard Qty is 5000 pcs (25 magazines) in a carton.

Ultra-Kap®, 3VDC through 100VDC, Low Voltage EIA Class IV



DESCRIPTION:

Mepco/Centralab's Ultra-Kap® capacitors provide many advantages when compared to ordinary ceramic capacitors. Their unique semi-conductor design allows for the maximum in capacitance while retaining the miniature size required for today's ever decreasing printed circuit board sizes.

Three types of Ultra-Kap®'s are being offered by Mepco/Centralab, Inc.:

1. 3V:
   These units have the highest capacitance density of all disc capacitors; the Standard Tolerance is GMV (+100/−0%); Std TC is Y5T.
2. Ultra-Kap® I:
   This is the most commonly used Class IV capacitor; Standard Tolerance is +/−20%, units are also available with +80/−20% tolerance.
3. Ultra-Kap® II:
   These units, available with both +/−20% and +80/−20% tolerance and with Standard TC of Y5T, have the advantage of being able to withstand, for up to 5 seconds, a DC Voltage as high as twice their rated Voltage. They are also available with voltage ratings as high as 100VDC and typically they are one Standard Size SMALLER than an equivalent UKI for a given voltage and Capacitance combination.

ELECTRICAL PARAMETERS:

CAPACITANCE:
Measured @ 1KHz @ 0.1VRMS max. @ 25°C.

DISSIPATION FACTOR:
Measured @ 1KHz @ 0.1VRMS Max. @ 25°C.

DIELECTRIC STRENGTH:
Ultra-Kap® I: Rated Voltage
Ultra-Kap® II: 200% of Rated Voltage

INSULATION RESISTANCE:
Per EIA RS-198C; IR is specified as MegOhm-MicroFarad Product by Voltage:
3V Rated Parts: .004 M Ω μ F
12V Rated Parts: .04 M Ω μ F
16V Rated Parts: .10 M Ω μ F
25V Rated Parts: 1.0 M Ω μ F
50, 75 and 100V Rated Parts: 10.0 M Ω μ F
Refer to Standard Stock Listing.
For Standard Stock Part IR ratings, see Listing.

ENCAPSULATION:
Phenolic Resin, Green colored.

OPERATING TEMPERATURE RANGE:
−55°C to +125°C for 12, 16, 25, 50, 75 and 100V Rating,
−55°C to +85°C for 3V Rating.

MARKING:
Mepco/Centralab Logo (Diamond Shape), Capacitance Value (in Micro-Farad), EIA Capacitance Tolerance Code, Rated Voltage, EIA Temperature Characteristic (in this order, as size permits).

SERIES U

Ultra-Kap® 3VDC through 100VDC, Low Voltage EIA Class IV

PACKAGING:
Both Bulk and Radial Tape and Reel (per EIA RS-468) product is available. Taped and Reeled product available on 2000 pcs. Reels only.

LEADFORMS:
Bulk Product available in variety of Forms, Spacings, Lengths and Wire Diameters. Taped and Reeled Product available with 5MM (.197") Nominal Spacing, #24AWG CCS Wire, IKC (Standard), SOL or SLC Leads.

ULTRA-KAP® RANGE CHARTS

Size and Electrical Code

Type of UK		3V	UKI	UKII	UKI	UKII	UKI	UKII	UKI	UKII	UKII
Voltage		3	12	12	16	16	25	25	50	50	75
Voltage Code		A	B	B	C	C	E	E	F	F	G
Maximum DF		10%	7%	7%	5%	5%	5%	5%	5%	5%	5%
EIA CAPACITANCE CODE	103		20KM	20KH	20KW	20KW	20KW	20KW	27LJ	20LJ	27LJ
	153		27KH	27KH	27KH	27KU	27KU	27KU	40LJ	27LJ	40LJ
	183		27KH	27KG	27KG	27KU	27KU	27KU	40LJ	27LJ	40LJ
	223		27KG	27KF	27KF	27KU	27KU	27KU	47LJ	27LJ	47LJ
	333		27KF	27KC	27KE	27KU	40KR	27KU	47LJ	40LJ	47LJ
	473		27KC	27JY	40KE	40KY	40KP	40KY	59LJ	40LJ	59LJ
	503		27JY	27JY	40KE	40KY	40KP	40KY	59LJ	40LJ	59LJ
	683		40KC	27KC	40KD	40KY	47KN	40KY	69LJ	47LJ	69LJ
	104	20TK	40JY	40KC	47KC	40KY	59KM	40KY	82LJ	59LJ	69LJ
	154	29TH	47JY	47KC	59KA	47KM	69KJ	47KM		69LJ	
	224	29TH	59JX	59JX	69JX	59KM	82KG	59KM		82LJ	
	334	40TG	69JW	69JW	82JW	82KM		82KM			
	474	40TF	82JW	82JW							
	684	59TE									
	105	59TD									
	225	82TB									

The last two digits in this chart represent the electrical detail code, needed for P/N assignment; while the first two digits are the size code:

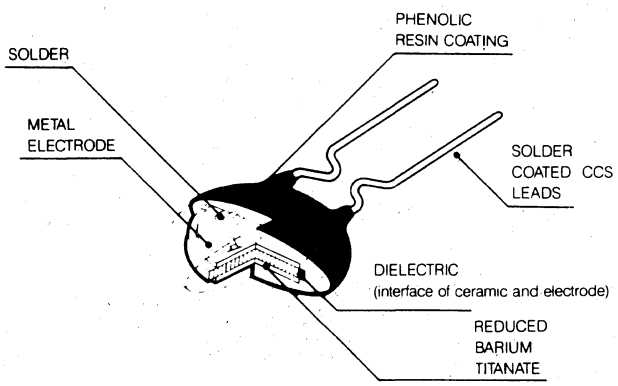
20 = .197" dia
27 = .275" dia
40 = .394" dia
47 = .472" dia
59 = .590" dia
69 = .690" dia
82 = .820" dia

All 3V units are .190" maximum thickness, all others .156" maximum.

Available Temperature Characteristics by Type of UK MTL.

EIA TC Code	Material	EIA TC Code	Material	EIA TC Code	Material
X5R	UKI	Y5P	UKI	Z5P	UKI
X5S	UKI	Y5R	UKI	Z5R	UKI
X5T	UKI	Y5S	UKI	Z5S	UKI
X5U	UKI,UKII	Y5T	UKI,UKII,3V	Z5T	UKI,UKII
X5V	UKI,UKII	Y5U	UKI,UKII	Z5U	UKI,UKII
X7S	UKI	Y5V	UKI,UKII	Z5V	UKI,UKII
X7T	UKI				
X7U	UKI,UKII				
X7V	UKI,UKII				

TYPICAL CHARACTERISTICS



SERIES U

Ultra-Kap,® 3VDC through 100VDC, Low Voltage EIA Class IV

STANDARD STOCK LISTING

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	MAX. DIA.	MAX. THICK.	LEAD SPACE	LEAD STYLE	MIN. I.R. MEG OHMS	MAX. D.F.
Ultra-Kap 3 Volt DCW Y5T									
.1 mf	U104P20Y5TAAATK	UK104	GMV	.20"	.190"	.250"	SLL	.04	10%
.22 mf	U224P40Y5TAAATH	UK224	GMV	.40"	.190"	.250"	SLL	.02	10%
.47 mf	U474P40Y5TAAATF	UK474	GMV	.40"	.190"	.250"	SLL	.008	10%
1.0 mf	U105P59Y5TAABTD	UK105	GMV	.59"	.156"	.375"	SLL	.004	10%
2.2 mf	U225P82Y5TAABTB	UK225	GMV	.82"	.156"	.375"	SLL	.002	10%
12 Volt DCW Y5S									
.05 uf	U503M29Y5PBAAJY	UK12503	±20%	.29"	.156"	.250"	SLL	0.5	7%
■.05 uf	U503M29Y5PBTHKC	—	±20%	.29"	.140"	.200"	IKC*	0.5	7%
.05 uf	U503M29Y5PBBEJY	XXUK12503	±20%	.29"	.156"	.250"	SLC	0.5	7%
■.05 uf	U503Z29Y5PBAAJY	UK10-503	+80-20%	.29"	.156"	.250"	SLL	0.5	7%
.1 uf	U104M40Y5PBAAJY	UK12104	±20%	.40"	.156"	.250"	SLL	0.5	7%
■.1 uf	U104M40Y5PBTHJY	—	±20%	.40"	.140"	.200"	IKC*	0.5	7%
.1 uf	U104M40Y5PBBEJY	XXUK12104	±20%	.40"	.156"	.250"	SLC	0.5	7%
■.1 uf	U104Z40Y5PBAAJY	UK10-104	+80-20%	.40"	.156"	.250"	SLL	0.5	7%
.2 uf	U204M59Y5PBABJX	UK12204	±20%	.59"	.156"	.375"	SLL	0.4	7%
■.2 uf	U204Z59Y5PBABJX	—	+80-20%	.59"	.156"	.375"	SLL	0.4	7%
.47 uf	U474M82Y5PBABJT	UK12474	±20%	.82"	.156"	.375"	SLL	0.2	7%
.47 uf	U474M82Y5PBBFJT	XXUK12474	±20%	.82"	.156"	.375"	SLC	0.2	7%
■.47 uf	U474Z82Y5PBABJT	—	+80-20%	.82"	.156"	.375"	SLL	0.2	7%
16 Volt DCW Y5S									
.01 uf	U103M20Y5PCAAKH	UK16103	±20%	.20"	.156"	.250"	SLL	5.0	5%
.01 uf	U103M20Y5PCBEKH	XXUK16103	±20%	.20"	.156"	.250"	SLC	5.0	5%
.022 uf	U223M29Y5PCAAKF	UK16223	±20%	.29"	.156"	.250"	SLL	3.0	5%
.022 uf	U223M29Y5PCBEKF	XXUK16223	±20%	.29"	.156"	.250"	SLC	3.0	5%
.033 uf	U333M29Y5PCAAKF	UK16333	±20%	.29"	.156"	.250"	SLL	3.0	5%
.033 uf	U333M29Y5PCBEKF	XXUK16333	±20%	.29"	.156"	.250"	SLC	3.0	5%
.05 uf	U503M39Y5PCAAKE	UK16503	±20%	.39"	.156"	.250"	SLL	2.0	5%
.05 uf	U503M39Y5PCBEKE	XXUK16503	±20%	.39"	.156"	.250"	SLC	2.0	5%
.068 uf	U683M40Y5PCAAKD	UK16683	±20%	.40"	.156"	.250"	SLL	1.5	5%
.1 uf	U104M47Y5PCABKC	UK16104	±20%	.47"	.156"	.375"	SLL	1.0	5%
.1 uf	U104M47Y5PCBFKC	XXUK16104	±20%	.47"	.156"	.375"	SLC	1.0	5%
.15 uf	U154M59Y5PCABKA	UK16154	±20%	.59"	.156"	.375"	SLL	.6	5%
.15 uf	U154M59Y5PCBFKA	XXUK16154	±20%	.59"	.156"	.375"	SLC	.6	5%
.2 uf	U204M69Y5PCABJX	UK16204	±20%	.69"	.156"	.375"	SLL	.4	5%
.2 uf	U204M69Y5PCBFJX	XXUK16204	±20%	.69"	.156"	.375"	SLC	.4	5%
.3 uf	U304M82Y5PCBFJW	UK16304	±20%	.82"	.156"	.375"	SLL	.3	5%
.3 uf	U304M82Y5PCABJW	XXUK16304	±20%	.82"	.156"	.375"	SLC	.3	5%
25 Volt DCW Y5S									
.01 uf	U103M20Y5PEAAKW	UK25103	±20%	.20"	.156"	.250"	SLL	65	5%
■.01 uf	U103M20Y5PETHKW	—	±20%	.20"	.140"	.200"	IKC*	65	5%
.01 uf	U103M20Y5PEBEKW	XXUK25103	±20%	.20"	.156"	.250"	SLC	65	5%
.022 uf	U223M29Y5PEAAKU	UK25223	±20%	.29"	.156"	.250"	SLL	45	5%
.022 uf	U223M29Y5PEBEKF	XXUK25223	±20%	.29"	.156"	.250"	SLC	45	5%
.033 uf	U333M40Y5PEAAKR	UK25333	±20%	.40"	.156"	.250"	SLL	30	5%
.033 uf	U333M40Y5PEBEKR	XXUK25333	±20%	.40"	.156"	.250"	SLC	30	5%
.05 uf	U503M40Y5PEAAKP	UK25503	±20%	.40"	.156"	.250"	SLL	20	5%
■.05 uf	U503M40Y5PETHKP	—	±20%	.40"	.140"	.200"	IKC*	20	5%

Note: 12 volt DCW Y5P Series includes previous 10 volt DCW Y5P Series.

SERIES U

Ultra-Kap,® 3VDC through 100VDC, Low Voltage EIA Class IV

STANDARD STOCK LISTING

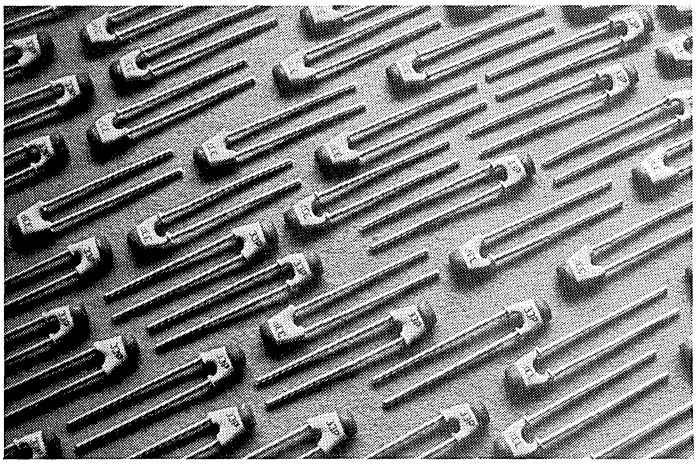
CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	MAX. DIA.	MAX. THICK.	LEAD SPACE	LEAD STYLE	MIN. I.R. MEG OHMS	MAX. D.F.
.05 uf	U503M40Y5PEBEKP	XXUK25503	±20%	.40"	.156"	.250"	SLC	20	5%
■.05 uf	U503Z40Y5PEAAKP	—	+80-20%	.40"	.156"	.250"	SLL	20	5%
.068 uf	U683M47Y5PEAAKN	UK25683	±20%	.47"	.156"	.250"	SLL	15	5%
.068 uf	U683M47Y5PEBEKN	XXUK25683	±20%	.47"	.156"	.250"	SLC	15	5%
.1 uf	U104M59Y5PEABKM	UK25104	±20%	.59"	.156"	.375"	SLL	10	5%
.1 uf	U104M59Y5PEBFKM	XXUK25104	±20%	.59"	.156"	.375"	SLC	10	5%
■.1 uf	U104Z59Y5PEABKM	—	+80-20%	.59"	.156"	.375"	SLL	10	5%
.15 uf	U154M69Y5PEABKJ	UK25154	±20%	.69"	.156"	.375"	SLL	6	5%
.15 uf	U154M69Y5PEBFKJ	XXUK25154	±20%	.69"	.156"	.375"	SLC	6	5%
.2 uf	U204M82Y5PEABKG	UK25204	±20%	.82"	.156"	.375"	SLL	4	5%
■.2 uf	U204Z82Y5PEABKG	—	+80-20%	.82"	.156"	.375"	SLL	4	5%
50 Volt DCW Y5P									
.01 uf	U103M29Y5PFAALJ	UK50103	±20%	.29"	.156"	.250"	SLL	1000	5%
■.01 uf	U103M29Y5PFTHLJ	—	±20%	.29"	.140"	.200"	IKC*	1000	5%
.01 uf	U103M29Y5PFBELJ	XXUK50103	±20%	.29"	.156"	.250"	SLC	1000	5%
.015 uf	U153M40Y5PFAALJ	UK50153	±20%	.40"	.156"	.250"	SLL	1000	5%
.015 uf	U153M40Y5PFBELJ	XXUK50153	±20%	.40"	.156"	.250"	SLC	1000	5%
.022 uf	U223M47Y5PFAALJ	UK50223	±20%	.47"	.156"	.250"	SLL	1000	5%
.022 uf	U223M47Y5PFBELJ	XXUK50223	±20%	.47"	.156"	.250"	SLC	1000	5%
.033 uf	U333M47Y5PFABLJ	UK50333	±20%	.47"	.156"	.375"	SLL	1000	5%
.033 uf	U333M47Y5PFBFLJ	XXUK50333	±20%	.47"	.156"	.375"	SLC	1000	5%
.047 uf	U473M59Y5PFABLJ	UK50473	±20%	.59"	.156"	.375"	SLL	1000	5%
.047 uf	U473M59Y5PFBFLJ	XXUK50473	±20%	.59"	.156"	.375"	SLC	1000	5%
.05 uf	U503M59Y5PFABLJ	UK50503	±20%	.59"	.156"	.375"	SLL	1000	5%
.05 uf	U503M59Y5PFBFLJ	XXUK50503	±20%	.59"	.156"	.375"	SLC	1000	5%
.068 uf	U683M69Y5PFABLJ	UK50683	±20%	.69"	.156"	.375"	SLL	1000	5%
.068 uf	U683M69Y5PFBFLJ	XXUK50683	±20%	.69"	.156"	.375"	SLC	1000	5%
.1 uf	U104M82Y5PFABLJ	UK50104	±20%	.82"	.156"	.375"	SLL	1000	5%
.1 uf	U104M82Y5PFBFLJ	XXUK50104	±20%	.82"	.156"	.375"	SLC	1000	5%
Ultra-Kap II 75 Volt DCW Y5U									
.01 uf	U103Z29Y5UGAAPK	UKZ75103	+80-20%	.29"	.156"	.250"	SLL	5000	5%
.018 uf	U183Z40Y5UGAAPK	UKZ75183	+80-20%	.40"	.156"	.250"	SLL	5000	5%
.022 uf	U223Z47Y5UGAAPK	UKZ75223	+80-20%	.47"	.156"	.250"	SLL	5000	5%
.033 uf	U333Z59Y5UGABPK	UKZ75333	+80-20%	.59"	.156"	.375"	SLL	5000	5%
.1 uf	U104Z69Y5UGABPK	UKZ75104	+80-20%	.69"	.156"	.375"	SLL	5000	5%
100 Volt DCW Y5T									
■.01 uf	U103M29Y5THMBLK	—	±20%	.29"	.156"	.197"	SLL	5000	5%

■New Mepco/Centralab Product

* Tape & Reel Packaging

SERIES R

50VDC AND 100VDC, Temperature Compensating and General Purpose Ceramic Plate Capacitors



DESCRIPTION:

Mepco/Centralab's Single Plate Capacitors are radial leaded, conformal coated capacitors; they are similar to disc capacitors except for their rectangular shape and non-noble metal electrodes; this type of electrode system makes them extremely cost effective.

They may be used as direct replacements for disc or multi-layer capacitors of equivalent ratings.

ELECTRICAL SPECIFICATIONS:

CAPACITANCE:
.68pF to .022uF, per Range Chart; Standard Parts are shown in P/N Stock Listing.

CAPACITANCE TOLERANCE:
Depends both on Capacitance Value and Temp. Char., as shown below:
Value $<$ 10pF: $\pm$ .25 pF, any TC
Value $\geq$ 10pF: $\pm$ 2% for TC's other than Y5P and Z5V.
Y5P TC: $\pm$ 10% for all values.
Z5V TC: +80/−20% for all values.

DISSIPATION FACTOR:
3.5% Maximum for Y5P and Z5V TC's.
.15% Maximum (C = greater than 50pF) or .15 [(15/C) + .7]% maximum
(C = $<$ 50 pF) for all others.

STANDARD CAP. AND DF MEASUREMENT CONDITIONS:
Y5P and Z5V: Measure @ 1 $\pm$.1 KHz, 1 $\pm$ .1VRMS, @ (or referred to) 20°C.
All Others: Measure @ 1 $\pm$ .1 MHz, @ 1.2 VRMS Max, @ (or referred to) 20°C.

CAPACITANCE MARKING:
Marked in pF for units below 100 pF, with "p" denoting the decimal position; for units 100 pF and above, the NANO Farad is used, with "n" denoting the decimal position.

WORKING VOLTAGE:
Z5V: 50VDC
All Others: 100VDC

DIELECTRIC STRENGTH:
250% of Rated Working Voltage.

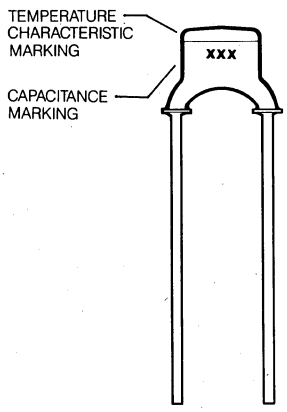
SERIES R

50VDC AND 100VDC, Temperature Compensating and General Purpose Ceramic Plate Capacitors

INSULATION RESISTANCE:
Measured @ Rated Voltage @ 25°C.
Y5P and Z5V: 1000MegΩ Minimum
All Others: 1000MegΩ Minimum

OPERATING TEMPERATURE RANGE:
−55°C to +125°C.
50% Voltage De-Rating @ 125°C.
90% Insulation Resistance De-Rating @ 125°C.

EIA Code	Temperature Characteristics (C=) 22pf)	Color Code
M7J	P100 + 120/-40PPM	Red / Violet
C0G	NPO ± 30PPM	Black
U1G	N075 ± 30PPM	Red
P2G	N150 ± 40PPM	Orange
R2H	N220 ± 40PPM	Yellow
S2H	N330 ± 60PPM	Green
T2J	N470 ± 60PPM	Blue
U2J	N750 ± 120PPM	Violet
P3K	N1500 + 500/-0PPM	Orange/Orange
Y5P	±10% △C from -30°C to +85°C	Yellow
Z5V	+22/-82% △C from +10 to 85°C	Green



SIZE CHART:

Size Code	W (Max.)	H (Max.)
13	3.6	6.3
23	4.5	7.3
33	5.1	7.9
43	6.2	9.0
53	6.2	11.2

(DIMENSIONS IN MILLIMETERS)

SINGLE PLATE CAPACITORS: STOCK LISTING

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	VDCW	TC CODE	SIZE CODE	LEAD SPACING	LEAD STYLE	PACK'G	LEAD LENGTH
1.0 pF	R109C13M7JHWCAP	–	+−.25pf	100	M7J	13	.100"	SLF	BULK	.59"MIN
1.5 pF	R159C13M7JHWCAP	–	+−.25pf	100	M7J	13	.100"	SLF	BULK	.59"MIN
2.2 pF	R229C13C0GHWCAP	–	+−.25pf	100	C0J	13	.100"	SLF	BULK	.59"MIN
2.7 pF	R279C13C0GHWCAP	–	+−.25pf	100	C0J	13	.100"	SLF	BULK	.59"MIN
2.7 pF	R279C13C0GHWCAP	–	+−.25pf	100	C0J	13	.100"	SLF	BULK	.59"MIN
3.3 pF	R339C13M7JHWCAP	–	+−.25pf	100	M7J	13	.100"	SLF	BULK	.59"MIN
3.9 pF	R399C13C0GHWCAP	–	+−.25pf	100	C0J	13	.100"	SLF	BULK	.59"MIN
3.9 pF	R399C13U2JHWCAP	–	+−.25pf	100	U2J	13	.100"	SLF	BULK	.59"MIN
4.7 pF	R479C13C0GHWCAP	–	+−.25pf	100	C0H	13	.100"	SLF	BULK	.59"MIN
4.7 pF	R479C13U2JHWCAP	–	+−.25pf	100	U2J	13	.100"	SLF	BULK	.59"MIN
5.6 pF	R569C13C0GHWCAP	–	+−.25pf	100	C0H	13	.100"	SLF	BULK	.59"MIN
5.6 pF	R569C13U2JHWCAP	–	+−.25pf	100	U2J	13	.100"	SLF	BULK	.59"MIN
6.8 pF	R689C13C0GHWCAP	–	+−.25pf	100	C0H	13	.100"	SLF	BULK	.59"MIN
6.8 pF	R689C13U2JHWCAP	–	+−.25pf	100	U2J	13	.100"	SLF	BULK	.59"MIN
8.2 pF	R829C13C0GHWCAP	–	+−.25pf	100	C0H	13	.100"	SLF	BULK	.59"MIN
8.2 pF	R829C13U2JHWCAP	–	+−.25pf	100	U2J	13	.100"	SLF	BULK	.59"MIN

50VDC AND 100VDC, Temperature Compensating and General Purpose Ceramic Plate Capacitors

SINGLE PLATE CAPACITORS: STOCK LISTING

CAP.		NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	VDCW	TC CODE	SIZE CODE	LEAD SPACING	LEAD STYLE	PACK'G	LEAD LENGTH
10	pF	R100G13C0GHWCAP	–	+–2%	100	C0H	13	.100"	SLF	BULK	.59"MIN
10	pF	R100G13C0GHWFAP	–	+–2%	100	C0H	13	.200"	SLF	BULK	.59"MIN
10	pF	R100G13P2GHWCAP	–	+–2%	100	P2G	13	.100"	SLF	BULK	.59"MIN
10	pF	R100G13U2JHWCAP	–	+–2%	100	U2J	13	.100"	SLF	BULK	.59"MIN
12	pF	R120G13C0GHWCAP	–	+–2%	100	C0G	13	.100"	SLF	BULK	.59"MIN
12	pF	R120G13C0GHWFAP	–	+–2%	100	C0G	13	.200"	SLF	BULK	.59"MIN
12	pF	R120G13P2GHWCAP	–	+–2%	100	P2G	13	.100"	SLF	BULK	.59"MIN
12	pF	R120G13U2JHWCAP	–	+–2%	100	U2J	13	.100"	SLF	BULK	.59"MIN
15	pF	R150G13C0GHWCAP	–	+–2%	100	C0G	13	.100"	SLF	BULK	.59"MIN
15	pF	R150G13C0GHWFAP	–	+–2%	100	C0G	13	.200"	SLF	BULK	.59"MIN
15	pF	R150G13P2GHWCAP	–	+–2%	100	P2G	13	.100"	SLF	BULK	.59"MIN
15	pF	R150G13U2JHWCAP	–	+–2%	100	U2J	13	.100"	SLF	BULK	.59"MIN
18	pF	R180G13C0GHWCAP	–	+–2%	100	C0G	13	.100"	SLF	BULK	.59"MIN
18	pF	R180G13C0GHWFAP	–	+–2%	100	C0G	13	.200"	SLF	BULK	.59"MIN
18	pF	R180G13P2GHWCAP	–	+–2%	100	P2G	13	.100"	SLF	BULK	.59"MIN
18	pF	R180G13U2JHWCAP	–	+–2%	100	U2J	13	.100"	SLF	BULK	.59"MIN
22	pF	R220G23C0GHWCAP	–	+–2%	100	C0G	23	.100"	SLF	BULK	.59"MIN
22	pF	R220G23C0GHWFAP	–	+–2%	100	C0G	23	.200"	SLF	BULK	.59"MIN
22	pF	R220G13P2GHWCAP	–	+–2%	100	P2G	13	.100"	SLF	BULK	.59"MIN
22	pF	R220G13U2JHWCAP	–	+–2%	100	U2J	13	.100"	SLF	BULK	.59"MIN
27	pF	R270G23C0GHWCAP	–	+–2%	100	C0G	23	.100"	SLF	BULK	.59"MIN
27	pF	R270G23C0GHWFAP	–	+–2%	100	C0G	23	.200"	SLF	BULK	.59"MIN
27	pF	R270G23P2GHWCAP	–	+–2%	100	P2G	23	.100"	SLF	BULK	.59"MIN
27	pF	R270G13U2JHWCAP	–	+–2%	100	U2J	13	.100"	SLF	BULK	.59"MIN
33	pF	R330G23C0GHWCAP	–	+–2%	100	C0G	23	.100"	SLF	BULK	.59"MIN
33	pF	R330G23C0GHWFAP	–	+–2%	100	C0G	23	.200"	SLF	BULK	.59"MIN
33	pF	R330G23P2GHWCAP	–	+–2%	100	P2G	23	.100"	SLF	BULK	.59"MIN
33	pF	R330G13U2JHWCAP	–	+–2%	100	U2J	13	.100"	SLF	BULK	.59"MIN
39	pF	R390G23C0GHWCAP	–	+–2%	100	C0G	23	.100"	SLF	BULK	.59"MIN
39	pF	R390G23C0GHWFAP	–	+–2%	100	C0G	23	.200"	SLF	BULK	.59"MIN
39	pF	R390G23P2GHWCAP	–	+–2%	100	P2G	23	.100"	SLF	BULK	.59"MIN
39	pF	R390G13U2JHWCAP	–	+–2%	100	U2J	13	.100"	SLF	BULK	.59"MIN
47	pF	R470G33C0GHWFAP	–	+–2%	100	C0G	33	.200"	SLF	BULK	.59"MIN
47	pF	R470G23P2GHWCAP	–	+–2%	100	P2G	23	.100"	SLF	BULK	.59"MIN
47	pF	R470G13U2JHWCAP	–	+–2%	100	U2J	13	.100"	SLF	BULK	.59"MIN
56	pF	R560G33C0GHWFAP	–	+–2%	100	C0G	33	.200"	SLF	BULK	.59"MIN
56	pF	R560G33P2GHWCAP	–	+–2%	100	P2G	33	.100"	SLF	BULK	.59"MIN
56	pF	R560G23U2JHWCAP	–	+–2%	100	U2J	23	.100"	SLF	BULK	.59"MIN
68	pF	R680G43C0GHWFAP	–	+–2%	100	C0G	43	.200"	SLF	BULK	.59"MIN
68	pF	R680G33P2GHWCAP	–	+–2%	100	P2G	33	.100"	SLF	BULK	.59"MIN
68	pF	R680G23U2JHWCAP	–	+–2%	100	U2J	23	.100"	SLF	BULK	.59"MIN
82	pF	R820G43C0GHWFAP	–	+–2%	100	C0G	43	.200"	SLF	BULK	.59"MIN
82	pF	R820G43P2GHWCAP	–	+–2%	100	P2G	43	.100"	SLF	BULK	.59"MIN
82	pF	R820G23U2JHWCAP	–	+–2%	100	U2J	23	.100"	SLF	BULK	.59"MIN
100	pF	R101G53C0GHWFAP	–	+–2%	100	C0G	53	.200"	SLF	BULK	.59"MIN

SERIES R

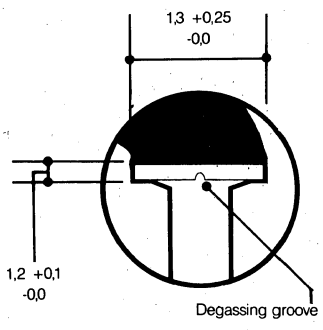
50VDC AND 100VDC, Temperature Compensating and General Purpose Ceramic Plate Capacitors

SINGLE PLATE CAPACITORS: STOCK LISTING

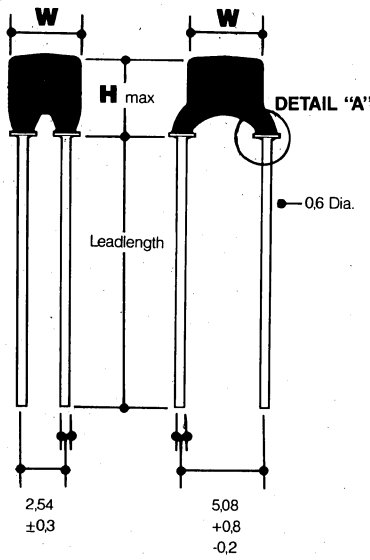
CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	VDCW	TC CODE	SIZE CODE	LEAD SPACING	LEAD STYLE	PACK'G	LEAD LENGTH
100 pF	R101G43P2GHWCAP	–	+–2%	100	P2G	43	.100"	SLF	BULK	.59"MIN
100 pF	R101G23P3KHWCAP	–	+–2%	100	P3K	23	.100"	SLF	BULK	.59"MIN
100 pF	R101G23U2JHWCAP	–	+–2%	100	U2J	23	.100"	SLF	BULK	.59"MIN
120 pF	R121G23P3KHWCAP	–	+–2%	100	P3K	23	.100"	SLF	BULK	.59"MIN
150 pF	R151G23P3KHWCAP	–	+–2%	100	P3K	23	.100"	SLF	BULK	.59"MIN
180 pF	R181G23P3KHWCAP	–	+–2%	100	P3K	23	.100"	SLF	BULK	.59"MIN
220 pF	R221G33P3KHWCAP	–	+–2%	100	P3K	33	.100"	SLF	BULK	.59"MIN
270 pF	R271G33P3KHWCAP	–	+–2%	100	P3K	33	.100"	SLF	BULK	.59"MIN
330 pF	R331G43P3KHWCAP	–	+–2%	100	P3K	43	.100"	SLF	BULK	.59"MIN
390 pF	R391G43P3KHWCAP	–	+–2%	100	P3K	43	.100"	SLF	BULK	.59"MIN
470 pF	R471G53P3KHWCAP	–	+–2%	100	P3K	53	.100"	SLF	BULK	.59"MIN
560 pF	R561G53P3KHWCAP	–	+–2%	100	P3K	53	.100"	SLF	BULK	.59"MIN
.001 uF	R102K23Y5PHWFSP	–	+–10%	100	Y5P	23	.200"	SLF	BULK	.59"MIN
.001 uF	R102K23Y5PHWGSP	–	+–10%	100	Y5P	23	.200"	SLF	T&R	.50"REF
.01 uF	R103Z23Z5VFWFSP	–	80/20%	50	Z5V	23	.200"	SLF	BULK	.59"MIN
.01 uF	R103Z23Z5VFWGSP	–	80/20%	50	Z5V	23	.200"	SLF	T&R	.50"REF

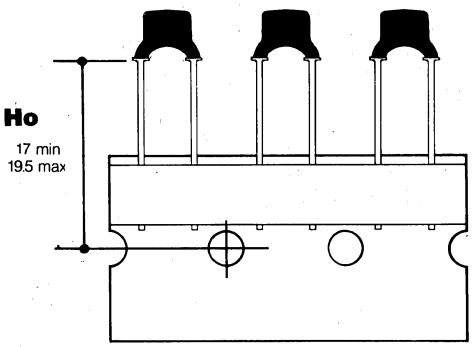
Mechanical Specifications.

(ALL DIMENSIONS IN MILLIMETERS)



DETAIL "A"





TAPE AND REEL DETAIL "B"

Pitch for both 2,54 and 5,08 leadspacing is 12,7MM (.5")
Quantity per reel is 4000 Pcs.

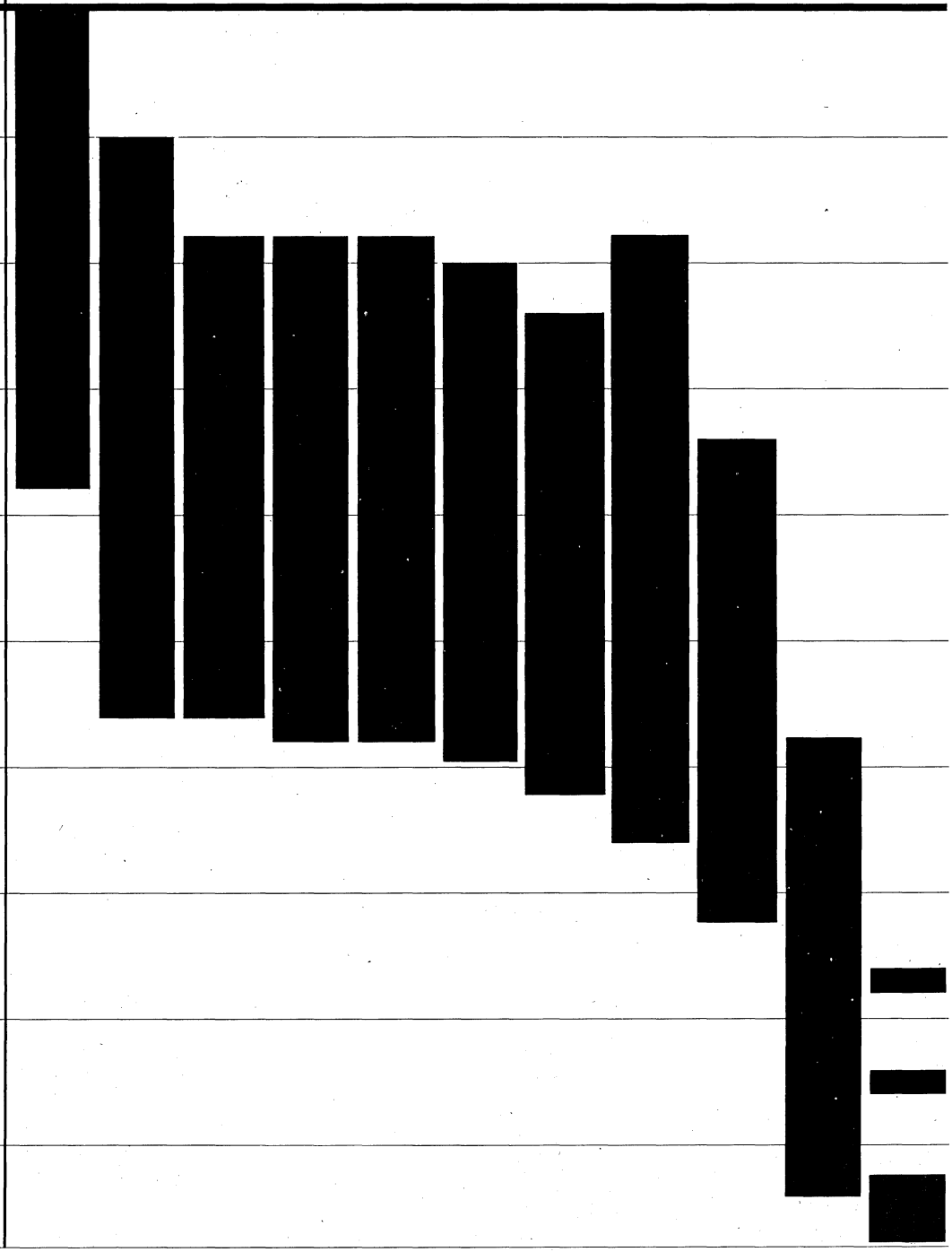
MECHANICAL DETAIL CODES

PRODUCT FORM	LEAD SPACING	LEAD LENGTH	CODE
BULK	2,54	13MIN	WC
BULK	5,08	4±0,5	WD
BULK	2,54	4±0,5	WE
BULK	5,08	13MIN	WF
T&R	2,54	N/A	WH
T&R	5,08	N/A	WG

50VDC AND 100VDC, Temperature Compensating and General Purpose Ceramic Plate Capacitors

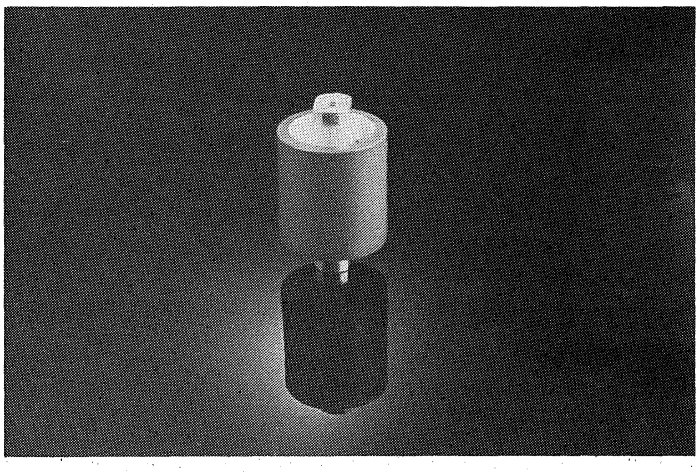
Single Plate Capacitors Range Chart

Type Designation (TC)		M7J	C0G	U1G	P2G	R2H	S2H	T2J	U2J	P3K	Y5P	Z5V
Voltage (DC) Rating		100V	100V	100V	100V	100V	100V	100V	100V	100V	50V	50V
Electrical Detail Code		AP	AP	AP	AP	AP	AP	AP	AP	AP	SP	SP
Cap in pF	Marking	Size	Size	Size	Size	Size	Size	Size	Size	Size	Size	Size
.68	p68											
.82	p82											
1.0	1p0											
1.2	1p2											
1.5	1p5											
1.8	1p8											
2.2	2p2											
2.7	2p7											
3.3	3p3											
3.9	3p9											
4.7	4p7											
5.6	5p6											
6.8	6p8											
8.2	8-2											
10	10-											
12	12p											
15	15p											
18	18p											
22	22p											
27	27p											
33	33p											
39	39p											
47	47p											
56	56p											
68	68p											
82	82p											
100	n10											
120	n12											
150	n15											
180	n18											
220	n22											
270	n27											
330	n33											
390	n39											
470	n47											
560	n56											
680	n68											
820	n82											
1000	1n0											
1200	1n2											
1500	1n5											
1800	1n8											
2200	2n2											
2700	2n7											
3300	3n3											
3900	3n9											
4700	4n7											
10000	10n											
22000	22n											



SERIES T

5KVDC through 20KVDC RF RATED, Transmitting, Special Applications Ceramic Capacitors



DESCRIPTION:

Mepco/Centralab RF Rated, ceramic transmitting capacitors are designed primarily for use in applications where very high RF currents, high KVA ratings and high working voltages exist. Special capacitor design reduces terminal self-inductance to permit higher frequency operation. A humidity resistant silicone coating and long flashover path assures safe, high voltage operation in free air. Units also feature stable temperature-capacitance characteristics and rugged mechanical construction for maximum reliability.

The 850-Series capacitors are extensively used in transmitters, antennas, induction heaters, X-ray, diathermy and electronic welding equipment.

SPECIFICATIONS

CAPACITANCE RANGE:
3pf to .001mf. Tested at 0.5 to 5.0 volts RMS, listed Test Freq. and +25°C.

CAPACITANCE TOLERANCE:
± 10% or ± 20% as listed.

WORKING VOLTAGE:
5,000, 7,500, 15,000 or 20,000 volts DC as listed.

DISSIPATION FACTOR (D.F.):
0.1% to 1.5% maximum as listed. Tested at 0.5 to 5.0 volts RMS, listed Test Freq. and +25°C.

DIELECTRIC STRENGTH:
150% of rated Working Voltage.

INSULATION RESISTANCE:
10,000 megohms minimum. Tested at 1000 volts DC maximum.

TEMPERATURE COEFFICIENT OR CHARACTERISTIC:
NP0, N750, N3300 or EIA code X5T, X5V as listed.

OPERATING TEMPERATURE RANGE:
−55°C to +85°C.

HUMIDITY PROTECTION:
Silicone coated. (850S, 857, 858S and 859S series)

LEADS:
Tinned Wire.

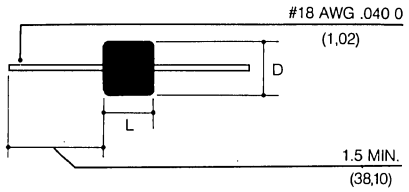
TERMINALS:
Silver Plated.

MARKING:
CRL®, catalog number, capacitance value, capacitance tolerance, working voltage and temperature coefficient or EIA temperature characteristic code.

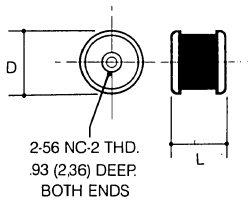
PACKAGING:
Individually wrapped or bulk packaged, one per cavity in protective nest.

5KVDC through 20KVDC RF RATED, Transmitting, Special Applications Ceramic Capacitors

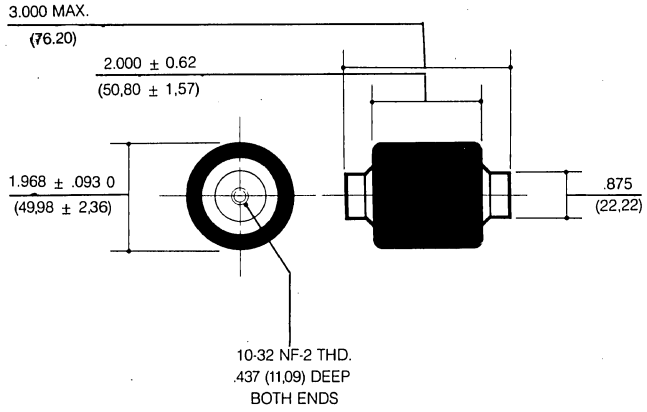
8530, 8540, 8550 — SERIES



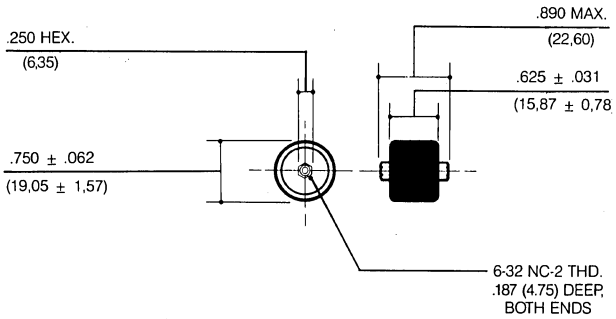
853A, 854A, 855A — SERIES



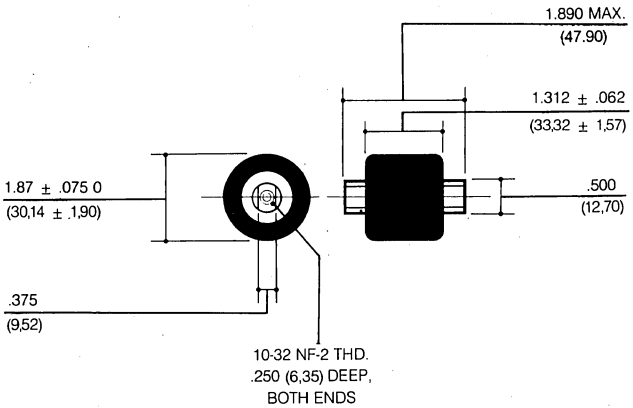
859S — SERIES



850S, 858S — SERIES



8570 — SERIES



SERIES	LENGTH in. ±.031	LENGTH mm ±0.78	DIA. in. ±.031	DIA. mm ±0.78
853	.437	11.09	.500	12.70
854	.375	9.52	.375	9.52
855	.343	8.71	.250	6.35
853A	.484	12.29	.562	14.27
854A	.422	10.71	.437	11.09
855A	.390	9.90	.312	7.92

INCH **(MILLIMETER)**

INCH
(MILLIMETER)

SERIES T

5KVDC through 20KVDC RF RATED, Transmitting, Special Applications Ceramic Capacitors

STANDARD STOCK LISTING:

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	VOLTAGE DCW PLUS HF PEAK	TEMP. COEF/ EIA CODE	MAX. D.F.	TEST FREQ.
8530, 8540, 8550—Series Wire Leads							
3 pf	T309K99C0GT8550	855-3Z	±10%	5,000	NPO	0.217%	1 MHz
5	T509K99C0GT8550	855-5Z	±10%	5,000	NPO	0.200%	1 MHz
10	T100K99U2JT8550	855-10N	±10%	5,000	N750	0.167%	1 MHz
10	T100K99C0GT8540	854-10Z	±10%	5,000	NPO	0.167%	1 MHz
20	T200K99C0GT8530	853-20Z	±10%	5,000	NPO	0.120%	1 MHz
40	T400K99U2JT8530	853-40N	±10%	5,000	N750	0.100%	1 MHz
853A, 854A, 855A—Series Threaded Terminals							
3 pf	T309K99C0GT855A	855A-3Z	±10%	5,000	NPO	0.217%	1 MHz
5	T509K99C0GT855A	855A-5Z	±10%	5,000	NPO	0.200%	1 MHz
10	T100K99C0GT854A	854A-10Z	±10%	5,000	NPO	0.167%	1 MHz
20	T200K99U2JT854A	854A-20N	±10%	5,000	N750	0.120%	1 MHz
40	T400K99U2JT853A	853A-40N	±10%	5,000	N750	0.100%	1 MHz
850S, 858S—Series Threaded Terminals							
25 pf	T250K99C0GV850S	850S-25Z	±10%	7,500	NPO	0.1%	1 MHz
50	T500K99C0GV850S	850S-50Z	±10%	7,500	NPO	0.1%	1 MHz
50	R500K99U2JV850S	850S-50N	±10%	7,500	N750	0.1%	1 MHz
75	T750K99U2JV850S	850S-75N	±10%	7,500	N750	0.1%	1 MHz
100	T101K99U2JT850S	850S-100N	±10%	5,000	N750	0.1%	1 MHz
500	T501M99X5TT858S	858S-500	±20%	5,000	X5T	1.5%	1 KHz
.001 mf	T102M99X5UT858S	858S-1000	±20%	5,000	X5U	1.5%	1 KHz
8570—Series Threaded Terminals							
25 pf	T250K99C0GW8570	857-25Z	±10%	15,000	NPO	0.1%	1 MHz
50	T500K99C0GW8570	857-50Z	±10%	15,000	NPO	0.1%	1 MHz
100	T101K99U2JW8570	857-100N	±10%	15,000	N750	0.1%	1 MHz
200	T201K99U2JV8570	857-200N	±10%	7,500	N750	0.1%	1 MHz
859S—Series Threaded Terminals							
50 pf	T500K99C0GZ859S	859S-50Z	±10%	20,000	NPO	0.1%	1 MHz
100	T101K99C0GZ859S	859S-100Z	±10%	20,000	NPO	0.1%	1 MHz
250	T251K99U2JZ859S	859S-250N	±10%	20,000	N750	0.1%	1 MHz
500	T501K99S3NW859S	859S-500N	±10%	15,000	N3300	0.2%	1 MHz

TYPICAL RF CHARACTERISTICS

Data is based on not exceeding the maximum rated voltage ("*" readings) or a 30°C maximum rise above a 25°C ambient in still air.

Reactive power ratings (KVAR) are calculated from voltage limited currents.

For operation in an air stream, multiply the R.F. MAX. AMPS by specific Fan Factor to obtain allowable higher current rating. Rated Working Voltage must not be exceeded.

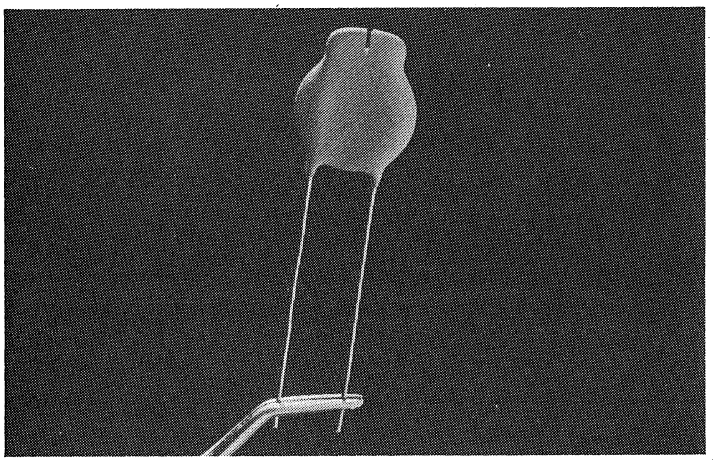
SERIES T

5KVDC through 20KVDC RF RATED, Transmitting, Special Applications Ceramic Capacitors

CATALOG NUMBER	1 MHz R.F. MAX. AMPS	KVAR	Q TYP.	10 MHz R.F. MAX. AMPS	KVAR	Q TYP.	30 MHz R.F. MAX. AMPS	KVAR	Q TYP	FAN FACTORS FEET PER MINUTE 50	100	250	650
855-3Z	0.066*	0.23	2,000	0.66*	2.3	5,000	1.4	3.2	5,000	1.15	1.3	1.7	2.6
855-5Z	0.11*	0.38	5,000	1.1*	3.8	5,000	1.6	2.8	2,000	1.15	1.3	1.7	2.6
855-10N	0.22*	0.78	10,000	1.7	4.2	10,000	2.3	2.9	7,500	1.15	1.3	1.7	2.6
854-10Z	0.22*	0.78	10,000	1.8	5.4	10,000	2.1	2.3	7,500	1.1	1.2	1.4	1.8
853-20Z	0.44*	1.5	9,000	2.7	5.6	4,500	2.8	2.0	4,300	1.1	1.2	1.4	1.8
853-40N	0.89*	3.1	15,000	4.4	7.7	15,000	3.5	1.7	3,500	1.1	1.2	1.4	1.8
855A-3Z	0.066*	0.23	2,000	0.66*	2.3	5,000	1.4	3.2	5,000	1.15	1.3	1.7	2.6
855A-5Z	0.11*	0.38	5,000	1.1*	3.8	5,000	1.6	2.8	2,000	1.15	1.3	1.7	2.6
854A-10Z	0.22*	0.78	10,000	1.8	5.4	10,000	2.1	2.3	7,500	1.1	1.2	1.4	1.8
854A-20N	0.44*	1.55	7,000	3.1	7.5	12,000	3.4	3.0	15,000	1.1	1.2	1.4	1.8
853A-40N	0.89*	3.1	15,000	4.4	7.7	15,000	3.5	1.7	3,500	1.1	1.2	1.4	1.8
850S-25Z	0.84*	4.4	4,300	3.1	6.1	4,000	5.6	6.6	4,800	1.1	1.3	1.6	2.4
850S-50Z	1.7*	8.9	7,000	4.2	5.6	4,200	7.6	6.0	3,000	1.1	1.25	1.6	2.3
850S-50N	1.7*	8.9	7,000	5.0	7.9	7,600	8.5	7.7	4,000	1.1	1.25	1.6	2.3
850S-75N	2.5*	13.2	14,000	6.2	8.1	5,500	9.0	5.6	3,700	1.1	1.25	1.6	2.3
850S-100N	3.4	19.0	15,000	7.3	8.7	9,000	9.2	4.6	2,000	1.1	1.25	1.6	2.3
858S-500	1.1	0.39	300	2.5	0.21	120	3.0	0.1	55	1.1	1.2	1.4	2.0
858S-1000	1.4	0.3	200	3.1	0.15	–	3.7	0.076	–	1.1	1.2	1.4	2.0
857-25Z	1.7*	18.5	5,000	6.2	22.0	4,000	6.7	8.6	8,000	1.15	1.3	1.6	1.9
857-50Z	3.3*	35.4	4,000	7.4	18.0	4,500	8.1	7.1	3,000	1.15	1.3	1.6	1.9
857-100N	4.6	35.0	6,500	12.0	22.0	6,500	15.0	11.1	4,000	1.15	1.3	1.6	1.9
857-200N	5.1	23.0	5,000	8.5	6.2	4,000	15.0	6.0	2,000	1.15	1.3	1.6	1.9
859S-50Z	3.1	31.5	5,000	10.4	36.0	6,200	16.2	28.8	5,000	1.15	1.3	1.7	2.3
859S-100Z	3.8	23.5	4,500	12.9	27.4	4,500	19.4	20.6	3,000	1.15	1.3	1.7	2.3
859S-250N	9.2	52.0	5,000	13.0	11.0	3,000	35.0	25.0	1,000	1.15	1.3	1.7	2.3
859S-500N	6.7	14.0	3,800	14.0	5.9	800	23.0	5.4	–	1.15	1.3	1.7	2.3

SERIES S

Gap-Kap,® 1000VDC through 3000VDC, Capacitor—Spark—Gap, Special Application Ceramic Capacitors



DESCRIPTION:

Mepco/Centralab Gap-Kap® capacitors provide a safe, reliable discharge path for stray transient over-voltages and static voltage build-up. Combination capacitor-spark-gap construction allows the circuit designer to specify lower voltage components and consequently lower cost, with the assurance that over-voltage conditions will be prevented.

The Gap-Kap® capacitor is ideally suited for many industrial and commercial equipment applications. A typical application in color TV, utilizes a minimum capacitance Gap-Kap® which is inserted between the grid lead and chassis ground. This protects the control components by providing a low impedance path to ground for transient voltages of 1500 volts and above.

SPECIFICATIONS:

CAPACITANCE RANGE:
.75pf to .02mf. Tested at 1.0±.2VRMS at 1KHz at +25°C.

CAPACITANCE TOLERANCE:
±10%. ±20% or Maximum Value, as listed.

WORKING VOLTAGE:
1000, 1500 or 3000 volts DC as listed.

ARC VOLTAGE:
1000-2000, 2000-3000 or 4000-6000 volts DC as listed.

DISSIPATION FACTOR:
2.5% Max. Tested at 1.0±.2VRMS at 1KHz at +25°C.

INSULATION RESISTANCE:
10,000 megohms minimum. Tested at 500 volts DC maximum.

TEMPERATURE CHARACTERISTIC:
EIA code Z5P or Z5U as listed. See "Capacitance vs. Temperature" for specifications.

OPERATING TEMPERATURE RANGE:
−55°C to +85°C

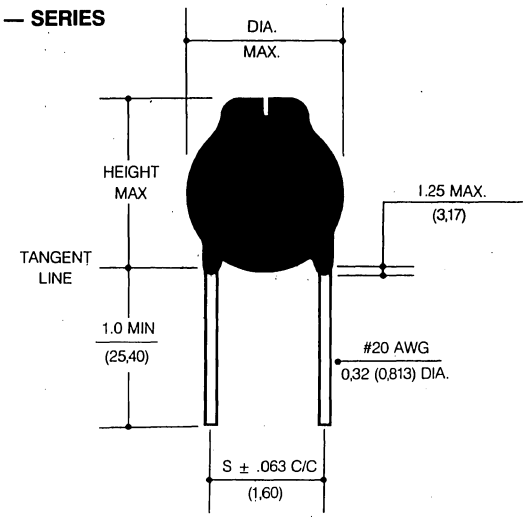
ENCAPSULATION:
Phenolic resin.

LEADS-CONFIGURATION:
Tinned wire. Type SLL, see drawing for dimensions.

MARKING:
Mepco/Centralab diamond, Gap-Kap,® capacitance value, capacitance tolerance or code letter (K = ±10%, M = ±20%), working voltage, arc voltage and EIA temperature characteristic code as space permits GAP-R75 marked with arc voltage and trademarks only.

Gap-Kap® 1000VDC through 3000VDC, Capacitor—Spark—Gap, Special Application Ceramic Capacitors

GAP — SERIES



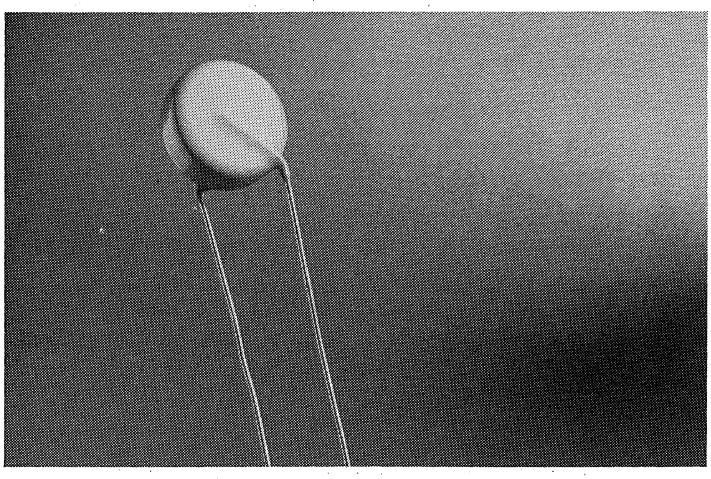
STANDARD STOCK LISTING

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP TOL.	VOLTAGE WORKING KVDC	VOLTAGE ARC KVDC	TC CODE	MAX. DIA.	MAX. HT.	MAX. THICK	LEAD SPACE	LEAD STYLE
Spark-Gap Capacitor											
.75 pf	S758X44000NAZAA	GAPR75	Max Value	1	1-2	*	.44"	.620"	.250"	.250"	SLL
.001 mf	S102M40Z5PNAZAA	GAP102	±20%	1	2-3	Z5P	.40"	.545"	.195"	.250"	SLL
.004 mf	S402K96Z5PRAZAA	GAP402	±10%	3	4-6	Z5P	.96"	1.060"	.216"	.375"	SLL
.01 mf	S103M69Z5UNAZAB	GAP103	±20%	1.5	2-3	Z5U	.69"	.830"	.195"	.375"	SLL
.02 mf	S203M93Z5UNAZAA	GAP203	±20%	1	2-3	Z5U	.93"	1.060"	.216"	.375"	SLL

*Inherent capacitance of leads, no disc capacitor used.

SERIES S-UL

125VAC and 250VAC, Across-The-Line UL and CSA Listed, Ceramic Disc Capacitors



DESCRIPTION:

Mepco/Centralab's disc capacitors, Type DL, are listed by Underwriter Laboratories, Inc. and Canadian Standard's Association. They comply with UL1414 and CSA Guide 361-A-4.1, Class 2221 for Across-the-Line, Antenna Isolation and Line-Bypass Applications. They are listed with UL on Yellow Card E32296 or E95439(N). CSA File #LR39939 or LR61253-1.

Electrical Parameters:

CAPACITANCE:
Available range: 100pF to 10,000pF, as listed. Measured @ 1KHz @ 1.0VRMS ±.2VRMS @ 25°C.

DISSIPATION FACTOR:
2.5% Maximum;
Measurements conditions are the same as for Capacitance measurement.

DIELECTRIC STRENGTH:
Per Para. 11.1 of UL-1414 and per CSA Standard C22.2, 0-M1982 and 1-M1981.

INSULATION RESISTANCE:
10,000 Meg Ohms minimum when measured @ 25°C and 500 VDC.

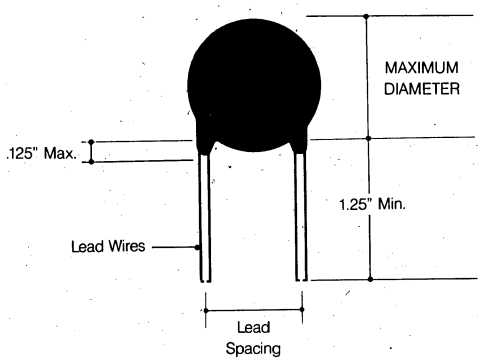
ENCAPSULATION:
Conformal Epoxy or Phenolic Resin, at Mepco/-Centralab's option and in conformance with UL and CSA listing requirements.

OPERATING TEMPERATURE RANGE
−55°C to +125°C

STANDARD MARKING (MINIMUM):
Manufacturer's Identification
DL-125 (to indicate UL/CSA listing for 125VAC applications) or
DL-250 (to indicate UL/CSA listing for 250VAC applications)
3 digit Capacitance Code
1 digit Tolerance Code
UL/CSA Registration Mark as required by size.

PACKAGING:
Bulk only; 500, 1000 or 2000 per box, depending on size.

MECHANICAL CONFIGURATION:



SERIES S-UL

125VAC and 250VAC, Across-The-Line, UL and CSA Listed Ceramic Disc Capacitors

125 VOLT AC, UL AND CSA LISTED

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	MAX. DIA.	MAX. THICK.	LEAD SPACE	LEAD WIRES
100 pF	S101K33Z5PYAWST	—	±10%	0.33	0.24	.250±.062	#20AWGCu
100 pF	S101M33Z5PYAWST	—	±20%	0.33	0.24	.250±.062	#20AWGCu
150 pF	S151K33Z5PYAWST	—	±10%	0.33	0.24	.250±.062	#20AWGCu
150 pF	S151M33Z5PYAWST	—	±20%	0.33	0.24	.250±.062	#20AWGCu
220 pF	S221K43Z5PYAWST	—	±10%	0.43	0.24	.250±.062	#20AWGCu
220 pF	S221M43Z5PYAWST	—	±20%	0.43	0.24	.250±.062	#20AWGCu
330 pF	S331K43Z5PYAWST	—	±10%	0.43	0.24	.250±.062	#20AWGCu
330 pF	S331M43Z5PYAWST	—	±20%	0.43	0.24	.250±.062	#20AWGCu
470 pF	S471K43Z5PYAZAA*	—	±10%	0.43	0.24	.250±.062	#22AWGCCS
470 pF	S471M43Z5UYAWST	—	±20%	0.43	0.24	.250±.062	#20AWGCu
470 pF	S471Z43Z5UYAWST	—	+80-20%	0.43	0.24	.250±.062	#20AWGCu
560 pF	S561M43Z5UYAWST	—	±20%	0.43	0.24	.250±.062	#20AWGCu
560 pF	S561Z43Z5UYAWST	—	+80-20%	0.43	0.24	.250±.062	#20AWGCu
680 pF	S681K43Z5PYAZAA*	—	±10%	0.43	0.24	.250±.062	#22AWGCCS
680 pF	S681M43Z5UYAWST	—	±20%	0.43	0.24	.250±.062	#20AWGCu
680 pF	S681Z43Z5UYAWST	—	+80-20%	0.43	0.24	.250±.062	#20AWGCu
1000 pF	S102K52Z5PYAZAA*	—	±10%	0.52	0.24	.375±.062	#22AWGCCS
1000 pF	S102M43Z5UYAWST	—	±20%	0.43	0.24	.250±.062	#20AWGCu
1000 pF	S102Z43Z5UYAWST	—	+80-20%	0.43	0.24	.250±.062	#20AWGCu
1500 pF	S152K73Z5PYAZAA*	—	±10%	0.73	0.24	.375±.062	#22AWGCCS
1500 pF	S152M52Z5UYAXST	—	±20%	0.52	0.24	.375±.062	#20AWGCu
1500 pF	S152Z52Z5UYAXST	—	+80-20%	0.52	0.24	.375±.062	#20AWGCu
1800 pF	S182K73Z5PYAZAA*	—	±10%	0.73	0.24	.375±.062	#22AWGCCS
1800 pF	S182M66Z5UYAXST	—	±20%	0.66	0.24	.375±.062	#20AWGCu
1800 pF	S182Z66Z5UYAXST	—	+80-20%	0.66	0.24	.375±.062	#20AWGCu
2200 pF	S222M66Z5UYAXST	—	±20%	0.66	0.24	.375±.062	#20AWGCu
2200 pF	S222Z66Z5UYAXST	—	+80-20%	0.66	0.24	.375±.062	#20AWGCu
3300 pF	S332M76Z5UYAXST	—	±20%	0.76	0.24	.375±.062	#20AWGCu
3300 pF	S332Z76Z5UYAXST	—	+80-20%	0.76	0.24	.375±.062	#20AWGCu
4700 pF	S472M76Z5UYAXST	—	±20%	0.76	0.24	.375±.062	#20AWGCu
4700 pF	S472Z76Z5UYAXST	—	+80-20%	0.76	0.24	.375±.062	#20AWGCu
5100 pF	S512M76Z5UYAXST	—	±20%	0.76	0.24	.375±.062	#20AWGCu
5100 pF	S512Z76Z5UYAXST	—	+80-20%	0.76	0.24	.375±.062	#20AWGCu
6800 pF	S682M79Z5UYAXST	—	±20%	0.79	0.24	.375±.062	#20AWGCu
6800 pF	S682Z79Z5UYAXST	—	+80-20%	0.79	0.24	.375±.062	#20AWGCu
8200 pF	S822M86Z5UYAXST	—	±20%	0.86	0.24	.375±.062	#20AWGCu
8200 pF	S822Z86Z5UYAXST	—	+80-20%	0.86	0.24	.375±.062	#20AWGCu
10000 pF	S103M96Z5UYAXST	—	±20%	0.96	0.24	.375±.062	#20AWGCu
10000 pF	S103Z96Z5UYAXST	—	+80-20%	0.96	0.24	.375±.062	#20AWGCu

*Indicates capacitors not agency listed

SERIES S-UL

125VAC and 250VAC, Across-The-Line UL and CSA Listed, Ceramic Disc Capacitors

250 VOLT AC, UL AND CSA LISTED DL-250 SERIES

CAP.	NEW PART NUMBER	FORMER DIST. PART NUMBER	CAP. TOL.	MAX. DIA.	MAX. THICK.	LEAD SPACE	LEAD WIRES
100 pF	S101K33Z5PQAWST	—	±10%	0.33	0.24	.250±.062	#20AWGCu
100 pF	S101M33Z5PQAWST	—	±20%	0.33	0.24	.250±.062	#20AWGCu
150 pF	S151K33Z5PQAWST	—	±10%	0.33	0.24	.250±.062	#20AWGCu
150 pF	S151M33Z5PQAWST	—	±20%	0.33	0.24	.250±.062	#20AWGCu
220 pF	S221K43Z5PQAWST	—	±10%	0.43	0.24	.250±.062	#20AWGCu
220 pF	S221M43Z5PQAWST	—	±20%	0.43	0.24	.250±.062	#20AWGCu
330 pF	S331K43Z5PQAWST	—	±10%	0.43	0.24	.250±.062	#20AWGCu
330 pF	S331M43Z5PQAWST	—	±20%	0.43	0.24	.250±.062	#20AWGCu
470 pF	S471M43Z5UQAWST	—	±20%	0.43	0.24	.250±.062	#20AWGCu
470 pF	S471Z43Z5UQAWST	—	+80-20%	0.43	0.24	.250±.062	#20AWGCu
560 pF	S561M43Z5UQAWST	—	±20%	0.43	0.24	.250±.062	#20AWGCu
560 pF	S561Z43Z5UQAWST	—	+80-20%	0.43	0.24	.250±.062	#20AWGCu
680 pF	S681M43Z5UQAWST	—	±20%	0.43	0.24	.250±.062	#20AWGCu
680 pF	S681Z43Z5UQAWST	—	+80-20%	0.43	0.24	.250±.062	#20AWGCu
1000 pF	S102M43Z5UQAWST	—	±20%	0.43	0.24	.250±.062	#20AWGCu
1000 pF	S102Z43Z5UQAWST	—	+80-20%	0.43	0.24	.250±.062	#20AWGCu
1500 pF	S152M52Z5UQAXST	—	±20%	0.52	0.24	.375±.062	#20AWGCu
1500 pF	S152Z52Z5UQAXST	—	+80-20%	0.52	0.24	.375±.062	#20AWGCu
1800 pF	S182M66Z5UQAXST	—	±20%	0.66	0.24	.375±.062	#20AWGCu
1800 pF	S182Z66Z5UQAXST	—	+80-20%	0.66	0.24	.375±.062	#20AWGCu
2200 pF	S222M66Z5UQAXST	—	±20%	0.66	0.24	.375±.062	#20AWGCu
2200 pF	S222Z66Z5UQAXST	—	+80-20%	0.66	0.24	.375±.062	#20AWGCu
3300 pF	S332M76Z5UQAXST	—	±20%	0.76	0.24	.375±.062	#20AWGCu
3300 pF	S332Z76Z5UQAXST	—	+80-20%	0.76	0.24	.375±.062	#20AWGCu
4700 pF	S472M76Z5UQAXST	—	±20%	0.76	0.24	.375±.062	#20AWGCu
4700 pF	S472Z76Z5UQAXST	—	+80-20%	0.76	0.24	.375±.062	#20AWGCu
5100 pF	S512M76Z5UQAXST	—	±20%	0.76	0.24	.375±.062	#20AWGCu
5100 pF	S512Z76Z5UQAXST	—	+80-20%	0.76	0.24	.375±.062	#20AWGCu

CERAMIC CAPACITOR KITS

KIT-110MG-A AXIAL LEADED MULTI-LAYER MONO-GLASS® CAPACITORS

KIT-110MG-A contains a wide assortment of the most popular axial leaded Mono-Glass multilayer capacitors in three industry standard temperature characteristics, COG (NPO), X7R, Z5U. 37 values, ranging from 10pf to .47mf in four tolerances, 50WVDC Rating.

CAP.	QTY.	VDC	CAT. NO.	CAP.	QTY.	VDC	CAT. NO.
10 pf	5	50	G100J17C0GFVXWA	.001 mf	10	50	G102M17X7RFVXWA
12 pf	5	50	G120J17C0GFVXWA	.0015 mf	5	50	G152K17X7RFVXWA
15 pf	5	50	G150J17C0GFVXWA	.0022 mf	5	50	G222K17X7RFVXWA
18 pf	5	50	G180J17C0GFVXWA	.0033 mf	5	50	G332K17X7RFVXWA
22 pf	5	50	G220J17C0GFVXWA	.0047 mf	5	50	G472K17X7RFVXWA
27 pf	5	50	G270J17C0GFVXWA	.0056 mf	5	50	G562K17X7RFVXWA
33 pf	5	50	G330J17C0GFVXWA	.0068 mf	5	50	G682K17X7RFVXWA
47 pf	5	50	G470J17C0GFVXWA	.01 mf	20	50	G103K17X7RFVXWA
56 pf	5	50	G560J17C0GFVXWA	.01 mf	20	50	G103M17X7RFVXWA
68 pf	5	50	G680J17C0GFVXWA	.015 mf	5	50	G153K20X7RFVXWC
82 pf	5	50	G820J17C0GFVXWA	.022 mf	5	50	G223K25X7RFVXWE
100 pf	10	50	G101J17C0GFVXWA	.033 mf	5	50	G333K25X7RFVXWG
120 pf	5	50	G121J17C0GFVXWA	.047 mf	5	50	G473K30X7RFVXWJ
150 pf	5	50	G151J17C0GFVXWA	.068 mf	5	50	G683K30X7RFVXWL
220 pf	5	50	G221J17C0GFVXWA	.1 mf	20	50	G104K30X7RFVXWN
330 pf	5	50	G331J17C0GFVXWA	.1 mf	20	50	G104M30X7RFVXWN
470 pf	5	50	G471J17C0GFVXWA	.0047 mf	5	50	G472M17Z5UFVXWA
680 pf	5	50	G682J17C0GFVXWA	.0068 mf	5	50	G682M17Z5UFVXWA
820 pf	5	50	G821J25C0GFVXWA	.01 mf	20	50	G103M17Z5UFVXWA
.001 mf	10	50	G102J25C0GFVXWA	.01 mf	20	50	G103Z17Z5UFVXWA
.0015 mf	5	50	G152J30C0GFVXWA	.022 mf	5	50	G223M17Z5UFVXWE
.0022 mf	5	50	G222J30C0GFVXWA	.033 mf	5	50	G333M17Z5UFVXWG
.0033 mf	5	50	G332J30C0GFVXWA	.047 mf	5	50	G473M17Z5UFVXWJ
.0047 mf	5	50	G472J40C0GFVXWA	.047 mf	5	50	G473Z17Z5UFVXWJ
.0068 mf	5	50	G682J40C0GFVXWA	.068 mf	5	50	G683M25Z5UFVXWL
150 pf	5	50	G151K17X7RFVXWA	.1 mf	20	50	G104M17Z5UFVXWN
220 pf	5	50	G221K17X7RFVXWA	.1 mf	20	50	G104Z17Z5UFVXWN
330 pf	5	50	G331K17X7RFVXWA	.15 mf	5	50	G154M30Z5UFVXWR
470 pf	5	50	G471K17X7RFVXWA	.22 mf	5	50	G224M30Z5UFVXWT
680 pf	5	50	G681K17X7RFVXWA	.33 mf	5	50	G334M40Z5UFVXWW
.001 mf	10	50	G102K17X7RFVXWA	.47 mf	5	50	G474M40Z5UFVXWY

CERAMIC CAPACITOR KITS

KIT-100MK-A RADIAL LEADED MULTILAYER MONO-KAP® CAPACITORS

KIT-100MK-A contains a wide assortment of the most popular radial leaded Mono-Kap multilayer capacitors in three industry standard temperature characteristics, COG (NPO), X7R, Z5U. 39 values, ranging from 10pf to 2.2mfd, in four tolerances, 50 and 100VDC Ratings.

CAP.	QTY.	VDC	CAT. NO.	CAP.	QTY.	VDC	CAT. NO.
10 pf	5	100	K100K15C0GHVAWA	.022 mf	5	50	K223K20X7RFVBWE
12 pf	5	100	K120K15C0GHVAWA	.033 mf	5	50	K333K20X7RFVBWG
15 pf	5	100	K150K15C0GHVAWA	.047 mf	5	50	K473K20X7RFVBWJ
18 pf	5	100	K180K15C0GHVAWA	.068 mf	5	50	K683K20X7RFVBWL
22 pf	5	100	K220K15C0GHVAWA	.1 mf	10	50	K104K20X7RFVBWN
27 pf	5	100	K270K15C0GHVAWA	.1 mf	5	50	K104M20X7RFVBWN
33 pf	5	100	K330K15C0GHVAWA	.1	10	100	K104K30X7RHVCWN
47 pf	5	100	K470K15C0GHVAWA	.22 mf	5	50	K224K30X7RFVCWT
56 pf	5	100	K560K15C0GHVAWA	.33 mf	5	50	K334K30X7RFVCWW
68 pf	5	100	K680K15C0GHVAWA	.47 mf	5	50	K474K40X7RFVCWY
82 pf	5	100	K820K15C0GHVAWA	.68 mf	5	50	K684K40X7RFVCXB
100 pf	10	100	K101K15C0GHVAWA	1.0 mf	5	50	K105K50X7RFVHXD
120 pf	5	100	K121K15C0GHVAWA	1.0 mf	5	50	K105M50X7RFVHXD
150 pf	5	100	K151K15C0GHVAWA	.0022 mf	5	50	K222M15Z5UFVAWA
220 pf	5	100	K221K15C0GHVAWA	.0033 mf	5	100	K332M15Z5UHVAWA
330 pf	5	100	K331K15C0GHVAWA	.0047 mf	5	100	K472M15Z5UHVAWA
470 pf	5	100	K471K20C0GHVBWA	.0068 mf	5	50	K682M15Z5UFVAWA
680 pf	5	100	K681K20C0GHVBWA	.01 mf	10	100	K103M15Z5UHVAWA
820 pf	5	100	K821K20C0GHVBWA	.01 mf	5	100	K103Z15Z5UHVAWA
.001 mf	10	100	K102K20C0GHVBWA	.01 mf	10	50	K103M15Z5UFVAWA
.0015 mf	5	100	K152K20C0GHVBWA	.01 mf	5	50	K103Z15Z5UFVAWA
.01 mf	10	50	K103J30C0GFVCWA	.022 mf	5	50	K223M15Z5UFVAWE
.01 mf	10	50	K103K30C0GFVCWA	.033 mf	5	50	K333M15Z5UFVAWG
150 pf	5	100	K151K15X7RHVAWA	.047 mf	5	100	K473M20Z5UHVBWJ
220 pf	5	100	K221K15X7RHVAWA	.047 mf	5	50	K473M20Z5UFVBWJ
330 pf	5	100	K331K15X7RHVAWA	.047 mf	5	50	K473Z20Z5UFVBWJ
470 pf	5	100	K471K15X7RHVAWA	.068 mf	5	50	K683M20Z5UFVBWL
680 pf	5	100	K681K15X7RHVAWA	.1 mf	10	100	K104M20Z5UHVBWN
.001 mf	5	100	K102K15X7RHVAWA	.1 mf	5	100	K104Z20Z5UHVBWN
.001 mf	5	100	K102M15X7RHVAWA	.1 mf	10	50	K104M20Z5UFVBWN
.0015 mf	5	100	K152K15X7RHVAWA	.1 mf	5	50	K104Z20Z5UFVBWN
.0022 mf	5	100	K222K15X7RHVAWA	.15 mf	5	50	K154M20Z5UFVBWR
.0033 mf	5	100	K332K15X7RHVAWA	.22 mf	5	50	K224M20Z5UFVBWT
.0047 mf	5	100	K472K15X7RHVAWA	.33 mf	5	50	K334M30Z5UFVCWW
.0056 mf	5	100	K562K15X7RHVAWA	.47 mf	5	50	K474M30Z5UFVCWY
.0068 mf	5	100	K682K20X7RHVBWA	.68 mf	5	50	K684M30Z5UFVCXB
.01 mf	10	50	K103K15X7RFVAWA	1.0 mf	10	50	K105M30Z5UFVCXD
.01 mf	10	50	K103M15X7RFVAWA	1.0 mf	5	50	K105Z30Z5UFVCXD
.01 mf	5	100	K103K20X7RHVBWA	1.0 mf	5	100	K105M40Z5UHVCXD
.015 mf	5	50	K153K15X7RFVAWC	2.2 mf	5	50	K225M40Z5UFVCXF

A = .100" Spacing, #26 AWG.
B = .100" Spacing, #24 AWG.
C = .200" Spacing, #24 AWG.
H = .400" Spacing, #22 AWG.

CERAMIC CAPACITOR KITS

KIT-63L-A LOW VOLTAGE DISCS

KIT-63L-A contains a popular assortment of low voltage Ultra-Kap® and general purpose ceramic disc capacitors. Units are offered in 3 to 100 volt DC ratings in 14 different values from .005mf to 1.0mf.

CAP.	QTY.	VDC	CAT. NO.	CAP.	QTY.	VDC	CAT. NO.
.22 mf	5	3	U224P40Y5TAAATH	.1 mf	15	25	U104M59Y5PEABKM
.47 mf	5	3	U474P40Y5TAATF	.2 mf	5	25	U204M82Y5PEABKG
1.0 mf	5	3	U105P59Y5TAABTD	.01 mf	15	50	U103M29Y5PFAALJ
.05 mf	10	12	U503M29Y5PBAAJY	.022 mf	5	50	U223M47Y5PFAALJ
.1 mf	10	12	U104M40Y5PBAAJY	.033 mf	5	50	U333M47Y5PFABLJ
.2 mf	5	12	U204M59Y5PBABJX	.047 mf	5	50	U473M59Y5PFABLJ
.47 mf	5	12	U474M82Y5PBABJT	.05 mf	5	50	U503M59Y5PFABLJ
.01 mf	15	16	U103M20Y5PCAAKH	.1 mf	5	50	U104M82Y5PFABLJ
.022 mf	5	16	U223M29Y5PCAAKF	.01 mf	15	75	U103Z29Y5UGAAPK
.05 mf	5	16	U503M40Y5PCAAKE	.1 mf	5	75	U104Z69Y5UGABPK
.1 mf	15	16	U104M47Y5PCABKC	.01 mf	5	100	U103M29Y5THMBLK
.2 mf	5	16	U204M69Y5PCABMX	.005 mf	5	100	D502M29Z5VHAAEU
.3 mf	5	16	U304M82Y5PCABJW	.01 mf	15	100	D103M39Z5VHAAEU
.01 mf	15	25	U103M20Y5PEAAKW	.02 mf	5	100	D203M59Z5VHABEU
.022 mf	10	25	U223M29Y5PEAAKU	.025 mf	5	100	D253M59Z5VHABEU
.033 mf	5	25	U333M40Y5PEAAKR	.05 mf	5	100	D503M69Z5VHABEU
.05 mf	10	25	U503M40Y5PEAAKP	.1 mf	5	100	S104M72Z5VHAZAA

KIT-70H-A HIGH VOLTAGE DISCS

KIT-70H-A features a well balanced stock of high voltage, ceramic disc capacitors. Units include 3000 and 6000 volt DC rated discs in 33 values from 4.7pf to .005mf. A complete assortment of Mepco/Centralab's GAP-KAP®, combination capacitor–spark-gap is also included in the kit.

CAP.	QTY.	VDC	CAT. NO.	CAP.	QTY.	VDC	CAT. NO.
4.7 pf	2	3000	D479M33S2LRAAAL	15 pf	2	6000	D150M66S2LUAZAA
47 pf	2	3000	D470M33S3NRAAAL	50 pf	2	6000	D500M66S3NUABAL
68 pf	2	3000	D680M33S3NRAAAL	75 pf	2	6000	D750M66S3NUABAL
82 pf	2	3000	D820M33S3NRAAAL	100 pf	2	6000	D101M66S3NUAZAA
100 pf	2	3000	D101M33Z5URAAEM	120 pf	2	6000	D121M66S3NUABAL
150 pf	2	3000	D151M33Z5URAAEM	150 pf	2	6000	D151M66S3NUABAL
220 pf	2	3000	D221M33Z5URAAEM	200 pf	2	6000	D201M66Z5UUABEM
270 pf	2	3000	D271M33Z5URAAEM	250 pf	2	6000	D251M66Z5UUABEM
390 pf	2	3000	D391M33Z5URAAEM	300 pf	2	6000	D301M66Z5UUABEM
470 pf	2	3000	D471M33Z5URAAEM	470 pf	2	6000	D471M66Z5UUABEM
500 pf	2	3000	D501M33Z5URAAEM	500 pf	2	6000	D501M66Z5UUABEM
680 pf	2	3000	D681M33Z5URAAEM	750 pf	2	6000	D751M66Z5UUABEM
750 pf	2	3000	D751M33Z5URAAEM	820 pf	2	6000	D821M66Z5UUABEM
820 pf	2	3000	D821M43Z5URAAEM	.001 mf	2	6000	D102M66Z5UUABEM
.001 mf	2	3000	D102M43Z5URAAEM	.0015 mf	2	6000	D152M66Z5UUABEM
.0015 mf	2	3000	D152M63Z5URABEM	.002 mf	2	6000	D202M76Z5UUABEM
.002 mf	2	3000	D202M63Z5URABEM	.0022 mf	2	6000	D222M76Z5UUAZAA
.0022 mf	2	3000	D222M63Z5URABEM	.75 pf*	2	1000	S758X44000NAZAA
.003 mf	2	3000	D302M63Z5URABEM	.001 mf*	2	1000	S102M40Z5PNAZAA
.0033 mf	2	3000	D332M63Z5URABEM	.004 mf*	2	3000	S402K96Z5PRAZAA
.0047 mf	2	3000	D472M73Z5URABEM	.01 mf*	2	1000	S103M69Z5UNAZAB
.005 mf	2	3000	D502M73Z5URABEM	.02 mf*	2	1000	S203M93Z5UNAZAA

CERAMIC CAPACITOR KITS

KIT-66T-A TEMPERATURE COMPENSATING DISCS

KIT-66T-A provides a balanced stock of temperature compensating ceramic disc capacitors. Discs are offered in NPO, N750 and N1500 temperature coefficients in 24 different values from 1.5pf to 220pf.

CAP.	QTY.	VDC	CAT. NO.	CAP.	QTY.	VDC	CAT. NO.
1.5 pf	2	600	D159D20C0KLAAAA	120 pf	2	600	D121J47C0GLABAA
2.2 pf	2	600	D229D20C0KLAAAA	5 pf	2	600	D509D20U2JLAAAA
3.3 pf	2	600	D339D20C0JLAAAA	10 pf	2	600	D100J20U2JLAAAA
4.7 pf	2	600	D479D20C0JLAAAA	15 pf	2	600	D150J20U2JLAAAA
6.8 pf	2	600	D689D20C0HLAAAA	22 pf	2	600	D220J20U2JLAAAA
10 pf	5	600	D100J20C0GLAAAA	25 pf	2	600	D250J20U2JLAAAA
15 pf	5	600	D150J20C0GLAAAA	27 pf	2	600	D270J20U2JLAAAA
20 pf	2	600	D200J20C0GLAAAA	33 pf	2	600	D330J29U2JLAAAA
22 pf	2	600	D220J29C0GLAAAA	47 pf	2	600	D470J29U2JLAAAA
25 pf	2	600	D250J29C0GLAAAA	68 pf	2	600	D680J39U2JLAAAA
27 pf	2	600	D270J29C0GLAAAA	75 pf	2	600	D750J39U2JLAAAA
33 pf	5	600	D330J29C0GLAAAA	100 pf	2	600	D101J39U2JLAAAA
47 pf	2	600	D470J40C0GLAAAA	100 pf	2	600	D101J39P3KLAAAA
50 pf	2	600	D500J40C0GLAAAA	120 pf	2	600	D121J39P3KLAAAA
68 pf	2	600	D680J40C0GLAAAA	150 pf	2	600	D151J47P3KLAAAA
75 pf	2	600	D750J40C0GLABAA	180 pf	2	600	D181J47P3KLAAAA
82 pf	2	600	D820J40C0GLABAA	200 pf	2	600	D201J59P3KLABAA
100 pf	5	600	D101J40C0GLABAA	220 pf	2	600	D221J59P3KLABAA

KIT-60D GENERAL PURPOSE DISCS

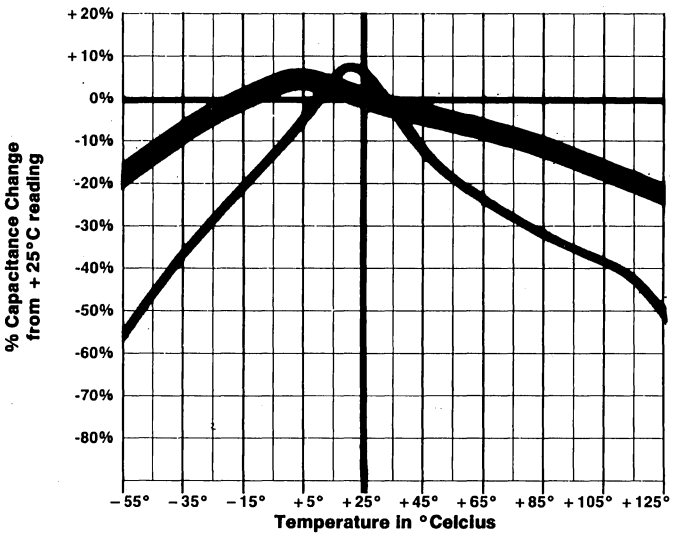
KIT-60D offers an assortment of the most widely used general purpose, ceramic disc capacitors. Discs include both 600 and 1000 volt DC ratings in 36 different values from 5pf to .05mf.

CAP.	QTY.	VDC	CAT. NO.	CAP.	QTY.	VDC	CAT. NO.
5 pf	5	1000	D509K20S2LNAAAL	390 pf pf	5	1000	D391K20Z5FNAAEM
10 pf	5	1000	D100K20S2LNAAAL	470 pf	5	1000	D471K20Z5FNAAEM
15 pf	5	1000	D150K20S2LNAAAL	500 pf	5	1000	D501K29Z5FNAAEM
20 pf	5	1000	D200K20S2LNAAAL	680 pf	5	1000	D681K29Z5RNAAEM
22 pf	5	1000	D220K20S2LNAAAL	820 pf	5	1000	D821K29Z5FNAAEM
25 pf	5	1000	D250K29S2LNAAAL	.001 mf	15	1000	D102K29Z5FNAAEM
33 pf	5	1000	D330K29S2LNAAAL	.001 mf	10	1000	D102P29Z5UNAAEM
47 pf	5	1000	D470K29S2LNAAAL	.0015 mf	5	1000	D152K39Z5RNAAEM
50 pf	5	1000	D500K29S3NNAAAL	.002 mf	10	1000	D202M39Z5UNAAEM
68 pf	5	1000	D680K29S3NNAAAL	.0022 mf	5	1000	D222M39Z5UNAAEM
100 pf	10	1000	D101K29S3NNAAAL	.003 mf	5	1000	D302M39Z5UNAAEM
120 pf	5	1000	D121K29S3NNAAAL	.0047 mf	5	1000	D472M47Z5UNAAEM
150 pf	5	1000	D151K29S3NNAAAL	.005 mf	5	1000	D502P59Z5UNABEM
180 pf	5	1000	D181K29S3NNAAAL	.005 mf	10	1000	D502M47Z5UNAAEM
200 pf	10	1000	D201K29S3NNAAAL	.0068 mf	5	1000	D682M59Z5UNABEM
220 pf	5	1000	D221K20Z5FNAAEM	.01 mf	5	1000	D103P69Z5UNABEM
250 pf	5	1000	D251K20Z5FNAAEM	.01 mf	15	1000	D103M59Z5UNABEM
270 pf	5	1000	D271K20Z5FNAAEM	.01 mf	5	600	D103P59Z5ULABED
300 pf	5	1000	D301K20Z5FNAAEM	.02 mf	5	600	D203Z69Z5ULABED
330 pf	5	1000	D331K20Z5FNAAEM	.05 mf	5	600	S503Z85Z5ULAZAA

Ultra-Kap™

DISC TEMPERATURE CHARACTERISTICS

Typical Curves.

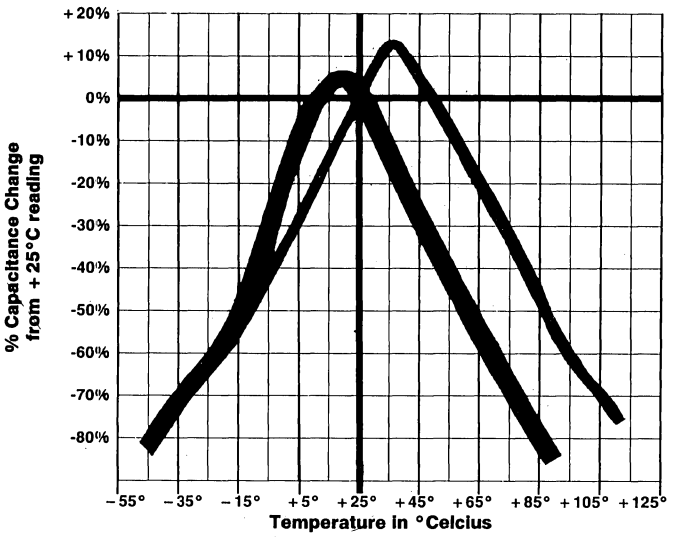


UKI

UKII and 3V

General Purpose

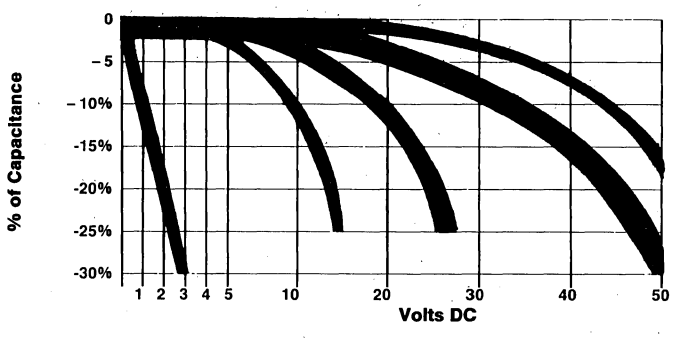
Typical Curves.



T66 Ceramic

T82 Ceramic

Capacitance vs. Applied DC Voltage.



UK I 12VDC

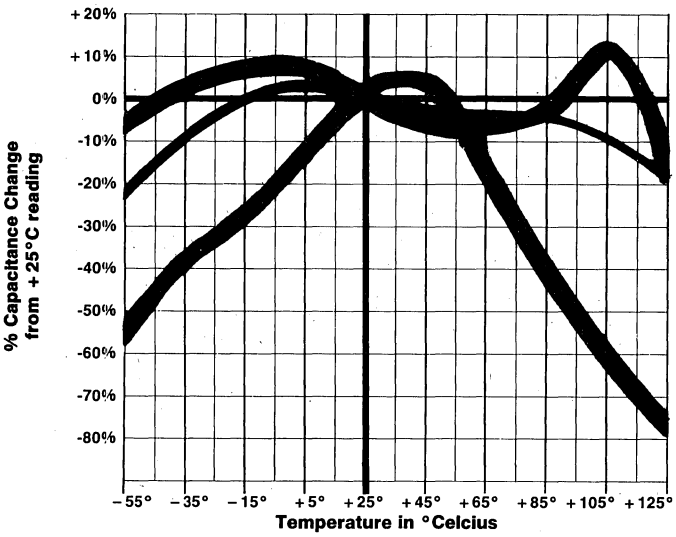
UK I 16 & 25VDC

3V Ultra-Kap

UK I 50VDC

UK II

Typical Curves.



T27 Ceramic

T4 Ceramic

T32 Ceramic

GLOSSARY

AC:
Alternating Current

Aging:
The dielectric constant of Class II, III and IV ceramic capacitors decreases with age. This decrease, which is very rapid for the first few hours, diminishes with time and becomes almost imperceptible after about one month.

Bias Voltage:
A voltage, usually DC, used to set the operating point of a circuit above or below a reference voltage.

Blocking Capacitor:
A capacitor which limits the flow of DC or low frequency AC without materially affecting the flow of high frequency AC.

By-pass Capacitor:
A capacitor which provides a low impedance path around a circuit element.

Capacitance:
The property of a system of two or more conductors which permit it to store electrical energy in an electrostatic field between them. The electrical capacity for ceramic capacitors is measured in either μF (micro-farad, which is 10^{-6} farad) of pF (pico-farad, or $\mu\mu$F, which is 10^{-12} farad).

The formula for capacitance in a system of two plates, as in a single disc construction ceramic disc capacitor, is:

C in pF = .2249 KA/t or (KA)/(4.45t), where

K is the dielectric constant of the material separating the two electrodes

A is the surface area in inches where the two electrodes overlap

t is the dielectric thickness in inches

This formula disregards edge effects which for materials with dielectric constants of approximately 1000 or greater may be disregarded for practical purposes.

From the above formula, one may see that the capacitance of any unit is directly proportional to the electrode area (diameter for discs and length and width, as well as number of layers, for multilayers) and the dielectric constant of the material, and inversely proportional to the thickness of the ceramic. Since different manufacturers of ceramic capacitors employ different dielectric materials, with different dielectric constants, it can be easily understood why differences in size for a given capacitance value occur.

Capacitive Reactance (X_c):
Opposition offered to the flow of alternating current by a capacitor or any unit having capacitance.

Coupling Capacitor:
A capacitor used to transfer signals of a specific frequency from one circuit to another circuit.

Curie Point:
In ferro electric dielectrics, the temperature(s) at which the dielectric constant reaches peak values. At the curie point temperature(s) the crystal form is changing from cubic to tetragonal. Manufacturers use modifiers in their specific ceramic formulations to shift curie points such that the rapid change in capacitance value which normally occurs around the curie point will have no effect on the specified characteristics of the capacitor over its specified temperature range.

Dielectric Constant (K) (Permitivity):
The ratio of the ability of a dielectric material to store electrostatic energy to that stored by a vacuum as the dielectric utilizing the same electrode system.

Dielectric Strength (DWV, Breakdown Voltage, Flash Test Voltage):

This is the maximum potential gradient that a dielectric can withstand before it ruptures or a conductive path is formed through (or around) it. Since the dielectric strength is affected by many factors, its measurement will result in large variations unless the conditions of test are standardized. The dielectric strength is the ratio of the breakdown voltage to the thickness of the ceramic; in encapsulated units it is also influenced by the coating material used.

Unencapsulated units of voltages around 1KVDC and higher are generally not recommended, unless special design criteria are used to prevent arc-over between the electrodes through the air surrounding the part.

Dissipation Factor (D.F., Tanσ, Tangent Delta):
The tangent of the dielectric loss angle i.e. tan σ is sometimes stated as Tan Delta; it is most frequently expressed as a percentage (% D.F. = 100 X Tan σ)

Electronic Industry Association (EIA):
An industry sponsored body, comprised of Manufacturers, Users and Equipment Manufacturers, which sets standards for Electronic Components, such as Capacitors, Resistors, Coils, Connectors, Computer Keyboards, Display Tubes; it also sets standards for Packaging of Components, Measurement Methods of Components, Handling Methods for Components, etc.

Equivalent Series Resistance:
All internal AC series resistance of a Capacitor treated as a single resistor.

Impedance (Z):
The total opposition offered to the flow of alternating current at a given frequency.

Inductive Reactance (X_L):
Opposition offered to the flow of alternating current by coils, leads, solder connections or other inductors.

Insulation Resistance (IR):
The ratio of the DC voltage applied to the terminals of a capacitor and the resulting leakage current flow after the initial charging current has ceased. It includes both the volume and surface resistance. Industry capacitor specifications typically performed after some two minutes charging time.

For many types of capacitors it is expressed as the product of Insulation Resistance and capacitance values (megOhm-microfarad).

KiloHertz (kHz,Kc):
Unit of frequency, 10^3 cycles per second; this is the standard measurement frequency for EIA Class II, III and IV ceramic capacitors for both capacitance and DF measurement.

Life Test:
An accelerated test, designed to measure the ability of a capacitor to withstand its rated operating conditions for a lengthy, useful life. The test conditions depend upon the rating of the capacitor. For example, for ceramic capacitors, rated 1000VDC or less, a common test consists of subjecting the part to a DC Voltage equal to two times its rated working voltage for 250, 500 or 1000 hours at either 85°C or 125°C. Limits are set, per EIA Standard RS-198C, for changes in the properties of the capacitor after this conditioning. For Class II, III and IV type capacitors, the initial measurements are typically taken some 24 hours after de-aging the parts for one hour at +125°C minimum; the measurements upon the completion of the test are again taken approx. 24 hours after completion. This 24 hour period insures that variances in capacitance are not due to the life test conditioning.

MegaHertz (mHz, Mc):
Unit of Frequency, 10^6 cycles per second. This is also the standard test frequency for EIA Class I capacitors (such as NPO or COG, N330, etc.) for both capacitance and DF (1/Q) measurement.

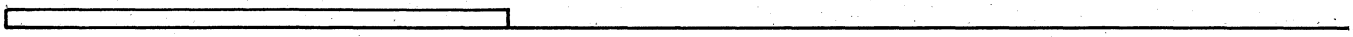
Multilayer Capacitor:
A ceramic capacitor, made up of several alternately stacked electrodes, separated by ceramic dielectric layers, fired into a single homogenous package.

Rated Working Voltage:
The maximum voltage at which a capacitor can be safely operated. Ceramic capacitors are typically rated with a DC rating; the AC component should typically not exceed 10% of the DC rating and the combination of AC and DC voltage should not exceed the rated voltage.

An example: A 50VDC rated unit will be subjected to 2VAC, can this be used in a 24VDC circuit?

2VAC converts to approx. 20VDC; when this is deducted from the 50VDC rating, this leaves 30VDC. Since the circuit is only 24VDC, the unit will be used within the design voltage limits.

Resonant Frequency (f0):
The frequency at which the total inductive and capacitive reactance of a capacitor (or of the components in a circuit) are equally low. This results in the component's impedance being equivalent to a pure resistor.



Tantalum Capacitors
QUICK REFERENCE INDEX

MILITARY

INDUSTRIAL

TYPE	MIL SLASH NO.	DESIGNATION	M/C STYLE	DESCRIPTION	CAPACITANCE RANGE	VOLTAGE RANGE	PAGE
WET SLUG MIL-C-3965							220
	/1	CL14 CL16	43XW	Hermetic Seal, Screw Mount, Cylindrical Case	3.5– 200 uf	20–630v	222
	/19	CL17 CL18	43XW	Hermetic Seal, Stud Mount, Cylindrical Case	12–1300 uf	30–630v	224
	/21	CL55	43JW	Hermetic Seal, Rectangular Module	70–2400 uf	15–150v	226
	/4	CL64 CL65	40LW	Elastomer Seal, Axial Lead, Tubular Case	1.7– 560 uf	6–125v	228
	/24	CL66 CL67	40SW	Hermetic Seal, Axial Lead, Tubular Case	1.7– 560 uf	6–125v	230
	MIL-C-39006			Established Reliability			232
	/18	CLR10	43XW	Extended Range, Axial Lead, Tubular Case	2.0– 140 uf	8–360v	235
	/19	CLR14	43XW	Extended Range, Cylindrical Case, Solder Lug Terminal	3.5– 200 uf	20–630v	236
	/20	CLR17	43XW	Extended Range, Cylindrical Case, Solder Lug Terminal	12–1300 uf	30–630v	237
	/09D	CLR65- 8000	40SW	Glass-to-Tantalum Hermetic Seal, Axial Lead, Tubular Case	1.7–1200 uf	6–125v	239
	/22C	CLR79	40AW	Hermetic Seal, Non-Silver Case, Axial Lead, Tubular Case	1.7–1200 uf	6–125v	243
WET FOIL MIL-C-3965							248
	/17	CL20 CL21	40AF	Polar, Etched Foil, Tubular Case, Axial Lead	1– 580 uf	15–150v	249
	/18	CL22 CL23	40BF	Non-Polar, Etched Foil, Tubular Case, Axial Lead	0.5– 350 uf	15–150v	250
	/15	CL30 CL31	40AG	Polar, Plain Foil, Tubular Case, Axial Lead	0.27– 300 uf	3–300v	251
	/16	CL32 CL33	40BG	Non-Polar, Plain Foil, Tubular Case, Axial Lead	0.12– 400 uf	3–300v	252
	/9	CL51	43KG	Polar, Plain Foil, KSR™, Hermetic Rectangular Module	40– 960 uf	15–150v	256
	/10	CL52	43JG	Non-Polar, Plain Foil, KSR™, Hermetic Rectangular Module	20– 600 uf	15–150v	256
	/11	CL53	43KF	Polar, Etched Foil, KSR™, Hermetic Rectangular Module	70–3500 uf	15–150v	257
	/12	CL54	43JF	Non-Polar, Etched Foil, KSR™, Hermetic Rectangular Module	35–2100 uf	15–150v	257
	/22	CL70 CL71	40RF	Polar, High Etched Foil, Tubular Case, Axial Lead	1.6– 920 uf	15–150v	253
	/23	CL72 CL73	40SF	Non-Polar, High Etched Foil, Tubular Case, Axial Lead	0.75– 590 uf	15–150v	254
	MIL-C-39006			Established Reliability			259
	/01	CLR25	40EF	Polar, Etched Foil, Hermetic and Non-Hermetic, Axial Lead	1.0– 580 uf	15–150v	259
	/02	CLR27	40FF	Non-Polar, Etched Foil, Hermetic and Non-Hermetic, Axial Lead	0.5– 350 uf	14–150v	261
	/03	CLR35	40EG	Polar, Plain Foil, Hermetic and Non-Hermetic, Axial Lead	0.35– 160 uf	15–200v	262
	/04	CLR37	40FG	Non-Polar, Plain Foil, Hermetic and Non-Hermetic, Axial Lead	0.15– 100 uf	15–200v	263
	/16	CLR71	40TF	Polar, High Etched Foil, Hermetic and Non-Hermetic, Axial Lead	1.6– 920 uf	15–150v	264
	/17	CLR73	40VF	Non-Polar, High Etched Foil, Hermetic and Non-Hermetic, Axial Lead	0.75– 590 uf	15–150v	265
SOLID SLUG MIL-C-26665B							266
		CS12 CS13	40SS	Hermetic Seal, Axial Lead, Tubular Case	.0047– 330 uf	6–100v	266
	MIL-C-39003			Established Reliability			272
	/02	CSR09	40TS	Polar, Miniature, Hermetic Seal, Axial Lead, Tubular Case	.047– 18 uf	6– 75v	275
	/01	CSR13	40SS	Polar, Hermetic Seal, Axial Lead, Tubular Case	.0047– 330 uf	6–100v	277
	/09	CSR21	40ZS	Polar, High Frequency Hermetic, Tubular Case, Axial Lead	5.6– 330 uf	6– 50v	286
	/03	CSR23	40XS	Polar, Extended Range, Hermetic Seal, Axial Lead, Tubular Case	1.2–1000 uf	6– 50v	289
	/06	CSR33	40YS	Polar, Extended Range, Hermetic Seal, for Low Impedance Application	1.2–1000 uf	6– 50v	292
	/04	CSR91	40NS	Non-Polar, Hermetic Seal, Axial Lead, Tubular Case	.0023– 160 uf	6–100v	295
WET SLUG			40AW	Hermetic, Non-Silver Case, Axial Lead, Tubular Case	1.7–1200 uf	6–125v	301
			40CW	Miniature, Polar, Non-Hermetic, Tubular, Axial Lead	3.3– 450 uf	6– 60v	308
			40EW	Extended Range, Polar, Non-Hermetic, Tubular, Axial	6.8–1800 uf	6–125v	312
			43JW	Hermetic, Rectangular Module, Spade Lugs	35–22000 uf	6–150v	319
			40LW	Polar, Non-Hermetic, Tubular, Axial Lead	1.7–1100 uf	6–125v	328
			40SW	Hermetic, Polar, Glass to Tantalum Seal, Tubular, Axial	1.7–1200 uf	6–125v	335
			40TW	Hermetic, Non-Silver Case, Tubular, Axial, High Temp.	1.7–1200 uf	6–125v	340
			43XW	Hermetic, Cylindrical Case, Stud or Screw Mount	3.5–1300 uf	20–630v	347
			40YW	Miniature, Non-Acid Electrolyte, Polar, Tubular, Non-Hermetic	0.1– 320 uf	6– 60v	351
SOLID SLUG			40CS	Polar, Miniature Non-Hermetic, Tubular Metal Case, Axial Lead	.0047– 68 uf	2– 50v	354
			40ES	Polar, Non-Hermetic, Tubular Metal Case, Axial Lead	.0047– 330 uf	6–100v	357
			41GS	Polar, Dipped, Non-Hermetic, Miniature, Radial Lead	0.1– 680 uf	3– 50v	361
			40MS	Polar, Molded, Non-Hermetic, Axial Lead	0.1– 68 uf	2– 50v	365
			40NS	Non-Polar, Hermetic, Tubular Case, Axial Lead	.0023– 160 uf	6–100v	371
			41PS	Polar, Non-Hermetic, Rectangular Plastic Case, Radial Lead	0.1– 220 uf	6– 50v	375
			40SS	Polar, Standard Hermetic, Tubular Case, Axial Lead	.0047– 330 uf	6–100v	379
			40TS	Polar, Miniature Hermetic, Tubular Case, Axial Lead	.0047– 39 uf	4–100v	386
			40XS	Polar, Extended Range, Hermetic Tubular, Axial Lead	0.82–1000 uf	6– 60v	390
			40YS	Polar, Extended Range, Hermetic, For Low Impedance Applications	1.0–1000 uf	6– 60v	394
			40ZS	Polar, High Frequency Hermetic, Tubular Case, Axial Lead	5.6– 330 uf	6– 50v	398
APPLICATION DATA: WET, FOIL, SOLID							401, 404, 410
TANTALUM CAPACITOR PACKAGING INFORMATION							414, 415

MIL-C-3965

Military Style Tantalum Capacitors

MIL-C-3965

DESIGN AND CONSTRUCTION

Each capacitor is enclosed in a metallic case and is effectively sealed against the entry of contaminants and leakage or evaporation of the electrolyte.

TERMINALS

All terminals are permanently secured internally and externally as required in MIL-C-3965. All external joints are soldered or welded, all terminals used for soldered connections are hot-tin-dipped or soldered to facilitate soldering.

DC LEAKAGE

After a five minute, ±½ minute period with full rated working voltage across the capacitor, the leakage current will not exceed the maximum shown in the table.

CAPACITANCE

Capacitors are tested in accordance with method 305 of MIL-STD-202, using a polarized capacitance bridge. The following details apply:

A. Test conditions: Measurements are made at a frequency of 120 ±5Hz. The AC voltage shall be limited to 30 percent of the rated DC working voltage or 1 volt root-mean-square (RMS), whichever is smaller. The polarizing and 120 Hz. voltages are such that the peak AC voltage is less than the DC voltage, and the sum of peak AC and DC voltages does not exceed the rated DC working voltage.
B. Measurement accuracy — within ±2 percent.
C. Magnitude of polarizing voltage — of such magnitude as to cause no reversal of polarity.

STABILITY AT REDUCED AND HIGH TEMPERATURES

The measurements specified below are made in the order shown at thermal stability. Thermal stability has been reached when no further change in capacitance is observed between two successive measurements taken at 15 minute intervals.

The capacitor values at −55°C and the applicable high test temperatures do not change more than the percentage specified in the tables from the initial values at 25°C. The second and third capacitance measurement at 25°C do not change more than ±5% from the initial values at 25°C.

Step	Temperature	Measurements
1	25°C	DC Leakage Capacitance Equivalent Series Resistance
2	+0°C -55°C -3°C	Impedance Capacitance
3	25°C	DC Leakage Capacitance Equivalent Series Resistance
4	High Test Temperature +3°C -0°C	DC Leakage Capacitance Equivalent Series Resistance
5	25°C	DC Leakage Capacitance Equivalent Series Resistance

VIBRATION

When testing in accordance with method 204 of MIL-STD-202 as modified by MIL-C-3965, these capacitors will not have intermittent contacts or exhibit open or short circuiting while under vibration or, after testing, be mechanically damaged.

SALT SPRAY (Corrosion)

There will be no harmful corrosion, and at least 90% of any exposed metallic surface of the capacitors will be unaffected when subjected to the corrosion test specified in Standard MIL-STD-202, method 101, test condition B.

THERMAL SHOCK AND IMMERSION

When tested as specified in MIL-STD-202 under method 107 and method 104, the capacitors will not leak electrolyte or evidence any harmful corrosion. The DC leakage shall not exceed 125 percent, and the equivalent series resistance will not exceed 115 percent, of their values tabulated in the table. The capacitance will not change more than ±5 percent from that initially measured.

INSULATING SLEEVES

Style CL65 has insulating sleeves which, when tested as specified in MIL-C-3965, will not exhibit dielectric breakdown, and the insulation resistance will not be less than 100 meg ohms.

TERMINAL STRENGTH

All terminals will withstand a pull of three pounds $^{+2}_{-0}$ ounces in axial direction for 30 seconds. The lead will withstand insertion into the hold of a fixture so that the lower side of the weld or soldered joint is flush with the fixture. The case can then be forced over in such a manner that the tantalum stub is maintained in its axial position as close as possible while bending the lead until the end of the case touches the top surface of the fixture. When the case is returned to its normal position, one bend has been completed. The capacitors will withstand four bends in alternating directions.

SURGE VOLTAGE

The capacitors will withstand 1000 cycles of the DC surge voltage shown below. The ambient temperature during cycling is the applicable high test temperature specified by the appropriate letter symbol.

Capacitors, when subjected to 1000 cycles of the DC surge voltage specified above will not exhibit any electrical intermittance during test. On completion of testing there will be no visual evidence of mechanical damage or leakage of the electrolyte. The ambient temperature during cycling shall be the applicable high test temperature. (See characteristic in the coding system).

Each cycle consists of a 30 second surge-voltage application followed by a 5½ minute discharge period. Voltage application is made through a resistance of 1000 ±100 ohms in series with the capacitor and the voltage source. Each surge voltage cycle shall be performed in such a manner that the capacitor is discharged through the 1000 ohm resistor at the end of the 30 second application.

MOISTURE RESISTANCE

When tested in accordance with method 106 of Standard MIL-STD-202 as modified by MIL-C-3965, the capacitors will not evidence any harmful corrosion and will meet the following electrical requirements.

DC Leakage — Will not exceed 125 percent of the initial requirements. (See table).

Capacitance — Will not change more than ±10 percent from that measured prior to the start of testing.

Dissipation Factor — Will not exceed 115 percent of the initial requirement. (See table).

Sleeved capacitors will meet the requirements listed under insulating sleeves after exposure to the above moisture resistance test.

LIFE

These capacitors, after being exposed for 2000 hours to the applicable high test temperature with continuous application of the DC working voltage, will meet the following requirements:

Leakage Current — Original requirements (See Table).

Capacitance — +25 - 15 percent of initial measurement.

Equivalent Series Resistance — 130 percent of initial requirement. (See table).

BAROMETRIC PRESSURE (Reduced)

When tested in accordance with method 105 of Standard MIL-STD-202 as modified by MIL-C-3965 and stabilized at an atmospheric pressure of 0.82 inches of mercury for 5 minutes, will not leak electrolyte, show intermittent contacts or mechanical damage.

MARKING

Capacitors are marked in accordance with MIL-C-3965 with military type designation, capacitance in mfd., DC working voltage, date of manufacture (indicated by the number of the month followed by a hyphen and the last two figures of the year), and an arrow indicating the negative terminal, mfg. source code or logo.

WORKMANSHIP

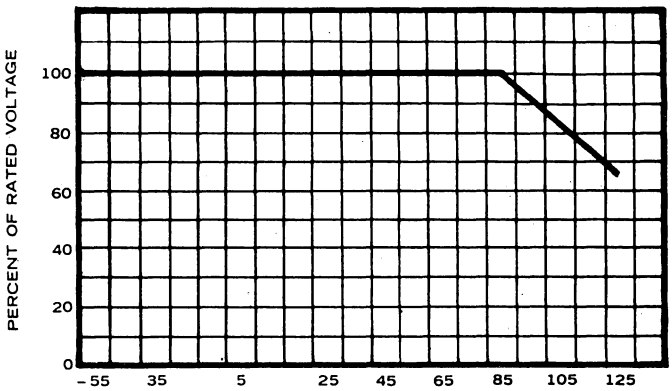
Workmanship is such as to permit the capacitors to meet all the requirements of this specification.

QUALITY ASSURANCE

Statistical sampling and inspection are in accordance with Standard MIL-STD-105. The acceptable quality levels (AQL) are as specified in MIL-C-3965.

Symbol	DC Working Voltage	Surge Voltage at 85°C
	VOLTS	VOLTS
B	6	6.9
C	8	9.2
D	10	11.5
E	15	17.2
G	25	28.8
H	30	34.5
J	50	57.5
K	60	69.0
L	75	86.2
N	100	115.0
P	125	144.0

TEMPERATURE IN DEGREES CENTIGRADE
(THIS CURVE IS USED IN CONJUNCTION WITH THE TABLE)



APPLICABLE TO CHARACTERISTIC "C" CAPACITORS

NOTE:
MIL-C-3965 INACTIVE FOR NEW DESIGN

MIL-C-3965
Military Style Tantalum Capacitors

MIL-C-3965/1
STYLES CL14 & CL16

DESIGN AND CONSTRUCTION
Each capacitor consists of an assembly of tubular wet tantalum capacitors potted in a metal case and hermetically sealed with each terminal insulated from the capacitor case.

TERMINALS
Terminals are the solder-lug or screw mount type.

D.C. LEAKAGE
DCL shall be measured following a rated voltage electrification period not exceeding 5 minutes. The DCL shall not exceed the value shown for each specific rating.

CAPACITANCE
Capacitance shall be determined in accordance with Method 305 of MIL-STD-202 at 120 ±5Hz. The magnitude of the A.C. voltage shall not exceed 1.0 vrms and the D.C. bias shall not exceed 2.2 VDC.

DISSIPATION FACTOR
When measured as specified above, the D.F. for capacitors shall not exceed value shown in table.

TEMPERATURE CHARACTERISTICS

	-55°C	+25 C	85°C	125°C
	-60%(20v)			
	-45%(30v)		+15%(>30v)	+20%(>26v)
Capacitance	-35%(>30v)	±5% of retrace	+10%(>30v)	+10%(>26v)
Dissipation Factor	——	Initial Limits	Initial Limits	Initial Limits
DCL	——	(See Table)	(See Table)	(See Table)
Impedance	(See Table)	——	——	——

LIFE TEST
Following a 2000 hour life test at 85°C and full rated voltage applied:
1. The DCL shall not exceed initial limit
2. The capacitance change shall not exceed ±15%
3. The Dissipation Factor shall not exceed initial measurement.

The above limits also apply following a life test of 2000 hours at 125°C with derated voltage applied, except D.F. which shall not exceed 130% of initial limit.

MILITARY CODING SYSTEM

CL14 B F 201 U P G

- G — SEAL TYPE — G = Hermetic
- P — POLARITY — P = Polar
- U — CAPACITANCE TOLERANCE — U = +75 — 15%
- 201 — CAPACITANCE in Microfarads first two digits are significant figures, third digit is number of zeroes to follow: i.e., 961 = 960uf.
- F — OPERATING VOLTAGE at 85°C.

F = 20	M = 90	T = 360	W = 630
H = 30	R = 180	U = 450	
K = 60	S = 270	V = 540	

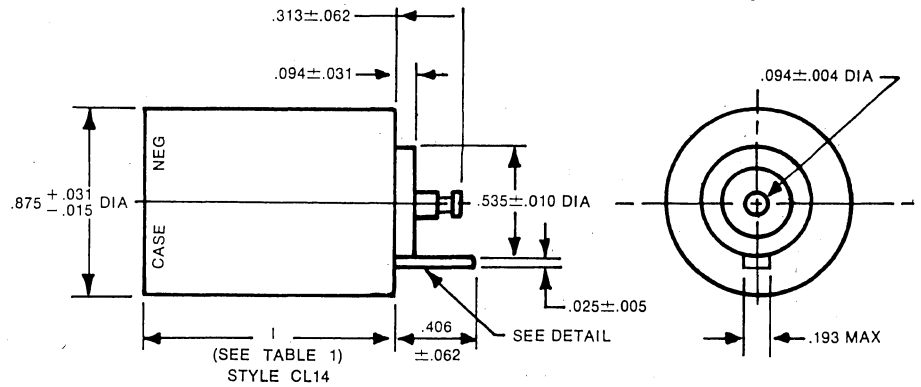
- B — TEMPERATURE CHARACTERISTIC: B = full operating voltage -55°C to 85°C and linearly derated to ⅔ rated voltage at 125°C.
- CL14 — STYLE: Fixed non solid electrolyte sintered anode tantalum capacitor.
  CL14 — stud and lug mount
  CL16 — screw and lug mount

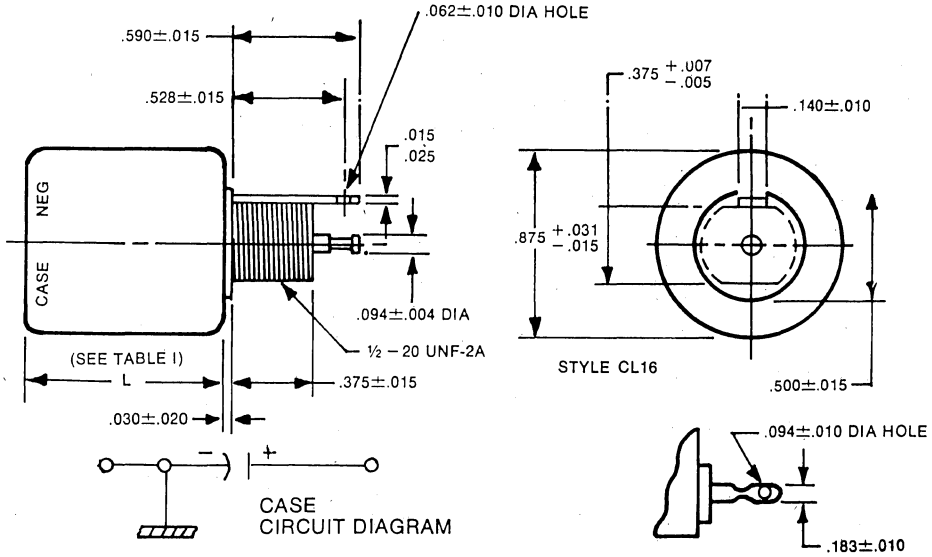
NOTE: Military number does not designate case size. See table for specific capacitance and voltage rating.

MIL-C-3965/1
STYLES CL14 & CL16

Type Designation 1/	Voltage Rated (85°C)	Voltage Derated (125°C)	Voltage Surge (85°C)	Capacitance	DC Leakage (max.) 25°C	DC Leakage (max.) 85°C	DC Leakage (max.) 125°C	Dissipation Factor (max.)	Impedance (max.)	Dimension L ±.062 (1.57)
	volts, dc	volts, dc	volts, dc	uF	uA	uA	uA	percent	ohms	inches (mm)
CL1-BF101UPG	20	18	23	100.0	10	50	80	21.0	30	0.540(13.72)
CL1-BF201UPG	20	18	23	200.0	16	80	128	36.0	20	0.732(18.59)
CL1-BH750UPG	30	26	34.5	75.0	11	55	88	15.0	45	0.540(13.72)
CL1-BH151UPG	30	26	34.5	150.0	13	90	104	29.0	30	0.732(18.59)
CL1-BK400UPG	60	52	69	40.0	12	60	96	8.2	65	0.540(13.72)
CL1-BK800UPG	60	52	69	80.0	19	95	152	16.0	35	0.732(18.59)
CL1-BM250UPG	90	78	103	25.0	11	55	88	5.1	90	0.540(13.72)
CL1-BM500UPG	90	78	103	50.0	18	90	144	10.0	45	0.732(18.59)
CL1-BR120UPG	180	155	207	12.0	11	55	88	5.1	180	0.920(23.37)
CL1-BR250UPG	180	155	207	25.0	18	90	144	10.0	90	1.300(33.02)
CL1-BS080UPG	270	235	310	8.0	11	55	88	5.1	270	1.270(32.36)
CL1-BS160UPG	270	235	310	16.0	18	90	144	10.0	135	1.865(47.37)
CL1-BT060UPG	360	310	414	6.0	11	55	88	5.0	360	1.635(41.53)
CL1-BT120UPG	360	310	414	12.0	18	90	144	10.0	180	2.420(61.47)
CL1-BU050UPG	450	390	518	5.0	11	55	88	4.9	450	2.000(50.80)
CL1-BU100UPG	450	390	518	10.0	18	90	144	9.8	225	2.980(75.69)
CL1-BV040UPG	540	470	621	4.0	11	55	88	5.1	540	2.365(60.07)
CL1-BV080UPG	540	470	621	8.0	18	90	144	10.0	270	3.532(89.71)
CL1-BW3R5UPG	630	545	724	3.5	11	55	88	5.0	630	2.720(69.09)
CL1-BW070UPG	630	545	724	7.0	18	90	144	10.0	315	4.062(103.17)

1/ Complete type designation will include an additional symbol to indicate style.





INCHES	MM
.004	.10
.005	.13
.007	.18
.010	.25
.015	.38
.020	.51
.025	.64
.030	.76
.031	.79
.062	1.57
.094	2.39
.140	3.56
.183	4.65
.193	4.90
.313	7.95
.375	9.53
.406	10.31
.500	12.70
.528	13.41
.535	13.59
.590	14.99
.875	22.23

MIL-C-3965
Military Style Tantalum Capacitors

MIL-C-3965/19
STYLES CL17 & CL18

DESIGN AND CONSTRUCTION
Each capacitor consists of an assembly of tubular wet tantalum capacitors potted in a metal case and hermetically sealed with each terminal insulated from the capacitor case.

TERMINALS
Terminals are the solder-lug or screw mount type.

D.C. LEAKAGE
DCL shall be measured following a rated voltage electrification period not exceeding 5 minutes. The DCL shall not exceed the value shown for each specific rating.

CAPACITANCE
Capacitance shall be determined in accordance with Method 305 of MIL-STD-202 at 120 ±5Hz. The magnitude of the A.C. voltage shall not exceed 1.0 vrms and the D.C. bias shall not exceed 2.2 VDC.

DISSIPATION FACTOR
When measured as specified above, the D.F. for capacitors shall not exceed value shown in Table.

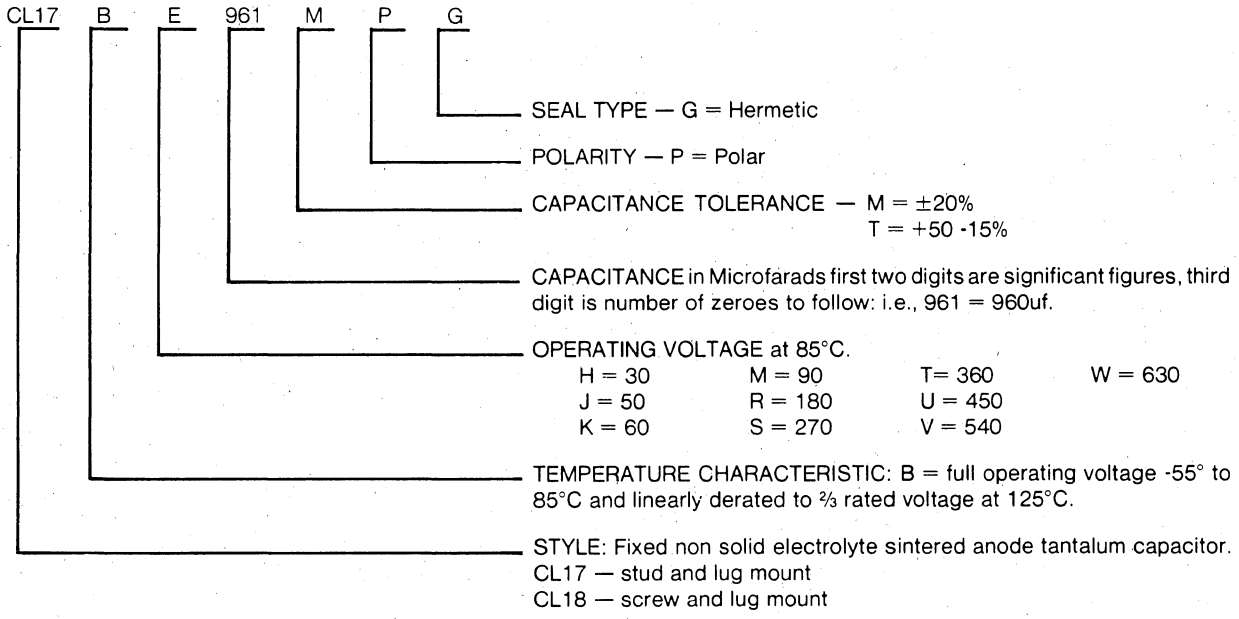
TEMPERATURE CHARACTERISTICS

	-55°C	+25°C	85°C	125°C
Capacitance	(See Table)	±5% of retrace	+20% △ C	+25% △ C
Power Factor	———	Initial Limits	Initial Limits	Initial Limits
DCL	———	(See Table)	(See Table)	(See Table)
Impedance	(See Table)	———	———	———

LIFE TEST
Following a 2000 hours life test at 85°C and full rated voltage applied:
1. The DCL shall not exceed initial limit
2. The capacitance charge shall not exceed ±20%
3. The Dissipation Factor shall not exceed initial limit

The above limits also apply following a life test of 2000 hours at 125°C with derated voltage applied, except D.F. which shall not exceed 150% of initial limit.

MILITARY CODING SYSTEM



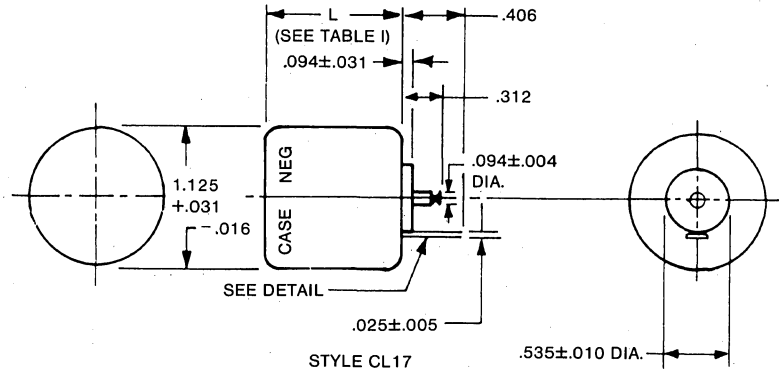
NOTE: Military number does not designate case size. See table for specific capacitance and voltage rating.

MIL-C-3965
Military Style Tantalum Capacitors

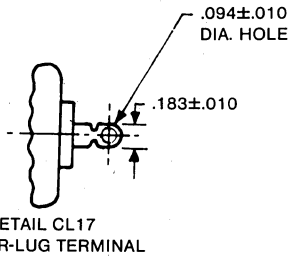
MIL-C-3965/19
STYLES CL17 & CL18

Type Designation 1/	Voltage Rated (+85°C)	Voltage Derated (+125°C)	Surge (+85°C)	Capacitance	Cap. Tolerance	Dissipation Factor (max.)	DC Leakage (max.) +25°C	DC Leakage (max.) +85°C	DC Leakage (max.) +125°C	Impedance (max.)	Cap. Change (-55°C)	Dimension L ±.062 (1.57)
	volts, dc	volts, dc	volts, dc	uF		%	uA	uA	uA	ohms	%	inches (mm)
CL1-BH371-PG	30	26	34.5	370	M,T	41.0	18	125	180	15	-65	.600(15.24)
CL1-BH651-PG	30	26	34.5	650	M,T	74.0	21	145	210	15	-85	1.100(27.94)
CL1-BH132-PG	30	26	34.5	1300	M,T	148.0	27	190	270	10	-85	1.100(27.94)
CL1-BK201-PG	60	52	69.0	200	M,T	22.5	19	135	190	30	-50	.600(15.24)
CL1-BK351-PG	60	52	69.0	350	M,T	39.8	22	155	220	25	-70	1.100(27.94)
CL1-BK701-PG	60	52	69.0	700	M,T	79.0	29	200	290	15	-70	1.100(27.94)
CL1-BM121-PG	90	78	103.0	120	M,T	13.0	19	135	190	40	-40	.600(15.24)
CL1-BM221-PG	90	78	103.0	220	M,T	24.8	21	145	210	30	-60	1.100(27.94)
CL1-BM451-PG	90	78	103.0	450	M,T	50.2	29	195	290	35	-60	1.100(27.94)
CL1-BR420-PG	180	155	207.0	42	M,T	16.1	17	120	170	75	-40	.976(24.79)
CL1-BR600-PG	180	155	207.0	60	M,T	13.0	19	135	190	60	-40	.976(24.79)
CL1-BR111-PG	180	155	207.0	110	M,T	24.8	21	145	210	60	-60	1.938(49.23)
CL1-BR231-PG	180	155	207.0	230	M,T	52.0	29	200	290	50	-60	1.938(49.23)
CL1-BS280-PG	270	235	310.0	28	M,T	16.1	19	120	190	80	-40	1.350(34.29)
CL1-BS400-PG	270	235	310.0	40	M,T	22.5	19	135	190	100	-40	1.350(34.29)
CL1-BS750-PG	270	235	310.0	75	M,T	24.8	21	145	210	90	-60	2.812(71.42)
CL1-BS151-PG	270	235	310.0	150	M,T	52.0	28	195	280	75	-60	2.812(71.42)
CL1-BT220-PG	360	310	414.0	22	M,T	16.1	18	125	180	100	-40	1.705(43.31)
CL1-BT300-PG	360	310	414.0	30	M,T	22.5	19	135	190	120	-40	1.705(43.31)
CL1-BU170-PG	450	390	518.0	17	M,T	16.1	18	125	180	130	-40	2.080(52.83)
CL1-BU250-PG	450	390	518.0	25	M,T	23.5	19	135	190	150	-40	2.080(52.83)
CL1-BV140-PG	540	470	621.0	14	M,T	16.1	17	120	170	160	-40	2.435(61.85)
CL1-BV200-PG	540	470	621.0	20	M,T	22.5	19	135	190	170	-40	2.435(61.85)
CL1-BW120-PG	630	545	724.0	12	M,T	16.1	17	120	170	180	-40	2.810(71.37)
CL1-BW180-PG	630	545	724.0	18	M,T	23.5	19	135	190	200	-40	2.810(71.37)

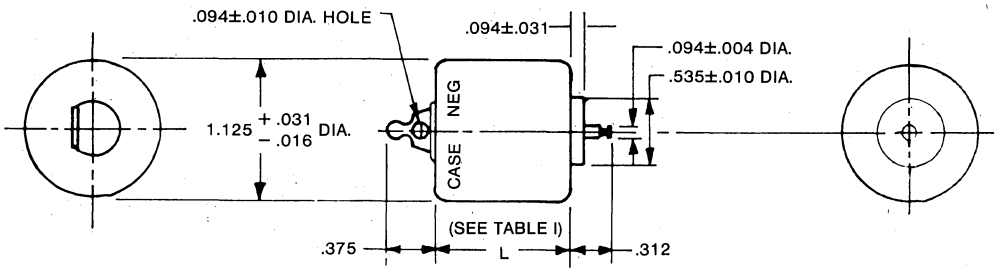
1/ Complete type designation will include additional symbols to indicate style and capacitance tolerance.



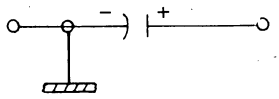
STYLE CL17



DETAIL CL17
SOLDER-LUG TERMINAL



STYLE CL18



CASE
CIRCUIT DIAGRAM

INCHES	MM	INCHES	MM
.004	.10	.183	4.65
.005	.13	.312	7.92
.010	.25	.375	9.53
.016	.41	.406	10.31
.025	.64	.535	13.59
.031	.79	1.125	28.58
.094	2.39		

MIL-C-3965

Military Style Tantalum Capacitors

MIL-C-3965/21
STYLE CL55

DESIGN AND CONSTRUCTION
Each capacitor consists of an assembly of tubular wet tantalum capacitors potted in a metal case and hermetically sealed with each terminal insulated from the capacitor case.

TERMINALS
Terminals are the solder-lug type.

D.C. LEAKAGE
DCL shall be measured following a rated voltage electrification period not exceeding 5 minutes. The DCL shall not exceed the value shown for each specific rating.

CAPACITANCE
Capacitance shall be determined in accordance with Method 305 of MIL-STD-202 at 120 ±5Hz. The magnitude of the A.C. voltage shall not exceed 1.0 vrms and the D.C. bias shall not exceed 2.2 VDC.

POWER FACTOR
When measured as specified above, the P.F. for capacitors of 50 VDC rating and less shall not exceed 15%, and for ratings of 50 VDC or more shall not exceed 12%.

TEMPERATURE CHARACTERISTICS

	-55°C	+25°C	85°C	125°C
		±20% of nominal		
Capacitance	-35% ΔC	±5% of retrace	+25% ΔC	+25% ΔC
Power Factor	———	Initial Limits	Initial Limits	Initial Limits
DCL	———	(See Table)	(See Table)	(See Table)
Impedance	(See Table)	———	———	———

LIFE TEST
Following a 2000 hours life test at 85°C and full rated voltage applied:
1. The DCL shall not exceed initial limit
2. The capacitance change shall not exceed ±25%
3. The Power Factor shall not exceed 130% of initial measurement.

The above limits also apply following a life test of 2000 hours at 125°C with derated voltage applied.

MILITARY CODING SYSTEM

CL55 B E 961 M P G

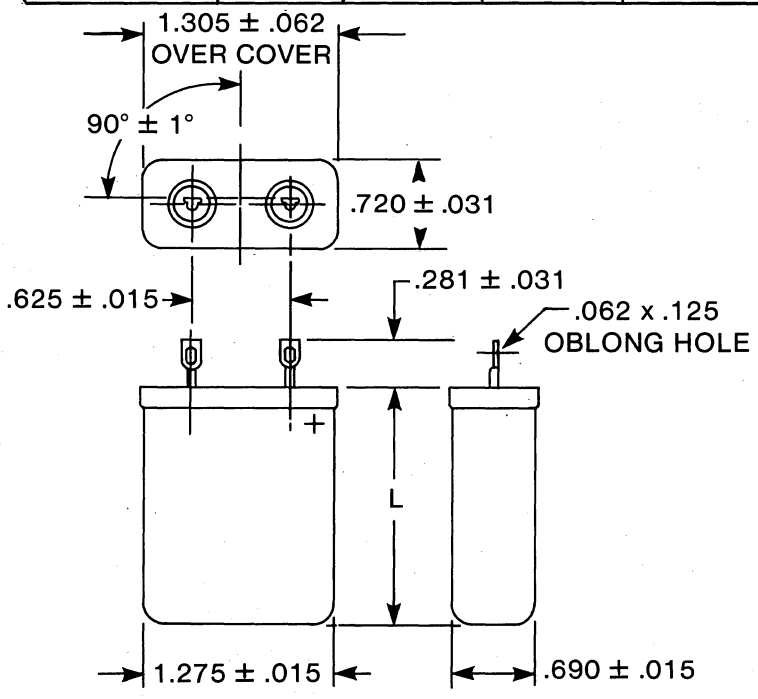
- G — SEAL TYPE — G = Hermetic
- P — POLARITY — P = Polar
- M — CAPACITANCE TOLERANCE — M = ±20%
- 961 — CAPACITANCE in Microfarads first two digits are significant figures, third digit is number of zeroes to follow: i.e., 961 = 960 uf.
- E — OPERATING VOLTAGE at 85°C.
  - E = 15
  - H = 30
  - J = 50
  - L = 75
  - N = 100
  - Q = 150
- B — TEMPERATURE CHARACTERISTIC: B = full operating voltage -55°C to 85°C and linearly derated to ⅔ rated voltage at 125°C.
- CL55 — STYLE: Fixed non solid electrolyte sintered anode tantalum capacitor.

NOTE: Military number does not designate case size. See table for specific capacitance and voltage rating.

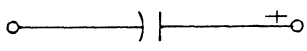
MIL-C-3965
Military Style Tantalum Capacitors

MIL-C-3965/21
STYLE CL55

Type Designation	Rated (85°C)	Voltage Derated (125°C)	Surge (85°C)	Capacitance	DC Leakage (max.) 25°C	DC Leakage (max.) 85°C & 125°C	Impedance (max.)	Case Size
	volts, dc	volts, dc	volts, dc	uf	uA	uA	ohms	
CL55BE961MPG	15	10	17.2	960	7	58	3.10	A1
CL55BE122MPG	15	10	17.2	1200	9	72	2.30	A2
CL55BE142MPG	15	10	17.2	1400	11	84	1.70	A3
CL55BE212MPG	15	10	17.2	2100	16	126	1.30	A4
CL55BE242MPG	15	10	17.2	2400	18	144	1.15	A5
CL55BH521MPG	30	20	34.5	520	8	63	5.30	A1
CL55BH661MPG	30	20	34.5	660	10	80	4.20	A2
CL55BH821MPG	30	20	34.5	820	13	99	2.90	A3
CL55BH122MPG	30	20	34.5	1200	18	144	2.30	A4
CL55BH132MPG	30	20	34.5	1300	20	156	2.10	A5
CL55BJ401MPG	50	30	57.5	400	10	80	7.20	A1
CL55BJ431MPG	50	30	57.5	430	10	78	6.40	A1
CL55BJ501MPG	50	30	57.5	500	13	100	5.60	A2
CL55BJ601MPG	50	30	57.5	600	15	120	4.10	A3
CL55BJ801MPG	50	30	57.5	800	20	160	3.10	A4
CL55BJ102MPG	50	30	57.5	1000	23	180	2.80	A5
CL55BL271MPG	75	50	86.2	270	9	81	8.50	A1
CL55BL331MPG	75	50	86.2	330	12	99	7.00	A2
CL55BL401MPG	75	50	86.2	400	15	119	5.00	A3
CL55BL601MPG	75	50	86.2	600	23	180	3.65	A4
CL55BL661MPG	75	50	86.2	660	25	198	3.50	A5
CL55BN171MPG	100	65	115.0	170	9	68	15.00	A1
CL55BN221MPG	100	65	115.0	220	11	88	11.60	A2
CL55BN261MPG	100	65	115.0	260	13	104	8.00	A3
CL55BN351MPG	100	65	115.0	350	18	140	6.50	A4
CL55BN441MPG	100	65	115.0	440	22	176	5.80	A5
CL55BQ700MPG	150	100	172.0	70	6	42	28.80	A1
CL55BQ900MPG	150	100	172.0	90	7	54	22.40	A2
CL55BQ101MPG	150	100	172.0	100	8	60	16.40	A3
CL55BQ141MPG	150	100	172.0	140	11	84	12.40	A4
CL55BQ181MPG	150	100	172.0	180	14	104	11.20	A5



	Dimensions	
	L±.031(.79)	
	In	mm
A1	1.062	26.97
A2	1.375	34.93
A3	1.625	41.28
A4	2.000	50.80
A5	2.500	63.50



CIRCUIT DIAGRAM

INCHES	MM	INCHES	MM
.015	.38	.625	15.88
.031	.79	.690	17.53
.062	1.57	.720	18.29
.125	3.18	1.275	32.39
.281	7.14	1.305	33.15

MIL-C-3965

Military Style Tantalum Capacitors

MIL-C-3965/4
STYLES CL64 & CL65

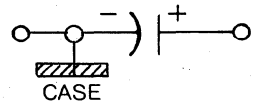
MILITARY CODING SYSTEM

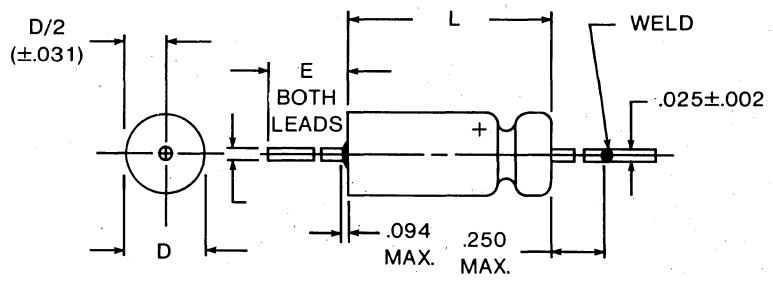
CL65 B J 820 K P E

- E — ELASTOMER SEAL
- P — P = Polarized N = Non Polarized (Not available in CL64 or CL65)
- K — CAPACITANCE TOLERANCE: J = ±5% K = ±10% M = ±20%
- 820 — CAPACITANCE, NOMINAL: Expressed in microfarads. First two digits are significant figures, third digit is number of zeros to follow. Use "R" for decimal point. Examples: 1R7 means 1.7 MFD; 330 means 33 MFD; 331 means 330 MFD
- J — RATED VOLTAGE AT 85°C: B = 6, C = 8, D = 10, E = 15, G = 25, H = 30, J = 50, K = 60, L = 75, N = 100, P = 125
- B — CHARACTERISTIC: Rated -55°C to +85°C; Operable to 125°C with derating.
- CL65 — STYLE

NOTE: Military number does not designate case size. See table for specific capacitance and voltage rating.

CIRCUIT DIAGRAM





Dimensions

Case Size	L 1/ +.031 (.79) −.016 (.41)	D ±.016 (.41) (CL64)	D Max (CL65)	E ±.250 (6.35)
T1	.453 (11.51)	.188 (4.78)	.219 (5.56)	1.500 (38.10)
T2	.641 (16.28)	.281 (7.14)	.312 (7.92)	2.250 (57.15)
T3	.766 (19.46)	.375 (9.53)	.406 (10.31)	2.250 (57.15)

1/ For Style CL65, nonshrinkable sleeving shall extend .016 inch minimum, 0.62 inch maximum, beyond each end of the case; shrinkable sleeving shall lap over the ends of case.

NOTES:
1. All dimensions in inches.
2. Millimeters are in parentheses.
3. Metric equivalents (to the nearest .01 mm) are given for general information and are based upon 1 inch =25.4 mm.
4. The weld shall not be enclosed in the end seal.

MIL-C-3965
Military Style Tantalum Capacitors

MIL-C-3965/4
STYLES CL64 & CL65

Type designation 1/	Rated (+85°C)	Voltage Derated (+125°C)	Surge (+85°C)	Capacitance 2/	Cap. tolerance	DC leakage (max.) +25°C	DC leakage (max.) +85°C & +125°C	Power factor (max.)	Impedance (max.)	Capacitance change -55°C	Capacitance change +85°C	Capacitance change +125°C	Case size
	volts, dc	volts, dc	volts, dc	uf		ua	ua	percent	ohms	percent	percent	percent	
CL6-BB300-PE	6	4	6.9	30.0	J, K, M,	1	2	9.1	100	-40	+10.5	+12	T1
CL6-BB680-PE	6	4	6.9	68.0*	J, K, M	1	2	20.0	60	-40	+14	+16	T1
CL6-BB141-PE	6	4	6.9	140.0	J, K, M	1	3	20.8	40	-40	+14	+16	T2
CL6-BB271-PE	6	4	6.9	270.0*	J, K, M	1	7	63.3	25	-44	+17.5	+20	T2
CL6-BB331-PE	6	4	6.9	330.0	J, K, M	2	8	44.4	20	-44	+14	+16	T3
CL6-BB561-PE	6	4	6.9	560.0*	J, K, M	2	13	78.8	25	-64	+17.5	+20	T3
CL6-BC250-PE	8	5	9.2	25.0	J, K, M	1	2	7.6	100	-40	+10.5	+12	T1
CL6-BC560-PE	8	5	9.2	56.0*	J, K, M	1	2	16.8	59	-40	+14	+16	T1
CL6-BC221-PE	8	5	9.2	220.0*	J, K, M	1	7	55.3	30	-44	+17.5	+20	T2
CL6-BC431-PE	8	5	9.2	430.0*	J, K, M	2	14	67.5	25	-64	+17.5	+20	T3
CL6-BD200-PE	10	7	11.5	20.0	J, K, M	1	2	6.1	175	-32	+10.5	+12	T1
CL6-BD470-PE	10	7	11.5	47.0*	J, K, M	1	2	17.8	100	-36	+14	+16	T1
CL6-BD101-PE	10	7	11.5	100.0	J, K, M	1	4	15.0	60	-36	+14	+16	T2
CL6-BD181-PE	10	7	11.5	180.0*	J, K, M	1	7	47.8	40	-36	+14	+16	T2
CL6-BD251-PE	10	7	11.5	250.0	J, K, M	2	10	35.4	30	-40	+14	+16	T3
CL6-BD391-PE	10	7	11.5	390.0*	J, K, M	2	16	65.9	25	-64	+17.5	+20	T3
CL6-BE150-PE	15	10	17.2	15.0	J, K, M	1	2	5.7	155	-24	+10.5	+12	T1
CL6-BE330-PE	15	10	17.2	33.0*	J, K, M	1	2	12.4	90	-28	+14	+16	T1
CL6-BE700-PE	15	10	17.2	70.0	J, K, M	1	4	13.0	75	-28	+14	+16	T2
CL6-BE121-PE	15	10	17.2	120.0*	J, K, M	1	7	34.5	50	-28	+17.5	+20	T2
CL6-BE171-PE	15	10	17.2	170.0	J, K, M	2	10	24.6	35	-32	+14	+16	T3
CL6-BE271-PE	15	10	17.2	270.0*	J, K, M	2	16	52.0	30	-56	+17.5	+20	T3
CL6-BG100-PE	25	15	28.8	10.0	J, K, M	1	2	4.6	220	-16	+8	+9	T1
CL6-BG220-PE	25	15	28.8	22.0*	J, K, M	1	2	8.3	140	-20	+10.5	+12	T1
CL6-BG101-PE	25	15	28.8	100.0*	J, K, M	1	10	30.0	50	-28	+13	+15	T2
CL6-BG181-PE	25	15	28.8	180.0*	J, K, M	2	18	47.7	32	-48	+13	+15	T3
CL6-BH080-PE	30	20	34.5	8.0	J, K, M	1	2	4.5	275	-16	+8	+12	T1
CL6-BH150-PE	30	20	34.5	15.0*	J, K, M	1	2	9.1	175	-20	+10.5	+12	T1
CL6-BH400-PE	30	20	34.5	40.0	J, K, M	1	5	12.1	65	-24	+10.5	+12	T2
CL6-BH680-PE	30	20	34.5	68.0*	J, K, M	1	8	29.6	60	-24	+13	+15	T2
CL6-BH101-PE	30	20	34.5	100.0	J, K, M	2	12	18.6	40	-28	+10.5	+12	T3
CL6-BH151-PE	30	20	34.5	150.0*	J, K, M	2	18	41.5	35	-48	+13	+15	T3
CL6-BJ050-PE	50	30	57.5	5.0	J, K, M	1	2	3.4	400	-16	+5	+6	T1
CL6-BJ100-PE	50	30	57.5	10.0*	J, K, M	1	2	6.0	250	-24	+8	+9	T1
CL6-BJ250-PE	50	30	57.5	25.0	J, K, M	1	5	11.1	95	-20	+10.5	+12	T2
CL6-BJ470-PE	50	30	57.5	47.0*	J, K, M	1	9	20.9	70	-28	+13	+15	T2
CL6-BJ600-PE	50	30	57.5	60.0	J, K, M	2	12	13.5	45	-16	+10.5	+12	T3
CL6-BJ820-PE	50	30	57.5	82.0*	J, K, M	2	16	24.2	45	-32	+13	+15	T3
CL6-BK040-PE	60	40	69.0	4.0	J, K, M	1	2	3.0	550	-16	+5	+6	T1
CL6-BK8R2-PE	60	40	69.0	8.2*	J, K, M	1	2	5.0	275	-24	+8	+9	T1
CL6-BK200-PE	60	40	69.0	20.0	J, K, M	1	5	7.6	105	-16	+10.5	+12	T2
CL6-BK390-PE	60	40	69.0	39.0*	J, K, M	1	9	20.3	90	-28	+10.5	+12	T2
CL6-BK500-PE	60	40	69.0	50.0	J, K, M	2	12	15.1	50	-16	+10.5	+12	T3
CL6-BK680-PE	60	40	69.0	68.0*	J, K, M	2	16	29.3	50	-32	+10.5	+12	T3
CL6-BL3R5-PE	75	50	86.2	3.5	J, K, M	1	2	2.5	650	-16	+5	+6	T1
CL6-BL6R8-PE	75	50	86.2	6.8*	J, K, M	1	2	4.1	300	-20	+8	+9	T1
CL6-BL150-PE	75	50	86.2	15.0	J, K, M	1	5	7.5	150	-16	+8	+9	T2
CL6-BL330-PE	75	50	86.2	33.0*	J, K, M	1	10	17.2	90	-24	+10.5	+15	T2
CL6-BL400-PE	75	50	86.2	40.0	J, K, M	2	12	15.0	60	-16	+10.5	+12	T3
CL6-BL560-PE	75	50	86.2	56.0*	J, K, M	2	17	24.9	60	-28	+10.5	+15	T3
CL6-BN2R5-PE	100	65	115.0	2.5	J, K, M	1	2	1.9	950	-16	+7	+8	T1
CL6-BN4R7-PE	100	65	115.0	4.7*	J, K, M	1	2	3.6	500	-16	+7	+8	T1
CL6-BN110-PE	100	65	115.0	11.0	J, K, M	1	4	5.0	200	-16	+7	+8	T2
CL6-BN220-PE	100	65	115.0	22.0*	J, K, M	1	9	11.7	100	-16	+7	+8	T2
CL6-BN300-PE	100	65	115.0	30.0	J, K, M	2	12	9.1	80	-16	+7	+8	T3
CL6-BN430-PE	100	65	115.0	43.0*	J, K, M	2	17	19.3	70	-20	+7	+8	T3
CL6-BP1R7-PE	125	85	144.0	1.7	J, K, M	1	2	1.9	1,250	-16	+7	+8	T1
CL6-BP3R6-PE	125	85	144.0	3.6*	J, K, M	1	2	4.1	600	-16	+7	+8	T1
CL6-BP090-PE	125	85	144.0	9.0	J, K, M	1	5	10.2	240	-16	+7	+8	T2
CL6-BP140-PE	125	85	144.0	14.0*	J, K, M	1	7	12.6	167	-16	+7	+8	T2
CL6-BP250-PE	125	85	144.0	25.0*	J, K, M	2	13	18.7	93	-16	+7	+8	T3

1/ *Complete type designation will include additional symbols to indicate style and capacitance tolerance.*
2/ *The asterick (*) indicates high-capacitance series.*

MIL-C-3965
Military Style Tantalum Capacitors

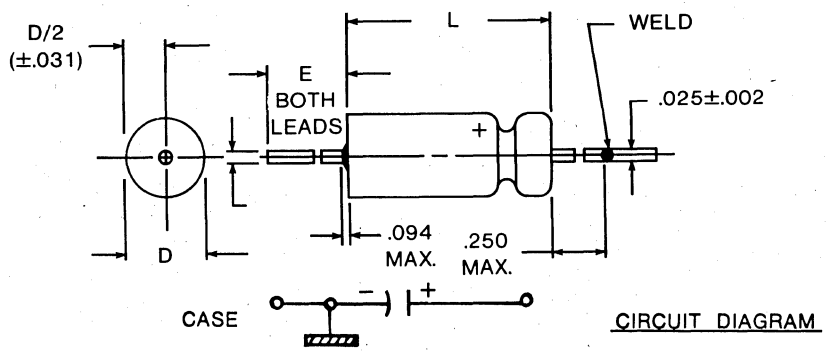
MIL-C-3965/24
STYLES CL66 & CL67

MILITARY CODING SYSTEM

CL66 B J 820 K P G

- G — GLASS TO METAL HERMETIC SEAL
- P — P = Polarized N = Non Polarized (Not available in CL66 or CL67)
- K — CAPACITANCE TOLERANCE: J = ±5% M = ±20% K = ±10%
- 820 — CAPACITANCE, NOMINAL: Expressed in microfarads. First two digits are significant figures, third digit is number of zeros to follow. Use "R" for decimal point. Examples: 1R7 means 1.7 MFD; 330 means 33 MFD; 331 means 330 MFD
- J — RATED VOLTAGE AT 85°C: B = 6, C = 8, D = 10, E = 15, G = 25, H = 30, J = 50, K = 60, L = 75, N = 100, P = 125
- B — CHARACTERISTIC: Rated -55°C to +85°C; Operable to 125°C with derating.
- CL66 — STYLE: CL66 uninsulated; CL67 insulated, fixed non solid electrolyte, sintered anode, tantalum capacitor.

NOTE: *Military number does not designate case size. See table for specific capacitance and voltage rating.*



Case Size	DIMENSIONS — INCHES (mm)			
	L [1]	D		E
	+.031(.79) −.016(.41)	±.016(.41) (CL66)	Max. (CL67)	±.250(6.35)
T1	.453(11.51)	.188(4.78)	.219(5.56)	1.500(38.10)
T2	.641(16.28)	.281(7.14)	.312(7.92)	2.250(57.15)
T3	.766(19.46)	.375(9.53)	.406(10.31)	2.250(57.15)

1/ For style CL67, nonshrinkable sleeving shall extend .016 inch minimum, .062 inch maximum, beyond each end of the case; shrinkable sleeving shall lap over the ends of the case.

MIL-C-3965/24
STYLES CL66 & CL67

Type designation 1/	Voltage Rated (+85°C)	Voltage Derated (+125°C)	Surge (+85°C)	Capacitance 2/	Cap. tolerance	DC leakage (max.) +25°C	DC leakage (max.) +85°C & +125°C	Dissipation factor (max.)	Impedance (max.)	Capacitance change -55°C	Capacitance change +85°C	Capacitance change +125°C	Case size
	volts, dc	volts, dc	volts, dc	uF		uA	uA	percent	ohms	percent	percent	percent	
CL6-BB300-PG	6	4	6.9	30.0	J, K, M,	1	2	9.1	100	-40	+10.5	+12	T1
CL6-BB680-PG	6	4	6.9	68.0*	J, K, M	1	2	20.4	60	-40	+14	+16	T1
CL6-BB141-PG	6	4	6.9	140.0	J, K, M	1	3	21.3	40	-40	+14	+16	T2
CL6-BB271-PG	6	4	6.9	270.0*	J, K, M	1	7	81.8	25	-44	+17.5	+20	T2
CL6-BB331-PG	6	4	6.9	330.0	J, K, M	2	8	49.6	20	-44	+14	+16	T3
CL6-BB561-PG	6	4	6.9	560.0*	J, K, M	2	13	128.0	25	-64	+17.5	+20	T3
CL6-BC250-PG	8	5	9.2	25.0	J, K, M	1	2	7.6	100	-40	+10.5	+12	T1
CL6-BC560-PG	8	5	9.2	56.0*	J, K, M	1	2	17.0	59	-40	+14	+16	T1
CL6-BC221-PG	8	5	9.2	220.0*	J, K, M	1	7	66.4	30	-44	+17.5	+20	T2
CL6-BC431-PG	8	5	9.2	430.0*	J, K, M	2	14	91.5	25	-64	+17.5	+20	T3
CL6-BD200-PG	10	7	11.5	20.0	J, K, M	1	2	6.1	175	-32	+10.5	+12	T1
CL6-BD470-PG	10	7	11.5	47.0*	J, K, M	1	2	18.1	100	-36	+14	+16	T1
CL6-BD101-PG	10	7	11.5	100.0	J, K, M	1	4	15.2	60	-36	+14	+16	T2
CL6-BD181-PG	10	7	11.5	180.0*	J, K, M	1	7	54.4	40	-36	+14	+16	T2
CL6-BD251-PG	10	7	11.5	250.0	J, K, M	2	10	37.8	30	-40	+14	+16	T3
CL6-BD391-PG	10	7	11.5	390.0*	J, K, M	2	16	87.6	25	-64	+17.5	+20	T3
CL6-BE150-PG	15	10	17.2	15.0	J, K, M	1	2	5.7	155	-24	+10.5	+12	T1
CL6-BE330-PG	15	10	17.2	33.0*	J, K, M	1	2	12.5	90	-28	+14	+16	T1
CL6-BE700-PG	15	10	17.2	70.0	J, K, M	1	4	13.1	75	-28	+14	+16	T2
CL6-BE121-PG	15	10	17.2	120.0*	J, K, M	1	7	36.8	50	-28	+17.5	+20	T2
CL6-BE171-PG	15	10	17.2	170.0	J, K, M	2	10	25.4	35	-32	+14	+16	T3
CL6-BE271-PG	15	10	17.2	270.0*	J, K, M	2	16	60.9	30	-56	+17.5	+20	T3
CL6-BG100-PG	25	15	28.8	10.0	J, K, M	1	2	4.6	220	-16	+8	+9	T1
CL6-BG220-PG	25	15	28.8	22.0*	J, K, M	1	2	8.3	140	-20	+10.5	+12	T1
CL6-BG101-PG	25	15	28.8	100.0*	J, K, M	1	10	31.4	50	-28	+13	+15	T2
CL6-BG181-PG	25	15	28.8	180.0*	J, K, M	2	18	54.3	32	-48	+13	+15	T3
CL6-BH080-PG	30	20	34.5	8.0	J, K, M	1	2	4.5	275	-16	+8	+12	T1
CL6-BH150-PG	30	20	34.5	15.0*	J, K, M	1	2	9.1	175	-20	+10.5	+12	T1
CL6-BH400-PG	30	20	34.5	40.0	J, K, M	1	5	12.2	65	-24	+10.5	+12	T2
CL6-BH680-PG	30	20	34.5	68.0*	J, K, M	1	8	31.0	60	-24	+13	+15	T2
CL6-BH101-PG	30	20	34.5	100.0	J, K, M	2	12	19.0	40	-28	+10.5	+12	T3
CL6-BH151-PG	30	20	34.5	150.0*	J, K, M	2	18	46.0	35	-48	+13	+15	T3
CL6-BJ050-PG	50	30	57.5	5.0	J, K, M	1	2	3.4	400	-16	+5	+6	T1
CL6-BJ100-PG	50	30	57.5	10.0*	J, K, M	1	2	6.0	250	-24	+8	+9	T1
CL6-BJ250-PG	50	30	57.5	25.0	J, K, M	1	5	11.2	95	-20	+10.5	+12	T2
CL6-BJ470-PG	50	30	57.5	47.0*	J, K, M	1	9	21.4	70	-28	+13	+15	T2
CL6-BJ600-PG	50	30	57.5	60.0	J, K, M	2	12	13.6	45	-16	+10.5	+12	T3
CL6-BJ820-PG	50	30	57.5	82.0*	J, K, M	2	16	24.9	45	-32	+13	+15	T3
CL6-BK040-PG	60	40	69.0	4.0	J, K, M	1	2	3.0	550	-16	+5	+6	T1
CL6-BK8R2-PG	60	40	69.0	8.2*	J, K, M	1	2	5.0	275	-24	+8	+9	T1
CL6-BK200-PG	60	40	69.0	20.0	J, K, M	1	5	7.6	105	-16	+10.5	+12	T2
CL6-BK390-PG	60	40	69.0	39.0*	J, K, M	1	9	20.7	90	-28	+10.5	+12	T2
CL6-BK500-PG	60	40	69.0	50.0	J, K, M	2	12	15.3	50	-16	+10.5	+12	T3
CL6-BK680-PG	60	40	69.0	68.0*	J, K, M	2	16	20.7	50	-32	+10.5	+12	T3
CL6-BL3R5-PG	75	50	86.2	3.5	J, K, M	1	2	2.5	650	-16	+5	+6	T1
CL6-BL6R8-PG	75	50	86.2	6.8*	J, K, M	1	2	4.1	300	-20	+8	+9	T1
CL6-BL150-PG	75	50	86.2	15.0	J, K, M	1	5	7.5	150	-16	+8	+9	T2
CL6-BL330-PG	75	50	86.2	33.0*	J, K, M	1	10	17.5	90	-24	+10.5	+15	T2
CL6-BL400-PG	75	50	86.2	40.0	J, K, M	2	12	15.2	60	-16	+10.5	+12	T3
CL6-BL560-PG	75	50	86.2	56.0*	J, K, M	2	17	26.0	60	-28	+10.5	+15	T3
CL6-BN2R5-PG	100	65	115.0	2.5	J, K, M	1	2	5.0	950	-16	+7	+8	T1
CL6-BN4R7-PG	100	65	115.0	4.7*	J, K, M	1	2	3.6	500	-16	+7	+8	T1
CL6-BN110-PG	100	65	115.0	11.0	J, K, M	1	4	5.0	200	-16	+7	+8	T2
CL6-BN220-PG	100	65	115.0	22.0*	J, K, M	1	9	11.8	100	-16	+7	+8	T2
CL6-BN300-PG	100	65	115.0	30.0	J, K, M	2	12	9.1	80	-16	+7	+8	T3
CL6-BN430-PG	100	65	115.0	43.0*	J, K, M	2	17	19.7	70	-20	+7	+8	T3
CL6-BP1R7-PG	125	85	144.0	1.7	J, K, M	1	2	7.0	1,250	-16	+7	+8	T1
CL6-BP3R6-PG	125	85	144.0	3.6*	J, K, M	1	2	4.1	600	-16	+7	+8	T1
CL6-BP090-PG	125	85	144.0	9.0	J, K, M	1	5	10.2	240	-16	+7	+8	T2
CL6-BP140-PG	125	85	144.0	14.0*	J, K, M	1	7	12.7	167	-16	+7	+8	T2
CL6-BP250-PG	125	85	144.0	25.0*	J, K, M	2	13	19.0	93	-16	+7	+8	T3

1/ Complete type designation will include additional symbols to indicate style and capacitance tolerance.
2/ The asterick (*) indicates high-capacitance series.

MIL-C-39006

Military Style Tantalum Capacitors

MIL-C-39006

DESIGN AND CONSTRUCTION

Each fixed capacitor consists of a sintered tantalum anode isolated by an electrolytically formed oxide dielectric, and a thixotropic non solid electrolyte cathode, enclosed in a tubular fine grade silver metal case and integrally sealed.

CASE INSULATION

Insulating sleeving is of nonfungus nutrient material and will not shrink, creep, or soften so as to expose the cylindrical portion of the case following any of the tests described herein. The dielectric strength of the insulating material shall not be less than 2000 volts and the insulation resistance shall not be less than 100 megohms.

LEADS

Leads are of solid conductor type of length and diameter described in tables. The anode lead is of N5 type to MIL-STD-1276, and cathode lead is of C5 copper.

Each lead shall withstand 4 bends, and one 3 pound lead pull without loosening, breaking or showing other permanent damage. One bend will consist of rotating the capacitor body 90° from vertical to horizontal and return while the lead is firmly held within .313 inches of the body.

DC LEAKAGE

DCL shall be measured following a rated voltage electrification period not exceeding 5 minutes.

CAPACITANCE

Capacitance shall be determined in accordance with Method 305 of MIL-STD-202 at 120 ±5Hz. The magnitude of the A.C. voltage shall not exceed 1.0V RMS and the bias shall not exceed 2.2V DC.

DISSIPATION FACTOR

Shall be determined by a polarized bridge.

IMPEDANCE

The capacitor shall be conditioned at -55°C $^{+0°}_{-3°}$C for a period of not less than 30 minutes or until stable measurements can be obtained. The impedance shall then be measured directly or determined from measurements obtained on a bridge. Measurements shall be made at 120 ±5Hz. Measurement accuracy shall be within ±5 percent.

SHOCK, MEDIUM IMPACT

Capacitors shall be tested in accordance with method 213, condition of MIL-STD-202. The following details and exceptions shall apply.

(a) Special mounting means: Capacitors with axial-wire lead terminals shall be rigidly mounted on a mounting fixture to the body with their terminals secured to rigidly supported stud-terminals, so spaced that the length of each terminal from the capacitor is approximately .375 inch when measured from the edge of the supporting stud-terminal. Capacitor terminals shall be within 30 degrees of being parallel. When securing capacitor terminals, care shall be taken to avoid pinching the capacitor terminals.

(b) Test-condition letter — I (Sawtooth)

(c) Measurements and electrical loading during shock: DC rated voltage shall be applied to the capacitor during test. Observations shall be made to determine intermittent contact or arcing or open- or short-circuiting. Detecting equipment shall be sufficiently sensitive to detect any interruption of 0.5 ms or greater duration.

When capacitors are tested as specified, there shall be no intermittent contacts of 0.5 millisecond (ms) or greater duration, or arcing or any other indication of breakdown, nor shall there by any open- or short-circuiting, mechanical damage, or leakage of electrolyte.

VIBRATION, HIGH FREQUENCY

Capacitors shall be tested in accordance with method 204 of MIL-STD-202. The following details and exceptions shall apply:

(a) Mounting of specimens: The body of the capacitor shall be rigidly mounted to the vibration-test apparatus.

(b) Test-condition letter — B (15G). The motion shall be applied for a total of 8 hours (4 hours in each of two mutually perpendicular directions, one parallel to and the other perpendicular to the cylindrical axis).

(c) Measurements: During the last 30 minutes of vibration in each direction, an electrical measurement shall be made on the capacitors to determine intermittent contacts or open- or short-circuiting. Detecting equipment shall be sufficiently sensitive to detect any interruption of 0.5 ms or greater duration.

(d) Capacitors must also meet the end point electrical requirements specified, and when devices are tested as specified, there shall be no intermittent contacts of 0.5 ms or greater duration, open- or short-circuiting, mechanical damage, or leakage of electrolyte.

SALT SPRAY (Corrosion)

Capacitors shall be tested in accordance with method 101 of MIL-STD-202. The following details and exception shall apply.

(a) Applicable salt solution — 5 percent.

(b) Test-condition letter — B (48 hours).

(c) Measurements after test — Not applicable.

When capacitors are tested as specified, there shall be no harmful corrosion, and at least 90 percent of any exposed metal surface of the capacitor shall be protected by the finish. There shall be no unwrapping of, or mechanical damage to the insulation sleeving, when applicable. Marking shall remain legible.

NOTE: Harmful corrosion shall be construed as being any type of corrosion which in any way interferes with the mechanical or electrical performance of the capacitor.

THERMAL SHOCK

THERMAL SHOCK: Capacitors shall be tested in accordance with method 107 of MIL-STD-202. The following details and exception shall apply:

(a) Conditioning prior to first cycle — 15 minutes at room ambient conditions.

(b) Test condition letter — A, except 125°C $^{+4°C}_{-0°C}$ and 30 cycles.

(c) Measurements before and after cycling — Not applicable.

SURGE VOLTAGE

Capacitors shall be subjected to 1,000 cycles of the applicable surge voltage. The ambient temperature during cycling shall be 85°C. Each cycle shall consist of a 30-second surge voltage application followed by a 5½-minute discharge period. Voltage application shall be made through a resistance of 1,000 ±100 ohms including the source in series with the capacitor and the voltage source. Each surge voltage cycle shall be performed in such a manner that the capacitor is discharged through the 1,000-ohm resistor at the end of the 30-second application. The test shall be terminated on the discharge portion of the cycle. During the test, an electrical measurement shall be made to detect intermittent contacts and open- and short-circuiting. After the test, capacitors shall be visually examined for mechanical damage and leakage of electrolyte.

When capacitors are tested as specified, there shall be no intermittent contacts, open- or short-circuiting, mechanical damage, or leakage of electrolyte.

MOISTURE RESISTANCE

Capacitors shall be tested in accordance with method 106 of MIL-STD-202. The following details and exceptions shall apply:

(a) Mounting — Except during examination and measurements, capacitors shall be securely fastened by normal mounting means.
(b) Polarization and loading voltages — 6 volts dc.
(c) Step 7b — Vibration is not required during step 7b.
(d) Final measurements — After the final cycle and within 2 to 6 hours after removal of the capacitors from the humidity chamber, the dc leakage, capacitance, and power factor shall be measured as specified at the initial inspection conditions.

When tested as specified, capacitors shall meet the following requirements:

DC leakage — Shall not exceed 125 percent of the applicable value specified.

Capacitance — Shall change not more than ±8% from the initial measured value.

Power factor — Shall not exceed 115 percent of the applicable value specified.

Visual examination — There shall be no evidence of harmful corrosion, mechanical damage, obliteration of marking, or leakage of electrolyte.

STABILITY AT LOW AND HIGH TEMPERATURES

The measurements specified shall be made in the order shown. The capacitors shall be brought to thermal stability. Thermal stability will have been reached when no further change in capacitance is observed between two successive measurements taken at 15-minute intervals.

When tested as specified, capacitors shall meet the following requirements:

Step 1 (+25°C):
DC leakage — shall not exceed the applicable value specified.
Capacitance — Shall be within the applicable tolerance specified.
Power factor — Shall not exceed the applicable value specified.

Step 2 (-55°C):
Impedance — Shall not exceed the applicable value specified.
Capacitance — Shall change not more than the percent specified from the step 1 measured value.

Step 3 (+25°C):
DC leakage — shall not exceed the applicable value specified.
Capacitance — Shall change not more than ±5% from the step 1 measured value.
Power factor — Shall not exceed the applicable value specified.

Step 4 (+85°C):
DC leakage — Shall not exceed the applicable value specified.
Capacitance — Shall change not more than the percent specified from the step 1 measured value.
Power factor — Shall not exceed the applicable value specified.

Step 5 (+125°C):
DC leakage — Shall not exceed the applicable value specified.
Capacitance — Shall change not more than the percent specified from the step 1 measured value.
Power factor — Shall not exceed the applicable value specified.

Step 6 (+25°C):
DC leakage — Shall not exceed the applicable value specified.
Capacitance — Shall change not more than ±5% from the step 1 measured value.
Power factor — Shall not exceed the applicable value specified.

LIFE TEST

Capacitors shall be tested in accordance with method 108 of MIL-STD-202. The following details and exceptions shall apply.

(a) Distance of temperature measurements from specimens, in inches — Not applicable.
(b) Method of mounting — Capacitors shall be mounted by their terminals.
(c) Test temperature and tolerance — 85° $^{+3°C}_{-0°}$ C.
(d) Operating conditions — DC rated voltage shall be applied gradually (not to exceed 5 minutes either by a slow build-up of the voltage or through a resistor which shall be shorted out within 5 minutes). Voltage shall be applied continuously except for measurement periods. The impedance of the voltage source, as seen from the terminals of each capacitor, shall not exceed 10 ohms. Storage batteries, or an electronic power supply, capable of supplying at least 100 milliampers when a capacitor is shorted out shall be used. For nonpolarized capacitors, the voltage shall be reversed every 125 ± 10 hours.
(e) Test-condition letter — F ($^{+72}_{-0}$ hours).
(f) Measurements during exposure (at 85°C) — DC leakage shall be measured as specified at 0; 240 $^{+48}_{-0}$; 1000 $^{+48}_{-0}$; and 2,000 $^{+72}_{-0}$ hours.
(g) Measurements after exposure — Capacitors shall be returned to the inspection conditions specified and dc leakage, capacitance and power factor shall be measured as specified.
(h) Examination after test — Capacitors shall be visually examined for damage, obliteration of marking, and leakage of electrolyte.

AFTER 2000 HOURS

DC leakage (at 85°C and 25°C) — Shall not exceed the applicable value specified.
Capacitance — Shall change not more than ±10% from the initial measured value.
Dissipation factor — Shall not exceed the applicable value specified.
Visual examination — There shall be no damage, obliteration of marking, or leakage of electrolyte.

AFTER 10,000 HOURS

Except as specified in the following, capacitors shall be tested as specified above.

(a) Test duration shall be 10,000 $^{+96}_{-0}$ hours.
(b) DC leakage shall be measured during exposure at 0; 240 $^{+48}_{-0}$; 1,000 $^{+48}_{-0}$; 2,000 $^{+72}_{-0}$; and every 2,000 $^{+72}_{-0}$ hours thereafter until 10,000 $^{+96}_{-0}$ hours have elapsed. In addition, insulated capacitors shall be tested for dielectric withstanding voltage and insulation resistance.

When tested as specified above, capacitors shall meet the following requirements:

DC leakage (at 85°C) — Shall not exceed 125 percent of the applicable value specified.
DC leakage (at 25°C) — Shall not exceed the applicable value specified.
Capacitance — Shall change not more than +10. -60% from the initial measured value.
Dissipation factor — Shall not exceed 200% of the applicable value specified.
Dielectric withstanding voltage and insulation resistance (insulated capacitors only) — Shall meet the requirements specified.
Visual examination — There shall be no damage, obliteration of marking, or leakage of electrolyte.

MIL-C-39006
Military Style Tantalum Capacitors

MIL-C-39006

For Quality Conformance capacitors shall be tested as specified and the following requirements apply:

DC leakage (at 85°C and 25°C) — Shall not exceed the applicable value specified.

Capacitance — Shall change not more than ±10 percent from the initial measured value.

Dissipation factor — Shall not exceed the applicable value specified.

Visual examination — There shall be no damage, obliteration of marking, or leakage of electrolyte.

QUALITY CONFORMANCE INSPECTION

For quality conformance inspection capacitors shall be Group B tested as shown in the table below, on an inspection lot sampling basis: (Group C environmentals are also a requirement.)

Test	Requirement paragraph	Test paragraph	Sample selection (all FR levels)
Subgroup 1			
Stability at low and high temperatures	3.22	4.7.18	1.5% AQL 10.0% LQ
			No. of sample units to be inspected (all FR levels)
Subgroup 2			
Thermal shock	3.13	4.7.9	20 3/
Life (10,000-hour @ 85°C) 1/	3.24.2	4.7.20.2	10
Life (10,000-hour @ 125°C) 1/	3.27.1	4.7.23.1	10 2/

1/ Only unit hours generated at 85°C shall be used for FR level computation.
2/ One failure (maximum) permitted per 80,000 unit hours.
3/ Twenty samples minimum; reject criteria shall be 0.65% AQL and 11.0% LQ."

NOTE: Parts undergoing above referenced testing will not be shipped as standard product.

MIL-C-39006/18
STYLE CLR10

CAPACITORS, FIXED, ELECTROLYTIC (NONSOLID ELECTROLYTE), TANTALUM, (POLARIZED, SINTERED SLUG), 85°C (VOLTAGE DERATED TO 125 C), ESTABLISHED RELIABILITY.

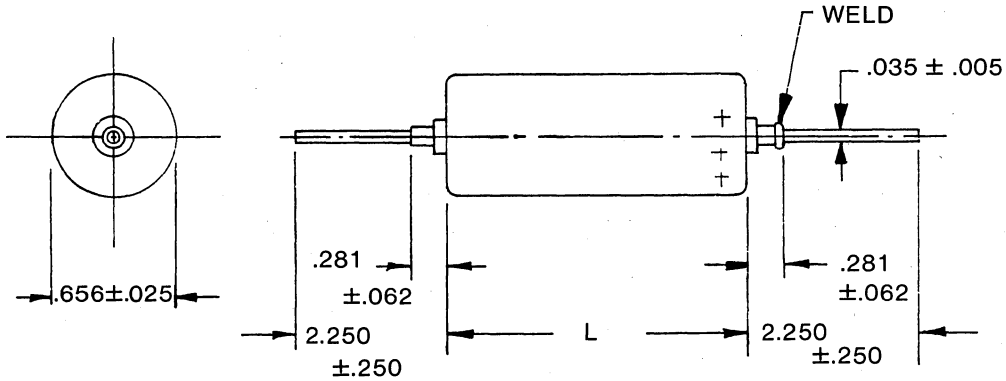
MILITARY CODING SYSTEM

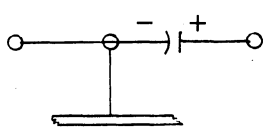
M39006 / 18 - 1000

- DASH NUMBER FROM TABLE. For specific value of Capacitance, Capacitance Tolerance, Voltage, Fuse Size, and Failure Rate Level the table must be consulted.
- DETAIL SHEET FOR APPLICABLE STYLE /18 is CLR10.
- Abbreviated form of MIL-C-39006. All devices procured to this specification will show this number as minimum marking.

Capacitor characteristics

RATED VOLTAGE (85°C)	CAP.	DC LEAKAGE (Max.)			DISSI-PATION FACTOR (max.)	DERATED VOLTAGE (125°C)	SURGE VOLTAGE (85°C)	IMPED-ANCE (max.)	DIMENSION L ±.062 (1.57)	PART NO. M39006/18 FAILURE RATE LEVEL (%/1,000 Hr.)				
		25°C	85°C	125°C						L(2.0)	M(1.0)	P(0.1)	R(0.01)	S(0.001)
volts, dc	uF	uA	uA	uA	percent	volts, dc	volts, dc	ohms	inches (mm)					
8	70.0	6	30	48	47	7	9.2	60	.438 (11.13)	1000	1018	1036	1054	1072
8	140.0	10	50	80	47	7	9.2	30	.562 (14.27)	1001	1019	1037	1055	1073
10	50.0	5	25	40	35	9	11.5	75	.438 (11.13)	1002	1020	1038	1056	1074
10	100.0	9	45	72	35	9	11.5	40	.562 (14.27)	1003	1021	1039	1057	1075
20	28.0	6	30	48	21	18	23.0	85	.438 (11.13)	1004	1022	1040	1058	1076
20	56.0	10	50	80	21	18	23.0	45	.562 (14.27)	1005	1023	1041	1059	1077
30	20.0	7	35	56	15	26	34.5	125	.438 (11.13)	1006	1024	1042	1060	1078
30	40.0	12	60	96	15	26	34.5	75	.562 (14.27)	1007	1025	1043	1061	1079
60	12.0	7	35	56	9.1	52	69.0	180	.438 (11.13)	1008	1026	1044	1062	1080
60	25.0	12	60	96	9.6	52	69.0	90	.562 (14.27)	1009	1027	1045	1063	1081
90	8.0	7	35	56	6.1	78	103.0	250	.438 (11.13)	1010	1028	1046	1064	1082
90	16.0	12	60	96	6.1	78	103.0	125	.562 (14.27)	1011	1029	1047	1065	1083
180	4.0	7	35	56	6.1	155	207.0	500	.719 (18.26)	1012	1030	1048	1066	1084
180	8.0	12	60	96	6.1	155	207.0	250	.938 (23.83)	1013	1031	1049	1067	1085
270	2.5	7	35	56	5.7	235	310.0	750	1.031 (26.19)	1014	1032	1050	1068	1086
270	5.0	11	55	88	5.7	235	310.0	375	1,375 (34.93)	1015	1033	1051	1069	1087
360	2.0	7	35	56	6.1	310	414.0	1000	1.312 (33.32)	1016	1034	1052	1070	1088
360	4.0	12	60	96	6.1	310	414.0	500	1.781 (45.24)	1017	1035	1053	1071	1089





CASE
CIRCUIT DIAGRAM

INCHES	MM
.005	.13
.025	.64
.035	.89
.062	1.57
.250	6.35
.281	7.14
.656	16.66
2.250	57.15

MIL-C-39006

Military Style Tantalum Capacitors

MIL-C-39006/19
STYLE CLR14

CAPACITORS, FIXED, ELECTROLYTIC (NONSOLID ELECTROLYTE), TANTALUM, (POLARIZED, SINTERED SLUG), 85°C (VOLTAGE DERATED TO 125°C), ESTABLISHED RELIABILITY.

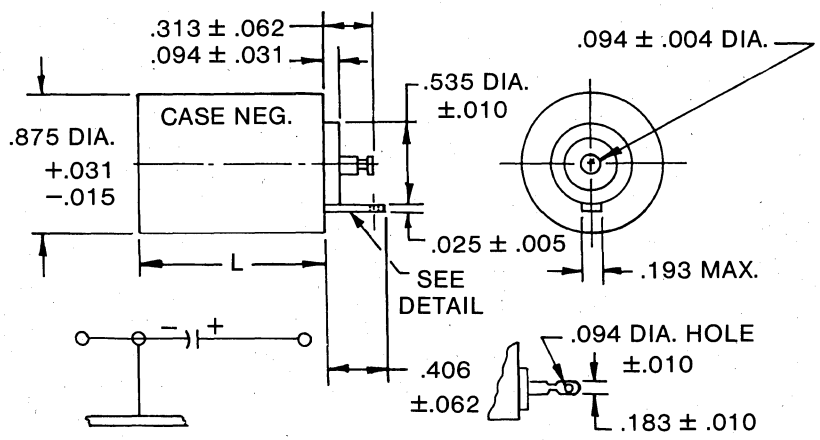
MILITARY CODING SYSTEM

M39006 / 19 - 1000

- DASH NUMBER FROM TABLE. For specific value of Capacitance, Capacitance Tolerance, Voltage Fuse Size, and Failure Rate Level the table must be consulted.
- DETAIL SHEET FOR APPLICABLE STYLE /19 is CLR14.
- Abbreviated form of MIL-C-39006. All devices procured to this specification will show this number as minimum marking.

Capacitor characteristics

RATED VOLTAGE (85°C)	CAP.	DC LEAKAGE (Max.)			DISSI-PATION FACTOR (max.)	DERATED VOLTAGE (125°C)	SURGE VOLTAGE (85°C)	IMPED-ANCE (max.)	DIMENSION L ±.062 (1.57)	PART NO. M39006/19 FAILURE RATE LEVEL (%/1,000 Hr.)				
		25°C	85°C	125°C						L(2.0)	M(1.0)	P(0.1)	R(0.01)	S(0.001)
volts, dc	uF	uA	uA	uA	percent	volts, dc	volts, dc	ohms	inches (mm)					
20	100.0	10	50	80	21.0	18	23	30	0.540 (13.72)	1000	1020	1040	1060	1080
20	200.0	16	80	128	36.0	18	23	20	0.732 (18.59)	1001	1021	1041	1061	1081
30	75.0	11	55	88	15.0	26	34.5	45	0.540 (13.72)	1002	1022	1042	1062	1082
30	150.0	13	90	104	29.0	26	34.5	30	0.732 (18.59)	1003	1023	1043	1063	1083
60	40.0	12	60	96	8.2	52	69	65	0.540 (13.72)	1004	1024	1044	1064	1084
60	80.0	19	95	152	16.0	52	69	35	0.782 (18.59)	1005	1025	1045	1065	1085
90	25.0	11	55	88	5.1	78	103	90	0.540 (13.72)	1006	1026	1046	1066	1086
90	50.0	18	90	144	10.0	78	103	45	0.732 (18.59)	1007	1027	1047	1067	1087
180	12.0	11	55	88	5.1	155	207	180	0.920 (23.37)	1008	1028	1048	1068	1088
180	25.0	18	90	144	10.0	155	207	90	1.300 (33.02)	1009	1029	1049	1069	1089
270	8.0	11	55	88	5.1	235	310	270	1.270 (32.36)	1010	1030	1050	1070	1090
270	16.0	18	90	144	10.0	235	310	135	1.865 (47.37)	1011	1031	1051	1071	1091
360	6.0	11	55	88	5.0	310	414	360	1.635 (41.53)	1012	1032	1052	1072	1092
360	12.0	18	90	144	10.0	310	414	180	2.420 (61.47)	1013	1033	1053	1073	1093
450	5.0	11	55	88	4.9	390	518	450	2.000 (50.80)	1014	1034	1054	1074	1094
450	10.0	18	90	144	9.8	390	518	225	2.980 (75.69)	1015	1035	1055	1075	1095
540	4.0	11	55	88	5.1	470	621	540	2.365 (60.07)	1016	1036	1056	1076	1096
540	8.0	18	90	144	10.0	470	621	270	3.532 (89.71)	1017	1037	1057	1077	1097
630	3.5	11	55	88	5.0	545	724	630	2.720 (69.09)	1018	1038	1058	1078	1098
630	7.0	18	90	144	10.0	545	724	315	4.062(103.17)	1019	1039	1059	1079	1099



CASE CIRCUIT DIAGRAM

DETAIL OF SOLDER-LUG TERMINAL

INCHES	MM
.004	.10
.005	.13
.010	.25
.015	.38
.025	.64
.031	.79
.062	1.57
.094	2.39
.183	4.65
.193	4.90
.313	7.95
.406	10.31
.535	13.59
.875	22.23

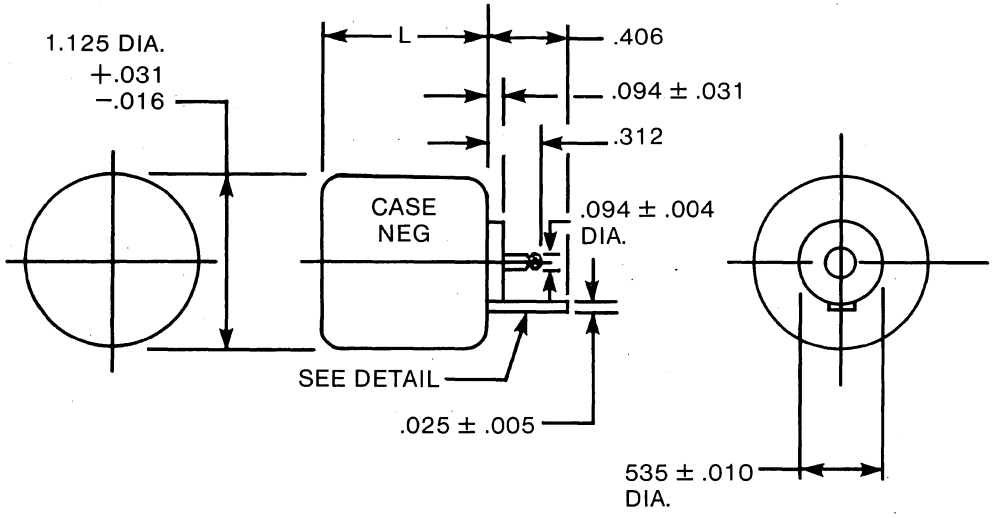
MIL-C-39006/20
STYLE CLR17

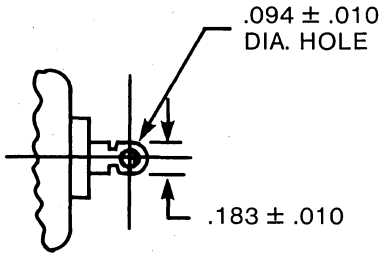
CAPACITORS, FIXED, ELECTROLYTIC (NONSOLID ELECTROLYTE), TANTALUM, (POLARIZED, SINTERED SLUG), 85°C (VOLTAGE DERATED TO 125°C), ESTABLISHED RELIABILITY.

MILITARY CODING SYSTEM

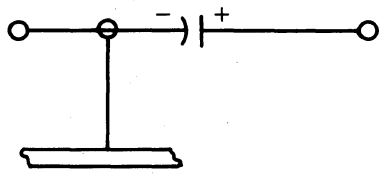
M39006 / 20 - 1000

- DASH NUMBER FROM TABLE. For specific value of Capacitance, Capacitance Tolerance, Voltage, Fuse Size, and Failure Rate Level the table must be consulted.
- DETAIL SHEET FOR APPLICABLE STYLE /20 is CLR17.
- Abbreviated form of MIL-C-39006. All devices procured to this specification will show this number as minimum marking.





DETAIL OF
SOLDER-LUG TERMINAL



CASE
CIRCUIT DIAGRAM

INCHES	MM
.004	.10
.005	.13
.010	.25
.016	.41
.025	.64
.031	.79
.094	2.39
.183	4.65
.312	7.92
.406	10.31
.535	13.59
1.125	28.58

MIL-C-39006

Military Style Tantalum Capacitors

Capacitor characteristics.

Rated voltage (+85°C)	Cap.	Cap. tolerance	DC leakage (max)			Dissipation factor (max)	Derated voltage (+125°C)	Surge voltage (+85°C)	Impedance (max)	Cap. change (-55°C)	Dimension L ±.062 (1.57)	Part No. M39006/20- (Failure rate level (% 1,000 hr)				
			+25°C	+85°C	+125°C							L (2.0)	M (1.0)	P (0.1)	R(0.01)	S(0.001)
volts, dc	uF	%	uA	uA	uA	%	volts, dc	volts, dc	ohms	%	inches (mm)					
30	370	±20	18	125	180	39	26	34.5	15	-65	.600 (15.24)	1000	1050	1100	1150	1200
30	370	+50,-15	18	125	180	39	26	34.5	15	-65	.600 (15.24)	1001	1051	1101	1151	1201
30	650	±20	21	145	210	60	26	34.5	15	-85	1.100 (27.94)	1002	1052	1102	1152	1202
30	650	+50,-15	21	145	210	60	26	34.5	15	-85	1.100 (27.94)	1003	1053	1103	1153	1203
30	1300	±20	27	190	270	83	26	34.5	10	-85	1.100 (27.94)	1004	1054	1104	1154	1204
30	1300	+50,-15	27	190	270	83	26	34.5	10	-85	1.100 (27.94)	1005	1055	1105	1155	1205
60	200	±20	19	135	190	22	52	69.0	30	-50	.600 (15.24)	1006	1056	1106	1156	1206
60	200	+50,-15	19	135	190	22	52	69.0	30	-50	.600 (15.24)	1007	1057	1107	1157	1207
60	350	±20	22	155	220	37	52	69.0	25	-70	1.100 (27.94)	1008	1058	1108	1158	1208
60	350	+50,-15	22	155	220	37	52	69.0	25	-70	1.100 (27.94)	1009	1059	1109	1159	1209
60	700	±20	29	200	290	62	52	69.0	15	-70	1.100 (27.94)	1010	1060	1110	1160	1210
60	700	+50,-15	29	200	290	62	52	69.0	15	-70	1.100 (27.94)	1011	1061	1111	1161	1211
90	120	±20	19	135	190	13	78	103.0	40	-40	.600 (15.94)	1012	1062	1112	1162	1212
90	120	+50,-15	19	135	190	13	78	103.0	40	-40	.600 (15.94)	1013	1063	1113	1163	1213
90	220	±20	21	145	210	24	78	103.0	30	-60	1.100 (27.94)	1014	1064	1114	1164	1214
90	220	+50,-15	21	145	210	24	78	103.0	30	-60	1.100 (27.94)	1015	1065	1115	1165	1215
90	450	±20	29	195	290	45	78	103.0	35	-60	1.100 (27.94)	1016	1066	1116	1166	1216
90	450	+50,-15	29	195	290	45	78	103.0	35	-60	1.100 (27.94)	1017	1067	1117	1167	1217
180	42	±20	17	120	170	16	155	207.0	75	-40	.976 (24.79)	1018	1068	1118	1168	1218
180	42	+50,-15	17	120	170	16	155	207.0	75	-40	.976 (24.79)	1019	1069	1119	1169	1219
180	60	±20	19	135	190	13	155	207.0	60	-40	.976 (24.79)	1020	1070	1120	1170	1220
180	60	+50,-15	19	135	190	13	155	207.0	60	-40	.976 (24.79)	1021	1071	1121	1171	1221
180	110	±20	21	145	210	24	155	207.0	60	-60	1.938 (49.23)	1022	1072	1122	1172	1222
180	110	+50, -15	21	145	210	24	155	207.0	60	-60	1.938 (49.23)	1023	1073	1123	1173	1223
180	230	±20	29	200	290	46	155	207.0	50	-60	1.938 (49.23)	1024	1074	1124	1174	1224
180	230	+50,-15	29	200	290	46	155	207.0	50	-60	1.938 (49.23)	1025	1075	1125	1175	1225
270	28	±20	19	120	190	16	235	310.0	80	-40	1.350 (34.29)	1026	1076	1126	1176	1226
270	28	+50,-15	19	120	190	16	235	310.0	80	-40	1.350 (34.29)	1027	1077	1127	1177	1227
270	40	±20	19	135	190	22	235	310.0	100	-40	1.350 (34.29)	1028	1078	1128	1178	1228
270	40	+50,-15	19	135	190	22	235	310.0	100	-40	1.350 (34.29)	1029	1079	1129	1179	1229
270	75	±20	21	145	210	24	235	310.0	90	-60	2.812 (71.42)	1030	1080	1130	1180	1230
270	75	+50,-15	21	145	210	24	235	310.0	90	-60	2.812 (71.42)	1031	1081	1131	1181	1231
270	150	±20	28	195	280	45	235	310.0	75	-60	2.812 (71.42)	1032	1082	1132	1182	1232
270	150	+50,-15	28	195	280	45	235	310.0	75	-60	2.812 (71.42)	1033	1083	1133	1183	1233
360	22	±20	18	125	180	16	310	414.0	100	-40	1.705 (43.31)	1034	1084	1134	1184	1234
360	22	+50,-15	18	125	180	16	310	414.0	100	-40	1.705 (43.31)	1035	1085	1135	1185	1235
360	30	±20	19	135	190	22	310	414.0	120	-40	1.705 (43.31)	1036	1086	1136	1186	1236
360	30	+50,-15	19	135	190	22	310	414.0	120	-40	1.705 (43.31)	1037	1087	1137	1187	1237
450	17	±20	18	125	180	16	390	518.0	130	-40	2.080 (52.83)	1038	1088	1138	1188	1238
450	17	+50,-15	18	125	180	16	390	518.0	130	-40	2.080 (52.83)	1039	1089	1139	1189	1239
450	25	±20	19	135	190	23	390	518.0	150	-40	2.080 (52.83)	1040	1090	1140	1190	1240
450	25	+50,-15	19	135	190	23	390	518.0	150	-40	2.080 (52.83)	1041	1091	1141	1191	1241
540	14	±20	17	120	170	16	470	621.0	160	-40	2.435 (61.85)	1042	1092	1142	1192	1242
540	14	+50,-15	17	120	170	16	470	621.0	160	-40	2.435 (61.85)	1043	1093	1143	1193	1243
540	20	±20	19	135	190	22	470	621.0	170	-40	2.435 (61.85)	1044	1094	1144	1194	1244
540	20	+50,-15	19	135	190	22	470	621.0	170	-40	2.435 (61.85)	1045	1095	1145	1195	1245
630	12	±20	17	120	170	16	545	724.0	180	-40	2.810 (71.37)	1046	1096	1146	1196	1246
630	12	+50,-15	17	120	170	16	545	724.0	180	-40	2.810 (71.37)	1047	1097	1147	1197	1247
630	18	±20	19	135	190	23	545	724.0	200	-40	2.810 (71.37)	1048	1098	1148	1198	1248
630	18	+50,-15	19	135	190	23	545	724.0	200	-40	2.810 (71.37)	1049	1099	1149	1199	1249

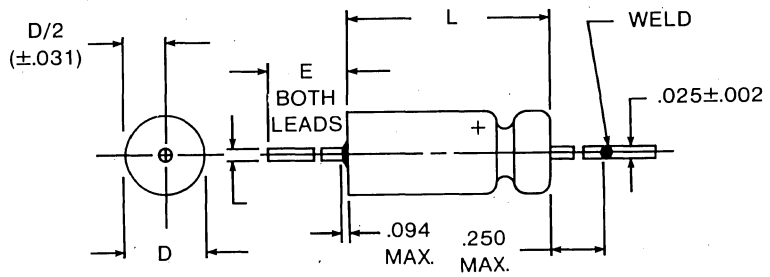
MIL-C-39006/09
STYLE CLR65

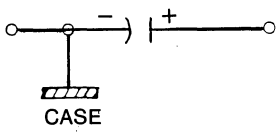
MILITARY CODING SYSTEM

M39006 / 09 - 8000*

- 8000*: DASH NUMBER FROM TABLE. For specific value of Capacitance, Capacitance Tolerance, Voltage, Fuse Size, and Failure Rate Level the table must be consulted.
- 09: DETAIL SHEET FOR APPLICABLE STYLE - /09 is CLR65.
- M39006: Abbreviated form of MIL-C-39006. All devices procured to this specification will show this number as minimum marking.

**Substitution for 2000, 4000 and 6000 Series which cannot carry JAN code.*





CIRCUIT DIAGRAM

© Case size	Dimensions — Inches (mm)			
	Basic case		Insulated case	
	L 1/ +.031(.79) −.016(.41)	D ±.016(.41)	D max	E ±.250(6.35)
T1	.453(11.51)	.188(4.78)	.219(5.56)	1.500(38.10)
T2	.641(16.28)	.281(7.14)	.312(7.92)	2.250(57.15)
T3	.766(19.46)	.375(9.53)	.406(10.31)	2.250(57.15)
T4	1.062(26.97)	.375(9.53)	.406(10.31)	2.250(57.15)

1/ Length of basic case; sleeving shall be as specified in MIL-C-39006.

MIL-C-39006

Military Style Tantalum Capacitors

MIL-C-39006/09
STYLE CLR65
TANTALUM-TO-GLASS HERMETIC SEAL

Rated voltage (+85°C)	Cap. 1/	Cap. tolerance	DC leakage (max)		Dissipation factor (max)	Derated voltage (+125°C)	Surge voltage (+85°C)	Impedance (max)	Capacitance change at			Case size	Part No. M39006/09- Failure rate level (%/1,000 hr)				
			+25°C	+85°C & +125°C					-55°C	+85°C	+125°C		L (2.0)	M (1.0)	P (0.1)	R (0.01)	S (0.001)
volts, dc	uF	percent	uA	uA	percent	volts, dc	volts, dc	ohms	percent	percent	percent						
6	30	±20	1	2	9.1	4	6.9	100	-40	+10.5	+12	T1	8001	8206	8411	8616	8821
6	30	±10	1	2	9.1	4	6.9	100	-40	+10.5	+12	T1	8002	8207	8412	8617	8822
6	30	± 5	1	2	9.1	4	6.9	100	-40	+10.5	+12	T1	8003	8208	8413	8618	8823
6	*68	±20	1	2	20.4	4	6.9	60	-40	+14	+16	T1	8004	8209	8414	8619	8824
6	*68	±10	1	2	20.4	4	6.9	60	-40	+14	+16	T1	8005	8210	8415	8620	8825
6	*68	± 5	1	2	20.4	4	6.9	60	-40	+14	+16	T1	8006	8211	8416	8621	8826
6	140	±20	1	3	21.3	4	6.9	40	-40	+14	+16	T2	8007	8212	8417	8622	8827
6	140	±10	1	3	21.3	4	6.9	40	-40	+14	+16	T2	8008	8213	8418	8623	8828
6	140	± 5	1	3	21.3	4	6.9	40	-40	+14	+16	T2	8009	8214	8419	8624	8829
6	*270	±20	1	6.5	81.8	4	6.9	25	-44	+17.5	+20	T2	8010	8215	8420	8625	8830
6	*270	±10	1	6.5	81.8	4	6.9	25	-44	+17.5	+20	T2	8011	8216	8421	8626	8831
6	*270	± 5	1	6.5	81.8	4	6.9	25	-44	+17.5	+20	T2	8012	8217	8422	8627	8832
6	330	±20	2	7.9	49.6	4	6.9	20	-44	+14	+16	T3	8013	8218	8423	8628	8833
6	330	±10	2	7.9	49.6	4	6.9	20	-44	+14	+16	T3	8014	8219	8424	8629	8834
6	330	± 5	2	7.9	49.6	4	6.9	20	-44	+14	+16	T3	8015	8220	8425	8630	8835
6	*560	±20	2	13	128.0	4	6.9	25	-64	+17.5	+20	T3	8016	8221	8426	8631	8836
6	*560	±10	2	13	128.0	4	6.9	25	-64	+17.5	+20	T3	8017	8222	8427	8632	8837
6	*560	± 5	2	13	128.0	4	6.9	25	-64	+17.5	+20	T3	8018	8223	8428	8633	8838
6	*1200	±20	3	14	144.4	4	6.9	20	-80	+25	+25	T4	8019	8224	8429	8634	8939
6	*1200	±10	3	14	144.4	4	6.9	20	-80	+25	+25	T4	8020	8225	8430	8635	8840
8	25	±20	1	2	7.6	5	9.2	100	-40	+10.5	+12	T1	8021	8226	8431	8636	8841
8	25	±10	1	2	7.6	5	9.2	100	-40	+10.5	+12	T1	8022	8227	8432	8637	8842
8	25	± 5	1	2	7.6	5	9.2	100	-40	+10.5	+12	T1	8023	8228	8433	8638	8843
8	*56	±20	1	2	17.0	5	9.2	59	-40	+14	+16	T1	8024	8229	8434	8639	8844
8	*56	±10	1	2	17.0	5	9.2	59	-40	+14	+16	T1	8025	8230	8435	8640	8845
8	*56	± 5	1	2	17.0	5	9.2	59	-40	+14	+16	T1	8026	8231	8436	8641	8846
8	*220	±20	1	7	66.4	5	9.2	30	-44	+17.5	+20	T2	8027	8232	8437	8642	8847
8	*220	±10	1	7	66.4	5	9.2	30	-44	+17.5	+20	T2	8028	8233	8438	8643	8848
8	*220	± 5	1	7	66.4	5	9.2	30	-44	+17.5	+20	T2	8029	8234	8439	8644	8849
8	*430	±20	2	14	91.5	5	9.2	25	-64	+17.5	+20	T3	8030	8235	8440	8645	8850
8	*430	±10	2	14	91.5	5	9.2	25	-64	+17.5	+20	T3	8031	8236	8441	8646	8851
8	*430	± 5	2	14	91.5	5	9.2	25	-64	+17.5	+20	T3	8032	8237	8442	8647	8852
8	*850	±20	4	16	65.8	5	9.2	22	-80	+25	+25	T4	8033	8238	8443	8648	8853
8	*850	±10	4	16	65.8	5	9.2	22	-80	+25	+25	T4	8034	8239	8444	8649	8854
10	20	±20	1	2	6.1	7	11.5	175	-32	+10.5	+12	T1	8035	8240	8445	8650	8855
10	20	±10	1	2	6.1	7	11.5	175	-32	+10.5	+12	T1	8036	8241	8446	8651	8856
10	20	± 5	1	2	6.1	7	11.5	175	-32	+10.5	+12	T1	8037	8242	8447	8652	8857
10	*47	±20	1	2	18.1	7	11.5	100	-36	+14	+16	T1	8038	8243	8448	8653	8858
10	*47	±10	1	2	18.1	7	11.5	100	-36	+14	+16	T1	8039	8244	8449	8654	8859
10	*47	± 5	1	2	18.1	7	11.5	100	-36	+14	+16	T1	8040	8245	8450	8655	8860
10	100	±20	1	4	15.2	7	11.5	60	-36	+14	+16	T2	8041	8246	8451	8656	8861
10	100	±10	1	4	15.2	7	11.5	60	-36	+14	+16	T2	8042	8247	8452	8657	8862
10	100	± 5	1	4	15.2	7	11.5	60	-36	+14	+16	T2	8043	8248	8453	8658	8863
10	*180	±20	1	7	54.4	7	11.5	40	-36	+14	+16	T2	8044	8249	8454	8659	8864
10	*180	±10	1	7	54.4	7	11.5	40	-36	+14	+16	T2	8045	8250	8455	8660	8865
10	*180	± 5	1	7	54.4	7	11.5	40	-36	+14	+16	T2	8046	8251	8456	8661	8866
10	250	±20	2	10	37.8	7	11.5	30	-40	+14	+16	T3	8047	8252	8457	8662	8867
10	250	±10	2	10	37.8	7	11.5	30	-40	+14	+16	T3	8048	8253	8458	8663	8868
10	250	± 5	2	10	37.8	7	11.5	30	-40	+14	+16	T3	8049	8254	8459	8664	8869
10	*390	±20	2	16	87.6	7	11.5	25	-64	+17.5	+20	T3	8050	8255	8460	8665	8870
10	*390	±10	2	16	87.6	7	11.5	25	-64	+17.5	+20	T3	8051	8256	8461	8666	8871
10	*390	± 5	2	16	87.6	7	11.5	25	-64	+17.5	+20	T3	8052	8257	8462	8667	8872
10	*750	±20	4	16	56.5	7	11.5	23	-80	+25	+25	T4	8053	8258	8463	8668	8873
10	*750	±10	4	16	56.5	7	11.5	23	-80	+25	+25	T4	8054	8259	8464	8669	8874
15	15	±20	1	2	5.7	10	17.2	155	-24	+10.5	+12	T1	8055	8260	8465	8670	8875
15	15	±10	1	2	5.7	10	17.2	155	-24	+10.5	+12	T1	8056	8261	8466	8671	8876
15	15	± 5	1	2	5.7	10	17.2	155	-24	+10.5	+12	T1	8057	8262	8467	8672	8877
15	*33	±20	1	2	12.5	10	17.2	90	-28	+14	+16	T1	8058	8263	8468	8673	8878
15	*33	±10	1	2	12.5	10	17.2	90	-28	+14	+16	T1	8059	8264	8469	8674	8879
15	*33	± 5	1	2	12.5	10	17.2	90	-28	+14	+16	T1	8060	8265	8470	8675	8880
15	70	±20	1	4	13.1	10	17.2	75	-28	+14	+16	T2	8061	8266	8471	8676	8881
15	70	±10	1	4	13.1	10	17.2	75	-28	+14	+16	T2	8062	8267	8472	8677	8882
15	70	± 5	1	4	13.1	10	17.2	75	-28	+14	+16	T2	8063	8268	8473	8678	8883
15	*120	±20	1	7	36.8	10	17.2	50	-28	+17.5	+20	T2	8064	8269	8474	8679	8884
15	*120	±10	1	7	36.8	10	17.2	50	-28	+17.5	+20	T2	8065	8270	8475	8680	8885
15	*120	± 5	1	7	36.8	10	17.2	50	-28	+17.5	+20	T2	8066	8271	8476	8681	8886
15	170	±20	2	10	25.4	10	17.2	35	-32	+14	+16	T3	8067	8272	8477	8682	8887
15	170	±10	2	10	25.4	10	17.2	35	-32	+14	+16	T3	8068	8273	8478	8683	8888
15	170	± 5	2	10	25.4	10	17.2	35	-32	+14	+16	T3	8069	8274	8479	8684	8889

1/ The asterisk (*) indicates high-capacitance series.

MIL-C-39006/09 STYLE CLR65
TANTALUM-TO-GLASS HERMETIC SEAL

Rated voltage (+85°C)	Cap. 1/	Cap. tolerance	DC leakage (max)		Dissipation factor (max)	Derated voltage (+125°C)	Surge voltage (+85°C)	Impedance (max)	Capacitance change at			Case size	Part No. M39006/09- Failure rate level (%/1,000 hr)				
			+25°C	+85°C & +125°C					-55°C	+85°C	+125°C		L (2.0)	M (1.0)	P (0.1)	R (0.01)	S (0.001)
volts, dc	uF	percent	uA	uA	percent	volts, dc	volts, dc	ohms	percent	percent	percent						
15	*270	±20	2	16	60.9	10	17.2	30	-56	+17.5	+20	T3	8070	8275	8480	8685	8890
15	*270	±10	2	16	60.9	10	17.2	30	-56	+17.5	+20	T3	8071	8276	8481	8686	8891
15	*270	± 5	2	16	60.9	10	17.2	30	-56	+17.5	+20	T3	8072	8277	8482	8687	8892
15	*540	±20	6	24	49.0	10	17.2	23	-80	+25	+25	T4	8073	8278	8483	8688	8893
15	*540	±10	6	24	49.0	10	17.2	23	-80	+25	+25	T4	8074	8279	8484	8689	8894
25	10	±20	1	2	4.6	15	28.8	220	-16	+ 8	+ 9	T1	8075	8280	8485	8690	8895
25	10	±10	1	2	4.6	15	28.8	220	-16	+ 8	+ 9	T1	8076	8281	8486	8691	8896
25	10	± 5	1	2	4.6	15	28.8	220	-16	+ 8	+ 9	T1	8077	8282	8487	8692	8897
25	*22	±20	1	2	8.3	15	28.8	140	-20	+10.5	+12	T1	8078	8283	8488	8693	8898
25	*22	±10	1	2	8.3	15	28.8	140	-20	+10.5	+12	T1	8079	8284	8489	8694	8899
25	*22	± 5	1	2	8.3	15	28.8	140	-20	+10.5	+12	T1	8080	8285	8490	8695	8900
25	*100	±20	1	10	31.4	15	28.8	50	-28	+13	+15	T2	8081	8286	8491	8696	8901
25	*100	±10	1	10	31.4	15	28.8	50	-28	+13	+15	T2	8082	8287	8492	8697	8902
25	*100	± 5	1	10	31.4	15	28.8	50	-28	+13	+15	T2	8083	8288	8493	8698	8903
25	*180	±20	2	18	54.3	15	28.8	32	-48	+13	+15	T3	8084	8289	8494	8699	8904
25	*180	±10	2	18	54.3	15	28.8	32	-48	+13	+15	T3	8085	8290	8495	8700	8905
25	*180	± 5	2	18	54.3	15	28.8	32	-48	+13	+15	T3	8086	8291	8496	8701	8906
25	*350	±20	7	28	35.0	15	28.8	24	-70	+25	+25	T4	8087	8292	8497	8702	8907
25	*350	±10	7	28	35.0	15	28.8	24	-70	+25	+25	T4	8088	8293	8498	8703	8908
30	8	±20	1	2	4.5	20	34.5	275	-16	+ 8	+12	T1	8089	8294	8499	8704	8909
30	8	±10	1	2	4.5	20	34.5	275	-16	+ 8	+12	T1	8090	8295	8500	8705	8910
30	8	± 5	1	2	4.5	20	34.5	275	-16	+ 8	+12	T1	8091	8296	8501	8706	8911
30	*15	±20	1	2	9.1	20	34.5	175	-20	+10.5	+12	T1	8092	8297	8502	8707	8912
30	*15	±10	1	2	9.1	20	34.5	175	-20	+10.5	+12	T1	8093	8298	8503	8708	8913
30	*15	± 5	1	2	9.1	20	34.5	175	-20	+10.5	+12	T1	8094	8299	8504	8709	8914
30	40	±20	1	5	12.2	20	34.5	65	-24	+10.5	+12	T2	8095	8300	8505	8710	8915
30	40	±10	1	5	12.2	20	34.5	65	-24	+10.5	+12	T2	8096	8301	8506	8711	8916
30	40	± 5	1	5	12.2	20	34.5	65	-24	+10.5	+12	T2	8097	8302	8507	8712	8917
30	*68	±20	1	8	31.0	20	34.5	60	-24	+13	+15	T2	8098	8303	8508	8713	8918
30	*68	±10	1	8	31.0	20	34.5	60	-24	+13	+15	T2	8099	8304	8509	8714	8919
30	*68	± 5	1	8	31.0	20	34.5	60	-24	+13	+15	T2	8100	8305	8510	8715	8920
30	100	±20	2	12	19.0	20	34.5	40	-28	+10.5	+12	T3	8101	8306	8511	8716	8921
30	100	±10	2	12	19.0	20	34.5	40	-28	+10.5	+12	T3	8102	8307	8512	8717	8922
30	100	± 5	2	12	19.0	20	34.5	40	-28	+10.5	+12	T3	8103	8308	8513	8718	8923
30	*150	±20	2	18	46.0	20	34.5	35	-48	+13	+15	T3	8104	8309	8514	8719	8924
30	*150	±10	2	18	46.0	20	34.5	35	-48	+13	+15	T3	8105	8310	8515	8720	8925
30	*150	± 5	2	18	46.0	20	34.5	35	-48	+13	+15	T3	8106	8311	8516	8721	8926
30	*300	±20	8	32	35.0	20	34.5	25	-60	+25	+25	T4	8107	8312	8517	8722	8927
30	*300	±10	8	32	35.0	20	34.5	25	-60	+25	+25	T4	8108	8313	8518	8723	8928
50	5	±20	1	2	3.4	30	57.5	400	-16	+ 5	+ 6	T1	8109	8314	8519	8724	8929
50	5	±10	1	2	3.4	30	57.5	400	-16	+ 5	+ 6	T1	8110	8315	8520	8725	8930
50	5	± 5	1	2	3.4	30	57.5	400	-16	+ 5	+ 6	T1	8111	8316	8521	8726	8931
50	*10	±20	1	2	6.0	30	57.5	250	-24	+ 8	+ 9	T1	8112	8317	8522	8727	8932
50	*10	±10	1	2	6.0	30	57.5	250	-24	+ 8	+ 9	T1	8113	8318	8523	8728	8933
50	*10	± 5	1	2	6.0	30	57.5	250	-24	+ 8	+ 9	T1	8114	8319	8524	8729	8934
50	25	±20	1	5	11.2	30	57.5	95	-20	+10.5	+12	T2	8115	8320	8525	8730	8935
50	25	±10	1	5	11.2	30	57.5	95	-20	+10.5	+12	T2	8116	8321	8526	8731	8936
50	25	± 5	1	5	11.2	30	57.5	95	-20	+10.5	+12	T2	8117	8322	8527	8732	8937
50	*47	±20	1	9	21.4	30	57.5	70	-28	+13	+15	T2	8118	8323	8528	8733	8938
50	*47	±10	1	9	21.4	30	57.5	70	-28	+13	+15	T2	8119	8324	8529	8734	8939
50	*47	± 5	1	9	21.4	30	57.5	70	-28	+13	+15	T2	8120	8325	8530	8735	8940
50	60	±20	2	12	13.6	30	57.5	45	-16	+10.5	+12	T3	8121	8326	8531	8736	8941
50	60	±10	2	12	13.6	30	57.5	45	-16	+10.5	+12	T3	8122	8327	8532	8737	8942
50	60	± 5	2	12	13.6	30	57.5	45	-16	+10.5	+12	T3	8123	8328	8533	8738	8943
50	*82	±20	2	16	24.9	30	57.5	45	-32	+13	+15	T3	8124	8329	8534	8739	8944
50	*82	±10	2	16	24.9	30	57.5	45	-32	+13	+15	T3	8125	8330	8535	8740	8945
50	*82	± 5	2	16	24.9	30	57.5	45	-32	+13	+15	T3	8126	8331	8536	8741	8946
50	*160	±20	8	32	25.7	30	57.5	27	-50	+25	+25	T4	8127	8332	8537	8742	8947
50	*160	±10	8	32	25.7	30	57.5	27	-50	+25	+25	T4	8128	8333	8538	8743	8948
60	4	±20	1	2	3.0	40	69.0	550	-16	+ 5	+ 6	T1	8129	8334	8539	8744	8949
60	4	±10	1	2	3.0	40	69.0	550	-16	+ 5	+ 6	T1	8130	8335	8540	8745	8950
60	4	± 5	1	2	3.0	40	69.0	550	-16	+ 5	+ 6	T1	8131	8336	8541	8746	8951
60	*8.2	±20	1	2	5.0	40	69.0	275	-24	+ 8	+ 9	T1	8132	8337	8542	8747	8952
60	*8.2	±10	1	2	5.0	40	69.0	275	-24	+ 8	+ 9	T1	8133	8338	8543	8748	8953
60	*8.2	± 5	1	2	5.0	40	69.0	275	-24	+ 8	+ 9	T1	8134	8339	8544	8749	8954
60	20	±20	1	5	7.6	40	69.0	105	-16	+10.5	+12	T2	8135	8340	8545	8750	8955
60	20	±10	1	5	7.6	40	69.0	105	-16	+10.5	+12	T2	8136	8341	8546	8751	8956
60	20	± 5	1	5	7.6	40	69.0	105	-16	+10.5	+12	T2	8137	8342	8547	8752	8957
60	*39	±20	1	9	20.7	40	69.0	90	-28	+10.5	+12	T2	8138	8343	8548	8753	8958
60	*39	±10	1	9	20.7	40	69.0	90	-28	+10.5	+12	T2	8139	8344	8549	8754	8959
60	*39	± 5	1	9	20.7	40	69.0	90	-28	+10.5	+12	T2	8140	8345	8550	8755	8960

1/ The asterisk (*) indicates high-capacitance series.

MIL-C-39006

Military Style Tantalum Capacitors

MIL-C-39006/09
STYLE CLR65
TANTALUM-TO-GLASS HERMETIC SEAL

Rated voltage (+85°C)	Cap. 1/	Cap. tolerance	DC leakage (max)		Dissipation factor (max)	Derated voltage (+125°C)	Surge voltage (+85°C)	Impedance (max)	Capacitance change at			Case size	Part No. M39006/09- Failure rate level (%/1,000 hr)				
			+25°C	+85°C & +125°C					-55°C	+85°C	+125°C		L (2.0)	M (1.0)	P (0.1)	R (0.01)	S (0.001)
volts, dc	uF	percent	uA	uA	percent	volts, dc	volts, dc	ohms	percent	percent	percent						
60	50	±20	2	12	15.3	40	69.0	50	-16	+10.5	+12	T3	8141	8346	8551	8756	8961
60	50	±10	2	12	15.3	40	69.0	50	-16	+10.5	+12	T3	8142	8347	8552	8757	8962
60	50	± 5	2	12	15.3	40	69.0	50	-16	+10.5	+12	T3	8143	8348	8553	8758	8963
60	*68	±20	2	16	20.7	40	69.0	50	-32	+10.5	+12	T3	8144	8349	8554	8759	8964
60	*68	±10	2	16	20.7	40	69.0	50	-32	+10.5	+12	T3	8145	8350	8555	8760	8965
60	*68	± 5	2	16	20.7	40	69.0	50	-32	+10.5	+12	T3	8146	8351	8556	8761	8966
60	*140	±20	8	32	25.7	40	69.0	28	-40	+20	+20	T4	8147	8352	8557	8762	8967
60	*140	±10	8	32	25.7	40	69.0	28	-40	+20	+20	T4	8148	8353	8558	8763	8968
75	3.5	±20	1	2	2.5	50	86.2	650	-16	+ 5	+ 6	T1	8149	8354	8559	8764	8969
75	3.5	±10	1	2	2.5	50	86.2	650	-16	+ 5	+ 6	T1	8150	8355	8560	8765	8970
75	3.5	± 5	1	2	2.5	50	86.2	650	-16	+ 5	+ 6	T1	8151	8356	8561	8766	8971
75	*6.8	±20	1	2	4.1	50	86.2	300	-20	+ 8	+ 9	T1	8152	8357	8562	8767	8972
75	*6.8	±10	1	2	4.1	50	86.2	300	-20	+ 8	+ 9	T1	8153	8358	8563	8768	8973
75	*6.8	± 5	1	2	4.1	50	86.2	300	-20	+ 8	+ 9	T1	8154	8359	8564	8769	8974
75	15	±20	1	5	7.5	50	86.2	150	-16	+ 8	+ 9	T2	8155	8360	8565	8770	8975
75	15	±10	1	5	7.5	50	86.2	150	-16	+ 8	+ 9	T2	8156	8361	8566	8771	8976
75	15	± 5	1	5	7.5	50	86.2	150	-16	+ 8	+ 9	T2	8157	8362	8567	8772	8977
75	*33	±20	1	10	17.5	50	86.2	90	-24	+10.5	+15	T2	8158	8363	8568	8773	8978
75	*33	±10	1	10	17.5	50	86.2	90	-24	+10.5	+15	T2	8159	8364	8569	8774	8979
75	*33	± 5	1	10	17.5	50	86.2	90	-24	+10.5	+15	T2	8160	8365	8570	8775	8980
75	40	±20	2	12	15.2	50	86.2	60	-16	+10.5	+12	T3	8161	8366	8571	8776	8981
75	40	±10	2	12	15.2	50	86.2	60	-16	+10.5	+12	T3	8162	8367	8572	8777	8982
75	40	± 5	2	12	15.2	50	86.2	60	-16	+10.5	+12	T3	8163	8368	8573	8778	8983
75	*56	±20	2	17	26.0	50	86.2	60	-28	+10.5	+15	T3	8164	8369	8574	8779	8984
75	*56	±10	2	17	26.0	50	86.2	60	-28	+10.5	+15	T3	8165	8370	8575	8780	8985
75	*56	± 5	2	17	26.0	50	86.2	60	-28	+10.5	+15	T3	8166	8371	8576	8781	8986
75	*110	±20	9	36	25.7	50	86.2	29	-35	+20	+20	T4	8167	8372	8577	8782	8987
75	*110	±10	9	36	25.7	50	86.2	29	-35	+20	+20	T4	8168	8373	8578	8783	8988
100	2.5	±20	1	2	5.0	65	115	950	-16	+ 7	+ 8	T1	8169	8374	8579	8784	8989
100	2.5	±10	1	2	5.0	65	115	950	-16	+ 7	+ 8	T1	8170	8375	8580	8785	8990
100	2.5	± 5	1	2	5.0	65	115	950	-16	+ 7	+ 8	T1	8171	8376	8581	8786	8991
100	*4.7	±20	1	2	3.6	65	115	500	-16	+ 7	+ 8	T1	8172	8377	8582	8787	8992
100	*4.7	±10	1	2	3.6	65	115	500	-16	+ 7	+ 8	T1	8173	8378	8583	8788	8993
100	*4.7	± 5	1	2	3.6	65	115	500	-16	+ 7	+ 8	T1	8174	8379	8584	8789	8994
100	11	±20	1	4	5.0	65	115	200	-16	+ 7	+ 8	T2	8175	8380	8585	8790	8995
100	11	±10	1	4	5.0	65	115	200	-16	+ 7	+ 8	T2	8176	8381	8586	8791	8996
100	11	± 5	1	4	5.0	65	115	200	-16	+ 7	+ 8	T2	8177	8382	8587	8792	8997
100	*22	±20	1	9	11.8	65	115	100	-16	+ 7	+ 8	T2	8178	8383	8588	8793	8998
100	*22	±10	1	9	11.8	65	115	100	-16	+ 7	+ 8	T2	8179	8384	8589	8794	8999
100	*22	± 5	1	9	11.8	65	115	100	-16	+ 7	+ 8	T2	8180	8385	8590	8795	9000
100	30	±20	2	12	9.1	65	115	80	-16	+ 7	+ 8	T3	8181	8386	8591	8796	9001
100	30	±10	2	12	9.1	65	115	80	-16	+ 7	+ 8	T3	8182	8387	8592	8797	9002
100	30	± 5	2	12	9.1	65	115	80	-16	+ 7	+ 8	T3	8183	8388	8593	8798	9003
100	*43	±20	2	17	19.7	65	115	70	-20	+ 7	+ 8	T3	8184	8389	8594	8799	9004
100	*43	±10	2	17	19.7	65	115	70	-20	+ 7	+ 8	T3	8185	8390	8595	8800	9005
100	*43	± 5	2	17	19.7	65	115	70	-20	+ 7	+ 8	T3	8186	8391	8596	8801	9006
100	*86	±20	9	36	20.7	65	115	30	-25	+15	+15	T4	8187	8392	8597	8802	9007
100	*86	±10	9	36	20.7	65	115	30	-25	+15	+15	T4	8188	8393	8598	8803	9008
125	1.7	±20	1	2	7.0	85	144	1250	-16	+ 7	+ 8	T1	8189	8394	8599	8804	9009
125	1.7	±10	1	2	7.0	85	144	1250	-16	+ 7	+ 8	T1	8190	8395	8600	8805	9010
125	1.7	± 5	1	2	7.0	85	144	1250	-16	+ 7	+ 8	T1	8191	8396	8601	8806	9011
125	*3.6	±20	1	2	4.1	85	144	600	-16	+ 7	+ 8	T1	8192	8397	8602	8807	9012
125	*3.6	±10	1	2	4.1	85	144	600	-16	+ 7	+ 8	T1	8193	8398	8603	8808	9013
125	*3.6	± 5	1	2	4.1	85	144	600	-16	+ 7	+ 8	T1	8194	8399	8604	8809	9014
125	9	±20	1	5	10.2	85	144	240	-16	+ 7	+ 8	T2	8195	8400	8605	8810	9015
125	9	±10	1	5	10.2	85	144	240	-16	+ 7	+ 8	T2	8196	8401	8606	8811	9016
125	9	± 5	1	5	10.2	85	144	240	-16	+ 7	+ 8	T2	8197	8402	8607	8812	9017
125	*14	±20	1	7	12.7	85	144	167	-16	+ 7	+ 8	T2	8198	8403	8608	8813	9018
125	*14	±10	1	7	12.7	85	144	167	-16	+ 7	+ 8	T2	8199	8404	8609	8814	9019
125	*14	± 5	1	7	12.7	85	144	167	-16	+ 7	+ 8	T2	8200	8405	8610	8815	9020
125	18	±20	2	9	15.0	85	144	129	-16	+ 7	+ 8	T3	8201	8406	8611	8816	9021
125	18	±10	2	9	15.0	85	144	129	-16	+ 7	+ 8	T3	8202	8407	8612	8817	9022
125	18	± 5	2	9	15.0	85	144	129	-16	+ 7	+ 8	T3	8203	8408	8613	8818	9023
125	*25	±20	2	13	19.0	85	144	93	-16	+ 7	+ 8	T3	8204	8409	8614	8819	9024
125	*25	±10	2	13	19.0	85	144	93	-16	+ 7	+ 8	T3	8205	8410	8615	8820	9025
125	*25	± 5	2	13	19.0	85	144	93	-16	+ 7	+ 8	T3	9026	9029	9032	9035	9038
125	*56	±20	10	40	17.5	85	144	32	-25	+15	+15	T4	9027	9030	9033	9036	9039
125	*56	±10	10	40	17.5	85	144	32	-25	+15	+15	T4	9028	9031	9034	9037	9040

1/ The asterisk (*) indicates high-capacitance series. NOTE: "L" Level Inactive for New Design.

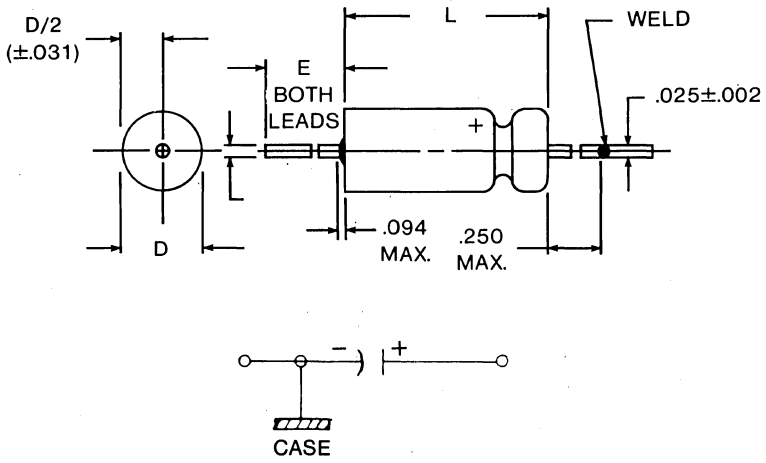
MIL-C-39006/22
STYLE CLR79

APPROVED BY DESC TO THE "H" CHARACTERISTIC

MILITARY CODING SYSTEM

M39006/22-0437

- DASH NUMBER FROM TABLE. For specific value of Capacitance, Capacitance Tolerance, Voltage, Case Size, and Failure Rate Level the table must be consulted
- DETAIL SHEET FOR APPLICABLE STYLE — /22 is CLR 79.
- Abbreviated form of MIL-C-39006. All devices procured to this specification will show this number as minimum marking.



CIRCUIT DIAGRAM

Case size	Dimensions — Inches (mm)			
	Basic case		Insulated case	
	L* +.031 (.79) −.016 (.41)	D ±.016 (.41)	D max	E ±.250 (6.35)
T1	.453 (11.51)	.188 (4.78)	.219 (5.56)	1.500 (38.10)
T2	.641 (16.28)	.281 (7.14)	.312 (7.92)	2.250 (57.15)
T3	.766 (19.46)	.375 (9.53)	.406 (10.31)	2.250 (57.15)
T4	1.062 (26.97)	.375 (9.53)	.406 (10.31)	2.250 (57.15)

**Length of basic case; sleeving shall be as specified in MIL-C-39006.*
Failure rate level "L" inactive for new design after May 22, 1976.

MIL-C-39006

Military Style Tantalum Capacitors

MIL-C-39006/22
STYLE CLR79

1/ Rated voltage (+85°C)	Cap.	Cap. tolerance	DC leakage (max)		Dissipation factor (max)	Derated voltage (+125°C)	Surge voltage (+85°C)	Impedance (max)	Capacitance change at			2/Max. 85 C 40 kHz ripple current	Case size	Part No. M39006/22-* Failure rate level (%1,000 hr)			
			+25°C	+85°C & +125°C					-55°C	+85°C	+125°C			M(1.0)	P(0.1)	R(0.01)	S(0.001)
Vdc	uF	%	uA	uA	%	Vdc	Vdc	Ohms	%	%	%	mA rms					
6	30	±20	1	2	9	4	6.9	100	-40	+10.5	+12	820	T1	0001	0221	0441	0661
6	30	±10	1	2	9	4	6.9	100	-40	+10.5	+12	820	T1	0002	0222	0442	0662
6	30	± 5	1	2	9	4	6.9	100	-40	+10.5	+12	820	T1	0003	0223	0443	0663
6	68	±20	1	2	15	4	6.9	60	-40	+14	+16	960	T1	0004	0224	0444	0664
6	68	±10	1	2	15	4	6.9	60	-40	+14	+16	960	T1	0005	0225	0445	0665
6	68	± 5	1	2	15	4	6.9	60	-40	+14	+16	960	T1	0006	0226	0446	0666
6	140	±20	1	3	21	4	6.9	40	-40	+14	+16	1200	T2	0007	0227	0447	0667
6	140	±10	1	3	21	4	6.9	40	-40	+14	+16	1200	T2	0008	0228	0448	0668
6	140	± 5	1	3	21	4	6.9	40	-40	+14	+16	1200	T2	0009	0229	0449	0669
6	270	±20	1	6.5	45	4	6.9	25	-44	+17.5	+20	1375	T2	0010	0230	0450	0670
6	270	±10	1	6.5	45	4	6.9	25	-44	+17.5	+20	1375	T2	0011	0231	0451	0671
6	270	± 5	1	6.5	45	4	6.9	25	-44	+17.5	+20	1375	T2	0012	0232	0452	0672
6	330	±20	2	7.9	36	4	6.9	20	-44	+14	+16	1800	T3	0013	0233	0453	0673
6	330	±10	2	7.9	36	4	6.9	20	-44	+14	+16	1800	T3	0014	0234	0454	0674
6	330	± 5	2	7.9	36	4	6.9	20	-44	+14	+16	1800	T3	0015	0235	0455	0675
6	560	+20	2	13	55	4	6.9	25	-64	+17.5	+20	1900	T3	0016	0236	0456	0676
6	560	±10	2	13	55	4	6.9	25	-64	+17.5	+20	1900	T3	0017	0237	0457	0677
6	560	± 5	2	13	55	4	6.9	25	-64	+17.5	+20	1900	T3	0018	0238	0458	0678
6	1200	±20	3	14	90	4	6.9	20	-80	+25	+25	2265	T4	0019	0239	0459	0679
6	1200	±10	3	14	90	4	6.9	20	-80	+25	+25	2265	T4	0020	0240	0460	0680
8	25	±20	1	2	7.5	5	9.2	100	-40	+10.5	+12	820	T1	0021	0241	0461	0681
8	25	±10	1	2	7.5	5	9.2	100	-40	+10.5	+12	820	T1	0022	0242	0462	0682
8	25	± 5	1	2	7.5	5	9.2	100	-40	+10.5	+12	820	T1	0023	0243	0463	0683
8	56	±20	1	2	14	5	9.2	59	-40	+14	+16	900	T1	0024	0244	0464	0684
8	56	±10	1	2	14	5	9.2	59	-40	+14	+16	900	T1	0025	0245	0465	0685
8	56	± 5	1	2	14	5	9.2	59	-40	+14	+16	900	T1	0026	0246	0466	0686
8	120	±20	1	2	20	5	9.2	50	-44	+17.5	+20	1220	T2	0027	0247	0467	0687
8	120	±10	1	2	20	5	9.2	50	-44	+17.5	+20	1220	T2	0028	0248	0468	0688
8	120	± 5	1	2	20	5	9.2	50	-44	+17.5	+20	1220	T2	0029	0249	0469	0689
8	220	±20	1	7	37	5	9.2	30	-44	+17.5	+20	1370	T2	0030	0250	0470	0690
8	220	±10	1	7	37	5	9.2	30	-44	+17.5	+20	1370	T2	0031	0251	0471	0691
8	220	± 5	1	7	37	5	9.2	30	-44	+17.5	+20	1370	T2	0032	0252	0472	0692
8	290	±20	2	6	34	5	9.2	25	-64	+17.5	+20	1770	T3	0033	0253	0473	0693
8	290	±10	2	6	34	5	9.2	25	-64	+17.5	+20	1770	T3	0034	0254	0474	0694
8	290	± 5	2	6	34	5	9.2	25	-64	+17.5	+20	1770	T3	0035	0255	0475	0695
8	430	±20	2	14	46	5	9.2	25	-64	+17.5	+20	1825	T3	0036	0256	0476	0696
8	430	±10	2	14	46	5	9.2	25	-64	+17.5	+20	1825	T3	0037	0257	0477	0697
8	430	± 5	2	14	46	5	9.2	25	-64	+17.5	+20	1825	T3	0038	0258	0478	0698
8	850	±20	4	16	60	5	9.2	22	-80	+25	+25	2330	T4	0039	0259	0479	0699
8	850	±10	4	16	60	5	9.2	22	-80	+25	+25	2330	T4	0040	0260	0480	0700
10	20	±20	1	2	6	7	11.5	175	-32	+10.5	+12	820	T1	0041	0261	0481	0701
10	20	±10	1	2	6	7	11.5	175	-32	+10.5	+12	820	T1	0042	0262	0482	0702
10	20	± 5	1	2	6	7	11.5	175	-32	+10.5	+12	820	T1	0043	0263	0483	0703
10	47	±20	1	2	13	7	11.5	100	-36	+14	+16	855	T1	0044	0264	0484	0704
10	47	±10	1	2	13	7	11.5	100	-36	+14	+16	855	T1	0045	0265	0485	0705
10	47	± 5	1	2	13	7	11.5	100	-36	+14	+16	855	T1	0046	0266	0486	0706
10	100	±20	1	4	15	7	11.5	60	-36	+14	+16	1200	T2	0047	0267	0487	0707
10	100	±10	1	4	15	7	11.5	60	-36	+14	+16	1200	T2	0048	0268	0488	0708
10	100	± 5	1	4	15	7	11.5	60	-36	+14	+16	1200	T2	0049	0269	0489	0709
10	180	±20	1	7	30	7	11.5	40	-36	+14	+16	1365	T2	0050	0270	0490	0710
10	180	±10	1	7	30	7	11.5	40	-36	+14	+16	1365	T2	0051	0271	0491	0711
10	180	± 5	1	7	30	7	11.5	40	-36	+14	+16	1365	T2	0052	0272	0492	0712
10	250	±20	2	10	30	7	11.5	30	-40	+14	+16	1720	T3	0053	0273	0493	0713
10	250	±10	2	10	30	7	11.5	30	-40	+14	+16	1720	T3	0054	0274	0494	0714
10	250	± 5	2	10	30	7	11.5	30	-40	+14	+16	1720	T3	0055	0275	0495	0715
10	390	±20	2	16	44	7	11.5	25	-64	+17.5	+20	1800	T3	0056	0276	0496	0716
10	390	±10	2	16	44	7	11.5	25	-64	+17.5	+20	1800	T3	0057	0277	0497	0717
10	390	± 5	2	16	44	7	11.5	25	-64	+17.5	+20	1800	T3	0058	0278	0498	0718
10	750	±20	4	16	50	7	11.5	23	-80	+25	+25	2360	T4	0059	0279	0499	0719
10	750	±10	4	16	50	7	11.5	23	-80	+25	+25	2360	T4	0060	0280	0500	0720

See footnotes at end of table.

MIL-C-39006/22
STYLE CLR79

1/ Rated voltage (+85°C)	Cap.	Cap. tolerance	DC leakage (max)		Dissipation factor (max)	Derated voltage (+125°C)	Surge voltage (+85°C)	Impedance (max)	Capacitance change at			2/Max. 85 C 40 kHz ripple current	Case size	Part No. M39006/22-* Failure rate level (%1,000 hr)			
			+25°C	+85°C & +125°C					-55°C	+85°C	+125°C			M(1.0)	P(0.1)	R(0.01)	S(0.001)
Vdc	uF	%	uA	uA	%	Vdc	Vdc	Ohms	%	%	%	mA rms					
15	15	±20	1	2	5	10	17.2	155	-24	+10.5	+12	780	T1	0061	0281	0501	0721
15	15	±10	1	2	5	10	17.2	155	-24	+10.5	+12	780	T1	0062	0282	0502	0722
15	15	± 5	1	2	5	10	17.2	155	-24	+10.5	+12	780	T1	0063	0283	0503	0723
15	33	±20	1	2	10	10	17.2	90	-28	+14	+16	820	T1	0064	0284	0504	0724
15	33	±10	1	2	10	10	17.2	90	-28	+14	+16	820	T1	0065	0285	0505	0725
15	33	± 5	1	2	10	10	17.2	90	-28	+14	+16	820	T1	0066	0286	0506	0726
15	70	±20	1	4	13	10	17.2	75	-28	+14	+16	1150	T2	0067	0287	0507	0727
15	70	±10	1	4	13	10	17.2	75	-28	+14	+16	1150	T2	0068	0288	0508	0728
15	70	± 5	1	4	13	10	17.2	75	-28	+14	+16	1150	T2	0069	0289	0509	0729
15	120	±20	1	7	18	10	17.2	50	-28	+17.5	+20	1450	T2	0070	0290	0510	0730
15	120	±10	1	7	18	10	17.2	50	-28	+17.5	+20	1450	T2	0071	0291	0511	0731
15	120	± 5	1	7	18	10	17.2	50	-28	+17.5	+20	1450	T2	0072	0292	0512	0732
15	170	±20	2	10	25	10	17.2	35	-32	+14	+16	1480	T3	0073	0293	0513	0733
15	170	±10	2	10	25	10	17.2	35	-32	+14	+16	1480	T3	0074	0294	0514	0734
15	170	± 5	2	10	25	10	17.2	35	-32	+14	+16	1480	T3	0075	0295	0515	0735
15	270	±20	2	16	32	10	17.2	30	-56	+17.5	+20	1740	T3	0076	0296	0516	0736
15	270	±10	2	16	32	10	17.2	30	-56	+17.5	+20	1740	T3	0077	0297	0517	0737
15	270	± 5	2	16	32	10	17.2	30	-56	+17.5	+20	1740	T3	0078	0298	0518	0738
15	540	±20	6	24	40	10	17.2	23	-80	+25	+25	2300	T4	0079	0299	0519	0739
15	540	±10	6	24	40	10	17.2	23	-80	+25	+25	2300	T4	0080	0300	0520	0740
25	10	±20	1	2	4	15	28.8	220	-16	+ 8	+ 9	715	T1	0081	0301	0521	0741
25	10	±10	1	2	4	15	28.8	220	-16	+ 8	+ 9	715	T1	0082	0302	0522	0742
25	10	± 5	1	2	4	15	28.8	220	-16	+ 8	+ 9	715	T1	0083	0303	0523	0743
25	22	±20	1	2	6.6	15	28.8	140	-20	+10.5	+12	825	T1	0084	0304	0524	0744
25	22	±10	1	2	6.6	15	28.8	140	-20	+10.5	+12	825	T1	0085	0305	0525	0745
25	22	± 5	1	2	6.6	15	28.8	140	-20	+10.5	+12	825	T1	0086	0306	0526	0746
25	50	±20	1	2	11	15	28.8	70	-28	+13	+15	1130	T2	0087	0307	0527	0747
25	50	±10	1	2	11	15	28.8	70	-28	+13	+15	1130	T2	0088	0308	0528	0748
25	50	± 5	1	2	11	15	28.8	70	-28	+13	+15	1130	T2	0089	0309	0529	0749
25	100	±20	1	10	15	15	28.8	50	-28	+13	+15	1435	T2	0090	0310	0530	0750
25	100	±10	1	10	15	15	28.8	50	-28	+13	+15	1435	T2	0091	0311	0531	0751
25	100	± 5	1	10	15	15	28.8	50	-28	+13	+15	1435	T2	0092	0312	0532	0752
25	120	±20	2	6	21	15	28.8	38	-32	+13	+15	1450	T3	0093	0313	0533	0753
25	120	±10	2	6	21	15	28.8	38	-32	+13	+15	1450	T3	0094	0314	0534	0754
25	120	± 5	2	6	21	15	28.8	38	-32	+13	+15	1450	T3	0095	0315	0535	0755
25	180	±20	2	18	26	15	28.8	32	-48	+13	+15	1525	T3	0096	0316	0536	0756
25	180	±10	2	18	26	15	28.8	32	-48	+13	+15	1525	T3	0097	0317	0537	0757
25	180	± 5	2	18	26	15	28.8	32	-48	+13	+15	1525	T3	0098	0318	0538	0758
25	350	±20	7	28	35	15	28.8	24	-70	+25	+25	1970	T4	0099	0319	0539	0759
25	350	±10	7	28	35	15	28.8	24	-70	+25	+25	1970	T4	0100	0320	0540	0760
30	8	±20	1	2	4	20	34.5	275	-16	+ 8	+12	640	T1	0101	0321	0541	0761
30	8	±10	1	2	4	20	34.5	275	-16	+ 8	+12	640	T1	0102	0322	0542	0762
30	8	± 5	1	2	4	20	34.5	275	-16	+ 8	+12	640	T1	0103	0323	0543	0763
30	15	±20	1	2	5	20	34.5	175	-20	+10.5	+12	780	T1	0104	0324	0544	0764
30	15	±10	1	2	5	20	34.5	175	-20	+10.5	+12	780	T1	0105	0325	0545	0765
30	15	± 5	1	2	5	20	34.5	175	-20	+10.5	+12	780	T1	0106	0326	0546	0766
30	40	±20	1	5	10	20	34.5	65	-24	+10.5	+12	1120	T2	0107	0327	0547	0767
30	40	±10	1	5	10	20	34.5	65	-24	+10.5	+12	1120	T2	0108	0328	0548	0768
30	40	± 5	1	5	10	20	34.5	65	-24	+10.5	+12	1120	T2	0109	0329	0549	0769
30	68	±20	1	8	13	20	34.5	60	-24	+13	+15	1285	T2	0110	0330	0550	0770
30	68	±10	1	8	13	20	34.5	60	-24	+13	+15	1285	T2	0111	0331	0551	0771
30	68	± 5	1	8	13	20	34.5	60	-24	+13	+15	1285	T2	0112	0332	0552	0772
30	100	±20	2	12	17	20	34.5	40	-28	+10.5	+12	1450	T3	0113	0333	0553	0773
30	100	±10	2	12	17	20	34.5	40	-28	+10.5	+12	1450	T3	0114	0334	0554	0774
30	100	± 5	2	12	17	20	34.5	40	-28	+10.5	+12	1450	T3	0115	0335	0555	0775
30	150	±20	2	18	23	20	34.5	35	-48	+13	+15	1525	T3	0116	0336	0556	0776
30	150	±10	2	18	23	20	34.5	35	-48	+13	+15	1525	T3	0117	0337	0557	0777
30	150	± 5	2	18	23	20	34.5	35	-48	+13	+15	1525	T3	0118	0338	0558	0778
30	300	±20	8	32	31	20	34.5	25	-60	+25	+25	1950	T4	0119	0339	0559	0779
30	300	±10	8	32	31	20	34.5	25	-60	+25	+25	1950	T4	0120	0340	0560	0780

See footnotes at end of table.

MIL-C-39006

Military Style Tantalum Capacitors

MIL-C-39006/22
STYLE CLR79

1/ Rated voltage (+85°C)	Cap.	Cap. tolerance	DC leakage (max)		Dissipation factor (max)	Derated voltage (+125°C)	Surge voltage (+85°C)	Impedance (max)	Capacitance change at			2/Max. 85°C 40 kHz ripple current	Case size	Part No. M39006/22-* Failure rate level (%1,000 hr)			
			+25°C	+85°C & +125°C					-55°C	+85°C	+125°C			M(1.0)	P(0.1)	R(0.01)	S(0.001)
Vdc	uF	%	uA	uA	%	Vdc	Vdc	Ohms	%	%	%	mA rms					
50	5	±20	1	2	3	30	57.5	400	-16	+ 5	+ 6	580	T1	0121	0341	0561	0781
50	5	±10	1	2	3	30	57.5	400	-16	+ 5	+ 6	580	T1	0122	0342	0562	0782
50	5	± 5	1	2	3	30	57.5	400	-16	+ 5	+ 6	580	T1	0123	0343	0563	0783
50	10	±20	1	2	4	30	57.5	250	-24	+ 8	+ 9	715	T1	0124	0344	0564	0784
50	10	±10	1	2	4	30	57.5	250	-24	+ 8	+ 9	715	T1	0125	0345	0565	0785
50	10	± 5	1	2	4	30	57.5	250	-24	+ 8	+ 9	715	T1	0126	0346	0566	0786
50	25	±20	1	5	8	30	57.5	95	-20	+10.5	+12	1005	T2	0127	0347	0567	0787
50	25	±10	1	5	8	30	57.5	95	-20	+10.5	+12	1005	T2	0128	0348	0568	0788
50	25	± 5	1	5	8	30	57.5	95	-20	+10.5	+12	1005	T2	0129	0349	0569	0789
50	47	±20	1	9	11	30	57.5	70	-28	+13	+15	1155	T2	0130	0350	0570	0790
50	47	±10	1	9	11	30	57.5	70	-28	+13	+15	1155	T2	0131	0351	0571	0791
50	47	± 5	1	9	11	30	57.5	70	-28	+13	+15	1155	T2	0132	0352	0572	0792
50	60	±20	2	12	12	30	57.5	45	-16	+10.5	+12	1335	T3	0133	0353	0573	0793
50	60	±10	2	12	12	30	57.5	45	-16	+10.5	+12	1335	T3	0134	0354	0574	0794
50	60	± 5	2	12	12	30	57.5	45	-16	+10.5	+12	1335	T3	0135	0355	0575	0795
50	82	±20	2	16	15	30	57.5	45	-32	+13	+15	1400	T3	0136	0356	0576	0796
50	82	±10	2	16	15	30	57.5	45	-32	+13	+15	1400	T3	0137	0357	0577	0797
50	82	± 5	2	16	15	30	57.5	45	-32	+13	+15	1400	T3	0138	0358	0578	0798
50	160	±20	8	32	17	30	57.5	27	-50	+25	+25	1900	T4	0139	0359	0579	0799
50	160	±10	8	32	17	30	57.5	27	-50	+25	+25	1900	T4	0140	0360	0580	0800
60	4	±20	1	2	2.8	40	69.0	550	-16	+ 5	+ 6	525	T1	0141	0361	0581	0801
60	4	±10	1	2	2.8	40	69.0	550	-16	+ 5	+ 6	525	T1	0142	0362	0582	0802
60	4	± 5	1	2	2.8	40	69.0	550	-16	+ 5	+ 6	525	T1	0143	0363	0583	0803
60	8.2	±20	1	2	4	40	69.0	275	-24	+ 8	+ 9	625	T1	0144	0364	0584	0804
60	8.2	±10	1	2	4	40	69.0	275	-24	+ 8	+ 9	625	T1	0145	0365	0585	0805
60	8.2	± 5	1	2	4	40	69.0	275	-24	+ 8	+ 9	625	T1	0146	0366	0586	0806
60	20	±20	1	5	7	40	69.0	105	-16	+10.5	+12	930	T2	0147	0367	0587	0807
60	20	±10	1	5	7	40	69.0	105	-16	+10.5	+12	930	T2	0148	0368	0588	0808
60	20	± 5	1	5	7	40	69.0	105	-16	+10.5	+12	930	T2	0149	0369	0589	0809
60	39	±20	1	9	10	40	69.0	90	-28	+10.5	+12	1110	T2	0150	0370	0590	0810
60	39	±10	1	9	10	40	69.0	90	-28	+10.5	+12	1110	T2	0151	0371	0591	0811
60	39	± 5	1	9	10	40	69.0	90	-28	+10.5	+12	1110	T2	0152	0372	0592	0812
60	50	±20	2	12	10	40	69.0	50	-16	+10.5	+12	1330	T3	0153	0373	0593	0813
60	50	±10	2	12	10	40	69.0	50	-16	+10.5	+12	1330	T3	0154	0374	0594	0814
60	50	± 5	2	12	10	40	69.0	50	-16	+10.5	+12	1330	T3	0155	0375	0595	0815
60	68	±20	2	16	13	40	69.0	50	-32	+10.5	+12	1365	T3	0156	0376	0596	0816
60	68	±10	2	16	13	40	69.0	50	-32	+10.5	+12	1365	T3	0157	0377	0597	0817
60	68	± 5	2	16	13	40	69.0	50	-32	+10.5	+12	1365	T3	0158	0378	0598	0818
60	140	±20	8	32	16	40	69.0	28	-40	+20	+20	1850	T4	0159	0379	0599	0819
60	140	±10	8	32	16	40	69.0	28	-40	+20	+20	1850	T4	0160	0380	0600	0820
75	3.5	±20	1	2	2.5	50	86.2	650	-16	+ 5	+ 6	525	T1	0161	0381	0601	0821
75	3.5	±10	1	2	2.5	50	86.2	650	-16	+ 5	+ 6	525	T1	0162	0382	0602	0822
75	3.5	± 5	1	2	2.5	50	86.2	650	-16	+ 5	+ 6	525	T1	0163	0383	0603	0823
75	6.8	±20	1	2	3.5	50	86.2	300	-20	+ 8	+ 9	610	T1	0164	0384	0604	0824
75	6.8	±10	1	2	3.5	50	86.2	300	-20	+ 8	+ 9	610	T1	0165	0385	0605	0825
75	6.8	± 5	1	2	3.5	50	86.2	300	-20	+ 8	+ 9	610	T1	0166	0386	0606	0826
75	15	±20	1	5	6	50	86.2	150	-16	+ 8	+ 9	890	T2	0167	0387	0607	0827
75	15	±10	1	5	6	50	86.2	150	-16	+ 8	+ 9	890	T2	0168	0388	0608	0828
75	15	± 5	1	5	6	50	86.2	150	-16	+ 8	+ 9	890	T2	0169	0389	0609	0829
75	33	±20	1	10	10	50	86.2	90	-24	+10.5	+15	1000	T2	0170	0390	0610	0830
75	33	±10	1	10	10	50	86.2	90	-24	+10.5	+15	1000	T2	0171	0391	0611	0831
75	33	± 5	1	10	10	50	86.2	90	-24	+10.5	+15	1000	T2	0172	0392	0612	0832
75	40	±20	2	12	9	50	86.2	60	-16	+10.5	+12	1250	T3	0173	0393	0613	0833
75	40	±10	2	12	9	50	86.2	60	-16	+10.5	+12	1250	T3	0174	0394	0614	0834
75	40	± 5	2	12	9	50	86.2	60	-16	+10.5	+12	1250	T3	0175	0395	0615	0835
75	56	±20	2	17	11	50	86.2	60	-28	+10.5	+15	1335	T3	0176	0396	0616	0836
75	56	±10	2	17	11	50	86.2	60	-28	+10.5	+15	1335	T3	0177	0397	0617	0837
75	56	± 5	2	17	11	50	86.2	60	-28	+10.5	+15	1335	T3	0178	0398	0618	0838
75	110	±20	9	36	12	50	86.2	29	-35	+20	+20	1850	T4	0179	0399	0619	0839
75	110	±10	9	36	12	50	86.2	29	-35	+20	+20	1850	T4	0180	0400	0620	0840

See footnotes at end of table.

