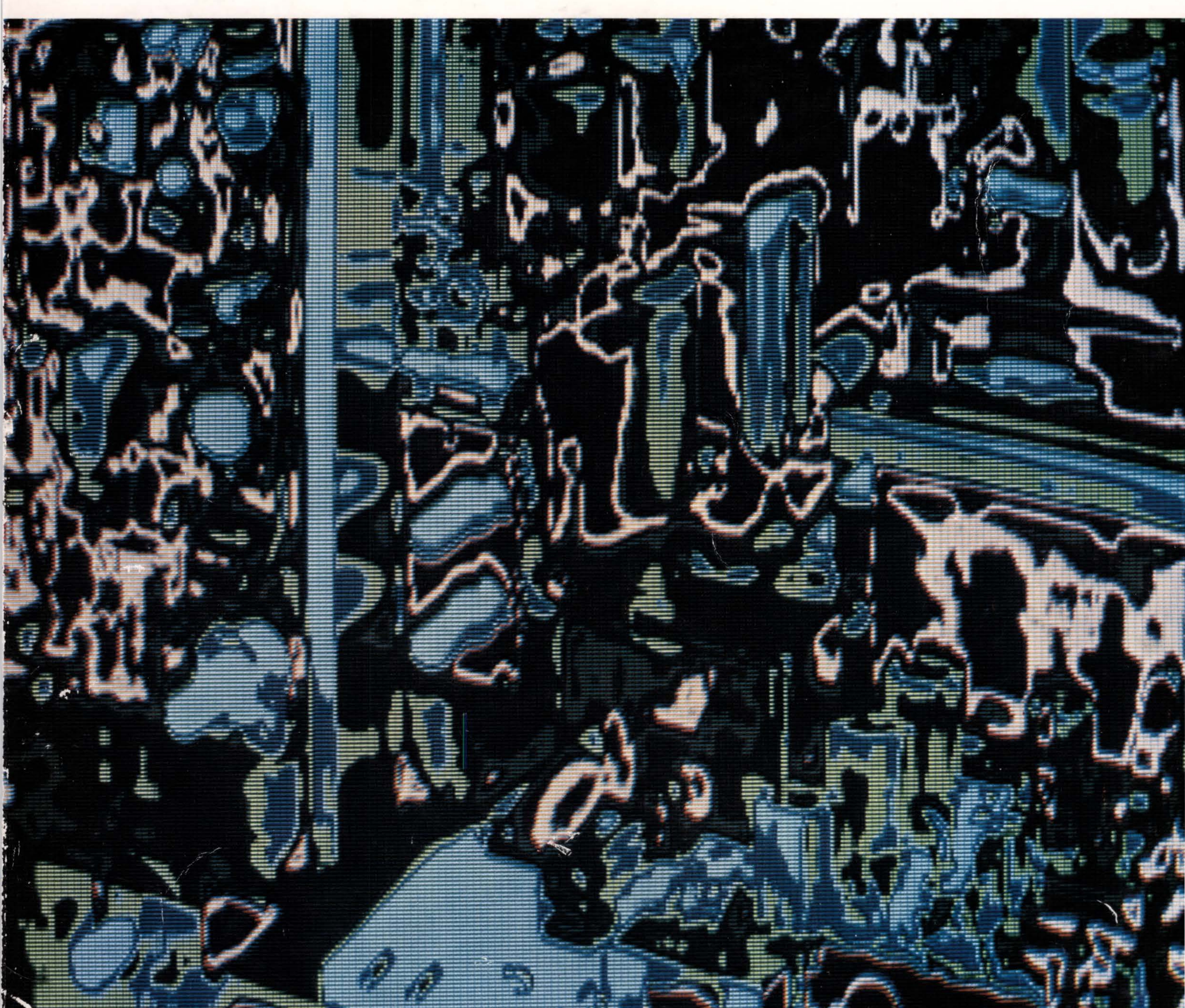
Electronic Components Catalog 1974-5



MATSUSHITA ELECTRIC

1974-5

ELECTRONIC COMPONENTS CATALOG

MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.

1974-5 ELECTRONIC COMPONENTS CATALOG

CONTENTS

I FIXED RESISTORS

QUICK REFERENCE GUIDE

Fixed Resistors

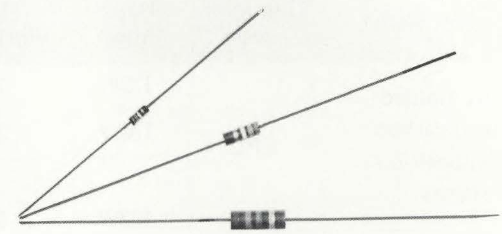
Part Name	Common Code	Rated Power	Max. Working Volt.	Res. Tol.	Res. Range	MIL No.	Page
Hot molded fixed carbon composition resistors	ERC	1/8W	150V	±5, ±10, ±20%	4.7~ 1M	MIL-R-11F (RC05)	I-2
		1/4W	250V	±5, ±10, ±20%	2.2~ 10M	MIL-R-11F (RC07)	
		1/2W	350V	±5, ±10, ±20%	2.2~ 10M	MIL-R-11F (RC20)	
				±5, ±10% (type XG)	27M~100M		
Carbon Film Resistors	ERD	1/8W	250V	±5%	4.7~470K	————	I-6
				±2%	4.7~150K		
				±1%	10 ~150K		
		1/4W	300V	±5%	4.7~ 1M	————	
				±2%	4.7~200K		
				±1%	10 ~270K		
		1/2W	350V	±5%	4.7~2.2M	————	
				±2%	4.7~470K		
				±1%	10 ~470K		
Precision Type Metal Film Resisters	ERO	1/4W	250V	±1.0, ±2.0, ±5.0%	20 ~470K	MIL-R-22684	I-9
		1/8W	200V	±1.0, ±2.0, ±5.0%	10 ~ 47K		
Flame-Proof Metal (Oxide) Film Resistors	ERX	1W	350V	±2%, ±5%	0.39~13		I-11
		2W	350V	±2%, ±5%	0.47~27		
		3W	500V	±2%, ±5%	0.47~27		
		5W	750V	±2%, ±5%	1~27		
		7W	750V	±2%, ±5%	1~27		
	ERG	1W	350V	±2%, ±5%	15~47K		
		2W	350V	±2%, ±5%	30~100K		
		3W	500V	±2%, ±5%	30~100K		
		5W	750V	±2%, ±5%	30~100K		
		7W	750V	±2%, ±5%	30~150K		

This chart is intended to serve as a guide only.

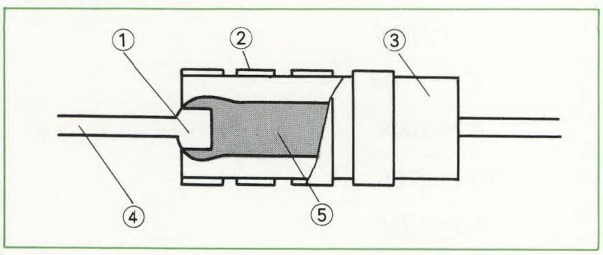
HOT MOLDED CARBON COMPOSITION RESISTORS

Type ERC

- Dependable: MATSUSHITA carbon composition resistors have a high degree of stability in resistance value as far as they operate in accordance with the ratings.
- Uniform Quality: MATSUSHITA carbon composition resistors exhibit extremely uniform characteristics due to the complete quality control system.
- Solid Construction and Superb Appearance: Resistance material, insulation and lead wires are solidly combined. MATSUSHITA carbon composition resistors provide exceptional mechanical strength and smooth and fine appearance having no crack to damage the performance.
- Small Mounting Space: Small in size, light in weight and insulation construction to require smallest mounting space

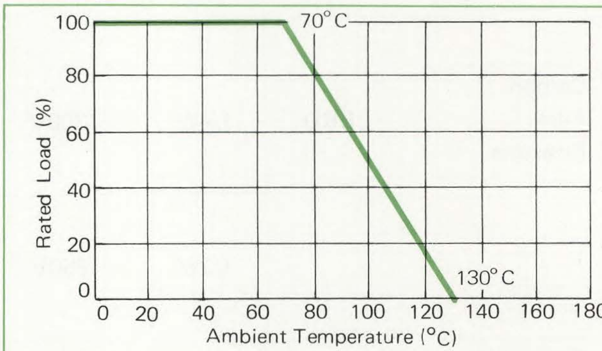


Constructions

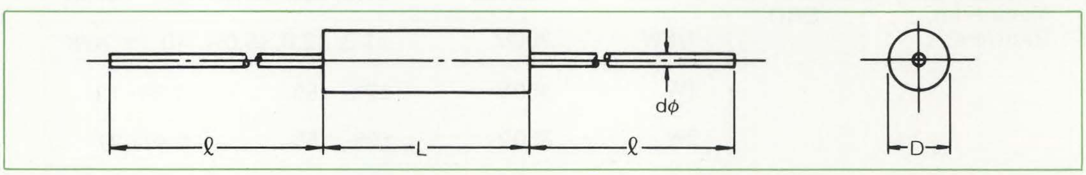


① Solidly embeded leads
② Color code
③ Rugged construction (insulated)
④ Soldered copper leads
⑤ Solid resistance elements

Derating Curve



Dimensions



Specifications

Type No.	Power Rating (W)	Max. W.V. (V)	Resistance Tolerance (%)	Resistance Range (Ω)	Dimensions mm (inch)				Specifications
					L	D	ℓ	d	
ERC-18G	0.125	150	±5, ±10, ±20	10~1M	3.68±0.38 (0.145±0.015)	1.57±0.10 (0.062±0.004)	25.40±3.18 (1.000±0.125)	0.38±0.08 (0.015±0.003)	MIL-R-11F (RC05)
ERC-14G	0.25	250	±5, ±10, ±20	2.2~10M	6.35±0.79 (0.250±0.031)	2.29±0.20 (1.500±0.125)	38.10±3.18 (1.500±0.125)	0.64±0.04 (0.025±0.002)	MIL-R-11F (RC07)
ERC-12G	0.5	350	±5, ±10, ±20	2.2~10M	$9.53^{+1.04}_{-0.79}$	3.51±0.58	38.10±3.18	0.79±0.13	MIL-R-11F (RC20)
ERC-12XG			±10, ±20	27M~100M	$(0.375^{+0.041}_{-0.031})$	(0.138±0.023)	(1.500±0.125)	(0.031±0.005)	

Note: When ERC-12XG is used as non-insulation type, special values shown right are available. But the dielectric withstanding voltage and insulation resistance shown in the characteristics should not be applied.

Max. Operating Voltage	Max. Overload Voltage
1,000V	2,000V

Summary of Characteristics

1) Low-value resistors exhibit less change due to humidity, temperature, and voltage than high-value resistors.
2) Changes of resistance due to increase in moisture content are always positive and they may be essentially eliminated by drying at 100°C.
3) The effects of humidity may be minimized by operating the resistor with load.
4) Resistance changes due to load life are permanent and ultimately negative.
5) Resistance change due to soldering is positive and resistance change ratio becomes greater if the resistor has moisture present in its body.
6) Temperature characteristics of MATSUSHITA carbon composition resistors are extremely stable and negative change at a high temperature is negligible.

Characteristics

All measurements shall be conducted at room temperature except for temperature characteristics test and load life test.
As for specific conditions such as mounting, test procedures, sequence of tests, etc., refer to MATSUSHITA Specifications

Item \ Specifications / Style	Matsushita Standard Products	MIL-R-11F	EIA RS-172
	1/8W : ERC-18G 1/4W : ERC-14G 1/2W : ERC-12G	1/8W : RC05 1/4W : RC07 1/2W : RC20	1/8W : RRC05 1/4W : RRC07 1/2W : RRC20

Item	Matsushita	-55°C	+105°C	MIL-R-11F	-55°C	+105°C	EIA RS-172	+55°C	+105°C
Resistance Temperature Characteristics (%) Maximum Percent Resistance Change from +25°C	1KΩ under	+6.5 -3	+5 -4	1KΩ under	±6.5	±5	1KΩ under	±6.5	±5
	1.1KΩ - 10KΩ	+10 -3	+6.5 -5	1.1KΩ - 10KΩ	±10	±6	1.1KΩ - 10KΩ	±10	±6
	11KΩ~100KΩ	+13 -3	+7.5 -6	11KΩ - 100KΩ	±13	±7.5	11KΩ - 100KΩ	±13	±7.5
	110KΩ - 1MΩ	+15 -3	+10 -7	110KΩ - 1MΩ	±15	±10	110KΩ - 1MΩ	±15	±10
	1.1MΩ - 10MΩ	+20 -3	+10 -7	1.1MΩ - 10MΩ	±20	±15	1.1MΩ - 10MΩ	±20	±15
	11MΩ over	+25 -3	+10 -7	11MΩ over	±25	±15	11MΩ over	±25	±15

Item	Rating	Max. Res. Change	Rating	Max. Res. Change	Rating	Max. Res. Change
Voltage Coefficient Maximum Resistance change per Volt. based on △R for △V of (1.0-0.1) RCWV. over 1K	1/8W	-0.050%/V or 2%	1/8W	-0.050%/V or 2%	1/8W	-0.050%/V or 2%
	1/4W	-0.035%/V or 2%	1/4W	-0.035%/V or 2%	1/4W	-0.035%/V or 2%
	1/2W	-0.035%/V or 2%	1/2W	-0.035%/V or 2%	1/2W	-0.035%/V or 2%

Item	Rating	Atmospheric press.	Barometric Press.	Rating	Atmospheric Press.	Barometric Press.	Rating	Atomospheric Press.	Barometric Press.
Dielectric Withstanding Voltage	1/8W	300V	200V	1/8W	300V	200V	1/8W	200V	—
	1/4W	500V	325V	1/4W	500V	325V	1/4W	500V	—
	1/2W	700V	450V	1/2W	700V	450V	1/2W	700V	—

Item	Matsushita Standard Products	MIL-R-11F	EIA RS-172
Insulation Resistance Test Voltage 500V (100V for 1/8W, 1/4W)	10,000MΩ min.	10,000MΩ min.	—
Temperature Cycling Limits: -55°C and +85°C Resistance change After five cycles.	±4%	±4%	±4%

Item	Rating	Max.	Typical	Rating	Max.	Ave.	EIA RS-172
Moisture Resistance 240 hours from -10°C to +65°C 90~98% RH.	1/8W	15%	12%	1/8W	15%	1MΩ under 12%	–
	1/4, 1/2,	15%	10%	1/4, 1/2,	15%	10%	

Item	Matsushita Standard Products	MIL-R-11F	EIA RS-172
Short Time Overload 5 second Test of 2.5 Times Rated Voltage	±(2% +0.05Ω)	±2.5%	±(2.5% +0.05Ω)

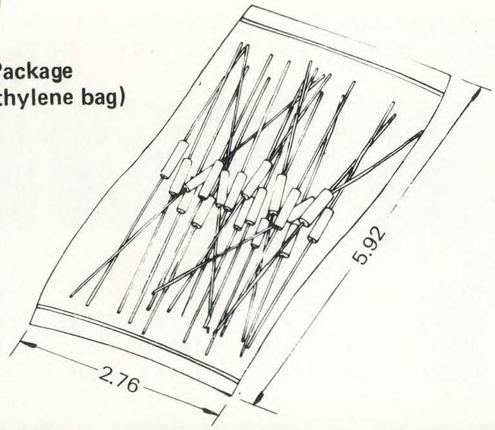
Item	Rating	Max.	Typical	Rating	Max.	Ave.	EIA RS-172
Load Life 1.5 hours on 0.5 hour off at 70°C for 1,000 hours.	1/8W	±8%	±6%	1/8W	8%	6%	±10%
	1/4, 1/2,	±10%	±6%	1/4, 1/2,	10%	6%	

Item	Matsushita Standard Products	MIL-R-11F	EIA RS-172
Terminal Strength Direct load 5 lbs. (2lbs. for 1/8W) 5 turn twist	±(1% + 0.05Ω)	±(1% +0.05Ω)	±(1% +0.05Ω)
Resistance to Soldering Heat 3 sec. test Leads immersed in Solder to 3.2mm from body at 350°C (250° for 1/8W)	±3%	±(3% + 0.05Ω)	±(3% +0.05Ω)
Shock 100G 6msec. Vibration 12 hours at 10 - 2,000Hz, 0.06 inch peak-to-peak or 20G whickever is less	No damage ±(2% +0.05Ω)	No damage ±(2% +0.05Ω)	–
Low Temperature Operation at -65 $^{+0}_{-5}$°C apply the rated voltage for 45 minutes.	±3%	±3%	±(3% +0.05Ω)
Solderability 230°C solder for 5 seconds	95% coverage	95% coverage	Negotiate between user and supplier.

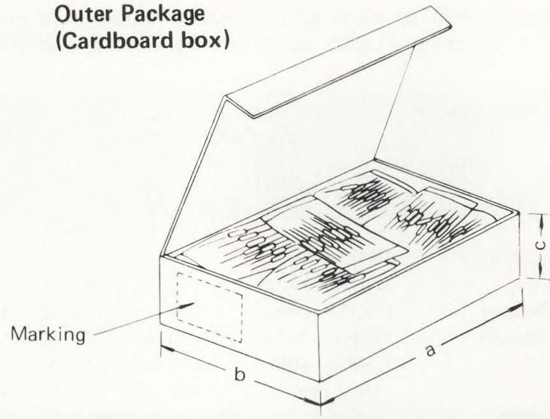
Item	Matsushita	Max.	Typical	MIL-R-11F	EIA RS-172
Humidity (%) (Steady state) 240 hours, +40°C and 95% RH Temporary resistance change	1KΩ under	+8 -0	+6	–	±10%
	1.1KΩ - 10KΩ	+8 -0	+6		
	11KΩ - 100KΩ	+8 -0	+6		
	110KΩ - 1MΩ	+10 -0	+8		
	1.1MΩ - 10MΩ	+10 -0	+8		
	11MΩ over	+10 -0	+8		

Bulk Packing

Inner Package
(Polyethylene bag)

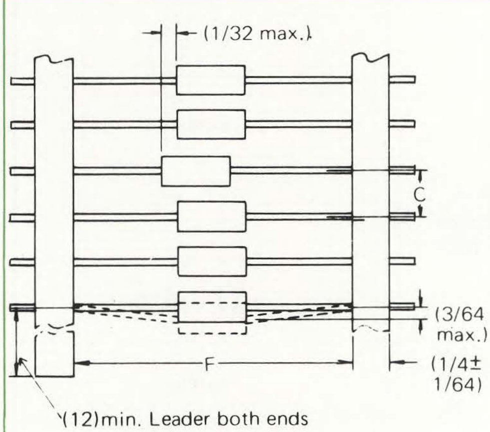


Outer Package
(Cardboard box)

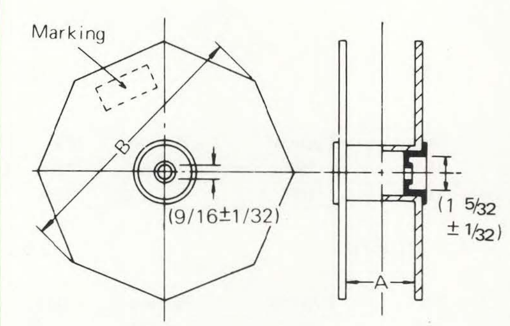


Part No.	Inner Package Quantity (pcs)	Quantity (pcs)	Outer Package	Unit: mm (inch)	
			a	b	c
ERC-18G	200	5,000	24.8 (9.77)	15.8 (6.22)	6.0 (2.36)
ERC-14G	100	3,000			
ERC-12G	100	2,000			

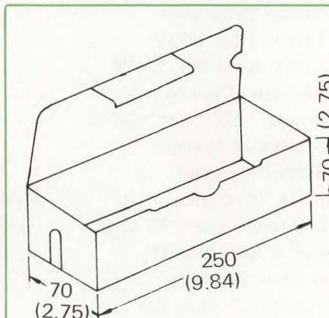
Lead Tape



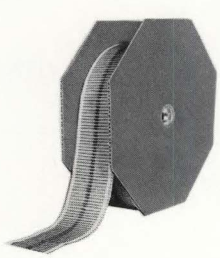
Reel Packaging

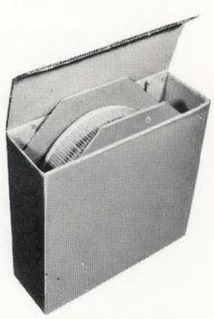


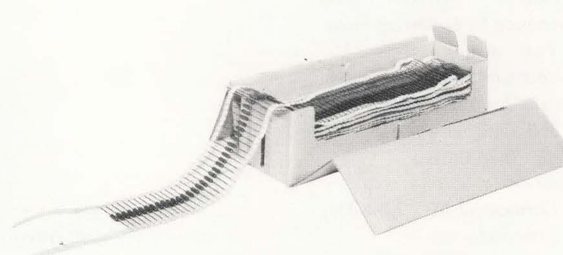
Fan Fold, Boxed Packaging



Lead wire of the resistors encased in this box shall be cut away by the portion protruded beyond tape.

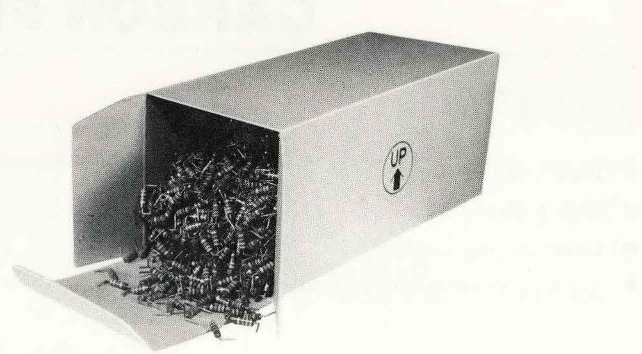






Type No.	Reel Packaging					Fan Fold, Boxed Packaging
	Dimensions		mm (inch)			
	Across Flanges	Across Points	Resistor Spacing	Tape Spacing	Quantity per Reel	Quantity per Box
	A	B	C	F		
ERC-18G	66±2 (2.6±0.1)	262±2 (10.3±0.1)	5.0±0.4 (.200±0.15)	46±1.6 (1-13/16±1/16)	5,000	6,000
ERC-14G	86±2 (3.4 ±0.1)	343 max. (13-1/2 max.)	5.0±0.4 (.200±0.15)	52±2 (2-1/16±5/64)	5,000	3,000
ERC-12G	86 ±2 (3.4±0.1)	343 max. (13-1/2 max.)	5.0±0.4 (.200±0.15)	52±2 (2-1/16±5/64)	4,000	1,000

Cut-and-Formed Leads

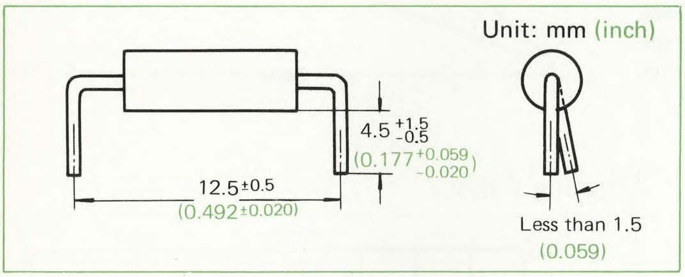


Cut-and-formed lead types are designed for mounting on printed circuit board, featuring as follows:

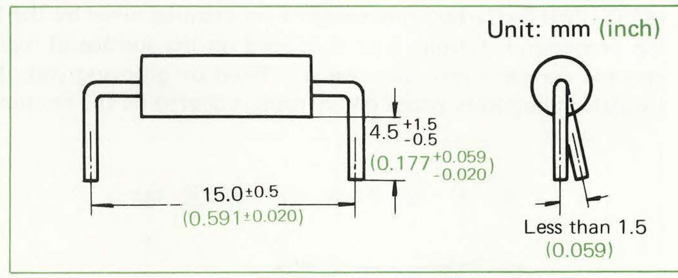
- Preparatory processing for wiring (lead bending or cutting) unnecessary.
- Uniform and precise lead spacing and lengths in accordance with p-c-b standard 2.5n (n=1,2,3...)mm.

Lead Style and Dimensions

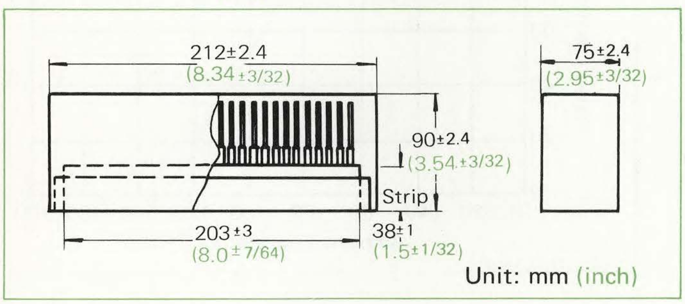
1/4W Type C

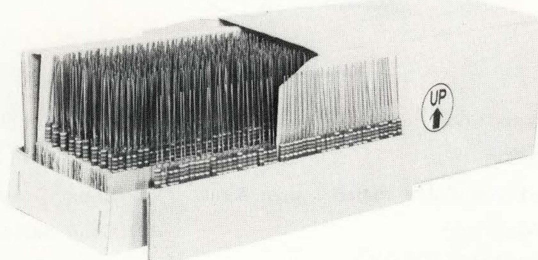


1/2W Type C



Cardboard Packaging 1/4W, 1/2W





Q'ty per Strip 50 pcs.
Q'ty per Box 1,000 pcs.

Part Number Code

E R C – ☐ ☐ ☐ ☐ ☐ ☐ ☐

Common Code

Common Code
Fixed Composition Resistors, Insulated

Rated Power

MATSUSHITA Type	Rating (Watt.)	MIL-R-11 Style
18	1/8	RC05
14	1/4	RC07
12	1/2	RC20

Specification

Nil	Standard
X	High Resistance Range 27M～100M 1/2W only

Characteristic

G	Maximum ambient temperature for full-load operation

Resistance Tolerance

MATSUSHITA	Tolerance	MIL-R-11
J	±5%	J
K	±10%	K
M	±20%	M

Nominal Resistance Value

The first two digits are significant figures of resistance and the third one denotes number of zeros following. Decimal point is expressed by R. as 2.2 = 2R2

Suffix

C	Lead Cut & Formed
Q	Card Board
V	Lead Tape

For example: E R C – 1 2 G K 1 0 4 C

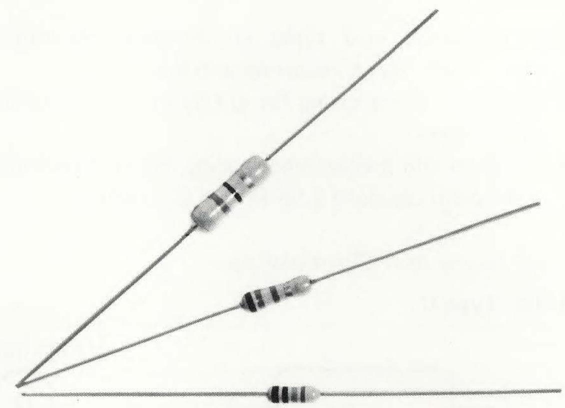
MIL-R-11 TYPE DESIGNATION R C 2 0 G F 1 0 4 K

EIA RS-172 DESIGNATION R R C 2 0 1 0 4 K

CARBON FILM RESISTORS

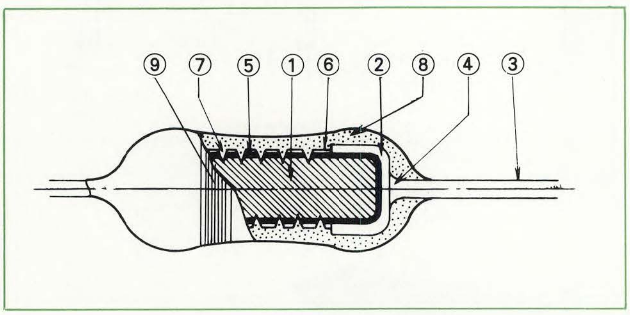
Type ERD

- Very small in size
- High stability
- Long life and low noise
- Superior coating for humidity protection, insulation



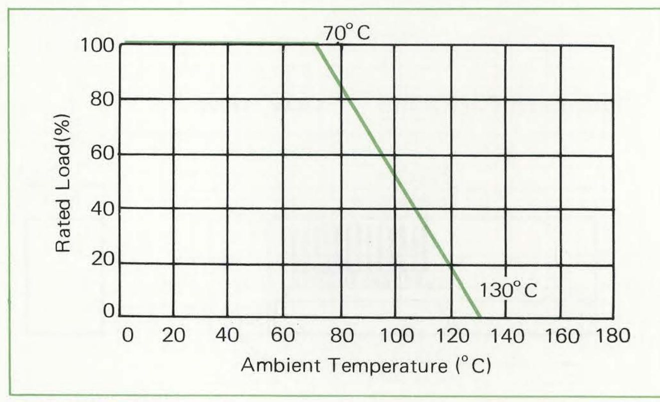
Constructions

MATSUSHITA Carbon film resistors are manufactured by the following procedures: Carbon film is formed on the surface of high-grade ceramic core and resistance value is fixed by grooving and painting. Insulation humidity-proof epoxy resin is coated on the resistor.

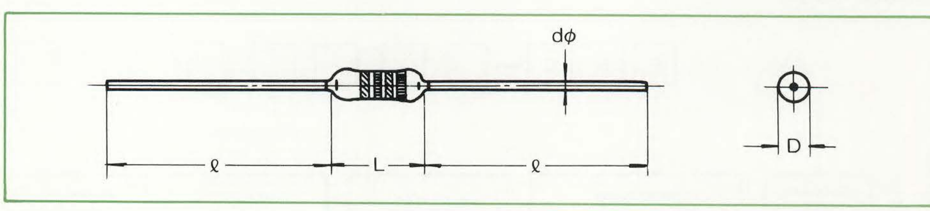


① Ceramic Core
② End Cap
③ Lead Wire (Solder-Plated Copper Wire)
④ Welded Point
⑤ Carbon film
⑥ Protective Subcoating
⑦ Spiral Cut
⑧ Epoxy Coating
⑨ Color code bands

Derating Curve



Dimensions



Specifications

Type No.	Power Rating (W)	Max. W.V. (V)	Res. Tol. (%)	Res. Range (Ω)	* Series	** Color Bands	Dimensions mm (inch) L	D	ℓ	d	Specifications
ERD-18T	0.125	250	±5	4.7~470K	E24	4	$6.3^{+0.5}_{-0.3}$ ($0.248^{+0.020}_{-0.012}$)	2.3±0.5 (0.091±0.020)	30±3 (1.181±0.118)	0.6±0.05 (0.024 ±0.005)	DIN 44051 0207
			±2	4.7~150K	E96	5					
			±1	10~150K							
ERD-14T	0.25	300	±5	4.7~1M	E24	4	$9^{+1.0}_{-0.5}$ ($0.354^{+0.039}_{-0.020}$)	2.8±0.5 (0.110±0.020)	30±3 (1.181±0.118)	0.6±0.05 (0.024 ±0.005)	DIN 44051 0309
			±2	4.7~270K	E96	5					
			±1	10~270K							
ERD-12T	0.5	350	±5	4.7~1M	E24	4	$12^{+1.0}_{-0.5}$ ($0.472^{+0.039}_{-0.020}$)	4.0±0.5 (0.157±0.020)	30±3 (1.181±0.118)	0.6±0.05 (0.024 ±0.005)	DIN 44051 0414
			±2	4.7~470K	E96	5					
			±1	10~470K							

* See the "Standard Resistance Table in Decade" on page I-14.
** See the "Color Code Table" on page I-13.

Characteristics

Item	Test Method	Limits
Temperature Coefficient (ppm/ °C)	$Te = \frac{\triangle R}{R} \times \frac{1}{\triangle t} \times 10^6$ (ppm/°C) R: Resistance at room temperature △ R: R– (Resistance at room temperature +50) △ t: Room temperature +50	Less than 100K Ω +350 ~ –500 100K Ω or more +350 ~ –700
Short Time Overload	2.5 times the rated a-c or d-c voltage shall be applied for 5 seconds.	± 1%
Load Life In Humidity	Application of the rated d-c voltage at 40°C, 90 ~ 95%RH with a period of 1.5 hours "ON" and 0.5 hour "OFF" shall be repeated 1000 times.	± 5%
Load Life	Application of the rated d-c voltage at 70°C with a period of 1.5 hours "ON" and 0.5 hour "OFF" shall be repeated 1000 times.	± 2 ~ ± 5%
Dip-Soldering	The lead of a resistor shall be dipped in 350°C solder at the height of 3.2 ~ 4.8mm from the body of the resistor for 3 seconds.	± 1%
Temperature Cycling	Temperature cycling between –55°C and +85°C shall be repeated 5 times.	± 1%
Vibration Durability	A vibration (amplitude : 0.75mm, frequency: 10 ~ 55Hz with a cycle of one minute) shall be applied to 3 directions perpendicular to each other for 6 hours with each direction for 2 hours.	± 1%
Pulse Characteristics	Application of 4 times the rated voltage shall be repeated 10,000 times with a cycle of 1 second "ON" and 25 seconds "OFF"	± 0.75 %
Noise	Noise shall be measured at room temperature with the rated voltage applied.	Less than 10kΩ 0.5µv/v max. 10kΩ or more and less than 100KΩ 1.0µv/v max. 100kΩ or more 1.5µv/v max.
Withstand Voltage	A resistor shall be placed on a metal V-block and be applied with a-c voltage for 5 seconds.	ERD-12T 1000V ERD-14T 700V ERD-18T 500V

Part Number Code

E R D — 14 T G 2 7 4 □ □

Common Code

ERD	Carbon film resistor

Rated Power

18	1/8W
14	1/4W
12	1/2W

Terminal Shape

T	Type T
V	Type V

Res. Tol.

F	±1%
G	±2%
J	±5%

Nominal Res. Value

The first two digits are significant figures of resistance and the third one denotes number of zeros following. As to ±1%, ±2% tol., the first 3 digits are significant figures of resistance and the 4th one denotes number of zeros following. Desimal point is expressed by R as 4.7Ω = 4R7.

Suffix

A	Lead cut 1/4W
C	Lead cut 1/2W
V	Lead taping (Box)

Examples: (1) Carbon film resistor of 1/2W, 27 kΩ, ±5% tol.
ERD–12TJ273

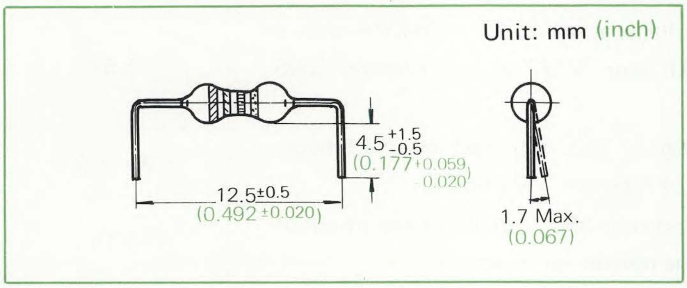
(2) Carbon film resistor of 1/4W, 6.8Ω, ±5% tol. lead-cut form,
ERD–14TJ6R8A

Cut-and- formed Lead

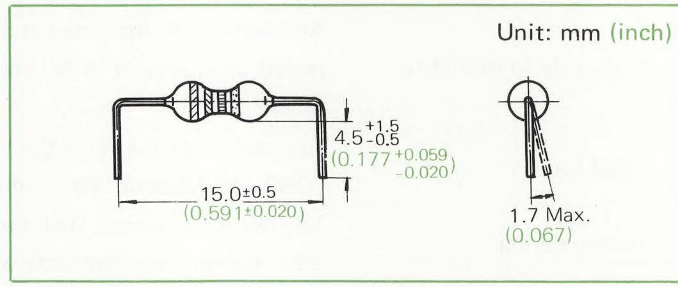
Cut-and-formed lead types are designed for printed circuit board mounting, featuring as follows:

- Preparatory processing for wiring (lead bending or cutting) unnecessary
- Uniform and precise dimensions
- Very small mounting space (Type V)
- No problem of shorting with other components due to lacquer coating on leads (Type V)

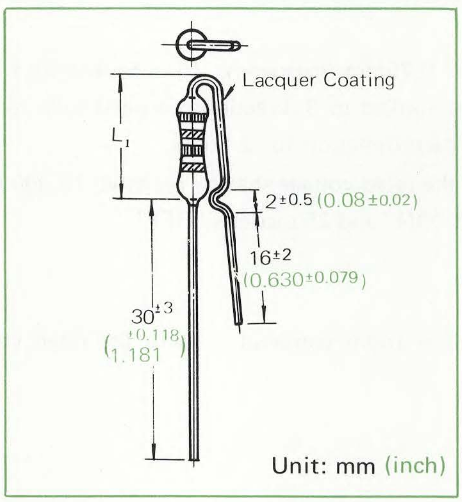
1/4W Type A



1/2W Type C



1/8W, 1/4W Type V



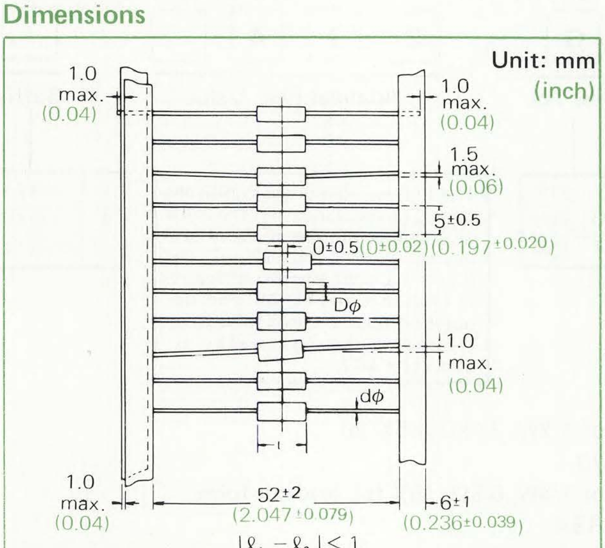
Part No. \ Dimensions	L_1
ERD-18VJ	8.5±1 (0.335±0.039)
ERD-14VJ	11.5±1 (0.453±0.039)

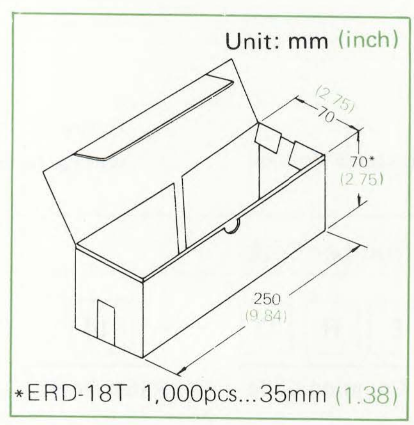
Lead Taping

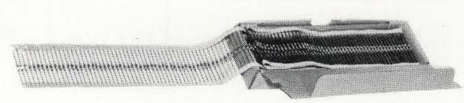
Features

- Precise dimensions, uniform spacing
- Automatic mounting on p-c-b possible
- Preparation for p-c-b mounting simplified due to uniform lead spacing

Dimensions





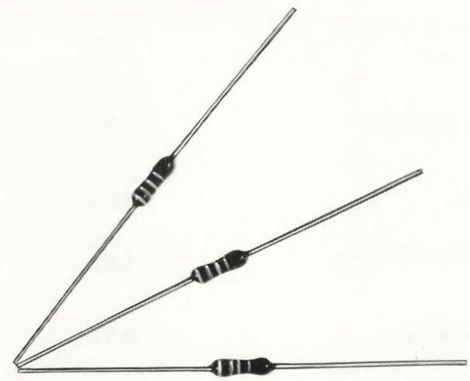


Part No.	Q'ty per Box
ERD-18T . . . V	1,000 pcs.
ERD-14T . . . V	2,000
ERD-12T . . . V	1,000

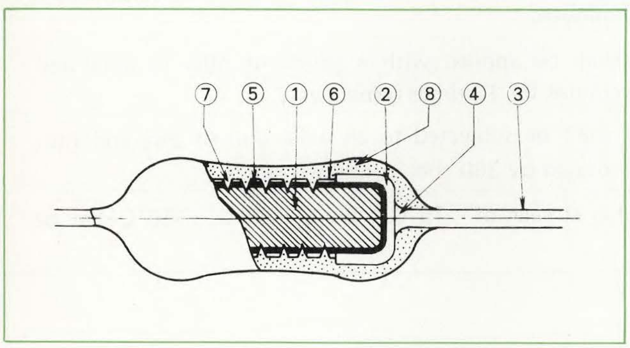
PRECISION TYPE METAL FILM RESISTORS

Type ERO (Coated Type)

- Wide operating temperature of -55°C to +150°C
- Resistance tolerance of ±1.0%, ±2.0%, ±5.0%
- Resistance temperature coefficient of ±100 ppm
- Very excellent humidity chracteristics due to newly developed epoxy resin coating
- Available at attractive price
- High reliability due to complete MATSUSHITA quality control system

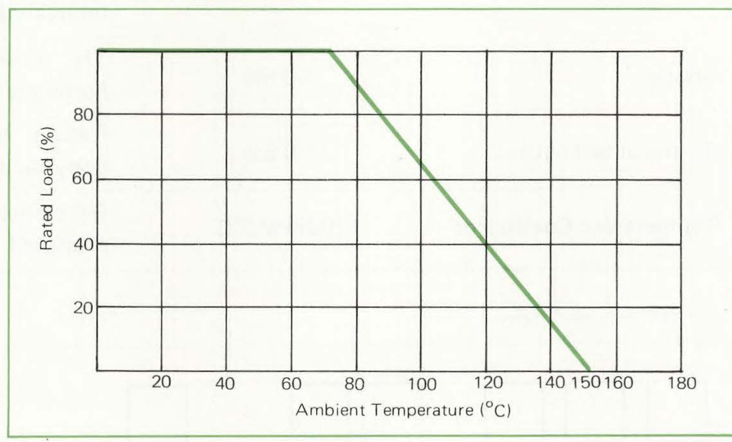


Constructions

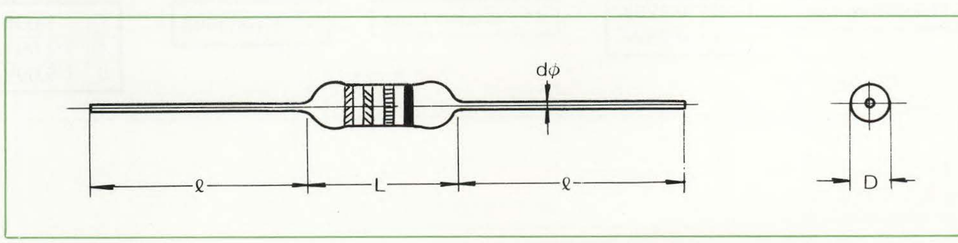


① Ceramic Core
② End Cap
③ Lead Wire (Solder-Plated Copper Wire)
④ Welded Point
⑤ Metal Film
⑥ Protective Subcoating
⑦ Spiral Cut
⑧ Epoxy Coating

Power Derating Curve



Dimensions



±1%, ±2% tolerances with 5 color bands

Specifications

Rating Type	Rated Power (Watt)	Max. Operating Volt.	Resistance Tol.(%)	Resistance Range(Ω)	Dimensions		mm (inch)	
					L	D	ℓ	dϕ
ERO-14C	0.25W (70°C)	250	±1.0 ±2.0 ±5.0	20~560K	$9^{+1.5}_{-1.0}$ $(0.359^{+0.059}_{-0.039})$	2.8±0.5 (0.110±0.020)	30±3 (1.181±0.118)	0.65±0.05 (0.0256 ±0.002)
ERO-18C	0.125W (70°C)	200	±1.0 ±2.0 ±5.0	20~301K	$6.3^{+1.0}_{-0.5}$ $(0.248^{+0.039}_{-0.020})$	2.3±0.5 (0.091±0.020)	30±3 (1.181±0.118)	0.65±0.05 (0.0256 ±0.002)

Characteristics

Item	Max. Res. Change	Test Method (per MIL-R-22684)
Short Time Overload	± 0.5%	Applying 2.5 times the rated a-c or d-c voltage for 5 seconds
Operation at Low Temperature	± 0.5%	Applying the rated d-c load at −55°C for 45 minutes.
Moisture Resistance	± 1.5%	Humidity cycling test per MIL-STD-202, 106C shall be repeated 10 times.
Load Life	± 2.0%	Applying the rated d-c voltage at 70°C at a cycle of 1.5 hours "ON" and 0.5 hour "OFF" for 1,000 hours.
Temperature Cycling	± 1.0%	A cycle between −55°C and +150°C shall be repeated 5 times.
Heat Soldering	± 0.5%	Resister lead shall be dipped into molten solder of 350°C up to 3.2 ~ 4.8 mm (0.125 ~ 0.19 inch) from the body of the resistor for 3 seconds.
Vibration	± 0.5%	The resistor shall be applied with a vibration of 10 ~ 2000 Hz to each of three perpendicular directions for 12 times respectively at an interval of 20 minutes.
Shock	± 0.5%	The resistor shall be applied with a shock of 50G to axial and horizontal directions for 10 times respectively.
Terminal Strength	± 0.5%	Resistor lead shall be subjected to an axial pull of 2kg and the body shall be rotated by 360° horizontally 5 times.
Temperature Coefficient	±100PPM/°C	Resistance value at each of −15°C, −55°C, +65°C, +150°C shall be measured.

Part Number Code

☐☐☐ ☐☐ ☐ ☐ ☐ ☐☐☐☐

Common Code

ERO	Metal Film Res.

Rated Power

18	0.125W
14	0.25W

Construction

C	Coated Type

Temperature Coef.

K	± 100 PPM

Res. Tol.

F	± 1.00%
G	± 2.00%
J	± 5.00%

Resistance Value

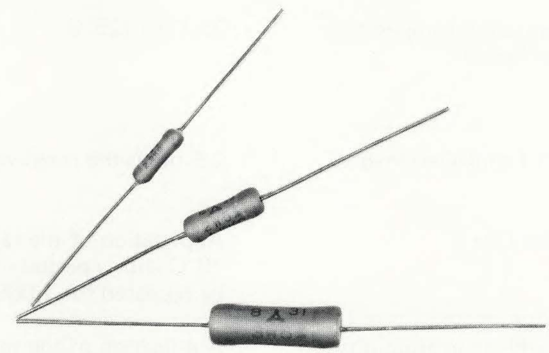
± 1, ± 2%	E96 Series
± 5.0%	E24 Series

FLAME-PROOF METAL (OXIDE) FILM RESISTORS

Type ERX, ERG

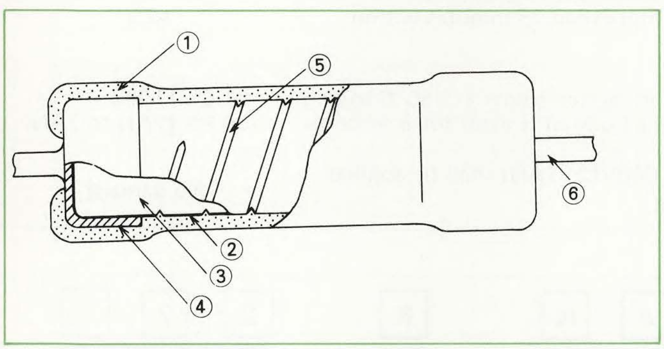
Features

- Flame-proof insulation type
- Superb high frequency characteristics and little current noise
- Extremely stable due to metal (oxide) film
- Maximum operating temperature of 70°C
- Metal alloy film for type ERX, and metal oxide film for type ERG



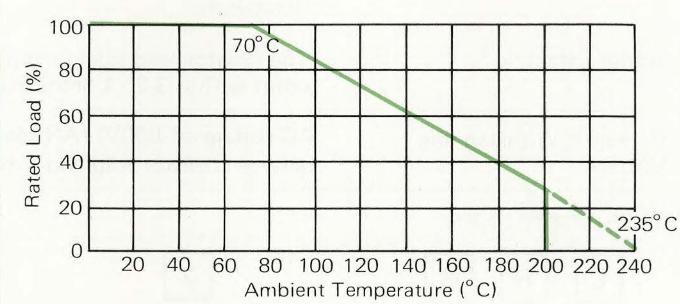
Construction

Types ERG, ERX are metal (oxide) film resistors comprising superior metal (oxide) film formed on heat-proof alkaliless ceramic material. After connected with a couple of cap and lead the metal (oxide) film is grooved in a spiral shape to define resistance value and covered with flame-proof insulation coating material.

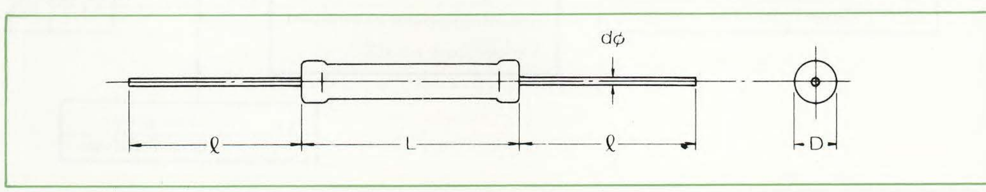


① Flame-proof insulation paint coating
② Metal film or metal oxide film
③ Heat-proof alkaliless ceramic
④ Press-fitted end cap
⑤ Spiral cutting
⑥ Soldered Copper Wire

Derating Curve



Dimensions



Specifications

Style	Power Rating (W)	Max. Volt. (V)	Resistance Tolerance (%)	Resistance Range (Ω)	Dimensions L	D	mm(inch) ℓ	d
ERX-1AN	1	350		0.39~13	$12^{+1.5}_{-1.0}$	4.0±1	30±3	0.6±0.1
ERG-1AN				15~22K	$(0.47^{+0.06}_{-0.04})$	(0.16±0.04)	(1.18±0.12)	(0.024±0.004)
ERX-2AN	2	350	±2 ±5	0.47~27	15±1.5	5.5±1.0	38±3 (1.50±0.12)	0.8±0.1 (0.031±0.004)
ERG-2AN				30~100K	(0.59±0.06)	(0.22±0.04)		
ERX-3AN	3	500		0.47~27	24±1.5	8.0±1.0		
ERG-3AN				30~100K	(0.94±0.06)	(0.31±0.04)		
ERX-5AN	5	750		1~27	40±1.5	8.0±1.0		
ERG-5AN				30~100K	(1.57±0.06)	(0.31±0.04)		
ERX-7AN	7	750		1~27	52±1.5	8.0±1.0		
ERG-7AN				30~150K	(2.05±0.06)	(0.31±0.04)		

Characteristics

Item	Applicable Test Specifications	Limits
Flame Test	Per UL-492-278	UL-492-278
Flammability in Overload Conditions	After 1.2 times the rated power is applied, 16 times the rated power shall be applied.	No flame
Resistance Temperature Coefficient	25°C to 125°C	±350 ppm/°C (1AN) ±300 ppm/°C (2AN) ±200 ppm/°C (3 to 7AN)
Short-time Overload	2.5 times the rated voltage shall be applied for 5 seconds.	±2% (1AN) ±1% (2 to 7AN)
Load Life	Application of the rated voltage at an ambient temperature of 70°C with a period of 1.5 hours "ON" and 0.5 hour "OFF" shall be repeated for 1,000 hours.	±5%
Load Life in Humidity	Application of the rated voltage at an ambient temperature of 40°C, 95%RH with a period of 1.5 hours "ON" and 0.5 hour "OFF" shall be repeated for 1,000 hours.	±5%
Thermal Shock	After the rated voltage is applied at 40°C for 30 minutes, the resistor shall be left at -35°C for more than 15 minutes within 10 seconds.	±2%
Solder Effect	The resistor lead shall be dipped in molten solder at 350°C to a point within 3.2~4.8mm from the body of resistor for 3 seconds.	±1.0% (1AN) ±0.5% (2AN to 7AN)
Dielectric Withstanding Voltage	AC voltage of 600V(1AN) and 1,000V(2~7AN) shall be applied between resistor lead and V-block.	No damage

Part Number Code

E R G | 2 | A N | K | 2 7 □

Common Code

ERX	Metal film resistors
ERG	Metal oxide film resistors.

Rated Power

Denotes max. continuous operating power at ambient temperature of 70°C

Construction

AN	Flame-proof insulation type

Resistance Tolerance

G	±2%
J	±5 %

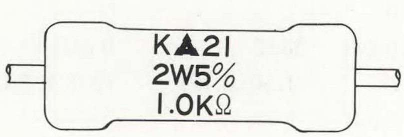
The first two digits are significant figures of resistance and the third one denotes number of zeros following.
Decimal point is expressed by R as 1.4 = 1 R 4

Marking

Type: 1W

A) "1" stands for wattage rating.
B) "J" stands for resistance tolerance. (G, J)
C) "K2" stands for date code. The first digit denotes the calender month when produced (1 to 9 and J, K, L) and the second digit denotes the end digit of the year produced.
D) 2nd line shows nominal resistance value.

Type: 2W, 3W, 5W, 7W

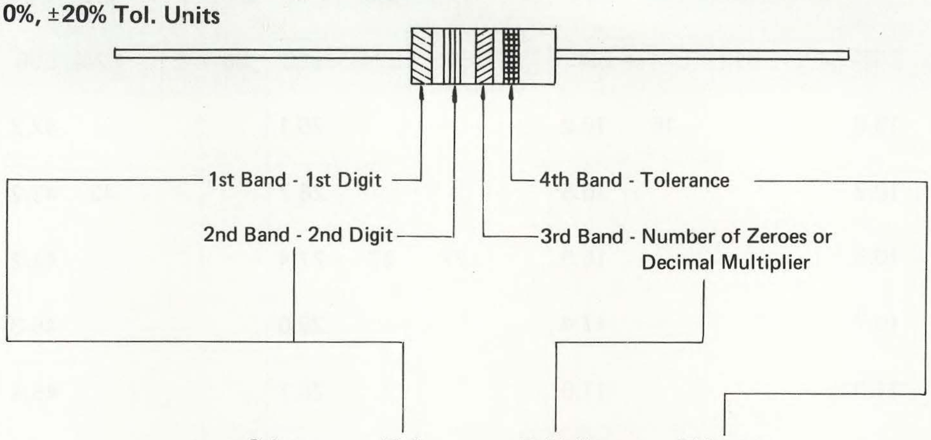


A) "K" stands for the calendar month when produced. (1 to 9 and J, K, L)
B) "▲" stands for Matsushita emblem.
C) "21" stands for date code. The first digit denotes the end digit of the year produced and the second one shows any of each one-third calendar month when produced. (1, 2 and 3 for the beginning, middle and end one-third month)
D) 2nd line shows wattage rating and resistance tolerance.
E) 3rd line shows the nominal resistance value.

Standard Color Code

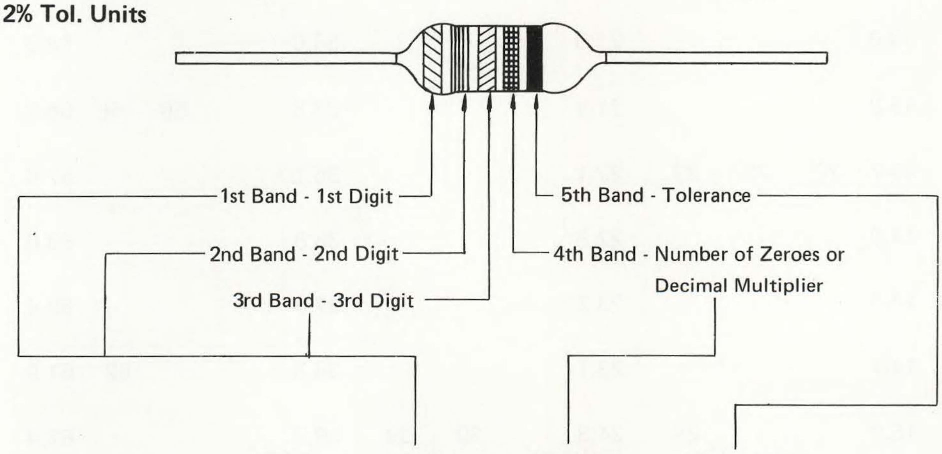
Resistors are symbolized on the body by the color code system described. The symbolization shown has been adopted as the standard EIA color code method of identification.

±5%, ±10%, ±20% Tol. Units



Color	Digit	Multiplier	Tolerance
Black	0	10^0	
Brown	1	10^1	
Red	2	10^2	
Orange	3	10^3	
Yellow	4	10^4	
Green	5	10^5	
Blue	6	10^6	
Violet	7	10^7	
Gray	8	10^8	
White	9	10^9	
Gold	- - -	10^{-1}	±5%
Silver	- - -	10^{-2}	±10%
Nil	- - -	- - -	±20%

±1%, ±2% Tol. Units



Color	Digit	Multiplier	Tolerance
Black	0	10^0	±1%
Brown	1	10^1	±2%
Red	2	10^2	
Orange	3	10^3	
Yellow	4	10^4	
Green	5	10^5	
Blue	6	10^6	
Violet	7	10^7	
Gray	8	10^8	
White	9	10^9	
Gold	-----	10^{-1}	
Silver	-----	10^{-2}	
Nil	-----	-----	

Standard Resistance Table

- Please inform resistance value based on standard resistance table when ordering resistors. This will enable us to process your purchase order faster and thereby speed up delivery.

20%	10%	5%	1,2%	20%	10%	5%	1,2%	20%	10%	5%	1,2%	20%	10%	5%	1,2%	20%	10%	5%	1,2%
E6	E12	E24	E96	E6	E12	E24	E96	E6	E12	E24	E96	E6	E12	E24	E96	E6	E12	E24	E96
10	10	10	10.0			16	16.2				26.1				42.2	68	68	68	68.1
			10.2				16.5				26.7			43	43.2				69.8
			10.5				16.9		27	27	27.4				44.2				71.5
			10.7				17.4				28.0				45.3				73.2
		11	11.0				17.8				28.7				46.4				75.0
			11.3		18	18	18.2				29.4	47	47	47	47.5				76.8
			11.5				18.7			30	30.1				48.7				78.7
			11.8				19.1				30.9				49.9				80.6
	12	12	12.1				19.6				31.6			51	51.1		82	82	82.5
			12.4			20	20.0				32.4				52.3				34.5
			12.7				20.5	33	33	33	33.2				53.6				86.6
		13	13.0				21.0				34.0				54.9				88.7
			13.3				21.5				34.8		56	56	56.2			91	90.9
			13.7	22	22	22	22.1				35.7				57.6				93.1
			14.0				22.6				36.5				59.0				95.3
			14.3				23.2				37.4				60.4				97.6
			14.7				23.7				38.3			62	61.9				
15	15	15	15.0			24	24.3		39	39	39.2				63.4				
			15.4				24.9				40.2				64.9				
			15.8				25.5				41.2				66.5				

II NONLINEAR RESISTORS

QUICK REFERENCE GUIDE

Nonlinear Resistors

Classification			Major Ratings	Part No.	Page
Voltage Dependent Resistors	"ZNR" Varistors	Disk Type	Varistor Voltage (V±10%): 82~1000 Rated Power (WDC): 0.3, 0.8 and 1.5 Voltage Ratio: $V_{10mA}/V_{1mA} \leqq 1.08$	ERZ-□□D	II-5
		Stacked Type	Varistor Voltage (V±10%): 6~25K Rated Power (WDC): 2,6,8,10 and 20 Voltage Ratio: $V_{500\mu A}/V_{50\mu A} \leqq 1.08$	ERZ-□□H	II-11
	"ZNR" Surge Absorbers	Type D	Varistor Voltage (V_{1mA}): 33~880V Tolerance(%): ±10 or 15 Surge Withstand Rating(A): 500~2000	ERZ-$^{A}_{B}$□□D	II-17
		Type E	Varistor Voltage (V_{1mA}): 220~1000V Tolerance(%): ±15 Surge Withstand Rating(A): 2,000~20,000	ERZ-A□□E	II-17
		Type P	Varistor Voltage (V_{1mA}): 250~7000V Tolerance(%): ±10 Surge Withstand Rating(A): 1500	ERZ-A□□P	II-17
		Type R	Varistor Voltage (V_{1mA}): 6~12KV Tolerance(%): ±10 Surge Withstand Rating(A): 10	ERZ-□□R	II-25
	Ceramic Diode Varistor "VARIATITE"		Varistor Voltage(V): 1.0~3.0 (at 1.5mA) Tolerance(%): ±5 Volt. Temp. Coef.: -0.3%/°C max.	EYV-	II-29
	SiC Varistors		Varistor Voltage(V±10%): 5.0~1000 Rated Power(W): 0.1,0.2,0.8,1.0,1.5,2.0 Current (mA): 1, 10, 100	ERV-	II-34
Temperature Dependent Resistors	PTC Thermistors & Application	(A Char.)	Resistance(Ω): 500~20K Rated Power(W): 0.5W Temp. Coef. (%/°C): 2.5, 3.5, 4.5	ERP-F□A	II-44
		(B Char.)	Resistance(Ω): 5~100 Max. Rated Power(W): 1,1.5,2,2.5,3,3.5 Switching Temp.(°C): 50, 75, 90, 120	ERP-F□B	II-47
		Degaussing Elements	Rated Voltage (VAC): 100, 120, 220 Resistance (Ω±20%): 8~60 Inrush Current [$A^{(o\text{-}p)}$]: 6~10min. Residual Current [mA rms]: 10~15max.	ERP-$^{C}_{F}$	II-52
	NTC Thermistors & Application	PTC Thermistor Unit for Thermostat	(Various types are available.)	EUP-	II-55
		Types D2~D8	Rated Power(W): 0.25,0.6,1.2,2,3,4 Resistance R25°C(Ω): 8~200K Constant(B° K): 2000~5500	ERT-D2~8	II-67
		Low B	Rated Power(W): 0.25, 0.6, 1.2 Resistance R25°C(Ω): 4~200 Constant(B° K): 1500		II-69
		Thermistor Temperature Detectors	(Various types of detectors and sensors are available.)	ERT-A ERT-W	II-71
		Fuel Level Gauge	Rated Volt. (VDC): 12.0 Operating Temp. (°C): -10~+60 Display Method: 12V, 3.4W lamp Detection(minute): 3 max.	ERT-LG	II-76
Spark Gap		Type H	Discharge Voltage(V): 750,1200,1500,2000 Tolerance(V): ±250, ±500 Insulation Resistance(Ω): 10^9 min.	EGP-H	II-79
		Type M	Discharge Voltage(V): 6000, 7000 Tolerance(V): $^{+2000}_{-1000}$ Insulation Resistance(Ω): 10^9 min.	EGP-M	

This chart is intended to serve as a guide only.

ZINC OXIDE NONLINEAR RESISTOR "ZNR"

"ZNR", abbreviation of Zinc Oxide Nonlinear Resistor, is an epoch-making voltage dependent resistor developed by Matsushita Electric.
Its element is sintered ceramic material which comprises zinc oxide as a main ingredient and several kinds of metal oxide additives. Thus, ZNR is featured in the great nonlinearity coefficient and incomparable surge suppression capability. ZNR is, therefore, applied in such a broad manner as for voltage stabilization (DC), pulse voltage suppression, surge voltage absorption and protection against lightning.

Patents

- 348 patents, registered or pending in Japan
- 204 patents, registered or pending over USA, Great Britain, W. Germany, France, Holland, Canada, Italy, Australia, Taiwan, Sweden and Ireland

Features

For voltage stabilization and pulse suppression

- Excellent voltage stabilization and pulse suppression effect due to higher nonlinearity coefficient
- Stable against temperature and humidity changes and load application
- Lower temperature coefficient of varistor voltage (Less than 0.05%/°C)
- Quick response to the pulse and voltage changes
- Wide varistor voltage range 33V to 26kV

For surge absorption and lightning arrester

- Excellent surge suppression capability [2000 to 3000A/cm^2 (8x20μ sec)]
- Lower residual voltage ratio showing excellent surge suppression capability at higher current range
- Quick response to pulse
- Symmetrical V-I characteristics
- No follow current
- Compact in size

Application

- Voltage stabilization at various circuits of electronic appliances
- Protection of various semiconductor elements against surge
- Suppression of voltage and current
- Protection of various relays avoiding sparks
- Protection of various electronic equipment against lightning

Terms Concerning ZNR

ZNR is a voltage dependent resistor whose resistance value changes depending on the applied voltage, and its characteristics are decided by its varistor voltage and nonlinearity coefficient as in the case of conventional varistor.

"Varistor voltage (Vc)"

Since ZNR has the voltage-current characteristics (V-I characteristics) as shown in the Fig.1, measuring current is needed to be specified in order to specify the varistor voltage. In this catalog, the varistor voltage, which is the voltage between the terminals of ZNR with the current CmA applied, is called Vc. For example, therefore, the varistor voltage with 1mA applied is shown as V_1. Varistor voltage measuirng should be made in as short time as possible, because the varistor voltage changes with Joule heat effect. Varistor voltage is also called "zero power" voltage, which means the measuring must be made avoiding heat. Usually, the standard measuring current is specified 1mA, but in such cases as in ZNR for high voltage stabilization, rod type ZNR for high voltage, the measuring current is specified for each type, for example, 0.5mA, 0.1mA, etc.

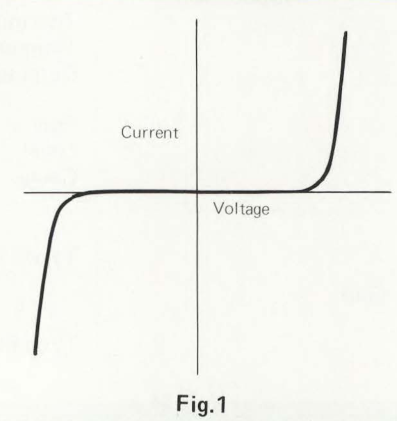


Fig.1

"Voltage ratio R (Nonlinearity coefficient α)"

Generally, V-I characteristics of varistor is shown by the equation (1).

$$I = \left(\frac{V}{C}\right)^{\alpha} \quad \text{.............................} \quad (1)$$

I: Current
V: Voltage
α, C: Constant

The constant α in the equation (1) is called "nonlinearity coefficient" and is figured out by the equation (2) after measuring the varistor voltage V_1 and V_2 at the measuring current I_1 and I_2.

$$\alpha = \frac{\log I_1 - \log I_2}{\log V_1 - \log V_2} = \frac{\log\left(\frac{I_1}{I_2}\right)}{\log\left(\frac{V_1}{V_2}\right)} \quad \text{...........} \quad (2)$$

When $\frac{I_1}{I_2}$ is 10, α is shown by the equation (3).

$$\alpha = \frac{1}{\log\left(\frac{V_1}{V_2}\right)} \quad \text{...................} \quad (3)$$

V_1: Voltage at current I_1
V_2: Voltage at current I_2

In voltage dependent resistor the nonlinearity coefficient α is higher than 1. The higher the nonlinearity coefficient becomes, the greater the voltage dependency, i.e. the varistor effect. The α in ZNR is 30 to 70. In this catalog, the nonlinearity is shown by the voltage ratio $\frac{V_1}{V_2}$ instead of α.

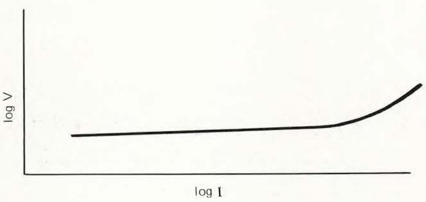


Fig.2 An example of V-I characteristics of "ZNR"

"V-I characteristics"

The V-I characteristics of ZNR is shown as Fig.2 by means of logarithmic graduation. Though the α (nonlinearity coefficient) is mentioned constant before, it isn't so strictly defined. As shown in Fig.2, the α in the higher current range is less than that in the lower current range. In case of "ZNR" applied for surge absorption, the α in the higher current range or the residual voltage ratio is more important. Therefore, refer to the technical data of the relevant product in the catalog.

"Rated power"

Rated power of ZNR is specified only for the ZNR applied for voltage stabilization and pulse suppression and it is defined as the maximum DC power applicable under the specified temperature, which differs depending on each product. (Use the power derating curve which shows the relation between the ambient temperature and the DC power, if such a curve is given.)
If ZNR is used for the circuits where no DC is applied, for example, for pulse suppression, the rated power as is can not be adopted. Using ZNR under high temperature and application of the power beyond specification will result in the rapid deterioration of ZNR characteristics.

"Voltage-temperature characteristics"

Voltage-temperature characteristics show the changes of varistor voltage influenced by the ambient temperature, and as the temperature becomes higher, the varistor voltage becomes slightly lower.
In case of ZNR, the change in the varistor voltage between 20°C and 70°C of the ambient temperature is shown as ΔVc%/°C by means of the following equation, and it is approximately -0.03%/°C.

$$\frac{Vc(\text{at }20^\circ C) - Vc(\text{at }70^\circ C)}{Vc(\text{at }20^\circ C)} \times \frac{1}{50} \times 100 = \Delta Vc\%/^\circ C$$

"Surge suppression capability"

Surge suppression capability is specified for the ZNR for surge voltage absorption such as surge absorber and lightning arrester, and is shown as the maximum allowable value of the peak current with ampere as unit under the condition that the specified impulse current is applied. In case of ZNR surge absorber, the current wave form of 8x20μsec (as shown in Fig.3), specified by JEC, is adopted as a standard wave form. The impulse current of the above wave form is applied twice at intervals of 5 minutes, and the surge suppression capability is shown with the current value (peak) at which the varistor voltage V_1 changes by ±10%.
When the wave form differs, the energy applied to the ZNR naturally differs, and the different surge suppression capability will result. When the impulse current is applied several times the maximum current, at which the ZNR shows stable performance, becomes lower.

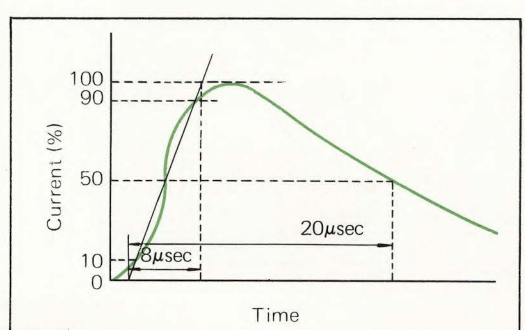


Fig.3 Standard impulse current wave form (8X20μsec.)

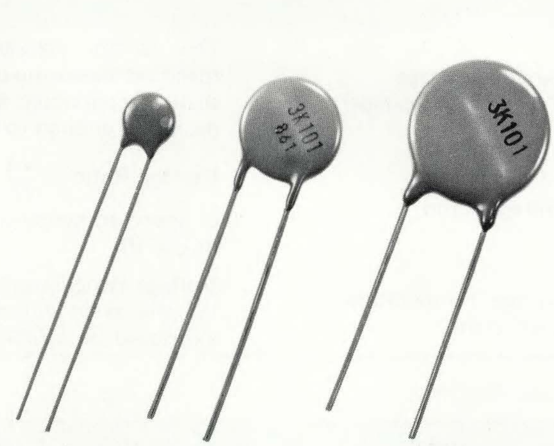
"Residual voltage ratio"

Residual voltage ratio shows the nonlinearity at higher current range needed in adopting the ZNR for the purpose of surge absorption, and is expressed by the ratio of the varistor voltages at 1mA and 100A (10A in case of low voltage ZNR) i.e. V_{100A} (V_{10A})/V_{1mA} (V_{100A} and V_{10A} are measured with the pulse of the standard current wave form 8 x 20μsec).

As shown in this catalog, the residual voltage ratio of ZNR is 1.8 to 2.2 as maximum value, which is very low in comparison with that of selenium and SiC varistor, thus showing ZNR has the excellent surge suppression capability.

"ZNR" VARISTORS

Disc Type



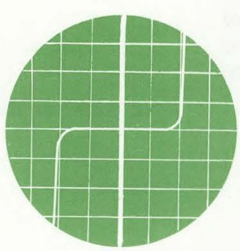
Features

- Far greater nonlinearity coefficient (α) than that of conventional SiC varistors, equivalent to that of zener diode as shown below
- Superb temperature and humidity characteristics
- Wide varistor voltage range from 82V to 1000V

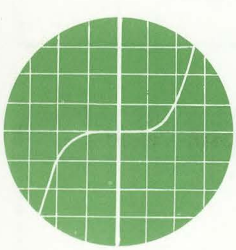
Application

- Voltage stabilization of various kinds of electronic circuits
- Suppression and limitation of voltage and current
- Protection of semiconductive elements

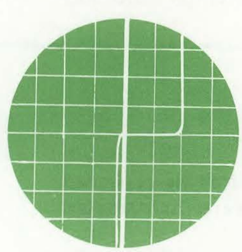
V-I Characteristics



"ZNR"
Horiz: 100V/div.
Vert: 1mA/div.



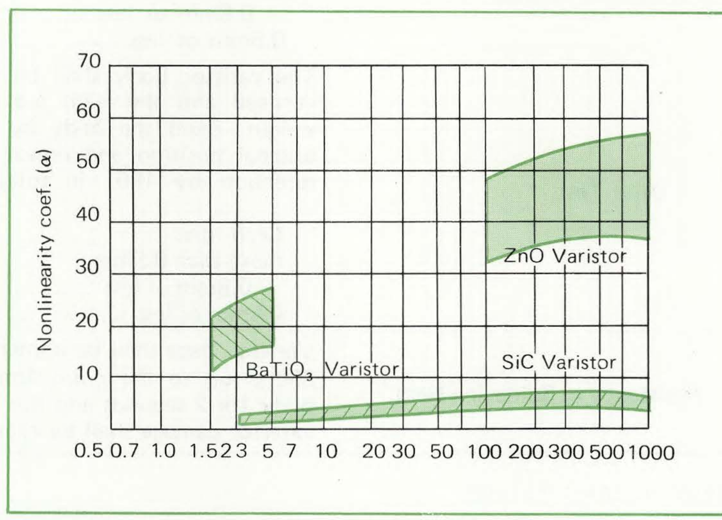
SiC Varistor
Horiz: 200V/div.
Vert: 1mA/div.



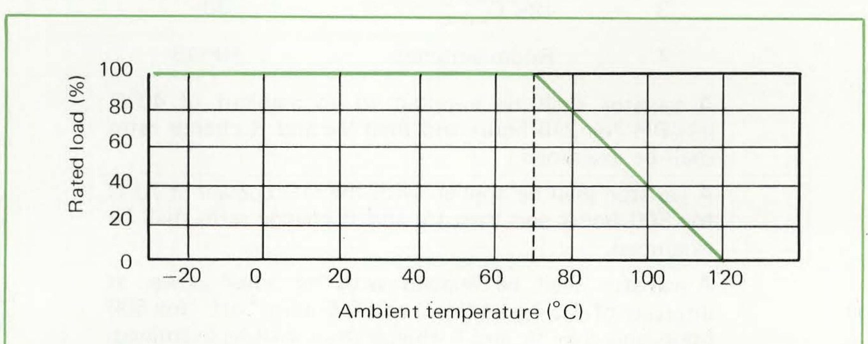
Zener Diode
Horiz: 10V/div.
Vert: 1mA/div.

Voltage Non-Linearity

(Comparison of voltage non-linearity coefficients between ZNR and SiC varistor)



Power Derating Curve



Ratings

Electrical Ratings

Item	Test Method	Rated Values
Varistor Voltage (Zero-power Voltage)	The varistor voltage shall be measured applying the specified measuring current (C) to a varistor. All the tests shall be conducted at the standard temperature of 20°C, promptly enough to avoid heat affection.	Satisfy the specified value
Voltage Ratio	Voltage Ratio = $\frac{Vd}{Vc}$ c: specified measuring current d: c x 10	Satisfy the specified value
Voltage Temperature Coefficient	Voltage temperature coefficient shall be measured applying the rated current at each of 20°C and 70°C and expressed by $\Delta Vc\%/°C$.	-0.05%/°C max.

Mechanical Ratings

Item	Test Method	Rated Values
Pull Test	The varistor body shall be secured and each lead shall be subjected to an axial pull of the specified weight. Lead dia. — Weight more than 0.5mm 0.8mm or less .... 1.0 kg 0.5mm or less .... 0.5 kg	No exterior damage
Bend Test	The varistor body shall be secured to keep the leads verticall and the leads are subjected to the specified weight. Bend the body by 90° and return it to the original position and repeat the same in the opposite direction by 180° in total. Lead dia. — Weight more than 0.5mm 0.8mm or less .... 0.5 kg 0.5mm or less .... 0.25 kg	No exterior damage
Resistance to Soldering Heat	Varistor leads shall be immersed into a molten solder of 350°C up to the point 4mm below from the varistor body for 2 seconds and the Vc and R change ratio and exterior damage shall be examined.	$\Delta Vc/Vc \leqq \pm 5\%$ $\Delta R/R \leqq \pm 5\%$

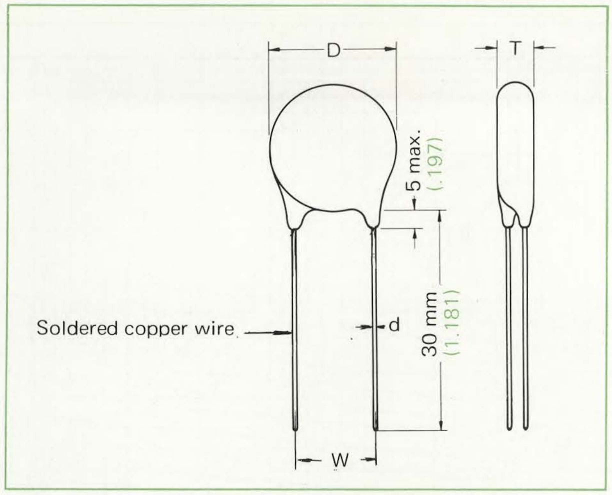
Environmental Ratings

Item	Test Method	Rated Values
Temperature Cycling	The temperature cycling shown below shall be repeated 5 times and Vc and R change ratio and exterior damages are examined. (see table below)	$\Delta Vc/Vc \leqq \pm 5\%$ $\Delta R/R \leqq \pm 5\%$
Humidity Test	A varistor shall be exposed to an ambient of 40°C, 95%RH for 240 hours and then Vc and R change ratio shall be examined.	$\Delta Vc/Vc \leqq \pm 5\%$ $\Delta R/R \leqq \pm 5\%$
Life	A varistor shall be applied with the rated power at 70°C, for 500 hours and then Vc and R change ratio shall be examined.	$\Delta Vc/Vc \leqq \pm 10\%$ $\Delta R/R \leqq \pm 5\%$
Humidity Load Life	A varistor shall be applied with the rated power at intervals of 1.5 hours "on" and 0.5 hour "off" for 500 hours and then Vc and R change ratio shall be examined.	$\Delta c/Vc \leqq \pm 10\%$ $\Delta R/R \leqq \pm 5\%$

Step	Temperature	Time (minutes)
1	$-25°C^{+0°C}_{-3°C}$	30
2	Room ambinet	10~15
3	$+85°C^{+3°C}_{-0°C}$	30
4	Room ambinet	10~15

Dimensions

Unit:mm (inch)



Specifications

■ 0.3W

Part No.	Measuring Current (mA)	Rated Voltage (V)	Voltage Ratio V10mA/V1mA	Rated Wattage (W.D.C.)	Dimensions mm (inch)			
					D max.	T	W	d
ERZ-03D3K820	1	82±10%	1.08 max.	0.3	9.0 (.354)	4±2 (.157 ±.079)	5±1.5 (.196 ±.059)	0.5ϕ (.019ϕ) or 0.6ϕ (.024ϕ)
ERZ-03D3K101	1	100±10%	1.08 max.	0.3				
ERZ-03D3K121	1	120±10%	1.08 max.	0.3				
ERZ-03D3K151	1	150±10%	1.08 max.	0.3				
ERZ-03D3K181	1	180±10%	1.08 max.	0.3		5±2 (.196 ±.079)		
ERZ-03D3K221	1	220±10%	1.08 max.	0.3				
ERZ-03D3K271	1	270±10%	1.08 max.	0.3				
ERZ-03D3K331	1	330±10%	1.08 max.	0.3				
ERZ-03D3K391	1	390±10%	1.08 max.	0.3				
ERZ-03D3K471	1	470±10%	1.08 max.	0.3				

Note: Operating Temperature: -25~+70° C

■ 0.8W

Part No.	Measuring Current (mA)	Rated Voltage (V)	Voltage Ratio V10mA/V1mA	Rated Wattage (W.D.C)	Dimensions mm (inch)			
					D max.	T	W	d
ERZ-08D3K820	1	82±10%	1.08 max.	0.8	18.0 (.709)	4±2 (.157 ±.079)	11±2 (.433 ±.079)	0.8ϕ (.031ϕ)
ERZ-08D3K101	1	100±10%	1.08 max.	0.8				
ERZ-08D3K121	1	120±10%	1.08 max.	0.8				
ERZ-08D3K151	1	150±10%	1.08 max.	0.8				
ERZ-08D3K181	1	180±10%	1.08 max.	0.8		5±2 (.196 ±.079)		
ERZ-08D3K221	1	220±10%	1.08 max.	0.8				
ERZ-08D3K271	1	270±10%	1.08 max.	0.8				
ERZ-08D3K331	1	330±10%	1.08 max.	0.8				
ERZ-08D3K391	1	390±10%	1.08 max.	0.8				
ERZ-08D3K471	1	470±10%	1.08 max.	0.8				
ERZ-08D3K561	1	560±10%	1.08 max.	0.8				
ERZ-08D3K681	1	680±10%	1.08 max.	0.8				
ERZ-08D3K821	1	820±10%	1.08 max.	0.8				
ERZ-08D3K102	1	1000±10%	1.08 max.	0.8				

Note: Operating Temperature: -25~+70° C

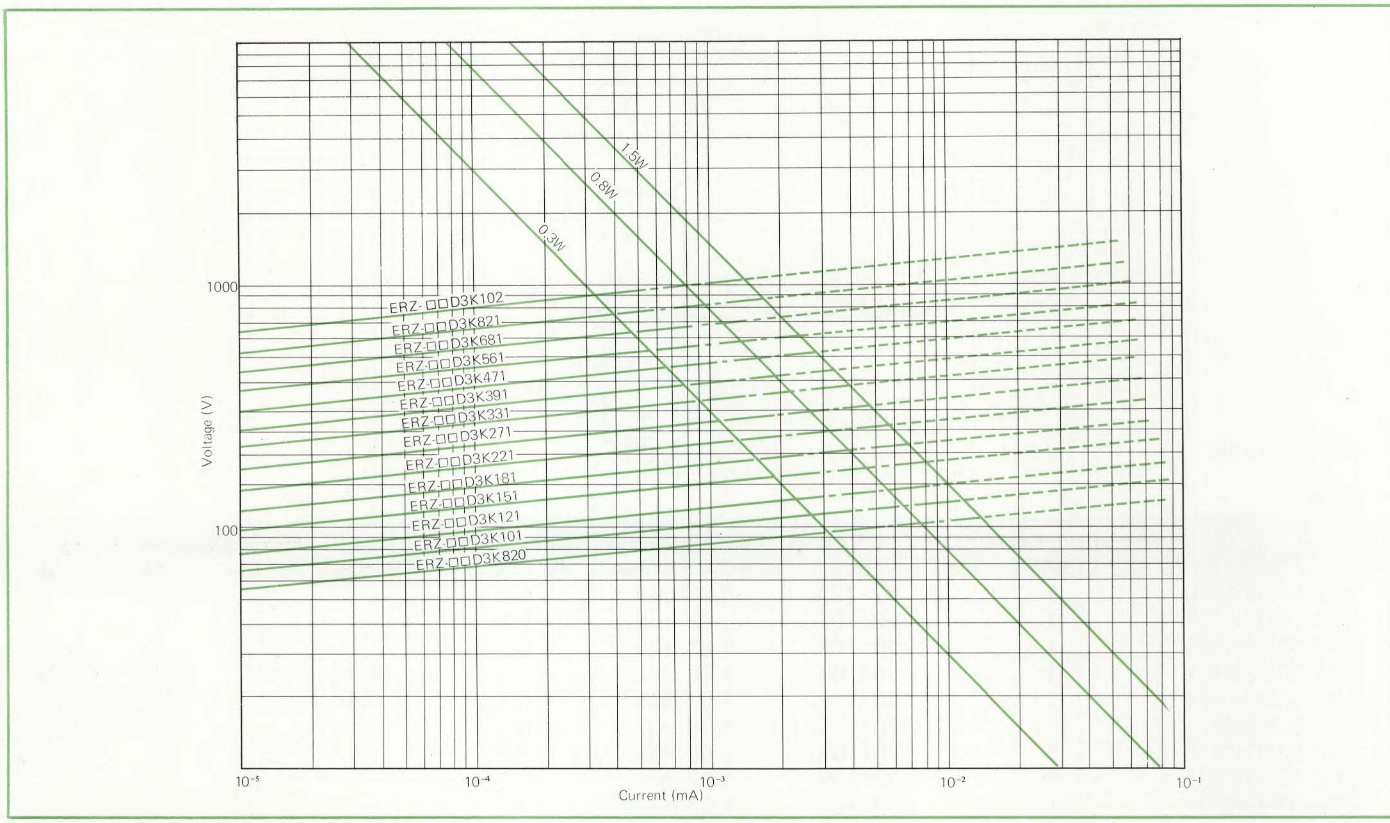
■ 1.5W

Part No.	Measuring Current (mA)	Rated Voltage (V)	Voltage Ratio V10mA/V1mA	Rated Wattage (W.D.C)	Dimensions mm (inch)			
					D max.	T	W	d
ERZ-15D3K101	1	100±10%	1.08 max.	1.5	25.0 (.985)	4±2 (.157 ±.079)	11±2 (.433 ±.079)	0.8ϕ (.031ϕ)
ERZ-15D3K121	1	120±10%	1.08 max.	1.5				
ERZ-15D3K151	1	150±10%	1.08 max.	1.5				
ERZ-15D3K181	1	180±10%	1.08 max.	1.5				
ERZ-15D3K221	1	220±10%	1.08 max.	1.5		5±2 (.196 ±.079)		
ERZ-15D3K271	1	270±10%	1.08 max.	1.5				
ERZ-15D3K331	1	330±10%	1.08 max.	1.5				
ERZ-15D3K391	1	390±10%	1.08 max.	1.5				
ERZ-15D3K471	1	470±10%	1.08 max.	1.5				
ERZ-15D3K561	1	560±10%	1.08 max.	1.5				
ERZ-15D3K681	1	680±10%	1.08 max.	1.5				
ERZ-15D3K821	1	820±10%	1.08 max.	1.5				
ERZ-15D3K102	1	1000±10%	1.08 max.	1.5				

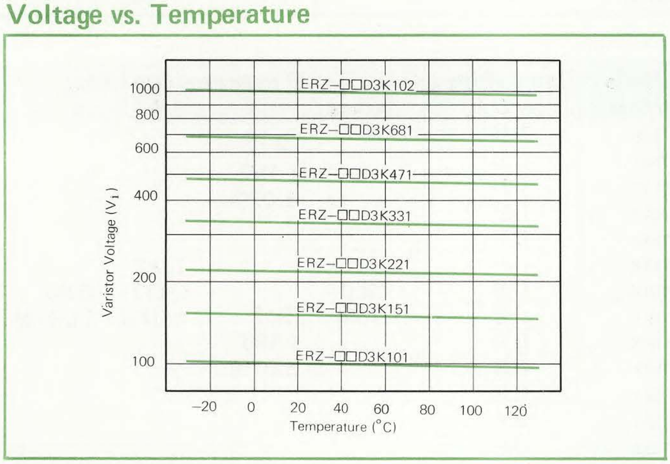
Note: Operating Temperature -25~+70°C

Characteristics Example

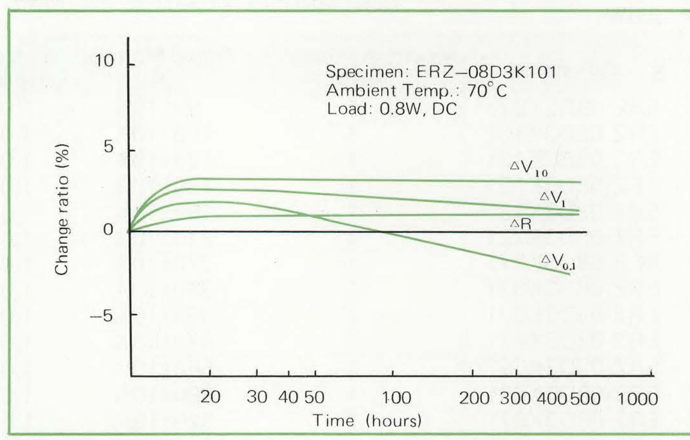
Voltage vs. Current



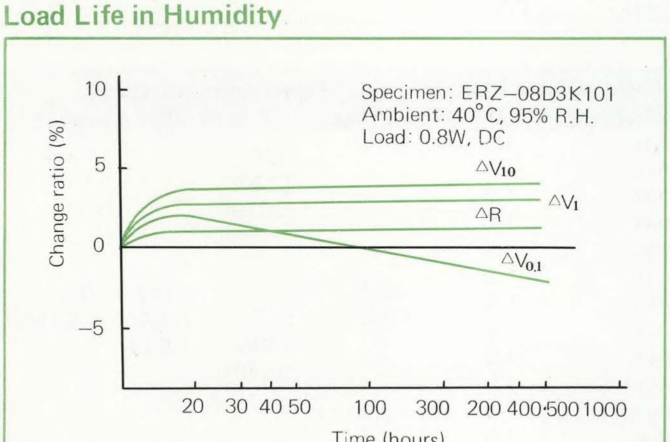
Voltage vs. Temperature



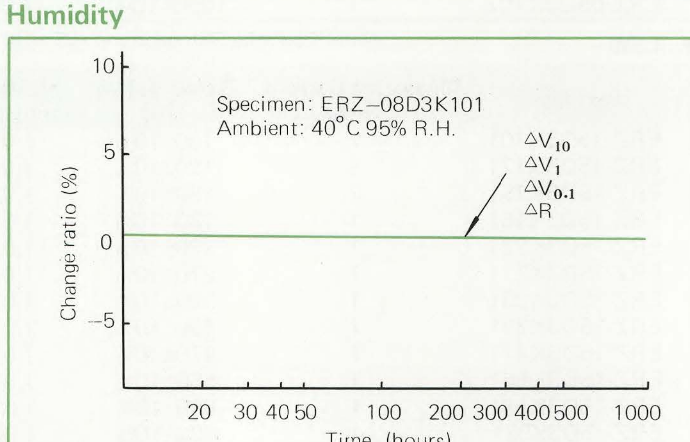
Life



Load Life in Humidity

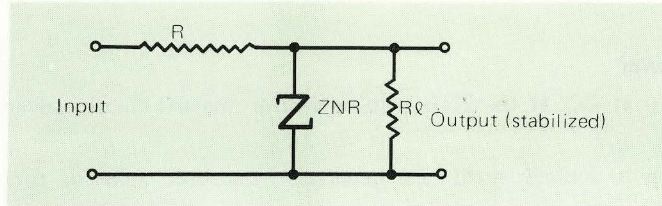


Humidity



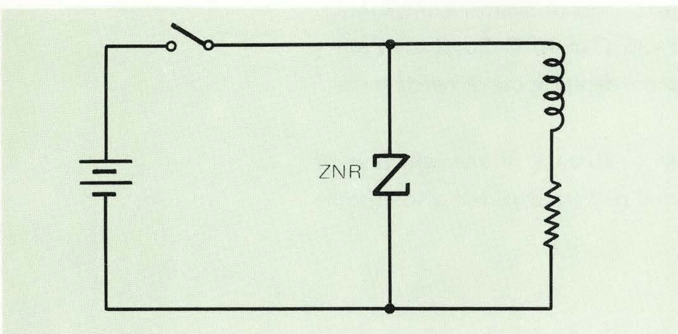
Aplication Examples

1) Voltage Stabilization

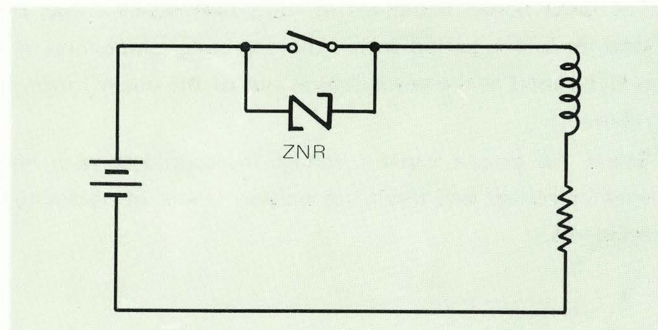


2) Spark Killer for Contact Protection

2)-1 Connection between load

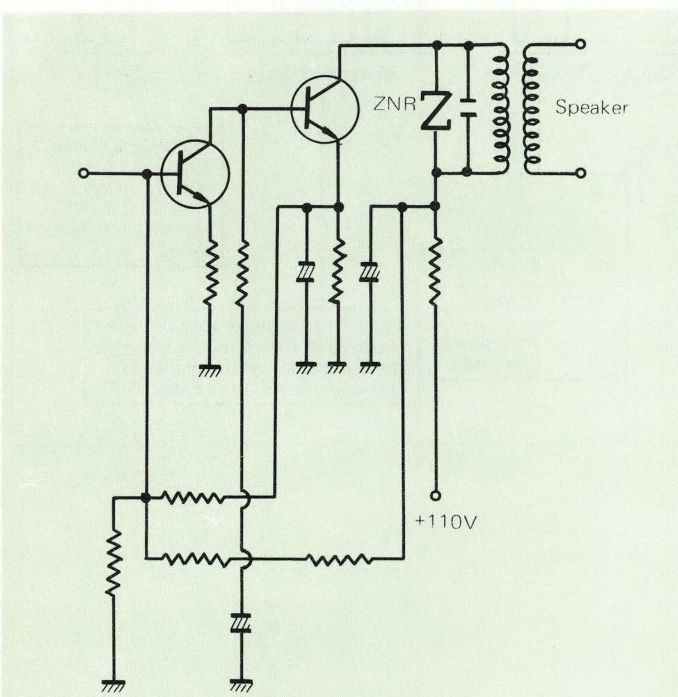


2)-2 Connection between contact points

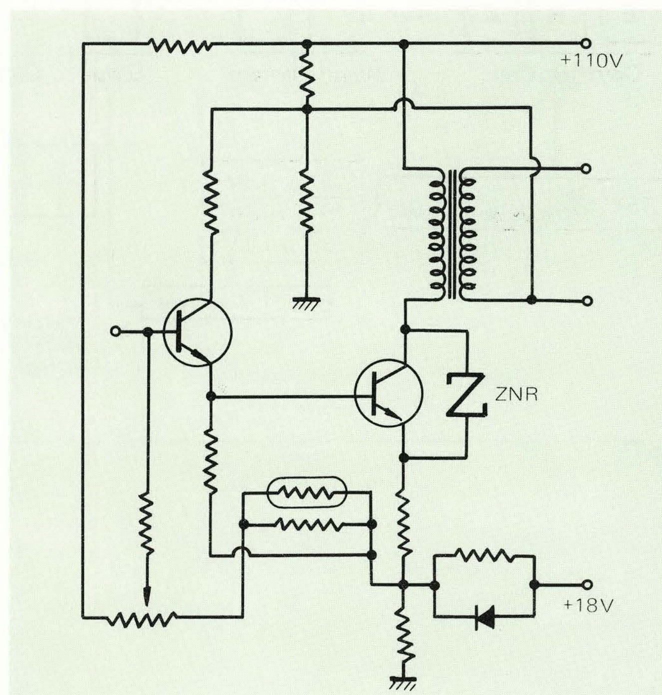


3) Suppression of Surge Voltage

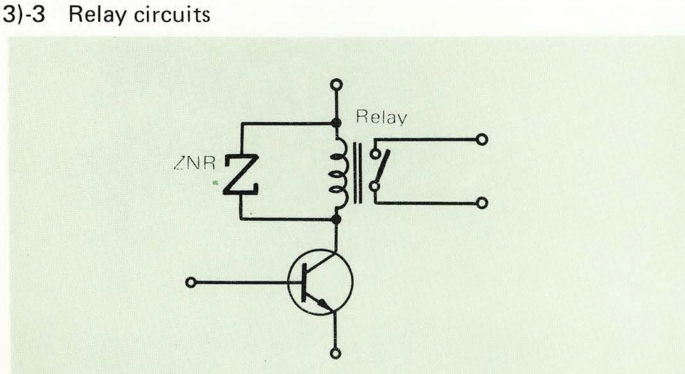
3)-1 Audio frequency circuit with an output transformer which operates by line voltage

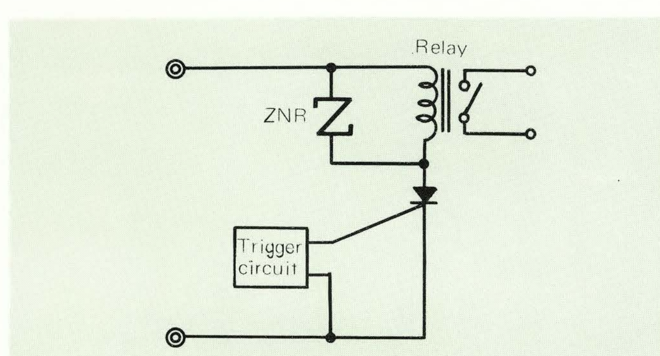


3)-2 Vertical circuit of color TV's



3)-3 Relay circuits





Suggestinos for Handling

Keep the correct rated power

1. The rated power is specified at DC. If the ZNR is to be used in the AC circuit, advance notice to that effect is needed.
2. If the power beyond rating is applied, great heat generation is caused lowering the varistor voltage, which gives rise to overcurrent. As a result, the element temperature rises finally damaging the element.
3. The rated power is defined as the power which shows stable performance against continuous load for a long period within the operating temperature range of -25°C to 70°C. So, if the ZNR is to be used at the temperatures out of the above range, the power derating curve needs to be referred.
4. Select the proper varistor voltage in accordance with nonlinearity. Mistake in the selection of varistor voltage will result not only in failure of obtaining expected performance but also in some accidents.

Part Number Code

E R Z — □□ □ □ □ □□□ □

Common Code

ERZ	ZNR (Zinc Oxide Varistor)

Rated Wattage

03	0.3W
08	0.8W
15	1.5W

Shape

D	Disc type

Current Value

2	10mA
3	1mA

Measuring current value for varistor voltage

Tolerance

J	±5%
K	±10%
L	±15%
M	±20%
S	otherwise specified

Voltage Value

The first two digits are significant figures and the third one denotes the number of zeros following. Decimal point is expressed by R.

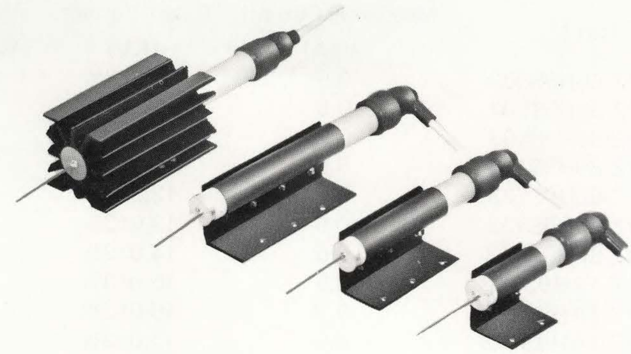
Suffix

Alphabets A to Z, signifying special specifications apart from shape and electrical characteristics.

Stacked Type

Features

- Quick response and sharp knee with voltage nonlinearity coefficient α 50
- Wide varistor voltage from 8kV to 26kV with closed tolerance of ±3%
- Uncomparable high power available (ex. ERZ-1DH9S253 permits 20W continuous application at 60°C)

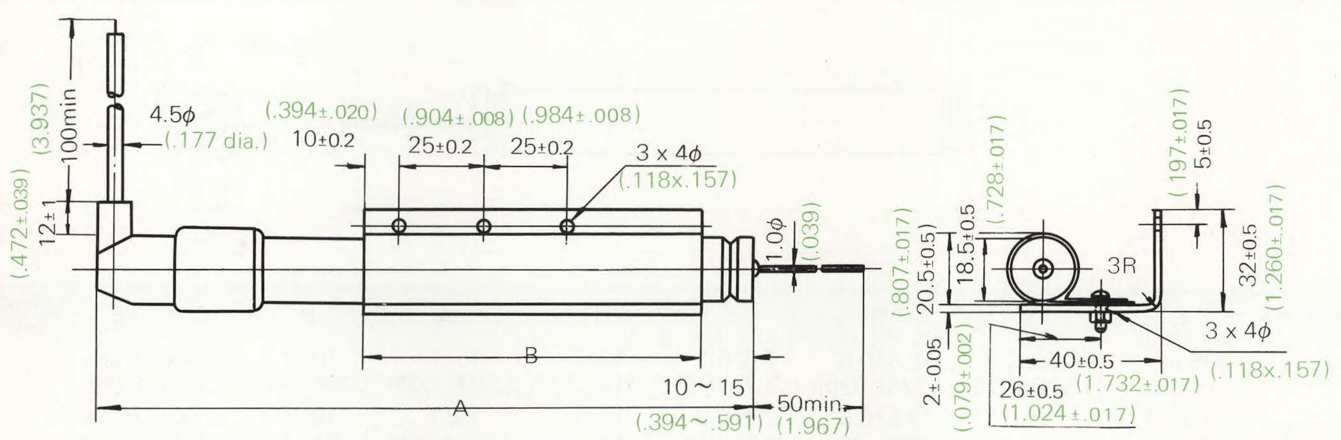


Application

- Stabilization of high voltage circuitries of picture tube of consumer and industrial televisions

Dimensions (Type A)

Unit: mm(inch)



Specifications

- **2W type**

Part No.	Measuring Current (mA)	Rated Voltage (KV)	Voltage Ratio $V_{0.1}mA/V_{10}\mu A$	Rated Wattage (W.D.C.)	Shape	Dimensions mm (inch) A max.	Dimensions mm (inch) B
ERZ-20H4K702	0.1	7.0±10%	1.08 max.	2.0	A	110 (.433)	40±1 (1.575±.039)
ERZ-20H4K802	0.1	8.0±10%	1.08 max.	2.0			
ERZ-20H4K902	0.1	9.0±10%	1.08 max.	2.0			
ERZ-20H4K103	0.1	10.0±10%	1.08 max.	2.0			
ERZ-20H4K113	0.1	11.0±10%	1.08 max.	2.0			
ERZ-20H4K123	0.1	12.0±10%	1.08 max.	2.0			
ERZ-20H4K133	0.1	13.0±10%	1.08 max.	2.0			
ERZ-20H4K143	0.1	14.0±10%	1.08 max.	2.0			

1. Operating Temperature: -25~+60°C

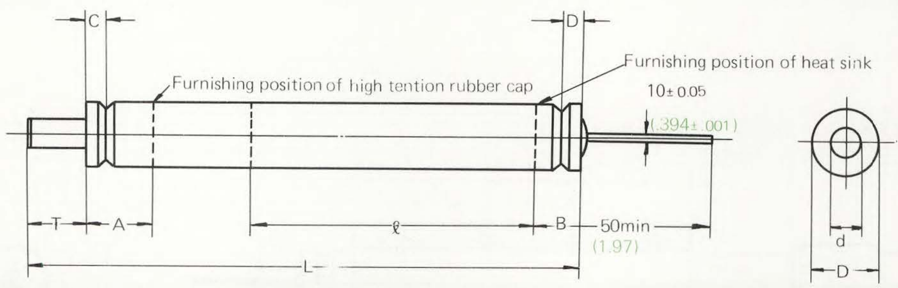
▪ 6~10W Type

Part No.	Measuring Current (mA)	Rated Voltage (KV)	Voltage Ratio $V_{0.5mA}/V_{50\mu A}$	*Rated Wattage (W.D.C.)	Shape	Dimensions mm(inch)	
						A max.	B
ERZ-60H9S802	0.5	8.0±3%	1.08 max	6.0	A	110 (4.331)	40±1 (1.575±.039)
ERZ-60H9S902	0.5	9.0±3%	1.08 max	6.0			
ERZ-80H9S103	0.5	10.0±3%	1.08 max	8.0		150 (5.906)	70±1 (2.756±.039)
ERZ-80H9S113	0.5	11.0±3%	1.08 max	8.0			
ERZ-80H9S123	0.5	12.0±3%	1.08 max	8.0			
ERZ-80H9S133	0.5	13.0±3%	1.08 max	8.0			
ERZ-80H9S143	0.5	14.0±3%	1.08 max	8.0			
ERZ-1AH9S153	0.5	15.0±3%	1.08 max	10.0		190 (7.480)	100±1 (3.937±.039)
ERZ-1AH9S163	0.5	16.0±3%	1.08 max	10.0			
ERZ-1AH9S173	0.5	17.0±3%	1.08 max	10.0			
ERZ-1AH9S183	0.5	18.0±3%	1.08 max	10.0			

1. Operating Temperature: -25~+60°C
2. The rated wattage values are specified under the condition that a heat sink is equipped within the operating temperature range.

Dimensions

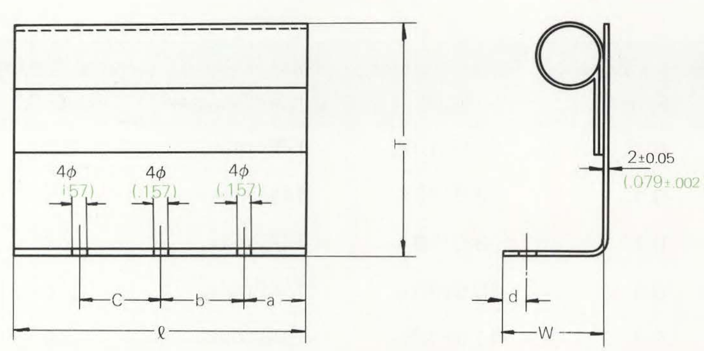
Unit: mm (inch)



Part No.	L	ℓ	D	d	T	A	B	C	E	Heat Sink
ERZ-20H~	95max (3.740)	40±0.5 (1.575±.020)	18.5±0.5 (.728±.020)	7.8±0.3 (.307±.012)	13±1 (.512±.039)	15±1 (.591±.039)	10±2 (.394±.079)	7max. (.276)	7max. (.276)	A
ERZ-60H~	95max. (3.740)	40±0.5 (1.575±.020)	18.5±0.5 (.728±.020)	7.8±0.3 (.307±.012)	13±1 (.512±.039)	15±1 (.591±.039)	10±2 (.394±.079)	7max. (.276)	7max. (.276)	A
ERZ-80H~	135max. (5.315)	70±1.0 (2.756±.039)	18.5±0.5 (.728±.020)	7.8±0.3 (.307±.012)	13±1 (.512±.039)	15±1 (.591±.039)	10±2 (.394±.079)	7max. (.276)	7max. (.276)	B
ERZ-1AH~	175max. (6.890)	100±1.0 (3.937±.039)	18.5±0.5 (.728±.020)	7.8±0.3 (.307±.012)	13±1 (.512±.039)	15±1 (.591±.039)	10±2 (.394±.079)	7max. (.276)	7max. (.276)	C

Heat Sink Specifications

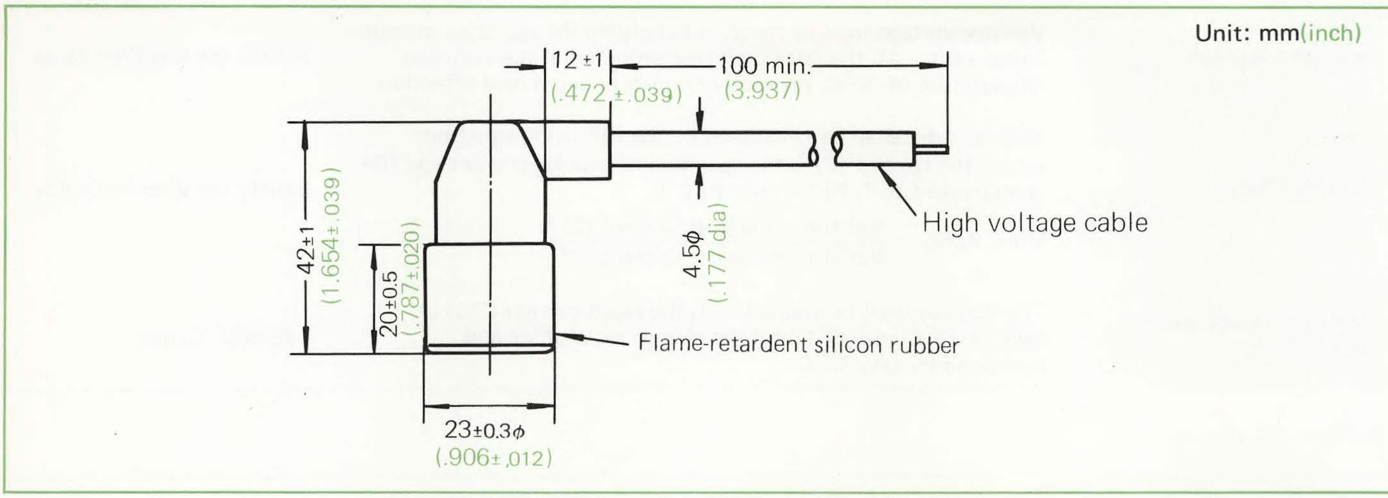
Unit: mm (inch)



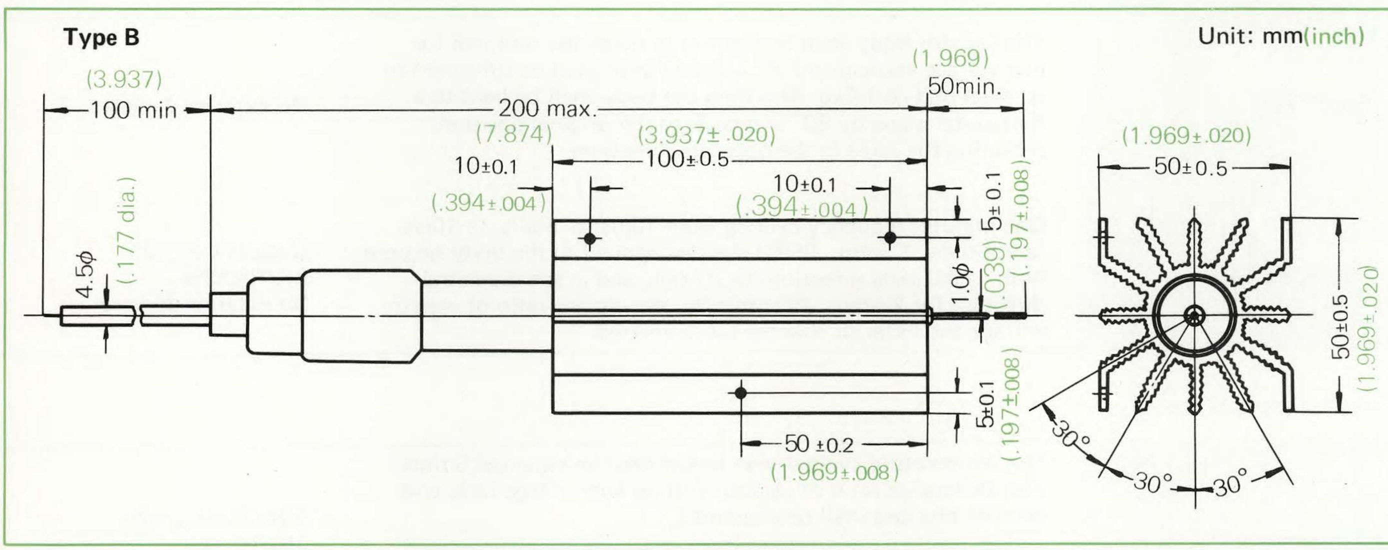
Heat Sink	ℓ	T	W	a	b	c	d	material
A	40±0.5 (1.575±.020)	40±1 (1.575±.039)	32±1 (1.260±.039)	7.5±0.5 (.295±.020)	25±0.5 (.984±.020)	—	5±0.5 (.197±.020)	Aluminum surfaced with alumite (black)
B	70±1 (2.756±.039)	40±1 (1.575±.039)	32±1 (1.260±.039)	10±0.5 (.394±.020)	25±0.5 (.984±.020)	25±0.5 (.984±.020)	5±0.5 (.197±.020)	
C	100±1 (3.937±.020)	40±1 (1.575±.039)	32±1 (1.260±.039)	25±0.5 (.984±.020)	25±0.5 (.984±.020)	25±0.5 (.984±.020)	5±0.5 (.197±.020)	

High Tention Rubber Cap (Dimensions)

■ **For 2W, 6W, 8W and 10W Type**



Dimensions



Specifications

■ **20W Type**

Part No.	Measuring Current (mA)	Rated Voltage (KV)	Voltage Ratio $V_{0.5mA}/V_{50\mu A}$	Rated Wattage (W.D.C)	Shape
ERZ-1DH9S193	0.5	19.0±3%	1.08 max	20.0	B
ERZ-1DH9S203	0.5	20.0±3%	1.08 max	20.0	
ERZ-1DH9S213	0.5	21.0±3%	1.08 max	20.0	
ERZ-1DH9S223	0.5	22.0±3%	1.08 max	20.0	
ERZ-1DH9S233	0.5	23.0±3%	1.08 max	20.0	
ERZ-1DH9S243	0.5	24.0±3%	1.08 max	20.0	
ERZ-1DH9S253	0.5	25.0±3%	1.08 max	20.0	
ERZ-1DH9S263	0.5	26.0±3%	1.08 max	20.0	

1. Operating Temperature: -25~+60°C

Ratings

Electrical Ratings

Varistor Voltage	Varistor voltage shall be measured applying the specified measuring current. All the tests shall be conducted at the standard temperature of 20°C, promptly enough to avoid heat affection.	Satisfy the specified value
Voltage Ratio	Voltage ratio shall be calculated by the following equation, where the current (C) is the specified measuring current and (D) is equivalent to 1/10 the current (C). $\text{Volt. Ratio} = \dfrac{\text{Varistor voltage at Current (C)}}{\text{Varistor voltage at Current (D)}}$	Satisfy the specified value
Voltage Temperature Coefficient	The varistor shall be applied with the rated current (DC) at each of 20°C and 70°C and the change ratio of Vc and expressed by $\Delta Vc\%/^\circ C$.	$-0.05\%/^\circ C$ max.

Mechanical Ratings

Pull Test	The varistor body shall be secured and the leads shall be subjected to a pull of 2.5kg for 5 seconds.	No exterior damage
Bent Test	The varistor body shall be secured to make the terminal for low voltage vertical and the terminal lead shall be subjected to an axial pull of 1.0kg. And then the body shall be bent to a horizontal plane by 90° and back to the original position, repeating the same in the opposite direction.	No exterior damage
Vibration Test	One minute frequency cycling from 10c/s to 55c/s to 10c/s (amplitude: 1.5mm, .059") shall be applied to the body secured both in the axial direction for 2 hours and in the diametral direction for 2 hours. Accordingly, the change ratio of varistor voltage and exterior changes are examined.	$\Delta V_{0.5}/V_{0.5} \leqq \pm 3\%$ $\Delta R/R \leqq \pm 3\%$ No exterior damage

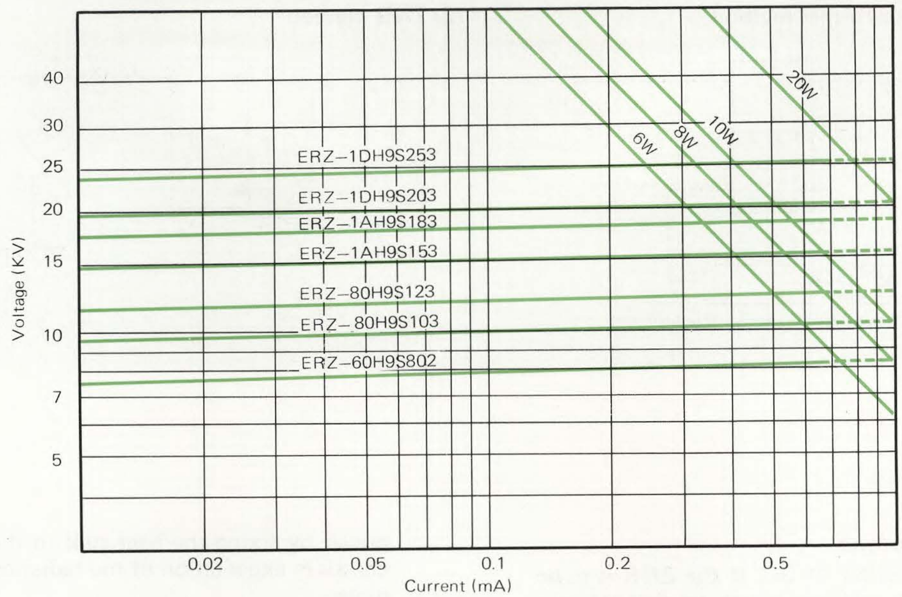
Environmental Ratings

Temperature Cycling	The temperature cycle shown below shall be repeated 5 times and the change ratio of varistor voltage and voltage ratio and exterior changes shall be examined. (see table below)	$\Delta V_{0.5}/V_{0.5} \leqq \pm 3\%$ $\Delta R/R \leqq \pm 3\%$ No exterior damage
Low Temperature Test	The varistor shall be left at an ambient of −25°C for 500 hours and the change ratio of varistor voltage and voltage ratio and exterior changes shall be examined.	$\Delta V_{0.5}/V_{0.5} \leqq \pm 3\%$ $\Delta R/R \leqq \pm 3\%$ No exterior damage
High Temperature Durability	The varistor shall be left at an ambient of 125°C for 500 hours and the change ratio of varistor voltage and voltage ratio and exterior changes shall be examined.	$\Delta V_{0.5}/V_{0.5} \leqq \pm 3\%$ $\Delta R/R \leqq \pm 3\%$ No exterior damage
Humidity Test	The varistor shall be left at an ambinet of 40°C, 90~95%RH for 500 hours and the change ratio of varistor voltage and voltage ratio and exterior changes are examined.	$\Delta V_{0.5}/V_{0.5} \leqq \pm 3\%$ $\Delta R/R \leqq \pm 3\%$ No exterior damage
Life	The varistor shall be applied with the rated wattage at a temperature of 60°C for 500 hours and the change ratio of varistor voltage and voltage ratio shall be measured.	$\Delta V_{0.5}/V_{0.5} \leqq \pm 3\%$ $\Delta R/R \leqq \pm 3\%$

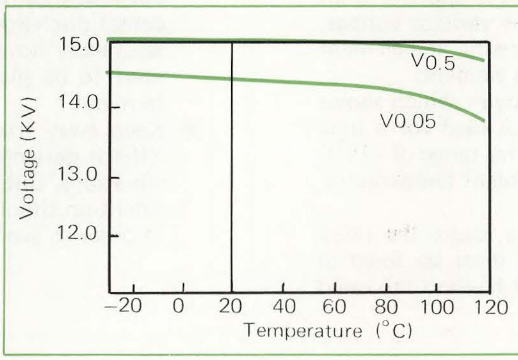
Step	Temperature	Time (minu.)
1	125°C ±3°C	60
2	room ambient	10 to 15
3	−25°C ± 3°C	60
4	room ambient	10 to 15

Characteristic Examples

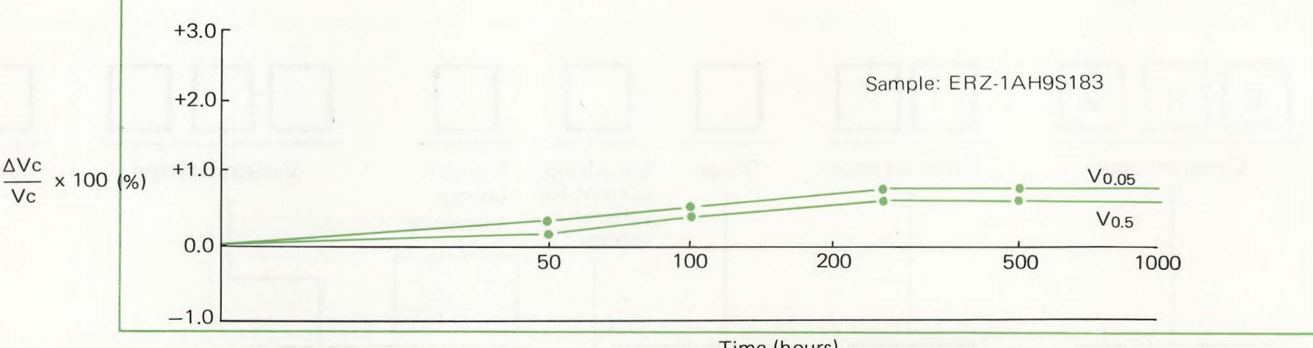
Voltage vs. Current



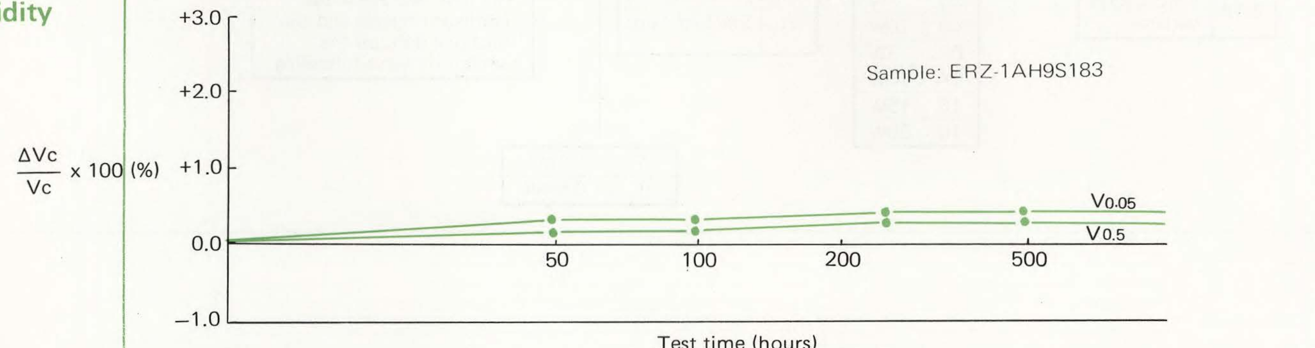
Voltage vs. Temperature



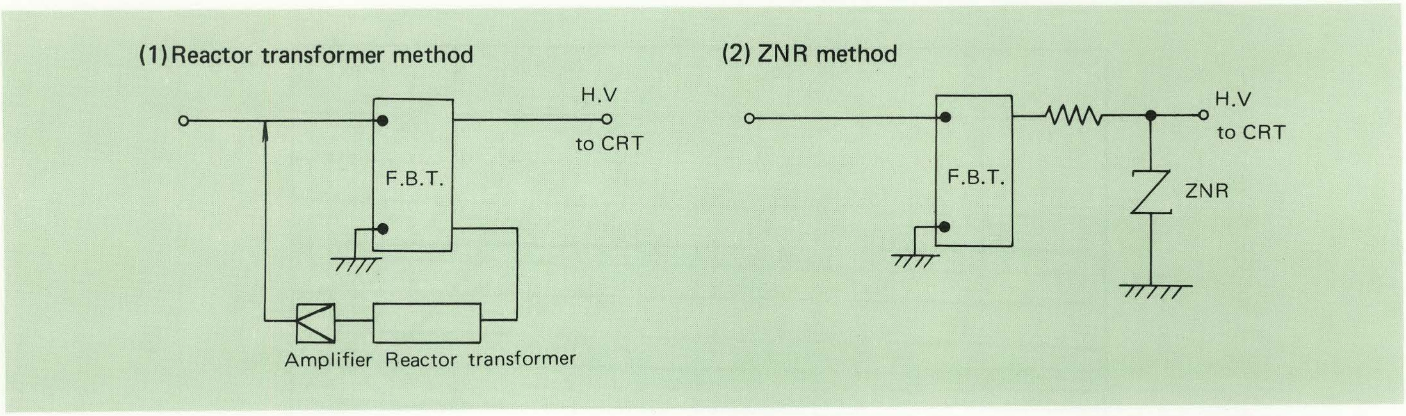
Life



Humidity



Application Example



Suggestions for Handling

- Keep the correct rated power.

1. The rated power is specified at DC. If the ZNR is to be used in the AC circuit, advance notice to that effect is needed.
2. If the power exceeding the rated value is applied, great heat generation is caused lowering the varistor voltage, which gives rise to overcurrent. As a result, the element temperature rises, finally damaging the element.
3. The rated power is defined as the power which shows stable performance against continuous load for a long period within the operating temperature range of -25°C to 60°C. So, care must be taken to ambient tempeeraute.

- Fix the heat sink in correct manner.
  Since a heat sink is indispensable to assure the rated power application, the required type must be fixed in correct manner. Avoid using the ZNR beyond the rated power by fixing the heat sink to the metal part such as chassis in expectation of the radiation effect of the metal plate.
- Pay much attention to high voltage.
  Sufficient consideration should be given to avoid accidental discharge at the high voltage terminal. For safety assurance, however, the chassis and other components need to be placed at least 30mm off the high voltage terminal.
- Keep away from shocks and vibrations
  ZNR is designed to endure a certain grade of shocks and vibrations. But as ZNR is encapsulated in a ceramic tube attention should be paid to direct shocks and vibrations in order to avoid unexpected accidents.

Part Number Code

E	R	Z	□	□	□	□	□	□	□	□	□
Common code			Rated wattage		Shape	Measuring current for varistor voltage	Varistor voltage tolerance	Varistor voltage			Suffix

Common code

ERZ	Zinc Oxide varistor

Rated wattage

20	2W
60	6W
80	8W
1A	10W
1C	15W
1D	20W

Shape

H	Stacked Type

Measuring current for varistor voltage

4	0.1mA
9	0.5mA

Varistor voltage tolerance

S	±3%
J	±5%
K	±10%

Varistor voltage

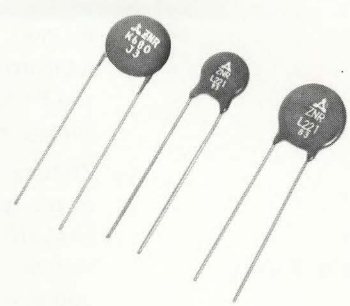
The first two digits are significant figures and the third one denotes the number of zeros following.

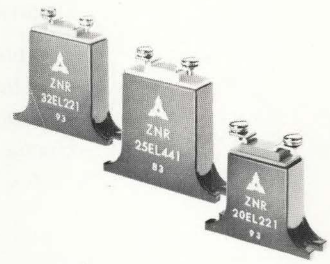
"ZNR" SURGE ABSORBERS

Types D, E and P

Features

- Large withstand surge current (500A~20kA)
- Excellent in residual voltage ratio
- Quick response to surge with steep rise
- No follow current
- Symmetrical V-I characteristics
- Any voltage rating within a V_{1mA} range from 33V to 1kV available (V_{1mA}: varistor voltage)
- Type P equipped with an indicator facilitates maintenance.





Application

- Protection of semiconductive elements such as diodes, transistors, thyristors, triacs
- Protection of various kinds of consumer equipment
- Protection of broadcasting equipment
- Protection of traffic and railway signal system equipment
- Protection of communication, measuring, control equipment
- Protection of low voltage switchboards
- Protection of various kinds of automatic control equipment for power distribution line
- Switching surge suppression of relays
- Protection of water system from lightning surge

Ratings

Electrical Ratings

Item	Test Method	Rated Values
Varistor Voltage	The varistor voltage (V_{1mA}) is the voltage measured between the both terminals of ZNR applying a d.c. current of 1mA. Measurement should be conducted promptly enough to avoid heat affection.	To meet the specified value
Withstand Surge Capability	V_1 change ratio is measured after the specified impulse shall be applied 2 times at intervals of 5 minutes.	$\Delta V_{1mA}/V_{1mA} \leqq \pm 10\%$
Surge Life	V_1 change ratio is measured after the specified impulse shall be applied 10,000 times at intervals of 10 seconds. Impulse: $V_1 \leqq 68V$ .... 2msec, 5A $V_1 \geqq 82V$ 8x20μsec, 100A	$\Delta V_{1mA}/V_{1mA} \leqq \pm 10\%$
Residual Voltage Ratio (Rc)	Impulse: 8x20μsec, 10A($V_{1mA} \leqq 68V$) or 100A($V_{1mA} \geqq 82V$) Residual voltage ratio (Rc) is expressed by the ratio between a voltage when the above current is applied and a voltage when 1mA d.c. is applied.	To meet the specified value
Varistor Voltage Temperature Coefficient	Temperature coefficient is V_{1mA} change ratio expressed in %/°C when measured at ambient temperatures of 20°C and 70°C respectively.	-0.05%/°C max.
Withstand Voltage (pertinent to Type E and P)	Withstand voltage test between terminals and metal for mounting are tested under the condition of commercial frequency voltage 2kV a.c. for one minute. (16kV a.c. for High Voltage Surge Absorber)	No damage

Mechanical Ratings

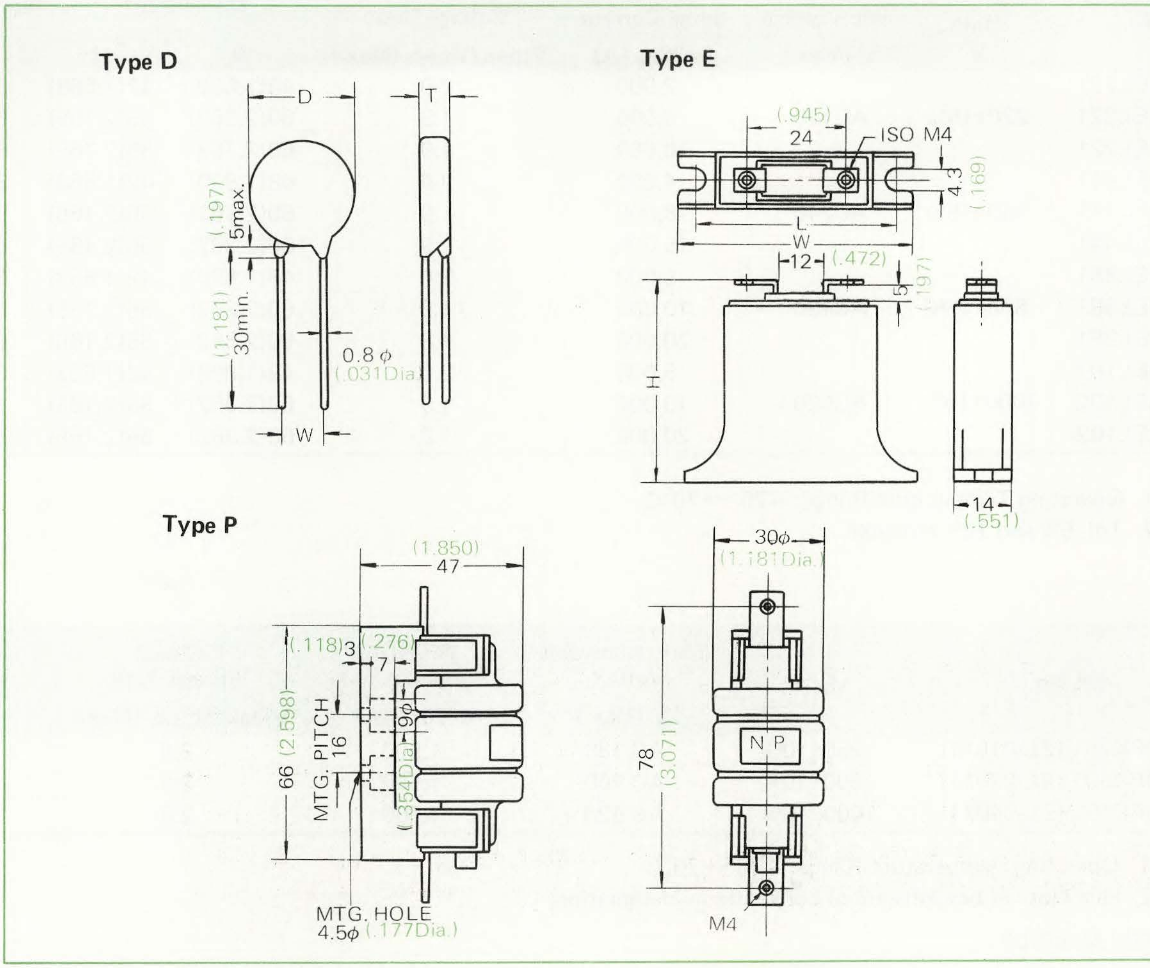
Item	Test Method	Rated Values
Pull Test	A ZNR body shall be secured and the terminals are subjected to the specified weight (Type D: 1kg, Type E and P: 5kg) axially applied for 10 seconds, and exterior damage is examined.	No exterior damage
Bend Test (pertinent to Type D)	ZNR terminals are secured and subjected to an axial pull of the specified weight (0.5kg) and the body is bent to a horizontal position by 90° and returned to the original vertical position. Same bending is conducted in the opposite direction, and then exterior change shall be examined.	No exterior damage
Vibrations	The body is fixed on a vibration plate and the vibration specified below shall be applied in three perpendicular directions for 2 hours respectively, and then exterior change is examined. A vibration: 1 minute cycle (10Hz→55Hz→10Hz) amplitude is 0.75mm (total amplitude: 1.5mm)	No exterior damage
Solderability (pertinent to Type D)	ZNR terminals shall be dipped in a solder of 230±5°C for 2±0.5 seconds. Method details are as per JIS C 5102, 8.4.	All the surface dipped should be covered with solder.
Resistance to Soldering Heat (pertinent to Type D)	ZNR terminals shall be dipped in a solder of 350°±10°C for 3±0.5 seconds up to the point 4mm below from the body. Method details are as per JISC5102, 8.4.	$\Delta V_1 mA/V_1 mA \leqq \pm 10\%$

Environmental Ratings

<table>
<tr><th>Item</th><th colspan="3">Test Method</th><th>Rated Values</th></tr>
<tr><td>High Temperature Storage</td><td colspan="3">After ZNR is subjected to 70°±2°C without load application for 1,000 hours and then to a room ambient for 1 hour min. to 2 hours max., the characteristic change is examined.</td><td>$\Delta_1 mA/V_1 mA \leqq \pm 5\%$</td></tr>
<tr><td>Humidity</td><td colspan="3">After ZNR is subjected to 40°±2°C, 90~95%RH without load application for 1,000 hours and then to a room ambient for 1 hour min. to 2 hours max., the characteristic change is examined.</td><td>$\Delta V_1 mA/V_1 mA \leqq \pm 5\%$</td></tr>
<tr><td rowspan="6">Temperature Cycling</td><td colspan="3">After the temperature cycling shown below is repeated 5 times and then the sample is subjected to a room ambient for 1 hour min. to 2 hours max., the characteristic change shall be measured.</td><td rowspan="6">$\Delta V_1 mA/V_1 mA \leqq \pm 5\%$</td></tr>
<tr><th>Step</th><th>Temperature (°C)</th><th>Time (minutes)</th></tr>
<tr><td>1</td><td>-25^{+0}_{-3}</td><td>30</td></tr>
<tr><td>2</td><td>room ambient</td><td>10~15</td></tr>
<tr><td>3</td><td>$+85^{+2}_{-0}$</td><td>30</td></tr>
<tr><td>4</td><td>room ambient</td><td>10~15</td></tr>
</table>

Dimensions

Unit: mm (inch)



Specifications

■ Type D

Part No.	V_{1mA} (V)	Max. Allowable Voltage V (max.)	Withstand Surge Current 8x20μs (A)	Residual Voltage Ratio V100A/V1mA (max.)	Dimensions mm(inch) D max.	T max.	W
ERZ-B14DK330	33±10%	DC 15	500	* 2.0	18(.709)	7(.276)	11(.433)
ERZ-B14DK390	39±10%	DC 20	500	* 2.0			
ERZ-B14DK470	47±10%	DC 24	500	* 2.0			
ERZ-B14DK560	56±10%	DC 28	500	* 2.0			
ERZ-B14DK680	68±10%	DC 35	500	* 2.0			
ERZ-A10DL820	82±15%	AC 40	500	2.5	13(.512)	5(.197)	8(.315)
ERZ-A10DL101	100±15%	AC 50	500	2.5		8(.315)	
ERZ-A10DL221	220±15%	AC120	500	2.2			
ERZ-A14DL221			1000	2.1	17(.669)		
ERZ-A14DL441	440±15%	AC240	2000	2.1	18(.709)	9(.354)	

Notes)
1. Operating Temperature Range: $-25 \sim +70^{\circ}C$
2. * Residual Volt. Ratio: V_{10A}/V_{1mA}
3. Tolerance 5% and 10% available
4. Other values at V_{1mA} ($V_{1mA} > 33V$) available

■ Type E

Part No.	V_{1mA} V	Max. Allowable Voltage V (Max.)	Withstand Surge Current 8x20μs (A)	Residual Voltage Ratio V_{100A}/V_{1mA} (Max.)	Dimensions mm (inch) W	H	L
ERZ-A20EL221	220±15%	AC120	2,000	2.0	48(1.890)	42(1.653)	39(1.535)
ERZ-A25EL221			5,000	1.9	60(2.362)	55(2.165)	51(1.969)
ERZ-A32EL221			10,000	1.9	60(2.362)	55(2.165)	51(1.969)
ERZ-A20EL441	440±15%	AC240	4,000	2.0	48(1.890)	42(1.653)	39(1.535)
ERZ-A25EL441			8,000	1.9	60(2.362)	55(2.165)	51(1.969)
ERZ-A32EL441			15,000	1.9	60(2.362)	55(2.165)	51(1.969)
ERZ-A20EL881	880±15%	AC480	5,000	2.0	48(1.890)	42(1.653)	39(1.535)
ERZ-A25EL881			10,000	1.9	60(2.362)	55(2.165)	51(1.969)
ERZ-A32EL881			20,000	1.8	60(2.362)	55(2.165)	51(1.969)
ERZ-A20EL102	1000±15%	AC520	5,000	2.0	48(1.890)	42(1.653)	39(1.535)
ERZ-A25EL102			10,000	1.9	60(2.362)	55(2.165)	51(1.969)
ERZ-A32EL102			20,000	1.8	60(2.362)	55(2.165)	51(1.969)

Notes) 1. Operating Temperature Range: −25 ~+70°C
2. Tol. 5% and 10% available

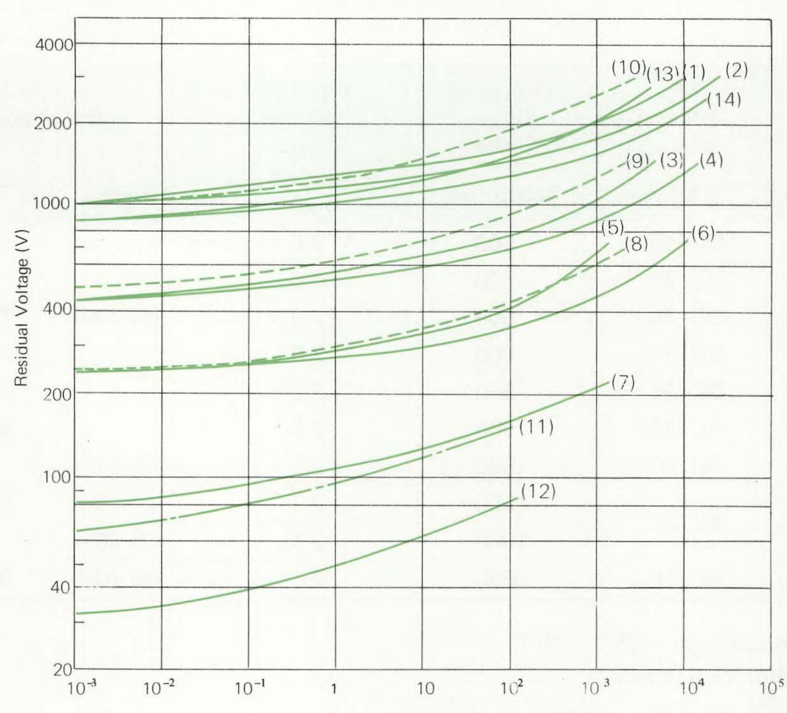
■ Type P

Part No.	V_{1mA} V	Max. Allowable Voltage V (Max.)	Withstand Surge Current 8x20μs (A)	Residual Voltage Ratio V_{100A}/V_{1mA} (Max.)	Others
ERZ-A20PK251 (ZL-01011)	250±10%	AC 130	1,500	2.0	With indicator
ERZ-A20PK501 (ZL-02011)	500±10%	AC 260	1,500	2.0	
ERZ-A20PK102 (ZL-04011)	1000±10%	AC 520	1,500	2.0	

Notes) 1. Operating Temperature Range: −20~+70°C
2. Part Nos. in brackets are of conventional designation.