MIL-C-39006/22
STYLE CLR79

1 Rated voltage (+85°C)	Cap.	Cap. tolerance	DC leakage (max)		Dissipation factor (max)	Derated voltage (+125°C)	Surge voltage (+85°C)	Impedance (max)	Capacitance change at			2/Max. 85 C 40 kHz ripple current	Case size	Part No. M39006/22-* Failure rate level (%1.000 hr)			
			+25°C	+85°C & +125°C					−55°C	+85°C	+125°C			M(1.0)	P(0.1)	R(0.01)	S(0.001)
Vdc	uF	%	uA	uA	%	Vdc	Vdc	Ohms	%	%	%	mA rms					
100	2.5	±20	1	2	2	65	115	950	−16	+ 7	+ 8	505	T1	0181	0401	0621	0841
100	2.5	±10	1	2	2	65	115	950	−16	+ 7	+ 8	505	T1	0182	0402	0622	0842
100	2.5	± 5	1	2	2	65	115	950	−16	+ 7	+ 8	505	T1	0183	0403	0623	0843
100	4.7	±20	1	2	3	65	115	500	−16	+ 7	+ 8	565	T1	0184	0404	0624	0844
100	4.7	±10	1	2	3	65	115	500	−16	+ 7	+ 8	565	T1	0185	0405	0625	0845
100	4.7	± 5	1	2	3	65	115	500	−16	+ 7	+ 8	565	T1	0186	0406	0626	0846
100	11	±20	1	4	5	65	115	200	−16	+ 8	+ 8	835	T2	0187	0407	0627	0847
100	11	±10	1	4	5	65	115	200	−16	+ 8	+ 8	835	T2	0188	0408	0628	0848
100	11	± 5	1	4	5	65	115	200	−16	+ 8	+ 8	835	T2	0189	0409	0629	0849
100	22	±20	1	9	7.5	65	115	100	−16	+ 8	+ 8	965	T2	0190	0410	0630	0850
100	22	±10	1	9	7.5	65	115	100	−16	+ 8	+ 8	965	T2	0191	0411	0631	0851
100	22	± 5	1	9	7.5	65	115	100	−16	+ 8	+ 8	965	T2	0192	0412	0632	0852
100	30	±20	2	12	7	65	115	80	−16	+ 8	+ 8	1240	T3	0193	0413	0633	0853
100	30	±10	2	12	7	65	115	80	−16	+ 8	+ 8	1240	T3	0194	0414	0634	0854
100	30	± 5	2	12	7	65	115	80	−16	+ 8	+ 8	1240	T3	0195	0415	0635	0855
100	43	±20	2	17	8.5	65	115	70	−20	+ 8	+ 8	1335	T3	0196	0416	0636	0856
100	43	±10	2	17	8.5	65	115	70	−20	+ 8	+ 8	1335	T3	0197	0417	0637	0857
100	43	± 5	2	17	8.5	65	115	70	−20	+ 8	+ 8	1335	T3	0198	0418	0638	0858
100	86	±20	9	36	10	65	115	30	−25	+15	+15	1800	T4	0199	0419	0639	0859
100	86	±10	9	36	10	65	115	30	−25	+15	+15	1800	T4	0200	0420	0640	0860
125	1.7	±20	1	2	2	85	144	1250	−16	+ 7	+ 8	415	T1	0201	0421	0641	0861
125	1.7	±10	1	2	2	85	144	1250	−16	+ 7	+ 8	415	T1	0202	0422	0642	0862
125	1.7	± 5	1	2	2	85	144	1250	−16	+ 7	+ 8	415	T1	0203	0423	0643	0863
125	3.6	±20	1	2	2.7	85	144	600	−16	+ 7	+ 8	520	T1	0204	0424	0644	0864
125	3.6	±10	1	2	2.7	85	144	600	−16	+ 7	+ 8	520	T1	0205	0425	0645	0865
125	3.6	± 5	1	2	2.7	85	144	600	−16	+ 7	+ 8	520	T1	0206	0426	0646	0866
125	9	±20	1	5	5	85	144	240	−16	+ 7	+ 8	755	T2	0207	0427	0647	0867
125	9	±10	1	5	5	85	144	240	−16	+ 7	+ 8	755	T2	0208	0428	0648	0868
125	9	± 5	1	5	5	85	144	240	−16	+ 7	+ 8	755	T2	0209	0429	0649	0869
125	14	±20	1	7	6	85	144	167	−16	+ 7	+ 8	860	T2	0210	0430	0650	0870
125	14	±10	1	7	6	85	144	167	−16	+ 7	+ 8	860	T2	0211	0431	0651	0871
125	14	± 5	1	7	6	85	144	167	−16	+ 7	+ 8	860	T2	0212	0432	0652	0872
125	18	±20	2	9	5	85	144	129	−16	+ 7	+ 8	1130	T3	0213	0433	0653	0873
125	18	±10	2	9	5	85	144	129	−16	+ 7	+ 8	1130	T3	0214	0434	0654	0874
125	18	± 5	2	9	5	85	144	129	−16	+ 7	+ 8	1130	T3	0215	0435	0655	0875
125	25	±20	2	13	6	85	144	93	−16	+ 7	+ 8	1200	T3	0216	0436	0656	0876
125	25	±10	2	13	6	85	144	93	−16	+ 7	+ 8	1200	T3	0217	0437	0657	0877
125	25	± 5	2	13	6	85	144	93	−16	+ 7	+ 8	1200	T3	0218	0438	0658	0878
125	56	±20	10	40	6.5	85	144	32	−25	+15	+15	1800	T4	0219	0439	0659	0879
125	56	±10	10	40	6.5	85	144	32	−25	+15	+15	1800	T4	0220	0440	0660	0880

Ripple current multipliers vs frequency, temperature, and applied peak voltage.

Frequency of applied ripple		120Hz Temp C				800 Hz Temp C				1 kHz Temp C				10kHz Temp C				40kHz Temp C				100kHz Temp C			
	current Ambient still air	<55	85	105	125	<55	85	105	125	<55	85	105	125	<55	85	105	125	<55	85	105	125	<55	85	105	125
% of 85 C rated peak voltage	100%	.60	.39	–	–	.71	.43	–	–	.72	.45	–	–	.88	.55	–	–	1.0	.63	–	–	1.1	.69	–	–
	90%	.60	.46	–	–	.71	.55	–	–	.72	.55	–	–	.88	.67	–	–	1.0	.77	–	–	1.1	.85	–	–
	80%	.60	.52	.35	–	.71	.62	.42	–	.72	.62	.42	–	.88	.76	.52	–	1.0	.87	.59	–	1.1	.96	.65	–
	70%	.60	.58	.44	–	.71	.69	.52	–	.72	.70	.52	–	.88	.85	.64	–	1.0	.97	.73	–	1.1	1.07	.80	–
	≤66 ⅔%	.60	.60	.46	.27	.71	.71	.55	.32	.72	.72	.55	.32	.88	.88	.68	.40	1.0	1.0	.77	.45	1.1	1.1	.85	.50

1/Reverse voltage rating at 85°C is 3 VDC and at 125°C is 2 VDC.

2/For ripple current limits at various temperatures, voltages, and frequencies, see table directly above.

*For the optional vibration & shock requirements (i.e., 51G Random Vibration, 80G Sinusoidal Vibration, and 500G Shock) the letter "H" must appear following the four digit dash number.

MIL-C-3965

Military Style Tantalum Capacitors

CL20 CL21

MIL-C-3965 Part Number System

Example: CL31 B J 200 M P G

Style	Description
CL20	Polar, etch foil, uninsulated
CL21	Polar, etch foil, insulated
CL22	Non polar, etch foil, uninsulated
CL23	Non polar, etch foil, insulated
CL30	Polar, plain foil, uninsulated
CL31	Polar, plain foil, insulated
CL32	Non polar, plain foil, uninsulated
CL33	Non polar, plain foil, insulated
CL70	Polar, high-etch foil, uninsulated
CL71	Polar, high-etch foil, insulated
CL72	Non polar, high-etch foil, uninsulated
CL73	Non polar, high-etch foil, insulated

Characteristic
−55°C to 85°C
(Will operate up to 125°C when properly derated)

Capacitance—Expressed in (uf)
First two digits represent significant figures; third digit represents number of zeros to follow. "R" indicates decimal point.

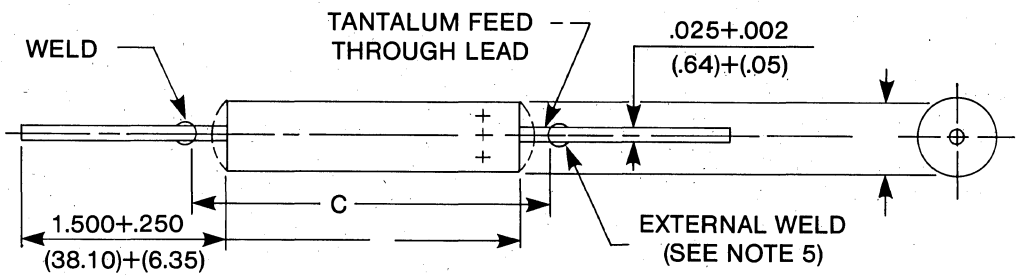
Seal
G—Hermetic (Glass)
E—Non hermetic (Elastomer)

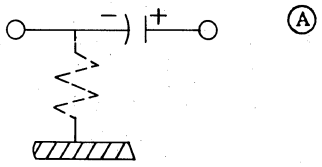
Construction
P—Polar
N—Non polar

Voltage Symbol	Volts 85°C/125°C	Voltage Symbol	Volts 85°C/125°C
A	3/2	N	100/65
B	6/4	O	250/165
C	8/5	P	125/85
D	10/7	Q	150/100
E	15/10	R	180/120
F	20/13	S	270/180
G	25/15	T	360/240
H	30/20	U	450/300
I	112/75	V	540/360
J	50/30	W	630/420
K	60/40	X	300/200
L	75/50	Y	375/250
M	90/60	Z	200/150

Capacitance Symbol	Tolerance %
J	±5
K	±10
L	±15
M	±20
S	+30-15
T	+50-15
U	+75-15

Outline Drawing and Dimensions
Styles CL20-23, CL30-33, and CL70-73





CIRCUIT DIAGRAM
(SEE NOTE 4)

Case size	Dimensions			
	Basic case		Insulated case	
	L* ±.062 (1.57)	D ±.016 (.41)	D Max	C Max
E1	.688 (17.48)	.188 (4.78)	.219 (5.56)	1.188 (30.18)
E2	.906 (23.01)	.281 (7.14)	.312 (7.92)	1.406 (35.71)
G2	.969 (24.61)	.281 (7.14)	.312 (7.92)	1.469 (37.31)
E3, G3	1.438 (36.53)	.375 (9.53)	.406 (10.31)	1.938 (49.23)
E4, G4	2.125 (53.98)	.375 (9.53)	.406 (10.31)	2.625 (66.68)
E5, G5	2.750 (69.85)	.375 (9.53)	.406 (10.31)	3.250 (82.55)

**For insulated styles shrinkable sleeving shall lap over the ends of the case.*

NOTES:
1. Dimensions are in inches.
2. Millimeters are in parentheses.
3. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.
4. There is an indeterminate resistance between the metal case and the negative terminal.
5. The weld shall not be enclosed in the end seal.

MIL-C-3965/17
STYLES CL20 & CL21

Type designation 1/	Voltage			Capacitance	DC leakage (max)		Impedance (max)	Case size 2/
	Rated (85°C)	Derated (125°C)	Surge (85°C)		25°C	85°C & 125°C		
	volts, dc	volts, dc	volts, dc	uF	uA	uA	ohms	
CL2-BE150UPE	15	10	17.2	15	2	4	220	E1
CL2-BE600UP-	15	10	17.2	60	2	10	55	E2
CL2-BE201UP-	15	10	17.2	200	3	40	17	E3
CL2-BE401UP-	15	10	17.2	400	6	80	9	E4
CL2-BE581UP-	15	10	17.2	580	9	100	6	E5
CL2-BG100UPE	25	15	28.8	10	2	4	330	E1
CL2-BG400UP-	25	15	28.8	40	2	13	83	E2
CL2-BG121UP-	25	15	28.8	120	3	40	27	E3
CL2-BG251UP-	25	15	28.8	250	6	80	13	E4
CL2-BG351UP-	25	15	28.8	350	10	100	10	E5
CL2-BH080UPE	30	20	34.5	8	2	6	424	E1
CL2-BH320UP-	30	20	34.5	32	2	14	106	E2
CL2-BH111UP-	30	20	34.5	110	4	50	31	E3
CL2-BH221UP-	30	20	34.5	220	8	90	16	E4
CL2-BH301UP-	30	20	34.5	300	11	120	11	E5
CL2-BJ4R5TPE	50	30	57.5	4.5	2	4	730	E1
CL2-BJ180TP-	50	30	57.5	18	2	13	180	E2
CL2-BJ600TP-	50	30	57.5	60	3	40	55	E3
CL2-BJ101TP-	50	30	57.5	100	4	75	33	E4
CL2-BJ151TP-	50	30	57.5	150	5	100	22	E5
CL2-BL030TPE	75	50	86.2	3	2	4	1000	E1
CL2-BL120TP-	75	50	86.2	12	2	13	270	E2
CL2-BL300TP-	75	50	86.2	30	3	34	110	E3
CL2-BL700TP-	75	50	86.2	70	6	80	47	E4
CL2-BL101TP-	75	50	86.2	100	10	100	33	E5
CL2-BN020SPE	100	65	115.0	2	2	4	1600	E1
CL2-BN080SP-	100	65	115.0	8	2	12	410	E2
CL2-BN250SP-	100	65	115.0	25	2.5	37	130	E3
CL2-BN500SP-	100	65	115.0	50	5	75	66	E4
CL2-BN700SP-	100	65	115.0	70	7	100	47	E5
CL2-BQ010SPE	150	100	172.0	1	2	4	3000	E1
CL2-BQ040SP-	150	100	172.0	4	2	13	750	E2
CL2-BQ130SP-	150	100	172.0	13	3	30	250	E3
CL2-BQ250SP-	150	100	172.0	25	5	80	130	E4
CL2-BQ360SP-	150	100	172.0	36	8	100	94	E5

1/ Complete type designation will include an additional symbol to indicate style, and where applicable, an additional symbol to indicate type of seal.
2/ Where applicable, the complete case size will include an additional symbol to indicate type of seal.

MIL-C-3965

Military Style Tantalum Capacitors

MIL-C-3965/18
STYLES CL22 & CL23

Type designation 1/	Voltage			Capacitance	DC leakage (max)		Impedance (max)	Case size 2/
	Rated (85°C)	Derated (125°C)	Surge (85°C)		25°C	85°C & 125°C		
	volts, dc	volts, dc	volts, dc	uF	uA	uA	ohms	
CL2-BE100UNE	15	10	17.2	10	2	4	339	E1
CL2-BE400UN-	15	10	17.2	40	2	10	85	E2
CL2-BE121UN-	15	10	17.2	120	3	40	27	E3
CL2-BE251UN-	15	10	17.2	250	6	80	14	E4
CL2-BE351UN-	15	10	17.2	350	9	100	10	E5
CL2-BG050UNE	25	15	28.8	5	2	4	680	E1
CL2-BG200UN-	25	15	28.8	20	2	13	170	E2
CL2-BG700UN-	25	15	28.8	70	3	40	49	E3
CL2-BG141UN-	25	15	28.8	140	6	80	24	E4
CL2-BG201UN-	25	15	28.8	200	10	100	17	E5
CL2-BH4R5UNE	30	20	34.5	4.5	2	6	754	E1
CL2-BH180UN-	30	20	34.5	18	2	14	188	E2
CL2-BH600UN-	30	20	34.5	60	4	50	57	E3
CL2-BH121UN-	30	20	34.5	120	8	90	28	E4
CL2-BH171UN-	30	20	34.5	170	11	120	20	E5
CL2-BJ2R5TNE	50	30	57.5	2.5	2	4	1355	E1
CL2-BJ100TN-	50	30	57.5	10	2	13	339	E2
CL2-BJ300TN-	50	30	57.5	30	3	40	113	E3
CL2-BJ600TN-	50	30	57.5	60	4	75	57	E4
CL2-BJ800TN-	50	30	57.5	80	5	100	41	E5
CL2-BL1R5TNE	75	50	86.2	1.5	2	4	2255	E1
CL2-BL060TN-	75	50	86.2	6	2	13	560	E2
CL2-BL150TN-	75	50	86.2	15	3	34	226	E3
CL2-BL350TN-	75	50	86.2	35	5	80	97	E4
CL2-BL500TN-	75	50	86.2	50	10	100	68	E5
CL2-BN010TNE	100	65	115.0	1	2	4	3385	E1
CL2-BN040TN-	100	65	115.0	4	2	13	845	E2
CL2-BN120TN-	100	65	115.0	12	3	37	283	E3
CL2-BN250TN-	100	65	115.0	25	5	75	135	E4
CL2-BN350TN-	100	65	115.0	35	7	100	97	E5
CL2-BQ0R5SNE	150	100	172.0	0.5	2	4	6780	E1
CL2-BQ020SN-	150	100	172.0	2	2	13	1693	E2
CL2-BQ060SN-	150	100	172.0	6	3	30	565	E3
CL2-BQ120SN-	150	100	172.0	12	5	80	283	E4
CL2-BQ180SN-	150	100	172.0	18	8	100	188	E5

1/ Complete type designation will include an additional symbol to indicate style, and where applicable, an additional symbol to indicate type of seal.
2/ Where applicable, the complete case size will include an additional symbol to indicate type of seal.

MIL-C-3965/15
STYLES CL30 & CL31

Type designation 1/	Rated (85°C)	Voltage Derated (125°C)	Surge (85°C)	Capacitance	DC leakage (max) 25°C	DC leakage (max) 85°C & 125°C	Impedance (max)	Case size 2/
	volts, dc	volts, dc	volts, dc	uF	uA	uA	ohms	
CL3-BA100MPE	3	2	3.4	10	1	2	250	E1
CL3-BA500MP-	3	2	3.4	50	2	6	50	E2
CL3-BB080MPE	6	4	6.9	8	1	2	329	E1
CL3-BB300MP-	6	4	6.9	30	2	6	88	E2
CL3-BB101MP-	6	4	6.9	100	2	10	26	E3
CL3-BB201MP-	6	4	6.9	200	4	30	13	E4
CL3-BB301MP-	6	4	6.9	300	5	50	9	E5
CL3-BD060MPE	10	7	11.5	6	1	2	440	E1
CL3-BD250MP-	10	7	11.5	25	2	6	105	E2
CL3-BD800MP-	10	7	11.5	80	2	10	33	E3
CL3-BD161MP-	10	7	11.5	160	4	20	17	E4
CL3-BD221MP-	10	7	11.5	220	5	50	12	E5
CL3-BE4R5MPE	15	10	17.2	4.5	1	2	495	E1
CL3-BE100MP-	15	10	17.2	10	2	4	250	E2
CL3-BE180MP-	15	10	17.2	18	2	4	125	E2
CL3-BE550MP-	15	10	17.2	55	2	10	41	E3
CL3-BE111MP-	15	10	17.2	110	4	20	20	E4
CL3-BE161MP-	15	10	17.2	160	5	30	14	E5
CL3-BG030MPE	25	15	28.8	3	1	2	744	E1
CL3-BG120MP-	25	15	28.8	12	2	4	186	E2
CL3-BG350MP-	25	15	28.8	35	2	10	64	E3
CL3-BG700MP-	25	15	28.8	70	4	20	32	E4
CL3-BG101MP-	25	15	28.8	100	6	30	23	E5
CL3-BH2R5MPE	30	20	34.5	2.5	2	5	893	E1
CL3-BH100MP-	30	20	34.5	10	2	6	265	E2
CL3-BH300MP-	30	20	34.5	30	2	13	75	E3
CL3-BH600MP-	30	20	34.5	60	4	26	37	E4
CL3-BH850MP-	30	20	34.5	85	6	38	27	E5
CL3-BJ1R5MPE	50	30	57.5	1.5	1	4	1487	E1
CL3-BJ060MP-	50	30	57.5	6	2	6	372	E2
CL3-BJ200MP-	50	30	57.5	20	2	13	112	E3
CL3-BJ400MP-	50	30	57.5	40	4	26	56	E4
CL3-BJ550MP-	50	30	57.5	55	6	38	41	E5
CL3-BL010MPE	75	50	86.2	1	1	4	2232	E1
CL3-BL040MP-	75	50	86.2	4	2	6	558	E2
CL3-BL140MP-	75	50	86.2	14	2	13	159	E3
CL3-BL280MP-	75	50	86.2	28	4	26	80	E4
CL3-BL400MP-	75	50	86.2	40	6	38	56	E5
CL3-BN0R8MPE	100	65	115.0	0.8	1	3.5	2790	E1
CL3-BN030MP-	100	65	115.0	3	2	6	743	E2
CL3-BN100MP-	100	65	115.0	10	2	13	223	E3
CL3-BN200MP-	100	65	115.0	20	3	25	112	E4
CL3-BN300MP-	100	65	115.0	30	6	38	74	E5
CL3-BQ0R5MPE	150	100	172.0	0.5	2	4	4454	E1
CL3-BQ020MP-	150	100	172.0	2	2	6	1115	E2
CL3-BQ040MP-	150	100	172.0	4	3	13	558	E3
CL3-BQ070MP-	150	100	172.0	7	3	13	319	E3
CL3-BQ080MP-	150	100	172.0	8	4	26	265	E4
CL3-BQ120MP-	150	100	172.0	12	4	26	208	E4
CL3-BQ140MP-	150	100	172.0	14	4	26	159	E4
CL3-BQ200MP-	150	100	172.0	20	6	38	112	E5
CL3-BZR35LPE	200	150	230.0	0.35	4	25	5577	E1
CL3-BZ1R5LP-	200	150	230.0	1.5	8	32	1300	E2
CL3-BZ050LP-	200	150	230.0	5	16	64	400	E3
CL3-BZ100LP-	200	150	230.0	10	28	100	200	E4
CL3-BZ150LP-	200	150	230.0	15	40	160	130	E5
CL3-BOR30LPE	250	165	287.0	.30	6	32	6600	E1
CL3-BO1R2LP-	250	165	287.0	1.2	8	40	1600	E2
CL3-BO040LP-	250	165	287.0	4	16	80	500	E3
CL3-BO080LP-	250	165	287.0	8	28	140	250	E4
CL3-BO120LP-	250	165	287.0	12	40	200	160	E5
CL3-BXR27LPE	300	200	345.0	.27	6	40	9000	E1
CL3-BX010LP-	300	200	345.0	1	10	50	2250	E2
CL3-BX030LP-	300	200	345.0	3	20	100	750	E3
CL3-BX070LP-	300	200	345.0	7	35	175	322	E4
CL3-BX100LP-	300	200	345.0	10	50	250	225	E5

1/ Complete type designation will include an additional symbol to indicate style, and where applicable, an additional symbol to indicate type of seal.
2/ Where applicable, the complete case size will include an additional symbol to indicate type of seal.

MIL-C-3965

Military Style Tantalum Capacitors

MIL-C-3965/16
STYLES CL32 & CL33

Type designation 1/	Rated (85°C)	Voltage Derated (125°C)	Surge (85°C)	Capacitance	DC leakage (max) 25°C	DC leakage (max) 85°C & 125°C	Impedance (max)	Case size 2/
	volts, dc	volts, dc	volts, dc	uF	uA	uA	ohms	
CL3-BA100MNE	3	2	3.4	10	1	2	263	E1
CL3-BA450-MN-	3	2	3.4	45	2	4	59	E2
CL3-BA141MN-	3	2	3.4	140	2	10	19	E3
CL3-BA281MN-	3	2	3.4	280	3	20	10	E4
CL3-BA401MN-	3	2	3.4	400	5	30	6	E5
CL3-BB070MNE	6	4	6.9	7	1	2	377	E1
CL3-BB250MN-	6	4	6.9	25	2	4	105	E2
CL3-BB850MN-	6	4	6.9	85	2	10	31	E3
CL3-BB171MN-	6	4	6.9	170	4	20	15	E4
CL3-BB251MN-	6	4	6.9	250	5	30	11	E5
CL3-BD040MNE	10	7	11.5	4	1	2	660	E1
CL3-BD160MN-	10	7	11.5	16	2	4	165	E2
CL3-BD550MN-	10	7	11.5	55	2	10	48	E3
CL3-BD111MN-	10	7	11.5	110	4	20	24	E4
CL3-BD151MN-	10	7	11.5	150	5	30	18	E5
CL3-BE2R5MNE	15	10	17.2	2.5	1	2	893	E1
CL3-BE100MN-	15	10	17.2	10	2	4	223	E2
CL3-BE350MN-	15	10	17.2	35	2	10	64	E3
CL3-BE700MN-	15	10	17.2	70	4	20	32	E4
CL3-BE101MN-	15	10	17.2	100	5	30	23	E5
CL3-BG1R5MNE	25	15	28.8	1.5	1	3	1487	E1
CL3-BG060MN-	25	15	28.8	6	2	6	372	E2
CL3-BG200MN-	25	15	28.8	20	2	10	112	E3
CL3-BG400MN-	25	15	28.8	40	4	20	56	E4
CL3-BG600MN-	25	15	28.8	60	5	30	37	E5
CL3-BH1R4MNE	30	20	34.5	1.4	2	5	1594	E1
CL3-BH5R5MN-	30	20	34.5	5.5	2	6	406	E2
CL3-BH180MN-	30	20	34.5	18	2	12	124	E3
CL3-BH360MN-	30	20	34.5	36	4	26	62	E4
CL3-BH450MN-	30	20	34.5	45	6	36	50	E5
CL3-BJ0R8MNE	50	30	57.5	0.8	1	4	2790	E1
CL3-BJ030MN-	50	30	57.5	3	2	6	743	E2
CL3-BJ100MN-	50	30	57.5	10	2	12	223	E3
CL3-BJ200MN-	50	30	57.5	20	4	24	112	E4
CL3-BJ300MN-	50	30	57.5	30	6	36	75	E5
CL3-BL0R5MNE	75	50	86.2	0.5	1	4	4460	E1
CL3-BL020MN-	75	50	86.2	2	2	6	1115	E2
CL3-BL070MN-	75	50	86.2	7	2	13	319	E3
CL3-BL140MN-	75	50	86.2	14	4	24	159	E4
CL3-BL200MN-	75	50	86.2	20	6	36	112	E5
CL3-BN0R4MNE	100	65	115.0	0.4	1	3.5	5580	E1
CL3-BN1R5MN-	100	65	115.0	1.5	2	6	1487	E2
CL3-BN050MN-	100	65	115.0	5	2	13	446	E3
CL3-BN100MN-	100	65	115.0	10	4	24	223	E4
CL3-BN150MN-	100	65	115.0	15	6	36	149	E5
CL3-BQR25MNE	150	100	172.0	0.25	2	4	8908	E1
CL3-BQ010MN-	150	100	172.0	1	2	6	2227	E2
CL3-BQ3R5MN-	150	100	172.0	3.5	3	13	638	E3
CL3-BQ070MN-	150	100	172.0	7	4	24	319	E4
CL3-BQ100MN-	150	100	172.0	10	6	36	223	E5
CL3-BZR15LNE	200	150	259.0	0.15	4	25	14000	E1
CL3-BZR75LN-	200	150	259.0	0.75	8	32	2600	E2
CL3-BZ2R5LN-	200	150	259.0	2.5	16	64	800	E3
CL3-BZ050LN-	200	150	259.0	5	28	112	400	E4
CL3-BZ7R5LN-	200	150	259.0	7.5	40	160	260	E5
CL3-BOR15LNE	250	165	287.0	0.15	6	32	13000	E1
CL3-BO0R6LN-	250	165	287.0	0.6	8	40	3300	E2
CL3-BO020LN-	250	165	287.0	2	16	80	1000	E3
CL3-BO040LN-	250	165	287.0	4	28	140	500	E4
CL3-BO060LN-	250	165	287.0	6	40	200	330	E5
CL3-BXR12LNE	300	200	345.0	0.12	4	25	17500	E1
CL3-BXR47LN-	300	200	345.0	0.47	10	50	4500	E2
CL3-BX1R5LN-	300	200	345.0	1.5	20	100	1500	E3
CL3-BX3R3LN-	300	200	345.0	3.3	35	175	643	E4
CL3-BX4R7LN-	300	200	345.0	4.7	50	250	450	E5

1/ Complete type designation will include an additional symbol to indicate style, and where applicable, an additional symbol to indicate type of seal.
2/ Where applicable, the complete case size will include an additional symbol to indicate type of seal.

MIL-C-3965/22
STYLES CL70 & CL71

Type designation 1/	Voltage			Capacitance	DC leakage (max)			Impedance (max)	Case size
	Rated (85°C)	Derated (125°C)	Surge (85°C)		25°C	85°C	125°C		
	volts, dc	volts, dc	volts, dc	uF	uA	uA	uA	ohms	
CL7-BE290UPE	15	10	17.2	29	7	35	23	137	E1
CL7-BE101UPE	15	10	17.2	100	23	100	80	37	E2
CL7-BE311UPE	15	10	17.2	310	61	370	250	10.8	E3
CL7-BE651UPE	15	10	17.2	650	130	780	520	5.1	E4
CL7-BE921UPE	15	10	17.2	920	185	1100	750	4.0	E5
CL7-BG170UPE	25	15	28.8	17	6	34	21	220	E1
CL7-BG600UPE	25	15	28.8	60	23	100	72	62	E2
CL7-BG181UPE	25	15	28.8	180	60	360	220	20.5	E3
CL7-BG381UPE	25	15	28.8	380	125	760	460	9.6	E4
CL7-BG551UPE	25	15	28.8	550	185	1100	660	6.7	E5
CL7-BH150UPE	30	20	34.5	15	6	34	22	250	E1
CL7-BH520UPE	30	20	34.5	52	23	120	80	71	E2
CL7-BH151UPE	30	20	34.5	150	60	360	240	25	E3
CL7-BH321UPE	30	20	34.5	320	125	750	500	11.5	E4
CL7-BH461UPE	30	20	34.5	460	165	1000	700	8	E5
CL7-BJ070TPE	50	30	57.5	7	5	28	17	550	E1
CL7-BJ250TPE	50	30	57.5	25	19	100	60	150	E2
CL7-BJ750TPE	50	30	57.5	75	50	300	180	49	E3
CL7-BJ161TPE	50	30	57.5	160	100	640	390	23	E4
CL7-BJ231TPE	50	30	57.5	230	150	920	550	16	E5
CL7-BL040TPE	75	50	86.2	4	5	24	16	930	E1
CL7-BL150TPE	75	50	86.2	15	17	90	60	250	E2
CL7-BL450TPE	75	50	86.2	45	45	270	180	83	E3
CL7-BL950TPE	75	50	86.2	95	95	570	380	39	E4
CL7-BL131TPE	75	50	86.2	130	130	780	520	29	E5
CL7-BN030SPE	100	65	115.0	3	4	20	14	1210	E1
CL7-BN100SPE	100	65	115.0	10	15	80	52	370	E2
CL7-BN300SPE	100	65	115.0	30	40	230	150	121	E3
CL7-BN630SPE	100	65	115.0	63	80	480	310	58	E4
CL7-BN900SPE	100	65	115.0	90	120	720	470	41	E5
CL7-BQ1R6SPE	150	100	172.0	1.6	3	18	12	2340	E1
CL7-BQ5R5SPE	150	100	172.0	5.5	12	64	42	675	E2
CL7-BQ170SPE	150	100	172.0	17	30	190	130	220	E3
CL7-BQ350SPE	150	100	172.0	35	65	400	260	106	E4
CL7-BQ500SPE	150	100	172.0	50	95	560	380	74	E5

1/ Complete type designation will include an additional symbol to indicate style.

MIL-C-3965

Military Style Tantalum Capacitors

MIL-C-3965/23
STYLES CL72 & CL73

Type designation 1/	Voltage			Capacitance	DC leakage (max)			Impedance (max)	Case size
	Rated (85°C)	Derated (125°C)	Surge (85°C)		25°C	85°C	125°C		
	volts, dc	volts, dc	volts, dc	uF	uA	uA	uA	ohms	
CL7-BE200UNE	15	10	17.2	20	5	24	16	185	E1
CL7-BE700UNE	15	10	17.2	70	15	84	56	55	E2
CL7-BE201UNE	15	10	17.2	200	40	240	160	18.5	E3
CL7-BE411UNE	15	10	17.2	410	75	500	330	8.9	E4
CL7-BE591UNE	15	10	17.2	590	118	710	470	6.2	E5
CL7-BG100UNE	25	15	28.8	10	4	20	12	370	E1
CL7-BG350UNE	25	15	28.8	35	12	70	43	106	E2
CL7-BG101UNE	25	15	28.8	100	30	200	120	37	E3
CL7-BG211UNE	25	15	28.8	210	40	400	250	17.5	E4
CL7-BG301UNE	25	15	28.8	300	100	600	360	12.1	E5
CL7-BH080UNE	30	20	34.5	8	3	19	12	455	E1
CL7-BH290UNE	30	20	34.5	29	11	60	40	137	E2
CL7-BH800UNE	30	20	34.5	80	30	180	120	45.5	E3
CL7-BH171UNE	30	20	34.5	170	65	390	260	22	E4
CL7-BH241UNE	30	20	34.5	240	90	550	370	7.8	E5
CL7-BJ3R5TNE	50	30	57.5	3.5	3	14	9	1060	E1
CL7-BJ130TNE	50	30	57.5	13	10	52	31	285	E2
CL7-BJ360TNE	50	30	57.5	36	24	145	86	104	E3
CL7-BJ750TNE	50	30	57.5	75	45	300	180	49	E4
CL7-BJ111TNE	50	30	57.5	110	75	440	260	34	E5
CL7-BL020TNE	75	50	86.2	2	2	12	8	1850	E1
CL7-BL070TNE	75	50	86.2	7	8	42	28	550	E2
CL7-BL200TNE	75	50	86.2	20	23	120	80	185	E3
CL7-BL430TNE	75	50	86.2	43	45	260	170	86	E4
CL7-BL600TNE	75	50	86.2	60	60	360	240	62	E5
CL7-BN1R4SNE	100	65	115.0	1.4	2	11	7	2700	E1
CL7-BN050SNE	100	65	115.0	5	7	38	25	750	E2
CL7-BN140SNE	100	65	115.0	14	15	110	68	268	E3
CL7-BN290SNE	100	65	115.0	29	35	220	145	137	E4
CL7-BN410SNE	100	65	115.0	41	50	320	210	91	E5
CL7-BQR75SNE	150	100	172.0	0.75	2	9	6	5000	E1
CL7-BQ2R7SNE	150	100	172.0	2.7	6	30	20	1380	E2
CL7-BQ7R5SNE	150	100	172.0	7.5	15	84	56	490	E3
CL7-BQ150SNE	150	100	172.0	15	30	180	120	250	E4
CL7-BQ220SNE	150	100	172.0	22	45	270	175	170	E5

1/ Complete type designation will include an additional symbol to indicate style.

MIL-C-3965

Military Style Tantalum Capacitors

CL51 CL52

MIL-C-3965 Part Number System

Example: CL51 B J 200 M P G

Style	Description
CL51	Polar, plain foil, KSR™
CL52	Non polar, plain foil, KSR™
CL53	Polar, etch foil, KSR™
CL54	Non polar, etch foil, KSR™

Characteristic
−55°C to 85°C
(Will operate up to 125°C when properly derated)

Capacitance–Expressed in (uf)
First two digits represent significant figures; third digit represents number of zeros to follow. "R" indicates decimal point.

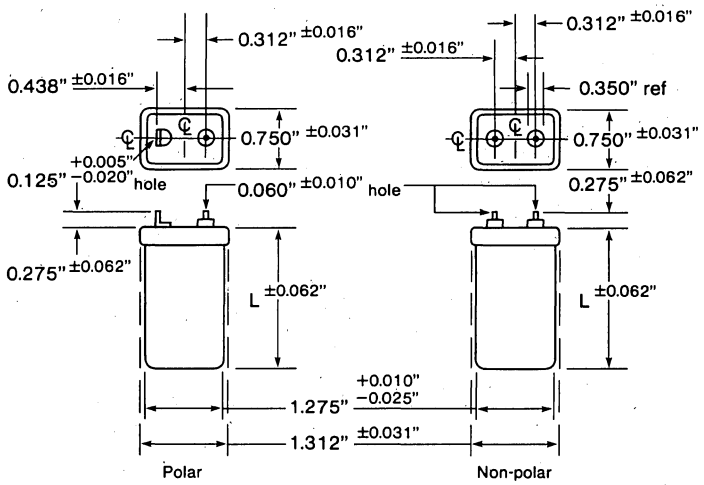
Seal
G–Hermetic (Glass)

Construction
P–Polar
N–Non polar

Voltage Symbol	Volts 85°C/125°C	Voltage Symbol	Volts 85°C/125°C
A	3/2	N	100/65
B	6/4	O	250/165
C	8/5	P	125/85
D	10/7	Q	150/100
E	15/10	R	180/120
F	20/13	S	270/180
G	25/15	T	360/240
H	30/20	U	450/300
I	112/75	V	540/360
J	50/30	W	630/420
K	60/40	X	300/200
L	75/50	Y	375/250
M	90/60	Z	200/150

Capacitance Symbol	Tolerance %
J	±5
K	±10
L	±15
M	±20
S	+30-15
T	+50-15
U	+75-15

Outline Drawing and Dimensions
Styles CL51-54



Dimensions
L ±.062 (1.57)

	In	mm
D1	1.375	34.93
D2	2.000	50.80
D3	2.500	63.50

INCHES	MM	INCHES	MM	INCHES	MM
.010	.25	.070	1.78	.395	10.03
.016	.41	.156	3.96	.703	17.86
.025	.64	.275	6.99	.750	19.05
.031	.79	.312	7.92	.783	19.89
.060	1.52	.350	8.89	1.275	32.39
.062	1.57	.364	9.25	1.378	35.00
		.374	9.50		

NOTES:
1. All dimensions in inches.
2. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.
3. Orientation of terminal hole not fixed.

MIL-C-3965

Military Style Tantalum Capacitors

MIL-C-3965/9
STYLE CL51

Type designation	Rated (85°C)	Voltage Derated (125°C)	Surge (85°C)	Capacitance	DC leakage (max)			Impedance (max)	Case size
					25°C	85°C	125°C		
	volts, dc	volts, dc	volts, dc	uF	uA	uA	uA	ohms	
CL51BE331MPG	15	10	17.2	330	23	185	230	8.5	D1
CL51BE661MPG	15	10	17.2	660	46	370	460	4.2	D2
CL51BE961MPG	15	10	17.2	960	67	535	670	2.9	D3
CL51BH181MPG	30	20	34.5	180	25	200	250	15.5	D1
CL51BH361MPG	30	20	34.5	360	50	400	500	7.8	D2
CL51BH511MPG	30	20	34.5	510	71	570	710	5.5	D3
CL51BJ121MPG	50	30	57.5	120	26	210	260	22.5	D1
CL51BJ251MPG	50	30	57.5	250	52	415	520	11.0	D2
CL51BJ351MPG	50	30	57.5	350	73	585	730	8.0	D3
CL51BL750MPG	75	50	86.2	75	26	210	260	37.0	D1
CL51BL151MPG	75	50	86.2	150	52	415	520	18.5	D2
CL51BL221MPG	75	50	86.2	220	77	615	770	12.5	D3
CL51BI500MPG	112	75	129.0	50	26	210	260	55.5	D1
CL51BI101MPG	112	75	129.0	100	52	415	520	29.5	D2
CL51BI151MPG	112	75	129.0	150	78	625	780	18.5	D3
CL51BQ400MPG	150	100	172.0	40	28	225	280	70.0	D1
CL51BQ800MPG	150	100	172.0	80	56	450	560	35.0	D2
CL51BQ101MPG	150	100	172.0	100	70	560	700	30.0	D3

MIL-C-3965/10
STYLE CL52

Type designation	Rated (85°C)	Voltage Derated (125°C)	Surge (85°C)	Capacitance	DC leakage (max)			Impedance (max)	Case size
					25°C	85°C	125°C		
	volts, dc	volts, dc	volts, dc	uF	uA	uA	uA	ohms	
CL52BE211MNG	15	10	17.2	210	21	170	210	13.2	D1
CL52BE421MNG	15	10	17.2	420	42	335	420	6.6	D2
CL52BE601MNG	15	10	17.2	600	60	480	600	4.6	D3
CL52BH780MNG	30	20	34.5	78	15	120	150	35.6	D1
CL52BH151MNG	30	20	34.5	150	30	240	300	18.5	D2
CL52BH271MNG	30	20	34.5	270	54	430	540	10.3	D3
CL52BJ650MNG	50	30	57.5	65	19	150	190	42.7	D1
CL52BJ131MNG	50	30	57.5	130	39	310	390	21.4	D2
CL52BJ171MNG	50	30	57.5	170	51	410	510	16.3	D3
CL52BL380MNG	75	50	86.2	38	19	150	190	73.2	D1
CL52BL750MNG	75	50	86.2	75	37	295	370	37.1	D2
CL52BL111MNG	75	50	86.2	110	55	440	550	25.2	D3
CL52BI250MNG	112	75	129.0	25	18	145	180	111	D1
CL52BI500MNG	112	75	129.0	50	37	295	370	55.6	D2
CL52BI750MNG	112	75	129.0	75	56	450	560	37.1	D3
CL52BQ200MNG	150	100	172.0	20	20	160	200	139	D1
CL52BQ400MNG	150	100	172.0	40	40	320	400	69.5	D2
CL52BQ500MNG	150	100	172.0	50	50	400	500	55.6	D3

MIL-C-3965/11
STYLE CL53

Type designation	Rated (85°C)	Voltage Derated (125°C)	Surge (85°C)	Capacitance	DC leakage (max)			Impedance (max)	Case size
					25°C	85°C	125°C		
	volts, dc	volts, dc	volts, dc	uF	uA	uA	uA	ohms	
CL53BE122UPG	15	10	17.2	1,200	42	335	420	7	D1
CL53BE242UPG	15	10	17.2	2,400	84	670	840	4	D2
CL53BE352UPG	15	10	17.2	3,500	122	975	1,220	2	D3
CL53BH661UPG	30	20	34.5	660	46	370	460	13	D1
CL53BH132UPG	30	20	34.5	1,300	75	600	750	6	D2
CL53BH182UPG	30	20	34.5	1,800	92	735	920	5	D3
CL53BJ351UPG	50	30	57.5	350	36	290	360	11.5	D1
CL53BJ701UPG	50	30	57.5	700	73	585	730	5.7	D2
CL53BJ102UPG	50	30	57.5	1,000	105	840	1,050	4.0	D3
CL53BL201UPG	75	50	86.2	200	35	280	350	20	D1
CL53BL401UPG	75	50	86.2	400	70	560	700	10	D2
CL53BL551UPG	75	50	86.2	550	96	770	960	7.2	D3
CL53BI121UPG	112	75	129.0	120	31	250	310	86	D1
CL53BI241UPG	112	75	129.0	240	63	505	630	16.5	D2
CL53BI321UPG	112	75	129.0	320	84	670	840	12.5	D3
CL53BQ700UPG	150	100	172.0	70	24	190	240	57	D1
CL53BQ141UPG	150	100	172.0	140	49	390	490	29	D2
CL53BQ201UPG	150	100	172.0	200	70	560	700	20	D3

MIL-C-3965/12
STYLE CL54

Type designation	Rated (85°C)	Voltage Derated (125°C)	Surge (85°C)	Capacitance	DC leakage (max)			Impedance (max)	Case size
					25°C	85°C	125°C		
	volts, dc	volts, dc	volts, dc	uF	uA	uA	uA	ohms	
CL54BE751UNG	15	10	17.2	750	52	400	500	11	D1
CL54BE152UNG	15	10	17.2	1,500	105	840	1,050	6	D2
CL54BE212UNG	15	10	17.2	2,100	147	1,175	1,470	4	D3
CL54BH361UNG	30	20	34.5	360	50	400	500	24	D1
CL54BH721UNG	30	20	34.5	720	100	800	1,000	12	D2
CL54BH102UNG	30	20	34.5	1,000	140	1,120	1,400	8	D3
CL54BJ201UNG	50	30	57.5	200	42	335	420	20	D1
CL54BJ401UNG	50	30	57.5	400	84	670	840	10	D2
CL54BJ551UNG	50	30	57.5	550	115	920	1,150	7.2	D3
CL54BL101UNG	75	50	86.2	100	35	280	350	40	D1
CL54BL201UNG	75	50	86.2	200	70	560	700	20	D2
CL54BL271UNG	75	50	86.2	270	94	750	940	15	D3
CL54BI600UNG	112	75	129.0	60	31	250	310	66	D1
CL54BI121UNG	112	75	129.0	120	63	505	630	33	D2
CL54BI161UNG	112	75	129.0	160	84	670	840	25	D3
CL54BQ350UNG	150	100	172.0	35	24	190	240	115	D1
CL54BQ700UNG	150	100	172.0	70	49	390	490	57	D2
CL54BQ101UNG	150	100	172.0	100	70	560	700	40	D3

CL53 CL54

Military Style Tantalum Capacitors

CL53 CL54

BRACKET INFORMATION

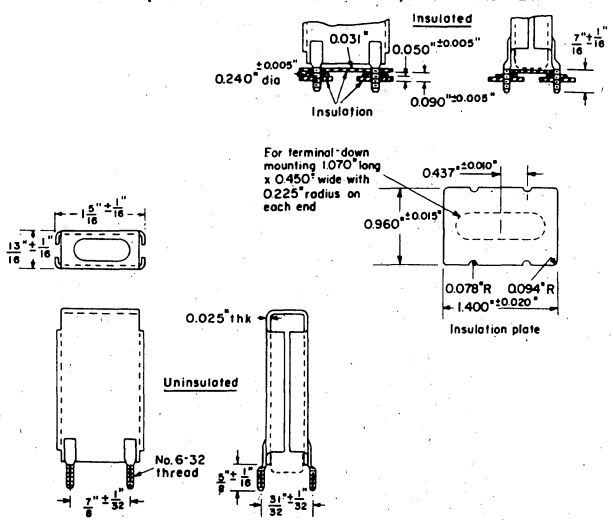
STAINLESS-STEEL MOUNTING BRACKETS

Case Size*	Case Height In Inches	Insulated Terminal Up	Bracket Identification		MIL No. † Uninsulated
			Insulated Terminal Down	Uninsulated	
10	2.5	942A797P48	942A797P58	942A798P45	CL050SD33
20	2.0	942A797P47	942A797P57	942A798P44	CL050SD23
30	1.375	942A797P46	942A797P56	942A798P42	CL050SD13

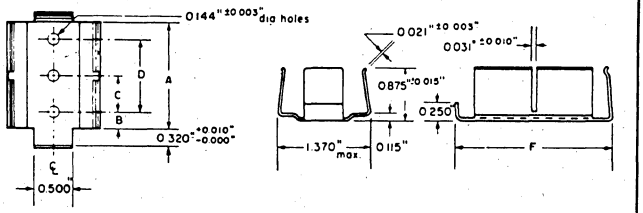
*Common base dimension — 1.312 by 0.750 inches.

† For MIL marked parts. Order by MIL number.

These KSR™ capacitor brackets meet vibration and shock requirements of MIL-STD-202A, Method 204B.



Non-MIL Spring-clip Type



TOL.	±.010	±.005	±.005	±.005	—	Max	Case Size	Finish
Pt. No.	A	B	C	D	E	F		
21	1.000	0.250	0.500	—	2	1.500	30	Cadmium plate and gold iridite
22	1.625	.250	.562	1.125	3	2.125	20	
23	2.125	.312	.750	1.500	3	2.625	10	
24	1.000	.250	.500	—	2	1.500	30	Silver plated
25	1.625	.250	.562	1.125	3	2.125	20	
26	2.125	.312	.750	1.500	3	2.625	10	

MIL-C-39006 PART NUMBER SYSTEM CLR25

M39006 01 3001*

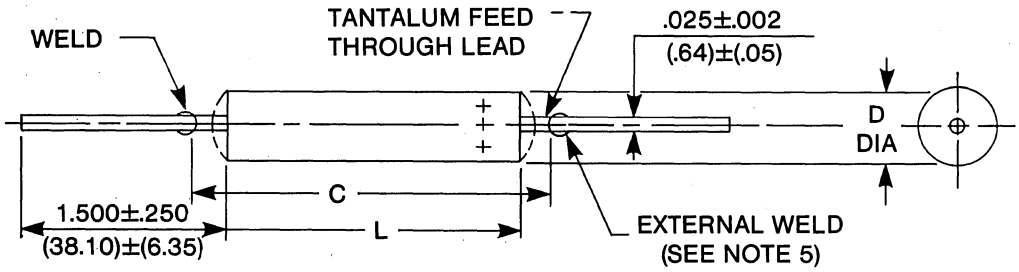
Abbreviated form of MIL-C-39006

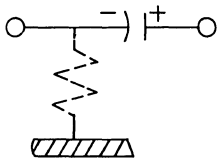
Sequential dash number from table. For specific value of capacitance, tolerance, voltage, case size and failure rate level the table must be consulted.
*Add the letter "H" to indicate optional Random Vibration requirement.

DETAIL SHEET FOR APPLICABLE STYLE:

01: Style CLR 25—Polar Etched
02: Style CLR 27—Nonpolar Etched
03: Style CLR 35—Polar Plain
04: Style CLR 37—Nonpolar Plain
16: Style CLR 71—Polar High Etched
17: Style CLR 73—Nonpolar High Etched

OUTLINE DRAWING AND DIMENSIONS





CASE
CIRCUIT DIAGRAM
(SEE NOTE 4)

Case size	Dimensions			
	Basic case		Insulated case	
	L* ±.062 (1.57)	D ±.016 (.41)	D Max	C Max
E1	.688 (17.48)	.188 (4.78)	.219 (5.56)	1.188 (30.18)
E2	.906 (23.01)	.281 (7.14)	.312 (7.92)	1.406 (35.71)
G2	.969 (24.61)	.281 (7.14)	.312 (7.92)	1.469 (37.31)
E3, G3	1.438 (36.53)	.375 (9.53)	.406 (10.31)	1.938 (49.23)
E4, G4	2.125 (53.98)	.375 (9.53)	.406 (10.31)	2.625 (66.68)
E5, G5	2.750 (69.85)	.375 (9.53)	.406 (10.31)	3.250 (82.55)

Length of basic case; sleeving shall be as specified in MIL-C-39006.

NOTES:
1. Dimensions are in inches.
2. Millimeters are in parentheses.
3. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.
4. There is an indeterminate resistance between the metal case and the negative terminal.
5. The weld shall not be enclosed in the end seal.

MIL-C-39006

Military Style Tantalum Capacitors

MIL-C-39006/01
STYLE CLR25

Rated voltage (85°C)	Cap.	Cap. tolerance	DC leakage (max) 25°C	DC leakage (max) 85°C & 125°C	Derated voltage (125°C)	Surge voltage (85°C)	Impedance (max)	Case size	Part No. M39006/01- Failure rate level (%/1,000 hr) L(2.0)	M(1.0)	P(0.1)	R(0.01)	S(0.001)
HERMETICALLY-SEALED													
volts, dc	uF	%	uA	uA	volts, dc	volts, dc	ohms						
15	60.0	+75, -15	2	10	10	17.2	55	G2	3001	3030	3059	3088	3117
15	200.0	+75, -15	3	40	10	17.2	17	G3	3002	3031	3060	3089	3118
15	400.0	+75, -15	6	80	10	17.2	9	G4	3003	3032	3061	3090	3119
15	580.0	+75, -15	9	100	10	17.2	6	G5	3004	3033	3062	3091	3120
25	40.0	+75, -15	2	13	15	28.8	83	G2	3005	3034	3063	3092	3121
25	120.0	+75, -15	3	40	15	28.8	27	G3	3006	3035	3064	3093	3122
25	250.0	+75, -15	6	80	15	28.8	13	G4	3007	3036	3065	3094	3123
25	350.0	+75, -15	10	100	15	28.8	10	G5	3008	3037	3066	3095	3124
30	32.0	+75, -15	2	14	20	34.5	106	G2	3009	3038	3067	3096	3125
30	110.0	+75, -15	4	50	20	34.5	31	G3	3010	3039	3068	3097	3126
30	220.0	+75, -15	8	90	20	34.5	16	G4	3011	3040	3069	3098	3127
30	300.0	+75, -15	11	120	20	34.5	11	G5	3012	3041	3070	3099	3128
50	18.0	+50, -15	2	13	30	57.5	180	G2	3013	3042	3071	3100	3129
50	60.0	+50, -15	3	40	30	57.5	55	G3	3014	3043	3072	3101	3130
50	75.0	+50, -15	4	70	30	57.5	52	G3	3200	3201	3203	3204	3205
50	100.0	+50, -15	4	75	30	57.5	33	G4	3016	3045	3074	3103	3132
50	150.0	+50, -15	5	100	30	57.5	22	G5	3017	3046	3075	3104	3133
75	12.0	+50, -15	2	13	50	86.2	270	G2	3018	3047	3076	3105	3134
75	30.0	+50, -15	3	34	50	86.2	110	G3	3019	3048	3077	3106	3135
75	70.0	+50, -15	6	80	50	86.2	47	G4	3020	3049	3078	3107	3136
75	100.0	+50, -15	10	100	50	86.2	33	G5	3021	3050	3079	3108	3137
100	8.0	+30, -15	2	12	65	115.0	410	G2	3022	3051	3080	3109	3138
100	25.0	+30, -15	2.5	37	65	115.0	130	G3	3023	3052	3081	3110	3139
100	50.0	+30, -15	5	75	65	115.0	66	G4	3024	3053	3082	3111	3140
100	70.0	+30, -15	7	100	65	115.0	47	G5	3025	3054	3083	3112	3141
150	4.0	+30, -15	2	13	100	172.0	750	G2	3026	3055	3084	3113	3142
150	13.0	+30, -15	3	30	100	172.0	250	G3	3027	3056	3085	3114	3143
150	25.0	+30, -15	5	80	100	172.0	130	G4	3028	3057	3086	3115	3144
150	36.0	+30, -15	8	100	100	172.0	94	G5	3029	3058	3087	3116	3145
NONHERMETICALLY-SEALED													
15	15.0	+75, -15	2	4	10	17.2	220	E1	2200	2232	2264	2296	2328
25	10.0	+75, -15	2	4	15	28.8	330	E1	2205	2237	2269	2301	2333
30	8.0	+75, -15	2	6	20	34.5	424	E1	2210	2242	2274	2306	2338
50	4.5	+50, -15	2	4	30	57.5	730	E1	2212	2244	2276	2308	2340
75	3.0	+50, -15	2	4	50	86.2	1000	E1	2217	2249	2281	2313	2345
100	2.0	+30, -15	2	4	65	115.0	1600	E1	2222	2254	2286	2318	2350
150	1.0	+30, -15	2	4	100	172.0	3000	E1	2227	2259	2291	2323	2355

Shaded area denotes failure rate levels not available at time of this printing. Refer to your Mepco/Centralab sales person or factory for latest update.

MIL-C-39006/02
STYLE CLR27

Rated voltage (85°C)	Cap.	Cap. tolerance	DC leakage (max) 25°C	DC leakage (max) 85°C & 125°C	Derated voltage (125°C)	Surge voltage (85°C)	Impedance (max)	Case size	Part No. M39006/02- Failure rate level (%/1,000 hr) L(2.0)	M(1.0)	P(0.1)	R(0.01)	S(0.001)
HERMETICALLY-SEALED													
volts, dc	uF	%	uA	uA	volts, dc	volts, dc	ohms						
15	40	+75, -15	2	10	10	17.2	85	G2	1200	1228	1256	1284	1312
15	120	+75, -15	3	40	10	17.2	27	G3	1201	1229	1257	1285	1313
15	250	+75, -15	6	80	10	17.2	14	G4	1202	1230	1258	1286	1314
15	350	+75, -15	9	100	10	17.2	10	G5	1203	1231	1259	1287	1315
25	20	+75, -15	2	13	15	28.8	170	G2	1204	1232	1260	1288	1316
25	70	+75, -15	3	40	15	28.8	49	G3	1205	1233	1261	1289	1317
25	140	+75, -15	6	80	15	28.8	24	G4	1206	1234	1262	1290	1318
25	200	+75, -15	10	100	15	28.8	17	G5	1207	1235	1263	1291	1319
30	18	+75, -15	2	14	20	34.5	188	G2	1208	1236	1264	1292	1320
30	60	+75, -15	4	50	20	34.5	57	G3	1209	1237	1265	1293	1321
30	120	+75, -15	8	90	20	34.5	28	G4	1210	1238	1266	1294	1322
30	170	+75, -15	11	120	20	34.5	20	G5	1211	1239	1267	1295	1323
50	10	+50, -15	2	13	30	57.5	339	G2	1212	1240	1268	1296	1324
50	30	+50, -15	3	40	30	57.5	113	G3	1213	1241	1269	1297	1325
50	60	+50, -15	4	75	30	57.5	57	G4	1214	1242	1270	1298	1326
50	80	+50, -15	5	100	30	57.5	41	G5	1215	1243	1271	1299	1327
75	6	+50, -15	2	13	50	86.2	560	G2	1216	1244	1272	1300	1328
75	15	+50, -15	3	34	50	86.2	226	G3	1217	1245	1273	1301	1329
75	35	+50, -15	5	80	50	86.2	97	G4	1218	1246	1274	1302	1330
75	50	+50, -15	10	100	50	86.2	68	G5	1219	1247	1275	1303	1331
100	4	+30, -15	2	13	65	115.0	845	G2	1220	1248	1276	1304	1332
100	12	+30, -15	3	37	65	115.0	283	G3	1221	1249	1277	1305	1333
100	25	+30, -15	5	75	65	115.0	135	G4	1222	1250	1278	1306	1334
100	35	+30, -15	7	100	65	115.0	97	G5	1223	1251	1279	1307	1335
150	2	+30, -15	2	13	100	172.0	1693	G2	1224	1252	1280	1308	1336
150	6	+30, -15	3	30	100	172.0	565	G3	1225	1253	1281	1309	1337
150	12	+30, -15	5	80	100	172.0	283	G4	1226	1254	1282	1310	1338
150	18	+30, -15	8	100	100	172.0	188	G5	1227	1255	1283	1311	1339
NONHERMETICALLY-SEALED													
15	10	+75, -15	2	4	10	17.2	339	E1	2200	2232	2264	2296	2328
25	5	+75, -15	2	4	15	28.8	680	E1	2205	2237	2269	2301	2333
30	4.5	+75, -15	2	6	20	34.5	754	E1	2210	2242	2274	2306	2338
50	2.5	+50, -15	2	4	30	57.5	1355	E1	2212	2244	2276	2308	2340
75	1.5	+50, -15	2	4	50	86.2	2255	E1	2217	2249	2281	2313	2345
100	1	+30, -15	2	4	65	115.0	3385	E1	2222	2254	2286	2318	2350
150	0.5	+30, -15	2	4	100	172.0	6780	E1	2227	2259	2291	2323	2355

Shaded area denotes failure rate levels not available at time of this printing. Refer to your Mepco/Centralab sales person or factory for latest update.

MIL-C-39006

Military Style Tantalum Capacitors

MIL-C-39006/03
STYLE CLR35

Rated voltage (85°C)	Cap.	Cap. tolerance	DC leakage (max) 25°C	DC leakage (max) 85°C & 125°C	Derated voltage (125°C)	Surge voltage (85°C)	Impedance (max)	Case size	Part No. M39006/03- Failure rate level (%/1,000 hr) L(2.0)	M(1.0)	P(0.1)	R(0.01)	S(0.001)
HERMETICALLY-SEALED													
volts, dc	uF	%	uA	uA	volts, dc	volts, dc	ohms						
15	18.0	±20	2	4	10	17.2	125	G2	1300	1349	1398	1447	1496
15	55.0	±20	2	10	10	17.2	41	G3	1301	1350	1399	1448	1497
15	110.0	±20	4	20	10	17.2	20	G4	1302	1351	1400	1449	1498
15	160.0	±20	5	30	10	17.2	14	G5	1303	1352	1401	1450	1499
25	12.0	±20	2	4	15	28.8	186	G2	1304	1353	1402	1451	1500
25	35.0	±20	2	10	15	28.8	64	G3	1305	1354	1403	1452	1501
25	70.0	±20	4	20	15	28.8	32	G4	1306	1355	1404	1453	1502
25	100.0	±20	6	30	15	28.8	23	G5	1307	1356	1405	1454	1503
30	10.0	±20	2	6	20	34.5	265	G2	1308	1357	1406	1455	1504
30	30.0	±20	2	13	20	34.5	75	G3	1309	1358	1407	1456	1505
30	60.0	±20	4	26	20	34.5	37	G4	1310	1359	1408	1457	1506
30	85.0	±20	6	38	20	34.5	27	G5	1311	1360	1409	1458	1507
35	68.0	±20	5	25	25	40.2	40	G5	1312	1361	1410	1459	1508
50	6.0	±20	2	6	30	57.5	372	G2	1313	1362	1411	1460	1509
50	20.0	±20	2	13	30	57.5	112	G3	1314	1363	1412	1461	1510
50	40.0	±20	4	26	30	57.5	56	G4	1315	1364	1413	1462	1511
50	55.0	±20	6	38	30	57.5	41	G5	1316	1365	1414	1463	1512
75	4.0	±20	2	6	50	86.2	558	G2	1317	1366	1415	1464	1513
75	14.0	±20	2	13	50	86.2	159	G3	1318	1367	1416	1465	1514
75	28.0	±20	4	26	50	86.2	80	G4	1319	1368	1417	1466	1515
75	40.0	±20	6	38	50	86.2	56	G5	1320	1369	1418	1467	1516
100	3.0	±20	2	6	65	115.0	743	G2	1321	1370	1419	1468	1517
100	10.0	±20	2	13	65	115.0	223	G3	1322	1371	1420	1469	1518
100	20.0	±20	3	25	65	115.0	112	G4	1323	1372	1421	1470	1519
100	30.0	±20	6	38	65	115.0	74	G5	1324	1373	1422	1471	1520
150	2.0	±20	2	6	100	172.0	1115	G2	1325	1374	1423	1472	1521
150	7.0	±20	3	13	100	172.0	319	G3	1326	1375	1424	1473	1522
150	14.0	±20	4	26	100	172.0	159	G4	1327	1376	1425	1474	1523
150	20.0	±20	6	38	100	172.0	112	G5	1328	1377	1426	1475	1524
200	1.5	±15	8	32	150	230.0	1300	G2	1329	1378	1427	1476	1525
200	5.0	±15	16	64	150	230.0	400	G3	1330	1379	1428	1477	1526
200	10.0	±15	28	100	150	230.0	200	G4	1331	1380	1429	1478	1527
200	15.0	±15	40	160	150	230.0	130	G5	1332	1381	1430	1479	1528
NONHERMETICALLY-SEALED													
15	4.5	±20	1	2	10	17.2	495	E1	2300	2360	2420	2480	2540
25	3.0	±20	1	2	15	28.8	744	E1	2305	2365	2425	2485	2545
30	2.5	±20	2	5	20	34.5	893	E1	2310	2370	2430	2490	2550
50	1.5	±20	1	4	30	57.5	1487	E1	2315	2375	2435	2495	2555
75	1.0	±20	1	4	50	86.2	2232	E1	2320	2380	2440	2500	2560
100	0.8	±20	1	3.5	65	115.0	2790	E1	2325	2385	2445	2505	2565
150	0.5	±20	2	4	100	172.0	4454	E1	2330	2390	2450	2510	2570
200	0.35	±15	4	25	150	230.0	5577	E1	2335	2395	2455	2515	2575

Shaded area denotes failure rate levels not available at time of this printing. Refer to your Mepco/Centralab sales person or factory for latest update.

MIL-C-39006/04
STYLE CLR37

Rated voltage (85°C)	Cap.	Cap. tolerance	DC leakage (max) 25°C	DC leakage (max) 85°C & 125°C	Derated voltage (125°C)	Surge voltage (85°C)	Impedance (max)	Case size)	Part No. M39006/04 Failure rate level (%/1,000 hr) L(2.0)	M(1.0)	P(0.1)	R(0.01)	S(0.001)
HERMETICALLY-SEALED													
volts, dc	uF	%	uA	uA	volts, dc	volts, dc	ohms						
15	10.0	±20	2	4	10	17.2	223	G2	1200	1245	1290	1335	1380
15	35.0	±20	2	10	10	17.2	64	G3	1201	1246	1291	1336	1381
15	70.0	±20	4	20	10	17.2	32	G4	1202	1247	1292	1337	1382
15	100.0	±20	5	30	10	17.2	23	G5	1203	1248	1293	1338	1383
25	6.0	±20	2	6	15	28.8	372	G2	1204	1249	1294	1339	1384
25	20.0	±20	2	10	15	28.8	112	G3	1205	1250	1295	1340	1385
25	40.0	±20	4	20	15	28.8	56	G4	1206	1251	1296	1341	1386
25	60.0	±20	5	30	15	28.8	37	G5	1207	1252	1297	1342	1387
30	5.5	±20	2	6	20	34.5	406	G2	1208	1253	1298	1343	1388
30	18.0	±20	2	12	20	34.5	124	G3	1209	1254	1299	1344	1389
30	36.0	±20	4	26	20	34.5	62	G4	1210	1255	1300	1345	1390
30	45.0	±20	6	36	20	34.5	50	G5	1211	1256	1301	1346	1391
50	3.0	±20	2	6	30	57.5	743	G2	1212	1257	1302	1347	1392
50	10.0	±20	2	12	30	57.5	223	G3	1213	1258	1303	1348	1393
50	20.0	±20	4	24	30	57.5	112	G4	1214	1259	1304	1349	1394
50	30.0	±20	6	36	30	57.5	75	G5	1215	1260	1305	1350	1395
75	2.0	±20	2	6	50	86.2	1115	G2	1216	1261	1306	1351	1396
75	7.0	±20	2	13	50	86.2	319	G3	1217	1262	1307	1352	1397
75	14.0	±20	4	24	50	86.2	159	G4	1218	1263	1308	1353	1398
75	20.0	±20	6	36	50	86.2	112	G5	1219	1264	1309	1354	1399
100	1.5	±20	2	6	65	115.0	1487	G2	1220	1265	1310	1355	1400
100	5.0	±20	2	13	65	115.0	446	G3	1221	1266	1311	1356	1401
100	10.0	±20	4	24	65	115.0	223	G4	1222	1267	1312	1357	1402
100	15.0	±20	6	36	65	115.0	149	G5	1223	1268	1313	1358	1403
150	1.0	±20	2	6	100	172.0	2227	G2	1224	1269	1314	1359	1404
150	1.2	±20	3	12	100	172.0	2000	G2	1225	1270	1315	1360	1405
150	3.5	±20	3	13	100	172.0	638	G3	1226	1271	1316	1361	1406
150	7.0	±20	4	24	100	172.0	319	G4	1227	1272	1317	1362	1407
150	10.0	±20	6	36	100	172.0	223	G5	1228	1273	1318	1363	1408
200	0.75	±15	8	32	150	230.0	2700	G2	1229	1274	1319	1364	1409
200	2.5	±15	16	64	150	230.0	800	G3	1230	1275	1320	1365	1410
200	5.0	±15	28	112	150	230.0	400	G4	1231	1276	1321	1366	1411
200	7.5	±15	40	160	150	230.0	260	G5	1232	1277	1322	1367	1412
NONHERMETICALLY-SEALED													
15	2.5	±20	1	2	10	17.2	893	E1	2300	2355	2410	2465	2520
25	1.5	±20	1	3	15	28.8	1487	E1	2305	2360	2415	2470	2525
30	1.4	±20	2	5	20	34.5	1594	E1	2310	2365	2420	2475	2530
50	0.8	±20	1	4	30	57.5	2790	E1	2315	2370	2425	2480	2535
75	0.5	±20	1	4	50	86.2	4460	E1	2320	2375	2430	2485	2540
100	0.4	±20	1	3.5	65	115.0	5580	E1	2325	2380	2435	2490	2545
150	0.25	±20	1	4	100	172.0	8909	E1	2330	2385	2440	2495	2550
200	0.15	±15	4	25	150	230.0	14000	E1	2335	2390	2445	2500	2555

Shaded area denotes failure rate levels not available at time of this printing. Refer to your Mepco/Centralab sales person or factory for latest update.

MIL-C-39006

Military Style Tantalum Capacitors

MIL-C-39006/16
STYLE CLR71

Rated voltage (85°C)	Cap.	Cap. tolerance	DC leakage (max) 25°C	85°C	125°C	Derated voltage (125°C)	Surge voltage (85°C)	Impedance (max)	Case size	Part No. M39006/16- Failure rate level (%/1,000 hr) L(2.0)	M(1.0)	P(0.1)	R(0.01)	S(0.001)
HERMETICALLY-SEALED														
volts, dc	uF	%	uA	uA	uA	volts, dc	volts, dc	ohms						
15	100	+75, -15	23	100	80	10	17.2	37	G2	2001	2036	2071	2106	2141
15	310	+75, -15	61	370	250	10	17.2	10.8	G3	2002	2037	2072	2107	2142
15	650	+75, -15	130	780	520	10	17.2	5.1	G4	2003	2038	2073	2108	2143
15	920	+75, -15	185	1100	750	10	17.2	4.0	G5	2004	2039	2074	2109	2144
25	60	+75, -15	23	100	72	15	28.8	62	G2	2006	2041	2076	2111	2146
25	180	+75, -15	60	360	220	15	28.8	20.5	G3	2007	2042	2077	2112	2147
25	380	+75, -15	125	760	460	15	28.8	9.6	G4	2008	2043	2078	2113	2148
25	550	+75, -15	185	1100	660	15	28.8	6.7	G5	2009	2044	2079	2114	2149
30	52	+75, -15	23	120	80	20	34.5	71	G2	2011	2046	2081	2116	2151
30	150	+75, -15	60	360	240	20	34.5	25	G3	2012	2047	2082	2117	2152
30	320	+75, -15	125	750	500	20	34.5	11.5	G4	2013	2048	2083	2118	2153
30	460	+75, -15	165	1000	700	20	34.5	8	G5	2014	2049	2084	2119	2154
50	25	+50, -15	19	100	60	30	57.5	150	G2	2016	2051	2086	2121	2156
50	75	+50, -15	50	300	180	30	57.5	49	G3	2017	2052	2087	2122	2157
50	160	+50, -15	100	640	390	30	57.5	23	G4	2018	2053	2088	2123	2158
50	230	+50, -15	150	920	550	30	57.5	16	G5	2019	2054	2089	2124	2159
75	15	+50, -15	17	90	60	50	86.2	250	G2	2021	2056	2091	2126	2161
75	45	+50, -15	45	270	180	50	86.2	83	G3	2022	2057	2092	2127	2162
75	95	+50, -15	95	570	380	50	86.2	39	G4	2023	2058	2093	2128	2163
75	130	+50, -15	130	780	520	50	86.2	29	G5	2024	2059	2094	2129	2164
100	10	+30, -15	15	80	52	65	115.0	370	G2	2026	2061	2096	2131	2166
100	30	+30, -15	40	230	150	65	115.0	121	G3	2027	2062	2097	2132	2167
100	63	+30, -15	80	480	310	65	115.0	58	G4	2028	2063	2098	2133	2168
100	90	+30, -15	120	720	470	65	115.0	41	G5	2029	2064	2099	2134	2169
150	5.5	+30, -15	12	64	42	100	172.0	675	G2	2031	2066	2101	2136	2171
150	17	+30, -15	30	190	130	100	172.0	220	G3	2032	2067	2102	2137	2172
150	35	+30, -15	65	400	260	100	172.0	106	G4	2033	2068	2103	2138	2173
150	50	+30, -15	95	560	380	100	172.0	74	G5	2034	2069	2104	2139	2174
NONHERMETICALLY SEALED														
15	29	+75, -15	7	35	23	10	17.2	137	E1	1000	1035	1070	1105	1140
15	100	+75, -15	23	100	80	10	17.2	37	E2	1001	1036	1071	1106	1141
15	310	+75, -15	61	370	250	10	17.2	10.8	E3	1002	1037	1072	1107	1142
15	650	+75, -15	130	780	520	10	17.2	5.1	E4	1003	1038	1073	1108	1143
15	920	+75, -15	185	1100	750	10	17.2	4.0	E5	1004	1039	1074	1109	1144
25	17	+75, -15	6	34	21	15	28.8	220	E1	1005	1040	1075	1110	1145
25	60	+75, -15	23	100	72	15	28.8	62	E2	1006	1041	1076	1111	1146
25	180	+75, -15	60	360	220	15	28.8	20.5	E3	1007	1042	1077	1112	1147
25	380	+75, -15	125	760	460	15	28.8	9.6	E4	1008	1043	1078	1113	1148
25	550	+75, -15	185	1100	660	15	28.8	6.7	E5	1009	1044	1079	1114	1149
30	15	+75, -15	6	34	22	20	34.5	250	E1	1010	1045	1080	1115	1150
30	52	+75, -15	23	120	80	20	34.5	71	E2	1011	1046	1081	1116	1151
30	150	+75, -15	60	360	240	20	34.5	25	E3	1012	1047	1082	1117	1152
30	320	+75, -15	125	750	500	20	34.5	11.5	E4	1013	1048	1083	1118	1153
30	460	+75, -15	165	1000	700	20	34.5	8	E5	1014	1049	1084	1119	1154
50	7	+50, -15	5	28	17	30	57.5	550	E1	1015	1050	1085	1120	1155
50	25	+50, -15	19	100	60	30	57.5	150	E2	1016	1051	1086	1121	1156
50	75	+50, -15	50	300	180	30	57.5	49	E3	1017	1052	1087	1122	1157
50	160	+50, -15	100	640	390	30	57.5	23	E4	1018	1053	1088	1123	1158
50	230	+50, -15	150	920	550	30	57.5	16	E5	1019	1054	1089	1124	1159
75	4	+50, -15	5	24	16	50	86.2	930	E1	1020	1055	1090	1125	1160
75	15	+50, -15	17	90	60	50	86.2	250	E2	1021	1056	1091	1126	1161
75	45	+50, -15	45	270	180	50	86.2	83	E3	1022	1057	1092	1127	1162
75	95	+50, -15	95	570	380	50	86.2	39	E4	1023	1058	1093	1128	1163
75	130	+50, -15	130	780	520	50	86.2	29	E5	1024	1059	1094	1129	1164
100	3	+30, -15	4	20	14	65	115.0	1210	E1	1025	1060	1095	1130	1165
100	10	+30, -15	15	80	52	65	115.0	370	E2	1026	1061	1096	1131	1166
100	30	+30, -15	40	230	150	65	115.0	121	E3	1027	1062	1097	1132	1167
100	63	+30, -15	80	480	310	65	115.0	58	E4	1028	1063	1098	1133	1168
100	90	+30, -15	120	720	470	65	115.0	41	E5	1029	1064	1099	1134	1169
150	1.6	+30, -15	3	18	12	100	172.0	2340	E1	1030	1065	1100	1135	1170
150	5.5	+30, -15	12	64	42	100	172.0	675	E2	1031	1066	1101	1136	1171
150	17	+30, -15	30	190	130	100	172.0	220	E3	1032	1067	1102	1137	1172
150	35	+30, -15	65	400	260	100	172.0	106	E4	1033	1068	1103	1138	1173
150	50	+30, -15	95	560	380	100	172.0	74	E5	1034	1069	1104	1139	1174

Shaded area denotes failure rate levels not available at time of this printing. Refer to your Mepco/Centralab sales person or factory for latest update.

MIL-C-39006/17
STYLE CLR73

Rated voltage (85°C)	Cap.	Cap. tolerance	DC leakage (max) 25°C	DC leakage (max) 85°C	DC leakage (max) 125°C	Derated voltage (125°C)	Surge voltage (85°C)	Impedance (max)	Case size	Part No. M39006/17- Failure rate level (%/1,000 hr) L(2.0)	M(1.0)	P(0.1)	R(0.01)	S(0.001)
HERMETICALLY SEALED														
volts, dc	uF	%	uA	uA	uA	volts, dc	volts, dc	ohms						
15	70.0	+75, -15	15	84	56	10	17.2	55	G2	2001	2036	2071	2106	2141
15	200.0	+75, -15	40	240	160	10	17.2	18.5	G3	2002	2037	2072	2107	2142
15	410.0	+75, -15	75	500	330	10	17.2	8.9	G4	2003	2038	2073	2108	2143
15	590.0	+75, -15	118	710	470	10	17.2	6.2	G5	2004	2039	2074	2109	2144
25	35.0	+75, -15	12	70	43	15	28.8	106	G2	2006	2041	2076	2111	2146
25	100.0	+75, -15	30	200	120	15	28.8	37	G3	2007	2042	2077	2112	2147
25	210.0	+75, -15	40	400	250	15	28.8	17.5	G4	2008	2043	2078	2113	2148
25	300.0	+75, -15	100	600	360	15	28.8	12.1	G5	2009	2044	2079	2114	2149
30	29.0	+75, -15	11	60	40	20	34.5	137	G2	2011	2046	2081	2116	2151
30	80.0	+75, -15	30	180	120	20	34.5	45.5	G3	2012	2047	2082	2117	2152
30	170.0	+75, -15	65	390	260	20	34.5	22	G4	2013	2048	2083	2118	2153
30	240.0	+75, -15	90	550	370	20	34.5	7.8	G5	2014	2049	2084	2119	2154
50	13.0	+50, -15	10	52	31	30	57.5	285	G2	2016	2051	2086	2121	2156
50	36.0	+50, -15	24	145	86	30	57.5	104	G3	2017	2052	2087	2122	2157
50	75.0	+50, -15	45	300	180	30	57.5	49	G4	2018	2053	2088	2123	2158
50	110.0	+50, -15	75	440	260	30	57.5	34	G5	2019	2054	2089	2124	2159
75	7.0	+50, -15	8	42	28	50	86.2	550	G2	2021	2056	2091	2126	2161
75	20.0	+50, -15	23	120	80	50	86.2	185	G3	2022	2057	2092	2127	2162
75	43.0	+50, -15	45	260	170	50	86.2	86	G4	2023	2058	2093	2128	2163
75	60.0	+50, -15	60	360	240	50	86.2	62	G5	2024	2059	2094	2129	2164
100	5.0	+30, -15	7	38	25	65	115.0	750	G2	2026	2061	2096	2131	2166
100	14.0	+30, -15	15	110	68	65	115.0	268	G3	2027	2062	2097	2132	2167
100	29.0	+30, -15	35	220	145	65	115.0	137	G4	2028	2063	2098	2133	2168
100	41.0	+30, -15	50	320	210	65	115.0	91	G5	2029	2064	2099	2134	2169
150	2.7	+30, -15	6	30	20	100	172.0	1380	G2	2031	2066	2101	2136	2171
150	7.5	+30, -15	15	84	56	100	172.0	490	G3	2032	2067	2102	2137	2172
150	15.0	+30, -15	30	180	120	100	172.0	250	G4	2033	2068	2103	2138	2173
150	22.0	+30, -15	45	270	175	100	172.0	170	G5	2034	2069	2104	2139	2174
NONHERMETICALLY SEALED														
15	20.0	+75, -15	5	24	16	10	17.2	185	E1	1000	1035	1070	1105	1140
15	70.0	+75, -15	15	84	56	10	17.2	55	E2	1001	1036	1071	1106	1141
15	200.0	+75, -15	40	240	160	10	17.2	18.5	E3	1002	1037	1072	1107	1142
15	410.0	+75, -15	75	500	330	10	17.2	8.9	E4	1003	1038	1073	1108	1143
15	590.0	+75, -15	118	710	470	10	17.2	6.2	E5	1004	1039	1074	1109	1144
25	10.0	+75, -15	4	20	12	15	28.8	370	E1	1005	1040	1075	1110	1145
25	35.0	+75, -15	12	70	43	15	28.8	106	E2	1006	1041	1076	1111	1146
25	100.0	+75, -15	30	200	120	15	28.8	37	E3	1007	1042	1077	1112	1147
25	210.0	+75, -15	40	400	250	15	28.8	17.5	E4	1008	1043	1078	1113	1148
25	300.0	+75, -15	100	600	360	15	28.8	12.1	E5	1009	1044	1079	1114	1149
30	8.0	+75, -15	3	19	12	20	34.5	455	E1	1010	1045	1080	1115	1150
30	29.0	+75, -15	11	60	40	20	34.5	137	E2	1011	1046	1081	1116	1151
30	80.0	+75, -15	30	180	120	20	34.5	45.5	E3	1012	1047	1082	1117	1152
30	170.0	+75, -15	65	390	260	20	34.5	22	E4	1013	1048	1083	1118	1153
30	240.0	+75, -15	90	550	370	20	34.5	7.8	E5	1014	1049	1084	1119	1154
50	3.5	+50, -15	3	14	9	30	57.5	1060	E1	1015	1050	1085	1120	1155
50	13.0	+50, -15	10	52	31	30	57.5	285	E2	1016	1051	1086	1121	1156
50	36.0	+50, -15	24	145	86	30	57.5	104	E3	1017	1052	1087	1122	1157
50	75.0	+50, -15	45	300	180	30	57.5	49	E4	1018	1053	1088	1123	1158
50	110.0	+50, -15	75	440	260	30	57.5	34	E5	1019	1054	1089	1124	1159
75	2.0	+50, -15	2	12	8	50	86.2	1850	E1	1020	1055	1090	1125	1160
75	7.0	+50, -15	8	42	28	50	86.2	550	E2	1021	1056	1091	1126	1161
75	20.0	+50, -15	23	120	80	50	86.2	185	E3	1022	1057	1092	1127	1162
75	43.0	+50, -15	45	260	170	50	86.2	86	E4	1023	1058	1093	1128	1163
75	60.0	+50, -15	60	360	240	50	86.2	62	E5	1024	1059	1094	1129	1164
100	1.4	+30, -15	2	11	7	65	115.0	2700	E1	1025	1060	1095	1130	1165
100	5.0	+30, -15	7	38	25	65	115.0	750	E2	1026	1061	1096	1131	1166
100	14.0	+30, -15	15	110	68	65	115.0	268	E3	1027	1062	1097	1132	1167
100	29.0	+30, -15	35	220	145	65	115.0	137	E4	1028	1063	1098	1133	1168
100	41.0	+30, -15	50	320	210	65	115.0	91	E5	1029	1064	1099	1134	1169
150	0.75	+30, -15	2	9	6	100	172.0	5000	E1	1030	1065	1100	1135	1170
150	2.7	+30, -15	6	30	20	100	172.0	1380	E2	1031	1066	1101	1136	1171
150	7.5	+30, -15	15	84	56	100	172.0	490	E3	1032	1067	1102	1137	1172
150	15.0	+30, -15	30	180	120	100	172.0	250	E4	1033	1068	1103	1138	1173
150	22.0	+30, -15	45	270	175	100	172.0	170	E5	1034	1069	1104	1139	1174

Shaded area denotes failure rate levels not available at time of this printing. Refer to your Mepco/Centralab sales person or factory for latest update.

MIL-C-26655B
Military Style Tantalum Capacitors

MIL-C-26655B
STYLES CS12 & CS13

MILITARY CODING SYSTEM

CS12 B B 475 K

TOLERANCE
K ±10%
M ±20%

CAPACITANCE
Nominal capacitance in micro micro farads.
First two digits are significant figures, 3rd figure is number of zeros to follow.
Example: 475 means 4.7 MFD; 476 means 47 MFD.

VOLTAGE

B = 6	E = 20	H = 75
C = 10	F = 35	J = 100
D = 15	G = 50	

CHARACTERISTIC
B
-55°C to +85°C at full rated voltage, to +125°C with derated voltage.

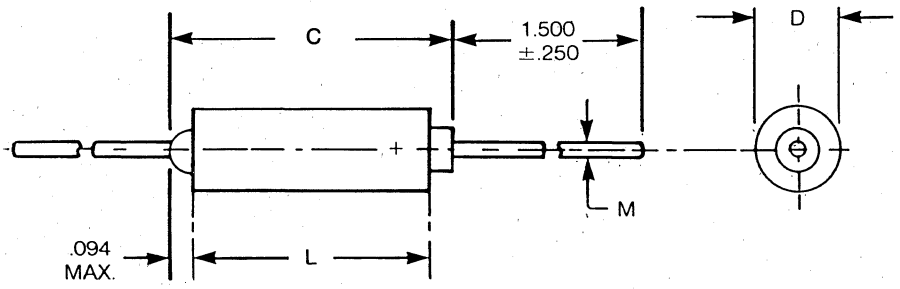
STYLE

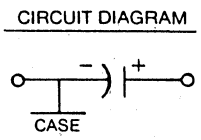
CS12
Tantalum
slug
solid electrolyte
unsleeved metal
case.

CS13
Tantalum
slug
solid electrolyte
sleeved metal
case.

NOTE: *Military number does not designate case size.* See table *for specific capacitance and voltage rating.*

OUTLINE DRAWING AND DIMENSIONS





Dimensions for style CS12, non-insulated (mm)				
Case Size	C max.	D +0.016 (.41) −0.010 (.25)	L ±0.031 (.79)	M +0.005 −0.001
A	0.422 (10.7)	0.125 (3.2)	0.250 (6.4)	0.020 (.51)
B	0.610 (15.5)	0.175 (4.5)	0.438 (11.1)	0.020 (.51)
C	0.822 (20.9)	0.279 (7.1)	0.650 (16.5)	0.025 (.51)
D	0.922 (23.4)	0.341 (8.7)	0.750 (19.1)	0.025 (.64)

Dimensions for style CS13, insulated (mm)				
Case Size	C max.	D +0.016 (.41) −0.015 (.38)	L ±0.031 (.79)	M +0.005 −0.001
A	0.422 (10.7)	0.135 (3.4)	0.286 (7.3)	0.020 (.51)
B	0.610 (15.5)	0.185 (4.7)	0.474 (12.0)	0.020 (.51)
C	0.822 (20.9)	0.289 (7.3)	0.686 (17.4)	0.025 (.51)
D	0.922 (23.4)	0.351 (8.9)	0.786 (20.0)	0.025 (.64)

NOTE: MIL-C-26655 is a cancelled specification. Current military contracts should order MIL-C-39003. Substitutable parts.

MIL-C-26655B
STYLES CS12 & CS13

Type designation 1/	DC rated voltage	Capacitance	Cap. Tolerance	DC leakage at:			Dissipation factor at:		Case size	Dash Number	
				+25°C	+85°C	+125°C	+25°C -55°C	+85°C +125°C		CS12	CS13
	volts	uf		ua	ua	ua	percent				
CS1-BB565K	6	5.6	K	.5	5	6.3	3	4	A	0001	0002
CS1-BB685K	6	6.8	K	.5	5	6.3	6	6	A	0003	0004
CS1-BB685M	6	6.8	M	.5	5	6.3	6	6	A	0005	0006
CS1-BB476K	6	47	K	3	30	38	6	6	B	0007	0008
CS1-BB476M	6	47	M	3	30	38	6	6	B	0009	0010
CS1-BB566K	6	56	K	3	30	38	6	6	B	0011	0012
CS1-BB157K	6	150	K	9	90	113	8	8	C	0013	0014
CS1-BB157M	6	150	M	9	90	113	8	8	C	0015	0016
CS1-BB187K	6	180	K	11	110	138	8	8	C	0017	0018
CS1-BB277K	6	270	K	13	130	163	8	8	D	0019	0020
CS1-BB337K	6	330	K	15	150	188	8	8	D	0021	0022
CS1-BB337M	6	330	M	15	150	188	8	8	D	0023	0024
CS1-BC395K	10	3.9	K	.6	6	7.5	3	4	A	0025	0026
CS1-BC475K	10	4.7	K	.7	7	8.8	3	4	A	0027	0028
CS1-BC475M	10	4.7	M	.7	7	8.8	3	4	A	0029	0030
CS1-BC276K	10	27	K	4	40	50	6	6	B	0031	0032
CS1-BC336K	10	33	K	5	50	63	6	6	B	0033	0034
CS1-BC336M	10	33	M	5	50	63	6	6	B	0035	0036
CS1-BC396K	10	39	K	5	50	63	6	6	B	0037	0038
CS1-BC826K	10	82	K	8	80	100	6	6	C	0039	0040
CS1-BC107K	10	100	K	10	100	125	8	8	C	0041	0042
CS1-BC107M	10	100	M	10	100	125	8	8	C	0043	0044
CS1-BC127K	10	120	K	12	120	150	8	8	C	0045	0046
CS1-BC187K	10	180	K	18	180	226	8	8	D	0047	0048
CS1-BC227K	10	220	K	20	200	250	8	8	D	0049	0050
CS1-BC227M	10	220	M	20	200	250	8	8	D	0051	0052
CS1-BD275K	15	2.7	K	.6	6	7.5	3	4	A	0053	0054
CS1-BD335K	15	3.3	K	.8	8	10	3	4	A	0055	0056
CS1-BD335M	15	3.3	M	.8	8	10	3	4	A	0057	0058
CS1-BD186K	15	18	K	3.5	35	44	6	6	B	0059	0060
CS1-BD226K	15	22	K	4	40	50	6	6	B	0061	0062
CS1-BD226M	15	22	M	4	40	50	6	6	B	0063	0064
CS1-BD566K	15	56	K	8	80	100	6	6	C	0065	0066
CS1-BD686K	15	68	K	10	100	125	6	6	C	0067	0068
CS1-BD686M	15	68	M	10	100	125	6	6	C	0069	0070
CS1-BD127K	15	120	K	18	180	226	8	8	D	0071	0072
CS1-BD157K	15	150	K	20	200	250	8	8	D	0073	0074
CS1-BD157M	15	150	M	20	200	250	8	8	D	0075	0076
CS1-BE125K	20	1.2	K	.6	6	7.5	3	4	A	0077	0078
CS1-BE155K	20	1.5	K	.6	6	7.5	3	4	A	0079	0080
CS1-BE155M	20	1.5	M	.6	6	7.5	3	4	A	0081	0082
CS1-BE185K	20	1.8	K	.6	6	7.5	3	4	A	0083	0084
CS1-BE225K	20	2.2	K	.8	8	10	3	4	A	0085	0086
CS1-BE225M	20	2.2	M	.8	8	10	3	4	A	0087	0088

1/ Complete type designation will include additional symbols to indicate style, and where applicable, capacitance tolerance.

MIL-C-26655B

Military Style Tantalum Capacitors

MIL-C-26655B
STYLES CS12 & CS13

Type designation 1/	DC rated voltage	Capacitance	Cap. Tolerance	DC leakage at:			Dissipation factor at:		Case size	Dash Number	
				+25°C	+85°C	+125°C	+25°C -55°C	+85°C +125°C		CS12	CS13
	volts	uf		ua	ua	ua	percent				
CS1-BE825K	20	8.2	K	2	20	25	6	6	B	0089	0090
CS1-BE106K	20	10	K	3	30	38	6	6	B	0091	0092
CS1-BE106M	20	10	M	3	30	38	6	6	B	0093	0094
CS1-BE126K	20	12	K	3.5	35	44	6	6	B	0095	0096
CS1-BE156K	20	15	K	4	40	50	6	6	B	0097	0098
CS1-BE156M	20	15	M	4	40	50	6	6	B	0099	0100
CS1-BE276K	20	27	K	5	50	63	6	6	C	0101	0102
CS1-BE336K	20	33	K	7	70	88	6	6	C	0103	0104
CS1-BE336M	20	33	M	7	70	88	6	6	C	0105	0106
CS1-BE396K	20	39	K	8	80	100	6	6	C	0107	0108
CS1-BE476K	20	47	K	9	90	113	6	6	C	0109	0110
CS1-BE476M	20	47	M	9	90	113	6	6	C	0111	0112
CS1-BE566K	20	56	K	11	110	138	6	6	D	0113	0114
CS1-BE686K	20	68	K	14	140	175	6	6	D	0115	0116
CS1-BE686M	20	68	M	14	140	175	6	6	D	0117	0118
CS1-BE826K	20	82	K	16	160	200	6	6	D	0119	0120
CS1-BE107K	20	100	K	20	200	250	8	8	D	0121	0122
CS1-BE107M	20	100	M	20	200	250	8	8	D	0123	0124
CS1-BF334K	35	0.33	K	.5	5	6.3	3	4	A	0125	0126
CS1-BF334M	35	0.33	M	.5	5	6.3	3	4	A	0127	0128
CS1-BF394K	35	0.39	K	.5	5	6.3	3	4	A	0129	0130
CS1-BF474K	35	0.47	K	.5	5	6.3	3	4	A	0131	0132
CS1-BF474M	35	0.47	M	.5	5	6.3	3	4	A	0133	0134
CS1-BF564K	35	0.56	K	.5	5	6.3	3	4	A	0135	0136
CS1-BF684K	35	0.68	K	.5	5	6.3	3	4	A	0137	0138
CS1-BF684M	35	0.68	M	.5	5	6.3	3	4	A	0139	0140
CS1-BF824K	35	0.82	K	.6	6	7.5	3	4	A	0141	0142
CS1-BF105K	35	1.0	K	.6	6	7.5	3	4	A	0143	0144
CS1-BF105M	35	1.0	M	.6	6	7.5	3	4	A	0145	0146
CS1-BF125K	35	1.2	K	.6	6	7.5	3	4	B	0147	0148
CS1-BF155K	35	1.5	K	.8	8	10	3	4	B	0149	0150
CS1-BF155M	35	1.5	M	.8	8	10	3	4	B	0151	0152
CS1-BF185K	35	1.8	K	1	10	13	3	4	B	0153	0154
CS1-BF225K	35	2.2	K	1.2	12	15	3	4	B	0155	0156
CS1-BF225M	35	2.2	M	1.2	12	15	3	4	B	0157	0158
CS1-BF275K	35	2.7	K	1.5	15	19	3	4	B	0159	0160
CS1-BF335K	35	3.3	K	2	20	25	3	4	B	0161	0162
CS1-BF335M	35	3.3	M	2	20	25	3	4	B	0163	0164
CS1-BF395K	35	3.9	K	2.5	25	32	3	4	B	0165	0166
CS1-BF475K	35	4.7	K	2.5	25	32	3	4	B	0167	0168
CS1-BF475M	35	4.7	M	2.5	25	32	3	4	B	0169	0170
CS1-BF565K	35	5.6	K	2.5	25	32	3	4	B	0171	0172
CS1-BF685K	35	6.8	K	3	30	38	6	6	B	0173	0174
CS1-BF685M	35	6.8	M	3	30	38	6	6	B	0175	0176
CS1-BF825K	35	8.2	K	3	30	38	6	6	C	0177	0178

1/ Complete type designation will include additional symbols to indicate style, and where applicable, capacitance tolerance.

MIL-C-26655B
STYLES CS12 & CS13

Type designation 1/	DC rated voltage	Capacitance	Cap. Tolerance	DC leakage at:			Dissipation factor at:		Case size	Dash Number	
				+25°C	+85°C	+125°C	+25°C -55°C	+85°C +125°C		CS12	CS13
	volts	uf		ua	ua	ua	percent				
CS1-BF106K	35	10	K	4	40	50	6	6	C	0179	0180
CS1-BF106M	35	10	M	4	40	50	6	6	C	0181	0182
CS1-BF126K	35	12	K	4	40	50	6	6	C	0183	0184
CS1-BF156K	35	15	K	5	50	63	6	6	C	0185	0186
CS1-BF156M	35	15	M	5	50	63	6	6	C	0187	0188
CS1-BF186K	35	18	K	6	60	75	6	6	C	0189	0190
CS1-BF226K	35	22	K	8	80	100	6	6	C	0191	0192
CS1-BF226M	35	22	M	8	80	100	6	6	C	0193	0194
CS1-BF276K	35	27	K	9	90	113	6	6	D	0195	0196
CS1-BF336K	35	33	K	11	110	138	6	6	D	0197	0198
CS1-BF336M	35	33	M	11	110	138	6	6	D	0199	0200
CS1-BF396K	35	39	K	14	140	175	6	6	D	0201	0202
CS1-BF476K	35	47	K	16	160	200	6	6	D	0203	0204
CS1-BF476M	35	47	M	16	160	200	6	6	D	0205	0206
CS1-BG105K	50	1	K	.8	8	10	3	4	A	0207	0208
CS1-BG105M	50	1	M	.8	8	10	3	4	A	0209	0210
CS1-BG125K	50	1.2	K	.9	9	11	3	4	B	0211	0212
CS1-BG155K	50	1.5	K	1.2	12	15	3	4	B	0213	0214
CS1-BG155M	50	1.5	M	1.2	12	15	3	4	B	0215	0216
CS1-BG185K	50	1.8	K	1.4	14	18	3	4	B	0217	0218
CS1-BG225K	50	2.2	K	1.7	17	22	3	4	B	0219	0220
CS1-BG225M	50	2.2	M	1.7	17	22	3	4	B	0221	0222
CS1-BG275K	50	2.7	K	2	20	25	3	4	B	0223	0224
CS1-BG335K	50	3.3	K	2.5	25	32	3	4	B	0225	0226
CS1-BG335M	50	3.3	M	2.5	25	32	3	4	B	0227	0228
CS1-BG395K	50	3.9	K	3	30	38	3	4	B	0229	0230
CS1-BG475K	50	4.7	K	3.5	35	44	3	4	B	0231	0232
CS1-BG475M	50	4.7	M	3.5	35	44	3	4	B	0233	0234
CS1-BG565K	50	5.6	K	4.5	45	56	3	4	C	0235	0236
CS1-BG685K	50	6.8	K	4.5	45	56	6	6	C	0237	0238
CS1-BG685M	50	6.8	M	4.5	45	56	6	6	C	0239	0240
CS1-BG825K	50	8.2	K	5	50	63	6	6	C	0241	0242
CS1-BG106K	50	10	K	5	50	63	6	6	C	0243	0244
CS1-BG106M	50	10	M	5	50	63	6	6	C	0245	0246
CS1-BG126K	50	12	K	6	60	75	6	6	C	0247	0248
CS1-BG156K	50	15	K	8	80	100	6	6	C	0249	0250
CS1-BG156M	50	15	M	8	80	100	6	6	C	0251	0252
CS1-BG186K	50	18	K	9	90	113	6	6	C	0253	0254
CS1-BG226K	50	22	K	11	110	138	6	6	D	0255	0256
CS1-BG226M	50	22	M	11	110	138	6	6	D	0257	0258

1/ Complete type designation will include additional symbols to indicate style, and where applicable, capacitance tolerance.

MIL-C-26655B

Military Style Tantalum Capacitors

MIL-C-26655B
STYLES CS12 & CS13

Type designation 1/	DC rated voltage	Capacitance	Cap. Tolerance	DC leakage at:			Dissipation factor at:		Case size	Dash Number	
				+25°C	+85°C	+125°C	+25°C -55°C	+85°C +125°C		CS12	CS13
	volts	uf		ua	ua	ua	percent				
CS1-BH104K	75	.10	K	.5	5	6.3	3	4	A	0259	0260
CS1-BH104M	75	.10	M	.5	5	6.3	3	4	A	0261	0262
CS1-BH124K	75	.12	K	.5	5	6.3	3	4	A	0263	0264
CS1-BH154K	75	.15	K	.5	5	6.3	3	4	A	0265	0266
CS1-BH154M	75	.15	M	.5	5	6.3	3	4	A	0267	0268
CS1-BH184K	75	.18	K	.5	5	6.3	3	4	A	0269	0270
CS1-BH224K	75	.22	K	.5	5	6.3	3	4	A	0271	0272
CS1-BH224M	75	.22	M	.5	5	6.3	3	4	A	0273	0274
CS1-BH274K	75	.27	K	.5	5	6.3	3	4	A	0275	0276
CS1-BH334K	75	.33	K	.5	5	6.3	3	4	A	0277	0278
CS1-BH334M	75	.33	M	.5	5	6.3	3	4	A	0279	0280
CS1-BH394K	75	.39	K	.5	5	6.3	3	4	A	0281	0282
CS1-BH474K	75	.47	K	.5	5	6.3	3	4	A	0283	0284
CS1-BH474M	75	.47	M	.5	5	6.3	3	4	A	0285	0286
CS1-BH564K	75	.56	K	.5	5	6.3	3	4	A	0287	0288
CS1-BH684K	75	.68	K	.5	5	6.3	3	4	A	0289	0290
CS1-BH684M	75	.68	M	.5	5	6.3	3	4	A	0291	0292
CS1-BH824K	75	.82	K	.5	5	6.3	3	4	B	0293	0294
CS1-BH105K	75	1.0	K	.5	5	6.3	3	4	B	0295	0296
CS1-BH105M	75	1.0	M	.5	5	6.3	3	4	B	0297	0298
CS1-BH125K	75	1.2	K	.5	5	6.3	3	4	B	0299	0300
CS1-BH155K	75	1.5	K	1.0	10	13	3	4	B	0301	0302
CS1-BH155M	75	1.5	M	1.0	10	13	3	4	B	0303	0304
CS1-BH185K	75	1.8	K	1.0	10	13	3	4	B	0305	0306
CS1-BH225K	75	2.2	K	1.5	15	19	3	4	B	0307	0308
CS1-BH225M	75	2.2	M	1.5	15	19	3	4	B	0309	0310
CS1-BH275K	75	2.7	K	1.5	15	19	3	4	B	0311	0312
CS1-BH335K	75	3.3	K	2	20	25	3	4	B	0313	0314
CS1-BH335M	75	3.3	M	2	20	25	3	4	B	0315	0316
CS1-BH395K	75	3.9	K	2	20	25	3	4	B	0317	0318
CS1-BH475K	75	4.7	K	6	60	75	3	4	C	0319	0320
CS1-BH475M	75	4.7	M	6	60	75	3	4	C	0321	0322
CS1-BH565K	75	5.6	K	6	60	75	3	4	C	0323	0324
CS1-BH685K	75	6.8	K	10	100	125	6	6	C	0325	0326
CS1-BH685M	75	6.8	M	10	100	125	6	6	C	0327	0328
CS1-BH825K	75	8.2	K	10	100	125	6	6	C	0329	0330
CS1-BH106K	75	10	K	10	100	125	6	6	C	0331	0332
CS1-BH106M	75	10	M	10	100	125	6	6	C	0333	0334
CS1-BH126K	75	12	K	10	100	125	6	6	D	0335	0336
CS1-BH156K	75	15	K	14	140	175	6	6	D	0337	0338
CS1-BH156M	75	15	M	14	140	175	6	6	D	0339	0340

1/ Complete type designation will include additional symbols to indicate style, and where applicable, capacitance tolerance.

MIL-C-26655B
STYLES CS12 & CS13

Type designation 1/	DC rated voltage	Capacitance	Cap. Tolerance	DC leakage at:			Dissipation factor at:		Case size	Dash Number	
				+25°C	+85°C	+125°C	+25°C -55°C	+85°C +125°C		CS12	CS13
	volts	uf		ua	ua	ua	percent				
CS1-BJ472K	100	.0047	K	.5	5	6.3	3	4	A	0341	0342
CS1-BJ472M	100	.0047	M	.5	5	6.3	3	4	A	0343	0344
CS1-BJ562K	100	.0056	K	.5	5	6.3	3	4	A	0345	0346
CS1-BJ682K	100	.0068	K	.5	5	6.3	3	4	A	0347	0348
CS1-BJ682M	100	.0068	M	.5	5	6.3	3	4	A	0349	0350
CS1-BJ822K	100	.0082	K	.5	5	6.3	3	4	A	0351	0352
CS1-BJ103K	100	.01	K	.5	5	6.3	3	4	A	0353	0354
CS1-BJ103M	100	.01	M	.5	5	6.3	3	4	A	0355	0356
CS1-BJ123K	100	.012	K	.5	5	6.3	3	4	A	0357	0358
CS1-BJ153K	100	.015	K	.5	5	6.3	3	4	A	0359	0360
CS1-BJ153M	100	.015	M	.5	5	6.3	3	4	A	0361	0362
CS1-BJ183K	100	.018	K	.5	5	6.3	3	4	A	0363	0364
CS1-BJ223K	100	.022	K	.5	5	6.3	3	4	A	0365	0366
CS1-BJ223M	100	.022	M	.5	5	6.3	3	4	A	0367	0368
CS1-BJ273K	100	.027	K	.5	5	6.3	3	4	A	0369	0370
CS1-BJ333K	100	.033	K	.5	5	6.3	3	4	A	0371	0372
CS1-BJ333M	100	.033	M	.5	5	6.3	3	4	A	0373	0374
CS1-BJ393K	100	.039	K	.5	5	6.3	3	4	A	0375	0376
CS1-BJ473K	100	.047	K	.5	5	6.3	3	4	A	0377	0378
CS1-BJ473M	100	.047	M	.5	5	6.3	3	4	A	0379	0380
CS1-BJ563K	100	.056	K	.5	5	6.3	3	4	A	0381	0382
CS1-BJ683K	100	.068	K	.5	5	6.3	3	4	A	0383	0384
CS1-BJ683M	100	.068	M	.5	5	6.3	3	4	A	0385	0386
CS1-BJ823K	100	.082	K	.5	5	6.3	3	4	A	0387	0388
CS1-BJ104K	100	.1	K	.5	5	6.3	3	4	A	0389	0390
CS1-BJ104M	100	.1	M	.5	5	6.3	3	4	A	0391	0392
CS1-BJ124K	100	.12	K	.5	5	6.3	3	4	A	0393	0394
CS1-BJ154K	100	.15	K	.5	5	6.3	3	4	A	0395	0396
CS1-BJ154M	100	.15	M	.5	5	6.3	3	4	A	0397	0398
CS1-BJ184K	100	.18	K	.5	5	6.3	3	4	A	0399	0400
CS1-BJ224K	100	.22	K	.5	5	6.3	3	4	A	0401	0402
CS1-BJ224M	100	.22	M	.5	5	6.3	3	4	A	0403	0404
CS1-BJ274K	100	.27	K	.5	5	6.3	3	4	A	0405	0406
CS1-BJ334K	100	.33	K	.5	5	6.3	3	4	A	0407	0408
CS1-BJ334M	100	.33	M	.5	5	6.3	3	4	A	0409	0410
CS1-BJ394K	100	.39	K	.5	5	6.3	3	4	A	0411	0412
CS1-BJ474K	100	.47	K	.5	5	6.3	3	4	A	0413	0414
CS1-BJ474M	100	.47	M	.5	5	6.3	3	4	A	0415	0416
CS1-BJ564K	100	.56	K	.5	5	6.3	3	4	A	0417	0418
CS1-BJ684K	100	.68	K	.5	5	6.3	3	4	B	0419	0420
CS1-BJ684M	100	.68	M	.5	5	6.3	3	4	B	0421	0422
CS1-BJ824K	100	.82	K	.5	5	6.3	3	4	B	0423	0424
CS1-BJ105K	100	1.0	K	.5	5	6.3	3	4	B	0425	0426
CS1-BJ105M	100	1.0	M	.5	5	6.3	3	4	B	0427	0428
CS1-BJ125K	100	1.2	K	.5	5	6.3	3	4	B	0429	0430
CS1-BJ155K	100	1.5	K	1.0	10	13	3	4	B	0431	0432
CS1-BJ155M	100	1.5	M	1.0	10	13	3	4	B	0433	0434
CS1-BJ185K	100	1.8	K	1.0	10	13	3	4	B	0435	0436
CS1-BJ225K	100	2.2	K	1.5	15	19	3	4	B	0437	0438
CS1-BJ225M	100	2.2	M	1.5	15	19	3	4	B	0439	0440
CS1-BJ275K	100	2.7	K	1.5	15	19	3	4	B	0441	0442

1/ Complete type designation will include additional symbols to indicate style, and where applicable, capacitance tolerance.

MIL-C-39003
Military Style Tantalum Capacitors

MIL-C-39003

DESIGN AND CONSTRUCTION

Each established reliability capacitor consists of a highly purified sintered tantalum anode body utilizing an electrolytically formed oxide dielectric, and a solid electrolyte, enclosed in a hermetically sealed metal case with axial leads. This construction will enable the capacitor to withstand the most stringent environmental requirements.

CASE INSULATION

Case insulation of Style CSR capacitor will not soften or creep at the high ambient temperature. Insulation shall possess a minimum dielectric strength of 2000 VDC and insulation resistance of 1000 megohms minimum.

TERMINALS

Leads are the solid conductor type with lengths and diameters specified in table. Material is Type N4 to MIL-STD-1276 electro tin plated to provide coverages and solderability as specified in MIL-STD-202. method 208. The tin content of the coating does not exceed 70 percent. N5 (Hot Solder Dipped) leads are an option.

Each lead shall withstand five bends and five twists per method 211 of MIL-STD-202, without loosening, breaking, or showing other permanent damage. One bend consists of rotating the capacitor body 90° from vertical to horizontal and return with a three (3) pound weight attached to the lead. One twist is defined as one 360° rotation of the lead about its own axis in a period not to exceed 5 seconds.

D.C. LEAKAGE

D.C. leakage shall be measured using the dc rated voltage at ±2 percent at the applicable test temperature, after a maximum electrification period of 5 minutes. A 1,000-ohm resistor shall be placed in series with the capacitor to limit the charging current. A steady source of power, such as a regulated power supply shall be used. Measurement accuracy shall be within ±2 percent or 0.02 microampere (ua), whichever is greater.

CAPACITANCE

Capacitors shall be tested in accordance with method 305 of MIL-STD-202. The following details shall apply:

(a) Test frequency — 120 ± 5 Hertz (cycles per second).
(b) Limit of accuracy — Measurement accuracy shall be within ±2 percent of the reading.
(c) Magnitude of polarizing voltage — Maximum dc bias shall be 2.2 volts for all ac measurements. The magnitude of the ac voltage shall be limited to 1.0 volts rms.

DISSIPATION FACTOR

The dissipation factor of each capacitor shall be measured at a frequency of 120 ± 5 Hertz (Hz) by means of a polarized capacitance bridge. The bridge shall provide a dial reading accuracy of 0.1 percent dissipation factor and a measuring accuracy of ± 2 percent of the measured dissipation factor plus 0.1 percent.

SHOCK, MEDIUM IMPACT

Capacitors shall be tested in accordance with method 205 of MIL-STD-202. The following details and exceptions shall apply:

(a) Special mounting means — Capacitors shall be rigidly mounted on a mounting fixture by the body. Leads shall be secured to rigidly supported terminals, so spaced that the length of each lead from the capacitor is approximately ⅜ inch when measured from the edge of the supporting terminal. Leads shall be within 30 degrees of being parallel. When securing leads, care shall be taken to avoid pinching the leads.
(b) Test condition letter — C (30-inch drop).
(c) Measurements and electrical loading during shock — during the test, observations shall be made to determine intermittent contact or arcing or open or short-circuiting. Detecting equipment shall be sufficiently sensitive to detect any interruption with a duration of 0.5 ms. The dc rated voltage shall be applied to the capacitors during the test.

When capacitors are tested as specified there shall be no intermittent contacts of 0.5 milliseconds (ms) or greater duration, or arcing or other indication of breakdown, nor shall there by any open- or short-circuiting or evidence of mechanical damage.

VIBRATION, HIGH FREQUENCY

Capacitors shall be tested in accordance with method 204 of MIL-STD-202. The following details and exceptions shall apply:

(a) Mounting of specimens — Capacitors shall be securely mounted by their leads and by their bodies by supplementary mounting means.
(b) Electrical-load conditions — During the test, the specified dc rated voltage shall be applied to the capacitors.
(c) Test condition letter — D (20G's).
(d) Duration and direction of motion — 4 hours in each of two mutually perpendicular directions (total of 8 hours), one parallel and the other perpendicular to the cylindrical axis.
(e) Measurements during vibration — During the last cycle, an electrical measurement shall be made to determine intermittent operation or open- or short-circuiting. Observations shall also be made to determine intermittent contact or arcing or open- or short-circuiting. Detecting equipment shall be sufficiently sensitive to detect any interruption with a duration of 0.5 ms, or greater.

When capacitors are tested as specified, there shall be no intermittent contacts of 0.5 ms or greater duration, or arcing or other indication of breakdown, nor shall there be any open- or short-circuiting or evidence of mechanical damage.

SALT SPRAY (Corrosion)

Capacitors shall be tested in accordance with method 101 of MIL-STD-202. The following details and exception shall apply:

(a) Applicable salt solution — 5 percent.
(b) Test condition letter — B (48 hours).

When capacitors are tested as specified, there shall be no harmful corrosion, and at least 90 percent of any exposed metal surface of the capacitor shall be unaffected. In addition, there shall be not more than 10 percent corrosion of the terminal surface. There shall be no unwrapping or mechanical damage to insulating sleeves. The marking shall remain legible.

THERMAL SHOCK AND IMMERSION

THERMAL SHOCK: Capacitors shall be tested in accordance with method 107 of MIL-STD-202. The following details and exceptions shall apply:

(a) Conditioning prior to first cycle — 15 minutes at the inspection conditions specified in MIL-STD-202.
(b) Test condition letter — B.
(c) Measurements before and after cycling — Not applicable.

IMMERSION: Following temperature cycling, capacitors shall be tested in accordance with method 104 of MIL-STD-202. The following details and exceptions shall apply:

(a) Test condition letter — B.
(b) Measurements after final cycle — Within 30 minutes after removal from the final immersion bath, the dc leakage, capacitance, and dissipation factor shall be measured as specified above.
(c) Examination after test — Capacitors shall be visually examined for evidence of corrosion, mechanical damage, and obliteration of marking.

When tested as specified, capacitors shall meet the following requirements:

DC leakage — Shall not exceed the requirement specified in table for specific rating.
Capacitance — Shall change not more than ±3 percent from the initial value.
Dissipation factor — Shall not exceed the requirement specified in table for specific rating.

RADIOGRAPHIC INSPECTION

Capacitors shall be X-rayed in one plane at 90-degree rotation perpendicular to their longitudinal axis for evidence of improperly made connections, misalignment of slugs and seals or eyelets, substandard soldering or structural weakness, or solder particles or slivers attached to one end. The X-rays thus obtained shall be retained by the manufacturer. X-rays shall be available for each lot produced to allow a review at the discretion of the procuring activity. The magnification during visual examination shall be 2 power, minimum. If number of defectives exceed the allowable limit, X-ray shall be performed in two planes for all subsequent lots. Manufacturer may return to one plane testing when three sequential lots meet specification limits.

When capacitors are tested as specified, radiographic inspection shall disclose no evidence of improperly made connections, misalignment of slugs and seals or eyelets, substandard soldering or structural weakness, or solder particles or slivers attached to one end.

MOISTURE RESISTANCE

Capacitors shall be tested in accordance with method 106 of MIL-STD-202. The following details and exceptions shall apply:

(a) Mounting — Except during examination and measurements, capacitors shall be securely fastened by the body.
(b) Initial measurements — Not applicable.
(c) Polarization and loading voltages — Not applicable.
(d) Final measurements — After the final cycle and within 2 to 6 hours after removal of the capacitors from the humidity chamber, the dc leakage, capacitance, and dissipation factor shall be measured, at the initial inspection conditions specified.
(e) Examinations after test — Capacitors shall be visually examined for evidence of corrosion, mechanical damage, and obliteration of marking.

When tested as specified, capacitors shall meet the following requirements.

DC leakage — Shall not exceed the requirement specified.
Capacitance — Shall change not more than ±2% from initial value.
Dissipation factor — Shall not exceed the requirement specified.
Visual examination — There shall be no evidence of mechanical damage and the marking shall remain legible.

STABILITY AT LOW AND HIGH TEMPERATURE

Capacitors will meet the following requirements as applicable.

Step 1 (+25°C):
DC leakage — Shall not exceed the applicable value specified.
Capacitance — Shall be within the tolerance specified in the type designation specified.
Dissipation factor — Shall not exceed the applicable value specified.

Step 2 (-55°C):
Capacitance — Shall change not more than ±10% from the step 1 measured value.
Dissipation factor — Shall not exceed the applicable value specified.

Step 3 (+25°C):
DC leakage — Shall not exceed the applicable value specified.
Capacitance — Shall change not more than ±2 percent from the step 1 measured value.
Dissipation factor — Shall not exceed the applicable value specified.

Step 4 (+85°C):
DC leakage — Shall not exceed the applicable value specified.
Capacitance — Shall change not more than ±8% from the step 1 measured value.
Dissipation factor — Shall not exceed the applicable value specified.

Step 5 (+25°C):
DC leakage — Shall not exceed the applicable value specified.
Capacitance — Shall change not more than ±2 percent from the step 1 measured value.
Dissipation factor — Shall not exceed the applicable value specified.

SURGE VOLTAGE

Capacitors shall be subjected to 1,000 cycles of the applicable surge voltage. The ambient temperature during cycling shall be +85°C. Each cycle shall consist of a 30-second surge voltage application followed by a 30-second discharge period. Voltage application shall be made through a resistor of 33 ohms. The tolerance of the resistor shall be ±5 percent. Each surge voltage cycle shall be performed in such a manner that the capacitor is shorted terminal to terminal through a copper bar, or an equivalent low resistance at the end of the 30-second application. An alternate method of shorting the capacitors is discharge through the same resistance that is utilized for charging. After the final cycle, the capacitors shall be stabilized at the inspection conditions, and the dc leakage, capacitance, and dissipation factor shall be measured.

When tested as specified, capacitors shall meet the following requirements:

DC leakage — Shall not exceed the requirement specified.
Capacitance — Shall change not more than ±2% from initial value.
Dissipation factor — Shall not exceed the requirement specified.

WEIBULL AND EXPONENTIAL DISTRIBUTIONS

Exponential lifetest devices (dash numbers) are available for existing equipment designs in the M, P, R, and S failure rate levels. All new designs must utilize the Weibull distribution (dash numbers) and associated failure rate(s). (After August 15, 1984)

Symbol	Exponential Failure Rate Level (%/1,000 hr)	Symbol	Weibull Failure Rate Level (%/1,000 hr)
M	1.0	–	–
P	0.1	B	0.1
R	0.01	C	0.01
S	0.001	D	0.001

The existing exponential lifetest CSR styles required only a 40 hour voltage aging at rated voltage prior to shipment. The failure rate on each lot was determined by the demonstrated generic lifetest data history of any given manufacturer, and that manufacturers' internal testing to guarantee the given failure rate level shipped.

The new CSR Weibull lifetest system, and associated military dash numbers, requires a lot/lot 100% accelerated aging sequence on each lot processed. This aging method utilizes the decreasing rate of failure which is applicable to solid tantalum capacitors, i.e., the rate of failure in any given lot gets smaller and smaller for times in excess of 100,000 hours. The decreasing rate of failure seen during life testing on solid tantalum capacitors makes the Weibull (accelerated voltage) aging concept uniquely correct for these designs.

Statistical treatment becomes somewhat more difficult, but the Weibull approximation fits very nicely and enables a straight line slope when predicting failure rate(s) from observed failure(s) at precise time intervals. This method additionally permits extrapolation to predict the time needed on voltage age to reach a desired failure rate.

In effect, by accelerating the applied voltage during the 85°C aging sequence, we are accelerating the incidence of failure(s) that might occur. These higher than rated voltage applied levels are called acceleration levels (factors) and are carefully designed for each voltage family of devices. As an example, an applied voltage of 1.1 times the rated voltage may indicate that for every hour of test under these conditions is equal to 4X the number of standard 85°C hours, at applied rated voltage. Obviously there are limits of applied voltage permissable under accelerated conditions since the device design could be over stressed.

As can be seen, all new equipment design (August 15, 1984) requires the Weibull dash number series for any CSR style. A thorough grounding in the Weibull theory, as applied to accelerated voltage aging of tantalum capacitors, can be reviewed in the latest revision of MIL-C-39003, capacitors fixed, electrolytic tantalum, general specification for.

MIL-C-39003

Military Style Tantalum Capacitors

MIL-C-39003

QUALIFICATION

LIFE TEST (EXPONENTIAL DASH NUMBERS)

Capacitors shall be tested in accordance with method 108 of MIL-STD-202. The following details and exception shall apply:

(a) Distance of temperature measurements from specimens, in inches — Not applicable.

(b) Method of mounting — Capacitors shall be mounted by their leads.

(c) Test temperature and tolerance — The applicable high test temperature is 125° $^{+4°}_{-0°}$C. The standard high temperature shall be 85° $^{+4°}_{-0°}$C.

(d) Operating conditions — rated dc voltage or the derated voltage at 125°C, as applicable, shall be applied gradually (not to exceed 5 minutes either by a slow build-up of the voltage or through a resistor which shall be shorted out within 5 minutes). Voltage shall be applied continuously,except for measurement periods. The impedance of the voltage source, as seen from the terminals of each capacitor, shall not exceed 3 ohms. Storage batteries or an electronic power supply capable of supplying at least 1 ampere when a capacitor is shorted shall be used.

(e) Test condition letter — F (2,000 hours).

(f) Measurements during exposure — DC leakage at the applicable high test temperature shall be made at the following intervals: 0; $^{+48}_{-0}$; $^{+48}_{-0}$; $^{+72}_{-0}$ hours.

QUALITY CONFORMANCE INSPECTION:

For group C inspection — When tested as specified above, capacitors shall meet the following requirements:

At 25°C:

DC leakage — Shall not exceed the applicable value specified.

Capacitance — Shall change not more than ±2% from the value obtained when measured as specified.

Dissipation factor — Shall not exceed the applicable value specified.

At 85°C:

DC leakage — Shall not exceed the applicable value specified.

At 125°C:

DC leakage — Shall not exceed the applicable value specified.

Capacitors shall be visually examined for evidence of mechanical damage. In addition, capacitors shall be subjected to the insulating sleeving dielectric strength test as specified following these measurements.

Group B Performance check (Exponential Dash Number only)—Capacitor shall be tested as specified above with the following exceptions:

(a) The duration of the test shall be 250 hours.

(b) The 85°C rated voltage shall be used for this test.

(c) The test temperature shall be 85° $^{+4°}_{-0°}$C.

(d) The insulating sleeving dielectric strength test need not be performed.

Following the Performance check, capacitors shall meet the same requirements as specified for Group C inspection.

Extended life test — Capacitors shall be tested as specified above, except that the duration of the test shall be 10,000 hours. DC leakage (at the applicable high test temperature) shall be made at the following intervals: 0; $^{+48}_{-0}$; $^{+48}_{-0}$; $^{+72}_{-0}$; and every 2,000 hours $^{+96}$ thereafter until 10,000 $^{-0}$ hours have elapsed.

When tested as specified above, capacitors shall meet the following requirements:

At 25°C:

DC leakage — Shall not exceed 200 percent of the value specified.

Capacitance — Shall change not more than ±10 percent from initial measurement.

Dissipation factor — Shall not exceed the applicable value specified.

At 85°C:

DC leakage — Shall not exceed 200 percent of the value specified.

At 125°C:

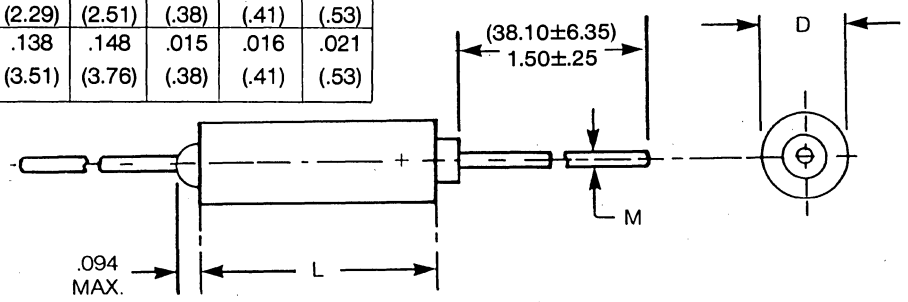
DC leakage — Shall not exceed 200 percent of the value specified.

DC Rated and Surge Voltages

Voltage Symbol	DC rated voltage	DC working voltage		DC surge voltage	
		85°C	125°C	85°C	125°C
B	6	6	4	8	5
C	10	10	7	13	9
D	15	15	10	20	12
E	20	20	13	26	16
F	35	35	23	46	28
G	50	50	33	65	40
H	75	75	50	98	64
J	100	100	67	130	86

Dimensions — Inches (mm)									
CASE SIZE	L			D			M		
	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.
A1	.235	.250	.281	.081	.090	.099	.015	.016	.021
	(5.97)	(6.35)	(7.14)	(2.06)	(2.29)	(2.51)	(.38)	(.41)	(.53)
B1	.375	.390	.405	.128	.138	.148	.015	.016	.021
	(9.53)	(9.91)	(10.29)	(3.25)	(3.51)	(3.76)	(.38)	(.41)	(.53)

MIL-C-39003/02
STYLE CSR09



DC rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage at			Dissipation factor at			Case size	Dash no. Failure rate level for (%1,000 hrs)						
			+25°C	+85°C	+125°C	−55°C	+25°C	+85°C +125°C		M 1.0	P 0.1	R 0.01	S 0.001	B 0.1	C 0.01	D 0.001
Volts	µF	Percent	µA	µA	µA	Percent	Percent	Percent								
6	2.7	5	0.6	6.0	8.0	8	6	6	A1	1001	1061	1121	1181	2001	3001	4001
6	2.7	10	0.6	6.0	8.0	8	6	6	A1	0001	0061	0121	0181	2002	3002	4002
6	18.0	5	1.4	21.6	36.7	8	6	6	B1	1002	1062	1122	1182	2003	3003	4003
6	18.0	10	1.4	21.6	36.7	8	6	6	B1	0002	0062	0122	0182	2004	3004	4004
10	1.8	5	0.6	6.0	8.0	8	6	6	A1	1007	1067	1127	1187	2005	3005	4005
10	1.8	10	0.6	6.0	8.0	8	6	6	A1	0007	0067	0127	0187	2006	3006	4006
10	2.2	5	0.6	6.0	8.0	8	6	6	A1	1008	1068	1128	1188	2007	3007	4007
10	2.2	10	0.6	6.0	8.0	8	6	6	A1	0008	0068	0128	0188	2008	3008	4008
10	10.0	5	2.5	20.0	34.0	8	6	6	B1	1009	1069	1129	1189	2009	3009	4009
10	10.0	10	2.5	20.0	34.0	8	6	6	B1	0009	0069	0129	0189	2010	3010	4010
10	12.0	5	2.5	24.0	40.8	8	6	6	B1	1010	1070	1130	1190	2011	3011	4011
10	12.0	10	2.5	24.0	40.8	8	6	6	B1	0010	0070	0130	0190	2012	3012	4012
10	15.0	5	2.5	30.0	51.0	8	6	6	B1	1011	1071	1131	1191	2013	3013	4013
10	15.0	10	2.5	30.0	51.0	8	6	6	B1	0011	0071	0131	0191	2014	3014	4014
15	1.0	5	0.6	6.0	8.0	8	6	6	A1	1012	1072	1132	1192	2015	3015	4015
15	1.0	10	0.6	6.0	8.0	8	6	6	A1	0012	0072	0132	0192	2016	3016	4016
15	1.2	5	0.6	6.0	8.0	8	6	6	A1	1013	1073	1133	1193	2017	3017	4017
15	1.2	10	0.6	6.0	8.0	8	6	6	A1	0013	0073	0133	0193	2018	3018	4018
15	1.5	5	0.6	6.0	8.0	8	6	6	A1	1014	1074	1134	1194	2019	3019	4019
15	1.5	10	0.6	6.0	8.0	8	6	6	A1	0014	0074	0134	0194	2020	3020	4020
15	8.2	5	1.8	24.6	42.0	8	6	6	B1	1015	1075	1135	1195	2021	3021	4021
15	8.2	10	1.8	24.6	42.0	8	6	6	B1	0015	0075	0135	0195	2022	3022	4022
20	.56	5	0.6	6.0	8.0	4	3	4	A1	1016	1076	1136	1196	2023	3023	4023
20	.56	10	0.6	6.0	8.0	4	3	4	A1	0016	0076	0136	0196	2024	3024	4024
20	.68	5	0.6	6.0	8.0	4	3	4	A1	1017	1077	1137	1197	2025	3025	4025
20	.68	10	0.6	6.0	8.0	4	3	4	A1	0017	0077	0137	0197	2026	3026	4026
20	.82	5	0.6	6.0	8.0	4	3	4	A1	1018	1078	1138	1198	2027	3027	4027
20	.82	10	0.6	6.0	8.0	4	3	4	A1	0018	0078	0138	0198	2028	3028	4028
20	1.0	5	0.6	6.0	8.0	4	3	4	A1	1019	1079	1139	1199	2029	3029	4029
20	1.0	10	0.6	6.0	8.0	4	3	4	A1	0019	0079	0139	0199	2030	3030	4030
20	3.3	5	1.0	13.2	22.4	4	3	4	B1	1020	1080	1140	1200	2031	3031	4031
20	3.3	10	1.0	13.2	22.4	4	3	4	B1	0020	0080	0140	0200	2032	3032	4032
20	3.9	5	2.0	15.6	26.5	4	3	4	B1	1021	1081	1141	1201	2033	3033	4033
20	3.9	10	2.0	15.6	26.5	4	3	4	B1	0021	0081	0141	0201	2034	3034	4034
20	4.7	5	2.0	18.8	32.0	4	3	4	B1	1022	1082	1142	1202	2035	3035	4035
20	4.7	10	2.0	18.8	32.0	4	3	4	B1	0022	0082	0142	0202	2036	3036	4036
20	5.6	5	2.0	22.4	38.1	4	3	4	B1	1023	1083	1143	1203	2037	3037	4037
20	5.6	10	2.0	22.4	38.1	4	3	4	B1	0023	0083	0143	0203	2038	3038	4038
20	6.8	5	2.0	27.2	46.2	4	3	4	B1	1024	1084	1144	1204	2039	3039	4039
20	6.8	10	2.0	27.2	46.2	4	3	4	B1	0024	0084	0144	0204	2040	3040	4040
35	0.33	5	0.6	6.0	8.0	4	3	4	A1	1025	1085	1145	1205	2041	3041	4041
35	0.33	10	0.6	6.0	8.0	4	3	4	A1	0025	0085	0145	0205	2042	3042	4042
35	0.39	5	0.6	6.0	8.0	4	3	4	A1	1026	1086	1146	1206	2043	3043	4043
35	0.39	10	0.6	6.0	8.0	4	3	4	A1	0026	0086	0146	0206	2044	3044	4044
35	0.47	5	0.6	6.0	8.0	4	3	4	A1	1027	1087	1147	1207	2045	3045	4045
35	0.47	10	0.6	6.0	8.0	4	3	4	A1	0027	0087	0147	0207	2046	3046	4046
35	2.2	5	1.4	15.4	26.2	4	3	4	B1	1028	1088	1148	1208	2047	3047	4047
35	2.2	10	1.4	15.4	26.2	4	3	4	B1	0028	0088	0148	0208	2048	3048	4048
35	2.7	5	1.4	18.9	32.1	4	3	4	B1	1029	1089	1149	1209	2049	3049	4049
35	2.7	10	1.4	18.9	32.1	4	3	4	B1	0029	0089	0149	0209	2050	3050	4050

MIL-C-39003

Military Style Tantalum Capacitors

MIL-C-39003/02
STYLE CSR09

DC rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage at			Dissipation factor at			Case size	Dash no. Failure rate level for (%1,000 hrs)						
			+25°C	+85°C	+125°C	−55°C	+25°C	+85°C +125°C		M 1.0	P 0.1	R 0.01	S 0.001	B 0.1	C 0.01	D 0.001
Volts	µF	Percent	µA	µA	µA	Percent	Percent	Percent								
50	0.22	5	0.6	6.0	8.0	4	3	4	A1	1030	1090	1150	1210	2051	3051	4051
50	0.22	10	0.6	6.0	8.0	4	3	4	A1	0030	0090	0150	0210	2052	3052	4052
50	0.27	5	0.6	6.0	8.0	4	3	4	A1	1031	1091	1151	1211	2053	3053	4053
50	0.27	5	0.6	6.0	8.0	4	3	4	A1	0031	0091	0151	0211	2054	3054	4054
50	1.5	5	1.4	15.0	25.5	4	3	4	B1	1032	1092	1152	1212	2055	3055	4055
50	1.5	10	1.4	15.0	25.5	4	3	4	B1	0032	0092	0152	0212	2056	3056	4056
50	1.8	5	1.4	18.0	30.6	4	3	4	B1	1033	1093	1153	1213	2057	3057	4057
50	1.8	10	1.4	18.0	30.6	4	3	4	B1	0033	0093	0153	0213	2058	3058	4058
75	0.047	5	0.6	6.0	8.0	4	3	4	A1	1034	1094	1154	1214	2059	3059	4059
75	0.047	10	0.6	6.0	8.0	4	3	4	A1	0034	0094	0154	0214	2060	3060	4060
75	0.056	5	0.6	6.0	8.0	4	3	4	A1	1035	1095	1155	1215	2061	3061	4061
75	0.056	10	0.6	6.0	8.0	4	3	4	A1	0035	0095	0155	0215	2062	3062	4062
75	0.068	5	0.6	6.0	8.0	4	3	4	A1	1036	1096	1156	1216	2063	3063	4063
75	0.068	10	0.6	6.0	8.0	4	3	4	A1	0036	0096	0156	0216	2064	3064	4064
75	0.082	5	0.6	6.0	8.0	4	3	4	A1	1037	1097	1157	1217	2065	3065	4065
75	0.082	10	0.6	6.0	8.0	4	3	4	A1	0037	0097	0157	0217	2066	3066	4066
75	0.10	5	0.6	6.0	8.0	4	3	4	A1	1038	1098	1158	1218	2067	3067	4067
75	0.10	10	0.6	6.0	8.0	4	3	4	A1	0038	0098	0158	0218	2068	3068	4068
75	0.12	5	0.6	6.0	8.0	4	3	4	A1	1039	1099	1159	1219	2069	3069	4069
75	0.12	10	0.6	6.0	8.0	4	3	4	A1	0039	0099	0159	0219	2070	3070	4070
75	0.15	5	0.6	6.0	8.0	4	3	4	A1	1040	1100	1160	1220	2071	3071	4071
75	0.15	10	0.6	6.0	8.0	4	3	4	A1	0040	0100	0160	0220	2072	3072	4072
75	0.18	5	0.6	6.0	8.0	4	3	4	A1	1041	1101	1161	1221	2073	3073	4073
75	0.18	10	0.6	6.0	8.0	4	3	4	A1	0041	0101	0161	0221	2074	3074	4074
75	0.22	5	0.6	6.0	8.0	4	3	4	B1	1042	1102	1162	1222	2075	3075	4075
75	0.22	10	0.6	6.0	8.0	4	3	4	B1	0042	0102	0162	0222	2076	3076	4076
75	0.27	5	0.6	6.0	8.0	4	3	4	B1	1043	1103	1163	1223	2077	3077	4077
75	0.27	10	0.6	6.0	8.0	4	3	4	B1	0043	0103	0163	0223	2078	3078	4078
75	0.33	5	0.6	6.0	8.4	4	3	4	B1	1044	1104	1164	1224	2079	3079	4079
75	0.33	10	0.6	6.0	8.4	4	3	4	B1	0044	0104	0164	0224	2080	3080	4080
75	0.39	5	0.6	6.0	9.9	4	3	4	B1	1045	1105	1165	1225	2081	3081	4081
75	0.39	10	0.6	6.0	9.9	4	3	4	B1	0045	0105	0165	0225	2082	3082	4082
75	0.47	5	0.6	7.0	12.0	4	3	4	B1	1046	1106	1166	1226	2083	3083	4083
75	0.47	10	0.6	7.0	12.0	4	3	4	B1	0046	0106	0166	0226	2084	3084	4084
75	0.56	5	0.6	8.4	14.3	4	3	4	B1	1047	1107	1167	1227	2085	3085	4085
75	0.56	10	0.6	8.4	14.3	4	3	4	B1	0047	0107	0167	0227	2086	3086	4086
75	0.68	5	0.6	10.2	17.3	4	3	4	B1	1048	1108	1168	1228	2087	3087	4087
75	0.68	10	0.6	10.2	17.3	4	3	4	B1	0048	0108	0168	0228	2088	3088	4088
75	0.82	5	0.7	12.3	20.9	4	3	4	B1	1049	1109	1169	1229	2089	3089	4089
75	0.82	10	0.7	12.3	20.9	4	3	4	B1	0049	0109	0169	0229	2090	3090	4090
75	1.0	5	0.9	15.0	25.5	4	3	4	B1	1050	1110	1170	1230	2091	3091	4091
75	1.0	10	0.9	15.0	25.5	4	3	4	B1	0050	0110	0170	0230	2092	3092	4092
75	1.2	5	0.9	18.0	30.6	4	3	4	B1	1051	1111	1171	1231	2093	3093	4093
75	1.2	10	0.9	18.0	30.6	4	3	4	B1	0051	0111	0171	0231	2094	3094	4094

MILITARY CODING SYSTEM

PART NUMBER SYSTEM

EXAMPLE M39003 /02 −0042

- −0042: Dash # assigned for each specific value of capacitance voltage, capacitance tolerance, and failure rate level. See table for specific rating.
- /02: Detail sheet for specific style—CSR09
- M39003: MIL-C-39003 – Generic specification for established reliability solid tantalum capacitors.

NOTE: *Military number does not specify capacitance voltage, capacitance tolerance, failure rate, or case size. See table.*

MIL-C-39003/01
STYLE CSR13

MILITARY CODING SYSTEM

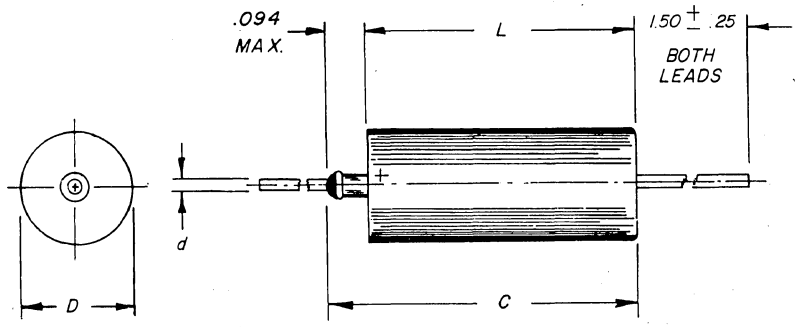
PART NUMBER SYSTEM

EXAMPLE **M39003** **/01** **–2242**

- **–2242** — Dash # assigned for each specific value of capacitance voltage, capacitance tolerance, and failure rate level. See table for specific rating.
- **/01** — Detail sheet for specific style–CSR13
- **M39003** — MIL-C-39003 – Generic specification for established reliability solid tantalum capacitors.

NOTE: *Military number does not specify capacitance voltage, capacitance tolerance, failure rate, or case size. See table.*

NOTE: *Military number does not designate case size. See Table for specific capacitance and voltage rating.*



CASE SIZE	Dimensions – Inches (mm)			
	L ±.031 (.79)	D +.016 (.41) −.015 (.38)	d ±.002 (.05)	C max.
A	0.286 (7.26)	0.135 (3.43)	0.020 (0.51)	0.422 (10.72)
B	0.474 (12.04)	0.185 (4.70)	0.020 (0.51)	0.610 (15.49)
C	0.686 (17.42)	0.289 (7.34)	0.025 (0.64)	0.822 (20.88)
D	0.786 (19.96)	0.351 (8.92)	0.025 (0.64)	0.922 (23.42)

MIL-C-39003

Military Style Tantalum Capacitors

MIL-C-39003/01
STYLE CSR13

DC rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage at			Dissipation factor at		Case size	Dash no. M39003/01- Failure rate level for (%1,000 hrs)						
			+25°C	+85°C	+125°C	−55°C +25°C	+85°C +125°C		M 1.0	P 0.1	R 0.01	S 0.001	B 0.1	C 0.01	D 0.001
Volts	µF	Percent	µA	µA	µA	Percent	Percent								
6	5.6	5	.3	6.0	7.5	4	4	A	5001	5201	5401	5601	6001	7001	8001
6	5.6	10	.3	6.0	7.5	4	4	A	2241	2481	2721	2961	6002	7002	8002
6	6.8	5	.3	6.0	7.5	6	6	A	5002	5202	5402	5602	6003	7003	8003
6	6.8	10	.3	6.0	7.5	6	6	A	2242	2482	2722	2962	6004	7004	8004
6	6.8	20	.3	6.0	7.5	6	6	A	2243	2483	2723	2963	6005	7005	8005
6	47.0	5	1.5	24.0	30.0	6	6	B	5003	5203	5403	5603	6006	7006	8006
6	47.0	10	1.5	24.0	30.0	6	6	B	2244	2484	2724	2964	6007	7007	8007
6	47.0	20	1.5	24.0	30.0	6	6	B	2245	2485	2725	2965	6008	7008	8008
6	56.0	5	1.5	24.0	30.0	6	6	B	5004	5204	5404	5604	6009	7009	8009
6	56.0	10	1.5	24.0	30.0	6	6	B	2246	2486	2726	2966	6010	7010	8010
6	150.0	5	4.5	90.0	113.0	8	8	C	5005	5205	5405	5605	6011	7011	8011
6	150.0	10	4.5	90.0	113.0	8	8	C	2247	2487	2727	2967	6012	7012	8012
6	150.0	20	4.5	90.0	113.0	8	8	C	2248	2488	2728	2968	6013	7013	8013
6	180.0	5	5.5	110.0	138.0	8	8	C	5006	5206	5406	5606	6014	7014	8014
6	180.0	10	5.5	110.0	138.0	8	8	C	2249	2489	2729	2969	6015	7015	8015
6	270.0	5	6.5	130.0	163.0	8	8	D	5007	5207	5407	5607	6016	7016	8016
6	270.0	10	6.5	130.0	163.0	8	8	D	2250	2490	2730	2970	6017	7017	8017
6	330.0	5	7.5	150.0	188.0	8	8	D	5088	5208	5408	5608	6018	7018	8018
6	330.0	10	7.5	150.0	188.0	8	8	D	2251	2491	2731	2971	6019	7019	8019
6	330.0	20	7.5	150.0	188.0	8	8	D	2252	2492	2732	2972	6020	7020	8020
10	3.9	5	.3	6.0	7.5	4	4	A	5009	5209	5409	5609	6021	7021	8021
10	3.9	10	.3	6.0	7.5	4	4	A	2253	2493	2733	2973	6022	7022	8022
10	4.7	5	.4	7.0	8.8	4	4	A	5010	5210	5410	5610	6023	7023	8023
10	4.7	10	.4	7.0	8.8	4	4	A	2254	2494	2734	2974	6024	7024	8024
10	4.7	20	.4	7.0	8.8	4	4	A	2255	2495	2735	2975	6025	7025	8025
10	27.0	5	2.0	40.0	50.0	6	6	B	5011	5211	5411	5611	6026	7026	8026
10	27.0	10	2.0	40.0	50.0	6	6	B	2256	2496	2736	2976	6027	7027	8027
10	33.0	5	2.5	50.0	63.0	6	6	B	5012	5212	5412	5612	6028	7028	8028
10	33.0	10	2.5	50.0	63.0	6	6	B	2257	2497	2737	2977	6029	7029	8029
10	33.0	20	2.5	50.0	63.0	6	6	B	2258	2498	2738	2978	6030	7030	8030
10	39.0	5	2.5	50.0	63.0	6	6	B	5013	5213	5413	5613	6031	7031	8031
10	39.0	10	2.5	50.0	63.0	6	6	B	2259	2499	2739	2979	6032	7032	8032
10	82.0	5	4.0	80.0	100.0	6	6	C	5014	5214	5414	5614	6033	7033	8033
10	82.0	10	4.0	80.0	100.0	6	6	C	2260	2500	2740	2980	6034	7034	8034
10	100.0	5	5.0	100.0	125.0	8	8	C	5015	5215	5415	5615	6035	7035	8035
10	100.0	10	5.0	100.0	125.0	8	8	C	2261	2501	2741	2981	6036	7036	8036
10	100.0	20	5.0	100.0	125.0	8	8	C	2262	2502	2742	2982	6037	7037	8037
10	120.0	5	6.0	120.0	150.0	8	8	C	5016	5216	5416	5616	6038	7038	8038
10	120.0	10	6.0	120.0	150.0	8	8	C	2263	2503	2743	2983	6039	7039	8039
10	180.0	5	9.0	180.0	226.0	8	8	D	5017	5217	5417	5617	6040	7040	8040
10	180.0	10	9.0	180.0	226.0	8	8	D	2264	2504	2744	2984	6041	7041	8041
10	220.0	5	10	200.0	250.0	8	8	D	5018	5218	5418	5618	6042	7042	8042
10	220.0	10	10	200.0	250.0	8	8	D	2265	2505	2745	2985	6043	7043	8043
10	220.0	20	10	200.0	250.0	8	8	D	2266	2506	2746	2986	6044	7044	8044
15	2.7	5	.3	6.0	7.5	4	4	A	5019	5219	5419	5619	6045	7045	8045
15	2.7	10	.3	6.0	7.5	4	4	A	2267	2507	2747	2987	6046	7046	8046
15	3.3	5	.4	8.0	10.0	4	4	A	5020	5220	5420	5620	6047	7047	8047
15	3.3	10	.4	8.0	10.0	4	4	A	2268	2508	2748	2988	6048	7048	8048
15	3.3	20	.4	8.0	10.0	4	4	A	2269	2509	2749	2989	6049	7049	8049
15	18.0	5	2.0	35.0	44.0	6	6	B	5021	5221	5421	5621	6050	7050	8050

MIL-C-39003/01
STYLE CSR13

DC rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage at			Dissipation factor at		Case size	Dash number M39003/01- Failure rate level for (%1,000 hrs)						
			+25°C	+85°C	+125°C	−55°C +25°C	+85°C +125°C		M 1.0	P 0.1	R 0.01	S 0.001	B 0.1	C 0.01	D 0.001
Volts	µF	Percent	µA	µA	µA	Percent	Percent								
15	18.0	10	2.0	35.0	44.0	6	6	B	2270	2510	2750	2990	6051	7051	8051
15	22.0	5	2.0	40.0	50.0	6	6	B	5022	5222	5422	5622	6052	7052	8052
15	22.0	10	2.0	40.0	50.0	6	6	B	2271	2511	2751	2991	6053	7053	8053
15	22.0	20	2.0	40.0	50.0	6	6	B	2272	2512	2752	2992	6054	7054	8054
15	56.0	5	4.0	80.0	100.0	6	6	C	5023	5223	5423	5623	6055	7055	8055
15	56.0	10	4.0	80.0	100.0	6	6	C	2273	2513	2753	2993	6056	7056	8056
15	68.0	5	5.0	100.0	125.0	6	6	C	5024	5224	5424	5624	6057	7057	8057
15	68.0	10	5.0	100.0	125.0	6	6	C	2274	2514	2754	2994	6058	7058	8058
15	68.0	20	5.0	100.0	125.0	6	6	C	2275	2515	2755	2995	6059	7059	8059
15	120.0	5	9.0	180.0	226.0	8	8	D	5025	5225	5425	5625	6060	7060	8060
15	120.0	10	9.0	180.0	226.0	8	8	D	2276	2516	2756	2996	6061	7061	8061
15	150.0	5	10.0	200.0	250.0	8	8	D	5026	5226	5426	5626	6062	7062	8062
15	150.0	10	10.0	200.0	250.0	8	8	D	2277	2517	2757	2997	6063	7063	8063
15	150.0	20	10.0	200.0	250.0	8	8	D	2278	2518	2758	2998	6064	7064	8064
20	1.2	5	.3	6.0	7.5	4	4	A	5027	5227	5427	5627	6065	7065	8065
20	1.2	10	.3	6.0	7.5	4	4	A	2279	2519	2759	2999	6066	7066	8066
20	1.5	5	.3	6.0	7.5	4	4	A	5028	5228	5428	5628	6067	7067	8067
20	1.5	10	.3	6.0	7.5	4	4	A	2280	2520	2760	3000	6068	7068	8068
20	1.5	20	.3	6.0	7.5	4	4	A	2281	2521	2761	3001	6069	7069	8069
20	1.8	5	.3	6.0	7.5	4	4	A	5029	5229	5429	5629	6070	7070	8070
20	1.8	10	.3	6.0	7.5	4	4	A	2282	2522	2762	3002	6071	7071	8071
20	2.2	5	.4	8.0	10.0	4	4	A	5030	5230	5430	5630	6072	7072	8072
20	2.2	10	.4	8.0	10.0	4	4	A	2283	2523	2763	3003	6073	7073	8073
20	2.2	20	.4	8.0	10.0	4	4	A	2284	2524	2764	3004	6074	7074	8074
20	8.2	5	1.0	20.0	25.0	6	6	B	5031	5231	5431	5631	6075	7075	8075
20	8.2	10	1.0	20.0	25.0	6	6	B	2285	2525	2765	3005	6076	7076	8076
20	10.0	5	1.5	30.0	38.0	6	6	B	5032	5232	5432	5632	6077	7077	8077
20	10.0	10	1.5	30.0	38.0	6	6	B	2286	2526	2766	3006	6078	7078	8078
20	10.0	20	1.5	30.0	38.0	6	6	B	2287	2527	2767	3007	6079	7079	8079
20	12.0	5	1.8	35.0	44.0	6	6	B	5033	5233	5433	5633	6080	7080	8080
20	12.0	10	1.8	35.0	44.0	6	6	B	2288	2528	2768	3008	6081	7081	8081
20	15.0	5	2.0	40.0	50.0	6	6	B	5034	5234	5434	5634	6082	7082	8082
20	15.0	10	2.0	40.0	50.0	6	6	B	2289	2529	2769	3009	6083	7083	8083
20	15.0	20	2.0	40.0	50.0	6	6	B	2290	2530	2770	3010	6084	7084	8084
20	27.0	5	2.5	50.0	63.0	6	6	C	5035	5235	5435	5635	6085	7085	8085
20	27.0	10	2.5	50.0	63.0	6	6	C	2291	2531	2771	3011	6086	7086	8086
20	33.0	5	3.5	70.0	88.0	6	6	C	5036	5236	5436	5636	6087	7087	8087
20	33.0	10	3.5	70.0	88.0	6	6	C	2292	2532	2772	3012	6088	7088	8088
20	33.0	20	3.5	70.0	88.0	6	6	C	2293	2533	2773	3013	6089	7089	8089
20	39.0	5	4.0	80.0	100.0	6	6	C	5037	5237	5437	5637	6090	7090	8090
20	39.0	10	4.0	80.0	100.0	6	6	C	2294	2534	2774	3014	6091	7091	8091
20	47.0	5	4.5	90.0	113.0	6	6	C	5038	5238	5438	5638	6092	7092	8092
20	47.0	10	4.5	90.0	113.0	6	6	C	2295	2535	2775	3015	6093	7093	8093
20	47.0	20	4.5	90.0	113.0	6	6	C	2296	2536	2776	3016	6094	7094	8094
20	56.0	5	5.5	110.0	138.0	6	6	D	5039	5239	5439	5639	6095	7095	8095
20	56.0	10	5.5	110.0	138.0	6	6	D	2297	2537	2777	3017	6096	7096	8096
20	68.0	5	7.0	140.0	175.0	6	6	D	5040	5240	5440	5640	6097	7097	8097
20	68.0	10	7.0	140.0	175.0	6	6	D	2298	2538	2778	3018	6098	7098	8098
20	68.0	20	7.0	140.0	175.0	6	6	D	2299	2539	2779	3019	6099	7099	8099
20	82.0	5	8.0	160.0	200.0	6	6	D	5041	5241	5441	5641	6100	7100	8100

MIL-C-39003

Military Style Tantalum Capacitors

MIL-C-39003/01
STYLE CSR13

DC rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage at			Dissipation factor at		Case size	Dash no. M39003/01- Failure rate level for (%1,000 hrs)						
			+25°C	+85°C	+125°C	−55°C +25°C	+85°C +125°C		M 1.0	P 0.1	R 0.01	S 0.001	B 0.1	C 0.01	D 0.001
Volts	µF	Percent	µA	µA	µA	Percent	Percent								
20	82.0	10	8.0	160.0	200.0	6	6	D	2300	2540	2780	3020	6101	7101	8101
20	100.0	5	10.0	200.0	250.0	8	8	D	5042	5242	5442	5642	6102	7102	8102
20	100.0	10	10.0	200.0	250.0	8	8	D	2301	2541	2781	3021	6103	7103	8103
20	100.0	20	10.0	200.0	250.0	8	8	D	2302	2542	2782	3022	6104	7104	8104
35	5.6	5	1.3	25.0	32.0	4	4	B	5043	5243	5443	5643	6105	7105	8105
35	5.6	10	1.3	25.0	32.0	4	4	B	2303	2543	2783	3023	6106	7106	8106
35	6.8	5	1.5	30.0	38.0	6	6	B	5044	5244	5444	5644	6107	7107	8107
35	6.8	10	1.5	30.0	38.0	6	6	B	2304	2544	2784	3024	6108	7108	8108
35	6.8	20	1.5	30.0	38.0	6	6	B	2305	2545	2785	3025	6109	7109	8109
35	22.0	5	4.0	80.0	100.0	6	6	C	5045	5245	5445	5645	6110	7110	8110
35	22.0	10	4.0	80.0	100.0	6	6	C	2306	2546	2786	3026	6111	7111	8111
35	22.0	20	4.0	80.0	100.0	6	6	C	2307	2547	2787	3027	6112	7112	8112
35	27.0	5	4.5	90.0	113.0	6	6	D	5046	5246	5446	5646	6113	7113	8113
35	27.0	10	4.5	90.0	113.0	6	6	D	2308	2548	2788	3028	6114	7114	8114
35	33.0	5	5.5	110.0	138.0	6	6	D	5047	5247	5447	5647	6115	7115	8115
35	33.0	10	5.5	110.0	138.0	6	6	D	2309	2549	2789	3029	6116	7116	8116
35	33.0	20	5.5	110.0	138.0	6	6	D	2310	2550	2790	3030	6117	7117	8117
35	39.0	5	7.0	140.0	175.0	6	6	D	5048	5248	5448	5648	6118	7118	8118
35	39.0	10	7.0	140.0	175.0	6	6	D	2311	2551	2791	3031	6119	7119	8119
35	47.0	5	8.0	160.0	200.0	6	6	D	5049	5249	5449	5649	6120	7120	8120
35	47.0	10	8.0	160.0	200.0	6	6	D	2312	2552	2792	3032	6121	7121	8121
35	47.0	20	8.0	160.0	200.0	6	6	D	2313	2553	2793	3033	6122	7122	8122
50	.0047	5	.3	5.0	6.3	2	4	A	5050	5250	5450	5650	6123	7123	8123
50	.0047	10	.3	5.0	6.3	2	4	A	2314	2554	2794	3034	6124	7124	8124
50	.0047	20	.3	5.0	6.3	2	4	A	2315	2555	2795	3035	6125	7125	8125
50	.0056	5	.3	5.0	6.3	2	4	A	5051	5251	5451	5651	6126	7126	8126
50	.0056	10	.3	5.0	6.3	2	4	A	2316	2556	2796	3036	6127	7127	8127
50	.0068	5	.3	5.0	6.3	2	4	A	5052	5252	5452	5652	6128	7128	8128
50	.0068	10	.3	5.0	6.3	2	4	A	2317	2557	2797	3037	6129	7129	8129
50	.0068	20	.3	5.0	6.3	2	4	A	2318	2558	2798	3038	6130	7130	8130
50	.0082	5	.3	5.0	6.3	2	4	A	5053	5253	5453	5653	6131	7131	8131
50	.0082	10	.3	5.0	6.3	2	4	A	2319	2559	2799	3039	6132	7132	8132
50	.01	5	.3	5.0	6.3	2	4	A	5054	5254	5454	5654	6133	7133	8133
50	.01	10	.3	5.0	6.3	2	4	A	2320	2560	2800	3040	6134	7134	8134
50	.01	20	.3	5.0	6.3	2	4	A	2321	2561	2801	3041	6135	7135	8135
50	.012	5	.3	5.0	6.3	2	4	A	5055	5255	5455	5655	6136	7136	8136
50	.012	10	.3	5.0	6.3	2	4	A	2322	2562	2802	3042	6137	7137	8137
50	.015	5	.3	5.0	6.3	2	4	A	5056	5256	5456	5656	6138	7138	8138
50	.015	10	.3	5.0	6.3	2	4	A	2323	2563	2803	3043	6139	7139	8139
50	.015	20	.3	5.0	6.3	2	4	A	2324	2564	2804	3044	6140	7140	8140
50	.018	5	.3	5.0	6.3	2	4	A	5057	5257	5457	5657	6141	7141	8141
50	.018	10	.3	5.0	6.3	2	4	A	2325	2565	2805	3045	6142	7142	8142
50	.022	5	.3	5.0	6.3	2	4	A	5058	5258	5458	5658	6143	7143	8143
50	.022	10	.3	5.0	6.3	2	4	A	2326	2566	2806	3046	6144	7144	8144
50	.022	20	.3	5.0	6.3	2	4	A	2327	2567	2807	3047	6145	7145	8145
50	.027	5	.3	5.0	6.3	2	4	A	5059	5259	5459	5659	6146	7146	8146
50	.027	10	.3	5.0	6.3	2	4	A	2328	2568	2808	3048	6147	7147	8147
50	.033	5	.3	5.0	6.3	2	4	A	5060	5260	5460	5660	6148	7148	8148
50	.033	10	.3	5.0	6.3	2	4	A	2329	2569	2809	3049	6149	7149	8149
50	.033	20	.3	5.0	6.3	2	4	A	2330	2570	2810	3050	6150	7150	8150

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DC rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage at			Dissipation factor at		Case size	Dash no. M39003/01- Failure rate level for (%1,000 hrs)						
			+25°C	+85°C	+125°C	−55°C +25°C	+85°C +125°C		M 1.0	P 0.1	R 0.01	S 0.001	B 0.1	C 0.01	D 0.001
Volts	µF	Percent	µA	µA	µA	Percent	Percent								
50	.039	5	.3	5.0	6.3	2	4	A	5061	5261	5461	5661	6151	7151	8151
50	.039	10	.3	5.0	6.3	2	4	A	2331	2571	2811	3051	6152	7152	8152
50	.047	5	.3	5.0	6.3	2	4	A	5062	5262	5462	5662	6153	7153	8153
50	.047	10	.3	5.0	6.3	2	4	A	2332	2572	2812	3052	6154	7154	8154
50	.047	20	.3	5.0	6.3	2	4	A	2333	2573	2813	3053	6155	7155	8155
50	.056	5	.3	5.0	6.3	2	4	A	5063	5263	5463	5663	6156	7156	8156
50	.056	10	.3	5.0	6.3	2	4	A	2334	2574	2814	3054	6157	7157	8157
50	.068	5	.3	5.0	6.3	2	4	A	5064	5264	5464	5664	6158	7158	8158
50	.068	10	.3	5.0	6.3	2	4	A	2335	2575	2815	3055	6159	7159	8159
50	.068	20	.3	5.0	6.3	2	4	A	2336	2576	2816	3056	6160	7160	8160
50	.082	5	.3	5.0	6.3	2	4	A	5065	5265	5465	5665	6161	7161	8161
50	.082	10	.3	5.0	6.3	2	4	A	2337	2577	2817	3057	6162	7162	8162
50	.1	5	.3	5.0	6.3	2	4	A	5066	5266	5466	5666	6163	7163	8163
50	.1	10	.3	5.0	6.3	2	4	A	2338	2578	2818	3058	6164	7164	8164
50	.1	20	.3	5.0	6.3	2	4	A	2339	2579	2819	3059	6165	7165	8165
50	.12	5	.3	5.0	6.3	2	4	A	5067	5267	5467	5667	6166	7166	8166
50	.12	10	.3	5.0	6.3	2	4	A	2340	2580	2820	3060	6167	7167	8167
50	.15	5	.3	5.0	6.3	2	4	A	5068	5268	5468	5668	6168	7168	8168
50	.15	10	.3	5.0	6.3	2	4	A	2341	2581	2821	3061	6169	7169	8169
50	.15	20	.3	5.0	6.3	2	4	A	2342	2582	2822	3062	6170	7170	8170
50	.18	5	.3	5.0	6.3	2	4	A	5069	5269	5469	5669	6171	7171	8171
50	.18	10	.3	5.0	6.3	2	4	A	2343	2583	2823	3063	6172	7172	8172
50	.22	5	.3	5.0	6.3	2	4	A	5070	5270	5470	5670	6173	7173	8173
50	.22	10	.3	5.0	6.3	2	4	A	2344	2584	2824	3064	6174	7174	8174
50	.22	20	.3	5.0	6.3	2	4	A	2345	2585	2825	3065	6175	7175	8175
50	.27	5	.3	5.0	6.3	2	4	A	5071	5271	5471	5671	6176	7176	8176
50	.27	10	.3	5.0	6.3	2	4	A	2346	2586	2826	3066	6177	7177	8177
50	.33	5	.3	5.0	6.3	2	4	A	5072	5272	5472	5672	6178	7178	8178
50	.33	10	.3	5.0	6.3	2	4	A	2347	2587	2827	3067	6179	7179	8179
50	.33	20	.3	5.0	6.3	2	4	A	2348	2588	2828	3068	6180	7180	8180
50	.39	5	.3	5.0	6.3	2	4	A	5073	5273	5473	5673	6181	7181	8181
50	.39	10	.3	5.0	6.3	2	4	A	2349	2589	2829	3069	6182	7182	8182
50	.47	5	.3	5.0	6.3	2	4	A	5074	5274	5474	5674	6183	7183	8183
50	.47	10	.3	5.0	6.3	2	4	A	2350	2590	2830	3070	6184	7184	8184
50	.47	20	.3	5.0	6.3	2	4	A	2351	2591	2831	3071	6185	7185	8185
50	.56	5	.3	5.0	6.3	2	4	A	5075	5275	5475	5675	6186	7186	8186
50	.56	10	.3	5.0	6.3	2	4	A	2352	2592	2832	3072	6187	7187	8187
50	.68	5	.3	5.0	6.3	2	4	A	5076	5276	5476	5676	6188	7188	8188
50	.68	10	.3	5.0	6.3	2	4	A	2353	2593	2833	3073	6189	7189	8189
50	.68	20	.3	5.0	6.3	2	4	A	2354	2594	2834	3074	6190	7190	8190
50	.82	5	.3	5.0	6.3	2	4	A	5077	5277	5477	5677	6191	7191	8191
50	.82	10	.3	5.0	6.3	2	4	A	2355	2595	2835	3075	6192	7192	8192
50	1.0	5	.4	8.0	10.0	2	4	A	5078	5278	5478	5678	6193	7193	8193
50	1.0	10	.4	8.0	10.0	2	4	A	2356	2596	2836	3076	6194	7194	8194
50	1.0	20	.4	8.0	10.0	2	4	A	2357	2597	2837	3077	6195	7195	8195
50	1.2	5	.4	9.0	11.0	4	4	B	5079	5279	5479	5679	6196	7196	8196
50	1.2	10	.4	9.0	11.0	4	4	B	2358	2598	2838	3078	6197	7197	8197
50	1.5	5	.6	12.0	15.0	4	4	B	5080	5280	5480	5680	6198	7198	8198
50	1.5	10	.6	12.0	15.0	4	4	B	2359	2599	2839	3079	6199	7199	8199
50	1.5	20	.6	12.0	15.0	4	4	B	2360	2600	2840	3080	6200	7200	8200

MIL-C-39003

Military Style Tantalum Capacitors

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STYLE CSR13

DC rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage at			Dissipation factor at		Case size	Dash number M39003/01- Failure rate level for (%1,000 hrs)						
			+25°C	+85°C	+125°C	−55°C +25°C	+85°C +125°C		M 1.0	P 0.1	R 0.01	S 0.001	B 0.1	C 0.01	D 0.001
Volts	µF	Percent	µA	µA	µA	Percent	Percent								
50	1.8	5	.7	14.0	18.0	4	4	B	5081	5281	5481	5681	6201	7201	8201
50	1.8	10	.7	14.0	18.0	4	4	B	2361	2601	2841	3081	6202	7202	8202
50	2.2	5	.8	17.0	22.0	4	4	B	5082	5282	5482	5682	6203	7203	8203
50	2.2	10	.8	17.0	22.0	4	4	B	2362	2602	2842	3082	6204	7204	8204
50	2.2	20	.8	17.0	22.0	4	4	B	2363	2603	2843	3083	6205	7205	8205
50	2.7	5	1.0	20.0	25.0	4	4	B	5083	5283	5483	5683	6206	7206	8206
50	2.7	10	1.0	20.0	25.0	4	4	B	2364	2604	2844	3084	6207	7207	8207
50	3.3	5	1.2	25.0	32.0	4	4	B	5084	5284	5484	5684	6208	7208	8208
50	3.3	10	1.2	25.0	32.0	4	4	B	2365	2605	2845	3085	6209	7209	8209
50	3.3	20	1.2	25.0	32.0	4	4	B	2366	2606	2846	3086	6210	7210	8210
50	3.9	5	1.5	30.0	38.0	4	4	B	5085	5285	5485	5685	6211	7211	8211
50	3.9	10	1.5	30.0	38.0	4	4	B	2367	2607	2847	3087	6212	7212	8212
50	4.7	5	1.7	35.0	44.0	4	4	B	5086	5286	5486	5686	6213	7213	8213
50	4.7	10	1.7	35.0	44.0	4	4	B	2368	2608	2848	3088	6214	7214	8214
50	4.7	20	1.7	35.0	44.0	4	4	B	2369	2609	2849	3089	6215	7215	8215
50	5.6	5	2.2	45.0	56.0	4	4	C	5087	5287	5487	5687	6216	7216	8216
50	5.6	10	2.2	45.0	56.0	4	4	C	2370	2610	2850	3090	6217	7217	8217
50	6.8	5	2.2	45.0	56.0	6	6	C	5088	5288	5488	5688	6218	7218	8218
50	6.8	10	2.2	45.0	56.0	6	6	C	2371	2611	2851	3091	6219	7219	8219
50	6.8	20	2.2	45.0	56.0	6	6	C	2372	2612	2852	3092	6220	7220	8220
50	8.2	5	2.5	50.0	63.0	6	6	C	5089	5289	5489	5689	6221	7221	8221
50	8.2	10	2.5	50.0	63.0	6	6	C	2373	2613	2853	3093	6222	7222	8222
50	10.0	5	2.5	50.0	63.0	6	6	C	5090	5290	5490	5690	6223	7223	8223
50	10.0	10	2.5	50.0	63.0	6	6	C	2374	2614	2854	3094	6224	7224	8224
50	10.0	20	2.5	50.0	63.0	6	6	C	2375	2615	2855	3095	6225	7225	8225
50	12.0	5	3.0	60.0	75.0	6	6	C	5091	5291	5491	5691	6226	7226	8226
50	12.0	10	3.0	60.0	75.0	6	6	C	2376	2616	2856	3096	6227	7227	8227
50	15.0	5	4.0	80.0	100.0	6	6	C	5092	5292	5492	5692	6228	7228	8228
50	15.0	10	4.0	80.0	100.0	6	6	C	2377	2617	2857	3097	6229	7229	8229
50	15.0	20	4.0	80.0	100.0	6	6	C	2378	2618	2858	3098	6230	7230	8230
50	18.0	5	4.5	90.0	113.0	6	6	C	5093	5293	5493	5693	6231	7231	8231
50	18.0	10	4.5	90.0	113.0	6	6	C	2379	2619	2859	3099	6232	7232	8232
50	22.0	5	5.5	110.0	138.0	6	6	D	5094	5294	5494	5694	6233	7233	8233
50	22.0	10	5.5	110.0	138.0	6	6	D	2380	2620	2860	3100	6234	7234	8234
50	22.0	20	5.5	110.0	138.0	6	6	D	2381	2621	2861	3101	6235	7235	8235
75	.1	5	.3	5.0	6.3	2	4	A	5095	5295	5495	5695	6236	7236	8236
75	.1	10	.3	5.0	6.3	2	4	A	2382	2622	2862	3102	6237	7237	8237
75	.1	20	.3	5.0	6.3	2	4	A	2383	2623	2863	3103	6238	7238	8238
75	.12	5	.3	5.0	6.3	2	4	A	5096	5296	5496	5696	6239	7239	8239
75	.12	10	.3	5.0	6.3	2	4	A	2384	2624	2864	3104	6240	7240	8240
75	.15	5	.3	5.0	6.3	2	4	A	5097	5297	5497	5697	6241	7241	8241
75	.15	10	.3	5.0	6.3	2	4	A	2385	2625	2865	3105	6242	7242	8242
75	.15	20	.3	5.0	6.3	2	4	A	2386	2626	2866	3106	6243	7243	8243
75	.18	5	.3	5.0	6.3	2	4	A	5098	5298	5498	5698	6244	7244	8244
75	.18	10	.3	5.0	6.3	2	4	A	2387	2627	2867	3107	6245	7245	8245
75	.22	5	.3	5.0	6.3	2	4	A	5099	5299	5499	5699	6246	7246	8246
75	.22	10	.3	5.0	6.3	2	4	A	2388	2628	2868	3108	6247	7247	8247
75	.22	20	.3	5.0	6.3	2	4	A	2389	2629	2869	3109	6248	7248	8248
75	.27	5	.3	5.0	6.3	2	4	A	5100	5300	5500	5700	6249	7249	8249
75	.27	10	.3	5.0	6.3	2	4	A	2390	2630	2870	3110	6250	7250	8250

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DC rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage at			Dissipation factor at		Case size	Dash no. M39003/01- Failure rate level for (%1,000 hrs)						
			+25°C	+85°C	+125°C	−55°C +25°C	+85°C +125°C		M 1.0	P 0.1	R 0.01	S 0.001	B 0.1	C 0.01	D 0.001
Volts	µF	Percent	µA	µA	µA	Percent	Percent								
75	.33	5	.3	5.0	6.3	2	4	A	5101	5301	5501	5701	6251	7251	8251
75	.33	10	.3	5.0	6.3	2	4	A	2391	2631	2871	3111	6252	7252	8252
75	.33	20	.3	5.0	6.3	2	4	A	2392	2632	2872	3112	6253	7253	8253
75	.39	5	.3	5.0	6.3	2	4	A	5102	5302	5502	5702	6254	7254	8254
75	.39	10	.3	5.0	6.3	2	4	A	2393	2633	2873	3113	6255	7255	8255
75	.47	5	.3	5.0	6.3	2	4	A	5103	5303	5503	5703	6256	7256	8256
75	.47	10	.3	5.0	6.3	2	4	A	2394	2634	2874	3114	6257	7257	8257
75	.47	20	.3	5.0	6.3	2	4	A	2395	2635	2875	3115	6258	7258	8258
75	.56	5	.3	5.0	6.3	2	4	A	5104	5304	5504	5704	6259	7259	8259
75	.56	10	.3	5.0	6.3	2	4	A	2396	2636	2876	3116	6260	7260	8260
75	.68	5	.3	5.0	6.3	2	4	A	5105	5305	5505	5705	6261	7261	8261
75	.68	10	.3	5.0	6.3	2	4	A	2397	2637	2877	3117	6262	7262	8262
75	.68	20	.3	5.0	6.3	2	4	A	2398	2638	2878	3118	6263	7263	8263
75	.82	5	.3	5.0	6.3	2	4	B	5106	5306	5506	5706	6264	7264	8264
75	.82	10	.3	5.0	6.3	2	4	B	2399	2639	2879	3119	6265	7265	8265
75	1.0	5	.3	5.0	6.3	2	4	B	5107	5307	5507	5707	6266	7266	8266
75	1.0	10	.3	5.0	6.3	2	4	B	2400	2640	2880	3120	6267	7267	8267
75	1.0	20	.3	5.0	6.3	2	4	B	2401	2641	2881	3121	6268	7268	8268
75	1.2	5	.3	5.0	6.3	4	4	B	5108	5308	5508	5708	6269	7269	8269
75	1.2	10	.3	5.0	6.3	4	4	B	2402	2642	2882	3122	6270	7270	8270
75	1.5	5	.6	10.0	13.0	4	4	B	5109	5309	5509	5709	6271	7271	8271
75	1.5	10	.6	10.0	13.0	4	4	B	2403	2643	2883	3123	6272	7272	8272
75	1.5	20	.6	10.0	13.0	4	4	B	2404	2644	2884	3124	6273	7273	8273
75	1.8	5	.7	10.0	13.0	4	4	B	5110	5310	5510	5710	6274	7274	8274
75	1.8	10	.7	10.0	13.0	4	4	B	2405	2645	2885	3125	6275	7275	8275
75	2.2	5	.8	15.0	19.0	4	4	B	5111	5311	5511	5711	6276	7276	8276
75	2.2	10	.8	15.0	19.0	4	4	B	2406	2646	2886	3126	6277	7277	8277
75	2.2	20	.8	15.0	19.0	4	4	B	2407	2647	2887	3127	6278	7278	8278
75	2.7	5	1.0	15.0	19.0	4	4	B	5112	5312	5512	5712	6279	7279	8279
75	2.7	10	1.0	15.0	19.0	4	4	B	2408	2648	2888	3128	6280	7280	8280
75	3.3	5	1.2	20.0	25.0	4	4	B	5113	5313	5513	5713	6281	7281	8281
75	3.3	10	1.2	20.0	25.0	4	4	B	2409	2649	2889	3129	6282	7282	8282
75	3.3	20	1.2	20.0	25.0	4	4	B	2410	2650	2890	3130	6283	7283	8283
75	3.9	5	1.5	20.0	25.0	4	4	B	5114	5314	5514	5714	6284	7284	8284
75	3.9	10	1.5	20.0	25.0	4	4	B	2411	2651	2891	3131	6285	7285	8285
75	4.7	5	3.0	60.0	75.0	4	4	C	5115	5315	5515	5715	6286	7286	8286
75	4.7	10	3.0	60.0	75.0	4	4	C	2412	2652	2892	3132	6287	7287	8287
75	4.7	20	3.0	60.0	75.0	4	4	C	2413	2653	2893	3133	6288	7288	8288
75	5.6	5	3.0	60.0	75.0	4	4	C	5116	5316	5516	5716	6289	7289	8289
75	5.6	10	3.0	60.0	75.0	4	4	C	2414	2654	2894	3134	6290	7290	8290
75	6.8	5	5.0	100.0	125.0	6	6	C	5117	5317	5517	5717	6291	7291	8291
75	6.8	10	5.0	100.0	125.0	6	6	C	2415	2655	2895	3135	6292	7292	8292
75	6.8	20	5.0	100.0	125.0	6	6	C	2416	2656	2896	3136	6293	7293	8293
75	8.2	5	5.0	100.0	125.0	6	6	C	5118	5318	5518	5718	6294	7294	8294
75	8.2	10	5.0	100.0	125.0	6	6	C	2417	2657	2897	3137	6295	7295	8295
75	10.0	5	5.0	100.0	125.0	6	6	C	5119	5319	5519	5719	6296	7296	8296
75	10.0	10	5.0	100.0	125.0	6	6	C	2418	2658	2898	3138	6297	7297	8297
75	10.0	20	5.0	100.0	125.0	6	6	C	2419	2659	2899	3139	6298	7298	8298
75	12.0	5	5.0	100.0	125.0	6	6	D	5120	5320	5520	5720	6299	7299	8299
75	12.0	10	5.0	100.0	125.0	6	6	D	2420	2660	2900	3140	6300	7300	8300

MIL-C-39003

Military Style Tantalum Capacitors

MIL-C-39003/01
STYLE CSR13

DC rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage at			Dissipation factor at		Case size	Dash no. M39003/01- Failure rate level for (%1,000 hrs)						
			+25°C	+85°C	+125°C	−55°C +25°C	+85°C +125°C		M 1.0	P 0.1	R 0.01	S 0.001	B 0.1	C 0.01	D 0.001
Volts	µF	Percent	µA	µA	µA	Percent	Percent								
75	15.0	5	7.0	140.0	175.0	6	6	D	5121	5321	5521	5721	6301	7301	8301
75	15.0	10	7.0	140.0	175.0	6	6	D	2421	2661	2901	3141	6302	7302	8302
75	15.0	20	7.0	140.0	175.0	6	6	D	2422	2662	2902	3142	6303	7303	8303
100	.0047	5	.3	5.0	6.3	2	4	A	5122	5322	5522	5722	6304	7304	8304
100	.0047	10	.3	5.0	6.3	2	4	A	2423	2663	2903	3143	6305	7305	8305
100	.0047	20	.3	5.0	6.3	2	4	A	2424	2664	2904	3144	6306	7306	8306
100	.0056	5	.3	5.0	6.3	2	4	A	5123	5323	5523	5723	6307	7307	8307
100	.0056	10	.3	5.0	6.3	2	4	A	2425	2665	2905	3145	6308	7308	8308
100	.0068	5	.3	5.0	6.3	2	4	A	5124	5324	5524	5724	6309	7309	8309
100	.0068	10	.3	5.0	6.3	2	4	A	2426	2666	2906	3146	6310	7310	8310
100	.0068	20	.3	5.0	6.3	2	4	A	2427	2667	2907	3147	6311	7311	8311
100	.0082	5	.3	5.0	6.3	2	4	A	5125	5325	5525	5725	6312	7312	8312
100	.0082	10	.3	5.0	6.3	2	4	A	2428	2668	2908	3148	6313	7313	8313
100	.01	5	.3	5.0	6.3	2	4	A	5126	5326	5526	5726	6314	7314	8314
100	.01	10	.3	5.0	6.3	2	4	A	2429	2669	2909	3149	6315	7315	8315
100	.01	20	.3	5.0	6.3	2	4	A	2430	2670	2910	3150	6316	7316	8316
100	.012	5	.3	5.0	6.3	2	4	A	5127	5327	5527	5727	6317	7317	8317
100	.012	10	.3	5.0	6.3	2	4	A	2431	2671	2911	3151	6318	7318	8318
100	.015	5	.3	5.0	6.3	2	4	A	5128	5328	5528	5728	6319	7319	8319
100	.015	10	.3	5.0	6.3	2	4	A	2432	2672	2912	3152	6320	7320	8320
100	.015	20	.3	5.0	6.3	2	4	A	2433	2673	2913	3153	6321	7321	8321
100	.018	5	.3	5.0	6.3	2	4	A	5129	5329	5529	5729	6322	7322	8322
100	.018	10	.3	5.0	6.3	2	4	A	2434	2674	2914	3154	6323	7323	8323
100	.022	5	.3	5.0	6.3	2	4	A	5130	5330	5530	5730	6324	7324	8324
100	.022	10	.3	5.0	6.3	2	4	A	2435	2675	2915	3155	6325	7325	8325
100	.022	20	.3	5.0	6.3	2	4	A	2436	2676	2916	3156	6326	7326	8326
100	.027	5	.3	5.0	6.3	2	4	A	5131	5331	5531	5731	6327	7327	8327
100	.027	10	.3	5.0	6.3	2	4	A	2437	2677	2917	3157	6328	7328	8328
100	.033	5	.3	5.0	6.3	2	4	A	5132	5332	5532	5732	6329	7329	8329
100	.033	10	.3	5.0	6.3	2	4	A	2438	2678	2918	3158	6330	7330	8330
100	.033	20	.3	5.0	6.3	2	4	A	2439	2679	2919	3159	6331	7331	8331
100	.039	5	.3	5.0	6.3	2	4	A	5133	5333	5533	5733	6332	7332	8332
100	.039	10	.3	5.0	6.3	2	4	A	2440	2680	2920	3160	6333	7333	8333
100	.047	5	.3	5.0	6.3	2	4	A	5134	5334	5534	5734	6334	7334	8334
100	.047	10	.3	5.0	6.3	2	4	A	2441	2681	2921	3161	6335	7335	8335
100	.047	20	.3	5.0	6.3	2	4	A	2442	2682	2922	3162	6336	7336	8336
100	.056	5	.3	5.0	6.3	2	4	A	5135	5335	5535	5735	6337	7337	8337
100	.056	10	.3	5.0	6.3	2	4	A	2443	2683	2923	3163	6338	7338	8338
100	.068	5	.3	5.0	6.3	2	4	A	5136	5336	5536	5736	6339	7339	8339
100	.068	10	.3	5.0	6.3	2	4	A	2444	2684	2924	3164	6340	7340	8340
100	.068	20	.3	5.0	6.3	2	4	A	2445	2685	2925	3165	6341	7341	8341
100	.082	5	.3	5.0	6.3	2	4	A	5137	5337	5537	5737	6342	7342	8342
100	.082	10	.3	5.0	6.3	2	4	A	2446	2686	2926	3166	6343	7343	8343
100	.1	5	.3	5.0	6.3	2	4	A	5138	5338	5538	5738	6344	7344	8344
100	.1	10	.3	5.0	6.3	2	4	A	2447	2687	2927	3167	6345	7345	8345
100	.1	20	.3	5.0	6.3	2	4	A	2448	2688	2928	3168	6346	7346	8346
100	.12	5	.3	5.0	6.3	2	4	A	5139	5339	5539	5739	6347	7347	8347
100	.12	10	.3	5.0	6.3	2	4	A	2449	2689	2929	3169	6348	7348	8348
100	.15	5	.3	5.0	6.3	2	4	A	5140	5340	5540	5740	6349	7349	8349
100	.15	10	.3	5.0	6.3	2	4	A	2450	2690	2930	3170	6350	7350	8350

MIL-C-39003/01
STYLE CSR13

DC rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage at			Dissipation factor at		Case size	Dash number M39003/01- Failure rate level for (%1,000 hrs)						
			+25°C	+85°C	+125°C	−55°C +25°C	+85°C +125°C		M 1.0	P 0.1	R 0.01	S 0.001	B 0.1	C 0.01	D 0.001
Volts	µF	Percent	µA	µA	µA	Percent	Percent								
100	.15	20	.3	5.0	6.3	2	4	A	2451	2691	2931	3171	6351	7351	8351
100	.18	5	.3	5.0	6.3	2	4	A	5141	5341	5541	5741	6352	7352	8352
100	.18	10	.3	5.0	6.3	2	4	A	2452	2692	2932	3172	6353	7353	8353
100	.22	5	.3	5.0	6.3	2	4	A	5142	5342	5542	5742	6354	7354	8354
100	.22	10	.3	5.0	6.3	2	4	A	2453	2693	2933	3173	6355	7355	8355
100	.22	20	.3	5.0	6.3	2	4	A	2454	2694	2934	3174	6356	7356	8356
100	.27	5	.3	5.0	6.3	2	4	A	5143	5343	5543	5743	6357	7357	8357
100	.27	10	.3	5.0	6.3	2	4	A	2455	2695	2935	3175	6358	7358	8358
100	.33	5	.3	5.0	6.3	2	4	A	5144	5344	5544	5744	6359	7359	8359
100	.33	10	.3	5.0	6.3	2	4	A	2456	2696	2936	3176	6360	7360	8360
100	.33	20	.3	5.0	6.3	2	4	A	2457	2697	2937	3177	6361	7361	8361
100	.39	5	.3	5.0	6.3	2	4	A	5145	5345	5545	5745	6362	7362	8362
100	.39	10	.3	5.0	6.3	2	4	A	2458	2698	2938	3178	6363	7363	8363
100	.47	5	.3	5.0	6.3	2	4	A	5146	5346	5546	5746	6364	7364	8364
100	.47	10	.3	5.0	6.3	2	4	A	2459	2699	2939	3179	6365	7365	8365
100	.47	20	.3	5.0	6.3	2	4	A	2460	2700	2940	3180	6366	7366	8366
100	.56	5	.3	5.0	6.3	2	4	A	5147	5347	5547	5747	6367	7367	8367
100	.56	10	.3	5.0	6.3	2	4	A	2461	2701	2941	3181	6368	7368	8368
100	.68	5	.3	5.0	6.3	2	4	B	5148	5348	5548	5748	6369	7369	8369
100	.68	10	.3	5.0	6.3	2	4	B	2462	2702	2942	3182	6370	7370	8370
100	.68	20	.3	5.0	6.3	2	4	B	2463	2703	2943	3183	6371	7371	8371
100	.82	5	.4	5.0	6.3	2	4	B	5149	5349	5549	5749	6372	7372	8372
100	.82	10	.4	5.0	6.3	2	4	B	2464	2704	2944	3184	6373	7373	8373
100	1.0	5	.5	5.0	6.3	2	4	B	5150	5350	5550	5750	6374	7374	8374
100	1.0	10	.5	5.0	6.3	2	4	B	2465	2705	2945	3185	6375	7375	8375
100	1.0	20	.5	5.0	6.3	2	4	B	2466	2706	2946	3186	6376	7376	8376
100	1.2	5	.5	5.0	6.3	4	4	B	5151	5351	5551	5751	6377	7377	8377
100	1.2	10	.5	5.0	6.3	4	4	B	2467	2707	2947	3187	6378	7378	8378
100	1.5	5	.7	10.0	13.0	4	4	B	5152	5352	5552	5752	6379	7379	8379
100	1.5	10	.7	10.0	13.0	4	4	B	2468	2708	2948	3188	6380	7380	8380
100	1.5	20	.7	10.0	13.0	4	4	B	2469	2709	2949	3189	6381	7381	8381
100	1.8	5	.7	10.0	13.0	4	4	B	5153	5353	5553	5753	6382	7382	8382
100	1.8	10	.7	10.0	13.0	4	4	B	2470	2710	2950	3190	6383	7383	8383
100	2.2	5	.9	15.0	19.0	4	4	B	5154	5354	5554	5754	6384	7384	8384
100	2.2	10	.9	15.0	19.0	4	4	B	2471	2711	2951	3191	6385	7385	8385
100	2.2	20	.9	15.0	19.0	4	4	B	2472	2712	2952	3192	6386	7386	8386
100	2.7	5	1.1	15.0	19.0	4	4	B	5155	5355	5555	5755	6387	7387	8387
100	2.7	10	1.1	15.0	19.0	4	4	B	2473	2713	2953	3193	6388	7388	8388
100	3.3	5	1.5	30.0	38.0	6	6	C	5156	5356	5556	5756	6389	7389	8389
100	3.3	10	1.5	30.0	38.0	6	6	C	5157	5357	5557	5757	6390	7390	8390
100	3.3	20	1.5	30.0	38.0	6	6	C	5158	5358	5558	5758	6391	7391	8391
100	3.9	5	1.5	30.0	38.0	6	6	C	5159	5359	5559	5759	6392	7392	8392
100	3.9	10	1.5	30.0	38.0	6	6	C	5160	5360	5560	5760	6393	7393	8393
100	4.7	5	2.5	50.0	63.0	6	6	C	5161	5361	5561	5761	6394	7394	8394
100	4.7	10	2.5	50.0	63.0	6	6	C	5162	5362	5562	5762	6395	7395	8395
100	4.7	20	2.5	50.0	63.0	6	6	C	5163	5363	5563	5763	6396	7396	8396
100	5.6	5	2.5	50.0	63.0	6	6	C	5164	5364	5564	5764	6397	7397	8397
100	5.6	10	2.5	50.0	63.0	6	6	C	5165	5365	5565	5765	6398	7398	8398
100	6.8	5	2.5	50.0	63.0	6	6	C	5166	5366	5566	5766	6399	7399	8399
100	6.8	10	2.5	50.0	63.0	6	6	C	5167	5367	5567	5767	6400	7400	8400
100	6.8	20	2.5	50.0	63.0	6	6	C	5168	5368	5568	5768	6401	7401	8401

MIL-C-39003
Military Style Tantalum Capacitors

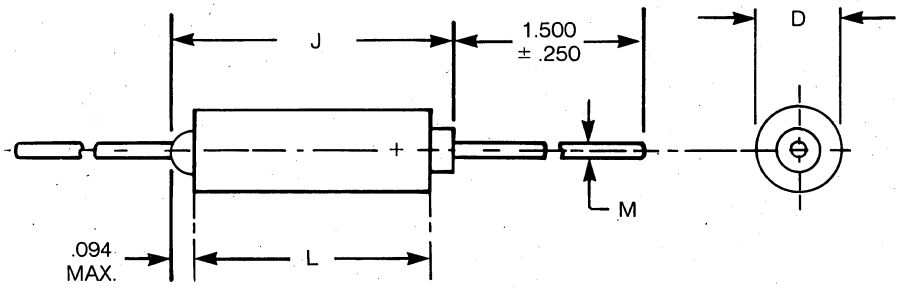
MIL-C-39003/09
STYLE CSR21
PART NUMBER SYSTEM

EXAMPLE M39003 /09 −0042

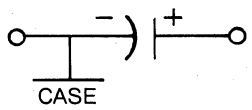
- −0042 — Dash # assigned for each specific value of capacitance voltage, capacitance tolerance, and failure rate level. See table for specific rating.
- /09 — Detail sheet for specific style — CSR 21
- M39003 — MIL-C-39003 — Generic specification for established reliability solid tantalum capacitors.

NOTE: *Military number does not specify capacitance voltage, capacitance tolerance, failure rate, or case size. See table.*

OUTLINE DRAWING AND DIMENSIONS



CIRCUIT DIAGRAM



CASE SIZE	Dimensions — Inches (mm) L ±.031 (.79)	D +.016 (.41) −.015 (.38)	M ±.002 (.05)	J max.
C	0.686 (17.42)	0.289 (7.34)	0.025 (0.64)	0.822 (20.88)
D	0.786 (19.96)	0.351 (8.92)	0.025 (0.64)	0.922 (23.42)

NOTES:

1. The case insulation shall extend .015" (0.38mm) minimum beyond each end. However, when a shrink-fitted insulation is used, it shall lap over the ends of the capacitor body.
2. Lead length may be a minimum of 1-inch long for use in tape and reel automatic insertion equipment, when specified.
3. Insulation thickness is included in dimension D.

MIL-C-39003/09
STYLE CSR21

DC rated voltage	Capacitance	Capacitance tolerance	DC leakage at			Dissipation factor 1 kHz +25°C	ESR 100 kHz +25°C (max)	Ripple current 40 kHz 25°C (max)	Derated ripple current 1 KHz 25°C (max)	Case size	Part no. M39003/09- Failure rate level for (%1,000 hrs)						
			+25°C	+85°C	+125°C						M 1.0	P 0.1	R 0.01	S 0.001	B 0.1	C 0.01	D 0.001
Volts	µF	Percent	µA	µA	µA	Percent	Ohms	A									
6	150	5	4.5	90	113	10	.065	3.3	2.0	C	0001	0101	0201	0301	2001	3001	4001
6	150	10	4.5	90	113	10	.065	3.3	2.0	C	0002	0102	0202	0302	2002	3002	4002
6	150	20	4.5	90	113	10	.065	3.3	2.0	C	0003	0103	0203	0303	2003	3003	4003
6	180	5	5.5	110	138	10	.060	3.4	2.4	C	0004	0104	0204	0304	2004	3004	4004
6	180	10	5.5	110	138	10	.060	3.4	2.4	C	0005	0105	0205	0305	2005	3005	4005
6	270	5	6.5	130	163	10	.050	4.1	3.4	D	0006	0106	0206	0306	2006	3006	4006
6	270	10	6.5	130	163	10	.050	4.1	3.4	D	0007	0107	0207	0307	2007	3007	4007
6	330	5	7.5	150	188	12	.045	4.3	3.8	D	0008	0108	0208	0308	2008	3008	4008
6	330	10	7.5	150	188	12	.045	4.3	3.8	D	0009	0109	0209	0309	2009	3009	4009
6	330	20	7.5	150	188	12	.045	4.3	3.8	D	0010	0110	0210	0310	2010	3010	4010
10	82	5	4	80	100	8	.085	2.9	1.8	C	0011	0111	0211	0311	2011	3011	4011
10	82	10	4	80	100	8	.085	2.9	1.8	C	0012	0112	0212	0312	2012	3012	4012
10	100	5	5	100	125	8	.075	3.0	2.2	C	0013	0113	0213	0313	2013	3013	4013
10	100	10	5	100	125	8	.075	3.0	2.2	C	0014	0114	0214	0314	2014	3014	4014
10	100	20	5	100	125	8	.075	3.0	2.2	C	0015	0115	0215	0315	2015	3015	4015
10	120	5	6	120	150	8	.070	3.2	2.5	C	0016	0116	0216	0316	2016	3016	4016
10	120	10	6	120	150	8	.070	3.2	2.5	C	0017	0117	0217	0317	2017	3017	4017
10	180	5	9	180	226	8	.060	3.7	3.4	D	0018	0118	0218	0318	2018	3018	4018
10	180	10	9	180	226	8	.060	3.7	3.4	D	0019	0119	0219	0319	2019	3019	4019
10	220	5	10	200	250	10	.055	3.9	3.4	D	0020	0120	0220	0320	2020	3020	4020
10	220	10	10	200	250	10	.055	3.9	3.4	D	0021	0121	0221	0321	2021	3021	4021
10	220	20	10	200	250	10	.055	3.9	3.4	D	0022	0122	0222	0322	2022	3022	4022
15	56	5	4	80	100	6	.100	2.6	1.8	C	0023	0123	0223	0323	2023	3023	4023
15	56	10	4	80	100	6	.100	2.6	1.8	C	0024	0124	0224	0324	2024	3024	4024
15	68	5	5	100	125	6	.095	2.7	2.2	C	0025	0125	0225	0325	2025	3025	4025
15	68	10	5	100	125	6	.095	2.7	2.2	C	0026	0126	0226	0326	2026	3026	4026
15	68	20	5	100	226	6	.095	2.7	2.2	C	0027	0127	0227	0327	2027	3027	4027
15	120	5	9	180	226	8	.070	3.5	2.8	D	0028	0128	0228	0328	2028	3028	4028
15	120	10	9	180	226	8	.070	3.5	2.8	D	0029	0129	0229	0329	2029	3029	4029
15	150	5	10	200	250	8	.065	3.6	3.1	D	0030	0130	0230	0330	2030	3030	4030
15	150	10	10	200	250	8	.065	3.6	3.1	D	0031	0131	0231	0331	2031	3031	4031
15	150	20	10	200	250	8	.065	3.6	3.1	D	0032	0132	0232	0332	2032	3032	4032
20	27	5	2.5	50	63	5	.145	2.2	1.2	C	0033	0133	0233	0333	2033	3033	4033
20	27	10	2.5	50	63	5	.145	2.2	1.2	C	0034	0134	0234	0334	2034	3034	4034
20	33	5	3.5	70	88	5	.130	2.3	1.4	C	0035	0135	0235	0335	2035	3035	4035
20	33	10	3.5	70	88	5	.130	2.3	1.4	C	0036	0136	0236	0336	2036	3036	4036
20	33	20	3.5	70	88	5	.130	2.3	1.4	C	0037	0137	0237	0337	2037	3037	4037
20	39	5	4.0	80	100	5	.120	2.4	1.7	C	0038	0138	0238	0338	2038	3038	4038
20	39	10	4.0	80	100	5	.120	2.4	1.7	C	0039	0139	0239	0339	2039	3039	4039
20	47	5	4.5	90	113	6	.110	2.5	1.8	C	0040	0140	0240	0340	2040	3040	4040
20	47	10	4.5	90	113	6	.110	2.5	1.8	C	0041	0141	0241	0341	2041	3041	4041

MIL-C-39003

Military Style Tantalum Capacitors

MIL-C-39003/09
STYLE CSR21

DC rated voltage	Capacitance	Capacitance tolerance	DC leakage at +25°C	DC leakage at +85°C	DC leakage at +125°C	Dissipation factor 1kHz +25°C	ESR 100kHz +25°C (max)	Ripple current 40kHz 25°C (max)	Derated ripple current 1KHz25°C (max)	Case size	Part no. M39003/09- Failure rate level for (%1,000 hrs) M 1.0	P 0.1	R 0.01	S 0.001	B 0.1	C 0.01	D 0.001
Volts	µF	Percent	µA	µA	µA	Percent	Ohms	A									
20	47	20	4.5	90	113	6	.110	2.5	1.8	C	0042	0142	0242	0342	2042	3042	4042
20	56	5	5.5	110	138	6	.100	2.9	2.2	D	0043	0143	0243	0343	2043	3043	4043
20	56	10	5.5	110	138	6	.100	2.9	2.2	D	0044	0144	0244	0344	2044	3044	4044
20	68	5	7	140	175	6	.095	3.0	2.4	D	0045	0145	0245	0345	2045	3045	4045
20	68	10	7	140	175	6	.095	3.0	2.4	D	0046	0146	0246	0346	2046	3046	4046
20	68	20	7	140	175	6	.095	3.0	2.4	D	0047	0147	0247	0347	2047	3047	4047
20	82	5	8	160	200	6	.085	3.1	2.5	D	0048	0148	0248	0348	2048	3048	4048
20	82	10	8	160	200	6	.085	3.1	2.5	D	0049	0149	0249	0349	2049	3049	4049
20	100	5	10	200	250	8	.075	3.3	2.5	D	0050	0150	0250	0350	2050	3050	4050
20	100	10	10	200	250	8	.075	3.3	2.5	D	0051	0151	0251	0351	2051	3051	4051
20	100	20	10	200	250	8	.075	3.3	2.5	D	0052	0152	0252	0352	2052	3052	4052
35	22	5	4	80	100	4	.160	2.1	1.5	C	0053	0153	0253	0353	2053	3053	4053
35	22	10	4	80	100	4	.160	2.1	1.5	C	0054	0154	0254	0354	2054	3054	4054
35	22	20	4	80	100	4	.160	2.1	1.5	C	0055	0155	0255	0355	2055	3055	4055
35	27	5	4.5	90	113	4	.145	2.4	1.9	D	0056	0156	0256	0356	2056	3056	4056
35	27	10	4.5	90	113	4	.145	2.4	1.9	D	0057	0157	0257	0357	2057	3057	4057
35	33	5	5.5	110	138	5	.130	2.5	1.9	D	0058	0158	0258	0358	2058	3058	4058
35	33	10	5.5	110	138	5	.130	2.5	1.9	D	0059	0159	0259	0359	2059	3059	4059
35	33	20	5.5	110	138	5	.130	2.5	1.9	D	0060	0160	0260	0360	2060	3060	4060
35	39	5	7	140	175	5	.120	2.6	2.0	D	0061	0161	0261	0361	2061	3061	4061
35	39	10	7	140	175	5	.120	2.6	2.0	D	0062	0162	0262	0362	2062	3062	4062
35	47	5	8	160	200	5	.110	2.7	2.2	D	0063	0163	0263	0363	2063	3063	4063
35	47	10	8	160	200	5	.110	2.7	2.2	D	0064	0164	0264	0364	2064	3064	4064
35	47	20	8	160	200	5	.110	2.7	2.2	D	0065	0165	0265	0365	2065	3065	4065
50	5.6	5	2.2	45	56	3	.300	1.5	.6	C	0066	0166	0266	0366	2066	3066	4066
50	5.6	10	2.2	45	56	3	.300	1.5	.6	C	0067	0167	0267	0367	2067	3067	4067
50	6.8	5	2.2	45	56	3	.275	1.6	.7	C	0068	0168	0268	0368	2068	3068	4068
50	6.8	10	2.2	45	56	3	.275	1.6	.7	C	0069	0169	0269	0369	2069	3069	4069
50	6.8	20	2.2	45	56	3	.275	1.6	.7	C	0070	0170	0270	0370	2070	3070	4070
50	8.2	5	2.5	50	63	3	.250	1.6	.9	C	0071	0171	0271	0371	2071	3071	4071
50	8.2	10	2.5	50	63	3	.250	1.6	.9	C	0072	0172	0272	0372	2072	3072	4072
50	10	5	2.5	50	63	3	.230	1.7	1.1	C	0073	0173	0273	0373	2073	3073	4073
50	10	10	2.5	50	63	3	.230	1.7	1.1	C	0074	0174	0274	0374	2074	3074	4074
50	10	20	2.5	50	63	3	.230	1.7	1.1	C	0075	0175	0275	0375	2075	3075	4075
50	12	5	3	60	75	3	.210	1.8	1.3	C	0076	0176	0276	0376	2076	3076	4076
50	12	10	3	60	75	3	.210	1.8	1.3	C	0077	0177	0277	0377	2077	3077	4077
50	15	5	4	80	100	3	.190	1.9	1.4	C	0078	0178	0278	0378	2078	3078	4078
50	15	10	4	80	100	3	.190	1.9	1.4	C	0079	0179	0279	0379	2079	3079	4079
50	15	20	4	80	100	3	.190	1.9	1.4	C	0080	0180	0280	0380	2080	3080	4080
50	18	5	4.5	90	113	4	.175	2.0	1.4	C	0081	0181	0281	0381	2081	3081	4081
50	18	10	4.5	90	113	4	.175	2.0	1.4	C	0082	0182	0282	0382	2082	3082	4082
50	22	5	5.5	110	138	4	.160	2.3	1.7	D	0083	0183	0283	0383	2083	3083	4083
50	22	10	5.5	110	138	4	.160	2.3	1.7	D	0084	0184	0284	0384	2084	3084	4084
50	22	20	5.5	110	138	4	.160	2.3	1.7	D	0085	0185	0285	0385	2085	3085	4085

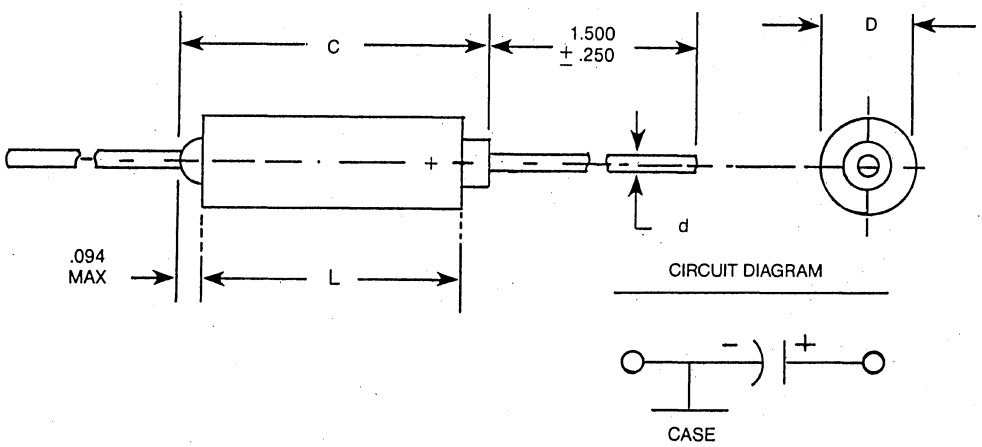
MIL-C-39003/03
STYLE CSR23

MILITARY CODING SYSTEM

M39003 /03 —0001

- —0001: Dash number assigned for each specific value of capacitance-voltage, capacitance tolerance, and failure rate level. See table for specific rating.
- /03: Detail sheet for specific style — CSR23
- M39003: MIL-C-39003 — Generic specification for established reliability solid tantalum capacitors.

NOTE: *Military number does not specify capacitance, voltage, capacitance, tolerance, failure rate, or case size. See table.*



CASE SIZE	Dimensions — Inches (mm)			
	L ±.031 (.79)	D +.016 (.41) −.015 (.38)	d ±.002 (.05)	C max.
A	0.286 (7.26)	0.135 (3.43)	0.020 (0.51)	0.422 (10.72)
B	0.474 (12.04)	0.185 (4.70)	0.020 (0.51)	0.610 (15.49)
C	0.686 (17.42)	0.289 (7.34)	0.025 (0.64)	0.822 (20.88)
D	0.786 (19.96)	0.351 (8.92)	0.025 (0.64)	0.922 (23.42)

MIL-C-39003

Military Style Tantalum Capacitors

MIL-C-39003/03
STYLE CSR23

DC rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage at			Dissipation factor at		Case size	Part no. M39003/03- Failure rate level for (%1,000 hrs)						
			+25°C	+85°C	+125°C	−55°C	+25°C		M 1.0	P 0.1	R 0.01	S 0.001	B 0.1	C 0.01	D 0.001
Volts	µF	Percent	µA	µA	µA	Percent	Percent								
6	10.0	10	0.9	9.0	11.0	6	6	A	0101	0201	0301	0401	2001	3001	4001
6	10.0	20	0.9	9.0	11.0	6	6	A	0102	0202	0302	0402	2002	3002	4002
6	12.0	10	1.0	10.0	12.5	6	6	A	0103	0203	0303	0403	2003	3003	4003
6	100.0	10	6.0	60.0	75.0	8	8	B	0104	0204	0304	0404	2004	3004	4004
6	100.0	20	6.0	60.0	75.0	8	8	B	0105	0205	0305	0405	2005	3005	4005
6	330.0	10	15.0	150.0	188.0	8	8	C	0106	0206	0306	0406	2006	3006	4006
6	330.0	20	15.0	150.0	188.0	8	8	C	0107	0207	0307	0407	2007	3007	4007
6	390.0	10	15.0	150.0	188.0	10	10	C	0108	0208	0308	0408	2008	3008	4008
6	470.0	10	15.0	150.0	188.0	10	10	C	0109	0209	0309	0409	2009	3009	4009
6	470.0	20	15.0	150.0	188.0	10	10	C	0110	0210	0310	0410	2010	3010	4010
6	680.0	10	20.0	200.0	250.0	10	10	D	0111	0211	0311	0411	2011	3011	4011
6	680.0	20	20.0	200.0	250.0	10	10	D	0112	0212	0312	0412	2012	3012	4012
6	820.0	10	20.0	200.0	250.0	10	10	D	0113	0213	0313	0413	2013	3013	4013
6	1000.0	10	30.0	300.0	375.0	10	10	D	0114	0214	0314	0414	2014	3014	4014
6	1000.0	20	30.0	300.0	375.0	10	10	D	0115	0215	0315	0415	2015	3015	4015
10	6.8	10	1.0	10.0	12.5	6	6	A	0116	0216	0316	0416	2016	3016	4016
10	6.8	20	1.0	10.0	12.5	6	6	A	0117	0217	0317	0417	2017	3017	4017
10	8.2	10	1.2	12.0	15.0	6	6	A	0118	0218	0318	0418	2018	3018	4018
10	47.0	10	5.0	50.0	63.0	6	6	B	0119	0219	0319	0419	2019	3019	4019
10	47.0	20	5.0	50.0	63.0	6	6	B	0120	0220	0320	0420	2020	3020	4020
10	56.0	10	6.0	60.0	75.0	6	6	B	0121	0221	0321	0421	2021	3021	4021
10	68.0	10	7.0	70.0	88.0	6	6	B	0122	0222	0322	0422	2022	3022	4022
10	68.0	20	7.0	70.0	88.0	6	6	B	0123	0223	0323	0423	2023	3023	4023
10	82.0	10	8.0	80.0	100.0	6	6	B	0124	0224	0324	0424	2024	3024	4024
10	220.0	10	15.0	150.0	188.0	8	8	C	0125	0225	0325	0425	2025	3025	4025
10	220.0	20	15.0	150.0	188.0	8	8	C	0126	0226	0326	0426	2026	3026	4026
10	270.0	10	15.0	150.0	188.0	8	8	C	0127	0227	0327	0427	2027	3027	4027
10	390.0	10	20.0	200.0	250.0	10	10	D	0128	0228	0328	0428	2028	3028	4028
10	470.0	10	20.0	200.0	250.0	10	10	D	0129	0229	0329	0429	2029	3029	4029
10	470.0	20	20.0	200.0	250.0	10	10	D	0130	0230	0330	0430	2030	3030	4030
10	560.0	10	30.0	300.0	375.0	10	10	D	0131	0231	0331	0431	2031	3031	4031
15	4.7	10	1.0	10.0	12.5	4	4	A	0132	0232	0332	0432	2032	3032	4032
15	4.7	20	1.0	10.0	12.5	4	4	A	0133	0233	0333	0433	2033	3033	4033
15	5.6	10	1.3	13.0	16.5	4	4	A	0134	0234	0334	0434	2034	3034	4034
15	33.0	10	6.0	60.0	75.0	6	6	B	0135	0235	0335	0435	2035	3035	4035
15	33.0	20	6.0	60.0	75.0	6	6	B	0136	0236	0336	0436	2036	3036	4036
15	39.0	10	6.0	60.0	75.0	6	6	B	0137	0237	0337	0437	2037	3037	4037
15	150.0	10	15.0	150.0	188.0	8	8	C	0138	0238	0338	0438	2038	3038	4038
15	150.0	20	15.0	150.0	188.0	8	8	C	0139	0239	0339	0439	2039	3039	4039
15	180.0	10	15.0	150.0	188.0	8	8	C	0140	0240	0340	0440	2040	3040	4040
15	220.0	10	20.0	200.0	250.0	8	8	D	0141	0241	0341	0441	2041	3041	4041
15	220.0	20	20.0	200.0	250.0	8	8	D	0142	0242	0342	0442	2042	3042	4042
15	270.0	10	20.0	200.0	250.0	8	8	D	0143	0243	0343	0443	2043	3043	4043
15	330.0	10	20.0	200.0	250.0	8	8	D	0144	0244	0344	0444	2044	3044	4044
15	330.0	20	20.0	200.0	250.0	8	8	D	0145	0245	0345	0445	2045	3045	4045

MIL-C-39003/03
STYLE CSR23

DC rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage at			Dissipation factor at		Case size	Part no. M39003/03- Failure rate level for (%1,000 hrs)						
			+25°C	+85°C	+125°C	−55°C	+25°C		M 1.0	P 0.1	R 0.01	S 0.001	B 0.1	C 0.01	D 0.001
Volts	µF	Percent	µA	µA	µA	Percent	Percent								
20	2.7	10	0.8	8.0	10.0	4	4	A	0146	0246	0346	0446	2046	3046	4046
20	3.3	10	1.0	10.0	12.5	4	4	A	0147	0247	0347	0447	2047	3047	4047
20	3.3	20	1.0	10.0	12.5	4	4	A	0148	0248	0348	0448	2048	3048	4048
20	3.9	10	1.2	12.0	15.0	4	4	A	0149	0249	0349	0449	2049	3049	4049
20	18.0	10	4.0	40.0	50.0	6	6	B	0150	0250	0350	0450	2050	3050	4050
20	22.0	10	4.0	40.0	50.0	6	6	B	0151	0251	0351	0451	2051	3051	4051
20	22.0	20	4.0	40.0	50.0	6	6	B	0152	0252	0352	0452	2052	3052	4052
20	27.0	10	5.0	50.0	63.0	6	6	B	0153	0253	0353	0453	2053	3053	4053
20	56.0	10	9.0	90.0	110.0	6	6	C	0154	0254	0354	0454	2054	3054	4054
20	68.0	10	10.0	100.0	125.0	6	6	C	0155	0255	0355	0455	2055	3055	4055
20	68.0	20	10.0	100.0	125.0	6	6	C	0156	0256	0356	0456	2056	3056	4056
20	82.0	10	10.0	100.0	125.0	6	6	C	0157	0257	0357	0457	2057	3057	4057
20	100.0	10	15.0	150.0	188.0	6	6	C	0158	0258	0358	0458	2058	3058	4058
20	100.0	20	15.0	150.0	188.0	6	6	C	0159	0259	0359	0459	2059	3059	4059
20	120.0	10	15.0	150.0	188.0	6	6	C	0160	0260	0360	0460	2060	3060	4060
20	150.0	10	20.0	200.0	250.0	8	8	D	0161	0261	0361	0461	2061	3061	4061
20	150.0	20	20.0	200.0	250.0	8	8	D	0162	0262	0362	0462	2062	3062	4062
20	180.0	10	20.0	200.0	250.0	8	8	D	0163	0263	0363	0463	2063	3063	4063
35	1.8	10	1.0	10.0	12.5	4	4	A	0164	0264	0364	0464	2064	3064	4064
35	8.2	10	3.5	35.0	44.0	6	6	B	0165	0265	0365	0465	2065	3065	4065
35	10.0	10	4.0	40.0	50.0	6	6	B	0166	0266	0366	0466	2066	3066	4066
35	10.0	20	4.0	40.0	50.0	6	6	B	0167	0267	0367	0467	2067	3067	4067
35	33.0	10	10.0	100.0	125.0	6	6	C	0168	0268	0368	0468	2068	3068	4068
35	33.0	20	10.0	100.0	125.0	6	6	C	0169	0269	0369	0469	2069	3069	4069
35	39.0	10	10.0	100.0	125.0	6	6	C	0170	0270	0370	0470	2070	3070	4070
35	47.0	10	10.0	100.0	125.0	6	6	C	0171	0271	0371	0471	2071	3071	4071
35	47.0	20	10.0	100.0	125.0	6	6	C	0172	0272	0372	0472	2072	3072	4072
35	56.0	10	15.0	150.0	188.0	6	6	D	0173	0273	0373	0473	2073	3073	4073
35	68.0	10	15.0	150.0	188.0	6	6	D	0174	0274	0374	0474	2074	3074	4074
35	68.0	20	15.0	150.0	188.0	6	6	D	0175	0275	0375	0475	2075	3075	4075
50	1.2	10	0.9	9.0	11.0	4	4	A	0176	0276	0376	0476	2076	3076	4076
50	1.5	10	1.2	12.0	15.0	4	4	A	0177	0277	0377	0477	2077	3077	4077
50	1.5	20	1.2	12.0	15.0	4	4	A	0178	0278	0378	0478	2078	3078	4078
50	5.6	10	4.5	45.0	56.0	4	4	B	0179	0279	0379	0479	2079	3079	4079
50	6.8	10	4.5	45.0	56.0	6	6	B	0180	0280	0380	0480	2080	3080	4080
50	6.8	20	4.5	45.0	56.0	6	6	B	0181	0281	0381	0481	2081	3081	4081
50	22.0	10	10.0	100.0	125.0	6	6	C	0182	0282	0382	0482	2082	3082	4082
50	22.0	20	10.0	100.0	125.0	6	6	C	0183	0283	0383	0483	2083	3083	4083
50	27.0	10	10.0	100.0	125.0	6	6	C	0184	0284	0384	0484	2084	3084	4084
50	33.0	10	10.0	100.0	125.0	6	6	D	0185	0285	0385	0485	2085	3085	4085
50	33.0	20	10.0	100.0	125.0	6	6	D	0186	0286	0386	0486	2086	3086	4086
50	39.0	10	10.0	100.0	125.0	6	6	D	0187	0287	0387	0487	2087	3087	4087

MIL-C-39003
Military Style Tantalum Capacitors

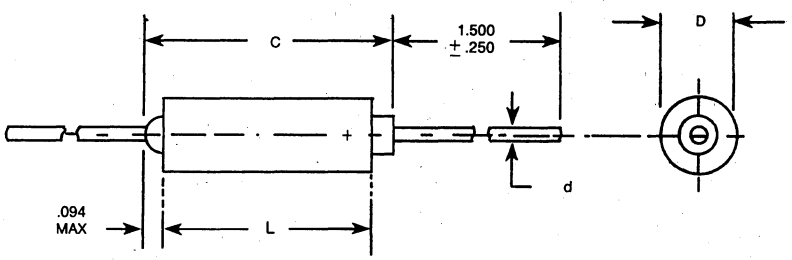
MIL-C-39003/06
STYLE CSR33

MILITARY CODING SYSTEM

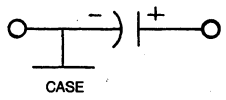
M39003 /06 —0001

- —0001: Dash number assigned for each specific value of capacitance-voltage, capacitance tolerance, and failure rate level. See table for specific rating.
- /06: Detail sheet for specific style — CSR33
- M39003: MIL-C-39003 — Generic specification for established reliability solid tantalum capacitors.

NOTE: *Military number does not specify capacitance, voltage, capacitance, tolerance, failure rate, or case size. See table.*



CIRCUIT DIAGRAM



CASE SIZE	Dimensions — Inches (mm)			
	L ±.031 (.79)	D +.016 (.41) −.015 (.38)	d ±.002 (.05)	C max.
A	0.286 (7.26)	0.135 (3.43)	0.020 (0.51)	0.422 (10.72)
B	0.474 (12.04)	0.185 (4.70)	0.020 (0.51)	0.610 (15.49)
C	0.686 (17.42)	0.289 (7.34)	0.025 (0.64)	0.822 (20.88)
D	0.786 (19.96)	0.351 (8.92)	0.025 (0.64)	0.922 (23.42)

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Military Style Tantalum Capacitors

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STYLE CSR33

DC rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage at			Dissipation factor at		Case size	Part no. M39003/06- Failure rate level for (%1,000 hrs)						
			+25°C	+85°C	+125°C	−55°C +25°C	+85°C +125°C		M 1.0	P 0.1	R 0.01	S 0.001	B 0.1	C 0.01	D 0.001
Volts	µF	Percent	µA	µA	µA	Percent	Percent								
6	10.0	10	0.5	2.0	2.0	6	6	A	0001	0101	0201	0301	2001	3001	4001
6	10.0	20	0.5	2.0	2.0	6	6	A	0002	0102	0202	0302	2002	3002	4002
6	12.0	10	0.5	2.0	2.0	6	6	A	0003	0103	0203	0303	2003	3003	4003
6	100.0	10	1.0	3.0	3.0	8	8	B	0004	0104	0204	0304	2004	3004	4004
6	100.0	20	1.0	3.0	3.0	8	8	B	0005	0105	0205	0305	2005	3005	4005
6	330.0	10	2.0	8.0	8.0	8	8	C	0006	0106	0206	0306	2006	3006	4006
6	330.0	20	2.0	8.0	8.0	8	8	C	0007	0107	0207	0307	2007	3007	4007
6	390.0	10	2.0	8.0	8.0	10	10	C	0008	0108	0208	0308	2008	3008	4008
6	470.0	10	2.0	8.0	8.0	10	10	C	0009	0109	0209	0309	2009	3009	4009
6	470.0	20	2.0	8.0	8.0	10	10	C	0010	0110	0210	0310	2010	3010	4010
6	680.0	10	5.0	10.0	10.0	10	10	D	0011	0111	0211	0311	2011	3011	4011
6	680.0	20	5.0	10.0	10.0	10	10	D	0012	0112	0212	0312	2012	3012	4012
6	820.0	10	5.0	10.0	10.0	10	10	D	0013	0113	0213	0313	2013	3013	4013
6	1000.0	10	5.0	10.0	10.0	10	10	D	0014	0114	0214	0314	2014	3014	4014
6	1000.0	20	5.0	10.0	10.0	10	10	D	0015	0115	0215	0315	2015	3015	4015
10	6.8	10	.5	2.0	2.0	6	6	A	0016	0116	0216	0316	2016	3016	4016
10	6.8	20	.5	2.0	2.0	6	6	A	0017	0117	0217	0317	2017	3017	4017
10	8.2	10	.5	2.0	2.0	6	6	A	0018	0118	0218	0318	2018	3018	4018
10	47.0	10	1.0	2.0	2.0	6	6	B	0019	0119	0219	0319	2019	3019	4019
10	47.0	20	1.0	2.0	2.0	6	6	B	0020	0120	0220	0320	2020	3020	4020
10	56.0	10	1.0	4.0	4.0	6	6	B	0021	0121	0221	0321	2021	3021	4021
10	68.0	10	1.0	4.0	4.0	6	6	B	0022	0122	0222	0322	2022	3022	4022
10	68.0	20	1.0	4.0	4.0	6	6	B	0023	0123	0223	0323	2023	3023	4023
10	82.0	10	1.0	4.0	4.0	6	6	B	0024	0124	0224	0324	2024	3024	4024
10	220.0	10	1.0	7.0	7.0	8	8	C	0025	0125	0225	0325	2025	3025	4025
10	220.0	20	1.0	7.0	7.0	8	8	C	0026	0126	0226	0326	2026	3026	4026
10	270.0	10	2.0	10.0	10.0	8	8	C	0027	0127	0227	0327	2027	3027	4027
10	390.0	10	2.0	16.0	16.0	10	10	D	0028	0128	0228	0328	2028	3028	4028
10	470.0	10	4.0	16.0	16.0	10	10	D	0029	0129	0229	0329	2029	3029	4029
10	470.0	20	4.0	16.0	16.0	10	10	D	0030	0130	0230	0330	2030	3030	4030
10	560.0	10	4.0	16.0	16.0	10	10	D	0031	0131	0231	0331	2031	3031	4031
15	4.7	10	.5	2.0	2.0	4	4	A	0032	0132	0232	0332	2032	3032	4032
15	4.7	20	.5	2.0	2.0	4	4	A	0033	0133	0233	0333	2033	3033	4033
15	5.6	10	.5	2.0	2.0	4	4	A	0034	0134	0234	0334	2034	3034	4034
15	33.0	10	1.0	2.0	2.0	6	6	B	0035	0135	0235	0335	2035	3035	4035
15	33.0	20	1.0	2.0	2.0	6	6	B	0036	0136	0236	0336	2036	3036	4036
15	39.0	10	1.0	2.0	2.0	6	6	B	0037	0137	0237	0337	2037	3037	4037
15	150.0	10	1.0	7.0	7.0	8	8	C	0038	0138	0238	0338	2038	3038	4038
15	150.0	20	1.0	7.0	7.0	8	8	C	0039	0139	0239	0339	2039	3039	4039
15	180.0	10	2.0	10.0	10.0	8	8	C	0040	0140	0240	0340	2040	3040	4040
15	220.0	10	2.0	10.0	10.0	8	8	D	0041	0141	0241	0341	2041	3041	4041
15	220.0	20	2.0	10.0	10.0	8	8	D	0042	0142	0242	0342	2042	3042	4042
15	270.0	10	2.0	16.0	16.0	8	8	D	0043	0143	0243	0343	2043	3043	4043
15	330.0	10	2.0	16.0	16.0	8	8	D	0044	0144	0244	0344	2044	3044	4044
15	330.0	20	2.0	16.0	16.0	8	8	D	0045	0145	0245	0345	2045	3045	4045

MIL-C-39003

Military Style Tantalum Capacitors

MIL-C-39003/06
STYLE CSR33

DC rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage at			Dissipation factor at		Case size	Part no. M39003/06- Failure rate level for (%1,000 hrs)						
			+25°C	+85°C	+125°C	−55°C +25°C	+85°C +125°C		M 1.0	P 0.1	R 0.01	S 0.001	B 0.1	C 0.01	D 0.001
Volts	µF	Percent	µA	µA	µA	Percent	Percent								
20	2.7	10	.5	2.0	2.0	4	4	A	0046	0146	0246	0346	2046	3046	4046
20	3.3	10	.5	2.0	2.0	4	4	A	0047	0147	0247	0347	2047	3047	4047
20	3.3	20	.5	2.0	2.0	4	4	A	0048	0148	0248	0348	2048	3048	4048
20	3.9	10	.5	2.0	2.0	4	4	A	0049	0149	0249	0349	2049	3049	4049
20	18.0	10	1.0	2.0	2.0	6	6	B	0050	0150	0250	0350	2050	3050	4050
20	22.0	10	1.0	2.0	2.0	6	6	B	0051	0151	0251	0351	2051	3051	4051
20	22.0	20	1.0	2.0	2.0	6	6	B	0052	0152	0252	0352	2052	3052	4052
20	27.0	10	1.0	2.0	2.0	6	6	B	0053	0153	0253	0353	2053	3053	4053
20	56.0	10	1.0	10.0	10.0	6	6	C	0054	0154	0254	0354	2054	3054	4054
20	68.0	10	1.0	10.0	10.0	6	6	C	0055	0155	0255	0355	2055	3055	4055
20	68.0	20	1.0	10.0	10.0	6	6	C	0056	0156	0256	0356	2056	3056	4056
20	82.0	10	1.0	10.0	10.0	6	6	C	0057	0157	0257	0357	2057	3057	4057
20	100.0	10	1.0	10.0	10.0	6	6	C	0058	0158	0258	0358	2058	3058	4058
20	100.0	20	1.0	10.0	10.0	6	6	C	0059	0159	0259	0359	2059	3059	4059
20	120.0	10	1.0	10.0	10.0	6	6	C	0060	0160	0260	0360	2060	3060	4060
20	150.0	10	2.0	10.0	10.0	8	8	D	0061	0161	0261	0361	2061	3061	4061
20	150.0	20	2.0	10.0	10.0	8	8	D	0062	0162	0262	0362	2062	3062	4062
20	180.0	10	2.0	10.0	10.0	8	8	D	0063	0163	0263	0363	2063	3063	4063
35	1.8	10	.5	2.0	2.0	4	4	A	0064	0164	0264	0364	2064	3064	4064
35	8.2	10	1.0	2.0	2.0	6	6	B	0065	0165	0265	0365	2065	3065	4065
35	10.0	10	1.0	2.0	2.0	6	6	B	0066	0166	0266	0366	2066	3066	4066
35	10.0	20	1.0	2.0	2.0	6	6	B	0067	0167	0267	0367	2067	3067	4067
35	33.0	10	1.0	5.0	5.0	6	6	C	0068	0168	0268	0368	2068	3068	4068
35	33.0	20	1.0	5.0	5.0	6	6	C	0069	0169	0269	0369	2069	3069	4069
35	39.0	10	1.0	5.0	5.0	6	6	C	0070	0170	0270	0370	2070	3070	4070
35	47.0	10	1.0	5.0	5.0	6	6	C	0071	0171	0271	0371	2071	3071	4071
35	47.0	20	1.0	5.0	5.0	6	6	C	0072	0172	0272	0372	2072	3072	4072
35	56.0	10	2.0	10.0	10.0	6	6	D	0073	0173	0273	0373	2073	3073	4073
35	68.0	10	2.0	10.0	10.0	6	6	D	0074	0174	0274	0374	2074	3074	4074
35	68.0	20	2.0	10.0	10.0	6	6	D	0075	0175	0275	0375	2075	3075	4075
50	1.2	10	.5	2.0	2.0	4	4	A	0076	0176	0276	0376	2076	3076	4076
50	1.5	10	.5	2.0	2.0	4	4	A	0077	0177	0277	0377	2077	3077	4077
50	1.5	20	.5	2.0	2.0	4	4	A	0078	0178	0278	0378	2078	3078	4078
50	5.6	10	1.0	2.0	2.0	4	4	B	0079	0179	0279	0379	2079	3079	4079
50	6.8	10	1.0	2.0	2.0	6	6	B	0080	0180	0280	0380	2080	3080	4080
50	6.8	20	1.0	2.0	2.0	6	6	B	0081	0181	0281	0381	2081	3081	4081
50	22.0	10	1.0	5.0	5.0	6	6	C	0082	0182	0282	0382	2082	3082	4082
50	22.0	20	1.0	5.0	5.0	6	6	C	0083	0183	0283	0383	2083	3083	4083
50	27.0	10	1.0	5.0	5.0	6	6	C	0084	0184	0284	0384	2084	3084	4084
50	33.0	10	1.0	9.0	9.0	6	6	D	0085	0185	0285	0385	2085	3085	4085
50	33.0	20	1.0	9.0	9.0	6	6	D	0086	0186	0286	0386	2086	3086	4086
50	39.0	10	1.0	9.0	9.0	6	6	D	0087	0187	0287	0387	2087	3087	4087

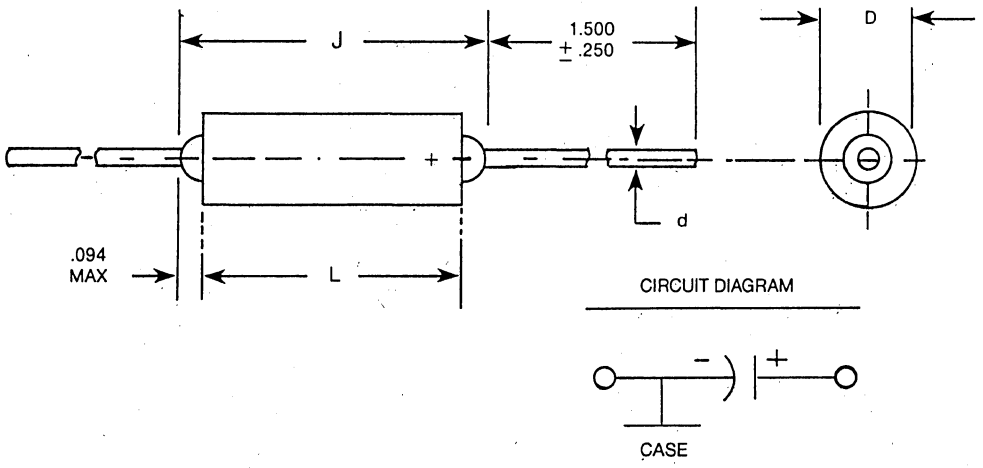
MIL-C-39003/04
STYLE CSR91
NON-POLAR

MILITARY CODING SYSTEM

M39003 /04 −1195

- −1195 — Dash number assigned for each specific value of capacitance-voltage, capacitance tolerance, and failure rate level. See table for specific rating.
- /04 — Detail sheet for specific style — CSR91.
- M39003 — MIL-C-39003 — Generic specification for established reliability solid tantalum capacitors.

NOTE: *Military number does not specify capacitance, voltage, capacitance tolerance, failure rate, or case size. See table.*



CASE SIZE	Dimensions — Inches (mm)			
	L ±0.031 (0.79)	D +0.010 (0.25) −0.015 (0.38)	d ±0.002 (0.05)	J max.
W	0.575 (14.61)	0.161 (4.09)	0.020 (0.51)	0.750 (19.05)
X	0.955 (24.26)	0.207 (5.26)	0.020 (0.51)	1.130 (28.70)
Y	1.350 (34.29)	0.314 (7.98)	0.025 (0.64)	1.525 (38.74)
Z	1.550 (39.37)	0.376 (9.55)	0.025 (0.64)	1.725 (43.82)

1. The case insulation shall extend .015 (.38 mm) minimum beyond each end. However, when a shrink-fitted insulation is used, it shall lap over the ends of the capacitor body.
2. All CSR91 capacitors are insulated.

MIL-C-39003

Military Style Tantalum Capacitors

MIL-C-39003/04
STYLE CSR91
NON-POLAR

Rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage) (max) +25°C	Dissipation factor (max) +25°C	Case size	Dash number						
						Failure rate level for (%1,000 hrs)						
						M 1.0	P 0.1	R 0.01	S 0.001	B 0.01	C 0.01	D 0.001
Volts, NP	µF	Percent	µA	Percent								
6	2.8	10	.3	4	W	0221	0441	0661	0881	3001	4001	5001
6	3.4	10	.3	6	W	0222	0442	0662	0882	3002	4002	5002
6	3.4	20	.3	6	W	0223	0443	0663	0883	3003	4003	5003
6	23.0	10	1.5	6	X	0224	0444	0664	0884	3004	4004	5004
6	23.0	20	1.5	6	X	0225	0445	0665	0885	3005	4005	5005
6	28.0	10	1.5	6	X	0226	0446	0666	0886	3006	4006	5006
6	75.0	10	4.5	8	Y	0227	0447	0667	0887	3007	4007	5007
6	75.0	20	4.5	8	Y	0228	0448	0668	0888	3008	4008	5008
6	90.0	10	5.5	8	Y	0229	0449	0669	0889	3009	4009	5009
6	130.0	10	6.5	8	Z	0231	0451	0671	0891	3010	4010	5010
6	160.0	10	7.5	8	Z	0233	0453	0673	0893	3011	4011	5011
6	160.0	20	7.5	8	Z	0234	0454	0674	0894	3012	4012	5012
10	1.9	10	.3	4	W	0235	0455	0675	0895	3013	4013	5013
10	2.3	10	.4	4	W	0236	0456	0676	0896	3014	4014	5014
10	2.3	20	.4	4	W	0237	0457	0677	0897	3015	4015	5015
10	13.0	10	2.0	6	X	0238	0458	0678	0898	3016	4016	5016
10	16.0	10	2.5	6	X	0239	0459	0679	0899	3017	4017	5017
10	16.0	20	2.5	6	X	0240	0460	0680	0900	3018	4018	5018
10	19.0	10	2.5	6	X	0241	0461	0681	0901	3019	4019	5019
10	41.0	10	4.0	6	Y	0242	0462	0682	0902	3020	4020	5020
10	50.0	10	5.0	8	Y	0243	0463	0683	0903	3021	4021	5021
10	50.0	20	5.0	8	Y	0244	0464	0684	0904	3022	4022	5022
10	60.0	10	6.0	8	Y	0245	0465	0685	0905	3023	4023	5023
10	90.0	10	9.0	8	Z	0247	0467	0687	0907	3024	4024	5024
10	110.0	10	10.0	8	Z	0248	0468	0688	0908	3025	4025	5025
10	110.0	20	10.0	8	Z	0249	0469	0689	0909	3026	4026	5026
15	1.3	10	.3	4	W	0250	0470	0690	0910	3027	4027	5027
15	1.6	10	.4	4	W	0251	0471	0691	0911	3028	4028	5028
15	1.6	20	.4	4	W	0252	0472	0692	0912	3029	4029	5029
15	9.0	10	2.0	6	X	0253	0473	0693	0913	3030	4030	5030
15	11.0	10	2.0	6	X	0254	0474	0694	0914	3031	4031	5031
15	11.0	20	2.0	6	X	0255	0475	0695	0915	3032	4032	5032
15	28.0	10	4.0	6	Y	0256	0476	0696	0916	3033	4033	5033
15	34.0	10	5.0	6	Y	0257	0477	0697	0917	3034	4034	5034
15	34.0	20	5.0	6	Y	0258	0478	0698	0918	3035	4035	5035
15	60.0	10	9.0	8	Z	0259	0479	0699	0919	3036	4036	5036
15	75.0	10	10.0	8	Z	0260	0480	0700	0920	3037	4037	5037
15	75.0	20	10.0	8	Z	0261	0481	0701	0921	3038	4038	5038
20	.6	10	.3	4	W	0262	0482	0702	0922	3039	4039	5039
20	.75	10	.3	4	W	0263	0483	0703	0923	3040	4040	5040
20	.75	20	.3	4	W	0264	0484	0704	0924	3041	4041	5041
20	.9	10	.3	4	W	0265	0485	0705	0925	3042	4042	5042
20	1.1	10	.4	4	W	0266	0486	0706	0926	3043	4043	5043
20	1.1	20	.4	4	W	0267	0487	0707	0927	3044	4044	5044
20	4.1	10	1.0	6	X	0268	0488	0708	0928	3045	4045	5045
20	5.0	10	1.5	6	X	0269	0489	0709	0929	3046	4046	5046
20	5.0	20	1.5	6	X	0270	0490	0710	0930	3047	4047	5047

MIL-C-39003/04
STYLE CSR91
NON-POLAR

Rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage) (max) +25°C	Dissipation factor (max) +25°C	Case size	Dash number						
						Failure rate level for (%1,000 hrs)						
						M 1.0	P 0.1	R 0.01	S 0.001	B 0.01	C 0.01	D 0.001
Volts, NP	μF	Percent	μA	Percent								
20	6.0	10	1.8	6	X	0271	0491	0711	0931	3048	4048	5048
20	7.5	10	2.0	6	X	0272	0492	0712	0932	3049	4049	5049
20	7.5	20	2.0	6	X	0273	0493	0713	0933	3050	4050	5050
20	13	10	2.5	6	Y	0274	0494	0714	0934	3051	4051	5051
20	16	10	3.5	6	Y	0275	0495	0715	0935	3052	4052	5052
20	16	20	3.5	6	Y	0276	0496	0716	0936	3053	4053	5053
20	19	10	4.0	6	Y	0277	0497	0717	0937	3054	4054	5054
20	23	10	4.5	6	Y	0278	0498	0718	0938	3055	4055	5055
20	23	20	4.5	6	Y	0279	0499	0719	0939	3056	4056	5056
20	28	10	5.5	6	Z	0280	0500	0720	0940	3057	4057	5057
20	34	10	7.0	6	Z	0281	0501	0721	0941	3058	4058	5058
20	34	20	7.0	6	Z	0282	0502	0722	0942	3059	4059	5059
20	41	10	8.0	6	Z	0283	0503	0723	0943	3060	4060	5060
20	50	10	10.0	6	Z	0284	0504	0724	0944	3061	4061	5061
20	50	20	10.0	6	Z	0285	0505	0725	0945	3062	4062	5062
35	2.8	10	1.3	4	X	0289	0509	0729	0949	3063	4063	5063
35	3.4	10	1.5	6	X	0290	0510	0730	0950	3064	4064	5064
35	3.4	20	1.5	6	X	0291	0511	0731	0951	3065	4065	5065
35	11.0	10	4.0	6	Y	0292	0512	0732	0952	3066	4066	5066
35	11.0	20	4.0	6	Y	0293	0513	0733	0953	3067	4067	5067
35	13.0	10	4.5	6	Z	0294	0514	0734	0954	3068	4068	5068
35	16.0	10	5.5	6	Z	0295	0515	0735	0955	3069	4069	5069
35	16.0	20	5.5	6	Z	0296	0516	0736	0956	3070	4070	5070
35	19.0	10	7.0	6	Z	0297	0517	0737	0957	3071	4071	5071
35	23.0	10	8.0	6	Z	0298	0518	0738	0958	3072	4072	5072
35	23.0	20	8.0	6	Z	0299	0519	0739	0959	3073	4073	5073
50	.0023	10	.3	2	W	1171	1241	1311	1381	3074	4074	5074
50	.0023	20	.3	2	W	1172	1242	1312	1382	3075	4075	5075
50	.0028	10	.3	2	W	1173	1243	1313	1383	3076	4076	5076
50	.0034	10	.3	2	W	1174	1244	1314	1384	3077	4077	5077
50	.0034	20	.3	2	W	1175	1245	1315	1385	3078	4078	5078
50	.0041	10	.3	2	W	1176	1246	1316	1386	3079	4079	5079
50	.005	10	.3	2	W	1177	1247	1317	1387	3080	4080	5080
50	.005	20	.3	2	W	1178	1248	1318	1388	3081	4081	5081
50	.006	10	.3	2	W	1179	1249	1319	1389	3082	4082	5082
50	.0075	10	.3	2	W	1180	1250	1320	1390	3083	4083	5083
50	.0075	20	.3	2	W	1181	1251	1321	1391	3084	4084	5084
50	.009	10	.3	2	W	1182	1252	1322	1392	3085	4085	5085
50	.011	10	.3	2	W	1183	1253	1323	1393	3086	4086	5086
50	.011	20	.3	2	W	1184	1254	1324	1394	3087	4087	5087
50	.013	10	.3	2	W	1185	1255	1325	1395	3088	4088	5088
50	.016	10	.3	2	W	1186	1256	1326	1396	3089	4089	5089
50	.016	20	.3	2	W	1187	1257	1327	1397	3090	4090	5090
50	.019	10	.3	2	W	1188	1258	1328	1398	3091	4091	5091
50	.023	10	.3	2	W	1189	1259	1329	1399	3092	4092	5092
50	.023	20	.3	2	W	1190	1260	1330	1400	3093	4093	5093
50	.028	10	.3	2	W	1191	1261	1331	1401	3094	4094	5094
50	.034	10	.3	2	W	1192	1262	1332	1402	3095	4095	5095
50	.034	20	.3	2	W	1193	1263	1333	1403	3096	4096	5096
50	.041	10	.3	2	W	1194	1264	1334	1404	3097	4097	5097

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Military Style Tantalum Capacitors

MIL-C-39003/04
STYLE CSR91
NON-POLAR

Rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage) (max) +25°C	Dissipation factor (max) +25°C	Case size	Dash number Failure rate level for (%1,000 hrs) M 1.0	P 0.1	R 0.01	S 0.001	B 0.01	C 0.01	D 0.001
Volts, NP	µF	Percent	µA	Percent								
50	.05	10	.3	2	W	1195	1265	1335	1405	3098	4098	5098
50	.05	20	.3	2	W	1196	1266	1336	1406	3099	4099	5099
50	.06	10	.3	2	W	1197	1267	1337	1407	3100	4100	5100
50	.075	10	.3	2	W	1198	1268	1338	1408	3101	4101	5101
50	.075	20	.3	2	W	1199	1269	1339	1409	3102	4102	5102
50	.09	10	.3	2	W	1200	1270	1340	1410	3103	4103	5103
50	.11	10	.3	2	W	1201	1271	1341	1411	3104	4104	5104
50	.11	20	.3	2	W	1202	1272	1342	1412	3105	4105	5105
50	.13	10	.3	2	W	1203	1273	1343	1413	3106	4106	5106
50	.16	10	.3	2	W	1204	1274	1344	1414	3107	4107	5107
50	.16	20	.3	2	W	1205	1275	1345	1415	3108	4108	5108
50	.19	10	.3	2	W	1206	1276	1346	1416	3109	4109	5109
50	.23	10	.3	2	W	1207	1277	1347	1417	3110	4110	5110
50	.23	20	.3	2	W	1208	1278	1348	1418	3111	4111	5111
50	.28	10	.3	2	W	1209	1279	1349	1419	3112	4112	5112
50	.34	10	.3	2	W	1210	1280	1350	1420	3113	4113	5113
50	.34	20	.3	2	W	1211	1281	1351	1421	3114	4114	5114
50	.41	10	.3	2	W	0300	0520	0740	0960	3115	4115	5115
50	.50	10	.4	2	W	0301	0521	0741	0961	3116	4116	5116
50	.50	20	.4	2	W	0302	0522	0742	0962	3117	4117	5117
50	.60	10	.4	4	X	1212	1282	1352	1422	3118	4118	5118
50	.75	10	.6	4	X	2001	2101	2201	2301	3119	4119	5119
50	.75	20	.6	4	X	2002	2102	2202	2302	3120	4120	5120
50	.90	10	.7	4	X	1215	1285	1355	1425	3121	4121	5121
50	1.1	10	.8	4	X	1216	1286	1356	1426	3122	4122	5122
50	1.1	20	.8	4	X	1217	1287	1357	1427	3123	4123	5123
50	1.3	10	1.0	4	X	1218	1288	1358	1428	3124	4124	5124
50	1.6	10	1.2	4	X	1219	1289	1359	1429	3125	4125	5125
50	1.6	20	1.2	4	X	1220	1290	1360	1430	3126	4126	5126
50	1.9	10	1.5	4	X	1221	1291	1361	1431	3127	4127	5127
50	2.3	10	1.7	4	X	1222	1292	1362	1432	3128	4128	5128
50	2.3	20	1.7	4	X	1223	1293	1363	1433	3129	4129	5129
50	2.8	10	2.2	4	Y	1224	1294	1364	1434	3130	4130	5130
50	3.4	10	2.2	6	Y	1225	1295	1365	1435	3131	4131	5131
50	3.4	20	2.2	6	Y	1226	1296	1366	1436	3132	4132	5132
50	4.1	10	2.5	6	Y	1227	1297	1367	1437	3133	4133	5133
50	5.0	10	2.5	6	Y	1228	1298	1368	1438	3134	4134	5134
50	5.0	20	2.5	6	Y	1229	1299	1369	1439	3135	4135	5135
50	6.0	10	3.0	6	Y	0303	0523	0743	0963	3136	4136	5136
50	7.5	10	4.0	6	Y	0304	0524	0744	0964	3137	4137	5137
50	7.5	20	4.0	6	Y	0305	0525	0745	0965	3138	4138	5138
50	9.0	10	4.5	6	Y	0306	0526	0746	0966	3139	4139	5139
50	11.0	10	5.5	6	Z	0307	0527	0747	0967	3140	4140	5140
50	11.0	20	5.5	6	Z	0308	0528	0748	0968	3141	4141	5141
75	.34	10	.3	2	W	0309	0529	0749	0969	3142	4142	5142
75	.34	20	.3	2	W	0310	0530	0750	0970	3143	4143	5143
75	.41	10	.3	2	X	2008	2108	2208	2308	3144	4144	5144
75	.50	10	.4	2	X	2009	2109	2209	2309	3145	4145	5145
75	.50	20	.4	2	X	2010	2110	2210	2310	3146	4146	5146
75	.60	10	.4	4	X	2011	2111	2211	2311	3147	4147	5147

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STYLE CSR91
NON-POLAR

Rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage) (max) +25°C	Dissipation factor (max) +25°C	Case size	Dash number: Failure rate level for (%1,000 hrs) M 1.0	P 0.1	R 0.01	S 0.001	B 0.01	C 0.01	D 0.001
Volts,NP	µF	Percent	µA	Percent								
75	.75	10	.6	4	X	2012	2112	2212	2312	3148	4148	5148
75	.75	20	.6	4	X	2013	2113	2213	2313	3149	4149	5149
75	.90	10	.7	4	X	2014	2114	2214	2314	3150	4150	5150
75	1.1	10	.8	4	X	2015	2115	2215	2315	3151	4151	5151
75	1.1	20	.8	4	X	2016	2116	2216	2316	3152	4152	5152
75	1.3	10	1.0	4	X	2017	2117	2217	2317	3153	4153	5153
75	1.6	10	1.2	4	X	0311	0531	0751	0971	3154	4154	5154
75	1.6	20	1.2	4	X	0312	0532	0752	0972	3155	4155	5155
75	1.9	10	1.5	4	X	0313	0533	0753	0973	3156	4156	5156
75	2.3	10	3.0	4	Y	2003	2103	2203	2303	3157	4157	5157
75	2.3	20	3.0	4	Y	2004	2104	2204	2304	3158	4158	5158
75	2.8	10	3.0	6	Y	2005	2105	2205	2305	3159	4159	5159
75	3.4	10	5.0	6	Y	2006	2106	2206	2306	3160	4160	5160
75	3.4	20	5.0	6	Y	2007	2107	2207	2307	3161	4161	5161
75	4.1	10	5.0	6	Y	0314	0534	0754	0974	3162	4162	5162
75	5.0	10	5.0	6	Y	0315	0535	0755	0975	3163	4163	5163
75	5.0	20	5.0	6	Y	0316	0536	0756	0976	3164	4164	5164
75	6.0	10	5.0	6	Z	0317	0537	0757	0977	3165	4165	5165
75	7.5	10	7.0	6	Z	0318	0538	0758	0978	3166	4166	5166
75	7.5	20	7.0	6	Z	0319	0539	0759	0979	3167	4167	5167
100	.0023	10	.3	2	W	0320	0540	0760	0980	3168	4168	5168
100	.0023	20	.3	2	W	0321	0541	0761	0981	3169	4169	5169
100	.0028	10	.3	2	W	0322	0542	0762	0982	3170	4170	5170
100	.0034	10	.3	2	W	0323	0543	0763	0983	3171	4171	5171
100	.0034	20	.3	2	W	0324	0544	0764	0984	3172	4172	5172
100	.0041	10	.3	2	W	0325	0545	0765	0985	3173	4173	5173
100	.005	10	.3	2	W	0326	0546	0766	0986	3174	4174	5174
100	.005	20	.3	2	W	0327	0547	0767	0987	3175	4175	5175
100	.006	10	.3	2	W	0328	0548	0768	0988	3176	4176	5176
100	.0075	10	.3	2	W	0329	0549	0769	0989	3177	4177	5177
100	.0075	20	.3	2	W	0330	0550	0770	0990	3178	4178	5178
100	.009	10	.3	2	W	0331	0551	0771	0991	3179	4179	5179
100	.011	10	.3	2	W	0332	0552	0772	0992	3180	4180	5180
100	.011	20	.3	2	W	0333	0553	0773	0993	3181	4181	5181
100	.013	10	.3	2	W	0334	0554	0774	0994	3182	4182	5182
100	.016	10	.3	2	W	0335	0555	0775	0995	3183	4183	5183
100	.016	20	.3	2	W	0336	0556	0776	0996	3184	4184	5184
100	.019	10	.3	2	W	0337	0557	0777	0997	3185	4185	5185
100	.023	10	.3	2	W	0338	0558	0778	0998	3186	4186	5186
100	.023	20	.3	2	W	0339	0559	0779	0999	3187	4187	5187
100	.028	10	.3	2	W	0340	0560	0780	1000	3188	4188	5188
100	.034	10	.3	2	W	0341	0561	0781	1001	3189	4189	5189
100	.034	20	.3	2	W	0342	0562	0782	1002	3190	4190	5190
100	.041	10	.3	2	W	0343	0563	0783	1003	3191	4191	5191
100	.05	10	.3	2	W	0344	0564	0784	1004	3192	4192	5192
100	.05	20	.3	2	W	0345	0565	0785	1005	3193	4193	5193
100	.06	10	.3	2	W	0346	0566	0786	1006	3194	4194	5194
100	.075	10	.3	2	W	0347	0567	0787	1007	3195	4195	5195
100	.075	20	.3	2	W	0348	0568	0788	1008	3196	4196	5196
100	.09	10	.3	2	W	0349	0569	0789	1009	3197	4197	5197
100	.11	10	.3	2	W	0350	0570	0790	1010	3198	4198	5198
100	.11	20	.3	2	W	0351	0571	0791	1011	3199	4199	5199

MIL-C-39003

Military Style Tantalum Capacitors

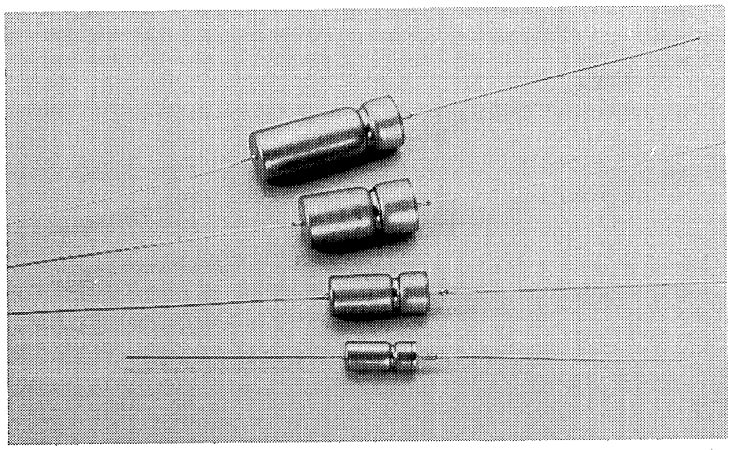
MIL-C-39003/04
STYLE CSR91
NON-POLAR

Rated voltage	Capacitance (nom)	Capacitance tolerance	DC leakage) (max) +25°C	Dissipation factor (max) +25°C	Case size	Dash number Failure rate level for (%1,000 hrs) M 1.0	P 0.1	R 0.01	S 0.001	B 0.01	C 0.01	D 0.001
Volts, NP	μF	Percent	μA	Percent								
100	.13	10	.3	2	W	0352	0572	0792	1012	3200	4200	5200
100	.16	10	.3	2	W	0353	0573	0793	1013	3201	4201	5201
100	.16	20	.3	2	W	0354	0574	0794	1014	3202	4202	5202
100	.19	10	.3	2	W	0355	0575	0795	1015	3203	4203	5203
100	.23	10	.3	2	W	0356	0576	0796	1016	3204	4204	5204
100	.23	20	.3	2	W	0357	0577	0797	1017	3205	4205	5205
100	.28	10	.3	2	W	0358	0578	0798	1018	3206	4206	5206
100	.34	10	.3	2	X	0359	0579	0799	1019	3207	4207	5207
100	.34	20	.3	2	X	0360	0580	0800	1020	3208	4208	5208
100	.41	10	.4	2	X	0361	0581	0801	1021	3209	4209	5209
100	.50	10	.5	2	X	0362	0582	0802	1022	3210	4210	5210
100	.50	20	.5	2	X	0363	0583	0803	1023	3211	4211	5211
100	.60	10	.5	4	X	0364	0584	0804	1024	3212	4212	5212
100	.75	10	.7	4	X	0365	0585	0805	1025	3213	4213	5213
100	.75	20	.7	4	X	0366	0586	0806	1026	3214	4214	5214
100	.90	10	.7	4	X	0367	0587	0807	1027	3215	4215	5215
100	1.1	10	.9	4	X	0368	0588	0808	1028	3216	4216	5216
100	1.1	20	.9	4	X	0369	0589	0809	1029	3217	4217	5217
100	1.3	10	1.1	4	X	0370	0590	0810	1030	3218	4218	5218

SERIES 40AW

Tantalum Case Hermetically Sealed Tubular Tantalum Wet-Slug Capacitor

−55°C to 125°C 1.7 to 1200 μF
4-125 Volts DC



DESCRIPTION

The 40AW capacitor is an all tantalum cased high reliability porous anode type with a glass to tantalum hermetic seal. This type capacitor is primarily suited for military and aerospace application. This capacitor meets or exceeds all requirements of MIL-C-39006/22.

These capacitors are ideal for such functions as filtering, by-passing, coupling and timing in applications where minimum size and weight conditions must be achieved and reverse voltage up to 3VDC, or high ripple currents, are required.

GLASS-TO-TANTALUM SEAL

The glass-to-tantalum seal is one unique feature of the 40AW Series. This seal differs from other hermetic seals in that it is a tantalum feed-through seal. This construction provides a true glass-to-tantalum seal.

TANTALUM CASE

Use of a tantalum case and tantalum powder cathode permits 3VDC reverse capability without harm; and the sintered powder cathode allows higher vibration and shock levels than comparable silver cased devices.

FEATURES

- ALL TANTALUM CONSTRUCTION
- REVERSE VOLTAGE CAPABILITY OF 3VDC
- HIGH RIPPLE CURRENT
- LONG LIFE
- RATED FOR −55°C TO 125°C OPERATION
- EXTENDED RANGE CAPACITANCE AVAILABLE CONSULT FACTORY FOR DETAILS

SERIES 40AW

Industrial Type Tantalum Capacitors

DIMENSIONS

OUTLINE DRAWING

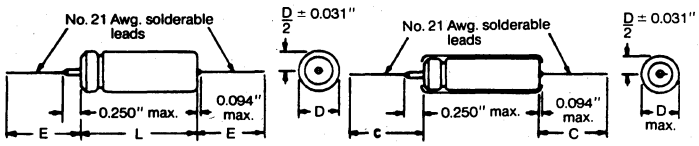


FIG. 1 UNINSULATED FIG.2 INSULATED

OUTLINE DIMENSIONS

Case Code		Dimensions — Inches (mm)				
			Basic case	Insulated case		
Type 40AW	MIL Equiv.	L* +.031 (.79) −.016 (.41)	D ±.016 (.41)	D max	E ±.250 (6.35)	d ±.002 (.05)
A	T1	.453 (11.51)	.188 (4.78)	.219 (5.56)	1.500 (38.10)	.025 (.64)
B	T2	.641 (16.28)	.281 (7.14)	.312 (7.92)	2.250 (57.15)	.025 (.64)
C	T3	.766 (19.46)	.375 (9.53)	.406 (10.31)	2.250 (57.15)	.025 (.64)
D	T4	1.062 (26.97)	.375 (9.53)	.406 (10.31)	2.250 (57.15)	.025 (.64)

*Length of basic case; sleeving shall lap over the ends of the capacitor body. Non-shrinkable sleeving extends .016 inch minimum, .062 inch maximum beyond each end of the case.

STANDARD RATINGS

μF	Case Code	Catalog Number *	Max. DF at 25°C and 120 Hz %	Max. Impedance at −55°C and 120 Hz (Ω)	Max. D-C Leakage Current at 25°C (μA)	Max. D-C Leakage Current at 85°C & 125°C (μA)	Maximum Capacitance Change in Per Cent at −55°C	Maximum Capacitance Change in Per Cent at +85°C	Maximum Capacitance Change in Per Cent at +125°C	Max. RMS Ripple Current AT 40 KHz (mA)
		6 VOLTS D-C AT 85°C, 4 VOLTS D-C AT 125°C								
30	A	40AW306A006KIA	9	100	0.75	1.5	−40	10.5	12	820
68	A	40AW686A006KIA	15	60	0.75	1.5	−40	14	16	960
140	B	40AW147B006KIA	21	40	1.0	2.0	−40	14	16	1200
270	B	40AW277B006KIA	45	25	1.0	2.0	−44	12.5	20	1375
330	C	40AW337C006KIA	36	20	2.0	6.0	−44	14	16	1800
560	C	40AW567C006KIA	55	25	2.0	6.0	−64	17.5	20	1900
1200	D	40AW128D006KIA	90	20	3.0	12.0	−80	25	25	2265
		8 VOLTS D-C AT 85°C, 5 VOLTS D-C AT 125°C								
25	A	40AW256A008KIA	7.5	100	0.75	1.5	−40	10.5	12	820
56	A	40AW566A008KIA	14	59	0.75	1.5	−40	14	16	900
120	B	40AW127B008KIA	20	50	1.0	2.0	−44	17.5	20	1220
220	B	40AW227B008KIA	40	30	1.0	2.0	−44	17.5	20	1370
290	C	40AW297C008KIA	40	25	2.0	6.0	−64	17.5	20	1770
430	C	40AW437C008KIA	46	25	2.0	6.0	−64	17.5	20	1825
850	D	40AW857D008KIA	60	22	3.0	12.0	−80	25	25	2330
		10 VOLTS D-C AT 85°C, 7 VOLTS D-C AT 125°C								
20	A	40AW206A010KIA	6	120	0.75	1.5	−32	10.5	12	820
47	A	40AW476A010KIA	13	90	0.75	1.5	−36	14	16	855
100	B	40AW107B010KIA	15	60	1.0	2.0	−36	16	16	1200
180	B	40AW187B010KIA	33	40	1.0	2.0	−36	14	16	1365
250	C	40AW257C010KIA	30	30	2.0	6.0	−40	14	16	1720
390	C	40AW397C010KIA	44	25	2.0	6.0	−64	17.5	20	1800
750	D	40AW757D010KIA	50	23	3.0	12.0	−80	25	25	2360
		15 VOLTS D-C AT 85°C, 10 VOLTS D-C AT 125°C								
15	A	40AW156A015KIA	5	155	0.75	1.5	−24	10.5	12	780
33	A	40AW336A015KIA	10	90	0.75	1.5	−28	14	16	820
70	B	40AW706B015KIA	13	75	1.0	2.0	−28	14	16	1150
120	B	40AW127B015KIA	25	50	1.0	2.0	−28	17.5	20	1450
170	C	40AW177C015KIA	25	35	2.0	6.0	−32	14	16	1480
270	C	40AW277C015KIA	43	30	2.0	6.0	−56	17.5	20	1740
540	D	40AW547D015KIA	40	23	3.0	12.0	−80	25	25	2300
		25 VOLTS D-C AT 85°C, 15 VOLTS D-C AT 125°C								
10	A	40AW106A025KIA	4	220	0.75	1.5	−16	8	9	715
22	A	40AW226A025KIA	7	140	0.75	1.5	−20	10.5	12	825
50	B	40AW506B025KIA	11	70	1.0	2.0	−28	13	15	1130
100	B	40AW107B025KIA	21	50	1.0	2.0	−28	13	15	1435
120	C	40AW127C025KIA	25	38	2.0	6.0	−32	13	15	1450
180	C	40AW187C025KIA	28	32	2.0	6.0	−48	13	15	1525
350	D	40AW357D025KIA	35	24	3.0	12.0	−70	25	25	1970

SERIES 40AW

Industrial Type Tantalum Capacitors

μF	Case Code	Catalog Number *	Max. DF at 25°C and 120 Hz %	Max. Impedance at −55°C and 120 Hz (Ω)	Max. D-C Leakage Current at 25°C (μA)	Max. D-C Leakage Current at 85°C & 125°C (μA)	Maximum Capacitance Change in Per Cent at −55°C	Maximum Capacitance Change in Per Cent at +85°C	Maximum Capacitance Change in Per Cent at +125°C	Max. RMS Ripple Current At 40 KHz (mA)
30 VOLTS D-C AT 85°C, 20 VOLTS D-C AT 125°C										
8	A	40AW805A030KIA	4	275	0.75	1.5	−16	8	12	640
15	A	40AW156A030KIA	7	175	0.75	1.5	−20	10.5	12	780
40	B	40AW406B030KIA	12	65	1.0	2.0	−24	10.5	12	1120
68	B	40AW686B030KIA	15	60	1.0	2.0	−24	13	15	1285
100	C	40AW107C030KIA	17	40	2.0	6.0	−28	10.5	12	1450
150	C	40AW157C030KIA	23	35	2.0	6.0	−48	13	15	1525
300	D	40AW307D030KIA	31	25	3.0	12.0	−60	25	25	1950
50 VOLTS D-C AT 85°C, 30 VOLTS D-C AT 125°C										
5	A	40AW505A050KIA	3	400	0.75	2.0	−16	5	6	580
10	A	40AW106A050KIA	5	250	0.75	2.0	−24	8	9	715
25	B	40AW256B050KIA	9	95	1.0	3.0	−20	10.5	12	1005
47	B	40AW476B050KIA	13	70	1.0	3.0	−28	13	15	1155
60	C	40AW606C050KIA	13	45	2.0	7.0	−16	10.5	12	1335
82	C	40AW826C050KIA	15	45	2.0	7.0	−32	13	15	1400
160	D	40AW167D050KIA	17	27	4.0	16.0	−50	25	25	1900
60 VOLTS D-C AT 85°C, 40 VOLTS D-C AT 125°C										
4	A	40AW405A060KIA	2.8	550	0.75	2.0	−16	5	6	525
8.2	A	40AW825A060KIA	4	275	0.75	2.0	−24	8	9	625
20	B	40AW206B060KIA	7	105	1.0	4.0	−16	8	9	930
39	B	40AW396B060KIA	12	90	1.0	4.0	−28	10.5	15	1110
50	C	40AW506C060KIA	11	50	2.0	7.0	−16	10.5	12	1330
68	C	40AW686C060KIA	13	50	2.0	7.0	−32	10.5	15	1365
140	D	40AW147D060KIA	16	28	4.0	16.0	−40	20	20	1850
75 VOLTS D-C at 85°C, 50 VOLTS D-C AT 125°C										
3.5	A	40AW355A075KIA	2.5	650	1.0	2.0	−16	5	6	525
6.8	A	40AW685A075KIA	3.5	300	1.0	2.0	−20	8	9	610
15	B	40AW156B075KIA	6	150	1.0	4.0	−16	8	9	890
33	B	40AW336B075KIA	10	90	1.0	4.0	−24	10.5	15	1000
40	C	40AW406C075KIA	9	60	2.0	8.0	−16	10.5	12	1250
56	C	40AW566C075KIA	11	60	2.0	8.0	−28	10.5	15	1335
110	D	40AW117D075KIA	12	29	4.0	20.0	−35	20	20	1850
100 VOLTS D-C AT 85°C, 65 VOLTS D-C AT 125°C										
2.5	A	40AW255A100KIA	2	950	1.0	2.0	−16	7	8	505
4.7	A	40AW475A100KIA	3	500	1.0	2.0	−16	7	8	565
11	B	40AW116B100KIA	5	200	1.0	4.0	−16	8	8	835
22	B	40AW226B100KIA	8	100	1.0	4.0	−16	8	8	965
30	C	40AW306C100KIA	7.5	80	2.0	8.0	−16	8	8	1240
43	C	40AW436C100KIA	8.5	70	2.0	8.0	−20	8	8	1335
86	D	40AW866D100KIA	10	30	4.0	20.0	−25	15	15	1800
125 VOLTS D-C AT 85°C, 85 VOLTS D-C AT 125°C										
1.7	A	40AW175A125KIA	2	1250	1.0	2.0	−16	7	8	415
3.6	A	40AW365A125KIA	3	600	1.0	2.0	−16	7	8	415
9	B	40AW905B125KIA	5	240	1.0	4.0	−16	7	8	755
14	B	40AW145B125KIA	6	167	1.0	4.0	−16	7	8	860
18	C	40AW186C125KIA	5	129	2.0	8.0	−16	7	8	1130
25	C	40AW256C125KIA	6	93	2.0	8.0	−16	7	8	1200
56	D	40AW566D125KIA	6.5	32	4.0	20.0	−25	15	15	1800

*Catalog numbers listed are for 2=10% capacitance tolerance and are for insulated capacitors.

SERIES 40AW

Industrial Type Tantalum Capacitors

PERFORMANCE CHARACTERISTICS

1. Operating Temperature Range. These capacitors are designed to operate over a temperature range of −55°C to +125°C at the appropriate voltage rating given in Para. 17.

2. DC Working Voltage. The dc working voltage is the maximum operating voltage for continuous duty at the rated temperature.

Up to 85°C	125°C
6	4
8	5
10	7
15	10
25	15
30	20
50	30
60	40
75	50
100	65
125	85

3. DC Leakage Current. Measurements shall be made at the applicable rated working voltage at 25°C ±5°C through application of a steady source of power, such as a regulated power supply. A current limiting resistor of 1000 ohms shall be connected in series with each capacitor under test. Rated DC working voltage shall be applied for a maximum period of 5 minutes before making leaking current measurements.

3.1 The maximum leakage current values are as listed in the standard ratings table.

4. Capacitance and Tolerance. The capacitance of all capacitors shall be within the specified tolerance limits of the nominal rating.

4.1 Measurements shall be made by the bridge method at or referred to a frequency of 120 Hz at a temperature of +25°C. The maximum voltage applied to the capacitors during measurements shall be 1 volt rms. Measurement accuracy of the bridge shall be within ±2%.

5. Dissipation Factor. Measurements are made with a polarized capacitance bridge at a frequency of 120 Hz at a temperature of +25°C.

6. Capacitance Change with Temperature. Capacitance change with temperature shall not exceed the limits given in the standard ratings table.

7. Low Temperature Impedance. The impedance of any capacitor at −55°C at 120 Hz shall not exceed the values given in the standard ratings table.

8. Mechanical Shock. Capacitors shall withstand a shock of 100g when tested in accordance with method 213 of MIL-STD-202, test condition I.

8.1 Following the shock test, capacitors shall be examined for evidence of mechanical damage and leakage of electrolyte.

9. High Frequency Vibration. Capacitors shall withstand vibration from 10 to 2000 Hz at 20g without internal damage when tested in accordance with MIL-STD-202, method 204, test condition D. Electrical measurements made while under these conditions shall show no intermittent contacts or open or short circuiting.

9.1 Following the vibration test, the dc leakage current shall not exceed 125% of the original requirement; the capacitance shall change not more than ±5% from the initial measured value and the DF shall not exceed 115% of initial requirement.

9.2 In addition, there shall be no evidence of mechanical damage, obliteration of marking, or leakage of electrolyte.

10. Pull Test. Leads shall withstand a tensile stress of 3 lbs. for 30 seconds applied axially in accordance with MIL-STD-202, method 211A, test condition A.

11. Lead Bend Test. Leads shall meet the bend test specified in MIL-STD-202, method 211A, test condition C except that the number of bends shall be 4.

12. Surge Voltage. The surge voltage rating is the maximum voltage to which the capacitors shall be subjected under any conditions. This includes transients and peak ripple at the highest line voltage. The surge voltage of these capacitors is 115% of rated dc working voltage.

12.1 The capacitors shall withstand the surge voltage applied through a 1000 ohm ±10% resistor in series with the capacitor and voltage source at the rate of ½ minute on, 5½ minutes off, for 1000 successive test cycles at 85°C.

12.2 Following the surge voltage test, there shall be no intermittent contacts, open or short circuiting, mechanical damage, or leakage of electrolyte.

13. Moisture Resistance. Capacitors shall be subjected to the moisture resistance cycling test specified in MIL-STD-202, method 106.

PERFORMANCE CHARACTERISTICS

13.1 Following the moisture resistance test, the dc leakage current shall not exceed 125% of the original requirement; the capacitance shall change not more than ±8% from the initial measured value and the DF shall not exceed 115% of initial requirement.

14. Seal Test. Capacitors shall be tested in accordance with MIL-STD-202, method 112, test condition C, procedure IIIa, 10^{-8} atm cc/sec followed by test condition A.

15. Reverse Voltage Test. Capacitors shall be subjected to a dc potential of 3 volts, applied in the reverse polarity direction, for 125 ±10 hours. The ambient temperature during the test shall be +85°C. Capacitors shall be maintained at +85°C and dc rated voltage shall be applied in the forward direction for an additional period of 125 · 10 hours.

15.1 Following the reverse voltage testing, the dc leakage current shall not exceed 125% of the original requirement; the capacitance shall be within the initial value specified and the DF shall not exceed the original requirements.

16. Ripple Life Test at +85°C. Capacitors shall be tested in accordance with MIL-C-39006. a. Operating Conditions. This test shall be run at a frequency of 40 KHz ±2 KHz and at the rms ripple current levels specified in the standard ratings table. b. Applied dc voltage plus the peak a-c voltage shall not exceed the rated voltage of the capacitor.

16.1 When tested as specified above, capacitors shall meet the following requirements: a. The dc leakage current at +25°C and at +85°C shall not exceed the original requirements. b. The capacitance shall not change more than ±10% from the initial measured value. c. The DF shall not exceed the original requirements. d. Visual examination. There shall be no damage, obliteration of marking, or leakage of electrolyte.

17. Life Test. Capacitors are capable of withstanding life test at the following conditions:

Temperature	Hrs.	% Rated Voltage
+85°C	2000	100*
+125°C	2000	100*

*Refer to the standard ratings table.

17.1 After life test and for those tested at +85 and/or +125°C, shall not exceed the initial requirement; the DF shall not exceed the initial requirement; and the capacitance value shall not change more than 10% from the initial measurement.

18. Barometric Pressure (reduced). Capacitors shall be tested in accordance with MIL-STD-202, method 105, test condition E. Rated dc voltage shall be applied for 1 minute ±5 seconds.

18.1 Following Barometric Pressure test, capacitors shall be visually examined for harmful deformation of the case, mechanical damage, obliteration of marking, leakage of electrolyte and indications of flashover and breakdown.

19. Thermal Shock. Capacitors shall be subjected to 300 cycles in accordance with MIL-STD-202, method 107 and MIL-C-39006.

19.1 Following the thermal shock test, dc leakage current shall not exceed 200% of the initial requirement, capacitance shall not have changed more than ±5% from initial measured value and DF shall not exceed 115% of initial specified value.

20. Marking. Capacitors shall be marked with M/C, type number (40AW), rated capacitance and tolerance, rated dc working voltage and the standard EIA date code of manufacture.

21. Polarity. Polarity shall be indicated by plus (+) signs adjacent to the positive terminal.

22. Insulation. When an insulated device is required, the insulating material will be MYLAR.

SERIES 40AW

Industrial Type Tantalum Capacitors

RIPPLE CURRENT MULTIPLIERS VS. FREQUENCY, TEMPERATURE & APPLIED PEAK VOLTAGE

Frequency of applied ripple current / Ambient still air	120 Hz Temp °C				800 Hz Temp °C				1 kHz Temp °C				10 kHz Temp °C				40 kHz Temp °C				100 kHz Temp °C			
% of 85°C rated peak voltage	≤55°	85°	105°	125°	≤55°	85°	105°	125°	≤55°	85°	105°	125°	≤55°	85°	105°	125°	≤55°	85°	105°	125°	≤55°	85°	105°	125°
100%	.60	.39	–	–	.71	.43	–	–	.72	.45	–	–	.88	.55	–	–	1.0	.63	–	–	1.1	.69	–	–
90%	.60	.46	–	–	.71	.55	–	–	.72	.55	–	–	.88	.67	–	–	1.0	.77	–	–	1.1	.85	–	–
80%	.60	.52	.35	–	.71	.62	.42	–	.72	.62	.42	–	.88	.76	.52	–	1.0	.87	.59	–	1.1	.96	.65	–
70%	.60	58	.44	–	.71	.69	.52	–	.72	.70	.52	–	.88	.85	.64	–	1.0	.97	.73	–	1.1	1.07	.80	–
≤66-2/3%	.60	.60	.46	.27	.71	.71	.55	.32	.72	.72	.55	32	.88	.88	.68	.40	1.0	1.0	.77	.45	1.1	1.1	.85	50

NOTES:
1. At 125°C the rated voltage of the capacitors decreases to 66-2/3% of the 85°C rated voltage.
2. The peak of the applied ac ripple voltage plus the applied dc voltage must not exceed the dc voltage rating of the capacitor either forward or reverse.
3. The ripple current listed in table I represents a rating calculated using a maximum internal temperature rise (△T) of 50°C at 40 kHz at 85°C ambient with a maximum peak rated voltage of 66-2/3% of the 85°C peak voltage rating.
4. The maximum allowable internal temperature rise (△T) decreases linearly to a calculated 10°C rise at 125°C ambient.
5. The internal temperature rise is directly proprotional to the ESR of the capacitor, and ESR increases with decreasing frequency.

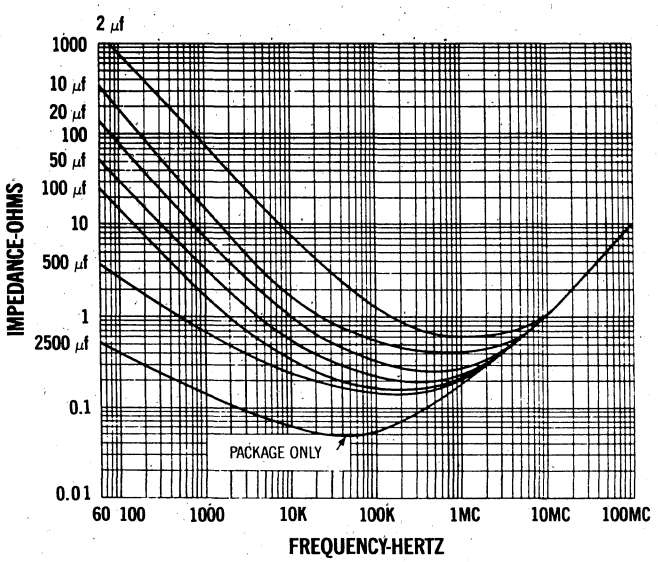
TYPICAL CURVES

Impedance

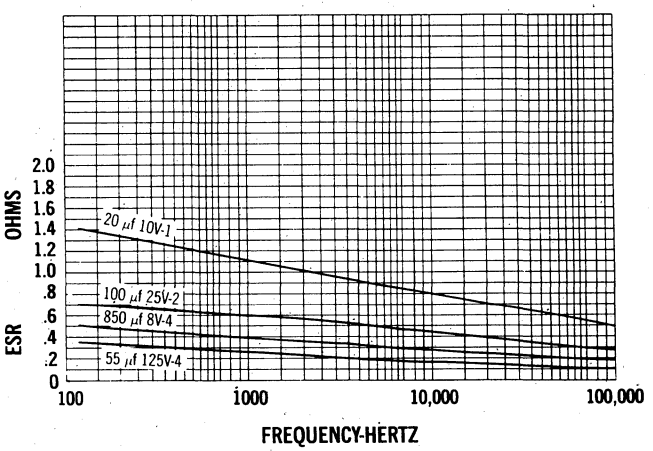
A. Impedance in ohms at 25° C may be read directly from Curve 1.

B. To obtain impedance at temperatures other than 25° C, multiply the impedance from Curve 5 by a correction factor from Curve 2, 3, or 4.

IMPEDANCE FOR TANTALUM WET SLUGS AT 25°C NO. 1



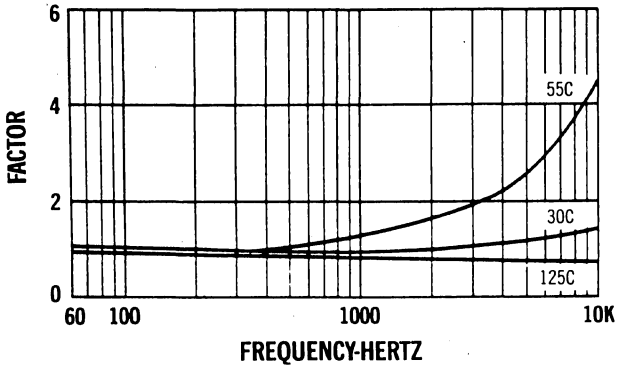
TYPICAL ESR VS. FREQUENCY AT 25°C



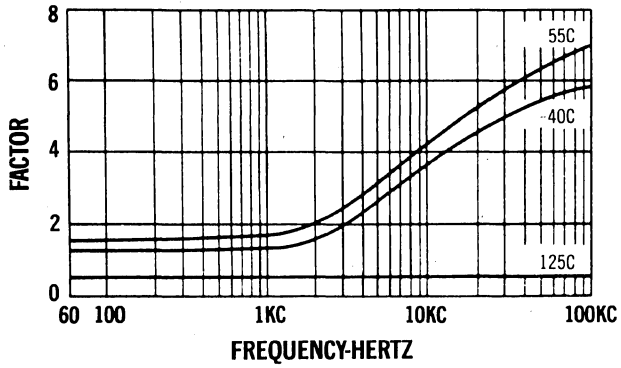
SERIES 40AW

Industrial Type Tantalum Capacitors

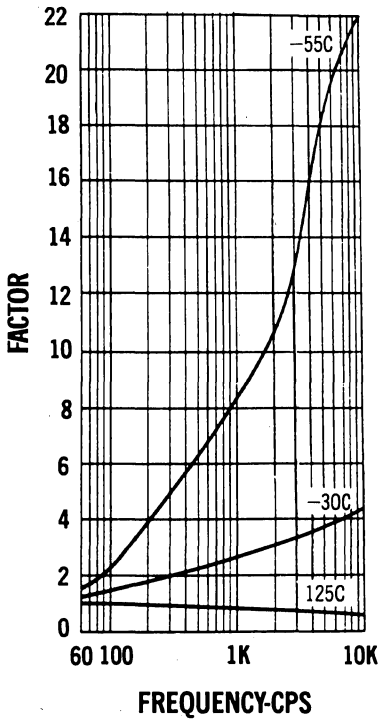
WET SLUG IMPEDANCE CORRECTION FACTORS
UP TO 5 μf
NO. 2



WET SLUG IMPEDANCE CORRECTION FACTORS
FOR CAPACITANCE 5-100 μf
NO. 3



WET SLUG IMPEDANCE CORRECTION FACTORS
FOR CAPACITANCE 100 μf
AND ABOVE INCLUDING PACKAGES
NO. 4



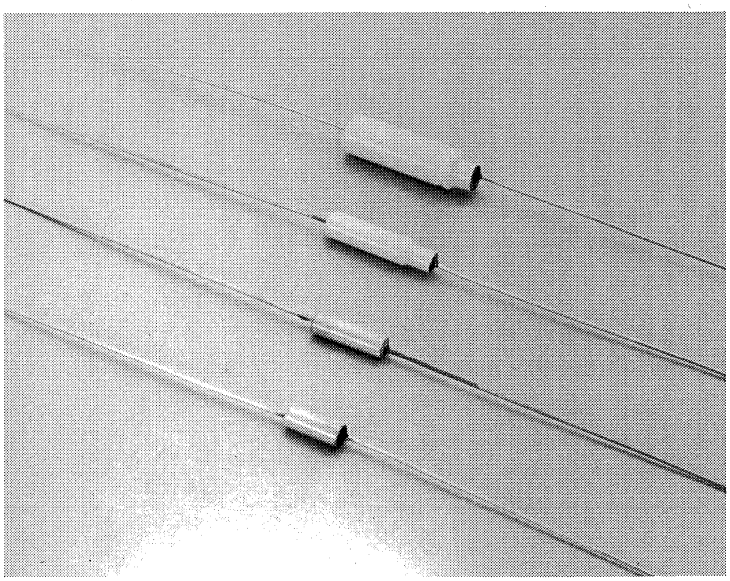
HOW TO SPECIFY

Series 40AW can be specified using the following designation:

4	0	A	W	225	A	075	K	I	A
Tantalum Capacitor	Axial Lead	Series	Wet Slug	Capacitance in (pF) First two digits are significant figures. Third digit numbers of zeros to follow 225 = 2.2μF 226 = 22μF	Case Size	Voltage Rating @ 85°C	Capacitance Tolerance J = ±5% K = ±10% M = ±20%	O = Unsleeved I = Sleeved	Industrial

SERIES 40CW

Miniature Tubular Wet Tantalum Capacitor



DESCRIPTION

40CW Type Tantalum Capacitors are the miniature versions of the popular 40LW Type, Tubular Wet Tantalum Capacitors which have been proven through years of production and use in the nation's most sophisticated space and weapons systems. The proven seal integrity of the 40CW Type, combined with its long life and superior electrical characteristics make it ideal for miniaturized printed circuit applications. These capacitors are supplied with an insulated case without additional cost to the customer.

FEATURES

- 85°C OPERATION
- INSULATED CASE
- PROVEN SEAL INTEGRITY
- FOUR STANDARD CASE SIZES
- HIGH CAPACITANCE
- NO EXTERNAL WELDS
- SOLDERABLE AND WELDABLE LEADS
- LOW D.C. LEAKAGE CURRENT

SERIES 40CW

Industrial Type Tantalum Capacitors

POLARITY

M/C 40CW Type are polar devices for use in applications where no voltage reversals occur.

OPERATING TEMPERATURE RANGE

M/C 40CW Tantalum Capacitors are designed to operate over a temperature range of −55°C to +85°C without derating.

DC WORKING VOLTAGE

The dc working voltage is the maximum operating voltage for continuous duty at the rated temperature.

CAPACITANCE

Capacitance measurements shall be made a 120 Hz with 1.0 vrms max and 2.2 vdc max applied at a temperature of 25°C.

The capacitance shall be within the specified tolerance limits of the nominal rating.

DISSIPATION FACTOR

Measurements are made with a polarized capacitance bridge at a frequency of 120 Hz at a temperature of +25°C.

The dissipation factor shall not exceed the maximum value in percent listed in the table for each capacitor.

LEAKAGE CURRENT

Measurements shall be made at rated working voltage at 25°C ±5° with an application of a steady source of power, such as a regulated power supply with a 1000 ohm resistance to limit the charging current, connected in series with each capacitor under test. Rated working voltage shall be applied to capacitors for 5 minutes before making leakage current measurements.

The maximum leakage current in microamps (uA) for any capacitor shall not exceed that given in the table.

The D.C. leakage current at 85°C shall not exceed five times the 25°C limit.

CAPACITANCE VS. TEMPERATURE

The 40CW type capacitors change typically 1500ppm/°C over the temperature range from −55°C to +85°C.

RIPPLE VOLTAGE

The A.C. Ripple Voltage at 120 Hz shall not exceed 5% of rated working voltage and applications of other frequencies shall be limited so as to produce the same heating effect as that allowed at 120 Hz.

The sum of the peak A.C. ripple voltage and the D.C. bias voltage shall not exceed the rated working voltage of the capacitor. A D.C. polarizing voltage of sufficient magnitude to prevent polarity reversal caused by A.C. ripple must be applied.

SURGE VOLTAGE

The surge dc rating is the maximum voltage to which the capacitors should be subjected under any condition. This includes transients and peak ripple at the highest line voltage. The surge voltage of all M/C 40CW Type Tantalum Capacitors is 115% of rated dc working voltage.

Capacitors shall withstand the surge voltage applied for 1000 successive test cycles at 85°C. Each cycle shall consist of the application of the test potential for ½ minute on, followed by 4½ minutes off. The surge voltage shall be applied through a 1000 ohm ±10% resistor in series with the capacitor and the source of voltage.

Following the surge test, the capacitance at 25°C shall not have changed by more than ±10%, the dissipation factor will not exceed the value shown in the standard ratings table, and the leakage current will not exceed the requirements of paragraph 6.

LIFE TEST

Capacitors are capable of withstanding a 1000 hour life test at a temperature of 85°C at rated dc working voltage.

After the life test, the leakage current shall not be in excess of the original requirement, the equivalent series resistance shall not be more than 130% of the initial requirement, and the capacitance value shall not have changed by more than ±20% value. There shall not be more than 1 failure permitted in 12 units tested.

HIGH FREQUENCY VIBRATION

Capacitors shall withstand vibration from 10 to 2000 cycles at 15g without internal damage. Electrical measurements made while under these conditions shall show no intermittent open or short circuit.

Capacitors shall be securely fastened by means of suitable component clips or brackets.

SHOCK

Capacitors shall withstand three blows of 30G, 11 millisecond duration in each of 6 planes in accordance with MIL-STD-202 Method 205 condition C.

PULL TEST

Leads shall withstand a tensile stress of 3 lbs. for 30 seconds applied axially.

LEAD BEND TEST

Leads shall meet the bend test described in section 4.6.13.2 of MIL-C-3965D.

MOISTURE RESISTANCE

Capacitors shall withstand the moisture resistance cycling test specified in MIL-STD-202, Method 106A, without departure from the original limits of capacitance, equivalent series resistance, and leakage current.

SHELF TEST

Capacitors shall withstand a 250 hour shelf test at 85°C with no voltage applied.

Following the shelf test, the capacitance shall not have changed by more than ±10% from the initial value and the leakage current shall meet the original requirements.

TEMPERATURE AND IMMERSION

Capacitors shall withstand the thermal shock and immersion tests specified in MIL-STD-202, Method 107, test condition A and Method 104A, test condition B respectively, without departure from the original limits for capacitance, equivalent series resistance, and leakage current. There shall be no electrolyte leakage as evidenced by examination with thymol blue indicator.

MARKING

Capacitors will be marked with M/C type (CW), rated capacitance and tolerance, rated DC voltage and date code where space permits.

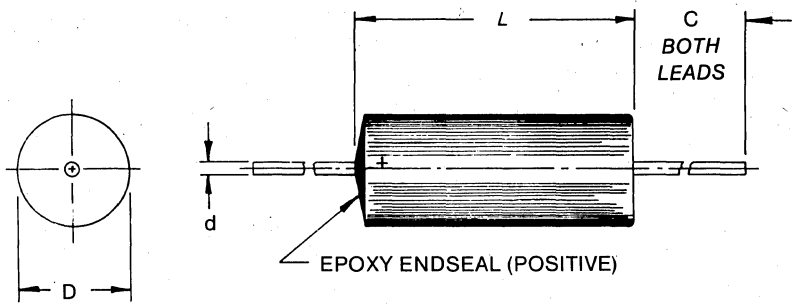
SERIES 40CW

Industrial Type Tantalum Capacitors

PART NUMBER SYSTEM

EXAMPLE 4 O C W 335 A 060 K 1 A

- 4 — TANTALUM CAPACITOR
- O — AXIAL LEAD
- C — SERIES
- W — WET ELECTROLYTE
- 335 — CAPACITANCE IN PICOFARADS
  First two digits are significant figures.
  Third digit number of zeros to follow:
  335 = 3.5 mf
  336 = 33 mf
- A — CASE SIZE
- 060 — VOLTAGE RATING AT 85 C
- K — CAPACITANCE TOLERANCE
  J = ±5% K = ±10% M = ±20%
- 1 — SLEEVED
- A — INDUSTRIAL



DIMENSIONS FOR 40CW-TYPE, INSULATED-MYLAR SLEEVE

Case Size	"L" Max. inches (mm)	"D" Max. inches (mm)	"C" inches (mm)	Lead Dia. inches (mm)	Approx. Weight (Grams)	Volume Cu. In. (CC)
A	0.312 (7.9)	0.115 (2.9)	2.00 (50.8)	.020 (0.5)	0.401	.0032 (.05)
B	0.400 (10.2)	0.115 (2.9)	2.00 (50.8)	.020 (0.5)	0.486	.0042 (.07)
C	0.600 (15.0)	0.145 (3.7)	2.00 (50.8)	.020 (0.5)	0.996	.0097 (.16)
D	0.778 (19.7)	0.225 (5.7)	2.00 (50.8)	.020 (0.5)	2.915	.0316 (.52)

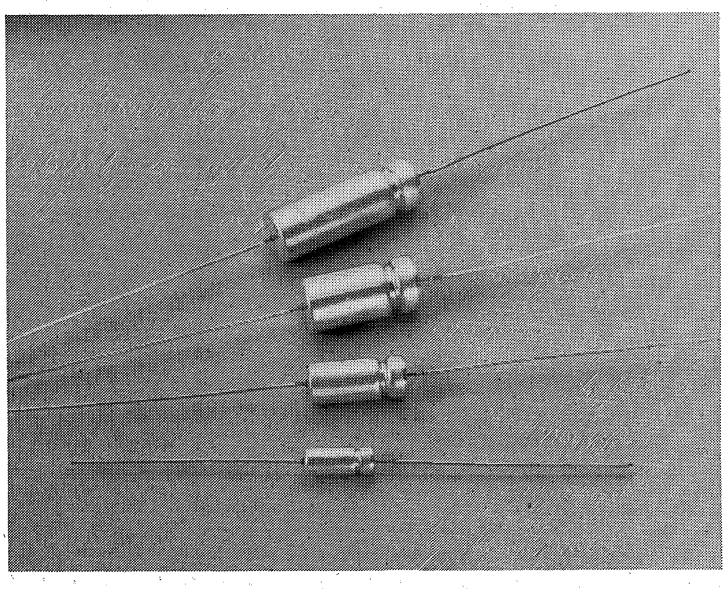
SERIES 40CW

Industrial Type Tantalum Capacitors

Case Size	Capacitance uF	WVDC 85°C	Surge 85°C	Max. Impedance -55°C ohms	Max. D.C. Leakage 25°C uA	Max. D.C. Leakage 85°C uA	Max. D.F. % 25°C	Max. D.F. % 85°C	% Cap. Change from 25°C -55°C	% Cap. Change from 25°C 85°C	Part Number ±10%
A	22	6	7	250	1.0	5.0	20	20	-45	+15	40CW226A006K1A
B	50	6	7	120	1.0	6.0	24	24	-60	+15	40CW506B006K1A
C	180	6	7	80	1.5	7.5	26	25	-45	+15	40CW187C006K1A
D	450	6	7	65	2.0	10	35	35	-50	+15	40CW457D006K1A
A	15	10	12	300	1.0	5.0	18	18	-40	+15	40CW156A010K1A
B	33	10	12	160	1.0	6.0	21	21	-55	+15	40CW336B010K1A
C	120	10	12	120	1.5	7.5	24	24	-40	+15	40CW127C010K1A
D	300	10	12	75	2.0	10	26	26	-45	+15	40CW307D010K1A
A	10	15	17	400	1.0	5.0	16	16	-35	+15	40CW106A015K1A
B	22	15	17	200	1.0	6.0	18	18	-45	+15	40CW226B015K1A
C	80	15	17	85	1.5	7.5	21	21	-40	+15	40CW806C015K1A
D	200	15	17	80	2.0	10	21	21	-40	+15	40CW207D015K1A
A	6.8	20	23	480	1.0	5.0	14	14	-35	+15	40CW685A020K1A
B	15	20	23	250	1.0	6.0	16	16	-40	+15	40CW156B020K1A
C	60	20	23	100	1.5	7.5	18	16	-35	+15	40CW606C020K1A
D	180	20	23	80	2.0	10	20	20	-35	+15	40CW187D020K1A
A	6	30	35	480	1.0	5.0	12	12	-35	+15	40CW605A030K1A
B	10	30	35	400	1.0	6.0	14	14	-35	+15	40CW106B030K1A
C	45	30	35	120	1.5	7.5	18	16	-35	+15	40CW456C030K1A
D	120	30	35	80	2.0	10	21	21	-35	+15	40CW127D030K1A
A	4	50	58	850	1.0	5.0	10	10	-30	+15	40CW405A050K1A
B	6.8	50	58	480	1.0	6.0	14	12	-35	+15	40CW685B050K1A
C	30	50	58	150	1.5	7.5	14	12	-30	+15	40CW306C050K1A
D	78	50	58	80	2.0	10	14	14	-30	+15	40CW786D050K1A
A	3.3	60	70	950	1.0	5.0	10	10	-30	+15	40CW335A060K1A
B	6	60	70	480	1.0	6.0	14	12	-35	+15	40CW605B060K1A
C	22	60	70	180	1.5	7.5	18	14	-30	+15	40CW226C060K1A
D	60	60	70	90	2.0	10	14	14	-30	+15	40CW606D060K1A

SERIES 40EW

Extended Range Tubular Wet Tantalum Capacitor



DESCRIPTION

40EW Type Tantalum Capacitors are uniquely designed for 125°C applications with a leak proof construction that surpasses all military specifications. The M/C 40EW Type capacitor offers extreme savings in both weight and space as compared with the conventional flange type construction. Savings up to 30% in weight and 40% in volume are available.

M/C research and development facilities, coupled with years of manufacturing experience, have resulted in these advantages, together with extremely low leakage current. These capacitors are normally supplied with an insulated case, without additional cost, for added protection in compact circuits.

FEATURES

- EXTENDED RANGE
- TUBULAR-POLAR
- THIXOTROPIC ELECTROLYTE
- SINTERED ANODE
- TANTALUM CAPACITOR
- +125°C OPERATION
- ELASTOMER SEAL
- HIGHEST CAPACITANCE PER UNIT VOLUME

SERIES 40EW

Industrial Type Tantalum Capacitors

OPERATING TEMPERATURE RANGE

M/C 40EW Type Tantalum Capacitors are designed to operate over a temperature range of −55°C to +85°C without derating. The units must be derated @ 125°C.

DC WORKING VOLTAGE

The dc working voltage is the maximum operating voltage for continuous duty at the rated temperature.

SURGE VOLTAGE

The surge dc rating is the maximum voltage to which the capacitors should be subjected under any conditions. This includes transients and peak ripple at the highest line voltage. The surge voltage of all 40EW Type Tantalum Capacitors is 115% of rated dc working voltage.

The capacitors shall withstand the surge test voltage applied through a 1000 ohm ±10% resistor in series with the capacitor and voltage source at the rate of ½ minute on, 4½ minutes off, for 1000 successive test cycles at 125°C.

Following the surge test, the capacitance at 25°C shall not have changed by more than ±10%, the equivalent series resistance will not exceed the value shown in the tables for each capacitor, and the leakage current will not exceed the requirements of paragraph 7. Not more than 1 failure for any of the above reasons shall be allowed for any 12 samples tested.

CAPACITANCE

Capacitance measurements shall be made at or referred to 120 Hz and a temperature of +25°C.

The capacitance of all capacitors shall be within the specified tolerance limits of the nominal rating.

CAPACITANCE CHANGE WITH TEMPERATURE

Capacitance change with temperature shall not exceed the limits given in the tables for each capacitor.

DISSIPATION FACTOR

Measurements shall be made by the bridge method at or referred to a frequency of 120 Hz at a temperature of +25°C.

The Dissipation Factor shall not exceed the maximum value in percent listed in the tables for each capacitor.

LEAKAGE CURRENT

Measurements shall be made at rated working voltage with an application of a steady source of power, such as a regulated power supply with a 1000 ohm resistance to limit the charging current, connected in series with each capacitor under test. Rated working voltage shall be applied to capacitors for 5 minutes before making leakage current measurements.

The maximum leakage current for any capacitor shall not exceed the maximum value in microamperes listed in the tables.

LOW TEMPERATURE IMPEDANCE

The impedance of any capacitor, at −55°C and 120 Hz, shall not exceed the values given in the tables for each capacitor.

LIFE TEST

Capacitors are capable of withstanding a 2000 hour life test at a temperature of 125°C at rated dc working voltage.

After life test, the leakage current shall not be in excess of the original requirements, the equivalent series resistance shall not be more than 130% of the initial requirement, and the capacitance value shall not have increased by more than 25% or decreased by more than 15% from the initial value.

Not more than 1 failure shall be permitted in 12 units tested.

LOW FREQUENCY VIBRATION

Capacitors shall withstand a simple harmonic motion having an amplitude of 0.03" (max. total excursion 0.06") with the frequency being varied uniformly between the approximate limits of 10 to 55 Hz and ratings to be transversed in approximately 1 minute for a total of 1½ hours.

After vibration test, capacitors shall meet the original requirements for capacitance tolerance, equivalent series resistance, and leakage current.

HIGH FREQUENCY VIBRATION

Capacitors shall withstand vibration from 10 to 2000 Hz at 15g without internal damage. Electrical measurements made while under these conditions shall show no intermittent open or short circuit.

Capacitors shall be securely fastened by means of suitable component clips or brackets.

PULL TEST

Leads shall withstand a tensile stress of 3 lbs. for 30 seconds applied axially.

LEAD BEND TEST

Leads shall meet the bend test described in MIL-C-39006.

MOISTURE RESISTANCE

Capacitors shall withstand the moisture resistance cycling test specified in MIL Standard 202C, method 106A, without departure from the original limits of capacitance, equivalent series resistance, and leakage current.

SHELF TEST

Capacitors shall withstand a 2000 hour shelf test at 125°C with no voltage applied.

Following the shelf test, the capacitance shall not have changed by more than ±10% from the initial value and the leakage current and equivalent series resistance shall not exceed the values given in the tables for each capacitor.

THERMAL SHOCK

Capacitors shall be tested in accordance with method 107 of MIL-STD-202. The following details and exception shall apply:

(a) Conditioning prior to first cycle—15 minutes at room ambient conditions.
(b) Test condition letter—B.
(c) Measurements before and after cycling—Not applicable.

REDUCED PRESSURE

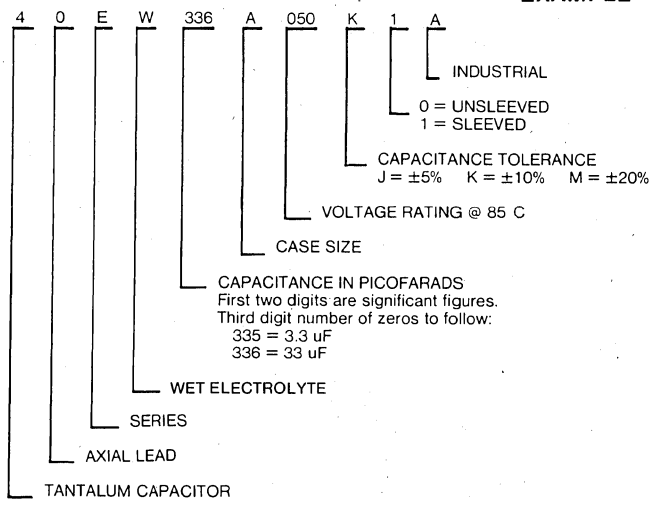
Capacitors shall be stabilized at a reduced atmospheric pressure of $1.69X10^{-1}$ Torr. for a period of 5 minutes. Rated dc voltage shall be applied for 1 minute. Capacitors shall not flash over nor shall end seals be damaged by this test nor should the capacitors be electrically effected insofar as capacitance, equivalent series resistance, or leakage current is concerned.

MARKING

Capacitors will be marked with M/C type (CW), rated capacitance and tolerance, rated DC voltage and date code where space permits.

PART NUMBER SYSTEM

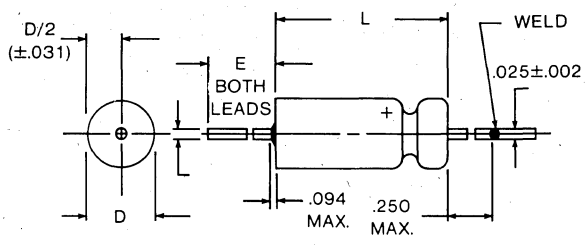
EXAMPLE



SERIES 40EW

Industrial Type Tantalum Capacitors

OUTLINE DRAWING AND DIMENSIONS



Dimensions — Inches (mm)

Case Size	L* + .031 (0.79) - .016 (0.41)	D ±.016 (0.41) Uninsulated	D Max Insulated	E ±.250 (6.35)
A	.453 (11.51)	.188 (4.78)	.219 (5.56)	1.500 (38.10)
B	.641 (16.28)	.281 (7.14)	.312 (7.92)	2.250 (57.15)
C	.766 (19.46)	.375 (9.53)	.406 (10.31)	2.250 (57.15)
D	1.062 (26.98)	.375 (9.53)	.406 (10.31)	2.250 (57.15)

*For insulated style, shrinkable sleeving laps over the ends of the case.

Case Size	Capacitance uF	WVDC/ Surge 85 C	WVDC/ Surge 125 C	Max DF 25 C %	Max Impedance -55 C (Ohms)	Max D-c Leakage Current (ua) 25C	Max D-c Leakage Current (ua) 85C/125C	Max Capacitance Change (%) -55C	Max Capacitance Change (%) +85C	Max Capacitance Change (%) +125C	Max RMS Ripple Current (Milliamps) +85C	Max RMS Ripple Current (Milliamps) +125C	Part Number ±10%
A	220	6/7	4/4.7	32.5	30	2	9	-65	+13	+16	50	40	40EW227A006K1A
B	820	6/7	4/4.7	79.0	16	3	14	-80	+16	+20	250	200	40EW827B006K1A
C	1500	6/7	4/4.7	91.0	12	5	20	-85	+20	+25	500	400	40EW158C006K1A
D	1800	6/7	4/4.7	82.5	10	7	25	-80	+20	+25	750	550	40EW188D006K1A
A	180	8/9.2	5/5.8	22.5	32	2	9	-60	+13	+16	50	40	40EW187A008K1A
B	620	8/9.2	5/5.8	58.5	16	3	14	-80	+16	+20	250	200	40EW627B008K1A
C	1200	8/9.2	5/5.8	72.5	13	5	20	-80	+20	+25	500	400	40EW128C008K1A
D	1600	8/9.2	5/5.8	72.5	11	7	25	-80	+20	+25	750	550	40EW168D008K1A
A	150	10/11.6	7/8.2	23.0	33	2	9	-50	+13	+16	50	40	40EW157A010K1A
B	510	10/11.6	7/8.2	59.0	17	3	16	-70	+16	+20	250	200	40EW517B010K1A
C	1000	10/11.6	7/8.2	61.0	13	5	20	-75	+20	+25	500	400	40EW108C010K1A
D	1300	10/11.6	7/8.2	61.0	12	7	25	-75	+20	+25	750	550	40EW138D010K1A
A	100	15/17.5	10/11.6	21.5	40	2	9	-40	+13	+16	50	40	40EW107A015K1A
B	360	15/17.5	10/11.6	40.5	18	3	16	-60	+16	+20	250	200	40EW367B015K1A
C	750	15/17.5	10/11.6	57.0	14	6	24	-70	+20	+25	500	400	40EW757C015K1A
D	1100	15/17.5	10/11.6	50.0	12	8	26	-70	+20	+25	750	550	40EW118D015K1A
A	68	25/29	15/17.4	15.5	50	2	9	-35	+12	+15	50	40	40EW686A025K1A
B	220	25/29	15/17.4	25.0	19	3	16	-45	+13	+16	250	200	40EW227B025K1A
C	510	25/29	15/17.4	39.0	14	7	28	-60	+20	+25	500	400	40EW517C025K1A
D	750	25/29	15/17.4	40.0	13	8	29	-60	+20	+25	750	550	40EW757D025K1A
A	56	30/35	20/23.2	17.0	55	2	9	-32	+12	+15	50	40	40EW566A030K1A
B	200	30/35	20/23.2	23.0	20	3	16	-40	+13	+16	250	200	40EW207B030K1A
C	430	30/35	20/23.2	33.0	15	7	28	-55	+20	+25	500	400	40EW437C030K1A
D	620	30/35	20/23.2	33.0	14	8	29	-60	+20	+25	750	550	40EW627D030K1A
A	33	50/58	30/35	10.0	80	2	9	-24	+10	+12	50	40	40EW336A050K1A
B	120	50/58	30/35	13.9	26	3	18	-35	+12	+15	250	200	40EW127B050K1A
C	270	50/58	30/35	25.0	16	7	28	-40	+20	+25	500	400	40EW277C050K1A
D	360	50/58	30/35	27.5	15	8	32	-45	+20	+25	750	550	40EW367D050K1A
A	27	60/69	40/46	8.2	90	3	12	-20	+10	+12	50	40	40EW276A060K1A
B	100	60/69	40/46	11.5	28	4	20	-30	+12	+15	250	200	40EW107B060K1A
C	220	60/69	40/46	20.0	17	7	28	-35	+16	+20	500	400	40EW227C060K1A
D	300	60/69	40/46	23.0	16	8	32	-45	+16	+20	750	550	40EW307D060K1A
A	22	75/87	50/58	7.5	100	3	12	-16	+10	+12	50	40	40EW226A075K1A
B	82	75/87	50/58	11.5	33	4	24	-25	+12	+15	250	200	40EW826B075K1A
C	180	75/87	50/58	16.5	17	8	32	-30	+16	+20	500	400	40EW187C075K1A
D	240	75/87	50/58	18.5	16	9	36	-40	+16	+20	750	550	40EW247D075K1A
A	10	100/116	70/82	9.2	200	3	12	-17	+10	+12	50	40	40EW106A100K1A
B	39	100/116	70/82	10.9	80	5	24	-20	+12	+15	250	200	40EW396B100K1A
C	68	100/116	70/82	12.0	40	10	40	-30	+14	+16	500	400	40EW686C100K1A
D	120	100/116	70/82	25.9	30	12	48	-35	+15	+17	750	550	40EW127D100K1A
A	6.8	125/144	85/99	4.1	300	3	12	-14	+10	+12	50	40	40EW685A125K1A
B	27	125/144	85/99	7.5	90	5	24	-18	+12	+15	250	200	40EW276B125K1A
C	47	125/144	85/99	8.3	50	10	40	-26	+14	+16	500	400	40EW476C125K1A
D	82	125/144	85/99	17.5	32	12	48	-30	+15	+17	750	550	40EW826D125K1A

TYPICAL CURVES
Capacitance Change With Temperature (120 Hz)

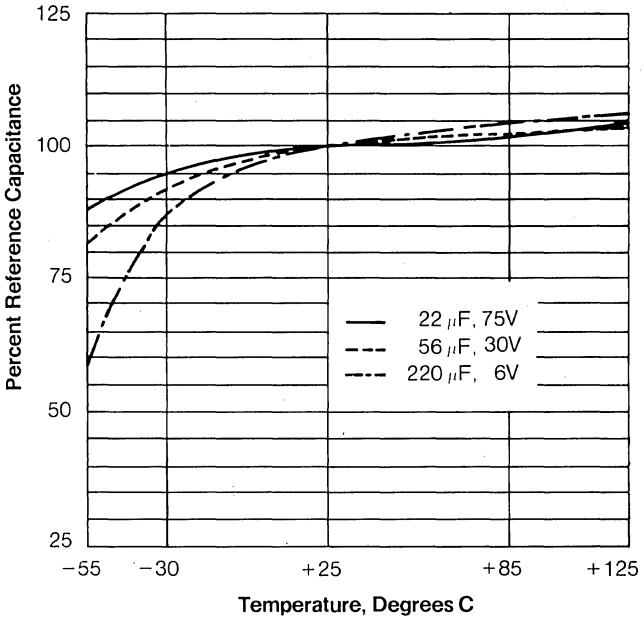


Fig. 1. Case Size A

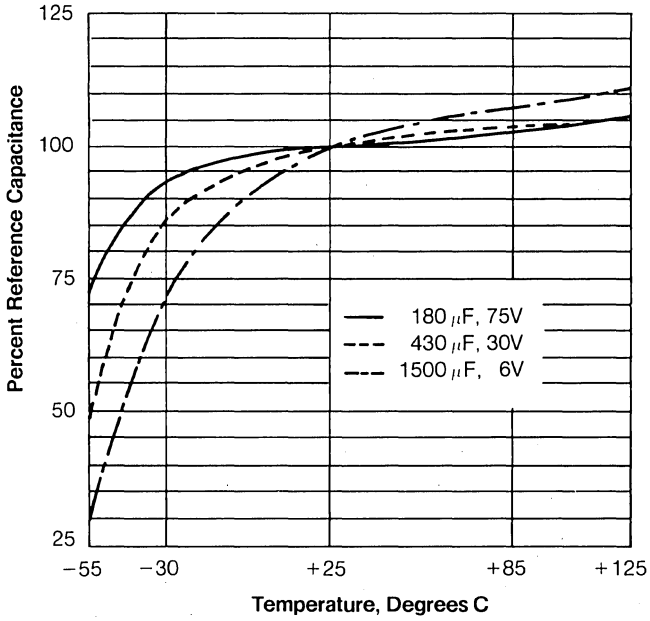


Fig. 3. Case Size C

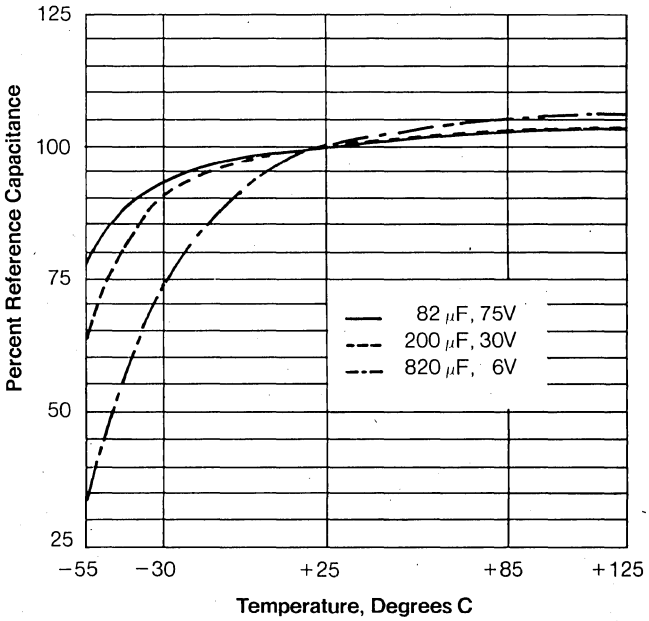


Fig. 2. Case Size B

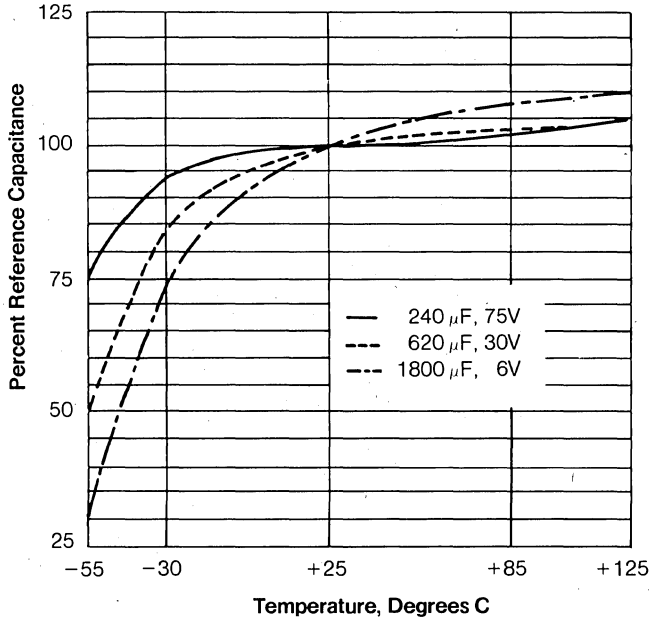


Fig. 4. Case Size D

SERIES 40EW

Industrial Type Tantalum Capacitors

TYPICAL CURVES (Cont'd)

Equivalent Series Resistance (ESR) With Temperature (120 Hz)

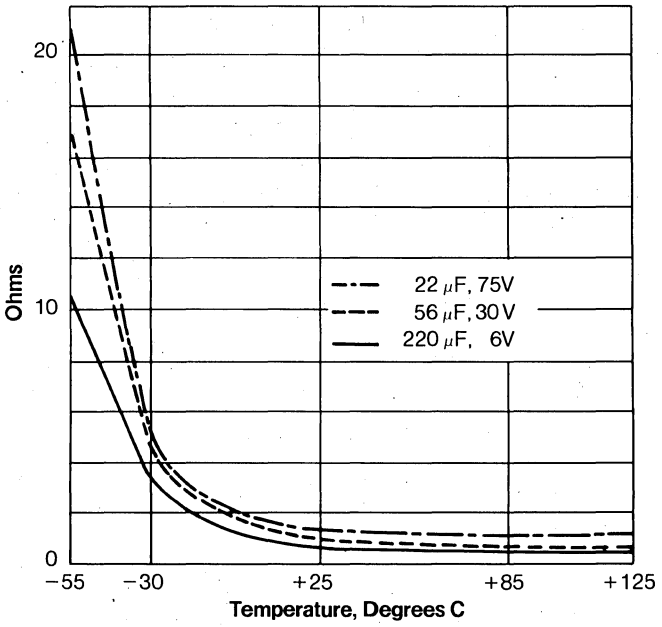


Fig. 5. Case Size A

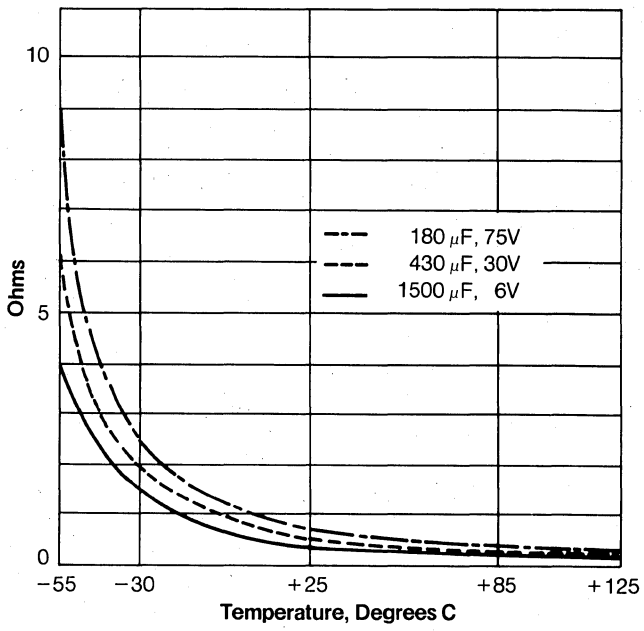


Fig. 7. Case Size C

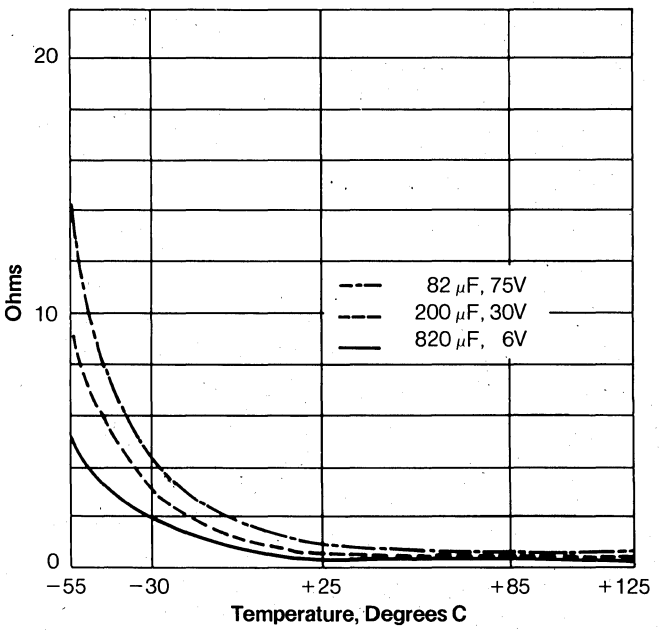


Fig. 6. Case Size B

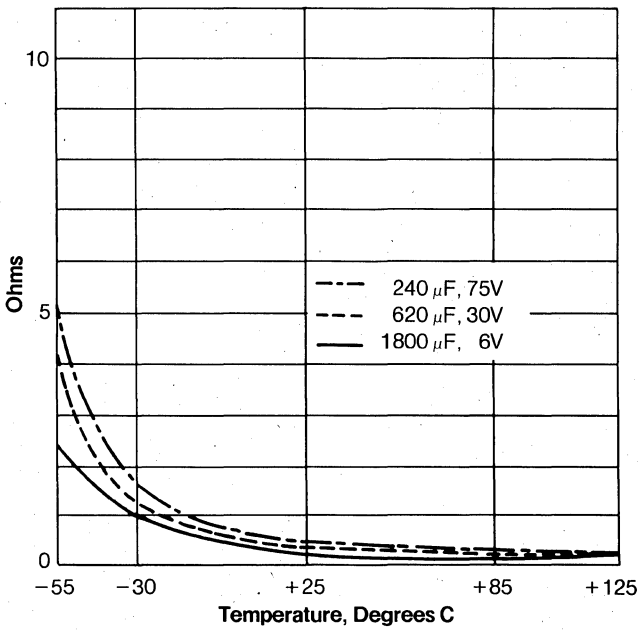


Fig. 8. Case Size D

TYPICAL CURVES (Cont'd)
Impedance With Frequency

Case Size A

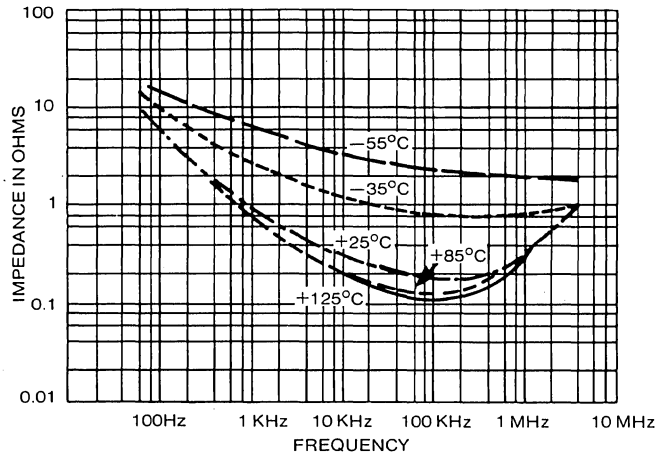


Fig. 9. 220μf, 6 Volts.

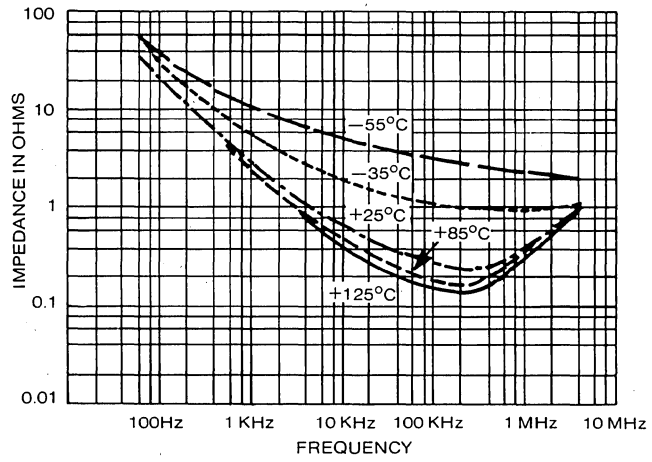


Fig. 10. 56μf, 30 Volts.

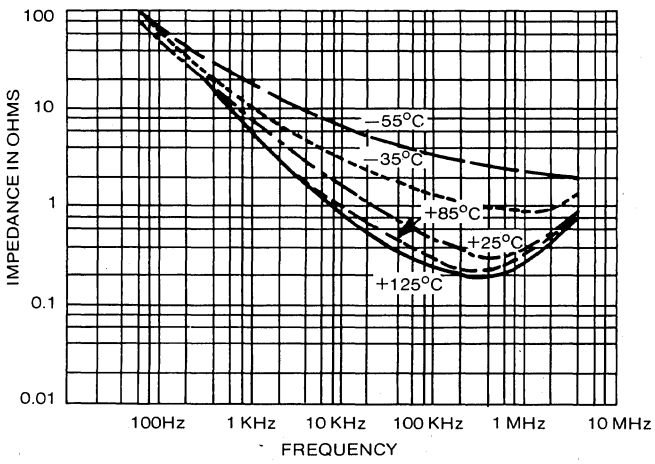


Fig. 11. 22μf, 75 Volts.

Case Size B

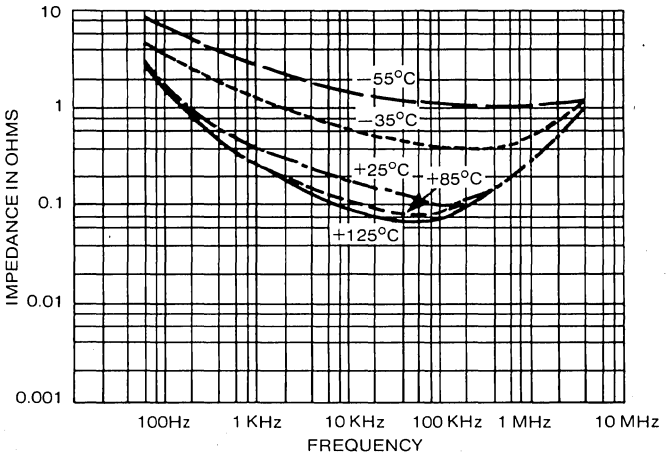


Fig. 12. 820μf, 6 Volts.

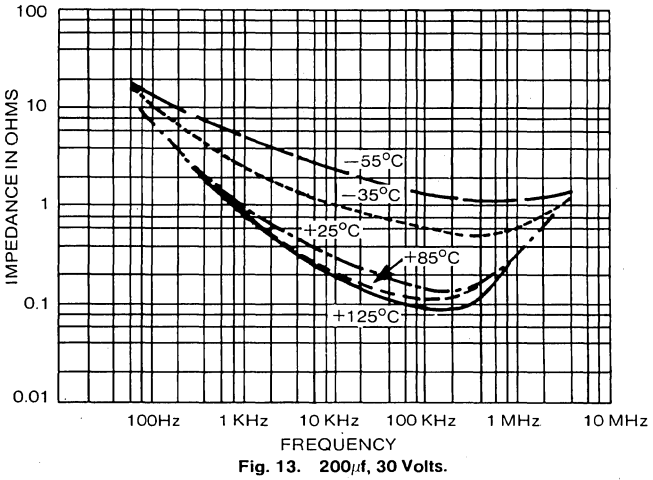


Fig. 13. 200μf, 30 Volts.

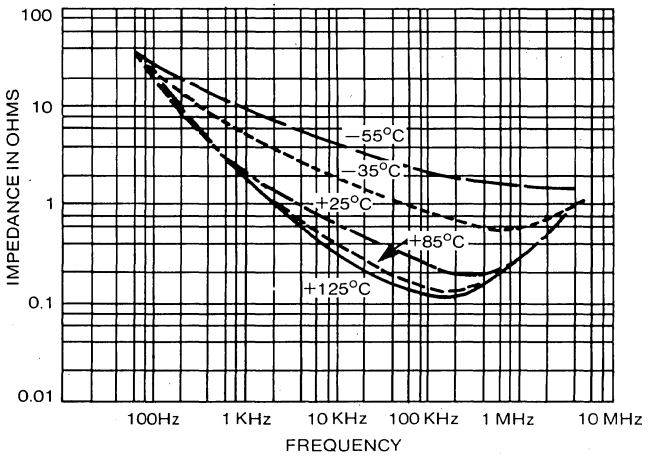


Fig. 14. 82μf, 75 Volts.

SERIES 40EW

Industrial Type Tantalum Capacitors

TYPICAL CURVES (Cont'd)

Impedance With Frequency (Cont'd)

Case Size C

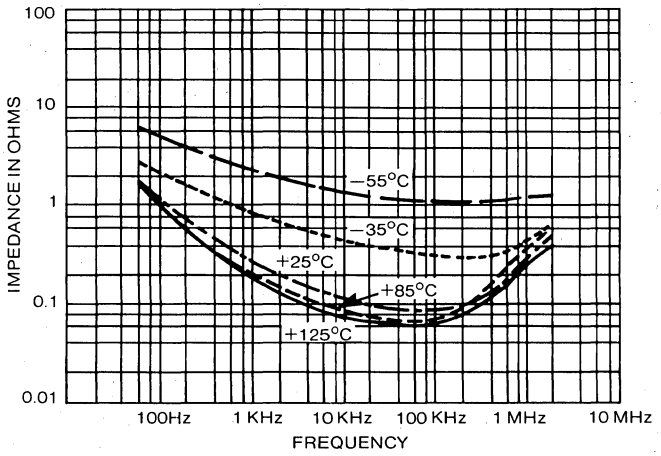


Fig. 15. 1500μf, 6 Volts.

Case Size D

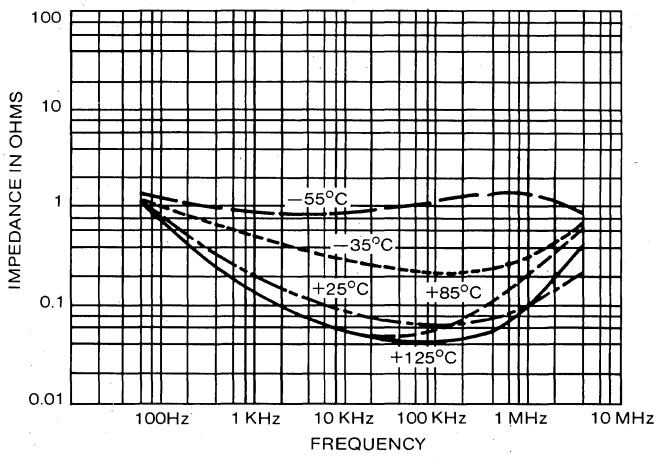


Fig. 18. 1800μf, 6 Volts.

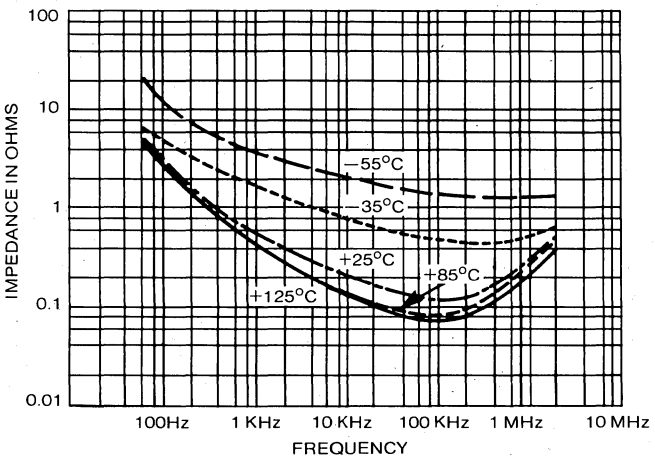


Fig. 16. 430μf, 30 Volts.

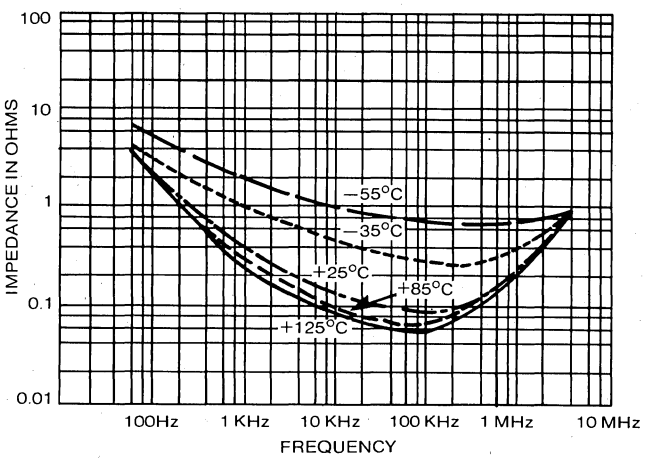


Fig. 19. 620μf, 30 Volts.

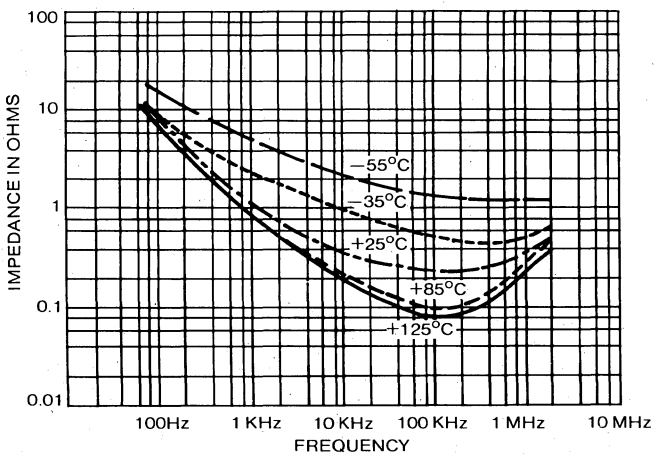


Fig. 17. 180μf, 75 Volts.

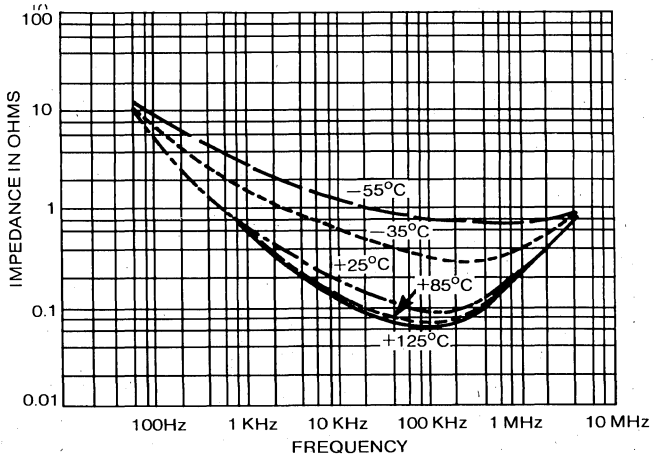
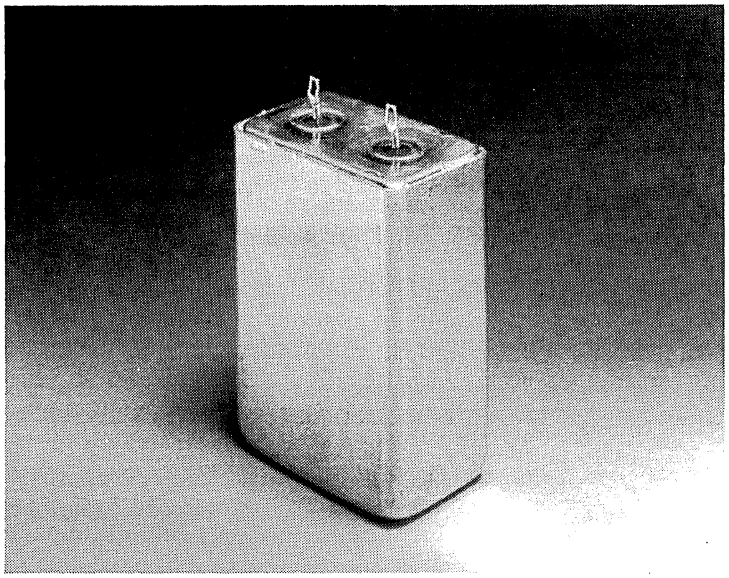


Fig. 20. 240μf, 75 Volts.

SERIES 43JW

Module Tantalum Capacitor



DESCRIPTION

M/C 43JW Wet Tantalum Capacitors offer ultra-high capacitance and extremely small physical dimensions uniquely combined in an exclusive true glass-to-metal hermetic seal. This tested and proven design is manufactured in a rectangular case for easy mounting in any application.

Modern production facilities and highly trained, skilled personnel make it possible for M/C to produce tantalum capacitors having guaranteed low impedance, long life and extremely low loss characteristics.

The Type 43JW series is designed to operate over the full military temperature range (−55°C to +125°C). Specifications and test conditions are presented on the following pages. Thixotropic gelled electrolyte assures electrical stability throughout extreme temperature ranges.

FEATURES

- **HERMETIC SEAL**
- **HIGH CAPACITANCE IN ONE CONVENIENT CASE**
- **THIXOTROPIC GELLED ELECTROLYTE**
- **HIGHER RATINGS AVAILABLE**
- **AVAILABLE WITH ALL TANTALUM 40AW STYLE CELLS**

SERIES 43JW

Industrial Type Tantalum Capacitors

TEST SPECIFICATIONS

DESIGN AND CONSTRUCTION

43JW series is constructed from modular assemblies of M/C 40LW type straight wall 125°C wet electrolyte tantalum capacitors. Module assembly epoxy-encapsulated in tinned-metal case and sealed with glass-to-glass seals.

OPERATING TEMPERATURE RANGE

Designed to operate over a temperature range of −55°C to +85°C without derating. May be operated at 125°C with derating.

CAPACITANCE

Series capacitance measurements made by polarized bridge method at or referred to 120 Hz with 1.0VAC rms max and 2.2 VDC max @ +25°C. Capacitance shall be within the specified tolerance limits of nominal rating.

CAPACITANCE CHANGE WITH TEMPERATURE

Change in capacitance between initial measurements at +25°C ±5°C and measurements at temperatures listed below shall not exceed the applicable values specified at:

−55°C	−35 percent
+125°C	+25 percent

EQUIVALENT SERIES RESISTANCE (ESR)

Bridge measurements at or referred to 120 Hz with 1.0VAC rms max and 2.2 VDC max at a temperature of 25°C ±5°C. Measured equivalent series resistance shall not exceed the values shown for each rating.

LEAKAGE CURRENT

Measurements at rated working voltage at 25°C ±5°C with steady source of power applied (regulated power supply) with a 1000Ω resistance in series with capacitor under test. Rated working voltage applied for 5 mintues before making measurements. Maximum leakage current shall not exceed the listed maximum value.

LOW TEMPERATURE IMPEDANCE

Impedance value measured @ 120 Hz @ −55°C shall not exceed listed value.

DC WORKING VOLTAGE

WVDC is maximum operating voltage for continuous duty at rated temperature.

SURGE VOLTAGE

Surge dc rating is the maximum voltage under any condition. Includes transients and peak ripple at highest line voltage. Surge voltage is 115% of rated WVDC.

Surge test voltage applied through a 1000 ohm ±10% series resistor at rate of ½ minute on, 5½ minutes off, for 1000 successive test cycles @ 85°C.

Following surge test, capacitance @ 25°C not to change more than ±10%, dissipation factor not to exceed value shown and leakage current not to exceed stated requirements.

LIFE TEST

Tested for 2000 hours at rated dc working voltage @ 85°C. Leakage current not to exceed original requirements, equivalent series resistance not to exceed 130% of the initial requirement, and capacitance not to change more than ±25%.

HIGH FREQUENCY VIBRATION

Vibration from 10 to 2000 Hz @ 20g. Electrical measurements to show no intermittent open or short circuit during test.

After test, capacitance, ESR and leakage current shall meet the original requirements.

PULL TEST

Terminals shall withstand a tensile stress of 5 lbs. for 30 seconds applied axially.

MOISTURE RESISTANCE

Moisture resistance cycling test specified in MIL Standard 202, method 106. After test, capacitance, equivalent series resistance, and leakage current shall meet the original requirements.

SHELF TEST

A 2000-hour test @ 85°C with no voltage applied. Capacitance not to change more than 10% from the initial value, leakage current not to exceed requirements specified, and ESR not to exceed values stated.

THERMAL SHOCK AND IMMERSION

Tests specified in MIL Standard 202, method 107 and 104 to be complied with. After test, capacitance, ESR and leakage current shall meet the original requirements.

ALTITUDE

Stabilized at a reduced atmospheric pressure up to 100 miles for 5 minutes. Capacitors not to flash over with rated dc voltage applied 1 minute. End-seals not to be damaged. Electrical measurements shall show no intermittent contacts and capacitance, ESR and leakage current shall meet original limits.

POLARITY

Polarity will be indicated by a Red Glass Seal on the positive (+) terminal and a black glass seal on the negative (−) terminal.

SERIES 43JW

Industrial Type Tantalum Capacitors

APPLICATION NOTES

DC Working Voltages

85 C WVDC	85 C Surge	125 C WVDC	125 C Surge
6	7	4	4.7
8	9.2	5	5.8
10	11.6	7	8.2
15	17.2	10	11.6
25	28.8	15	17.3
30	34.5	20	23.0
45	51.7	30	35.0
50	57.5	33	38.0
60	69.0	40	46.0
75	86.2	50	57.5
100	115	70	80.5
110	126.5	73	84.3
125	143.8	83	95.5
150	172	100	115.0

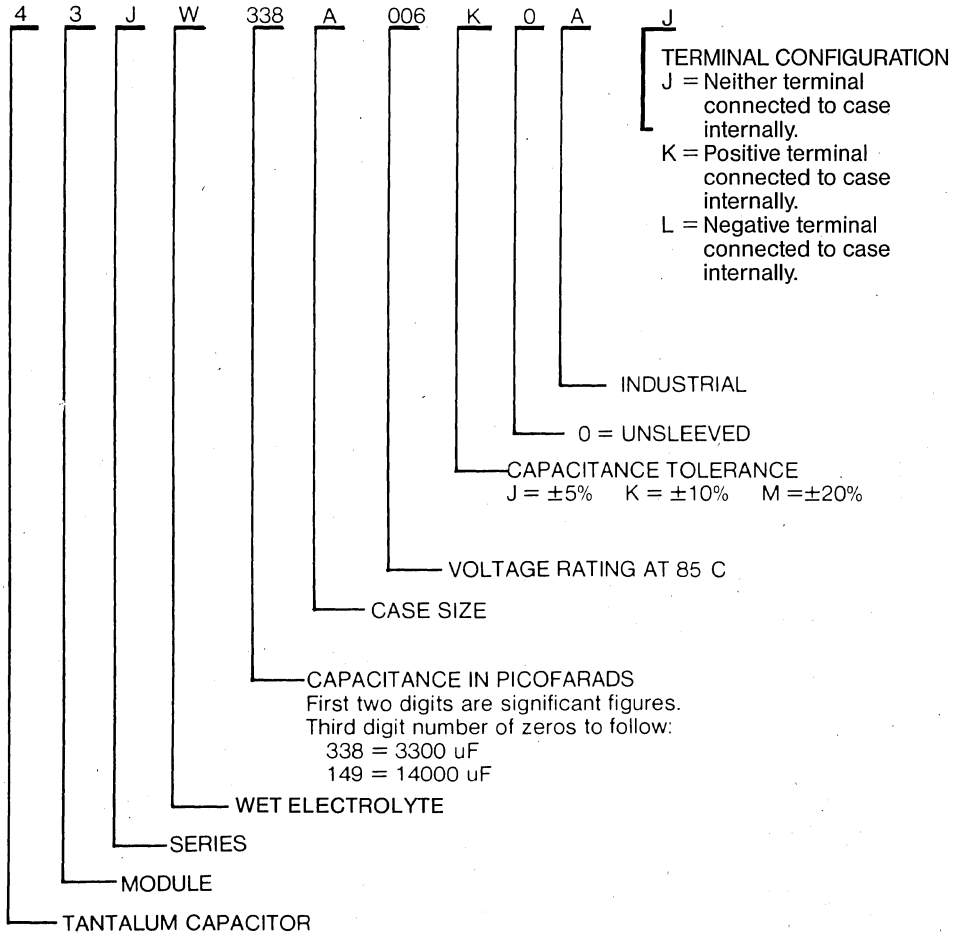
M/C Type 43JW Tantalum Capacitors will withstand the ripple current heating effects as shown in the typical operating data. In operation, the peak voltage across the capacitor (DC working voltage plus peak ripple voltage) must not exceed the rated working voltage of the capacitor. The DC component of the applied voltage should always be large with respect to the AC component to prevent polarity reversal.

M/C Type 43JW Tantalum Capacitors will withstand the ripple current heating effects equivalent to the values specified for each case size:

Case Size	Ripple Current (Amperes) at 120 Hz
A	0.8
B	1.0
C	1.2
D	1.8
E	2.0
F	1.5
G	2.0
H	2.5
J	3.0
K	3.5
L	4.0
M	4.5

PART NUMBER SYSTEM

EXAMPLE 4 3 J W 338 A 006 K 0 A J



SERIES 43JW

Industrial Type Tantalum Capacitors

Case Size	Capacitance uF	WVDC @ 85°C	Max. D.C. Leakage Current (uA) 25°C	85°C	125°C	Max. ESR Ω	Max. Z Ω -55°C	Part Number ±10%
A	3300	6	4.0	24	36	.32	6.10	43JW338A006K0A
B	4400	6	5.5	33	49	.24	5.00	43JW448B006K0A
C	5500	6	6.5	39	59	.19	4.25	43JW558C006K0A
D	6600	6	8.0	48	72	.16	3.90	43JW668D006K0A
F	7200	6	10.8	65	108	.16	3.30	43JW728F006K0A
G	9600	6	14.4	86	144	.13	2.50	43JW968G006K0A
E	9800	6	12.0	72	108	.11	2.25	43JW988E006K0A
H	12000	6	18.0	108	180	.10	2.00	43JW129H006K0A
J	14000	6	21.0	126	210	.08	1.70	43JW149J006K0A
K	17000	6	25.5	153	255	.07	1.40	43JW179K006K0A
L	19000	6	28.5	171	285	.06	1.20	43JW199L006K0A
M	22000	6	33.0	198	330	.05	1.10	43JW229M006K0A
F	5100	8	10.2	61	102	.16	5.50	43JW518F008K0A
G	6800	8	13.6	82	136	.13	2.80	43JW688G008K0A
H	8500	8	17.0	102	170	.10	2.20	43JW858H008K0A
J	10000	8	20.0	120	200	.08	1.80	43JW109J008K0A
K	12000	8	24.0	144	240	.07	1.60	43JW129K008K0A
L	14000	8	28.0	168	280	.06	1.40	43JW149L008K0A
M	15000	8	30.0	180	300	.05	1.20	43JW159M008K0A
A	2300	10	4.5	27	40	.32	66.00	43JW238A010K0A
B	3000	10	6.0	36	54	.24	5.50	43JW308B010K0A
C	3800	10	7.5	45	67	.19	4.70	43JW388C010K0A
D	4500	10	9.0	54	81	.16	3.80	43JW458D010K0A
F	4500	10	11.3	68	113	.16	3.80	43JW458F010K0A
E	6000	10	12.0	72	108	.12	3.15	43JW608E010K0A
G	6000	10	15.0	90	150	.13	2.90	43JW608G010K0A
H	7500	10	18.8	113	188	.10	2.30	43JW758H010K0A
J	9000	10	22.5	135	225	.08	1.90	43JW908J010K0A
K	10000	10	25.0	150	250	.07	1.60	43JW109K010K0A
L	12000	10	30.0	180	300	.06	1.40	43JW129L010K0A
M	14000	10	35.0	210	350	.05	1.30	43JW149M010K0A
A	480	15	1.5	9	14	.41	6.80	43JW487A015K0A
A	960	15	3.0	18	27	.21	3.10	43JW967A015K0A
B	1200	15	3.5	21	32	.16	2.30	43JW128B015K0A
A	1400	15	4.0	24	36	.29	1.70	43JW148A015K0A
C	1400	15	4.0	24	36	.14	1.70	43JW148C015K0A
A	1600	15	5.0	30	45	.25	1.63	43JW168A015K0A
B	1900	15	5.5	33	49	.22	1.55	43JW198B015K0A
B	2100	15	6.0	36	54	.19	1.30	43JW218B015K0A
D	2100	15	6.0	36	54	.10	1.30	43JW218D015K0A
C	2400	15	7.0	42	63	.17	1.15	43JW248C015K0A
E	2400	15	7.0	42	63	.08	1.15	43JW248E015K0A
C	2700	15	8.0	48	72	.15	1.10	43JW278C015K0A
D	2900	15	9.0	54	81	.14	1.05	43JW298D015K0A
D	3200	15	10.0	60	90	.12	1.00	43JW328D015K0A
F	3200	15	12.0	72	120	.20	3.80	43JW328F015K0A
E	3900	15	12.0	72	108	.10	1.00	43JW398E015K0A
E	4300	15	13.0	78	117	.09	1.00	43JW438E015K0A
G	4300	15	16.2	97	162	.15	2.90	43JW438G015K0A
H	5400	15	20.3	122	203	.12	2.30	43JW548H015K0A
J	6500	15	24.4	147	244	.10	1.90	43JW658J015K0A
K	7600	15	28.5	171	285	.09	1.60	43JW768K015K0A
L	8600	15	32.3	194	323	.08	1.40	43JW868L015K0A
M	9700	15	36.4	219	364	.07	1.30	43JW978M015K0A

SERIES 43JW

Industrial Type Tantalum Capacitors

Case Size	Capacitance uF	WVDC @85°C	Max. D.C. Leakage Current (uA) 25°C	85°C	125°C	Max. ESR Ω	Max. Z Ω -55°C	Part Number ±10%
F	2100	25	13.2	79	132	.20	4.00	43JW218F025K0A
G	2800	25	17.5	105	175	.16	3.00	43JW288G025K0A
H	3500	25	21.9	132	219	.13	2.40	43JW358H025K0A
J	4200	25	26.3	158	263	.10	2.00	43JW428J025K0A
K	4900	25	30.7	184	307	.09	1.70	43JW498K025K0A
L	5600	25	35.0	210	350	.08	1.50	43JW568L025K0A
M	6300	25	39.4	237	394	.07	1.30	43JW638M025K0A
A	270	30	1.5	9	14	.74	8.50	43JW277A030K0A
A	520	30	3.0	18	27	.38	5.30	43JW527A030K0A
B	660	30	4.0	24	36	.30	4.20	43JW667B030K0A
A	820	30	5.0	30	45	.40	2.90	43JW827A030K0A
C	820	30	5.0	30	45	.24	2.90	43JW827C030K0A
A	900	30	5.5	33	49	.37	2.75	43JW907A030K0A
B	1100	30	6.5	39	59	.30	2.50	43JW118B030K0A
B	1200	30	7.0	42	63	.28	2.30	43JW128B030K0A
D	1200	30	7.0	42	63	.17	2.30	43JW128D030K0A
E	1300	30	8.0	48	72	.15	2.10	43JW138E030K0A
C	1400	30	8.0	48	72	.24	2.00	43JW148C030K0A
C	1500	30	9.0	54	81	.22	2.40	43JW158C050K0A
D	1600	30	10.0	60	90	.21	2.30	43JW168D030K0A
D	1800	30	11.0	66	99	.19	2.25	43JW188D030K0A
F	1800	30	13.5	81	135	.25	4.20	43JW188F030K0A
E	2200	30	13.0	78	117	.15	1.40	43JW228E030K0A
E	2400	30	14.0	84	126	.14	1.20	43JW248E030K0A
G	2400	30	18.0	108	180	.19	3.10	43JW248G030K0A
H	3000	30	22.5	135	225	.15	2.50	43JW308H030K0A
J	3600	30	27.0	162	270	.12	2.10	43JW368J030K0A
K	4200	30	31.5	189	315	.11	1.80	43JW428K030K0A
L	4800	30	36.0	216	360	.10	1.60	43JW488L030K0A
M	5400	30	40.5	243	405	.08	1.40	43JW548M030K0A
A	430	45	4.0	24	36	.62	7.20	43JW437A045K0A
B	550	45	5.0	30	45	.48	5.60	43JW557B045K0A
A	570	45	5.0	50	45	.47	4.80	43JW577A045K0A
B	600	45	5.5	30	49	.45	4.60	43JW607B045K0A
C	660	45	6.0	36	54	.40	4.00	43JW667C045K0A
B	750	45	7.0	42	63	.35	3.70	43JW757B045K0A
B	800	45	7.5	45	67	.33	3.10	43JW807B045K0A
C	940	45	7.5	45	67	.28	2.90	43JW947C045K0A
C	1000	45	9.0	54	81	.27	2.80	43JW108C045K0A
D	1000	45	9.0	54	81	.27	2.80	43JW108D045K0A
E	1100	45	10.0	60	90	.24	2.70	43JW118E045K0A
D	1200	45	11.0	66	99	.22	2.50	43JW128D045K0A
E	1500	45	13.0	78	117	.18	2.40	43JW158E045K0A
E	1600	45	14.5	87	130	.17	2.30	43JW168E045K0A
A	200	50	2.0	12	18	.99	8.10	43JW207A050K0A
A	400	50	4.0	24	36	.50	7.20	43JW407A050K0A
A	430	50	4.5	27	41	.47	6.40	43JW437A050K0A
A	480	50	5.0	30	45	.55	5.90	43JW487A050K0A
B	500	50	5.0	30	45	.40	5.60	43JW507B050K0A
C	600	50	6.0	36	54	.33	4.10	43JW607C050K0A
B	640	50	6.5	39	59	.42	3.90	43JW647B050K0A
C	800	50	8.0	48	72	.33	3.10	43JW807C050K0A
D	800	50	8.0	48	72	.25	3.10	43JW807D050K0A
E	960	50	9.5	57	85	.28	2.45	43JW967E050K0A
F	960	50	12.0	72	120	.30	4.50	43JW967F050K0A
E	1000	50	10.0	60	90	.20	2.80	43JW108E050K0A
E	1300	50	13.0	78	117	.21	2.70	43JW138E050K0A
G	1300	50	16.3	98	163	.26	3.40	43JW138G050K0A
H	1600	50	20.0	120	200	.18	2.70	43JW168H050K0A
J	1900	50	23.8	143	238	.15	2.30	43JW198J050K0A
K	2200	50	27.5	165	275	.13	1.90	43JW228K050K0A
L	2600	50	32.5	195	325	.12	1.70	43JW268L050K0A
M	2900	50	36.3	218	363	.10	1.50	43JW298M050K0A

SERIES 43JW

Industrial Type Tantalum Capacitors

Case Size	Capacitance uF	WVDC @85°C	Max. D.C. Leakage Current (uA) 25°C	85°C	125°C	Max. ESR Ω	Max. Z Ω -55°C	Part Number ±10%
A	400	60	5.0	30	45	.67	5.00	43JW407A060K0A
B	560	60	6.5	39	59	.48	3.10	43JW567B060K0A
C	700	60	8.5	51	76	.38	3.10	43JW707C060K0A
D	840	60	10.0	60	90	.32	2.70	43JW847D060K0A
F	840	60	12.6	76	126	.33	4.70	43JW847F060K0A
E	1100	60	13.0	78	117	.24	2.00	43JW118E060K0A
G	1100	60	16.5	99	165	.25	3.50	43JW118G060K0A
H	1400	60	21.0	126	210	.20	2.80	43JW148H060K0A
J	1700	60	25.5	153	255	.17	2.30	43JW178J060K0A
K	2000	60	30.0	180	300	.15	2.00	43JW208K060K0A
L	2200	60	33.0	198	330	.13	1.80	43JW228L060K0A
M	2500	60	37.5	225	375	.11	1.60	43JW258M060K0A
A	150	75	2.0	12	18	1.06	15.60	43JW157A075K0A
A	270	75	4.0	24	36	.59	8.50	43JW277A075K0A
A	330	75	5.0	30	45	.81	7.00	43JW337A075K0A
B	330	75	5.0	30	45	.49	7.00	43JW337B075K0A
A	400	75	6.0	36	54	.67	5.00	43JW407A075K0A
C	400	75	6.0	36	54	.40	5.00	43JW407C075K0A
B	440	75	6.5	39	59	.61	5.00	43JW447B075K0A
B	530	75	8.0	48	72	.50	4.80	43JW537B075K0A
C	550	75	8.5	51	76	.48	3.85	43JW557C075K0A
D	600	75	9.0	54	72	.27	3.65	43JW607D075K0A
C	660	75	10.0	60	90	.41	3.50	43JW667C075K0A
E	660	75	10.0	60	90	.24	3.50	43JW667E075K0A
F	660	75	12.4	75	124	.42	4.80	43JW667F075K0A
D	790	75	12.0	72	108	.34	3.10	43JW797D075K0A
E	880	75	13.0	78	117	.30	2.60	43JW887E075K0A
G	880	75	16.5	99	165	.31	3.60	43JW887G075K0A
E	1100	75	16.0	96	144	.24	1.40	43JW118E075K0A
H	1100	75	20.7	124	207	.25	2.90	43JW118H075K0A
J	1400	75	26.3	158	263	.21	2.40	43JW148J075K0A
K	1500	75	28.2	169	282	.18	2.10	43JW158K075K0A
L	1800	75	33.8	203	338	.15	1.80	43JW188L075K0A
M	2000	75	37.5	225	375	.14	1.60	43JW208M075K0A
A	85	100	2.0	12	18	1.88	31.50	43JW856A100K0A
A	170	100	3.5	21	32	.94	15.00	43JW177A100K0A
B	220	100	4.5	27	40	.73	11.60	43JW227B100K0A
A	260	100	5.0	30	45	.61	8.00	43JW267A100K0A
C	260	100	5.0	30	45	.61	8.00	43JW267C100K0A
B	350	100	7.0	42	63	.46	6.50	43JW357B100K0A
D	350	100	7.0	42	63	.46	6.50	43JW357D100K0A
C	440	100	9.0	54	72	.36	5.80	43JW447C100K0A
E	440	100	9.0	54	72	.36	5.80	43JW447E100K0A
F	510	100	12.8	77	128	.50	5.00	43JW517F100K0A
D	530	100	11.0	66	99	.30	5.70	43JW537D100K0A
G	680	100	17.0	102	170	.37	3.80	43JW687G100K0A
E	700	100	14.0	84	126	.23	4.10	43JW707E100K0A
H	850	100	21.3	128	213	.30	3.00	43JW857H100K0A
J	1000	100	25.0	150	250	.25	2.50	43JW108J100K0A
K	1200	100	30.0	180	300	.21	2.10	43JW128K100K0A
L	1400	100	35.0	210	350	.19	1.90	43JW148L100K0A
M	1500	100	37.5	225	375	.17	1.70	43JW158M100K0A

SERIES 43JW

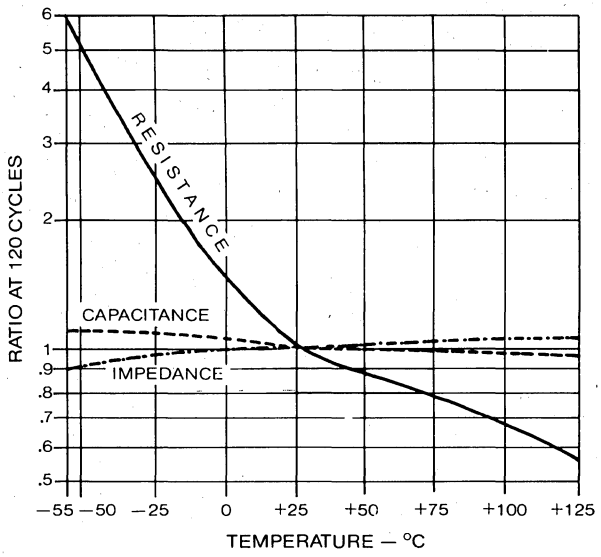
Industrial Type Tantalum Capacitors

Case Size	Capacitance uF	WVDC @85°C	Max. D.C. Leakage Current (uA) 25°C	85°C	125°C	Max. ESR Ω	Max. Z Ω -55°C	Part Number ±10%
A	140	110	3.0	18	27	1.14	22.00	43JW147A110K0A
B	180	110	4.0	24	36	.89	20.00	43JW187B110K0A
C	220	110	5.0	30	45	.73	10.00	43JW227C110K0A
A	240	110	5.5	33	49	.67	13.00	43JW247A110K0A
B	320	110	7.0	42	63	.50	8.20	43JW327B110K0A
E	360	110	8.0	48	72	.45	7.40	43JW367E110K0A
C	400	110	9.0	54	81	.40	7.00	43JW407C110K0A
D	480	110	10.5	63	94	.33	5.80	43JW487D110K0A
E	640	110	14.0	84	126	.25	4.90	43JW647E110K0A
A	170	125	4.0	24	36	.94	20.00	43JW177A125K0A
A	180	125	4.5	27	40	.89	19.00	43JW187A125K0A
B	220	125	5.5	33	49	.73	16.00	43JW227B125K0A
B	240	125	6.0	36	54	.67	14.00	43JW247B125K0A
C	280	125	7.0	42	63	.57	13.00	43JW287C125K0A
C	300	125	7.5	45	67	.53	12.00	43JW307C125K0A
D	340	125	8.5	51	76	.47	8.30	43JW347D125K0A
F	340	125	10.7	64	107	.67	5.50	43JW347F125K0A
E	350	125	8.5	51	76	.46	8.20	43JW357E125K0A
D	360	125	9.0	54	81	.45	8.30	43JW367D125K0A
G	450	125	14.1	85	141	.50	4.10	43JW457G125K0A
E	480	125	12.0	72	108	.33	7.30	43JW487E125K0A
H	560	125	17.5	105	175	.40	3.30	43JW567H125K0A
J	670	125	21.0	126	210	.33	2.80	43JW677J125K0A
K	790	125	24.7	149	247	.29	2.40	43JW797K125K0A
L	900	125	28.2	169	282	.25	2.10	43JW907L125K0A
M	1000	125	31.3	188	313	.22	1.80	43JW108M125K0A
A	35	150	1.0	6	9	4.55	40.00	43JW356A150K0A
A	60	150	2.0	12	18	2.66	33.00	43JW606A150K0A
A	70	150	2.0	12	18	2.28	28.80	43JW706A150K0A
B	90	150	2.5	15	22	1.76	22.40	43JW907B150K0A
C	100	150	3.0	18	27	1.60	16.40	43JW107C150K0A
B	120	150	3.5	21	32	1.33	15.20	43JW127B150K0A
A	130	150	4.0	24	36	1.22	13.65	43JW137A150K0A
D	140	150	4.0	24	36	1.14	12.40	43JW147D150K0A
B	170	150	5.0	30	54	.84	11.45	43JW177B150K0A
D	180	150	5.5	33	49	.89	11.20	43JW187D150K0A
E	180	150	5.5	33	49	.89	11.20	43JW187E150K0A
C	220	150	6.5	39	59	.73	16.00	43JW227C150K0A
E	240	150	7.0	42	63	.67	8.30	43JW247E150K0A
D	260	150	8.0	48	72	.62	8.20	43JW267D150K0A
E	350	150	10.0	60	90	.46	8.10	43JW357E150K0A

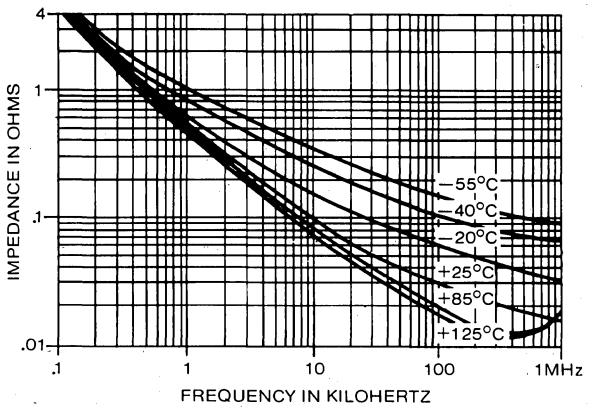
SERIES 43JW

Industrial Type Tantalum Capacitors

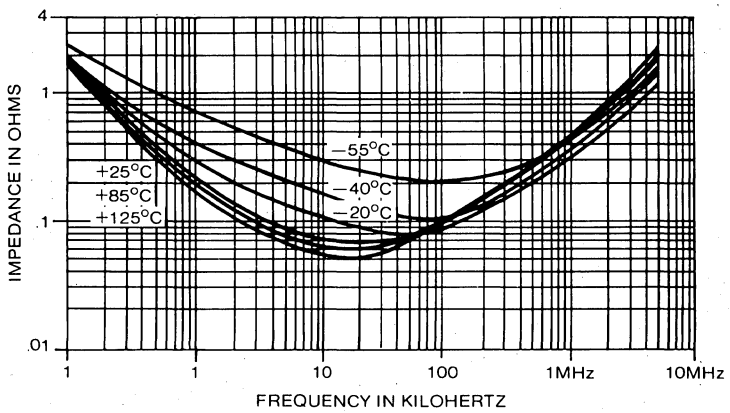
IMPEDANCE, CAPACITANCE, AND EQUIVALENT SERIES RESISTANCE WITH TEMPERATURE FOR TYPE 43JW507B050K0A



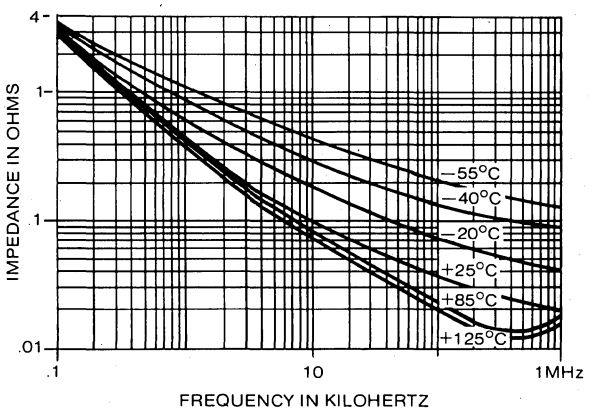
IMPEDANCE WITH FREQUENCY AT VARIOUS TEMPERATURES FOR TYPE 43JW267A100K0A



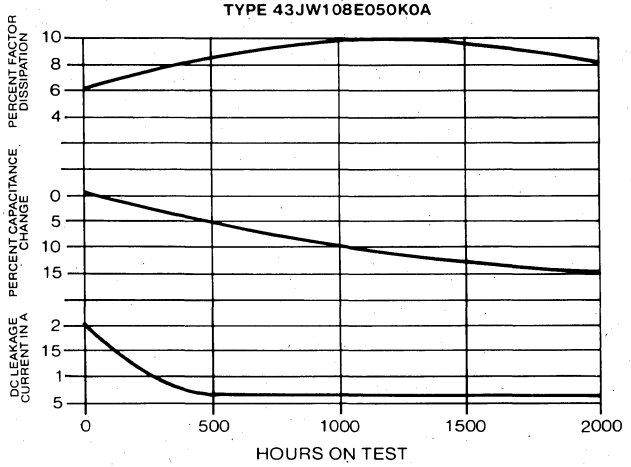
IMPEDANCE WITH FREQUENCY AT VARIOUS TEMPERATURES FOR TYPE 43JW108E050K0A



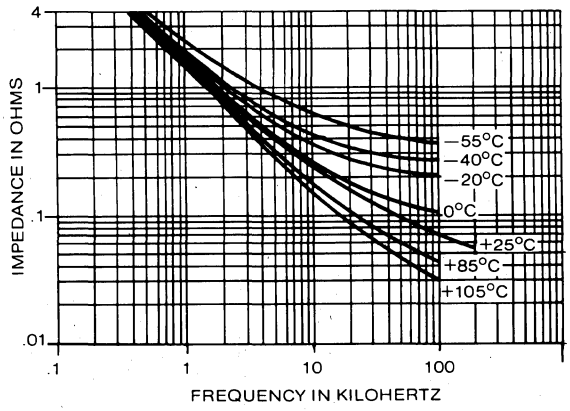
IMPEDANCE WITH FREQUENCY AT VARIOUS TEMPERATURES WITH TYPE 43JW447E100K0A



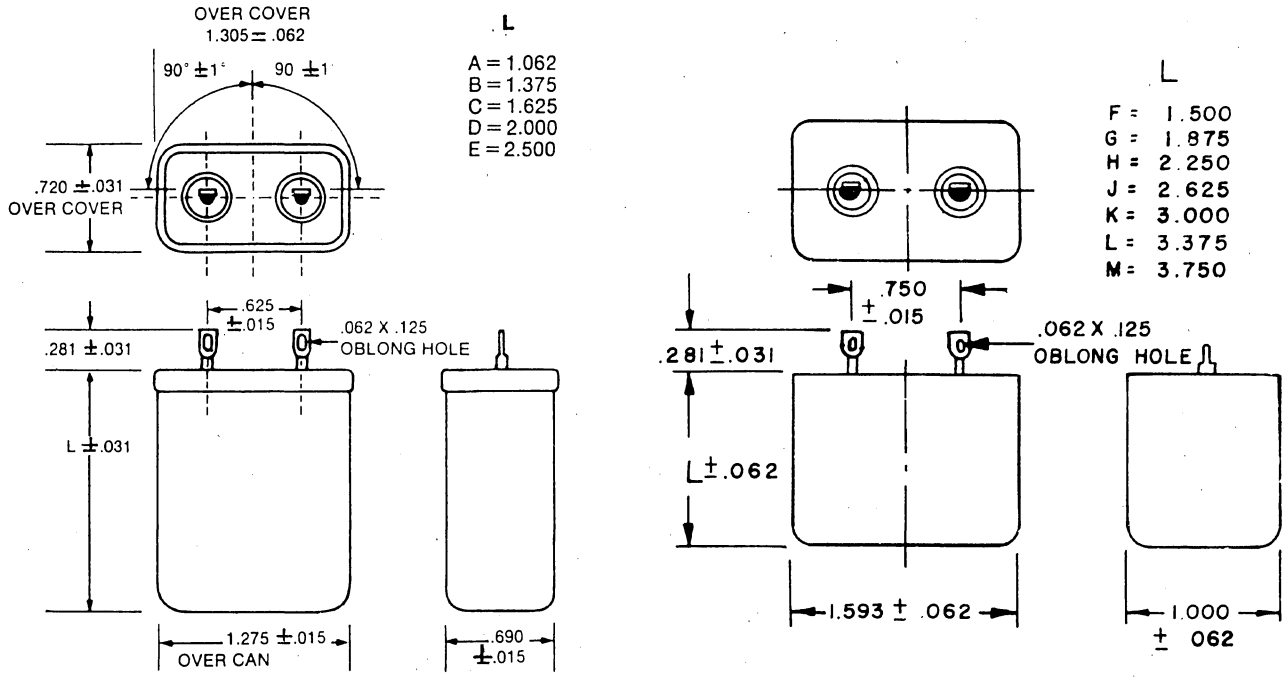
DISSIPATION FACTOR, CAPACITANCE CHANGE, AND DC LEAKAGE CURRENT AFTER LIFE TEST AT 125 C AND RATED VOLTAGE FOR TYPE 43JW108E050K0A



IMPEDANCE WITH FREQUENCY AT VARIOUS TEMPERATURES FOR TYPE 43JW177A100K0A

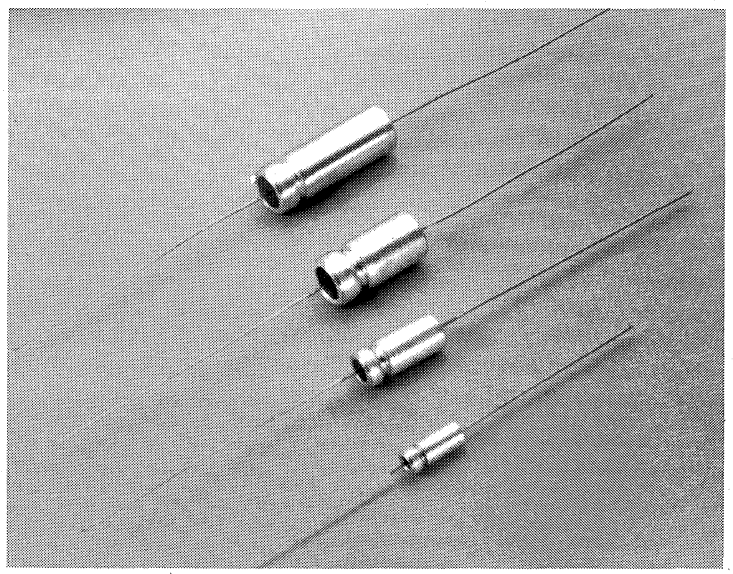


OUTLINE DRAWING AND DIMENSIONS



SERIES 40LW

Tubular Tantalum Capacitor



DESCRIPTION

M/C 40LW Type Tantalum Capacitors are uniquely designed. These capacitors offer extreme savings in both weight and space as compared with the conventional flange type construction. Savings up to 30% in weight and 40% in volume are available.

M/C research and development facilities, coupled with years of manufacturing experience, have resulted in these advantages, together with extremely low leakage current. These capacitors are normally supplied with an insulated case, without additional cost, for added protection in compact circuits.

FEATURES

- TUBULAR—POLAR
- THIXOTROPIC ELECTROLYTE
- SINTERED ANODE
- TANTALUM CAPACITOR
- 85°C—125°C WITH DERATING
- ELASTOMER SEAL

Voltage Rating	
85 C	125 C
6	4
8	5
10	7
15	10
25	15
30	20
50	30
60	40
75	50
100	70
125	85

OPERATING TEMPERATURE RANGE

M/C 40LW Type Tantalum Capacitors are designed to operate over a temperature range of −55°C to +85°C without derating.

DC WORKING VOLTAGE

The dc working voltage is the maximum operating voltage for continuous duty at the rated temperature.

SURGE VOLTAGE

The surge dc rating is the maximum voltage to which the capacitors should be subjected under any conditions. This includes transients and peak ripple at the highest line voltage. The surge voltage of all 40LW Type Tantalum Capacitors is 115% of rated dc working voltage.

The capacitors shall withstand the surge test voltage applied through a 1000 ohm ±10% resistor in series with the capacitor and voltage source at the rate of ½ minute on, 4½ minutes off, for 1000 successive test cycles at 85°C.

Following the surge test the capacitance at 25°C shall not have changed by more than ±10%, the equivalent series resistance will not exceed the value shown in the tables for each capacitor, and the leakage current will not exceed the requirements of paragraph 7. Not more than 1 failure for any of the above reasons shall be allowed for any 12 samples tested.

CAPACITANCE

Capacitance measurements shall be made at or referred to 120 Hz and a temperature of +25°C.

The capacitance of all capacitors shall be within the specified tolerance limits of the nominal rating.

CAPACITANCE CHANGE WITH TEMPERATURE

Capacitance change with temperature shall not exceed the limits given in the tables for each capacitor.

DISSIPATION FACTOR

Measurements shall be made by the bridge method at or referred to a frequency of 120 Hz at a temperature of +25°C.

The Dissipation Factor shall not exceed the maximum value in percent listed in the tables for each capacitor.

LEAKAGE CURRENT

Measurements shall be made at rated working voltage with an application of a steady source of power, such as a regulated power supply with a 1000 ohm resistance to limit the charging current, connected in series with each capacitor under test. Rated working voltage shall be applied to capacitors for 5 mintues before making leakage current measurements.

The maximum leakage current for any capacitor shall not exceed the maximum value in microamperes listed in the tables.

LOW TEMPERATURE IMPEDANCE

The impedance of any capacitor, at −55°C and 120 Hz, shall not exceed the values given in the tables for each capacitor.

LIFE TEST

Capacitors are capable of withstanding a 2000 hour life test at a temperature of 85°C at rated dc working voltage.

After the life test, the leakage current shall not be in excess of the original requirement, the equivalent series resistance shall not be more than 130% of the initial requirement, and the capacitance value shall not have increased by more than 25% or decreased by more than 15% from the initial value.

Not more than 1 failure shall be permitted in 12 units tested.

LOW FREQUENCY VIBRATION

Capacitors shall withstand a simple harmonic motion having an amplitude of 0.03" (max. total excusrion 0.06") with the frequency being varied uniformly between the approximate limits of 10 to 55 Hz and ratings to be transversed in approximately 1 minute for a total of 1½ hours.

After vibration test, capacitors shall meet the original requirements for capacitance tolerance, equivalent series resistance, and leakage current.

HIGH FREQUENCY VIBRATION

Capacitors shall withstand vibration from 10 to 2000 Hz at 15g without internal damage. Electrical measurements made while under these conditions shall show no intermittent open or short circuit.

Capacitors shall be securely fastened by means of suitable component clips or brackets.

PULL TEST

Leads shall withstand a tensile stress of 3 lbs. for 30 seconds applied axially.

LEAD BEND TEST

Leads shall meet the bend test described in MIL-C-39006.

MOISTURE RESISTANCE

Capacitors shall withstand the moisture resistance cycling test specified in MIL Standard 202C, method 106A, without departure from the original limits of capacitance, equivalent series resistance, and leakage current.

SHELF TEST

Capacitors shall withstand a 2000 hour shelf test at 125°C with no voltage applied.

Following the shelf test, the capacitance shall not have changed by more than ±10% from the initial value and the leakage current and equivalent series resistance shall not exceed the values given in the tables for each capacitor.

THERMAL SHOCK AND IMMERSION

Capacitors shall withstand the thermal shock and immersion tests specified in MIL Standard 202C, method 107, test condition B, except that the low temperature shall be −55°C and method 104A, test condition B, respectively, without departure from the original limits for capacitance, equivalent series resistance, and leakage current.

REDUCED PRESSURE

Capacitors shall be stabilized at a reduced atmospheric pressure of $1.69X10^{-1}$ Torr. for a period of 5 minutes. Rated dc voltage shall be applied for 1 minute. Capacitors shall not flash over nor shall end seals be damaged by this test nor should the capacitors be electrically effected insofar as capacitance, equivalent series resistance, or leakage current is concerned.

MARKING

Capacitors will be marked with M/C type (CW), rated capacitance and tolerance, rated DC voltage and date code where space permits.

SERIES 40LW

Industrial Type Tantalum Capacitors

APPLICATION NOTES

120 CYCLE RIPPLE VOLTAGE

Capacitors in case size A will withstand the ripple current heating effects equivalent to 40 ma RMS at 120 Hz. Capacitors in case size B will withstand the ripple current heating effects equivalent to 200 ma RMS at 120 Hz. Capacitors in case size C will withstand the ripple current heating effects equivalent to 400 ma RMS at 120 Hz. Capacitors in case D and E will withstand the ripple current heating effects equivalent to 550 ma RMS at 120 Hz in operation, the peak voltage across the capacitor (dc working voltage plus peak ripple voltage) must not exceed the rated working voltage of the capacitor. The dc component of the applied voltage should be sufficiently large to prevent polarity reversal because of the ac component.

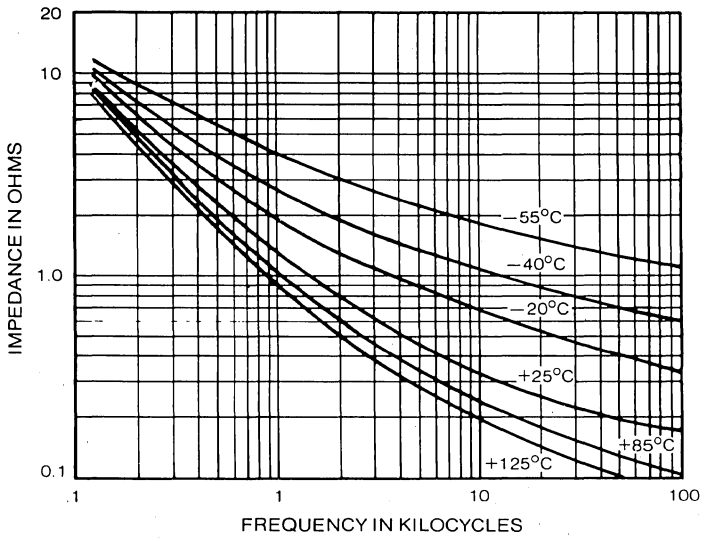
STORAGE LIFE

A storage life of ten years or more, with no voltage at room temperature, may be expected.

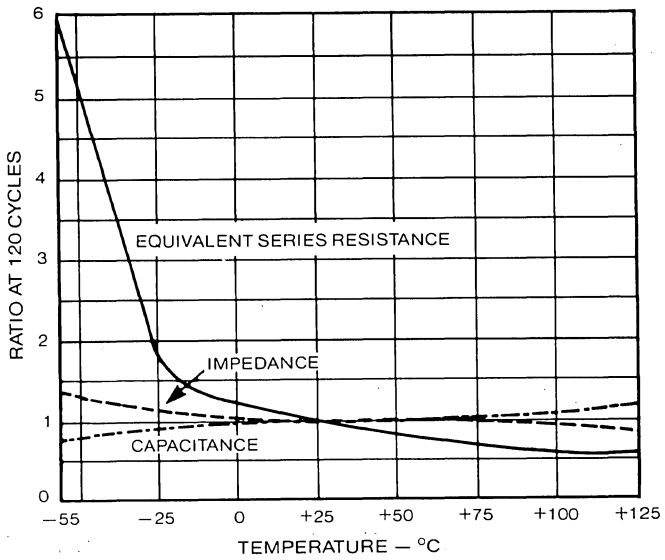
USE OF INDUSTRIAL SOLVENTS FOR CLEANING APPLICATIONS

The use of isopropyl alcohol is recommended for cleaning applications. Before using any other solvent, please consult the M/C Engineering Department.

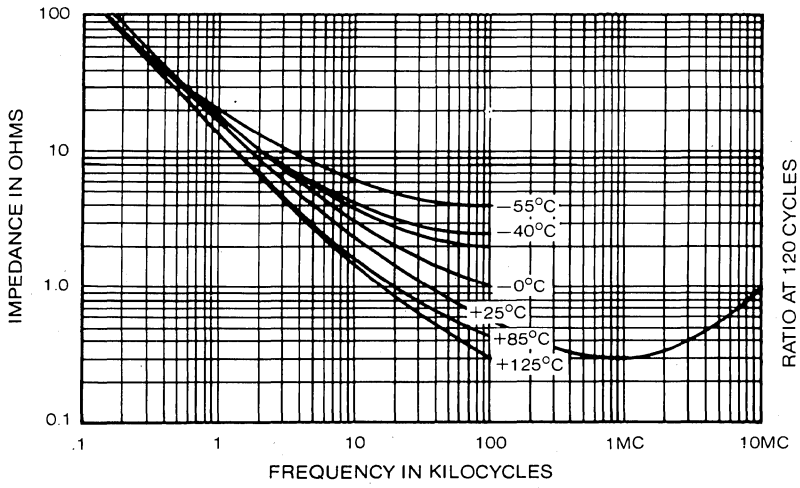
IMPEDANCE, CAPACITANCE AND EQUIVALENT SERIES RESISTANCE WITH TEMPERATURE FOR 40LW TYPE 140uF, 4 VOLT CAPACITORS



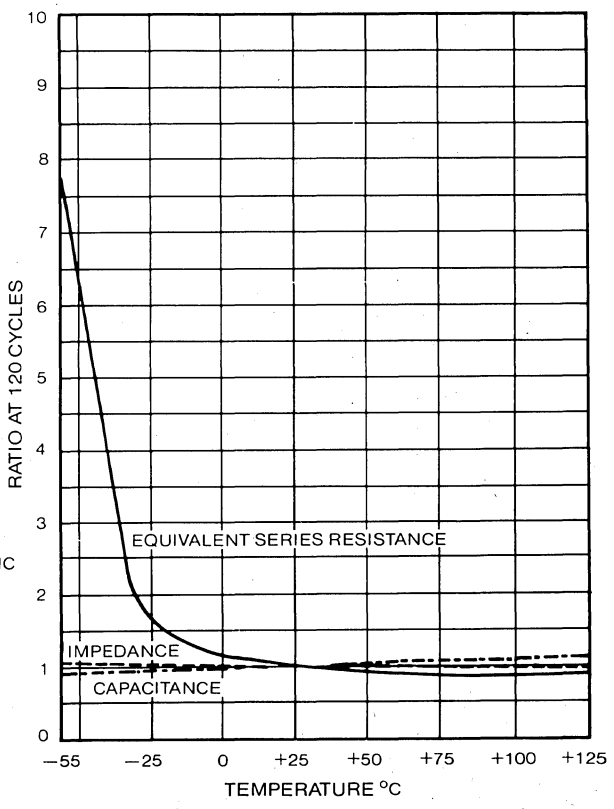
IMPEDANCE. WITH FREQUENCY AT VARIOUS TEMPERATURES FOR 40 LW TYPE 140uF, 4 VOLT CAPACITORS



IMPEDANCE, WITH FREQUENCY AT VARIOUS TEMPERATURES FOR 40 LW TYPE 11uF, 70 VOLT CAPACITORS



IMPEDANCE, CAPACITANCE AND EQUIVALENT SERIES RESISTANCE WITH TEMPERATURE FOR 40 W TYPE 11uF, 70 VOLT CAPACITORS



SERIES 40LW

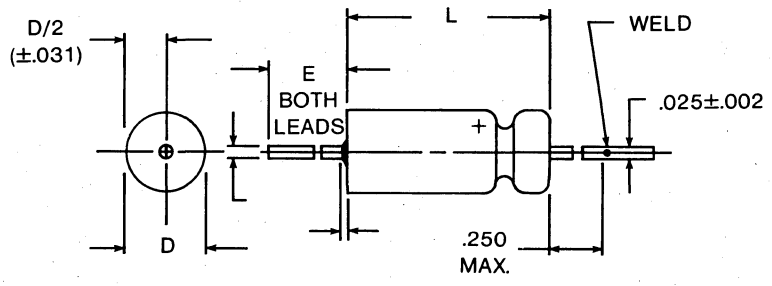
Industrial Type Tantalum Capacitors

PART NUMBER SYSTEM

EXAMPLE 4 0 L W 255 A 100 K 0 A

- 4 — TANTALUM CAPACITOR
- 0 — AXIAL LEAD
- L — SERIES
- W — WET ELECTROLYTE
- 255 — CAPACITANCE IN PICOFARADS
  First two digits are significant figures.
  Third digit number of zeros to follow:
  255 = 2.5 uF
  256 = 25 uF
- A — CASE SIZE
- 100 — VOLTAGE RATING @ 85°C
- K — CAPACITANCE TOLERANCE
  J = ±5% K = ±10% M = ±20%
- 0 — 0 = UNSLEEVED
  1 = SLEEVED
- A — INDUSTRIAL

OUTLINE DRAWING AND DIMENSIONS



Case Size	Dimensions — Inches (mm)			
	L*	D		E
	+ .031 (0.79) - .016 (0.41)	±.016 (0.41) Uninsulated	Max Insulated	±.250 (6.35)
A	.453 (11.51)	.188 (4.78)	.219 (5.56)	1.500 (38.10)
B	.641 (16.28)	.281 (7.14)	.312 (7.92)	2.250 (57.15)
C	.766 (19.46)	.375 (9.53)	.406 (10.31)	2.250 (57.15)
D	1.062 (26.98)	.375 (9.53)	.406 (10.31)	2.250 (57.15)

**For insulated style, the nonshrinkable sleeving extends .016 inch minimum, .062 inch maximum beyond each end of the case; shrinkable sleeving laps over the ends of the case.*

SERIES 40LW

Industrial Type Tantalum Capacitors

Case Size	uF	WVDC at 85 C	Max. D.F. at 25 C %	Max. Ω Impedance at -55 C	Max uA DC Leakage			Max. Capacitance Change in Per Cent		Part Number ±10%
					+25 C	+85 C	+125 C	-55 C	+125 C	
A	30	6	9.1	100	0.5	2	2	-50	+15	40LW306A006K1A
A	68	6	20.4	59	0.5	2	2	-50	+20	40LW686A006K1A
B	140	6	21.3	40	1	3	3	-50	+20	40LW147B006K1A
B	270	6	81.8	25	1	6	6	-55	+25	40LW277B006K1A
C	330	6	49.6	20	2	6	6	-70	+20	40LW337C006K1A
C	560	6	128.0	25	2	10	10	-80	+25	40LW567C006K1A
D	1200	6	81.0	20	3	12	12	-80	+25	40LW128D006K1A
A	25	8	7.6	100	0.5	2	2	-50	+15	40LW256A008K1A
A	56	8	17.0	59	1	2	2	-40	+16	40LW566A008K1A
B	120	8	18.5	48	1	2	2	-50	+20	40LW127B008K1A
B	220	8	66.4	30	1	7	7	-44	+20	40LW227B008K1A
C	290	8	42.0	24	1.2	4	4	-70	+20	40LW297C008K1A
C	430	8	91.5	25	2	14	14	-80	+25	40LW437C008K1A
D	850	8	65.8	22	4	16	16	-80	+25	40LW857D008K1A
A	20	10	6.1	120	0.5	2	2	-40	+15	40LW206A010K1A
A	47	10	18.1	90	0.5	2	2	-45	+20	40LW476A010K1A
B	100	10	15.2	60	1	4	4	-45	+20	40LW107B010K1A
B	180	10	54.4	40	1	7	7	-45	+25	40LW187B010K1A
C	250	10	37.8	30	1.5	6	6	-60	+20	40LW257C010K1A
C	390	10	87.6	25	2	10	10	-80	+25	40LW397C010K1A
D	750	10	56.5	23	4	16	16	-80	+25	40LW757D010K1A
A	15	15	5.7	145	0.5	2	2	-30	+15	40LW156A015K1A
A	33	15	12.5	90	0.5	2	2	-35	+20	40LW336A015K1A
B	70	15	13.1	63	1	4	4	-35	+20	40LW706B015K1A
B	120	15	36.8	50	1	7	7	-35	+25	40LW127B015K1A
C	170	15	25.4	35	2	8	8	-55	+20	40LW177C015K1A
C	270	15	60.9	30	2	10	10	-70	+25	40LW277C015K1A
D	540	15	49.0	23	6	24	24	-80	+25	40LW547D015K1A
A	10	25	4.6	190	0.5	2	2	-20	+15	40LW106A025K1A
A	22	25	8.3	140	0.5	2	2	-25	+20	40LW226A025K1A
B	50	25	11.5	65	1	5	5	-35	+20	40LW506B025K1A
B	100	25	31.4	50	1	8	8	-35	+25	40LW107B025K1A
C	110	25	16.8	42	2	8	8	-55	+20	40LW117C025K1A
C	180	25	54.3	32	2	10	10	-60	+25	40LW187C025K1A
D	350	25	35.0	24	7	28	28	-70	+25	40LW357D025K1A

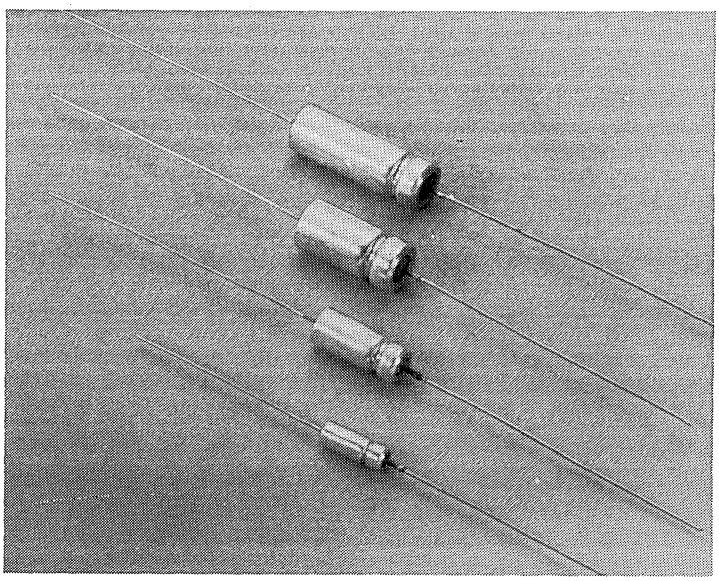
SERIES 40LW

Industrial Type Tantalum Capacitors

Case Size	uF	WVDC at 85°C	Max. D.F. at 25°C %	Max. Ω Impedance at -55°C	Max uA DC Leakage +25°C	Max uA DC Leakage +85°C	Max uA DC Leakage +125°C	Max. Capacitance Change in Per Cent -55°C	Max. Capacitance Change in Per Cent +125°C	Part Number ±10%
A	8	30	4.5	235	0.5	2	2	-20	+15	40LW805A030K1A
A	15	30	9.1	175	0.5	2	2	-25	+30	40LW156A030K1A
B	40	30	12.2	65	1	5	5	-30	+20	40LW406B030K1A
B	68	30	31.0	60	1	7.5	7.5	-30	+25	40LW686B030K1A
C	100	30	19.0	40	2	10	10	-45	+20	40LW107C030K1A
C	150	30	46.0	35	2	10	10	-60	+25	40LW157C030K1A
D	300	30	35.0	25	8	32	32	-60	+25	40LW307D030K1A
A	5	50	3.4	355	0.5	2	2	-20	+10	40LW505A050K1A
A	10	50	6.0	250	0.5	2	2	-30	+15	40LW106A050K1A
B	25	50	11.2	90	1	5	5	-25	+20	40LW256B050K1A
B	47	50	21.4	70	1	8.5	8.5	-35	+25	40LW476B050K1A
C	60	50	13.6	45	2	10	10	-30	+20	40LW606C050K1A
C	82	50	24.9	45	2	12	12	-40	+25	40LW826C050K1A
D	160	50	25.7	27	8	32	32	-50	+20	40LW167D050K1A
A	4	60	3.0	405	0.5	2	2	-20	+10	40LW405A060K1A
A	8.2	60	5.0	275	0.5	2	2	-30	+15	40LW825A060K1A
B	20	60	7.6	105	1	5	5	-25	+15	40LW206B060K1A
B	39	60	20.7	90	1	9	9	-35	+20	40LW396B060K1A
C	50	60	15.3	50	2	10	10	-25	+15	40LW506C060K1A
C	68	60	20.7	50	2	12	12	-40	+20	40LW686C060K1A
D	140	60	25.7	28	8	32	32	-40	+20	40LW147D060K1A
A	3.5	75	2.5	505	1	2	2	-20	+10	40LW355A075K1A
A	6.8	75	4.1	300	1	2	2	-25	+15	40LW685A075K1A
B	15	75	7.5	135	1	5	5	-20	+15	40LW156B075K1A
B	33	75	17.5	90	1.5	9	9	-30	+20	40LW336B075K1A
C	40	75	15.2	60	2	12	12	-20	+15	40LW406C075K1A
C	56	75	26.0	60	2	14	14	-35	+20	40LW566C075K1A
D	110	75	25.7	29	9	36	36	-35	+15	40LW117D075K1A
A	2.5	100	5.0	710	1	2	2	-15	+10	40LW255A100K1A
A	4.7	100	3.6	500	1	2	2	-20	+15	40LW475A100K1A
B	11	100	5.0	200	1	4	4	-16	+10	40LW116B100K1A
B	22	100	11.8	100	1	9	9	-20	+15	40LW226B100K1A
C	30	100	9.1	80	2	12	12	-15	+10	40LW306C100K1A
C	43	100	19.7	70	2	14	14	-25	+15	40LW436C100K1A
D	86	100	20.7	30	9	36	36	-25	+15	40LW866D100K1A
A	1.7	125	7.0	1090	1	2	2	-20	+10	40LW175A125K1A
A	3.6	125	4.1	600	1	2	2	-20	+15	40LW365A125K1A
B	9	125	10.2	220	1	5	5	-20	+15	40LW905B125K1A
B	14	125	12.7	160	1	7	7	-20	+15	40LW146B125K1A
C	25	125	19.0	93	2	13	13	-20	+20	40LW256C125K1A
C	32	125	29.0	85	4	16	16	-25	+20	40LW326C125K1A
D	60	125	18.5	30	10	40	40	-25	+15	40LW606D125K1A

SERIES 40SW

Tantalum-To-Glass Hermetic Seal Tantalum Capacitor



DESCRIPTION

M/C 40SW type tantalum capacitors offer the "leak-proof" integrity of a tantalum-to-glass hermetic seal. This construction assures operational capability in space or deep oceanographic environments where dependability is required for tens of thousands of storage or operating hours.

A product of M/C's research and development, the 40SW type meets or exceeds the requirements of Mil-C-39006. Available in four case sizes with operation to 125°C.

FEATURES

- TANTALUM-TO-GLASS SEAL
- THIXOTROPIC ELECTROLYTE
- SINTERED ANODE
- TANTALUM CAPACITOR
- POLAR

SERIES 40SW

Industrial Type Tantalum Capacitors

TANTALUM-TO-GLASS HERMETIC SEAL • FOR 125°C APPLICATIONS

CONSTRUCTION. The 40SW type uses the time proven patented construction of the 40 LW type enclosed in a silver case to provide ruggedness and then hermetically sealed using tantalum-to-glass seals.

OPERATING TEMPERATURE RANGE. The 40SW type is processed and constructed to withstand continuous operation at rated voltage from -55 C C to +85 C, and with proper derating, to 125 C. See Table 1.

D.C. WORKING VOLTAGE. The D.C. working voltage is the maximum operating voltage for continuous duty at the rated temperature. See Table 1.

SURGE VOLTAGE. The surge voltage is the maximum voltage capacitors can withstand for short duration under any conditions. This includes transients and peak ripple at the highest line voltage. See Table 1.

TABLE I

Operating 55 C to 85 C	Surge -55 C to 85 C	Operating 85 C to 125 C	Operating 125 C	Surge 125 C
6	6.9	Linear derating	4	4.6
8	9.2	applies from 85 C	5	5.7
10	11.5	operating voltage	7	8.0
15	17.2	shown to 125 C	10	11.5
20	23.0	operating voltage	13	15.0
25	28.8	shown.	15	17.2
30	34.5		20	23.0
35	40.2		24	28.0
50	57.5		30	34.5
60	69.0		40	46.0
75	86.2		50	57.2
100	115		70	80.5
125	144		85	97.5

CAPACITANCE. Capacitance measurements shall be made at 120 Hz with 1.0 VRMS max. and 2.2 VDC max. applied at a temperature of 25 C.

CAPACITANCE TOLERANCE. 40SW type capacitors are available in ±20%, ±10% and ±5% tolerance.

DISSIPATION FACTOR. Measurements shall be made by the bridge method at a frequency of 120 Hz with 1.0 VRMS max. and 2.2 VDC max. applied at a temperature of 25°C. Values shall not exceed those shown for each rating shown in table.

LEAKAGE CURRENT. Measurements shall be made at rated working voltage at 25 C ±5 with an application of a steady source of power, such as a regulated power supply with a 1000 ohm resistance to limit the charging current, connected in series with each capacitor under test. Rated working voltage shall be applied to capacitors for 5 minutes before making leakage current measurements.

IMPEDANCE. The impedance of any capacitor, at -55 C and 120 Hz, shall not exceed the values given in the table for each capacitor.

HIGH FREQUENCY VIBRATION. Capacitors shall withstand vibration from 10 to 2000 cycles at 20g without internal damage. Electrical measurements made while under these conditions shall show no intermittent open or short circuit.

Capacitors shall be securely fastened by means of suitable component clips or brackets.

LEAD PULL AND BEND TEST. Leads shall withstand a tensile stress of 3 pounds applied axially for 30 seconds. Leads shall meet the bend test requirement of Mil-C-39006.

MOISTURE RESISTANCE. Capacitors shall withstand the moisture resistance cycling test specified in MIL Standard 202C, Method 106A, without departure from the original limits of capacitance, equivalent series resistance and leakage current.

SHELF TEST. Capacitors shall withstand a 2000 hour shelf test at 125 C with no voltage applied.

Following the shelf test, the capacitance shall not have changed by more than ±5% from the initial value and the leakage current and equivalent series resistance shall not exceed the values given in the table for each capacitor.

THERMAL SHOCK AND IMMERSION. Capacitors shall withstand the thermal shock immersion tests specified in MIL Standard 202C, Method 107, test condition B, except that the low temperature shall be -55 C and Method 104A, test condition B, respectively, without departure from the original limits for capacitance, equivalent series resistance and leakage current.

REDUCED PRESSURE. Capacitors shall be stabilized at a reduced atmospheric pressure of 1.69×10^{-1} Torr. for a period of 5 minutes. Rated dc voltage shall be applied for 1 minute. Capacitors shall not flash over nor shall end seals be damaged by this test nor should the capacitors be electrically effected insofar as capacitance, equivalent series resistance, or leakage current is concerned.

SEAL TEST. Capacitors shall withstand 5 temperature altitude cycles without showing evidence of electrolyte leakage when checked with electrolyte indicating thymol blue dye. Each cycle shall consist of a 60 minute exposure at -55 C with the last 30 minutes at 1.69×10^{-1} Torr. and a 60 minute exposure to +125 C with the last 30 minutes at 1.69×10^{-1} Torr.

MARKING

Capacitors will be marked with M/C Type SW, rated capacitance and tolerance, rated dc voltage and date code where space permits.

APPLICATION NOTES

The 40 SW type exceeds the requirements of MIL-C-39006/09D and can be used as direct replacement for these types where Mil Spec QPL product is NOT required.

The 40 SW type utilizes the basic time proven integral seal of the 40 LW tantalum capacitors covered by a hermetic tantalum-to-glass seal. This will enable the 40 SW type to operate under extreme conditions of altitude (150,000 ft.) or pressure (26,000 lbs./IN) without seal damage or evidence of electrolyte leakage.

CONSULT THE M/C SALES DEPARTMENT FOR ENGINEERING ASSISTANCE ON THE FOLLOWING:

NON STANDARD RATINGS. Ratings and electrical limits other than those shown in the tables are available on special request.

EXTREME TEMPERATURES. Under special conditions the 40 SW type may be operated or stored at temperatures exceeding the specified range.

SERIES 40SW

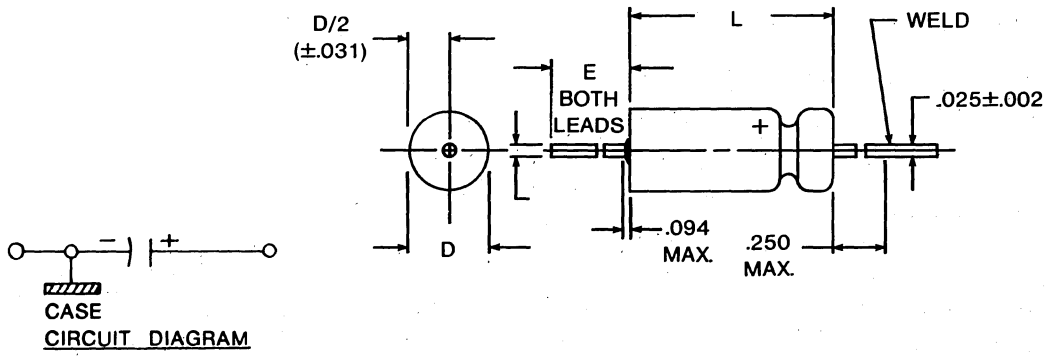
Industrial Type Tantalum Capacitors

TANTALUM-TO-GLASS HERMETIC SEAL • FOR 125°C APPLICATIONS

PART NUMBER SYSTEM

EXAMPLE 4 0 S W 225 A 070 K 1 A

- 4 — TANTALUM CAPACITOR
- 0 — AXIAL LEAD
- S — SERIES
- W — WET ELECTROLYTE
- 225 — CAPACITANCE IN PICOFARADS
  First two digits are significant figures.
  Third digit number of zeros to follow.
  255 = 2.5 uF
  256 = 25 uF
- A — CASE SIZE
- 070 — VOLTAGE RATING @ 85 C
- K — CAPACITANCE TOLERANCE
  J = ±5% K = ±10% M = ±20%
- 1 — 0 = UNSLEEVED
  1 = SLEEVED
- A — INDUSTRIAL



CIRCUIT DIAGRAM

Case Size	DIMENSIONS FOR 40SW TYPE — INCHES (mm)						Approximate Weight
	Uninsulated		Insulated		Lead Dia.	Lead Length	
	D ±0.016 (±0.41)	L + 0.031(0.79) L − 0.016 (0.41)	D Max	L Max	D ±.002 (0.05)	E ±0.25 (±6.35)	
A	0.188 (4.8)	0.453 (11.5)	0.219 (5.6)	0.515 (13.1)	0.025 (0.64)	1.50 (38.10)	1.7 GM
B	0.281 (7.1)	0.641 (16.3)	0.313 (7.9)	0.703 (17.8)	0.025 (0.64)	2.25 (57.15)	4.3 GM
C	0.375 (9.5)	0.766 (19.5)	0.406 (10.3)	0.828 (21.0)	0.025 (0.64)	2.25 (57.15)	9.0 GM
D	0.375 (9.5)	1.062 (27.0)	0.406 (10.3)	1.124 (28.6)	0.025 (0.64)	2.25 (57.15)	9.5 GM

SERIES 40SW

Industrial Type Tantalum Capacitors

Case Size	uF	WVDC at 85°C	Max. D.F. at 25°C %	Max. Ω Impedance at -55°C	Max. uA DC Leakage		Max. Capacitance Change In %			Part Number ±10%
					+25°C	+85°C	-55°C	+85°C	+125°C	
A	30	6	9.1	100	1.0	2.0	-40	+10.5	+12	40SW306A006K1A
A	68	6	20.4	59	1.0	2.0	-35	+13	+16	40SW686A006K1A
B	140	6	21.3	40	1.0	3.0	-40	+14	+16	40SW147B006K1A
B	270	6	81.8	25	1.0	6.0	-44	+17.5	+20	40SW277B006K1A
C	330	6	49.6	20	1.5	6.0	-44	+14	+16	40SW337C006K1A
C	560	6	128.0	25	2.0	10.0	-64	+17.5	+20	40SW567C006K1A
D	1200	6	144.4	15	3.0	14.0	-80	+20	+25	40SW128D006K1A
A	25	8	7.6	100	1.0	2.0	-40	+10.5	+12	40SW256A008K1A
A	56	8	17.0	59	1.0	2.0	-40	+14	+16	40SW566A008K1A
B	220	8	66.4	30	1.0	6.0	-44	+17.5	+20	40SW227B008K1A
C	430	8	91.5	25	1.5	6.0	-64	+17.5	+20	40SW437C008K1A
D	850	8	65.8	20	3.0	12.0	-80	+17.5	+25	40SW857D008K1A
A	20	10	6.1	120	1.0	2.0	-32	+10.5	+12	40SW206A010K1A
A	47	10	18.1	100	1.0	2.0	-36	+14	+16	40SW476A010K1A
B	100	10	15.2	60	1.0	4.0	-36	+14	+16	40SW107B010K1A
B	180	10	54.4	40	1.0	7.0	-36	+14	+16	40SW187B010K1A
C	250	10	37.8	30	1.5	6.0	-40	+14	+16	40SW257C010K1A
C	390	10	87.6	25	2.0	10.0	-64	+17.5	+20	40SW397C010K1A
D	750	10	56.5	23	4.0	16.0	-80	+17.5	+25	40SW757D010K1A
A	15	15	5.7	145	1.0	2.0	-24	+10.5	+12	40SW156A015K1A
A	33	15	12.5	90	1.0	2.0	-28	+14	+16	40SW336A015K1A
B	70	15	13.1	63	1.0	4.0	-28	+14	+16	40SW706B015K1A
B	120	15	36.8	50	1.0	6.5	-28	+17.5	+20	40SW127B015K1A
C	170	15	25.4	35	2.0	8.0	-32	+14	+16	40SW177C015K1A
C	270	15	60.9	30	2.0	10.0	-56	+17.5	+20	40SW277C015K1A
D	540	15	49.0	23	6.0	24.0	-80	+17.5	+25	40SW547D015K1A
A	27	20	8.0	100	0.5	2.0	-20	+11	+14	40SW276A020K1A
A	56	20	17.0	90	2.0	9.0	-38	+13	+16	40SW566A020K1A
B	100	20	15.0	50	1.0	7.0	-28	+12	+15	40SW107B020K1A
C	220	20	32.0	30	2.0	16.0	-38	+13	+16	40SW227C020K1A
C	390	20	54.0	25	6.0	24.0	-65	+20	+25	40SW397C020K1A
D	470	20	41.0	20	6.0	24.0	-60	+20	+25	40SW477D020K1A
A	10	25	4.6	190	1.0	2.0	-16	+ 8	+ 9	40SW106A025K1A
A	22	25	8.3	140	1.0	2.0	-20	+10.5	+12	40SW226A025K1A
B	100	25	31.4	50	1.0	8.0	-28	+13	+15	40SW107B025K1A
C	180	25	54.3	32	2.0	10.0	-48	+13	+15	40SW187C025K1A
D	350	25	35.0	24	7.0	28.0	-70	+13	+15	40SW357D025K1A
A	8	30	4.5	235	1.0	2.0	-16	+ 8	+12	40SW805A030K1A
A	15	30	9.1	175	1.0	2.0	-20	+10.5	+12	40SW156A030K1A
B	40	30	12.2	65	1.0	5.0	-24	+10.5	+12	40SW406B030K1A
B	68	30	31.0	60	1.0	7.0	-24	+13	+15	40SW686B030K1A
C	100	30	19.0	40	2.0	10.0	-28	+10.5	+12	40SW107C030K1A
C	150	30	46.0	40	3.0	16.0	-50	+13	+16	40SW157C030K1A
D	300	30	35.0	25	8.0	32.0	-60	+17.5	+20	40SW307D030K1A

SERIES 40SW

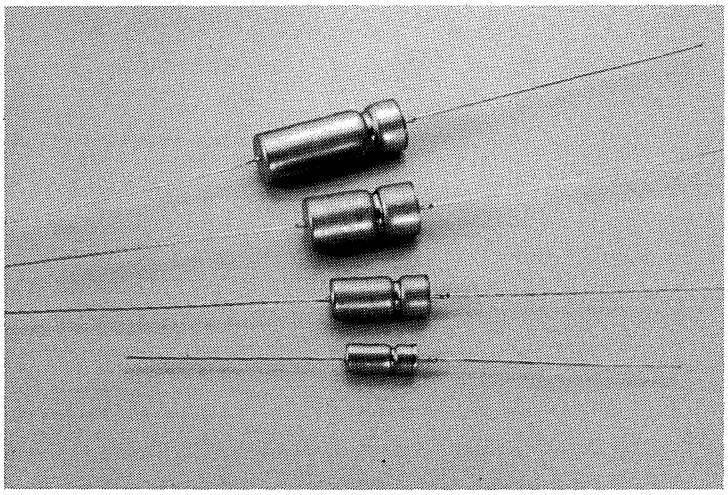
Industrial Type Tantalum Capacitors

Case Size	uF	WVDC at 85°C	Max. D.F. at 25°C %	Max. Ω Impedance at -55°C	Max. uA DC Leakage		Max. Capacitance Change in %			Part Number ±10%
					+25°C	+85°C	-55°C	+85°C	+125°C	
A	15	35	4.6	150	5.0	2.0	-16	+10	+12	40SW156A035K1A
A	26	35	8.0	140	2.0	9.0	-28	+10	+12	40SW266A035K1A
A	33	35	10.0	130	2.0	9.0	-30	+10	+12	40SW336A035K1A
B	56	35	13.0	60	1.0	7.0	-20	+12	+15	40SW566B035K1A
B	68	35	15.5	60	1.0	7.0	-24	+12	+15	40SW686B035K1A
C	100	35	15.5	40	2.0	16.0	-28	+10	+12	40SW107C035K1A
C	120	35	18.0	38	2.0	16.0	-30	+10	+12	40SW127C035K1A
C	180	35	24.9	30	8.0	32.0	-40	+20	+25	40SW187C035K1A
D	220	35	25.5	24	8.0	32.0	-40	+20	+25	40SW227D035K1A
A	5	50	3.4	355	1.0	2.0	-16	+ 5	+ 6	40SW505A050K1A
A	10	50	6.0	250	1.0	2.0	-24	+ 8	+ 9	40SW106A050K1A
B	25	50	11.2	90	1.0	5.0	-20	+10.5	+12	40SW256B050K1A
B	47	50	21.4	70	1.0	8.5	-28	+13	+15	40SW476B050K1A
C	60	50	13.6	45	2.0	10.0	-16	+10.5	+12	40SW606C050K1A
C	82	50	24.9	45	2.0	12.0	-32	+13	+15	40SW826C050K1A
D	160	50	25.7	27	8.0	32.0	-50	+17.5	+20	40SW167D050K1A
A	4	60	3.0	405	1.0	2.0	-16	+ 5	+ 6	40SW405A060K1A
A	8.2	60	5.0	275	1.0	2.0	-24	+ 8	+ 9	40SW825A060K1A
B	20	60	7.6	105	1.0	5.0	-16	+10.5	+12	40SW206B060K1A
B	39	60	20.7	90	1.0	9.0	-28	+10.5	+12	40SW396B060K1A
C	50	60	15.3	50	2.0	10.0	-16	+10.5	+12	40SW506C060K1A
C	68	60	20.7	50	2.0	12.0	-32	+10.5	+12	40SW686C060K1A
D	140	60	25.7	28	8.0	32.0	-40	+17.5	+20	40SW147D060K1A
A	3.5	75	2.5	505	1.0	2.0	-16	+ 5	+ 6	40SW355A075K1A
A	6.8	75	4.1	300	1.0	2.0	-20	+ 8	+ 9	40SW685A075K1A
B	15	75	7.5	135	1.0	5.0	-16	+ 8	+ 9	40SW156B075K1A
B	33	75	17.5	90	1.0	9.0	-24	+10.5	+15	40SW336B075K1A
C	40	75	15.2	60	2.0	12.0	-16	+10.5	+12	40SW406C075K1A
C	56	75	26.0	60	2.0	14.0	-28	+10.5	+15	40SW566C075K1A
D	110	75	25.7	29	9.0	36.0	-35	+17.5	+20	40SW117D075K1A
A	2.5	100	5.0	710	1.0	2.0	-16	+ 7	+ 8	40SW255A100K1A
A	4.7	100	3.6	500	1.0	2.0	-16	+ 7	+ 8	40SW475A100K1A
B	11	100	5.0	200	1.0	4.0	-16	+ 7	+ 8	40SW116B100K1A
B	22	100	11.8	100	1.0	9.0	-16	+ 7	+ 8	40SW226B100K1A
C	30	100	9.1	80	2.0	12.0	-16	+ 7	+ 8	40SW306C100K1A
C	43	100	19.7	70	2.0	14.0	-20	+ 7	+ 8	40SW436C100K1A
D	86	100	20.7	30	9.0	36.0	-25	+12.5	+15	40SW866D100K1A
A	1.7	125	7.0	1250	1.0	2.0	-16	+ 7	+ 8	40SW175A125K1A
A	3.6	125	4.1	600	1.0	2.0	-16	+ 7	+ 8	40SW365A125K1A
B	9	125	10.2	220	1.0	5.0	-16	+ 7	+ 8	40SW905B125K1A
B	14	125	12.7	167	1.0	7.0	-16	+ 7	+ 8	40SW146B125K1A
C	18	125	3.0	135	2.0	12.0	-15	+ 7	+ 8	40SW186C125K1A
C	25	125	19.0	93	2.0	13.0	-16	+ 7	+ 8	40SW256C125K1A
D	56	125	18.5	32	10.0	40.0	-20	+12	+15	40SW566D125K1A

SERIES 40TW

Tantalum Case Hermetically Sealed Tubular Tantalum Wet-Slug Capacitor

−55°C to 200°C 1.7 to 1200 μF 4-125 Volts DC



DESCRIPTION

The 40TW capacitor is an all tantalum cased high reliability porous anode type with a glass to tantalum hermetic seal. This type capacitor is primarily suited for military and aerospace application. This capacitor meets or exceeds all requirements of MIL-C-39006/22.

These capacitors are ideal for such functions as filtering, by-passing, coupling and timing in applications where minimum size and weight conditions must be achieved and reverse voltage up to 3VDC, or high ripple currents, are required.

GLASS-TO-TANTALUM SEAL

The glass-to-tantalum seal is one unique feature of the 40TW Series. This seal differs from other hermetic seals in that it is a tantalum feed-through seal. This construction provides a true glass-to-tantlum seal.

TANTALUM CASE

Use of a tantalum case and tantalum powder cathode permits 3VDC reverse capability without harm; and the sintered powder cathode allows higher vibration and shock levels than comparable silver cased devices.

FEATURES

- All tantalum construction
- Reverse voltage capability of 3VDC
- High ripple current
- Long life
- Derated for 200°C operation

SERIES 40TW

Industrial Type Tantalum Capacitors

DIMENSIONS

OUTLINE DRAWING

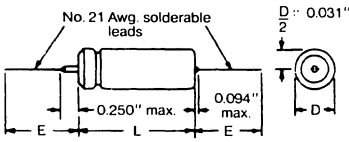


FIG. 1 UNINSULATED

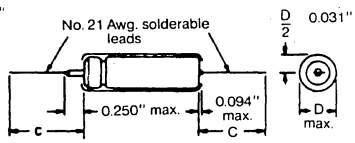


FIG.2 INSULATED

OUTLINE DIMENSIONS

Case Code		Dimensions — Inches (mm)				
		Basic case		Insulated case		
Type 40TW	MIL Equiv.	L* .031 (.79) .016 (.41)	D ± .016 (.41)	D max	E .250 (6.35)	d .002 (.05)
A	T1	.453 (11.51)	.188 (4.78)	.219 (5.56)	1.500 (38.10)	.025 (.64)
B	T2	.641 (16.28)	.281 (7.14)	.312 (7.92)	2.250 (57.15)	.025 (.64)
C	T3	.766 (19.46)	.375 (9.53)	.406 (10.31)	2.250 (57.15)	.025 (.64)
D	T4	1.062 (26.97)	.375 (9.53)	.406 (10.31)	2.250 (57.15)	.025 (.64)

*Length of basic case; sleeving shall lap over the ends of the capacitor body. Non-shrinkable sleeving extends .016 inch minimum, .062 inch maximum beyond each end of the case.

STANDARD RATINGS

μF	Case Code	Catalog Number *	Max. DF at 25°C and 120 Hz %	Max. Impedance at −55°C and 120 Hz (Ω)	Max. D-C Leakage Current at 25°C (μA)	Max. D-C Leakage Current at 85°C & 125°C (μA)	Maximum Capacitance Change in Per Cent at −55°C	Maximum Capacitance Change in Per Cent at +85°C	Maximum Capacitance Change in Per Cent at +125°C	Max. RMS Ripple Current At 40 KHz (mA)
6 VOLTS D-C AT 85°C, 4 VOLTS D-C AT 125°C										
30	A	40TW306A006KIA	9	100	0.75	1.5	−40	10.5	12	820
68	A	40TW686A006KIA	15	60	0.75	1.5	−40	14	16	960
140	B	40TW147B006KIA	21	40	1.0	2.0	−40	14	16	1200
270	B	40TW277B006KIA	45	25	1.0	2.0	−44	12.5	20	1375
330	C	40TW337C006KIA	36	20	2.0	6.0	−44	14	16	1800
560	C	40TW567C006KIA	55	25	2.0	6.0	−64	17.5	20	1900
1200	D	40TW128D006KIA	90	20	3.0	12.0	−80	25	25	2265
8 VOLTS D-C AT 85°C, 5 VOLTS D-C AT 125°C										
25	A	40TW256A008KIA	7.5	100	0.75	1.5	−40	10.5	12	820
56	A	40TW566A008KIA	14	59	0.75	1.5	−40	14	16	900
120	B	40TW127B008KIA	20	50	1.0	2.0	−44	17.5	20	1220
220	B	40TW227B008KIA	40	30	1.0	2.0	−44	17.5	20	1370
290	C	40TW297C008KIA	40	25	2.0	6.0	−64	17.5	20	1770
430	C	40TW437C008KIA	46	25	2.0	6.0	−64	17.5	20	1825
850	D	40TW857D008KIA	60	22	3.0	12.0	−80	25	25	2330
10 VOLTS D-C AT 85°C, 7 VOLTS D-C AT 125°C										
20	A	40TW206A010KIA	6	120	0.75	1.5	−32	10.5	12	820
47	A	40TW476A010KIA	13	90	0.75	1.5	−36	14	16	855
100	B	40TW107B010KIA	15	60	1.0	2.0	−36	16	16	1200
180	B	40TW187B010KIA	33	40	1.0	2.0	−36	14	16	1365
250	C	40TW257C010KIA	30	30	2.0	6.0	−40	14	16	1720
390	C	40TW397C010KIA	44	25	2.0	6.0	−64	17.5	20	1800
750	D	40TW757D010KIA	50	23	3.0	12.0	−80	25	25	2360
15 VOLTS D-C AT 85°C, 10 VOLTS D-C AT 125°C										
15	A	40TW156A015KIA	5	155	0.75	1.5	−24	10.5	12	780
33	A	40TW336A015KIA	10	90	0.75	1.5	−28	14	16	820
70	B	40TW706B015KIA	13	75	1.0	2.0	−28	14	16	1150
120	B	40TW127B015KIA	25	50	1.0	2.0	−28	17.5	20	1450
170	C	40TW177C015KIA	25	35	2.0	6.0	−32	14	16	1480
270	C	40TW277C015KIA	43	30	2.0	6.0	−56	17.5	20	1740
540	D	40TW547D015KIA	40	23	3.0	12.0	−80	25	25	2300
25 VOLTS D-C AT 85°C, 15 VOLTS D-C AT 125°C										
10	A	40TW106A025KIA	4	220	0.75	1.5	−16	8	9	715
22	A	40TW226A025KIA	7	140	0.75	1.5	−20	10.5	12	825
50	B	40TW506B025KIA	11	70	1.0	2.0	−28	13	15	1130
100	B	40TW107B025KIA	21	50	1.0	2.0	−28	13	15	1435
120	C	40TW127C025KIA	25	38	2.0	6.0	−32	13	15	1450
180	C	40TW187C025KIA	28	32	2.0	6.0	−48	13	15	1525
350	D	40TW357D025KIA	35	24	3.0	12.0	−70	25	25	1970

SERIES 40TW

Industrial Type Tantalum Capacitors

μF	Case Code	Catalog Number *	Max. DF at 25°C and 120 Hz %	Max. Impedance at −55°C and 120 Hz (Ω)	Max. D-C Leakage Current at 25°C (μA)	Max. D-C Leakage Current at 85°C & 125°C (μA)	Maximum Capacitance Change in Per Cent at −55°C	Maximum Capacitance Change in Per Cent at +85°C	Maximum Capacitance Change in Per Cent at +125°C	Max. RMS Ripple Current At 40 KHz (mA)
30 VOLTS D-C AT 85°C, 20 VOLTS D-C AT 125°C										
8	A	40TW805A030KIA	4	275	0.75	1.5	−16	8	12	640
15	A	40TW156A030KIA	7	175	0.75	1.5	−20	10.5	12	780
40	B	40TW406B030KIA	12	65	1.0	2.0	−24	10.5	12	1120
68	B	40TW686B030KIA	15	60	1.0	2.0	−24	13	15	1285
100	C	40TW107C030KIA	17	40	2.0	6.0	−28	10.5	12	1450
150	C	40TW157C030KIA	23	35	2.0	6.0	−48	13	15	1525
300	D	40TW307D030KIA	31	25	3.0	12.0	−60	25	25	1950
50 VOLTS D-C AT 85°C, 30 VOLTS D-C AT 125°C										
5	A	40TW505A050KIA	3	400	0.75	2.0	−16	5	6	580
10	A	40TW106A050KIA	5	250	0.75	2.0	−24	8	9	715
25	B	40TW256B050KIA	9	95	1.0	3.0	−20	10.5	12	1005
47	B	40TW476B050KIA	13	70	1.0	3.0	−28	13	15	1155
60	C	40TW606C050KIA	13	45	2.0	7.0	−16	10.5	12	1335
82	C	40TW826C050KIA	15	45	2.0	7.0	−32	13	15	1400
160	D	40TW167D050KIA	17	27	4.0	16.0	−50	25	25	1900
60 VOLTS D-C AT 85°C, 40 VOLTS D-C AT 125°C										
4	A	40TW405A060KIA	2.8	550	0.75	2.0	−16	5	6	525
8.2	A	40TW825A060KIA	4	275	0.75	2.0	−24	8	9	625
20	B	40TW206B060KIA	7	105	1.0	4.0	−16	8	9	930
39	B	40TW396B060KIA	12	90	1.0	4.0	−28	10.5	15	1110
50	C	40TW506C060KIA	11	50	2.0	7.0	−16	10.5	12	1330
68	C	40TW686C060KIA	13	50	2.0	7.0	−32	10.5	15	1365
140	D	40TW147D060KIA	16	28	4.0	16.0	−40	20	20	1850
75 VOLTS D-C AT 85°C, 50 VOLTS D-C AT 125°C										
3.5	A	40TW355A075KIA	2.5	650	1.0	2.0	−16	5	6	525
6.8	A	40TW685A075KIA	3.5	300	1.0	2.0	−20	8	9	610
15	B	40TW156B075KIA	6	150	1.0	4.0	−16	8	9	890
33	B	40TW336B075KIA	10	90	1.0	4.0	−24	10.5	15	1000
40	C	40TW406C075KIA	9	60	2.0	8.0	−16	10.5	12	1250
56	C	40TW566C075KIA	11	60	2.0	8.0	−28	10.5	15	1335
110	D	40TW117D075KIA	12	29	4.0	20.0	−35	20	20	1850
100 VOLTS D-C AT 85°C, 65 VOLTS D-C AT 125°C										
2.5	A	40TW255A100KIA	2	950	1.0	2.0	−16	7	8	505
4.7	A	40TW475A100KIA	3	500	1.0	2.0	−16	7	8	565
11	B	40TW116B100KIA	5	200	1.0	4.0	−16	8	8	835
22	B	40TW226B100KIA	8	100	1.0	4.0	−16	8	8	965
30	C	40TW306C100KIA	7.5	80	2.0	8.0	−16	8	8	1240
43	C	40TW436C100KIA	8.5	70	2.0	8.0	−20	8	8	1335
86	D	40TW866D100KIA	10	30	4.0	20.0	−25	15	15	1800
125 VOLTS D-C AT 85°C, 85 VOLTS D-C AT 125°C										
1.7	A	40TW175A125KIA	2	1250	1.0	2.0	−16	7	8	415
3.6	A	40TW365A125KIA	3	600	1.0	2.0	−16	7	8	520
9	B	40TW905B125KIA	5	240	1.0	4.0	−16	7	8	755
14	B	40TW146B125KIA	6	167	1.0	4.0	−16	7	8	860
18	C	40TW186C125KIA	5	129	2.0	8.0	−16	7	8	1130
25	C	40TW256C125KIA	6	93	2.0	8.0	−16	7	8	1200
56	D	40TW566D125KIA	6.5	32	4.0	20.0	−25	15	15	1800

*Catalog numbers listed are for ±10% capacitance tolerance and are for insulated capacitors.

PERFORMANCE CHARACTERISTICS

1. Operating Temperature Range. These capacitors are designed to operate over a temperature range of −55°C to +125°C/200°C at the appropriate voltage rating given in Para. 17.

2. DC Working Voltage. The dc working voltage is the maximum operating voltage for continuous duty at the rated temperature.

Up to 85°C	125°C	175°C	200°C
6	4	*	*
8	5	*	*
10	7	*	*
15	10	*	*
25	15	*	*
30	20	*	*
50	30	*	*
60	40	*	*
75	50	*	*
100	65	*	*
125	85	*	*

*Ref. Paragraph 17 for the derating percentages and the associated life test.

3. DC Leakage Current. Measurements shall be made at the applicable rated working voltage at 25°C ±5°C through application of a steady source of power, such as a regulated power supply. A current limiting resistor of 1000 ohms shall be connected in series with each capacitor under test. Rated DC working voltage shall be applied for a maximum period of 5 minutes before making leaking current measurements.

3.1 The maximum leakage current values are as listed in the standard ratings table.

4. Capacitance and Tolerance. The capacitance of all capacitors shall be within the specified tolerance limits of the nominal rating.

4.1 Measurements shall be made by the bridge method at or referred to a frequency of 120 Hz at a temperature of +25°C. The maximum voltage applied to the capacitors during measurements shall be 1 volt rms. Measurement accuracy of the bridge shall be within ±2%.

5. Dissipation Factor. Measurements are made with a polarized capacitance bridge at a frequency of 120 Hz at a temperature of +25°C.

6. Capacitance Change with Temperature. Capacitance change with temperature shall not exceed the limits given in the standard ratings table.

7. Low Temperature Impedance. The impedance of any capacitor at −55°C at 120 Hz shall not exceed the values given in the standard ratings table.

8. Mechanical Shock. Capacitors shall withstand a shock of 100g when tested in accordance with method 213 of Military Standard MIL-STD-202, test condition I.

8.1 Following the shock test, capacitors shall be examined for evidence of mechanical damage and leakage of electrolyte.

9. High Frequency Vibration. Capacitors shall withstand vibration from 10 to 2000 Hz at 20g without internal damage when tested in accordance with Military Standard MIL-STD-202, method 204, test condition D. Electrical measurements made while under these conditions shall show no intermittent contacts or open or short circuiting.

9.1 Following the vibration test, the dc leakage current shall not exceed 125% of the original requirement; the capacitance shall change not more than ±5% from the initial measured value and the DF shall not exceed 115% of initial requirement.

9.2 In addition, there shall be no evidence of mechanical damage, obliteration of marking, or leakage of electrolyte.

10. Pull Test. Leads shall withstand a tensile stress of 3 lbs. for 30 seconds applied axially in accordance with MIL-STD-202, method 211A, test condition A.

11. Lead Bend Test. Leads shall meet the bend test specified in MIL-STD-202, method 211A, test condition C except that the number of bends shall be 4.

12. Surge Voltage. The surge voltage rating is the maximum voltage to which the capacitors shall be subjected under any conditions. This includes transients and peak ripple at the highest line voltage. The surge voltage of these capacitors is 115% of rated dc working voltage.

12.1 The capacitors shall withstand the surge voltage applied through a 1000 ohm ±10% resistor in series with the capacitor and voltage source at the rate of ½ minute on, 4½ minutes off, for 1000 successive test cycles at 85°C.

12.2 Following the surge voltage test, there shall be no intermittent contacts, open or short circuiting, mechanical damage, or leakage of electrolyte.

13. Moisture Resistance. Capacitors shall be subjected to the moisture resistance cycling test specified in MIL-STD-202, method 106.

SERIES 40TW

Industrial Type Tantalum Capacitors

PERFORMANCE CHARACTERISTICS

13.1 Following the moisture resistance test, the dc leakage current shall not exceed 125% of the original requirement; the capacitance shall change not more than ±8% from the initial measured value and the DF shall not exceed 115% of initial requirement.

14. Seal Test. Capacitors shall be tested in accordance with MIL-STD-202, method 112, test condition C, procedure IIIa, 10^{-8} atm cc/sec followed by test condition A.

15. Reverse Voltage Test. Capacitors shall be subjected to a dc potential of 3 volts, applied in the reverse polarity direction, for 125 ±10 hours. The ambient temperature during the test shall be +85°C. Capacitors shall be maintained at +85°C and dc rated voltage shall be applied in the forward direction for an additional period of 125 ±10 hours.

15.1 Following the reverse voltage testing, the dc leakage current shall not exceed 125% of the original requirement; the capacitance shall be within the initial value specified and the DF shall not exceed the original requirements.

16. Ripple Life Test at +85°C. Capacitors shall be tested in accordance with Military Specification MIL-C-39006. a. Operating Conditions. This test shall be run at a frequency of 40 KHz ± 2 KHz and at the rms ripple current levels specified in the standard ratings table. b. Applied dc voltage plus the peak a-c voltage shall not exceed the rated voltage of the capacitor.

16.1 When tested as specified above, capacitors shall meet the following requirements: a. The dc leakage current at +25°C and at +85°C shall not exceed the original requirements. b. The capacitance shall not change more than ±10% from the initial measured value. c. The DF shall not exceed the original requirements. d. Visual examination. There shall be no damage, obliteration of marking, or leakage of electrolyte.

17. Life Test. Capacitors are capable of withstanding life test at the following conditions:

Temperature	Hrs.	% Rated Voltage
+85°C	2000	100*
+125°C	2000	100*
+175°C	2000	50
+175°C	300	65
+200°C	300	60

*Refer to the standard ratings table.

17.1 After life test and for those tested at +85 and/or +125°C, the capacitors shall be returned to +25°C ±5°C. The dc leakage current, measured at +25°C, +85 and/or +125°C, shall not exceed the initial requirement; the DF shall not exceed the initial requirement; and the capacitance value shall not change more than 10% from the initial measurement.

17.2 After life test and for those tested at +175°C and +200°C, the capacitor shall be returned to +25°C ±5°C. The dc leakage current at the rated voltage shall not exceed 200% of the original requirement or ±10 ua, whichever is greater; the DF shall not be greater than 200% of the original requirement; and the capacitance value shall not increase by more than 10% or decrease by more than 20% from the initial requirement.

17.3 Not more than 1 failure shall be permitted in 12 units tested.

18. Barometric Pressure (reduced). Capacitors shall be tested in accordance with MIL-STD-202, method 105, test condition E. Rated dc voltage shall be applied for 1 minute ±5 seconds.

18.1 Following Barometric Pressure test, capacitors shall be visually examined for harmful deformation of the case, mechanical damage, obliteration of marking, leakage of electrolyte and indications of flashover and breakdown.

19. Thermal Shock. Capacitors shall be subjected to 300 cycles in accordance with MIL-STD-202, method 107 and MIL-C-39006.

19.1 Following the thermal shock test, dc leakage current shall not exceed 200% of the initial requirement, capacitance shall not have changed more than ±5% from initial measured value and DF shall not exceed 115% of initial specified value.

20. Marking. Capacitors shall be marked with M/C, type number (TW), rated capacitance and tolerance, rated dc working voltage and the standard EIA date code of manufacture.

21. Polarity. Polarity shall be indicated by plus (+) signs adjacent to the positive terminal.

22. Insulation. When an insulated device is required, the insulating material will be KAPTON.

RIPPLE CURRENT MULTIPLIERS VS. FREQUENCY, TEMPERATURE & APPLIED PEAK VOLTAGE

Frequency of applied ripple current		120 Hz				800 Hz				1 kHz				10 kHz				40 kHz				100 kHz			
		Temp °C				Temp °C				Temp °C				Temp °C				Temp °C				Temp °C			
	Ambient still air	55°	85°	105°	125°	55°	85°	105°	125°	55°	85°	105°	125°	55°	85°	105°	125°	55°	85°	105°	125°	55°	85°	105°	125°
% of 85°C rated peak voltage	100%	.60	.39	–	–	.71	.43	–	–	.72	.45	–	–	.88	.55	–	–	1.0	.63	–	–	1.1	.69	–	–
	90%	.60	.46	–	–	.71	.55	–	–	.72	.55	–	–	.88	.67	–	–	1.0	.77	–	–	1.1	.85	–	–
	80%	.60	.52	.35	–	.71	.62	.42	–	.72	.62	.42	–	.88	.76	.52	–	1.0	.87	.59	–	1.1	.96	.65	–
	70%	.60	.58	.44	–	.71	.69	.52	–	.72	.70	.52	–	.88	.85	.64	–	1.0	.97	.73	–	1.1	1.07	.80	–
	66-2/3%	.60	.60	.46	.27	.71	.71	.55	.32	.72	.72	.55	32	.88	.88	.68	.40	1.0	1.0	.77	.45	1.1	1.1	.85	50

NOTES:
1. At 125°C the rated voltage of the capacitors decreases to 66-2/3% of the 85°C rated voltage.
2. The peak of the applied ac ripple voltage plus the applied dc voltage must not exceed the dc voltage rating of the capacitor either forward or reverse.
3. The ripple current listed in table I represents a rating calculated using a maximum internal temperature rise (△T) of 50°C at 40 kHz at 85°C ambient with a maximum peak rated voltage of 66-2/3% of the 85°C peak voltage rating.
4. The maximum allowable internal temperature rise (△T) decreases linearly to a calculated 10°C rise at 125°C ambient.
5. The internal temperature rise is directly proprotional to the ESR of the capacitor, and ESR increases with decreasing frequency.

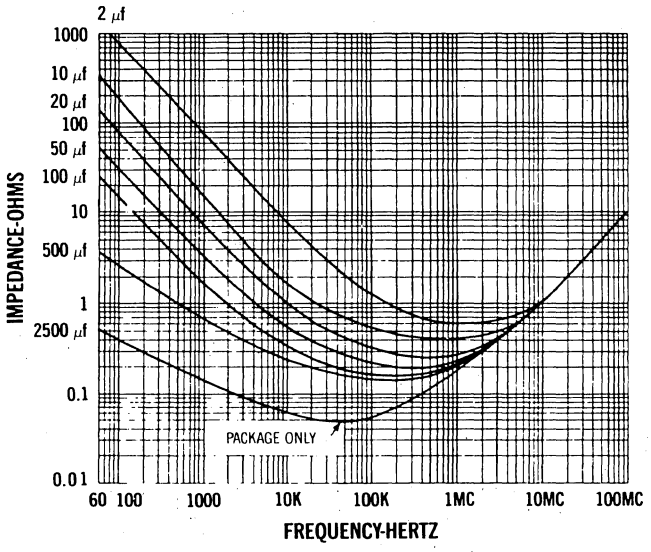
TYPICAL CURVES

Impedance

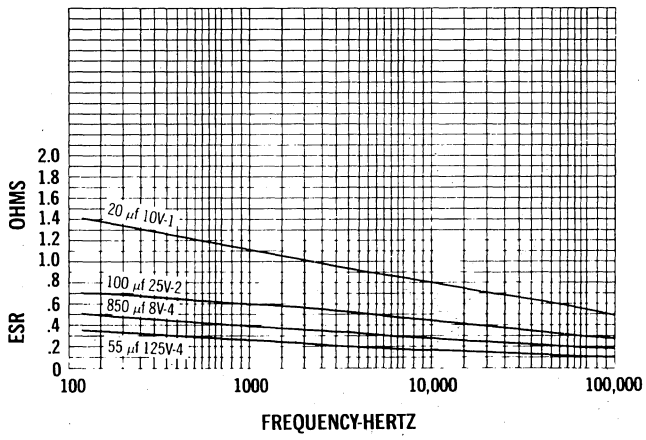
A. Impedance in ohms at 25°C may be read directly from Curve 1.

B. To obtain impedance at temperatures other than 25°C, multiply the impedance from Curve 1 by a correction factor from Curve 2, 3, or 4.

IMPEDANCE FOR TANTALUM WET SLUGS AT 25°C NO. 1



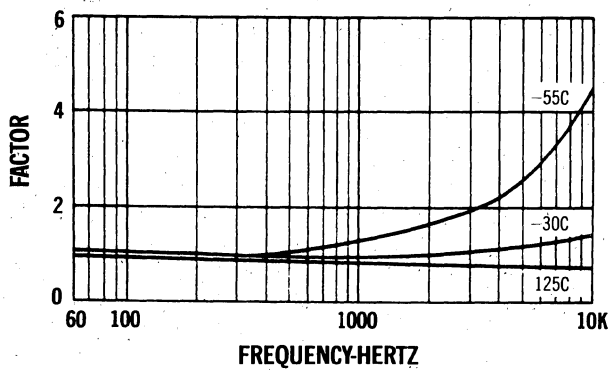
TYPICAL ESR VS. FREQUENCY AT 25°C



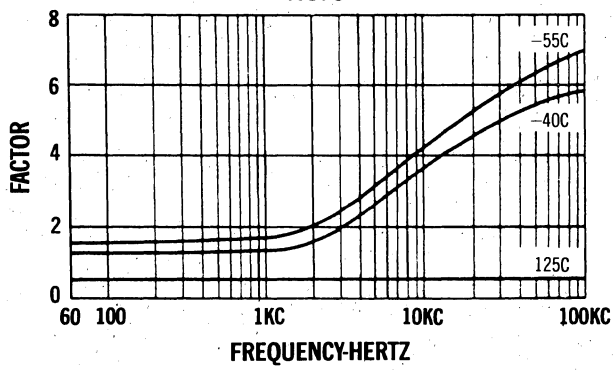
SERIES 40TW

Industrial Type Tantalum Capacitors

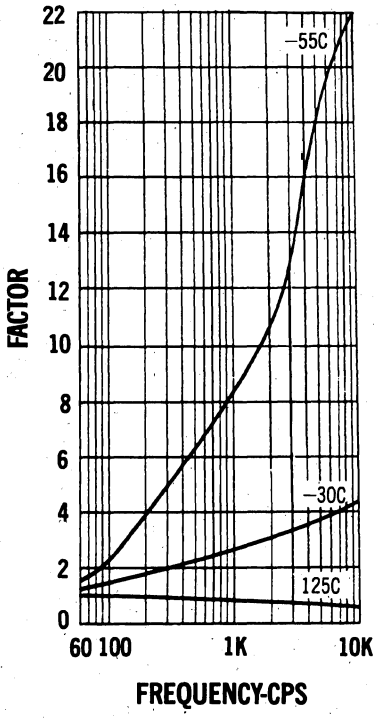
WET SLUG IMPEDANCE CORRECTION FACTORS
UP TO 5 μf
NO. 2



WET SLUG IMPEDANCE CORRECTION FACTORS
FOR CAPACITANCE 5-100 μf
NO. 3



WET SLUG IMPEDANCE CORRECTION FACTORS
FOR CAPACITANCE 100 μf
AND ABOVE INCLUDING PACKAGES
NO. 4



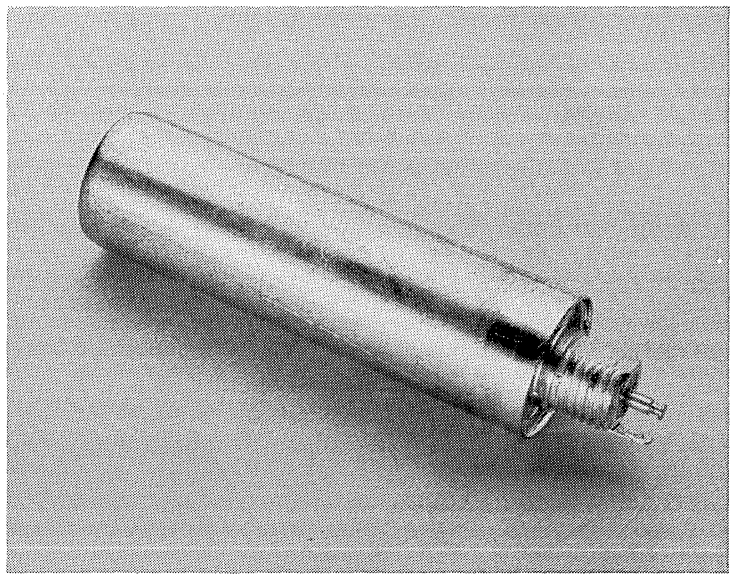
HOW TO SPECIFY

Series 40TW can be specified using the following designation:

4	0	T	W	225	A	075	K	I	A
Tantalum Capacitor	Axial Lead	Series	Wet Slug	Capacitance in (pF) First two digits are significant figures. Third digit numbers of zeros to follow 225 = 2.2μF 226 = 22μF	Case Size	Voltage Rating @ 85°C	Capacitance Tolerance J = ± 5% K = ±10% M = ±20%	O = Unsleeved I = Sleeved	Industrial

SERIES 43XW

Hermetic Cylindrical Case Tantalum Capacitor



DESCRIPTION

M/C Series 43XW offer varied capacitance and voltage ratings and have the inherent electrical and physical environmental stability of the sintered anode-gelled electrolyte construction.

All 43XW Series capacitors are hermetically sealed and meet or exceed the requirements of Mil-C-3965 and Mil-C-39006.

Because of the rugged construction and extreme purity of the sintered tantalum anodes used in the capacitor elements, the 43XW Series will operate reliably from −55°C to +125°C.

FEATURES

- MODULES
- HERMETICALLY SEALED
- +125°C OPERATION
- 20V TO 630V RATINGS
- 3.5 uf TO 1300 uf

SERIES 43XW

Industrial Type Tantalum Capacitors

APPLICATIONS

REVERSE VOLTAGE

43XW capacitors are not recommended for circuits where reversals of any magnitude occur.

DERATED VOLTAGE OPERATION

Type 43XW may be operated at voltages less than the rated values designated. The reliability of operation increases, and long term degradation decreases.

SPECIAL RATINGS & CONFIGURATIONS

Many ratings of capacitance and voltage other than those shown are available.

All 43XW capacitors function with the case negative (ground) and glass sealed terminal as positive. Reverse ground configurations are available but will carry special part numbers.

For your special rating and configuration requirements, contact the M/C Sales Engineering Department.

VIBRATION

Capacitors shall withstand a simple harmonic motion having an amplitude of 0.03" (max. total excursion 0.06") with the frequency being varied uniformly between the approximate limits of 10 to 55 cycles and ratings to be transversed in approximately 1 minute for a total of 1½ hours.

Capacitors shall withstand vibration from 10 to 2000 cycles at 15G without internal damage. Electrical measurements made while under these conditions shall show no intermittent open or short circuit.

CASE INSULATION

When specifying case insulation, add 0.031" to the H and D dimensions.

GENERAL SPECIFICATIONS

OPERATING TEMPERATURE

M/C 43XW type tantalum capacitors are designed to operate over a temperature range of -55 C to +85 C without derating. Operation up to 125 C is also permissible with proper derating.

DC WORKING VOLTAGE

The DC working voltage is the maximum operating voltage for continuous duty at the rated temperature.

CAPACITANCE

Will be measured by the bridge method with a 120 Hz 0.6 VRMS and 2.0 VDC bias applied.

SURGE VOLTAGE

The surge DC rating is the maximum voltage to which the capacitors should be subjected under any conditions. This includes transients and peak ripple at the highest line voltage. The surge voltage of all M/C 43XW type tantalum capacitors is 115% of rated DC working voltage.

-55° to 85°C		125°C
Rated	Surge	Rated
20	23	17.5
30	34.5	25
60	69	50
90	103	80
180	207	160
270	310	240
360	415	320
450	517	400
540	620	480
630	725	560

DC LEAKAGE

Measurements shall be made at rated working voltage with an application of a steady source of power, such as a regulated power supply with a 1000 ohm resistance to limit the charging current, connected in series with each capacitor under test. Rating working voltage shall be applied to capacitors for 5 minutes before making leakage current measurements.

POWER FACTOR

Will be measured by the bridge method with a 120 Hz 0.6 VRMS and a 2.0 VDC bias applied.

IMPEDANCE

Measured at -55° with a 120 Hz signal. The value shall not exceed that specified in the table for each rating.

SERIES 43XW

Industrial Type Tantalum Capacitors

Cap (uF)	Volt	Size D +.031 −.015	Size H±.062	Percent Power Factor (Max) 120Hz 25 C	DC Leakage Current (Max) Microamperes 25°C	85°C	125°C	Impedance Ohms (Max) 120Hz -55 C	Maximum Capacitance Change Percent — Referenced to as 25 C -55°C	85°C	125°C	Part Number
100	20	.875	.540	21	10	50	75	30	-60	+15	+20	43XW107A020K0AE
		.875	.540	21	10	50	75	30	-60	+15	+20	43XW107A020K0AF
200	20	.875	.732	36	16	80	120	20	-60	+15	+20	43XW207B020K0AE
		.875	.732	36	16	80	120	20	-60	+15	+20	43XW207B020K0AF
75	30	.875	.540	15	11	55	82	45	-45	+15	+10	43XW756A030K0AE
		.875	.540	15	11	55	82	45	-45	+15	+10	43XW756A030K0AF
150	30	.875	.732	29	13	90	135	30	-45	+15	+10	43XW157B030K0AE
		.875	.732	29	13	90	135	30	-45	+15	+10	43XW157B030K0AF
370	30	1.125	.600	39	18	125	170	15	-65	+20	+25	43XW377P030K0AE
		1.125	.600	39	18	125	170	15	-65	+20	+25	43XW377P030K0AA
650	30	1.125	1.100	60	21	145	202	15	-85	+20	+25	43XW657R030K0AE
		1.125	1.100	60	21	145	202	15	-85	+20	+25	43XW657R030K0AA
1300	30	1.125	1.100	83	27	190	282	10	-85	+20	+25	43XW138R030K0AE
		1.125	1.100	83	27	190	282	10	-85	+20	+25	43XW138R030K0AA
40	60	.875	.540	8.2	12	60	90	65	-35	+10	+10	43XW406A060K0AE
		.875	.540	8.2	12	60	90	65	-35	+10	+10	43XW406A060K0AF
80	60	.875	.732	16	19	95	142	35	-35	+10	+10	43XW806B060K0AE
		.875	.732	16	19	95	142	35	-35	+10	+10	43XW806B060K0AF
200	60	1.125	.600	22	19	135	182	30	-50	+20	+25	43XW207P060K0AE
		1.125	.600	22	19	135	182	30	-50	+20	+25	43XW207P060K0AA
350	60	1.125	1.100	37	22	155	210	25	-70	+20	+25	43XW357R060K0AE
		1.125	1.100	37	22	155	210	25	-70	+20	+25	43XW357R060K0AA
700	60	1.125	1.100	62	29	200	275	15	-70	+20	+25	43XW707R060K0AE
		1.125	1.100	62	29	200	275	15	-70	+20	+25	43XW707R060K0AA
25	90	.875	.540	5.1	11	55	82	90	-35	+10	+10	43XW256A090K0AE
		.875	.540	5.1	11	55	82	90	-35	+10	+10	43XW256A090K0AF
50	90	.875	.732	10	18	90	135	45	-35	+10	+10	43XW506B090K0AE
		.875	.732	10	18	90	135	45	-35	+10	+10	43XW506B090K0AF
120	90	1.125	.600	13	19	135	182	40	-40	+20	+25	43XW127P090K0AE
		1.125	.600	13	19	135	182	40	-40	+20	+25	43XW127P090K0AA
220	90	1.125	1.100	24	21	145	202	30	-60	+20	+25	43XW227R090K0AE
		1.125	1.100	24	21	145	202	30	-60	+20	+25	43XW227R090K0AA
450	90	1.125	1.100	45	29	195	215	25	-60	+20	+25	43XW457R090K0AE
		1.125	1.100	45	29	195	215	25	-60	+20	+25	43XW457R090K0AA
12	180	.875	.920	5.1	11	55	82	180	-35	+10	+10	43XW126C180K0AE
		.875	.920	5.1	11	55	82	180	-35	+10	+10	43XW126C180K0AF
25	180	.875	1.300	10	18	90	135	90	-35	+10	+10	43XW256E180K0AE
		.875	1.300	10	18	90	135	90	-35	+10	+10	43XW256E180K0AF
42	180	1.125	.976	10	18	90	135	90	-40	+20	+25	43XW426Q180K0AE
		1.125	.976	10	18	90	135	90	-40	+20	+25	43XW426Q180K0AA
60	180	1.125	.976	13	19	135	182	60	-40	+20	+25	43XW606Q180K0AE
		1.125	.976	13	19	135	182	60	-40	+20	+25	43XW606Q180K0AA
110	180	1.125	1.938	24	21	145	202	60	-60	+20	+25	43XW117U180K0AE
		1.125	1.938	24	21	145	202	60	-60	+20	+25	43XW117U180K0AA
230	180	1.125	1.938	46	29	200	275	50	-60	+20	+25	43XW237U180K0AE
		1.125	1.938	46	29	200	275	50	-60	+20	+25	43XW237U180K0AA
8	270	.875	1.270	5.1	11	55	82	270	-35	+10	+10	43XW805D270K0AE
		.875	1.270	5.1	11	55	82	270	-35	+10	+10	43XW805D270K0AF
16	270	.875	1.865	10	18	90	135	135	-35	+10	+10	43XW166G270K0AE
		.875	1.865	10	18	90	135	135	-35	+10	+10	43XW166G270K0AF
28	270	1.125	1.350	16	19	120	162	80	-40	+20	+25	43XW286S270K0AE
		1.125	1.350	16	19	120	162	80	-40	+20	+25	43XW286S270K0AA
40	270	1.125	1.350	22	19	135	182	100	-40	+20	+25	43XW406S270K0AE
		1.125	1.350	22	19	135	182	100	-40	+20	+25	43XW406S270K0AA
75	270	1.125	2.812	24	21	145	202	90	-60	+20	+25	43XW756Y270K0AE
		1.125	2.812	24	21	145	202	90	-60	+20	+25	43XW756Y270K0AA
150	270	1.125	2.812	45	28	195	215	75	-60	+20	+25	43XW157Y270K0AE
		1.125	2.812	45	28	195	215	75	-60	+20	+25	43XW157Y270K0AA
6	360	.875	1.635	5.0	11	55	82	360	-35	+10	+10	43XW605F360K0AE
		.875	1.635	5.0	11	55	82	360	-35	+10	+10	43XW605F360K0AF
12	360	.875	2.420	10	18	90	135	180	-35	+10	+10	43XW126K360K0AE
		.875	2.420	10	18	90	135	180	-35	+10	+10	43XW126K360K0AF
22	360	1.125	1.705	16	18	125	170	100	-40	+20	+25	43XW226T360K0AE
		1.125	1.705	16	18	125	170	100	-40	+20	+25	43XW226T360K0AA
30	360	1.125	1.705	22	19	135	182	120	-40	+20	+25	43XW306T360K0AE
		1.125	1.705	22	19	135	182	120	-40	+20	+25	43XW306T360K0AA
5	450	.875	2.000	4.9	11	55	82	450	-35	+10	+10	43XW505H450K0AE
		.875	2.000	4.9	11	55	82	450	-35	+10	+10	43XW505H450K0AF
10	450	.875	2.980	9.8	18	90	135	225	-35	+10	+10	43XW106M450K0AE
		.875	2.980	9.8	18	90	135	225	-35	+10	+10	43XW106M450K0AF
17	450	1.125	2.080	16	18	125	170	130	-40	+20	+25	43XW176V450K0AE
		1.125	2.080	16	18	125	170	130	-40	+20	+25	43XW176V450K0AA
25	450	1.125	2.080	23	19	135	182	150	-40	+20	+25	43XW256V450K0AE
		1.125	2.080	23	19	135	182	150	-40	+20	+25	43XW256V450K0AA

SERIES 43XW

Industrial Type Tantalum Capacitors

Cap (uF)	Volt	Size D +.031 −.015	Size H±.062	Percent Power Factor (Max) 120Hz 25°C	DC Leakage Current (Max) Microamperes 25°C	85°C	125°C	Impedance Ohms (Max) 120Hz -55°C	Maximum Capacitance Change Percent — Referenced to as 25 C -55°C	85°C	125°C	Part Number
4	540	.875	2.365	5.1	11	55	82	540	-35	+10	+10	43XW405J540K0AE
		.875	2.365	5.1	11	55	82	540	-35	+10	+10	43XW405J540K0AF*
8	540	.875	3.532	10	18	90	135	270	-35	+10	+10	43XW805N540K0AE
		.875	3.532	10	18	90	135	270	-35	+10	+10	43XW805N540K0AF
14	540	1.125	2.435	16	17	120	162	160	-40	+20	+25	43XW146W540K0AE
		1.125	2.435	16	17	120	162	160	-40	+20	+25	43XW146W540K0AA
20	540	1.125	2.435	22	19	135	182	170	-40	+20	+25	43XW206W540K0AE
		1.125	2.435	22	19	135	182	170	-40	+20	+25	43XW206W540K0AA
3.5	630	.875	2.720	5.0	11	55	82	630	-35	+10	+10	43XW355L630K0AE
		.875	2.720	5.0	11	55	82	630	-35	+10	+10	43XW355L630K0AF
7	630	.875	4.062	10	18	90	135	315	-35	+10	+10	43XW705O630K0AE
		.875	4.062	10	18	90	135	315	-35	+10	+10	43XW705O630K0AF
12	630	1.125	2.810	16	17	120	162	180	-40	+20	+25	43XW126X630K0AE
		1.125	2.810	16	17	120	162	180	-40	+20	+25	43XW126X630K0AA
18	630	1.125	2.810	23	19	135	182	200	-40	+20	+25	43XW186X630K0AE
		1.125	2.810	23	19	135	182	200	-40	+20	+25	43XW186X630K0AA

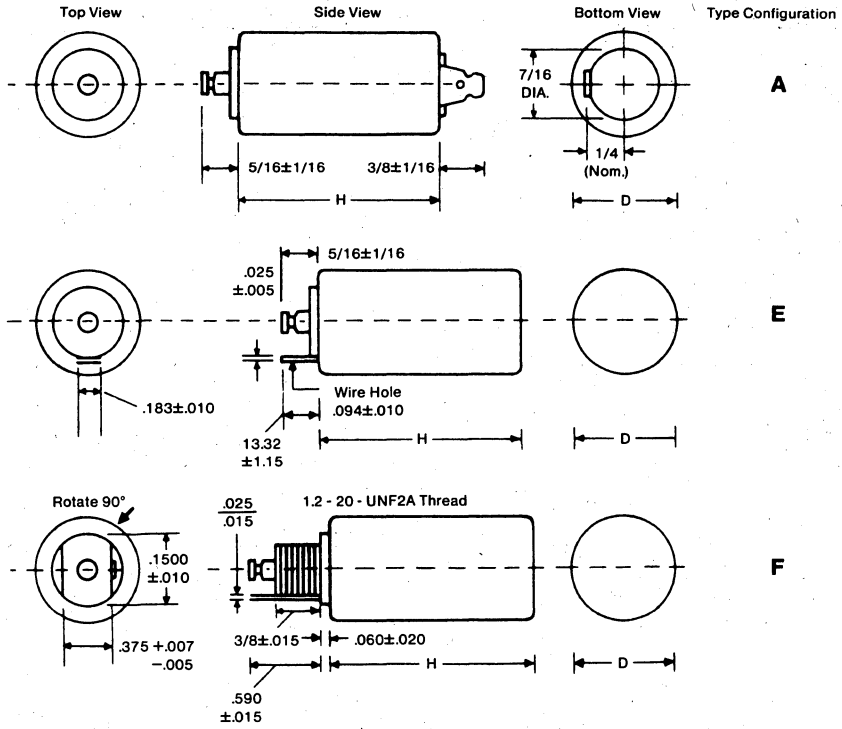
**Other Ratings Readily Available*

PART NUMBER SYSTEM

4 3 X W 107 A 020 K 0 A E

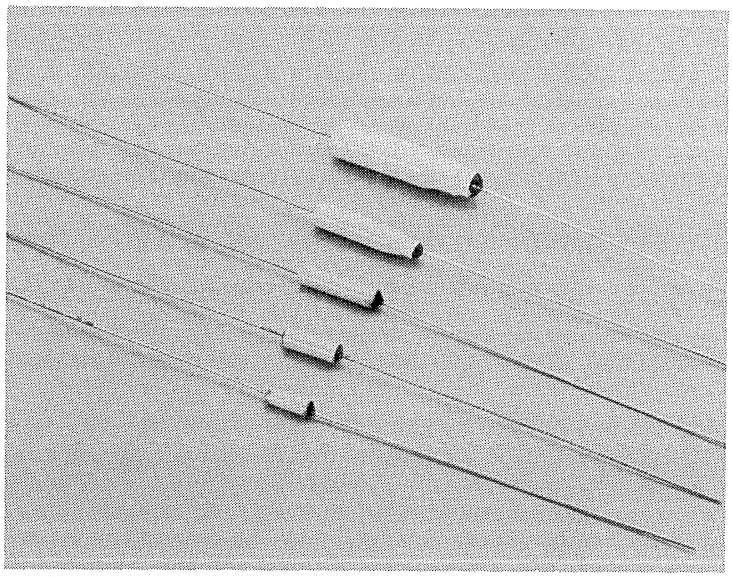
- E — CONFIGURATION: A = CL18; E = CL14, CL17; F = CL16
- A — INDUSTRIAL
- 0 — 0 = UNSLEEVED; 1 = SLEEVED
- K — CAPACITANCE TOLERANCE: K = ±10% M = ±20% U = +75 -15%
- 020 — VOLTAGE RATING @ 85 C
- A — CASE SIZE
- 107 — CAPACITANCE IN PICOFARADS. First two digits are significant figures. Third digit number of zeros to follow: 106 = 10 uF; 107 = 100 uF
- W — WET ELECTROLYTE
- X — SERIES
- 3 — MODULE
- 4 — TANTALUM

TYPE AND CONFIGURATION



SERIES 40YW

Non-Acid Electrolyte Fully Insulated Tantalum Capacitor



DESCRIPTION

M/C 40YW liquid electrolyte miniature Tantalum electrolytic capacitors fill d-c capacitor requirements where large capacitance values are required in very small spaces. These wet-electrolyte capacitors are suitable for storage at temperatures to −65°C, and will meet military vibration requirements at 2000 Hz, 15 G acceleration and all normal shock requirements.

FEATURES

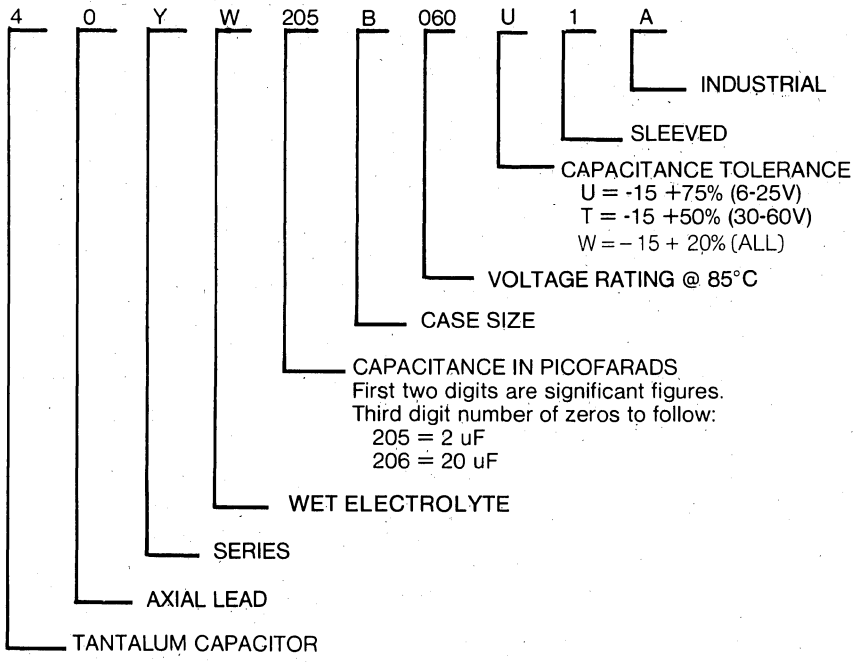
- 6 TO 60 VOLTS
- −55°C TO +85°C
- 0.1 uF TO 325 uF
- SOLDER COATED NICKEL LEADS

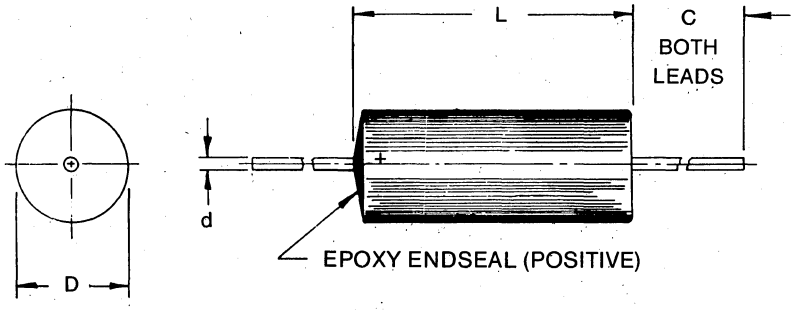
SERIES 40YW

Industrial Type Tantalum Capacitors

PART NUMBER SYSTEM

EXAMPLE





DIMENSIONS FOR 40YW TYPE — INCHES (mm)

Case Size	D max	L max	Lead dia. d	Lead length C ±.375	Weight (grams)
A	.080 (2.0)	.285 (7.2)	.020 (0.5)	2.0 (50.8)	.26
B	.115 (2.9)	.312 (7.9)	.020 (0.5)	2.0 (50.8)	.36
C	.115 (2.9)	.438 (11.1)	.020 (0.5)	2.0 (50.8)	.50
D	.145 (3.7)	.656 (16.7)	.020 (0.5)	2.0 (50.8)	1.00
E	.225 (5.7)	.875 (22.2)	.020 (0.5)	2.0 (50.8)	2.76

SERIES 40YW

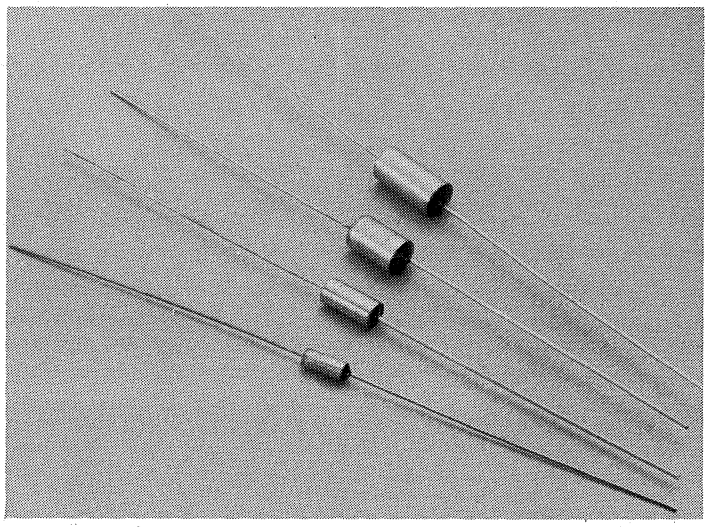
Industrial Type Tantalum Capacitors

Case Size	Cap (uF)	WVDC at 85°C	Surge Voltage at 85°C	Max Impedance 120 Hz (Ohms)			Max D-c Leakage Current (ua)		Max ESR — 120 Hz (Ohms)		Typical ESR at 25°C (Ohms)	Part Number Standard
				-55°C	25°C	85°C	25°C	85°C	25°C	85°C		
B	15	6	7	500	110	110	1	3	27	13	14	40YW156B006U1A
C	30	6	7	300	56	54	1	6	20	14	8	40YW306C006U1A
D	140	6	7	150	12	12	1.5	7.5	5	3.5	5	40YW147D006U1A
E	320	6	7	100	6	5.6	2	10	3.6	2.8	3	40YW327E006U1A
C	25	8	9	350	68	66	1	6	17	10	8	40YW256C008U1A
B	10	10	12	600	165	160	1	3	32	16	14	40YW106B010U1A
D	100	10	12	160	17	16	1.5	7.5	6	4	5	40YW107D010U1A
E	250	10	12	110	7	6.5	2	10	2.3	2	3	40YW257E010U1A
B	8	15	18	700	200	200	1	3	40	20	14	40YW805B015U1A
C	20	15	18	400	80	80	1	6	16	12	8	40YW206C015U1A
D	70	15	18	170	23	23	1.5	7.5	7	6	5	40YW706D015U1A
E	170	15	18	120	9.6	9.4	2	10	3.4	2.8	3	40YW177E015U1A
C	15	20	23	450	110	110	1	6	22	16	8	40YW156C020U1A
D	50	20	23	180	33	32	1.5	7.5	8	6.5	5	40YW506D020U1A
B	6	25	29	900	270	270	1	3	40	19	14	40YW605B025U1A
C	10	25	29	500	160	160	1	6	24	16	8	40YW106C025U1A
B	5	30	35	1,000	320	320	1	3	48	22	14	40YW505B030T1A
C	8	30	35	550	200	200	1	6	20	20	8	40YW805C030T1A
D	40	30	35	190	41	40	1.5	7.5	10	8	5	40YW406D030T1A
E	100	30	35	140	17	16.5	2	10	5.8	5	3	40YW107E030T1A
A	0.1	50	58	16,000	15,000	15,000	1	2	800	800	150	40YW104A050T1A
A	0.5	50	58	4,000	3,500	3,500	1	2	160	160	30	40YW504A050T1A
A	1.0	50	58	2,500	2,000	2,000	1	2	80	80	16	40YW105A050T1A
B	3	50	58	1,200	540	540	1	3	53	26	14	40YW305B050T1A
C	6	50	58	600	275	275	1	6	40	27	8	40YW605C050T1A
D	25	50	58	200	65	65	1.5	7.5	13	9	5	40YW256D050T1A
E	60	50	58	180	27	26.5	2	10	5.3	5	3	40YW606E050T1A
B	2	60	70	1,250	800	800	1	3	80	40	14	40YW205B060T1A
C	4	60	70	750	400	400	1	6	40	28	8	40YW405C060T1A
D	20	60	70	200	82	80	1.5	7.5	16	12	5	40YW206D060T1A
E	50	60	70	200	32	32	2	10	4.7	4.7	3	40YW506E060T1A

CAPACITANCE TOLERANCE		
Condition	Voltage Rating	Percent Tolerance Standard
25°C @ 120 Hz	6 to 25	-15+75
	30 to 60	-15+50

SERIES 40CS

Miniature Tubular Solid Electrolyte Tantalum Capacitor



DESCRIPTION

CONSTRUCTION—M/C Series 40CS is a solid electrolyte sintered tantalum anode capacitor body soldered into a tabular metal case, and sealed with epoxy resin.

CAPACITANCE—Measured at 25°C, 120 Hz on polarizing bridge with 2.2 VDC max. and 1 VRMS max. applied. Capacitance tolerances available are 20%, 10%, 5%.

DISSIPATION FACTOR—Measured with capacitance, the D.F. shall not exceed:

2 WVDC	– 10% max.
4 WVDC	– 8% max.
6 WVDC and up	– 6% max.

DC LEAKAGE CURRENT—Measured at 25°C rated voltage with 1000 ohm resistor in series, the DCL value shall not exceed:

1.0 uA	40CS-T
1.0 uA	40CS-M
2.0 uA	40CS-L
3.0 uA	40CS-B

At 85°C the DCL will not exceed 10 times the limit shown above.

WORKING VOLTAGE DC—Capacitors will operate at rated voltage from −55°C to +85°C and at 125°C at two-thirds of rated voltage. AC ripple voltage plus the forward DC voltage must not exceed rated WVDC.

SURGE VOLTAGE—40CS Series will withstand 1000-30 second pulses at 130% rated WVDC at 60 second intervals, within the operating range.

MOISTURE RESISTANCE—M/C Series 40CS will meet the requirements of Mil-Std-202, Method 106. Within 6 hours of test completion the capacitance will not change more than 5% from inital value. Dissipation factor will not exceed twice initial limits, and DC Leakage Current will not exceed initial limits.

LEADS—Solder coated high purity nickel.

MARKING—Capacitors will be marked with M/C type (CW), rated capacitance and tolerance, rated DC voltage and date code where space permits.

FEATURES

- **0.0047 uf TO 68 uf**
- **2 THROUGH 50 VOLTS**
- **FOUR STANDARD SIZES**
- **−55 TO 125°C OPERATION**
- **METAL CASE**
- **WELDABLE/SOLDERABLE LEADS**

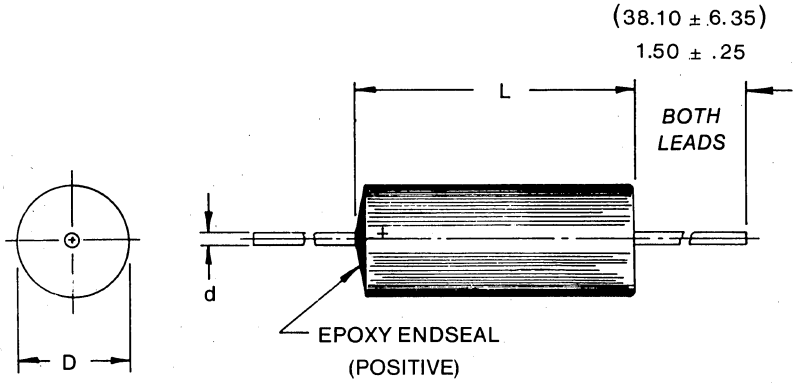
SERIES 40CS

Industrial Type Tantalum Capacitors

PART NUMBER SYSTEM

EXAMPLE 4 0 C S 475 B 050 K 1 A

- 4 — TANTALUM CAPACITOR
- 0 — AXIAL LEAD
- C — SERIES
- S — SOLID ELECTROLYTE
- 475 — CAPACITANCE IN PICOFARADS. First two digits are significant figures. Third digit is number of zeros to follow: 475 = 4.7 uF, 476 = 47 uF
- B — CASE SIZE
- 050 — RATED VOLTAGE AT 85°C
- K — CAPACITANCE TOLERANCE J = ±5% R = ±10% M = ±20%
- 1 — 0 = UNSLEEVED, 1 = SLEEVED
- A — INDUSTRIAL



Dimensions—Inches (mm)			
Case Size	L Max	D Max	d ±.001 (.03)
	INSULATED		
T	.260 (6.60)	.095 (2.41)	.020 (0.51)
M	.320 (8.13)	.133 (3.38)	.020 (0.51)
L	.345 (8.76)	.180 (4.57)	.020 (0.51)
B	.420 (10.67)	.183 (4.65)	.020 (0.51)
	UNINSULATED		
T	.250 (6.35)	.090 (2.29)	.020 (0.51)
M	.300 (7.62)	.128 (3.25)	.020 (0.51)
L	.325 (8.26)	.175 (4.45)	.020 (0.51)
B	.400 (10.16)	.178 (4.52)	.020 (0.51)

SERIES 40CS

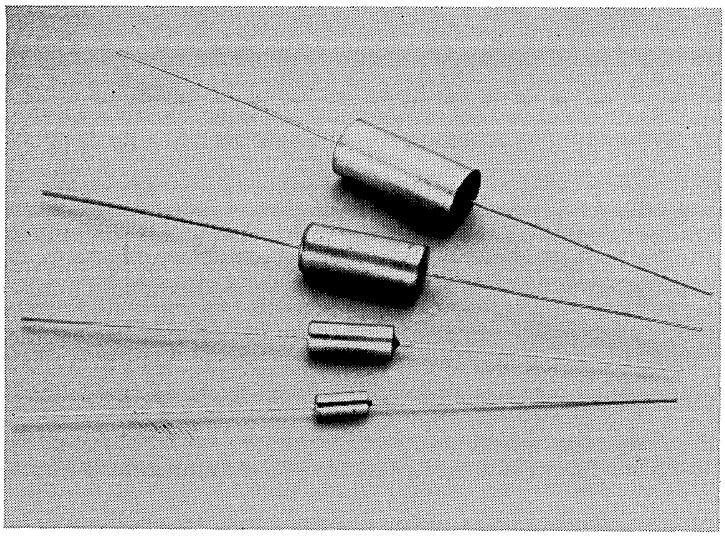
Industrial Type Tantalum Capacitors

CAPACITANCE +25°C 120 Hz	3 WVDC ±.10% Insulated	4 WVDC ±.10% Insulated	6 WVDC ±.10% Insulated	10 WVDC ±.10% Insulated	15 WVDC ±.10% Insulated
1.8	–	–	–	–	40CS185T015K1A
2.2	–	–	–	–	40CS225T015K1A
2.7	–	–	–	40CS275T010K1A	–
3.3	–	–	–	40CS335T010K1A	–
3.9	–	–	40CS395T006K1A	–	–
4.7	–	–	40CS475T006K1A	–	–
5.6	–	40CS565T004K1A	–	–	40CS565M015K1A
6.8	–	40CS685T004K1A	–	–	40CS685M015K1A
8.2	40CS825T002K1A	–	–	40CS825M010K1A	–
10.0	40CS106T002K1A	–	–	40CS106M010K1A	–
12.0	–	–	40CS126M006K1A	–	40CS126L105K1A
15.0	–	–	40CS156M006K1A	–	40CS156L105K1A
18.0	–	40CS186M004K1A	–	40CS186L010K1A	40CS186B015K1A
22.0	–	40CS226M004K1A	–	40CS226L101K1A	40CS226B015K1A
27.0	40CS276M002K1A	–	40CS276L006K1A	40CS276B010K1A	–
33.0	40CS336M002K1A	–	40CS336L006K1A	40CS336B010K1A	–
39.0	–	40CS396L004K1A	40CS396B006K1A		
47.0	–	40CS476L004K1A	40CS476B006K1A		
56.0	40CSA566L002K1A	40CS566B004K1A			
68.0	40CSA686L002K1A	40CS686B004K1A			

CAPACITANCE +25°C 120 Hz	20 WVDC ±.10% Insulated	25 WVDC ±.10% Insulated	35 WVDC ±.10% Insulated	50 WVDC ±.10% Insulated
.0047			40CS472T035K1A	40CS472T050K1A
.0056			40CS562T035K1A	40CS562T050K1A
.0068			40CS682T035K1A	40CS682T050K1A
.0082			40CS822T035K1A	40CS822T050K1A
.010			40CS103T035K1A	40CS103T050K1A
.012			40CS123T035K1A	40CS123T050K1A
.015			40CS153T035K1A	40CS153T050K1A
.018			40CS183T035K1A	40CS183T050K1A
.022			40CS223T035K1A	40CS223T050K1A
.027			40CS273T035K1A	40CS273T050K1A
.033			40CS333T035K1A	40CS333T050K1A
.039			40CS393T035K1A	40CS393T050K1A
.047			40CS473T035K1A	40CS473T050K1A
.056			40CS563T035K1A	40CS563T050K1A
.068			40CS683T035K1A	40CS683T050K1A
.082			40CS823T035K1A	40CS823T050K1A
.10			40CS104T035K1A	40CS104T050K1A
.12			40CS124T035K1A	40CS124T050K1A
.15			40CS154T035K1A	40CS154T050K1A
.18			40CS184T035K1A	40CS184T050K1A
.22			40CS224T035K1A	40CS224T050K1A
.33			40CS334T035K1A	40CS334T050K1A
.39			40CS394T035K1A	40CS394T050K1A
.47			40CS474T035K1A	40CS474T050K1A
.56	–	40CS564T025K1A	40CS564M035K1A	40CS564M050K1A
.68	–	40CS684T025K1A	40CS684M035K1A	40CS684M050K1A
.82	–	40CS824T025K1A	40CS824M035K1A	40CS824M050K1A
1.00	–	40CS105T025K1A	40CS105M035K1A	40CS105M050K1A
1.2	40CS125T020K1A	–	40CS125M035K1A	40CS125M050K1A
1.5	40CS155T020K1A	–	40CS155M035K1A	–
1.8	–	40CS185M025K1A	40CS185L035K1A	40CS185L050K1A
2.2	–	40CS225M025K1A	40CS225L035K1A	40CS225L050K1A
2.7	–	40CS275M025K1A	40CS275L035K1A	40CS275L050K1A
3.3	–	40CS335M025K1A	40CS335L035K1A	40CS335L050K1A
3.9	40CS395M020K1A	40CS395L025K1A	40CS395B035K1A	40CS395B050K1A
4.7	40CS475M020K1A	40CS475L025K1A	40CS475B035K1A	40CS475B050K1A
5.6	–	40CS565L025K1A	40CS565B035K1A	
6.8	–	40CS685L025K1A	40CS685B035K1A	
8.2	40CS825L020K1A	40CS825B025K1A		
10.0	40CS106L020K1A	40CS106B025K1A		
12.	40CS126L020K1A			
15.	40CS156L020K1A			

SERIES 40ES

Endsealed Solid Electrolyte Tantalum Capacitor



DESCRIPTION

The M/C Inc. 40ES Series is a solid electrolyte sintered tantalum anode capacitor body, soldered into a tubular metal can and sealed with epoxy resin.

Available in four standard sizes, insulated and uninsulated, the 40ES Series is manufactured utilizing the highly automated processing and assembly techniques which M/C has developed for producing established reliability devices.

The 40ES Series is especially adapted for applications involving coupling, filtering, and timing in those computer, industrial, and commerical circuits requiring consistent, economical capacitors in volume.

FEATURES

- **–55° to 125°C OPERATION**
- **6 THRU 100 VOLTS**
- **0.0047 uf THRU 330 uf**
- **FOUR STANDARD SIZES**
- **METAL CASE**
- **WELDABLE/SOLDERABLE LEADS**
- **ENERGY STORAGE–FILTERING**
- **COUPLING–DECOUPLING**
- **BY PASSING–TIMING**

SERIES 40ES

Industrial Type Tantalum Capacitors

DESIGN AND CONSTRUCTION

Each 40ES type capacitor consists of a highly purified sintered tantalum anode body, utilizing an electrolytically formed oxide dielectric and a solid electrolyte, soldered in a metal case with axial leads and sealed with epoxy resin.

INSULATION

When specified, a MYLAR* sleeve will be placed over the metal can. The insulation will not soften or creep over the operating temperature range.

RADIAL CONFIGURATION

When radial lead configuration is desired, the negative lead can be bent down the side of the metal can.

LEADS

Lead material is Grade A nickel, tin lead plated to facilitate soldering. Other lead material available on request.

MARKING

Capacitors will be marked with Mepco/Centralab logo, capacitance, voltage, and a + sign for polarity as a minimum. Polarity is also noted by the red end seal on the + end. When space permits, Mepco/Centralab capacitance tolerance and date code will be added.

DC WORKING VOLTAGE

40ES Series capacitors are available in 8 voltage ratings applicable from −55°C to 85°C without derating, and to 125°C with ⅔ linear derating, (see chart under para. 3).

SURGE VOLTAGE

The surge voltage is the maximum DC voltage, including peak AC or other pulses, which may be applied for short duration.

In no case shall the sum of AC voltage and applied DC working voltage exceed the working voltage of the capacitor.

* Copyright, DuPont Company

The surge voltages are as follows:

Rated WVDC up to 85°C	Derated 125°C	SURGE VOLTAGE 85°C	SURGE VOLTAGE 125°C
6	4	8	5
10	7	13	9
15	10	20	12
20	13	26	16
35	23	46	28
50	33	65	40
75	50	97	64
100	66	130	86

CAPACITANCE

Capacitance shall be measured on a polarized bridge, at or referred to 120 Hz at 25°C. The maximum DC bias shall be 2.2 VDC for all A.C. measurements. The magnitude of the A.C. signal shall be limited to 1.0 VRMS.

The capacitance so determined shall be within specified initial capacitance tolerance.

TOLERANCE

The 40ES Series is available in ±20%, ±10% and ±5% capacitance tolerances.

DISSIPATION FACTOR

DF shall be measured on a polarized bridge, at or referred to 120 cps at 25°C. The maximum DC bias shall be 2.2 VDC for all AC measurements. The magnitude of the AC signal shall be limited to 1.0 VRMS.

The DF so determined shall not exceed:

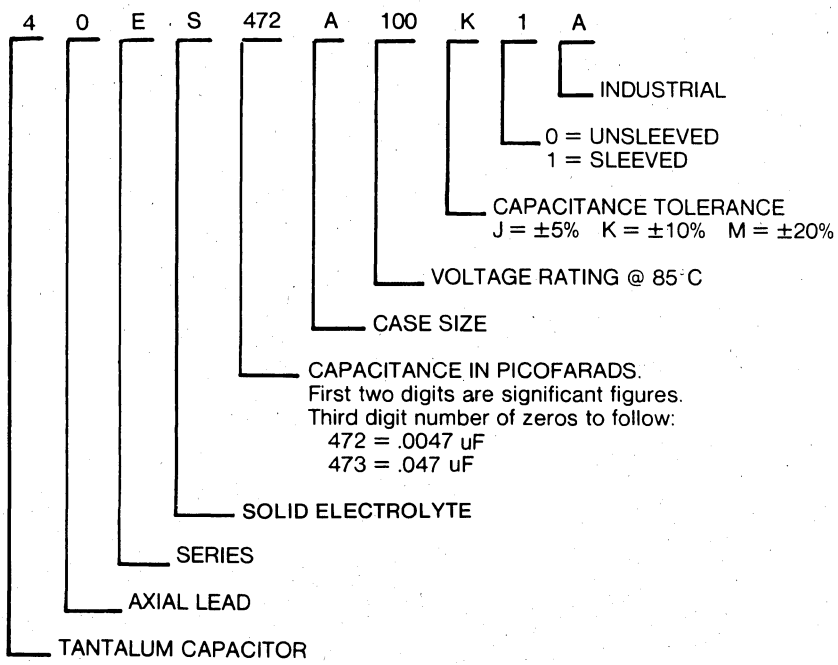
0.01 uf to 56 uf	6% DF maximum
68 uf to 120 uf	8% DF maximum
150 uf and Up	10% DF maximum

D.C. LEAKAGE CURRENT

DCL shall not exceed 0.02 uA/ufV, but need not be less than 1 uA when determined with a 1000 ohm current limiting resistor in series with the test capacitor after a 5 minute application of rated voltage at 25°C. The DCL at 85° shall not exceed 10 times the 25°C limits. At 125°C the DCL shall not exceed 12 times the 25°C limits.

PART NUMBER SYSTEM

EXAMPLE



M/C STANDARD RATINGS

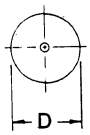
CAPACITANCE +25°C 120 Hz	6 WVDC ±10% INSULATED 4V @ 125°C	10 WVDC ±10% INSULATED 7V @ 125°C	15 WVDC ±10% INSULATED 10V @ 125°C	20 WVDC ±10% INSULATED 13V @ 125°C
.0047	40ES472A006K1A	40ES472A010K1A	40ES472A015K1A	40ES472A020K1A
.0056	40ES562A006K1A	40ES562A010K1A	40ES562A015K1A	40ES562A020K1A
.0068	40ES682A006K1A	40ES682A010K1A	40ES682A015K1A	40ES682A020K1A
.0082	40ES822A006K1A	40ES822A010K1A	40ES822A015K1A	40ES822A020K1A
.01	40ES103A006K1A	40ES103A010K1A	40ES103A015K1A	40ES103A020K1A
.012	40ES123A006K1A	40ES123A010K1A	40ES123A015K1A	40ES123A020K1A
.015	40ES153A006K1A	40ES153A010K1A	40ES153A015K1A	40ES153A020K1A
.018	40ES183A006K1A	40ES183A010K1A	40ES183A015K1A	40ES183A020K1A
.022	40ES223A006K1A	40ES223A010K1A	40ES223A015K1A	40ES223A020K1A
.027	40ES273A006K1A	40ES273A010K1A	40ES273A015K1A	40ES273A020K1A
.033	40ES333A006K1A	40ES333A010K1A	40ES333A015K1A	40ES333A020K1A
.039	40ES393A006K1A	40ES393A010K1A	40ES393A015K1A	40ES393A020K1A
.047	40ES473A006K1A	40ES473A010K1A	40ES473A015K1A	40ES473A020K1A
.056	40ES563A006K1A	40ES563A010K1A	40ES563A015K1A	40ES563A020K1A
.068	40ES683A006K1A	40ES683A010K1A	40ES683A015K1A	40ES683A020K1A
.082	40ES823A006K1A	40ES823A010K1A	40ES823A015K1A	40ES823A020K1A
.1	40ES104A006K1A	40ES104A010K1A	40ES104A015K1A	40ES104A020K1A
.12	40ES124A006K1A	40ES124A010K1A	40ES124A015K1A	40ES124A020K1A
.15	40ES154A006K1A	40ES154A010K1A	40ES154A015K1A	40ES154A020K1A
.18	40ES184A006K1A	40ES184A010K1A	40ES184A015K1A	40ES184A020K1A
.22	40ES224A006K1A	40ES224A010K1A	40ES224A015K1A	40ES224A020K1A
.27	40ES274A006K1A	40ES274A010K1A	40ES274A015K1A	40ES274A020K1A
.33	40ES334A006K1A	40ES334A010K1A	40ES334A015K1A	40ES334A020K1A
.39	40ES394A006K1A	40ES394A010K1A	40ES394A015K1A	40ES394A020K1A
.47	40ES474A006K1A	40ES474A010K1A	40ES474A015K1A	40ES474A020K1A
.56	40ES564A006K1A	40ES564A010K1A	40ES564A015K1A	40ES564A020K1A
.68	40ES684A006K1A	40ES684A010K1A	40ES684A015K1A	40ES684AO20K1A
.82	40ES824A006K1A	40ES824A010K1A	40ES824A015K1A	40ES824A020K1A
1.0	40ES105A006K1A	40ES105A010K1A	40ES105A015K1A	40ES105A020K1A
1.2	40ES125A006K1A	40ES125A010K1A	40ES125A015K1A	40ES125A020K1A
1.5	40ES155A006K1A	40ES155A010K1A	40ES155A015K1A	40ES155A020K1A
1.8	40ES185A006K1A	40ES185A010K1A	40ES185A015K1A	40ES185A020K1A
2.2	40ES225A006K1A	40ES225A010K1A	40ES225A015K1A	40ES225A020K1A
2.7	40ES275A006K1A	40ES275A010K1A	40ES275A015K1A	40ES275B020K1A
3.3	40ES335A006K1A	40ES335A010K1A	40ES335A015K1A	40ES335B020K1A
3.9	40ES395A006K1A	40ES395A010K1A	40ES395B015K1A	40ES395B020K1A
4.7	40ES475A006K1A	40ES475A010K1A	40ES475B015K1A	40ES475B020K1A
5.6	40ES565A006K1A	40ES565B010K1A	40ES565B015K1A	40ES565B020K1A
6.8	40ES685A006K1A	40ES685B010K1A	40ES685B015K1A	40ES685B020K1A
8.2	40ES825B006K1A	40ES825B010K1A	40ES825B015K1A	40ES825B020K1A
10	40ES106B006K1A	40ES106B010K1A	40ES106B015K1A	40ES106B020K1A
12	40ES126B006K1A	40ES126B010K1A	40ES126B015K1A	40ES126B020K1A
15	40ES156B006K1A	40ES156B010K1A	40ES156B015K1A	40ES156B020K1A
18	40ES186B006K1A	40ES186B010K1A	40ES186B015K1A	40ES186C020K1A
22	40ES226B006K1A	40ES226B010K1A	40ES226B015K1A	40ES226C020K1A
27	40ES276B006K1A	40ES276B010K1A	40ES276C015K1A	40ES276C020K1A
33	40ES336B006K1A	40ES336B010K1A	40ES336C015K1A	40ES336C020K1A
39	40ES396B006K1A	40ES396B010K1A	40ES396C015K1A	40ES396C020K1A
47	40ES476B006K1A	40ES476C010K1A	40ES476C015K1A	40ES476C020K1A
56	40ES566B006K1A	40ES566C010K1A	40ES566C015K1A	40ES566D020K1A
68	40ES686C006K1A	40ES686C010K1A	40ES686C015K1A	40ES686D020K1A
82	40ES826C006K1A	40ES826C010K1A	40ES826D015K1A	40ES826D020K1A
100	40ES107C006K1A	40ES107C010K1A	40ES107D015K1A	40ES107D020K1A
120	40ES127C006K1A	40ES127C010K1A	40ES127D015K1A	
150	40ES157C006K1A	40ES157D010K1A	40ES157D015K1A	
180	40ES187C006K1A	40ES187D010K1A		
220	40ES227D006K1A	40ES227D010K1A		
270	40ES277D006K1A			
330	40ES337D006K1A			

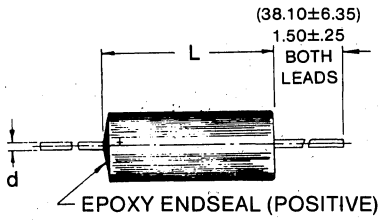
SERIES 40ES

Industrial Type Tantalum Capacitors

M/C STANDARD RATINGS

CAPACITANCE +25°C 120 Hz	35 WVDC ±10% INSULATED 23V @ 125°C	50 WVDC ±10% INSULATED 33V @ 125°C	75 WVDC ±10% INSULATED 50V @ 125°C	100 WVDC ±10% INSULATED 67V @ 125°C
.0047	40ES472A035K1A	40ES472A050K1A	40ES472A075K1A	40ES472A100K1A
.0056	40ES562A035K1A	40ES562A050K1A	40ES562A075K1A	40ES562A100K1A
.0068	40ES683A035K1A	40ES683A050K1A	40ES683A075K1A	40ES683A100K1A
.0082	40ES822A035K1A	40ES822A050K1A	40ES822A075K1A	40ES822A100K1A
.01	40ES103A035K1A	40ES103A050K1A	40ES103A075K1A	40ES103A100K1A
.012	40ES123A035K1A	40ES123A050K1A	40ES123A075K1A	40ES123A100K1A
.015	40ES153A035K1A	40ES153A050K1A	40ES153A075K1A	40ES153A100K1A
.018	40ES183A035K1A	40ES183A050K1A	40ES183A075K1A	40ES183A100K1A
.022	40ES223A035K1A	40ES223A050K1A	40ES223A075K1A	40ES223A100K1A
.027	40ES273A035K1A	40ES273A050K1A	40ES273A075K1A	40ES273A100K1A
.033	40ES333A035K1A	40ES333A050K1A	40ES333A075K1A	40ES333A100K1A
.039	40ES393A035K1A	40ES393A050K1A	40ES393A075K1A	40ES393A100K1A
.047	40ES473A050K1A	40ES473A050K1A	40ES473A075K1A	40ES473A100K1A
.056	40ES563A035K1A	40ES563A050K1A	40ES563A075K1A	40ES563A100K1A
.068	40ES683A035K1A	40ES683A050K1A	40ES683A075K1A	40ES683A100K1A
.082	40ES823A035K1A	40ES823A050K1A	40ES823A075K1A	40ES823A100K1A
.1	40ES104A035K1A	40ES104A050K1A	40ES104A075K1A	40ES104A100K1A
.12	40ES124A035K1A	40ES124A050K1A	40ES124A075K1A	40ES124A100K1A
.15	40ES154A035K1A	40ES154A050K1A	40ES154A075K1A	40ES154A100K1A
.18	40ES184A035K1A	40ES184A050K1A	40ES184A075K1A	40ES184A100K1A
.22	40ES224A035K1A	40ES224A050K1A	40ES224A075K1A	40ES224A100K1A
.27	40ES274A035K1A	40ES274A050K1A	40ES274A075K1A	40ES274A100K1A
.33	40ES334A035K1A	40ES334A050K1A	40ES334A075K1A	40ES334A100K1A
.39	40ES394A035K1A	40ES394A050K1A	40ES394A075K1A	40ES394A100K1A
.47	40ES474A035K1A	40ES474A050K1A	40ES474A075K1A	40ES474A100K1A
.56	40ES564A035K1A	40ES564A050K1A	40ES564A075K1A	40ES564A100K1A
.68	40ES684A035K1A	40ES684A050K1A	40ES684A075K1A	40ES684B100K1A
.82	40ES824A035K1A	40ES824A050K1A	40ES824B075K1A	40ES824B100K1A
1.0	40ES105A035K1A	40ES105A050K1A	40ES105B075K1A	40ES105B100K1A
1.2	40ES125B035K1A	40ES125B050K1A	40ES125B075K1A	40ES125B100K1A
1.5	40ES155B035K1A	40ES155B050K1A	40ES155B075K1A	40ES155B100K1A
1.8	40ES185B035K1A	40ES185B050K1A	40ES185B075K1A	40ES185B100K1A
2.2	40ES225B035K1A	40ES225B050K1A	40ES225B075K1A	40ES225B100K1A
2.7	40ES275B035K1A	40ES275B050K1A	40ES275B075K1A	40ES275B100K1A
3.3	40ES335B035K1A	40ES335B050K1A	40ES335B075K1A	
3.9	40ES395B035K1A	40ES395B050K1A	40ES395B075K1A	
4.7	40ES475B035K1A	40ES475B050K1A	40ES475C075K1A	
5.6	40ES565B035K1A	40ES565C050K1A	40ES565C075K1A	
6.8	40ES685B035K1A	40ES685C050K1A	40ES685C075K1A	
8.2	40ES825C035K1A	40ES825C050K1A	40ES825C075K1A	
10	40ES106C035K1A	40ES106C050K1A	40ES106C075K1A	
12	40ES126C035K1A	40ES126C050K1A	40ES126D075K1A	
15	40ES156C035K1A	40ES156C050K1A	40ES156D075K1A	
18	40ES186C035K1A	40ES186C050K1A		
22	40ES226C035K1A	40ES226D050K1A		
27	40ES276D035K1A			
33	40ES336D035K1A			
39	40ES396D035K1A			
47	40ES476D035K1A			

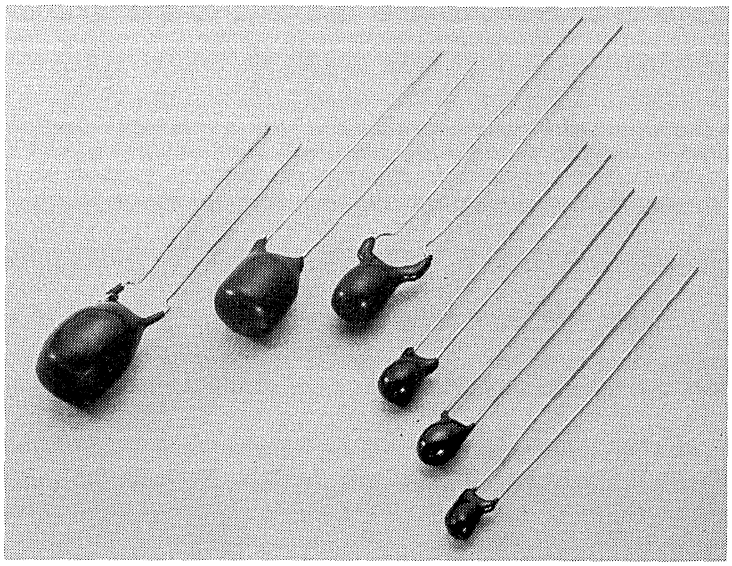




DIMENSIONS — INCHES (mm)						
Case Size	Insulated		Uninsulated		d Lead Diam. ±.002 (0.05)	Approx. Weight Grams
	D Max.	L Max.	D Max.	L Max.		
A	0.151 (3.83)	0.317 (8.05)	0.141 (3.58)	0.281 (7.14)	0.020 (0.51)	0.7
B	0.201 (5.10)	0.505 (12.81)	0.191 (4.85)	0.469 (11.90)	0.020 (0.51)	1.6
C	0.305 (7.75)	0.717 (18.21)	0.295 (7.50)	0.681 (17.30)	0.025 (0.64)	4.9
D	0.367 (9.82)	0.817(20.78)	0.357(9.06)	0.781(19.83)	0.025(0.64)	8.8

SERIES 41GS

Econodip Commercial Grade Dipped-Radial Lead Solid Electrolyte Tantalum Capacitor



DESCRIPTION

The 41GS type capacitors are designed and manufactured for low unit cost in volume production quantities and reliable operation in a wide variety of commercial and consumer circuit applications.

The inherent reliability of the solid tantalum capacitor is offered in a radial lead capacitor which incorporates an insulating protective body coating to withstand production handling in automated processing or assembly equipment.

The 41GS Series provides a wide variety of standard capacitance-voltage ratings to accommodate the use of the dipped capacitor series for replacement of axial lead capacitor styles on printed circuit boards.

The six case sizes are supplied with standard lead spacing of 0.100" (2.54 mm), 0.125" (3.18 mm), 0.200" (5.08 mm).

Four of the case sizes are available with hockey-stick leads with 0.250" (6.35 mm) lead spacing.

FEATURES

- **–55°C to +85°C TEMPERATURE RANGE**
- **0.1 uf THROUGH 680.0 uf**
- **3 VDC THROUGH 50 VDC**
- **SIX STANDARD CASE SIZES**
- **STRAIGHT AND FORMED LEADS AVAILABLE**
- **STABLE ELECTRICAL CHARACTERISTICS**
- **RESIN COATED**
- **LOW COST**
- **LOW D.C. LEAKAGE**
- **STANDARD .020" DIAMETER LEAD WIRES**

SERIES 41GS

Industrial Type Tantalum Capacitors

CAPACITANCE — Measured at 25 C at 120 Hz using the bridge method with 1 VRMS and 2.2 VDC maximum applied to the device. See table for standard capacitance-voltage ratings.

CAPACITANCE TOLERANCE — ±20% (M) is standard. ±10% (K) is available upon request.

DISSIPATION FACTOR — Determined by the same method as capacitance. DF in percent shall not exceed the following:

Rated Capacitance	Maximum DF
0.1 uf to 6.8 uf	6%
8.2 uf to 68 uf	8%
82 uf to 330 uf	10%
470 uf to 680 uf	12%

D.C. LEAKAGE– Shall not exceed .02 X CV (capacitance X voltage) or 1 ua whichever is greater at 25°C when measured with rated voltage applied. The electrification period, prior to measurement, shall be 5 minutes. A regulated power supply with an external 1000 ohm resistor in series with each unit should be used to supply the D.C. test and electrification voltage. 85 C.D.C. leakage shall not exceed 10 X CV or 10 ua, whichever is greater, when measured as described above.

WVDC WORKING VOLTS D.C.
RVDC RATED VOLTAGE D.C. — The 41GS Series is designed to operate reliably in a wide variety of environments between -55 C and +85 C with rated voltage applied.

SURGE VOLTAGE — The surge voltage is the maximum D.C. voltage, including peak AC or other pulse voltages which may be applied to the capacitor for short periods of time.

Rated D.C. Voltage	Maximum Surge Voltage
3	3.6
6.3	8
10	12
16	19
20	26
25	30
35	42
50	60

CIRCUIT RESISTANCE — Low impedance surges may do permanent damage to solid tantalum capacitors. Normal circuit applications should include a total resistance value equal to 3 ohms per applied volt.

CAPACITANCE CHANGE WITH TEMPERATURE —

Temperature	Capacitance Change (Maximum)
-55 C	-12% of initial measurement
+85 C	+12% of initial measurement

Reference measurement (initial) will be taken at +25 C.

REVERSE VOLTAGE — The maximum allowable reverse voltage at 25°C is 10% of the rated voltage or 0.8 volt, whichever is greater.

At 85°C the maximum allowable reverse voltage is 5% of the voltage rating or 0.4 volt, whichever is greater.

The 41GS is a polarized capacitor series and should not be subjected to reverse voltages for long time periods.

LEAD MATERIAL — Lead material is #24 AWG/.020" (.051 mm) diameter Grade A nickel, tin lead plated to facilitate soldering.

TERMINAL STRENGTH — Each lead will withstand a 2 lb. (907.2 gr) pull applied axially for a period of 10 seconds without lead or weld failure. Each lead will withstand two 90° bends, with no stress applied to the case, without failure.

The terminal strength test is considered a destructive test.

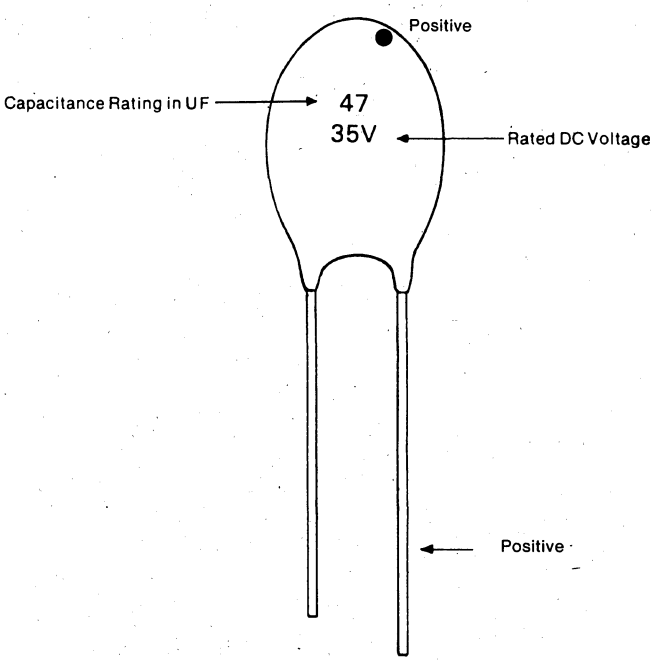
LIFE TEST — Capacitors shall withstand a 1000 hour life test at 85°C with rated voltage continuously applied. A minimum of circuit impedance in series with each unit will be 3 ohms per applied volt.

At the completion of the life test, the following electrical limits apply:

Characteristic	Post Life Test Requirements
Capacitance	±10% of initial value
Dissipaton Factor	150% of original requirments
D.C. Leakage	200% of initial requirement

MARKING — Each capacitor will be marked with the rated capacitance, a capacitance tolerance identifier letter and the rated voltage.

The positive lead is the longer of the two leads. A red dot will indicate positive lead wire.