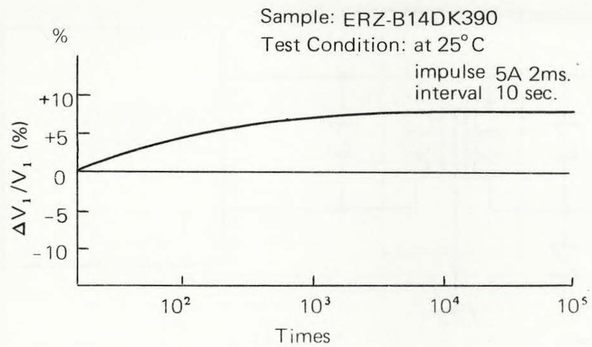
Characteristic Examples

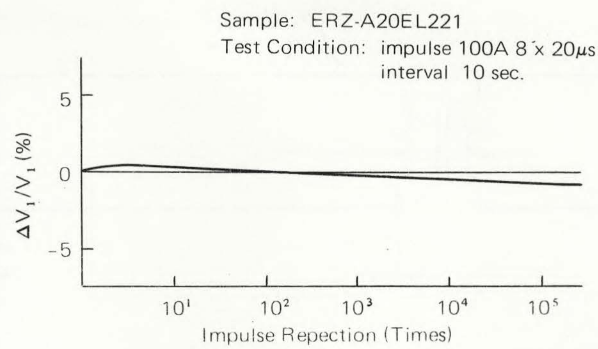
Residual Voltage Characteristics (Typical Values)



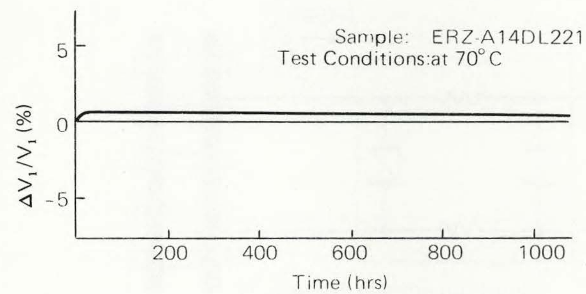
(1) ERZ−A20EL102
(2) ERZ−A32EL102
(3) ERZ−A14DL441
(4) ERZ−A32EL441
(5) ERZ−A10DL221
(6) ERZ−A32EL221
(7) ERZ−A10DL820
(8) ERZ−A20PK251
(9) ERZ−A20PK501
(10) ERZ−A20PK102
(11) ERZ−B14DK680
(12) ERZ−B14DK330
(13) ERZ−A20EL881
(14) ERZ−A32EL881

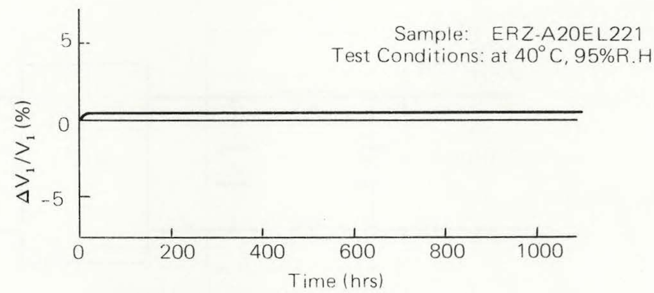
Surge Life





Heat Durability

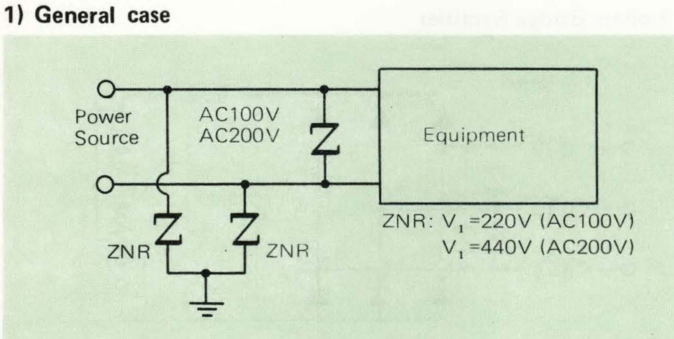




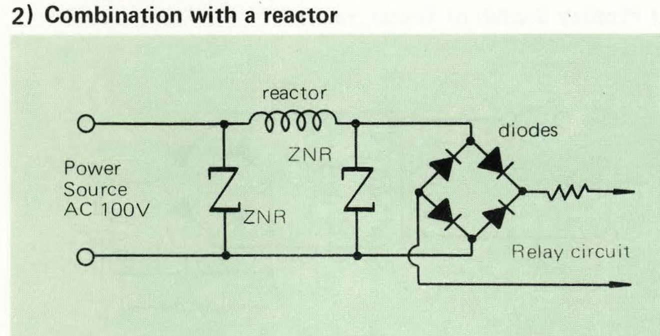
Application Examples

Lightning Surge Suppression

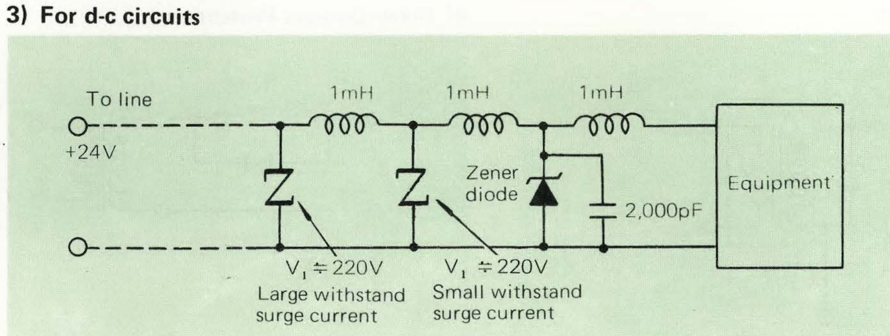
1) General case



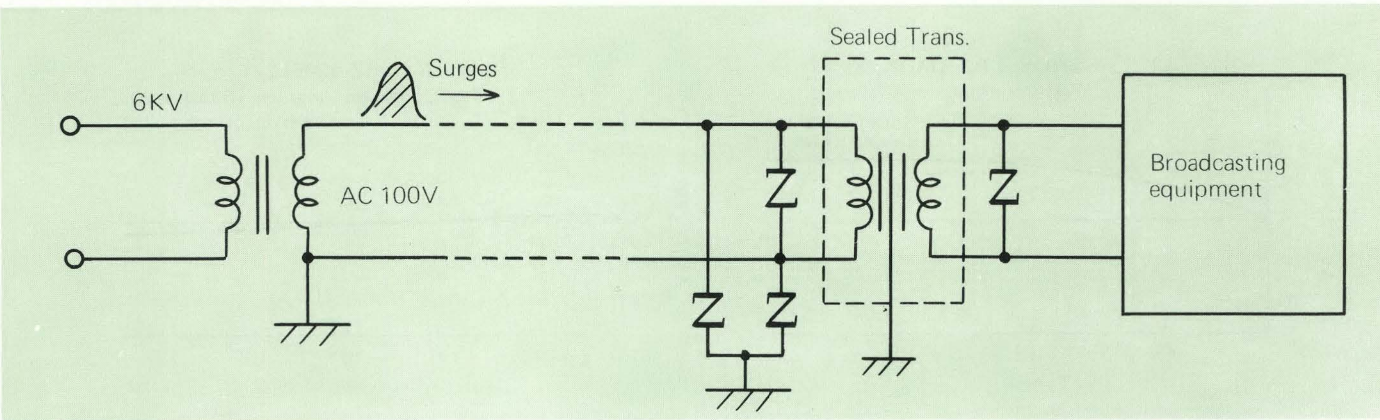
2) Combination with a reactor



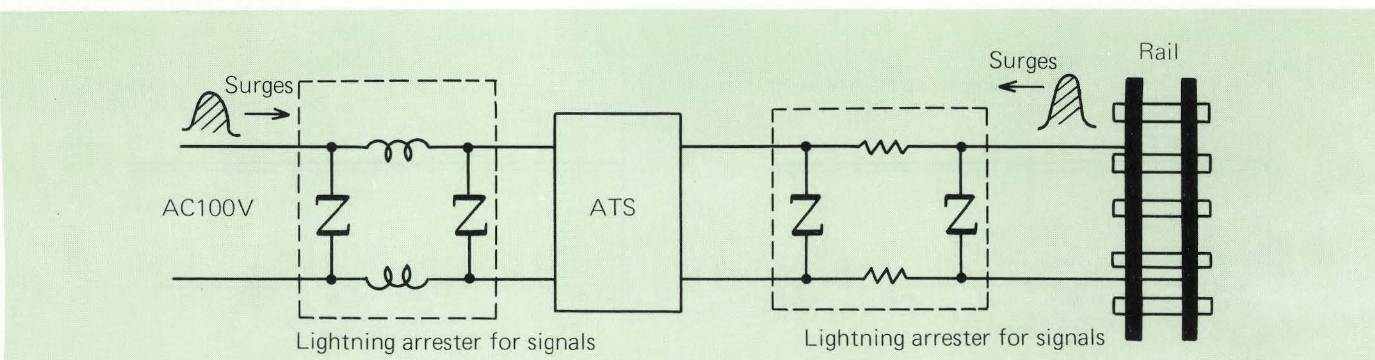
3) For d-c circuits



·4) For broadcasting equipment



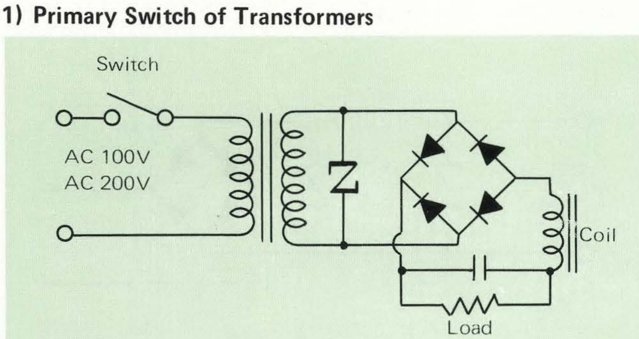
5) For railway signal system



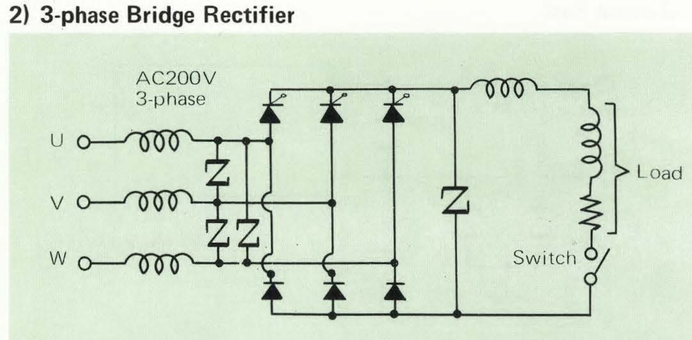
Lightning Surge Protection in combination with R or L.

Switching Surge Suppression

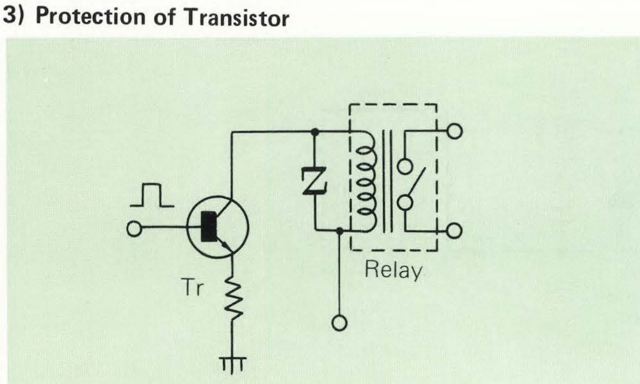
1) Primary Switch of Transformers



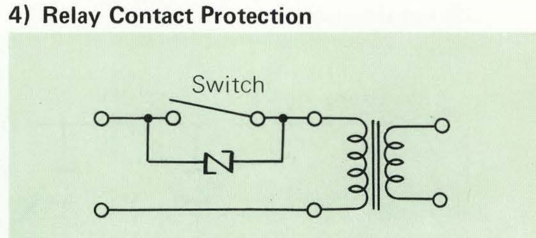
2) 3-phase Bridge Rectifier



3) Protection of Transistor



4) Relay Contact Protection



Application Products

Traffic Lightning Arrester

This device is used as a lightning arrester for traffic signals (ATS, AFO, etc.), with its great surge voltage suppression effect caused by the combination with R or L.

Home Lightning Arrester

This device is used as a protector for various electrical appliances against switching surge and lightning surge induced through the power source. Two types are available, one with the power service entrance and the other connected easily with plug sockets.

High Voltage Surge Absorber

This device is used as the surge suppressor for vacuum switch with its capability of high voltage suppression. (3300V~11,000V a.c.)

Suggestions for Handling

1. Selection of the best suited model

V_{1mA}

V_{1mA} must be decided so that the leakage current can be 1mA or less even when the power source voltage rises by 20% at the most and the characteristics of the unit deteriorate by 10%.

Residual voltage

Residual voltage is decided by the surge current and the residual voltage/current (V-I) characteristics of the unit. Therefore, proper unit must be selected in accordance with the surge current and withstand voltage of the appliances where the unit is to be adopted.

Surge suppression capability

Surge suppression capability must be selected based on the surge energy generated. For example, the surge energy (E) accumulated at inductance load is figured out by the following equation;

$$E = mp/2\pi f$$

p: load (VA)
m: leakage inductance (H)
f: power source frequency (Hz)

Also, surge generation frequency must be taken into consideration.

2. Other cautions

Special conditions

When the insulation resistance test of the appliance, where the unit is adopted, is made, attention must be paid to the relation between megatest voltage and leakage current of the unit so that insulation resistance may not be misjudged. Also when the unit is adopted in the high frequency circuit, heat generation must be avoided taking care of electrostatic capacitance and dielectric loss angle of the unit.

Combination with reactor

In supression of surge voltage generated at the distribution lines, the residual voltage can be lowered by adding another impedance to the surge impedance of the lines.

Part Number Code

E	R	Z	– A(B)	1	0	D	L	2	2	1	
Common Code				Element		Type	Tolerance	V_{1mA}			Suffix

Common Code: ZNR Surge Absorber

Element:

10
14
20
25
32

Type:

D	Disc
E	Molded
P	Encapsulated

Tolerance:

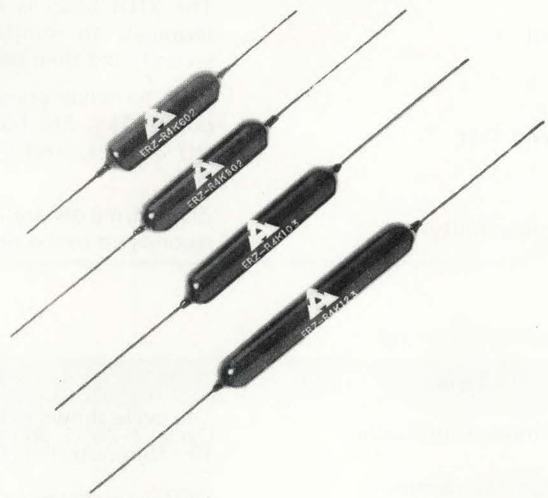
L	±15%
K	±10%
J	±5%

V_{1mA}: The first two digits are significant figures of resistance and the third one denotes number of zeros following.

Type R

Features

- Wide voltage range from 6,000V to 12,000V
- Stable against temperature, humidity changes and load application
- Excellent surge suppression capability

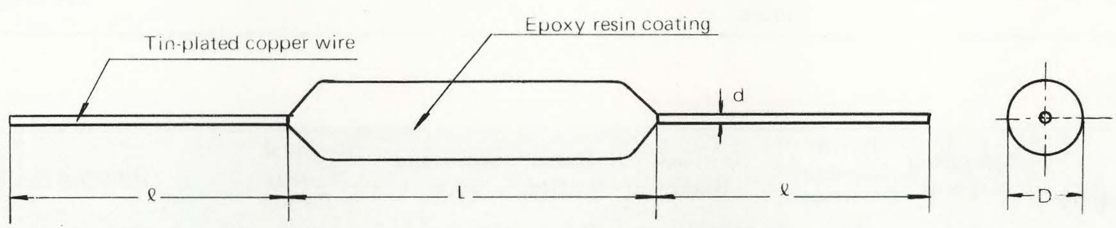


Application

- Stabilization of circuit voltages and protection of circuit components in high voltage circuitries, (e.g., microwave oven)
- Limitation and suppression of voltage and current

Dimensions

Unit: mm(inch)



Ratings

Electrical Ratings

Item	Test Method	Rated Values
Varistor Voltage	Varistor voltage shall be measured applying the specified measuring current (C), and the measurement shall be conducted promptly enough to avoid heat affection. Standard test temperature is 20°C.	To meet the specified value
Voltage Ratio	Voltage Ratio = $\frac{\text{Voltage at current D}}{\text{Voltage at current C}}$ C: specified measuring current D: 10 times as large as C	To meet the specified value
Varistor Voltage Temperature Coefficient	Temperature coefficient is $V_{0.1}$ change ratio expressed in $\Delta V_{0.1}$ %/°C when measured at ambient temperatures of 20°C and 70°C respectively.	-0.05%/°C max.
Withstand Surge Capability	A current of 10A (8x20μsec) is applied twice at intervals of 10 seconds.	$\Delta V_{0.1}/V_{0.1} \leqq \pm 10\%$
Residual Voltage Ratio (Rc)	Rc is equivalent to the ratio between V_{100mA} (measured with a current of 100mA, 8x20μsec) and $V_{0.1mA}$ (measured with a current of 0.1mA)	To satisfy the specified value

Mechanical Ratings

Item	Test Method	Rated Values
Pull Test	The ZNR body is secured in vertical direction and the terminals are subjected to an axial pull of 2 kg for 5 seconds and then the exterior change is examined.	No exterior damage
Bend Test	ZNR terminals are secured and subjected to a static axial pull of 1kg. The body is bent by 90° (vertical⇄horizontal) 3 times. And the exterior change is examined.	No exterior damage
Solderability	ZNR terminals are dipped in a solder of 230°±5°C for 2 seconds up to the point 4mm below the body.	To be covered with new solder

Environmental Ratings

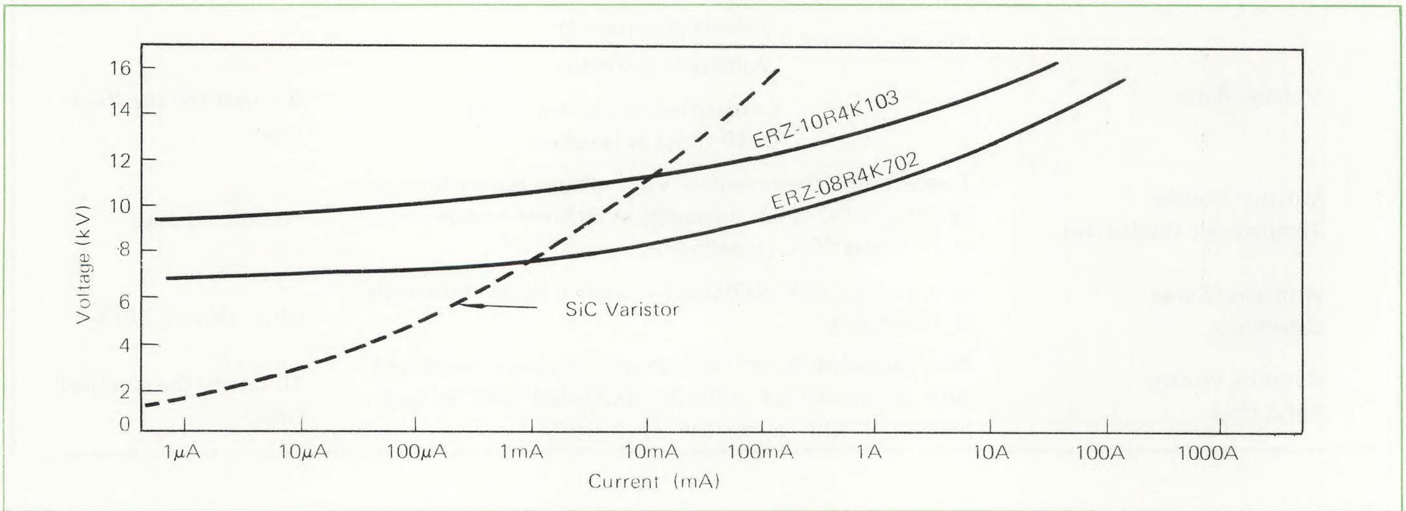
Item	Test Method	Rated Values
Temperature Cycling	The cycle shown below shall be repeated 10 times. Cycle: (-25°C, 30 minutes)→(room ambient, 10~15minutes)→(+85°C, 30 minutes)	$\Delta V_{0.1}/V_{0.1} \leqq \pm 5\%$
High Temperature Storage	ZNR is subjected to an ambient of 125°C for 500 hours.	$\Delta V_{0.1}/V_{0.1} \leqq \pm 5\%$
Humidity Test	ZNR is subjected to an ambient of 40°C, 90~95%RH for 240 hours.	$\Delta V_{0.1}/V_{0.1} \leqq \pm 5\%$
Life	ZNR is applied with the rated power at 70°C for 500 hours.	$\Delta V_{0.1}/V_{0.1} \leqq \pm 10\%$

Specifications

Part Number	Measuring Current (mA)	Rated Varistor Voltage (kV)	Voltage Ratio V_1mA/$V_{0.1}$mA	Rated Wattage W.D.C.	Withstand Surge 8x20μs(A)	Residual Voltage Ratio V_{100}mA/$V_{0.1}$mA	Dimensions mm (inch) L max.	ℓ mim.	Dφ	dφ
ERZ-05R4K602	0.1	6.0±10%	1.06max	0.5	10	1.5max	40(1.58)	20 (.787)	$10.0^{+1.5}_{-0.5}$ (.394 +.059 -.0197)	1.0 +0.1 -0.05 (.039 +.004 -.002)
ERZ-08R4K702	0.1	7.0±10%	1.06max	0.8	10	1.5max	45(1.78)			
ERZ-08R4K802	0.1	8.0±10%	1.06max	0.8	10	1.5max	50(1.97)			
ERZ-10R4K902	0.1	9.0±10%	1.06max	1.0	10	1.5max	55(2.17)	30 (1.181)		
ERZ-10R4K103	0.1	10.0±10%	1.06max	1.0	10	1.5max	60(2.37)			
ERZ-10R4K113	0.1	11.0±10%	1.06max	1.0	10	1.5max	65(2.56)			
ERZ-10R4K123	0.1	12.0±10%	1.06max	1.0	10	1.5max	70(2.76)			

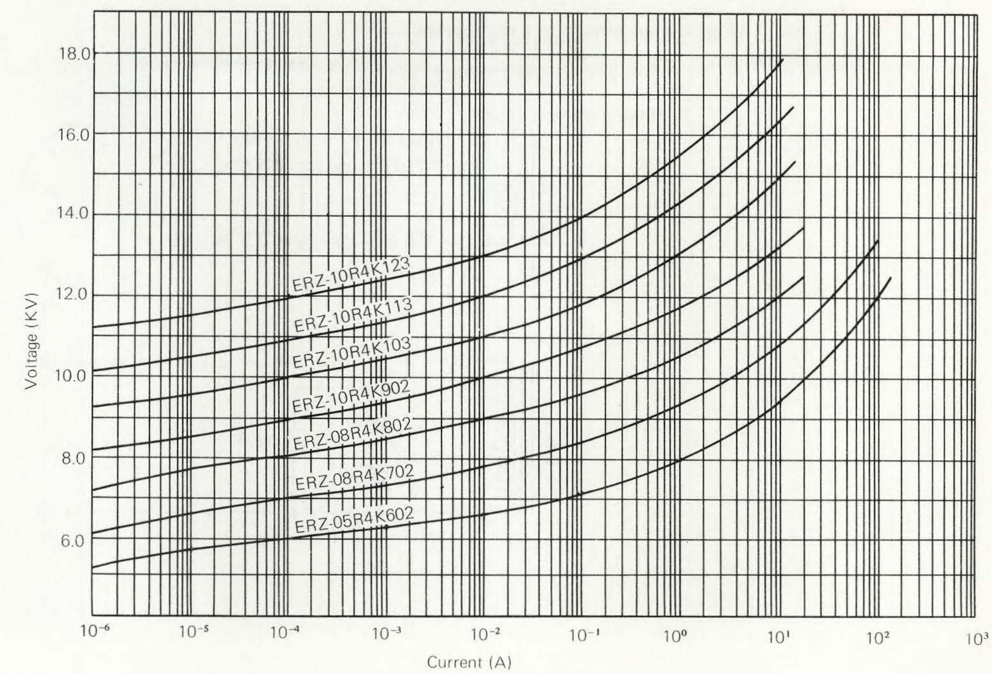
1. Operating Temperature: -25~70°C

Voltage vs. Current

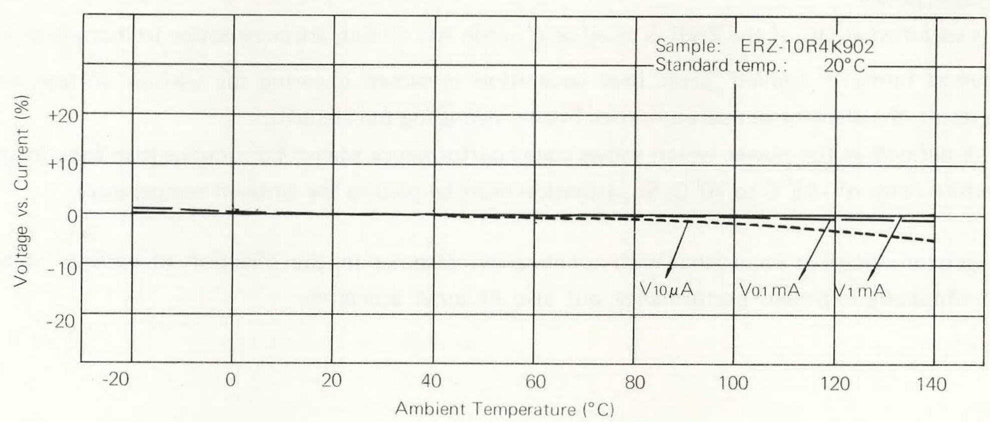


Characteristics Examples

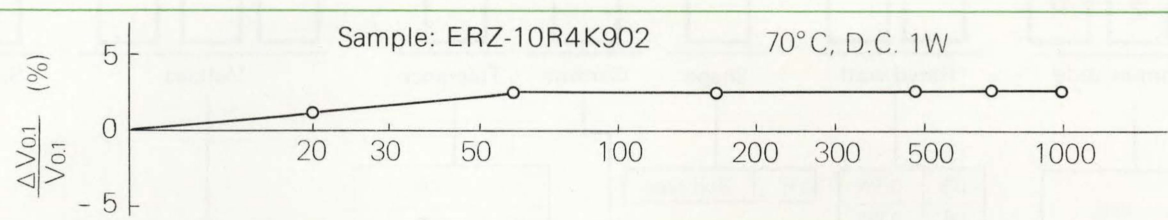
Voltage vs. Current



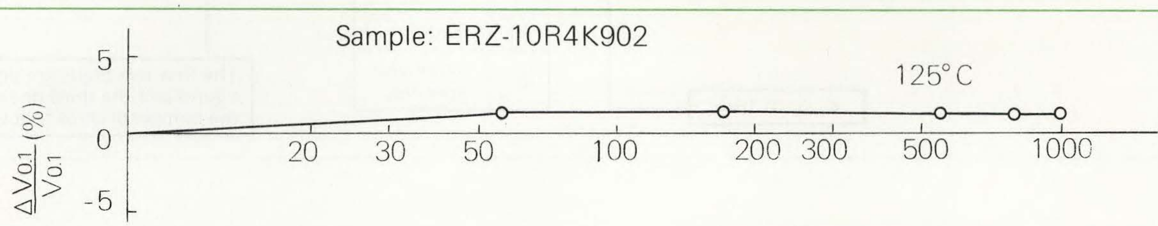
Voltage vs. Temperature

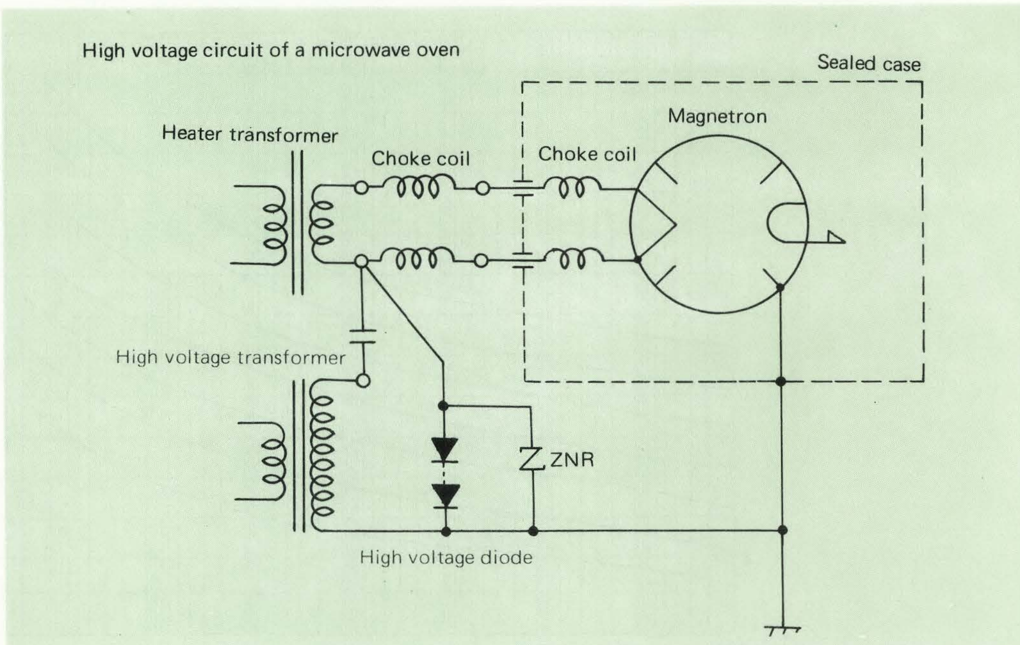


Life



Heat Durability





Suggestions for Handling

- Keep the correct rated power

1. The rated power is specified at DC. If the ZNR is to be used in the AC circuit, advance notice to that effect is needed.
2. If the power beyond rating is applied, great heat generation is caused lowering the varistor voltage, which gives rise to overcurrent. As a result, the element temperature rises finally, damaging the element.
3. The rated power is defined as the power which shows stable performance against continuous load for a long period within the operating temperature range of -25°C to 70°C. So, attention must be paid to the ambient temperautre.

- Select the proper varistor voltage in accordance with nonlinearity. Mistake in the selection of varistor voltage will result not only in failure of obtaining expected performance but also in some accidents.

Part Number Code

E Z R □□ □ □ □ □□□ □

Common code | Rated watt | Shape | Current | Tolerance | Voltage | Suffix

Common code:

ERZ	ZNR

Rated watt:

05	0.5W
08	0.8W
10	1.0W

Shape:

R	Rod type

Current:

4	0.1mA

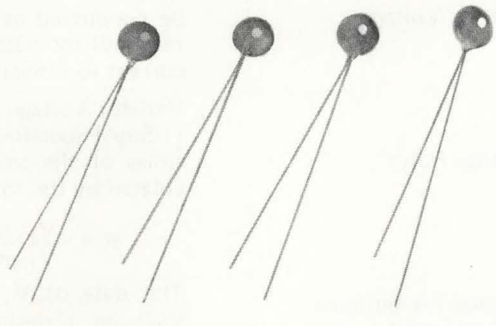
Tolerance:

J	± 5%
K	±10%
L	±15%
M	±20%
S	otherwise specified

Voltage: The first two digits are significant figures and the third one denotes the number of zeros following.

CERAMIC DIODE VARISTORS "VARIATITE"

Type EYV



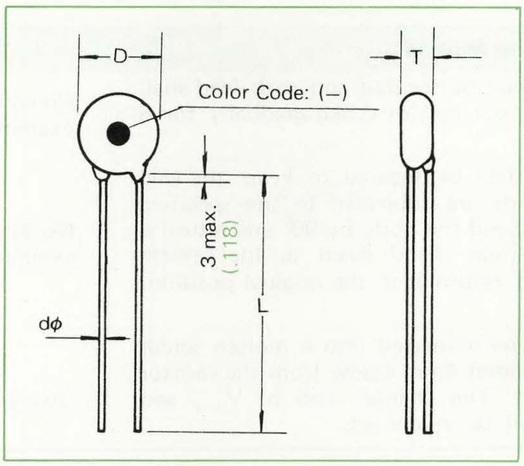
The variatite is an asymmetric voltage dependent resistor (ceramic diode varistor) utilizing the forward current voltage charactaristics of a potential formed at the interface of a semiconductive titanate ceramic and an electrode.

Features

- Asymmetric volrage current characteristics comparable to diode
- Superior in forward voltage non-linearity coefficient
- Small temperature coefficient of varistor voltage as about 1/2 to 1/3 of diode and stable characteristics in wide temprature range

Dimensions

Unit: mm(inch)



Specifications

Part No.	Foward Direction			Voltage Ratio (MAX.) $V_{15}/V_{1.5}$	Reverse Direction		Dimensions mm (inch)				Color Code (—)
	Rated Current (mA)	Rated Voltage (V)	Tol. (%)		Max. Permissible Voltage (V)	Max. Leakage Current (μA)	D max.	T max.	L min.	d	
EYV-320D010JA	1.5	1.0	±5	1.35	3	20	7.0 (.276)	5.0 (.197)	30.0 (1.180)	0.5 (.020)	Black
EYV-320D1R1JA	1.5	1.1	±5	1.35	3	20	7.0 (.276)	5.0 (.197)	30.0 (1.180)	0.5 (.020)	Brown
EYV-320D1R2JA	1.5	1.2	±5	1.35	3	20	7.0 (.276)	5.0 (.197)	30.0 (1.180)	0.5 (.020)	Red
EYV-420D1R3JA	1.5	1.3	±5	1.35	4	20	7.0 (.276)	5.0 (.197)	30.0 (1.180)	0.5 (.020)	Orange
EYV-420D1R4JA	1.5	1.4	±5	1.35	4	20	7.0 (.276)	5.0 (.197)	30.0 (1.180)	0.5 (.020)	Yellow
EYV-420D1R5JA	1.5	1.5	±5	1.35	4	20	7.0 (.276)	5.0 (.197)	30.0 (1.180)	0.5 (.020)	Green
EYV-620D2R2JA	1.5	2.2	±5	1.35	6	20	7.5 (.295)	6.0 (.236)	30.0 (1.180)	0.5 (.020)	White
EYV-830D030KA	1.5	3.0	±10	1.35	8	30	7.5 (.295)	6.0 (.236)	30.0 (1.180)	0.5 (.020)	Silver

Note: Color code is marked on the cathode side.

* 1 Operating temperature range: -25°C to +85°C

* 2 Voltage ratio = $\frac{V_{15}}{V_{1.5}}$ $V_{1.5}$: Varistor voltage at DC1.5mA current
V_{15} : Varistor voltage at DC15mA current

MATSUSHITA ELECTRIC

Ratings

Electrical Ratings

Item	Test Method	Test Results
Varistor Voltage	The varistor voltage shall be measured applying the specified measuring current to a varistor. All tests shall be conducted at the standard temperature of 20°C and read out the data 2 to 3 seconds after applying the test current to forward direction of variatite.	Satisfy the specified value
Voltage Ratio	Varistor voltage shall be measured by the test current (1.5mA) specified in rating and the current (15mA) ten times of the test current and the voltage ratio is calculated by the following equation: $R = \frac{V_{15}mA}{V_{1.5}mA}$	Satisfy the specified value
Voltage Temperature Coefficient	The data of $V_{1.5}$ voltage applying the rated current shall be measured at each of 20°C and 70°C and specified by $\Delta V_{1.5}$ %/°C.	To be less than 0.3%/°C

Mechanical Ratings

Item	Test Method	Test Results
Pull Test	The varistor body shall be secured and each lead shall be subjected to an axial pull of 0.5kg gradually for 5 seconds.	No damage with visual examination
Bend Test	The varistor body shall be secured to keep the lead vertical and the leads are subjected to the specified weight 0.25kg. And bend the body by 90° and return it to the original position, bend again to the reverse direction by 90° and return it to the original position.	No damage with visual examination
Solderability Test	Varistor leads shall be immersed into a molten solder of 270°C up to the point 4mm below from the varistor body for 3 seconds. The change ratio of $V_{1.5}$ and exterior damage shall be examined.	$\Delta V_{1.5}/V_{1.5} \leqq \pm 5\%$

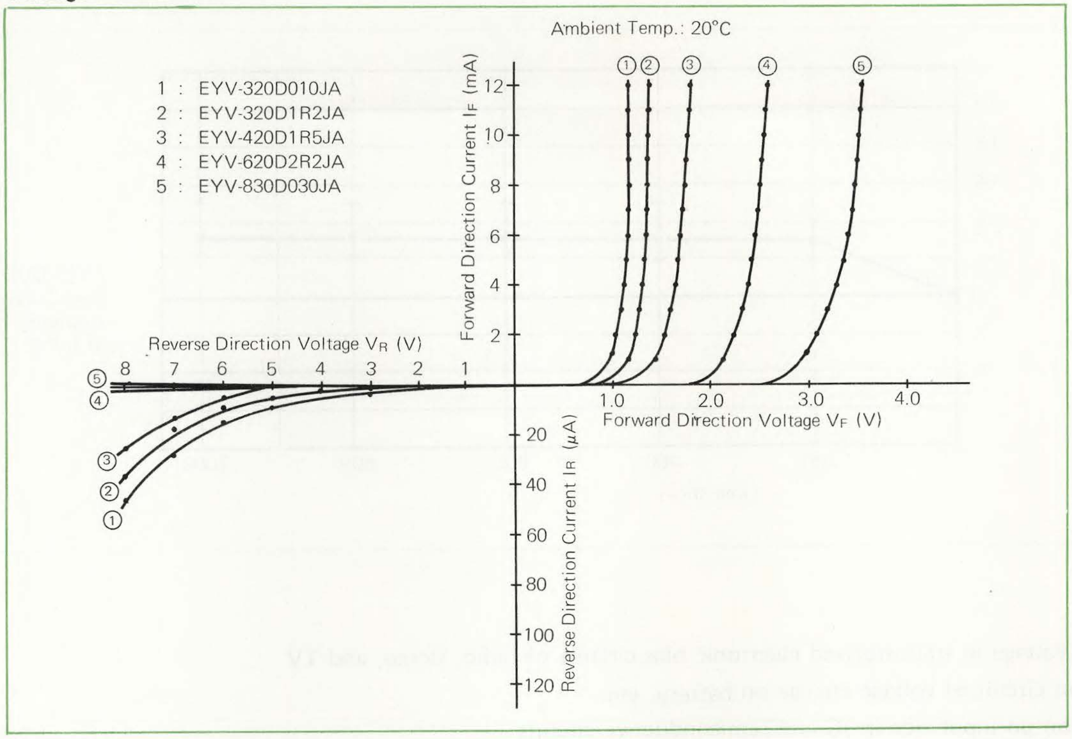
Environmental Ratings

Item	Test Method	Test Results
Temperature Cycling	The temperature cycling shown below shall be repeated 5 times and the change ratio of $V_{1.5}$ and exterior damage are examined. (see cycling table below)	$\Delta V_{1.5}/V_{1.5} \leqq \pm 5\%$
Humidity Test	A varistor shall be exposed to an ambient of 40°C, 90 to 95%RH for 240 hours and then, the change ratio of $V_{1.5}$ shall be examined.	$\Delta V_{1.5}/V_{1.5} \leqq \pm 5\%$
Life Test	A varistor shall be applied with the rated current at 80°C for 240 hours and the change ratio of $V_{1.5}$ shall be examined.	$\Delta V_{1.5}/V_{1.5} \leqq \pm 10\%$
Humidity Load Life Test	A varistor shall be applied with the rated load current 1.5mA being exposed to an ambient of 40°C, 90 to 95% RH for 240 hours and the change ratio of $V_{1.5}$ shall be examined.	$\Delta V_{1.5}/V_{1.5} \leqq \pm 10\%$

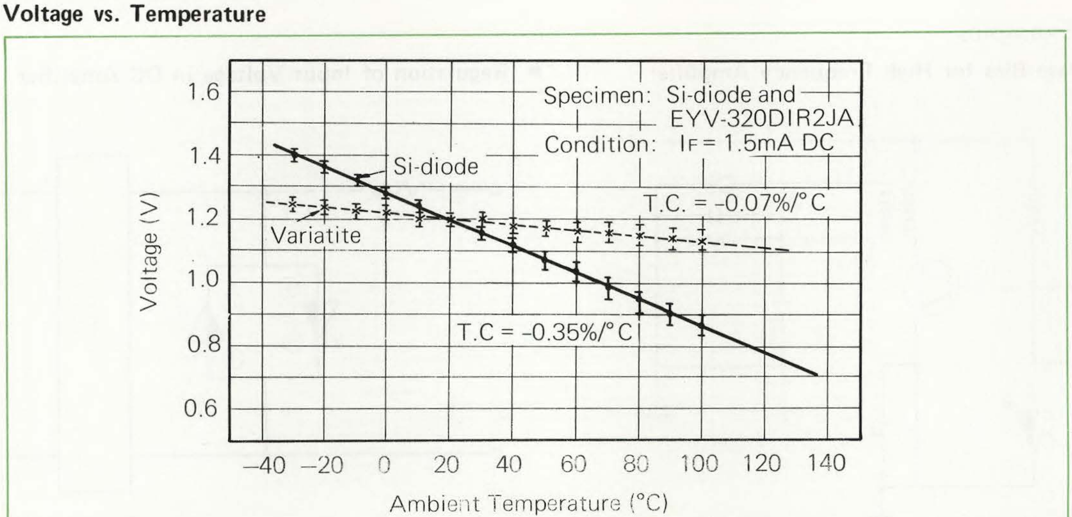
Step	Temperature (°C)	Time (minutes)
1	-25^{+0}_{-3}	30
2	Room ambient	10 ~ 15
3	$+85^{+3}_{-0}$	30
4	Room ambient	10 ~ 15

Characteristics

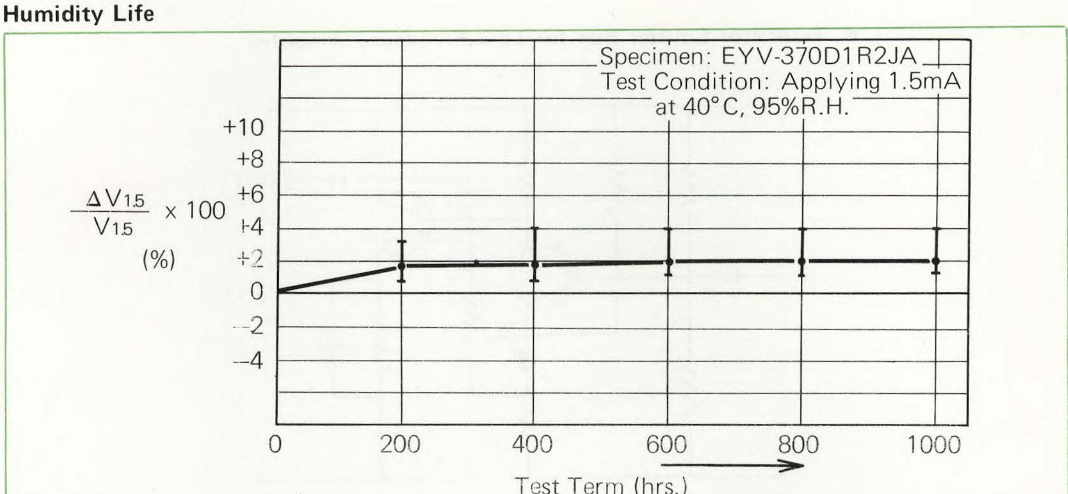
Voltage vs. Current



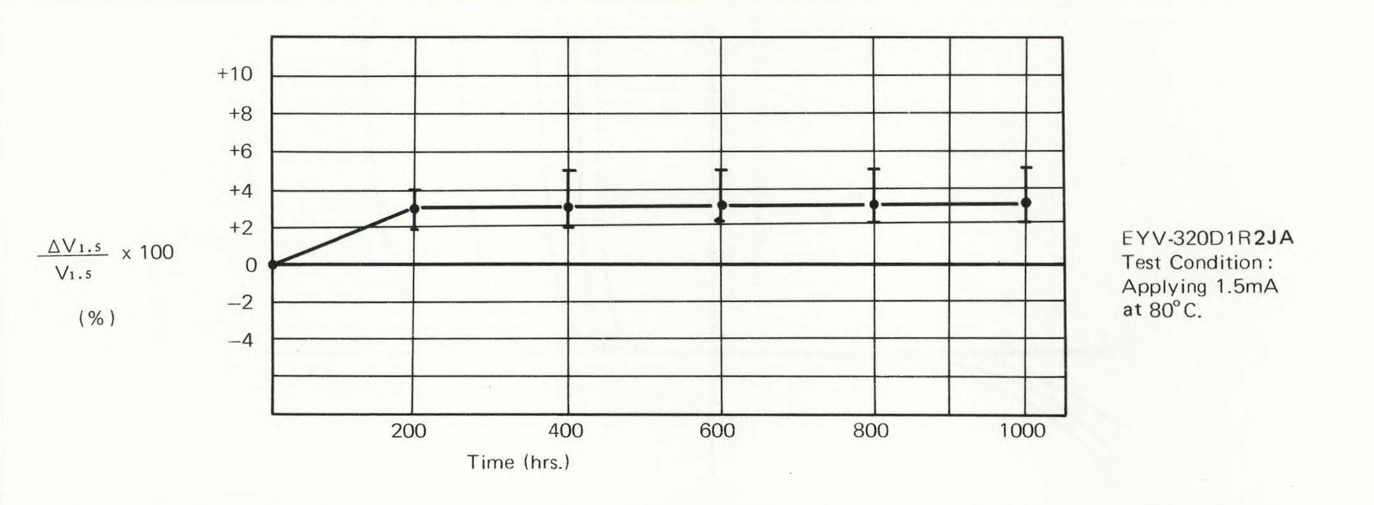
Voltage vs. Temperature



Humidity Life



Life

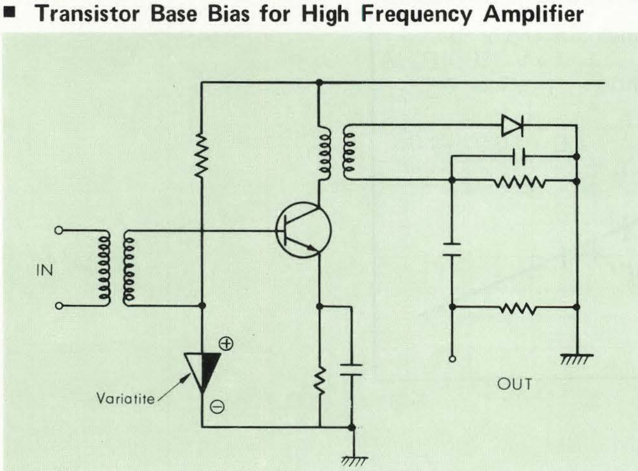


Application

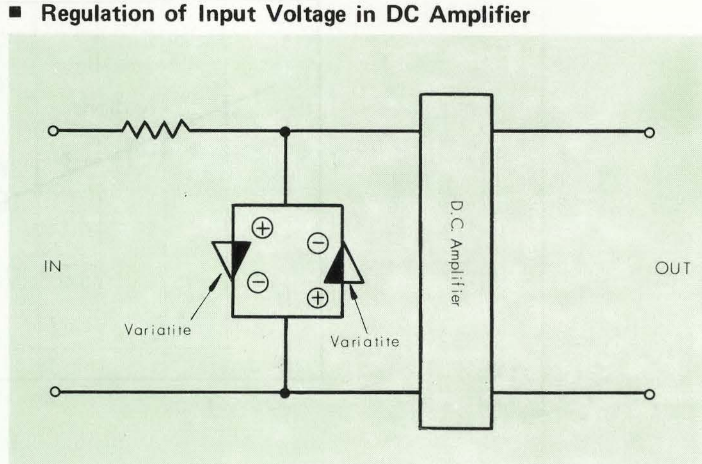
- To stabilize voltage in transistorized electronic bias circuits of radio, stereo, and TV
- For detection circuit of voltage change on battery, etc.
- For protection on input side in IC and semiconductive circuits

Application Examples

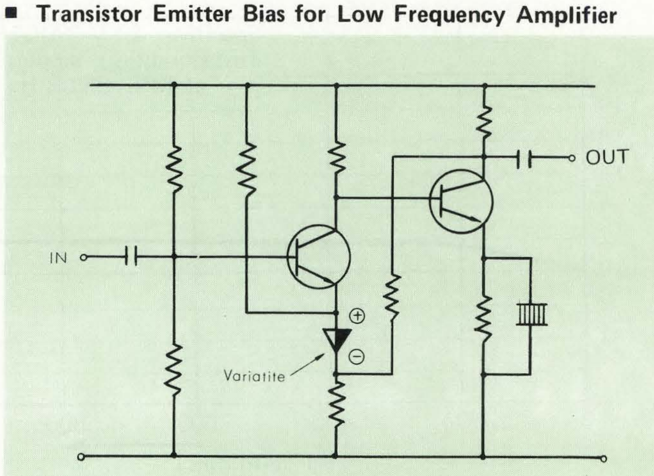
- **Transistor Base Bias for High Frequency Amplifier**



- **Regulation of Input Voltage in DC Amplifier**



- **Transistor Emitter Bias for Low Frequency Amplifier**



Precautions for Application

1. Continuous use in over 85°C should be avoided due to wax impregnated treatment for humidity proof.
2. The current to be applied to variatite should be designed to be 1.5mA. Variatite is not broken by the current up to approximately 10mA exceeding the specified 1.5mA, but the change ratio of varistor voltage can not satisfy the value of the rating.
3. The voltage current characteristics of variatite being asymmetric, it should be operated to meet the polarity marked on each product.
4. Variatite, being compared with silicon diode, having smaller temperature coefficient of varistor voltage such as 1/2 to 1/3 that of diode, it cannot be used for temperature compensation of bias voltage in complimentary circuits.

Part Number Code

E Y V – □ □□ □ □□□ □ □

Common Code: E Y V

Rev. dir. max. Permissible volt.

3	3V
4	4V
6	6V
8	8V

Rev. dir. max. Leakage Current

20	20μA
30	30μA

Structure

D	Dise Type

For. dir. volt. (at 1.5mA)

The first two digits are significant figures of voltage at 1.5 mA and the third digit indicates number of zeros following them. R signfies a decimal point.

Tolerance

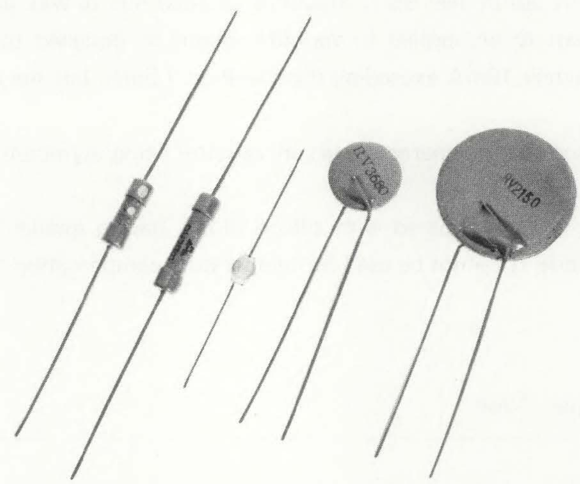
J	±5%
K	±10%

Suffix

SiC VARISTORS

Type ERV

SiC varistor is a symmetrical voltage dependent resistor utilizing characteristics of voltage non-lineality of silicon carbide (SiC).



Features

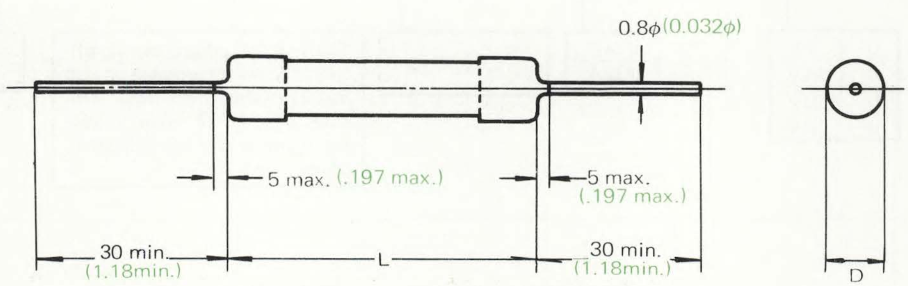
- Symmetrical polarity for voltage
- Stable thermal characteristics
- Minimum time constant
- Durable against high voltage

Application

- Spark absorber in relay circuits
- Voltage stabilizer
- Protector of various semiconductive elements
- Noise suppressor and contact protector of mini motors

Dimensions of Rod Type

Unit: mm(inch)



Specifications of Rod Type (0.8W)

Part No.	Rated Current (mA)	Rated Volt. (V)	Volt. Ratio (MAX.)	Rated Power (W)	Dimensions mm (inch) L	Dimensions mm (inch) D max.
ERV-08S3101K	1	100 ± 10%	2.15	0.8	13±1.5 (.512±.060)	5.5 (.22)
ERV-08S3121K		120 ± 10%				
ERV-08S3151K		150 ± 10%	1.77			
ERV-08S3181K		180 ± 10%			15±1.5 (.591 ± .060)	
ERV-08S3221K		220 ± 10%				
ERV-08S3271K		270 ± 10%			18±1.5 (.709 ± .060)	
ERV-08S3331K		330 ± 10%				
ERV-08S3391K		390 ± 10%				
ERV-08S3471K		470 ± 10%	1.69		21±1.5 (.827 ± .060)	
ERV-08S3561K		560 ± 10%				
ERV-08S3681K		680 ± 10%				
ERV-08S3821K		820 ± 10%				
ERV-08S3102K		1000 ± 10%				

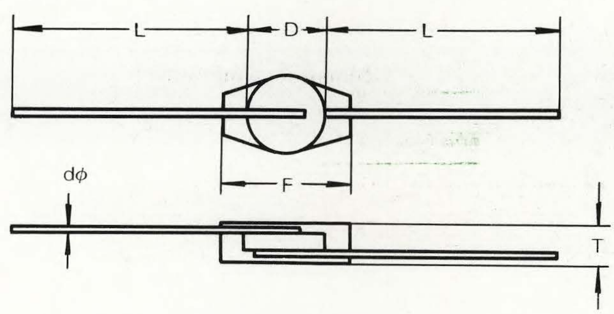
Specifications of Rod Type (1.5W)

Part No.	Rated current (mA)	Rated Volt. (V)	Volt. Ratio (MAX.)	Rated Power (W)	Dimensions mm (inch) L	D max.
ERV-15S3101K		100±10%	2.15		13±1.5 (.512 ± .060)	
ERV-15S3121K		120±10%				
ERV-15S3151K		150±10%	1.77		15 ± 1.5 (.591 ± .060)	
ERV-15S3181K		180±10%				
ERV-15S3221K		220±10%				
ERV-15S3271K		270±10%			17 ± 1.5 (.669 ± .060)	
ERV-15S3331K	1	330±10%		1.5		9.0 (.354)
ERV-15S3391K		390±10%				
ERV-15S3471K		470±10%	1.69		21 ± 1.5 (.827 ± .060)	
ERV-15S3561K		560±10%				
ERV-15S3681K		680±10%				
ERV-15S3821K		820±10%				
ERV-15S3102K		1000±10%				

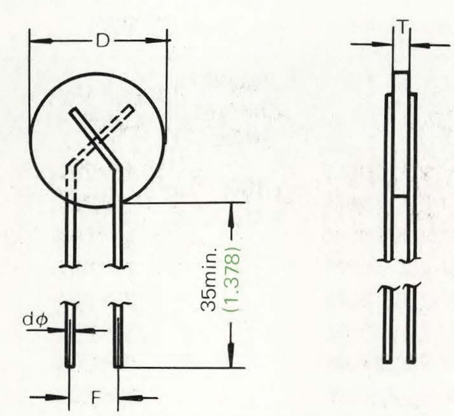
Dimensions of Disc Type

Unit: mm(inch)

ERV-01G



ERV-□□ D and ERV-□□E



Specifications of Disc Type (0.1W ~ 0.2W)

Part No.	Rated current (mA)	Rated Volt. (V)	Volt. Ratio (MAX.)	Rated power (W)	Dimensions mm (inch) D max.	T max.	d	F
ERV-01G2050M		5 ± 20%	3.15		4.5 (.177)	4.0 (.157)	0.5 (.020)	$5.5^{+0.5}_{-1.0}$ $(.217^{+.020}_{-.039})$
ERV-01G27R5M		7.5 ± 20%						
ERV-01G2100M		10 ± 20%	2.51					
ERV-01G2130M		13 ± 20%						
ERV-01G2180M	10	18 ± 20%		0.1				
ERV-01E2050M		5 ± 20%	3.15		6.0 (.236)	4.0 (.157)	0.5 (.020)	2.5 ± 1.5 (.098 ± .059)
ERV-01E27R5M		7.5 ± 20%						
ERV-01E2100M		10 ± 20%	2.51					
ERV-01E2130M		13 ± 20%						
ERV-01E2180M		18 ± 20%						
ERV-02E2100M	10	10 ± 20%	2.51	0.2	8.0 (.315)	4.0 (.157)	0.5 (.020)	2.5 ± 1.5 (.098 ± .059)
ERV-02E2130M		13 ± 20%						
ERV-02E2180M		18 ± 20%						
ERV-02E2240M		24 ± 20%						

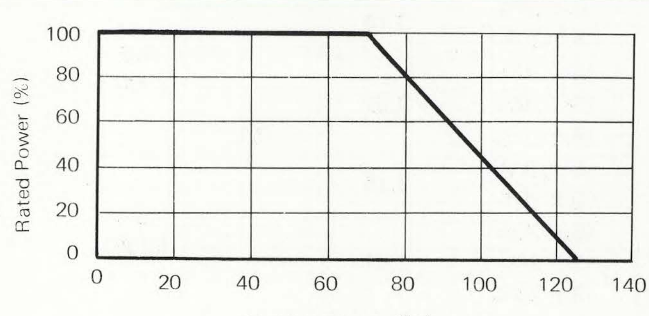
Specifications of Disc Type (0.8W)

Part No.	Rated Current (mA)	Rated Volt. (V)	Volt. Ratio (MAX.)	Rated Power (W)	Dimensions mm (inch)			
					D	T	d	F
ERV-08D2220M	10	22±20%	2.15	0.8	13 ± 1 (.512 ± .039)	2.0~7.0 (.118~.276)	0.8 (.032)	5.0 ± 1.5 (.197 ± .059)
ERV-08D2330M		33±20%						
ERV-08D2470M		47±20%						
ERV-08D2680M		68±20%						
ERV-08D3470M	1	47±20%	1.77					
ERV-08D3680M		68±20%						
ERV-08D3101M		100±20%						
ERV-1D1100M	100	10±20%	2.51	1.0	18 ± 1 (.709 ± .039)	2.0~7.0 (.118~.276)	0.8 (.032)	5.0 ± 1.5 (.197 ± .059)
ERV-1D1150M		15±20%						
ERV-1D2100M	10	10±20%	2.15					
ERV-1D2150M		15±20%						
ERV-1D2220M		22±20%						
ERV-1D2330M		33±20%						
ERV-1D2470M		47±20%						
ERV-1D2680M		68±20%						
ERV-1D3470M	1	47±20%	1.77					
ERV-1D3680M		68±20%						
ERV-1D3101M		100±20%						

Specifications of Disc Type (2.0W)

Part No.	Rated Current (mA)	Rated Volt. (V)	Volt. Ratio (MAX.)	Rated Power (W)	Dimensions mm (inch)			
					D	T	d	F
ERV-2D1100M	100	10±20%	2.51	2.0	25 ± 1.5 (.984 ± .059)	2.0 ~ 7.0 (.118 ~ .276)	1.0 (.039)	100 ± 1.5 (.394 ± .059)
ERV-2D1150M		15±20%						
ERV-2D2100M	10	10±20%	2.15					
ERV-2D2150M		15±20%						
ERV-2D2220M		22±20%						
ERV-2D2330M		33±20%						
ERV-2D2470M		47±20%						
ERV-2D2680M		68±20%						
ERV-2D3470M	1	47±20%	1.77					
ERV-2D3680M		68±20%						
ERV-2D3101M		100±20%						
ERV-2D3151M		150±20%	1.58					
ERV-2D3221M		220±20%						
ERV-2D3331M		330±20%						

Power Derating Curve



When ambient temperature exceeds 70° C, the load should be derated in accordance with the Derating Curve.

Ratings

Electrical Ratings

Item	Test Method	Test Results
Varistor Voltage	The varistor voltage shall be measured applying the specified measuring current to a varistor. All the tests shall be conducted at the standard temperature of 20°C, promptly enough to avoid heat affection.	Satisfy the specified value
Voltage Ratio	Varistor voltage shall be measured by the measuring current Vx specified in the rating and the current $V_{0.1x}$ of 1/10 the current (Vx) and calculated by the following equation. $R = \frac{Vx}{V_{0.1x}}$	Satisfy the specified value
Voltage Temperature Coefficient	Voltage Vx and change ratio R shall be measured applying the rated current in ambient temperature 20°C and 70°C and shall be specified by ΔVx(%)/°C, and ΔR(%)/°C.	Vx: $^{+0}_{-0.2}$ %/°C R: ±0.2%/°C

Mechanical Ratings

Item	Test Method	Test Results
Pull Test	The varistor body shall be secured and the leads shall be subjected to a pull of the rated weight. Lead diameter / Weight: 1.0 mm — 2.5 kg 0.8 mm — 1 kg 0.5 mm — 0.5 kg	No exterior damage shall be found.
Bend Test	The varistor body shall be secured to keep the leads vertical and the leads are subjected to the specified weight. And bend the body by 90° and return it to the original position and bend again to the reverse direction by 90° and return it to the original position. Lead diameter / Weight: 1.0 mm — 1 kg 0.8 mm — 0.5 kg 0.5 mm — 0.25kg	No exterior damage shall be found
Resistance to Soldering Heat	Varistor leads shall be immersed into a molten solder of 350°C up to the point 3mm below from the varistor body for 3 seconds. The change ratio of Vx and R and the appearance shall be examined.	ΔVx/Vx$\leqq$±5% ΔR/R$\leqq$±10%

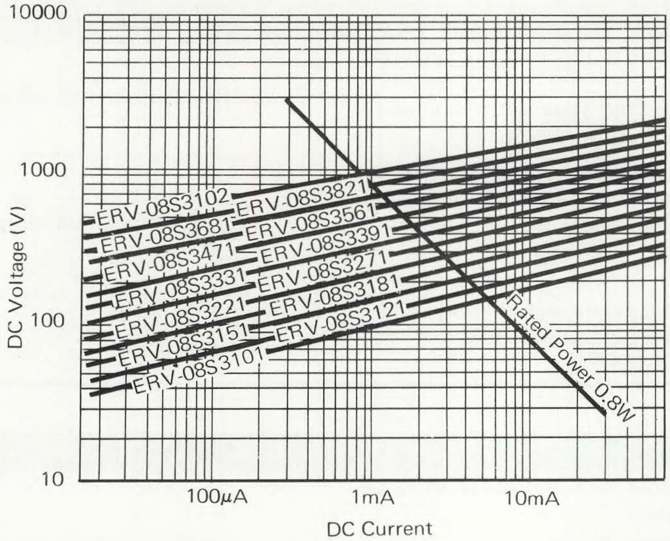
Environmental Ratings

Item	Test Method	Test Results
Temperature Cycling	The temperature cycling shown below shall be repeated 5 times and the change ratio of Vx and R and the appearance shall be examined. Step / Temperature (°C) / Time (min.): 1 — -25^{+0}_{-3} — 30 2 — Room ambient — 10 to 15 3 — $+85^{+3}_{-0}$ — 30 4 — Room ambient — 10 to 15	ΔVx/Vx$\leqq$±5% ΔR/R$\leqq$±10%
Humidity Test	The varistor shall be left at an ambient temperature of 40°C, 95%RH for 240 hours and the change ratio of Vx and R shall be examined.	ΔVx/Vx$\leqq$±5% ΔR/R$\leqq$±10%
High Temperature Load Test	The varistor shall be applied with the rated load current at 70°C for 500 hours and the change ratio of Vx and R shall be examined.	ΔVx/Vx$\leqq$±10% ΔR/R$\leqq$±20%
High Humidity Load Test	The varistor shall be applied with the rated load current for 1.5 hours 'on' and 0.5 hour 'off' and cycling for 500 hours in total and the change ratio of Vx and R shall be examined.	ΔVx/Vx$\leqq$ ±10% ΔR/R$\leqq$ ±20%

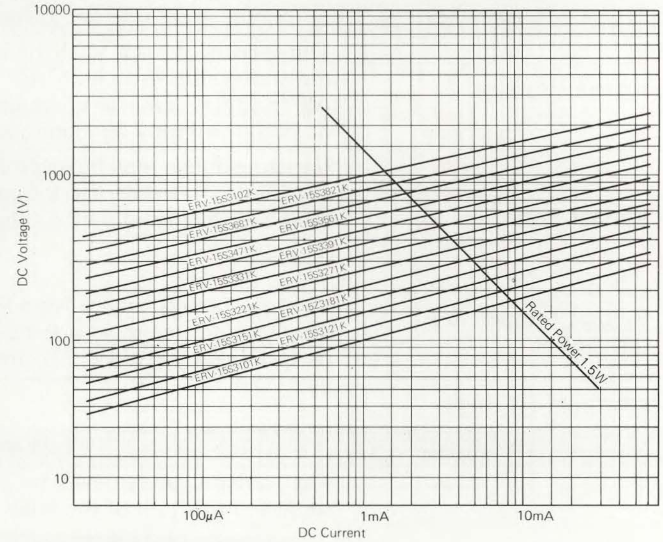
Characteristics

Voltage vs. Current

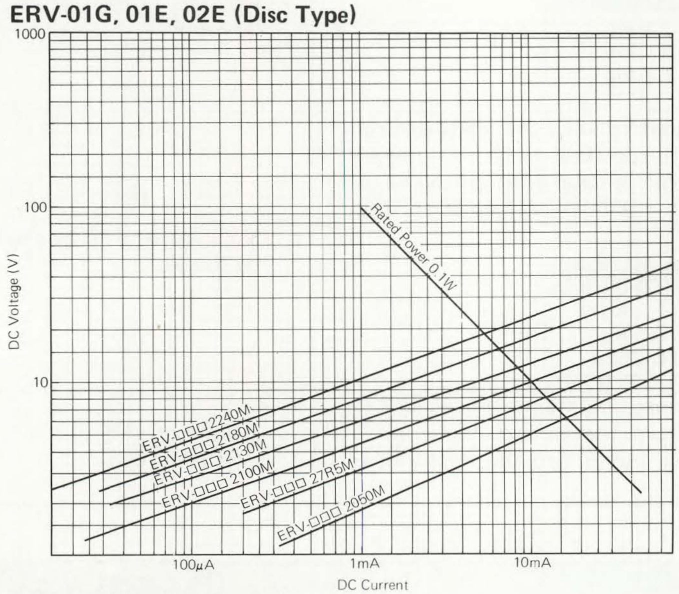
ERV-08S(Rod Type)



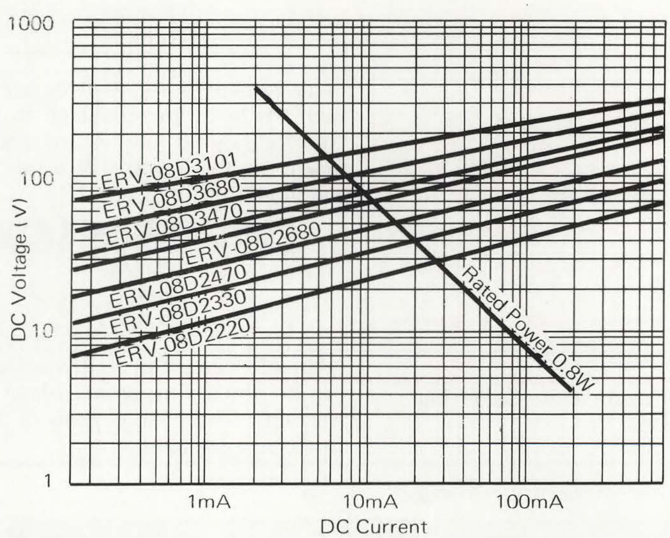
ERV-15S(Rod Type)



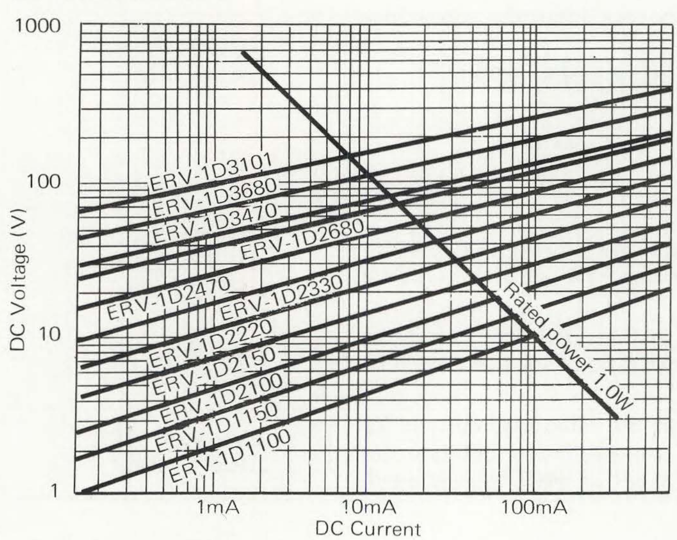
ERV-01G, 01E, 02E (Disc Type)



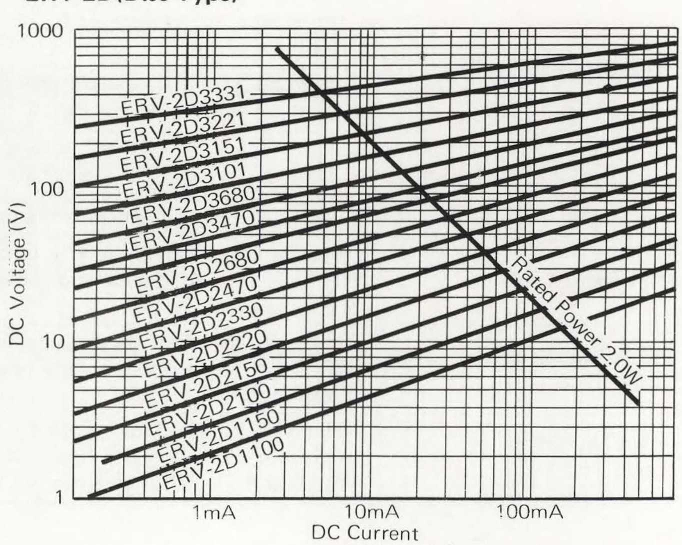
ERV-08D (Disc Type)



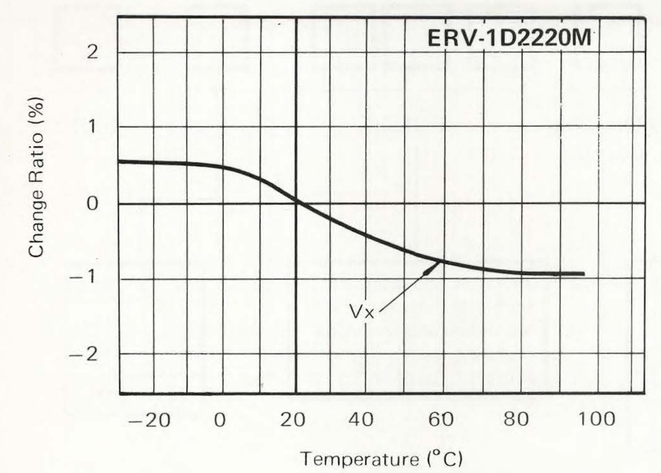
ERV-1D(Disc Type)



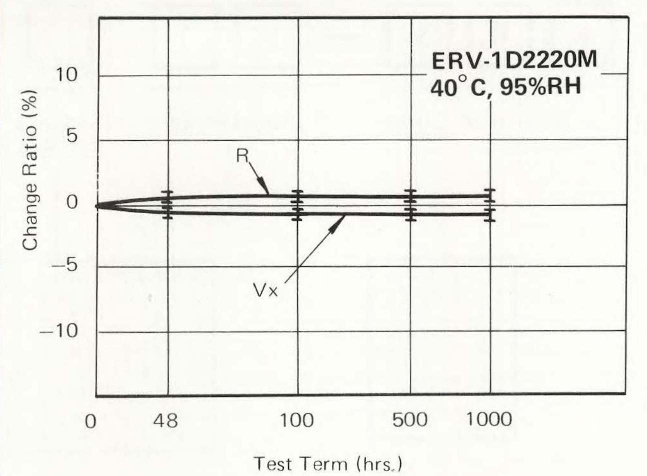
ERV-2D(Disc Type)



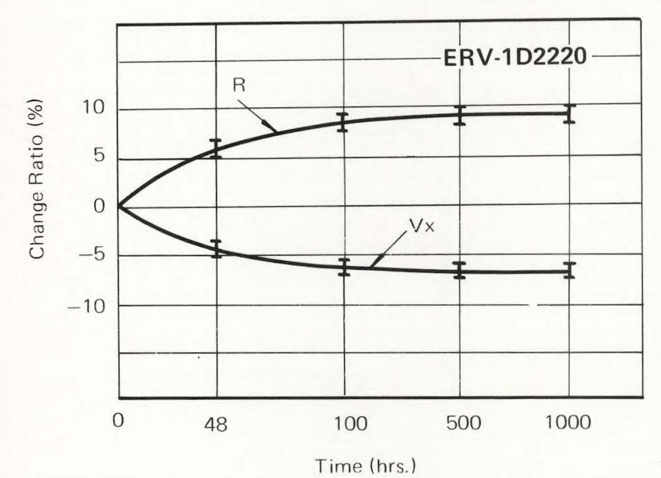
Temperature Characteristics



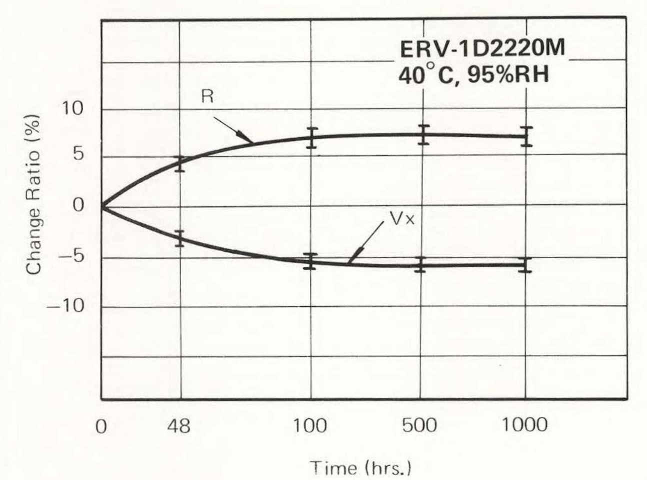
Humidity



High Temperature Load Life



Humidity Load Life



Precaution for Application

SiC varistor can be used in continuous operation at less than 70°C ambient temperature, but in the case of over 70°C this should be used in the condition of derating the load according to the derating curve.

And the voltage temperature coefficient of SiC varistor being negative, varistor should be carefully designed to use when applying such load as around the rated power and operating in around 70°C ambient temperature.

Part Number Code

E R V — □□ □ □ □□□ □ □

Common Code	Rated Power	Shape & Coating	Measuring Current	Voltage	Tolerance	Suffix

Rated Power

01	0.1W
02	0.2W
08	0.8W
1	1.0W
15	1.5W
2	2.0W

Shape & Coating

Symbol	Shape	Coating
D	Disc	NO.
E	Disc	Lacquer
G	Disc	With insulating tube
S	Rod	Lacquer

Measuring Current

3	1mA D.C.
2	10mA D.C.
1	100mA D.C.

Voltage

The first two digits are significant figures of resistance and the third one denotes number of zeros following them.

Tolerance

J	±5%
K	±10%
L	±15%
M	±20%

PTC THERMISTORS

The PTC thermistor is a semiconductive ceramic resistor comprising barium titanate, being featured by its large temperature coefficient by resistance change. Its positive characteristics are classified into two types. The one characteristic named 'A characteristic' shows linear change of logarithmic resistance values against temperature change. The other 'B characteristic' exhibits abrupt increase of resistance when the temperature becomes higher than a specified value, while, at temperatures below the specified value, the resistance value shows small change.

Major Characteristics of PTC Thermistor

1) Resistance Value (R)

The resistance value of a PTC thermistor is measured at ambient temperature of 25°C with the voltage less than 1.5 VDC suppressing self heat generation. At a voltage higher than the specified 1.5 VDC, the thermistor element generates heat, affecting the values after measurements due to its self-heating and voltage-dependency.

2) Resistance Temperature Coefficient (α)

Resistance temperature coefficient of a PTC thermistor within a certain temperature range appears in positive and in large values. The coefficient in this case is indicated by the following equation:

$$\alpha = 230.3 \frac{\log(R_2/R_1)}{T_2 - T_1} \ (\%/^\circ C)$$

When temperature and logarithmic resistance values are in approximately linear relationship, α is kept constant independent of T_1 and T_2. But when the above relationship does not exist, T_1 and T_2 are specified as follows.

(For A Characteristic)

T_1: 25°C R_1: Resistance at T_1 (°C)

T_2: 80°C R_2: Resistance at T_2 (°C)

α is calculated by the following equation:

$\alpha = 4.19 \log (R_{80}/R_{25})$ (%/°C)

(For B Characteristic)

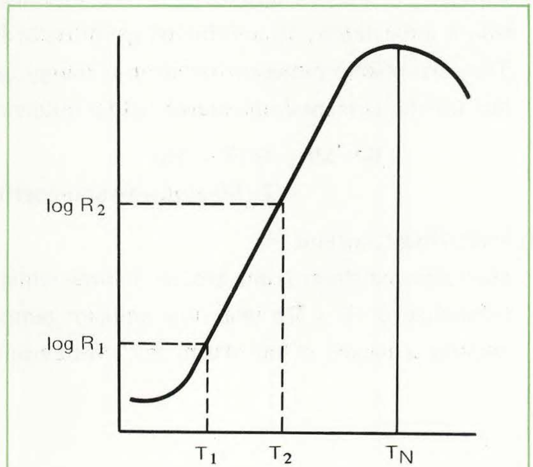
T_1: Switching temperature (Ts)

T_2: Temperature higher than switching temperature by 50°C.

α is calculated by the following equation:

$\alpha = 461 \log (R_2/R_1)$ (%/°C)

Fig. 1



3) Switching temperature (Ts)

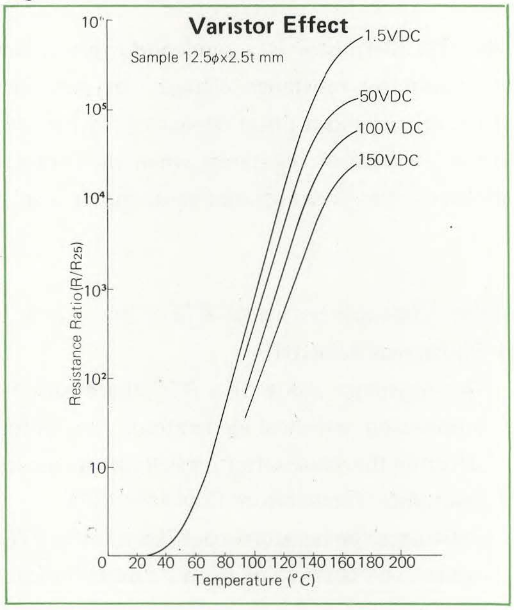
B characteristic thermistor's resistance shows constant values below a certain temperature, but when the temperature exceeds that value, the resistance increases abruptly.

The temperature at which the resistance begins to increase abruptly shall be called "a switching temperature", which is defined as the temperature at which the resistance value is equivalent to twice the resistance value at 25°C as shown in the resistance temperature curves in Fig. 2.

4) Varistor Effect

Resistance value of a PTC thermistor varies with the measured voltage. As far as the temperature of a PTC thermistor is kept constant, the resistance becomes smaller as the voltage applied becomes higher, which is called "varistor effect".

Fig. 2



5) Withstand Voltage

When a voltage is applied, a PTC thermistor generates heat as jule heat and the temperature of element rises.

When a higher voltage is applied, the temperature of element also rises, and when this temperature reaches more than T_N in the Fig. 1., the function of the current limitation is lost and accordingly the element is destructed because the temperature coefficient of resistance becomes negative just as an ordinary semiconductor.

Therefore a PTC thermistor should be operated at temperatures below T_N in order to avoid destruction of elements.

The ambient temperature and heat radiation are fixed, and thereby the maximum operating voltage is limited. The withstand voltage is practically specified below this maximum voltage.

6) Maximum Rated Voltage

The maximum rated voltage is an allowable voltage for long-term operation, being fixed under the withstanding voltage specified.

7) Heat Dissipation Coefficient (D)

Heat dissipation coefficient is equivalent to the heat dissipated from the thermistor body in a specified period of time by 1°C change with ambient temperatures changed from T (°C) to To (°C).

Voltage (V) shall be applied to a PTC thermistor at an ambient temperature (To). The current measured under a static condition is indicated by (I) and the temperature of the PTC thermistor as (T).

The relationship between the electric energy applied to the thermistor for a specified period of time and thermal energy to be lost for the same period is shown as the following equation.

$$W = VI = D\,(T - T_o)$$

D: Heat dissipation coefficient (W/°C)

8) Heat Time Constant (τ)

Heat time constant is the period of time while the temperature of a PTC thermistor is 0.632 time as high as the temperature difference of T − To when the ambient temperature is changed from To to T. Heat time constant is utilized as an index to measure a degree of the thermistor's response time against heat.

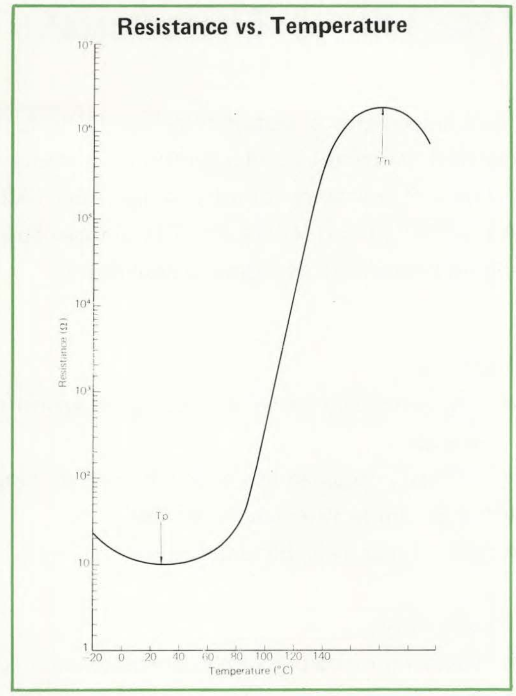
9) Resistance vs.Termperature

Resistance - temperature characteristic is measured applying a voltage of less than 1.5V DC reducing the effect of self heat generation and varistor effect.. Fig. 1 shows resistance - temperature characteristics in which when the temperature is below Tp, the resistance value decreases as temperature rises but when the temperature exceeds Tp, the temperature coefficient becomes positive and thereby the resistance value becomes larger.

When the temperature exceeds Tn, the resistance - temperature coefficient becomes negative.

The change characteristics of resistance value caused by the temperature changes (Tp, Tn and other degrees) varies with the composition of materials.

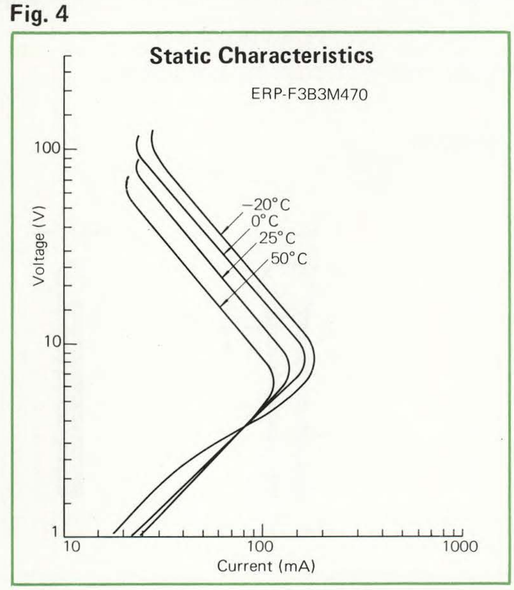
Fig. 3



10) Static Characteristics

Static characteristics denotes the relationship between the voltage and current measured under thermally static condition after a certain voltage is applied to a PTC thermistor..

Fig. 4



11) Dynamic Characteristics (Current - Time Characteristics)

When the current exceeding the specified value is applied to a PTC thermistor in the circuit as shown in the Fig. 5, the thermistor generates heat and thereby the resistance value becomes larger.

As shown in Fig. 6 the current is kept constance within a certain period of time but later the current decreases abruptly.

Fig. 5

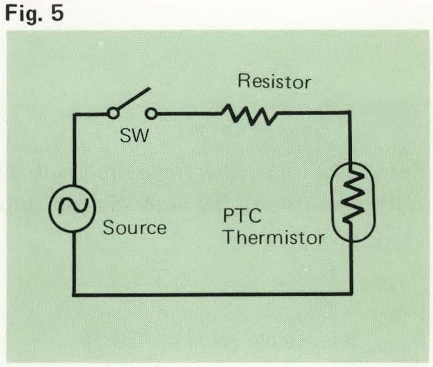
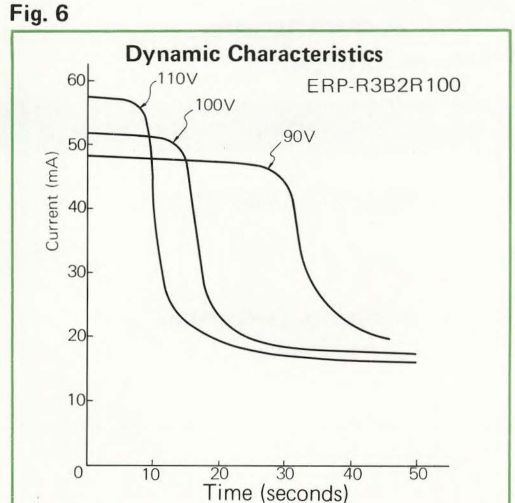


Fig. 6



Type ERP "A Characteristic"

'A Characteristic' is featured by nearly linear relationship between temperature and logarithmic resistance values.
3 types of resistance ratio by temperature [A2 (2.5%/°C), A3 (3.5%/°C) and A4 (4.5%/°C)] are available, and types should be selected according to application.

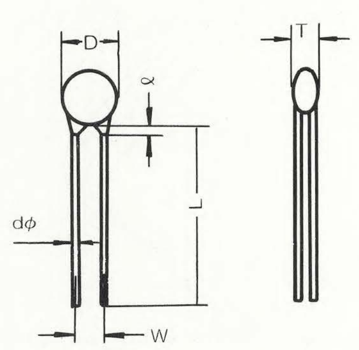
Features

- Logarithmically linear characteristics against temperature change
- Linearity obtained in a wide temperature range
- Large temperature coefficient (α)
- Many types available upon request

Application

- Temperature compensation of transistor circuits
- As thermo-sensitive elements for temperature measurements and temperature control
- Overheat protectors for transistors

Dimensions

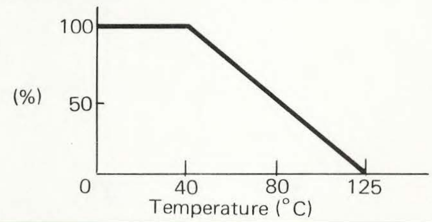


Symbol	D	T	W	L	dφ	ℓ
Dimensions	8±1 (0.315±0.039)	MAX.5 (.197)	5±2 (.197±0.079)	MIN.20 (.787)	0.6 (0.024)	MAX.5 (0.197)

Ratings (A characteristic)
Electrical Ratings

Item	Test Method	Rated Value
Resistance Value (R_{25})	Resistance value when measured with a D C voltage less than 1.5V applied at an ambient of 25°C	Satisfy the specified value
Resistance Temperature Characteristics	$\frac{R_{-20}}{R_{25}}$, $\frac{R_{80}}{R_{25}}$ R_{-20}; Resistance value at -20°C R_{25} ; Resistance value at 25°C R_{80} ; Resistance value at 80°C	Satisfy the specified value

(Electrical ratings continued)

Item	Test Method	Rated Value
Max. Operating Temperature	Max. operating temperature when the rated power is derated to the limit in the derating curve	125°C
Rated Power	The rated power should be derated according to the following derating curve when the ambient temperature exceeds 40°C.  	Satisfy the specified value
Max. Rated Voltage	Equivalent to the voltage allowed to be applied within a temperature range from -20°C to 80°C	Max. 18V DC

Mechanical Ratings

Item	Test Method	Rated Value
Pull Test	The PTC thermistors shall withstand a steady pull of the weight applied axially to each lead for 10 seconds without damage.	1.0 kg
Lead Bend Strength	Secure a sample unit with the vertical force applied to the lead wires. Move the body to a horizontal position by 90° bending and return it to the initial vertical position. Move it to the opposite horizontal position and return it to the initial vertical position.	0.5 kg
Solder Heat Shock	The lead wires are dipped in the molton solder of 350°C for 3 sec. up to 4mm from the body.	$\Delta R/R_{25} \leqq 20\%$ No exterior damage
Solderability	The lead wires shall be dipped in the melted solder of 230°C for 2 seconds up to 4mm from the body after dipping in flux.	All the surface of lead wires are covered with solder

Environmental Ratings

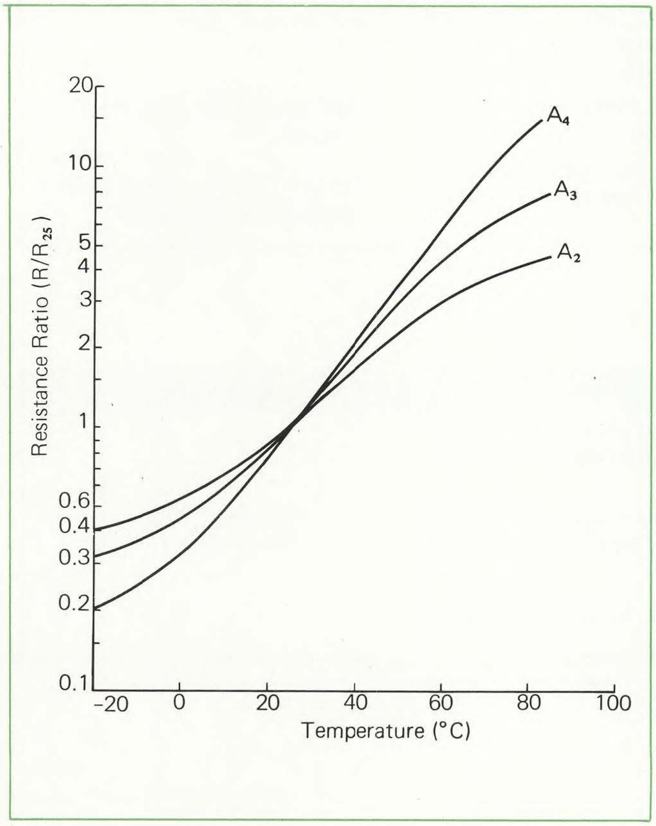
Item	Test Method	Rated Value
Intermittent Load Life	Change ratio of R_{25} after applying the rated voltage at room ambient for 1000 hours at intervals of 1.5 hours 'on' and 0.5 hour 'off'	$\Delta R/R_{25} \leqq 20\%$ No exterior damage
Humidity Load Life	Change ratio of R_{25} after applying the rated voltage at 40°C, 95%RH for 500 hours at intervals of 1.5 hours 'on' and 0.5 hour 'off'	
High Temperature Load Life	Change ratio of R_{25} after applying the rated voltage at 80°C continuously for 1000 hours	

Specifications

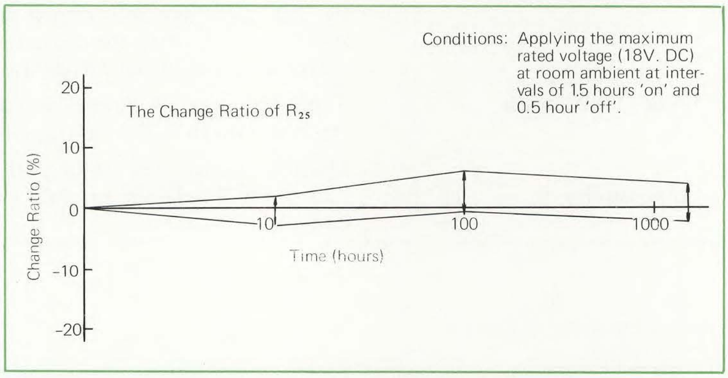
Char.	Part No.	Resistance Value (Ω) (at 25°C)	Res. Temp. Char. (%/°C)	Rated Power (W)	Heat Dissp. Coef.	Heat Time Constant
A2	ERP-F3A2M471 ERP-F3A2M681 ERP-F3A2M102 ERP-F3A2M122 ERP-F3A2M152 ERP-F3A2M222	470 680 1.0K 1.2K 1.5K 2.2K	2.5	0.5	10	20
A3	ERP-F3A3M861 ERP-F3A3M102 ERP-F3A3M152 ERP-F3A3M222 ERP-F3A3M272 ERP-F3A3M332	860 1.0K 1.5K 2.2K 2.7K 3.3K	3.5	0.5	10	20
A4	ERP-F3A4M102 ERP-F3A4M152 ERP-F3A4M222 ERP-F3A4M272 ERP-F3A4M332 ERP-F3A4M402	1.0K 1.5K 2.2K 2.7K 3.3K 4.0K	4.5	0.5	10	20

Characteristics

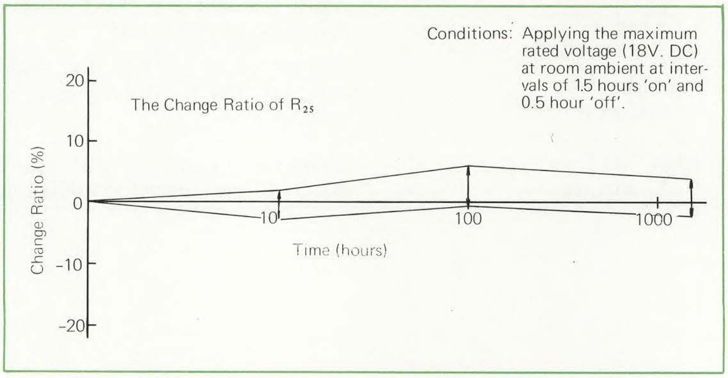
Resistance-Temperature Characterisitcs



Intermittent Load Life

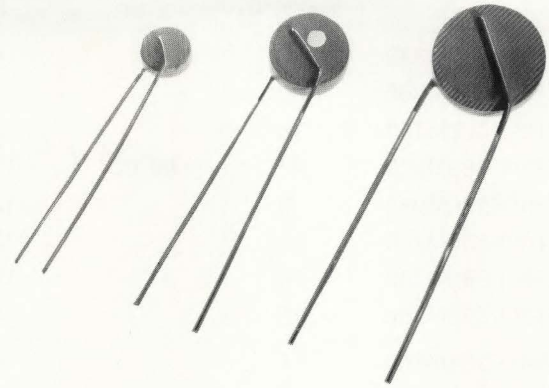


High Temperature Load Life



Type ERP "B Characteristic"

'B Characteristic' PTC Thermistor shall be classified into B0 (50°C), B1 (75°C), B2 (90°C), B3 (120°C) according to switching temperatures and have various resistances of 8 through 100Ω and shapes of 8 through 25mm in diameter. This is very suitable for use with degaussing in color TV, overload protection, overheat protection, temperature control thermostatic devices and motor starting devices.



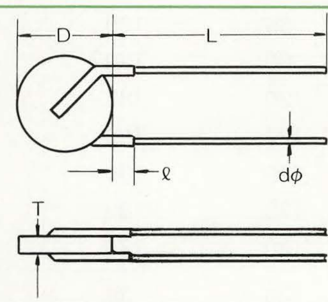
Features

- Extremely large temperature coefficient of resistance, increasing abruptly when the temperature exceeds the specified value
- Wide selection of switching temperature
- Withstand high voltages

Application

- Overload protection of transistor, transistor circuits, motors and coils
- Limitation of current of motors and transformers, etc.
- For timers
- Degaussing for color TV and color VTR
- Temperature detection for various equipment

Dimensions



	D	T max.	L min.	ℓ max.	dφ
F3	$8^{\pm1}$(0.315±0.039)	5(0.197)	20(0.787)	5(0.197)	0.6(0.024)
F4	$12^{\pm1}$(0.472±0.039)	5(0.197)	20(0.787)	5(0.197)	0.6(0.024)
F5	$15^{\pm1}$(0.591±0.039)	5(0.197)	20(0.787)	5(0.197)	0.65(0.026)
F6	$18^{\pm1}$(0.709±0.039)	5(0.197)	20(0.787)	5(0.197)	0.8(0.031)
F7	$25^{\pm1}$(0.984±0.039)	5(0.197)	20(0.787)	5(0.197)	0.8(0.031)

Resistance Table

	F3	F4	F5	F6	F7
B0	20 ~ 100Ω	8 ~ 60Ω	8 ~ 60Ω	8 ~ 50Ω	8 ~ 40Ω
B1	20 ~ 100Ω	8 ~ 60Ω	8 ~ 60Ω	8 ~ 50Ω	8 ~ 40Ω
B2	15 ~ 80Ω	8 ~ 60Ω	8 ~ 60Ω	8 ~ 50Ω	8 ~ 40Ω
B3	10 ~ 70Ω	5 ~ 50Ω	5 ~ 50Ω	5 ~ 40Ω	5 ~ 30Ω

Specifications

Char	Part No.	Res. Value (at 25°C)	Switching Temp. (°C)	Max. Rated Volt. (V)	Withstand Volt. (V)	Max. Rated Power (W)	Heat Dissp. Coef. (m V/°C)	Heat Time Constant (sec.)
B0	ERP-F3B0M330	33	$50°C^{\pm5°C}$	40	60	1.0	10	20
	ERP-F3B0M800	80		80	120	1.0	10	20
	ERP-F4B0M150	15		120	180	1.5	14	30
	ERP-F4B0M270	27		120	180	1.5	14	30
	ERP-F5B0M080	8		120	180	2.0	18	50
	ERP-F5B0M220	22		120	180	2.0	18	50
	ERP-F6B0M100	10		120	180	3.0	25	70
	ERP-F6B0M150	15		150	225	3.0	25	70
B1	ERP-F3B1M150	15	$75°C^{\pm5°C}$	40	60	1.0	10	20
	ERP-F3B1M470	47		40	60	1.0	10	20
	ERP-F3B1M101	100		80	120	1.0	10	20
	ERP-F4B1M150	15		80	120	1.0	14	30
	ERP-F4B1M270	27		80	120	2.0	14	30
	ERP-F5B1M100	100		120	180	2.0	18	50
	ERP-F5B1M150	15		120	180	2.0	18	50
	ERP-F6B1M100	10		120	180	3.0	25	70
	ERP-F6B1M150	15		120	180	3.0	25	70
	ERP-F6B1M220	22		120	180	3.0	25	70
B2	ERP-F3B2M220	22	$90°C^{\pm5°C}$	40	60	1.0	10	20
	ERP-F3B2M470	47		40	60	1.0	10	20
	ERP-F3B2M101	100		80	120	1.0	10	20
	ERP-F4B2M150	15		80	120	2.0	14	30
	ERP-F4B2M270	27		80	120	1.5	14	30
	ERP-F5B2M150	15		120	180	1.5	18	50
	ERP-F5B2M270	27		120	180	1.5	18	50
	ERP-F6B2M100	10		120	180	3.0	25	70
	ERP-F6B2M150	15		120	180	3.0	25	70
	ERP-F6B2M220	22		120	180	3.0	25	70
B3	ERP-F3B3M150	15	$120°C^{\pm5°C}$	20	30	1.0	10	20
	ERP-F3B3M470	47		40	60	1.0	10	20
	ERP-F4B3M150	15		80	120	2.0	14	30
	ERP-F5B3M100	10		80	120	3.0	18	50
	ERP-F5B3M150	15		80	120	2.5	18	50
	ERP-F6B3M100	10		80	120	3.0	25	70
	ERP-F6B3M150	15		80	120	3.0	25	70

Ratings (B Characteristic)

Electrical Ratings

Item	Test Method	Rated Value
Resistance Value (R_{25})	Resistance value when measured with a d-c voltage less than 1.5V at an ambient of 25°C	Satisfy the specified value
Switching Temperature (Ts)	The resistance values measured at each of the upper and lower limits of the operating temperature range should involve, in its range, the resistance value twice the value at 25°C.	Satisfy the specified value
Withstand Voltage	No damage after application of the rated votlage for 3 minutes at an ambient 25°C	Satisfy the specified value
Operating Temperature Range	Permissible operating temperature range when the maximum rated power is applied	-20°C ~+60°C
Max. Permissible Voltage	Maximum voltage to be applied continuously within the specified operating temperature range	Satisfy the specified value
Operating Temperature Range in Zero Power	Permissible operating temperature range under the zero power condition	-20°C~+60°C
Max. Rated Power	Maximum power when the maximum permissible voltage is applied at an ambient 25°C	Satisfy the specified value

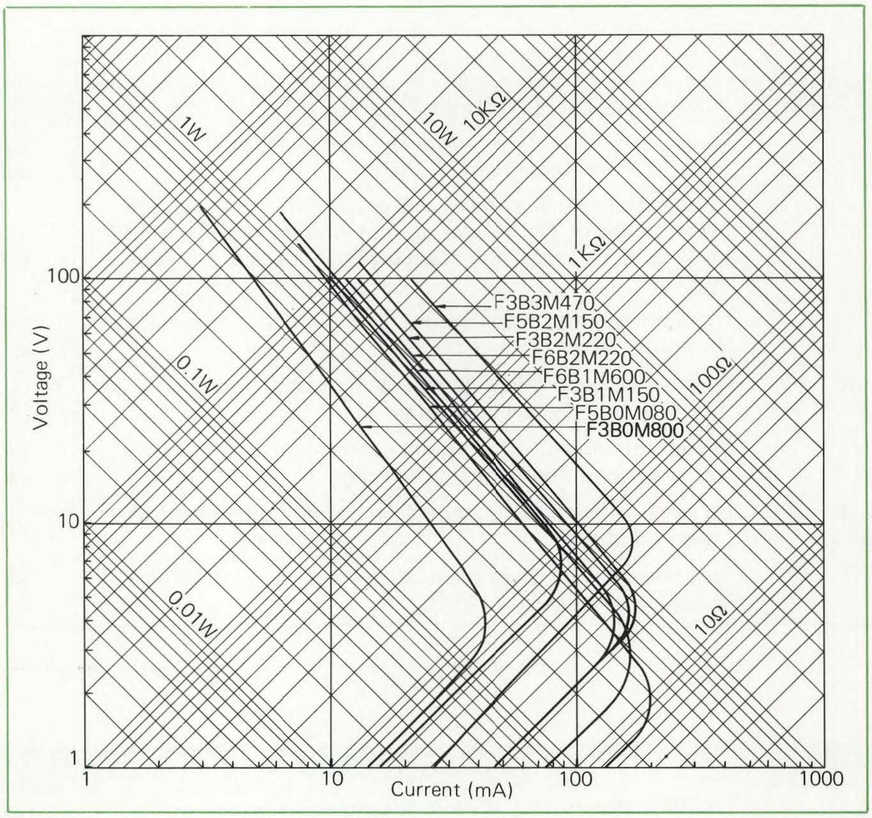
Mechanical Ratings

Item	Test Method	Rated Value
Pull Test	The PTC thermistors shall withstand a steady pull of the weight applied axially to each lead for 10 seconds without any exterior damage.	Lead ϕ Weight 0.5mm~0.8mm 0.5 Kg 0.8mm min. 1 Kg
Lead Bend Strength	Secure a sample unit with the vertical force applied to the lead wires. Bend the body to a horizontal position by 90° and return it to the initial vertical position. Bend it to the opposite horizontal position and return it to the initial vertical position.	Lead ϕ Weight 0.5mm~0.8mm 0.5 Kg 0.8mm min. 1 Kg
Solder Heat Shock	The lead wires are dipped in the melted solder of 350°C for 3 sec. up to 4mm from the body.	$\Delta R/R_{25} \leq 20\%$ No exterior damage
Solderability	The lead wires are dipped in the melted solder of 350°C for 3 sec. up to 4mm from the body after dipping in flux.	All the surface of lead wires are covered with solder.

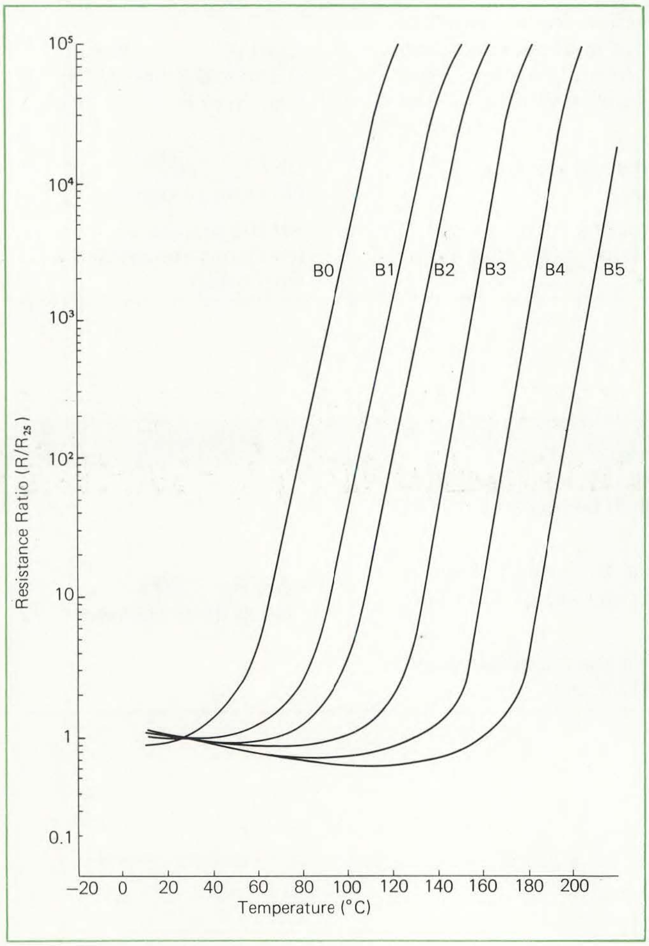
Environmental Ratings

Item	Test Method	Rated Value
Intermittent Load Life	Change ratio of R_{25} after a cycle of 1 minute "ON" and 5 minutes "OFF" operation shall be repeated 10,000 times at room ambient	$\Delta R/R_{25} \leq 20\%$ No exterior damage
Humidity Load Life	Change ratio of R_{25} after applying the rated voltage at 40°C, 95% RH for 500 hours at intervals of 1.5 hours "ON" and 0.5 hour "OFF"	
High Temperature Load Life	Change ratio of R_{25} after applying the maximum rated voltage at 60°C for continuous 1000 hours	

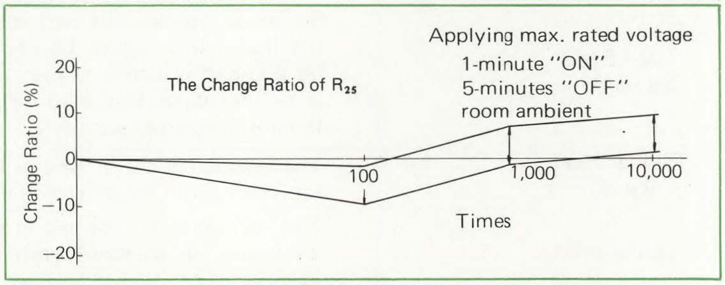
Characteristics
Voltage vs. Current



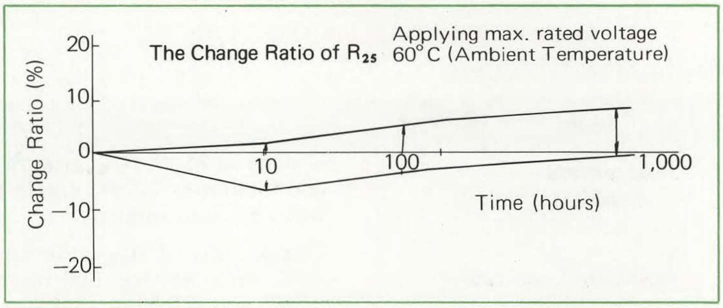
Resistance vs. Temperature



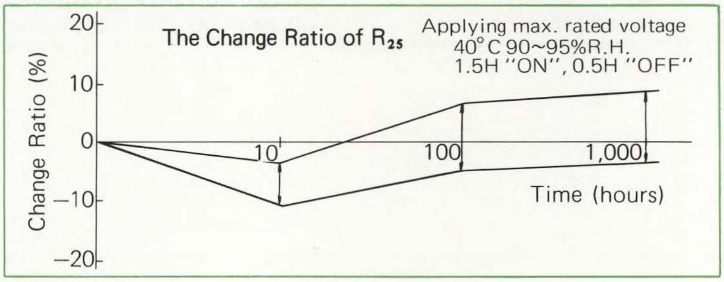
Intermittent Load Life



Load Life at High Temperature



Load Life in Humidity



Application

- Temperature compensation
  e.g. transistors, transistor circuits, measuring equipment
- Limitation of current
  e.g. transistors, transistor circuit
- Thermostatic control
  e.g. electronic jar, electronic rice cooking jar, electronic mosquito killer, hot plate, electronic kettle
- Non-contact switch
  e.g. timer, motor starting
- Degausser for color TV, color VTR

Caution

1. In case of B characteristic PTC thermistor application, the components around the thermistors should be free from the heat generated in the thermistor with voltage application.
2. Cares should be taken not to operate the thermistor at temperatures exceeding the specified values and with the voltages over the maximum rated values.

Part Number Code

E R P	– □	□	□ □	□	□ □ □	□
Common Code	Form & Terminal	Dimensions	Characteristics	Resistance Tolerance	Resistance	Suffix

Dimensions

Size mm (inch)	
1	3(0.118)
2	5(0.197)
3	8(0.315)
4	12(0.472)
5	15(0.591)
6	18(0.709)
7	25(0.984)

Characteristics

Temperature Coefficient of Resistance for "A type" PTC-Thermistor

Temperature Coef. of Res. (α) (%/°C)	
2	2.5
3	3.5
4	4.5

Switching Temperature for "B type" PTC-Thermistor

	Switching Temp. (°C)
0	50
1	75
2	90
3	120

Resistance Tolerance

Tolerance of Resistance at 25°C

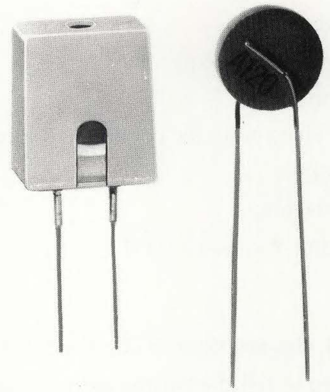
Symbol	Tolerance %
K	±10
L	±15
M	±20
R	±40

Resistance

The first two digits are significant figures of resistance and the third one denotes number of zeros following them. Decimal point is expressed by R as 1.4=1R4.

Degaussing Elements

The degaussing PTC thermistor elements from Matsushita are ideal for use in automatic degaussing circuits of color TV's.
Type ERP-C, a PTC thermistor element encased in flame-proof insulation resin, and Type ERP-F of disc type, the both of which are also ideal for reduction of winding number of coils enabling cost reduction.

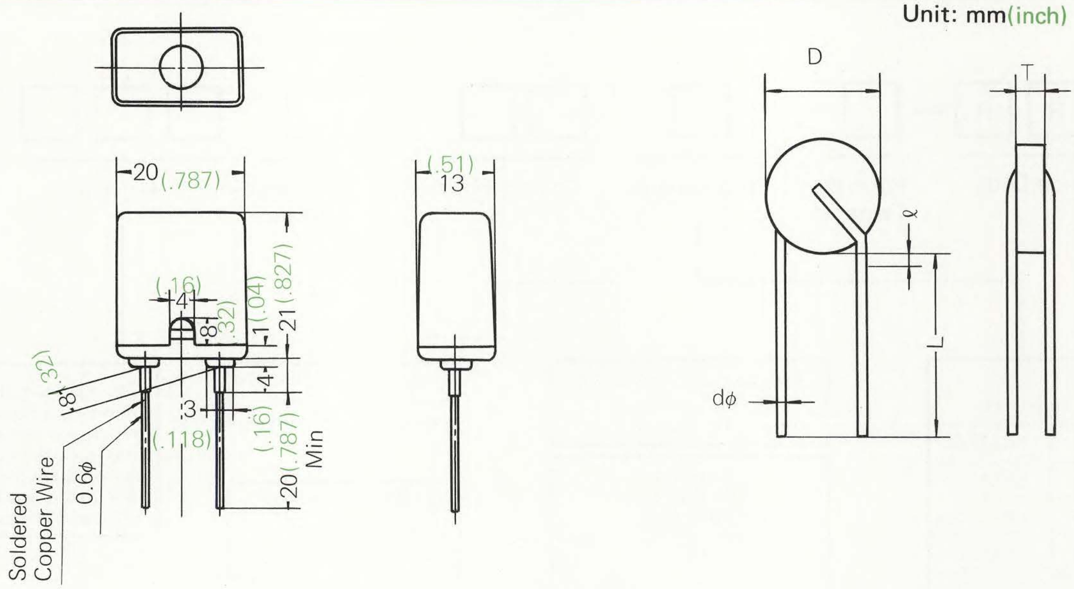


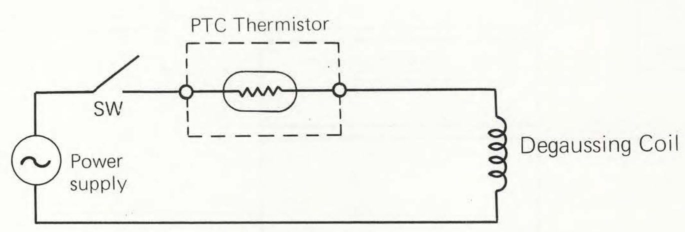
Features

- Non-contact construction
- Applicable to any type of power supply on market
- Quick response (Types ERP-C, ERP-F)
- Large inrush current (Types ERP-C, ERP-F)
- Quick recovery (Types ERP-C, ERP-F)

Shapes, Dimensions and Application Circuits

Unit: mm(inch)





Dimensions (Type ERP-F)

Part No.	D	T	L min.	ℓ max.	dϕ
ERP-F4B0M8R0	12.5 ± 1 (.492 ± .039)	2.5 ± 0.7 (.098 ± .031)	20 (.787)	5 (.197)	0.6 (.024)
ERP-F5B0M120	14.5 ± 1 (.571 ± .039)	2.5 ± 0.7 (.098 ± .031)	20 (.787)	5 (.197)	0.6 (.024)
ERP-F5B0M180	14.5 ± 1 (.571 ± .039)	2.5 ± 0.7 (.098 ± .031)	20 (.787)	5 (.197)	0.6 (.024)
ERP-F5B0M250	14.5 ± 1 (.571 ± .039)	2.5 ± 0.7 (.098 ± .031)	20 (.787)	5 (.197)	0.6 (.024)
ERP-F5B0M600	14.5 ± 1 (.571 ± .039)	5.0 ± 1 (.197 ± .039)	20 (.787)	5 (.197)	0.8 (.031)

Ratings

Electrical Ratings

Inrush Current	When the rated voltage is applied at an ambient of 25°C ± 1°C with a degaussing coil of standard resistance value, the current meets the specified values.
Current Attenuation	When the rated voltage is applied at an ambient of 25°C ± 1°C with a degaussing coil of standard resistance value, the current through coil meets the specified values.
Resistance Value	When measured with a d-c voltage of less than 1.5V at an ambient of 25°C ± 1°C, the resistance value is within the specified values.
Max. Rated Voltage	Within a temperature range from −20°C to 60°C the voltage to be applied to the unit should be within the specified range.
Withstand Voltage	No damage after application of the rated voltage at an ambient of 25°C±1°C for 3 minutes.

Environmental Ratings

ON-OFF Load Life	A cycle of 1 minute "ON" and 5 minutes "OFF" operation shall be repeated 10,000 times at room ambient and after the test, the change ratio of the resistance value is within ± 20%.
Continuous Load Life	After 1,000 hour application of the maximum rated voltage at room ambient, the change ratio of the resistance value is within ± 20%.
Humidity Load Life	After 500 hour application of the maximum rated voltage at an ambient of 40°C, 90 ~ 95%RH at intervals of 1.5 hours "ON" and 0.5 hour "OFF", the change ratio of the resistance value is within ± 20%.

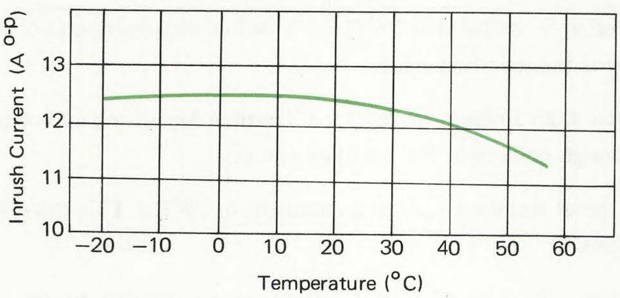
Specifications

Part No.	Res. Value	Rated Voltage	Max. Rated Voltage	Withstand Voltage	Inrush Current	Current Attenuation		Degaussing Coil
						After 1.0 sec.	After 2 minu.	
ERP-C4B0M080 ERP-F4B0M080	8Ω ±20%	100V	132V	150V	7A	0.5A	11mA	9Ω
ERP-C5B0M120 ERP-F5B0M120	12Ω±20%	120V	132V	150V	9A	0.5A	10mA	6Ω
ERP-C5B0M180 ERP-F5B0M180	18Ω±20%	120V	132V	150V	6.5A	0.5A	10mA	6Ω
ERP-C5B0M250 ERP-F5B0M250	25Ω±20%	120V	132V	150V	5A	0.5A	10mA	6Ω
ERP-C5B0M600 ERP-F5B0M600	60Ω±20%	220V	242V	280V	5A	0.5A	10mA	14Ω

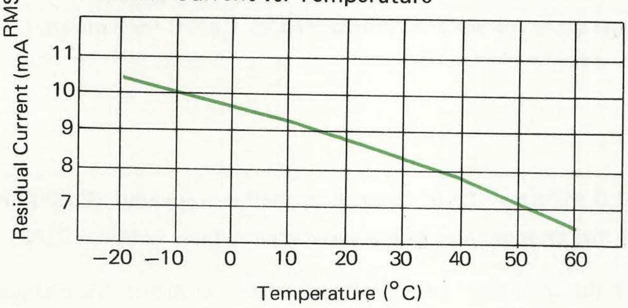
Typical Characteristics

ERP-C5B0M120

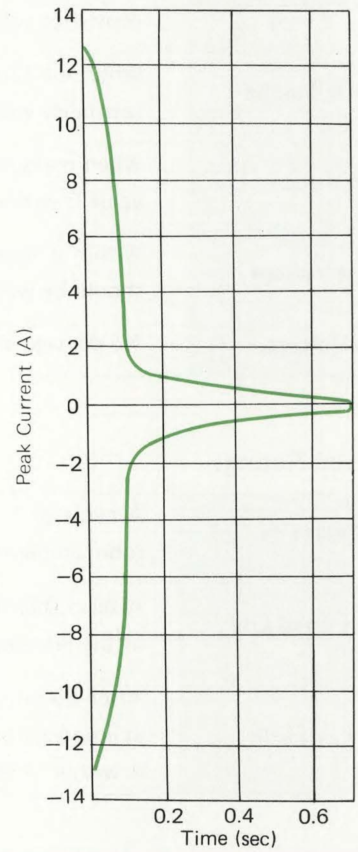
Inrush Current vs. Temperature



Residual Current vs. Temperature

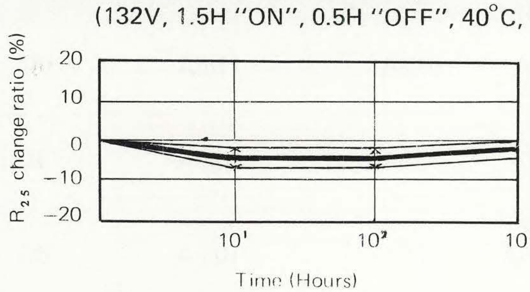


Current Attenuation

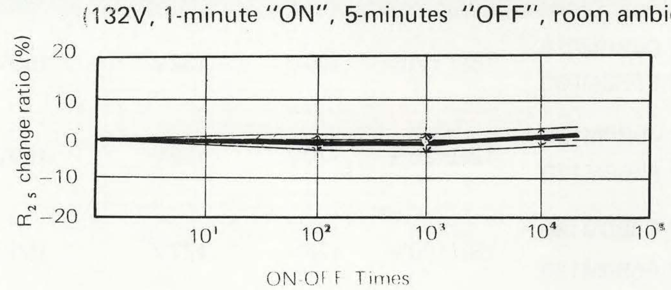


Life Characteristics

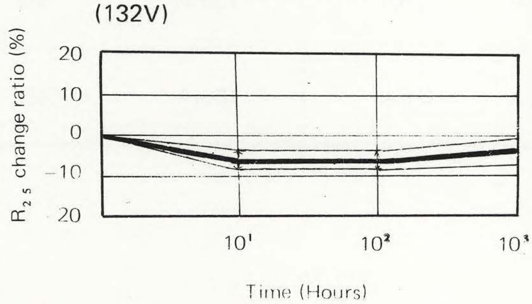
Intermittent Load in Humidity
(132V, 1.5H "ON", 0.5H "OFF", 40°C, 90%RH)



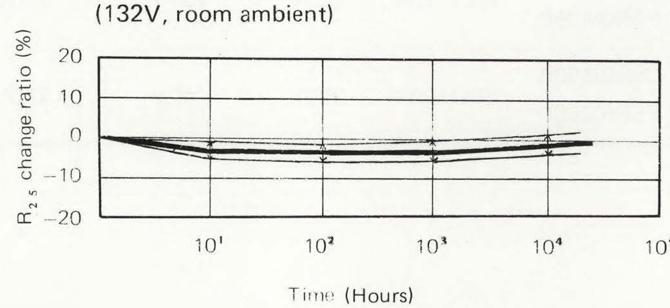
Intermittent Load
(132V, 1-minute "ON", 5-minutes "OFF", room ambient)



Continuous Load in Humidity
(132V)

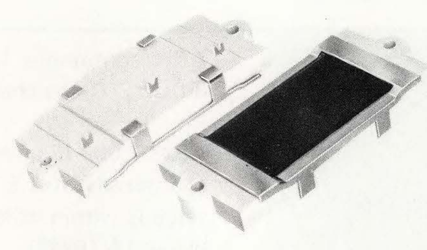


Continuous Load
(132V, room ambient)



PTC Thermistor Unit for Thermostat

This thermostat unit is of non-contact construction, employing a PTC thermistor's switching characteristic that the resistance value increases rapidly when the temperature becomes higher than the specified value, and taking the most of its self-heat-generation characteristic after switching.
Ideal for use in home electric apparatus and industrial equipment.



Features

- Non-contact construction and semi-permanent life, being free from damage
- Fast temperature rise
- Stable temperature retention against changes of applied voltages and ambient temperatures
- Small inrush current due to connection in series with a heater (or resistor)

Application

- 'Electronic jar' ('Electronic jar' is a popular device in Japan to keep cooked rice warm)
- 'Electronic Cooking Jar' equipped with cooking and warming device
- 'Hot Plate''and electronic kettle
- Electronic mosquito killer device
- Dew remover of Electronic Jar

Shapes and Dimensions

Fig. 1 Unit: mm (inch)

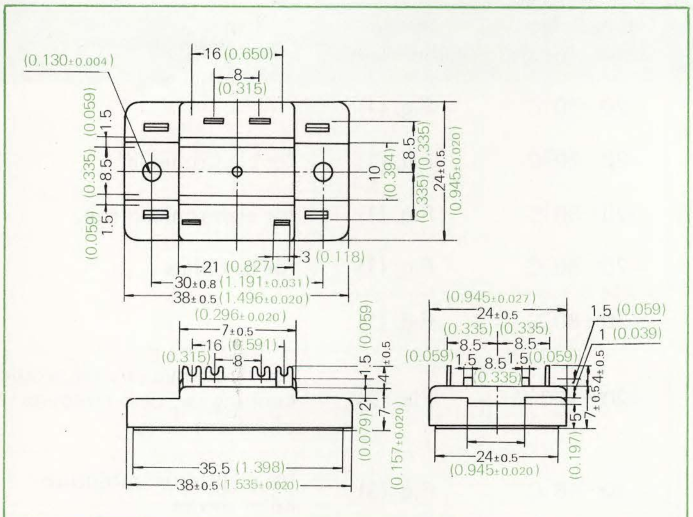


Fig. 2 Unit: mm (inch)

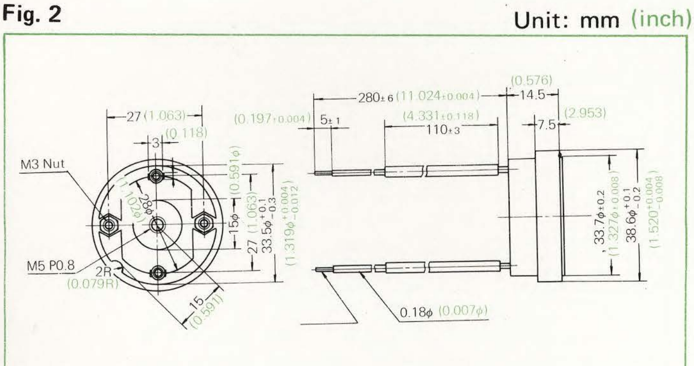
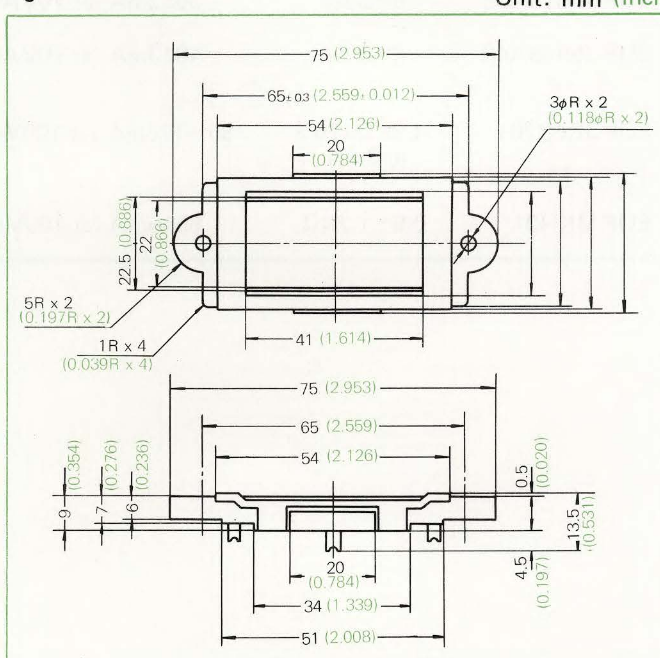


Fig. 3 Unit: mm (inch)



Ratings
Electrical Ratings

Resistance Value	When the voltage of 1.5 VDC or less is applied at an ambient temperature of 25°C, the resistance meets the specified value.
Steady Current	After 10 minute application of the rated voltage ±0.5V at an ambient temperature of 25°C±1°C, steady current meets the specified value.
Max. Rated Voltage	Within the temperature range from –20°C to +80°C the maximum allowable voltage is 130VAC.

Environmental Ratings

Continuous Load Life	After continuous 1,000 hour application of 125VAC ±1V at an ambient temperature of 80°C ±2°C, the change ratio of the resistance value is within ±5%.
ON-OFF Load Life	After 1,000 hour application of 125VAC ±1V at an ambient temperature of 25°C ±5°C at intervals of 1.5 hours 'ON' and 0.5 hour 'OFF', the change ratio of the resistance value is within ±5%. The resistor must be connected in series to keep the inrush current below 1A (RMS).
Humidity	The unit is left at an ambient of 40°C ±2°C, 90 to 95%RH for 350 hours, and then left at room ambient for 30 minutes. The change ratio of resistance value is within ±5%.

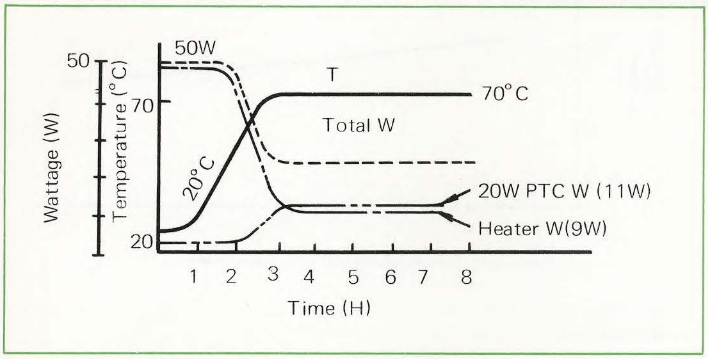
Specifications

Part No.	Resistance Value	Steady Current Value	Operating Temp. Range	No. in Dimensions	Application
EUP-J6B1SA20	6~60Ω	20±3mA (at 70VAC)	–20~80°C	Fig. (1)	for electronic jar for electronic kettle for hot plate
EUP-J6B1SA25	6~60Ω	25±3mA (at 70VAC)	–20~80°C	Fig. (1)	
EUP-J6B1SA30	6~60Ω	30±3mA (at 70VAC)	–20~80°C	Fig. (1)	
EUP-J6B1SA35	6~60Ω	35±3mA (at 70VAC)	–20~80°C	Fig. (1)	
EUP-J6B1SA40	6~60Ω	40±3mA (at 70VAC)	–20~80°C	Fig. (1)	
EUP-JR6B201	4.5KΩ±20% at 2mA	85~125mA (at 100VAC)	–20~120°C	Fig. (2)	for electronic jar, electronic cooking jar, dew remover of electronic jar
EUP-MKH01	0.5~1.2KΩ	65±5mA (at 100VAC)	–10~45°C	Fig. (3)	for electronic mosquito killer device

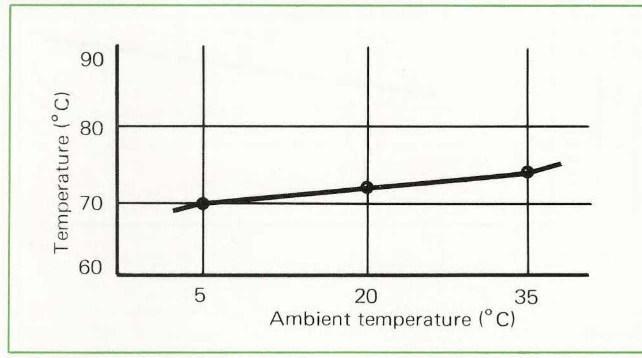
Characteristics

(1) Thermostat unit of 'Electronic Jar'

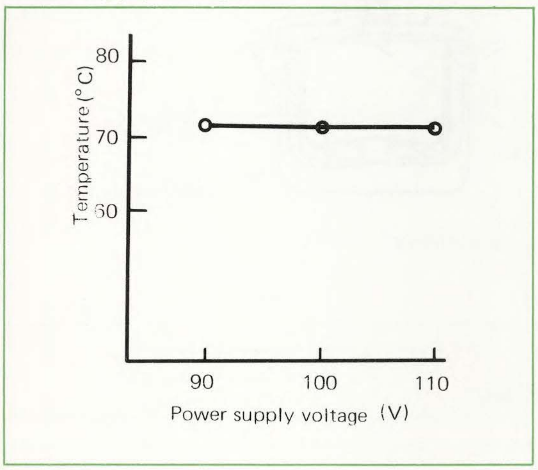
Time vs. Wattage and Temperature of Cooked Rice



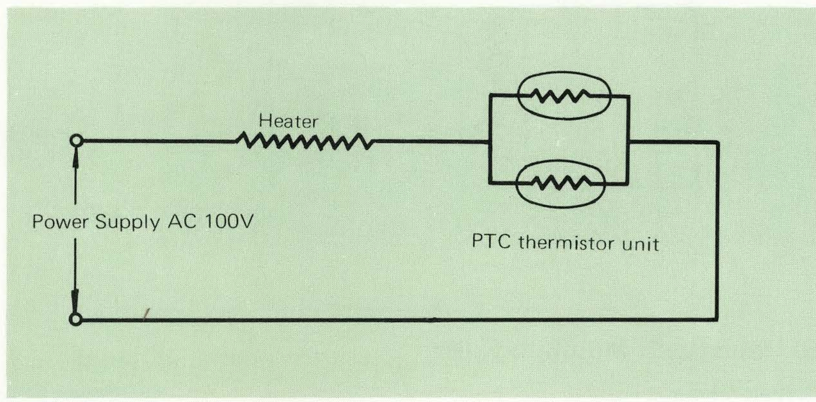
Temperature of Cooked Rice vs. Ambient Temperature



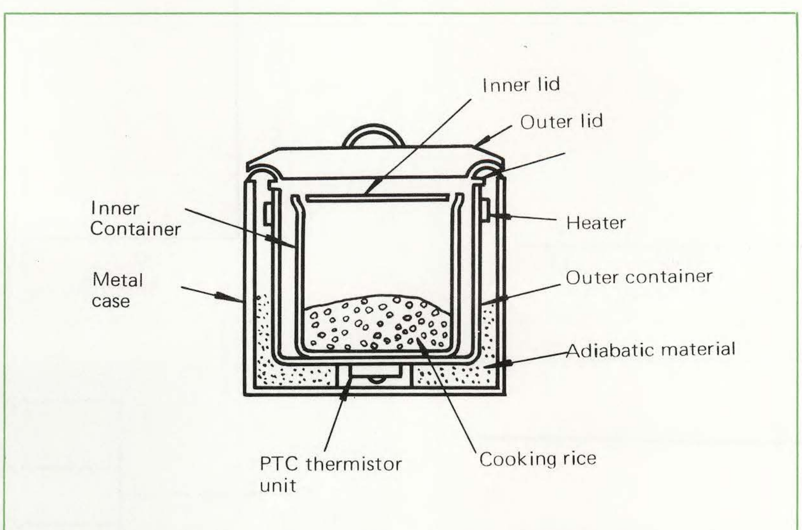
Temperature of Cooked Rice vs. Power Supply Voltage



Terminal Connection

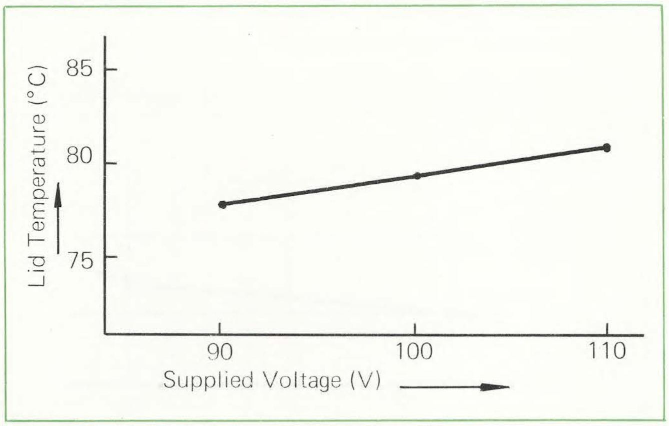


Construction

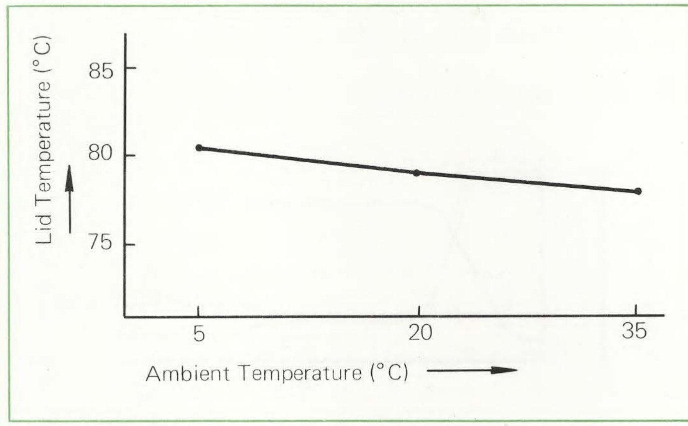


(2) Heating Unit of Dew Remover of Electronic Jar

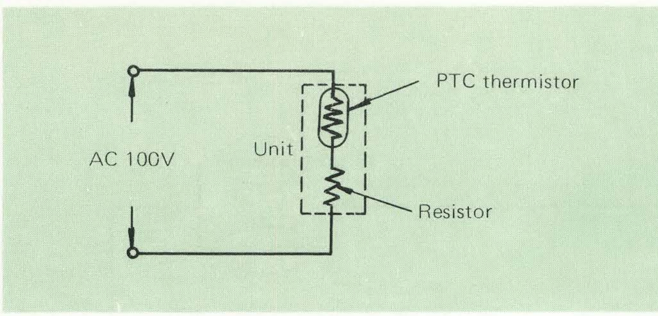
Voltage Characteric



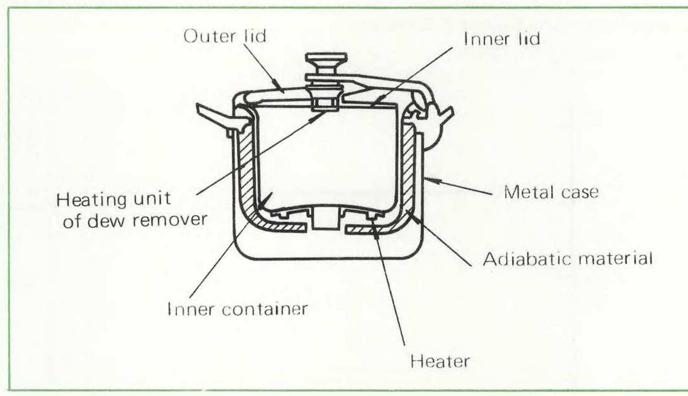
Ambient Temperature (When mounted in a Electronic Jar)



Circuit

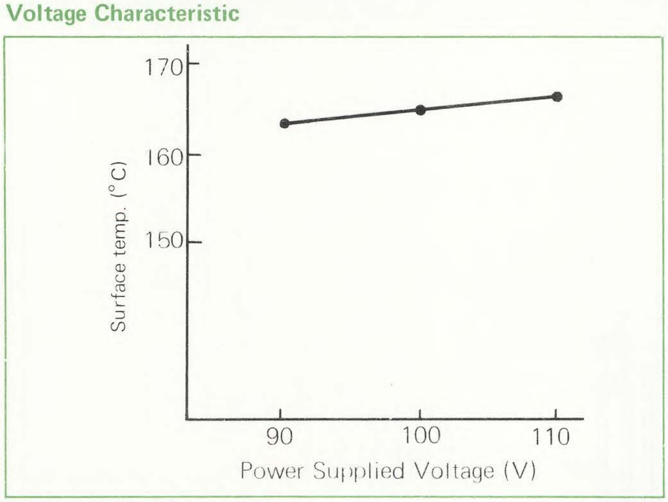


Construction

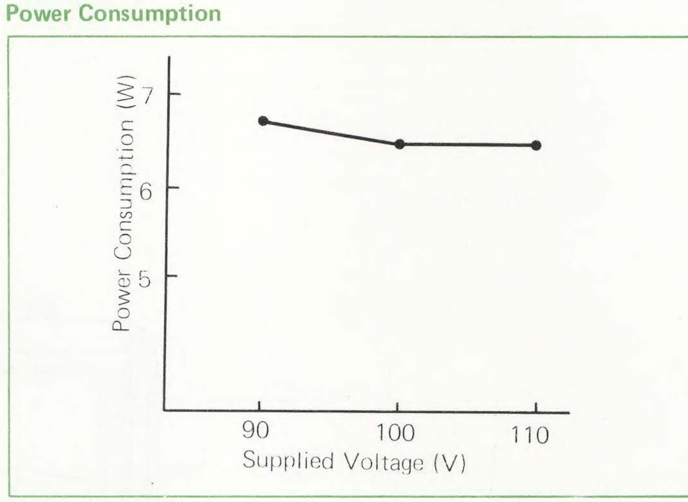


(3) Electronic Mosquito Killer

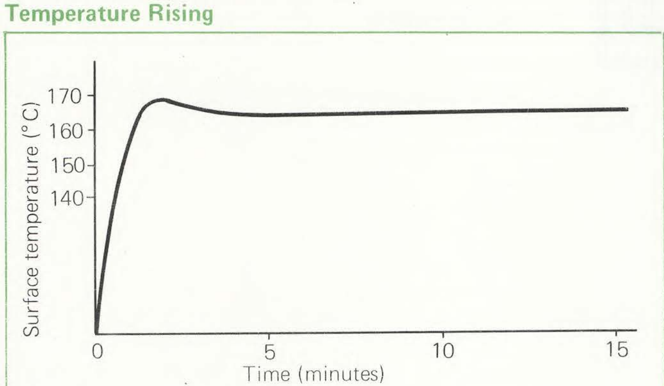
Voltage Characteristic

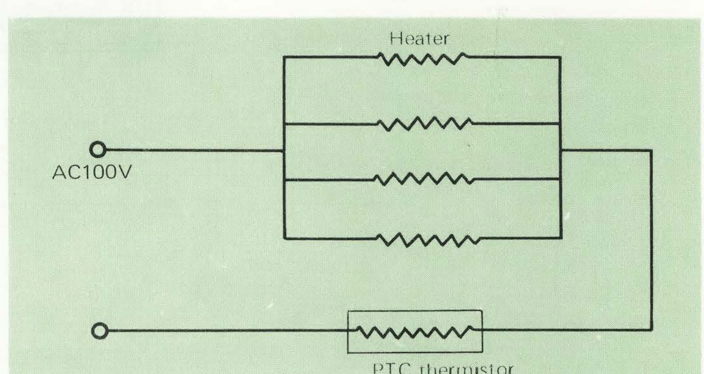


Power Consumption



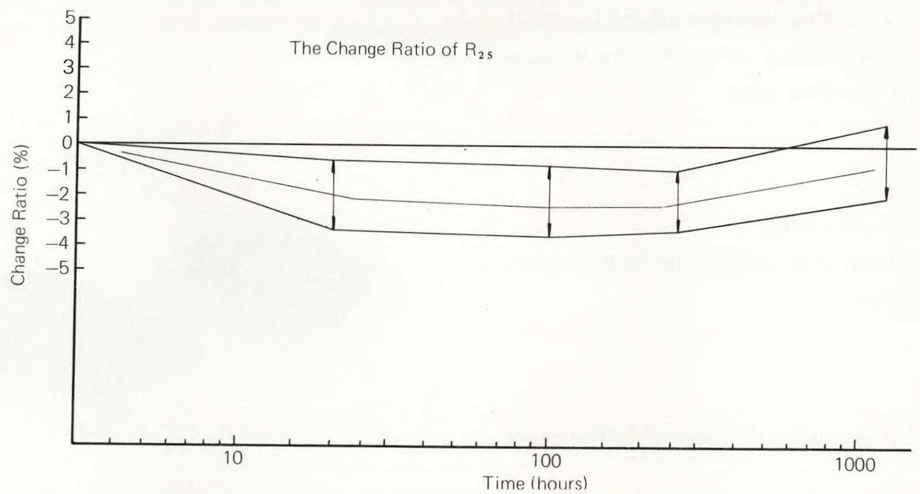
Temperature Rising



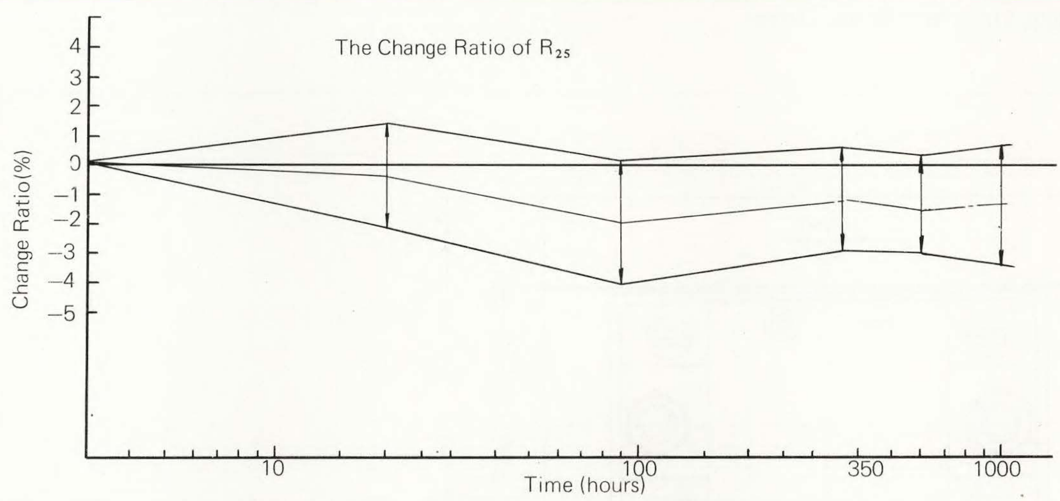


Environmental Characteristics

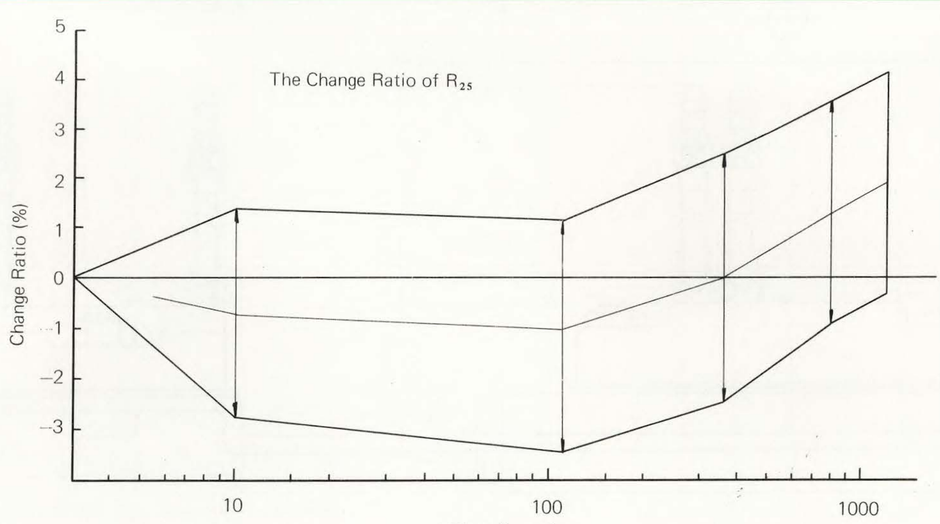
Continuous Load Life (80°C, 125VAC)



Humidity (40°C, 90~95% RH)

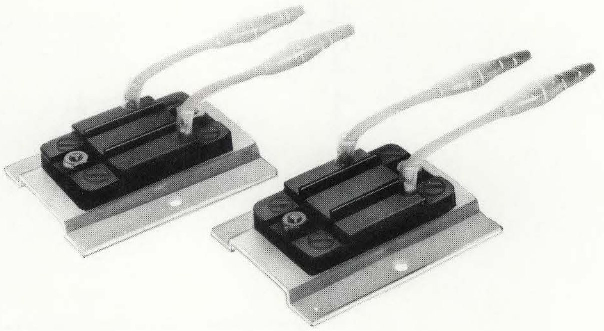


ON-OFF Load Life (25°C, 125VAC)



Non-Contact Switch

Non-contact switch operates electrically without relays or by-metals, utilizing the switching function caused by rapid increase of resistance which occurs when the temperature becomes higher than the specified value.