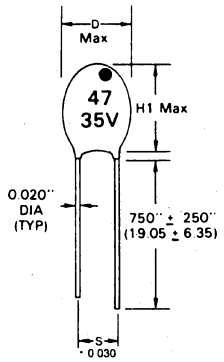


M/C PART NUMBERING SYSTEM

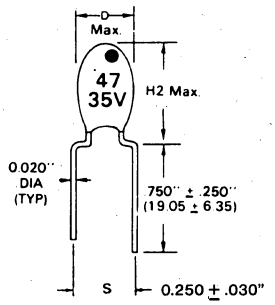
4 1 G S 154 A 050 K 0 A V

- 4 — TANTALUM CAPACITOR
- 1 — RADIAL LEAD
- G — SERIES
- S — SOLID ELECTROLYTE
- 154 — CAPACITANCE IN PICOFARADS. First two digits are significant figures. Third digit is number of zeros to follow: 154 = 15 uF, 155 = 1.5 uF
- A — CASE SIZE
- 050 — RATED VOLTAGE AT 85°C
- K — CAPACITANCE TOLERANCE J = ±5% K = ±10% M = ±20%
- 0 — UNSLEEVED
- A — INDUSTRIAL
- V — LEAD SPACING CODE V = .100 grid, W = .125 grid, X = .200 grid, Y = .250 grid

Case Code	Terminal Codes Available	Diameter "D" Max. In. (mm)	Height "H1" Max. In. (mm)	Height "H2" Max. In. (mm)
A	V, Y	0.180 (4.57)	0.280 (7.11)	.410 (10.41)
B	V, Y	0.200 (5.08)	0.300 (7.62)	.430 (10.92)
C	W, Y	0.260 (6.60)	0.360 (9.14)	.490 (12.45)
D	W, Y	0.340 (8.64)	0.400 (10.16)	.540 (13.72)
E	X & Y	0.400 (10.16)	0.560 (14.22)	.650 (16.50)
F	X & Y	0.440 (11.18)	0.680 (17.27)	.750 (19.05)



TERMINAL V



TERMINAL Y

Lead Wire Diameter .020"/#24 AWG On All Case Sizes

SERIES 41GS

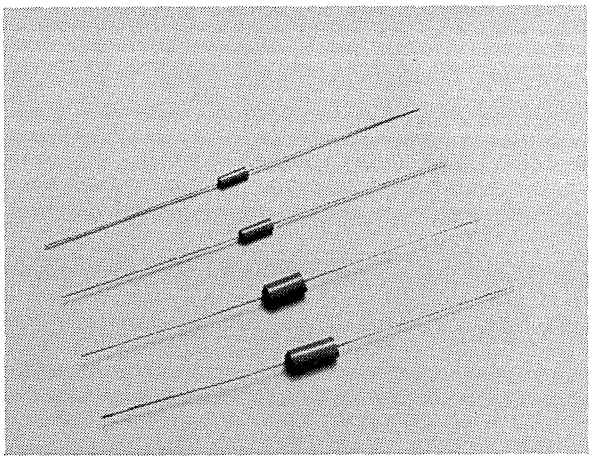
Industrial Type Tantalum Capacitors

-55°C to +85°C — M/C STANDARD RATINGS — 41GS SERIES

Capacitance 120 Hz	A 3 WVDC 3.6 VDC Surge	B 6.3 WVDC 8 VDC Surge	D 10 WVDC 12 VDC Surge	E 16 WVDC 19 VDC Surge
.10	41GS104A003K0A	41GS104A006K0A	41GS104A010K0A	41GS104A016K0A
.15	41GS154A003K0A	41GS154A006K0A	41GS154A010K0A	41GS154A016K0A
.22	41GS224A003K0A	41GS224A006K0A	41GS224A010K0A	41GS224A016K0A
.33	41GS334A003K0A	41GS334A006K0A	41GS334A010K0A	41GS334A016K0A
.47	41GS474A003K0A	41GS474A006K0A	41GS474A010K0A	41GS474A016K0A
.68	41GS684A003K0A	41GS684A006K0A	41GS684A010K0A	41GS684A016K0A
1.0	41GS105A003K0A	41GS105A006K0A	41GS105A010K0A	41GS105A016K0A
1.5	41GS155A003K0A	41GS155A006K0A	41GS155A010K0A	41GS155A016K0A
2.2	41GS225A003K0A	41GS225A006K0A	41GS225A010K0A	41GS225A016K0A
3.3	41GS335A003K0A	41GS335A006K0A	41GS335A010K0A	41GS335B016K0A
4.7	41GS475A003K0A	41GS475A006K0A	41GS475B010K0A	41GS475C016K0A
6.8	41GS685A003K0A	41GS685B006K0A	41GS685C010K0A	41GS685C016K0A
10	41GS106B003K0A	41GS106C006K0A	41GS106C010K0A	41GS106C016K0A
15	41GS156B003K0A	41GS156C006K0A	41GS156C010K0A	41GS156D016K0A
22	41GS226C003K0A	41GS226C006K0A	41GS226D010K0A	41GS226D016K0A
33	41GS336C003K0A	41GS336D006K0A	41GS336D010K0A	41GS336D016K0A
47	41GS476C003K0A	41GS476D006K0A	41GS476D010K0A	41GS476E016K0A
68	41GS686D003K0A	41GS686D006K0A	41GS686D010K0A	41GS686E016K0A
100	41GS107D003K0A	41GS107D006K0A	41GS107E010K0A	41GS107F016K0A
150	41GS157D003K0A	41GS157D006K0A	41GS157E010K0A	41GS157F016K0A
220	41GS227E003K0A	41GS227E006K0A	41GS227F010K0A	
330	41GS337E003K0A	41GS337F006K0A		
470	41GS447F003K0A			
680	41GS687F003K0A			

Capacitance 120 Hz	F 20 WVDC 26 VDC Surge	G 25 WVDC 30 VDC Surge	H 35 WVDC 42 VDC Surge	J 50 WVDC 60 VDC Surge
.10	41GS104A020K0A	41GS104A025K0A	41GS104A035K0A	41GS104A050K0A
.15	41GS154A020K0A	41GS154A025K0A	41GS154A035K0A	41GS154A050K0A
.22	41GS224A020K0A	41GS224A025K0A	41GS224A035K0A	41GS224A050K0A
.33	41GS334A020K0A	41GS334A025K0A	41GS334A035K0A	41GS334B050K0A
.47	41GS474A020K0A	41GS474A025K0A	41GS474A035K0A	41GS474B050K0A
.68	41GS684A020K0A	41GS684A025K0A	41GS684A035K0A	41GS684C050K0A
1.0	41GS105A020K0A	41GS105A025K0A	41GS105B035K0A	41GS105C050K0A
1.5	41GS155A020K0A	41GS155A025K0A	41GS155B035K0A	41GS155C050K0A
2.2	41GS225B020K0A	41GS225B025K0A	41GS225C035K0A	41GS225D050K0A
3.3	41GS335C020K0A	41GS335C025K0A	41GS335C035K0A	41GS335D050K0A
4.7	41GS475C020K0A	41GS475C025K0A	41GS475D035K0A	41GS475D050K0A
6.8	41GS685C020K0A	41GS685C025K0A	41GS685D035K0A	41GS685F050K0A
10	41GS106D020K0A	41GS106D025K0A	41GS106D035K0A	41GS106F050K0A
15	41GS156D020K0A	41GS156D025K0A	41GS156E035K0A	
22	41GS226D020K0A	41GS226D025K0A	41GS226E035K0A	
33	41GS336E020K0A	41GS336E025K0A	41GS336F035K0A	
47	41GS476E020K0A	41GS476E025K0A	41GS476F035K0A	
68	41GS686F020K0A	41GS686F025K0A		

Extended Range Molded Solid-Tantalum Industrial Grade Capacitor



DESCRIPTION

The Mepco/Centralab "40MS" type molded solid-tantalum capacitor series offers all of the advantages of solid-tantalum capacitors while providing the cost savings associated with non-metal case technology.

The fabrication of the tantalum anode is performed on the same presses and chemical processing is accomplished using the same equipment that is utilized in the fabrication of established reliability, military style capacitors.

Over 300 standard capacitance-voltage ratings, encased in four precision molded case sizes, provide just the right capacitor to meet most circuit requirements for electrical performance and physical size.

The "40MS" product is intended for large quantity usage to optimize cost savings associated with molded case products.

This industrial grade product is widely used in industrial, automotive and commercial products, and in circuit applications which include filtering, time constant, coupling, by-passing and energy storage applications.

The positive lead is indicated by the chamfered case end, which provides easy visual identification of the positive lead of this polarized capacitor style.

The "40MS" product is supplied lead taped and reeled for use in high speed automatic insertion equipment.

FEATURES

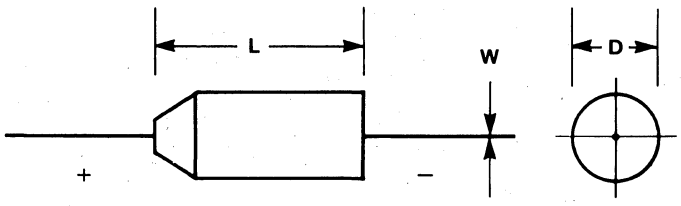
- Molded, Insulated Case Construction
- −55°C Through +125°C Operation
- 4 Standard "Chamfered End" Case Sizes
- Capacitance Range: 0.1 μF Through 68.0 μF
- Voltage Range: 2 VDC Through 50 VDC
- Tape and Reel Packaging
- Weldable And Solderable Leads

SERIES 40MS

Industrial Type Tantalum Capacitors

PHYSICAL SPECIFICATIONS

OUTLINE DRAWING AND DIMENSIONS



W = WIRE DIA.

Case Size	Dimensions — Inches (mm)		
	D Max.	L Max.	W Max.
A	0.095 (2.41)	0.260 (6.60)	0.020 (.51)
B	0.110 (2.79)	0.290 (7.37)	0.020 (.51)
C	0.180 (4.57)	0.345 (8.76)	0.020 (.51)
D	0.180 (4.57)	0.420 (10.67)	0.020 (.51)

Lead Length = 1.50 ± .125 inch (38.1 ± 3.18)

Maximum Capacitance (μF) by Case Size and Voltage

Volts	A	B	C	D
2	10.0	33.0	68.0	—
4	6.8	22.0	47.0	68.0
6	4.7	15.0	33.0	56.0
10	3.3	10.0	22.0	47.0
15	2.2	6.8	15.0	33.0
20	1.5	4.7	10.0	22.0
25	1.0	3.3	10.0	15.0
35	0.47	1.5	4.7	10.0
50	0.27	1.0	2.2	4.7

Marking

Capacitors will be marked with Mepco/Centralab logo, capacitance, tolerance, rated DC voltage, a + sign for polarity and EIA date code. Capacitance tolerance will be expressed as K=10%, M=20% or J=5%.

ELECTRICAL DATA

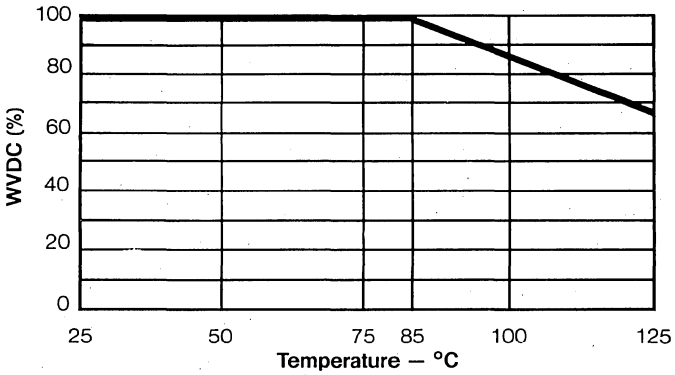
DC Working Voltage

Mepco/Centralab type 40MS solid-tantalum capacitors are available in nine standard operating voltages, as shown in the capacitance-voltage table.

All 40MS type capacitors may be operated at their rated voltage throughout the temperature range of −55°C through +85°C.

These capacitors may be operated at 2/3 of the rated voltage up to a maximum temperature of +125°C.

AC ripple voltage plus the DC polarizing voltage must not exceed the rated WVDC voltage.



(NOTE — See Table Following)

Surge Voltage and Voltage Derating

The surge voltage is the maximum short duration voltage which may be applied to the capacitor, i.e., "Turn On" transients, peak AC voltages or any other voltage pulses which may be superimposed on the applied DC voltage.

85°C and 125°C surge voltages and voltage derating with temperature for 40MS capacitors are shown in the following table.

Working Voltage WVDC 85°C	Derated VDC 125°C	Surge VDC	
		85°C	125°C
2	1.3	2.6	1.6
4	3.0	5.0	4.0
6	4.0	8.0	5.0
10	7.0	13.0	9.0
15	10.0	20.0	12.0
20	13.0	26.0	16.0
25	16.5	31.0	20.0
35	23.0	46.0	28.0
50	33.0	65.0	40.0

Capacitance...(Effective Series Capacitance)

Mepco/Centralab 40MS molded solid-tantalum capacitors are measured on a polarized capacitance bridge. All measurements are made at, and referred to, a 120 HZ frequency at 25°C measurement condition.

The AC measuring signal shall be limited to 2 VAC peak.

The sum of the peak AC voltage and the applied (polarizing) DC voltage shall not exceed the rated (WVDC) voltage of the capacitor.

Capacitance Tolerance

The 40MS series is available in ±20%(M), ±10%(K) or ±5%(J) capacitance tolerances.

Dissipation Factor

The dissipation factor at 120 HZ and 25°C will be measured concurrently with capacitance. Maximum dissipation factor (DF) limits are specified in the capacitance voltage rating table by individual unit.

Rated Voltage (WVDC)	Maximum Dissipation Factor Range (%)
2	10
4	8
6	6
Greater Than 6	6

DC Leakage Current

DC leakage measurements will be taken after a five minute period of electrification, with rated DC voltage applied.

The voltage will be applied with a 1000 Ohm, ±50 Ohm, resistor connected in series with the capacitor.

The DC leakage limit values for individual units are shown in the Capacitance-Voltage Rating Table.

The maximum allowable DC leakage limit at 85°C will be 10 times the maximum specified 25°C DC leakage limit.

Capacitance Change with Temperature

The maximum capacitance change with temperature is:

Temperature °C	Maximum Change In Capacitance (%)
25	Within Specified Tolerance
−55	15
85	15

Moisture Resistance

The Mepco/Centralab series capacitors will meet the moisture resistance requirements of MIL-STD 202D, method 106.

Within 6 hours of the completion of the test, the capacitance will not change more than ±5% from the initial value. The dissipation factor will not exceed the initial requirement.

SERIES 40MS

Industrial Type Tantalum Capacitors

CAPACITANCE VOLTAGE RATING TABLE

μF	VDC	Case Size	120 HZ DF (%)	25°C DCL (μA)	Mepco/Centralab Part Number
6.8	2	A	10	0.5	40MS685A002K0A
8.2	2	A	10	0.5	40MS825A002K0A
10.0	2	A	10	0.5	40MS106A002K0A
12.0	2	B	10	0.5	40MS126B002K0A
15.0	2	B	10	0.5	40MS156B002K0A
18.0	2	B	10	0.5	40MS186B002K0A
22.0	2	B	10	0.5	40MS226B002K0A
27.0	2	B	10	0.5	40MS276B002K0A
33.0	2	B	10	0.7	40MS336B002K0A
39.0	2	C	10	0.7	40MS396C002K0A
47.0	2	C	10	1.0	40MS476C002K0A
56.0	2	C	10	1.0	40MS566C002K0A
68.0	2	C	10	1.4	40MS686C002K0A
4.7	4	A	8	0.5	40MS475A004K0A
5.6	4	A	8	0.5	40MS565A004K0A
6.8	4	A	8	0.5	40MS685A004K0A
8.2	4	B	8	0.5	40MS825B004K0A
10.0	4	B	8	0.5	40MS106B004K0A
12.0	4	B	8	0.5	40MS126B004K0A
15.0	4	B	8	0.6	40MS156B004K0A
18.0	4	B	8	0.6	40MS186B004K0A
22.0	4	B	8	0.9	40MS226B004K0A
27.0	4	C	8	0.9	40MS276C004K0A
33.0	4	C	8	1.4	40MS336C004K0A
39.0	4	C	8	1.4	40MS396C004K0A
47.0	4	C	8	1.9	40MS476C004K0A
56.0	4	D	8	1.9	40MS566D004K0A
68.0	4	D	8	2.8	40MS686D004K0A
3.3	6	A	4	0.5	40MS335A006K0A
3.9	6	A	4	0.5	40MS395A006K0A
4.7	6	A	4	0.5	40MS475A006K0A
5.6	6	B	4	0.5	40MS565B006K0A
6.8	6	B	6	0.5	40MS685B006K0A
8.2	6	B	6	0.5	40MS825B006K0A
10.0	6	B	6	0.6	40MS106B006K0A
12.0	6	B	6	0.6	40MS126B006K0A
15.0	6	B	6	0.9	40MS156B006K0A
18.0	6	C	6	0.9	40MS186C006K0A
22.0	6	C	6	1.4	40MS226C006K0A
27.0	6	C	6	1.4	40MS276C006K0A
33.0	6	C	6	1.5	40MS336C006K0A
39.0	6	D	6	2.0	40MS396D006K0A
47.0	6	D	6	2.8	40MS476D006K0A
56.0	6	D	6	2.8	40MS566D006K0A
68.0	6	D	6	4.1	40MS686D006K0A
2.2	10	A	4	0.5	40MS225A010K0A
2.7	10	A	4	0.5	40MS275A010K0A
3.3	10	A	4	0.5	40MS335A010K0A
3.9	10	B	4	0.5	40MS395B010K0A

μF	VDC	Case Size	120 HZ DF (%)	25°C DCL (μA)	Mepco/Centralab Part Number
4.7	10	B	4	0.5	40MS475B010K0A
5.6	10	B	4	0.5	40MS565B010K0A
6.8	10	B	6	0.7	40MS685B010K0A
8.2	10	B	6	0.7	40MS825B010K0A
10.0	10	B	6	1.0	40MS106B010K0A
12.0	10	C	6	1.0	40MS126C010K0A
15.0	10	C	6	1.5	40MS156C010K0A
18.0	10	C	6	1.5	40MS186C010K0A
22.0	10	C	6	1.5	40MS226C010K0A
27.0	10	D	6	2.2	40MS276D010K0A
33.0	10	D	6	3.0	40MS336D010K0A
39.0	10	D	6	3.3	40MS396D010K0A
47.0	10	D	6	4.7	40MS476D010K0A
1.5	15	A	4	0.5	40MS155A015K0A
1.8	15	A	4	0.5	40MS185A015K0A
2.2	15	A	4	0.5	40MS225A015K0A
2.7	15	B	4	0.5	40MS275B015K0A
3.3	15	B	4	0.5	40MS335B015K0A
3.9	15	B	4	0.5	40MS395B015K0A
4.7	15	B	4	0.7	40MS475B015K0A
5.6	15	B	4	0.7	40MS565B015K0A
6.8	15	B	6	1.0	40MS685B015K0A
8.2	15	C	6	1.1	40MS825C015K0A
10.0	15	C	6	1.5	40MS106C015K0A
12.0	15	C	6	1.5	40MS126C015K0A
15.0	15	C	6	1.5	40MS156C015K0A
18.0	15	D	6	2.3	40MS186D015K0A
22.0	15	D	6	3.0	40MS226D015K0A
27.0	15	D	6	3.3	40MS276D015K0A
33.0	15	D	6	5.0	40MS336D015K0A
1.0	20	A	4	0.5	40MS105A020K0A
1.2	20	A	4	0.5	40MS125A020K0A
1.5	20	A	4	0.5	40MS155A020K0A
1.8	20	B	4	0.5	40MS185B020K0A
2.2	20	B	4	0.5	40MS225B020K0A
2.7	20	B	4	0.5	40MS275B020K0A
3.3	20	B	4	0.7	40MS335B020K0A
3.9	20	B	4	0.7	40MS395B020K0A
4.7	20	B	4	1.0	40MS475B020K0A
5.6	20	C	4	1.0	40MS565C020K0A
6.8	20	C	6	1.4	40MS685C020K0A
8.2	20	C	6	1.4	40MS825C020K0A
10.0	20	C	6	2.0	40MS106C020K0A
12.0	20	D	6	2.0	40MS126D020K0A
15.0	20	D	6	3.0	40MS156D020K0A
18.0	20	D	6	3.0	40MS186D020K0A
22.0	20	D	6	4.4	40MS226D020K0A
0.47	25	A	3	0.5	40MS474A025K0A

*Insert Capacitance Tolerance Letter in Part Number: M = ±20% K = ±10% J = ±5%

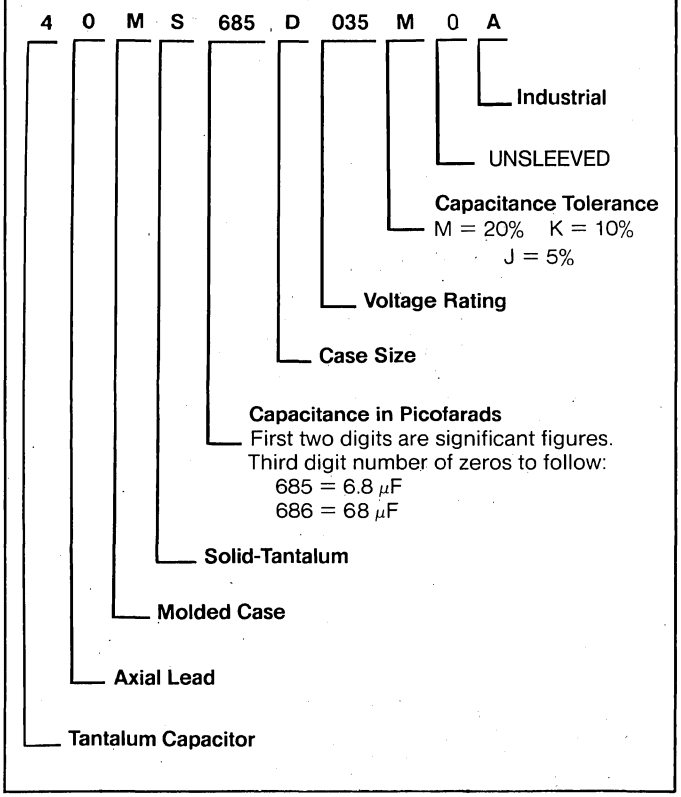
SERIES 40MS

Industrial Type Tantalum Capacitors

CAPACITANCE VOLTAGE RATING TABLE

μF	VDC	Case Size	120 HZ DF (%)	25°C DCL (μA)	Mepco/Centralab Part Number
0.56	25	A	3	0.5	40MS564A025K0A
0.68	25	A	3	0.5	40MS684A025K0A
0.82	25	A	3	0.5	40MS824A025K0A
1.0	25	A	3	0.5	40MS105A025K0A
1.2	25	B	3	0.5	40MS125B025K0A
1.5	25	B	3	0.5	40MS155B025K0A
1.8	25	B	3	0.5	40MS185B025K0A
2.2	25	B	3	0.6	40MS225B025K0A
2.7	25	B	3	0.6	40MS275B025K0A
3.3	25	B	3	0.9	40MS335B025K0A
3.9	25	C	3	0.9	40MS395C025K0A
4.7	25	C	4	1.2	40MS475C025K0A
5.6	25	C	4	1.2	40MS565C025K0A
6.8	25	C	4	1.5	40MS685C025K0A
8.2	25	C	4	1.5	40MS825C025K0A
10.0	25	C	4	1.5	40MS106C025K0A
12.0	25	D	4	2.5	40MS126D025K0A
15.0	25	D	4	3.8	40MS156D025K0A
0.10	35	A	3	0.5	40MS104A035K0A
0.12	35	A	3	0.5	40MS124A035K0A
0.15	35	A	3	0.5	40MS154A035K0A
0.18	35	A	3	0.5	40MS184A035K0A
0.22	35	A	3	0.5	40MS224A035K0A
0.27	35	A	3	0.5	40MS274A035K0A
0.33	35	A	3	0.5	40MS334A035K0A
0.39	35	A	3	0.5	40MS394A035K0A
0.47	35	A	3	0.5	40MS474A035K0A
0.56	35	B	3	0.5	40MS564B035K0A
0.68	35	B	3	0.5	40MS684B035K0A
0.82	35	B	3	0.5	40MS824B035K0A
1.0	35	B	3	0.5	40MS105B035K0A
1.2	35	B	3	0.5	40MS125B035K0A
1.5	35	B	3	0.6	40MS155B035K0A
1.8	35	C	3	0.6	40MS185C035K0A
2.2	35	C	3	0.8	40MS225C035K0A
2.7	35	C	3	0.8	40MS275C035K0A
3.3	35	C	4	1.2	40MS335C035K0A
3.9	35	C	4	1.2	40MS395C035K0A
4.7	35	C	4	1.5	40MS475C035K0A
5.6	35	D	4	1.7	40MS565D035K0A
6.8	35	D	4	2.4	40MS685D035K0A
8.2	35	D	4	2.4	40MS825D035K0A
10.0	35	D	4	3.5	40MS106D035K0A
0.1	50	A	3	0.5	40MS104A050K0A
0.12	50	A	3	0.5	40MS124A050K0A
0.15	50	A	3	0.5	40MS154A050K0A
0.18	50	A	3	0.5	40MS184A050K0A
0.22	50	A	3	0.5	40MS224A050K0A
0.27	50	A	3	0.5	40MS274A050K0A
0.33	50	B	3	0.5	40MS334B050K0A
0.39	50	B	3	0.5	40MS394B050K0A
0.47	50	B	3	0.5	40MS474B050K0A
0.56	50	B	3	0.5	40MS564B050K0A
0.68	50	B	3	0.5	40MS684B050K0A
0.82	50	B	3	0.5	40MS824B050K0A
1.0	50	B	3	0.5	40MS105B050K0A
1.2	50	C	3	0.5	40MS125C050K0A
1.5	50	C	4	0.8	40MS155C050K0A
1.8	50	C	4	0.8	40MS185C050K0A
2.2	50	C	4	1.1	40MS225C050K0A
2.7	50	D	4	1.1	40MS275D050K0A
3.3	50	D	4	1.7	40MS335D050K0A
3.9	50	D	4	1.7	40MS395D050K0A
4.7	50	D	4	2.4	40MS475D050K0A

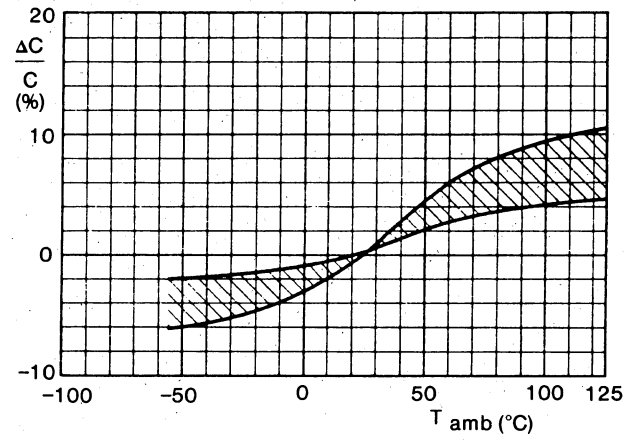
HOW TO SPECIFY



*Insert Capacitance Tolerance Letter in Part Number: M = ±20% K = ±10% J = ±5%

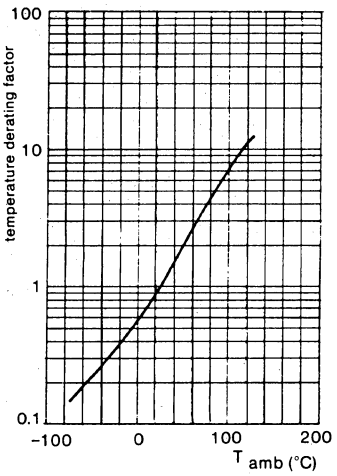
SERIES 40MS
Industrial Type Tantalum Capacitors

Capacitance Change with Temperature

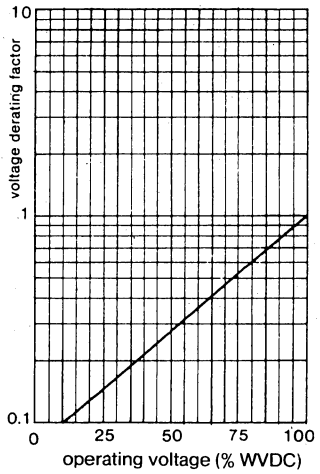


Typical capacitance as a function of ambient temperature.

Leakage Current



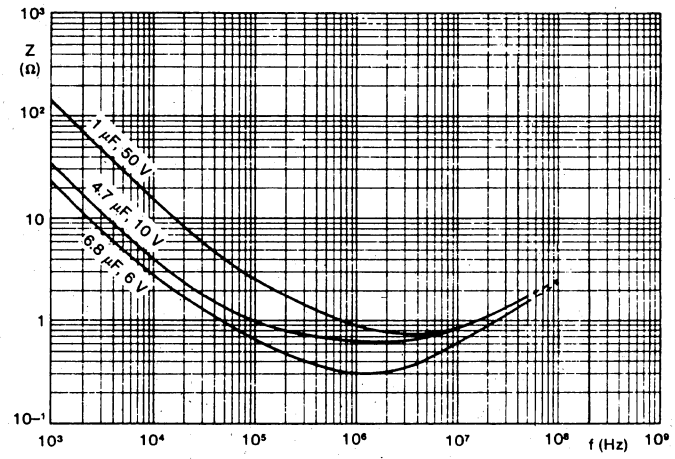
Typical effect of ambient temperature on leakage current.



Typical effect of operating voltage on leakage current.

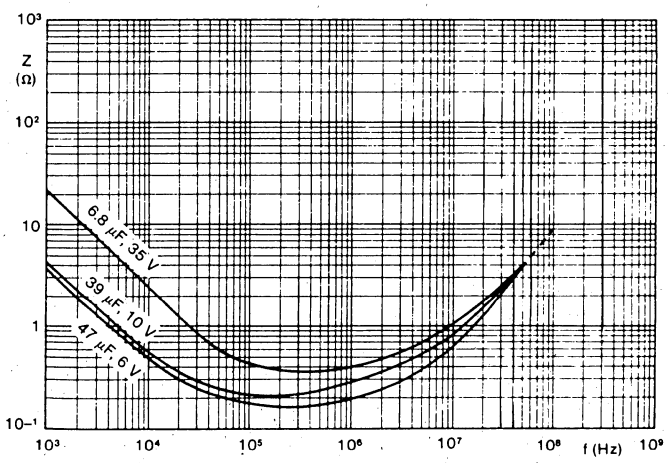
Impedance

The impedance is measured by means of a four-terminal circuit (Thomson circuit)



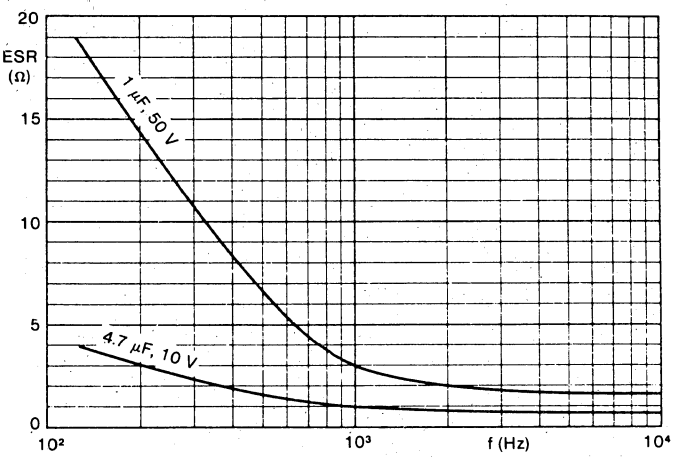
Typical impedance as a function of frequency at 25°C; case sizes B and E.

Impedance



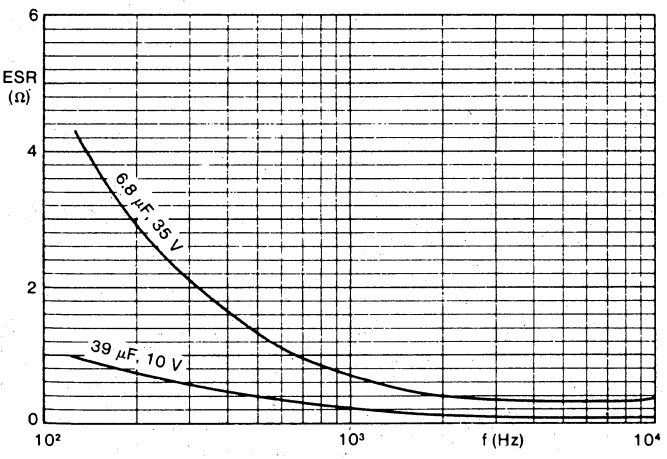
Typical impedance as a function of frequency at 25°C; case sizes D and F.

Equivalent Series Resistance



Typical ESR as a function of frequency; case sizes B and E.

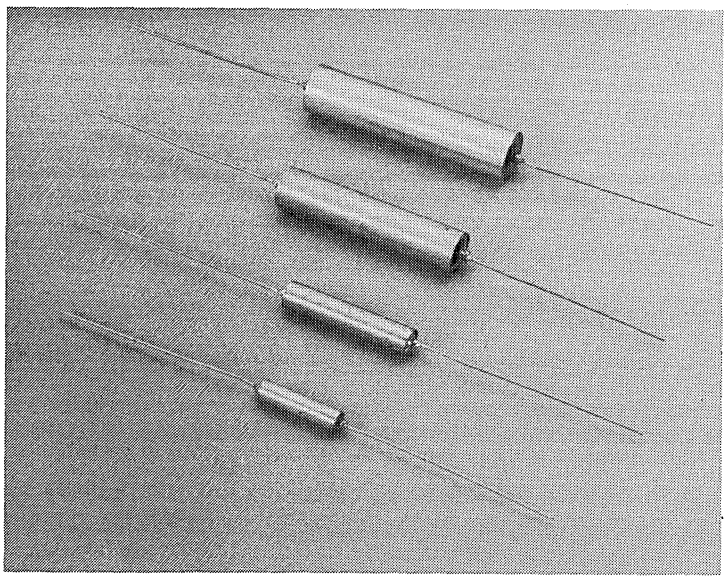
Equivalent Series Resistance



Typical ESR as a function of frequency; case sizes D and F.

SERIES 40NS

Non Polar Solid Electrolyte Tantalum Capacitor



DESCRIPTION

The M/C Inc. 40NS Series consists of two polar solid electrolyte sintered tantalum anode capacitors, assembled into a tubular metal can in a back-to-back configuration.

Available in four standard sizes, insulated or uninsulated styles, the 40NS Series is manufactured utilizing the highly automated processing and assembly techniques which M/C has developed for producing established reliability CSR91 devices to MIL-C-39003.

The 40NS Series is especially adapted for applications involving coupling, filtering, and timing in those computer, industrial, and commercial circuits where AC signals are prevalent, or where voltage reversals are common.

FEATURES

- NON POLAR
- HERMETIC SEAL
- –55°C to 125°C OPERATING
- 6 THRU 100 VOLTS
- 0.0023 uf THRU 160 uf
- FOUR STANDARD SIZES
- COUPLING

SERIES 40NS

Industrial Type Tantalum Capacitors

M/C STANDARD RATINGS

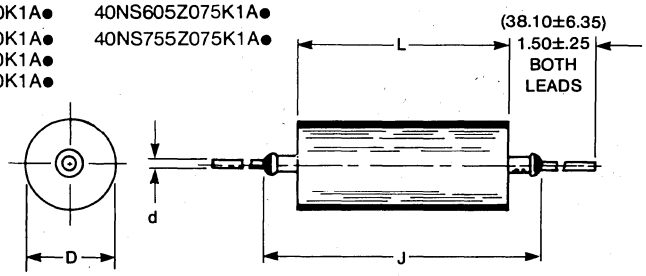
CAPACITANCE +25°C 120 Hz	6 WVDC N.P. ±10% INSULATED 4V @ 125°C	10 WVDC N.P. ±10% INSULATED 7V @ 125°C	15 WVDC N.P. ±10% INSULATED 10V @ 125°C	20 WVDC N.P. ±10% INSULATED 13V @ 125°C
0.0023	40NS232W006K1A	40NS232W010K1A	40NS232W015K1A	40NS232W020K1A
0.0028	40NS282W006K1A	40NS282W010K1A	40NS282W015K1A	40NS282W020K1A
0.0034	40NS342W006K1A	40NS342W010K1A	40NS342W015K1A	40NS342W020K1A
0.0041	40NS412W006K1A	40NS412W010K1A	40NS412W015K1A	40NS412W020K1A
0.005	40NS502W006K1A	40NS502W010K1A	40NS502W015K1A	40NS502W020K1A
0.006	40NS602W006K1A	40NS602W010K1A	40NS602W015K1A	40NS602W020K1A
0.0075	40NS752W006K1A	40NS752W010K1A	40NS752W015K1A	40NS752W020K1A
0.009	40NS902W006K1A	40NS902W010K1A	40NS902W015K1A	40NS902W020K1A
0.011	40NS113W006K1A	40NS113W010K1A	40NS113W015K1A	40NS113W020K1A
0.013	40NS133W006K1A	40NS133W010K1A	40NS133W015K1A	40NS133W020K1A
0.016	40NS163W006K1A	40NS163W010K1A	40NS163W015K1A	40NS163W020K1A
0.019	40NS193W006K1A	40NS193W010K1A	40NS193W015K1A	40NS193W020K1A
0.023	40NS233W006K1A	40NS233W010K1A	40NS233W015K1A	40NS233W020K1A
0.028	40NS283W006K1A	40NS283W010K1A	40NS283W015K1A	40NS283W020K1A
0.034	40NS343W006K1A	40NS343W010K1A	40NS343W015K1A	40NS343W020K1A
0.041	40NS413W006K1A	40NS413W010K1A	40NS413W015K1A	40NS413W020K1A
0.05	40NS503W006K1A	40NS503W010K1A	40NS503W015K1A	40NS503W020K1A
0.06	40NS603W006K1A	40NS603W010K1A	40NS603W015K1A	40NS603W020K1A
0.075	40NS753W006K1A	40NS753W010K1A	40NS753W015K1A	40NS753W020K1A
0.09	40NS903W006K1A	40NS903W010K1A	40NS903W015K1A	40NS903W020K1A
0.11	40NS114W006K1A	40NS114W010K1A	40NS114W015K1A	40NS114W020K1A
0.13	40NS134W006K1A	40NS134W010K1A	40NS134W015K1A	40NS134W020K1A
0.16	40NS164W006K1A	40NS164W010K1A	40NS164W015K1A	40NS164W020K1A
0.19	40NS194W006K1A	40NS194W010K1A	40NS194W015K1A	40NS194W020K1A
0.23	40NS234W006K1A	40NS234W010K1A	40NS234W015K1A	40NS234W020K1A
0.28	40NS284W006K1A	40NS284W010K1A	40NS284W015K1A	40NS284W020K1A
0.34	40NS344W006K1A	40NS344W010K1A	40NS344W015K1A	40NS344W020K1A
0.41	40NS414W006K1A	40NS414W010K1A	40NS414W015K1A	40NS414W020K1A
0.5	40NS504W006K1A	40NS504W010K1A	40NS504W015K1A	40NS504W020K1A
0.6	40NS604W006K1A	40NS604W010K1A	40NS604W015K1A	40NS604W020K1A●
0.75	40NS754W006K1A	40NS754W010K1A	40NS754W015K1A	40NS754W020K1A●
0.9	40NS904W006K1A	40NS904W010K1A	40NS904W015K1A	40NS904W020K1A●
1.1	40NS115W006K1A	40NS115W010K1A	40NS115W015K1A	40NS115W020K1A●
1.3	40NS135W006K1A	40NS135W010K1A	40NS135W015K1A●	40NS135X020K1A
1.6	40NS165W006K1A	40NS165W010K1A	40NS165W015K1A●	40NS165X020K1A
1.9	40NS195W006K1A	40NS195W010K1A●	40NS195X015K1A	40NS195X020K1A
2.3	40NS235W006K1A	40NS235W010K1A●	40NS235X015K1A	40NS235X020K1A
2.8	40NS285W006K1A●	40NS285X010K1A	40NS285X015K1A	40NS285X020K1A
3.4	40NS345W006K1A●	40NS345X010K1A	40NS345X015K1A	40NS345X020K1A
4.1	40NS415X006K1A	40NS415X010K1A	40NS415X015K1A	40NS415X020K1A●
5.0	40NS505X006K1A	40NS505X010K1A	40NS505X015K1A	40NS505X020K1A●
6.0	40NS605X006K1A	40NS605X010K1A	40NS605X015K1A	40NS605X020K1A●
7.5	40NS755X006K1A	40NS755X010K1A	40NS755X015K1A	40NS755X020K1A●
9	40NS905X006K1A	40NS905X010K1A	40NS905X015K1A●	40NS905Y020K1A
11	40NS116X006K1A	40NS116X010K1A	40NS116X015K1A●	40NS116Y020K1A
13	40NS136X006K1A	40NS136X010K1A●	40NS136Y015K1A	40NS136Y020K1A●
16	40NS166X006K1A	40NS166X010K1A●	40NS166Y015K1A	40NS166Y020K1A●
19	40NS196X006K1A	40NS196X010K1A●	40NS196Y015K1A	40NS196Y020K1A●
23	40NS236X006K1A●	40NS236Y010K1A	40NS236Y015K1A	40NS236Y020K1A●
28	40NS286X006K1A●	40NS286Y010K1A	40NS286Y015K1A●	40NS286Z020K1A●
34	40NS346Y006K1A	40NS346Y010K1A	40NS346Y015K1A●	40NS346Z020K1A●
41	40NS416Y006K1A	40NS416Y010K1A●	40NS416Z015K1A	40NS416Z020K1A●
50	40NS506Y006K1A	40NS506Y010K1A●	40NS506Z015K1A	40NS506Z020K1A●
60	40NS606Y006K1A	40NS606Y010K1A●	40NS606Z015K1A●	
75	40NS756Y006K1A●	40NS756Z010K1A	40NS756Z015K1A●	
90	40NS906Y006K1A●	40NS906Z010K1A●		
110	40NS117Z006K1A	40NS117Z010K1A●		
130	40NS137Z006K1A●			
160	40NS167Z006K1A●			

● EQUIVALENT VALUE AVAILABLE
CSR91 STYLE PER MIL-C-39003

SERIES 40NS

Industrial Type Tantalum Capacitors

CAPACITANCE +25°C 120 Hz	35 WVDC N.P. ±10% INSULATED 23V @ 125°C	50 WVDC N.P. ±10% INSULATED 33 V @ 125°C	75 WVDC N.P. ±10% INSULATED 50V @ 125°C	100 WVDC N.P. ±10% INSULATED 67V @ 125°C
0.0023	40NS232W035K1A	40NS232W050K1A●	40NS232W075K1A	40NS232W100K1A●
0.0028	40NS282W035K1A	40NS282W050K1A●	40NS282W075K1A	40NS282W100K1A●
0.0034	40NS342W035K1A	40NS342W050K1A●	40NS342W075K1A	40NS342W100K1A●
0.0041	40NS412W035K1A	40NS412W050K1A●	40NS412W075K1A	40NS412W100K1A●
0.005	40NS502W035K1A	40NS502W050K1A●	40NS502W075K1A	40NS502W100K1A●
0.006	40NS602W035K1A	40NS602W050K1A●	40NS602W075K1A	40NS602W100K1A●
0.0075	40NS752W035K1A	40NS752W050K1A●	40NS752W075K1A	40NS752W100K1A●
0.009	40NS902W035K1A	40NS092W050K1A●	40NS902W075K1A	40NS902W100K1A●
0.011	40NS113W035K1A	40NS113W050K1A●	40NS113W075K1A	40NS113W100K1A●
0.013	40NS133W035K1A	40NS133W050K1A●	40NS133W075K1A	40NS133W100K1A●
0.016	40NS163W035K1A	40NS163W050K1A●	40NS163W075K1A	40NS163W100K1A●
0.019	40NS193W035K1A	40NS193W050K1A●	40NS193W075K1A	40NS193W100K1A●
0.023	40NS233W035K1A	40NS233W050K1A●	40NS233W075K1A	40NS233W100K1A●
0.028	40NS283W035K1A	40NS283W050K1A●	40NS283W075K1A	40NS283W100K1A●
0.034	40NS343W035K1A	40NS343W050K1A●	40NS343W075K1A	40NS343W100K1A●
0.041	40NS413W035K1A	40NS413W050K1A●	40NS413W075K1A	40NS413W100K1A●
0.05	40NS503W035K1A	40NS503W050K1A●	40NS503W075K1A	40NS503W100K1A●
0.06	40NS603W035K1A	40NS603W050K1A●	40NS603W075K1A	40NS603W100K1A●
0.075	40NS753W035K1A	40NS753W050K1A●	40NS753W075K1A	40NS753W100K1A●
0.09	40NS903W035K1A	40NS903W050K1A●	40NS903W075K1A	40NS903W100K1A●
0.11	40NS114W035K1A	40NS114W050K1A●	40NS114W075K1A	40NS114W100K1A●
0.13	40NS134W035K1A	40NS134W050K1A●	40NS134W075K1A	40NS134W100K1A●
0.16	40NS164W035K1A	40NS164W050K1A●	40NS164W075K1A	40NS164W100K1A●
0.19	40NS194W035K1A	40NS194W050K1A●	40NS194W075K1A	40NS194W100K1A●
0.23	40NS234W035K1A	40NS234W050K1A●	40NS234W075K1A	40NS234W100K1A●
0.28	40NS284W035K1A	40NS284W050K1A●	40NS284W075K1A	40NS284W100K1A●
0.34	40NS334W035K1A	40NS344W050K1A●	40NS334W075K1A	40NS334X100K1A●
0.41	40NS414W035K1A	40NS414W050K1A●	40NS414X075K1A	40NS414X100K1A●
0.50	40NS504W035K1A	40NS504W050K1A●	40NS504X075K1A	40NS504X100K1A●
0.60	40NS604X035K1A	40NS604X050K1A●	40NS604X075K1A	40NS604X100K1A●
0.75	40NS754X035K1A	40NS754X050K1A●	40NS754X075K1A	40NS754X100K1A●
0.90	40NS904X035K1A	40NS904X050K1A●	40NS904X075K1A●	
1.1	40NS115X035K1A	40NS115X050K1A●	40NS115X075K1A	40NS115X100K1A●
1.3	40NS135X035K1A	40NS135X050K1A●	40NS135X075K1A	40NS135X100K1A●
1.6	40NS165X035K1A	40NS165X050K1A●	40NS165X075K1A●	
1.9	40NS195X035K1A	40NS195X050K1A●	40NS195X075K1A●	
2.3	40NS235X035K1A	40NS235X050K1A●	40NS235Y075K1A	
2.8	40NS285X035K1A●	40NS285Y050K1A●	40NS285Y075K1A	
3.4	40NS345X035K1A●	40NS345Y050K1A●	40NS345Y075K1A	
4.1	40NS415Y035K1A	40NS415Y050K1A●	40NS415Y075K1A●	
5.0	40NS505Y035K1A	40NS505Y050K1A●	40NS505Y075K1A●	
6.0	40NS605Y035K1A	40NS605Y050K1A●	40NS605Z075K1A●	
7.5	40NS755Y035K1A	40NS755Y050K1A●	40NS755Z075K1A●	
9.0	40NS905Y035K1A	40NS905Y050K1A●		
11	40NS116Y035K1A●	40NS116Z050K1A●		
13	40NS136Z035K1A●			
16	40NS166Z035K1A●			
19	40NS196Z035K1A●			
23	40NS236Z035K1A●			



DIMENSIONS — INCHES (mm)						
	Insulated		Uninsulated		d	
Case Size	D±0.010 (.25) −.015 (.38)	L±.031 (.79)	D±.010 (.25)	L±.031 (.79)	Lead Diam. ±.002 (0.05)	J. Max.
W	0.161 (4.09)	0.575 (14.61)	0.150 (3.81)	0.565 (14.35)	0.020 (0.51)	0.750 (19.05)
X	0.207 (5.26)	0.955 (24.26)	0.199 (5.05)	0.925 (23.50)	0.020 (0.51)	1.130 (28.70)
Y	0.314 (7.98)	1.350 (34.29)	0.305 (7.75)	1,345 (34.25)	0.025 (0.64)	1.525 (38.74)
Z	0.376 (9.55)	1.550 (39.37)	0.368 (9.37)	1.555 (39.41)	0.025 (0.64)	1.725 (43.82)

SERIES 40NS

Industrial Type Tantalum Capacitors

DESIGN AND CONSTRUCTION

Each 40NS type capacitor consists of a highly purified sintered tantalum anode body, utilizing an electrolytically formed oxide dielectric and a solid electrolyte, soldered in a metal case. Two individual metal cases are then connected back-to-back in a metal sleeve.

INSULATION

When specified, a MYLAR* sleeve will be placed over the metal can. The insulation will not soften or creep over the operating temperature range.

RADIAL CONFIGURATION

When radial lead configuration is desired, the negative lead can be bent down the side of the metal can.

LEADS

Lead material is Grade A nickel, tin lead plated to facilitate soldering. Other lead material available on request.

MARKING

Capacitors will be marked with M/C, capacitance, voltage, and + signs for polarity as a minimum. Nonpolarity is noted by the + on each end. When space permits, capacitance tolerance and date code will be added.

DC WORKING VOLTAGE

40NS Series capacitors are available in 8 voltage ratings applicable from −55°C to 85°C without derating, and to 125°C with ⅔ linear derating (see chart under para. 3). This voltage may be applied in either direction.

These capacitors may be operated with AC only applied. Consult the M/C Sales Engineerings Dept. for your specific application.

SURGE VOLTAGE

The surge voltage is the maximum DC voltage, including peak AC or other pulses, which may be applied for short duration.

In no case shall the sum of AC voltage and applied DC working voltage exceed the working voltage of the capacitor.

*Copyright, DuPont Company

The surge voltages are as follows:

Rated WVDC up to 85°C	Derated 125°C	SURGE VOLTAGE 85°C	SURGE VOLTAGE 125°C
6	4	8	5
10	7	13	9
15	10	20	12
20	13	26	16
35	23	46	28
50	33	65	40
75	50	97	64
100	66	130	86

CAPACITANCE

Capacitance shall be measured on a polarized bridge, at or referred to 120 cps at 25°C. The maximum DC bias shall be 2.2VDC for all A.C. measurements. The magnitude of the A.C. signal shall be limited to 1.0 VRMS.

The capacitance so determined shall be within specified initial capacitance tolerance.

TOLERANCE

The 40NS Series is available in ±20%, ±10% and ±5% capacitance tolerance.

DISSIPATION FACTOR

DF shall be measured on a polarized bridge, at or referred to 120 cps at 25°C. The maximum DC bias shall be 2.2 VDC for all A.C. measurements. The magnitude of the A.C. signal shall be limited to 1.0 VRMS.

The DF so determined shall not exceed:

0.01 uf to 68 uf	6% DF maximum
82 uf to 180 uf	8% DF maximum
220 and up	10% DF maximum

D.C. LEAKAGE CURRENT

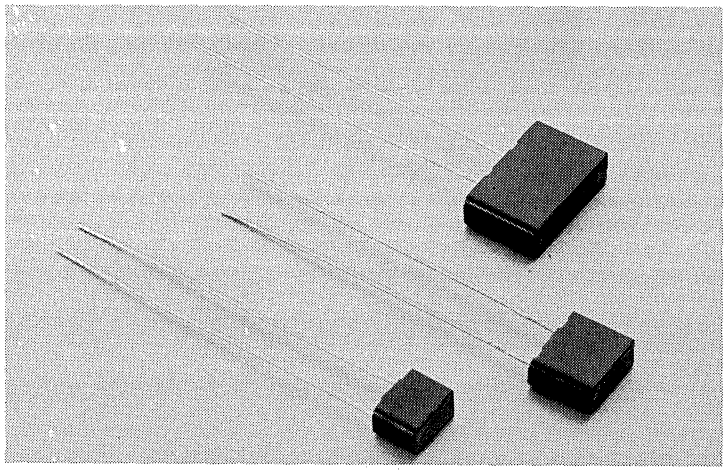
DCL shall not exceed 0.04 uA/ufV, but need not be less than 1 uA when determined with a 1000 ohm current limiting resistor in series with the test capacitor after a 5 minute application of rated voltage at 25°C. The DCL at 85° shall not exceed 10 times the 25°C limits. At 125°C the DCL shall not exceed 12 times the 25°C limits.

PART NUMBER SYSTEM

EXAMPLE 4 0 N S 165 X 035 K 1 A

- A — INDUSTRIAL
- 1 — 0 = UNSLEEVED, 1 = SLEEVED
- K — CAPACITANCE TOLERANCE: J = ±5% K = ±10% M = ±20%
- 035 — RATED VOLTAGE @ 85°C
- X — CASE SIZE
- 165 — CAPACITANCE IN PICOFARADS. First two digits are significant figures. This is number of zeros to follow: 165 = 1.6 uF, 166 = 16 uF
- S — SOLID ELECTROLYTE
- N — SERIES
- 0 — AXIAL LEAD
- 4 — TANTALUM CAPACITOR

Rectangular Solid Electrolyte Tantalum Capacitor

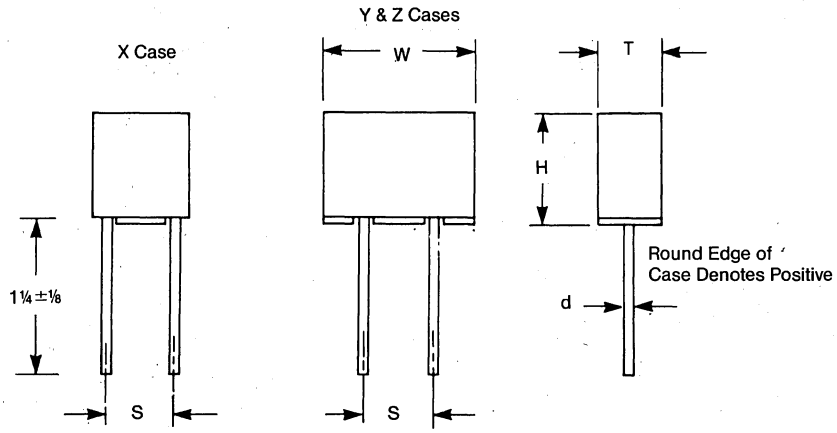


DESCRIPTION

The M/C Inc. 41PS Series is a solid electrolyte sintered tantalum anode capacitor body, molded into a rectangular epoxy resin package.

Available in three sizes, the 41PS Series is manufactured utilizing the highly automated processing and assembly techniques which M/C has developed for producing established reliablity devices.

The 41PS Series offers consistent precision dimensions, precision lead spacing, higher microfarad per cubic inch, and a very low D.C. leakage current and dissipation factor.



Note: Positive indicated by Red Dot on top of Case

DIMENSIONS 41PS TYPE — INCHES (mm)					
CASE SIZE	±.015 (0.4) W	±.015(0.4) H	±.015(0.4) T	±.001(0.02) d	±.005(0.1) S
X	.285(7.2)	.225(5.7)	.170(4.3)	.025(0.6)	.200(5.1)
Y	.360(9.2)	.325(8.3)	.170(4.3)	.025(0.6)	.200(5.1)
Z	.600(15.2)	.375(9.5)	.195(4.9)	.025(0.6)	.200(5.1)

SERIES 41PS

Industrial Type Tantalum Capacitors

ELECTRICAL SPECIFICATION

CAPACITANCE

Type 41PS capacitors are measured on a polarized capacitance bridge. The measurements are made at, or referred to, 120 cps and 25°C conditions. The AC measuring signal shall be limited to 2 volts peak and have a frequency of 120 cps. The bridge shall have a DC polarizing voltage large enough to prevent a reversal of polarity by the AC measuring voltage and at the same time the peak AC should not exceed the rated DC working voltage of the capacitor.

DISSIPATION FACTOR

The low D.F. of the 41PS type capacitors, even at the extremes of the operating temperature range, is another very useful characteristic. Dissipation factor is read directly on most capacitance bridges when making the capacitance measurement discussed above. However, some bridges read ESR (Equivalent Series Resistance) in place of dissipation factor in which case the following formula is applicable — D.F. = $2\pi fRC$. "R" is the equivalent series resistance. All measurements are made at or referred to a frequency of 120 cps.

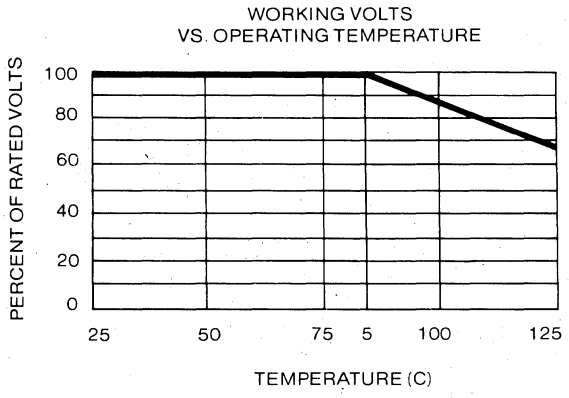
D.C. LEAKAGE

The leakage current when measured after 5 minutes at rated working voltage shall not exceed the DC leakage current limits of .02 ua/uFV or 1.0 ua whichever is greater at 25°C. A 1000 current limiting resistor should be placed in series with the capacitor during DC leakage current measurement.

At 85°C the maximum leakage will be 10 times the 25°C maximum. At 125°C the maximum leakage will not exceed 12.5 times the 25°C maximum.

D.C. WORKING VOLTAGE

M/C 41PS type tantalum capacitors are available in 8 voltage ratings and may be operated at full rated voltage from -80°C to +85°C. The 41PS type may be further operated up to 125°C by derating the DC working voltage in accordance with the following graph and chart:



SURGE VOLTAGE

The surge voltage rating (see table above) of the Type 41PS capacitor is the maximum short duration voltage which may be applied to the capacitor, i.e. "turn on" transients, peak AC voltage or any other voltage pulses which may be superimposed on the rated DC working voltage.

In no case may the sum of the AC voltage and the applied DC working voltage exceed the rated DC surge voltage.

Rated DC Working Voltage		Rated DC Surge Voltage	
−55° to 85° C	125° C	Up to 85° C	125° C
6	4	8	5
10	7	13	9
15	10	20	12
25	17	33	22
35	23	46	28
50	33	65	40

PHYSICAL SPECIFICATIONS

TEMPERATURE RANGE

Type 41PS will operate from -55° to 85°C without derating. When properly derated. reliable operation is possible up to 125°C.

VIBRATION

The capacitors shall be rigidly mounted by suitable case clamps and subjected to a simple harmonic motion having a maximum amplitude of 0.03" or 15G in 2 mutually perpendicular directions — -1 parallel and 1 perpendicular to the cylindrical axis. Capacitors shall withstand vibration from 10 to 10,000 cycles at 15G without internal damage. The frequency shall be varied uniformly over a frequency range of 55-2000 cps in approximately 20 minutes at a uniform rate for a total of 4 hours. During the last ½ hour of test the test units will be monitored by an instrument capable of detecting intermittent open or short circuits with a duration of .5 milliseconds or greater. Rated DC voltage will be applied to the units during test.

After vibration the capacitors shall meet the initial requirements of dissipation factor and leakage current. The capacitance shall not change more than ±5% from the initial measured value.

LEAD MATERIAL

Standard construction will include tin lead plated nickel leads for soldering. Plain nickel leads are also available for welding.

TERMINAL STRENGTH

With the body of the capacitor secured, the leads shall withstand a 3 lb. load applied in any direction for 30 seconds.

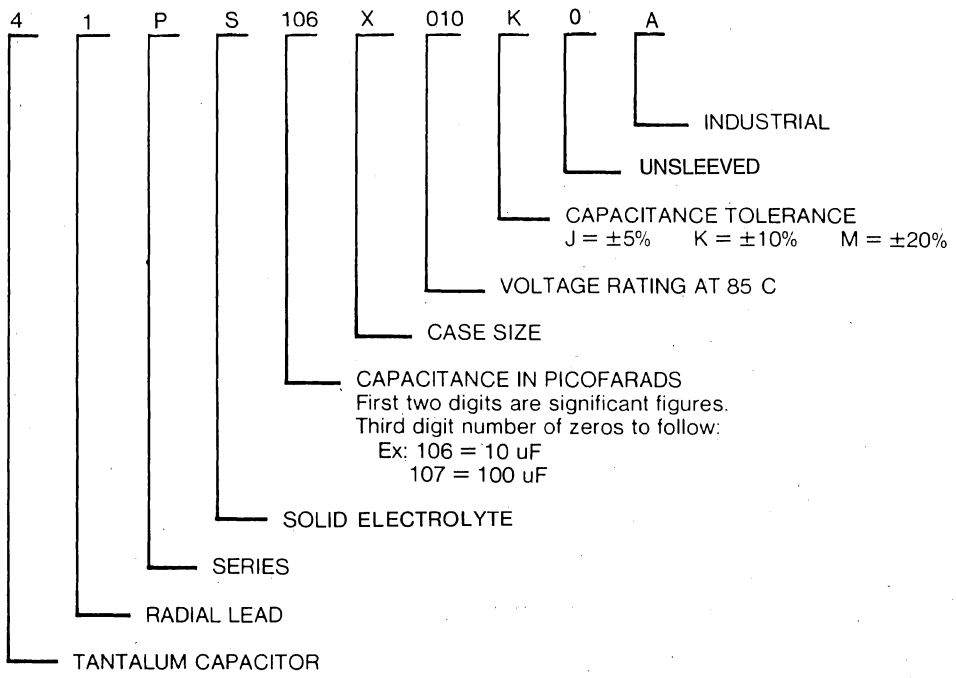
MARKING

Capacitors will be marked with M/C, capacitance, voltage and polarity as a minimum. Where space permits, capacitance tolerance, & date code, will be added in that sequence, with red dot on top of case indicating polarity.

SERIES 41PS

Industrial Type Tantalum Capacitors

PART NUMBER SYSTEM



Capacitance uf 25°C 120 cps	M/C Part Number ±10%	Maximum Dissipation Factor, % 25°C 120 cps
6 VOLT RATING AT 85°C		
1.0	41PS105X006K0A	6
1.2	41PS125X006K0A	6
1.5	41PS155X006K0A	6
1.8	41PS185X006K0A	6
2.2	41PS225X006K0A	6
2.7	41PS275X006K0A	6
3.3	41PS335X006K0A	6
3.9	41PS395X006K0A	6
4.7	41PS475X006K0A	6
5.6	41PS565X006K0A	6
6.8	41PS685X006K0A	6
8.2	41PS825X006K0A	6
10	41PS106X006K0A	6
12	41PS126X006K0A	6
15	41PS156X006K0A	6
18	41PS186X006K0A	6
22	41PS226X006K0A	6
27	41PS276Y006K0A	8
33	41PS336Y006K0A	8
39	41PS396Y006K0A	8
47	41PS476Y006K0A	8
56	41PS566Y006K0A	8
68	41PS686Y006K0A	8
82	41PS826Z006K0A	8
100	41PS107Z006K0A	8
120	41PS127Z006K0A	8
150	41PS157Z006K0A	8
180	41PS187Z006K0A	8
220	41PS227Z006K0A	10

Capacitance uf 25°C 120 cps	M/C Part Number ±10%	Maximum Dissipation Factor, % 25°C 120 cps
10 VOLT RATING AT 85°C		
1.0	41PS105X010K0A	6
1.2	41PS125X010K0A	6
1.5	41PS155X010K0A	6
1.8	41PS185X010K0A	6
2.2	41PS225X010K0A	6
2.7	41PS275X010K0A	6
3.3	41PS335X010K0A	6
3.9	41PS395X010K0A	6
4.7	41PS475X010K0A	6
5.6	41PS565X010K0A	6
6.8	41PS685X010K0A	6
8.2	41PS825X010K0A	6
10	41PS106X010K0A	6
12	41PS126X010K0A	6
15	41PS156Y010K0A	6
18	41PS186Y010K0A	6
22	41PS226Y010K0A	6
27	41PS276Y010K0A	6
33	41PS336Y010K0A	8
39	41PS396Y010K0A	8
47	41PS476Z010K0A	8
56	41PS566Z010K0A	8
68	41PS686Z010K0A	8
82	41PS826Z010K0A	8
100	41PS107Z010K0A	8
120	41PS127Z010K0A	8
150	41PS157Z010K0A	8

SERIES 41PS

Industrial Type Tantalum Capacitors

Capacitance uf 25°C 120 cps	M/C Part Number ±10%	Maximum Dissipation Factor, % 25°C 120 cps
15 VOLT RATING AT 85°C		
1.0	41PS105X015K0A	6
1.2	41PS125X015K0A	6
1.5	41PS155X015K0A	6
1.8	41PS185X015K0A	6
2.2	41PS225X015K0A	6
2.7	41PS275X015K0A	6
3.3	41PS335X015K0A	6
3.9	41PS395X015K0A	6
4.7	41PS475X015K0A	6
5.6	41PS565X015K0A	6
6.8	41PS685X015K0A	6
8.2	41PS825X015K0A	6
10	41PS106Y015K0A	6
12	41PS126Y015K0A	6
15	41PS156Y015K0A	6
18	41PS186Y015K0A	6
22	41PS226Y015K0A	6
27	41PS276Y015K0A	6
33	41PS336Z015K0A	8
39	41PS396Z015K0A	8
47	41PS476Z015K0A	8
56	41PS566Z015K0A	8
68	41PS686Z015K0A	8
82	41PS826Z015K0A	8

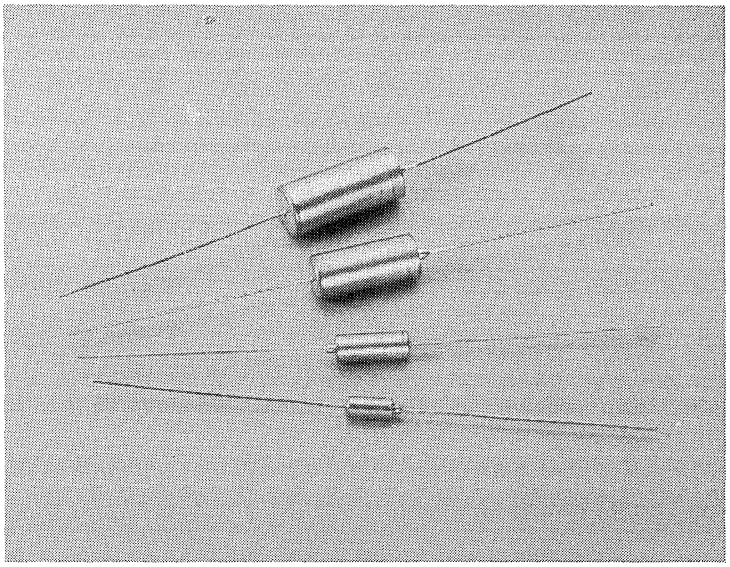
Capacitance uf 25°C 120 cps	M/C Part Number ±10%	Maximum Dissipation Factor, % 25°C 120 cps
25 VOLT RATING AT 85°C		
1.0	41PS105X025K0A	6
1.2	41PS125X025K0A	6
1.5	41PS155X025K0A	6
1.8	41PS185X025K0A	6
2.2	41PS225X025K0A	6
2.7	41PS275X025K0A	6
3.3	41PS335X025K0A	6
3.9	41PS395X025K0A	6
4.7	41PS475X025K0A	6
5.6	41PS565Y025K0A	6
6.8	41PS685Y025K0A	6
8.2	41PS825Y025K0A	6
10	41PS106Y025K0A	6
12	41PS126Y025K0A	6
15	41PS156Y025K0A	6
18	41PS186Z025K0A	6
22	41PS226Z015K0A	6
27	41PS276Z025K0A	6
33	41PS336Z025K0A	6
39	41PS396Z025K0A	6
47	41PS476Z025K0A	6

Capacitance uf 25°C 120 cps	M/C Part Number ±10%	Maximum Dissipation Factor, % 25°C 120 cps
35 VOLT RATING AT 85°C		
.10	41PS104X035K0A	6
.12	41PS124X035K0A	6
.15	41PS154X035K0A	6
.18	41PS184X035K0A	6
.22	41PS224X035K0A	6
.27	41PS274X035K0A	6
.33	41PS334X035K0A	6
.39	41PS394X035K0A	6
.47	41PS474X035K0A	6
.56	41PS564X035K0A	6
.68	41PS684X035K0A	6
.82	41PS824X035K0A	6
1.0	41PS105X035K0A	6
1.2	41PS125X035K0A	6
1.5	41PS155X035K0A	6
1.8	41PS185X035K0A	6
2.2	41PS225X035K0A	6
2.7	41PS275X035K0A	6
3.3	41PS335X035K0A	6
3.9	41PS395Y035K0A	6
4.7	41PS475Y035K0A	6
5.6	41PS565Y035K0A	6
6.8	41PS685Y035K0A	6
8.2	41PS825Y035K0A	6
10	41PS106Y035K0A	6
12	41PS126Z035K0A	6
15	41PS156Z035K0A	6
18	41PS186Z035K0A	6
22	41PS226Z035K0A	6
27	41PS276Z035K0A	6
33	41PS336Z035K0A	6

Capacitance uf 25°C 120 cps	M/C Part Number ±10%	Maximum Dissipation Factor, % 25°C 120 cps
50 VOLT RATING AT 85°C		
.10	41PS104X050K0A	6
.12	41PS124X050K0A	6
.15	41PS154X050K0A	6
.18	41PS184X050K0A	6
.22	41PS224X050K0A	6
.27	41PS274X050K0A	6
.33	41PS334X050K0A	6
.39	41PS394X050K0A	6
.47	41PS474X050K0A	6
.56	41PS564X050K0A	6
.68	41PS684X050K0A	6
.82	41PS824X050K0A	6
1.0	41PS105X050K0A	6
1.2	41PS125X050K0A	6
1.5	41PS155X050K0A	6
1.8	41PS185X050K0A	6
2.2	41PS225X050K0A	6
2.7	41PS275Y050K0A	6
3.3	41PS335Y050K0A	6
3.9	41PS395Y050K0A	6
4.7	41PS475Y050K0A	6
5.6	41PS565Y050K0A	6
6.8	41PS685Z050K0A	6
8.2	41PS825Z050K0A	6
10	41PS106Z050K0A	6
12	41PS126Z050K0A	6
15	41PS156Z050K0A	6
18	41PS186Z050K0A	6

SERIES 40SS

Solid Electrolyte Tantalum Capacitor



DESCRIPTION

The 40SS type solid tantalum capacitors are products of extensive research and development activities. While their unique design makes the 40SS type capacitors extremely stable over a wide temperature range, their high purity, porous sintered tantalum anode and highly refined tantalum oxide dielectric result in capacitors with low DC leakage currents and low dissipation factor values.

FEATURES

- HERMETIC SEAL
- LOWEST DC LEAKAGE CURRENT
- REDUCED ESR RESULTING IN LOW DISSIPATION FACTOR
- MINIMAL CHANGE IN CAPACITANCE AT TEMPERATURE EXTREMES
- HERMETIC DEVICE

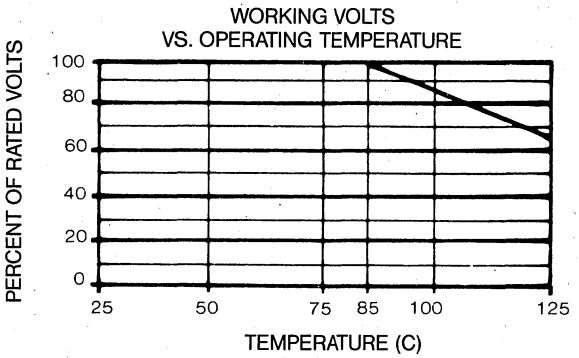
SERIES 40SS

Industrial Type Tantalum Capacitors

ELECTRICAL CHARACTERISTICS

DC WORKING VOLTAGE

M/C 40SS Type Tantalum Capacitors are available in 8 voltage ratings and may be operated at full rated voltage from 80°C to +85°C. The "S" type may be further operated up to 125°C by derating the DC working voltage in accordance with the following graph and chart:



Rated DC Working Voltage		Rated DC Surge Voltage	
Up to 85°C	125°C	Up to 85°C	125°C
6	4	8	5
10	7	13	9
15	10	20	12
20	13	26	16
35	23	46	28
50	33	65	40
75	50	97	64
100	66	130	86

SURGE VOLTAGE

The surge voltage rating (see table above) of the 40SS Type capacitor is the maximum short duration voltage which may be applied to the capacitor; i.e., "turn on" transients, peak AC voltage, or any other voltage pulses which may be superimposed on the rated DC working voltage.

In no case may the sum of the AC voltage and the applied DC working voltage exceed the rated DC surge voltage.

SURGE VOLTAGE TEST

Appropriate surge voltage shall be applied to the test capacitor(s) through a 1000 ohm series limiting resistor for 30 seconds. The test capacitors shall then be discharged through the 1000 ohm resistor for 5½ minutes. This charge discharge cycle shall be repeated 2000 times.

Following the surge test the following requirements must be met:

A. Capacitance shall not change more than ±5%.
B. Dissipation Factor shall meet initial requirements.
C. DC Leakage Current shall meet initial requirements.

CAPACITANCE RATINGS

The 40SS Type Capacitors are available from .0047 MFD to 330 MFD in an incremental series of nominal values so chosen that the minimum and maximum allowable tolerance of two successive ratings overlap. In the tabulation of standard ratings you will find nominal ratings for ±10% tolerance series.

Intermediate values for a ±5% and ±20% tolerance series are available on special order.

CAPACITANCE MEASUREMENT

40SS Type capacitors are measured on a polarized capacitance bridge. The measurements are made at, or referred to, 120 hz and 25°C conditions. The AC measuring signal shall be limited to 2 volts peak and have a frequency of 120 hz. The bridge shall have a DC polarizing voltage large enough to prevent a reversal of polarity by the AC measuring voltage and at the same time the peak AC measuring voltage and at the same time the peak AC should not exceed the rated DC working voltage of the capacitor.

CAPACITANCE CHANGE WITH TEMPERATURES

One of the most significant characteristics of the "40SS" Type Capacitor Series is the relatively small change in capacitance at temperature extremes compared to other types of electrolytic capacitors.

The change in capacitance from the initial 25°C measured capacitance shall not exceed the following percentages:

TEMPERATURE	MAX. CHANGE IN CAPACITANCE
−55°C	10%
+85°C	8%
+125°C	12%

DISSIPATION FACTOR

DF shall be measured on a polarized bridge, at or referred to 120 cps at 25°C. The maximum DC bias shall be 2.2 VDC for all AC measurements. The magnitude of the AC signal shall be limited to 1.0 VRMS.

The DF so determined shall not exceed:

0.01 uf to 56 uf	6% DF maximum
68 uf to 120 uf	8% DF maximum
150 uf and Up	10% DF maximum

D.C. LEAKAGE CURRENT

When measured at 25°C, rated voltage, and after a 5 minute electrification period, the values in no case need be less than 1 uA or .02uA/ufV, whichever is greater. At 85°C the leakage will not exceed 10 times the 25°C limit and at 125°C will not exceed 12 times the 25°C limit.

LIFE TEST

Capacitors shall be life tested for 2000 hours at 85°C or 125°C with the appropriate DC working voltage applied. After life test when measured at 25°C the dissipation factor shall meet the initial requirement. This leakage current shall not be more than 125% of the original requirements and capacitors shall not have changed more than ±10% from the initial value.

PHYSICAL ENVIRONMENTS

The M/C 40SS Type Solid Electrolyte Tantalum Capacitors are capable of meeting the following requirements on environmental test.

In the interest of standardization, these tests follow very closely the testing specified in military specifications on solid tantalums. They do not represent the maximum environment capabilities of the M/C 40SS Type.

For more extreme conditions the M/C Capacitor Engineering Department should be consulted.

LOW FREQUENCY VIBRATION

The capacitors shall be rigidly mounted by suitable case clamps and subjected to a simple harmonic motion having a maximum amplitude of 0.03". The frequency shall be varied uniformly over a frequency range of 10-55 Hz in approximately 1 minute at a uniform rate for a total of 2 hours. Rated DC voltage will be applied to the units during test. During the last ½ hour of test, the test units will be monitored by an instrument capable of detecting intermittent open or short circuits with a duration of .5 milliseconds or greater.

After vibration the capacitors shall meet the initial requirements of dissipation factor and leakage current. The capacitance shall not change more than ±5% from the initial measured value.

HIGH FREQUENCY VIBRATION

The capacitors shall be rigidly mounted by suitable case clamps and subjected to a simple harmonic motion having a maximum amplitude of 0.03" or 15G in 2 mutually perpendicular directions—1 parallel and 1 perpendicular to the cylindrical axis. Capacitors shall withstand vibration from 10 to 10,000 Hz at 15g without internal damage. The frequency shall be varied uniformly over a frequency range (f55-2000 Hz in approximately 20 minutes at a uniform rate for a total of 4 hours. During the last ½ hour of test the test units will be monitored by an instrument capable of detecting intermittent open or short circuits with a duration of .5 milli-seconds or greater. Rated DC voltage will be applied to the units during test.

After vibration the capacitors shall meet the initial requirements of dissipation factor and leakage current. The capacitance shall not change more than ±5% from the initial measured value.

PULL TEST

With the body of the capacitor secured, the leads shall withstand a 3 lb. load applied in any direction for 30 seconds.

BEND TEST

Each capacitor lead shall be capable of withstanding 5 bends. A bend shall be defined as follows:

With the capacitor vertical and a 1 lb. weight attached to the lead, the capacitor body shall be slowly rotated (in approximately 5 seconds) to a horizontal position and then rotated to the vertical position. The 4 succeeding bends shall then be made in the same manner but in alternate directions.

MOISTURE RESISTANCE

M/C 40SS type capacitors shall be tested in accordance with method 106 of MIL Standard 202. The following details and exceptions shall apply:

a. Mounting—The capacitors shall be securely mounted by normal mounting means during the test. This does not apply during measurements.
b. Initial measurements are not applicable.
c. Polarization and loading voltages are not applicable during the test.
d. Final Measurements—With 2-6 hours after the capacitors have been removed from the humidity chamber following the final cycle, the DC leakage, capacitance and dissipation factor shall be measured as specified.
e. Examinations After Test—Following the final measurements the capacitors shall be examined visually for evidence of corrosion, mechanical damage and obliteration of marking.

INSULATING SLEEVES

For insulated capacitors, the insulating sleeves shall be tested as follows for dielectric strength and insulation resistance.

Two wire windings shall be placed around the insulating sleeves ¼" apart. Each winding to consist of 2 close turns of 24AWG bare copper wire.

DIELECTRIC STRENGTH

For dielectric strength a DC test potential of 2000 V shall be applied for 1 minute between the 2 windings. There shall be no breakdown of case insulation.

INSULATION RESISTANCE

For insulation resistance a DC test potential of 100 V shall be applied for 2 minutes. The insulation resistance shall not be less than 100 megohms.

SHELF LIFE TEST

When the capacitors have been exposed to 5000 hours shelf life test at 85°C with no voltage applied capacitance shall not change more than ±4% from the initial measured value. The dissipation factor shall not exceed 150% of the initial requirement and the leakage current shall meet the initial requirement.

SHOCK

The capacitors shall be tested for shock resistance in accordance with MIL Standard 202A methods 205 with the following exceptions.

a. The capacitors shall be rigidly mounted by suitable body clamps.
b. The capacitor shall be subjected to 20 impacts of 50g with an 11 milli-seconds duration. Ten impacts to be applied in the direction of the longitudinal axis, and 10 impacts in a plane normal to the longitudinal axis of the capacitor.
c. Rated DC voltage shall be applied to the capacitors during the shock test.

The test units shall be monitored during test by an instrument capable of detecting intermittent open and short circuits with a duration of .5 milli-seconds or greater.

After test the capacitors shall meet the initial requirements of capacitance, dissipation factor and leakage requirements.

THERMAL SHOCK AND IMMERSION CYCLING

After the capacitors are tested as specified in 8A and 8B, the DC leakage current shall meet the initial requirement. The capacitance change shall not exceed ±5% of the value measured prior to test and the dissipation factor shall meet the initial requirement. When examined visually, at least 90% of all exposed metallic surfaces shall show no evidence of harmful corrosion. When examined internally there shall be no evidence of dye penetration.

THERMAL SHOCK

Capacitors shall be tested in accordance with Method 107 of MIL Standard 202. The following exceptions and details shall apply:

a. Capacitors should be conditioned at a temperature of 25°C for 15 minutes before the first cycle of test one.
b. The B test condition will be followed except that in the third step thereof, the capacitors will be subjected to a test at the highest applicable temperature.
c. Measurements before and after cycling may be omitted.

IMMERSION CYCLING

After temperature cycling, a capacitor test should be made following Method 104 set down in MIL Standard 202. The following details and exceptions, however, shall apply:

a. A non-corrosive dye, Rhodamine B (tetraethylrhodamine), or its equivalent, shall be added in both baths in addition to steps provided in test condition B.

b. Measurements after final cycle—Measurements of DC leakage, capacitance and dissipation factor shall be made within 30 minutes after the capacitors are removed from the final immersion bath.

c. Examinations after test—The capacitors shall be visually examined for traces of corrosion, mechanical damage, and obliteration of marking. Capacitors shall then be sectioned for evidence of dye penetration.

REDUCED PRESSURE

After the capacitors have been stabilized for 5 minutes in a vacuum of 1.69×10^{1} Torr., rated DC voltage shall be applied for 1 minute. There shall be no voltage flash over nor shall the end seals show evidence of damage by this test. The capacitance, dissipation factor, and leakage current shall meet the initial requirements.

LEAD MATERIAL

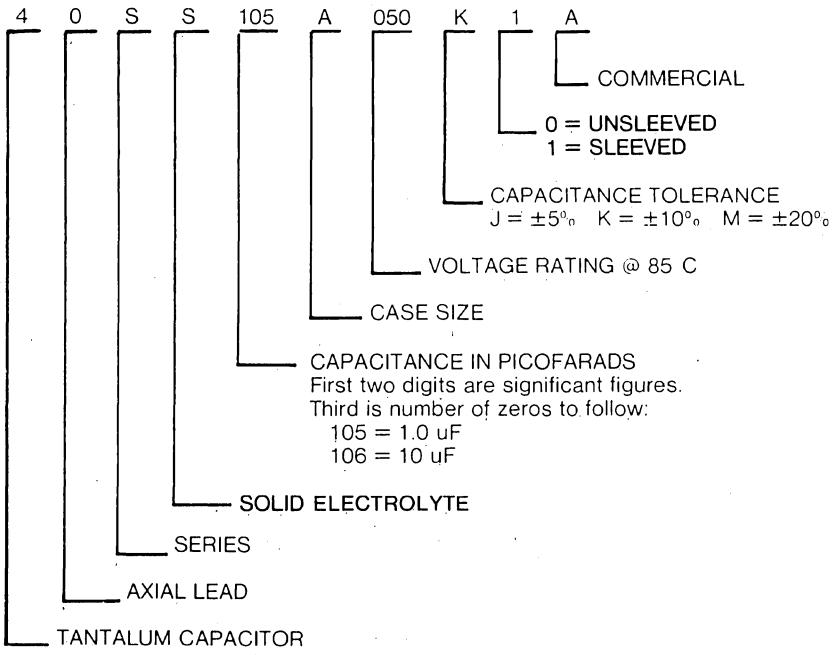
Standard construction will include tin lead plated leads for soldering. Plain nickel leads are also available for welding.

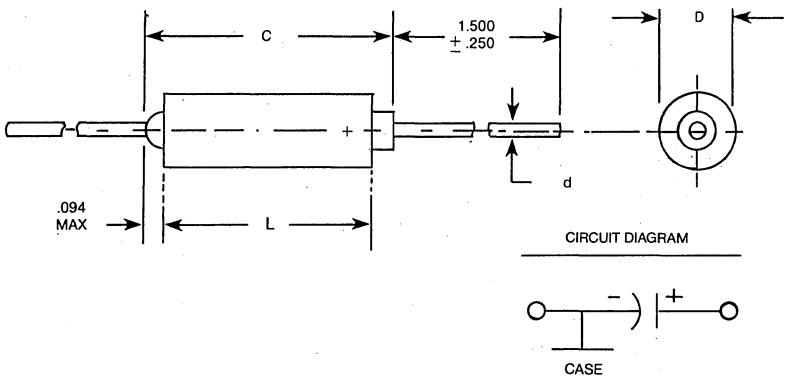
MARKING

Capacitors shall be marked with M/C rated capacitance, tolerance, polarity, rated DC working voltage, date code where space permits. Polarity will be marked on one end with a + sign to identify the positive terminal.

M/C PART NUMBER SYSTEM

EXAMPLE:





DIMENSIONS — INCHES (mm)								
Case Size	Uninsulated		Insulated		C Max.	d Lead Dia. d±002 (0.05)	Lead Length l±.25 (±6.40)	Approx. Weight Grams
	D +.016 (0.41) −.015 (0.38)	L±.031 (.079)	D +.016 (0.41) −.015 (0.38)	L±.031				
A	0.125 (3.18)	0.250 (635)	0.135 (3.43)	0.286 (7.26)	.422 (10.72)	0.020 (0.51)	1.50	0.7
B	0.175 (4.45)	0.438 (11.12)	0.185 (4.70)	0.474 (12.04)	.610 (15.49)	0.020 (0.51)	1.50	1.6
C	0.279 (7.10)	0.650 (16.50)	0.289 (7.34)	0.686 (17.42)	.822 (20.88)	0.025 (0.64)	1.50	4.9
D	0.341 (8.65)	0.750 (19.05)	0.351 (8.92)	0.786 (19.96)	.922 (23.42)	0.025 (0.64)	1.50	8.8

SERIES 40SS

Industrial Type Tantalum Capacitors

STANDARD RATINGS

CAPACITANCE +25°C 120Hz	6 WVDC ±10% INSULATED 4V @ 125°C	DCL @ 25°C TYPICAL	10 WVDC ±10% INSULATED 7V @ 125°C	DCL @ 25°C TYPICAL	15 WVDC ±10% INSULATED 10V @ 125°C	DCL @ 25°C TYPICAL	20 WVDC ±10% INSULATED 13V @ 125°C	DCL @ 25°C TYPICAL	MFD
.0047	40SS472A006K1A	0.1	40SS472A010K1A	0.1	40SS472A015K1A	0.1	40SS472A020K1A	0.1	.0047
.0056	40SS562A006K1A	0.1	40SS562A010K1A	0.1	40SS562A015K1A	0.1	40SS562A020K1A	0.1	.0056
.0068	40SS682A006K1A	0.1	40SS682A010K1A	0.1	40SS682A015K1A	0.1	40SS682A020K1A	0.1	.0068
.0082	40SS822A006K1A	0.1	40SS822A010K1A	0.1	40SS822A015K1A	0.1	40SS822A020K1A	0.1	.0082
.01	40SS103A006K1A	0.1	40SS103A010K1A	0.1	40SS103A015K1A	0.1	40SS103A020K1A	0.1	.01
.012	40SS123A006K1A	0.1	40SS123A010K1A	0.1	40SS123A015K1A	0.1	40SS123A020K1A	0.1	.012
.015	40SS153A006K1A	0.1	40SS153A010K1A	0.1	40SS153A015K1A	0.1	40SS153A020K1A	0.1	.015
.018	40SS183A006K1A	0.1	40SS183A010K1A	0.1	40SS183A015K1A	0.1	40SS183A020K1A	0.1	.018
.022	40SS223A006K1A	0.1	40SS223A010K1A	0.1	40SS223A015K1A	0.1	40SS223A020K1A	0.1	.022
.027	40SS273A006K1A	0.1	40SS273A010K1A	0.1	40SS273A015K1A	0.1	40SS273A020K1A	0.1	.027
.033	40SS333A006K1A	0.1	40SS333A010K1A	0.1	40SS333A015K1A	0.1	40SS333A020K1A	0.1	.033
.039	40SS393A006K1A	0.1	40SS393A010K1A	0.1	40SS393A015K1A	0.1	40SS393A020K1A	0.1	.039
.047	40SS473A006K1A	0.1	40SS473A010K1A	0.1	40SS473A015K1A	0.1	40SS473A020K1A	0.1	.047
.056	40SS563A006K1A	0.1	40SS563A010K1A	0.1	40SS563A015K1A	0.1	40SS563A020K1A	0.1	.056
.068	40SS683A006K1A	0.1	40SS683A010K1A	0.1	40SS683A015K1A	0.1	40SS683A020K1A	0.1	.068
.082	40SS823A006K1A	0.1	40SS823A010K1A	0.1	40SS823A015K1A	0.1	40SS823A020K1A	0.1	.082
.1	40SS104A006K1A	0.5	40SS104A010K1A	0.5	40SS104A015K1A	0.5	40SS104A020K1A	0.5	.1
.12	40SS124A006K1A	0.5	40SS124A010K1A	0.5	40SS124A015K1A	0.5	40SS124A020K1A	0.5	.12
.15	40SS154A006K1A	0.5	40SS154A010K1A	0.5	40SS154A015K1A	0.5	40SS154A020K1A	0.5	.15
.18	40SS184A006K1A	0.5	40SS184A010K1A	0.5	40SS184A015K1A	0.5	40SS184A020K1A	0.5	.18
.22	40SS224A006K1A	0.5	40SS224A010K1A	0.5	40SS224A015K1A	0.5	40SS224A020K1A	0.5	.22
.27	40SS274A006K1A	0.5	40SS274A010K1A	0.5	40SS274A015K1A	0.5	40SS274A020K1A	0.5	.27
.33	40SS334A006K1A	0.5	40SS334A010K1A	0.5	40SS334A015K1A	0.5	40SS334A020K1A	0.5	.33
.39	40SS394A006K1A	0.5	40SS394A010K1A	0.5	40SS394A015K1A	0.5	40SS394A020K1A	0.5	.39
.47	40SS474A006K1A	0.5	40SS474A010K1A	0.5	40SS474A015K1A	0.5	40SS474A020K1A	0.5	.47
.56	40SS564A006K1A	0.5	40SS564A010K1A	0.5	40SS564A015K1A	0.5	40SS564A020K1A	0.5	.56
.68	40SS684A006K1A	0.5	40SS684A010K1A	0.5	40SS684A015K1A	0.5	40SS684A020K1A	0.5	.68
.82	40SS824A006K1A	0.5	40SS824A010K1A	0.5	40SS824A015K1A	0.5	40SS824A020K1A	0.5	.82
1.0	40SS105A006K1A	0.5	40SS105A010K1A	0.5	40SS105A015K1A	0.5	40SS105A020K1A	0.5	1.0
1.2	40SS125A006K1A	0.5	40SS125A010K1A	0.5	40SS125A015K1A	0.5	40SS125A020K1A	0.5	1.2
1.5	40SS155A006K1A	0.5	40SS155A010K1A	0.5	40SS155A015K1A	0.5	40SS155A020K1A	0.5	1.5
1.8	40SS185A006K1A	0.5	40SS185A010K1A	0.5	40SS185A015K1A	0.5	40SS185A020K1A	0.5	1.8
2.2	40SS225A006K1A	0.5	40SS225A010K1A	0.5	40SS225A015K1A	0.5	40SS225A020K1A	0.5	2.2
2.7	40SS275A006K1A	0.5	40SS275A010K1A	0.5	40SS275A015K1A	0.5	40SS275B020K1A	0.5	2.7
3.3	40SS335A006K1A	0.5	40SS335A010K1A	0.5	40SS335A015K1A	0.5	40SS335B020K1A	1.0	3.3
3.9	40SS395A006K1A	0.5	40SS395A010K1A	0.5	40SS395B015K1A	0.5	40SS395B020K1A	1.0	3.9
4.7	40SS475A006K1A	0.5	40SS475A010K1A	0.5	40SS475B015K1A	1.0	40SS475B020K1A	1.0	4.7
5.6	40SS565A006K1A	0.5	40SS565B010K1A	0.5	40SS565B015K1A	1.0	40SS565B020K1A	1.0	5.6
6.8	40SS685A006K1A	0.5	40SS685B010K1A	1.0	40SS685B015K1A	1.0	40SS685B020K1A	1.0	6.8
8.2	40SS825A006K1A	0.5	40SS825B010K1A	1.0	40SS825B015K1A	1.0	40SS825B020K1A	1.0	8.2
10	40SS106B006K1A	0.5	40SS106B010K1A	1.0	40SS106B015K1A	1.0	40SS106B020K1A	1.0	10.
12	40SS126B006K1A	0.5	40SS126B010K1A	1.0	40SS126B015K1A	1.0	40SS126B020K1A	2.0	12.
15	40SS156B006K1A	1.0	40SS156B010K1A	1.0	40SS156B015K1A	2.0	40SS156B020K1A	3.0	15.
18	40SS186B006K1A	1.0	40SS186B010K1A	1.0	40SS186B015K1A	2.0	40SS186C020K1A	3.0	18.
22	40SS226B006K1A	1.0	40SS226B010K1A	2.0	40SS226B015K1A	3.0	40SS226C020K1A	3.0	22.
27	40SS276B006K1A	1.0	40SS276B010K1A	2.0	40SS276C015K1A	3.0	40SS276C020K1A	3.0	27.
33	40SS336B006K1A	1.0	40SS336B010K1A	2.0	40SS336C015K1A	3.0	40SS336C020K1A	3.0	33.
39	40SS396B006K1A	1.0	40SS396B010K1A	2.0	40SS396C015K1A	3.0	40SS396C020K1A	3.0	39.
47	40SS476B006K1A	2.0	40SS476C010K1A	3.0	40SS476C015K1A	6.0	40SS476C020K1A	6.0	47.
56	40SS566B006K1A	2.0	40SS566C010K1A	3.0	40SS566C015K1A	6.0	40SS566D020K1A	6.0	56.
68	40SS686C006K1A	3.0	40SS686C010K1A	3.0	40SS686C015K1A	6.0	40SS686D020K1A	6.0	68.
82	40SS826C006K1A	3.0	40SS826C010K1A	3.0	40SS826D015K1A	6.0	40SS826D020K1A	6.0	82.
100	40SS107C006K1A	3.0	40SS107C010K1A	6.0	40SS107D015K1A	6.0	40SS107D020K1A	10.0	100.
120	40SS127C006K1A	3.0	40SS127C010K1A	6.0	40SS127D015K1A	6.0			
150	40SS157C006K1A	6.0	40SS157D010K1A	10.0	40SS157D015K1A	10.0			
180	40SS187C006K1A	6.0	40SS187D010K1A	10.0					
220	40SS227D006K1A	6.0	40SS227D010K1A	10.0					
270	40SS277D006K1A	6.0							
330	40SS337D006K1A	10.0							

SERIES 40SS

Industrial Type Tantalum Capacitors

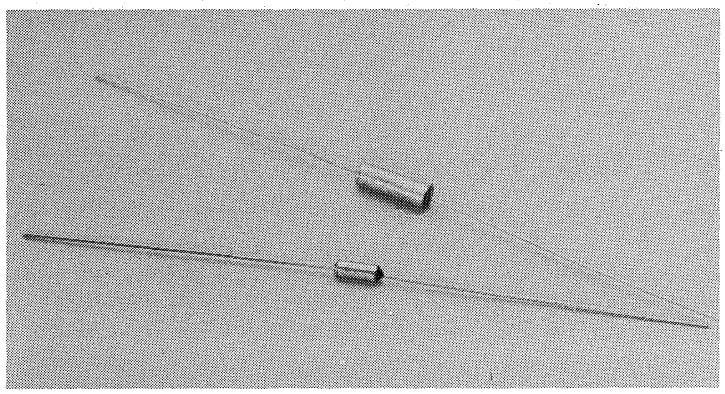
STANDARD RATINGS

CAPACITANCE +25°C 120 Hz	35 WVDC ±10% INSULATED 23V @ 125°C	DCL @25°C TYPICAL	50 WVDC ±10% INSULATED 33V @ 125°C	DCL @25°C TYPICAL	75 WVDC ±10% INSULATED 50V @ 125°C	DCL @ 25°C TYPICAL	100 WVDC ±10% INSULATED 67V @ 125°C	DCL @25°C TYPICAL	MFD
.0047	40SS472A035K1A	0.1	40SS472A050K1A	0.1	40SS472A075K1A	0.5	40SS472A100K1A	0.5	.0047
.0056	40SS562A035K1A	0.1	40SS562A050K1A	0.1	40SS562A075K1A	0.5	40SS562A100K1A	0.5	.0056
.0068	40SS682A035K1A	0.1	40SS682A050K1A	0.1	40SS682A075K1A	0.5	40SS682A100K1A	0.5	.0068
.0082	40SS822A035K1A	0.1	40SS822A050K1A	0.1	40SS822A075K1A	0.5	40SS822A100K1A	0.5	.0082
.01	40SS103A035K1A	0.1	40SS103A050K1A	0.1	40SS103A075K1A	0.5	40SS103A100K1A	0.5	.01
.012	40SS123A035K1A	0.1	40SS123A050K1A	0.1	40SS123A075K1A	0.5	40SS103A100K1A	0.5	.012
.015	40SS153A035K1A	0.1	40SS153A050K1A	0.1	40SS153A075K1A	0.5	40SS153A100K1A	0.5	.015
.018	40SS183A035K1A	0.1	40SS183A050K1A	0.1	40SS183A075K1A	0.5	40SS183A100K1A	0.5	.108
.022	40SS223A035K1A	0.1	40SS223A050K1A	0.1	40SS223A075K1A	0.5	40SS223A100K1A	0.5	.022
.027	40SS273A035K1A	0.1	40SS273A050K1A	0.1	40SS273A075K1A	0.5	40SS273A100K1A	0.5	.027
.033	40SS333A035K1A	0.1	40SS333A050K1A	0.1	40SS333A075K1A	0.5	40SS333A100K1A	0.5	.033
.039	40SS393A035K1A	0.1	40SS393A050K1A	0.1	40SS393A075K1A	0.5	40SS393A100K1A	0.5	.039
.047	40SS473A035K1A	0.1	40SS473A050K1A	0.1	40SS473A075K1A	0.5	40SS473A100K1A	0.5	.047
.056	40SS563A035K1A	0.1	40SS563A050K1A	0.1	40SS563A075K1A	0.5	40SS563A100K1A	0.5	.056
.068	40SS683A035K1A	0.1	40SS683A050K1A	0.1	40SS683A075K1A	0.5	40SS683A100K1A	0.5	.068
.082	40SS823A035K1A	0.1	40SS823A050K1A	0.1	40SS823A075K1A	0.5	40SS823A100K1A	0.5	.082
.1	40SS104A035K1A	0.5	40SS104A050K1A	0.5	40SS104A075K1A	0.5	40SS104A100K1A	0.5	.1
.12	40SS124A035K1A	0.5	40SS124A050K1A	0.5	40SS124A075K1A	0.5	40SS124A100K1A	0.5	.12
.15	40SS154A035K1A	0.5	40SS154A050K1A	0.5	40SS154A075K1A	0.5	40SS154A100K1A	0.5	.15
.18	40SS184A035K1A	0.5	40SS184A050K1A	0.5	40SS184A075K1A	0.5	40SS184A100K1A	0.5	.18
.22	40SS224A035K1A	0.5	40SS224A050K1A	0.5	40SS224A075K1A	0.5	40SS224A100K1A	0.5	.22
.27	40SS274A035K1A	0.5	40SS274A050K1A	0.5	40SS274A075K1A	0.5	40SS274A100K1A	0.5	.27
.33	40SS334A035K1A	0.5	40SS334A050K1A	0.5	40SS334A075K1A	0.5	40SS334A100K1A	0.5	.33
.39	40SS394A035K1A	0.5	40SS394A050K1A	0.5	40SS394A075K1A	0.5	40SS394A100K1A	0.5	.39
.47	40SS474A035K1A	0.5	40SS474A050K1A	0.5	40SS474A075K1A	0.5	40SS474A100K1A	0.5	.47
.56	40SS564A035K1A	0.5	40SS564A050K1A	0.5	40SS564A075K1A	0.5	40SS564A100K1A	0.5	.56
.68	40SS684A035K1A	0.5	40SS684A050K1A	0.5	40SS684A075K1A	0.5	40SS684B100K1A	0.5	.68
.82	40SS824A035K1A	0.5	40SS824A050K1A	0.5	40SS824B075K1A	0.5	40SS824B100K1A	0.5	.82
1.0	40SS105A035K1A	0.5	40SS105A050K1A	0.5	40SS105B075K1A	0.5	40SS105B100K1A	0.5	1.0
1.2	40SS125B035K1A	0.5	40SS125B050K1A	0.5	40SS125B075K1A	0.5	40SS125B100K1A	0.5	1.2
1.5	40SS155B035K1A	0.5	40SS155B050K1A	0.5	40SS155B075K1A	1.0	40SS155B100K1A	1.0	1.5
1.8	40SS185B035K1A	0.5	40SS185B050K1A	0.5	40SS185B075K1A	1.0	40SS185B100K1A	1.0	1.8
2.2	40SS225B035K1A	1.0	40SS225B050K1A	1.0	40SS225B075K1A	1.5	40SS225B100K1A	1.5	2.2
2.7	40SS275B035K1A	1.0	40SS275B050K1A	1.0	40SS275B075K1A	1.5	40SS275B100K1A	1.5	2.7
3.3	40SS335B035K1A	1.0	40SS335B050K1A	2.0	40SS335B075K1A	2.0			3.3
3.9	40SS395B035K1A	1.0	40SS395B050K1A	2.0	40SS395B075K1A	2.0			3.9
4.7	40SS475B035K1A	1.0	40SS475B050K1A	3.0	40SS475C075K1A	6.0			4.7
5.6	40SS565B035K1A	1.0	40SS565C050K1A	3.0	40SS565C075K1A	6.0			5.6
6.8	40SS685B035K1A	2.0	40SS685C050K1A	3.0	40SS685C075K1A	10.0			6.8
8.2	40SS825C035K1A	3.0	40SS825C050K1A	3.0	40SS825C075K1A	10.0			
10	40SS106C035K1A	3.0	40SS106C050K1A	3.0	40SS106C075K1A	10.0			10.
12	40SS126C035K1A	3.0	40SS126C050K1A	3.0	40SS126D075K1A	10.0			12.
15	40SS156C035K1A	3.0	40SS156C050K1A	6.0	40SS156D075K1A	12.0			15.
18	40SS186C035K1A	3.0	40SS186C050K1A	6.0					
22	40SS226C035K1A	6.0	40SS226D050K1A	6.0					
27	40SS276D035K1A	6.0							
33	40SS336D035K1A	6.0							
39	40SS396D035K1A	6.0							
47	40SS476D035K1A	10.0							

CASE SIZE — The case size in the tabulation above is indicated by the use of the eighth character in the part number.

SERIES 40TS

Miniature Hermetic Seal Solid Electrolyte Tantalum Capacitor



DESCRIPTION

M/C TYPE 40TS is a miniature hermetically sealed solid electrolyte sintered tantalum anode capacitor. The construction offers an extremely small clean lead to clean lead dimension because the unique integral lead glass-to-metal seal eliminates the usual hermetic seal tubulature. This, combined with special dimensions, makes the 40TS ideal for cordwood packaging.

CONSTRUCTION

Each TYPE 40TS capacitor consists of a processed sintered tantalum anode soldered into a metal enclosure and hermetically sealed with an integral lead-glass-to-metal seal. A small amount of red epoxy may be utilized to protect the seal where lead bends are performed close to the positive end of the capacitor. Identical construction as CSR09 of MIL 39003/02.

CAPACITANCE

Capacitances available are 0.0047 uf thru 39 uf in standard EIA decade values. Capacitance is measured at 120 Hz with a maximum of 1 VRMS and 2.2 VDC applied. Measurements are made at 25°C.

DISSIPATION FACTOR

Usually determined simultaneously with capacitance by the bridge method. The DF will generally conform to the following: 6% DF at 25°C, 8% at all other temperatures.

D.C. WORKING VOLTS

The maximum working voltage including ripple can not exceed the rated voltage for each specific capacitor value. Values for all temperatures is as follows,—linear derate applies from 85°C to 125°C:

+85°C		+125°C	
Rated	Surge	Rated	Surge
4	5	3	4
6	8	4	5
10	12	7	9
15	18	10	12
20	24	13	16
35	42	23	28
50	60	33	40
60	69	40	46
75	86	50	58
100	130	67	86

D.C. LEAKAGE CURRENT

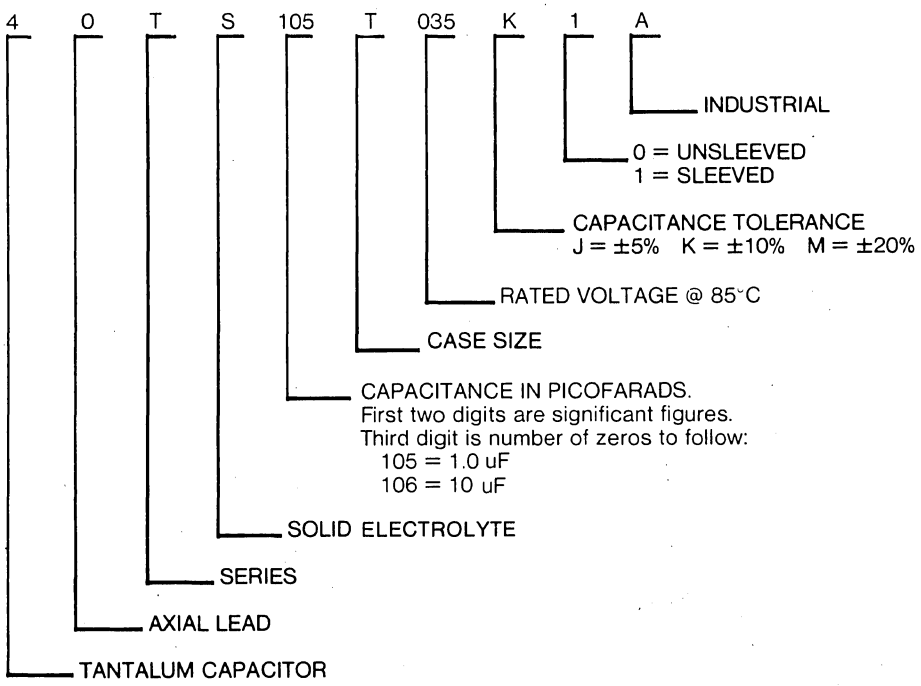
DCL shall not exceed 0.02 uA/ufv, but need not be less than 1 uA when determined with a 1000 ohm current limiting resistor in series with the test capacitor after a 5 minute application of rated voltage at 25°C. The DCL at 85°C shall not exceed 10 times the 25°C limits. At 125°C the DCL shall not exceed 12 times the 25°C limits.

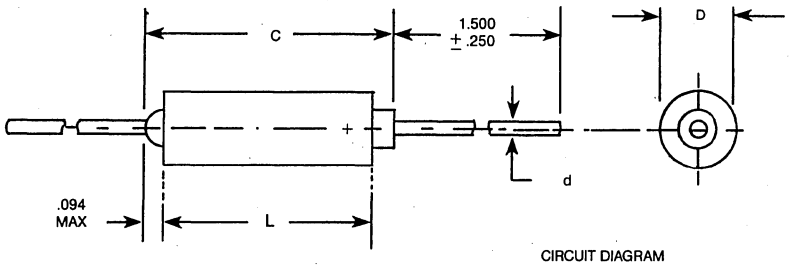
FEATURES

- **−80 TO +125°C OPERATION**
- **4 THROUGH 100 VDC**
- **EXCELLENT FOR CORDWOOD PACKAGING**
- **2 CASE SIZES**

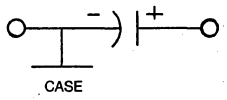
PART NUMBER SYSTEM

EXAMPLE





CIRCUIT DIAGRAM



DIMENSIONS — INCHES (mm)					
Case Size	Uninsulated		Insulated		Lead Dia. d. +.005 (.01) −.001 (.003)
	D ±.005 (.01)	L ±.005 (.01)	D ±.005 (.01)	L +.031 (.08) −.005 (.01)	
T	0.087 (2.21)	0.235 (6.35)	0.090 (2.29)	0.250 (6.35)	0.016 (0.41)
X	0.125 (3.51)	0.375 (9.55)	0.138 (3.51)	0.390 (9.91)	0.016 (0.41)

SERIES 40TS

Industrial Type Tantalum Capacitors

M/C STANDARD RATINGS

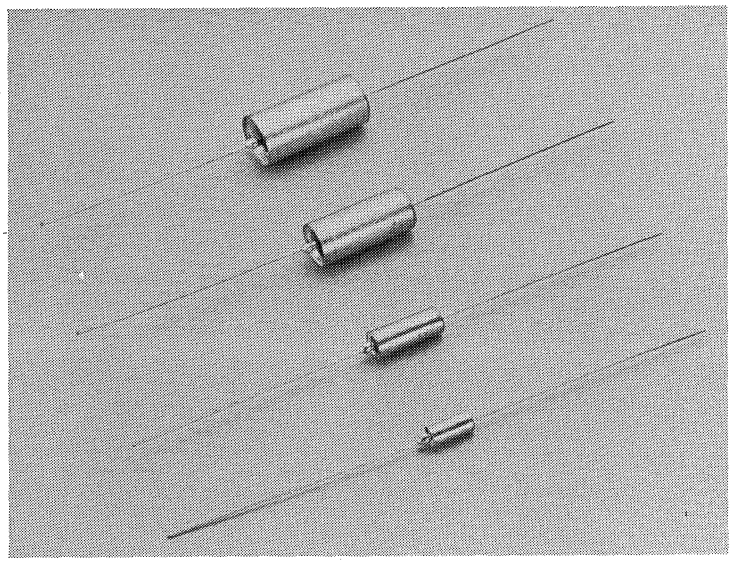
Capacitance	4 WVDC ±10% Insulated	6 WVDC ±10% Insulated	10 WVDC ±10% Insulated	15 WVDC ±10% Insulated
.0047	40TS472T004K1A	40TS472T006K1A	40TS472T010K1A	40TS472T015K1A
.0056	40TS562T004K1A	40TS562T006K1A	40TS562T010K1A	40TS562T015K1A
.0068	40TS682T004K1A	40TS682T006K1A	40TS682T010K1A	40TS682T015K1A
.0082	40TS822T004K1A	40TS822T006K1A	40TS822T010K1A	40TS822T015K1A
.010	40TS103T004K1A	40TS103T006K1A	40TS103T010K1A	40TS103T015K1A
.012	40TS123T004K1A	40TS123T006K1A	40TS123T010K1A	40TS123T015K1A
.015	40TS153T004K1A	40TS153T006K1A	40TS153T010K1A	40TS153T015K1A
.018	40TS183T004K1A	40TS183T006K1A	40TS183T010K1A	40TS183T015K1A
.022	40TS223T004K1A	40TS223T006K1A	40TS223T010K1A	40TS223T015K1A
.027	40TS273T004K1A	40TS273T006K1A	40TS273T010K1A	40TS273T015K1A
.033	40TS333T004K1A	40TS333T006K1A	40TS333T010K1A	40TS333T015K1A
.039	40TS393T004K1A	40TS393T006K1A	40TS393T010K1A	40TS393T015K1A
.047	40TS473T004K1A	40TS473T006K1A	40TS473T010K1A	40TS473T015K1A
.056	40TS563T004K1A	40TS563T006K1A	40TS563T010K1A	40TS563T015K1A
.068	40TS683T004K1A	40TS683T006K1A	40TS683T010K1A	40TS683T015K1A
.082	40TS823T004K1A	40TS823T006K1A	40TS823T010K1A	40TS823T015K1A
.10	40TS104T004K1A	40TS104T006K1A	40TS104T010K1A	40TS104T015K1A
.12	40TS124T004K1A	40TS124T006K1A	40TS124T010K1A	40TS124T015K1A
.15	40TS154T004K1A	40TS154T006K1A	40TS154T010K1A	40TS154T015K1A
.18	40TS184T004K1A	40TS184T006K1A	40TS184T010K1A	40TS184T015K1A
.22	40TS224T004K1A	40TS224T006K1A	40TS224T010K1A	40TS224T015K1A
.27	40TS274T004K1A	40TS274T006K1A	40TS274T010K1A	40TS274T015K1A
.33	40TS334T004K1A	40TS334T006K1A	40TS334T010K1A	40TS334T015K1A
.39	40TS394T004K1A	40TS394T006K1A	40TS394T010K1A	40TS394T015K1A
.47	40TS474T004K1A	40TS474T006K1A	40TS474T010K1A	40TS474T015K1A
.56	40TS564T004K1A	40TS564T006K1A	40TS564T010K1A	40TS564T015K1A
.68	40TS684T004K1A	40TS684T006K1A	40TS684T010K1A	40TS684T015K1A
.82	40TS824T004K1A	40TS824T006K1A	40TS824T010K1A	40TS824T015K1A
1.0	40TS105T004K1A	40TS105T006K1A	40TS105T010K1A	40TS105T015K1A
1.2	40TS125T004K1A	40TS125T006K1A	40TS125T010K1A	40TS125T015K1A
1.5	40TS155T004K1A	40TS155T006K1A	40TS155T010K1A	40TS155T015K1A
1.8	40TS185T004K1A	40TS185T006K1A	40TS185T010K1A	40TS185T015K1A
2.2	40TS225T004K1A	40TS225T006K1A	40TS225T010K1A	40TS225T015K1A
2.7	40TS275T004K1A	40TS275T006K1A	40TS275T010K1A	
3.3	40TS335T004K1A	40TS335T006K1A	40TS335T010K1A	
3.9	40TS395T004K1A	40TS395T006K1A		
4.7	40TS475T004K1A	40TS475T006K1A		40TS475X015K1A
5.6	40TS565T004K1A			40TS565X015K1A
6.8	40TS685T004K1A		40TS685X010K1A	40TS685X015K1A
8.2			40TS825X010K1A	40TS825X015K1A
10		40TS106X006K1A	40TS106X010K1A	40TS106X015K1A
12		40TS126X006K1A	40TS126X010K1A	40TS126X015K1A
15		40TS156X006K1A	40TS156X010K1A	40TS156X015K1A
18	40TS186X004K1A	40TS186X006K1A	40TS186X010K1A	
22	40TS226X004K1A	40TS226X006K1A		
27	40TS276X004K1A	40TS276X006K1A		
33	40TS336X004K1A			
39	40TS396X004K1A			

M/C STANDARD RATINGS

Capacitance	20 WVDC ±10% Insulated	35 WVDC ±10% Insulated	50 WVDC ±10% Insulated	75 WVDC ±10% Insulated
.0047	40TS472T020K1A	40TS472T035K1A	40TS472T050K1A	40TS472T075K1A
.0056	40TS562T020K1A	40TS562T035K1A	40TS562T050K1A	40TS562T075K1A
.0068	40TS682T020K1A	40TS682T035K1A	40TS682T050K1A	40TS682T075K1A
.0082	40TS822T020K1A	40TS822T035K1A	40TS822T050K1A	40TS822T075K1A
.010	40TS103T020K1A	40TS103T035K1A	40TS103T050K1A	40TS103T075K1A
.012	40TS123T020K1A	40TS123T035K1A	40TS123T050K1A	40TS123T075K1A
.015	40TS153T020K1A	40TS153T035K1A	40TS153T050K1A	40TS153T075K1A
.018	40TS183T020K1A	40TS183T035K1A	40TS183T050K1A	40TS183T075K1A
.022	40TS223T020K1A	40TS223T035K1A	40TS223T050K1A	40TS223T075K1A
.027	40TS273T020K1A	40TS273T035K1A	40TS273T050K1A	40TS273T075K1A
.033	40TS333T020K1A	40TS333T035K1A	40TS333T050K1A	40TS333T075K1A
.039	40TS393T020K1A	40TS393T035K1A	40TS393T050K1A	40TS393T075K1A
.047	40TS473T020K1A	40TS473T035K1A	40TS473T050K1A	40TS473T075K1A
.056	40TS563T020K1A	40TS563T035K1A	40TS563T050K1A	40TS563T075K1A
.068	40TS683T020K1A	40TS683T035K1A	40TS683T050K1A	40TS683T075K1A
.082	40TS823T020K1A	40TS823T035K1A	40TS823T050K1A	40TS823T075K1A
.10	40TS104T020K1A	40TS104T035K1A	40TS104T050K1A	40TS104T075K1A
.12	40TS124T020K1A	40TS124T035K1A	40TS124T050K1A	40TS124T075K1A
.15	40TS154T020K1A	40TS154T035K1A	40TS154T050K1A	40TS154T075K1A
.18	40TS184T020K1A	40TS184T035K1A	40TS184T050K1A	40TS184T075K1A
.22	40TS224T020K1A	40TS224T035K1A	40TS224T050K1A	40TS224T075K1A
.27	40TS274T020K1A	40TS274T035K1A	40TS274T050K1A	40TS274T075K1A
.33	40TS334T020K1A	40TS334T035K1A	40TS334T050K1A	40TS334T075K1A
.39	40TS394T020K1A	40TS394T035K1A	40TS394T050K1A	40TS394X075K1A
.47	40TS474T020K1A	40TS474T035K1A	40TS474T050K1A	40TS474X075K1A
.56	40TS564T020K1A	40TS564T035K1A		40TS564X075K1A
.68	40TS684T020K1A	40TS684T035K1A		40TS684X075K1A
.82	40TS824T020K1A	40TS824T035K1A		40TS824X075K1A
1.0	40TS105T020K1A	40TS105T035K1A		40TS105X075K1A
1.2	40TS125T020K1A			40TS125X075K1A
1.5	40TS155T020K1A		40TS155X050K1A	40TS155X075K1A
1.8		40TS185X035K1A	40TS185X050K1A	40TS185X075K1A
2.2		40TS225X035K1A	40TS225X050K1A	
2.7		40TS275X035K1A	40TS275X050K1A	
3.3	40TS335X020K1A	40TS335X035K1A	40TS335X050K1A	
3.9	40TS395X020K1A	40TS395X035K1A	40TS395X050K1A	
4.7	40TS475X020K1A	40TS475X035K1A		
5.6	40TS565X020K1A	40TS565X035K1A		
6.8	40TS685X020K1A			
8.2	40TS825X020K1A			
10	40TS106X020K1A			
12				
15				

SERIES 40XS

Xtra-Capacitance Hermetically Sealed Solid Electrolyte Tantalum Capacitor



DESCRIPTION

The M/C Inc. 40XS Series is a solid electrolyte sintered tantalum anode capacitor body, soldered into a tubular metal can and hermetically sealed with a glass-to-metal seal.

Available in four standard sizes, insulated and uninsulated, the 40XS Series is manufactured utilizing the highly automated processing and assembly techniques which M/C has developed for producing established reliability devices.

The 40XS Series is especially adapted for applications involving coupling, filtering, and timing in those computer, industrial, and commercial circuits requiring capacitors with more capacitance than available in standard devices.

FEATURES

- **–55° TO 125°C OPERATION**
- **6 THRU 60 VOLTS**
- **0.82 uf THRU 1000 uf**
- **FOUR STANDARD SIZES**
- **COUPLING**
- **FILTERING**
- **TIMING**

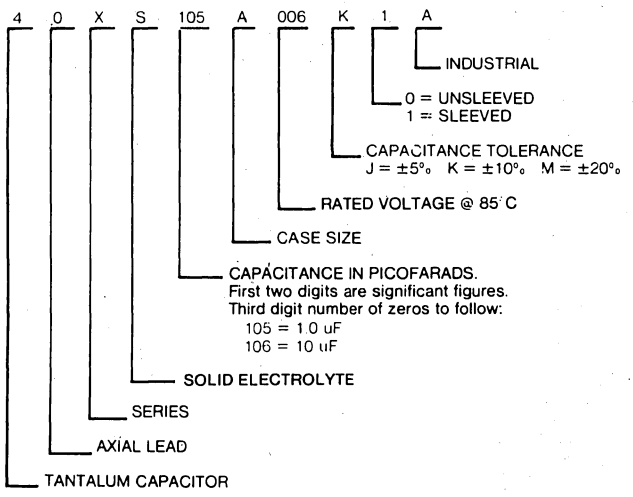
M/C STANDARD RATINGS

CAPACITANCE +25°C 120 Hz	6 WVDC ±10% INSULATED 4V @ 125°C	10 WVDC ±10% INSULATED 7V @ 125°C	15 WVDC ±10% INSULATED 10V @ 125°C	20 WVDC ±10% INSULATED 13V @ 125°C
.82	40XS824A006K1A	40XS824A010K1A	40XS824A015K1A	40XS824A020K1A
1.0	40XS105A006K1A	40XS105A010K1A	40XS105A015K1A	40XS105A020K1A
1.2	40XS125A006K1A	40XS125A010K1A	40XS125A015K1A	40XS125A020K1A
1.5	40XS155A006K1A	40XS155A010K1A	40XS155A015K1A	40XS155A020K1A
1.8	40XS185A006K1A	40XS185A010K1A	40XS185A015K1A	40XS185A020K1A
2.2	40XS225A006K1A	40XS225A010K1A	40XS225A015K1A	40XS225A020K1A
2.7	40XS275A006K1A	40XS275A010K1A	40XS275A015K1A	40XS275A020K1A●
3.3	40XS335A006K1A	40XS335A010K1A	40XS335A015K1A	40XS335A020K1A●
3.9	40XS395A006K1A	40XS395A010K1A	40XS395A015K1A	40XS395A020K1A●
4.7	40XS475A006K1A	40XS475A010K1A	40XS475A015K1A●	40XS475B020K1A
5.6	40XS565A006K1A	40XS565A010K1A	40XS565A015K1A●	40XS565B020K1A
6.8	40XS685A006K1A	40XS685A010K1A●	40XS685B015K1A	40XS685B020K1A
8.2	40XS825A006K1A	40XS825A010K1A●	40XS825B015K1A	40XS825B020K1A
10	40XS106A006K1A●	40XS106B010K1A	40XS106B015K1A	40XS106B020K1A
12	40XS126A006K1A●	40XS126B010K1A	40XS126B015K1A	40XS126B020K1A
15	40XS156B006K1A	40XS156B010K1A	40XS156B015K1A	40XS156B020K1A
18	40XS186B006K1A	40XS186B010K1A	40XS186B015K1A	40XS186B020K1A●
22	40XS226B006K1A	40XS226B010K1A	40XS226B015K1A	40XS226B020K1A●
27	40XS276B006K1A	40XS276B010K1A	40XS276B015K1A	40XS276B020K1A●
33	40XS336B006K1A	40XS336B010K1A	40XS336B015K1A●	40XS336C020K1A
39	40XS396B006K1A	40XS396B010K1A	40XS396B015K1A●	40XS396C020K1A
47	40XS476B006K1A	40XS476B010K1A●	40XS476C015K1A	40XS476C020K1A
56	40XS566B006K1A	40XS566B010K1A●	40XS566C015K1A	40XS566C020K1A●
68	40XS686B006K1A	40XS686B010K1A●	40XS686C015K1A	40XS686C020K1A●
82	40XS826B006K1A	40XS826B010K1A●	40XS826C015K1A	40XS826C020K1A●
100	40XS107B006K1A●	40XS107C010K1A	40XS107C015K1A	40XS107C020K1A●
120	40XS127C006K1A	40XS127C010K1A	40XS127C015K1A	40XS127C020K1A●
150	40XS157C006K1A	40XS157C010K1A●	40XS157C015K1A●	40XS157D020K1A●
180	40XS187C006K1A	40XS187C010K1A	40XS187C015K1A●	40XS187D020K1A●
220	40XS227C006K1A	40XS227C010K1A●	40XS227D015K1A●	
270	40XS277C006K1A	40XS277C010K1A●	40XS277D015K1A●	
330	40XS337C006K1A●	40XS337D010K1A	40XS337D015K1A●	
390	40XS397C006K1A●	40XS397D010K1A●		
470	40XS477C006K1A●	40XS477D010K1A●		
560	40XS567D006K1A	40XS567D010K1A●		
680	40XS687D006K1A●			
820	40XS827D006K1A●			
1000	40XS108D006K1A●			

● ITEM AVAILABLE TO MIL-C-39003 STYLE CSR23

PART NUMBER SYSTEM

EXAMPLE

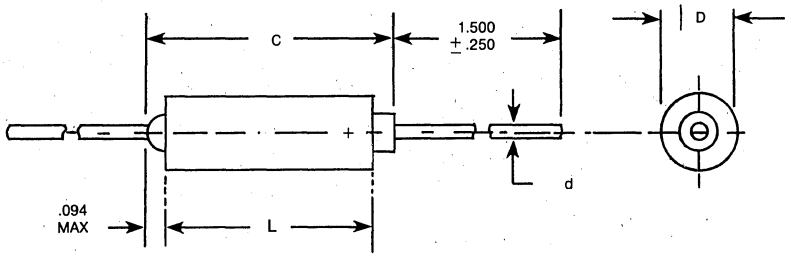


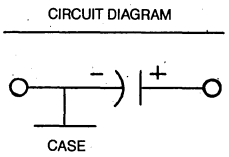
SERIES 40XS

Industrial Type Tantalum Capacitors

M/C STANDARD RATINGS

CAPACITANCE +25°C 120 Hz	30 WVDC ±10% INSULATED 20V @ 125°C	35 WVDC ±10% INSULATED 23V @ 125°C	50 WVDC ±10% INSULATED 33V @ 125°C	60 WVDC ±10% INSULATED 40V @ 125°C
.82	40XS824A030K1A	40XS824A035K1A	40XS824A050K1A	40XS824A060K1A
1.0	40XS105A030K1A	40XS105A035K1A	40XS105A050K1A	40XS105A060K1A
1.2	40XS125A030K1A	40XS125A035K1A	40XS125A050K1A●	40XS125B060K1A
1.5	40XS155A030K1A	40XS155A035K1A	40XS155A050K1A●	40XS155B060K1A
1.8	40XS185A030K1A	40XS185A035K1A●	40XS185B050K1A	40XS185B060K1A
2.2	40XS225A030K1A	40XS225B035K1A	40XS225B050K1A	40XS225B060K1A
2.7	40XS275A030K1A	40XS275B035K1A	40XS275B050K1A	40XS275B060K1A
3.3	40XS335B030K1A	40XS335B035K1A	40XS335B050K1A	40XS335B060K1A
3.9	40XS395B030K1A	40XS395B035K1A	40XS395B050K1A	40XS395B060K1A
4.7	40XS475B030K1A	40XS475B035K1A	40XS475B050K1A	40XS475B060K1A
5.6	40XS565B030K1A	40XS565B035K1A	40XS565B050K1A●	40XS565B060K1A
6.8	40XS685B030K1A	40XS685B035K1A	40XS685B050K1A●	40XS685C060K1A
8.2	40XS825B030K1A	40XS825B035K1A●	40XS825C050K1A	40XS825C060K1A
10	40XS106B030K1A	40XS106B035K1A●	40XS106C050K1A	40XS106C060K1A
12	40XS126B030K1A	40XS126C035K1A	40XS126C050K1A	40XS126C060K1A
15	40XS156B030K1A	40XS156C035K1A	40XS156C050K1A	40XS156C060K1A
18	40XS186B030K1A	40XS186C035K1A	40XS186C050K1A	40XS186C060K1A
22	40XS226C030K1A	40XS226C035K1A	40XS226C050K1A●	40XS226C060K1A
27	40XS276C030K1A	40XS276C035K1A	40XS276C050K1A●	40XS276D060K1A
33	40XS336C030K1A	40XS336C035K1A●	40XS336D050K1A●	40XS336D060K1A
39	40XS396C030K1A	40XS396C035K1A●	40XS396D050K1A●	
47	40XS476C030K1A	40XS476C035K1A●		
56	40XS566C030K1A	40XS566D035K1A●		
68	40XS686C030K1A	40XS686D035K1A●		
82	40XS826D030K1A			
100	40XS107D030K1A			





DIMENSIONS — INCHES (mm)								
Case Size	Uninsulated D +.016 (0.41) −.015 (0.38)	Uninsulated L ±.031 (.079)	Insulated D +.016 (0.41) −.015 (0.38)	Insulated L ±.031	C Max.	d Lead Dia. d ±002 (0.05)	Lead Length l ±.25 (±6.40)	Approx. Weight Grams
A	0.125 (3.18)	0.250 (635)	0.135 (3.43)	0.286 (7.26)	.422 (10.72)	0.020 (0.51)	1.50	0.7
B	0.175 (4.45)	0.438 (11.12)	0.185 (4.70)	0.474 (12.04)	.610 (15.49)	0.020 (0.51)	1.50	1.6
C	0.279 (7.10)	0.650 (16.50)	0.289 (7.34)	0.686 (17.42)	.822 (20.88)	0.025 (0.64)	1.50	4.9
D	0.341 (8.65)	0.750 (19.05)	0.351 (8.92)	0.786 (19.96)	.922 (23.42)	0.025 (0.64)	1.50	8.8

SERIES 40XS

Industrial Type Tantalum Capacitors

DESIGN AND CONSTRUCTION

Each 40XS type capacitor consists of a highly purified sintered tantalum anode body, utilizing an electrolytically formed oxide dielectric and a solid electrolyte, soldered in a metal case with axial leads and hermetically sealed.

INSULATION — When specified, a MYLAR* sleeve will be placed over the metal can. The insulation will not soften or creep over the operating temperature range.

RADIAL CONFIGURATION — When radial lead configuration is desired, the negative lead can be bent down the side of the metal can.

LEADS — Lead material is Grade A nickel, tin lead plated to facilitate soldering. Other lead material available on request.

MARKING — Capacitors will be marked with M/C capacitance, voltage, and a + sign for polarity as a minimum. When space permits, capacitance tolerance and date code will be added.

DC WORKING VOLTAGE

40XS Series capacitors are available in 8 voltage ratings applicable from -55°C to 85°C without derating, and to 125°C with ⅔ linear derating, (see chart under para. 3).

SURGE VOLTAGE

The surge voltage is the maximum DC voltage, including peak AC or other pulses, which may be applied for short duration.

In no case shall the sum of AC voltage and applied DC working voltage exceed the working voltage of the capacitor. The surge voltages are as follows:

Rated WVDC up to 85°C	Derated 125°C	SURGE VOLTAGE 85°C	125°C
6	4	8	5
10	7	13	9
15	10	20	12
20	13	26	16
30	20	40	27
35	23	46	28
50	33	65	40
60	40	80	54

CAPACITANCE

Capacitance shall be measured on a polarized bridge, at or referred to 120 cps at 25°C. The maximum DC bias shall be 2.2 VDC for all A.C. measurements. The magnitude of the A.C. signal shall be limited to 1.0 VRMS.

The capacitance so determined shall be within specified initial capacitance tolerance.

TOLERANCE — The 40XS Series is available in ±20%, ±10% and ±5% capacitance tolerances.

DISSIPATION FACTOR

DF shall be measured on a polarized bridge, at or referred to 120 cps at 25°C. The maximum DC bias shall be 2.2 VDC for all AC measurements. The magnitude of the AC signal shall be limited to 1.0 VRMS.

The DF so determined shall not exceed:

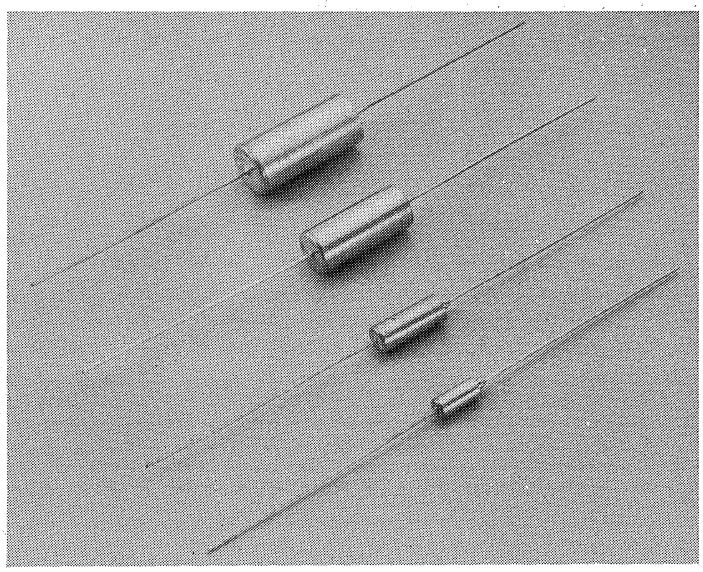
0.01 uf to 56 uf	6% DF maximum
68 uf to 120 uf	8% DF maximum
150 uf and Up	10% DF maximum

D.C. LEAKAGE CURRENT

DCL shall not exceed 0.02 uA/ufV, but need not be less than 1uA when determined with a 1000 ohm current limiting resistor in series with the test capacitor after a 5 minute application of rated voltage at 25°C. The DCL at 85° shall not exceed 10 times the 25°C limits. At 125°C the DCL shall not exceed 12 times the 25°C limits.

SERIES 40YS

Xtra-Capacitance Hermetically Sealed Solid Electrolyte Tantalum Capacitor



DESCRIPTION

The M/C Inc. 40YS Series is a solid electrolyte sintered tantalum anode capacitor body, soldered into a tubular metal can and hermetically sealed with a glass-to-metal seal.

Available in four standard sizes, insulated and uninsulated, the 40YS Series is manufactured utilizing the highly automated processing and assembly techniques which M/C has developed for producing established reliability devices.

The 40YS Series is especially adapted for applications involving coupling, filtering, and timing in those computer, industrial, and commerical circuits requiring capacitors with more capacitance than available in standard devices.

FEATURES

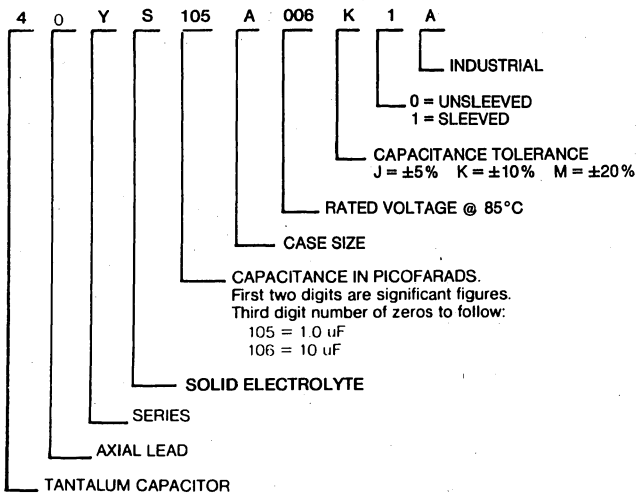
- **–55° TO 125°C OPERATION**
- **6 THRU 60 VOLTS**
- **1.0 uf THRU 1000 uf**
- **FOUR STANDARD SIZES**
- **COUPLING**
- **FILTERING LOW IMPEDANCE**
- **TIMING**

M/C STANDARD RATINGS

CAPACITANCE +25°C 120 Hz	6 WVDC ±10% INSULATED 4V @ 125°C	10 WVDC ±10% INSULATED 7V @ 125°C	15 WVDC ±10% INSULATED 10V @ 125°C	20 WVDC ±10% INSULATED 13V @ 125°C
1.0	40YS105A006K1A	40YS105A010K1A	40YS105A015K1A	40YS105A020K1A
1.2	40YS125A006K1A	40YS125A010K1A	40YS125A015K1A	40YS125A020K1A
1.5	40YS155A006K1A	40YS155A010K1A	40YS155A015K1A	40YS155A020K1A
1.8	40YS185A006K1A	40YS185A010K1A	40YS185A015K1A	40YS185A020K1A
2.2	40YS225A006K1A	40YS225A010K1A	40YS225A015K1A	40YS225A020K1A
2.7	40YS275A006K1A	40YS275A010K1A	40YS275A015K1A	40YS275A020K1A•
3.3	40YS335A006K1A	40YS335A010K1A	40YS335A015K1A	40YS335A020K1A•
3.9	40YS395A006K1A	40YS395A010K1A	40YS395A015K1A	40YS395A020K1A•
4.7	40YS475A006K1A	40YS475A010K1A	40YS475A015K1A•	40YS475B020K1A
5.6	40YS565A006K1A	40YS565A010K1A	40YS565A015K1A•	40YS565B020K1A
6.8	40YS685A006K1A	40YS685A010K1A•	40YS685B015K1A	40YS685B020K1A
8.2	40YS825A006K1A	40YS825A010K1A•	40YS825B015K1A	40YS825B020K1A
10	40YS106A006K1A•	40YS106B010K1A	40YS106B015K1A	40YS106B020K1A
12	40YS126A006K1A•	40YS125B010K1A	40YS126B015K1A	40YS126B020K1A
15	40YS156B006K1A	40YS156B010K1A	40YS156B015K1A	40YS156B020K1A
18	40YS186B006K1A	40YS186B010K1A	40YS186B015K1A	40YS186B020K1A•
22	40YS226B006K1A	40YS226B010K1A	40YS226B015K1A	40YS226B020K1A•
27	40YS276B006K1A	40YS276B010K1A	40YS276B015K1A	40YS276B020K1A•
33	40YS336B006K1A	40YS336B010K1A	40YS336B015K1A	40YS336C020K1A
39	40YS396B006K1A	40YS396B010K1A	40YS396B015K1A•	40YS396C020K1A
47	40YS576B006K1A	40YS476B010K1A•	40YS476C015K1A	40YS476C020K1A
56	40YS566B006K1A	40YS566B010K1A•	40YS566C015K1A	40YS566C020K1A•
68	40YS686B006K1A	40YS686B010K1A•	40YS686C015K1A	40YS686C020K1A•
82	40YS826B006K1A	40YS826B010K1A•	40YS826C015K1A	40YS826C020K1A•
100	40YS107B006K1A•	40YS107C010K1A	40YS107C015K1A	40YS107C020K1A•
120	40YS127C006K1A	40YS127C010K1A	40YS127C015K1A	40YS127C020K1A•
150	40YS157C006K1A	40YS157C010K1A•	40YS157C015K1A•	40YS157D020K1A•
180	40YS187C006K1A	40YS187C010K1A	40YS187C015K1A•	40YS187D020K1A•
220	40YS227C006K1A	40YS227C010K1A•	40YS227D015K1A•	
270	40YS277C006K1A	40YS277C010K1A•	40YS277D015K1A•	
330	40YS337C006K1A•	40YS337D010K1A	40YS337D015K1A•	
390	40YS397C006K1A•	40YS397D010K1A•		
470	40YS477C006K1A•	40YS477D010K1A•		
560	40YS567D006K1A	40YS567D010K1A•		
680	40YS687D006K1A•			
820	40YS827D006K1A•			
1000	40YS108D006K1A•			

PART NUMBER SYSTEM

EXAMPLE

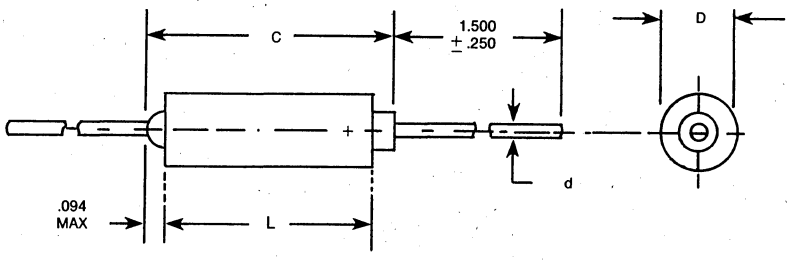


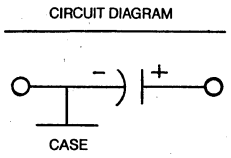
SERIES 40YS

Industrial Type Tantalum Capacitors

M/C STANDARD RATINGS

CAPACITANCE +25°C 120 Hz	30 WVDC ±10% INSULATED 20V @ 125°C	35 WVDC ±10% INSULATED 23V @ 125°C	50 WVDC ±10% INSULATED 33V @ 125°C	60 WVDC ±10% INSULATED 40V @ 125°C
1.0	40YS105A030K1A	40YS105A035K1A	40YS105A050K1A	40YS105A060K1A
1.2	40YS125A030K1A	40YS125A035K1A	40YS125A050K1A•	40YS125B060K1A
1.5	40YS155A030K1A	40YS155A035K1A	40YS155A050K1A•	40YS155B060K1A
1.8	40YS185A030K1A	40YS185A035K1A•	40YS185B050K1A	40YS185B060K1A
2.2	40YS225A030K1A	40YS225B035K1A	40YS225B050K1A	40YS225B060K1A
2.7	40YS275A030K1A	40YS275B035K1A	40YS275B050K1A	40YS275B060K1A
3.3	40YS335B030K1A	40YS335B035K1A	40YS335B050K1A	40YS335B060K1A
3.9	40YS395B030K1A	40YS395B035K1A	40YS395B050K1A	40YS395B060K1A
4.7	40YS475B030K1A	40YS475B035K1A	40YS475B050K1A	40YS475B060K1A
5.6	40YS565B030K1A	40YS565B035K1A	40YS565B050K1A•	40YS565B060K1A
6.8	40YS685B030K1A	40YS685B035K1A	40YS685B050K1A•	40YS685C060K1A
8.2	40YS825B030K1A	40YS825B035K1A•	40YS825C050K1A	40YS825C060K1A
10	40YS106B030K1A	40YS106B035K1A•	40YS106C050K1A	40YS106C060K1A
12	40YS126B030K1A	40YS126C035K1A	40YS126C050K1A	40YS126C060K1A
15	40YS156B030K1A	40YS156C035K1A	40YS156C050K1A	40YS156C060K1A
18	40YS186B030K1A	40YS186C035K1A	40YS186C050K1A	40YS186C060K1A
22	40YS226C030K1A	40YS226C035K1A	40YS226C050K1A•	40YS226C060K1A
27	40YS276C030K1A	40YS276C035K1A	40YS276C050K1A•	40YS276D060K1A
33	40YS336C030K1A	40YS336C035K1A•	40YS336D050K1A•	40YS336D060K1A
39	40YS396C030K1A	40YS396C035K1A•	40YS396D050K1A•	
47	40YS476C030K1A	40YS476C035K1A•		
56	40YS566C030K1A	40YS566D035K1A•		
68	40YS686C030K1A	40YS686D035K1A•		
82	40YS826D030K1A			
100	40YS107D030K1A			





DIMENSIONS — INCHES (mm)								
Case Size	Uninsulated		Insulated		C Max.	d Lead Dia. d ±002 (0.05)	Lead Length l ±.25 (±6.40)	Approx. Weight Grams
	D +.016 (0.41) −.015 (0.38)	L ±.031 (.079)	D +.016 (0.41) −.015 (0.38)	L ±.031				
A	0.125 (3.18)	0.250 (635)	0.135 (3.43)	0.286 (7.26)	.422 (10.72)	0.020 (0.51)	1.50	0.7
B	0.175 (4.45)	0.438 (11.12)	0.185 (4.70)	0.474 (12.04)	.610 (15.49)	0.020 (0.51)	1.50	1.6
C	0.279 (7.10)	0.650 (16.50)	0.289 (7.34)	0.686 (17.42)	.822 (20.88)	0.025 (0.64)	1.50	4.9
D	0.341 (8.65)	0.750 (19.05)	0.351 (8.92)	0.786 (19.96)	.922 (23.42)	0.025 (0.64)	1.50	8.8

SERIES 40YS

Industrial Type Tantalum Capacitors

1. DESIGN AND CONSTRUCTION

Each 40YS type capacitor consists of a highly purified sintered tantalum anode body, utilizing an electrolytically formed oxide dielectric and a solid electrolyte, soldered in a metal case with axial leads and hermetically sealed.

INSULATION – When specified, a MYLAR sleeve will be placed over the metal can. The insulation will not soften or creep over the operating temperature range.

RADIAL CONFIGURATION – When radial lead configuration is desired, the negative lead can be bent down the side of the metal can.

LEADS – Lead material is Grade A nickel, tin lead plated to facilitate soldering. Other lead material available on request.

MARKING – Capacitors will be marked with M/C capacitance, voltage, and a + sign for polarity as a minimum. When space permits, capacitance tolerance and date code will be added.

2. DC WORKING VOLTAGE

40YS Series capacitors are available in 8 voltage ratings applicable from −55°C to 85°C without derating, and to 125°C with ⅔ linear derating, (see chart under para. 3).

3. SURGE VOLTAGE

The surge voltage is the maximum DC voltage, including peak AC or other pulses, which may be applied for short duration.

In no case shall the sum of AC voltage and applied DC working voltage exceed the working voltage of the capacitor. The surge voltages are as follows:

Rated WVDC up to 85°C	Derated 125°C	SURGE VOLTAGE 85°C	125°C
6	4	8	5
10	7	13	9
15	10	20	12
20	13	26	16
30	20	40	27
35	23	46	28
50	33	65	40
60	40	80	54

4. CAPACITANCE

Capacitance shall be measured on a polarized bridge, at or referred to 120 cps at 25°C. The maximum DC bias shall be 2.2 VDC for all A.C. measurements. The magnitude of the A.C. signal shall be limited to 1.0 VRMS.

The capacitance so determined shall be within specified initial ±5% capacitance tolerances.

TOLERANCE – The 40YS Series is available in ±20%, ±10% and ±5% capacitance tolerances.

5. DISSIPATION FACTOR

DF shall be measured on a polarized bridge, at or referred to 120 cps at 25°C. The maximum DC bias shall be 2.2 VDC for all AC measurements. The magnitude of the AC signal shall be limited to 1.0 VRMS.

The DF so determined shall not exceed:

0.01 uf to 56 uf	6% DF maximum
68 uf to 120 uf	8% DF maximum
150 uf and Up	10% DF maximum

6. D.C. LEAKAGE CURRENT

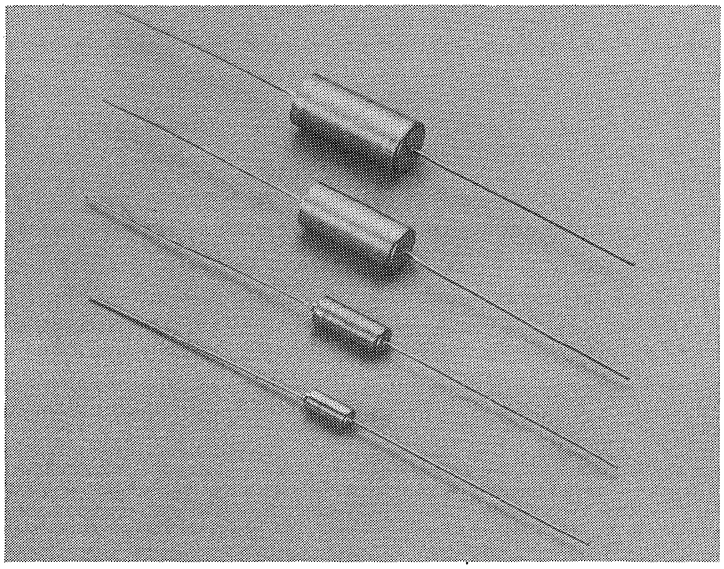
DCL shall not exceed .02 uA/ufV, but need not be less than 1uA when determined with a 1000 ohm current limiting resistor in series with the test capacitor after a 5 minute application of rated voltage at 25°C. The DCL at 85° shall not exceed 10 times the 25°C limits. At 125°C the DCL shall not exceed 12 times the 25°C limits.

7. SURGE CURRENT

Test as specified in MIL-C-39003/6.

SERIES 40ZS

High Frequency Solid Tantalum Capacitor



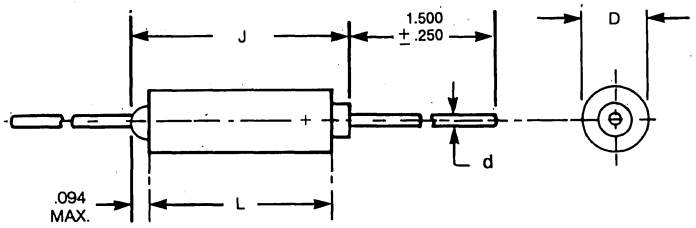
DESCRIPTION

Mepco/Centralab type 40ZS capacitor is a fixed solid electrolyte tantalum type with hermetic seal. This construction provides an inherently long life and very stable electric characteristics in a temperature range of −55 through +125°C. This capacitor provides low impedence to ripple current at frequencies above 1KHz through 100KHz. At these frequencies, the 40ZS also provides lower equivalent series resistance (ESR) than conventional type solid tantalum capacitors. Lower ESR means lower power loss which results in cost, space and weight savings.

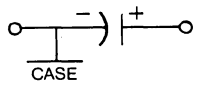
FEATURES

- High Ripple Current
- Low ESR
- Low Impedence at High Frequency
- Small Size
- Extremely Stable Capacitance
- Hermetic Seal
- Long Life
- CSR 21 Style

OUTLINE DRAWING AND DIMENSIONS



CIRCUIT DIAGRAM



DIMENSIONS—INCHES (mm)								
	Uninsulated		Insulated					
Case Size	D +.016 (0.41) −.015 (0.38)	L±.031 (.079)	D+.016 (0.41) −.015 (0.38)	L±.031	J Max.	d Lead Dia. d±002 (0.05)	Lead Length l±.25 (±6.40)	Approx. Weight Grams
C	0.279 (7.10)	0.650 (16.50)	0.289 (7.34)	0.686 (17.42)	.822 (20.88)	0.025 (0.64)	1.50	4.9
D	0.341 (8.65)	0.750 (19.05)	0.351 (8.92)	0.786 (19.96)	.922 (23.42)	0.025 (0.64)	1.50	8.8

NOTES:
1. The case insulation shall extend .015" (0.38mm) minimum beyond each end. However, when a shrink-fitted insulation is used, it shall lap over the ends of the capacitor body.
2. Lead length may be a minimum of 1-inch long for use in tape and reel automatic insertion equipment, when specified.
3. Insulation thickness is included in dimension D.

M/C STANDARD RATINGS

CAPACITANCE −55°C +125°C	6WVDC ±.10% INSULATED	10 WVDC ±.10% INSULATED	15 WVDC ±.10% INSULATED	20WVDC ±.10% INSULATED	35 WVDC ±.10% INSULATED	50 WVDC ±.10% INSULATED
5.6				—	—	40ZS565C050K1A
6.8				—	—	40ZS685C050K1A
8.2				—	—	40ZS825C050K1A
10				—	—	40ZS106C050K1A
12				—	—	40ZS126C050K1A
15				—	—	40ZS156C050K1A
18				—	—	40ZS186C050K1A
22				—	40ZS226C035K1A	40ZS226D050K1A
27				40ZS276C020K1A	40ZS276D035K1A	
33				40ZS336C020K1A	40ZS336D035K1A	
39				40ZS396C020K1A	40ZS396D035K1A	
47				40ZS476C020K1A	40ZS476D035K1A	
56	—	—	40ZS566C015K1A	40ZS566D020K1A		
68	—	—	40ZS686C015K1A	40ZS686D020K1A		
82	—	40ZS826C010K1A	—	40ZS826D020K1A		
100	—	40ZS107C010K1A	—	40ZS107D020K1A		
120	—	40ZS127C010K1A	40ZS127D015K1A			
150	40ZS157C006K1A	—	40ZS157D015K1A			
180	40ZS187C006K1A	40ZS187D010K1A	—			
220	—	40ZS227D010K1A	—			
270	40ZS277D006K1A	—	—			
330	40ZS337D006K1A	—	—			

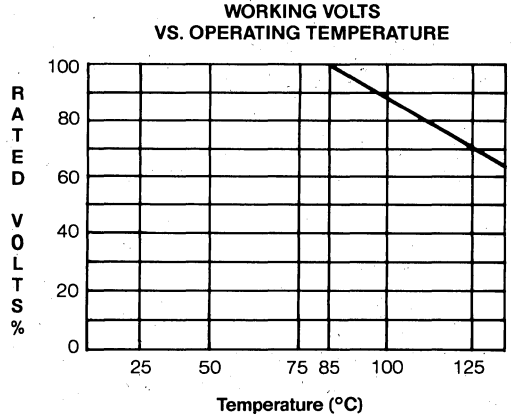
SERIES 40ZS

Industrial Type Tantalum Capacitors

ELECTRICAL DATA

1. DC Working Voltage

Mepco/Centralab's type 40ZS is designed to operate reliably at voltages from −55°C to 125°C. This capacitor is offered in six different voltages: six through fifty volts.



2. Surge Voltage and Voltage Derating

Surge voltage is the maximum amount of voltage which may be applied to the capacitor. 85°C and 125°C surge voltages and voltage derating with temperature are shown below.

Working Voltage WVDC 85°C	Derated VDC 125°C	Surge VDC	
		85°C	125°C
6	4	8	5
10	7	13	9
15	10	20	12
20	13	26	16
35	23	46	28
50	33	65	40

3. Capacitance-Effective Series

The 40ZS capacitors are measured on a polarized capacitance bridge. The capacitance is measured at 25°C and at 1 KHz. No more than two volts A.C. shall be applied and accuracy of the bridge will be within 2%.

4. Capacitance Tolerance

The 40ZS is available in 20%(M), 10%(K), 5%(J).

5. DC Leakage Current

DC leakage measurements will be taken after a five minute period of electrification, with rated DC voltage applied.

The voltage will be applied with a 1000 Ohm, ± 50 Ohm, resistor connected in series with the capacitor.

The Maximum allowable DC leakage limit at 85°C will be 10 times the maximum specified 25°C DC leakage limit.

6. Capacitance Change with Temperature

The maximum change is:

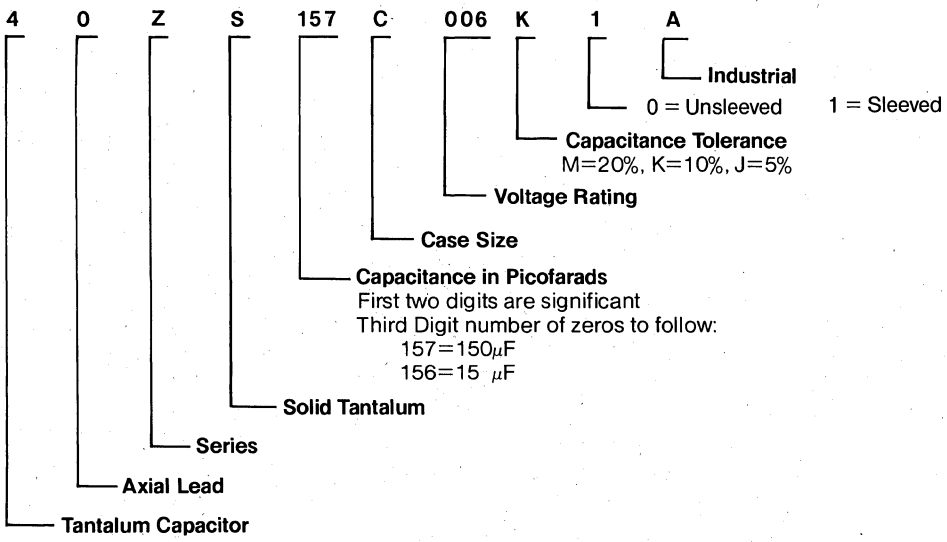
Temperature °C	Maximum Change In Capacitance
−55	−10
+85	+8
+125	+12

7. Moisture Resistance

The Mepco/Centralab series capacitors will meet the moisture resistance requirements of MIL-STD 202D, method 106. Within 6 hours of the completion of the test, the capacitance will not change more than +5% from the initial value. The DF will not exceed the requirements.

HOW TO SPECIFY

PART NUMBER SYSTEM
EXAMPLE



WET TANTALUM CAPACITORS

STYLES: CL64, CL65 (40LW) CLR65 (40SW)

Use: These capacitors are limited to low voltage applications. Their primary use is in low voltage power supply filtering circuits. Their low leakage current (lowest of all the tantalum types) is not appreciable below +85°C and, at ordinary operating temperatures, is comparable to good quality paper capacitors, yet they are much smaller in size. Style CLR65 capacitors are for dc applications only - no reverse voltage can be tolerated. (The most common failure mode, electrolyte leakage due to seal failure, is primarily due to the application of reverse voltage.)

Construction: These capacitors consist of a sintered-slug, acting as the anode, which is electrochemically treated to form a layer of tantalum oxide dielectric.

Physical size comparison:

With paper capacitors. These capacitors may utilize only 15 percent of the area normally required by a paper capacitor of the same capacitance value.

With aluminum electrolytic capacitors. The larger the dielectric constant the larger the capacitance which can be realized in a given space, thus a size advantage can be realized since the dielectric constant of tantalum oxide film is approximately 24 as compared to 8 for an aluminum oxide. Because of differences in foil and paper-thickness requirements, the actual size ratio will vary with different capacitances and voltage ratings and may be much more than 2:1 in favor of the tantalum capacitor.

Voltage ratings: The maximum dc rated voltages for these styles range from 6V to 125V.

Operating temperature range (with full rated voltage applied). These capacitors are suitable for operation over a temperature range of -55°C to +85°C without derating. These capacitors may be operated up to +125°C when properly derated, see figure -1.

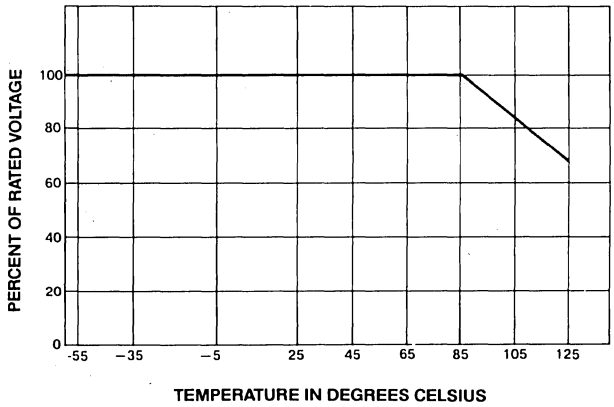


FIGURE -1. Voltage derating with temperature.

Series and parallel applications.

Series operation. Whenever tantalum capacitors are connected in series for higher voltage operation, a resistor should be paralleled across each unit. Unless a shunt resistor is used, the dc rated voltage can easily be exceeded on the capacitor in the series network with the lowest dc leakage current. To prevent capacitor destruction, a resistance value not exceeding a certain maximum should be used; this value will depend on capacitance, average dc leakage, and capacitor construction. For example: For style CLR65, size T1 units will require a maximum resistance, in megohms, equal to 3.4 divided by the square root of the capacitance (in μF); size T2, $5.2/\sqrt{C}$; size T3, $6.5/\sqrt{C}$; and size T4, $7.5/\sqrt{C}$.

Parallel operation. To obtain a higher capacitance than can be obtained from a single capacitor, a number of units may be connected in parallel. However, the sum of the peak ripple and the applied dc voltage should not exceed the dc rated voltage. The connecting leads of the parallel network should be large enough to carry the combined currents without reducing the effective capacitance due to series lead resistance.

ADDITIONAL APPLICATION INFORMATION

WET TANTALUM CAPACITORS

Stability and life. Tantalum electrolytic capacitors have excellent life and shelf life characteristics. Life, at higher temperatures than with aluminum electrolytics, will show a comparatively lower decrease in capacitance. With rated voltage applied, more than 10,000 hours of life can be expected at +85°C. All styles may be expected to operate at least 2,000 hours at+85°C with less than 10 percent loss of capacitance.

Because the more stable tantalum oxide film is less subject to dissolving the surrounding electrolyte than the film in an aluminum capacitor, the shelf life of the tantalum unit is much longer, and less re-forming is required. After storage for long periods, the re-forming current is low and the time is comparatively short; it may be expected to take less than 10 minutes. These properties are affected by the storage temperature to a significant degree, being excellent at temperatures from −55°C to +25°C; good at +65°C; and relatively poor at +85°C.

NOTE: The predominant mode of failure of the wet electrolytic tantalum capacitors will most probably be a "hidden" failure mode of high or erratic leakage current which could result in a catastrophic short-circuit. This is a result of electrolyte migration past the inner seal and touching the cathodic case or ground.

Reverse Voltage. Wet slug capacitors are not suitable for applications involving any voltage reversal. They cannot be operated on unbiased ac voltage or applied in nonpolar applications involving back-to-back connections. Any ac ripple applied to wet slug capacitors must be superimposed on sufficient dc bias voltage to prevent voltage reversal. Ripple current is limited to small values because progressive degradation of the unit will result if the cathode (silver case) becomes positive during the discharge cycle.

Max. Ripple Voltage/Current. Figure 2 indicates the maximum allowable rms voltage or current for sintered-slug type capacitors at +25°C and 60 Hz.

To determine ac capability at some other frequency, multiply the voltage or current values obtained from figure 2 by a correction value from figure 3.

To determine ac capability at some other temperature, multiply the voltage or current value from figure 2 or 3, if applicable, by a correction value from figure 4.

Complex wave-shapes. When complex ripple wave-shapes are involved, they should be measured on an oscilloscope or by some other method which will give the peak rating. These capacitors should be limited to operation at ripple frequencies between 60 and 10,000 Hz (above 10,000 Hz, effective capacitance rapidly drops off). At frequencies of only a few hundred kHz, these tantalum units act as practically pure resistance.

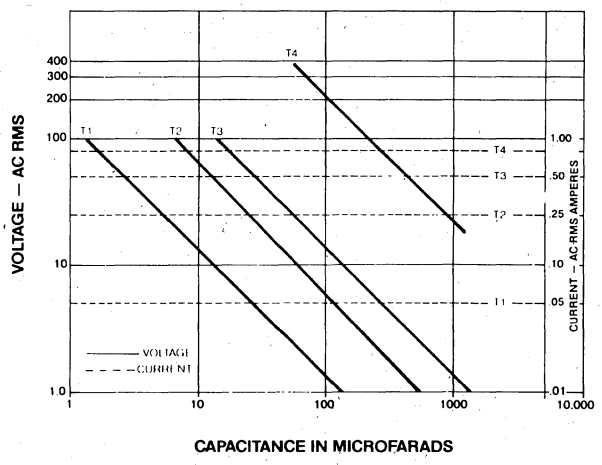


FIGURE 2. Maximum allowable ripple voltage/current vs capacitance

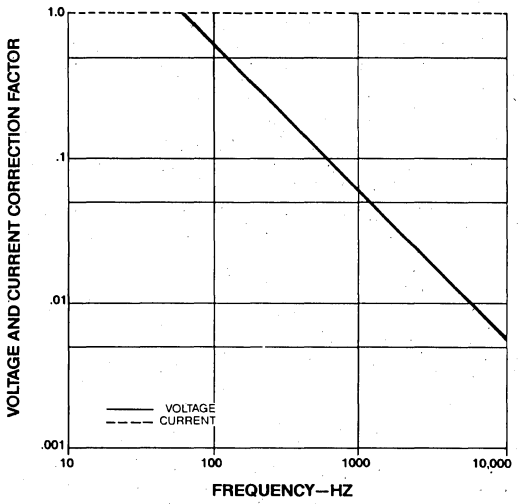


FIGURE 3. Correction factor for maximum allowable ripple voltage/current vs frequency.

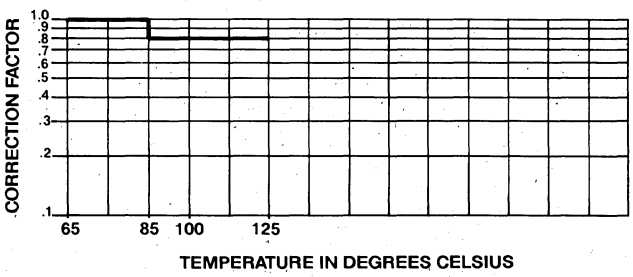


FIGURE 4. Correction factor for maximum allowable ripple voltage vs temperature

ADDITIONAL APPLICATION INFORMATION

WET TANTALUM CAPACITORS

STYLE CLR 79 (40AW)

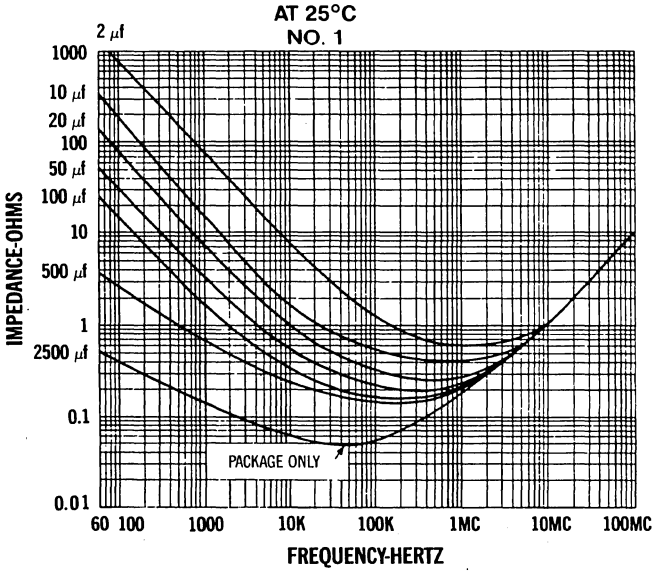
TYPICAL CURVES

Impedance

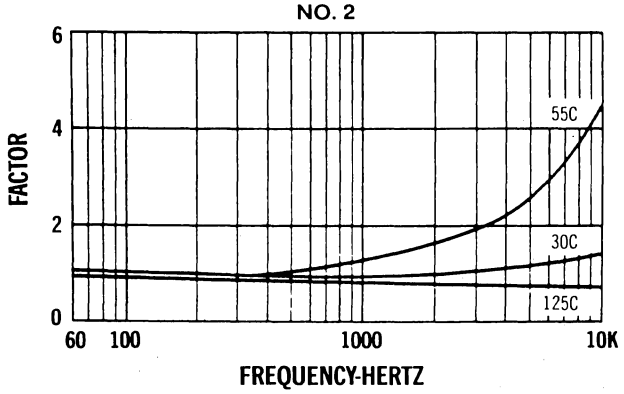
A. Impedance in ohms at 25°C may be read directly from Curve 1.

B. To obtain impedance at temperatures other than 25°C, multiply the impedance from Curve 1 by a correction factor from Curve 2, 3 or 4.

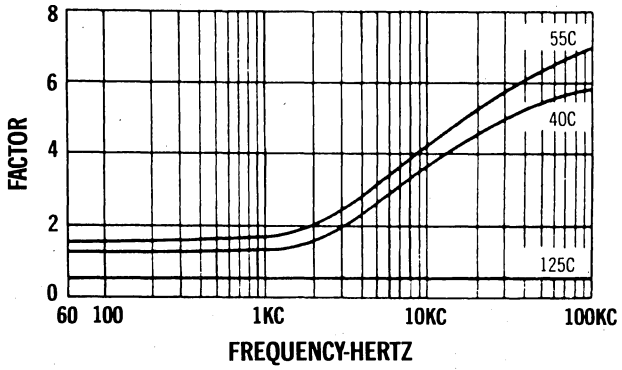
IMPEDANCE FOR TANTALUM WET SLUGS
AT 25°C
NO. 1



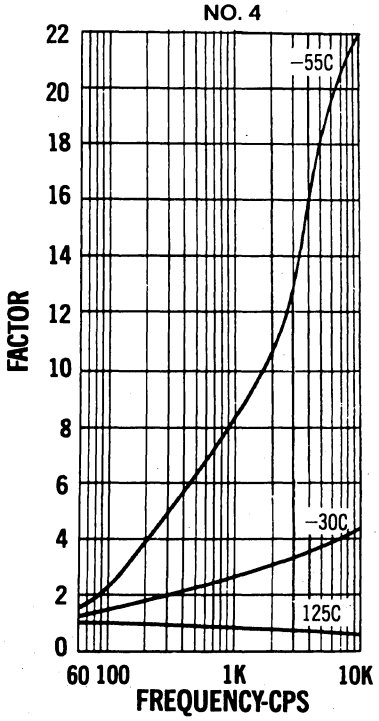
WET SLUG IMPEDANCE CORRECTION FACTORS
UP TO 5 μf
NO. 2



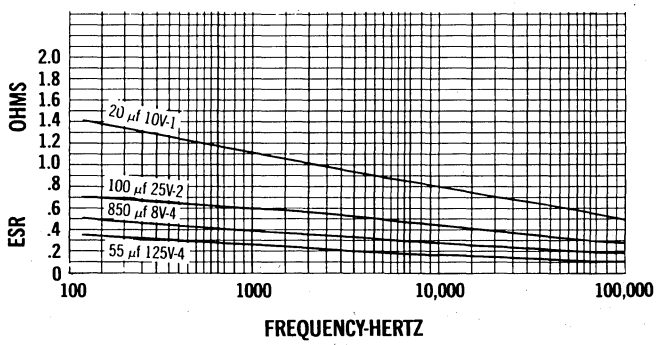
WET SLUG IMPEDANCE CORRECTION FACTORS
FOR CAPACITANCE 5-100 μf
NO. 3



WET SLUG IMPEDANCE CORRECTION FACTORS
FOR CAPACITANCE 100 μf
AND ABOVE INCLUDING PACKAGES
NO. 4



TYPICAL ESR VS. FREQUENCY AT 25°C



ADDITIONAL APPLICATION INFORMATION

TANTALUM FOIL CAPACITORS

CAPACITANCE CHANGE WITH TEMPERATURE

The values for capacitance change with temperature indicated below are specification limits and represent maximum values. The majority of units will exhibit considerably less capacitance change over the indicated temperature range.

Temperature	Tubular					Packaged	
	Foil Type	85°C		125°C		Voltage Ratings	Percent
		Voltage Ratings	Percent	Voltage Ratings	Percent		
Standard Tol 25°C, 120 Hz	Plain	3-150 200-450	±20 ±15	10-150 200-300	±20 ±15	All	±20
	Etched & High Etched	6-49 50-99 100-150	−15 +75 −15 +50 −15 +30	10-29 30-64 65-100	−15 +75 −15 +50 −15 +30	10-35 50 75-100	−15 +15 −15 +50 −15 +30
Temperature	**Foil Type**	**Voltage Ratings**	**Percent Change from 25C Cap.**	**Voltage Ratings**	**Percent Change from 25C Cap.**	**Voltage Ratings**	**Percent Change from 25C Cap.**
−55°C, 120 Hz Max.	Plain	3-14 15-375 450	−30 −20 −40	10-250 300	−25 −40	10-100	−35
	Etched	Under 15 15-49 50-150	−45 −40 −35	Polar 10-64 65-100 Nonpolar 10-100	−40 −35 −40	120 21-100	−50 −45
	High Etched	6-150	−40	10-100	−40		
+85°C, 120 Hz Max.	Plain	3-14 15-150 200-450	+20 +15 +10				
	Etched	Under 15 15-150	+50 +20				
	High Etched	6-150	+50				
+125°C, 120 Hz Max.	Plain			10-39 40-300	+25 +25		+25
	Etched			Polar 10-64 65-100 Nonpolar 10-64 65-100	+50 +30 +45 +30	10-100	+75
	High Etched	10-100	+75				

DISSIPATION FACTOR LIMITS

These dissipation factor limits are maximum values. Typical capacitors will exhibit lower DF.

Tubular								Packaged KSR™			
85°C				125°C				125°C			
Foil Type	**Voltage Range**	**Max. 120 Hz Dissipation Factor 25°C**	**Max. 120 Hz Dissipation Factor 85°C**	**Foil Type**	**Voltage Range**	**Max. 120 Hz Dissipation Factor 25°C**	**Max. 120 Hz Dissipation Factor 125°C**	**Foil Type**	**Voltge Range**	**Max. 120 Hz Dissipation Factor 25°C**	**Max.120 Hz Dissipation Factor 125°C**
Polar Plain	3-14 15-150	15% 10	20% 15	Plain	10-30 50-150 200 250-300	10% 10 6 10	25% 15 8 12	Plain	10-100	10%	25%
Plain	200-300 375-450	6 8	8 12					Etched	Up to 14 15-69 70-100	30 20 15	50 50 50
Nonpolar Plain	3-14 15-150	15 10	25 15	Polar Etched	10-15 30 50-100	20 15 15	30 30 20				
Etched	Up to 14 15-49 50-150	30 15 10	45 20 15	Non-polar Etched	10-15 30 50-100	20 15 15	40 40 30				
High Etched	15-30 50-150	20 15	55 45	High Etched	10-20 30 50-100	20 15 15	55 55 40				

ADDITIONAL APPLICATION INFORMATION

TANTALUM FOIL CAPACITORS

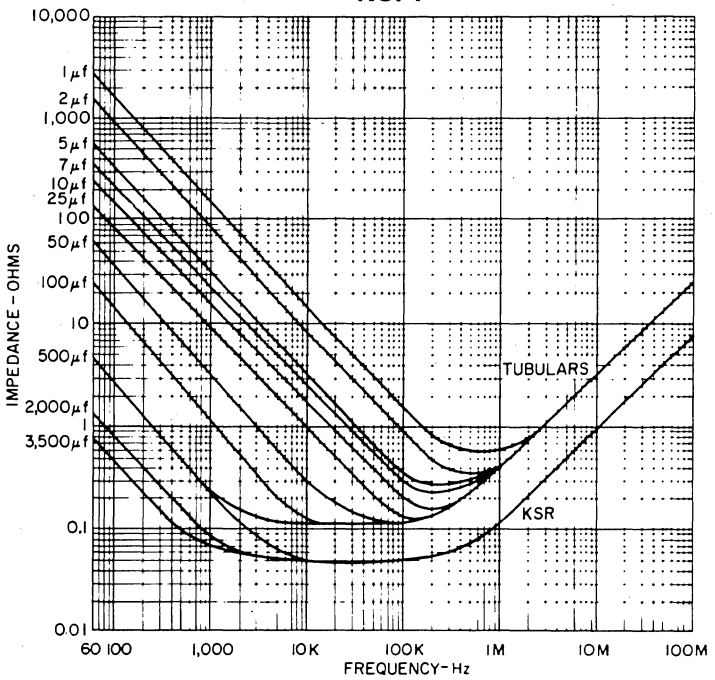
TYPICAL CURVES

Impedance

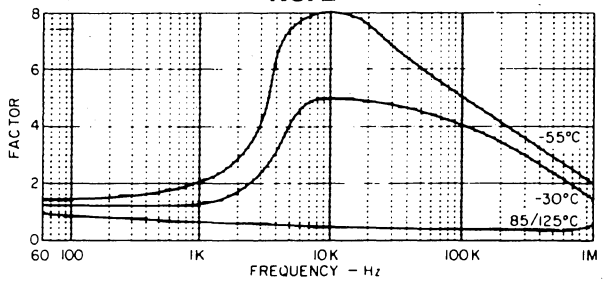
A. Impedance in ohms at 25°C may be read directly from Curve 1.

B. To obtain impedance at temperatures other than 25°C, multiply the impedance from Curve 1 by a correction factor from Curve 2, 3, or 4.

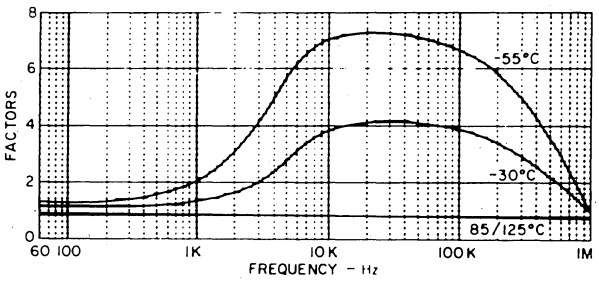
IMPEDANCE CURVES FOR TANTALUM FOIL AT 25°C NO. 1



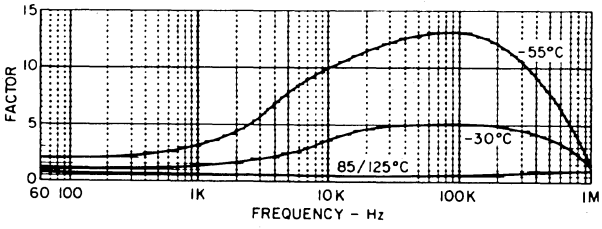
TANTALUM FOIL IMPEDANCE CORRECTON FACTORS FOR CAPACITANCE UP TO 2 μf NO. 2



TANTALUM FOIL IMPEDANCE CORRECTION FACTORS FOR CAPACITANCE 2-50μf NO. 3



TANTALUM FOIL IMPEDANCE CORRECTION FACTORS FOR CAPACITANCE 50μf AND OVER NO. 4



ADDITIONAL APPLICATION INFORMATION

TANTALUM FOIL CAPACITORS

TYPICAL CURVES (Cont'd)
Equivalent Series Resistance (ESR)

EQUIVALENT SERIES RESISTANCE

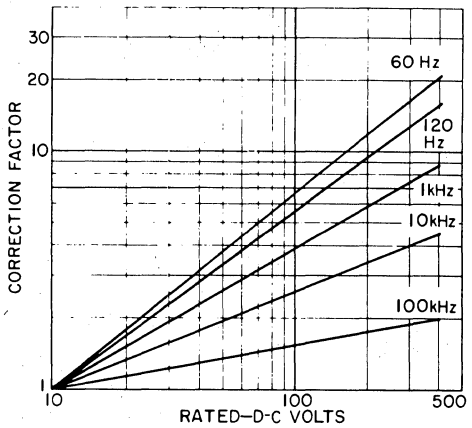
Equivalent Series Resistance (ESR) is the term given to the net resistive component comprising series connections of metallic elements, electrolyte, losses occurring in the dielectric, and leakage currents. This resistance is the limiting factor in obtaining low impedance, and is the "bottom" in the impedance-versus-frequency curves. Furthermore, ESR is the limiting factor in applying ripple current due to the heat generated Watts=I^2R, and is often used to calculate estimated case-temperature rises.

A. ESR in ohms for the smallest case size at 10 volts may be read directly from Curve 5.

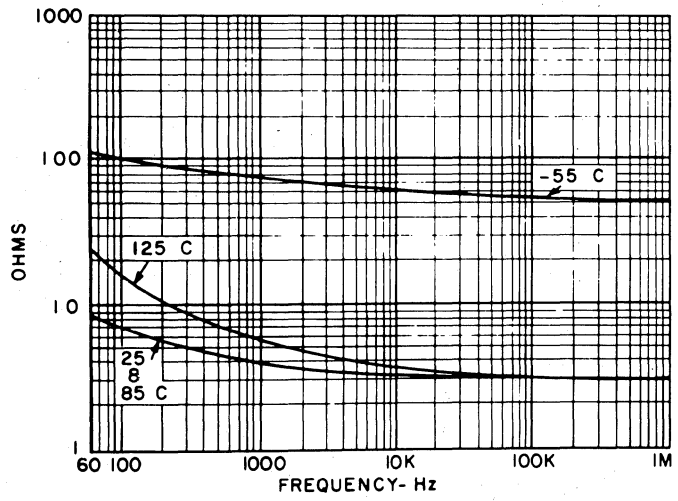
B. To obtain ESR for other voltage ratings, multiply the value from step A by a correction factor from Curve 6.

C. To obtain ESR for other case sizes, multiply the value from step A or B by a correction factor from Table 7.

TANTALUM FOIL ESR CORRECTION FACTORS NO. 6



BASIC ESR FOR TANTALUM-FOIL A CASE, 10 VOLTS NO. 5



7. TANTALUM-FOIL ESR CORRECTION TABLE

Case Size	Correction Factor
A	1.0
B	0.255
C	0.0875
D	0.0386
E	0.0275
KSR™–A	0.0124
KSR™–B	0.010
KSR™–C	0.009

TANTALUM FOIL CAPACITORS

TYPICAL CURVES (Cont'd)

A-c Ripple Voltage and Current

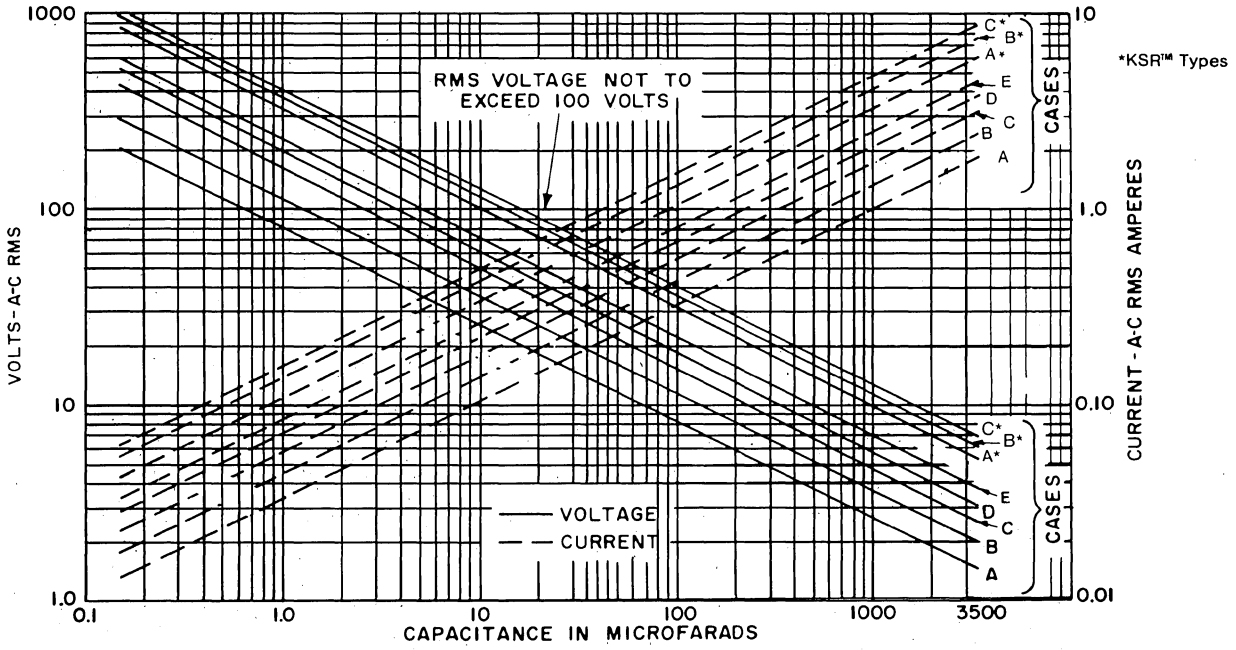
Tantalum-foil capacitors are the only electrolytic capacitors capable of operating continuously on unbiased a-c voltages. The a-c ripple capability curves in Figure 8 are applicable for unbiased a-c voltages on nonpolar units, and biased a-c ripple voltages on polar units. Peak a-c voltages up to 150 volts are permissible provided that the d-c voltage rating is not exceeded. The only limitation is the I^2R heating effect. Due to higher ESR, etched-foil capacitors have only half the a-c capability of plain-foil capacitors.

A. Permissible rms voltage or current for plain-foil capacitors at 25°C and 60 Hz may be read directly from Curve 8. For etched-foil capacitors, use one-half this value.

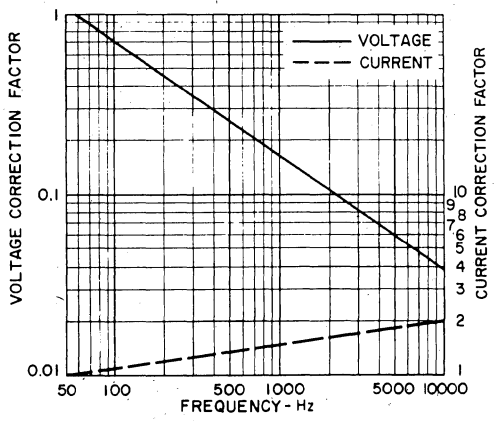
B. To determine a-c capability at some other frequency, multiply the current or voltage-value obtained in step A by a correction factor from Curve 9.

C. To determine a-c capability at some other temperature, multiply the voltage or current value from step A or B by a correction factor from Curve 10.

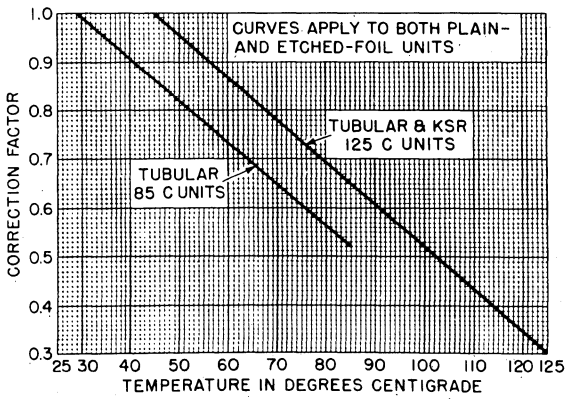
A-C RIPPLE CAPABILITY FOR TANTALUM-FOIL TUBULAR AND PACKAGED KSR™ (PLAIN FOIL) AT 60 Hz 26°C
NO. 8



TUBULAR AND PACKAGED KSR™ TANTALUM-FOIL A-C RIPPLE CORRECTION FACTORS
NO. 9



TUBULAR AND PACKAGED KSR™ TANTALUM FOIL A-C RIPPLE CORRECTION FACTORS
NO. 10



ADDITIONAL APPLICATION INFORMATION

TANTALUM FOIL CAPACITORS

PERFORMANCE AND APPLICATION DATA

Estimated Life and Reliability

To estimate the reliability of a capacitor in a given application, a constant failure rate over the operating or normal wearout period is assumed. This period varies widely with operating conditions and type of product, but in no case becomes less than 4000 hours at maximum conditions.

Fig. 11 shows life vs. temperature for Elastomer and Hermetic Sealed foil capacitors covered by this application. It is important to keep in mind when using this chart that life has no bearing on reliability. The Hermetically sealed unit is designed for longest life at 125°C. Elastomer sealed units, without glass-to-tantalum hermetic seals, begin to degrade at 4000 hours at 125°C.

Temperature also has a pronounced affect on the reliability of foil tantalum capacitors. See Fig. 12.

Voltage derating has very little affect on the reliability of foil tantalum capacitors, therefore derating information is not provided.

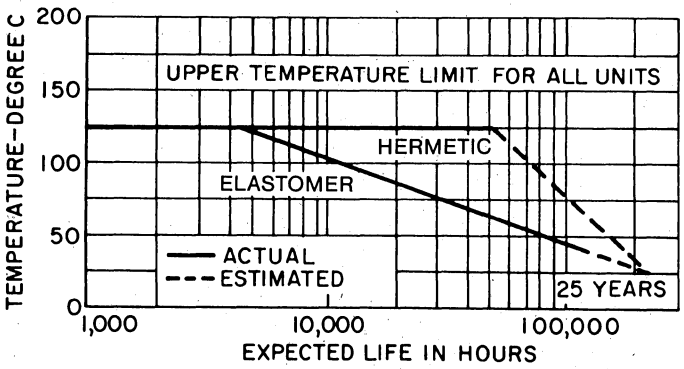


Fig. 11. Effect of temperature on life for Elastomer and Hermetic units.

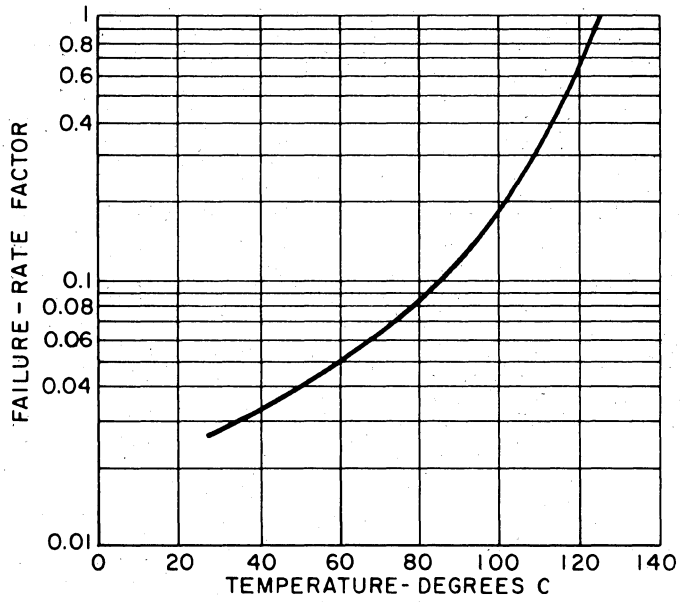


Fig. 12. Reliability vs. temperature.

FEATURES

Polar and nonpolar designs

Low leakage current decreases with time... well suited for transistorized circuits.

Neutral electrolyte.

Proven reliability of tantalum foil.

Wide application range: Up to 300 volts d-c; 0.15 to 3500μf.

Single-cell construction up to 300 volts d-c... requires less space, more reliable.

Long shelf life...over 30 years proved.

Proved long life, even at elevated temperatures... up to 40,000 hours 125°C test data...up to 50,000 hours 85°C test data with less than 10 percent capacitance change.

No limitation on charge or discharge current.

High stable characteristics over broad range of environments.

TANTALUM FOIL CAPACITORS

PERFORMANCE AND APPLICATION DATA

Vacuum

Hermetically sealed units are unaffected by a vacuum.

The effect of vacuum on non-hermetically sealed capacitors is similar to the effect of temperature in that they both accelerate vapor transmission through the end seals and thus hasten the dry-out mechanism. Fig. 13 shows how seals vary as a function of capacitors weight loss through evaporation of the eletrolyte. In general, when half of the original electrolyte weight has been lost, serious electrical characteristic degradation begins. This makes size and electrolyte content of a unit important in its ability to survive erosion. At present, the only way to virtually eliminate the failure mode is to use M/C's glass to tantalum hermetically sealed capacitors.

Fig. 14 relates the effect of weight loss to life of a capacitor. Relations between vacuum and atmospheric environments demonstrate the benefit of the glass-to-tantalum hermetic seal.

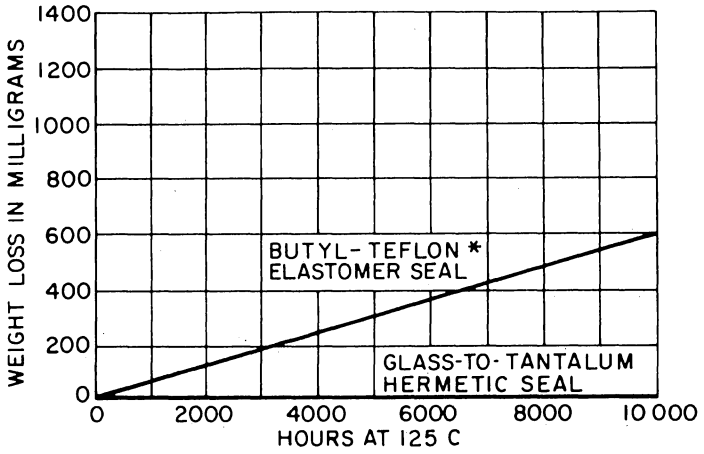


Fig. 13. Weight loss comparison of seals at atmospheric pressure

*Registered trademark of E. I. DuPont de Nemours & Co.

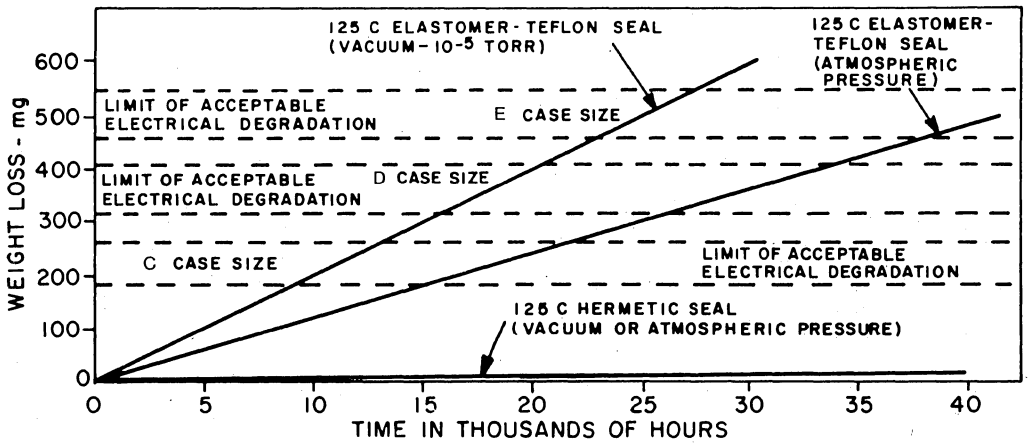


Fig. 14. Effect of weight loss on capacitor life.

Radiation

Most of the capacitors described in this brochure have been tested to 7 X 10^6 rads (integrated gamma), and 2 X 10^{13} e/cm^2 (3.6 X 10^{10} electrons/cm^2/sec rate). These values are those prescribed by MIL-R-38009 for spacecraft, and represent about eight years in the highest intensity Van Allen Belt.

Tests were run at atmospheric conditions only in order to place the greatest stress upon the materials. The results indicated no change in electrical characteristics either during or after the irradiation dosage, and no physical deterioration was discernable.

ADDITIONAL APPLICATION INFORMATION

SOLID TANTALUM CAPACITORS
STYLES CS12, CS13 (40SS)
CSR13 (40SS)
CSR91 (40NS)

APPLICATION INFORMATION

Use. These capacitors are intended for use in equipment where a known order of reliability is required. These electrolytic capacitors are the most stable and most reliable electrolytic available, having a longer life characteristic than any of the other electrolytic capacitors. Because of their passive electrolyte being solid and dry, these capacitors are not temperature-sensitive; they have a lower capacitance temperature characteristic than any of the other electrolytic capacitors. Their limitations are the relatively high leakage current, limited voltage range available (6 to 100 volts), and a maximum allowable reverse voltage of 15 percent of the rated dc voltage at +25°C to 1 percent at +125°C. These capacitors are generally used where low-frequency pulsating dc components are to be bypassed or filtered out and for other uses in electronic equipment where large capacitance values are required, where space is at a premium, and where there are significant quantities of shock and vibration. These capacitors are mainly designed for filter, bypass, coupling, blocking, energy storage, and other low voltage dc applications (such as transistor circuits in missile, computer, and aircraft electronic equipment) where stability, size, weight, and shelf life are important factors. When designing transistor, timing, phaseshifting, and vacuum-tube grid circuits, the dissipation factor and power factor should be taken into consideration. For bypassing resistors, a ratio of bias resistance to capacitive reactance of 10 to 1 is usually allowed. Ratios up to 20 to 1 may be used in high-fidelity amplifier work or where space and economical considerations permit. In circuits where linear amplification is required, the amount of capacitive reactance shunting a cathode resistor will depend on the percentage of degenerative feedback desired.

These capacitors are available as polarized and nonpolarized types. Polarized types should have their cases at the same potential as the negative lead; they should be used only in dc circuits with polarity observed. Nonpolarized types should be used where reversal of potential occurs.

Construction. A porous tantalum pellet or wire serves as the anode of a solid tantalum capacitor. The surfaces of the anode are electrochemically converted to an oxide of tantalum which serves as the dielectric. These surfaces are coated with an oxide semiconductor which is the working electrolyte in solid form. This oxide semiconductor establishes contact with all of the complex surfaces of the anodized pellet and is capable of healing imperfections of the tantalum oxide dielectric film.

NOTE: In high impedance circuits, momentary breakdowns (if present) will self-heal; however, in low impedance circuits, their self-healing characteristics under momentary breakdown of the dielectric film will be nonexistent. The large currents in low impedance circuits will cause permanent damage to the capacitor. Experience has shown that a circuit resistance of 3Ω per volt is desirable to limit possible surge damage to the dielectric.

Reverse voltage. These capacitors are capable of withstanding peak voltages in the reverse direction equal to 15 percent of their dc rating at +25°C; 10 percent at +55°C; 5 percent at +85°C; and 1 percent at +125°C.

Capacitance. The tolerance on nominal capacitance at 100Hz is ±20% and ±10% (±5% on request).

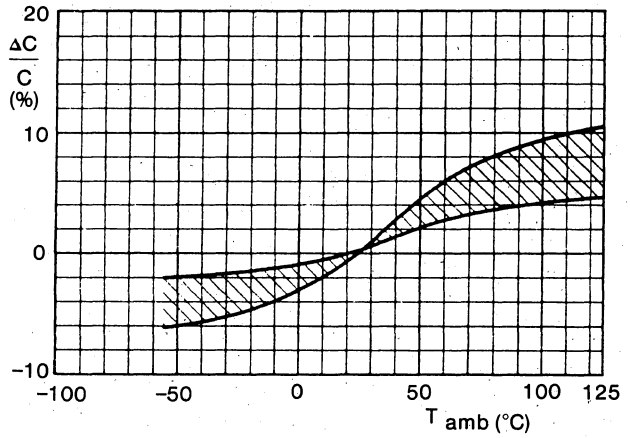


FIG. 1 Typical capacitance as a function of ambient temperature.

The change in capacitance from the initial value measured at 25°C shall not exceed the following percentages:
10% at −55°C;
8% at +85°C; 12% at +125°C.

Voltage rating. These capacitors have a voltage rating over a range of 6 to 100 volts.

Operating temperature range. These capacitors are suitable for operation over a temperature range of −55°C to +85°C.

Voltage derating. When properly derated, these units may be operated over a temperature range of −55° to +125°C. The derated voltage at +125°C is approximately 66 percent of the full rated voltage.

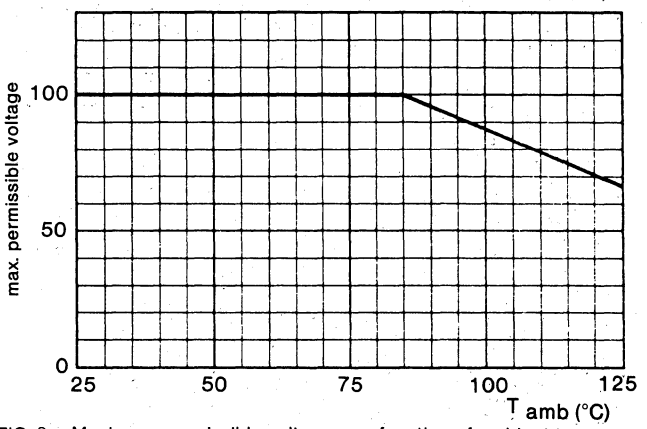


FIG. 2 Maximum permissible voltage as a function of ambient temperature.

Permissible ripple voltage. These capacitors may be operated with an impressed ripple (ac) voltage provided the capacitors do not exceed their heat-dissipation limits. Total heat-dissipation limits depend on the ambient operating temperature and the operating frequency. For example: A 10μf of any voltage may be operated at 3 volts RMS, 60 Hz, 25°C (see Fig. 3). When this same capacitor is subjected to different temperatures, or different frequencies, the appropriate derating factors are found in Figs. 4 and 5. If this same 10 μf capacitor is subjected to 125° and a ripple frequency of 1000 Hz, the permissible ripple voltage would be 3 x .4 x .18 which equals .216 volts.

SOLID TANTALUM CAPACITORS

Leakage Current

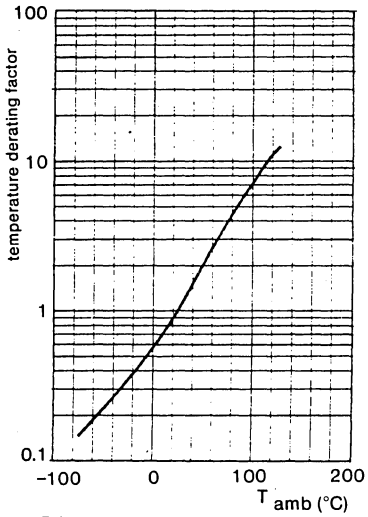


FIG. 6. Typical effect of ambient temperature on leakage current.

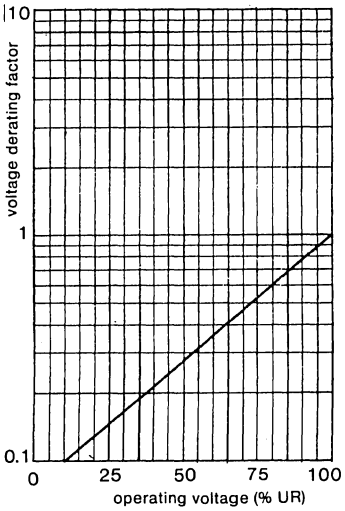


FIG. 7. Typical effect of operating voltage on leakage current.

Equivalent series resistance

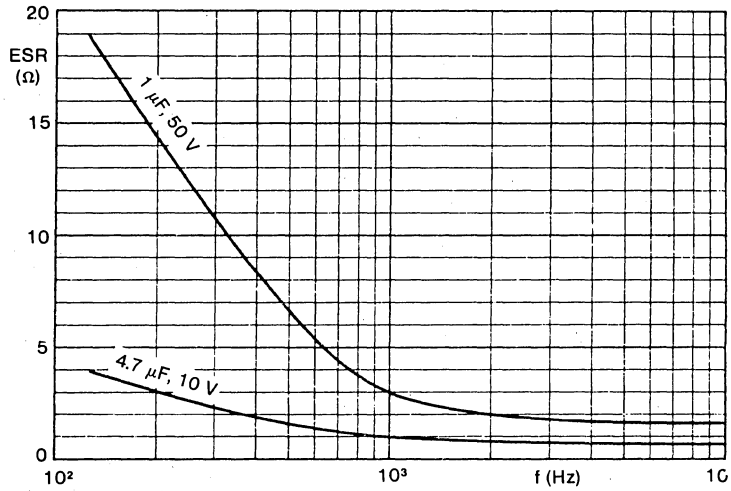


FIG. 8. Typical ESR as a function of frequency; case size A.

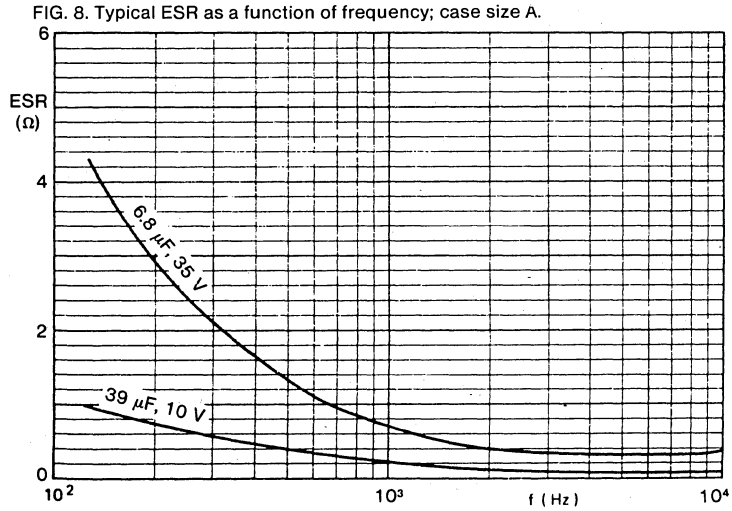


FIG. 9. Typical ESR as a function of frequency; case size B

The sum of the applied dc bias voltage and the peak of the ac ripple voltage should not exceed the dc rated voltage for the applicable ambient temperature. Permissible ac voltage determined from figures 3, 4 and 5, may be applied when the dc voltage is zero or near zero, provided the negative peak of the ac voltage does not exceed the allowable reverse voltage limits of 1 volt at 125°C.

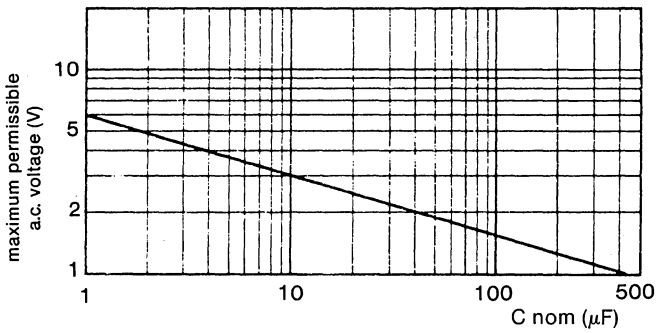


FIG. 3. Maximum permissible ac voltage at 25°C and 60 Hz as a function of nominal capacitance.

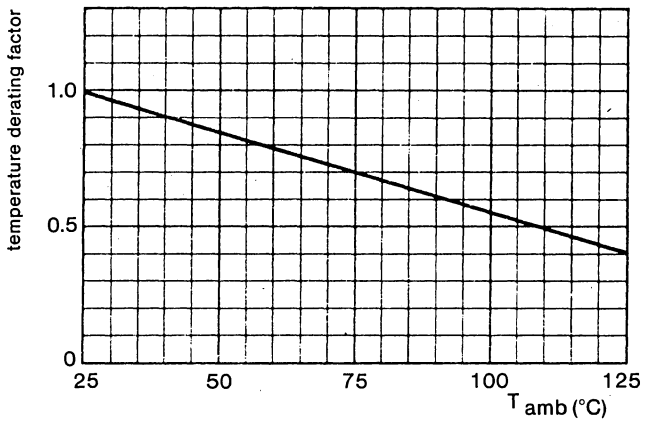


FIG. 4. Effect of temperature on maximum permissible a.c. voltage.

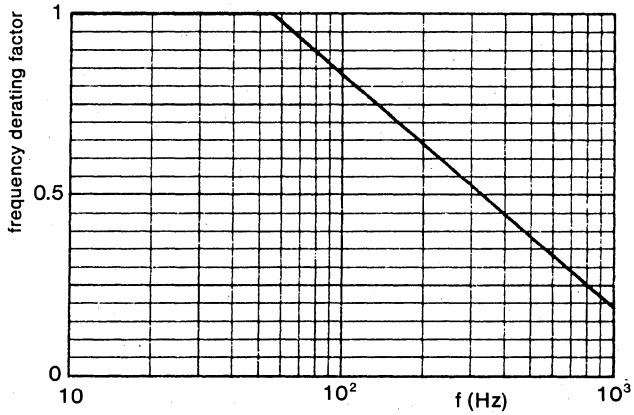


FIG. 5. Effect of frequency on maximum permissible a.c. voltage.

ADDITIONAL APPLICATION INFORMATION

SOLID TANTALUM CAPACITORS

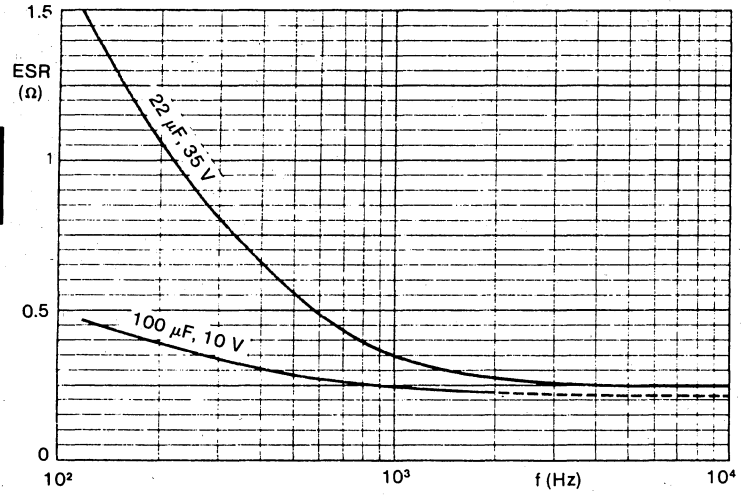


FIG. 10. Typical ESR as a function of frequency, case size C.

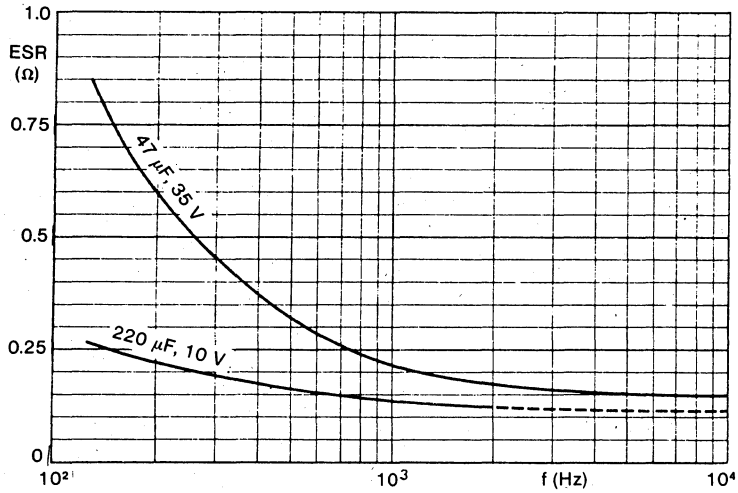


FIG. 11. Typical ESR as a function of frequency, case size D.

Impedance

The impedance is measured by means of a four-terminal circuit (Thomson circuit). See the following graphs.

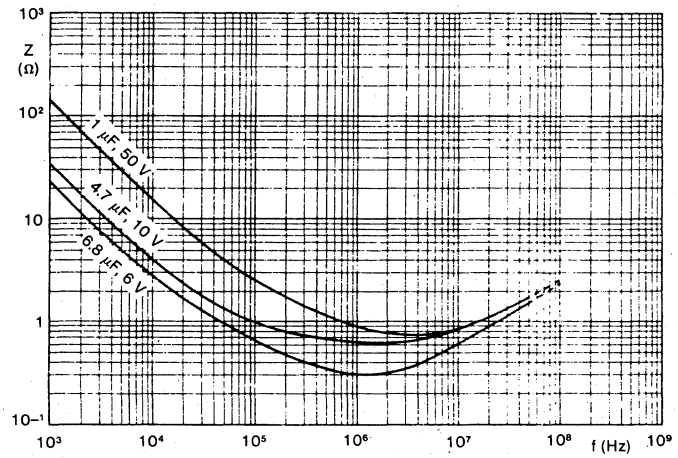


FIG. 12. Typical impedance as a function of frequency at 25°C; case size A.

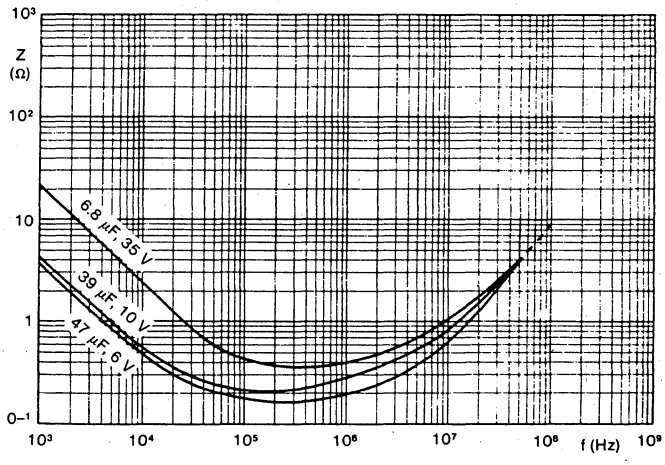


FIG. 13. Typical impedance as a function of frequency at 25°C; case size B.

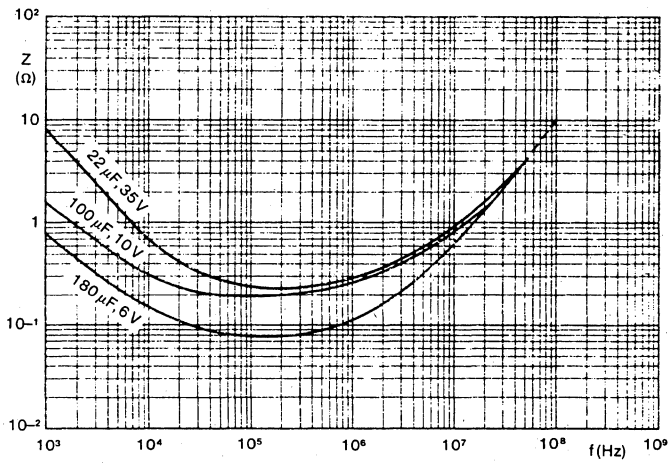


FIG. 14. Typical impedance as a function of frequency at 25°C; case size C.

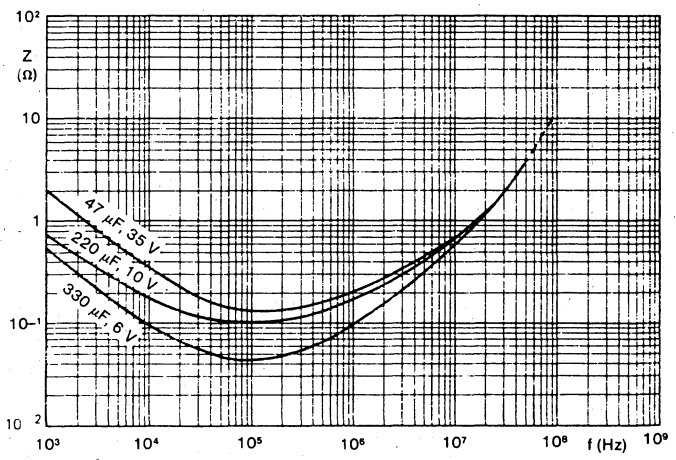


FIG. 15. Typical impedance as a function of frequency at 25°C; case size D.

ADDITIONAL APPLICATION INFORMATION

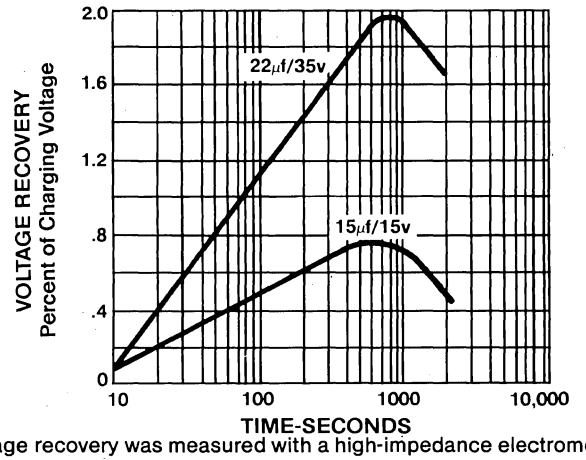
SOLID TANTALUM CAPACITORS

Series and parallel networks:

Series. It is recommended that when these capacitors are connected in series, the maximum voltage across the network should not be greater than the lowest voltage rating of any capacitor in the network, or that voltage divider resistors be used to prevent over voltage on one or more units of the series capacitor group.

Parallel. To obtain a higher capacitance than can be obtained from a single capacitor, a number of units may be connected in parallel. However, the sum of the peak ripple and the applied dc voltage should not exceed the dc working voltage of the unit with the lowest voltage rating. The connecting leads of the parallel network should be large enough to carry the combined currents without reducing the effective capacitance due to series lead resistance.

Dielectric absorption. Dielectric absorption may be observed by the reappearance of potential across the capacitor after it has been shorted and the short removed. This characteristic is important in RC timing circuits, triggering systems, and phase-shift networks. The curves shown in figure 16 were established by charging capacitors for 1 hour at rated voltage and then discharging them through a dead short for 1 minute.



Voltage recovery was measured with a high-impedance electrometer at the intervals given on the curves. Increasing the ambient temperature shifts the curves to the left and decreases the amplitude but does not affect the shape. Shortening charge time, lengthening discharge time, or decreasing charging voltage results in reduction of the peak amplitude of the curve, but has little effect on its shape or relative position.

Comparison with aluminum electrolytics. Tantalum solid electrolytic capacitors differ from aluminum electrolytics in several important aspects: namely, substantially indefinite shelf life, superior low temperature characteristics, complete freedom from electrolyte leakage, and higher operating temperatures.

Mounting. Supplementary mounting means should be used where the application of these capacitors involves vibration frequencies above 55 Hz.

Increased reliability. Failure rate is a function of temperature, applied voltage, and circuit impedance. Increased reliability may be obtained by derating the temperature and applied voltage and increasing circuit impedances.

DC leakage current increases when either voltage or temperature is increased; the rate of increase is greater at the higher values of voltage and temperature. A point can be reached where the dc leakage current will avalanche and attain proportions that will permanently damage the capacitor. Consequently, capacitors should never be operated above their rated temperature and rated voltage for that temperature.

By increasing the circuit impedance, the leakage current is reduced. In life testing the solid tantalum capacitor, the capacitance and dissipation factor are very stable over long periods of time and hence are not a suitable measure of deterioration. Leakage current variation is a better indicator of capacitor condition. In the life test in MIL-C-39003, a maximum impedance of 3 ohms is allowed. It is recommended that a minimum circuit impedance of 3 ohms per applied volt be utilized to attain improved reliability.

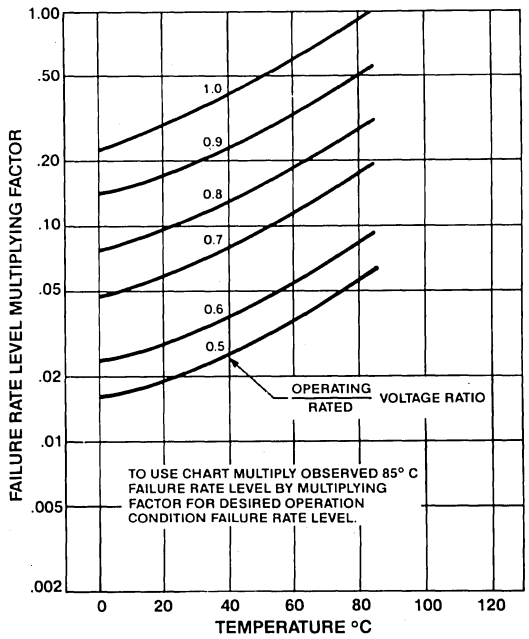


FIG. 17: Failure rate level curves.

NOTE: Multiply the value read from figure 17 by the following applicable multiplying factor.

Circuit Impedance Ohms/Volt	Multiplying Factor	Circuit Impedance Ohms/Volt	Multiplying Factor
3 or greater	1.0	0.5	4.5
2	1.4	0.4	5.1
1	2.8	0.3	6.1
0.9	2.9	0.2	7.5
0.8	3.2	0.15	9.0
0.6	4.0	0.10	12.0

Failure-rate determination. The curves presented on figure - 4 are the best engineering approximation of the reliability characteristics (random failures) for these capacitors when employed repeatedly, within their specification ratings, in complex electronic equipment. These reliability characteristics are based on ground-level severity experience. Failures are considered to be opens, shorts, or radical departures from initial characteristics. The failures are considered to be occurring in an unpredictable manner and in too short a period of time to permit detection through normal preventive maintenance. The curves shown on figure - 4 are based on "catastrophic failures" and will differ from the failure rates established in the specification, since the established failure rates are based on "parametric failures" over long term life tests at rated conditions. Figure - 4 has been extracted from MIL-HDBK-217, "Reliability Stress and Failure Rate Data for Electronic Equipment." The curves have been modified from their original version in that the ordinate has been normalized in order to provide multiplier factors in place of discrete failure rate levels and in order that the multiplying factor for a failure rate at rated conditions is unity. As indicated, these curves are the best estimates based on "catastrophic failures";however, they can provide an estimate of the relative effect of operating under conditions other than rated.

Tape and Reel Packaging

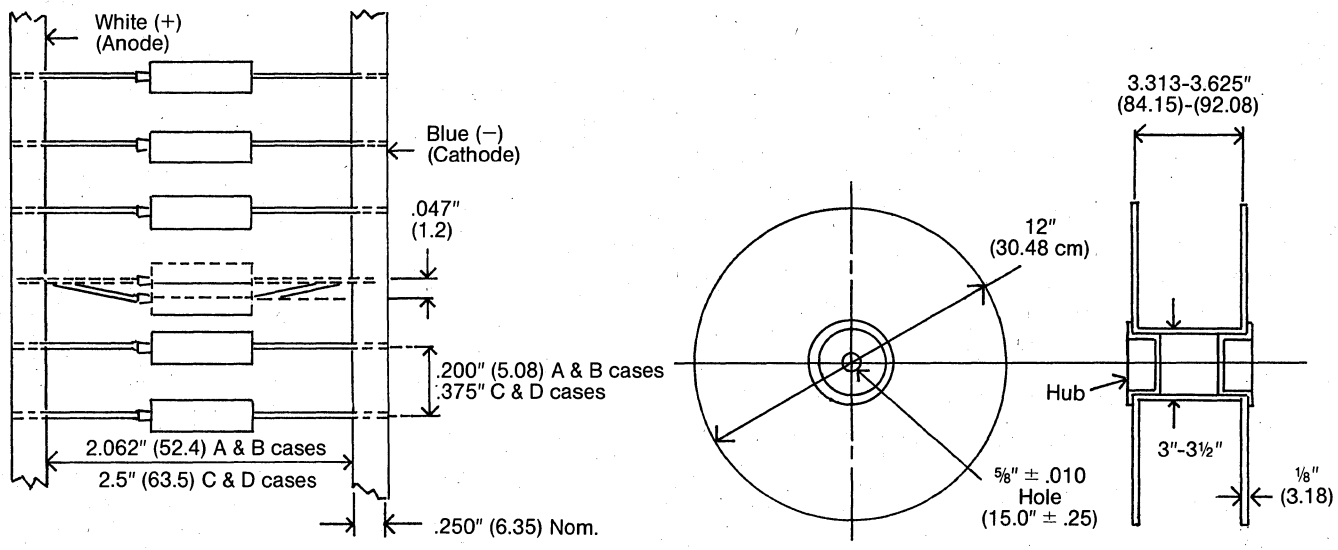
Mepco/Centralab offers lead tape and reel packaging for axial leaded tantalum capacitors. Standard tape and reeling is per EIA specification RS-296, optional configurations for specific applications are available.

Capacitors are reeled with the positive lead oriented towards the white tape, negative leads oriented toward blue tape. Capacitor lead length may extend a maximum of .0625" beyond edge of tape. Capacitors are centered in a row between both tapes and will deviate a maximum of ±.031" from center.

Figures below slow the standard Mepco/Centralab reel. Distance between flanges of the reel is .218" (±.093) greater than the overall capacitor length. A minimum of 36" of leader tape is supplied at both ends of the reeled capacitors.

Standard Reeling Quantities

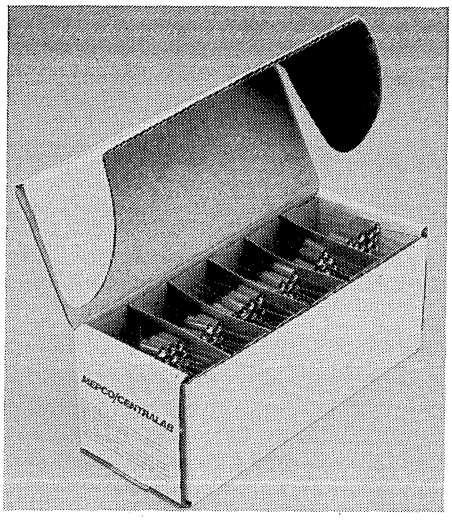
Case Size	Quantity
A	2500
B	2000
C	400
D	300



Standard Packaging of Solid Tantalum Capacitors

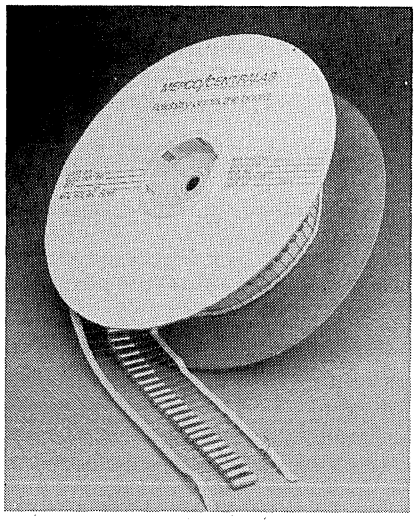
BULK PACK

Capacitors are packaged in 100 unit sections in standard cartons. This is the only package style available for radial leaded capacitors.



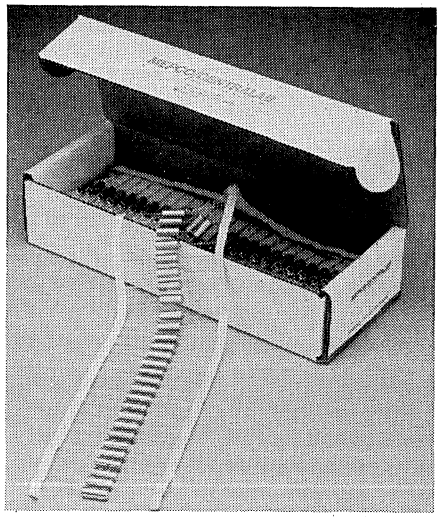
TAPE AND REEL

Axial leaded capacitors may be lead taped and reeled for use in automatic insertion applications.



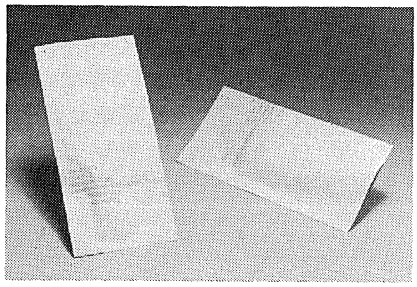
AMMO PACK

Axial leaded capacitors may be lead taped and folded into cartons where required for automated insertion applications.



BARRIER BAG

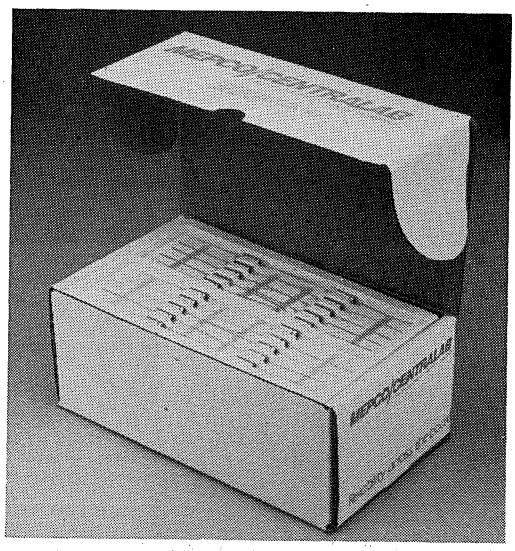
Individual capacitors are sealed in a metalized, moisture-proof envelope in accordance with MIL-B-131G. This is the most expensive packaging method normally used in military spare parts requirements when required by specifications.

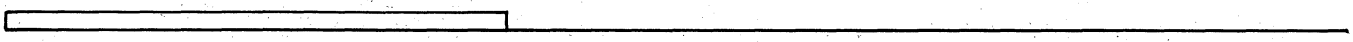


Standard Packaging of Wet Tantalum Capacitors

TRAY PACK

Preformed plastic trays are used in packaging all wet tantalum capacitors. Each tray is accurately sized to hold up to twenty capacitors in individual slots for secure handling and shipping.





Film Capacitors
QUICK REFERENCE INDEX

Applications Guide

	GENERAL PURPOSE	TIGHT TOLERANCE	PULSE	SUPPRESSION
	(ALL)	±1%, ±2% FLAT T.C. (POLYPROP./POLYSTY.)	HIGH CURRENT/VAC RMS (POLYPROP./MET.)	PROTECTION FREQUENCY (POLYPROP./MET.)
BLOCKING	•	•	•	
COUPLING/DECOUPLING	•	•	•	•
BYPASSING	•	•	•	•
FILTERING				•
ENERGY STORAGE	F/F		•	•
TIMING	•	•	•	
SMOOTHING	•	•	•	•
TUNING	•	•	•	•
FREQUENCY DISCRIMINATION		•		•
PULSE DISCHARGE	F/F		•	•
ARC SUPPRESSING	F/F		•	•
TRANSIENT VOLTAGE SUPPRESSION	F/F		•	•

F/F = FILM/FOIL ONLY

TEMPERATURE CONVERSION CHART Centigrade—Fahrenheit

°C.	°F.	°C.	°F.	°C.	°F.	°C.	°F.	°C.	°F.
–80	–112.	1	33.8	31	87.8	61	141.8	91	195.8
–70	– 94.	2	35.6	32	89.6	62	143.6	92	197.6
–60	– 65.	3	37.4	33	91.4	63	145.4	93	199.4
–50	– 58.0	4	39.2	34	93.2	64	147.2	94	201.2
–45	– 49.1	5	41.0	35	95.0	65	149.0	95	203.0
–40	– 40.0	6	42.8	36	96.8	66	150.8	96	204.8
–35	– 31.0	7	44.6	37	98.6	67	152.6	97	206.6
–30	– 22.0	8	46.4	38	100.4	68	154.4	98	208.4
–25	– 13.0	9	48.2	39	102.2	69	156.2	99	210.2
–20	– 4.0	10	50.0	40	104.0	70	158.0	100	212.0
–19	– 2.2	11	51.8	41	105.8	71	159.8	105	221.
–18	– .4	12	53.6	42	107.6	72	161.1	110	230.
–17	1.4	13	55.4	43	109.4	73	163.4	115	239.
–16	3.2	14	57.2	44	111.2	74	165.2	120	248.
–15	5.0	15	59.0	45	113.0	75	167.0	130	266.
–14	6.8	16	60.8	46	114.8	76	168.8	140	284.
–13	8.6	17	62.6	47	116.6	77	170.6	150	302.
–12	10.4	18	64.4	48	118.4	78	172.4	160	320.
–11	12.2	19	66.2	49	120.2	79	174.2	170	338.
–10	14.0	20	68.0	50	122.0	80	176.0	180	356.
– 9	15.8	21	69.8	51	123.8	81	177.8	190	374.
– 8	17.6	22	71.6	52	125.6	82	179.6	200	392.
– 7	19.4	23	73.4	53	127.4	83	181.4	250	482.
– 6	21.2	24	75.2	54	129.2	84	183.2	300	572.
– 5	23.0	25	77.0	55	131.0	85	185.0	350	662.
– 4	24.8	26	78.8	56	132.8	86	186.8	400	752.
– 3	26.6	27	80.6	57	134.6	87	188.6	500	932.
– 2	28.4	28	82.4	58	136.4	88	190.4	600	1112.
– 1	30.2	29	84.2	59	138.2	89	192.2	700	1292.
0	32.0	30	86.0	60	140.0	90	194.0	800	1472.
								900	1652.
								1000	1832.

FORMULA °F = (°C x 9/5) +32 °C = (°F-32) x 5/9

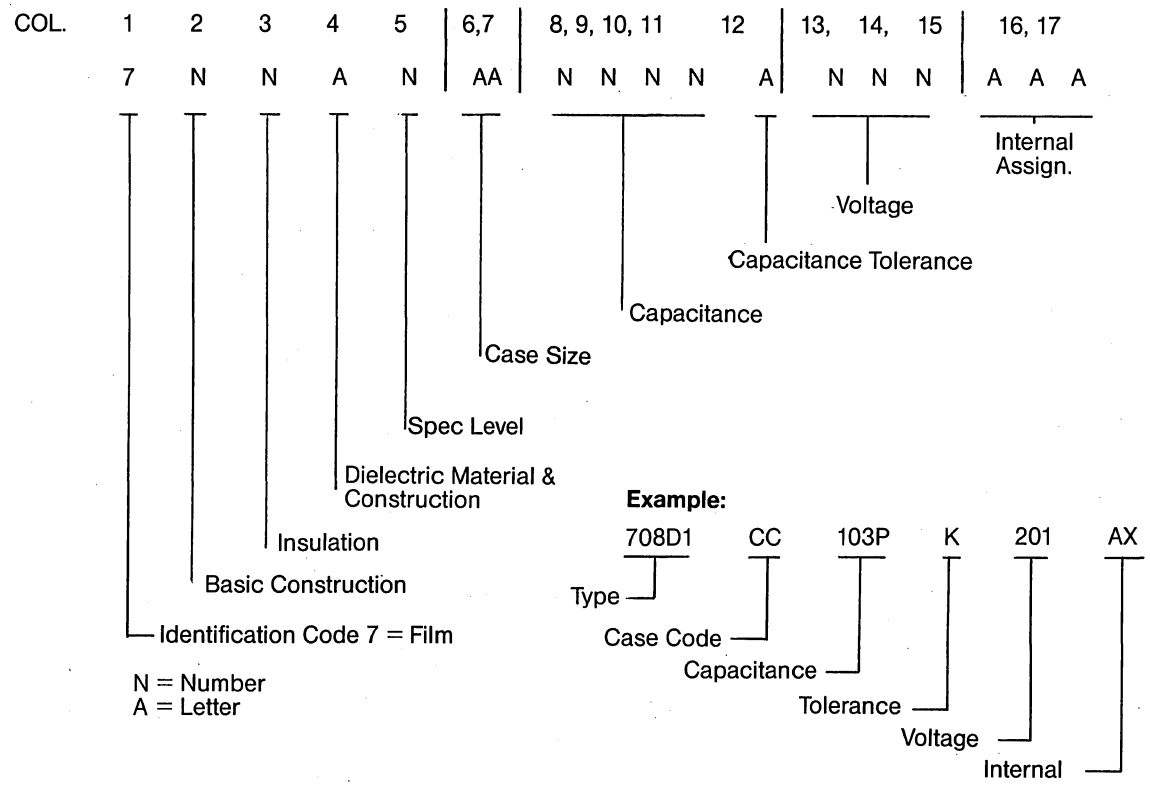
PREFIXES OF UNITS

Multiples and sub-multiples	Prefixes	Symbols
1 000 000 000 000 = 10^{12}	tera	T
1 000 000 000 = 10^{9}	giga	G
1 000 000 = 10^{6}	mega	M
1 000 = 10^{3}	kilo	k
100 = 10^{2}	hecto	h
10 = 10	deka	da
0.1 = 10^{-1}	deci	d
0.01 = 10^{-2}	centi	c
0.001 = 10^{-3}	milli	m
0.000 001 = 10^{-6}	micro	μ
0.000 000 001 = 10^{-9}	nano	n
0.000 000 000 001 = 10^{-12}	pico	p
0.000 000 000 000 001 = 10^{-15}	femto	f
0.000 000 000 000 000 001 = 10^{-18}	atto	a

AMERICAN WIRE GAUGE TABLE

Wire Gauge	Nominal Dia. (Inches)	Nominal Dia. (mm)
18	.040	1.02
20	.032	0.81
22	.025	0.64
24	.020	.051

MEPCO/CENTRALAB FILM CAPACITOR GENERAL PART NUMBER DESCRIPTION



Column 1 = Mepco/Centralab Film Capacitor Code

Column 2 = Lead Construction
0 = Axial Leaded
1 = Radial Leaded

Column 3 = Insulation (Enclosure)
0 = No Coating
1 = Molded
2 = Epoxy
3 = Conformal
4 = Wrap
5 = Open
6 = Open
7 = Open
8 = Wrap & Pot
9 = Potted

Column 4 = Dielectric Material
A = Metalized Polyester
B = Metalized Polycarbonate
C = Polystyrene
D = Polyester and Foil
E = Polypropylene and Foil
F = Polyester and Polypropylene
G = Polycarbonate Foil
H = Polypropylene Metalized
J = Polyester and Paper

Column 5 = Specification Level or Terminal Description
1 = Standard
2 = Military
3 to 9 = Terminal description for Series 711H

Columns 6 & 7 = Case Size Code

Columns 8, 9, 10 & 11 = Capacitance Code
Multipliers:
1 = 10^1
2 = 10^2
3 = 10^3
4 = 10^4
5 = 10^5
6 = 10^6
7 = 10^7
8 = 10^8
9 = 10^9
0 = 10^0
Example:
10000PF (.01UF) = 103P
12700PF (.0127UF) = 1273

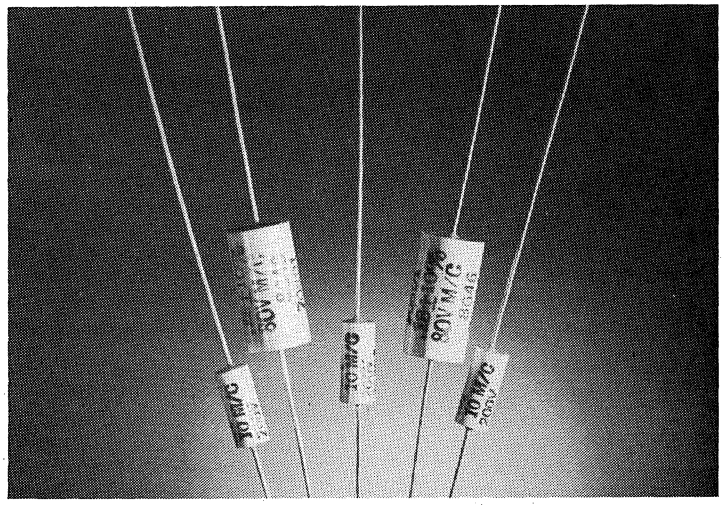
Column 12 = Capacitance Tolerance %
A = Special
F = ±1%
G = ±2%
L = ±3%
J = ±5%
H = ±6%
K = ±10%
M = ±20%

Columns 13, 14 & 15 = Voltage Rating (VDC)
Voltage Rating—First two numbers are significant digits, third digit gives number of zeros. Refer to specific data sheet to determine VDC and/or VAC.

Columns 16 & 17 = Internal Assignment
Use to denote special requirements: lead spacing, lead length, tape and reel, etc.

SERIES 708D1

Polyester & Foil Capacitors



4 Film Capacitors

DESCRIPTION:

Series 708D1 polyester/foil capacitors are round units wound with aluminum foil and capacitor grade polyester (polyethylene terephthalate) film dielectric. These compact rolls incorporate welded tinned copper clad steel wire leads and are wrapped with electrical grade tape and end filled.

Mepco/Centralab has achieved a goal of providing a film dielectric unit which when applied within its rating will give the highest order or reliability per dollars cost known to the industry.

FEATURES:

Electrical

- Dielectric Withstanding—250% x Rated (VDC) for one sec.
- Dissipation Factor (% @ 25°C)
  ≤ 1.0uFD @ 1 KHz ≤ 0.6%
  > 1.0uFD @ 60Hz ≤ 0.6%
- Insulation Resistance @ 25°C
  ≤0.5uFD 100000 MΩ min.
  > 0.5uFD 50000 MΩ MFD min.
- Maximum Capacitance Change with Temp.
  @ −55°C −10%
  @ +85°C +10%
  @ +125°C +15%
- Standard Voltage Ratings—80, 100 & 200VDC @ −55°C to 85°C. Operating temperature to 125°C with proper voltage derating
- Voltage Derating @ 125°C is 50% of rated voltage.

Mechanical

- Small size
- Lightweight-non metallic case welded lead construction providing strong positive contact terminations.
- Lead strength—5 lb. axially

HOW TO SPECIFY:

Mepco/Centralab Series 708D1 Capacitors can be completely specified using the following designation:

708D1 CC 103P K 201

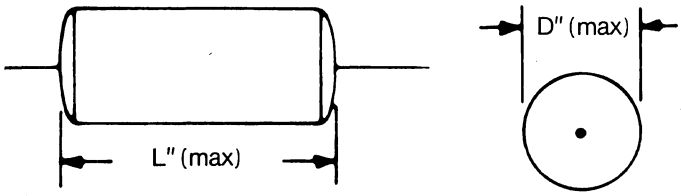
- **708D1** — **M/C Series**
- **CC** — **Case Size**
- **103P** — **Capacitance in (pF)**: First two digits represent significant figures and last digit indicated the number of zeros to follow.
- **K** — **Tolerance**: J = ± 5%, K = ±10%
- **201** — **Voltage at 85°C**: 800 = 80V, 101 = 100V, 201 = 200V

SERIES 708D1

Polyester & Foil Capacitors

SPECIFICATIONS

OUTLINE DRAWING



LEAD LENGTH: 1.63" MIN. BOTH SIDES

TYPICAL MARKING EXAMPLE	
Nominal Capacitance	0.10uf
Tolerance	±10%
Rated Voltage DC	200VDC
Mepco/Centralab Series	M/C 708D1
Date Code (Yr & Wk)	8712

708D1 SERIES

CAP VALUE UF	POLYESTER FILM/FOIL 80VDC				POLYESTER FILM/FOIL 200 VDC			
	MEPCO/CENTRALAB PART NUMBER*	MAX. DIMENSIONS IN INCHES LENGTH	DIAMETER	LEAD SIZE AWG	MEPCO/CENTRALAB PART NUMBER*	MAX. DIMENSIONS IN INCHES LENGTH	DIAMETER	LEAD AWG.
.0010	708D1AA102P*800AX	.406	.153	22	708D1CC102P*201AX	.450	.185	22
.0012	AA122	.406	.153	22	CC122	.450	.185	22
.0015	AA152	.406	.153	22	CC152	.450	.185	22
.0018	AA182	.406	.153	22	CC182	.450	.185	22
.0022	AA222	.406	.153	22	CC222	.450	.185	22
.0027	AA272	.406	.153	22	CC272	.450	.185	22
.0033	AA332	.406	.153	22	CC332	.450	.185	22
.0039	AA392	.406	.153	22	CC392	.450	.185	22
.0047	AA472	.406	.153	22	CC472	.450	.185	22
.0056					CC562	.450	.185	22
.0068	NOT AVAILABLE USE 200 VOLT DEVICE				CC682	.450	.185	22
.0082					CC822	.450	.185	22
.010					CC103	.450	.185	22
.012	708D1EC123P*800AX	.530	.185	22	EH123	.530	.229	22
.015	EC153	.530	.185	22	EH153	.530	.229	22
.018	EC183	.530	.185	22	HH183	.594	.229	22
.022	EC223	.530	.185	22	HH223	.594	.229	22
.027	EH273	.530	.229	22	HJ273	.594	.250	22
.033	EH333	.530	.229	22	HJ333	.594	.250	22
.039	HH393	.594	.229	22	HP393	.594	.315	22
.047	HH473	.594	.229	22	HP473	.594	.315	22
.056	HJ563	.594	.250	22	MP563	.719	.315	22
.068	HJ683	.594	.250	22	MP683	.719	.315	22
.082	HP823	.594	.315	22	MR823	.719	.328	22
.10	HP104	.594	.315	22	MR104	.719	.328	22
.12	MP124	.719	.315	22	XS124	.969	.343	22
.15	MP154	.719	.315	22	XS154	.969	.343	22
.18	MV184	.719	.343	22	HS184	1.28	.343	22
.22	MV224	.719	.343	22	HS224	1.28	.343	22
.27	XS274	.969	.343	20	GN274	1.25	.562	22
.33	XS334	.969	.343	20	GN334	1.25	.562	20
.39	HV394	1.28	.375	20	RO394	1.59	.578	20
.47	HV474	1.28	.375	20	RO474	1.59	.578	20
.56					VU564	1.72	.630	20
.68	NOT AVAILABLE USE 100 VOLT DEVICE				VU684	1.72	.630	20
.82					CE824	1.90	.750	20
1.00					CE105	1.90	.750	20

	POLYESTER FILM/FOIL 100VDC				
.27	708D1GC274P*101AX	1.25	.436	20	.032
.33	GC334	1.25	.436	20	.032
.39	GK394	1.25	.531	20	.032
.47	GK474	1.25	.531	20	.032
.56	RN564	1.59	.562	20	.032
.68	RN684	1.59	.562	20	.032
.82	RQ824	1.59	.610	20	.032
1.00	RQ105	1.59	.610	20	.032

INCHES TO METRICS: INCHES X 25.4

NOTE: Higher voltage ratings and other tolerances available upon special request.

* INSERT APPROPRIATE LETTER INTO PART NUMBER FOR TOLERANCE

J = ± 5%
K = ± 10% STANDARD

AVAILABLE BULK OR ON TAPE & REEL.

SEE PAGE 465 FOR TAPE & REEL SPECIFICATIONS.

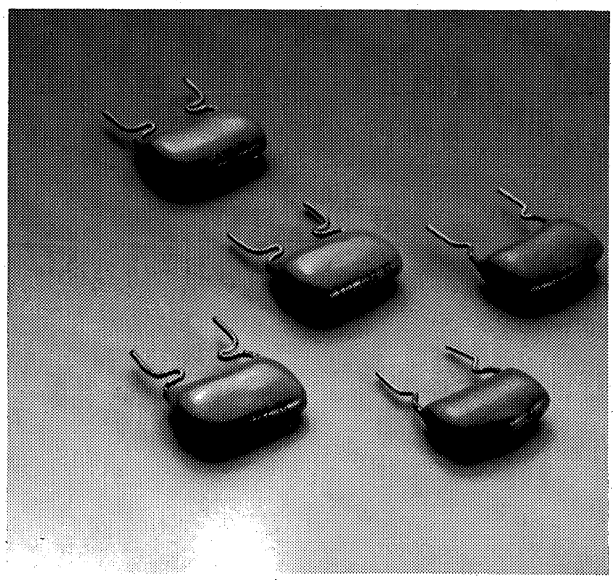
NOTICE: MISAPPLICATION SUCH AS EXCEEDING DESIGN LIMITS MAY RESULT IN DESTRUCTION OR EXPLOSION OF CAPACITORS.

SERIES 713D1 (TYPE KT)

Polyester & Foil Capacitors (12NC2222-347)

DESCRIPTION:

Series 713D1 polyester/foil capacitors are wound with high purity foil and capacitor grade polyester (polyethylene terephthalate) film dielectric, extended foil construction encapsulated in a rigid dipped lacquer case with solder coated wire leads designed for high peak current capability and unlimited pulse steepness; in very small packages designed for high-density PC Board installation.



FEATURES

Electrical

- Rated capacitance range 0,001 to 1 μF
- Climatic category, IEC 68 40/100/21
- Related specification IEC 384-11
- Dielectric Withstanding—200% x Rated (VDC) for one minute.
- Dissipation Factor $\leq$0.6% @ 1KHz/$\leq$1.1% @ 10KHz
- Insulation resistance
  The insulation resistance is measured after a voltage has been applied for 1 min $\pm$5 s, the voltage being 100 $\pm$15V for the 100V, 250V and 400V versions, and 500 $\pm$50V for the 630V version, at T_{amb} = 20°C.
  R between terminations, for $C_R \leq 0{,}33$ μF >50,000 MΩ
  RC between terminations, for $C_R > 0{,}33$ μF >16,500 s
- Standard Voltage Ratings 100V, 250V, 400V & 630VDC @ −40°C to +85°C
- Storage Temperature Range −40°C to +100°C

Mechanical

- Extended Foil Construction
- Flame Retardant
- Solvent Resistance
- Resistance to soldering heat with pre-heating:
  Capacitors mounted on a 1,6 mm board with non-plated holes
  Body temp.: 80°C
  Bath temp.: 260°C
  Dwell time: 2 x 5 s with interim free period of 5 s
- High Peak Current Capability
- Solderability-tested in accordance with MIL-STD-202, Method 208.

HOW TO SPECIFY

Mepco/Centralab Series 713D1 Capacitors can be completely specified using the following designation:

713D1	MJ	104P	K	251	S	F

713D1 — **M/C Series**

MJ — **Case Size**

104P — **Capacitance in (pF)**
First two digits represent significant figures and last digit indicates the number of zeros to follow.

K — **Tolerance**
K = ±10%

251 — **Voltage at 85°C**
101 = 100V
251 = 250V
401 = 400V
631 = 630V

S — Specification
S = Standard

F — **Lead Configuration**

Crimp Lead Code	Lead Spacing
K	.400
L	.600
F	.900
N	1.100

AVAILABLE BULK ONLY.

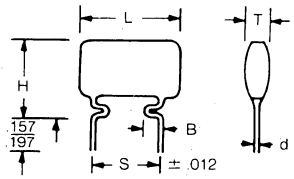
NOTICE: MISAPPLICATION SUCH AS EXCEEDING DESIGN LIMITS MAY RESULT IN DESTRUCTION OR EXPLOSION OF CAPACITORS.

SERIES 713D1
Polyester & Foil Capacitors

713D1 SERIES

CAP VALUE	100VDC/50VAC		250VDC/80VAC		400VDC/125VAC		630VDC/200VAC	
UF	M/C PART NO.	CASE SIZE	M/C PART NO.	CASE SIZE	M/C PART NO.	CASE SIZE	M/C PART NO.	CASE SIZE
.0010							713D1BE102PK631SK	BE
.0012							BE122	BE
.0015							BE152	BE
.0018							BE182	BE
.0022							BE222	BE
.0027							BE272	BE
.0033	FOR THESE RATINGS USE THE CORRESPONDING HIGHER VOLTAGE LEVEL		FOR THESE RATINGS USE THE CORRESPONDING HIGHER VOLTAGE LEVEL		FOR THESE RATINGS USE THE CORRESPONDING HIGHER VOLTAGE LEVEL		BE332	BE
.0039							BE392	BE
.0047							BF472	BF
.0056							BG562	BG
.0068							BH682	BH
.0082			713D1BC822PK251SK	BC	713D1BD472PK401SK	BD	GE822PK631SL	GE
.010			BD103	BD	BD562	BD	GF103	GF
.012			BE123	BE	BE682	BE	GG123	GG
.015	713D1BC153PK101SK	BC	BE153	BE	BE822	BE	GH153	GH
.018	BD183	BD	BF183	BF	BF103	BF	GJ183	GJ
.022	BE223	BE	BG223	BG	BG123	BG	GK223	GK
.027	BE273	BE	BH273	BH	BH153	BH	MI273PK631SF	MI
.033	BF333	BF	GE333PK251SL	GE	GE183PK401SL	GE	MJ333	MJ
.039	BG393	BG	GF393	GF	GF223	GF	MK393	MK
.047	BH473	BH	GG473	GG	GG273	GG	ML473	ML
.056	GE563PK101SL	GE	GH563	GH	GH333	GH	MN563	MN
.068	GF683	GF	GJ683	GJ	GJ393	GJ	MR683	MR
.082	GG823	GG	GK823	GK	GK473	GK	RP823PK631SN	RP
.10	GH104	GH	MI104PK251SF	MI	MI563PK401SF	MI	RS104	RS
.12	GJ124	GJ	MJ124	MJ	MJ683	MJ	RV124	RV
.15	GK154	GK	MK154	MK	MK823	MK	RX154	RX
.18	MI184PK101SF	MI	ML184	ML	ML104	ML		
.22	MJ224	MJ	MN224	MN	MN124	MN		
.27	MK274	MK	MR274	MR	MR154	MR		
.33	ML334	ML	RP334PK251SN	RP	RP184PK401SN	RP		
.39	MN394	MN	RS394	RS	RS224	RS		
.47	MR474	MR	RV474	RV	RV274	RV		
.56	RP564PK101SN	RP	RX564	RX	RX334	RX		
.68	RS684	RS	RY684	RY				
.82	RU824	RU						
1.0	RX105	RX						

OUTLINE DRAWING (ALL DIMENSIONS IN INCHES)



CRIMP B:
For #22 AWG .098±.02,
for #20 AWG .134±.02.

Standard Tolerance is K ±10%

"SHORT CRIMP LEADS ONLY"

TYPICAL MARKING EXAMPLE

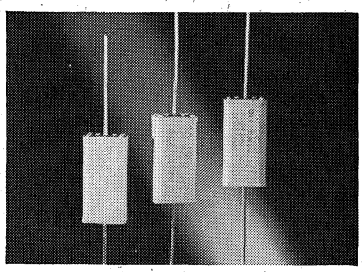
RATED CAP. (pF OR μF) AND TOL.	1 μF 10% (OR K)
VOLTAGE (DC)	100V
CODE FOR DIELECTRIC	KT
MANUFACTURER'S NAME	PHILIPS

CASE SIZE TABLE

CASE SIZE CODE	"L" LENGTH INCHES	"L" LENGTH MM	"H" HEIGHT INCHES	"H" HEIGHT MM	"T" THICKNESS INCHES	"T" THICKNESS MM	"S" LEAD SPACING INCHES	"S" LEAD SPACING MM	LEAD SIZE AWG
BC	.532	13.5	.473	12.0	.177	4.5	.400	10.16	22
BD	.532	13.5	.493	12.5	.197	5.0	.400	10.16	22
BE	.532	13.5	.512	13.0	.217	5.5	.400	10.16	22
BF	.532	13.5	.531	13.5	.236	6.0	.400	10.16	22
BG	.532	13.5	.552	14.0	.256	6.5	.400	10.16	22
BH	.532	13.5	.571	14.5	.276	7.0	.400	10.16	22
GE	.748	19.0	.552	14.0	.217	5.5	.600	15.24	20
GF	.748	19.0	.571	14.5	.236	6.0	.600	15.24	20
GG	.748	19.0	.591	15.0	.256	6.5	.600	15.24	20
GH	.748	19.0	.611	15.5	.276	7.0	.600	15.24	20
GJ	.748	19.0	.630	16.0	.296	7.5	.600	15.24	20
GK	.748	19.0	.650	16.5	.315	8.0	.600	15.24	20
MI	1.063	27.0	.709	18.0	.296	7.5	.900	22.86	20
MJ	1.063	27.0	.728	18.5	.296	7.5	.900	22.86	20
MK	1.063	27.0	.768	19.5	.315	8.0	.900	22.86	20
ML	1.063	27.0	.788	20.0	.334	8.5	.900	22.86	20
MN	1.063	27.0	.827	21.0	.374	9.5	.900	22.86	20
MR	1.063	27.0	.867	22.0	.413	10.5	.900	22.86	20
RP	1.26	32.0	.847	21.5	.394	10.0	1.10	27.94	20
RS	1.26	32.0	.886	22.5	.433	11.0	1.10	27.94	20
RV	1.26	32.0	.926	23.5	.473	12.0	1.10	27.94	20
RX	1.26	32.0	.985	25.0	.531	13.5	1.10	27.94	20
RY	1.26	32.0	1.044	26.5	.591	15.0	1.10	27.94	20

SERIES 701A1 (TYPE MKT)

Metalized Polyester Capacitors (12NC2222-341)



DESCRIPTION

Series 701A1 metalized polyester (polyethylene terephthalate) dielectric resistance welded with solder coated wire leads encased in a flame retardant yellow polypropylene molded case material used to provide ample insulation for high voltage circuits in close configurations, which is unaffected by operation over a broad range of temperature.

FEATURES

Electrical

- Maximum pulse load

rated voltage V	maximum pulse load (V/μs)			
	L = 14,5 mm	L = 18 mm	L = 23,5 mm	L = 31 mm
100	30	13	7,5	4,5
250	45	18	12	7
400	70	30	18	11
630	100	45	25	15
1000		45	40	20

The maximum pulse load values in the table are valid for pulse voltages equal to the rated voltage.

For lower pulse voltages the given values may be multiplied by U_R/applied voltage.

Note
If the pulse load requirement is satisfied, a check must be made to ascertain that the maximum dissipation is not exceeded.

- Insulation resistance
  The insulation resistance is measured after a voltage of 100 ±15 has been applied for 1 min. ±5 s, at T_{amb} = 20°C.
  R between terminations, for $C_R \leq 0{,}33\mu F$
  100 V version >15,000MΩ
  250 V and 400 V versions >30,000MΩ
  RC between terminations, for $C_R > 0{,}33\mu F$
  100 V version > 5,000s
  250 V and 400 V versions >10,000s
  R between interconnected terminations and case (foil method) >30,000MΩ
- Rated capacitance range—0.0082 to 6.8 μF
- Tolerance on rated capacitance—±10%, ±5%
- Climatic category—55/100/56
- Related specification—IEC384-6
- Dielectric Withstanding—160% x rated (VDC) terminal to terminal. 200% x rated (VDC) terminal to case.
- Dissipation Factor

capacitance	DISSIPATION FACTOR		
	1 kHz	10 kHz	100 kHz
$C_R \leq 0{,}1\ \mu F$	$\leq 30 \times 10^{-4}$	$\leq 60 \times 10^{-4}$	$\leq 130 \times 10^{-4}$
$0{,}1\mu F < C_R \leq 0{,}1\ \mu F$	$\leq 30 \times 10^{-4}$	$\leq 60 \times 10^{-4}$	
$C_R > 0{,}1\ \mu F$	$\leq 30 \times 10^{-4}$	$\leq 75 \times 10^{-4}$	

- Maximum Capacitance Change with Temp.
  @ −55°C −5%
  @ +85°C +4%
- Standard Voltage Ratings—100, 250, & 400 VDC @ +85°C
- Storage Temperature Range −40°C to +100°C

Mechanical

- Resistance to soldering heat with pre-heating Capacitors mounted on a 1,6 mm board with non-plated holes
  Body temp.: 80°C
  Bath temp.: 260°C
  Dwell time: 5 s.
- High Capacitance/Volume Ratio
- High Insulation between circuit element
- Precisely Dimensioned Rectangular Case.
- Self-healing
- Solvent Resistance
- Suitable for both point to point wiring and PC board insertion.
- Lead strength—5 lb. pull
- Solderability—tested in accordance with MIL-STD-202, Method 208.
- Storage temperature −40°C to +100°C

HOW TO SPECIFY

Mepco/Centralab Series 701A1 Capacitors can be completely specified using the following designation:

701A1 — M/C Series
EA — Case Size
104P — Capacitance in (pF): First two digits represent significant figures and last digit indicates the number of zeros to follow.
K — J = ± 5%; K = ±10% STANDARD
101 — Voltage at 85°C: 101 = 100V; 251 = 250V; 401 = 400V
SX — Specification: S = Standard; X = Axial Lead

4 Film Capacitors

SERIES 701A1

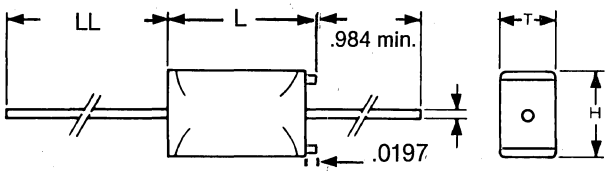
Metalized Polyester Capacitors

701A1 SERIES

CAP VALUE UF	100VDC (63VAC RMS) MEPCO/CENTRALAB PART NUMBER*	CASE SIZES	250VDC (160VAC RMS) MEPCO/CENTRALAB PART NUMBER*	CASE CODE	400VDC (220VAC RMS) MEPCO/CENTRALAB PART NUMBER*	CASE CODE
.0082					701A1EA822P*401SX	EA
.010					EA103	EA
.012	FOR THESE		FOR THESE		EA123	EA
.015	RATINGS USE THE		RATINGS USE THE		EA153	EA
.018	CORRESPONDING		CORRESPONDING		EA183	EA
.022	HIGHER VOLTAGE		HIGHER VOLTAGE		EA223	EA
.027	LEVEL.		LEVEL.		EA273	EA
.033					EA333	EA
.039			701A1EA393P*251SX	EA	EC393	EC
.047			EA473	EA	EC473	EC
.056			EA563	EA	701A1HD563P*401SX	HD
.068			EA683	EA	HD683	HD
.082	701A1EA823P*101SX	EA	EB823	EB	HE823	HE
.10	EA104	EA	EB104	EB	HE104	HE
.12	EA124	EA	701A1HD124P*251SX	HD	701A1LF124P*401SX	LF
.15	EA154	EA	HD154	HD	LF154	LF
.18	EA184	EA	HD184	HD	LG184	LG
.22	EA224	EA	HD224	HD	LG224	LG
.27	EB274	EB	701A1LF274P*251SX	LF	LH274	LH
.33	701A1HD334P*101SX	HD	LF334	LF	LH334	LH
.39	HD394	HD	LF394	LF	701A1SJ394P*401SX	SJ
.47	HD474	HD	LF474	LF	SJ474	SJ
.56	HE564	HE	LG564	LG	SK564	SK
.68	701A1LF684P*101SX	LF	LG684	LG	SK684	SK
.82	LF824	LF	701A1SJ824P*251SX	SJ	SL824	SL
1.0	LG105	LG	SJ105	SJ	SL105	SL
1.2	LG125	LG	SJ125	SJ		
1.5	LH155	LH	SK155	SK		
1.8	LH185	LH	SK185	SK		
2.2	701A1SJ225P*101SX	SJ	SK225	SK		
2.7	SJ275	SJ				
3.3	SK335	SK				
3.9	SK395	SK				
4.7	SK475	SK				
5.6	SL565	SL				
6.8	SL685	SL				

*Insert appropriate letter into part number for tolerance J = ±5% K = ±10% STANDARD

OUTLINE DRAWING



NOTICE: MISAPPLICATION SUCH AS EXCEEDING DESIGN LIMITS MAY RESULT IN DESTRUCTION OR EXPLOSION OF CAPACITORS.

TYPICAL MARKING EXAMPLE

—SIDE ONE—

pF or UF/Tolerance/ Rated Voltage DC	0.15/10/100
Philips Type No.	341
Code for Dielectric	MKT
Date Code (IEC 62, Clause 5)	V6

—SIDE TWO—

Philips Code for Factory of Origin

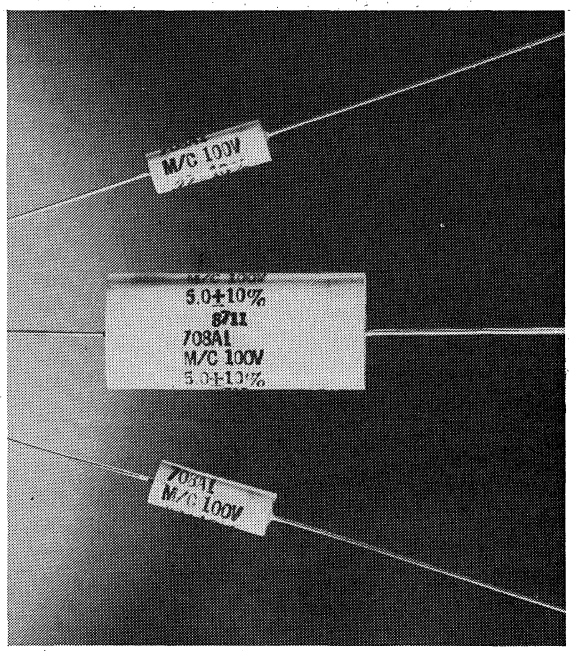
AVAILABLE BULK ONLY.

CASE SIZE TABLE

CASE SIZE CODE	"L" LENGTH INCHES	"L" LENGTH MM	"H" HEIGHT INCHES	"H" HEIGHT MM	"T" THICKNESS INCHES	"T" THICKNESS MM	LEAD SIZE AWG	"LL" LEAD LENGTH INCHES	"LL" LEAD LENGTH MM
EA	.575	14.6	.347	8.8	.200	5.1	20	1.575	40
EB	.575	14.6	.374	9.5	.225	5.7	20	1.575	40
EC	.575	14.6	.418	10.6	.276	7	20	1.575	40
HD	.713	18.1	.409	10.4	.260	6.6	20	1.575	40
HE	.713	18.1	.453	11.5	.311	7.9	20	1.575	40
LF	.925	23.5	.457	11.6	.307	7.8	20	1.575	40
LG	.925	23.5	.508	12.9	.362	9.2	20	1.575	40
LH	.925	23.5	.571	14.5	.426	10.8	20	1.575	40
SJ	1.22	31	.575	14.6	.422	10.7	18	1.970	50
SK	1.22	31	.768	19.5	.488	12.5	18	1.970	50
SL	1.22	31	.871	22.1	.607	15.4	18	1.970	50

SERIES 708A1

Metalized Polyester Capacitor



DESCRIPTION

Series 708A1 metalized polyester (polyethylene terephthalate) dielectric wrapped with tape and potted in a flat oval configuration with resistance welded tinned copper clad steel leads.

FEATURES

Electrical

- Dielectric Withstanding—200% x rated (VDC) for one sec.
- Dissipation Factor @ 25°C ≤1.0% @ 1KHz
- Insulation Resistance @ 25°C 15000Ω x MFD min.
- Maximum Capacitance change with temp.
  @ −55°C −5%
  @ +85°C +10%
  @ +125°C +20%
- Standard voltage ratings—100 & 200VDC @ −55°C to +85°C operation at temperatures to 125°C with proper voltage derating.
- Voltage derating @ 125°C is 50% of rated voltage.

Mechanical

- Small size
- Flat—space saving configuration
- Long trouble-free life
- Self-healing
- Solvent resistance
- Lead strength—5 lb. pull

HOW TO SPECIFY

Mepco/Centralab Series 708A1 Capacitors can be completely specified using the following designation:

708A1 — **M/C Series**

JJ — **Case Size**

104P — **Capacitance in (pF)**
First two digits represent significant figures and last digit indicates the number of zeros to follow.

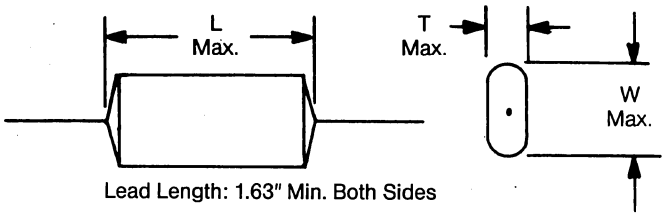
K — **Tolerance**
J=± 5%
K=±10%

201 — **Voltage at 85°C**
101=100V
201=200V

SERIES 708A1

Metalized Polyester Capacitor

OUTLINE DRAWING



Lead Length: 1.63" Min. Both Sides

TYPICAL MARKING EXAMPLE	
Mepco/Centralab rated voltage (DC)	M/C 100V
Type	708A1
Nominal Capacitance (UF) Tol.	.10 ±10%

708A1 SERIES

100VDC AT 85°C						
			MAXIMUM DIMENSIONS IN INCHES			
CAP VALUE UF	MEPCO/CENTRALAB PART NUMBER*	CASE SIZE	"L" LENGTH INCHES	"W" WIDTH INCHES	"T" THICKNESS INCHES	LEAD AWG.
.10	708A1JC104P*101AX	JC	.656	.311	.195	22
.15	JG154	JG	.656	.358	218	22
.22	OB224	OB	.782	.311	171	22
.33	OG334	OG	.782	.358	218	22
.47	OJ474	OJ	.782	.374	.249	22
.68	OO684	OO	.782	.421	.311	22
1.0	VL105	VL	.906	.452	.280	22
1.5	ZR155	ZR	1.031	.530	.327	20
2.0	ZV205	ZV	1.031	.593	.374	20
3.0	JZ305	JZ	1.344	.624	.405	20
4.0	RV405	RV	1.594	.718	.374	20
5.0	RC505	RC	1.594	.765	.436	20
8.0	ZG805	ZG	1.844	.905	.483	20
10.0	Z0106	ZO	1.844	.983	.577	20

200VDC AT 85°C						
			MAXIMUM DIMENSIONS IN INCHES			
CAP VALUE UF	MEPCO/CENTRALAB PART NUMBER*	CASE SIZE	"L" LENGTH INCHES	"W" WIDTH INCHES	"T" THICKNESS	LEAD AWG.
.10	708A1JJ104P*201AX	JJ	.656	.374	.249	22
.15	JO154	JO	.656	.436	311	22
.22	OL224	OL	.782	.421	.280	22
.33	OR334	OR	.782	.514	.327	20
.47	OX474	OX	.782	.577	.389	20
.68	ZV684	ZV	1.031	.577	.374	20
1.0	ZC105	ZC	1.031	.640	.436	20
1.5	JD155	JD	1.344	.640	.452	20
2.0	JD205	JD	1.344	.780	.452	20
3.0	RI305	RI	1.594	.827	.499	20
4.0	RM405	RM	1.594	.952	.546	20
5.0	ZO505	ZO	1.844	.968	.577	20
8.0	CE805	CE	1.906	1.249	.749	18
10.0	CF106	CF	1.906	1.265	.812	18

* INSERT APPROPRIATE LETTER PART NUMBER FOR TOLERANCE:

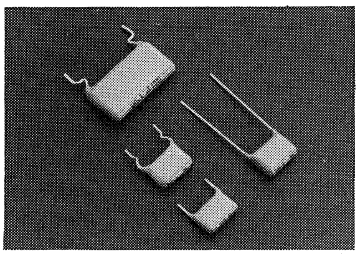
J = ± 5%
K = ±10% STANDARD

AVAILABLE BULK ONLY.

NOTICE: MISAPPLICATION SUCH AS EXCEEDING DESIGN LIMITS MAY RESULT IN DESTRUCTION OR EXPLOSION OF CAPACITORS.

SERIES 712A1 (TYPE MKT)

Metalized Polyester Capacitors (12 NC NO.-2222-365 thru 369)



DESCRIPTION

Series 712A1 Metalized Polyester (Polyethylene Terephthalate) Film Dielectric encapsulated in a hard epoxy case with solder coated wire leads. Their high ratio of capacitance to volume affords an inherently high packaging density and excellent compatability with PC board assembly.

APPLICATIONS

For general purpose and industrial use in electronic equipment, e.g., for coupling and decoupling applications.

FEATURES

Electrical

- Rated Capacitance Range—.001 to 6.8μF
- Climatic Category—40/100/56
- Related Specification—IEC 384-2
- Dielectric Withstanding—160% x rated (VDC) terminal to terminal. 200% x rated (VDC) between interconnected terminals and case.
- Dissipation Factor

capacitance	frequency		
	1 kHz	10 kHz	100 kHz
$C \leq 0{,}1\,\mu F$	$\leq 75 \times 10^{-4}$	$\leq 130 \times 10^{-4}$	$\leq 225 \times 10^{-4}$
$0{,}1\,\mu F < C \leq 0{,}47\,\mu F$	$\leq 75 \times 10^{-4}$	$\leq 130 \times 10^{-4}$	$\leq 300 \times 10^{-4}$
$0{,}47\,\mu F < C \leq 1\,\mu F$	$\leq 75 \times 10^{-4}$	$\leq 130 \times 10^{-4}$	
$C > 1\,\mu F$	$\leq 75 \times 10^{-4}$	$\leq 150 \times 10^{-4}$	

- Insulation resistance—
  The insulation resistance is measured after a voltage has been applied for 1 min. ±5 s, the voltage being 10±1V for the 63V version, 100 ±15V for the 100V, 250V and 400V versions and 500 ±50V for the 630V version at T_{amb} = 20°C.

  R between terminations, for $C_R \leq 0{,}33\,\mu F$
  63V and 100V versions >15,000MΩ
  250V, 400V and 630V versions >30,000MΩ

  RC between terminations, for $C_R > 0{,}33\,\mu F$
  63V and 100V versions > 5,000s
  250V, 400V and 630V versions >10,000s

  R between interconnected terminations and case (foil method) >30,000MΩ

- Maximum Capacitance Change with Temp.
  @ −55°C −5%
  @ +85°C +4%
- Standard Voltage Ratings—63, 100, 250, 400 & 630VDC @ +85°C
- Storage Temperature Range −40°C to +100°C

Maximum pulse load

rated voltage V	maximum pulse load V/μs					
	L=7,5 mm	L=10 mm	L=12,5 mm	L=17,5 mm	L=26 mm	L=30 mm
63	30	17				
100	55	18	24	10	4	3,5
250		35	35	14	6	5
400		95	55	22	10	8
630			80	35	14	12

The maximum pulse load values in the table are valid for pulse voltages equal to the rated voltage. For lower pulse voltages the given values may be multiplied by U_R/applied voltage.

Note:
If the pulse requirement is satisfied, a check must be made to ascertain that the maximum dissipation is not exceeded.

Mechanical

- Very low cost
- Self-healing
- The body will withstand most solvent and aqueous liquids
- Long trouble-free life
- Tape & reel available (.200" (5mm) lead spacing)
- Strong lead pull and bend capability
- Lead Solderability—tested in accordance with MIL-STD-202, Method 208.
- Resistance to soldering heat with pre-heating capacitors mounted on a 1.6 mm board with non-plated holes.
  Body Temp.: 80°C
  Bath Temp.: 260°C
  Dwell Time: 2 x 5 s with interim free period of 5 s

SERIES 712A1

Metalized Polyester Capacitors

HOW TO SPECIFY

Mepco/Centralab Series 712A1 capacitors can be completely specified using the following designation:

712A1 — **M/C Series** (Epoxy Coated)

BD — **Case Size**

104P — **Capacitance in (pF)**
First two digits represent significant figures and last digit indicates the number of zeros to follow.

K — **Tolerance**
M=±20%
K = ±10% STANDARD
J = ± 5% SPECIAL

251 — **Voltage at 85°C**

630=63V
101=100V
251=250V
401=400V
631=630V

# — Specification
L=Long Lead (bulk)
S=Short Lead (bulk)
T=Tape & Reel
A=Ammo Pack

K — **Lead Configuration**

Lead Spacing	Crimp Code	Straight Code
.200	G	S
.300	H	T
.400	K	A
.600	L	B*
.900	F	D*
1.100	N	E*

*Not released; special only. Contact factory for information.

SEE PAGE 466 FOR TAPE & REEL SPECIFICATIONS.

Note: # denotes lead length, tape & reel or ammo pack.

Factory Code=2222-365/366/367/368/369

LEAD SPACING (Inches)	DIMENSIONS of CRIMP "A"	
	CRIMP A Inches	CRIMP A mm
.200	.055/.079	1.4/2.0
.300	.059/.098	1.5/2.5
.400	.059/.118	1.5/3.0
.600	.078/.154	2.0/3.9
.900	.078/.154	2.0/3.9
1.100	.078/.154	2.0/3.9

DIMENSIONS OF EPOXY CREEPAGE "C" ON STRAIGHT LEADS

.200, .300, and .400 Lead Spacings
≤1.5 mm (.059 inch)

.600, .900 and 1.10 Lead Spacings
Special Only—Not Released
≤3 or 5 mm (.118 or .197 inch)
Contact factory for information.

LEAD LENGTH VS PART NUMBER CODE

As part number codes are very important in description, the following table is presented for reference:

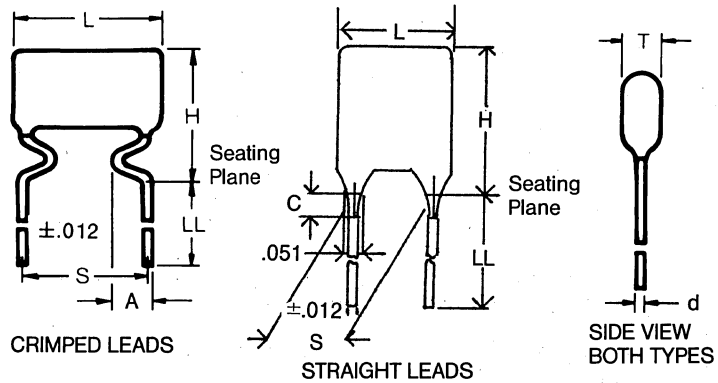
LEAD SPACING	CRIMP CODE		STRAIGHT CODE	
INCHES (mm)	SHORT	LONG	SHORT	LONG
0.200 (5.08)	SG	LG	SS	LS
0.300 (7.62)	SH	LH	ST	LT
0.400 (10.16)	SK	LK	SA	LA
0.600 (15.24)	SL	LL	SB*	LB*
0.900 (22.86)	SF	LF	SD*	LD*
0.10 (27.94)	SN	LN	SE*	LE*

*Not released. Special only. Contact factory for information. Minimums will apply.

LEAD LENGTH

CUT & FORM	STRAIGHT
Short = 5 ± 1 mm (.157/.236 in)	Short = 5 ± 1 mm (.157/.236 in.)
.400 & .600 Spacing Long = 17 ± 4 mm (.512/.826 in.)	Long = 22 ± 4 mm (.708/1.02 in.)
.900 Spacing Long = 25 ± 4 mm (.826/1.14 in.)	
1.10 Spacing Long = 24 ± 4 mm (.787/1.10 in.)	

CASE OUTLINE DRAWING All Dimensions in Inches (mm)



*LL [Long Leads (.512/.827)]

(Also Available upon Special Request)

NOTICE: MISAPPLICATION SUCH AS EXCEEDING DESIGN LIMITS MAY RESULT IN DESTRUCTION OR EXPLOSION OF CAPACITORS.

SERIES 712A1

Metalized Polyester Capacitors

TYPICAL MARKING EXAMPLE (TOP VIEW)

MANUFACTURER

CAP (PF OR UF) TOLERANCE CODE

VOLTAGE (DC) DIELECTRIC CODE

(.400 & LARGER LEAD SPACING)

PHILIPS 0.1 K MKT □ CODE OF ORIGIN

250

CAP (PF OR UF) TOLERANCE CODE

VOLTAGE (DC) DIELECTRIC CODE

(.200 OR .300 LEAD SPACINGS)

0.1 K

250 MKT

CAP (PF OR UF)

TOL. CODE VOLTAGE (DC)

(.200 LEAD SPACINGS)

0.047

K 63

CASE SIZE TABLE
DIMENSIONS IN INCHES (mm) MAXIMUM

CASE SIZE CODE	"L" LENGTH INCHES	(mm)	"H" HEIGHT INCHES CUT/FORM INCHES	(mm)	STRAIGHT INCHES	(mm)	"T" THICKNESS INCHES	(mm)	"S" SPACING INCHES	(mm)	"D" WIRE DIA. LEAD SIZE AWG	INCHES
".200 INCH LEAD SPACING" (2e)												
XA	.295	7.5	.492	12.5	.295	7.5	.138	3.5	.200	5.08	22	.025
XC	.295	7.5	.531	13.5	.335	8.5	.177	4.5	.200	5.08	22	.025
XE	.295	7.5	.571	14.5	.413	10.5	.217	5.5	.200	5.08	22	.025
XF	.295	7.5	.610	15.5	.453	11.5	.236	6.0	.200	5.08	22	.025
".200 INCH LEAD SPACING" (2e-3e)												
AB	.394	10.0	.531	13.5	.315	8.0	.157	4.0	.200	5	22	.025
AC	.413	10.5	.551	14.0	.335	8.5	.177	4.5	.200	5	22	.025
AD	.413	10.5	.571	14.5	.354	9.0	.197	5.0	.200	5	22	.025
AE	.413	10.5	.591	15.0	.374	9.5	.217	5.5	.200	5	22	.025
AF	.413	10.5	.610	15.5	.413	10.5	.236	6.0	.200	5	22	.025
".300 INCH LEAD SPACING" (3e)												
AB	.394	10.0	.472	12.0	.335	8.5	.157	4.0	.300	7.62	22	.025
AC	.413	10.5	.512	13.0	.355	9.0	.177	4.5	.300	7.62	22	.025
AD	.413	10.5	.531	13.5	.374	9.5	.197	5.0	.300	7.62	22	.025
AE	.413	10.5	.551	14.0	.394	10.0	.217	5.5	.300	7.62	22	.025
AF	.413	10.5	.571	14.5	.413	10.5	.236	6.0	.300	7.62	22	.025
AG	.413	10.5	.591	15.0	.453	11.5	.236	6.0	.300	7.62	22	.025
".400 INCH LEAD SPACING"												
BB	.492	12.5	.472	12.0	.374	9.5	.157	4.0	.400	10.16	22	.025
BC	.492	12.5	.492	12.5	.394	10.0	.177	4.5	.400	10.16	22	.025
BD	.492	12.5	.512	13.0	.413	10.5	.197	5.0	.400	10.16	22	.025
BE	.492	12.5	.531	13.5	.433	11.0	.217	5.5	.400	10.16	22	.025
BF	.492	12.5	.551	14.0	.492	12.5	.236	6.0	.400	10.16	22	.025
BG	.492	12.5	.571	14.5	.473	12.0	.256	6.5	.400	10.16	22	.025
".600 INCH LEAD SPACING"												
GD	.689	17.5	.551	14.0	*Not released		.197	5.0	.600	15.24	20	.032
GE	.689	17.5	.571	14.5	only specials		.217	5.5	.600	15.24	20	.032
GF	.689	17.5	.591	15.0	with 5mm		.236	6.0	.600	15.24	20	.032
GG	.689	17.5	.630	16.0	creepage on		.256	6.5	.600	15.24	20	.032
GH	.689	17.5	.630	16.0	leads. Con-		.276	7.0	.600	15.24	20	.032
GJ	.689	17.5	.650	16.5	tact factory		.295	7.5	.600	15.24	20	.032
GK	.689	17.5	.669	17.0	for additional		.315	8.0	.600	15.24	20	.032
GL	.689	17.5	.689	17.5	info.		.335	7.5	.600	15.24	20	.032
".900 INCH LEAD SPACING"												
MD	1.02	26	.669	17.0			.197	5.0	.900	22.86	20	.032
ME	1.02	26	.689	17.5	*Not released		.217	5.5	.900	22.86	20	.032
MF	1.02	26	.709	18.0	only specials		.236	6.0	.900	22.86	20	.032
MG	1.02	26	.728	18.5	with 5mm		.256	6.5	.900	22.86	20	.032
MH	1.02	26	.748	19.0	creepage on		.276	7.0	.900	22.86	20	.032
MJ	1.02	26	.768	19.5	leads. Con-		.295	7.5	.900	22.86	20	.032
MK	1.02	26	.788	20.0	tact factory		.315	8.0	.900	22.86	20	.032
ML	1.02	26	.807	20.5	for additional		.335	8.5	.900	22.86	20	.032
MM	1.02	26	.846	21.5	info.		.374	9.5	.900	22.86	20	.032
"1.100 INCH LEAD SPACING"												
RJ	1.18	30	.768	19.5	*Not released		.295	7.5	1.100	27.94	20	.032
RK	1.18	30	.788	20.0	only specials		.315	8.0	1.100	27.94	20	.032
RL	1.18	30	.807	20.5	with 5mm		.335	8.5	1.100	27.94	20	.032
RN	1.18	30	.846	21.5	creepage on		.374	9.5	1.100	27.94	20	.032
RR	1.18	30	.866	22.0	leads. Con-		.394	10.0	1.100	27.94	20	.032
RS	1.18	30	.905	23.0	tact factory		.433	11.0	1.100	27.94	20	.032
RU	1.18	30	.945	24.0	for additional		.473	12.0	1.100	27.94	20	.032
RX	1.18	30	.984	25.0	info.		.512	13.0	1.100	27.94	20	.032

SERIES 712A1

Metalized Polyester Capacitors

63 VDC (40 VAC RMS)

CAP UF	MEPCO/CENTRALAB PART NUMBER	
	.200 SPACING (2e)	
.047	712A1XA473P*630	#G
.056	XA563	#G
.068	XA683	#G
.082	XA823	#G
.10	XA104	#G
.12	XA124	#G
.15	XC154	#G
.18	XC184	#G
.22	XC224	#G
.27	XE274	#G
.33	XE334	#G
.39	XE394	#G
.47	XF474	#G
.56	XF564	#G
.68	XF684	#G
.82	XF824	#G
1.0	XG105	#G
	.200 SPACING (2e 3e)	
.12	712A1AB124P*630	#G
.15	AB154	#G
.18	AB184	#G
.22	AB224	#G
.27	AC274	#G
.33	AD334	#G
.39	AD394	#G
.47	AE474	#G
.56	AE564	#G
.68	AE684	#G
.82	AE824	#G
1.0	AE105	#G
	.300 SPACING	
.12	712A1AB124P*630	SH
.15	AB154	SH
.18	AB184	SH
.22	AB224	SH
.27	AC274	SH
.33	AD334	SH
.39	AD394	SH
.47	AE474	SH
.56	AG564	SH
.68	AG684	SH
.82	AG824	SH
1.0	AG105	SH

100 VDC (63 VAC RMS)

CAP UF	MEPCO/CENTRALAB PART NUMBER	
	.200 SPACING (2e)	
.010	712A1XA103P*101	#G
.012	XA123	#G
.015	XA153	#G
.018	XA183	#G
.022	XA223	#G
.027	XA273	#G
.033	XA333	#G
.039	XA393	#G
.047	XC473	#G
.056	XC563	#G
.068	XC683	#G
.082	XC823	#G
.10	XC104	#G
	.200 SPACING (2e 3e)	
.039	712A1AB393P*101	#G
.047	AB473	#G
.056	AB563	#G
.068	AB683	#G
.082	AB823	#G
.10	AB104	#G
.12	AC124	#G
.15	AD154	#G
.18	AD184	#G
.22	AE224	#G
.27	AF274	#G
.33	AF334	#G
.39	AF394	#G
.47	AF474	#G
	.300 SPACING	
.039	712A1AB393P*101	SH
.047	AB473	SH
.056	AB563	SH
.068	AB683	SH
.082	AB823	SH
.10	AB104	SH
.12	AC124	SH
.15	AD154	SH
.18	AD184	SH
.22	AE224	SH
.27	AF274	SH
.33	AG334	SH
.39	AG394	SH
.47	AG474	SH
	.400 SPACING	
.056	712A1BB563P*101	SK
.068	BB683	SK
.082	BB823	SK
.10	BB104	SK
.12	BB124	SK
.15	BB154	SK
.18	BC184	SK
.22	BD224	SK
	.600 SPACING	
.27	712A1GD274P*101	SL
.33	GD334	SL
.39	GD394	SL
.47	GE474	SL
.56	GE564	SL
.68	GF684	SL
.82	GG824	SL
1.0	GJ105	SL
	.900 SPACING	
1.2	712A1MF125P*101	SF
1.5	MF155	SF
1.8	MF185	SF
2.2	MG225	SF
2.7	MJ275	SF
3.3	ML335	SF
	1.10 SPACING	
3.9	712A1RL395P*101	SN
4.7	RN475	SN
5.6	RS565	SN
6.8	RU685	SN

250 VDC (160 VAC RMS)

CAP UF	MEPCO/CENTRALAB PART NUMBER	
	.200 SPACING (2e 3e)	
.018	712A1AB183P*251	#G
.022	AB223	#G
.027	AB273	#G
.033	AB333	#G
.039	AB393	#G
.047	AC473	#G
	.300 SPACING	
.018	712A1AB183P*251	SH
.022	AB223	SH
.027	AB273	SH
.033	AB333	SH
.039	AB393	SH
.047	AB473	SH
	.400 SPACING	
.027	712A1BB273P*251	SK
.033	BB333	SK
.039	BB393	SK
.047	BB473	SK
.056	BC563	SK
.068	BC683	SK
.082	BD823	SK
.10	BD104	SK
	.600 SPACING	
.12	712A1GD124P*251	SL
.15	GD154	SL
.18	GE184	SL
.22	GF224	SL
.27	GG274	SL
.33	GH334	SL
	.900 SPACING	
.39	712A1MD394P*251	SF
.47	ME474	SF
.56	MF564	SF
.68	MG684	SF
.82	MH824	SF
1.0	MJ105	SF
	1.10 SPACING	
1.2	712A1RJ125P*251	SN
1.5	RL155	SN
1.8	RN185	SN
2.2	RS225	SN

400 VDC (220 VAC RMS)

CAP UF	MEPCO/CENTRALAB PART NUMBER	
	.200 SPACING (2e 3e)	
.0039	712A1AB392P*401	#G
.0047	AB472	#G
.0056	AB562	#G
.0068	AB682	#G
.0082	AB822	#G
.010	AB103	#G
.012	AB123	#G
.015	AB153	#G
	.300 SPACING	
.0039	712A1AB392P*401	SH
.0047	AB472	SH
.0056	AB562	SH
.0068	AB682	SH
.0082	AB822	SH
.010	AB103	SH
.012	AB123	SH
.015	AB153	SH
	.400 SPACING	
.0010	712A1BB102P*401	SK
.0012	BB122	SK
.0015	BB152	SK
.0018	BB182	SK
.0022	BB222	SK
.0027	BB272	SK
.0033	BB332	SK
.0039	BB392	SK
.0047	BB472	SK
.0056	BB562	SK
.0068	BB682	SK
.0082	BB822	SK
.010	BB103	SK
.012	BB123	SK
.015	BB153	SK
.018	BB183	SK
.022	BB223	SK
.027	BC273	SK
.033	BC333	SK
	.600 SPACING	
.039	712A1GD393P*401	SL
.047	GD473	SL
.056	GD563	SL
.068	GD683	SL
.082	GE823	SL
.10	GF104	SL
.12	GG124	SL
.15	GH154	SL
	.900 SPACING	
.18	712A1MD184P*401	SF
.22	ME224	SF
.27	MF274	SF
.33	MG334	SF
.39	MH394	SF
.47	MK474	SF
	1.10 SPACING	
.56	712A1RK564P*401	SN
.68	RL684	SN
.82	RN824	SN
1.0	RS105	SN

630 VDC (220 VAC RMS)

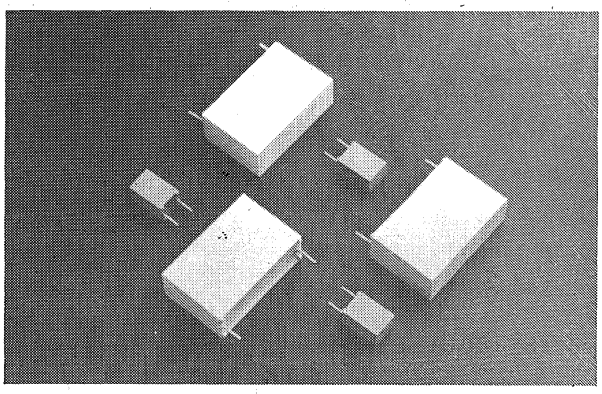
CAP UF	MEPCO/CENTRALAB PART NUMBER	
	.400 SPACING	
.010	712A1BD103P*631	SK
.012	BD123	SK
.015	BE153	SK
.018	BF183	SK
.022	BG223	SK
	.600 SPACING	
.027	712A1GE273P*631	SL
.033	GF333	SL
.039	GG393	SL
.047	GH473	SL
.056	GJ563	SL
.068	GK683	SL
	.900 SPACING	
.082	712A1ME823P*631	SF
.10	MF104	SF
.12	MH124	SF
.15	MJ154	SF
.18	ML184	SF
.22	MM224	SF
	1.10 SPACING	
.27	712A1RR274P*631	SN
.33	RR334	SN
.39	RS394	SN
.47	RU474	SN

SERIES 719A1 (TYPE MKT)

Metalized Polyester Capacitors (12 NC 2222-344, 370 & 371)

DESCRIPTION

Nugget Series 719A1 metalized polyester (polyethylene terephthalate) dielectric encased in a rectangular epoxy encapsulated flame retardant polypropylene case with sturdy solder coated terminal pins, they lend themselves readily to insertion into printed circuit cards, motherboards, and similar modular assemblies.



FEATURES

Electrical

- Rated capacitance range .0039 to 10 μf
- Climatic category 55/100/56
- Related specification IEC 384-2
- Dielectric Withstanding—160% x rated (VDC) terminal to terminal. 200% x rated (VDC) between interconnected terminals and case.
- Maximum pulse load

rated voltage V	maximum pulse load (V/μs)					
	L=7,2 mm	L=10 mm	L=13 mm	L=17,5 mm	L=26 mm	L=31 mm
63	55	17	15	6	3	2
100	90	30	24	10	4	3,5
250		60	35	14	6	5
400		95	55	22	10	8

The maximum pulse load values in the table are valid for pulse voltages equal to the rated voltage. For lower pulse voltages the given values may be multiplied by the U_R/applied voltage.

Note:
If the pulse load requirement is satisfied, a check must be made to ascertain that the maximum dissipation is not exceeded.

- Dissipation Factor

style	capacitance	tangent of loss angle		
		1 kHz	10 kHz	100 kHz
2222 370 2222 371	C≤0,1 μF	≤75 x 10^{-4}	≤130 x 10^{-4}	≤200 x 10^{-4}
	0,1 μF<C≤0,47 μF	≤75 x 10^{-4}	≤130 x 10^{-4}	≤300 x 10^{-4}
	0,47 μF<C≤1 μF	≤75 x 10^{-4}	≤130 x 10^{-4}	
2222 344	C≤0,1 μF	≤75 x 10^{-4}	≤130 x 10^{-4}	≤250 x 10^{-4}
	0,1 μF<C≤1 μF	≤75 x 10^{-4}	≤130 x 10^{-4}	
	C>1 μF	≤75 x 10^{-4}	≤150 x 10^{-4}	

- Insulation resistance

The insulation resistance is measured after a voltage has been applied for 1 min ±5 s, the voltage being 10 ±1V for the 63V version and 100 ±15V for the 100V, 250V and 400V versions at Tamb = 20°C.

R between terminations, for $C_R \leq 0{,}33$ μF
63V and 100V versions >15,000 MΩ
250V and 400V versions >30,000 MΩ

RC between terminations, for $C_R > 0{,}33$ μF
63 V and 100 V versions > 5,000 s
250 V and 400 V versions >10,000 s

R between interconnected terminations and case (foil method) >30,000 MΩ

- Maximum Capacitance Change with Temp.
  @ −55°C −5%
  @ +85°C +4%
- Standard Voltage Ratings—63, 100, 250 & 400 VDC @ +85°C
- Storage Temperature Range—−55°C to 100°C

Mechanical

- Low cost
- Precisely dimensioned case—permits high package density
- Mounting feet
- Self-healing
- Lead strength—5 lb. pull
- Lead solderability—tested in accordance with MIL-STD-202, Method 208.
- Resistance to soldering heat with pre-heating capacitors mounted on a 1.6 mm board with non-plated holes.
  Body Temp.: 80°C
  Bath Temp.: 260°C
  Dwell Time: 2 x 5 s with interim free period of 5 s

SERIES 719A1
Metalized Polyester Capacitors

HOW TO SPECIFY

Mepco/Centralab Series 719A1 Capacitors can be completely specified using the following designation:

719A1 — M/C Series

GD — Case Size

104P — Capacitance In (pF)
First two digits represent significant figures and last digit indicates the number of zeros to follow.

K — Tolerance
J = ± 5%
K = ±10% STANDARD

251 — Voltage At 85°C
101=100V
251=250V
401=400V

# — Specification
L = Long Lead (bulk)
S = Short Lead (bulk)
T = Tape & Reel
A = Ammo Pack

B — Lead Configuration

Straight Lead Code	Lead Spacing
G	0.200
H	0.300
A	0.394
B	0.591
D	0.886
E	1.080

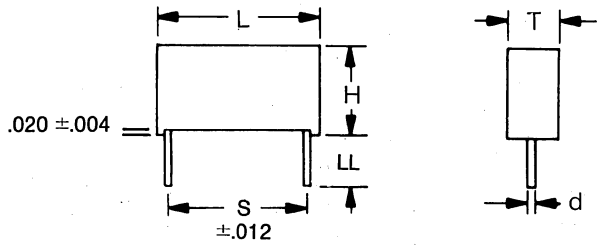
NOTE: # denotes lead length, tape & reel or ammo pack.

SEE PAGE 467 FOR TAPE & REEL SPECIFICATIONS.

"LL" LEAD LENGTH*			LEAD DIA.*
LEAD SPACING	SHORT LEAD	LONG LEAD	"d"
.200 & .300	.137 / .177	.984 / 1.063	.024
.400 & UP	.157 / .236	NOT AVAILABLE	.032

*INCHES, MIN./MAX.

OUTLINE DRAWING



"X" CASE SIZES (.200 SPACING) ARE AVAILABLE BULK, SHORT OR LONG LEADS. ALSO TAPE & REEL OR AMMO PACK IS AVAILABLE FOR "X" CASE SIZES.
"A" CASE SIZES (.300 SPACING) ARE AVAILABLE BULK, SHORT OR LONG LEADS. TAPE & REEL IS ALSO AVAILABLE FOR "A" CASE SIZES.
"C", "G", "M", AND "R" CASE SIZES ARE AVAILABLE BULK ONLY WITH SHORT LEADS.

NOTICE: MISAPPLICATION SUCH AS EXCEEDING DESIGN LIMITS MAY RESULT IN DESTRUCTION OR EXPLOSION OF CAPACITORS.

SERIES 719A1

Metalized Polyester Capacitors

CASE SIZE TABLE M/C SERIES 719A1

CASE SIZE CODE	DIMENSION IN INCHES (MM) MAXIMUM								
	"L" LENGTH		"H" LENGTH		"T" THICKNESS		"S" SPACING		LEAD SIZE
	INCHES	MM	INCHES	MM	INCHES	MM	INCHES	MM	AWG
XA	.283	7.2	.256	6.5	.098	2.5	.200	5.08	22
XB	.283	7.2	.315	8	.138	3.5	.200	5.08	22
XC	.283	7.2	.354	9	.177	4.5	.200	5.08	22
XD	.283	7.2	.394	10	.197	5	.200	5.08	22
XE	.283	7.2	.433	11	.236	6	.200	5.08	22
AX	.394	10	.256	6.5	.098	2.5	.300	7.62	22
AA	.394	10	.315	8	.118	3	.300	7.62	22
AB	.394	10	.354	9	.157	4	.300	7.62	22
AC	.394	10	.414	10.5	.197	5	.300	7.62	22
AD	.394	10	.453	11.5	.236	6	.300	7.62	22
CA	.511	13	.394	10	.177	4.5	.394	10	20
CB	.511	13	.433	11	.197	5	.394	10	20
CC	.511	13	.472	12	.236	6	.394	10	20
GD	.689	17.5	.433	11	.197	5	.591	15	20
GE	.689	17.5	.472	12	.236	6	.591	15	20
GF	.689	17.5	.511	13	.276	7	.591	15	20
GG	.689	17.5	.571	14.5	.335	8.5	.591	15	20
MH	1.02	26	.610	15.5	.256	6.5	.886	22.5	20
MJ	1.02	26	.650	16.5	.295	7.5	.886	22.5	20
MK	1.02	26	.689	17.5	.335	8.5	.886	22.5	20
ML	1.02	26	.748	19	.374	9.5	.886	22.5	20
RM	1.22	31	.788	20	.433	11	1.08	27.5	20
RN	1.22	31	.886	22.5	.511	13	1.08	27.5	20
RG	1.22	31	.984	25	.591	15	1.08	27.5	20

TYPICAL MARKING EXAMPLE
(FOR .200 & .300 LEAD SPACINGS)

TOP VIEW:

Rated Cap. (nf or μf), Tol. Code
0.10 K

SIDE VIEW:

Rated VDC	100 VDC
Code for Dielectric and	MKT
Code for Factory of Origin	
Philips Type No.	370
Manufacturer I.D.	PH
Date Code (Year & Week)	8714

(FOR .400 & LARGER LEAD SPACINGS)

(TOP VIEW)

Cap/Tolerance/Voltage (VDC)	0.10/10/250
MKT Factory Code	MKT 344 HQ
Philips Identification Symbol	

METALIZED POLYESTER "NUGGET" TYPE 719A1

63 VDC (40 VAC RMS)

CAP UF	MEPCO/CENTRALAB PART NUMBER	
	.200 SPACING	
.039	719A1XA393P*630	#G
.047	XA473	#G
.056	XA563	#G
.068	XA683	#G
.082	XA823	#G
.10	XA104	#G
.12	XB124	#G
.15	XB154	#G
.18	XB184	#G
.22	XB224	#G
.27	XC274	#G
.33	XC334	#G
.39	XD394	#G
.47	XD474	#G
.56	XE564	#G
.68	XE684	#G
.82	XE824	#G
1.0	XE105	#G
	.300 SPACING	
.056	719A1AX563P*630	#H
.068	AX683	#H
.082	AX823	#H
.10	AX104	#H
.12	AA124	#H
.15	AA154	#H
.18	AA184	#H
.22	AA224	#H
.27	AB274	#H
.33	AB334	#H
.39	AB394	#H
.47	AB474	#H
.56	AC564	#H
.68	AC684	#H
.82	AD824	#H
1.0	AD105	#H
	.394 SPACING	
.18	719A1CA184P*630	SA
.22	CA224	SA
.27	CB274	SA
.33	CB334	SA
.39	CC394	SA
.47	CC474	SA
	.591 SPACING	
.56	719A1GE564P*630	SB
.68	GE684	SB
.82	GF824	SB
1.0	GF105	SB
1.2	GG125	SB
1.5	GG155	SB
	.886 SPACING	
1.8	719A1MH185P*630	SD
2.2	MH225	SD
2.7	MK275	SD
3.3	MK335	SD
3.9	ML395	SD
4.7	ML475	SD
	1.08 SPACING	
5.6	719A1RM565P*630	SE
6.8	RM685	SE
8.2	RN825	SE
10.0	RN106	SE

100 VDC (63 VAC RMS)

CAP UF	MEPCO/CENTRALAB PART NUMBER	
	.200 SPACING	
.0039	719A1XA392P*101	#G
.0047	XA472	#G
.0056	XA562	#G
.0068	XA682	#G
.0082	XA822	#G
.01	XA103	#G
.012	XA123	#G
.015	XA153	#G
.018	XA183	#G
.022	XA223	#G
.027	XA273	#G
.033	XA333	#G
.039	XB393	#G
.047	XB473	#G
.056	XB563	#G
.068	XB683	#G
.082	XB823	#G
.10	XB104	#G
	.300 SPACING	
.018	719A1AX183P*101	#H
.022	AX223	#H
.027	AX273	#H
.033	AX333	#H
.039	AX393	#H
.047	AX473	#H
.056	AA563	#H
.068	AA683	#H
.082	AA823	#H
.10	AA104	#H
.12	AB124	#H
.15	AB154	#H
.18	AB184	#H
.22	AB224	#H
.27	AC274	#H
.33	AC334	#H
.39	AD394	#H
.47	AD474	#H
	.394 SPACING	
.082	719A1CA823P*101	SA
.10	CA104	SA
.12	CA124	SA
.15	CA154	SA
.18	CA184	SA
.22	CA224	SA
	.591 SPACING	
.27	719A1GD274P*101	SB
.33	GD334	SB
.39	GD394	SB
.47	GD474	SB
.56	GE564	SB
.68	GE684	SB
.82	GF824	SB
1.0	GF105	SB
	.886 SPACING	
1.2	719A1MH125P*101	SD
1.5	MH155	SD
1.8	MK185	SD
2.2	MK225	SD
2.7	ML275	SD
3.3	ML335	SD
	1.08 SPACING	
3.9	719A1RM395P*101	SE
4.7	RM475	SE
5.6	RN565	SE
6.8	RN685	SE
8.2	RG825	SE
10.0	RG106	SE

250 VDC (160 VAC RMS)

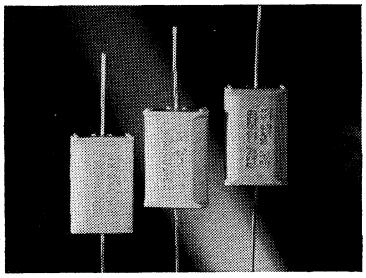
CAP UF	MEPCO/CENTRALAB PART NUMBER	
	.300 SPACING	
.0082	719A1AX822P*251	#H
.010	AX103	#H
.012	AX123	#H
.015	AX153	#H
.018	AA183	#H
.022	AA223	#H
.027	AA273	#H
.033	AA333	#H
.039	AB393	#H
.047	AB473	#H
.056	AC563	#H
.068	AC683	#H
.082	AD823	#H
.10	AD104	#H
	.394 SPACING	
.039	719A1CA393P*251	SA
.047	CA473	SA
.056	CA563	SA
.068	CA683	SA
	.591 SPACING	
.082	719A1GD823P*251	SB
.10	GD104	SB
.12	GD124	SB
.15	GD154	SB
.18	GE184	SB
.22	GE224	SB
.27	GF274	SB
.33	GF334	SB
	.886 SPACING	
.39	719A1MH394P*251	SD
.47	MH474	SD
.56	MH564	SD
.68	MH684	SD
.82	MK824	SD
1.0	MK105	SD
	1.08 SPACING	
1.2	719A1RM125P*251	SE
1.5	RM155	SE
1.8	RM185	SE
2.2	RM225	SE

400 VDC (220 VAC RMS)

CAP UF	MEPCO/CENTRALAB PART NUMBER	
	.300 SPACING	
.0039	719A1AX392P*401	#H
.0047	AX472	#H
.0056	AX562	#H
.0068	AX682	#H
.0082	AA822	#H
.010	AA103	#H
	.394 SPACING	
.010	719A1CA103P*401	SA
.012	CA123	SA
.015	CA153	SA
.018	CA183	SA
.022	CA223	SA
.027	CA273	SA
.033	CA333	SA
	.591 SPACING	
.039	719A1GD393P*401	SB
.047	GD473	SB
.056	GE563	SB
.068	GE683	SB
.082	GF823	SB
.10	GF104	SB
.12	GG124	SB
.15	GG154	SB
	.886 SPACING	
.18	719A1MH184P*401	SD
.22	MH224	SD
.27	MJ274	SD
.33	MJ334	SD
.39	ML394	SD
.47	ML474	SD
	1.08 SPACING	
.56	719A1RM564P*401	SE
.68	RM684	SE
.82	RN824	SE
1.0	RN105	SE

SERIES 701B1
(TYPE MKC)

Metalized Polycarbonate Capacitors (12 NC 2222-341)



DESCRIPTION

Series 708B1 metalized polycarbonate dielectric resistance welded with solder coated wire leads encased in a flame retardant polypropylene molded case material used to provide ample insulation for high voltage circuits in close configurations which is unaffected by operation over a broad range of temperature.

FEATURES

Electrical

- Rated Capacitance Range—0,0082 to 6,8μF
- Tolerance on Rated Capacitance—$\pm$10%, $\pm$5%
- Climatic Category—55/100/56
- Related Specification—IEC 384-6
- Dielectric Withstanding—160% x Rated (VDC) terminal to terminal. 200% x Rated (VDC) terminal to case.
- Dissipation Factor

capacitance	DISSIPATION FACTOR		
	1 kHz	10 kHz	100 kHz
$C_R \leq 0{,}1\ \mu F$	$\leq 30 \times 10^{-4}$	$\leq 60 \times 10^{-4}$	$\leq 130 \times 10^{-4}$
$0{,}1\mu F < C_R \leq 0{,}1\ \mu F$	$\leq 30 \times 10^{-4}$	$\leq 60 \times 10^{-4}$	
$C_R > 0{,}1\ \mu F$	$\leq 30 \times 10^{-4}$	$\leq 75 \times 10^{-4}$	

- Insulation resistance

The insulation resistance is measured after a voltage has been applied for 1 min $\pm$ 5 s, the voltage being 100 $\pm$ 15 V for the 100 V, 250 V and 400 V versions, and 500 $\pm$ 50 V for the 630 V and 1000 V versions, at T_{amb} = 20°C.

R between terminations, for $C_R \leq 0{,}33\ \mu F$
100 V version >15,000MΩ
250 V, 400 V, 630 V, 1000 V versions >30,000MΩ

RC between terminations, for $C_R > 0{,}33\mu F$
100 V version > 5,000 s
250 V, 400 V, 630 V, 1000 V versions >10,000 s

R between interconnected terminations and case (foil method) >30,000MΩ

- Maximum Capacitance Change with Temp.
  @ −55°C −4%
  @ +85°C +5%
- Standard Voltage Ratings—
  100, 250, 400, 630, 1000 VDC @ +85°C
- Storage Temperature −55°C to +100°C
- Low dissipation factor

Maximum pulse load

rated voltage V	maximum pulse load (V/μs)			
	L=14,5 mm	L=18 mm	L=23,5mm	L=31 mm
100	30	13	7,5	4,5
250	45	18	12	7
400	70	30	18	11
630	100	45	25	15
1000		45	40	20

The maximum pulse load values in the table are valid for pulse voltages equal to the rated voltage.

For lower pulse voltages the given values may be multiplied by U_R/ applied voltage.

Note:
If the pulse load requirement is satisfied, a check must be made to ascertain that the maximum dissipation is not exceeded.

Mechanical

- High capacitance/volume ratio
- High insulation between circuit element
- Precisely dimensioned rectangular case
- Self-healing
- Resistance to soldering heat with pre-heating:
  Capacitors mounted on a 1,6 mm board with non-plated holes
  Body Temp.: 80°C
  Bath Temp.: 260°C
  Dwell Time: 5 s
- Solvent resistant
- Suitable for both point to point wiring and PC board insulation

HOW TO SPECIFY

Mepco/Centralab Series 701B1 Capacitors can be completely, specified using the following designation:

701B1 EC 104P K 251 S X

- **701B1** — **M/C Series**
- **EC** — **Case Size**
- **104P** — **Capacitance in (pF)**: First two digits represent significant figures and last digit indicates the number of zeros to follow.
- **K** — **Tolerance**: J = $\pm$ 5%, K = $\pm$10%
- **251** — **Voltage at 85°C**: Standard; 101= 100V, 251= 250V, 401= 400V, 631= 630V, 102=1000V
- **S** — **Specification**: S=Standard
- **X** — X=Axial Leads

SERIES 701B1

Metalized Polycarbonate Capacitors

SERIES 701B1

CASE SIZE TABLE

CASE SIZE CODE	"L" LENGTH INCHES	"L" LENGTH MM	"H" HEIGHT INCHES	"H" HEIGHT MM	"T" THICKNESS INCHES	"T" THICKNESS MM	LEAD SIZE AWG	"LL" LEAD LENGTH INCHES	"LL" LEAD LENGTH MM
EA	.575	14.6	.347	8.8	.200	5.1	20	1.575	40
EB	.575	14.6	.374	9.5	.225	5.7	20	1.575	40
EC	.575	14.6	.418	10.6	.276	7	20	1.575	40
HD	.713	18.1	.409	10.4	.260	6.6	20	1.575	40
HE	.713	18.1	.453	11.5	.311	7.9	20	1.575	40
LF	.925	23.5	.457	11.6	.307	7.8	20	1.575	40
LG	.925	23.5	.508	12.9	.362	9.2	20	1.575	40
LH	.925	23.5	.571	14.5	.426	10.8	20	1.575	40
SJ	1.22	31	.575	14.6	.422	10.7	18	1.970	50
SK	1.22	31	.768	19.5	.488	12.5	18	1.970	50
SL	1.22	31	.871	22.1	.607	15.4	18	1.970	50

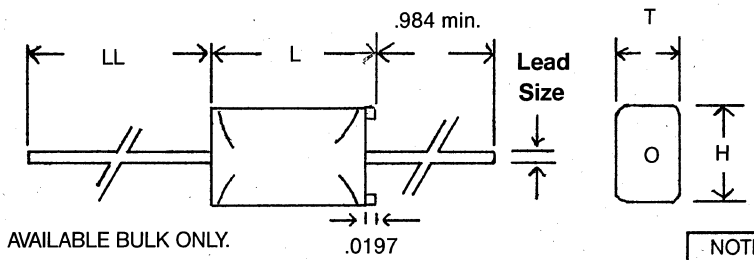
701B1 SERIES

CAP VALUE UF	100VDC (63VAC RMS) MEPCO/CENTRALAB PART NUMBER*	CASE SIZE	250VDC (160VAC RMS) MEPCO/CENTRALAB PART NUMBER*	CASE SIZE	400VDC (220VAC RMS) MEPCO/CENTRALAB PART NUMBER*	CASE SIZE	630VDC (220VAC RMS) MEPCO/CENTRALAB PART NUMBER*	CASE SIZE	1000VDC (250VAC RMS) MEPCO/CENTRALAB PART NUMBER*	CASE SIZE
.0082					701B1EA822P*401SX	EA	701B1EA822P*631SX	EA	701B1HD822PK102SX	HD
.010					EA103	EA	EA103	EA	HD103	HD
.012					EA123	EA	EB123	EB	HE123	HE
.015					EA153	EA	EB153	EB	HE153	HE
.018	FOR THESE RATINGS USE THE CORRESPONDING HIGHER VOLTAGE LEVEL		FOR THESE RATINGS USE THE CORRESPONDING HIGHER VOLTAGE LEVEL		EA183	EA	EC183	EC	701B1LF183	LF
.022					EA223	EA	EC223	EC	LF223	LF
.027					EA273	EA	701B1HD273	HD	LG273	LG
.033					EB333	EB	HD333	HD	LG333	LG
.039					EC393	EC	HE393	HE	LH393	LG
.047			701B1EA393P*251SX	EA	EC473	EC	HE473	HE	LH473	LH
.056			EA473	EA	701B1HD563	HD	701B1LF563	LF	701B1SJ563	SJ
.068			EA563	EA	HD683	HD	LF683	LF	SJ683	SJ
.082	701B1EA823P*101SX	EA	EA683	EA	HE823	HE	LG823	LG	SK823	SK
.10	EA104	EA	EB823	EB	HE104	HE	LG104	LG	SK104	SK
.12	EA124	EA	EB104	EB	701B1LF124	LF	LH124	LH	SL124	SL
.15	EA154	EA	701B1HD124	HD	LF154	LF	LH154	LH	SL154	SL
.18	EB184	EB	HD154	HD	LG184	LG	701B1SJ184P*631SX	SJ		
.22	EC224	EC	HE184	HE	LG224	LG	SJ224	SJ	±10% ONLY for 1000 V	
.27	EC274	EC	HE224	HE	LH274	LH	SK274	SK		
.33	701B1HD334	HD	701B1LG274	LF	LH334	LH	SK334	SK		
.39	HD394	HD	LF334	LF	701B1SJ394	SJ	SL394	SL		
.47	HE474	HE	LG394	LG	SJ474	SJ	SL474	SL		
.56	HE564	HE	LG474	LG	SK564	SK				
.68	701B1LF684	LF	LH564	LH	SK684	SK				
.82	LF824	LF	LH584	LH	SL824	SL				
1.0	LG105	LG	701B1SJ824	SJ	SL105	SL				
1.2	LG125	LG	SJ105	SJ						
1.5	LH155	LH	SK125	SK						
1.8	LH185	LH	SK155	SK						
2.2	701B1SJ225	SJ	SL185	SL						
2.7	SJ275	SJ	SL225	SL						
3.3	SK335	SK								
3.9	SK395	SK								
4.7	SK475	SK								
5.6	SL565	SL								
6.8	SL585	SL								

*Insert appropriate letter into part number for tolerance

J = ±5%
K = ±10% Standard

OUTLINE DRAWING



AVAILABLE BULK ONLY.

TYPICAL MARKING EXAMPLE

—SIDE ONE—

pF or UF/Tolerance/ Rated Voltage DC	0.15/10/100
Philips Type No.	341
Code for Dielectric	MKC
Date Code (IEC 62, Clause 5)	V6

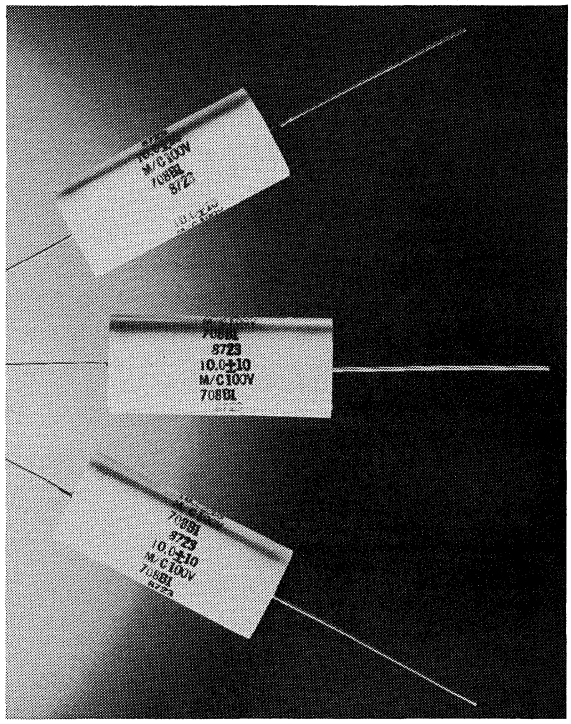
—SIDE TWO—

Philips Code for Factory of Origin

NOTICE: MISAPPLICATION SUCH AS EXCEEDING DESIGN LIMITS MAY RESULT IN DESTRUCTION OR EXPLOSION OF CAPACITORS.

SERIES 708B1

Metalized Polycarbonate Capacitors



4

Film Capacitors

DESCRIPTION

Series 708B1 metalized polycarbonate dielectric wrapped with tape and end potted in a flat oval configuration with resistance welded axial tinned copper clad steel leads.

FEATURES

Electrical

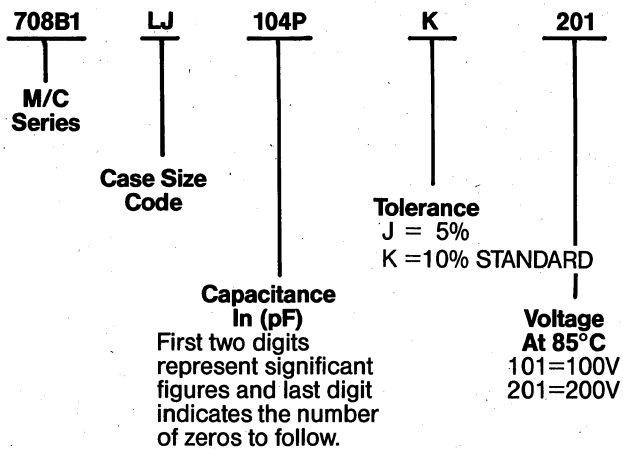
- Dielectric Withstanding—150% x Rated (VDC) for one minute
- Dissipation Factor @ 25°C
  ≤1.0uFD @ 1KHz ≤0.3%
  >1.0uFD @ 60Hz ≤0.3%
- Insulation Resistance @ 25°C
  ≤0.10uFD 300000 MΩ min.
  >0.10uFD 30000 MΩ x MFD min.
- Maximum Capacitance Change with Temp.
  @ −55°C −2.5%
  @ +85°C +1.5%
  @ +125°C +2.5%
- Standard Voltage Ratings—100 & 200 VDC @ −55°C to +85°C. Operating temperatures to +125°C with proper voltage derating.
- Voltage derating @ 125°C is 50% of rated voltage.

Mechanical

- Small size
- Flat-surface-saving configuration
- Long trouble-free life
- Self-healing
- Solvent resistant
- Low temperature coefficient
- Low dissipation factor
- Ideal for AC voltage application
- Superior high-frequency characteristics
- Lead strength—5 lb. pull

HOW TO SPECIFY

Mepco/Centralab Series 708B1 Capacitors can be completely specified using the following designation:



SERIES 708B1

Metalized Polycarbonate Capacitors

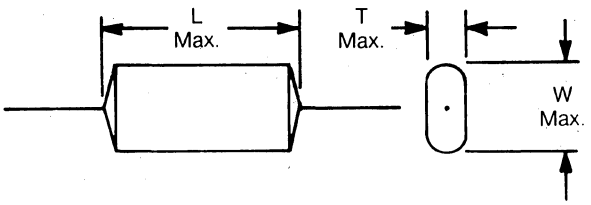
708B1 SERIES

100VDC AT 85°C						
CAP VALUE UF	MEPCO/CENTRALAB PART NUMBER*	CASE SIZE	DIMENSIONS IN INCHES MAXIMUM			
			"L" LENGTH INCHES	"W" WIDTH INCHES	"T" THICKNESS INCHES	LEAD SIZE AWG.
.10	708B1IE104P*101AX	IE	.625	.310	.190	22
.15	IH154	IH	.625	.355	.230	22
.22	IL224	IL	.625	.400	.280	22
.33	NI334	NI	.750	.365	.240	22
.47	NM474	NM	.750	.425	.295	22
.68	VN684	VN	.875	.450	.300	22
1.0	VT105	VT	.875	.505	.350	20
1.5	VB155	VB	.875	.610	.420	20
2.0	AY205	AY	1.062	.585	.400	20
3.0	IA305	IA	1.312	.600	.415	20
4.0	II 405	II	1.312	.685	.500	20
5.0	QB505	QB	1.562	.790	.420	20
10.0	BN106	BN	1.875	.930	.560	20

4

Film Capacitors

OUTLINE DRAWING



Lead Length 1.63" Min Both Sides

TYPICAL MARKING EXAMPLE

Mepco/Centralab Voltage (DC)	M/C 100V
Type	708B1
Capacitance & Tol.	.10 ±10%
Date Code (Yr & Wk)	8640

200VDC AT 85°C						
CAP VALUE UF	MEPCO/CENTRALAB PART NUMBER*	CASE SIZE	DIMENSIONS IN INCHES MAXIMUM			
			"L" LENGTH INCHES	"W" WIDTH INCHES	"T" THICKNESS INCHES	LEAD SIZE AWG.
.10	708B1LJ104P*201AX	LJ	.710	.375	.250	22
.15	RI154	RI	.840	.375	.240	22
.22	RN224	RN	.840	.430	.300	20
.33	RU334	RU	.840	.475	.360	20
.47	BQ474	BQ	1.09	.460	.320	20
.68	BY684	BY	1.09	.540	.400	20
1.0	BE105	BE	1.09	.660	.460	20
1.5	RY155	RY	1.59	.600	.400	20
2.0	RH205	RH	1.59	.680	.490	20
3.0	RL305	RL	1.59	.880	.540	20
4.0	RT405	RT	1.59	.975	.630	20
5.0	ZV505	ZV	1.84	1.00	.640	20
10.0	HG106	HG	2.062	1.225	.850	20

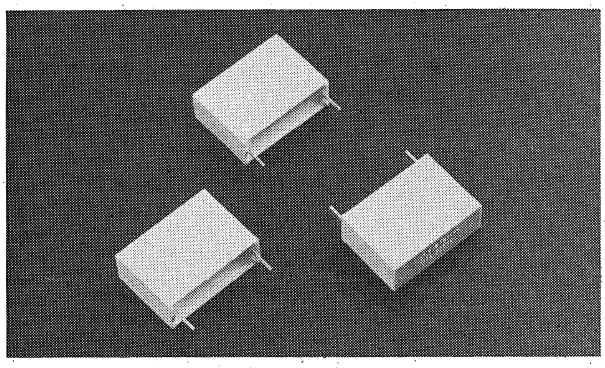
*TOLERANCE: J = ±5%, K = ±10% STANDARD

AVAILABLE BULK ONLY

NOTICE: MISAPPLICATION SUCH AS EXCEEDING DESIGN LIMITS MAY RESULT IN DESTRUCTION OR EXPLOSION OF CAPACITORS.

SERIES 719B1
(TYPE MKC)

Metalized Polycarbonate Capacitors (12NC2222-344)



DESCRIPTION

Nugget Series 719B1 metalized polycarbonate dielectric encased in a rectangular epoxy-encapsulated flame retardant polypropylene case with sturdy solder coated terminal pins, they lend themselves readily to insertion into printed circuit cards, motherboards and similar modular assemblies.

FEATURES

Electrical

- Rated capacitance range .01 to 6.8 μf
- Tolerance on rated capacitance ±10%, ±5%
- Climatic category 55/100/56
- Related specification IEC 384-2
- Dielectric Withstanding—160% x rated (VDC) terminal to terminal
  200% x rated VDC between interconnected terminals & case
- Dissipation Factor

capacitance	tangent of loss angle		
	1kHz	10 kHz	100 kHz
$C_R \leq 0{,}1\ \mu F$	$\leq 30 \times 10^{-4}$	$\leq 60 \times 10^{-4}$	$\leq 130 \times 10^{-4}$
$0{,}1\ \mu F < C_R \leq 1\ \mu F$	$\leq 30 \times 10^{-4}$	$\leq 60 \times 10^{-4}$	
$C_R > 1\ \mu F$	$\leq 30 \times 10^{-4}$	$\leq 75 \times 10^{-4}$	

- Insulation resistance

The insulation resistance is measured after a voltage has been applied for 1 min ±5 s, the voltage being 100 ± 15V for the 100V, 250V and 400V versions, and 500 ±50V for the 630V version, at T_{amb} = 20°C.

R between terminations, for $C_R \leq 0{,}33\ \mu F$
100V version >15,000 MΩ
250V, 400V, 630V versions >30,000 MΩ

RC between terminations, for $C_R > 0{,}33\ \mu F$
100V version >5,000 s
250V, 400V, 630V versions >10,000 s

R between interconnected terminations and case (foil method) >30,000 MΩ

- Maximum pulse load

rated voltage V	maximum pulse load (V/μs)			
	L = 13 mm	L = 17,5 mm	L = 26 mm	L = 31 mm
100	30	13	6	4,5
250	45	18	8	7
400	70	30	13	11
630	100	45	18	15

The maximum pulse load values in the table are valid for pulse voltage equal to the rated voltage.

For lower pulse voltages the given values may be multiplied by U_R/applied voltage.

Note
If the pulse load requirement is satisfied, a check must be made to ascertain that the maximum dissipation is not exceeded.

- Maximum Capacitance Change with Temp.
  @ −55°C −4%
  @ +85°C +5%
- Standard Voltage Ratings—100, 250, 400 & 630 VDC @ +85°C
- Storage Temperature −55°C to +100°C

Mechanical

- Low cost
- Precision dimensioned case—permits high package density
- Mounting feet
- Self-healing
- Low dissipation factor
- High capacitance stability with temperature
- Resistance to soldering heat with preheating capacitors mounted on a 1.6 mm board with non-plated holes
  Body Temp.: 80°C
  Bath Temp.: 260°C
  Dwell Time: 5 s

HOW TO SPECIFY

Mepco/Centralab Series 719B1 Capacitors can be completely specified using the following designation:

719B1 GD 104P K 251 S B

- 719B1 — M/C Series
- GD — Case Size
- 104P — Capacitance in (pF): First two digits represent significant figures and last digit indicates the number of zeros to follow.
- K — Tolerance: J = 5%, K = 10% STANDARD
- 251 — Voltage at 85°C: 101 = 100V, 251 = 250V, 401 = 400V, 631 = 630V
- S — Specification: S = Standard
- B — Lead Configuration

Straight Lead Code	Lead Spacing
A	0.394
B	0.591
D	0.886
E	1.08

4 Film Capacitors

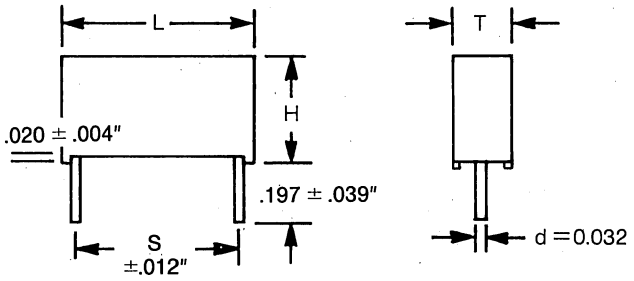
SERIES 719B1

Metalized Polycarbonate Capacitors

719B1 Series

CAP VALUE UF	100VDC (63VAC RMS) MEPCO/CENTRALAB PART NUMBER*	CASE SIZE	250VDC (160VAC RMS) MEPCO/CENTRALAB PART NUMBER*	CASE SIZE	400VDC (220VAC RMS) MEPCO/CENTRALAB PART NUMBER*	CASE SIZE	630VDC (220VAC RMS) MEPCO/CENTRALAB PART NUMBER*	CASE SIZE
.010					719B1CA103P*401SA	CA	719B1CA103P*631SA	CA
.012					CA123	CA	CB123	CB
.015	FOR THESE		FOR THESE		CA153	CA	CB153	CB
.018	RATINGS USE		RATINGS USE		CA183	CA	CC183	CC
.022	THE CORRE-		THE CORRE-		CA223	CA	CC223	CC
.027	SPONDING		SPONDING		CA273	CA	719B1GE273P*631SB	GE
.033	HIGHER VOLTAGE		HIGHER VOLTAGE		CA333	CA	GE333	GE
.039	LEVEL.		LEVEL.		719B1GD393P*401SB	GD	GF393	GF
.047			719B1CA393P*251SA	CA	GD473	GD	GF473	GF
.056			CA473	CA	GE563	GE	GG563	GG
.068			CA563	CA	GE683	GE	GG683	GG
.082	719B1CA823P*101SA	CA	CA683	CA	GF823	GF	719B1MH823P*631SD	MH
.10	CA104	CA	719B1GD823P*251SB	GD	GF104	GF	MH104	MH
.12	CA124	CA	GD104	GD	GG124	GG	MJ124	MJ
.15	CA154	CA	GE124	GE	GG154	GG	MJ154	MJ
.18	CB184	CB	GE154	GE	719B1MH184P*401SD	MH	ML184	ML
.22	CB224	CB	GF184	GF	MH224	MH	ML224	ML
.27	719B1GD274P*101SB	GD	GF224	GF	MJ274	MJ	719B1RM274P*31SE	RM
.33	GD334	GD	GG274	GG	MJ334	MJ	RM334	RM
.39	GE394	GE	GG334	GG	ML394	ML	RN394	RN
.47	GE474	GE	719B1MH394P*251SD	MH	ML474	ML	RN474	RN
.56	GF564	GF	MH474	MH	719B1RM564P*401SE	RM		
.68	GF684	GF	MJ564	MJ	RM684	RM		
.82	GG824	GG	MJ684	MJ	RN824	RM		
1.0	GG105	GG	ML824	ML	RN105	RN		
1.2	719B1MH125P*101SD	MH	ML105	ML				
1.5	MH155	MH	719B1RM125P*251SE	RM				
1.8	MK185	MK	RM155	RM				
2.2	MK225	MK	RN185	RN				
2.7	ML275	ML	RN225	RN				
3.3	ML335	ML						
3.9	719B1RM395P*101SE	RM						
4.7	RM475	RM						
5.6	RN565	RN						
6.8	RN685	RN						

OUTLINE DRAWING



TYPICAL MARKING EXAMPLE

MARKING (TOP VIEW)
CAP UF / TOLERANCE / VOLTAGE WVDC
FACTORY CODE
0.10/10/250
344/45104

CASE SIZE TABLE M/C SERIES 719B1

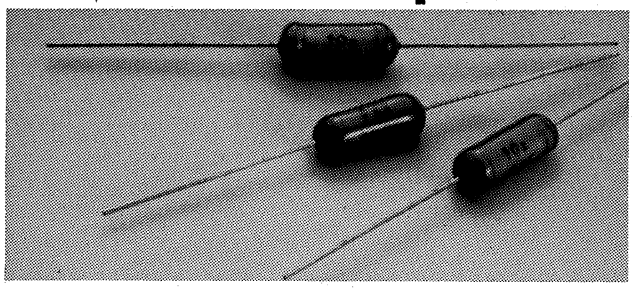
CASE SIZE CODE	DIMENSION IN INCHES (mm) MAXIMUM "L" LENGTH INCHES	mm	"H" HEIGHT INCHES	mm	"T" THICKNESS INCHES	mm	"S" SPACING INCHES	mm	LEAD SIZE AWG
CA	.511	13	.394	10	.177	4.5	.394	10	20
CB	.511	13	.433	11	.197	5	.394	10	20
CC	.511	13	.472	12	.236	6	.394	10	20
GD	.689	17.5	.433	11	.197	5	.591	15	20
GE	.689	17.5	.472	12	.236	6	.591	15	20
GF	.689	17.5	.511	13	.276	7	.591	15	20
GG	.689	17.5	.571	14.5	.335	8.5	.591	15	20
MH	1.02	26	.610	15.5	.256	6.5	.886	22.5	20
MJ	1.02	26	.650	16.5	.295	7.5	.886	22.5	20
MK	1.02	26	.689	17.5	.335	8.5	.886	22.5	20
ML	1.02	26	.748	19	.374	9.5	.886	22.5	20
RM	1.22	31	.788	20	.433	11	1.08	27.5	20
RN	1.22	31	.886	22.5	.511	13	1.08	27.5	20
RG	1.22	31	.984	25	.591	15	1.08	27.5	20

NOTICE: MISAPPLICATION SUCH AS EXCEEDING DESIGN LIMITS MAY RESULT IN DESTRUCTION OR EXPLOSION OF CAPACITORS.

* TOLERANCE: K = ± 10% (STD), J = ± 5%,
AVAILABLE BULK ONLY

SERIES 703C1 (TYPE KS)

Polystyrene & Foil Conformal Coated Capacitors



DESCRIPTION

Series 703C1 polystyrene/foil capacitors consist of low-inductive wound cells of metal foil with a polystyrene capacitor grade film. The cells are conformally coated with a thermo-setting, unfilled epoxy urethane which provides thermal protection during wave soldering under control conditions. The axial solder coated leads allow the capacitors to be vertically or horizontally mounted.

FEATURES

Electrical

- Rated capacitance range 51 to 18,000 PF
- Tolerance on rated capacitance ±5%, ±2%, ±1%
- Climatic category 63V-40/070/21, 160V, 250V, 630V-40/085/21
- Related specification IEC 384-7
- Dielectric Withstanding—200% x Rated (VDC) terminal to terminal
  200% x rated VDC between interconnected terminals & case; min. 400V
- Dissipation Factor

capacitance	tangent of loss angle		
	at 1 kHz	at 100 kHz	at 1 MHz
$C_R \leq 1000$ pF	$\leq 5 \times 10^{-4}$		$\leq 10 \times 10^{-4}$
1000 pF < $C_R \leq$ 10000 pF	$\leq 5 \times 10^{-4}$	$\leq 10 \times 10^{-4}$	
10000 pF < $C_R \leq$ 20000 pF	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$	
$C_R >$ 20000 pF	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$	

- Insulation Resistance > 100,000 MΩ
- Temperature Coefficients (PPM/°C) −125 ± 60
- Standard Voltage Ratings
  63VDC @ −40°C to 70°C
  160VDC, 250VDC & 630VDC @ −40°C to +85°C

Mechanical

- Conformal coated for additional thermal protection
- Translucent coating to preserve marking legibility through the manufacturing process
- Low self inductance
- Precisely centered lead—making them compatible with automatic lead cutting and bending machine.
- Suitable for both point to point wiring and PC board insertion.
  Recommended for most wave solder & cleaning situations. See solderability statement below.
- Resistance to soldering heat with pre-heating capacitors mounted on a 1.6 mm board with non-plated holes.
  Body Temp.: 80°C
  Bath Temp.: 260°C
  Dwell Time: 5 s

HOW TO SPECIFY

Mepco/Centralab Series 703C1 Capacitors can be completely specified using the following designation.

703C1 BB 102P F 251 A X

- **703C1** — **M/C Series**
- **BB** — **Case Size**
- **102P** — **Capacitance in (pF)**
  First two digits represent significant figures and last digit indicates the number of zeros to follow.

Rating	Code
10PF	100
100PF	101
1000PF	102
.01UF	103

- **F** — **Tolerance**
  J = ±5%
  G = ±2%
  F = ±1%
- **251** — **Voltage at 85°C**
  630- 63V (70°C)
  161-160V
  251-250V
  631-630V
- **A** — **Specification**
  A=Standard
  T=Tape and Reel
- **X** — X=Axial Lead

SERIES 703C1

Polystyrene & Foil Conformal Coated Capacitors

703C1 SERIES

CAP VALUE UF	63VDC (25 VAC RMS)			160VDC (63 VAC RMS)			250VDC (125 VAC RMS)			630VDC (250VAC RMS)		
		MAX. DIMENSIONS			MAX. DIMENSIONS			MAX. DIMENSIONS			MAX. DIMENSIONS	
	MEPCO/CENTRALAB PART NUMBER*	"L" LENGTH	"D" DIAMETER	MEPCO/CENTRALAB PART NUMBER*	"L" LENGTH	"D" DIAMETER	MEPCO/CENTRALAB PART NUMBER*	"L" LENGTH	"D" DIAMETER	MEPCO/CENTRALAB PART NUMBER*	"L" LENGTH	"D" DIAMETER
56PF										703C1BB560P*631AX	.487	.187
68PF										BB680	.487	.187
82PF										BB820	.487	.187
100PF							FOR THESE RATINGS USE THE CORRESPONDING HIGHER VOLTAGE LEVEL			BB101	.487	.187
120PF				FOR THESE RATINGS USE THE CORRESPONDING HIGHER VOLTAGE LEVEL						BB121	.487	.187
150PF	FOR THESE RATINGS USE THE CORRESPONDING HIGHER VOLTAGE LEVEL									BB151	.487	.187
180PF										BB181	.487	.187
220PF										BB221	.487	.187
270PF										BB271	.487	.187
330PF										BB331	.487	.187
390PF										BB391	.487	.187
470PF										BJ471	.487	.300
560PF							703C1BD561P*251AX	.487	.197	BJ561	.487	.300
680PF							BD681	.487	.197	BJ681	.487	.300
820PF							BD821	.487	.197	BJ821	.487	.300
.0010							BD102	.487	.197	BJ102	.487	.300
.0012				703C1BD122P*161AX	.487	.197	BJ122	.487	.300	BJ122	.487	.300
.0015				BD152	.487	.197	BJ152	.487	.300	HJ152	.700	.300
.0018				BD182	.487	.197	BJ182	.487	.300	HJ182	.700	.300
.0022	703C1BD222P*630AX	.487	.197	BJ222	.487	.300	BJ222	.487	.300	HJ222	.700	.300
.0027	BD272	.487	.197	BJ272	.487	.300	HJ272	.700	.300	HJ272	.700	.300
.0033	BD332	.487	.197	BJ332	.487	.300	HJ332	.700	.300			
.0039	BD392	.487	.197	BJ392	.487	.300	HJ392	.700	.300			
.0047	BJ472	.487	.300	HJ472	.700	.300	HJ472	.700	.300			
.0056	BJ562	.487	.300	HJ562	.700	.300	HJ562	.700	.300			
.0068	BJ682	.487	.300	HJ682	.700	.300						
.0082	HJ822	.700	.300	HJ822	.700	.300						
.010	HJ103	.700	.300	HJ103	.700	.300						
.012	HJ123	.700	.300									
.015	HJ153	.700	.300									
.018	HJ183	.700	.300									

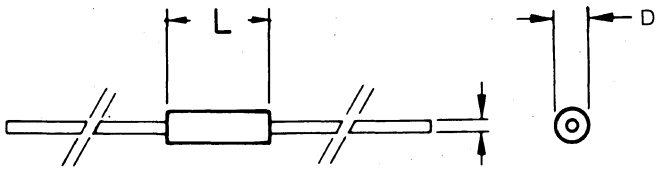
*INSERT APPROPRIATE LETTER INTO PART NUMBER
F = ± 1% (OR IPF, WHICHEVER IS GREATER)
G = ± 2%
J = ± 5%

For capacitance ratings not listed refer to decade table on page 464.

±5% Tol. E24 Series
±2% Tol. E24, E48 Series
±1% Tol. E24, E48, E96 Series

NOTICE: MISAPPLICATION SUCH AS EXCEEDING DESIGN LIMITS MAY RESULT IN DESTRUCTION OR EXPLOSION OF CAPACITORS.

OUTLINE DRAWING



Lead Length: 1.10 inch min. both sides

AVAILABLE BULK OR ON TAPE & REEL

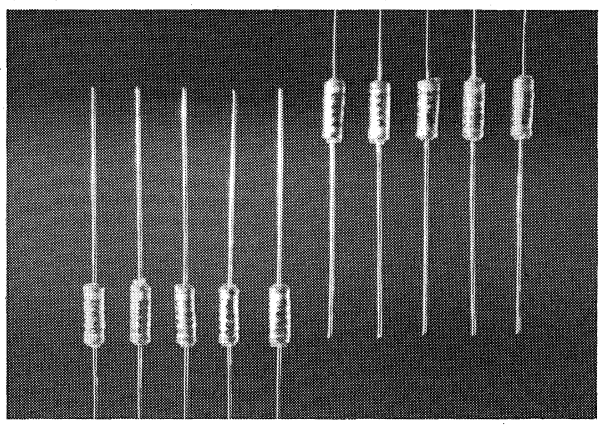
SEE PAGE 468 FOR TAPE & REEL SPECIFICATIONS

TYPICAL MARKING EXAMPLE

NOMINAL CAPACITANCE 1n8
IN NANOFARADS OR PICOFARADS, WITH LETTER DESIGNATION INSERTED IN THE DECIMAL POSITION. (1800=1.8 NF MARKED 1N 8)
TOLERANCE (EIA), RATED VOLTAGE . . . . . F 63
FACTORY DATE CODE N4KS

SERIES 704C1 (Type KS)

Polyestyrene & Foil Capacitors (12NC2222-424 thru 431)



DESCRIPTION

"Micro Poco" polystyrene and foil capacitors consist of low-inductive wound cells of metal foil with a polystyrene capacitor grade film. The cells are covered with a green plastic film. The axial leads consist of solder coated wire making capacitors suitable for vertical or horizontal mounting.

4 Film Capacitors

FEATURES

Electrical

- Rated capacitance range 51 pF to 39,000 pF
- Tolerance on rated capacitance ±5%, ±2%, ±1%
- Climatic category
  63V-40/070/21 160V, 250V, 630V-40/085/21
- Related specification IEC 384-7
- Dielectric Withstanding—200% x Rated (VDC) terminal to terminal
  200% x rated VDC between interconnected terminals & case; min. 400V
- Dissipation Factor

capacitance	tangent of loss angle		
	at 1 kHz	at 100 kHz	at 1 MHz
$C_R \leq 1000$ pF	$\leq 5 \times 10^{-4}$		$\leq 10 \times 10^{-4}$
1000 pF $< C_R \leq$ 10000 pF	$\leq 5 \times 10^{-4}$	$\leq 10 \times 10^{-4}$	
10000 pF $< C_R \leq$ 20000 pF	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$	
$C_R >$ 20000 pF	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$	

- Insulation Resistance >100,000MΩ
- Temperature Coefficients (PPM/°C) −125 ±60
- Standard Voltage Ratings
  63VDC @ −40°C to 70°C
  160VDC, 250VDC & 630VDC @ −40°C to +85°C

Mechanical

- Translucent sleeve to preserve marking legibility through the manufacturing process.
- Low self inductance
- Low series resistance
- High precision—±1%, ±2% tolerance
- Very small size
- Recommended for hand insertion only. Caution: Cleaning (open ends).
- Very high stability
- Precisely centered lead—making them compatible with automatic lead cutting and bending machine.
- Suitable for both point to point wiring and PC board insertion.
- Resistance to soldering heat with pre-heating capacitors mounted on a 1.6 mm board with non-plated holes.
  Body Temp.: 80°C
  Bath Temp.: 260°C
  Dwell Time: 5 s

HOW TO SPECIFY

Mepco/Centralab Series 704C1 Capacitors can be completely specified using the following designation:

704C1	FJ	103P	F	251	A	X
M/C Series	Case Size	Capacitance in (pF)	Tolerance	Voltage at 85°C	Specification	

Tolerance
J = ±5%
G = ±2%
F = ±1%

Specification
A=Standard
T=Tape and Reel

X=Axial Lead

Capacitance in (pF)
First two digits represent significant figures and last digit indicates the number of zeros to follow.

Rating	Code
10PF	100
100PF	101
1000PF	102
.01UF	103

Voltage at 85°C
630= 63V (70°C)
161=160V
251=250V
631=630V

SERIES 704C1

Polystyrene & Foil Capacitors

TYPE 704C1

CAP VALUE UF	63VDC (25VAC RMS)			160VDC (63VAC RMS)			250VDC (125VAC RMS)			630VDC (250 VAC RMS)		
		MAX. DIMENSIONS			MAX. DIMENSIONS			MAX. DIMENSIONS			MAX. DIMENSIONS	
	MEPCO/CENTRALAB PART NUMBER*	"L" LENGTH	"D" DIAMETER	MEPCO CENTRALAB PART NUMBER*	"L" LENGTH	"D" DIAMETER	MEPCO/CENTRALAB PART NUMBER*	"L" LENGTH	"D" DIAMETER	MEPCO/CENTRALAB PART NUMBER*	"L" LENGTH	"D" DIAMETER
56PF										704C1AA560P*631AX	.433	.150
68PF										AA680	.433	.150
82PF							FOR THESE			AA820	.433	.150
100PF				FOR THESE			RATINGS USE THE			AA101	.433	.150
120PF				RATINGS USE			CORRESPONDING			AA121	.433	.150
150PF	FOR THESE			THE CORRE-			HIGHER VOLTAGE			AA151	.433	.150
180PF	RATINGS USE			SPONDING			LEVEL			AA181	.433	.150
220PF	THE CORRE-			HIGHER VOLTAGE						AA221	.433	.150
270PF	SPONDING			LEVEL.						AA271	.433	.150
330PF	HIGHER VOLTAGE									AB331	.433	.157
390PF	LEVEL.									AB391	.433	.157
470PF										AC471	.433	.177
560PF							704C1AA561P*251AX	.433	.150	AC561	.433	.177
680PF							AA681	.433	.150	AC681	.433	.177
820PF							AA821	.433	.157	AD821	.433	.197
.0010							AB102	.433	.157	AD102	.433	.197
.0012				704C1AB122P*161AX	.433	.157	AC122	.433	.177	AD122	.433	.197
.0015				AB152	.433	.157	AC152	.433	.177	FD152	.591	.197
.0018				AB182	.433	.157	AD182	.433	.197	FE182	.591	.217
.0022	704C1AA222P*630AX	.433	.150	AC222	.433	.177	AD222	.433	.197	FE222	.591	.217
.0027	AB272	.433	.157	AC272	.433	.177	FD272	.591	.197	FF272	.591	.236
.0033	AB332	.433	.157	AD332	.433	.197	FD332	.591	.197	FG332	.591	.256
.0039	AB392	.433	.157	AD392	.433	.197	FD392	.591	.197	FH392	.591	.276
.0047	AC472	.433	.177	FD472	.591	.197	FE472	.591	.217	FK472	.591	.315
.0056	AC562	.433	.177	FD562	.591	.197	FF562	.591	.236	FK562	.591	.315
.0068	AD682	.433	.197	FE682	.591	.217	FG682	.591	.256			
.0082	FD822	.591	.197	FF822	.591	.236	FH822	.591	.276			
.010	FD103	.591	.197	FF103	.591	.236	FJ103	.591	.296			
.012	FE123	.591	.217	FG123	.591	.256						
.015	FE153	.591	.217	FH153	.591	.276						
.018	FF183	.591	.236									
.022	FG223	.591	.256									
.027	FH273	.591	.276									
.033	FJ333	.591	.296									
.039	FK393	.591	.315									

*INSERT APPROPRIATE LETTER INTO PART NUMBER
F = ±1% (OR IPF, WHICHEVER IS GREATER)
G = ±2%
J = 5%

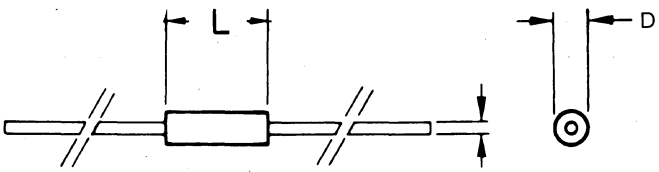
NOTICE: MISAPPLICATION SUCH AS EXCEEDING DESIGN LIMITS MAY RESULT IN DESTRUCTION OR EXPLOSION OF CAPACITORS.

FOR CAPACITANCE RATINGS NOT LISTED REFER TO DECADE TABLE ON PAGE 464
±5% Tol. E24 SERIES
±2% Tol. E24, E48 SERIES
±1% Tol. E24, E48, E96 SERIES

AVAILABLE BULK OR TAPE & REEL.

SEE PAGE 468 FOR TAPE & REEL SPECIFICATIONS.

OUTLINE DRAWING



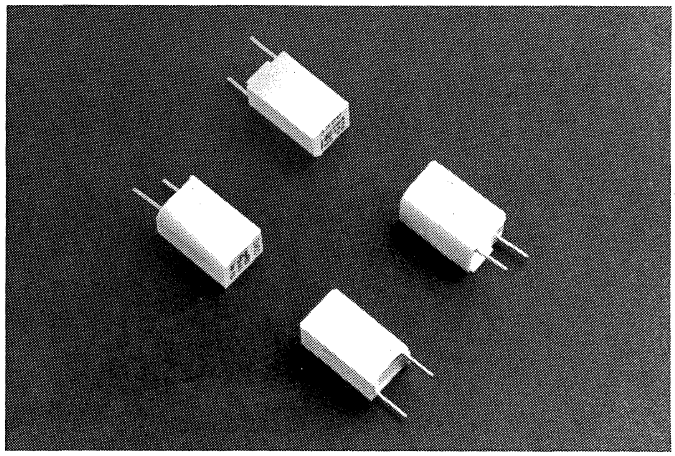
Lead Length: 1.10 inch min. both sides

TYPICAL MARKING EXAMPLE

NOMINAL CAPACITANCE 1n8
IN NANOFARADS OR PICOFARADS, WITH LETTER DESIGNATION INSERTED IN THE DECIMAL POSITION. (1800 = 1.8 NF MARKED 1N 8)
TOLERANCE (EIA), RATED VOLTAGE . . . . . F 63
FACTORY DATE CODE N4KS

SERIES 719C1
(TYPE KS)

Polystyrene & Foil Capacitors (12NC2222 443)



DESCRIPTION
Series 719C1 polystyrene and foil capacitors consist of low-inductive wound cells of metal foil with polystyrene capacitor grade film. Encased in a rectangular epoxy encapsulated flame retardant polypropylene case with sturdy tinned solder coated pins. They lend themselves readily to insertion into printed circuit cards, mother boards, and similar modular assemblies.

APPLICATIONS
For use in LC filters, particularly in telephone equipment where high requirements are imposed on precision, stability, humidity, dissipation factor, and reliability. The dimensions are such that in combination with current available ferrites, a high package density is possible.

FEATURES
Electrical

- Rated capacitance range 100 to 34,000 pF
- Tolerance on rated capacitance ±1%
- Climatic category: Class 1 55/70/56
  Class 3 55/85/56
- Related specification IEC 384-7
- Dielectric Withstanding—200% x Rated (VDC) terminal to terminal.
  400 VDC between interconnected terminals & case (foil method).
- Dissipation Factor

capacitance	tangent of loss angle		
	at 1 kHz	at 100 kHz	at 1 MHz
$C_R \leq$ 500 pF	$\leq 5 \times 10^{-4}$		$\leq 5 \times 10^{-4}$
500 pF $< C_R \leq$ 1000 pF	$\leq 5 \times 10^{-4}$		$\leq 10 \times 10^{-4}$
1000 pF $< C_R \leq$ 10000 pF	$\leq 5 \times 10^{-4}$	$\leq 10 \times 10^{-4}$	
10000 pF $< C_R \leq$ 15000 pF	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$	
15000 pF $< C_R \leq$ 20000 pF	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$	
20000 pF $< C_R \leq$ 30000 pF	$\leq 5 \times 10^{-4}$	$\leq 40 \times 10^{-4}$	
$C_R >$ 30000 pF	$\leq 5 \times 10^{-4}$	$\leq 60 \times 10^{-4}$	

- Insulation resistance
  The insulation resistance is measured after a voltage of 10 ± 1V has been applied for 1 min ±5 s, at T_{amb} = 20°C.
  R between terminations >500000 MΩ
  R between interconnected terminations and case >500000 MΩ
- Temperature Coefficients (PPM/°C)
  −90 to −185
- Standard Voltage Ratings—
  Class 1 (Stability Class) 63VDC @ −55°C to +70°C
  Class 3 (Stability Class) 63VDC @ −55°C to +85°C

Mechanical

- Low inductance
- Low series resistance
- High precision ±1% tolerance
- Precisely dimensioned case—Permits high package density.
- Mounting feet
- Flame retardant
- Withstand most solvent and rinsing liquids
- Lead solderability—Tested in accordance with MIL-STD-202, Method 208.
- Resistance to soldering heat with pre-heating capacitors mounted on a 1.6 mm board with non-plated holes.
  Body Temp.: 80°C
  Bath Temp.: 260°C
  Dwell Time: 5 s

TYPICAL MARKING EXAMPLE
CASE SIZE "CA" (FIGURE 1)

LINE 1: CAPACITANCE IN PF WITHOUT PF UNIT SYMBOL
LINE 2: TOLERANCE CODE (F=±1%); RATED VOLTAGE VDC
LINE 3: PRODUCTION DATE CODE; DIELECTRIC CODE (POLYSTYRENE=KS)

OUTSIDE FOIL (EARTH SIDE) IS INDICATED BY A VERTICAL LINE TO LEFT OF 2ND AND 3RD LINE OF MARKING AND BY THE BEVELLED CORNER.

CASE SIZES "CB" & "CC"
LINE 1: CAPACITANCE IN PF WITHOUT PF UNIT SYMBOL
LINE 2: TOLERANCE CODE (F=±1%), RATED VOLTAGE VDC
LINE 3: PHILIPS TYPE NO. 443
LINE 4: PRODUCTION DATE CODE; DIELECTRIC CODE (POLYSTYRENE = KS)

CASE SIZE "CA"

412P
F 63
KO KS

CASE SIZES "CB" & "CC"

412P
F 63
443
KO KS

4 Film Capacitors

HOW TO SPECIFY:

Mepco/Centralab Series 719C1 can be completely specified using the following designation:

719C1 CB 103P F 630 S G

- **719C1** — **M/C Series**
- **CB** — **Case Size**
- **103P** — **Capacitance in (pF)**: First two digits represent significant figures and last digit indicates the number of zeros to follow.
- **F** — **Tolerance** F=±1%
- **630** — **Voltage at 85°C** 630=63V
- **S** — **Specification** S=Standard
- **G** — **Lead Configuration**

Straight Lead Code	Case Size
F	"CA"
G	"CB"
H	"CC"

AVAILABLE BULK ONLY.

NOTICE: MISAPPLICATION SUCH AS EXCEEDING DESIGN LIMITS MAY RESULT IN DESTRUCTION OR EXPLOSION OF CAPACITORS.

Mounting

The capacitors are designed for mounting on printed-wiring boards. The required space on the printed-wiring board for a hole diameter of 1 mm is given in Figs 4, 5 and 6.

Mechanical Data

63 VDC-25 VAC RMS (±1% TOLERANCE ONLY)
FOR CAPACITANCE VALUES AVAILABLE SEE FIGURES 1, 2 AND 3

CASE SIZE "CA"

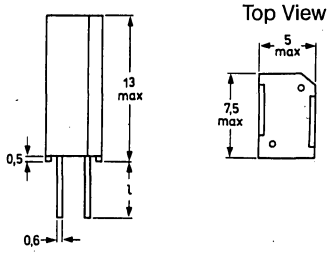


Fig. 1 Capacitors of rated capacitance range 100 to 3920 pF.

CASE SIZE "CB"

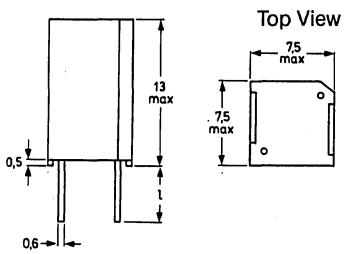


Fig. 2 Capacitors of rated capacitance range 100 to 15000 pF.

CASE SIZE "CC"

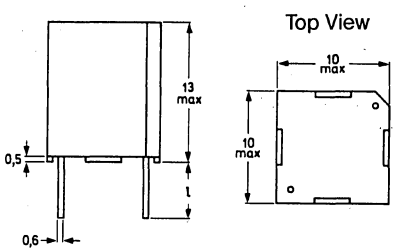


Fig. 3 Capacitors of rated capacitange range 15400 to 34000 pF.

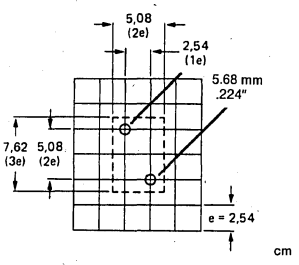


Fig. 4 Required space for capacitors according to Fig. 1.

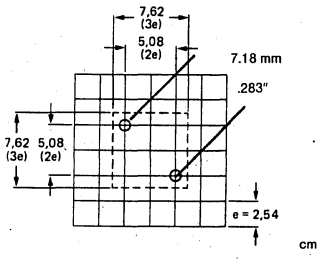


Fig. 5 Required space for capacitors according to Fig. 2.

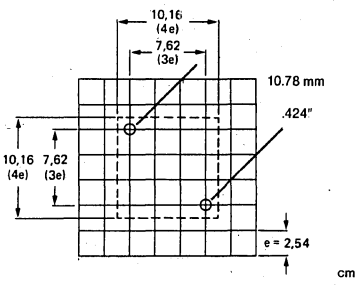


Fig. 6 Required space for capacitors according to Fig. 3.

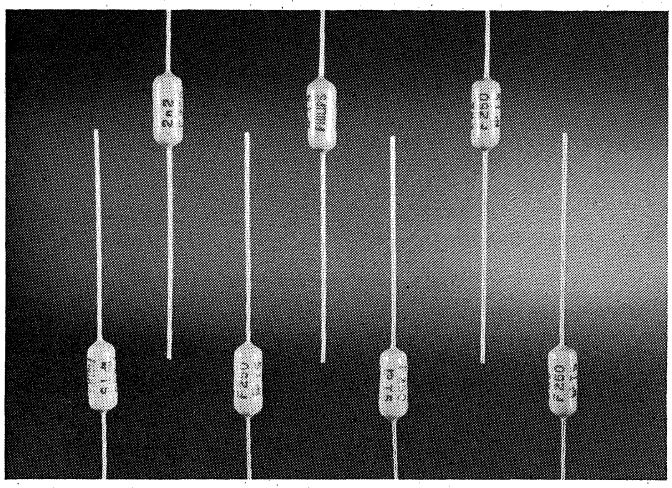
REFER TO THE DECADE TABLE, PAGE 464, E96 SERIES

SERIES 703E1 (TYPE KP)

Polypropylene Film & Foil Conformal Coated Capacitors (12NC2222-460 Thru 462)

DESCRIPTION

Polypropylene and foil capacitors consist of low inductive wound cells of metal foil and a polypropylene film. The cell is protected by a hard, water repellant solvent resistant blue epoxy coating. The long axial leads of solder-coated wire make the capacitors suitable for vertical or horizontal mounting on printed-wiring boards.



APPLICATION

For use in circuits where precision, reliability and low losses are of prime importance, i.e., Tuned Circuits, Filter Networks, Timing Networks, etc.

FEATURES

Electrical

- Climatic category 40/100/56.
- Related specification IEC 384-13.
- Dielectric Withstanding—200% x Rated (VDC) terminals to terminals.
  200% x rated VDC between interconnected terminals and case, min. 400V.
- Dissipation Factor

capacitance	tangent of loss angle		
	at 1KHz	at 100KHz	at 1MHz
$C_R \leq$ 1000 pF	$\leq 5 \times 10^{-4}$		$\leq 10 \times 10^{-4}$
1000 pF $< C_R \leq$ 5000 pF	$\leq 5 \times 10^{-4}$	$\leq 10 \times 10^{-4}$	
5000 pF $< C_R \leq$ 20000 pF	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$	
20000 pF $< C_R \leq$ 47000 pF	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$	
$C_R >$ 47000 pF	$\leq 5 \times 10^{-4}$	$\leq 40 \times 10^{-4}$	

- Insulation Resistance
  The insulation resistance is measured after a voltage has been applied for 1 min ± 5 s, the voltage being 10 ± 1V for the 63V version, 100 ± 15V for the 160V and 250V versions.
  R between terminations >100000 MΩ
  R between interconnected terminations and case >100000 MΩ
- Temperature coefficient
  between −40 and +20°C
  for 400V-630V −(125±125) 10^{-6}/K
  for 63V-160V-250V −(125±60) 10^{-6}/K
  between +20 and +100°C −(250±120) 10^{-6}/K
- Standard Voltage Ratings
  63, 160, 250, 400, & 630 VDC @ +85°C
- Capacitance Range (Available) 47 to 62,000 pf
  ±5%+E24 DECADE
  ±2%—E24 & E48 DECADE
- Tolerance On Rated Capacitance:
  ±5%, ±2% or 2 pF whichever is greater.

Mechanical

- Low series resistance
- Low self inductance
- Very small size
- Precision ±2% tolerance
- Precisely centered lead making them compatible with automatic lead cutting and bending machines.
- Suitable for both point to point wiring and PC board insertion.
- Lead solderability—Tested in accordance with MIL-STD-202, Method 208.
- Resistance to soldering heat with pre-heating: capacitors mounted on a 1.6 mm board with non-plated holes.
  Body Temp.: 80°C
  Bath Temp.: 260°C
  Dwell Time: 5 s

HOW TO SPECIFY

Mepco/Centralab Series 703E1 Capacitors can be completely specified using the following designation:

703E1 — **M/C Series**

FE — **Case Size**

103P — **Capacitance in (pF)**
First two digits represent significant figures and last digit indicates the number of zeros to follow.

G — **Tolerance**
J = ±5%
G = ±2%

161 — **Voltage at 85°C**
630= 63V
161=160V
251=250V

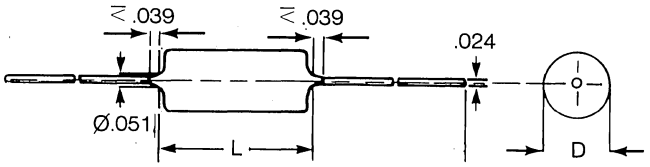
A — **Specification**
A = Standard
T = Tape & Reel
S = Single-ended (Radial) Tape & Reel

X — X = Axial Lead

SERIES 703E1

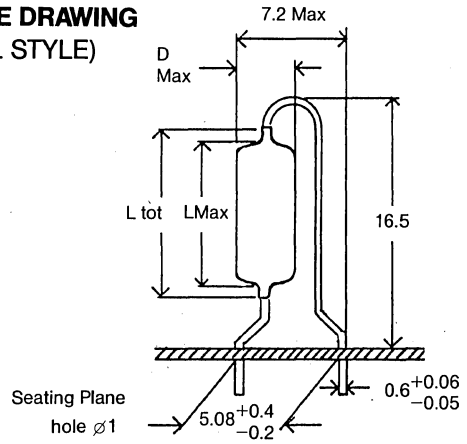
Polypropylene Film & Foil Conformal Coated Capacitors

OUTLINE DRAWING
(AXIAL STYLE)



Lead Length: 1.10 Min. Both Sides

OUTLINE DRAWING
(RADIAL STYLE)



Dimensions in mm

CASE SIZE TABLE

CASE SIZE CODE	DIMENSIONS IN INCHES (MM) MAXIMUM			
	"L" LENGTH*		"D" DIAMETER	
	INCHES	MM	INCHES	MM
AD	.433	11.0	.197	5.0
FE	.591	15.0	.217	5.5
FF	.591	15.0	.236	6.0
FG	.591	15.0	.256	6.5
FH	.591	15.0	.276	7.0
FJ	.591	15.0	.296	7.5
FK	.591	15.0	.315	8.0

*For clean lead to clean lead due to conformal coating Case A is .512" max and Case F is .670" max

TYPICAL MARKING EXAMPLE	
Nominal Capacitance (NF or PF)	10n
Tolerance Code & Rated D.C. Voltage (without symbol)	G 160
Dielectric Code & Date Code	KP 9
Name of Manufacturer	Philips

	63VDC (40VAC)	160VDC (63VAC)	250VDC (125VAC)	400VDC (160VAC)	630VDC (200VAC)
CAP VALUE UF	MEPCO/CENTRALAB PART NUMBER	MEPCO/CENTRALAB PART NUMBER	MEPCO/CENTRALAB PART NUMBER	MEPCO/CENTRALAB PART NUMBER	MEPCO/CENTRALAB PART NUMBER
47PF	FOR THESE RATINGS, USE THE CORRESPONDING HIGHER VOLTAGE LEVEL		FOR THESE RATINGS USE THE CORRESPONDING HIGHER VOLTAGE LEVEL		703E1AD470P*631AX
56PF					AD560
68PF					AD680
82PF					AD820
100PF					AD101
120PF					AD121
150PF				703E1AD151P*401AX	
180PF				AD181	
220PF				AD221	
270PF				AD271	
330PF				AD331	
390PF				AD391	
470PF				AD471	
560PF				AD561	
680PF				AD681	
820PF				AD821	
.0010				AD102	
.0012			703E1AD122P*251AX		
.0015			AD152		
.0018			AD182		
.0022			AD222		
.0027			AD272		
.0033			AD332		
.0039		703E1AD392P*161AX	FE392		
.0047		AD472	FE472		
.0056		AD562	FE562		
.0068	703E1AD682P*630AX	FE682	FE682		
.0082	AD822	FE822	FE822		
.010	FE103	FE103	FF103		
.012	FE123	FE123	FG123		
.015	FE153	FE153	FH153		
.018	FE183	FF183	FJ183		
.022	FE223	FG223	FK223		
.027	FF273	FH273			
.033	FG333	FJ333			
.039	FH393	FK393			
.047	FJ473				
.056	FK563				
.062	FK623				

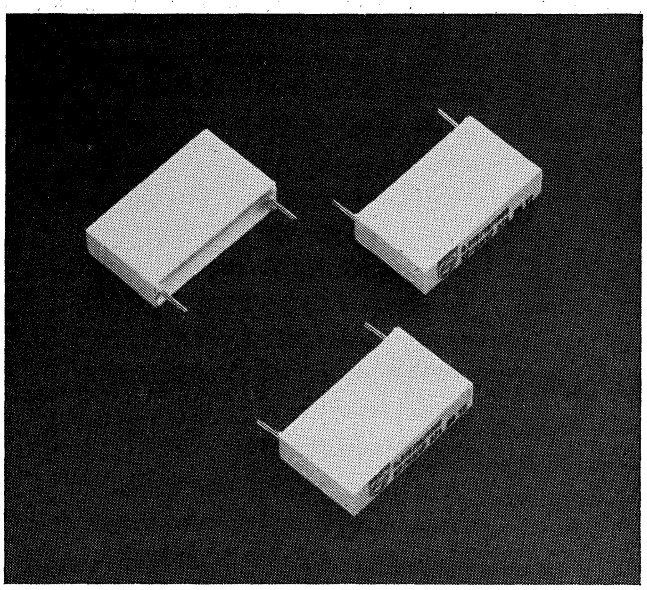
CAPACITANCE TOLERANCE J=±5%
G=±2%

NOTICE: Misapplication such as exceeding design limits may result in destruction or explosion of capacitors.

STRAIGHT AXIAL LEADS AVAILABLE BULK OR ON TAPE & REEL. RADIAL LEADS TAPE & REEL ONLY.
SEE PAGE 469 FOR TAPE & REEL SPECIFICATIONS.

SERIES 719F1 (TYPE KP/MMKP)

Polypropylene Series Construction Capacitors (12NC 2222-376)



DESCRIPTION

The capacitors consist of a series-constructed, low-inductance wound cell of polypropylene film, aluminum foil and double metallized polyester film. The cell is potted with epoxy resin in a flame retardent polypropylene case. The radial leads are of solder-coated wire. The capacitors can withstand solvents and rinsing liquids without damage. They are provided with small stand-off pips to allow removal of solder flux etc., when cleaning the printed-wiring board.

APPLICATION

These capacitors are for applications where high currents and steep pulses occur. They are mainly used for deflection circuits in television receivers, to operate at high peak currents at line frequency.

FEATURES

Electrical

- Rated Capacitance Range (E12, E24 Series) .001μF to 0.27μF
- Climatic Category 55/100/56
- Related Specification IEC 384-17
- Dielectric withstanding—160% x rated (VDC) terminal to terminal. 2840 VDC between interconnected terminations and case.
- Dissipation Factor @ 100KHz @ 25°C
  22.5mm pitch (.886 in. spacing)
  630V version ≤0.15
  All other voltage versions ≤0.10%
  27.5mm pitch (1.08 in. spacing)
  630V version ≤0.20%
  All other voltage versions ≤0.15%
- Insulation resistance
  The insulation resistance is measured after a voltage of 500 ±50 V has been applied for 1 min.±5 s, at T_{amb}=23°C.

R between terminations	>100000 MΩ
R between interconnected terminations and case	>100000 MΩ

- Standard voltage (DC) ratings 630V, 1000V, 1600V, 2000V @ +85°C

Mechanical

- Low cost
- Precisely dimensioned case-permits high density
- Mounting feet
- Flame retardant
- Lead solderability—Tested in accordance with MIL-STD-202 method 208
- Withstand most solvent and rinsing liquids

HOW TO SPECIFY

Mepco/Centralab Series 719F1 capacitors can be completely specified using the following designation:

719F1 RM 104P K 631 S E

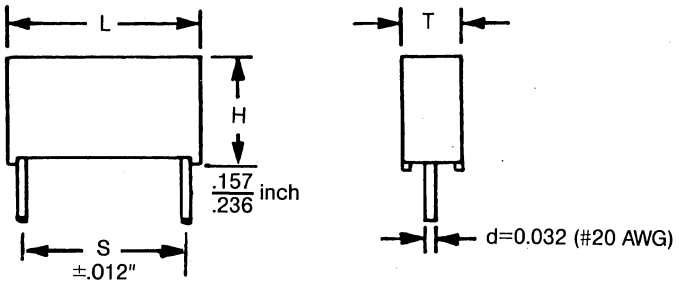
- **719F1** — M/C Series
- **RM** — Case Size
- **104P** — Capacitance in (pF): First two digits represent significant figures and last digit indicates the number of zeros to follow.
- **K** — Tolerance: J = ± 5%, K = ± 10%
- **631** — Voltage @ 85°C: 630VDC = 631, 1000VDC = 102, 1600VDC = 162, 2000VDC = 202
- **S** — Specification: S = standard
- **E** — Lead Configuration

Straight Lead Code	Lead Spacing
B	0.591
D	0.886
E	1.08

SERIES 719F1

Polypropylene Series Construction Capacitors

OUTLINE DRAWING



TYPICAL MARKING EXAMPLE

Top View

Nominal Cap (μf)/Tol./ Rated D.C. Voltage	0.1/10/630
Dielectric Code, Type Code, Factory Code, Date Code (Yr/Mo)	KP/MKP 376 HQ U9

CASE SIZE TABLE

CASE SIZE	"L" LENGTH		"H" HEIGHT		"T" THICKNESS		LEAD SPACING	
CODE	INCHES	MM	INCHES	MM	INCHES	MM	INCHES	MM
GD	.689	17.5	.433	11	.197	5	.591	15
GE	.689	17.5	.472	12	.236	6	.591	15
GF	.689	17.5	.511	13	.276	7	.591	15
GG	.689	17.5	.571	14.5	.335	8.5	.591	15
MH	1.024	26	.610	15.5	.256	6.5	.886	22.5
MJ	1.024	26	.650	16.5	.295	7.5	.886	22.5
MK	1.024	26	.689	17.5	.335	9.5	.886	22.5
ML	1.024	26	.748	19	.374	8.5	.886	22.5
RM	1.22	31	.788	20	.433	11	1.08	27.5
RN	1.22	31	.886	22.5	.512	13	1.08	27.5
RG	1.22	31	.985	25	.591	15	1.08	27.5
RH	1.22	31	1.102	28	.709	18	1.08	27.5

719F1 SERIES

CAP VALUE UF	630 VDC (300 VAC) MEPCO/CENTRALAB PART NUMBER*	CASE SIZE	1000 VDC (400 VAC) MEPCO/CENTRALAB PART NUMBER*	CASE SIZE	1600 VDC (500 VAC) MEPCO/CENTRALAB PART NUMBER*	CASE SIZE	2000 VDC (600 VAC) MEPCO/CENTRALAB PART NUMBER*	CASE SIZE
.001							719F1GD102PJ202SB	GD
.0012							GE122	GE
.0015	FOR THESE RATINGS		FOR THESE RATINGS				GE152	GE
.0018	USE THE		USE THE		719F1GD182P*162SB	GD	GF182	GF
.0022	CORRESPONDING		CORRESPONDING		GE222	GE	GG222	GG
.0027	HIGHER VOLTAGE		HIGHER VOLTAGE		GF272	GF	GG272	GG
.0033	LEVEL		LEVEL		GF332	GF	MH332	MH
.0039					GG392	GG	MH392	MH
.0047			719F1GD472P*102SB	GD	GG472	GG	MJ472	MJ
.0056			GD562	GD	719F1MH562P*162SD	MH	MJ562	MJ
.0068	719F1GD682P*631SB	GD	GE682	GE	MH682	MH	MJ682	MJ
.0082	GD822	GD	GE822	GE	MH822	MH	MK822	MK
.010	GE103	GE	GF103	GF	MJ103	MJ	ML103	ML
.012	GE123	GE	GG123	GG	MK123	MK	719F1RM123PJ202SE	RM
.015	GF153	GF	719F1MH153P*102SD	MH	ML153	ML	RM153	RM
.018	GF183	GF	MJ183	MJ	719F1RM183P*162SE	RM	RN183	RN
.022	GG223	GG	MK223	MK	RM223	RM	RN223	RN
.027	719F1MH273P*631SD	MH	MK273	MK	RN273	RN	RG273	RG
.033	MJ333	MJ	MK333	MK	RN333	RN	RH333	RH
.039	MJ393	MJ	ML393	ML	RG393	RG		
.047	MK473	MK	719F1RM473P*102SE	RM	RH473	RH		
.056	ML563	ML	RM563	RM	RH563	RH		
.068	719F1RM683P*631SE	RM	RM683	RM			±5% ONLY FOR 2000 V	
.082	RM823	RM	RN823	RN				
.10	RM104	RM	RN104	RN				
.12	RN124	RN	RG124	RG				
.15	RN154	RN	RH154	RH				
.18	RG184	RG	RH184	RH				
.22	RH224	RH						
.27	RH274	RH						

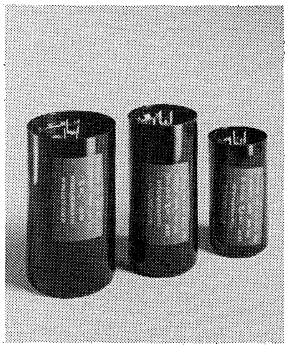
*Insert appropriate letter into part number for tolerance J=±5% K=±10%.

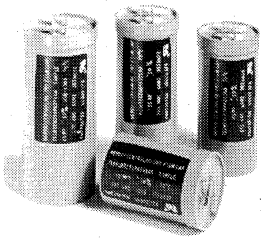
AVAILABLE BULK ONLY.

NOTICE: MISAPPLICATION SUCH AS EXCEEDING DESIGN LIMITS MAY RESULT IN DESTRUCTION OR EXPLOSION OF CAPACITORS.

SERIES 711H

Dry Metalized Polypropylene Capacitors For A.C. Applications





4

Film Capacitors

'A' Style Non-Protected

DESCRIPTION

Mepco/Centralab 711H metalized polypropylene capacitors consist of a non-inductive wound cell housed in a round phenolic case. These capacitors are supplied to a maximum voltage of 370 VAC @ 50/60Hz. Additional information with regard to electrical, environmental and mechanical specification is summarized on the following pages. *These capacitors are not protected—see Product Safety Statement.*

FEATURES

- Non-Inductive Windings
- Self-Healing Dielectric
- Dry Construction—Non PCB
- Rugged Mechanical Construction
- Phenolic Case Requires No Insulation
- Low Energy Consumption
- Brackets and End Caps Available
- Available Capacitance Tolerance—±10% (±3% & ±6%, available on request)

'B' Style—Protected U.L. Recognized C.S.A. Certified

DESCRIPTION

Mepco/Centralab 711H U.L. Recognized—Protected Dry Metalized Polypropylene capacitors consist of a non-inductive wound cell housed in a round flame-retardant thermo plastic case. These capacitors are supplied to a maximum voltage of 370VAC @ 50/60Hz. Additional information with regard to electrical, environmental, and mechanical specifications is summarized within this specification. *These capacitors are protected and are Underwriters Laboratories recognized components—U.L. File #E100883 and C.S.A. certified, file no. LR64220-1.* Additional room is not required when mounting to allow protection device to function. *See product Safety Statement.*

Protective device covered under one or more of the following U.S. Patents, 4,618, 910/4, 639,827/4,639,828/4,633,367/4661,876.

FEATURES

- Additional height is not required when mounting the capacitor for the protective device to function.
- Non-Inductive windings
- Self-healing dielectric
- Dry construction—NON-PCB
- Rugged mechanical construction
- Flame retardent thermo plastic case requires no insulation
- Low energy consumption
- Available capacitance tolerances—10% (±3% & ±6% available on request)
- *Protected dry capacitors* to 10,000 AFC @ rated voltage

SERIES 711H

Dry Metalized Polypropylene Capacitors for A.C. Application

'A' Style & 'B' Style

A.C. FILM CAPACITOR SPECIFICATIONS & TEST METHODS

I. Physical

A. See appropriate section for standard ratings, sizes & physical characteristics.

B. All 'A' style capacitor cases are made from mineral filled thermoset phenolic for durability & corrosion resistance. The case material has a U.L. temperature index of 150°C and a U.L. 94V-1 minimum flamability rating.

C. Capacitors may be mounted in any position.

II. Temperature Rating—these capacitors are rated as follows:

A. *Operating Case Temperature*—40°C to +70°C (−40°F to +158°F)

B. *Storage (Ambient)*—40°C to +90°C (−40°F to +194°F)

C. *Temperature Rating*—"Capacitors shall have rated life performance when operated within case temperature range. Operation at higher case temperatures will result in reduced life."

III. Voltage Rating

Mepco/Centralab metalized film capacitors are rated for stable operation at the rated voltage. Decreased life can be expected if the capacitors are operated at 110% of the rated voltage at 60HZ provided the maximum case temperature is not exceeded. Special voltage ratings are available. Please contact the factory.

IV. Capacitance & Tolerance

All capacitors supplied shall be within the specified limits of rated capacitance when measured at a temperature of +25°C. Standard capacitance tolerance is ±10%. Tolerances of ±6%, ±3% capacitance are available upon request.

All capacitance measurements shall be made on an A.C. bridge at a frequency of 60HZ or referred to measurements made at that frequency.

A. Capacitance change with temperature—when capacitance is measured at the maximum & minimum rated case temperatures, the capacitance will vary no more than −5% to +2% of the +25°C capacitance value.

V. Rated Life

"When operated @ rated voltage & rated case temperature (70°C max), capacitor survival shall be not less than 94% after 60,000 hours operation. After 5000 hours operation, survival shall be not less than 99% with capacitors operating at rated conditions."

"The useful life of the capacitor will be shortened by exceeding the rated voltage and/or temperature limits. Acceleration effects of temperature & voltage are now under study."

VI. Volt-Ampere Loading

"Capacitors shall be capable of operating at a volt ampere loading resulting from the combined effects of capacitance tolerance, frequency variations, voltage & harmonics, not exceeding 130% of the volt-ampere loading calculated at rated capacitance & at rated 60HZ (sinusoidal) voltage, provided rated case temperature is not exceeded." Please contact the factory prior to using these capacitors at a VA higher than rated.

VII. Dissipation Factor

The dissipation factor of each capacitor shall not exceed 0.1% when measured at or referred to 60HZ rated voltage applied at any temperature between 23°C & the capacitors maximum rated case temperature.

VIII. Dielectric Strength

Terminal-to-Terminal—The capacitors are capable of withstanding the applications of 1.75 x rated A.C. voltage for one (1) second. Capacitors should be discharged through a 10,000 Ohm resistor to limit the current.

Terminal-to-Case—The capacitors are capable of withstanding an application of 2 x rated A.C. voltage plus 1000 volts for one (1) second.

NOTE: An alternate test method may be used by applying a D.C. voltage equal to the peak voltage of the specified A.C. test voltage. (The capacitors must be charged & discharged through a 10,000Ω resistor.)

SERIES 711H

Dry Metalized Polypropylene Capacitors for A.C. Application

IX. Life Tests

A. High temperature life test—tested @ 125% x rated A.C. @ 80°C for 500, 1500, or 2000 hours (circulating air).

B. Room temperature life test—test @ 135% x rated A.C. @ room temperature for 120 hours (circulating air).

NOTE: These life tests are designed to indicate the relative quality of the capacitor lot being tested. Actual life in application can only be determined after extensive long-term test data accumulation.

C. The typical results expected after a life test are:

1. No short circuits between terminals or terminals & case
2. No intermittent or continuous open circuits between terminals
3. A typical D.F. $\leqq$ .10% @ 60Hz
4. Capacitance loss—

'A' Style—
(240VAC Rated) 500 hour test $\%\Delta C = \leqq 3\%$
(370VAC Rated) 500 hour test $\%\Delta C = \leqq 10\%$

'B' Style—
(240VAC Rated) 2000 hour test $\%\Delta C = \leqq 3\%$
(370VAC Rated) 1500 hour test $\%\Delta C = \leqq 3\%$

X. Environmental Tests

Mepco/Centralab metalized film capacitors meet or exceed the applicable environmental tests recommended by E.I.A.

SERIES 711H

Dry Metalized Polypropylene Capacitors for A.C. Application

CAPACITOR COMPARISON SHEET

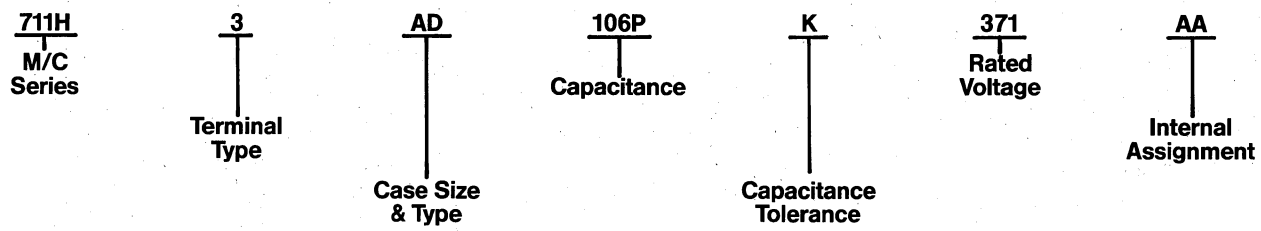
Characteristic	Dry Metalized Film	Wet Metalized Film	Free Foil/Oil Filled Paper or Paper/Film Cap
Failure Mode	Self-healing open circuit failure mode typical.	Same as dry	Short Circuit
Capacitance Stability	Excellent—self-healing implies capacitance loss during life thru electrode evaporation, oxidation or erosion.	Same as dry	Good
High Voltage A.C. Operation	Working voltages up to 370VAC in a single unit can be used at this stage of development, up to 660VAC under certain conditions.	Same except 440VAC available	High Voltage A.C. Operation Dependent on Impregnant Used And Thickness of Paper
Current Limitation	Exceptionally high currents are not recommended.	Same as dry	None
High Frequency Operation	Lower frequency operation due to the high inductance and resistive effects of metalized electrode & end connection.	Same as dry	Up To 10MHz With Non-Inductive Construction
Capacitance Values	1—100 MFD	Same as dry	1—100 MFD
Loss (Dissipation Factor)	Typically .01 to .1% D.F. @ 60HZ @ Rated VAC	Same as dry	Typically .3 to .6% D.F. @60HZ @ Rated Voltage
Size & Weight	Smallest & Lightest/M.F.D.	Between oil filled, free foil & dry metalized	Largest & Heaviest/M.F.D.
Life	Typically 60,000 Hours Plus	Same as dry	Typically 60,000 Hours
U.L. Requirements & Impregnant	No impregnant, no oil to leak 'B' Style Capacitors are protected and U.L. recognized per U.L. 810.	Same as oil filled free foil	Oil filled must be protected per U.L. requirement. Free oil combustible & can leak & be a serious hazard.

SERIES 711H

Dry Metalized Polypropylene Capacitors for A.C. Application

HOW TO SPECIFY

Mepco/Centralab Series 711H capacitors can be completely specified using the following designation:



PHENOLIC			PLASTIC		
	Dia.	Ht.		Dia.	Ht.
(1)AA=	1.437"	x 2.750"	BB=	1.75"	x 2.735"
(2)AB=	1.437"	x 3.375"	BF=	1.75"	x 3.78"
(3)AC=	1.437"	x 4.375"	BG=	1.75"	x 4.45"
(4)AD=	1.812"	x 3.375"	BH=	2.00"	x 4.45"
(5)AE=	1.812"	x 4.375"			
(6)AF=	2.062"	x 3.375"			
(7)AG=	2.062"	x 4.375"			
(8)AH=	2.562"	x 4.375"			

TERMINAL TYPE

3=(2) 2BQC
4=(1) 2BQC/(1) 4BQC
5=(2) 4BQC
6=(2) 1BQC
7=(2) 2BQC w/Solder Lug
8=(2) Solder Lugs
9=Lead Wire

('B' Style design available with termination option 3 & 9 only)

A=Phenolic
B=Plastic
C=Open
D=Open
E=Wrap & Pot
F-Z=Open

FIRST ALPHA OF CODE (6th Field of M/C Part Number)

CAPACITANCE

For whole capacitance values in micro farads, Columns 8 & 9 contain significant digits, Column 10 contains multiplier, Column 11 contains a 'P'. For fractional capacitance values in Microfarads, Columns 8 & 9 contain significant digits, Column 10 contains the fractional value and Column 11 contains the multiplier. The 'P' is dropped.

Multipliers

1 = 10^1	6 = 10^6
2 = 10^2	7 = 10^7
3 = 10^3	8 = 10^8
4 = 10^4	9 = 10^9
5 = 10^5	0 = 10^0

Example

25μf = 256P
12.5μf = 1256
8μf = 805P

CAPACITANCE TOLERANCE

L=±3%
H=±6%
K=±10% (STANDARD)
A=±Special

VOLTAGE RATING

Column #13 & 14 are significant digits. Column #15 gives number of zeros.

EXAMPLE: 240VAC = 241
370VAC = 371

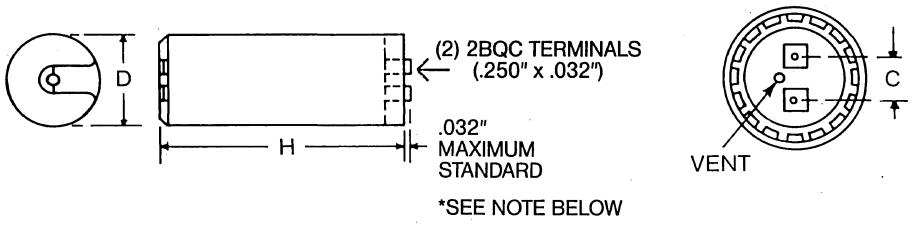
INTERNAL ASSIGNMENT

Used to denote individual customers.
'AA' is used to designate a standard part not specifically assigned to a specific customer.

SERIES 711H

Dry Metalized Polypropylene Capacitors for A.C. Application "A" Style

CASE OUTLINE DRAWING



TERMINAL TYPES

2 Blade QC | 1 Blade QC | 2 Blade QC with solder lug | Solder lug

(Quick-connect terminals are also suitable for soldered connections)

Case Code	Case Diameter 'D'		Case Height 'H'		Terminal C-C 'C'	
	Inches (±.015)	mm (±.38)	Inches (±.032)	mm (±.81)	Inches (±.005)	mm (±.13)
AA (1)	1.437	36.5	2.750	69.9	.500	12.7
AB (2)	1.437	36.5	3.375	85.7	.500	12.7
AC (3)	1.437	36.5	4.375	111.1	.500	12.7
AD (4)	1.812	46.0	3.375	85.7	.625	15.9
AE (5)	1.812	46.0	4.375	111.1	.625	15.9
AF (6)	2.062	52.4	3.375	85.7	.812	20.6
AG (7)	2.062	52.4	4.375	111.1	.812	20.6
AH (8)	2.562	65.1	4.375	111.1	.812	20.6

"A" STYLE

TYPICAL MARKING EXAMPLE

1ST LINE — MANUFACTURERS NAME
2ND LINE — M/C PART NUMBER
3RD LINE — RATED CAPACITANCE, TOLERANCE, CUSTOMER PART NUMBER IF REQUIRED
4TH LINE — RATED VOLTAGE, FREQUENCY, & DATE CODE
5TH LINE — CAPACITOR TYPE — NOT PROTECTED

EXAMPLE (RED LABEL WITH WHITE CHARACTERS)

MEPCO/CENTRALAB
711H3AD106PK371AA
10μF ±10% [ ]
370 VAC 60HZ 362 [DATE]
DRY FILM CAP — NOT PROTECTED

*NOTE: SHALLOW RECESS COVER DEPTH AVAILABLE ON ALL CASE SIZES EXCEPT AH (8). TERMINAL HEIGHT = .250 MAX.

SERIES 711H

Dry Metalized Polypropylene Capacitors for A.C. Application "A" Style

'A' STYLE CAPACITANCE DECADE VS CASE SIZE

(For special capacitance values please contact Mepco/Centralab sales office or manufacturing facility. Certain restrictions may apply to non-standard values.)

Capacitance MPD	@ 240VAC Standard Case Size	@ 370VAC Standard Case Size
3	AA (1)	AA (1)
4	AA (1)	AA (1)
5	AA (1)	AB (2)
6	AA (1)	AB (2)
7	AA (1)	AB (2)
7.5	AA (1)	AB (2)
9	AB (2)	AC (3)
10	AB (2)	AC (3)
11	AB (2)	AC (3)
12.5	AC (3)	AD (4)
15	AD (4)	AD (4)
17.5	AD (4)	AE (5)
20	AD (4)	AE (5)
22.5	AD (4)	AG (7)
25	AD (4)	AG (7)
27.5	AD (4)	AG (7)
30	AE (5)	AH (8)
35	AE (5)	AH (8)
40	AE (5)	AH (8)
45	AG (7)	AH (8)
50	AG (7)	AH (8)
55	AH (8)	
60	AH (8)	
65	AH (8)	Not
70	AH (8)	Available
75	AH (8)	

NOTES:

1. Capacitance tolerance: Standard 10%(K) +6%(H) & 3%(L) at slightly higher costs.
2. Accessories: For mounting brackets & end caps see accessory sheet section.
3. These capacitors are designed for operation in symmetrical sinewave circuits operating at rated 60HZ or lower. For special applications, please contact your nearest sales office, representative, or the factory.

Some capacitors' failure modes could cause the capacitor's case to rupture due to internally generated gases. Please read the following information before energizing the capacitors. If you have any questions, please contact your local Mepco/Centralab Field Sales Representative or the Mepco/Centralab Film Capacitor Facility, Columbia, South Carolina.

NOTICE

Missapplication, such as exceeding design limits may result in destruction or explosion of capacitors.

CAUTION

Mepco/Centralab 711H series capacitors are housed in flame-retardant thermoset phenolic cases and do not contain internal protection.

Before these products are energized, to avoid possible damage from overheating or rupture, they must be separately housed in a suitable enclosure.

Also, each part shall be marked with the words "not protected."

SERIES 711H

Dry Metalized Polypropylene Capacitors for A.C. Application "A" Style

BRACKET DIMENSIONS

DRAWING NO.	A	B	C	D	E
614A765ABP1	5.015	4.656	2.0	—	2.078
614A765ABP2	4.015	3.650	1.703	.906	1.578
614A765ABP3	3.374	3.015	1.062	.586	1.258

CASE SIZE	END CAPS		BRACKETS
	LEAD HOLE DWG. #614a766****		DWG. NO. 614a765****
	BOTTOM	TOP	
AA (1)	AAP001	ABP001	ABP003
AB (2)	AAP001	ABP001	ABP002
AC (3)	AAP001	ABP001	ABP001
AD (4)	AAP002	ABP002	ABP002
AE (5)	AAP002	ABP002	ABP001
AF (6)	AAP003	ABP003	ABP002
AG (7)	AAP003	ABP003	ABP001
AH (8)	AAP004	ABP004	ABP001

ORDERING INFORMATION

1. (1) one cap & (1) bracket required per capacitor.
2. When ordering caps (614A766****) or brackets (614A765****) insert the appropriate alpha/numeric code from the chart above.

DISCHARGE RESISTOR

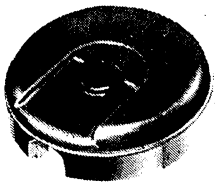
Some applications require that the capacitor discharge automatically once the voltage source is disconnected. This minimizes the shock hazard. Normally a 15K Ohm 20% 2 watt resistor is used. Other resistance values are available upon request. Consult the factory for this option.

ACCESSORY ITEMS

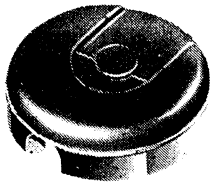
Order as separate items
'A' Style Only

END CAPS

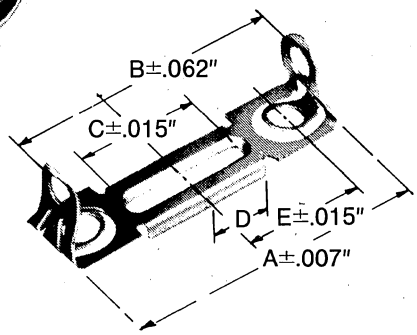
Bottom Lead Hold



Top Lead Hole



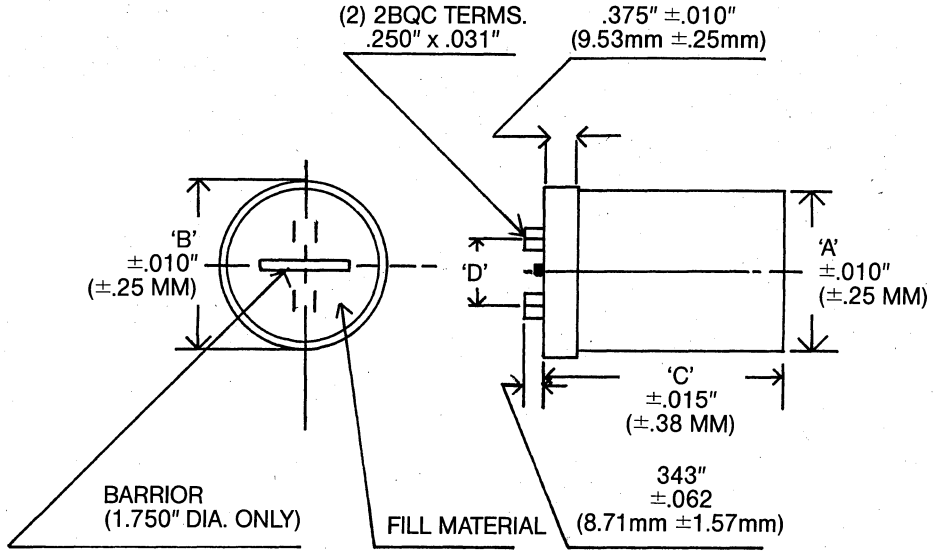
BRACKET DRAWING



SERIES 711H

Dry Metalized Polypropylene Capacitors for A.C. Application "B" Style

CASE OUTLINE DRAWING:



Case Code	Case Diameter 'A'		Lip Diameter 'B'		Case Height 'C'		Terminal C-C 'D'	
	Inches	mm	Inches	mm	Inches	mm	Inches	mm
BB	1.750	44.5	1.835	46.6	2.735	69.5	.710	18
BF	1.750	44.5	1.835	46.6	3.780	96.0	.710	18
BG	1.750	44.5	1.835	46.6	4.450	113.0	.710	18
BH	2.000	51.0	2.085	53.0	4.450	113.0	.812	20.6

TYPICAL MARKING EXAMPLE 'B' STYLE:

1st Line = Mfg. Name or Symbol and Capacitor Type
2nd Line = Mepco/Centralab part number and maximum case temperature
3rd Line = Capacitance, tolerance, voltage, frequency
4th Line = EIA Code-Date Code, Cust. Part No., when required
5th Line = Word "Protected," AFC Rating, C.S.A. & U.L. Symbol

Example: (Black label with/white characters)

Mepco/Centralab—Dry Film Cap
711H3BG156PK371AA 70°C
15 MFD ±10% 370 VAC 60 HZ
3628602
Protected 10,000 AFC

The above label information is required in order to comply with specifications for protected dry capacitors.

SERIES 711H

Dry Metalized Polypropylene Capacitors for A.C. Application "B" Style

STANDARD CAPACITANCE DECADE vs CASE SIZE

(For special capacitance values please contact Mepco/Centralab—certain restriction may apply to non-standard values).

Capacitance (MFD)	@ 240 VAC Standard Case Size	@ 370 VAC Standard Case Size
2 3 4 5 6	USE 370 VAC DESIGN	BB BB BB BB BB
7 7.5 8		BB BB,BF BB,BF
9 10 11 12.5	BB BB BB BB	BF BF BF BF
15 16 17.5	BB,BF BB,BF BB,BF	BF,BG,BH BF,BG,BH BF,BG,BH
20 22.5 25	BF BF BF,BG	BG,BH BG,BH BG,BH
27.5 30 32.5 35	BG BG BG BG	BH BH BH BH
40 45	BG,BH BG,BH	NOT AVAILABLE
50 55 60 62.5	BH BH BH BH	

NOTES:

1. Capacitance tolerance: Standard ±10%(K) [+6%(H) & ±3%(L) at slightly higher costs].
2. These capacitors are designed for operation in symmetrical sinewave circuits operating at rated 60HZ or lower. For special applications, please contact your nearest sales office, representative, or the factory.

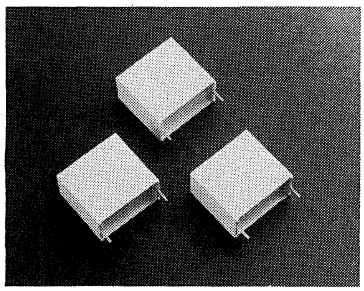
PRODUCT SAFETY

Some capacitor failure modes could cause the capacitor's case to rupture due to internally generated gases. Please read the following information before energizing the capacitors. If you have any questions, please contact your local Mepco/Centralab Field Sales Representative or the Mepco/Centralab Film Capacitor Facility, Columbia, South Carolina (803-772-2500).

NOTICE: MISAPPLICATION, SUCH AS EXCEEDING DESIGN LIMITS MAY RESULT IN DESTRUCTION OR EXPLOSION OF CAPACITORS. THESE CAPACITORS ARE NOT INTENDED FOR USE IN APPLICATIONS WHERE CAPACITORS ARE WIRED IN SERIES TO ACHIEVE VOLTAGE. AS WITH ANY CAPACITOR, MOUNT WITHIN A SUITABLE ENCLOSURE.

SERIES 719J1 (RADIAL) (TYPE MKT-P)

Metalized Polyester and Paper Capacitors (For Interference Supression (12NC2222-330)



DESCRIPTION

Series 719J1 (Radial) impregnated metalized polyester and paper capacitors incapsulated in precision made flame retardant polypropylene cases. The leads are solder coated wire.

PERFORMANCE CLASS X2 QUALIFIED ACCORDING TO VDE 565-1 AND SEMKO.

APPLICATION

For Radio Interference Suppression In:

- Small Household Appliances e.g. Coffee Grinders, Mixers
- Audio and TV Circuits
- General Industrial Applications; e.g. Test & Measuring Equipment.

FEATURES

Electrical

- Insulation resistance
  The insulation resistance is measured after a voltage of 100 ±15 V has been applied for 1 min. ±5 s, at T_{amb}=20°C.
  R between terminations, for $C_R \leq 0{,}33\mu F$ $>15000M\Omega$
  RC between terminations, for $C_R > 0{,}33\mu F$ > 5000 s
  R between interconected terminations and case (foil method) $>30000M\Omega$
- Rated Capacitance Range .01 to 1.0 μF
- Tolerance on Rated Capacitance ±20%, ±10%
- Standard Voltage 250 VAC @ +85°C
- Climatic Category 40/85/21
- Related Specification IEC 384-14
- Max. Pulse Load 100V/μS
- Dissipation Factor
  @ 1KHz ≤ 75×10^{-4}
  @ 10 KHz ≤ 130×10^{-4}
- Test Voltage
  Between terminals 1075 VDC
  Between interconnected terminals & case 2000 VAC (foil method)

Mechanical

- Flame Retardent
- Precisely Dimensioned Cases
- Self-Healing
- Solvent Resistant
- Suitable For Both Point To Point Wiring and PC Board Insertion

Mepco/Centralab Series 719J1 Capacitors can be completely specified using the following designation:

719J1 | GG | 104P | M | 251 | S | B

- 719J1: M/C Series
- GG: Case Size
- 104P: Capacitance in (pF) — First two digits represent significant figures and last digit indicates the number of zeros to follow.
- M: Tolerance — K=±10%, M=±20%
- 251: Voltage at 85°C — 251=250V
- S: Specification — S=Short Leads, L=Long Leads, I=Insulated Leads, See Special Note
- B: Lead Configuration Straight

Lead Code	Lead Spacing
B	0.591
D	0.886
E	1.080

CASE SIZE CODE	SERIES 719J1 (RADIAL)									
	"L" LENGTH		"H" HEIGHT		"T" THICKNESS		"S" SPACING		"d" LEAD DIA.	
	INCHES	mm	INCHES	mm	INCHES	mm	INCHES	mm	INCHES	mm
GD	.689	17.5	.433	11.0	.197	5.0	.591	15.0	20	.032
GE	.689	17.5	.453	11.5	.236	6.0	.591	15.0	20	.032
GF	.689	17.5	.511	13.0	.276	7.0	.591	15.0	20	.032
GG	.689	17.5	.571	14.5	.335	8.5	.591	15.0	20	.032
MH	1.020	26.0	.630	16.0	.276	7.0	.886	22.5	20	.032
MJ	1.020	26.0	.670	17.5	.335	8.5	.886	22.5	20	.032
ML	1.020	26.0	.729	18.5	.394	10.0	.886	22.5	20	.032
SN	1.22	31.0	.886	22.5	.531	13.5	1.08	27.5	20	.032
SP	1.22	31.0	.984	25.0	.591	15.0	1.08	27.5	20	.032
SR	1.22	31.0	1.10	28.0	.709	18.0	1.08	27.5	18	.040

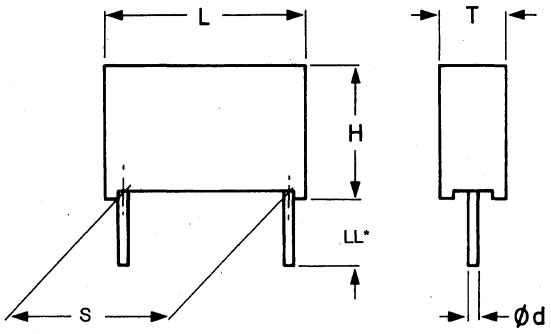
SERIES 719J1

ON TOP (LINE ONE)
RATED CAP μF/TOL. ±10%=K,
±20% NOT IDENTIFIED
RATED VOLTAGE & PERFORMANCE
CLASS
PHILIPS TYPE NO. & (LINE TWO)
CODE FOR DIELECTRIC MKT-P
(LINE 3)
CLIMATIC CATEGORY, DATE CODE
APPROBATION & PHILIPS SYMBOLS

SERIES 7191J1 (RADIAL)		
0.010	719J1GD103P*251SB	GD
0.015	GD153	GD
0.022	GD223	GD
0.033	GD333	GD
0.047	GE473	GE
0.068	GF683	GF
0.10	GG104	GG
0.15	719J1MH154P*251SD	MH
0.22	MJ224	MJ
0.33	719J1ML334P*251SE	ML
0.47	SN474	SN
0.68	SP684	SP
1.0	SR105	SR

*INSERT APPROPRIATE LETTER INTO PART NUMBER FOR TOLERANCE
K = ±10% M = ±20%

OUTLINE DRAWING SERIES 719J1



LL
*SHORT LEADS 5±1 MM (.157/.236 INCH) LENGTH
LONG LEADS 25^{+2}_{0} MM (.985/1.06 INCH) LENGTH
(INSULATED LONG LEADS ARE AVAILABLE—PLEASE CONTACT THE FACTORY FOR MORE INFORMATION)

NOTICE: MISAPPLICATION SUCH AS EXCEEDING DESIGN LIMITS MAY RESULT IN DESTRUCTION OR EXPLOSION OF CAPACITORS.

STANDARD SERIES OF VALUES IN A DECADE

STANDARD SERIES OF VALUES IN A DECADE

for resistances and capacitances

according to IEC publication 63

E192	E96	E48	E192	E96	E48	E192	E96	E48	E192	E96	E48	E192	E96	E48
100	100	100	169	169	169	287	287	287	487	487	487	825	825	825
101			172			291			493			835		
102	102		174	174		294	294		499	499		845	845	
104			176			298			505			856		
105	105	105	178	178	178	301	301	301	511	511	511	866	866	866
106			180			305			517			876		
107	107		182	182		309	309		523	523		887	887	
109			184			312			530			898		
110	110	110	187	187	187	316	316	316	536	536	536	909	909	909
111			189			320			542			920		
113	113		191	191		324	324		549	549		931	931	
114			193			328			556			942		
115	115	115	196	196	196	332	332	332	562	562	562	953	953	953
117			198			336			569			965		
118	118		200	200		340	340		576	576		976	976	
120			203			344			583			988		
121	121	121	205	205	205	348	348	348	590	590	590			
123			208			352			597					
124	124		210	210		357	357		604	604		E24	E12	E6	E3
126			213			361			612					
127	127	127	215	215	215	365	365	365	619	619	619	10	10	10	10
129			218			370			626			11			
130	130		221	221		374	374		634	634		12	12		
132			223			379			642			13			
133	133	133	226	226	226	383	383	383	649	649	649	15	15	15	
135			229			388			657			16			
137	137		232	232		392	392		665	665		18	18		
138			234			397			673			20			
140	140	140	237	237	237	402	402	402	681	681	681	22	22	22	22
142			240			407			690			24			
143	143		243	243		412	412		698	698		27	27		
145			246			417			706			30			
147	147	147	249	249	249	422	422	422	715	715	715	33	33	33	
149			252			427			723			36			
150	150		255	255		432	432		732	732		39	39		
152			258			437			741			43			
154	154	154	261	261	261	442	442	442	750	750	750	47	47	47	47
156			264			448			759			51			
158	158		267	267		453	453		768	768		56	56		
160			271			459			777			62			
162	162	162	274	274	274	464	464	464	787	787	787	68	68	68	
164			277			470			796			75			
165	165		280	280		475	475		806	806		82	82		
167			284			481			816			91			

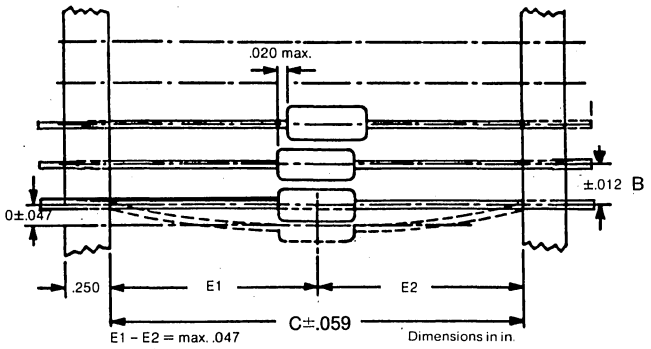
HOW TO INTERPRET CAPACITANCE DECADES EXAMPLES:

A decade of 100 indicates:
100PF...order P/N 719C1CA101PF630SF
.001μF...order P/N 719C1CA102PF630SF
.01μF...order P/N 719C1CB103PF630SG

A decade of 215 indicates:
215PF...order P/N 719C1CA2151F630SF
.00215μF...order P/N 719C1CA2152F630SF
.0215μF...order P/N 719C1CC2153F630SH

A decade of 324 indicates:
324PF...order P/N 719C1CA3241F630SF
.00324μF...order P/N 719C1CA3242F630SF
.0324μF...order P/N 719C1CC3243F630SH

A decade of 56 indicates:
56PF...order P/N 704C1AA560PF631AX
560PF...order P/N 704C1AA561PF251AX
5600PF...order P/N 704C1AC562PF630AX

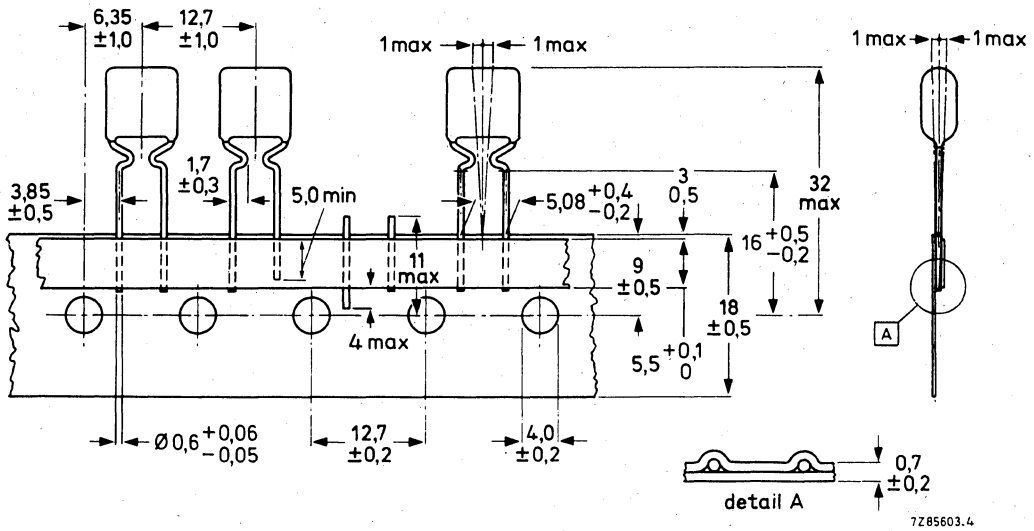


TAPE & REEL PER EIA RS296 (LATEST ISSUE)

A DIA. RANGE	B UNIT SPACING	C TAPE SPACING
.197 max	.200	*
.394 max	.400	*
.594 max	.600	*

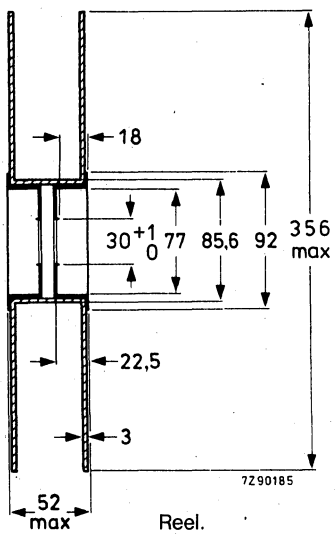
Notes: 1) For "C" all "B" dimensions are available in tape spacings of 2.062, 2.500, or 2.874 inches
2) Reel diameter is 14 inches

SERIES 712A1
Tape & Reel Specifications

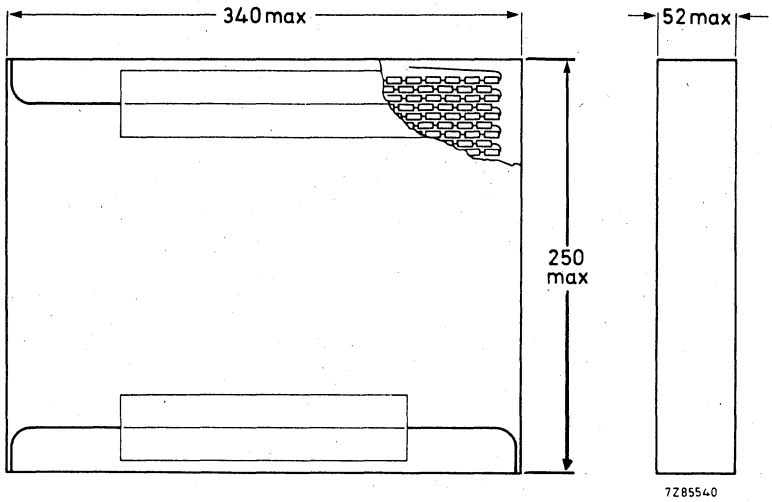


Capacitors on tape.

Cumulative pitch error: 1,0 mm/20 pitches.
Maximum 0,5% of the total number of capacitors per reel may be missing, but no more than 2 consecutive positions may be vacant.

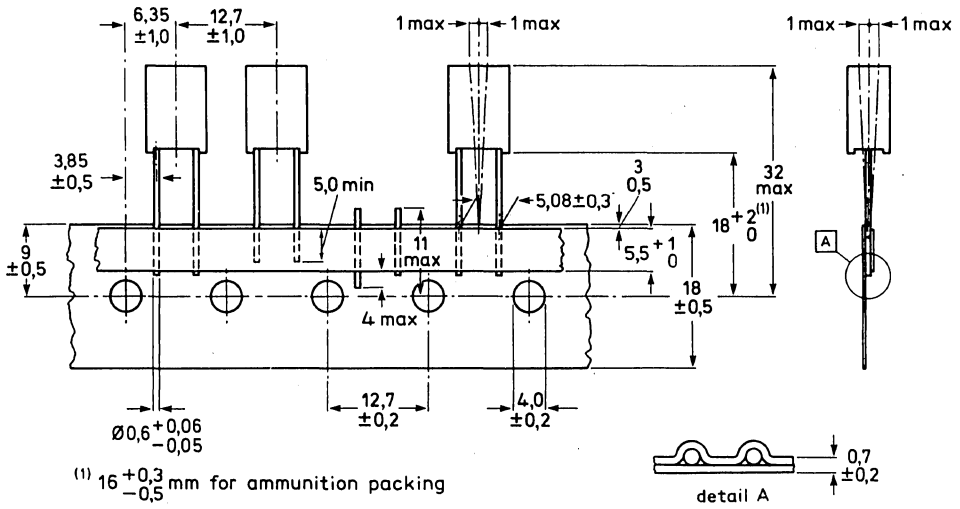


Reel.



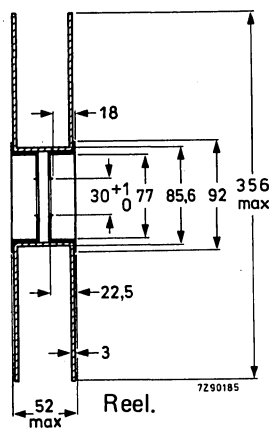
Capacitors on tape in ammunition packing.

Characteristics concerning taped capacitors:	
Pull-out force of the component	≥5 N
Pull-off force of adhesive tape	≥ 6N
Tearing force of tape	≥15 N
Storage conditions:	
Storage temperature range	−25 to +40°C
Relative humidity	≤80%

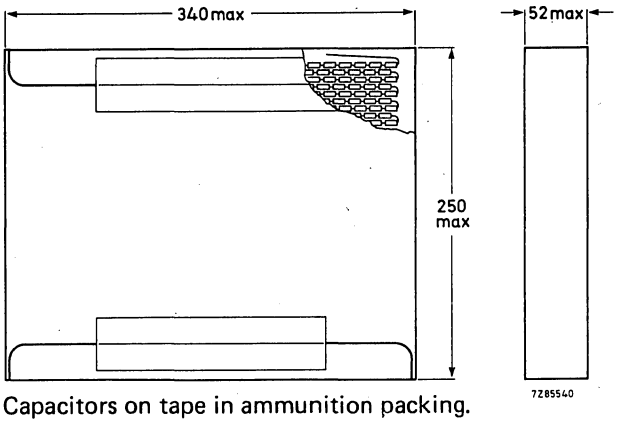


Capacitors 2222 370 on tape.

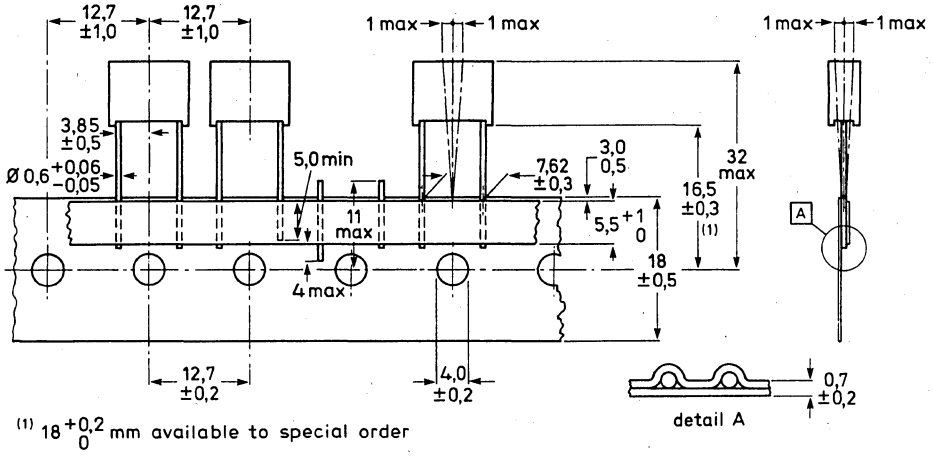
Cumulative pitch error: 1,0 mm/20 pitches.
Max. 0,5% of the total number of capacitors per reel may be missing, but no more than 2 consecutive positions may be vacant.



Reel.



Capacitors on tape in ammunition packing.

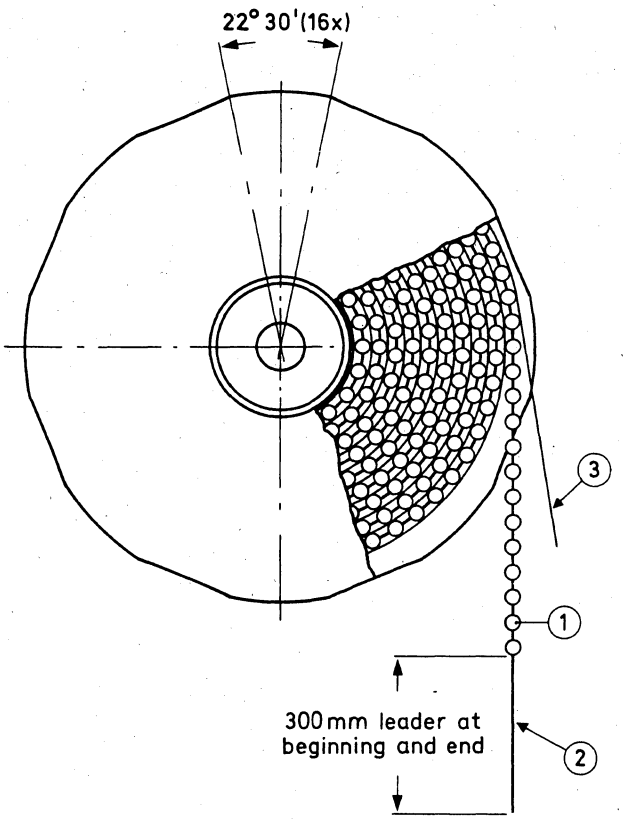


Capacitors 2222 371 on tape & reel only.

Characteristics concerning taped capacitors:		Storage conditions:	
Pull-out force of the component	≥5 N	Storage temperature range	−25 to +40°C
Pull-off force of adhesive tape	≥6 N	Relative humidity	≤80%
Tearing force of tape	≥15 N		

SERIES 703C1 & 704C1

Tape & Reel Packaging Specifications



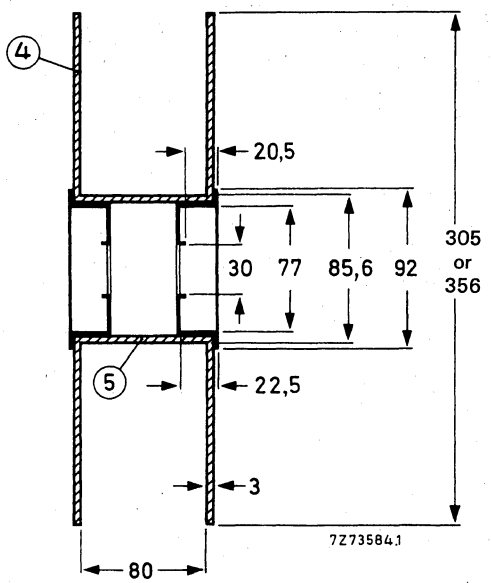
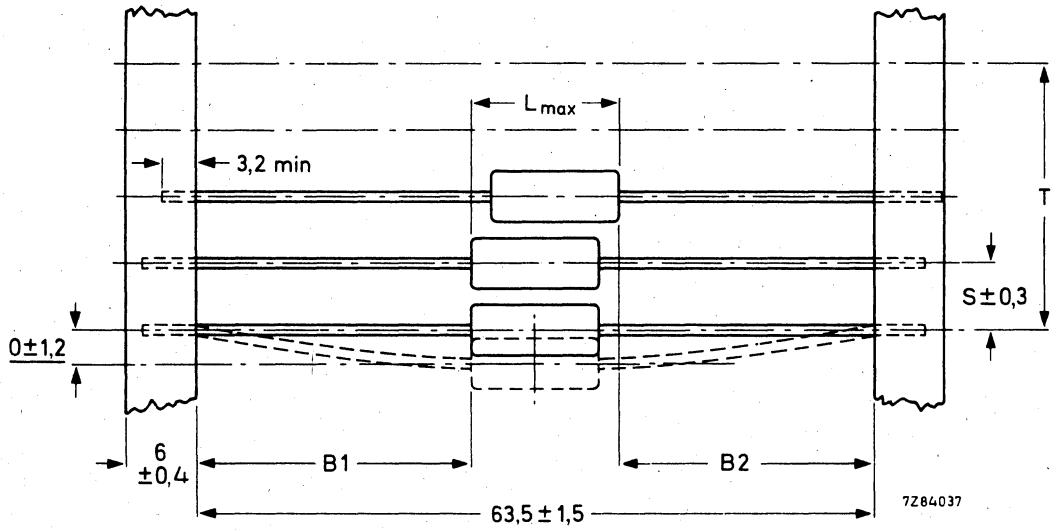


Fig. 11 Reel; for dimensions B see Table 9.
1: capacitor
2: bandolier
3: paper
4: flange
5: cylinder

Packing on bandoliers on reels

Dimensions in mm



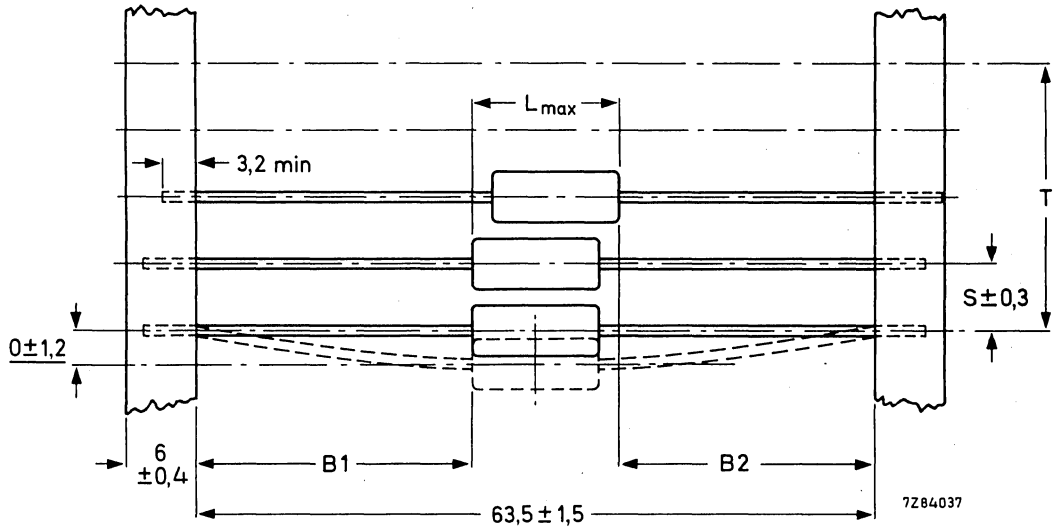
703C1 & 704C1 Series

capacitance values (pF) of				S	T for number (n) of capacitors	
63 V version	160 V version	250 V version	630 V version		n <50	50<n<100
2 000– 5 000	1 100–2 700	560– 1 500	51– 680	5	5(n-1)±2	5(n-1)±4
6 200–39 000	3 000–16 000	1 600–11 000	750–5 600	10	10(n-1)±2	10(n-1)±4

Characteristics concerning taped capacitors:		Storage conditions:	
Pull-out force of the component	≥2 N	Storage temperature range	−25 to +40°C
Tearing force of tape	≥10 N	Relative humidity	≤80%

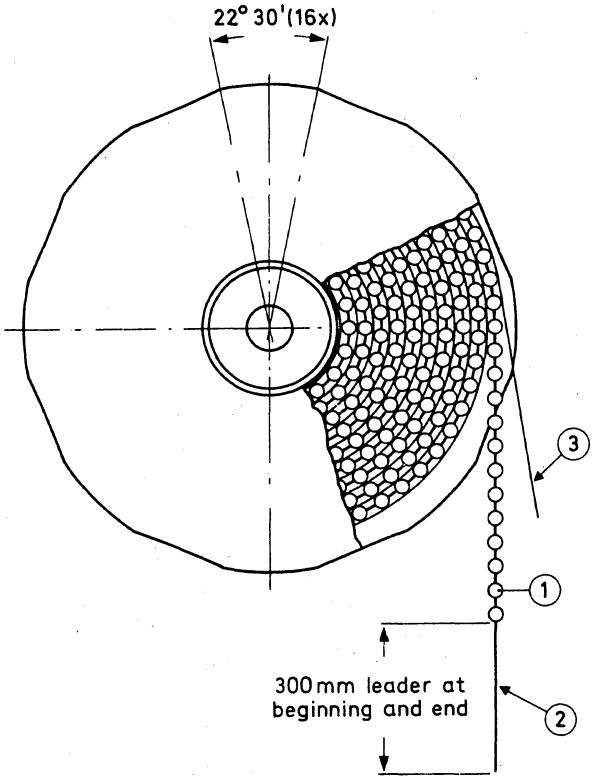
Packing on bandoliers on reels

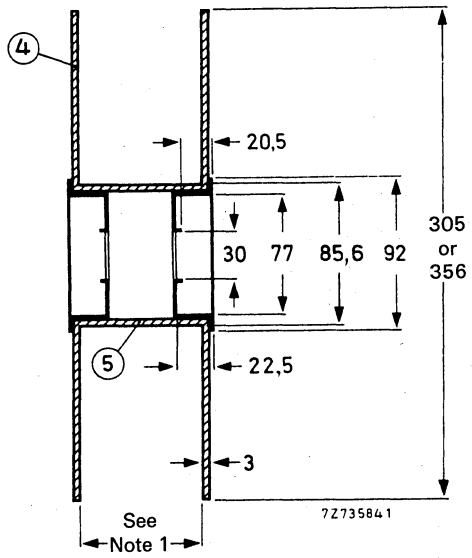
Dimensions in mm



Capacitors on bandoliers; for dimensions S and T, see Table
$|B1-B2|$ = max. 1,4 mm; for dimension L_{max}, see size table.

capacitance values (pF) of			S	T for number (n) of capacitors	
63 V version	160 V version	250/400/630 V version		n <50	50<n<100
6 800– 9 100	3 600– 6 200	47– 3 300	5	5(n-1)±2	5(n-1)±4
10 000–62 000	6 800–39 000	3 600–22 000	10	10(n-1)±2	10(n-1)±4



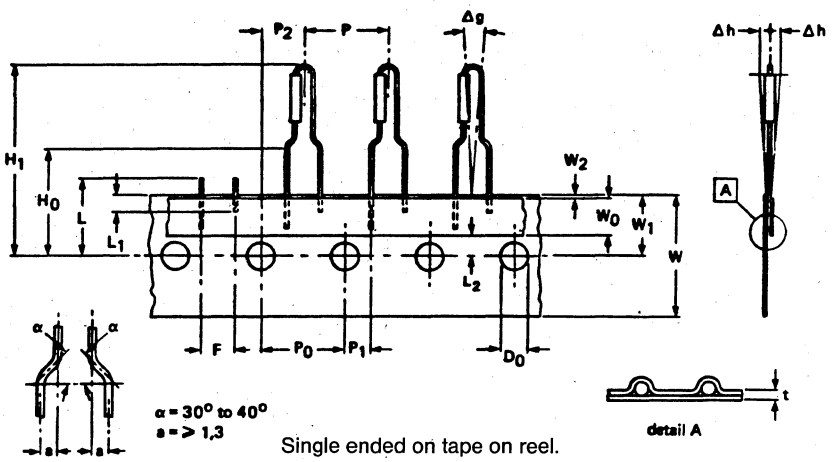


1: capacitor
2: bandolier
3: paper
4: flange
5: cylinder

Note 1—axial lead 80 mm/radial lead 52 mm

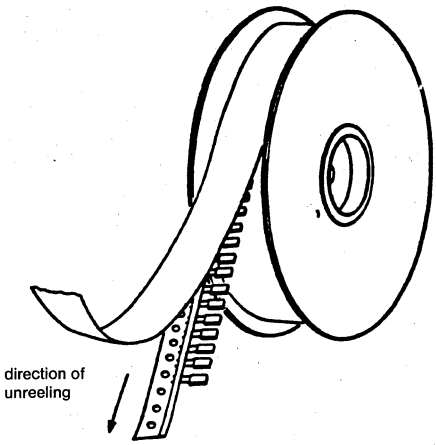
SERIES 703E1

Tape & Reel Specifications (Radial)



Single ended on tape on reel.

Pitch of components	P		12,7±1,0
Feed hole pitch	P_0		12,7±0,2
Cumulative pitch error	T		1,0 per 20 spacings 0,5 per 4 spacings
Feed hole centre to lead at topside at the tape	P_1		3,85±0,5
Feed hole centre to body centre	P_2		6,35±1,0
Lead to lead distance	F		5,08 +0,4 −0,2
Component alignment	Δh		0±1,2
Component alignment	Δp		±1,0
Tape width	W		18,0±0,5
Hold down tape width	W_0	min.	5,5
Hole position	W_1		9,0±0,5
Hold down tape position	W_2	max.	0,5
Lead wire clinch height	H_0		16,0±0,5
Component height	H_1	max.	32
Feed hole diameter	D_0		4,0±0,2
Total tape thickness	t		0,7±0,2
Length of snipped lead	L	max.	11,0
Lead wire (tape portion) shortest lead	L_1	min.	2,0
Lead wire protrusion	L_2	max.	4



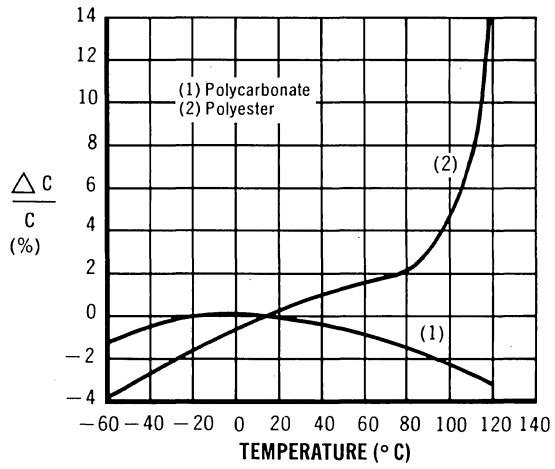
Reel for single ended version.

Characteristics concerning taped products

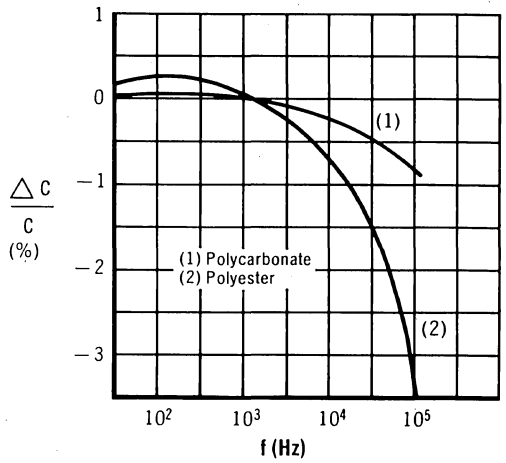
For axial leads	
Pull-out force of the component	≥2 N
Pull-off force of adhesive tape	≥6 N
Tearing force of tape	≥15 N
For radial leads	
Pull-out force of the component	≥5 N
Pull-off force of adhesive tape	≥6 N
Tearing force of tape	≥15 N
Storage conditions	
Storage temperature range	−25°C to +40°C
Relative humidity	≤80%

TYPICAL PERFORMANCE CURVES

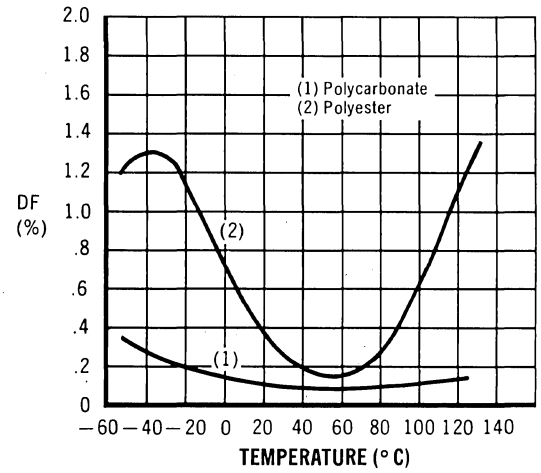
Capacitance vs. Temperature



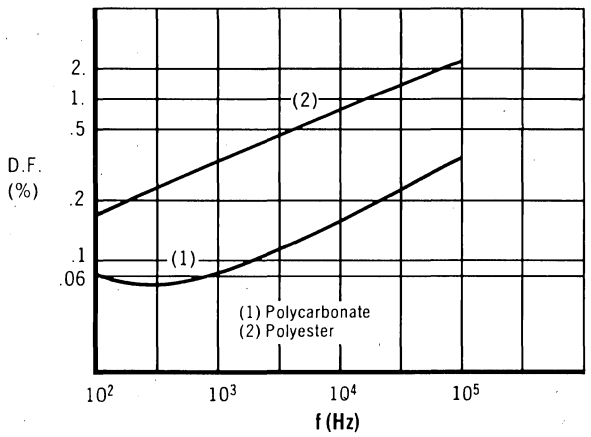
Capacitance vs. Frequency



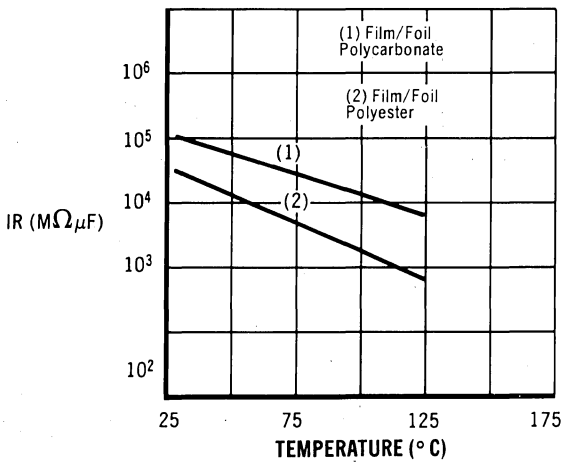
Dissipation Factor vs. Temperature



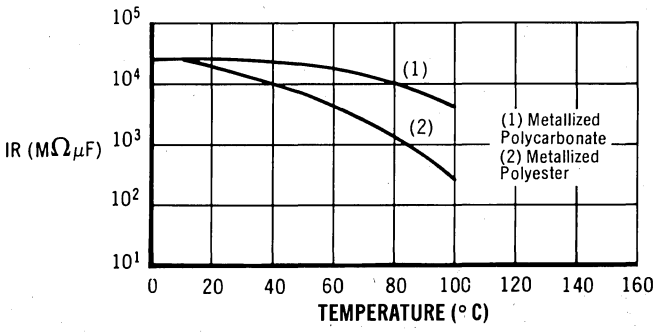
Dissipation Factor vs. Frequency



Insulation Resistance vs. Temperature



Insulation Resistance vs. Temperature

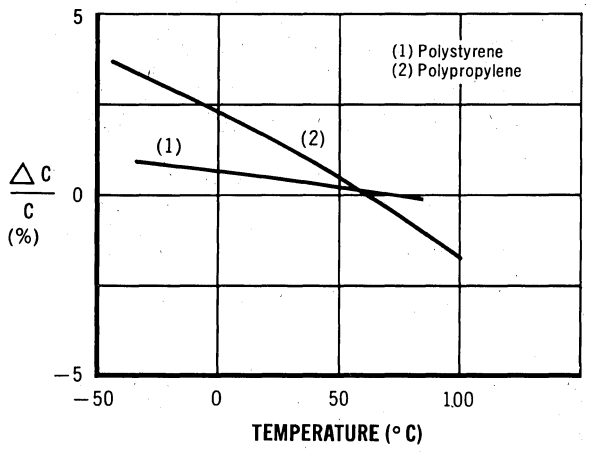


SERIES 7000

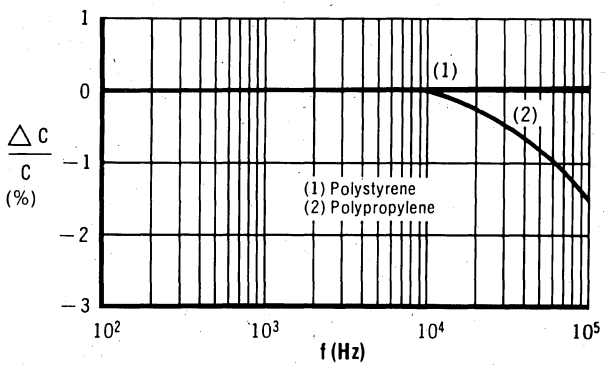
Film Capacitors Polystyrene & Polypropylene

TYPICAL PERFORMANCE CURVES

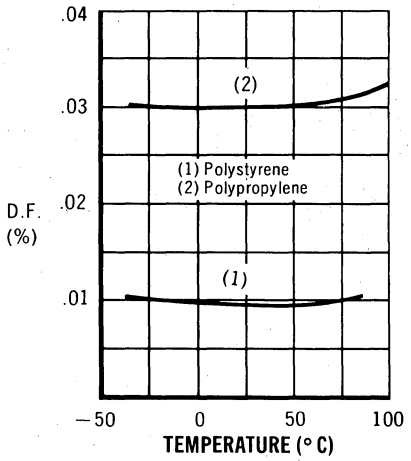
Capacitance vs. Temperature



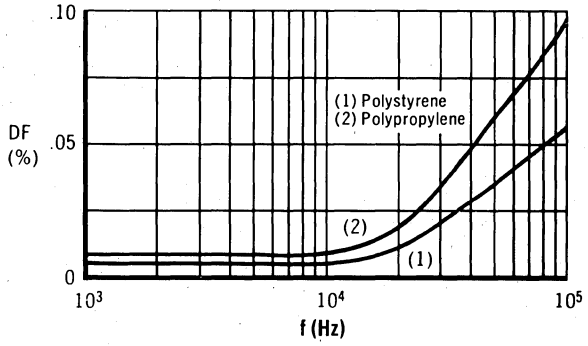
Capacitance vs. Frequency



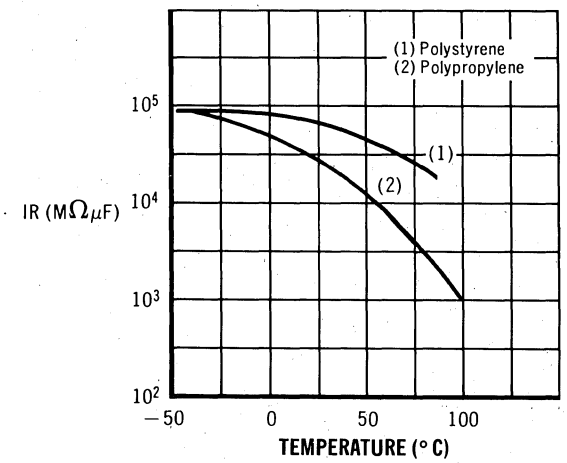
Dissipation Factor vs. Temperature



Dissipation Factor vs. Frequency



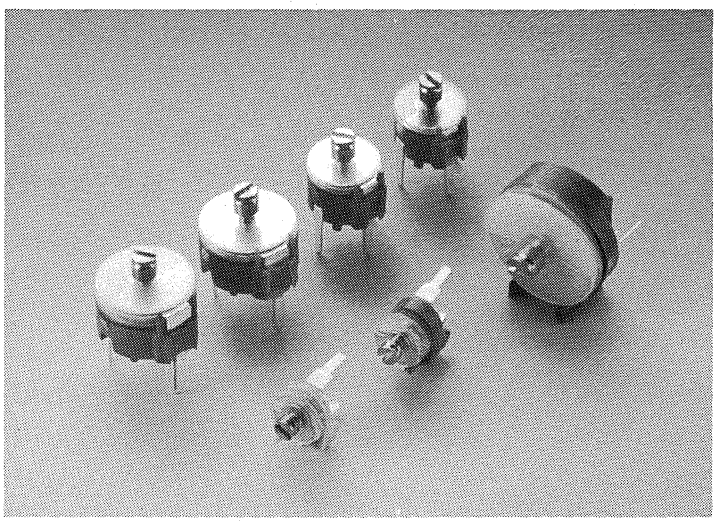
Insulation Resistance vs. Temperature



Variable Capacitors
QUICK REFERENCE INDEX

SERIES 2800C (808)

Film Dielectric Trimmer Capacitors For Commercial And Industrial Applications



5 Variable Capacitors

DESCRIPTION

MEPCO/CENTRALAB film dielectric trimmer capacitors are state-of-the-art designs both in materials and in construction. They bring the advantage of film dielectrics to trimmer capacitor applications, enabling new mechanical designs with improved adjustment capabilities and higher performance. Yet they require less space than conventional trimmers, and permit a reduction in cost as well.

DESIGN FEATURES

- Wide Capacitance Range: 1-5 pf to 12-120 pf
- Polypropylene, Polyethylene or Polycarbonate Dielectric.
- Excellent Mechanical and Electrical Stability.
- High Voltage Rating: up to 250 VDC working—500 VDC Test (1 min.)
- Wide Operating Temperature Range: −40°C to as much as 85°C.
- Easy Installation: Designed for P.C. Board 0.100″ Grid Spacing.
- Horizontal or Vertical Mounting
- Adjustable from either end: contact factory for special tuning tool.
- Insulation Resistance: greater than 10000 meg-ohms.

HOW TO SPECIFY

SERIES 2800C Film Dielectric Trimmer Capacitors can be completely specified using the following designation:

28	07	C	00105	M	H*****
Planar Trimmer Capacitor	**Rotor Diameter** 05= 5mm 07= 7mm 10=10mm 13=13mm	**Commercial Industrial Type**	**Capacitance Range** min. & max. with R denoting decimal point, i.e., 5.5pf to 40pf=5R540	**Lead Configuration** (See mounting diagram)	**Dielectric Material** J =Polyprop K=Polycarb M=Polyethyl

Part Number will also include 5 additional digits on end which are for internal assignments (for reference only)

SERIES 2800C (808)
Film Dielectric Trimmer Capacitors

5mm TYPES

Fig. No.	Lead Configuration	Part Number	Type 808	Guaranteed Capacitance Range (Picofarad)	Dielectric Material	Temp. Coeff. PPM/C°	Minimum Q @ 1 MHz	Temp. Range (°C)	Body Color
1	G	2805C1R505GJ	23508	1.5-5	Polyprop.	−200 ± 300	1000	−40 to +70	GREY
1	G	2805C00210GJ	23109	2-10	Polyprop.	−200 ± 300	1000	−40 to +70	YELLOW
1	G	2805C2R515GJ	23159	2.5-15	Polyprop.	−50 ± 200	1000	−40 to +70	BLUE
1	G	2805C00420GJ	23209	4-20	Polyprop.	−50 ± 200	1000	−40 to +70	GREEN
1	G	2805C4R527GJ	23279	4.5-27	Polyprop.	−250 ± 200	1000	−40 to +70	RED

Voltage Rating: 150 VDC Test Voltage (1 Minute): 300 VDC

7.5mm TYPES

Fig. No.	Lead Configuration	Part Number	Type 808	Guaranteed Capacitance Range (Picofarad)	Dielectric Material	Temp. Coeff. PPM/C°	Minimum Q @ 1 MHz	Temp. Range (°C)	Body Color
2	M	2807C1R406MM	11558	1.4-5.5	Polyethyl.	−400 ± 300	1000	−40 to +85	GREY
2	M	2807C00209MJ	11109	2-9	Polyprop.	−450 ± 350	1000	−40 to +70	YELLOW
2	M	2807C00215MJ	11159	2-15	Polyprop.	−200 ± 350	1000	−40 to +70	BLUE
2	M	2807C00222MJ	11229	2-22	Polyprop.	−250 ± 350	1000	−40 to +70	GREEN
2	M	2807C00227MK	11279	2-27	Polycarb.	−250 ± 300	200	−40 to +85	RED
2	M	2807C00333MJ	11339	3-33	Polyprop.	−250 ± 300	1000	−40 to +70	BROWN
2	M	2807C00340MK	11409	3-40	Polycarb.	−100 ± 300	200	−40 to +85	VIOLET
2	M	2807C00350MK	11509	3-50	Polycarb.	−100 ± 300	200	−40 to +85	BLACK

Voltage Rating: 250 VDC Test Voltage (1 Minute): 500 VDC

10mm TYPES

Fig. No.	Lead Configuration	Part Number	Type 808	Guaranteed Capacitance Range (Picofarad)	Dielectric Material	Temp. Coeff. PPM/C°	Minimum Q @ 1 MHz	Temp. Range (°C)	Body Color
3	Q	2810C2R515QJ	32159	2.5-15	Polyprop.	−150 ± 500	1000	−40 to +70	BLUE
3	Q	2810C00322QJ	32229	3-22.5	Polyprop.	−150 ± 400	1000	−40 to +70	GREEN
3	Q	2810C5R540QJ	32409	5.5-40	Polyprop.	−150 ± 350	1000	−40 to +70	GREY
3	Q	2810C5R565QJ	32659	5.5-65	Polyprop.	−200 ± 300	1000	−40 to +70	YELLOW
3	Q	2810C5R580QK	32809	6-80	Polycarb.	−100 ± 300	200	−40 to +85	RED
3	Q	2810C07100QK	32101	7-100	Polycarb.	−100 ± 300	200	−40 to +85	VIOLET
4	P	2810C00215PJ	31159	2.5-15	Polyprop.	−150 ± 500	1000	−40 to +70	BLUE
4	P	2810C00322PJ	31229	3-22.5	Polyprop.	−150 ± 400	1000	−40 to +70	GREEN
4	P	2810C5R540PJ	31409	5.5-40	Polyprop.	−150 ± 350	1000	−40 to +70	GREY
4	P	2810C5R565PJ	31659	5.5-65	Polyprop.	−200 ± 300	1000	−40 to +70	YELLOW
4	P	2810C2R515PK	31809	6-80	Polycarb.	−100 ± 300	200	−40 to +85	RED
4	P	2810C07100PK	31101	7-100	Polycarb.	−100 ± 300	200	−40 to +85	VIOLET
5	U	2810C2R515UJ	61159	2.5-15	Polyprop.	−150 ± 500	1000	−40 to +70	BLUE
5	U	2810C00322UJ	61229	3-22.5	Polyprop.	−150 ± 400	1000	−40 to +70	GREEN
5	U	2810C5R540UJ	61409	5.5-40	Polyprop.	−150 ± 350	1000	−40 to +70	GREY
5	U	2810C5R565UJ	61659	5.5-65	Polyprop.	−200 ± 300	1000	−40 to +70	YELLOW
5	U	2810C00680UK	61809	6-80	Polycarb.	−100 ± 300	200	−40 to +85	RED
5	U	2810C07100UK	61101	7-100	Polycarb.	−100 ± 300	200	−40 to +85	VIOLET

Voltage Rating: 250 VDC Test Voltage (1 Minute): 500 VDC

13.5mm TYPES

Fig. No.	Lead Configuration	Part Number	Type 808	Guaranteed Capacitance Range (Picofarad)	Dielectric Material	Temp. Coeff. PPM/C°	Minimum Q @ 1 MHz	Temp. Range (°C)	Body Color
6	P	2813C12120PK	41121	12-120	Polycarb.	0 ± 300	200	−40 to +85	GREEN
7	U	2813C12120UK	71121	12-120	Polycarb.	−200 ± 300	200	−40 to +85	GREEN

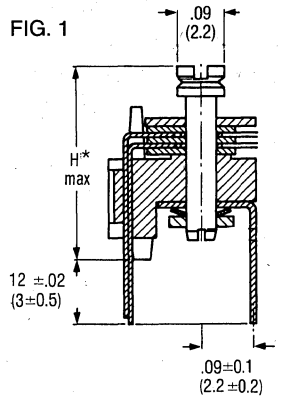
Voltage Rating: 150 VDC Test Voltage (1 Minute): 300 VDC

SERIES 2800C (808)

Film Dielectric Trimmer Capacitors

5mm—2805C

FIG. 1



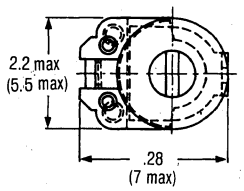
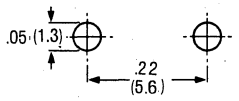


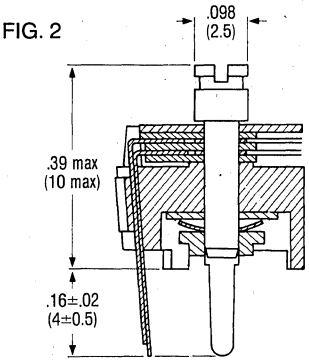
FIG. G



*H max	in.	mm
1.5-5pf	.267	(6.8)
2-10pf	.267	(6.8)
2.5-15pf	.347	(8.8)
4-20pf	.347	(8.8)
4.5-27pf	.347	(8.8)

7.5mm—2807C

FIG. 2



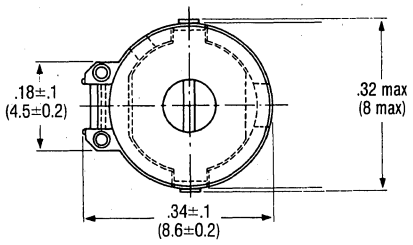
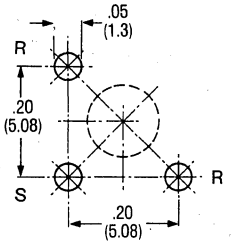


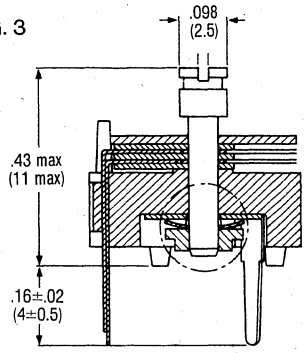
FIG. M



R=ROTOR
S=STATOR

10mm—2810C

FIG. 3



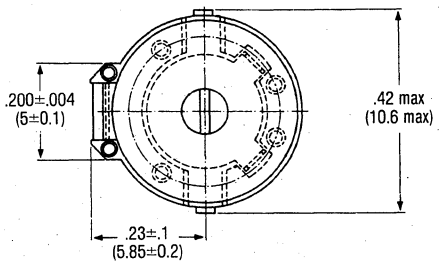
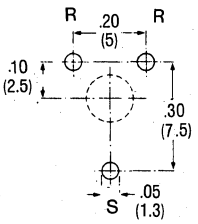


FIG. Q

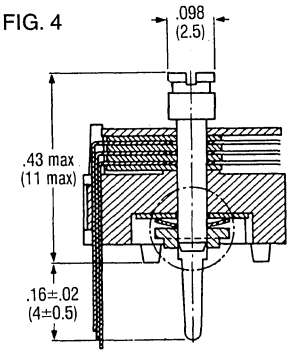


R=ROTOR
S=STATOR

5 Variable Capacitors

10mm—2810C

FIG. 4



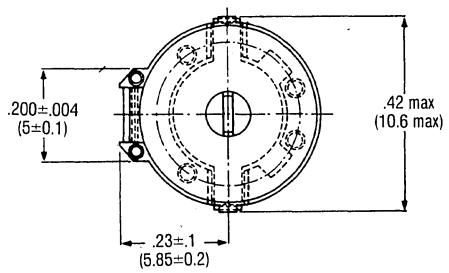


FIG. P

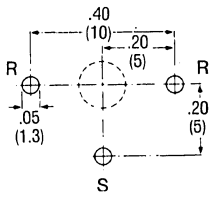
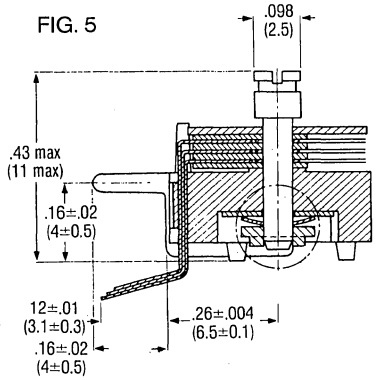
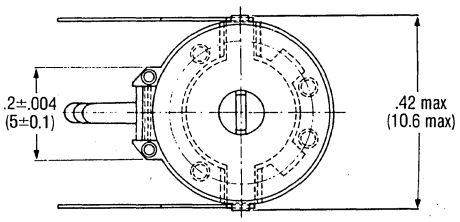


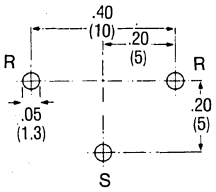
FIG. 5





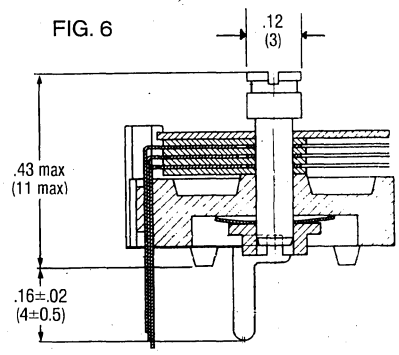
R=ROTOR
S=STATOR

FIG. U



13.5mm

FIG. 6



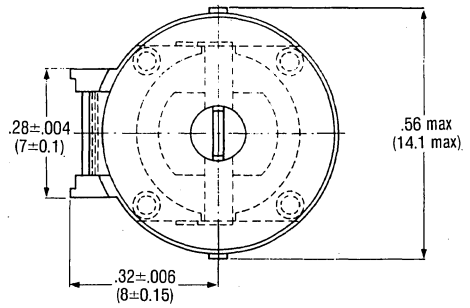


FIG. P

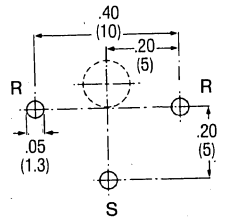
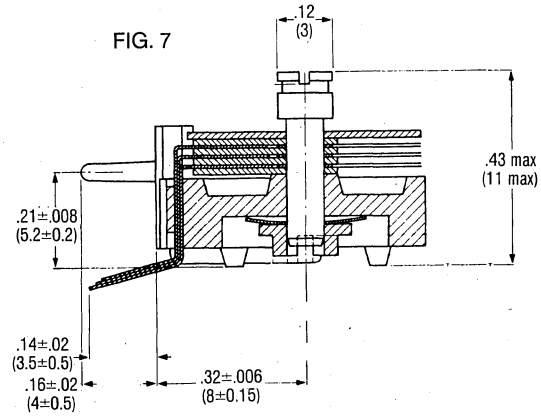
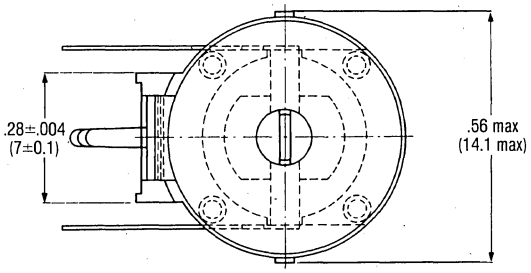


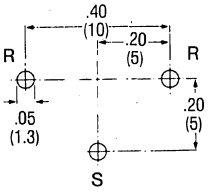
FIG. 7





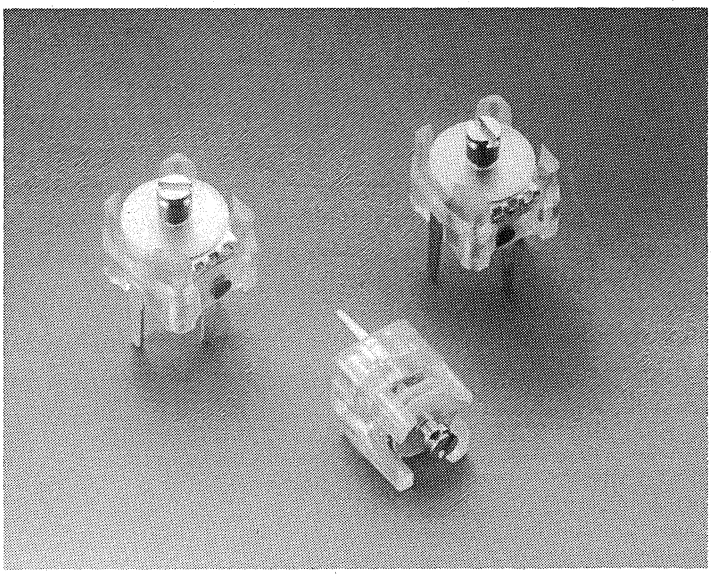
R=ROTOR
S=STATOR

FIG. U



SERIES 2800D/E (809)

Film Dielectric Trimmer Capacitors For Professional Applications



DESCRIPTION

Series 2800D/E Trimmer Capacitors offer a selection of trimming ranges that provide very high resolution, yet each design permits calibration and adjustment of capacitance with unusually high precision. The Series features PTFE or with its capability of operation at ambient temperatures as high as 125°C, and offers the extremely advantageous combination of low temperature coefficient, low losses, high DC working voltage, low-torque operation, and very small size.

The design consists of a polysulphone housing, brass rotor, and silver-plated brass stator. The stator plates are sealed to the housing and the rotor contacts are gold-plated to ensure stable, long life contact under adverse environmental conditions. All units are available with top adjustment, or top and bottom adjustments, and are marked with a color identification dot. Contact pins are arranged to fit a 0.1" PC board grid.

DESIGN FEATURES

- High Working Voltage: tested up to 600 VDC
- Wide Operating Temperature Range. From −40° to +125°C, at full ratings.
- Wide Tuning Range: 1-3.5pf to 7-100pf.
- Low Leakage: Insulation resistance is greater than 10,000 Megohms.
- Easy Installation: Designed for direct insertion in 0.1"-grid PC boards (hole diameter, 0.05").
- Convenient Tuning: Screwdriver adjustment at top and bottom ends of rotor permits adjustment from either side of PC board.
- Gold-Plated Rotor Contacts, silver-plated stator, sealed to housing for immunity to environmental influences.

SERIES 2800D/E (809)

Series Dielectric Trimmer Capacitors for Professional Applications

HOW TO SPECIFY

Series 2800D FIlm Dielectric Trimmer Capacitors can be completely specified using the following designation:

28	05	D/E	013R5	B	H*****
Planar Trimmer Capacitor	**Rotor Diameter** 05= 5mm 08= 8mm 10=10mm	**Professional Types**	**Capacitance Range** Min. & Max. with R Denoting Decimal Point, i.e.: 1pf to 3.5pf=013R5 (see table pg. 483)	**Lead Configuration** (See mounting diagrams)	**Dielectric Material** H=PTFE Teflon®

Part Number will also include 5 additional digits on end which are for internal assignments (for reference only)

DIMENSIONS: INCHES (mm)

FIG. 1

STYLE 2805D

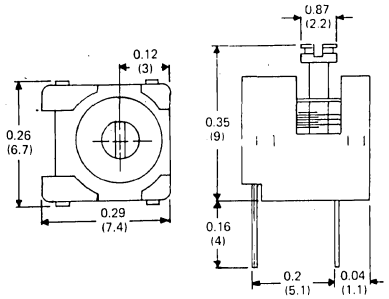
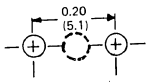


FIG. B

MOUNTING DIAGRAMS:



All pin mounting holes = 0.05" dia. (1.3mm)

All adjustment through holes = 0.15" dia. (4mm)

ELECTRICAL SPECIFICATIONS:

Fig.	Lead Configuration	MEPCO/CENTRALAB PART NUMBER*	Type 809	Guaranteed Capacitance Range Min.	Guaranteed Capacitance Range Max.	Dielectric Material	Temperature Coefficient PPM/°C	Minimum Q 1MHz	Minimum Q 100MHz
1	B	2805DIR203BH	05001	≤1.2	≥3.5	PTFE Teflon®	−250 ± 150	1000	500
1	B	2805D1R810BH	05002	≤1.8	≥10	PTFE Teflon®	−350 ± 150	1000	500
1	B	2805D00218BH	05003	≤2	≥18	PTFE Teflon®	−350 ± 150	400	250
2	M	2808D1R405MH	09001	≤1.4	≥5.5	PTFE Teflon®	−250 ± 200	1000	650
2	N	2808D1R405NH	09004	≤1.4	≥5.5	PTFE Teflon®	−250 ± 200	1000	650
2	M	2808D00209MH	09002	≤2	≥9	PTFE Teflon®	−250 ± 200	1000	650
2	N	2808D00209NH	09005	≤2	≥9	PTFE Teflon®	−250 ± 200	1000	650
2	M	2808D00218MH	09003	≤2	≥18	PTFE Teflon®	−250 ± 200	1000	650
2	N	2808D00218NH	09006	≤2	≥18	PTFE Teflon®	−250 ± 200	1000	650
3	Q	2810D00440QH	08002	≤4	≥40	PTFE Teflon®	−250 ± 200	1000	400
3	Q	2810D00560QH	08003	≤5	≥60	PTFE Teflon®	−250 ± 200	1000	400
4	W	2810E00440WH	07008	≤4	≥40	PTFE Teflon®	0 ± 200	1000	500
4	W	2810E07100WH	07015	≤7	≥100	PTFE Teflon®	0 ± 200	1000	400

†See outline drawings below

Operating Temperature Range: −40° to +125°C

Soldering: Maximum 260°C for 10 seconds.

Insulation resistance between stator and rotor: Min. 10000MΩ

SERIES 2800D/E (809)

Series Dielectric Trimmer Capacitors for Professional Applications

MECHANICAL SPECIFICATIONS:

M/C Series	2805D			2808D			2810D		2810E
Type	05001	05002	05003	09001 09004	09002 09005	09003 09006	08002	08003	
Color dot	Orange	White	Red	Green	White	Red	Yellow	Blue	
D.C. Voltage Rating	300V			300V			300V		200V
D.C. Test Voltage	600V			600V			600V		400V
Operating torque	0.15 to 2.0 oz.-in. 0.35 to 2.7 oz.-in.			0.15 to 2.0 oz.-in. 0.35 to 2.7 oz.-in.			0.28 to 3.5 oz.-in.		0.15 to 4.9 oz.-in.

FIG. 2
2808D

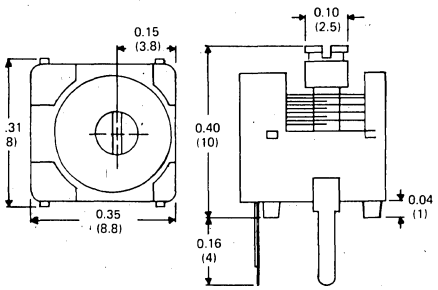


FIG. 3
2810D

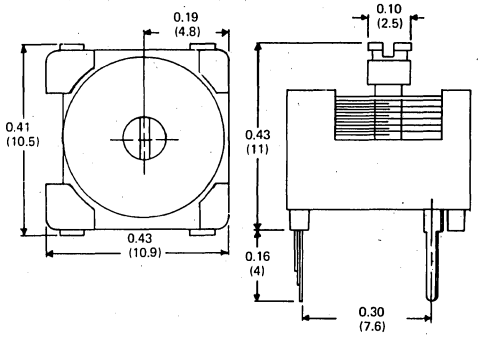


FIG. 4
2810E

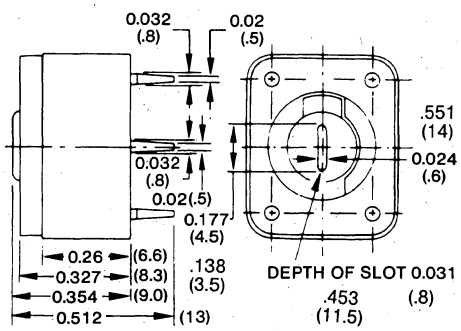


FIG. N

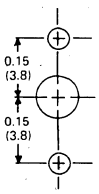


FIG.M

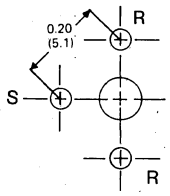


FIG. Q

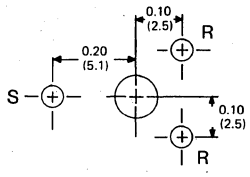
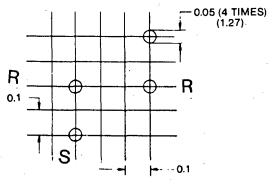


FIG. W



R=ROTOR
S=STATOR

NOTE: All dimensions are in inches (mm) with a tolerance of ±0.020" (0.5) unless otherwise specified.

5 Variable Capacitors

Design data for selecting and applying variable capacitors

Configurations. The variable capacitors listed in this catalog are direct-engagement, rather than screw-compression, types.

Film-Dielectric Trimmer Capacitors (Figure 1) are composed of a set of D-shaped plates rigidly mounted in a round or rectangular plastic housing, engaging a set of similar plates mounted on a central rotor shaft, interleaved with discs of plastic film dielectric. Most types are single-stator designs (Figure 2A), with a continuously rotatable rotor providing minimum-to-maximum capacitance adjustment over an effective angle of adjustment of 180°.

Series 809-070 trimmers offer a choice of single-stator (Figure 2A) or differential (Figure 2B) configurations.

The differential design provides reciprocal engagement of the rotor with two separate stators, so that the capacitance between one stator and the rotor increases, as the capacitance between the other stator and the rotor decreases, over an effective angle of rotation of 180°. In this Series, rotation of the rotor shaft is not continuous, but is limited to a maximum of 180°. In all models, connections to the rotor plates, and to all stators, are brought out as pins or tabs for direct insertion into P.C. boards.

Figure 1. *Film Dielectric Trimmer Capacitor Styles*

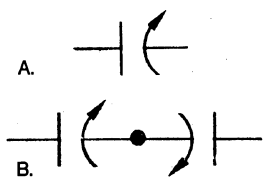


Figure 2. *Electrical Configurations*
A. Single-Stator
B. Differential

Capacitance Limits. Even when the rotor plates in a film dielectric trimmer are competely disengaged from the stator, a measurable amount of capacitance exists between the capacitor terminals. Though small, this "zero capacitance" can be significant in some applications, and its maximum possible value is therefore given for each capacitor listed in this catalog. This value may vary slightly during a production run; for any given type, it will often be less than the rated value in the tables, but it will never be greater.

Similarly, the maximum attainable capacitance, with rotor fully engaged, will always be at least as great as the specified maximum (or the rated minimum plus capacitance swing) for any given model.

Capacitance is measured at a standard test temperature, at a standard test frequency, and at negligibly low test voltage.

NOTES: The standard test temperature for Mepco/Centralab capacitors is 25°C (77°F). Measurements at other ambient temperatures must allow for the temperature coefficient of the capacitor. The standard test frequency is 1 MHz. "Negligibly low test voltage" means that the test voltage applied is not high enough to cause significant temperature rise due to losses and leakage. Usually, at the standard test frequency, the test voltage is not critical.

Temperature Coefficient (of Capacitance). The maximum change in capacitance per unit change in the temperature of the capacitor, usually expressed in (±) parts per million of nominal per degree Centigrade. A T.C. rating is associated with a specific temperature range, over which the maximum T.C. is never exceeded.

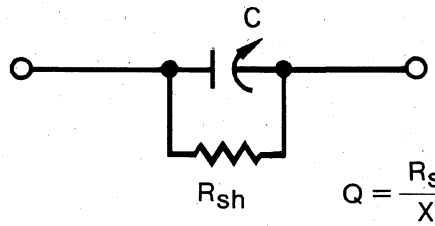
Design data for selecting and applying variable capacitors

NOTES: The temperature reference in this specification is that of the capacitor, not the ambient temperature...although, in the absence of self-heating due to losses or leakage, if the capacitor has had time to reach thermal equilibrium with the ambient, the capacitor temperature will be the same as the ambient temperature. The preferred test method is to measure capacitance (at negligible test voltage for the frequency specified) at several different temperatures, holding each temperature long enough for the capacitance to stabilize.

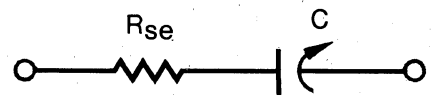
T.C. Tolerance. The maximum uncertainty in the temperature coefficient, expressed as a deviation in the nominal T.C. rating, over the temperature range for which the nominal T.C. was given. This tolerance indicates the variations in T.C., from unit to unit of the same model, that must be allowed for in a worst-case analysis of compensation or stabilization.

Quality Factor (Q). The ratio of the equivalent shunt resistance to the reactance of the capacitor, at a specified test frequency. Alternatively, the ratio of the reactance of the capacitor to its equivalent *series* resistance.

NOTES: The equivalent shunt (or series) resistance represents *all* the losses in the capacitor, regardless of their source, at the specified frequency. Clearly, the sources of power loss in a capacitor are *both* series-connected (e.g. lead resistance) and shunt-connected (e.g., dielectric losses), but it is assumed, in Q calculations, that all losses may be represented by a single resistor. Q is sometimes called "Storage Factor."



$$Q = \frac{R_{sh}}{X_C} = 2\pi f\, C\, R_{sh}$$



$$Q = \frac{X_C}{R_{se}} = \frac{1}{2\pi f\, C\, R_{se}}$$

Figure 4. Derivation of Quality factor.

Dissipation Factor (D). The inverse of Quality Factor, as defined above, usually expressed in percent of unity:

$$D = \frac{1}{Q}$$

$$D\,(\%) = \frac{100\%}{Q}$$

Example: for Q = 50, D = 0.02 or 2%.

DC Leakage and Insulation Resistance. The insulation resistance is the ratio of the DC test voltage impressed across a capacitor to the current that flows through it, at a specified DC test voltage and a specified capacitor temperature. The current is measured *after* the capacitor has had an opportunity to charge up to the test voltage. The leakage current is simply the current measured in the above-described test, usually with a test voltage set at the rated working voltage of the capacitor.

NOTES: The insulation resistance is not to be confused with the equivalent shunt resistance described under Quality Factors. The two are only equal at DC; at AC, the equivalent shunt resistance is lower, to account for dielectric and series losses. *Leakage is only one loss component.*

Fixed Resistors
QUICK REFERENCE INDEX

INDUSTRIAL/CONSUMER GROUP

Mepco/ Centralab Series	Category	Body Type	Resistance Range (ohms)	Tolerance Range (±%)	Temperature Coefficient Range (PPM/°C)	Power Range @ 70°C (watts)	Max. Voltage Range (volts)	Page No.
SPACE MISER®	GENERAL PURPOSE	METAL FILM Conformal Coated	22Ω-5.1Meg 10Ω-5.1Meg	5% 1%	±100 ±100	⅓ ⅓	200 200	484
CR	GENERAL PURPOSE	CARBON FILM Conformal Coated	1Ω-10Meg	5%	−200 to +500 ±300	¼ ½	250-350	490
SFR	GENERAL PURPOSE	METAL FILM Conformal Coated	1Ω-10MegΩ	1%-2% 5%	±200 & ±100	¼ ½	250-350	492
SFR (5000Y)	STANDARD PRECISION	METAL FILM Conformal Coated	1Ω-1Gig	0.5%-5%	±50 to ±150	¼-1	250-500	500
UPR & MATCHED SETS (5000Z)	ULTRA PRECISION	METAL FILM Conformal Coated	51.1Ω-511K	0.02%-1.0%	±5 to ±25	1/20-⅓	200-300	503

INDUSTRIAL/STANDARD MILITARY

MIL Style	MIL Spec	Body Type	Resistance Range (ohms)	Tolerance Range (±%)	Temperature Coefficient Range (PPM/°C)	Power Range @ 70°C (watts)	Max. Voltage Range (volts)	Page No.
RL (5000T)	MIL-R-22684	METAL FILM Conformal Coated	4.3Ω-470KΩ	2% 5%	±100	¼-½	250-350	507
RN (5000R/M)	MIL-R-10509	METAL FILM Conformal Coated	1Ω-4M	0.1%-1%	±25 to ±100	1/10-½	200-350	509

ESTABLISHED RELIABILITY (MIL)

RLR (5000U)	MIL-R-39017	METAL FILM Conformal Coated	4.3Ω-1.33MΩ	1%-2%	±100	⅛-½	200-350	512
RNC (5000V)	MIL-R-55182	METAL FILM Conformal Coated	10Ω-3.01MΩ	0.1%-1%	±25 to ±100	@+125°C 1/20-¼	200-300	514
RNR (5000A)	MIL-R-55182	METAL FILM Hermetic Seal	10Ω-1.21M	0.1%-1%	±25 to ±50	@+125°C 1/10-¼	200-300	516
PACKAGING INFORMATION FOR MEPCO/CENTRALAB RESISTORS								519
DESIGN DATA FOR SELECTING AND APPLYING FILM RESISTORS								520

SERIES HC2 FIXED RESISTOR NETWORKS SINGLE-IN-LINE PACKAGE

Mepco/ Centralab Series	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Circuits Available	Pin Styles Available	Page No.
HC2	22Ω-1MΩ	±2%	±200	Terminator Pull Up/Pull Down	6, 8, & 10 Single-in-Line	526
HC23	22Ω-1MΩ	±2%	±200	Dual Terminator Circuit	6, 8, & 10 Single-in-Line	528

SERIES RZ040, RZ030 MILITARY STYLE (MIL-R-83401) RESISTOR NETWORKS

Military Part No.	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Circuits Available	Pin Styles Available	Page No.
M83401 RZ040, 050, 060	10Ω-1MΩ	±1% ±2% ±5%	±100 ±300	Terminator Pull Up	6, 8, 10 Pin High Profile	532
M83401 RZ070, 080, 090	10Ω-1MΩ	±1% ±2% ±5%	±100 ±300	Terminator Pull Up	6, 8, 10 Pin Low Profile	534
M83401 RZ030	18Ω-1MΩ	±1% ±2% ±5%	±100 ±300	Terminator Pull Up	14 Pin Flat Pack	530

10K AND 100K ECL TERMINATORS

Mepco/ Centralab Series	Standard Resistance Values	Tolerance	Temperature Coefficient (ppm/°C)	Circuits Available	Capacitors	Pin Styles Available	Page No.
E34	68Ω, 100Ω, **150Ω	±5%	±200	For 10K	.01μf	8 Pin, 10 Pin, Single-in-Line	536
E35	50Ω, 68Ω, **100Ω	±5%	±200	For 100K	Z5U 25VDC		

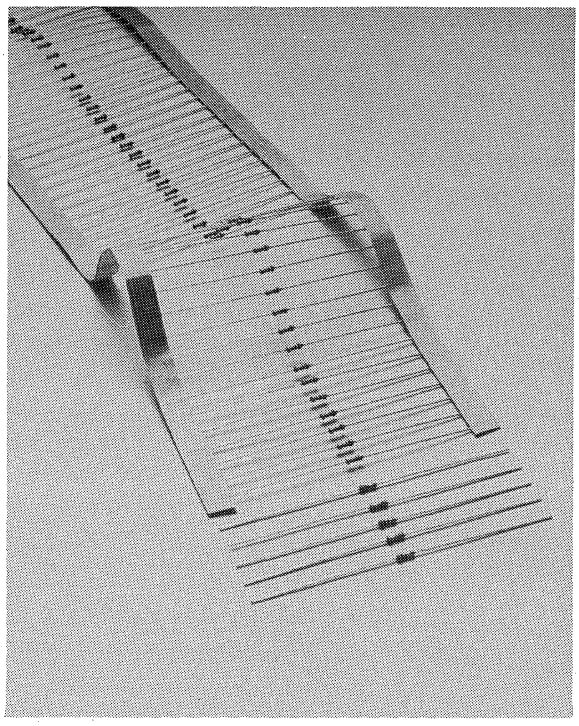
SERIES HD3 CAPACITOR BANKS

Mepco/Centralab Series	Capacitor Range	TOLERANCE			Pin Style Available	Page No.
		NPO	X7R	Z5U		
HD3	68pf-0.27μf	±5, ±10, ±20	±10, ±20	+80/−20%	6, 8, & 10 Pin	538

SPACE MISER®

5063J Metal Film Resistor

1% & 5% Tolerances
100 PPM/°C T.C.R.
Power Rating
1/3 Watt @ 70°C for 10,000 Hr. Operating Life
1/4 Watt @ 70°C for 225,000 Hr. Operating Life



DESCRIPTION

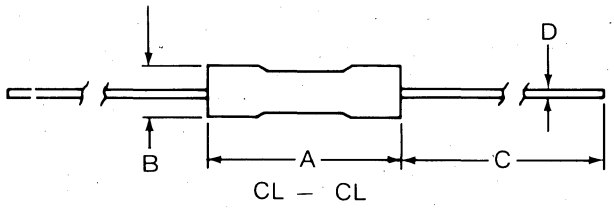
Mepco/Centralab and Beyschlag of West Germany combine to offer general purpose metal film resistors suitable for high density packaging. The 5063J Space Miser dissipates 1/3 Watt in a package the size of the smallest 1/8 watt.

In addition to the small size, the 5063J Space Miser offers the outstanding electrical characteristics—low noise, low reactance, stability, temperature coefficient—of a truly superior metal film resistor.

The 5063J Space Miser features a high alumina core for superior mechanical strength and heat dissipation; 0.020 in leads for ease of auto insertion and heat dissipation; inline pulse testing for reliability enhancement; and an effective coating system for solvent and environmental protection.

FEATURES

- Designed for High Density Applications
- Capable of Automatic Insertion on as Close as .200 in (5.08mm) Centers
- 1/3 Watt (No Power Sacrifice While Downsizing)
- Tape and Reel & Ammo Packaging for Automatic Insertion
- Exceeds the Stability Requirements of Mil-R-10509
- 100% In-Line Reliability Testing
- Excellent Pulse-Handling Characteristic



SPECIFICATIONS

Mepco/ Centralab P/N	Resistance Tolerance	Resistance Range (ohms)*	T.C.R.	Max Voltage (VRMS)	A Max (mm)	B Max (mm)	C Max (mm)	D Nom (mm)
5063J	±5% ±1%	.22-10 MEG 1-5.1 MEG	±100 ±100	200 200	0.142 in. (3.6)	0.063 in. (1.6)	1.1 in. (29)	0.020 in. (.5)

Power Rating at 70°C—1/3 Watt for 10,000 hour life; 1/4 watt for 225,000 hour life.

*The 5063J is also available as a zero ohm resistor.

SPACE MISER®

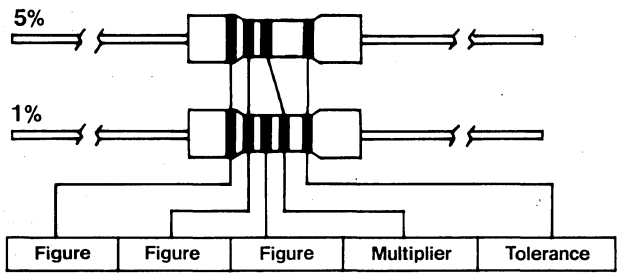
5063J Metal Film Resistor

PERFORMANCE SPECIFICATIONS COMPARISON

Test	% Change in Resistance (△R)				
	5063J Tolerance		Mil-R-39008 Style RCR Requirement	Mil-R-22684 Style RL Requirement	Mil-R-10509 Style RN Requirement
	1%	5%			
Temperature Cycling, −65°C to +150°C	±0.25%	±0.25%	4.0%	1.0%	0.5%
Low Temperature Operation, −65°C	±0.25%	±0.25%	3.0%	0.5%	0.5%
Short Time Overload	±0.25%	±0.25%	2.5%	0.5%	0.5%
Terminal Strength, 5 lb. pull	±0.2%	±0.2%	1.0%	0.5%	0.2%
Resistance to Soldering Heat, +350°C	±0.25%	±0.25%	3.0%	0.5%	0.5%
Moisture Resistance, Mil Std 202	±1%	±1%	15.0%	1.5%	1.5%
Life 1000 hrs (1/3 watt)	±0.5%	±1%	—	—	—
Life 1000 hrs (1/4 watt)	±0.25%	±0.7%	—	—	—
Life 1000 hrs (1/8 watt)	±0.15%	±0.4%	10.0%	2.0%	1.0%
Shock, 50G, 11ms	±0.25%	±0.25%	—	0.5%	0.5%
Vibration-High Frequency, 10-2000Hz	±0.25%	±0.25%	2.0%	0.5%	0.5%

*95% of parts tested had smaller changes than indicated.

PART MARKING



Color	Figure	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	1%
Red	2	100	—
Orange	3	1K	—
Yellow	4	10K	—
Green	5	100K	—
Blue	6	1M	—
Violet	7	—	—
Gray	8	—	—
White	9	—	—
Gold	—	.1	5%
Silver	—	.01	—

HOW TO SPECIFY

5063J Resistors can be completely specified using the following designation:

50 — **Fixed Resistor Axial Lead**

6 — **Power Rating** 1/3 Watt

3 — **Encapsulation Style** 3 = Conformal

J — **Style** J = MBA

D — **Temperature Coefficient** D = ±100 PPM/°C

270KO — **Resistance Value** R—ohm, K—1,000 ohm, M—1,000,000 ohm, 49R90 = 49.9Ω, 499R0 = 499Ω, 1K000 = 1KΩ, 1M000 = 1 megΩ

F — **Resistance Tolerance** F = ±1%, J = ±5%

SPACE MISER®

5063J Metal Film Resistor

Application Guidelines

PREFACE

A resistor is a simple device. So why are we issuing an applications guide?

One reason is that film resistors really aren't quite so simple. For example, the materials selection is critical. Materials must be matched for thermal expansion characteristics, for chemical compatibility under a variety of ambient conditions, and for stability with time and temperature. Plus the processes involved in the manufacture of a resistor are quite sophisticated. Many processes used in IC or hybrid production were developed for, or first used for, discrete resistors.

A second reason is that pure, absolute resistance exists only in textbooks. All resistors have some degree of capacitance and/or inductance. All resistors are, to some degree, unstable with time, temperature and load.

Our third reason is that, as in the development of any product, the design and manufacture of the 5063J resistor involves a number of technical alternative decisions which impact your application of the product.

To simplify the introduction of the 5063J, we have presented a series of questions and answers related to each major application factor. In developing the answers, we have tried to include some of the reasoning behind the design alternative decisions.

We may not have answered the question in your mind or we may not have provided enough detail. If not, give us a call and we'll do our best to help you.

POWER RATING

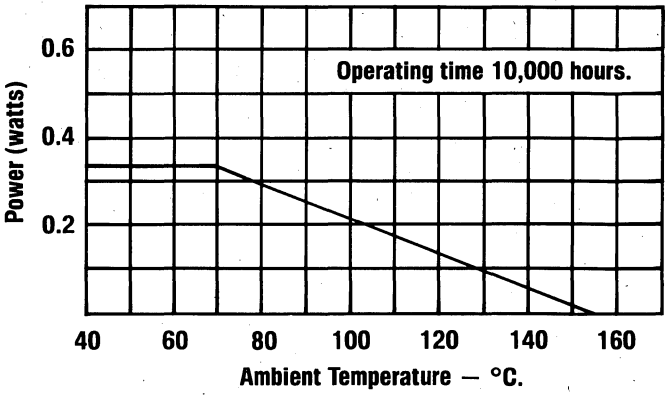
The power rating indicates the maximum power that can be dissipated continuously at a specified ambient temperature with the "hot spot" temperature not exceeding a specified maximum temperature.

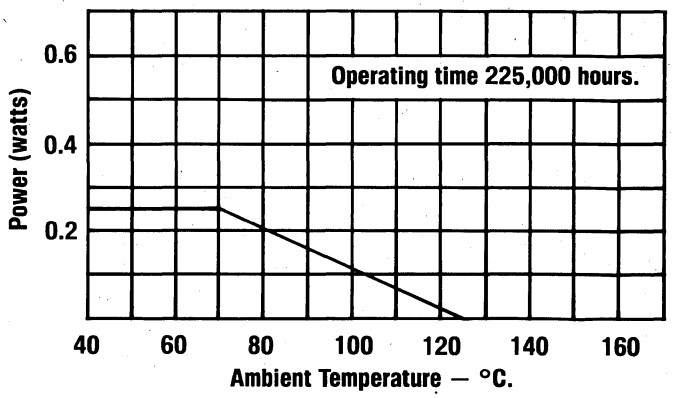
By lowering the "hot spot" temperature, the resistance change over time can be reduced and the useful life of the resistor extended.

Power Rating @70°C	Resistance Value (ohms)	Hot Spot Temperature (°C)	Max % ΔR vs. Time		
			1000 Hrs.	10000 Hrs.	225000 Hrs.
1/3 Watt	10 to 100K	155	0.50	1.10	—
1/4 Watt	10 to 100K	125	0.25	0.55	1.60

POWER DERATING

The 5063J Space Miser can be operated at ambient temperatures higher than 70°C, provided the dissipated power rating is reduced per the following curves.





Q. How can the 5063J be rated as a ⅓ watt when it's only a ⅛ watt body size?

A. First, there is an historical aspect to the size vs. power rating question. In the U.S. in the late 1950's, when the first metal film resistor specifications were being written, it was deemed desir-

able to have the film resistor the same size as a carbon composition of the same power rating, even though the thermal characteristics were quite different.

So when we say that a resistor is a "⅛ watt size", one meaning is that it is the size set by the military originally for carbon composition for ⅛ watt dissipation. In actuality, the ability of a resistor to dissipate power is a function of (1) the temperature hardness of the materials used and (2) the efficiency of heat transfer to the world outside the resistor. Size is, of course, a factor, but for film resistors, not the most important one.

The 5063J was designed specifically to be able to dissipate maximum power in the minimum size to allow downsizing without electrical redesign.

Q. Why the double (1/3 & 1/4 watt) ratings and how are they to be used?

A. We divided applications into normal and long-term classifications. A "normal" application is defined as one where the useful operating life of the equipment is 10,000 hours or less. An example would be an automobile. The life of an auto is estimated as 100,000 miles at an average speed of 20 miles/hour or 5,000 hours.

The definition of "long-term" is 225,000 hours operation. An example of this kind of application would be telephone switch gear, which is in continuous operation for many years.

Since the resistor is not required to "last" as long in a normal application, it can be rated higher, with a higher operating temperature. Conversely, for the long-term application, the operating temperature must be lower to extend the life of the resistor.

Application	Surface Temperature (ambient of 70°C)	Life
Normal	155°C	10,000 Hrs
Long-term	125°C	225,000 Hrs

Q. How does the 5063J differ from other film resistors?

A. Let's look at how the 5063J is constructed and how it functions thermally. The mechanics are simple—a ceramic rod is coated with a thin film of various resistive alloys, end caps are press-fitted, the film is cut in a helix around the cylindrical rod to increase the resistance, leads are welded to the end caps, the body is coated for environmental protection and the body is color banded for identification.

The electrical energy is converted to heat in the resistive film. The heat is then conducted to the outside (using air as the immediate environment) by two primary paths:

1. FILM → CORE → CAP → AIR
   - → LEAD → AIR
   - → PCB → AIR
2. FILM → COATING → AIR

To optimize the heat transfer, the 5063J has several interesting features:

(1) The core material is a specially developed, high alumina, highly thermally-conductive formulation which improves the transfer of heat from the core through the core to the cap.

(2) The bottom of the end cap is uncoated, which increases the area of metal to air surface exposure.

(3) The 5063J has larger leads. Most resistors of this size have .016" diameter leads while the 5063J has .020". This increases the metal to air surface area and, more importantly, as heat transfer is proportional to cross sectional area of the lead, increases the heat transfer to the printed circuit board by a factor of 1.56.

(4) The coating on the 5063J is thinner than normal. The most important role of the coating is to protect the resistor from adverse environments—abrasion and humidity primarily—and to isolate the resistor electrically.

Unfortunately, the materials which do this best are also good thermal insulators, so that heat transfer along the second path cannot be maximized without compromising the main purpose of the coating. A proprietary coating has been developed for the 5063J which will perform the primary function of protection and isolation with a minimum thickness.

MOUNTING

Packaged to allow use of standard auto insertion equipment (Ammo pack or reel).

.200 in. centers possible (leads bent at right angles).

Rugged construction with high alumina core prevents breakage.

0.020 in. leads provide easier handling by automatic insertion equipment.

Color banding for ease of on-board identification.

SPACE MISER®
5063J Metal Film Resistor

Q. Because of the unique design, are there any special precautions which need to be taken in the application of the 5063J?

A. Possibly. Remember, the body temperature of the 5063J at maximum dissipation and ambient temperature is 155°C so check the temperature rating of the printed circuit board. If your application is at maximum dissipation and ambient temperature with minimum spacing, the solder joint temperature may also be critical.

RELIABILITY

100% inline pulse test to eliminate infant mortality.

High alumina core and 0.020" leads provide a "cooler" hot spot at any given wattage than other resistors of the same size for longer life.

In use failure rate of .00007%/1000 hrs.

Manufactured under CECC quality assessment program.

Q. What is Mepco/Centralab's position on Quality of the 5063J?

A. Although Mepco/Centralab doesn't manufacture the 5063J, we back the product exactly as though we did.

Before offering this product, we conducted an extensive evaluation in our own test facilities, using the same equipment and procedures we use to test Mepco/Centralab products to the Established Reliability Specifications. We found the performance to be excellent. A summary of this test is an addendum to this guide.

We have visited Beyschlag to review the manufacturing facilities and to talk with their technical, quality and management people. The Beyschlag organization is of the finest caliber. (We believe we should know because we're not exactly new to this business.)

Beyschlag has earned an international reputation for superior quality—that's one reason we joined with them in offering this product.

Q. What is the inline pulse test?

A. The inline pulse test consists of
[a] reading of the resistance;
[b] loading the resistor with a maximum pulse of 50 times the rating;
[c] reading the resistance;
[d] calculating the change in resistance;
[e] eliminating any resistors which change more than a specified amount.

The initial resistance reading establishes the norm for that resistor. If the resistor has a critical defect or flaw, the pulse applied will induce a change in resistance. The second reading measures that change and compares it to a standard for expected change. If the standard is exceeded, the resistor is rejected.

Q. What is the "in use failure rate"?

A. This is the maximum estimated failure rate at 60% confidence, valid for resistances from 10 to 100,000 ohms, mounted in equipment after the equipment has left the equipment test area.

Q. The 5063J is manufactured under the CECC Quality Assessment Program. What exactly does that mean?

A. CECC stands for the CENELEC Electronic Components Committee. CENELEC is the European Committee for Electrotechnical Standards. This is a European International standardization and Quality Assessment group with the power to grant a Mark or Certificate of conformity.

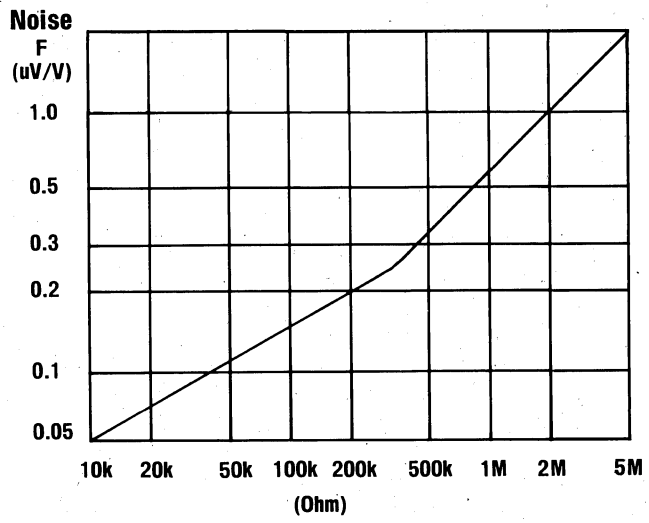
CURRENT NOISE

Current noise is generated by the passage of current through the resistive material. It is inversely proportional to frequency and proportional to the square of the current.

In addition to the above general relationships, current noise depends greatly on materials, design, manufacturing techniques and resistance value.

Noise index is the ratio of current-noise voltage to average DC voltage produced by a specified current, measured over a one-decade frequency bandwidth and is expressed in microvolts/volt.

The following chart presents the maximum value of 95% of the population.



Q. Why is noise considered important?

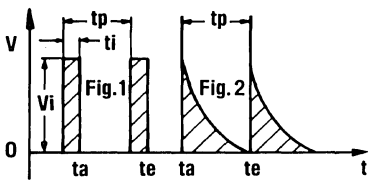
A. In addition to the obvious concern that a low level signal may get lost in the noise, noise is an indication of the reliability of the resistor. The same defects which can cause failure of the resistor most likely will make the resistor noisy.

Q. What types of defects cause noisy resistors?

A. Generally, defects which can intermittently impede current flow, such as flaws in the core, film defects and helixing flaws.

PULSE LOAD RATING

■ Instantaneous power can be higher than that shown by the derating curve provided the following conditions are observed:



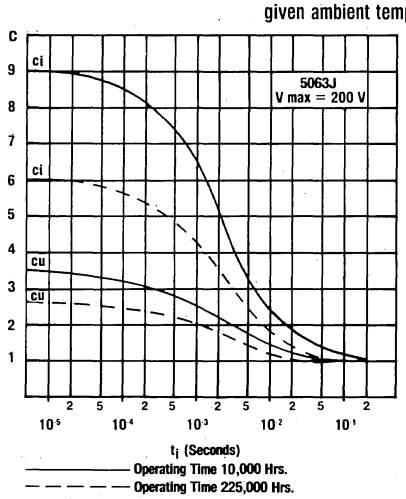
Following conditions must be fulfilled simultaneously:

$$\frac{1}{t_p R}\int_{ta}^{te} Vi^2 dt \leq P_T \quad (1)$$

$$|V_i| \leq ci\sqrt{P_T \cdot R} \quad (2)$$

$$|V_i| \leq cu \cdot V_{max} \quad (3)$$

P_T: Permissible constant load at a given ambient temperature T



Q. What do these conditions mean?

A. The first equation in essence says that the average power over the duration of one pulse cycle must not exceed the rated power. The second limits the peak voltage to a multiple of the rated voltage for the resistance under test, while the third places a further restriction on the voltage by limiting it to a multiple of the maximum continuous voltage. The multiples are a function of the duration of the pulse and are given in the graph.

EXAMPLE: Pulse load rating for long-term operation.

GIVEN: R = 100 Ohms
T = 70°C
Vi = 25 V (square wave)
ti = 0.2 ms
tp = 0.1 sec

LIMITS: P_{70} = 0.25 watt

V_{max} = 200 V

FROM GRAPH: cu = 2.4, ci = 5.4

CONDITION 1:

$$\frac{1}{0.1 \text{ X } 100 \text{ ohm}}\int_0^1 (25V)^2 \text{ X } 0.0002 \text{ sec} =$$

0.0125 Watt ≤ 0.25 Watt

CONDITION 1 - OK

CONDITION 2:

$25V \leq 5.4\sqrt{0.25 \text{ Watt} \cdot 100\Omega} \leq 25V$

CONDITION 2 - OK

CONDITION 3:

$25V \leq 2.4 \cdot 200V \leq 480$

CONDITION 3 - OK

REACTANCE

The reactance of the 5063J is primarily capacitive. (There may be some inductance at very high frequencies on small ohmic values, but it will be low.)

Because the reactance of film resistors is small, it is very difficult to measure. External factors such as length of leads, layout of the circuit, environmental stray capacitance, measuring equipment, etc. may have a significant effect on the measured value.

When measured with a Hewlett Packard 4720A automatic capacitance bridge, the 5063J displays the following characteristics:
(a) floating connections: C=0.15 to 0.20 pF
(b) one side grounded connections: C<0.5 pF
The capacitance was independent of resistance value and frequency up to 1 MHz.

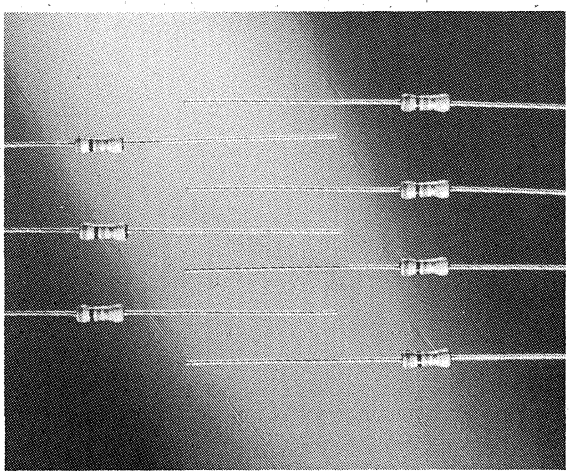
Q. How does this compare to other film resistors?

A. The reactance of film resistors is primarily dominated by the cap to cap capacitance so that resistors of the capped construction and same physical size will have about the same reactance.

CR SERIES

Industrial/Consumer Conformal-Coated Fixed Film Resistors

5% Tolerance
1/4, and 1/2 Watts (70°C)



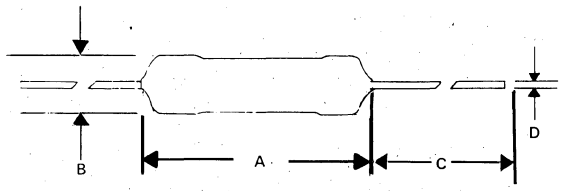
DESCRIPTION

CR Series resistors are the highest-performance, highest-reliability low-cost carbon-film resistors available at the current state of the resistor art. They are particularly well suited to those applications that require significantly better performance than can be obtained with carbon-composition resistors, and offer a simultaneous reduction in cost as well. These resistors feature very low noise, excellent stability, and wide operating frequency range, in minimum size for their power ratings.

DESIGN FEATURES

- Highest Carbon-Film Temperature and Time Stability, approaching those of industrial metal-film resistors.
- Low Voltage and Power Coefficients, approaching those of metal-film resistors of comparable size.
- Lowest Noise Index Ever Attained in Carbon-Film.
- Very Low Reactance—negligible series L, very low shunt C; reactance error is generally less than tolerance up to 10MHz, for most resistance values.
- Excellent Immunity to Environmental and Electrical Stress. Highest reliability, longest stable life of any design in this class.
- Most Compact Construction in this class.
- Very Durable Design. Especially well suited to automatic assembly, wave soldering, conveyorized handling. Easily withstands industrial solvents used in cleaning circuit assemblies

DIMENSIONS



SPECIFICATIONS & NOMENCLATURE

Mepco/ Centralab P/N (Type)	Power Rating (70°C)	Resistance Range (Ohms)*	Resistance Tolerance	Max. Voltage (Volts)	Dimensions Inches (mm)—see diagram			
					A Max.**	B Max.	C	D
5043C (CR25)	1/4W	1Ω-10 Meg	±5%	250	0.268 (6.8)	0.098 (2.5)	1.102±.079 (28±2)	0.024 (0.6)
5053C (CR37)	1/2W	1Ω-1 Meg	±5%	350	0.394 (10)	0.146 (3.7)	1.102±.079 (28±2)	0.028 (0.7)

*Within the resistance ranges shown, the available resistance values are indicated in the MIL 10 to 100 decade table of values (see table page 525), and their decade multiples.

**Maximum run off on lead is 1 MM max. (0.039") when both sides are added together.

CR SERIES

Industrial/Consumer Conformal-Coated Fixed Film Resistors

PERFORMANCE CHARACTERISTICS

SPECIFICATIONS	1/4 W	1/2 W
Power rating P_{nom} at 70°C	0.25W	0.5W
Maximum voltage AC or DC	250V	350V
Voltage (RMS) that may be applied for 1 sec. across insulated coat	500V	700V
Insulation resistance	10^4MΩ	10^4MΩ
	ALL TYPES	
Ambient temperature	−55 to +155°C	
Temperature coefficient	see figure 2	
Noise voltage	see figure 1	

Dielectric Withstanding Voltage
2x limiting voltage for 1 min. between terminals of resistor and metal foil . . . . . no breakdown or flashover

MARKING
CR series resistors are marked using four color bands, per EIA specification RS-196A.

PACKAGING
Available in Bulk (100 pieces per box) or Tape and Reel (5000 pieces per reel).

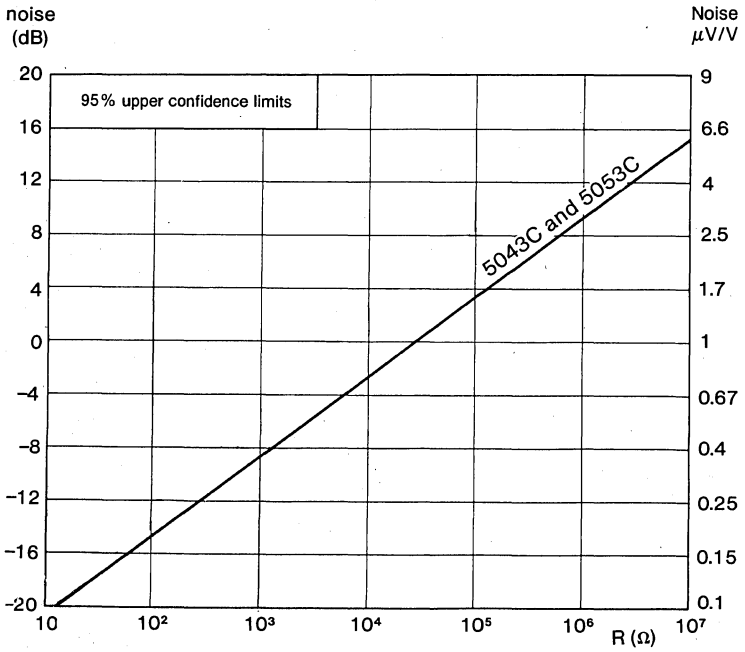
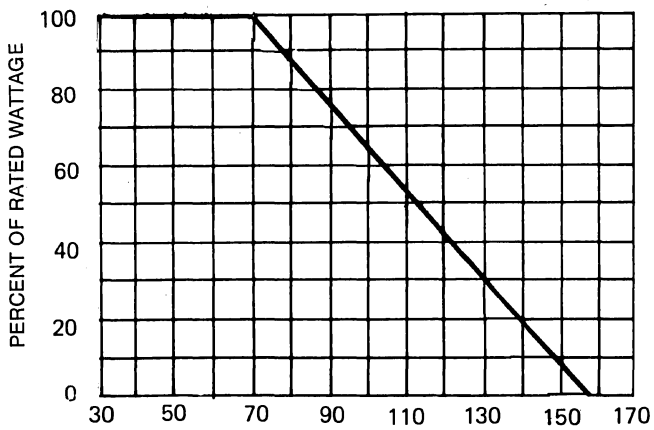


Figure 1. Noise as a function of the resistance value, applicable to all resistor wattages.

DERATING CURVE



HOW TO SPECIFY

CR SERIES Resistors can be completely specified using the following designation:

50 — **Fixed Resistor Axial Lead**

5 — **Wattage**
4 = 1/4
5 = 1/2

3 — **Encapsulation Style**
3 = Conformal

C — **Style**
C = Carbon Film Resistor

X — **Temperature Coefficient**

470K0 — **Resistance Value**
R—ohm
K—1,000 ohm
M—1,000,000 ohm
49R90 = 49.9Ω
499R0 = 499Ω
1K000 = 1K Ω
1M000 = 1 megΩ

J — **Resistance Tolerance**
J = ±5%

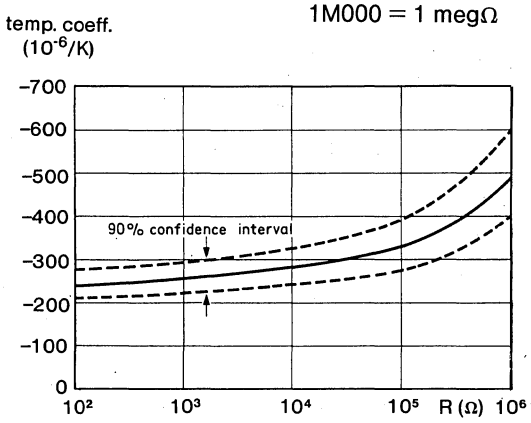


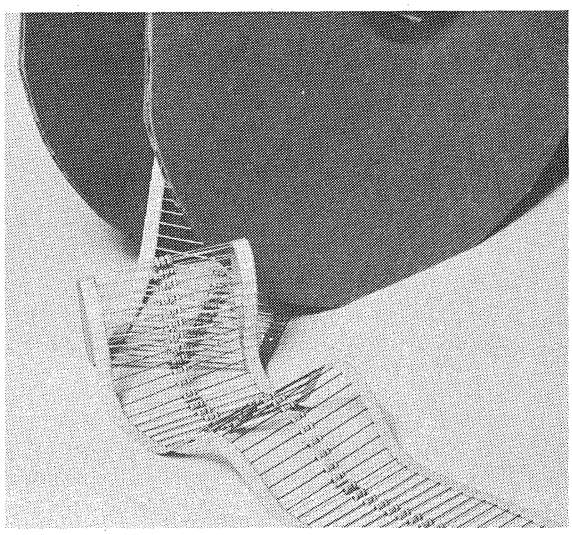
Figure 2. Temperature coefficient as a function of the resistance value, applicable to all resistor wattages. For values < 10 Ω & > 1Meg the Temperature Coefficient is ≤ + 200 x 10^{-6}/ °C

6 Fixed Resistors

SFR SERIES

Standard Film Resistor

METAL FILM
1%, 2%, 5% Tolerances
¼ and ½ Watt (70°C)
Power Ratings



DESCRIPTION

Mepco/Centralab now offers a low cost metal film resistor in 1/4 watt and 1/2 watt styles and a wide range of resistance values and tolerances. Designed for high value manufacturing and automatic insertion, the SFR series provides an economic way to upgrade your circuit with the superior stability, temperature coefficient, low noise and low reactance inherent in a well designed metal film resistor.