Features

- Electrical switching effect
- No deterioration in contact point
- Stable against vibrations and shocks, facilitating miniaturization of equipment
- No contact noise

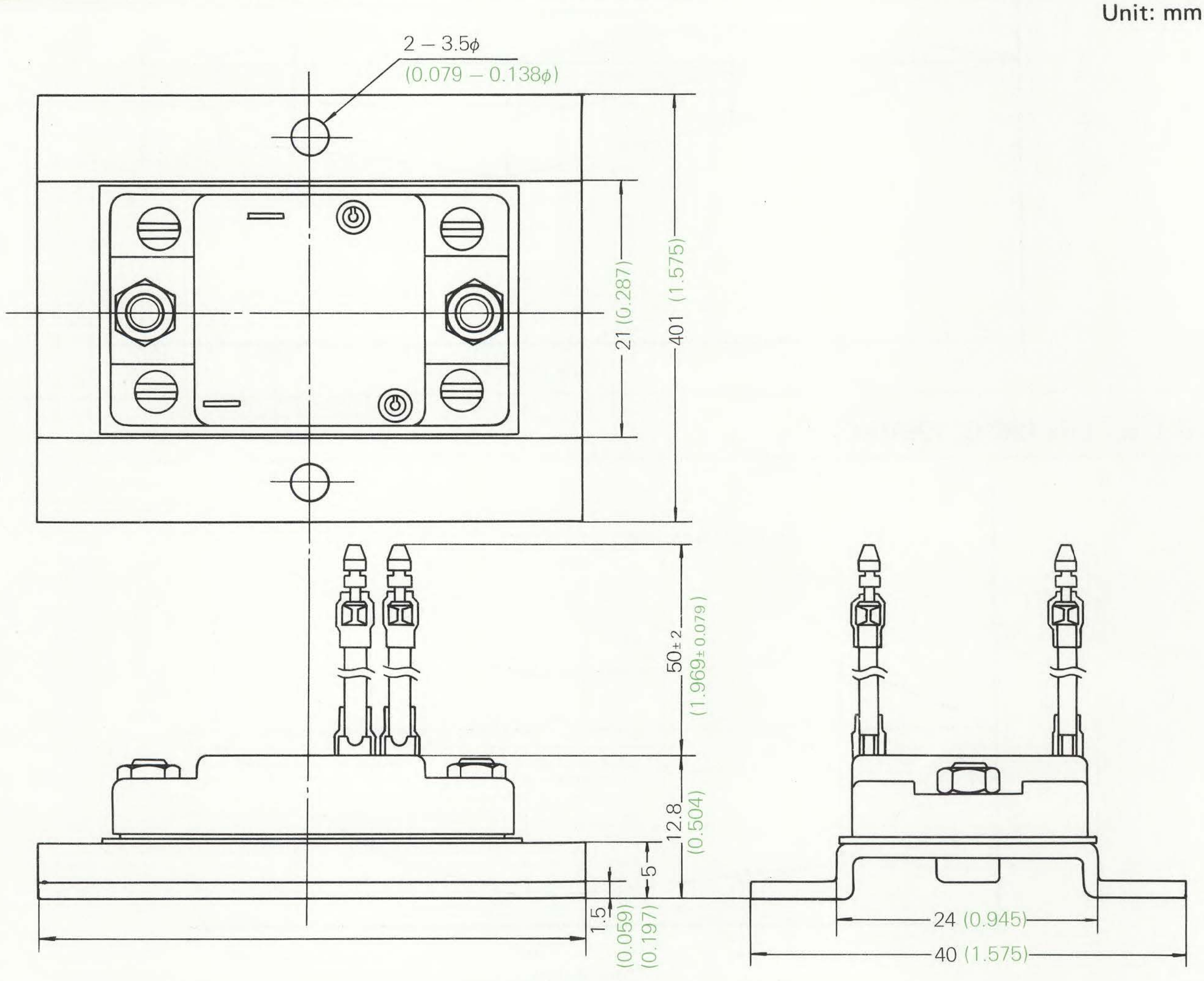
Application

- For motor drive for compressors used in refrigerators and coolers
- For use in overcurrent suppression units

PTC Thermistor Unit for Motor Drive

Dimensions

Unit: mm (inch)



Ratings

Electrical Ratings

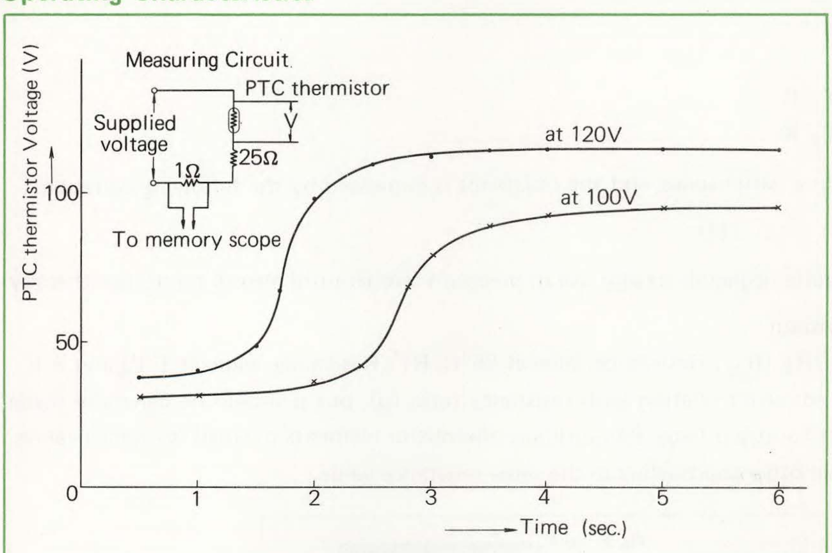
Item	Test Method	Rated Value
Resistance Value	The resistance value measured with a d-c voltage of less than 1.5V at an ambient of 25°C±1°C	7.0Ω±15%
Max. Rated Voltage	The max. rated voltage measured within a temperature range from -20°C to 45°C	150VAC
Rated Power Consumption	The rated power consumption measured when a voltage of 100VAC is applied at room ambient	Below 7W

Environmental Ratings

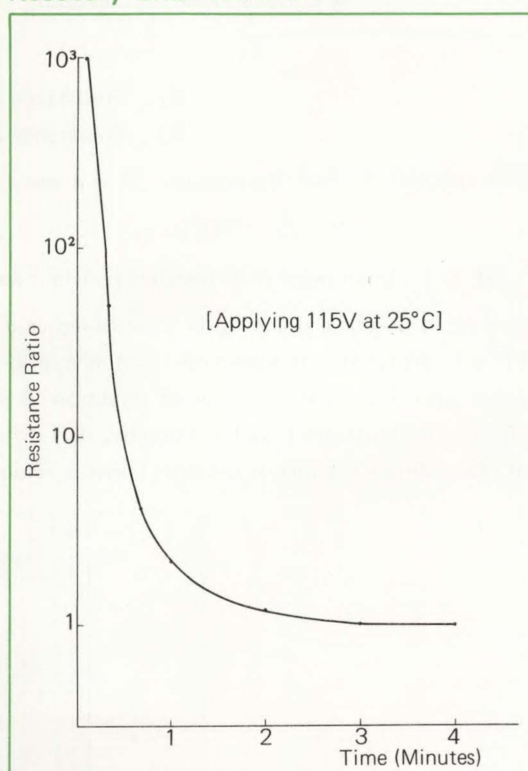
Item	Test Method	Rated Value
Continuous Load Life	Change ratio of R_{25} after continuous 1000 hour application of 150VAC at a room ambient	$\Delta R/R_{25} \leqq 20\%$ No exterior damage
Intermittent Load Life	Change ratio of R_{25} measured after 1000 hour application of 150VAC in the circuit where a 25Ω resistor is connected in series at room ambient at intervals of 5 seconds "ON" and 55 seconds "OFF".	

Characteristics

Operating Characteristics



Recovery Characteristics



THERMISTORS

This is a Negative Temperature Coefficient Resistor whose resistance changes as an ambient temperature changes. This thermistor comprises 2 or 4 kinds of metal oxides of iron, titanium, nickel, cobalt, manganese and copper, being shaped and sintered at high temperature (1200°C ~ 1500°).

Physical Characteristics

Thermistor is a resistor sensitive to temperature utilizing the large temperature-coefficient of metal oxide semi-conductor. And its temperature dependency of resistance value is indicated by the following equation:

$$R = R_0 \exp B \left(\frac{1}{T} - \frac{1}{T_0}\right) \ldots\ldots\ldots\ldots (1)$$

T_0: Standard temperature 298°K (25°C)

R_0: Resistance value at T_0°K

B: Thermistor constant (°K)

So called temperature coefficient (α) is generally indicated as follows:

$$\alpha = \frac{B}{T^2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

But α is not adequate for use as a constant, because a change by temperature is considerably large, so B is used as a coefficient of thermistor.

Major Characteristics

The relation between resistance and temperature of a thermistor is linear as shown in Fig. 2, in which resistance is shown in vertical direction in a logarithmic scale and reciprocal of absolute temperature in horizontal direction. Bias degrees in these straight lines are determined according to the value B expressed by the following equation:

$$B = \frac{2.303\ (\log R_1/\log R_2)}{\dfrac{1}{T_1} - \dfrac{1}{T_2}}$$

R_1: Resistance at T_1°K

R_2: Resistance at T_2°K

When calculated from this equation, B is a variable in a strict sense, and the resistance is expressed by the following equation:

$$R = AT^{-C}e^{D/T} \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

In (4), C is a small positive or negative constant and quite negligible except use in precision temperature-measuring device, thereby the B is, in practical usage, to be considered as a constant.

In Fig. 1, the relation between the resistance ratio R_{25}/R_T (R_{25}: Resistance value at 25°C, R_T: Resistance value at T°C) and B is shown with T°C in the horizontal direction. B has not strict relation with resistance ratio (p), but p should be generally made larger to obtain larger B value. Thereby, it is difficult to attain large B in ordinary thermistor elements of small resistance values, but Matsushita's thermistor provides larger B value than other thermistors in the same resistance value.

Fig. 1

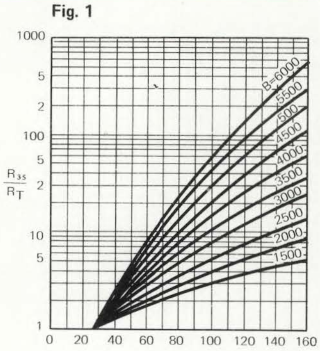


Fig. 2

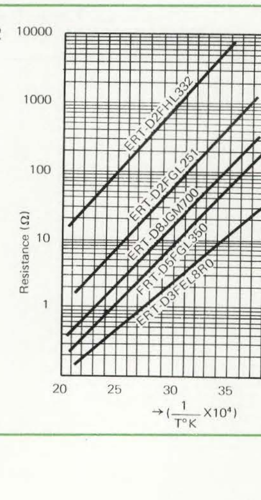


Fig. 3-5 exhibits static characteristic curves which show the relationship between current and voltage of a thermistor, and when the current exceeds a specified value, the curve becomes for negative resistance.

In this case, the following equation exists between the temperature of thermistor, which is indicated as (T°C), and electric energy consumption when the current I is applied.

$$IV = K(T - T_0) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

T_0: Room temperature

K: Heat dissipation coefficient (mw/°C)

Fig. 3 shows the static characteristic curve when heat dissipation coefficient K varies. When K becomes larger, the curve transfers toward the arrow direction.

Fig. 4 shows the static characteristic curve when temperature constant B varies. As B value becomes larger, the resistance value becomes smaller due to affection of self heat generation.

Fig. 5 shows the static characteristic curve when the temperature T_0 varies and when T_0 becomes larger, the curve transfers toward the arrow direction.

And various kinds of static characteristics can be obtained by means of changing the initial resistance value and by connecting the fixed resistors.

Fig. 3

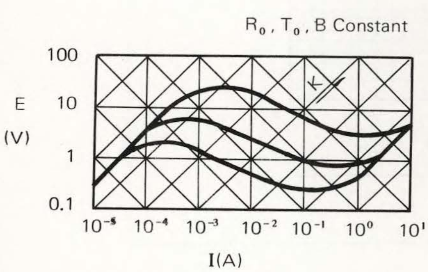


Fig. 4

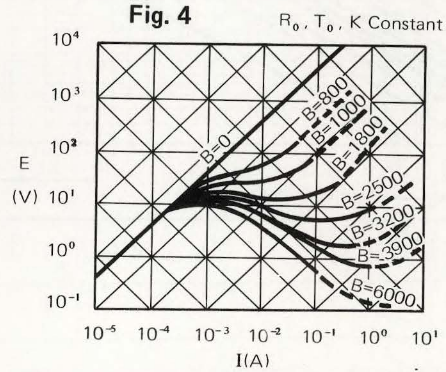
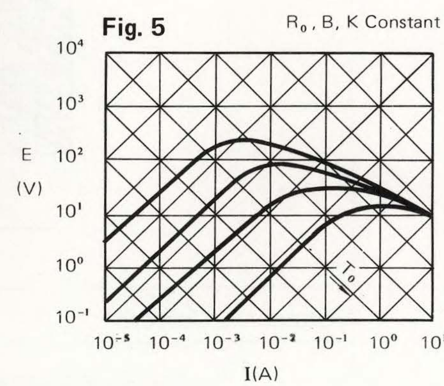


Fig. 5



Features

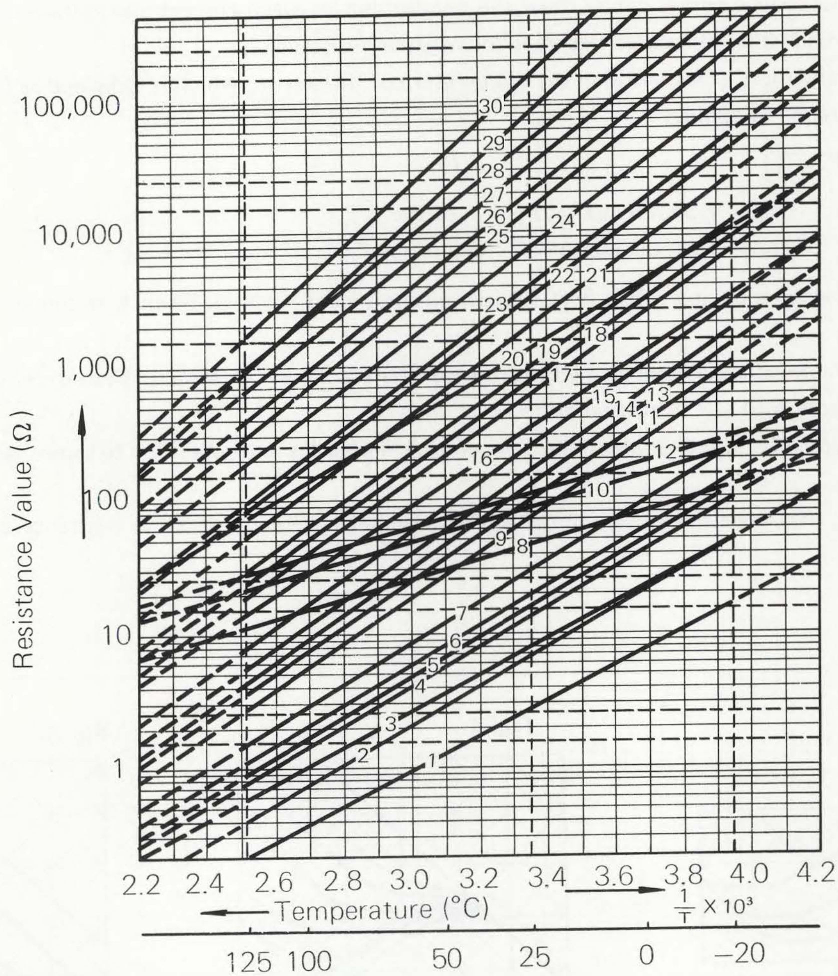
- Resistance temperature coefficient is negative and extremely large.
- Various kinds of types especially smaller ones are available.
- Resistance values are available from 1Ω to 10Ω.

Application

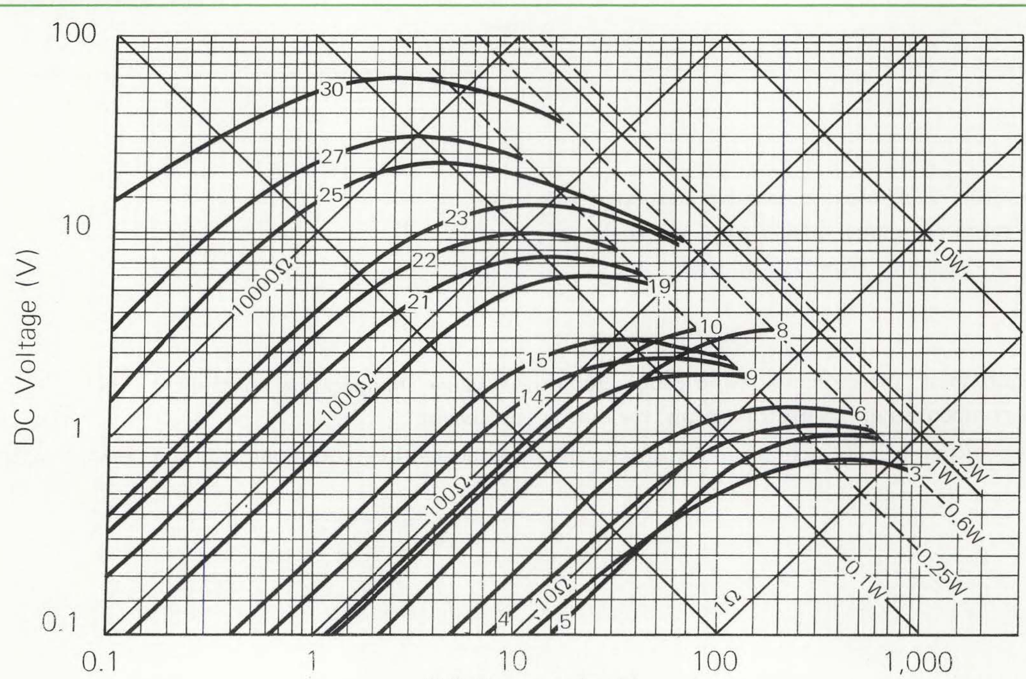
- For measuring equipment: thermometer, wind gauge, liquid level gauge, temperature controller
- For temperature compensation: transistor circuit, measuring equipment
- For driving: delay-setting in relay operation, inrush current surge protection, communication equipment, AGC, time lag

Characteristics

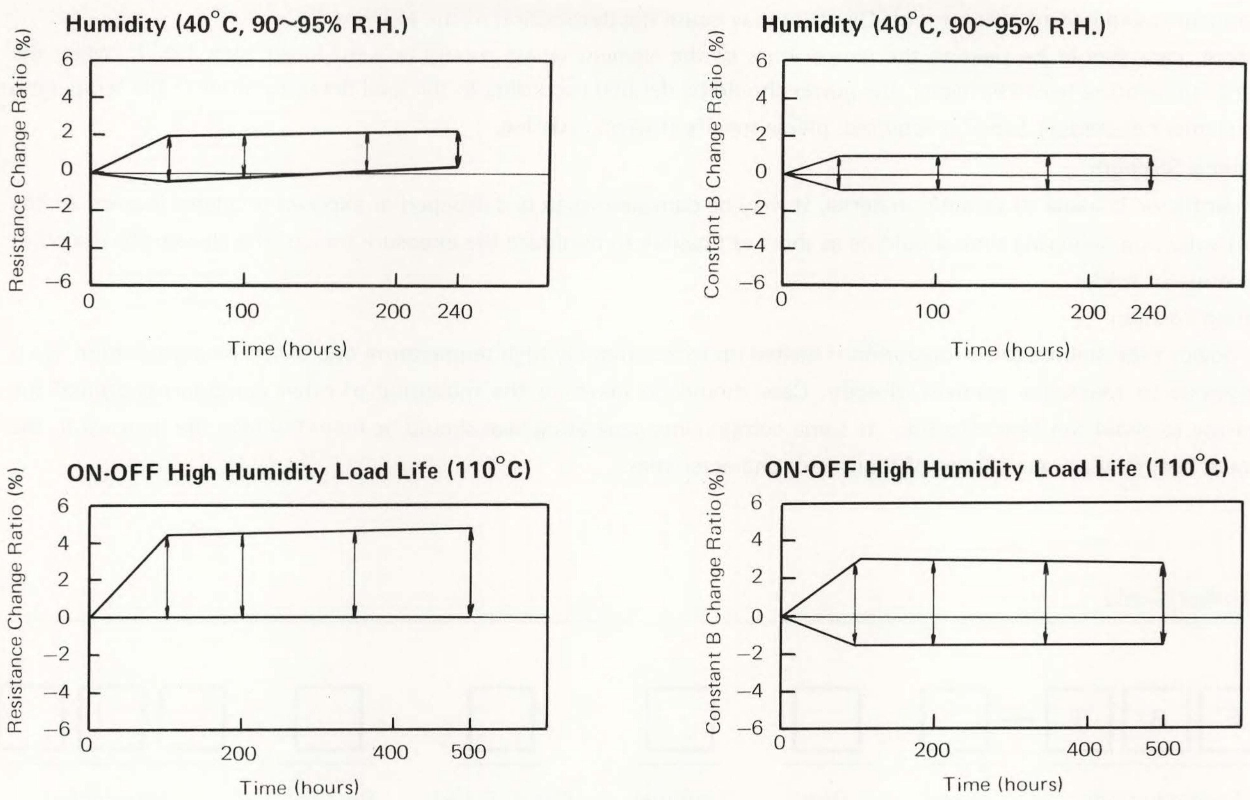
Resistance vs. Temperature



Voltage vs. Current



Standard Life Characteristic



Constant B, Resistance Value and Dimensions

Constant B	D2 Series (Ω)	D3 Series (Ω)	D5 Series (Ω)	D6 Series (Ω)	D7 Series (Ω)	D8 Series (Ω)
1500°K	70 ~ 120	10 ~ 60	2 ~ 10			
1550°K	80 ~ 110					
2400°K		35 ~ 45				
2700°K	800 ~ 1000	500 ~ 600				
3000°K	500 ~ 800	250 ~ 400				
3100°K	85 ~ 270					
3300°K	25 ~ 80	13 ~ 40	4 ~ 6			
3500°K	300 ~ 1600	140 ~ 750				
3700°K	70 ~ 110	30 ~ 100				
3900°K	150 ~ 230	75 ~ 100				
3950°K	300 ~ 2500	100 ~ 1000				
4000°K	600 ~ 800	270 ~ 500				
4100°K				70 ~ 130	70 ~ 130	30 ~ 70
4200°K	800 ~ 4000	400 ~ 2000	800 ~ 1000	2.5K ~ 3.5K	180 ~ 250	
4250°K	800 ~ 1500					
4300°K	8K ~ 10K	3.5K ~ 4.5K				
4500°K	30K ~ 100K	15K ~ 50K				
4600°K	100K~160K	50K ~ 80K				
5300°K	200K ~ 300K	100K ~ 150K				

Precautions for Application

1. Rated Power

   If a thermistor should be operated exceeding the rated power, making it generate heat, resistance decreases and thereby a thermistor is exposed to over-current. Overheat may cause the destruction of the element.

   Therefore, care should be paid to the temperature of the element which should be kept lower than 125°C. When the ambient temperature becomes higher, the power should be derated according to the load derating curve. If the temperature of the element exceeding 125°C is required, please specify it when ordering.

2. Mechanical Strength

   As a thermistor is made of ceramic material, it may be damaged when it is dropped or exposed to a large impact. At the time of soldering, soldering time should be as short as possible to minimize the exposure time of the element to the point temperature of solder.

3. Mounting Position

   Large power type thermistor in operation is heated up to a extremely high temperature due to self heat generation. So it is dangerous to touch the element directly. Care should be taken to the mounting of other components around the thermistor to avoid the heat affection. If some components generating heat should be mounted near the thermistor, the generated heat may cause a change of thermistor characteristics.

Part Number Code

E R T	– ☐	☐	☐	☐	☐	☐☐☐
Common Code	Shape	Dim.	Terminal	Const. B (°k)	Res. Tol.	Resistance

Shape:

D	Disc Type
R	Rod Type

Dim.:

	mm (inch)
1	3.0 (0.11)
2	5.0 (0.19)
3	7.5 (0.30)
4	10.0 (0.40)
5	13.0 (0.51)
6	17.0 (0.67)
7	21.0 (0.83)
8	25.0 (0.98)

Const. B (°k):

A	upto 1000
B	1000~1500
C	1501~2000
D	2001~2500
E	2501~3000
F	3001~3500
G	3501~4000
H	4001~4500
I	4501~5000
J	5001~5500
K	5501~6000
L	over 6001

Res. Tol.:

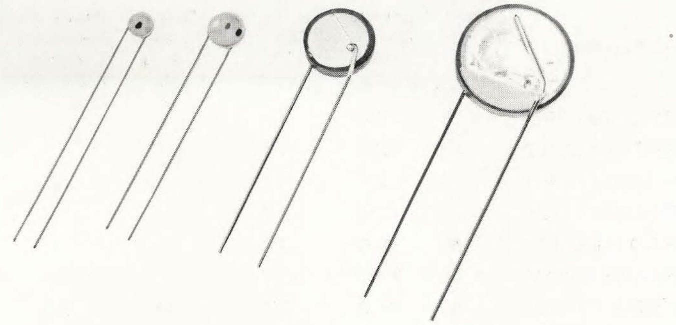
J	± 5%
K	±10%
L	±15%
M	±20%
R	±40%

Resistance:

First 2 digits are significant figures of resistance and the third one denotes number of zeros following them.
Decimal point is expressed by R as 1.4=1R4.

Type ERT

This is a Negative Temperature Coefficient Resistor which changes its resistance value according to its ambient temperature change.



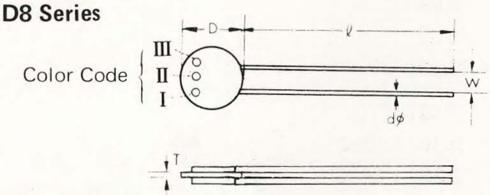
- Wide range and little variation of temperature coefficient (Constant B) compared with resistivity
- Low B types can omit parallel fixed resistors when using for temperature compensation
- Excellent electrical and thermal stability
- Semipermanent life

Application

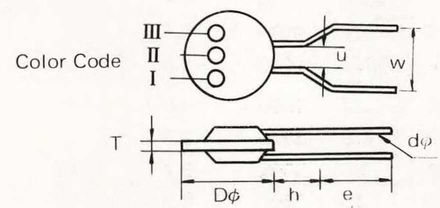
- Time delay circuits, Surge protection, Temperature compensation, Temperature sensitive resistors

Standard Products

D2 ~ D8 Series



D2, D3 Series



	Dφ	T	u	e	h	W	dφ		Dφ	T	u	e	h	W	dφ
D2	5.0±0.5 (.197 ±.020)	1.3±0.5 (.050 ±.020)	3(.118) min. 2.5(.100) nom.	4.5±1.0 (.177 ±.039)	6(.236) max. 5(.196) nom.	5.0±1.0 (.197 ±.039)	0.6 (.024)	D3	7.5±0.5 (.300 ±.020)	1.4±0.5 (.055 ±.020)	5.5(.220) min. 5(.200) nom.	4.5±1.0 (.177 ±.039)	6(.236) max. 5(.196) nom.	7.5±1.0 (.300 ±.039)	0.6 (.024)

Part No.	Resist-ance at 25°C (Ω)	Nominal Con-stant B (°K)	Res. Temp. Coef. (25°C) (%/°C)	Max. Wattage Rating (W)	Nominal Dissipation Constant (MW/°C)	Nominal Time Constant (sec)	Resistance Ratio 25°C/50°C	Dimensions mm (inch)					Curve No.
								D	T	min. ℓ	dφ	Nom. W	
ERT-D2FEL200S	20	3000	−3.4				2.18						—
ERT-D2FFL400S	40	3300	−3.7				2.36						—
ERT-D2FGL750S	75	3700	−4.2				2.62						9
ERT-D2FCL101S	100	1600	−1.8				1.51						—
ERT-D2FDL101S	100	2400	−2.7				1.87						—
ERT-D2FFL101S	100	3100	−3.5				2.24						—
ERT-D2FGL101S	100	3700	−4.2				2.62						11
ERT-D2FFL171S	170	3100	−3.5				2.24						—
ERT-D2FGL171S	170	3900	−4.4				2.76						14
ERT-D2FFL251S	250	3300	−3.7				2.36						—
ERT-D2FGL251S	250	3900	−4.4				2.76						15
ERT-D2FGL301S	300	3900	−4.4				2.76						—
ERT-D2FFL351S	350	3500	−3.9				2.48						16
ERT-D2FFL601S	600	3500	−3.9	0.25	7.0	20	2.48	5.0±.5 (.197 ±.020)	1.3±.5 (.050 ±.020)	30 (1.180)	.4 (.016)	2.5±1 (.100 ±.039)	—
ERT-D2FGL601S	600	4000	−4.5				2.83						17
ERT-D2FHL801S	800	4100	−4.6				2.90						18
ERT-D2FFL102S	1000	3500	−3.9				2.48						—
ERT-D2FHL102S	1000	4100	−4.6				2.90						19
ERT-D2FFL142S	1400	3500	−3.9				2.48						20
ERT-D2FHL142S	1400	4200	−4.7				2.98						—
ERT-D2FHL202S	2000	4100	−4.6				2.90						21
ERT-D2FHL332S	3300	4200	−4.7				2.98						22
ERT-D2FHL462S	4600	4200	−4.7				2.98						—
ERT-D2FHL802S	8000	4300	−4.8				3.06						24
ERT-D2FHL103S	10000	4300	−4.8				3.06						—
ERT-D2FHL153S	15000	4300	−4.8				3.06						25
ERT-D2FHL333S	33000	4500	−5.1				3.22						27
ERT-D2FHL503S	50000	4500	−5.1				3.22						28
ERT-D2FIL154S	150000	5000	−5.6				3.70						30

Part No.	Resistance at 25°C (Ω)	Nominal Constant B (°K)	Res. Temp. Coef. (25°C) (%/°C)	Max. Wattage Rating (W)	Nominal Dissipation Constant (MW/°C)	Nominal Time Constant (sec)	Resistance Ratio 25°C/50°C	Dimensions mm (inch)					Fig. 1 Curve No.
								D	T	min. ℓ	dφ	w	
ERT-D3FEL8R0S	8	3000	−3.4				2.18						3
ERT-D3FFL130S	13	3300	−3.7				2.36						4
ERT-D3FFL160S	16	3300	−3.7				2.36						5
ERT-D3FFL200S	20	3300	−3.7				2.36						6
ERT-D3FFL300S	30	3400	−3.8				2.42						7
ERT-D3FDL400S	40	2400	−2.7				1.87						—
ERT-D3FFL400S	40	3300	−3.7	0.6	9.0	27	2.36	7.5±.5 (.300 ±.020)	1.4±.5 (.055 ±.020)	30 (1.180)	0.5 (.020)	5±2 (.200 ±.080)	—
ERT-D3FGL750S	75	3800	−4.3				2.68						—
ERT-D3FGL800S	80	3800	−4.3				2.68						—
ERT-D3FGL121S	120	4000	−4.5				2.83						—
ERT-D3FGL131S	130	4000	−4.5				2.83						13
ERT-D3FGL501S	500	4000	−4.5				2.83						—
ERT-D3FHL402S	4000	4300	−4.8				3.06						23
ERT-D3FHL203S	20000	4500	−5.1				3.22						26
ERT-D3FIL803S	80000	5000	−5.6				3.70						29
ERT-D5FEL2R7S	2.7	3000	−3.4				2.18						1
ERT-D5FFL6R6S	6.6	3300	−3.7				2.36						2
ERT-D5FFL8R0S	8.0	3300	−3.7	1.2	14	60	2.36	13±2 (.510 ±.080)	1.4 ±0.5 (.055 ±.020)	30 (1.180)	0.6 (.024)	7.5 (.300)	—
ERT-D5FGL350S	35	3800	−4.3				2.69						—
ERT-D5FHL102S	1000	4200	−4.7				2.98						—
ERT-D5FGM121S	120	4000	−4.5	1.5	15	70	2.83	13±2 (.510 ±.080)	2±0.7 (.079 ±.028)	30 (1.180)	0.8 (.031)	7.5 (.300)	—
ERT-D6FGM101S	100	4000	−4.5	2.0	16	80	2.83	17±2 (.669 ±.080)	2±0.7 (.079 ±.028)	30 (1.180)	0.8 (.031)	7.5 (.300)	—
ERT-D6FHM101S	100	4100	−4.6				2.90						—
ERT-D7FGM101S	100	4000	−4.5	3.0	17	100	2.83	2.1±2 (.827 ±.080)	2.5±1 (.100 ±.039)	30 (1.180)	0.8 (.031)	7.5 (.300)	—
ERT-D7FHM201S	200	4200	−4.7				2.98						—
ERT-D8FGM700S	70	4000	−4.5	4.0	18	150	2.83	25±2 (1.00 ±.080)	2.5±1 (.100 ±.039)	30 (1.180)	0.8 (.031)	10 (.390)	—
ERT-D8FGM101S	100	4000	−4.5				2.83						—

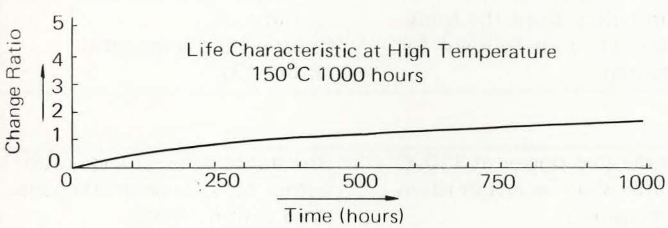
- Resistance Tolerance ERT-D.F.K. .... ±10%
  ERT-D.F.L. .... ±15% (Standard)
  ERT-D.F.M. .... ±20%
- Constant B Tolerance .... ±10%

Low B Thermistor

	Resistance at 25°C (Ω)	Nominal Coef. (25°C) (%/°C)	Nominal Constant B (°K)	Max. Voltage Rating (W)	Nominal Dissipation Constant (MW/°C)	Nominal Time Constant (sec.)	Resistance Ratio 25°C/50°C	Dimensions mm (inch)					Fig.1 Curve No.
								D	T	min. ℓ	dφ	Nom. W	
ERT-D2FBK450S	45	−1.7	1500	0.25	7.0	20	1.48	5.0 ±5 (.197 ±.020)	1.3 ±.5 (.050 ±.020)	30 (1.180)	.5 (.020)	2.5 (.100)	8
ERT-D2FBK600S	60												—
ERT-D2FBK850S	85												10
FRT-D2FBK101S	100												—
FRT-D2FBK111S	110												—
FRT-D2FBK151S	150												—
ERT-D3FBK8R8S	8.8	−1.7	1500	0.6	9.0	27	1.48	7.5 ±.5 (.300 ±.020)	1.4 ±.5 (.055 ±.020)	30 (1.180)	.5 (.020)	5.0 (.200)	—
ERT-D3FBK150S	15												—
ERT-D3FBK220S	22												—
ERT-D3FBK260S	26												—
ERT-D3FBK450S	45												8
ERT-D5FBK4R0S	4	−1.7	1500	1.2	14	60	1.48	13.0 ±.2 (.510 ±.080)	1.4 ±.5 (.055 ±.020)	30 (1.180)	.6 (.024)	7.5 (.300)	—
ERT-D5FBK4R6S	4.6												—

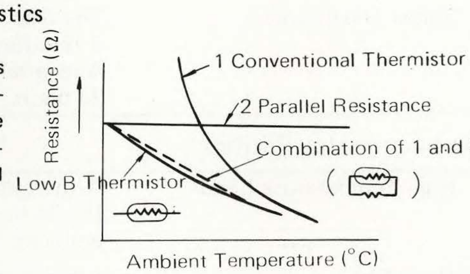
Characteristics

Life



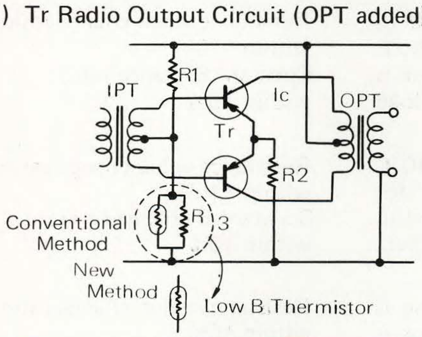
Electrical Characteristics

The right Fig. indicates the characteristic comparison between the conventional temperature compensation and low B thermistor.



Application Examples

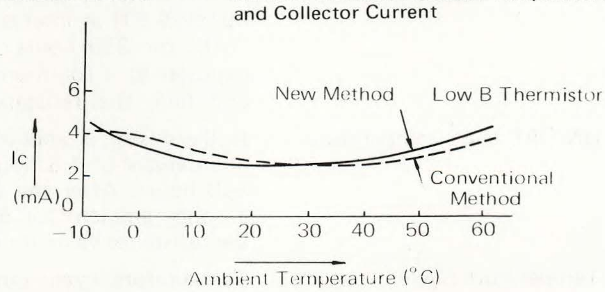
I) Tr Radio Output Circuit (OPT added)



II) Temperature Compensation Effect

The curves shown in the right indicates relationship between ambient temperature and collector current. Both curves show no difference in effect in the temperature range from 0°C to +60°C.

Relation between Ambient Temperature and Collector Current

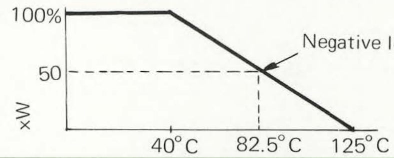


Ratings

Electrical Ratings

Item	Test Method	Rated Value
Resistance Value	Resistance value is measured with AC voltage applied to the linear when the self heat generation does not occur at room ambient (25±0.2°C).	Meets the specified value.
Constant B	After the resistance values at 25°C and 50°C respectively are measured, the constant B is calculated by the following equation; $B = 8.868 \times 10^3 \log \frac{R_{25}}{R_{50}}$ R_{25}: resistance value at 25±0.2°C R_{50}: resistance value at 50±0.2°C	Meets the specified value.

(Electrical ratings continued)

Item	Test Method	Rated Value
Rated Power	The rated power should be derated according to the following curve when the ambient temperature exceeds 40°C. 	Meets the specified value
Max. Operating Temperature	Max. operating temperature when the rated power is derated to the derating limit.	125°C
Max. Allowable Current	Equivalent to the rated power at 25°C.	Meets the specified value
Max Allowable Voltage	Equivalent to the current value when the self heat generation does not occur.	Meets the specified value

Mechanical Ratings

Pull Test	The body of thermistor is fixed and subjected to the weight which shall be increased gradually to the breaking limit.	Lead dia. / Weight 1.0mm over 3kg 0.8~1.0mm below 2kg 0.5~0.8mm below 1kg 0.5mm below 0.5kg
Solder Heat Shock	The lead wire is dipped in a molten solder of 350°C for 3 minutes up to the point 4mm below from the body. And after the sample shall be left at room ambient for 24 hours, resistance value is measured.	Resistance value change ratio: within ±3%. Constant B change ratio: within ±3%

Environmental Ratings

<table>
<tr><td>High Temperature Load</td><td>A thermistor is applied with the derated power at 110°C for 24 hours. And after the sample shall be left at room ambient, the resistance value is measured.</td><td>Resistance value change ratio: within ±5%. Constant B change ratio within ±2.5%</td></tr>
<tr><td>Humidity</td><td>After a thermistor is exposed to an ambient of 40°C, 90~95% RH for 240 hours without load and then to dry air of 50°C for 1 hour and then to cooling air for 1 hour, the resistance value is measured.</td><td>Resistance value change ratio: within ±5%.
Constant B change ratio: within ±2.5%</td></tr>
<tr><td>Humidity Load Life</td><td>A thermistor is applied with the rated power at 40°C, 90~95% RH at intervals of 1.5 hours "on" and 0.5 hour "off" for 350 hours. After the test, the thermistor is exposed to a room ambient for one hour without load and then, the resistance value is measured.</td><td>Resistance value change ratio: within ±10%.
Constant B change ratio: within ±5%.</td></tr>
<tr><td>ON-OFF High Temperature</td><td>A thermistor is applied with the rated power at 110°C at intervals of 1.5 hours "on" and 0.5 hour "off" for 500 hours. After the test, the thermistor is exposed to a room ambient for one hour without load and then, the resistance value is measured.</td><td>Resistance value change ratio: within ±10%
Constant B change ratio: within ±5%</td></tr>
<tr><td>Temperature Cycle</td><td>Temperature cycle operation of the following table is repeated 5 times continuously. After the thermistor is exposed to a room ambient for more than one hour, the resistance value is measured.
<table>
<tr><th></th><th>Temperature (°C)</th><th>Time (minute)</th></tr>
<tr><td>1</td><td>Room ambient</td><td>10~15</td></tr>
<tr><td>2</td><td>−20</td><td>30</td></tr>
<tr><td>3</td><td>Room ambient</td><td>10~15</td></tr>
<tr><td>4</td><td>+125</td><td>30</td></tr>
</table></td><td>Resistance value change ratio: within ±5%
Constant B change ratio: within ±2.5%</td></tr>
</table>

THERMISTOR TEMPERATURE DETECTORS

This detector is ideal for temperature indication and control device in consumer equipment, automobils and other industrial equipment exhibiting high accuracy in temperature detection. Temperature detector varies with applicable equipment, that is, for general use (−20°C to +125°C), for high temperature use (−20°C to 300°C), for humidity-proof use (sealed types) and for shock-proof use (for automobils etc).

Features

- Large constant B and high accuracy in temperature detection
- Small in size with high impedance, facilitating mounting operation
- Designed individually according to its application, providing high reliability

Application

- For electronic oven
- Room heater by boiling water
- For electronic jar and electronic rice-cooking jar
- For hair dryer.
- Water temperature sensor and temperature detector of exhausting gas for automobils

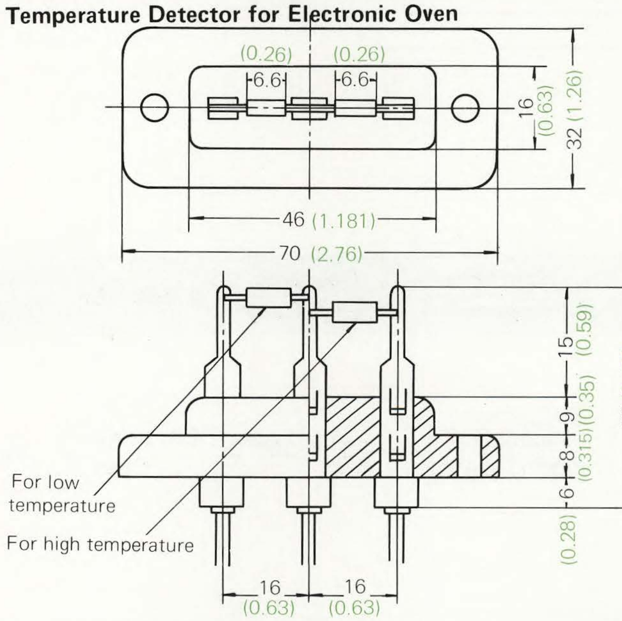
General Temperature Detectors

Type ERT-A07Y01, ERT-A05D332, ERT-A06D822, ERT-A09D203

Dimensions

Unit: mm (inch)

Fig.(1) Temperature Detector for Electronic Oven



Unit: mm (inch)

Fig.(2) Temperature Detector for Hair Dryer

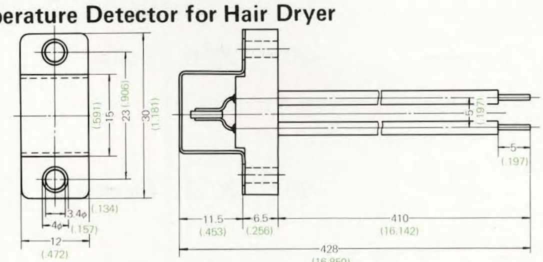
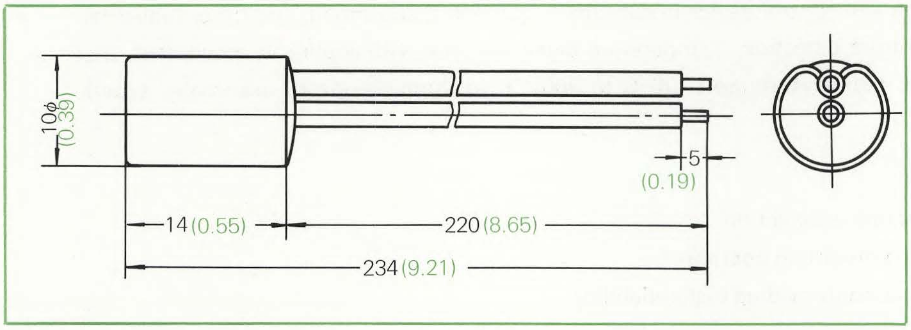


Fig.(3) Temperature Detector for Room Heater By Boiling Water

Unit: mm (inch)



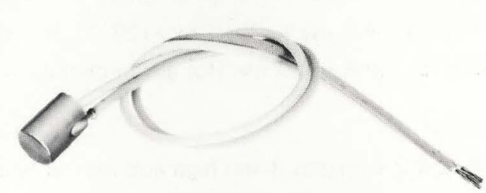
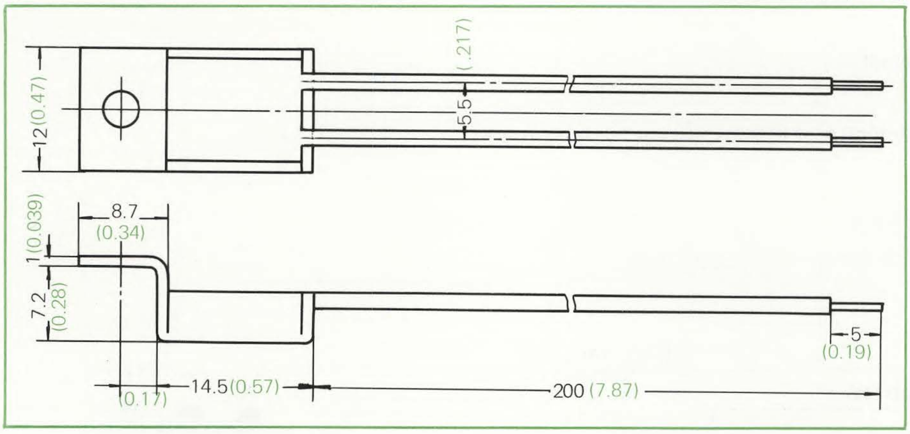
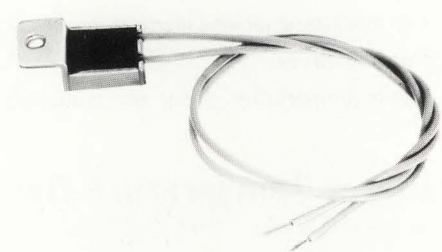


Fig.(4) Temperature Detector for Electroric Jar

Unit: mm (inch)





Ratings

Part No.	Resistance	Constant B	Rated Power	Heat Time Constant	Operating Temp. Range	Application	Shape Dimension
ERT-A07Y01 (ERT-RIEGK563C) (ERT-RIEIK405C)	46KΩ±10% (30±0.2°C)	(4000°K)	10mW	15 miniute (200°C→25°C)	−20 ~ +300°C	Electronic Oven	Fig. (1)
	120KΩ±10% (100±0.2°C)	(5000°K)					
	4.6KΩ±10% (200±0.2°C)						
ERT-A05D332	3.3KΩ±5% (25±0.2°C)	4300°K±5%	5mW	——	−20 ~ 125°C	Hair dryer	Fig. (2)
ERT-A06D822	700Ω±5% (25 ± 0.2°C)	4300±150°K	20mW	——	−20 ~ 120°C	Boiler	Fig. (3)
ERT-A09D203	20KΩ±10% (25±0.2°C)	(4233±9.5%)	5mW	——	−20 ~ 120°C	Electronic Jar	Fig. (4)
	3KΩ ± 15% (70 ± 0.2°C)						

Ratings

Electrical Ratings

Item	Test Method	Rating
1) Resistance Value	At the specified ambient, the resistance value shall be measured applying the rated current.	Within the rated value
2) Constant B	B can be calculated by the following equation; $B = 8.865 \times 10^3 \log (R_{25}/R_{50})$	Within the rated value
3) Rated Power	Maximum power to be allowed to operate	Within the rated value
4) Max. Operating Temperature	Maximum temperature to be allowed to operate	Within the rated value
5) Heat Time	Equivalent to the period of time while resistance value at a specified ambient temperature reaches $(1 - \frac{1}{e}) \times 100(\%)$ of the resistance value at another specified ambient temperature.	Within the rated value

Mechanical Ratings

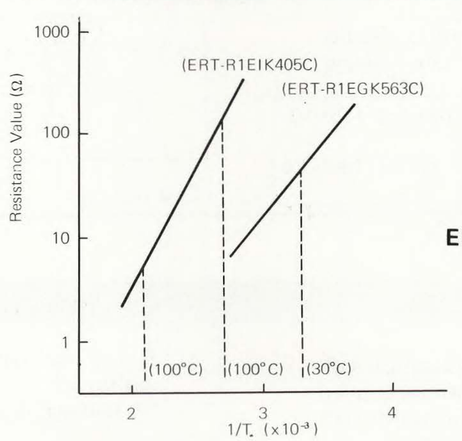
Item	Test Method	Rating
1) Pull Strength	One terminal is secured and another one is subjected to an axial pull of 5 kg.	No damage

Environmental Ratings

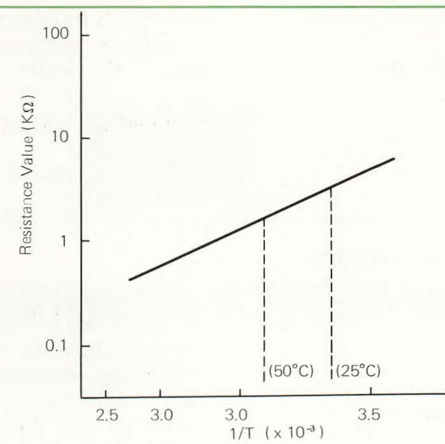
Item	Test Method	Rating
1) Heat Durability	A thermistor is exposed to the maximum operating temperature for 1000 hours continuously.	Resistance change: within ±5%
2) Moisture Proof	A thermistor is exposed to the ambient of 40°C, 95%RH for 1000 hours continuously.	Resistance change: within ±5%

Resistance–Temperature Characteristic

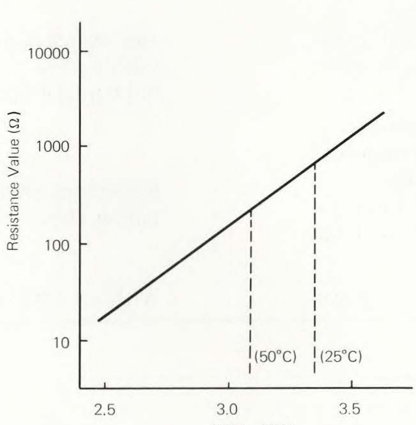
ERT-A07Y01



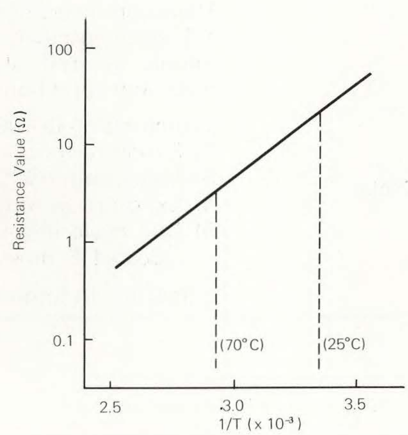
ERT-A05D332



ERT-A06D822

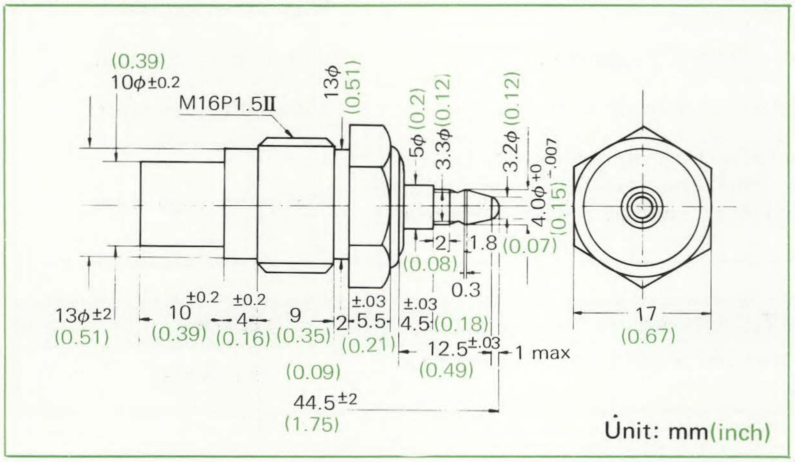


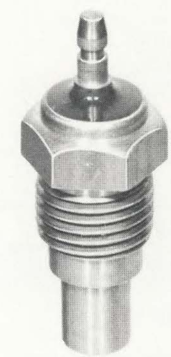
ERT-A09D203



Water Temperature Sensor
Type ERT-WOIG421

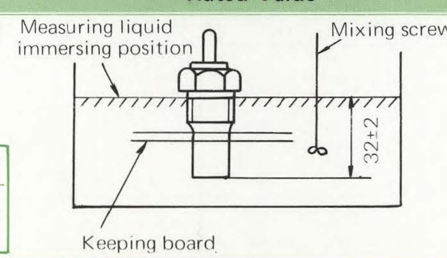
Dimensions





Ratings

Electrical Ratings

Item	Test Method	Rated Value
Resistance Value	The resistance values are measured according to the conditions indicated in the right fig. Resistance value at each temperature should satisfy the values shown in the table below.	

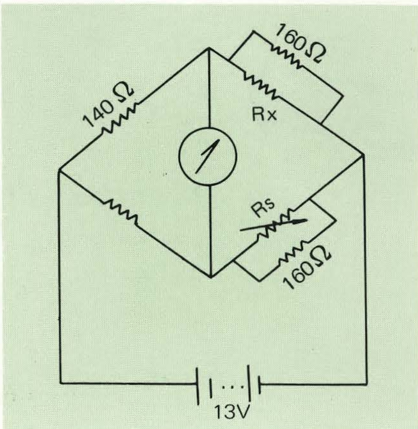
Temperature(°C)	35±0.2	40±0.2	80±0.2	100±0.2	115±0.3
Resistance Value (Ω)	290±30	231±24	51±4.2	28±2.8	18.2±1.9

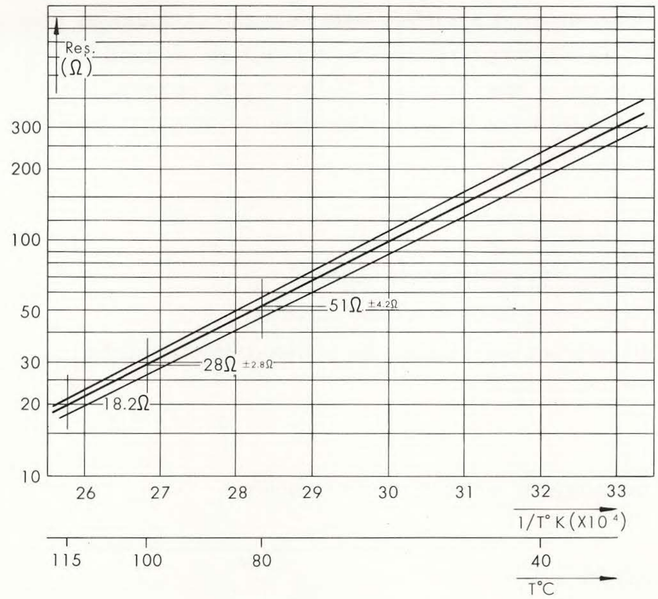
Environmental Ratings

Item	Test Method	Rated Value
High Temperature Load Life	Liquid temperature: 80°C ± 3°C Protecting resistance value and application voltage shall be determined to make 50mA applied to the sample. 30 minutes operation at intervals of 30 minutes are repeated for 250 hours.	Resistance change ratio: within 5% No damage in sealing
Vibration	Vibration times: 50c/s Amplitude: 2mm Vibration specified above shall be applied to the sample in each of the axial and rectangular directions for 4 hours.	Resistance change ratio: within ±1% No damage in sealing
Temperature Cycle	1) Immersion in 100°C water for 30 minutes 2) Exposure to room ambient for 5-10 minutes 3) Immersion in 0°C water for 30 minutes 4) Exposure to room ambient for 5-10 minutes 5) One cycle including above 4 steps shall be repeated 5 times.	Resistance change ratio: below ±5%
Sealing	Immersion in torque converter oil for one minute	Without continuous foaming

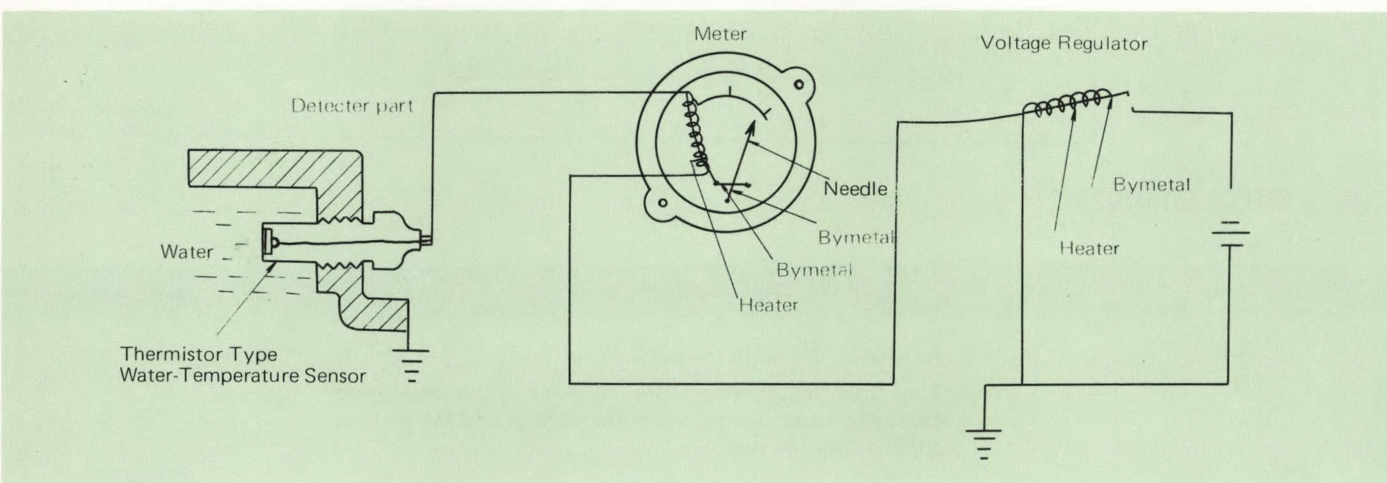
Resistance vs. Temperature Characteristics

Measuring Circuit



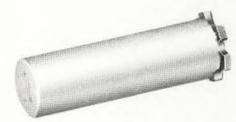


Application Examples



FUEL LEVEL GAUGE

The fuel level gauge is a surface level detector of liquid to indicate with a warning lamp whether the surface of liquid is above or below a specified level. A thermistor element is employed to detect the liquid surface level in a non-contact manner.



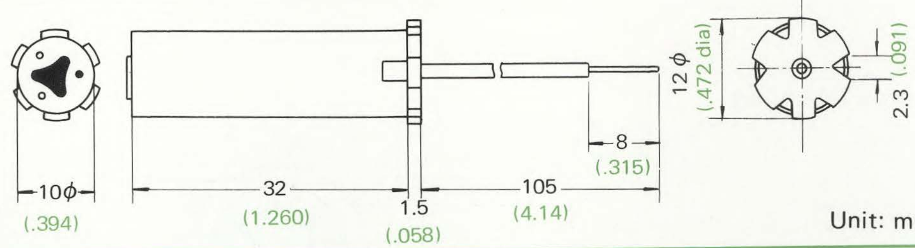
Features

- Small in size with simple construction
- Stable operation against shock and vibration
- Long life without any trouble due to non-contact construction

Application

- Fuel level gauge for all kinds of automobiles

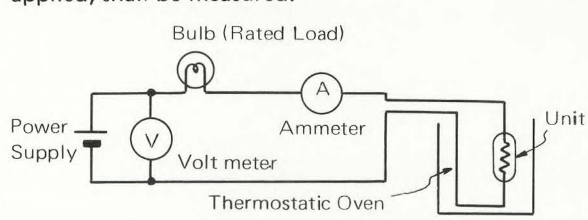
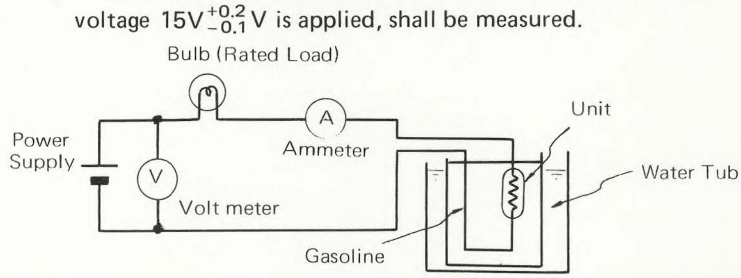
Dimensions



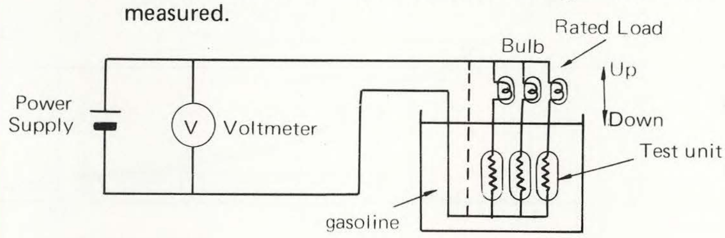
Unit: mm(inch)

Ratings (ERT-LG12N02)

Electrical Ratings

Item	Test Method	Rated Value
"ON" Characteristic	1. At $-10°C^{+0.5}_{-1}°C$ in the calm air 2. The time required for the current in the measuring circuit to reach 13mA, when the voltage of $11V^{+0.2}_{-0.1}V$ is applied, shall be measured.  	135mA min. within 180 seconds
"OFF" Characteristic	1. Stabilize in the gasoline at $60°C^{+1.0}_{-0.5}°C$. 2. The saturant current value in the circuit, when the voltage $15V^{+0.2}_{-0.1}V$ is applied, shall be measured.  	60mA max.

Environmental Ratings

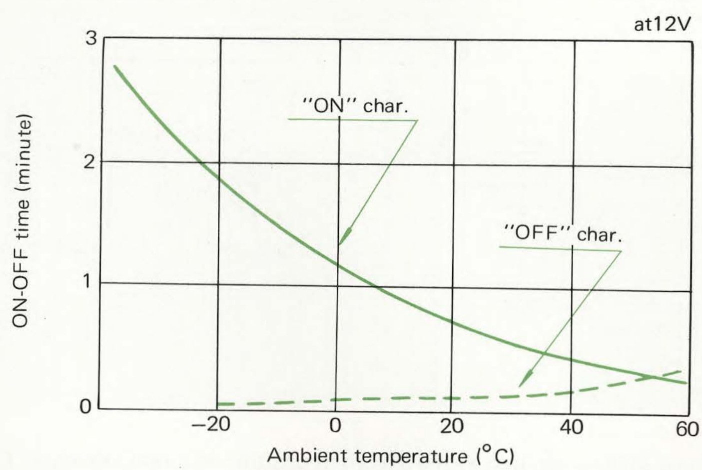
Item	Test Method	Rated Value
Durability	1. A sample gauge is exposed alternately to a room ambient and to the fuel for one minute respectively, making the indication lamp turned "on" and "off". 2. Then, voltage application of 12V shall be repeated 3000 times and the resistance change shall be measured.  	Resistance value change ratio: within 5%
Vibration	Vibration times: 2000 cpm Amplitude: 2mm Period: Horizontally and vertically for 4 hours respectively	Resistance value change ratio: within 5%

Specifications

Rated Voltage	DC 12V
Operating Voltage	11V to 15V
Operating Temperature	$-10^{\circ}C$ to $+60^{\circ}C$
Detection Time	Within 3 minutes
Rated Load	12V, 3.4W
Durability	"ON" and "OFF" lamp operation is repeated 3000 times under applied situation at intervals of 2 times per minute, resulting in no damage.
Shock and Vibration	No damage after testing in accordance with JIS automotive accessaries test method. (As per JIS D-1601 2 B)

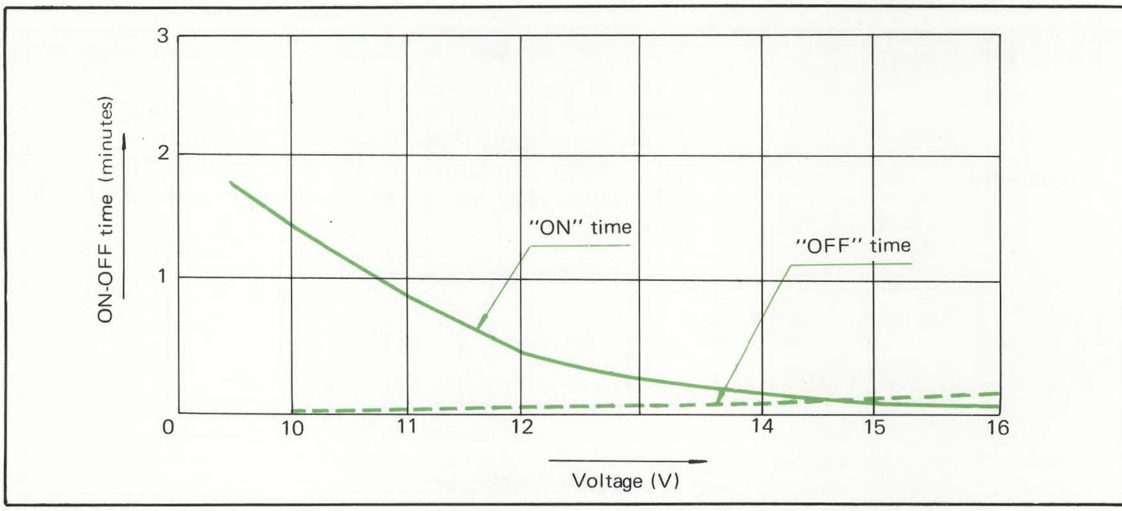
Typical Characteristics

Temperature

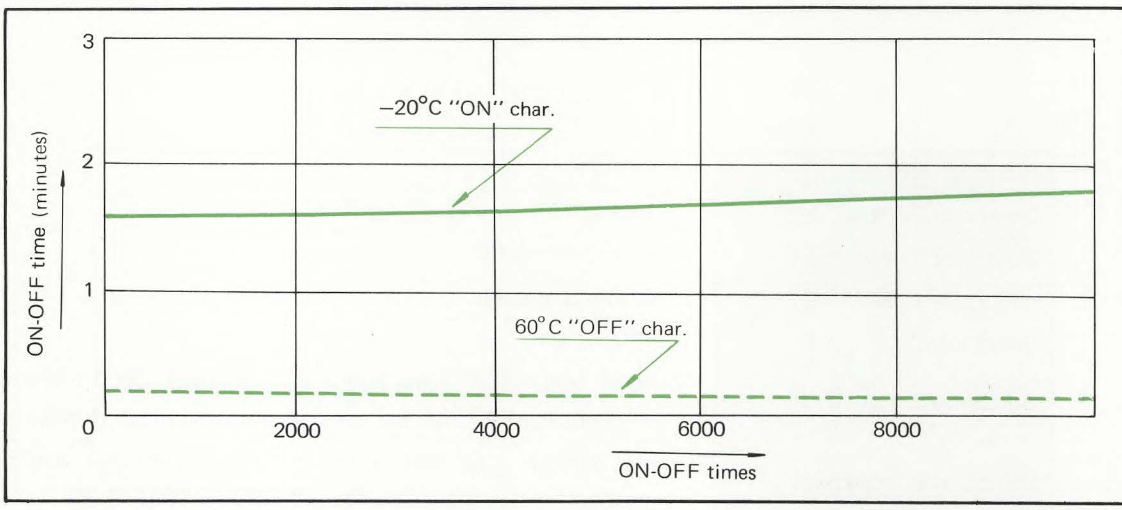


Characteristics

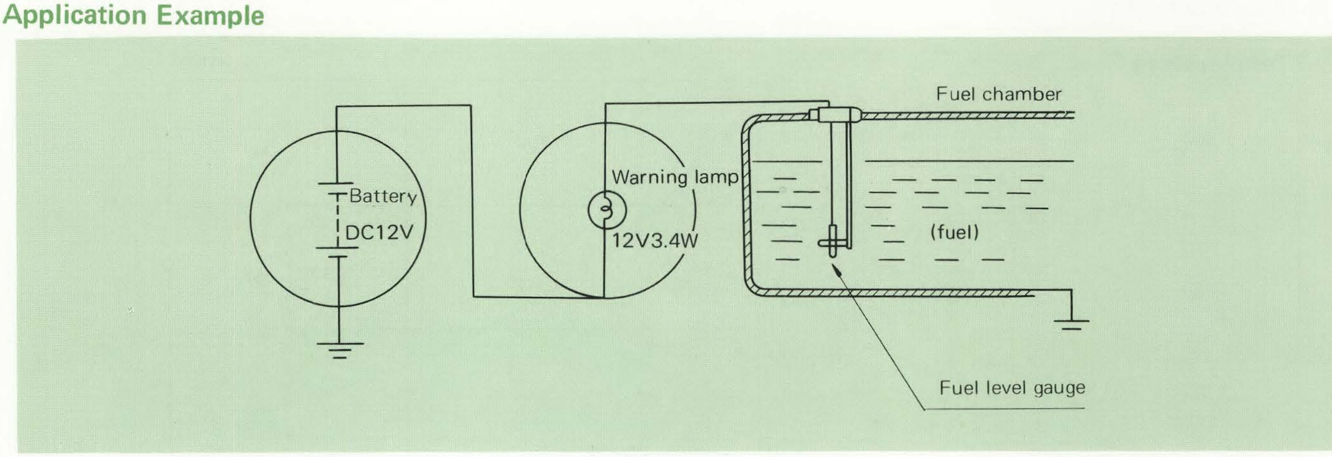
Voltage



Durability



Application Example

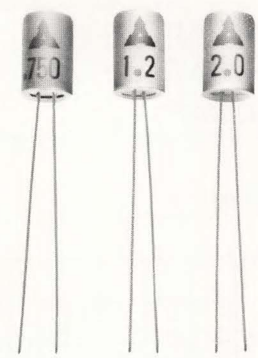


A fuel level gauge shall be secured at the specified position in a fuel chamber. The lead shall be connected to the anode of a battery through a warning lamp. The fuel chamber should be grounded.

SPARK GAP

Type EGP-H

Matsushita spark gaps exhibit high stability in discharge voltage due to hermetic-sealed construction, providing ideal protection of high voltage circuitries of color TV's, oscilloscopes, etc., from surge transient.



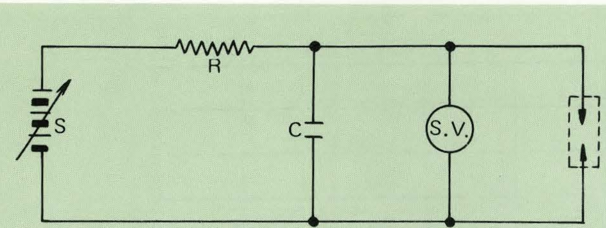
Features

- Uniform in specified discharge voltage
- Stable in discharge voltage
- Excellent humidity characteristics
- Long life

Application

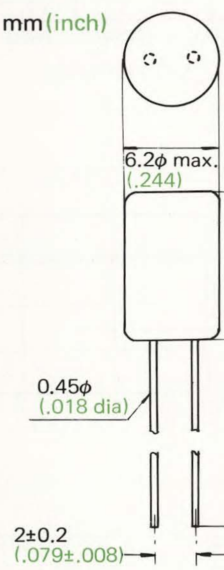
- Protection of circuit components used in color and B&W televisions, oscilloscopes, etc.

Measuring Circuit



S: DC current
R: High resistance resistor 20MΩ
C: High voltage capacitor 0.001μF
SV: Electrostatic voltmeter

Dimensions



Ratings

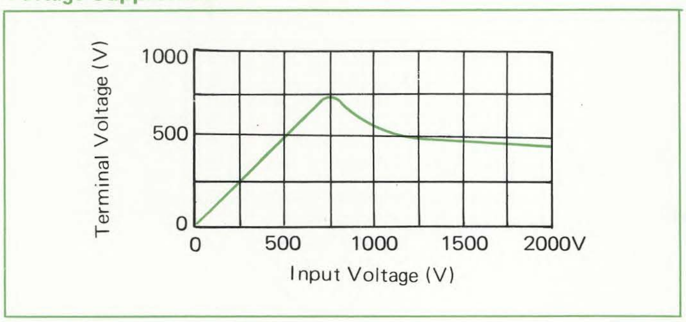
Item	Test Method	Rated Values
Humidity	A gap is subjected to 40°C±2°C, 90~95%RH for 120 hours and then exposed to a room ambient of less than 50%RH for 3 hours, and insulation resistance shall be measured.	Insulation res.: 500MΩ
Temperature Cycling	A cycle: (-30°C, 20hours)→(room ambient, 4 hours)→(+85°C,20 hours) → (room ambient, 4 hours) The above cycle shall be repeated 5 times and electrical performance shall be measured.	To satisfy the specified values
Solderability	After gap terminals shall be dipped in a flux and in a solder of 230°C±5°C for 2±0.5 seconds, terminal surfaces are examined.	All the surface dipped should be covered with solder.
Withstand Voltage	After 60 sec. application of 2.5kV(DC) between the case and lead wire, it shall be examined whether discharge may take place or not.	No discharge
Pull Test	Each lead wire shall be subjected to an axial pull of 1kg and the terminal shall be visually examined.	No damage
Life Test (A)	After 5,000 time discharge repetition, electrical performance shall be measured.	To satisfy the specified values
Life Test (B)	After 300 time discharge repetition applying 25kVDC, insulation resistance shall be measured at 250VDC.	Insulation res.: 10MΩmin. at 250VDC

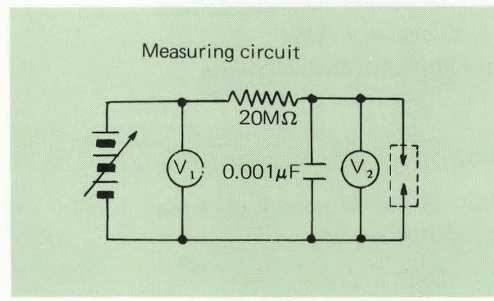
Ratings

Part Number	Discharge Volt.	Tol.	Insulation Resistance
EGP–H751A1	750V	± 250V	$10^9\,\Omega$ min.
EGP–H122A1	1,200V	± 250V	$10^9\,\Omega$ min.
EGP–H152A1	1,500V	± 250V	$10^9\,\Omega$ min.
EGP–H202B1	2,000V	± 500V	$10^9\,\Omega$ min.

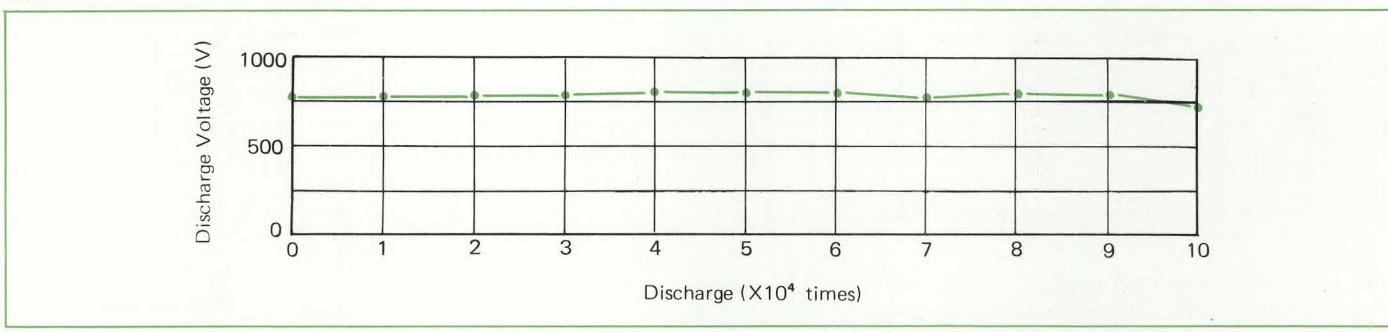
Characteristics

Voltage Suppression

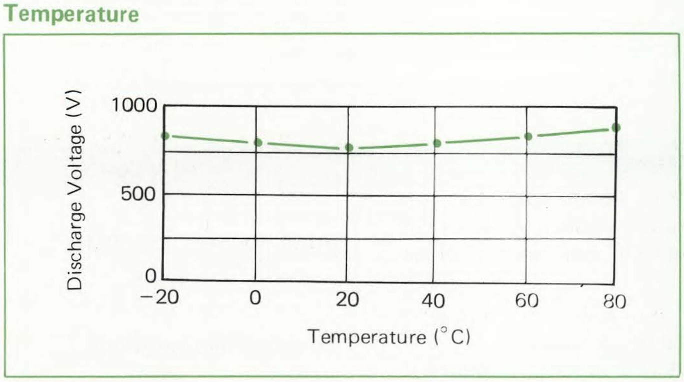




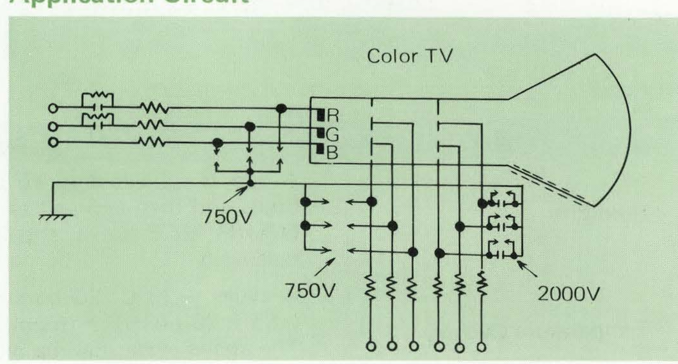
Life



Temperature



Application Circuit



Part Number Code

E	G	P	☐	☐	☐	☐	☐	☐

Common code

EGP	Spark gap

Structure

H	Hermetic-sealed type
M	Molded type

Discharge voltage

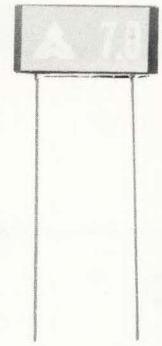
The first two digits are significant figures and the third one denotes the number of zeros following.

Tol.

Suffix

Type EGP-M

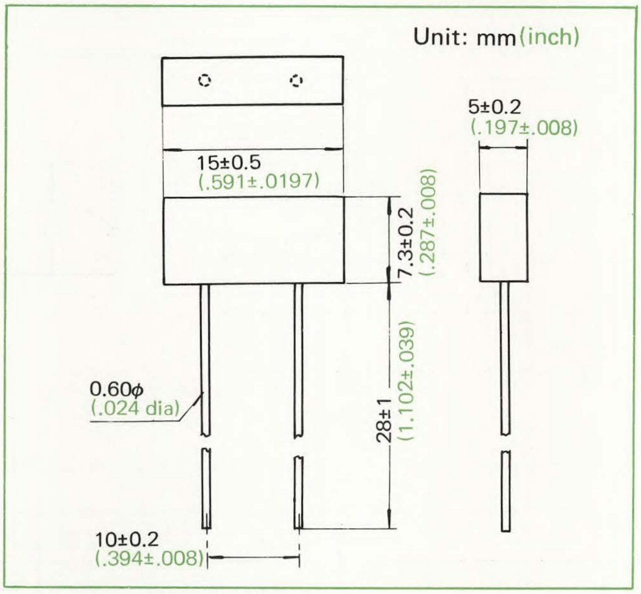
Type EGP-M spark gap provides stable discharge voltage due to 3-needle electrode construction, being ideal as a surge suppressor to protect semiconductive and other circuit components in color TV's, oscilloscopes, etc.



Features

- Uniform in specified discharge voltage due to 3-needle electrode construction
- Stable in discharge voltage
- Excellent in humidity characteristics
- Long life

Dimensions



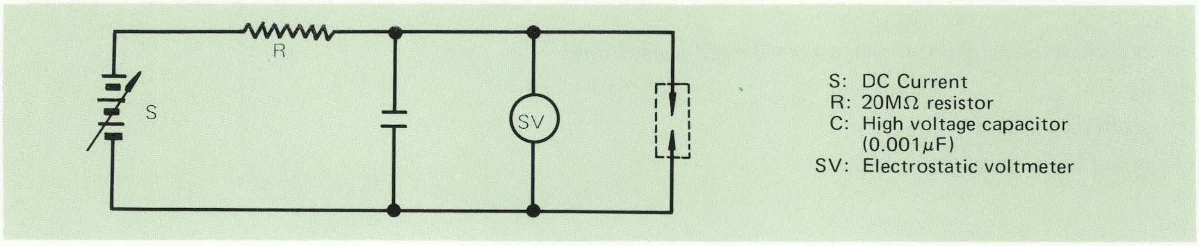
Ratings

Item	Test Method	Rated Values
Humidity	A gap is subjected to 40°C±2°C, 90~95%RH for 120 hours and then exposed to a room ambient of less than 50%RH for 3 hours, and insulation resistance shall be measured.	Insulation Res: 500MΩ Discharge Volt.: 5.5kV min.
Temperature Cycling	A cycle: (-30°C, 20 hours)→(room ambient, 4 hours) → (+85°C, 20 hours) → (room ambient, 4 hours) The above cycle shall be repeated 5 times and electrical performance shall be measured.	To satisfy the specified values
Solderability	After gap terminals shall be dipped in a flux and in a solder of 230°C±5°C for 2±0.5 seconds, terminal surfaces are examined.	All the surface dipped should be covered with solder.
Pull Test	Each lead wire shall be subjected to an axial pull of 1kg and the terminal shall be visually examined.	No damage
Life Test	After 5,000 time discharge repetition, electrical performance shall be measured.	To satisfy the specified values

Ratings

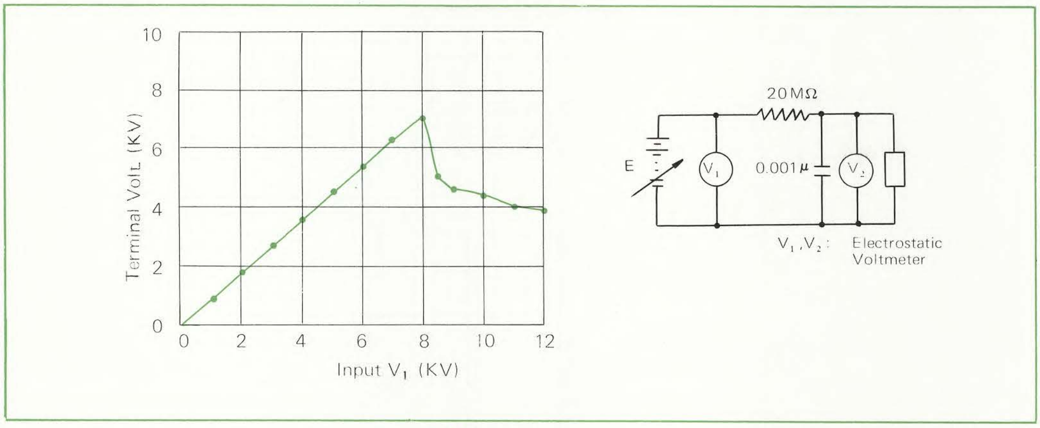
Part No.	Discharge Voltage	Tolerance	Insulation Resistance
EGP-M602C2	6,000V	+2000V -1000V	$10^9\,\Omega$ min.
EGP-M702C1	7,000V	+2000V -1000V	$10^9\,\Omega$ min.

Measuring Circuit

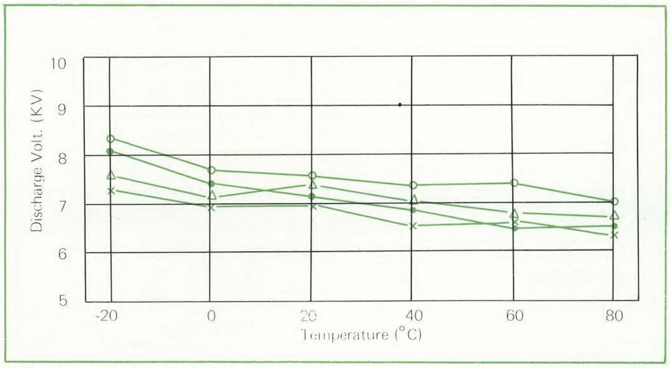


Characteristics

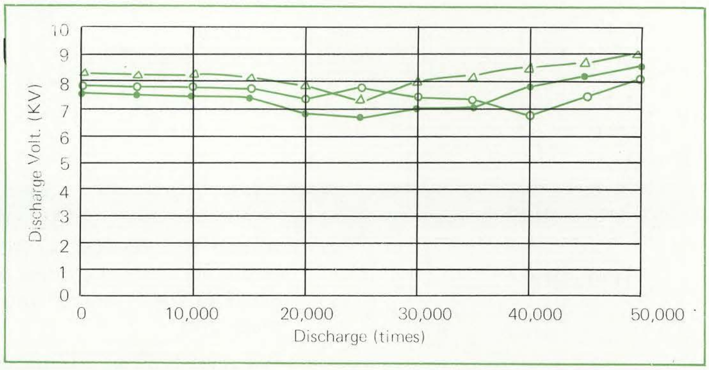
Voltage Suppression



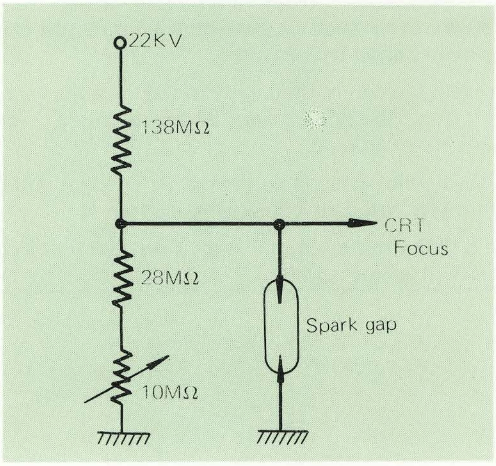
Temperature



Life



Application Example



III VARIABLE RESISTORS

QUICK REFERENCE GUIDE

15/16 (24mm) Dia. Standard Variable Resistors

	Part No.	Dia.	Construction	Special Information: Switch	Shaft	Terminal	Mounting & Others	Page
American Standard	EVD-A8	15/16"	Single	With / Without Rotary Switch	Metal	Solder	Threaded Bushing	III-13
	EVD-N0 EVD-P0 EVD-65			With / Without Rotary Switch	Insulating	Solder Wire Wrap P.C.B.	Twist Tabs	III-16 III-18 III-18
	EVD-AB EVD-NA			With TV Rating Rotary Switch	Metal Insulating	Solder	Threaded Bushing Twist Tabs	III-20 III-22
	EVD-MA EVD-MO			With TV Rating Pull-Push Switch With Pull-Push Switch	Metal	Solder	Threaded Bushing	III-23 III-25
	EVD-40			With Push-Push Switch	Metal	Solder	Threaded Bushing	III-27
	EVF-21 EVF-20		Tandem	With / Without Rotary Switch	Metal	P.C.B. Solder	Threaded Bushing	III-29 III-31
Standard	EVC-BO EVE-DO EVC-SO	24 mm	Single	With / Without Rotary Switch	Metal	Solder Solder P.C.B.	Threaded Bushing Center Tap Threaded Bushing	III-15 III-15 III-15
	EVV-BO EVV-B3A			With / Without Rotary Switch Without Switch	Insulating	Solder	Twist Tabs	III-19 III-19
	EVD-NA			With TV Rating Rotary Switch	Insulating	Solder	Twist Tabs	III-22
	EVV-FO EVC-MO EVV-25D EVC-M6 EVC-HO			With Pull-Push Switch With Pull-Push Switch With DPDT Pull-Push Switch With Pull-Push Switch Meeting SEMKO With Push-Push Switch	Insulating Metal Insulating Metal Metal	Solder	Threaded Bushing	III-25 III-25 III-26 III-26 III-28
	EVF-N1 EVF-K1 EVG-K1 EVF-87A		Tandem	With / Without Rotary Switch With / Without Rotary Switch With / Without Rotary Switch Without Switch		P.C.B. Solder Solder Solder	Threaded Bushing Threaded Bushing Center Tap Loclick Stop	III-31 III-32 III-32 III-32
	EWF-PO EWF-NO			With / Without Rotary Switch	Metal	Solder P.C.B.	Threaded Bushing Center Tap	III-33 III-33
	EWI-NIA EWI-60A	24 mm	Quadruple	Without Rotary Switch	Metal	Solder P.C.B.	Threaded Bushing	III-34 III-34

Multi Shaft Control Levers Operation Variable Resistors

	Part No.	Dia.	Construction	Special Information: Switch	Shaft	Terminal	Mounting & Others	Page
US Std.	EVX-P2A		Quadruple	Without Rotary Switch	Metal	Solder	Screw Mount	III-35

GENERAL INFORMATION

Part Number Code

Part number code of MATSUSHITA standard variable resistor consists of 12 digits and alphabets as follows:

□ □	□	□	□	□	□	□ □	□ □ □
Common Code	Shape (class I)	Shape (class II)	Constr. Char.	Switch	Shaft Trims	Shaft Dimensions	Resistance and Taper

		Shape	Shaft		Part No.
American Standard	15/16" DIA.	Single	Metal	Standard	EVD-A8
	15/16" DIA.	Single	Insulating	Standard	EVD-NO
	15/16" DIA.	Single	Insulating	Wire Wrap	EVD-PO
	15/16" DIA.	Single	Insulating	P.C.B.	EVD-65
	15/16" DIA.	Single	Metal	TV Rating (UL) Rotary Switch	EVD-AB
	15/16" DIA.	Single	Insulating	Rotary Switch	EVD-NA
	15/16" DIA.	Single	Metal	TV Rating (UL) Pull-Push Switch	EVD-MA
	15/16" DIA.	Single	Metal	General Rating (UL) Pull-Push Switch	EVD-MO
	15/16" DIA.	Single	Metal	General Rating (UL) Push-Push Switch	EVD-40
	15/16" DIA.	Tandem	Metal	Standard	EVF-20
	15/16" DIA.	Tandem	Metal	P.C.B.	EVF-21
Standard	24ϕ	Single	Metal	Standard	EVC-BO
	24ϕ	Single	Metal	Center Tap	EVE-DO
	24ϕ	Single	Metal	P.C.B.	EVC-SO
	24ϕ	Single	Insulating	Twist Tab, Bushing, Standard	EVV-BO
	24ϕ	Single	Insulating	Twist Tab Click Stop	EVV-B3
	24ϕ	Single	Insulating	Pull-Push Switch	EVV-FO
	24ϕ	Single	Metal	Pull-Push Switch	EVC-MO
	24ϕ	Single	Insulating	DPDT, Pull-Push	EVV-25
	24ϕ	Single	———	For SEMCO, SEV Pull-Push	EVC-M6
	24ϕ	Single	Metal	Push-Push	EVC-HO
	24ϕ	Tandem	Metal	For Volume Control, Standard	EVF-K1 (EVF-KO)
	24ϕ	Tandem	Metal	For Volume Control P.C.B.	EVF-N1 (EVF-NO)
	24ϕ	Tandem	Metal	For Volume Control Center Tap	EVG-K1 (EVG-KO)
	24ϕ	Tandem	Metal	10 clicks	EVF-87
	24ϕ	Dual	Metal	Standard	EVG-BO
	24ϕ	Dual	Metal	Center Tap	EVG-BO

Switch

A	Without Switch
B	SPST
D	SPST
E	SPST
H	SPDT
J	SPDT
K	DPST
L	DPST
M	DPST
N	DPST
P	TPST
Q	DPDT
T	SPST
3	UL-Listed TPST
4	UL-Listed SPDT
5	UL-Listed SPST
6	UL-Listed SPST
7	UL-Listed DPST
8	UL-Listed DPST
9	UL-Listed SPDT

Shaft Trims

F	Flatted
S	Slotted
K	6ϕ 18 Pitches Serration
M	.235" DIA. 24 Pitches Serration

Shaft Dimensions

(1) Single or Std. dimensions: Sig. fig. of 2 digits.
(2) Modified or Dual: otherwise specified

No-shaft construction

7	8	9
A	O	O

Resistance and Taper

(1) Single; Tandem and Dual (Uniform resistance and taper)

10	11	12
Taper Designation	Sig. fig. of res.	n: (Sig. fig. x 10^n) *

Taper Designation: A, B, C, D, E

(Example)

Res. Value	Designation
500Ω	52
10KΩ	14
1 MΩ	16

* Sig. fig. when sig. fig. consists of 2 digits.

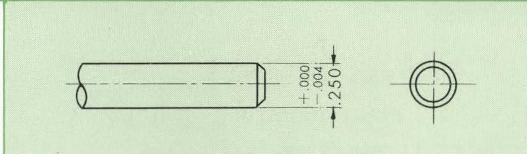
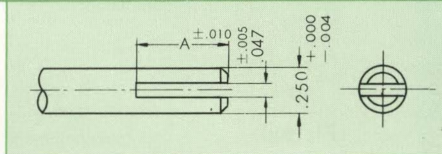
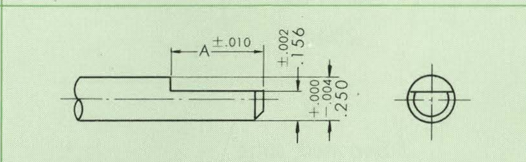
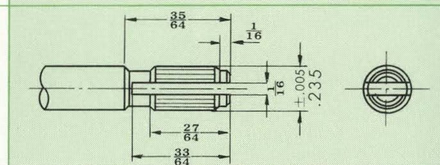
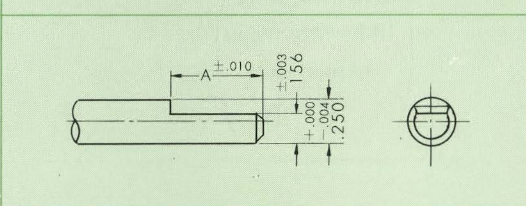
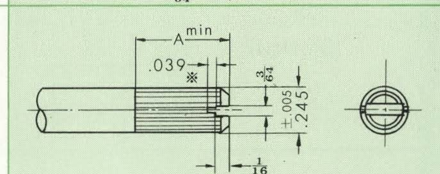
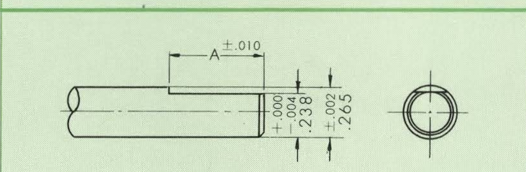
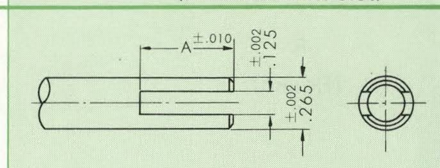
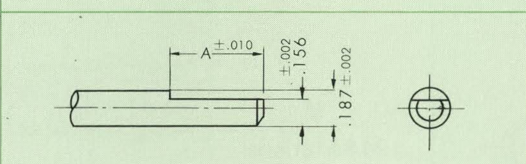
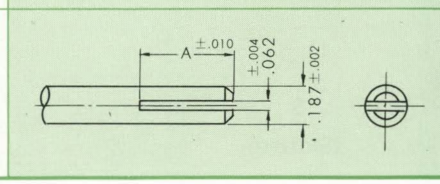
(Example)

Symbol	Sig.fig.	Symbol	Sig.fig.
A	1.2	F	2.5
C	1.5	J	7.5

(2) Tandem and Dual (Different resistance and taper) Otherwise specified.

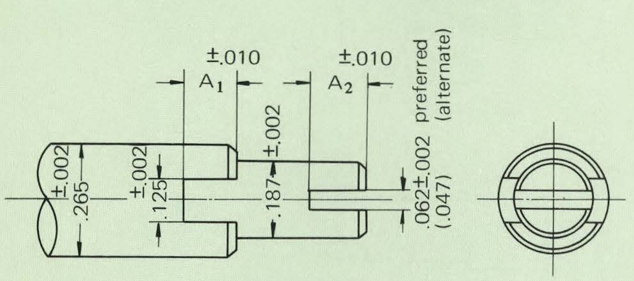
Shaft Trims and Dimensions

For American Standard

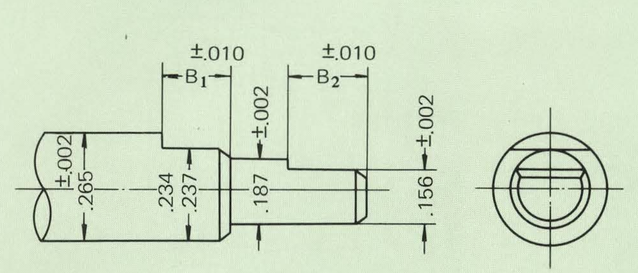
Type			Trims and Dimensions (inch)	Type	Trims and Dimensions (inch)
Single and Tandem Construction	Metal Shaft	R (Round)		S (Slotted)	
		F (Flatted)		M (Knurled with 24 teeth)	
	Molded Shaft	F (Flatted)		S (Serrated) (Knurled with 24 teeth)	* (Recessed Screw Slot)
Dual Construction	Outer Shaft (Brass)	F (Flatted)		S (Slotted)	
	Inner Shaft (Aluminum Alloy)	F (Flatted)		S (Slotted)	

Examples of Shaft Combination in Dual Concentric Variable Resistors (for American Standard)

Unit : inch

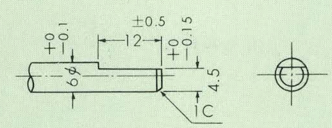
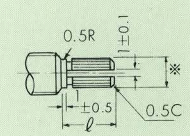
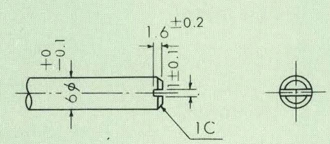
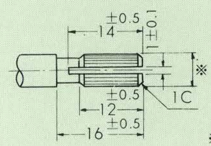
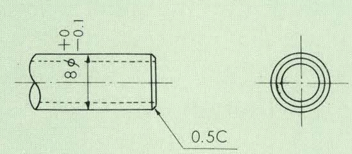
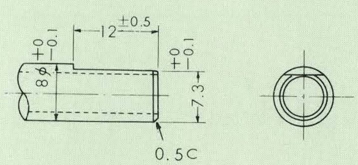
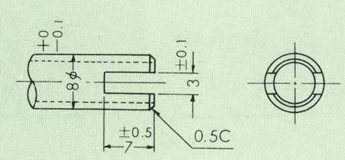
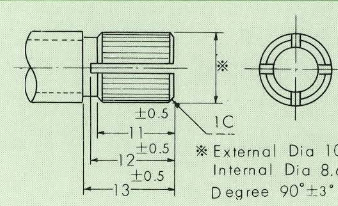


Unit : inch

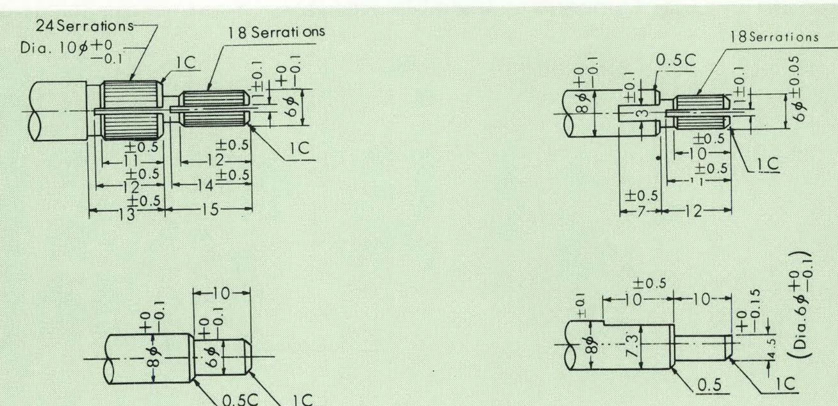


Shaft Trims and Dimensions

Standard

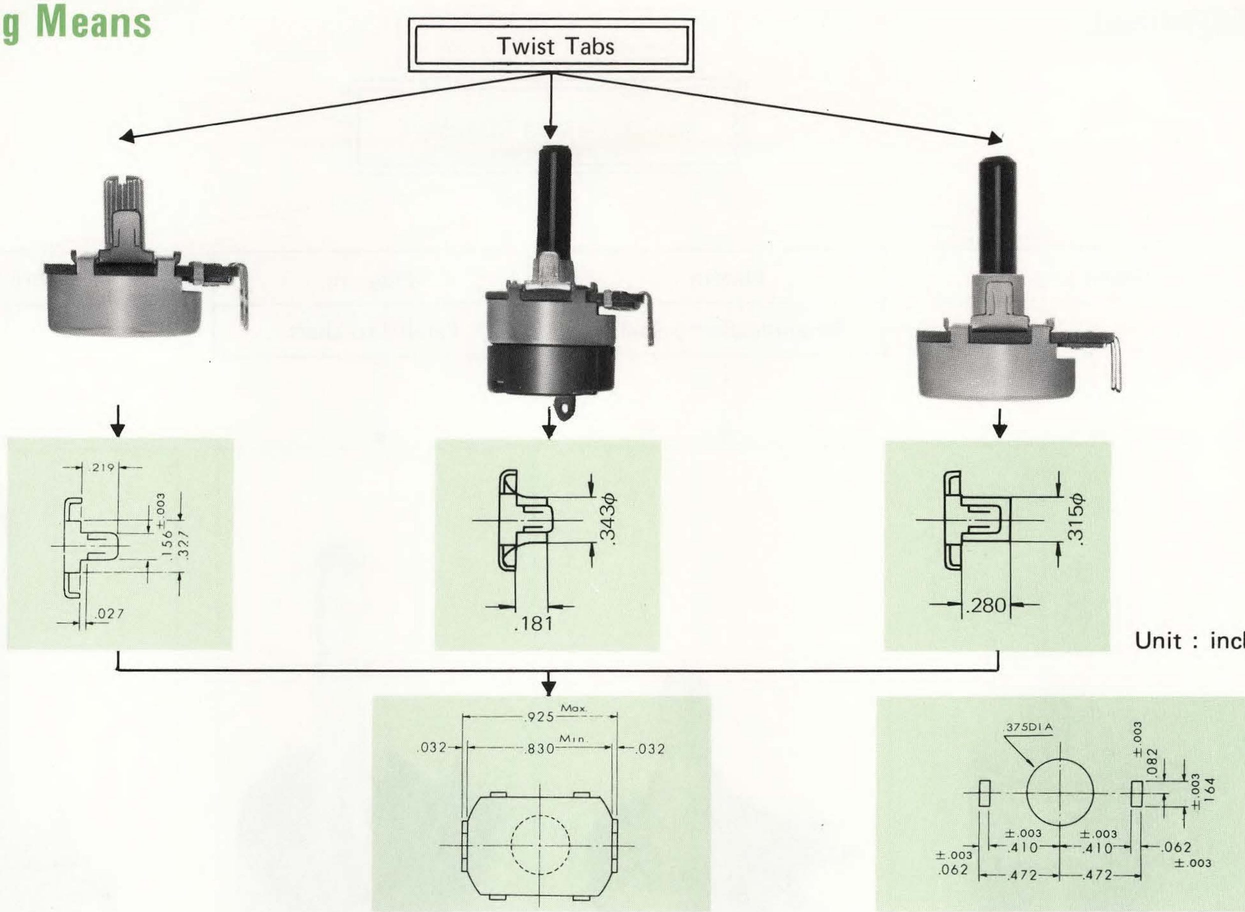
	Type	Trims and Dimensions (mm)	Type	Trims and Dimensions (mm)
Single and Tandem Construction	F (Flatted)		K (Serrated, split 18 Serrations, in case of less 25mm)	 ※External Dia $6\phi\pm0.05$ Internal Dia $4.9\phi^{+0.05}_{-0.1}$ Degree $90°\pm3°$
	S (Slotted)		K (Serrated, split 18 Serrations, in case of over 25mm)	 ※External Dia $6\phi^{+0}_{-0.1}$ Internal Dia $5.15\phi^{+0.05}_{-0.1}$ $90°\pm3°$
Dual Construction	R (Round)		F (Flatted)	
	S (Slotted)		M (24 Serrations)	 ※External Dia $10\phi^{+0}_{-0.1}$ Internal Dia $8.66\phi^{+0.05}_{-0.1}$ Degree $90°\pm3°$

Examples of Shaft Combination in Dual Concentric Variable Resistors (Standard)

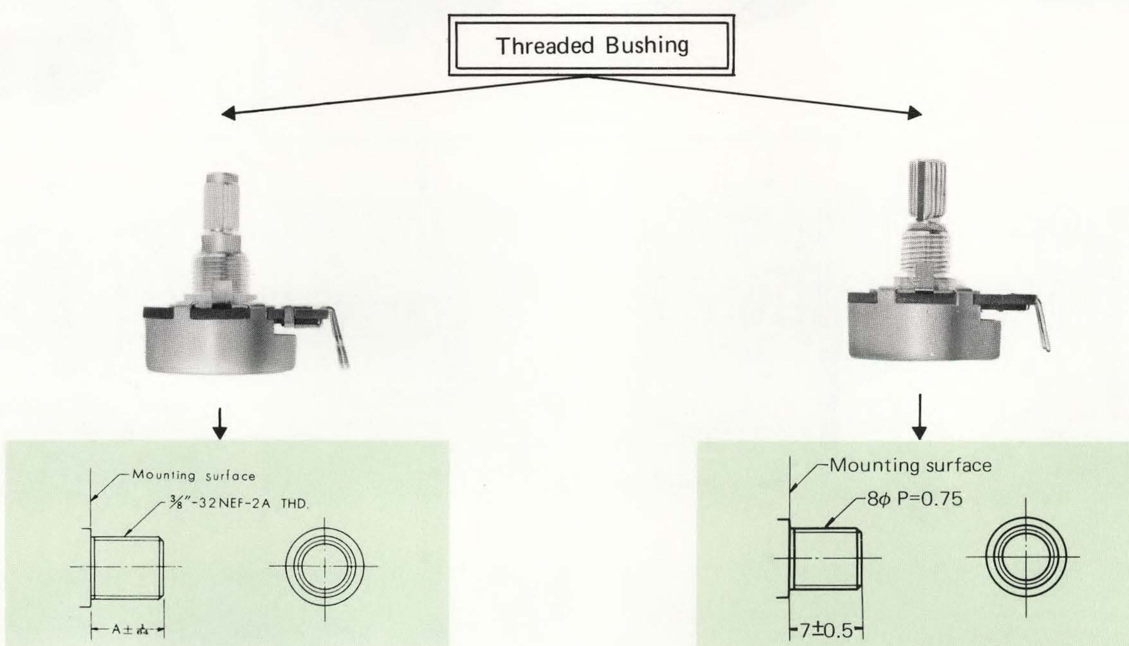


Unit : mm

Mounting Means



Unit : inch



Unit : inch

Unit : mm

Suggested Bushing Lengths For Proper Bearing Support

(Single section, straight tandems and dual concentric tandems)

Bushing Length (A)	Length of shaft from mounting surface
1/4	Through 1
3/8	Through 2

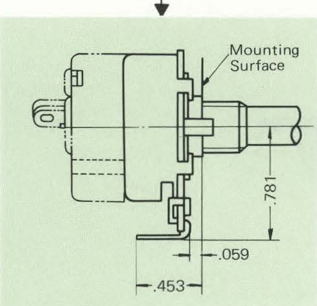
Please consult with Matsushita on other special requirements.

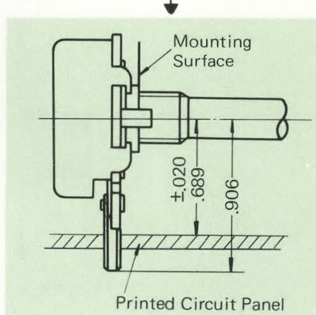
Terminals

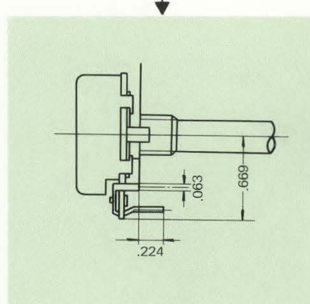
For American Standard

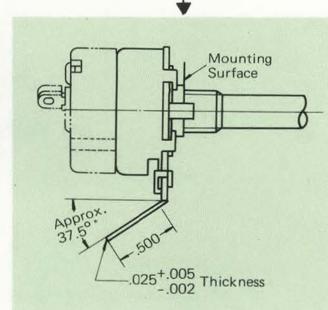
Unit : inch

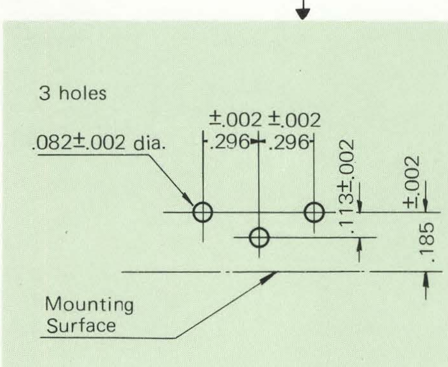
Solder Lug	Plug-In Perpendicular to Shaft	Plug - In Parallel to Shaft	Wire Wrap



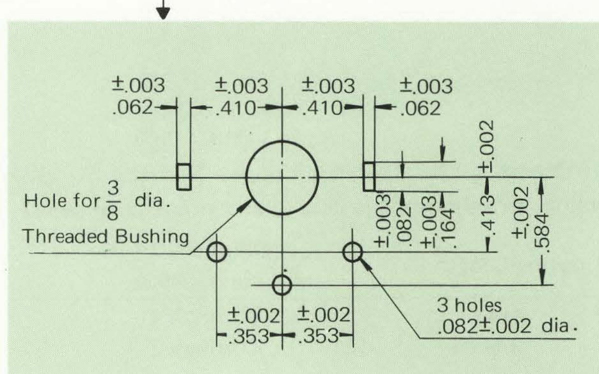








Panel Piercing Diagram

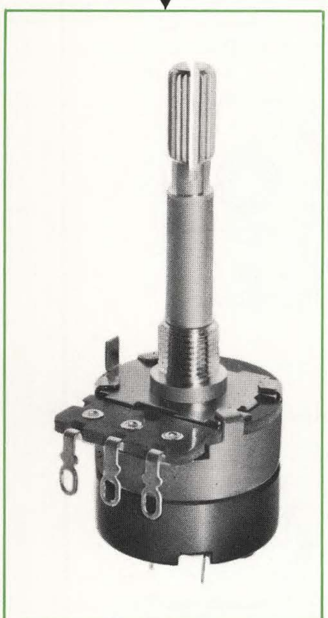


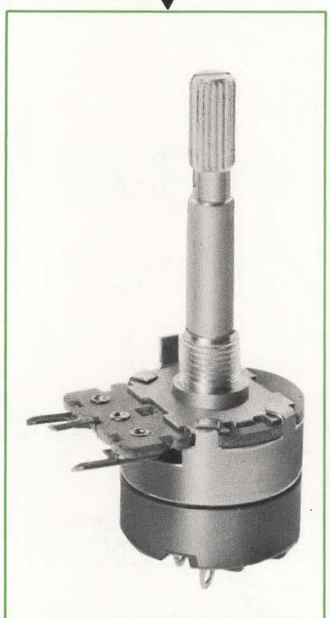
Panel Piercing Diagram

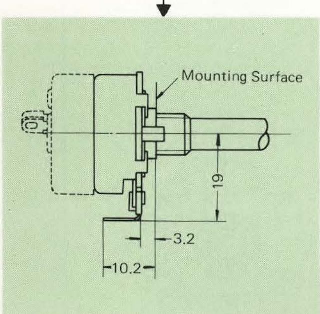
Standard

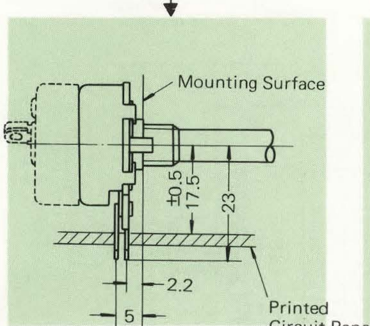
Unit : mm

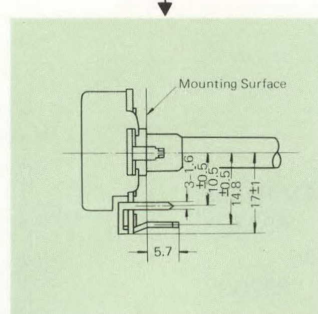
Solder Lug	Plug - In Perpendicular to Shaft	Plug - In Parallel to Shaft	Wire Wrap

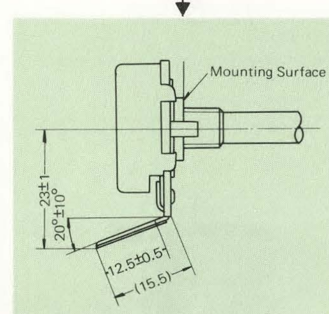


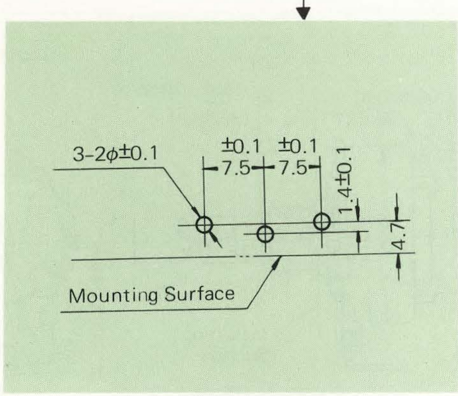




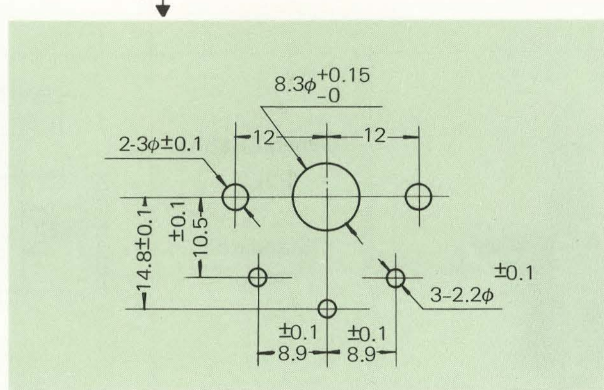








Panel Piercing Diagram

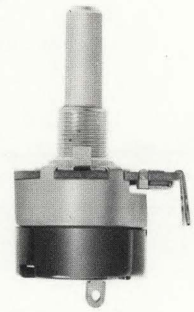


Panel Piercing Diagram

Switches

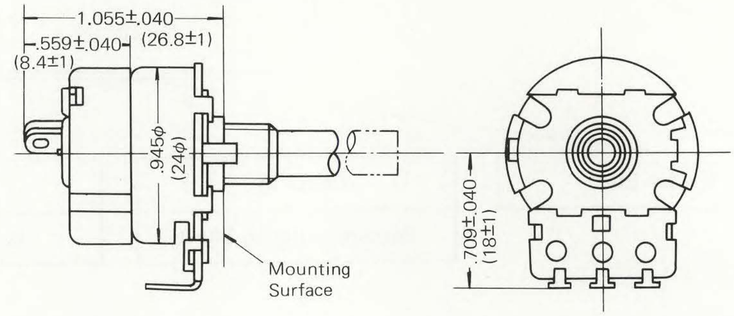
Unit : inch (mm)

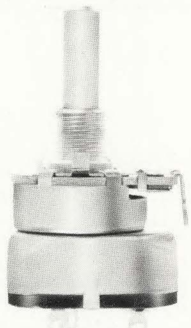
Rotary



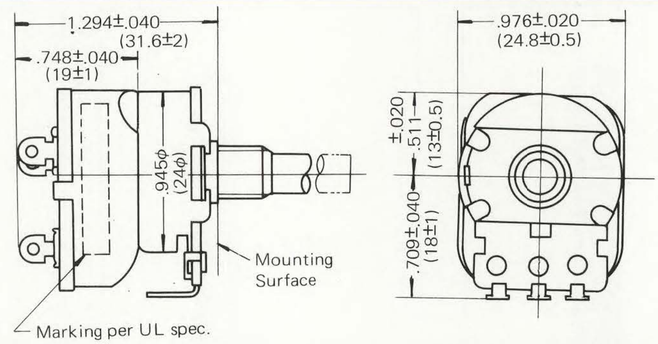
General Rating
"2D"

Standard
" D "

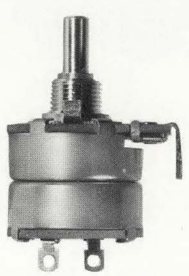




TV Rating
"2D3"

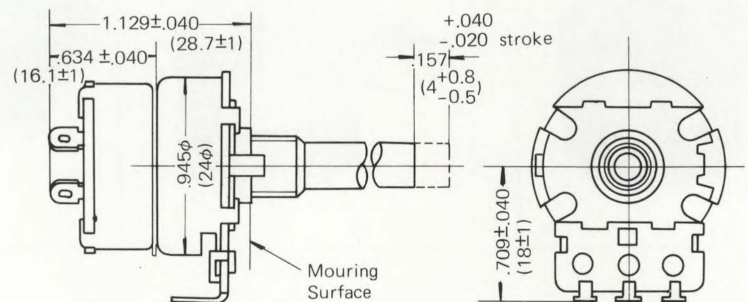


Pull-Push

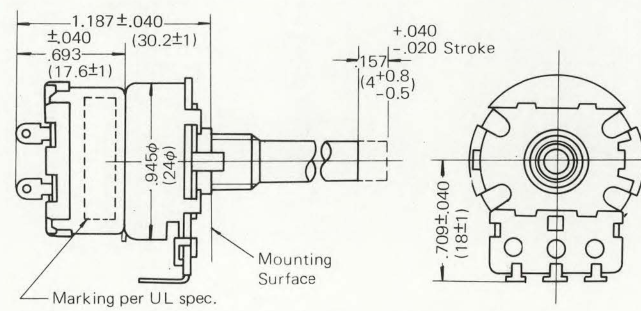


General Rating
"PP2E" or
"PP2N"

Standard
"E" or
"N"



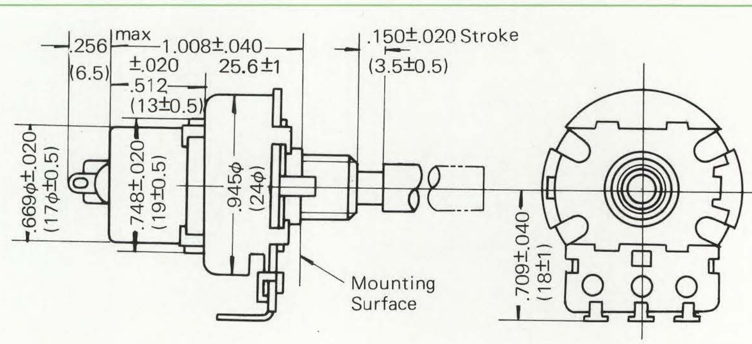
TV Rating
"PP2S5"
or
"PP2D3"



Push-Push

General Rating
"P2E"

Standard
"B" or
"E"



For American Standard

(1) General Rating (UL)

Type		UL listed cat. Nos.	Electrical Rating	Function	Schematic
15/16" DIA.	Rotary	2D 2SF	3.0 A @ 125 VAC 1.5 A @ 250 VAC	S.P.S.T.	
		2E	6.0 A @ 125 VAC 3.0 A @ 250 VAC		
		2L 2DE	1.0 A @ 125 VAC 0.5 A @ 250 VAC	D.P.S.T. may be used for double-double-pole, 2-circuit.	
		2M 2DF	3.0 A @ 125 VAC 1.5 A @ 250 VAC		
		2H	1.0 A @ 125 VAC 0.5 A @ 250 VAC	S.P.D.T.	
		2J	3.0 A @ 125 VAC 1.5 A @ 250 VAC		
	Pull-Push	PP2E	6.0 A @ 125 VAC 3.0 A @ 250 VAC	S.P.S.T.	
		PP2N	3.0 A @ 125 VAC 1.5 A @ 250 VAC	D.P.S.T., may be used for double-pole, 2-circuit.	
		PP2NT	3.0 A @ 125 VAC 1.5 A @ 250 VAC 1.0 A @ 15 VAC 0.5 A @ 30 VAC	Triple-pole, single-throw 3-circuit, 2 high voltage and 1 low voltage	
	Push-Push	P2E	3.0 A @ 125 VAC 1.5 A @ 250 VAC	S.P.S.T.	
		P2J	3.0 A @ 125 VAC 1.5 A @ 250 VAC	S.P.D.T.	

(2) TV Rating (UL, C.S.A)

* marked items meet CSA.

Type		UL listed cat. Nos.	Electrical Rating	Function	Schematic
15/16" DIA.	Rotary	* 2S4	TV-4	S.P.S.T.	
		* 2D3	TV-3	D.P.S.T.	
		* 2M3	TV-3	S.P.D.T.	
	Pull-Push	* PP2S5	TV-5	S.P.S.T.	
		* PP2D3	TV-3	D.P.S.T.	
		PP2T3	TV-3	Triple-pole, single-throw 3-circuit, 2 TV-3 and 1 low voltage	
	Vacation	PPV2D3 and	TV-3 and	D.P.S.T. and	and

For Standard

Type			Function	Electrical Rating	Schematic
24mm	Rotary	D	S.P.S.T.	125V 3A	
		E	S.P.S.T.	125V 6A	
		H	S.P.D.T.	125V 3A	
		J	S.P.D.T.	125V 3A	
		L	D.P.S.T.	125V 1A	
		M	D.P.S.T.	125V 3A	
		Q	D.P.D.T.	125V 0.5A	
	Pull-Push	E	S.P.S.T.	125V 6A	
		N	D.P.S.T.	125V 6A	
		P	T.P.S.T.	125V 3A 15V 1A	
		W	D.P.D.T.	125V 3A 125V 1A	
	Push-Push	B	S.P.S.T.	12V 1A	
		E	S.P.S.T.	125V 3A	
		F	S.P.D.T.	12V 1A	
		S	S.P.S.T.	12V 1A	

Rated Power

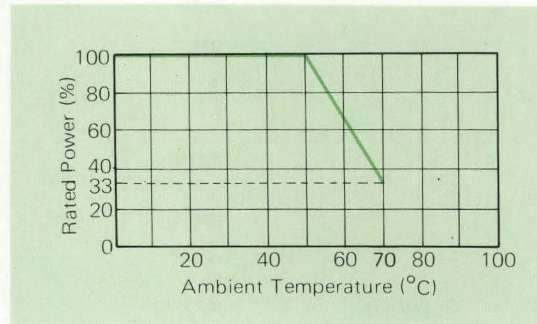
Wattage Rating: 0.50 watt for linear taper controls and 0.25 watt for non-linear taper controls across element at 50°C derated to 33% load at 70°C based on a linear derating curve.

Voltage Rating: The maximum allowable voltage rating should be the one that is allowed by the wattage rating. But in no case shall the voltage rating exceed 500VDC for linear taper controls and 250 VDC for non-linear taper controls. Accordingly, the wattage rating shall be held within the voltage rating.

Rated Power

Taper	Nom. Overall Res.	Rated Power	Max. Operating Volt.(V)
B Linear	200K Ω or less	0.5	500
	More than 200K Ω	0.25	
10% LOG 20% LOG "S" A, C, D	–	0.25	250
E	–	0.5	–

Power Derating Curve



Taper

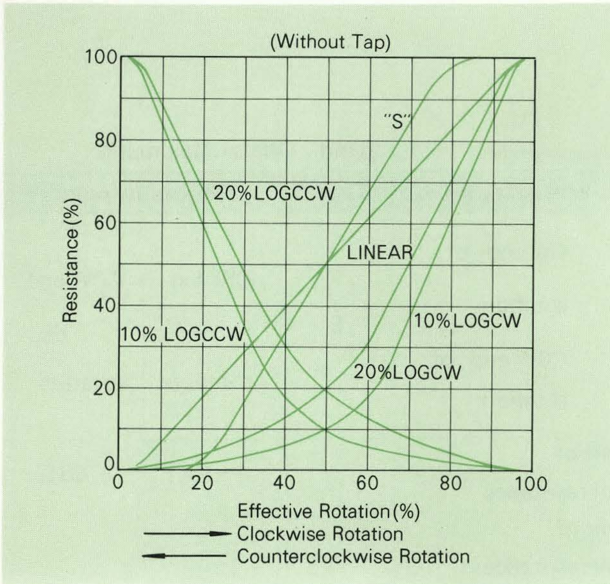
For American Standard

Unit: %

Type	Taper	Overall Resistance	Effective Rotation at 50% ± 3%		
15/16" DIA.	Linear	less than 250K Ω	40 ~ 60		
		250K Ω or more	35 ~ 65		
	10% LOG CW	less than 250K Ω	8 ~ 12		
	10% LOG CCW	250K Ω or more	7 ~ 13		
	20% LOG CW	less than 250K Ω	16 ~ 24		
	20% LOG CCW	250K Ω or more	14 ~ 26		
	"S"		at 25% ± 3%	at 50% ± 3%	at 75% ± 3%
		less than 250K Ω	6.4 ~ 9.6	40 ~ 60	90.4 ~ 93.6
		250K Ω or more	5.6 ~ 10.4	35 ~ 65	89.6 ~ 94.4

10% LOG CCW and 20% LOG CCW: $\dfrac{\text{Resistance value between Terminals 2 and 3}}{\text{Overall resistance value}} \times 100$

Linear, 10% LOG CW.
20% LOG CW and "S" : $\dfrac{\text{Resistance value between Terminals 1 and 2}}{\text{Overall resistance value}} \times 100$



Taper with single tap and double tap

- Single Tap : 40%, 50%, 60% or 35%, 50%, 65% available upon request.
- Double Tap: 35% & 65%, or 40% & 60% available upon request.
- Other types are available upon request.

For Standard

Unit:%

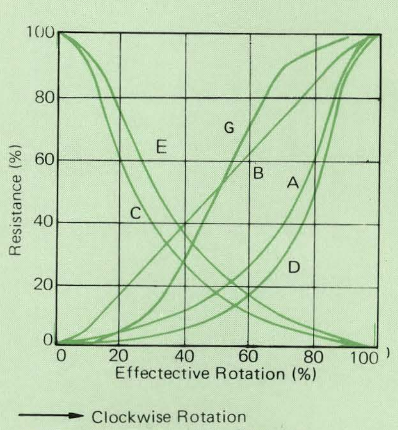
Type	Taper	Effective Rotation	
		at 50%	at 60%
24mm DIA.	A & C	–	15~30 (10~30)
	B	40~60	–
	D	2~15	–
	E	15~35	–

Note : ( ) applied for tandem type

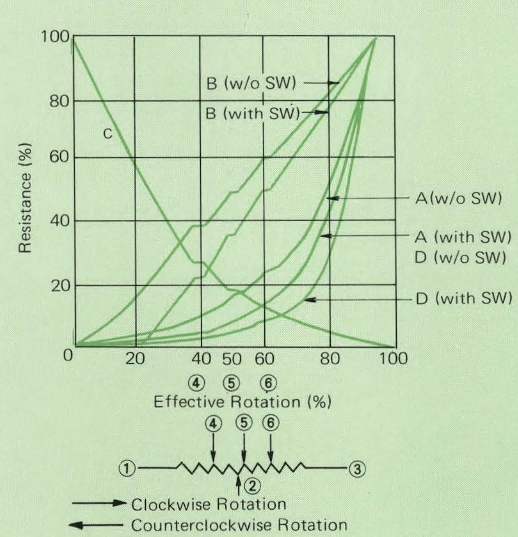
C and E : $\dfrac{\text{Resistance value between terminal 2 and 3}}{\text{Overall resistance value}} \times 100$

A,B and D : $\dfrac{\text{Resistance value between terminal 1 and 2}}{\text{Overall resistance value}} \times 100$

(Without Tap)



(Single Tap and Double Tap)



Remarks:

1. In taper with tap, only one of ④ , ⑤ and ⑥ is available.
2. In sound volume control, audio sets, tap position ④ , ⑤ in variable resistor with switch and tap position ④ in variable resistor without switch are not available.

Residual Resistance

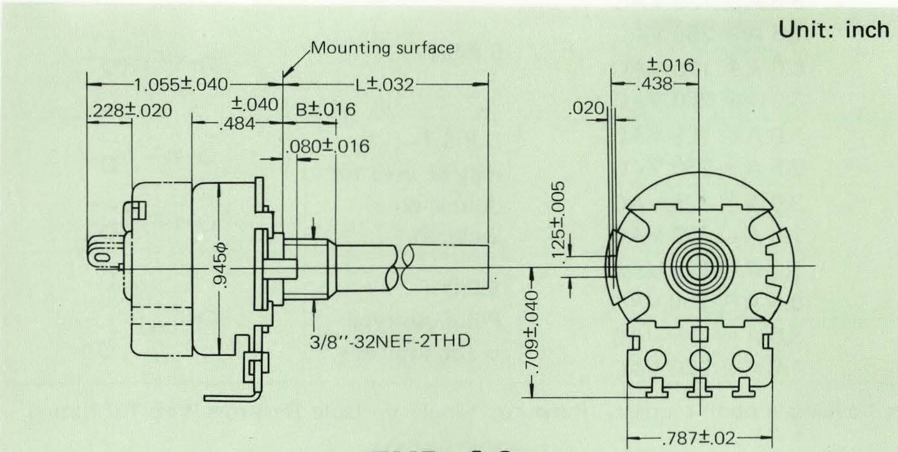
Standard residual resistance at ends of rotation is shown as follows.

(Unit : Ohms - Maximum)

Overall Resistance (R)	Taper	Measuring point	Taper	Measuring point	Taper	Measuring point	
	LOG CW. A.D	CCW end of rotation	LOG CW A,D	CW end of rotation	E	CW end of rotation	CCW end of rotation
	LOG CCW. C	CW end of rotation	LOG CCW. C	CCW end of rotation			
	Linear. B	Both ends of rotation					
R ≦ 5K Ω	2 Ω		1 percent of overall resistance			1~15Ω	50 Ω
5K Ω < R ≦ 50K Ω	3 Ω		1 percent of overall resistance		–		
50K Ω < R < 1M Ω	100 Ω		1 percent of overall resistance		–		
R ≧ 1M Ω	200 Ω		1 percent of overall resistance		–		

15/16" (24mm) DIA. SINGLE VARIABLE RESISTORS

(Metal Shaft, With or Without Rotary Switch)



EVD-A8

Features

- Smooth rotation and no shaft play
- Any type of rotary switch available
- Variation as to the followings available upon request
  - (1) Resistance and taper specified upon your request
  - (2) Shaft and bushing specified upon your request
  - (3) With a tap, single or double
  - (4) Terminals, printed circuit or wire wrapping
  - (5) With a click, center and ten teeth
  - (6) Dust-proof type
- Applicable to all kinds of electronic equipment

Electrical Specifications

- Resistance Range: 100Ω to 10MΩ
  Standard resistance and sub-standard resistance are in the table shown below.

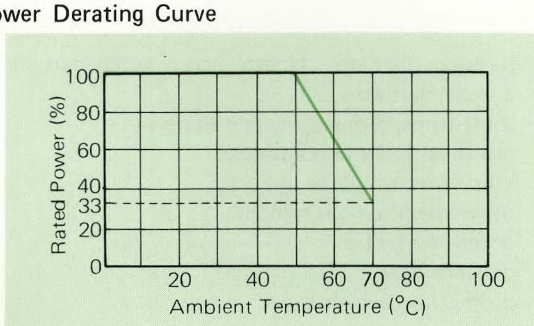
Standard Resistance Value Unit:Ω

Taper	Resistance	
	Standard	Semi-Std.
B	1K, 5K, 10K, 50K, 100K, 500K, 1M	2K, 20K, 200K, 2M
A,C	5K, 10K, 50K, 100K, 500K, 1M	20K, 200K
D	5K, 10K	20K
E	500, 1K	—

Any type of LOG Curve is available.

- Standard Tolerance: ± 20% for 2M Ω or less
  ± 30% for more than 2MΩ

- Power Derating Curve

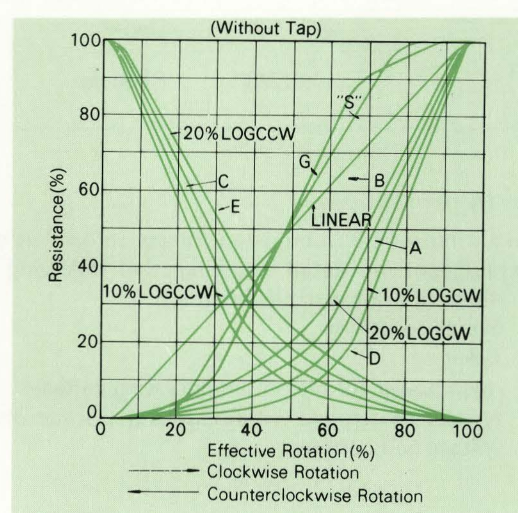


- Rated Power and Maximum Operating Voltage:

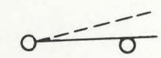
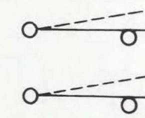
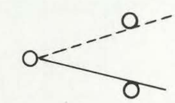
Taper	Nom. Overall Res. Value	Rated Power (W)	Max. Operating (V)
B Linear	R≦200KΩ	0.5	500
	R>200KΩ	0.25	
10% LOG, 20% LOG, "S" A, C, D	Shown in "Standard Resistance Value"	0.25	250
E	"	0.5	—

- Standard Curve: 10% LOG, 20% LOG, "S", A, B, C, D and

  Other curves are available upon request.



Switch

Type	UL listed cat. Nos.	Electrical Rating	Function	Schematic
Rotary (General Rating)	2D 2SF	3.0 A @ 125 VAC 1.5 A @ 250 VAC	S.P.S.T.	
	2E	6.0 A @ 125 VAC 3.0 A @ 250 VAC		
	2L 2DE	1.0 A @ 125 VAC 0.5 A @ 250 VAC	D.P.S.T. may be used for double-pole, 2-circuit.	
	2M 2DF	3.0 A @ 125 VAC 1.5 A @ 250 VAC		
	2H	1.0 A @ 125 VAC 0.5 A @ 250 VAC	S.P.D.T. Pull-push type is also available.	
	2J	3.0 A @ 125 VAC 1.5 A @ 250 VAC		

Notes: ■ TV Rating (UL) (TV-3, TV-4, etc.) available upon request. Refer to "Single Variable Resistors With TV Rating Rotary Switches" on p.III-20.

■ As to switches in detail, see "General Information" on p.III-2.

- Switch Operating Torque: 1.30 in-lbs max. at 5 - 35°C, (1.5kg. cm max.)
- Switch Operating Angle: 60° max.
- Withstand Voltage: Withstand AC 1,000V (1 minute)
- Insulating Resistance: 100M Ω min. (DC 500V)

Mechanical Specifications

- Rotating Angle: 300° ± 5° with or without switch
- Rotating Torque: 0.7~6.3 in-ozs (50~450g.cm)
- Stopper Strength: 8.0 in-lbs min. (9kg. cm min.)
- Tap Position: Single tap; 40%, 50%, 60% point of the rotating angle
  Double tap; 40%, 60% points of the rotating angle
- Standard Shaft and Bushing Dimensions: Dimensions are shown in the table below. Special dimensions are available upon request. (As to shaft trims, refer to "General Information" on p.III-2.)

Part No.	EVD-A8		
Shaft Trim	Bushing (inch)		Shaft Length (inch)
	Diameter	Length	
M	3/8"	1/4"	Upon Request
F			
S, R		3/8"	
H			

Part No.	EVC-BO EVE-DO EVC-SO			
Shaft Trim	Bushing (mm)		Shaft Length (mm)	
	Diameter	Length	Standard	Sub-Standard
K	8 φ	7 mm	20,25,30,40	35
F			25, 30	—
S,R			10,15,20,40	—

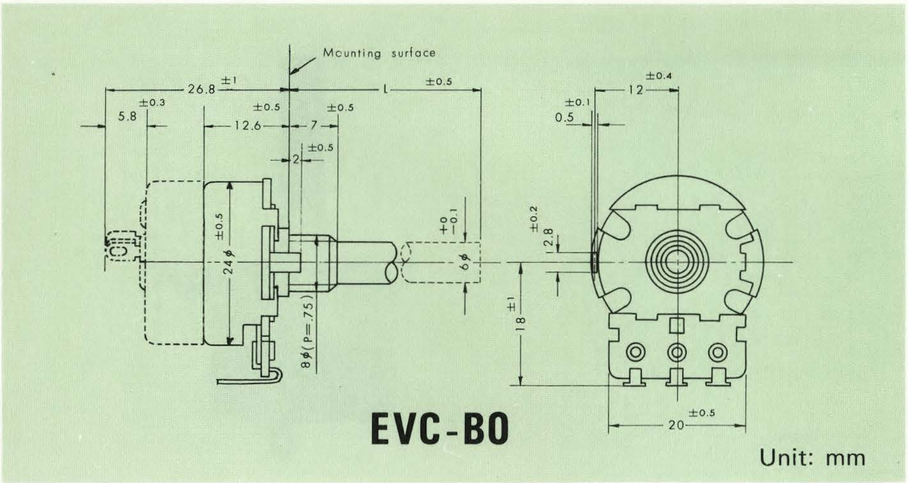
Sample Information

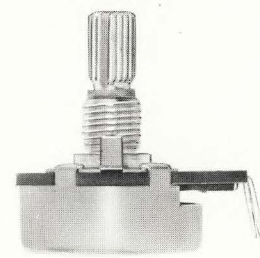
When requiring sample submission, please inform us of your own requirement in detail covering the following items:

(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) type of switch and maximum and normal operating voltage and current
(6) bushing diameter, length, screw pitch and material
(7) mounting means
(8) shaft trims, dimensions and material
(9) tap (position and resistance)
(10) kind of assembly or circuit
(11) other specific requirements
(12) ordering number
(13) delivery date
(14) production schedule

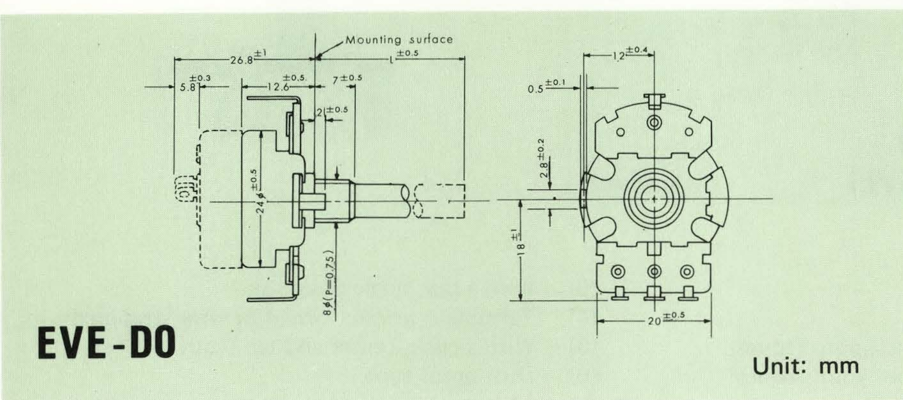
For Standard

- Standard Type

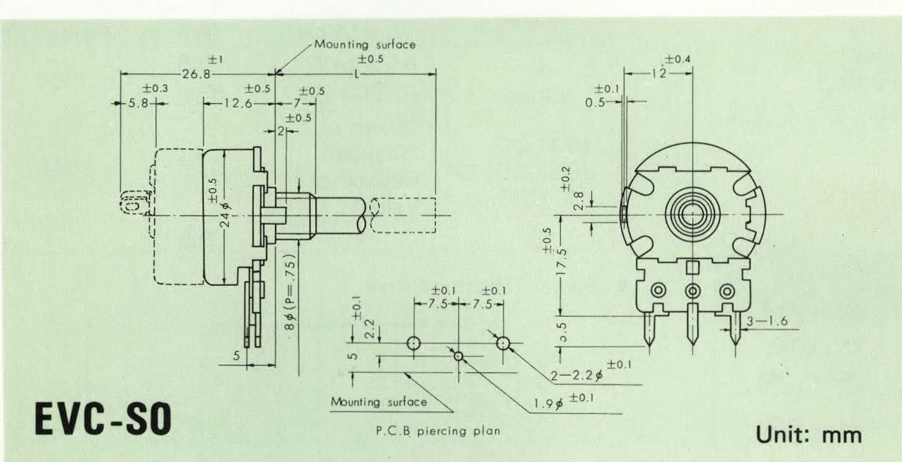


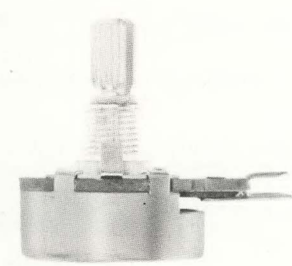


- Center tap construction



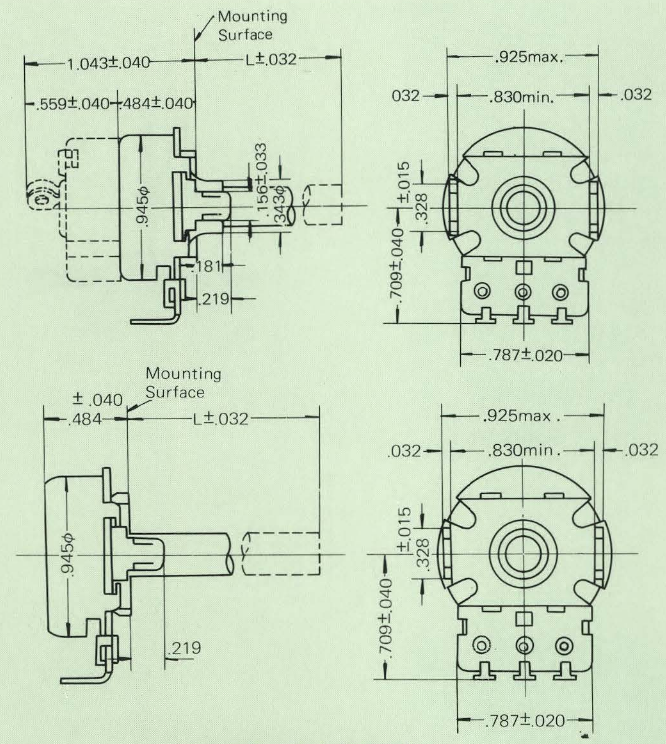
- Terminal construction for P.C.B.





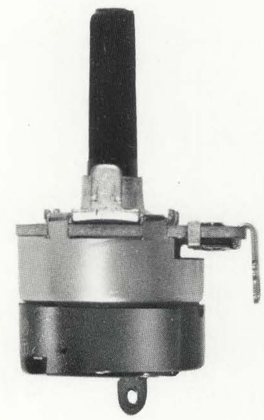
15/16" (24mm) DIA. SINGLE VARIABLE RESISTORS

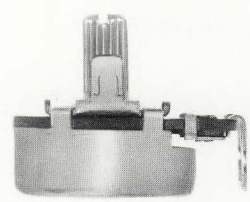
(Insulated Shaft, With or Without Rotary Switch)



EVD-N0 (W/SW)
EVD-N0A (W0/SW)

Unit: inch





Features

- Twist tab type for easy mounting
- Any type of rotary switch available
- Variation as to the followings available upon request
  - (1) Resistance and taper specified upon your request
  - (2) Shaft trims specified upon your request
  - (3) With a tap, single or double.
  - (4) Terminals, printed circuit or wire wrapping
  - (5) With a click, center and ten teeth
  - (6) Dust-proof type
- Applicable to all kinds of electronic equipment

Electrical Specifications

- Resistance Range: 100Ω to 10MΩ
  Standard resistance and sub-standard resistance are in the table shown below.
- Standard Tolerance: ± 20% for 2MΩ or less
  ± 30% for more than 2MΩ
- Standard Curve: 10% LOG, 20% LOG, "S", A, B, C, D and E
  Other curves are available upon request.

- Standard Resistance Value

Unit:Ω

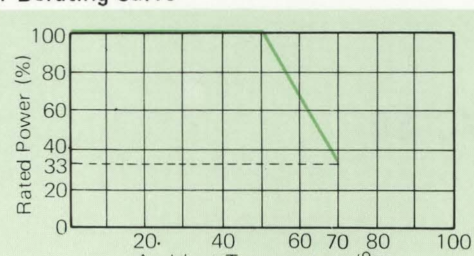
Taper	Resistance	
	Standard	Semi-Std.
B	1K, 5K, 10K, 50K, 100K, 500K, 1M	2K, 20K, 200K, 2M
A,C	5K, 10K, 50K, 100K, 500K, 1M	20K, 200K
D	5K, 10K	20K
E	500, 1K	—

Any type of LOG Curve is available.

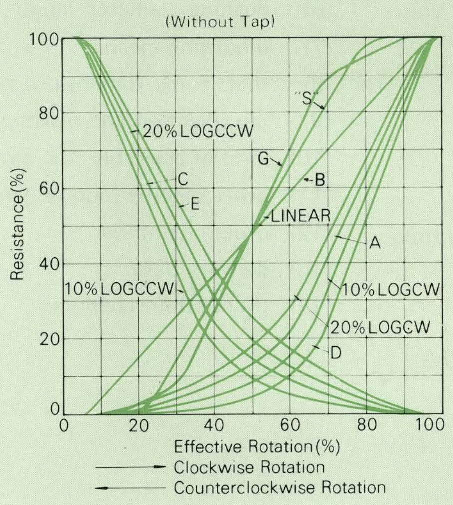
- Rated Power and Maximum Operating Voltage:

Taper	Nom. Overall Res. Value	Rated Power (W)	Max. Operating (V)
B Linear	R≦200KΩ	0.5	500
	R>200KΩ	0.25	
10% LOG, 20% LOG, "S" A, C, D	Shown in "Standard Resistance Value"	0.25	250
E	"	0.5	—

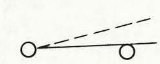
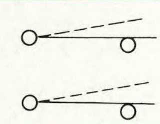
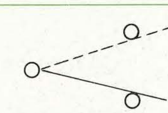
- Power Derating Curve



■ Standard Curve



Switch

Type	UL listed cat. Nos.	Electrical Rating	Function	Schematic
Rotary (General Rating)	2D 2SF	3.0 A @ 125 VAC 1.5 A @ 250 VAC	S.P.S.T.	
	2E	6.0 A @ 125 VAC 3.0 A @ 250 VAC		
	2L 2DE	1.0 A @ 125 VAC 0.5 A @ 250 VAC	D.P.S.T. may be used for double-pole, 2-circuit.	
	2M 2DF	3.0 A @ 125 VAC 1.5 A @ 250 VAC		
	2H	1.0 A @ 125 VAC 0.5 A @ 250 VAC	S.P.D.T. Pull-push type is also available.	
	2J	3.0 A @ 125 VAC 1.5 A @ 250 VAC		

Notes: TV Rating (UL, CSA) (TV-3, TV-4, etc.) available upon request. Refer to "Single Variable Resistors With TV Rating Rotary Switches" on p.III-20.
As to switches in detail, see "General Information" on p.III-2.