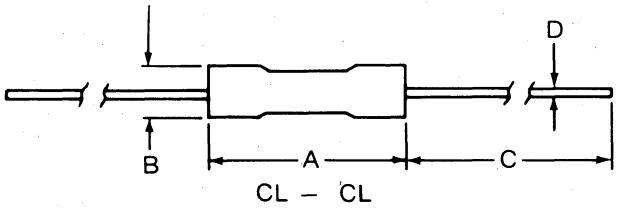
The ±2% and ±5% tolerance SFR's have a temperature coefficient of ±200 PPM/°C and are specifically designed for replacement of carbon composition (RCR 07 & 20), carbon film and older design metal film resistors such as RL07 and RL20.

The ±1% SFR55D and SFR60D with their ±100 PPM/°C temperature coefficient are specifically designed for high volume 1/4 and 1/2 watt resistor applications requiring RN55D and RN60D performance.

FEATURES

- Better than Military Performance (MIL-R-10509, RN55-RN60)
- Compact Construction for Down to .350 in. Centers (.260 In. Max. Clean Lead to Clean Lead)
- Color Band Marking for Ease of Identification after Mounting
- Tape and Reel Package for Automatic Insertion

Designed To Put The Maximum Performance Into The Circuit At The Lowest Possible Cost.



SPECIFICATIONS

SFR Style	Resistance Range	Resistance Tolerance	Temperature Coefficient	70°C Power Rating	Maximum Voltage	A Max	B Max	C Max	D Nom
5043EM (SFR 25)	10Ω - 1MΩ 1Ω - 10MΩ	±2% ±5%	±200 PPM/°C	¼ watt	250 VRMS	.260 in. 6.6 mm	.098 in. 2.49 mm	1.1 in. 27.9 mm	.024 in. .6 mm
5043ED (SFR 55D)	10Ω - 1MΩ	±1%	±100 PPM/°C	¼ watt	250 VRMS	.260 in. 6.6 mm	.098 in. 2.49 mm	1.1 in. 27.9 mm	.024 in. .6mm
5053H (SFR 25H)	10Ω - 1MΩ 1Ω - 10MΩ	±1% ±5%	±100 PPM/°C ±200 PPM/°C	½ watt	350 VRMS	.260 in. 6.6 mm	.098 in. 2.49 mm	1.1 in. 28.0 mm	.024 in. .6 mm

Lead Material: Oxygen free copper 30/70 Tin/Lead Plated Type C (Mil-Std 1276)
Coating: Modified epoxy phenol

SFR SERIES
Standard Film Resistor

ELECTRICAL CHARACTERISTICS COMPARISON

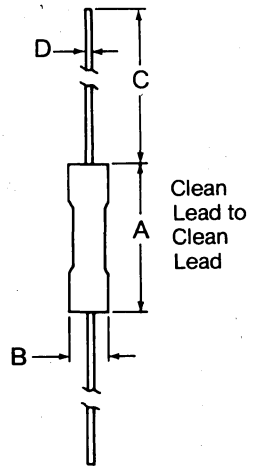
Specification	Size	SFR Series	Mil-R-39008 RCR	Mil-R-22684 RL	Mil-R-10509 Char. D, RN
Resistance Range	¼ watt ½ watt	1Ω - 10MΩ 1Ω - 1MΩ	2.7Ω - 22MΩ 2.7Ω - 22MΩ	51Ω - 150KΩ 4.3Ω - 470KΩ	10Ω - 301KΩ 10Ω - 2MΩ
Tolerance	½ watt ¼ watt	±1%, ±5% ±1%, ±2%, ±5%	±5%, ±10% ±5%, ±10%	±2%, ±5% ±2%, ±5%	±1% ±1%
Temperature Coefficient PPM/°C	½ watt ¼ watt	±100, ±200 ±100, ±200	±5000 ±5000	±200 ±200	±100 ±100
Maximum Operating Voltage	¼ watt	250	250	250	250
(DC or RMS)	½ watt	350	350	350	350
Operating Temperature Range		−55°C to +155°C	−55°C to 150°C	−55°C to 150°C	−55°C to +165°C

PERFORMANCE SPECIFICATIONS COMPARISON

	Maximum % Change in Resistance (△R)			
Test	SFR Series Average	Mil-R-39008 Style RCR Requirement	Mil-R-22684 Style RL Requirement	Mil-R-10509 Style RN Requirement
Temperature Cycling, −65°C to +150°C	0.1%	4.0%	1.0%	0.5%
Low Temperature Operation, −65°C	0.1%	3.0%	0.5%	0.5%
Short Time Overload	0.1%	2.5%	0.5%	0.5%
Terminal Strength, 5 lb. pull	0.01%	1.0%	0.5%	0.2%
Resistance to Soldering Heat, +350°C	0.05%	3.0%	0.5%	0.5%
Moisture Resistance, Mil Std 202	0.1%	15.0%	1.5%	1.5%
Life 1000 hrs	0.25%	10.0%	2.0%	1.0%
Shock, 50G, 11 ms	0.05%	—	0.5%	0.5%
Vibration-High Frequency, 10-2000Hz	0.05%	2.0%	0.5%	0.5%

PHYSICAL COMPARISON

OUTLINE DRAWING

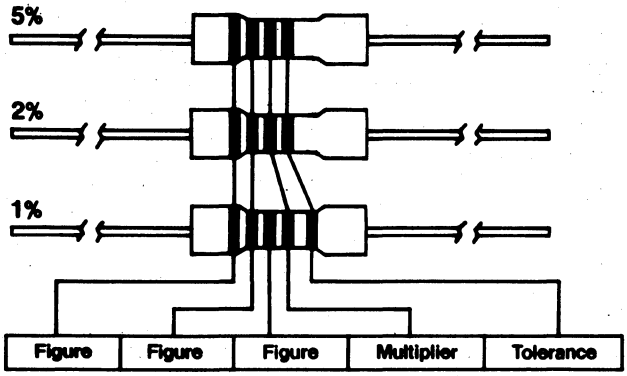


Style	Dimensions			
	A	B	C	D
5043E RCR07 RL07	.260 max .250 ± .031 .243 ± .038	.098 max .090 ± .008 .090 ± .008	1.1 min 1.5 ± .125 1.5 ± .125	.024 ± .002 .023 to .027 .019 to .027
RN55D	.250 +.031 −.046	.109 ± .031	1.5 ± .125	.023 to .027
5053H RCR20 RL20	.260 max .375 ± .031 .380 ± .036	.098 max .138 ± .023 .138 ± .023	1.1 min 1.5 ± .125 1.5 ± .125	.028 ± .002 .026 to .036 .026 to .036

SFR SERIES

Standard Film Resistor

PART MARKINGS



Color	Figure	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	1%
Red	2	100	2%
Orange	3	1K	—
Yellow	4	10K	—
Green	5	100K	—
Blue	6	1M	—
Violet	7	—	—
Gray	8	—	—
White	9	—	—
Gold	—	.1	5%

HOW TO SPECIFY

SFR Series Resistors can be completely specified using the following designation:

50 — **Fixed Resistor Axial Lead**

4 — **Power Rating**
4 = ¼ W—SFR 25, SFR55D
5 = ½ W—SFR 30, SFR60D

3 — **Encapsulation Style**
3 = Conformal

E — **Style**
E = Standard Film Resistor

M — **Temperature Coefficient**
D = ±100 PPM/°C (SFR 55D, SFR 60D)
M = ±200 PPM/°C

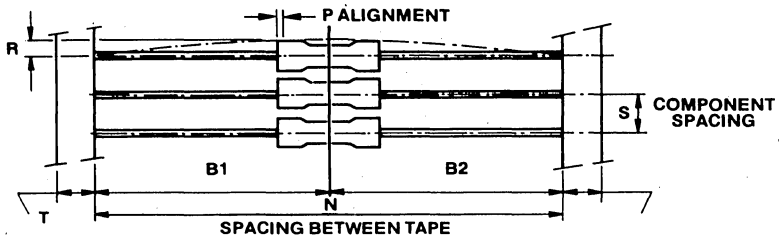
470K0 — **Resistance Value**
R—ohm
K—1,000 ohm
M—1,000,000 ohm
49R90 = 49.9Ω
499R0 = 499Ω
1K000 = 1KΩ
1M000 = 1 megΩ

G — **Resistance Tolerance**
F = ±1% (SFR55D, SFR60D)
G = ±2%
J = ±5%

TAPED LEAD & REEL PACKAGE CONFIGURATIONS

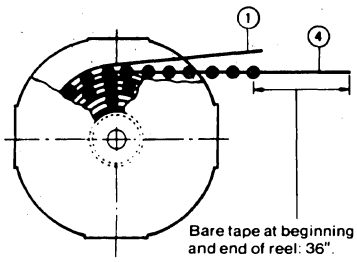
All Mepco/Centralab SFR Fixed Film resistors are furnished in taped-lead format, in multiples of 5000 pieces, to suit the requirements of automated production.

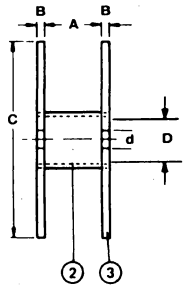
LEAD TAPING DIMENSIONS



Dimension in Inches (millimeters in bold type)—see diagram.						
P/N	B1-B2 (± max.)	N	P (max.)	R (max.)	S	T
5043E	0.047 **1.2**	2.062 ± .062 **52.4 ± 1.6**	0.031 **0.8**	0.039 **1**	0.200 **5**	0.250
5043H	0.047 **1.2**	2.062 ± .062 **52.4 ± 1.6**	0.031 **0.8**	0.039 **1**	0.200 **5**	0.250 **6.35**

REEL PACKAGING DIMENSIONS





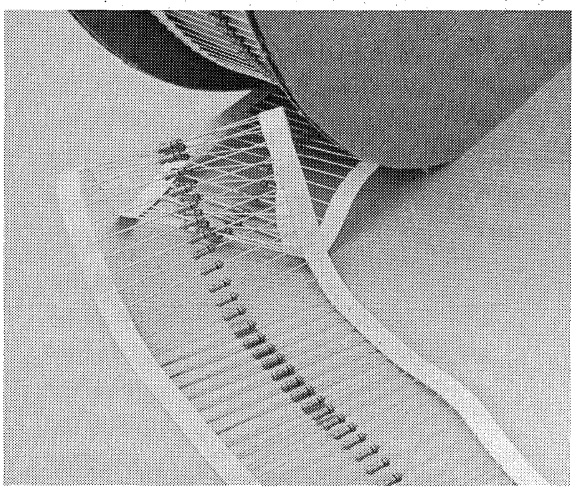
1. Kraft paper (brown)
2. Spirally-wound paper spool
3. Cardboard disc
4. Scotch No. 267, or comparable tape/tape system

Dimension in Inches (millimeters in bold type)—see diagram.						
P/N	A (max.)	B	C	D	d	Quantity Per Reel
5043E	2.95 **75**	0.118 **3**	12.0 **305**	3.03 **77**	1.18 **30**	5,000
5043H	2.95 **75**	0.118 **3**	14.0 **356**	3.03 **77**	1.18 **30**	

5053H (SFR25H)

Metal Film Resistor

1%, 5% Tolerances ½ Watt at 70°C Power Rating
Miniature Size



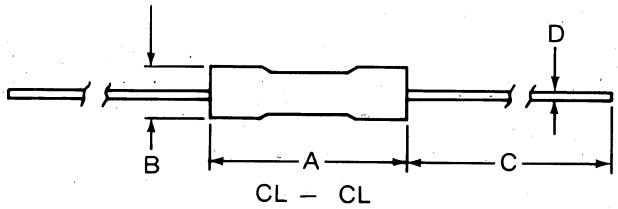
Designed to put the maximum performance into the circuit in the minimum space.

DESCRIPTION

Mepco/Centralab has combined the low cost manufacturing of the SFR series with a high conductivity, high density alumina substrate resulting in a low cost, superior performance, ½ watt resistor with about 50% of the footprint of a conventional ½ watt resistor. The 5053H retains all the advantages of the SFR series: Uniform size, low reactance, low noise, excellent temperature coefficient of resistance and stability. The 5053H complements the SFR60D and SFR30 in the Mepco/Centralab line. It is a replacement for the RC20, RN60, and RL20 Mil styles in applications not requiring qualification.

FEATURES

- Miniature Size for Minimum Board Space Requirements (Can be placed on .350 in. centers)
- Color Band Marking for Ease of Identification after mounting.
- Tape & Reel Packaging for Automatic Insertion.
- Better than Mil Performance (MIL-R-10509, MIL-R-22684)



SPECIFICATIONS

Mepco/ Centralab P/N (Type)	Resistance Range*	Resistance Tolerance	Temperature Coefficient	70°C Power Rating	Maximum Voltage	A Max	B Max	C Nom	D Nom
5053H (SFR25H)	10Ω - 1MΩ 1Ω - 10MΩ	±1% ±5%	±100 PPM/°C ±200 PPM/°C	½ watt	350 VRMS	.260 in. 6.6 mm	.098 in. 2.49 mm	1.1 in. 28.0 mm	.024 in. .6 mm

*Within the resistance ranges shown, the available resistance values are indicated in the MIL 10 to 100 decade table of values and their decade multiples.

SERIES 5053H
Metal Film Resistor

ELECTRICAL CHARACTERISTICS COMPARISON

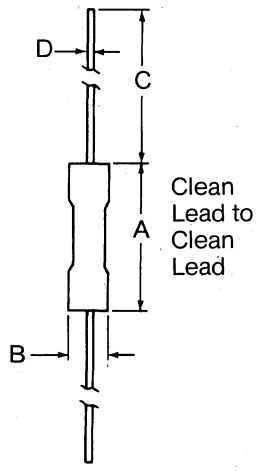
Specification	5053H (½ Watt)		MIL-R-39008 RCR (1/2 Watt)	MIL-R-22684 RL (1/2 Watt)	MIL-R-10509 Char. D, RN (1/2 Watt)
	1%	5%			
Resistance Range	10Ω - 1MΩ	1Ω - 10MΩ	2.7Ω - 22MΩ	51Ω - 150KΩ	10Ω - 301KΩ
Tolerance	±1%	±5%	±5%, ±10%	±2%, ±5%	±1%
Temperature Coefficient PPM/°C	±100	±200	±5000	±200	±100
Maximum Operating Voltage (DC or RMS)	350	350	350	350	350
Operating Temperature Range	−55°C to +155°C		−55°C to +150°C	−55°C to +150°C	−55°C to +165°C

PERFORMANCE SPECIFICATIONS COMPARISON

Test	Maximum % Change In Resistance (△R)			
	5053H	MIL-R-39008 Style RCR Requirement	MIL-R-22684 Style RL Requirement	MIL-R-10509 Style RN Requirement
Temperature Cycling, −65°C to +150°C	≤ .25%	4.0%	1.0%	0.5%
Low Temperature Operation, −65°C	≤ .25%	3.0%	0.5%	0.5%
Short Time Overload	≤ .25%	2.5%	0.5%	0.5%
Terminal Strength, 5 lb. pull	≤ .25%	1.0%	0.5%	0.2%
Resistance to Soldering Heat, +350°C	≤ .25%	3.0%	0.5%	0.5%
Moisture Resistance, Mil-Std-202	≤ .5%	15.0%	1.5%	1.5%
Life, 1000 hrs	≤ 1.0%	10.0%	2.0%	1.0%
Shock, 50G, 11ms	≤ .25%	—	0.5%	0.5%
Vibration-High Frequency, 10-2000 Hz	≤ .25%	2.0%	0.5%	0.5%

PHYSICAL COMPARISON

OUTLINE DRAWING



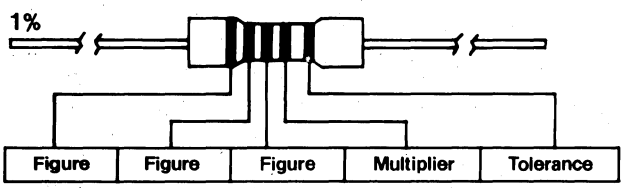
Style	Dimension (in.)			
	A	B	C	D
5053H	.260 max	.098 max	1.1 nom	.024 ± .002
RC20	.375 ± .031	.138 ± .023	1.5 ± .125	.026 to .036
RL20	.380 ± .036	.138 ± .023	1.5 ± .125	.026 to .036
RN60D	.375 ± .062	.125 ± .40	1.5 ± .125	.025 ± .002

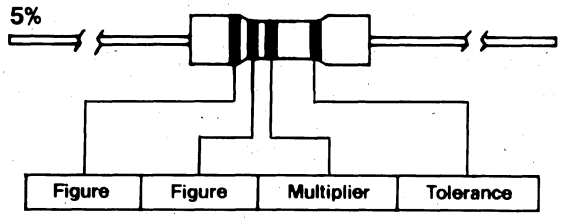
SERIES 5053H

Metal Film Resistor

PART MARKINGS

5053H (1%, 5%)





Color	Figure	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	1%
Red	2	100	—
Orange	3	1K	—
Yellow	4	10K	—
Green	5	100K	—
Blue	6	1M	—
Violet	7	—	—
Gray	8	—	—
White	9	—	—
Gold	—	.1	5%

HOW TO SPECIFY

5053H Series Resistors can be completely specified using the following designation:

50 — **Fixed Resistor Axial Lead**

5 — **Power Rating**
5 = ½ W

3 — **Encapsulation Style**
3 = Conformal

H — **Style**
H = Standard Film Resistor Miniature ½ W

D — **Temperature Coefficient**
D = ±100 PPM/°C
M = ±200 PPM/°C

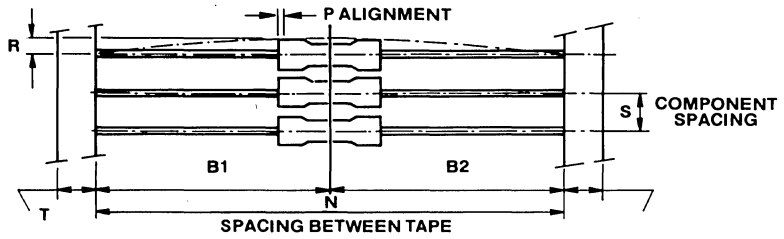
470K0 — **Resistance Value**
R = ohm
K = 1,000 ohm
M = 1,000,000 ohm
49R9 = 49.9
499R0 = 499
1K000 = 1K
1M000 = 1 Meg

F — **Resistance Tolerance**
F = ±1%
J = ±5%

TAPED LEAD AND REEL PACKAGE CONFIGURATIONS

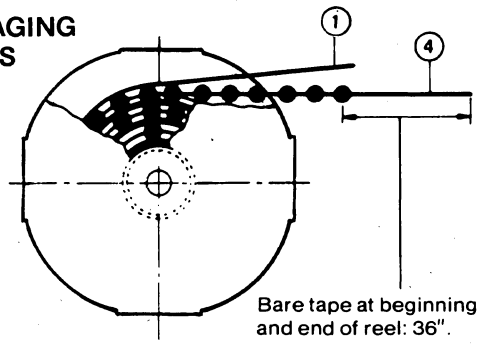
The 5053H Series of Fixed Film resistors are furnished in taped-lead format, in multiples of 5000 pieces, to suit the requirements of automated production.

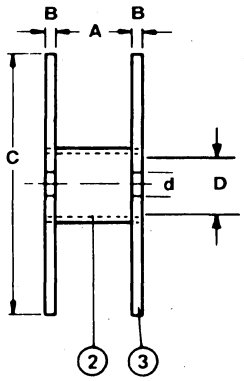
LEAD TAPING DIMENSIONS



Dimensions — see diagram						
P/N	B1-B2 (± max.)	N	P (max.)	R (max.)	S	T
5053H	0.047 in. 1.2 mm	2.062 ± .062 in. 52.4 ± 1.6 mm	0.031 in. 0.8 mm	0.039 in. 1 mm	0.200 in. 5 mm	0.250 in. 6.35 mm

REEL PACKAGING DIMENSIONS





1. Kraft paper (brown)
2. Spirally-wound paper spool
3. Cardboard disc
4. Comparable to Scotch No. 267

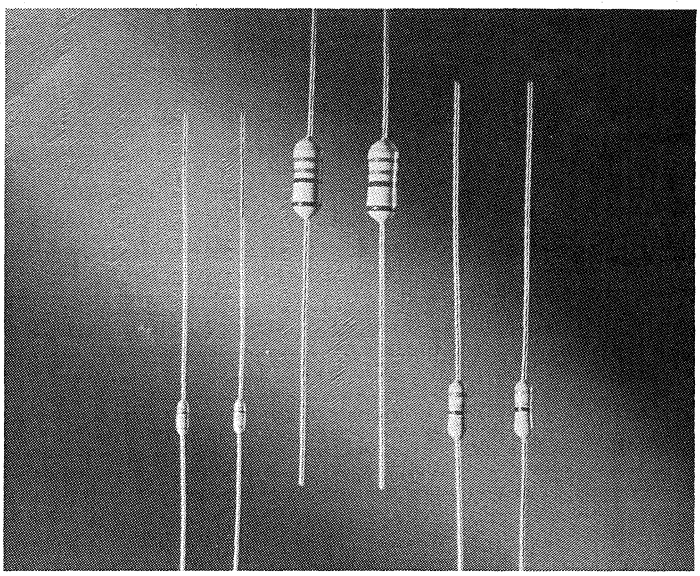
Dimensions — see diagram						
P/N	A (max.)	B	C	D	d	Quantity Per Reel
5053H	2.95 in. 75 mm	0.118 in. 3 mm	12.0 in. 305 mm	3.03 in. 77 mm	1.18 in. 30 mm	5000

SPR 5000Y SERIES

Standard Precision Film Resistor Resistance Range

1 ohm—1 gigohm, .5 to 5% Tolerance

5033Y 1/10 **Watt @ 125°C**
1/3 **Watt @ 70°C**
5053Y 1/4 **Watt @ 125°C**
1/2 **Watt @ 70°C**
5073Y 1/2 **Watt @ 125°C**
1 Watt @ 70°C



6 Fixed Resistors

DESCRIPTION

Mepco/Centralab offers a film resistor series more compact and with greater power handling capacity. For example, the 5033Y is a mil spec 1/10 watt size yet handles up to 1/3 watt (70°C rating). This combination allows reduction of inventory by a selection of the most convenient 5000Y values to reduce the number of wattage ratings carried. The size/power handling characteristic is also a distinct advantage in "down sized" boards. The 5000Y series is available in standard values between resistance range limits noted below. Operating temperatures up to 150°C are permissible.

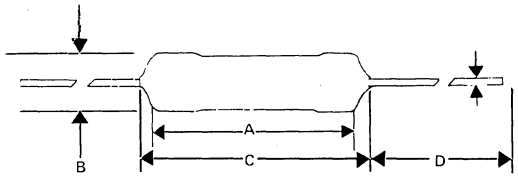
DESIGN FEATURES

- Wide Resistance Range: 1 ohm to 250 megohm.
- Excellent Temperature and Time Stabilities, approaching those of wirewound resistors.
- Low Voltage and Power Coefficients, approaching those of wirewound resistors of comparable size.
- Low Noise. Johnson noise is lowest attainable, except in best wirewound designs.
- High initial accuracy and tracking. Tolerance of 1% is standard.
- Very Low Reactance—low series L, low shunt C; reactance error is generally less than tolerance up to 10MHz, for most resistance values.

SPR 5000Y SERIES

Standard Precision Film Resistor

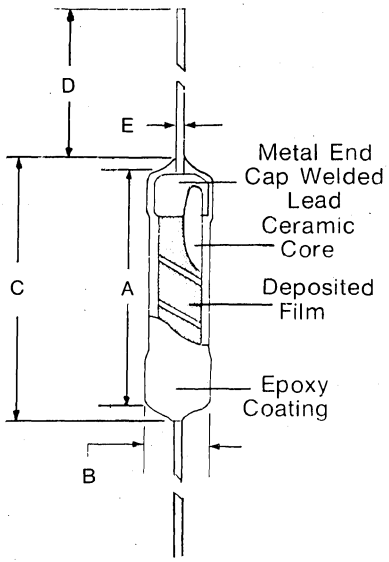
DIMENSIONS



SPECIFICATIONS & NOMENCLATURE–5000Y SERIES

Mepco/ Centralab Style	Maximum Power Rating	Resistance Range* (ohms)	Temperature Coefficient (PPM/°C)	Resistance Tolerance	Max. Voltage (volts)	Dimensions–see diagram Inches (mm)				
						A	B	C**	D	E
5033Y	1/10 W@ 125°C 1/3 W@ 70°C	1 Ω to 12 M	±50 PPM 10Ω-499K ±100 PPM 1Ω-4.99 M ±150 PPM 5.11 M-12 M	±0.5% (10Ω499K) ±1.0% ±2.0% ±5.0%	250	.150 ±.020 (3.81) ±0.51	.070 ±.010 (1.79) (±0.23)	.200 Max. (5.08)	1.5 (38.1)	.020 (.51) #24
5053Y	1/4 W@ 125°C 1/2 W@ 70°C	1 Ω to 250 M	±50 PPM 10Ω-2 M ±100 PPM 1Ω-10 M ±150 PPM 2 M-250 M	±0.5% (10Ω-2 M) ±1.0% ±2.0% ±5.0%	350	.261 ±.020 (6.63 ±0.51)	.093 ±.005 (2.362 ±0.13)	.300 Max. (7.62)	1.5 (38.1)	.025 (.63) #22
5073Y	1/2 W@ 125°C 1 W@ 70°C	1 Ω to 25 M	±50 PPM 10Ω-4 M ±100 PPM 1 Ω-25 M	±0.5% (10Ω-4 M) ±1.0% ±2.0% ±5.0%	500	.390 ±.020 (9.91 ±0.51)	.152 ±.009 (3.861 ±0.23)	.430 Max. (10.92)	1.5 (38.1)	.025*** (.63) #22

*Within the resistance ranges shown, values indicated in the decade table of values, and their decade multiples, are available as standard. Other values are available on special order.
Clean-lead to clean-lead. *.032" leads available on request.



PERFORMANCE CHARACTERISTICS

As a guide to the performance that can be expected of SPR5000Y resistors, the following chart indicates typical results of tests performed in accordance with MIL-R-10509.

Test	Max. % Change in Resistance: MIL-R-10509 (Characteristics C & E) Requirements	SPR 5000Y Average
Temperature Cycling, −65° to +150°C	.25%	.05%
Low temperature operation, −65°C	.25%	.02%
Short time overload	.25%	.02%
Terminal strength, 5 lb. load	.20%	.02%
Dielectric Withstanding Voltage	.25%	.01%
Resistance to soldering heat, 350°C	.10%	.01%
Moisture resistance	.50%	.05%
Life (1,000 hours)	.50%	.25%
Shock, medium impact, 50G, 11 ms.	.25%	.01%
Vibration, High frequency 10-2000 Hz	.25%	.01%

SPR 5000Y SERIES

Standard Precision Film Resistor

COMPARISON SPECIFICATIONS			
STYLE	**MEPCO/CENTRALAB SPR5000Y**	**MIL-R-22684**	**MIL-R-10509**
Maximum Operating Temperature	1Ω-22.1 M 150°C >22.1 M 125°C	+150°C	+165°C
1000 Hour Load Life △ R	<1.0%	<1.0%	<1.0%
Moisture Resistance △ R	<0.5%	<1.5%	<1.5%
Short Time Overload △ R	<0.1%	<0.5%	<0.5%

MARKING

Resistors are marked using color bands or alpha-numeric marking as specified by customer.

PACKAGING

Bulk (100 pieces per box) or Lead Tape and Reel per EIA RS-296D.

LEAD MATERIAL

Type C, MIL-STD-1276 (tin-lead plating over Oxygen-free high conductivity Copper)

HOW TO SPECIFY

SPR 5000Y Resistors can be completely specified using the following designation:

50 — **Fixed Resistor Axial Lead**

5 — **Wattage**
3 = 1/3
5 = 1/2
7 = 1

3 — **Encapsulation**
3 = Conformal

Y — **Style**

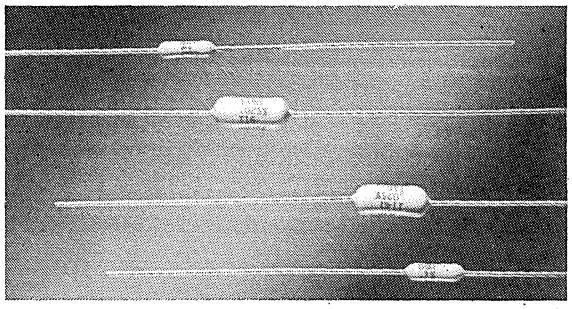
D — **Temperature Coefficient**
C = ±50
D = ±100
L = ±150PPM

1K000 — **Resistance Value**
R—ohm
K—1,000 ohm
M—1,000,000 ohms
49R90 = 49.9Ω
499R0 = 499Ω
1K000 = 1KΩ
1M000 = 1 megΩ

P — **Resistance Tolerance**
D = ±0.5%
F = ±1.0%
G = ±2.0%
J = ±5.0%

UPR 5000Z SERIES

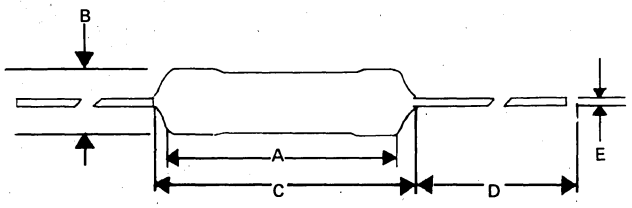
Ultra Precision Resistor Tolerance To ±0.02% Temperature Coefficients To ±2 PPM/°C



DESCRIPTION

Mepco/Centralab offers a film resistor designed for use in ultra precision applications previously requiring the finest wirewound resistors available. The 5000Z series of resistors is available with tolerances to .02% and temperature coefficients to ±2PPM/°C in package sizes much smaller than those of wirewounds. The 5000Z series is particularly well suited for uses in matched sets, with matches to ±.02% and 2 PPM/°C tracking. Proprietary Mepco/Centralab processes make the 5000Z one of the most stable film resistors currently available on the market.

DIMENSIONS



DESIGN FEATURES

- Temperature coefficients and tolerances approaching the lowest attainable using film techniques.
- Excellent temperature and time stabilities, approaching those of wirewound resistors.
- Low voltage and power coefficients, approaching those of wirewound resistors of comparable size.
- Low noise. Johnson noise is close to lowest attainable, except in best wirewound designs.
- High initial accuracy and tracking. Tolerance matches of .02% and TC tracks of 2 PPM/°C are available.
- Very low reactance—low series L, low shunt C: reactance error is generally less than tolerance up to 10MHz, for most resistance values.
- Temperature Range: −20°C to +85°C.

SPECIFICATIONS AND NOMENCLATURE—5000Z SERIES

Mepco/ Centralab Series	Maximum Power Rating (85°C)	Resistance Range* (ohms)	Temperature Coefficient*** (PPM/°C)	Resistance Tolerance	Max Voltage	Dimensions—See Diagram Inches (mm)				
						A	B	C**	D	E
5013Z	1/20 WATT	51.1Ω to 100K	±2 PPM (100Ω-301K) ±5 PPM ±10 PPM ±15 PPM ±20 PPM ±25 PPM	± .02 % ± .025% ± .05 % ± .10 % ± .25 % ± .50 % ±1.00 %	200V	.150±.020 (3.81±0.51)	.070±.010 (1.79±0.23)	200 (5.08	1.5 (38.1)	0.16 (#26) (.41)
5023Z	1/8 WATT	51.1Ω to 511K			250V	.261±.020 (6.63±0.51)	.093±.005 (2.36±.13)	.300 max (7.62 max.)	1.5 (38.1)	.025 (#22) (.63)
5033Z	1/4 WATT	51.1Ω to 511K			300V	.396±.020 (10.1±.51)	.152±.009 (3.86±.23)	.430 max (10.9 max)	1.5 (38.1)	.025 (#22) .63
5063Z	1/3 WATT	51.1± to 511K			300V	.390±.020 (9.91±5.1)	.152±.009 (3.86±.23)	.430 max 10.9)	1.5 (38.1)	.032 (#20) (.81)

*Within the resistance ranges shown, values indicated in the decade table of values and their decade multiples, are available as standard. Other values are available on special order.

**Clean-lead to clean-lead.

***Temperature coefficient is measured over the temperature range of −20°C to +85°C for all TC's except 2 PPM. 2 PPM is measured at 0°C to +60°C.

UPR 5000Z SERIES

Ultra Precision Resistor

PERFORMANCE COMPARISONS TO MIL SPEC TEST GROUPS

	Wirewound Specification MIL-R-93D	Metal Film Specification MIL-R-55182	Mepco/Centralab 5000Z Series
Standard Tolerance Range	±.005% to ±1%	±.1% to ±1%	±.02% to ±1%
Test Group II	Specified Max. ΔR	Specified Max. ΔR	Max. ΔR
Temperature Cycling	.20%	.20%	.02%
Low Temperature Operation	.25%	.15%	.01%
Short time Overload	.10%	N/A	.01%
Terminal Strength	.05%	.20%	.02%
Test Group III	Specified Max. ΔR	Specified Max. ΔR	Max. ΔR
Dielectric withstand voltage			
(a) Atmospheric Pressure	.05%	.15%	.01%
(b) Barometric Pressure	.05%	.15%	.01%
Insulation resistances	N/A	>10,000 MegΩ	>10,000 MegΩ
Effect of Soldering	N/A	.10%	.01%
Moisture resistance	.25%	.40%	.04%
Test Group IV	Specified Max. ΔR	Specified Max. ΔR	Max. ΔR
Temperature Coefficient	20PPM/°C to 90PPM/°C	25PPM/°C to 100PPM/°C	2PPM/°C to 25PPM/°C
Life Test	.50% (125°C)	.50% (125°C)	.02% (85°C)
Test Group V	Specified Max. ΔR	Specified Max. ΔR	Max. ΔR
Shock	.10%	.20%	.01%
Vibration, High Frequency	.10%	.20%	.01%
Non Military Tests			
Voltage Coefficient	N/A	N/A	≤.1 PPM/V
Thermal EMF	N/A	N/A	<2 μV/°C

MARKING

*Standard marking is Alpha-Numeric
Example: M/C
5023Z
100K
.1% T16
*Special marking is available per customer requirement

PACKAGING

Bulk (100 pieces per box) or Lead Tape and Reel per EIA RS-296D

LEAD MATERIAL

Type C, MIL-STD-1276 (tin-lead plating over Oxygen-free high conductivity Copper)

HOW TO SPECIFY

UPR 5000Z Series Resistors can be completely specified using the following designation.

50 — **Fixed Resistor Axial Lead**

2 — **Wattage**
1 = 1/20
2 = 1/8
3 = 1/4
6 = 1/3

3 — **Encapsulation**
3 = Conformal

Z — **Style**

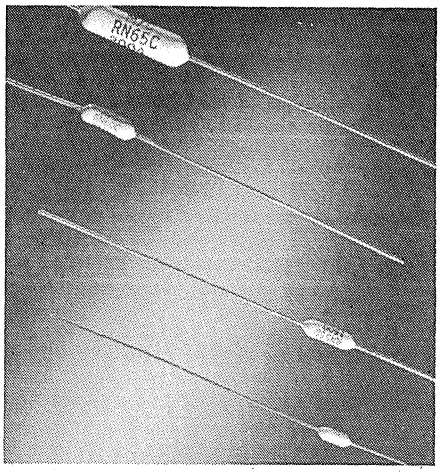
B — **Temperature Coefficient (PPM/°C)**
T = ±2 PPM (T18)
A = ±5 PPM (T16)
B = ±10 PPM (T13)
F = ±15 PPM (T10)
G = ±20 PPM (T14)
E = ±25 PPM (T9)

1K000 — **Resistance Value R–ohm**
K–1,000 ohm
M–1,000,000 ohm
49R90 = 49.9Ω
499R0 = 499Ω
1K000 = 1KΩ

A — **Tolerance**
N = ±0.02%
Z = ±0.025%
A = ±0.05%
B = ±0.10%
C = ±0.25%
D = ±0.5%
F = ±1.00%

RN SERIES
CUSTOM MATCHED SETS

Resistance Ratio Match to .10%, Temperature Coefficient Match to 10 PPM/C°



±0.1%, 0.25%, 0.5%, and 1% Tolerance
Characteristics C (±50PPM), and E (±25PPM)
1/20, 1/10, 1/8, 1/4, 1/2 Watt (125°C)
1/10, 1/8, 1/4, 1/2, Watt (70°)

DESCRIPTION

For applications not requiring the ultra precision & stability of the UPR 5000Z series, the RN series of custom matched sets provide a very economical alternative. The RN series, with broad selections of tolerances, temperature coefficient characteristics, resistance values, and power ratings, is available in matched sets with resistance ratio tolerances to .1% and temperature coefficient matches to 10PPM/C°.

PACKAGING

Coin Envelope, stamped with "Matched Set-Do Not Separate" and customer part number.

DESIGN FEATURES

- Excellent Initial Accuracy and Long-Term Stabilities, approaching wirewound resistor performance.
- Lowest Voltage and Power Coefficients ever attained in a metal-film resistor.
- Low Temperature Coefficients. Characteristic E equals the performance of conventional wirewound designs.
- Excellent Matching and Tracking. Tolerance of 0.1%, 0.25%, 0.5%, 1%, and TC tracks of 10PPM, 25PPM and 50PPM/°C are available.
- Very Low Reactance-low series L, low shunt C; reactance error is generally less than tolerance up to 10 MHz, for most resistance values.

MATCHED SET REQUIREMENTS ARE UNIQUE TO THE CUSTOMER SPECIFICATION
APPLICATION ENGINEERING ASSISTANCE IS AVAILABLE BY CALLING OR WRITING THE FACTORY

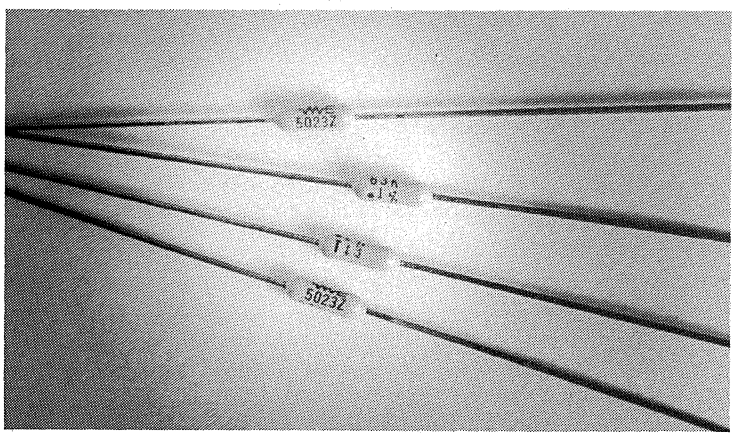
SPECIFICATIONS AND NOMENCLATURE

Mepco/ Centralab Style	Power Rating (Watts) MIL-R-10509 125°C	MIL-R-10509 70°C	Mepco/ Centralab 70°C	Resistance Range (ohms)	Temperature Coefficient (PPM/°C)	Resistance Tolerance	RN Matched Set Configurations *Resistance Ratio Match	*Temperature Coefficient Track
5023R	1/20	1/10	1/8	30.1Ω to 301K	±25PPM ±50PPM	±0.1% to ±1.0%	.10% .25% .50% 1.00%	10PPM 25PPM 50PPM
5033R	1/10	1/8	1/4	49.9Ω to 750K	±25PPM ±50PPM	±0.1% to ±1.0%		
5043R	1/8	1/4	1/2	30.1Ω to 1M	±25PPM	±0.1% to ±1.0%		
				30.1Ω to 2M	±50PPM			
5053R	1/4	1/2	1	49.1Ω to 1M	±25PPM	±0.1% to ±1.0%		
				49.9Ω to 4M	±50PPM			

*Most common configurations other combinations available

UPR SERIES
CUSTOM MATCHED SETS

Resistance Ratio Match to .02%, Temperature Coefficient Match to 2 PPM/C°



DESCRIPTION

Mepco/Centralab offers the superior stability of the 5000Z series in custom factory matched sets to achieve maximum precision of resistance ratio at minimum cost. The 5000Z sets are available with absolute resistance tolerance of ±.02%, resistance ratio matches to .02% and temperature coefficient tracking to 2PPM/C°. The combination of rapid response time, stability, low noise, precision and low cost make these sets the outstanding value for precision analog circuitry.

PACKAGING

Coin Envelope, stamped with "Matched Set-Do Not Separate" and customer part number.

DESIGN FEATURES

- Temperature Coefficients and Tolerances approaching the lowest attainable in resistor technology.
- Excellent Temperature and Time Stabilities, equivalent to the best competitive devices.
- Lowest Voltage and Power Coefficients ever attained in metal film resistors.
- Low noise. Johnson noise is unmeasurable with existing techniques.
- High Initial Accuracy and Tracking. Tolerance matches of .02% and TC tracks of 2PPM/C° are available.
- Very Low Reactance—low series L, low shunt C: Reactance error is generally less than tolerance up to 10MHz, for most resistance values.

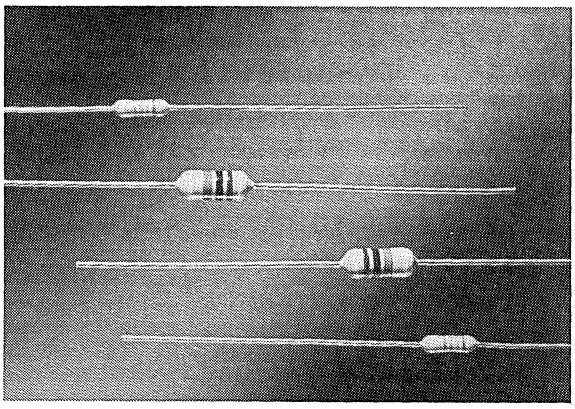
MATCHED SET REQUIREMENTS ARE UNIQUE TO THE CUSTOMER SPECIFICATION
APPLICATION ENGINEERING ASSISTANCE IS AVAILABLE BY CALLING OR WRITING THE FACTORY

SPECIFICATIONS AND NOMENCLATURE—5000Z MATCHED SETS

Mepco/ Centralab Style	Maximum Power Rating (85°C)	Resistance Range (ohms)	Temperature Coefficient (PPM/°C)	Resistance Tolerance	5000Z Matched Set Configuration	
					*Resistance Ratio Match	*Temperature Coefficient Track
5013Z	1/20 WATT	51.1Ω to	±2PPM (100Ω-301K)	± .02%	.0.02%	2PPM
5023Z	1/8 WATT	511KΩ		± .025%	0.05%	5PPM
5033Z	1/4 WATT		± 5PPM	± .05%	0.10%	10PPM
5063Z	1/3 WATT		±10PPM	± .10%		
			±15PPM	± .25%	*Most common configurations other combinations available	
			±20PPM	± .5%		
			±25PPM	±1.0%		

Standard Military Resistors Conformal-Coated (MIL-R-22684)

2% and 5% Tolerance 100 PPM Temperature Coefficient 1/4 and 1/2 Watt (70°C)



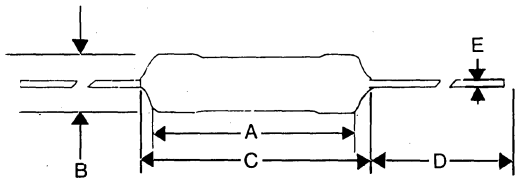
DESCRIPTION

This RL Series comprises MIL-R-22684 resistors of moderate accuracy and good stability, and is particularly suited to replacement of RL-type metal-glaze or tin-oxide resistors where higher stability, lower noise, and better voltage/power coefficients are required in the same or smaller space. Over a very broad frequency spectrum, these resistors exhibit negligible reactance, and are entirely suitable for fast-pulse circuitry.

DESIGN FEATURES

- Lowest Voltage and Power Coefficients ever achieved in metal-film resistors.
- Excellent Temperature/Time Stability—significantly better than that achieved by other film resistors in the RL class.
- Low Noise—Johnson noise is lowest attainable, except in best wirewound designs.
- Very Low Reactance—Low Series L, low shunt C; reactance error is generally less than tolerance up to 10 MHz, for most resistance values.

DIMENSIONS



SPECIFICATIONS & NOMENCLATURE–RL (5000T) SERIES

MIL Type	Mepco/ Centralab Style	MIL Power Rating (70°C)	Resistance Range* (ohms)	Temperature Coefficient (PPM/°C)	Resistance Tolerance	Max. Voltage (Volts)	Dimensions—See Diagram Inches (mm)				
							A	B	C**	D	E (AWG)
RL07	5043T	1/4 W	51Ω to 150K	±100PPM	±2% ±5%	250V	.261±.020 (6.63±0.51)	.093±.005 (2.36±0.13)	.300 Max. (7.62)	1.5 (38.1)	.025 (.63) (#22)
RL20	5053T	1/2 W	4.3Ω to 470K	±100PPM	±2% ±5%	350V	.390±.020 (9.91±0.51)	.152±.009 (3.86±.23)	.430 Max. (10.92)	1.5 (38.1)	.032 (.81) (#20)

*Within the resistance ranges shown, values indicated in the decade table of values and their decade multiples, are available as standard. Other values are available on special order.
**Clean-lead to clean-lead.

MIL STYLE RL

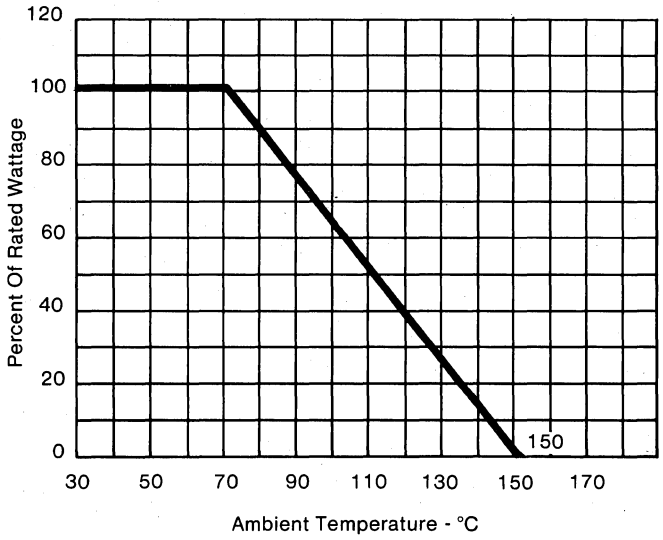
Standard Military Resistors Conformal-Coated (MIL-R-22684)

PERFORMANCE CHARACTERISTICS

As a guide to the performance that can be expected of RL Series resistors, the following chart indicates typical results of tests performed in accordance with MIL-R-22684.

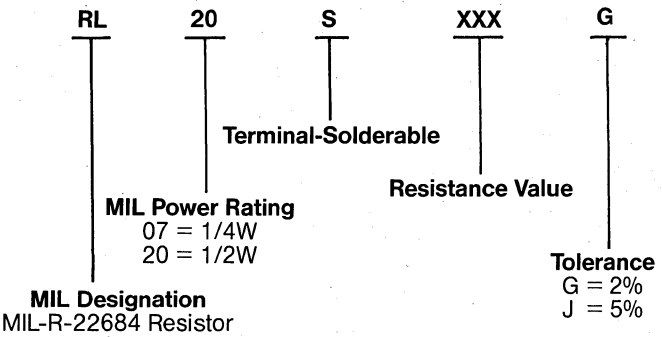
	Max. % Change in Resistance	
	MIL-R-22684 Requirements	M/C RL Average
Temperature Cycling, −55° to +85°C	.1%	.05%
Low temperature operation, −65°C	.5%	.03%
Short time overload	.5%	.05%
Terminal strength, 5 lb. load	.5%	.02%
Dielectric withstanding Voltage	.5%	.02%
Resistance to soldering heat, 350°C	.5%	.08%
Moisture resistance	1.5%	.20%
Life (1,000 hours)	.2%	.15%
Shock (Specified pulse 100G, 6 ms)	.5%	.03%
Vibration, High frequency 10-2000 Hz	.5%	.03%

DERATING CURVE



HOW TO SPECIFY

MIL STYLE RL Resistors can be completely specified using the following designation.



MARKING

RL Series resistors are marked using 5 color bands per MIL-R-22684.

PACKAGING

Bulk (100 pieces per box) or Lead Tape and Reel per EIA RS-296D.

LEAD MATERIAL

Type C, MIL-STD-1276 (tin-lead plating over Oxygen-free high conductivity Copper).

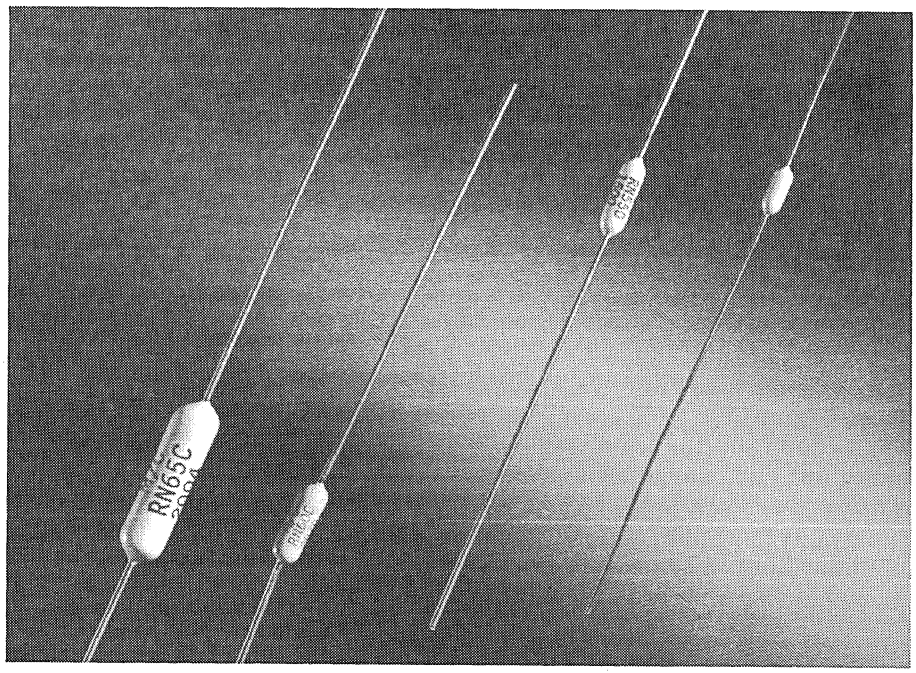
typical capacitance values

Style	5043T	5053T
C (pF) ±25%	0.18	0.21
Voltage Coefficient (PPM/Volt) ±25%	5	3
Power Coefficient (°C/Watt) ±10%	130	150

MIL STYLE RN

Standard Military Resistors Conformal-Coated (MIL-R-10509 Qualified)

±0.1%, 0.25%, 0.5%, and 1% Tolerance Characteristics E (±25PPM), C ±50PPM, and D (±100PPM)



DESCRIPTION

This Series encompasses an unusually broad selection of tolerances, temperature characteristics, and power ratings, in all their combinations, with full MIL-R-10509 performance. Typically the MIL requirements are exceeded to a substantial degree. These resistors feature the low noise, high stability, and wide operating frequency range characterizing the Mepco/Centralab metal-film design, in minimum size for their power ratings.

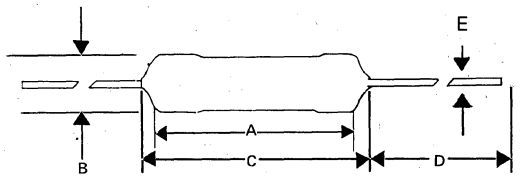
DESIGN FEATURES

- Excellent Initial Accuracy and Long-Term Stabilities, approaching wirewound resistor performance.
- Lowest Voltage and Power Coefficients ever attained in a metal-film resistor.
- Low Temperature Coefficients. Characteristic E equals the performance of conventional wirewound designs.
- Excellent Matching and Tracking. Tolerances of 0.1%, 0.25%, 0.5% and 1% are standard. Ratio sets track closely over wide temperature ranges, long term.
- Very Low Reactance—low series L, low shunt C; reactance error is generally less than tolerance up to 10MHz, for most resistance values.

MIL STYLE RN

Standard Military Resistors Conformal-Coated (MIL-R-10509)

DIMENSIONS



SPECIFICATIONS & NOMENCLATURE–RN (5000R/M) SERIES

MIL (QPL) Type	Mepco/ Centralab Style	Power Ratings (Watts) Commercial 70°C	Power Ratings (Watts) MIL-R-10509 125°C	Power Ratings (Watts) MIL-R-10509 70°C	Qualified (QPL) Resistance Range (ohms)†	Mepco/ Centralab Resistance Range (ohms)†	Temperature Coefficient (PPM/°C)	Resistance Tolerance	Max Voltage	Dimensions—See Diagram Inches (mm) A	B	C**	D	E
RN50	5023R	1/8	1/20		30.1Ω-100K	10Ω750K	E = ±25PPM	±0.1% ±0.25% ±0.5% ±1.0%	200	.150±.020 (3.81 ±0.51)	.070±.010 (1.79 ±0.23)	200 (5.08)	1.5 (38.1)	.016" (.41) (#26)
					30.1Ω-100K	10Ω750K	C = ±50PPM							
				1/10	*	10Ω-750K	D = ±100PPM							
RN55	5033R	1/4	1/10		49.9Ω-100K	10Ω-1M	E = ±25PPM	±0.1% ±0.25% ±0.5% ±1.0%	200 E C	.261±.020 (6.63 ±0.51)	.093±.005 (2.36 ±0.13)	.300 (7.62)	1.5 (38.1)	.025" (.63) (#22)
					49.9Ω-100K	10Ω-2M	C = ±50PPM							
				1/8	10Ω-300K	1Ω-2M	D = ±100PPM		250 D					
RN60	5043M	1/2	1/8		49.9Ω-499K	30.1Ω-1M	E = ±25PPM	±0.1% ±0.25% ±0.5% ±1.0%	250 E C	.303±.020 (7.70 ±0.50)	.104±.010 (2.64 ±0.25)	.350 (8.89)	1.5 (38.1)	.025" (.63) (#22)
					49.9Ω-499K	30.1Ω-1M	C = ±50PPM							
				1/4	10Ω-1M	10Ω-2M	D = ±100PPM		300 D					
RN60	5043R	1/2	1/8		49.9Ω-499K	30.1Ω-1M	E = ±25PPM	±0.1% ±0.25% ±0.5% ±1.0%	250 E C	.390±.020 (9.91 ±0.51)	.152±.009 (3.86 ±0.23)	.430 (10.92)	1.5 (38.1)	.025" (.63) (#22)
					49.9Ω-499K	30.1Ω-2M	C = ±50PPM							
				1/4	10Ω-1M	1Ω-2M	D = ±100PPM		300 D					
RN65	5053R	1	1/4		49.9Ω-1M	49.9Ω-2M	E = ±25PPM	±0.1% ±0.25% ±0.5% ±1.0%	300 E C	.620±.020 (15.75 ±0.51)	.167±.010 (4.24 ±0.26)	.650 (16.51)	1.5 (38.1)	.025" (.63) (#22)
					49.9Ω-1M	49.9Ω-4M	C = ±50PPM							
				1/2	10Ω-2M	1Ω-4M	D = ±100PPM		350 D					

*MIL-R-10509 does not include a RN50, for 100PPM Temperature Coefficient.

**Clean-lead to clean-lead.

†Within the resistance ranges shown, values indicated in the decade table of values and their decade multiples, are available as standard. Other values are available on special order.

MIL STYLE RN

Standard Military Resistors Conformal-Coated (MIL-R-10509)

PERFORMANCE CHARACTERISTICS

As a guide to the performance that can be expected of RN Series resistors, the following chart indicates typical results of tests performed in accordance with MIL-R-10509.

Test	Max. % Change in Resistance: MIL-R-10509 (Characteristics C & E) Requirements	Max. % Change in Resistance: Mepco/ Centralab RN—Series Average
Temperature Cycling, −65 to +150°C	.25%	.05%
Low temperature operation, −65°C*	.25%	.02%
Short time overload	.25%	.02%
Terminal strength, 5 lb. load	.2%	.02%
Dielectric withstanding Voltage	.25%	.01%
Resistance to soldering heat, 350°C	.10%	.01%
Moisture resistance	.50%	.05%
Life (1,000 hours)	.50%	.10%
Shock, medium impact, 50G, 11 ms.	.25%	.01%
Vibration, High frequency 10-2000 Hz	.25%	.01%

MARKING

Standard military RN Series resistors are marked with the MIL style, characteristic, resistance, and tolerance, as specified in MIL-R-10509. (See JAN Marking)

PACKAGING

Bulk (100 pieces per box) or Lead Tape and Reel per EIA RS-296D.

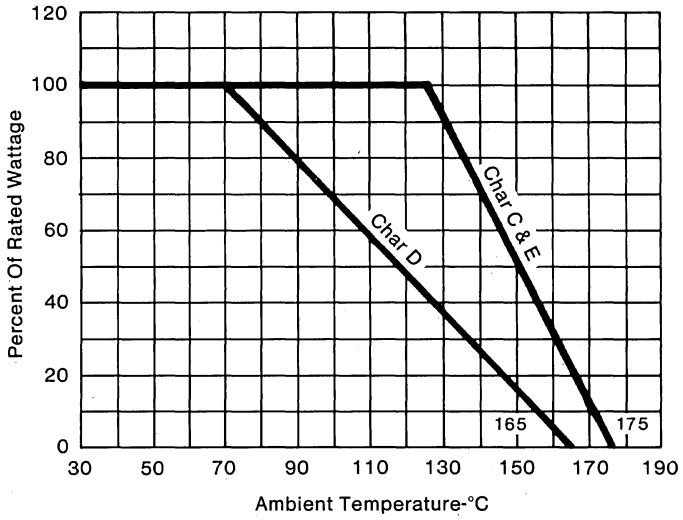
LEAD MATERIAL

Type C, MIL-STD-1276 (tin-lead plating over Oxygen-free high conductivity Copper).

typical capacitance values.

M/C Style	5023R	5033R	5043M	5043	5053R
C (pF) ±25%	0.18	0.18	0.19	0.21	0.33
Voltage Coefficient (PPM/Volt) ±25%	6	5	4	3	2
Power Coefficient (°C/Watt) ±10%	220	130	120	93	75

DERATING CURVE



HOW TO SPECIFY

MIL STYLE RN Resistors can be completely specified using the following designation:

RN 60 D XXXX F

Temperature Coefficient
E = ±25 PPM/°C
C = ±50 PPM/°C
D = ±100 PPM/°C

MIL Power Rating

	125°C	70°C
50 =	1/20W	1/10W
55 =	1/10W	1/8W
60 =	1/8W	1/4W
65 =	1/4W	1/2W

Tolerance
B ±0.1%
C ±0.25%
D ±0.5%
F ±1%

MIL Designation
MIL-R-10509 Resistor

Resistance Value
XXRX<100
XXXX≥100

*Power Rating is Dependent on Temperature Coefficient. See Specifications And Nomenclature.

MIL-R-10509 "J" OR "JAN" MARKING

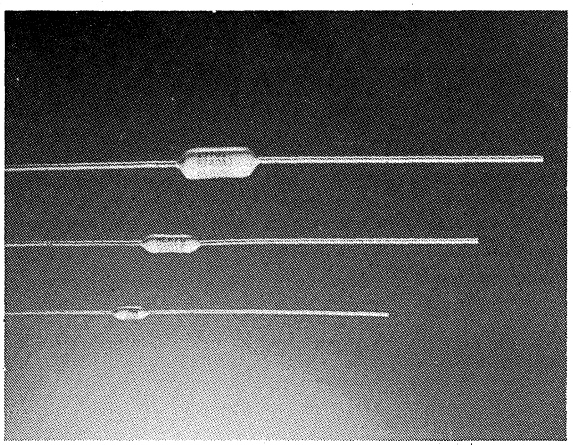
The Defense Electronics Supply Center (D.E.S.C.) has stated that all MIL-R-10509 qualified products, manufactured after January 4, 1982 must be marked with the "J" or "JAN" marking to prevent the sale of non-qualified product as qualified product.

MIL-R-10509 has limited resistance ranges (compared to MIL-R-55182. Mepco/Centralab's policy is to supply products qualified to MIL-R-10509 with the JAN marking. Resistance values above or below those specified in MIL-R-10509, where Mepco/Centralab testing demonstrates the capability of meeting the performance requirement of MIL-R-10509, will be marked in accordance with MIL-R-10509 but without the JAN marking.

MIL STYLE RLR

Established Reliability Resistors Conformal-Coated (MIL-R-39017)

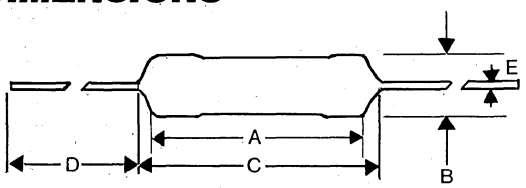
±2%, ±1% Tolerance ±100PPM Temperature Coefficient
1/8, 1/4 and 1/2 Watt (70°C)
Failure Rate "S" (0.001% per 1000 Hours)



DESCRIPTION

The RLR Series provide the highest attainable margins of reliability in this class of resistors—performance substantially better than that required by MIL-R-39017 (RLR). This design offers moderate accuracy and good stability, and is particularly suited to replacement of carbon-film, carbon-composition, or even conventional metal-film resistors, where the ultimate in reliability, as well as higher stability, lower noise, and low voltage/power coefficients are required, in the same or smaller space. Over a very broad frequency spectrum, these resistors exhibit negligible reactance, and are entirely suitable to fast-pulse circuitry. Mepco/Centralab's established-reliability program, which operates in full conformance with MIL-STD-790, attains unprecedented reliability levels for RLR Series resistors.

DIMENSIONS



DESIGN FEATURES

- Lowest Voltage and Power Coefficients ever attained in a metal-film resistor.
- Low Noise. Johnson noise is lowest attainable, except in best wirewound designs.
- Wide Resistance Range: 4.3 Ohms to 1.33 Megohms.
- Excellent Immunity to Environmental Stress. Highest reliability in this class.
- Very Low Reactance—low series L, low shunt C; reactance error is generally less than tolerance up to 10MHz, for most resistance values.

SPECIFICATIONS & NOMENCLATURE—RLR (5000U) SERIES

MIL (QPL) Type	Mepco/ Centralab Style	MIL Power Rating (70°C)	*Qualified (QPL) Resistance Range (ohms)	Temperature Coefficient (PPM/°C)	Resistance Tolerance	Life-Failure Rate (Per 1000 hrs.)	Voltage (Volts)	Dimensions—see diagram Inches (mm)				
								A	B	C** Max.	D	E (AWG)
RLR05	5033U	1/8W	10Ω to 750K	±100 PPM	±1% ±2%	S = 0.001% R = 0.01% P = 0.1% M = 1.0%	200	.150 ±.020 (3.8) (±.51)	.066 ±.008 (1.68) (±.20)	.187 (4.75)	1.25 ±266 (31.8) (±6.76)	.016 (.41) (#26)
RLR07	5043U	1/4W	10Ω to 1.33M	±100 PPM	±1% ±2%	S = 0.001% R = 0.01% P = 0.1% M = 1.0%	250	.261 ±.020 (6.63 ±0.51)	.093 ±.005 (2.36 ±0.13)	.300 (7.62)	1.5 (38.1)	.025 (.63) (#22)
RLR20	5053U	1/2W	4.3Ω to 1M	±100 PPM	±1% ±2%	S = 0.001% R = 0.01% P = 0.1% M = 1.0%	350	.390 ±.020 (9.91 ±0.51)	.152 ±.009 (3.86 ±0.23)	.430 (10.92)	1.5 (38.1)	.032 (.81) (#20)

*Within resistance ranges shown, values indicated in the decade table of values and their decade multiples, are available as standard. Other values are available on special order.
**Clean-lead to clean-lead.

MIL STYLE RLR

Established Reliability Resistors Conformal-Coated (MIL-R-39017)

PERFORMANCE CHARACTERISTICS

As a guide to the performance that can be expected of RLR Series resistors, the following chart indicates typical results of tests performed in accordance with MIL-R-39017.

Test	Max. % Change in Resistance	
	MIL-R-39017 Requirements	RLR Series Average
Power conditioning 150% max W.	.5%	.10%
Thermal Shock, −55 to +150°C	.25%	.05%
Low temperature operation, −55°C	.25%	.03%
Short time overload	.5 %	.05%
Terminal strength, 5 lb. load	.25%	.02%
Dielectric Withstanding Voltage	.25%	.02%
Resistance to soldering heat, 350°C	.25%	.02%
Moisture resistance	1%	.20%
Life (2,000 hours)	2%	.15%
Shock, medium impact, 50G, 11ms.	.5%	.03%
Vibration, High frequency 10-2000Hz	.5%	.03%
High tem. exposure 150°C/2000 hrs.	2%	.15%

RLR Series resistors are marked with the type designation, JAN marking, date code, source code, and manufacturer's production lot code, as specified by MIL-R-39017.

PACKAGING

Bulk (100 pieces per box) or Lead Tape and Reel per EIA RS-296D. Custom packaging available per customer requirements.

LEAD MATERIAL

Type C, MIL-STD-1276 (tin-lead plating over Oxygen-free high conductivity Copper).

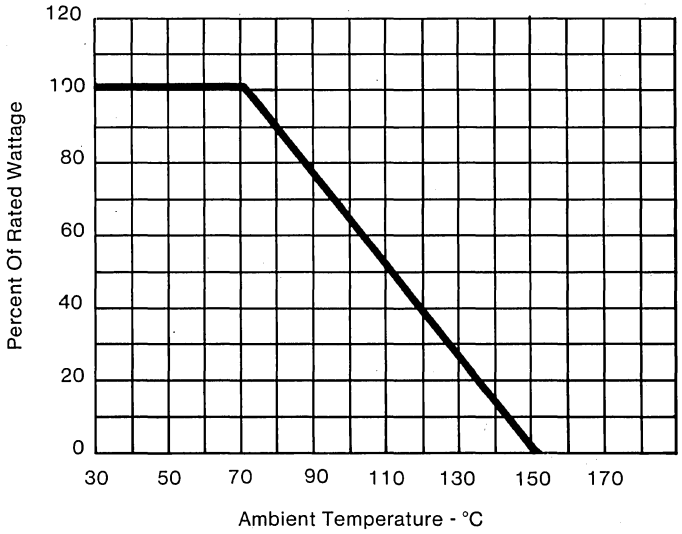
M/C Style	typical capacitance values 5033U	5043U	5053U
C (pF) ±25%	0.18	0.15	0.21
Voltage Coefficient (PPM/Volt) ±25%	6	5	3
Power Coefficient (°C/Watt) ±10%	220	130	150

MIL-R-39017 PLUS

Additional screening (100 hour burn-in, thermal shock, X-ray, and serialization or other custom marking) is available per customer specifications.

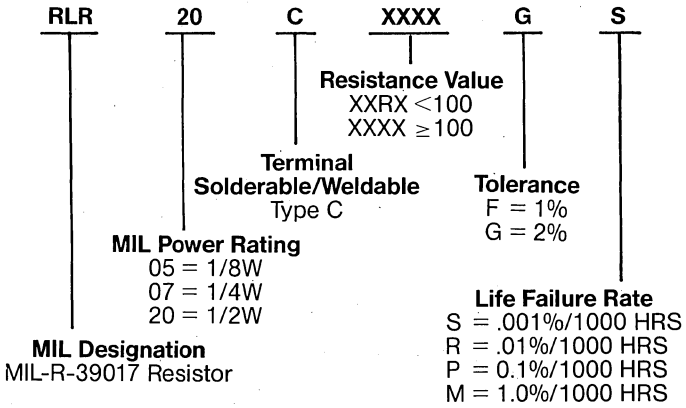
NOTE: Only resistors made to the *exact* specifications of MIL-R-39017 may be JAN marked.

DERATING CURVE



HOW TO SPECIFY

MIL STYLE RLR Resistors can be completely specified using the following designation:

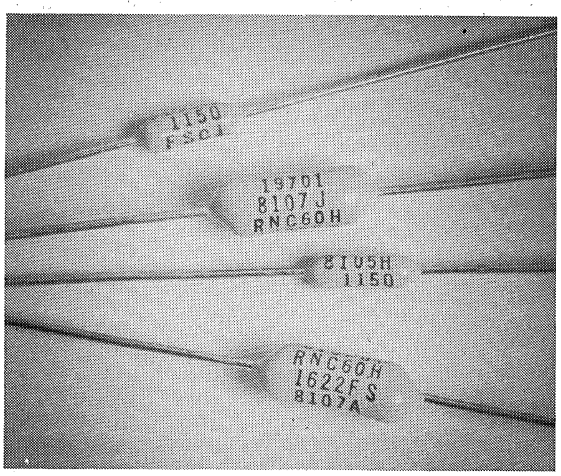


6 Fixed Resistors

MIL STYLE RNC

Established Reliability Resistors Conformal Coated (MIL-R-55182)

±0.1%, 0.5%, and 1% Tolerances
Characteristics J (±25PPM), H (±50PPM), K (±100PPM)
1/20, 1/10, 1/8, and 1/4 Watt (125°C)
1/10, 1/8, 1/4 and 1/2 W (70°C)
Failure Rate—"S" (0.001% Per 1000 Hours)



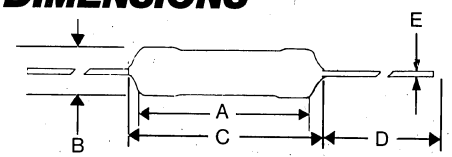
DESCRIPTION

These resistors provide substantial margins of reliability above and beyond those implicit in the stringent requirements of MIL-R-55182, and a wide choice of power ratings, tolerances, temperature coefficients, and resistance values. Mepco/Centralab's established-reliability program—the most experienced and respected in the industry—ensures unprecedented freedom from failure or performance anomaly. These resistors are manufactured by procedures that are in full conformance with MIL-STD-790. They feature the low noise, high stability, and wide operating frequency range that characterize Mepco/Centralab's metal-film designs, in minimum size for their power ratings.

DESIGN FEATURES

- Excellent Initial Accuracy and Long-Term Stabilities, approaching wirewound resistor performance.
- Lowest Voltage and Power Coefficients ever attained in a metal-film resistor.
- Low Temperature Coefficients. Characteristic J equals the performance of conventional wirewound designs.
- Low Noise. Johnson noise is lowest attainable, except in best wirewound designs.
- Excellent Immunity to Environmental Stress. Highest reliability in this class.

DIMENSIONS



SPECIFICATIONS & NOMENCLATURE—RNC (5000V) SERIES

MIL (QPL) Type	Mepco/ Centralab Style	MIL Power Rating 125°C 70°C	*Qualified (QPL) Resistance Range (ohms)	Temperature Coefficient (PPM/°C)	Resistance Tolerance	Life Failure Rate (Per 1000 hrs)	Max Voltage (Volts)	Dimensions See Diagram Inches (mm) A	B	C** MAX	D	E (AWG)
RNC50	5013V	1/20W 1/10W	10Ω to 750K	J = ±25PPM H = ±50PPM K = ±100PPM	±0.1% ±0.5% ±1.0%	S = 0.001% R = 0.01% P = 0.1% M = 1.0%	200VDC	.150 ±.020 (3.81) (±0.5)	.070 ±.010 (1.78) (±0.3)	.200 (5.1)	1.25 ±.266 (31.8) (±6.76)	.016 (.41) (#26)
RNC55	5023V	1/10W 1/8W	10Ω to 1M	J = ±25PPM H = ±50PPM K = ±100PPM	±0.1% ±0.5% ±1.0%	S = 0.001% R = 0.01% P = 0.1% M = 1.0%	200VDC	.261 ±.020 (6.63) (±0.5)	.093 ±.005 (2.36) (±0.13)	.300 (7.62)	1.5 (38.1)	.025 (.63) (#22)
RNC60	5033V	1/8W 1/4W	24.9Ω to 3.01M	J = ±25PPM H = ±50PPM K = ±100PPM	±0.1% ±0.5% ±1.0%	S = 0.001% R = 0.01% P = 0.1% M = 1.0%	250VDC	.390 ±.020 (9.91) (±0.5)	.152 ±.009 (3.86) (±0.23)	.430 (10.92)	1.5 (38.1)	.025 (.63) (#22)
RNC65	5043V	1/4W 1/2W	30.1Ω to 3.01M	J = ±25PPM H = ±50PPM K = ±100PPM	±0.1% ±0.5% ±1.0%	S = 0.001% R = 0.01% P = 0.1% M = 1.0%	300VDC	.595 ±.020 (15.11) (±0.5)	.163 ±.006 (4.14) (±0.15)	.637 (16.18)	1.5 (38.1)	.025 (.63) (#22)

*Within the resistance ranges shown, values indicated in the decade table or value and their decade multiples are available as standard. Other values are available on special order. **Clean-lead to clean-lead.

MIL STYLE RNC

Established Reliability Resistors Conformal-Coated (MIL-R-55182)

PERFORMANCE CHARACTERISTICS

As a guide to the performance that can be expected of the RNC Series resistors, the following chart indicates typical results of tests performed in accordance with MIL-R-55182.

	Max. % Change in Resistance	
	MIL-R-55182 Requirements	RNC Series Average
Thermal Shock & Overload, −65°C to ±150°C	.2%	.02%
Low temperature operation, −65°C	.15%	.05%
Terminal strength	.2%	.02%
Dielectric Withstanding Voltage	.15%	.02%
Resistance to soldering heat, 350°C	.1%	.05%
Moisture resistance	.4%	.20%
Life 2,000 hours	.5%	.10%
10,000 hours	2.0%	.25%
Shock, (specified pulse)	.2%	.02%
Vibration, High frequency 10-2000Hz, 20G	.2%	.02%
High Temp. Exposure 175°C, 2000 hours	.5%	.35%

MARKING

Established-Reliability Series resistors are marked with the MIL type designation, JAN marking, date code, source code, and manufacturer's production lot code, in compliance with MIL-R-55182.

PACKAGING

Bulk (100 pieces per box) or Lead Tape and Reel per EIA RS-296D. Custom packaging available per customer requirements.

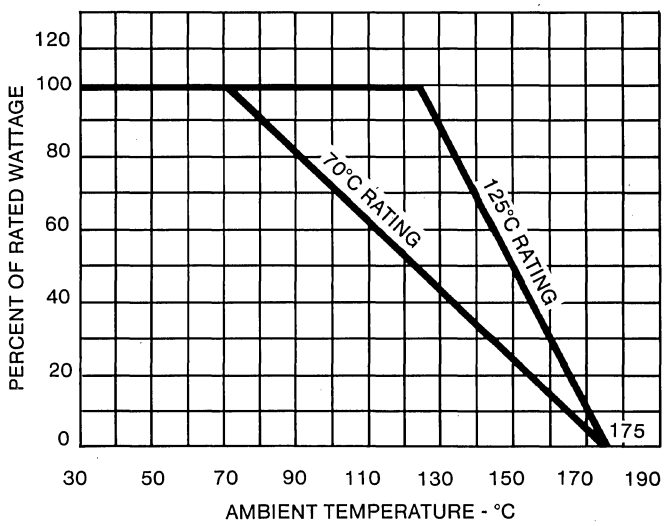
LEAD MATERIAL

Type C, MIL-STD-1276 (tin-lead plating over Oxygen-free high conductivity Copper).

typical capacitance values.

M/C P/N	5013V	5023V	5033V	5043V
C(pF) ±25%	0.18	0.18	0.21	0.33
Voltage Coefficient (PPM/Volt) ±25%	6	5	3	2
Power Coefficient (°C/Watt ±10%	220	130	93	75

DERATING CURVE



HOW TO SPECIFY

MIL STYLE RNC Resistors can be completely specified using the following designation:

RNC 50 H XXXX F S

Resistance Value
XXRX <100
XXXX ≥100

Temperature Coefficient
J ±25PPM/°C
H ±50PPM/°C
K ±100PPM/°C

Power Rating

	125°C	70°C
50 =	1/20W	1/10W
55 =	1/10W	1/8W
60 =	1/8W	1/4W
65 =	1/4W	1/2W

Lead Configuration
RNC = Solderable/Weldable (Type C)*
RNR = Solderable

Tolerance
B ±0.1%
D ±0.5%
F ±1.0%

Life Failure Rate
S = 0.001%/1000 HRS
R = 0.01%/1000 HRS
P = 0.1%/1000 HRS
M = 1%/1000 HRS

*MIL STD 1276

MIL-R-PLUS

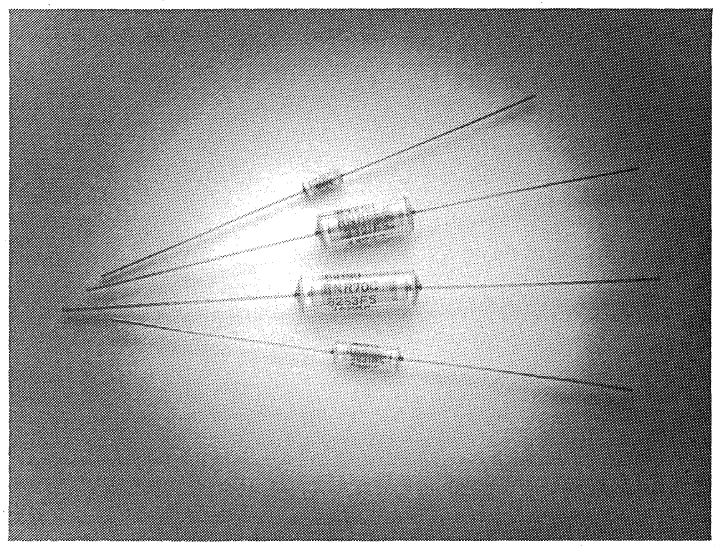
Additional screening (100 hour burn-in, X-ray, and serialization or other custom marking) is available per customer specifications.

NOTE: Only resistors made to the *exact* specifications of MIL-R may be JAN marked.

MIL STYLE RNR/RNN

Established Reliability Resistors Hermetic Seal (MIL-R-55182)

±0.1%, 0.5% and 1% Tolerance
Characteristics E (±25PPM) and C(±50PPM)
1/10, 1/8, 1/4 Watt (125°C)
1/8, 1/4, 1/2 Watt (70°C)
Failure Rate "S" (0.001% Per 1000 Hours)



DESCRIPTION

These hermetically sealed, inert-gas-filled premium resistors are the most reliable, most uniform, most stable metal-film devices ever produced in conformance with MIL-R-55182. For the most demanding applications in aerospace and weaponry systems, under the most hostile environments, the performance of Series RNR/RNN resistors have been proven superior to that of any other design in this class. These resistors exhibit the same low noise, high stability, and wide operating frequency range that distinguish the Mepco/Centralab metal-film design, in remarkably small sizes, considering the protection afforded by hermetic sealing.

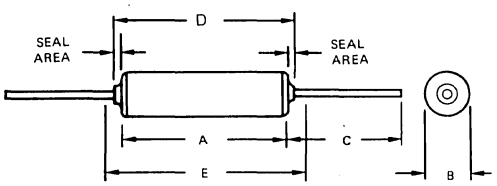
DESIGN FEATURES

- Excellent Immunity to Environmental Stress. Highest reliability in a metal-film resistor. Glass enclosure eliminates both moisture erosion and outgassing.
- Excellent Temperature and Time Stabilities, approaching those of wirewound resistors.
- Low Noise. Johnson noise is lowest attainable, except in best wirewound designs.
- Very Low Reactance—low series L, low shunt C; reactance error is generally less than tolerance up to 10MHz, for most resistance values.
- Low Voltage and Power Coefficients, approaching those of wirewound resistors of comparable size.

MIL STYLE RNR/RNN

Established Reliability Resistors (MIL-R-55182) Hermetic Seal

DIMENSIONS



SPECIFICATIONS & NOMENCLATURE–RNR/RNN (5000A) STYLE

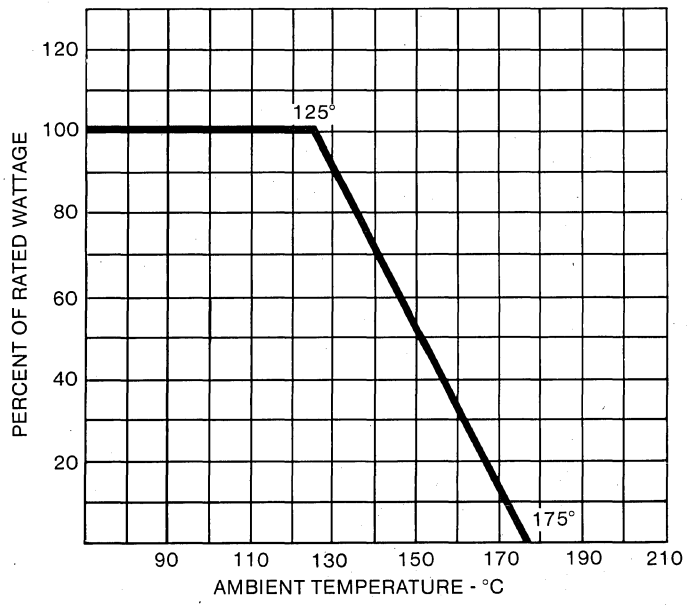
MIL (QPL) Type	Mepco/ Centralab Style	MIL Power Rating 125°C 70°C	*Qualified (QPL) Resistance Range (ohms)	Temperature Coefficient (PPM/°C)	Resistance Tolerance	Life Failure Rate (Per 1000 HRS)	Max. Voltage (Volts)	Dimensions—see diagram Inches (mm) A Length	B Dia.	C Leads (AWG)	D Case Length Plus Seal	E CL to CL**	Average Weight Grams*
RNR55 RNN55	5025A	1/10W 1/8W	10Ω to 1.21M	E = ±25PPM C = ±50PPM	±0.1% ±0.5% ±1.0%	S = 0.001% R = 0.01% P = 0.1% M = 1.0%	200	.272 ±.009 (6.91 ±0.29)	.110 ±.010 (2.79 ±0.25)	1.5 ±.125 (38.1 ±3.18) (#22)	320 (8.13)	.345 (8.76)	.3141
RNR60 RNN60	5035A	1/8W 1/4W	49.9Ω to 499K	E = ±25PPM C = ±50PPM	±0.1% ±0.5% ±1.0%	S = 0.001% R = 0.01% P = 0.1% M = 1.0%	250	.422 ±.015 (10.72 ±0.38)	.147 ±.003 (3.73 ±0.08)	1.5 ±.125 (38.1 ±3.18) (#22)	.500 (12.70)	.561 (14.25)	.4848
RNR65 RNN65	5045A	1/4W 1/2W	49.9Ω to 1M	E = ±25PPM C = ±50PPM	±0.1% ±0.5% ±1.0%	S = 0.001% R = 0.01% P = 0.1% M = 1.0%	300	.641 ±.015 (16.28 ±0.38)	.243 ±.008 (6.17 ±0.20)	1.5 ±.125 (38.1 ±3.18) (#22)	.740 (18.80)	.780 (19.80)	1.2597

*Within the resistance ranges shown, values indicated in the decade table values and their decade multiples, are available as standard. Other values are available on special order. **Clean-lead to clean-lead.

PERFORMANCE CHARACTERISTICS

As a guide to the performance that can be expected of RNR/RNN Series resistors, the following chart indicates typical results of tests performed in accordance with MIL-R-55182.

	Max. % Change in Resistance	
	MIL-R-55182 Requirements	RNR Series Average
Thermal Shock & Overload, −65° to +125°C	.2%	.02%
Low temperature operation, −65°C	.15%	.05%
Terminal strength	.2%	.02%
Dielectric withstanding Voltage	.1%	.02%
Resistance to soldering heat, 350°C	.1%	.02%
Moisture resistance	.2%	.05%
Life 2,000 hours;	.5%	.10%
10,000 hours	2.0%	.20%
Shock, (specified pulse)	.2%	.02%
Vibration, High frequency 10-2000Hz, 20G	.2%	.02%
High Temperature Exposure 175°C, 2000 hrs	.5%	.20%



6 Fixed Resistors

MIL STYLE RNR/RNN

Established Reliability Resistors (MIL-R-55182) Hermetic Seal

MARKING

Established-Reliability Series resistors are marked with the MIL type designation, JAN marking, date code, source code, and manufacturer's production lot code, in compliance with MIL-R-55182.

PACKAGING

Bulk (100 pieces per box) or Lead Tape and Reel per EIA RS-296D. Custom packaging available per customer requirements.

LEAD MATERIAL

RNR = N2b per MIL-STD-1276
RNN = N2a per MIL-STD-1276

typical capacitance values

M/C Style	5025A	5035A	5045A
C (pF) ±25%	0.11	0.10	0.14
Voltage Coefficient (PPM/Volt) ±50%	2.0	0.5	0.2
Power Coefficient (°C/Watt) ±10%	140	170	120

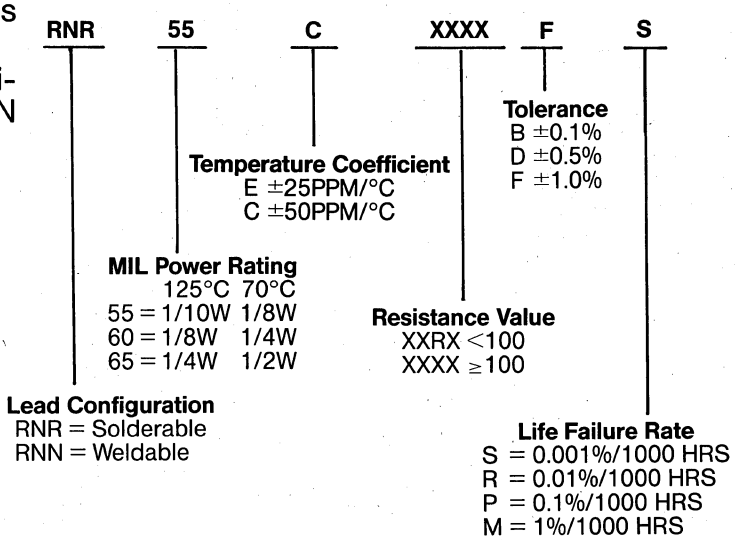
MIL-R-55182 PLUS

Additional screening (100 hour burn-in, X-ray and serialization or other custom marking) is available per customer specifications.

NOTE: Only resistors made to the *exact* specifications of MIL-R-55182 may be JAN marked.

HOW TO SPECIFY

MIL STYLE RNR/RNN Resistors can be completely specified using the following designation:



Standard Packaging of Film Resistors

BULK PACK

Resistors are packed 100 to a standard carton, either 1" x 1" or 1¾" x 1¾" by 3¾" long, overall dimensions, depending upon the resistor size.

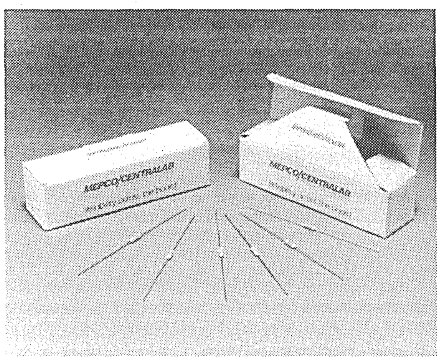


Figure 1. Bulk-Pack Resistor Cartons

INSERT CARD

Resistors are mounted in slotted cards, and locked in place by a card strip inserted beneath them. Up to 15 large, or 20 small resistors per card, readily amenable to bulk shipment.

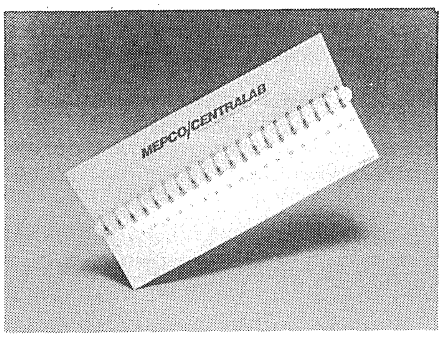


Figure 2. Insert Card Packs

LEAD TAPE EIA RS-296-D

Lead-taped resistors are packaged in the two formats following. In the Ammo Pack, the taped resistors are folded into cartons of (usually) 1000 resistors per tape. The Reel Pack holds up to 5000 resistors per tape, on a 12" diameter reel. Resistors can be furnished taped in a considerable variety of configurations, in either Ammo or Reel packs, to suit production-line requirements and dimensional specifications for the automatic insertion machinery employed.

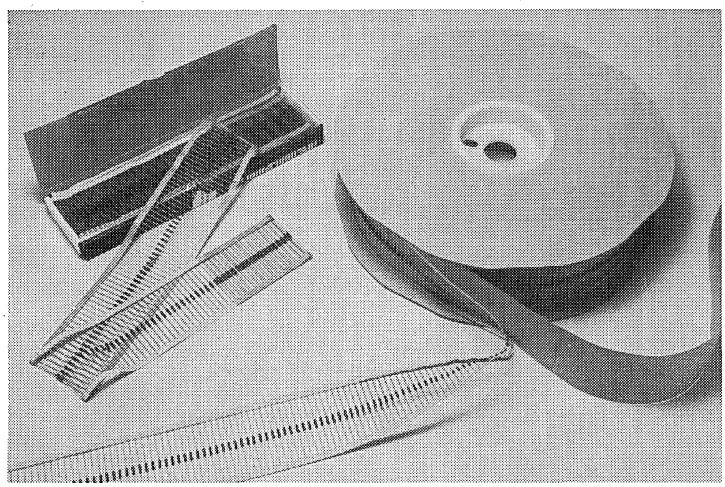


Figure 3. Lead-Taped Resistors in Ammo Pack (left) and Reel Pack (right) Formats.

ESD (Electro-Static Discharge) packaging is available. Please contact factory for details.

Design Data for Selecting and Applying Film Resistors

The Resistor has been with us ever since Georg Simon Ohm straightened out the R = E/I situation, early in the last century. For many decades, there was no appreciable demand for high-precision resistance; when the needs began to develop, it was often cheaper to make the essential values in-house, to add trimmers, or to design around them by placing the accuracy burden elsewhere in the circuit. Even today, there remains an inherent tendency to make do with resistance accuracies of ±20% or ±10% in many design areas, on the basis that, if you use a tighter-tolerance resistor, it won't stay that way very long, but it will add a considerable boost to your production costs.

A designer who thinks this way, without investigating the facts, does himself and his designs a serious disservice. Over the past thirty years, military and space program demands have sponsored a technological revolution in all of the disciplines. In the manufacture of resistors, we have developed new materials, new techniques and controls, and particularly new automatic test, sorting, and selection processes under computer control; exhaustive laboratory investigations and rigorous field tests have established an enormous fund of reliable technical information on the performance of resistors under all combinations of conditions—long term as well as short term. Such data are made available in condensed form in the specifications for each MEPCO/CENTRALAB resistor Series. Armed with these, and a familiarity with the *significance* of such ratings, as outlined in the pages that follow, the designer can both *extrapolate* the performance of a particular resistor to a given *set* of operating conditions, and *estimate* its performance over any anticipated *range* of conditions. He can confidently select a lower wattage, a different shape or size, a more-compatible characteristic, or a more economic style. He can unburden his circuits of the need for trimming or recalibration provisions by selecting a higher accuracy for certain critical resistors. This additional degree of freedom can pay off handsomely in improved performance, higher reliability, and in significant reductions in size, weight, and cost.

Design Data for Selecting and Applying Film Resistors

Resistor Parameters—Defined and Interpreted. Although the definitions that follow are widely accepted by the electronics engineering community as the most specific and useful means for describing the performance of a fixed resistor, it is unfortunately true that some manufacturers deviate from standard specification practice. Indeed, many of the parameters defined here are actually *omitted* from many resistor specifications. Furthermore, this lack of industry-wide standardization has led to uncertainty, and even confusion, as to both the interpretation and the significance of certain specifications... to the detriment of the final circuit design. The reader is urged, therefore, to review these definitions, and to refer back to their interpretations, when evaluating and selecting resistors for his application.

Accuracy (Tolerance). The maximum deviation from the nominal value of the resistance, *at the standard trimming temperature,* measured at negligibly low test voltage and dissipation, usually expressed as a percentage of nominal resistance (or the equivalent in parts per million). *Initial* accuracy (the figure specified in a catalog) is the accuracy of the resistor at the time of shipment.

NOTES: The "standard trimming temperature" for Mepco/Centralab resistors is 23°C (73.4°F). Measurements at other ambient temperatures *must* allow for the temperature coefficient (T.C.) of the resistor. "Negligibly low test voltage and dissipation" means that the test voltage applied is not high enough to cause significant changes in resistance value, considering both the voltage coefficient of resistivity (defined elsewhere) and self-heating effects (see definition of power coefficient).

Temperature Coefficient (of Resistivity). The maximum change in resistance per unit change in the temperature of the resistor, usually expressed in (±) parts per million of nominal per degree Centigrade. Usually, a T.C. rating is associated with a specific temperature range, over which the maximum T.C. is never exceeded.

NOTES: The temperature reference in this specification is that of the *resistor,* not the ambient temperature... although, in the absence of self-heating, if the resistor has had time to reach thermal equilibrium with the ambient, the resistor temperature may be the same as the ambient temperature. The preferred test method is to measure resistance (at negligible dissipation) at several different temperatures, holding each temperature long enough for the resistance to stabilize. (See later discussion of power coefficient, for method of correction for significant dissipation.)

Time Stability. The degree to which the initial resistance value is maintained, to a stated degree of certainty (probability), under stated conditions of use, over a stated period of time; usually expressed in (±) percent or (±) per unit (ppm) change in resistance per 1000 hours of continuous use.

NOTES: This parameter is very dependent on the conditions of use, drift being at a minimum for nominal ambient temperature and negligible dissipation.

Power (Temperature-Rise) Coefficient. The maximum rise in "hot-spot" temperature of the resistor above ambient, per Watt of dissipation, assuming free-air convection, and negligible loss of heat through the leads, after thermal equilibrium has been reached usually expressed in °C/Watt.

NOTES: Remember that this coefficient relates the *rise* in temperature (*above* ambient) to the power dissipated in it. Thus, if the power coefficient is 80°C/Watt, the power dissipated is 0.5 Watts, and the ambient temperature is 50°C, the final equilibrium hot-spot temperature will be:

$$80°C \times 0.5 + 50°C = 90°C$$

Note also that a hot-spot temperature of 90°C constitutes a 67°C rise above the standard trimming temperature of 23°C.

Self-Heating Coefficient (of Resistivity). The maximum change in resistance due to temperature change caused by power dissipation, at constant ambient temperature, usually expressed in percent of per-unit (PPM) change in nominal resistance per Watt of dissipation.

NOTE: This parameter is actually the product of the Power Coefficient and the Temperature Coefficient.

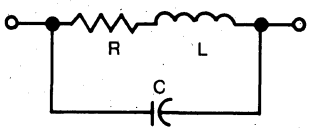
Voltage Coefficient (of Resistivity). The maximum change in nominal resistance due to the application of a voltage across the resistor, *after correcting for the self-heating effect,* usually expressed in percent or per-unit (PPM) change in nominal resistance per Volt applied.

Design Data for Selecting and Applying Film Resistors

NOTE: This relatively small error source is *not* due to heating, but rather to molecular distortion in the resistive material; however, an applied voltage *can* cause significant self-heating, and resistance changes due to temperature rise must be accounted for in measuring voltage coefficient. Voltage coefficient is also, to a very slight degree, a function of voltage *cycling* (repetitive application and removal of a voltage near the maximum rated voltage limit of the resistor).

AC/DC Impedance Ratio. The maximum ratio of the *magnitude* of the complex impedance (Z) to the DC resistance at the frequency of interest.

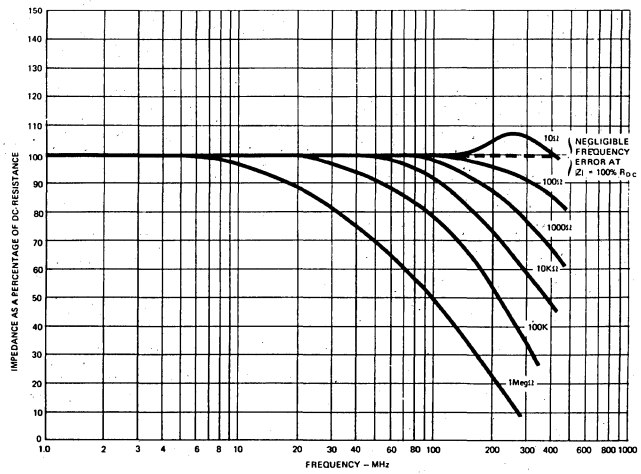
NOTES: The simple equivalent circuit of a resistor shown here is valid, for all Mepco/Centralab film resistors, over the entire frequency range from DC to hundreds of megahertz.



Because skin effect is negligible in all Mepco/Centralab film resistors, R, the resistive component of the impedance in the equivalent circuit, is constant at all frequencies. In almost all designs and resistance values, the inductance, L, has negligible effect up to several hundred megahertz. (The only exception to this statement is very low resistance values, of the order of 10-100 Ohms, in large wattage ratings, and then only above 100MHz.) The capacitance, C, however, may be significant, particularly in high-value resistors, at high frequencies. Generally speaking, the capacitance for any given style and wattage rating does not vary more than ±20% with the resistance value. In some of the individual resistor specifications, this capacitance is given for the styles and wattage ratings, to within ±25%. The AC/DC impedance ratio is then calculable from:

$$\frac{|Z|}{R} = \frac{1}{\sqrt{1 + (2\pi fRC)^2}}$$

where f is the frequency of interest. A family of typical curves of $\frac{|Z|}{R}$ *vs frequency for various resistance values are shown in the following column. Note that the 10Ω curve (only) shows appreciable series inductance, but only above 150MHz.*



"Useful" Frequency Range. This definition is arbitrary, because the range of usefulness depends on the nature of the application. In some applications, an AC/DC impedance ratio of 0.5 may be tolerable (e.g., in terminating certain filters), whereas in others, 0.99 may not be acceptable. At Mepco/Centralab the "useful" *precision* frequency range (for attenuators, voltage dividers, etc.) is defined very conservatively, by limiting it to *the highest frequency at which the impedance differs from the resistance by more than the tolerance of the resistor.* Thus, if a 1,000 Ohm, ±0.5% resistor has a nominal shunt capacitance of 0.5pF, then the "useful" frequency range is from DC to the frequency at which:

$$\left(1 - \frac{|Z|}{R}\right) = 0.5\%$$

$$\text{or: } \left(1 - \sqrt{\frac{1}{1 + (2\pi fCR)^2}}\right) = 5 \times 10^{-3}$$

from which f ≅ 2.5 MHz...although, as noted earlier, many applications can use such a resistor from DC to many times that frequency. Indeed, Mepco/Centralab film resistors are used in many applications approaching the *gigahertz* range... for example, the "useful" frequency range for terminating transmission lines and filter networks is at least 300MHz, between 50Ω and 1000Ω, the range of values most often used for this purpose.

Design Data for Selecting and Applying Film Resistors

Failure Rate. The statistical probability of the incidence of "catastrophic" failure in a large number of identical resistors operated continuously for a given period of time under stated environmental conditions, usually expressed as maximum percentage of units predicted to fail under continuous service at maximum rated power (or voltage, if that limit is reached first), at 25°C ambient.

NOTES: The above definition is for an *industrial* failure-rate specification. MIL failure rates are established by the applicable MIL standards, to which the reader is referred. The "confidence level" implicit in the failure-rate calculation used to specify the reliability of Mepco/Centralab industrial resistors is 95%. Note also that "specification" failure rates (as opposed to catastrophic failure rates) may be significantly higher—i.e., a resistor may exceed its stability limits, as given by the preceding nomograph, without failing catastrophically.

Thermal Noise Level. The equivalent RMS voltage value, over a stated bandwidth, of all energy components generated by the resistor at a stated resistor temperature, with no externally supplied current flowing through the resistor.

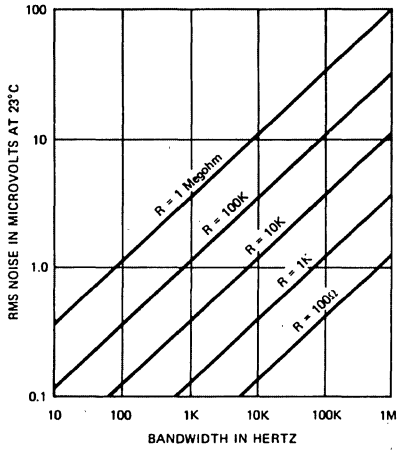
NOTES: The basic equation relating bandwidth, temperature, and noise in any resistor may be derived from the theoretical Johnson thermal-noise equation, and has the form:

$$E\,(\text{RMS}) = 7.4\sqrt{RT\triangle f}\times 10^{-12}$$

where: R is the resistance in Ohms; T is the temperature in degrees Kelvin (°C+273); and △f is the bandwidth in Hertz over which the noise energy is measured. See nomograph following for calculation of the magnitude of thermal noise, for *any* resistor. This inevitable thermal noise is sometimes called "white noise," because its energy level is the same at all frequencies. There is *another* noise component in film and composition resistors, called "current noise" or "1/f noise," the energy of which is inversely proportional to frequency, and is a function of both the current flowing in the resistor and the value of the resistor.

Current noise energy is almost exactly proportional, over wide ranges, to the square of the current flowing—i.e., to the square of the voltage across the resistor. Its variation with resistance, however, is a very complex function of the construction and metallurgy of the resistor. This parameter is discussed under Noise Index.

Noise Index. The ratio of the RMS current-noise voltage (over a one-decade bandwidth) to the average (DC) voltage caused by a specified constant current passed through the resistor, at a specified hot-spot temperature, usually expressed either in μV/Volt, or in decibels of voltage ratio:



$$Noise\ Index = 20\log_{10}\left(\frac{Noise\ Voltage}{DC\ Voltage}\right)$$

NOTES: A useful form of the above equation gives the total noise voltage for a given bandwidth, f_1 to f_2:

$$E_{RMS} = V_{DC}\times 10^{\left(\frac{N.I.}{20}\right)}\sqrt{\log\left(\frac{f_2}{f_1}\right)}$$

where V_{DC} is the IR drop across the resistor and N.I. is the Noise Index in dB. Test conditions must be controlled carefully, to assure that the specified hot-spot temperature is established. The measurement *must* be made on an instrument especially designed to permit correction for its own thermal noise, and the thermal noise of the resistor under test (usually negligible). If more than one decade of frequency is of interest, the RMS noise voltages add as the square root of the sum of the squares, so that the resultant multi-decade noise level is given by:

$$E_n = \sqrt{nE_1}$$

where E_n is the total voltage for n decades of frequency and E_1 is the noise voltage for one decade.

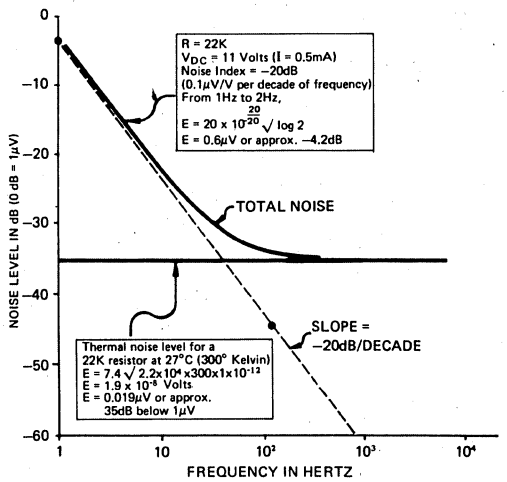
Design Data for Selecting and Applying Film Resistors

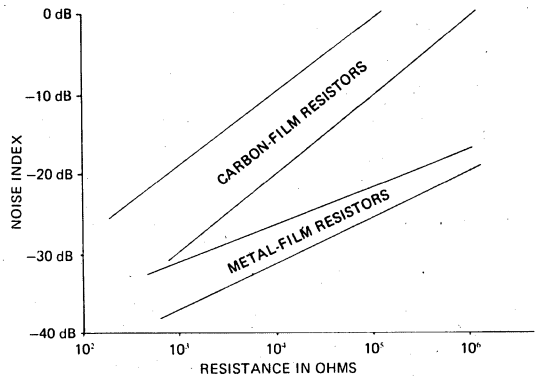
The curve at the top of the next column shows the relationship between noise level and frequency for a typical film resistor. At higher frequencies, the current noise approaches the thermal noise, and finally falls below it.

The curve following shows how noise index varies with resistance for typical Mepco/Centralab film resistors.

Second-Order and Third-Order Error Sources. These parameters are of limited interest, and are usually not specified, because they are not required for design evaluation, but are worthy of mention here, for consideration in the rare application in which they may acquire some significance. (NOTE: All MIL specifications incorporate tests of these effects.)

- Insulation Resistance. The minimum resistance between any point on the protective coating of a resistor and either of its terminals.
- Insulation Voltage Limit. The maximum voltage that may be impressed across the path from either terminal to any point on the protective coating of a resistor.
- Temperature Retrace. The maximum change in resistance value caused by a specified number of cycles in resistor hot-spot temperature (caused by dissipation and/or ambient temperature changes), usually expressed as: a percentage or per-unit (PPM) change from nominal resistance value (after "N" cycles between T_1 and T_2). **NOTE:** A special form of this test is the "Short-Term Overload" procedure.
- Voltage Retrace. The maximum change in resistance value caused by a specified number of cycles of application and removal of a specified voltage to the resistor, with the "on" and "off" times also specified, usually expressed as: a percentage or per-unit (PPM) change in nominal resistance value (after "N" cycles or "V", "on" for t_1 and "off" for t_2).
- Environmental Retrace. The maximum change in resistance value caused by a specified number of cycles of exposure of the resistor between two different sets of environmental-stress conditions (e.g., high to low humidity, with or without simultaneous temperature change; corrosive atmosphere, shock, vibration, etc.), expressed as a percentage or per-unit (PPM) change from the nominal resistance value (for "N" cycles between condition A, for a period of t_A, and condition B, for a period of t_B).
- Thermal Transient Response Time Constant. The maximum time required for the resistor to attain 63% of the steady-state (equilibrium) change in resistance from the initial value, as the result of suddenly (theoretically, *instantaneously*) changing either the ambient temperature or the dissipation, expressed in seconds. Note that this is a measure of the "thermal mass" of the resistor in its convection/conduction cooling environment, and the value measured may not correspond to that observed in practice, unless the environments are similar.





Design Data for Selecting and Applying Film Resistors

RESISTANCE DESIGNATION

The code for specifying a resistor in any Mepco/Centralab Series is described in the catalog pages for that Series. The desired resistance value, in Industrial/Consumer types, is usually designated by standard nomenclature (i.e.: 15.4Ω, 5.1K, 1.0M, etc.). Military types require MIL-spec designation of resistance:

For 1% or smaller Tolerance

6193 = 619,000

1st significant figure
2nd significant figure
3rd significant figure
number of zeroes

For 2% or larger Tolerance

624 = 620,000

1st significant figure
2nd significant figure
number of zeroes

When the value of resistance is less than 100 ohms, or when fractional values of an ohm are required, the letter "R" is substituted for one of the significant digits to represent the decimal point, and succeeding digits of the group then represent significant figures (i.e.: 47R6 = 47.6 ohms; R50 = 0.50 ohms).

STANDARD RESISTANCE VALUES

For each size of resistor in each resistor Series in this catalog, a resistance range is given in the Characteristics and Nomenclature Table for the Series. In some cases, more than one range is listed, corresponding to the various temperature coefficients and/or resistance tolerances available in a given resistor size. The listed range in each case determines the limits within which standard resistance values are obtainable. *Within those limits,* standard values may be selected in accordance with the following table, and the specified resistance tolerance.

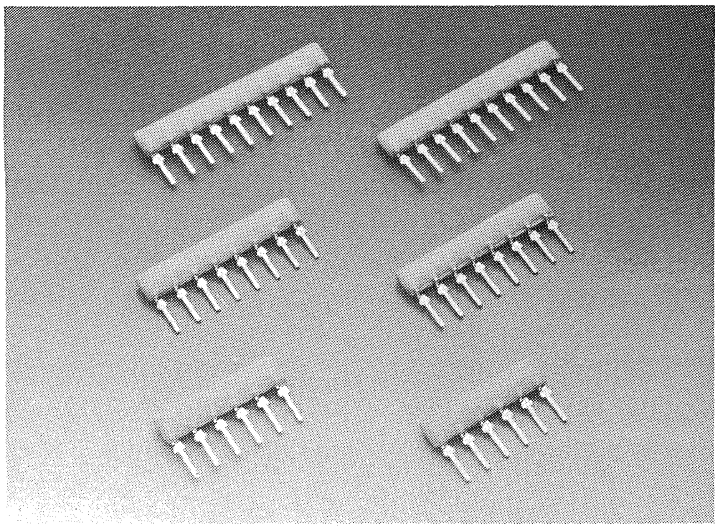
For a particular tolerance, any resistance value in the appropriate column may be specified, or any decade multiple (or submultiple) of that value, within the stated range. Non-standard resistance values are available on special order.

STANDARD RESISTANCE VALUES FOR THE 10-TO-100 DECADE
(also usable in decade multiples or sub-multiples)
RESISTANCE TOLERANCE (±%)

0.1% 0.25% 0.5%	1%	2% 5% 10%	0.1% 0.25% 0.5%	1%	2% 5% 10%	0.1% 0.25% 0.5%	1%	2% 5% 10%	0.1% 0.25% 0.5%	1%	2% 5% 10%	0.1% 0.25% 0.5%	1%	2% 5% 10%	0.1% 0.25% 0.5%	1%	2% 5% 10%
10.0	10.0	10	14.7	14.7	–	21.5	21.5	–	31.6	31.6	–	46.4	46.4	–	68.1	68.1	68
10.1	–	–	14.9	–	–	21.8	–	–	32.0	–	–	47.0	–	47	69.0	–	–
10.2	10.2	–	15.0	15.0	15	22.1	22.1	22	32.4	32.4	–	47.5	47.5	–	69.8	69.8	–
10.4	–	–	15.2	–	–	22.3	–	–	32.8	–	–	48.1	–	–	70.6	–	–
10.5	10.5	–	15.4	15.4	–	22.6	22.6	–	33.2	33.2	33	48.7	48.7	–	71.5	71.5	–
10.6	–	–	15.6	–	–	22.9	–	–	33.6	–	–	49.3	–	–	72.3	–	–
10.7	10.7	–	15.8	15.8	–	23.2	23.2	–	34.0	34.0	–	49.9	49.9	–	73.2	73.2	–
10.9	–	–	16.0	–	16	23.4	–	–	34.4	–	–	50.5	–	–	74.1	–	–
11.0	11.0	11	16.2	16.2	–	23.7	23.7	–	34.8	34.8	–	51.1	51.1	51	75.0	75.0	75
11.1	–	–	16.4	–	–	24.0	–	24	35.2	–	–	51.7	–	–	75.9	–	–
11.3	11.3	–	16.5	16.5	–	24.3	24.3	–	35.7	35.7	–	52.3	52.3	–	76.8	76.8	–
11.4	–	–	16.7	–	–	24.6	–	–	36.1	–	36	53.0	–	–	77.7	–	–
11.5	11.5	–	16.9	16.9	–	24.9	24.9	–	36.5	36.5	–	53.6	53.6	–	78.7	78.7	–
11.7	–	–	17.2	–	–	25.2	–	–	37.0	–	–	54.2	–	–	79.6	–	–
11.8	11.8	–	17.4	17.4	–	25.5	25.5	–	37.4	37.4	–	54.9	54.9	–	80.6	80.6	–
12.0	–	12	17.6	–	–	25.8	–	–	37.9	–	–	55.6	–	–	81.6	–	–
12.1	12.1	–	17.8	17.8	–	26.1	26.1	–	38.3	38.3	–	56.2	56.2	56	82.5	82.5	82
12.3	–	–	18.0	–	18	26.4	–	–	38.8	–	–	56.9	–	–	83.5	–	–
12.4	12.4	–	18.2	18.2	–	26.7	26.7	–	39.2	39.2	39	57.6	57.6	–	84.5	84.5	–
12.6	–	–	18.4	–	–	27.1	–	27	39.7	–	–	58.3	–	–	85.6	–	–
12.7	12.7	–	18.7	18.7	–	27.4	27.4	–	40.2	40.2	–	59.0	59.0	–	86.6	86.6	–
12.9	–	–	18.9	–	–	27.7	–	–	40.7	–	–	59.7	–	–	87.6	–	–
13.0	13.0	13	19.1	19.1	–	28.0	28.0	–	41.2	41.2	–	60.4	60.4	–	88.7	88.7	–
13.2	–	–	19.3	–	–	28.4	–	–	41.7	–	–	61.2	–	–	89.8	–	–
13.3	13.3	–	19.6	19.6	–	28.7	28.7	–	42.2	42.2	–	61.9	61.9	62	90.9	90.9	91
13.5	–	–	19.8	–	–	29.1	–	–	42.7	–	–	62.6	–	–	92.0	–	–
13.7	13.7	–	20.0	20.0	20	29.4	29.4	–	43.2	43.2	43	63.4	63.4	–	93.1	93.1	–
13.8	–	–	20.3	–	–	29.8	–	–	43.7	–	–	64.2	–	–	94.2	–	–
14.0	14.0	–	20.5	20.5	–	30.1	30.1	30	44.2	44.2	–	64.9	64.9	–	95.3	95.3	–
14.2	–	–	20.8	–	–	30.5	–	–	44.8	–	–	65.7	–	–	96.5	–	–
14.3	14.3	–	21.0	21.0	–	30.9	30.9	–	45.3	45.3	–	66.5	66.5	–	97.6	97.6	–
14.5	–	–	21.3	–	–	31.2	–	–	45.9	–	–	67.3	–	–	98.8	–	–

SERIES HC2

Standard S.I.P. Resistor Networks



DESCRIPTION

Mepco/Centralab's Series HC2 Low Profile Resistor Networks provide you with the special size reduction of a vertically integrated network along with the outstanding performance characteristics of Thick Film process technology. The product consists of an Alumina substrate with Thick Film pastes fritted to the substrate to provide the circuit pattern. The leads are copper (Tinned) and are high temperature soldered to the alumina substrate. The superior coating is a phenolic resin and is resistant to most solvents used in the industry today.

AVAILABLE RESISTANCE VALUES

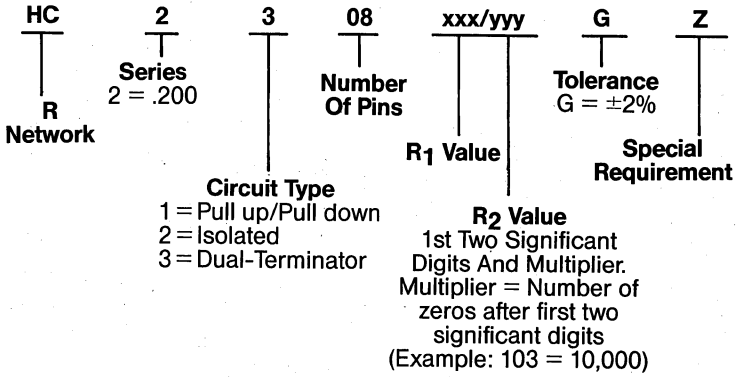
VALUE Ω	VALUE Ω	VALUE Ω	VALUE Ω	VALUE Ω	VALUE Ω
	100	1000	10K	100K	1.0M
	120	1200	12K	120K	
	150	1500	15K	150K	
	180	1800	18K	180K	
	220	2200	22K	220K	
	270	2700	27K	270K	
33	330	3300	33K	330K	
39	390	3900	39K	390K	
47	470	4700	47K	470K	
50	500	5000	50K	500K	
56	560	5600	56K	560K	
68	680	6800	68K	680K	
82	820	8200	82K	820K	

FEATURES

- Resistance range 33Ω to 1MΩ.
- Pull up and isolated circuit configurations.
- Low profile, .200" MAX seated height.
- 6, 8, and 10 pin versions.
- ±2% Standard Tolerance.
- ±200 PPM/°C Temperature Coefficient.

HOW TO SPECIFY

Mepco/Centralab Series HC-2 Networks can be completely specified using the following designations.

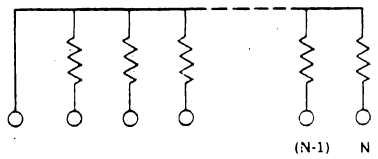


SERIES HC2

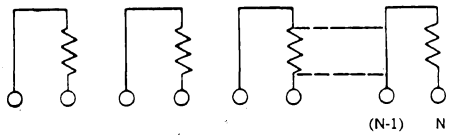
Standard S.I.P. Resistor Networks

CIRCUIT CONFIGURATIONS

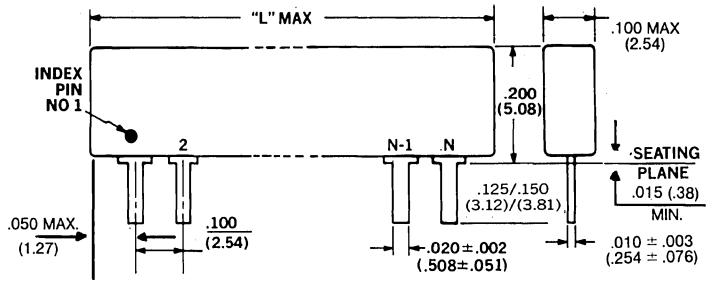
TYPE 1—PULL UP/PULL DOWN



TYPE 2—ISOLATED



DIMENSIONS



POWER RATINGS

POWER RATINGS—EACH RESISTOR

	Low Profile — Single-In-Line					
	Pull-Up/Pull Down			Terminator		
Ambient Temp.	(5 RES.) 6 PIN	(7 RES.) 8 PIN	(9 RES.) 10 PIN	(3 RES.) 6 PIN	(4 RES.) 8 PIN	(5 RES.) 10 PIN
25°C.	.200W.	.200W.	.200W.	.250W.	.250W.	.250W.
70°C.	.125W.	.125W.	.125W.	.150W.	.150W.	.150W.

POWER RATINGS—PACKAGE

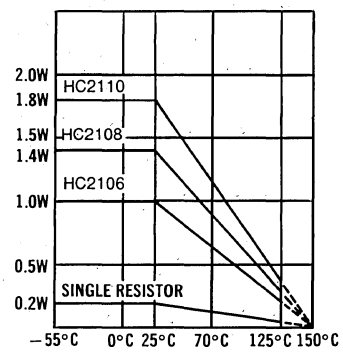
	Low Profile — Single-In-Line					
	Pull-Up/Pull-Down			Terminator		
Ambient Temp.	(5 RES.) 6 PIN	(7 RES.) 8 PIN	(9 RES.) 10 PIN	(3 RES.) 6 PIN	(4 RES.) 8 PIN	(5 RES.) 10 PIN
25°C.	1.00W.	1.4W.	1.80W.	0.75W.	1.00W.	1.25W.
70°C.	0.625W.	0.875W.	1.125W.	0.45W.	0.60W.	0.75W.

ELECTRICAL CHARACTERISTICS

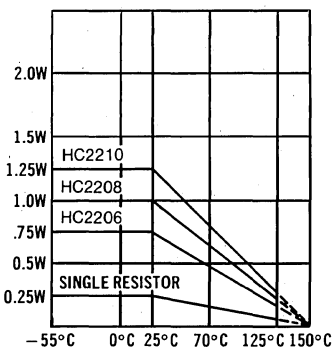
Resistance Range:	33Ω to 1MΩ
Operating Temperature Range:	−55°C to +125°C
Voltage Rating:	50 VDC or RMS
Tolerance:	±2%
Temperature Coefficient:	±200 PPM/°C Standard
T.C. Tracking Between Resistors:	±50 PPM/°C
Voltage Coefficient:	150 PPM/V (MAX) 25 PPM/V (TYPICAL)

TEMPERATURE DERATING CURVES

TYPE 1—PULL-UP/PULL-DOWN



TYPE 2—ISOLATED

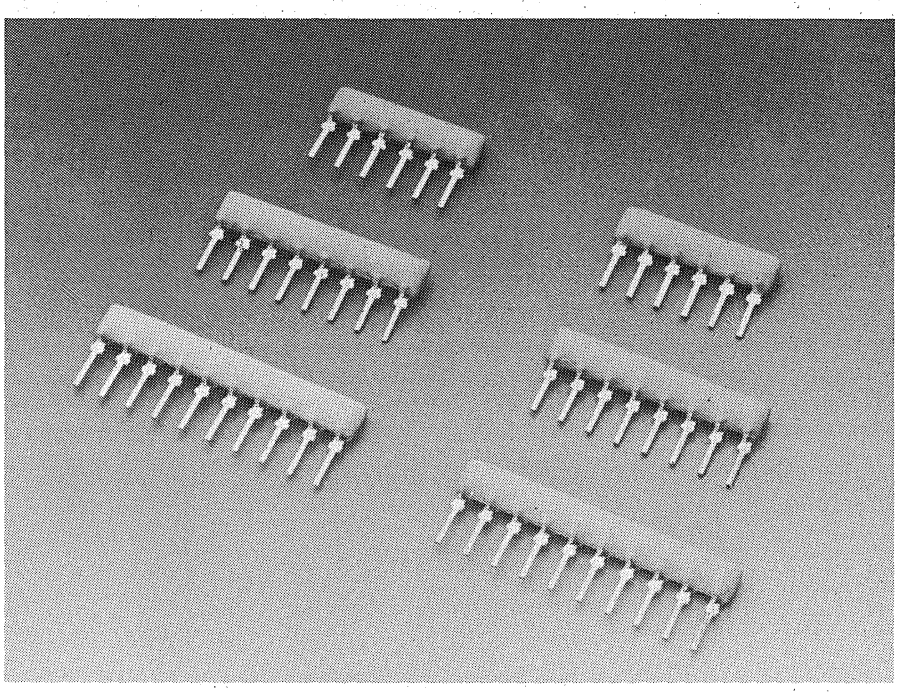


ENVIRONMENTAL CHARACTERISTICS Per Mil-R-83401

Mil-R-83401 Test	Mil-R-83401M Requirement	Series HC-2 Typical
Thermal Shock	± 0.50%	± 0.02%
Low Temperature Operation	± 0.50%	± 0.05%
Short — Time Overload	± 0.50%	± 0.06%
Terminal Strength	± 0.25%	± 0.05%
Moisture Resistance	± 0.50%	± 0.05%
Shock	± 0.25%	± 0.05%
Vibration	± 0.25%	± 0.05%
Load Life (1000 hours)	± 2.00%	± 0.30%
High Temperature Exposure	± 1.00%	± 0.07%
Resistance to Soldering Heat	± 0.25%	± 0.06%

SERIES HC23

Standard Dual Terminator



DESCRIPTION

Mepco/Centralab's Series HC23 Low Profile Dual Terminator Networks provide the accuracy and reliability expected of Thick Film Technology along with the special size concentration of a 200 mil Single-In-Line Network. The product consists of an Alumina substrate with Thick Film Conductors, Resistors and Passivation fritted into the substrate to provide the circuit pattern. The leads are copper (Tinned) and are high temperature soldered to the substrate. The superior coating is a phenolic resin and is resistant to most solvents used in industry today.

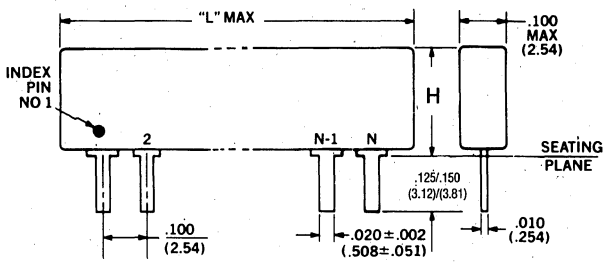
FEATURES

- Resistance range 33Ω to 1MΩ.
- Low profile, .200" MAX seated height.
- 6, 8, and 10 pin versions.

VALUES IN COMMON USE

R_1/R_2 Value (Ohms)	P/N Designator	R_1/R_2 Value (Ohms)	P/N Designator
81/130	810/131	220/270	221/271
120/190	121/191	220/330	221/331
160/240	161/241	330/390	331/391
160/260	161/261	330/470	331/470
160/270	161/271	330/680	331/681
180/240	181/241	470/1000	471/102
180/390	181/391	560/1200	561/122
220/220	221/221	3000/6200	302/622

DIMENSIONS



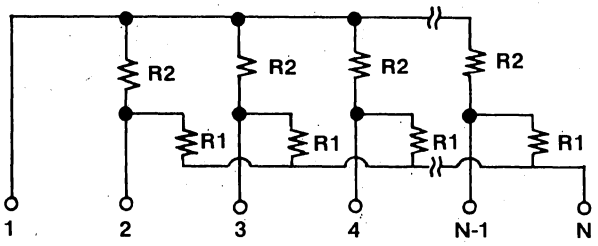
No. of Pins	L" (mm)	H" (mm)
6	.598 (15.2)	.200 (5.08)
8	.798 (20.3)	.200
10	.998 (25.4)	.200

SERIES HC23

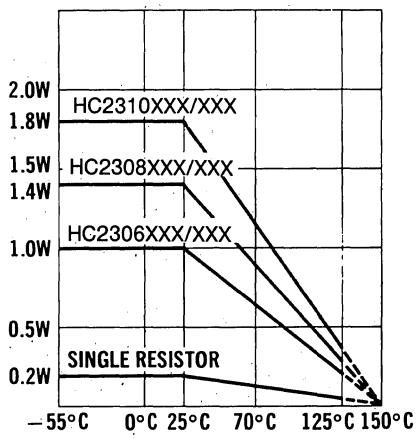
Standard Dual Terminator

CIRCUIT CONFIGURATIONS

N-PIN DUAL TERMINATOR N = 6, 8, 10



TEMPERATURE DERATING CURVES



ELECTRICAL CHARACTERISTICS

Resistance Range:	33Ω to 1MΩ
Operating Temperature Range:	–55°C to +125°C
Voltage Rating:	50 VDC MAX
Tolerance:	±2% Standard ±1%, ±5% Available
Temperature Coefficient:	±200 PPM/°C
Voltage Coefficient:	150 PPM/V (MAX) 25 PPM/V (TYPICAL)

ENVIRONMENTAL CHARACTERISTICS Per Mil-R-83401

Mil-R-83401 Test	Mil-R-83401M Requirement	Series HC23 Typical
Thermal Shock	± 0.50%	± 0.02%
Low Temperature Operation	± 0.50%	± 0.05%
Short — Time Overload	± 0.50%	± 0.06%
Terminal Strength	± 0.25%	± 0.05%
Moisture Resistance	± 0.50%	± 0.05%
Shock	± 0.25%	± 0.05%
Vibration	± 0.25%	± 0.05%
Load Life (1000 hours)	± 2.00%	± 0.30%
High Temperature Exposure	± 1.00%	± 0.07%
Resistance to Soldering Heat	± 0.25%	± 0.06%

HOW TO SPECIFY

Mepco/Centralab Series HC23 Networks can be completely specified using the following designations.

HC — **R Network**

2 — **Series**
2 = .200

3 — **Circuit Type**
1 = Pull up/Pull Down
2 = Isolated
3 = Dual-Terminator

08 — **Number Of Pins**

xxx/yyy
R_1 Value
R_2 Value
1st Two Significant Digits And Multiplier. Multiplier = Number of zeros after first two significant digits (Example: 103 = 10,000)

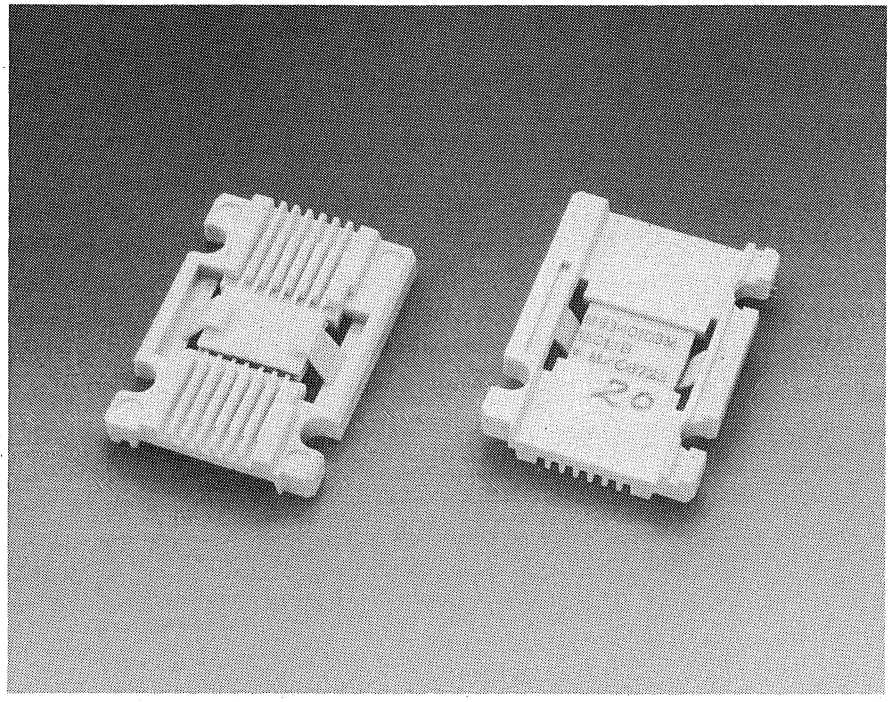
G — **Tolerance**
G = ±2%

Z — **Special Requirement**

6 Fixed Resistors

SERIES RZ030

Mil-R-83401 Resistor Networks (Flat Packs)



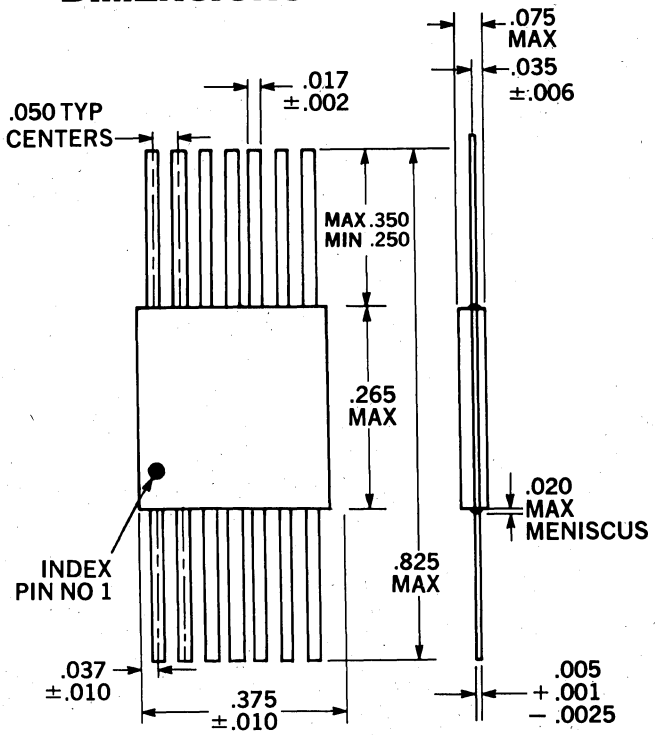
DESCRIPTION

These burned-in and reliability tested resistor networks consist of alumina substrates on which are deposited precious metal conductors and cermet resistors. The lead frames on 0.050 inch centers are soldered to the conductor pads on the substrates. Another alumina plate is placed over this assembly and a seal is made with a high temperature epoxy.

FEATURES

- Resistance range of 18Ω to 1MΩ.
- Temperature coefficients of ±100 and ±300 PPM/°C.
- Resistance tolerances of ±1.0%, ±2.0%, ±5.0%.
- Pull up, terminator, & dual terminator circuit configurations.
- Maximum continuous working voltage of 50 Volts DC or AC RMS.

DIMENSIONS

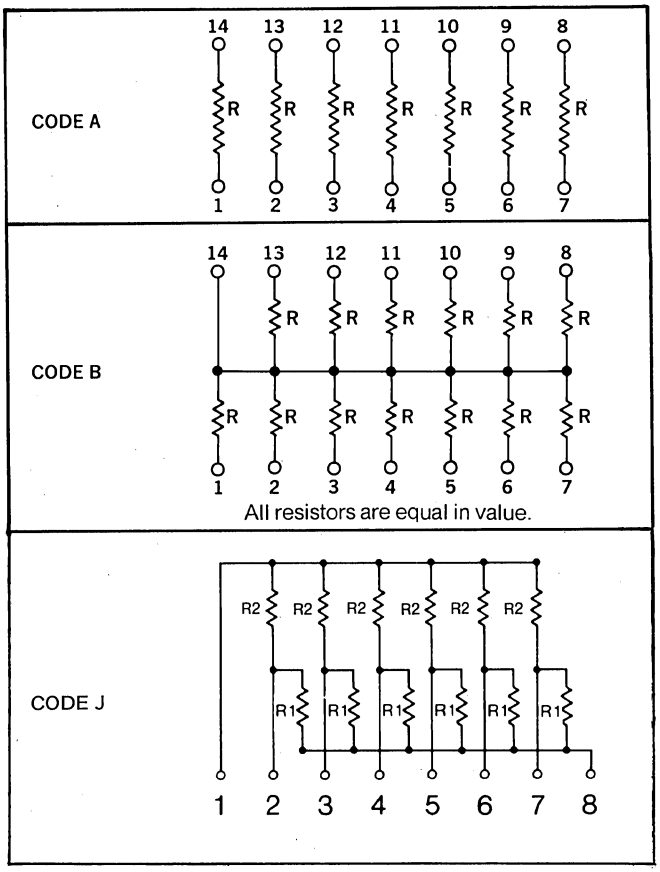


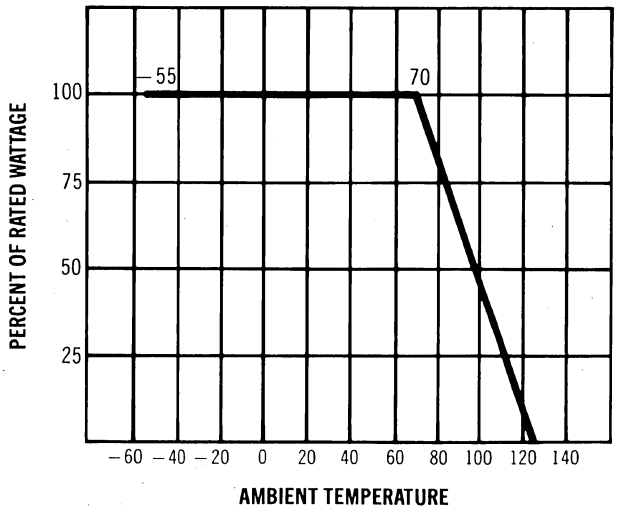
SERIES RZ030

Mil-R-83401 Resistor Networks (Flat Packs)

ELECTRICAL SPECIFICATIONS

CIRCUIT CONFIGURATIONS





The power rating for the resistor networks and individual resistors is based on continuous full-load operation at 70°C and is derated as per the figure below. In addition, the 25°C power ratings have been established to facilitate design for room temperature operation.

POWER RATING DUAL TERMINATOR

Style	Circuit	Power Rating (Watt) 25°C Element Power Rating	25°C Network Power Rating	70°C Element Power Rating	70°C Network Power Rating
M83401	A	0.063	0.438	0.05	0.35
RZ030	B	0.031	0.406	0.025	0.325

HOW TO SPECIFY

Mepco/Centralab's Military Qualified Networks can be completely specified using the following designation:

M83401 — **Specification Number**

07 — **Slash Sheet**

03 = 14 Pin Flat Pack
04 = 6 Lead SIP–High Profile
05 = 8 Lead SIP–High Profile
06 = 10 Lead SIP–High Profile
07 = 6 Lead SIP–Low Profile
08 = 8 Lead SIP–Low Profile
09 = 10 Lead SIP–Low Profile

M — **Characteristic**
K = ±100 PPM/°C
M = ±300 PPM/°C

1002 — **Resistance Value**
Three significant digits followed by a digit designating number of zeros

J — **Resistance Tolerance**
F = ±1.0%
G = ±2.0%
J = ±5.0%

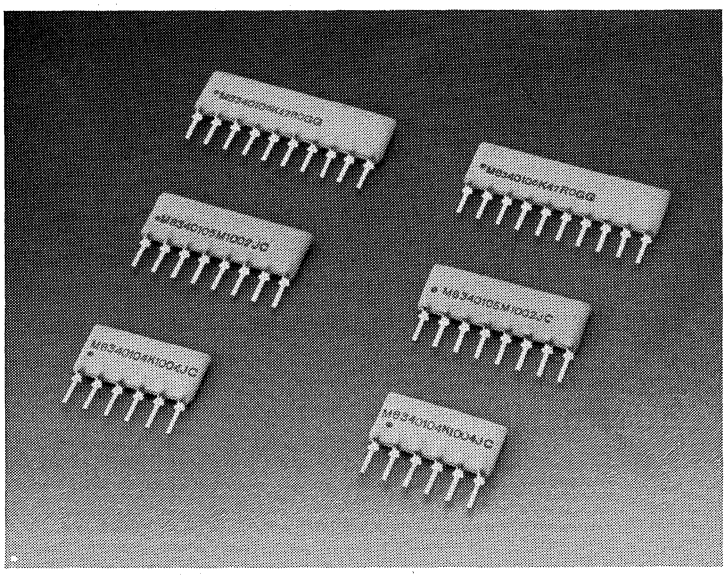
Circuit Type (Available In:)

Type 03
B–DIP Pull Up/Down
A–DIP Isolated
J–DIP Dual Term
Type 04,05,06
C–SIP Pull Up/Down
G–SIP Isolated
Type 07,08,09
C–SIP Pull Up/Down
G–SIP Isolated
J–SIP Dual Term
(See Schematic)

Note: All parts have manufacturer's identification, date code, and pin 1 markings.

SERIES RZ040, 050 AND 060

Mil-R-83401 Resistor Networks (High Profile)



DESCRIPTION

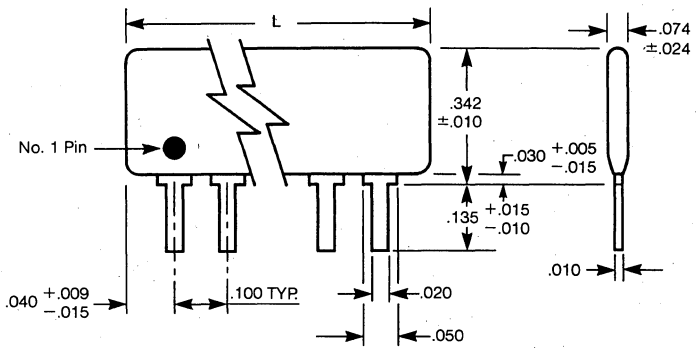
These burned-in and reliability tested resistor networks consist of alumina substrates on which are deposited precious metal conductors and cermet resistors. Flat tinned copper leads are attached to the conductor pads assuring both secure mechanical bonds and positive electrical connections. The networks are conformally coated and marked using solvent resistant marking.

FEATURES

- Resistance range: 10Ω to 1MΩ.
- Temperature coefficients of ±100 and ±300 PPM/°C.
- Resistance tolerances of ±1.0%, ±2.0%, ±5.0%.
- Pull up and terminator circuit configurations.
- 6 lead (RZ040), 8 lead (RZ050) and 10 lead (RZ060) packages.
- Maximum continuous working voltage of 50 volts DC or AC RMS.

DIMENSIONS

M83401—STYLE RZ040, RZ050, RZ060



HIGH PROFILE

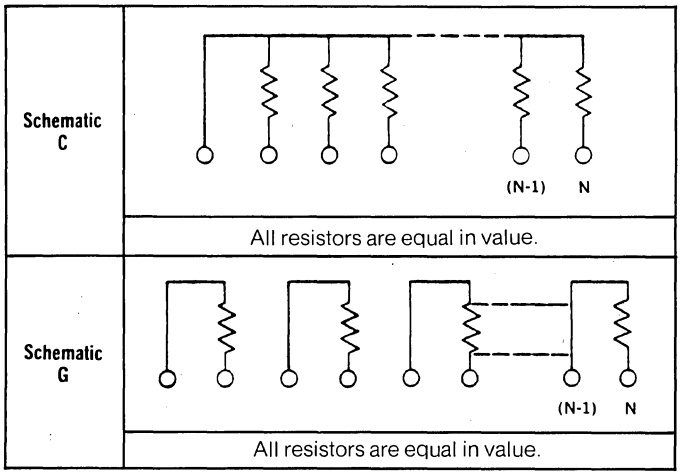
No. of Pins	L-In.
6	.583±.015
8	.783±.015
10	.983±.015

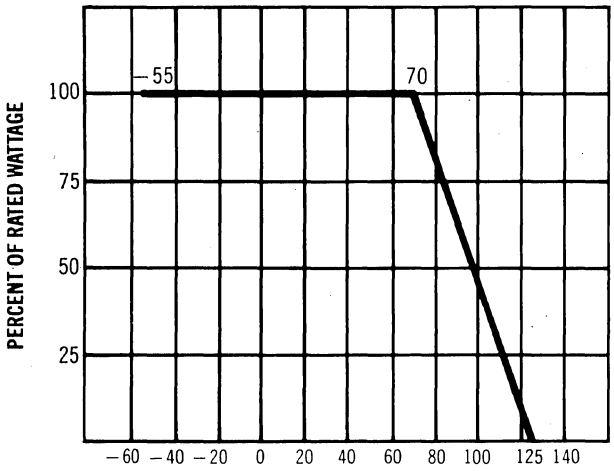
SERIES RZ040, 050 AND 060

Mil-R-83401 Resistor Networks (High Profile)

ELECTRICAL SPECIFICATIONS

CIRCUIT CONFIGURATIONS





POWER RATING

Style	Circuit	Power Rating (Watt)			
		25°C		70°C	
		Element Power Rating	Network Power Rating	Element Power Rating	Network Power Rating
M83401 RZ040	C	0.250	1.250	0.200	1.000
	G	0.250	0.750	0.200	0.600
M83401 RZ050	C	0.250	1.750	0.200	1.400
	G	0.250	1.000	0.200	0.800
M83401 RZ060	C	0.250	2.250	0.200	1.800
	G	0.250	1.250	0.200	1.000

The power rating for the resistor networks and individual resistors is based on continuous full-load operation at 70°C and is derated as per the figure below. In addition, the 25°C power ratings have been established to facilitate design for room temperature operation.

HOW TO SPECIFY

Mepco/Centralab Military Qualified Networks can be completely specified using the following designations:

M83401 — **Specification Number**

07 — **Slash Sheet**
- 03 = 14 Pin Flat Pack
- 04 = 6 Lead SIP—High Profile
- 05 = 8 Lead SIP—High Profile
- 06 = 10 Lead SIP—High Profile
- 07 = 6 Lead SIP—Low Profile
- 08 = 8 Lead SIP—Low Profile
- 09 = 10 Lead SIP—Low Profile

M — **Characteristic**
- K = ±100 PPM/°C
- M = ±300 PPM/°C

1002 — **Resistance Value**
Three significant digits followed by a digit designating number of zeros

J — **Resistance Tolerance**
- F = ±1.0%
- G = ±2.0%
- J = ±5.0%

Circuit Type (Available In:)

Type 03
- B—DIP Pull Up/Down
- A—DIP Isolated
- J—DIP Dual Term

Type 04,05,06
- C—SIP Pull Up/Down
- G—SIP Isolated

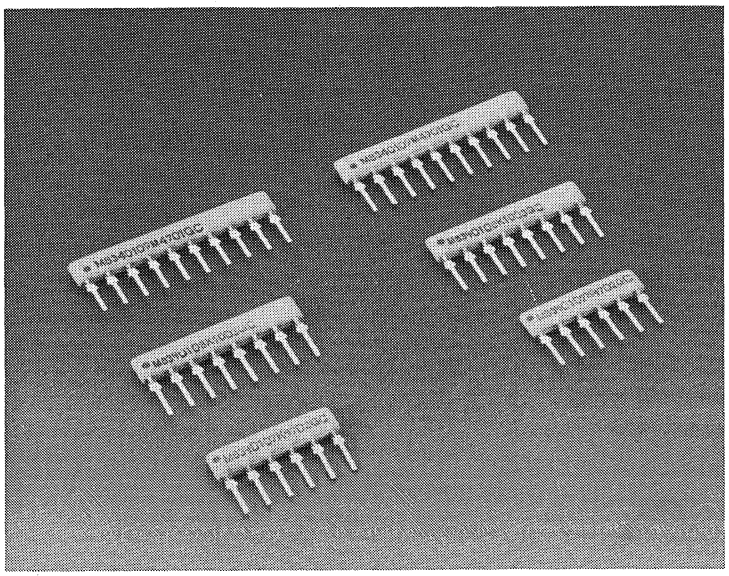
Type 07,08,09
- C—SIP Pull Up/Down
- G—SIP Isolated
- J—SIP Dual Term

(See Schematic)

Note: All parts have manufacturer's identification, date code, and pin 1 markings.

SERIES RZ070, 080 AND 090

Mil-R-83401 Resistor Networks (Low Profile)



DESCRIPTION

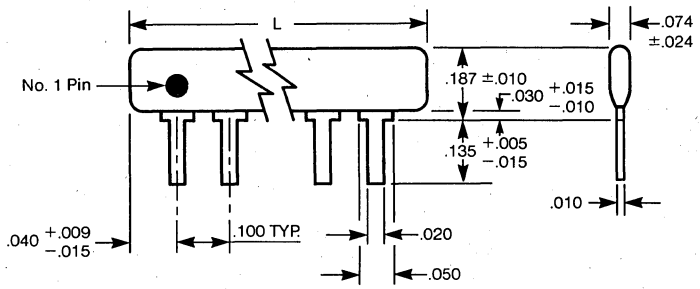
These burned-in and reliability tested resistor networks consist of alumina substrates on which are deposited precious metal conductors and cermet resistors. Flat tinned copper leads are attached to the conductor pads assuring both secure mechanical bonds and positive electrical connections. The networks are conformally coated and marked using solvent resistant marking.

FEATURES

- Resistance range: 10Ω to 1MΩ.
- Temperature coefficients of ±100 and ±300 PPM/°C.
- Resistance tolerances of ±1.0%, ±2.0%, ±5.0%.
- Pull up, terminator, & dual terminator circuit configurations.
- 6 lead (RZ070), 8 lead (RZ080) and 10 lead (RZ090) packages.
- Maximum continuous working voltage of 50 volts DC or AC RMS.

DIMENSIONS

M83401—STYLE RZ070, RZ080, RZ090



LOW PROFILE

No. of Pins	L-In.
6	.583±.015
8	.783±.015
10	.983±.015

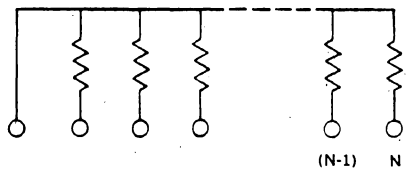
SERIES RZ070, 080 AND 090

Mil-R-83401 Resistor Networks (Low Profile)

ELECTRICAL SPECIFICATIONS

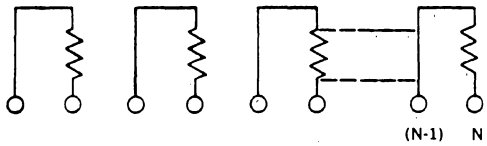
CIRCUIT CONFIGURATIONS

Schematic C



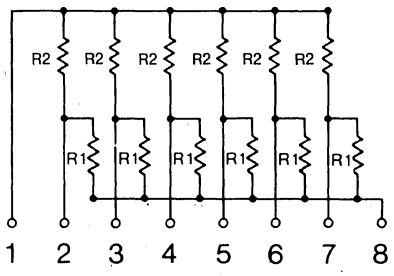
All resistors are equal in value.

Schematic G



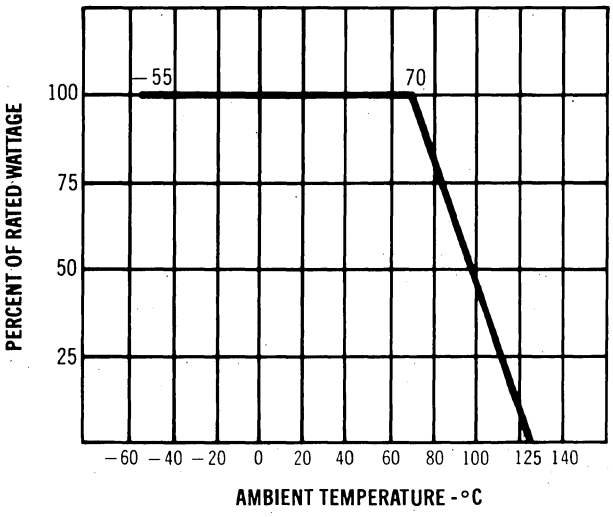
All resistors are equal in value.

Schematic J



POWER RATING

Style	Circuit	Power Rating (Watt) 25°C Element Power Rating	25°C Network Power Rating	70°C Element Power Rating	70°C Network Power Rating
M83401 RZ070	C	0.150	0.750	0.120	0.600
	G	0.150	0.450	0.120	0.360
M83401 RZ080	C	0.150	1.050	0.120	0.840
	G	0.150	0.600	0.120	0.480
M83401 RZ090	C	0.150	1.350	0.120	1.080
	G	0.150	0.750	0.120	0.600



The power rating for the resistor networks and individual resistors is based on continuous full-load operation at 70°C and is derated as per the figure below. In addition, the 25°C power ratings have been established to facilitate design for room temperature operation.

HOW TO SPECIFY

Mepco/Centralab Military Qualified Networks can be completely specified using the following designations:

M83401 — **Specification Number**

07 — **Slash Sheet**
03 = 14 Pin Flat Pack
04 = 6 Lead SIP–High Profile
05 = 8 Lead SIP–High Profile
06 = 10 Lead SIP–High Profile
07 = 6 Lead SIP–Low Profile
08 = 8 Lead SIP–Low Profile
09 = 10 Lead SIP–Low Profile

M — **Characteristic**
K = ±100 PPM/°C
M = ±300 PPM/°C

1002 — **Resistance Value**
Three significant digits followed by a digit designating number of zeros

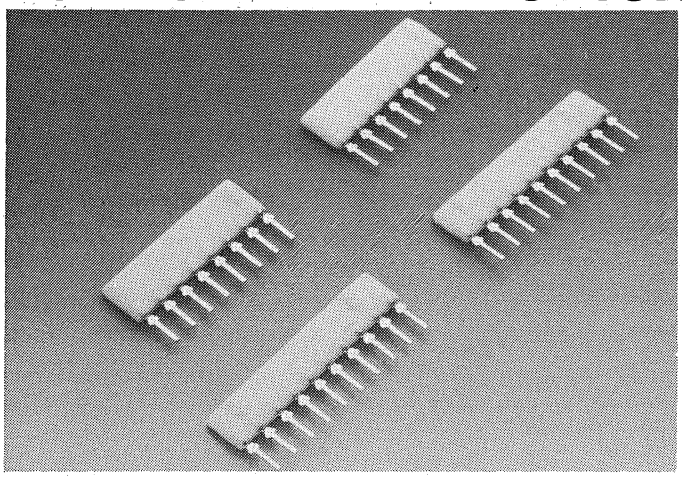
J — **Resistance Tolerance**
F = ±1.0%
G = ±2.0%
J = ±5.0%

Circuit Type (Available In:)
Type 03
B–DIP Pull Up/Down
A–DIP Isolated
J–DIP Dual Term
Type 04,05,06
C–SIP Pull Up/Down
G–SIP Isolated
J–SIP Dual Term
Type 07,08,09
C–SIP Pull Up/Down
G–SIP Isolated
(See Schematic)

Note: All parts have manufacturer's identification, date code, and pin 1 markings.

SERIES E34 AND E35

ECL Terminator Networks



DESCRIPTION

Mepco/Centralab's Emitter Coupled Logic (ECL) terminators offer standard resistor and capacitor circuit configurations in single-in-line and dual-in-line packages. Commonly used in high speed computer operations, ECL terminators minimize cross talk and signal delay propagation in digital signalling processing. Overall, they offer the distinct advantages of size reduction, increased operating speed, reliability and performance. In addition, since they are mounted on alumina substrates, they provide excellent thermal tracking characteristics.

ECL terminator networks can be custom designed to meet the exact electrical specifications of a particular circuit.

ELECTRICAL CHARACTERISTICS

Capacitors

- Capacitance Value: .01μF
- Capacitance Tolerance: ±20%
- Characteristic: X7R
- Voltage Rating: 25VDC

Other capacitor values available upon request.

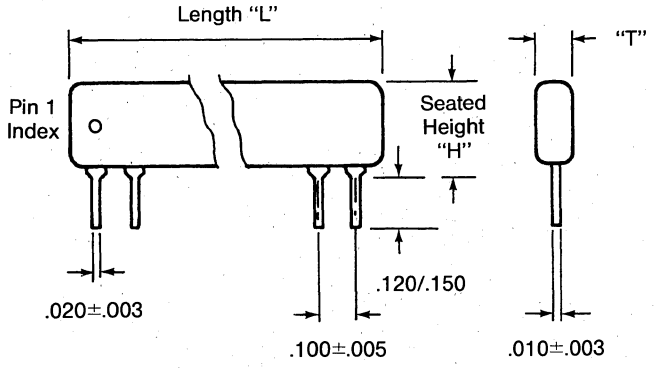
Resistors

- Resistors values: 10K: 50Ω, 68Ω, 100Ω
  100K: 50Ω, 68Ω, 100Ω
- Resistance Tolerance: ±2%
- Temperature Coefficient (TCR): ±200PPM/°C

DIMENSIONS

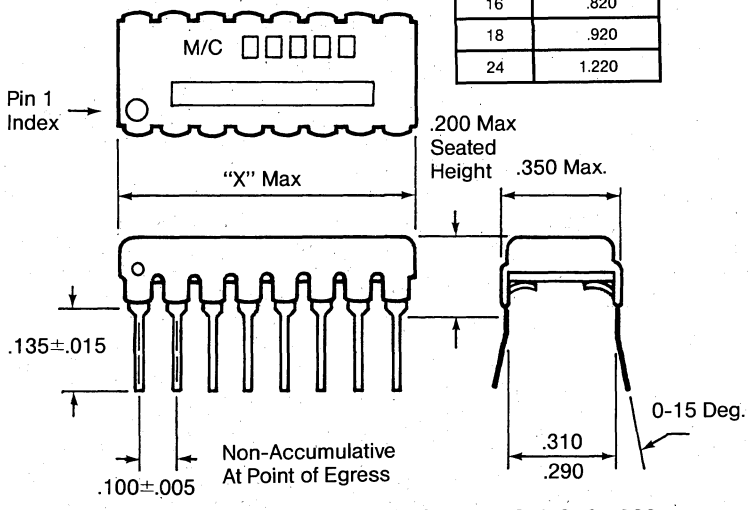
10K:

Dimension	Type 1-8 Pin	Type 1-10 Pin	Type 2
"L"	.900 Max.	1.100 Max.	1.100 Max.
"H"	.250 Max.	.250 Max.	.325 Max.
"T"	.150 Max.	.150 Max.	.150 Max.



100K:

Pins/Unit	"X" Dimension
8	.420
14	.720
16	.820
18	.920
24	1.220

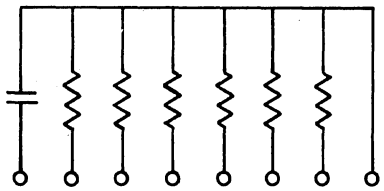


SERIES E34 AND E35

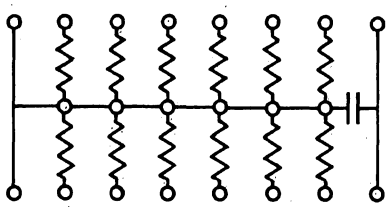
ECL Terminator Network

CIRCUIT CONFIGURATIONS

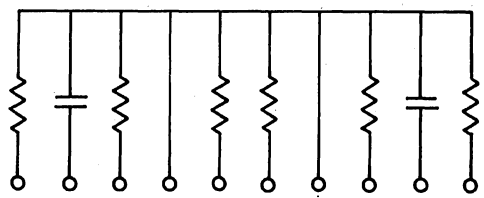
Type 1



Type 3

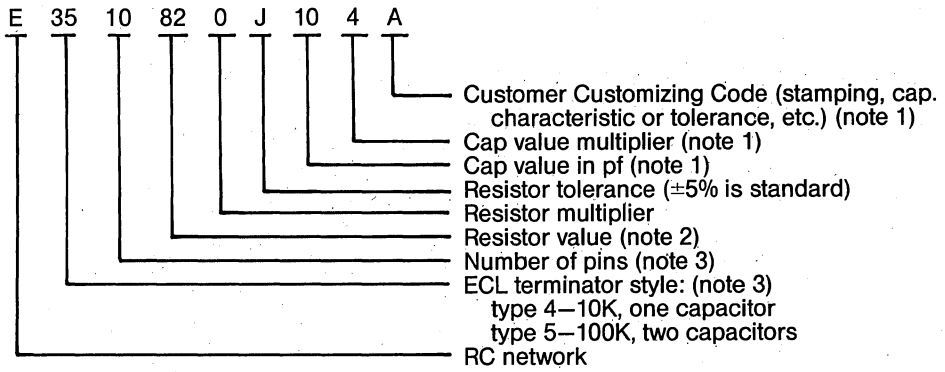


Type 2



HOW TO SPECIFY

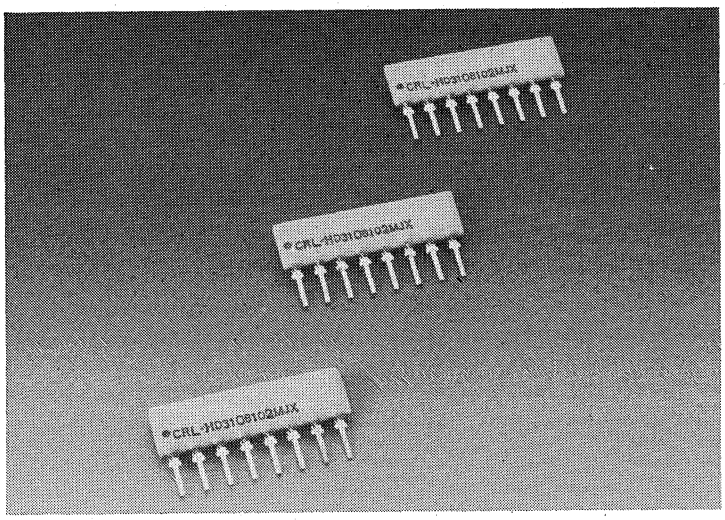
Following is the part numbering system that will be followed for ECL terminators, both standard and custom. Standard parts will be stamped with the part number, pin #1 identification dot, manufacturer's ID, and date code.



NOTES:
(1) Not required on standard networks. Standard cap is .01 mf, +100%, −20%, X7R, 25VDC
(2) Standard resistor values are 50 ohms, 68 ohms, and 100 ohms.
(3) The only meaningful combinations are 3408 and 3510.

SERIES HD3

Single-In-Line Capacitor Banks



DESCRIPTION

Mepco/Centralab's Series HD3 Capacitor Banks gives you vertical size integration for a series of common ceramic capacitor values. The network uses superior Thick Film Technology with highly stable NPO, X7R or Z5U Ceramic Capacitors.

Custom single-in-line (SIP) configurations, in a full range of EIA values, are predesigned and ready for issue with artwork on file at our West Lafayette facility. When a customer orders a specific capacitor circuit, the predesigned artwork is pulled from file and set up for immediate production.

FEATURES

- Predesigned artwork reduces design time to zero
- Immediate delivery for "standard in-stock packages"
- Low profile .300 seated height
- Full EIA capacitance range
- Lead requirements chosen by customer
- Conformal coating for handling protection

SPECIFICATIONS

Electrical
Capacitance Range: 68pF to .27μF
NPO: 68pF to 1800pF
X7R: 500pF to .1μF
Z5U: .047μF to .27μF

Capacitance Tolerance:
NPO: ±5%, ±10%, ±20% (Below 100pf, add 0.5pf to high limit tolerance)
X7R: ±10%, ±20%
Z5U: +80/−20%

Working Voltage: 50VDC, 100VDC

Capacitor Temperature Coefficient per EIA RS-198B:

NPO: 0±30ppm/°C	(+25°C to +85°C)
X7R: ±15%ΔC	(−55°C to +125°C)
Z5U: +22% to −56ΔC	(+1°C to +85°C)

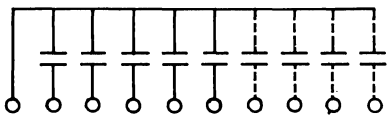
Substrate: 96% alumina

MARKINGS
Manufacturer's code, Catalog part number, Pin 1, Index (•) stamp for identification.

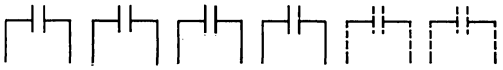
SERIES HD3
Single-In-Line Capacitor Banks

CIRCUIT CONFIGURATIONS

Type 1



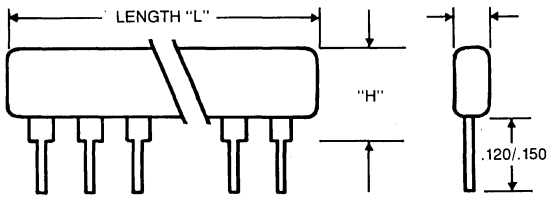
Type 2



STANDARD PACKAGES

PART NUMBER	CAPACITANCE	TOLERANCE	VOLTAGE	TC
HD3108471MJX	470pF	20%	50V	X7R
HD3110471MJX	470pF	20%	50V	X7R
HD3108102MJX	1,000pF	20%	50V	X7R
HD3110102MJX	1,000pF	20%	50V	X7R
HD3108222MJX	2,200pF	20%	50V	X7R
HD3110222MJX	2,200pF	20%	50V	X7R
HD3108103MJX	10,000pF	20%	50V	X7R
HD3110103MJX	10,000pF	20%	50V	X7R
HD3108104MJX	.1µF	20%	50V	X7R
HD3110104MJX	.1µF	20%	50V	X7R

DIMENSIONS



"L" = (# OF LEADS X 0.1)+0.04 MAX.
"H" = .300 SEATED HEIGHT MAX.

T = 0.135" MAX.

HOW TO SPECIFY

HD — **Product Type**

3 — **.300 Seated Height**

1 — **Circuit Type**

08 — **Number Of Leads**

VV — **1st Two Significant Digits Of Capacitor**
Example:
103=10,000pF

M — **Multiplier**

T — **Tolerance**
J =5%
K=10%
M=20%
Z =−20+80

V — **Voltage**
J=50V
K=100V

B — **TC:**
C=NPO
X=X7R
Z=Z5U

X — **Individual Customer Requirements**

CERMET TRIMMERS
Quick Reference Index

Type	Shape	No. of Turns	Series	Size Inch (mm)	Resistance Range	Power Rating (°C)	Operating Temperature Range (°C)	Page #
SINGLE TURN	ROUND	1	RJ-4	3/16 .19 (4.9)	10-2 Meg	.50W@70°	−55 to +125	**557**
		1	8014	1/4 .25 (6.4)	10-5 Meg	.50W@25°	−25 to +125	**543**
		1	RJ-6	1/4 .25 (7.0)	10-5 Meg	.50W@70°	−55 to +125	**558**
		1	RJ-13	1/2 .50 (12.6)	10-5 Meg	.75W@70°	−55 to +125	**559**
	SQUARE	1	CT-6	1/4 .25 (7.0)	10-5 Meg	.50W@70°	−55 to +125	**555**
		1	8038	3/8 .38 (9.5)	10-5 Meg	.50W@85°	−25 to +125	**551**
MULTI TURN	ROUND	3	TM-7	5/16 .28 (7.2)	50-2 Meg	.50W@70°	−55 to +125	**563**
		12	8026	1/4 .25 (6.4)	10-5 Meg	.25W@85°	−65 to +150	**547**
	SQUARE	25	8024	3/8 .38 (9.5)	10-5 Meg	1.0W@70°	−65 to +150	**545**
		18	CT-9	3/8 .38 (9.5)	10-5 Meg	.50W@70°	−55 to +125	**562**
	REC-TANGLE	15	8035	3/4 .75 (19.0)	10-5 Meg	.75W@70°	−55 to +125	**549**
		15	CT-20	3/4 .75 (19.0)	10-5 Meg	.50W@70°	−55 to +125	**562**
MILITARY		MIL Style Per MIL-R-22097				MIL Style Per MIL-R-39035		
		RJ24				RJR24		**545**
		RJ26				RJR26		**547**

Mepcopal Company is a joint venture of Mepco/Centralab and Copal Electronics.

Mepco/Centralab is the sales agent for all Mepcopal products.

The joint venture company combines the Mepco/Centralab trademark products with the Copal trademark products to offer the broad line of cermet trimmers presented in this catalog.

The manufacturing facilities in San Diego have been expanded to include the highly automated assembly equipment for production of the Copal trademark CT series trimmers.

In addition Mepcopal Company offers

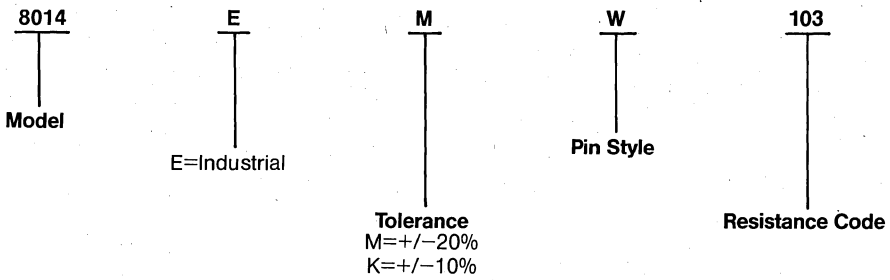
- SURFACE MOUNT CERMET TRIMMERS
  See the Mepco/Centralab Surface Mount Device catalog for details
- WIREWOUND TRIMMERS
- BINARY CODED DIP ROTARY SWITCHES
- PRECISION WIREWOUND POTENTIOMETERS
- TURNS COUNTING DIALS
- HIGH RELIABILITY FUSES

Contact the Mepcopal factory or your local Mepco/Centralab sales office or representative for details on these products.

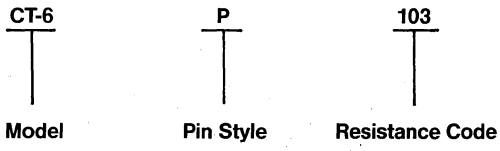
PART NUMBERING SYSTEM

HOW TO SPECIFY INDUSTRIAL CERMET TRIMMERS

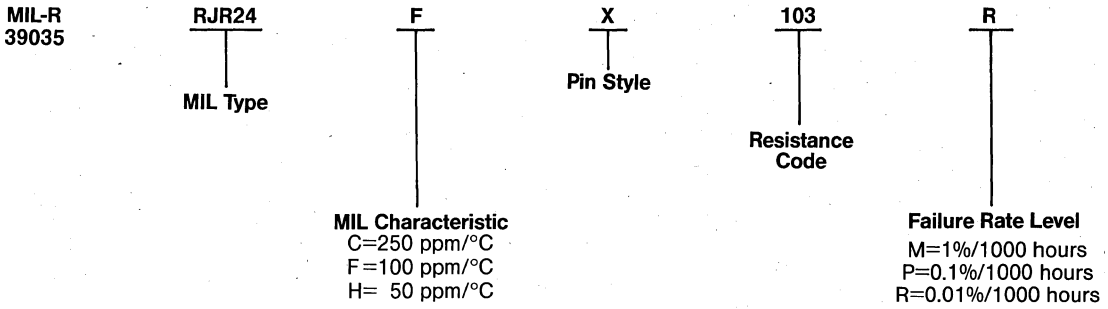
MEPCO/ELECTRA TRADEMARK

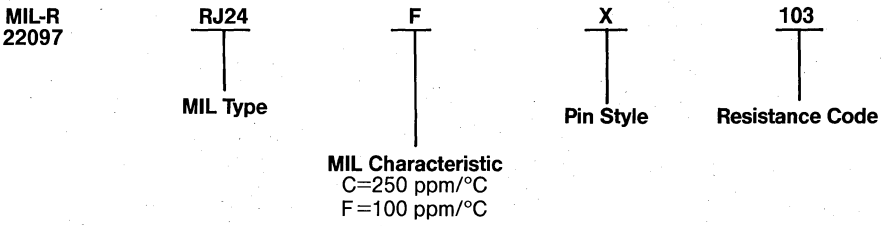


COPAL TRADEMARK



HOW TO SPECIFY MILITARY CERMET TRIMMERS

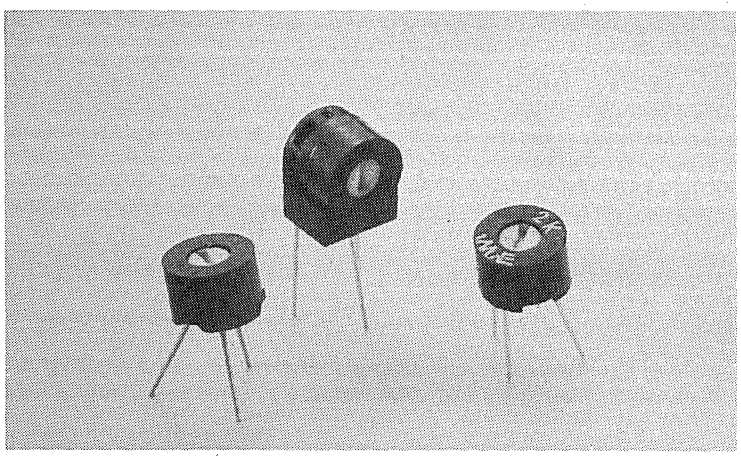




Mepcopal military trimmers are qualified to Failure Rate Level "R" and MIL Characteristic "F" for all ohmic values, and MIL Characteristic "H" for ohmic values greater than or equal to 20,000 ohms.

SERIES 8014

Single Turn ¼" Round Diameter Miniature Cermet Trimmers



DESCRIPTION

Series 8014 single turn cermet trimmer is the smallest size trimmer of its type available today. The ¼" diameter 8014 has a maximum height of .180. Specifications include a maximum contact resistance variation (CRV) of 3% maximum and less than 0.25% average.

The Series 8014 represents a major breakthrough in the design of high performance, high reliability potentiometers combining an exceptionally low profile with equally low prices.

DESIGN FEATURES

- **Low Cost**
- **Sealed** – withstands automated soldering and Industrial cleaning processes.
- **Broad Resistance Range available** – 10 Ohms to 5 Megohms.
- **Tolerance** – 20% Standard; 10% available.
- **Temperature Coefficient of Resistance** – ±100PPM/°C over entire operating range.
- **CRV** – typically less than 0.25% average and 3% maximum.
- **Cermet Element** – inherent environmental stability.
- **Infinite Resolution** – For smooth, continuous adjustment of voltage or resistance . . . Even in lowest resistance designs.

RESISTANCE VALUES AND CODES

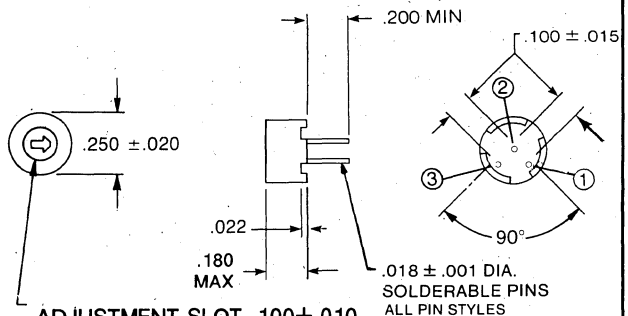
STANDARD			
Ohms	Code	Ohms	Code
100	101	25K	253
200	201	50K	503
500	501	100K	104
1K	102	200K	204
2K	202	250K	254
5K	502	500K	504
10K	103	1 Meg	105
20K	203		

SPECIAL			
Ohms	Code	Ohms	Code
10	100	2 Meg	205
20	200	5 Meg	505
50	500		

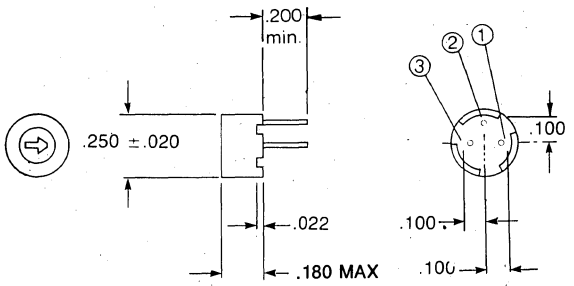
SERIES 8014
Miniature Cermet Trimmers

DIMENSIONS

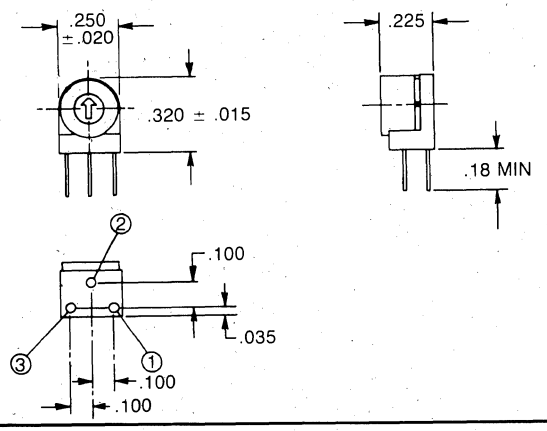
8014EMW



8014EMP



8014EMX



SPECIFICATIONS

ELECTRICAL

Resistance Range:
100 ohms to 1 megohm, standard.
10, 20, 50 ohms, 2, 5 megohms, special.
Resistance Tolerance: ±20%; ±10% available.
Temperature Coefficient: ±100 ppm/°C
Power Rating: .5 watt at 25°C derated linearly to 0 watt at 125°C.
Operating Voltage: 200 V maximum.
Slider Current: 100 mA, or within power rating, whichever is less.
End Resistance: 2 ohms, maximum.
Contact Resistance Variation: 3 ohms or 3% TR, whichever is greater.
Adjustability: ±0.03% voltage ratio; ±0.1% resistance.
Resolution: Essentially infinite.
Insulation Resistance: 1000 megohms minimum.
Dielectric Strength: 600 VAC minimum.
Operating Range: −25°C to +125°C.
Electrical Angle: 190° nominal.

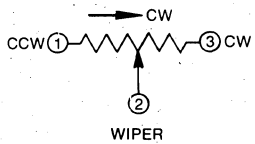
MECHANICAL

Element: Cermet
Seal: Sealed to allow wave soldering and immersion cleaning.
Adjustment: 240° nominal.
Operating Torque: 3 oz-in maximum.
Stops: Solid both ends.
Rotational Life: 200 cycles.
Terminals: .018" dia. solderable pins.
Terminal Strength: 2 lbs. min., four 90° bends.
Weight: .30 g (.011 oz.) maximum.
Housing & Rotor: Thermoplastic.
Marking: Mepco/Electra logo, resistance value.

ENVIRONMENTAL

Will perform satisfactorily under the following test conditions:
Thermal Shock: −25°C to +125°C.
Shock: 100G
Vibration: 20 G, 10 Hz to 2000 Hz.
Moisture: 10 days, 80-98% RH
Life: .5 watt at 25°C for 1000 hours
Resistance to Soldering Heat: 350°C for 3 seconds.

SCHEMATIC

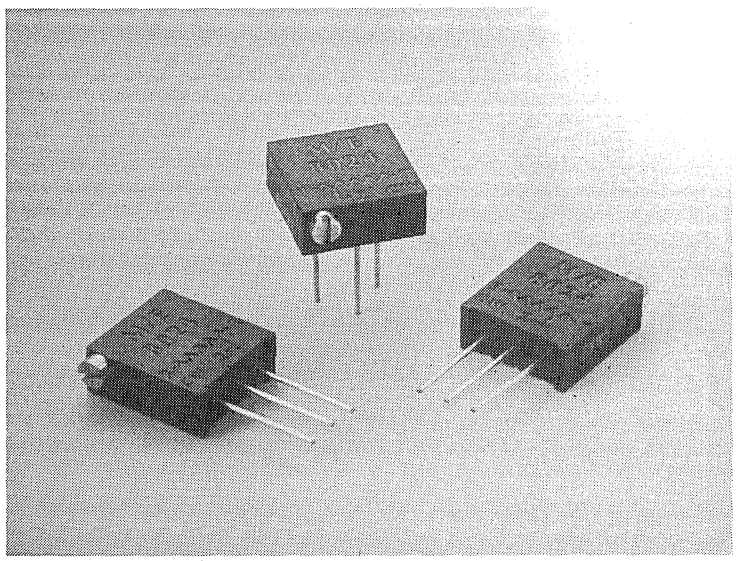


- TOLERANCES NOT SPECIFIED ARE ±.010
- NOTE: W PIN SPACING FITS JEDEC TO-18 PATTERN. P AND X PIN SPACING FITS JEDEC TO-5 PATTERN.

7 Cermet Trimmers

SERIES 8024 RJ24/RJR24

Multiturn Cermet Trimmers 3/8" Square



DESCRIPTION

Series 8024 (Industrial), RJ24 (MIL) and RJR24 (MIL-Established Reliability) trimmers consist of a ceramic/metal resistance element deposited on a ceramic substrate that is sealed against moisture and contaminants in a rugged housing designed to withstand high levels of vibration and shock. End-to-end resistance values range from 10 ohms to 5 megohms, with very low T.C. over a wide temperature span.

Continuous cermet film provides infinite resolution. Performance, both AC and high frequency, meets MIL-R-22097 and MIL-R-39035. Electro-mechanical and time/temperature stabilities are excellent. Series provides the highest reliability and performance in applications where miniature size is crucial.

DESIGN FEATURES

- **Essentially Infinite Resolution** — for smooth, continuous adjustment of voltage or resistance... even in lowest-resistance designs.
- **Excellent Electromechanical Stability** — initial adjustment is maintained even under severe shock and/or continuous vibration.
- **Greatest Design Freedom** — ever provided in a p.c. trimmer; three different orientations of mounting and adjustment access.
- **Very High Temperature/Time Stability** — T.C. and long-term-drift characteristics approach those of wirewound controls costing far more and providing much less resolution.
- **Widest Range of Resistances** — ever offered in this class of adjustable resistors.
- **Full MIL Conformance** — Plus generous safety margins.
- **Extremely Low Reactance** — negligible L, minimal C over very wide bandwidth. (Most resistance values exhibit negligible frequency error up to and beyond 100MHz.)

RESISTANCE VALUES AND CODES

STANDARD			
Ohms	Code	Ohms	Code
100	101	25K	253
200	201	50K	503
500	501	100K	104
1K	102	200K*	204
2K	202	250K	254
5K	502	500K	504
10K	103	1 Meg	105
20K	203		

SPECIAL			
Ohms	Code	Ohms	Code
10	100	2 Meg*	205
20	200	5 Meg*	505
50	500		

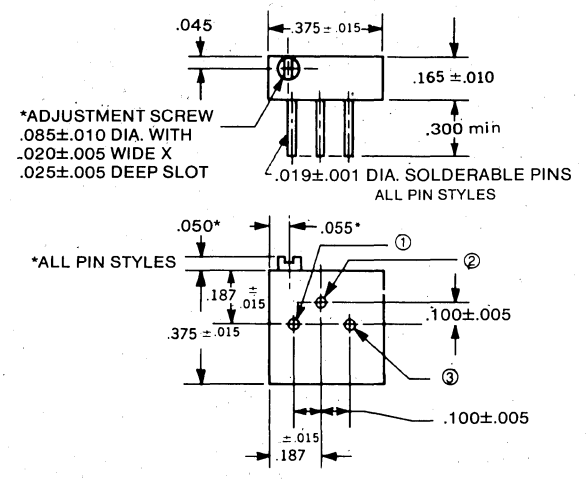
*Not standard for military models

SERIES 8024 RJ24/RJR24

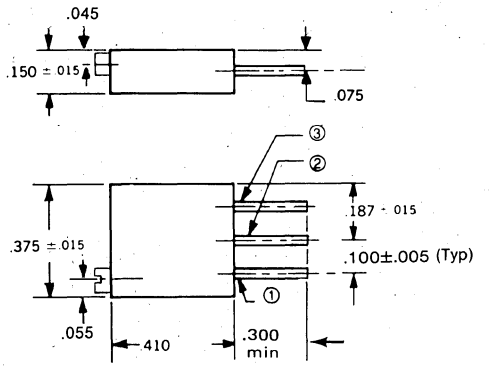
Multiturn Cermet Trimmers

DIMENSIONS

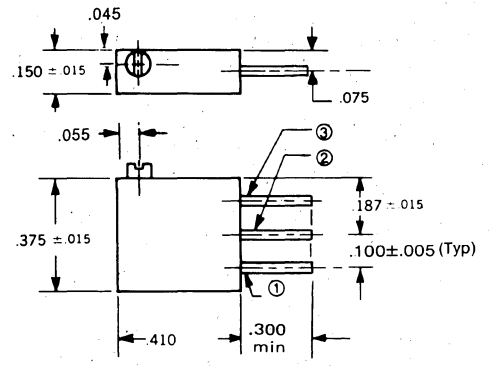
INDUSTRIAL	MIL-R-22097	MIL-R-39035
8024EKP	RJ24FP	RJR24FP RJR24HP



INDUSTRIAL	MIL-R-22097	MIL-R-39035
8024EKW	RJ24FW	RJR24FW RJR24HW



INDUSTRIAL	MIL-R-22097	MIL-R-39035
8024EKX	RJ24FX	RJR24FX RJR24HX



■ TOLERANCES NOT SPECIFIED ARE ±.010

SPECIFICATIONS

ELECTRICAL

Resistance Range:
100 ohms to 1 megohm, standard.
10, 20, 50 ohms, 2, 5 megohms, special.

Resistance Tolerance: ±10%

Temperature Coefficient: ±100 ppm/°C; 50 ppm/°C for RJR "H" characteristic (20K ohm minimum).

Power Rating: 1 watt at 70°C, industrial; .5 watt at 85°C derated linearly to 0 watt at 150°C, military.

Operating Voltage: 300 V maximum.

Slider Current: 100 mA, or within power rating, whichever is less.

End Resistance: 2 ohms, maximum.

Contact Resistance Variation: 3 ohms or 3% TR, whichever is greater.

Adjustability: ±0.03% voltage ratio; ±0.1% resistance.

Resolution: Essentially infinite.

Insulation Resistance: 1000 megohms minimum.

Dielectric Strength: 900 VAC minimum.

Operating Range: –65°C to +150°C.

MECHANICAL

Element: Cermet

Seal: Sealed to allow wave soldering and immersion cleaning.

Adjustment: 25 turns nominal.

Operating Torque: 5 oz-in maximum.

Stops: Clutch action both ends.

Rotational Life: 200 cycles (ΔT.R.≤2%).

Terminals: .019" dia. solderable pins.

Terminal Strength: 2 lbs. min., four 90° bends.

Weight: .90 g (.031 oz.) maximum.

Housing: Thermoplastic

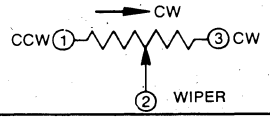
Marking: Mepco/Electra logo, part number, pin numbers, schematic, pin style, resistance code, date code.

ENVIRONMENTAL – Per MIL-R-22097/MIL-R-39035

Characteristic	"F"	"H"
Temp. Coeff. PPM/°C	±100	±50
Maximum % change in total resistance:		
Thermal shock –65°C to + 150°C	1%	1%
Moisture, 10 days, 80-98% R.H.	1%	1%
Shock, 100G	1%	1%
Vibration, 20G to 2kHz	1%	1%
Life. 0.5W @ +85°C		
RJ - 1000 hours	2%	–
RJR - 10000 hours	5%	5%
Low Temp. exposure –55°C	1%	1%
High Temp. exposure @ 150°C		
RJ - 250 hours	2%	3%
RJR - 1000 hours	2%	3%
Rotational life, 200 cycles	2%	2%
Immersion, water, no leaks	85°C	85°C
Solderability	95% coverage	
Salt spray, 96 hours	Resistant	
Dielectric strength	350VAC at 70,000 ft.	
Operating Range	–65°C to +150°C	

NOTE: Industrial models designed to meet Mil-R-22097 Characteristic "F".

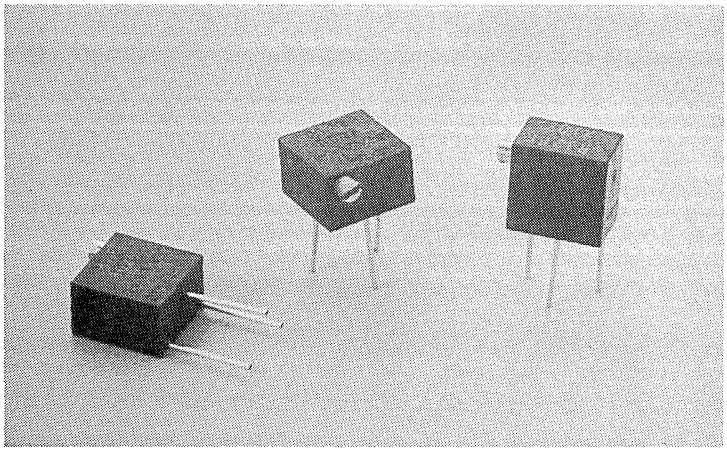
SCHEMATIC



7 Cermet Trimmers

SERIES 8026/ RJ26/RJR26

Multiturn Cermet Trimmers ¼" Square



DESCRIPTION

Series 8026 (Industrial), RJ26 (MIL) and RJR26 (MIL-Established Reliability) consist of a ceramic/metal resistance element on a ceramic substrate that is sealed against moisture and other contaminants in a rugged enclosure designed to withstand high levels of shock and vibration. End-to-end resistance values range from 10 ohms to 5 megohms with very low temperature coefficient.

Continuous cermet film provides infinite resolution. With 12 adjustment turns, setability is excellent. Performance, both AC and high frequency, meets MIL-R-22097 and MIL-R-39035. End resistance is negligible, and electromechanical and time/temperature stabilities are excellent. This series provides the highest reliability and performance in 0.25-Watt applications where multiturn setability in the smallest possible space is required.

RESISTANCE VALUES AND CODES

STANDARD			
Ohms	Code	Ohms	Code
100	101	25K	253
200	201	50K	503
500	501	100K	104
1K	102	200K*	204
2K	202	250K	254
5K	502	500K	504
10K	103	1 Meg	105
20K	203		
SPECIAL			
Ohms	Code	Ohms	Code
10	100	2 Meg*	205
20	200	5 Meg*	505
50	500		

*Not standard for military models

DESIGN FEATURES

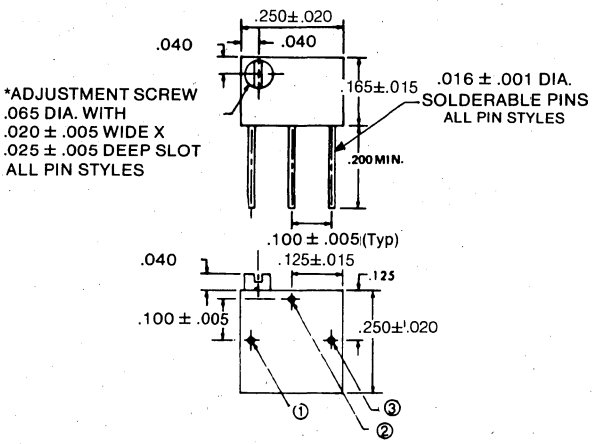
- **Wide Design Freedom** — all three orientations of mounting and adjustment access.
- **Widest Range of Resistances** – Ever offered in this class of adjustable resistors.
- **Full MIL Conformance** – Plus Generous Safety Margins.
- **Extremely Low Reactance** — negligible L, minimal C over very wide bandwidth. (Most resistance values exhibit negligible frequency error up to and beyond 100MHz.)
- **Essentially Infinite Resolution** — for smooth, continuous adjustment of voltage or resistance... even in lowest-resistance designs.
- **Excellent Electromechanical Stability** — Initial adjustment is maintained even under severe shock and/or continuous vibration.
- **Very High Temperature/Time Stability** — T.C. and long-term-drift characteristics approach those of wirewound controls costing far more and providing much less resolution.
- **Very Low End Resistance** — minimum resistance at either end of range is essentially negligible, except in lowest-resistance units.

SERIES 8026 RJ26/RJR26

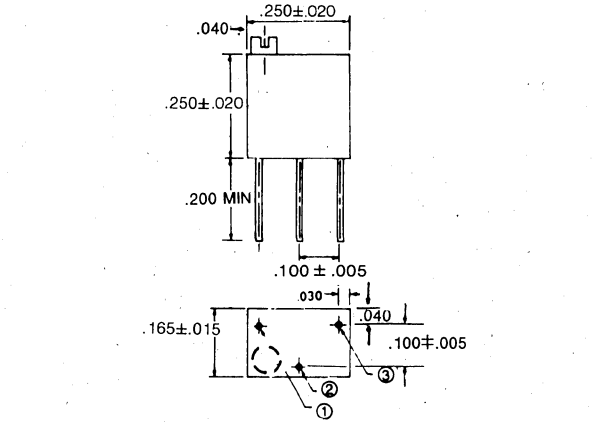
Multiturn Cermet Trimmers

DIMENSIONS

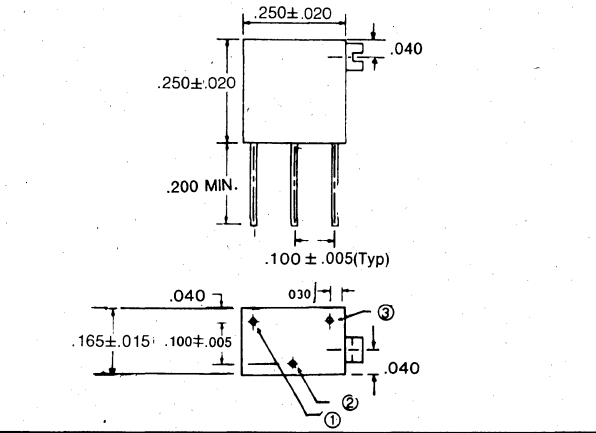
INDUSTRIAL	MIL-R-22097	MIL-R-39035
8026EKP	RJ26FP	RJR26FP RJR26HP



INDUSTRIAL	MIL-R-22097	MIL-R-39035
8026EKW	RJ26FW	RJR26FW RJR26HW



INDUSTRIAL	MIL-R-22097	MIL-R-39035
8026EKX	RJ26FX	RJR26FX RJR26HX



■ TOLERANCES NOT SPECIFIED ARE ±.010

SPECIFICATIONS

ELECTRICAL

Resistance Range:
100 ohms to 1 megohm, standard.
10, 20, 50 ohms, 2, 5 megohms, special.

Resistance Tolerance: ±10%

Temperature Coefficient: ±100 ppm/°C
50 ppm/°C for RJR "H" characteristic
(20K ohm minimum).

Power Rating: .25 watt at 85°C derated linearly to 0 watt at 150°C.

Operating Voltage: 200 V maximum.

Slider Current: 100 mA, or within power rating, whichever is less.

End Resistance: 2 ohms maximum.

Contact Resistance Variation: 3 ohms or 3% TR, whichever is greater.

Adjustability: ±0.03% voltage ratio; ±0.1% resistance.

Resolution: Essentially infinite.

Insulation Resistance: 1000 megohms minimum.

Dielectric Strength: 600 VAC minimum.

Operating Range: –65°C to +150°C.

MECHANICAL

Element: Cermet

Seal: Sealed to allow wave soldering and immersion cleaning.

Adjustment: 12 turns nominal.

Operating Torque: 3 oz-in maximum.

Stops: Clutching action both ends.

Rotational Life: 200 cycles (ΔT.R.≤2%).

Terminals: .016 dia. solderable pins.

Terminal Strength: 2 lbs. min., four 90° bends.

Weight: .44 g (.015 oz) maximum.

Housing: Thermoplastic.

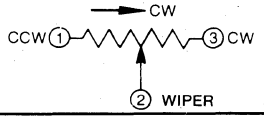
Marking: Mepco/Electra logo, part number, pin numbers, schematic, pin style, resistance code, date code.

ENVIRONMENTAL – Per MIL-R-22097/MIL-R-39035

Characteristic	"F"	"H"
Temp. Coeff. PPM/°C	±100	±50
Maximum % change in total resistance:		
Thermal shock –65°C to + 150°C	1%	1%
Moisture, 10 days, 80-98% R.H.	1%	1%
Shock, 100G	1%	1%
Vibration, 20G to 2kHz	1%	1%
Life, 0.5W @ +85°C		
RJ - 1000 hours	2%	–
RJR - 10000 hours	5%	5%
Low Temp. exposure –55°C	1%	1%
High Temp. exposure @ 150°C		
RJ - 250 hours	2%	3%
RJR - 1000 hours	2%	3%
Rotational life, 200 cycles	2%	2%
Immersion, water, no leaks	85°C	85°C
Solderability	95% coverage	
Salt spray, 96 hours	Resistant	
Dielectric strength	350VAC at 70,000 ft.	
Operating Range	–65°C to +150°C	

NOTE: Industrial models designed to meet Mil-R-22097 Characteristic "F".

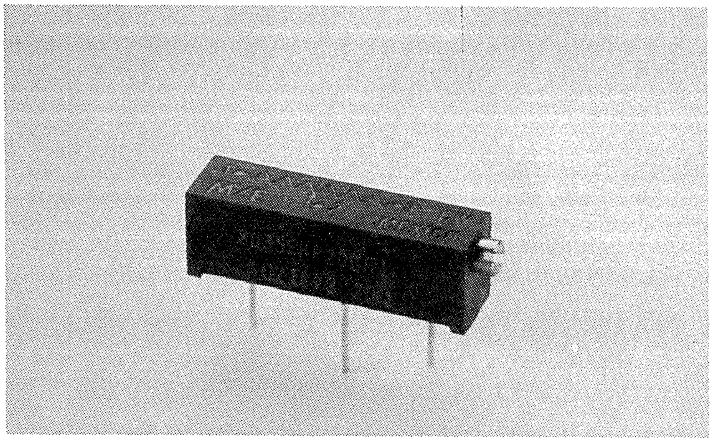
SCHEMATIC



7 Cermet Trimmers

SERIES 8035

Multiturn Cermet Trimmers ¾" Rectangular



DESCRIPTION

The Series 8035 trimmer also has a low 0.25" height, for "low profile" applications. Its extremely rugged construction is sealed against deterioration during automated soldering and high humidity applications.

MEPCOPAL Series 8035 trimming potentiometers are economical cermet units, specifically designed for industrial applications requiring extremely accurate adjustment.

DESIGN FEATURES

- **Low Cost**
- **Sealed** – withstands automated soldering and industrial cleaning processes.
- **Broad Resistance Range available** – 10 Ohms to 5 Megohms.
- **Tolerance** – 10% Standard.
- **Temperature Coefficient of Resistance** – ±100PPM/°C over entire operating range.
- **Adjustability** – ±0.03% max. voltage divider and ±0.1% max. rheostat.
- **CRV** – 1% or 1 ohm, whichever is greater.
- **Cermet Element** – inherent environmental stability.
- **Infinite Resolution** – For smooth, continuous adjustment of voltage or resistance . . . Even in lowest resistance designs.

RESISTANCE VALUES AND CODES

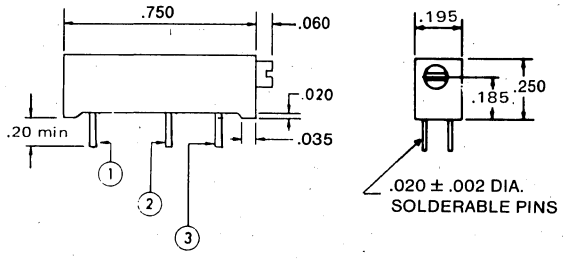
STANDARD			
Ohms	Code	Ohms	Code
100	101	25K	253
200	201	50K	503
500	501	100K	104
1K	102	200K	204
2K	202	250K	254
5K	502	500K	504
10K	103	1 Meg	105
20K	203		

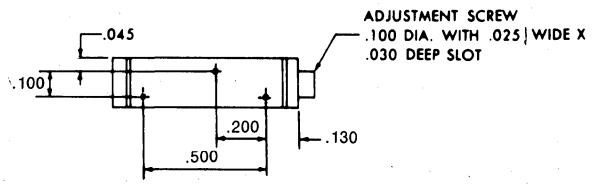
SPECIAL			
Ohms	Code	Ohms	Code
10	100	2 Meg	205
20	200	5 Meg	505
50	500		

SERIES 8035
Multiturn Cermet Trimmers

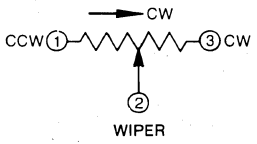
DIMENSIONS

8035EKP





SCHEMATIC



■ TOLERANCES NOT SPECIFIED ARE ±0.010

SPECIFICATIONS

ELECTRICAL

Resistance Range:
100 ohms to 1 megohm, standard.
10, 20, 50 ohms, 2, 5 megohms, special.
Resistance Tolerance: ±10%
Temperature Coefficient: 100 ppm/°C
Power Rating: .75 watt at 70°C derated linearly to 0 at 125°C.
Operating Voltage: 300 V maximum.
Slider Current: 100 mA, or within power rating, whichever is less.
End Resistance: 2 ohms maximum.
Contact Resistance Variation: 1 ohm or 1% TR, whichever is greater.
Adjustability: ±0.03% voltage ratio; ±0.1 resistance.
Resolution: Essentially infinite.
Insulation Resistance: 1000 megohms minimum.
Dielectric Strength: 900 VAC minimum.
Operating Range: −55°C to +125°C.

MECHANICAL

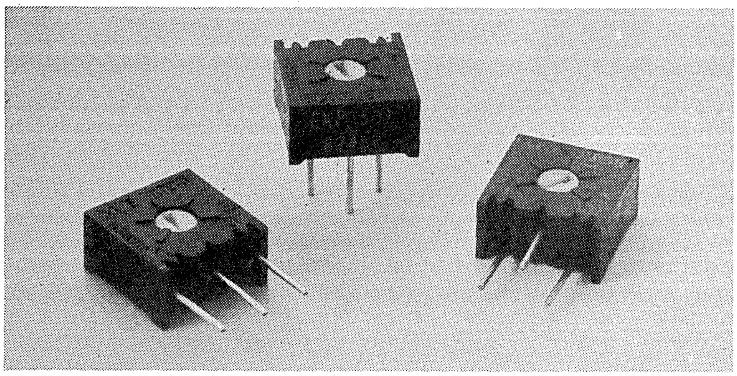
Element: Cermet
Seal: Sealed to allow wave soldering and immersion cleaning.
Adjustment: 15 turns nominal.
Operating Torque: 5 oz-in maximum.
Stops: Clutch action both ends.
Rotational Life: 200 cycles (ΔT.R.≤2%).
Terminals: .020" dia. solderable pins.
Terminal Strength: 2 lbs. min., four 90° bends.
Weight: 1.29 g (.043 oz.) maximum.
Housing: Thermoplastic
Marking: Mepco/Electra logo, part number, pin numbers, schematic, pin style, resistance code, date code.

ENVIRONMENTAL

Will perform satisfactorily under the following test conditions:
Thermal Shock: −55°C to +125°C
Shock: 100 G
Vibration: 20 G, 10 Hz to 2000 Hz.
Moisture: 10 days, 80-98% RH
Life: .75 watt at 70°C for 1000 hours.
Resistance to Soldering Heat: 350°C for 3 seconds.

SERIES 8038

Single Turn Cermet Trimmers 3/8" Square



DESCRIPTION

Series 8038 single turn cermet trimmer consists of a ceramic/metal resistance element deposited on a ceramic substrate that is sealed against moisture and contaminants in a rugged thermoplastic housing.

The Series 8038 offers high performance and high reliability at an economical price.

RESISTANCE VALUES AND CODES

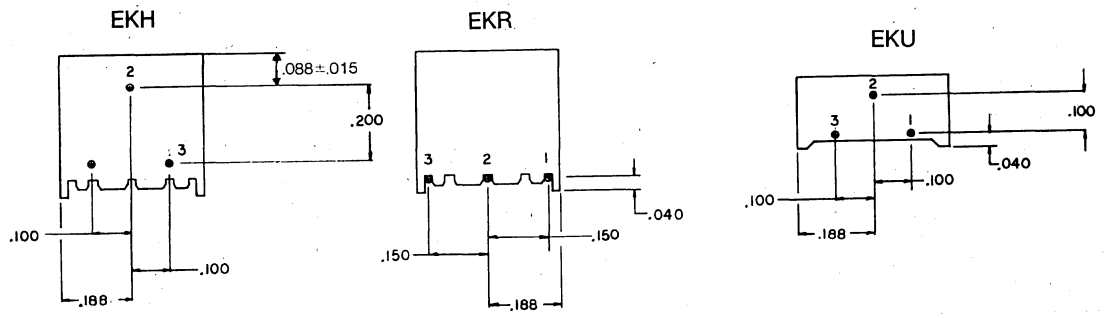
STANDARD			
Ohms	Code	Ohms	Code
100	101	25K	253
200	201	50K	503
500	501	100K	104
1K	102	200K	204
2K	202	250K	254
5K	502	500K	504
10K	103	1 Meg	105
20K	203		

SPECIAL			
Ohms	Code	Ohms	Code
10	100	2 Meg	205
20	200	5 Meg	505
50	500		

DESIGN FEATURES

- **Low Cost**
- **Sealed** – withstands automated soldering and industrial cleaning processes.
- **Broad Resistance Range available** – 10 Ohms to 5 Megohms.
- **Tolerance** – 10% Standard.
- **Temperature Coefficient of Resistance** – ±100PPM/°C over entire operating range.
- **CRV** – typically less than 0.25% average and 3% maximum.
- **Cermet Element** – inherent environmental stability.
- **Infinite Resolution** – For smooth, continuous adjustment of voltage or resistance . . . Even in lowest resistance designs.

SPECIAL PIN STYLES 8038 EKH, EKR, EKU



Contact factory for price and delivery.

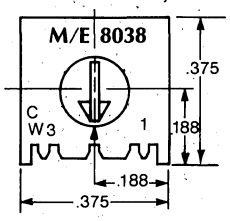
7 Cermet Trimmers

SERIES 8038

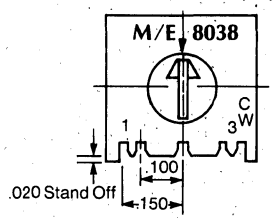
Single Turn Cermet Trimmers

DIMENSIONS

PIN STYLES P, V

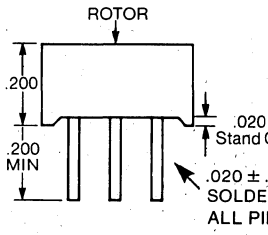


PIN STYLES W, X, Z

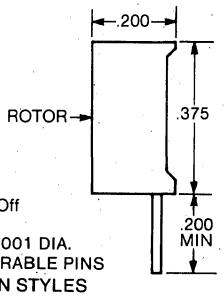


ADJUSTMENT SLOT –
.100 LONG X .030 ± .005 WIDE X .030 ± .005 DEEP

TOP ADJUST



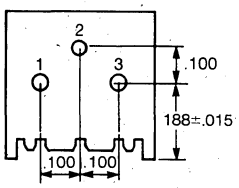
SIDE ADJUST



PIN STYLES

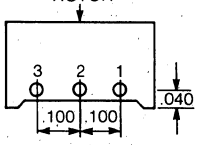
TOP ADJUST

8038 EKP
TO-5

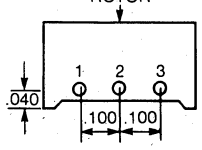


SIDE ADJUST

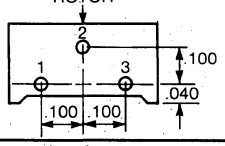
8038 EKV
.100 IN-LINE
ROTOR



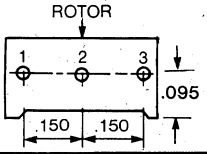
8038 EKW
.100 IN-LINE
ROTOR



8038 EKX
TO-5
ROTOR



8038 EKZ
.150 IN-LINE
ROTOR



SPECIFICATIONS

ELECTRICAL

Resistance Range:
100 ohms to 1 megohm, standard.
10, 20, 50 ohms, 2, 5 megohms, special.
Resistance Tolerance: ±10%
Temperature Coefficient: ±100 ppm/°C
Power Rating: .5 watt at 85°C derated linearly to 0 watt at 125°C.
Operating Voltage: 300 V maximum.
Slider Current: 100 mA, or within power rating, whichever is less.
End Resistance: 2 ohms, maximum
Contact Resistance Variation: 3 ohms or 3% TR, whichever is greater.
Adjustability: ±0.03% voltage ratio; ±0.10% resistance.
Resolution: Essentially infinite.
Insulation Resistance: 1000 megohms minimum.
Dielectric Strength: 900 VAC minimum.
Operating Range: –25°C to +125°C.
Electrical Angle: 270° nominal.

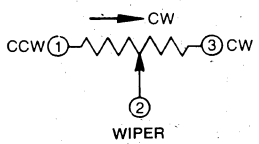
MECHANICAL

Element: Cermet
Seal: Sealed to allow wave soldering and immersion cleaning.
Adjustment: 300° nominal.
Operating Torque: 3 oz-in maximum.
Stops: Solid both ends.
Rotational Life: 200 cycles.
Terminals: .020" dia. solderable pins.
Terminal Strength: 2 lbs. min., four 90° bends.
Weight: 1.13 g (.04 oz.) maximum.
Housing & Rotor: Thermoplastic
Marking: Mepco/Electra logo, part number, pin numbers, CW pin, rotor indicator, resistance code, date code and pin style.

ENVIRONMENTAL

Will perform satisfactorily under the following test conditions:
Thermal Shock: –25°C to +125°C.
Shock: 100 G
Vibration: 20 G, 10 Hz to 2000 Hz
Moisture: 10 days, 80-98% RH
Life: .5 watt at 85°C for 1000 hours.
Resistance to Soldering Heat: 350°C for 3 seconds.

SCHEMATIC



■ TOLERANCES NOT SPECIFIED ARE ±.010

7 Cermet Trimmers

Single Turn Cermet Trimmers

STANDARD SPECIFICATIONS

ELECTRICAL

Model No / Item	CT-6	RJ-4	RJ-6	RJ-13
Resistance range	10Ω ~ 2MΩ	10Ω ~ 2MΩ	10Ω ~ 5MΩ	
Resistance tolerance	±10%	±20%	±10%	
Power ratings	0.5W(70°C) 0W (125°C)			0.75W(70°C) 0W (125°C)
Max. input voltage	200V DC			300V DC
	or power rating, whichever is smaller.			
Max. wiper current	100mA or power rating, whichever is smaller.			
Electrical angle, nominal	220°	200°	230°	
Electrical continuity	Continuous for full mechanical range.			
End resistance, max.	1% or 2Ω, whichever is greater.			
Resolution	Essentially infinite			
C.R.V. (MIL-R-22097), max.	1% or 3Ω, whichever is greater.			
Operating temp. range	−55°C~+125°C			
Temp. coefficient, max. (−55°C ~+125°C)	50Ω~2MΩ: ±100pm/°C Other values: ±250ppm/°C	100Ω~2M: ±100 ppm/°C 10Ω~50Ω: ±250ppm/°C	50Ω~2MΩ: ±100pm/°C Other values: ±250ppm/°C	
Insulation resistance, min.	1,000MΩ (DC500V)			
Dielectric strength	900 Vrms (1 minute)	500 Vrms (1 minute)	900 Vrms (1 minute)	

MECHANICAL

Model No. / Item	CT-6	RJ-4	RJ-6	RJ-13
Mechanical angle, nominal	260°	230°	270°	
Shaft torque, max.	20~200 g-cm	150 g-cm	20~150 g-cm	30~350 g-cm
Stop strength min.	500 g-cm	450 g-cm	500 g-cm	1kg-cm
Terminal strength, min.	1 kg (MIL-R-22097)			2 kg
Rotational life	200 cycles (△R/R≦±(2Ω+3%))	200 cycles (10Ω~200Ω △R/R≦±(0.5Ω +3%)), (500Ω up: △R/R≦±(0.5Ω +2%))		
Style	P, W, R, V, S, X, H, TV, TH MP, MS	W, WS	P, W, S, X, F	P, S, B, PR, SR

ENVIRONMENTAL (MIL-R-22097)

Thermal Shock	−65°C ~ +125°C	
	(△R/R≦1%) (S.S.≦1%)	
Humidity	80~98%RH, 10 cycles, 240hrs.,	
	(△R/R≦2%)	(△R/R≦1%)
Shock	100G	
	(△R/R≦1%) (S.S.≦1%)	
Vibration	20G, 10~2,000Hz,	
	(△R/R≦1%) (S.S.≦1%)	
Load life	70°C, Rated power, 1,000hrs.	
	(△R/R≦3%) (S.S.≦1%)	(△R/R≦2%) (S.S.≦1%)
Low temperature operation	−55°C, 2hrs.	
	(△R/R≦2%) (S.S.≦2%)	(△R/R≦1%) (S.S.≦2%)
High temperature operation	125°C, 250hrs.	
	(△R/R≦3%) (S.S.≦2%)	(△R/R≦2%) (S.S.≦2%)
Immersion seal	No leaks @ 85°C	
Soldering heat	350°C, 3 sec. (△R/R≦1%)	

△R/R: Change in total resistance S.S.: Setting stability

SERIES CT & RJ

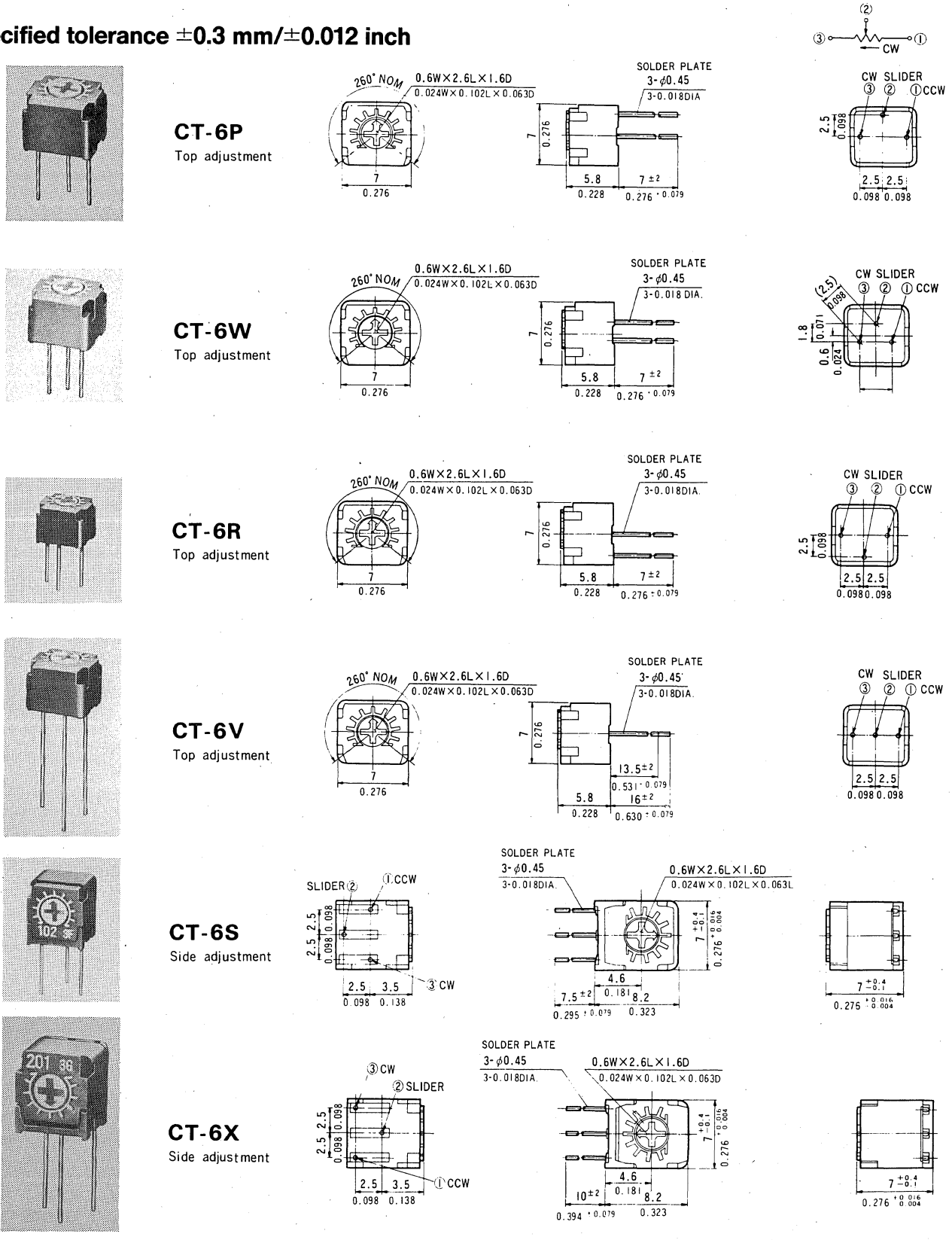
Single Turn Cermet Trimmers

STANDARD RESISTANCE VALUES AND MAX. INPUT RATINGS

Resistance		Max. input voltage (V)				Max. wiper current (mA)			
Ohm (Ω)	Code	CT-6	RJ-4	RJ-6	RJ-13	CT-6	RJ-4	RJ-6	RJ-13
10	100	1.00				100			
20	200	2.00				100			
50	500	5.00				100			
100	101	7.02			8.66	70.7			86.6
200	201	10.0			12.2	50.0			61.0
500	501	15.8			19.4	31.6			38.8
1K	102	22.4			27.4	22.4			27.4
2K	202	31.6			38.7	15.8			19.3
5K	502	50.0			61.2	10.0			12.2
10K	103	70.7			86.6	7.07			8.66
20K	203	100			122	5.00			6.10
25K	253	/	/	112	137	/	/	4.48	5.48
50K	503	158			194	3.16			3.88
100K	104	200			274	2.00			2.74
200K	204	200			300	1.00			1.50
250K	254	/	/	200	300	/	/	.80	1.20
500K	504	200			300	0.40			0.60
1M	105	200			300	0.20			0.30
2M	205	200			300	0.10			0.15
5M	505	/	/	200	300	/	/	0.04	0.06

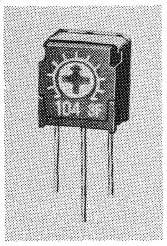
DIMENSIONS (in mm/inch)

CT-6
Unspecified tolerance ±0.3 mm/±0.012 inch



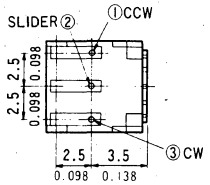
SERIES CT & RJ

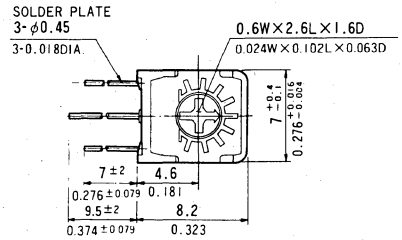
Single Turn Cermet Trimmers

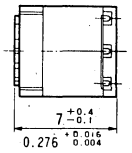


CT-6H

Side adjustment



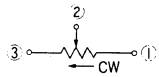




CT-6 for automatic insertion
Unspecified tolerance ±0.3 mm/±0.012 inch

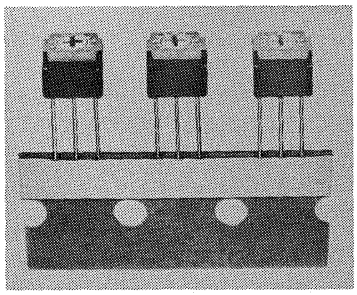
Taped Version

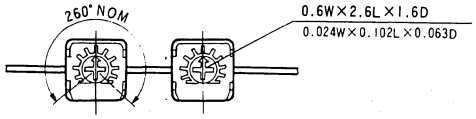
1,000 pcs per reel

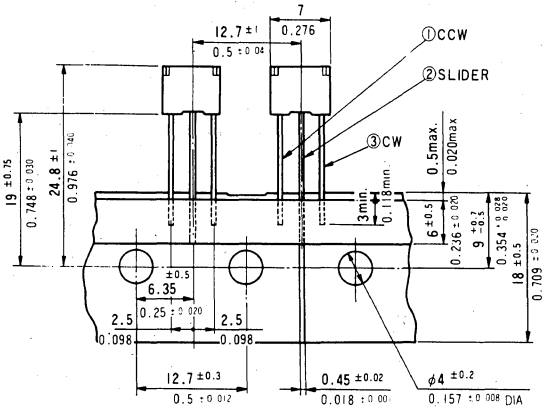


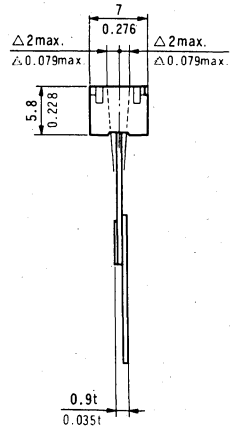
CT-6TV

Top adjustment



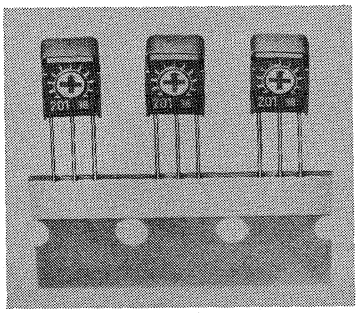


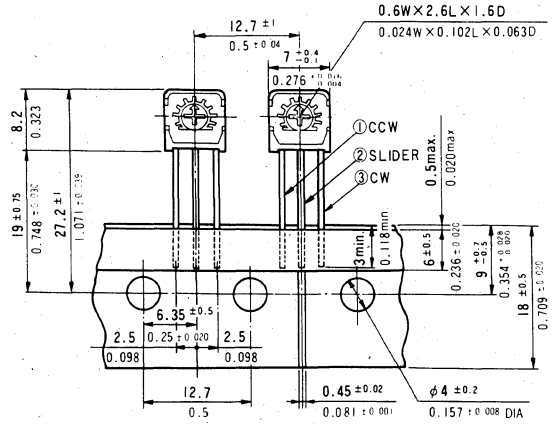


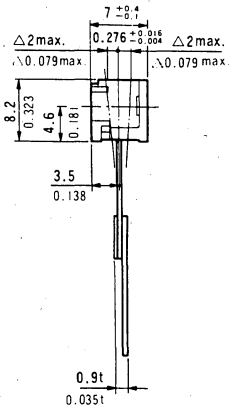


CT-6TH

Side adjustment



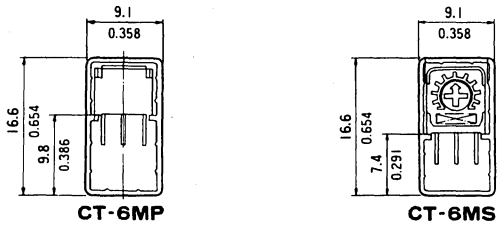


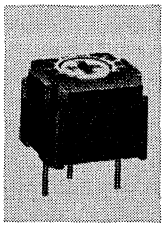


7 Cermet Trimmers

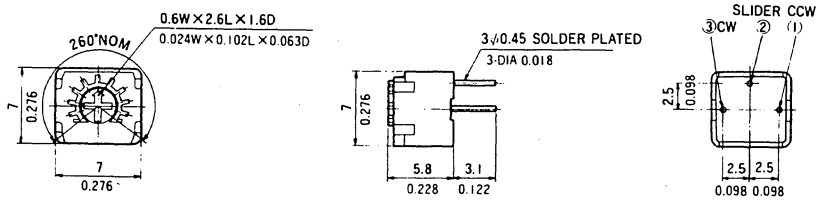
SERIES CT & RJ
Single Turn Cermet Trimmers

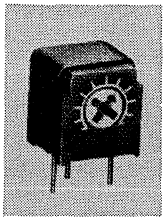
Plastic Magazine Version
75 pcs per stick



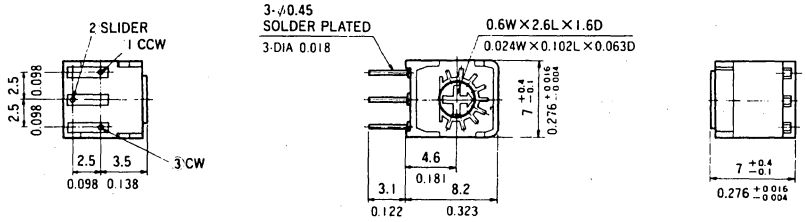


CT-6MP
Top adjustment

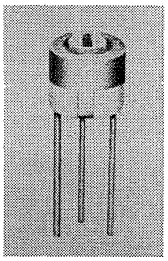




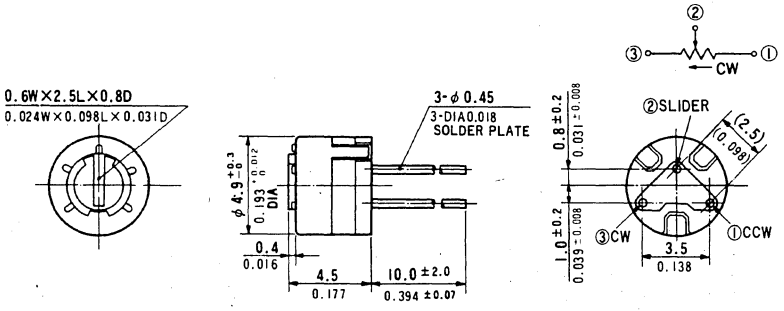
CT-6MS
Side adjustment

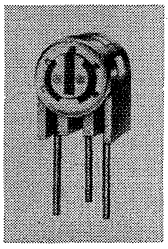


RJ-4
Unspecified tolerance ±0.3 mm/±0.012 inch

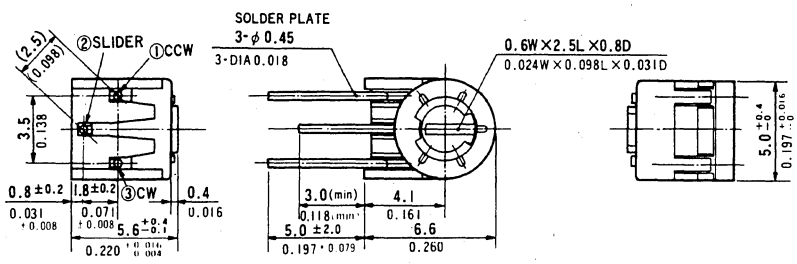


RJ-4W
Top adjustment





RJ-4WS
Side adjustment

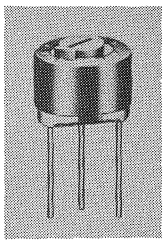


7 Cermet Trimmers

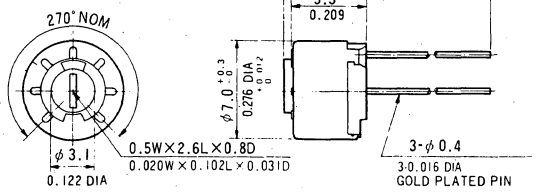
SERIES CT & RJ

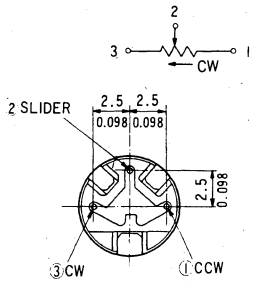
Single Turn Cermet Trimmers

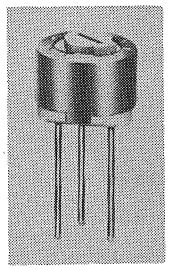
RJ-6
Unspecified tolerance ±0.3 mm/±0.012 inch



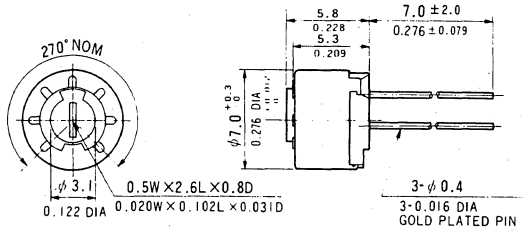
RJ-6P
Top adjustment

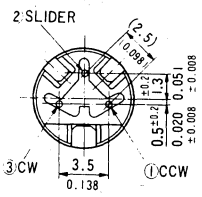


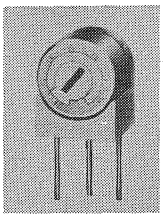




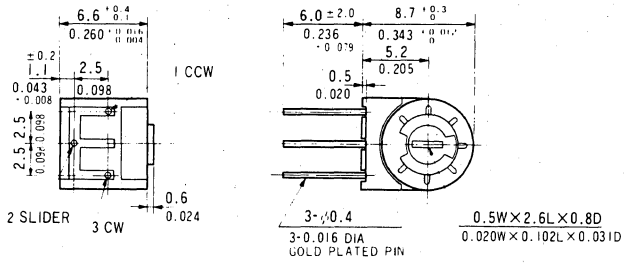
RJ-6W
Top adjustment

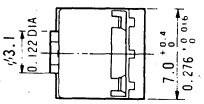


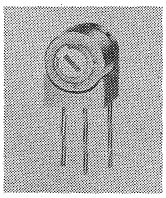




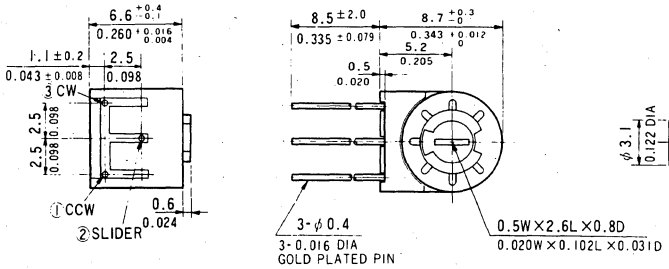
RJ-6S
Side adjustment

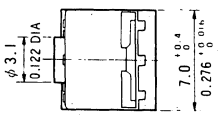


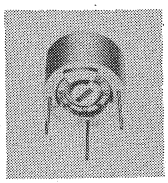




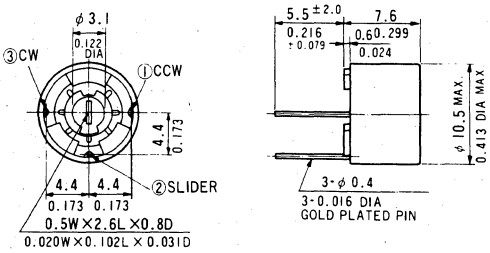
RJ-6X
Side adjustment

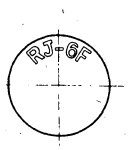






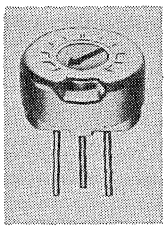
RJ-6F
Rear adjustment



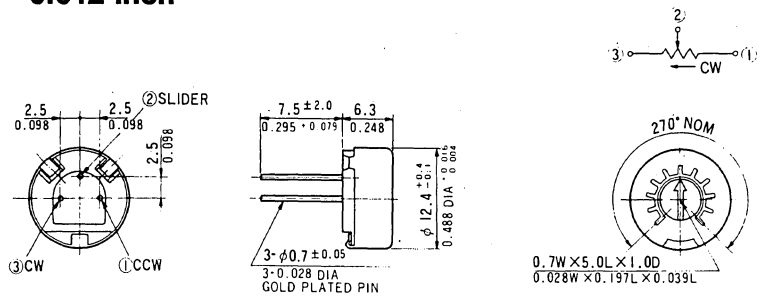


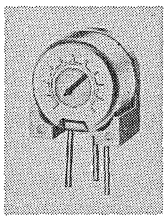
7 Cermet Trimmers

RJ-13
Unspecified tolerance ±0.3 mm/±0.012 inch

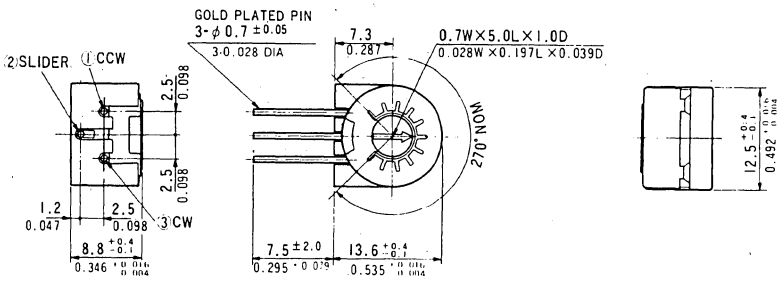


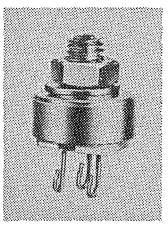
RJ-13P
Top ajustment



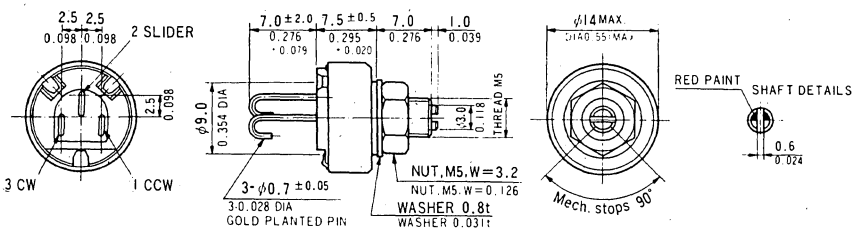


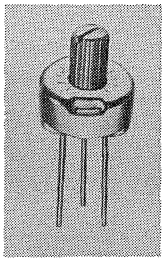
RJ-13S
Side adjustment



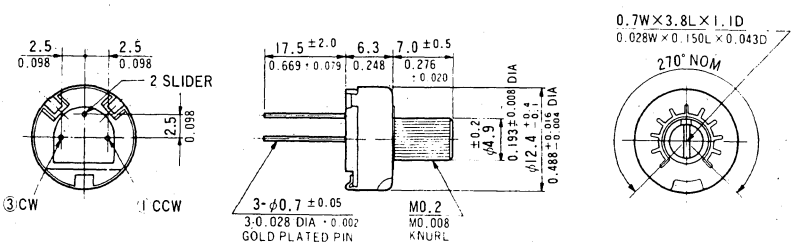


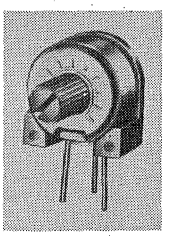
RJ-13B
Panel mount



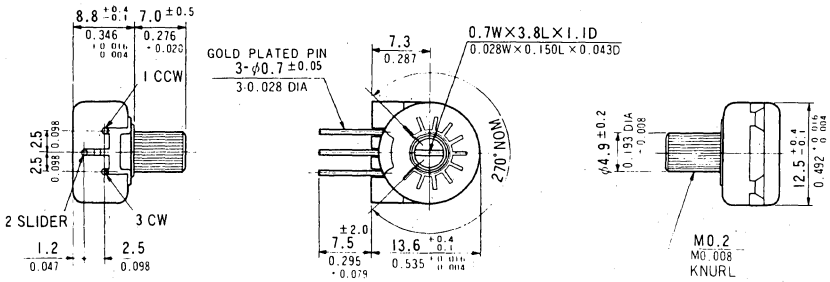


RJ-13PR
Top adjustment





RJ-13SR
Side adjustment



7 Cermet Trimmers

SERIES CT & TM

Multiturn Cermet Trimmers

STANDARD SPECIFICATIONS

ELECTRICAL

Item \ Model No.	CT-20	CT-9	TM-7
Resistance range	10Ω~5MΩ		50Ω~2MΩ
Resistance tolerance	±10%		
Power ratings	0.5W (70°C) 0W (125°C)		
Max input voltage	300V DC or power rating, whichever is smaller.		
Max. wiper current	100mA or power rating, whichever is smaller.		
Electrical continuity	Continuous full mechanical range.		
End resistance, max.	1% or 2Ω, whichever is greater.		
Resolution	Essentially infinite		
C.R.V., max. (MIL-R-22097)	1% or 3Ω, whichever is greater.		
Operating temp. range	−55°C ~ +125°C		
Temp. coefficient, max. (−55°C~+125°C)	50Ω ~ 2MΩ ····· ±100ppm/°C 10Ω, 20Ω, 5MΩ ····· ±250ppm/°C		
Insulation Resistance, min.	1,000 MΩ (DC 500V)		
Dielectric strength	600 Vrms (1 minute)	900 Vrms (1 minute)	

MECHANICAL

Item \ Model No.	CT-20	CT-9	TM-7
Mechanical adjustment	15 turns	18 turns	3 turns
Shaft torque, max.	360 g-cm		200 g-cm
Mechanical stop	Clutch action		
Terminal strength, min.	900 g	1 kg	
Rotational life	200 cycles		
	(10Ω~200Ω △R/R≦(0.5Ω+3%)) (500Ω~5MΩ △R/R≦(0.5Ω+2%))		(△R/R≦ (2Ω+3%))
Style	P, X	P, W, X	P, W, S, X

ENVIRONMENTAL (MIL-R-22097)

Thermal shock	−65°C~+125°C, (△R/R≦1%) (S.S.≦1%)	
Humidity	80~98% RH, 10 cycles, 240 hrs.,	
	(△R/R≦1%)	(△R/R≦2%)
Shock	100G, (△R/R≦1%) (S.S.≦1%)	
Vibration	20G, 10~2,000Hz, (△R/R≦1%) (S.S.≦1%)	
Load life	70°C, Rated power, 1,000 hrs.	
	(△R/R≦2%) (S.S.≦1%)	(△R/R≦3%) (S.S.≦1%)
Low temperature operation	−55°C, 2 hrs.,	
	(△R/R≦1%) (S.S.≦2%)	(△R/R≦2%) (S.S.≦2%)
High temperature exposure	125°C, 250 hrs.,	
	(△R/R≦2%) (S.S.≦2%)	(△R/R≦3%) (S.S.≦2%)
Immersion seal	No leaks @ 85°C	
Soldering heat	350°C, 3 sec. (△R/R≦1%)	

△R/R: Change in total resistance
S.S.: Setting stability

7 Cermet Trimmers

STANDARD RESISTANCE VALUES AND MAX. INPUT RATINGS

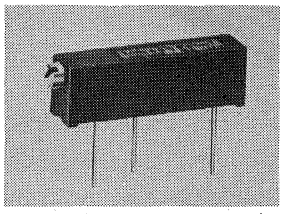
Resistance		Max, input voltage (V)			Max. wiper current (mA)		
(Ω)	Code	CT-20	CT-9	TM-7	CT-20	CT-9	TM-7
10	100	1.00			100		
20	200	2.00			100		
50	500	5.00			100		
100	101	7.07			70.7		
200	201	10.0			50.0		
500	501	15.8			31.6		
1K	102	22.4			22.4		
2K	202	31.6			15.8		
5K	502	50.0			10.0		
10K	103	70.7			7.07		
20K	203	100			5.00		
25K	253	112			4.48		
50K	503	158			3.16		
100K	104	224			2.24		
200K	204	300			1.50		
250K	254	300			1.20		
500K	504	300			0.60		
1M	105	300			0.30		
2M	205	300			0.15		
5M	505	300			0.06		

SERIES CT & TM

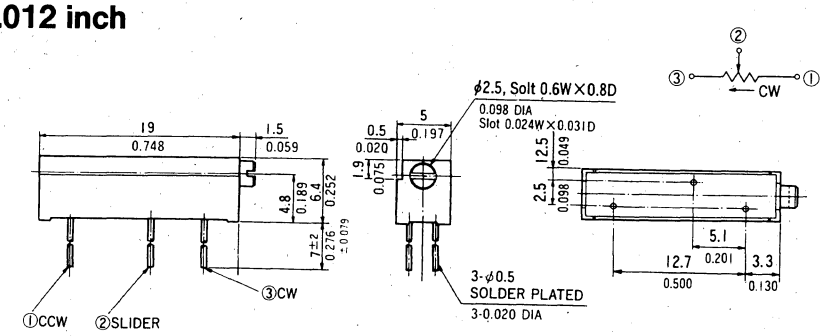
Multiturn Cermet Trimmers

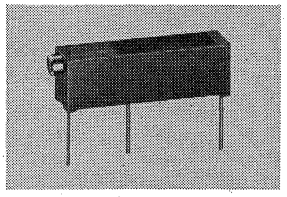
DIMENSIONS (in mm/inch)

CT-20 (15 turn)
Unspecified tolerance: ±0.3mm/±0.012 inch

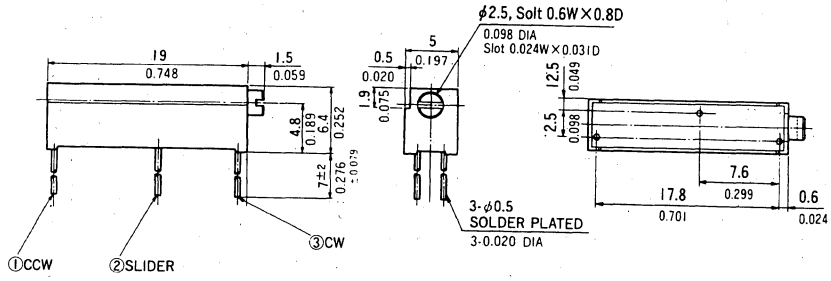


CT-20P
Side adjustment

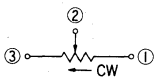


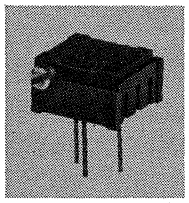


CT-20X
Side adjustment

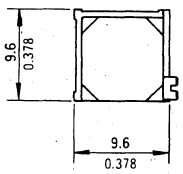


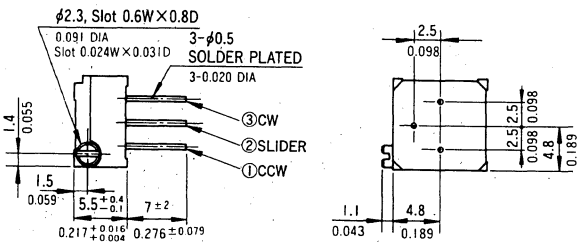
CT-9 (18 turn)
Unspecified tolerance: ±0.3mm/±0.012 inch

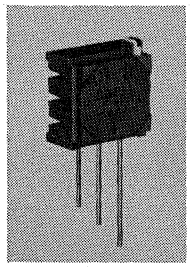




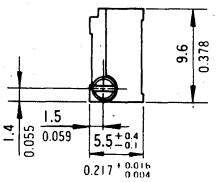
CT-9P
Side adjustment

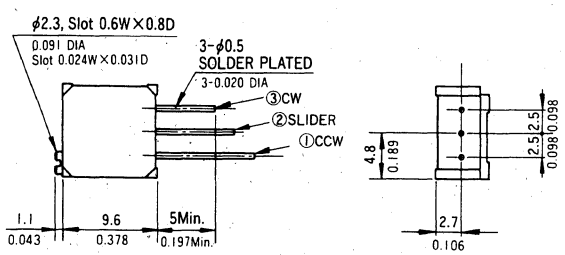




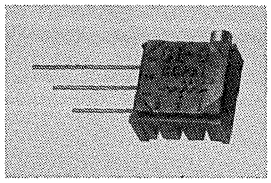


CT-9W
Top adjustment

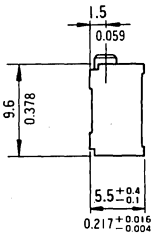


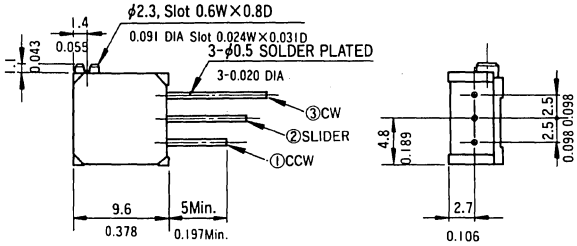


7 Cermet Trimmers

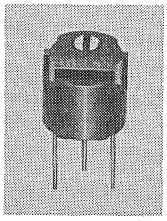


CT-9X
Side adjustment

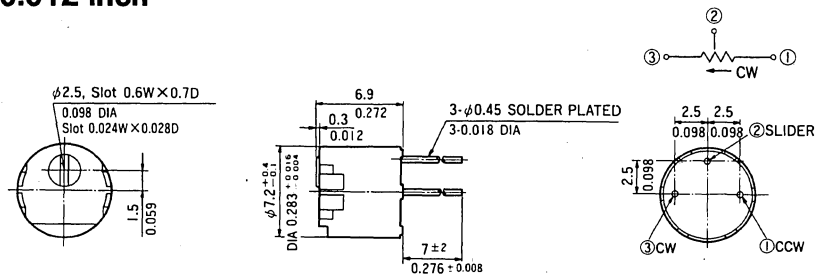


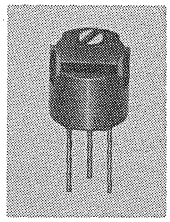


TM-7 (3 turn)
Unspecified tolerance: ±0.3mm/±0.012 inch

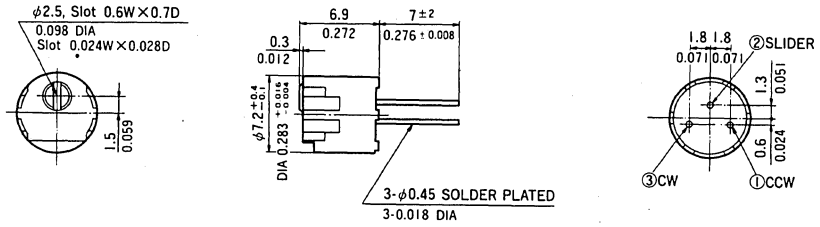


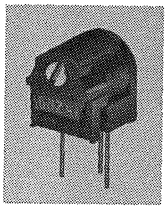
TM-7P
Top adjustment



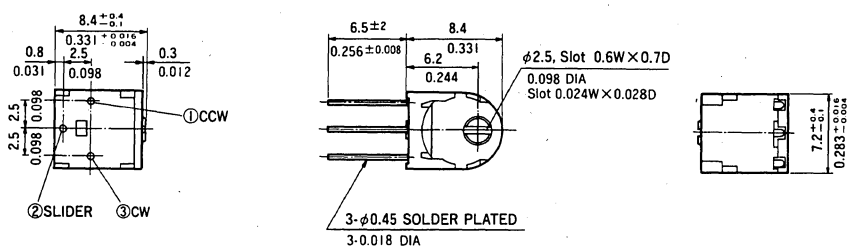


TM-7W
Top adjustment

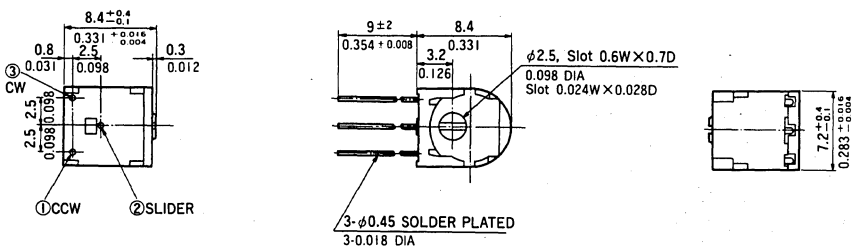




TM-7S
Side adustment



TM-7X
Side adjustment



7 Cermet Trimmers

Non-Linear Resistors
QUICK REFERENCE INDEX

VOLTAGE DEPENDENT RESISTORS (Metal Oxide Varistors) Listed under UL File #E98144 as a Recognized Component

Mepco/ Centralab Series	Style & Size Range Inches (mm)	R.M.S. Working Voltage	Temperature Coefficient @ 1mA, +25°C to +85°C	Insulation Voltage	Max. Non-Repetitive Transient Current	Page No.
592-593-594-595-596	.276–.886 O.D. (D-22.5) O.D.	14–680 All types	–0.065%/K All types	2500v	50–6500A	567

LIGHT DEPENDENT RESISTORS (LDR)

Mepco/ Centralab Series	Minimum Dark Resistance	Light Resistance	Maximum Dissipation at 40°C	Minimum Recovery Rate	Page No.
600	1MΩ to 10MΩ	30Ω to 300Ω	0.1w to 0.2w	200KΩ/sec	578

NEGATIVE-TEMPERATURE-COEFFICIENT (NTC) THERMISTORS

Mepco/ Centralab Series	Style and Size Range	Resistance Range (at 25°C)	B-Value (25°C-85°C) °K	Maximum Dissipation	Thermal† Time Constant	Operating Temperature Range (Zero Power)	Page No.
610	DISC 0.34" O.D.	4Ωto 1300Ω	2800 to 5450	1W	60 sec.	–25°C to +125°C	583
626 & 633	MINIATURE BEAD, & GLASS ENCAPS. 0.032"–0.063" Dia.	1kΩ to 1MegΩ	2075 to 4100	100mW		300°C max.	584
640	Temperature Sensing and Control	2.7kΩ to 470kΩ	3660 to 4570	250mW		200°C Max.	585
642	DISC/STUD 0.22" to 0.32" dia.	3.3Ω to 470kΩ	2675 to 4650	0.5W	17 to 20 sec.	–25°C to +125°C	608
644	DISC 0.630" to 0.638"	2Ω to 82Ω	2975 to 4650	1.5 to 7.4W	115 to 148 Sec.	–25°C to +155°C	610

STABLE LINE NTC TEMPERATURE SENSORS

Mepco/ Centralab Series	Style and Size Range	Resistance Range (at 25°C)	B-Value (25°C-75°C) °K	Maximum Dissipation	Thermal† Time Constant	Operating Temperature Range (Zero Power)	Page No.
645	Diameter 0.1" to 0.3"	1KΩ to 10KΩ	3965	0.1 to 0.75W	7 sec. to 43 sec.	–40°C to 110°C	611

†**Thermal Time Constant:** The time (in seconds) required for a thermistor to change 63.2% of the total difference between its initial and final body temperature, when subjected to step-function change in temperature under zero-power conditions.

POSITIVE-TEMPERATURE-COEFFICIENT (PTC) THERMISTORS

Mepco/ Centralab Series	Style and Size Range	Resistance Range at 25°C	Useful Maximum Resistance Range	Temperature Coefficient of Resistance Range	Switch* Temperature Range	Thermal† Time Constant Range	Operating Temperature Range (Zero Power)	Maximum Voltage	Page No.
660	DISC 0.24" O.D.	60Ω to 250Ω	3kΩ to 1.2MΩ	+5% to +40%/°C	+6° to +105°C	17 to 20 sec.	–25°C to +155°C	25VDC	615
661	DISC 0.34" O.D.	30Ω to 50Ω	1kΩ to 10kΩ	+9% to +75%/°C	+25° to +110°C	40 to 50 sec.	–10°C to +125°C	50VDC	617
662	DISC 0.42" to 0.50" O.D.	36Ω to 120Ω	120Ω to 45kΩ	+23% to +35%/°C	+80° to +115°C	80 to 130 sec.	–0°C to +155°C	265 VRMS	619
672 (Motor Protection)	SPECIAL FOR INSERTION IN MOTOR WINDING 0.16" O.D.	30Ω to 250Ω	1kΩ to 70kΩ	+18% to +35%/°C	+68° to +137°C	~14 sec.	–25°C to +180°C	15 VDC	621
672 (General Purpose)	DISC 0.12" O.D.	30Ω to 250Ω	10kΩ to 70kΩ	+18% to +38%/°C	+70° to +150°C	~9 sec.	–25°C to +190°C	25 VDC	623
672	Plastic Case	115Ω	15kΩ	+10%/°C	+97°C		–25° to +155°C	33v	625

Non-Linear Resistors
QUICK REFERENCE INDEX

DUAL DEGAUSSING PTC

Mepco/ Centralab Series	Maximum RMS Operating Voltage	Peak (Min) Inrush Current	Maximum Current After 30 sec.	Maximum Current After 3 min.	Page No.
662	145v to 265v	3.6A to 10A	5ma to 10 ma	1ma to 5ma	628

SELF REGULATING PTC HEATERS

Mepco/ Centralab Series	Maximum RMS Voltage Range	Regulated Temperature Range	Maximum Cold Start Power	Power Range After Regulation	Page No.
680	145v to 265v	115° to 245°C	~1Kw	10w to 20w	642

PTC—CURRENT OVERLOAD PROTECTION

Mepco/ Centralab Series	Resistance Range at 25°C	Maximum Operating Voltage	Trip Current (ma) at 10°C	No Trip Current (ma) at 55°C	Page No.
66.0...1 66.1...1	1.8 to 90Ω	56v	112 to 1360 ma	56 to 680 ma	650
66.0...3 66.1...3	3.5 to 1900Ω	265v	24 to 940 ma	12 to 470 ma	658

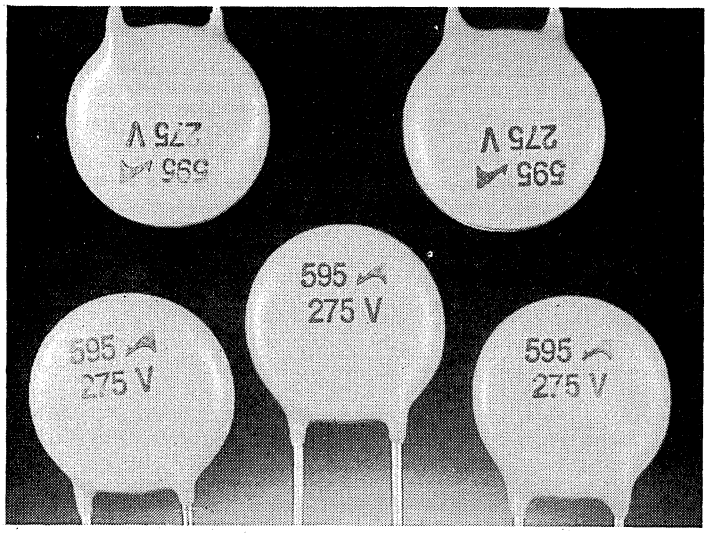
HUMIDITY SENSOR

Mepco/ Centralab Series	Capacitance at 25°C 43% R.H. and 100k Hz	Sensitivity 33 to 43% R.H.	Maximum Voltage ac or dc	Humidity Range	Page No.
691	122pF±15%	0.4±0.05pF/% R.H.	15v	10 to 90% R.H.	669

ZNO SERIES METAL OXIDE VARISTORS

Zinc Oxide Disc Voltage Dependent Resistor

Max A.C. Voltage (RMS, 14-680V) U.L. Listed File #E98144



DESCRIPTION

GENERAL

V(oltage) D(ependent) R(esistor)—varistors—have a high degree of non-linearity between resistance value and applied voltage. This characteristic is created by non-homogeneous metal oxide materials selected for rectifying action at the interface of two crystals. The electrical characteristic of the component is the product of a large number of these interstitial junctions, forming a complex network of series and parallel rectifying junctions.