■ Switch Operating Torque: 1.30 in-lbs max. (1.5kg.cm) at 5 ~ 35°C,
■ Switch Operating Angle: 60° max.
■ Withstand Voltage: Withstand AC 1,000V (1 minute)
■ Insulating Resistance: 100MΩ min. (DC 500V)

Mechanical Specifications

■ Rotating Angle: 300° ± 5° with or without switch
■ Rotating Torque: 0.5 ~ 6.3 in-ozs (35~450g.cm)
■ Stopper Strength: 8.0 in-lbs min. (9kg. cm min.)
■ Tap Position: Single tap; 40%, 50%, 60% point of the rotating angle
Double tap; 40%, 60% points of the rotating angle.
■ Standard Shaft Dimensions: Dimensions are shown in the table below.
Special dimensions are available upon request. (As to shaft trim, refer to "General Information" on p.III-2.)

Part No.		EVD-NO EVD-PO	Part No.		EVV-BO EVV-B3A
Shaft Trims	Shaft Diameter (inch)	Shaft Length (inch)	Shaft Trims	Shaft Diameter (mm)	Shaft Length (mm)
S	.245	Upon Request	S	–	–
F	.250		F	6φ	26

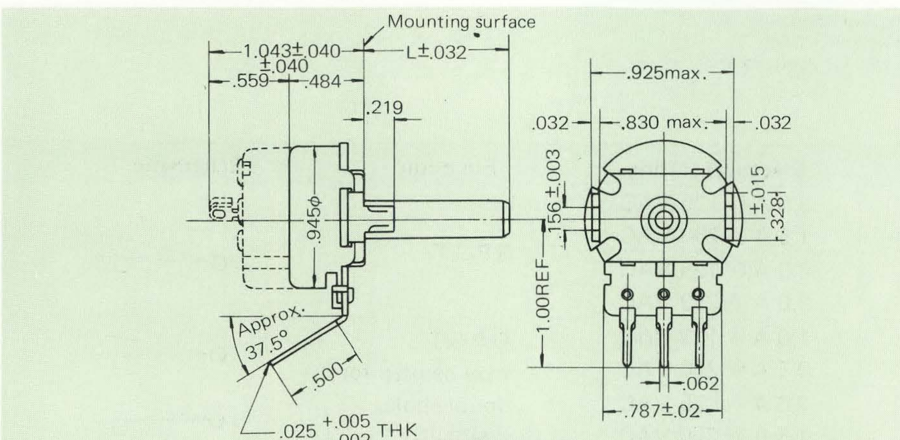
Sample Information

When requiring sample submission, please inform us of your own requirement in detail covering the following items:

(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating valtage)
(5) type of switch and maximum and normal operating voltage and current
(6) bushing diameter, length, screw pitch and material
(7) mounting means
(8) shaft trims, dimensions and material
(9) tap (position and resistance)
(10) kind of assembly or circuit
(11) other specific requirements
(12) ordering number
(13) delivery date
(14) production schedule

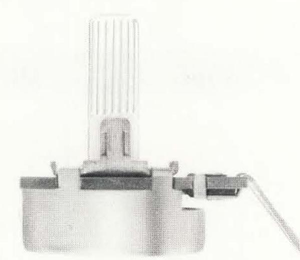
For American Standard

■ Wire-wrap terminal construction

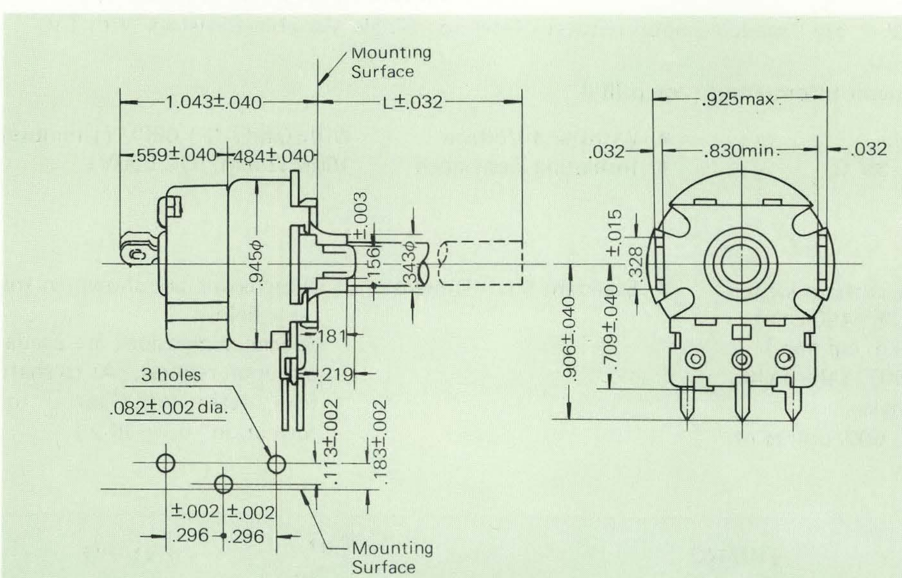


EVD-PO

Unit:inch

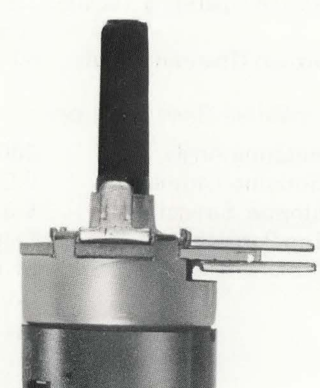


■ Printed circuit terminal construction



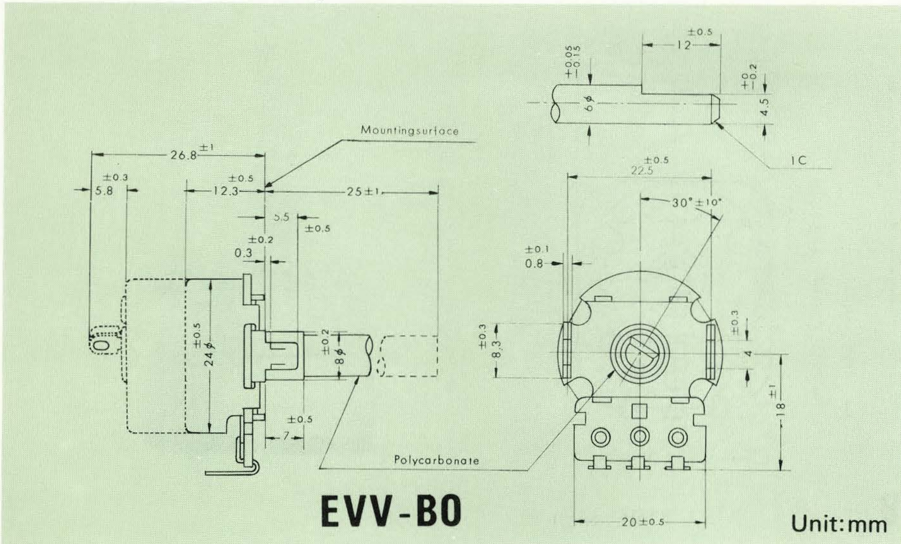
EVD-65

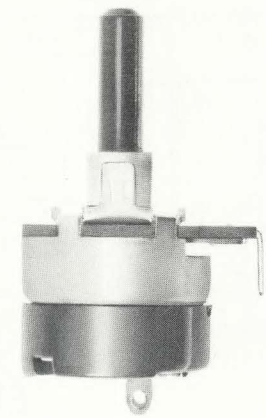
Unit:inch



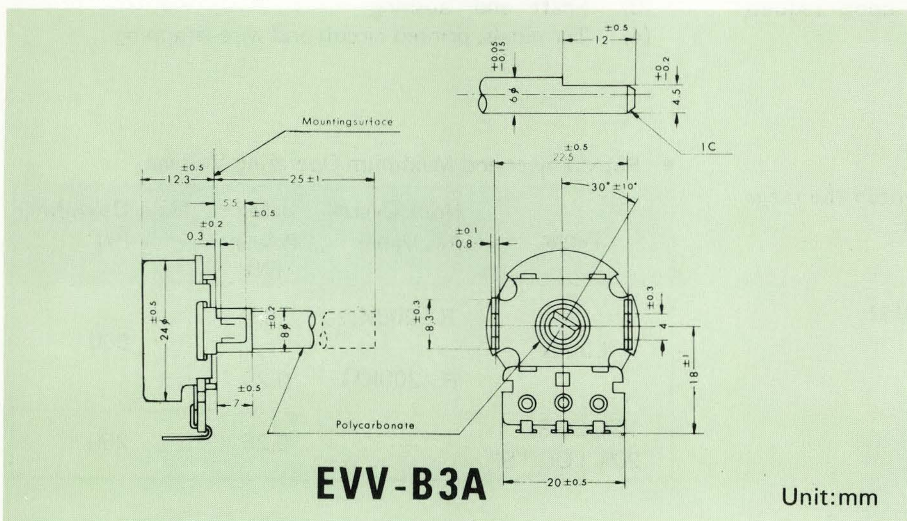
For Standard

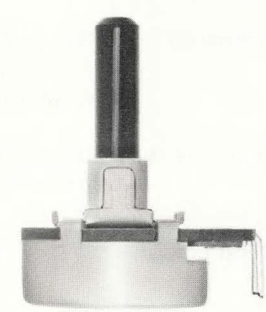
- With non-threaded bushing



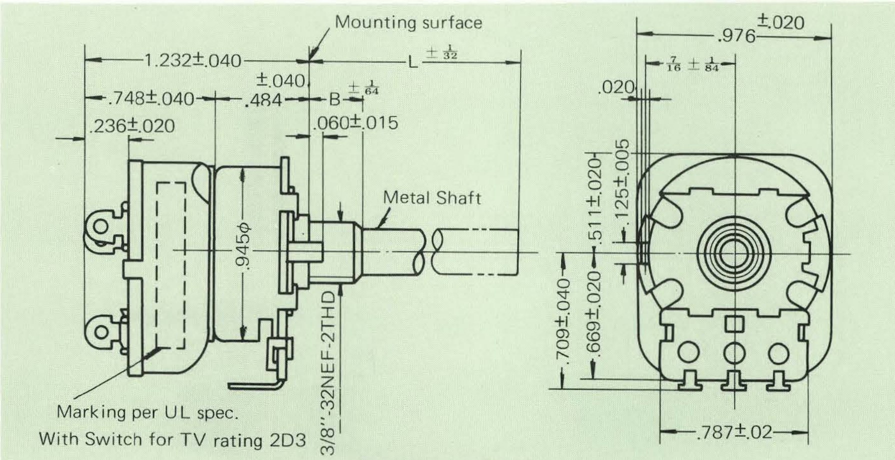


- With center click stop



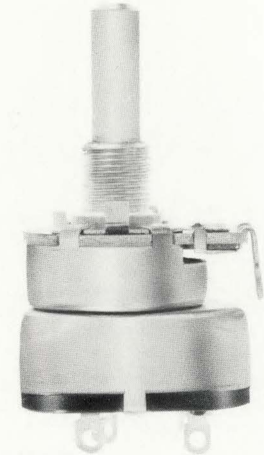


15/16" (24mm) DIA. SINGLE VARIABLE RESISTORS



EVD-AB8

Unit : inch

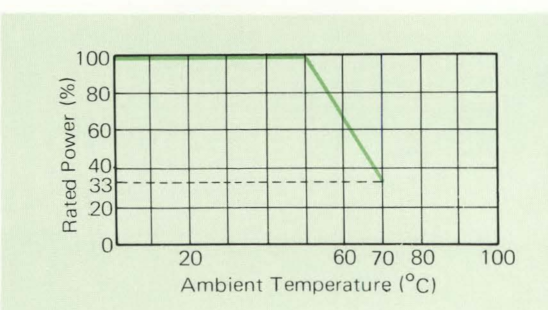


Features

- With rotary switch for TV rating (UL, ÇSA)
- Variation as to the followings available upon request
  (1) Metal shaft and insulated shaft
  (2) Resistance and taper
  (3) Shaft and bushing
  (4) Terminals, printed-circuit and wire-wrapping

Electrical Specifications

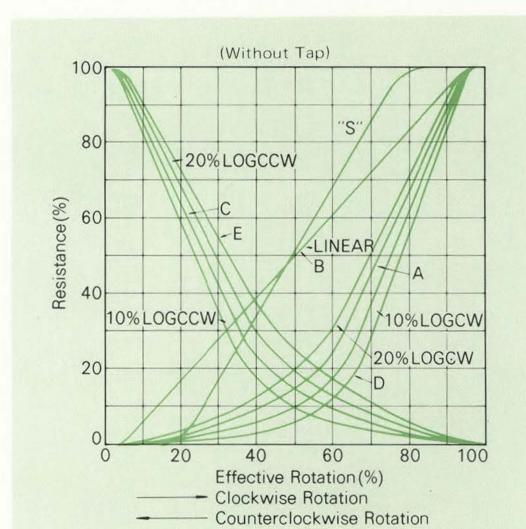
- Resistance Range: 100Ω to 10MΩ
  Any resistance value within the range is available upon request.
- Standard Tolerance: ± 20% for 2M Ω or less
  ± 30% for more than 2M Ω
- Power Derating Curve



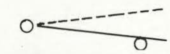
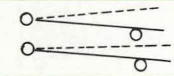
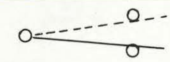
- Rated Power and Maximum Operating Voltage:

Taper	Nom. Overall Res.Value	Rated Power (W)	Max. Operating (V)
Linear	R≦200KΩ	0.5	500
	R>200KΩ	0.25	
10% LOG, 20% LOG "S"	–	0.25	250

- Standard Curve: 10% LOG, 20% LOG, "S",
  Other tapers are available upon request.



Switch

Type	UL, CSA Listed cat. No.	Electrical Rating	Function	Schematic
Rotary	2S4	TV–4	S.P.S.T.	
	2D3	TV–3	D.P.S.T.	
	2M3	TV–3	S.P.D.T.	

- Switch Operating Torque: 1.30 in-lbs max. (1.5kg.cm) at 5~35°C
- Switch Operating Angle: 60° max.
- Withstand Voltage: Withstand AC 1,000V (1 minute)
- Insulating Resistance: 100M Ω min. (DC 500V)

Mechanical Specifications

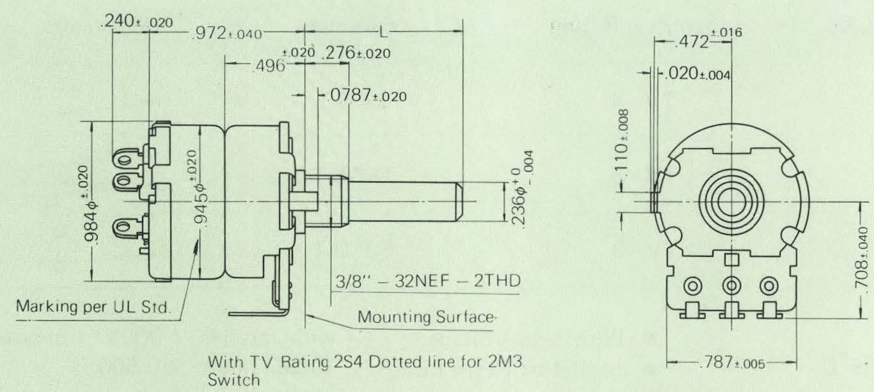
- Rotating Angle: With switch and without switch 300° ±5°
- Rotating Torque: 0.5 - 6.3 in-ozs (35~450g.cm)
- Stopper Strength: 8.0 in-lbs min. (9kg. cm min.)
- Standard Shaft and Bushing Dimensions: Dimensions are shown in the table below. Special dimensions are available upon request. (As to shaft trims, refer to "General Information" on p.III-2.)

Part No.	EVD-AB8 EVD-AB6 (Metal Shaft) EVD-AB4			Part No.		EVD-NA8 EVD-NA6 (Insulated Shaft) EVD-NA4
Shaft Trims	Bushing (inch) Diameter	Bushing (inch) Length	Shaft Length (inch)	Shaft Trims	Shaft Diameter (inch)	Shaft Length (inch)
M	3/8"	1/4"	Upon Request	S	.245	Upon Request
F						
S,R		3/8"		F	.250	
H						

Sample Information

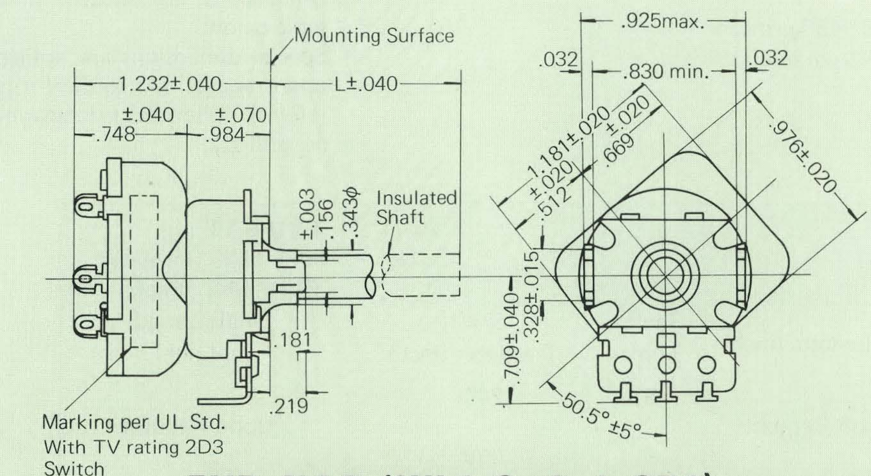
When requiring sample submission, please inform us of your own requirement in detail covering the following items:

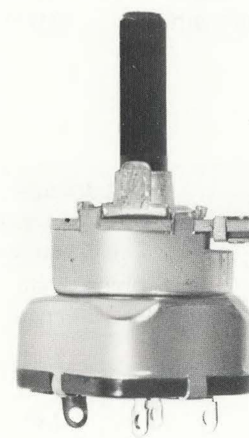
(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) type of switch and maximum and normal operating voltage and current
(6) bushing diameter, length, screw pitch and material
(7) mounting means
(8) shaft trims, dimensions and material
(9) tap (position and resistance)
(10) kind of assembly or circuit
(11) other specific requirements
(12) ordering number
(13) delivery date
(14) production schedule



EVD-AB5(With Switch 2S4)
EVD-AB4(With Switch 2M3)

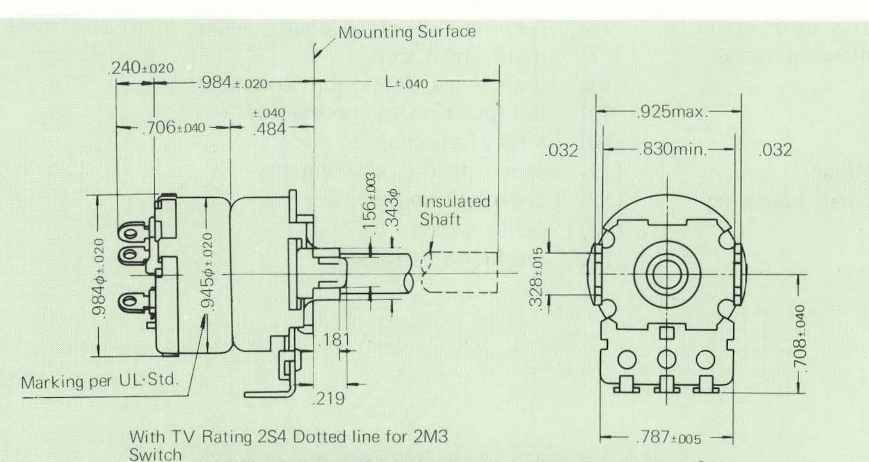
Unit: mm (inch)

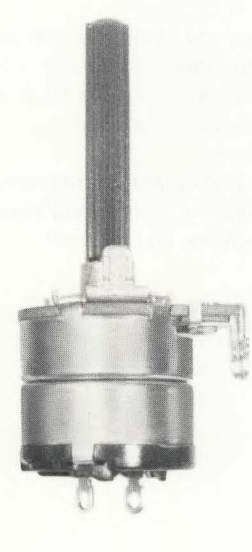




EVD-NA8 (With Switch 2D3)

Unit: inch



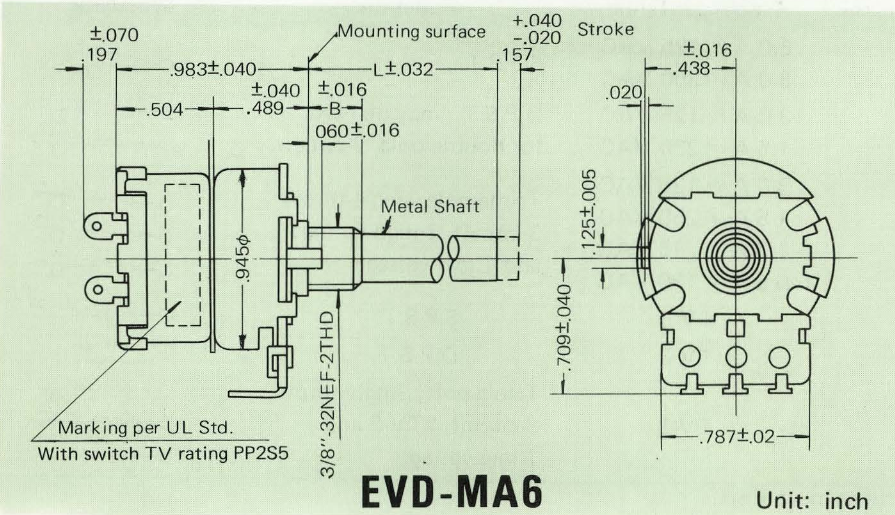


EVD-NA5(With Switch 2S4)
EVD-NA4(With Switch 2M3)

Unit: mm (inch)

15/16" (24mm) DIA. SINGLE VARIABLE RESISTORS

(With Pull-Push Switch ;TV Rating, Standard and Others)



Features

- Any type of pull-push switch available (Pull-on Push-off Construction)
- Variation as to the followings available upon request
  - (1) Resistance and taper
  - (2) Shaft and bushing
  - (3) With a tap, single or double
  - (4) Terminals, printed circuit or wire-wrapping
  - (5) Insulated shaft

Electrical Specifications

- Resistance Range: 100 Ω to 10M Ω
  Standard resistance and sub-standard resistance are in the table shown below.

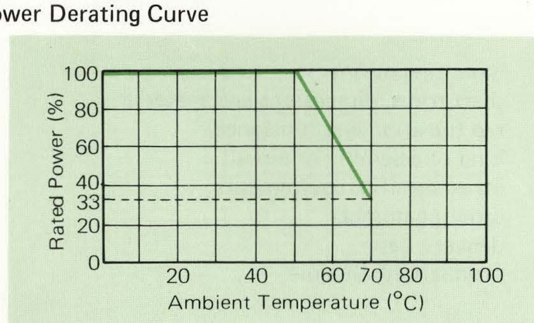
Standard Resistance Value Unit:Ω

Taper	Resistance	
	Standard	Semi-Std.
B	1K, 5K, 10K, 50K, 100K, 500K, 1M	2K, 20K, 200K, 2M
A,C	5K, 10K, 50K, 100K, 500K, 1M	20K, 200K
D	5K, 10K	20K
E	500, 1K	—

Any type of LOG curve is available.

- Standard Tolerance: ± 20% for 2M Ω or less
  ± 30% for more than 2M Ω

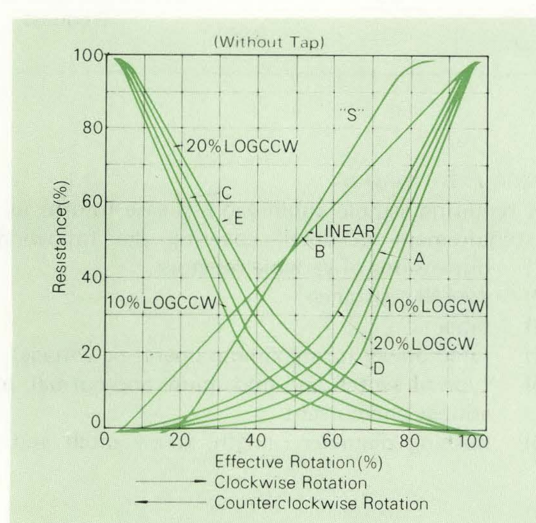
- Power Derating Curve



- Rated Power and Maximum Operating Voltage:

Taper	Nom. Overall Res. Value	Rated Power (W)	Max. Operating (V)
B Linear	R≦200KΩ	0.5	500
	R>200KΩ	0.25	
10% LOG, 20% LOG, "S" A, C, D	Shown in "Standard Resistance Value"	0.25	250
E	"	0.5	—

- Standard Curve: 10% LOG, 20% LOG, "S", A, B, C, D and E
  Other taper are available upon request.



Switch

Type		UL, CSA listed cat. No.	Electrical Rating	Function	Schematic
General Rating	Pull-Push	PP2E	6.0 A @ 125 VAC 3.0 A @ 250 VAC	S.P.S.T.	
		PP2N	3.0 A @ 125 VAC 1.5 A @ 250 VAC	D.P.S.T., may be used for double-pole, 2-circuit.	
		PP2NT	3.0 A @ 125 VAC 1.5 A @ 250 VAC 1.0 A @ 15 VAC 0.5 A @ 30 VAC	Triple-pole, single-throw 3-circuit, 2 high voltage and 1 low voltage	
TV Rating	Pull-Push	* PP2S5	* TV-5	S.P.S.T.	
		* PP2D3	* TV-3	D.P.S.T.	
		PP2T3	TV-3	Triple-pole, Single-throw 3-circuit, 2TV-3 and 1 low voltage	

* marked items meet CSA.

- Switch Operating Torque: 200 ~ 700 grams.
- Switch Operating Shaft Stroke: As shown in the figure
- Withstand Voltage: Withstand AC 1,000V (1 minute)
- Insulating Resistance: 100MΩ min. (DC 500V)
- Switch Contact Resistance: Max. 0. 1Ω (D.C about 1A: in initial)

Mechanical Specifications

- Rotating Angle: 300° ±15° with or without switch
- Rotating Torque: 0.7 - 6.3 in-ozs (50~450g.cm)
- Stopper Strength: 8.0 in-lbs min. (9kg. cm min.)
- Tap Position: Single tap; 40%, 50%, 60% point of the rotating angle
  Double tap; 40%, 60% points of the rotating angle
- Standard Shaft and Bushing Dimensions: Dimensions are shown in the table below.
  Special dimensions are available upon request.
  (As to shaft trims, refer to "General Information" on p.III-2.)

Part No.	EVD-MA EVD-MO		
Shaft Trims	Bushing (inch)		Shaft Length (inch)
	Diameter	Length	
M	3/8"	1/4"	Upon Request
F			
S,R		3/8"	
H			

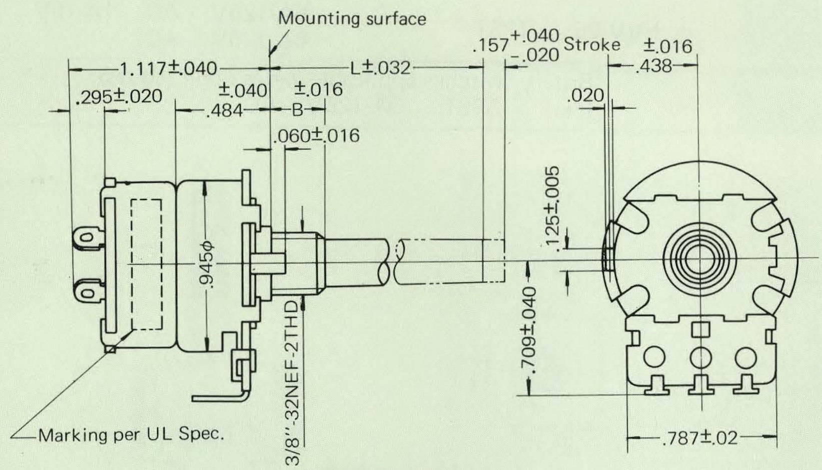
Part No.	EVC-MO EVV-FO EVV-25D			
Shaft Trims	Bushing (mm)		Shaft Length (mm)	
	Diameter	Length	Standard	Sub-Standard
K	8 ϕ	7 mm	25	20, 30
F				
S,R				

Sample Information

When requiring sample submission, please inform us of your own requirement in detail covering the following items:

(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) type of switch and maximum and normal operating voltage and current
(6) bushing diameter, length, screw pitch and material
(7) mounting means
(8) shaft trims, dimensions and material
(9) tap (position and resistance)
(10) kind of assembly or circuit
(11) other specific requirements
(12) ordering number
(13) delivery date
(14) production schedule

General Type

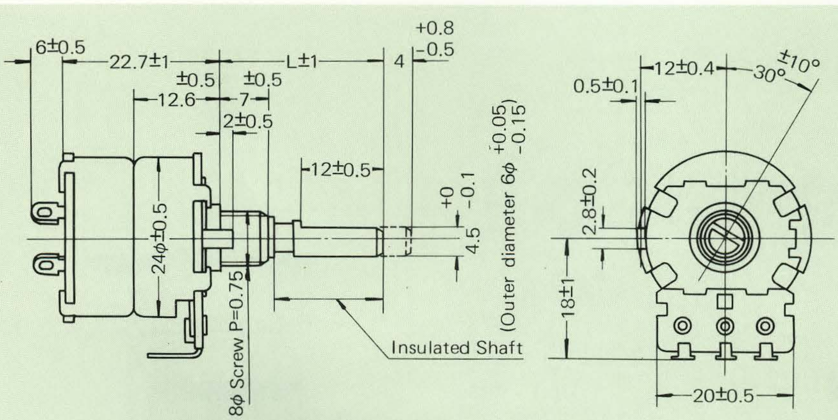


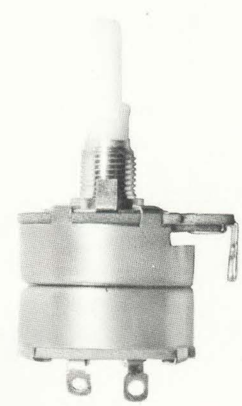
EVD-MO

Unit : inch

Standard Type

Type	Switch No.	Function	Electrical Rating	Schematic
pull-push	E	S.P.S.T.	125V 6A	
	N	D.P.S.T.	125V 6A	
	P	T.P.S.T.	125V 3A (15V 1A)	



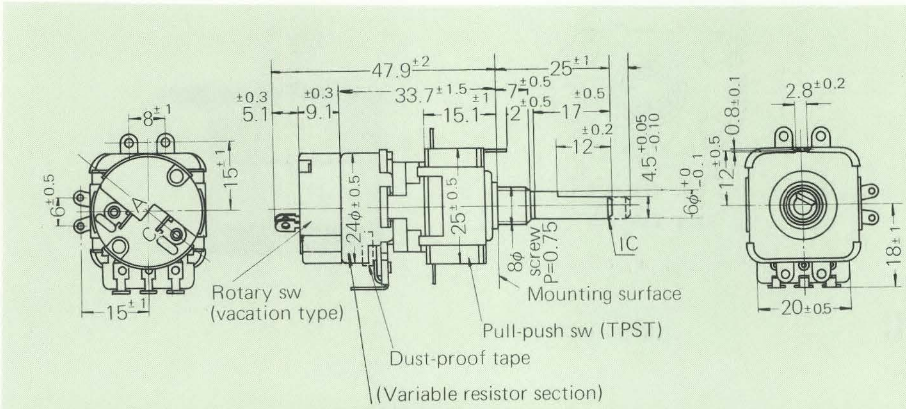


EVV-FO(Insulated Shaft)
EVC-MO(Metal Shaft)

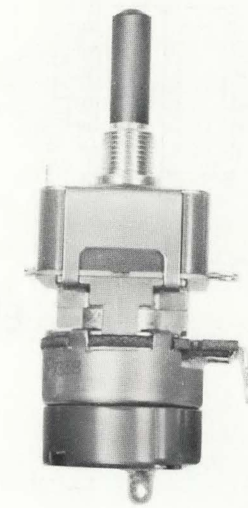
Unit : mm

■ With DP DT pull-push switch

Switch	Pull-push SW	EVV-25 TPST	6A-125V AC 1A-15V 6A-125V AC
	Rotory SW	Rotary switches applicable varies upon request. (ex.) SPST 3A-125V AC	

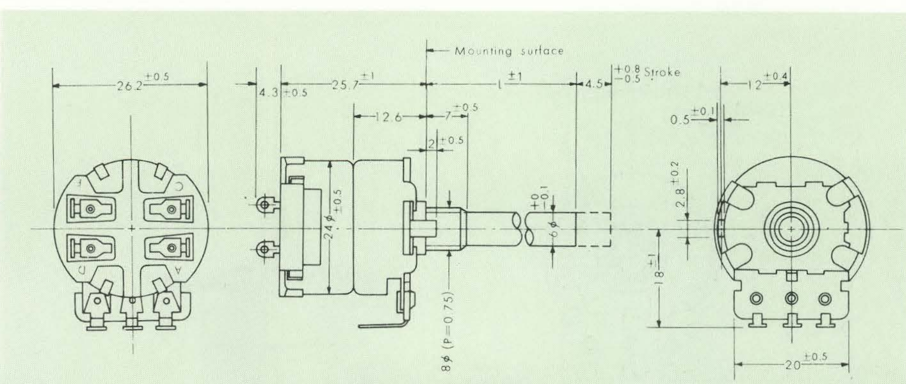


EVV-25D



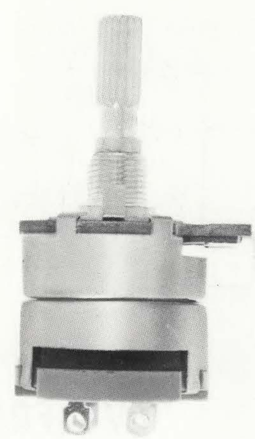
■ Meets specifications of SEMKO (Sweden), SEV (Switzerland)

Type	Switch No.	Function	Electrical Rating	Schematic
pull-push	N	D.P.S.T.	250V 2A	



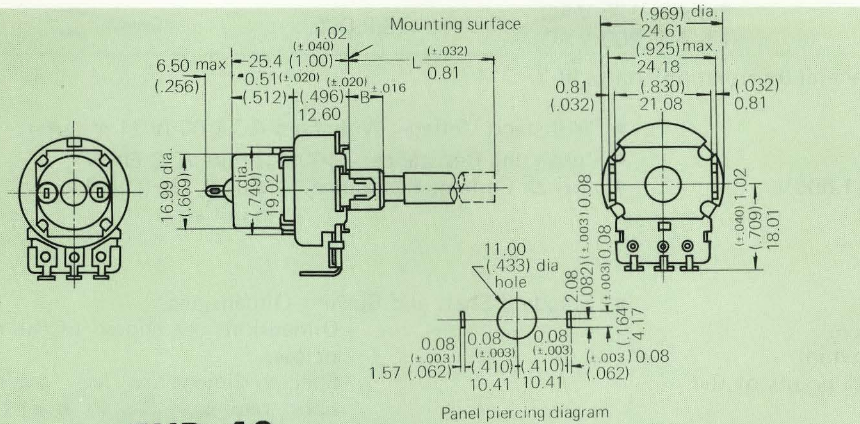
EVC-M6N

Unit : mm

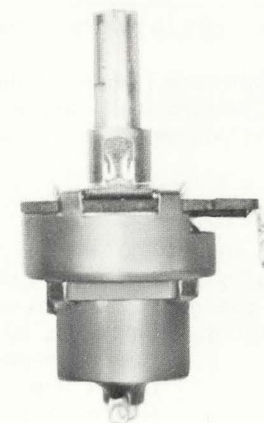


15/16" (24mm) DIA. SINGLE VARIABLE RESISTORS

(With Push-Push Switches)



EVD-40



Features

- Any type of Push-Push switch available
- Variation as to the followings available upon request
  - (1) Resistance and taper
  - (2) Shaft and bushing
  - (3) With a tap, single or double
  - (4) Terminals, printed circuit or wire-wrapping
  - (5) Insulated shaft

Electrical Specifications

- Resistance Range: 100Ω to 10MΩ
  Standard resistance and sub-standard resistance are in the table shown below.

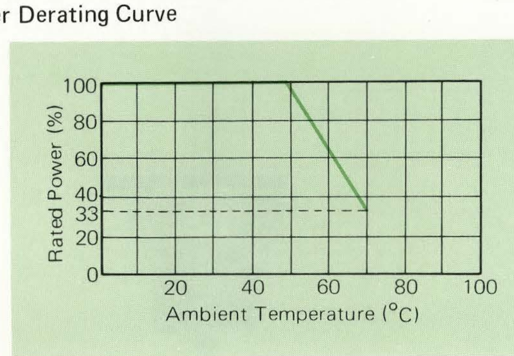
- Standard Resistance Value Unit:Ω

Taper	Resistance	
	Standard	Semi-Std.
B	1K, 5K, 10K, 50K, 100K, 500K, 1M	2K, 20K, 200K, 2M
A,C	5K, 10K, 50K, 100K, 500K, 1M	20K, 200K
D	5K, 10K	20K
E	500, 1K	–

Any type of LOG Curve is available.

- Standard Tolerance: ± 20% for 2MΩ or less
  ± 30% for more than 2MΩ

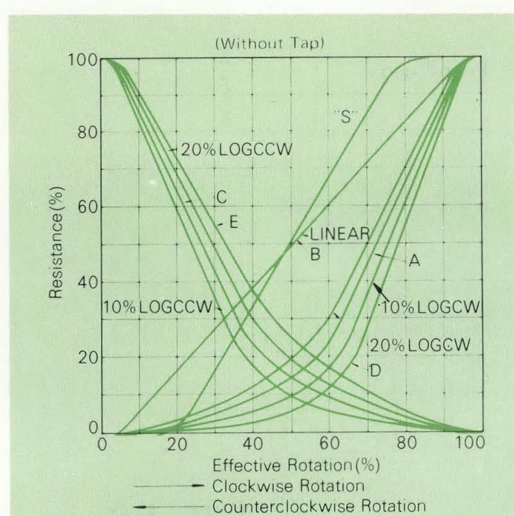
- Power Derating Curve



- Rated Power and Maximum Operating Voltage:

Taper	Nom. Overall Res. Value	Rated Power (W)	Max. Operating (V)
B Linear	R≦200KΩ	0.5	500
	R>200KΩ	0.25	
10% LOG, 20% LOG, "S" A, C, D	Shown in "Standard Resistance Value"	0.25	250
E	"	0.5	–

- Standard Curve: 10% LOG, 20% LOG, "S", A, B, C, D and E
  Other curves are available upon request.



Switch

Type	UL listed cat. Nos.	Electrical Rating	Function	Schematic
Push-Push	P2E	3.0 A @ 125 VAC 1.5 A @ 250 VAC	S.P.S.T.	
	P2J	3.0 A @ 125 VAC 1.5 A @ 250 VAC	S.P.D.T.	

Note: As to switchs in detail, see "General Information" on p. III-2.

- Switch Operating Torque: 2kg.cm max.
- Switch Operating Shaft Stroke: .150 ± .020
- Withstand Voltage: Withstand AC 1,000V (1 minute)
- Withstand Voltage: Withstand AC 1,000V (1 minute)
- Insulating Resistance: 100MΩ min. (DC 500V)
- Switch Contact Resistance: Max. 0.1Ω (D.C 1A: in initial)

Mechanical Specifications

- Rotating Angle: 300° ± 15°
- Rotating Torque: 0.7 - 6.3 in-ozs (50~450g.cm)
- Stopper Strength: 8.0 in-lbs min. (9kg. cm min.)
- Tap Positions: Single tap; 40%, 50%, 60% points of the rotating angle
  Double tap; 40%, 60% points of the rotating angle
- Standard Shaft and Bushing Dimensions: Dimensions are shown in the table below. Special dimensions are available upon request. (As to shaft trims, refer to "General Information" on p.III-2.)

Part No.	EVD-LO			Part No.	EVC-HO			
Shaft Trims	Bushing (inch)		Shaft Length (inch)	Shaft Trims	Bushing (mm)		Shaft Length (mm)	
	Diameter	Length			Diameter	Length	Standard	Sub-Standard
M	3/8"	1/4"	Upon	K	8 φ	7 mm	25,30,40	35
F				F				
S,R		3/8"	Request					
H				S,R				

Sample Information

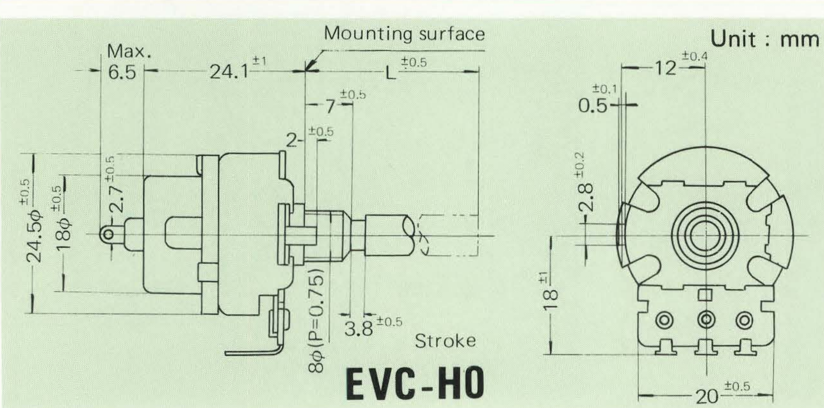
When requiring sample submission, please inform us of your own requirement in detail covering the following items:

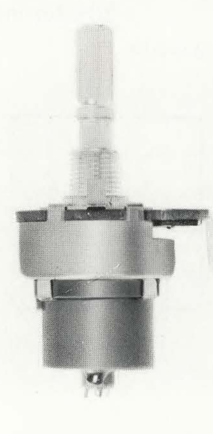
(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) type of switch and maximum and normal operating voltage and current
(6) bushing diameter, length, screw pitch and material
(7) mounting means
(8) shaft trims, dimensions and material
(9) tap (position and resistance)
(10) kind of assembly or circuit
(11) other specific requirements
(12) ordering number
(13) delivery date
(14) production schedule

Standard Products

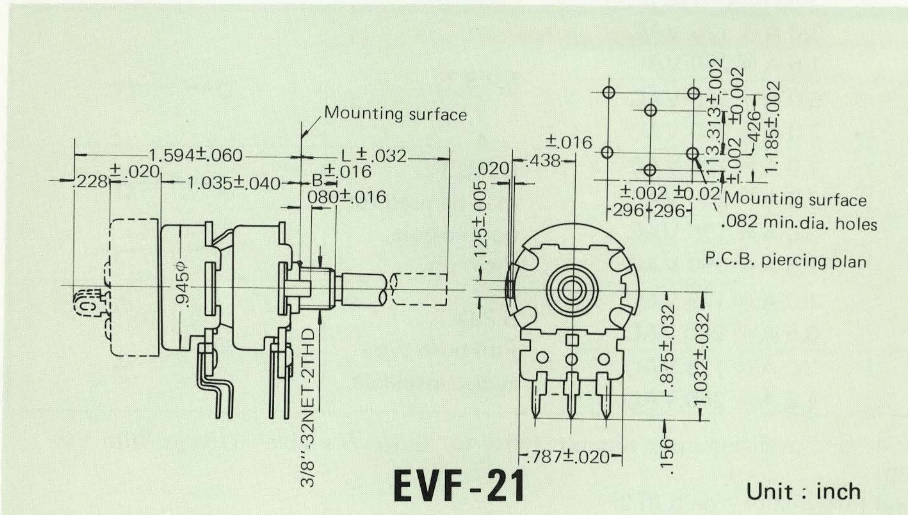
- Standard with push-push switches

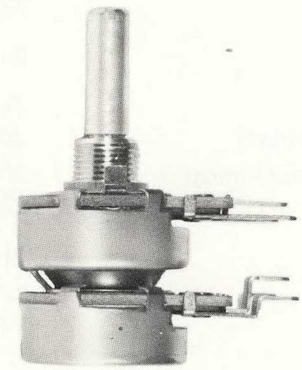
Type	Part No.	Function	Electrical Rating	Schematic
Push-Push	B	S.P.S.T.	12V1A	
	E	S.P.S.T.	125V3A	
	F	S.P.D.T.	12V1A	
	S	S.P.S.T.	12V1A	





15/16" (24mm) DIA. TANDEM VARIABLE RESISTORS





Features

- Smooth rotation and no shaft play
- Any type of rotary switch available
- Variation as to the followings available upon request
  (1) Resistance and taper
  (2) Shaft and bushing
  (3) With a tap, single or double
  (4) Terminals, printed circuit or wire-wrapping
  (5) With a click, center and ten teeth
  (6) Dust-proof type
- Applicable to all kinds of electronic equipment, especially for stereo-audio sets

Electrical Specifications

- Resistance Range: 100Ω to 10MΩ
  Standard resistance and sub-standard resistance are in the table shown below.

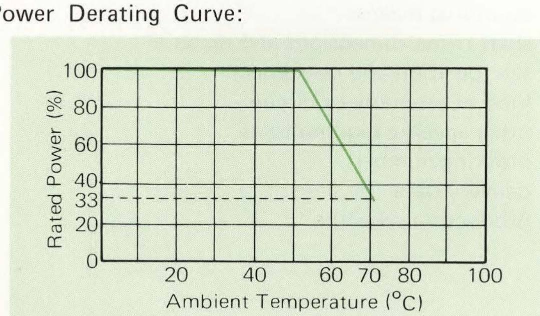
Standard Resistance Value Unit:Ω

Taper	Resistance	
	Standard	Semi-Std.
B	1K, 5K, 10K, 50K, 100K, 500K, 1M	2K, 20K, 200K, 2M
A,C	5K, 10K, 50K, 100K, 500K, 1M	20K, 200K
D	5K, 10K	20K
E	500, 1K	–

Any type of LOG curve is available.

- Standard Tolerance: ± 20% for 2MΩ or less
  ± 30% for more than 2MΩ

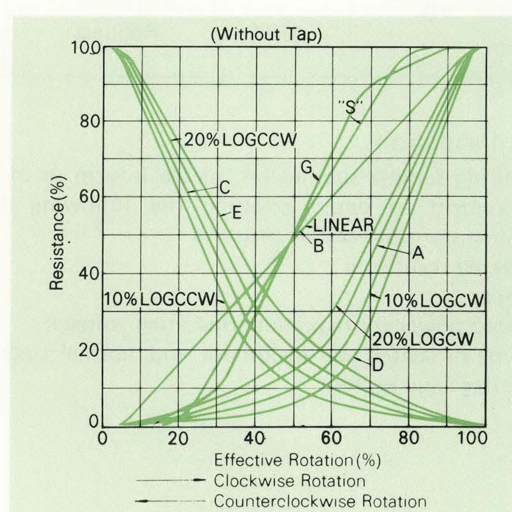
- Power Derating Curve:



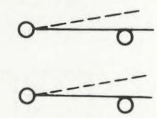
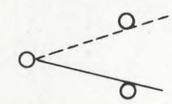
- Rated Power and Maximum Operating Voltage:

Taper	Nom. Overall Res. Value	Rated Power (W)	Max. Operating (V)
B Linear	R≦200KΩ	0.5	500
	R>200KΩ	0.25	
10% LOG, 20% LOG, "S" A, C, D	Shown in "Standard Resistance Value"	0.25	250
E	"	0.5	–

- Standard Curve: 10% LOG, 20% LOG, "S", A, B, C, D and E
  Other curves are available upon request.



Switch

Type	UL listed cat. Nos.	Electrical Rating	Function	Schematic
Rotary (General Rating)	2D 2SF	3.0 A @ 125 VAC 1.5 A @ 250 VAC	S.P.S.T.	
	2E	6.0 A @ 125 VAC 3.0 A @ 250 VAC		
	2L 2DE	1.0 A @ 125 VAC 0.5 A @ 250 VAC	D.P.S.T. may be used for double-pole, 2-circuit.	
	2M 2DF	3.0 A @ 125 VAC 1.5 A @ 250 VAC		
	2H	1.0 A @ 125 VAC 0.5 A @ 250 VAC	S.P.D.T. Pull-push type is also available.	
	2J	3.0 A @ 125 VAC 1.5 A @ 250 VAC		

Notes: TV Rating (UL, CSA) (TV-3, TV-4, etc.) available upon request. Refer to "Single Variable Resistors With TV Rating Rotary Switches" on p.III-20.
As to switches in detail, see "General Information" on p.III-2.

- Switch Operating Torque: 1.30 in-lbs max. at 5 ~ 35°C (1.5kg. cm)
- Switch Operating Angle: 60° max.
- Withstand Voltage: Withstand AC 1,000V (1 minute)
- Insulating Resistance: 100MΩ min. (DC 500V)
- DB Specification: Specified for your requirement.

Mechanical Specifications

- Rotating Angle: 300° ±5° with or without switch
- Rotating Torque: 0.7-6.3 in-ozs(50~450g.cm)
- Stopper Strength: 8.0 in-lbs min. (9kg. cm min.)
- Tap Position: Single tap; 40%, 50%, 60% point of the rotating angle
  Double tap; 40%, 60% point of the rotating angle
- Standard Shaft and Bushing Dimensions: Dimensions are shown in the table below.
  Special dimensions are available upon request. (As to shaft trims, refer to "General Information" on p.III-2.)

Part No.	EVF-21 EVF-20		
Shaft Trims	Bushing (inch)		Shaft Length (inch)
	Diameter	Length	
M	3/8"	1/4" 1/8"	Upon Request
F			
S,R			
H			

Part No.	EVF-N1 EVF-K1 EVG-K1 EVF-87A			
Shaft Trims	Bushing (mm)		Shaft Length (mm)	
	Diameter	Length	Standard	Sub-Standard
K	8 ϕ	7 mm	25.30.40	35
F				
S,R				

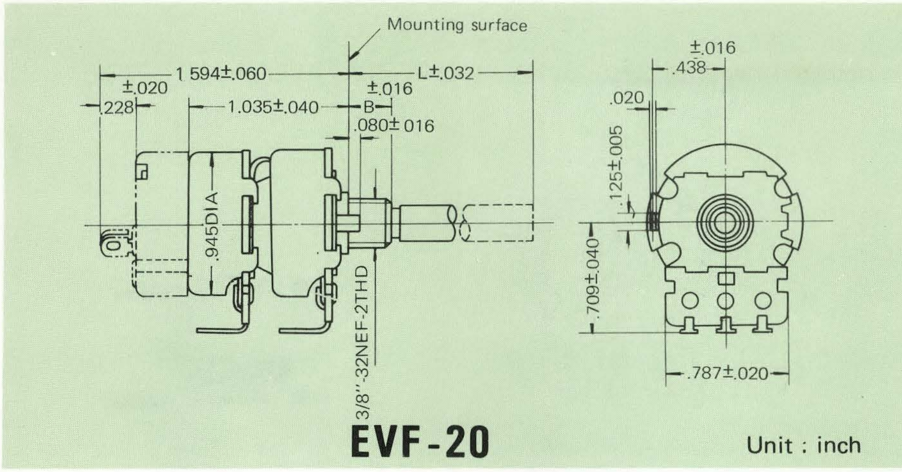
Sample Information

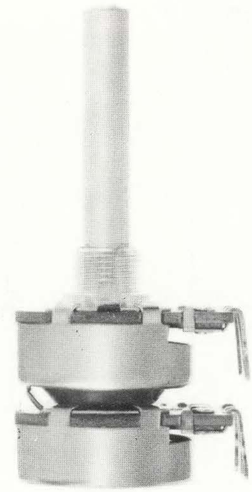
When requiring sample submission, please inform us of your own requirement in detail covering the following items:

(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) type of switch and maximum and normal operating voltage and current
(6) bushing diameter, length, screw pitch and material
(7) mounting means
(8) shaft trims, dimensions and material
(9) tap (position and resistance)
10) kind of assembly or circuit
11) other specific requirements
12) ordering number
13) delivery date
14) production schedule

For American Standard

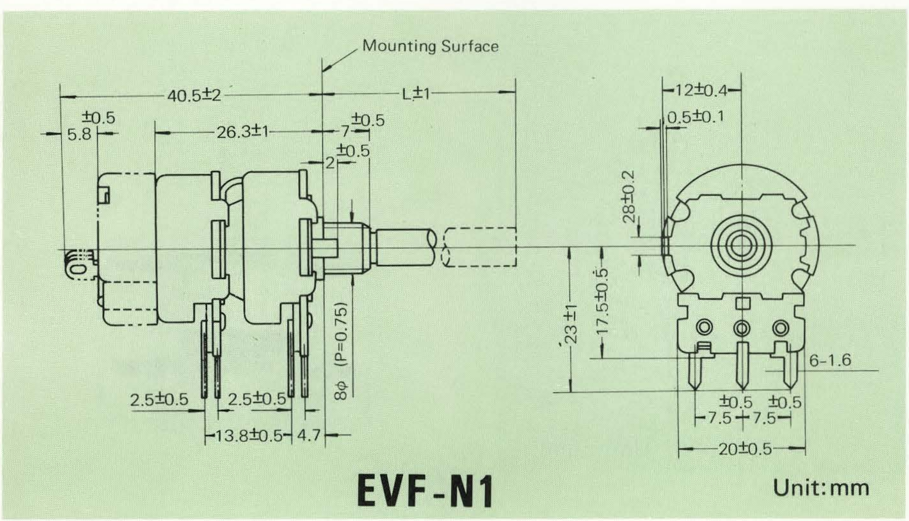
- Solder terminal construction

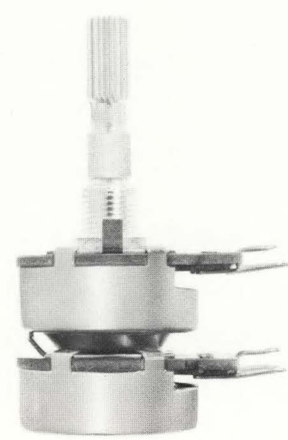


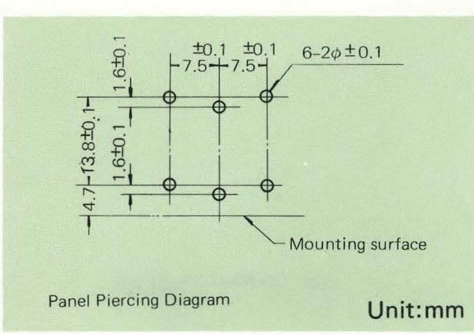


For Standard

- Terminal construction for P.C.B

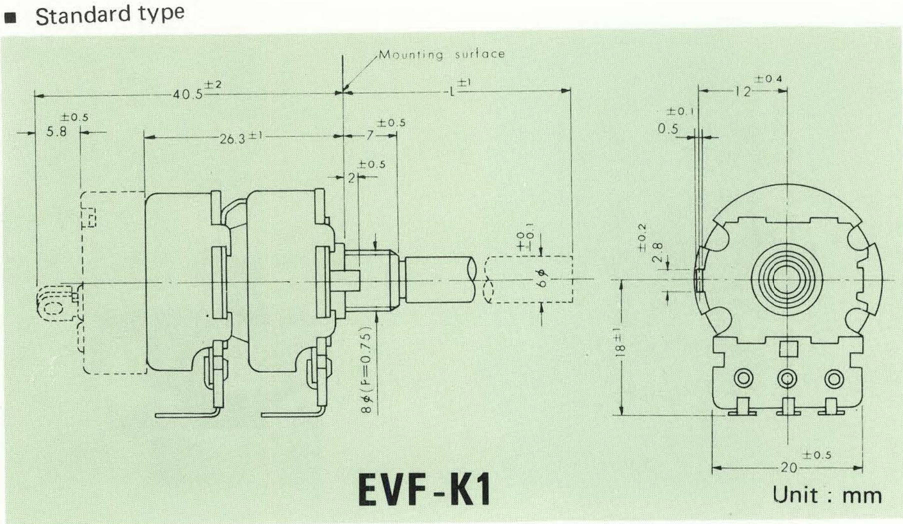


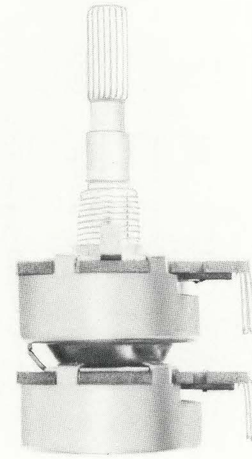




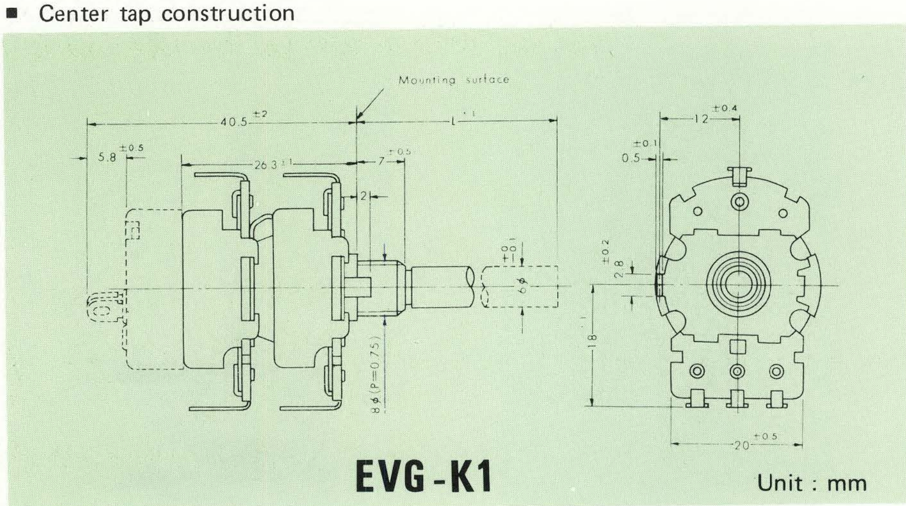
Panel Piercing Diagram

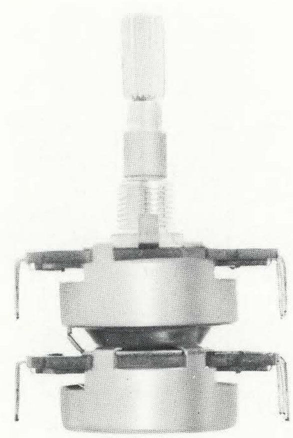
■ Standard type



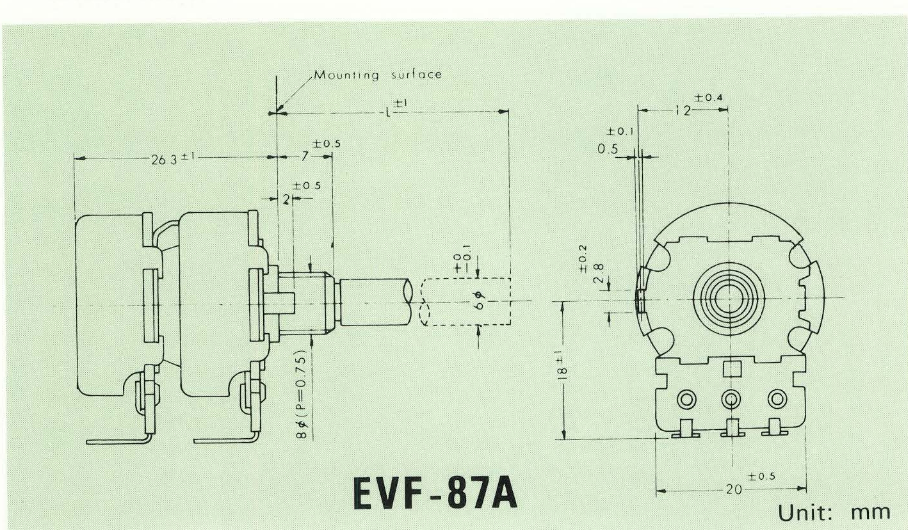


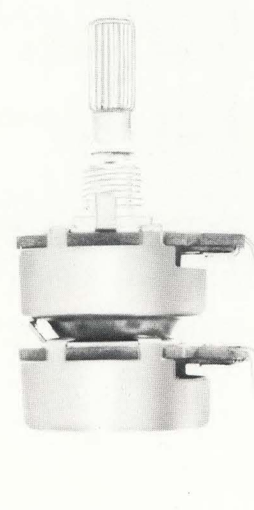
■ Center tap construction



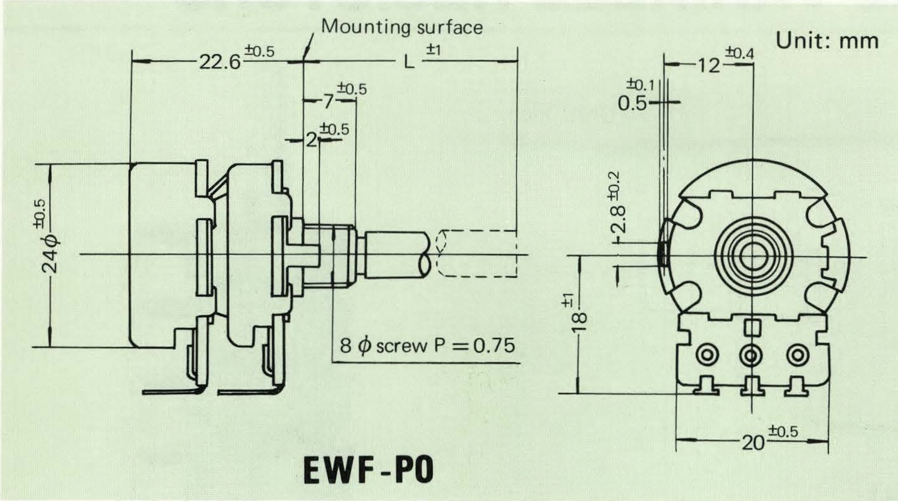


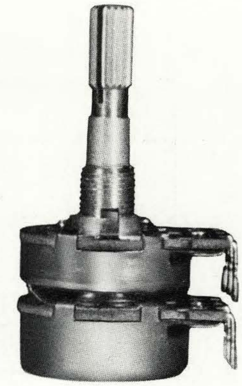
■ With 10 click stop
■ Without switch

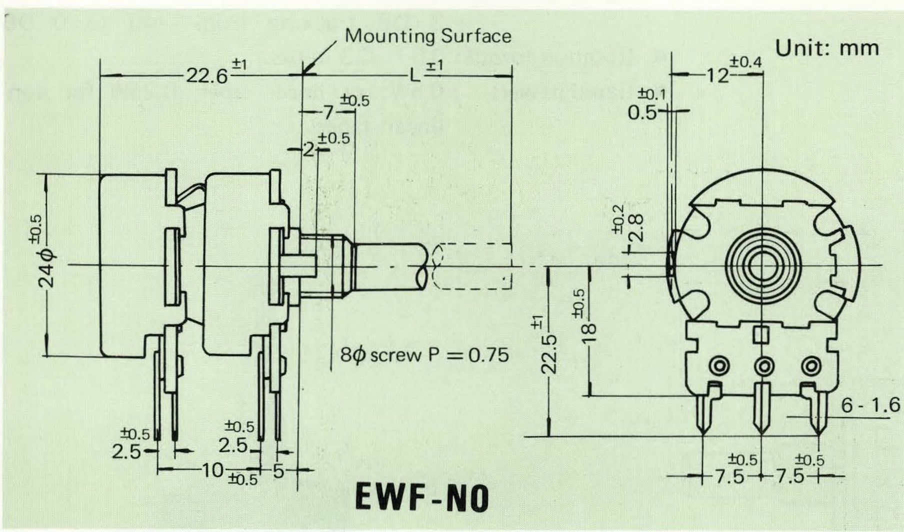


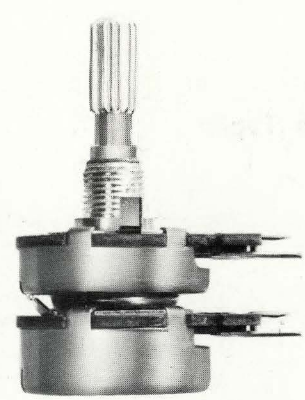


Thin Type

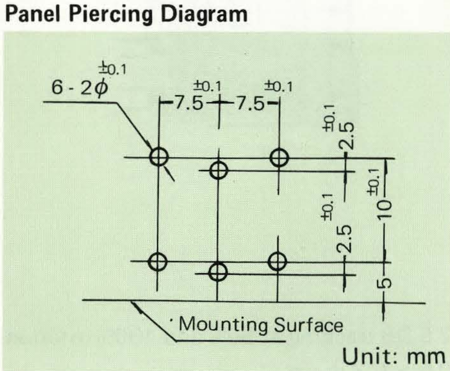




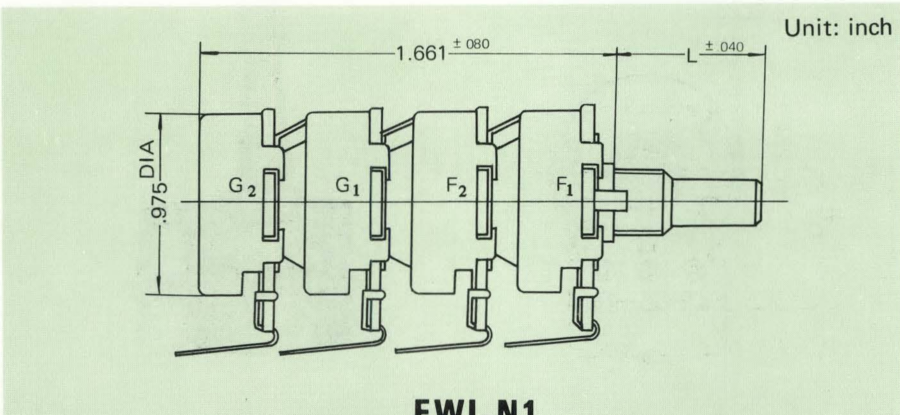




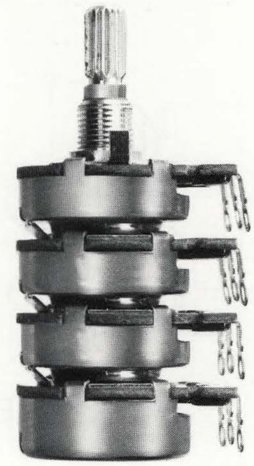
Panel Piercing Diagram



QUADRUPLE VARIABLE RESISTORS



EWI-N1



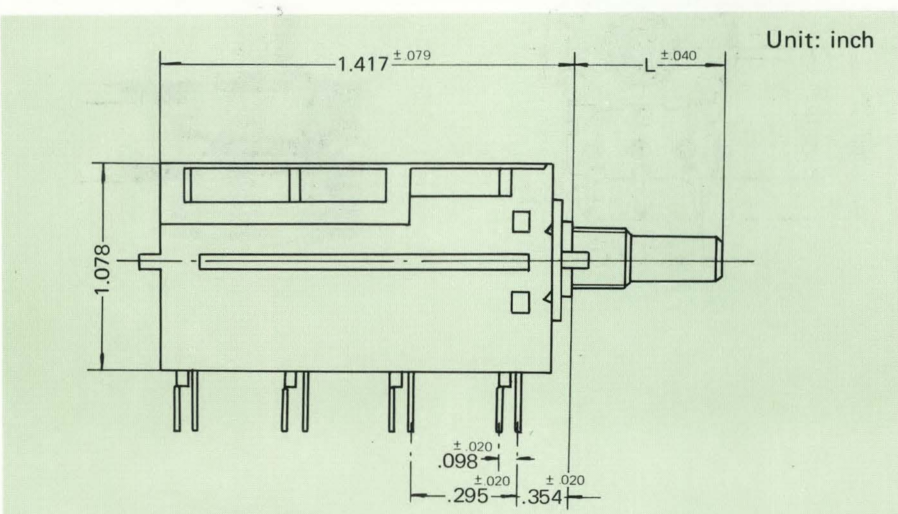
Features

This quadruple variable resistor has excellent characteristics and is applicable for 4ch. stereo-audio sets.

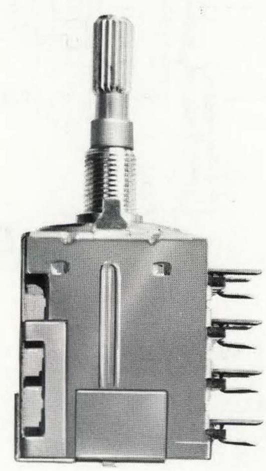
Specifications

- DB specification: 5 DB tracking from −60 to −40 DB
  3 DB tracking from −40 to 0 DB
- Rotation torque: 0.5 ~ 6.3 in-ozs.
- Rated power: 0.5W for linear taper, 0.25W for non-linear taper.

Simple Type



EWI-60



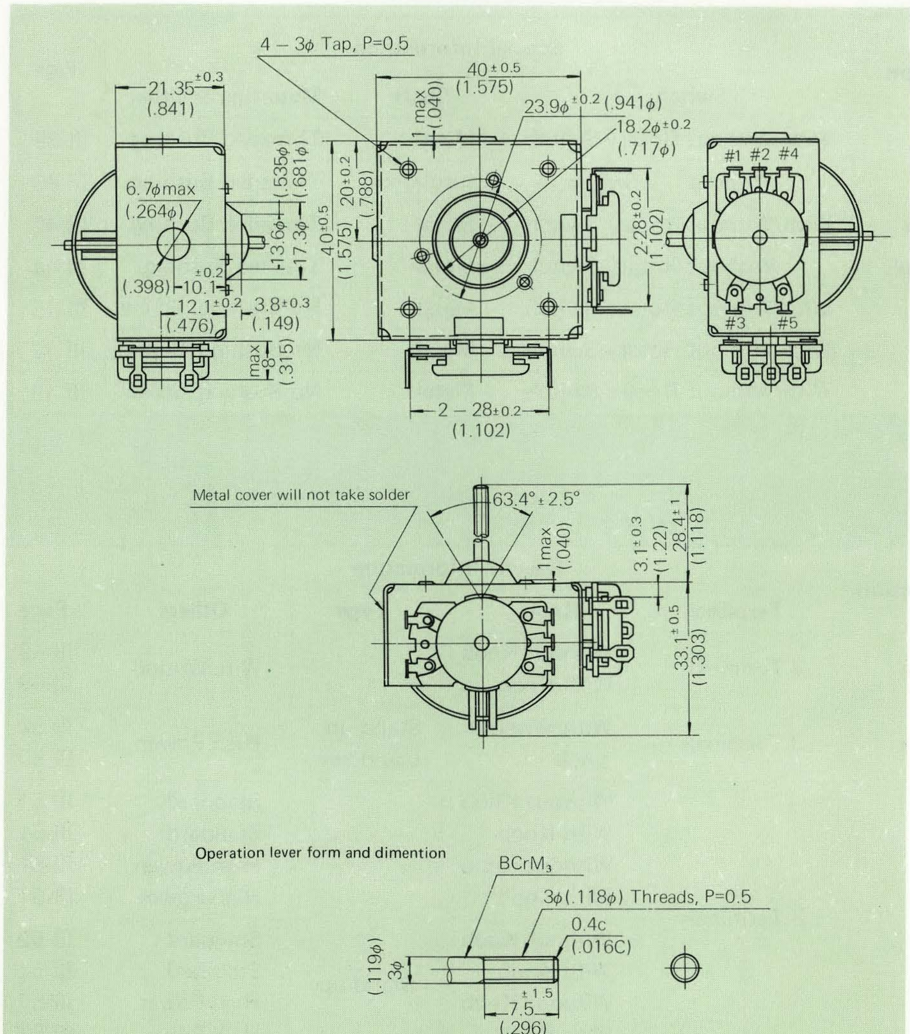
Features

This simple type quadruple variable resistor has excellent characteristics and is applicable for 4ch. stereo-audio sets.

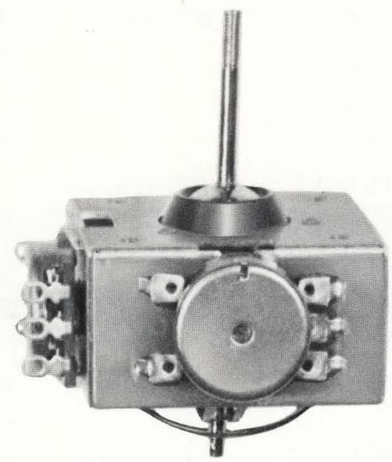
Specifications

- DB specification: 2.5 DB tracking at 50% and 100% rotation.
- Rotation torque: 0.5 ~ 6.3 in-ozs.
- Rated power: 0.5W for linear taper, 0.25W for non-linear taper.

MULTI SHAFT CONTROL
LEVER OPERATION VARIABLE RESISTORS



EVX-P2A



Features

This variable resistor has a lever to operate four single or tandem variable resistors at the same time and is quite ideal for the balancer of 4ch. stereo-audio set or dimmer equipment.

Specifications

- Taper: Linear & G
- Lever operation angle: 63.4° ±2.5°
- Lever operation stop: 9 in-lbs. (10kg.cm) min.
- Rated power: 0.03W for linear taper, 0.015W for non-linear taper

QUICK REFERENCE GUIDE

Miniature Standard Variable Resistors

Part No.	Dia.	Construction	Special Information			Page
			Switch	Shaft	Mounting & Other	
EVH-BO	5/8" (16mm)	Single	With/Without Rotary Switch	Metal	Threaded Bushing	III-38
EVH-GOA			Without Switch	Insulating	Threaded Bushing	III-40
EVK-CI		Tandem	With/Without Rotary Switch	Metal	Threaded Bushing	III-42
EVK-GIA		Quadruple	Without Rotary Switch	Metal	Treaded Bushing	III-44
EVJ-AO		Single	With/Without Rotary Switch	Metal	No Bushing, Screw	III-45
EVJ-DO			With/Without Rotary Switch	Metal	No Bushing, Screw	III-47
EVL-MO	15/32"(12mm)		With/Without Rotary Switch	Metal	No Bushing, Screw	III-48

Preset Variable Resistors

Part No.	Dia.	Construction	Special Information				Page
			Terminal	Knob	Type	Others	
EVW-R0A EVW-R1A	3/4"(19mm)	Single	3 Terminals	Without Knob With Knob		Wire Wound	III-49 III-49
EVT-J6A EVT-81A	35/64"(14mm)	Single	3 Terminals	With/Without Knob	Stand-up Lay-down	High Power	III-50 III-50
EVL-N0A EVL-Q0A EVT-N0A EVT-Q0A	25/64"(10mm)	Single	3 Terminals	Without Knob With Knob Without Knob With Knob	Stand-up	Standard Standard High Power High Power	III-51 III-51 III-51 III-51
EVL-S0A EVL-V0A EVT-S0A EVT-V0A				Without Knob With Knob Without Knob With Knob		Standard Standard High Power High Power	III-52 III-52 III-52 III-52
EVL-T0A EVL-W0A EVT-T3A EVT-W3A			2 Terminals	Without Knob Without Knob Without Knob With Knob		Standard Standard High Power High Power	III-52 III-52 III-52 III-52
EVL-N1A EVL-Q1A EVT-N1A EVT-Q1A			3 Terminals	Without Knob With Knob Without Knob With Knob	Lay-down	Standard Standard High Power High Power	III-53 III-53 III-53 III-53
EVL-S3A EVL-V3A EVT-S3A EVT-V3A				Without Knob With Knob Without Knob With Knob		Standard Standard High Power High Power	III-53 III-53 III-53 III-53
EVL-R6A			3 Terminals	Without Knob		Standard	III-54
EVN-K0A EVN-K4A	5/16"(8mm)	Single	3 Terminals	Without Knob Without Knob	Stand-up Lay-down	Standard	III-56 III-55
EVN-J0A			2 Terminals	Without Knob	Lay-down	Standard	III-56

This chart is intended to serve as a guide only.

GENERAL INFORMATION

Part Number Code

Part number code of MATSUSHITA standard variable resistors consists of 12 digits and alphabets as follows:

1	2	3	4	5	6	7	8	9	10	11	12
Common Code		Shape (Class I)	Shape (Class II)	Constr. Char.	Switch	Shaft Trims	Shaft Dimensions		Resistance and Taper		

	Shape	Part No.
5/8" DIA. (16 ϕ)	Single. Bushing. Metal. Standard	EVH-BO
5/8" DIA. (16 ϕ)	Single. Bushing. Insulating. Standard	EVH-GO
5/8" DIA. (16 ϕ)	Tandem. Bushing. Metal. Standard	EVK-HO
5/8" DIA. (16 ϕ)	No - Bushing Type	EVJ-AO
5/8" DIA. (16 ϕ)	No - Bushing Type	EVJ-DO
15/32" DIA. (12 ϕ)	No - Bushing Type	EVL-MO
3/4" DIA. (19 ϕ)	Wire-Wrap. Pre-set	EVW-RO
3/4" DIA. (19 ϕ)	Wire-Wrap. Pre-set. Knob	EVW-R1
35/64" DIA. (14 ϕ)	High Power. Pre-set. Stand-up Type	EVT-J6A
35/64" DIA. (14 ϕ)	High Power. Pre-set. Lay-down Type	EVT-81A
25/64" DIA. (10 ϕ)	3 terminals. Stand-up	EVL-NO
25/64" DIA. (10 ϕ)	3 terminals. Stand-up. Knob	EVL-QO
25/64" DIA. (10 ϕ)	3 terminals. High Power. Stand-up	EVT-NO
25/64" DIA. (10 ϕ)	3 terminals. High Power. Stand-up. Knob	EVT-QO
25/64" DIA. (10 ϕ)	3 terminals. Stand-up	EVL-SO
25/64" DIA. (10 ϕ)	3 terminals. Stand-up. Knob	EVL-VO
25/64" DIA. (10 ϕ)	3 terminals. High Power. Stand-up	EVT-SO
25/64" DIA. (10 ϕ)	3 terminals. High Power. Stand-up. Knob	EVT-VO
25/64" DIA. (10 ϕ)	2 terminals	EVL-T0
25/64" DIA. (10 ϕ)	2 terminals. Knob	EVL-W0
25/64" DIA. (10 ϕ)	High Power. 2 terminals	EVT-T3
25/64" DIA. (10 ϕ)	High Power. 2 terminals. Knob	EVT-W3
25/64" DIA. (10 ϕ)	3 terminals. Lay-down	EVL-N1
25/64" DIA. (10 ϕ)	3 terminals. Lay-down. Knob	EVL-Q1
25/64" DIA. (10 ϕ)	3 terminals. High-Power. Lay-down	EVT-N1
25/64" DIA. (10 ϕ)	3 terminals. High-Power, Lay-down. Knob	EVT-Q1
25/64" DIA. (10 ϕ)	3 terminals. Lay-down	EVL-S3
25/64" DIA. (10 ϕ)	3 terminals. Lay-down. Knob	EVL-V3
25/64" DIA. (10 ϕ)	3 terminals. High-Oower. Lay-down	EVT-S3
25/64" DIA. (10 ϕ)	3 terminals. High Power. Lay-down Nob	EVT-V3
5/16" DIA. (8 ϕ)	3 terminals. Lay-down	EVN-K4
5/16" DIA. (8ϕ)	3 terminals. Stand-up	EVN-KO
5/16" DIA. (8 ϕ)	2 terminals. Stand-up	EVN-JO

Switch

A	Without Switch
B	S.P.S.T.
T	S.P.S.T.
K	D.P.S.T.

Shaft Trims

F	Flatted
S	Slotted
K	6ϕ 18 teeth serration

Shaft Dimensions

(1) Single and tandem, Std. dimensions : Sig. fig. of 2 digits.

(2) Modified or Dual: Specified upon your information

No - Shaft Construction

7	8	9
A	0	0

Resistance and Taper

(1) Single: Tandem and Dual (Uniform resistance and taper)

10	11	12
Taper Designation	Sig. fig. of resistance	n: (Sig. fig. x 10^n) *
A B C D E		

Example

Res. Value	Designation
500 Ω	52
10KΩ	14
1M Ω	16

* Sig. fig. when sig. fig. consists of 2 digits.

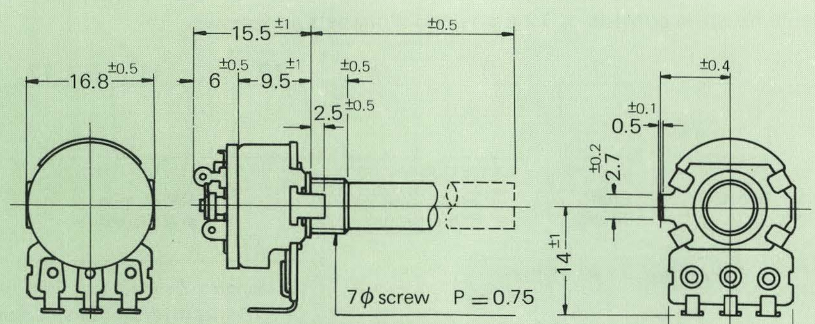
Example

Symbol	Sig. fig.	Symbol	Sig. fig.
A	1.2	F	2.5
C	1.5	J	7.5

(2) Tandem and Dual (Different resistance and taper) Specified upon your information

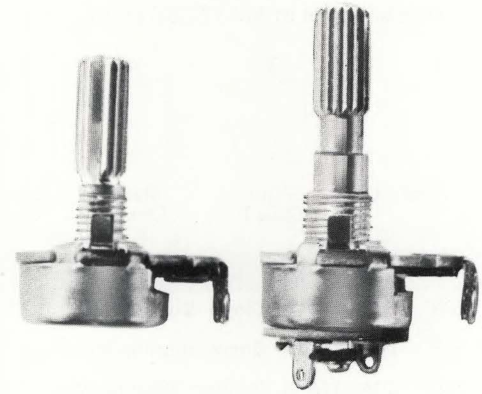
5/8" (16mm) DIA. SINGLE VARIABLE RESISTORS

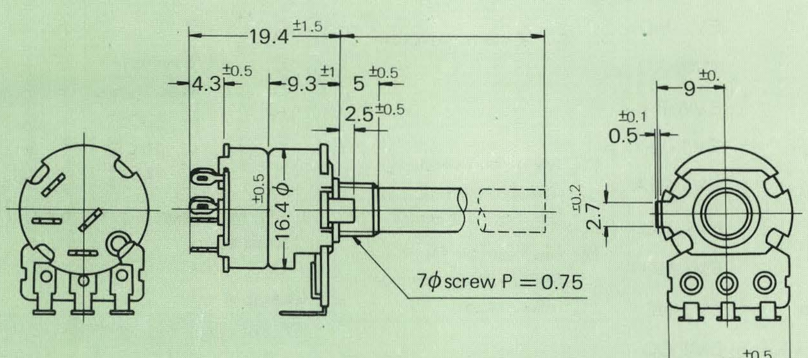
(Metal Shaft, With or Without Rotary Switch)



EVH-B0A (W/O Switch)
EVH-B0B

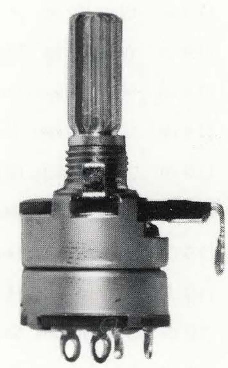
Unit: mm





EVH-B0K (T)

Unit: mm



Features

- Smooth rotation and no shaft play
- Any type of rotary switch available
- Variation as to the followings available upon request
  - (1) Resistance and taper
  - (2) Trims and dimensions of shaft and bushing
  - (3) Printed-circuit terminals
- Excellent characteristics with small dimensions

Electrical Specifications

- Resistance Range: Unit: Ω

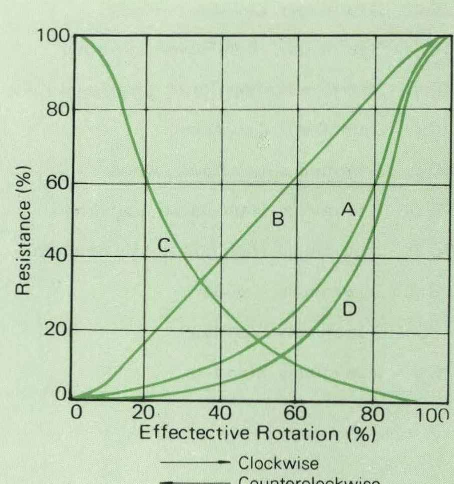
Taper	Resistance	
	Standard	Semi-Std.
B	1K, 5K, 10K, 50K, 100K, 500K, 1M	2K, 20K, 200K, 2M
A,C	5K, 10K, 50K, 100K, 500K, 1M	20K, 200K
D	5K, 10K	20K

- Standard Tolerance: ±20% for 2MΩ or less
  ±30% for more than 2MΩ
- Standard Taper: A, B, C and D in Table 2 and Fig. 1

Table 2
Unit: %

	Effective Rotation	
	at 50%	at 60%
B	40 ~ 60	–
A & C	–	15 ~ 30
D	2 ~ 15	–

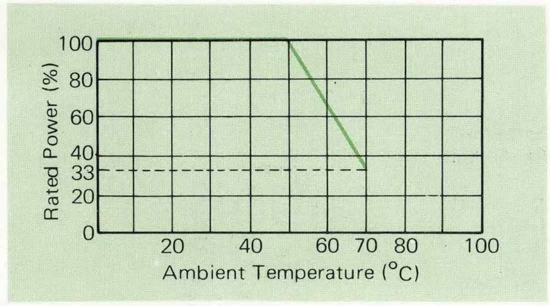
- Standard Curve: **Fig. 1**



■ Rated Power and Maximum Operating Voltage

Taper	Rated Power (W)	Max. Operating Voltage (V)
B	0.2	200
A, C & D	0.1	150

■ Power Derating Curve



Switch

Part No.	SW Desig.	Electrical Rating	Function	Schematic
EVH-BOB	B (SG)	12V 1A	S.P.S.T.	
EVH-BOT	T (ST)	12V 1A	S.P.S.T.	
EVH-BOK	K (DG)	12V 1A	D.P.S.T.	

■ Switch Operating Torque: less than 1kg-cm (at 5 ~ 35°C)

■ Switch Operating Angle: Within 50°

■ Withstand Voltage: 500V AC (1 minute)

■ Insulation Resistance: more than 50MΩ (500V DC)

Mechanical Specifications

■ Rotating Angle: 300° ± 5° with or without switch

■ Rotating Torque: 20 ~ 200g-cm (at 5 ~ 35°C)

■ Stopper Strength: more than 5kg-cm

■ Standard Shaft and Bushing: See the table in the right.

As to trims, refer to "General Information" for 24mm dia. on p.III-20.

Other dimensions are available upon request.

Shaft	Bushing	Std. Shaft (Dimension L) (mm)
K	7 ϕ 5mm	15, 20, 25
S	7 ϕ 5mm	10, 15

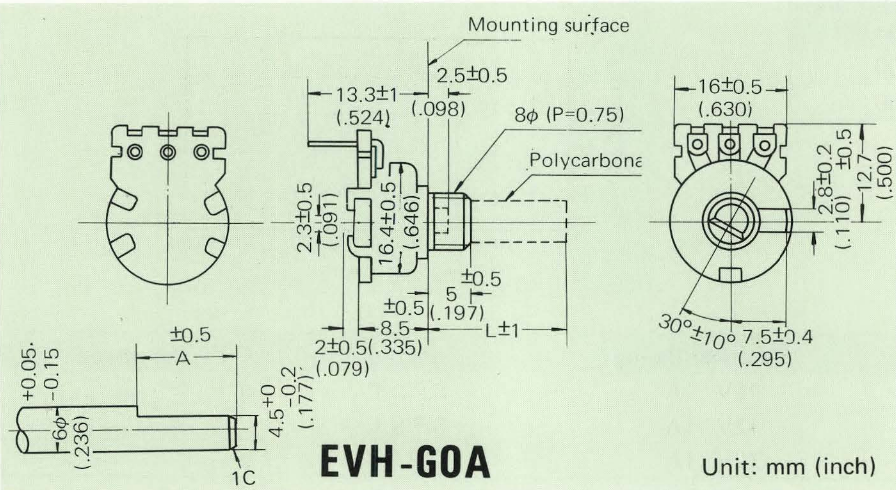
Sample Information

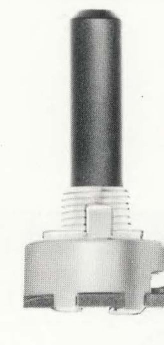
When requiring sample submission, please inform us of your own requirement in detail covering the following items:

(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) type of switch and maximum and normal operating voltage and current
(6) bushing diameter, length, screw pitch and material
(7) mounting means
(8) shaft trims, dimensions and material
(9) tap (position and resistance)
(10) kind of assembly or circuit
(11) other specific requirements
(12) ordering number
(13) delivery date
(14) production schedule

5/8" (16mm) DIA. SINGLE VARIABLE RESISTORS

(Insulated Shaft ;Without Switch)





The shaft in the figure is positioned at the counterclockwise limit.

Features

- Insulating shaft
- Flatted type (Type F) for easy knob fitting
- Excellent characteristics with small dimensions
- Resistance and taper specified for your requirement available
- Printed circuit terminal available

Electrical Specifications

- Standard Resistance Value:

Unit:Ω

Taper	Resistance	
	Standard	Semi-Std.
B	1K, 5K, 10K, 50K, 100K, 500K, 1M	2K, 20K, 200K, 2M
A,C	5K, 10K, 50K, 100K, 500K, 1M	20K, 200K
D	5K, 10K	20K

- Standard Tolerance: ± 20% for 2MΩ or less
  ± 30% for more than 2MΩ
- Standard Taper: A, B, C and D in Table 2 and Fig. 1

Table 2 Unit:%

	Effective Rotation	
	at 50%	at 60%
B	40 ~ 60	–
A & C	–	15 ~ 30
C	2 ~ 15	–

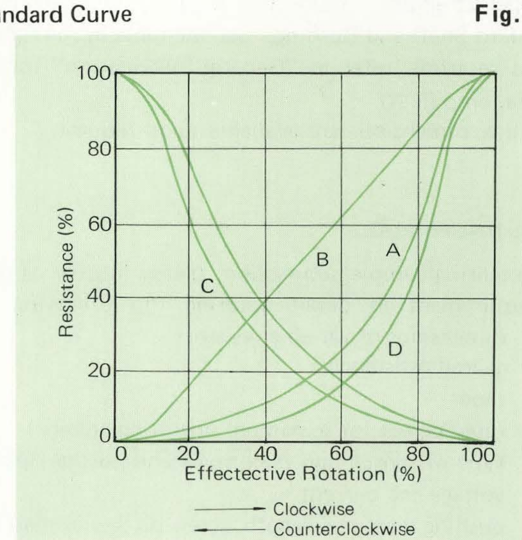
- Rated Power and Maximum Operating Voltage:

Taper	Rated Power (W)	Max. Operating Voltage (V)
B	0.2	200
A C & D	0.1	150

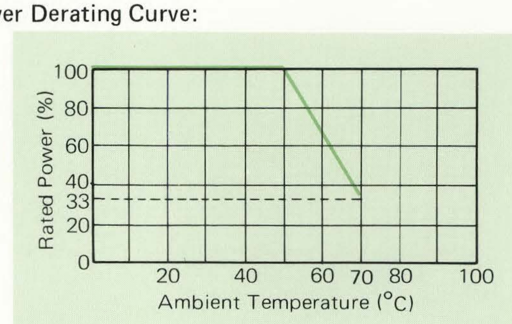
- Withstand Voltage: 500V AC (1 minute)
- Insulation Resistance: 50MΩ min. (500V DC)

- Standard Curve

Fig.1



- Power Derating Curve:



Mechanical Specifications

- Rotating Angle: 300° ±5°
- Rotating Torque: 20 ~ 200g-cm (at 5~ 35°C)
- Stopper Strength: 9kg-cm min.

- Standard Shaft and Bushing:

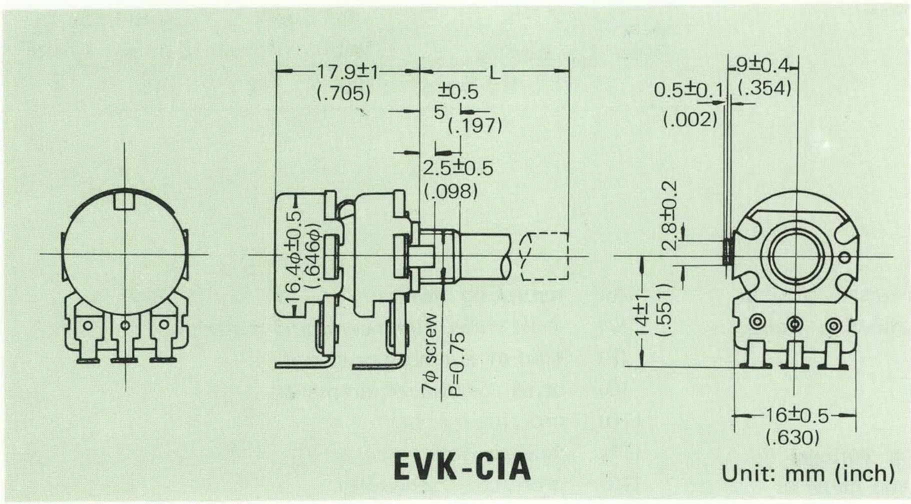
Shaft Trims	Bushing	Std. Shaft		Sub-Std.Shaft	
		L(mm)	A(mm)	L(mm)	A(mm)
F	8 ϕ,5mm	20	12	15	9

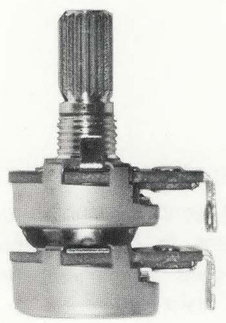
Sample Information

When requiring sample submission, please inform us of your own requirement in detail covering the following items:

(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) bushing diameter, length, screw pitch and material
(6) mounting means
(7) shaft trims, dimensions and material
(8) kind of assembly or circuit
(9) other specific requirements
(10) ordering number
(11) delivery date
(12) production schedule

5/8" (16mm) DIA. TANDEM VARIABLE RESISTORS





Features

- Miniature tandem type
- Smooth rotation and no shaft play
- Variation as to the followings available upon request
  - (1) Resistance and taper
  - (2) Trims and dimensions of shaft and bushing
  - (3) Printed-circuit terminals

Electrical Specifications

- Standard Resistance Value

Unit:Ω

Taper	Resistance	
	Standard	Semi-Std.
B	1K, 5K, 10K, 50K, 100K, 500K, 1M	2K, 20K, 200K, 2M
A,C	5K, 10K, 50K, 100K, 500K, 1M	20K, 200K
D	5K, 10K	20K

- Standard Tolerance: ±20% for 2MΩ or less
  ±30% for more than 2MΩ
- Standard Taper: A, B, C and D in Table 2 and Fig. 1

Table 2

Unit:%

Taper	Effective Rotation	
	at 50%	at 60%
B	40 ~ 60	–
A & C	–	15 ~ 30
D	2 ~ 15	–

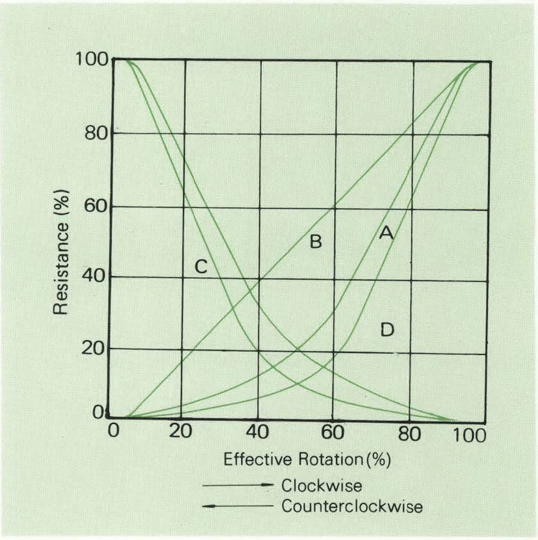
- Rated Power and Maximum Operating Voltage

Taper	Rated Power	Max. Operating Voltage (V)
B	0.1	200
A C & D	0.05	150

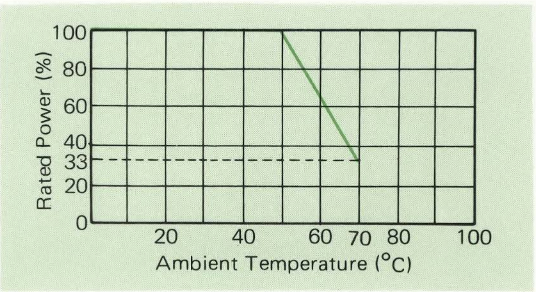
- Withstand Voltage: 500V AC (1 minute)
- Insulation Resistance: 50MΩmin. (500V DC)
- DB Specification: Adjustment will be made upon your own specifications.

- Standard Curve

Fig.1



- Power Derating Curve



Mechanical Specifications

- Rotating Angle: $300^\circ \pm 5^\circ$ with or without switch
- Rotating Torque: 20 ~ 200g-cm (at 5 ~ 35°C)
- Stopper Strength: more than 5kg-cm
- Standard Shaft and Bushing:
  See the table in the right.
  As to shape, refer to "General Information" for 24mm dia. on p.III–2.
  Other dimensions are available upon request.

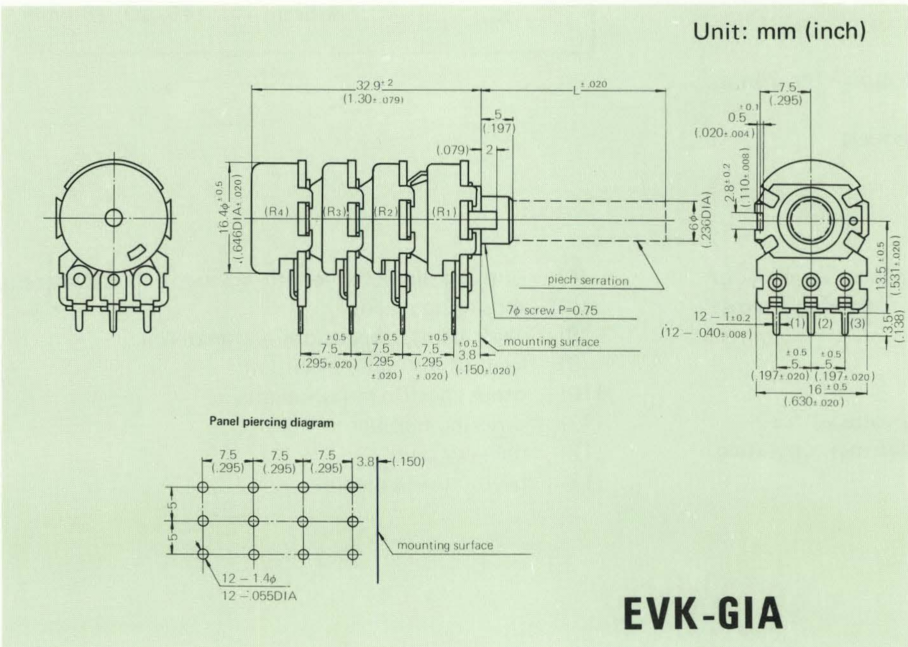
Shaft Trim \ Bushing		Std. Shaft
K	7 ϕ 5mm	15, 20, 25

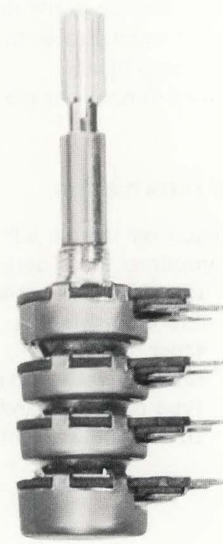
Sample Information

When requiring sample submission, please inform us of your own requirement in detail covering the following items:

(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) type of switch and maximum and normal operating voltage and current
(6) bushing diameter, length, screw pitch and material
(7) mounting means
(8) shaft trims, dimensions and material
(9) kind of assembly or circuit
(10) other specific requirements
(11) ordering number
(12) delivery date
(13) production schedule

5/8" (16mm) QUADRUPLE VARIABLE RESISTORS



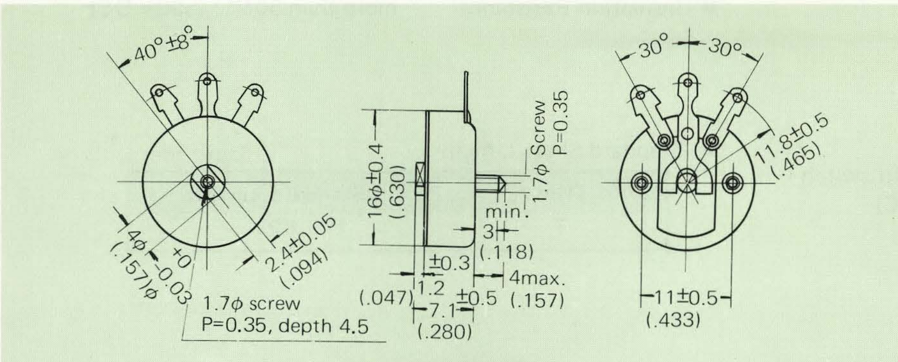


This small type quadruple variable resistor has excellent characteristics and applicable for 4 ch. stereo-audio sets.

- DB specification: 3DB tracking from −40 to 0dB
- Rotation troque: 0.5~6.3 in-ozs.
- Rated power: 0.2 W for linear taper, 0.1W for non-linear tape
- Terminal: P.C.B & Solder

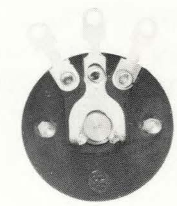
5/8" (16mm) DIA. SINGLE VARIABLE RESISTORS

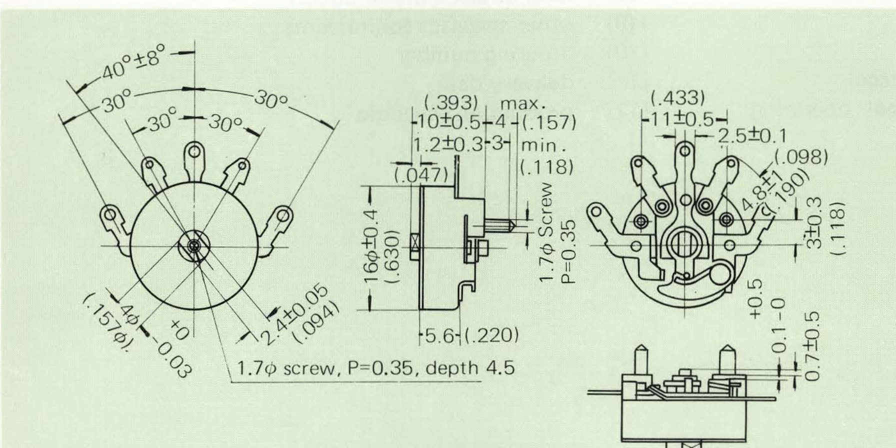
(No Bushing Type)



EVJ-A0A

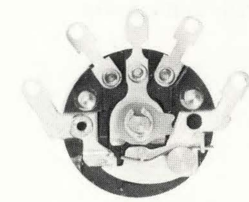
Unit: mm (inch)





EVJ-A0B

Unit: mm (inch)



Features

- No bushing construction
- Thin type for small mounting space
- With or without switch

Electrical Specifications

- Standard Resistance Value:

Unit:Ω

Taper	Resistance	
	Standard	Semi-Std.
B	1K,5K,10K,50K, 100K,500K,1M	2K, 20K, 200K
A,C,D	5K, 10K	20K

- Standard Tolerance : ± 20%

- Rated Power and Maximum Operating Voltage

Taper	Rated Power (W)	Max. Operating Voltage (V)
B	0.10	200
A C & D	0.05	150

- Standard Taper: A, B, C and D

Unit: %

Taper	Effective Rotation at 50%
A&C	5 ~ 25
B	40 ~ 60
D	2 ~ 15

Switch

- Switch Operating Torque: less than 500g-cm (at 5 ~ 35°C)
- Switch Operating Angle: Withing 50°
- Withstand Voltage: 500V AC (1 minute)
- Insulation Resistance: more than 50MΩ (500V DC)

Mechanical Specifications

- Rotating Angle: 255° ±10° with or without switch
- Rotating Torque: 20 ~ 200g-cm (at 5~35°C)
- Stopper Strength: 3kg-cm min.

- Standard Shaft Length

Unit: mm

Trim	Standard Length
T	1.2

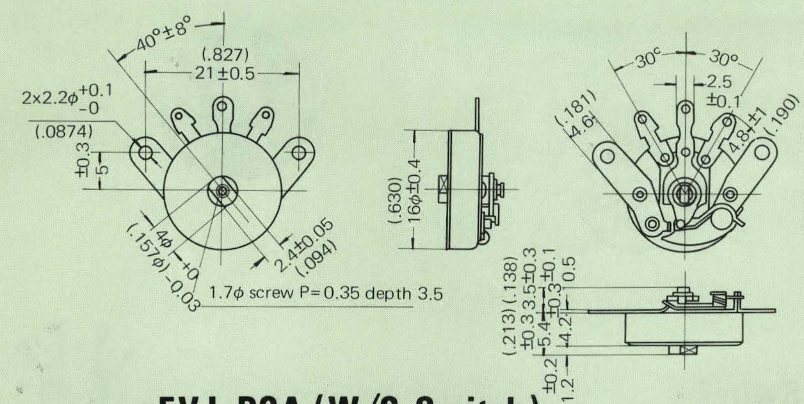
Sample Information

When requiring sample submission, please inform us of your own requirement in detail covering the following items:

(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) type of switch and maximum and normal operating voltage and current
(6) mounting means
(7) shaft trims, dimensions and material
(8) kind of assembly or circuit
(9) other specific requirements
(10) ordering number
(11) delivery date
(12) production schedule

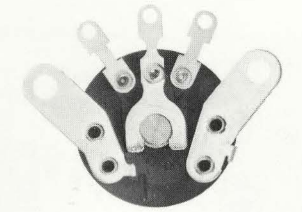
5/8" (16mm) DIA. SINGLE VARIABLE RESISTORS

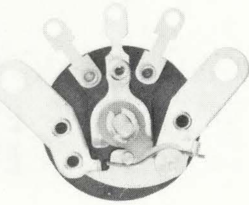
(No Bushing Type)



EVJ-D0A (W/O Switch)
EVJ-D0B (With Switch)

Unit: mm (inch)





Features

- No bushing construction
- Thin type for small mounting space
- With or without switch

Electrical Specifications

- Standard Resistance Value — Unit:Ω

Taper	Resistance	
	Standard	Semi-Std.
B	1K,5K,10K,50K, 100K,500K,1M	2K,20K, 200K
A,C,D	5K,10K	

- Rated Power and Maximum Operating Voltage

Taper	Rated Power	Max. Operating Voltage (V)
B	0.1	200
A C & B	0.05	150

- Standard Tolerance: ± 20%
- Standard Taper: A, B, C and D — Unit:%

Taper	Effective Rotation at 50%
A, & C	5 ~ 25
B	40 ~ 60
D	2 ~ 15

Switch

- Switch Operating Torque: less than 500g-cm (at 5 ~ 35°C)
- Switch Operating Angle: Within 40°
- Withstand Voltage: 500V AC (1 minute)
- Insulation Resistance: more than 50MΩ (500V DC)

Mechanical Specifications

- Rotating Angle: 255° ± 10° with or without switch
- Rotating Torque: 15 ~ 150g-cm (at 5 ~ 35°C)
- Stopper Strength: 3kg-cm min.
- Standard Shaft Dimension

Trim	Standard Length
T	1.2

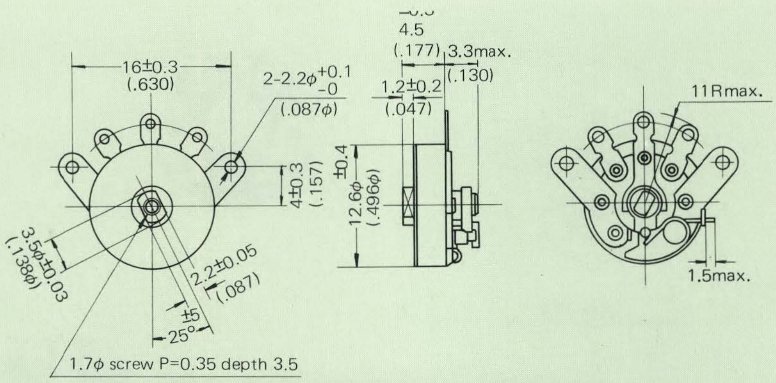
Sample Information

When requiring sample submission, please inform us ot your own requirement in detail covering the following items:

(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) type of switch and maximum and normal operating voltage and current
(6) mounting means
(7) shaft trims, dimensions and material
(8) kind of assembly or circuit
(9) other specific requirements
(10) ordering number
(11) delivery date
(12) production schedule

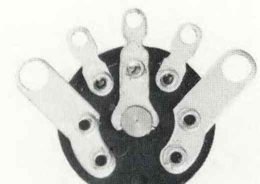
15/32″ (12mm) DIA. SINGLE VARIABLE RESISTORS

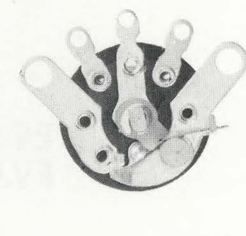
(No Bushing Type)



EVL-M0A (Without Switch)
EVL-M0B (With Switch)

Unit: mm (inch)





Features

- No bushing construction
- Thin type for small mounting space
- With or without switch

Electrical Specifications

- Standard Resistance Value:

Unit:Ω

Taper	Resistance	
	Standard	Semi-Std.
B	1K,5K,10K,50K, 100K,500K,1M	2K,20K, 200K,2M
A, C, D	5K, 10K	–

- Standard Tolerance: ± 20%
- Standard Taper: A, B, C and D

Unit:%

Taper	Effective Rotation at 50%
A & C	5 ~ 25
B	40 ~ 60
D	2 ~ 15

- Rated Power and Maximum Operating Voltage:

Taper	Rated Power(W)	Max. Operating Voltage (V)
B	0.1	200
A, C, D	0.05	150

Switch

- Switch Operating Torque: less than 500g-cm (at 5 ~ 35°C)
- Switch Operating Angle: Within 50°
- Withstand Voltage: 500V AC (1 minute)
- Insulation Resistance: more than 50MΩ (500V DC)

Mechanical Specifications

- Rotating Angle: 230° ± 10°, with or without switch
- Rotating Torque: 20 ~ 200g-cm (at 5 ~ 35°C)
- Stopper Strength: 3kg-cm min.
- Standard Shaft Dimension

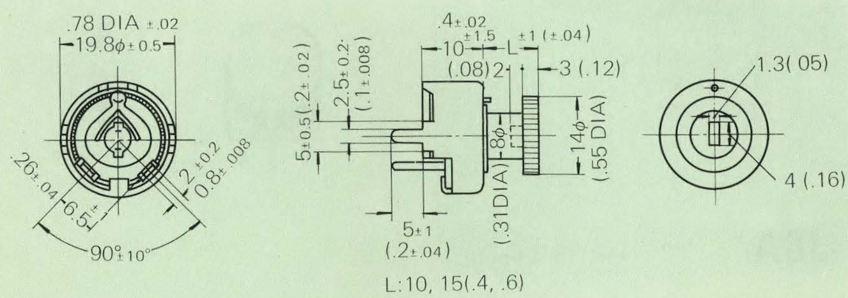
Trim	Standard Length
T	1.2

Sample Information

When requiring sample submission, please inform us of your own requirement in detail covering the following items:

(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) type of switch and maximum and normal operating voltage and current
(6) mounting means
(7) shaft trims, dimensions and material
(8) kind of assembly or circuit
(9) other specific requirements
(10) ordering number
(11) delivery date
(12) production schedule

3/4 " (19mm) DIA. WIRE WOUND PRESET VARIABLE RESISTORS



EVW-ROA(W/O Knob)
EVW-RIA(W/Knob)

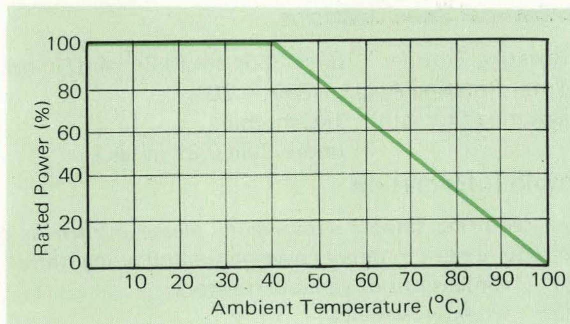
Unit: mm (inch)

Features

- Stable characteristics due to high-grade resistor wire
- Withstand high power of 1.5W
  (Types for 2W and 3W available upon request)
- Very small resistance change against high temperature and high humidity
- Coloring of knobs available upon request
- Small in size and light in weight

Electrical Specifications

- Resistance Range: 10Ω ~ 500Ω
- Standard Tolerance: ± 10%
- Rated Power: 1.5W (2W, 3W) derating in accordance with Power Derating Curve in the right
- Residual Resistance: 0.5Ω max.
- Power Derating Curve



Mechanical Specifications

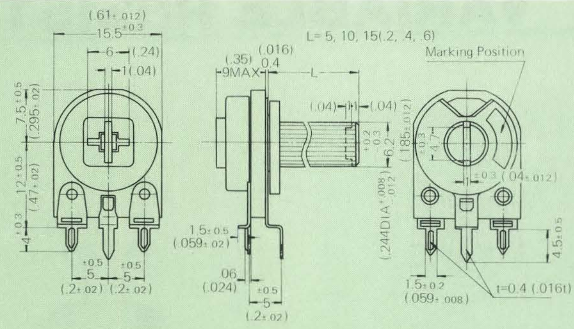
- Rotating Torque: 100 ~ 700g-cm
  (1.4 ~ 9.74 in-ozs.)
- Rotating Angle: 240° ± 10°
- Stopper Strength : 1kg-cm min.
  (0.87 in-lbs. min.)

Sample Information

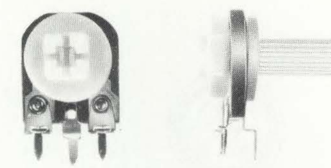
When requiring sample submission, please inform us of your own requirement in detail covering the following items:

(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) type, length and color of insulating shaft (knob)
(6) number of terminals
(7) kind of assembly or circuit
(8) other specific requirements
(9) ordering number
(10) delivery date
(11) production schedule

35/64"(14mm) DIA. PRESET VARIABLE RESISTORS



EVT-J6A Unit: mm (inch)



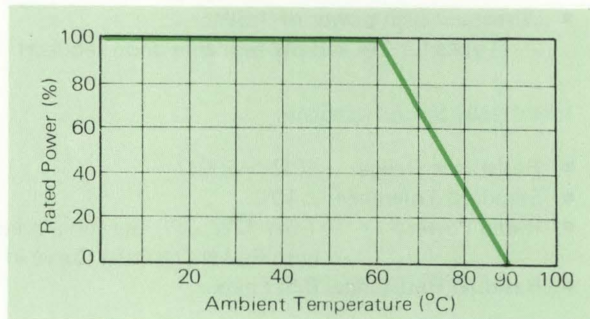
Features

- Withstand about 3 to 5 times the maximum power for general class due to heat-proof resin substrate
- Very small change even after a long-term storage under any circumstance
- Dust-proof construction free from dust and flux
- Coloring of knobs available upon request
- Small in size and light in weight

Electrical Specifications

- Resistance Range: 200Ω ~ 2MΩ
- Standard Tolerance: ± 30%
- Standard Curve: only B (linear)
- Rated Power: 0.5W derating in accordance with "Power Derating Curve" in the right
- Max. Operating Voltage: 350V
- Residual Resistance: 5% of overall resistance or 10kΩ max. whichever is smaller.

- Power Derating Curve



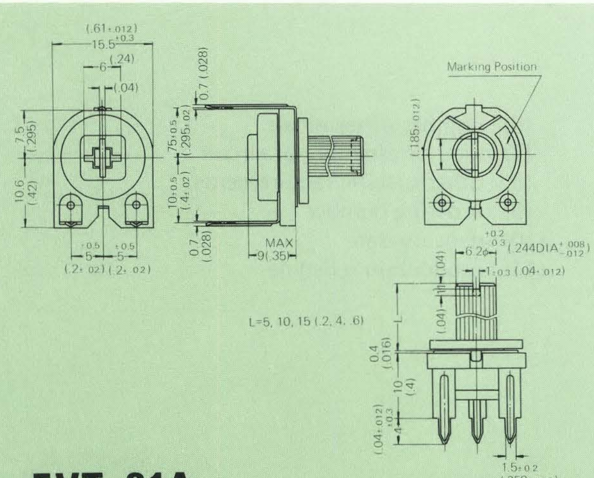
Mechanical Specifications

- Rotating Torque: 60 ~ 350g-cm (0.84~4.87 in-ozs.)
- Total Rotating Angle: 260° ± 20°
- Rotating Strength: 1kg-cm min. (more than 0.87 in-lbs.)

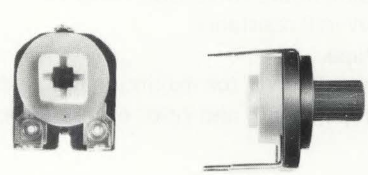
Sample Information

When requiring sample submission, please inform us of your own requirement in detail covering the following items:

(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) type, length and color of insulating shaft (knob)
(6) number of terminals
(7) stand-up type and lay-down type
(8) kind of assembly or circuit
(9) other specific requirements
(10) ordering number
(11) delivery date
(12) production schedule

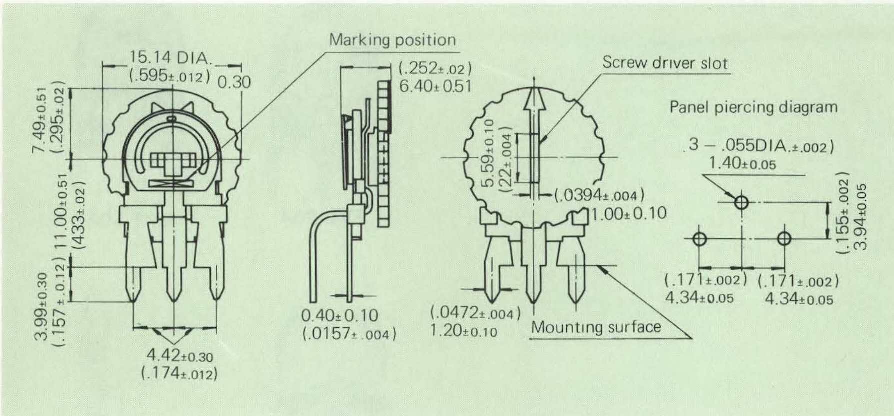


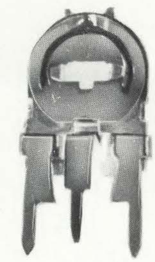
EVT-81A Unit: mm (inch)

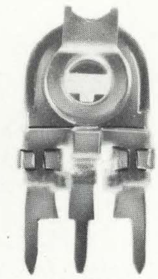


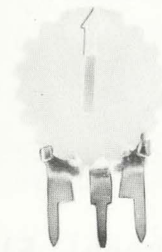
25/64"(10mm)DIA. PRESET VARIABLE RESISTORS

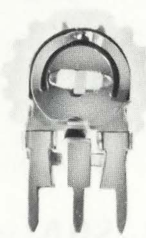
Unit: mm (inch)




EVL-N0A


EVT-N0A


EVL-Q0A


EVT-Q0A

EVL-N0A(w/o knob), EVT-N0A(w/o knob)
EVL-Q0A(w/knob), EVT-Q0A(w/knob)

Features

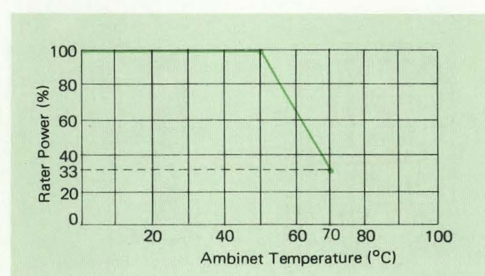
- Ideal for miniaturization of assembly such as color television
- Small in size and light in weight
- Coloring of knobs available upon request

Electrical Specifications

- Resistance Range: 200 Ω ~ 2M Ω
- Standard Tolerance: ± 30%
- Standard Curve: only B (linear)
- Rated Power: 0.2W or 0.25W derating in accordance with "Power Derating Curve" in the right
- Residual Resistance: 5% of overall resistance or 10kΩ max. whichever is smaller.
- Rated Voltage and Max. Operating Voltage:

	Rated Wattage (W)	Max. Operating Voltage (V)
EVL –	0.2	200
EVT - (For High Power)	0.25	350

- **Power Derating Curve**



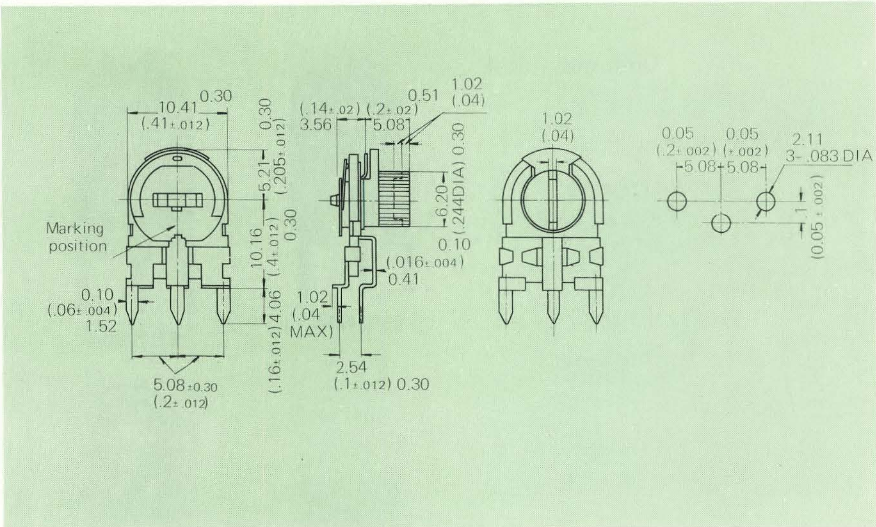
Mechanical Speifications

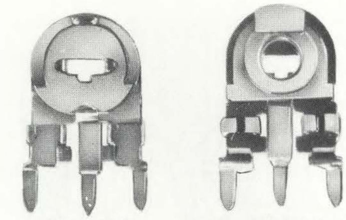
- Rotating Torque: 50 ~ 350g - cm (0.7 ~ 4.87 in-ozs)
- Total Rotating Angle: 260°±20°
- Rotating Strength: 1 kg-cm min. (0.87 in-lbs. min.)

Sample Information

When requiring sample submission, please inform us of your own requirement in detail covering the following items:

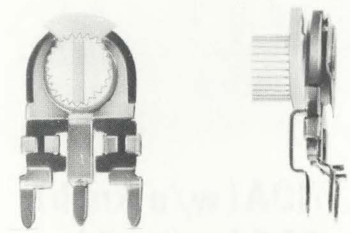
(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) type, length and color of insulating shaft (knob)
(6) number of terminals
(7) stand-up type or lay-down type
(8) kind of assembly or circuit
(9) other specific requirements
(10) ordering number
(11) delivery date
(12) production schedule





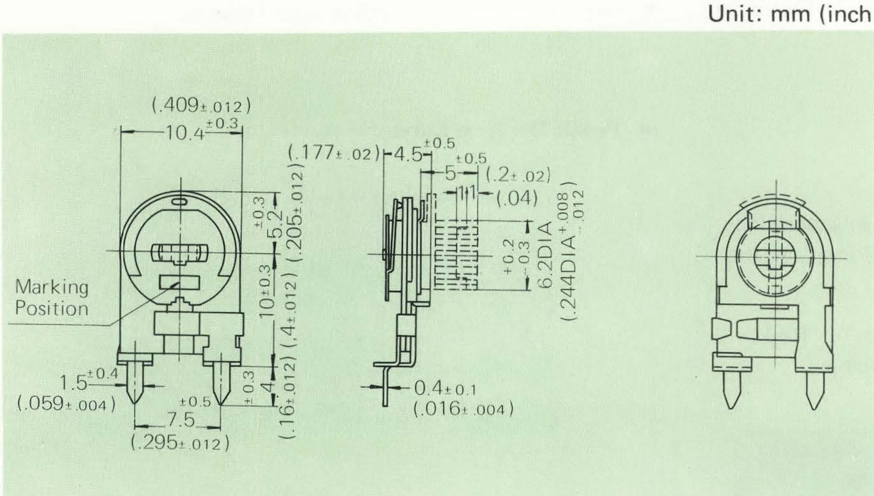
EVL-S0A EVT-S0A

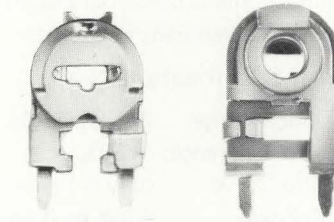
EVL-S0A(w/o knob), EVT-S0A(w/o knob)
EVL-V0A(w/knob), EVT-V0A(w/knob)



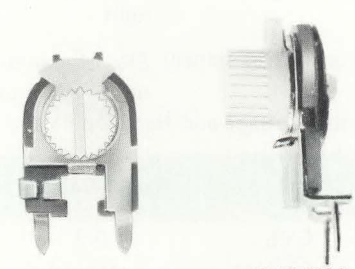
EVL-V0A EVT-V0A

Unit: mm (inch)





EVL-T0A EVT-T3A

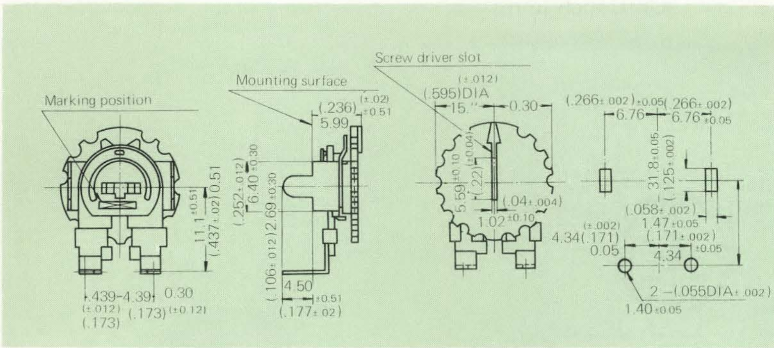


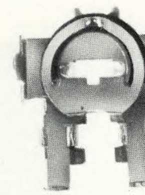
EVL-W0A EVT-W3A

EVL-T0A(w/o knob), EVT-T3A (w/o knob)
EVL-W0A(w/knob), EVT-W3A (w/knob)

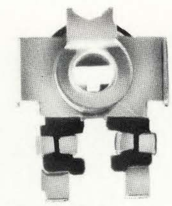
25/64"(10mm) DIA. PRESET VARIABLE RESISTORS

Unit: inch (mm)

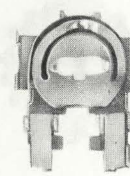




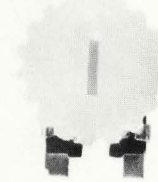
EVL-N1A



EVT-N1A



EVL-Q1A



EVT-Q1A

EVL-N1A(w/o knob), EVT-N1A(w/o knob)
EVL-Q1A(w/knob), EVT-Q1A(w/knob)

Features

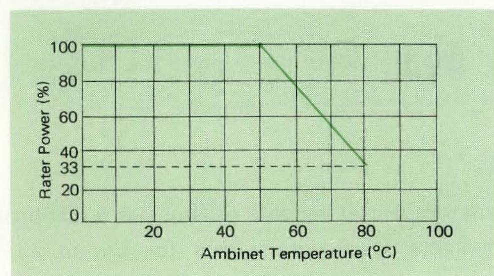
- Small in size and withstand high power

Electrical Specifications

- Resistance Range: 200Ω ~ 2MΩ
- Standard Tolerance: ± 30%
- Standard Curve: only B (linear)
  Rated Power: 0.2W or 0.25W derating in accordance with "Power Derating Curve" in the right
- Residual Resistance: 5% of overall resistance or 10kΩ max. whichever is smaller.
- Rated Voltage and Max. Operating Voltage:

Part No.	Rated Wattage (W)	Max. Operating Voltage (V)
EVL –	0.2	200
EVT - (For High Power)	0.25	350

- Residual Resistance: 5% of overall resistance or 10kΩ max. whichever is smaller.
- Power Derating Curve



Mechanical Speifications

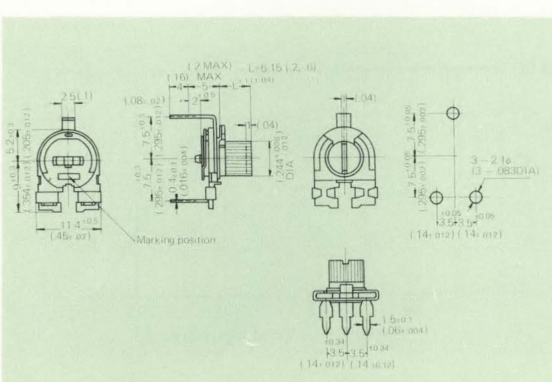
- Rotating Torque: 50 ~ 350g-cm (0.7 ~ 4.87 in-ozs)
- Total Rotating Angle: 260° ± 20°
- Rotating Strength: Min. 1kg-cm (more than 0.87 in-lbs.)

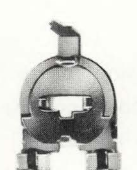
Sample Information

When requiring sample submission, please inform us of your own requirement in detail covering the following items:

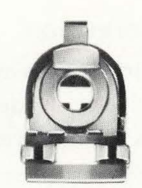
(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) type, length and color of insulating shaft (knob)
(6) number of terminals
(7) stand up type or lay down type
(8) kind of assembly or circuit
(9) other specific requirements
(10) ordering number
(11) delivery date
(12) production schedule

Unit: mm (inch)

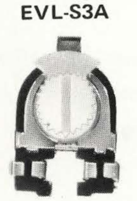




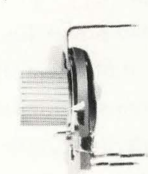
EVL-S3A



EVT-S3A



EVL-V3A

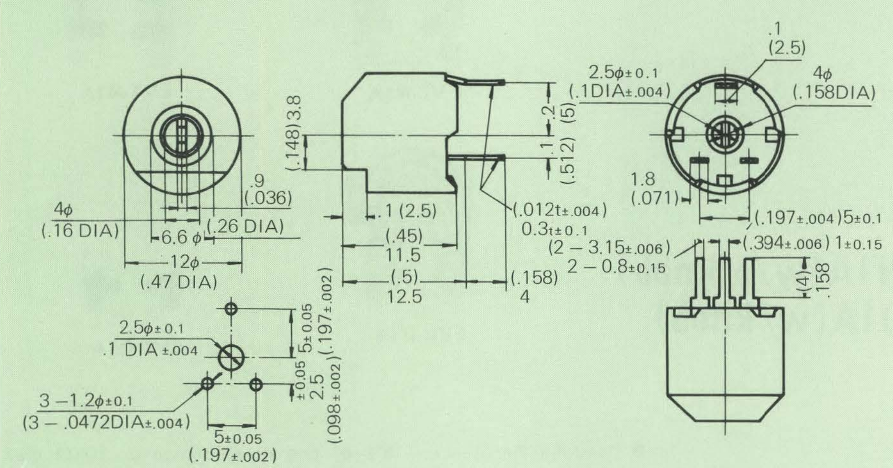


EVT-V3A

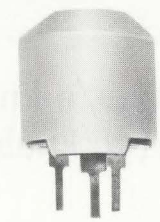
EVL-S3A(w/o knob), EVT-S3A(w/o knob)
EVL-V3A(w/knob), EVT-V3A(w/knob)

25/64" (10mm) DIA. DIRT-PROOF PRESET VARIABLE RESISTORS

Unit: inch (mm)



EVL-R6A



Features

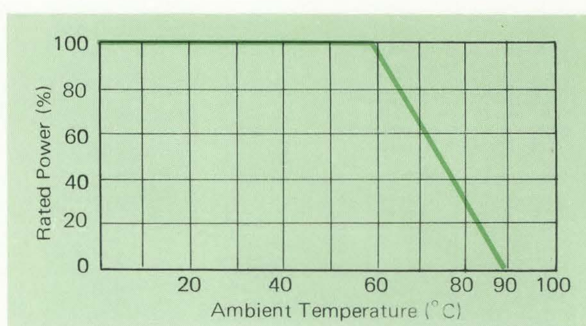
This miniature preset variable resistor has a dirt-proof cap to stable characteristics and is ideal for use in all kinds of electric equipments.

Electrical Specifications

- Resistance Range: 300Ω ~ 100kΩ
- Standard Tolerance: ± 30%
- Standard Curve: only B (linear)
- Rated Power: 0.15W derating in accordance with Power Derating Curve Shown below.
- Residual Resistance: 5% of overall resistance or 10kΩ Max. which is smaller.
- Rated Voltage and Max. Operating Voltage: 125V

Mechanical Specifications

- Rotating Torque: 30 ~ 350g · cm (0.42 ~ 4.87 in-ozs)
- Total Rotating Angle: 230° ± 20°
- Power Derating Curve:



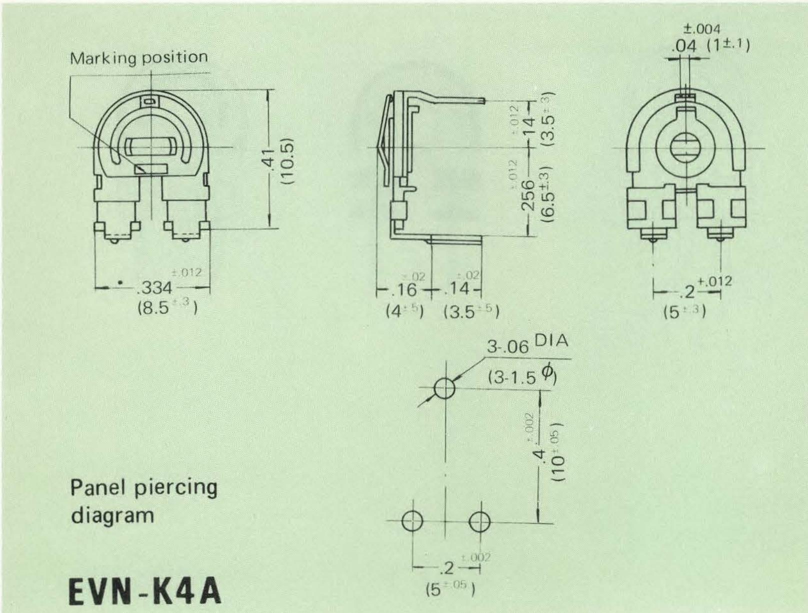
Sample Information

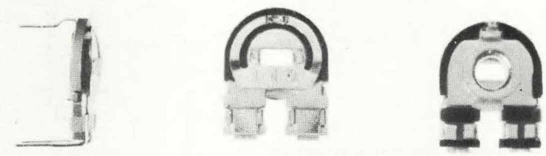
When requiring sample submission please inform us of your own requirement in detail covering the following items;

(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) kind of assembly or circuit
(6) other specific requirements
(7) ordering number
(8) delivery date
(9) production schedule

5/16"(8mm) DIA. PRESET VARIABLE RESISTORS

Unit: mm (inch)





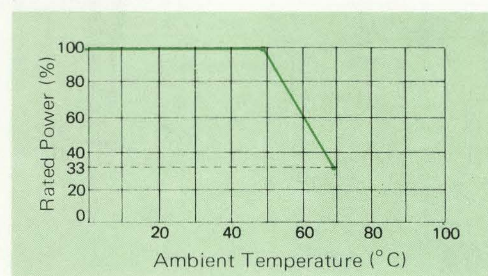
Feature

- Small in size and very little mounting space

Electrical Specifications

- Resistance Range: 300Ω ~ 2MΩ
- Standard Tolerance: ± 30%
- Standard Curve: only B (linear)
- Rated Power: 0.1W derating in accordance with "Power Derating Curve" in the right
- Max. Operating Voltage: 100V
- Residual Resistance: 5% of overall resistance or 10kΩ max. whichever is smaller.

- Power Derating Curve :



Mechanical Specifications

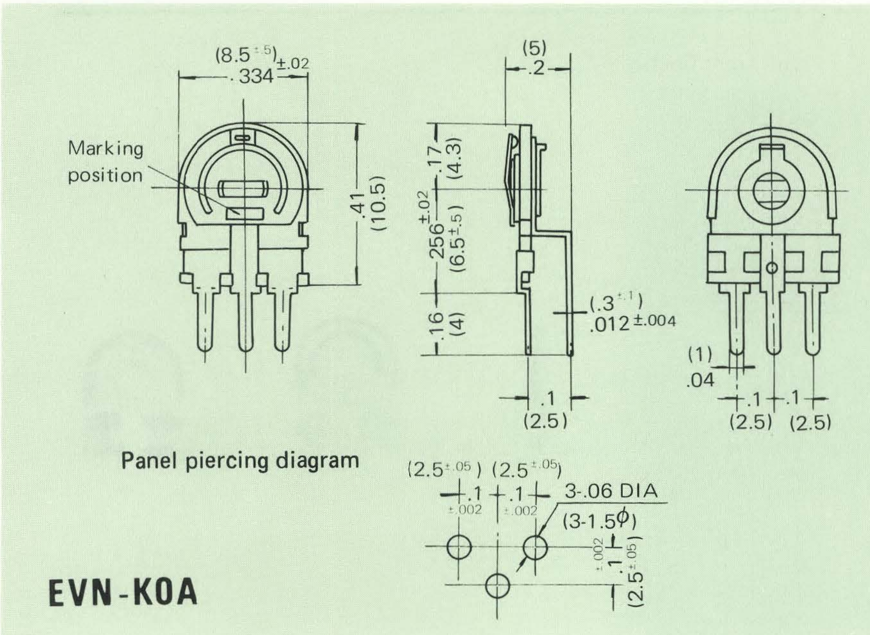
- Rotating Torque: 30 ~ 300g-cm (0.42 ~ 4.2 in-oz)
- Rotating Angle: 260° ± 20°
- Rotating Strength: Min. 1kg-cm (0.87 in-oz. min.)

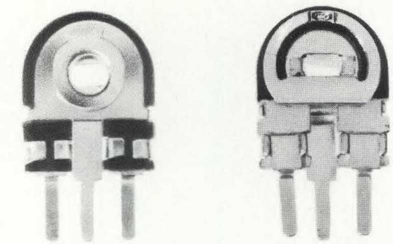
Sample Information

When requiring sample submission, please inform us of your own requirement in detail covering the following items:

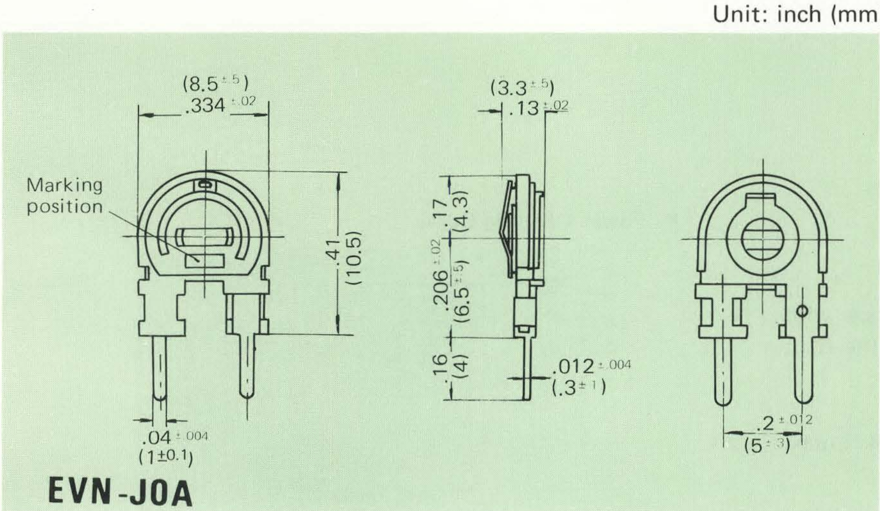
(1) dimensions of variable resistors
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) type, length and color of insulating shaft (knob)
(6) number of terminals
(7) stand up type or lay down type
(8) kind of assembly or circuit
(9) other specific requirements
(10) ordering number
(11) delivery date
(12) production schedule

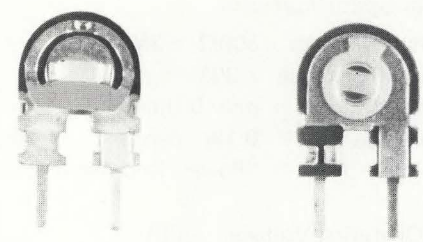
Unit: inch (mm)





Unit: inch (mm)





QUICK REFERENCE GUIDE

Carbon Composition Variable Resistors

Part No.	Dia.	Construction	Special Information			Page
			Switch	Shaft	Others	
EVS-N6A	1/2"(12mm)	Single	Without Switch	Insulating	Prefixed, Stand-up Type	III-69
EVS-N7A					Prefixed, Lay-down Type	III-70
EVS-P1A	5/16"(8mm)	Single	Without Switch	Insulating	Prefixed, Stand-up Type	III-71
EVS-P4A					Prefixed, Lay-down Type	III-72

This chart is intended to serve as a guide only.

GENERAL INFORMATION

Part Number Code

(This code shows carbon composition variable resistors)

1	2	3		4	5	6	7	8	9	10	11	12
E	V	S	—	□	□	□	□	□	□	□	□	□

Common Code (1–3) · Shape & Dimensions (4) · Structure & Performance (5) · Switch (6) · Shaft Trims (7) · Shaft Dimensions (8–9) · Taper Char. Designation (10) · Overall Resistance (11–12)

Common Code / Shape & Dimensions

Symbol	MIL	STD
A	RV4	–
B	–	–
C	GRV4	–
D	–	–
E	3GRV4	–
F	–	–
G	RV6	–
H	RV2	–
J	–	–
K	–	–
L	–	–
M	–	–
N	–	RV12V
P	–	RV8VP
Q	–	–
R	–	–
S	–	RV24
T	–	RV28VD
U	–	–
V	–	–
W	–	RV28V3G
X	–	RV28VG
Y	–	RV28V

Structure & Performance

Symbol		MIL	STD
0	Standard Type Bushing	NT	Type 8 Printed Circuit
1	Standard Type Bushing	NX	–
2	Standard Type Bushing	NY	VN
3	Lock Type Bushing	NT	–
4	Lock Type Bushing	NX	–
5	Lock Type Bushing	NY	VL
6	Water-Proof Type Bushing	NT	Type 12 Printed Circuit
7	Water-Proof Type Bushing	NX	Type 12 Printed Circuit
8	Water-Proof Type Bushing	NY	VS
9	Otherwise Specified		Special Specification

MIL-Approved Type is only class Y

Switch

Symbol	Function	Rating
D	SPST JIS SF	125V-3A
E	SPST JIS SH	High Performance 125V-3A
G	SPDT JIS ME	125V-1A
L	DPST JIS DE	125V-1A
M	DPST JIS DF	125V-3A
Q	DPDT JIS Q	125V-0.5A

Without Switch: A

Shaft Trims

Symbol	STD MIL
S	S
F ③	F
R ③	R

1 Type S is most recommended
2 Others are available upon your specifications
3 MIL-Approved type is Type S only. (MIL-R-94C)

Shaft Dimensions

(1) MIL Specification

Symbol	MIL-Symbol Dimensions (mm)
OA	A(15.9)
②OB	B(12.7)
OD	D(22.2)
DG	G(31.8)
OK	K(63.5)
③OL	L(9.5)

1 Shaft Diameter $6.35\phi\ ^{+0.02}_{-0.05}$
2 Lock Bushing Type excludes Symbol OB
3 Symbol OL use for only RV6 std. type

(2)
For STD Type, the actual dimensions are noted.

Standard value of actual dimension
13, 15, 20, 25 40

1 Shaft dia.: $6\phi\ ^{+0}_{-0.1}$
2 Fractions should be ignored.
3 Other shafts are available upon your specifications

(3)

No-shaft Constraction		
7	8	9
A	O	O

Taper Char. Designation

Symbol	R Value Tolerance	MIL Symbol
A	±10%	C
D	±20%	D
B	±10%	A
E	±20%	B
C	±10%	E
F	±20%	F

Overall Resistance

(1) Single Type

11th figure: Sig. fig.
12th figure:
The number of zeroes following the sig. fig.
(Unit: Ω)
Ex.
100kΩ – 15

(2) Uniform overall resistance and taper: same as (1)
Ex.
100kΩ x 2 – 15

(3) Different resistance:
Expressed by 3 digits (10th ~ 12th)
(For special resistance value, otherwise specified)

Part Numbers & Ratings

MIL VS. MATSUSHITA
(MIL-approved Products)

Classification		Shape	Switch	MIL Std. Part No.	MATSUSHITA Part No.	* Taper	Res. Range	Rated Power		Note
Size	Construction						min.(Ω)~Max.(Ω)	Power (W)	Max. Volt.(V)	
Type RV4	Single	standard	W/O	RV4NAY	EVS-A2A	A	50~5M	2	500	carbon
			With	RV4NBY	EVS-A2D	C or F	100~5M	1	350	brush
		watertight shaft	W/O	RV4SAY	EVS-A8A	A	50~5M	2	500	carbon
			With	RV4SBY	EVS-A8D	C or F	100~5M	1	350	brush
		shaft lock	W/O	RV4LAY	EVS-A5A	A	50~5M	2	500	carbon
						C or F	100~5M	1	350	brush
	Tandem (Double)	standard	W/O	GRV4NAY (per MIL)	EVS-C2A	A	50~5M	2	500	per MIL
						C or F	100~5M	1	350	
	Tandem (Tripple)	standard	W/O	3GRV4NAY (per MIL)	EVS-E2A	A	50~1M	2	500	per MIL
						C or F	100~5M	1	350	
Type RV2	Single	standard	W/O	RV2NAY	EVS-H2A	A	50~5M	1	350	carbon
			With	RV2NBY	EVS-H2D	C or F	100~5M	0.5	200	brush
		watertight shaft	W/O	RV2SAY	EVS-H8A	A	50~5M	1	350	carbon
			With	RV2SBY	EVS-H8D	C or F	100~5M	0.5	200	brush
		shaft lock	W/O	RV2LAY	EVS-H5A	A	50~5M	1	350	carbon
						C or F	100~5M	0.5	200	brush
Type RV6	Single	standard	W/O	RV6NAY	EVS-G2A	A	50~5M	0.5	350	carbon
		watertight	W/O	RV6SAY	EVS-G8A	C or F	100~5M	0.25	200	brush
		shaft lock	W/O	RV6LAY	EVS-G5A					

Note: * Alphabet designation for taper is as per MIL.

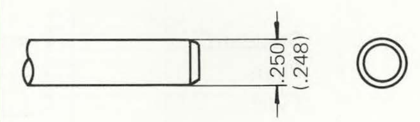
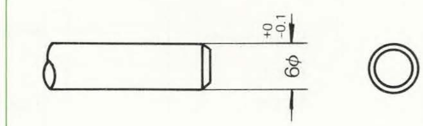
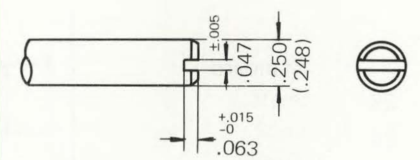
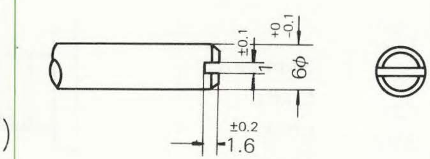
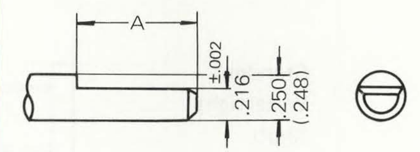
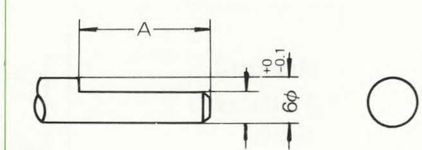
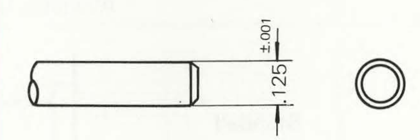
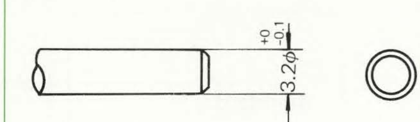
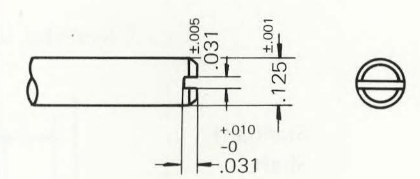
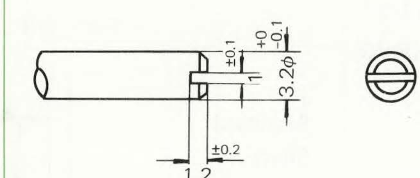
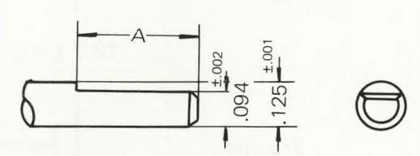
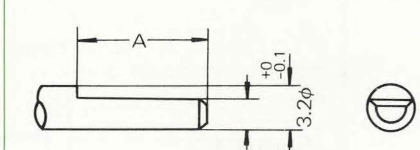
Standard Products Table (Except MIL-approved types)

Classification: Type	Classification: Construction	Shape	Switch	MATSUSHITA Part No.	* Taper	Res. Range min.(Ω)~max.(Ω)	Rated Power: Power (W)	Rated Power: Max. Operating Volt. (V)	Note
28	single	standard	W/O	EVS-Y2A	B	50~100M	2	500	carbon brush
			With	EVS-Y2D	A or C	100~100M	1	350	carbon brush any switch available
		shaft lock	W/O	EVS-Y5A	B	50~100M	2	500	carbon brush
					A or C	100~100M	1	350	
	dual concentric	standard	W/O	EVS-T2A	B	50~100M	2	500	carbon brush
					A or C	100~100M	1	350	
	tandem (double)	standard	W/O	EVS-X2A	B	50~100M	2	500	carbon brush
			With	EVS-X2D	A or C	100~100M	1	350	
	tandem (tripple)	standard	W/O	EVS-W2A	B	50~100M	2	500	carbon brush
					A or C	100~100M	1	350	
24	single	standard	W/O	EVS-S2A	B	50~ 5M	1	350	carbon brush
			With	EVS-U2D	A or C	100~ 2M	0.5	200	carbon brush any switch available
		shaft lock	W/O	EVS-S5A	B	50~ 5M	1	350	carbon brush
					A or C	100~ 2M	0.5	200	
	dual concentric	standard	W/O	EVS-50A	B	50~100M	1	350	carbon brush
					A or C	100~100M	0.5	200	
	tandem	standard	W/O	EVS-40A	B	50~100M	1	350	carbon brush
			With	EVS-40D	A or C	50~100M	0.5	200	any switch available
12	single	standard	W/O	EVS-N2A	B	50~ 5M	0.5	350	carbon brush
					A or C	100~ 1M	0.25	200	
		shaft lock	W/O	EVS-N5A	B	50~ 5M	0.5	350	carbon brush
					A or C	100~ 1M	0.25	200	
12	trimmer pot (single)	Stand Up Type	W/O	EVS-N6A	B	50~ 5M	0.5	350	carbon brush
		Lay Down Type	W/O	EVS-N7A	B	50~ 5M	0.5	350	carbon brush
8		Stand Up Type	W/O	EVS-P1A	B	50~ 2M	0.2	200	carbon brush
		Lay Down Type	W/O	EVS-P4A	B	50~ 2M	0.2	200	carbon brush

Note: * Taper designation (alphabets) is as per MATSUSHITA STANDARD.

Shaft Trims and Dimensions

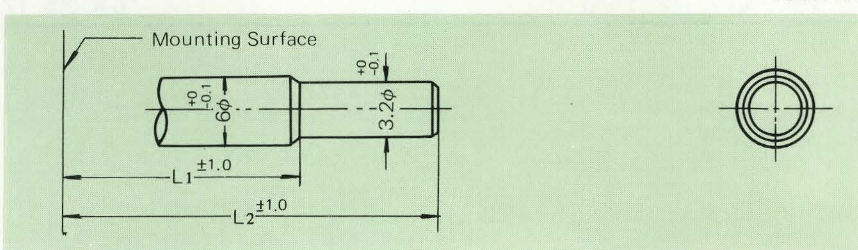
Standard

MIL-Approved			Standard (except MIL-approved Types)		
Type		Trims and Dimensions (inch)	Type		Trims and Dimensions (mm)
1 3/32'' 29/32'' (RV4 RV2)	R (Plain Round)		28 24	B (Plain Round)	
	S (Screwdriver Slotted)			S (Screwdriver Slotted)	
	F (Flatted)			F (Flatted)	
1/2'' (RV6)	R (Plain Round)		12	R (Plain Round)	
	S (Screwdriver Slotted)			S (Screwdriver Slotted)	
	F (Flatted)			F (Flatted)	

Type S is most recommended.

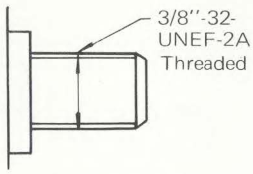
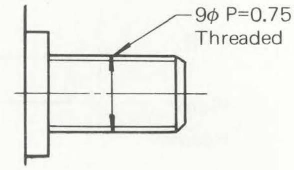
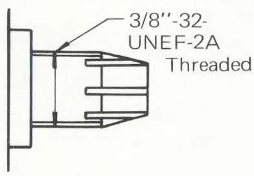
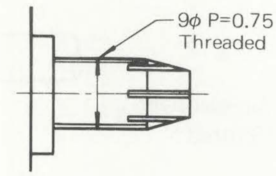
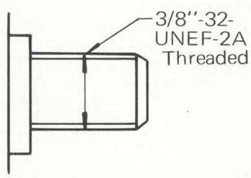
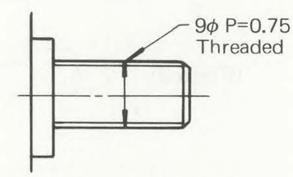
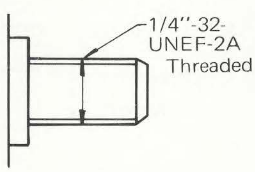
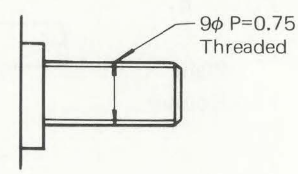
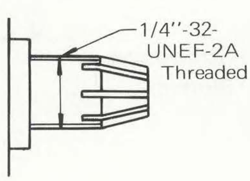
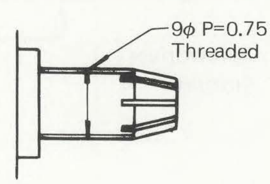
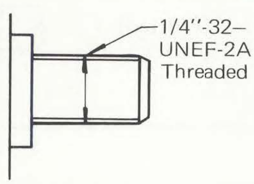
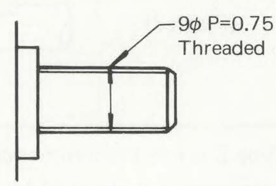
Examples of shaft combination in Dual Concentric Type (for 28, 24 types only)

Unit: mm



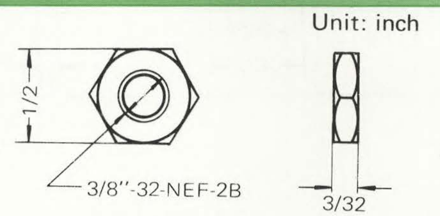
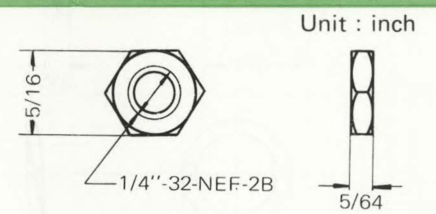
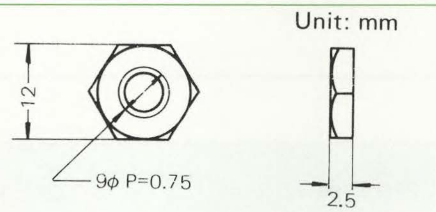
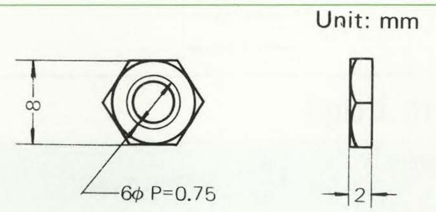
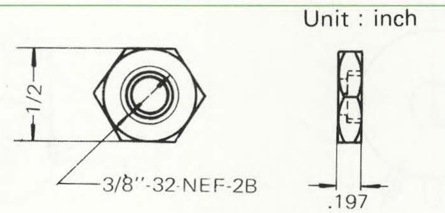
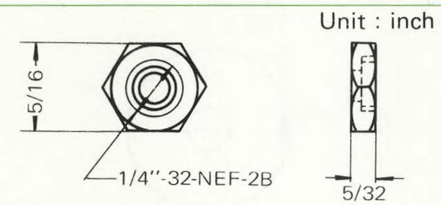
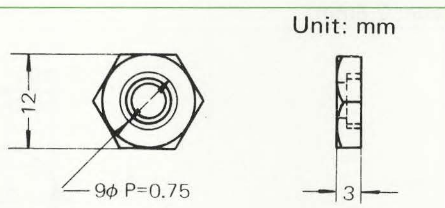
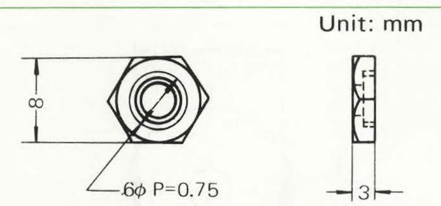
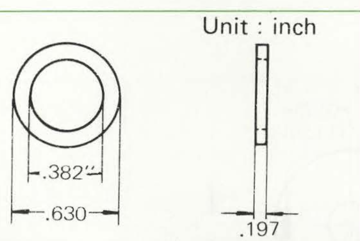
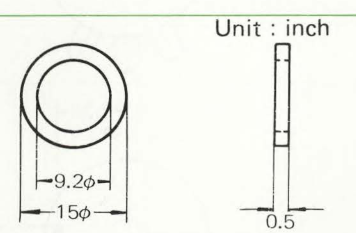
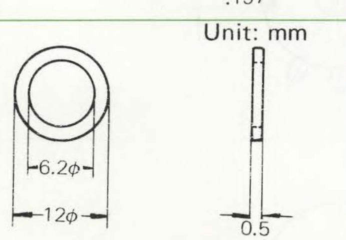
Bushing Trims and Dimensions

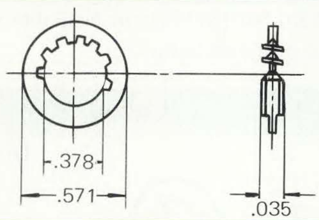
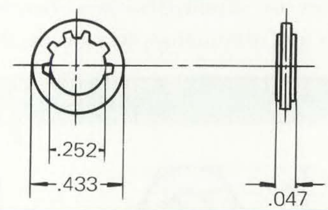
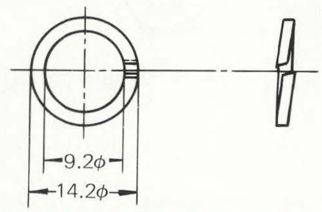
Standard

MIL-approved			Standard (except MIL-approved types)		
Type		Trims and Dimensions (inch)	Type		Trims and Dimensions (mm)
$1\frac{3}{32}$″ $\frac{29}{32}$″ (RV4 RV2)	Standard Plain Type	 * 1/8″. 1/4″. 3/8″. 1/2″ Long	28 24	Standard Plain Type	 * Available upon request
	Standard Shaft Lock Type	 * 1/2″ Long		Standard Shaft Lock Type	 * 12.7 Long
	Standard Watertight Shaft Type	 * 1/4″. 3/8″. 1/2″ Long		Standard Watertight Shaft Type	 * Available upon request
1/2″ (RV6)	Standard Plain Type	 * 1/4″. 3/8″. 1/2″ Long	12	Standad Plain Type	 * Available upon request
	Standard Shaft Lock Type	 * 1/2″ Long		Standard Shaft Lock Type	 * 12.7 Long
	Standard Watertight Shaft Type	 * 1/4″. 3/8″. 1/2″ Long		Standard Watertight Shaft Type	 *6.4, 9.5, 12.7 Long

Your Choice of Hardware

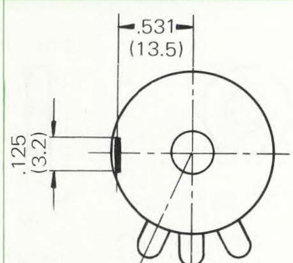
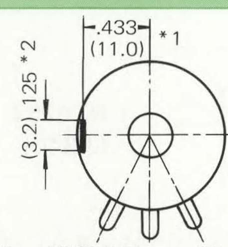
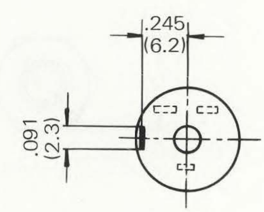
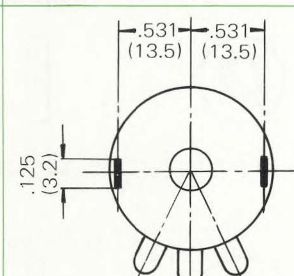
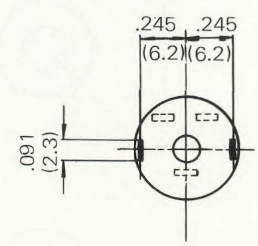
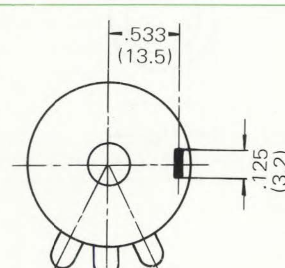
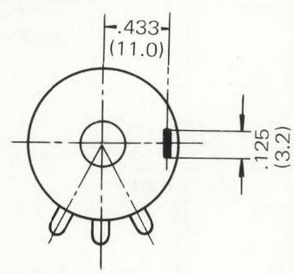
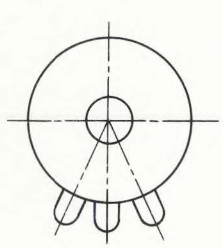
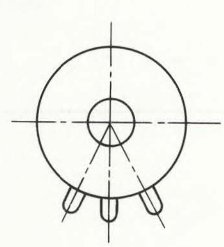
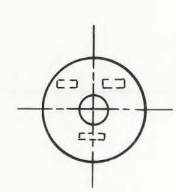
Variable Resistors are supplied without hardware. But there are many standard hardware items available to help you match the variable resistors and attenuators to your needs. You can specify the hardware pictured below.

Type	Drawing	Part No.	Drawing	Part No.
Nut		NTA291 (3/8")		NTA261 (1/4")
		NTA290 (9ϕ)		NTA260 (6ϕ)
Lock Nut		NTA293 (3/8")		NTA263 (1/4")
		NTA292 (9ϕ)		NTA262 (6ϕ)
Washer		WAA091 (3/8")		WAA090 (9ϕ)
		WAA060 (6ϕ)	————	———

Type	Drawing	Part No.	Drawing	Part No.
Lock Washer		WAA291 (3/8")		WAA261 (1/4")
Spring Washer		WAA290 (9φ)	—	—

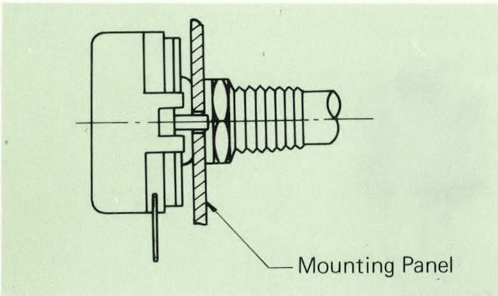
Locating Lugs

Unit: inch (mm)

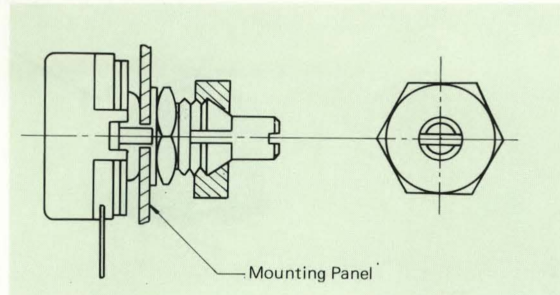
Type \ Model	$1\frac{3}{32}$" . 28φ Type	29/32" . 24φ Type	1/2" . 12φ Type
1		 *1 EVS-S Type: 10mm *2 EVS-S Type: 2.8mm	
2		—	
3			—
4			

Mounting Means

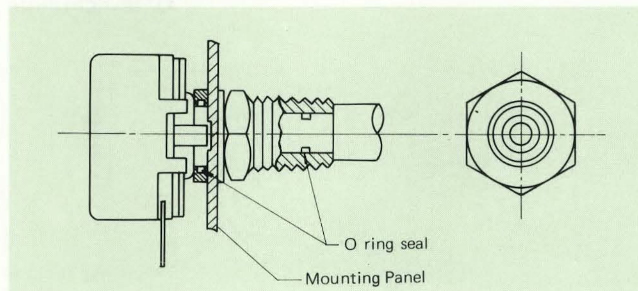
Standard Type



Shaft Lock Type

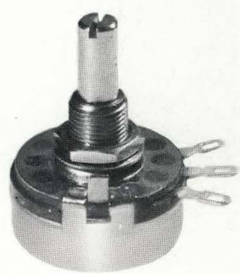


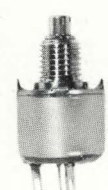
Watertight Type



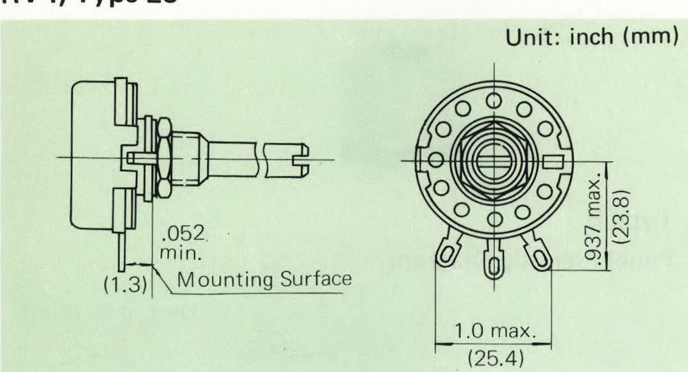
Terminals

Solder Lugs

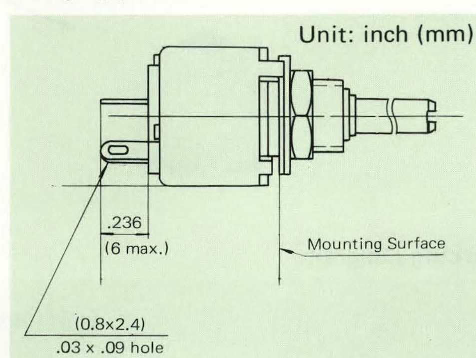




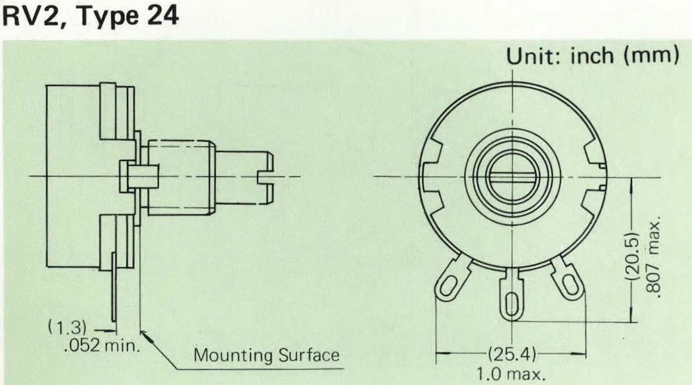
RV4, Type 28



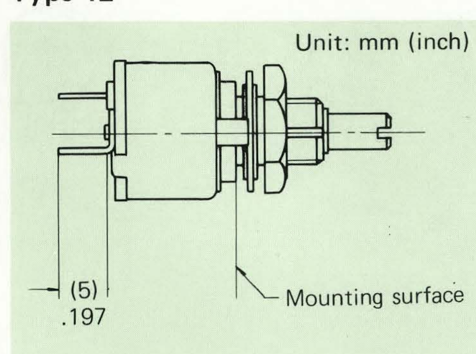
RV6, Type 12



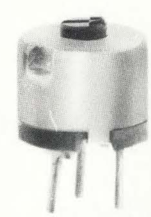
RV2, Type 24



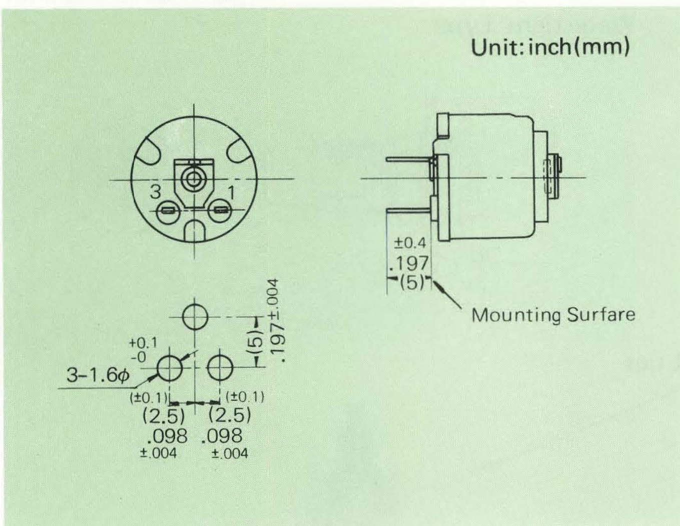
Type 12



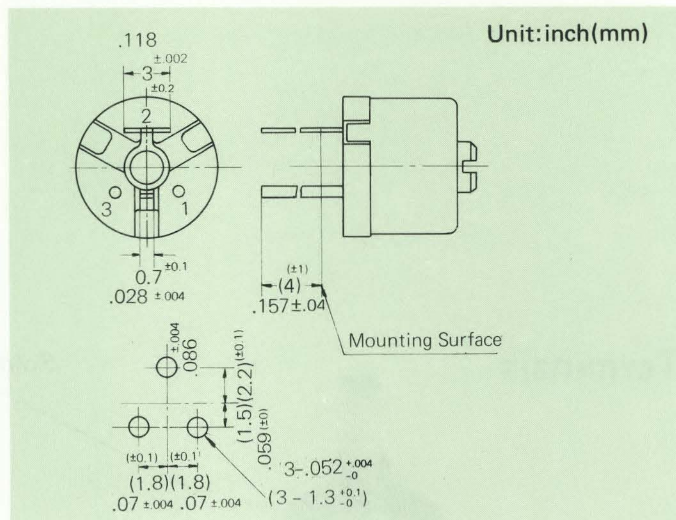
Plug In
(Parallel to case)



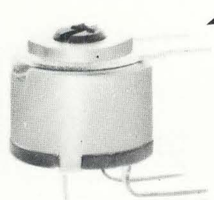
Type 12
Panel Piercing Diagram

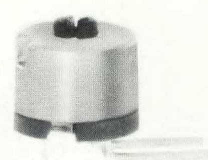


Type 8
Panel Piercing Diagram

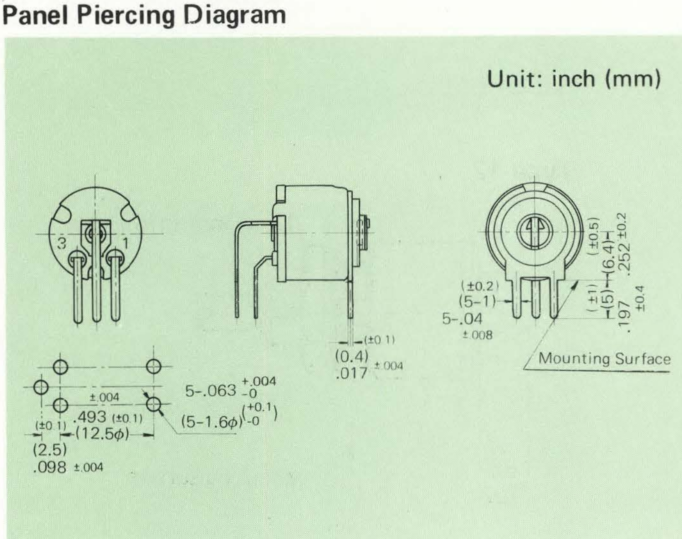


Plug In
(Perpendicular to case)

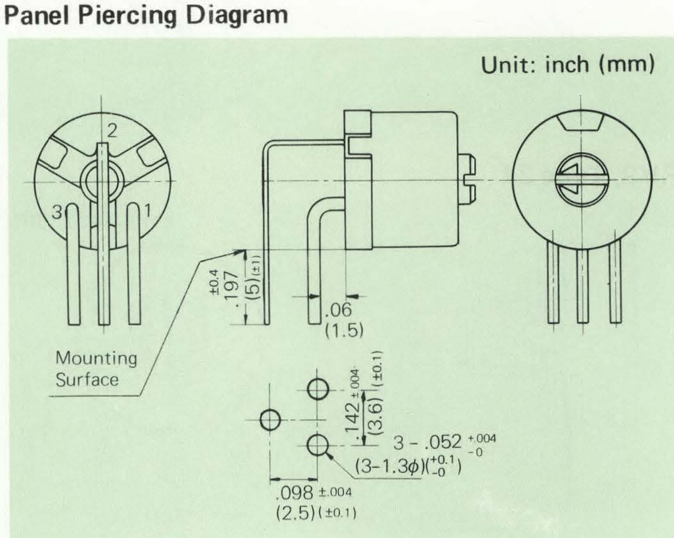




Type 12
Panel Piercing Diagram



Type 8
Panel Piercing Diagram



Rated Power and Voltage

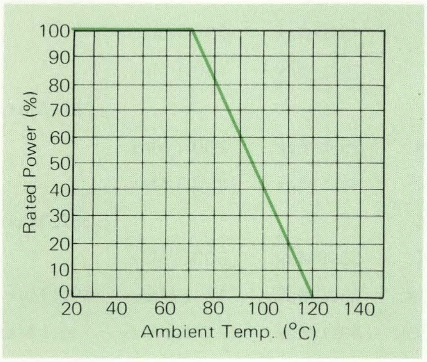
The table shown below exhibits the maximum rated power measured at ambient temperature under 70°C with continuous voltage application. As to the maximum power at temperatures exceeding 70°C, the derating curve should be referred.

Rated Power and Voltage

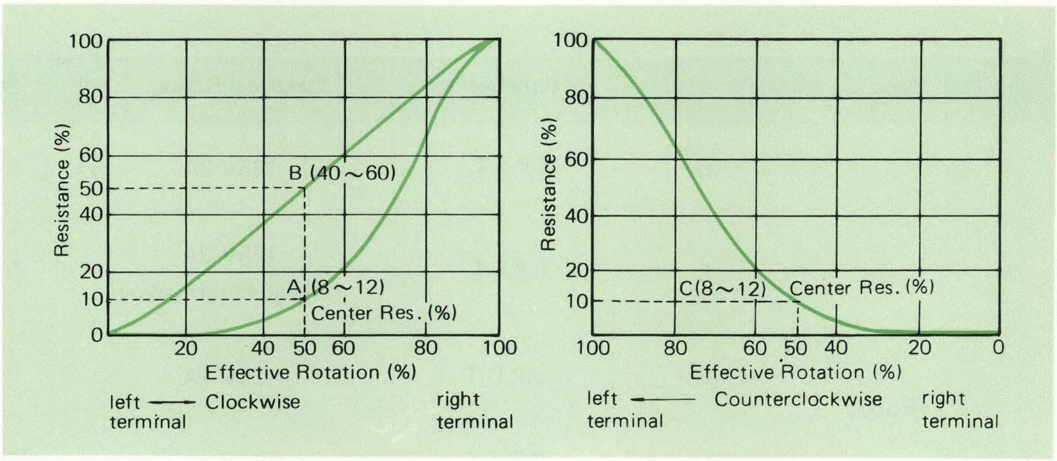
Type	Taper	Rated Power	Max. Working Voltage
RV4 Type 28	B	2W	500V
	A. C	1W	350V
RV2 Type 24	B	1W	350V
	A, C	0.5W	200V
RV6 Type 12	B	0.5W	350V
	A. C	0.25W	200V
Type 8	B	0.2W	200V

* Taper designation is as per MATSUSHITA Std.

Power Derating Curve



Taper



$$C = \frac{\text{Resistance Value between terminals 2 and 3}}{\text{Overall Resistance Value}} \times 100$$

$$A, B = \frac{\text{Resistance Value between terminals 1 and 2}}{\text{Overall Resistance Value}} \times 100$$

* Taper designation table

Symbol	R.Value Tolerance	MIL Symbol
A	±10%	C
D	±20%	D
B	±10%	A
E	±20%	B
C	±10%	E
F	±20%	F

Residual Resistance

Type / Taper / Overall Res. Ranking (Ω)	RV4, RV2, RV6						28	24	12	8
	A (C for MIL)		B (A for MIL)		C (E for MIL)		A, B, C	A, B, C	A, B, C	B
	1–2T	2–3T	1–2T	2–3T	1–2T	2–3T				
50 ~ 750	——	——	*5Ω Max.	5Ω Max.			(less than 1KΩ) 1–2T: 5Ω Max. 2–3T: 5Ω Max. (1KΩ or more) 1–2T: 25Ω Max. 2–3T: 25Ω Max.			(less than 1KΩ 1KΩ) 1–2T: 10Ω Max. 2–3T: 10Ω Max. (1KΩ or more) 1–2T: 25Ω Max. 2–3T: 25Ω Max.
100 ~ 750	*5Ω Max.	20Ω Max.			20Ω Max.	5Ω Max.				
1K ~ 5K	25Ω Max.	100Ω Max.			100Ω Max.	25Ω Max.				
1K ~ 10K	—	—	25Ω Max.	25Ω Max.						
7.5K ~ 10K	25Ω Max.	200Ω Max.			200Ω Max.	25Ω Max.				
15K ~ 25K	35Ω Max.	250Ω Max.			250Ω Max.	35Ω Max.				
15K ~ 50K	—	—	35Ω Max.	35Ω Max.						
35K ~ 50K	35Ω Max.	500Ω Max.			500Ω Max.	35Ω Max.				
75K ~ 100K	35Ω Max.	1KΩ Max.	50Ω Max.	50Ω Max.	1KΩ Max.	35Ω Max.				
150K ~ 250K	50Ω Max.	2.5KΩ Max.	125Ω Max.	125Ω Max.	2.5KΩ Max.	50Ω Max.				
350K ~ 500K	100Ω Max.	5KΩ Max.	250Ω Max.	250Ω Max.	5KΩ Max.	100Ω Max.				
750K ~ 1M	200Ω Max.	10KΩ Max.	500Ω Max.	500Ω Max.	10KΩ Max.	200Ω Max.				
1.5M ~ 2.5M	500Ω Max.	25KΩ Max.	1KΩ Max.	1KΩ Max.	25KΩ Max.	500Ω Max.				
3.5M ~ 5.0M	600Ω Max.	50KΩ Max.	1.5Ω Max.	1.5KΩ Max.	50KΩ Max.	600Ω Max.				

* 15Ω max. for RV 6 ranking from 100Ω to 500Ω

Switch

Standard

Type			Function	Electrical Rating	Schematic
RV4 * RV2 * Type 28 Type 24	Rotary	D	S.P.S.T.	125V 3A	
		E	S.P.S.T.	125V 3A (High Peformance)	
		G	S.P.D.T.	125V 1A	
		L	D.P.S.T.	125V 1A	
		M	D.P.S.T.	125V 3A	
		Q	D.P.D.T.	125V 0.5A	

* Switch Rating: 125V 3A only

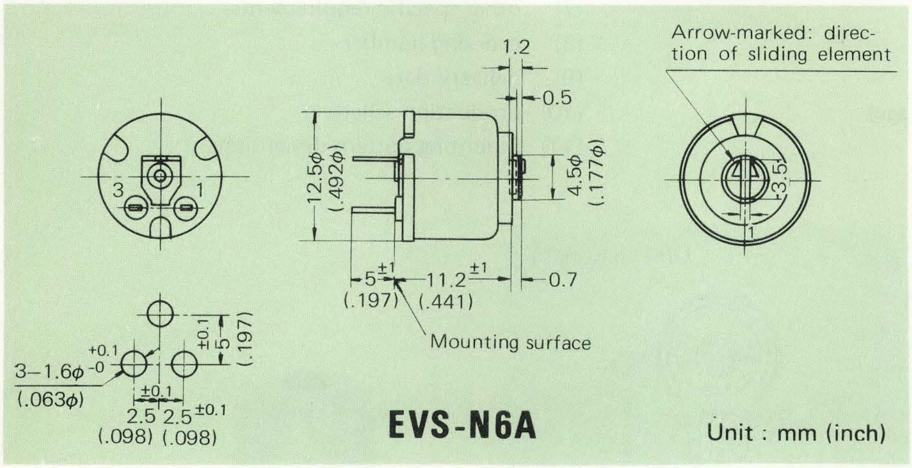
Shaft Rotation Angle

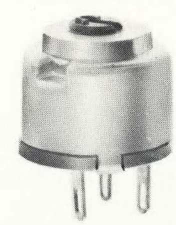
Type	Rotation Angle	
	w/o sw	with sw
RV4, Type 28	315° ± 5°	335° ± 5°
RV2, Type 24	300° ± 5°	300° ± 5°
RV6, Type 12	295° ± 5° *	~
Type 8	260° ± 10°	~

* RV6 : 295° ± 3°

1/2 " (12mm) DIA. CARBON COMPOSITION PRESET VARIABLE RESISTORS

(Standard Type; Pre-fixed Type)





Features

- Very small resistance change even when the rated voltage is applied continuously at 70°C
- Withstand 0.5W for types of linear taper
- Electrically and mechanically stable due to monobloc composition of resistor element, terminals, bushing and radiation panel
- Miniature type for small mounting space
- Extremely stable against humidity due to excellent composing material and manufacturing system
- Very small rotation noise
- Excellent heat radiation and small resistance change at dip-soldering
- Wide operating temperature range of -15°C to +120°C
- Lay-down type available

Electrical Specifications

- Resistance Range: 50Ω ~ 5MΩ

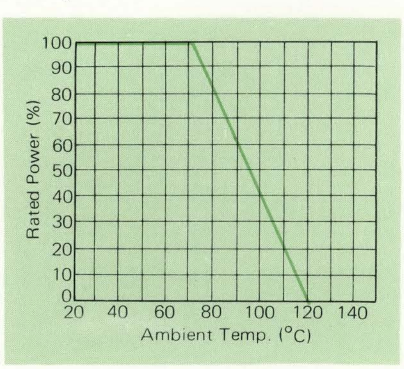
Taper*	Std. and sub-std. resistance (Ω)
B	100, 500, 1K, 5K, 10K, 50K, 100K, 1M, 2M, 5M

Note: * Taper designation is as per MIL Std.

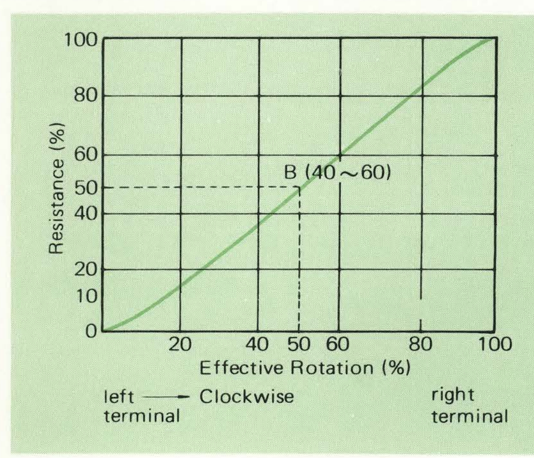
- Standard Tolerance: ±20%
- Rated Power and Max. Operating Voltage

Taper	Rated Power	Max. Working Voltage
B	0.5W	350V

- Power Derating Curve



- Standard Curve: B Curve. R Value Tolerance ±20%.



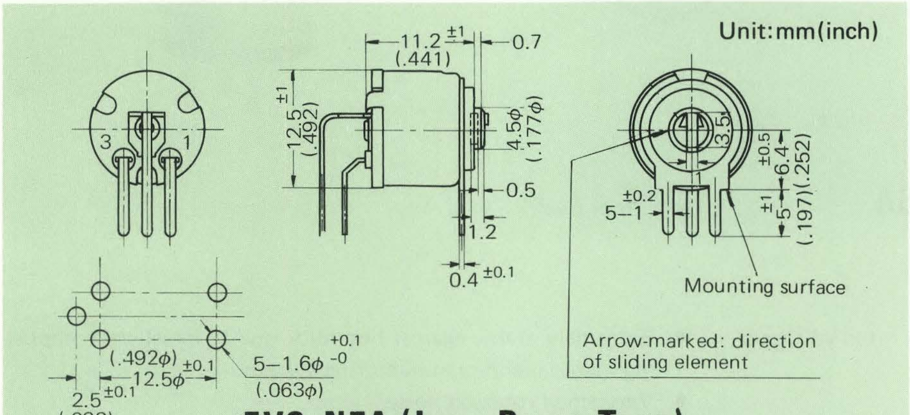
$$B = \frac{\text{Res. Value between terminals 1 and 2}}{\text{Overall Resistance Value}} \times 100$$

- Withstand Voltage: AC 500V (1 minute)
- Insulation Resistance: More than 100M (DC 500V)
- Rotating Angle: 295° ± 5° without switch.
- Rotating Torque: 35 ~ 450 g-cm.
- Stopper Strength: 1 kg-cm min.

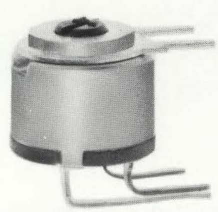
Sample Information

When requiring sample submission, please inform us of your own requirement in detail covering the following items:

(1) dimensions (or part number)
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) mounting means
(6) kind of assembly or circuit
(7) other specific requirements
(8) ordering number
(9) delivery date
(10) production schedule
(11) mounting pattern dimensions

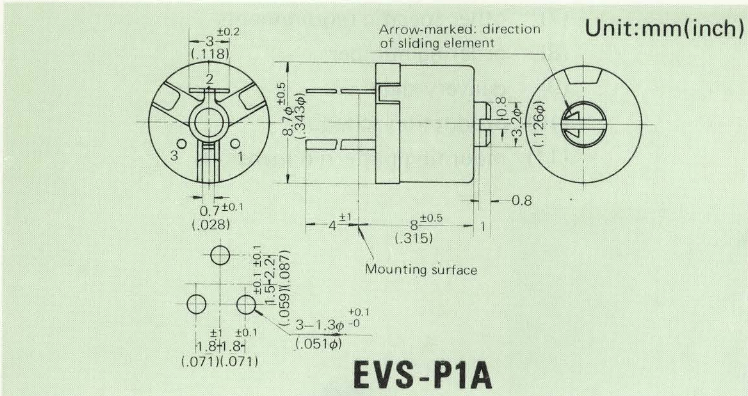


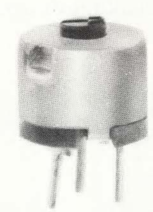
EVS-N7A (Lay -Down Type)



5/16"(8mm) DIA. CARBON COMPOSITION PRESET VARIABLE RESISTORS

[Type8; Standard Type; Pre-fixed Type(Stand-Up Type; Lay-Down Type)]





Features

- Very small resistance change even when the rated voltage is applied continuously at 70°C
- Withstand 0.2W for types of linear taper
- Very small rotation noise
- Excellent heat radiation and small resistance change at dip-soldering
- Wide operating temperature range of -15°C to +120°C
- Electrically and mechanically stable due to monobloc composition of resistor element, terminals, bushing and radiation panel
- Extremely stable against humidity due to excellent composing material and manufacturing system
- Lay-down type available

Electrical Specifications

- Resistance Range: 50Ω ~ 2MΩ

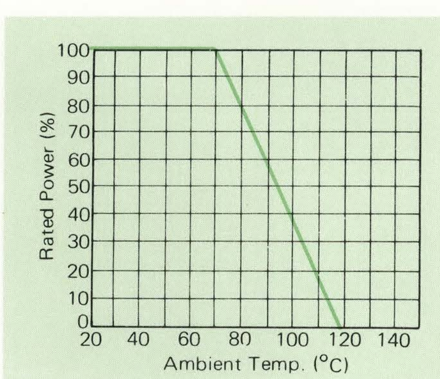
Taper*	Std. and Sub-std. resistance (Ω)
B	100, 500, 1K, 5K, 10K, 50K, 100K, 1M, 2M

Note: *Taper designation is per MATSUSHITA Std.

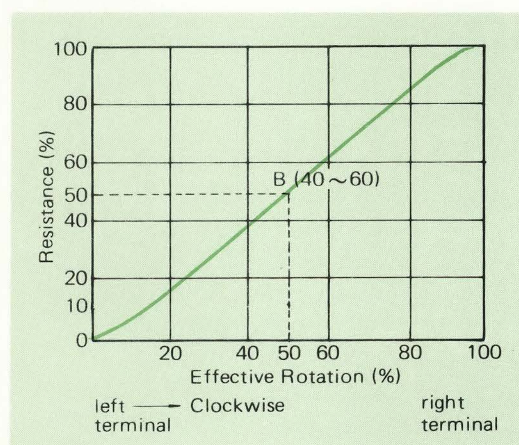
- Standard Tolerance: ±20%.
- Rated Power and Max. Operating Voltage;

Taper	Rated Power	Max. Operating Voltage
B	0.2W	200V

- Power Derating Curve:



- Standard Curve:



$$B = \frac{\text{Res. Value between terminals 1 and 2}}{\text{Overall Resistance Value}} \times 100$$

- Withstand Voltage: AC 500V (1 minute).
- Insulation Resistance: More than 100M (DC 500V)

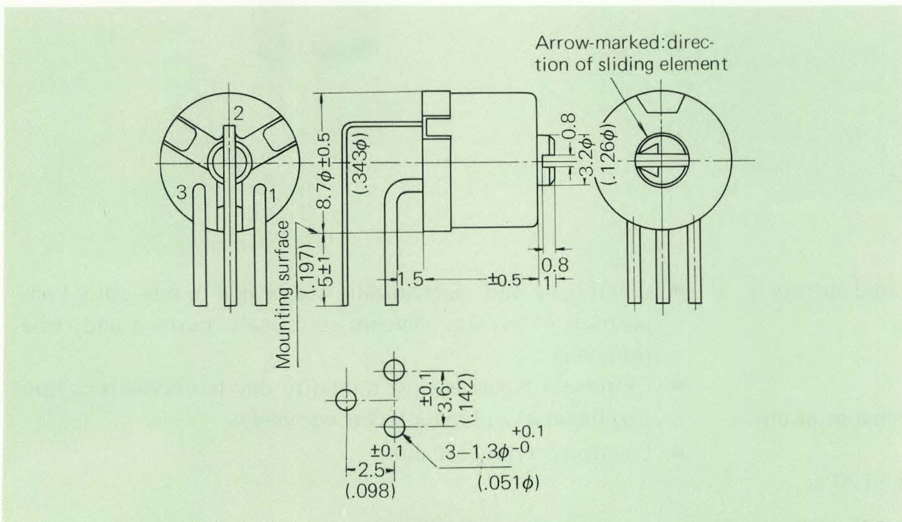
Mechanical Specifications

- Rotating Angle: 260°±5° without switch
- Rotating Torque: 20 ~ 200 g-cm
- Stopper Strength: 1.0 kg-cm min.
- Driver Groove Strength: 400 g-cm min.

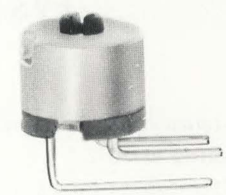
Sample Information

When requiring sample submission, please inform us of your own requirement in detail covering the following items:

(1) dimensions (or part number)
(2) overall resistance
(3) taper
(4) rated power (or maximum operating voltage)
(5) mounting means
(6) kind of assembly or circuit
(7) other specific requirements
(8) ordering number
(9) delivery date
(10) production schedule
(11) mounting pattern dimensions



EVS-P4A Unit:mm(inch)



Application Information

1. Heat
Care should be taken that adjacent components not be affected by the heat generated in variable resistors when the load is applied. Especially, care should be taken as to the mounting of high power types where heat radiation should become most efficient.

2. Corrosive atmosphere
Variable resistors should not be exposed to corrosive atmosphere (for example, sulfurous acid, chloric acid, formic acid, ammonia, etc.). Coherent material for cabinet assembling may also be harmful to the variable resistors.

3. Ambient temperature
Care should be taken with regard to ambient temperature when variable resistors are operated. Especially at high temperatures, the load should be derated in accordance with specified derating curves.

4. Mounting
Mounting of variable resistors on chassis or printed circuit boards should be done firmly and precisely. Warp or distortion of the chassis or printed circuit board may cause improper operation, and when attaching nuts are fastened too firmly, the bushing of the variable resistor may be distorted, eventually hindering smooth rotation.

5. Mechanical treatment
Too large a shock or strain, such as dropping on the floor, may deform the variable resistor and cause a malfunction. Variable resistors mounted on chassis or printed circuit boards should also be free from such shocks or strains.

6. Soldering
Soldering of the variable resistors should be conducted in as short a period of time as possible. Long-time soldering at a high temperature may bring forth degradation of the characteristics. Dip-soldering of variable resistors for printed circuit boards should not be performed until the flux attached dries completely, because scattered flux may degrade the performance.

7. Resistance setting
The rotational torque due to the rotation of the shaft should not exeed the rated value. Too large a rotational torque may damage the stop and control groove.

8. Terminal connections
When high-resistance variable resistors are connected, terminals 1 or 3 should be the minus terminal and terminal 2 the plus terminal.

9. Choice of types
Characteristics and dimensions should meet the porpose of application. MATSUSHITA is ready for consultation regarding your own specifications, including operating environment, attaching means, etc.

10. Storage
Variable resistors should not be stored in such places as are exposed to high temperature, high humidity and corrosive gas, especially when the storage is for a long period of time.

Application Table (Variable Resistors for Color TV)

Application Circuit	MATSUSHITA Part No. (for American Std.)	MATSUSHITA Part No. (for Standard)
POWER SUPPLY SW & VOLUME	EVD-MA (w/pull-push sw-TV Rating-UL) EVD-AB (w/rotary sw-TV Rating-UL)	EVC-M0 (w/pull-push sw) EVV-B0 (w/rotary sw) EVC-MA (w/pull-push sw-TV Rating-UL) EVV-BA (w/rotary sw-TV Rating-UL)
BRIGHT	EVD-A8A, EVD-N0A	EVV-B0A, EVD-N0A
V. HOLD	EVD-A8A, EVD-N0A	EVV-B0A, EVD-N0A
H. HOLD	EVD-A8A, EVD-N0A	EVV-B0A, EVD-N0A
TINT	EVD-A8A, EVD-N0A	EVV-B0A, EVD-N0A
CONTRAST	EVD-A8A, EVDN0A	EVV-B1A, EVD-N1A
COLOR	EVD-A8A, EVD-N0A	EVV-B0A, EVD-N0A, EVV-081 (w/Auto sw)
PICTURE	EVD-A8A, EVD-N0A	EVV-B0A, EVD-N0A EVV-B3A, EVD-N3A
AUTO TINT	EVD-N0A	EVV-B0A, EVD-N0A EVV-B3A, EVD-N3A
AUTO COLOR	EVD-N0A	EVV-B0A, EVD-N0A EVV-B3A, EVD-N3A
SCREEN	EVT-J6A, EVT-81A	EVT-J6A, EVT-81A
RF AGC	EVT-S0A, EVT-V0A EVT-S3A, EVT-V3A	EVT-S0A, EVT-V0A EVT-S3A, EVT-V3A
ABL	EVT-J6A, EVT-81A EVT-S3A, EVT-V3A	EVT-S0A, EVT-V0A EVT-S3A, EVT-V3A
UHF GAIN CONTROL	EVT-J6A, EVT-81A EVT-S3A, EVT-V3A	EVT-S0A, EVT-V0A EVT-S3A, EVT-V3A
IF AGC	EVT-J6A, EVT-81A EVT-S3A, EVT-V3A	EVT-S0A, EVT-V0A EVT-S3A, EVT-V3A
SUB. LIN	EVL-T0A, EVL-W0A	EVL-T0A, EVL-W0A
V. HEIGHT	EVT-81A, EVT-J6A	EVT-81A, EVT-J6A
V. LIN	EVT-81A, EVT-J6A	EVT-81A, EVT-J6A
KILLER	EVT-81A, EVT-J6A	EVT-81A, EVT-J6A
DRIVE	EVT-81A, EVT-J6A	EVT-81A, EVT-J6A
CONVERGENCE	EVW-RIA, EVW-R0A	EVW-R1A, EVW-R0A

IV ELECTROLYTIC CAPACITORS

QUICK REFERENCE GUIDE

Function	Type		Voltage Range(V)	Capacitance Range(μF)	Operating Temperature Range	Life Assurance	Page
Miniature Aluminum Electrolytics	New L Series	Type A Type B	6.3 ~ 100	0.47 ~ 2,200	-40 ~ +85°C	85°C 1,000 Hours	IV-2
	For High Voltage	Type A	160 ~ 350	1 ~ 47	-25 ~ +85°C	85°C 500 Hours	IV-10
		Type B	160 ~ 500	1 ~ 220			
	2H Series	Type A Type B	10 ~ 100	0.47 ~ 2,200	-55 ~ +105°C	105°C 1,000 Hours	IV-12
	Non-polarized Miniature	Type A	16 ~ 50	1 ~ 1,000	-25 ~ +70°C	70°C 500 Hours	IV-17
	For Crossover Network	Type B	50	1 ~ 100	-25 ~ +70°C	70°C 500 Hours	IV-19
	For Horizontal Deflection Correction of TR TV	Type A	25	3.5, 6.5, 10	-25 ~ +70°C	85°C 500 Hours	IV-21
	For Vertical Time Constant Circuit of TR TV	Type A	50	1 ~ 47	-40 ~ +85°C	85°C 1,000 Hours	IV-22
	For Timing Circuits	Type A Type B	10	3.3 ~ 2,200 47 ~ 2,200	-25 ~ +85°C	85°C 100,000 cycles (charge/discharge)	IV-24
Large Aluminum Electrolytics	For PC Board	Type TS	16 ~ 80	470 ~ 4,700	-40 ~ +85°C	85°C 1,000 Hrs	IV-26
	With Lug	Type M	16 ~ 450	22 ~ 10,000	-40(-25)~+85°C	85°C 1,000 (500) Hrs	IV-28
	For P.C. Board	Type T	16 ~ 450	22 ~ 10,000	-40(-25)~+85°C	85°C 1,000(500) Hrs	IV-31
	Twist Prong	Type KP	16 ~ 450	22 ~ 10,000	-25 ~ 85°C	85°C 500 Hours	IV-32
	Prong for P,C, Board	Type KQ	16 ~ 450	22 ~ 10,000	-25 ~ 85°C	85°C 500 Hours	IV-34
	For A.C. Motor Starting	Type M	125, 160	40 ~ 160	-20 ~ +65°C	———	IV-35
	For Photo Flash	Type M	330,360, 480	100 ~ 800	0 ~ +55°C	25°C 1,000 cycles (charge/discharge)	IV-38
	For High Power use	Type M	25 ~ 100	3,300 ~ 22,000	-40 ~ +85°C	85°C 1,000 Hours	IV-40
	For Computor Power Supply	Type GS	6.3 ~ 160	470 ~ 470,000	-25 ~ +85°C	85°C 1,000 Hours	IV-42
		Type GH	6.3 ~ 450	220 ~ 220,000			
Solid Tantalum Electrolytics	Dipped Tantalum	Type EF	3.15 ~ 35	0.47 ~ 100	-55 ~ +85°C	85°C 1,000 Hours	IV-47
	Miniature Solid	Type EG Type EA	3.15 ~ 35	0.47 ~ 470 0.047~470	-55 ~ +85°C	85°C 1,000 Hours	IV-50
		Type VH	6.3 ~ 35	1 ~ 330	-55 ~ +85°C (125°C derating)	85°C 1,000 Hours (125°C derating)	IV-55
	Molded Tantalum	Type VS	6.3 ~ 50	0.68 ~22	-55 ~ +85°C	85°C 2,000 Hours	IV-58

This chart is intended to serve as a guide only.

MINIATURE ALUMINUM ELECTROLYTICS

New L Series

New L series is a miniature aluminum electrolytic capacitor for use in a wide temperature range from -40°C to +85°C, and exhibits long life at 85°C with compact size.
New L series is ideal for the circuit where low impedance and low tanδ are required.

Features

- Wide operating temperature range from -40°C to +85°C
- Long load life and shelf life (1,000 hours at 85°C)
- Excellent temperature characteirstics and low tan δ
- Low impedance especially at low temperature
- Closed capacitance tolerance
- Wide operating ratings with voltage rating from 6.3WV to 100WVDC and with capacitance rating from 0.47μF to 2200μF
- Very small in size with uniform quality

Electrical Specifications

1) Operating Temperature Range: -40°C ~+85°C
2) Rated Working Voltage Range: 6.3WV ~100WVDC
3) Rated Capacitance Range: 0.47~2,200μF
4) Capacitance Tolerance:
   More than 4.7μF: -10~+50%
   4.7μF or less: -10~+75%
   * ±20% is available as "LM-Series" upon request.
5) Surge Voltage and Tanδ:

Working Volt.	Surge Volt.	Tan δ	(CR-Product)
6.3	8	0.25	332
10	13	0.20	265
16	20	0.17	226
25	32	0.15	200
35	44	0.13	173
50	63	0.10	133
63	79	0.10	133
100	125	0.08	106

(Capacitance and Tanδ shall be measured at 120Hz and 20°C.)

6) Leakage Current: $I = 0.02CV + 3\mu A$ MAX
   where I: Max. leakage current (μA)
   C: Rated capacitance (μF)
   V: Rated d-c working voltage (V)
   Leakage current shall be measured at 25°C after 5-minute application of the rated d-c working voltage.

7) Load Life:
   After 1,000-hour application of d-c working voltage with ripple current at +85°C (at 120Hz), capacitor shall meet the following limits.
   - Leakage current: Less than the initial specified value
   - Cap. change: (1)Within ±30% of the initial measured value for 5mm(.197") and 6.3mm (.268") dia. products
     (2)Within ±25% of the initial measured value for 8mm(.315") or larger dia. products.
   - Tan δ: Less than 200% of the initial specified value
8) Shelf Life:
   After storage for 1,000 hours at +85°C with no voltage applied, the leakage current, capacitance and tan δ shall meet the same limits specified in Load Life Test.
9) Low Temperature Stability:
   Impedance ratio based on value at +20°C and 120Hz.

W.VDC	At -25°C/+20°C	At -40°C/+20°C
6.3V	4	8
10	3	6
16	2	4
25	2	4
35	2	4
50	2	4
63	2	3
100	2	3

Pretreatment For Test

All the test shall be performed after the capacitor is applied with d-c voltage equal to the rated working voltage through the series protective resistor (about 1,000Ω) for 30 minutes and is left for 24 to 48 hours thereafter.

10) Ripple Current: Maximum 120 Hz ripple current at the rated d-c working voltage. (−40°C to +85°C)

Unit: mA (r-m-s)

W.V \ μF	0.47	1	2.2	3.3	4.7	10	22	33	47	100	220	330	470	1000	2200
6.3	↑	↑	↑	↑	↑	↑	45	50	60	105	185	210	300	530	800
10	↑	↑	↑	↑	↑	↑	45	55	65	120	200	250	350	550	850
16	↑	↑	↑	↑	↑	25	54	79	108	200	320	405	480	700	1000
25	↑	↑	10	15	20	25	54	79	108	200	320	430	570	850	—
35	↑	↑	10	15	20	25	54	79	108	200	320	430	570	1000	—
50	4	8	10	15	20	25	54	79	108	200	320	430	570	—	—
63	4	8	10	15	20	25	54	79	108	200	320	430	—	—	—
100	6	12	16	24	32	40	88	132	185	200	—	—	—	—	—

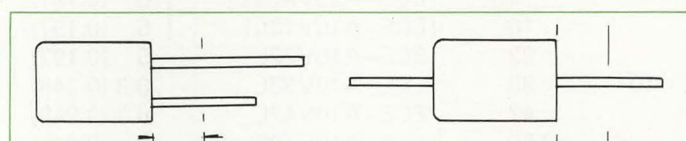
Note: The values in the squares crossed with arrows are substituted for the values at the starting point of the arrows.
(Refer to "Standard Products Table" on pp. IV-4~7.)

Mechanical Specifications

1) Lead Pull Strength: Capacitor leads shall withstand the steady pull specified below axially applied for 5 minutes.
2) Lead Bend Strength: Capacitor leads shall withstand the following bend test: Secure the capacitor in the vertical position subjecting the lead to an axial pull speficied below. Bend the body of the capacitor to one direction by 90° and back to the original position, and then 90° to the opposite direction.

Diameter of lead wire	Static load
0.5 mm (0.02") or less	0.25 kg (0.55 lb)
0.6 mm (0.024") to 0.8 mm (0.032").	0.5 kg (1.1 lbs)

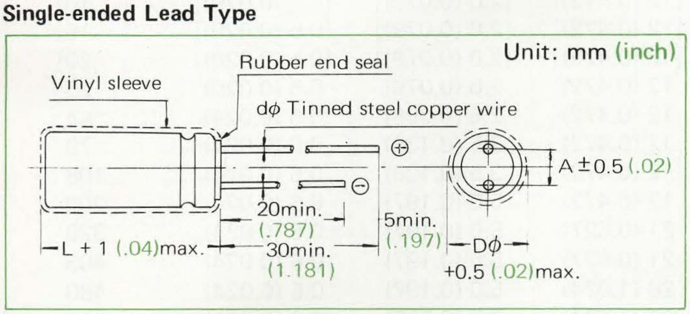
3) Solderability: When the lead wire or terminal to be used being soldered is dipped for 2 ± 0.5 seconds in the methanol or isopropyl alcohol solution (10 ± 2%) of rosin, then is dipped for 2 ± 0.5 seconds in the soldering bath containing the Soft Solder molten at 230 ± 5°C, up to 4 ± 0.8 mm, as shown below the part not soldered shall not exceed 1/4 the portion dipped.



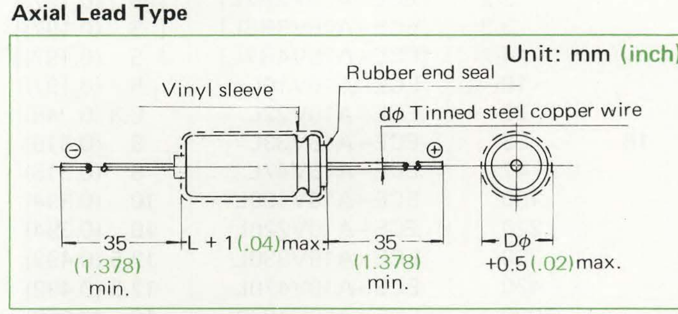
4) Standard Marking Item: Rated capacitance, Rated working voltage, Symbol of MATSUSHITA (▲), Manufactured date code, Symbol of electrolytic capacitor (CE), Polarity.

Dimensions

Single-ended Lead Type



Axial Lead Type



Lead Diameter and Spacing Unit: mm (inch)

Lead \ Body dia. (ϕ)	5 (.197)	6.3 (.248)	8 (.315)	10 (.394)	12.5 (.492)	16 (.630)	18 (.709)
Lead Diameter (d)	0.5 (.02)	0.6 (.024)	0.6 (.024)	0.6 (.024)	0.6 (.024)	0.8 (.032)	0.8 (.032)
Lead Spacing (A)	2 (.079)	2.5 (.098)	3.5 (.138)	5 (.197)	5 (.197)	7.5 (.295)	7.5 (.295)

Unit: mm (inch)

Body Diameter	5 (.197)	6.3 (.248)	8 (.315)	10 (.394)	12.5 (.492)	16 (.630)	18 (.709)
Lead Diameter	0.6 (.024)	0.6 (.024)	0.6 (.024)	0.6 (.024)	0.8 (.032)	0.8 (.032)	0.8 (.032)

Standard Products Table (Single-ended Lead Type)

Part numbers in brackets [ ] are description of substitutes. For example, the substitute of a capacitor for 6.3V and 0.47μF is shown as [ECE–A50VR47L], which is common to the part number of the capacitor for 50V, 0.47μF.

Ratings		Part Number	Dimensions: mm (inch)		(Refer to IV-3)		*Max. Ripple Current
Voltage (V,DC)	Cap. (μF)		Dφ	L	A	dφ	(mA)
	0.47	[ECE–A50VR47L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[4]
	1	[ECE–A50V1L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[8]
	2.2	[ECE–A25V2R2L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[10]
	3.3	[ECE–A25V3R3L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[15]
	4.7	[ECE–A25V4R7L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[20]
	10	[ECE–A16V10L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[25]
	22	ECE–A6V22L	5 (0.197)	12 (0.472)	2.0 (0.079)	0.5 (0.020)	45
6.3	33	ECE–A6V33L	6.3 (0.248)	12 (0.472)	2.5 (0.098)	0.6 (0.024)	50
	47	ECE–A6V47L	6.3 (0.248)	12 (0.472)	2.5 (0.098)	0.6 (0.024)	60
	100	ECE–A6V100L	8 (0.315)	12 (0.472)	3.5 (0.138)	0.6 (0.024)	105
	220	ECE–A6V220L	10 (0.394)	12 (0.472)	5.0 (0.197)	0.6 (0.024)	185
	330	ECE–A6V330L	10 (0.394)	16 (0.630)	5.0 (0.197)	0.6 (0.024)	210
	470	ECE–A6V470L	10 (0.394)	21 (0.827)	5.0 (0.197)	0.6 (0.024)	300
	1000	ECE–A6V1000L	12.5 (0.492)	26 (1.024)	5.0 (0.197)	0.6 (0.024)	530
	2200	ECE–A6V2200L	16 (0.630)	26 (1.024)	7.5 (0.295)	0.8 (0.032)	800
	0.47	[ECE–A50VR47L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[4]
	1	[ECE–A50V1L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[8]
	2.2	[ECE–A25V2R2L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[10]
	3.3	[ECE–A25V3R3L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[15]
	4.7	[ECE–A25V4R7L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[20]
	10	[ECE–A16V10L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[25]
	22	ECE–A10V22L	5 (0.197)	12 (0.472)	2.0 (0.079)	0.5 (0.020)	45
10	33	ECE–A10V33L	6.3 (0.248)	12 (0.472)	2.5 (0.098)	0.6 (0.024)	55
	47	ECE–A10V47L	6.3 (0.248)	12 (0.472)	2.5 (0.098)	0.6 (0.024)	65
	100	ECE–A10V100L	8 (0.315)	12 (0.472)	3.5 (0.138)	0.6 (0.024)	120
	220	ECE–A10V220L	10 (0.394)	16 (0.630)	5.0 (0.197)	0.6 (0.024)	200
	330	ECE–A10V330L	10 (0.394)	21 (0.827)	5.0 (0.197)	0.6 (0.024)	250
	470	ECE–A10V470L	12.5 (0.492)	21 (0.827)	5.0 (0.197)	0.6 (0.024)	350
	1000	ECE–A10V1000L	12.5 (0.492)	26 (1.024)	5.0 (0.197)	0.6 (0.024)	550
	2200	ECE–A10V2200L	16 (0.630)	33 (1.299)	7.5 (0.295)	0.8 (0.032)	850
	0.47	[ECE–A50VR47L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[4]
	1	[ECE–A50V1L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[8]
	2.2	[ECE–A25V2R2L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[10]
	3.3	[ECE–A25V3R3L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[15]
	4.7	[ECE–A25V4R7L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[20]
	10	ECE–A16V10L	5 (0.197)	12 (0.472)	2.0 (0.079)	0.5 (0.020)	25
	22	ECE–A16V22L	6.3 (0.248)	12 (0.472)	2.5 (0.098)	0.6 (0.024)	54
16	33	ECE–A16V33L	8 (0.315)	12 (0.472)	3.5 (0.138)	0.6 (0.024)	79
	47	ECE–A16V47L	8 (0.315)	12 (0.472)	3.5 (0.138)	0.6 (0.024)	108
	100	ECE–A16V100L	10 (0.394)	12 (0.472)	5.0 (0.197)	0.6 (0.024)	200
	220	ECE–A16V220L	10 (0.394)	21 (0.827)	5.0 (0.197)	0.6 (0.024)	320
	330	ECE–A16V330L	12.5 (0.492)	21 (0.827)	5.0 (0.197)	0.6 (0.024)	405
	470	ECE–A16V470L	12.5 (0.492)	26 (1.024)	5.0 (0.197)	0.6 (0.024)	480
	1000	ECE–A16V1000L	16 (0.630)	26 (1.024)	7.5 (0.295)	0.8 (0.032)	700
	2200	ECE–A16V2200L	18 (0.709)	41 (1.614)	7.5 (0.295)	0.8 (0.032)	1000
	0.47	[ECE–A50VR47L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[4]
	1	[ECE–A50V1L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[8]
	2.2	ECE–A25V2R2L	5 (0.197)	12 (0.472)	2.0 (0.079)	0.5 (0.020)	10
25	3.3	ECE–A25V3R3L	5 (0.197)	12 (0.472)	2.0 (0.079)	0.5 (0.020)	15
	4.7	ECE–A25V4R7L	5 (0.197)	12 (0.472)	2.0 (0.079)	0.5 (0.020)	20
	10	ECE–A25V10L	6.3 (0.248)	12 (0.472)	2.5 (0.098)	0.6 (0.024)	25
	22	ECE–A25V22L	8 (0.315)	12 (0.472)	3.5 (0.138)	0.6 (0.024)	54

Ratings		Part Number	Dimensions: mm (inch) (Refer to P. IV-3)				*Max. Ripple Current (mA)
Voltage (V, DC)	Cap. (μF)		Dϕ	L	A	dϕ	
25	33	ECE–A25V33L	8 (0.315)	12 (0.472)	3.5 (0.138)	0.6 (0.024)	79
	47	ECE–A25V47L	10 (0.394)	12 (0.472)	5.0 (0.197)	0.6 (0.024)	108
	100	ECE–A25V100L	10 (0.394)	16 (0.630)	5.0 (0.197)	0.6 (0.024)	200
	220	ECE–A25V220L	12.5 (0.492)	21 (0.827)	5.0 (0.197)	0.6 (0.024)	320
	330	ECE–A25V330L	12.5 (0.492)	26 (1.024)	5.0 (0.197)	0.6 (0.024)	430
	470	ECE–A25V470L	16 (0.630)	26 (1.024)	7.5 (0.295)	0.8 (0.032)	570
	1000	ECE–A25V1000L	18 (0.709)	33 (1.299)	7.5 (0.295)	0.8 (0.032)	850
35	0.47	[ECE–A50VR47L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[4]
	1	[ECE–A50V1L]	[5 (0.197)]	[12 (0.472)]	[2.0 (0.079)]	[0.5 (0.020)]	[8]
	2.2	ECE–A35V2R2L	5 (0.197)	12 (0.472)	2.0 (0.079)	0.5 (0.020)	10
	3.3	ECE–A35V3R3L	5 (0.197)	12 (0.472)	2.0 (0.079)	0.5 (0.020)	15
	4.7	ECE–A35V4R7L	5 (0.197)	12 (0.472)	2.0 (0.079)	0.5 (0.020)	20
	10	ECE–A35V10L	6.3 (0.248)	12 (0.472)	2.5 (0.098)	0.6 (0.024)	25
	22	ECE–A35V22L	10 (0.394)	12 (0.472)	5.0 (0.197)	0.6 (0.024)	54
	33	ECE–A35V33L	10 (0.394)	12 (0.472)	5.0 (0.197)	0.6 (0.024)	79
	47	ECE–A35V47L	10 (0.394)	16 (0.630)	5.0 (0.197)	0.6 (0.024)	108
	100	ECE–A35V100L	10 (0.394)	21 (0.827)	5.0 (0.197)	0.6 (0.024)	200
	220	ECE–A35V220L	12.5 (0.492)	26 (1.024)	5.0 (0.197)	0.6 (0.024)	320
	330	ECE–A35V330L	16 (0.630)	26 (1.024)	7.5 (0.295)	0.8 (0.032)	430
	470	ECE–A35V470L	16 (0.630)	33 (1.299)	7.5 (0.295)	0.8 (0.032)	570
	1000	ECE–A35V1000L	18 (0.709)	41 (1.614)	7.5 (0.295)	0.8 (0.032)	1000
50	0.47	ECE–A50VR47L	5 (0.197)	12 (0.472)	2.0 (0.079)	0.5 (0.020)	4
	1	ECE–A50V1L	5 (0.197)	12 (0.472)	2.0 (0.079)	0.5 (0.020)	8
	2.2	ECE–A50V2R2L	5 (0.197)	12 (0.472)	2.0 (0.079)	0.5 (0.020)	10
	3.3	ECE–A50V3R3L	6.3 (0.248)	12 (0.472)	2.5 (0.098)	0.6 (0.024)	15
	4.7	ECE–A50V4R7L	6.3 (0.248)	12 (0.472)	2.5 (0.098)	0.6 (0.024)	20
	10	ECE–A50V10L	8 (0.315)	12 (0.472)	3.5 (0.138)	0.6 (0.024)	25
	22	ECE–A50V22L	10 (0.394)	16 (0.630)	5.0 (0.197)	0.6 (0.024)	54
	33	ECE–A50V33L	10 (0.394)	16 (0.630)	5.0 (0.197)	0.6 (0.024)	79
	47	ECE–A50V47L	10 (0.394)	21 (0.827)	5.0 (0.197)	0.6 (0.024)	108
	100	ECE–A50V100L	12.5 (0.492)	26 (1.024)	5.0 (0.197)	0.6 (0.024)	200
	220	ECE–A50V220L	16 (0.630)	33 (1.299)	7.5 (0.295)	0.8 (0.032)	320
	330	ECE–A50V330L	18 (0.709)	33 (1.299)	7.5 (0.295)	0.8 (0.032)	430
	470	ECE–A50V470L	18 (0.709)	41 (1.614)	7.5 (0.295)	0.8 (0.032)	570
63	0.47	ECE–A63VR47L	5 (0.197)	12 (0.472)	2.0 (0.079)	0.5 (0.020)	4
	1	ECE–A63V1L	5 (0.197)	12 (0.472)	2.0 (0.079)	0.5 (0.020)	8
	2.2	ECE–A63V2R2L	6.3 (0.248)	12 (0.472)	2.5 (0.098)	0.6 (0.024)	10
	3.3	ECE–A63V3R3L	6.3 (0.248)	12 (0.472)	2.5 (0.098)	0.6 (0.024)	15
	4.7	ECE–A63V4R7L	8 (0.315)	12 (0.472)	3.5 (0.138)	0.6 (0.024)	20
	10	ECE–A63V10L	10 (0.394)	12 (0.472)	5.0 (0.197)	0.6 (0.024)	25
	22	ECE–A63V22L	10 (0.394)	16 (0.630)	5.0 (0.197)	0.6 (0.024)	54
	33	ECE–A63V33L	10 (0.394)	21 (0.827)	5.0 (0.197)	0.6 (0.024)	79
	47	ECE–A63V47L	12.5 (0.492)	21 (0.827)	5.0 (0.197)	0.6 (0.024)	108
	100	ECE–A63V100L	16 (0.630)	26 (1.024)	7.5 (0.295)	0.8 (0.032)	200
	220	ECE–A63V220L	18 (0.709)	33 (1.299)	7.5 (0.295)	0.8 (0.032)	320
100	0.47	ECE–A100VR47L	5 (0.197)	12 (0.472)	2.0 (0.079)	0.5 (0.020)	6
	1	ECE–A100V1L	6.3 (0.248)	12 (0.472)	2.5 (0.098)	0.6 (0.024)	12
	2.2	ECE–A100V2R2L	8 (0.315)	12 (0.472)	3.5 (0.138)	0.6 (0.024)	16
	3.3	ECE–A100V3R3L	10 (0.394)	12 (0.472)	5.0 (0.197)	0.6 (0.024)	24
	4.7	ECE–A100V4R7L	10 (0.394)	12 (0.472)	5.0 (0.197)	0.6 (0.024)	32
	10	ECE–A100V10L	10 (0.394)	16 (0.630)	5.0 (0.197)	0.6 (0.024)	40
	22	ECE–A100V22L	12.5 (0.492)	21 (0.827)	5.0 (0.197)	0.6 (0.024)	88
	33	ECE–A100V33L	16 (0.630)	26 (1.024)	7.5 (0.295)	0.8 (0.032)	132
	47	ECE–A100V47L	16 (0.630)	26 (1.024)	7.5 (0.295)	0.8 (0.032)	185
	100	ECE–A100V100L	18 (0.709)	33 (1.299)	7.5 (0.295)	0.8 (0.032)	200

(Note) "Max. Ripple Current" (marked*) denotes the maximum permissible rms ripple current at 120Hz within the operating temperature range of -40°C to +85°C with the rated d-c voltage applied.

Standard Products Table (Axial Lead Type)

Part numbers in brackets [ ] are description of substitutes. For example, the substitute of a capacitor for 6.3V and 0.47μF is shown as [ECE−B50VR47L], which is common to the part number of the capacitor for 50V, 0.47μF.

Ratings		Part Number	Dimensions: mm (inch) (Refer to P. IV-3)			*Max. Ripple Current (mA)
Voltage (V, DC)	Cap. (μF)		Dφ	L	dφ	
6.3	0.47	[ECE−B50VR47L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[4]
	1	[ECE−B50V1L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[8]
	2.2	[ECE−B25V2R2L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[10]
	3.3	[ECE−B25V3R3L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[15]
	4.7	[ECE−B25V4R7L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[20]
	10	[ECE−B16V10L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[25]
	22	ECE−B6V22L	5 (0.197)	12.5 (0.492)	0.6 (0.024)	45
	33	ECE−B6V33L	6.3 (0.248)	13.5 (0.531)	0.6 (0.024)	50
	47	ECE−B6V47L	6.3 (0.248)	13.5 (0.531)	0.6 (0.024)	60
	100	ECE−B6V100L	6.3 (0.248)	21.5 (0.846)	0.6 (0.024)	105
	220	ECE−B6V220L	8 (0.315)	21.5 (0.846)	0.6 (0.024)	185
	330	ECE−B6V330L	10 (0.394)	21.5 (0.846)	0.6 (0.024)	210
	470	ECE−B6V470L	10 (0.394)	21.5 (0.846)	0.6 (0.024)	300
	1000	ECE−B6V1000L	12.5 (0.492)	33 (1.299)	0.8 (0.032)	530
	2200	ECE−B6V2200L	16 (0.630)	33 (1.299)	0.8 (0.032)	800
10	0.47	[ECE−B50VR47L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[4]
	1	[ECE−B50V1L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[8]
	2.2	[ECE−B25V2R2L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[10]
	3.3	[ECE−B25V3R3L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[15]
	4.7	[ECE−B25V4R7L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[20]
	10	[ECE−B16V10L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[25]
	22	ECE−B10V22L	5 (0.197)	12.5 (0.492)	0.6 (0.024)	45
	33	ECE−B10V33L	6.3 (0.248)	13.5 (0.531)	0.6 (0.024)	55
	47	ECE−B10V47L	6.3 (0.248)	13.5 (0.531)	0.6 (0.024)	65
	100	ECE−B10V100L	6.3 (0.248)	21.5 (0.846)	0.6 (0.024)	120
	220	ECE−B10V220L	10 (0.394)	21.5 (0.846)	0.6 (0.024)	200
	330	ECE−B10V330L	10 (0.394)	21.5 (0.846)	0.6 (0.024)	250
	470	ECE−B10V470L	10 (0.394)	31.5 (1.240)	0.6 (0.024)	350
	1000	ECE−B10V1000L	12.5 (0.492)	33 (1.299)	0.8 (0.032)	550
	2200	ECE−B10V2200L	16 (0.630)	41 (1.614)	0.8 (0.032)	850
16	0.47	[ECE−B50VR47L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[4]
	1	[ECE−B50V1L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[8]
	2.2	[ECE−B25V2R2L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[10]
	3.3	[ECE−B25V3R3L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[15]
	4.7	[ECE−B25V4R7L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[20]
	10	ECE−B16V10L	5 (0.197)	12.5 (0.492)	0.6 (0.024)	25
	22	ECE−B16V22L	6.3 (0.248)	13.5 (0.531)	0.6 (0.024)	54
	33	ECE−B16V33L	6.3 (0.248)	13.5 (0.531)	0.6 (0.024)	79
	47	ECE−B16V47L	6.3 (0.248)	21.5 (0.846)	0.6 (0.024)	108
	100	ECE−B16V100L	8 (0.315)	21.5 (0.846)	0.6 (0.024)	200
	220	ECE−B16V220L	10 (0.394)	21.5 (0.846)	0.6 (0.024)	320
	330	ECE−B16V330L	10 (0.394)	31.5 (1.240)	0.6 (0.024)	405
	470	ECE−B16V470L	10 (0.394)	31.5 (1.240)	0.6 (0.024)	480
	1000	ECE−B16V1000L	16 (0.630)	33 (1.299)	0.8 (0.032)	700
	2200	ECE−B16V2200L	18 (0.709)	41 (1.614)	0.8 (0.032)	1000
25	0.47	[ECE−B50VR47L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[4]
	1	[ECE−B50V1L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[8]
	2.2	ECE−B25V2R2L	5 (0.197)	12.5 (0.492)	0.6 (0.024)	10
	3.3	ECE−B25V3R3L	5 (0.197)	12.5 (0.492)	0.6 (0.024)	15
	4.7	ECE−B25V4R7L	5 (0.197)	12.5 (0.492)	0.6 (0.024)	20
	10	ECE−B25V10L	6.3 (0.248)	13.5 (0.531)	0.6 (0.024)	25
	22	ECE−B25V22L	6.3 (0.248)	21.5 (0.846)	0.6 (0.024)	54

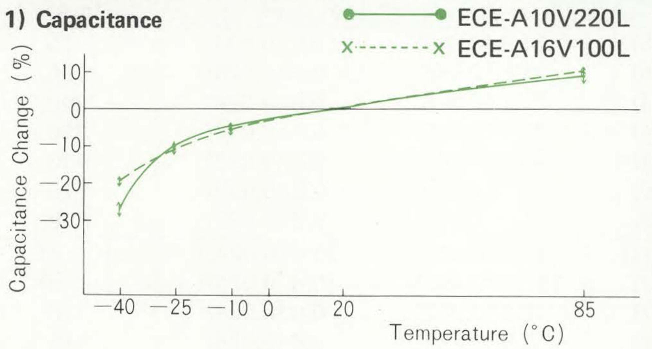
Ratings		Part Number	Dimensions: mm (inch)		(Refer to P. IV-3)	*Max. Ripple Current (mA)
Voltage (V, DC)	Cap. (μF)		Dϕ	L	dϕ	
25	33	ECE–B25V33L	6.3 (0.248)	21.5 (0.846)	0.6 (0.024)	79
	47	ECE–B25V47L	8 (0.315)	21.5 (0.846)	0.6 (0.024)	108
	100	ECE–B25V100L	10 (0.394)	21.5 (0.846)	0.6 (0.024)	200
	220	ECE–B25V220L	10 (0.394)	31.5 (1.240)	0.6 (0.024)	320
	330	ECE–B25V330L	12.5 (0.492)	33 (1.299)	0.8 (0.032)	430
	470	ECE–B25V470L	16 (0.630)	33 (1.299)	0.8 (0.032)	570
	1000	ECE–B25V1000L	18 (0.709)	41 (1.614)	0.8 (0.032)	850
35	0.47	[ECE–B50VR47L]	[5 (0.197)]	[12.5 (0.492)]	[0.6 (0.024)]	[4]
	1	[ECE–B50V1L]	[5 (0.197)	[12.5 (0.492)]	[0.6 (0.024)]	[8]
	2.2	ECE–B35V2R2L	5 (0.197)	12.5 (0.492)	0.6 (0.024)	10
	3.3	ECE–B35V3R3L	5 (0.197)	12.5 (0.492)	0.6 (0.024)	15
	4.7	ECE–B35V4R7L	5 (0.197)	12.5 (0.492)	0.6 (0.024)	20
	10	ECE–B35V10L	6.3 (0.248)	13.5 (0.531)	0.6 (0.024)	25
	22	ECE–B35V22L	6.3 (0.248)	21.5 (0.846)	0.6 (0.024)	54
	33	ECE–B35V33L	8 (0.315)	21.5 (0.846)	0.6 (0.024)	79
	47	ECE–B35V47L	8 (0.315)	21.5 (0.846)	0.6 (0.024)	108
	100	ECE–B35V100L	10 (0.394)	31.5 (1.240)	0.6 (0.024)	200
	220	ECE–B35V220L	12.5 (0.492)	33 (1.299)	0.8 (0.032)	320
	330	ECE–B35V330L	16 (0.630)	33 (1.299)	0.8 (0.032)	430
	470	ECE–B35V470L	16 (0.630)	33 (1.299)	0.8 (0.032)	570
	1000	ECE–B35V1000L	18 (0.709)	41 (1.614)	0.8 (0.032)	1000
50	0.47	ECE–B50VR47L	5 (0.197)	12.5 (0.492)	0.6 (0.024)	4
	1	ECE–B50V1L	5 (0.197)	12.5 (0.492)	0.6 (0.024)	8
	2.2	ECE–B50V2R2L	5 (0.197)	12.5 (0.492)	0.6 (0.024)	10
	3.3	ECE–B50V3R3L	6.3 (0.248)	13.5 (0.531)	0.6 (0.024)	15
	4.7	ECE–B50V4R7L	6.3 (0.248)	13.5 (0.531)	0.6 (0.024)	20
	10	ECE–B50V10L	6.3 (0.248)	21.5 (0.846)	0.6 (0.024)	25
	22	ECE–B50V22L	8 (0.315)	21.5 (0.846)	0.6 (0.024)	54
	33	ECE–B50V33L	10 (0.394)	21.5 (0.846)	0.6 (0.024)	79
	47	ECE–B50V47L	10 (0.394)	26.5 (1.043)	0.6 (0.024)	108
	100	ECE–B50V100L	12.5 (0.492)	33 (1.299)	0.8 (0.032)	200
	220	ECE–B50V220L	16 (0.630)	33 (1.299)	0.8 (0.032)	320
	330	ECE–B50V330L	16 (0.630)	41 (1.614)	0.8 (0.032)	430
	470	ECE–B50V470L	18 (0.709)	41 (1.614)	0.8 (0.032)	570
63	0.47	ECE–B63VR47L	5 (0.197)	12.5 (0.492)	0.6 (0.024)	4
	1	ECE–B63V1L	5 (0.197)	12.5 (0.492)	0.6 (0.024)	8
	2.2	ECE–B63V2R2L	6.3 (0.248)	13.5 (0.531)	0.6 (0.024)	10
	3.3	ECE–B63V3R3L	6.3 (0.248)	13.5 (0.531)	0.6 (0.024)	15
	4.7	ECE–B63V4R7L	6.3 (0.248)	21.5 (0.846)	0.6 (0.024)	20
	10	ECE–B63V10L	8 (0.315)	21.5 (0.846)	0.6 (0.024)	25
	22	ECE–B63V22L	10 (0.394)	21.5 (0.846)	0.6 (0.024)	54
	33	ECE–B63V33L	10 (0.394)	21.5 (0.846)	0.6 (0.024)	79
	47	ECE–B63V47L	10 (0.394)	31.5 (1.240)	0.6 (0.024)	108
	100	ECE–B63V100L	12.5 (0.492)	33 (1.299)	0.8 (0.032)	200
	220	ECE–B63V220L	16 (0.630)	41 (1.614)	0.8 (0.032)	320
	330	ECE–B63V330L	18 (0.709)	41 (1.614)	0.8 (0.032)	430
100	0.47	ECE–B100VR47L	5 (0.197)	12.5 (0.492)	0.6 (0.024)	6
	1	ECE–B100V1L	6.3 (0.248)	13.5 (0.531)	0.6 (0.024)	12
	2.2	ECE–B100V2R2L	6.3 (0.248)	21.5 (0.846)	0.6 (0.024)	16
	3.3	ECE–B100V3R3L	6.3 (0.248)	21.5 (0.846)	0.6 (0.024)	24
	4.7	ECE–B100V4R7L	8 (0.315)	21.5 (0.846)	0.6 (0.024)	32
	10	ECE–B100V10L	10 (0.394)	21.5 (0.846)	0.6 (0.024)	40
	22	ECE–B100V22L	10 (0.394)	31.5 (1.240)	0.6 (0.024)	88
	33	ECE–B100V33L	12.5 (0.492)	33 (1.299)	0.8 (0.032)	132
	47	ECE–B100V47L	12.5 (0.492)	33 (1.299)	0.8 (0.032)	185
	100	ECE–B100V100L	16 (0.630)	41 (1.614)	0.8 (0.032)	200

(Note) "Max. Ripple Current" (marked*) denotes the maximum permissible rms ripple current at 120Hz within the operating temperature range of -40°C to +85°C with the rated d-c voltage applied.

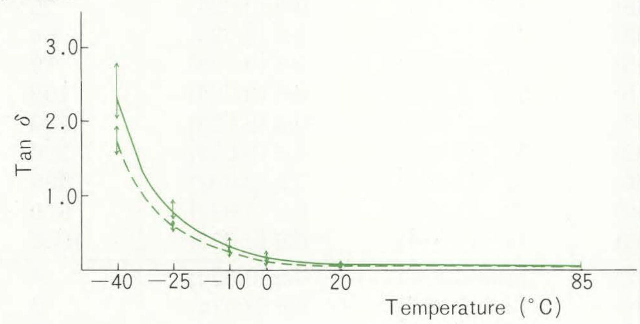
Characteristics

Temperature

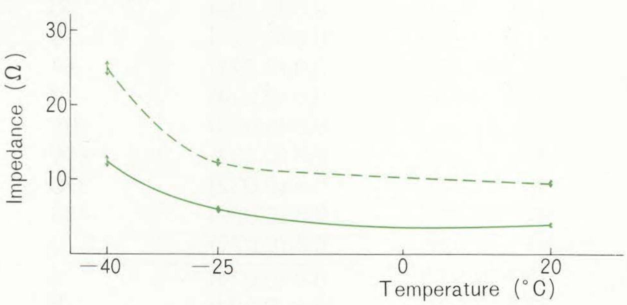
1) Capacitance



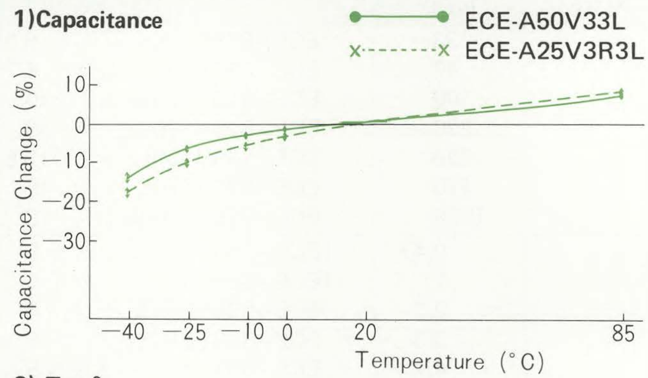
2) Tan δ



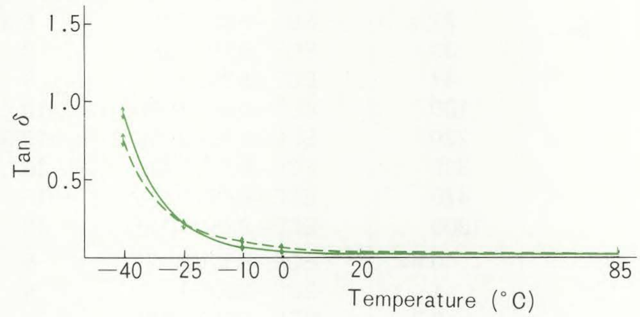
3) Impedance



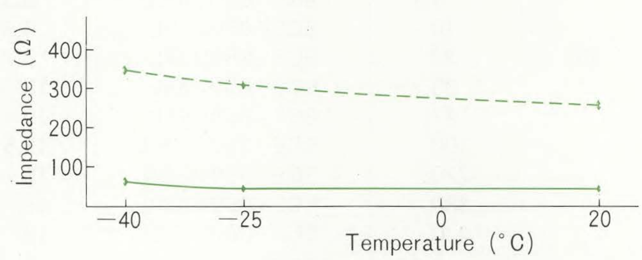
1)Capacitance



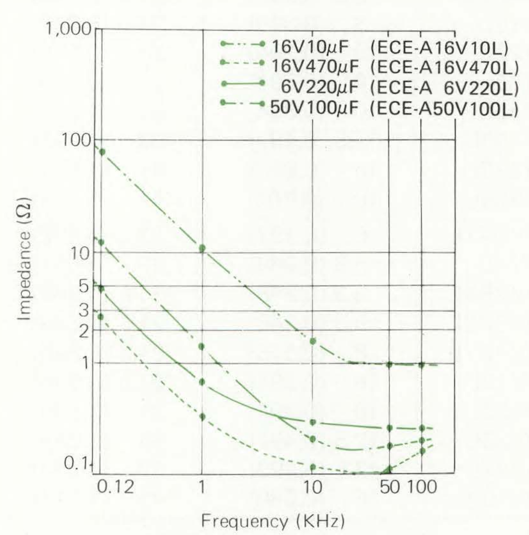
2) Tan δ



3) Impedance



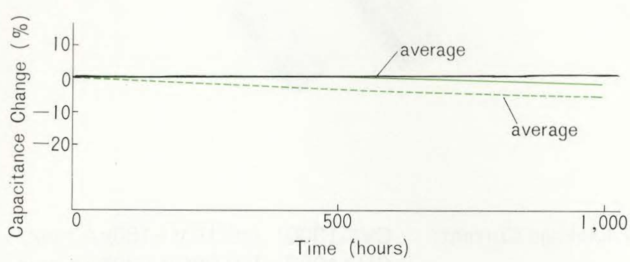
Frequency vs. Impedance (at 20°C)



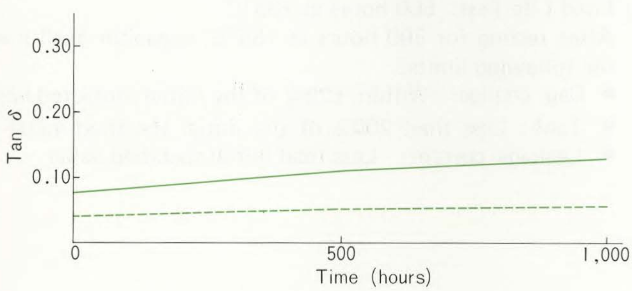
Life (W.V. applied at 85°C)

1) Capacitance

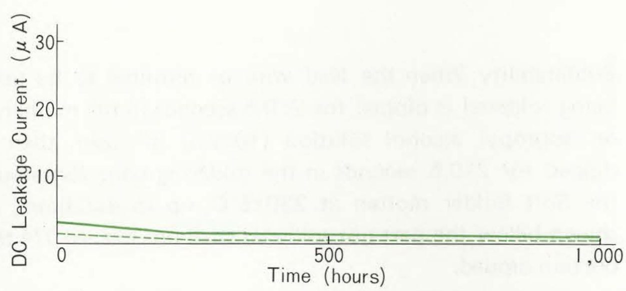
●——● ECE-A10V220L
x - - - - x ECE-A50V33L



2) Tan δ



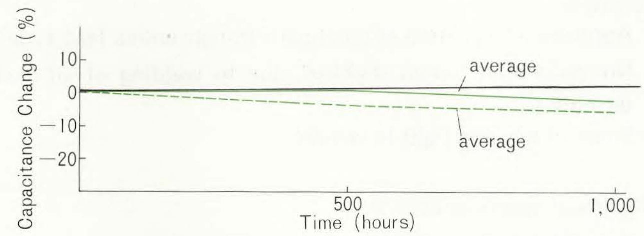
3) Leakage Current



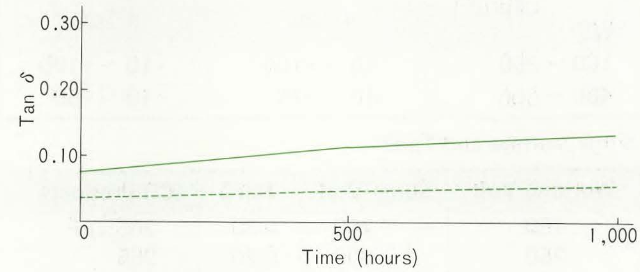
Shelf Life (no W.V. applied at 85°C)

1) Capacitance

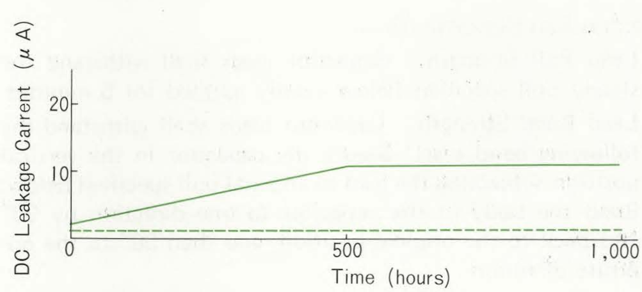
●——● ECE-A10V220L
x - - - - x ECE-A50V33L



2) Tan δ

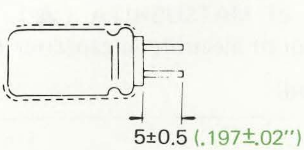


3) Leakage Current



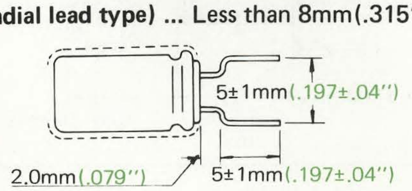
Lead Cut and Forming

- Lead cut: Lead cut for radial lead type is available at extra charge. Standard Cut-Lead length is 5.0±0.5mm(.197±.02")

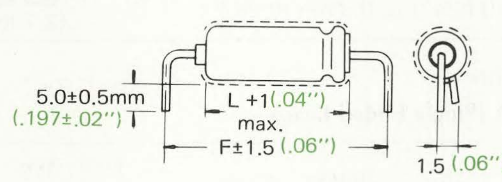


- Lead forming: Lead forming is available at extra charge. Standard dimensions are as follows.

(Radial lead type) ... Less than 8mm(.315") dia.



(Axial lead type)



L	F
12.5 (.492")	17.5 (.689")
13.5 (.531")	17.5 (.689")
21.5 (.846")	30.0 (1.18")
31.5 (1.24")	40.0 (1.58")
33.0 (1.30")	40.0 (1.58")
41.0 (1.61")	50.0 (1.97")

For High Voltage (Single-Ended Lead and Axial Lead Type)

This miniature electrolytics are especially designed for high voltage applications where tube is used.

Features

- Applicable to printed circuit board (Single-ended lead type)
- No noise even when shocked, due to welding of all lead terminals.
- Small in size and light in weight

Electrical Specifications

1) Operating Temperature Range: -25°C~+85°C
2) Rated working voltage Range:
   Single-ended lead type ... 160~350V
   Axial lead type ... 160~500V
3) Capacitance Tolerance:

WV \ Cap(μF)	4.7≧C	4.7<C
160 ~ 350	–10 ~ +100	-10 ~ +100
450 ~ 500	-10 ~ +75	-10 ~ +50

4) Surge Voltage and Tanδ

Working Volt.	Surge Volt.	Tan δ	(CR-Product)
160	200	0.20	265$\Omega\mu$F
250	300	0.20	265
350	400	0.25	332
450	500	0.25	332
500	550	0.30	398

5) Leakage Current: CV≦1000: I=0.1CV+160μA max.
   CV>1000: I=0.06CV+200μA max.

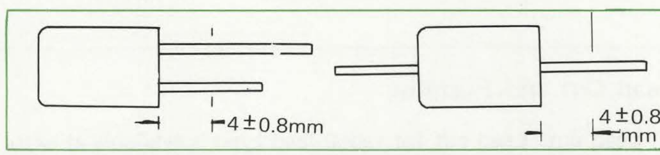
   Leakage current shall be measured after 5-minute application of the rated d-c working voltage.
6) Load Life Test: 500 hours at +85°C
   After testing for 500 hours at +85°C, capacitor shall meet the following limits;
   - Cap. change: Within ±20% of the initial measured value
   - Tanδ: Less than 200% of the initial specified value
   - Leakage current: Less than initial specified value

Mechanical Specifications

1) Lead Pull Strength: Capacitor leads shall withstand the steady pull specified below axially applied for 5 minutes.
2) Lead Bend Strength: Capacitor leads shall withstand the following bend test: Secure the capacitor in the vertical position subjecting the lead to an axial pull specified below. Bend the body of the capacitor to one direction by 90° and back to the original position, and then 90° to the opposite direction.

Diameter of lead wire	Static load
0.5mm (0.020") or less	0.25 kg (0.55 lb)
0.6mm (0.024") to 0.8mm (0.032")	0.5 kg (1.1 lbs)

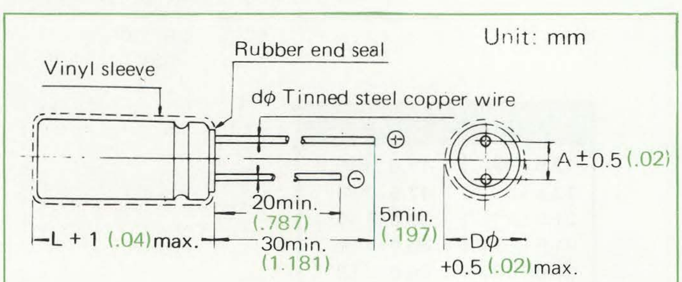
3) Solderability: When the lead wire or terminal to be used being soldered is dipped for 2±0.5 seconds in the methanol or isopropyl alcohol solution (10±2%) of rosin, then is dipped for 2±0.5 seconds in the soldering bath containing the Soft Solder molten at 230±5°C, up to 4±0.8mm, as shown below the part not soldered shall not exceed 1/4 the portion dipped.



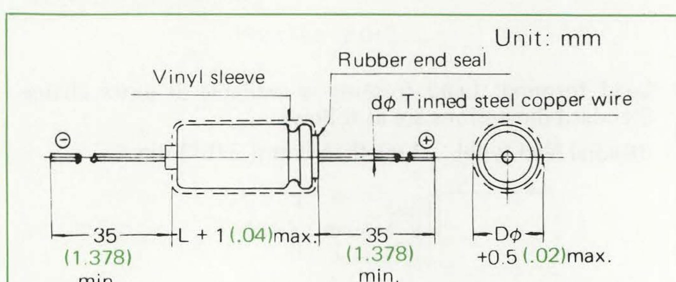
4) Standard Marking Item: Rated capacitance, Rated working voltage, Symbol of MATSUSHITA (▲), Manufactured date code, Symbol of electrolytic capacitor (CE), Polarity.

Dimensions

- Type A (Single Ended Lead)



- Type B (Axial Lead)



Standard Products Table

(Single-Ended Lead Type)

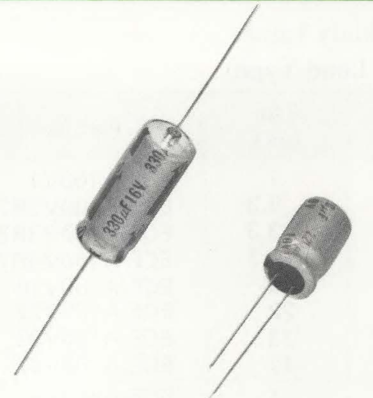
Note: As to the alphabets in "Dimensions" marked (*), see P. IV–10.

Working Volt. (VDC)	Cap. (μF)	Part No.	Dimensions* mm (inch)		
			Dφ x L	A	dφ
160	1	ECE-A160V1	8 x 12 (.315 x .472)	3.5 (.138)	0.6 (.024)
	2.2	ECE-A160V2R2	8 x 16 (.315 x .630)	3.5 (.138)	0.6 (.024)
	3.3	ECE-A160V3R3	8 x 16 (.315 x .630)	3.5 (.138)	0.6 (.024)
	4.7	ECE-A160V4R7	10 x 16 (.394 x .630)	5 (.197)	0.6 (.024)
	10	ECE-A160V10	10 x 21 (.394 x .827)	5 (.197)	0.6 (.024)
	22	ECE-A160V22	12.5 x 26 (.492 x 1.024)	5 (.197)	0.6 (.024)
	33	ECE-A160V33	16 x 26 (.630 x 1.024)	7.5 (.295)	0.8 (.032)
	47	ECE-A160V47	16 x 33 (.630 x 1.299)	7.5 (.295)	0.8 (.032)
250	1	ECE-A250V1	8 x 16 (.315 x .630)	3.5 (.138)	0.6 (.024)
	2.2	ECE-A250V2R2	10 x 16 (.394 x .630)	5 (.197)	0.6 (.024)
	3.3	ECE-A250V3R3	10 x 16 (.394 x .630)	5 (.197)	0.6 (.024)
	4.7	ECE-A250V4R7	10 x 21 (.394 x .827)	5 (.197)	0.6 (.024)
	10	ECE-A250V10	12.5 x 26 (.492 x 1.024)	5 (.197)	0.6 (.024)
	22	ECE-A250V22	16 x 26 (.630 x 1.024)	7.5 (.295)	0.8 (.032)
350	1	ECE-A350V1	10 x 16 (.394 x .630)	5 (.197)	0.6 (.024)
	2.2	ECE-A350V2R2	10 x 16 (.394 x .630)	5 (.197)	0.6 (.024)
	3.3	ECE-A350V3R3	10 x 21 (.394 x .827)	5 (.197)	0.6 (.024)
	4.7	ECE-A350V4R7	12.5 x 21 (.492 x .827)	5 (.197)	0.6 (.024)
	10	ECE-A350V10	16 x 26 (.630 x 1.024)	7.5 (.295)	0.8 (.032)

(Axial Lead Type)

Working Volt. (VDC)	Cap. (μF)	Part No.	Dimensions* mm (inch)	
			Dφ x L	dφ
160	1	ECE-B160V1	6.3 x 17.5 (.248 x .689)	0.6 (.024)
	2.2	ECE-B160V2R2	8 x 21.5 (.315 x .846)	0.6 (.024)
	3.3	ECE-B160V3R3	8 x 21.5 (.315 x .846)	0.6 (.024)
	4.7	ECE-B160V4R7	10 x 21.5 (.394 x .846)	0.6 (.024)
	10	ECE-B160V10	10 x 21.5 (.394 x .846)	0.6 (.024)
	22	ECE-B160V22	10 x 31.5 (.394 x 1.240)	0.6 (.024)
	33	ECE-B160V33	12.5 x 33 (.492 x 1.299)	0.8 (.032)
	47	ECE-B160V47	16 x 33 (.630 x 1.299)	0.8 (.032)
	100	ECE-B160V100	18 x 41 (.709 x 1.614)	0.8 (.032)
	220	ECE-B160V220	22.4 x 51 (.882 x 2.009)	0.8 (.032)
250	1	ECE-B250V1	8 x 17.5 (.315 x .689)	0.6 (.024)
	2.2	ECE-B250V2R2	8 x 21.5 (.315 x .846)	0.6 (.024)
	3.3	ECE-B250V3R3	10 x 21.5 (.394 x .846)	0.6 (.024)
	4.7	ECE-B250V4R7	10 x 21.5 (.394 x .846)	0.6 (.024)
	10	ECE-B250V10	10 x 31.5 (.394 x 1.240)	0.6 (.024)
	22	ECE-B250V22	16 x 33 (.630 x 1.299)	0.8 (.032)
	33	ECE-B250V33	16 x 33 (.630 x 1.299)	0.8 (.032)
	47	ECE-B250V47	18 x 41 (.709 x 1.614)	0.8 (.032)
	100	ECE-B250V100	22.4 x 51 (.882 x 2.009)	0.8 (.032)
350	1	ECE-B350V1	10 x 21.5 (.394 x .846)	0.6 (.024)
	2.2	ECE-B350V2R2	10 x 21.5 (.394 x .846)	0.6 (.024)
	3.3	ECE-B350V3R3	10 x 21.5 (.394 x .846)	0.6 (.024)
	4.7	ECE-B350V4R7	10 x 26.5 (.394 x 1.043)	0.6 (.024)
	10	ECE-B350V10	12.5 x 33 (.492 x 1.299)	0.8 (.032)
	22	ECE-B350V22	16 x 33 (.630 x 1.299)	0.8 (.032)
	33	ECE-B350V33	18 x 41 (.709 x 1.614)	0.8 (.032)
	47	ECE-B350V47	22.4 x 41 (.882 x 1.614)	0.8 (.032)
450	1	ECE-B450V1	10 x 21.5 (.394 x .846)	0.6 (.024)
	2.2	ECE-B450V2R2	10 x 26.5 (.394 x 1.043)	0.6 (.024)
	3.3	ECE-B450V3R3	10 x 31.5 (.394 x 1.240)	0.6 (.024)
	4.7	ECE-B450V4R7	12.5 x 33 (.492 x 1.299)	0.8 (.032)
	10	ECE-B450V10	16 x 33 (.630 x 1.299)	0.8 (.032)
	22	ECE-B450V22	18 x 41 (.709 x 1.614)	0.8 (.032)
	33	ECE-B450V33	22.4 x 41 (.882 x 1.614)	0.8 (.032)
500	1	ECE-B500V1	10 x 21.5 (.394 x .846)	0.6 (.024)
	2.2	ECE-B500V2R2	10 x 26.5 (.394 x 1.043)	0.6 (.024)
	3.3	ECE-B500V3R3	12.5 x 33 (.492 x 1.299)	0.8 (.032)
	4.7	ECE-B500V4R7	12.5 x 33 (.492 x 1.299)	0.8 (.032)
	10	ECE-B500V10	16 x 33 (.630 x 1.299)	0.8 (.032)
	22	ECE-B500V22	22.4 x 41 (.882 x 1.614)	0.8 (.032)

2H Series



2H series is a highly reliable miniature aluminum electrolytic capacitor ideal for use in the circuits where wide operating temperature and stable characteristics are required, proving long operation at high temperature of 105°C.

Features

1) Wide operating temperature -55 to +105°C
2) Excellent long life 1000 hours at 105°C
3) Stable characteristics even in low temperature operaion
4) Closed capacitance tolerance ±20%
5) Lower Tanδ

Electrical Specifications

1. Operating Temperature Range: -55 to +105°C
2. Rated Working Voltage Range: 10 to 100WV
3. Rated Capacitance Range: 0.47 to 2200μF
4. Capacitance Tolerance: ±20%
5. Surge Voltage and Tanδ:

Working Volt	Surge Volt	Tanδ	CR-product
10	13	0.1	133
16	20	0.1	133
25	32	0.075	100
35	44	0.075	100
50	63	0.05	66
63	79	0.05	66
100	125	0.05	66

(Capacitance and Tanδ shall be measured at 120Hz and 20°C)

6. DC Leakage Current: $I = 0.02CV + 3\mu A$ max.
   where I: Max. d-c leakage current (μA)
   C: Rated capacitance (μF)
   V: Rated d-c working voltage (V)

   Leakage current shall be measured at 25°C after 5-minute application of the rated d-c working voltage.

7. Low Temperature Stability:
   Impedance ratio between low temperature and +20°C at 120Hz shall be within the following maximum values.

Working Volt.	-55°C/+20°C	-40°C/+20°C	-25°C/+20°C
10	16	4	2
16	9	4	2
25	7	4	2
35	5	4	2
50	4	3	2
63	4	3	2
100	4	3	2

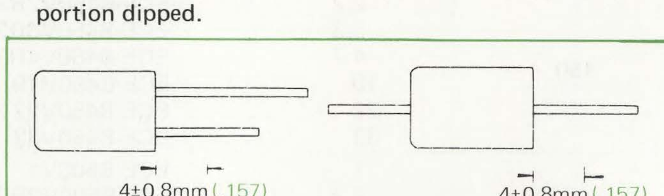
8. Load Life: After 1000 hours at +105°C or 2000 hours at +85°C application of d-c working voltage, the capacitor shall meet the following limits.
   - Capacitance change..... Within ±15% of the initial specified value.
   - Tanδ ....Less than 175% of the initial specified value
   - DC leakage current......Less than the initial specified value.
9. Shelf Life: After leaving for 1000 hours at +105°C or 2000 hours at +85°C without load, the capacitor shall meet the same limits specified in Load Life test.

Mechanical Sepcifications

1) Lead Pull Strength: Capacitor leads shall withstand the steady pull specified below axially applied for 5 minutes.
2) Lead Bend Strength: Capacitor leads shall withstand the following bend test: Secure the capacitor in the vertical position subjecting the lead to an axial pull speficied below. Bend the body of the capacitor to one direction by 90° and back to the original position, and then 90° to the opposite direction.

Diameter of lead wire	Static load
0.5 mm (0.02") or less	0.25 kg (0.55 lb)
0.6 mm (0.024") to 0.8 mm (0.032")	0.5 kg (1.1 lbs)

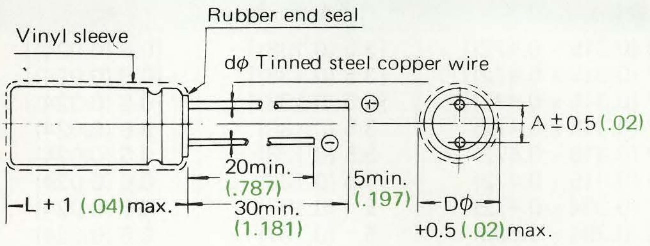
3) Solderability: When the lead wire or terminal to be used being soldered is dipped for 2±0.5 seconds in the methanol or isopropyl alcohol solution (10±2%) of rosin, then is dipped for 2±0.5 seconds in the soldering bath containing the Soft Solder molten at 230±5°C, up to 4±0.8 mm, as shown below the part not soldered shall not exceed 1/4 the portion dipped.



4) Standard Marking Item: Rated capacitance, Rated working voltage, Symbol of MATSUSHITA (▲), Manufactured date code, Symbol of electrolytic capacitor (CE), Polarity.

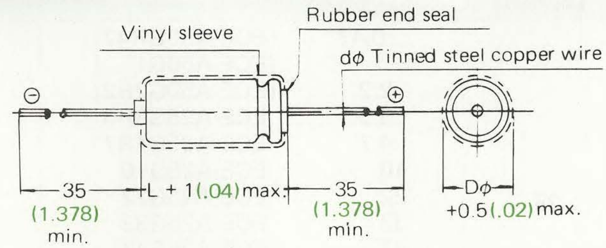
Dimensions

Radial Lead Type



Axial Lead Type

Unit: mm (inch)



Standard Products Table (Single-ended Lead Type)

Part numbers in the brackets [ ] are description of substitutes, For example, the substitute of a capacitor for 10V and 0.47μF is shown as [ECE-A50GR47], which is common to the part number of the capacitor for 50V, 0.47μF.

Rated Volt. (V, DC)	Cap. (μF)	Part No.	Dimensions mm (inch)		
			Dφ x L	A	dφ
10	0.47	[ECE-A50GR47]	[8 x 12 (0.315 x 0.472)]	[3.5 (0.138)]	[0.6 (0.024)]
	1	[ECE-A50G1]	[8 x 12 (0.315 x 0.472)]	[3.5 (0.138)]	[0.6 (0.024)]
	2.2	[ECE-A50G2R2]	[8 x 12 (0.315 x 0.472)]	[3.5 (0.138)]	[0.6 (0.024)]
	3.3	[ECE-A25G3R3]	[8 x 12 (0.315 x 0.472)]	[3.5 (0.138)]	[0.6 (0.024)]
	4.7	[ECE-A25G4R7]	[8 x 12 (0.315 x 0.472)]	[3.5 (0.138)]	[0.6 (0.024)]
	10	ECE-A10G10	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	22	ECE-A10G22	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	33	ECE-A10G33	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	47	ECE-A10G47	10 x 16 (0.394 x 0.630)	5 (0.197)	0.6 (0.024)
	100	ECE-A10G100	10 x 16 (0.394 x 0.630)	5 (0.197)	0.6 (0.024)
	220	ECE-A10G220	12.5 x 21 (0.492 x 0.827)	5 (0.197)	0.6 (0.024)
	330	ECE-A10G330	12.5 x 26 (0.492 x 1.024)	5 (0.197)	0.6 (0.024)
	470	ECE-A10G470	16 x 26 (0.630 x 1.024)	7.5 (0.295)	0.8 (0.032)
	1000	ECE-A10G1000	18 x 33 (0.709 x 1.299)	7.5 (0.295)	0.8 (0.032)
	2200	ECE-A10G2200	18 x 41 (0.709 x 1.614)	7.5 (0.295)	0.8 (0.032)
16	0.47	[ECE-A50GR47]	[8 x 12 (0.315 x 0.472)]	[3.5 (0.138)]	[0.6 (0.024)]
	1	[ECE-A50G1]	[8 x 12 (0.315 x 0.472)]	[3.5 (0.138)]	[0.6 (0.024)]
	2.2	[ECE-A50G2R2]	[8 x 12 (0.315 x 0.472)]	[3.5 (0.138)]	[0.6 (0.024)]
	3.3	[ECE-A25G3R3]	[8 x 12 (0.315 x 0.472)]	[3.5 (0.138)]	[0.6 (0.024)]
	4.7	[ECE-A25G4R7]	[8 x 12 (0.315 x 0.472)]	[3.5 (0.138)]	[0.6 (0.024)]
	10	ECE-A16G10	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	22	ECE-A16G22	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	33	ECE-A16G33	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	47	ECE-A16G47	10 x 16 (0.394 x 0.630)	5 (0.197)	0.6 (0.024)
	100	ECE-A16G100	10 x 21 (0.394 x 0.827)	5 (0.197)	0.6 (0.024)
	220	ECE-A16G220	12.5 x 26 (0.492 x 1.024)	5 (0.197)	0.6 (0.024)
	330	ECE-A16G330	16 x 26 (0.630 x 1.024)	7.5 (0.295)	0.8 (0.032)
	470	ECE-A16G470	16 x 26 (0.630 x 1.024)	7.5 (0.295)	0.8 (0.032)
	1000	ECE-A16G1000	18 x 33 (0.709 x 1.614)	7.5 (0.295)	0.8 (0.032)

Standard Products Table
(Single-ended Lead Type)

Rated Volt. (V, DC)	Cap. (μF)	Part No.	Dimensions mm (inch)		
			Dϕ x L	A	dϕ
	0.47	[ECE-A50GR47]	[8 x 12 (0.315 x 0.472)]	[3.5 (0.138)]	[0.6 (0.024)]
	1	[ECE-A50G1]	[8 x 12 (0.315 x 0.472)]	[3.5 (0.138)]	[0.6 (0.024)]
	2.2	[ECE-A50G2R2]	[8 x 12 (0.315 x 0.472)]	[3.5 (0.138)]	[0.6 (0.024)]
	3.3	ECE-A25G3R3	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	4.7	ECE-A25G4R7	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	10	ECE-A25G10	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
25	22	ECE-A25G22	10 x 12 (0.394 x 0.472)	5 (0.197)	0.6 (0.024)
	33	ECE-A25G33	10 x 16 (0.394 x 0.630)	5 (0.197)	0.6 (0.024)
	47	ECE-A25G47	10 x 21 (0.394 x 0.827)	5 (0.197)	0.6 (0.024)
	100	ECE-A25G100	12.5 x 21 (0.492 x 0.827)	5 (0.197)	0.6 (0.024)
	220	ECE-A25G220	12.5 x 21 (0.492 x 1.024)	5 (0.197)	0.6 (0.024)
	330	ECE-A25G330	16 x 26 (0.630 x 1.024)	7.5 (0.295)	0.8 (0.032)
	470	ECE-A25G470	16 x 33 (0.630 x 1.299)	7.5 (0.295)	0.8 (0.032)
	1000	ECE-A25G1000	18 x 41 (0.709 x 1.614)	7.5 (0.295)	0.8 (0.032)
	0.47	[ECE-A50GR47]	[8 x 12 (0.315 x 0.472)]	[3.5 (0.138)]	[0.6 (0.024)]
	1	[ECE-A50G1]	[8 x 12 (0.315 x 0.472)]	[3.5 (0.138)]	[0.6 (0.024)]
	2.2	[ECE-A50G2R2]	[8 x 12 (0.315 x 0.472)]	[3.5 (0.138)]	[0.6 (0.024)]
	3.3	ECE-A35G3R3	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	4.7	ECE-A35G4R7	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	10	ECE-A35G10	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
35	22	ECE-A35G22	10 x 12 (0.394 x 0.472)	5 (0.197)	0.6 (0.024)
	33	ECE-A35G33	10 x 16 (.0394 x 0.630)	5 (0.197)	0.6 (0.024)
	47	ECE-A35G47	10 x 21 (0.394 x 0.827)	5 (0.197)	0.6 (0.024)
	100	ECE-A35G100	12.5 x 26 (0.492 x 1.024)	5 (0.197)	0.6 (0.024)
	220	ECE-A35G220	16 x 33 (0.630 x 1.299)	7.5 (0.295)	0.8 (0.032)
	330	ECE-A35G330	18 x 33 (0.709 x 1.299)	7.5 (0.295)	0.8 (0.032)
	470	ECE-A35G470	18 x 41 (0.709 x 1.614)	7.5 (0.295)	0.8 (0.032)
	0.47	ECE-A50GR47	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	1	ECE-A50G1	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	2.2	ECE-A50G2R2	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	3.3	ECE-A50G3R3	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	4.7	ECE-A50G4R7	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
50	10	ECE-A50G10	10 x 12 (0.394 x 0.472)	5 (0.197)	0.6 (0.024)
	22	ECE-A50G22	10 x 16 (0.394 x 0.630)	5 (0.197)	0.6 (0.024)
	33	ECE-A50G33	10 x 21 (0.394 x 0.827)	5 (0.197)	0.6 (0.024)
	47	ECE-A50G47	12.5 x 21 (0.492 x 0.827)	5 (0.197)	0.6 (0.024)
	100	ECE-A50G100	16 x 26 (0.630 x 1.024)	7.5 (0.295)	0.8 (0.032)
	220	ECE-A50G220	18 x 33 (0.709 x 1.299)	7.5 (0.295)	0.8 (0.032)
	330	ECE-A50G330	18 x 41 (0.709 x 1.614)	7.5 (0.295)	0.8 (0.032)
	0.47	ECE-A63GR47	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	1	ECE-A63G1	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	2.2	ECE-A63G2R2	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	3.3	ECE-A63G3R3	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	4.7	ECE-A63G4R7	10 x 12 (0.394 x 0.472)	5 (0.197)	0.6 (0.024)
63	10	ECE-A63G10	10 x 16 (0.394 x 0.630)	5 (0.197)	0.6 (0.024)
	22	ECE-A63G22	10 x 21 (0.394 x 0.827)	5 (0.197)	0.6 (0.024)
	33	ECE-A63G33	12.5 x 26 (0.492 x 1.024)	5 (0.197)	0.6 (0.024)
	47	ECE-A63G47	12.5 x 26 (0.492 x 1.024)	5 (0.197)	0.6 (0.024)
	100	ECE-A63G100	16 x 33 (0.630 x 1.299)	7.5 (0.295)	0.8 (0.032)
	220	ECE-A63G220	18 x 41 (0.709 x 1.614)	7.5 (0.295)	0.8 (0.032)
	0.47	ECE-A100GR47	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	1	ECE-A100G1	8 x 12 (0.315 x 0.472)	3.5 (0.138)	0.6 (0.024)
	2.2	ECE-A100G2R2	10 x 12 (0.394 x 0.472)	5 (0.197)	0.6 (0.024)
	3.3	ECE-A100G3R3	10 x 16 (0.394 x 0.630)	5 (0.197)	0.6 (0.024)
100	4.7	ECE-A100G4R7	10 x 16 (0.394 x 0.630)	5 (0.197)	0.6 (0.024)
	10	ECE-A100G10	12.5 x 21 (0.492 x 0.827)	5 (0.197)	0.6 (0.024)
	22	ECE-A100G22	16 x 26 (0.630 x 1.024)	7.5 (0.295)	0.8 (0.032)
	33	ECE-A100G33	16 x 33 (0.630 x 1.299)	7.5 (0.295)	0.8 (0.032)
	47	ECE-A100G47	18 x 33 (0.709 x 1.614)	7.5 (0.295)	0.8 (0.032)

Standard Products Table

(Axial Lead Type)

Part numbers in the brackets [ ] are description of substitutes. For example, the substitute of a capacitor for 10V and 0.47μF is shown as [ECE-B50GR47], which is common to the part number of the capacitor for 50V, 0.47μF.

Rated Volt. (V, DC)	Cap. (μF)	Part No.	Dimensions mm (inch)	
			Dϕ x L	dϕ
10	0.47	[ECE-B50GR47]	[8 x 21.5 (0.315 x 0.846)]	[0.6 (0.024)]
	1	[ECE-B50G1]	[8 x 21.5 (0.315 x 0.846)]	[0.6 (0.024)]
	2.2	[ECE-B50G2R2]	[8 x 21.5 (0.315 x 0.846)]	[0.6 (0.024)]
	3.3	[ECE-B25G3R3]	[8 x 21.5 (0.315 x 0.846)]	[0.6 (0.024)]
	4.7	[ECE-B25G4R7]	[8 x 21.5 (0.315 x 0.846)]	[0.6 (0.024)]
	10	ECE-B10G10	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	22	ECE-B10G22	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	33	ECE-B10G33	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	47	ECE-B10G47	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	100	ECE-B10G100	10 x 21.5 (0.394 x 0.846)	0.6 (0.024)
	220	ECE-B10G220	10 x 31.5 (0.394 x 1.240)	0.6 (0.024)
	330	ECE-B10G330	12.5 x 33 (0.492 x 1.299)	0.8 (0.032)
	470	ECE-B10G470	16 x 33 (0.630 x 1.299)	0.8 (0.032)
	1000	ECE-B10G1000	16 x 41 (0.630 x 1.614)	0.8 (0.032)
16	0.47	[ECE-B50GR47]	[8 x 21.5 (0.315 x 0.846)]	[0.6 (0.024)]
	1	[ECE-B50G1]	[8 x 21.5 (0.315 x 0.846)]	[0.6 (0.024)]
	2.2	[ECE-B50G2R2]	[8 x 21.5 (0.315 x 0.846)]	[0.6 (0.024)]
	3.3	[ECE-B25G3R3]	[8 x 21.5 (0.315 x 0.846)]	[0.6 (0.024)]
	4.7	[ECE-B25G4R7]	[8 x 21.5 (0.315 x 0.846)]	[0.6 (0.024)]
	10	ECE-B16G10	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	22	ECE-B16G22	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	33	ECE-B16G33	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	47	ECE-B16G47	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	100	ECE-B16G100	10 x 21.5 (0.394 x 0.846)	0.6 (0.024)
	220	ECE-B16G220	10 x 31.5 (0.394 x 1.240)	0.6 (0.024)
	330	ECE-B16G330	12.5 x 33 (0.492 x 1.299)	0.8 (0.032)
	470	ECE-B16G470	16 x 33 (0.630 x 1.299)	0.8 (0.032)
	1000	ECE-B16G1000	18 x 41 (0.709 x 1.614)	0.8 (0.032)
25	0.47	[ECE-B50GR47]	[8 x 21.5 (0.315 x 0.846)]	[0.6 (0.024)]
	1	[ECE-B50G1]	[8 x 21.5 (0.315 x 0.846)]	[0.6 (0.024)]
	2.2	[ECE-B50G2R2]	[8 x 21.5 (0.315 x 0.846)]	[0.6 (0.024)]
	3.3	ECE-B25G3R3	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	4.7	ECE-B25G4R7	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	10	ECE-B25G10	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	22	ECE-B25G22	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	33	ECE-B25G33	10 x 21.5 (0.394 x 0.846)	0.6 (0.024)
	47	ECE-B25G47	10 x 21.5 (0.394 x 0.846)	0.6 (0.024)
	100	ECE-B25G100	10 x 31.5 (0.394 x 1.240)	0.6 (0.024)
	220	ECE-B25G220	12.5 x 33 (0.492 x 1.299)	0.8 (0.032)
	330	ECE-B25G330	16 x 33 (0.630 x 1.299)	0.8 (0.032)
	470	ECE-B25G470	16 x 41 (0.630 x 1.614)	0.8 (0.032)
	1000	ECE-B25G1000	18 x 41 (0.709 x 1.614)	0.8 (0.032)

Rated Volt. (V, DC)	Cap. (μF)	Part No.	Dimensions mm (inch)	
			Dφ x L	dφ
35	0.47	[ECE-B50GR47]	[8 x 21.5 (0.315 x 0.846)]	[0.6 (0.024)]
	1	[ECE-B50G1]	[8 x 21.5 (0.315 x 0.846)]	[0.6 (0.024)]
	2.2	[ECE-B50G2R2]	[8 x 21.5 (0.315 x 0.846)]	[0.6 (0.024)]
	3.3	ECE-B35G3R3	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	4.7	ECE-B35G4R7	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	10	ECE-B35G10	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	22	ECE-B35G22	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	33	ECE-B35G33	10 x 21.5 (0.394 x 0.846)	0.6 (0.024)
	47	ECE-B35G47	10 x 21.5 (0.394 x 0.846)	0.6 (0.024)
	100	ECE-B35G100	12.5 x 33 (0.492 x 1.299)	0.8 (0.032)
	220	ECE-B35G220	16 x 33 (0.630 x 1.299)	0.8 (0.032)
	330	ECE-B35G330	16 x 41 (0.630 x 1.614)	0.8 (0.032)
	470	ECE-B35G470	18 x 41 (0.709 x 1.614)	0.8 (0.032)
50	0.47	ECE-B50GR47	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	1	ECE-B50G1	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	2.2	ECE-B50G2R2	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	3.3	ECE-B50G3R3	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	4.7	ECE-B50G4R7	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	10	ECE-B50G10	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	22	ECE-B50G22	10 x 21.5 (0.394 x 0.846)	0.6 (0.024)
	33	ECE-B50G33	10 x 31.5 (0.394 x 1.240)	0.6 (0.024)
	47	ECE-B50G47	10 x 31.5 (0.394 x 1.240)	0.6 (0.024)
	100	ECE-B50G100	16 x 33 (0.630 x 1.299)	0.8 (0.032)
	220	ECE-B50G220	16 x 41 (0.630 x 1.614)	0.8 (0.032)
	330	ECE-B50G330	18 x 41 (0.709 x 1.614)	0.8 (0.032)
63	0.47	ECE-B63GR47	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	1	ECE-B63G1	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	2.2	ECE-B63G2R2	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	3.3	ECE-B63G3R3	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	4.7	ECE-B63G4R7	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	10	ECE-B63G10	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	22	ECE-B63G22	10 x 21.5 (0.394 x 0.846)	0.6 (0.024)
	33	ECE-B63G33	10 x 31.5 (0.394 x 1.240)	0.6 (0.024)
	47	ECE-B63G47	16 x 41 (0.630 x 1.614)	0.8 (0.032)
100	0.47	ECE-B100GR47	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	1	ECE-B100G1	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	2.2	ECE-B100G2R2	8 x 21.5 (0.315 x 0.846)	0.6 (0.024)
	3.3	ECE-B100G3R3	10 x 21.5 (0.394 x 0.846)	0.6 (0.024)
	4.7	ECE-B100G4R7	10 x 21.5 (0.394 x 0.846)	0.6 (0.024)
	10	ECE-B100G10	10 x 31.5 (0.394 x 1.240)	0.6 (0.024)
	22	ECE-B100G22	16 x 33 (0.630 x 1.299)	0.8 (0.032)
	33	ECE-B100G33	16 x 33 (0.630 x 1.299)	0.8 (0.032)
	47	ECE-B100G47	16 x 41 (0.630 x 1.614)	0.8 (0.032)

Non-Polarized Miniature

When electrolytic capacitors are used in such d-c circuits as to be exposed to reverse or a-c current which makes the polarity unstable, the capacitors may be degraded in performance and capacitance and sometimes may be damaged due to heat generation.

MATSUSHITA non-polarized capacitor is ideal for use in such circuits as mentioned above, exhibiting extremely stable characteristics.

(Note) AC overcurrent, which may damage the non-polarlized capacitors, should not be applied.

Features

- Designed to operate for reverse circuits applications
- Very small in size
- Stable characteristics

Electrical Specifications

1) Operating Temperature Range: -25°C to +85°C
2) Rated Working Voltage Range: 16WV to 50WV
3) Rated Capacitance Range: 1 to 1,000μF
4) Capacitance Tolerance: -10 to +100%
5) Surge Voltage and Tan δ:

Working Volt.	Surge Volt.	Tan δ	(CR-Products)
16	20	0.35	465
25	32	0.3	398
50	63	0.3	398

6) Leakage Current:

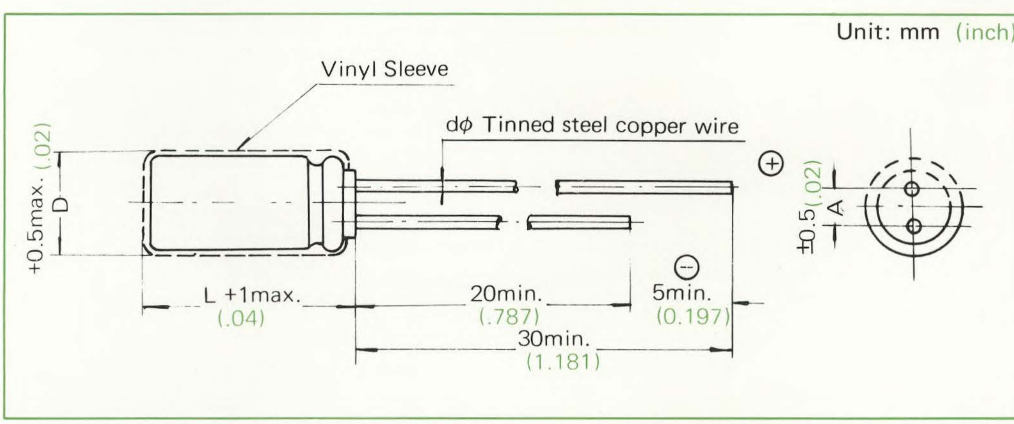
I=0.06CV + 4μA or 10μA whichever is the greater

where I=Max. leakage current (μA)
C=Rated capacitance (μF)
V=Rated voltage (V)

The d-c leakage current shall be measured after 5 minutes application of the rated d-c working voltage at 25°C.

7) Load Life Test: After 500 hours application of d-c working voltage at 85°C capacitor shall meet the following limits;
   - Cap. change: Within ±30% of the initial measured value
   - Tan δ: Less than 200% of the initial specified value
   - Leakage current: Less than the initial specified value
8) Unless otherwise specified, all the specifications are based on MATSUSHITA "New L series"

Dimensions



Standard Products Table

Part numbers in brackets [ ] are description of substitutes. For example, the substitute of a capacitor for 16V and 1μF is shown as [ECE-A50NI], which is common to the part number of the capacitor for 16V, 1μF.

Working Voltage (V, DC)	Capacitance (μF)	Part Number	Dimensions * Dφ x L	mm (inch) A	dφ
16	1	[ECE-A50N1]	5 x 12 (.197 x .472)	2 (.079)	0.5 (.020)
	3.3	ECE-A16N3R3	5 x 12 (.197 x .472)	2 (.079)	0.5 (.020)
	4.7	ECE-A16N4R7	5 x 12 (.197 x .472)	2 (.079)	0.5 (.020)
	10	ECE-A16N10	6.3 x 12 (.248 x .472)	2.5 (.098)	0.6 (.024)
	33	ECE-A16N33	8 x 16 (.315 x .630)	3.5 (.138)	0.6 (.024)
	47	ECE-A16N47	10 x 16 (.394 x .630)	5 (.197)	0.6 (.024)
	100	ECE-A16N100	10 x 21 (.394 x .827)	5 (.197)	0.6 (.024)
	220	ECE-A16N220	12.5 x 26 (.492 x 1.024)	5 (.197)	0.6 (.024)
	330	ECE-A16N330	16 x 26 (.630 x 1.024)	7.5 (.295)	0.8 (.032)
	470	ECE-A16N470	16 x 33 (.630 x 1.299)	7.5 (.295)	0.8 (.032)
	1000	ECE-A16N1000	18 x 41 (.709 x 1.610)	7.5 (.295)	0.8 (.032)
25	1	[ECE-A50N1]	5 x 12 (.197 x .472)	2 (.079)	0.5 (.020)
	3.3	ECE-A25N3R3	6.3 x 12 (.248 x .472)	2.5 (.098)	0.6 (.024)
	4.7	ECE-A25N4R7	6.3 x 12 (.248 x .472)	2.5 (0.98)	0.6 (.024)
	10	ECE-A25N10	8 x 12 (.315 x .472)	3.5 (.138)	0.6 (.024)
	33	ECE-A25N33	10 x 16 (.394 x .630)	5 (.197)	0.6 (.024)
	47	ECE-A25N47	10 x 21 (.394 x .827)	5 (.197)	0.6 (.024)
	100	ECE-A25N100	12.5 x 26 (.492 x 1.024)	5 (.197)	0.6 (.024)
	220	ECE-A25N220	16 x 33 (.630 x 1.299)	7.5 (.295)	0.8 (.032)
50	1	ECE-A50N1	5 x 12 (.197 x .472)	2 (.079)	0.5 (.020)
	3.3	ECE-A50N3R3	8 x 12 (.315 x .472)	3.5 (.138)	0.6 (.024)
	4.7	ECE-A50N4R7	8 x 16 (.315 x .630)	3.5 (.138)	0.6 (.024)
	10	ECE-A50N10	10 x 16 (.394 x .630)	5 (.197)	0.6 (.024)
	33	ECE-A50N33	12.5 x 26 (.492 x 1.024)	5 (.197)	0.6 (.024)
	47	ECE-A50N47	16 x 26 (.630 x 1.024)	7.5 (.295)	0.8 (.032)
	100	ECE-A50N100	16 x 33 (.630 x 1.299)	7.5 (.295)	0.8 (.032)

Note: As to the alphabets in "Dimensions" marked (*), see P. IV-17.

For Cross-Over Network

Non-polarized miniature electrolytic capacitors in low a-c voltage are designed for use in circuits where polality reversal may take place. Their characteristics remain very stable for long time.

These non-polarized electrolytic capacitors are specially designed for use in crossover networks for the finest 2,3 or 4-way high-fidelity speaker system and feature small fluctuation of capacitance and excellent frequency characteristics.

Features

- Excellent frequency characteristics
- Very closed capacitance tolerance (±20%)
- Very stable characteristics

Electrical Specifications

1) Operating Temperature Range: -25°C to +70°C
2) Rated Working Voltage: 50WV.DC
3) Rated Capacitance Range: 1 to 100μF
4) Capacitance Tolerance: ±20%
5) Surge Voltage and Tanδ:

Working Volt.	Surge Volt.	Tan δ	(CR-Product)
50V	60V	0.1	133

(Capacitance and Tanδ shall be measured at 120Hz and 20°C)

6) Leakage Current:

$I=0.04CV + 3\mu A$ max.

where I: Max.leakage current (μA)

C: Rated capacitance (μF)

V: Rated d-c working voltage (V)

leakage current shall be measured after 5 minutes application of the rated d-c working voltage at 25°C

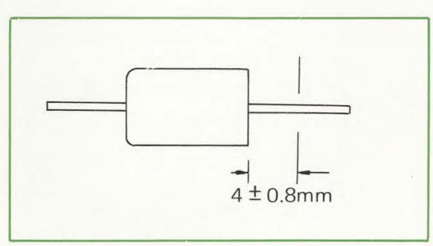
7) Load Life Test: +70°C, 500 hours

The capacitor shall be applied with the rated d-c voltage for 250 hours and accordingly subjected to the test for 250 hours at the opposite polarity. After test, the capacitor shall meet the following limits;

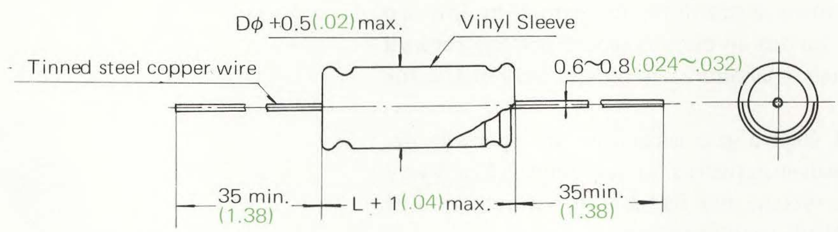
- Cap. change: Within ±20% of the initial measured value
- Tan δ: Less than 200% of the initial specified value
- Leakage current: Less than the initial specified value

Mechanical Specifications

1) Lead Pull Strength: Capacitor leads shall withstand a steady pull of 1.36kg (3 pounds) axially applied for 5 minutes.
2) Lead Bend Strength: Capacitor leads shall withstand the following bend test: Secure the capacitor in a vertical position subjecting the lead to an axial pull of 0.5kg (1.1 lbs). Bend the body of the capacitor to one direction by 90° and back to the original positon, and then 90° to the opposite direction.
3) Standard Marking Item: Rated capacitance, Rated working voltage, Symbol of MATSUSHITA (▲), manufactured date code, Symbol of electrolytic capacitor (CE), "BI-POLAR" MATSUSHITA Part No..
4) Solderability: When the lead wire or terminal to be used being soldered is dipped for 2±0.5 seconds in the methanol or isopropyl alcohol solution (10±2%) of rosin, then is dipped for 2±0.5 seconds in the soldering bath containing the Soft Solder molten at 230±5°C, up to 4±0.8mm, as shown below, the part not soldered shall not exceed 1/4 the portion dipped.



Dimensions



Standard Products Table

Rated Volt. (V, DC)	Cap. (μF)	Part No.	Dimensions mm (inch)	
			Dϕ x L	dϕ
50	1	ECE-B50Y1	10 x 30 (.394 x 1.181)	0.6 (.024)
	1.5	ECE-B50Y1R5	10 x 30 (.394 x 1.181)	0.6 (.024)
	2.2	ECE-B50Y2R2	10 x 30 (.394 x 1.181)	0.6 (.024)
	3.3	ECE-B50Y3R3	12.5 x 40 (.492 x 1.575)	0.8 (.032)
	4.7	ECE-B50Y4R7	12.5 x 40 (.492 x 1.575)	0.8 (.032)
	6.8	ECE-B50Y6R8	12.5 x 40 (.492 x 1.575)	0.8 (.032)
	10	ECE-B50Y10	12.5 x 40 (.492 x 1.575)	0.8 (.032)
	15	ECE-B50Y15	12.5 x 40 (.492 x 1.575)	0.8 (.032)
	22	ECE-B50Y22	12.5 x 40 (.492 x 1.575)	0.8 (.032)
	33	ECE-B50Y33	12.5 x 40 (.492 x 1.575)	0.8 (.032)
	47	ECE-B50Y47	12.5 x 40 (.492 x 1.575)	0.8 (.032)
	68	ECE-B50Y68	16 x 40 (.630 x 1.575)	0.8 (.032)
	100	ECE-B50Y100	18 x 40 (.709 x 1.575)	0.8 (.032)

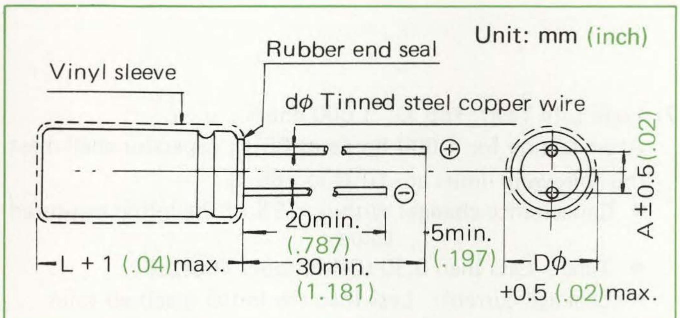
For Horizontal Deflection Correction of TR TV

This is a newly developed non-polarized electrolytic capacitor for use in the horizontal deflection correction circuit of transistorized television sets where the current is high at high frequencies.