The MEPCO/CENTRALAB product line uses ZnO (with doping) as the element material. ZnO offers much sharper V-I curves than other commonly used materials.

PHYSICAL

A disc of low beta metal oxide ceramic with two solid tinned copper wires. ZnO's are epoxy coated.

ELECTRICAL DATA, see also Table 2 and subsequent curves.

Climatic category	40/125/56
Insulation voltage	2500 V
Temperature coefficient of voltage (1 mA max.)	−0.065 %/K
Derating (see Fig. 2.)	

Mounting

The Varistor Series 592 and 593 are available on Tape & Reel.

Soldering

Solderability	max. 240°C, max. 4s
Resistance to heat	max. 265°C, max. 11s

Impact

free fall	39.4" (1000 mm)

Termination Strength

Tensile strength	2.25 lb (10 N)
Bending	1.12 lb (5 N)

Flammability Nonflammable

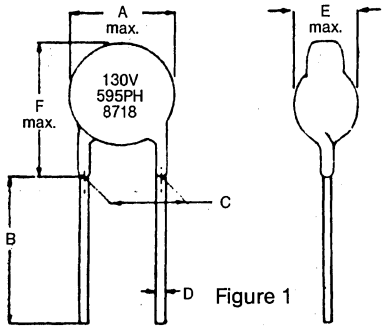


Figure 1

Table 1. Dimensions in inches (mm) for Figure 1

SERIES	A (MAX)	*E (MAX)	F (MAX)	B (MIN)	D (+10%)	C
592	0.276	0.228	0.433	0.787	0.024	0.197 $^{+0.031}_{-0.008}$
	(7)	(5.8)	(11)	(20)	(0.6)	(5.00) $(^{+0.8}_{-0.2})$
593	0.354	0.228	0.512	0.748	0.024	0.197 $^{+0.031}_{-0.008}$
	(9)	(5.8)	(13)	(19)	(0.6)	(5.00) $(^{+0.8}_{-0.2})$
594	0.492 (12.5)	0.315 (8)	0.630 (16)	0.669 (17)	0.032 (0.8)	0.300 +0.039 (7.62) (+1.0)
595	0.630 (16)	0.315 (8)	0.748 (19)	0.630 (16)	0.032 (0.8)	0.300 +0.039 (7.62) (+1.0)
596	0.886 (22.5)	0.315 (8)	1.004 (25.5)	0.630 (16)	0.032 (0.8)	0.300 +0.039 (7.62) (+1.0)

*Dimension 'E' is dependent on RMS Voltage rating (see Table 5).

ZNO SERIES METAL OXIDE VARISTORS

Zinc Oxide Disc

Fig. 2 Derating of max. DC and RMS working voltage with temperature.

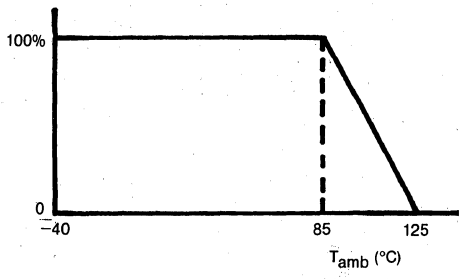


Table 2 Metal Oxide Varistor Performance Characteristics

Maximum Continuous Voltage		Voltage at 1 mA		*Mepco/Centralab Part Number	Maximum Clamping Voltage at Current (8 x 20 μS)		Maximum Energy (10 x 1000 μS)	Maximum Non-Repetitive Surge Current (8 x 20 μS)	Typical Capacitance at 1 KHz
V(RMS)	V(DC)	V(MIN)	V(MAX)		V	A	Joules	A	pF
14	18	20.0	24.0	#2322-592-.1406	51	2.0	0.20	50	900
				#2322-593-.1406	47	5.0	0.90	250	2000
				#2322-594-51406	43	5.0	2.00	500	4000
				#2322-595-51406	43	10.0	4.00	1000	15000
				#2322-596-51406	43	20.0	16.00	2000	17000
17	22	23.0	31.1	#2322-592-.1706	59	2.0	0.25	50	850
				#2322-593-.1706	57	5.0	1.00	250	1900
				#2322-594-51706	53	5.0	2.50	500	3000
				#2322-595-51706	53	10.0	5.00	1000	7500
				#2322-596-51706	50	20.0	17.00	2000	16000
20	26	29.5	36.5	#2322-592-.2006	67	2.0	0.30	50	800
				#2322-593-.2006	68	5.0	1.20	250	1800
				#2322-594-52006	64	5.0	3.00	500	2900
				#2322-595-52006	64	10.0	6.00	1000	7000
				#2322-596-52006	58	20.0	22.00	2000	15000
25	31	35.0	43.0	#2322-592-.2506	79	2.0	0.35	50	750
				#2322-593-.2506	79	5.0	1.50	250	1700
				#2322-594-52506	76	5.0	3.50	500	2800
				#2322-595-52506	76	10.0	7.20	1000	6500
				#2322-596-52506	77	20.0	26.00	2000	14000
30	38	42.0	52.0	2322-592-.3006	96	1.0	1.00	100	700
				2322-593-.3006	93	2.5	1.80	250	1600
				2322-594-53006	93	5.0	4.50	500	2700
				2322-595-53006	90	10.0	8.80	1000	6000
				#2322-596-53006	93	20.0	30.00	2000	13000
35	45	50.0	62.0	2322-592-.3506	123	1.0	1.10	100	560
				2322-593-.3506	115	2.5	2.30	250	1300
				2322-594-53506	110	5.0	5.60	500	2200
				2322-595-53506	105	10.0	10.40	1000	4800
				#2322-596-53506	110	20.0	35.00	2000	11000
40	56	61.0	75.0	2322-592-.4006	145	1.0	1.20	100	460
				2322-593-.4006	135	2.5	3.00	250	1000
				2322-594-54006	130	5.0	6.50	500	1800
				2322-595-54006	130	10.0	13.00	1000	3800
				#2322-596-54006	135	20.0	40.00	2000	7000
50	65	74.0	90.0	2322-592-.5006	145	5.0	1.90	400	370
				2322-593-.5006	140	10.0	4.20	1200	900
				2322-594-55006	140	25.0	8.40	2500	1500
				2322-595-55006	140	50.0	15.00	4500	3100
				#2322-596-55006	135	100.0	27.00	6500	5500
60	85	90.0	110.0	2322-592-.6006	165	5.0	2.20	400	290
				2322-593-.6006	165	10.0	5.40	1200	700
				2322-594-56006	165	25.0	10.00	2500	1200
				2322-595-56006	165	50.0	20.00	4500	2500
				#2322-596-56006	165	100.0	30.00	6500	4800
75	100	108.0	132.0	2322-592-.7506	190	5.0	2.70	400	240
				2322-593-.7506	200	10.0	6.30	1200	580
				2322-594-57506	200	25.0	12.00	2500	1000
				2322-595-57506	200	50.0	22.00	4500	2000
				#2322-596-57506	200	100.0	40.00	6500	3800
95	125	135.0	165.0	2322-592-.9506	230	5.0	3.40	400	180
				2322-593-.9506	250	10.0	8.00	1200	450
				2322-594-59506	250	25.0	16.00	2500	800
				2322-595-59506	250	50.0	30.00	4500	1500
				#2322-596-59506	250	100.0	50.00	6500	3000
130	170	185.0	225.0	2322-592-.1316	310	5.0	4.70	400	130
				2322-593-.1316	340	10.0	11.40	1200	320
				2322-594-51316	340	25.0	20.00	2500	580
				2322-595-51316	380	50.0	38.00	4500	1050
				#2322-596-51316	325	100.0	70.00	6500	2000

Maximum Continuous Voltage		Voltage at 1 mA		*Mepco/Centralab Part Number	Maximum Clamping Voltage at Current (8 x 20 μS)		Maximum Energy (10 x 1000 μS)	Maximum Non-Repetitive Surge Current (8 x 20 μS)	Typical Capacitance at 1 KHz
V(RMS)	V(DC)	V(MIN)	V(MAX)		V	A	Joules	A	pF
150	200	216.0	264.0	2322-592-.1516	395	5.0	5.50	400	110
				2322-593-.1516	400	10.0	13.00	1200	270
				2322-594-51516	400	25.0	25.00	2500	490
				2322-595-51516	400	50.0	45.00	4500	850
				#2322-596-51516	360	100.0	80.00	6500	1600
175	225	247.0	303.0	2322-592-.1716	410	5.0	6.20	400	90
				2322-593-.1716	455	10.0	15.00	1200	230
				2322-594-51716	455	25.0	30.00	2500	430
				2322-595-51716	455	50.0	55.00	4500	750
				#2322-596-51716	455	100.0	90.00	6500	1600
230	300	324.0	396.0	2322-592-.2316	560	5.0	8.00	400	70
				2322-593-.2316	600	10.0	20.00	1200	170
				2322-594-52316	600	25.0	35.00	2500	320
				2322-595-52316	600	50.0	70.00	4500	540
				#2322-596-52316	595	100.0	120.00	6500	1200
250	320	351.0	429.0	2322-592-.2516	600	5.0	8.60	400	60
				2322-593-.2516	650	10.0	21.00	1200	160
				2322-594-52516	650	25.0	40.00	2500	300
				2322-595-52516	650	50.0	72.00	4500	480
				#2322-596-52516	650	100.0	130.00	6500	1000
275	350	387.0	473.0	2322-592-.2716	695	5.0	9.80	400	55
				2322-593-.2716	710	10.0	23.00	1200	140
				2322-594-52716	710	25.0	45.00	2500	270
				2322-595-52716	710	50.0	75.00	4500	440
				#2322-596-52716	680	100.0	140.00	6500	900
300	385	423.0	517.0	2322-592-.3016	750	5.0	10.00	400	50
				2322-593-.3016	800	10.0	25.00	1200	130
				2322-594-53016	800	25.0	50.00	2500	240
				2322-595-53016	800	50.0	90.00	4500	400
				#2322-596-53016	775	100.0	150.00	6500	900
385	505	558.0	682.0	2322-592-.3816	1000	5.0	14.00	400	40
				2322-593-.3816	1025	10.0	28.00	1200	95
				2322-594-53816	1025	25.0	45.00	2500	180
				2322-595-53816	1025	50.0	85.00	4500	280
				#2322-596-53816	950	100.0	155.00	6500	750
420	560	612.0	748.0	2322-592-.4216	1100	5.0	16.00	400	35
				2322-593-.4216	1120	10.0	30.00	1200	85
				2322-594-54216	1120	25.0	46.00	2500	165
				2322-595-54216	1120	50.0	90.00	4500	250
				#2322-596-54216	1060	100.0	160.00	6500	600
460	615	675.0	825.0	2322-592-.4616	1200	5.0	20.00	400	30
				2322-593-.4616	1250	10.0	32.00	1200	75
				2322-594-54616	1240	25.0	50.00	2500	150
				2322-595-54616	1240	50.0	100.00	4500	225
				#2322-596-54616	1240	100.0	175.00	6500	420
510	670	738.0	902.0	#2322-594-55116	1355	25.0	55.00	2500	135
				#2322-595-55116	1355	50.0	110.00	4500	210
				#2322-596-55116	1280	100.0	190.00	6500	500
550	745	819.0	1001.0	#2322-594-55516	1500	25.0	60.00	2500	120
				#2322-595-55516	1500	50.0	120.00	4500	180
				#2322-596-55516	1500	100.0	215.00	6500	350
625	825	900.0	1100.0	#2322-594-56216	1650	25.0	95.00	2500	110
				#2322-595-56216	1650	50.0	135.00	4500	170
				#2322-596-56216	1650	100.0	230.00	6500	320
680	895	990.0	1210.0	#2322-594-56816	1815	25.0	105.00	2500	95
				#2322-595-56816	1815	50.0	150.00	4500	160
				#2322-596-56816	1815	100.0	250.00	6500	300

*For composition of the catalogue number, see Table 3
#Contact factory for availability

ZNO SERIES METAL OXIDE VARISTORS

Table 3. Metal Oxide Varistor Part Number Definition

2322	592	5	750	6
Philips Resistive Product	Varistor Disc Size	*Packaging/Lead Type	Maximum Continuous RMS Voltage	Ochre Epoxy Coating
	592 = 5 mm 593 = 7 mm 594 = 10 mm 595 = 14 mm 596 = 20 mm	0 = T & R/Straight 3 = T & R/Kinked 5 = Bulk/Straight 6 = Bulk/Kinked	140 = 14V 170 = 17V 200 = 20V 250 = 25V 300 = 30V 350 = 35V 400 = 40V 500 = 50V 600 = 60V 750 = 75V 950 = 95V 131 = 130V 151 = 150V 171 = 175V 231 = 230V 251 = 250V 271 = 275V 301 = 300V 381 = 385V 421 = 420V 461 = 460V 511 = 510V 551 = 550V 621 = 625V 681 = 680V	

*Series 594, 595, and 596 are only available as type 5 and 6

TAPE AND REEL DIMENSIONS STYLES 592 & 593

Dimensions of tape

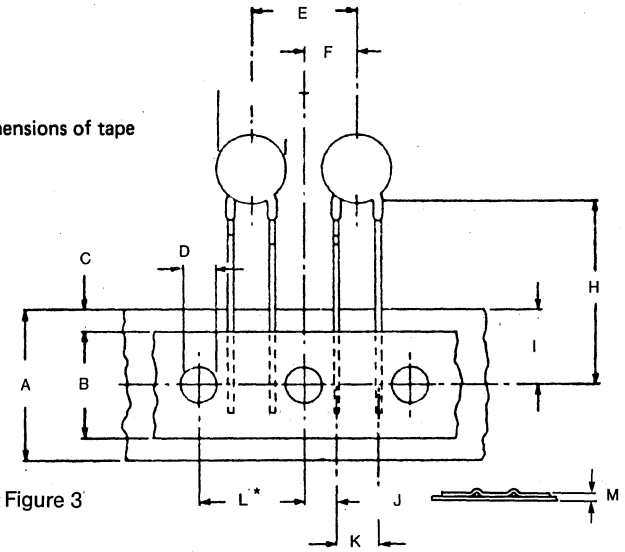


Figure 3

Table 4. Dimensions in inches (mm) for Figure 3

A	B (MIN)	C (MAX)	D	E	F (MAX)
0.709 (18)	0.492 (12.5)	0.118 (3)	0.157 ±0.012 (4) (±0.3)	0.500 ±0.039 (12.7) (±1.0)	0.250 ±0.051 (6.35) (±1.3)
H	**I**	**J**	**K**	***L**	**M**
0.787 (20)	0.354 (9)	0.152 ±0.028 (3.85) (±0.7)	0.197 (5)	0.500 ±0.012 (12.7) (±0.3)	0.028 ±0.008 (0.7) (±0.2)

*Cumulative pitch error = 0.039 inches (1 mm) per 20 pitch

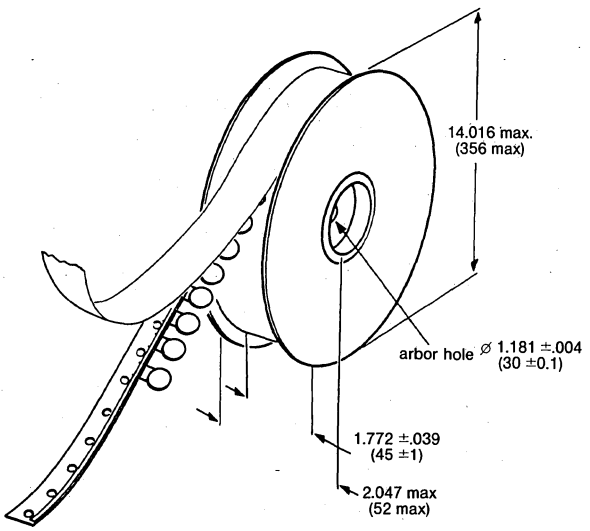


Figure 4 Dimensions of reel.

Table 5
Maximum thickness (E) in inches (mm) from Table 1

RMS VOLTAGE	SERIES 592, 593	SERIES 594, 595	SERIES 596
14-75	0.130 (3.3)	0.146 (3.7)	0.165 (4.2)
95	0.138 (3.5)	0.154 (3.9)	0.173 (4.4)
130	0.150 (3.8)	0.165 (4.2)	0.185 (4.7)
150	0.157 (4.0)	0.173 (4.4)	0.193 (4.9)
175	0.169 (4.3)	0.185 (4.7)	0.205 (5.2)
230-275	0.189 (4.8)	0.209 (5.3)	0.217 (5.5)
300	0.209 (5.3)	0.228 (5.8)	0.240 (6.1)
385	0.217 (5.5)	0.240 (6.1)	0.252 (6.4)
420	0.224 (5.7)	0.248 (6.3)	0.260 (6.6)
460	0.229 (5.8)	0.252 (6.4)	0.268 (6.8)
510	–	0.268 (6.8)	0.283 (7.2)
550	–	0.283 (7.2)	0.299 (7.6)
625	–	0.299 (7.6)	0.315 (8.0)
680	–	0.315 (8.0)	0.335 (8.5)

Table 6. Packaging configurations

Series	Packing	Quantity
2322-592-0....	T&R	1,500
2322-592-3....	T&R	1,500
2322-592-5....	Bulk	500
2322-592-6....	Bulk	500
2322-593-0....	T&R	1,500
2322-593-3....	T&R	1,500
2322-593-5....	Bulk	500
2322-593-6....	Bulk	500
2322-594-5....	Bulk	250
2322-594-6....	Bulk	250
2322-595-5....	Bulk	250
2322-595-6....	Bulk	250
2322-596-5....	Bulk	50
2322-596-6....	Bulk	50

ZNO SERIES METAL OXIDE VARISTORS

Electrical characteristics

Varistor characteristics are measured at high currents and high energy levels using an exponentially decaying waveform, as shown in Fig. 5, representative of lightning surges and the discharge of stored energy in reactive circuits. Based on CECC recommendations, the standard waveform used for current and voltage rating measurements has a virtual front duration of 8μs and an impulse duration of 20 μs. It is therefore called the 8/20 μ waveform.

For energy rating measurements, a longer duration waveform (the 10/1000 μs waveform) having exactly the same format as Fig. 5 is used.

Voltage-current characteristics for each varistor series are shown in Figs. 6 to 19.

t_1	t_2
8μs	20μs
10μs	1000μs

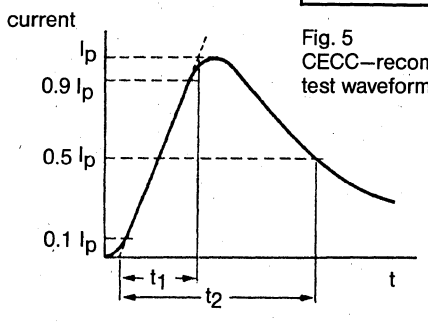


Fig. 5
CECC—recommended test waveform

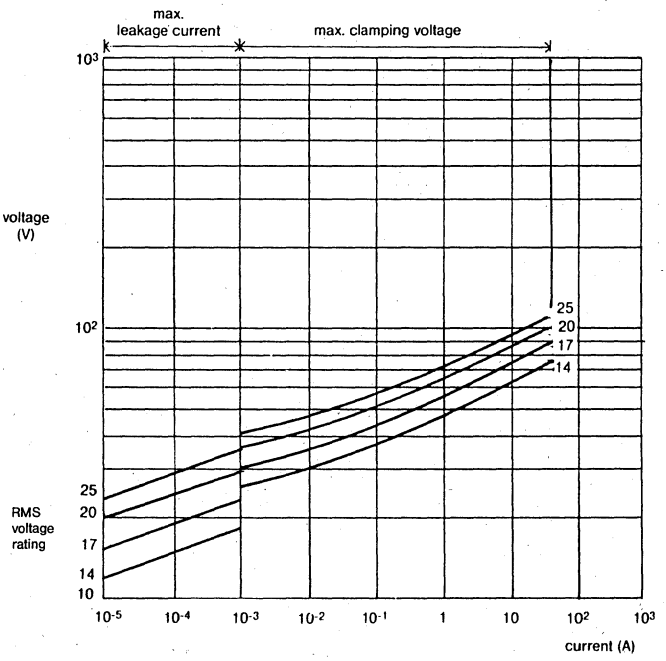


Fig. 6
V-I characteristics, 592 series, 14 to 25 V

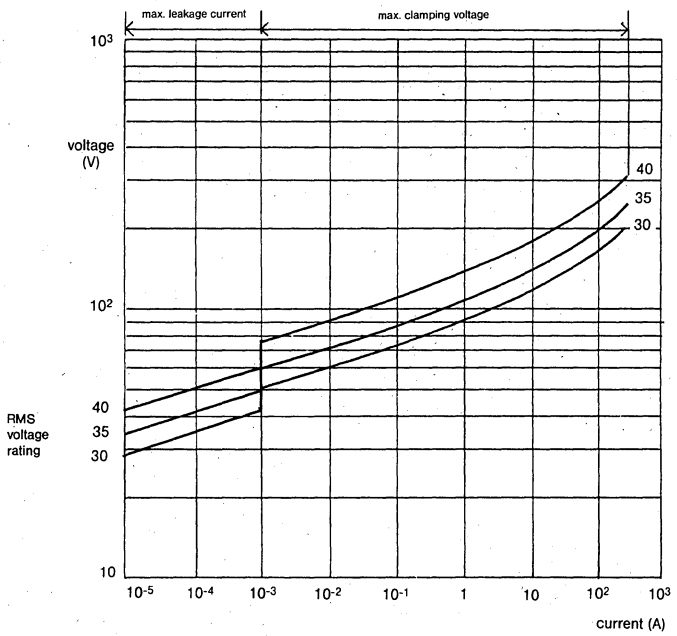


Fig. 7
V-I characteristics, 592series, 30 to 40 V

ZNO SERIES METAL OXIDE VARISTORS

Zinc Oxide Disc

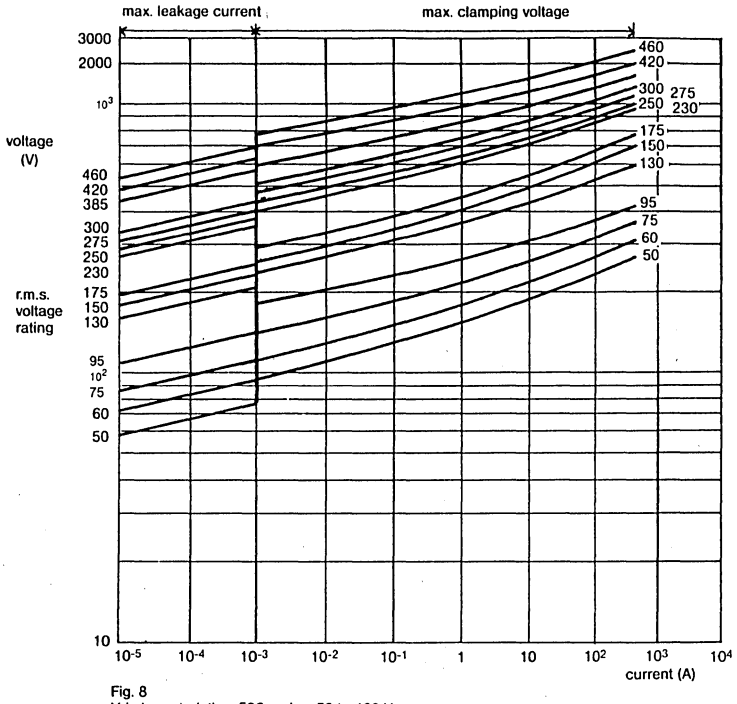


Fig. 8
V-I characteristics, 592 series, 50 to 460 V

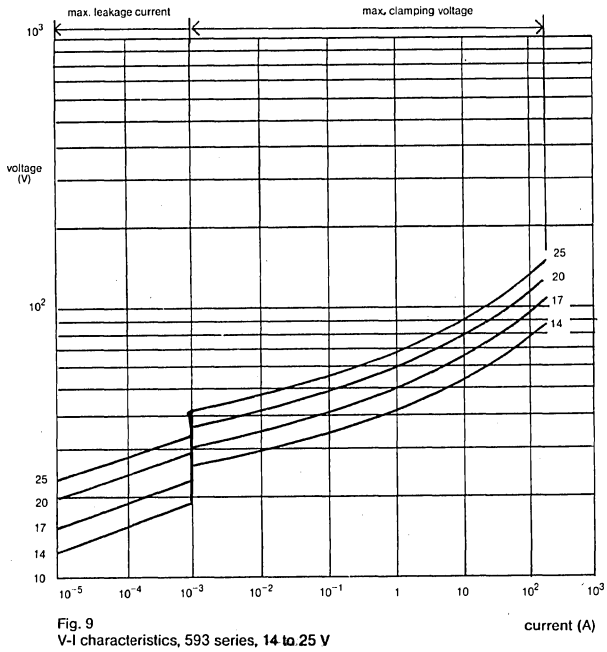


Fig. 9
V-I characteristics, 593 series, 14 to 25 V

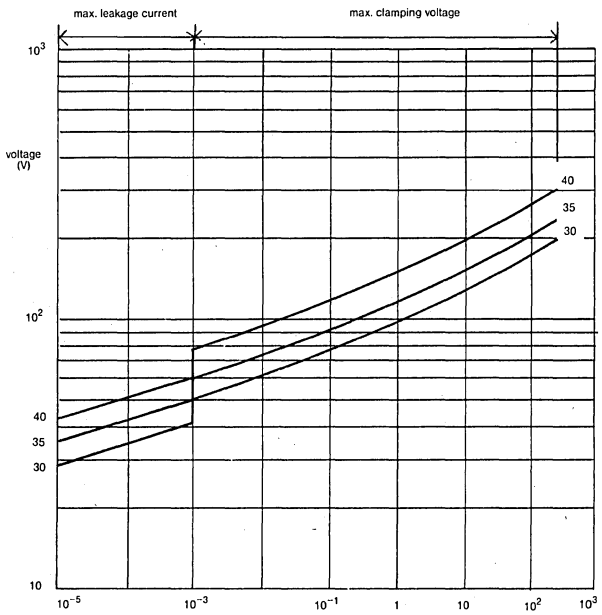


Fig. 10
V-I characteristics, 593 series, 30 to 40 V

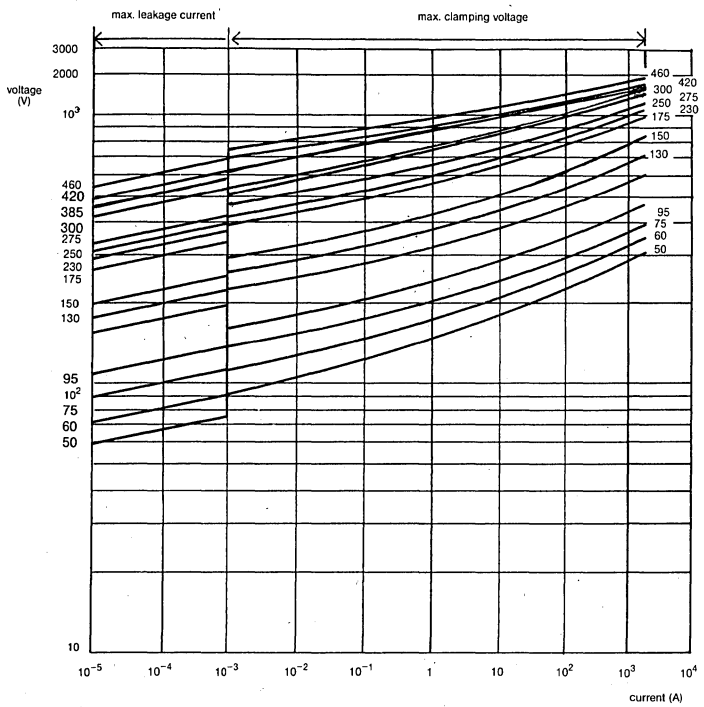


Fig. 11
V-I characteristics, 593 series, 50 to 460 V

ZNO SERIES METAL OXIDE VARISTORS

Zinc Oxide Disc

594 SERIES

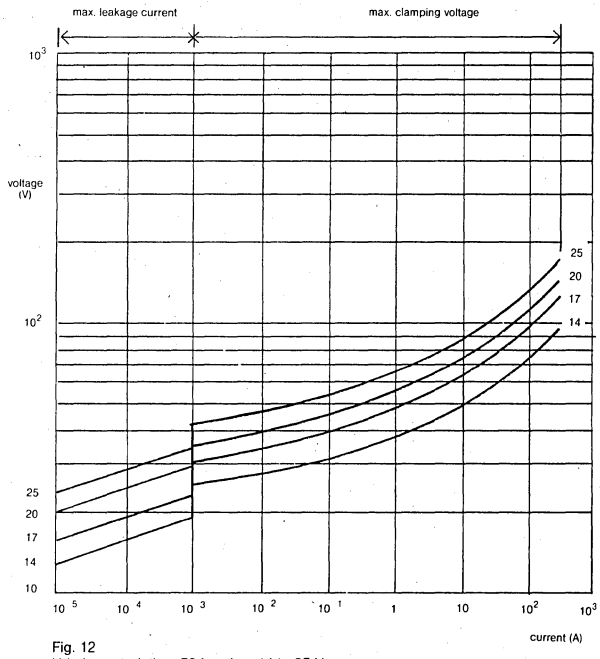


Fig. 12
V-I characteristics, 594 series, 14 to 25 V

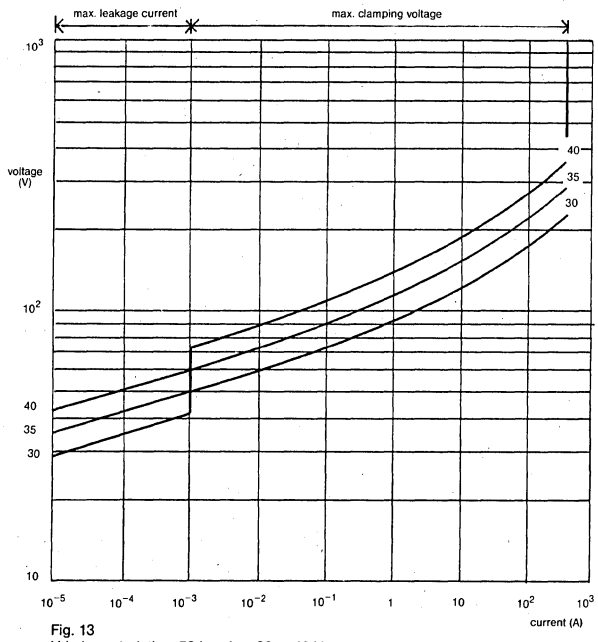


Fig. 13
V-I characteristics, 594 series, 30 to 40 V

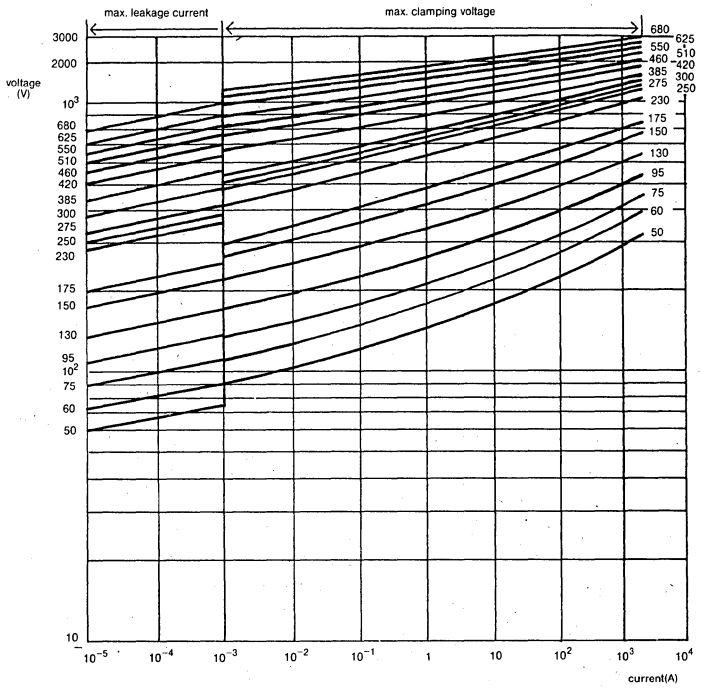


Fig. 14
V-I characteristics, 594 series, 50 to 680 V

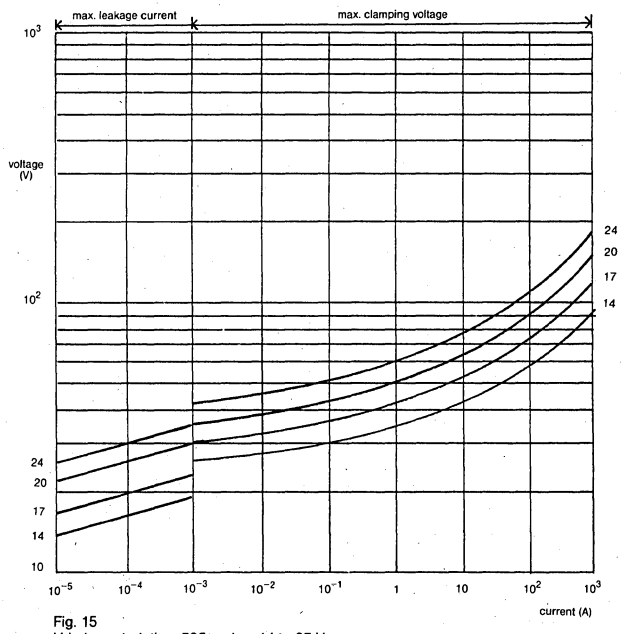


Fig. 15
V-I characteristics, 595 series, 14 to 25 V

ZNO SERIES METAL OXIDE VARISTORS

Zinc Oxide Disc

595 SERIES

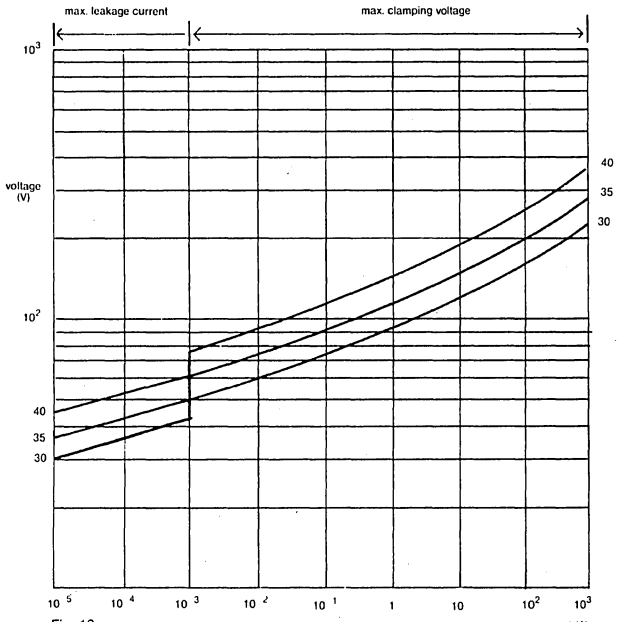


Fig. 16
V-I characteristics, 595 series, 30 to 40 V

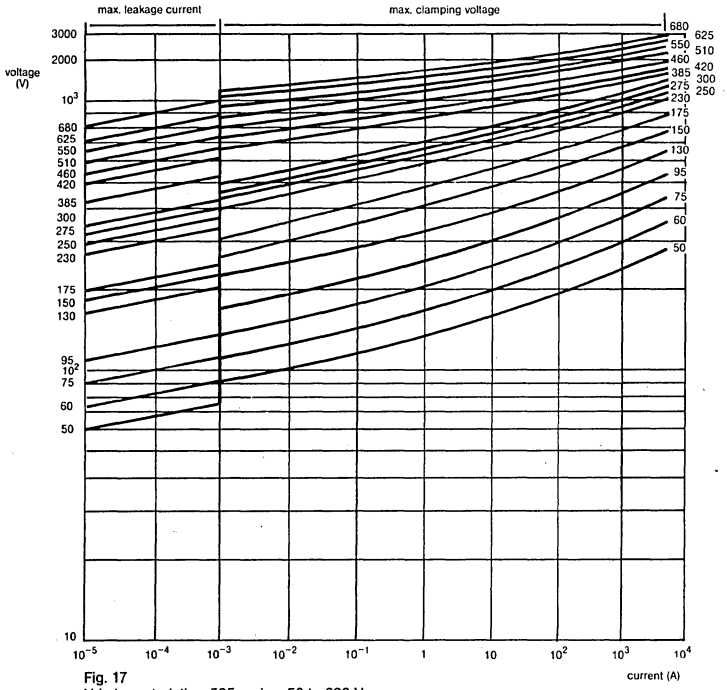


Fig. 17
V-I characteristics, 595 series, 50 to 680 V

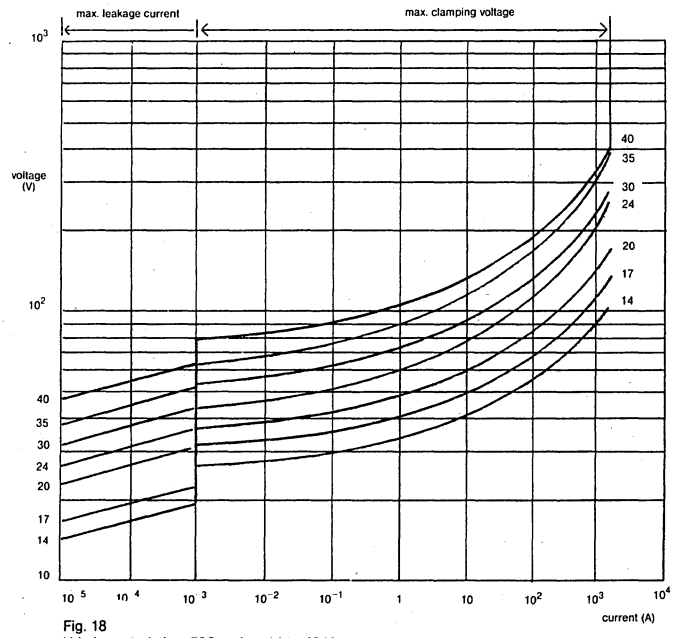


Fig. 18
V-I characteristics, 596 series, 14 to 40 V

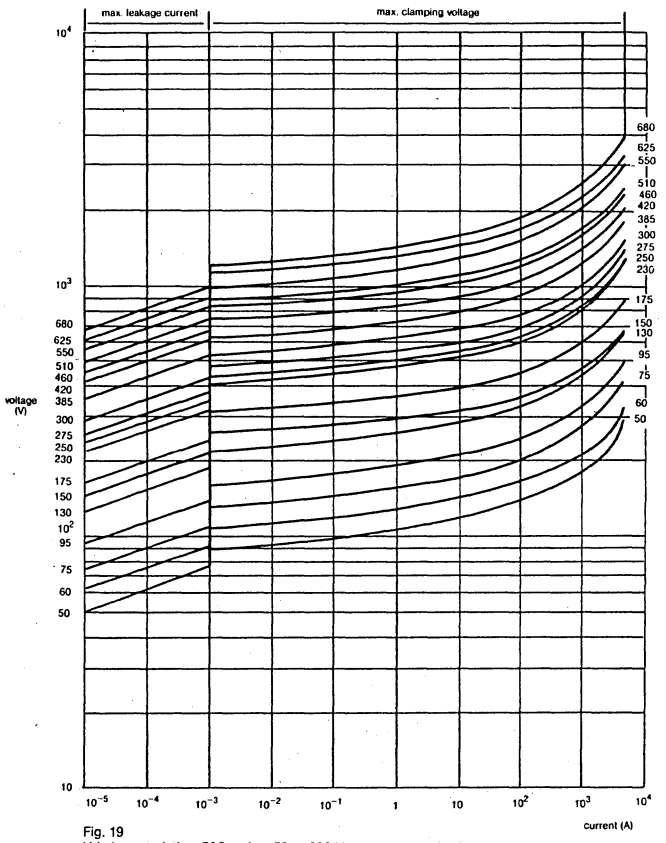


Fig. 19
V-I characteristics, 596 series, 50 to 680 V

8 Non-Linear Resistors

ZNO SERIES METAL OXIDE VARISTORS

Zinc Oxide Disc

MAX. APPLICABLE TRANSIENT CURRENT AS A FUNCTION OF IMPULSE DURATION

592 SERIES

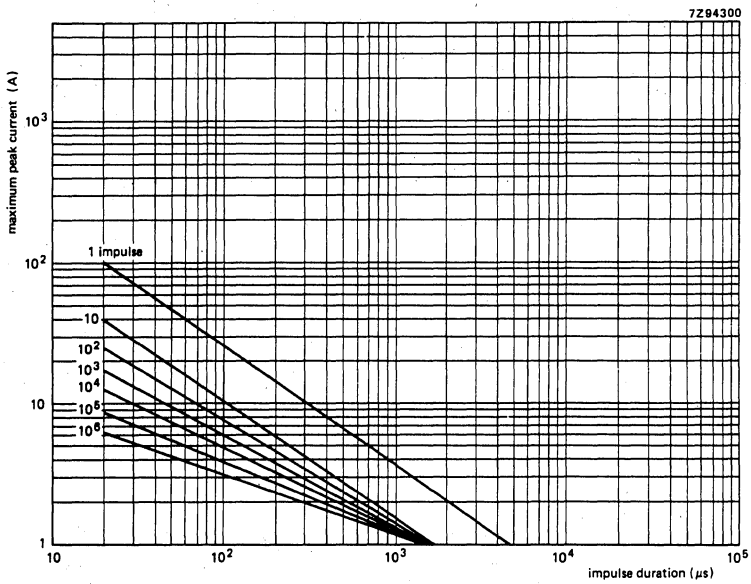


Fig. 20 Max. applicable transient current as a function of impulse duration, 14/40V, 592 series.

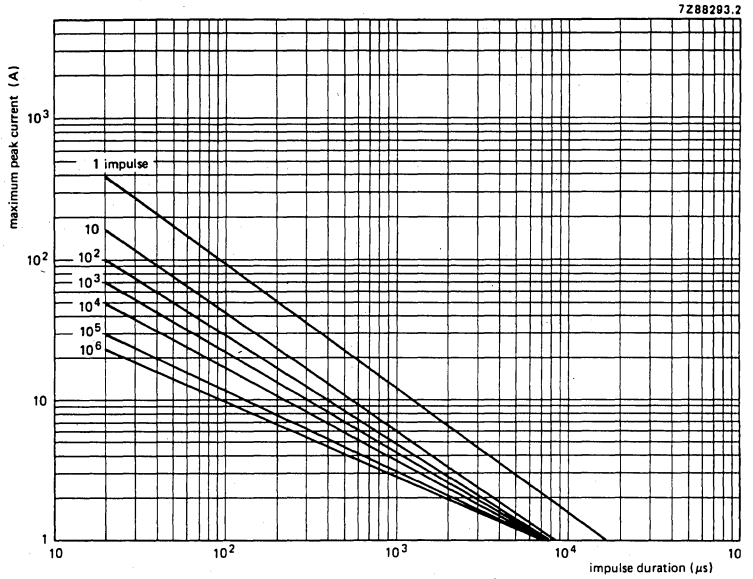


Fig. 21 Max. applicable transient current as a function of impulse duration, 50/460V, 592 series.

593 SERIES

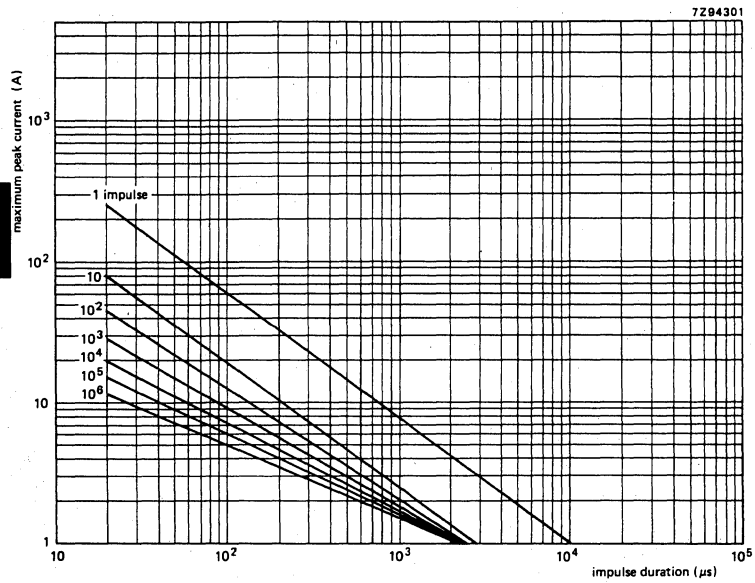


Fig. 22 Max. applicable transient current as a function of impulse duration, 14/40V, 593 series.

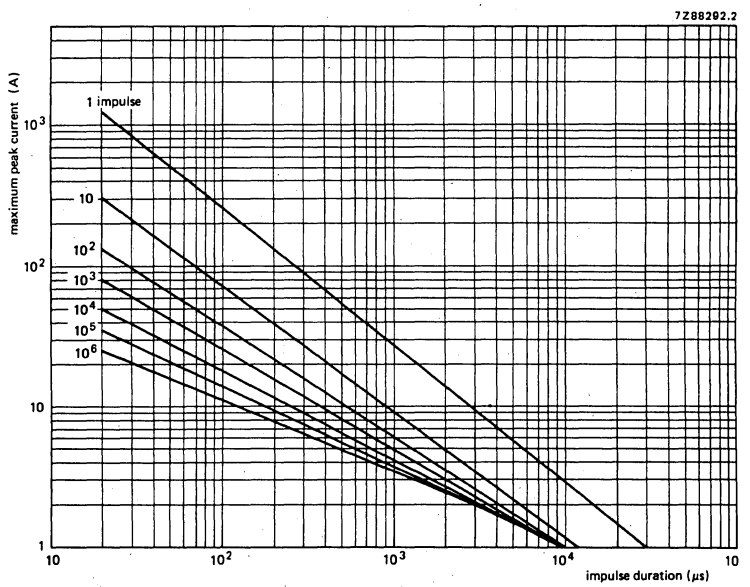


Fig. 23 Max. applicable transient current as a function of impulse duration, 50/460V, 593 series.

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MAX. APPLICABLE TRANSIENT CURRENT AS A FUNCTION OF IMPULSE DURATION

594 SERIES

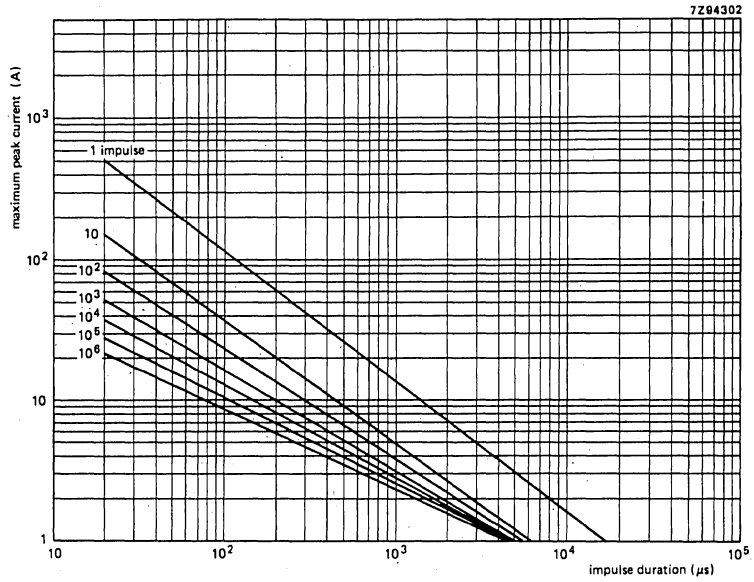


Fig. 24 Max. applicable transient current as a function of impulse duration, 14/40V, 594 series.

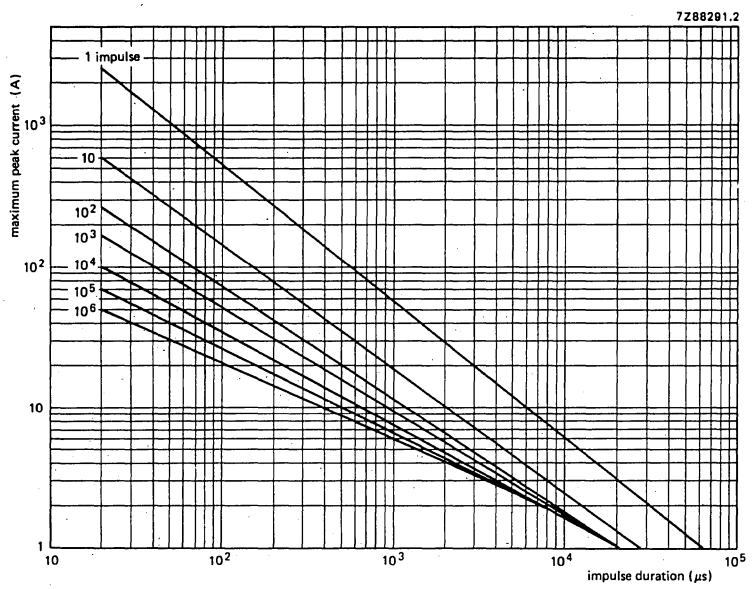


Fig. 25 Max. applicable transient current as a function of impulse duration, 50/680V, 594 series.

ZNO SERIES METAL OXIDE VARISTORS

Zinc Oxide Disc

MAX. APPLICABLE TRANSIENT CURRENT AS A FUNCTION OF IMPULSE DURATION

595 SERIES

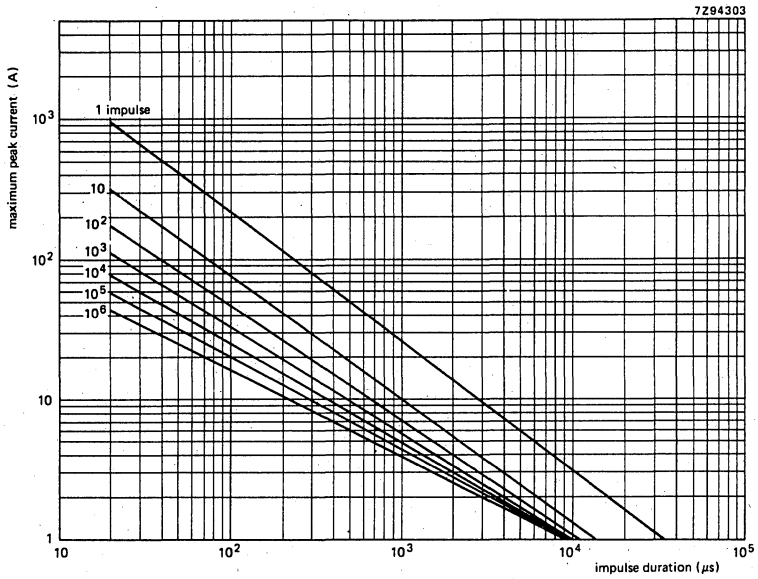


Fig. 26 Max. applicable transient current as a function of impulse duration, 14/40V, 595 series.

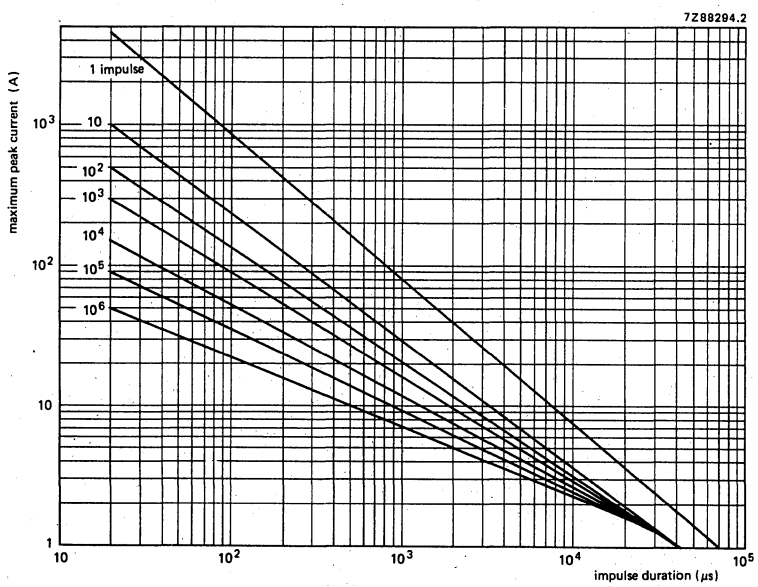


Fig. 27 Max. applicable transient current as a function of impulse duration, 50/680V, 595 series.

8 Non-Linear Resistors

MAX. APPLICABLE TRANSIENT CURRENT AS A FUNCTION OF IMPULSE DURATION

596 SERIES

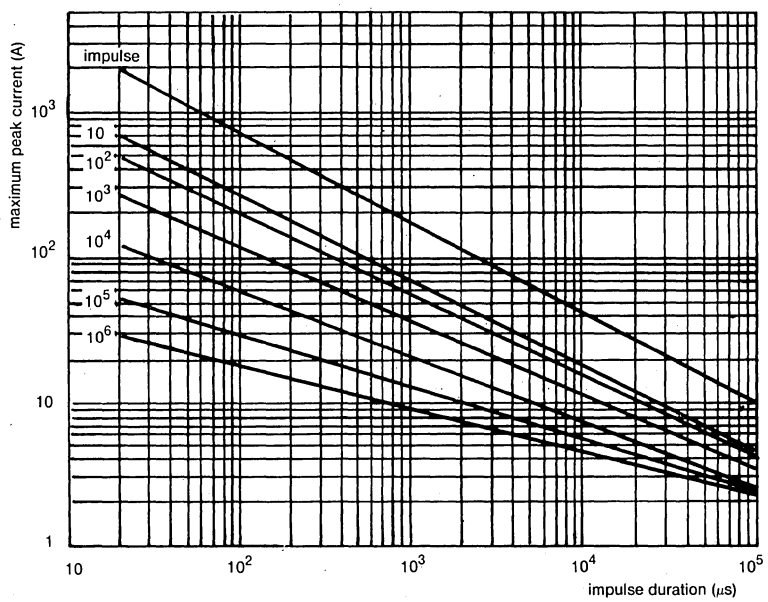


Fig. 28 Max. applicable transient current as a function of impulse duration, 14/40V, 596 series.

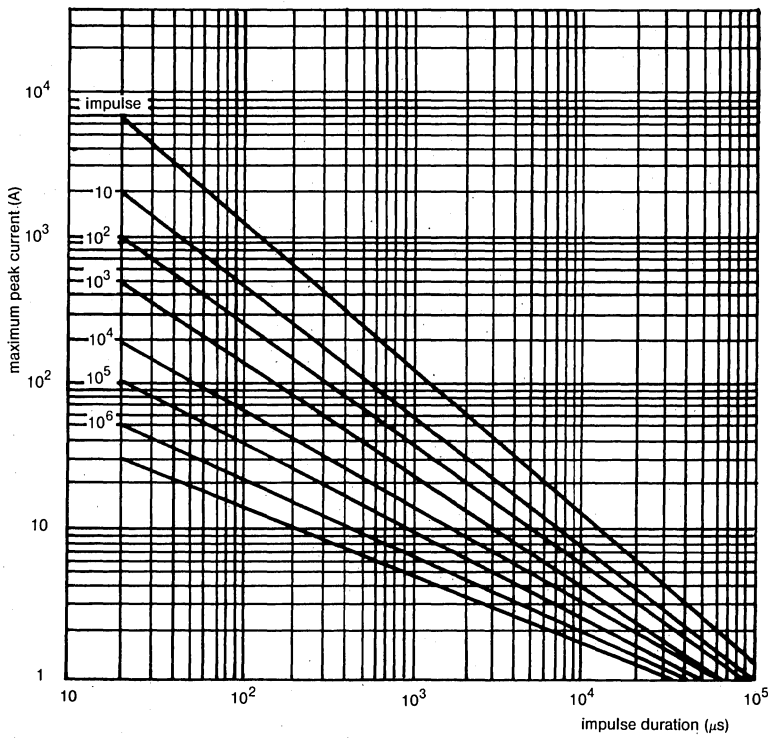
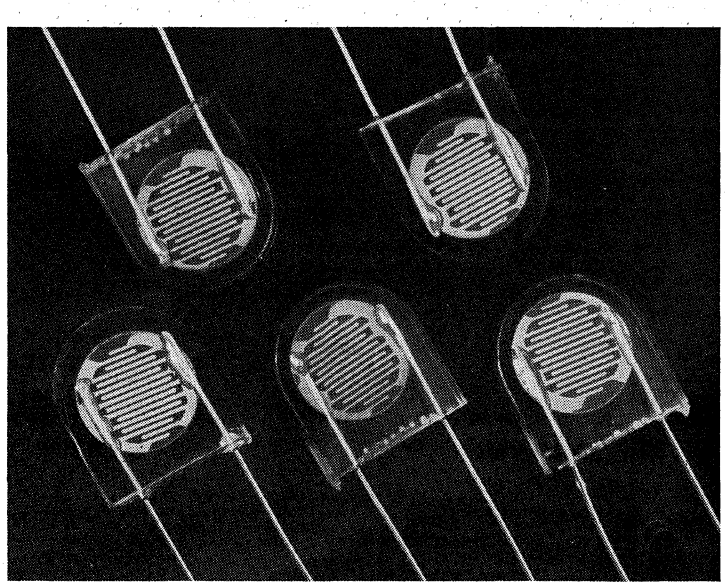


Fig. 29 Max. applicable transient current as a function of impulse duration, 50/680V, 596 series.

SERIES 600

Light Dependent Resistors



DESCRIPTION

GENERAL

Light dependent resistors (LDRs) are made from cadmium sulphide containing no or very few free electrons when not illuminated. Its resistance is then quite high. When it absorbs light, electrons are liberated and the conductivity of the material increases. Cadmium sulphide is therefore a photo-conductor. The approximate relationship between the resistance and illumination is:

$$R = A.\ L^{\alpha}$$

where: R = resistance in Ω
L = illumination in lux
A and α are constants.

The value of α depends on the cadmium sulphide used and on the manufacturing process. Values around 0.7 to 0.9 are quite common. The relationship between the resistance and the illumination is shown in the graph of Fig. 1.

SPECTRAL RESPONSE

The resistors are only light dependent over a limited range of wavelengths. LDRs have their maximum response at about 680 nm.

TEMPERATURE DEPENDENCY

Electrons can be excited not only by photons but also by thermal agitation. The dark resistance is therefore not infinite at normal temperatures. It increases with the ambient temperature and can be decreased by cooling the device.

The temperature can also affect the resistance under illumination. At practical illumination levels and normal ambient temperatures the temperature coefficient is, however, very small and can be neglected.

RECOVERY RATE

When an LDR is brought from a certain illumination level into total darkness, the resistance does not increase immediately to the dark value. The recovery rate is specified in kΩ/s and is more than 200 kΩ/s (during the first 20 seconds starting at a light level of 1,000 lux).

The recovery rate is much greater in the reverse direction, e.g. going from darkness to an illumination level of 300 lux, it takes less than 10 ms to reach a resistance which corresponds with a light level of 400 lux.

SURVEY

minimum dark resistance	light resistance	maximum dissipation at 40°C	ambient temperature range	catalogue number
10 MΩ	75 to 300Ω			2322 600 93001
1 MΩ	max. 110Ω	0,1W	−30 to +60°C	2322 600 93002
10 MΩ	75 to 300Ω			2322 600 94001
10 MΩ	75 to 300Ω			2322 600 95001
10 MΩ	max. 250Ω			2322 600 95003
1 MΩ	max. 110Ω	0,2W	−20 to +60°C	2322 600 95006
10 MΩ	30 to 96Ω			2322 600 95008
10 MΩ	150 to 300Ω			2322 600 95009
Recovery rate			min. 200 kΩ/s	

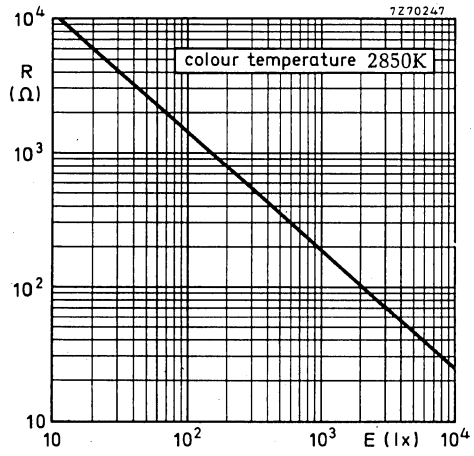
DESCRIPTION

Disc shaped resistors made of cadmium sulphide. They are sealed and have two solid tinned copper wires.

APPLICATION

LDRs are intended for non-critical on/off applications, in which a lamp or a relay is operated either directly (low power) or via a suitable amplifier (high power).

Fig. 1 TYPICAL CHARACTERISTICS



Resistance as a function of illumination.

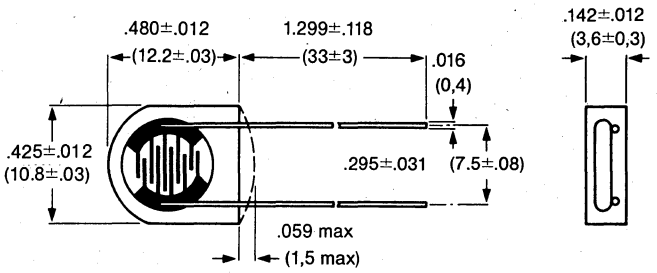
SERIES 600
Light Dependent Resistors

2322 600 93001
2322 600 93002

QUICK REFERENCE DATA

Dark resistance R_D	2322 600 93001	>10 MΩ
	2322 600 93002	>1 MΩ
Light resistance R_L	2322 600 93001	75 to 300 Ω
	2322 600 93002	<110 Ω
Recovery rate		>200 kΩ/s
Maximum dissipation at 40°C		0,1 W
Ambient temperature range		−30 to +60°C

MECHANICAL DATA—Inches (mm)
Outline drawing



ELECTRICAL DATA

Dark resistance R_D	2322 600 93001	min. 10 MΩ
	2322 600 93002	min. 1 MΩ
Light resistance R_L	2322 600 93001	75 to 300 Ω
	2322 600 93002	max. 110 Ω
Recovery rate		min. 200 kΩ/s
Dissipation at 40°C		max. 0,1 W
Capacitance at 1000 Hz		max. 8 pF
Repetitive peak voltage, not exceeding max. dissipation		max. 150 V
Dielectric withstanding peak voltage between terminals and body		min. 200 V
Dielectric d.c. test voltage between terminals for 1 s in total darkness		200 V
Operating ambient temperature range		−30 to +60°C

PACKAGING
100 per box

Marking
None

Mass
0,75 g approximately

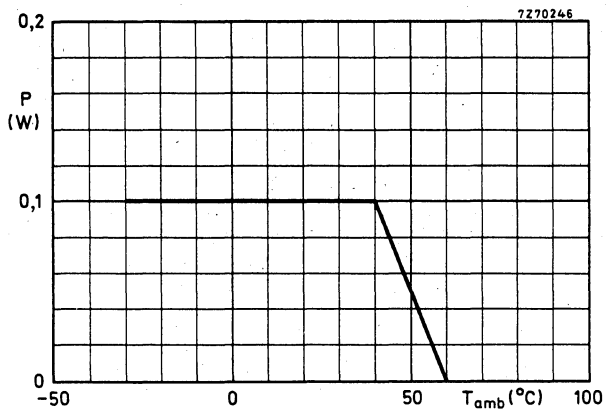
Mounting
In any position by soldering the leads at least .394 in. (10 mm) from the body.

Robustness of terminations

Tensile strength	1.12 lb. (5 N)
Bending	0.56 lb. (2,5 N)

Soldering

Solderability	max. 240°C, max. 4 s
Resistance to heat	max. 265°C, max. 11 s



Permissible dissipation as a function of ambient temperature.

8 Non-Linear Resistors

SERIES 600
Light Dependent Resistors

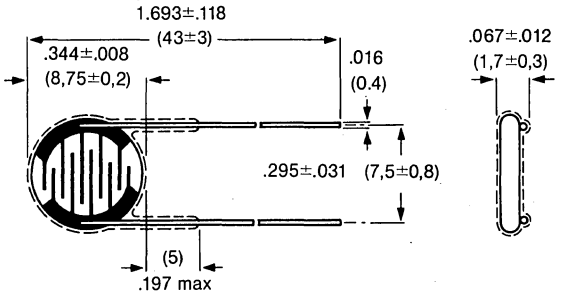
2322 600 94001

QUICK REFERENCE DATA

Dark resistance R_D	>10 MΩ
Light resistance R_L	75 to 300 Ω
Recovery rate	>200 kΩ/s
Maximum dissipation at 40°C	0,1 W
Ambient temperature range	−30 to +60°C

MECHANICAL DATA—Inches (mm)

Outline drawing



ELECTRICAL DATA

Dark resistance R_D	min. 10 MΩ
Light resistance R_L	75 to 300 Ω
Recovery rate	min. 200 kΩ/s
Dissipation at 40°C	max. 0,1 W
Capacitance at 1000 Hz	max. 8 pF
Repetitive peak voltage, not exceeding max. dissipation	max. 150 V
Dielectric withstanding peak voltage between terminals and body	min. 200 V
Dielectric d.c. test voltage between terminals for 1 s in total darkness	min. 200 V
Operating ambient temperature range	−30 to +60°C

PACKAGING

100 per box

Marking
None

Mass
0,35 g approximately

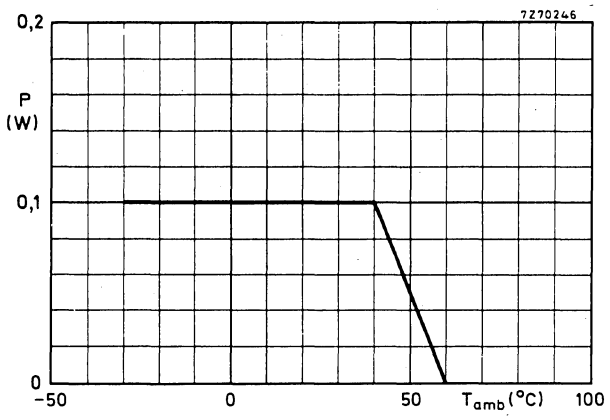
Mounting
In any position by soldering the leads at least .394 in. (10 mm) from the body.

Robustness of terminations

Tensile strength	1.12 lb. (5 N)
Bending	0.56 lb. (2,5 N)

Soldering

Solderability	max. 240°C, max. 4 s
Resistance to heat	max. 265°C, max. 11 s



Permissible dissipation as a function of ambient temperature.

8 Non-Linear Resistors

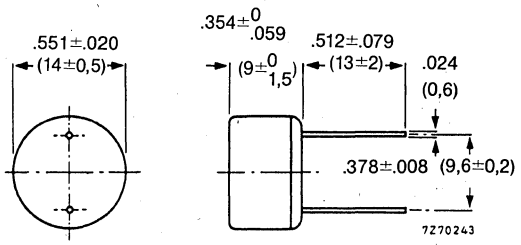
SERIES 600
Light Dependent Resistors

2322 600 9500

QUICK REFERENCE DATA

Dark resistance R_D	>10 MΩ 2322 600 95006 >1 MΩ
Light resistance R_L	30 to 300 Ω
Recovery rate	>200 kΩ/s
Maximum dissipation at 40°C	0,2 W
Ambient temperature range	−20 to +60°C

MECHANICAL DATA—Inches (mm)
Outline drawing



ELECTRICAL DATA

catalog number	resistance dark value R_D	resistance light value R_L
2322 600 95001	min. 10 MΩ	75 to 300Ω
95003	min. 10 MΩ	max. 250Ω
95006	min. 1 MΩ	max. 110Ω
95008	min. 10 MΩ	30 to 96Ω
95009	min. 10 MΩ	150 to 300Ω

Recovery rate	min. 200 kΩ/s
Dissipation at 40°C	max. 0,2 W
Capacitance at 1000 Hz	max. 6 pF
Repetitive peak voltage not exceeding max. dissipation	max. 110 V
Dielectric withstanding peak voltage between terminals and body	min. 150 V
Dielectric d.c. test voltage between terminals for 1 s in total darkness	150 V
Operating ambient temperature range	−20 to +60°C

PACKAGING
100 per box

Marking
Year and month of production is printed on the body in yellow.

Mass
1,3 g approximately.

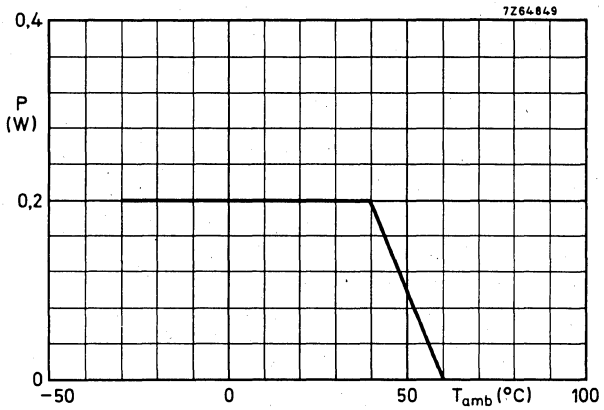
Mounting
In any position by soldering the leads at least .394 in. (10 mm) from the body.

Robustness of terminations

Tensile strength	2.25 lb. (10 N)
Bending	1.12 lb. (5 N)

Soldering

Solderability	max. 240°C, max. 4 s
Resistance to heat	max. 265°C, max. 11 s



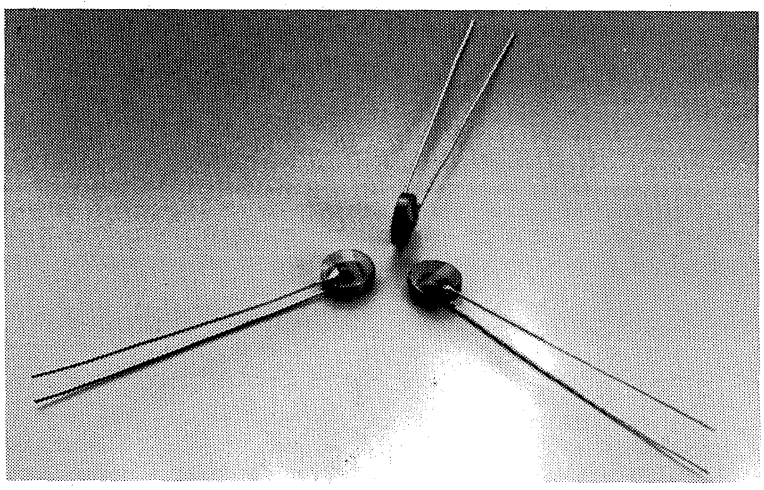
Permissible dissipation as a function of ambient temperature.

8 Non-Linear Resistors

MEPCO/CENTRALAB, INC. • P.O. Box 760, Mineral Wells, TX 76067 • 817-325-7871 • TWX 910-890-5855

Disc NTC Thermistors

−3% to −6% T.C. of R. 4 to 1300Ω at 25°C 1 Watt maximum



DESCRIPTION

Series 610 Thermistors present the equipment designer with a broad and uniform progression of characteristics, and a choice of cold-resistance in seven steps from 4 to 1300 ohms. This series is used in a virtually infinite variety of scientific, industrial, and consumer-appliance applications.

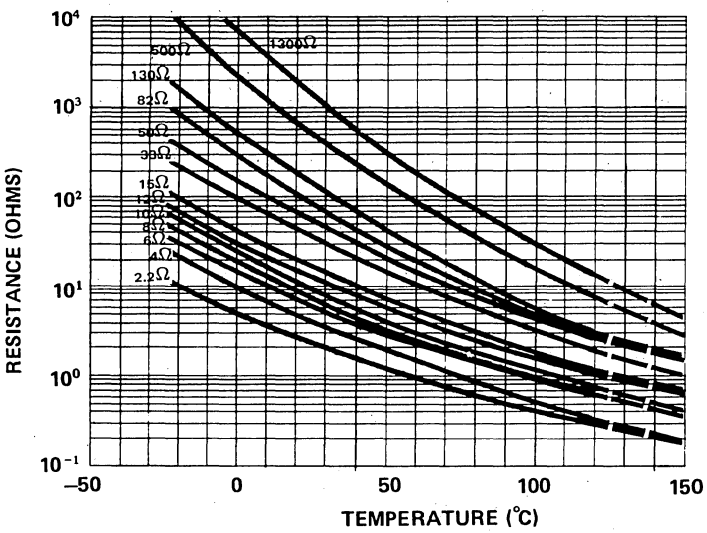
ELECTRICAL SPECIFICATIONS

Dissipation . . . . . 1 Watt, maximum
Dissipation Factor . . . approximately 10 mW/°C
Operating Temperature Range
at zero power . . . . . −25° to +125°C
at maximum power . . . . . +55°C max.

DIMENSIONS AND MARKING

As indicated in the table below, units are identified by color code bands.

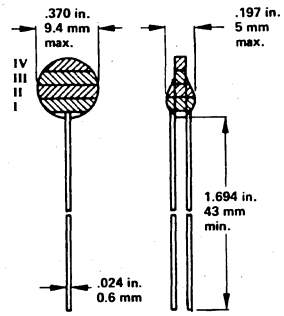
RESISTANCE vs TEMPERATURE



TYPICAL ELECTRICAL CHARACTERISTICS

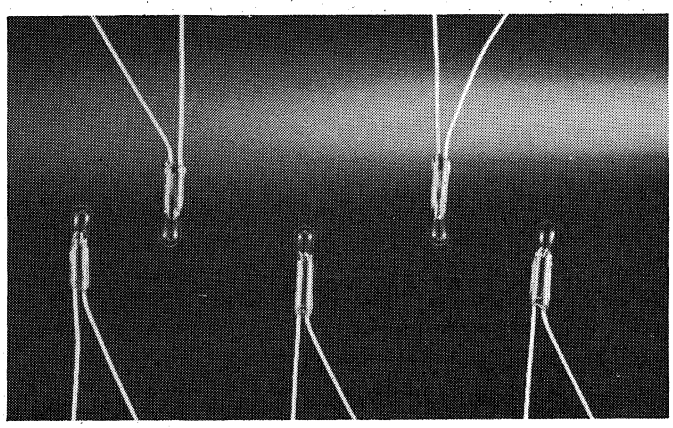
Resistance At 25°C (Ω)	$B_{25/85}$ ±5% (°K)	Temperature Coefficient (%/°C)	IDENTIFICATION MARKING and MEPCO/CENTRALAB PART NUMBER TINNED, SOLID COPPER LEADS			
			Color Code Band			Part Number*
			I	II	III	2322-
4	2800	−3.15	yellow	black	gold	610-11408
8	2900	−3.25	grey	black	gold	610-11808
15	3125	−3.40	brown	green	black	610-11159
33	3250	−3.65	orange	orange	black	610-11339
50	3300	−3.70	green	black	black	610-11509
130	4600	−5.15	brown	orange	brown	610-11131
500	5200	−5.85	green	black	brown	610-11501
1300	5450	−6.15	brown	orange	red	610-11132

*For tolerance of ±20°C. For ±10% tolerance, a silver band (band IV) is added, and second digit of part number become 2.—e.g., 610-12228.



SERIES 626 & 633

Miniature Bead NTC Thermistors



DESCRIPTION

Series 633 thermistors are naked miniature-bead units; Series 626 thermistors employ these same beads in a solid glass encapsulation, for use as a thermometer probe. Other versions (not listed below) include vacuum and air-filled glass encapsulated types. The range of resistance values and the resistance/temperature characteristics for all versions are the same as listed below, since all use the same NTC bead.

ELECTRICAL SPECIFICATIONS

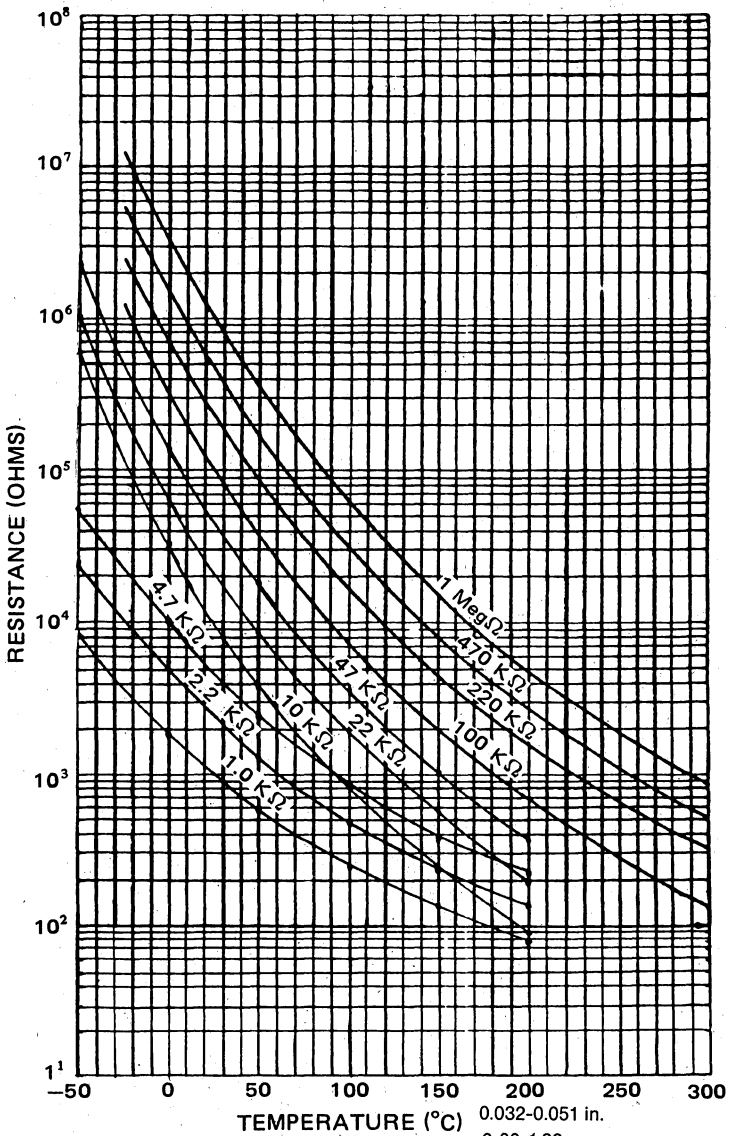
Resistance at 25°C 1K-1MegΩ
Resistance Tolerance . . . . . ±10%, ±5%
B-value at 25°C . . . . . 2075-4100°K (±5%)
Resistance Ratio (25°/125°) 7.25-37.54
Maximum Dissipation . . . . . 2.5 mW
Dissipation Factor . . . . . 0.8 mW/°C
Maximum Temperature (Tmax) . . . . . 300°C
Stability after 1000 hours at Tmax . . . . . <1%

TYPICAL ELECTRICAL CHARACTERISTICS

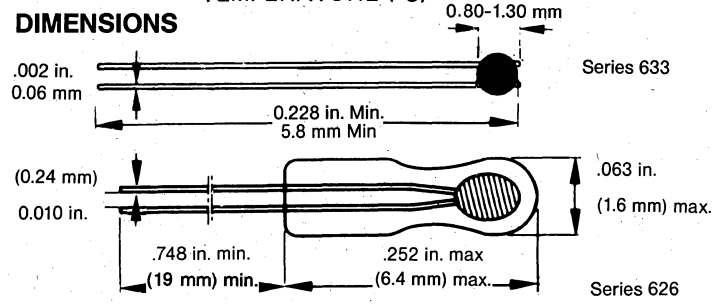
Resistance At 25°C (Ω)	B-Value ±5% At 25°C (°K)	Mepco/Centralab Part Number* 2322	
		626 Glass Encapsulated	633 Naked Bead
1K	2075	626-22102	633-12102
2.2K	2285	626-22222	633-12222
4.7K	2485	626-22472	633-12472
10K	3750	626-22103	633-12103
22K	3560	626-22223	633-12223
47K	3750	626-22473	633-12473
100K	3900	626-22104	633-12104
220K	3860	626-22224	633-12224
470K	3950	626-22474	633-12474
1000K	4100	626-22105	633-12105

*Part Numbers are listed for ±10% tolerance on resistance at 25°C. For ±5% tolerance, change second digit of part number suffix to 3 (e.g., 626-23102).

TYPICAL RESISTANCE vs TEMPERATURE



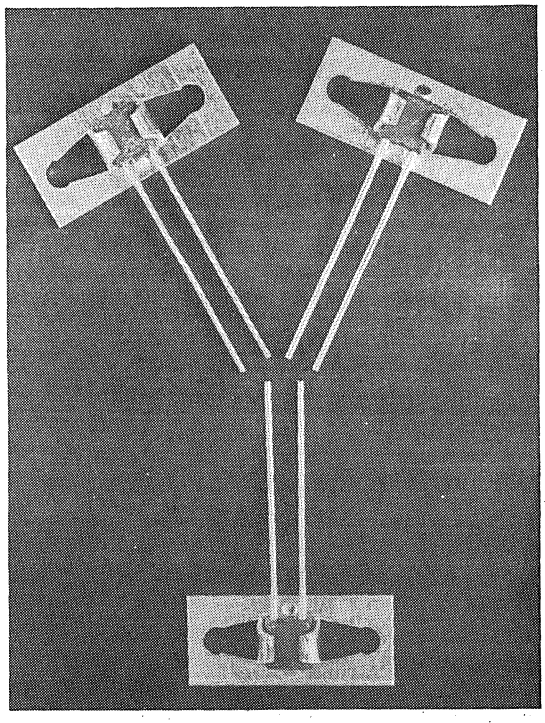
DIMENSIONS



8 Non-Linear Resistors

SERIES 640

NTC Thermistors



DESCRIPTION

GENERAL

Series 640 NTC Thermistors are produced under tightly controlled conditions for use in temperature sensing and control applications. A variety of resistance values and mechanical executions are provided to aid the design engineer. Style 2322-640-1...& 2322-640-6...

QUICK REFERENCE DATA

Resistance value at +25°C	2,7 to 470 KΩ
$B_{25/85}$ value	3660 to 4570 K
Maximum dissipation	0.25 W
Dissipation factor	7 mW/K
Thermal time constant	10 s
Operating temperature range	
at zero power	−25 to +125°C
at maximum power	0 to +55°C

APPLICATION

Temperature sensing and control.

DESCRIPTION

The thermistor has a negative temperature coefficient. It consists of a disc with two tinned copper wires. It is grey lacquered and colour coded.

MECHANICAL DATA—Inches (mm)

Outlines

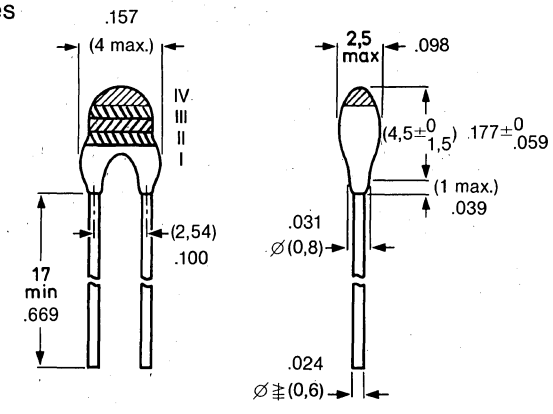


Fig.1.

Marking

The thermistors are marked with color bands in accordance with Fig. 1 and Table 1.

Mass

0,14 g approximately.

Mounting

In any position by soldering.

Robustness of terminations

Tensile strength	2.25 lb. (10 N)
Bending	1.12 lb. (5 N)

Soldering

Solderability	max. 240°C, max. 4 s
Resistance to heat	max. 265°C, max. 11 s

Impact

Free fall	39.4 in. (1000 mm)

Non-flammable

Resistant to solvents

According to IEC 68-2-45, resistant to R113 at T_{amb}

PACKAGING

500 thermistors in a cardboard box.

SERIES 640
NTC Thermistors

ELECTRICAL DATA

Unless otherwise specified, measured according to IEC publication 539.

Maximum dissipation at T_{amb} = +55 °C	0,25 W
Dissipation factor	7,0 mW/K approx.
Thermal time constant	10 s approx.
Heat capacity	0,135 J/K approx.
Operating temperature range	
at zero power	−25 to +125°C
at maximum power	0 to +55°C

Table 1

catalogue number 2322 640 1....		R_{25}	$B_{25/85}$ ± 5%	$B_{25/25}$ ± 5%	temperature coefficient at +25°C	color code *		
R_{25} ± 5%	R_{25} ± 10%	Ω	K	K	%/K	I	II	III
3272	2272	2700	4000	3800	−4.50	red	violet	red
3472	2472	4700	3660	3440	−4.12	yellow	violet	red
3123	2123	12000	3700	3540	−4.17	brown	red	orange
3223	2223	22000	3700	3420	−4.17	red	red	orange
3473	2473	47000	3850	3570	−4.33	yellow	violet	orange
3683	2683	68000	3880	3590	−4.37	blue	grey	orange
3334	2334	330000	4150	3830	−4.67	orange	orange	yellow

* Thermistors with a 5% tolerance have a gold band IV; 10% tolerance is identified by a silver band IV (Fig. 1). If band IV is not used see 2322 640 19....

Table 2

catalog number 2322 640 6....		R_{25}	$B_{25/85}$ ± 3%	τ approx.	resp. time approx.	b	color code (Fig. 1)			
R_{25}±5%	R_{25}±10%	kΩ	K	s	s	mm	I	II	III	IV*
3272	2272	2.7	3977	8	0.85	1.9	red	violet	red	
3332	2332	3.3	3977	8.5	0.95	2.0	orange	orange	red	
2472	2472	4.7	3977	9	1.10	2.1	yellow	violet	red	
3682	2682	6.8	3977	11	1.40	2.6	blue	grey	red	
3103	2103	10	3977	11	1.40	2.8	brown	black	orange	
3123	2123	12	3740	10.5	1.30	2.3	brown	red	orange	
3153	2153	15	3740	11	1.40	2.4	brown	green	orange	
3223	2223	22	3740	12	1.50	2.7	red	red	orange	
3333	2333	33	4070	10	1.30	2.4	orange	orange	orange	
3473	2473	47	4070	12	1.50	2.8	yellow	violet	orange	
3683	2683	68	4190	9.5	1.20	2.3	blue	grey	orange	
3104	2104	100	4190	11.5	1.45	2.8	brown	black	yellow	
3154	2154	150	4370	10	1.20	2.3	brown	green	yellow	
3224	2224	220	4370	10.5	1.30	2.5	red	red	yellow	
3334	2334	330	4570	9.5	1.10	2.1	orange	orange	yellow	
3474	2474	470	4570	10.5	1.30	2.5	yellow	violet	yellow	

* For R_{25} ± 5% band IV is gold for R_{25} ± 10% band IV is silver.

Note: R_{25} ± 3% is available on request.

2322-640-1...

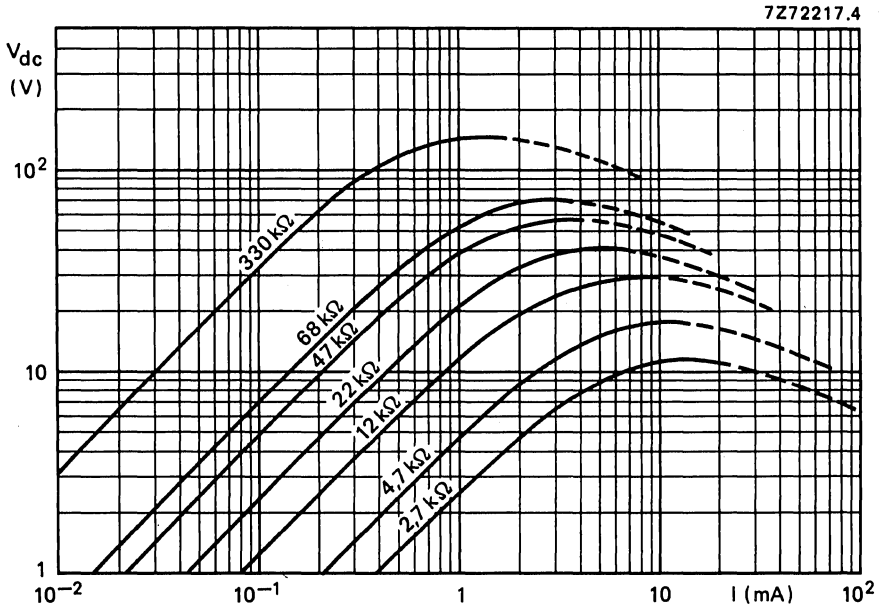


Fig. 2 Typical voltage/current characteristics. T_{amb} = +25 °C, still air.

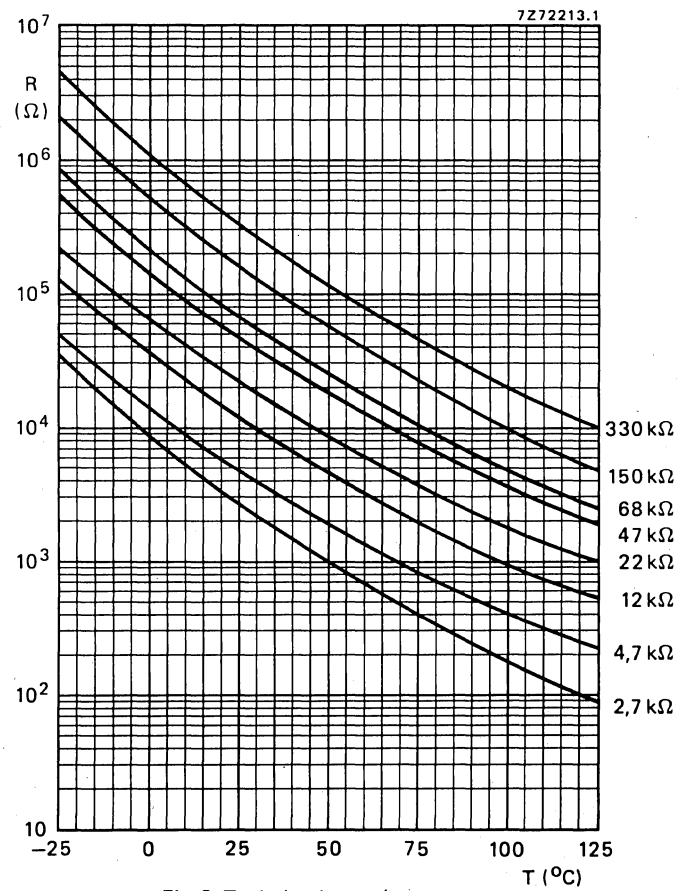


Fig. 3 Typical resistance/temperature characteristic.

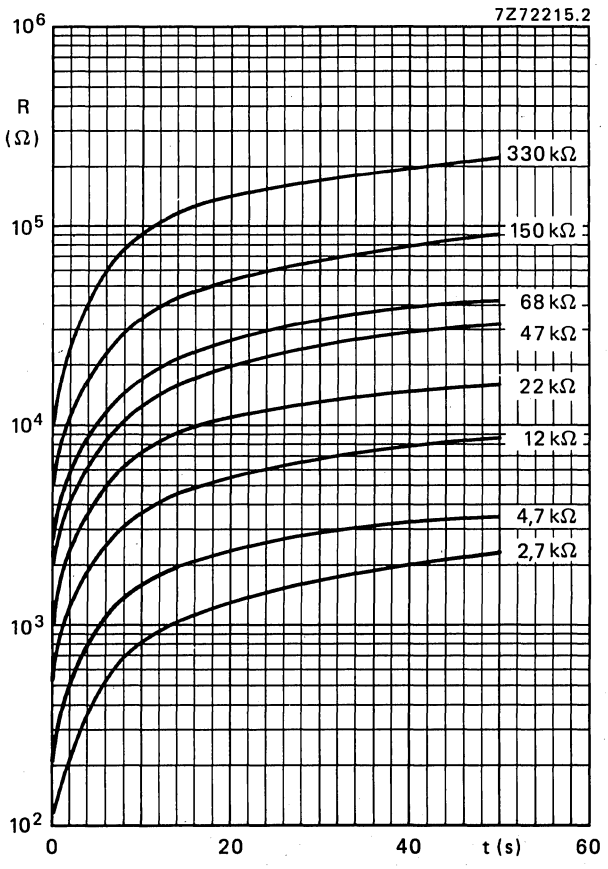


Fig. 4 Typical resistance/time (cooling) characteristic. T_{amb} = + 25 °C, still air; T_{start} = + 125 °C.

SERIES 640
NTC Thermistors

2322-640-19...

NTC THERMISTORS
two-point sensors

APPLICATION
For accurate temperature measurement between 0 and 30°C e.g. panel heating.

DESCRIPTION
The thermistor has a negative temperature coefficient. It consists of a disc with two tinned copper wires. It is grey lacquered and colour coded, but not insulated.

MECHANICAL DATA--Inches (mm)
Outlines

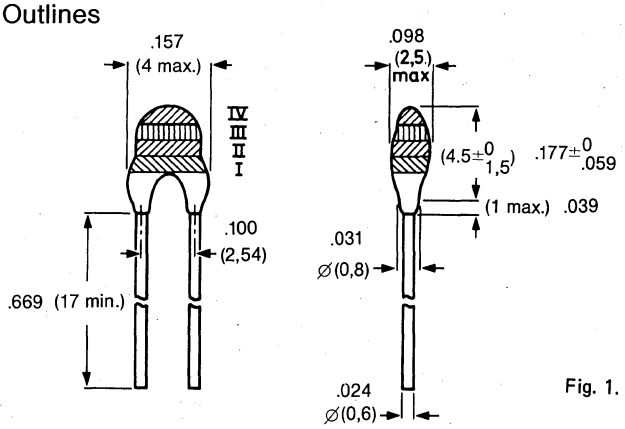


Fig. 1.

Marking
The thermistors are marked with color bands, see table for color code.

Mass
0,14 g approximately

Resistant to cleaning solvents

ELECTRICAL DATA
Unless otherwise specified, measured according to IEC publication 539.

Maximum dissipation at T_{amb} = +55°C	0,25 W
Dissipation factor	7,0 mW/K approx.
Thermal time constant	10 s approx.
Heat capacity	0,135 J/K approx.
Operating temperature range	
at zero power	−25 to +125°C
at maximum power	0 to +55°C

PACKAGING
500 thermistors in a cardboard box.

catalogue number	nominal resistance value Ω		colour code*		
2322 640 19...	5 ± 1 °C	25 ± 1 °C	I	II	III
472	10 900	4 700	yellow	violet	red
103	23 000	10 000	brown	black	orange
223	52 000	22 000	red	red	orange
473	114 000	47 000	yellow	violet	orange
104	250 000	100 000	brown	black	yellow

* Band IV is not used.
The nominal resistance value should be reached between 4 and 6 °C and also between 24 and 26 °C.

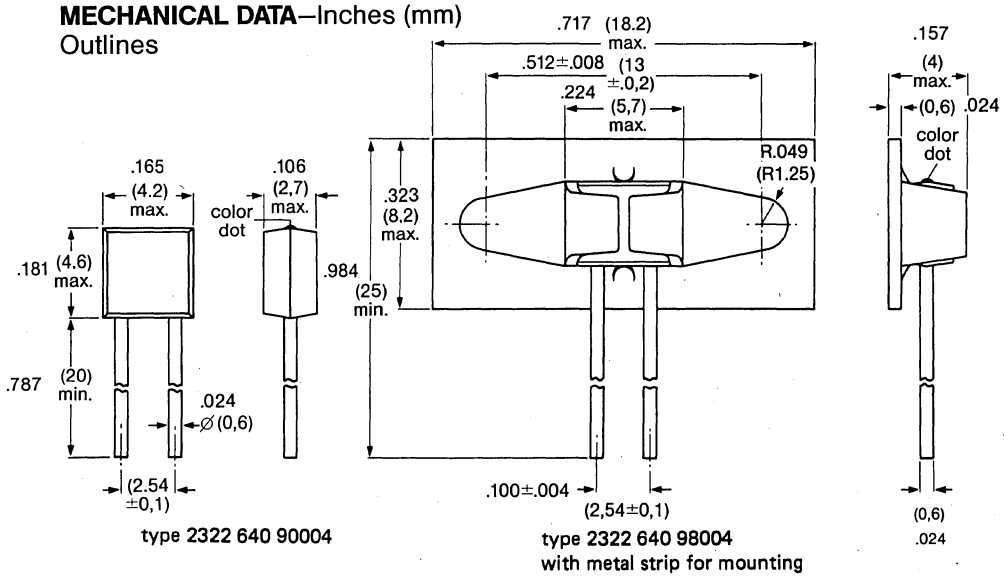
2322-640-90004
2322-640-98004

NTC THERMISTORS
molded

QUICK REFERENCE DATA

	2322 640 90004	2322 640 98004	
Resistance value at			
+25 °C	12 ± 7%	12 ± 7%	kΩ
+100 °C	950 ± 5%	950 ± 5%	Ω
$B_{25/85}$-value	3750	3750	K
Maximum dissipation	0,25	0,25	W
Dissipation factor	7	9,5	mW/K
when mounted on a heat-sink	19	27	mW/K
Thermal time constant	19	33	s
when mounted on a heat-sink	10	5	s
Operating temperature range			
at zero power	−10 to +125	−10 to +125	°C
at maximum power	0 to +55	0 to +55	°C

MECHANICAL DATA—Inches (mm)
Outlines



type 2322 640 90004

type 2322 640 98004
with metal strip for mounting

APPLICATION
For temperature control.

DESCRIPTION
Molded disc thermistor with negative temperature coefficient and with two solid tinned copper wires. The body color is dark grey.
The thermistor 2322 640 98004 is provided with a metal strip for mounting.

Marking
The thermistors have a grey dot.

Mass
Type 2322 640 90004 0,3 g approx.
Type 2322 640 98004 0,5 g approx.

Mounting
Type 2322 640 90004 in any position by soldering
Type 2322 640 98004 by means of the mounting strip

Robustness of terminations
Tensile strength 2.25 lb. (10 N)
Bending 1.12 lb. (5 N)

Soldering
Solderability max. 240°C, max. 4 s
Resistance to heat max. 265°C, max. 11 s

Impact
Free fall 39.4 in. (1000 mm)

Inflammability
Non-flammable—CCTU-01-01A specification, test 22.

PACKAGING
Type 2322 640 90004: 500 thermistors in a cardboard box.
Type 2322 640 98004: 400 thermistors in a cardboard box.

SERIES 640
NTC Thermistors

2322-640-90004
2322-640-98004

ELECTRICAL DATA

Unless otherwise specified, measured according to IEC publication 539.

All values in the table without further indication are approximate values.

	2322 640 90004	2322 640 98004	
Resistance at			
+25°C	12 ±7%	12 ±7%	kΩ
+100°C	950 ±5%	950 ±5%	Ω
$B_{25/85}$ value	3750	3750	K
Temperature coefficient	−4,2	−4,2	%/K
Maximum dissipation	0,25	0,25	W
Dissipation factor	7	9,5	mW/K
when mounted on a heatsink*	19	27	mW/K
Thermal time constant	19	33	s
when mounted on a heatsink*	10	5	s
Heat capacity of ceramic	0,028	0,028	J/K
of complete component	0,13	0,3	J/K
Response time**	3	3	s
Operating temperature range			
at zero power	−10 to +125	−10 to +125	°C
at maximum power	0 to +55	0 to +55	°C
Dielectric withstanding voltage (r.m.s.) between terminals and coating/strip	min. 350	min. 350	V
Insulation resistance between terminals and coating/strip at 100 V (d.c.)	min. 100	min. 100	MΩ

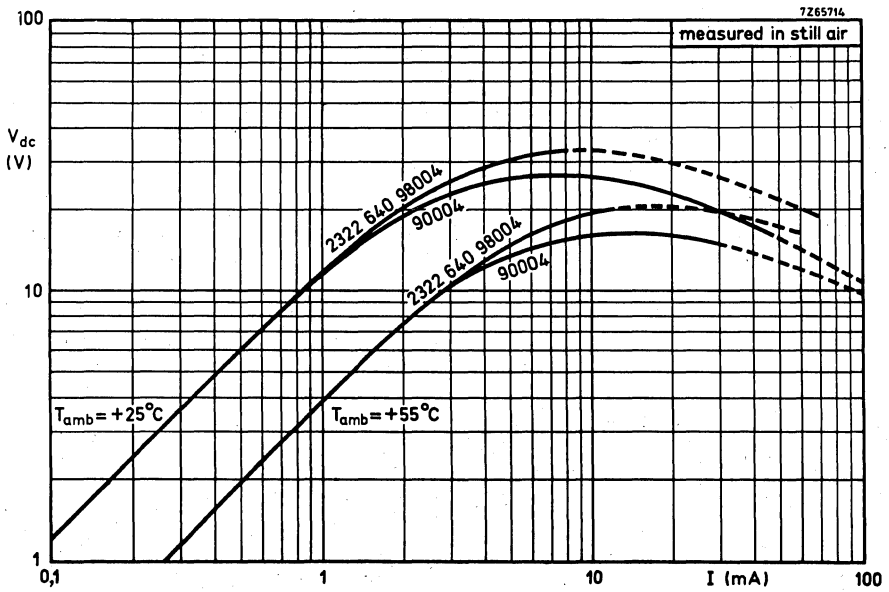


Fig. 2 Typical voltage/current characteristics.

2322-640-90004
2322-640-98004

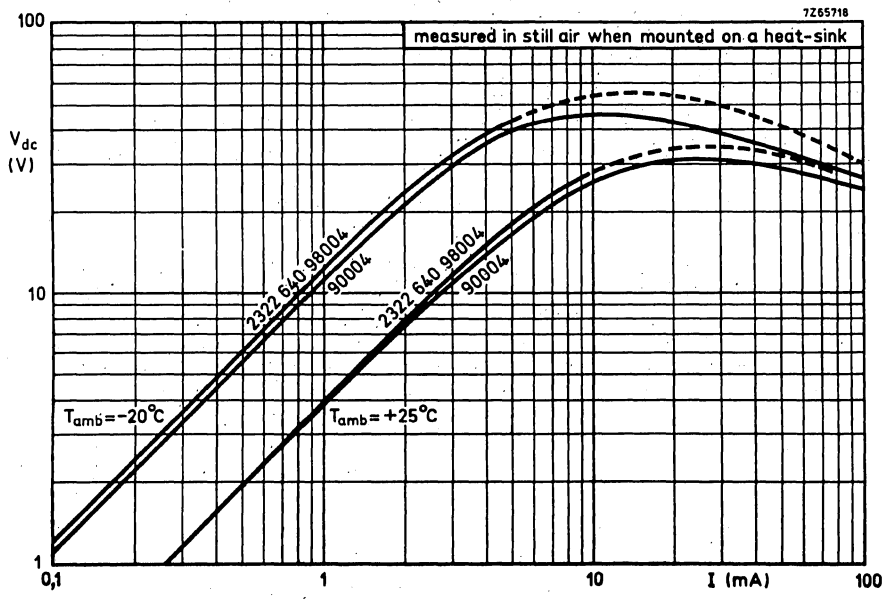


Fig. 3 Typical voltage/current characteristics.

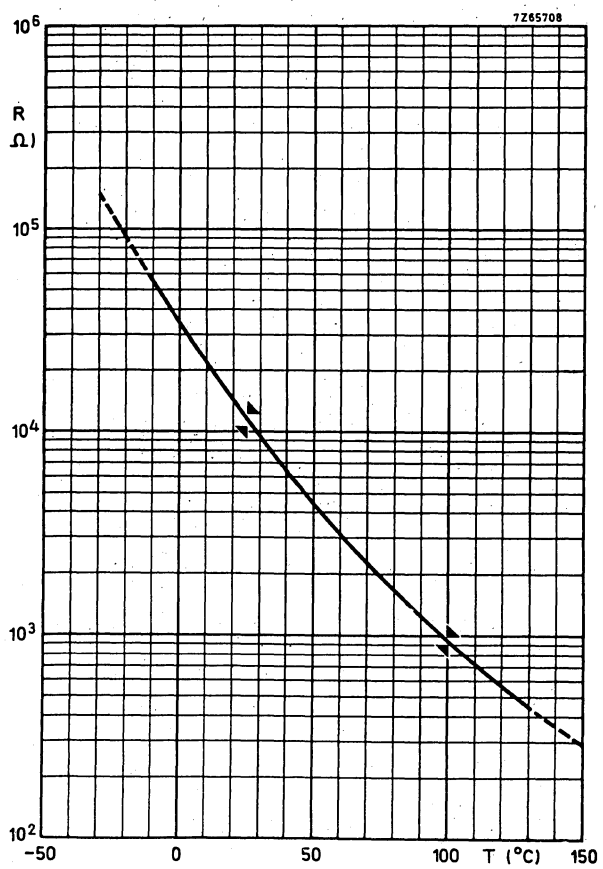


Fig. 4 Typical resistance/temperature characteristics.

*Measurements made in still air with the thermistor mounted on a heat-sink of 15.5 in.^{2}, (100 cm^2), thickness .059 in. (1,5 mm), and connected between phosphor-bronze wires (⌀.051 in. (1,3 mm)).

**The thermistor being transferred from ambient air of +25°C to a silicone oil (MS200/50) bath of +85°C.

2322-640-90004
2322-640-98004

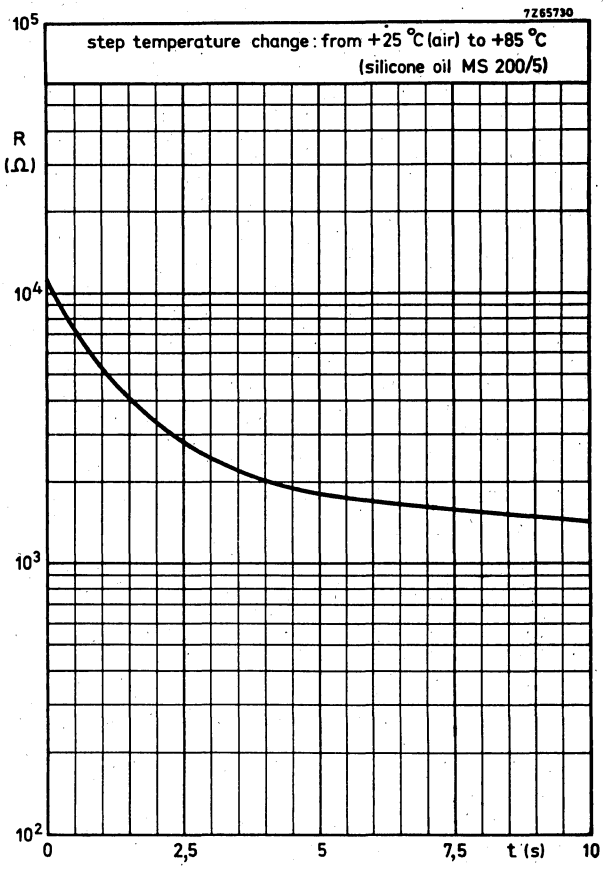
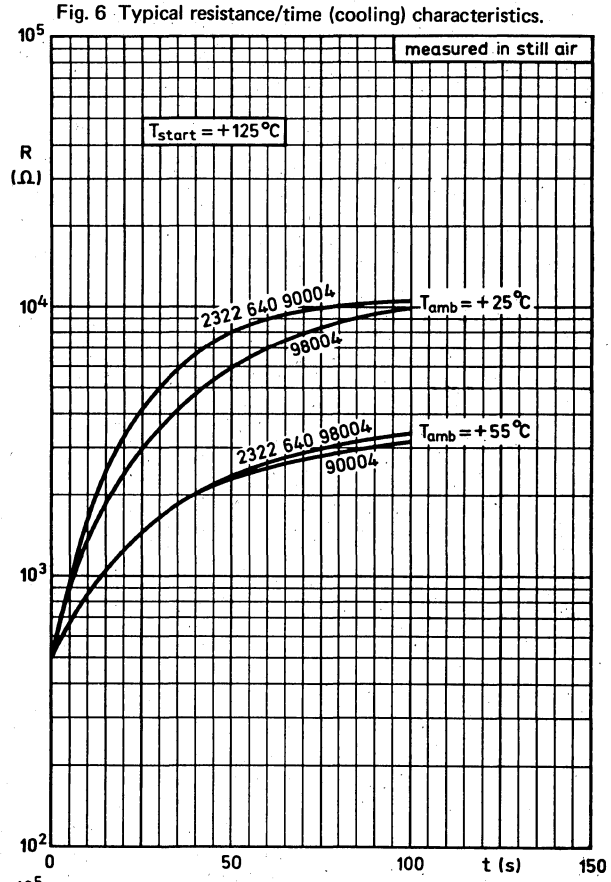


Fig. 5 Typical resistance/response time characteristics.

Fig. 6 Typical resistance/time (cooling) characteristics.



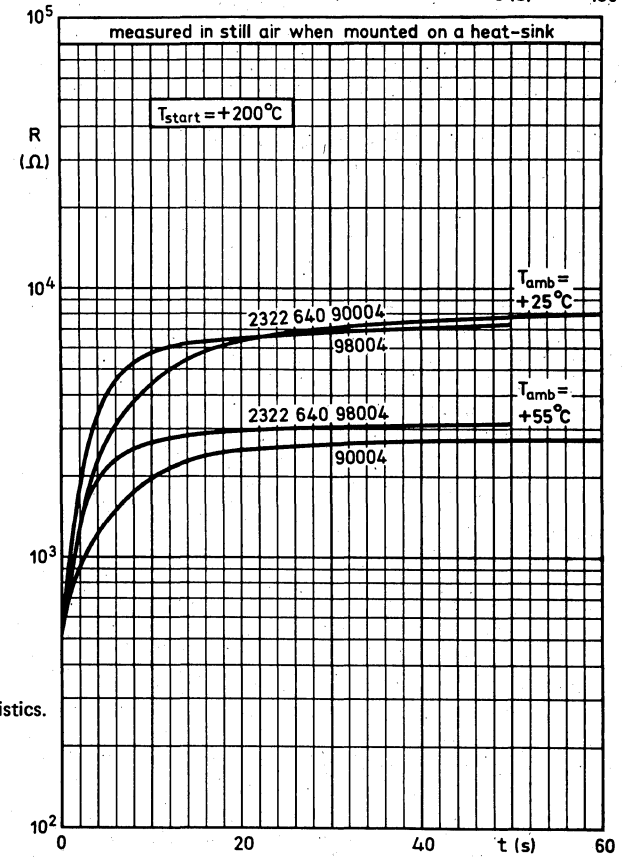


Fig. 7 Typical resistance/time (cooling) characteristics.

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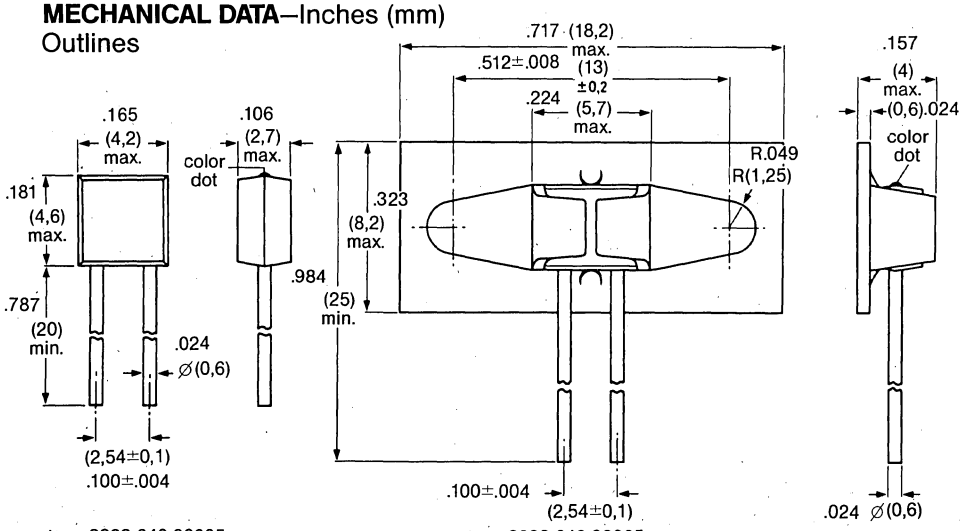
2322 640 90005
2322 640 98005

NTC THERMISTORS
molded

QUICK REFERENCE DATA

	2322 640 90005	2322 640 98005	
Resistance at			
+ 100 °C	16,7 ± 7%	16,7 ± 7%	kΩ
+ 200 °C	1120 ± 7%	1120 ± 7%	Ω
$B_{25/85}$-value	4300	4300	K
Maximum dissipation	0,25	0,25	W
Dissipation factor	7	9,5	mW/K
when mounted on a heat-sink	17,5	20,5	mW/K
Thermal time constant	19	33	s
when mounted on a heat-sink	12	8,5	s
Operating temperature range			
at zero power	−25 to + 200	−25 to + 200	°C
at maximum power	0 to + 55	0 to + 55	°C

MECHANICAL DATA—Inches (mm)
Outlines



type 2322 640 90005

type 2322 640 98005
with metal strip for mounting

APPLICATION
For high temperature control.

DESCRIPTION
Molded disc thermistor with negative temperature control and with two solid tinned copper wires. The body color is dark grey.
The thermistor 2322 640 98005 is provided with a metal strip for mounting.

Marking
The thermistors have a blue dot.

Mass
Type 2322 640 90005 0,3 g approx.
Type 2322 640 98005 0,5 g approx.

Mounting
Type 2322 640 90005 in any position by soldering
Type 2322 640 98005 by means of the mounting strip

Robustness of terminations
Tensile strength 2.25 lb. (10 N)
Bending 1.12 lb. (5 N)

Soldering
Solderability max. 240°C, max. 4 s
Resistance to heat max. 265°C, max. 11 s

Impact
Free fall 39.4 in. (1000 mm)

Inflammability
Non-flammable—CCTU-01-01A specification, test 22.

PACKAGING
Type 2322 640 90005: 500 thermistors in a cardboard box.
Type 2322 640 98005: 400 thermistors in a cardboard box.

SERIES 640
NTC Thermistors

2322 640 90005
2322 640 98005

ELECTRICAL DATA

Unless otherwisie specified, measuring according to IEC publication 539.

All values in the table without further indication are approximate values.

	2322 640 90005	2322 640 98005	
Resistance at			
+100°C	16,7 ±7%	16,7 ±7%	kΩ
+200°C	1120 ±7%	1120 ±7%	Ω
+25°C	310	310	kΩ
$B_{25/85}$ value	4300	4300	K
Temperature coefficient	−4,85	−4,85	%/K
Maximum dissipation	0,25	0,25	W
Dissipation factor	7	9,5	mW/K
when mounted on a heatsink*	17,5	20,5	mW/K
Thermal time constant	19	33	s
when mounted on a heatsink*	12	8,5	s
Heat capacity of ceramic	0,028	0,028	J/K
of complete component	0,13	0,31	J/K
Response time**	3	3	s
Operating temperature range			
at zero power	−25 to +200	−25 to +200	°C
at maximum power	0 to +55	0 to +55	°C
Dielectric withstanding voltage (r.m.s.) between terminals and coating	min. 350	min. 350	V
Insulation resistance between terminals and coating at 100 V (d.c.)	min. 100	min. 100	MΩ

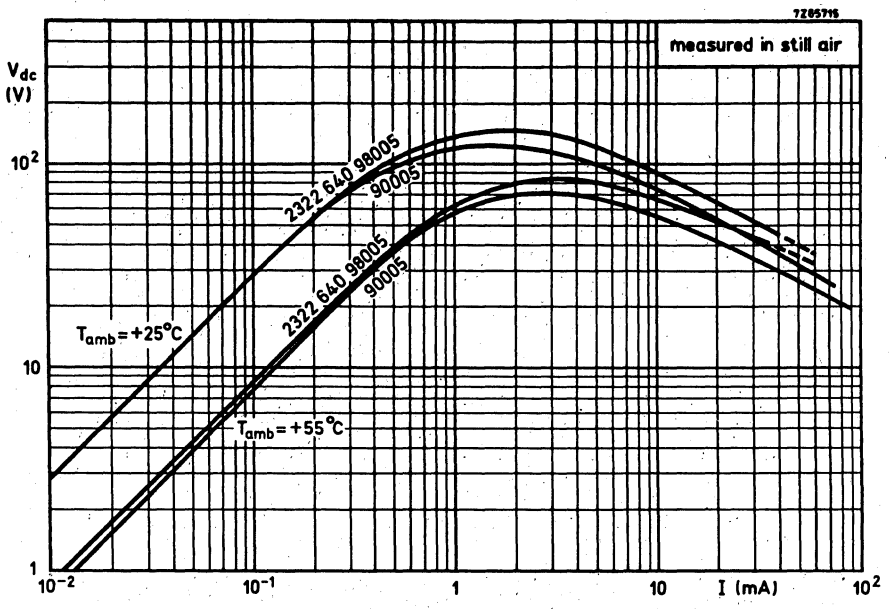


Fig. 2 Typical voltage/current characteristics.

8 Non-Linear Resistors

2322 640 90005
2322 640 98005

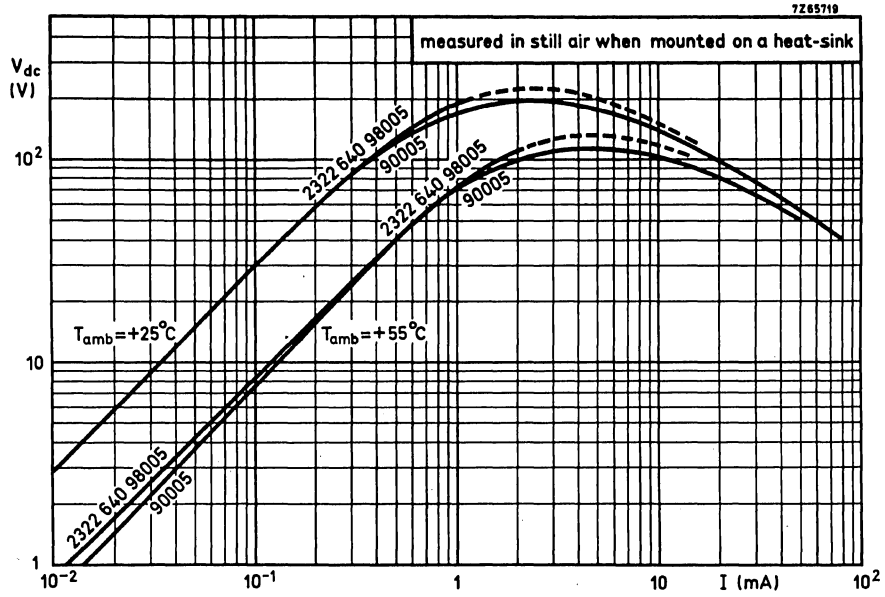


Fig. 3 Typical voltage/current characteristics.

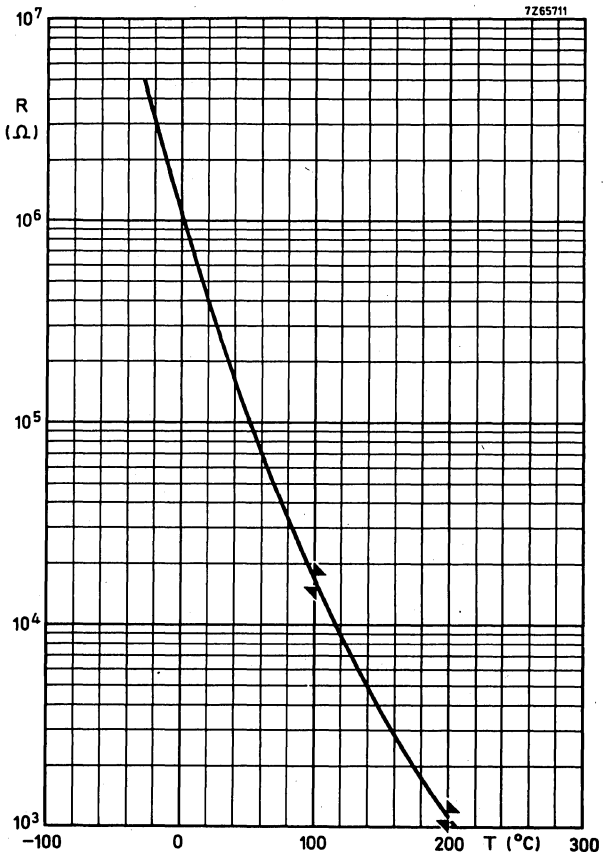


Fig. 4 Typical resistance/temperature characteristics.

*Measurements made in still air with the thermistor mounted on a heat-sink of 15.5 in.^{2} (100 cm^2), thickness .059 in. (1,5 mm), connected between phosphor-bronze wires (⌀ .051 in. (1,3 mm)).

**The thermistor being transferred from ambient air of +25°C to a silicone oil (MS200/50) bath of +85°C.

2322 640 90005
2322 640 98005

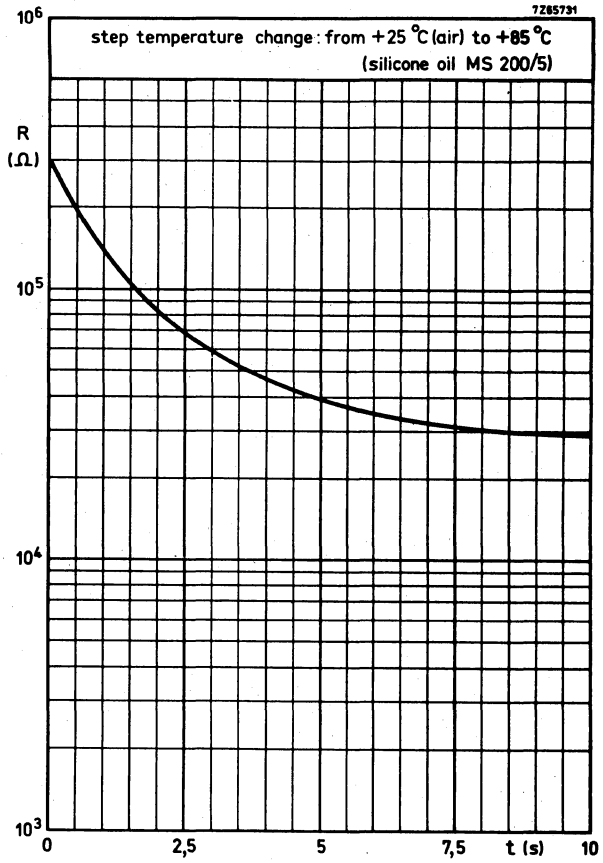
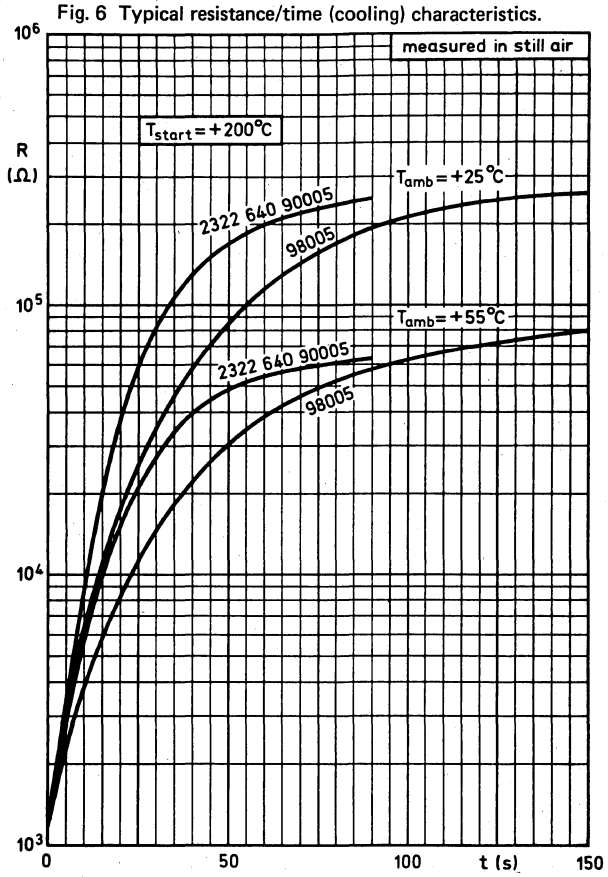


Fig. 5 Typical resistance/response time characteristics.

Fig. 6 Typical resistance/time (cooling) characteristics.



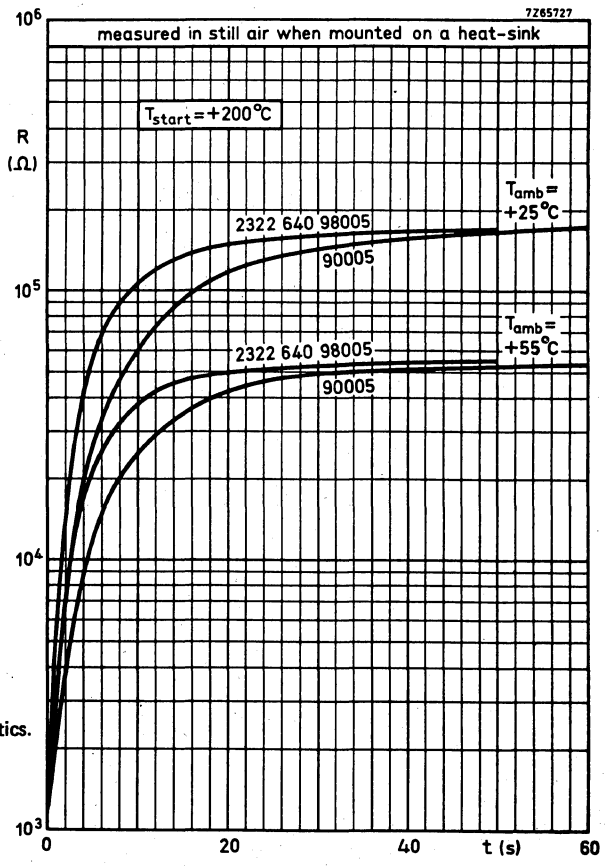


Fig. 7 Typical resistance/time (cooling) characteristics.

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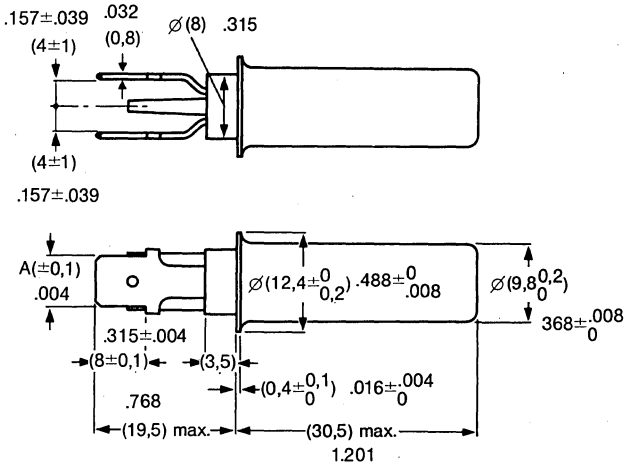
2322 640 90007
2322 640 90021

QUICK REFERENCE DATA

	2322 640 90007	2322 640 90021
Resistance value		
at +25 °C	12 kΩ ± 7%	12 kΩ ± 5,5%
at +90 °C	1,3 kΩ ± 5%	1285 Ω ± 3,5%
$B_{25/85}$-value	3700 K	3720 K
Maximum dissipation	0,25 W	
Dissipation factor		
in still air	7,5 mW/K	
in still water	18 mW/K	
Thermal time constant in still air	285 s	
Operating temperature range		
at zero power, continuously	−25 to +110 °C	
for max. 24 h	to +130 °C	
at maximum power	0 to +55 °C	

MECHANICAL DATA—Inches (mm)

Outlines Fig. 1



A = .248 (6,3) for thermistor 2322 640 90007
A = .110 (2,8) for thermistor 2322 640 90021

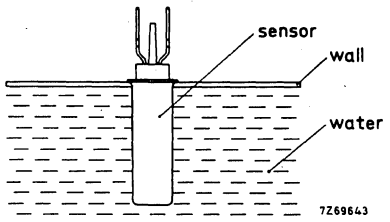


Fig. 2.

Marking

2322 640 90007	brown dot between connectors
2322 640 90021	orange dot between connectors

Mass

8 g approximately

Mounting

In any position

Robustness of terminations

Tensile strength 11.2 lb. (50 N)

Impact

Free fall 39.4 in. (1000 mm)

Inflammability

Non-flammable

ELECTRICAL DATA

Unless otherwise specified, measuring according to IEC publication 539.

Type	2322 640 90007	2322 640 90021
Resistance at		
+25°C	12 kΩ ±7%	12 kΩ ±5,5%
+90°C	1,3 kΩ ±5%	1285 Ω ±3,5%
$B_{25/85}$-value	3700 K	3720 K
Temperature coefficient	−4,2%/K	
Maximum dissipation	0,25 W	
Dissipation factor		
in still air	7,5 mW/K	
in still water	18 mW/K	
Thermal time constant in still air	285 s	
Response time*	11 s	
Temperature gradient**	0,02 K/K	
Operating temperature range		
at zero power	min. −25°C	
continuously	max. +110°C	
max. 24 h	max. +130°C	
at maximum power	0 to +55°C	
Dielectric withstanding voltage (r.m.s.)		
between terminals and capsule for 10 s	min. 1650 V	
60 s	min. 1500 V	
Insulation resistance between terminals and capsule at 100 V (d.c.)	min. 100 MΩ	

PACKAGING

50 thermistors in a cardboard box.

*The thermistor being transferred from ambient air of +25°C to water of +100°C.

**The temperature gradient is the difference between the liquid (water) temperature and the temperature measured by the sensor per degree difference between liquid and connector temperatures. This difference is caused by the heat conduction through the connectors.

SERIES 640
NTC Thermistors

2322 640 90007
2322 640 90021

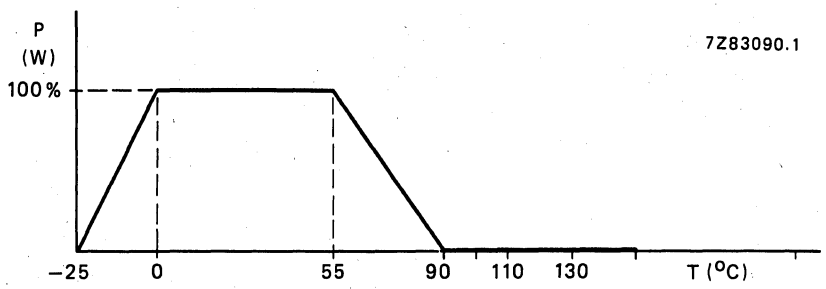


Fig. 3 Power derating with ambient temperature.

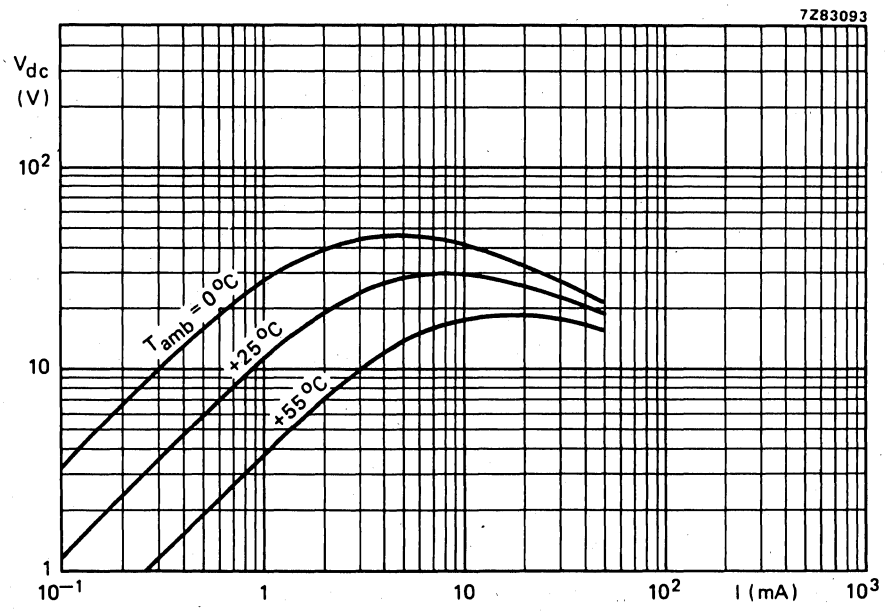


Fig. 4 Typical voltage/current characteristic measured in still air.

2322 640 90007
2322 640 90021

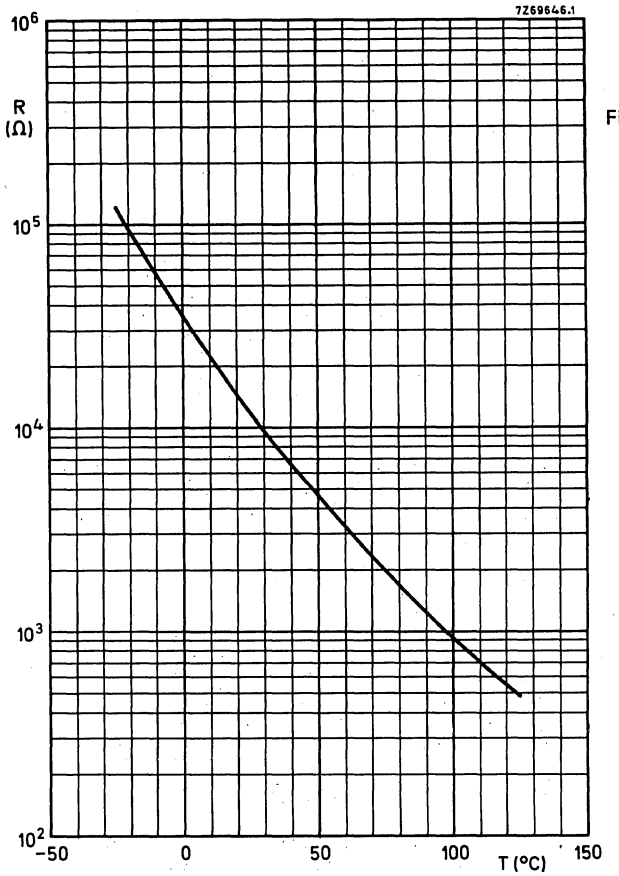


Fig. 5 Typical resistance/temperature characteristic.

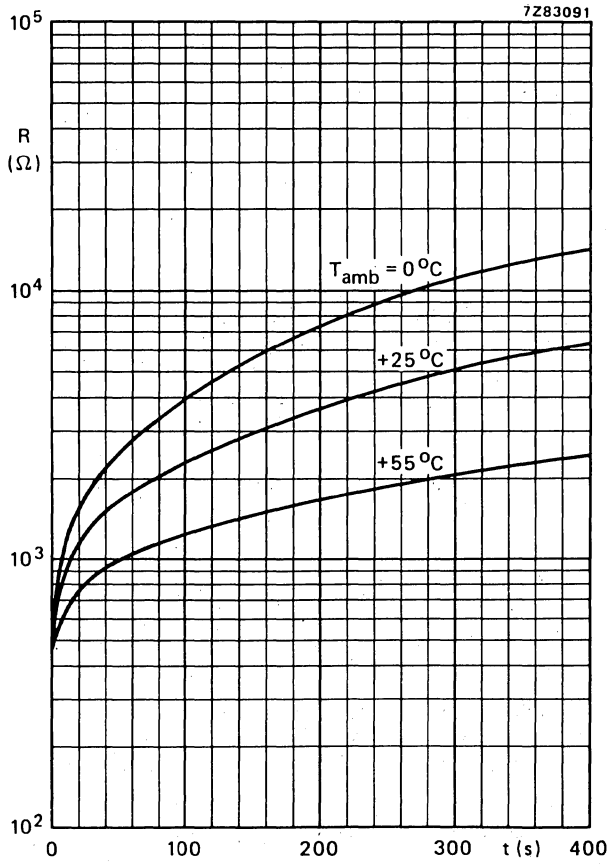


Fig. 6 Typical resistance/time (cooling) characteristics measured in still air, T_{start} = +125 °C.

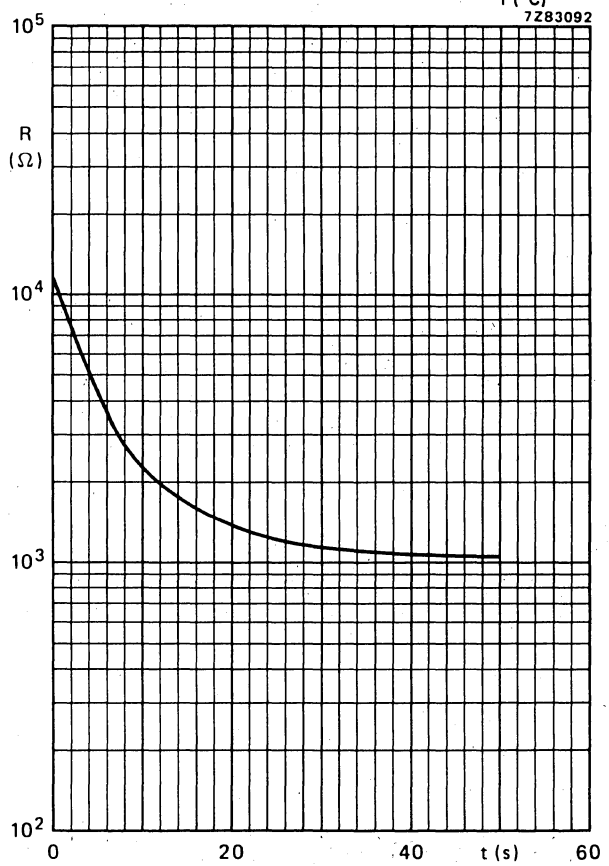


Fig. 7 Typical resistance/response time characteristic. Temperature step from still air of +25 °C to still water of +100 °C.

8 Non-Linear Resistors

SERIES 640
NTC Thermistors

2322 640 90012

NTC THERMISTOR
Three Point Sensor

QUICK REFERENCE DATA

Resistance value	
at −30 ±1,5°C	50 kΩ
at −20 ±1,5°C	27 kΩ
at −10 ±1,5°C	15 kΩ
$B_{25/85}$-value	4000 K
Maximum dissipation	0,25 W
Dissipation factor	7,5 mW/K
Thermal time constant	19 s
Operating temperature range	
at zero power	−55 to +85°C
at maximum power	−55 to +55°C

APPLICATION
For temperature control in deep-freezers.

DESCRIPTION
The thermistor has a negative temperature coefficient. It consists of a disc with two solid tinned copper wires. It is grey lacquered and colour coded, but not insulated.

MECHANICAL DATA—Inches (mm)
Outlines

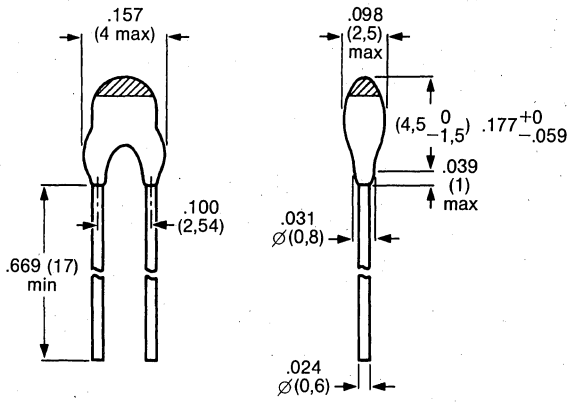


Fig.1.

Marking
The thermistor is marked with a brown band on top of the body.

Mass
0,14 g approximately.

Mounting
In any position by soldering.

Robustness of terminations

Tensile strength	2.25 lb. (10 N)
Bending	1.12 lb. (5 N)

Soldering

Solderability	max. 240°C, max. 4 s
Resistance to heat	max. 265°C, max. 11 s

Impact

Free fall	39.4 in. (1000 mm)

Non-flammable

Resistant to cleaning solvents

PACKAGING
500 thermistors in a cardboard box.

ELECTRICAL DATA
Unless otherwise specified, measured according to IEC publication 539.

Resistance value	
at −30 ±1,5°C	50 kΩ
at −20 ±1,5°C	27 kΩ
at −10 ±1,5°C	15 kΩ
$B_{25/85}$-value	4000 K approx.
Temperature coefficient at +25°C	−4,5 %/K approx.
Maximum dissipation at T_{amb}=+55°C	0,25 W
Dissipation factor	7,5 mW/K approx.
Thermal time constant	19 s approx.
Heat capacity	0,135 J/K approx.
Operating temperature range	
at zero power	−55 to +85°C
at maximum power	−55 to +55°C

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2322 640 90013
2322 640 98013

NTC THERMISTORS
molded
Three Point Sensor

QUICK REFERENCE DATA

	2322 640 90013	2322 640 98013	
Resistance value			
at −30 ±1,5°C	50	50	kΩ
at −20 ±1,5°C	27	27	kΩ
at −10 ±1,5°C	15	15	kΩ
$B_{25/85}$-value	4000	4000	K
Maximum dissipation	0,25	0,25	W
Dissipation factor	6,7	9	mW/K
when mounted on a heatsink	16	21	mW/K
Thermal time constant	17	32	s
when mounted on a heatsink	6	3	s
Operating temperature range			
at zero power	−55 to +85	−55 to +85	°C
at maximum power	−55 to +55	−55 to +55	°C

APPLICATION
For temperature control in deep-freezers.

DESCRIPTION
Dark grey molded disc thermistor with negative temperature coefficient and with two solid tinned copper wires. The thermistor 2322 640 98013 has a metal strip for mounting.

MECHANICAL DATA—Inches (mm)
Outlines

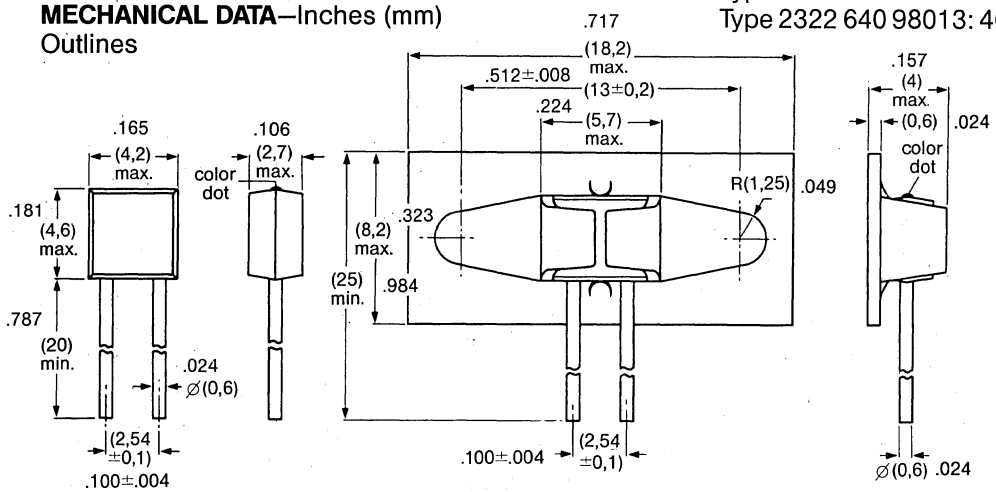

Fig. 1 Type 2322 640 90013.

Fig. 2 Type 2322 640 98013 with metal strip for mounting.

Marking
The thermistors have a brown dot.

Mass
Type 2322 640 90013 0,3 g approx.
Type 2322 640 98013 0,5 g approx.

Mounting
Type 2322 640 90013 in any position by soldering
Type 2322 640 98013 by means of the mounting strip

Robustness of terminations
Tensile strength 2.25 lb. (10 N)
Bending 1.12 lb. (5 N)

Soldering
Solderability max. 240°C, max. 4 s
Resistance to heat max. 265°C, max. 11 s, solder bath 5 mm from body

Impact
Free fall 39.4 in. (1000 mm)

Inflammability
Non-flammable

PACKAGING
Type 2322 640 90013: 500 thermistors in a cardboard box.
Type 2322 640 98013: 400 thermistors in a cardboard box.

SERIES 640
NTC Thermistors

2322 640 90013
2322 640 98013

ELECTRICAL DATA

Unless otherwise specified, measured according to IEC publication 539.

All values in the table without further indication are approximate values.

	2322 640 90013	2322 640 98013	
Resistance value			
at −30 ±1,5°C	50	50	kΩ
at −20 ±1,5°C	27	27	kΩ
at −10 ±1,5°C	15	15	kΩ
$B_{25/85}$-value	4000	4000	K
Temperature coefficient	−4,5	−4,5	%/K
Maximum dissipation at			
T_{amb} = +55°C	0,25	0,25	W
Dissipation factor	6,7	9	mW/K
when mounted on a heatsink	16	21	mW/K
Thermal time constant	17	32	s
when mounted on a heatsink	6	3	s
Heat capacity			
of ceramic	0,009	0,009	J/K
of complete component	0,11	0,29	J/K
Response time**	1,3		s
Operating temperature range			
at zero power	−55 to +85	−55 to +85	°C
at maximum power	−55 to +55	−55 to +55	°C
Dielectric withstanding voltage (r.m.s.) between terminals and coating	min. 350	min. 350	V
Insulation resistance between terminals and coating at 100 V (d.c.)	min. 100	min. 100	MΩ

*The thermistor mounted on a heatsink of 15.5 in.^{2} (100 cm^2), thickness .059 in. (1,5 mm).
**From air of +25°C to silicone oil (MS 200/5) of −20°C.

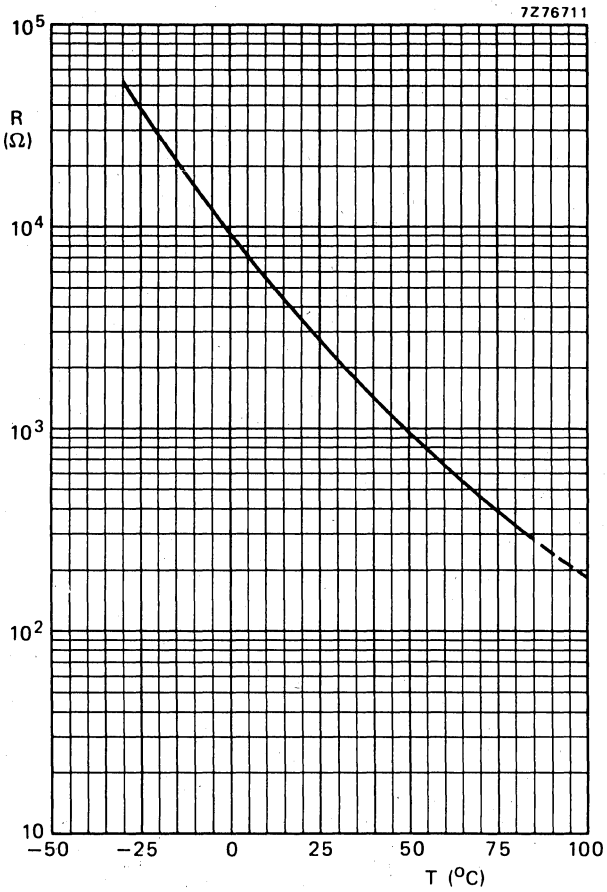

Fig. 3 Typical resistance/temperature characteristic.

NTC THERMISTOR
Two Point Sensor

QUICK REFERENCE DATA

Resistance value	
at −10 ±1,5°C	15 kΩ
at +25 ±1,5°C	2,7 kΩ
$B_{25/85}$-value	4000 K
Maximum dissipation	0,25 W
Dissipation factor	7,5 mW/K
Thermal time constant	19 s
Operating temperature range	
at zero power	−55 to +85°C
at maximum power	−55 to +55°C

APPLICATION
For room temperature control.

DESCRIPTION
The thermistor has a negative temperature coefficient. It consists of a disc with two solid tinned copper wires. It is grey lacquered and color coded, but not insulated.

MECHANICAL DATA—Inches (mm)
Outlines

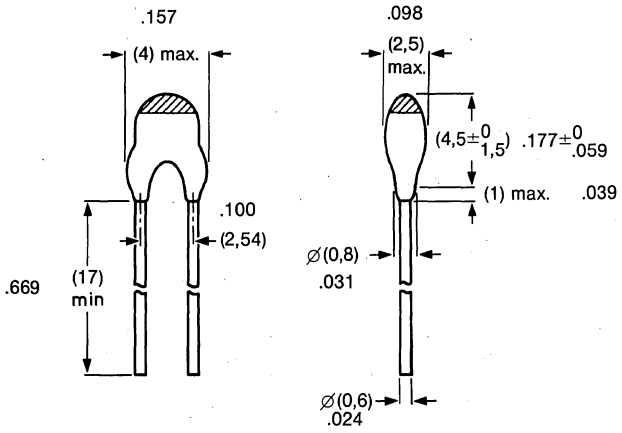

Fig. 1

Marking
The thermistor is marked with a red band on top of the body.

Mass
0,14 g approximately.

Mounting
In any position by soldering.

Robustness of terminations

Tensile strength	2.25 lb. (10 N)
Bending	1.12 lb. (5 N)

Soldering

Solderability	max. 240°C, max. 4 s
Resistance to heat	max. 265°C, max. 11 s

Impact

Free fall	39.4 in. (1000 mm)

Non-flammable

Resistant to cleaning solvents

PACKAGING
500 thermistors in a cardboard box.

ELECTRICAL DATA
Unless otherwise specified measured according to IEC publication 539.

Resistance value	
at −10 ±1,5°C	15 kΩ
at +25 ±1,5°C	2,7 kΩ
$B_{25/85}$-value	≈ 4000 K
Temperature coefficient at +25°C	≈ −4,5 %/K
Maximum dissipation at T_{amb} = +55°C	0,25 W
Dissipation factor	≈ 7,5 mW/K
Thermal time constant	≈ 19 s approx.
Heat capacity	≈ 0,135 J/K
Operating temperature range	
at zero power	−55 to +85°C
at maximum power	−55 to +55°C

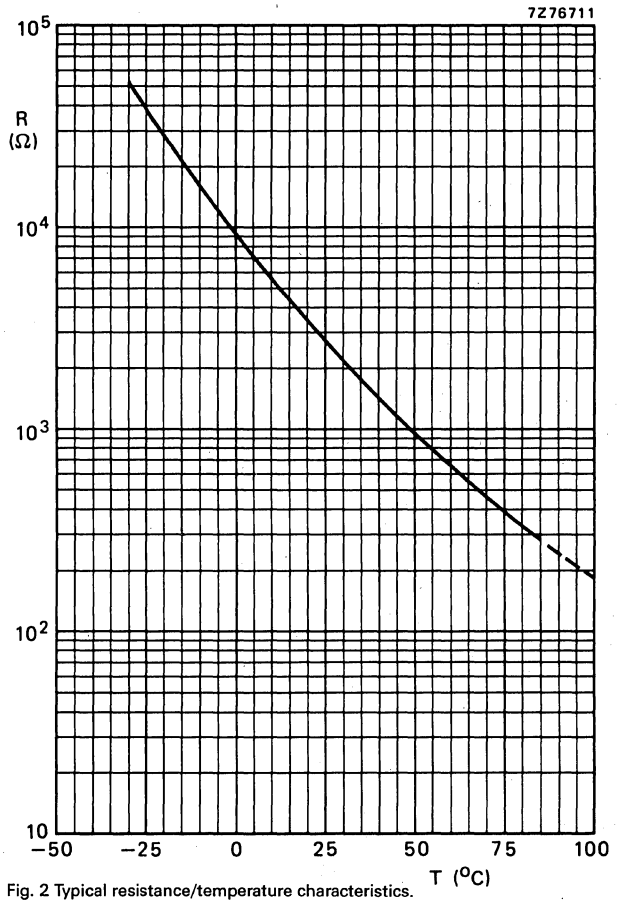

Fig. 2 Typical resistance/temperature characteristics.

SERIES 640
NTC Thermistors

2322 640 90015
2322 640 98015

NTC THERMISTORS
molded
Two Point Sensor

QUICK REFERENCE DATA

	2322 640 90015	2322 640 98015	
Resistance value			
at −10 ±1,5°C	15	15	kΩ
at −25 ±1,5°C	2,7	2,7	kΩ
$B_{25/85}$-value	4000	4000	K
Maximum dissipation	0,25	0,25	W
Dissipation factor	6,7	9	mW/K
when mounted on a heatsink	16	21	mW/K
Thermal time constant	17	32	s
when mounted on a heatsink	6	3	s
Operating temperature range			
at zero power	−55 to +85	−55 to +85	°C
at maximum power	−55 to +55	−55 to +55	°C

APPLICATION
For room temperature control.

DESCRIPTION
Molded disc thermistor with negative temperature coefficient and with two solid tinned copper wires. Body dark grey.

The thermistor 2322 640 98015 has a metal strip for mounting.

MECHANICAL DATA—Inches (mm)
Outlines

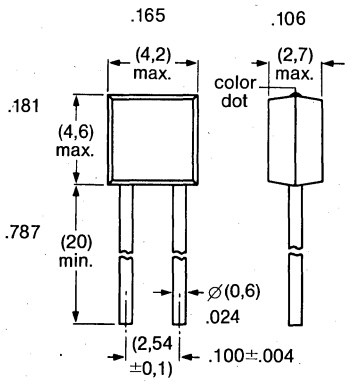

Fig.1 Type 2322 640 90015.

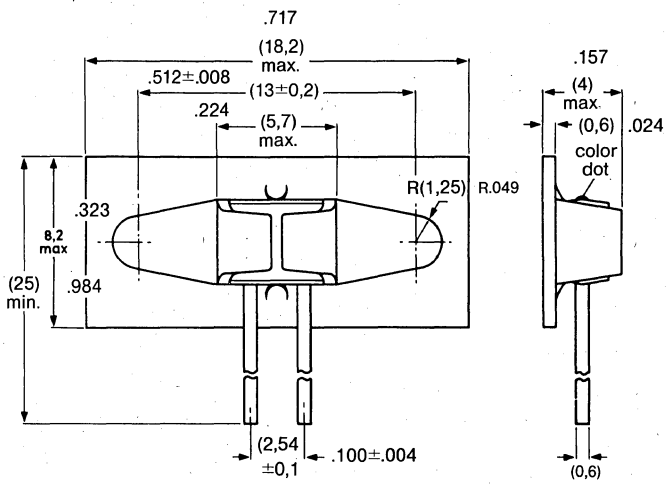

Fig.2 Type 2322 640 98015 with metal strip for mounting.

Marking
The thermistors have a red dot.

Mass
Type 2322 640 90015 0,3 g approx.
Type 2322 640 98015 0,5 g approx.

Mounting
Type 2322 640 90015 in any position by soldering
Type 2322 640 98015 by means of the mounting strip

Robustness of terminations
Tensile strength 2.25 lb. (10 N)
Bending 1.12 lb. (5 N)

Soldering
Solderability max. 240°C, max. 4 s
Resistance to heat max. 265°C, max. 11 s, solder bath 5 mm from body

Impact
Free fall 39.4 in. (1000 mm)

Inflammability
Non-flammable

PACKAGING
Type 2322 640 90015: 500 thermistors in a cardboard box.
Type 2322 640 98015: 400 thermistors in a cardboard box.

2322 640 90015
2322 640 98015

ELECTRICAL DATA

Unless otherwise specified, measured according to IEC publication 539.

All values in the table without further indication are approximate values.

	2322 640 90015	2322 640 98015	
Resistance value			
at −10 ±1,5°C	15	15	kΩ
at +25 ±1,5°C	2,7	2,7	kΩ
$B_{25/85}$-value	4000	4000	K
Temperature coefficient	−4,5	−4,5	%/K
Maximum dissipation at T_{amb} = +55°C	0,25	0,25	W
Dissipation factor	6,7	9	mW/K
when mounted on a heatsink*	16	21	mW/K
Thermal time constant	17	32	s
when mounted on a heatsink*	6	3	s
Heat capacity			
of ceramic	0,009	0,009	J/K
of complete component	0,11	0,29	J/K
Response time**	1,3		s
Operating temperature range			
at zero power	−55 to +85	−55 to +85	°C
at maximum power	−55 to +55	−55 to +55	°C
Dielectric withstanding voltage (r.m.s.) between terminals and coating	min. 350	min. 350	V
Insulation resistance between terminals and coating at 100 V (d.c.)	min. 100	min. 100	MΩ

*The thermistor mounted on a heatsink of 15.5 in.^{2} (100 cm^2), thickness .059 in. (1,5 mm).
**From air of +25°C to silicone oil (MS 200/5) of −20°C..

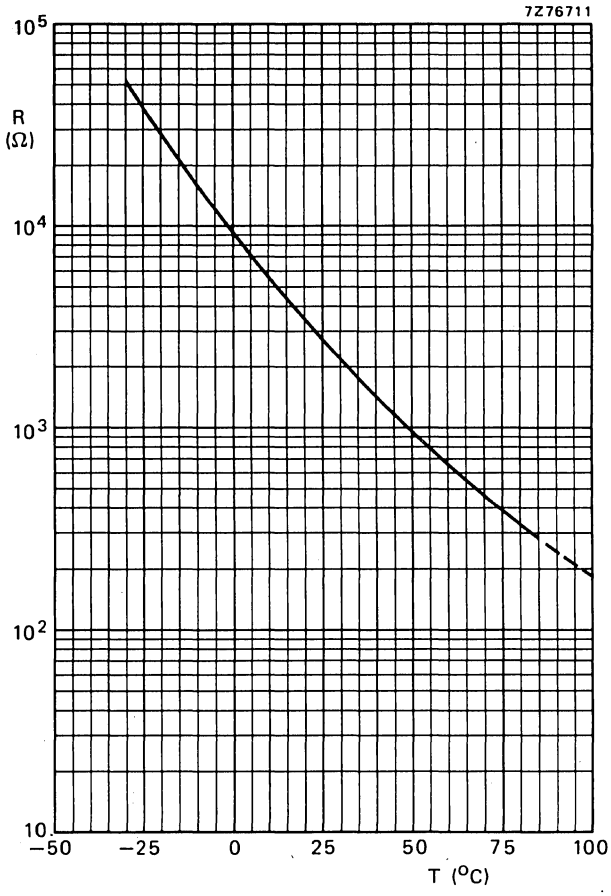

Fig. 3 Typical resistance/temperature characteristic.

SERIES 640
NTC Thermistors

INTERCHANGEABLE THERMISTORS 2322-640-10...

These NTC Thermistors are designed for ±0.5°C Interchangeability from 25°C to 85°C and ±1.0°C Interchangeability from −25°C to 110°C. Their small size, rugged construction, long term stability, and Interchangeability make this style ideal for accurate temperature sensing, measurement and control over a wide temperature range.

QUICK REFERENCE DATA

Resistance at 25°C	4,7 to 100	kΩ
$B_{25/85}$-value	3977	K
Maximum dissipation	0,1	W
Operating temperature range		
at zero power	−40 to 110	°C
at maximum power	−25 to 55	°C

DESCRIPTION
These thermistors have a negative temperature coefficient, they consist of a disc with two tinned solid copper wires. The thermistors have a non-flammable coating of a protective lacquer which is resistant against most commonly used cleaning solvents according to IEC 68-2-45.

APPLICATION
For accurate temperature sensing, measurement and control up to 110°C.

MECHANICAL DATA—Inches (mm)
Outlines

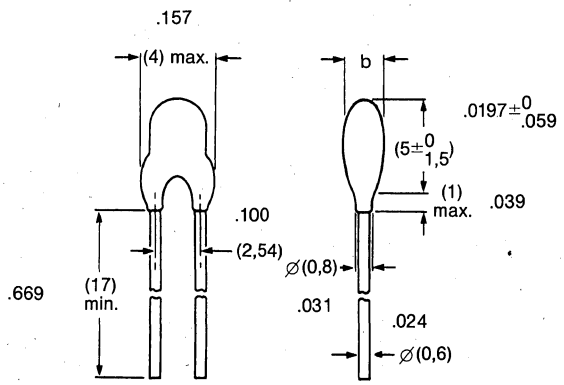

Fig. 1 For dimension b see Table 1.

Other lead styles are available on request.

Marking
None

Mass
See Table 1

Mounting
In any position by soldering

Robustness of terminations

Tensile strength	2.25 lb. (10 N)
Bending	1.12 lb. (5 N)

Soldering

Solderability	max. 240°C, max. 4 s
Resistance to heat	max. 265°C, max. 11 s

Impact

Free fall	39.4 in. (1000 mm)

Inflammability
Non-flammable according to IEC publication 695-2-2 (1980, needle flame)

PACKAGING
The thermistors are packed in cardboard boxes, the smallest packing quantity is 500.

ELECTRICAL DATA
Unless otherwise specified, measured according to IEC publication 539, see also Table 1.

$B_{25/85}$-value		3977	K
Stability between R_{25} and R_{85} for 1000 h at zero power and maximum power	±	1	%
Maximum dissipation		100	mW
Operating temperature range, see Fig. 2			
at zero power		−40 to 110	°C
at maximum power		0 to 55	°C

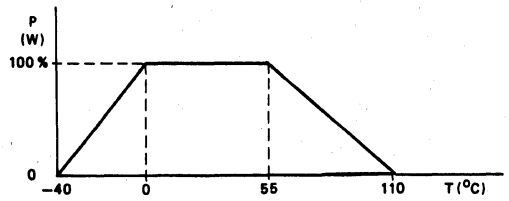

Fig. 2 Derating curve.

8 Non-Linear Resistors

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INTERCHANGEABLE THERMISTORS 2322-640-10...

Table 1

catalogue number	R_{25} ±0,5°C kΩ	R_{85} ±0,5°C Ω	$B_{25/85}$ typ. K	d_{25} typ. %/K	δ appr. mW/K	τ appr. s	resp. time appr.* s	mass g	b in. (mm)
2322 640 10472	4,7	502,9	3977	−4,5	6,6	7	0,95	0,12	.087 2,2
2322 640 10103	10	1070	3977	−4,5	6,6	9,5	1,2	0,18	.110 2,8
2322 640 10473	47								
2322 640 10104	100								

*Response time in silicone oil MS 200/50. This is the time the sensor needs to reach 63,2% of the total temperature when subjected to a temperature change, in this case from 25°C in air to 85°C in oil.

Formula to determine nominal resistance values. See Table 2.

The resistance values at intermediate temperatures can be calculated using the "Steinhert and Hart" equation:

$$\left\{ \sqrt[3]{\sqrt{E^2+D}-E} - \sqrt[3]{\sqrt{E^2+D}-E} \right\}$$

$$RT = \left(\frac{R_{25}}{10\,000}\right).e$$

in which $D = 4{,}76919 \times 10^8$ and

$$E = \frac{1{,}14102 - 10^3/T}{1{,}9786 \times 10^{-4}}$$

T = temperature in K.

Determination of the resistance/temperature deviation from nominal

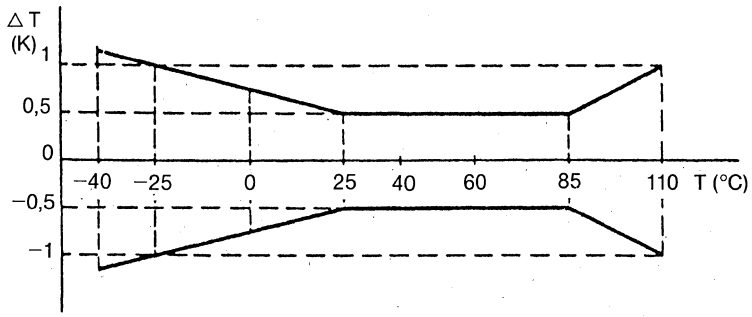


Fig. 3 Temperature deviation (in K) over the range from −40°C to 110°C.

Table 2
Resistance versus temperature characteristics.*

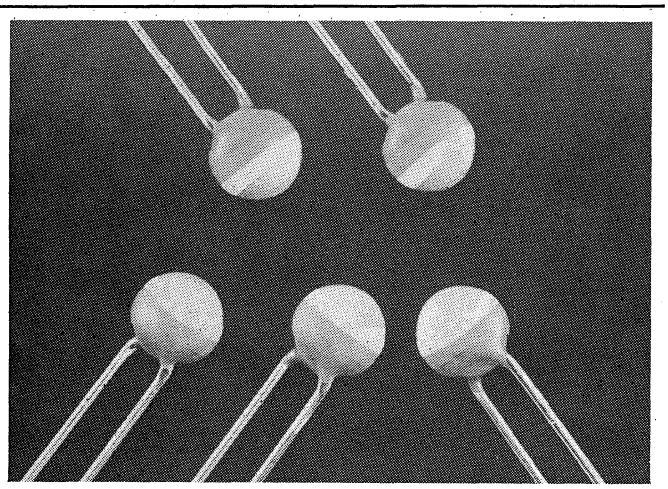
temperature	resistance values for types 2322 640 10472	10103	10473	10104
°C	Ω	Ω	Ω	Ω
− 40	154 300	328 400		
− 35	111 700	237 700		
− 30	81 730	173 900		
− 25	60 390	128 500		
− 20	45 070	95 890		
− 15	33 950	72 230		
− 10	25 800	54 890		
− 5	19 770	42 070		
0	15 280	32 510		
5	11 900	25 310		
10	9 334	19 860		
15	7 374	15 690		
20	5 870	12 490		
25	4 700	10 000		
30	3 788	8 060		
35	3 072	6 536		
40	2 506	5 331		
45	2 055	4 372		
50	1 695	3 606		
55	1 405	2 989		
60	1 170	2 490		
65	980,0	2 085		
70	823,9	1 753		
75	696,1	1 481		
80	590,3	1 256		
85	502,9	1 070		
90	430,3	915,5		
95	369,5	786,1		
100	318,4	677,5		
105	275,4	586,0		
110	239,0	508,6		

*For calculating intermediate values see formula on above left.

SERIES 642

Disc NTC Thermistors

3.3 to 470K ohms at 25° C
–25°C to +125°C
0.5 Watt maximum

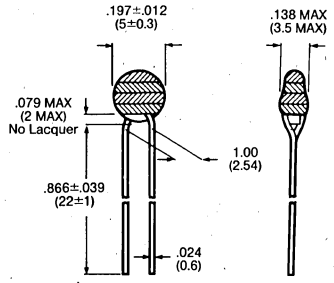


Series 642 Thermistors are available with or without mounting stud, and offer a choice of 32 standard cold-resistance values from 3.3 to 470,000 ohms.

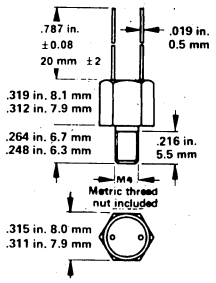
ELECTRICAL SPECIFICATIONS

	642-6 LEAD MOUNT	642-7 STUD MOUNT
Resistance Value (Ω)	3.3-470K (25°C)	3.3-470K (25°C)
Resistance Tolerance	±10%, 5%	±10%, 5%
B value, 25°-85°C (°K±5%)	2675-4650	2675-4650
Resistance Ratio (25°/125°C)	8.95-52.60	8.95-52.60
Dissipation Factor (mW/°C)	see table	25
Thermal Time Constant (sec)	see table	20
Max. dissipation at +55°C	0.5 W	0.5 W
Operating Temp. Range (°C)	–25° to +125°	–25° to 100°
Dielectric Withstand. Voltage	--	>100 VDC
Insulation Resistance	--	≥100 MΩ

DIMENSIONS



Lead Mount



Stud Mount

TYPICAL ELECTRICAL CHARACTERISTICS

Resistance* at 25°C (Ω)	Beta B25/85 ±5% (°K)	Lead-Mounting Types: Dissipation factor approx.	Lead-Mounting Types: Thermal Time Constant	Lead-Mounting Types: Part* Number* 2322—	Stud-Mounting Types: Part Number* 2322—
3.3	2675	8.5	17	642-62338	642-72338
4.7	2750	8.5	17	642-62478	642-72478
6.8	2800	8.5	17	642-62688	642-72688
10	2875	8.5	17	642-62109	642-72109
15	2950	8.5	17	642-62159	642-72159
22	3025	8.5	17	642-62229	642-72229
33	3100	8.5	17	642-62339	642-72339
47	3150	8.5	17	642-62479	642-72479
68	3225	8.5	17	642-62689	642-72689
100	3300	8.5	17	642-62101	642-72101
150	3375	8.5	17	642-62151	642-72151
220	3475	8.5	17	642-62221	642-72221
330	3575	8.5	17	642-62331	642-72331
470	3650	8.5	17	642-62471	642-72471
680	3725	8.5	17	642-62681	642-72681
1000	3825	8.5	17	642-62102	642-72102
1500	3975	8.5	17	642-62152	642-72152
2200	4125	8.5	17	642-62222	642-72222
3300	4250	8.5	17	642-62332	642-72332
4700	4350	8.5	17	642-62472	642-72472
6800	4400	8.5	17	642-62682	642-72682
10000	4275	8.5	17	642-62103	642-72103
15000	4200	8.5	17	642-62153	642-72153
22000	4275	8.5	17	642-62223	642-72223
33000	4350	8.5	17	642-62333	642-72333
47000	4400	8.5	17	642-62473	642-72473
68000	4450	8.5	17	642-62683	642-72683
100000	4500	8.5	17	642-62104	642-72104
150000	4550	8.5	17	642-62154	642-72154
220000	4600	8.5	17	642-62224	642-72224
330000	4625	8.5	17	642-62334	642-72334
470000	4650	8.5	17	642-62474	642-72474

MARKING

Lead-Mounting Types are marked with three color bands indicating the cold-resistance value in standard color code***: Bands I & II-1st and second digit; band III-multiplier. Band IV is used only for indicating ±10% tolerance (silver), or ±5% tolerance (gold).

Stud-mounting types are imprinted with the resistance value in code (IEC 62 system).

*Lead Mounted Part Numbers are for units with ±10% tolerance on resistance at 25°C. Stud mounted numbers are for units with ±10% tolerance on resistance at 25°C. To specify closer tolerances, change the second digit of Part Number suffix to 3 for ±5% tolerance (i.e. 642-63338).

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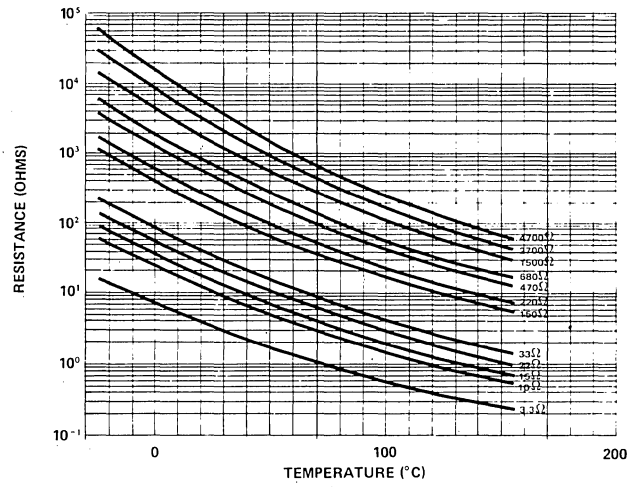
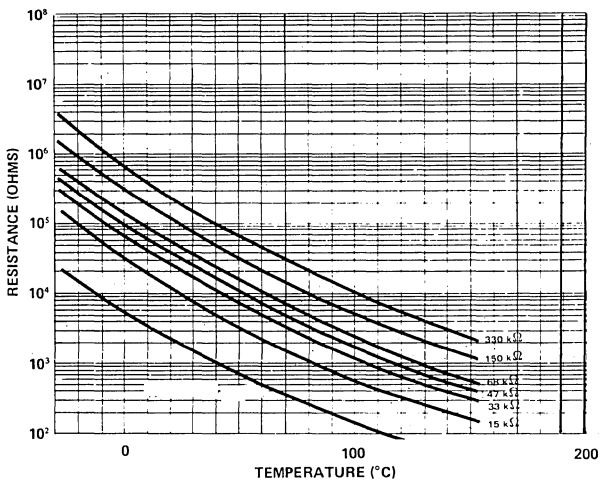
RESISTANCE vs. TEMPERATURE

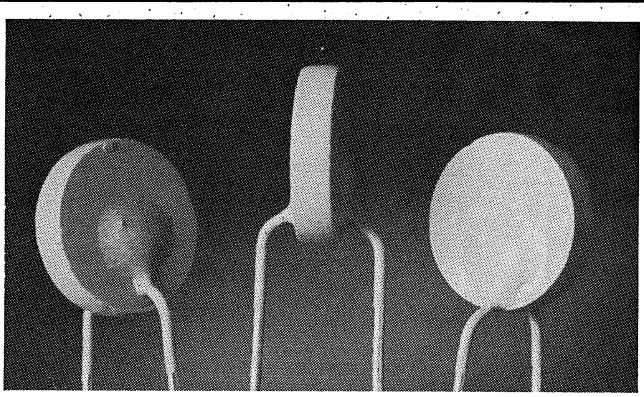




Standard Color Code Chart		
Resistance Band I & II (1st & 2nd Digit)	**Multiplier Band III**	**Tolerance Band IV**
0 = Black 1 = Brown 2 = Red 3 = Orange 4 = Yellow 5 = Green 6 = Blue 7 = Violet 8 = Gray	10^{-1} = Gold 10^{0} = Black 10^{1} = Brown 10^{2} = Red 10^{3} = Orange 10^{4} = Yellow	±10% = Silver ± 5% = Gold

SERIES 644

Disc NTC Thermistors



DESCRIPTION

Series 644 NTC Thermistors feature an appreciable power-handling capability, despite their small size. They are particularly well-suited for surge limitation in circuits that normally carry considerable current, and for protection of switch and relay contacts, and sensitive semiconductors.

ELECTRICAL SPECIFICATIONS

Catalogue number 2322	Resistance at 25°C (Ω)	Maximum continuous current, 0 to 55°C (A)	Power at maximum current, 25°C (W)	Approximate dissipation factor (mW/K)	Size (see Fig. 2)
644 90004	82	1.7	2.5	17	3A
644 90005	15	2.2	3	17	3B
644 90008	20	5	5	21	3C
644 90013	20	6	5.5	21	3C
644 90025	20	6	5.5	21	3D
644 90011	14	4	depends on mounting method (leadless disc)		4A
644 90012	5	8			4B
644 90016	2.5	8	3.6	14	5A
644 90017	4	8	4	15	5B
644 90018	5	7	4.1	15.5	5C
644 90019	7	6	4.3	16	5D
644 90021	10	3	2.7	12	5E
644 90022	2	15	7.4	27	5F
644 90023	2.5	12	7.0	28	5G

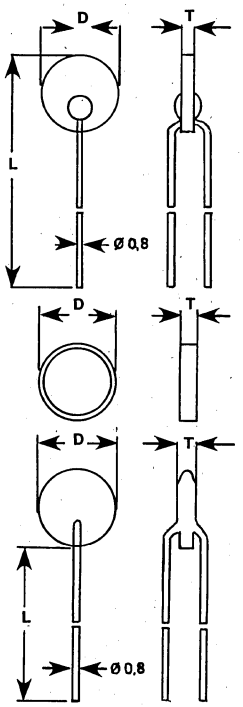
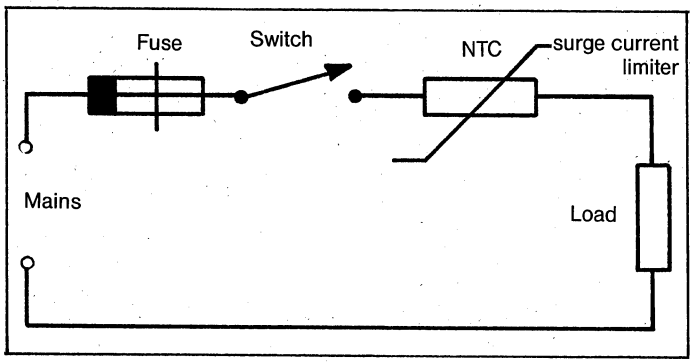


Fig. 2

Size	D	T	L
3A	15±0.5	3±0.5	59±3
3B	15±0.5	4±1	59±3
3C	22.8±1	4±1	62±2
3D	22.8±1	4±1	60±2
4A	15.65±0.35	3.75±0.35	–
4B	16±0.5	3.75±0.35	–
5A	13.5 max.	4 approx.	38 min.
5B	13.5 max.	4.5 approx.	38 min.
5C	13.5 max.	5 approx.	38 min.
5D	13.5 max.	6 approx.	38 min.
5E	10 max.	4.5 approx.	38 min.
5F	24 max.	6.5 approx.	38 min.
5G	24 max.	7 approx.	38 min.



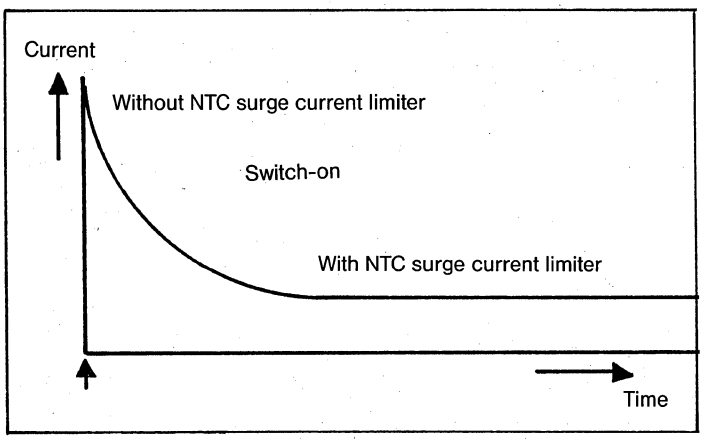
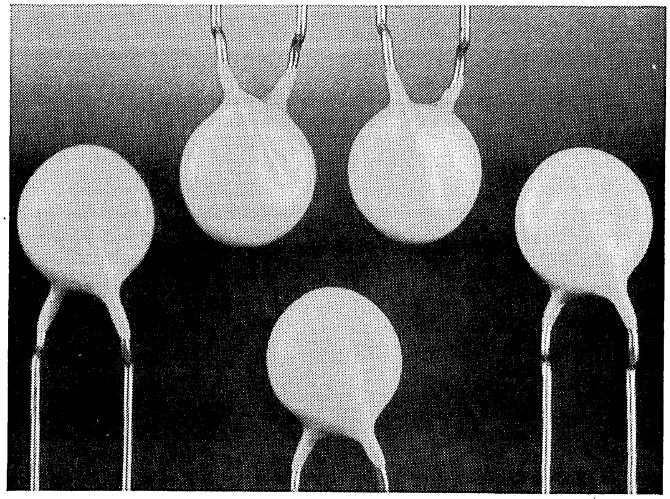


Fig. 1 Typical mains input circuit with an NTC surge current limiter in the input line.
The current/time characteristic shows the suppression effect of the NTC surge current limiter

SERIES 645

NTC Thermistors Stable-Line Thermistors



GENERAL

Series 645 NTC Thermistor were developed especially for their extremely stable characteristics and reproducibility. Stable-Line NTC Thermistors are produced with a Beta (25°C to 75°C) of 3965°K with standard tolerance of ±50°K. Resistance at 25°C is ±5% and ±10% standard. Tighter tolerances on Beta and R at 25°C are available.

QUICK REFERENCE DATA

Resistance at 25°C	1 to 10 kΩ
$B_{25/75}$ value	3965 K
Maximum dissipation	0,1 to 0,75 W
Operating temperature range	
at zero power	−40 to 110 °C
at maximum power	0 to 55 °C

DESCRIPTION

These thermistors have a negative coefficient, they consist of a disc with two tinned solid copper wires. The range includes some 20 versions which have been made from one base material, selected for its extremely stable characteristics. The various R_{25} values are obtained by dimensional variations. The thermistors have a non-flammable coating of a protective lacquer which is resistant against most commonly used cleaning solvents according to IEC 68-2-45.

APPLICATION

For accurate temperature sensing, measurement and control up to 110°C. The larger types (dia. .237 in. (6 mm) and .335 in. (8,5 mm)) are for general purpose application.

MECHANICAL DATA–Inches (mm)

Outlines

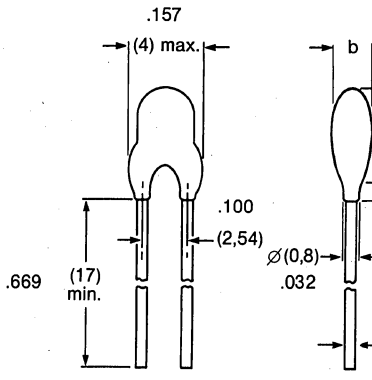


Fig. 1 0,1 W types.

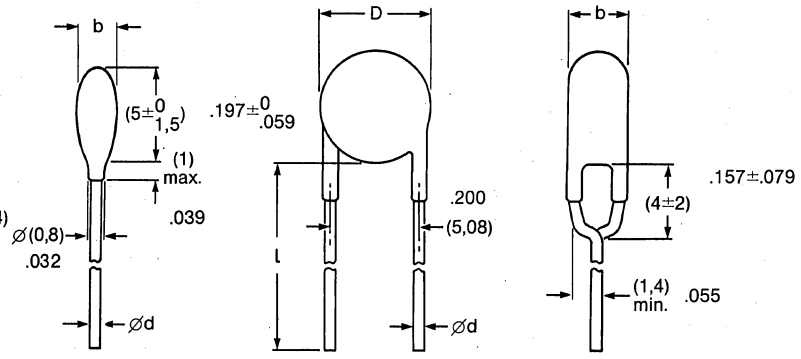


Fig. 2 0,25 and 0,75 W types.

For dimensions D, b, d and l see Table 1.

8 Non-Linear Resistors

SERIES 645

NTC Thermistors Stable-Line Thermistors

Marking
None

Mass
See Table 1

Mounting
In any position by soldering

Robustness of terminations

Tensile strength	2.25 lb. (10 N)
Bending	1.12 lb. (5 N)

Soldering

Solderability	max. 240°C, max. 4 s
Resistance to heat	max. 265°C, max. 11 s

Impact

Free fall	39.4 in. (1000 mm)

Non-flammable according to IEC publication 695-2-2 (1980, needle flame)

PACKAGING
The thermistors are packed in cardboard boxes, the smallest packing quantities are:
2322 645 0.... } 500
2322 645 2.... }
2322 645 4.... 250

ELECTRICAL DATA
Unless otherwise specified, measured according to IEC publication 539 see also Table 1.

$B_{25/75}$ value 3965 ± 1,25 %
Operating temperature range, see Fig. 3
at zero power −40 to 110°C
at maximum power 0 to 55 °C

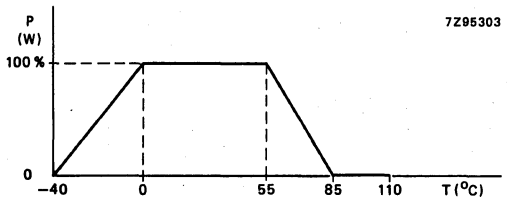


Fig. 3 Derating curve.

Table 1 Catalogue number 2322 645...

suffix of catalogue number		R_{25}	dissipation max.	δ appr.	τ appr.	resp. time appr.*	mass	Fig.	dimensions inches (mm)			
tol. ± 5%	tol. ± 10%	kΩ	W	mW/K	s	s	g		D	d	b	L
03502	02502	5	0,1	6,6	7	0,95	0,12	1	–	.024 (0.6)	.087 (2.2)	–
03602	02602	6	0,1	6,6	8	1,10	0,16	1	–	.024 (0.6)	.091 (2.3)	–
03802	02802	8	0,1	6,6	8,5	1,15	0,17	1	–	.024 (0.6)	.098 (2.5)	–
03103	02103	10	0,1	6,6	9,5	1,20	0,18	1	–	.024 (0.6)	.110 (2.8)	–
23202	22202	2	0,25	9,2	16	1,9	0,36	2	.236 (6)	.024 (0.6)	.110 (2.8)	1.201 (30.5)
23252	22252	2,5	0,25	9,2	18	2,0	0,37	2	.236 (6)	.024 (0.6)	.122 (3.1)	1.201 (30.5)
23302	22302	3	0,25	9,2	20	2,4	0,44	2	.236 (6)	.024 (0.6)	.130 (3.3)	1.201 (30.5)
23502	22502	5	0,25	9,2	25	3,2	0,47	2	.236 (6)	.024 (0.6)	.173 (4.4)	1.201 (30.5)
43102	42102	1	0,75	9,5	30	3,1	0,57	2	.335 (8.5)	.024 (0.6)	.118 (3.0)	1.102 (28)
43202	42202	2	0,75	11,0	43	4,5	0,80	2	.335 (8.5)	.024 (0.6)	.161 (4.1)	1.102 (28)

*Response time in silicone oil MS 200/50. This is the time the sensor needs to reach 63,2% of the total temperature difference when subjected to a temperature change, in this case from 25°C in air to 85°C in oil.

These thermistors have a narrow tolerance on the B value, the result of which is to provide a very small tolerance on the nominal resistance value over a wide temperature range. For this reason the usual graphs of R = f(T) are replaced by table 2, together with a formula with which the characteristics can be calculated with a high precision.

Formula to determine nominal resistance values.

The resistance values at intermediate temperatures can be calculated using the "Steinhert and Hart" equation:

$$R_T = \left(\frac{R_{25}}{10\,000}\right).e^{\left\{\sqrt[3]{\sqrt{E^2+D}-E} \;-\; \sqrt[3]{\sqrt{E^2+D}+E}\right\}}$$

in which $D = 4{,}76919 \times 10^8$ and

$$E = \frac{1{,}14102 - 10^3/T}{1{,}9786 \times 10^{-4}}$$

T = temperature in K.

Determination of the resistance/temperature deviation from nominal

The complete resistance deviation is obtained by combining the "R_{25} tolerance" and the "resistance deviation due to B tolerance."

Let X = R_{25} tolerance;
Y = resistance deviation due to B tolerance;
Z = complete resistance deviation; then:
$Z = [(1 = X/100) \times (1 + Y/100) - 1] \times 100$ or $Z = X + Y$ (approximation)
TC = temperature coefficient;
$\triangle T$ = temperature deviation, so:

$$\triangle T = \frac{Z}{TC}$$

Example:
at 0°C: let X = 5%, Y = 1,5% and TC = 5,08%/K (see table 2)
$Z = (1{,}05 \times 1{,}015 - 1) \times 100 = 6{,}575\%$ or
5% + 1,5% = 6.5% (approximation)
$\triangle T = 6{,}575/5{,}08 = 1{,}3°C$
So, an NTC having R_{25} = 10 kΩ has a value of 32510Ω between −1,3°C and +1,3°C, as also shown in Fig. 4.

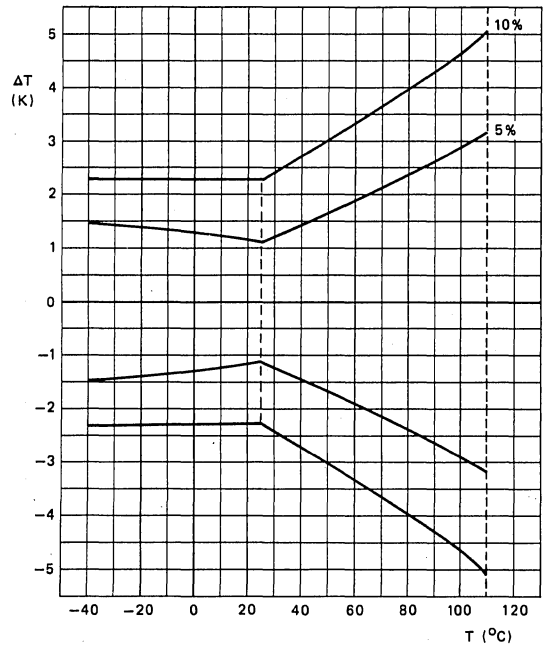


Fig. 4 Temperature deviation (in K) over the range from −40 °C to 110 °C for both 5% and 10% thermistors.

SERIES 645

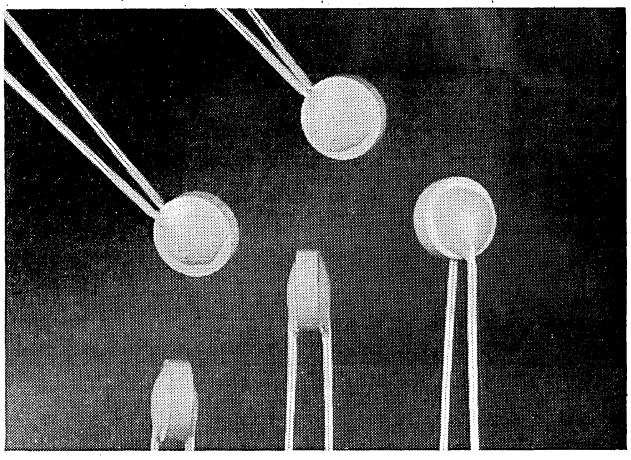
NTC Thermistors Stable-Line Thermistors

temperature °C	ratio R_T/R_{25}	R deviation due to B tol. %	temperature coefficient %/K	resistance (kΩ) for types 2322 645 followed by							
				42102 43102	22202 23202 42202 43202	22252 23352	22302 23302	02502 03502 22502 23502	02602 03602	02802 03802	02103 03103
−40	32,84	4,5	6,57	32,84	65,68	82,10	98,52	164,2	197,0	262,7	328,4
−35	23,77										
−30	17,39	3,7	6,15	17,39	34,78	43,48	52,17	86,95	104,3	139,1	173,9
−25	12,85										
−20	9,589	2,9	5,76	9,589	19,18	23,97	28,77	47,95	57,53	76,71	95,89
−15	7,223										
−10	5,489	2,2	5,40	5,489	10,98	13,72	16,47	27,45	32,93	43,91	54,89
5	4,207										
0	3,251	1,5	5,08	3,251	6,502	8,128	9,753	16,26	19,51	26,01	32,51
5	2,531										
10	1,986	0,9	4,78	1,986	3,972	4,965	5,958	9,930	11,92	15,88	19,86
15	1,569										
20	1,249	0,3	4,50	1,249	2,498	3,122	3,747	6,245	7,494	9,992	12,49
25	1,000	0,0	4,37	1,000	2,000	2,500	3,000	5,000	6,000	8,000	10,00
30	0,8060	0,3	4,25	0,8060	1,612	2,015	2,418	4,030	4,836	6,448	8,060
35	0,6536										
40	0,5331	0,8	4,02	0,5331	1,066	1,333	1,599	2,666	3,199	4,265	5,331
45	0,4372										
50	0,3606	1,3	3,80	0,3606	0,7212	0,9015	1,082	1,803	2,164	2,885	3,606
55	0,2989										
60	0,2490	1,8	3,60	0,2490	0,4980	0,6225	0,7470	1,245	1,494	1,992	2,490
65	0,2085										
70	0,1753	2,2	3,42	0,1753	0,3506	0,4382	0,5259	0,8765	1,052	1,402	1,753
75	0,1481										
80	0,1256	2,6	3,25	0,1256	0,2512	0,3140	0,3768	0,6280	0,7536	1,005	1,256
85	0,1070										
90	0,9155	3,0	3,09	0,09155	0,1831	0,2289	0,2747	0,4578	0,5493	0,7324	0,9155
95	0,07861										
100	0,06775	3,4	2,94	0,06775	0,1351	0,1694	0,2033	0,3388	0,4065	0,5420	0,6775
105	0,05860										
110	0,05086	3,8	2,80	0,05086	0,1017	0,1272	0,1526	0,2543	0,3052	0,4069	0,5086
115	0,04429										
120	0,03870	4,2	2,67	0,03870	0,0774	0,09675	0,1161	0,1935	0,2322	0,3096	0,3870
125	0,03392										

SERIES 660

Disc PTC Thermistors

5% to 40%/°C T. C. of R 50 to 250Ω at 25°C 6° to 105°C Switch Temperature 25 Volts maximum



DESCRIPTION

Series 660 Thermistors span a considerable operational spectrum, in both thermal and electrical domains. Operable at up to 25 VDC at 55°C, with a full ambient range extending from −10° to +125°C at zero power (even wider for certain types) the group offers a choice of five switch temperatures from +6° to +105°C. It features a low thermal time constant, providing rapid response to electrical and thermal overloads, and subsequent rapid recycling upon recovery.

DESIGN FEATURES

- **Low Time Constant**—18 seconds, average, for rapid response, quick recycling, upon overload or excessive temperature excursion.
- **Wide Operating Temperature Range**—as low as −25°C; as high as 155°C, at zero power. To +55°C at full rated voltage.
- **Five Selectable Switch Temperature Ratings:** +6°, +30°, +50°, +80°, and +105°C, in standard catalog thermistors.
- **Miniature Size**—maximum diameter, ¼."
- **Thermistors are lacquer coated.**

TYPICAL APPLICATIONS

- **Temperature Measurement,** for analog or digital monitoring, recording, and control of equipment and process operational temperatures.
- **Temperature Compensation** in electronic and electrical circuits, electromechanical devices, hermetic sealed components, and instrumentation.
- **Overvoltage and Overcurrent Protection** for light electronic and electrical loads.
- **Ambient Temperature Alarm** for high or low temperatures (outside a selected range) in critical circuitry, components, or processes.

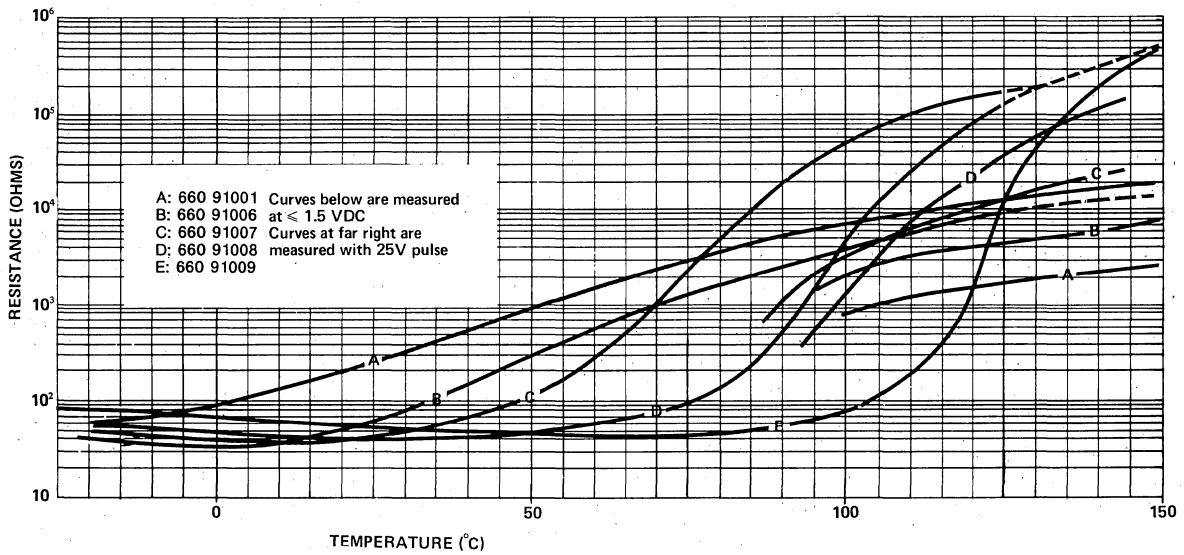
TYPICAL ELECTRICAL CHARACTERISTICS

Resistance* at +25°C	Resistance* At Other Temperatures		Switch** Temp. (°C)	Operating† Temperature Range At Zero Power (°C)	Temperature Coefficient of R (%/°C)	Dissipation Factor (mW/°C)	Thermal Time Constant (sec)	Color Band	Mepco/ Centralab Part Number 2322-
	Temp. (°C)	Resistance (Ω)							
250Ω ±25%	80°	3.7K±30%	+6°	−25° to +155°	+5%	6	17	none	660-91001
60Ω ±30%	125°	3-15K	+30°	−10° to +125°	+7%	7	20	Red	660-91006
50Ω ±30%	125°	100K-500K	+50°	−10° to +125°	+16%	7	18	Orange	660-91007
50Ω ±30%	125°	50K-500K	+80°	−10° to +125°	+23%	7	18	Yellow	660-91008
50Ω ±30%	150°	0.1M-1.2M	+105°	−10° to +150°	+40%	7	18	Green	660-91009

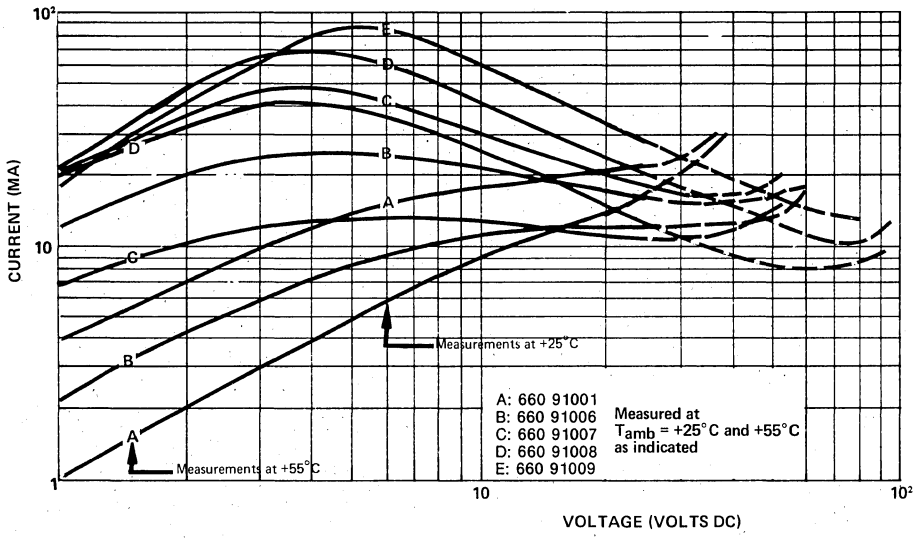
*Measuring voltage: ≤1.5 V to avoid self-heating. **Temperature at which the resistance is twice the minimum resistance.
†+55°C maximum at maximum voltage (25 VDC).

SERIES 660
Disc PTC Thermistors

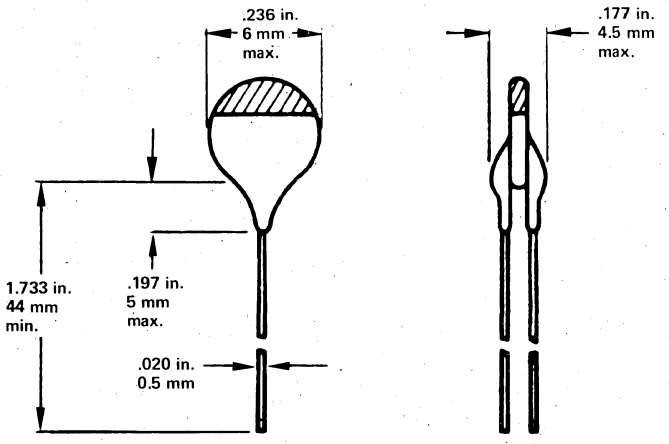
RESISTANCE vs TEMPERATURE



VOLTAGE vs CURRENT



DIMENSIONS AND MARKING



Series 660 thermistors are marked with an identifying color band as indicated at left, and in the table on previous page.

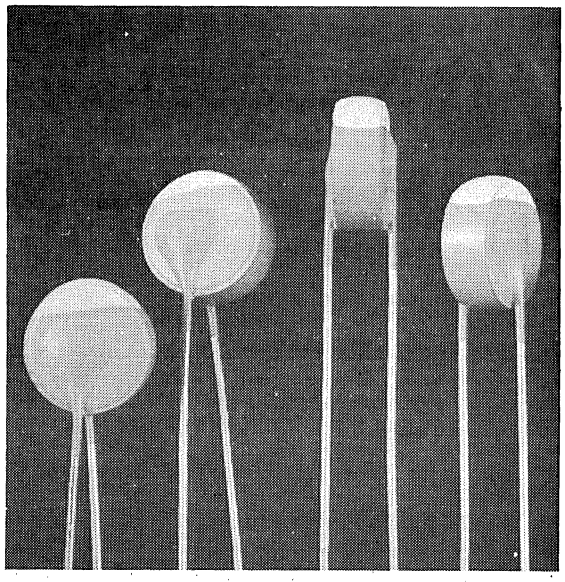
8 Non-Linear Resistors

MEPCO/CENTRALAB, INC. • P.O. Box 760, Mineral Wells, TX 76067 • 817-325-7871 • TWX 910-890-5855

SERIES 661

Disc PTC Thermistors

9% to 75%/°C T.C. of R 30 to 50Ω at 25°C +25° to 110°C Switch Temperature 50 Volts maximum



DESCRIPTION

Series 661 Thermistors offer a range of four well defined, switch temperatures between +25°C and +110°C, and are characterized by a relatively steep slope in the resistance/temperature characteristic beyond the switch point, over the normal operating region. This feature, plus the liberal −10°C to +125°C operating temperature range, and the ability to operate at up to 50 Volts DC at temperatures to +55°C, makes the Series particularly well-suited to thermostatic uses, as well as stabilization and equipment-protection applications of many kinds.

DESIGN FEATURES

- **High Temperature Coefficients,** for high sensitivity in the selected operating temperature range.
- **Wide Temperature Range:** −10° to +125°C at zero power; to +55°C at full rated voltage.
- **Wide Range of Switch Temperatures:** +25°, +45°, +80°, or +110°C, for choice of effective region of operation.
- **Thermistors are lacquer coated.**

TYPICAL APPLICATIONS

- **Current Stabilization,** by paralleling a conventional resistance in series with a power supply bus, to compensate for slowly varying supply voltage.
- **Thermostatic Control** of temperatures in household appliances, industrial processes.
- **Temperature Protection** against high or low temperature excursions in equipment or processes, by alarm and/or equipment shut-down.

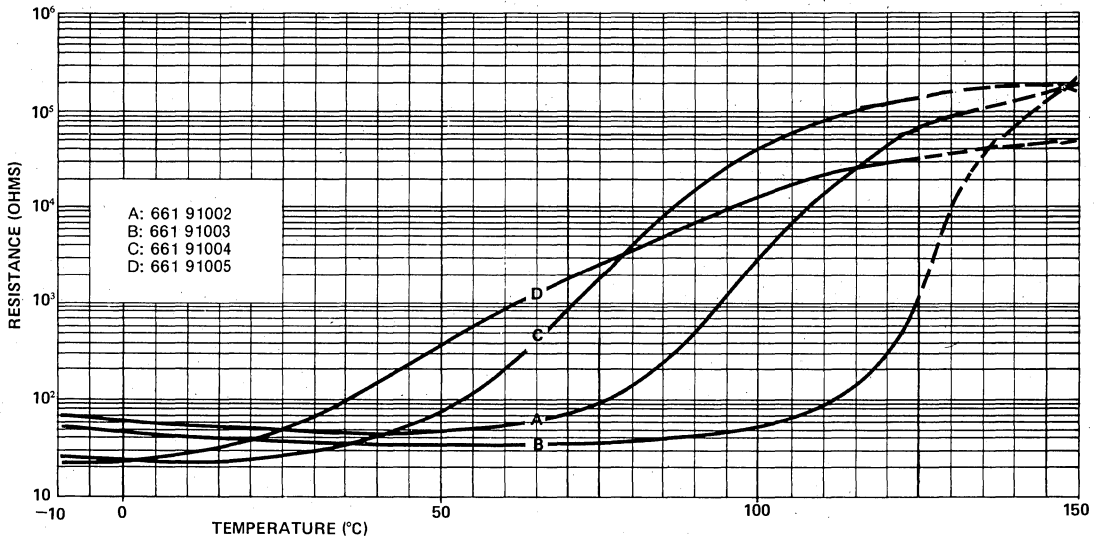
TYPICAL ELECTRICAL CHARACTERISTICS

Resistance* At +25°C (±15Ω)	Resistance* At Other Temperatures		Switch** Temperature (°C)	Temperature Coefficient of R (%/°C)	V_{max} (VDC)	Dissipation Factor (mW/°C)	Thermal Time Constant (s)	Color Band	Mepco/Centralab Part Number 2322-
	Temperature (°C)	Resistance (Ω)							
50Ω	60 to 100	100 to 1000	+80	18	50	8.5	50	Yellow	661-91002
40Ω	95 to 130	80 to 10000	+110	75	50	8.5	50	Green	661-91003
30Ω	40 to 100	90 to 10000	+45	16	50	8.5	50	Orange	661-91004
50Ω	100	3000 to 20000	+25	9	40	6	40	Red	661-91005

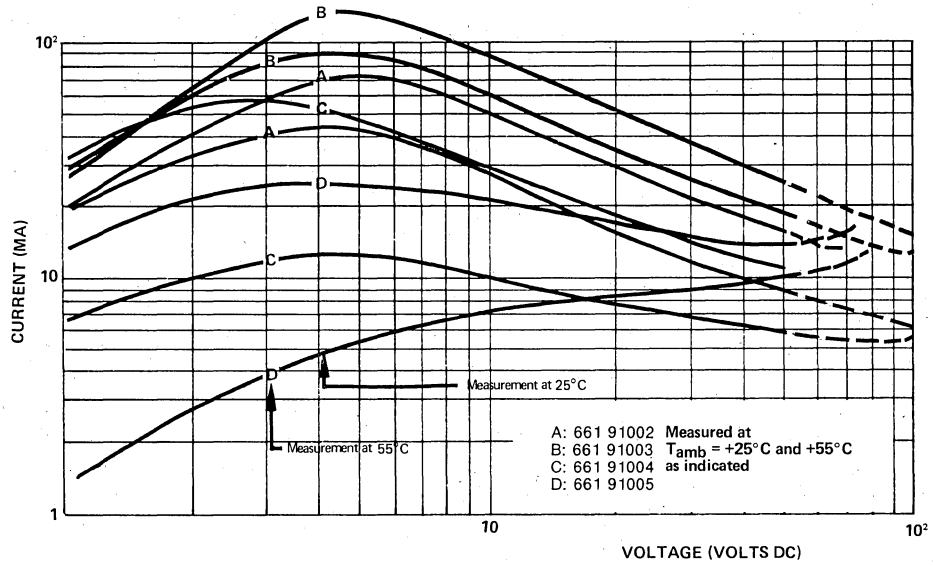
*Measuring voltage <1.5 V to avoid self-heating. Operating temperature range: −10° to +125°C at zero power; 0° to 55°C at V_{max}.
**Temperature at which the resistance is twice the normal resistance.

SERIES 661
Disc PTC Thermistors

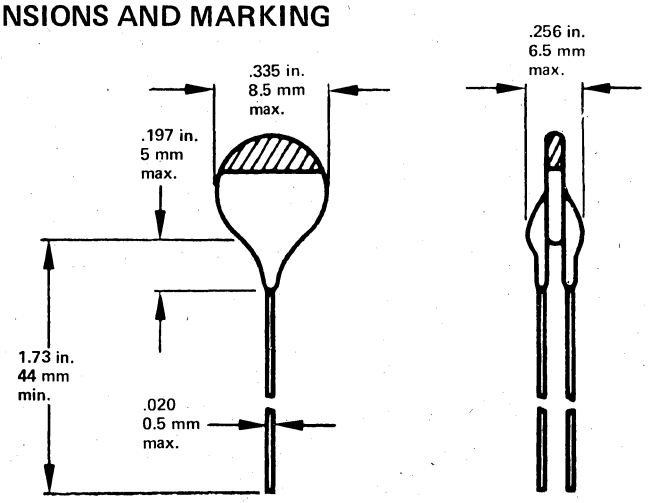
RESISTANCE vs TEMPERATURE



VOLTAGE vs CURRENT



DIMENSIONS AND MARKING



Series 661 thermistors are marked with an identifying color band, as indicated at left and in table on previous page.

8 Non-Linear Resistors

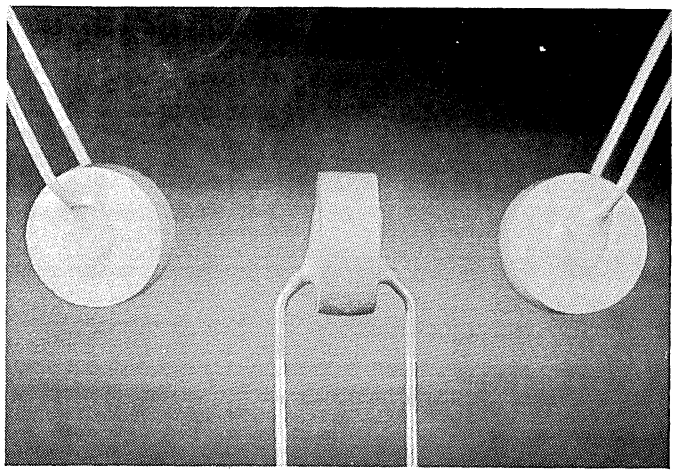
SERIES 662

Disc PTC Thermistors

23% to 35%/°C T.C. of R 36 to 120Ω at 25°C
75° to 115°C Switch Temperature 265 RMS maximum

DESCRIPTION

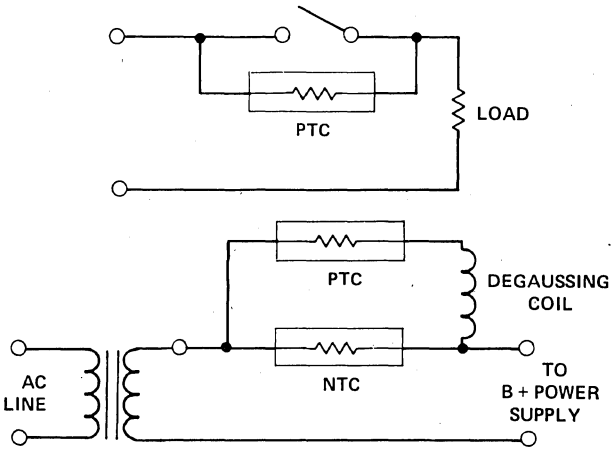
Series 662 Thermistors are special designs featuring low cold resistances, high operating voltage ratings, particularly for pulse applications, and high switch temperatures. Their large positive temperature coefficients and long time constants are of significant value in protective circuitry, and time delay functions.



TYPICAL APPLICATIONS

- **Spark Suppression.** Type 662-91022 finds wide application in protection of switch and relay contact, particularly in telegraph relays. As diagrammed at right, when the contacts open, the low resistance of the cold thermistor prevents sparking by minimizing the voltage appearing across the contacts.
- **TV Degaussing Circuits.** Types 662-93036 and 93066 may be connected in series with the degaussing coil, with both shunted by an NTC thermistor, as shown in the adjacent diagram. Initially the NTC has a high resistance, the PTC a low resistance; this provides a high initial degaussing current.

  Because of their large physical size, the 662 Series can be used to achieve longer time delays, or as self-regulating heaters for components and ovens. As a heater, they can also activate bi-metallic controls.



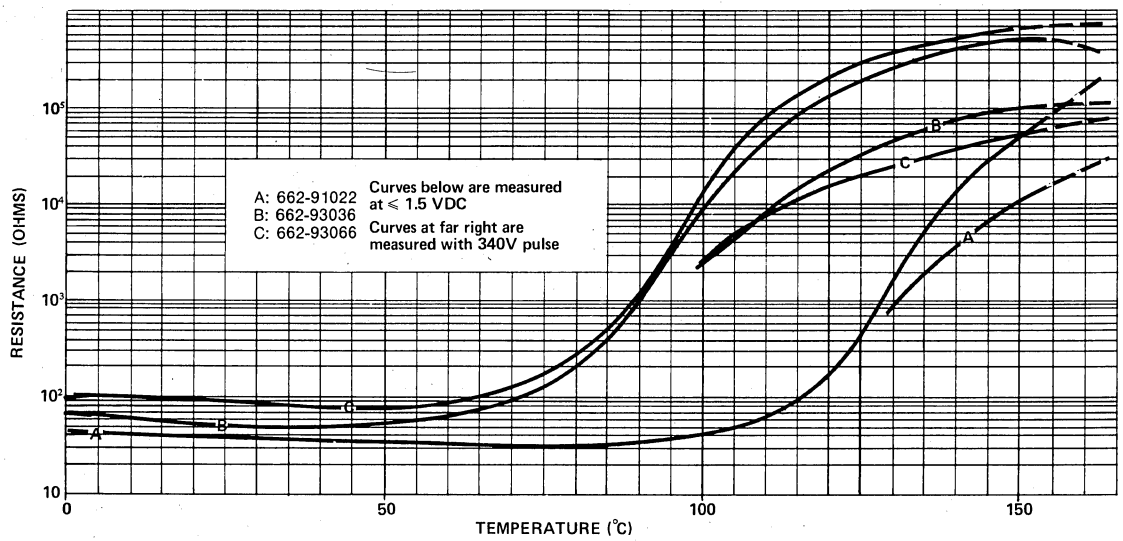
TYPICAL ELECTRICAL CHARACTERISTICS

Resistance* At +25°C (Ω)	Resistance* At Other Temperatures		Switch** Temperature (°C)	Temperature Coefficient of Resistance (%/°C)	Dissipation Factor (mW/°C)	Thermal Time Constant (sec)	Maximum Voltage (at 60°C)	Mepco/Centralab Part Number
	Temperature (°C)	Resistance (Ω)						
36 to 50	+115° +165°† (180V pulse)	<120 >20K	+115°C	+35%	13	80	180 VDC	662-91022
45 to 60	+75°C +150°† (340V pulse)	<160 >45K	+75°	+23%	17	130	265 VRMS	662-93036
80 to 120	+72° +85° +150°† (340V pulse)	$< x R_{25}$ $>2 x R_{25}$ >40K	+80°	+28%	15	100	265 VRMS	662-93066

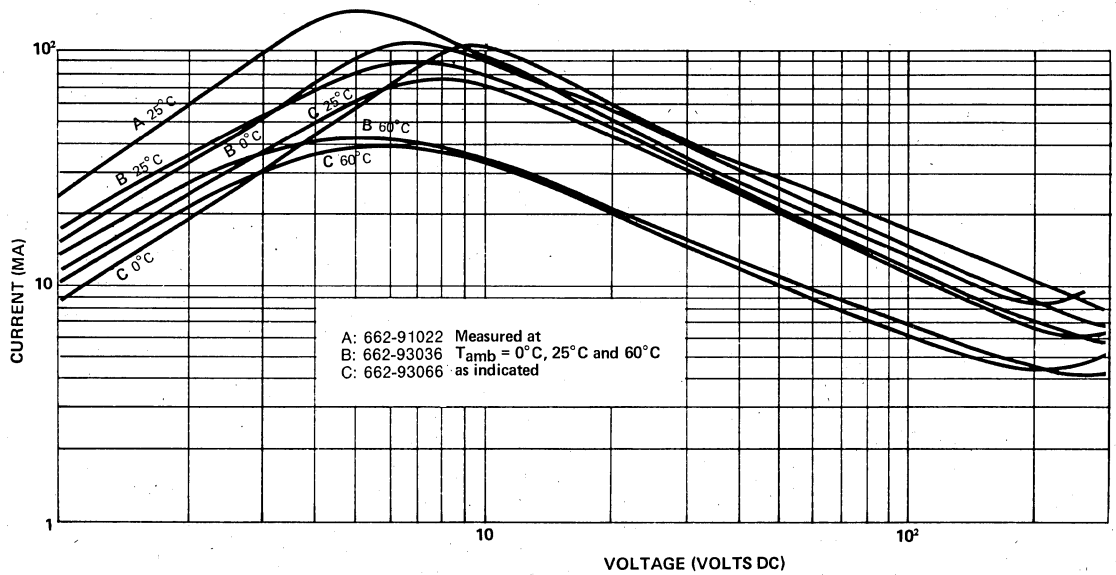
*Measuring voltage ≤ 1.5 V to avoid self-heating. Operating temperature at zero power, 0° to +155°C; 60°C maximum at maximum voltage.
†Pulse measurement without self-heating.
**Temperature at which the resistance is twice the minimum resistance.

SERIES 662
Disc PTC Thermistors

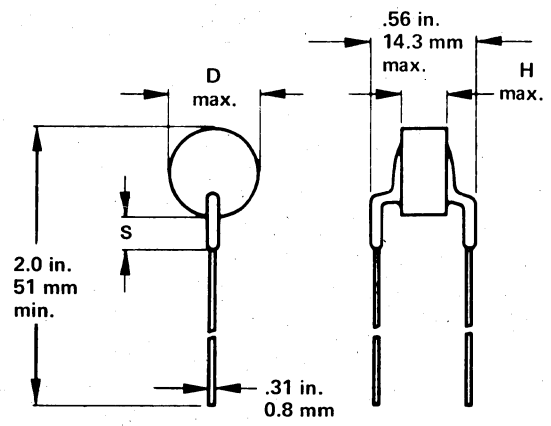
RESISTANCE vs TEMPERATURE



VOLTAGE vs CURRENT



DIMENSIONS AND MARKING



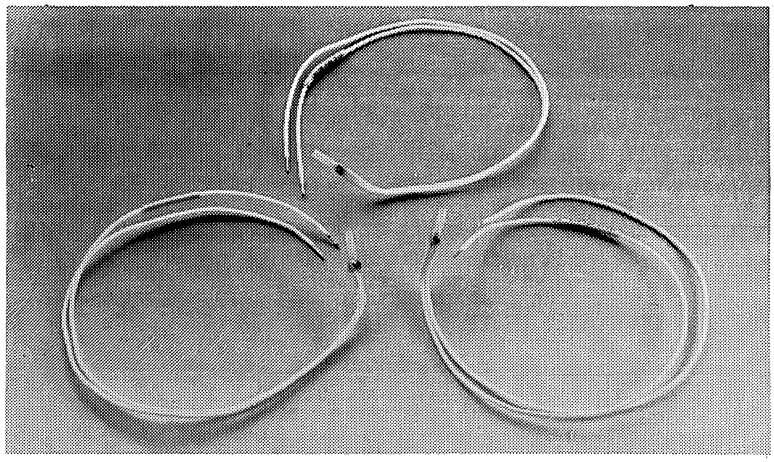
Part Number	Color	DIMENSIONS (max.) D in.	D mm.	H in.	H mm.	S in.	S mm.
662-91022	Blue	.426	10.8	.190	4.8	.200	5.0
662-93036	Blue, green band	.50	12.6	.26	6.5	.315	8.0
662-93066	Red band	.42	10.5	.22	5.5	NA	NA

Thermistor body is lacquer coated. (Except 662-93066)

SERIES 672

PTC Thermistors for Motor Protection

18% to 38%/°C T.C. of R Switch Temperatures, 68° to 137°C Cold Resistance 30 to 250Ω



DESCRIPTION

Series 672 Thermistors are designed to be built directly into the stator windings (one thermistor per phase) of electric motors, for use with transistorized circuits to protect against excessive motor temperatures. The Series includes eight units, offering protective thresholds (temperatures at which the thermistor is to make the protective system operative) in increments of 10°C, from 80° to 150°C.

DESIGN FEATURES

- **Eight Selectable Protective Thresholds,** from 80° to 150°C (Corresponding Switch Temperature range from 68° to 137°C.)
- **Fast Response**—Small size, low thermal inertia.
- **Wide Operating Temperature Range**—From −20°C to as high as +180°C at zero power (to +165°C at Maximum Voltage.)
- **Protection of Electric Motors.** Provide built-in protection against motor overheating, at a selectable temperature level.
- **Detection of Local Hot-Spot and Runaway Temperatures** in bearings, bushings, gear trains, clutches, brakes, cooling systems, as well as in electrical and electronic components.

TYPICAL APPLICATIONS

- **Protection of Electric Motors.** Provide built-in protection against motor overheating, at a selectable temperature level.
- **Detection of Local Hot-Spot and Runaway Temperatures** in bearings, bushings, gear trains, clutches, brakes, cooling systems, as well as in electrical and electronic components.

ELECTRICAL SPECIFICATIONS

Resistance between −20° and T_{ref} −20°C . . . . . 30 to 250Ω
Resistance at T_{ref} −5°C . . . . . <550Ω
Resistance at T_{ref} +5°C . . . . . >1330Ω
Resistance at T_{ref} +15°C (7.5V pulse) . >4000Ω
Dissipation Factor . . . . . 7 mW/°C
Maximum Voltage: . . . . . 15 VDC
Terminals and lead insulation
Dielectric Withstanding Voltage . >2500VRMS
Insulation Resistance . . . . . >1MΩ
Operating Temperature Range
at zero power . . . . . −20° to T_{ref} +30°C
at maximum voltage . . . . −20° to T_{ref} +15°C

TYPICAL ELECTRICAL CHARACTERISTICS

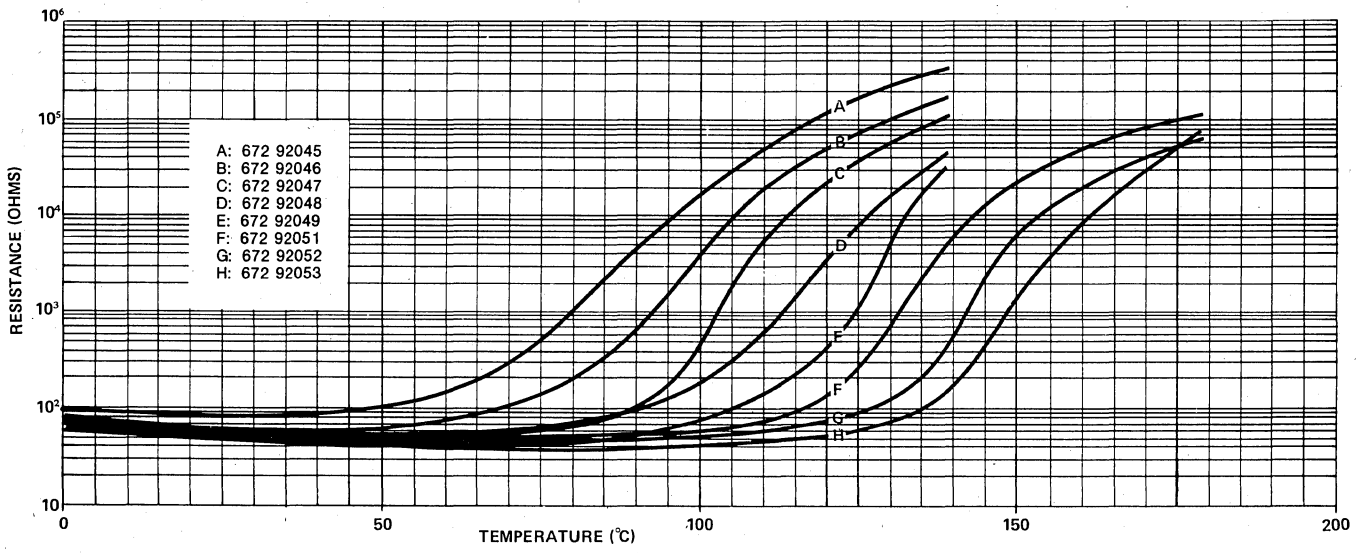
Nominal Resistance at 25°C (Ω)	Reference Temperature T_{ref} (°C)	Switch† Temp. T_s (°C)	Temp. Coeff. (%/°C)	Mepco/Centralab Part Number
95	80	68	18	672-92045
62	90	75	21	672-92046
60	100	88	31	782-92047
60	110	99	33	782-92048
60	120	113	38	672-92049
65	130	123	27	672-92051
72	140	130	33	672-92052
52	150	137	33	672-92053

†Temperature at which the resistance is twice the minimum resistance.
Measuring voltage: ≤1.5 V to avoid self-heating.

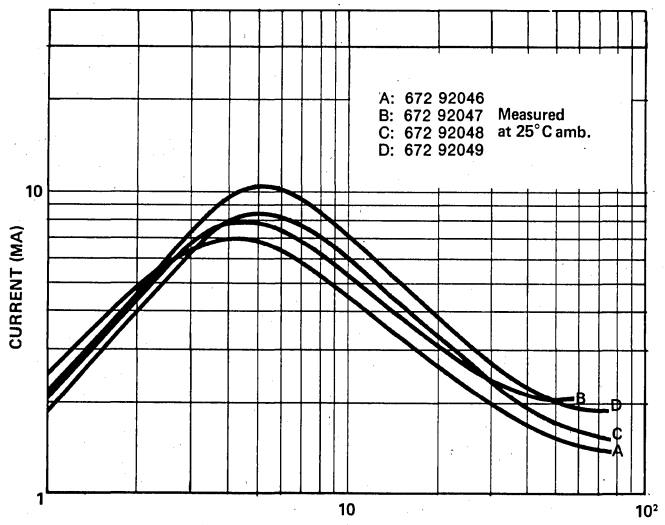
SERIES 672

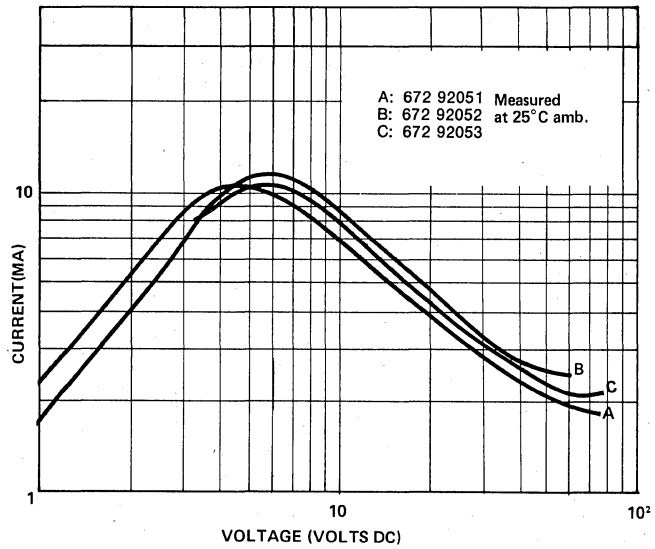
PTC Thermistors for Motor Protection

RESISTANCE vs TEMPERATURE

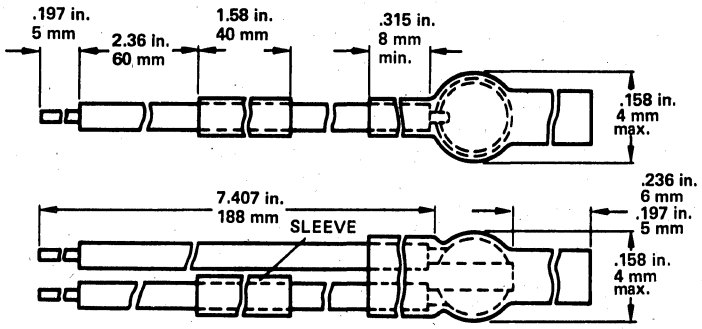


VOLTAGE vs CURRENT





DIMENSIONS AND MARKING

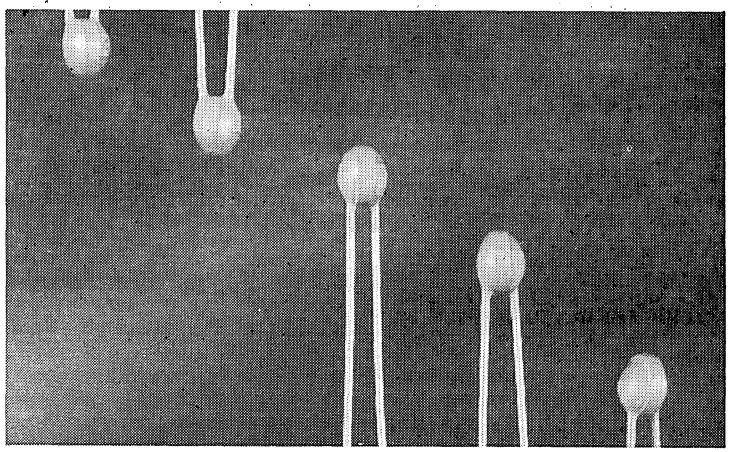


Series 672 Thermistors are provided with two tinned-copper litz-wire leads, with max. cross-section of 7/.0076" (0.194 mm), insulated with PTFE material (meets requirements of Ministry of Aviation Specification EL1930). They are marked for identification by imprinting the last 5 digits of the Part Number on the sleeve. **Weight:** approx. 1.6 g (.06 oz.) **Mounting:** In motor windings; soldered or clamped connections. **Solderability & Heat Resistance:** 240°C max, 4 seconds max.

SERIES 672

Disc PTC Thermistors for General Applications

18% to 38%/°C T.C. of R 30 to 250Ω at 25°C
70° to 150°C Switch Temperature 25 Volts maximum



DESCRIPTION

Series 672 General-Purpose Thermistors are rugged, lightweight, miniaturized units, available with or without leads, for accommodation of the widest possible range of industrial, commercial, and consumer applications.

DESIGN FEATURES

- **Choice of Nine Switch Temperatures** in 10°C increments from 70° to 150°C.
- **High Temperature Coefficients** for high detection sensitivity. 18% to 38%/°C, for standard types.
- **Wide Operating Temperature Range,** from −25°C to as high as +190°C.
- **Very Small Size.** Less than 9/64" in diameter. Leadless types are even smaller.

TYPICAL APPLICATIONS

- **Overvoltage and Short Circuit Protection.** Connected in series with a load circuit, the thermistor limits the load current to a safe value.
- **Current Stabilization for Constant Load.** Paralleled with a resistor, in series with the load, the thermistor compensates for slow voltage fluctuations.
- **Thermostatic Control.** Permits establishing and maintaining temperatures in tanks, compartments, process vessels, home appliances, and feedback controls.
- **Fire Alarm Warning and Shutdown.** Protects against over-temperature by actuation of warning device and/or shut-down of power.

ELECTRICAL SPECIFICATIONS

Resistance at 25°C . . . . . 30 to 250Ω
Resistance at T_S +5°C . . . . . <550Ω
Resistance at T_S +15°C . . . . . >1330Ω
Resistance at T_S +25°C . . . . . >4000Ω
Switch Temperature (T_S)† . . . . . 70° to 150°C
Maximum Voltage (V_{max}) . . . . . 25V DC
Dissipation Factor . . . . . 5.7 mW/°C
Thermal Time Constant . . . . . 9 seconds
Operating Temperature Range
at zero power . . . . . −25°C to T_S +40°C
at V_{max} . . . . . T_S +25°C max.

Measuring voltage: ≤1.5 V to avoid self-heating.

TYPICAL ELECTRICAL CHARACTERISTICS

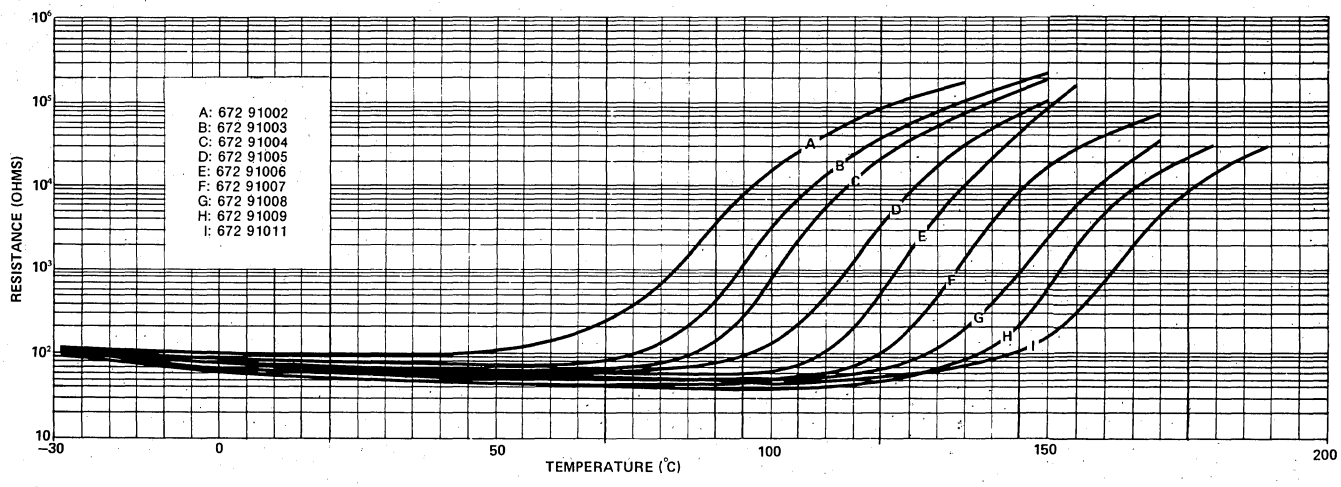
Nom. Res. at 25°C (Ω)	Switch† Temp. T_S (°C)	Temp. Coeff. (%/°C)	Color* Code	Mepco/Centralab Part Number	
				With Leads	Leadless
92	70	+18	Violet	672-91002	672-91026
62	80	+21	Gray	672-91003	672-91027
60	90	+31	White	672-91004	672-91028
62	100	+33	Black	672-91005	672-91029
57	110	+38	Brown	672-91006	672-91031
62	120	+27	Red	672-91007	672-91032
70	130	+33	Orange	672-91008	672-91033
50	140	+33	Yellow	672-91009	672-91034
70	150	+23	Green	672-91011	672-91035

*Leadless units are not color-coded. Units with leads are lacquer coated.
†Upper temperatures at which the resistance is twice the minimum resistance.

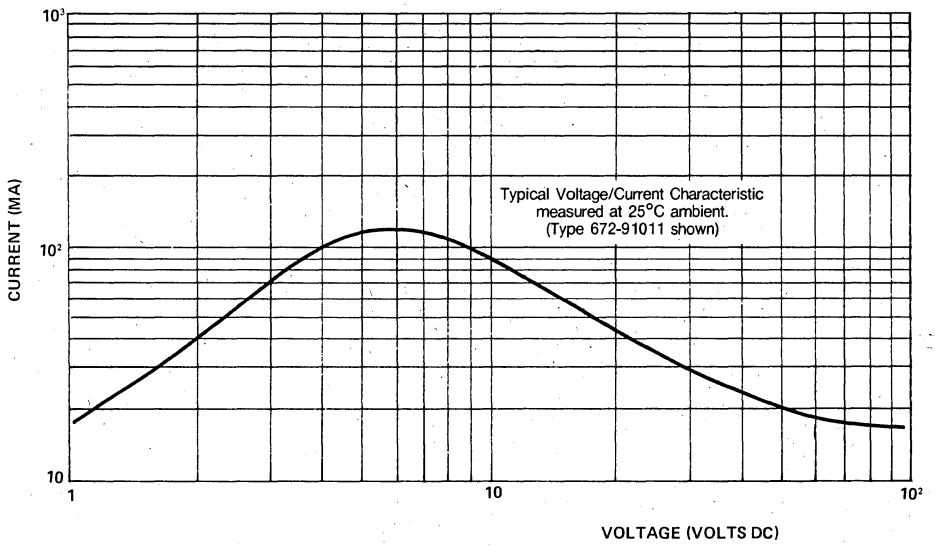
SERIES 672

Disc PTC Thermistors for General Application

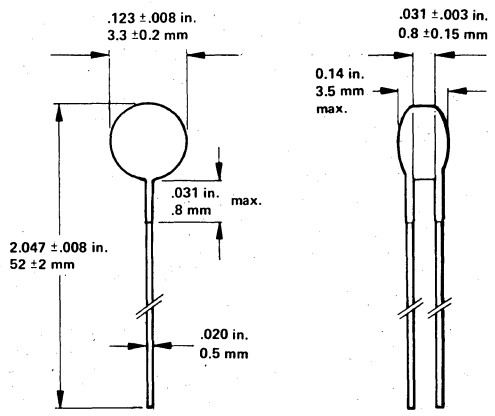
RESISTANCE vs TEMPERATURE



VOLTAGE vs CURRENT



DIMENSIONS AND MARKING



Types 672-91002 to 91011 are provided with tinned solid-copper leads.

8 Non-Linear Resistors

SERIES 672

PTC Thermistors

2322 672 98001

DESCRIPTION

Series 672 Special-Purpose Thermistors were designed especially for use as current stabilizers for compensation of variations in telephone line resistance. This small, lightweight device is also ideal for over-current protection and switching applications in low power circuits. The miniature PTC disc is mounted in a plastic housing with pressure contacts and two silver coated pins for long life and easy mounting in Printed Circuit Boards.

QUICK REFERENCE DATA

Resistance value at +25°C	115 ±25Ω
Resistance value at +155°C, V_{pulse} = 33V	min. 15 kΩ
Switch temperature	≈+97°C
Temperature coefficient	min 10%/K
Maximum voltage (d.c.)	33 V
Operating temperature range	
at zero power	−25 to +155°C
at maximum voltage	+5 to +55°C

MECHANICAL DATA—Inches (mm)

Outlines

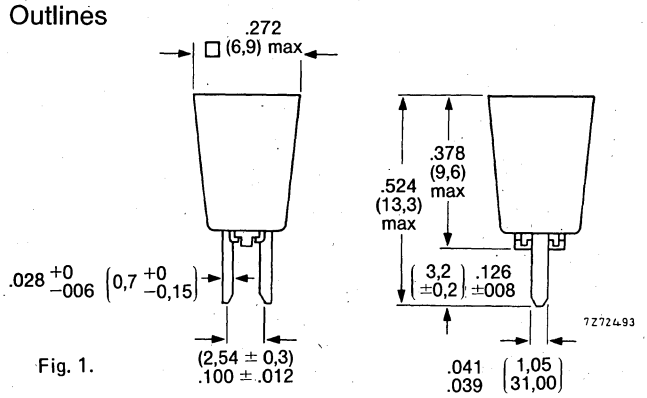


Fig. 1.

PACKAGING

5000 thermistors in a cardboard box (containing 10 foam plastic trays).

Marking

Manufacturer's identification symbol and the letters TPE, representing the model, are moulded in the top of the cap.

Mass

0.4 g approximately

Mounting

to be soldered onto a printed-wiring board

Robustness of terminations

Tensile strength 2.25 lb (10 N)

Soldering

Solderability	max. 240°C, max. 4 s
Resistance to heat	max. 265°C, max. 11 s

Vibration

in accordance with CCTU 01-01A fasc. 16 A severity 55 A

Impact

Free fall 39.4 in. (1000 mm)

Inflammability

Non-flammable

ELECTRICAL DATA

The values in the table without further indication are approximate values.

Resistance	
at +25°C	115 ±25Ω
at +97°C	max. 600Ω
at +155°C, V_{pulse} = 33V	min. 15,000Ω
Switch temperature	+97°C
Temperature coefficient	min. +10%/K
Operating temperature range	
at zero power	−25 to +125°C
at maximum voltage	+5 to +55°C

ELECTRICAL DATA (CONT.)

SERIES 672
PTC Thermistors

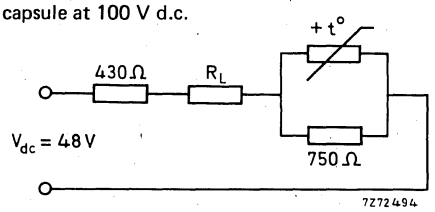
2322 672 98001

ELECTRICAL DATA (Cont.)

Voltage dependence at +155°C	0.29
Maximum voltage (d.c.)	33 V
Maximum dielectric withstanding voltage (r.m.s.) between terminals and capsule	500 V
Insulation resistance between terminals and capsule at 100 V d.c.	min. 10 MΩ

Maximum dielectric withstanding voltage (r.m.s.) between terminals and capsule

Insulation resistance between terminals and capsule at 100 V d.c.

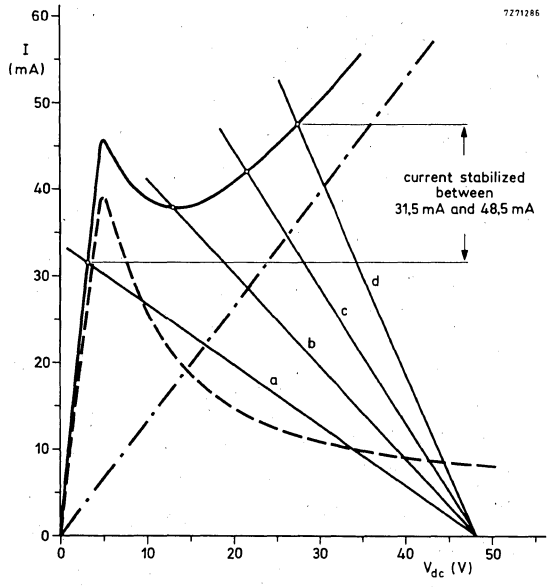


500 V

min. 10 MΩ

Fig. 2 Line resistance (R_L) compensation.

Initial current of +5 °C and R_L = 0	min. 75 mA max. 95 mA
Current after 10 s at +5 °C and R_L = 0	max. 60 mA
Initial current at +55 °C and R_L = 0	min. 85 mA max. 105 mA
Current after 10 s at +5 °C and R_L = 0	max. 55 mA



PTC + parallel-connected 750 Ω resistor;
PTC alone;
750 Ω resistor alone.

Fig. 3 (a) R_L = 1000 Ω; (c) R_L = 200 Ω;
(b) R_L = 500 Ω; (d) R_L = 0 Ω.

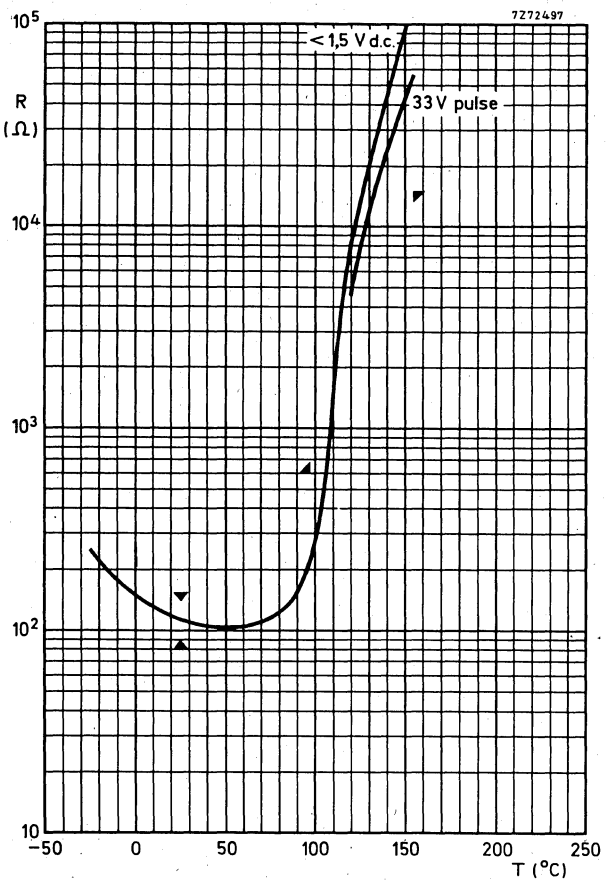


Fig. 4 Typical resistance/temperature characteristics.

8 Non-Linear Resistors

Electrical Data (Cont.)

2322 672 98001

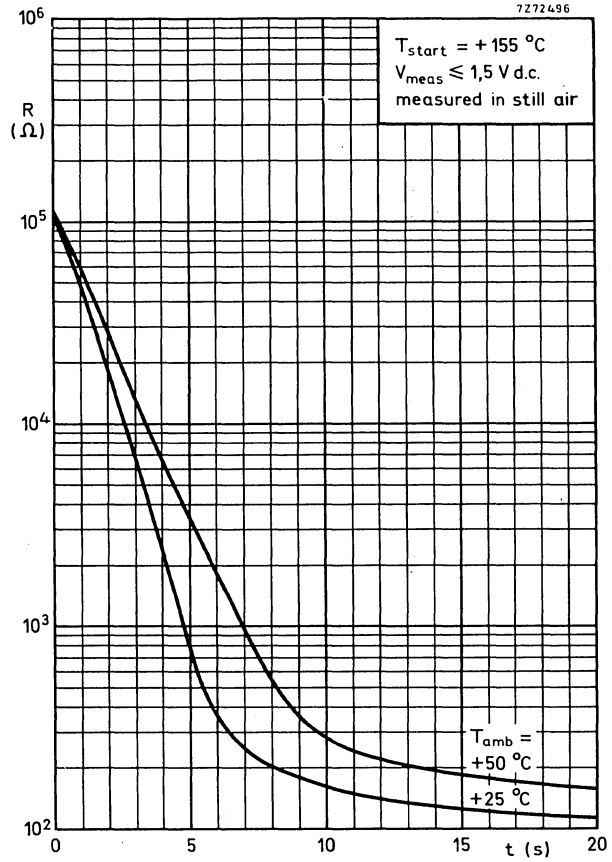


Fig. 5 Typical resistance/time (cooling) characteristics.

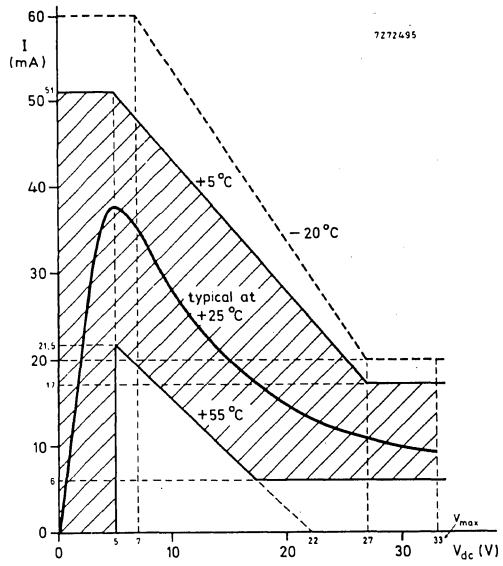


Fig. 7 Area of current/voltage characteristics.

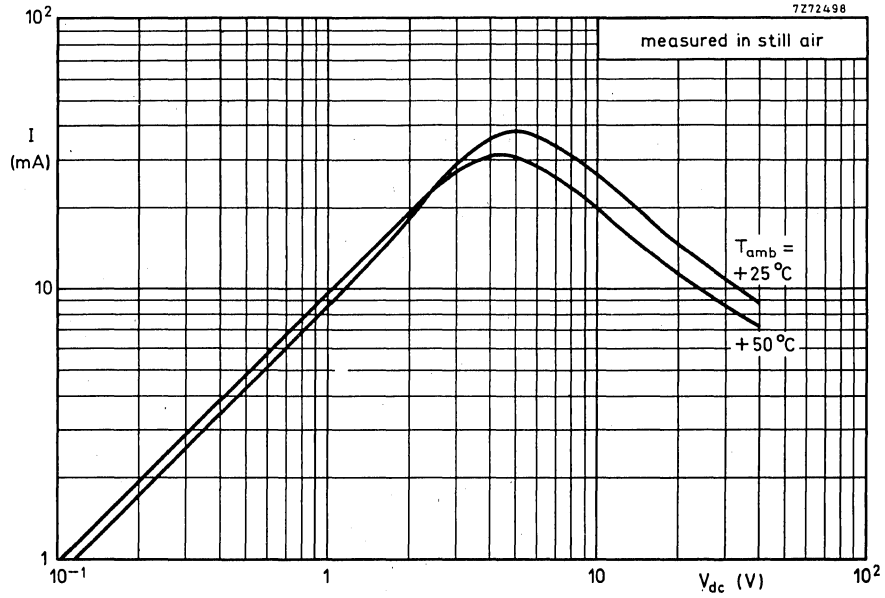


Fig. 6 Typical voltage/current characteristics.

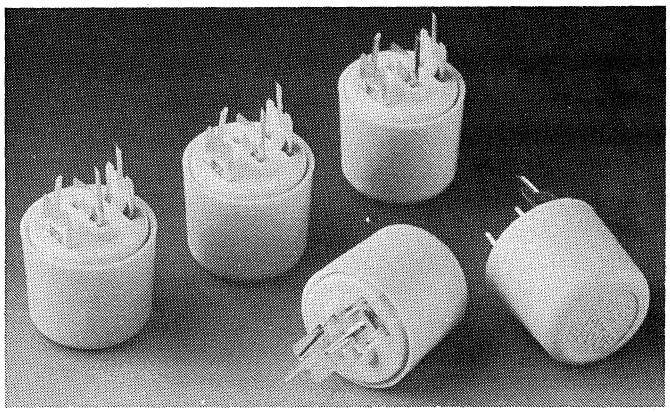
Note:

Figs 5, 6 and 7 are measured with the PTC mounted on a printed-wiring board.

SERIES 662

Dual Degaussing PTC Thermistors

2322-662-98009



DESCRIPTION

GENERAL

Series 662 Dual Degaussing PTC Thermistors are designed to provide the high initial degaussing current and low residual current flow required for high purity of color in color TV tubes. This quality is especially useful in color monitors.

QUICK REFERENCE DATA

Current through the coil at 200 V r.m.s.	
min. inrush peak current	5 A
max. peak current	
after 5 s	70 mA
after 30 s	5 mA
after 3 min	2 mA
Maximum r.m.s. voltage	265 V
Operating temperature range	
at zero power	−25 to +125°C
at maximum voltage	0 to +60°C

APPLICATION

In degaussing circuits of colour television sets.

DESCRIPTION

The dual PTC consists of two disc PTC thermistors clamped between spring contacts. This assembly ensures a good thermal contact between both discs, which is essential for the function of this device. The thermistor is enclosed in a white plastic housing. The three connecting pins are arranged to fit a printed-wiring board with an 0,1 inch grid.

The parallel PTC thermistor is connected across the supply, the series PTC thermistor is connected in series with the degaussing coil. The series PTC would not be itself lower the current to 2 mA, but would stabilize the current above this value. By applying further heat to the series PTC, its resistance will increase to the point where the coil current is limited to 2 mA. This extra heat is provided by the parallel PTC.

MECHANICAL DATA—Inches (mm)

Outlines

A and B are to be connected to the mains;
A and C are to be connected to the degaussing oil (see also Fig. 2)

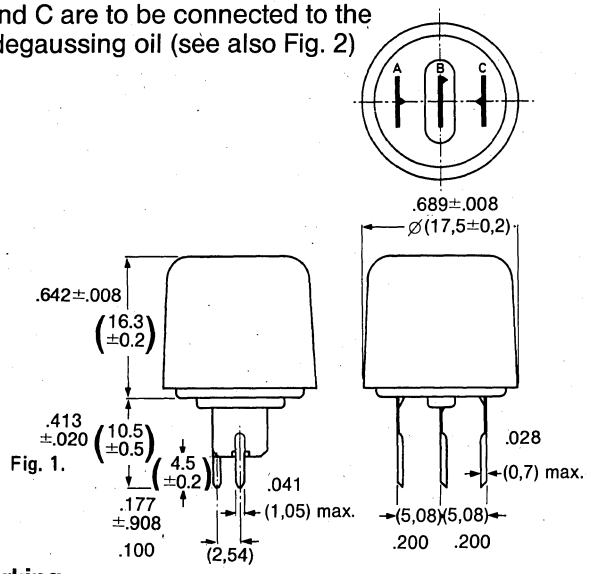


Fig. 1.

Marking

The catalogue number of molded in the top of the cap

Mass

7,3 g approximately

Mounting

The thermistor can be soldered directly onto a printed-wiring board.