Features

- Stable characteristics and long life at 70°C
- Small in size and light in weight
- Long storage (even at 85°C) without great change in characteristics
- Single-ended leads for printed circuit board mounting

Dimensions



Unit: mm (inch)

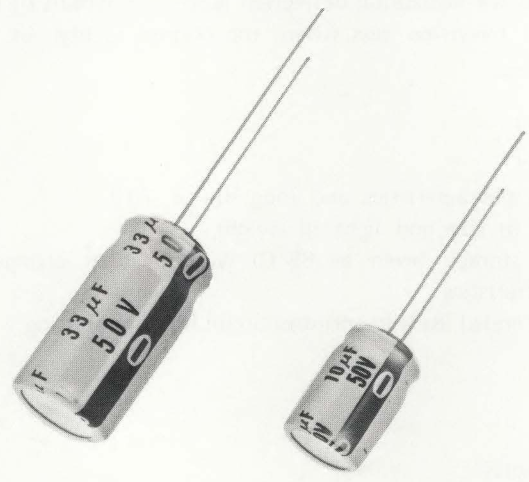
Part No. \ Dimensions	Dϕ	L	d	A
ECE-A25W10Z	18 (.709)	41 (1.614)	0.8 (.032)	7.5 (.295)
ECE-A25W6R5Z	16.5 (.650)	41 (1.614)	0.8 (.032)	7.5 (.295)
ECE-A25W3R5Z	16.5 (.650)	33 (1.299)	0.8 (.032)	7.5 (.295)

Electrical Specifications

Item	ECE-A25W10Z	ECE-A25W6R5Z	ECE-A25W3R5Z
1) Capacitance (μF)	10 (120 Hz)	6.5(120Hz)	3.5(120Hz)
2) Capacitance Tolerance (%)	±20	±20	±20
3) Rated Voltage (VAC)	25	25	25
4) Surge Voltage (VAC)	32	32	32
5) Leakage Current (mA)	0.1max. (DC25V)	0.1 max. (DC25V)	0.05 max. (DC25V)
6) Tan δ	0.038max. (120Hz)	0.038 max. (120Hz)	0.038 max. (120Hz)
7) Operating Temperature Range	-25°C ~ +70°C		
8) Temperature Characteristics	Capacitance change for the values at -25°C to +70°C shall not exceed ±10%.		
9) Load Life Test	After testing for 500 hours at +85°C with 12V DC over a ripple current of 15.75KHz and 6 Amp. (p-p), the characteristics at room temperature meet the following: ■ Cap. Change: ±15% max. of initial reading at 20°C ■ Tan δ: 200% max. of the limit of 6) ■ Leakage Current: bellow the limit of 5)		
10) Shelf Life Test	After testing for 500 hours at +85°C without voltage applied, capacitors shall meet the limits specified in the Load Life Test 9).		

For Vertical Time Constant Circuit of TR TV

In the vertical oscillator circuit of transistorized television sets, expensive tantalum electrolytic capacitors have been exclusively employed. It is because with conventional aluminum electrolytic capacitors, their characteristics change directly appears in the picture. However, our newly developed electrolytic capacitors for time-constant circuit can replace the expensive tantalum capacitors and realize excellent performance and high reliability with reasonable price.



Features

- High performance and long life over wide temperature range from -40°C to +85°C
- Very little change in characteristics even after load life test at 85°C

Electrical Specifications

1) Operating Temperature Range: -40°C to +85°C
2) Rated Working Voltage: 50V
3) Rated Capacitance Range: 1 to 47μF
4) Capacitance Tolorance: ±20%
   (±15% capacitance tolerance is also available upon request)
5) Surge Voltage and Tanδ:

Working Volt.	Surge Volt.	Tan δ	(CR-Product)
50	63	0.075	100

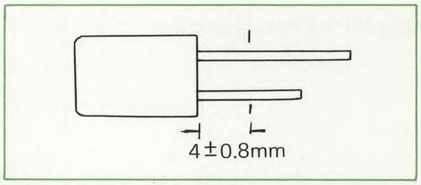
6) Leakage Current: I=0.02CV + 3μA max.
7) Load Life Test: +85°C, 1,000 hours
   After testing for 1,000 hours at 85°C, capacitor shall meet the following limits at -10°C to +85°C.
   - Capacitance change: Within ±15% of the initial measured value
   - Tanδ: Less than 0.30 (CR-Product 400ΩμF)
   - Leakage current: Less than the initial specified value
8) Shelf Life Test: +85°C, 1,000 hours
   After testing for 1,000 hours at +85°C, capacitors shall meet the limits specified in Load Life Test (7)

Mechanical Specifications

1) Lead Pull Strength: Capacitor leads shall withstand the steady pull specified below axially applied for 5 minutes.
2) Lead Bend Strength: Capacitor leads shall withstand the following bend test: Secure the capacitor in the vertical position subjecting the lead to an axial pull specified below. Bend the body of the capacitor to one direction by 90° and back to the original position, and then 90° to the opposite direction.

Diameter of lead wire	Static load
0.5mm (0.020") or less	0.25kg (0.55 lb)
0.6mm (0.024") to 0.8mm (0.032")	0.5kg (1.1 lbs)

3) Solderability: When the lead wire or terminal to be used being soldered is dipped for 2±0.5 seconds in the methanol or isopropyl alcohol solution (10±2%) of rosin, then is dipped for 2±0.5 seconds in the soldering bath containing the soft solder molten at 230±5°C, up to 4±0.8mm, as shown below the part not soldered shall not exceed 1/4 the portion dipped.

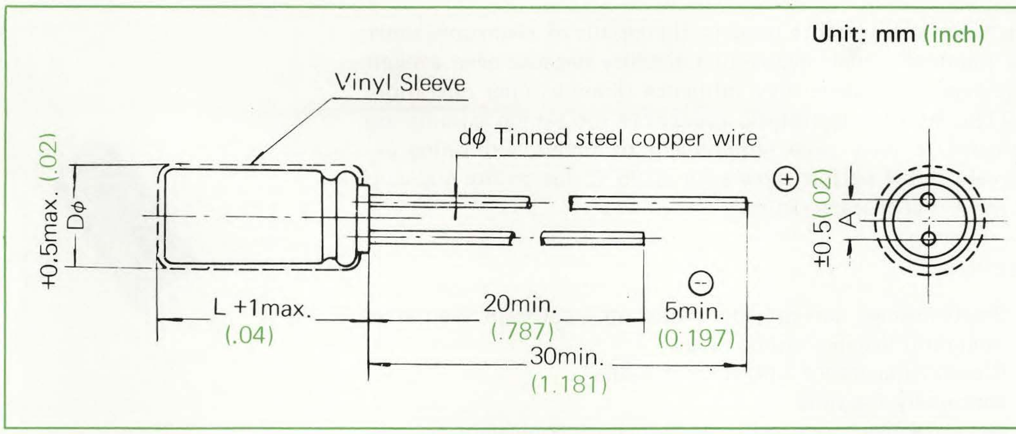


4) Standard Marking Item: Rated capacitance, Rated working voltage, Symbol of MATSUSHITA (▲), Manufactured date code, Symbol of electrolytic capacitor (CE), Polarity.

Application Examples

- Vertical time constant of transistor TV sets
- Convergence circuit of TR color TV set
- Other time constant circuit

Dimensions



Standard Products Table

Rated Volt. (VDC)	Cap. (μF)	Part No.	Dimension mm (inch)		
			Dϕ x L	A	dϕ
50	1	ECE-A50B1I	8 x 16 (.315 x .630)	3.5 (.138)	0.6 (.024)
	1.5	ECE-A50B1R5I	8 x 16 (.315 x .630)	3.5 (.138)	0.6 (.024)
	2.2	ECE-A50B2R2I	8 x 16 (.315 x .630)	3.5 (.138)	0.6 (.024)
	3.3	ECE-A50B3R3I	8 x 16 (.315 x .630)	3.5 (.138)	0.6 (.024)
	4.7	ECE-A50B4R7I	10 x 16 (.394 x .630)	5 (.197)	0.6 (.024)
	10	ECE-A50B10I	10 x 16 (.394 x .630)	5 (.197)	0.6 (.024)
	22	ECE-A50B22I	12.5 x 21 (.492 x .827)	5 (.197)	0.6 (.024)
	33	ECE-A50B33I	12.5 x 26 (.492 x 1.024)	5 (.197)	0.6 (.024)
	47	ECE-A50B47I	16 x 26 (.630 x 1.024)	7.5 (.295)	0.8 (.032)

For Timing Circuits

Electrolytic capacitors used in the circuit of electronic timer are required a high degree of reliability because even a slight characteristic change may influence directly timer operation. MATSUSHITA electrolytic capacitors for timing circuits are designed to meet such requirement of timers, exhibiting extremely stable performance even at 85°C due to the grade-up of the initial characteristics.

Features

- Small leakage current and stable time constant even after long-term leaving without load
- Closed capacitance tolerance of ±20%
- Extremely long life
- At attractive price with performance equivalent to tantalum electrolytic capacitors

Electrical Specifications

1) Operating Temperature Range: -25°C to +85°C
2) Rated Working Voltage: 10WV,DC
3) Rated Capacitance Range: 3.3 to 2,200μF
4) Capacitance Tolerance: ±20%
5) Surge Voltage and Tan δ:

Working Volt.	Surge Volt.	Tan δ	(CR-Product)
10V	13 V	0.2	266ΩμF

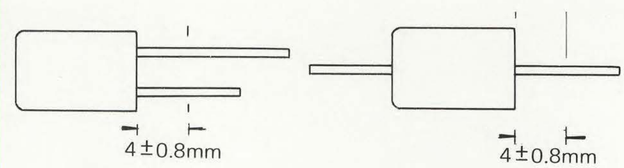
6) Leakage Current : I=0.001CV + 2μA max.
   Leakage current shall be measured after 5-minute application of the rated d-c working voltage.
7) Charge/Discharge Test: After testing of charge and discharge for 100,000 cycles at +85°C, the capacitor shall meet the initial specified value.
8) Load Life Test: +85°C, 1,000 hours
   After testing for 1,000 hours at 85°C, the capacitor shall meet the following limits;
   - Capacitance change: Within ±10% of the initial measured value
   - Tan δ: Less than 200% of the initial specified value
   - Leakage current: Less than the initial specified value
9) Shelf Life Test: +85°C 1,000 hours
   After testing for 1,000 hours at +85°C, the capacitor shall meet the limits specified in the Load Life Test (8) except leakage current which shall be less than 200% of the initial specified value.

Mechanical Specifications

1) Lead Pull Strength: Capacitor leads shall withstand the steady pull specified below axially applied for 5 minutes.
2) Lead Bend Strength: Capacitor leads shall withstand the following bend test: Secure the capacitor in the vertical position subjecting the lead to an axial pull specified below. Bend the body of the capacitor to one direction by 90° and back to the original position, and then 90° to the opposite direction.

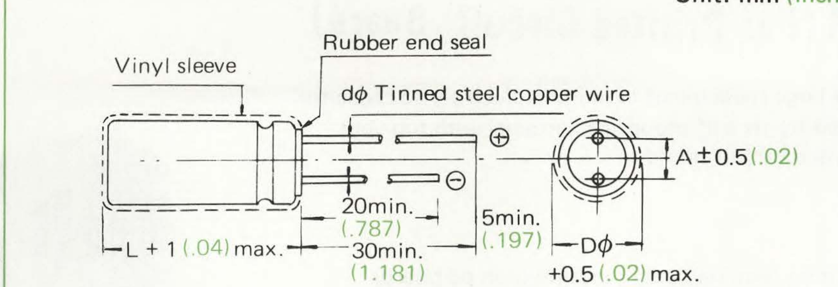
Diameter of lead wire	Static load
0.5mm (0.020") or less	0.25kg (0.55 lb)
0.6mm (0.024") to 0.8mm (0.032")	0.5kg (1.1 lbs)

3) Solderability: When the lead wire or terminal to be used being soldered is dipped for 2±0.5 seconds in the methanol or isopropyl alcohol solution (10±2%) of rosin, then is dipped in the soldering bath containing the soft solder molten at 230±5°C, up to 4±0.8mm, as shown below, the part not soldered shall not exceed 1/4 the portion dipped.



4) Standard Marking Item: Rated capacitance, Rated working voltage, Symbol of MATSUSHITA (▲), Manufactured date code, Symbol of electrolytic capacitor (CE), Polarity.

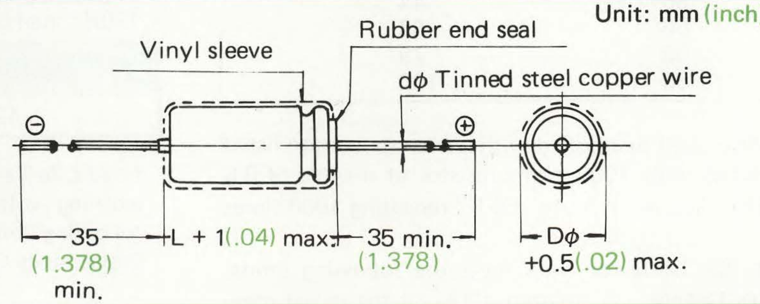
Dimensions (Single-ended Lead Type)



Standard Products Table

Rated Volt.(V, DC)	Cap. (μF)	Part No.	Dimensions mm (inch)		
			Dϕ x L	A	dϕ
10	3.3	ECE-A10V3R3T	6.3 x 12 (.248 x .472)	2.5 (.098)	0.6 (.024)
	4.7	ECE-A10V4R7T	6.3 x 12 (.248 x .472)	2.5 (.098)	0.6 (.C24)
	10	ECE-A10V10T	6.3 x 12 (.248 x .472)	2.5 (.098)	0.6 (.024)
	33	ECE-A10V33T	8 x 12 (.315 x .472)	3.5 (.138)	0.6 (.024)
	47	ECE-A10V47T	8 x 12 (.315 x .472)	3.5 (.138)	0.6 (.024)
	100	ECE-A10V100T	10 x 16 (.394 x .630)	5 (.197)	0.6 (.024)
	220	ECE-A10V220T	10 x 21 (.394 x .827)	5 (.197)	0.6 (.024)
	330	ECE-A10V330T	12.5 x 26 (.492 x 1.024)	5 (.197)	0.6 (.024)
	470	ECE-A10V470T	12.5 x 26 (.492 x 1.024)	5 (.197)	0.6 (.024)
	1000	ECE-A10V1000T	16 x 33 (.630 x 1.229)	7.5 (.295)	0.8 (.032)
	2200	ECE-A10V2200T	18 x 41 (.709 x 1.614)	7.5 (.295)	0.8 (.032)

Dimensions (Axial Lead Type)



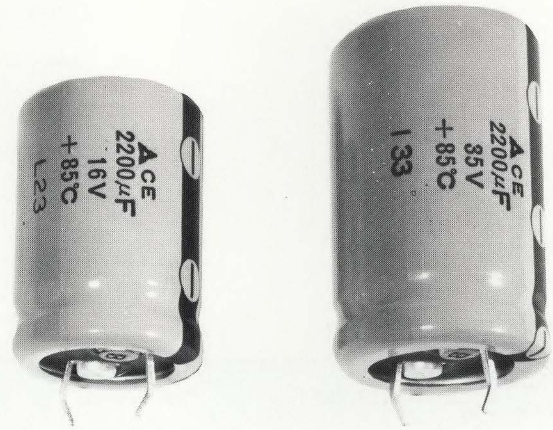
Standard Products Table

Rated Volt. (V, DC)	Cap. (μF)	Part No.	Dimensions mm (inch)	
			Dϕ x L	dϕ
10	47	ECE-B10V47T	8 x 21.5 (.315 x .846)	0.6 (.024)
	100	ECE-B10V100T	10 x 21.5 (.394 x .846)	0.6 (.024)
	220	ECE-B10V220T	10 x 26.5 (.394 x 1.043)	0.6 (.024)
	330	ECE-B10V330T	10 x 31.5 (.394 x 1.240)	0.6 (.024)
	470	ECE-B10V470T	12.5 x 33 (.492 x 1.299)	0.8 (.032)
	1000	ECE-B10V1000T	16 x 33 (.630 x 1.299)	0.8 (.032)
	2200	ECE-B10V2200T	18. x 41 (.709 x 1.614)	0.8 (.032)

LARGE ALUMINUM ELECTROLYTICS

Type TS (For Printed Circuit Board)

TS series is a large capacitance aluminum electrolytic capacitor being featured by its self mounting terminal with top-vent ideal for printed circuit board



Features

- Self mounting terminal, easily mounted on pc boards
- Safety ensured by solid top-vent construction
- Small in size, height 40mm (1.575") from board
- Long life of 1,000 hours at 85°C
- Wide operating temperature range from -40 to +85°C

Electrical Specifications

1. Operating Temperature Range: -40 to +85°C
2. Rated DC Working Voltage Range: 16 to 80 WV DC
3. Rated Capacitance Range: 470 to 4700μF
4. Capacitance Tolerance: -10 to +50%
5. DC Leakage Current: I = 0.03CV (μA) max.
   D-c leakage current shall be measured after 5-minute application of the rated d-c working voltage at 25°C.
   where, I: Maximum d-c leakage current in μA
   C: Rated capacitance in μF
   V: Rated d-c working voltage in V
6. Surge Voltage Test:

Working Voltage	Surge Voltage
16V	20V
25	32
35	44
50	63
63	79
80	100

The capacitor shall be applied with the surge voltage listed above in series with 1000 ohms resistor at a cycle of 0.5 minute "ON" and 4.5 minute "OFF" repeating 1000 times at 25°C.
After test, the capacitor shall meet the following limits.
Capacitance Change ....Within ±20% of the initial measured value.
Tanδ .... Less than 200% of limits per 7.
DC Leakage Current ....Less than the limits per 5.

7. Tanδ:

Working Voltage (V DC)	Tan δ	
	CV≦100000	CV>10000
16	0.35	0.50
25	0.30	0.50
35	0.30	0.40
50	0.30	0.35
63	0.30	0.30
80	0.30	0.30

Capacitance and Tanδ shall be measured at 120Hz, 25°C.

8. Low Temperature Stability:
   Impedance ratio between low temperature and 20°C at 120Hz shall be within the following maximum value.

-40°C/+20°C	-25°C/+20°C
12	3

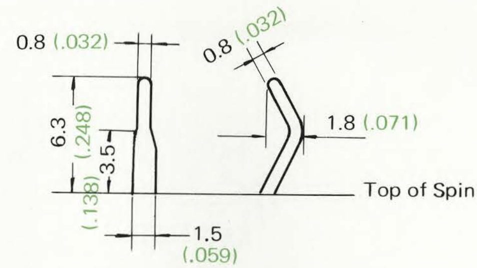
9. Load Life Test: After 1000 hour application of the rated working voltage at 85°C, the capacitor shall meet the following limits.
   Capacitance Change ....Within ±20% of the initial measured value
   Tan δ .... Less than 150% of the limits per 7.
   DC Leakage Current ....Less than the limits per 5.

Mechanical Specifications

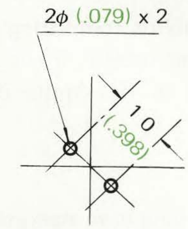
1. Solderability: When the terminal to be used being soldered is dipped for 2±0.5 seconds in the methanol or isopropyl alcohol solution (10±2%) of rosin, then is dipped for 2±0.5 seconds in the soldering bath containing the soft solder molten at 230±5°C, the part not soldered shall not exceed 1/4 the portion dipped.
2. Marking Items:
   a. Rated capacitance
   b. Rated d-c working voltage
   c. Symbol of Matsushita (▲)
   d. Polarity (negative bar)
   e. Maximum operating temperature
   f. Manufactured date code

Terminal Dimensions

Unit: mm (inch)

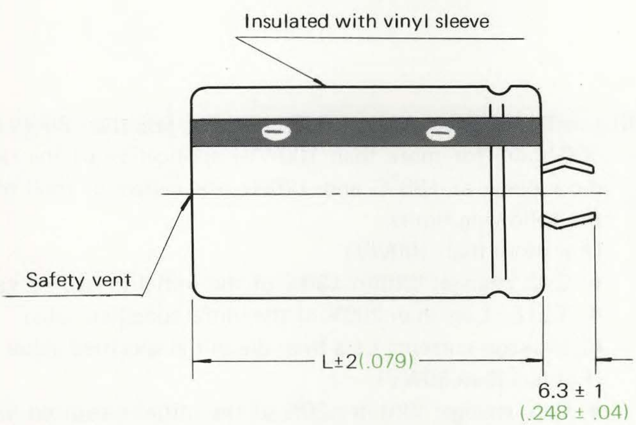


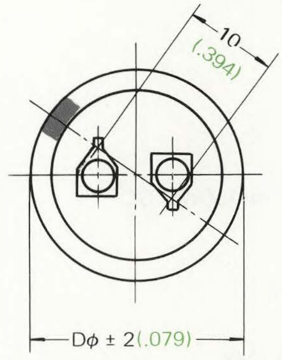
(PC board mounting holes)

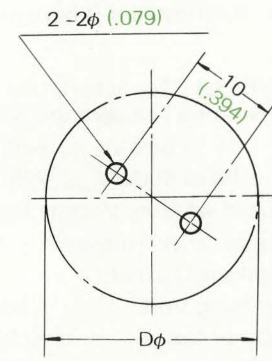


Dimensions

Unit: mm (inch)







PC Board Mounting Holes

Standard Products

Working Voltage (V, DC)	Capacitance (μF)	Part Number	Dimensions mm (inch) Dφ x L	Max. Ripple Current (mA) at 120Hz 20°C
16	2200	ECE-T16R2200S	22.5 x 32 (.886 x 1.260)	1000
	3300	ECE-T16R3300S	25.5 x 40 (1.004 x 1.575)	1300
	4700	ECE-T16R4700S	30.5 x 40 (1.200 x 1.575)	1500
25	1000	ECE-T25R1000S	22.5 x 32 (.886 x 1.260)	890
	2200	ECE-T25R2200S	25.5 x 40 (1.004 x 1.575)	1300
	3300	ECE-T25R3300S	30.5 x 40 (1.200 x 1.575)	1500
35	1000	ECE-T35R1000S	22.5 x 32 (.886 x 1.260)	1000
	2200	ECE-T35R2200S	25.5 x 40 (1.004 x 1.575)	1500
	3300	ECE-T35R3300S	30.5 x 40 (1.200 x 1.575)	1800
50	470	ECE-T50R 470S	22.5 x 32 (.886 x 1.260)	870
	1000	ECE-T50R1000S	25.5 x 40 (1.004 x 1.575)	1300
	2200	ECE-T50R2200S	30.5 x 40 (1.200 x 1.575)	1900
63	470	ECE-T63R 470S	22.5 x 32 (.886 x 1.260)	930
	1000	ECE-T63R1000S	25.5 x 40 (1.004 x 1.575)	1400
80	470	ECE-T80R 470S	25.5 x 40 (1.004 x 1.575)	1000
	1000	ECE-T80R1000S	30.5 x 40 (1.200 x 1.575)	1500

Type M

Type M is a large electrolytic capacitor comprising a terminal plate of compound of bakelite and rubber proving excellent sealing and high reliability due to its simple design and construction.

Features

- Stable characteristics over a long-term operation even at frequent charge & discharge in on-off switch operation of equipment due to etched aluminum foil applied to the all cathode elements
- Lead terminals caulked and welded, thereby exhibiting excellent connection against heat change
- Very small tanδ and excellent temperature characteristics due to newly developed electrolyte
- Wire wrapping terminals available upon request (Type E)
- A safety vent is built in all the types.

Electrical Characteristics

1) Operating Temperature Range:
   16 to 63WV ..... -40°C to +85°C
   100 to 450WV ..... -25°C to +85°C
2) Rated working Voltage Range: 16WV to 450WV.DC
3) Capacitance Tolerance: -10 to +50%
4) Leakage Current:
   Working Volt. Leakage Current
   80V or less ············ I=0.03CVµA max.
   100V or more·········· I=0.06CV +200µA max.
   Leakage current shall be measured after 5-minute application of the rated d-c voltage at 25°C.
   In the formula: CV=Rated Capacitance x Rated Working Voltage

5) Load Life Test: After 1,000-hour (for less than 80WV) or 500-hour (for more than 100WV) application of the rated d-c voltage at +85°C and 120Hz, the capacitor shall meet the following limits;
   (For more than 100WV)
   - Cap. change: Within ±30% of the initial measured value
   - Tan δ : Less than 200% of the initial specified value
   - Leakage current: Less than the initial specified value

   (For less than 80WV)
   - Cap. change: Within ±20% of the initial measured value
   - Tan δ: Less than 150% of the initial specified value
   - Leakage current: Less than the initial specified value

5) Surge Voltage and Tan δ

Working Volt.	Surge Volt.	CV≦100,000		100,000<CV≦220,000		220,000 < CV	
		Tan δ	(CR-Product)	Tan δ	(CR-Product)	Tan δ	(CR-Product)
16V	20V	0.35	464ΩµF	0.50	665ΩµF	—	—
25	32	0.30	398	0.50	665	0.80	1061
35	44	0.30	398	0.40	530	0.60	796
50	63	0.30	398	0.35	464	0.50	665
63	79	0.30	398	0.30	398	0.45	597
80	100	0.25	332	0.30	398	0.40	530
100	125	0.20	265	0.25	332	—	—
160	200	0.20	265	0.25	332	—	—
250	300	0.20	265	0.25	332	—	—
315	365	0.20	265	0.25	332	—	—
350	400	0.30	398	—	—	—	—
450	500	0.30	398	—	—	—	—

Mechanical Specifications

1) Solderability Test: When the terminal to be used for being soldered is dipped for 2±0.5 seconds in the methanol or isopropyl alcohol solution (10±2%) of rosin, then is dipped for 2±0.5 seconds in the soldering bath containing the soft solder molten at 230±5°C, up to 4±0.8mm, the part not soldered shall not exceed 1/4 the portion dipped.

2) Standard Marking Item: Rated capacitance, Rated working voltage, Symbol of MATSUSHITA (▲), Manufactured date code, Symbol of electrolytic capacitor (CE), MATSUSHITA Part No., "+85°C", etc.

Standard Products Table

Rated Volt (V, DC)	Cap. (μF)	Part No.	Leakage Current max. (mA)	Tanδ max.	Dimensions mm (inch) Dϕ x L
16	3300	ECE-M16R3300□	1.58	0.35	25 x 40 (.984 x 1.57)
	4700	4700□	2.26	0.35	25 x 50 (.984 x 1.97)
	6800	6800□	3.26	0.50	25 x 63 (.984 x 2.48)
	10000	103□	4.80	0.50	35 x 50 (1.38 x 1.97)
25	2200	ECE-M25R2200□	1.65	0.30	25 x 50 (.984 x 1.97)
	3300	3300□	2.48	0.30	25 x 50 (.984 x 1.97)
	4700	4700□	3.53	0.50	35 x 50 (1.38 x 1.97)
	6800	6800□	5.00	0.50	35 x 50 (1.38 x 1.97)
	10000	103□	5.00	0.80	35 x 60 (1.38 x 2.36)
35	1000	ECE-M35R1000□	1.05	0.30	25 x 40 (.984 x 1.57)
	2200	2200□	2.31	0.30	25 x 50 (.984 x 1.97)
	3300	3300□	3.47	0.40	35 x 50 (1.38 x 1.97)
	4700	4700□	4.94	0.40	35 x 50 (1.38 x 1.97)
	6800	6800□	5.00	0.60	35 x 60 (1.38 x 2.36)
	10000	103□	5.00	0.60	35 x 80 (1.38 x 3.15)
50	1000	ECE-M50R1000□	1.50	0.30	25 x 50 (.984 x 1.97)
	2200	2200□	3.30	0.35	35 x 50 (1.38 x 1.97)
	3300	3300□	4.95	0.35	35 x 60 (1.38 x 2.36)
	4700	4700□	5.00	0.50	35 x 60 (1.38 x 2.36)
	6800	6800□	5.00	0.50	35 x 80 (1.38 x 3.15)
63	1000	ECE-M63R1000□	1.89	0.30	25 x 50 (.984 x 1.97)
	2200	2200□	4.16	0.30	35 x 50 (1.38 x 1.97)
	3300	3300□	5.00	0.30	35 x 60 (1.38 x 2.36)
	4700	4700□	5.00	0.45	35 x 80 (1.38 x 3.15)
80	470	ECE-M80R 470□	1.13	0.25	25 x 50 (.984 x 1.97)
	1000	1000□	2.40	0.25	35 x 50 (1.38 x 1.97)
	2200	2200□	5.00	0.30	35 x 60 (1.38 x 2.36)
	3300	3300□	5.00	0.40	35 x 80 (1.38 x 3.15)
100	330	ECE-M100V330□	2.18	0.20	25 x 50 (.984 x 1.97)
	470	470□	3.02	0.20	25 x 80 (.984 x 3.15)
	680	680□	4.28	0.20	35 x 60 (1.38 x 2.36)
	1000	102□	6.20	0.20	35 x 80 (1.38 x 3.15)
160	100	ECE-M160V100□	1.16	0.20	25 x 40 (.984 x 1.57)
	220	220□	2.31	0.20	25 x 50 (.984 x 1.97)
	330	330□	3.37	0.20	35 x 50 (1.38 x 1.97)
	470	470□	4.71	0.20	35 x 50 (1.38 x 1.97)
	680	680□	6.73	0.25	35 x 80 (1.38 x 3.15)
	1000	102□	9.80	0.25	35 x 100 (1.38 x 3.94)

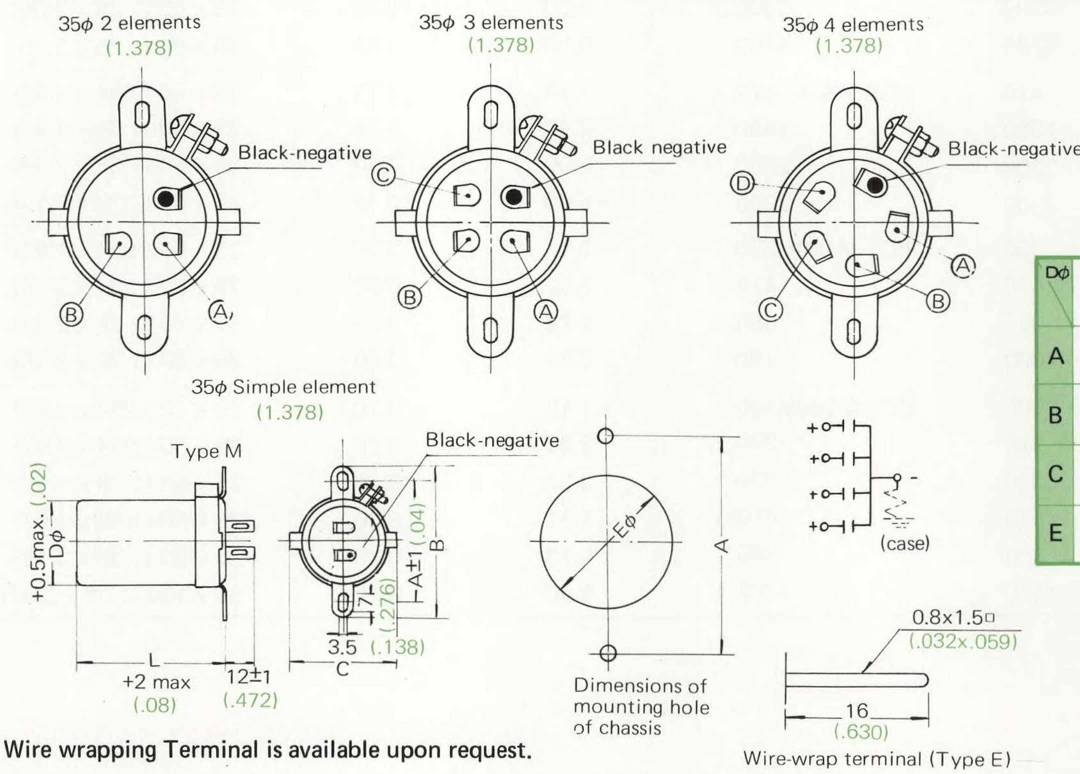
Standard Products Table

Rated Volt. (V, DC)	Cap. (μF)	Part No.	Leakage Current (mA)	Tanδ	Dimensions mm (inch) Dφ x L
200	100	ECE-M200V100□	1.40	0.20	25 x 50 (.984 x 1.97)
	220	220□	2.84	0.20	25 x 63 (.984 x 2.48)
	330	330□	4.16	0.20	35 x 50 (1.38 x 2.36)
	470	470□	5.84	0.20	35 x 60 (1.38 x 3.15)
250	100	ECE-M250V100□	1.70	0.20	25 x 50 (.984 x 1.97)
	220	220□	3.50	0.20	35 x 50 (1.38 x 1.97)
	330	330□	5.15	0.20	35 x 60 (1.38 x 2.36)
	470	470□	7.25	0.25	35 x 80((1.38 x 3.15)
315	100	ECE-M315V100□	2.09	0.20	25 x 63 (.984 x 2.48)
	220	220□	4.36	0.20	35 x 60 (1.38 x 2.36)
	330	330□	6.44	0.25	35 x 80 (1.38 x 3.15)
350	47	ECE-M350V 47□	1.19	0.25	25 x 50 (.984 x 1.97)
	100	100□	2.30	0.25	35 x 50 (1.38 x 1.97)
	220	220□	4.82	0.25	35 x 80 (1.38 x 3.15)
450	47	ECE-M450V 47□	1.47	0.25	25 x 63 (.984 x 2.48)
	100	100□	2.90	0.25	35 x 60 (1.38 x 2.36)

Notes:
- Vinyl sleeves are available on request.
- When can is covered with vinyl sleeve, Dφ + 0.5(.02") mm, L + 1.0 (.039")mm
- Multielement electrolytics are available upon request.
  35φ: Singles, Duals, Triples and Quads. 25φ: Singles and Duals
- Dimension "L" is subject to change for miniaturization without notice.
- Flame-retardant material is used for prong bases.
- Last words of part no. which indicated by □ is as follows: A: w/o sleeve w/o mounting ring
  B: w/ sleeve w/o mounting ring
  D: w/o sleeve w/ mounting ring
  E: w/ sleeve w/ mounting ring

Dimensions

Unit: mm (inch)



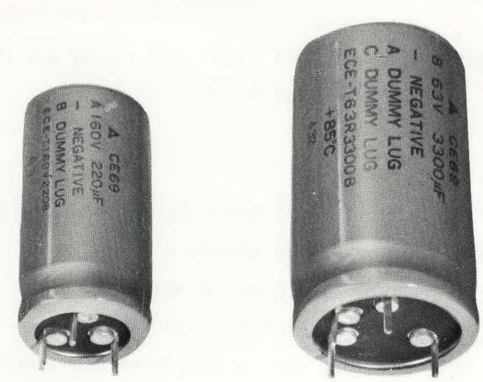
Dφ	25 (0.984)	35 (1.378)
A	38 (1.496)	48 (1.890)
B	50 (1.969)	60 (2.362)
C	35 (1.378)	45 (1.772)
E	21 (0.827)	30 (1.181)

* Wire wrapping Terminal is available upon request.

Type T

Type T is a large electrolytic capacitor developed for printed circuit board and ideal for miniaturization and cost reduction of equipment.

Special note: Standard size chart, the rating and characteristics are based on Type M (page IV-28) except the terminal construction.



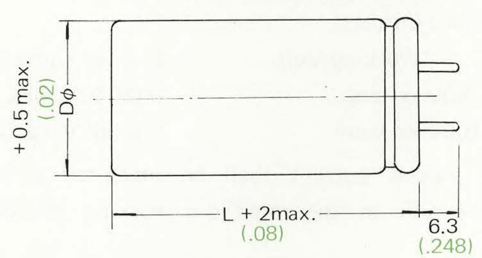
Features

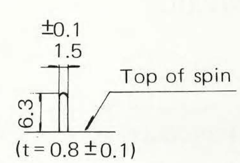
- Stable characteristics over a long-term operation even at frequent charge & discharge in on-off switch operation of equipment due to etched aluminum foil applied to the all cathode elements
- Lead terminals calked and welded, thereby exhibiting excellent connection against heat change
- Terminals soldered with eutectic-solder for excellent solderability
- Contact mounting on p-c-b possible due to terminals improvement
- A safety vent is built in all the types.

Dimensions

Unit: mm (inch)

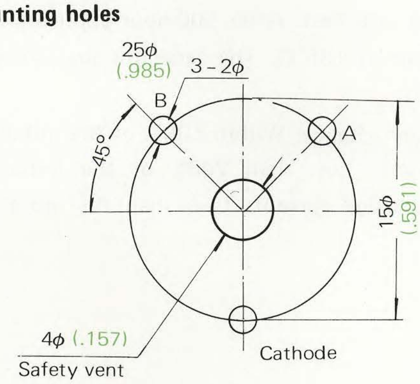
With vinyl sleeve: Dϕ+0.5, L+1.0

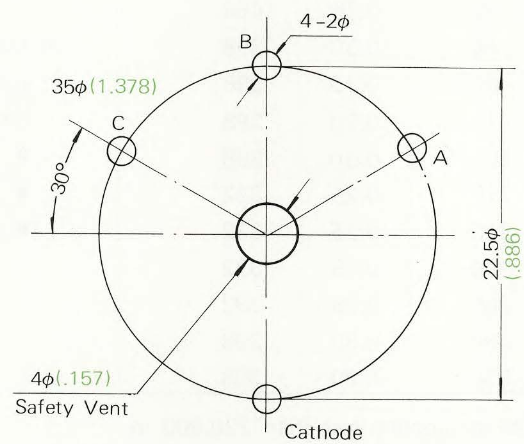




Elements Number \ Case diameter	25ϕ (.985)	35ϕ (1.378)
1	A	B
2	A, B	A, C
3	——	A,B,C

PC board mounting holes

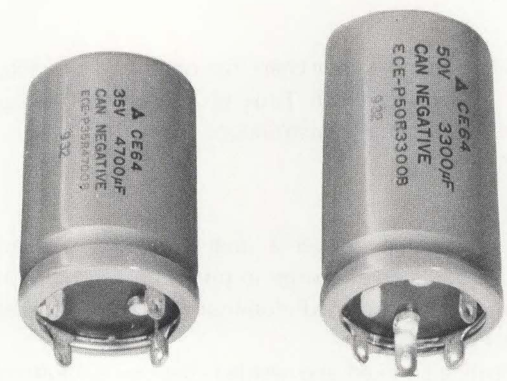




Type KP(Prong Type)

KP-Type is a prong lug terminal electrolytic capacitor enclosed in an aluminum case and recomemendable for use mounting chassis without use of mounting band.

Special note: Standard size chart and rating are based on Type M (page IV-28)



Features

- Prong type ideal for use when aluminum case should be kept apart from mounting chassis.
- (−) terminal is one of the prong terminals.
- Wire-wrapping terminal available upon request
- Stable characteristics over a long-term operation even at frequent charge & discharge in on-off switch operation of equipment due to etched aluminum foil applied to the all cathode elements.
  A safety vent is built in all the types.
- Maltiple section type is available up to 3 section for 35mm (1.38″) case diameter.

Electrical Specifications

1) Operating Temperature Range: -25°C to +85°C
2) Rated Working Voltage Range: 16WV to 450WV.DC
3) Capacitance Tolerance: -10 to +100%
4) Surge Voltage and Tanδ:

Working Volt.	Surge Volt.	Tanδ	(CR-Product)
16 V	20 V	0.35	464ΩμF
25	32	0.35	464
35	44	0.30	398
50	63	0.30	398
63	79	0.30	398
80	100	0.30	398
100	125	0.25	332
160	200	0.25	332
250	300	0.25	332
315	365	0.25	332
350	400	0.30	398
450	500	0.30	398

The value of tan δ shall be applied less than 220,000 in CV-Product (rated cap. x rated voltage).

5) Leakage Current:

Working Volt.		Leakage Current (μA)
80V or less	....	I=0.04CV max.
100V or more	....	I=0.06CV +200 max.

D-c leakage current shall be measured after 5-minute application of the rated d-c working voltage at 25°C.

6) Load Life Test: After 500-hour application of d-c working voltage at +85°C. The capacitor shall meet the following limits;
- Cap. change: Within ±30% of the initial measured value
- Tanδ : Less than 200% of the initial specified value
- Leakage current: Less than the initial specified value

Mechanical Specifications

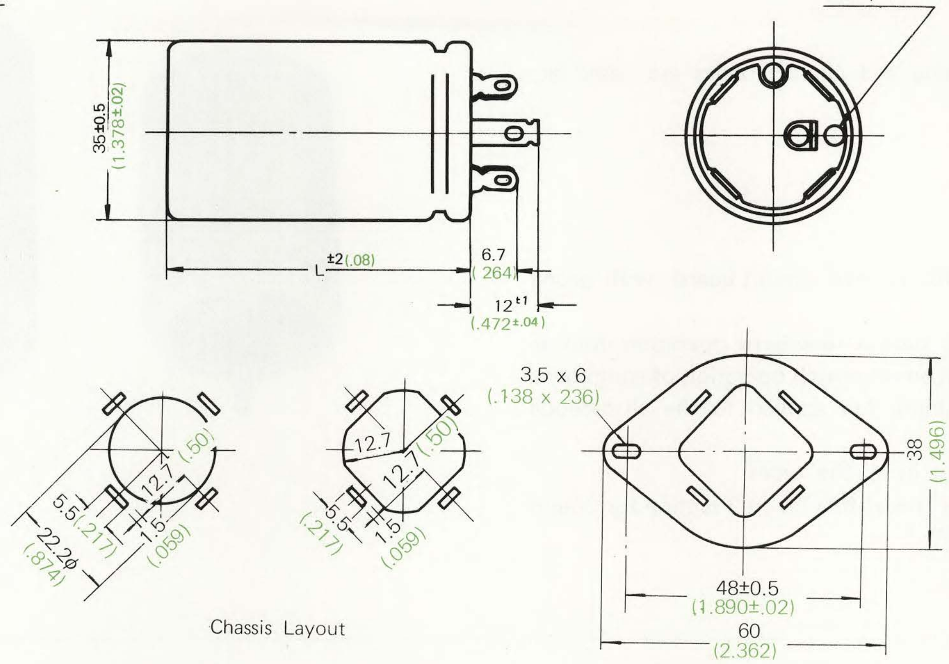
1) Solderability: When the terminal to be used being soldered is dipped for 2±0.5 seconds in the methanol or isopropyl alcohol solution (10±2%) of rosin, then dipped for 2±0.5 seconds in the soldering bath containing the soft solder molten at 230±5°C, up to 4±0.8mm, the part not soldered shall not exceed 1/4 the portion dipped.

2) Standard Marking Item: Rated capacitance, Rated working voltage, Symbol of MATSUSHITA(▲), Symbol of electrolytic capacitor (CE), Part No., Date code.

Dimensions

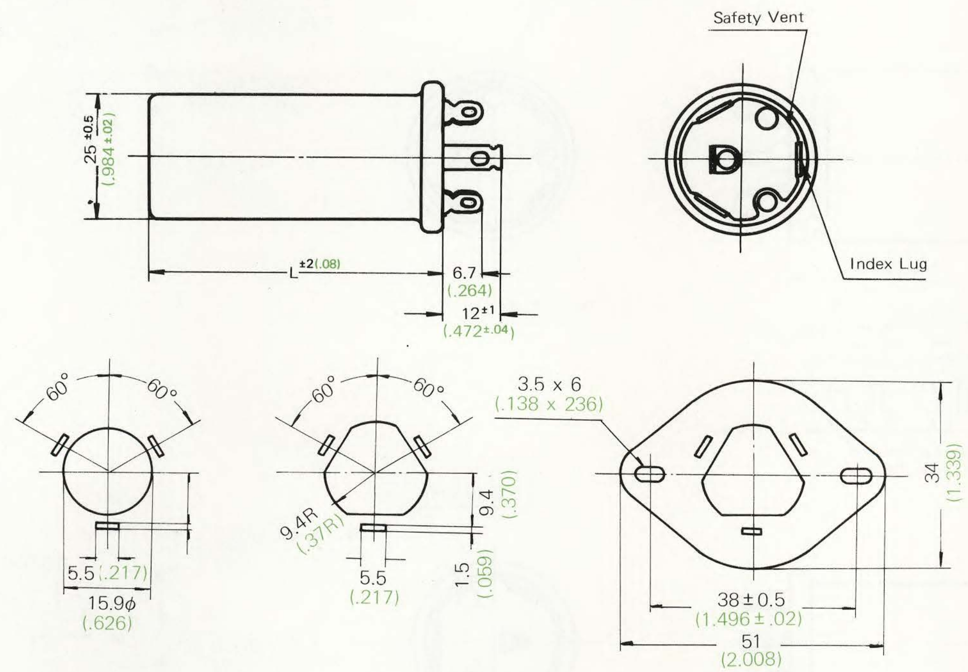
Unit: mm (inch)

35ϕ (1.378)



Chassis Layout

25ϕ (.984)

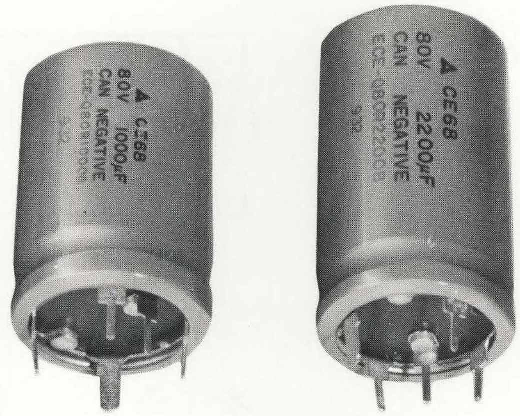


Notes:
- Vinyl sleeve is available upon request.
- When can is covered with vinyl sleeve, Dϕ +0.5(.02")mm, L+1.0(0.039")mm.
- Multi-element electrolytics are available upon request.
  - 35ϕ: Singles, Duals and Triples.
  - 25ϕ: Singles
- Dimension "L" is subject to change for miniaturization without notice.
- Flame-retardant material is used for prong bases.

Type KQ(Prong for Printed Circuit Board)

KQ-Type is designed for printed circuit board in TV, radio and other equipment.

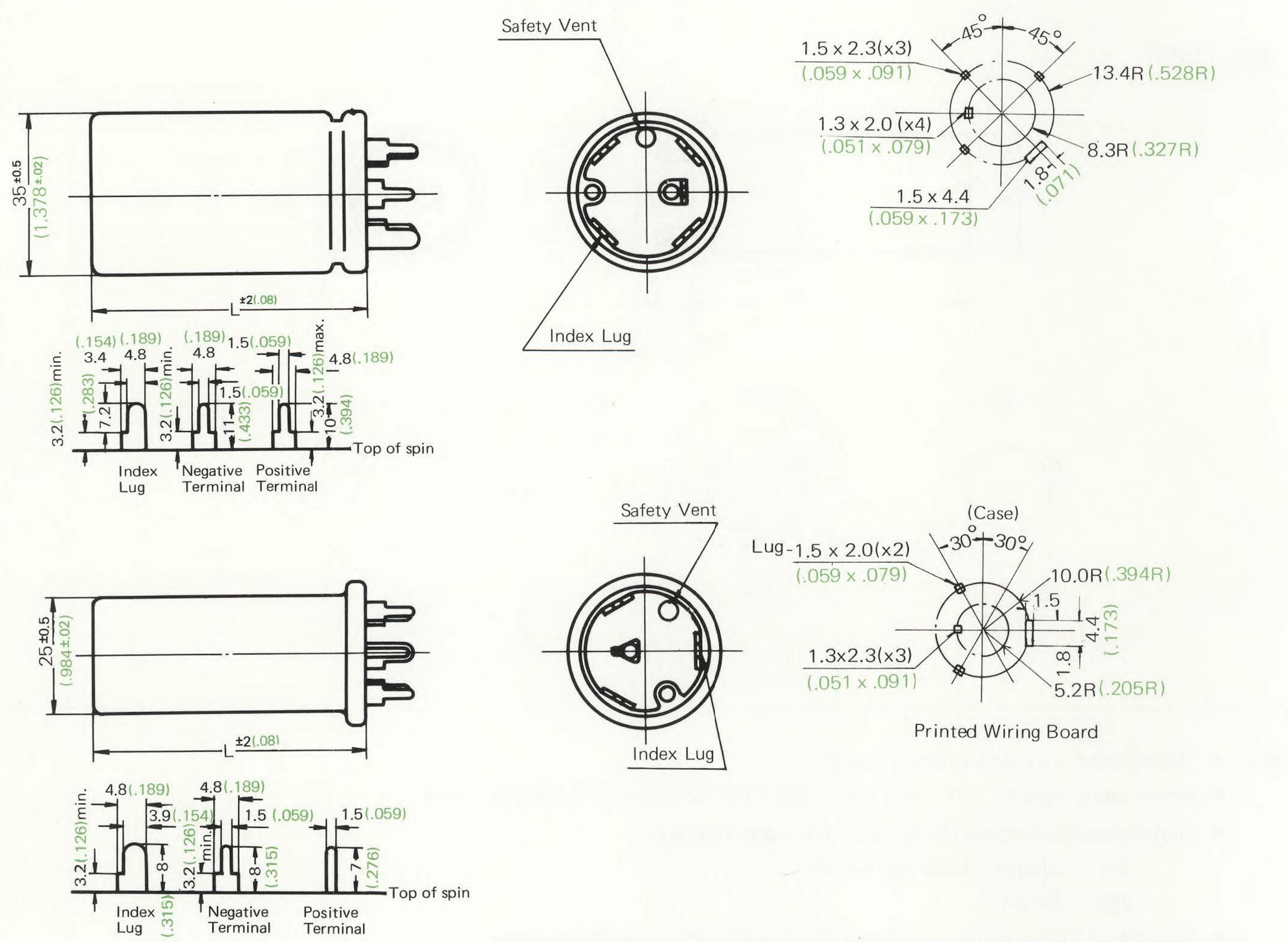
Special note:
standard size chart, rating and characteristics are based on Type KP (page IV-32)



Features

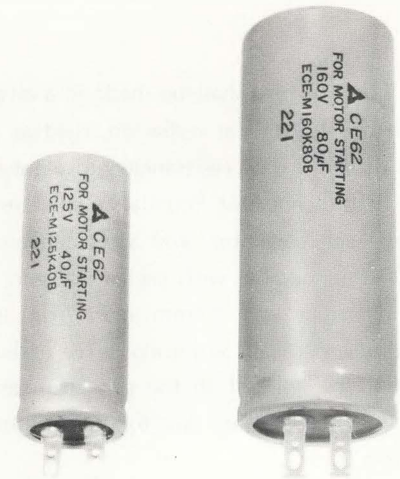
- Specially designed for printed circuit board with prong type
- Stable characteristics over a long-term operation even at charge & discharge in on-off switch operation of equipment due to etched aluminum foil applied to the all cathode elements
- A safety vent is built in all the types
- Maltiple section type is available up to 3 section for 35mm (1.378") case diameter.

Dimensions



Unit: mm (inch)

For AC Motor Starting



These are non-polarized electrolytic capacitors for intermittent-duty in a-c single phase motor starting circuits, such as air conditioners, electric refigerators, etc.

Features

- Stable characteristics even after long-term shelf life test and over a wide temperature range
- All the types equipped with safety vent to be free from explosion even at application of a-c current (These types may not withstand continuous application of a-c current.)

Electrical Specifications

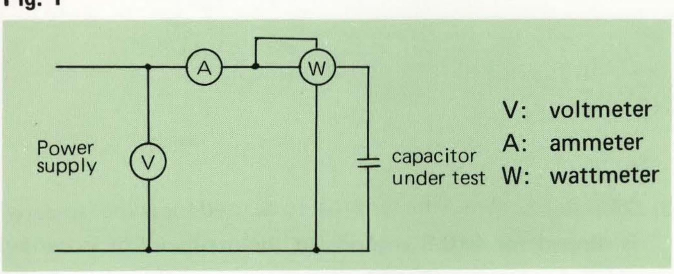
1) Operating Temperature Range: -20°C to +65°C
2) Rated Working Voltage Range: 125 WV to 160WV.AC
3) Capacitance Tolerance: 0 to +20%
4) Capacitance Test: The capacitor under the test shall be kept for 4 hours or more under the standard condition, and then applied with the rated voltage of nearly sinusoidal wave under the rated frequency, and 3 to 5 seconds later the readings of various instructions in the circuit Fig. 1 shall be taken. The capacitance shall be calculated by the following formula:

$$C=\frac{I\times10^6}{2\pi fE}$$

where,

C: capacitance (μF)
I: current (A)
f: frequency (c/s)
E: voltage (V)

Fig. 1



Tolerance on capacitance obtained as above shall be $^{+20}_{-0}$ % of the specified value

5) Power Factor Test: The capacitor under test shall be kept for 4 hours or more under the standard condition, and then applied with the rated voltage of nearly sinusoidal wave under the rated frequency and 3 to 5 seconds later the readings of various instruments in the circuit of Fig. 1 shall be taken. The power factor shall be calculated by the following formula:

$$Pf=\frac{W}{EI}\times 100$$

where,

Pf: power factor (%)
E: voltage (V)
I: current (A)
W: loss (W)

Power factor obtained from above shall not exceed 8%.

6) Overvoltage Test:
   a) The capacitor shall withstand for 30 seconds the application of a-c voltage of 1.4 times the rated voltage between its both terminals.
   b) The capacitor shall withstand for 2-minute application of a-c voltage of 1.2 times the rated voltage between its both terminals.
7) Immersion Cycle Test: The capacitor shall be subjected to 2 cycles of immersion operation into pure water saturated sodium chloride water solution as shown in Table 1. In this operation, the capacitor shall be transferred as quickly as with 3 seconds.
   The capacitor, after the complete operation, shall be washed with fresh water and dried at the pre-test treatment and shall satisfy the requirements specified in 4) capacitance test, 5) power-factor test and 6) overvoltage test.

Table 1

Order	Time of immersion (min.)	Immersion liquid	
		Temperature (°C)	Classification
1	30	65^{+5}_{0}	Pure water
2	30	0 ± 3	Saturated sodium chloride solution

8) Life Test: The life test shall be made in a circulating air oven, free from direct heat radiation, held at a constant temperature of 65±2°C. A resistance equivalent to approximately 10% of the capacitor impedance shall be connected in series with each capacitor, and a resistance of approximately 1,000Ω in parallel with each capacitor. Capacitors shall be mounted at least 25mm apart from each other. The rated voltage of nealy sinusoidal wave under the rated frequency shall be applied to the capacitor-resistor combination at the rated voltage and for the number of times shown in Table 2.

9) Storage Test: Capacitors which have been left at the ambinet temperature for one year, shall be subjected, without the pre-test treatment, to the voltage cycle test of Table 2 for 4 hours, at the ambient temperature, and shall be inspected for faults in construction. The capacitors shall then be subjected to the pre-test treatment and shall meet the requirements specified in 4) capacitance test, 5) power-factor test, and 6) overvoltage test.

Table 2

Rated voltage (V)	Voltage application cycle	No. of times of application
125	Twice per min. 1 sec. on, 29 sec. off	75000
160	Once per min. 1 sec. on, 59 sec. off	30000

After the test, the power factor at the normal temperature shall not differ by more than ±25% from the value measured before the test.

Mechanical Specifications

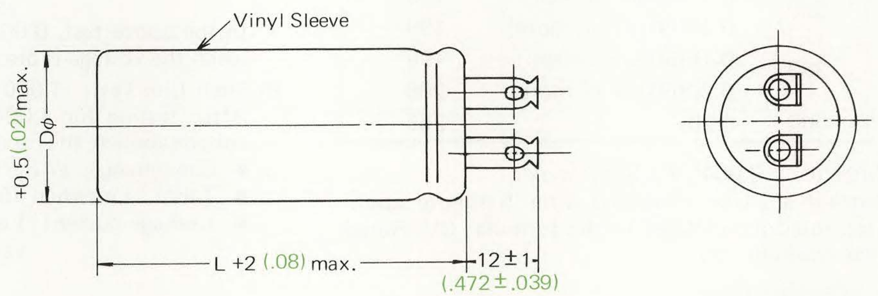
1) Terminal Strength: A static load of 2.5kg shall be applied for 10 seconds to each terminal in the axial direction of the capacitor. No coming-off or loosening of the terminal shall take place.
2) Explosion-proof Construction Test: Neither the internal elements of the capacitor shall be expelled nor the container disrupted, even when the capacitor is abnormally heated by the continuous application of the rated voltage.
3) Solderability: When the terminal to be used for being soldered is dipped for 2±0.5 seconds in the methanol or isopropyl alcohol solution (10±2%) of rosin, then is dipped for 2±0.5 seconds in the soldering bath containing the soft solder molten at 230±5°C, up to 4±0.8mm, the part not soldered shall not exceed 1/4 the portion dipped.
4) Standard Marking Item: Rated capacitance, Rated working voltage, Symbol of MATSUSHITA (▲), Symbol of electrolytic capacitor (CE), Part No., Date Code.

Standard Products Table

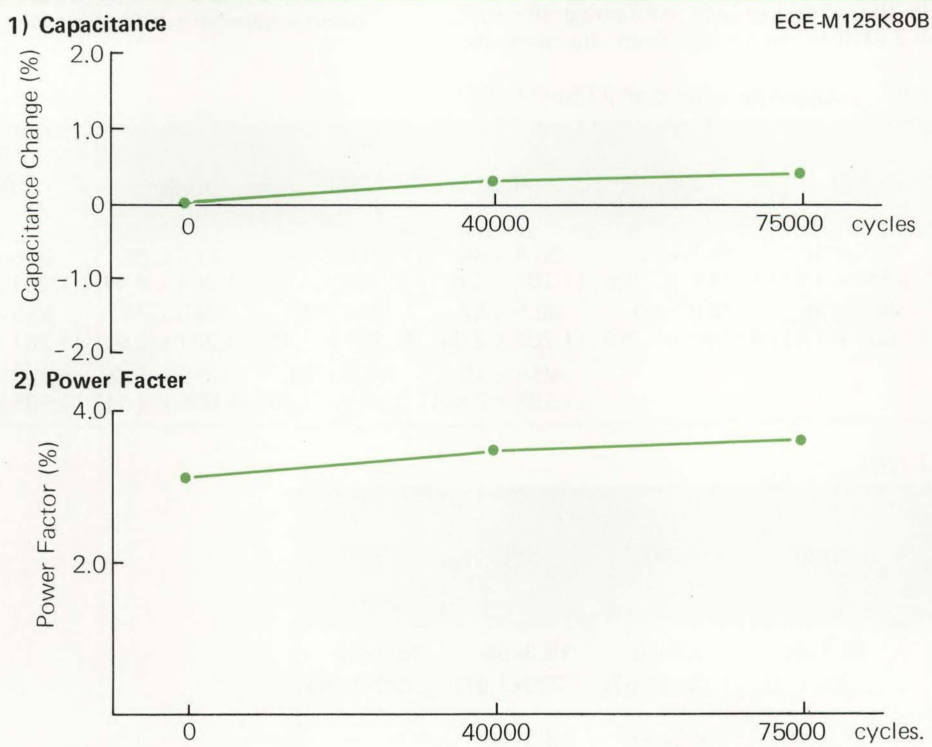
Rated Volt. (VAC)	Capacitance (μF)	Part No.	Dimensions mm (inch) Dϕ x L
125	40	ECE-M125K 40B	25.5 x 64 (1.00 x 2.52)
	60	ECE-M125K 60B	25.5 x 80 (1.00 x 3.15)
	80	ECE-M125K 80B	35.5 x 71 (1.397 x 2.80)
	100	ECE-M125K100B	35.5 x 71 (1.397 x 2.80)
	125	ECE-M125K125B	35.5 x 80 (1.397 x 3.15)
	160	ECE-M125K160B	35.5 x 80 (1.397 x 3.15)
160	40	ECE-M160K40B	35.5 x 51 (1.397 x 2.00)
	60	ECE-M160K60B	35.5 x 61 (1.397 x 2.40)
	80	ECE-M160K80B	35.5 x 80 (1.397 x 3.15)
	100	ECE-M160K100B	35.5 x 100 (1.397 x 3.94)

Dimension

Unit: mm (inch)



Characteristics Change/Discharge



For Photo Flash

This is a high performance electrolytic capacitor for photo-flash with extremely small tanδ due to newly developed electrolyte, converting discharge energy into light most efficiently.

Features

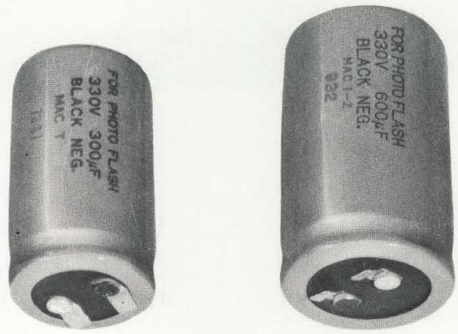
- Very small in size due to new etching technique
- Very small tanδ due to newly developed electrolyte
- Stable characteristics without any change even after a long shelf-life test

Electrical Specifications

1) Operating Temperature Range: 0°C to +55°C
2) Storage Temperature Range: -25°C to 70°C
3) Rated Working Voltage: 330, 360 and 480WVDC
4) Standard Capacitance Tolerance: -10 to +50%
5) Surge Voltage and Tanδ:

Working Volt	Surge Volt	Tanδ	CR-product
330	350	0.1 (600μF or less)	133
		0.15(601μF or more)	199
360	380	0.15(600μF or less)	199
		0.20(601μF or more)	265
480	500	0.20	265

6) Leakage Current: I=0.004CV + 50μA max.
Leakage current shall be measured after 5-minute application of the rated d-c voltage. In the formula: CV=Rated cap. x Rated working volt.



7) Charge/Discharge Test: After charge/discharge (10^{sec} "ON" and 10^{sec} "OFF" with the rated voltage) testing for 1,000 cycles at room temperature (15°C to 35°C), the capacitor shall meet the following limits:
   - Cap. change: Within ±20% of the initial measured value
   - Tanδ: Less than 150% of the initial measured value
   - Leakage current: Less than 150% of the initial specified value

   In the above test, 0.0032Ω resistor per 1μF should be used when the voltage is discharged.
8) Shelf-Life Test: 1,000 hours at +55°C
After testing for 1,000 hours at +55°C with no working voltage applied, the capacitor shall meet the following limits:
   - Cap. change: Within ±10% of the initial measured value
   - Tanδ: Less than 150% of the initial specified value
   - Leakage current: Less than 300% of the initial specified value

Mechanical Specifications

1) Solderability: When the terminal to be used for being soldered is dipped for 2±0.5 seconds in the methanol or isopropyl alcohol solution (10±2%) of rosin, then is dipped for 2±0.5 seconds in the soldering bath containing the soft solder molten at 230±5°C, up to 4±0.8mm, the part not soldered shall not exceed 1/4 the portion dipped.
2) Standard Marking Item: Rated capacitance, Rated working voltage, Symbol of MATSUSHITA (▲), Symbol of electrolytic capacitor (CE), Part No., "FOR PHOTO FLASH."

Standard Size Table

Diameter more than 22.5mm(.886)

Dϕ x L mm (inch)

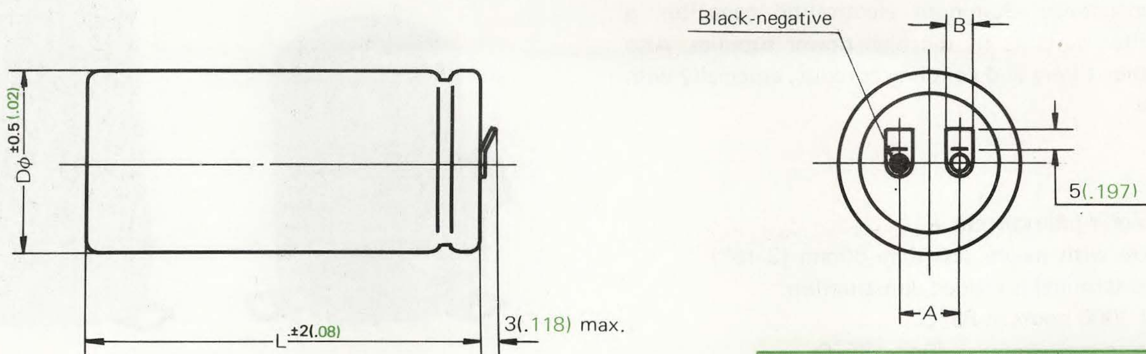
Rated Volt.(VDC) \ Cap.(μF)	200	300	400	500	600	700	800
330	22.5 x 46 (.886 x 1.81)	25.5 x 52 (1.004 x 2.05)	30.5 x 46 (1.201 x 1.81)	30.5 x 52 (1.201 x 2.05)	30.5 x 62 (1.201 x 2.44)	30.5 x 74 (1.201 x 2.91)	30.5 x 88 (1.201 x 3.46)
360	25.5 x 46 (1.004 x 1.81)	25.5 x 56 (1.004 x 2.20)	30.5 x 52 (1.201 x 2.05)	30.5 x 62 (1.201 x 2.44)	30.5 x 74 (1.201 x 2.91)	30.5 x 88 (1.201 x 3.46)	35.5 x 82 (1.397 x 3.23)
480	—	—	40.5 x 75 (1.595 x 2.95)	40.5 x 88 (1.595 x 3.46)	40.5 x 112 (1.595 x 4.41)	40.5 x 160 (1.595 x 6.30)	40.5 x 160 (1.595 x 6.30)

Diameter 18.3 mm (.720)

Rated Volt.(VDC) \ Cap.(μF)	100	150	200	250
330	18.3x30 (.720x1.18)	18.3x40 (.720x1.57)	18.3x50 (.720x1.97)	18.3x60 (.720x2.36)
360	18.3x40 (.720x1.57)	18.3x50 (.720x1.97)	18.3x60 (.720x2.36)	—

Dimensions (Standard Terminal)

Unit: mm(inch)



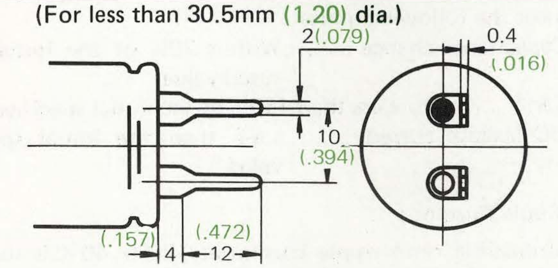
Dφ	A	B
18.3(0.72), 22.5(0.886)	6 (.236)	3 (.118)
more than 25.5(1.80)	10 (.394)	4.5 (.177)

Dimensions (Special Terminal)

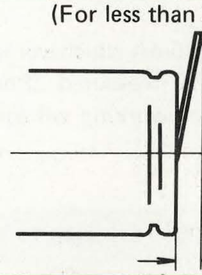
The following terminals are available depending on customers request.

Unit: mm (inch)

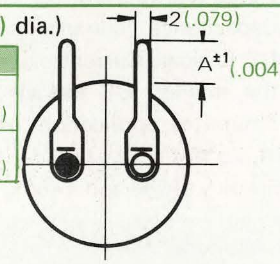
A (For less than 30.5mm (1.20) dia.)



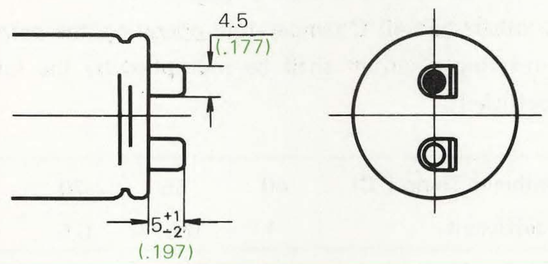
E (For less than 30.5mm (1.20) dia.)



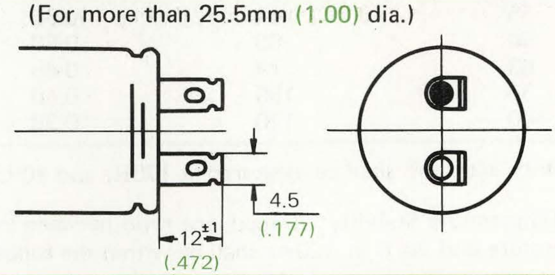
Dφ	A
25.5 (1.00)	5.5 (.610)
30.5 (1.20)	4.0 (.157)



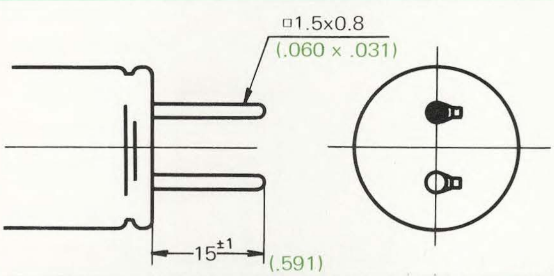
B



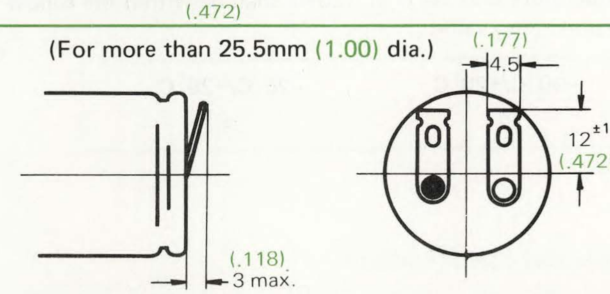
F (For more than 25.5mm (1.00) dia.)



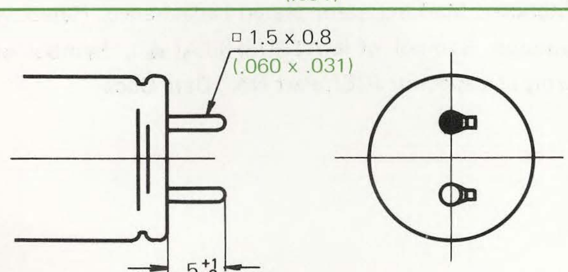
C



G (For more than 25.5mm (1.00) dia.)



D



Note:

The above terminal's dimensions are for 25.5 and 30.5mm diameter products and for the terminal of 18.3, 22.5, 35.5 and 40.5mm diameter case are slightly difference from the above dimensions.

Type M(For Large Power Use)

This large capacitance aluminum electrolytic capacitor is suitable for filter curcuits of d-c high power supplies. Also ideal for all other filters and coupling curcuits, especially with attractive price.

Features

- Withstand high ripple current
- Compact size with height less than 80mm (3.15")
- Foil tab and terminal is welded construction.
- Long life of 1000 hours at 85°C
- Wide operating temperature -40 to +85°C

Electrical Specifications

1) Operating Temperature Range: -40°C to +85°C
2) Rated Working Voltage Range: 25WV. to 100WV, DC
3) Capacitance Tolerance: -10 to +50%
4) DC Leakage Current: I=0.03CV(μA) or 5mA whichever is the smaller. DC leakage current shall be measured after 5 minutes application of the rated d-c working voltage at 25°C
5) Surge Voltage and Tanδ:

Working Volt.	Surge Volt.	Tanδ
25	32	0.80
35	44	0.60
50	63	0.50
63	79	0.45
80	100	0.40
100	120	0.30

(Capacitance and tanδ shall be measured at 120Hz and 20°C.)

6) Low Temperature Stability: Impedance ratio between low temperature and 20°C at 120Hz shall be within the following maximum value:

-40°C/+20°C	-25°C/+20°C
12	3

7) Load Life Test: After 1000 hour application of d-c working voltage with ripple current at 85°C, the capacitor shall meet the following limits:
   - Capacitance change ....Within 20% of the initial measured value
   - Tanδ .... Less than 150% of the initial specified value
   - DC leakage current ....Less than the initial specified value

8) Ripple Current:
   Permissible r-m-s ripple current at 120Hz, 40°C is listed in the standard products table on page IV-41.
   In other than 40°C temperature operating, the permissible r-m-s ripple current shall be multiplied by the following coefficient.

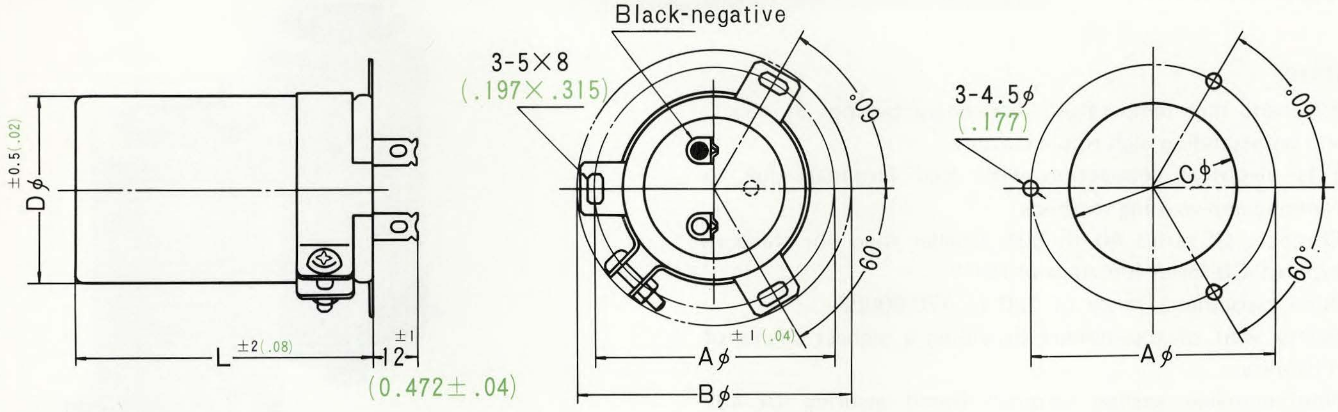
Ambient Temp.(°C)	40	55	70	85
Coefficient	1	0.67	0.5	0.33

Mechanical Specifications

1) Solderability: When the terminal to be used for being soldered is dipped for 2±0.5 seconds in the methanol or isopropyl alcohol solution (10±2%) of rosin, then dipped for 2±0.5 seconds in the soldering bath containing the soft solder molten at 230±5°C, the part not soldered shall not exceed 1/4 the portion dipped.
2) Standard Marking Item: Rated capacitance, Rated working voltage, Symbol of MATSUSHITA(▲), Symbol of electrolytic capacitor (CE), Part No., Date Code.

Dimensions

Unit: mm (inch)



Caseϕ	A	B	C
50ϕ(1.97)	65(2.56)	74(2.91)	45(1.77)
63ϕ(2.48)	76(2.99)	86(3.39)	58(2.28)

Standard Products Table

Rated Volt. (V, DC)	Cap. (μF)	Part No.	Tan δ max	Permissible ripple at 40°C 120 Hz max. A.	Dimensions mm(inch)	
					Dϕ x L	
25	22000	ECE-M25R223 □	0.80	12.0	50 x 60	(1.97 x 2.36)
35	15000	ECE-M35R153 □	0.60	11.7	50 x 60	(1.97 x 2.36)
	22000	223 □		14.1	50 x 80	(1.97 x 3.15)
50	10000	ECE-M50R103 □	0.50	12.0	50 x 60	(1.97 x 2.36)
	15000	153 □		14.7	50 x 80	(1.97 x 3.15)
	22000	223 □		17.7	63 x 80	(2.48 x 3.15)
63	6800	ECE-M63R682 □	0.45	10.5	50 x 60	(1.97 x 2.36)
	10000	103 □		12.9	50 x 80	(1.97 x 3.15)
	15000	153 □		15.6	63 x 80	(2.48 x 3.15)
80	4700	ECE-M80R472 □	0.40	9.6	50 x 60	(1.97 x 2.36)
	6800	682 □		11.7	50 x 80	(1.97 x 3.15)
	10000	103 □		13.8	63 x 80	(2.48 x 3.15)
100	3300	ECE-M100R332 □	0.30	8.1	50 x 60	(1.97 x 2.36)
	4700	472 □		9.6	50 x 80	(1.97 x 3.15)
	6800	682 □		11.7	63 x 80	(2.48 x 3.15)

For Computer Power Supply

GS-series for Compact Purpose (6.3 to 160WV.DC 470 to 470,000μF)
GH-series for High Ripple (6.3 to 450WV.DC 220 to 180,000μF)

Features

- Excellent high-temperature load characteristics at +85°C and withstanding high ripple current
- Fine electrical connection with lead terminals due to caulking-and-welding methods
- Compact GS-series 40 to 50% smaller than our standard type of GB-series (previous products)
- Wide capacitance range of 220 to 470,000μF
- Safety vent of top-molded providing a highest degree of reliability
- Nonflammable sealing terminal board assuring UL-492 (SE1) specification.

Application

1) For power supply filters of computers, rectifiers, etc.
2) For various kinds of control equipment
3) For industrial equipment such as high-class amplifiers that require large output, high performance and high reliability

Electrical Specifications

1) Operating Temperature Range: -25°C to +85°C
2) Storing Temperature Range: -40°C to +85°C
3) Capacitance Tolerance: 6.3V ~ 80V.W -10~+100%
   100V~350V -10~+75%
   400V~450V -10~+50%
4) Surge Voltage and Tanδ: Surge voltage and tanδ are listed in Standard Products Table on pp.IV-43~46.
5) Leakage Current:
   I = 0.02CVμA or 5mA whichever is the smaller
   Leakage current shall be measured after 5 minutes application of the rated d-c working voltage. In the formula, CV = rated cap. x rated working volt.
6) Load Life Test: 1,000 hours at +85°C
   After the testing for 1,000 hours at 85°C with maximum specified ripple current, the capacitor shall meet the following limits:
- Cap. change: Within ±15% of the initial measured value
- Tan δ: Less than 150% of the specified value
- Leakage current: Less than the initial specified value

7) Shelf Life Test: After storage for 1,000 hours at +85°C with no voltage applied, leakage current, capacitance and tanδ shall meet the same limits specified in the Load Life Test 6).
8) Maximum Ripple Current: The maximum allowable r-m-s ripple current are specified under the condition of 120Hz and +20°C in the Standard Products Table pp.IV-43~45. If the maximum ripple current of GS series will not be suitable, GH series will be preferable.
   Temperature-frequency conversion shall be performed by multiplying the coefficient in the following table

Ambient Temp. (°C)	40	55	70	85
Coefficient	1	0.67	0.5	0.33

Frequency	60Hz	400	1K	10K
Coefficient	0.8	1.1	1.3	1.4

Mechanical Specifications

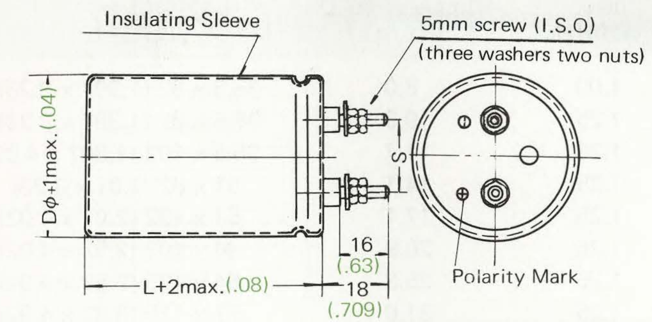
1) Standard Marking Item: Rated capacitance, Rated working voltage, Symbol of MATSUSHITA (▲), Manufactured date code, Symbol of electrolytic capacitor (CE), Operating temperature range, Part No.

2) Screw Torque: Screw torque of lead terminal shall withstand 50kg/cm.

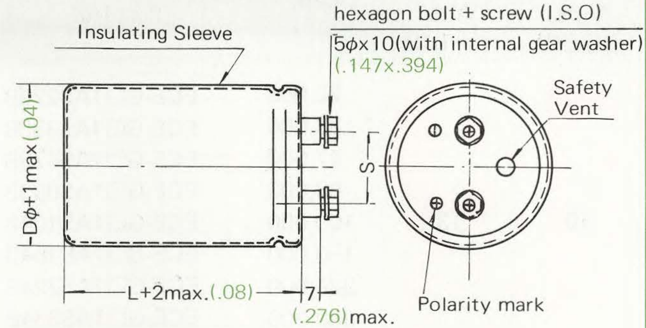
Dimensions

Unit:mm(inch)

GB-type terminal



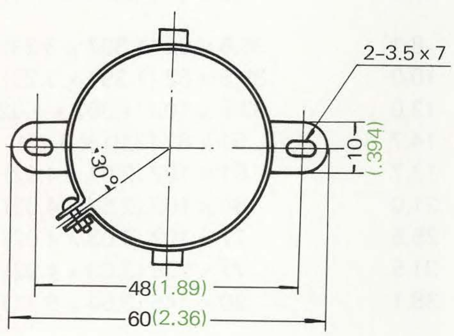
GA-type terminal



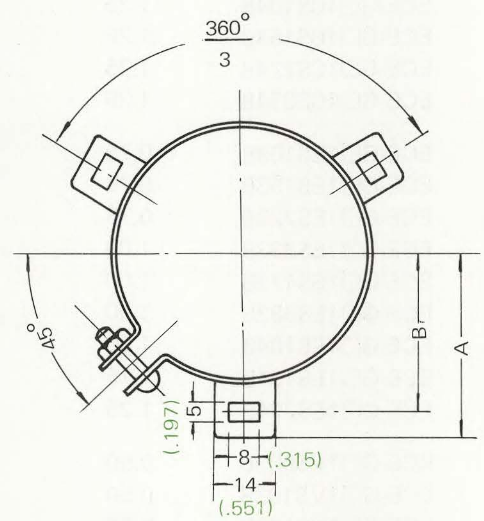
Case φ	35.5	51	64	77	90
Dimensions of S	13 (.512)	22 (.866)	28.6 (1.130)	31.8 (1.250)	35 (1.378)

Mounting Ware

Unit:mm(inch)



(For 35mm dia)



(For 51 to 90mm dia)

Case φ \ Dimensions	A	B
51	37 (1.456)	32.5 (1.28)
64	43 (1.693)	38.0 (1.50)
77	50 (1.970)	44.5 (1.75)
90	56 (2.195)	50.8 (2.00)

GS Series

Standard Products Table

☐ Shows terminal from A: GA-type terminal B: GB-type terminal

Rated Volt. (V, DC)	Surge Volt. (V, DC)	Cap. (μF)	Part No.	Tanδ max. (120 Hz)	Permissible ripple at 40°C 120Hz (A)	Dimensions* mm (inch) Dφ x L
6.3	8	22,000	ECE-G☐0JS223B	1.25	5.6A	35.5 x 53 (1.397 x 2.09)
		33,000	ECE-G☐0JS333B	1.50	6.8	35.5 x 82 (1.397 x 3.23)
		47,000	ECE-G☐0JS473B	1.50	8.1	35.5 x 82 (1.397 x 3.23)
		68,000	ECE-G☐0JS683B	1.50	9.8	51 x 63 (2.01 x 2.48)
		100,000	ECE-G☐0JS104B	1.50	11.9	51 x 82 (2.01 x 3.29)
		150,000	ECE-G☐0JS154B	1.50	14.5	51 x 125 (2.01 x 4.92)
		220,000	ECE-G☐0JS224B	1.50	17.6	64 x 102 (2.52 x 4.02)
		330,000	ECE-G☐0JS334B	1.50	21.6	77 x 102 (3.03 x 4.02)
		470,000	ECE-G☐0JS474B	1.50	25.7	77 x 145 (3.03 x 5.71)

(Standard products table continued)

Rated Volt. (V, DC)	Surge Volt. (V, DC)	Cap. (μF)	Part No.	Tanδ max. (120Hz)	Permissible Ripple at 40°C 120Hz (A)	Dimensions*mm (inch) Dφ x L
10	13	22,000	ECE-G□1AS223B	1.00	8.0	35.5 x 82 (1.397 x 3.23)
		33,000	ECE-G□1AS333B	1.25	9.8	35.5 x 82 (1.397 x 3.23)
		47,000	ECE-G□1AS473B	1.25	11.7	35.5 x 102 (1.397 x 4.02)
		68,000	ECE-G□1AS683B	1.25	14.1	51 x 82 (2.01 x 3.23)
		100,000	ECE-G□1AS104B	1.25	17.1	51 x 102 (2.01 x 4.02)
		150,000	ECE-G□1AS154B	1.25	20.9	64 x 102 (2.52 x 4.02)
		220,000	ECE-G□1AS224B	1.25	25.3	64 x 125 (2.52 x 4.92)
		330,000	ECE-G□1AS334B	1.25	31.0	77 x 125 (3.03 x 4.92)
		470,000	ECE-G□1AS474B	1.25	37.0	90 x 145 (3.54 x 5.71)
16	20	15,000	ECE-G□1CS153B	1.00	8.1	35.5 x 53 (1.392 x 2.09)
		22,000	ECE-G□1CS223B	1.00	10.0	35.5 x 8.2 (1.392 x 3.23)
		33,000	ECE-G□1CS333B	1.25	12.0	35.5 x 102 (1.392 x 4.02)
		47,000	ECE-G□1CS473B	1.25	14.4	51 x 82 (2.01 x 3.23)
		68,000	ECE-G□1CS683B	1.25	17.1	51 x 102 (2.01 x 4.02)
		100,000	ECE-G□1CS104B	1.25	21.0	51 x 125 (2.01 x 4.92)
		150,000	ECE-G□1CS154B	1.25	25.5	64 x 125 (2.52 x 4.92)
		220,000	ECE-G□1CS224B	1.25	30.9	77 x 125 (3.03 x 4.92)
		330,000	ECE-G□1CS334B	1.25	37.8	90 x 145 (3.54 x 5.71)
25	32	10,000	ECE-G□1ES103B	0.75	8.1	35.5 x 82 (1.397 x 3.23)
		15,000	ECE-G□1ES153B	0.75	10.0	35.5 x 82 (1.397 x 3.23)
		22,000	ECE-G□1ES223B	0.75	12.0	35.5 x 102 (1.397 x 4.02)
		33,000	ECE-G□1ES333B	1.00	14.7	51 x 82 (2.01 x 3.23)
		47,000	ECE-G□1ES473B	1.00	17.7	51 x 102 (2.01 x 4.02)
		68,000	ECE-G□1ES683B	1.00	21.0	64 x 102 (2.52 x 4.02)
		100,000	ECE-G□1ES104B	1.00	25.5	77 x 102 (3.03 x 4.02)
		150,000	ECE-G□1ES154B	1.25	31.5	77 x 125 (3.03 x 4.92)
		220,000	ECE-G□1ES224B	1.25	38.1	90 x 145 (3.54 x 5.71)
35	44	6,800	ECE-G□1VS682B	0.50	7.9	35.5 x 82 (1.397 x 3.23)
		10,000	ECE-G□1VS103B	0.50	9.6	35.5 x 82 (1.397 x 3.23)
		15,000	ECE-G□1VS153B	0.50	11.7	35.5 x 102 (1.397 x 4.02)
		22,000	ECE-G□1VS223B	0.75	14.1	51 x 82 (2.01 x 3.23)
		33,000	ECE-G□1VS333B	0.75	17.4	51 x 102 (2.01 x 4.02)
		47,000	ECE-G□1VS473B	0.75	20.8	64 x 102 (2.52 x 4.02)
		68,000	ECE-G□1VS683B	0.75	25.0	64 x 125 (2.52 x 4.92)
		100,000	ECE-G□1VS104B	0.75	30.4	77 x 125 (3.03 x 4.92)
		150,000	ECE-G□1VS153B	0.75	37.2	90 x 145 (3.54 x 5.71)
40	50	4,700	ECE-G□1GS472B	0.50	8.2	35.5 x 53 (1.397 x 2.09)
		6,800	ECE-G□1GS682B	0.50	9.9	35.5 x 82 (1.397 x 3.23)
		10,000	ECE-G□1GS103B	0.50	12.0	35.5 x 82 (1.397 x 3.23)
		15,000	ECE-G□1GS153B	0.50	14.7	35.5 x 102 (1.397 x 4.02)
		22,000	ECE-G□1GS223B	0.75	17.8	51 x 82 (2.01 x 3.23)
		33,000	ECE-G□1GS333B	0.75	21.8	51 x 125 (2.01 x 4.92)
		47,000	ECE-G□1GS473B	0.75	26.0	64 x 102 (2.52 x 4.02)
		68,000	ECE-G□1GS683B	0.75	31.3	77 x 102 (3.03 x 4.02)
		100,000	ECE-G□1GS104B	0.75	37.9	77 x 145 (3.03 x 5.71)

Standard Products Table (Continued)

Rated Volt. (V, DC)	Surge Volt. (V, DC)	Cap. (μF)	Part No.	Tanδ max. (120 Hz)	Permissible ripple at 40°C 120 Hz (A)	Dimensions mm (inch) Dφ x L
50	63	3,300	ECE-G□1HS332B	0.50	6.9	35.5 x 53 (1.397 x 2.09)
		4,700	ECE-G□1HS472B	0.50	8.2	35.5 x 82 (1.397 x 3.23)
		6,800	ECE-G□1HS682B	0.50	9.9	35.5 x 82 (1.397 x 3.23)
		10,000	ECE-G□1HS103B	0.50	12.0	51 x 63 (2.01 x 2.48)
		15,000	ECE-G□1HS153B	0.50	14.7	51 x 82 (2.01 x 3.23)
		22,000	ECE-G□1HS223B	0.75	17.7	51 x 125 (2.01 x 4.92)
		33,000	ECE-G□1HS333B	0.75	21.8	64 x 102 (2.52 x 4.02)
		47,000	ECE-G□1HS473B	0.75	26.0	77 x 102 (3.03 x 4.02)
		68,000	ECE-G□1HS683B	0.75	31.3	77 x 145 (3.03 x 5.71)
63	79	2,200	ECE-G□1JS222B	0.25	6.1	35.5 x 53 (1.397 x 2.09)
		3,300	ECE-G□1JS332B	0.25	7.4	35.5 x 82 (1.397 x 3.23)
		4,700	ECE-G□1JS472B	0.25	8.8	35.5 x 82 (1.397 x 3.23)
		6,800	ECE-G□1JS682B	0.25	10.5	35.5 x 102 (1.397 x 4.02)
		10,000	ECE-G□1JS103B	0.25	12.9	51 x 82 (2.01 x 3.23)
		15,000	ECE-G□1JS153B	0.50	15.6	51 x 102 (2.01 x 4.02)
		22,000	ECE-G□1JS223B	0.50	19.1	64 x 102 (2.52 x 4.02)
		33,000	ECE-G□1JS333B	0.50	23.4	77 x 102 (3.03 x 4.02)
		47,000	ECE-G□1JS473B	0.50	28.0	77 x 145 (3.03 x 5.71)
		68,000	ECE-G□1JS683B	0.50	33.6	90 x 145 (3.54 x 5.71)
80	100	2,200	ECE-G□1KS222B	0.25	6.5	35.5 x 82 (1.397 x 3.23)
		3,300	ECE-G□1KS332B	0.25	7.9	35.5 x 82 (1.397 x 3.23)
		4,700	ECE-G□1KS472B	0.25	9.6	35.5 x 102 (1.397 x 4.02)
		6,800	ECE-G□1KS682B	0.25	11.7	51 x 82 (2.01 x 3.23)
		10,000	ECE-G□1KS103B	0.30	13.8	51 x 102 (2.01 x 4.02)
		15,000	ECE-G□1KS153B	0.30	16.9	64 x 102 (2.52 x 4.02)
		22,000	ECE-G□1KS223B	0.30	20.5	77 x 102 (3.03 x 4.02)
		33,000	ECE-G□1KS333B	0.30	25.1	77 x 145 (3.03 x 5.71)
		47,000	ECE-G□1KS473B	0.30	30.0	90 x 145 (3.54 x 5.71)
100	125	1,000	ECE-G□2AS102B	0.25	4.5	35.5 x 53 (1.397 x 2.09)
		2,200	ECE-G□2AS222B	0.25	6.6	35.5 x 82 (1.397 x 3.23)
		3,300	ECE-G□2AS332B	0.25	8.1	51 x 63 (2.01 x 2.48)
		4,700	ECE-G□2AS472B	0.25	9.6	51 x 82 (2.01 x 3.23)
		6,800	ECE-G□2AS682B	0.30	11.7	51 x 102 (2.01 x 4.02)
		10,000	ECE-G□2AS103B	0.30	14.1	64 x 102 (2.52 x 4.02)
		15,000	ECE-G□2AS153B	0.30	17.3	77 x 102 (3.03 x 4.02)
		22,000	ECE-G□2AS223B	0.30	20.9	77 x 145 (3.03 x 5.71)
160	200	470	ECE-G□2CS471B	0.25	3.1	35.5 x 53 (1.397 x 2.09)
		680	ECE-G□2CS681B	0.25	3.8	35.5 x 82 (1.397 x 3.23)
		1,000	ECE-G□2CS102B	0.25	4.6	35.5 x 82 (1.397 x 3.23)
		2,200	ECE-G□2CS222B	0.25	6.8	51 x 82 (2.01 x 3.23)
		3,300	ECE-G□2CS332B	0.25	8.3	51 x 102 (2.01 x 4.02)
		4,700	ECE-G□2CS472B	0.25	9.9	64 x 102 (2.52 x 4.02)
		6,800	ECE-G□2CS682B	0.25	11.9	77 x 102 (3.03 x 4.02)
		10,000	ECE-G□2CS103B	0.25	14.4	77 x 145 (3.03 x 5.71)
		15,000	ECE-G□2CS153B	0.25	17.7	90 x 145 (3.54 x 5.71)

GH Series

Standard Products Table

□ shows terminal form

A: GA-type terminal
B: GB-type terminal

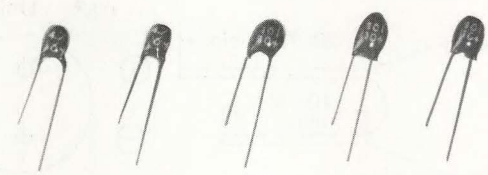
Working Volt. (V)	Surge Volt. (V)	Cap. (μF)	Part No.	Tan δ max. 120 Hz	Parmissible ripple at 40°C 120 Hz (A)	Dimensions mm(inch)
						Dφ x L
6.3	8	33000	ECE-G□0JH333B	1.5	13	51 x 102 (2.01 x 4.02)
		47000	473B	1.5	14	51 x 125 (2.01 x 4.92)
		100000	104B	1.9	19	77 x 125 (3.03 x 4.92)
		220000	224B	2.6	27	90 x 145 (3.54 x 5.71)
10	13	22000	ECE-G□1AH223B	1.5	15	51 x 102 (2.01 x 4.02)
		33000	333B	1.5	18	51 x 125 (2.01 x 4.92)
		47000	473B	1.5	21	64 x 102 (2.51 x 4.02)
		100000	104B	1.9	27	77 x 125 (3.03 x 4.92)
16	20	22000	ECE-G□1CH223B	1.1	17	51 x 125 (2.01 x 4.92)
		33000	333B	1.1	21	64 x 102 (2.52 x 4.02)
		47000	473B	1.1	24	77 x 102 (3.03 x 4.02)
		100000	104B	1.5	30	90 x 145 (3.54 x 5.71)
25	32	10000	ECE-G□1EH103B	0.8	13	51 x 102 (2.01 x 4.02)
		22000	223B	1.1	22	64 x 125 (2.52 x 4.92)
		33000	333B	1.1	24	77 x 125 (3.03 x 4.92)
		47000	473B	1.1	27	77 x 125 (3.03 x 4.92)
35	44	10000	ECE-G□1VH103B	0.4	16	51 x 125 (2.01 x 4.92)
		22000	223B	0.7	23	77 x 102 (3.03 x 4.02)
		33000	333B	0.8	26	77 x 135 (3.03 x 5.39)
		47000	473B	0.8	29	90 x 145 (3.54 x 5.71)
50	63	4700	ECE-G□1HH472B	0.4	11	51 x 102 (2.01 x 4.92)
		10000	103B	0.4	19	64 x 102 (2.51 x 4.02)
		22000	223B	0.8	26	77 x 125 (3.03 x 4.92)
63	79	4700	ECE-G□11JH472B	0.4	12	51 x 102 (2.01 x 4.02)
		10000	103B	0.4	19	77 x 102 (3.03 x 4.02)
		22000	223B	0.57	27	90 x 145 (3.54 x 5.71)
80	100	3300	ECE-G□1KH332B	0.4	9	51 x 102 (2.01 x 4.02)
		4700	472B	0.4	14	64 x 102 (2.52 x 4.02)
		10000	103B	0.4	22	77 x 125 (3.03 x 4.92)
100	125	1000	ECE-G□2AH102B	0.3	5.7	51 x 102 (2.01 x 4.02)
		2200	222B	0.3	10	64 x 102 (2.52 x 4.02)
		3300	332B	0.3	13	77 x 102 (3.03 x 4.02)
		4700	472B	0.3	16	77 x 125 (3.03 x 4.92)
160	200	1000	ECE-G□2CH102B	0.25	7	64 x 102 (2.52 x 4.02)
		2200	222B	0.25	12	77 x 125 (3.03 x 4.92)
		3300	332B	0.25	14	77 x 125 (3.03 x 5.31)
		4700	472B	0.25	16	90 x 145 (3.54 x 5.71)
200	250	1000	ECE-G□2DH102B	0.25	8	64 x 102 (2.52 x 4.02)
		2200	222B	0.25	13	77 x 125 (3.03 x 5.31)
		3300	332B	0.25	15	90 x 145 (3.54 x 5.71)
250	300	470	ECE-G□2EH471B	0.25	4.4	51 x 102 (2.01 x 4.02)
		1000	102B	0.25	8.0	64 x 125 (2.52 x 4.92)
		2200	222B	0.25	12	77 x 125 (3.03 x 4.92)
315	350	470	ECE-G□2FH471B	0.25	4.8	51 x 125 (2.01 x 4.92)
		1000	102B	0.25	8.6	77 x 102 (3.03 x 4.02)
		2200	222B	0.25	12	90 x 145 (3.54 x 5.71)
350	400	330	ECE-G□2VH331B	0.25	4.0	51 x 125 (2.01 x 4.92)
		470	471B	0.25	4.9	64 x 125 (2.52 x 4.92)
		1000	102B	0.25	8.7	77 x 125 (3.03 x 4.92)
400	450	220	ECE-G□2GH221B	0.25	3.0	51 x 102 (2.01 x 4.02)
		330	331B	0.25	4.3	64 x 102 (2.52 x 4.02)
		470	471B	0.25	5.6	77 x 102 (3.03 x 4.02)
		1000	102B	0.25	9.7	77 x 125 (3.03 x 4.92)
450	500	220	ECE-G□2WH221B	0.25	3.0	51 c 102 (2.01 x 4.02)
		330	331B	0.25	4.3	64 x 125 (2.52 x 4.92)
		470	471B	0.25	5.6	77 x 102 (3.03 x 4.02)
		1000	102B	0.25	8.2	77 x 125 (3.03 x 4.92)

Note: ▪ Mounting ware available upon request ▪ Dimensions L subject to change shorter without notice

SOLID TANTALUM ELECTROLYTICS

Dipped Tantalum

The dipped tantalum capacitor has been developed to meet sufficiently the requirements of entertainment equipment, proving excellent electrical and mechanical protection, a high degree of stability, good humidity characteristics and very little capacitance change over a wide operating temperature range from -55°C to +85°C at attractive price.



Features

- Excellent characteristics equivalent to metal-cased solid tantalum capacitors
- Small in size and light in weight
- No crack in resin and no increase of leakage current against mechanical shock
- Easy mounting on printed circuit board due to uniformity of the specified lead spacings
- No deterioration even after a long-term shelf-life test
- Dipped with nonflamable resin
- Easy reading for digital marking

Electrical Specifications

1) Operating Temperature Range: -55°C to +85°C
2) Rated Working Voltage Range: 3.15WV to 35WV.DC
3) Rated Capacitance Range: 0.47 to 100μF
4) Capacitance Tolerance: ±20%(-20~+40% for CV=10 or less)
5) Surge Voltage and Tanδ:

Working Volt.	Surge Volt.	Tan δ	(CR-Product)
3.15V	4V	0.10	133$\Omega\mu$F
6.3	8	0.08	106
10	13	0.06	80
16	20	0.06	80
25	32	0.06	80
35	44	0.06	80

6) Leakage Current: I=0.02CV or 1μA whichever is the greater
Leakage current shall be measured after 5-minute application of the rated d-c voltage.

7) Low and High Temperature Stability:

Items \ Temp.	-55°C	+85°C
Cap. Change	-15% max	+15% max
Leakage Current	——	0.2CV or 10μA whichever is the greater

8) Humidity Test: After testing for 500 hours at 40°C, 90~95%RH with no working voltage applied the capacitor shall meet the following limits:
- Cap. change: Within ±15% of the initial measured value
- Tan δ : Less than 150% of the initial specified value.
- Leakage Current: Less than 150% of the initial specified value.

9) Load Life Test: 1,000 hours at +85°C
After testing for 1,000 hours at +85°C, the capacitor shall meet the following limits:
- Cap. change: Within ±10% of the initial measured value
- Tan δ: Less than the initial specified value
- Leakage Current: Less than 125% of the initial specified value.

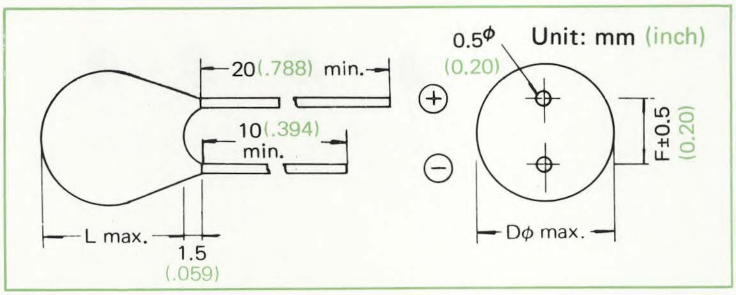
Mechanical Specifications

1) Lead Pull Strength: Capacitor leads shall withstand a steady pull of 0.5kg(1.1 lbs) applied axially to the leads of the capacitor for a period of 10 seconds.
2) Lead Bend Strength: Capacitor leads shall withstand the following bend test: Secure the capacitor in a vertical pisition subjecting the lead to an axial pull of 0.5kg (1.1 lbs). Bend the body of the capacitor to one direction by 90° and back to the original position, and then 90° to the opposite direction.
3) Solderability: The lead shall be immersed into a flux for 2±0.5 seconds and then immersed in the molten solder at 230±5°C to 4±0.5mm (0.157±0.02") from the capacitor body for 2±0.5 seconds.
The flux is composed of 10% by weight of rosin and methyl or isopropyl alcohol. Solder composition is 63% Tin and 37% Lead.
The dipped surface of the leads shall be at least ¾ covered with new, smooth solder.

Marking

- Rated Voltage: Printed digits
- Capacitance : Printed digits
- Polarity (⊕ Side)

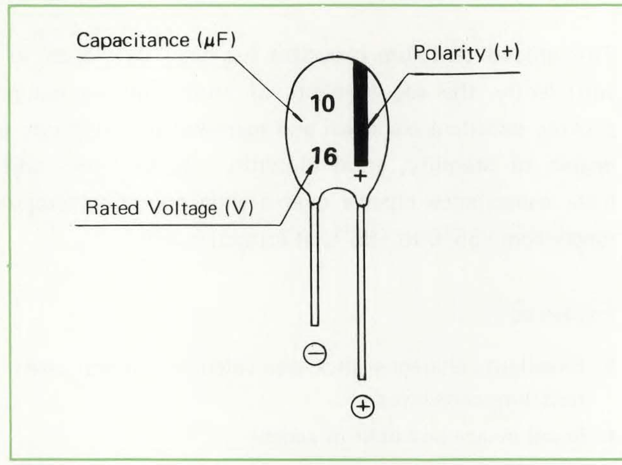
Dimensions



Unit: mm (inch)

Dϕ	4.5 (1.77)	5.0 (.197)	5.5 (.217)	6.0 (.236)	6.5 (.256)	7.0 (.276)
F	1.5 (.059)	2.5 (.098)	2.5 (.098)	2.5 (.098)	3.5 (.138)	3.5 (.138)

Marking Example



Standard Products Table

Part number in brackets [ ] are description of substitutes. For example, the substitute of a capacitor for 3.15V and 0.47μF is shown as [ECS-Z16EFR47], which is common to the part number of the capacitor for 16V, 0.47μF.

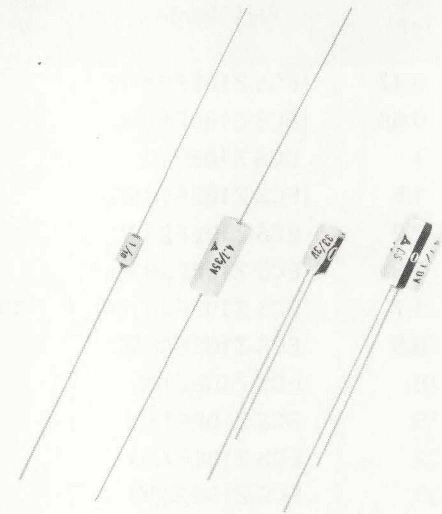
Rated Volt. V, DC (Color code)	Cap. (μF)	Part Number	Surge Volt. (V, DC)	Leakage Current (μA)	Dimensions mm (inch)		
					Dϕ max.	L max.	Lead Spacing
3.15	0.47	[ECS-Z16EFR47Q]	4	1.0	[4.5 (.177)]	[7.0 (.276)]	[1.5 (.059)]
	0.68	[ECS-Z16EFR68Q]		1.0	[4.5 (.177)]	[7.0 (.276)]	[1.5 (.059)]
	1	[ECS-Z10EF1Q]		1.0	[4.5 (.177)]	[7.0 (.276)]	[1.5 (.059)]
	1.5	[ECS-Z6EF1R5Q]		1.0	[4.5 (.177)]	[7.0 (.276)]	[1.5 (.059)]
	2.2	ECS-Z3EF2R2Q		1.0	4.5 (.177)	7.0 (.276)	1.5 (.059)
	3.3	ECS-Z3EF3R3Q		1.0	4.5 (.177)	7.0 (.276)	1.5 (.059)
	4.7	[ECS-Z6EF4R7Q]		1.0	[5.0 (.197)]	[8.0 (.315)]	[2.5 (.098)]
	6.8	ECS-Z3EF6R8Q		1.0	5.0 (.197)	8.0 (.315)	2.5 (.098)
	10	ECS-Z3EF10Q		1.0	5.0 (.197)	8.0 (.315)	2.5 (.098)
	15	[ECS-Z6EF15Q]		1.9	[5.5 (.217)]	[9.0 (.354)]	[2.5 (.098)]
	22	[ECS-Z6EF22Q]		2.7	[5.5 (.217)]	[9.0 (.354)]	[2.5 (.098)]
	33	ECS-Z3EF33Q		2.0	5.5 (.217)	9.0 (.354)	2.5 (.098)
	47	ECS-Z3EF47Q		2.5	6.0 (.236)	10.0 (.394)	2.5 (.098)
	68	ECS-Z3EF68Q		4.0	6.5 (.256)	11.0 (.433)	3.5 (.138)
	100	ECS-Z3EF100Q		6.0	7.0 (.276)	12.0 (.472)	3.5 (.138)
6.3	0.47	[ECS-Z16EFR47Q]	8	1.0	[4.5 (.177)]	[7.0 (.276)]	[1.5 (.059)]
	0.68	[ECS-Z16EFR68Q]		1.0	[4.5 (.177)]	[7.0 (.276)]	[1.5 (.059)]
	1	[ECS-Z10EF1Q]		1.0	[4.5 (.177)]	[7.0 (.276)]	[1.5 (.059)]
	1.5	ECS-Z6EF1R5Q		1.0	4.5 (.177)	7.0 (.276)	1.5 (.059)
	2.2	[ECS-Z10EF2R2Q]		1.0	[5.0 (.197)]	[8.0 (.315)]	[2.5 (.098)]
	3.3	[ECS-Z10EF3R3Q]		1.0	[5.0 (.197)]	[8.0 (.315)]	[2.5 (.098)]
	4.7	ECS-Z6EF4R7Q		1.0	5.0 (.197)	8.0 (.315)	2.5 (.098)
	6.8	ECS-Z6EF6R8Q		1.0	5.0 (.197)	8.0 (.315)	2.5 (.098)
	10	[ECS-Z10EF10Q]		2.0	[5.5 (.217)]	[9.0 (.354)]	[2.5 (.098)]
	15	ECS-Z6EF15Q		1.9	5.5 (.217)	9.0 (.354)	2.5 (.098)
	22	ECS-Z6EF22Q		2.7	5.5 (.217)	9.0 (.354)	2.5 (.098)
	33	ECS-Z6EF33Q		4.1	6.0 (.236)	10.0 (.394)	2.5 (.098)
	47	ECS-Z6EF47Q		5.6	6.5 (.256)	11.0 (.433)	3.5 (.138)
	68	ECS-Z6EF68Q		8.1	7.0 (.276)	12.0 (.472)	3.5 (.138)

(Standard products table continued)

Rated Volt. (V, DC)	Cap. (μF)	Part Number	Surge Volt. (V, DC)	Leakage Current (μA)	Dimensions mm (inch)		
					Dφ max.	L max.	Lead Spacing
10	0.47	[ECS-Z16EFR47Q]	13	1.0	[4.5 (.177)]	[7.0 (.276)]	[1.5 (.059)]
	0.68	[ECS-Z16EFR68Q]		1.0	[4.5 (.177)]	[7.0 (.276)]	[1.5 (.059)]
	1	ECS-Z10EF1Q		1.0	4.5 (.177)	7.0 (.276)	1.5 (.059)
	1.5	[ECS-Z16EF1R5Q]		1.0	[5.0 (.197)]	[8.0 (.315)]	[2.5 (.098)]
	2.2	ECS-Z10EF2R2Q		1.0	5.0 (.197)	8.0 (.315)	2.5 (.098)
	3.3	ECS-Z10EF3R3Q		1.0	5.0 (.197)	8.0 (.315)	2.5 (.098)
	4.7	ECS-Z10EF4R7Q		1.0	5.0 (.197)	8.0 (.315)	2.5 (.098)
	6.8	ECS-Z10EF6R8Q		1.4	5.5 (.217)	9.0 (.354)	2.5 (.098)
	10	ECS-Z10EF10Q		2.0	5.5 (.217)	9.0 (.354)	2.5 (.098)
	15	ECS-Z10EF15Q		3.0	6.0 (.236)	10.0 (.394)	2.5 (.098)
	22	ECS-Z10EF22Q		4.4	6.5 (.256)	11.0 (.433)	3.5 (.138)
	33	ECS-Z10EF33Q		6.6	7.0 (.276)	12.0 (.472)	3.5 (.138)
	47	ECS-Z10EF47Q		9.4	7.0 (.276)	12.0 (.472)	3.5 (.138)
16	0.47	ECS-Z16EFR47Q	18	1.0	4.5 (.177)	7.0 (.276)	1.5 (.059)
	0.68	ECS-Z16EFR68Q		1.0	4.5 (.177)	7.0 (.276)	1.5 (.059)
	1	[ECS-Z25EF1Q]		1.0	[5.0 (.197)]	[8.0 (.315)]	[2.5 (.098)]
	1.5	ECS-Z16EF1R5Q		1.0	5.0 (.197)	8.0 (.315)	2.5 (.098)
	2.2	[ECS-Z25EF2R2Q]		1.1	[5.0 (.197)]	[8.0 (.315)]	[2.5 (.098)]
	3.3	ECS-Z16EF3R3Q		1.0	5.0 (.197)	8.0 (.315)	2.5 (.098)
	4.7	ECS-Z16EF4R7Q		1.3	5.5 (.217)	9.0 (.354)	2.5 (.098)
	6.8	ECS-Z16EF6R8Q		2.2	5.5 (.217)	9.0 (.354)	2.5 (.098)
	10	ECS-Z16EF10Q		3.0	6.0 (.236)	10.0 (.394)	2.5 (.098)
	15	ECS-Z16EF15Q		4.8	6.5 (.256)	11.0 (.433)	3.5 (.138)
	22	ECS-Z16EF22Q		7.0	7.0 (.276)	12.0 (.472)	3.5 (.138)
	33	ECS-Z16EF33Q		10.5	7.0 (.276)	12.0 (.472)	3.5 (.138)
25	0.47	[ECS-Z35EFR47Q]	32	1.0	[5.0 (.197)]	[8.0 (.315)]	[2.5 (.098)]
	0.68	[ECS-Z35EFR68Q]		1.0	[5.0 (.197)]	[8.0 (.315)]	[2.5 (.098)]
	1	ECS-Z25EF1Q		1.0	5.0 (.197)	8.0 (.315)	2.5 (.098)
	1.5	ECS-Z25EF1R5Q		1.0	5.0 (.197)	8.0 (.315)	2.5 (.098)
	2.2	ECS-Z25EF2R2Q		1.1	5.0 (.197)	8.0 (.315)	2.5 (.098)
	3.3	ECS-Z25EF3R3Q		1.6	5.5 (.217)	9.0 (.354)	2.5 (.098)
	4.7	ECS-Z25EF4R7Q		2.3	6.0 (.236)	10.0 (.394)	2.5 (.098)
	6.8	ECS-Z25EF6R8Q		3.4	6.5 (.256)	11.0 (.433)	3.5 (.138)
	10	ECS-Z25EF10Q		5.0	7.0 (.276)	12.0 (.472)	3.5 (.138)
	15	ECS-Z25EF15Q		7.5	7.0 (.276)	12.0 (.472)	3.5 (.138)
35	0.47	ECS-Z35EFR47Q	44	1.0	5.0 (.217)	8.0 (.315)	2.5 (.098)
	0.68	ECS-Z35EFR68Q		1.0	5.0 (.217)	8.0 (.315)	2.5 (.098)
	1	ECS-Z35EF1Q		1.0	5.0 (.217)	8.0 (.315)	2.5 (.098)
	1.5	ECS-Z35EF1R5Q		1.0	5.5 (.217)	9.0 (.354)	2.5 (.098)
	2.2	ECS-Z35EF2R2Q		1.5	6.5 (.236)	11.0 (.433)	3.5 (.138)
	3.3	ECS-Z35EF3R3Q		2.3	6.5 (.236)	11.0 (.433)	3.5 (.138)
	4.7	ECS-Z35EF4R7Q		3.3	6.5 (.236)	11.0 (.433)	3.5 (.138)
	6.8	ECS-Z35EF6R8Q		4.7	7.0 (.276)	12.0 (.472)	3.5 (.138)

Miniature Solid Tantalum
Type EA & EG

The subminiature solid tantalum capacitors are the result of much research and superior techniques.
Requiring very little space, they are suitable for radios, televisions, and other electronic applications. Two types are available, EA-series with axial leads and EG-series with single-ended leads.



Features

- Excellent performance in severe environment
- Very small in size
- Stable electrical characteristics

Electrical Specifications

1) Operating Temperature Range: -55°C to +85°C
2) Rated Working Voltage Range: 3.15WV to 35WV.DC
3) Rated Capacitance Range: 0.047 to 470μF
4) Capacitance Tolerance: -20 to +40%
   Capacitance tolerance ±20% is also available upon request.
5) Surge Voltage:

Working Volt.	Surge Volt.
3.15	4
6.3	8
10	13
16	20
25	32
35	44

6) Tanδ: Tanδ is listed in the Standard Products Table on pp.IV-52~IV-54. (Capacitance and tanδ shall be measured at 120Hz and 25°C)
7) Leakage Current:
   I = 0.02CV or 1μA whichever is the greater
   Leakage current shall be measured after 5-minute application of the rated d-c working voltage.
8) Low and High Temperature Stability:

Items \ Temp.	-55°C	+85°C
Cap. Change	15% max.	15% max.
Leakage Current	——	I=0.2CV or 10μA max. whichever is the greater

9) Life Test: After testing for 1,000 hours at 85°C with the working voltage, the units shall meet the followings when measured at room temperature.
   - Cap. change: Within ±10% of the initial measured value
   - Tanδ: Less than the specified value
   - Leakage current: Less than 125% of the initial specified value
10) Humidity Test: Capacitor shall be subjected to continuous 500±4-hour application of the rated d-c working voltage at 40±2°C, 90~95%RH.
    After test, capacitors shall be stabilized at the room ambient and leakage current, capacitance, and Tan δ shall be measured. Capacitors shall meet the following requirements.
    - Leakage current: Less than the initial specified value
    - Capacitance change: Within ±10% of the initial measured value
    - Tanδ: Less than 150% of the initial specified value
11) Surge Voltage Test: Capacitor shall be subjected to continuous 1,000 cycles application of the specified surge voltages. The temperature of this test shall be 85°C. Each cycle shall consist of 30-second surge voltage application followed by a 4½-minute discharge period. Voltage application shall be made through a resistor of 1,000 ohms in series with the capacitor and the voltage source. After the last voltage application cycle, capacitor shall be stabilized for at least 4 hours at the room ambient and the leakage current, capacitance, and tanδ shall be measured as specified. The capacitor shall meet the following requirements.
    - Leakage current: Less than the initial specified value
    - Capacitance change: Within ±5% of the initial measured value
    - Tan δ: Less than the initial specified value
    - Visual exam.: There shall be no evidence of mechanical damage.

Mechanical Specifications

1) Lead Pull Strength: The body of the capacitor shall be secured, a pull of weights specified in the table below shall be applied to each lead. The pulling weight applied to the lead shall be gradually increased up to the specified value, when the weight shall be maintained at the specified value for 10 seconds. After the test, there shall be no loosening of the terminals and no permanent damage to the terminals.
2) Lead Bend Strength: Each lead shall be bent. The capacitor shall be placed in a vertical position and a weight specified in the table below shall be applied to each lead. Then the capacitor shall be slowly rotated, for approximately 2-1/2 seconds, in a horizontal position and then returned to the vertical position. After the test, there shall be no loosening of the terminals and no permanent damage to the terminals.

diameter of lead wire mm (inch)	pull weight kg (lbs.)	bend weight kg (lbs.)
0.4~0.5 (.0157~.0197)	0.5 (1.103)	0.25 (0.552)
0.6~0.8 (.0236~.0315)	1.0 (2.205)	0.5 (1.103)

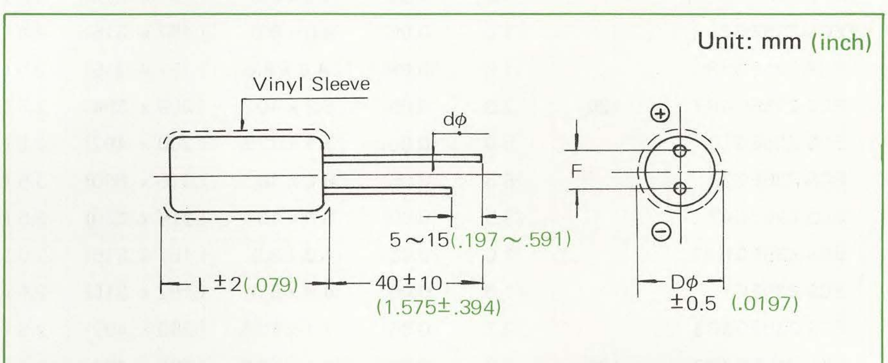
3) Solderability: The lead shall be immersed in a flux for 2±1/2 seconds and then immersed in the molten solder to 4±0.05mm (.157 ± .02″) from the capacitor body for 2±1/2 seconds.
   The flux is composed of 10±2% by weight of rosin and methyl alcohol or isopropyl alcohol. Solder composition is Sn 63%. The molten solder shall be stirred with a clean, stainless-steel paddle to assure that it is at a uniform temperature of 230±5°C. Following immersion, the leads shall be cooled in air. The flux shall be removed from the leads by dipping in isopropyl alcohol. After the test, the entire surface of the dip-coated lead shall be examined. The dipped surface of the leads shall be at least 3/4 covered with new, smooth solder coating.

4) Heat Shock by Soldering: The leads shall be immersed in the flux (see 3) and then immersed in the molten solder, at 270±5°C, 4±0.5mm (.157±.02″) from the capacitor body for 2±1/2 seconds. Following immersion, the capacitor is cooled at least 2 hours at room temperature. After the test leakage current, capacitance, and Tanδ shall be measured. The capacitor shall meet the following requirements.
   - Leakage current: shall not exceed the applicable specified value.
   - Capacitance: shall not change more than 3% from the value obtained before the test.
   - Tanδ : shall not exceed the applicable value specified.
   - Visual exam.: there shall be no evidence of mechanical damage.

5) Vibration Test: The capacitor shall be attached to a suitable mounting board. Test for 1-1/2 hours, at amplitude of 0.06″ maximum total excursion, the frequency being varied uniformly over the frequency range, from 10 to 55 to 10 c-p-s, shall be applied for a period of 45 minutes in each of 2 mutually perpendicular directions. During the last 30 minutes of vibration in each direction, the capacitance shall be measured several times. The capacitance value shall be stable. After the test, there shall be no evidence of visual change.
6) Standard Marking Item: Rated capacitance, Rated working voltage, symbol of MATSUSHITA (▲), symbol of solid tantalum Capacitor(CS), Polarity (Red end-seal), Manufactured Date Code.

Single-Ended Lead Type (EG-series)

Dimensions



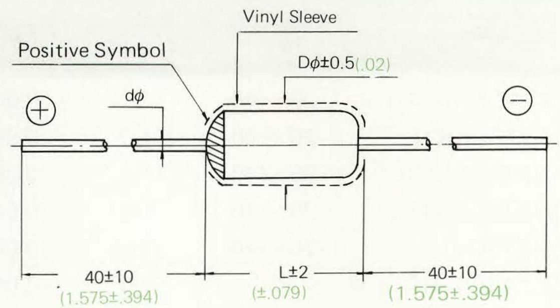
Standard Products Table (EG series)

Part numbers in brackets [ ] are description of substitutes. For example, the substitute of a capacitor for 3.15V and 4.7μF is shown as [ECS-Z16EG4R7], which is common to the part number of the capacitor for 16V, 4.7μF.

W.V. (VDC)	Cap. Tol. (μF)	Part No.	Cap. Tol. (%)	L.C. (μA) max.	Tan δ	Dimensions (Refer to P.IV-51) Dϕ x L	mm(inch)	F	Lead Wire dϕ
3.15	4.7	[ECS-Z16EG4R7]	±20	1.5	0.06	4.0 x 8.0	(.157 x .315)	2.0 (.079)	0.4 (.016)
	10	[ECS-Z10EG10]		2.0	0.06	4.0 x 8.0	(.157 x .315)	2.0 (.079)	0.4 (.016)
	33	ECS-Z3EG33		2.1	0.06	4.0 x 8.0	(.157 x .315)	2.0 (.079)	0.4 (.016)
	47	ECS-Z3EG47		3.0	0.06	5.3 x 10	(.029 x .394)	2.5 (.098)	0.4 (.016)
	100	ECS-Z3EG100		6.3	0.08	7.1 x 12.5	(.280 x .492)	3.0 (.118)	0.5 (.020)
	220	[ECS-Z6EG220]		27.6	0.08	8.0 x 16	(.315 x .630)	3.5 (.138)	0.6 (.024)
	330	ECS-Z3EG330		20.8	0.08	8.0 x 16	(.315 x .630)	3.5 (.118)	0.6 (.024)
	470	ECS-Z3EG470		29.6	0.08	10 x 20	(.394 x .787)	4.0 (.154)	0.6 (.024)
6.3	3.3	[ECS-Z25EG3R3]	±20	1.6	0.06	4.0 x 8.0	(.157 x .316)	2.0 (.079)	0.4 (.016)
	4.7	[ECS-Z16EG4R7]		1.5	0.06	4.0 x 8.0	(.157 x .315)	2.0 (.079)	0.4 (.016)
	10	[ECS-Z10EG10]		2.0	0.06	4.0 x 8.0	(.157 x .315)	2.0 (.079)	0.4 (.016)
	33	ECS-Z6EG33		4.1	0.06	5.3 x 10	(.209 x .394)	2.5 (.098)	0.4 (.016)
	47	ECS-Z6EG47		5.9	0.06	7.1 x 12.5	(.280 x .492)	3.0 (.118)	0.5 (.020)
	100	[ECE-Z10EG100]		20.0	0.08	8.0 x 16	(.315 x .630)	3.5 (.138)	0.6 (.024)
	220	ECS-Z6EG220		27.6	0.08	8.0 x 16	(.315 x .630)	3.5 (.138)	0.6 (.024)
	330	ECS-Z6EG330		41.5	0.08	10 x 20	(.394 x .787)	4.0 (.154)	0.6 (.024)
10	3.3	[ECS-Z25EG3R3]	±20	1.6	0.06	4.0 x 8.0	(.157 x .315)	2.0 (.079)	0.4 (.016)
	4.7	[ECS-Z16EG4R7]		1.5	0.06	4.0 x 8.0	(.157 x .315)	2.0 (.079)	0.4 (.016)
	10	ECS-Z10EG10		2.0	0.06	4.0 x 8.0	(.157 x .015)	2.0 (.079)	0.4 (.016)
	33	ECS-Z10EG33		6.6	0.06	7.1 x 12.5	(.280 x .492)	3.0 (.118)	0.5 (.020)
	47	ECS-Z10EG47		9.4	0.06	7.1 x 12.5	(.280 x .482)	3.0 (.118)	0.5 (.020)
	100	ECS-Z10EG100		20.0	0.08	8.0 x 16	(.315 x .630)	3.5 (.118)	0.6 (.024)
	220	ECS-Z10EG220		44.0	0.08	10 x 20	(.394 x .787)	4.0 (.154)	0.6 (.024)
16	1.0	[ECS-Z35EG1]	±20	1.0	0.06	4.0 x 8.0	(.157 x .315)	2.0 (.079)	0.4 (.016)
	3.3	[ECS-Z25EG3R3]		1.6	0.06	4.0 x 8.0	(.157 x .315)	2.0 (.079)	0.4 (.016)
	4.7	ECS-Z16EG4R7		1.5	0.06	4.0 x 8.0	(.157 x .315)	2.0 (.079)	0.4 (.016)
	10	ECS-Z16EG10		3.2	0.06	5.3 x 10	(.209 x .394)	2.5 (.098)	0.4 (.016)
	33	ECS-Z16EG33		10.5	0.06	7.1 x 12.5	(.280 x .492)	3.0 (.118)	0.5 (.020)
	47	[ECS-Z25EG47]		23.5	0.06	8.0 x 16	(.315 x .630)	3.5 (.138)	0.6 (.024)
	100	ECS-Z16EG100		32.0	0.08	8.0 x 16	(.315 x .630)	3.5 (.138)	0.6 (.024)
25	0.47	[ECS-Z35EGR47]	±20	1.0	0.06	4.0 x 8.0	(.157 x .315)	2.0 (.079)	0.4 (.016)
	1.0	[ECS-Z35EG1]		1.0	0.06	4.0 x 8.0	(.157 x .315)	2.0 (.079)	0.4 (.016)
	3.3	ECS-Z25EG3R3		1.6	0.06	4.0 x 8.0	(.157 x .315)	2.0 (.079)	0.4 (.016)
	4.7	ECS-Z25EG4R7		2.3	0.06	5.3 x 10	(.209 x .394)	2.5 (.098)	0.4 (.016)
	10	ECS-Z25EG10		5.0	0.06	7.1 x 12.5	(.280 x .492)	3.0 (.118)	0.5 (.020)
	33	ECS-Z25EG33		16.5	0.06	8.0 x 16	(.315 x .630)	3.5 (.138)	0.6 (.024)
	47	ECS-Z25EG47		23.5	0.06	8.0 x 16	(.315 x .630)	3.5 (.138)	0.6 (.024)
35	0.47	ECS-Z35EGR47	±20	1.0	0.06	4.0 x 8.0	(.157 x .315)	2.0 (.079)	0.4 (.016)
	1	ECS-Z35EG1		1.0	0.06	4.0 x 8.0	(.157 x .315)	2.0 (0.78)	0.4 (.016)
	3.3	ECS-Z35EG3R3		2.3	0.06	7.1 x 12.5	(.280 x .492)	2.5 (.098)	0.5 (.020)
	4.7	ECS-Z35EG4R7		3.0	0.06	7.1 x 12.5	(.280 x .492)	2.5 (.098)	0.5 (.020)
	10	ECS-Z35EG10		7.0	0.06	8.0 x 16	(.315 x .630)	3.0 (.118)	0.6 (.024)
	33	ECS-Z35EG33		23.1	0.06	10 x 20	(.394 x .787)	3.5 (.138)	0.6 (.024)
	47	ECS-Z35EG47		32.8	0.06	10 x 20	(.394 x .787)	3.5 (.138)	0.6 (.024)

Axial Lead Type
(EA-series)

Unit: mm (inch)



Note: Insulating sleeve color is light yellow.
Positive is indicated by red.

Standard Products Table
(EA series)

Part numbers in brackets [ ] are description of substitutes. For example, the substitute of a capacitor for 3.15V and 0.047μF is shown as [ECS-Z25EAR047], which is common to the part number of the capacitor for 25V,0.047μF.

W.V. (VDC)	Cap. (μF)	Part No.	Cap. Tol. (%)	L.C. (μA max.)	Tanδ	Dimensions mm (inch) Dφ x L	Lead Wire dφ
3.15	0.047	[ECS-Z25EAR047]	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	0.1	[ECS-Z25EAR1]	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	0.33	[ECS-Z25EAR33]	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	0.47	[ECS-Z16EAR47]	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	1.0	[ECS-Z10EA1]	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	3.3	ECS-Z3EA3R3	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	4.7	[ECS-Z6EA4R7]	±20	1.0	0.06	2.7 x 6.3 (.106 x .248)	0.4 (.016)
	10	ECS-Z3EA10	±20	1.0	0.06	2.7 x 6.3 (.106 x .248)	0.4 (.016)
	33	ECS-Z3EA33	±20	2.0	0.06	3.7 x 6.3 (.146 x .248)	0.4 (.016)
	47	ECS-Z3EA47	±20	3.0	0.06	3.7 x 8.5 (.146 x .335)	0.4 (.016)
	100	ECS-Z3EA100	±20	6.3	0.08	4.7 x 12.5 (.185 x .492)	0.5 (.020)
	220	[ECS-Z6EA220]	±20	27.6	0.08	7.3 x 16.0 (.287 x .630)	0.6 (.024)
	330	ECS-Z3EA330	±20	20.8	0.08	7.3 x 16.0 (.287 x .630)	0.6 (.024)
	470	ECS-Z3EA470	±20	29.6	0.08	7.3 x 16.0 (.287 x .630)	0.6 (.024)
6.3	0.047	[ECS-Z25EAR047]	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	0.1	[ECS-Z25EAR1]	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	0.33	[ECS-Z25EAR33]	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	0.47	[ECS-Z16EAR47]	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	1.0	[ECS-Z10EA1]	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	3.3	[ECS-Z10EA3R3]	±20	1.0	0.06	2.7 x 6.3 (.106 x .248)	0.4 (.016)
	4.7	ECS-Z6EA4R7	±20	1.0	0.06	2.7 x 6.3 (.106 x .248)	0.4 (.016)
	10	[ECS-Z10EA10]	±20	2.0	0.06	3.7 x 6.3 (.146 x .248)	0.4 (.016)
	33	ECS-Z6EA33	±20	4.1	0.06	3.7 x 8.5 (.146 x .335)	0.4 (.016)
	47	ECS-Z6EA47	±20	5.9	0.06	4.7 x 12.5 (.185 x .492)	0.5 (.020)
	100	[ECS-Z10EA100]	±20	20.0	0.08	7.3 x 16.0 (.287 x .630)	0.6 (.024)
	220	ECS-Z6EA220	±20	27.6	0.08	7.3 x 16.0 (.287 x .630)	0.6 (.024)
	330	ECS-Z6EA330	±20	46.5	0.08	7.3 x 16.0 (.287 x .630)	0.6 (.024)

(Continued)

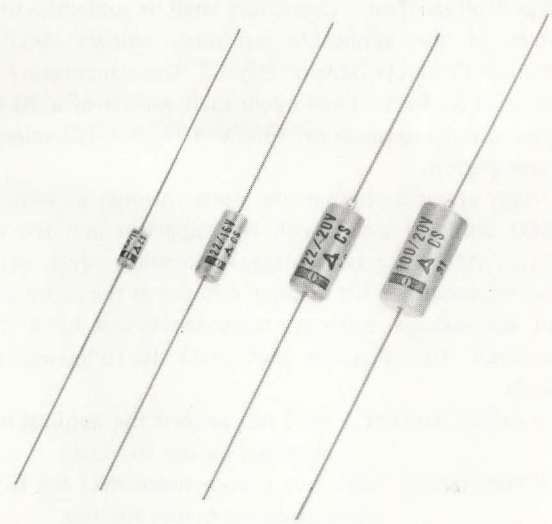
W.V. (VDC)	Cap. (μF)	Part No.	Cap. Tol. (%)	L.C. (μA max)	Tanδ	Dimensions mm (inch)	
						Dφ x L	Lead Wire dφ
10	0.047	[ECS-Z25EAR047]	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	0.1	[ECS-Z25EAR1]	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	0.33	[ECS-Z25EAR33]	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	0.47	[ECS-Z16EAR47	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	1.0	ECS-Z10EA1	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	3.3	ECS-Z10EA3R3	±20	1.0	0.06	2.7 x 6.3 (.106 x .248)	0.4 (.016)
	4.7	[ECS-Z16EA4R7]	±20	1.5	0.06	3.7 x 6.3 (.146 x .248)	0.4 (.016)
	10	ECS-Z10EA10	±20	2.0	0.06	3.7 x 6.3 (.146 x .248)	0.4 (.016)
	33	ECS-Z10EA33	±20	6.6	0.06	4.7 x 12.5 (.185 x .492)	0.5 (.020)
	47	ECS-Z10EA47	±20	9.4	0.06	4.7 x 12.5 (.185 x .492)	0.5 (.020)
	100	ECS-Z10EA100	±20	20.0	0.08	7.3 x 16.0 (.287 x .630)	0.6 (.024)
	220	ECS-Z10EA220	±20	44.0	0.08	7.3 x 16.0 (.287 x .630)	0.6 (.024)
16	0.047	[ECS-Z25EAR047]	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	0.1	[ECS-Z25EAR1]	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	0.33	[ECS-Z25EAR33]	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	0.47	ECS-Z16EAR47	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	1.0	[ECS-Z25EA1]	±20	1.0	0.06	2.7 x 6.3 (.106 x .248)	0.4 (.016)
	3.3	[ECS-Z25EA3R3]	±20	1.6	0.06	3.7 x 6.3 (.146 x .248)	0.4 (.016)
	4.7	ECS-Z16EA4R7	±20	1.5	0.06	3.7 x 6.3 (.146 x .248)	0.4 (.016)
	10	ECS-Z16EA10	±20	3.2	0.06	3.7 x 8.5 (.146 x .335)	0.4 (.016)
	33	ECS-Z16EA33	±20	10.5	0.06	4.7 x 12.5 (.185 x .492)	0.5 (.020)
	47	[ECS-Z25EA47]	±20	23.5	0.06	7.3 x 16.0 (.287 x .630)	0.6 (.024)
	100	ECS-Z16EA100	±20	32.0	0.08	7.3 x 16.0 (.287 x .630)	0.6 (.024)
25	0.047	ECS-Z25EAR047	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	0.1	ECS-Z25EAR1	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	0.33	ECS-Z25EAR33	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	0.47	ECS-Z25EAR47	±20	1.0	0.06	2.7 x 6.3 (.106 x .248)	0.4 (.016)
	1	ECS-Z25EA1	±20	1.0	0.06	2.7 x 6.3 (.106 x .248)	0.4 (.016)
	3.3	ECS-Z25EA3R3	±20	1.6	0.06	3.7 x 6.3 (.146 x .248)	0.4 (.016)
	4.7	ECS-Z25EA4R7	±20	2.3	0.06	3.7 x 8.5 (.146 x .335)	0.4 (.016)
	10	ECS-Z25EA10	±20	5.0	0.06	4.7 x 12.5 (.185 x .492)	0.5 (.020)
	33	ECS-Z25EA33	±20	16.5	0.06	7.3 x 16.0 (.287 x .630)	0.6 (.024)
	47	ECS-Z25EA47	±20	23.5	0.06	7.3 x 16.0 (.287 x .630)	0.6 (.024)
35	0.047	ECS-Z35EAR047	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	0.1	ECS-Z35EAR1	-20~+40	1.0	0.06	2.0 x 5.0 (.079 x .197)	0.4 (.016)
	0.33	ECS-Z35EAR33	±20	1.0	0.06	2.7 x 6.3 (.106 x .248)	0.4 (.016)
	0.47	ECS-Z35EAR47	±20	1.0	0.06	2.7 x 6.3 (.106 x .248)	0.4 (.016)
	1	ECS-Z35EA1	±20	1.0	0.06	3.7 x 6.3 (.146 x .248)	0.4 (.016)
	3.3	ECS-Z35EA3R3	±20	2.3	0.06	4.7 x 12.5 (.185 x .492)	0.5 (.020)
	4.7	ECS-Z35EA4R7	±20	3.0	0.06	4.7 x 12.5 (.185 x .492)	0.5 (.020)
	10	ECS-Z35EA10	±20	7.0	0.06	7.3 x 16.0 (.287 x .630)	0.6 (.024)
	33	ECS-Z35EA33	±20	23.1	0.06	9.0 x 20 (.354 x .787)	0.6 (.024)
	47	ECS-Z35EA47	±20	32.8	0.06	9.0 x 20 (.354 x .787)	0.6 (.024)

Miniature Solid Tantalum(Type VH)

Type VH is a highly reliable hermetic-sealed tantalum electrolytic capacitor, and ideal for industrial equipment which requires high performance.

Features

- The smallest size
- A solid semi-conductor used as electrolyte
- Stable against temperature change and aging
- Superior frequency characteristics
- Very small leakage current
- Extremely stable even in high humidity due to excellent hermetic-sealed terminals
- New procedure and equipment for solid semi-conductor baking process
- Meet MIL-C-26655A, CS12



Electrical Specifications

1) Operating Temperature Range: -55°C to +85°C
2) Operating Temperature Range With Derating: -55°C to +125°C
3) Rated Working Voltage Range: 6.3WV to 35WV.DC
4) Rated Capacitance Range: 1 to 330μF
5) Capacitance Tolerance: ±20%
   Cap. tol. ±10% is available upon request.
6) Surge Voltage and Tan δ:

Working Volt.	Surge Volt.	Tan δ	(CR-Product)
6.3V	8	0.06*	80**
10	12	0.06	80
16	18	0.06	80
20	23	0.06	80
35	42	0.06	80

Notes; * 0.08 for 300μF
** 106 for 300μF

7) Leakage Current:
   I=0.01CV or 0.5μA whichever is the greater
   Leakage current shall be measured after 5-minute application of the rated d-c working voltage.
8) Low and High Temperature Stability:

Temp. / Char.	-55°C	85°C	125°C	After return to room temperature
Cap. Change (%)	12max.	12max.	15max.	3max.
	of the initial value			
Tan δ	0.08 max.	0.08max.	0.08max.	The specified value
L.C. (μA) max.	——	0.1CV or 5	0.25CV or 12.5	The specified value
	whichever is the greater			

9) Moisture Resistance: Capacitor shall be subjected to continuous 120±4-hour application of the rated d-c working voltage at 40±2°C, 90~95%RH. After the test, capacitors shall be stabilized at the room ambient and leakage current, capacitance, and tanδ shall be measured. Capacitors shall meet the following limits.
   - Leakage current: shall not exceed the applicable specified value.
   - Capacitance: shall not change more than 5% from the value obtained before the test.
   - Tan δ: shall not exceed the applicable specified value
10) Temperature and Immersion Cycling:
    1. Temperature cycling: Capacitor shall be tested 5-time cycles from step 1 to 4 in accordance with the following table.

step	test temp.	test time (min.)
1	-55^{+0}_{-3}°C	30
2	+15~+35°C	10~15
3	$+85^{+3}_{-0}$°C	30
4	+15~+35°C	10~15

    2. Immersion cycling: After temperature cycling, capacitors shall be tested twice cycles in accordance with the following table.

step	immersion bath	immersion temp.	duration of each immersion (minutes)
1	fresh water	$+65^{+5}_{-0}$°C	30
2	saturated solution of sodium chloride and water	0 ± 3°C	30

After completion of the final cycle, capacitors shall be thoroughly and quickly washed and surfaces wiped or air-blasted clean and dry at least 4 hours.
After temperature and immersion cycling test, capacitor shall meet the following requirements.
- Leakage current: shall not exceed the applicable specified value.
- Capacitance: shall not change more than 5% from the value obtained before the test.
- Tan δ: shall not exceed the applicable specified value.

11) Surge Voltage Test: Capacitors shall be subjected to 1,000 cycles of the applicable d-c surge voltage specified in Standard Products Table on P.IV-55. The temperature of this test shall be 85°C. Each cycle shall consist of a 30 second surge voltage application followed by a 4-1/2 minute discharge period.
Voltage application shall be made through a resistance of 1,000 ohms in series with the capacitor and the voltage source. After the last voltage-application cycle, capacitor shall be stabilized for at least 4 hours at the room ambient and the leakage current, capacitance and tan δ shall be measured. The capacitor shall meet the following requirements.
- Leakage current: shall not exceed the applicable value obtained before the test.
- Capacitance: shall not change more than 5% from the value obtained before the test.
- Tan δ: there shall be no evidence of mechanical damage.
- Visual examination: there shall be no evidence of mechanical damage.

12) Life Test: Capacitor shall be subjected to continuous 1,000 ±12-hour application of the rated d-c working voltage at 85°C. The impedance of the voltage source, as seen from the terminals of each capacitor, shall not exceed ohm value approximately equal to the rated d-c working voltage in volts. D-c working voltage shall be applied gradually (not exceed 5 minutes either by a slow build-up to the voltage or through a resistor which shall be shorted out within 5 minutes). Storage batteries, or an electronic power supply shall be used. The voltage regulation shall be within 3%. After the test, capacitor shall then be returned to the room ambient and leakage current, capacitance, and tan δ shall be measured.
The capacitors shall then be visually examined for evidence of arcing, mechanical damage and obliteration of marking. Capacitor shall meet the following limits.
- Leakage current: shall not exceed 125% of the applicable specified value.
- Capacitance: shall not change more than 10% from the value obtained before the test.
- Tan δ: shall not exceed the applicable specified value.
- Visual examination: there shall be no evidence of arcing, mechanical damage and marking shall remain legible.

Mechanical Specifications

1) Lead Pull Strength: The capacitor shall be secured, and a pull of weight specified in the table below shall then be applied to each lead. The pull shall be applied in one direction and shall be increased gradually to the specified pull and left at that value for 10 seconds. After the test, there shall be no loosening of the terminals and no permanent damage to the terminals.

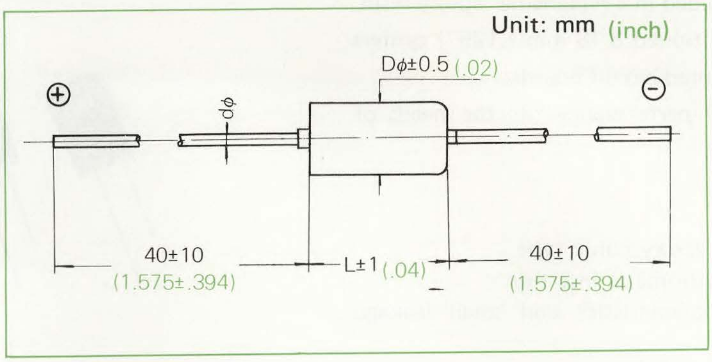
diameter of lead wire mm (inch)	pull weight kg (lbs.)	bend weight kg (lbs.)
0.4 ~0.5 (.0157~.0197)	0.5 (1.103)	0.25 (.552)
0.6 ~0.8 (.0236~.0315)	1.0 (2.205)	0.5 (1.103)

2) Lead Bend Strength: Each lead shall be bent. The capacitor shall be placed in a vertical position and a weight specified in table shall be applied to one lead. The capacitor shall be slowly rotated, in approximately 2-1/2 seconds, in a horizontal position and then returned to the vertical position. After the test, there shall be no loosening of the terminals and no permanent damage to the terminals.
3) Solderability Test: The leads shall be immersed in a flux for 2±1/2 seconds and then immersed in the molten solder to .079±.002" from the capacitor body for 2±1/2 seconds. The flux is composed of 10±2% by weight of rosin and methyl alcohol or isopropyl alcohol. Solder composition is Sn 63%. The molten solder shall be stirred with a clean, stainless-steel paddle to assure that it is at a uniform temperature of 230±5°C. Following immersion, the leads shall be cooled in air. The flux shall be removed from the leads by dipping in isopropyl alcohol. After the test, the entire surface of the dip-coated lead shall be examined. The dipped surface of the leads shall be at least 75% covered with new, smooth solder coating.
4) Heat Shock by Soldering Test: The leads shall be immersed in the flux and then immersed in the molten solder, at 270±5°C, to .079"±.002" from the capacitor body for 2±1/2 seconds. Following immersion, the capacitor is at least 2 hours in room ambient. After the test, leakage current, capacitance, and tanδ shall be measured, the capacitor shall meet the following requirements.
- Leakage current: shall not exceed the applicable specified value.
- Capacitance: shall not change more than 3% from the value specified.
- Tan δ: shall not exceed the applicable value specified.
- Visual examination: there shall be no evidence of mechanical damage.

5) Vibration Test: The capacitor shall be mounted using suitable mounting board. Test for 1-1/2 hours, at amplitude of .06" maximum total excursion, the frequency range, from 10 to 55 c-p-s and return to 10 c-p-s, shall be traversed approximately 1 minute. This motion shall be applied for a period of 45 minutes in each of 2 matually perpendicular direction. During the last 30 minutes of vibration in each direction, the capacitor shall be measured several times. The capacitance value shall be stable. After the test, there shall be no evidence of visual change.

6) Standard Marking Item: Rated capacitance, Rated working voltage, Symbol of MATSUSHITA (▲), Symbol of solid tantaum capacitor (CS), Polarity, Manufactured date code.

Dimensions

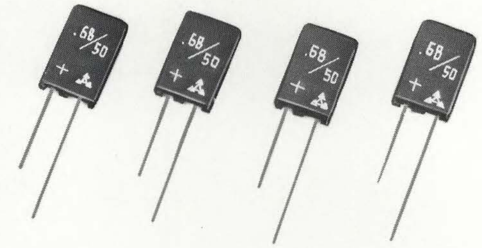


Standard Products Table

W.V. (VDC)	Surge Volt. (VDC)	Cap. (μF)	Part No.	Cap. Tol. (%)	Leakage Current (μA max.)	Tan δ	Dimensions Dϕ x L	mm (inch)	Lead wire dϕ
6.3	8	6.8	ECS-Z 6VH6R8	±20	0.5	0.06	3.15 x 6.4	(.124 x .252)	0.5 (.020)
		47	ECS-Z 6VH 47		2.8	0.06	4.5 x 12.5	(.177 x .492)	0.5 (.020)
		150	ECS-Z 6VH150		9.0	0.06	7.1 x 16.0	(.280 x .630)	0.6 (.024)
		330	ECS-Z 6VH330		20.0	0.08	9.0 x 20.0	(.354 x .787)	0.6 (.024)
10	13	4.7	ECS-Z 10VH4R7	±20	0.5	0.06	3.15 x 6.4	(.124 x .252)	0.5 (.020)
		33	ECS-Z 10VH 33		3.3	0.06	4.5 x 12.5	(.177 x .492)	0.5 (.020)
		100	ECS-Z 10VH100		10.0	0.06	7.1 x 16.0	(.280 x .630)	0.6 (.024)
		220	ECS-Z 10VH220		22.0	0.06	9.0 x 20.0	(.354 x .787)	0.6 (.024)
16	20	3.3	ECS-Z 16VH3R3	±20	0.5	0.06	3.15 x 6.4	(.124 x .252)	0.5 (.020)
		22	ECS-Z 16VH 22		3.3	0.06	4.5 x 12.5	(.177 x .492)	0.5 (.020)
		47	ECS-Z 16VH 47		7.5	0.06	7.1 x 16.0	(.280 x .630)	0.6 (.024)
		68	ECS-Z 16VH 68		10.9	0.06	7.1 x 16.0	(.280 x .630)	0.6 (.024)
		150	ECS-Z 16VH150		22.5	0.06	9.0 x 20.0	(.354 x .787)	0.6 (.024)
20	23	1	ECS-Z 20VH 1	±20	0.5	0.06	3.15 x 6.4	(.124 x .252)	0.5 (.020)
		1.5	ECS-Z 20VH1R5		0.5	0.06	3.15 x 6.4	(.124 x .252)	0.5 (.020)
		2.2	ECS-Z 20VH2R2		0.5	0.06	3.15 x 6.4	(.124 x .252)	0.5 (.020)
		3.3	ECS-Z 20VH3R3		0.6	0.06	4.5 x 12.5	(.177 x .492)	0.5 (.020)
		4.7	ECS-Z 20VH4R7		0.8	0.06	4.5 x 12.5	(.177 x .492)	0.5 (.020)
		6.8	ECS-Z 20VH6R8		1.3	0.06	4.5 x 12.5	(.177 x .492)	0.5 (.020)
		10	ECS-Z 20VH 10		2.0	0.06	4.5 x 12.5	(.177 x .492)	0.5 (.020)
		15	ECS-Z 20VH 15		3.0	0.06	4.5 x 12.5	(.177 x .492)	0.5 (.020)
		22	ECS-Z 20VH 22		4.4	0.06	7.1 x 16.0	(.280 x .630)	0.6 (.024)
		33	ECS-Z 20VH 33		6.6	0.06	7.1 x 16.0	(.280 x .630)	0.6 (.024)
		47	ECS-Z 20VH 47		9.4	0.06	7.1 x 16.0	(.280 x .630)	0.6 (.024)
		68	ECS-Z 20VH 68		13.6	0.06	9.0 x 20.0	(.354 x .787)	0.6 (.024)
		100	ECS-Z 20VH100		20.0	0.06	9.0 x 20.0	(.354 x .787)	0.6 (.024)
35	44	1	ECS-Z 35VH1	±20	0.5	0.06	3.15 x 6.4	(.124 x .252)	0.5 (.020)
		1.5	ECS-Z 35VH1R5		0.5	0.06	4.5 x 12.5	(.177 x .492)	0.5 (.020)
		2.2	ECS-Z 35VH2R2		0.7	0.06	4.5 x 12.5	(.177 x .492)	0.5 (.020)
		3.3	ECS-Z 35VH3R3		1.1	0.06	4.5 x 12.5	(.177 x .492)	0.5 (.020)
		4.7	ECS-Z 35VH4R7		1.6	0.06	4.5 x 12.5	(.177 x .492)	0.5 (.020)
		6.8	ECS-Z 35VH6R8		2.3	0.06	4.5 x 12.5	(.177 x .492)	0.5 (.020)
		10	ECS-Z 35VH 10		3.5	0.06	7.1 x 16.0	(.280 x .630)	0.6 (.024)
		15	ECS-Z 35VH 15		5.2	0.06	7.1 x 16.0	(.280 x .630)	0.6 (.024)
		22	ECS-Z 35VH 22		7.7	0.06	7.1 x 16.0	(.280 x .630)	0.6 (.024)
		33	ECS-Z 35VH 33		11.5	0.06	9.0 x 20.0	(.354 x .787)	0.6 (.024)
		47	ECS-Z 35VH 47		16.4	0.06	9.0 x 20.0	(.354 x .787)	0.6 (.024)

Molded Tantalum (Type VS)

These capacitors are fully molded in a rectangular epoxy resin. Radial leads on precisely positioned 3.18 mm (.125") centers provide easy mounting on printed circuit boards.
Electrical and environmental performance fits the needs of computer and industrial users.



Features

- Good space factor due to epoxy cubic type
- Projection at bottom for automatic insertion
- Excellent temperature characteristics and small leakage current
- Excellent frequency characteristics
- Stable for humidity and load life characteristics

Electrical Specifications

1) Operating Temperature Range: -55°C to +85°C
2) Rated Working Voltage Range: 6.3WV to 50WV.DC
3) Rated Capacitance Range: 0.68 to 22 μF
4) Capacitance Tolerance: Standard capacitance tolerance is ±20%. Capacitance tolerance shall be measured at 25°C with a 0.5VAC (r-m-s) 120Hz signal voltage and 1.5V to 2.0V.DC polarizing voltage applied.
5) Surge Voltage:

Working Volt.	Surge Volt.
6.3V	8V
10	13
16	20
20	25
25	32
35	44
50	63

6) Tan δ: Tan δ shall be measured at 25°C with 0.5WVAC (r-m-s) 120Hz signal voltage and 1.5WV to 2.0WVDC polarizing voltage applied.
   Tan δ=753CR where C: farads
   R: ohms
   Tanδ shall be less than 0.06
7) Leakage Current: D-C leakage current shall be measured at 25°C after 5-minute application of the rated d-c working voltage from a steady source of power.
   The maximum d-c leakage current shall not exceed the value determined from the following formula:
   I=0.01CV or 0.5 microampere, whichever is the greater
   where, I: microampere
   C: microfarads
   V: volts
8) Load Life: Capacitor shall be subjected to continuous 2,000±12 hours application of the rated d-c working voltage at 85±2°C.
   The rated d-c voltage shall be continuously applied for the full duration of the test.
   Voltage shall be applied gradually from zero to the rated voltage for about 5 minutes. After completion of the test, the capacitors shall be allowed to stabilize at room temperature for a minimum of 2 hours.
   - Leakage Current: shall not exceed 1.25 times the specified value
   - Capacitance: shall not exceed 10% of the initial value.
   - Tan δ: shall meet the specified value
   - Impedance: shall not exceed 1.5 times the specified value.
9) Stability at Low and High Temperature: Capacitor shall be measured for d-c leakage current, capacitance, Tanδ and impedance at each of the temperatures specified in the table below. The capacitors shall be brought to thermal stability at each test temperature.
   Thermal stability will have been reached when no further change in capacitance is observed between two successive measurements taken at 15-minute intervals.

Step.	Test Temp. (°C)	Specification			
		DC Leakage	Cap. Change (%)	Tan δ	Z (ohm)
1	+15~+35	shall not exceed spec. value.	——	shall not exceed spec. value.	shall not exceed spec. value.
2	-55±2	——	from step 1 within 10%	shall not exceed 0.08	——
3	+15~+35	shall not exceed spec. value.	——	shall not exceed spec. value.	shall not exceed spec. value.
4	+85±2	0.1CV or 5μA, whichever is greater	from step 1 within 10%	shall not exceed 0.08.	——
5	+15~+35	shall not exceed spec. value	during steps 3 and 5, not more than 3% from step 1	shall not exceed spec. value.	shall not exceed spec. value.

10) Temperature and Immersion Cycling Test:

(a) Temperature Cyling: Capacitor shall be tested in 5 cycles from step 1 to 4 in accordance with the following table.

Step	Test Temp. (°C)	Test Time (min.)
1	-55	30
2	+15~+35	10~15
3	+85	30
4	+15~+35	10~15

(b) Immersion Cycling: After temperature cycling, capacitors shall be tested in two cycles in accordance with the following table.

Step	Immersion bath	Immersion Temp. (°C)	Duration of each Immersion (min.)
1	fresh water	65	30
2	saturated solution of sodium chloride and water	0	30

After completion of the final cycle, capcitors shall be thoroughly and quickly washed and all surfaces wiped or air blasted clean and dried at least 4 hours.
After the test, capacitors shall meet the following requirements.

- Leakage current: shall not exceed spec. value
- Capacitance: shall not change more than 5% from the value obtained before the test.
- Tan δ: shall not exceed spec. value.
- Impedance: shall not exceed 150% of the spec. value.

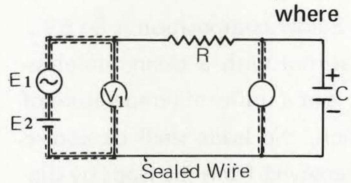
11) Surge Votlage Test: Capacitor shall be subjected to continuous 1,000 cycles application of the rated d-c surge voltage specified in 5) Surge Voltage table on p.IV-58. The temperature of this test shall be 85°C. Each cycle shall consist of a 30-second surge voltage application followed by a 4.30-minute discharge period.
Voltage application shall be made through a resistance of 1000 ohms in series with the capacitor and the voltage source. After the last voltage application cycle, capacitor shall be stabilized for at least 4 hours at the ambient temperature, and the leakage current, capacitance, tan δ and impedance shall be measured.
The capacitor shall meet the following requirements.

- Leakage current: shall not exceed specified value.
- Capacitance: shall not change more than 5% from the value obtained before the test.
- Tan δ: shall not exceed specified value.
- Impedance: shall not exceed specified value.

12) Load Humidity: The capacitors shall be exposed to an environment of 55±2°C ambient temperature, and 85 to 92% relative humidity for a period of 1000 hours. The rated d-c voltage shall be continuously applied for the full duration of the test.
Voltage shall be applied gradually from zero to the rated voltage for about 5 minutes.
After completion of the test, the capacitors shall be allowed to stabilize at room temperature for a minimum of 24 hours.

- Leakage current: shall not exceed twice the spec. value.
- Capacitance: shall not exceed 15% of the initial value.
- Tan δ: shall not exceed 1.5 times the spec. value.
- Impedance: shall not exceed twice the spec. value.

13) High Frequency Impedance (1 MHz): High frequency impedance shall be measured at 25°C in the circuit shown below.



where
E_1: generator
E_2: dry cell
V_1: AC valve voltmeter
V_2: AC valve voltmeter
R: resistor
C: capacitor

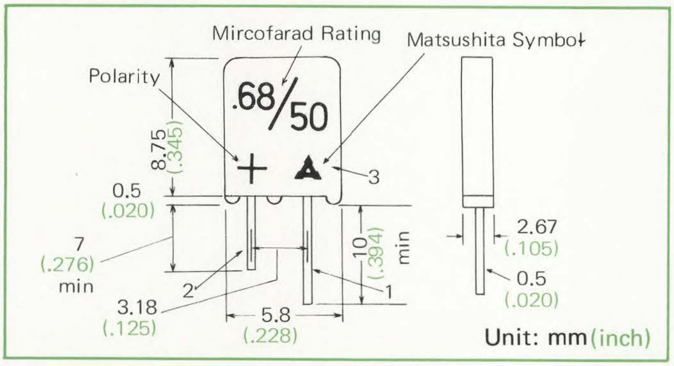
The output of the generator shall be increased and adjusted to 1V (V_1), and then the value of V_2 is recorded. The Z can be calculated by the following formula:

$$Z = V_2/V_1 \times R = V_2 \times R \text{ (ohm)}.$$

Mechanical Specifications

1) Lead Pull Strength: The body of the component shall be held firmly; and a tensile force of 1kg (2.2 lbs) applied gradually, shall be maintained along the longitudinal axis of each lead for 10 seconds.
   After the test, there shall be no loosening of the terminals and no permanent damage to the terminal.
2) Lead Bend Strength: Each lead shall be bent. The capacitor shall be placed in a vertical position and 0.5 kg (1.10 lbs) weight shall be attached to the one lead. The capacitor shall be slowly rotated, for approx. 2.5 seconds, in a horizontal position and returned to the vertical position. After the test, there shall be no loosening of the terminals and no permanent damage to the terminals.
3) Solderability Test: The lead shall be immersed in a flux for 2.5 seconds and immersed in the molten solder to 2±0.5mm (.079±.002") from the capacitor body for 2.5 seconds. The flux is composed of 10% by weight of resin and methyl alcohol or isopropyl alcohol. Solder composition is Sn 63%. The molten solder shall be stirred with a clean, stainless-steel paddle to assure that it is at a uniform temperature of 230°C±5. Following immersion, the leads shall be cooled in the air. The flux shall be removed from the leads by dipping in isopropyl alcohol.
   After the test, the entire surface of the dip-coated lead shall be examined. The dipped surface of the leads shall be at least 75% covered with smooth solder coating.
4) Heat Shock by Soldering: The leads shall be immersed in flux and then immersed in molten solder, at 270°C±5, to 2±0.5mm (.079±.002") from the capacitor body for 2.5 seconds.
   Following immersion, the capacitor is placed for at least 2 hours at ambient temperature. After the test, leakage current, capacitance, impedance and dissipation factors shall be measured.
   The capacitor shall meet the following requirements.
   - Leakage current: shall not exceed specified value
   - Capacitance: shall not change more than 3%
   - Tan δ: shall not exceed specified value
   - Impedance: shall not exceed specified value
5) Vibration Test: The capacitor shall withstand a simple harmonic motion having an amplitude of 1.5mm (.06") (peak-to-peak), with the frequency being varied uniformly between the approximate limits of 10 to 55 cycles and ratings to be traversed in approximately 1 minute for a 1.5 hours.
   This motion shall be applied for a period of 45 minutes in each of 2 mutually perpendicular directions. During the last 30 minutes of vibration in each direction, the capacitor shall be measured several times.
   After the test, there shall be no loosening of the terminals and no permanent damage to the terminal.

Dimensions



Materials

Symbol	Items	Meterials
1	Negative lead wire	Tinned-nickel
2	Positive lead wire	Tinned-nickel
3	Resin	Epoxy resin

Standard Products Table

W.V (V.DC)	Cap. (μF)	Part No.	DC Leakage Current max. (μA)	Impedance Ω/1 MHZ
6.3	22	ECS-Z6VS22	1.40	1.5
10	15	ECS-Z10VS15	1.50	2.5
16	10	ECS-Z16VS10	1.60	2.5
20	6.8	ECS-Z20VS6R8	1.40	2.5
25	3.3	ECS-Z25VS3R3	0.80	2.5
	4.7	ECS-Z25VS4R7	1.20	2.5
35	1	ECS-Z35VS1	0.50	2.5
	1.5	ECS-Z35VS1R5	0.50	2.5
	2.2	ECS-Z35VS2R2	0.80	2.5
50	0.68	ECS-Z50VSR68	0.50	2.5

Application Information

1) Voltage application of a reverse polarity may cause a short circuit in electrolytic capacitors, causing a capacitance decrease. This change may be permanent. If the application is for a very short period, recovery may take place. For such a circuit which is exposed to a polarity reversal non-polarized capacitors are preferable.

2) Frequent discharge operations may cause a degradation of cathode elements due to reverse voltage, and, simultaneously, capacitance may decrease by a large extent.
Electrolytic capacitors especially designed for frequent discharge are recommended.

3) Overvoltage exceeding the rated voltage (or the surge voltage in a short-time application) may cause an increase in leakage current as well as deterioration of insulation film. At the same time, the general characteristics may be degraded due mainly to heat generation.

4) Ripple current exceeding the specified value may bring forth excessive heat generation which may cause either a sharp decrease in capacitance, paste ooze or burst of the capacitors. Capacitors for high ripple current are available from MATSUSHITA.

5) As the operating temperature rises, leakage current and capacitance increase, while equivalent series resistance decreases. Operation at a temperature exceeding the rated value may cause an extremely large leakage current, shortening the life of the capacitor.
At lower temperatures, leakage current and capacitance reduces, but equivalent series resistance increases.
As long as the capacitor operates within the rated operating temperature range, those changes are temporary and recovery will take place once the temperature is normalized.

6) Capacitance values decrease as frequency increases. The specified capacitance values are measured at 120Hz, and become less by 5 - 15% at the frequency of 1,000Hz. The change is greater when the capacitor is of smaller capacitance and lower voltage ratings. Tantalum electrolytic capacitors, in general, exhibit more superior frequency characteristics than aluminum electrolytics. The upper frequency limits for wet tantalum electrolytics are from 10kHz to 50kHz, and for solid tantalum from 100kHz to 500kHz.

7) Aging treatment is required when electrolytic capacitors are operated after a long-term storage. Capacitors, after long-term storage, exhibit smaller withstand voltage and larger leakage current.
Application of the rated voltage to such capacitors may cause heat generation due to an extremely large leakage current, eventually damaging the capacitors. (If the storage period is within a few years, recovery will take place during operation.)

8) The cathode terminal of an electrolytic capacitor is, in general, not insulated from the case of the capacitor. Electrolyte of the capacitor works as an electric conductor which has a certain resistance.
Insulation is possible by fitting an insulator at the connecting point of the terminal.

9) Terminals should be free from excessive shock or strain. When tantalum electrolytic capacitors, especially type UC, are used with the terminals bent, the bending should be performed carefully at the outside of the welded point on the terminal lead. Excessive strain may cause intermittent contact inside the capacitor.

10) The outside case of tantalum electrolytic capacitors is generally used as the cathode terminal. Case sleeves are required for insulation.

11) Vinyl sleeves should not come in contact with a soldering iron. Vinyl sleeves act as insulators.

12) Care should be taken regarding temperature and time of dip-soldering.
Dip-soldering of miniature aluminum electrolytic capacitor leads should be within 10 seconds and 260°C.

13) Electrolytic capacitors should be stored in an area that is not exposed to direct sunshine and is free from moisture. Direct sunshine accelerates degradation of capacitors, and moisture deteriorates solderability of lead terminals.

V CERAMIC CAPACITORS

QUICK REFERENCE GUIDE

Disc Hi-K Ceramic Capacitors

Item	Capacitance Range	Characteristics	Related Standards	Page
500V By-Pass Coupling	1,000 ~ 10,000pF	2E5, 2F4/Z5U, Y5V	IEC Pub.187/EIA RS-198	V-7
	1,000 ~ 10,000pF	2D5, 2D4/Z5T, Y5T		V-8
500V Temperature Stable	100 ~ 2,200pF	2A5, 2A4/Z5E, Y5F		V-9
500V Temperature Stable	100 ~ 10,000pF	2B5, 2B4/Z5P, Y5P		V-10
50V By-Pass Coupling	1,000 ~ 47,000pF	2F5, 2F4/Z5V, Y5V		V-11
	1,000 ~ 10,000pF	2D5, 2D4/Z5T, Y5T		V-12
50V Temperature Stable	100 ~ 10,000pF	2B5, 2B4/Z5P, Y5P		V-13
50V Sub-Miniature	4,700 ~ 47,000pF	2F5/Z5V		V-14
25V Miniature	10,000~100,000pF	2F5/Z5V		V-15
1~4KV High Voltage	100 ~ 5,600pF	2B5, 2B4/Z5P, Y5P	IEC pub.187/EIA RS-165 class 2	V-16
1~3KV High Voltage For Pulse Circuits	100 ~ 3,900pF			V-17
8 ~ 15KV High Voltage	82 ~ 1,000pF			V-18
UL Listed (TYPE—AL—) AC Line By-Pass, Antenna Coupling	100 ~ 10,000pF	Z5P, Z5T, Z5U	UL Subject 492	V-19
UL Listed (TYPE—CL—) Across-The-Line	1,000 ~4,700pF	Z5U		V-20
European Safety Capacitor SEV, SEMKO, DEMKO Approved AC Line By-Pass, Antenna Coupling	100 ~4,700pF	2B4, 2D4, 2E5	IEC Pub.65 (CEE Pub.1) SEV 1016 DEMKO Afsnit 21	V-21
	47pF	1D		

Disc TC Ceramic Capacitors

Item	Capacitance Range	Characteristics	Related Standard	Page
500V General Purpose	1 ~ 470pF	1D/U2M	IEC Pub.108/EIA RS-198 class 1	V-25
50V General Purpose	1 ~ 470pF			V-26
500V General Purpose	1 ~ 270pF	NPO		V-27
50V General Purpose	1 ~ 270pF			V-28
500V Temperature Compensating	1 ~ 470pF	N30 throughN1500		V-29
50V Temperature Compensating	1 ~ 470pF			V-30
1 ~ 6KV High Voltage	1 ~ 470pF	1D/U2M	IEC Pub.108/EIA RS-165 class 1	V-31

Other Ceramic Capacitors

Item	Capacitance Range	Characteristics	Related Standard	Page
50V/500V Hi-K Feed Through	1000pF	1E5, 2E4/Z5U, Y5V	IEC Pub.187/EIA RS-198 class 2	V-34
50V/500V TC Feed Through	5 ~ 47pF	1D/U2M	IEC Pub.108/EIA RS-198 class 1	V-35
Mold Composition "Minic"	0.5 ~ 4.7pF	———	———	V-36
Glass Ceramic	1 ~10,000pF	———	MIL—C—11272B	V-38
Chip Type Multi-layer	10 ~ 6800pF	COH	IEC 40/EIA RS-198	V-41
	330 ~ 1.0 pF	X7R, Y5V		

This chart is intended to serve as a guide only.

Part Number Code

E	C	K	-	D	1	H	1	0	3	P	F	
Common Code				Shape	Working Voltage		Capacitance			Cap. Tol.	Temp. Char.	Suffix

Common Code

ECK	Hi-K CERAMIC CAPACITORS
ECC	TC CERAMIC CAPACITORS

Shape

D	Straight long leads Disc
C	Crimp leads Disc
B	Bare Bottom Disc
L	Cylindrical Feed Through
Y	Discoidal Feed Through

Working Voltage

IE	25VDC
IH	50VDC
2H	500VDC
3A	1KVDC
3D	2KVDC
3F	3KVDC
3G	4KVDC
3H	5KVDC
3J	6KVDC
3M	7KVDC
3K	8KVDC.
4A	10KVDC
4B	12KVDC
4C	15KVDC
AL CL	} 1500AC
DS	2500VAC

Capacitance

The first two digits are significant figures of capacitance and the third one denotes number of following zeros. Decimal point is expressed by R.

Examples

Code	Capacitance
010	1 pF
1R5	1.5 pF
100	10 pF
101	100 pF
472	4,700 pF
223	22,000 pF

Cap. Tol.

Capacitance ≦ 10pF		Capacitance > 10pF	
C	±0.25 pF	J	±5%
D	±0.5 pF	K	±10%
F	±1 pF	M	±20%
		Z	+80, -20%
		P	+100, -0%
		W	+200, -0%

Temp. Char.

ECK

Code	TC By IEC/EIA
A	2A5, 2A4 /Z5E, Y5F
B	2B5, 2B4 /Z5P, Y5P
D	2D5, 2D4 /Z5T, Y5T
E	2E5, 2F4 /Z5V, Y5V
F	2F5, 2F4 /Z5U, Y5V
FZ	2F5/Z5V

ECC

Code	TC
A	P100
C	NP0
L	N75
P	N150
R	N220
S	N330
T	N470
U	N750
W	N1500
X	N2200
Y	N3300
Nil	General purpose

Note

AL
CL } .... UL Listed

DS .... SEV. SEMKO, DEMKO Approved

General Precautions

1. Application Information

Matsushita Electric provides various ceramic capacitors varying with temperature characteristics. F, E and D characteristics of Disc Hi-K are ideal for time constant circuit requiring capacitance stability. Disc TC types of excellent high frequency characteristics are ideal for oscillation circuits.

2. Ordering Information

When ordering standard products covered in this catalogue, their part numbers should be cleared. Regarding other specific products, please send us your information including items shown below.

1) Rated capacitance and tolerance
2) Rated voltage and test voltage
   (DC or AC or pulse and wave form and frequency in case of AC or pulse circuit)
3) Operating temperature range and temperature characteristics
4) Shape and dimensions
5) Application circuit
6) Standards required
7) Other special requirements

3. Precautions for Application

Ceramic disc, being of thin dielectric ceramic, is liable to be damaged if large mechanical or thermal shock should be applied. Therefore they should be free from such impacts as dropping onto floors, direct exposure of soldering iron to the capacitor body.

Especially the soldering should be in a short period of time enough not to affect soldered electrodes inside the capacitor. If otherwise, such thermal impacts might cause decrease of capacitance, Q and tan δ.

DISC Hi-K CERAMIC CAPACITORS

Outlines of Disc Hi-K Ceramic Capacitors

Disk Hi-K ceramic capacitors are of most simplest construction among all kinds of capacitors, using high dielectric constant ceramic disc at the both sides of which silver electrode is connected by firing method (at 800°C).

Matsushita Electric disc Hi-K ceramic capacitors are available in a wide range of 25V~20kV in voltage and 100~100,000pF in capacitance.

And the capacitors meeting overseas standards such as UL, SEV, SEMKO, DEMKO, etc. are also available.

Characteristics of Disc Hi-K Ceramic Capacitors

Barium titanate ceramic material as a main ingredient of disc Hi-K ceramic capacitors is made from titanium dioxide and carbonate of baryta by forming and sintering method.

This barium titanate, generally, exhibits large dielectric change by temperature and small temperature range for actual application. These demerits are eliminated by means of applying some additives to barium titanate and of improvement in sintering process. Temperature characteristics varies with kind and quantity of the additives, and eventually ceramic capacitors of various kinds of temperature characteristics become available.

Temperature characteristics and capacitance (i.e. value of dielectric) are in inverse proportion, which should be taken into consideration so as to make selection less costly to meet the requirements of your circuits.

Features of Disc Hi-K Ceramic Capacitors

- Small in size and large in capacitance
- Very small in inductance and applicable to the high frequency circuits due to it's simple structure of electrode
- Exceptionally high insulation resistance
- Excellent in protection against humidity and very small in capacitance change, the decrement of loss and insulation resistance by humidity
- Excellent in heat withstand within the operating temperature range
- Ideal for p.c board mounting due to its flat structure
- Attractively priced due to large amount mass production

Usage of Disc Hi-K Ceramic Capacitors

- For by-pass and coupling of electronic equipment including radio and television
- For time constant of low frequency circuits
- For high voltage circuits
- For circuits where stability of capacitance and large dissipation factor are not strictly required

General Ratings

Related Standards — IEC Pub. 187, EIA-RS-198 Class 2

Item	Test Methods	Requirements
Dielectric Withstanding Voltage	1) Capacitors shall withstand, for 1~5 seconds, a d-c test voltage of 2.5 times the rated working voltage (2 times when the rated d-c voltage 1KV or over) charging current to 50 milli-amperes maximum. 2) Capacitors shall withstand, for 1~5 seconds, a d-c test voltage of 2.5 times the rated working voltage or 1.3 KV d-c voltage, whichever is smaller, between both leads connected together and metal foil wrapped closely around body of capacitor to within no less than 1/16" of lead wires, charging current to 50 milliamperes maximum.	Without damage or breakdown
Insulation Resistance	Insulation resistance between terminals of the capacitor shall be measured 1 minute after application of d-c test voltage of the rated voltage (rated at 100V or less), 100V (rated at 100 to 500V), or 500V (rated over 500V), charging current to 50 milliamperes maximum.	Exceed 10000 megohms or an CR product of 200ΩF, whichever is less
Capacitance	Capacitance shall be measured at a frequency of 1±0.1KHz with an applied voltage of 1V rms. at temperature of 20°C(IEC) or 25°C(EIA).	Within the tolerance shown by the type designation
Dissipation Factor	Dissipation factor shall be measured as in capacitance.	Not greater than 2.5% or 5% (applied at temperature characteristics Z5V at EIA, 2F5 at IEC).
Temperature Characteristic	Over the rated temperature range the capacitance shall be measured	Not exceed the limits as defined by Table 1 on p. V-6.
Seal Test	After capacitors shall be subjected to 40°C, 90~95% RH for 500 hours (240 hours at Z5 of EIA and 2..5 of IEC)	Meet the requirements as defined by Table 2 on p.V-6
Life Test	Capacitors shall be tested for a period of 1000 hours (500 hours at Z5 of EIA and 2‥5 of IEC) at 85°C (70°C at Z5 of EIA and 2‥5 of IEC) at 200% the rated voltage (150% of 1KV over).	Meet the requirements as defined by Table 2 on p.V-6.

Table 1

Letter Symbol	Temp. Range in °C	Max. Change in % of Cap. Value at 20°C	Letter Symbol	Temp. Range in °C	Max. Change in % of Cap. Value at 20°C
2A4	-25 to +85	± 5	Y5F	-30 to +85	±7.5
2B4	-25 to +85	±10	Y5P	-30 to +85	±10
2D4	-25 to +85	+20 to -30	Y5T	-30 to +85	+22 to -33
2F4	-25 to +85	+30 to -80	Y5V	-30 to +85	+22 to -82
2A5	-10 to +70	± 5	Z5E	+10 to +85	±4.7
2B5	-10 to +70	±10	Z5P	+10 to +85	±10
2D5	-10 to +70	+20 to -30	Z5T	+10 to +85	+22 to -33
2E5	-10 to +70	+20 to -55	Z5U	+10 to +85	+22 to -56
2F5	-10 to +70	+30 to -80	Z5V	+10 to +85	+22 to -82

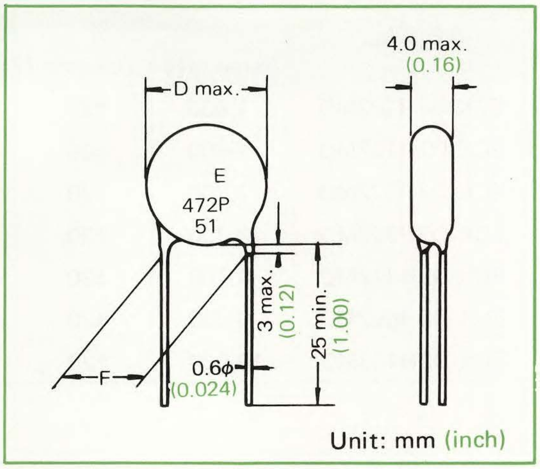
Table 2

Item	Insulation Resistance	Max. Dissipation Factor		Max. Change of the Capacitance			
IEC		2A4, 2A5 2B4, 2B5 2D4, 2D5 2F4, 2E5	2F4, 2F5	2A4 2B4 2A5 2B5	2D4 2D5	2F4 2E5	2F4 2F5
EIA		Y5F, Z5E Y5P, Z5P Y5T, Z5T Y5V, Z5U	Y5V, Z5V	Y5F Y5P Z5E Z5P	Y5T Z5T	Y5V Z5U	Y5V Z5V
Seal Test	Not less than 1000MΩ	5%	7.5%	±10%	±15%	±20%	±30%
Life Test	Not less than 1000MΩ	4%	7.5%	±10%	±15%	±20%	±30%

500V By-Bass, Coupling (IEC Char. 2E5, 2F4/EIA Char. Z5U, Y5V)

Standard Products

Part No.	Capacitance		Dimensions mm (inch)	
	Rated (pF)	Tolerance (%)	D	F
ECK-D2H102PE	1,000	+100, −0	7.0(0.280)	5±1.5 (0.20±0.06)
ECK-D2H222PE	2,200	+100, −0	9.5(0.375)	
ECK-D2H472PE	4,700	+100, −0	13.0(0.510)	10±2 (0.40±0.08)
ECK-D2H103PE	10,000	+100, −0	16.0(0.630)	



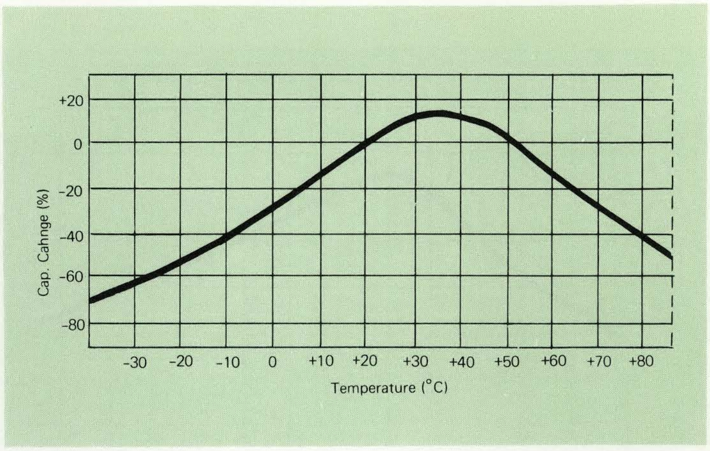
Features

- Comparatively large capacitance per unit
- Ideal for by-pass and coupling applications in a low frequency range

Specifications

1. Related Standards .... IEC Pub. 187 / EIA RS-198 class 2
2. Operating Temperature Range .... −30°C to +85°C
3. Capacitance .... Within tolerance at 1KHz and 20°C
4. Dissipation Factor .... 2.5% max., at 1KHz and 20°C
5. Temperature Characteristics .... Conform to IEC Pub.187 Char. 2E5, 2F4/EIA R5-198 Char. Z5U, Y5V
6. Working Voltage .... 500V DC
7. Dielectric Withstanding Voltage ...... 1250V DC for 1 to 5 seconds
8. Insulation Resistance .... 10000MΩ min. at 100V DC
9. Lead Styles Available .... See p. V-32

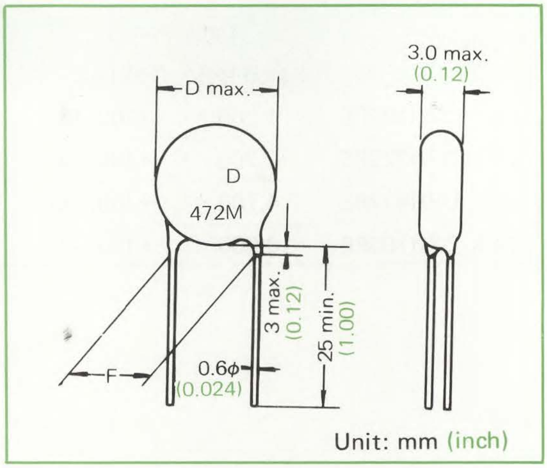
Typical Capacitance vs. Temperature



500V By-Bass Coupling (IEC Char. 2D5, 2D4/EIA Char. Z5T, Y5T)

Standard Products

Part No.	Capacitance		Dimensions mm (inch)	
	Rated (pF)	Tolerance(%)	D	F
ECK-D2H102MD	1,000	±20	7.0(0.280)	5±1.5 (0.20±0.06)
ECK-D2H152MD	1,500	±20	8.5(0.335)	
ECK-D2H222MD	2,200	±20	10.0(0.400)	
ECK-D2H332MD	3,300	±20	13.0(0.510)	10±2) (0.40±0.08)
ECK-D2H472MD	4,700	±20	13.0(0.510)	
ECK-D2H682MD	6,800	±20	14.0(0.550)	
ECK-D2H103MD	10,000	±20	19.0(0.750)	



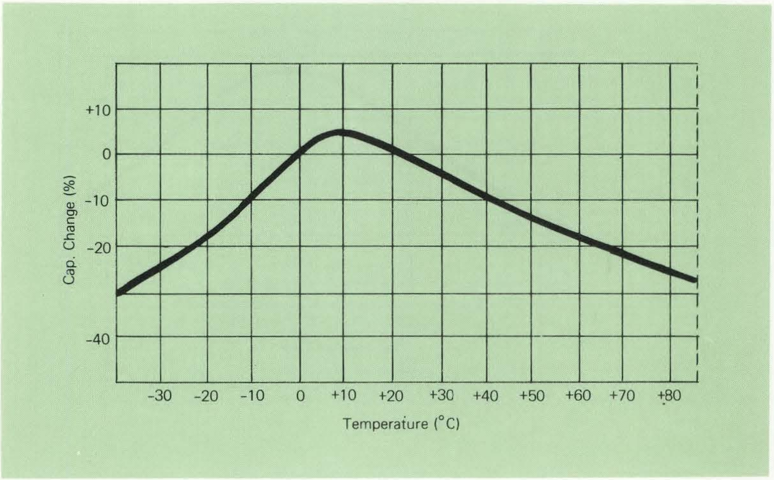
Features

- Ideal for by-pass and coupling circuits in low frequency range which require a comparatively high degree of stability

Specifications

1. Ralated Standards .... IEC Pub.187 / EIA RS-198 Class 2
2. Operating Temperature Range .... −30°C to +85°C
3. Capacitance .... Within tolerance at 1KHz and 20°C
4. Dissipation Factor .... 2.5% max. at 1KHz and 20°C
5. Temperature Characteristics .... Conform to IEC Pub.187 Char. 2D5, 2D4/EIA RS-198 Char. Z5T, Y5T
6. Working Voltage .... 500V DC
7. Dielectric Withstanding Voltage ...... 1250V DC for 1 to 5 seconds
8. Insulation Resistance .... 10000MΩ min. at 100V DC
9. Lead Styles Available .... See p.V-32

Typical Capacitance vs. Temperature

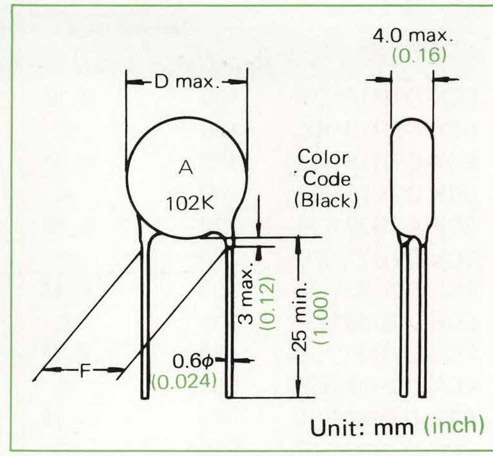


500V Temperature Stable (IEC Char. 2A5, 2A4/EIA Char. Z5E, Y5F)

Standard Products

Part No.	Capacitance		Dimensions mm (inch)	
	Rated(pF)	Tolerance(%)	D	F
ECK-D2H101□A	100	K, M	7.0(0.280)	5±1.5 (0.20±0.06)
ECK-D2H121KA	120	K		
ECK-D2H151□A	150	K, M		
ECK-D2H181KA	180	K		
ECK-D2H221□A	220	K, M		
ECK-D2H271KA	270	K		
ECK-D2H331□A	330	K, M	8.5(0.335)	
ECK-D2H391KA	390	K		
ECK-D2H471□A	470	K, M	10.0(0.400)	
ECK-D2H561KA	560	K		
ECK-D2H681□A	680	K, M	13.0(0.515)	10±2 (0.40±0.08)
ECK-D2H821KA	820	K		
ECK-D2H102□A	1,000	K, M		
ECK-D2H122KA	1,200	K	16.0(0.630)	
ECK-D2H152□A	1,500	K, M		
ECK-D2H181KA	1,800	K		
ECK-D2H222□A	2,200	K, M	19.0(0.750)	

└ Cap. tol. K(±10%) or M(±20%)



Unit: mm (inch)

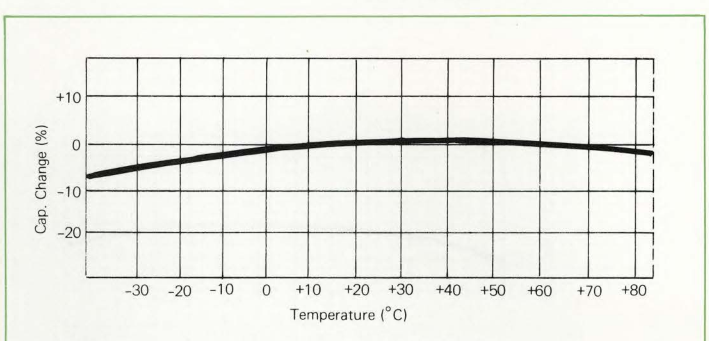
Features

- This capacitor exhibits little capacitance change over a wide temperature range, and ideal for such devices requiring a stable circuit constant as filter networks.

Specifications

1. Related Standards .... IEC Pub. 187/EIA RS-198 Class 2
2. Operating Temperature Range .... -30°C to +85°C
3. Capacitance .... Within tolerance at 1KHz and 20°C
4. Dissipation Factor .... 2.5% max. at 1KHz and 20°C
5. Temperature Characteristics .... Conform to IEC Pub.187 Char. 2A5, 2A4/EIA RS-198 Char. Z5E, Y5F
6. Working Voltage 500VDC
7. Dielectric Withstanding Voltage .... 1250V Dc for 1 to 5 seconds
8. Insulation Resistance .... 10000MΩ min. at 100V DC
9. Lead Styles Available .... See p. V-32

Typical Capacitance vs. Temperature

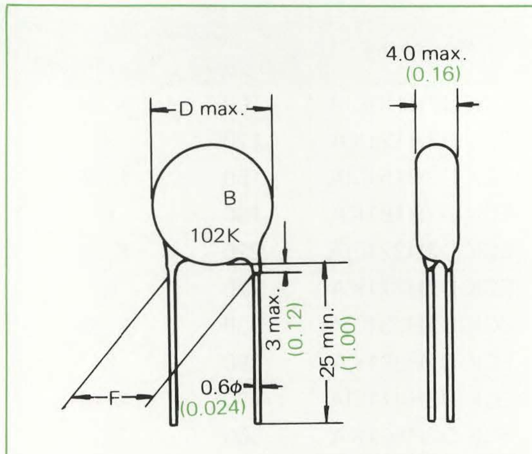


500V Temperature Stable (IEC Char. 2B5, 2B4/EIA Char.Z5P, Y5P)

Standard Products

Part No.	Capacitance		Dimensions mm (inch)	
	Rated(pF)	Tolerance(%)	D	F
ECK-D2H101□B	100	K, M	7.0(0.280)	5±1.5 (0.20±0.06)
ECK-D2H121KB	120	K		
ECK-D2H151□B	150	K, M		
ECK-D2H181KB	180	K		
ECK-D2H221□B	220	K, M		
ECK-D2H271KB	270	K		
ECK-D2H331□B	330	K, M		
ECK-D2H391KB	390	K		
ECK-D2H471□B	470	K, M		
ECK-D2H561KB	560	K		
ECK-D2H681□B	680	K, M		
ECK-D2H821KB	820	K	8.5(0.335)	
ECK-D2H102□B	1000	K, M		
ECK-D2H122KB	1200	K		
ECK-D2H152□B	1500	K, M	10.0(0.400)	
ECK-D2H182KB	1800	K		
ECK-D2H222□B	2200	K, M	13.0(0.510)	10±2 (0.40±0.08)
ECK-D2H272KB	2700	K		
ECK-D2H332□B	3300	K, M		
ECK-D2H392KB	3900	K	15.5(0.610)	
ECK-D2H472□B	4700	K, M		
ECK-D2H562KB	5600	K	18.0(0.710)	
ECK-D2H682□B	6800	K, M		
ECK-D2H822KB	8200	K	22.0(0.870)	
ECK-D2H103□B	10000	K, M		

└ Cap. tol. K(±10%) or M(±20%)



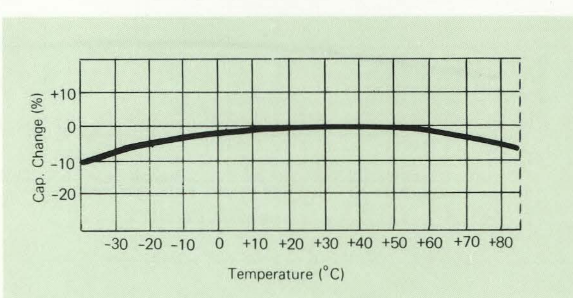
Features

- Little capacitance change over a wide temperature range
- Wide capacitance range

Specifications

1. Related Standards . . . . IEC Pub.187/EIA RS-198 Class 2
2. Operating Temperature Range . . . . -30°C to +85°C
3. Capacitance . . . . Within tolerance at 1KHz and 20°C
4. Dissipation Factor . . . . 2.5% max. at 1KHz at 20°C
5. Temperature Characteristics . . . . Conform to IEC Pub.187 Char. 2B5, 2B4/EIA R5-198 Char. Z5P, Y5P
6. Working Voltage . . . . 500V DC
7. Dielectric Withstanding Voltage . . . . 1250 VDC for 1 to 5 seconds
8. Insulation Resistance . . . . 10000MΩ min. at 100V DC
9. Lead Styles Available . . . . See p. V-32

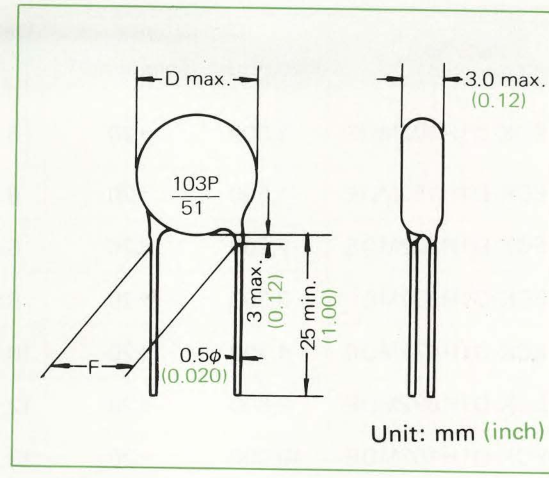
Typical Capacitance vs. Temperature



50V By-Pass, Coupling (IEC Char. 2F5, 2F4/EIA Char. Z5V, Y5V)

Standard Products

Part No.	Capacitance		Dimensions mm(inch)	
	Rated (pF)	Tolerance(%)	D	F
ECK-D1H102PFE	1,000	+100, −0	6.0(0.235)	2.5(0.100)
ECK-D1H222PFE	2,200	+100, −0	7.0(0.280)	
ECK-D1H472PFE	4,700	+100, −0	7.5(0.300)	5.0(0.200)
ECK-D1H103PFE	10,000	+100, −0	9.5(0.375)	
ECK-D1H223PFE	22,000	+100, −0	12.5(0.495)	10.0(0.400)
ECK-D1H473ZFE	47,000	+ 80, −20	13.5(0.530)	



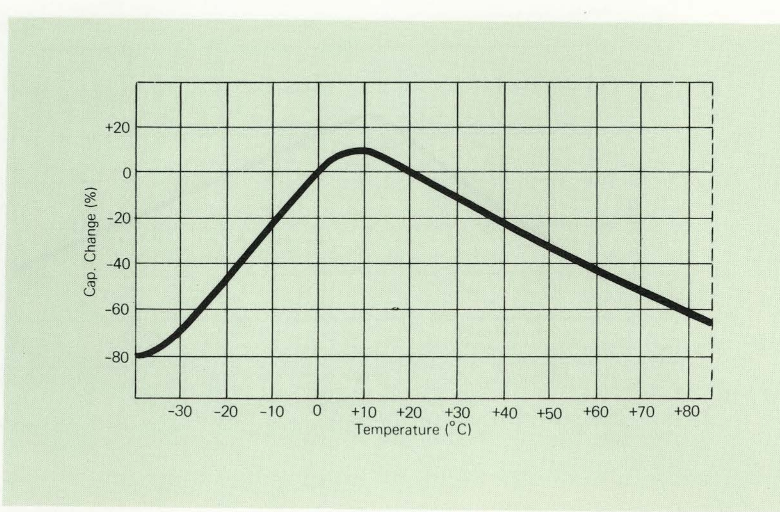
Features

- Very small in size
- Designed for low-voltage devices
- Ideal for by-pass and coupling applications in transistor circuits

Specifications

1. Related Standards. . . . . IEC Pub. 187/EIA RS-198 class 2
2. Operating Temperature Range . . . . -30°C to +85°C
3. Capacitance . . . . Within tolerance at 1KHz and 20°C
4. Dissipation Factor . . . . 5.0% max. at 1KHz and 20°C
5. Temperature Characteristics. . . . . Conform to IEC Pub. 187 Char. 2F5, 2F4/EIA RS-198 Char. Z5V, Y5V
6. Working Voltage . . . . 50V DC
7. Dielectric Withstanding Voltage . . . . 125V DC for 1 to 5 seconds
8. Insulation Resistance . . . . Greater than 10000MΩ or 200Ω-F whichever is less at 50V DC
9. Lead Styles Available . . . . See p. V-32

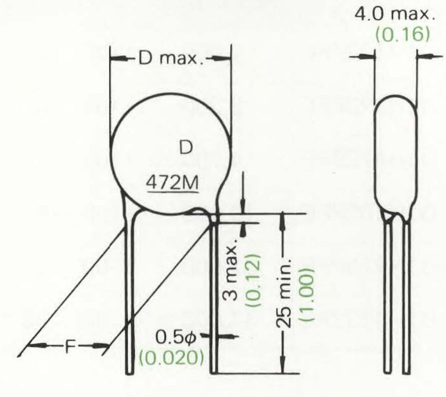
Typical Capacitance vs. Temperature



50V By-Pass, Coupling (IEC Char. 2D5, 2D4/EIA Char. Z5T, Y5T)

Standard Products

Part No.	Capacitance		Dimensions mm(inch)	
	Rated(pF)	Tolerance(%)	D	F
ECK-D1H102MDE	1,000	±20	5.0(0.200)	2.5±1.5 (0.10±0.06)
ECK-D1H152MDE	1,500	±20	6.5(0.255)	5±1.5 (0.20±0.06)
ECK-D1H222MDE	2,200	±20	6.5(0.255)	
ECK-D1H332MDE	3,300	±20	8.0(0.315)	
ECK-D1H472MDE	4,700	±20	10.0(0.400)	
ECK-D1H682MDE	6,800	±20	12.5(0.495)	10±2 (0.40±0.08)
ECK-D1H103MDE	10,000	±20	13.5(0.530)	



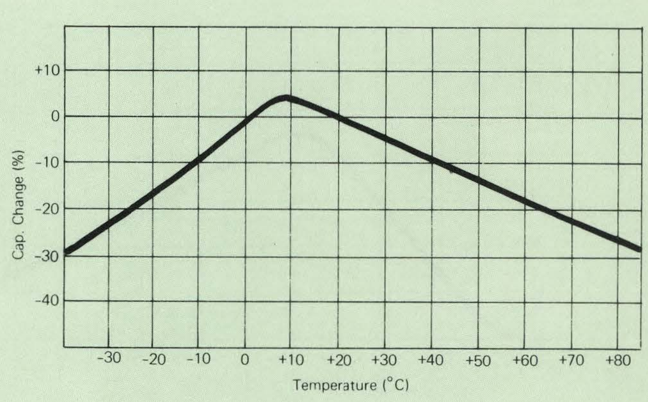
Features

- Ideal for by-pass and coupling applications of low voltage in low frequency range such as transistor circucits requiring comparatively high capacitance stability

Specifications

1. Related Standards .... IEC Pub. 187/EIA RS-198 Class 2
2. Operating Temperature Range .... -30°C to +85°C
3. Capacitance .... Within tolerance at 1KHz and 20°C
4. Dissipation Factor .... 2.5% max, at 1KHz and 20°C
5. Temperature Characteristics........... Conform to IEC Pub.187 char.2D5, 2D4/EIA RS-198 char. Z5T, Y5T
6. Working Voltage .... 50V DC
7. Dielectric Withstanding Voltage .... 125V DC for 1 to 5 seconds
8. Insulation Resistance .... 10000MΩ min. at 50V DC
9. Lead Styles Available .... See p. V-32

Typical Capacitance vs. Temperature

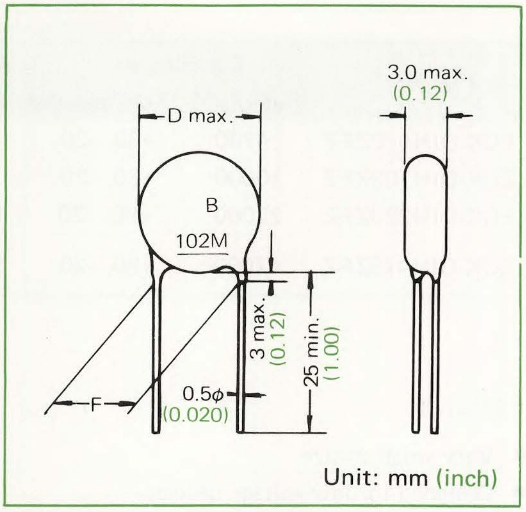


50V Temperature Stable (IEC Char. 2B5, 2B4/EIA Char Z5P. Y5P)

Standard Products

Part No.	Capacitance		Dimensions mm(inch)	
	Rated(pF)	Tolerance(%)	D	F
ECK-DIH101□B	100	K, M	5.0 (0.200)	2.5±1.5 (0.10±0.06)
ECK-DIH121KB	120	K		
ECK-DIH151□B	150	K, M		
ECK-DIH181KB	180	K		
ECK-DIH221□B	220	K, M		
ECK-DIH271KB	270	K		
ECK-DIH331□B	330	K, M		
ECK-DIH391KB	390	K		
ECK-DIH471□B	470	K, M		
ECK-DIH561KB	560	K		
ECK-DIH681□B	680	K, M		
ECK-DIH821KB	820	K	6.5 (0.255)	5±1.5 (0.20±0.06)
ECK-DIH102□B	1000	K, M		
ECK-DIH122KB	1200	K		
ECK-DIH152□B	1500	K, M	8.0 (0.315)	
ECK-DIH182KB	1800	K		
ECK-DIH222□B	2200	K, M		
ECK-DIH272KB	2700	K	10.0 (0.400)	
ECK-DIH332□B	3300	K, M		
ECK-DIH392KB	3900	K		
ECK-DIH472□B	4700	K, M	12.5 (0.495)	10±2 (0.40±0.08)
ECK-DIH562KB	5600	K		
ECK-DIH682□B	6800	K, M		
ECK-DIH822KB	8200	K	13.5 (0.535)	
ECK-DIH103□B	1000	K, M		

└ Cap. tol. K(±10%) or M(±20%).



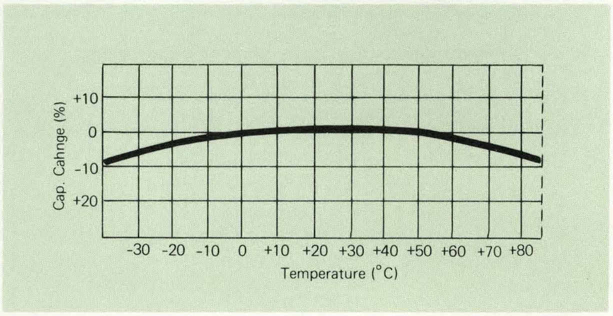
Features

- Little capacitance change over a wide temperature range
- Wide capacitance range
- Very small in size at 10% tol.

Specifications

1. Related Standards .... IEC Pub.187/EIA RS-198 class 2
2. Operating Temperature Range .... -30°C to +85°C
3. Capacitance .... Within tolerance at 1KHz and 20°C
4. Dissipation Factor .... 2.5% max. at 1KHz and 20°C
5. Temperature Characteristics........... Conform to IEC Pub. 187 char. 2B5, 2B4/EIA RS-198 char. Z5P, Y5P
6. Working Voltage .... 50V DC
7. Dielectric Withstanding Voltage .... 125V DC for 1 to 5 seconds
8. Insulation Resistance................. 10000MΩ min. at 50VDC
9. Lead Styles Available .... See p. V-32

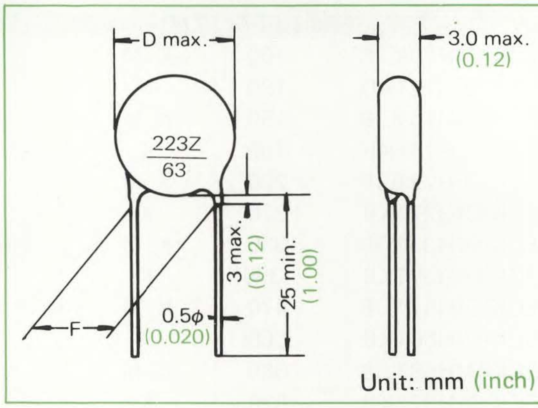
Typical Capacitance vs. Temperature



50V Sub-Miniature (IEC Char. 2F5/EIA Char. Z5V)

Standard Products

Part No.	Capacitance		Dimensions mm(inch)	
	Rated(pF)	Tolerance(%)	D	F
ECK-DIH472ZFZ	4700	+80, -20	7.5 (0.300)	5±1.5 (0.20±0.06)
ECK-DIH103ZFZ	10000	+80, -20		
ECK-DIH223ZFZ	22000	+80, -20	10.5 (0.415)	
ECK-DIH473ZFZ	47000	+80, -20	12.5 (0.495)	10±2 (0.40±0.08)



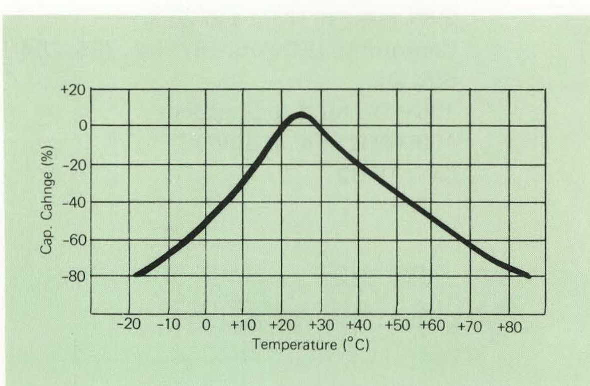
Features

- Very small in size
- Designed for low voltage devices
- Ideal for by-pass applications in transistor circuits of limited temperature range

Specifications

1. Related Standards .... IEC Pub. 187/EIA RS-198 Class 2
2. Operating Temperature Range .... -10°C to +70°C
3. Capacitance .... Within tolerance at 1KHz and 20°C
4. Dissipation Factor .... 5.0% max. at 1KHz and 20°C
5. Temperature Characteristics........... Conform to IEC Pub. 187 char. 2F5/EIA RS-198 char. Z5V
6. Working Voltage .... 50 VDC
7. Dielectric Withstanding Voltage .... 125 VDC for 1 to 5 seconds
8. Insulation Resistance .... Greater than 10000MΩ or 200Ω-F whichever is less at 50V.DC
9. Lead Styles Available .... See p. V-32

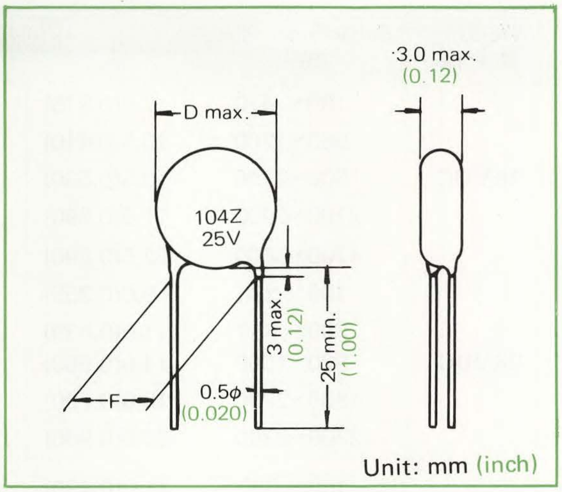
Typical Capacitance vs. Temperature



25V Miniature (IEC Char. 2F5/EIA Char. Z5V)

Standard Products

Part No.	Capacitance		Dimensions mm(inch)	
	Rated(pF)	Tolerance(%)	D	F
ECK-DIE103ZFZ	10000	+80, -20	6.0(0.235)	2.5±1.5 (0.10±0.06)
ECK-DIE223ZFZ	22000	+80, -20	7.0(0.280)	5±1.5 (0.20±0.06)
ECK-DIE473ZFZ	47000	+80, -20	10.0(0.400)	
ECK-DIE104ZFZ	100000	+80, -20	12.5(0.495)	10±2 (0.40±0.08)



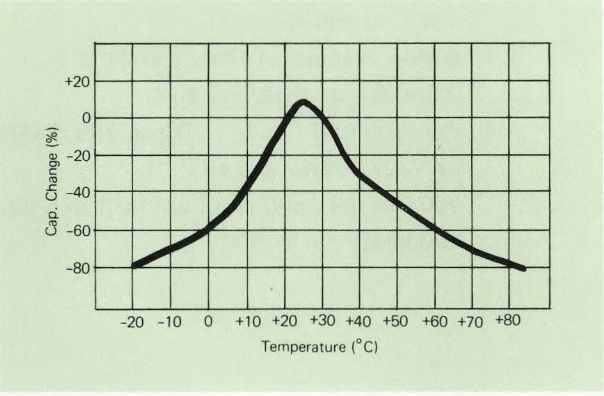
Features

- Very small in size
- Designed for low-voltage devices
- Ideal for by-pass application in transistor circuits or other very low-voltage circuit

Specifications

1. Related Standards . . . . IEC Pub.187/EIA RS-198 class 2
2. Operating Temperature Range . . . . -10°C to +70°C
3. Capacitance . . . . Within tolerance at 1KHz and 20°C
4. Dissipation Factor . . . . 5.0% max. at 1KHz and 20°C
5. Temperature Characteristics . . . . Conform to IEC Pub.187 Char. 2F5/EIA RS-198 Char.Z5V
6. Working Voltage . . . . 25V DC
7. Dielectric Withstanding Voltage. . . . . 62.5V DC for 1 to 5 seconds
8. Insulation Resistance . . . . Greater than 10,000MΩ or 200Ω-Fwhichever is less at 25V DC
9. Lead Styles Available . . . . See p.V-32

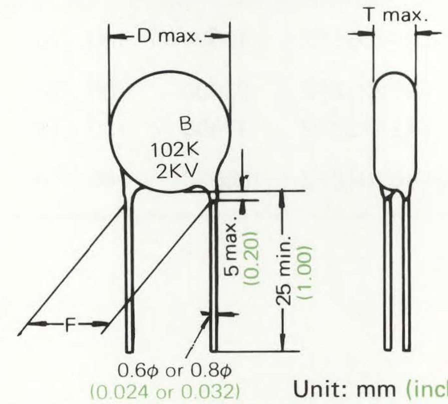
Typical Capacitance vs. Temperature



1KV–4KV Hi-K High Voltage

Standard Products

Working Voltage	Capacitance Range (pF)	Dimensions mm (inch)		
		D	F	T
1KVDC	100~ 470	7.0(0.275)	5±1.5 (0.20±0.06)	6.0(0.235)
	560~1200	10.5(0.410)		
	1500~2200	13.5(0.530)	10±2 (0.40±0.08)	
	2700~3900	17.5(0.690)		
	4700~5600	22.5(0.890)		
2KVDC	100~ 330	9.0(0.355)	7.5±2 (0.30±0.08)	7.0(0.275)
	390~ 680	11.0(0.430)		
	820~1500	14.0(0.550)	10±2 (0.40±0.08)	
	1800~2200	18.0(0.700)		
	2700~3300	23.0(0.900)		
3KVDC	100~ 390	11.0(0.430)	7.5±2 (0.30±0.08)	8.0(0.315)
	470~ 820	15.0(0.590)	10±2 (0.40±0.08)	
	1000~1200	19.0(0.750)		
	1500~1800	23.0(0.900)		
4KVDC	100~ 330	12.0(0.470)	7.5±2 (0.30±0.08)	8.5(0.335)
	390~ 560	15.0(0.590)	10±2 (0.40±0.08)	
	680~1000	19.0(0.750)		
	1200~1500	23.0(0.900)		



Unit: mm (inch)

Standard Capacitance Values in pF

± 10% Tol. 100, 120, 150, 180, 220, 270, 330, 390, 470, 560, 680, 820, 1000, 1200, 1500, 1800, 2200, 2700, 3300, 3900, 4700, 5600,

Features

- High voltage capacitor of excellent voltage withstanding characteristics
- Ideal for low frequency filters, series blocking circuits, voltage doublers
- Flame retardant insulation coating available upon request

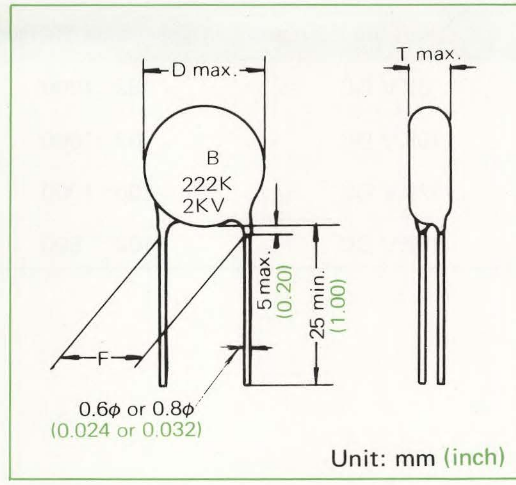
Specifications

1. Related Standards .... IEC Pub.187/EIA RS-165 class 2
2. Operating Temperature Range .... -30°C to +85°C
3. Capacitance .... Within tolerance at 1KHz and 20°C
4. Dissipation Factor .... 2.5% max, at 1KHz and 20°C
5. Temperature Characteristics .... Conform to IEC Pub. 187 Char. 2B5, 2B4/EIA RS-165 Z5P, Y5P
6. Working Voltage .... 1KV, 2KV, 3KV and 4KV DC
7. Dielectric Withstanding Voltage .... 200% of the working voltage for 1 to 5 seconds
8. Insulation Resistance .... 10000MΩ min.at 500V DC

1KV-3KV Hi-K High Voltage For Pulse Circuits

Standard Products

Working Voltage	Capacitance Range (pF)	Dimensions mm(inch)		
		D	F	T
1KV DC 500Vp-p max at 15.75KHz Pulse	100~ 330	8.0(0.315)	5±1.5 (0.20±0.06)	5.0 (0.200)
	390~ 680	11.0(0.430)		
	820~1500	14.0(0.550)	10±2 (0.40±0.08)	
	1800~2700	17.0(0.670)		
	3300~3900	25.0(1.00)		
2KV DC 1KVp-p max. at 15.75 KHz Pulse	100~ 300	11.0(0.430)	7.5±2 (0.30±0.08)	7.0 (0.275)
	390~ 820	17.0(0.670)	10±2 (0.40±0.08)	
	1000~1500	21.0(0.830)		
	1800~2200	26.0(1.02)		
3KV DC 1KV p-p max. at 15.75 KHz Pulse	100~ 270	14.0(0.550)	10±2 (0.40±0.08)	8.0 (0.315)
	330~ 680	18.0(0.710)		
	820~1000	21.0(0.830)		



Standard Capacitance Values in pF

±10% Tol. 100, 120, 150, 180, 220, 270, 330
390, 470, 560, 680, 870, 1000
1200, 1500, 1800, 2200, 2700, 3300, 3900

Part Number Code

E C K	—	D	3 D	1 0 2	K	B	9
Common Code See p.V-2.		Shape	W. Volt	Capacitance	Tol.	Temp. Char.	Suffix by "9" or "8"

Features

- High voltage capacitance of excellent voltage withstanding characteristics
- Ideal for high frequency pulse (15.75 KHz at Color TV) circuits
- Flame retardant insulation coating available upon request

Specifications

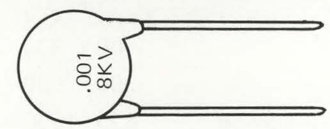
1. Related Standards .... IEC Pub.187/EIA RS-165 Class 2
2. Operating Temperature Range .... -30°C to +85°C
3. Capacitance .... Within tolerance at 1KHz and 20°C
4. Dissipation Factor .... 2.5% max. at 1KHz and 20°C
5. Temperature Characteristics........... Conform to IEC Pub.187 Char. 2B5, 2B4/EIA RS-165 Z5P, Y5P
6. Working Voltage .... 1KV, 2KV, and 3KV DC
7. Dielectric Withstanding Voltage .... 200% of the working voltage for 1 to 5 seconds
8. Insulation Resistance .... 10000MΩ min. at 500V DC

8KV–15KV Hi-K High Voltage

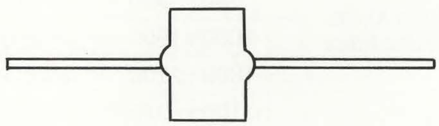
Capacitance Range

Working Voltage	Capacitance Range (pF)	Types
8KV DC	82~1000	1, 2
10KV DC	82~1000	2
12KV DC	100~1000	2
15KV DC	100~ 500	2

Type 1



Type 2



Features

- High voltage capacitor of excellent voltage withstanding characteristics
- Little capacitance change over a wide temperature range
- Noncombustible epoxy coating

Specifications

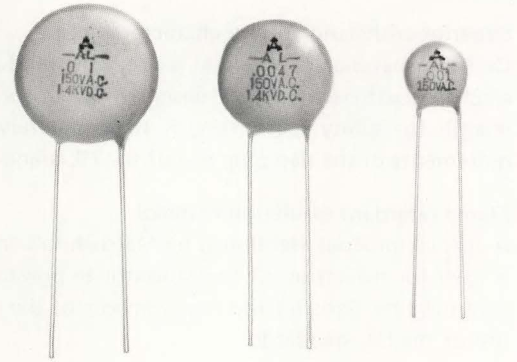
1. Related Standards .... IEC Pub.187/EIA RS-165 class 2
2. Operating Temperature Range .... -30°C to +85°C
3. Capacitance .... Within tolerance at 1KHz and 20°C
4. Dissipation Factor .... 2.5% max. at 1KHz and 20°C
5. Temperature Characteristics .... Conform to IEC Pub.187 Char. 2B5, 2B4/EIA RS-165 Char. Z5P, Y5P
6. Working Voltage .... 8 KV, 10KV, 12KV, 15KV DC
7. Dielectric Withstanding Voltage .... 150% of the working voltage for 1 to 5 seconds
8. Insulation Resistance .... 10000MΩ min at 500V DC

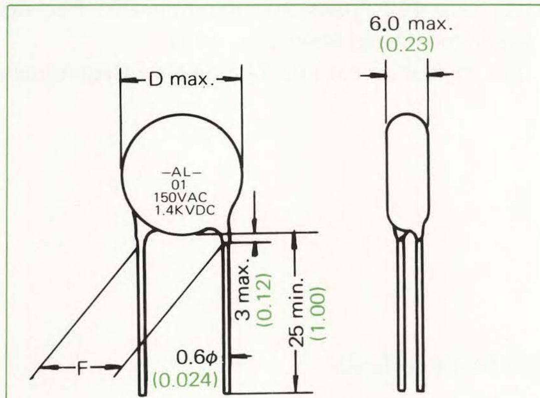
UL Listed (TYPE -AL-)

AC Line By-Pass, Antenna Coupling

Standard Products

Part No.	Capacitance		Temp.	Dimensions mm (inch)	
	Rated (pF)	Tolerance (%)	Coeff.	D	F
ECK-DAL101MBE	100	±20	Z5F		
ECK-DAL151MBE	150	±20	Z5F		
ECK-DAL221MBE	220	±20	Z5F		
ECK-DAL331MBE	330	±20	Z5F	12.0(0.475)	6.4(0.250)
ECK-DAL471MDE	470	±20	Z5T		
ECK-DAL681MDE	680	±20	Z5T		
ECK-DAL102PEE	1,000	+100, −0	Z5U		
ECK-DAL222PEE	2,200	+100, −0	Z5U	13.5(0.535)	
ECK-DAL472PEE	4,700	+100, −0	Z5U	19.0(0.750)	9.5(0.375)
ECK-DAL103PEE	10,000	+100, −0	Z5U	25.0(0.985)	





Unit: mm (inch)

Features

- Ideal for line by-pass and antenna coupling applications, especially for the circuits exposed to a danger of electric shock

Matsushita Type —AL—ceramic capacitors listed above are recognized under the component program of Underwirters' Labolatories, Inc.

Matsushita type designation	—AL—
Yellow card number	E37995

Specifications

1. Related Standards .... UL subject 492 (Provisional Requirements for Antenna Coupling and Line-By-Pass Components)
2. Operating Temperature Range .... -30°C to +85°C
3. Capacitance .... Within tolerance at 1KHz and 20°C
4. Dissipation Factor .... 2.5% max. at 1KHz and 20°C
5. Temperature Characteristics .... Z5P : ±10% capacitance change over temperature range of +10°C to +85°C
   Z5T: ±22, -33% capacitance change over temperature range of +10°C to +85°C
   Z5U: +22, -56% capacitance change over temperature range of +10°C to +85°C
6. Working Voltage.................. 150V AC, 1400V DC
7. Dielectric Withstanding Voltage....... 2800V DC for 1 to 5 seconds
8. Insulation Resistance .... 10000MΩ min. at 500V DC
9. Discharge Test .... As per UL Sub. 492
10. Life Test .... As per UL Sub. 492

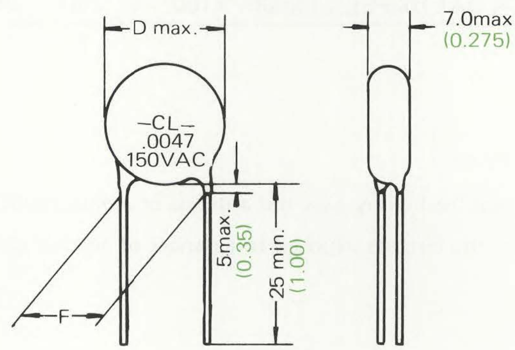
UL Listed (TYPE -CL-) Across-the-Line

Features

- **Superior withstand voltage characteristic**
  Ceramic material is excellent as to withstand voltage and dielectric coefficient, with a design which incorporates a large margin for safety, permitting it to completely satisfy the requirements of the damping test of the UL standards.

- **Flame retardant insulation material**
  A special material, developed by Matsushita's engineering staff, is used for insulation of the capacitor to prevent damage from external fire. Satisfies the requirements of the capacitor flame test of the UL standards.

- **Related UL Requirements**
  UL Sub. 492 Provisional Requirements For Across-The-Line Capacitors Dated March, 11, 1971
  (For the additional Life Test on New Requirements)



Unit: mm (inch)

Standard Products

Matsushita Type —CL— ceramic capacitor listed above are recognized under the component program of Underwriters' Labolatories, Inc.

Matsushita type designation	—CL—
Yellow card number	E37995

Part No.	Capacitance		Temp. Coeff.	Dimensions mm (inch)	
	Rated (pF)	Tolerance (%)		D	F
ECK-DCL102ZEE	1,000	+80, –20	Z5U	12.5 (0.492)	6.4 (0.250)
ECK-DCL222ZEE	2,200	+80, –20	Z5U	18.0 (0.709)	9.5 (0.375)
ECK-DCL472ZEE	4,700	+80, –20	Z5U	22.0 (0.866)	

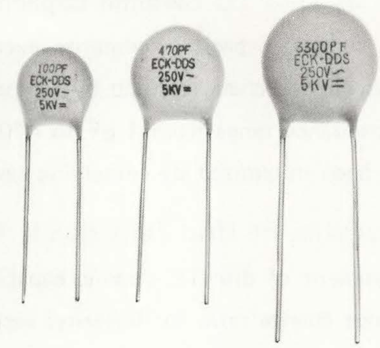
Specifications

1. Related Standards .... UL Subject 492. (Provisional Requirements For Across-The-Line Capacitors)
2. Operating Temperature Range .... -30°C to +85°C
3. Capacitance .... Within Tolerance at 1KHz and 20°C
4. Dissipation Factor .... 2.5% max. at 1KHz and 20°C
5. Temperature Characteristics .... Z5U: +22, -56% capacitance change over temperature range of +10°C to +85°C
6. Working Voltage .... 150V AC
7. Dielectric Withstanding Voltage .... 2800V DC for 1 to 5 seconds
8. Insulation Resistance .... 10000MΩ min. at 500V DC
9. Discharge Test .... As per UL Sub. 492
10. Life Test .... As per UL Sub. 492
11. Body Insulation .... Noncombustible epoxy coating

European Safety Standards SEV, SEMKO, DEMKO Approved
AC Line By-Pass. Antenna Coupling

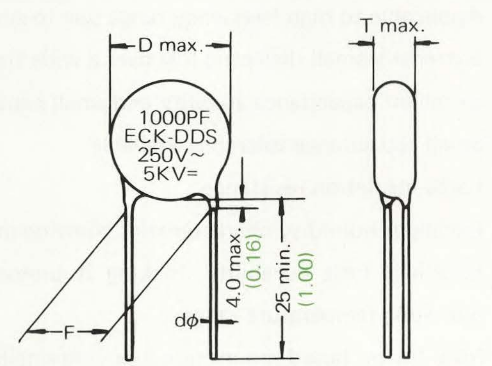
Standard Products

Part No.	Capacitance		Temp. Coeff.	Dimensions mm(inch)			
	Rated (pF)	Tol. (%)		D	T	F	α
ECC-DDS470M	47	±20	1D	13.0 (0.51)	7.0 (0.27)	7.5±2 (0.30 ±0.08)	0.6 (0.024)
ECK-DDS101MB	100	±20	2B4	14.0 (0.55)			
ECK-DDS221MB	220	±20	2B4				
ECK-DDS471MB	470	±20	2B4	16.0 (0.63)			
ECK-DDS102MD	1000	±20	2D4			10±2 (0.40 ±0.08)	
ECK-DDS152ME	1500	±20	2E5				
ECK-DDS222ME	2200	±20	2E5				
ECK-DDS332ME	3300	±20	2E5	22.0 (0.86)	10.0 (0.40)		0.8 (0.032)
ECK-DDS472ME	4700	±20	2E5	24.0 (0.94)			



Features

- These capacitors are approved by SEV (Switzerland), SEMKO (Sweden) and DEMKO (Denmark)
- Approval Range
  - SEV .... 1 ~ 1000 pF (Not Approved over 1000pF)
  - SEMKO .... 1 ~ 4700pF
  - DEMKO .... 1 ~ 4700pF



Specifications

1. Related Standards .... IEC Pub. 65 (CEE Pub.1). SEV 1016 and DEMKO Afsnit 21.
2. Operating Temperature Range .... -30°C to +85°C
3. Capacitance. .... Within tolerance at 1KHz and 20°C
4. Dissipation Factor .... 2.5% max. at 1KHz and 20°C
5. Temperature Characteristics .... 1D: Nominal temperature coeffcent between P150 and N1500
   - 2B4: Max. ±10% Capacitance Change over temperature range -25°C to +85°C
   - 2D4: Max. $^{+20}_{-30}$% Capacitance Change over temperature range -25°C to +85°C
   - 2E5: Max. $^{+20}_{-55}$% Capacitance Change over temperature range -10°C to +70°C
6. Working Voltage .... 250V AC
7. Dielectric Withstanding Voltage .... 2000V AC, 5000V DC 1 minute
8. Insulation Resistance .... 1000MΩ min. at 500V DC
9. Discharge Test .... As per IEC Pub. 65
10. Humidity Test .... As per IEC Pub. 65
11. Life Test .... As per IEC Pub. 65

DISC TC CERAMIC CAPACITORS

Outline of Disc TC Ceramic Capacitor

Disc TC ceramic capacitors comprise excellent ceramic dielectric material which exhibits extremely small dielectric loss and linear capacitance change caused by temperature changes.

Wide capacitance range from 1 pF to 470 pF over various temperature coefficient specifications are available.

Size has been minimized by empolying newly developed dielectric material and manufacturing process.

Characteristics of Disc TC Ceramic Capacitors

Main ingredient of disc TC ceramic capacitors is mixture with some metal oxide additives, being sintered at about 1300°C.

Capacitance change ratio (or linearity) varies with the quantity and kinds of the additives, compensating ideally the frequency fluctuations in electronic circuits.

Small dielectric loss and excellent capacitance stability prove satisfactory operation especially in high frequency circuits.

Capacitance change by temperature is generally expressed in temperature coefficient (the unit is PPM/°C – i.e. parts per million per 1°C rise)

Features of Disc TC Ceramic Capacitors

- Linear and reversable capacitance change and a wide range of temperature coefficient available
- Applicable to high frequency range due to simple electrode construction and small self inductance
- Extremely small dielectric loss over a wide frequency range (i.e. high Q)
- Excellent capacitance stability and small capacitance change after a long term shelf life test
- Small capacitance tolerance available
- Large insulation resistance
- Excellent humidity characteristics showing minimized change of capacitance, Q and insulation resistance after humidity tests
- Excellent heat durability, making it unnecessary to decrease the rated voltage as far as operation is within the specified operating temperature range
- Ideal for pc board mounting occupying smaller space due to the flat disc structure
- Attractively priced due to large amount mass production

Application of Disc TC Ceramic Capacitors

- TV's and radios, especially the circuit requiring stable capacitance and High Q.
- Temperature compensation for oscillation or tuning circuit

General Ratings

Related Standards — IEC Pub. 108
EIA-RS-198 Class 1

Item	Test Methods	Requirements
Dielectric Withstanding Voltage	1) Capacitors shall withstand, for 1~5 seconds, a d-c test voltage of 2.5 times the rated working voltage (2 times when the rated d-c voltage 1 KV or over) charging current to 50 milli-amperes maximum. 2) Capacitors shall withstand, for 1~5 seconds, a d-c test voltage of 2.5 times the rated working voltage or 1.3 KV d-c voltage, whichever is smaller, between both leads connected together and metal foil wrapped closely around body of capacitor to within no less than 1/16″ of lead wires, charging current to 50 milliamperes maximum.	Without damage or breakdown
Insulation Resistance	Insulation resistance between terminals of the capacitor shall be measured 1 minute after application of d-c test voltage of the rated voltage (rated at 100V or less), 100V (rated at 100 to 500V), or 500V (rated over 500V), charging current to 50 milliamperes maximum.	Exceed 10000 megohms
Capacitance	Capacitance shall be measured at a frequency of 1±0.2MHz with an applied voltage of 1Vrms at temperature of 20°C (IEC) or 25°C (EIA).	Within the tolerance shown by the type designation
Quality Factor (Q)	Quality factor shall be measured as in capacitance.	Not greater than the limits as defined by Table 1.
Temperature Characteristic	Over the rated temperature range the capacitance shall be measured.	Not exceed the limits as defined by Table 2.
Seal Test	After capacitors shall be subjected to an ambient of 40°C, 90~95%RH for 500 hours, capacitance shall be measured.	Meet the requirements as defined by Table 3.
Life Test	Capacitors shall be tested for a period of 1000 hours at 85°C at 200% the rated voltage (150% of 1KV over).	Meet the requirements as defined by Table 3.

Table 1

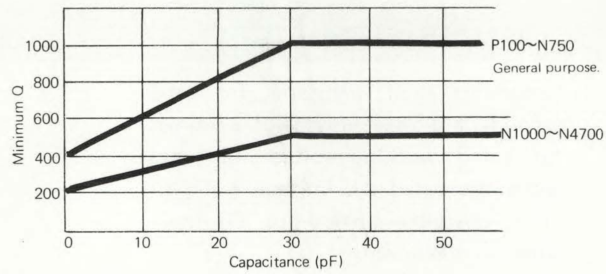
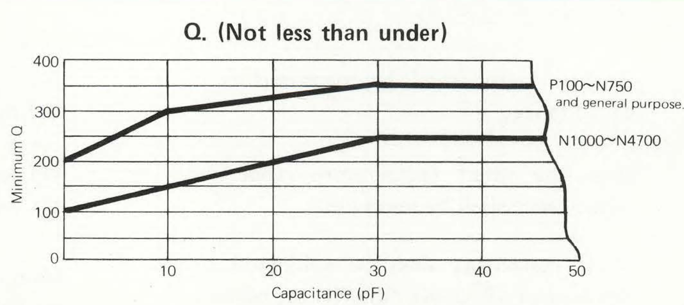


Table 2

Capacitance pF	Rated Temperature Coefficient Values							
	P100~N470	N750	N1000	N1500	N2200	N3300	N4700	General purpose
2.9 and under	±250	±250	—	—	—	—	—	P350 to N1000
3 to 3.9	±120	±120	—	—	—	—	—	P350 to N1000
4 and above	± 60	±120	±250	±250	±500	±500	±1000	P350 to N1000

Table 3

Item	Insulation Resistance	Change of the capacitance (not exceed whichever is more)		
		P100 ~ N750 General purpose	N1000~N2200	N3300~N4700
Seal Test	Not less than 1000MΩ	±5% or ±0.5pF	±7.5% or ±0.75pF	±10% or ±1pF
Life Test	Not less than 1000MΩ	±3% or ±0.3pF	±5% or ±0.5pF	±7.5% or ±0.75pF

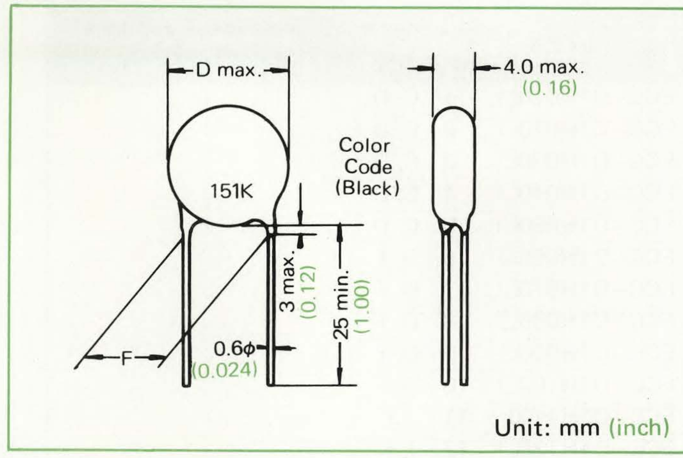


500V General Purpose (IEC Char 1D/EIA Char U2M)

Standard Products

Part No.	Capacitance (pF)	Capacitance TOL.	Dimensions mm(inch) D	Dimensions mm(inch) F
ECC–D2H010□	1	C, D	7.0(0.275)	5±1.5 (0.20±0.06)
ECC–D2H020□	2	C, D		
ECC–D2H030□	3	C, D		
ECC–D2H040□	4	C, D		
ECC–D2H050□	5	C, D		
ECC–D2H060□	6	D, F		
ECC–D2H070□	7	D, F		
ECC–D2H080□	8	D, F		
ECC–D2H090□	9	D, F		
ECC–D2H100□	10	D, F		
ECC–D2H110J	11	J		
ECC–D2H120□	12	J, K		
ECC–D2H130J	13	J		
ECC–D2H150□	15	J, K		
ECC–D2H160J	16	J		
ECC–D2H180□	18	J, K		
ECC–D2H200J	20	J		
ECC–D2H220□	22	J, K		
ECC–D2H240J	24	J		
ECC–D2H270□	27	J, K		
ECC–D2H300J	30	J		
ECC–D2H330□	33	J, K		
ECC–D2H360J	36	J		
ECC–D2H390□	39	J, K		
ECC–D2H430J	43	J		
ECC–D2H470□	47	J, K		
ECC–D2H510J	51	J	8.0(0.315)	
ECC–D2H560□	56	J, K		
ECC–D2H620J	62	J		
ECC–D2H680□	68	J, K		
ECC–D2H750J	75	J		
ECC–D2H820□	82	J, K		
ECC–D2H910J	91	J	10.0(0.400)	
ECC–D2H101□	100	J, K		
ECC–D2H111J	110	J		
ECC–D2H121□	120	J, K		
ECC–D2H131J	130	J	11.0(0.435)	
ECC–D2H151□	150	J, K		
ECC–D2H161J	160	J	13.0(0.515)	10±2 (0.40±0.08)
ECC–D2H181□	180	J, K		
ECC–D2H201J	200	J		
ECC–D2H221□	220	J, K		
ECC–D2H241J	240	J		
ECC–D2H271□	270	J, K	17.0(0.670)	
ECC–D2H301J	300	J		
ECC–D2H331□	330	J, K		
ECC–D2H361J	360	J		
ECC–D2H391□	390	J, K		
ECC–D2H431J	430	J	19.3(0.760)	
ECC–D2H471□	470	J, K		

└Cap. tol.: C(±0.25pF), D(±0.5pF), F(±1pF)
J(±5%), K(±10%)



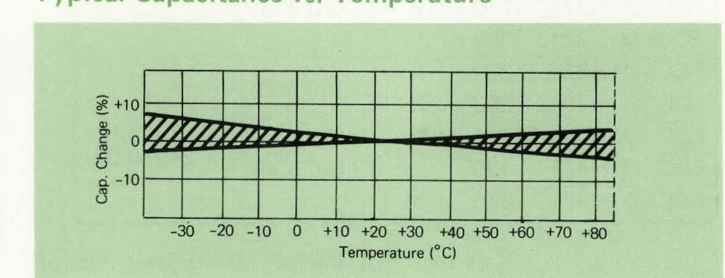
Features

- For general purposes, exhibiting high Q and stable electrical characteristics

Specifications

1. Related Standard:
   IEC Pub.108/EIA RS-198 Class 1
2. Operating Temperature Range:
   -30°C to +85°C
3. Capacitance:
   Within tolerance at 1MHz and 20°C
4. Q Facotr:
   30 pF or more Q≧ 1000
   Less than 30pF Q≧ 400 + 20C C: Capacitance(pF)
5. Temperature Coefficient:
   Conform to IEC Pub. 108 Char. 1D/EIA RS-198 Char. U2M (Nominal temp. coef. between P150 and N1750 PPM/°C)
6. Working Voltage:
   500V DC
7. Dielectric Withstanding Voltage:
   1250V DC for 1 to 5 seconds
8. Insulation Resistance:
   10000MΩ min.at 100V. DC
9. Lead Styles Available .... See P. V-32

Typical Capacitance vs. Temperature

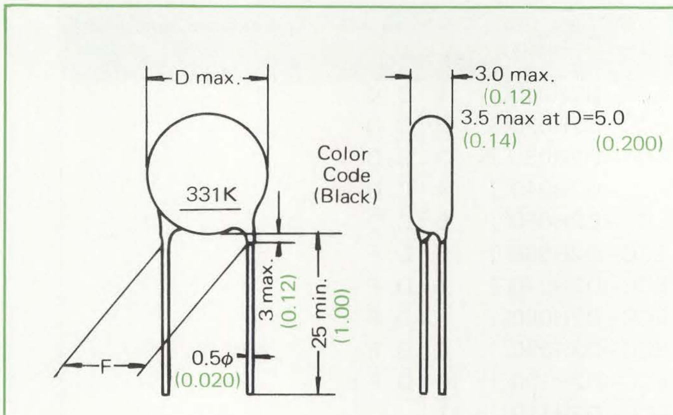


50V General Purpose (IEC Char 1D/EIA Char U2M)

Standard Products

Part No.	Capacitance (pF)	TOL.	Dimensions mm(inch) D	F
ECC–D1H010☐	1	C, D		
ECC–D1H020☐	2	C, D		
ECC–D1H030☐	3	C, D		
ECC–D1H040☐	4	C, D		
ECC–D1H050☐	5	C, D		
ECC–D1H060☐	6	D, F		
ECC–D1H070☐	7	D, F		
ECC–D1H080☐	8	D, F		
ECC–D1H090☐	9	D, F		
ECC–D1H100☐	10	D, F		
ECC–D1H110J	11	J		
ECC–D1H120☐	12	J, K		
ECC–D1H130J	13	J		
ECC–D1H150☐	15	J, K	5.0(0.200)	2.5±1.5 (0.10±0.06)
ECC–D1H160J	16	J		
ECC–D1H180☐	18	J, K		
ECC–D1H200J	20	J		
ECC–D1H220☐	22	J, K		
ECC–D1H240J	24	J		
ECC–D1H270☐	27	J, K		
ECC–D1H300J	30	J		
ECC–D1H330☐	33	J, K		
ECC–D1H360J	36	J		
ECC–D1H390☐	39	J, K		
ECC–D1H430J	43	J		
ECC–D1H470☐	47	J, K		
ECC–D1H510J	51	J		
ECC–D1H560☐	56	J, K		
ECC–D1H620J	62	J		
ECC–D1H680☐	68	J, K	7.0(0.275)	
ECC–D1H750J	75	J		
ECC–D1H820☐	82	J, K		
ECC–D1H910J	91	J		5±1.5 (0.20±0.06)
ECC–D1H101☐	100	J, K]		
ECC–D1H111J	110	J		
ECC–D1H121☐	120	J, K	8.0(0.315)	
ECC–D1H131J	130	J		
ECC–D1H151☐	150	J, K		
ECC–D1H161☐	160	J		
ECC–D1H181☐	180	J, K		
ECC–D1H201J	200	J	10.0(0.400)	
ECC–D1H221☐	220	J, K		
ECC–D1H241J	240	J		
ECC–D1H271☐	270	J, K	11.0(0.435)	
ECC–D1H301J	300	J		
ECC–D1H331☐	330	J, K	12.5(0.500)	
ECC–D1H361J	360	J		
ECC–D1H391☐	390	J,K		10±2 (0.40±0.08)
ECC–D1H431J	430	J	13.5(0.530)	
ECC–D1H471☐	470	J, K		

☐ — Cap. tol.: C(±0.25pF), D(±0.5pH), F(±1pF) J(±5%), K(±10%)



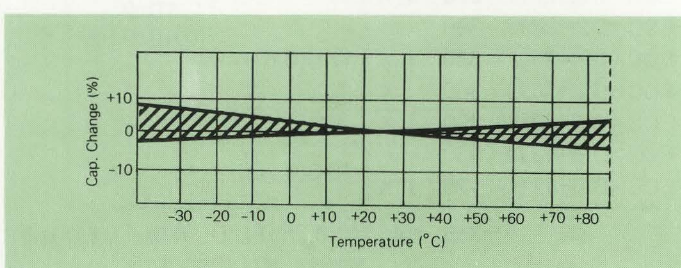
Unit: mm (inch)

Features

- Very small in size for general purposes
- Exhibiting high Q and stable electrical characteristics
- Ideal for high frequency transistor circuits

1. Related Standard:
   IEC Pub.108/EIA RS-198 Class 1
2. Operating Temperature Range:
   -30°C to +85°C
3. Capacitance:
   Within Tolerance at 1MHz and 20°C
4. Q Factor:
   30pF or more $Q \geq 1000$
   Less than 30pF $Q \geq 400 + 20C$ C: Capacitance (pF)
5. Temperature Coeffecient:
   Conform to IEC Pub. 108 Char. 1D/EIA RS-198 Char. U2M
   (Nominal temp. coef. between P150 and N1750 PPM/°C)
6. Working Voltage:
   50V DC
7. Dielectric Withstanding Voltage:
   125V DC for 1 to 5 second
8. Insulation Resistance:
   10000MΩ min. at 50V DC
9. Lead Styles Availabe:....... See P. V-32

Typical Capacitance vs. Temperature

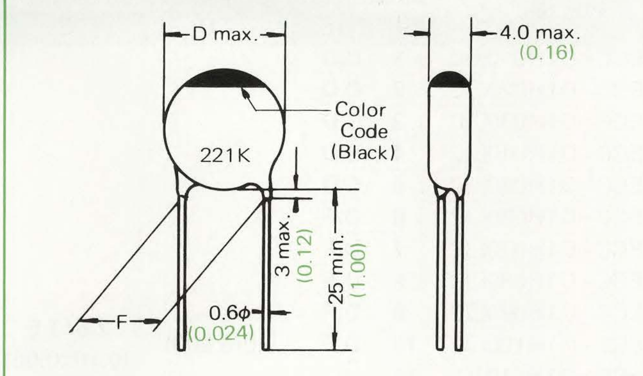


500V General Purpose (NPO Char.)

Standard Products

Part No.	Capacitance (pF)	TOL.	Dimensions mm (inch) D	F
ECC–D2H010□C	1	C,D	7.0(0.275)	5 ± 1.5 (0.20 ± 0.06)
ECC–D2H020□C	2	C,D		
ECC–D2H030□C	3	C,D		
ECC–D2H040□C	4	C,D		
ECC–D2H050□C	5	C,D		
ECC–D2H060□C	6	D,F		
ECC–D2H070□C	7	D,F		
ECC–D2H080□C	8	D,F		
ECC–D2H090□C	9	D,F		
ECC–D2H100□C	10	D,F		
ECC–D2H110JC	11	J		
ECC–D2H120□C	12	J,K,		
ECC–D2H130JC	13	J		
ECC–D2H150□C	15	J,K,		
ECC–D2H160JC	16	J		
ECC–D2H180□C	18	J,K		
ECC–D2H200JC	20	J		
ECC–D2H220□C	22	J,K		
ECC–D2H240JC	24	J		
ECC–D2H270□C	27	J,K		
ECC–D2H300JC	30	J	8.0(0.315)	
ECC–D2H330□C	33	J,K		
ECC–D2H360JC	36	J		
ECC–D2H390□C	39	J,K		
ECC–D2H430JC	43	J		
ECC–D2H470□C	47	J,K		
ECC–D2H510JC	51	J	10.0(0.400)	
ECC–D2H560□C	56	J,K		
ECC–D2H620JC	62	J		
ECC–D2H680□C	68	J,K		
ECC–D2H750JC	75	J	13.0(0.510)	10 ± 2 (0.40±0.08)
ECC–D2H820□C	82	J,K		
ECC–D2H910JC	91	J		
ECC–D2H101□C	100	J,K		
ECC–D2H111JC	110	J		
ECC–D2H121□C	120	J,K		
ECC–D2H131JC	130	J	17.0(0.670)	
ECC–D2H151□C	150	J,K		
ECC–D2H161JC	160	J		
ECC–D2H181□C	180	J,K		
ECC–D2H201JC	200	J		
ECC–D2H221□C	220	J,K		
ECC–D2H241JC	240	J	19.3(0.760)	
ECC–D2H271□C	270	J,K		
ECC–D2H301JC	300	J		

Cap. tol.: C(±0.25pF), D(±0.5pF), F(±1pF)
J(±5%), K(±10%)



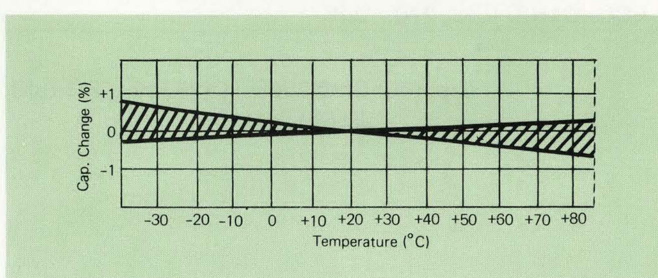
Features

- Very little capacitance change
- Very small in size for NPO char.
- Exhibiting high Q and stable electrical characteristics
- Ideal for high frequency transistor circuits

Specifications

1. Related Standard:
   IEC Pub. 108/EIA RS-198 class 1
2. Operating Temperature Range:
   –30°C to +85°C
3. Capacitance:
   Within Tolerance at 1MHz and 20°C
4. Q Factor:
   30pF or more Q≧1000
   Less than 30pF Q≧400+200 C: Capacitance (pF)
5. Temperature Coefficient:
   NPO±60 PPM/°C for 4pF and over
   NPO±120 PPM/°C for 3pF
   NPO±250 PPM/°C for 1pF and 2pF.
6. Working Voltage:
   50V DC
7. Dielectric Withstanding Voltage:
   125V DC for 1 to 5 seconds
8. Insulation Resistance:
   1000MΩ min at 50VDC
9. Lead Styles Available .... See P.V-32

Typical Capacitance vs. Temperature

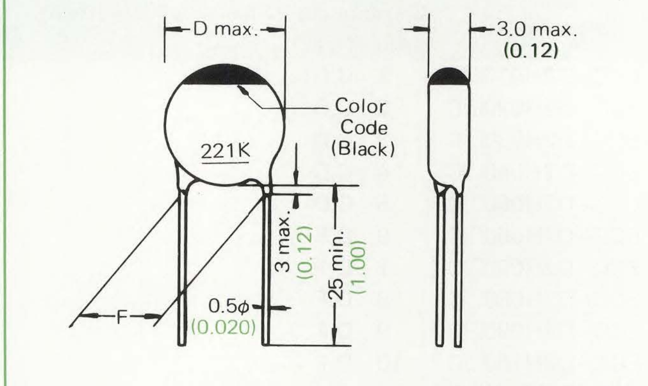


50V General Purpose (NPO Char.)

Standard Products

Part No.	Capacitance (pF)	TOL.	Dimensions mm(inch) D	F
ECC–D1H010□C	1	C,D	5,0(0.200)	2.5±1.5 (0.10±0.06)
ECC–D1H020□C	2	C,D		
ECC–D1H030□C	3	C,D		
ECC–D1H040□C	4	C,D		
ECC–D1H050□C	5	C,D		
ECC–D1H060□C	6	D,F		
ECC–D1H070□C	7	D,F		
ECC–D1H080□C	8	D,F		
ECC–D1H090□C	9	D,F		
ECC–D1H100□C	10	D,F		
ECC–D1H110JC	11	J		
ECC–D1H120□C	12	J,K		
ECC–D1H130JC	13	J		
ECC–D1H150□C	15	J,K		
ECC–D1H160JC	16	J		
ECC–D1H180□C	18	J,K		
ECC–D1H200JC	20	J		
ECC–D1H220□C	22	J,K		
ECC–D1H240JC	24	J		
ECC–D1H270□C	27	J,K		
ECC–D1H300JC	30	J	7.0(0.255)	5 ± 1.5 (0.20±0.06)
ECC–D1H330□C	33	J,K		
ECC–D1H360JC	36	J		
ECC–D1H390□C	39	J,K		
ECC–D1H430JC	43	J		
ECC–D1H470□C	47	J,K		
ECC–D1H510JC	51	J		
ECC–D1H560□C	56	J,K	8.0(0.315)	
ECC–D1H620JC	62	J		
ECC–D1H680□C	68	J,K		
ECC–D1H750JC	75	J		
ECC–D1H820□C	82	J,K		
ECC–D1H910JC	91	J		
ECC–D1H101□C	100	J,K	10.0(0.400)	
ECC–D1H111JC	110	J		
ECC–D1H121□C	120	J,K		
ECC–D1H131JC	130	J	11.0(0.435)	
ECC–D1H151□C	150	J,K		
ECC–D1H161JC	160	J		
ECE–D1H181□C	180	J,K	12.5(0.500)	10 ± 2 (0.40±0.08)
ECC–D1H201JC	200	J		
ECC–D1H221□C	220	J,K	13.5(0.530)	
ECC–D1H241JC	240	J		
ECC–D1H271□C	270	J,K		

Cap. tol.: C(±0.25pF), D(±0.5pF), F(±1pF) J(±5%), K(±10%)



Unit: mm (inch)

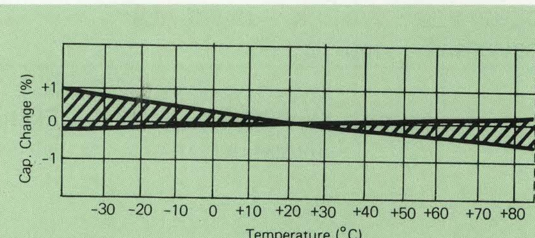
Features

- Very little capacitance change
- Very small in size for NPO Char.
- Exhibiting high Q and stable electrical characteristics
- Ideal for high frequency transistor circuits

Specifications

1. Related Standard:
   IEC Pub.108/EIA RS-198 class 1
2. Operating Temperature Range:
   –30°C to +85°C
3. Capacitance:
   Within tolerance at 1MHz and 20°C
4. Q Factor:
   30pF or more Q≧1000
   Less than 30pF Q≧400+20C C: Capacitance(pF)
5. Temperature Coefficient:
   NPO±60 PPM/°C for 4pF and over
   NPO±120 PPM/°C for 3pF
   NPO±250 PPM/°C for 1pF and 2pF
6. Working Voltage:
   50V DC
7. Dielectric Withstanding Voltage:
   125V DC for 1 to 5 seconds
8. Insulation Resistance:
   10000MΩ min. at 50V DC
9. Lead Styles Available . . . See P.V-32

Typical Capacitance vs. Temperature



New Product

500V Temperature Compensating (N30 to N1500 Char.)

Capacitance Range in pF

Temp. Char.	Color Code		D / T / F	7.0(0.275) / 4.0(0.16) / 5±1.5(0.20±0.06)	8.0(0.315) / 4.0(0.16) / 5±1.5(0.20±0.06)	10.0(0.400) / 4.0(0.16) / 5±1.5(0.20±0.06)	13.0(0.510) / 4.0(0.16) / 10±2(0.40±0.08)	17.0(0.670) / 4.0(0.16) / 10±2(0.40±0.08)	19.3(0.760) / 4.0(0.16) / 10±2(0.40±0.08)
N30	H	Brown		2~27	30~47	51~68	75~120	130~220	240~300
N80	L	Red		2~27	30~47	51~68	75~120	130~220	240~300
N150	P	Orange		2~27	30~47	51~68	75~130	130~240	270~300
N220	R	Yellow		2~27	30~47	51~75	82~120	130~240	270~300
N330	S	Green		2~27	30~47	51~75	82~120	130~240	270~300
N470	T	Blue		3~27	30~51	56~75	82~160	180~270	300~360
N750	U	Violet		3~39	43~75	82~100	110~200	220~360	390~470
N1500	W	Marking"W"		20~51	56~91	100~150	100~330	360~470	—

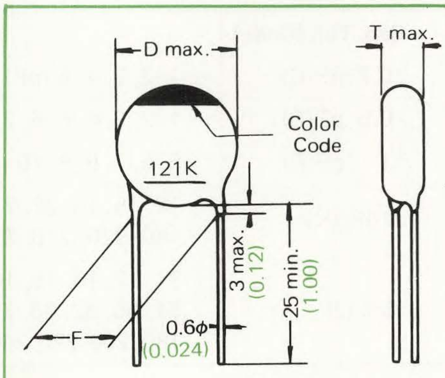
Part Number Code

ECC-D2H	101	K	R	N
Common	Cap.	Tol.	Char.	Suffix "N"

See P.V-2

Standard Capacitance Values

Cap. Tol.(Code)	Capacitance
±0.25pF(C)	1, 2, 3, 4, 5 (pF)
±0.5 pF(D)	1, 2, 3, 4, 6, 7, 8, 9, 10 (pF)
±1 pF(F)	5, 6, 7, 8, 9, 10 (pF)
±10%(K)	12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82, 100, 120, 150, 180, 220, 270, 330, 390, 470 (pF)
±5% (J)	11, 12, 13, 15, 16, 18, 20, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91, 100, 110, 120, 130, 150, 160, 180, 200, 240, 270, 300, 330, 360, 390, 430, 470 (pF)



Unit: mm (inch)

Features

- For high frequency application, exhibiting high Q and stable electrical characteristics

Specifications

1. Related Standards .... IEC Pub, 108/EIA RS-198 class 1
2. Operating Temperature Range .... -30°C to +85°C
3. Capacitance .... Within tolerance at 1MHz and 20°C
4. Q Factor .... 30pF or more Q≧1000
   Less than 30pF Q≧400 + 20C (C: Capacitance (pF))
5. Working Voltage .... 500V DC
6. Dielectric Withstanding Voltage .... 1250V DC for 1 to 5 seconds
7. Insulation Resistance .... 10000MΩ min. at 100V DC
8. Lead Styles Available .... See P. V-32

New Product

50V Temperature Compensating (N30 to N1500 Char.)

Capacitance Range in pF

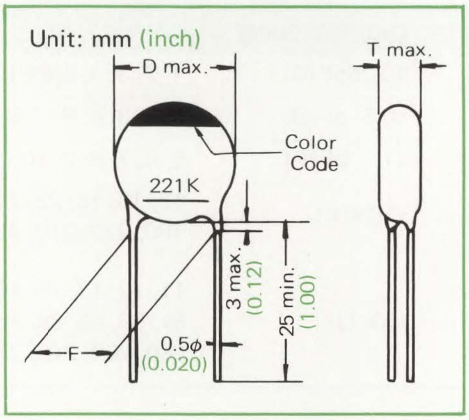
Temp. Char.	Color Code		D / T / F	5.0(0.200)	7.0(0.275)	8.0(0.315)	10.0(0.400)	12.5(0.500)	13.5(0.530)
			T	3.5(0.14)	3.0(0.12)	3.0(0.12)	3.0(0.12)	3.0(0.12)	3.0(0.12)
			F	2.5±1.5(0.10±0.06)	5±1.5(0.20±0.06)	5±1.5(0.20±0.06)	5±1.5(0.20±0.06)	10±2(0.40±0.08)	10±2(0.40±0.08)
N30	H	Brown		2~27	30~51	56~91	100~130	150~200	220~270
N80	L	Red		2~27	30~51	56~91	100~130	150~200	220~270
N150	P	Orange		2~27	30~51	56~91	100~130	150~200	220~270
N220	R	Yellow		2~27	30~51	56~91	100~130	150~200	220~270
N330	S	Green		2~27	30~51	56~91	100~130	150~200	220~270
N470	T	Blue		3~27	30~51	56~91	100~150	160~220	240~300
N750	U	Violet		3~39	43~82	91~120	130~180	200~330	360~390
N1500	W	Marking"W"		10~56	62~110	120~180	200~270	300~360	390~470

Part Number Code

ECC-DIH	101	K	R	N
Common code. See P.V-2.	Cap.	Tol.	Char.	Suffix "N"

Standard Capacitance Values

Cap. Tol. (Code)	Capacitance
±0.25pF(C)	1, 2, 3, 4, 5 (pF)
±0.5 pF(D)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10 (pF)
±1 pF(F)	5, 6, 7, 8, 9, 10 (pF)
±10% (K)	12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82, 100, 120, 150, 180, 220, 270, 330, 390, 470 (pF)
±5% (J)	11, 12, 13, 15, 16, 18, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91, 100, 110, 120, 130, 150, 160, 180, 200, 220, 240, 270, 300, 330, 360, 390, 430, 470 (pF)



Features

- For high frequency and low voltage application, exhibiting high Q and stable electrical characteristics
- Very small in size for low voltage application
- Uniform capacitance and uniform dimensions as to the types from N30 to N470 independent of temperature coefficient, convenient to equipment designing

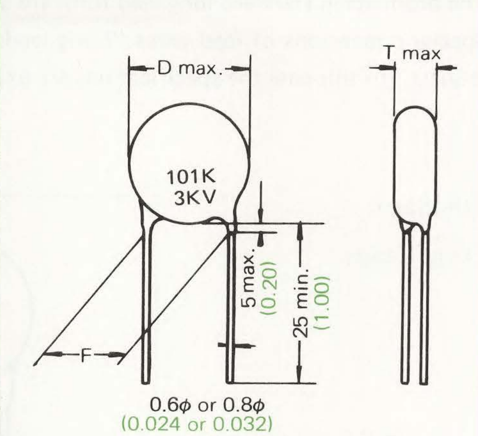
Specifications

1. Related Standards .... IEC Pub.108/EIA RS-198 class 1
2. Operating Temperautre Range .... -30°C to +85°C
3. Capacitance......................... Within tolerance at 1MHz and 20°C
4. Q Factor............................ 30 pF or more Q≧1000
   Less than 30pF Q≧400 + 20C (C: Capacitance (pF))
5. Working Voltage .... 50V DC
6. Dielectric Withstanding Voltage .... 125V DC for 1 to 5 seconds
7. Insulation Resistance .... 10000MΩ min. at 50V DC
8. Lead Styles Available .... See P. V-32

1KV-6KV TC High Voltage

Standard Products

Rated Voltage	Capacitance Range (pF)	Dimensions mm (inch) D	F	T
1KV DC	12 ~ 51	7.0(0.275)	5±1.5 (0.20±0.06)	4.5(0.175)
	56 ~ 91	8.0(0.315)		
	100~150	11.0(0.430)		
	160~330	14.0(0.550)	10±2 (0.40±0.08)	
	360~470	17.0(0.670)		
2KV DC	15 ~ 82	13.0(0.510)	7.5±2(0.30±0.08)	5.0(0.200)
	91~150	15.5(0.610)	10±2 (0.40±0.08)	
	160~240	18.3(0.720)		
	270~300	20.6(0.810)		
	330~470	24.6(0.970)	12.5±2(0.50±0.08)	
3KV DC	15 ~ 82	15.5(0.610)	10±2 (0.40±0.08)	6.0(0.235)
	91~130	18.3(0.720)		
	150~200	20.6(0.810)		
	220~300	24.6(0.970)	12.5±2(0.50±0.08)	
4KV DC	15 ~ 56	15.5(0.610)	10±2 (0.40±0.08)	6.5(0.255)
	62 ~ 82	18.3(0.720)		
	91~120	20.6(0.810)		
	130~200	24.6(0.970)	12.5±2(0.50±0.08)	
5KV DC	15 ~ 47	15.5(0.610)	10±2 (0.40±0.08)	7.0(0.275)
	51 ~ 82	18.3(0.720)		
	91~110	20.6(0.810)		
	120~180	24.6(0.970)	12.5±2(0.50±0.08)	
6KV DC	15 ~ 47	15.5(0.610)	10±2 (0.40±0.08)	8.0(0.315)
	51~ 82	18.3(0.720)		
	91~110	20.6(0.810)		
	120~180	24.6(0.970)	12.5±2(0.50±0.08)	



Unit: mm (inch)

Standard Capacitance Values

Tol.	Capacitance (pF)
±10%	12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82, 100, 120,150, 180, 220, 270, 330, 390, 470
±20%	15, 22, 33, 47, 68, 100,150, 220, 330, 470.

Features

- Ideal for high frequency coupling filters
- Anti-corona coating and flame retardant insulation material available upon request

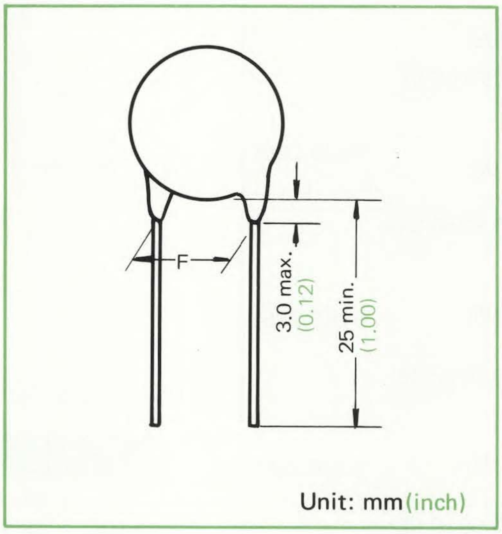
Specifications

1. Related Standards . . . . IEC Pub.108/EIA RS-165 class 1
2. Operating Temperature Range . . . . -30°C to +85°C
3. Capacitance . . . . Within tolerance at 1MHz and 20°C
4. Q Factor . . . . 30pF or more Q≧1000
   Less than 30pF Q≧400+20C (C: Capacitance pF)
5. Temperature Coefficient . . . . Conform to IEC Pub.108. char.1D/EIA RS-165 char. UZM
   U2M (Nominal temp. coef. between P250 and N1750 PPN/°C)
6. Working Voltage . . . . 1KV to 6KV DC
7. Dielectric Withstanding Voltage . . . . 200% of working voltage for 1 to 5 seconds
8. Insulation Resistance . . . . 10000MΩ min. at 500V DC

Lead Styles

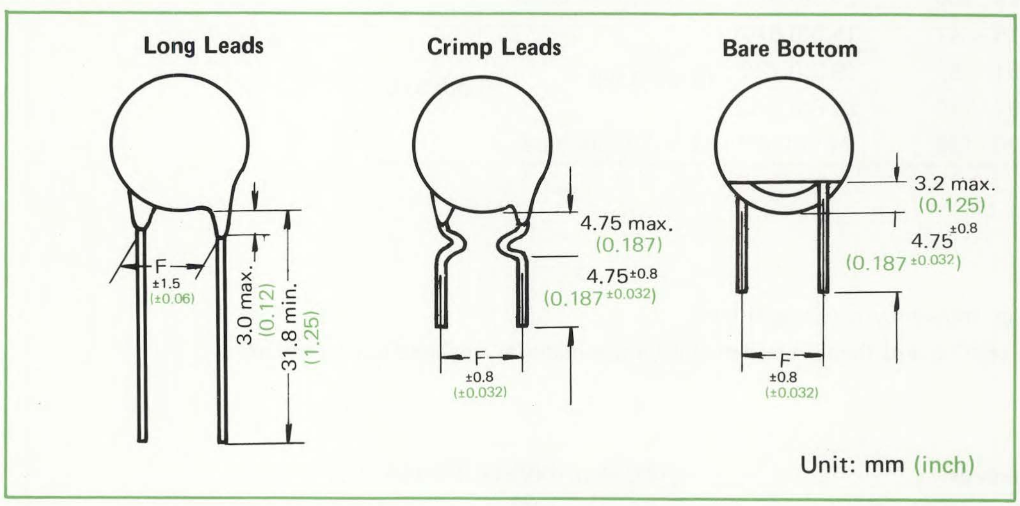
The products in standard long lead form are available from our large stock as standard products.
Special dimensions of lead wires "Long leads by EIA" and "Bare bottem ideal for PC board mounting" are also available upon request. (In this case the specifications are expressed as a suffix in its part number.)

Standard Long Leads



Lead Spacing "F"
2.5(0.10), 5.0(0.20) or 10.0(0.40)
Lead Dia.
0.5(0.02), 0.6(0.024)
or 0.8(0.032)

By EIA STD. RS-198
Long Leads and Plug-in Leads (Special)



Lead Spacing "F".... 6.4(0.250) (Disc Sizes under 12.5(0.50)
or 9.5 (0.375) (Disc Sizes 12.5(0.50) and over)
Lead Dia. .... 0.65(0.025).....#22 AWG
or 0.8(0.032)...#20 AWG

- Other dimensions are also available upon request.
- Bare Bottom type is not available for 50V, 25V rating.
- Special lead styles of capacitors of 6mm dia or less are available in a disc diameter of 7mm.

FEED THROUGH CERAMIC CAPACITORS

Outline of Feed Through Ceramic Capacitors

Comparatively large capacitance ceramic disc capacitors used in high frequency circuits in TV tuners generally lose its function as the frequency becomes higher due to inductance caused by lead terminals and electrodes.

Feed-through capacitors are of constructions minimizing such influence of inductance, being ideal for TV tuner's high frequency circuit.

Characteristics of Feed Through Ceramic Capacitors

Attenuation Characteristic Curves

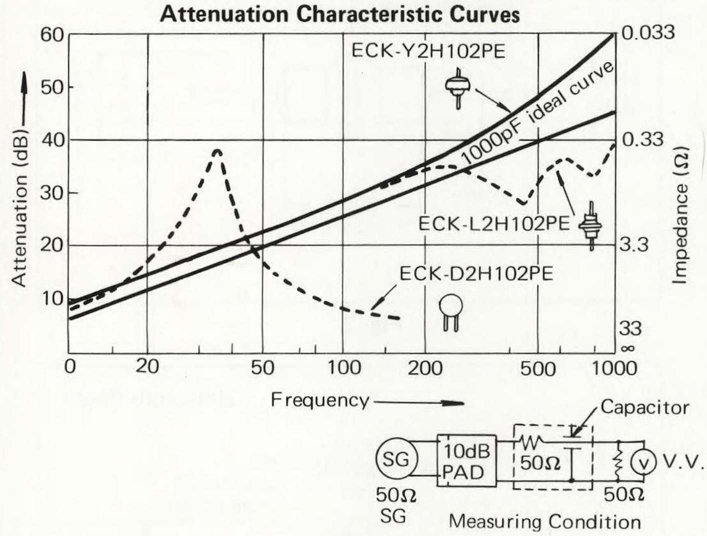


Figure shown in the left shows a comparison of frequency impedance characteristics between disc and feed through types.

These curves exhibit apparent superiority of feed through capacitors especially in bypass effects when applied in VHF bands in comparison with disc types.

Characteristics of Feed Through Ceramic Capacitors

- Small in self inductance and applicable to high frequency circuits
- Cylindrical type and Disc type are available.

Application of Feed Through Ceramic Capacitors

- For power supply of TV tuners
- For test point of TV tuners etc.
- For oscillation circuits of TV tuners etc.

Feed Through Hi-K Ceramic Capacitors

Standard Products

Part No.	Capacitnace		Rated Voltage	Fig.
	Rated(pF)	Tolerance(%)	(V) DC	
ECK–L1H102PE□	1000	+100, –0	50	1
ECK–L2H102PE□	1000	+100, –0	500	2
ECK–Y1H102WE□	1000	+200, –0	50	3
ECK–Y2H102WE□	1000	+200, –0	500	4

Suffix. code

Featuress

- Designed for application in high frequency by-pass, especially of TV tuners

Dimensions

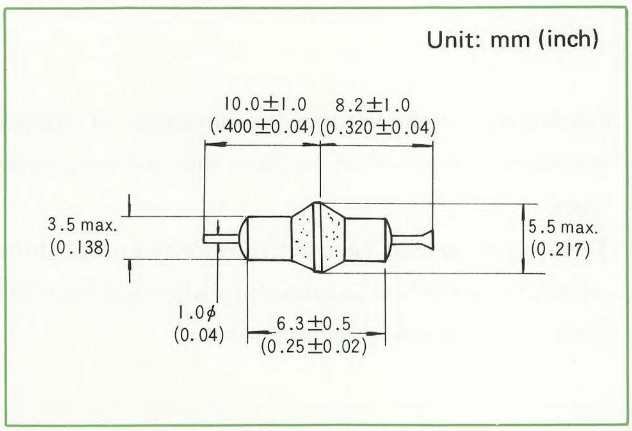


Fig. 1

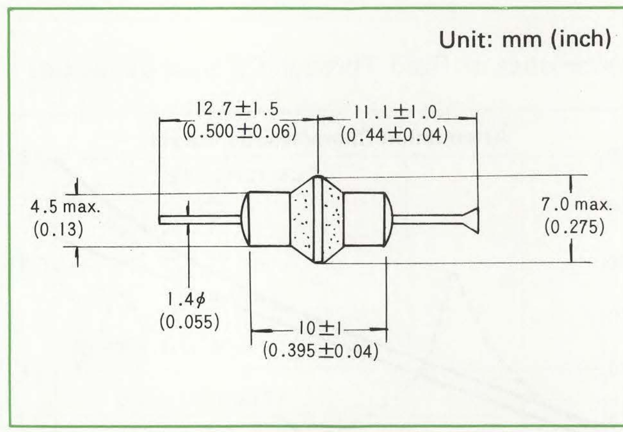


Fig. 2

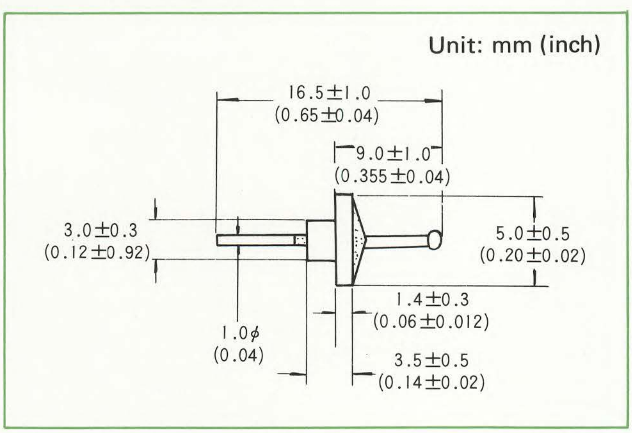


Fig. 3

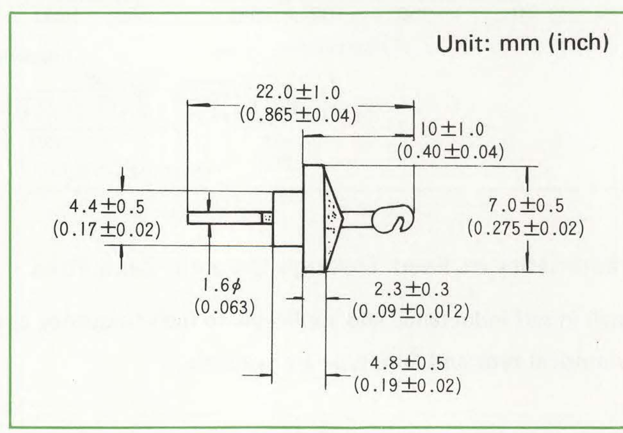


Fig. 4

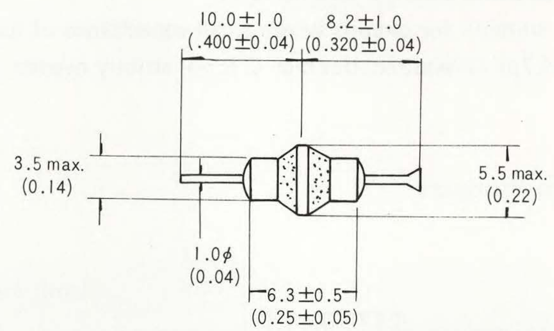
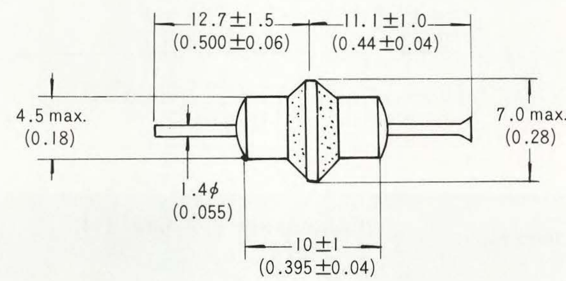
Notes:
- Figs. 1 and 2 are ideal for VHF tuners and Figs. 3 and 4 for UHF.
- Other dimensions available upon request

Specifications

1. Related Standards .... IEC Pub 187/EIA RS-198 class 2
2. Operating Temperature Range .... -30°C to +85°C
3. Capacitance .... Within tolerance at 1KHz and 20°C
4. Power Factor .... 2.5% max. at 1KHz and 20°C
5. Temperature Coefficient .... Conform to IEC Pub 108 char. 2E5, 2F4/EIA RS-198 char.Z5U, Y5V
6. Working Voltage..................... 50V DC, 500V DC
7. Dielectric Withstanding Voltage .... 250% of working voltage for 1 to 5 seconds
8. Insulation Resisatnce .... 10000MΩ min.

Feed Through TC Ceramic Capacitors

Standard Products

Part No.	Capacitance		Rated Voltage (V) DC	Construction Unit: mm (inch)
	Rated(pF)	Tolerance		
ECC–L1H050F	5	±1 pF	500	
ECC–L1H100F	10			
ECC–L1H120K	12	±10%		
ECC–L1H150K	15			
ECC–L1H180K	18			
ECC–L1H220K	22			
ECC–L1H270K	27			
ECC–L1H330K	33			
ECC–L1H390K	39			
ECC–L1H470K	47			
ECC–L2H100F	10	±1 pF	500	
ECC–L2H120K	12	±10%		
ECC–L2H150K	15			
ECC–L2H180K	18			
ECC–L2H220K	22			
ECC–L2H270K	27			
ECC–L2H330K	33			
ECC–L2H390K	39			
ECC–L2H470K	47			

Note: Other dimensions and TC are available upon request.

Features

- Ideal for applications in oscillators of VHF and UHF tuners

Specifications

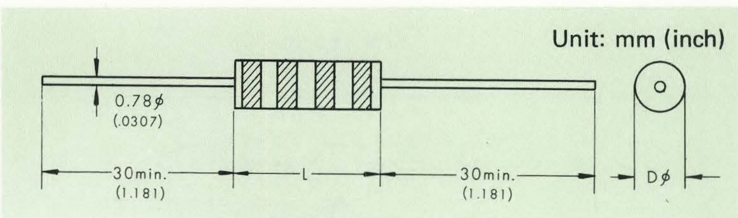
1. Related Standards . . . . IEC Pub. 108/EIA RS-198 class 1
2. Operating Temperature Range. . . . . -30°C to +85°C
3. Capacitance . . . . Within tolerance at 1MHz and 20°C
4. Q Factor . . . . 30pF or more Q≧1000
Less than 30pF Q≧400 + 20C (C: Capacitance pF)
5. Temperature Coefficient . . . . Conform to IEC Pub. 108 char 1D/EIA RS-198 char. U2M
(Nominal temp. coef. between P250 and N1500)
6. Working Voltage . . . . 50V DC, 500V DC
7. Dielectric Withstanding Voltage . . . . 250% of working voltage for 1 to 5 seconds
8. Insulation Resistance . . . . 10000MΩ min.

MOLDED COMPOSITION CERAMIC CAPACITORS "MINIC"

"Minic" Type ECG

- Easy in wiring and soldering due to the tight and tough molded construction with axial leads
- Very suitable for circuits where small capacitance of less than 4.7pF is required, but high Q is not strictly needed

Standard Products



Part No.	Capacitance (pF)	Cap. Tol. (%)	Char.	Dimensions mm (inch)		Color Code
				L max.	D max.	
ECG-N5R50K	0.50	±10	A	7 (0.276)	2.8±0.3 (0.110±0.012)	GRN-BLK-GRA-SIL
ECG-N5R75K	0.75	"	A	"	"	PRL-GRN-GRA-SIL
ECG-N5010K	1.0	"	A	"	"	BRN-BLK-WHI-SIL
ECG-N51R2K	1.2	"	A	"	"	BRN-RED-WHI-SIL
ECG-N51R5K	1.5	"	A	"	"	BRN-GRN-WHI-SIL
ECG-N51R8K	1.8	"	A	"	"	BRN-GRA-WHI-SIL
ECG-N52R2K	2.2	"	B	"	"	RED-RED-WHI-SIL
ECG-N52R7K	2.7	"	B	"	"	RED-PRL-WHI-SIL
ECG-N53R3K	3.3	"	B	"	"	ORA-ORA-WHI-SIL
ECG-N53R9K	3.9	"	B	"	"	ORA-WH-WHI-SIL
ECG-N54R7K	4.7	"	B	"	"	YLW-PRL-WHI-SIL

Color Code

Example

ECG–N51R5K
1st Color Brown
2nd Color Green
3rd Color White
4th Color Silver

Item / Color	Significant Figure of Capacitance	Decimal Multiplier	Capacitance Tolerance
Black	0	1	
Brown	1	10	
Red	2		
Orange	3		
Yellow	4		
Green	5		
Blue	6		
Purple	7		
Gray	8	0.01	
White	9	0.1	
Silver			±10%
Nil			±20%

Characteristics

1. Operating Temperature . . . . -25°~+85°C
2. Rated Voltage. . . . . 500V DC
3. Capacitance. . . . . Within tolerance at 1MHz and 20°C
4. Temperature Characteristics. . . . . Between -25°C to 85°C, (A) within ±3.3% (B) within ±5.0% of the capacitance value at 20°C (Sampling number : 30pcs)
5. Insulation Resistance. . . . . More than 10,000MΩ at 100V DC for 1 minute
6. Q . . . . 50 min. in the range below 1.0 pF
   30 min. in the range over 1.2 pF
7. Test Voltage. . . . . 1,500 V DC (1~5 sec.)
8. Lead Pulling Strength. . . . . No damage shall be observed when an axial pull of 1.0kg is applied.
9. Lead Bending Strength. . . . . No damage shall be observed when an upright weight of 0.5kg in center of the part is applied.

Part Number Code

E C G — N □ □□□ □

Common Code	Shape	Rated Volt.	Capacitance	Cap. Tol.
E C G	N	□	□□□	□

Rated Volt.:

5	500V

Capacitance:

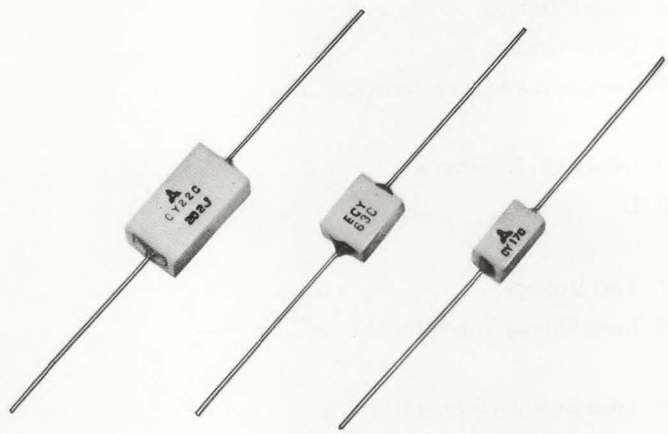
Example	Cap.(pF)
R50	0.5
010	1.0
1R5	1.5

Cap. Tol.:

J	±5%
K	±10%
M	±20%

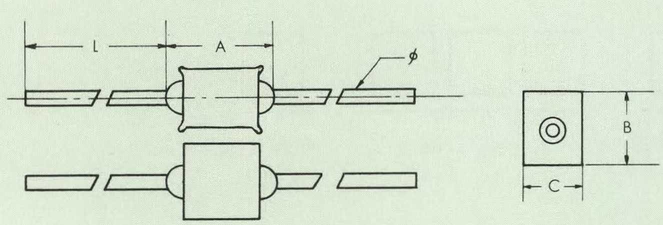
GLASS CERAMIC CAPACITORS

Unlike conventional low-dissipation-factor capacitors, this glass ceramic capacitor, designed referring to MIL standard MIL-C-11272B, assures a wide temperature range and excellent stability.
In comparison with the silvered mica capacitor, it is superior in all respects.

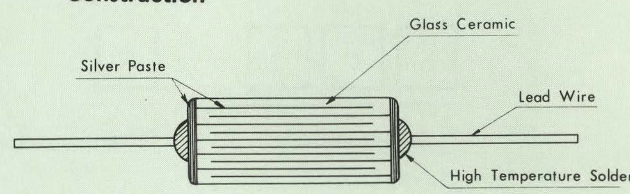


Features

- Exceptionally wide temperature range — from -55°C to +125°C — and excellent stability
- High Q and high resonance frequency
- Encased in a single unit. Dielectric material and electrodes laminated in a glass ceramic of low dissipation factor are molded together.
- Working voltages of 50, 300 and 500 volts are available with a capacitance range of 1 ~ 10,000pF.



Construction



Part No.	A		B		C		L		φ	
	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
ECY-13C□□□□	9.5±0.8	3/8±1/32	5.6±0.8	7/32±1/32	5.6+0.8−1.6	7/32+1/32−1/16	28.6	1−1/8	0.65	0.025
ECY-17C□□□□	14.3±0.8	9/16±1/32	6.7±0.8	17/64±1/32	5.6+0.8−1.6*	7/32+1/32−1/16*	28.6	1−1/8	0.65	0.025
ECY-22C□□□□	23.0±0.8	29/32±1/32	11.1±0.8	7/16±1/32	5.6+0.8−1.6	7/32+1/32−1/16	28.6	1−1/8	0.80	0.032
ECY-32C□□□□	23.0±0.8	29/32±1/32	19.8±0.8	25/32±1/32	4.8±0.8**	3/16±1/32**	28.6	1−1/8	0.80	0.032
ECY-51C□□□□	8.2±0.8	0.323±1/32	4.0±0.8	5/32±1/32	3.8±0.8	0.150±1/32	28.6	1−1/8	0.50	0.020
ECY-52C□□□□	11.2±0.8	0.441±1/32	7.0±0.8	0.276±1/32	4.0+0.8−1.0	5/32+1/32−0.04	28.6	1−1/8	0.50	0.020
ECY-53C□□□□	15.2±0.8	0.598±1/32	10.0±0.8	0.394±1/32	4.0+0.8−1.0	5/32+1/32−0.04	28.6	1−1/8	0.65	0.025
ECY-54C□□□□	23.0±0.8	29/32±1/32	11.1±0.8	7/16±1/32	4.0+0.8−1.0	5/32+1/32−0.04	28.6	1−1/8	0.65	0.025
ECY-55C□□□□	23.0±0.8	29/32±1/32	19.8±0.8	25/32±1/32	4.0+1.6−1.0	5/32+1/32−0.04	28.6	1−1/8	0.80	0.032
ECY-61C□□□□	8.2±0.8	0.323±1/32	4.0±0.8	5/32±1/32	4.0±0.8	5/32±1/32	28.6	1−1/8	0.50	0.020
ECY-62C□□□□	11.2±0.8	0.441±1/32	7.0±0.8	0.276±1/32	4.0±0.8	5/32±1/32	28.6	1−1/8	0.50	0.020
ECY-63C□□□□	15.2±0.8	0.598±1/32	10.0±0.8	0.394±1/32	4.0±0.8	5/32±1/32	28.6	1−1/8	0.65	0.025

* For any value above 820pF, this dimension shall be 7.1±0.8 (9/32±1/32)

** For any value above 2400pF, this dimension shall be $6.4^{+1.6}_{-0.8}$ ($1/4^{+1/16}_{-1/32}$)

Part No.	Capacitance Range (pF)			Cap. Tol.
	50WV	300WV	500WV	
ECY-13C□□□□	—	220~300	1~200	C.D.F.G.J.K *
ECY-17C□□□□	—	510~1,000	220~470	F.G.J.K
ECY-22C□□□□	—	1,100~2,000	510~1,000	F.G.J.K
ECY-32C□□□□	—	3,600~6,800	1,100~3,300	F.G.J.K
ECY-51C□□□□	1~150	—	—	C.D.F.G.J.K *
ECY-52C□□□□	160~600	—	—	F.G.J.K
ECY-53C□□□□	680~1,600	—	—	F.G.J.K
ECY-54C□□□□	1,800~3,900	—	—	F.G.J.K
ECY-55C□□□□	4,300~10,000	—	—	F.G.J.K
ECY-61C□□□□	—	—	1~51	C.D.F.G.J.K *
ECY-62C□□□□	—	—	56~200	F.G.J.K
ECY-63C□□□□	—	—	220~510	F.G.J.K

Cap. Tol.
Capacitance
Temp. Range

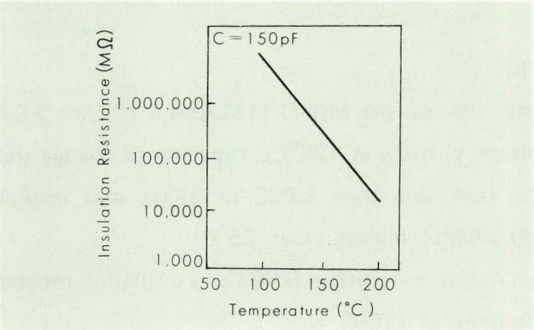
* Specified according to required capacitance

Part No.	Cap. Range (pF)	Cap. Tol.
ECY-13C ECY-51C ECY-61C	1 ~ 5.1 5.6 ~ 12 13 ~ 24 over 27	C, D C, J, K G, J, K F, G, J, K

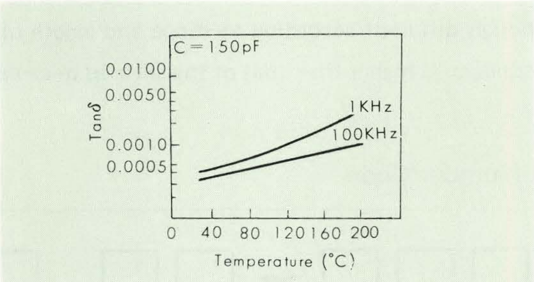
Characteristics

1. Operating Temperature Range
   −55°C to +125°C, and up to 200°C at derated voltage
2. Temperature Coefficient
   +105±25 ppm/°C at 100KHz from -55°C to +125°C
3. Capacitance Drift
   Within 0.1 percent per MIL-C-11272B
4. Insulation Resistance
   100,000MΩ minimum at 25°C and 10,000MΩ minimum at 125°C with applying rated voltage
5. tanδ
   Less than 0.001 at 25°C, 1KHz, less than 0.003 at +125°C, 1KHz
6. Q
   Greater than 2000 at 25°C, 1MHz
7. Dielectric Withstanding Voltage
   Applying five times the rated voltage at 25°C for 5 seconds
8. Shock, Vibration, Temperature Cycle Test and Immersion Test
   After the test per MIL-STD−202C (method 205: condition C, method 204: condition B, method 102A: condition C and method 104: condition B), capacitance change shall be less than 0.5%, tanδ less than 0.001 and insulation resistance 100,000 MΩ minimum.

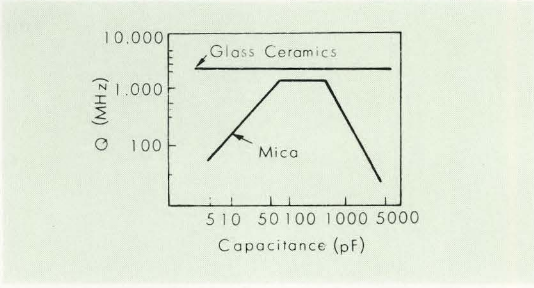
Insulation Resistance-Temperature



tanδ-Temperature



Q-Capacitance

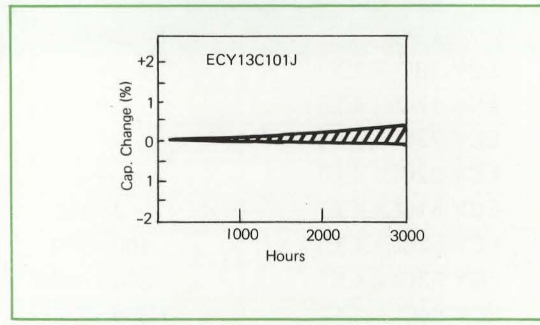


9. Humidity Resistance

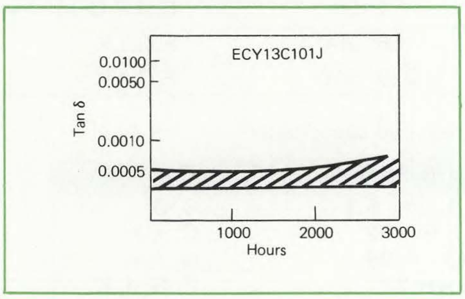
After the test per MIL-STD-202C (method 106), capacitance change shall be less than 0.5%, tanδ less than 0.001 and insulation resistance 100,000MΩ minimum.

After applying the rated voltage for 3,000 hours at 40°C, 95 percent RH, capacitance change shall be less than 0.5%, tanδ less than 0.001 and insulation resistance 100,000MΩ minimum.

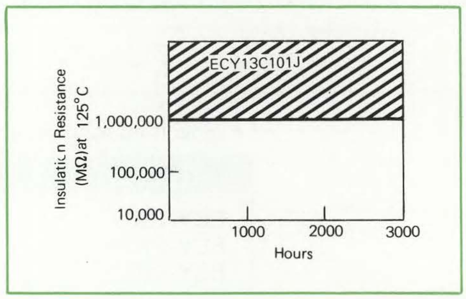
Humidity Test (Cap. Change)



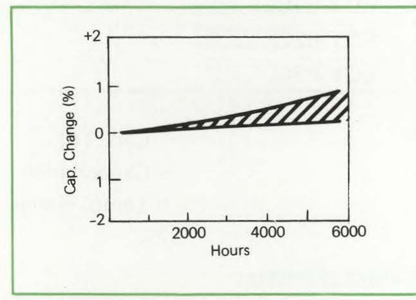
Humidity Test (Dissipation Factor)



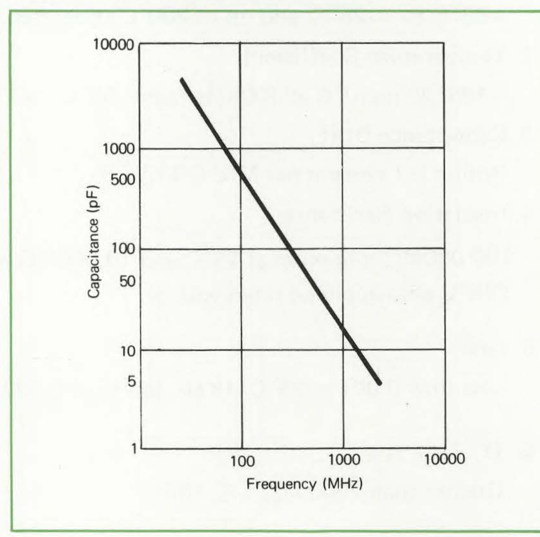
Humidity Test (Insulation Resistance)



Life Test



Frequency Characteristics



10. Life

After the test per MIL-C-11272B-4,6,12, (for 2,000 hours, rated voltage x 150% at 125°C), capacitance change shall be less than 1%, tanδ less than 0.002 at 1KHz and insulation resistance 100,000MΩ minimum at 25°C.

Tanδ shall be less than 0.003 and insulation resistance 10,000MΩ minimum at 125°C.

11. Resonant Frequency

Though different according to shape and length of lead, resonant frequency is higher than that of the silvered mica capacitor.

Part Number Code

□□□ – □□ □□ □□□ □ □

Common Code | Shape | Operating Temp. Range | Capacitance | Cap. Tol. | Suffix

Capacitance: The first two digits are significant figures of capacitance and the third one denotes number of following zeros. Decimal point is expressed by R.

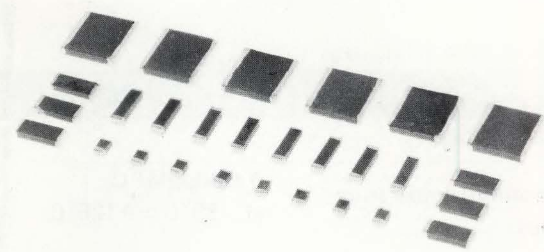
Cap. Tol.:

C	±0.25pF
D	±0.5pF
F	±1%
G	±2%
J	±5%
K	±10%

CHIP TYPE MULTI-LAYER CERAMIC CAPACITORS

Chip Type Multi-Layer Ceramic Capacitors

Type ECU-X



Chip type multi-layer ceramic capacitor is a sintered ceramic comprising ceramic dielectric layers and platina, paladium and other precious metal electrode layers which are piled alternately and coated with the same material as the dielectric material.