Robustness of terminations

Tensile strength	4.5 lb. (20 N)

Soldering

Solderability	max. 240°C, max. 4 s
Resistance to heat	max. 265°C, max. 11 s

Impact

Free fall	39.4 in. (1000 mm)

Inflammability

Non-flammable, according to IEC 695-2 2 (1980)

PACKAGING

500 thermistors in a cardboard box.

2322-662-98009

ELECTRICAL DATA

Unless otherwise specified measured according to IEC draft publication 40 (secretariat) 288.

Current through the coil measured in circuit of Fig. 2 at 200 V r.m.s.		
min. inrush peak current		5 A
max. peak current		
after 5 s		70 mA
after 30 s		5 mA
after 3 min		2 mA
Resistance at +25°C,		
R_S	~	40Ω
R_P	~	3000Ω
Maximum r.m.s. voltage in circuit*		265 V
Minimum degaussing coil resistance		17 Ω
Operating temperature range		
at zero power, complete assembly		−25 to +125°C
at zero power, ceramic in free air (10 h max.)		−55 to +225°C
at maximum voltage		0 to +60°C

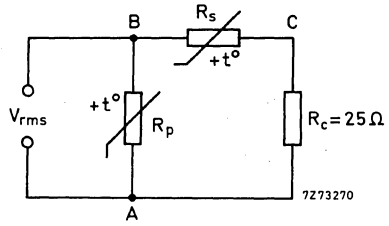


Fig. 2 Measuring circuit.

R_P = parallel PTC;
R_S = series PTC;
R_C = replaces the degaussing coil (Z = 25Ω).

*In still air, the thermistor soldered on printed wiring board.

SERIES 662

Dual Degaussing PTC Thermistors

2322-662-98009

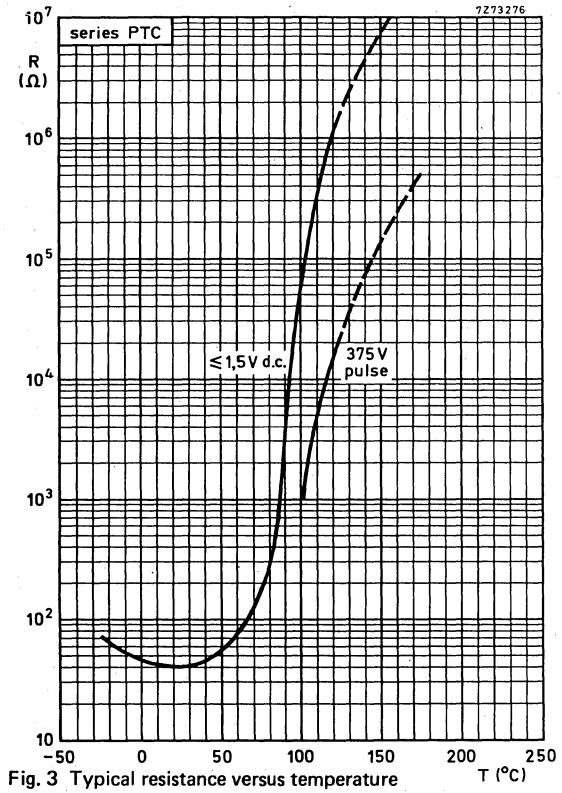


Fig. 3 Typical resistance versus temperature characteristics of the series PTC.

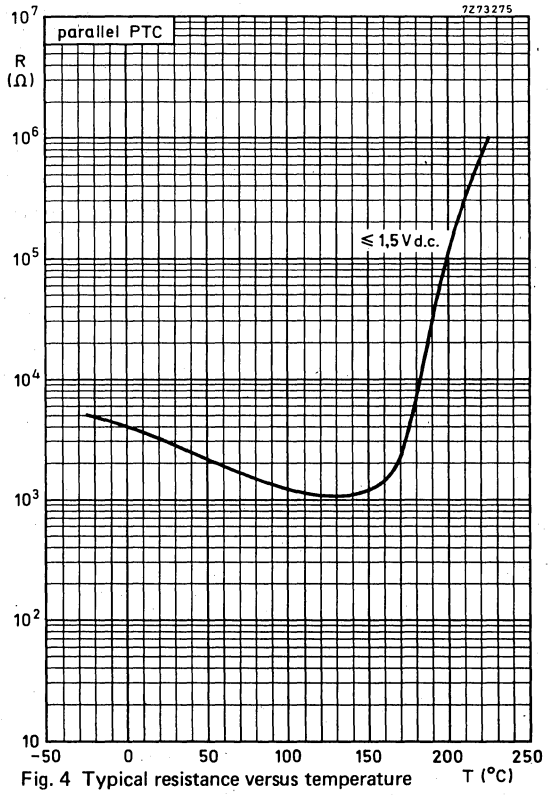


Fig. 4 Typical resistance versus temperature characteristics of the parallel PTC.

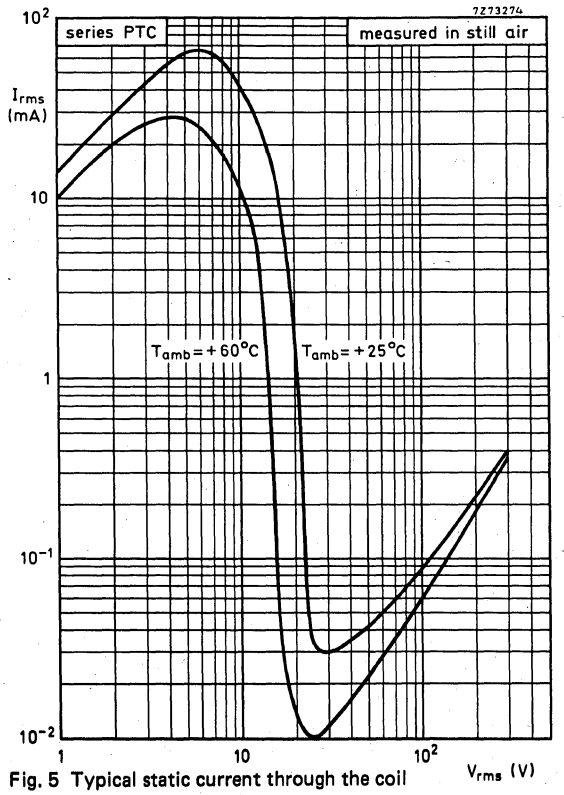


Fig. 5 Typical static current through the coil versus voltage characteristics.

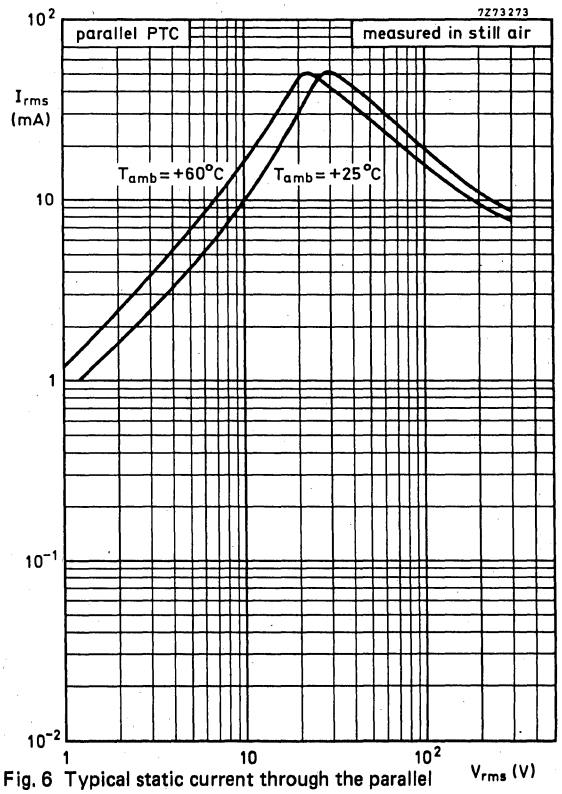


Fig. 6 Typical static current through the parallel PTC versus voltage characteristics.

8 Non-Linear Resistors

MEPCO/CENTRALAB, INC. • P.O. Box 760, Mineral Wells, TX 76067 • 817-325-7871 • TWX 910-890-5855

2322-662-98009

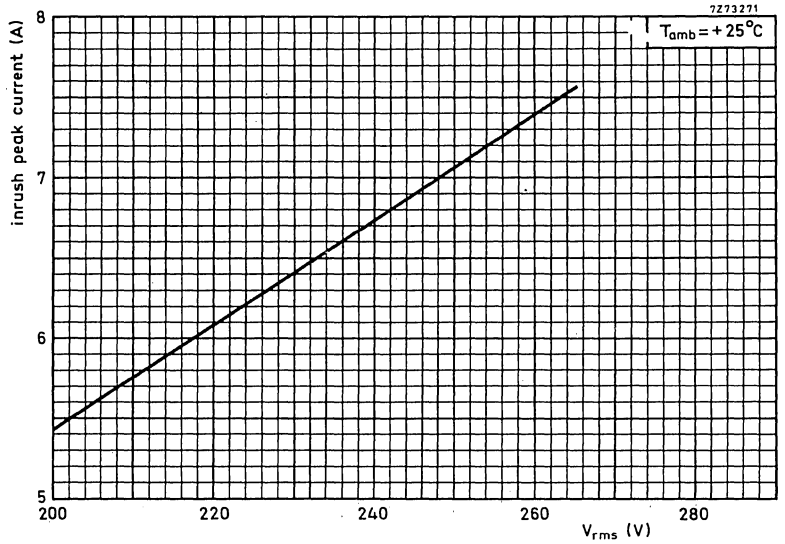


Fig. 7 Typical inrush peak current versus voltage characteristic.

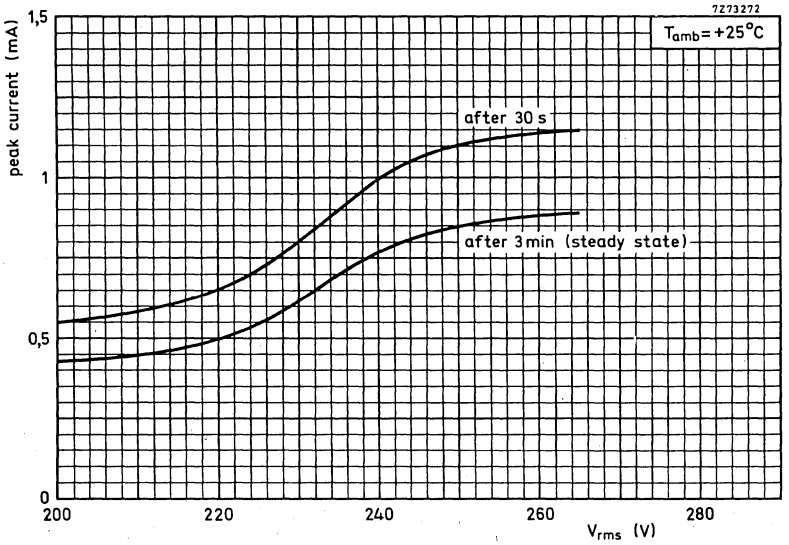


Fig. 8 Typical peak current versus voltage characteristics.

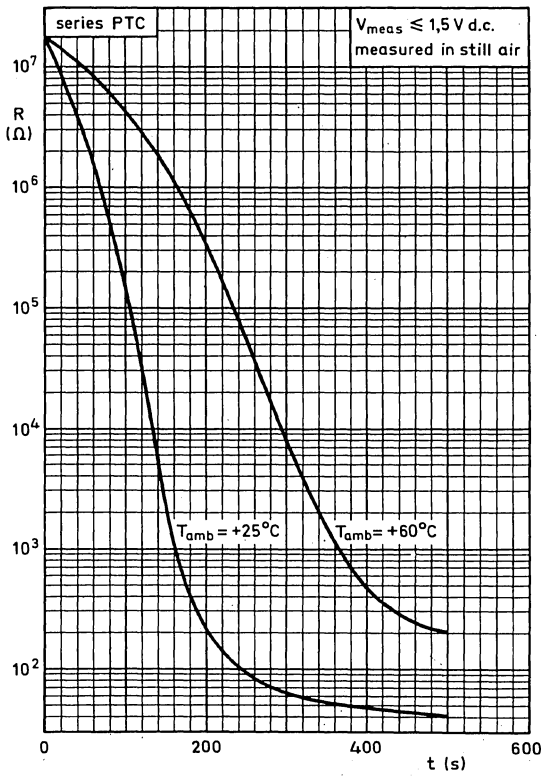


Fig. 9 Typical resistance versus cooling time characteristics of series PTC (cooling off after stationary operation at 220 V).

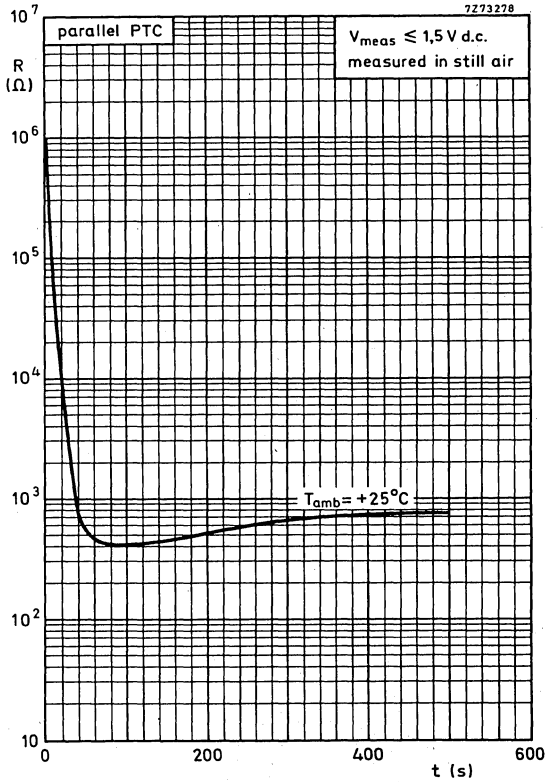


Fig. 10 Typical resistance versus cooling time characteristic of parallel PTC (cooling off after stationary operation at 220 V).

SERIES 662

Dual Degaussing PTC Thermistors

2322-662-98009

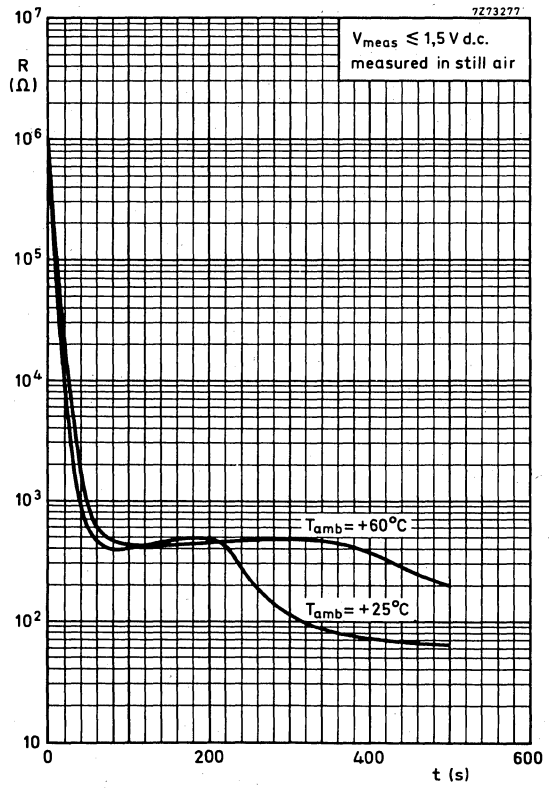


Fig. 11 Typical resistance of circuit versus cooling time characteristics (cooling off after stationary operation at 220 V).

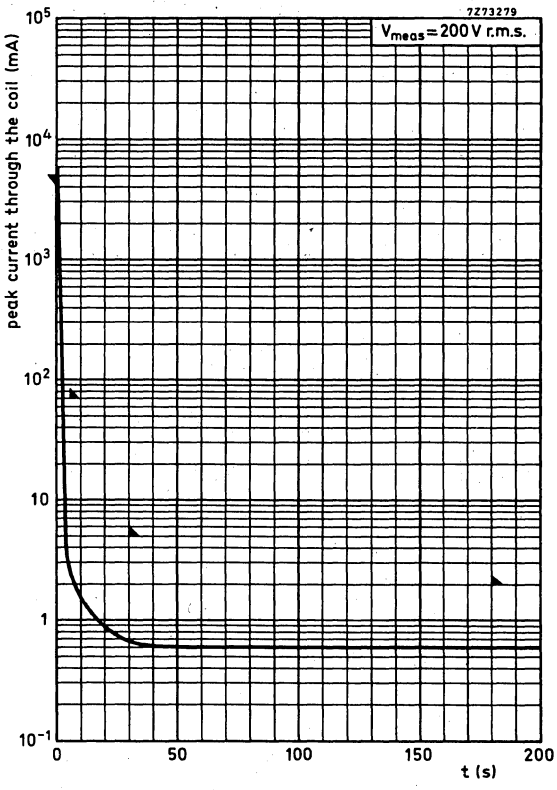


Fig. 12 Typical peak current through the coil versus time characteristic. Peak current limits are indicated by ◣ .

8 Non-Linear Resistors

SERIES 662

Dual Degaussing PTC Thermistors

QUICK REFERENCE DATA

Current through the coil at	200 V (r.m.s.)	120 V (r.m.s.)	
Minimum inrush peak current	6,5	3,6	A
Maximum peak current after 30 s	5	5	mA
Maximum peak current after 3 min	2	2	mA
Operating temperature range at zero power	−25 to 125		°C
at maximum voltage	0 to 60		°C

2322-662-98011

APPLICATION

In dagaussing circuits of color television sets, for operation on 120 and 240 V mains supply.

DESCRIPTION

This dual PTC thermistor consists of two discs with a positive temperature coefficient, mounted in a plastic housing. The three connecting pins are arranged to fit a printed wiring board with an 0,1 inch grid.

MECHANICAL DATA—Inches (mm)

Outlines

A and B are to be connected to the mains;
A and C are to be connected to the degaussing coil (see also Fig. 2).

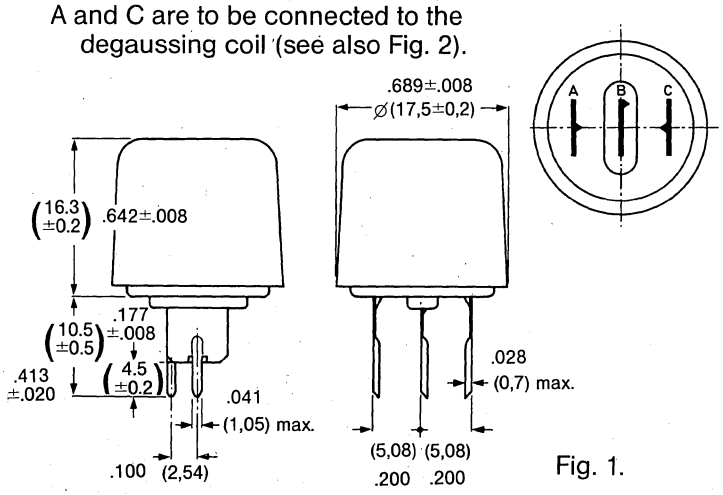


Fig. 1.

Marking

The catalogue number is molded in the top of the cap

Mass

7,3 g approximately

Mounting

The thermistor can be soldered directly onto a printed wiring board

Robustness of terminations

Tensile strength 4.5 lb. (20 N)

Soldering

Solderability max. 240°C, max. 4 s
Resistance to heat max. 265°C, max. 11 s

Impact

Free fall 39.4 in. (1000 mm)

Inflammability

Non-flammable, in accordance with IEC publication 695-2-2 of 1980.

PACKAGING

500 thermistors in a cardboard box.

ELECTRICAL DATA

Unless otherwise specified according to IEC draft publication 40/355 of June 1975

Current through the coil measured in circuit of Fig. 2 at	200 V (r.m.s.)	120 V (r.m.s.)	
Minimum inrush peak current	6,5	3,6	A
Maximum peak current after 30 s	5	5	mA
Maximum peak current after 3 min	2	2	mA
Resistance at 25°C of series PTC (R_S)	≈ 35		Ω
Resistance at 25°C of parallel PTC (R_P)	≈1000		Ω
Minimum resistance at 175°C and 375 V_{pulse} of R_S	130		kΩ
Minimum resistance at 225°C and 375 V_{pulse} of R_P	25		kΩ
Minimum degaussing coil resistance	16		Ω
Switch temperature of R_S	≈ 65		°C
Switch temperature of R_P	≈ 170		°C
Temperature coefficient of R_S	≈ +26		%/K
Temperature coefficient of R_P	≈ +19		%/K
Maximum r.m.s. voltage in circuit*	265		V
Dissipation factor* (δ)	≈ 12,5		mW/K
Thermal time constant*	≈ 225		s
Operating temperature range at zero power	−25 to 125		°C
at maximum voltage	0 to 60		°C

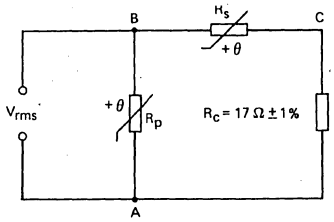


Fig. 2 Measuring circuit.
R_P = parallel PTC;
R_S = series PTC;
R_C = replaces the degaussing coil (Z = 17 Ω).

8 Non-Linear Resistors

SERIES 662

Dual Degaussing PTC Thermistors

2322-662-98011

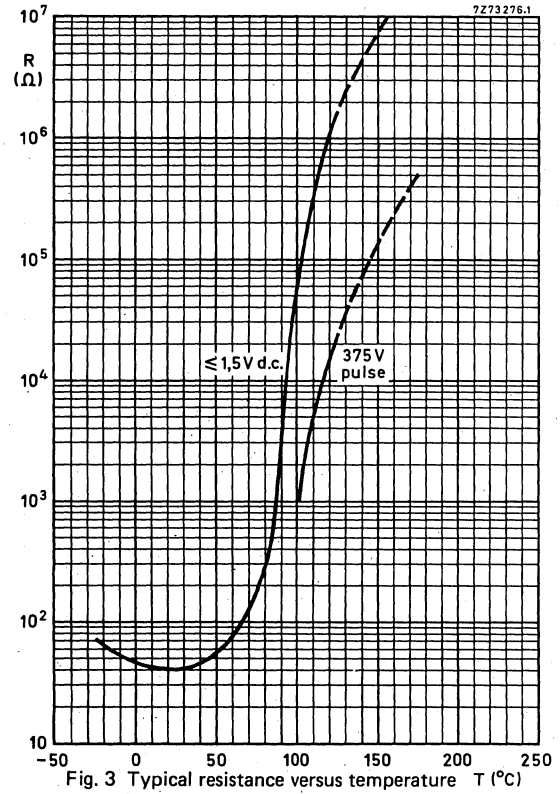


Fig. 3 Typical resistance versus temperature characteristics of the series PTC.

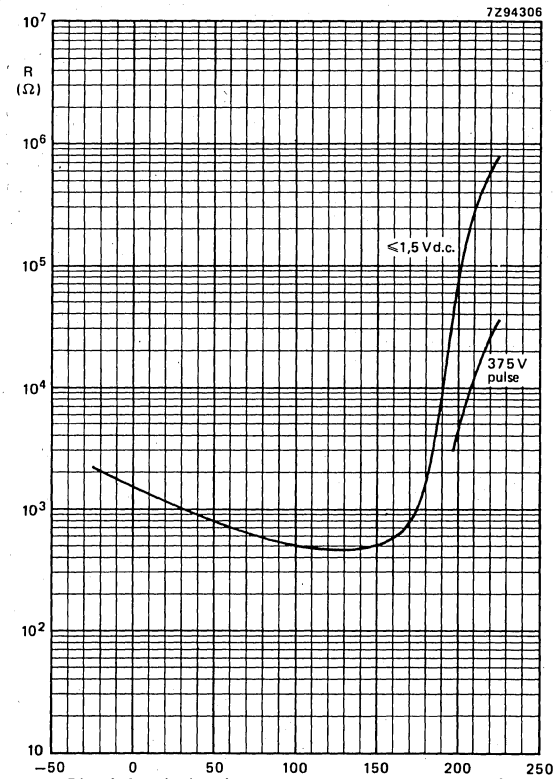


Fig. 4 Typical resistance versus temperature characteristics of the parallel PTC.

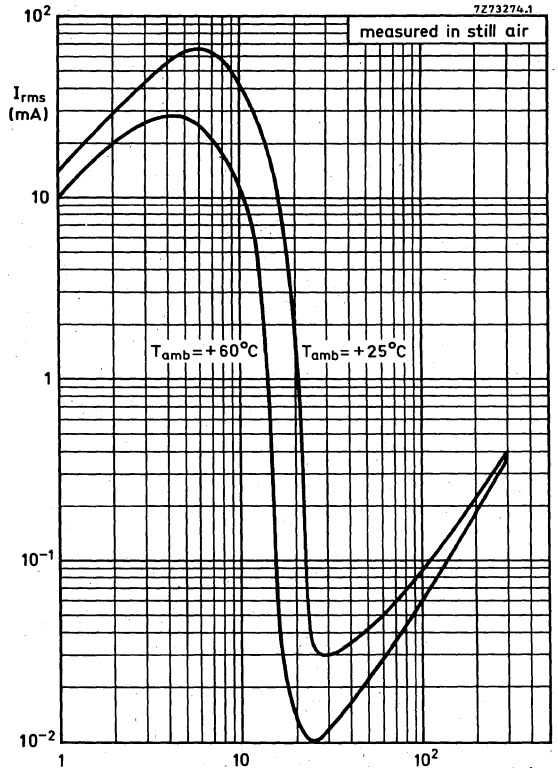


Fig. 5 Typical static current through the coil versus voltage characteristics.

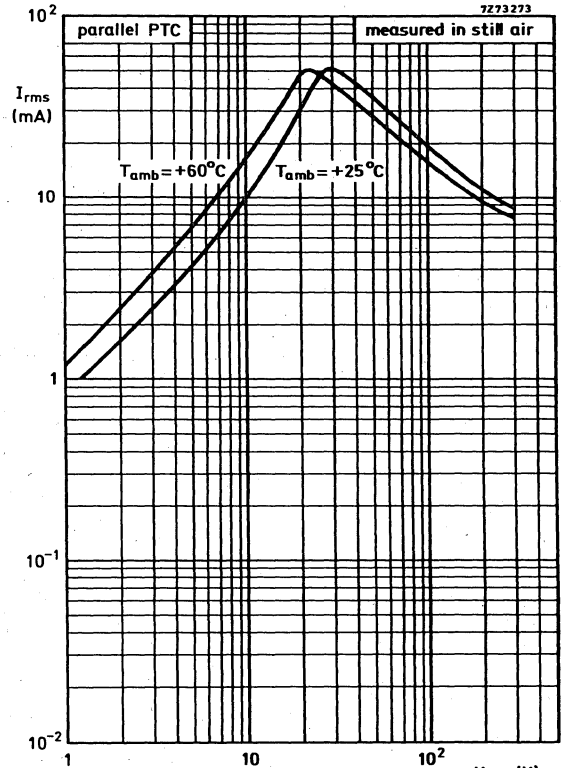


Fig. 6 Typical static current through the parallel PTC versus voltage characteristics.

2322-662-98011

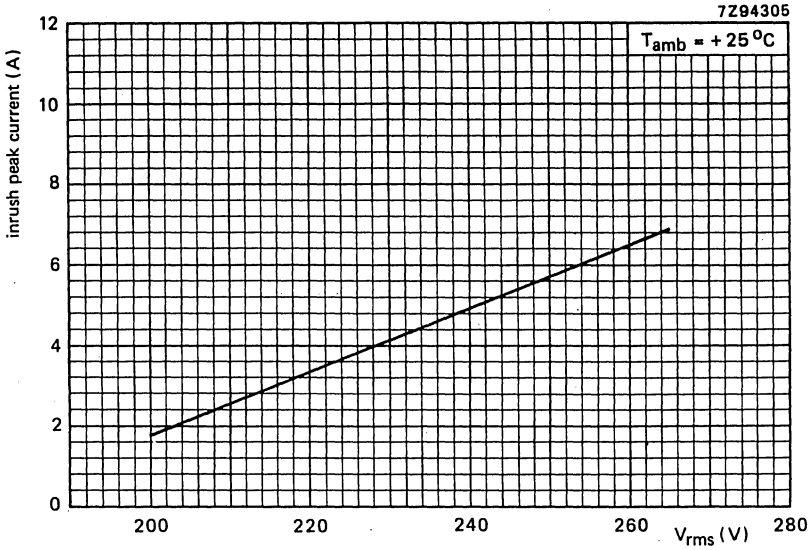


Fig. 7 Typical inrush peak current versus voltage characteristic.

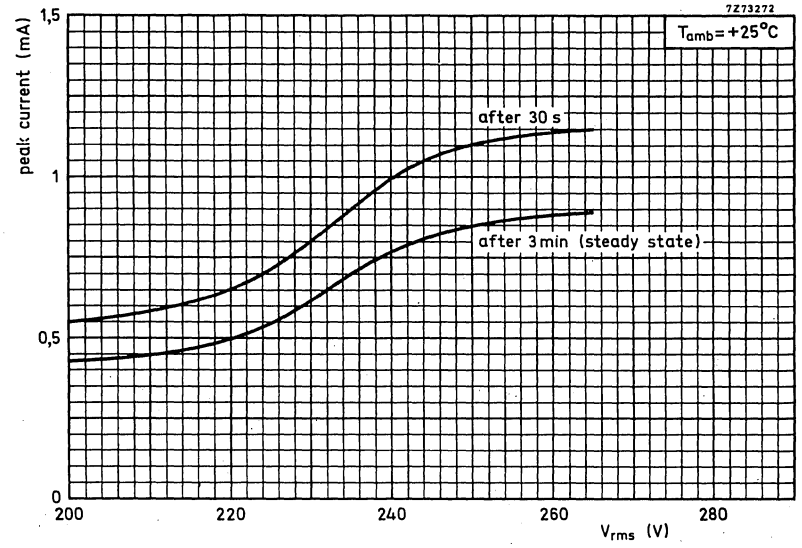


Fig. 8 Typical peak current versus voltage characteristics.

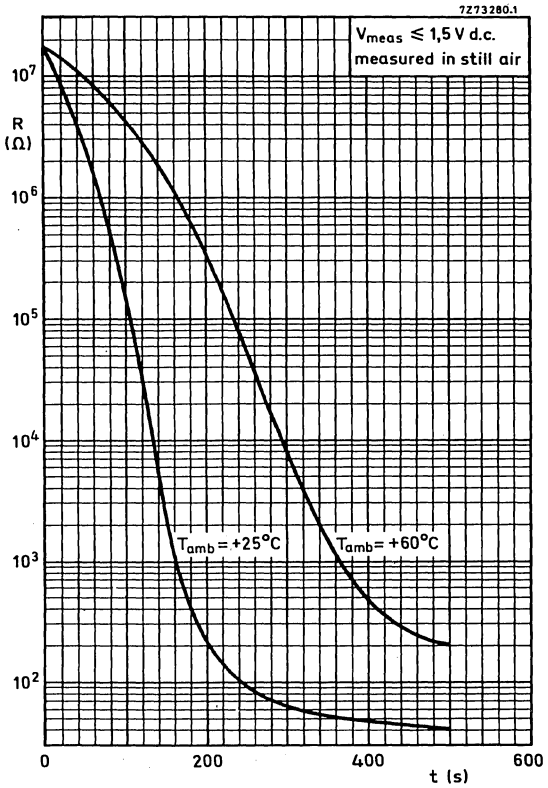


Fig. 9 Typical resistance versus cooling time characteristics of series PTC, T_{start} = 175 °C.

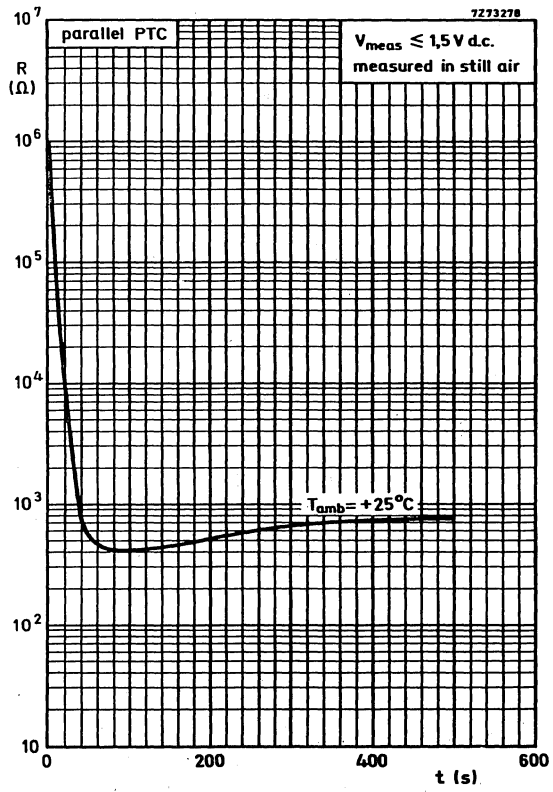


Fig. 10 Typical resistance versus cooling time characteristic of parallel PTC, T_{start} = 225 °C.

SERIES 662

Dual Degaussing PTC Thermistors

2322-662-98011

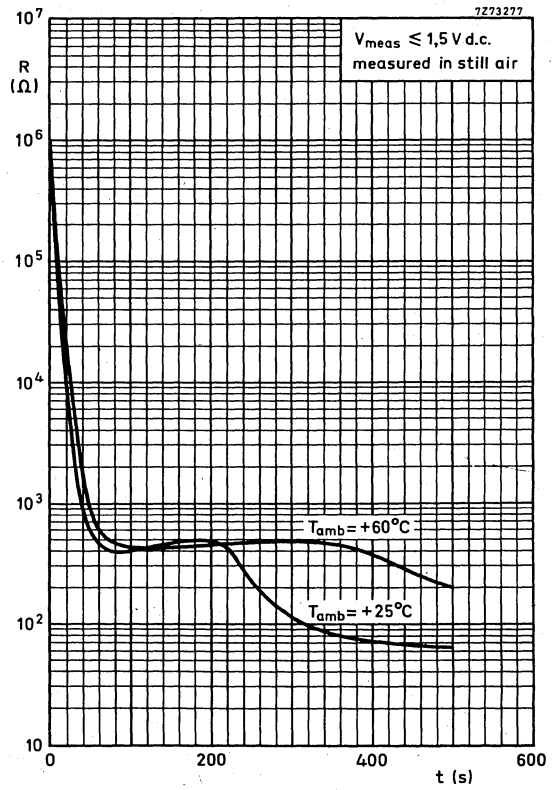


Fig. 11 Typical resistance of circuit versus cooling time characteristics, T_{start} = 225 °C.

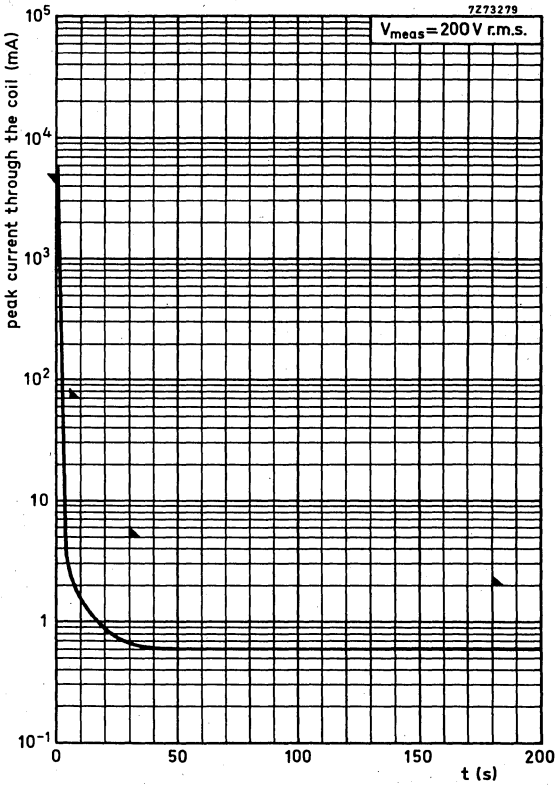


Fig. 12 Typical peak current through the coil versus time characteristic. Peak current limits are indicated by ◣ . .

8 Non-Linear Resistors

SERIES 662

Dual Degaussing PTC Thermistors

2322-662-98013

QUICK REFERENCE DATA

Current through the coil measured at 100 V r.m.s.	
min. inrush peak current	10 A
max. idle peak current	
after 5 s	140 mA
after 30 s	10 mA
after 3 min	5 mA
Maximum voltage (r.m.s.)	145 V
Switch temperature	
of series PTC	+70°C
of parallel PTC	+170°C
Operating temperature range	
at zero power	−25 to +125°C
at maximum voltage	0 to +60°C

APPLICATION

In the degaussing circuit of color television sets.

DESCRIPTION

The thermistor consists of two disc PTC thermistors clamped between stainless steel contacts. This assembly ensures a good thermal contact between both discs, which is essential for the function of this device. The Thermistor is enclosed in a plastic housing. The three connecting pins are arranged to fit a printed wiring board with a 0,1 inch grid.

MECHANICAL DATA—Inches (mm)

Outlines

A and B are to be connected to the mains;
A and C are to be connected to the degaussing coil (see Fig. 2).

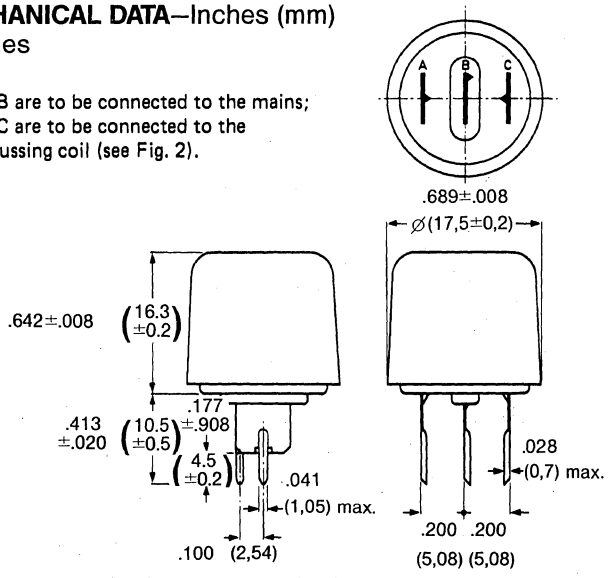


Fig. 1.

PACKAGING

500 thermistors in a cardboard box.

Marking

The catalogue number is moulded in the top of the cap

Mass

7,3 g approximately

Mounting

The thermistor can be soldered directly onto a printed wiring board

Robustness of terminations

Tensile strength	4.5 lb. (20 N)

Soldering

Solderability	max. 240°C, max. 4 s
Resistance to heat	max. 265°C, max. 11 s

Impact

Free fall	39.4 in. (1000 mm)

Inflammability

Non-flammable, in accordance with MIL-STD-202, method 111.

ELECTRICAL DATA

All values are approximate unless otherwise specified.

Current through the coil measured in circuit of Fig. 2 at 100 V r.m.s.	
min. inrush current	10 A
max. idle peak current	
after 5 s	140 mA
after 30 s	10 mA
after 3 min	5 mA
Resistance at +25°C	
of series PTC	10Ω
of parallel PTC	400 to 2400Ω
at T_{amb} = +200°C and 198 V pulsed	
of parallel PTC	>10 kΩ
Switch temperature	
of series PTC	+70°C
of parallel PTC	+170°C
Temperature coefficient	
of series PTC	+16%/K
of parallel PTC	+20%/K
Maximum voltage (r.m.s.) in circuit of Fig. 2	145 V
Operating temperature range	
at zero power	−25 to +125°C
at maximum voltage	0 to +60°C

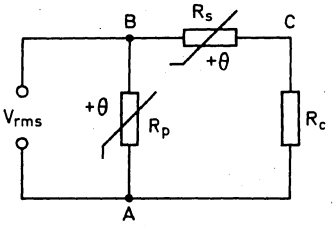


Fig. 2 Measuring circuit.
R_p = parallel PTC;
R_s = series PTC;
R_c = 6,2 Ω (replaces degaussing coil).

8 Non-Linear Resistors

SERIES 662

Dual Degaussing PTC Thermistors

2322-662-98013

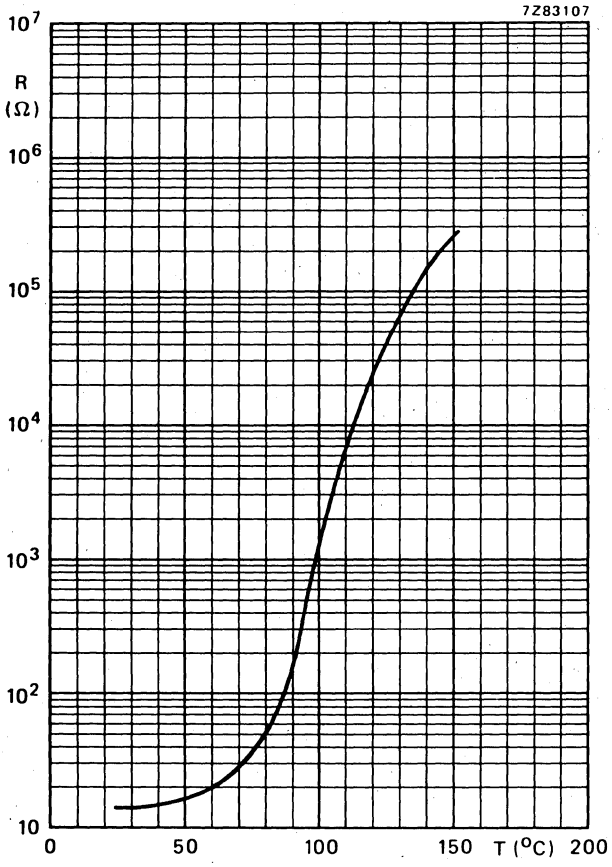


Fig. 3 Series PTC.

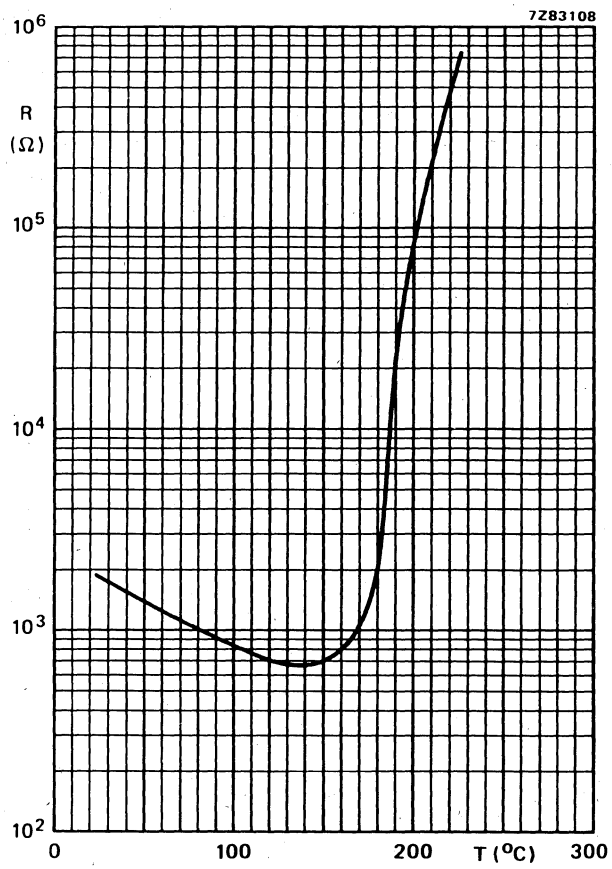


Fig. 4 Parallel PTC.

Typical resistance/temperature characteristics.

SERIES 662

Dual Degaussing PTC Thermistors

2322-662-98018

QUICK REFERENCE DATA

Current through the coil at 200V r.m.s.	
min. inrush peak current	5 A
max. peak current	
after 5 s	70 mA
after 30 s	5 mA
after 3 min	1 mA
Maximum r.m.s. voltage	265 V
Operating temperature range	
at zero power	−25 to +125 °C
at maximum voltage	0 to +60 °C

APPLICATION

In degaussing circuits of color monitors where very low residual current in the degaussing coil is necessary.

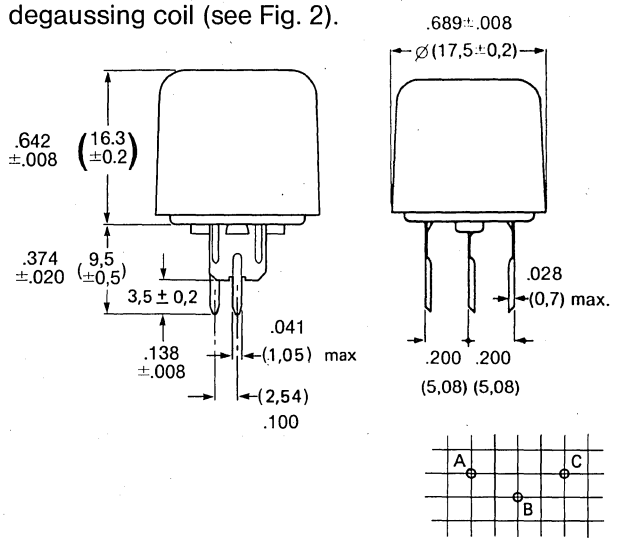
DESCRIPTION

This dual PTC thermistor consists of two discs with a positive temperature coefficient mounted in a plastic housing. The three connecting pins are arranged to fit a printed wiring board with an 0,1 inch grid.

MECHANICAL DATA—Inches (mm)

Outlines (mm)

A and B are to be connected to the mains:
A and C are to be connected to the degaussing coil (see Fig. 2).



Marking

The catalogue number is molded in the top of the cap.

Mass

7,3 g approximately

Mounting

The thermistor can be soldered directly onto a printed wiring board.

Robustness of terminations

Tensile strength (20 N) 4.5 lbs.

Soldering

Solderability	max. 240°C, max. 4 s
Resistance to heat	max. 265°C, max. 11 s

Impact

Free fall 39.4 in. (1000 mm)

Inflammability

Non-flammable, according to IEC 695 2-2 (1980)

PACKAGING

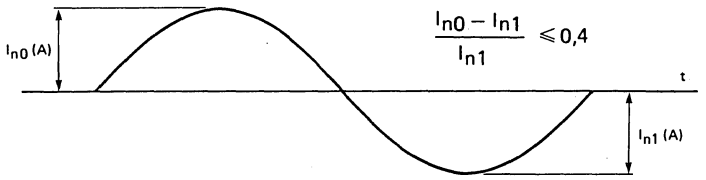
500 thermistors in a cardboard box.

ELECTRICAL DATA

Unless otherwise specified measured according to IEC draft publication 738 1 (1982).

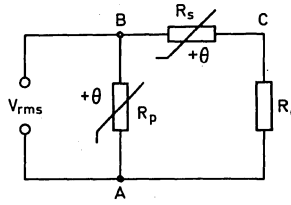
Current through the coil measured in circuit of Fig. 3 at 200 V (r.m.s.)	
Minimum inrush peak current	5 A
Maximum peak current	
after 5 s	70 mA
after 30 s	5 mA
after 3 min	1 mA
Inrush current decrease	

For voltages between 200 and 245 V_{rms} and series resistor of 17 ohm



Resistance at 25°C of series PTC (R_S)	≈	40 Ω
Resistance at 25°C of parallel PTC (R_P)	≈	3000 Ω
Minimum resistance at 175°C and 375 V_{pulse} of R_S		100 kΩ
Minimum resistance at 225°C and 375 V_{pulse} of R_P		25 kΩ
Degaussing coil impedance range		17 to 25 Ω
Switch temperature of R_S	≈	65 °C
Switch temperature of R_P	≈	170 °C
Maximum r.m.s. voltage in measuring circuit (Fig. 3)		265 V
Operating temperature range		
at zero power		−25 to 125 °C
at maximum voltage		0 to 60 °C

Fig. 3 Measuring circuit.



R_P = parallel PTC;
R_S = series PTC;
R_C = replaces the degaussing coil (Z = 25Ω).

SERIES 662

Dual Degaussing PTC Thermistors

2322-662-98018

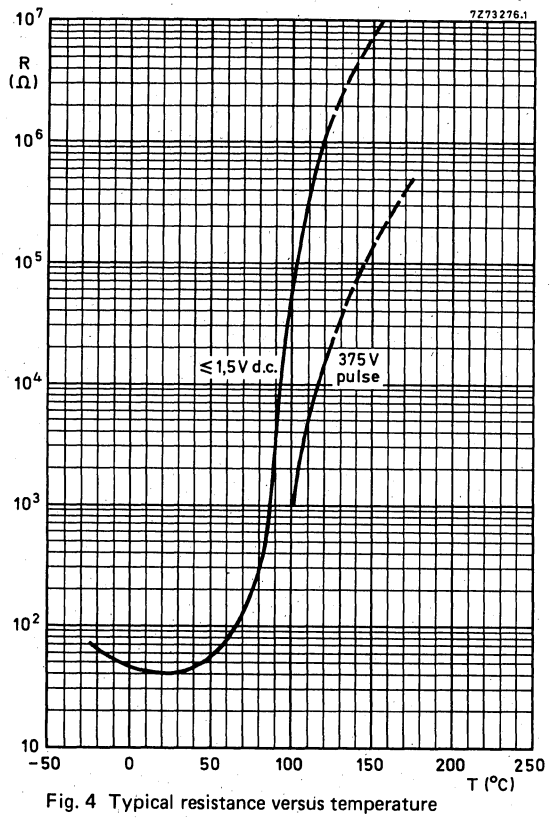
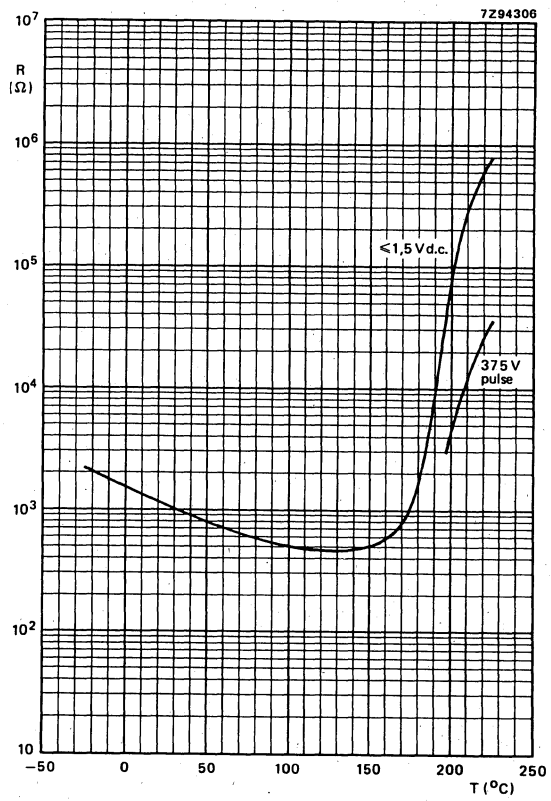


Fig. 4 Typical resistance versus temperature characteristics of the series PTC.



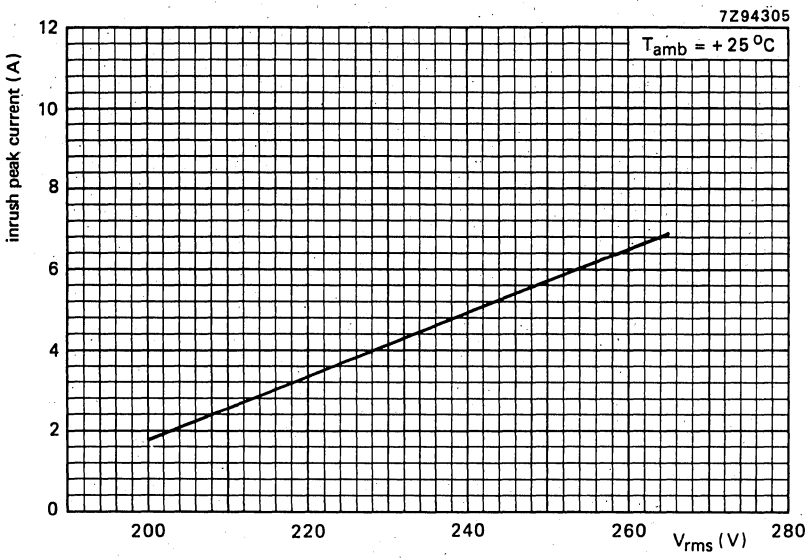


Fig. 6 Typical inrush peak current versus voltage characteristic.

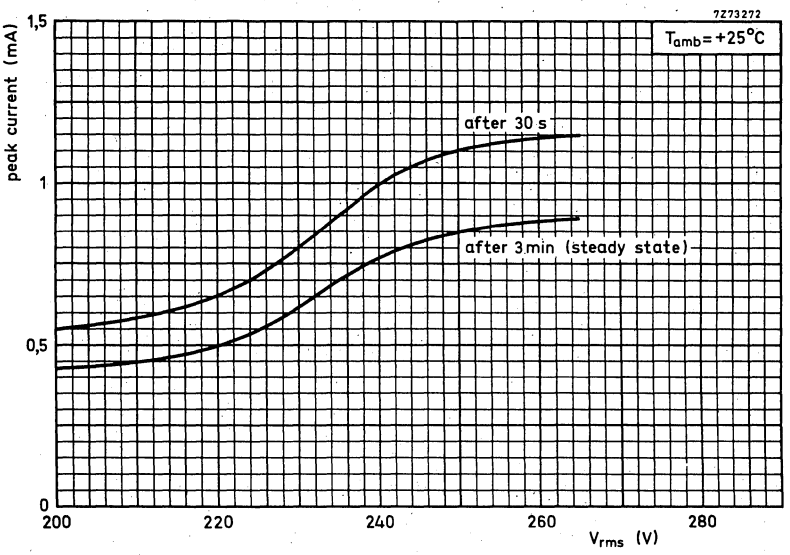


Fig. 7 Typical peak current versus voltage characteristics.

Fig. 5 Typical resistance versus temperature characteristics of the parallel PTC.

8 Non-Linear Resistors

MEPCO/CENTRALAB, INC. • P.O. Box 760, Mineral Wells, TX 76067 • 817-325-7871 • TWX 910-890-5855

2322-662-98018

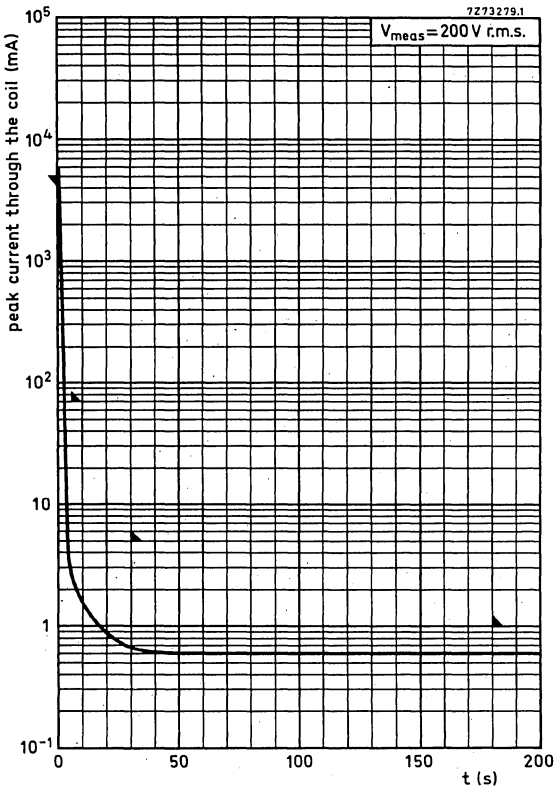


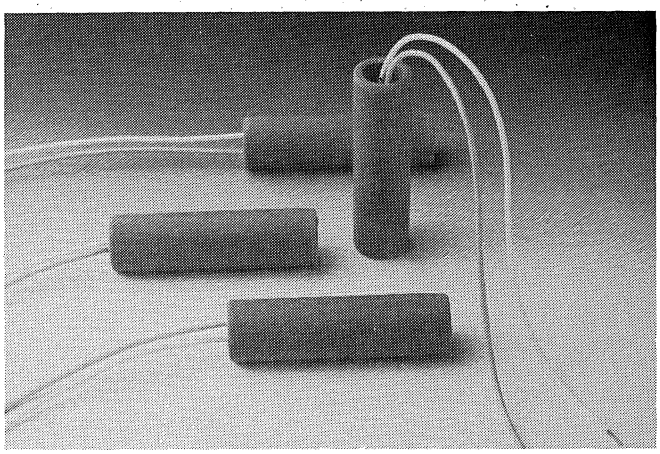
Fig. 8 Typical peak current through the coil versus time characteristic. Peak current limits are indicated by ◣ . .

SERIES 680

Self Regulating PTC Heaters

2322-680-00001

Self Regulating PTC Heaters work automatically to provide a preselected temperature every time—without the need of any temperature control. The wattage input from the heater is self regulated to only the amount required to maintain the selected temperature. All Mepco/Centralab PTC Heaters are U-L Approved.



QUICK REFERENCE DATA

Voltage range, r.m.s., 50 or 60 Hz	100 to 265 V
Temperature after 20 min at 220 V r.m.s.	160 ± 12 °C
Maximum time to reach 130°C at 220 V r.m.s.	5 min
Maximum inrush power at 265 V r.m.s.	1 kW
Operating temperature range	
at zero power	−25 to +85 °C
at maximum voltage	0 to +55 °C

APPLICATION

As heating element for general use.

DESCRIPTION

Encapsulated single insulated thermistor with positive temperature coefficient and provided with two single-core insulated silver plated copper wires.

MECHANICAL DATA

Outlines inches (mm)

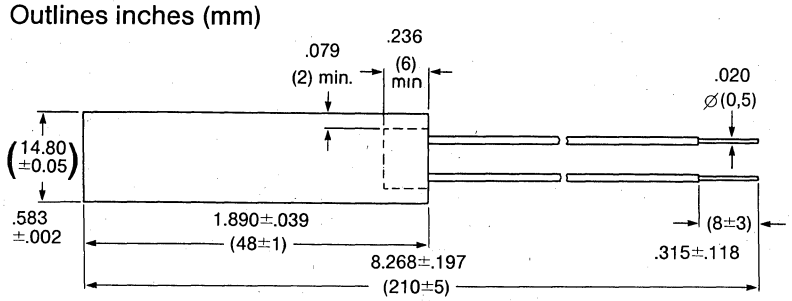


Fig. 1.

PACKAGING

500 thermistors in a cardboard box.
A label on the cardboard box is provided with the following details:

- Manufacturer's name
- Voltage range
- Operating power after 20 min—UL emblem
- Group name
- Catalogue number
- Quantity, reference, manufacturing date (year—month)

Marking

The thermistors are tan coloured; the connecting leads are blue.

Connections

PTFE wire according to Thermax wire 24-XTO-124 UL style 1180.

Mass

20 g approximately.

Mounting

In any position by soldering or clamping. Suitable for mounting in a tube with a diameter of .585 + .002 in. (14,86 + 0,05 mm).

Robustness of terminations

Tensile strength	2.25 lb. (10 N)
Bending	1.12 lb. (5 N)
Solderability	max. 240°C, max. 6 s

Impact

Free fall	39.4. in. (1000 mm)

Inflammability

Non-flammable, in accordance with IEC publication 695-2-2 of 1980.

ELECTRICAL DATA

Voltage range, r.m.s., 50 to 60 Hz	100 to 265 V
Temperature after 20 min. at 220 V r.m.s.	160 ±12 °C
Maximum time to reach 130°C at 220 V r.m.s.	5 min
Maximum inrush power at 265 V r.m.s.	1 kW
Operating power after 20 min. at 220 V r.m.s.	~13 W
Minimum dielectric withstanding voltage, r.m.s.	4 kV
Operating temperature range	
at zero power	−25 to +85 °C
at maximum voltage	0 to +55 °C

SERIES 680

Self Regulating PTC Heaters

2322-680-03001

QUICK REFERENCE DATA

Voltage range, r.m.s., 50 or 60 Hz	100 to 265 V
Temperature after 20 min at 220 V r.m.s.	160 ± 12 °C
Maximum time to reach 130°C at 220 V r.m.s.	5 min
Maximum inrush power at 265 V r.m.s.	1 kW
Operating temperature range	
at zero power	−25 to +85 °C
at maximum voltage	0 to +55 °C

APPLICATION

As heating element for general use.

DESCRIPTION

Encapsulated single insulated thermistor with positive temperature coefficient and provided with two single-core insulated silver plated copper wires.

MECHANICAL DATA—Inches (mm)

Outlines

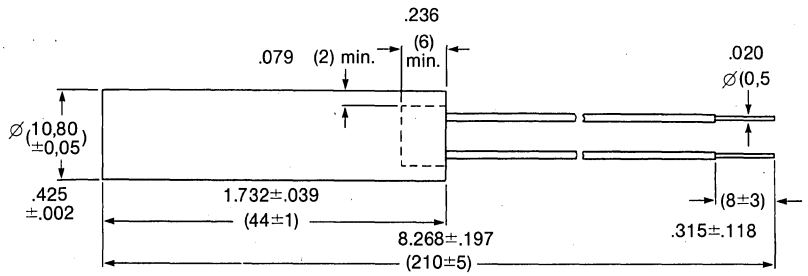


Fig. 1.

PACKAGING

1000 thermistors in a cardboard box.

A label on the cardboard box is provided with the following details:

- Manufacturer's name
- Voltage range
- Operating power after 20 min—UL emblem
- Group name
- Catalogue number
- Quantity, reference, manufacturing date (year—month)

Marking

The thermistors are tan colored; the connecting leads are white.

Connections

PTFE wire according to Thermax wire 24-XTO-124 UL style 1180.

Mass

10 g approximately.

Mounting

In any position by soldering or clamping. Suitable for mounting in a tube with a diameter of .428 + .002 in. (10,86 + 0,05 mm).

Robustness of terminations

Tensile strength	2.25 lb. (10 N)
Bending	1.12 lb. (5 N)
Solderability	max. 240°C, max. 6 s

Impact

Free fall	39.4 in. (1000 mm)

Inflammability

Non-flammable, in accordance with IEC publication 695-2-2 of 1980.

ELECTRICAL DATA

Voltage range, r.m.s., 50 to 60 Hz	100 to 265 V
Temperature after 20 min. at 220 V r.m.s.	160 ±12 °C
Maximum time to reach 130°C at 220 V r.m.s.	5 min
Maximum inrush power at 265 V r.m.s.	1 kW
Operating power after 20 min. at 220 V r.m.s.	~10 W
Minimum dielectric withstanding voltage, r.m.s.	4 kV
Operating temperature range	
at zero power	−25 to +85 °C
at maximum voltage	0 to +55 °C

SERIES 680

Self Regulating PTC Heaters

2322-680-04001

QUICK REFERENCE DATA

Voltage range, r.m.s., 50 or 60 Hz	100 to 265 V
Temperature after 20 min at 220 V r.m.s.	215 ± 12 °C
Maximum time to reach 170°C at 220 V r.m.s.	5 min
Maximum inrush power at 265 V r.m.s.	1 kW
Operating temperature range	
at zero power	−25 to +85 °C
at maximum voltage	0 to +55 °C

APPLICATION
As heating element for general use.

DESCRIPTION
Encapsulated single insulated thermistor with positive temperature coefficient and provided with two single-core insulated silver plated copper wires.

MECHANICAL DATA—Inches (mm)
Outlines

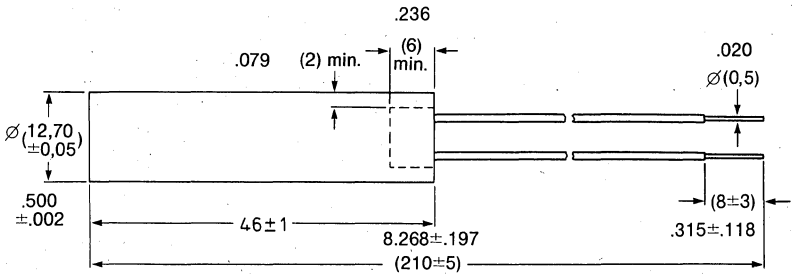


Fig. 1.

PACKAGING
1000 thermistors in a cardboard box.
A label on the cardboard box is provided with the following details:
- Manufacturer's name
- Voltage range
- Operating power after 20 min—UL emblem
- Group name
- Catalogue number
- Quantity, reference, manufacturing date (year—month)

Marking
The thermistors are red colored; the connecting leads are red.

Connections
PTFE wire according to Thermax wire 24-XTO-124 UL style 1180.

Mass
15 g approximately.

Mounting
In any position by soldering or clamping. Suitable for mounting in a tube with a diameter of .502 + .002 in. (12,76 + 0,05 mm).

Robustness of terminations

Tensile strength	2.25 lb. (10 N)
Bending	1.12 lb. (5 N)
Solderability	max. 240°C, max. 6 s

Impact

Free fall	39.4 in. (1000 mm)

Inflammability
Non-flammable, in accordance with IEC publication 695-2-2 of 1980.

ELECTRICAL DATA

Voltage range, r.m.s., 50 to 60 Hz	100 to 265 V
Temperature after 20 min. at 220 V r.m.s.	215 ±12 °C
Maximum time to reach 170°C at 220 V r.m.s.	5 min
Maximum inrush power at 265 V r.m.s.	1 kW
Operating power after 20 min. at 220 V r.m.s.	~18 W
Minimum dielectric withstanding voltage, r.m.s.	4 kV
Operating temperature range	
at zero power	−25 to +85 °C
at maximum voltage	0 to +55 °C

SERIES 680
Self Regulating PTC Heaters

2322-680-04002

QUICK REFERENCE DATA

Voltage range, r.m.s., 50 or 60 Hz	100 to 145 V
Temperature after 20 min at 120 V r.m.s.	215 ± 12 °C
Maximum time to reach 170°C at 120 V r.m.s.	5 min
Maximum inrush power at 145 V r.m.s.	1 kW
Operating temperature range	
at zero power	−25 to +85 °C
at maximum voltage	0 to +55 °C

APPLICATION
As heating element for general use.

DESCRIPTION
Encapsulated single insulated thermistor with positive temperature coefficient and provided with two single-core insulated silver plated copper wires.

MECHANICAL DATA—Inches (mm)
Outlines

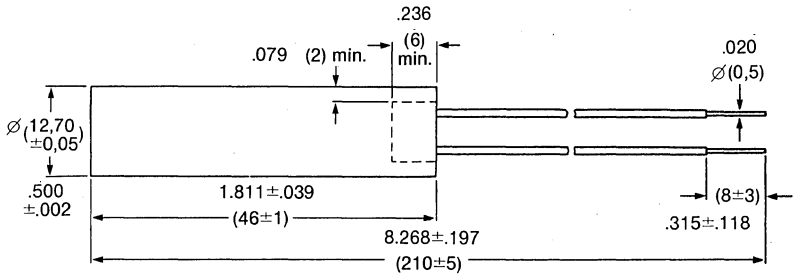


Fig. 1.

PACKAGING
1000 thermistors in a cardboard box.
A label on the cardboard box is provided with the following details:
- Manufacturer's name
- Voltage range
- Operating power after 20 min—UL emblem
- Group name
- Catalogue number
- Quantity, reference, manufacturing date (year—month)

Marking
The thermistors are red colored; the connecting leads are red and black.

Connections
PTFE wire according to Thermax wire 24-XTO-124 UL style 1180.

Mass
15 g approximately.

Mounting
In any position by soldering or clamping. Suitable for mounting in a tube with a diameter of .502 + .002 in. (12,76 + 0,05 mm).

Robustness of terminations

Tensile strength	2.25 lb. (10 N)
Bending	1.12 lb. (5 N)
Solderability	max. 240°C, max. 6 s

Impact

Free fall	39.4 in. (1000 mm)

Inflammability
Non-flammable, in accordance with IEC publication 695-2-2 of 1980.

ELECTRICAL DATA

Voltage range, r.m.s., 50 to 60 Hz	100 to 145 V
Temperature after 20 min. at 120 V r.m.s.	215 ±12 °C
Maximum time to reach 170°C at 120 V r.m.s.	5 min
Maximum inrush power at 145 V r.m.s.	1 kW
Operating power after 20 min. at 120 V r.m.s.	~18 W
Minimum dielectric withstanding voltage, r.m.s.	4 kV
Operating temperature range	
at zero power	−25 to +85 °C
at maximum voltage	0 to +55 °C

SERIES 680
Self Regulating PTC Heaters

2322-680-04003

QUICK REFERENCE DATA

Voltage range, r.m.s., 50 or 60 Hz	100 to 265 V
Temperature after 20 min at 220 V r.m.s.	160 ± 12 °C
Maximum time to reach 130°C at 220 V r.m.s.	5 min
Maximum inrush power at 265 V r.m.s.	1 kW
Operating temperature range	
at zero power	−25 to +85 °C
at maximum voltage	0 to +55 °C

APPLICATION
As heating element for general use.

DESCRIPTION
Encapsulated single insulated thermistor with positive temperature coefficient and provided with two single-core insulated silver plated copper wires.

MECHANICAL DATA—Inches (mm)
Outlines

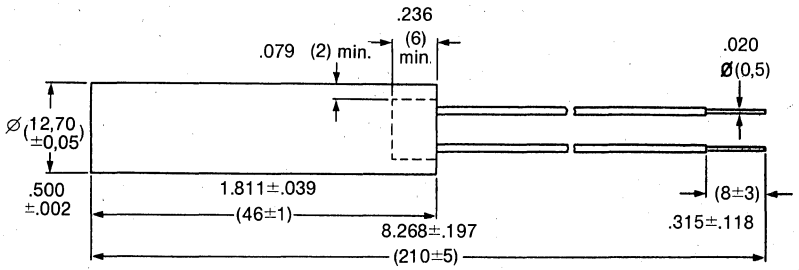


Fig. 1.

PACKAGING
1000 thermistors in a cardboard box.
A label on the cardboard box is provided with the following details:
- Manufacturer's name
- Voltage range
- Operating power after 20 min—UL emblem
- Group name
- Catalogue number
- Quantity, reference, manufacturing date (year—month)

Marking
The thermistors are tan colored; the connecting leads are red.

Connections
PTFE wire according to Thermax wire 24-XTO-124 UL style 1180.

Mass
15 g approximately.

Mounting
In any position by soldering or clamping. Suitable for mounting in a tube with a diameter of .502 + .002 in. (12,76 + 0,05 mm).

Robustness of terminations

Tensile strength	2.25 lb. (10 N)
Bending	1.12 lb. (5 N)
Solderability	max. 240°C, max. 6 s

Impact

Free fall	39.4 in. (1000 mm)

Inflammability
Non-flammable, in accordance with IEC publication 695-2-2 of 1980.

ELECTRICAL DATA

Voltage range, r.m.s., 50 to 60 Hz	100 to 265 V
Temperature after 20 min. at 220 V r.m.s.	160 ±12 °C
Maximum time to reach 130°C at 220 V r.m.s.	5 min
Maximum inrush power at 265 V r.m.s.	1 kW
Operating power after 20 min. at 220 V r.m.s.	~13 W
Minimum dielectric withstanding voltage, r.m.s.	4 kV
Operating temperature range	
at zero power	−25 to +85 °C
at maximum voltage	0 to +55 °C

SERIES 680
Self Regulating PTC Heaters

2322-680-04004

QUICK REFERENCE DATA

Voltage range, r.m.s., 50 or 60 Hz	100 to 145 V
Temperature after 20 min at 120 V r.m.s.	160 ± 12 °C
Maximum time to reach 130°C at 120 V r.m.s.	5 min
Maximum inrush power at 145 V r.m.s.	1 kW
Operating temperature range	
at zero power	−25 to +85 °C
at maximum voltage	0 to +55 °C

APPLICATION
As heating element for general use.

DESCRIPTION
Encapsulated single insulated thermistor with positive temperature coefficient and provided with two single-core insulated silver plated copper wires.

MECHANICAL DATA—Inches (mm)
Outlines

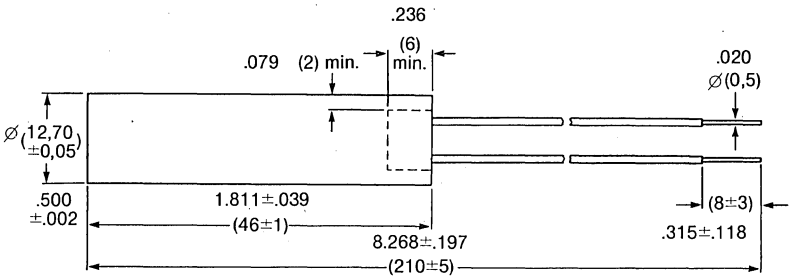


Fig. 1.

PACKAGING
1000 thermistors in a cardboard box.
A label on the cardboard box is provided with the following details:
- Manufacturer's name
- Voltage range
- Operating power after 20 min—UL emblem
- Group name
- Catalogue number
- Quantity, reference, manufacturing date (year—month)

Marking
The thermistors are tan colored; the connecting leads are red and black.

Connections
PTFE wire according to Thermax wire 24-XTO-124 UL style 1180.

Mass
15 g approximately.

Mounting
In any position by soldering or clamping. Suitable for mounting in a tube with a diameter of .502 + .002 in. (12,76 + 0,05 mm).

Robustness of terminations

Tensile strength	2.25 lb. (10 N)
Bending	1.12 lb. (5 N)
Solderability	max. 240°C, max. 6 s

Impact

Free fall	39.4 in. (1000 mm)

Inflammability
Non-flammable, in accordance with IEC publication 695-2-2 of 1980.

ELECTRICAL DATA

Voltage range, r.m.s., 50 to 60 Hz	100 to 145 V
Temperature after 20 min. at 120 V r.m.s.	160 ±12 °C
Maximum time to reach 130°C at 120 V r.m.s.	5 min
Maximum inrush power at 145 V r.m.s.	1 kW
Operating power after 20 min. at 120 V r.m.s.	~13 W
Minimum dielectric withstanding voltage, r.m.s.	4 kV
Operating temperature range	
at zero power	−25 to +85 °C
at maximum voltage	0 to +55 °C

SERIES 680
Self Regulating PTC Heaters

2322-680-04022

QUICK REFERENCE DATA

Voltage range (r.m.s.)	100 to 265 V
Maximum inrush power at 265 V	1 kW
Operating power at 220 V after 20 min.	19 W
Time to reach +180°C at 220 V	<5 min
Operating temperature range	
at zero power	−25 to +85 °C
at maximum voltage	0 to +55 °C

APPLICATION
Designed for applications that require high initial dissipation followed by moderate continuous dissipation, such as hot melt glue guns.

DESCRIPTION
Insulated heating element consisting of a PTC thermistor moulded in a silicone rubber tube with two insulated silver plated copper wires.

MECHANICAL DATA—Inches (mm)
Outlines

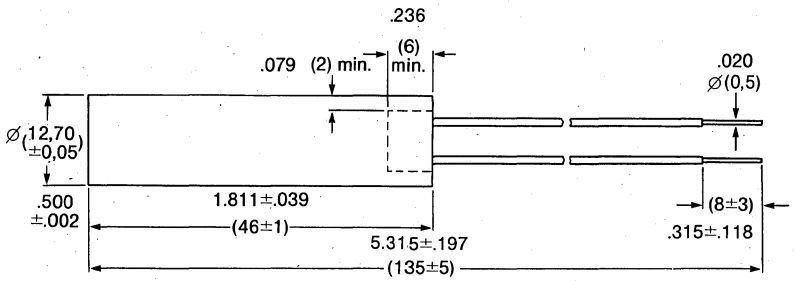


Fig. 1.

Marking
Connecting leads; red (twice).

Mounting
In any position by soldering or clamping.

Robustness of terminations

Tensile strength	2.25 lb. (10 N)
Bending	1.12 lb. (5 N)

Soldering
Solderability max. 240°C, max. 6 s

Impact
Free fall 39.4 in. (1000 mm)

PACKAGING
600 thermistors in a cardboard box.

ELECTRICAL DATA

Measurements made in still air at an ambient temperature of	+23 ± 1 °C
Voltage range (r.m.s.)	100 to 265 V
Maximum inrush power at 265 V	1 kW
Operating power at 220 V, after 20 min.	~19 W
Time to reach +180°C at 220 V	<5 min
Temperature on standard test mounting after 20 min at 220 V	220 ± 10 °C
Operating temperature range	
at zero power	−25 to +85 °C
at maximum voltage	0 to +55 °C

SERIES 680

Self Regulating PTC Heaters

2322-680-93...

QUICK REFERENCE DATA

Resistance at 25°C and 50 V pulse	300 Ω to 9,9 kΩ
Switch temperature	115 to 245 °C
Maximum voltage, r.m.s.	145 and 265 V
Operating temperature range at maximum voltage	0 to 55 °C

APPLICATION

Ceramic heating elements for low power domestic and industrial applications and in thermally delayed switches which require the temperature to be stabilized

DESCRIPTION

These thermistors have a positive temperature coefficient. They consist of a parallelepiped with two non-solderable electrical contacts.

MECHANICAL DATA—Inches (mm)

Outlines

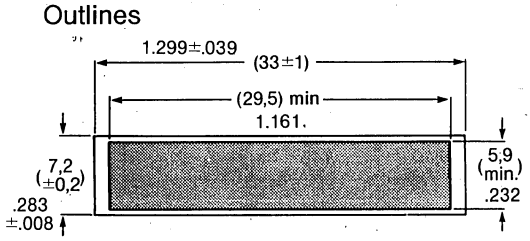


Fig. 1.

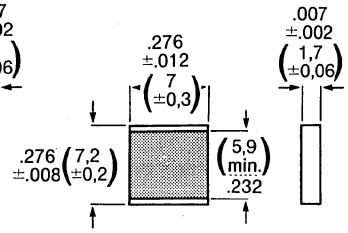


Fig. 2.

ELECTRICAL DATA

Unless otherwise specified, measured according to IEC publication 738-1 of 1982.

Table *

catalogue number	resistance at 50 V_{pulse}			T_S	maximum	dimensions	mass
	25 °C	T_S	T_S + 30 °C	approx.	voltage	see Fig.	approx.
2322 680 followed by	± 35%	max.	min.		r.m.s.		
	Ω	Ω	Ω	°C	V		g
93021	850	2000	5000	115	265	1	2,25
93022	220	500	1250	145	265	1	2,25
93023	850	1500	4000	170	265	1	2,25
93024	300	300	750	200	265	1	2,25
93025	1700	850	2000	230	265	1	2,25
93026	2300	700	1750	245	265	1	2,25
93027	400	750	2000	170	145	1	2,25
93028	680	350	800	240	145	1	2,25
93029	3650	8600	21500	115	265	2	0,46
93031	950	2200	5400	145	265	2	0,46
93032	3650	8600	21500	170	265	2	0,46
93033	1300	1300	3250	200	265	2	0,46
93034	7300	3600	8600	230	265	2	0,46
93035	9900	3000	4300	245	265	2	0,46
93036	1720	3250	8600	170	145	2	0,46
93037	2900	1500	3450	240	145	2	0,46

Flatness
.002 in. (50 μm) max.

Marking
None.

Mass
See table.

Mounting
In any position by clamping.

Impact
Free fall 7.87 in. (200 mm)

Inflammability
Non-flammable.

PACKAGING

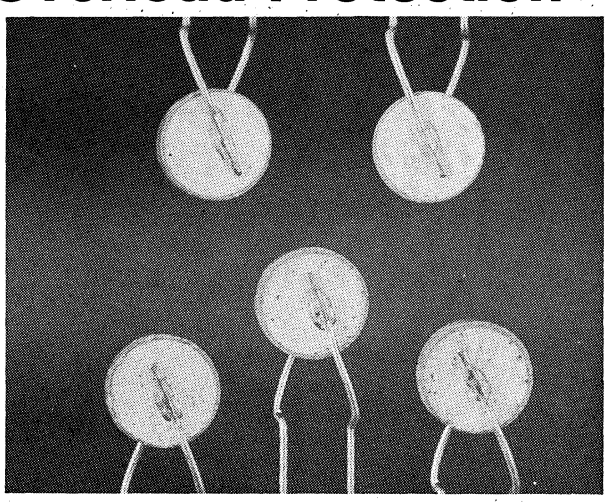
Types 2322 680 93021...29:
420 thermistors in a cardboard box.
Types 2322 680 93031...37:
1500 thermistors in a cardboard box.

* T_S = switch temperature

SERIES 66.

Current Overload Protection

2322-66.-0...1
2322-66.-1...1



DESCRIPTION

Series 66. PTC Thermistors provide safe, reliable, and automatically resettable protection against over-current conditions. Mepco/Centralab Series 66. Current Overload Protection Thermistors are uniquely designed so that the trip or switch current is always 2X the no-trip or normal operating current. This unique characteristic simplifies determination of protection levels for the design engineer.

QUICK REFERENCE DATA

Resistance at 25°C	1,8 to 90Ω
Switch temperature	approx. 120°C
Maximum d.c. voltage	56 V
Trip current at 10°C	112 to 1360 mA
Operating temperature range at V_{max}	0 to 55°C

APPLICATION

Overload protection, for use in electric and electronic equipment such as electric motors, transformers and semiconductor circuits.

DESCRIPTION

These thermistors have a positive temperature coefficient. They consist of a disc with two tinned brass wires, see Fig. 1a. Leadless types having metallized sides for soldering by the user are also available, see Fig. 1b.

MECHANICAL DATA—Inches (mm)

Outlines

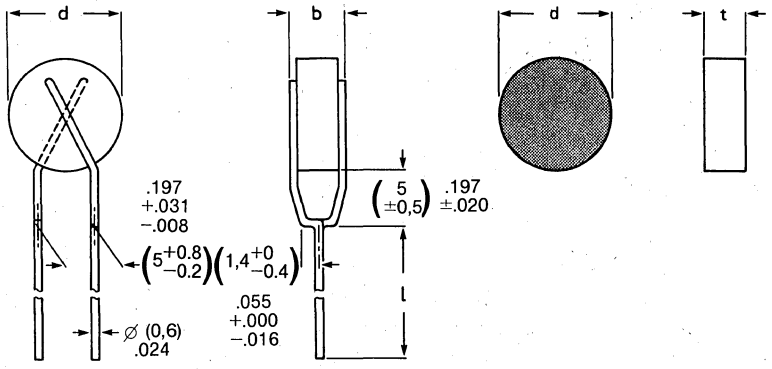


Fig. 1a.

Fig. 1b.

For dimensions b, d, l and t see Table 1.

8 Non-Linear Resistors

2322-66.-0...1
2322-66.-1...1

Marking
None

Mass
See Table 1

Mounting
In any position by soldering

Robustness of terminations

Tensile strength	2.25 lb (10 N)
Bending	1.12 lb (5 N)

Soldering

Solderability	max. 240°C, max.4 s
Resistance to heat	max. 265°C, max. 11 s

When soldering leadless types it is recommended to use a flux containing colofonium and aethyl alcohol only and to pre-heat the discs to approx. 100°C in order to avoid thermal shocks which might damage the thermistors.

Impact
7.87" (200 mm) free fall

Inflammability
Non-flammable

Packaging
Cardboard boxes containing following items for:

2322 660.... 1: 500	2322 662....1: 100
2322 661.... 1: 250	2322 663....1: 100
2322 662.1811:200	2322 663....1: 100

ELECTRICAL DATA
Unless otherwise specified measured according to IEC publication 738-1 (1982)

Maximum current for not tripping at 55°C (measuring time 5 minutes)	I_{nt}	See Table 1
Minimum current for tripping after 5 minutes at 10°C	$I_t = 2 \times I_{nt}$	See Table 1
Resistance at +25°C	R_{25}	See Table 1
Switch temperature	T_S	≈ 120°C
Maximum admissible current at 0°C	I_{max}	See Table 1
Maximum residual current at 56 V (d.c.) at 10°C	$I_{res\ max}$	See Table 1
Maximum d.c. voltage with a series resistor		56 V
Series resistor	R_S	See Table 1
Maximum d.c. voltage without series resistor		18 V
Dissipation factor at T_S	D	See Table 1
Heat capacity	H	See Table 1
Operating temperature range at zero power		−25 to +125°C
at maximum voltage		0 to +55°C

Table 1

catalogue number	I_{nt} at 55°C mA	I_t at 10°C mA	R_{25} approx. Ω	I_{max} at 0°C mA	$I_{res\ max}$ at 10°C mA	R_s ±5% Ω	D approx. mW/K	H approx. J/K	d inches (mm)	b max. inches (mm)	l (±3) .118 inches (mm)	t max. inches (mm)	mass approx. g
2322 660 .5691	56	112	90	460	30	56	6	0,08	.177 (4,5)	.157 (4)	.787 (20)	.110 (2,8)	0,35
660 .6891	68	136	60	600	30	51	6	0,08	.177 (4,5)	.157 (4)	.787 (20)	.110 (2,8)	0,35
660 .8291	82	164	42	750	30	43	6	0,08	.177 (4,5)	.157 (4)	.787 (20)	.110 (2,8)	0,35
661 .1011	100	200	32	950	35	36	7	0,15	.256 (6,5)	.157 (4)	.787 (20)	.110 (2,8)	0,47
661 .1211	120	240	22	1300	35	27	7	0,15	.256 (6,5)	.157 (4)	.787 (20)	.110 (2,8)	0,47
661 .1511	150	300	18	1600	40	22	7,5	0,16	.315 (8,0)	.157 (4)	.787 (20)	.110 (2,8)	0,65
662 .1811	180	360	12,5	2200	45	16	8	0,42	.394 (10,0)	.177 (4,5)	.787 (20)	.130 (3,3)	1,05
662 .2211	220	440	9	2900	50	13	9	0,55	.472 (12,0)	.177 (4,5)	.787 (20)	.130 (3,3)	1,43
662 .2711	270	540	6,5	4000	50	10	9	0,55	.472 (12,0)	.177 (4,5)	.787 (20)	.130 (3,3)	1,43
663 .3311	330	660	4,3	6300	60	5,6	10	0,83	.512 (13,0)	.197 (5)	.787 (20)	.150 (3,8)	2,15
663 .3911	390	780	3,8	7300	70	5,1	12	1,24	.630 (16,0)	.197 (5)	.787 (20)	.150 (3,8)	2,90
663 .4711	470	940	2,6	12000	70	2,7	12	1,24	.630 (16,0)	.197 (5)	.787 (20)	.150 (3,8)	2,90
664 .5611	560	1120	2,2	14000	100	2,4	16	2,34	.787 (20,0)	.236 (6)	.630 (16)	.189 (4,8)	5,30
664 .6811	680	1360	1,6	18000	100	2,0	16	2,34	.787 (20,0)	.236 (6)	.630 (16)	.189 (4,8)	5,30

For leadless types replace the dot in the catalog number by 0; for types with leads replace it by 1.

SERIES 66.
Current Overload Protection

2322-66.-0...1
2322-66.-1...1

Typical resistance/temperature characteristics.

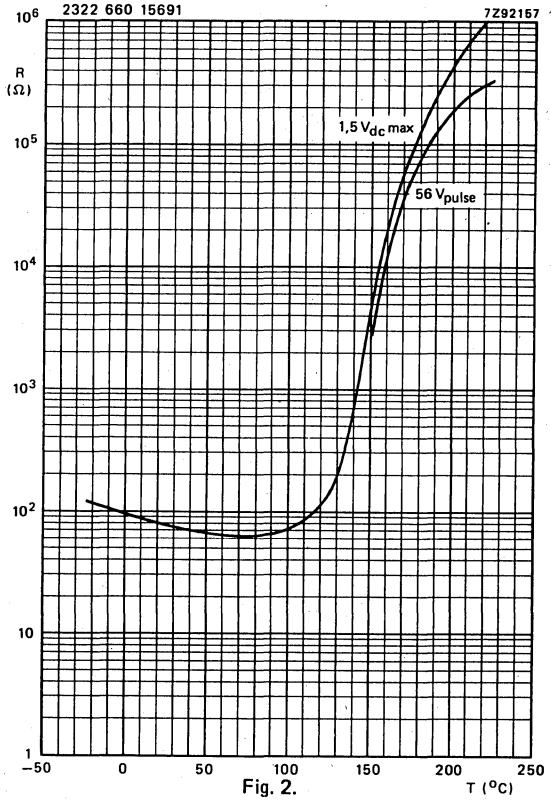


Fig. 2.

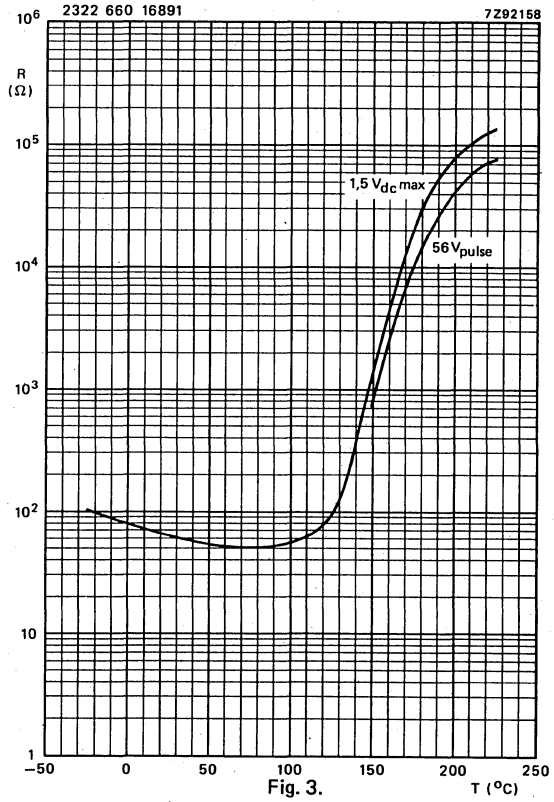


Fig. 3.

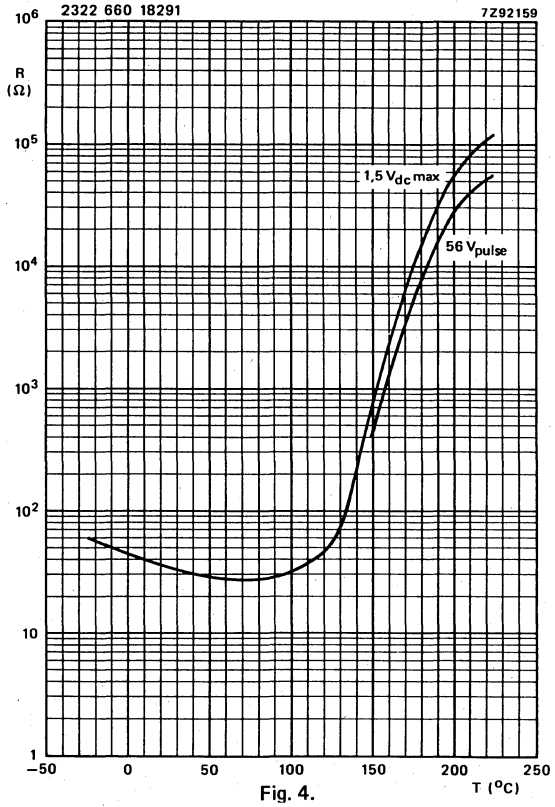


Fig. 4.

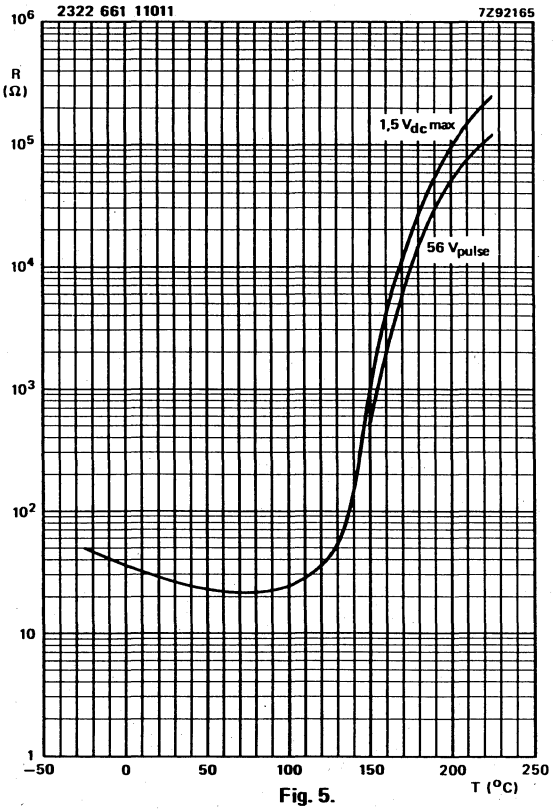


Fig. 5.

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2322-66.-0...1
2322-66.-1...1

Typical resistance/temperature characteristics.

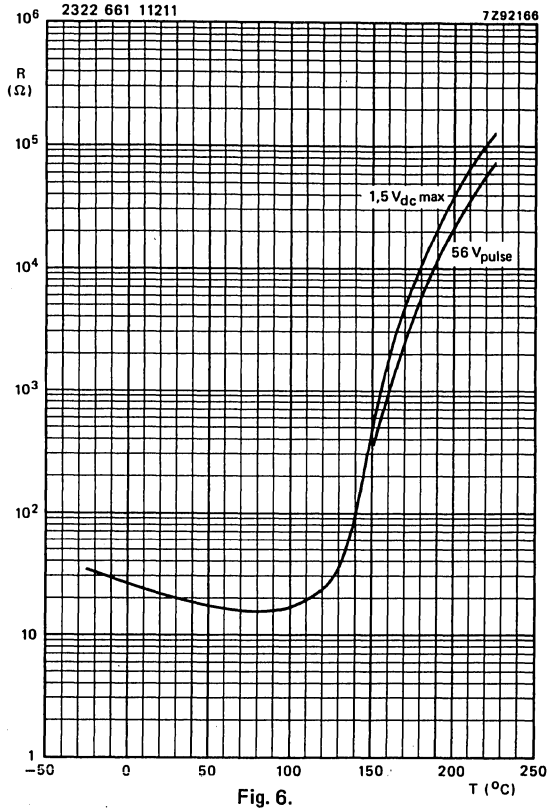

Fig. 6.

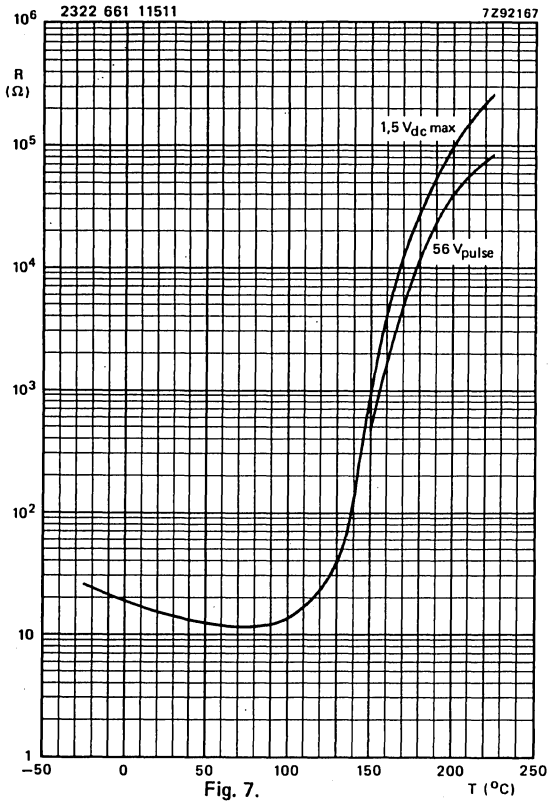

Fig. 7.

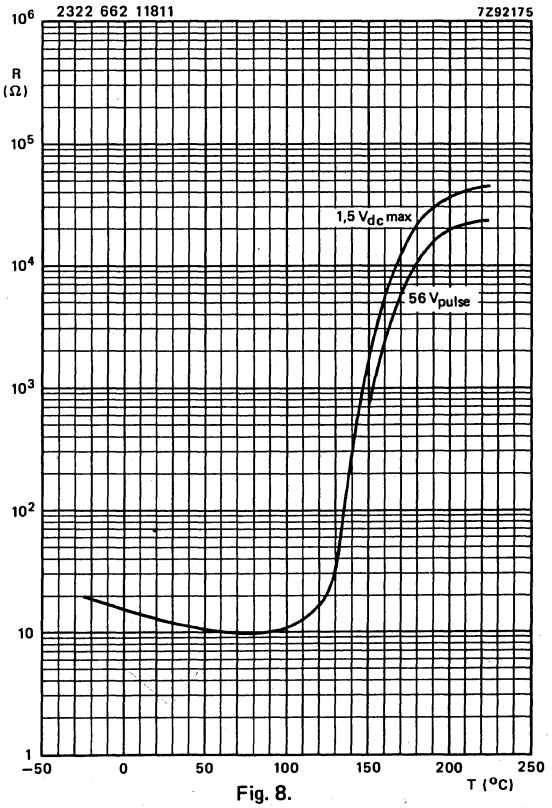

Fig. 8.

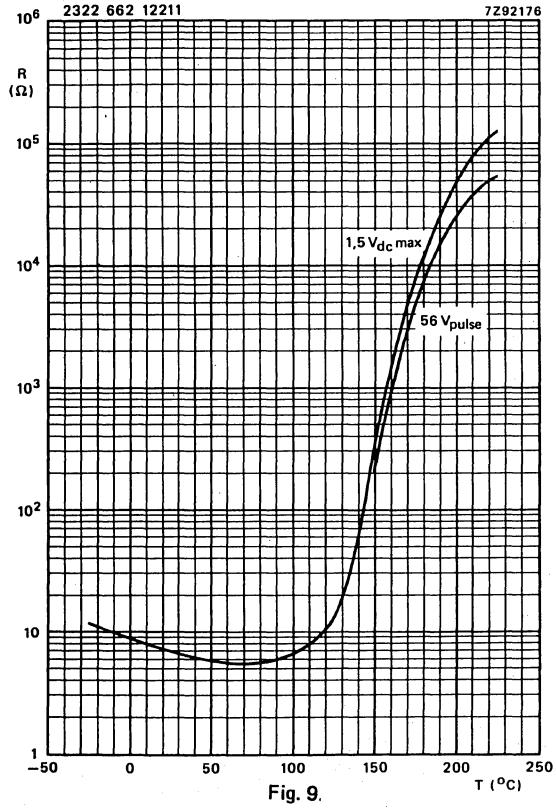

Fig. 9.

SERIES 66.

Current Overload Protection

2322-66.-0...1
2322-66.-1...1

Typical resistance/temperature characteristics.

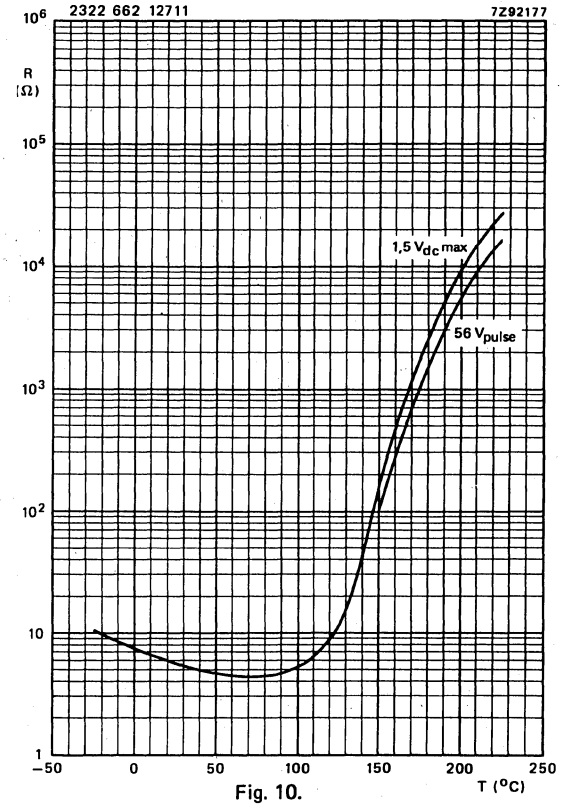

Fig. 10.

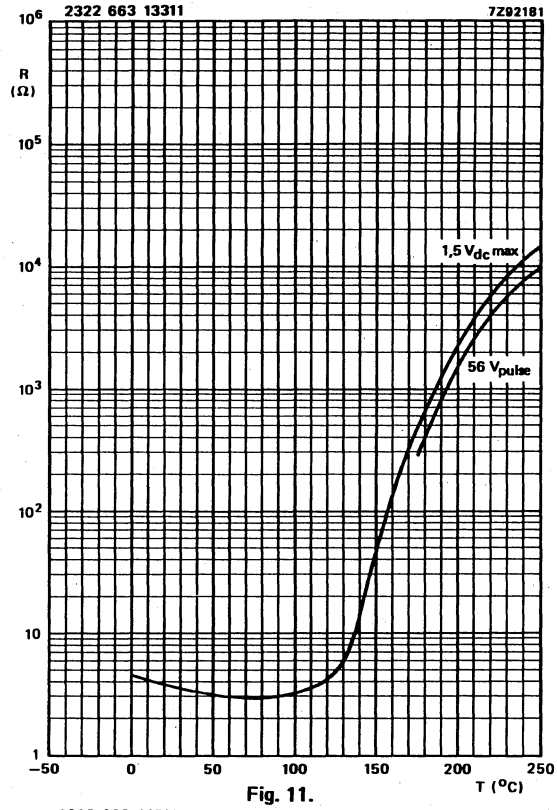

Fig. 11.

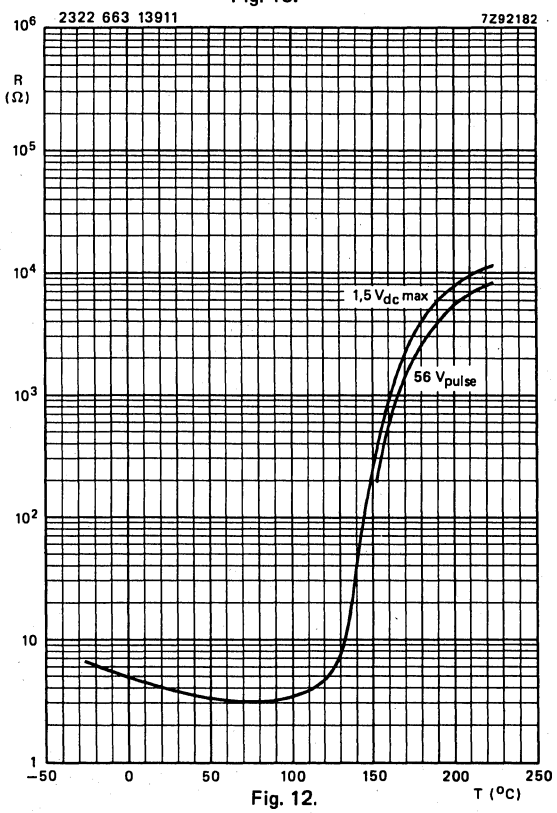

Fig. 12.

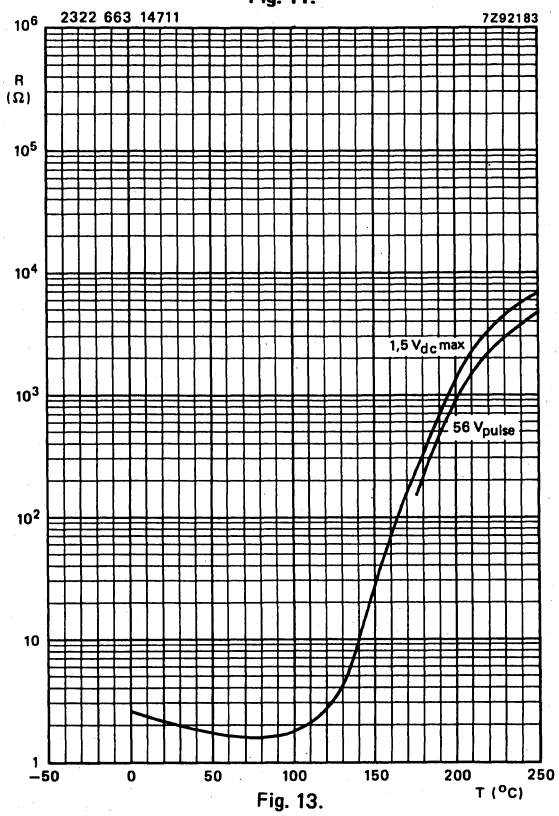

Fig. 13.

8 Non-Linear Resistors

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2322-66.-0...1
2322-66.-1...1

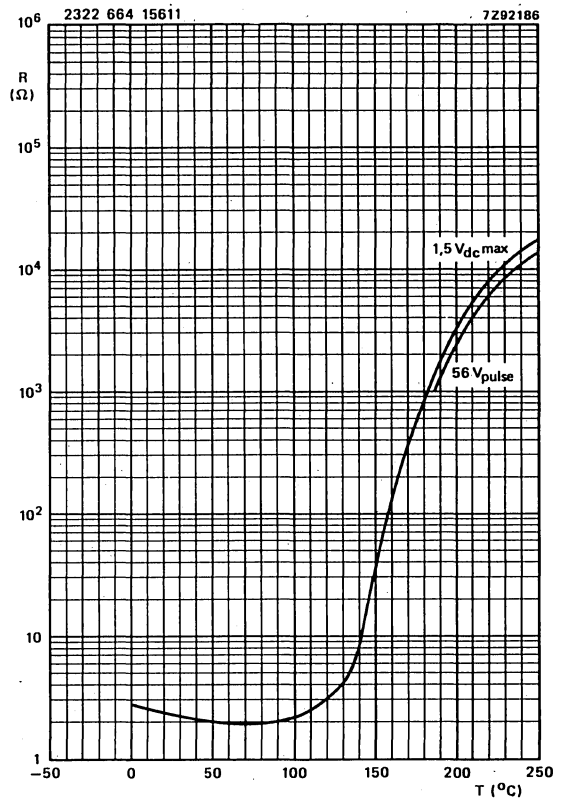


Fig. 14.

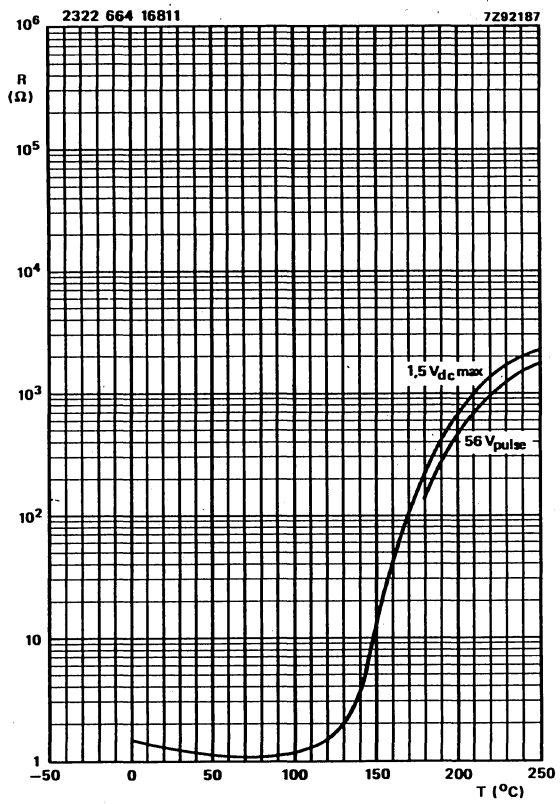


Fig. 15.

Typical resistance/temperature characteristics.

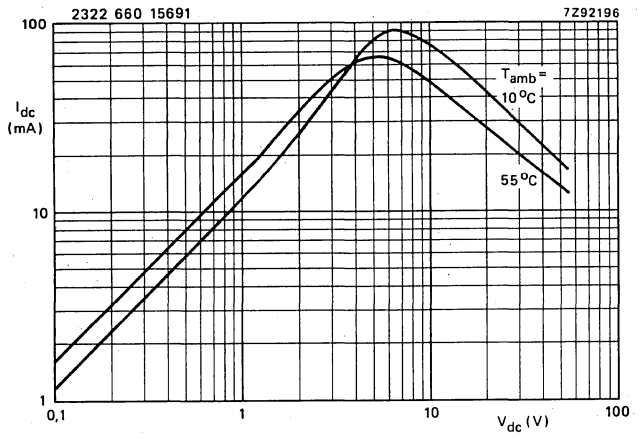


Fig. 16.

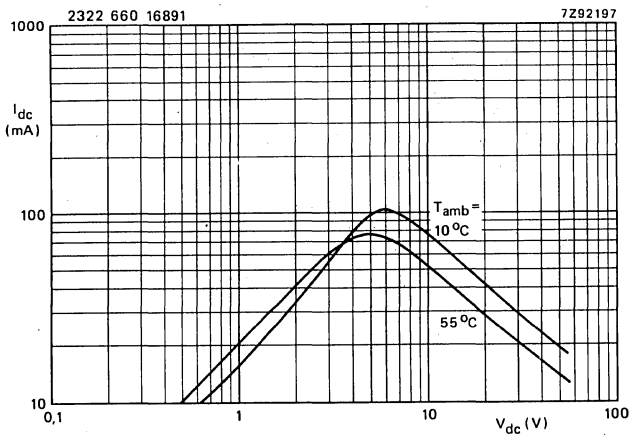


Fig. 17.

Typical voltage/current characteristics.

SERIES 66.
Current Overload Protection

2322-66.-0...1
2322-66.-1...1

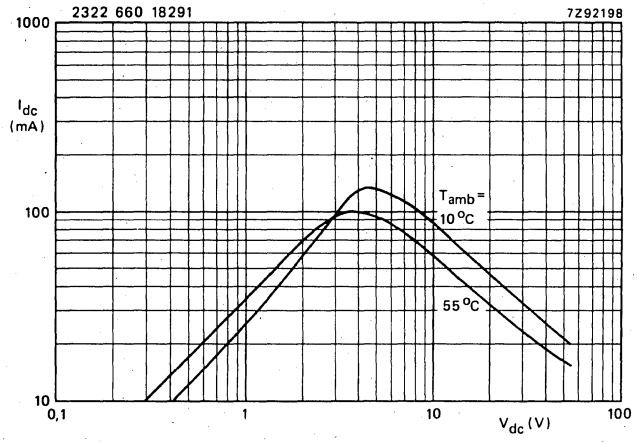


Fig. 18.

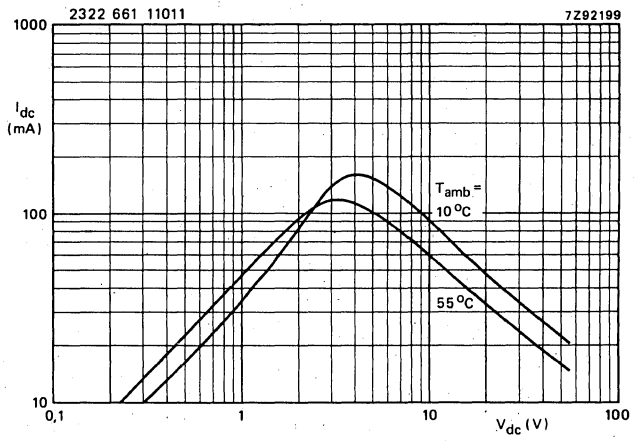
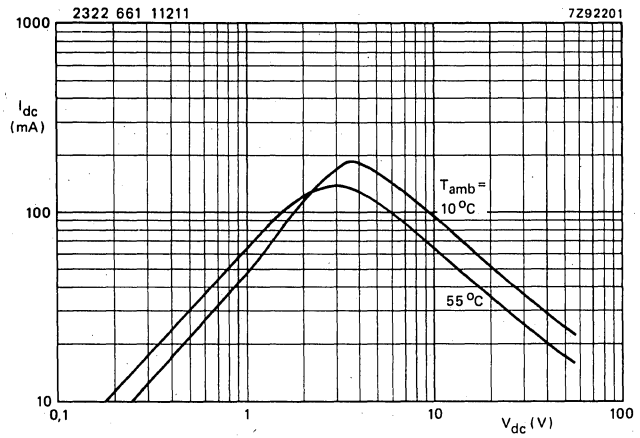


Fig. 19.



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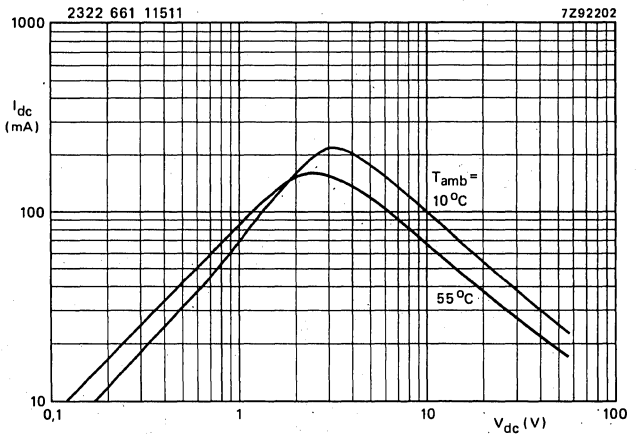

Fig. 21.

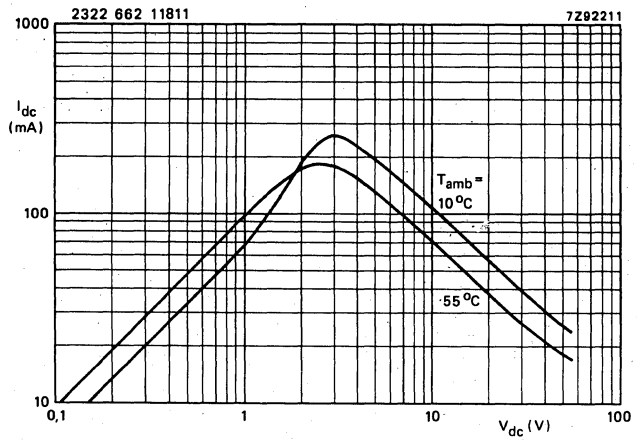

Fig. 22.

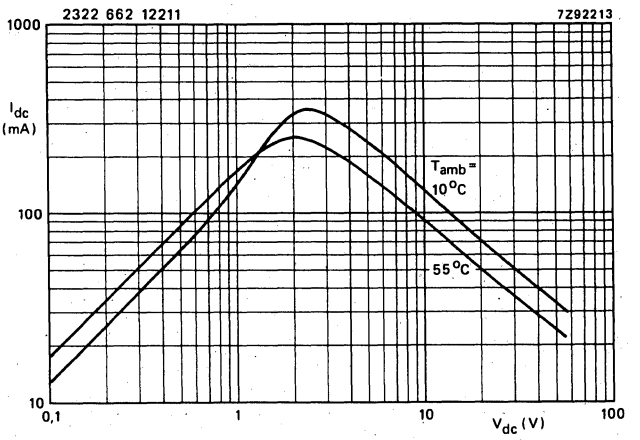

Fig. 23.

Typical voltage/current characteristics.

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2322-66.-0...1
2322-66.-1...1

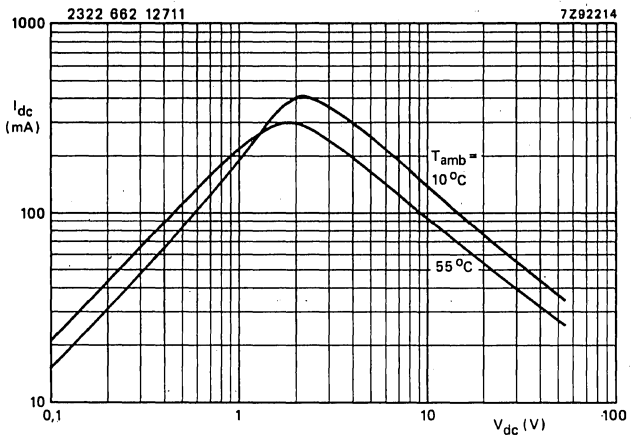


Fig. 24.

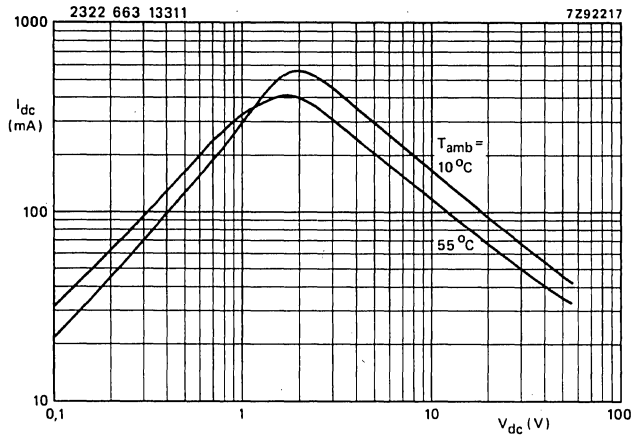


Fig. 25.

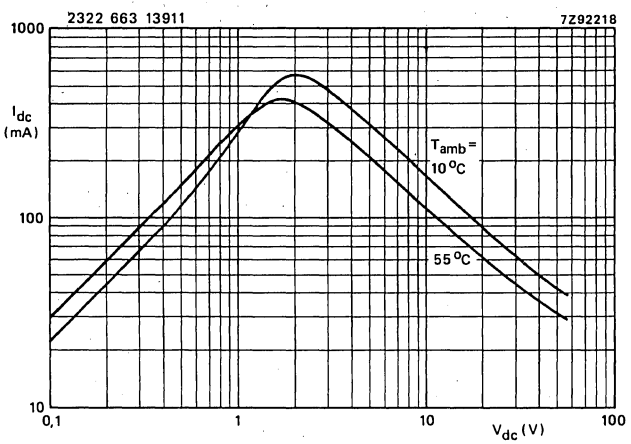


Fig. 26.

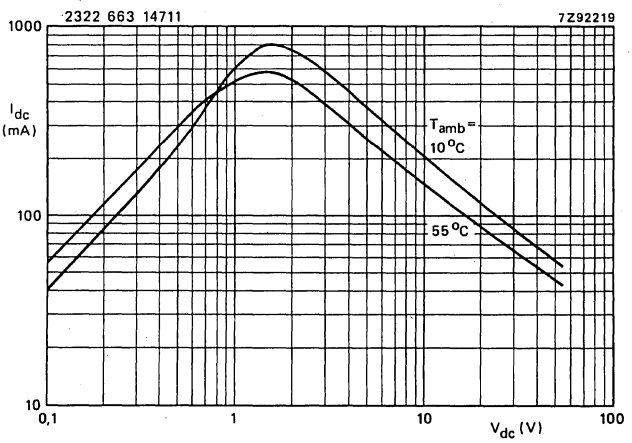


Fig. 27.

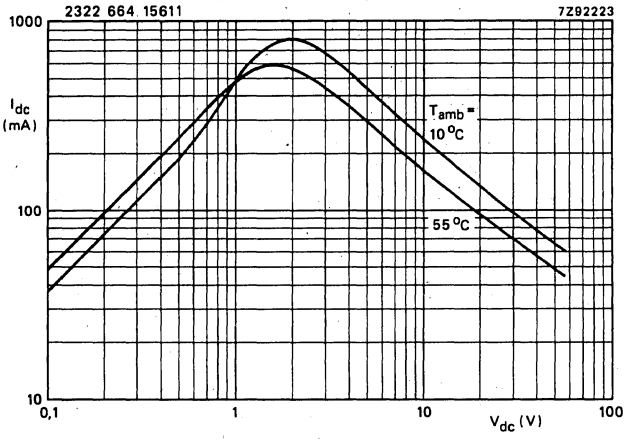


Fig. 28.

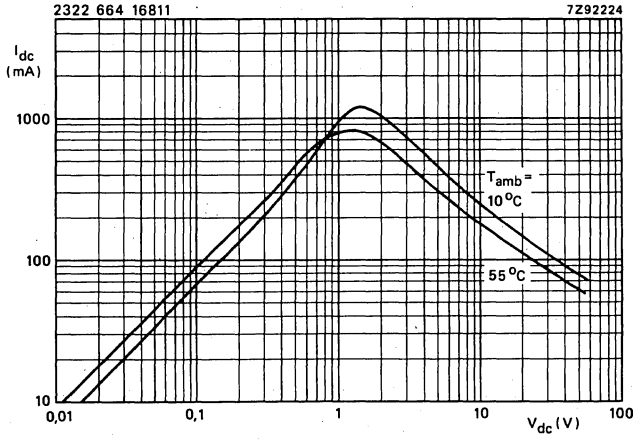


Fig. 29.

Typical voltage/current characteristics.

SERIES 66.
Current Overload Protection

2322-66.-0...3
2322-66.-1...3

QUICK REFERENCE DATA

Resistance at 25°C	3,5 to 1900Ω
Switch temperature	approx. 120°C
Maximum r.m.s. voltage	265 V
Trip current at 10°C	24 to 940 mA
Operating temperature range at V_{max}	0 to +55°C

APPLICATION
Overload protection, for use in electric and electronic equipment such as electric motors, transformers and semi-conductor circuits.

DESCRIPTION
These thermistors have a positive temperature coefficient. They consist of a disc with two tinned brass wires, see Fig. 1a. Leadless types having metallized sides for soldering by the user are also available, see Fig. 1b.

MECHANICAL DATA—Inches (mm)
Outlines

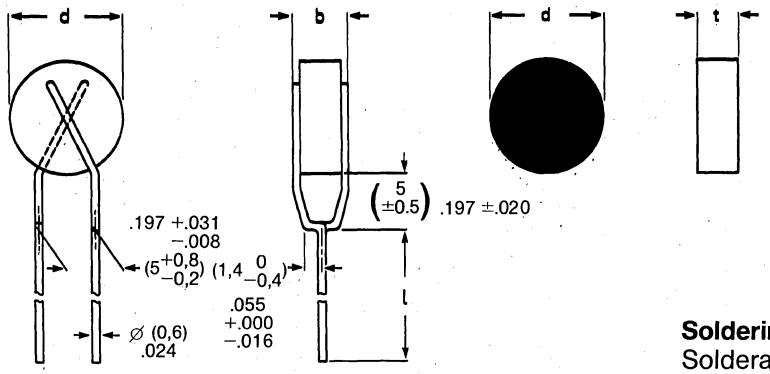


Fig. 1a.

Fig. 1b.

For dimensions b, d, l and t see Table 1.

Marking
None

Mass
See Table 1

Mounting
In any position by soldering

Robustness of terminations

Tensile strength	2.25 lb (10 N)
Bending	1.12 lb (5 N)

Soldering

Solderability	max. 240°C, max.4 s
Resistance to heat	max. 265°C, max. 11 s

When soldering leadless types it is recommended to use a flux containing colofonium and aethyl alcohol only and to pre-heat the discs to approx. 100°C in order to avoid thermal shocks which might damage the thermistors.

Impact
7.87" (200 mm) free fall

Inflammability
Non-flammable

Packaging
Cardboard boxes containing following items for:

2322 660....3: 500	2322 662....3: 100
2322 661....3: 250	2322 663....3: 100
2322 662.1213:200	2322 664....3: 100

8 Non-Linear Resistors

2322-66.-0...3
2322-66.-1...3

ELECTRICAL DATA

Unless otherwise specified measured according to IEC publication 738-1 (1982)

Maximum current for not tripping at 55°C (measuring time 5 minutes)	I_{nt}	See Table 1
Minimum current for tripping after 5 minutes at 10°C	$I_t = 2 \times I_{nt}$	See Table 1
Resistance at +25°C	R_{25}	See Table 1
Switch temperature	T_S	≈ 120°C
Maximum admissible current at 0°C	I_{max}	See Table 1
Maximum residual current at 265 V (d.c.) at 10°C	$I_{res\ max}$	See Table 1
Maximum r.m.s. voltage with a series resistor		265 V
Series resistor	R_S	See Table 1
Dissipation factor at T_S	D	See Table 1
Heat capacity	H	See Table 1
Operating temperature range at zero power		−25 to +125°C
at maximum voltage		0 to +55°C

Table 1

catalogue number 2322 followed by	I_{nt} at 55°C mA	I_t at 10°C mA	R_{25} approx. Ω	I_{max} at 0°C mA	$I_{res\ max}$ at 10°C mA	R_S ±5% Ω	D approx. mW/K	H approx. J/K	d inches (mm)	b max. inches (mm)	l .118 (±3) inches (mm)	t max. inches (mm)	mass approx. g
2322 660.1293	12	24	1900	110	5	1100	6	0,12	.177 (4,5)	.197 (5)	.787 (20)	.150 (3,8)	0,45
660.1593	15	30	1200	135	5	1100	6	0,12	.177 (4,5)	.197 (5)	.787 (20)	.150 (3,8)	0,45
660.1893	18	36	850	165	5	1000	6	0,12	.177 (4,5)	.197 (5)	.787 (20)	.150 (3,8)	0,45
660.2293	22	44	560	200	6	910	6	0,12	.177 (4,5)	.197 (5)	.787 (20)	.150 (3,8)	0,45
660.2793	27	54	380	250	6	820	6	0,12	.177 (4,5)	.197 (5)	.787 (20)	.150 (3,8)	0,45
661.3393	33	66	280	290	7	750	7	0,22	.256 (6,5)	.197 (5)	.787 (20)	.150 (3,8)	0,70
661.3993	39	78	200	350	7	620	7	0,22	.256 (6,5)	.197 (5)	.787 (20)	.150 (3,8)	0,70
661.4793	47	94	140	420	7	560	7	0,22	.256 (6,5)	.197 (5)	.787 (20)	.150 (3,8)	0,70
661.5693	56	112	100	500	8	470	7	0,22	.256 (6,5)	.197 (5)	.787 (20)	.150 (3,8)	0,70
661.6893	68	136	72	600	8	390	8	0,33	.315 (8,0)	.197 (5)	.787 (20)	.150 (3,8)	0,90
661.8293	82	164	50	730	9	330	8	0,33	.315 (8,0)	.197 (5)	.787 (20)	.150 (3,8)	0,90
661.1013	100	200	33	900	9	270	8	0,33	.315 (8,0)	.197 (5)	.787 (20)	.150 (3,8)	0,90
662.1213	120	240	26	1100	12	220	8,5	0,48	.394 (10,0)	.197 (5)	.787 (20)	.150 (3,8)	1,30
662.1513	150	300	20	1300	12	200	9,5	0,68	.472 (12,0)	.197 (5)	.787 (20)	.150 (3,8)	1,80
662.1813	180	360	14	1700	14	150	9,5	0,68	.472 (12,0)	.197 (5)	.787 (20)	.150 (3,8)	1,80
663.2213	220	440	10	2100	16	120	10	0,85	.512 (13,0)	.197 (5)	.787 (20)	.150 (3,8)	2,15
663.2713	270	540	8	2500	19	100	12	1,30	.630 (16,0)	.197 (5)	.787 (20)	.150 (3,8)	2,90
664.3313	330	660	7	3000	25	82	16	2,40	.787 (20,0)	.236 (6)	.630 (16)	.189 (4,8)	5,30
664.3913	390	780	5	3600	25	68	16	2,40	.787 (20,0)	.236 (6)	.630 (16)	.189 (4,8)	5,30
664.4713	470	940	3,5	4300	25	56	16	2,40	.787 (20,0)	.236 (6)	.630 (16)	.189 (4,8)	5,30

For leadless types replace the dot in the catalogue number by 0; for types with leads replace it by 1.

SERIES 66.

Current Overload Protection

2322-66.-0...3
2322-66.-1...3

Typical resistance/temperature characteristics.

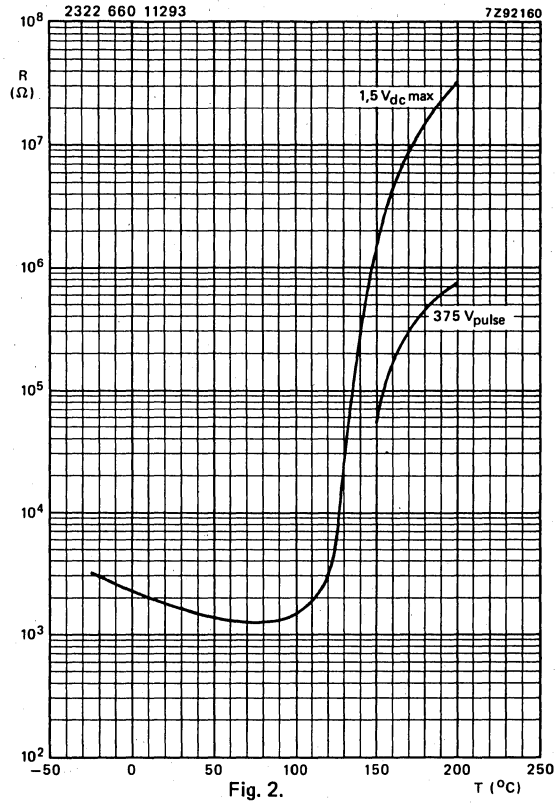


Fig. 2.

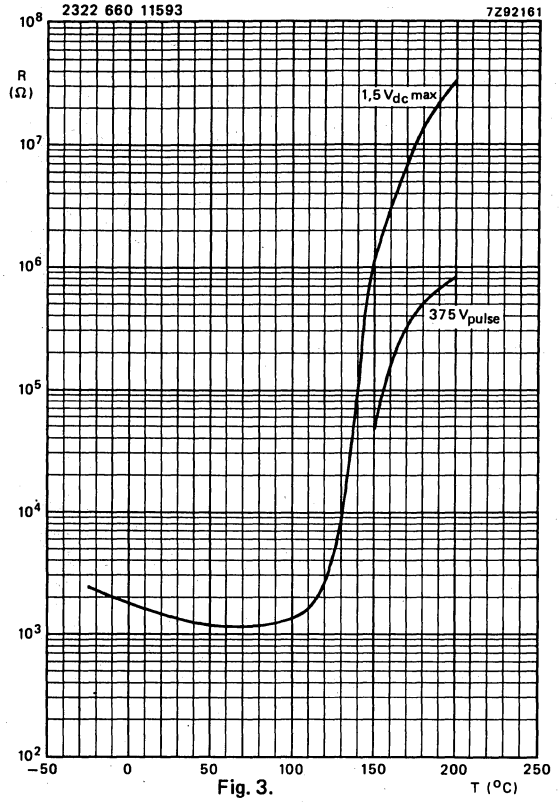


Fig. 3.

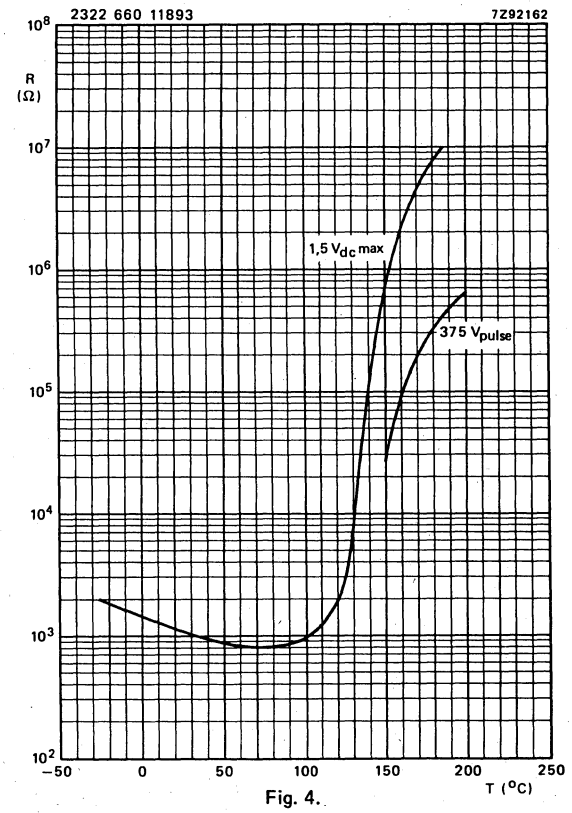


Fig. 4.

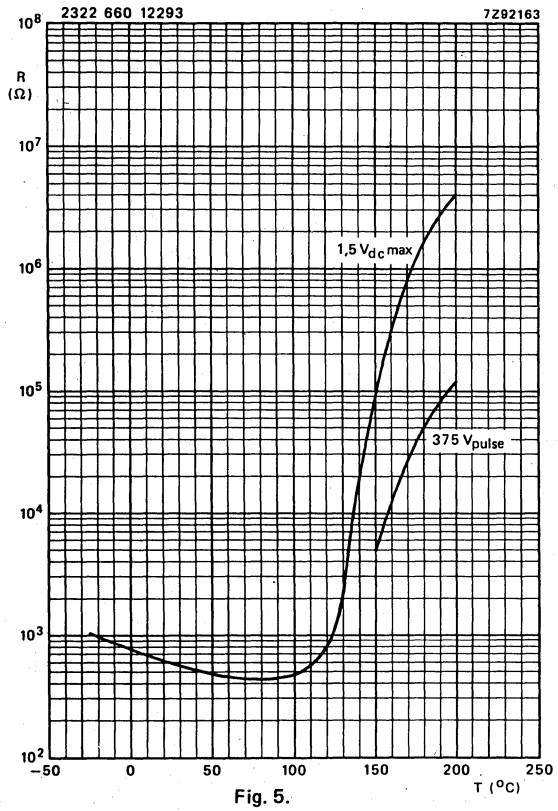


Fig. 5.

8 Non-Linear Resistors

2322-66.-0...3
2322-66.-1...3

Typical resistance/temperature characteristics.

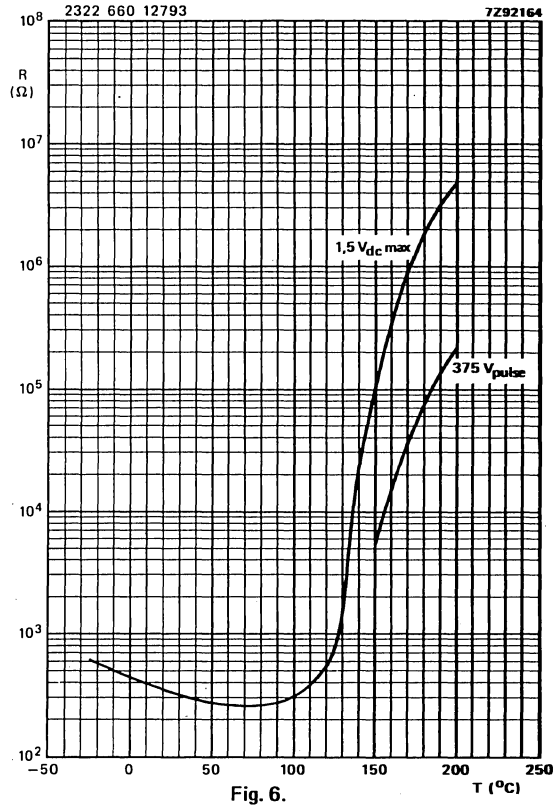


Fig. 6.

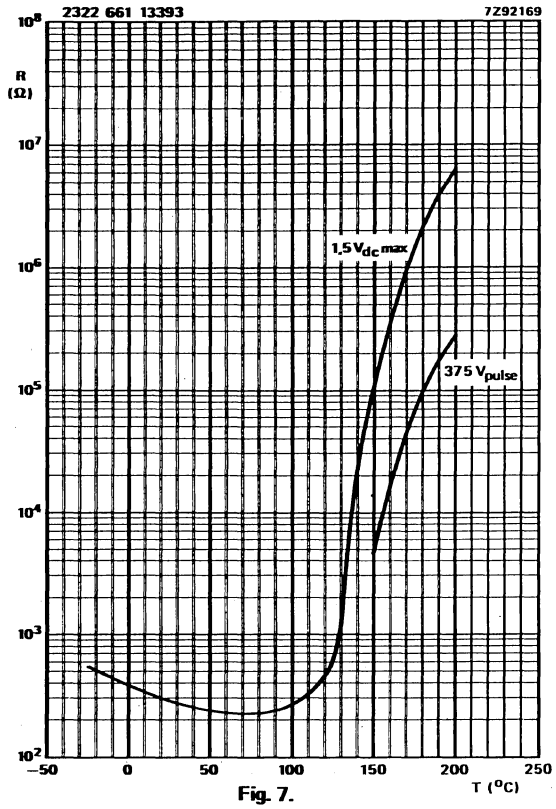
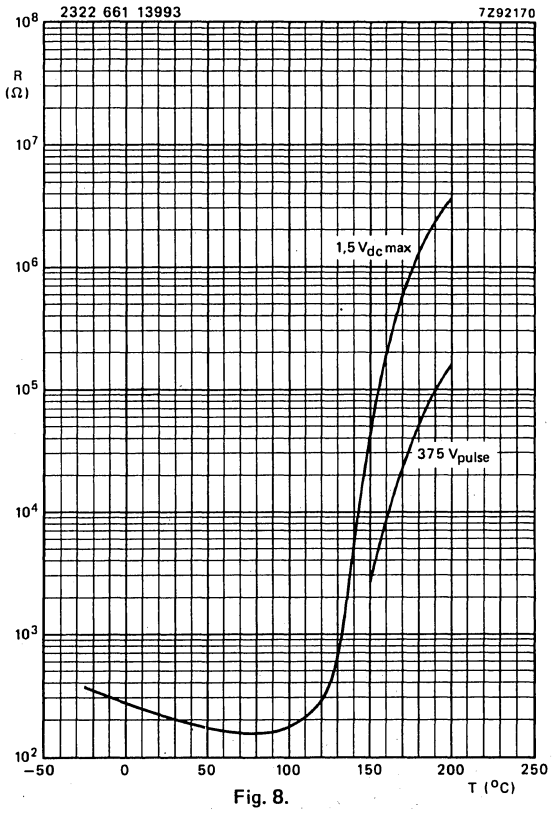


Fig. 7.



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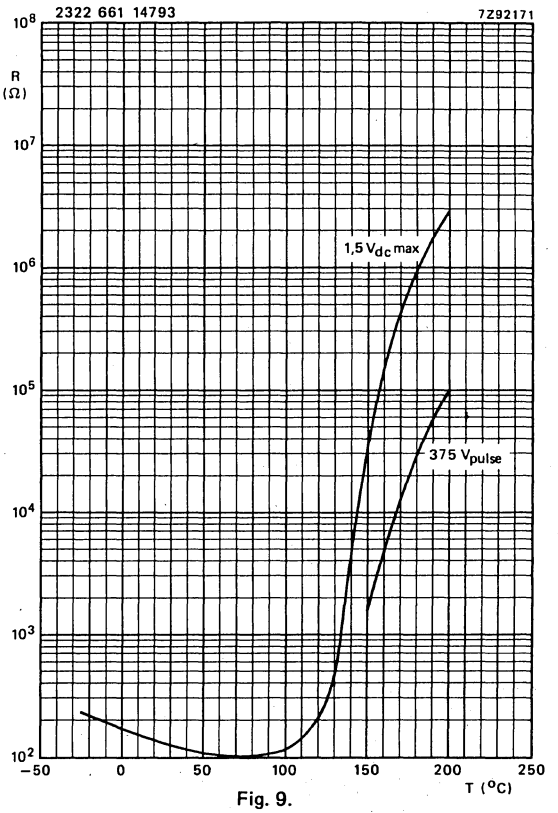

Fig. 9.

SERIES 66.
Current Overload Protection

2322-66.-0...3
2322-66.-1...3

Typical resistance/temperature characteristics.

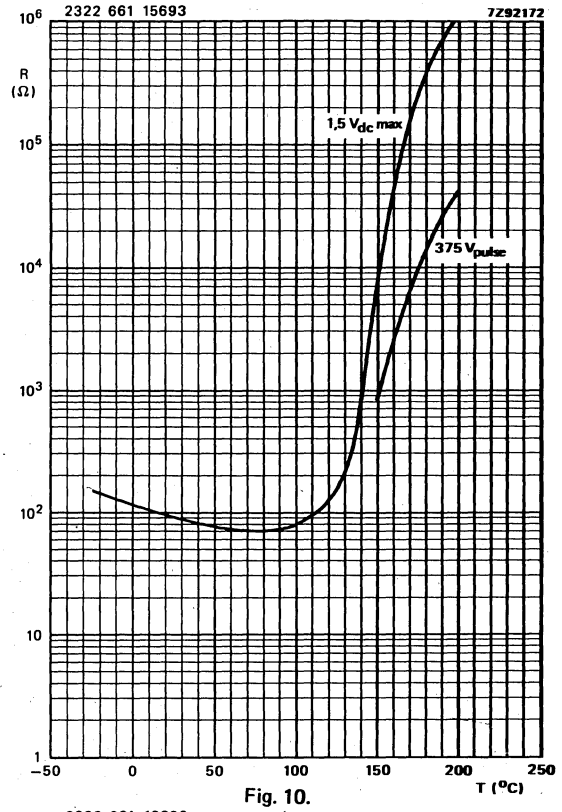

Fig. 10.

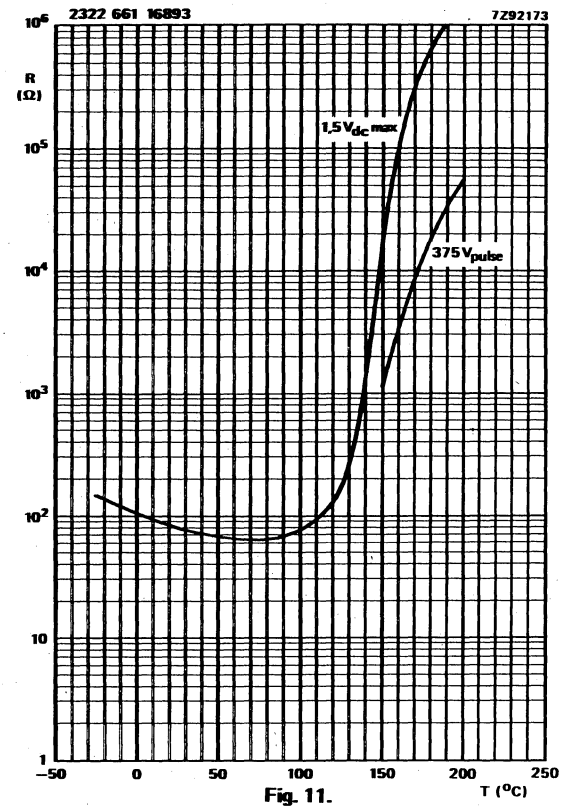

Fig. 11.

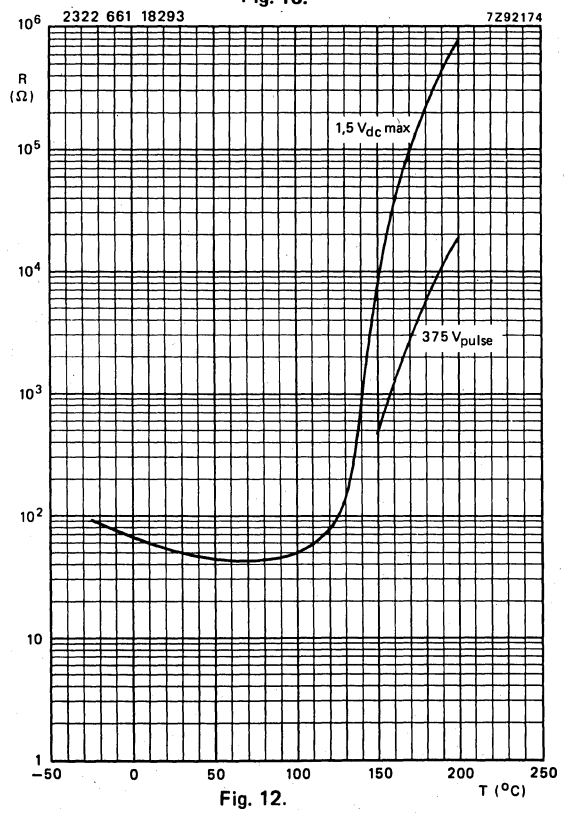

Fig. 12.

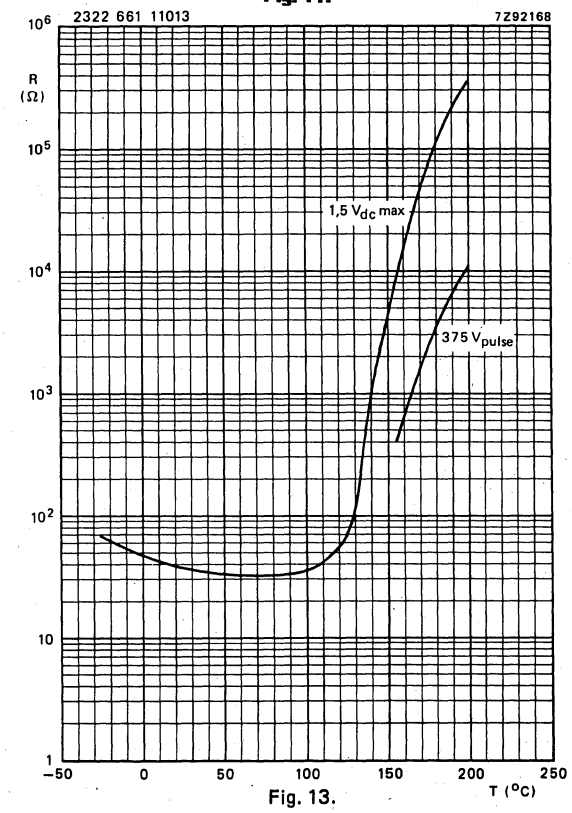

Fig. 13.

8 Non-Linear Resistors

2322-66.-0...3
2322-66.-1...3

Typical resistance/temperature characteristics.

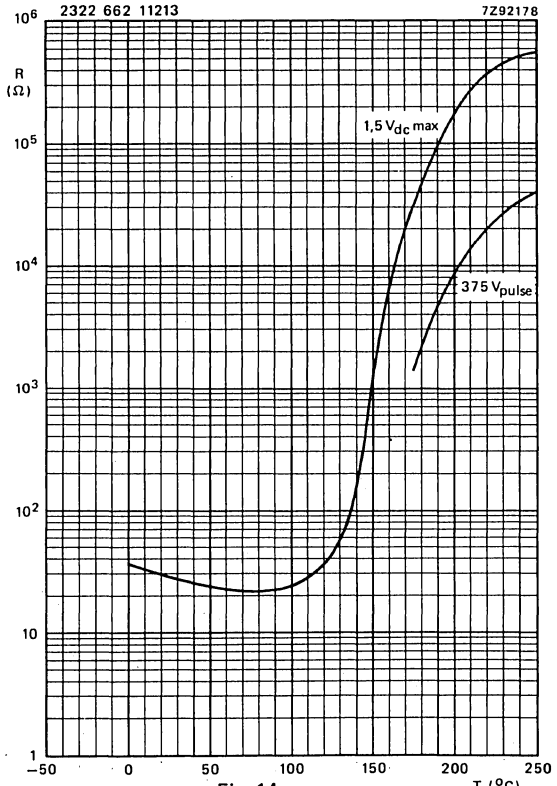

Fig. 14.

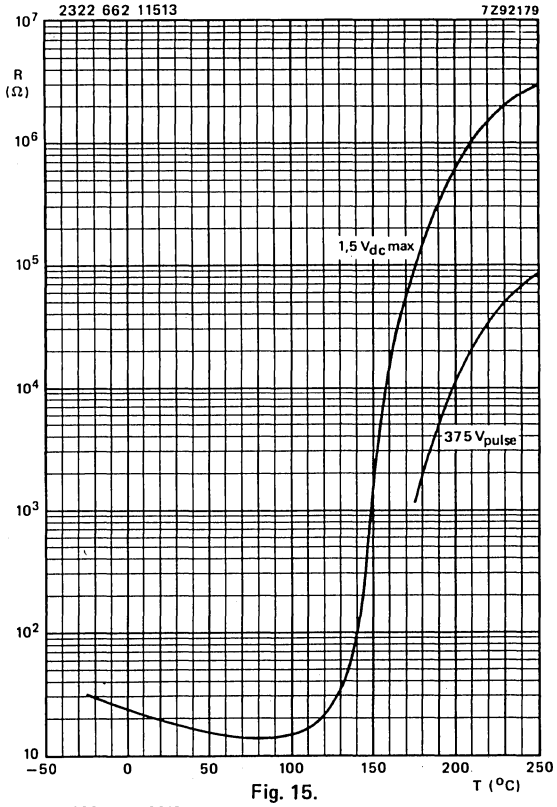

Fig. 15.

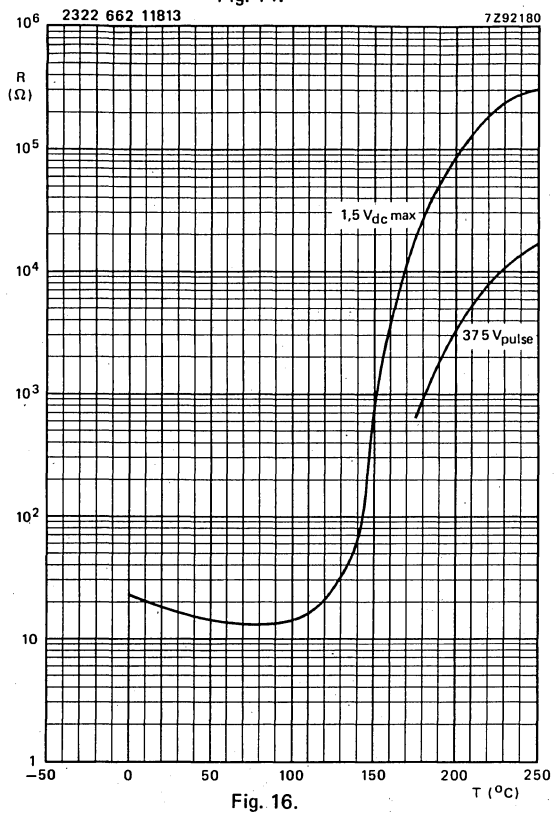

Fig. 16.

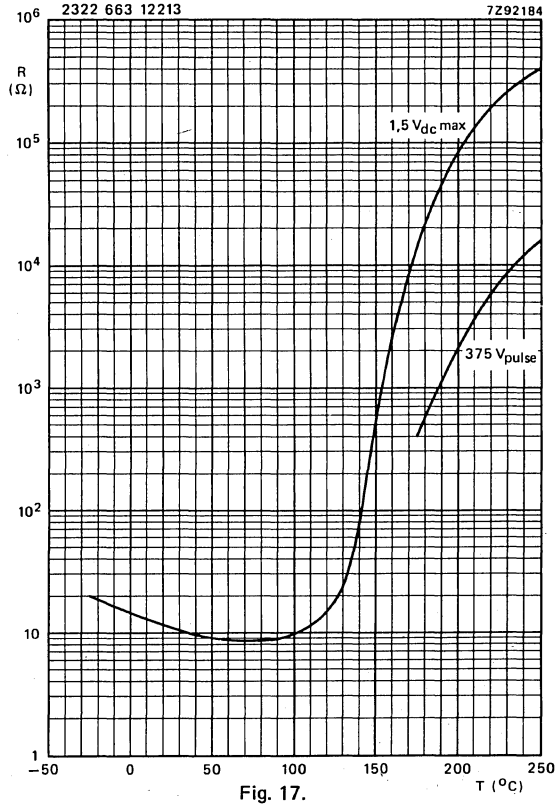

Fig. 17.

SERIES 66.
Current Overload Protection

2322-66.-0...
2322-66.-1...

Typical resistance/temperature characteristics.

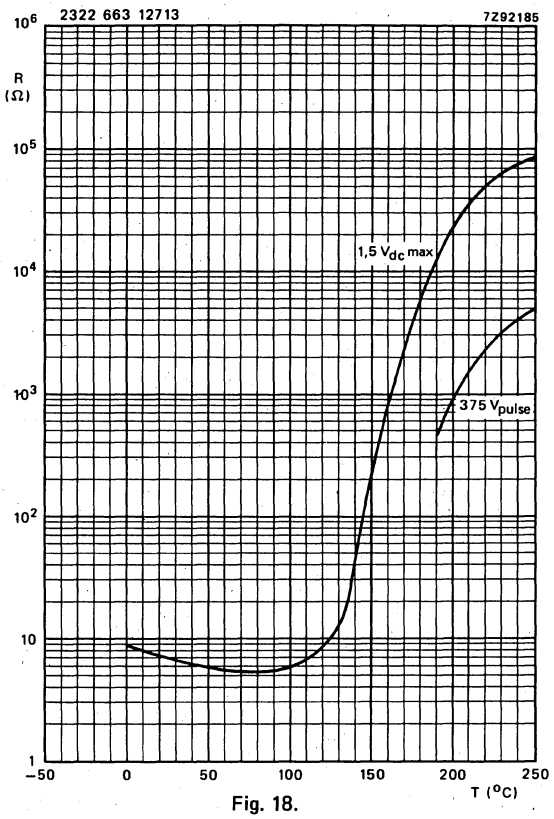

Fig. 18.

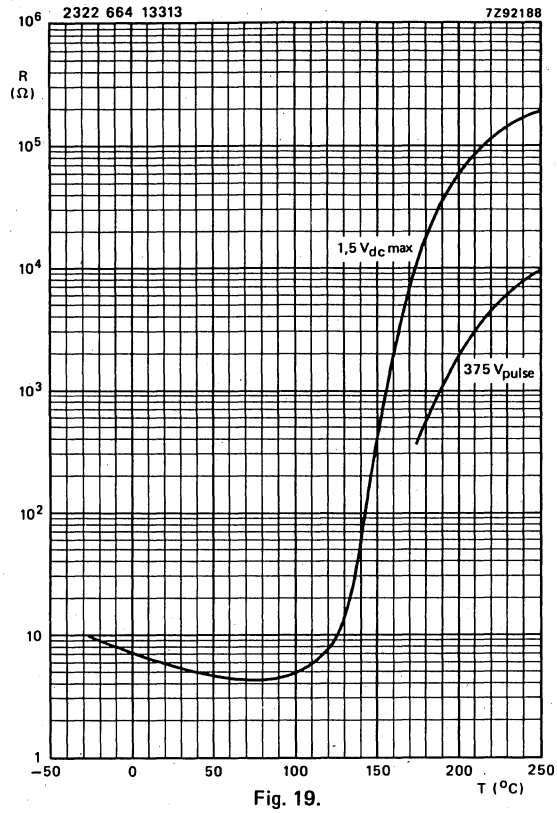

Fig. 19.

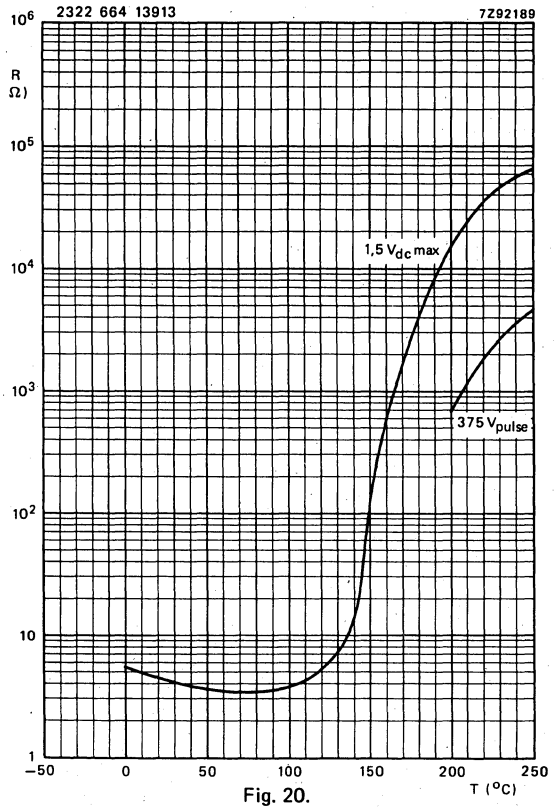

Fig. 20.

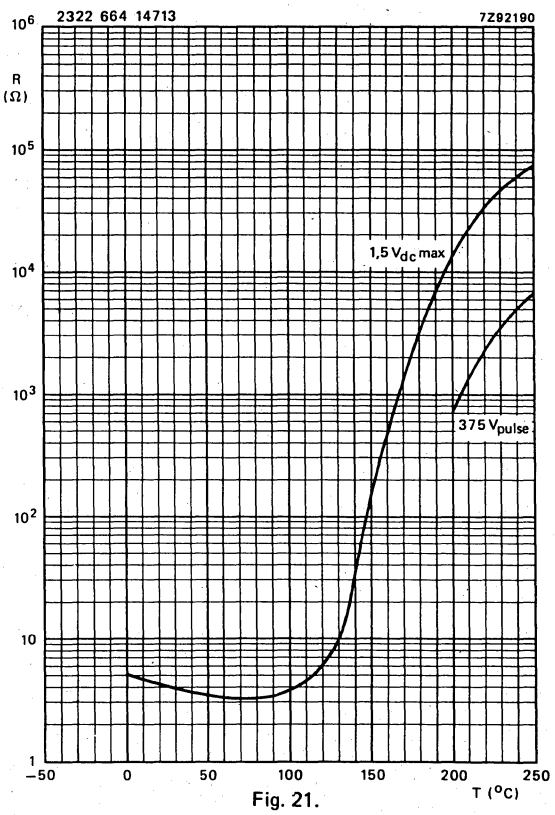

Fig. 21.

8 Non-Linear Resistors

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2322-66.-0...3
2322-66.-1...3

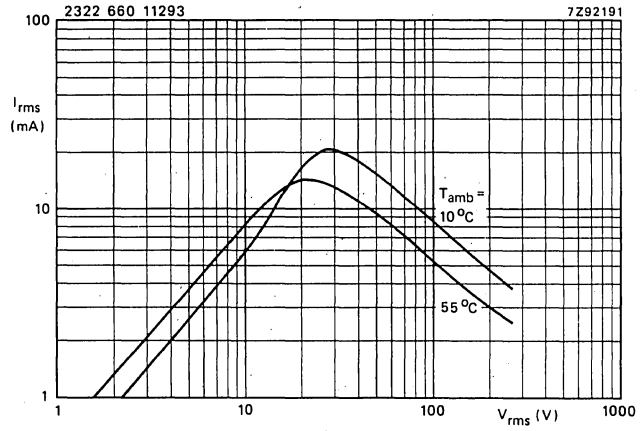


Fig. 22.

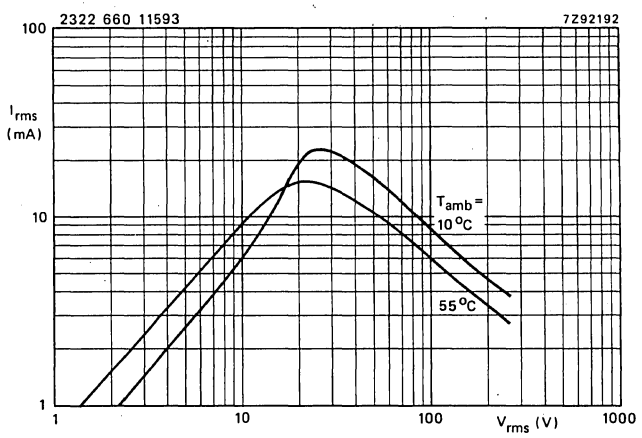
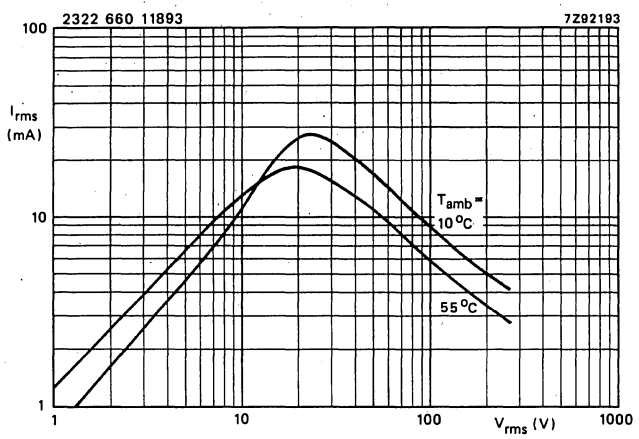


Fig. 23.



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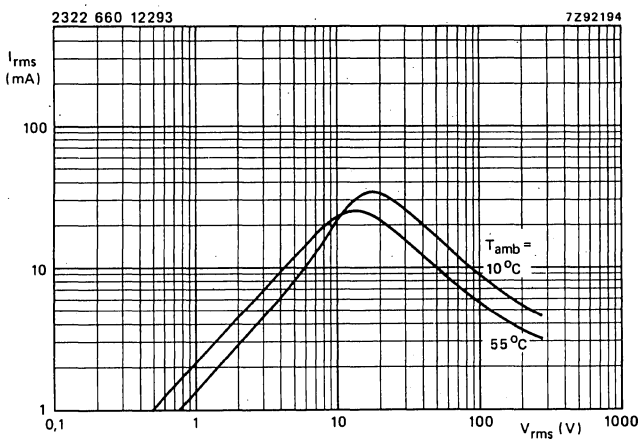


Fig. 25.

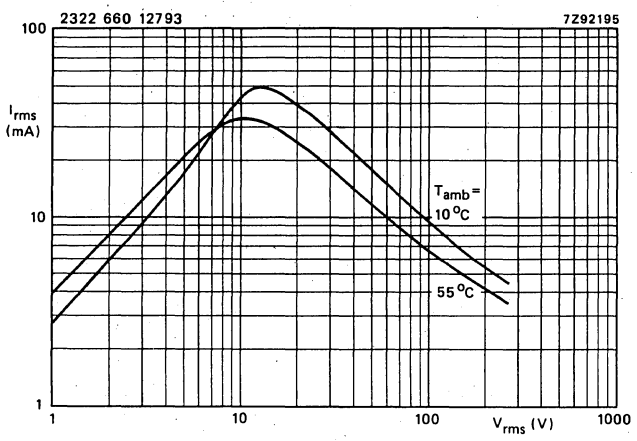


Fig. 26.

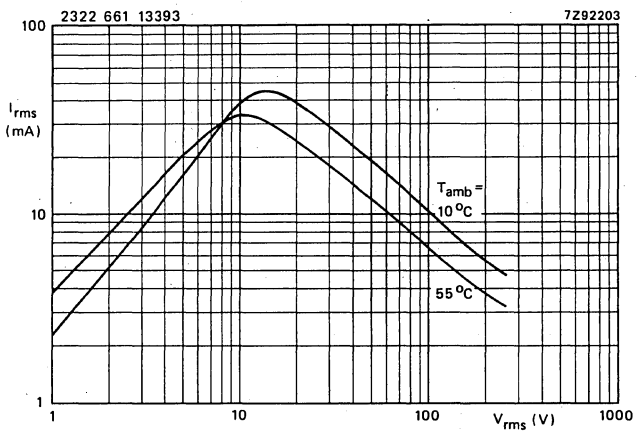


Fig. 27.

Typical voltage/current characteristics.

SERIES 66.
Current Overload Protection

2322-66.-0...3
2322-66.-1...3

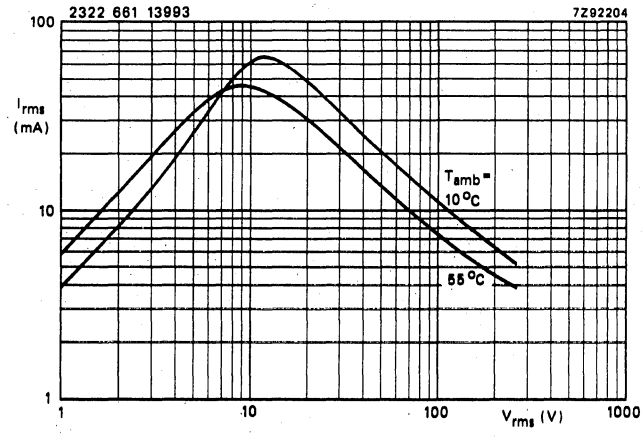


Fig. 28.

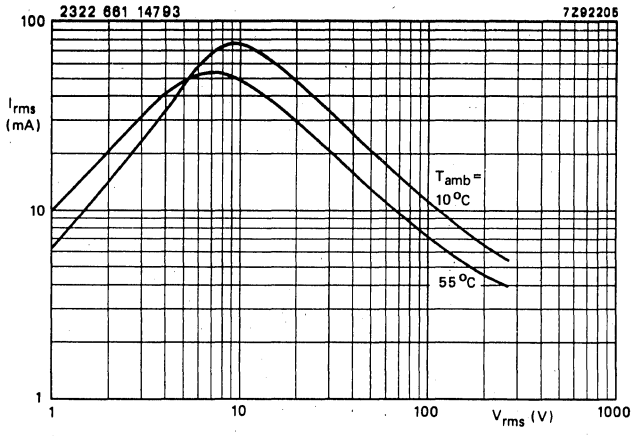


Fig. 29.

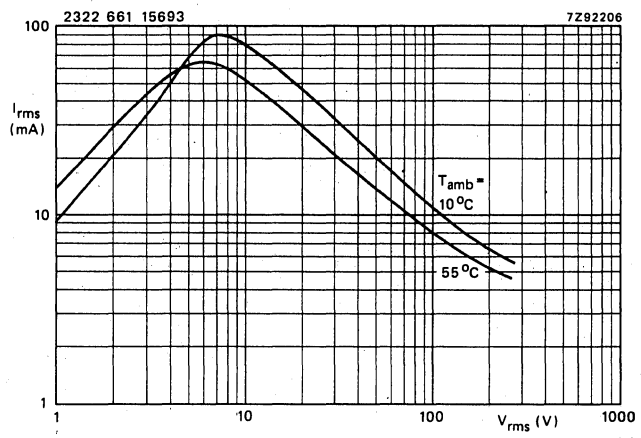


Fig. 30.

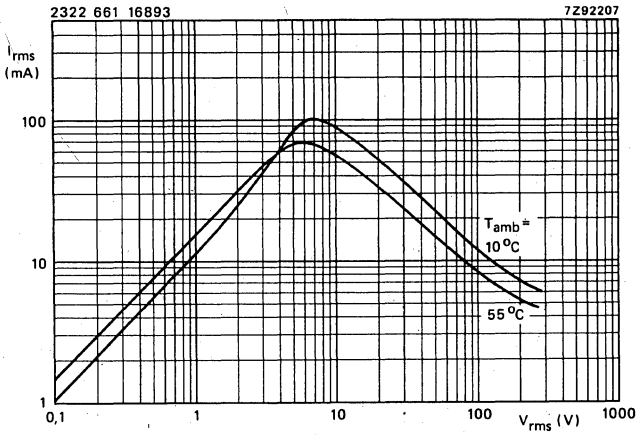


Fig. 31.

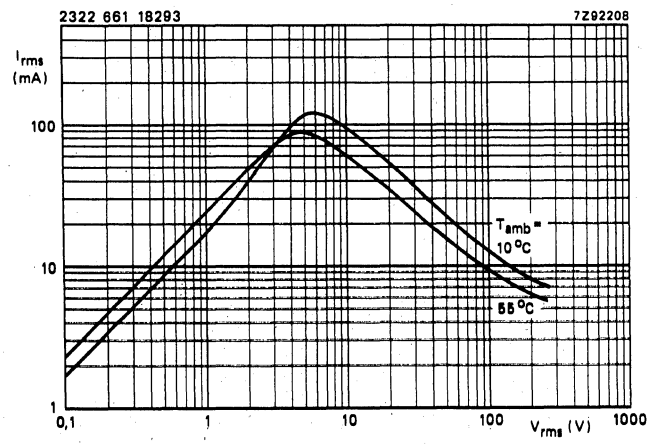


Fig. 32.

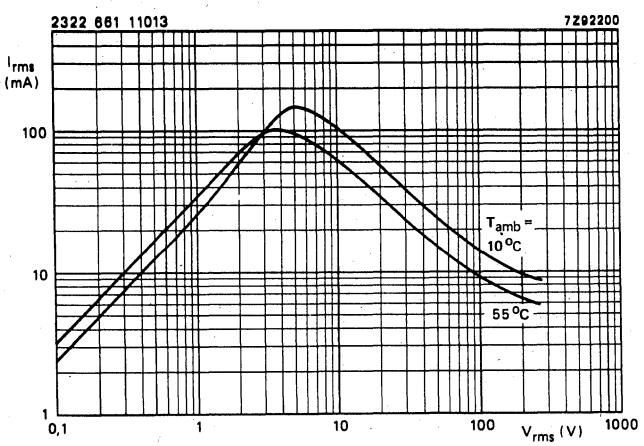


Fig. 33.

Typical voltage/current characteristics.

8 Non-Linear Resistors

2322-66.-0...3
2322-66.-1...3

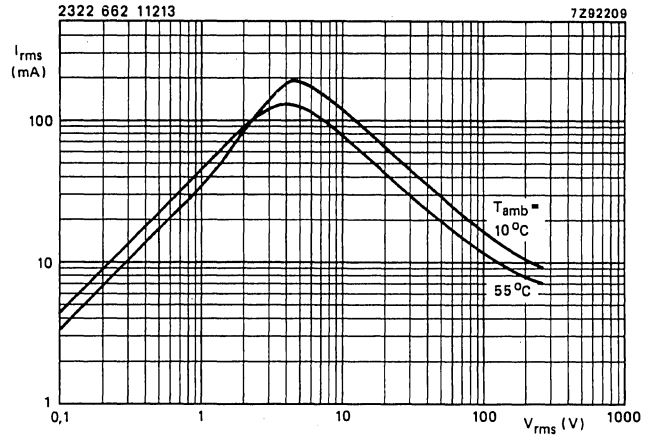


Fig. 34.

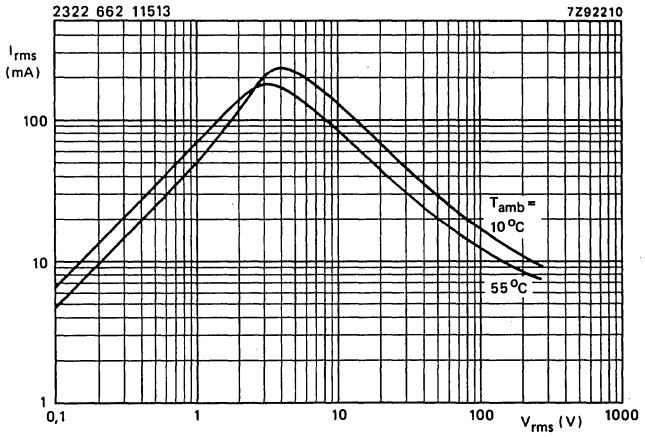


Fig. 35.

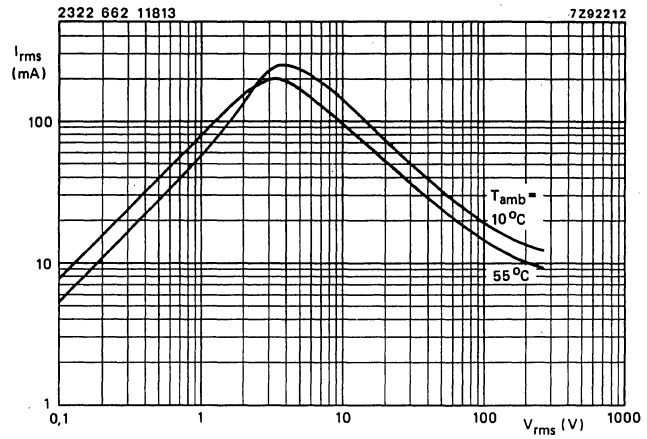


Fig. 36.

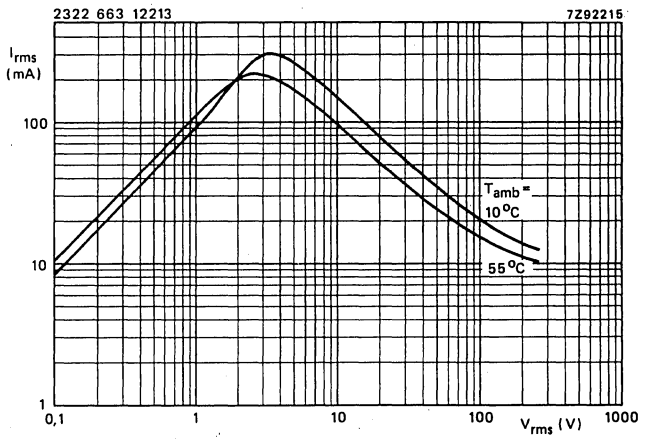


Fig. 37.

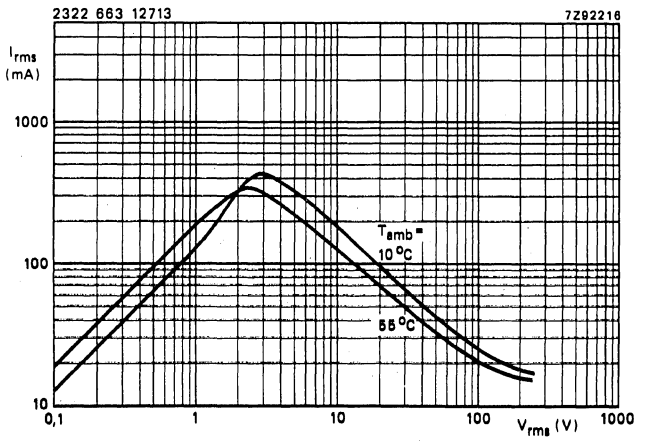


Fig. 38.

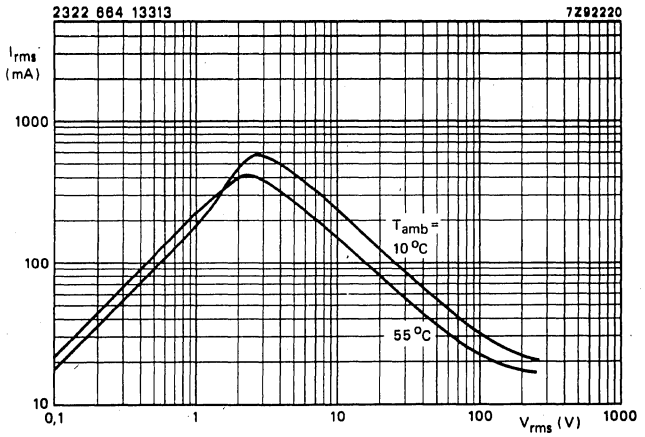


Fig. 39.

Typical voltage/current characteristics.

2322-66.-0...3
2322-66.-1...3

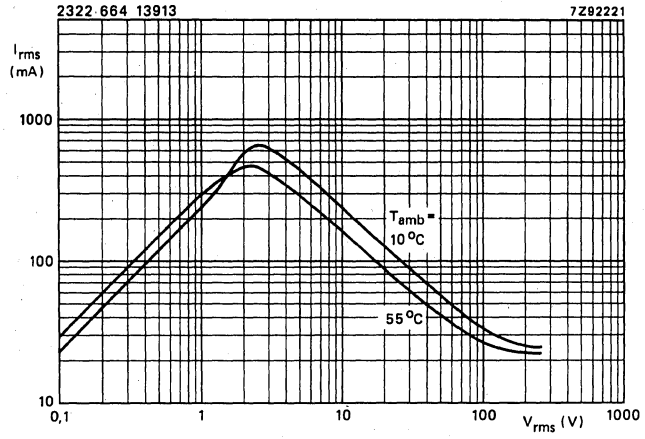


Fig. 40.

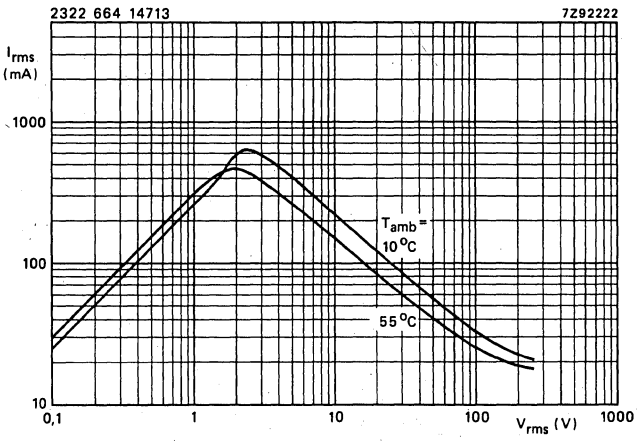


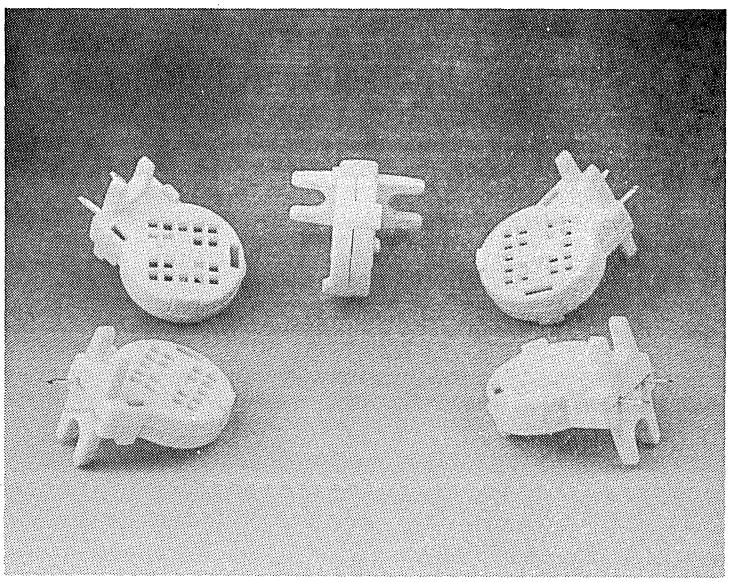
Fig. 41.

Typical voltage/current characteristics.

SERIES 691

Relative Humidity Sensor

2322 691 90001



DESCRIPTION

This capacitive humidity sensor consists of a plastic film, both sides of which are coated with gold, thus forming a capacitor element. The dielectric constant of the film changes as a function of relative humidity in the atmosphere. As a consequence, the capacitance value of the sensor is a function of relative humidity.

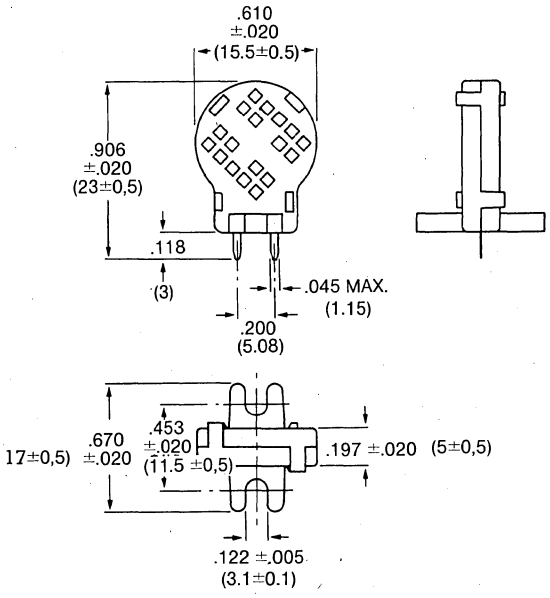
The plastic film is clamped between spring contacts and packaged in a plastic housing.

The sensor's characteristics are not affected by contact with water but acetone vapor exposure should be avoided.

FEATURES

- Wide relative humidity range, 10 to 90%
- Cost effective accuracy
- Operating temperature range, 0 to 85°C
- Undamaged by condensation
- Operating frequency range, 1KHz to 1MHz

DIMENSIONS INCHES (mm)



8 Non-Linear Resistors

SERIES 691
Relative Humidity Sensor

SPECIFICATIONS

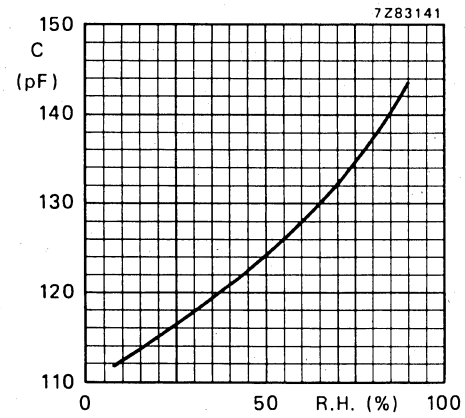
ELECTRICAL

Operating Humidity Range	10 to 90% R.H.
Operating Temperature Range	0 to 85°C
Capacitance at 25°C, 43% R.H., 100KHz	122pF ±15%
Dissipation Factor at 25°C 100KHz	3.5% max.
Frequency Range	1 KHz to 1MHz
Temperature Dependence	0.1% R.H./°C
Response Time (to 90% of indicated R.H. at 25°C, in circulating air)	
Between 10 and 43% R.H.	3 minutes max.
Between 43 and 90% R.H.	5 minutes max.
Typical Hysteresis (excursion of 10 to 90 to 10% R.H.)	3%
Maximum Voltage	15V
Storage Humidity Range	0 to 100% R.H.
Storage Temperature Range	−25 to 85°C

MECHANICAL

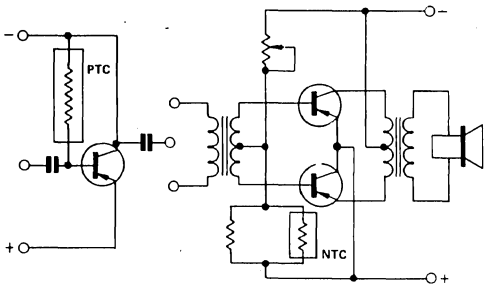
Assembly	Sensor can be soldered onto P.C. board or mounted with screws.
Solderability	240°C for 4 seconds max.
Lead Strength	2 lb. pull test with no damage.

TYPICAL CAPACITANCE & R.H. CURVE

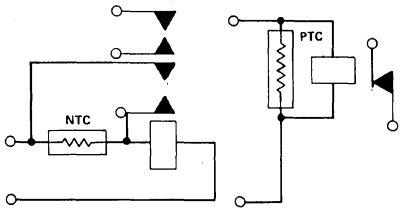


8 Non-Linear Resistors

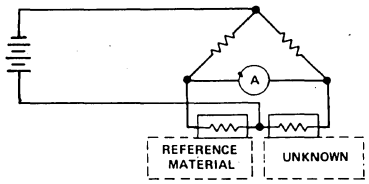
Typical Application Circuits



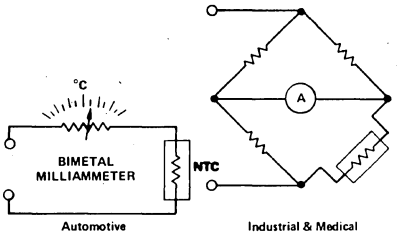
A. Temperature Compensation in Transistor Circuits.



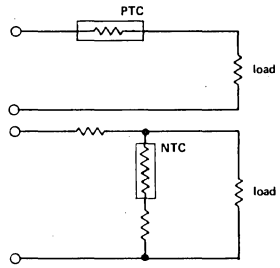
B. Time Delay
Thermal inertia of thermistor delays actuation of the relay.



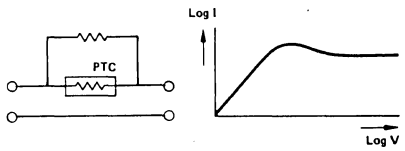
C. Thermal Conductivity Measurement.
Heat dissipated by the thermistors is conducted away by Reference and Unknown materials. Unequal conduction unbalances bridge (registers on meter) and can be calibrated for direct readout of thermal conductivity of unknown material.



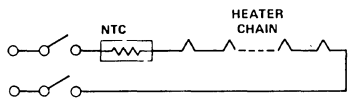
D. Temperature Measurement.



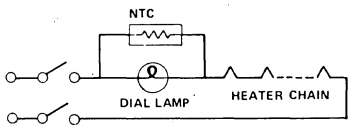
E. Voltage Regulation



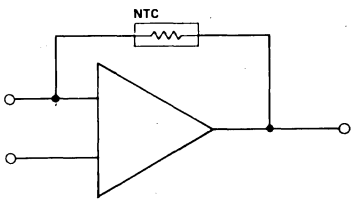
F. Current Regulation.



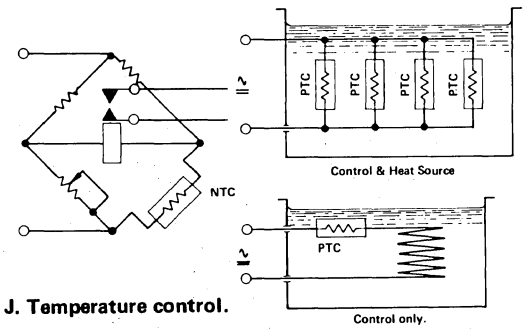
G. Surge Protection.



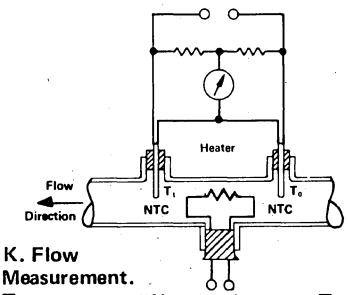
H. Continuity Protection.
When dial lamp falls, thermistor resistance drops, and heater chain remains energized.



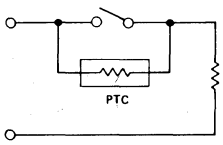
I. Automatic Power Level Control.



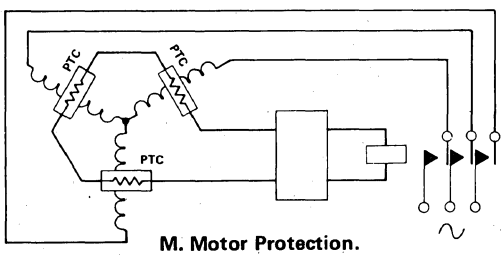
J. Temperature control.



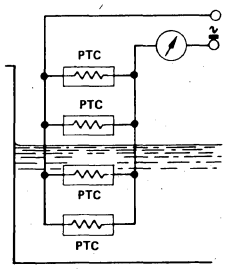
K. Flow Measurement.
Temperature difference between T_0 and T_1 is a measure of the flow velocity.



L. Spark Suppression.
When the switch opens, the low resistance of the PTC prevents sparking.



M. Motor Protection.
Overheating of one or more windings causes interruption of motor power.



N. Liquid-Level Indication & Control.

COMPETITOR CROSS REFERENCE

COMPETITOR NUMBER	COMPETITOR NAME	MEPCO/ CENTRALAB PART NUMBER	PAGE NUMBER
1C-5C	SPRAGUE	K	175
100SX	DALE	8038EKV, CT-6H*	551,555
101	SANGAMO	3120	11
101R	SANGAMO	3120	11
101SR	DALE	CT-6N*	555
101SX	DALE	CT-6X*	555
101T	DALE	8038EKP, CT-6R*	551,555
101X	SANGAMO	3120	11
102	SEACOR	708D1	420
102T	DALE	8038EKH*	551
104D	SPRAGUE	40ES	357
106	SEACOR	712A1	428
109D	SPRAGUE	40EW	312
109D	SPRAGUE	40LW	228,328
112	SEACOR	708B1	438
112D	SPRAGUE	40RF	253
113D	SPRAGUE	40SF	254
12	MIDWEC	708B1	438
120D	SPRAGUE	40AG	251
121D	SPRAGUE	40BG	252
122	SEACOR	703E	448
122D	SPRAGUE	40AF	249
123D	SPRAGUE	40BF	250
130D	SPRAGUE	40EW	312
130D	SPRAGUE	40LW	228,328
135D	SPRAGUE	40AW	243,301
137D	SPRAGUE	40SW	230,239,335
138D	SPRAGUE	40SW	230,239,335
139R	SANGAMO	3191	48
140D	SPRAGUE	43XW	222,224,235, 236,237
141D	SPRAGUE	43XW	222,224,235, 236,237
146D	SPRAGUE	40CW	308
150	VRN	RJ-13P*	559
150D	SPRAGUE	40SS	266,277,379
150SX	DALE	8038EKZ*	551
150TX	DALE	8038EKR*	551
151D	SPRAGUE	40NS	295,371
152	MALLORY WESTLAKE	708D1	420
152D	SPRAGUE	40XS	289,390
154D	SPRAGUE	40ES	357
158X	PLESSEY WESTLAKE	719J1	462
160	PLESSEY WESTLAKE	712A1, 719A1	428,432
162D	SPRAGUE	40CS	354
163D	SPRAGUE	40CS	354
167	MALLORY WESTLAKE	719A1	432
168	MALLORY WESTLAKE	719A1	432
170	VRN	8014EKW, CT-6W*	543,555
171	VRN	8014EKP, CT-6P*	543,555
172	VRN	8014EKX	543
172D	SPRAGUE	40TS	275,386
173D	SPRAGUE	40MS	365
176D	SPRAGUE	40TS	275,386
180	VRN	CT-6W*	555
181	VRN	CT-6P*	555
182	VRN	CT-6X*	555
183	VRN	CT-6N*	555
184	MALLORY WESTLAKE	719A1	432
185	MALLORY WESTLAKE	719A1	432
186	MALLORY WESTLAKE	719A1	432
190D	SPRAGUE	41PS	375
192P	SPRAGUE	708D1	420
196D	SPRAGUE	41GS	361
199D	SPRAGUE	41GS	361
202D	SPRAGUE	43JW	226,319
210C	ELECTROCUBE	708A1	426
212A	ELECTROCUBE	701A1	424
230B	ELECTROCUBE	708A1	426
231A	ELECTROCUBE	701A1	424
232A	ELECTROCUBE	719A1	432
250B	ELECTROCUBE	708D1	420
260-10	VRN	8026EKP*	547
260-207	VRN	8026EKX*	547
260-208	VRN	8026EKW*	547
3	MIDWEC	708D1	420
300D	SPRAGUE	43KG	256
3006P	BOURNS	8035EKP,CT-20P*	549,562
3006Y	BOURNS	CT-20X*	562
301D	SPRAGUE	43JG	256
302D	SPRAGUE	43KF	257
303D	SPRAGUE	43JF	257
3101P-1	BOURNS	8035EKP	549
3102P-1	BOURNS	8024EKP	545
3102W-1	BOURNS	8024EKW	545
3102X-1	BOURNS	8024EKX	545
3103P-1	BOURNS	8026EKP	547
3103W-1	BOURNS	8026EKW	547
3103X-1	BOURNS	8026EKX	547
3104C-1	BOURNS	8038EKV	551
3104H-1	BOURNS	8038EKX	551
3104P-1	BOURNS	8038EKP	551
3104S-1	BOURNS	8038EKZ	551
3104W-1	BOURNS	8038EKW	551
32D	SPRAGUE	3188	36
32DR	SPRAGUE	3188	36
32DX	SPRAGUE	3188	36
32M	WESCO	708D1	420
32PMC	WESCO	708B1	438
3262P	BOURNS	8026EKP, 8026EKP*	547
3262W	BOURNS	8026EKW, 8026EKW*	547
3262X	BOURNS	8026EKX, 8026EKX*	547
3266P	BOURNS	8026EKP	547
3266W	BOURNS	8026EKW, 8026EKW*	547
3266X	BOURNS	8026EKX, 8026EKX*	547
3292P	BOURNS	8024EKP,CT-9P*	545,562
3292W	BOURNS	8024EKW, CT-9W*	545,562
3292X	BOURNS	8024EKX,CT-9X*	545,562
3296P	BOURNS	8024EKP,CT-9P*	545,562
3296W	BOURNS	8024EKW, CT-9W*	545,562
3296X	BOURNS	8024EKX,CT-9X*	545,562
3296Y	BOURNS	8024EKY*	545
3299P	BOURNS	8024EKP,CT-9P*	545,562
3299W	BOURNS	8024EKW, CT-9W*	545,562
3299X	BOURNS	8024EKX,CT-9X*	545,562
3299Y	BOURNS	8024EKY*	545
3321H-1	MURATA ERIE	8014EMW	543
3321N-1	MURATA ERIE	8014EMX	543
3321P-1	MURATA ERIE	8014EMP	543
3321T-1	MURATA ERIE	8014EMW	543
3323P	BOURNS	8014EMP,CT-6P*	543,555
3323S	BOURNS	CT-6S*	555
3323U	BOURNS	CT-6V*	555
3323W	BOURNS	8014EMX,CT-6X*	543,555
3323X	BOURNS	CT-6N*	555
3329H	BOURNS	8014EKW, CT-6W*	543,555
3329P	BOURNS	CT-6P*	555
3329P	BOURNS	8014EKP	543
3329S	BOURNS	CT-6S*	555
3329W	BOURNS	8014EMX,CT-6S*	543,555
3339H	BOURNS	TM-7W*	563
3339P	BOURNS	TM-7P*	563
3339W	BOURNS	TM-7X*	563
3362M	BOURNS	CT-6TH*	555
3362U	BOURNS	CT-6TV*	555
3386C	BOURNS	8038EKV, 8038EKV*	551
3386F	BOURNS	8038EKH, 8038EKH*	551
3386H	BOURNS	8038EKX,CT-6N*	551,555
3386P	BOURNS	8038EKP,CT-6R*	551,555
3386R	BOURNS	8038EKR, 8038EKR*	551
3386S	BOURNS	8038EKZ, 8038EKZ*	551
3386T	BOURNS	CT-6V*	555
3386W	BOURNS	8038EKW,CT-6H*	551,555
3386X	BOURNS	8038EKU,CT-6X	551,555
343P	CLAROSTAT	CT-20P*	562
345T	CTS	8014EMW	543
356	GUDEMAN	708D1	420
359S	CTS	8038EKW	551
359X	CTS	8038EKX	551
36D	SPRAGUE	3186	24
36DX	SPRAGUE	3186	24
360S	CTS	8038EKZ	551
362S	CTS	8038EKW	551
362U	CTS	8038EKH	551
362X	CTS	8038EKX	551
362Y	CTS	8038EKP	551
363	GUDEMAN	708A1	426
363M	CLAROSTAT	8038EKH*	551
363P	CLAROSTAT	CT-6R*	555
363X	CLAROSTAT	CT-6X*	555
364P	CLAROSTAT	CT-9P*	562
364W	CLAROSTAT	CT-9W*	562
364X	CLAROSTAT	CT-9X*	562
364Y	CLAROSTAT	8024EKY*	545
367T	CLAROSTAT	CT-6W*	555
380	SANGAMO	3487	89
4M	WESTCAP SFE	719A1	432
410	TECHNO	8024EKX	545
410P	SPRAGUE	708D1	420
413P	SPRAGUE	708D1	420
43P	SPECTROL	8035EKP,CT-20P*	549,562
43Y	SPECTROL	CT-20X*	562
430P	SPRAGUE	708A1	426
4308R-101	BOURNS	HC2,HC23	526,528
4308R-102	BOURNS	HC2,HC23	526,528
4308R-104	BOURNS	HC2,HC23	526,528
431P	SPRAGUE	708A1	426
4310R-101	BOURNS	HC2,HC23	526,528
4310R-102	BOURNS	HC2,HC23	526,528
4310R-104	BOURNS	HC2,HC23	526,528
451P	SPRAGUE	719A1	432
453P	SPRAGUE	712A1	428
454P	SPRAGUE	719A1	432
4606X-101	BOURNS	HC2,HC23	526,528
4606X-102	BOURNS	HC2,HC23	526,528
4606X-104	BOURNS	HC2,HC23	526,528
4608X-101	BOURNS	HC2,HC23	526,528
4608X-102	BOURNS	HC2,HC23	526,528
4608X-104	BOURNS	HC2,HC23	526,528
4610X-101	BOURNS	HC2,HC23	526,528
4610X-102	BOURNS	HC2,HC23	526,528
4610X-104	BOURNS	HC2,HC23	526,528
500	SANGAMO	3188	36
500R	SANGAMO	3188	36
500X	SANGAMO	3188	36
501	EMCON/KYOCERA	P.	191
52P	SPECTROL	8024EKP	545
52W	SPECTROL	8024EKW	545
52X	SPECTROL	8024EKX	545
53-1-1	SPECTROL	CT-6R*	555
53-2-1	SPECTROL	CT-6N*	555
54700HS	WESTON	8024EKP	545
54800HS	WESTON	8024EKW	545
54872HS	WESTON	8024EKX	545
550D	SPRAGUE	40ZS	286,398
566-00HS	WESTON	8014EKW, CT-6W*	543,555
566-00S	WESTON	8014EKW	543
567-00HS	WESTON	8014EKP,CT-6P*	543,555
567-00S	WESTON	8014EKP	543
568-00HS	WESTON	8014EKX	543

*Mepcopal Company Part Number "This Cross Reference is not meant to infer exact interchangeability in all instances, but in most cases, pin configuration, performance specifications, and basic dimensions are similar."

NOTE: ALL MATSUSHITA-PANASONIC and SEIMENS part numbers are in series order designated by last set of numbers (Ex. ERZ-C05DK470, S05K30).

COMPETITOR CROSS REFERENCE

COMPETITOR NUMBER	COMPETITOR NAME	MEPCO/ CENTRALAB PART NUMBER	PAGE NUMBER
568-00S	WESTON	8014EKX	543
592C	SPRAGUE	G,A	170,153
602D	SPRAGUE	3120	11
602DX	SPRAGUE	3120	11
608	TRW	708D1	420
61M	BECKMAN	8014EKP	543
61P	BECKMAN	8014EKW	543
61PA	BECKMAN	8014EKX	543
611	MIAL	704C1	444
62M	BECKMAN	8014EKP,CT-6P*	543,555
62P	BECKMAN	8014EKW	543
62PA	BECKMAN	8014EKX	543
62-1	SPECTROL	CT-6W*	555
62-1-1	SPECTROL	8014EMW	543
62-1-2	SPECTROL	8014EKW	543
622D	SPRAGUE	3191	48
62-2	SPECTROL	CT-6X*	555
62-2-1	SPECTROL	8014EMX	543
62-2-2	SPECTROL	8014EKX	543
62-3	SPECTROL	CT-6P*	555
62-3-1	SPECTROL	8014EMP	543
62-3-2	SPECTROL	8014EKP	543
625B	ELECTROCUBE	708B1	438
627A	ELECTROCUBE	701B1	436
63H	SPECTROL	8038EKR*	551
63M	SPECTROL	8038EKH, 8038EKH*	551
63P	BECKMAN	8024EKP	545
63P	SPECTROL	8038EKP,CT-6R*	551,555
63S	SPECTROL	8038EKV,CT-6H*	551,555
63T	SPECTROL	CT-6V*	555
63V	SPECTROL	8038EKZ*	551
63W	BECKMAN	8024EKW	545
63X	BECKMAN	8024EKX	545
63X	SPECTROL	CT-6X*	555
630A	ELECTROCUBE	719B1	440
636D	SPRAGUE	3120	11
64P	BECKMAN	8026EKP, 8026EKP*	547
64P	SPECTROL	8024EKP,CT-9P*	545,562
64W	SPECTROL	8024EKW, 8026EKW, CT-9W*	545,547,562
64X	SPECTROL	8024EKX, 8026EKX, CT-9X*	545,547,562
64Y	SPECTROL	8024EKY*	545
65P	SPECTROL	8014EMP	543
65X	SPECTROL	8014EMX	543
65Y	SPECTROL	8014EMW	543
66P	BECKMAN	8024EKP,CT-9P*	545,562
66W	BECKMAN	8024EKW, CT-9W*	545,562
66X	BECKMAN	8024EKX,CT-9X*	545,562
663UW	TRW	708D1	420
67P	BECKMAN	CT-9P*	562
67P	SPECTROL	CT-6P*	555
67R	SPECTROL	CT-6W*	555
67T	SPECTROL	CT-6W*	555
67W	BECKMAN	CT-9W*	562
67X	BECKMAN	CT-9X*	562
67X	SPECTROL	CT-6N*	555
67Y	BECKMAN	8024EKY*	545
68P	BECKMAN	8024EKP,CT-9P*	545,562
68W	BECKMAN	8024EKW,CT-9W*	545,562
68X	BECKMAN	8024EKX,CT-9X*	545,562
7F	MIDWEC	708A1	426
706A	ALLEN BRADLEY	HC2,HC23	526,528
706B	ALLEN BRADLEY	HC2,HC23	526,528
706E	ALLEN BRADLEY	HC2,HC23	526,528
708A	ALLEN BRADLEY	HC2,HC23	526,528
708B	ALLEN BRADLEY	HC2,HC23	526,528
708E	ALLEN BRADLEY	HC2,HC23	526,528
710A	ALLEN BRADLEY	HC2,HC23	526,528
710B	ALLEN BRADLEY	HC2,HC23	526,528
710E	ALLEN BRADLEY	HC2,HC23	526,528
72P	BECKMAN	8038EKP,*CT-6R*	551
72PL	BECKMAN	CT-6V*	555
72PM	BECKMAN	8038EKH 8038EKH*	551
72PS	BECKMAN	CT-6R*	555
72PX	BECKMAN	8038EKR*	551
72RPX	BECKMAN	8038EKR*	551
72RX	BECKMAN	8038EKX,CT-6N*	551,555
72RXL	BECKMAN	8038EKW 8038EKW*	551 551
72RXW	BECKMAN	8038EKZ, 8038EKZ*	551
72X	BECKMAN	CT-6X*	555
72XL	BECKMAN	8038EKV,CT-6H*	551,555
72XW	BECKMAN	8038EKZ*	551
750-81	CTS	HC2,HC23	526,528
750-83	CTS	HC2,HC23	526,528
750-85	CTS	HC2,HC23	526,528
750-101	CTS	HC2,HC23	526,528
750-103	CTS	HC2,HC23	526,528
750-105	CTS	HC2,HC23	526,528
752-10	VRN	8024EKP	545
752-10P	VRN	CT-9P*	562
752-207	VRN	8024EKX	545
752-207X	VRN	CT-9X*	562
752-208	VRN	8024EKW	545
752-208W	VRN	CT-9W*	562
760-10	VRN	8038EKP	551
760-30	VRN	8038EKH	551
760-72	VRN	8038EKZ	551
76-10	VRN	8038EKP	551
76-20	VRN	8038EKV	551
764-1-R	BECKMAN	HC2,HC23	526,528
764-3-R	BECKMAN	HC2,HC23	526,528
764-5-R	BECKMAN	HC2,HC23	526,528
765-1-R	BECKMAN	HC2,HC23	526,528
765-3-R	BECKMAN	HC2,HC23	526,528
765-5-R	BECKMAN	HC2,HC23	526,528
770-61	CTS	HC2,HC23	526,528
770-63	CTS	HC2,HC23	526,528
770-81	CTS	HC2,HC23	526,528
770-83	CTS	HC2,HC23	526,528
770-101	CTS	HC2,HC23	526,528
770-103	CTS	HC2,HC23	526,528
780-10A	VRN	8038EKP,CT-6R*	551,555
780-12P	VRN	CT-6R*	555
780-20C	VRN	8038EKV, 8038EKV*	551
780-22W	VRN	8038EKW,CT-6H*	551,555
780-32F	VRN	8038EKH*	551
780-40X	VRN	CT-6X*	555
780-42H	VRN	8038EKX,CT-6N*	551,555
780-52R	VRN	8038EKR*	551
780-60T	VRN	CT-6V*	555
780-72S	VRN	8038EKZ*	551
780-92K	VRN	CT-6W*	555
781I	DALE	CT-20X*	562
781P	DALE	CT-20X*	562
784	DALE	8035EKP	549
784I	DALE	CT-20P*	562
784P	DALE	CT-20P*	562
80D	SPRAGUE	3487	89
81AE	ALLEN BRADLEY	8038EKX,CT-6X*	551,555
81E	ALLEN BRADLEY	CT-6W*	555
82M	BECKMAN	CT-6P*	555
82P	BECKMAN	8014EKW,CT-6W*	543,555
82PA	BECKMAN	8014EKX,CT-6X*	543,555
82W	BECKMAN	CT-6V*	555
830P	WESTON	8035EKP	549
840H	WESTON	8038EKX	551
840M	WESTON	8038EKH	551
840P	WESTON	8038EKP	551
840W	WESTON	8038EKW	551
85P	ALLEN BRADLEY	8024EKP,CT-9P*	545,562
85W	ALLEN BRADLEY	8024EKW,CT-9W*	545,562
85X	ALLEN BRADLEY	8024EKX,CT-9X*	545,562
850P	WESTON	8024EKP,	545
850W	WESTON	8024EKW	545,
850X	WESTON	8024EKX	545
850-20	VRN	8026EKX	547
850-208	VRN	8026EKW	547
860W	WESTON	8026EKW, 8026EKW*	547
860K	WESTON	8026EKX, 8026EKX*	547
89P	BECKMAN	8035EKP,CT-20P*	549,562
89X	BECKMAN	CT-20X*	562
923C	SPRAGUE	P	191
93P	BECKMAN	RJ-13P*	559
94P	ALLEN BRADLEY	8035EKP,CT-20P*	549,562
950P	WESTON	8024EKP,CT-9P*	545,562
950W	WESTON	8024EKW,CT-9W*	545,562
950X	WESTON	8024EKX,CT-9X*	545,562
960-20	VRN	8035EKP	549
961-20	VRN	8035EKP	549
961-20P	VRN	CT-20P*	562
988-20	VRN	CT-20X*	562
A21	DALE	5053Y	500
A2A	ALLEN BRADLEY	8014EDW	543
A2B	ALLEN BRADELY	8014EKP	543
A4B	ALLEN BRADLEY	8014EKX	543
A4C	ALLEN BRADLEY	8014EKX	543
A4D	ALLEN BRADLEY	8014EKX	543
B31063	SIEMENS	704C1	444
B31110	SIEMENS	704C1	444
B31310	SIEMENS	704C1	444
B32231	SIEMENS	701A1	424
B32234	SIEMENS	719A1	432
B32547	SIEMENS	719B1	440
B32548	SIEMENS	719B1	440
B32560	SIEMENS	719A1	432
B32561	SIEMENS	719A1	432
B33063	SIEMENS	703E1	448
B81111	SIEMENS	719J1	462
B(A)	ELPAC	708B1	438
BK	UNITED CHEMICON	3487	89
BR3C	TRW	5073Y	500
B(R)	ELPAC	719B1	440
BU	NICHICON	3479	69
B(X)	ELPAC	701B1	436
CO7	CORNING	5043T,5043E	507,492
C24P	TECHNO	CT-9P*	562
C24W	TECHNO	CT-9W*	562
C24X	TECHNO	CT-9X*	562
C26P	TECHNO	8026EKP*	547
C26W	TECHNO	8026EKW*	547
C26X	TECHNO	8026EKX*	547
C312-C350	KEMET	K	175
C4	CORNING	5043T,5043E	507,492
C410-C440	KEMET	G,A	170,153
C5	CORNING	5053T,5053H	507,490
C630C	KEMET	P	191
CAC	CORNING	G,A	170,153
CC50	ANGSTROM	5013V	514
CC55	ANGSTROM	5023V	514
CCA	TRW	5043M,5033V, 5043R	509,514,509
CCB	TRW	5053R,5043V	509,514
CCF-07	DALE	5043E	492
CCF-50	DALE	5063J	484
CCF-55	DALE	5043E	492
CCM	TRW	5033R,5023V	509,514
CD	UNITRODE	P	191
CEA	TRW	5033R,5023V	509,514
CEC	TRW	5073Y	500
CEFHW	MARCON	3487	89
CEFTWN	MARCON	3487	89
CG	MALLORY	3188	36
CG	UNITRODE	G,A	170,153
CGO	MALLORY	3191	48

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COMPETITOR CROSS REFERENCE

COMPETITOR NUMBER	COMPETITOR NAME	MEPCO/ CENTRALAB PART NUMBER	PAGE NUMBER
CGR	MALLORY	3120	11
CGS	MALLORY	3186	24
CH50	CORNING	5013V	514
CH55	CORNING	5023V	514
CH60	CORNING	5033V	514
CJ50	CORNING	5013V	514
CJ55	CORNING	5023V	514
CJ60	CORNING	5033V	514
CK50	CORNING	5013V	514
CK55	CORNING	5023V	514
CK60	CORNING	5033V	514
CLR25-G	SPRAGUE	40EF	259
CLR27-G	SPRAGUE	40FF	261
CLR35-G	SPRAGUE	40EG	262
CLR37-G	SPRAGUE	40FG	263
CLR71-G	SPRAGUE	40TF	264
CLR73-G	SPRAGUE	40VF	265
CMF-07	DALE	5043T,5043E	507,492
CMF-20	DALE	5053T,5053H	507,490
CMF-50	DALE	5023R	509
CMF-55	DALE	5033R,5043E, 5043T	509,492,507
CMF-60	DALE	5043M,5053H, 5053T,5043R	509,490,507, 509
CMF-65	DALE	5053R	509
CMK	SEACOR	701B1,719B1	436,440
CMR25	CAPAR	5033R	509
CN50	ANGSTROM	5025A	516
CN55	ANGSTROM	5035A	516
CRA60	R-OHM	5043M,5053H, 5043R	509,490,509
CRB12	R-OHM	5043T,5053H, 5053T,SFR30	507,490,507, 492
CRB14	R-OHM	5033R,5043E,	509,492,507
CRB20	R-OHM	5023R	509
CRB60	R-OHM	5043M,5043R	509
CRC	CORNING	K	175
CS20	CORNING	5053T,5053H	507,490
CSC06A-01	DALE	HC2,HC23	526,528
CSC06A-03	DALE	HC2,HC23	526,528
CSC06A-05	DALE	HC2,HC23	526,528
CSC08A-01	DALE	HC2,HC23	526,528
CSC08A-03	DALE	HC2,HC23	526,528
CSC08A-05	DALE	HC2,HC23	526,528
CSC10A-01	DALE	HC2,HC23	526,528
CSC10A-03	DALE	HC2,HC23	526,528
CSC10A-05	DALE	HC2,HC23	526,528
CT4	CORNING	5043T	507
CT55	CORNING	5033R	509
DCM	SANGAMO	3186	24
E2A	ALLEN BRADLEY	8038EKP	551
E4D	ALLEN BRADLEY	8038EKV	551
E4F	ALLEN BRADLEY	8038EKZ	551
E4J	ALLEN BRADLEY	8038EKW	551
ECQ-E(Z)	PANASONIC	712A1	428
ECQ-V	PANASONIC	719A1	432
ERC-50	DALE	5013V	514
ERC-55	DALE	5023V	514
ERC-60	DALE	5033V	514
ERC-65	DALE	5043V	514
ERL-05	DALE	5033U	512
ERL-07	DALE	5043U	512
ERL-20	DALE	5053U	512
ERN1/2	JARO	5043M,5043R	509
ERN1/4	JARO	5033R	509
ERN55	PANASONIC	5033R	509
ERN-SB	PANASONIC	5033R	509
ERO-10CK	PANASONIC	5023R	509
ERO-25CH	PANASONIC	5033R,5043E	509,492
ERO-25CK	PANASONIC	5033R,5043E, 5043T	509,492,507
ERO-25CJ	PANASONIC	5043E	492
ERO-50CH	PANASONIC	5043R,5053H, 5043M	509,490,509
ERO-50CK	PANASONIC	5043R,5053H,	509,490,509,
ERO-50CK	PANASONIC	5043M,5053T	507
ERO-51CKJ	PANASONIC	5053H	490
ERZ-C05DK101	MATSUSHITA,PANASONIC	2322-592-56006	567
ERZ-C07DK101	MATSUSHITA,PANASONIC	2322-593-56006	567
ERZ-C10DK101	MATSUSHITA,PANASONIC	2322-594-56006	567
ERZ-C14DK101	MATSUSHITA,PANASONIC	2322-595-56006	567
ERZ-C20DK101	MATSUSHITA,PANASONIC	2322-596-56006	567
ERZ-C10DK102	MATSUSHITA,PANASONIC	2322-594-56216	567
ERZ-C14DK102	MATSUSHITA,PANASONIC	2322-595-56216	567
ERZ-C20DK102	MATSUSHITA,PANASONIC	2322-596-56216	567
ERZ-C10DK112	MATSUSHITA,PANASONIC	2322-594-56816	567
ERZ-C14DK112	MATSUSHITA,PANASONIC	2322-595-56816	567
ERZ-C20DK112	MATSUSHITA,PANASONIC	2322-596-56816	567
ERZ-C05DK121	MATSUSHITA,PANASONIC	2322-592-57506	567
ERZ-C07DK121	MATSUSHITA,PANASONIC	2322-593-57506	567
ERZ-C10DK121	MATSUSHITA,PANASONIC	2322-594-57506	567
ERZ-C14DK121	MATSUSHITA,PANASONIC	2322-595-57506	567
ERZ-C20DK121	MATSUSHITA,PANASONIC	2322-596-57506	567
ERZ-C05DK151	MATSUSHITA,PANASONIC	2322-592-59506	567
ERZ-C07DK151	MATSUSHITA,PANASONIC	2322-593-59506	567
ERZ-C10DK151	MATSUSHITA,PANASONIC	2322-594-59506	567
ERZ-C14DK151	MATSUSHITA,PANASONIC	2322-595-59506	567
ERZ-C20DK151	MATSUSHITA,PANASONIC	2322-596-59506	567
ERZ-C05DK201	MATSUSHITA,PANASONIC	2322-592-51316	567
ERZ-C07DK201	MATSUSHITA,PANASONIC	2322-593-51316	567
ERZ-C10DK201	MATSUSHITA,PANASONIC	2322-594-51316	567
ERZ-C14DK201	MATSUSHITA,PANASONIC	2322-595-51316	567
ERZ-C20DK201	MATSUSHITA,PANASONIC	2322-596-51316	567
ERZ-C05DK220	MATSUSHITA,PANASONIC	2322-592-51406	567
ERZ-C07DK220	MATSUSHITA,PANASONIC	2322-593-51406	567
ERZ-C10DK220	MATSUSHITA,PANASONIC	2322-594-51406	567
ERZ-C14DK220	MATSUSHITA,PANASONIC	2322-595-51406	567
ERZ-C20DK220	MATSUSHITA,PANASONIC	2322-596-51406	567
ERZ-C05DK241	MATSUSHITA,PANASONIC	2322-592-51516	567
ERZ-C07DK241	MATSUSHITA,PANASONIC	2322-593-51516	567
ERZ-C10DK241	MATSUSHITA,PANASONIC	2322-594-51516	567
ERZ-C14DK241	MATSUSHITA,PANASONIC	2322-595-51516	567
ERZ-C20DK241	MATSUSHITA,PANASONIC	2322-596-51516	567
ERZ-C05DK270	MATSUSHITA,PANASONIC	2322-592-51706	567
ERZ-C07DK270	MATSUSHITA,PANASONIC	2322-593-51706	567
ERZ-C10DK270	MATSUSHITA,PANASONIC	2322-594-51706	567
ERZ-C14DK270	MATSUSHITA,PANASONIC	2322-595-51706	567
ERZ-C20DK270	MATSUSHITA,PANASONIC	2322-596-51706	567
ERZ-C05DK271	MATSUSHITA,PANASONIC	2322-592-51716	567
ERZ-C07DK271	MATSUSHITA,PANASONIC	2322-593-51716	567
ERZ-C10DK271	MATSUSHITA,PANASONIC	2322-594-51716	567
ERZ-C14DK271	MATSUSHITA,PANASONIC	2322-595-51716	567
ERZ-C20DK271	MATSUSHITA,PANASONIC	2322-596-51716	567
ERZ-C05DK330	MATSUSHITA,PANASONIC	2322-592-52006	567
ERZ-C07DK330	MATSUSHITA,PANASONIC	2322-593-52006	567
ERZ-C10DK330	MATSUSHITA,PANASONIC	2322-594-52006	567
ERZ-C14DK330	MATSUSHITA,PANASONIC	2322-595-52006	567
ERZ-C20DK330	MATSUSHITA,PANASONIC	2322-596-52006	567
ERZ-C05DK361	MATSUSHITA,PANASONIC	2322-592-52316	567
ERZ-C07DK361	MATSUSHITA,PANASONIC	2322-593-52316	567
ERZ-C10DK361	MATSUSHITA,PANASONIC	2322-594-52316	567
ERZ-C14DK361	MATSUSHITA,PANASONIC	2322-595-52316	567
ERZ-C20DK361	MATSUSHITA,PANASONIC	2322-596-52316	567
ERZ-C05DK390	MATSUSHITA,PANASONIC	2322-592-52506	567
ERZ-C07DK390	MATSUSHITA,PANASONIC	2322-593-52506	567
ERZ-C10DK390	MATSUSHITA,PANASONIC	2322-594-52506	567
ERZ-C14DK390	MATSUSHITA,PANASONIC	2322-595-52506	567
ERZ-C20DK390	MATSUSHITA,PANASONIC	2322-596-52506	567
ERZ-C05DK391	MATSUSHITA,PANASONIC	2322-592-52516	567
ERZ-C07DK391	MATSUSHITA,PANASONIC	2322-593-52516	567
ERZ-C10DK391	MATSUSHITA,PANASONIC	2322-594-52516	567
ERZ-C14DK391	MATSUSHITA,PANASONIC	2322-595-52516	567
ERZ-C20DK391	MATSUSHITA,PANASONIC	2322-596-52516	567
ERZ-C05DK431	MATSUSHITA,PANASONIC	2322-592-52716	567
ERZ-C07DK431	MATSUSHITA,PANASONIC	2322-593-52716	567
ERZ-C10DK431	MATSUSHITA,PANASONIC	2322-594-52716	567
ERZ-C14DK431	MATSUSHITA,PANASONIC	2322-595-52716	567
ERZ-C20DK431	MATSUSHITA,PANASONIC	2322-596-52716	567
ERZ-C05DK470	MATSUSHITA,PANASONIC	2322-592-53006	567
ERZ-C07DK470	MATSUSHITA,PANASONIC	2322-593-53006	567
ERZ-C10DK470	MATSUSHITA,PANASONIC	2322-594-53006	567
ERZ-C14DK470	MATSUSHITA,PANASONIC	2322-595-53006	567
ERZ-C05DK471	MATSUSHITA,PANASONIC	2322-592-53016	567
ERZ-C07DK471	MATSUSHITA,PANASONIC	2322-593-53016	567
ERZ-C10DK471	MATSUSHITA,PANASONIC	2322-594-53016	567
ERZ-C14DK471	MATSUSHITA,PANASONIC	2322-595-53016	567
ERZ-C20DK471	MATSUSHITA,PANASONIC	2322-596-53016	567
ERZ-C05DK560	MATSUSHITA,PANASONIC	2322-592-53506	567
ERZ-C07DK560	MATSUSHITA,PANASONIC	2322-593-53506	567
ERZ-C10DK560	MATSUSHITA,PANASONIC	2322-594-53506	567
ERZ-C14DK560	MATSUSHITA,PANASONIC	2322-595-53506	567
ERZ-C20DK560	MATSUSHITA,PANASONIC	2322-596-53506	567
ERZ-C10DK621	MATSUSHITA,PANASONIC	2322-594-53816	567
ERZ-C14DK621	MATSUSHITA,PANASONIC	2322-595-53816	567
ERZ-C20DK621	MATSUSHITA,PANASONIC	2322-596-53816	567
ERZ-C05DK680	MATSUSHITA,PANASONIC	2322-592-54006	567
ERZ-C07DK680	MATSUSHITA,PANASONIC	2322-593-54006	567
ERZ-C10DK680	MATSUSHITA,PANASONIC	2322-594-54006	567
ERZ-C14DK680	MATSUSHITA,PANASONIC	2322-595-54006	567
ERZ-C20DK680	MATSUSHITA,PANASONIC	2322-596-54006	567
ERZ-C10DK681	MATSUSHITA,PANASONIC	2322-594-54216	567
ERZ-C14DK681	MATSUSHITA,PANASONIC	2322-595-54216	567
ERZ-C20DK681	MATSUSHITA,PANASONIC	2322-596-54216	567
ERZ-C10DK751	MATSUSHITA,PANASONIC	2322-594-54616	567
ERZ-C14DK751	MATSUSHITA,PANASONIC	2322-595-54616	567
ERZ-C20DK751	MATSUSHITA,PANASONIC	2322-596-54616	567
ERZ-C05DK820	MATSUSHITA,PANASONIC	2322-592-55006	567
ERZ-C07DK820	MATSUSHITA,PANASONIC	2322-593-55006	567
ERZ-C10DK820	MATSUSHITA,PANASONIC	2322-594-55006	567
ERZ-C14DK820	MATSUSHITA,PANASONIC	2322-595-55006	567
ERZ-C20DK820	MATSUSHITA,PANASONIC	2322-596-55006	567
ERZ-C10DK821	MATSUSHITA,PANASONIC	2322-594-55116	567
ERZ-C14DK821	MATSUSHITA,PANASONIC	2322-595-55116	567
ERZ-C20DK821	MATSUSHITA,PANASONIC	2322-596-55116	567
ERZ-C10DK911	MATSUSHITA,PANASONIC	2322-594-55516	567
ERZ-C14DK911	MATSUSHITA,PANASONIC	2322-595-55516	567
ERZ-C20DK911	MATSUSHITA,PANASONIC	2322-596-55516	567
EVM-C0FA01BXX	PANASONIC	8035EKP	549
EVM-M7GA01BXX	PANASONIC	8038EKP	551
EVM-M8GA01BXX	PANASONIC	8038EKX	551
EVM-Q0GA01BXX	PANASONIC	8014EMP	543
EVM-Q1GA01BXX	PANASONIC	8014EMX	543
EVM-S0GA01BXX	PANASONIC	8014EMW	543
FAH	CORNELL-DUBILIER	3188	36
FAHM	CORNELL-DUBILIER	3186	24
FAL	CORNELL-DUBILIER	3188	36
FALM	CORNELL-DUBILIER	3186	24
FAM	CORNELL-DUBILIER	3191	48
GF04	TOCOS	RJ-4*	557
GF06P1	TOCOS	CT-6P*	555
GF06P2	TOCOS	CT-6R*	555
GF06S	TOCOS	CT-6S*	555
GF06U	TOCOS	CT-6V*	555
GF06UT	TOCOS	CT-6TV*	555
GF06V	TOCOS	CT-6H*	555
GF06VT	TOCOS	CT-6TH*	555
GF06W	TOCOS	CT-6W*	555
GF06X	TOCOS	CT-6N*	555
GF06X1	TOCOS	CT-6X*	555
GP	TRW/IRC	SFR25	492
H-08	KOA	5033Z	503
H-10	KOA	5023Z	503
HC3	CORNING	5033U	512
HC4	CORNING	5043U	512
HN3	CORNING	5033U	512
HN4	CORNING	5043U	512
HN5	CORNING	5053U	512
HN55	ANGSTROM	5025A	516
HN60	ANGSTROM	5035A	514
HN65	ANGSTROM	5045A	514
HPW	MARCON	3479	69
HU	NICHICON	3476	56
IB	NICHICON	3480	72
IR0607	THOMSON CSF	719A1	432
IR0807	THOMSON CSF	719A1	432

*Mepcopal Company Part Number "This Cross Reference is not meant to infer exact interchangeability in all instances, but in most cases, pin configuration, performance specifications, and basic dimensions are similar."

NOTE: ALL MATSUSHITA-PANASONIC and SEIMENS part numbers are in series order designated by last set of numbers (Ex. ERZ-C05DK470, S05K30).

COMPETITOR CROSS REFERENCE

COMPETITOR NUMBER	COMPETITOR NAME	MEPCO/ CENTRALAB PART NUMBER	PAGE NUMBER
IRO/MC	THOMSON CSF	719A1	432
K146Z	ACUSHNET	701B1	436
KB	NICHICON	3477	62
KM	NCC/UCC	3480	72
KT1801	RODERSTEIN	708D1	420
L04C	CORNING	5033R	509
L04D	CORNING	5033R	509
L05C	CORNING	5053Y	500
L05D	CORNING	5053Y	500
LB	NICHICON	3476	56
LBH	NICHICON	3487	89
LFL	NICHICON	3487	89
LL	NCC/UCC	3477	62
L-PH	NICHICON	3487	89
L-PS	NICHICON	3487	89
LPS	MALLORY	3487	89
LR	RUBICON	3478	66
LR	NCC/UCC	3478	66
LV-1/2	STACKPOLE	5053Y	500
LV-1/4	STACKPOLE	5053Y	500
M192P	MALLORY	708D1	420
M3	STACKPOLE	5033R,5043E	509,492
M4	STACKPOLE	5043M,5053H, 5043R	509,490,509
M5	STACKPOLE	5053R	509
MAR3	TRW	5013Z	503
MAR5	TRW	5023Z	503
MAR6	TRW	5033Z	503
MAR7	TRW	5063Z	503
MC65	CORNING	5053R	509
MCR	CORNELL-DUBILIER	701B1	436
MD01	AVX	P	191
MD02	AVX	P	191
MD(B)	ELPAC	708D1	420
MEA	TRW	5033R	509
MF	PAKTRON	719A1	432
MF 1/4	DALE	5053R	509
MF 1/8	DALE	5043M,5053H, 5043R	509,490,509
MF 1/10	DALE	5033R,5043E	509,492
MF-1	DALE	5073Y	500
MF50	KOA,DALE	5023R,5043E	509,492
MF55	KOA,DALE	5033R,5043E	509,492
MF60	KOA,DALE	5043M,5053H, 5043R	509,490,509
MF65	KOA,DALE	5053R	509
MF70	RCD	5073Y	500
MFDS	SEACOR	712A1	428
MFF-1	DALE	5073Y	500
MH	RUBICON	3480	72
MH55	CORNING	5023V	514
MH60	CORNING	5033V	514
MH65	CORNING	5043V	514
MIL07	KOA	5043T,5043E	507,492
MIL20	KOA	5053T,5053H	507,490
MJ65	CORNING	5043V	514
MK55	CORNING	5023V	514
MK60	CORNING	5033V	514
MK65	CORNING	5043V	514
MKC1860	RODERSTEIN	708B1	438
MKC1862	RODERSTEIN	719B1	440
MKC4	WIMA	719B1	440
MKS-2	WIMA	719A1	432
MKS-20	WIMA	719A1	432
MKS-3	WIMA	719A1	432
MKS-4	WIMA	719A1	432
MKS-4	WIMA	719J1	462
MKT1817	RODERSTEIN	719A1	432
MKT1818	RODERSTEIN	719A1	432
MKT1822	RODERSTEIN	719A1	432
MKT1826	RODERSTEIN	719A1	432
ML104	CADDOCK	5023Z	503
ML114	CADDOCK	5023Z	503
ML124	CADDOCK	5033Z	503
MMC	TRW	5023R,5013V	509,514
MMC	CORNELL-DUBILIER	708A1	426
MMK	EVOX/SEACOR	719A1	432
MMK-5	SEACOR	719A1	432
MMKO	SEACOR	719A1	432
MO 1/2	KOA	5053T,5053H	507,490
MO 1/4	KOA	5043T,5043E	507,492
MO-1	KOA	5073Y	500
MPE	F-DYNE	708A1	426
MPED2	F-DYNE	712A1	428
MPT-2R	ITT	719A1	432
MR	THOMSON CSF	712A1	428
MS	RUBICON	3476	56
MS	PANASONIC	3477	62
MSP08A-01	DALE	HC2,HC23	526,528
MSP08A-03	DALE	HC2,HC23	526,528
MPS08A-05	DALE	HC2,HC23	526,528
MSP10A-01	DALE	HC2,HC23	526,528
MSP10A-03	DALE	HC2,HC23	526,528
MSP10A-05	DALE	HC2,HC23	526,528
MS-R	PANASONIC	3478	66
MT2X	ALLEN BRADLEY	8024EKW	545
MT4Y	ALLEN BRADLEY	8024EKX	545
MTR3	TRW	5013Z	503
MTR5	TRW	5023Z	503
MTR6	TRW	5033Z	503
MTR7	TRW	5063Z	503
NA55	CORNING	5033R,5043E	509,492
NA60	CORNING	5043M,5053H, 5043R	509,490,509
NA60D	CORNING	5043M,5043R	509
NA65D	CORNING	5053R	509
NC3	CORNING	5023R	509
NC55	CORNING	5033R	509
NC6	CORNING	5043M,5043R	509
NC60	CORNING	5043M,5043R	509
NE4	CORNING	5033R,5043E	509,492
NE5	CORNING	5043M,5053H, 5043R	509,490,509
NE55	CORNING	5033R	509
NE6	CORNING	5053R	509
NE60	CORNING	5043M,5043R	509
NE65	CORNING	5053R	509
NH	PANASONIC	3480	72
NM(HR)	UNITED CHEMICON	3487	89
NM	UNITED CHEMICON	3487	89
NME	THOMSON CSF	701A1	424
PFE225	RIFA	719C1	446
PHE353	RIFA	719A1	432
PHE354	RIFA	719A1	432
PHE404	RIFA	719B1	440
PL-B	NICHICON	3487	89
PMC-2R	ITT	719B1	440
PME	RODERSTEIN	719J1	462
PME271	RIFA	719J1	462
PMT-2A	ITT	701A1	424
POT1102H	MURATA/ERIE	TM-7W*	563
POT1102P	MURATA/ERIE	TM-7P*	563
POT1102S	MURATA/ERIE	TM-7S*	563
POT1102T	MURATA/ERIE	TM-7X*	563
POT1103B	MURATA/ERIE	RJ-4WS*	557
POT1103H	MURATA/ERIE	RJ-4W*	557
POT2101P	MURATA/ERIE	CT-20P*	562
POT2101Y	MURATA/ERIE	CT-20X*	562
POT3102P	MURATA/ERIE	CT-9P*	562
POT3102W	MURATA/ERIE	CT-9W*	562
POT3102X	MURATA/ERIE	CT-9X*	562
POT3102Y	MURATA/ERIE	8024EKY*	545
POT3103P	MURATA/ERIE	8026EKP*	547
POT3103Y	MURATA/ERIE	8026EKW*	547
POT3103Z	MURATA/ERIE	8026EKX*	547
POT3104C	MURATA/ERIE	8038EKV*	551
POT3104F	MURATA/ERIE	8038EKH*	551
POT3104H	MURATA/ERIE	CT-6N*	555
POT3104P	MURATA/ERIE	CT-6R*	555
POT3104R	MURATA/ERIE	8038EKR*	551
POT3104S	MURATA/ERIE	8038EKZ*	551
POT3104W	MURATA/ERIE	CT-6H*	555
POT3104X	MURATA/ERIE	CT-6X*	555
POT3105P	MURATA/ERIE	CT-9P*	562
POT3105W	MURATA/ERIE	CT-9W*	562
POT3105X	MURATA/ERIE	CT-9X*	562
POT3105Y	MURATA/ERIE	8024EKY*	545
POT3321F	MURATA/ERIE	RJ-6F*	558
POT3321H	MURATA/ERIE	CT-6W*	555
POT3321N	MURATA/ERIE	CT-6X*	555
POT3321P	MURATA/ERIE	CT-6P*	555
POT3321S	MURATA/ERIE	CT-6S*	555
PR	WESTCAP SFE	708D1	420
PS11	F-DYNE	704C1	444
PT	PAKTRON	708D1	420
PTF-51	DALE	5013Z	503
PTF-56	DALE	5023Z	503
PTF-65	DALE	5033Z	503
R-25	R-OHM	5043CX	490
R-50	R-OHM	5053CX	490
RB	ELNA	3477	62
RC53	CORNELL-DUBILIER	43KF	257
RE	ELNA	3476	56
RG 1/2	TRW	5053H	490
RG 1/4	TRW	5043E	492
RG07	TRW	5043T,5043E	507,492
RG 20	TRW	5053T,5053H	507,490
RGR05	TRW	5033U	512
RGR07	TRW	5043U	512
RGR20	TRW	5053U	512
RH	ELNA	3476	56
RJ2	ELNA	3480	72
RJC06P	TOCOS	RJ-6P*	558
RJC06S	TOCOS	RJ-6S*	558
RJC06W	TOCOS	RJ-6W*	558
RJC06X	TOCOS	RJ-6X*	558
RJC-097P	TOCOS	CT-20P*	562
RJC-097X	TOCOS	CT-20X*	562
RN 1/2	STACKPOLE	5043M,5053H, 5043T,5043R	509,490,507, 509
RN 1/4	STACKPOLE	5033R,5043E	509,492
RNB	ELNA	3478	66
RPA	MURATA/ERIE	G,A	170,153
RPE	ELNA	3479	69
RPE	MURATA/ERIE	K	175
RS-1	STACKPOLE	5073Y	500
RX	NCC/UCC	3481	77
RX-11	RUBICON	3481	77
RX-12	RUBICON	3482	81
RZ	NCC/UCC	3482	81
S	PANASONIC	3476	56
S05K14	SEIMENS	2322-592-51406	567
S07K14	SEIMENS	2322-593-51406	567
S10K14	SEIMENS	2322-594-51406	567
S14K14	SEIMENS	2322-595-51406	567
S20K14	SEIMENS	2322-596-51406	567
S05K17	SEIMENS	2322-592-51706	567
S07K17	SEIMENS	2322-593-51706	567
S10K17	SEIMENS	2322-594-51706	567
S14K17	SEIMENS	2322-595-51076	567
S20K17	SEIMENS	2322-596-51706	567
S05K20	SEIMENS	2322-592-52006	567
S07K20	SEIMENS	2322-593-52006	567
S10K20	SEIMENS	2322-594-52006	567
S14K20	SEIMENS	2322-595-52006	567
S20K20	SEIMENS	2322-596-52006	567
S05K25	SEIMENS	2322-592-52506	567
S07K25	SEIMENS	2322-593-52506	567
S10K25	SEIMENS	2322-594-52506	567
S14K25	SEIMENS	2322-595-52506	567
S20K25	SEIMENS	2322-596-52506	567
S05K30	SEIMENS	2322-592-53006	567
S07K30	SEIMENS	2322-593-53006	567
S10K30	SEIMENS	2322-594-53006	567
S14K30	SEIMENS	2322-595-53006	567

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COMPETITOR CROSS REFERENCE

COMPETITOR NUMBER	COMPETITOR NAME	MEPCO/ CENTRALAB PART NUMBER	PAGE NUMBER
S05K35	SEIMENS	2322-592-53506	567
S07K35	SEIMENS	2322-593-53506	567
S10K35	SEIMENS	2322-594-53506	567
S14K35	SEIMENS	2322-595-53506	567
S20K35	SEIMENS	2322-596-53506	567
S05K40	SEIMENS	2322-592-54006	567
S07K40	SEIMENS	2322-593-54006	567
S10K40	SEIMENS	2322-594-54006	567
S14K40	SEIMENS	2322-595-54006	567
S20K40	SEIMENS	2322-596-54006	567
S05K50	SEIMENS	2322-592-55006	567
S07K50	SEIMENS	2322-593-55006	567
S10K50	SEIMENS	2322-594-55006	567
S14K50	SEIMENS	2322-595-55006	567
S20K50	SEIMENS	2322-596-55006	567
S05K60	SEIMENS	2322-592-56006	567
S07K60	SEIMENS	2322-593-56006	567
S10K60	SEIMENS	2322-594-56006	567
S14K60	SEIMENS	2322-595-56006	567
S20K60	SEIMENS	2322-596-56006	567
S05K75	SEIMENS	2322-592-57506	567
S07K75	SEIMENS	2322-593-57506	567
S10K75	SEIMENS	2322-594-57506	567
S14K75*	SEIMENS	2322-595-57506	567
S20K75	SEIMENS	2322-596-57506	567
S05K95	SEIMENS	2322-592-59506	567
S07K95	SEIMENS	2322-593-59506	567
S10K95	SEIMENS	2322-594-59506	567
S14K95	SEIMENS	2322-595-59506	567
S20K95	SEIMENS	2322-596-59506	567
S05K130	SEIMENS	2322-592-51316	567
S07K130	SEIMENS	2322-593-51316	567
S10K130	SEIMENS	2322-594-51316	567
S14K130	SEIMENS	2322-595-51316	567
S20K130	SEIMENS	2322-596-51316	567
S05K150	SEIMENS	2322-592-51516	567
S07K150	SEIMENS	2322-593-51516	567
S10K150	SEIMENS	2322-594-51516	567
S14K150	SEIMENS	2322-595-51516	567
S20K150	SEIMENS	2322-596-51516	567
S05K175	SEIMENS	2322-592-51716	567
S07K175	SEIMENS	2322-593-51716	567
S10K175	SEIMENS	2322-594-51716	567
S14K175	SEIMENS	2322-595-51716	567
S20K175	SEIMENS	2322-596-51716	567
S05K230	SEIMENS	2322-592-52316	567
S07K230	SEIMENS	2322-593-52316	567
S10K230	SEIMENS	2322-594-52316	567
S14K230	SEIMENS	2322-595-52316	567
S20K230	SEIMENS	2322-596-52316	567
S05K250	SEIMENS	2322-592-52516	567
S07K250	SEIMENS	2322-593-52516	567
S10K250	SEIMENS	2322-594-52516	567
S14K250	SEIMENS	2322-595-52516	567
S20K250	SEIMENS	2322-596-52516	567
S05K275	SEIMENS	2322-592-52716	567
S07K275	SEIMENS	2322-593-52716	567
S10K275	SEIMENS	2322-594-52716	567
S14K275	SEIMENS	2322-595-52716	567
S20K275	SEIMENS	2322-596-52716	567
S05K300	SEIMENS	2322-592-53016	567
S07K300	SEIMENS	2322-593-53016	567
S10K300	SEIMENS	2322-594-53016	567
S14K300	SEIMENS	2322-595-53016	567
S20K300	SEIMENS	2322-596-53016	567
S10K385	SEIMENS	2322-594-53816	567
S14K385	SEIMENS	2322-595-53816	567
S20K385	SEIMENS	2322-596-53816	567
S10K420	SEIMENS	2322-594-54216	567
S14K420	SEIMENS	2322-595-54216	567
S20K420	SEIMENS	2322-596-54216	567
S10K460	SEIMENS	2322-594-54616	567
S14K460	SEIMENS	2322-595-54616	567
S20K460	SEIMENS	2322-596-54616	567
S10K510	SEIMENS	2322-594-55116	567
S14K510	SEIMENS	2322-595-55116	567
S20K510	SEIMENS	2322-596-55116	567
S10K550	SEIMENS	2322-594-55516	567
S14K550	SEIMENS	2322-595-55516	567
S20K550	SEIMENS	2322-596-55516	567
S10K625	SEIMENS	2322-594-56216	567
S14K625	SEIMENS	2322-595-56216	567
S20K625	SEIMENS	2322-596-56216	567
S10K680	SEIMENS	2322-594-56816	567
S14K680	SEIMENS	2322-595-56816	567
S20K680	SEIMENS	2322-596-56816	567
SA	AVX	G,A	170,153
SBH	NICHICON	3487	89
SE-1/4	DALE	5045A	516
SE-1/8	DALE	5035A	516
SE-1/10	DALE	5025A	516
SF	SEACOR	704C1	444
SM	NCC/UCC	3476	56
SM55	STACKPOLE	5033R	509
SM60	STACKPOLE	5043M,5043R	509
SMA 0204	CORNING/DRALORIC	5023R	509
SMA 0207	CORNING/DRALORIC	5033R,5043E	509,492
SMA 0411	CORNING/DRALORIC	5043M,5053H, 5043R	509,490,509
SMA0617	CORNING/DRALORIC	5053R	509
SMA4C	CORNING	5033R	509
SMVP	NCC/UCC	3479	69
SR	AVX	K	175
SX	MALLORY	704C1	444
TO-55	TRW	5033R,5043E	509,492
TO-60	TRW	5043M,5053H, 5043R	509,490,509
TO-65	TRW	5053R	509
T2-55	TRW	5033R	509
T2-60	TRW	5043M,5043R	509
T2-65	TRW	5053R	509
T9-55	TRW	5033R	509
T9-60	TRW	5043M,5043R	509
T110	KEMET	40SS	266,277,379
T111	KEMET	40NS	295,371
T120	KEMET	40TS	275,386
T140	KEMET	40XS	289,390
T212	KEMET	40SS	266,277,379
T213	KEMET	40NS	295,371
T222	KEMET	40SS	266,277,379
T242	KEMET	40XS	289,390
T252	KEMET	40YS	292,394
T262	KEMET	40ZS	286,398
T310	KEMET	40MS	365
T314	KEMET	40ES	357
T320	KEMET	40MS	365
T322	KEMET	40MS	365
T323	KEMET	40MS	365
T330	KEMET	41PS	375
T360	KEMET	41GS	361
T362	KEMET	41GS	361
T390	KEMET	41GS	361
T392	KEMET	41GS	361
TAC	MALLORY	40MS,40CS	365,354
TAE	MALLORY	40ES	357
TAND	CORNELL-DUBILIER	40AF	249
TAND	CORNELL-DUBILIER	40BF	250
TAND	CORNELL-DUBILIER	40AG	251
TAND	CORNELL-DUBILIER	40BG	252
TAS	MALLORY	40SS	266,277,379
TE	TANSITOR	40RF	253
TE	TANSITOR	40SF	254
TE51	TANSITOR	43KG	256
TE52	TANSITOR	43JG	256
TE53	TANSITOR	43KF	257
TE54	TANSITOR	43JF	257
TER	MALLORY	40SS	266,277,379
TDC	MALLORY	41GS	361
TH	TANSITOR	40AF	249
TH	TANSITOR	40BF	250
TH	TANSITOR	40AG	251
TH	TANSITOR	40BG	252
TH55	TRW	5023V	514
TH60	TRW	5033V	514
TH65	TRW	5043V	514
THF	MALLORY	40ZS	286,398
TIM	MALLORY	41PS	375
TJ55	TRW	5023V	514
TJ60	TRW	5033V	514
TJ65	TRW	5043V	514
TK55	TRW	5023V	514
TK60	TRW	5033V	514
TK65	TRW	5043V	514
TNR	MALLORY	40NS	295,371
TXA	MALLORY	40XS	289,390
TXE	MALLORY	40XS	289,390
TXR	MALLORY	40YS	292,394
UFH	CORNELL-DUBILIER	3120	11
UFM	MARCON	3481	77
USM	MARCON	3480	72
UST	MARCON	3480	72
V22ZA05	GENERAL ELECTRIC	2322-592-51406	567
V22ZA1	GENERAL ELECTRIC	2322-593-51406	567
V22ZA2	GENERAL ELECTRIC	2322-594-51406	567
V22ZA3	GENERAL ELECTRIC	2322-595-51406	567
V27ZA05	GENERAL ELECTRIC	2322-592-51706	567
V27ZA1	GENERAL ELECTRIC	2322-593-51706	567
V27ZA2	GENERAL ELECTRIC	2322-594-51706	567
V27ZA4	GENERAL ELECTRIC	2322-595-51706	567
V27ZA60	GENERAL ELECTRIC	2322-596-51706	567
V33ZA05	GENERAL ELECTRIC	2322-592-52006	567
V33ZA1	GENERAL ELECTRIC	2322-593-52006	567
V33ZA2	GENERAL ELECTRIC	2322-594-52006	567
V33ZA5	GENERAL ELECTRIC	2322-595-52006	567
V33ZA70	GENERAL ELECTRIC	2322-596-52006	567
V39ZA05	GENERAL ELECTRIC	2322-592-52506	567
V39ZA1	GENERAL ELECTRIC	2322-593-52506	567
V39ZA3	GENERAL ELECTRIC	2322-594-52506	567
V39ZA6	GENERAL ELECTRIC	2322-595-52506	567
V47ZA05	GENERAL ELECTRIC	2322-592-53006	567
V47ZA1	GENERAL ELECTRIC	2322-593-53006	567
V47ZA3	GENERAL ELECTRIC	2322-594-53006	567
V47ZA7	GENERAL ELECTRIC	2322-595-53006	567
V56ZA05	GENERAL ELECTRIC	2322-592-53506	567
V56ZA2	GENERAL ELECTRIC	2322-593-53506	567
V56ZA3	GENERAL ELECTRIC	2322-594-53506	567
V56ZA8	GENERAL ELECTRIC	2322-595-53506	567
V68ZA05	GENERAL ELECTRIC	2322-592-54006	567
V68ZA2	GENERAL ELECTRIC	2322-593-54006	567
V68ZA3	GENERAL ELECTRIC	2322-594-54006	567
V68ZA10	GENERAL ELECTRIC	2322-595-54006	567
V82ZA05	GENERAL ELECTRIC	2322-592-55006	567
V82ZA2	GENERAL ELECTRIC	2322-593-55006	567
V82ZA4	GENERAL ELECTRIC	2322-594-55006	567
V82ZA12	GENERAL ELECTRIC	2322-595-55006	567
V100ZA05	GENERAL ELECTRIC	2322-592-56006	567
V100ZA3	GENERAL ELECTRIC	2322-593-56006	567
V100ZA4	GENERAL ELECTRIC	2322-594-56006	567
V100ZA15	GENERAL ELECTRIC	2322-595-56006	567
V119Z	ACUSHNET	719A1	432
V120ZA05	GENERAL ELECTRIC	2322-592-57506	567
V120ZA1	GENERAL ELECTRIC	2322-593-57506	567
V120ZA4	GENERAL ELECTRIC	2322-594-57506	567
V120ZA6	GENERAL ELECTRIC	2322-595-57506	567
V130LA1	GENERAL ELECTRIC	2322-593-51316	567
V130LA2	GENERAL ELECTRIC	2322-593-51316	567
V130LA5	GENERAL ELECTRIC	2322-594-51316	567
V130LA10A	GENERAL ELECTRIC	2322-595-51316	567
V130LA20A	GENERAL ELECTRIC	2322-596-51316	567
V146X	ACUSHNET	708A1	426
V146Z	ACUSHNET	708D1	420
V150LA1	GENERAL ELECTRIC	2322-593-51516	567
V150LA2	GENERAL ELECTRIC	2322-593-51516	567
V150LA5	GENERAL ELECTRIC	2322-594-51516	567
V150LA10A	GENERAL ELECTRIC	2322-595-51516	567

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COMPETITOR CROSS REFERENCE

COMPETITOR NUMBER	COMPETITOR NAME	MEPCO/ CENTRALAB PART NUMBER	PAGE NUMBER
V150LA20A	GENERAL ELECTRIC	2322-596-51516	567
V150ZA05	GENERAL ELECTRIC	2322-592-59506	567
V150ZA1	GENERAL ELECTRIC	2322-593-59506	567
V150ZA4	GENERAL ELECTRIC	2322-594-59506	567
V150ZA8	GENERAL ELECTRIC	2322-595-59506	567
V175LA2	GENERAL ELECTRIC	2322-593-51716	567
V175LA10A	GENERAL ELECTRIC	2322-595-51716	567
V230LA4	GENERAL ELECTRIC	2322-593-52316	567
V230LA10	GENERAL ELECTRIC	2322-594-52316	567
V230LA20A	GENERAL ELECTRIC	2322-595-52316	567
V250LA2	GENERAL ELECTRIC	2322-593-52516	567
V250LA4	GENERAL ELECTRIC	2322-593-52516	567
V250LA10	GENERAL ELECTRIC	2322-594-52516	567
V250LA20A	GENERAL ELECTRIC	2322-595-52516	567
V250LA40A	GENERAL ELECTRIC	2322-596-52516	567
V275LA2	GENERAL ELECTRIC	2322-593-52716	567
V275LA4	GENERAL ELECTRIC	2322-593-52716	567
V275LA10	GENERAL ELECTRIC	2322-594-52716	567
V275LA20A	GENERAL ELECTRIC	2322-595-52716	567
V275LA40A	GENERAL ELECTRIC	2322-596-52716	567
V300LA2	GENERAL ELECTRIC	2322-593-53016	567
V300LA4	GENERAL ELECTRIC	2322-593-53016	567
V420LA10	GENERAL ELECTRIC	2322-594-54216	567
V420LA20A	GENERAL ELECTRIC	2322-595-54216	567
V420LA40B	GENERAL ELECTRIC	2322-596-54216	567
V510LA40A	GENERAL ELECTRIC	2322-595-55116	567
V510LA80B	GENERAL ELECTRIC	2322-596-55116	567
VCG	MALLORY	3120	11
VZA048	THOMSON CSF	2322-593-55006	567
VZA060	THOMSON CSF	2322-593-56006	567
VZA075	THOMSON CSF	2322-593-57506	567
VZA095	THOMSON CSF	2322-593-59506	567
VZA130	THOMSON CSF	2322-593-51316	567
VZA150	THOMSON CSF	2322-593-51516	567
VZA175	THOMSON CSF	2322-593-51716	567
VZA230	THOMSON CSF	2322-593-52316	567
VZA250	THOMSON CSF	2322-593-52516	567
VZA275	THOMSON CSF	2322-593-52716	567
VZA300	THOMSON CSF	2322-593-53016	567
VZB095	THOMSON CSF	2322-594-59506	567
VZB130	THOMSON CSF	2322-594-51316	567
VZB150	THOMSON CSF	2322-594-51516	567
VZB175	THOMSON CSF	2322-594-51716	567
VZB230	THOMSON CSF	2322-594-52316	567
VZB250	THOMSON CSF	2322-594-52516	567
VZB275	THOMSON CSF	2322-594-52716	567
VZB300	THOMSON CSF	2322-594-53016	567
VZB420	THOMSON CSF	2322-594-54216	567
VZB460	THOMSON CSF	2322-594-54616	567
VZB510	THOMSON CSF	2322-594-55116	567
VZC095	THOMSON CSF	2322-595-59506	567
VZC130	THOMSON CSF	2322-595-51316	567
VZC150	THOMSON CSF	2322-595-51516	567
VZC175	THOMSON CSF	2322-595-51716	567
VZC230	THOMSON CSF	2322-595-52316	567
VZC250	THOMSON CSF	2322-595-52516	567
VZC275	THOMSON CSF	2322-595-52716	567
VZC300	THOMSON CSF	2322-595-53016	567
VZC420	THOMSON CSF	2322-595-54216	567
VZC460	THOMSON CSF	2322-595-54616	567
VZC510	THOMSON CSF	2322-595-55116	567
VZD130	THOMSON CSF	2322-596-51316	567
VZD150	THOMSON CSF	2322-596-51516	567
VZD175	THOMSON CSF	2322-596-51716	567
VZD230	THOMSON CSF	2322-596-52316	567
VZD250	THOMSON CSF	2322-596-52516	567
VZD275	THOMSON CSF	2322-596-52716	567
VZD300	THOMSON CSF	2322-596-53016	567
VZD420	THOMSON CSF	2322-596-54216	567
VZD460	THOMSON CSF	2322-596-54616	567
VZD510	THOMSON CSF	2322-596-55116	567
VZG048	THOMSON CSF	2322-592-55006	567
VZG060	THOMSON CSF	2322-592-56006	567
VZG075	THOMSON CSF	2322-592-57506	567
VZG095	THOMSON CSF	2322-592-59506	567
VZG130	THOMSON CSF	2322-592-51316	567
VZG150	THOMSON CSF	2322-592-51516	567
VZG175	THOMSON CSF	2322-592-51716	567
VZG230	THOMSON CSF	2322-592-52316	567
VZG250	THOMSON CSF	2322-592-52516	567
WC	PAKTRON	701A1,708A1	424,426
WD	PAKTRON	701B1,708B1	436,438
WF70	WESTCAP SFE	708A1	426
WF74	WESTCAP SFE	708B1	438
WF94	WESTCAP SFE	704C1	444
WMC	CORNELL-DUBILIER	708D1	420
WMF	CORNELL-DUBILIER	708D1	420
X440	TRW	719B1	440
X601PE	TRW	712A1	428
X663F	TRW	708A1	426
ZA	NICHICON	3478	66
ZD(A)	ELPAC	708A1	426
ZD(R)	ELPAC	719A1	432
ZD(X)	ELPAC	701A1	424
ZP2	IMB	719A1	432

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