Due to it's monolithic construction of dielectric material and electrode as shown below and due to complete sealing of inner electrodes with ceramic material, the capacitor provides high stability and reliability.

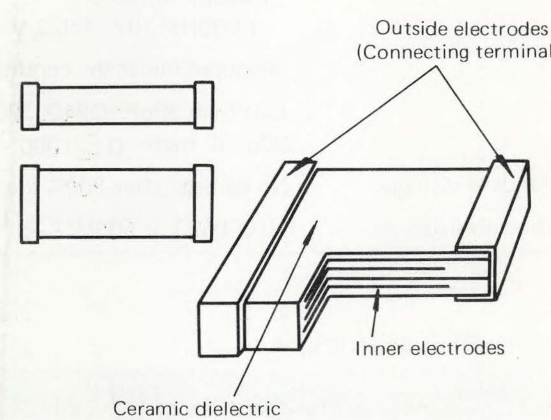
Features

- Small in size and large in capacitance
- Superior humidity characteristics and long life due to complete sealing of inner electrodes
- Small inductance and excellent frequency characteristics

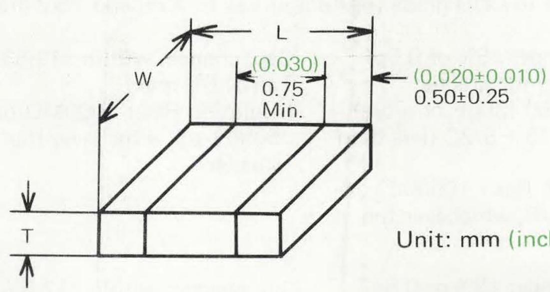
Application

- Hybrid thick and thin film integrated circuits
- Electronic wrist watches and cameras

Construction



Dimensions



50V D.C Capacitance Table

(Unit: pF)

	L mm(in.)	2.0±0.22 (.080±.009)	4.5±0.34 (.180±.014)	4.5±0.34 (.180±.014)	5.7±0.4 (.225±.016)
	W mm(in.)	1.25±0.18 (.050±.008)	1.25±0.18 (.050±.009)	2.0±0.22 (.080±.009)	6.3±0.43 (.250±.017)
	T mm(in.) / Char.	0.50~1.25(.020~.050)	0.50~1.25(.020~.050)	0.50~1.90(.020~.075)	0.50~1.90(.020~.075)
TC	COH	10~220	270~470	560~1500	2200~6800
Hi-K	X7R	330~5600	6800~12000	15000~33000	39000~56000
	Y5V	470~22000	33000~68000	0.1μF~0.22μF	0.33μF~1.00μF

Dimension in parentheses are based on EIA Standard

Specifications

- Applied Std. .... As per EIAJ Std. RC-3698
  (Operating temperature range is as per EIA Std. RS-198-B)

Electrical Specifications

Item	COH	X7R	Y5V
Rated Voltage	50V, D,C		
Operating Temperature Range	0 ± 60ppM/°C at –55°C ~ +125°C	Maximum capacitance ratio within ±15% at –55°C ~ +125°C	Maximum capacitance change within $^{+22}_{-82}$% at –30°C ~ +85°C
Capacitance Tolerance	Measured at 20°C with the following frequency and voltage		
	±10%, ±20% Less than 1,000pF: 1MHz±10%, 0.5~5 Vrms 1,000pF or more: 1,000Hz±10%, 1±0.2 Vrms	±10%, ±20% 1000Hz±10%, 1±0.2 Vrms	+80%, –20% 1000Hz±10%, 1±0.2 Vrms
Tan δ	Measured under the conditions same as above		
	Less than 30pF: Q2400±20C 30pF or more: Q ≧ 1000	2.5% max.	3.5% max.
Withstanding Voltage	No damage after 300% the rated d.c voltage application for 1 ~ 5 minutes		
Insulation Resistance	10,000MΩ or 500MΩ –μF whichever is the smaller		

Environmental Specifications

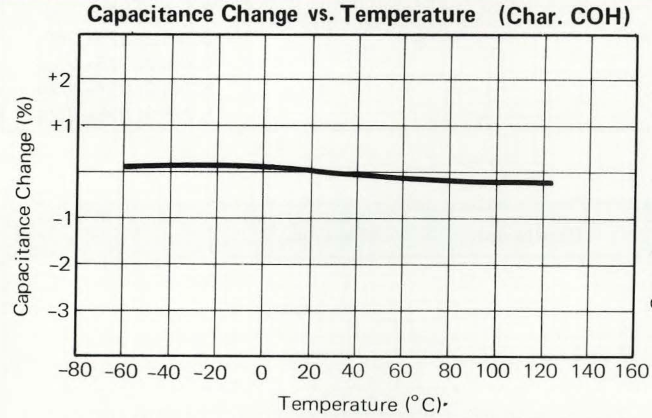
Item	COH	X7R	Y5V
Humidity test shall be conducted at 40°C, 90~95% RH for 500 hours, and high temperature load life at 85°C for 1000 hours. After above test, the capacitor tested shall be left at room ambient for 24 hours as to COH grade (or 48 hours as to X7R and Y5V grade)			
Humidity	Cap. change: ±5% or 0.5pF whichever the greater Q: Q ≧ 350 (30pF or more) Q ≧ 275 + 5/2C (less than 30pF) Insulation Res.: 1000MΩ or 50MΩ-μF, whichever the smaller	Cap. change: within ±12.5% Tan δ: 5% max. Insulation Res.: 1000MΩ or 50MΩ-μF, whichever the smaller	Cap. change: within ±20% Tan δ: 5% max. Insulation Res.: 1000MΩ or 50MΩ-μF, whichever the smaller
High Temperature Load Life	Cap. change: ±3% or 0.5pF, whichever the greater Q: Q ≧ 350 (30pF or more) Q ≧ 275 ± 5/2C (less than 30pF) Insulation Res.: 1000MΩ or 50MΩ-μF, whichever the smaller	Cap. change: within ±12.5% Tan δ: 4% max. Insulation Res.: 1000MΩ or 50MΩ-μF, whichever the smaller	Cap. change: within ±30% Tan δ: 5% max. Insulation Res.: 1000MΩ or 50MΩ–μF, whichever the smaller

50V D.C Rating Standard Products Table T5V
(-30°C ~ +85°C, +22%, -82%)

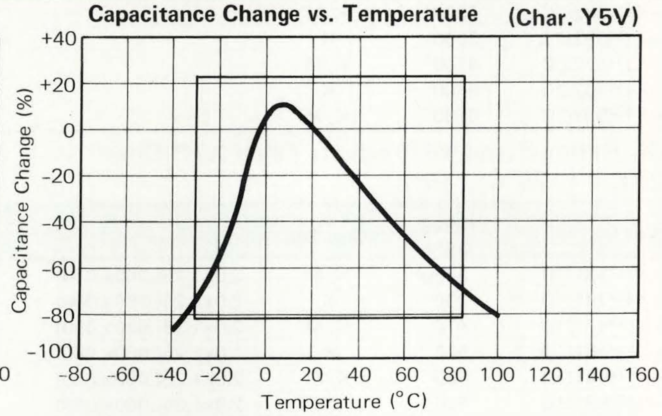
Part No.	Rated Cap.	Cap. Tol.	Dimensions		mm (inch)	
ECU–X1H471ZF	470pF	Z	2.0x1.25(.080x.050)			
ECU–X1H681ZF	680	Z	2.0x1.25(.080x.050)			
ECU–X1H102ZF	1000	Z	2.0x1.25(.080x.050)			
ECU–X1H152ZF	1500	Z	2.0x1.25(.080x.050)			
ECU–X1H222ZF	2200	Z	2.0x1.25(.080x.050)			
ECU–X1H332ZF	3300	Z	2.0x1.25(.080x.050)			
ECU–X1H472ZF	4700	Z	2.0x1.25(.080x.050)			
ECU–X1H682ZF	6800	Z	2.0x1.25(.080x.050)			
ECU–X1H103ZF	10000	Z	2.0x1.25(.080x.050)			
ECU–X1H153ZF	15000	Z	2.0x1.25(.080x.050)			
ECU–X1H223ZF	22000	Z	2.0x1.25(.080x.050)			
ECU–X1H333ZF	33000	Z		4.5x1.25(.180x.050)		
ECU–X1H473ZF	47000	Z		4.5x1.25(.180x.050)		
ECU–X1H683ZF	68000	Z		4.5x1.25(.180x.050)		
ECU–X1H104ZF	0.10μF	Z			4.5x2.0(.180x.080)	
ECU–X1H154ZF	0.15μF	Z			4.5x2.0(.180x.080)	
ECU–X1H224ZF	0.22μF	Z			4.5x2.0(.180x.080)	
ECU–X1H334ZF	0.33μF	Z				5.7x6.3(.225x.250)
ECU–X1H474ZF	0.47μF	Z				5.7x6.3(.225x.250)
ECU–X1H684ZF	0.68μF	Z				5.7x6.3(.225x.250)
ECU–X1H105ZF	1.00μF	Z				5.7x6.3(.225x.250)

Characteristics

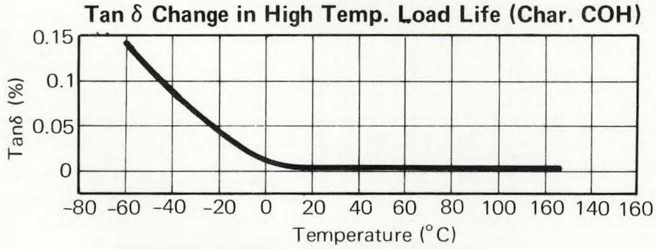
Capacitance Change vs. Temperature (Char. COH)



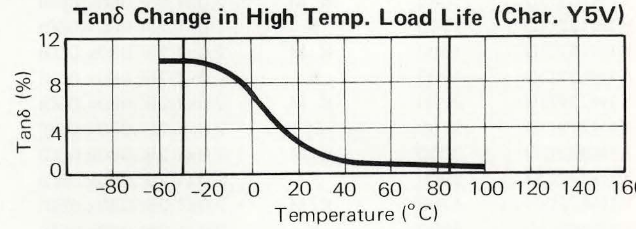
Capacitance Change vs. Temperature (Char. Y5V)



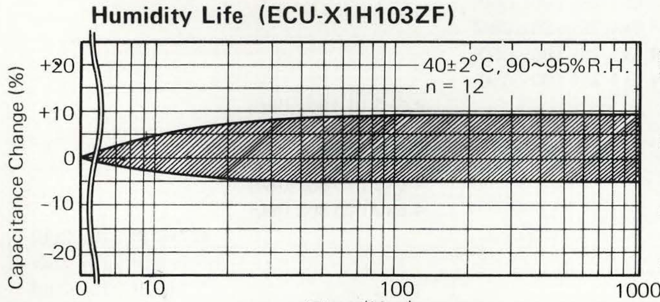
Tan δ Change in High Temp. Load Life (Char. COH)



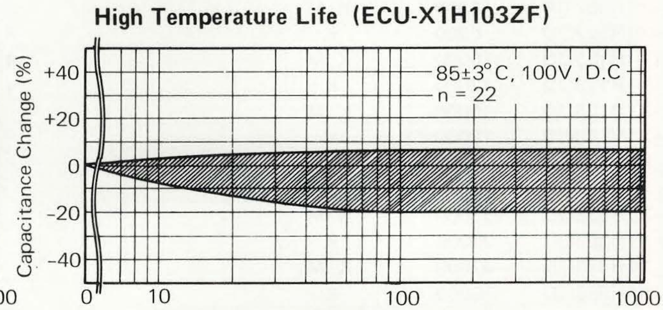
Tanδ Change in High Temp. Load Life (Char. Y5V)



Humidity Life (ECU-X1H103ZF)



High Temperature Life (ECU-X1H103ZF)



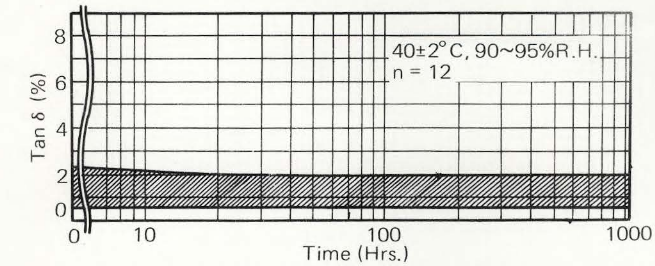
50V DC Rating Standard Products Table COH Char.
(-55°C~+125°C, NPO±60PPM)

Part No.	Rated Cap.	Cap. Tol.	Dimensions mm (inch)			
ECU−X1H100□C	10pF	K, M	2.0x1.25(.080x.050)			
ECU−X1H120□C	12	K	2.0x1.25(.080x.050)			
ECU−X1H150□C	15	K, M	2.0x1.25(.080x.050)			
ECU−X1H180□C	18	K	2.0x1.25(.080x.050)			
ECU−X1H220□C	22	K, M	2.0x1.25(.080x.050)			
ECU−X1H270□C	27	K	2.0x1.25(.080x.050)			
ECU−X1H330□C	33	K, M	2.0x1.25(.080x.050)			
ECU−X1H390□C	39	K	2.0x1.25(.080x.050)			
ECU−X1H470□C	47	K, M	2.0x1.25(.080x.050)			
ECU−X1H560□C	56	K	2.0x1.25(.080x.050)			
ECU−X1H680□C	68	K, M	2.0x1.25(.080x.050)			
ECU−X1H820□C	82	K	2.0x1.25(.080x.050)			
ECU−X1H101□C	100	K, M	2.0x1.25(.080x.050)			
ECU−X1H121□C	120	K	2.0x1.25(.080x.050)			
ECU−X1H151□C	150	K, M	2.0x1.25(.080x.050)			
ECU−X1H181□C	180	K	2.0x1.25(.080x.050)			
ECU−X1H221□C	220	K, M	2.0x1.25(.080x.050)			
ECU−X1H271□C	270	K		4.5x1.25(.180x.050)		
ECU−X1H331□C	330	K, M		4.5x1.25(.180x.050)		
ECU−X1H391□C	390	K		4.5x1.25(.180x.050)		
ECU−X1H471□C	470	K, M		4.5x1.25(.180x.050)		
ECU−X1H561□C	560	K			4.5x2.0(.180x.080)	
ECU−X1H681□C	680	K, M			4.5x2.0(.180x.080)	
ECU−X1H821□C	820	K			4.5x2.0(.180x.080)	
ECU−X1H102□C	1000	K, M			4.5x2.0(.180x.080)	
ECU−X1H122□C	1200	K			4.5x2.0(.180x.080)	
ECU−X1H152□C	1500	K, M			4.5x2.0(.180x.080)	
ECU−X1H182□C	1800	K				5.7x6.3(.225x.250)
ECU−X1H222□C	2200	K, M				5.7x6.3(.225x.250)
ECU−X1H272□C	2700	K				5.7x6.3(.225x.250)
ECU−X1H332□C	3300	K, M				5.7x6.3(.225x.250)
ECU−X1H392□C	3900	K				5.7x6.3(.225x.250)
ECU−X1H472□C	4700	K, M				5.7x6.3(.225x.250)
ECU−X1H562□C	5600	K				5.7x6.3(.225x.250)
ECU−X1H682□C	6800	K, M				5.7x6.3(.225x.250)

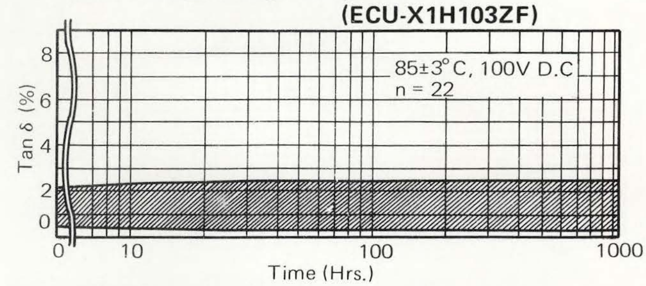
50V DC Rating Standard Products Table X7R Char.
(-55°C~ +125°C, ±15%)

Part No.	Rated Cap.	Cap. Tol.	Dimensions mm (inch)			
ECU−X1H331□D	330pF	K, M	2.0x1.25(.080x.050)			
ECU−X1H391□D	390	K	2.0x1.25(.080x.050)			
ECU−X1H471□D	470	K, M	2.0x1.25(.080x.050)			
ECU−X1H561□D	560	K	2.0x1.25(.080x.050)			
ECU−X1H681□D	680	K, M	2.0x1.25(.080x.050)			
ECU−X1H821□D	820	K	2.0x1.25(.080x.050)			
ECU−X1H102□D	1000	K, M	2.0x1.25(.080x.050)			
ECU−X1H122□D	1200	K	2.0x1.25(.080x.050)			
ECU−X1H152□D	1500	K, M	2.0x1.25(.080x.050)			
ECU−X1H182□D	1800	K	2.0x1.25(.080x.050)			
ECU−X1H222□D	2200	K, M	2.0x1.25(.080x.050)			
ECU−X1H272□D	2700	K	2.0x1.25(.080x.050)			
ECU−X1H332□D	3300	K, M	2.0x1.25(.080x.050)			
ECU−X1H392□D	3900	K	2.0x1.25(.080x.050)			
ECU−X1H472□D	4700	K, M	2.0x1.25(.080x.050)			
ECU−X1H562□D	5600	K	2.0x1.25(.080x.050)			
ECU−X1H682□D	6800	K, M		4.5x1.25(.180x.050)		
ECU−X1H822□D	8200	K		4.5x1.25(.180x.050)		
ECU−X1H103□D	10000	K, M		4.5x1.25(.180x.050)		
ECU−X1H123□D	12000	K		4.5x1.25(.180x.050)		
ECU−X1H153□D	15000	K, M			4.5x2.0(.180x.080)	
ECU−X1H183□D	18000	K			4.5x2.0(.180x.080)	
ECU−X1H223□D	22000	K, M			4.5x2.0(.180x.080)	
ECU−X1H273□D	27000	K			4.5x2.0(.180x.080)	
ECU−X1H333□D	33000	K, M			4.5x2.0(.180x.080)	
ECU−X1H393□D	39000	K				5.7x6.3(.225x.250)
ECU−X1H473□D	47000	K, M				5.7x6.3(.225x.250)
ECU−X1H563□D	56000	K				5.7x6.3(.225x.250)

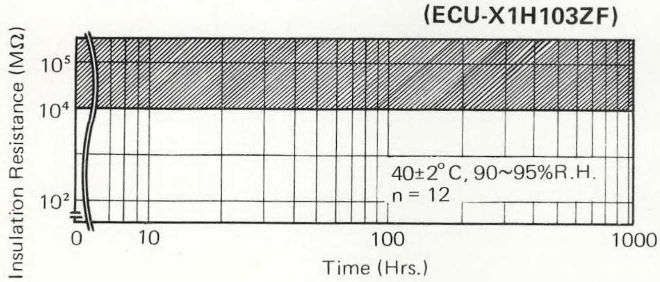
Tanδ Change in Humidty Test (ECU-X1H103ZF)



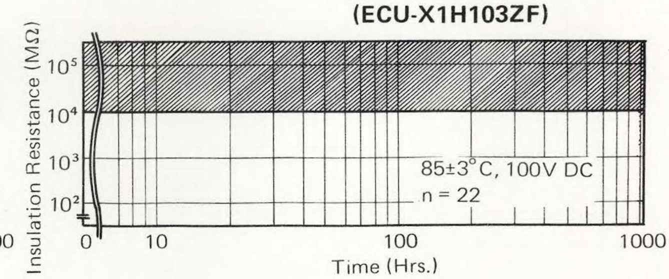
Tanδ Change in High Temp. Load Life Test (ECU-X1H103ZF)



Insulation Resistance Change in Humidity Test (ECU-X1H103ZF)



Insulation Resistance Change in High Temp. Load Life Test (ECU-X1H103ZF)



Precautions for Application

When soldering, attention should be paid to the following items.

- Sn. Pb eutectic solder comprising Ag by 2~5%.
- Rosin flux should be used.
- Soldering should be conducted in a short period of time (2~3 seconds).
- Sudden heating and chilling might cause mechanical damage.

Part Number Code

E C V — X ☐☐ ☐☐☐ ☐ ☐ ☐

Common Code | Shape | Rated Voltage | Capacitance | Cap. Tol. | Temp. Char. | Suffix

Shape

X	Chip Type

Rated Voltage

1H	50V.D.C.

Capacitance

The first two digits are significant figures of capacitance and the third one denotes number of following zeros. (Unit: pF)

Code	Capacitance
103	10,000pF

Cap. Tol.

K	±10%
M	±20%
Z	±80%, -20%

Temp. Char.

Code	EIA	Temp. Range	Cap. Change Ratio
C	COH	-55~+125°C	0±60PPM/°C
D	X7R	-55~+125°C	±15%
F	Y5V	-30~+ 85°C	+22%, -82%

VI FILM CAPACITORS

QUICK REFERENCE GUIDE

	Dielectrics	Type	Capacitance (Mfd)	Tolerance (%)	Working Volt D.C.V. (A.C.V)	Coating	Page
Polyester Capacitor	Polyester	ECQ-M (X) Axial Lead (Z) Radial Lead (ZB) Lead Form	.001~.47	±10% (K) or ±20% (M)	50V (40V) 100V (75V) 200V (100V) 400V (200V)	*Durez Resin	VI-5
		ECQ-B (Z) Radial Lead (ZB) Lead Form	.001~.22	±10% (K) or ±20% (M)	600V (250V)	Epoxy Resin	VI-14
		ECQ-U4 (Z) Radial Lead	.001~.22	±10% (K) or ±20% (M)	400V	Epoxy Resin	VI-17
	Metalized Polyester	ECQ-E (Z) Radial Lead (ZB) Lead Form	.015~2.0	±10% (K) ±20% (M)	250V (150V) 400V (200V) 630V (250V)	Epoxy Resin	VI-19
			.001~0.1	±10%(K) ±20%(M)	1000V (450V)		
		ECQ-H (Z) Radial Lead	.015~2.0	±10% (K) ±20% (M)	250V (150V) 400V (200V) 630V (250V)	*Durez Resin	VI-24
			.001~0.1	±10%(K), ±20%(M)	1000V (450V)		
		ECQ-T (X) Axial Lead	.1 ~ 6.8	±10%(K) ±20%(M)	250V (150V) 400V (200V) 630V (250V)	Epoxy Resin & Polyester Tape	VI-29
		ECQ-UD (Z) Radial Lead	.001~.22	±10%(K) ±20%(M)	(200V)	Epoxy Resin	VI-31
	Metalized Polyester/ Polypropylene	ECW-K	3.5~7.1	±5%(J)	(330V) (360V) (380V) (400V)	Same as above	VI-33
Polystyrene Capacitor	Polystyrene	ECQ-S (X) Axial Lead (Z) Radial Lead	.00001~.02	± 5% (J) ±10% (K)	125V (80V) 500V (250V)		VI-35
Polypropylene Capacitor	Polypropylene	ECQ-F (Z) Radial Lead	.001~.47	±10% (K) ±20% (M)	200V (100V) 400V (180V) 630V (250V)	*Durez Resin	VI-38
		ECW-H	.001~.039	± 5% (J) ±10% (K) ±20% (M)	600V 1000V 1200V 1500V	Epoxy Resin	VI-42
Polycarbonate Capacitor	Polycarbonate	ECQ-C	.001~.22	± 5% (J) ±10% (K) ±20% (M)	100V	Plastic Case	VI-45
Oil Paper Capacitor	Oil Paper	ECN-C (X) Axial Lead	.001~.22	±10% (K) ±20% (M)	(450V)	Ceramic Case	VI-47

* Durez is a trade mark. This chart is intended to serve as a guide only.

PERFORMANCE TEST (1)

				Polyester	Metalized Polyester	Oil-Filled Polyester	Polystyrene	Polypropylene	Polycarbonate
Life Test	Test Condition	Voltage		WV(DC) x 1.4	WV(DC) x 1.25	WV(DC) x 1.2	WV(DC) x 1.4	WV(DC) x 1.4	WV(DC) x 1.4
		Temperature		85°C	85°C	85°C	85°C	70°C	85°C
		Test Time		250 hr	250 hr	250 hr	250 hr	250 hr	250 hr
	After Test	Capacitance (of the initial value)		±8%	±8%	±7%	±3%(>33PF) ±1PF(<33PF)	±5%	±5%
		Dissipation Factor		<1.1%	<1.1%	<1.1%	<0.11%(>330PF) Q>900(33-330PF) Q>450 (<33PF)	<0.2%	<0.33%
		Insulation Resistance		Axial>15,000MΩ Radial>4,500MΩ	>1,000MΩ	>15,000MΩ	>22,500MΩ	>7,500MΩ	>25,000MΩ
		Other		These capacitors shall have no mechanical failure, leakage of impregnated content nor open or short circuit.					
Humidity Test	Test Condition	Humidity		90~95%	90~95%	90~95%	90~ 95%	90~95%	90~95%
		Temperature		40°C	40°C	40°C	40°C	40°C	40°C
		Voltage		WV(DC)	WV(DC)	WV(DC)	WV(DC)	WV(DC)	WV(DC)
		Time		500 hrs	500 hrs	250 hrs	96 hrs	500 hrs	500 hrs
	After Test	Dielectric strength	Voltage	WV(DC) x 1.75	WV(DC) x 1.3	WV(DC) x 1.75	WV(DC) x 1.75	WV(DC) x 1.75	WV(DC) x 1.75
			Time	1 min	1~5 sec	1 sec	1 min	1 min	1 min
		Capacitance change		±10%	±10%	±10%	±5%(>20PF) ±1PF(<20PF)	±5%	±5%
		Dissipation Factor		<1.2%	<1.2%	<1.2%	<0.11%(>330PF) Q>900(33-330PF) Q>450(<33PF)	<0.2%	<0.33%
		Insulation Resistance		Axial>9,000MΩ Radial>2,700MΩ	>600 MΩ	>9,000MΩ	>13,500MΩ	>500MΩ	>15,000MΩ
		other		These capacitors shall have no mechanical failure, leakage of impregnated content nor open circuit.					

PERFORMANCE TEST (2)

			Polyester	Metalized Polyester	Oil-Filled Polyester	Polystyrene	Polypropylene	Poly-Carbonate
Lead Pull Test	Test Condition	(Dia of wire)						
		1.0mmφ	>1.0 kg	>1.0 kg	>2.5 kg			
		0.8	1.0	1.0	2.5		> 2.0 kg	> 1.0 kg
		0.7	1.0	1.0	1.5	>1.0 kg	2.0	1.0
		0.6	1.0	1.0	1.5	1.0	2.0	1.0
		0.5	0.5			0.5	1.0	
		0.4	0.5			0.5		
		0.3				0.3		
		Time	10 sec	10 sec	10 sec	10 sec	10 sec	10 sec
	After test		These capacitors shall have no mechanical failure nor open or short circuit.					
Lead Bending Test	Test Condition	(Dia of wire)						
		1.0mmφ	>0.5 kg	>0.5	>1.0 kg			
		0.8	0.5	0. 5	1.0		> 0.5	> 0.5 kg
		0.7	0.5	0.5	0.5	>0.5 kg	0.5	0.5
		0.6	0.5	0.5	0.5	0.5	0.5	0.5
		0.5	0.25			0.25	0.25	
		0.4	0.25			0.25		
		0.3				0.15		
		*<Method>	Bend each lead wire under the rated vertical force by moving the body through an angle of 90 degrees in one direction, then through an angle of 180 degrees in the opposite direction, and finally 90 degrees back to the original position — all bends to be made in the same plane.					
	After test		These capacitors shall be no mechanical failure nor open or short circuit.					
Solderability	Test Condition	Solder Both Temperature	260°C	270±5	270°C	230°C	260°C	260°C
		Dip time	5 sec	5 sec	5 sec	5 sec	5 sec	5 sec
		From body	4 mm	4 mm	4 mm	4 mm	4 mm	4 mm
		Flux	Standard Rosin (methanol)	Standard Rosin (methanol)	Standard Rosin (methanol)	Standard Rosin (methanol)	Standard Rosin (methanol)	Standard Rosin (methanol)
		Dielectric Strength — Voltage	WV(DC) x 2	WV(DC) x 1.5	WV(DC) x 2	WV(DC) x 2	WV(DC) x 1.5	WV(DC) x 2
		Dielectric Strength — Time	1 min.	1 min.	1 min.	1 min.	1 min.	1 min.
	After test	Capacitance (of the initial value)	±3%	±3%	±3%	±1.9%	±3%	±3%
		Dissipation Factor	1.0%	1.0%	1.0%	0.1%	0.25%	0.5%
		Insulation Resistance	900MΩ	3000MΩ	9000MΩ	45000MΩ	15000MΩ	45000MΩ
		Other	These capacitors shall have no mechanical failure nor open or short circuit.					

Part Number Code

E C Q	M	1	2 2 3	K	Z	B
Common Code	Material	Rate Volt	Capacitance Value	Cap. Tol.	Lead Type	Lead Form

Common Code

ECQ ECW	Plastic Film
ECN	Paper Film

Material

Symbol M shows polyester film with *Durez resin. Refer to Quick Reference Guide

Rate Volt

0.5=50V
1 =100V
2 =200 or 250V
4 =400V
6 =600 or 630V
10 =1000V

Capacitance Value

The first two figures are significant figures of capacitance. Third one is a multiplier coinciding to 'n' of $(\frac{10^n}{1{,}000{,}000})$.

e.g.
222 = 0.0022μF
223 = 0.022 μF
224 = 0.22 μF

Cap. Tol.

M = ±20%
K = ±10%
J = ±5%

Lead Type

Z = Radial Type
X = Axial Type

Lead Form

Shape of lead wire forming.

* Durez resin = Phenolic resin

POLYESTER CAPACITORS

Type ECQ-M (Axial Lead)

Electrical Specifications

1. Rated Voltage .... 100 V.D.C., 400 V.D.C.
2. Capacitance .... See the Standard Products Table on p. VI-6.
3. Capacitance Tolerance .... ±10% (K), ±20% (M)
4. Insulation Resistance........... Less than 0.33μF ..... >25,000MΩ
   More than 0.33μF ..... ≧9,000MΩμF
5. Dissipation Factor .... <1.0% at 1KHz
6. Withstand Voltage .... Rated Voltage x 2.5 (1 sec. max.)
7. Operating Temperature......... −40°C ~ +85°C

Features

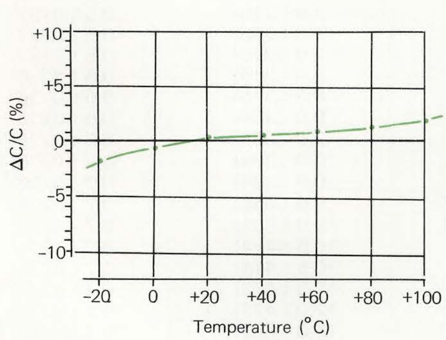
1. The capacitor consists of polyester film (=dielectric), aluminum foil (=electrode) and *Durez resin coating. (* Trade Mark.)
2. Marking comprises capacitance, capacitance tolerance, rated voltage and manufacturer's name or symbol of Matsushita.
3. Non-inductive

Application

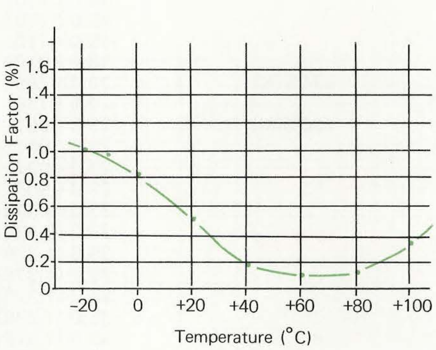
(1) Communication Equipment (2) TV Sets (3) Radio Sets (4) Transistorized Printed Circuits.

Temperature Characteristics

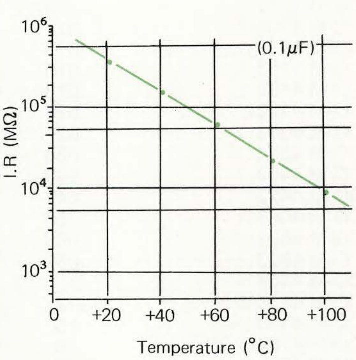
Capacitance Change



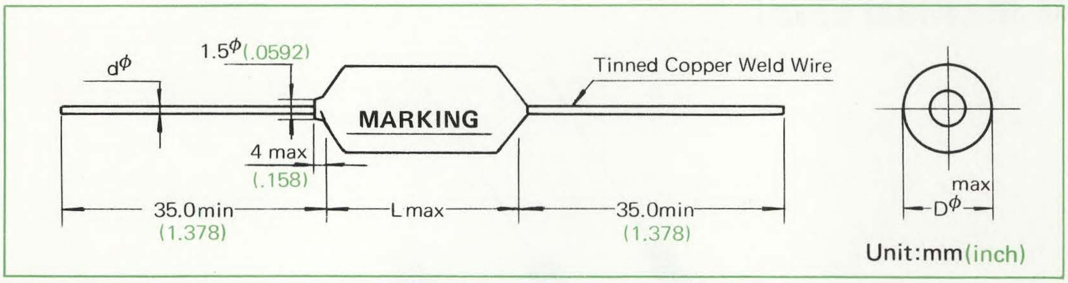
Dissipation Factor Change



Insulation Resistance Change



ECQ-M Standard Products Table



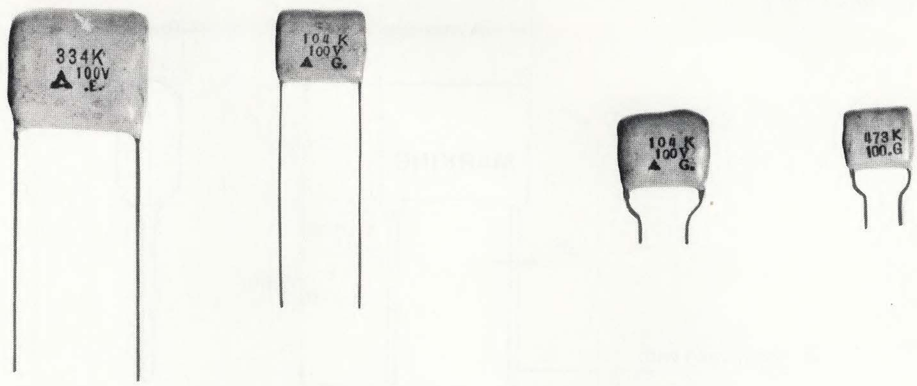
100 V.D.C

Part No.	Capacitance		Dimensions mm (inch)		
	Rated (μF)	Tolerance	L	Dϕ	dϕ
ECQ-M 1103□	.01		18.0 (.710)	7.0 (.276)	0.5 (.0197)
ECQ-M 1123□	.012		18.0 (.710)	7.0 (.276)	0.5 (.0197)
ECQ-M 1153□	.015		18.0 (.710)	7.0 (.276)	0.5 (.0197)
ECQ-M 1183□	.018		18.0 (.710)	7.0 (.276)	0.5 (.0197)
ECQ-M 1223□	.022		18.0 (.710)	7.0 (.276)	0.5 (.0197)
ECQ-M 1273□	.027		18.0 (.710)	7.0 (.276)	0.5 (.0197)
ECQ-M 1333□	.033		18.0 (.710)	7.0 (.276)	0.5 (.0197)
ECQ-M 1393□	.039		21.0 (.828)	7.5 (.295)	0.6 (.0236)
ECQ-M 1437□	.047		21.0 (.828)	7.5 (.295)	0.6 (.0236)
ECQ-M 1563□	.056		21.0 (.828)	8.5 (.335)	0.6 (.0236)
ECQ-M 1683□	.068		21.0 (.828)	8.5 (.335)	0.6 (.0236)
ECQ-M 1823□	.082	±10%(K)	24.0 (.946)	9.5 (.374)	0.7 (.0276)
ECQ-M 1104□	.1		24.0 (.946)	9.5 (.374)	0.7 (.0276)
ECQ-M 1124□	.12	±20%(M)	24.0 (.946)	10.5 (.414)	0.7 (.0276)
ECQ-M 1154□	.15		24.0 (.946)	10.5 (.414)	0.7 (.0276)
ECQ-M 1184□	.18		35.0 (1.378)	9.5 (.374)	0.7 (.0276)
ECQ-M 1224□	.22		35.0 (1.378)	9.5 (.374)	0.7 (.0276)
ECQ-M 1274□	.27		35.0 (1.378)	11.5 (.453)	0.7 (.0276)
ECQ-M 1334□	.33		35.0 (1.378)	11.5 (.453)	0.7 (.0276)
ECQ-M 1394□	.39		35.0 (1.378)	13.5 (.532)	0.7 (.0276)
ECQ-M 1474□	.47		35.0 (1.378)	13.5 (.532)	0.7 (.0276)
ECQ-M 1564□	.56		35.0 (1.378)	15.0 (.592)	0.7 (.0276)
ECQ-M 1684□	.68		35.0 (1.378)	15.0 (.592)	0.7 (.0276)
ECQ-M 1824□	.82		35.0 (1.378)	16.5 (.650)	0.7 (.0276)
ECQ-M 1105□	1.		35.0 (1.378)	16.5 (.650)	0.7 (.0276)

400 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)		
	Rated (μF)	Tolerance	L	Dϕ	dϕ
ECQ-M 4102□	.001		15.0 (.592)	7.3 (.285)	0.4 (.0158)
ECQ-M 4122□	.0012		15.0 (.592)	7.3 (.285)	0.4 (.0158)
ECQ-M 4152□	.0015		15.0 (.592)	5.5 (.217)	0.4 (.0158)
ECQ-M 4182□	.0018		15.0 (.592)	5.5 (.217)	0.4 (.0158)
ECQ-M 4222□	.0022		15.0 (.592)	5.5 (.217)	0.4 (.0158)
ECQ-M 4272□	.0027		15.0 (.592)	6.0 (.236)	0.4 (.0158)
ECQ-M 4332□	.0033		15.0 (.592)	6.0 (.236)	0.4 (.0158)
ECQ-M 4392□	.0039		15.0 (.592)	7.0 (.276)	0.4 (.0158)
ECQ-M 4472□	.0047		15.0 (.592)	7.0 (.276)	0.4 (.0158)
ECQ-M 4562□	.0056		18.0 (.710)	7.0 (.276)	0.4 (.0158)
ECQ-M 4682□	.0068		18.0 (.710)	7.0 (.276)	0.4 (.0158)
ECQ-M 4822□	.0082		18.0 (.710)	7.0 (.276)	0.5 (.0197)
ECQ-M 4103□	.01		18.0 (.710)	7.0 (.276)	0.5 (.0197)
ECQ-M 4123□	.012		18.0 (.710)	7.0 (.276)	0.5 (.0197)
ECQ-M 4153□	.015		18.0 (.710)	7.0 (.276)	0.5 (.0197)
ECQ-M 4183□	.018	±10%(K)	20.0 (.788)	8.0 (.315)	0.6 (.0236)
ECQ-M 4223□	.022		20.0 (.788)	8.0 (.315)	0.6 (.0236)
ECQ-M 4273□	.027	±20%(M)	23.0 (.907)	9.0 (.354)	0.6 (.0236)
ECQ-M 4333□	.033		23.0 (.907)	9.0 (.354)	0.6 (.0236)
ECQ-M 4393□	.039		23.0 (.907)	10.0 (.394)	0.7 (.0276)
ECQ-M 4473□	.047		23.0 (.907)	10.0 (.394)	0.7 (.0276)
ECQ-M 4563□	.056		35.0 (1.378)	9.0 (.354)	0.7 (.0276)
ECQ-M 4683□	.068		35.0 (1.378)	9.0 (.354)	0.7 (.0276)
ECQ-M 4823□	.082		35.0 (1.378)	10.5 (.414)	0.7 (.0276)
ECQ-M 4104□	.1		35.0 (1.378)	10.5 (.414)	0.7 (.0276)
ECQ-M 4124□	.12		35.0 (1.378)	12.0 (.473)	0.7 (.0276)
ECQ-M 4154□	.15		35.0 (1.378)	12.0 (.473)	0.7 (.0276)
ECQ-M 4184□	.18		35.0 (1.378)	14.0 (.552)	0.7 (.0276)
ECQ-M 4224□	.22		35.0 (1.378)	14.0 (.552)	0.7 (.0276)
ECQ-M 4274□	.27		35.0 (1.378)	16.0 (.630)	0.7 (.0276)
ECQ-M 4334□	.33		35.0 (1.378)	16.0 (.630)	0.7 (.0276)
ECQ-M 4394□	.39		35.0 (1.378)	18.0 (.710)	0.7 (.0276)
ECQ-M 4474□	.47		35.0 (1.378)	18.0 (.710)	0.7 (.0276)

Type ECQ-M (Z), ECQ-M (ZB)(Radial Lead)



Electrical Specifications

1. Rated Voltage .... 50 V.D.C., 100 V.D.C., 200 V.D.C., 400 V.D.C. 600 V.D.C.
2. Capacitance .... See the Standard Products Table on pp.VI-8~13.
3. Capacitance Tolerance.......... ±10%(K) or ±20%(M)
4. Insulation Resistance........... Less than 0.33μF >9,000MΩ at 25°C; More than 0.33μF ≧3,000MΩ at 25°C
5. Dissipation Factor .... <1.0% at 1kHz
6. Withstand Voltage .... Rated Voltage x 2.5 (1 sec.) max.
7. Operating Temperature .... −40°C~+85°C

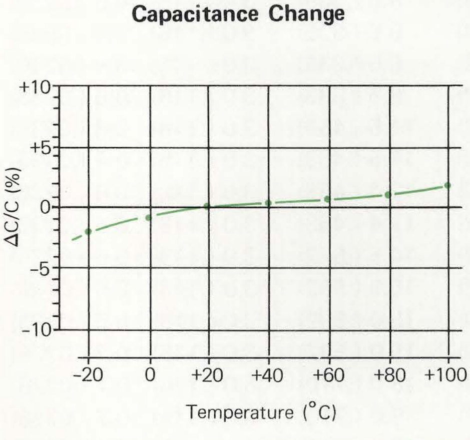
Application

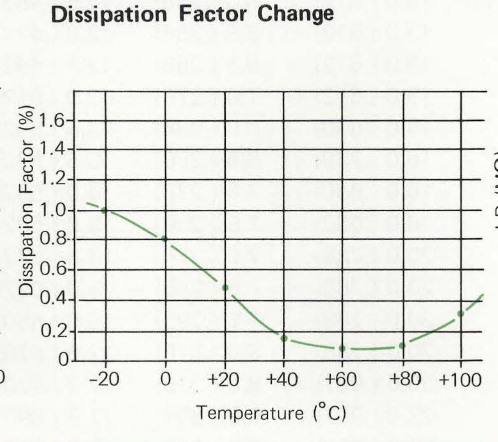
(1) Communication Equipment (2) TV, Radio (3) Transistorized Printed Circuit

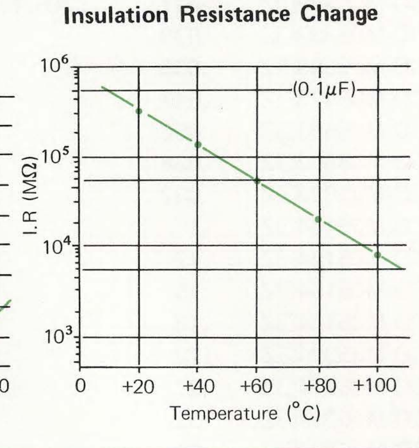
Features

1. The capacitor consists of polyester film (=dielectric), aluminum foil (=electrode) and *Durez resin coating. (* Trade Mark)
2. Marking comprises capacitance, capacitance tolerance, rated voltage and manufacturer's name or symbol.
3. Non-inductive.

Temperature Characteristics

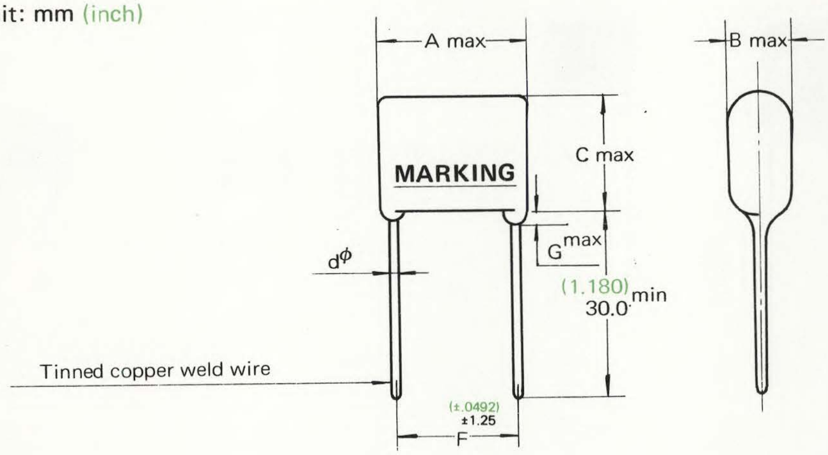






ECQ-M(Z) Standard Products Table

Unit: mm (inch)



50V.D.C.

Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolerance	A	B	C	F	G	dφ
ECQ-M05102□Z	.001		9.0 (.354)	5.0 (.197)	9.0 (.354)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M05122□Z	.0012		9.0 (.354)	5.0 (.197)	9.0 (.354)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M05152□Z	.0015		9.0 (.354)	5.0 (.197)	9.5 (.374)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M05182□Z	.0018		9.0 (.354)	5.5 (.217)	9.5 (.374)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M05222□Z	.0022		9.0 (.354)	6.0 (.236)	10.0 (.394)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M05272□Z	.0027		9.0 (.354)	5.0 (.197)	9.0 (.354)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M05332□Z	.0033		9.0 (.354)	5.0 (.197)	9.0 (.354)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M05392□Z	.0039		9.0 (.354)	5.5 (.217)	9.5 (.374)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M05472□Z	.0047		9.0 (.354)	5.0 (.197)	9.0 (.354)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M05562□Z	.0056		9.0 (.354)	5.0 (.197)	9.0 (.354)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M05682□Z	.0068	±10%(K)	9.0 (.354)	5.0 (.197)	9.5 (.374)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M05822□Z	.0082		11.0 (.433)	5.5 (.217)	11.5 (.453)	6.5 (.256)	2.0 (.079)	0.6 (.0236)
ECQ-M05103□Z	.01		11.0 (.433)	6.0 (.236)	12.0 (.473)	6.5 (.256)	2.0 (.079)	0.6 (.0236)
ECQ-M05123□Z	.012		11.0 (.433)	6.0 (.236)	12.0 (.473)	6.5 (.256)	3.0 (.118)	0.6 (.0236)
ECQ-M05183□Z	.015		11.0 (.433)	6.5 (.256)	12.0 (.473)	6.5 (.256)	3.0 (.118)	0.6 (.0236)
ECQ-M05183□Z	.018		11.0 (.433)	6.0 (.236)	11.5 (.453)	6.5 (.256)	3.0 (.118)	0.6 (.0236)
ECQ-M05223□Z	.022		11.0 (.433)	6.5 (.256)	12.0 (.473)	6.5 (.256)	3.0 (.118)	0.6 (.0236)
ECQ-M05273□Z	.027	±20%(M)	13.0 (.512)	6.0 (.236)	11.5 (.453)	8.5 (.335)	3.0 (.118)	0.6 (.0236)
ECQ-M05333□Z	.033		13.0 (.512)	6.5 (.256)	12.0 (.473)	8.5 (.335)	3.0 (.118)	0.6 (.0236)
ECQ-M05393□Z	.039		13.0 (.512)	6.5 (.256)	12.5 (.492)	8.5 (.335)	3.0 (.118)	0.6 (.0236)
ECQ-M05473□Z	.047		13.0 (.512)	7.0 (.276)	13.0 (.512)	8.5 (.335)	3.0 (.118)	0.6 (.0236)
ECQ-M05563□Z	.056		16.0 (.630)	6.0 (.236)	13.5 (.532)	11.5 (.453)	3.0 (.118)	0.6 (.0236)
ECQ-M05683□Z	.068		16.0 (.630)	6.5 (.256)	13.5 (.532)	11.5 (.453)	3.0 (.118)	0.6 (.0236)
ECQ-M05823□Z	.082		16.0 (.630)	7.0 (.276)	14.0 (.552)	11.4 (.453)	3.0 (.118)	0.6 (.0236)
ECQ-M05104□Z	.1		16.0 (.630)	7.5 (.295)	15.0 (.592)	11.4 (.453)	3.0 (.118)	0.6 (.0236)
ECQ-M05124□Z	.12		20.0 (.788)	7.0 (.276)	14.5 (.572)	14.5 (.572)	3.0 (.118)	0.6 (.0236)
ECQ-M05154□Z	.15		20.0 (.788)	7.5 (.295)	15.0 (.592)	15.0 (.592)	3.0 (.118)	0.6 (.0236)
ECQ-M05184□Z	.18		20.0 (.788)	7.5 (.295)	16.5 (.650)	15.0 (.592)	3.0 (.118)	0.6 (.0236)
ECQ-M05224□Z	.22		20.0 (.788)	8.0 (.315)	17.0 (.670)	15.0 (.592)	3.0 (.118)	0.7 (.0276)
ECQ-M05274□Z	.27		23.0 (.907)	8.0 (.315)	17.0 (.670)	18.0 (.710)	3.0 (.118)	0.7 (.0276)
ECQ-M05334□Z	.33		23.0 (.907)	9.0 (.354)	17.5 (.690)	18.0 (.710)	3.0 (.118)	0.7 (.0276)
ECQ-M05394□Z	.39		23.0 (.907)	9.5 (.374)	18.5 (.730)	18.0 (.710)	3.0 (.118)	0.7 (.0276)
ECQ-M05474□Z	.47		23.0 (.907)	10.5 (.413)	19.5 (.768)	18.5 (.730)	3.0 (.118)	0.7 (.0276)

100V.D.C.

Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolerance	A	B	C	F	G	dφ
ECQ-M1102□Z	.001		9.0 (.354)	5.0 (.197)	9.0 (.354)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M1122□Z	.0012		9.0 (.354)	5.0 (.197)	9.0 (.354)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M1152□Z	.0015		9.0 (.354)	5.0 (.197)	9.5 (.374)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M1182□Z	.0018		9.0 (.354)	5.5 (.217)	9.5 (.374)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M1222□Z	.0022		9.0 (.354)	6.0 (.236)	10.0 (.394)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M1272□Z	.0027		9.0 (.354)	5.0 (.197)	9.0 (.354)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M1332□Z	.0033		9.0 (.354)	5.0 (.197)	9.0 (.354)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M1392□Z	.0039		9.0 (.354)	5.5 (.217)	9.5 (.374)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M1472□Z	.0047		9.0 (.354)	5.0 (.197)	9.0 (.354)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M1562□Z	.0056		9.0 (.354)	5.0 (.197)	9.0 (.354)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M1682□Z	.0068	±10%(K)	9.0 (.354)	5.5 (.217)	9.5 (.374)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M1822□Z	.0082		11.0 (.433)	5.5 (.217)	11.5 (.453)	6.5 (.256)	2.0 (.079)	0.6 (.0236)
ECQ-M1103□Z	.01		11.0 (.433)	6.0 (.236)	12.0 (.473)	6.5 (.256)	2.0 (.079)	0.6 (.0236)
ECQ-M1123□Z	.012		11.0 (.433)	6.0 (.236)	12.0 (.473)	6.5 (.256)	3.0 (.118)	0.6 (.0236)
ECQ-M1153□Z	.015		11.0 (.433)	6.5 (.256)	12.0 (.473)	6.5 (.256)	3.0 (.118)	0.6 (.0236)
ECQ-M1183□Z	.018		11.0 (.433)	6.0 (.236)	11.5 (.453)	6.5 (.256)	3.0 (.118)	0.6 (.0236)
ECQ-M1223□Z	.022		11.0 (.433)	6.5 (.256)	12.0 (.473)	6.5 (.256)	3.0 (.118)	0.6 (.0236)
ECQ-M1273□Z	.027	±20%(M)	13.0 (.512)	6.0 (.236)	11.5 (.453)	8.5 (.335)	3.0 (.118)	0.6 (.0236)
ECQ-M1333□Z	.033		13.0 (.512)	6.5 (.256)	12.0 (.473)	8.5 (.335)	3.0 (.118)	0.6 (.0236)
ECQ-M1393□Z	.039		13.0 (.512)	6.5 (.256)	12.5 (.492)	8.5 (.335)	3.0 (.118)	0.6 (.0236)
ECQ-M1473□Z	.047		13.0 (.512)	7.0 (.276)	13.0 (.512)	8.5 (.335)	3.0 (.118)	0.6 (.0236)
ECQ-M1563□Z	.056		16.0 (.630)	6.0 (.236)	13.5 (.532)	11.5 (.453)	3.0 (.118)	0.6 (.0236)
ECQ-M1683□Z	.068		16.0 (.630)	6.5 (.256)	13.5 (.532)	11.5 (.453)	3.0 (.118)	0.6 (.0236)
ECQ-M1823□Z	.082		16.0 (.630)	7.0 (.276)	14.0 (.552)	11.5 (.453)	3.0 (.118)	0.6 (.0236)
ECQ-M1104□Z	.1		16.0 (.630)	7.5 (.295)	15.0 (.592)	11.5 (453)	3.0 (.118)	0.6 (.0236)
ECQ-M1124□Z	.12		20.0 (.788)	7.0 (.276)	14.5 (.572)	14.5 (.572)	3.0 (.118)	0.6 (.0236)
ECQ-M1154□Z	.15		20.0 (.788)	7.5 (.295)	15.0 (.592)	15.0 (.592)	3.0 (.118)	0.6 (.0236)
ECQ-M1184□Z	.18		20.0 (.788)	7.5 (.295)	16.5 (.650)	15.0 (.592)	3.0 (.118)	0.6 (.0236)
ECQ-M1224□Z	.22		20.0 (.788)	8.0 (.315)	17.0 (.670)	15.0 (.592)	3.0 (.118)	0.6 (.0236)
ECQ-M1274□Z	.27		23.0 (.907)	10.5 (.414)	19.5 (.768)	18.5 (.730)	3.0 (.118)	0.8 (.0315)
ECQ-M1334□Z	.33		23.0 (.907)	12.0 (.473)	21.0 (.828)	18.5 (.730)	3.0 (.118)	0.8 (.0315)
ECQ-M1394□Z	.39		28.0 (1.102)	11.0 (.433)	20.5 (.808)	23.5 (.927)	3.0 (.118)	0.8 (.0315)
ECQ-M1474□Z	.47		28.0 (1.102)	12.0 (.473)	21.5 (.848)	23.5 (.927)	3.0 (.118)	0.8 (.0315)

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Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolerance	A	B	C	F	G	dφ
ECQ-M2102□Z	.001		9.0 (.354)	5.0 (.197)	9.0 (.354)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M2122□Z	.0012		9.0 (.354)	5.0 (.197)	9.0 (.354)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M2152□Z	.0015		9.0 (.354)	5.0 (.197)	9.5 (.374)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M2182□Z	.0018		9.0 (.354)	5.5 (.217)	9.5 (.374)	5.5 (.217)	3.0 (.079)	0.6 (.0236)
ECQ-M2222□Z	.0022		9.0 (.354)	6.0 (.236)	10.0 (.394)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M2272□Z	.0027		9.0 (.354)	5.0 (.197)	9.0 (.354)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M2332□Z	.0033		9.0 (.354)	5.0 (.197)	9.0 (.354)	5.5 (.217)	2.0 (.079)	0.6 (.0236)
ECQ-M2392□Z	.0039		12.0 (.473)	5.5 (.217)	9.5 (.374)	7.5 (.295)	2.0 (.079)	0.6 (.0236)
ECQ-M2472□Z	.0047		12.0 (.473)	6.0 (.236)	9.5 (.374)	7.5 (.295)	2.0 (.079)	0.6 (.0236)
ECQ-M2562□Z	.0056		12.0 (.473)	6.0 (.236)	9.5 (.374)	7.5 (.295)	2.0 (.079)	0.6 (.0236)
ECQ-M2682□Z	.0068	±10%(K)	12.0 (.473)	6.0 (.236)	10.5 (.414)	7.5 (.295)	2.0 (.079)	0.6 (.0236)
ECQ-M2822□Z	.0082		14.0 (.552)	5.5 (.217)	10.0 (.394)	9.5 (.394)	2.0 (.079)	0.6 (.0236)
ECQ-M2103□Z	.01		14.0 (.552)	6.0 (.236)	10.0 (.394)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-M2123□Z	.012		14.0 (.552)	6.0 (.236)	10.5 (.414)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-M2153□Z	.015		14.0 (.552)	6.5 (.256)	11.5 (.453)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-M2183□Z	.018		17.0 (.670)	5.5 (.217)	10.0 (.394)	12.5 (.492)	3.0 (.118)	0.6 (.0236)
ECQ-M2223□Z	.022		17.0 (.670)	5.5 (.217)	11.0 (.433)	12.5 (.492)	3.0 (.118)	0.6 (.0236)
ECQ-M2273□Z	.027	±20%(M)	17.0 (.670)	6.0 (.236)	11.0 (.433)	12.5 (.492)	3.0 (.118)	0.6 (.0236)
ECQ-M2333□Z	.027		17.0 (.670)	6.5 (.256)	11.5 (.453)	12.5 (.492)	3.0 (.118)	0.6 (.0236)
ECQ-M2393□Z	.039		17.0 (.670)	6.0 (.236)	13.5 (.532)	12.5 (.492)	3.0 (.118)	0.6 (.0236)
ECQ-M2473□Z	.047		17.0 (.670)	6.5 (.256)	14.0 (.552)	12.5 (.492)	3.0 (.118)	0.6 (.0236)
ECQ-M2563□Z	.056		20.0 (.788)	6.5 (.256)	14.0 (.552)	14.5 (.572)	3.0 (.118)	0.6 (.0236)
ECQ-M2683□Z	.068		20.0 (.788)	7.0 (.276)	14.5 (.572)	14.5 (.572)	3.0 (.118)	0.6 (.0236)
ECQ-M2823□Z	.082		20.0 (.788)	7.5 (.295)	15.0 (.592)	15.0 (.592)	3.0 (.118)	0.6 (.0236)
ECQ-M2104□Z	.1		20.0 (.788)	8.0 (.315)	17.0 (.670)	15.0 (.592)	3.0 (.118)	0.6 (.0236)
ECQ-M2124□Z	.12		20.0 (.788)	8.5 (.335)	17.5 (.690)	15.0 (.592)	3.0 (.118)	0.8 (.0315)
ECQ-M2154□Z	.15		20.0 (.788)	9.5 (.374)	18.5 (.730)	15.0 (.592)	3.0 (.118)	0.8 (.0315)
ECQ-M2184□Z	.18		23.0 (.907)	13.0 (.512)	22.0 (.867)	18.5 (.730)	3.0 (.118)	0.8 (.0315)
ECQ-M2224□Z	.22		23.0 (.907)	14.0 (.552)	23.0 (.907)	18.5 (.730)	3.0 (.118)	0.8 (.0315)
ECQ-M2274□Z	.27		23.0 (.907)	15.5 (.611)	24.5 (.965)	18.5 (.730)	3.0 (.118)	0.8 (.0315)
ECQ-M2334□Z	.33		28.0 (1.102)	14.5 (.572)	23.0 (.907)	23.5 (.927)	3.0 (.118)	0.8 (.0315)
ECQ-M2394□Z	.39		28.0 (1.102)	15.5 (.611)	24.5 (.965)	23.5 (.927)	3.0 (.118)	0.8 (.0315)
ECQ-M2474□Z	.47		28.0 (1.102)	17.0 (.670)	26.0 (1.022)	23.5 (.927)	3.0 (.118)	0.8 (.0315)

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Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolerance	A	B	C	F	G	dφ
ECQ-M4102□Z	.001		11.0 (.433)	5.5 (.217)	9.5 (.374)	6.5 (.256)	2.0 (.079)	0.6 (.236)
ECQ-M4122□Z	.0012		11.0 (.433)	6.0 (.236)	10.0 (.394)	6.5 (.256)	2.0 (.079)	0.6 (.236)
ECQ-M4152□Z	.0015		11.0 (.433)	6.0 (.236)	10.0 (.394)	6.5 (.256)	2.0 (.079)	0.6 (.236)
ECQ-M4182□Z	.0018		11.0 (.433)	6.0 (.236)	10.0 (.394)	6.5 (.256)	2.0 (.079)	0.6 (.236)
ECQ-M4222□Z	.0022		11.0 (.433)	6.5 (.256)	10.5 (.414)	6.5 (.256)	2.0 (.079)	0.6 (.236)
ECQ-M4272□Z	.0027		12.0 (.473)	6.0 (.236)	10.0 (.394)	7.5 (.295)	2.0 (.079)	0.6 (.236)
ECQ-M4332□Z	.0033		12.0 (.473)	6.5 (.256)	10.5 (.414)	7.5 (.295)	2.0 (.079)	0.6 (.236)
ECQ-M4392□Z	.0039		12.0 (.473)	6.5 (.256)	10.5 (.414)	7.5 (.295)	2.0 (.079)	0.6 (.236)
ECQ-M4472□Z	.0047		14.0 (.552)	6.0 (.236)	10.0 (.394)	9.5 (.374)	2.0 (.079)	0.6 (.236)
ECQ-M4562□Z	.0056		14.0 (.552)	6.0 (.236)	10.0 (.394)	9.5 (.374)	2.0 (.079)	0.6 (.236)
ECQ-M4682□Z	.0068	±10%(K)	14.0 (.552)	6.5 (.256)	10.5 (.414)	9.5 (.374)	3.0 (.118)	0.6 (.236)
ECQ-M4822□Z	.0082		14.0 (.552)	6.5 (.256)	12.0 (.473)	9.5 (.374)	3.0 (.118)	0.6 (.236)
ECQ-M4103□Z	.01		14.0 (.552)	7.0 (.276)	12.5 (.492)	9.5 (.374)	3.0 (.118)	0.6 (.236)
ECQ-M4123□Z	.012		17.0 (.670)	6.0 (.236)	12.0 (.473)	12.5 (.492)	3.0 (.118)	0.6 (.236)
ECQ-M4153□Z	.015		17.0 (.670)	6.5 (.256)	12.5 (.492)	12.5 (.492)	3.0 (.118)	0.6 (.236)
ECQ-M4183□Z	.018		17.0 (.670)	6.0 (.276)	13.0 (.512)	12.5 (.492)	3.0 (.118)	0.6 (.236)
ECQ-M4223□Z	.022		17.0 (.670)	7.5 (.295)	13.5 (.532)	12.5 (492)	3.0 (.118)	0.6 (.236)
ECQ-M4273□Z	.027	±20%(M)	20.0 (.788)	7.0 (.276)	14.5 (.572)	15.0 (.592)	3.0 (.118)	0.7 (.0276)
ECQ-M4333□Z	.033		20.0 (.788)	7.5 (.295)	15.0 (.592)	15.0 (.592)	3.0 (.118)	0.7 (.0276)
ECQ-M4393□Z	.039		20.0 (.788)	8.5 (.335)	16.0 (.630)	15.0 (.592)	3.0 (.118)	0.7 (.0276)
ECQ-M4473□Z	.047		20.0 (.788)	9.0 (.354)	16.5 (.650)	15.0 (.592)	3.0 (.118)	0.7 (.0276)
ECQ-M4563□Z	.056		23.0 (.907)	8.5 (.335)	15.5 (.611)	18.0 (.710)	3.0 (.118)	0.7 (.0276)
ECQ-M4683□Z	.068		23.0 (.907)	9.0 (.354)	16.5 (.650)	18.0 (.710)	3.0 (.118)	0.7 (.0276)
ECQ-M4823□Z	.082		23.0 (.907)	9.5 (.374)	17.0 (.670)	18.0 (.710)	3.0 (.118)	0.8 (.0315)
ECQ-M4104□Z	.1		23.0 (.907)	10.0 (.394)	19.0 (.749)	18.0 (.710)	3.0 (.118)	0.8 (.0315)
ECQ-M4124□Z	.12		23.0 (.907)	11.0 (.433)	20.0 (.788)	18.5 (.730)	3.0 (.118)	0.8 (.0315)
ECQ-M4154□Z	.15		23.0 (.907)	12.5 (.492)	21.0 (.828)	18.5 (.730)	3.0 (.118)	0.8 (.0315)
ECQ-M4184□Z	.18		28.0 (1.102)	12.5 (.492)	21.5 (.848)	23.5 (.927)	3.0 (.118)	0.8 (.0315)
ECQ-M4224□Z	.22		28.0 (1.102)	14.0 (.552)	23.0 (.907)	23.5 (.927)	3.0 (.118)	0.8 (.0315)
ECQ-M4274□Z	.27		28.0 (1.102)	15.5 (.611)	24.5 (.965)	23.5 (.927)	3.0 (.118)	0.8 (.0315)
ECQ-M4334□Z	.33		28.0 (1.102)	17.5 (.690)	26.5 (1.042)	23.5 (.927)	3.0 (.118)	0.8 (.0315)
ECQ-M4394□Z	.39		34.0 (1.340)	16.0 (.630)	26.5 (1.042)	28.5 (1.120)	3.0 (.118)	0.8 (.0315)
ECQ-M4474□Z	.47		34.0 (1.340)	17.5 (.690)	28.0 (1.102)	28.5 (1.120)	3.0 (.118)	0.8 (.0315)

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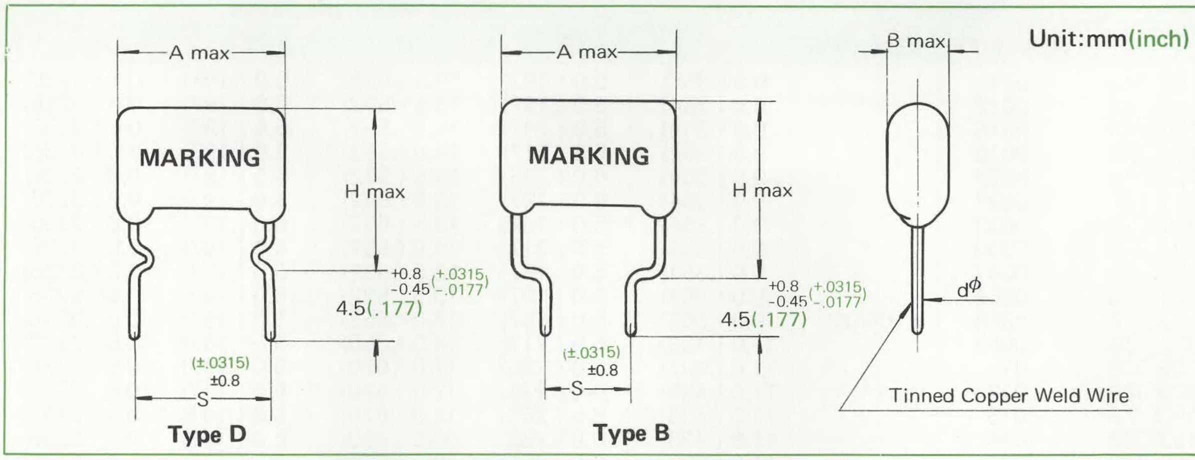
Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μ)	Tolerance	A	B	C	F	G	dφ
ECQ-M6102□Z	.001		13.0 (.512)	6.0 (.236)	10.0 (.394)	7.5 (.295)	3.0 (.118)	0.6 (.0236)
ECQ-M6122□Z	.0012		13.0 (.512)	6.5 (.256)	10.5 (.414)	7.5 (.295)	3.0 (.118)	0.6 (.0236)
ECQ-M6152□Z	.0015		13.0 (.512)	6.5 (.256)	10.5 (.414)	7.5 (.295)	3.0 (.118)	0.6 (.0236)
ECQ-M6182□Z	.0018		15.0 (.592)	6.0 (.236)	10.0 (.394)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-M6222□Z	.0022		15.0 (.592)	6.0 (.236)	10.0 (.394)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-M6272□Z	.0027		15.0 (.592)	6.5 (.256)	10.0 (.394)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-M6332□Z	.0033		15.0 (.592)	6.5 (.256)	10.0 (.394)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-M6392□Z	.0039		15.0 (.592)	6.5 (.256)	12.0 (.473)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-M6472□Z	.0047		15.0 (.592)	6.5 (.256)	12.0 (.473)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-M6562□Z	.0056		15.0 (.592)	7.5 (.295)	13.0 (.512)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-M6682□Z	.0068	±10%(K)	15.0 (.592)	7.5 (.295)	13.0 (.512)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-M6822□Z	.0082		20.0 (.788)	6.0 (.236)	13.0 (.512)	14.5 (.572)	3.0 (.118)	0.6 (.0236)
ECQ-M6103□Z	.01		20.0 (.788)	6.0 (.236)	13.0 (.512)	14.5 (.572)	3.0 (.118)	0.6 (.0236)
ECQ-M6123□Z	.012		20.0 (.788)	7.0 (.276)	14.0 (.552)	14.5 (.572)	3.0 (.118)	0.6 (.0236)
ECQ-M6153□Z	.015		20.0 (.788)	7.0 (.276)	14.0 (.552)	14.5 (.572)	3.0 (.118)	0.6 (.0236)
ECQ-M6183□Z	.018		20.0 (.788)	8.5 (.335)	15.0 (.592)	14.5 (.572)	3.0 (.118)	0.6 (.0236)
ECQ-M6223□Z	.022		20.0 (.788)	8.5 (.335)	15.0 (.592)	14.5 (.572)	3.0 (.118)	0.6 (.0236)
ECQ-M6273□Z	.027	±20%(M)	25.5 (.1005)	8.0 (.315)	15.0 (.592)	19.5 (.768)	4.0 (.158)	0.7 (.0276)
ECQ-M6333□Z	.033		25.5 (.1005)	8.0 (.315)	15.0 (.592)	19.5 (.768)	4.0 (.158)	0.7 (.0276)
ECQ-M6393□Z	.039		25.5 (.1005)	9.5 (.374)	16.5 (.650)	19.5 (.768)	4.0 (.158)	0.7 (.0276)
ECQ-M6473□Z	.047		25.5 (.1005)	9.5 (.374)	16.5 (.650)	19.5 (.768)	4.0 (.158)	0.7 (.0276)
ECQ-M6563□Z	.056		25.5 (.1005)	12.5 (.492)	19.0 (.749)	19.5 (.768)	4.0 (.158)	0.7 (.0276)
ECQ-M6683□Z	.068		25.5 (.1005)	12.5 (.492)	19.0 (.749)	19.5 (.768)	4.0 (.158)	0.7 (.0276)
ECQ-M6823□Z	.082		25.5 (.1005)	12.5 (.492)	22.5 (.887)	19.5 (.768)	4.0 (.158)	0.8 (.0315)
ECQ-M6104□Z	.1		25.5 (.1005)	12.5 (.492)	22.5 (.887)	19.5 (.768)	4.0 (.158)	0.8 (.0315)

ECQ-M(ZB) Standard Products Table



50V. D.C.

Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolerance	A	B	H	S	dφ	Type
ECQ-M05102□ZB	.001		9.0 (.354)	5.0 (.197)	13.5 (.532)	5.0 (.197)	0.6 (.0236)	D
ECQ-M05122□ZB	.0012		9.0 (.354)	5.0 (.197)	13.5 (.532)	5.0 (.197)	0.6 (.0236)	D
ECQ-M05152□ZB	.0015		9.0 (.354)	5.0 (.197)	14.0 (.552)	5.0 (.197)	0.6 (.0236)	D
ECQ-M05182□ZB	.0018		9.0 (.354)	5.5 (.217)	14.0 (.552)	5.0 (.197)	0.6 (.0236)	D
ECQ-M05222□ZB	.0022		9.0 (.354)	6.0 (.236)	14.5 (.572)	5.0 (.197)	0.6 (.0236)	D
ECQ-M05272□ZB	.0027		9.0 (.354)	5.0 (.197)	13.5 (.532)	5.0 (.197)	0.6 (.0236)	D
ECQ-M05332□ZB	.0033		9.0 (.354)	5.0 (.197)	13.5 (.532)	5.0 (.197)	0.6 (.0236)	D
ECQ-M05392□ZB	.0039		9.0 (.354)	5.5 (.217)	14.0 (.552)	5.0 (.197)	0.6 (.0236)	D
ECQ-M05472□ZB	.0047		9.0 (.354)	5.0 (.197)	13.5 (.532)	5.0 (.197)	0.6 (.0236)	D
ECQ-M05562□ZB	.0056		9.0 (.354)	5.0 (.197)	13.5 (.532)	5.0 (.197)	0.6 (.0236)	D
ECQ-M05682□ZB	.0068	±10%(K)	9.0 (.354)	5.0 (.197)	14.0 (.552)	5.0 (.197)	0.6 (.0236)	D
ECQ-M05822□ZB	.0082		11.0 (.433)	5.5 (.217)	16.5 (.650)	5.0 (.197)	0.6 (.0236)	D
ECQ-M05103□ZB	.01		11.0 (.433)	6.0 (.236)	17.0 (.670)	5.0 (.197)	0.6 (.0236)	D
ECQ-M05123□ZB	.012		11.0 (.433)	6.0 (.236)	17.0 (.670)	5.0 (.197)	0.6 (.0236)	D
ECQ-M05153□ZB	.015		11.0 (.433)	6.5 (.256)	17.0 (.670)	5.0 (.197)	0.6 (.0236)	D
ECQ-M05183□ZB	.018		11.0 (.433)	5.0 (.236)	16.5 (.650)	5.0 (.197)	0.6 (.0236)	D
ECQ-M05223□ZB	.022		11.0 (.433)	6.5 (.256)	17.0 (.670)	5.0 (.197)	0.6 (.0236)	D
ECQ-M05273□ZB	.027	±20%(M)	13.0 (.512)	6.0 (.236)	16.5 (.650)	5.0 (.197)	0.6 (.0236)	B
ECQ-M05333□ZB	.033		13.0 (.512)	6.5 (.256)	17.0 (.670)	5.0 (.197)	0.6 (.0236)	B
ECQ-M05393□ZB	.039		13.0 (.512)	6.5 (.256)	17.5 (.690)	5.0 (.197)	0.6 (.0236)	B
ECQ-M05473□ZB	.047		13.0 (.512)	7.0 (.276)	18.0 (.710)	5.0 (.197)	0.6 (.0236)	B
ECQ-M05563□ZB	.056		16.0 (.630)	6.0 (.236)	18.5 (.730)	7.5 (.295)	0.6 (.0236)	B
ECQ-M05683□ZB	.068		16.0 (.630)	6.5 (.256)	18.5 (.730)	7.5 (.295)	0.6 (.0236)	B
ECQ-M05823□ZB	.082		16.0 (.630)	7.0 (.276)	19.0 (.749)	7.5 (.295)	0.8 (.0315)	B
ECQ-M05104□ZB	.1		16.0 (.630)	7.5 (.295)	20.0 (.788)	7.5 (.295)	0.8 (.0315)	B
ECQ-M05124□ZB	.12		20.0 (.788)	7.0 (.276)	19.5 (.768)	10.0 (.394)	0.8 (.0315)	B
ECQ-M05154□ZB	.15		20.0 (.788)	7.5 (.295)	20.0 (.788)	10.0 (.394)	0.8 (.0315)	B
ECQ-M05184□ZB	.18		20.0 (.788)	7.5 (.295)	21.5 (.848)	12.5 (.492)	0.8 (.0315)	B
ECQ-M05224□ZB	.22		20.0 (.788)	8.0 (.315)	22.0 (.867)	12.5 (.492)	0.8 (.0315)	B
ECQ-M05274□ZB	.27		23.0 (.907)	8.0 (.315)	22.0 (.867)	12.5 (.492)	0.8 (.0315)	B
ECQ-M05334□ZB	.33		23.0 (.907)	9.0 (.354)	22.5 (.887)	12.5 (.492)	0.8 (.0315)	B
ECQ-M05394□ZB	.39		23.0 (.907)	9.5 (.374)	23.5 (.927)	12.5 (.492)	0.8 (.0315)	B
ECQ-M05474□ZB	.47		23.0 (.907)	10.5 (.413)	24.5 (.965)	12.5 (.492)	0.8 (.0315)	B

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Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolerance	A	B	H	F	dφ	Type
ECQ-M1102□ZB	.001		9.0 (.354)	5.0 (.197)	13.5 (.532)	5.0 (.197)	0.6 (.0236)	D
ECQ-M1122□ZB	.0012		9.0 (.354)	5.0 (.197)	13.5 (.532)	5.0 (.197)	0.6 (.0236)	D
ECQ-M1152□ZB	.0015		9.0 (.354)	5.0 (.197)	14.0 (.552)	5.0 (.197)	0.6 (.0236)	D
ECQ-M1182□ZB	.0018		9.0 (.354)	5.5 (.217)	14.0 (.552)	5.0 (.197)	0.6 (.0236)	D
ECQ-M1222□ZB	.0022		9.0 (.354)	6.0 (.236)	14.5 (.572)	5.0 (.197)	0.6 (.0236)	D
ECQ-M1272□ZB	.0027		9.0 (.354)	5.0 (.197)	13.5 (.532)	5.0 (.197)	0.6 (.0236)	D
ECQ-M1332□ZB	.0033		9.0 (.354)	5.0 (.197)	13.5 (.532)	5.0 (.197)	0.6 (.0236)	D
ECQ-M1392□ZB	.0039		9.0 (.354)	5.5 (.217)	14.0 (.552)	5.0 (.197)	0.6 (.0236)	D
ECQ-M1472□ZB	.0047		9.0 (.354)	5.0 (.197)	13.5 (.532)	5.0 (.197)	0.6 (.0236)	D
ECQ-M1562□ZB	.0056		9.0 (.354)	5.0 (.197)	13.5 (.532)	5.0 (.197)	0.6 (.0236)	D
ECQ-M1682□ZB	.0068	±10%(K)	9.0 (.354)	5.0 (.197)	14.0 (.552)	5.0 (.197)	0.6 (.0236)	D
ECQ-M1822□ZB	.0082		11.0 (.433)	5.5 (.217)	16.5 (.650)	5.0 (.197)	0.6 (.0236)	D
ECQ-M1103□ZB	.01		11.0 (.433)	6.0 (.236)	17.0 (.670)	5.0 (.197)	0.6 (.0236)	D
ECQ-M1123□ZB	.012		11.0 (.433)	6.0 (.236)	17.0 (.670)	5.0 (.197)	0.6 (.0236)	D
ECQ-M1153□ZB	.015		11.0 (.433)	6.5 (.256)	17.0 (.670)	5.0 (.197)	0.6 (.0236)	D
ECQ-M1183□ZB	.018		11.0 (.433)	6.0 (.236)	16.5 (.650)	5.0 (.197)	0.6 (.0236)	D
ECQ-M1223□ZB	.022		11.0 (.433)	6.5 (.256)	17.0 (.670)	5.0 (.197)	0.6 (.0236)	B
ECQ-M1273□ZB	.027	±20%(M)	13.0 (.512)	6.0 (.236)	16.5 (.650)	5.0 (.197)	0.6 (.0236)	B
ECQ-M1333□ZB	.033		13.0 (.512)	6.5 (.256)	17.0 (.670)	5.0 (.197)	0.6 (.0236)	B
ECQ-M1392□ZB	.039		13.0 (.512)	6.5 (.256)	17.5 (.690)	5.0 (.197)	0.6 (.0236)	B
ECQ-M1473□ZB	.047		13.0 (.512)	7.0 (.276)	18.0 (.710)	5.0 (.197)	0.6 (.0236)	B
ECQ-M1563□ZB	.056		16.0 (.630)	6.0 (.236)	18.5 (.730)	7.5 (.295)	0.6 (.0236)	B
ECQ-M1683□ZB	.068		16.0 (.630)	6.5 (.256)	18.5 (.730)	7.5 (.295)	0.6 (.0236)	B
ECQ-M1823□ZB	.082		16.0 (.630)	7.0 (.276)	19.0 (.749)	7.5 (.295)	0.8 (.0315)	B
ECQ-M1104□ZB	.1		16.0 (.630)	7.5 (.295)	20.0 (.788)	7.5 (.295)	0.8 (.0315)	B
ECQ-M1124□ZB	.12		20.0 (.788)	7.0 (.276)	19.5 (.768)	10.0 (.394)	0.8 (.0315)	B
ECQ-M1154□ZB	.15		20.0 (.788)	7.5 (.295)	20.0 (.788)	10.0 (.394)	0.8 (.0315)	B
ECQ-M1184□ZB	.18		20.0 (.788)	7.5 (.295)	21.5 (.848)	12.5 (.492)	0.8 (.0315)	B
ECQ-M1224□ZB	.22		20.0 (.788)	8.0 (.315)	22.0 (.867)	12.5 (.492)	0.8 (.0315)	B
ECQ-M1274□ZB	.27		23.0 (.907)	10.5 (.414)	24.5 (.965)	12.5 (.492)	0.8 (.0315)	B
ECQ-M1334□ZB	.33		23.0 (.907)	12.0 (.473)	26.0 (1.022)	12.5 (.492)	0.8 (.0315)	B
ECQ-M1394□ZB	.39		28.0 (1.102)	11.0 (.433)	25.5 (1.005)	15.0 (.592)	0.8 (.0315)	B
ECQ-M1474□ZB	.47		28.0 (1.102)	12.0 (.473)	26.5 (1.042)	15.0 (.592)	0.8 (.0315)	B

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Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolerance	A	B	H	S	dφ	Type
ECQ-M2102□ZB	.001		9.0 (.354)	5.0 (.197)	13.5 (.532)	5.0 (.197)	0.6 (.0236)	D
ECQ-M2122□ZB	.0012		9.0 (.354)	5.0 (.197)	13.5 (.532)	5.0 (.197)	0.6 (.0236)	D
ECQ-M2152□ZB	.0015		9.0 (.354)	5.0 (.197)	14.0 (.552)	5.0 (.197)	0.6 (.0236)	D
ECQ-M2182□ZB	.0018		9.0 (.354)	5.5 (.217)	14.0 (.552)	5.0 (.197)	0.6 (.0236)	D
ECQ-M2222□ZB	.0022		9.0 (.354)	6.0 (.236)	14.5 (.572)	5.0 (.197)	0.6 (.0236)	D
ECQ-M2272□ZB	.0027		9.0 (.354)	5.0 (.197)	13.5 (.532)	5.0 (.197)	0.6 (.0236)	D
ECQ-M2332□ZB	.0033		9.0 (.354)	5.0 (.197)	13.5 (.532)	5.0 (.197)	0.6 (.0236)	D
ECQ-M2392□ZB	.0039		12.0 (.473)	5.5 (.217)	14.5 (.572)	5.0 (.197)	0.6 (.0236)	D
ECQ-M2472□ZB	.0047		12.0 (.473)	6.0 (.236)	15.0 (.592)	5.0 (.197)	0.6 (.0236)	D
ECQ-M2562□ZB	.0056		12.0 (.473)	6.0 (.236)	15.0 (.592)	5.0 (.197)	0.6 (.0236)	D
ECQ-M2682□ZB	.0068	±10%(K)	12.0 (.473)	6.0 (.236)	15.5 (.611)	5.0 (.197)	0.6 (.0236)	D
ECQ-M2822□ZB	.0082		14.0 (.552)	5.5 (.217)	15.0 (.592)	5.0 (.197)	0.6 (.0236)	B
ECQ-M2103□ZB	.01		14.0 (.552)	6.0 (.236)	15.0 (.592)	5.0 (.197)	0.6 (.0236)	B
ECQ-M2123□ZB	.012		14.0 (.552)	6.0 (.236)	15.5 (.611)	5.0 (.197)	0.6 (.0236)	B
ECQ-M2153□ZB	.015		14.0 (.552)	6.5 (.256)	16.5 (.650)	5.0 (.197)	0.6 (.0236)	B
ECQ-M2183□ZB	.018		17.0 (.670)	5.5 (.217)	15.0 (.592)	7.5 (.197)	0.6 (.0236)	B
ECQ-M2223□ZB	.022		17.0 (.670)	5.5 (.217)	16.0 (.630)	7.5 (.197)	0.6 (.0236)	B
ECQ-M2273□ZB	.027	±20%(M)	17.0 (.670)	6.0 (.236)	16.0 (.630)	7.5 (.197)	0.6 (.0236)	B
ECQ-M2333□ZB	.033		17.0 (.670)	6.5 (.256)	16.5 (.650)	7.5 (.197)	0.8 (.0315)	B
ECQ-M2393□ZB	.039		17.0 (.670)	6.0 (.236)	18.5 (.730)	7.5 (.197)	0.8 (.0315)	B
ECQ-M2473□ZB	.047		17.0 (.670)	6.5 (.256)	19.0 (.749)	7.5 (.197)	0.8 (.0315)	B
ECQ-M2563□ZB	.056		20.0 (.788)	6.5 (.256)	19.0 (.749)	10.0 (.394)	0.8 (.0315)	B
ECQ-M2683□ZB	.068		20.0 (.788)	7.0 (.276)	19.5 (.768)	10.0 (.394)	0.8 (.0315)	B
ECQ-M2823□ZB	.082		20.0 (.788)	7.5 (.295)	20.0 (.788)	10.0 (.394)	0.8 (.0315)	B
ECQ-M2104□ZB	.1		20.0 (.788)	8.0 (.315)	22.0 (.867)	10.0 (.394)	0.8 (.0315)	B
ECQ-M2124□ZB	.12		20.0 (.788)	8.5 (.335)	22.5 (.887)	10.0 (.394)	0.8 (.0315)	B
ECQ-M2154□ZB	.15		20.0 (.788)	9.5 (.374)	23.5 (.927)	10.0 (.394)	0.8 (.0315)	B
ECQ-M2184□ZB	.18		23.0 (.907)	13.0 (.512)	27.0 (1.062)	12.5 (.492)	0.8 (.0315)	B
ECQ-M2224□ZB	.22		23.0 (.907)	14.0 (.552)	28.0 (1.102)	12.5 (.492)	0.8 (.0315)	B
ECQ-M2274□ZB	.27		23.0 (.907)	15.5 (.611)	29.5 (1.161)	12.5 (.492)	0.8 (.0315)	B
ECQ-M2334□ZB	.33		28.0 (1.102)	14.5 (.572)	28.0 (1.102)	15.0 (.592)	0.8 (.0315)	B
ECQ-M2394□ZB	.39		28.0 (1.102)	15.5 (.611)	29.5 (1.161)	15.0 (.592)	0.8 (.0315)	B
ECQ-M2474□ZB	.47		28.0 (1.102)	17.0 (.670)	31.0 (1.220)	15.0 (.592)	0.8 (.0315)	B

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Unit: mm(inch)

Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolerance	A	B	H	S	dφ	Type
ECQ-M4102□ZB	.001		11.0 (.433)	5.5 (.217)	14.5 (.572)	5.0 (.197)	0.6 (.0236)	D
ECQ-M4122□ZB	.0012		11.0 (.433)	6.0 (.236)	15.0 (.592)	5.0 (.197)	0.6 (.0236)	D
ECQ-M4152□ZB	.0015		11.0 (.433)	6.0 (.236)	15.0 (.592)	5.0 (.197)	0.6 (.0236)	D
ECQ-M4182□ZB	.0018		11.0 (.433)	6.0 (.236)	15.0 (.592)	5.0 (.197)	0.6 (.0236)	D
ECQ-M4222□ZB	.0022		11.0 (.433)	6.5 (.256)	15.5 (.611)	5.0 (.197)	0.6 (.0236)	D
ECQ-M4272□ZB	.0027		14.0 (.473)	5.5 (.217)	15.0 (.592)	5.0 (.197)	0.6 (.0236)	B
ECQ-M4332□ZB	.0033		14.0 (.473)	5.5 (.217)	15.0 (.592)	5.0 (.197)	0.6 (.0236)	B
ECQ-M4392□ZB	.0039		14.0 (.473)	6.0 (.236)	15.0 (.592)	5.0 (.197)	0.6 (.0236)	B
ECQ-M4472□ZB	.0047		14.0 (.473)	6.0 (.236)	15.0 (.592)	5.0 (.197)	0.6 (.0236)	B
ECQ-M4562□ZB	.0056		14.0 (.473)	6.0 (.236)	15.0 (.592)	5.0 (.197)	0.6 (.0236)	B
ECQ-M4682□ZB	.0068	±10%(K)	14.0 (.473)	6.5 (.256)	15.5 (.611)	5.0 (.197)	0.6 (.0236)	B
ECQ-M4822□ZB	.0082		14.0 (.473)	6.5 (.256)	17.0 (.680)	5.0 (.197)	0.6 (.0236)	B
ECQ-M4103□ZB	.01		14.0 (.473)	7.0 (.276)	17.5 (.690)	5.0 (.197)	0.6 (.0236)	B
ECQ-M4123□ZB	.012		17.0 (.670)	6.0 (.236)	17.0 (.670)	7.5 (.295)	0.6 (.0236)	B
ECQ-M4153□ZB	.015		17.0 (.670)	6.5 (.256)	17.5 (.690)	7.5 (.295)	0.6 (.0236)	B
ECQ-M4183□ZB	.018		17.0 (.670)	7.0 (.276)	18.0 (.710)	7.5 (.295)	0.6 (.0236)	B
ECQ-M4223□ZB	.022		17.0 (.670)	7.5 (.295)	18.5 (.730)	7.5 (.295)	0.6 (.0236)	B
ECQ-M4273□ZB	.027	±20%(M)	20.0 (.788)	7.0 (.276)	19.5 (.768)	10.0 (.394)	0.8 (.0315)	B
ECQ-M4333□ZB	.033		20.0 (.788)	7.5 (.295)	20.0 (.788)	10.0 (.394)	0.8 (.0315)	B
ECQ-M4393□ZB	.039		20.0 (.788)	8.5 (.335)	21.0 (.828)	10.0 (.394)	0.8 (.0315)	B
ECQ-M4473□ZB	.047		20.0 (.788)	9.0 (.354)	21.5 (.848)	10.0 (.394)	0.8 (.0315)	B
ECQ-M4563□ZB	.056		23.0 (.907)	8.5 (.335)	20.5 (.808)	12.5 (.492)	0.8 (.0315)	B
ECQ-M4683□ZB	.068		23.0 (.907)	9.0 (.354)	21.5 (.848)	12.5 (.492)	0.8 (.0315)	B
ECQ-M4823□ZB	.082		23.0 (.907)	9.5 (.374)	22.0 (.867)	12.5 (.492)	0.8 (.0315)	B
ECQ-M4104□ZB	.1		23.0 (.907)	10.0 (.394)	24.0 (.946)	12.5 (.492)	0.8 (.0315)	B
ECQ-M4124□ZB	.12		23.0 (.907)	11.0 (.433)	25.0 (.985)	12.5 (.492)	0.8 (.0315)	B
ECQ-M4154□ZB	.15		23.0 (.907)	12.5 (.492)	26.0 (1.022)	12.5 (.492)	0.8 (.0315)	B
ECQ-M4184□ZB	.18		28.0 (1.102)	12.5 (.492)	26.5 (1.042)	15.0 (.592)	0.8 (.0315)	B
ECQ-M4224□ZB	.22		28.0 (1.102)	14.0 (.552)	28.0 (1.102)	15.0 (.592)	0.8 (.0315)	B
ECQ-M4274□ZB	.27		28.0 (1.102)	15.5 (.611)	29.5 (1.161)	15.0 (.592)	0.8 (.0315)	B
ECQ-M4334□ZB	.33		28.0 (1.102)	17.5 (.690)	31.5 (1.240)	15.0 (.592)	0.8 (.0315)	B
ECQ-M4394□ZB	.39		34.0 (1.340)	16.0 (.630)	31.5 (1.240)	17.5 (.690)	0.8 (.0315)	B
ECQ-M4474□ZB	.47		34.0 (1.340)	17.5 (.690)	33.0 (1.300)	17.5 (.690)	0.8 (.0315)	B

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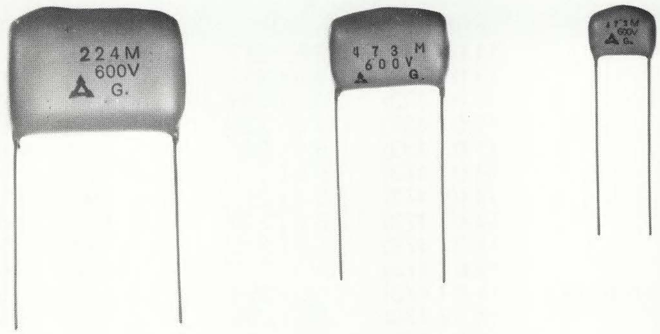
Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolerance	A	B	H	S	dφ	Type
ECQ-M6102□ZB	.001		13.0 (.512)	6.0 (.236)	14.0 (.552)	7.5 (.295)	0.6 (.0236)	D
ECQ-M6122□ZB	.0012		13.0 (.512)	6.5 (.256)	14.5 (.572)	7.5 (.295)	0.6 (.0236)	D
ECQ-M6152□ZB	.0015		13.0 (.512)	6.5 (.256)	14.5 (.572)	7.5 (.295)	0.6 (.0236)	D
ECQ-M6182□ZB	.0018		15.0 (.592)	6.0 (.236)	14.0 (.552)	10.0 (.394)	0.6 (.0236)	D
ECQ-M6222□ZB	.0022		15.0 (.592)	6.0 (.236)	14.0 (.552)	10.0 (.394)	0.6 (.0236)	D
ECQ-M6272□ZB	.0027		15.0 (.592)	6.5 (.256)	14.0 (.552)	10.0 (.394)	0.6 (.0236)	D
ECQ-M6332□ZB	.0033		15.0 (.592)	6.5 (.256)	14.0 (.552)	10.0 (.394)	0.6 (.0236)	D
ECQ-M6392□ZB	.0039		15.0 (.592)	6.5 (.256)	16.0 (.630)	10.0 (.394)	0.6 (.0236)	D
ECQ-M6472□ZB	.0047		15.0 (.592)	6.5 (.256)	16.0 (.630)	10.0 (.394)	0.6 (.0236)	D
ECQ-M6562□ZB	.0056		15.0 (.592)	7.5 (.295)	17.0 (.670)	10.0 (.394)	0.6 (.0236)	D
ECQ-M6682□ZB	.0068	±10%(K)	15.0 (.592)	7.5 (.295)	17.0 (.670)	10.0 (.394)	0.6 (.0236)	D
ECQ-M6822□ZB	.0082		20.0 (.788)	6.0 (.236)	17.0 (.670)	10.0 (.394)	0.6 (.0236)	B
ECQ-M6103□ZB	.01		20.0 (.788)	6.0 (.236)	17.0 (.670)	10.0 (.394)	0.6 (.0236)	B
ECQ-M6123□ZB	.012		20.0 (.788)	7.0 (.276)	18.0 (.710)	10.0 (.394)	0.6 (.0236)	B
ECQ-M6153□ZB	.015		20.0 (.788)	7.0 (.276)	18.0 (.710)	10.0 (.394)	0.6 (.0236)	B
ECQ-M6183□ZB	.018		20.0 (.788)	8.5 (.335)	19.0 (.749)	10.0 (.394)	0.6 (.0236)	B
ECQ-M6223□ZB	.022		20.0 (.788)	8.5 (.335)	19.0 (.749)	10.0 (.394)	0.6 (.0236)	B
ECQ-M6273□ZB	.027	±20%(M)	25.0 (.1005)	8.0 (.315)	20.0 (.788)	12.5 (.492)	0.7 (.0296)	B
ECQ-M6333□ZB	.033		25.0 (1.005)	8.0 (.315)	20.0 (.788)	12.5 (.492)	0.7 (.0296)	B
ECQ-M6393□ZB	.039		25.0 (1.005)	9.5 (.374)	21.5 (.848)	12.5 (.492)	0.7 (.0296)	B
ECQ-M6473□ZB	.047		25.0 (1.005)	9.5 (.374)	21.5 (.848)	12.5 (.492)	0.7 (.0296)	B
ECQ-M6563□ZB	.056		25.0 (1.005)	12.5 (.492)	24.0 (.946)	12.5 (.492)	0.7 (.0296)	B
ECQ-M6683□ZB	.068		25.0 (1.005)	12.5 (.492)	24.0 (.946)	12.5 (.492)	0.7 (.0296)	B
ECQ-M6823□ZB	.082		25.0 (1.005)	12.5 (.492)	27.5 (1.083)	12.5 (.492)	0.8 (.0315)	B
ECQ-M6104□ZB	.1		25.0 (1.005)	12.5 (.492)	27.5 (.1083)	12.5 (.492)	0.8 (.0315)	B

Type ECQ-B (Z), ECQ-B (ZB) (Radial Lead)



Electrical Specifications

1. Rated Voltage .... 600 V.D.C.
2. Capacitance .... See the Standard Products Table on pp. VI-15, 16.
3. Capacitance Tolerance .... ±10%(K), ±20%(M)
4. Insulation Resistance .... ≧10,000MΩ
5. Dissipation Factor .... <1.0% at 1kHz
6. Withstand Voltage .... Rated Voltage x 2.5 (1 sec.) max.
7. Operating Temperature......... –25°C~+85°C

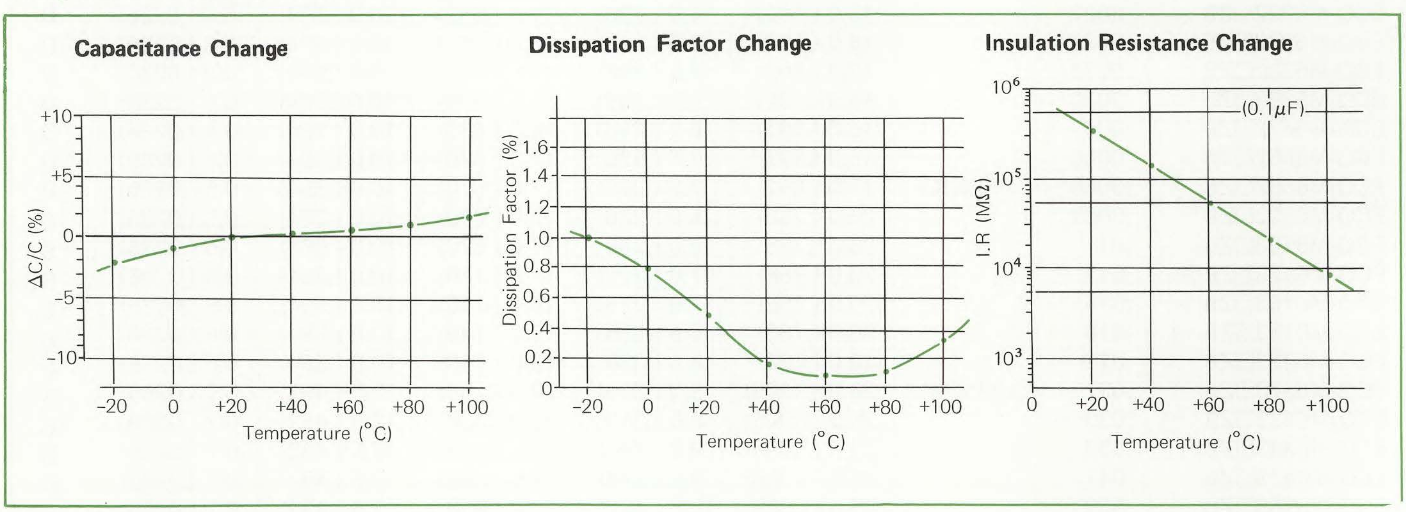
Features

1. The capacitor consists of polyester film (=dielectric), aluminum foil (=electrode) and epoxy resin coating.
2. Marking comprises capacitance, capacitance tolerance, rated voltage and manufactur's name or symbol.
3. Non-inductive and Non-combustible.

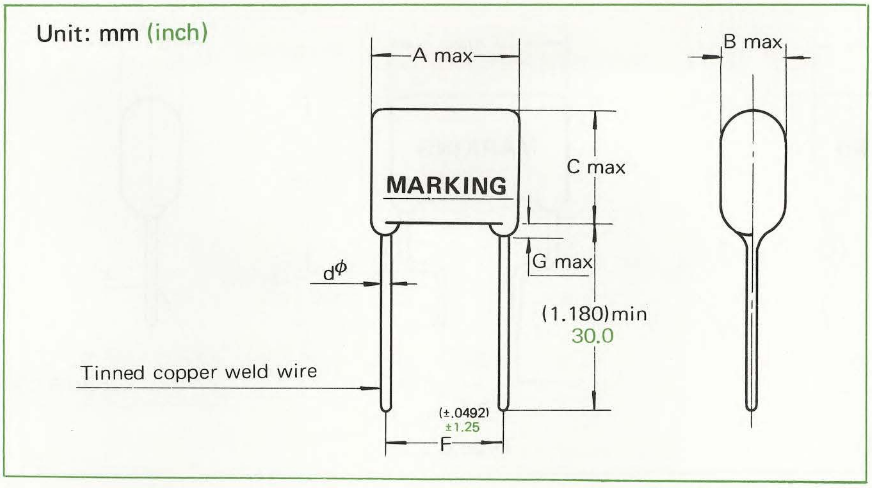
Application

(1) Communication Equipment (2) TV, Radio (3) Transistorized Printed Circuit

Temperature Characteristics



ECQ-B(Z) Standard Products Table

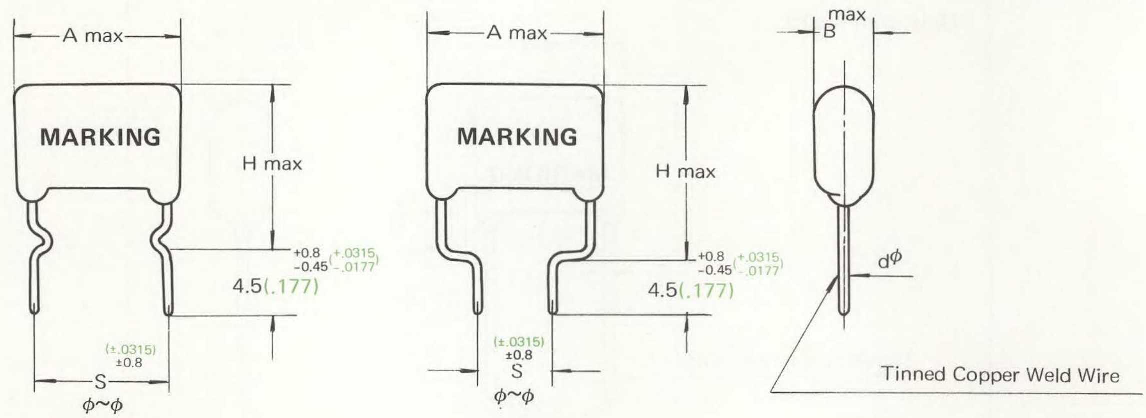


600V.D.C.

Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolerance	A	B	C	F	G	dφ
ECQ-B6102□Z	.001		14.5 (.571)	8.5 (.335)	13.0 (.512)	7.5 (.295)	3.0 (.118)	0.6 (.0236)
ECQ-B6122□Z	.0012		14.5 (.571)	9.0 (.354)	13.5 (.532)	7.5 (.295)	3.0 (.118)	0.6 (.0236)
ECQ-B6152□Z	.0015		14.5 (.571)	9.0 (.354)	13.5 (.532)	7.5 (.295)	3.0 (.118)	0.6 (.0236)
ECQ-B6182□Z	.0018		16.5 (.650)	8.5 (.335)	13.0 (.512)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-B6222□Z	.0022		16.5 (.650)	8.5 (.335)	13.0 (.512)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-B6272□Z	.0027		16.5 (.650)	9.0 (.354)	13.0 (.512)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-B6332□Z	.0033		16.5 (.650)	9.0 (.354)	13.0 (.512)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-B6392□Z	.0039		16.5 (.650)	9.0 (.354)	15.0 (.592)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-B6472□Z	.0047		16.5 (.650)	9.0 (.354)	15.0 (.592)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-B6562□Z	.0056		16.5 (.650)	10.0 (.394)	16.0 (.630)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-B6682□Z	.0068	±10%(K)	16.5 (.650)	10.0 (.394)	16.0 (.630)	9.5 (.374)	3.0 (.118)	0.6 (.0236)
ECQ-B6822□Z	.0082		21.5 (.847)	8.5 (.335)	16.0 (.630)	14.5 (.572)	3.0 (.118)	0.6 (.0236)
ECQ-B6103□Z	.01		21.5 (.847)	8.5 (.335)	16.0 (.630)	14.5 (.572)	3.0 (.118)	0.6 (.0236)
ECQ-B6123□Z	.012		21.5 (.847)	9.5 (.374)	17.0 (.670)	14.5 (.572)	3.0 (.118)	0.6 (.0236)
ECQ-B6153□Z	.015		21.5 (.847)	9.5 (.374)	17.0 (.670)	14.5 (.572)	3.0 (.118)	0.6 (.0236)
ECQ-B6183□Z	.018		21.5 (.847)	9.5 (.433)	18.0 (.710)	14.5 (.572)	3.0 (.118)	0.6 (.0236)
ECQ-B6223□Z	.022		21.5 (.847)	9.5 (.433)	18.0 (.710)	14.5 (.572)	3.0 (.118)	0.6 (.0236)
ECQ-B6273□Z	.027	±20%(M)	27.5 (1.084)	10.5 (.414)	18.0 (.710)	19.5 (.768)	4.0 (.157)	0.7 (.0276)
ECQ-B6333□Z	.033		27.5 (1.084)	10.5 (.414)	18.0 (.710)	19.5 (.768)	4.0 (.157)	0.7 (.0276)
ECQ-B6393□Z	.039		27.5 (1.084)	12.0 (.473)	19.5 (.768)	19.5 (.768)	4.0 (.157)	0.7 (.0276)
ECQ-B6473□Z	.047		27.5 (1.084)	12.0 (.473)	19.5 (.768)	19.5 (.768)	4.0 (.157)	0.7 (.0276)
ECQ-B6563□Z	.056		27.5 (1.084)	15.5 (.611)	22.5 (.887)	19.5 (.768)	4.0 (.157)	0.7 (.0276)
ECQ-B6683□Z	.068		27.5 (1.084)	15.5 (.611)	22.5 (.887)	19.5 (.768)	4.0 (.157)	0.7 (.0276)
ECQ-B6823□Z	.082		27.5 (1.084)	15.5 (.611)	26.0 (1.022)	19.5 (.768)	4.0 (.157)	0.8 (.0315)
ECQ-B6104□Z	.1		27.5 (1.084)	15.5 (.611)	26.0 (1.022)	19.5 (.768)	4.0 (.157)	0.8 (.0315)
ECQ-B6124□Z	.12		39.0 (1.537)	14.0 (.552)	26.0 (1.022)	33.0 (1.300)	4.0 (.157)	0.8 (.0315)
ECQ-B6154□Z	.15		39.0 (1.537)	14.0 (.552)	26.0 (1.022)	33.0 (1.300)	4.0 (.157)	0.8 (.0315)
ECQ-B6184□Z	.18		39.0 (1.537)	16.5 (.650)	28.5 (1.122)	33.0 (1.300)	4.0 (.157)	0.8 (.0315)
ECQ-B6224□Z	.22		39.0 (1.537)	16.5 (.650)	28.5 (1.122)	33.0 (.1300)	4.0 (.157)	0.8 (.0315)

ECQ-B(ZB) Standard Products Table

Unit: mm(inch)

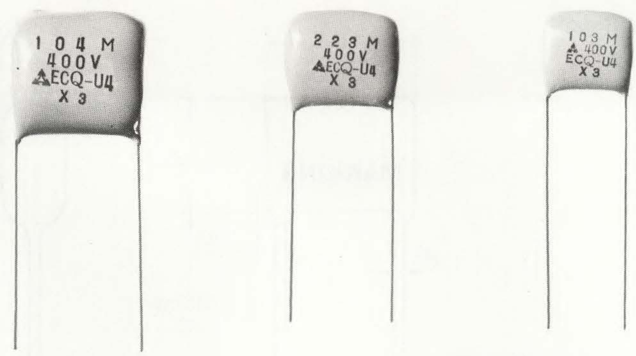


Type D   Type B

600 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolerance	A	B	H	S	dφ	Type
ECQ-B6102□ZB	.001		14.5 (.571)	8.5 (.335)	17.0 (.669)	7.5 (.295)	0.6 (.0236)	D
ECQ-B6122□ZB	.0012		14.5 (.571)	9.0 (.354)	17.5 (.689)	7.5 (.295)	0.6 (.0236)	D
ECQ-B6152□ZB	.0015		14.5 (.571)	9.0 (.354)	17.5 (.689)	7.5 (.295)	0.6 (.0236)	D
ECQ-B6182□ZB	.0018		16.5 (.650)	8.5 (.335)	17.0 (.669)	10.0 (.394)	0.6 (.0236)	D
ECQ-B6222□ZB	.0022		16.5 (.650)	8.5 (.335)	17.0 (.669)	10.0 (.394)	0.6 (.0236)	D
ECQ-B6272□ZB	.0027		16.5 (.650)	9.0 (.354)	17.0 (.669)	10.0 (.394)	0.6 (.0236)	D
ECQ-B6332□ZB	.0033		16.5 (.650)	9.0 (.354)	17.0 (.669)	10.0 (.394)	0.6 (.0236)	D
ECQ-B6392□ZB	.0039		16.5 (.650)	9.0 (.354)	19.0 (.748)	10.0 (.394)	0.6 (.0236)	D
ECQ-B6472□ZB	.0047		16.5 (.650)	9.0 (.354)	19.0 (.748)	10.0 (.394)	0.6 (.0236)	D
ECQ-B6562□ZB	.0056		16.5 (.650)	10.0 (.394)	20.0 (.787)	10.0 (.394)	0.6 (.0236)	D
ECQ-B6682□ZB	.0068	±10%(K)	16.5 (.650)	10.0 (.394)	20.0 (.787)	10.0 (.394)	0.6 (.0236)	D
ECQ-B6822□ZB	.0082		21.5 (.847)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)	B
ECQ-B6103□ZB	.01		21.5 (.847)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)	B
ECQ-B6123□ZB	.012		21.5 (.847)	9.5 (.374)	21.0 (.827)	10.0 (.394)	0.6 (.0236)	B
ECQ-B6153□ZB	.015		21.5 (.847)	9.5 (.374)	21.0 (.827)	10.0 (.394)	0.6 (.0236)	B
ECQ-B6183□ZB	.018		21.5 (.847)	11.0 (.433)	22.0 (.866)	10.0 (.394)	0.6 (.0236)	B
ECQ-B6223□ZB	.022		21.5 (.847)	11.0 (.433)	22.0 (.866)	10.0 (.394)	0.6 (.0236)	B
ECQ-B6273□ZB	.027	±20%(M)	27.5 (1.084)	10.5 (.414)	23.0 (.906)	12.5 (.492)	0.7 (.0276)	B
ECQ-B6333□ZB	.033		27.5 (1.084)	10.5 (.414)	23.0 (.906)	12.5 (.492)	0.7 (.0276)	B
ECQ-B6393□ZB	.039		27.5 (1.084)	12.0 (.473)	24.5 (.965)	12.5 (.492)	0.7 (.0276)	B
ECQ-B6473□ZB	.047		27.5 (1.084)	12.0 (.473)	24.5 (.965)	12.5 (.492)	0.7 (.0276)	B
ECQ-B6563□ZB	.056		27.5 (1.084)	15.5 (.611)	27.0 (1.063)	12.5 (.492)	0.7 (.0276)	B
ECQ-B6683□ZB	.068		27.5 (1.084)	15.5 (.611)	27.0 (1.063)	12.5 (.492)	0.7 (.0276)	B
ECQ-B6823□ZB	.082		27.5 (1.084)	15.5 (.611)	30.5 (1.201)	12.5 (.492)	0.8 (.0315)	B
ECQ-B6104□ZB	.1		27.5 (1.084)	15.5 (.611)	30.5 (1.201)	12.5 (.492)	0.8 (.0315)	B
ECQ-B6124□ZB	.12		39.0 (1.537)	14.0 (.552)	30.5 (1.201)	20.0 (.787)	0.8 (.0315)	B
ECQ-B6154□ZB	.15		39.0 (1.537)	14.0 (.552)	30.5 (1.201)	20.0 (.787)	0.8 (.0315)	B
ECQ-B6184□ZB	.18		39.0 (1.537)	16.5 (.650)	33.0 (1.299)	20.0 (.787)	0.8 (.0315)	B
ECQ-B6224□ZB	.22		39.0 (1.537)	16.5 (.650)	33.0 (.1299)	20.0 (.787)	0.8 (.0315)	B

UL-Listed Type ECQ-U4 (Z) (Radial Lead)



Electrical Specifications

1. Rated Voltage .... 400 V.D.C.
2. Capacitance .... See the Standard Products Table on p.VI-18.
3. Capacitance Tolerance .... ±10%(K), ±20%(M)
4. Insulation Resistance........... ≧3,000MΩ
5. Dissipation Factor .... <1.0% at 1kHz
6. Withstand Voltage .... 900 V.A.C. (1 min.) max
7. Operating Temperature......... –25°C~+85°C

Features

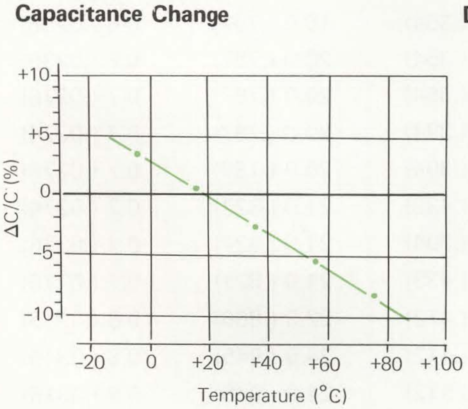
1. The capacitor consists of polyester film (=dielectric), aluminum foil (=electrode) and epoxy resin coating.
2. Marking comprises capacitance, capacitance tolerance, rated voltage, manufacturer's name or symbol and type name
3. Non-inductive and Non-combustible.
4. Approved by UL.

Application

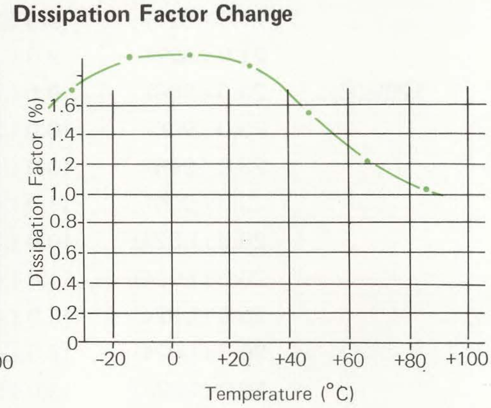
(1) Line-by-pass (Antenna Coupling)

Temperature Characteristics

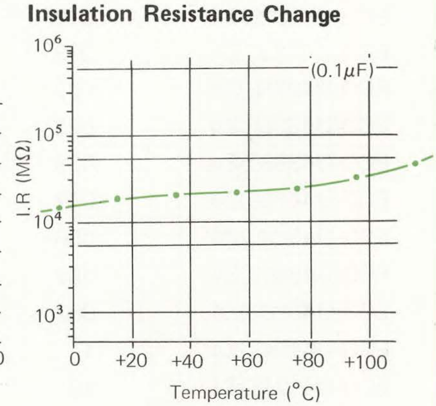
Capacitance Change



Dissipation Factor Change

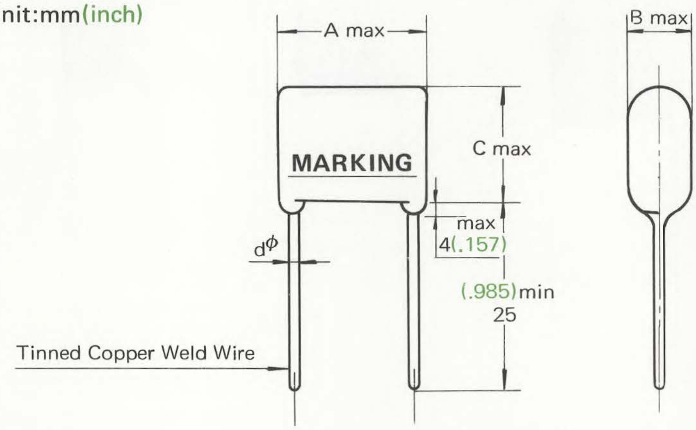


Insulation Resistance Change



ECQ-U4(Z) Standard Products Table

Unit:mm(inch)

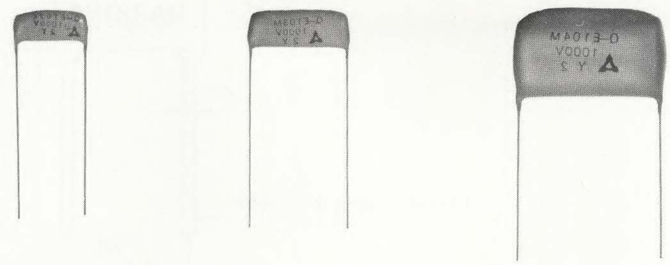


400V.D.C.

Part No.	Capacitance		Dimensions mm(inch)			
	Rated (μF)	Tolerance	A	B	C	dφ
ECQ-U4102□Z4	.001		16.0 (.630)	8.0 (.315)	15.0 (.591)	0.6 (.0236)
ECQ-U4122□Z4	.0012		16.0 (.630)	8.0 (.315)	15.0 (.591)	0.6 (.0236)
ECQ-U4152□Z4	.0015		16.0 (.630)	8.0 (.315)	16.0 (.630)	0.6 (.0236)
ECQ-U4182□Z4	.0018		16.0 (.630)	9.0 (.354)	16.0 (.630)	0.6 (.0236)
ECQ-U4222□Z4	.0022		16.0 (.630)	9.0 (.354)	16.0 (.630)	0.6 (.0236)
ECQ-U4272□Z4	.0027		16.0 (.630)	9.0 (.354)	16.0 (.630)	0.6 (.0236)
ECQ-U4332□Z4	.0033		16.0 (.630)	9.0 (.354)	16.0 (.630)	0.6 (.0236)
ECQ-U4392□Z4	.0039		16.0 (.630)	9.0 (.354)	16.0 (.630)	0.6 (.0236)
ECQ-U4472□Z4	.0047		18.0 (.709)	9.0 (.354)	16.0 (.630)	0.6 (.0236)
ECQ-U4562□Z4	.0056		18.0 (.709)	9.0 (.354)	16.0 (.630)	0.6 (.0236)
ECQ-U4682□Z4	.0068	±10%(K)	18.0 (.709)	9.0 (.354)	16.0 (.630)	0.6 (.0236)
ECQ-U4822□Z4	.0082		18.0 (.709)	9.0 (.354)	17.0 (.669)	0.6 (.0236)
ECQ-U4103□Z4	.01		18.0 (.709)	9.0 (.354)	17.0 (.669)	0.6 (.0236)
ECQ-U4123□Z4	.012		21.0 (.827)	9.0 (.354)	17.0 (.669)	0.6 (.0236)
ECQ-U4153□Z4	.015		21.0 (.827)	9.0 (.354)	18.0 (.709)	0.6 (.0236)
ECQ-U4183□Z4	.018		21.0 (.827)	9.0 (.354)	18.0 (.709)	0.6 (.0236)
ECQ-U4223□Z4	.022		21.0 (.827)	9.0 (.354)	20.0 (.787)	0.6 (.0236)
ECQ-U4273□Z4	.027	±20%(M)	23.0 (.906)	9.0 (.354)	20.0 (.787)	0.7 (.0276)
ECQ-U4333□Z4	.033		23.0 (.906)	10.0 (.394)	20.0 (.787)	0.7 (.0276)
ECQ-U4393□Z4	.039		23.0 (.906)	10.0 (.394)	20.0 (.787)	0.7 (.0276)
ECQ-U4473□Z4	.047		23.0 (.906)	11.0 (.433)	21.0 (.827)	0.7 (.0276)
ECQ-U4563□Z4	.056		26.0 (1.024)	10.0 (.394)	21.0 (.827)	0.7 (.0276)
ECQ-U4683□Z4	.068		26.0 (1.024)	11.0 (.433)	21.0 (.827)	0.7 (.0276)
ECQ-U4823□Z4	.082		26.0 (1.024)	12.0 (.472)	22.0 (.866)	0.8 (.0315)
ECQ-U4104□Z4	.1		26.0 (1.024)	12.0 (.472)	24.0 (.945)	0.8 (.0315)
ECQ-U4124□Z4	.12		26.0 (1.024)	13.0 (.512)	24.0 (.945)	0.8 (.0315)
ECQ-U4154□Z4	.15		26.0 (1.024)	14.0 (.551)	25.0 (.984)	0.8 (.0315)
ECQ-U4184□Z4	.18		30.0 (1.181)	15.0 (.591)	27.0 (1.06)	0.8 (.0315)
ECQ-U4224□Z4	.22		30.0 (1.181)	17.0 (.669)	28.0 (1.102)	0.8 (.0315)

METALIZED POLYESTER CAPACITORS

Type ECQ-E (Z), ECQ-E (ZB)(Radial Lead)



Electrical Specifications

1. Rated Voltage .... 250 V.D.C., 400 D.V.C., 630 V.D.C.
2. Capacitance .... See the Standard Product Table on pp. VI-20~23.
3. Capacitance Tolerance .... ±10%(K), ±20%(M)
4. Insulation Resistance .... Less than 0.33μF >9,000MΩ
   More than 0.33μ ≧3,000MΩ·μF
5. Dissipation Factor .... <1.0% at 1kHz
6. Withstand Voltage .... Rated Voltage x 1.5 (1 min.)-max.
7. Operating Temperature .... –25°C~+85°C

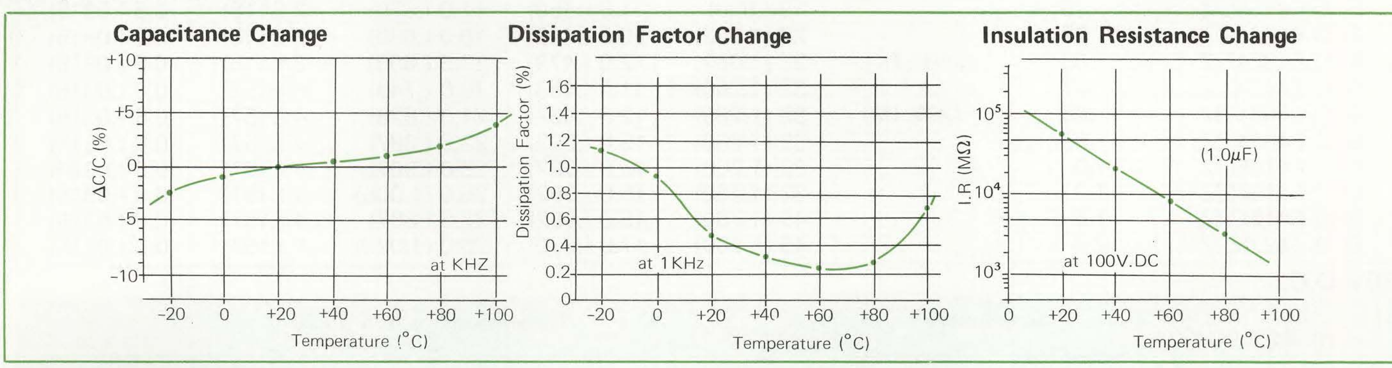
Features

1. The capacitor consists of metalized polyester film (=dielectric), and epoxy resin coating.
2. Marking comprises capacitance, capacitance tolerance, rated voltage and manufacturer's name or symbol.
3. Non-inductive and non-combustible.
4. The capacitor is very compact.

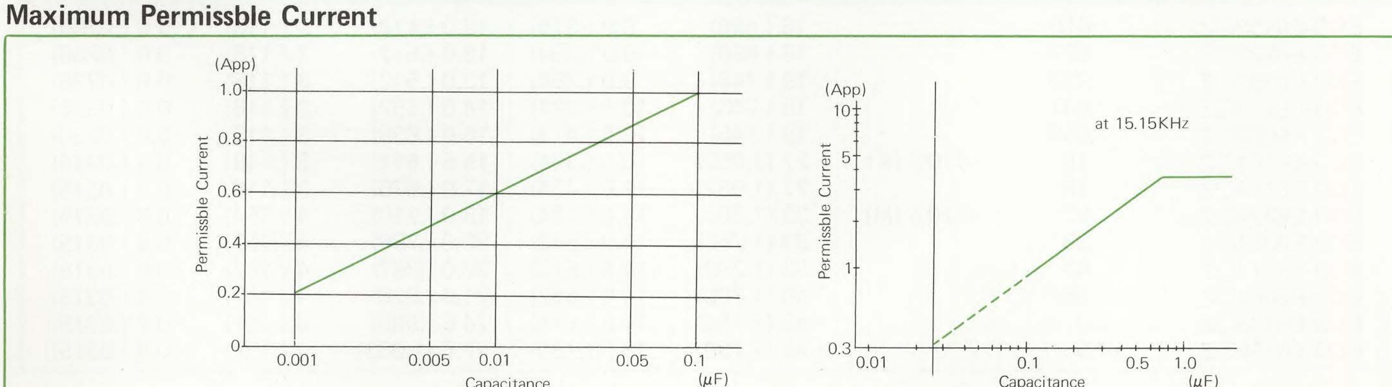
Application

(1) General communication equipment

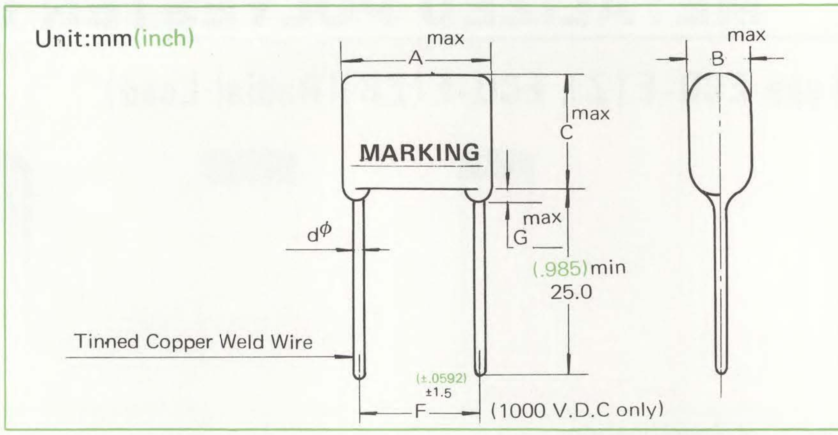
Temperature Characteristics



Maximum Permissble Current



ECQ-E(Z) Standard Products Table



250V.D.C.

Part No.	Capacitance		Dimensions mm (inch)				
	Rated (μF)	Tolerance	A	B	C	G	dφ
ECQ-E2683□Z	.068		16 (.690)	8.5 (.335)	12.5 (.492)	3 (.118)	0.6 (.0236)
ECQ-E2104□Z	.10		16 (.690)	9.5 (.374)	13.5 (.532)	3 (.118)	0.6 (.0236)
ECQ-E2154□Z	.15		16 (.690)	10.0 (.394)	15.5 (.611)	3 (.118)	0.6 (.0236)
ECQ-E2224□Z	.22		19 (.748)	9.5 (.374)	15.5 (.611)	3 (.118)	0.6 (.0236)
ECQ-E2334□Z	.33	±10% (K)	19 (.748)	11.0 (.434)	17.0 (.670)	3 (.118)	0.8 (.0315)
ECQ-E2474□Z	.47		27 (1.062)	10.0 (.394)	16.0 (.630)	3 (.118)	0.8 (.0315)
ECQ-E2684□Z	.68	±20% (M)	27 (1.062)	11.5 (.453)	17.0 (.670)	3 (.118)	0.8 (.0315)
ECQ-E2105□Z	1.0		32 (1.260)	11.5 (.453)	18.5 (.730)	4 (.157)	0.8 (.0315)
ECQ-E2125□Z	1.2		32 (1.260)	12.0 (.473)	19.5 (.768)	4 (.157)	0.8 (.0315)
ECQ-E2155□Z	1.5		32 (1.260)	13.0 (.512)	20.5 (.808)	4 (.157)	0.8 (.0315)
ECQ-E2205□Z	2.0		32 (1.260)	12.5 (.492)	24.5 (.965)	4 (.157)	0.8 (.0315)
ECQ-E2225□Z	2.2		32 (1.260)	15.0 (.592)	24.0 (.946)	4 (.157)	0.8 (.0315)
ECQ-E2335□Z	3.3		45 (1.780)	14.5 (.572)	23.0 (.907)	4 (.157)	0.8 (.0315)
ECQ-E2475□Z	4.7		45 (1.780)	17.0 (.670)	25.5 (1.005)	4 (.157)	0.8 (.0315)

400V.D.C.

Part No.	Capacitance		Dimensions mm (inch)				
	Rated (μF)	Tolerance	A	B	C	G	dφ
ECQ-E4683□Z	.068		19 (.690)	9.5 (.374)	13.5 (.532)	3 (.118)	0.6 (.0236)
ECQ-E4104□Z	.10		19 (.690)	10.0 (.394)	15.5 (.611)	3 (.118)	0.6 (.0236)
ECQ-E4154□Z	.15		19 (.690)	11.5 (.453)	17.0 (.670)	3 (.118)	0.8 (.0315)
ECQ-E4224□Z	.22		27 (1.062)	10.5 (.413)	16.0 (.630)	3 (.118)	0.8 (.0315)
ECQ-E4334□Z	.33	±10% (K)	27 (1.062)	12.0 (.473)	17.5 (.690)	3 (.118)	0.8 (.0315)
ECQ-E4474□Z	.47		32 (1.260)	11.5 (.453)	19.0 (.748)	4 (.157)	0.8 (.0315)
ECQ-E4684□Z	.68	±20% (M)	32 (1.260)	12.5 (.492)	21.0 (.828)	4 (.157)	0.8 (.0315)
ECQ-E4884□Z	.88		32 (1.260)	15.0 (.592)	22.5 (.887)	4 (.157)	0.8 (.0315)
ECQ-E4105□Z	1.0		32 (1.260)	15.0 (.592)	23.0 (.907)	4 (.157)	0.8 (.0315)
ECQ-E4125□Z	1.2		32 (1.260)	15.0 (.592)	25.5 (1.005)	4 (.157)	0.8 (.0315)
ECQ-E4155□Z	1.5		45 (1.780)	15.0 (.592)	22.5 (.887)	4 (.157)	0.8 (.0315)
ECQ-E4225□Z	2.2		45 (1.780)	17.0 (.670)	26.0 (1.022)	4 (.157)	0.8 (.0315)

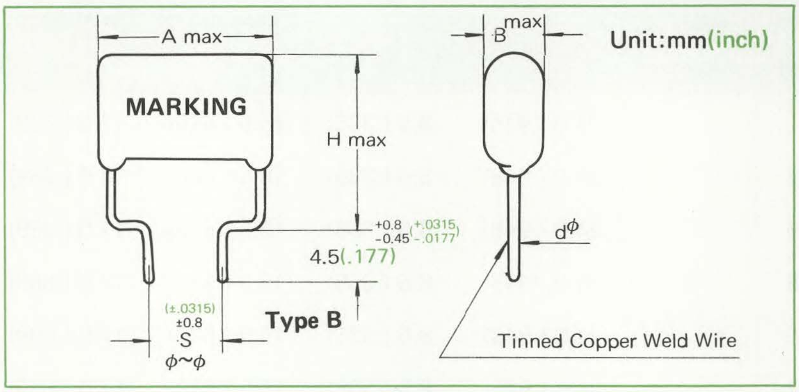
630V.D.C.

Part No.	Capacitance		Dimensions mm (inch)				
	Rated (μF)	Tolerance	A	B	C	G	dφ
ECQ-E6153□Z	.015		16 (.690)	8.0 (.315)	12.0 (.473)	3 (.118)	0.6 (.0236)
ECQ-E6223□Z	.022		16 (.690)	9.0 (.354)	13.0 (.512)	3 (.118)	0.6 (.0236)
ECQ-E6333□Z	.033		19 (.748)	9.0 (.354)	13.0 (.512)	3 (.118)	0.6 (.0236)
ECQ-E6473□Z	.047		19 (.748)	10.0 (.394)	14.0 (.552)	3 (.118)	0.6 (.0236)
ECQ-E6683□Z	.068		19 (.748)	10.5 (.413)	16.0 (.630)	3 (.118)	0.6 (.0236)
ECQ-E6104□Z	.10	±10% (K)	27 (1.062)	10.0 (.394)	15.5 (.611)	3 (.118)	0.8 (.0315)
ECQ-E6154□Z	.15		27 (1.062)	11.0 (.434)	17.0 (.670)	3 (.118)	0.8 (.0315)
ECQ-E6224□Z	.22	±20% (M)	32 (1.260)	11.0 (.434)	18.0 (.710)	4 (.157)	0.8 (.0315)
ECQ-E6334□Z	.33		32 (1.260)	13.0 (.512)	20.0 (.788)	4 (.157)	0.8 (.0315)
ECQ-E6474□Z	.47		32 (1.260)	14.5 (.572)	22.0 (.867)	4 (.157)	0.8 (.0315)
ECQ-E6684□Z	.68		45 (1.780)	14.0 (.552)	21.0 (.828)	4 (.157)	0.8 (.0315)
ECQ-E6105□Z	1.0		45 (1.780)	15.5 (.611)	24.5 (.965)	4 (.157)	0.8 (.0315)
ECQ-E6155□Z	1.5		45 (1.780)	18.5 (.730)	27.5 (1.083)	4 (.157)	0.8 (.0315)

1000 V.D.C

Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolernace	A	B	C	F	G	dφ
ECQ-E10102□Z	.001		24.0 (.945)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.0236)
ECQ-E10122□Z	.0012		24.0 (.945)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.0236)
ECQ-E10152□Z	.0015		24.0 (.945)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.0236)
ECQ-E10182□Z	.0018		24.0 (.945)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.0236)
ECQ-E10222□Z	.0022		24.0 (.945)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.0236)
ECQ-E10272□Z	.0027		24.0 (.945)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.0236)
ECQ-E10332□Z	.0033		24.0 (.945)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.0236)
ECQ-E10392□Z	.0039		24.0 (.945)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.0236)
ECQ-E10472□Z	.0047		24.0 (.945)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.0236)
ECQ-E10562□Z	.0056		24.0 (.945)	9.0 (.354)	16.0 (.630)	17.0 (.669)	3.0 (.118)	0.6 (.0236)
ECQ-E10682□Z	.0068	±10%(K)	24.0 (.945)	9.0 (.354)	16.5 (.650)	17.0 (.669)	3.0 (.118)	0.6 (.0236)
ECQ-E10822□Z	.0082		30.0 (1.181)	8.5 (.335)	15.5 (.610)	23.0 (.906)	3.0 (.118)	0.6 (.0236)
ECQ-E10103□Z	.01		30.0 (1.181)	8.5 (.335)	15.5 (.610)	23.0 (.906)	3.0 (.118)	0.6 (.0236)
ECQ-E10123□Z	.012		30.0 (1.181)	9.0 (.354)	16.5 (.650)	23.0 (.906)	3.0 (.118)	0.6 (.0236)
ECQ-E10153□Z	.015		30.0 (1.181)	9.0 (.354)	16.5 (.650)	23.0 (.906)	3.0 (.118)	0.6 (.0236)
ECQ-E10183□Z	.018		30.0 (1.181)	10.0 (.394)	17.5 (.689)	23.0 (.906)	3.0 (.118)	0.6 (.0236)
ECQ-E10223□Z	.022		30.0 (1.181)	10.0 (.394)	17.5 (.689)	23.0 (.906)	3.0 (.118)	0.6 (.0236)
ECQ-E10273□Z	.027	±20%(M)	36.0 (1.417)	10.5 (.413)	17.5 (.689)	28.0 (1.102)	4.0 (.157)	0.7 (.0276)
ECQ-E10333□Z	.033		36.0 (1.417)	10.5 (.413)	17.5 (.689)	28.0 (1.102)	4.0 (.157)	0.7 (.0276)
ECQ-E10393□Z	.039		36.0 (1.417)	11.0 (.433)	19.5 (.768)	28.0 (1.102)	4.0 (.157)	0.7 (.0276)
ECQ-E10473□Z	.047		36.0 (1.417)	11.0 (.433)	19.5 (.768)	28.0 (1.102)	4.0 (.157)	0.7 (.0276)
ECQ-E10563□Z	.056		40.0 (1.575)	11.5 (.453)	20.5 (.807)	32.0 (1.260)	4.0 (1.57)	0.8 (.0315)
ECQ-E10683□Z	.068		40.0 (1.575)	11.5 (.453)	20.5 (.807)	32.0 (1.260)	4.0 (1.57)	0.8 (.0315)
ECQ-E10823□Z	.082		40.0 (1.575)	13.0 (.512)	23.5 (.927)	32.0 (1.260)	4.0 (1.57)	0.8 (.0315)
ECQ-E10104□Z	.1		40.0 (1.575)	13.0 (.512)	23.5 (.927)	32.0 (1.260)	4.0 (1.57)	0.8 (.0315)

Type ECQ-E(ZB) Standard Products Table



250 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)				
	Rated (μF)	Tolerance	A	B	H	S	dϕ
ECQ-E2683□ZB	.068		16 (.630)	8.5 (.335)	17.5 (.690)	7.5 (.295)	0.6 (.0236)
ECQ-E2104□ZB	.1		16 (.630)	9.5 (.374)	18.5 (.730)	7.5 (.295)	0.6 (.0236)
ECQ-E2154□ZB	.15		16 (.630)	10.0 (.394)	20.5 (.808)	7.5 (.295)	0.6 (.0236)
ECQ-E2224□ZB	.22		19 (.748)	9.5 (.374)	20.5 (.808)	10.0 (.394)	0.6 (.0236)
ECQ-E2334□ZB	.33		19 (.748)	11.0 (.433)	23.0 (.907)	10.0 (.394)	0.8 (.0315)
ECQ-E2474□ZB	.47	±10% (K)	27 (1.063)	10.0 (.394)	22.0 (.867)	12.5 (.492)	0.8 (.0315)
ECQ-E2684□ZB	.68		27 (1.063)	11.5 (.453)	23.0 (.907)	12.5 (.492)	0.8 (.0315)
ECQ-E2105□ZB	1.0	±20% (M)	32 (1.260)	11.5 (.453)	24.5 (.965)	17.5 (.689)	0.8 (.0315)
ECQ-E2125□ZB	1.2		32 (1.260)	12.0 (.472)	25.5 (1.005)	17.5 (.689)	0.8 (.0315)
ECQ-E2155□ZB	1.5		32 (1.260)	13.0 (.512)	26.5 (1.042)	17.5 (.689)	0.8 (.0315)
ECQ-E2225□ZB	2.2		32 (1.260)	15.0 (.591)	30.5 (1.200)	17.5 (.689)	0.8 (.0315)
ECQ-E2335□ZB	3.3		45 (1.772)	14.5 (.571)	30.0 (1.182)	27.5 (1.083)	0.8 (.0315)
ECQ-E2475□ZB	4.7		45 (1.772)	17.0 (.669)	31.5 (1.240)	27.5 (1.083)	0.8 (.0315)

400 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)				
	Rated (μF)	Tolerance	A	B	H	S	dϕ
ECQ-E4683□ZB	.068		19 (.748)	9.5 (.374)	18.5 (.730)	10.0 (.394)	0.6 (.0236)
ECQ-E4104□ZB	.10		19 (.748)	10.0 (.394)	20.5 (.808)	10.0 (.394)	0.6 (.0236)
ECQ-E4154□ZB	.15		19 (.748)	11.5 (.453)	23.0 (.907)	10.0 (.394)	0.8 (.0315)
ECQ-E4224□ZB	.22		27 (1.063)	10.5 (.413)	22.0 (.867)	12.5 (.492)	0.8 (.0315)
ECQ-E4334□ZB	.33		27 (1.063)	12.0 (.472)	23.5 (.927)	12.5 (.492)	0.8 (.0315)
ECQ-E4474□ZB	.47	±10% (K)	32 (1.260)	11.5 (.453)	25.0 (.985)	17.5 (.689)	0.8 (.0315)
ECQ-E4684□ZB	.68		32 (1.260)	12.5 (.492)	27.0 (1.062)	17.5 (.689)	0.8 (.0315)
ECQ-E4884□ZB	.88	±20% (M)	32 (1.260)	15.0 (.591)	28.5 (1.122)	17.5 (.689)	0.8 (.0315)
ECQ-E4105□ZB	1.0		32 (1.260)	15.0 (.591)	29.0 (1.141)	17.5 (.689)	0.8 (.0315)
ECQ-E4125□ZB	1.2		32 (1.260)	15.0 (.591)	31.5 (1.240)	17.5 (.689)	0.8 (.0315)
ECQ-E4155□ZB	1.5		45 (1.772)	15.0 (.591)	28.5 (1.122)	27.5 (1.083)	0.8 (.0315)
ECQ-E4225□ZB	2.2		45 (1.772)	17.0 (.669)	32.0 (1.260)	27.5 (1.083)	0.8 (.0315)

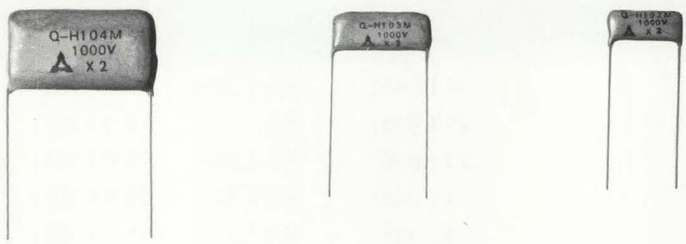
630 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)				
	Rated (μF)	Tolerance	A	B	H	S	dϕ
ECQ-E6153□ZB	.015		16 (.630)	8.0 (.315)	17.0 (.670)	7.5 (.295)	0.6 (.0236)
ECQ-E6223□ZB	.022		16 (.630)	9.0 (.354)	18.0 (.730)	7.5 (.295)	0.6 (.0236)
ECQ-E6333□ZB	.033		19 (.748)	9.0 (.354)	18.0 (.730)	10.0 (.394)	0.6 (.0236)
ECQ-E6473□ZB	.047		19 (.748)	10.0 (.394)	19.0 (.748)	10.0 (.394)	0.6 (.0236)
ECQ-E6683□ZB	.068		19 (.748)	10.5 (.413)	21.0 (.828)	10.0 (.394)	0.6 (.0236)
ECQ-E6104□ZB	.10	±10% (K)	27 (1.063)	10.0 (.394)	21.5 (.847)	12.5 (.492)	0.8 (.0315)
ECQ-E6154□ZB	.15		27 (1.063)	11.0 (.433)	23.0 (.907)	12.5 (.492)	0.8 (.0315)
ECQ-E6224□ZB	.22	±20% (M)	32 (1.260)	11.0 (.433)	24.0 (.946)	17.5 (.689)	0.8 (.0315)
ECQ-E6334□ZB	.33		32 (1.260)	13.0 (.512)	26.0 (1.023)	17.5 (.689)	0.8 (.0315)
ECQ-E6474□ZB	.47		32 (1.260)	14.5 (.571)	28.0 (1.102)	17.5 (.689)	0.8 (.0315)
ECQ-E6684□ZB	.68		45 (1.772)	14.0 (.551)	27.0 (1.062)	27.5 (1.083)	0.8 (.0315)
ECQ-E6105□ZB	1.0		45 (1.772)	15.5 (.610)	30.5 (1.200)	27.5 (1.083)	0.8 (.0315)
ECQ-E6155□ZB	1.5		45 (1.772)	18.5 (.728)	33.5 (1.320)	27.5 (1.083)	0.8 (.0315)

1000 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)				
	Rated (μ)	Tolerance	A	B	H	S	dϕ
ECQ-E10102□ZB	.001		24 (.945)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)
ECQ-E10122□ZB	.0012		24 (.945)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)
ECQ-E10152□ZB	.0015		24 (.945)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)
ECQ-E10182□ZB	.0018		24 (.945)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)
ECQ-E10222□ZB	.0022		24 (.945)	8.5 (.335)	20.0 (.787)	01.0 (.394)	0.6 (.0236)
ECQ-E10272□ZB	.0027		24 (.945)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)
ECQ-E10332□ZB	.0033		24 (.945)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)
ECQ-E10392□ZB	.0039		24 (.945)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)
ECQ-E10472□ZB	.0047	±10% (K)	24 (.945)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)
ECQ-E10562□ZB	.0056		24 (.945)	9.0 (.354)	20.5 (.807)	10.0 (.394)	0.6 (.0236)
ECQ-E10682□ZB	.0068	±20% (M)	24 (.945)	9.0 (.354)	21.0 (.827)	10.0 (.394)	0.6 (.0236)
ECQ-E10822□ZB	.0082		30 (1.181)	8.5 (.335)	20.0 (.787)	12.5 (.492)	0.6 (.0236)
ECQ-E10103□ZB	.01		30 (1.181)	8.5 (.335)	20.0 (.787)	12.5 (.492)	0.6 (.0236)
ECQ-E10123□ZB	.012		30 (1.181)	9.0 (.354)	20.5 (.807)	12.5 (.492)	0.6 (.0236)
ECQ-E10153□ZB	.015		30 (1.181)	9.0 (.354)	20.5 (.807)	12.5 (.492)	0.6 (.0236)
ECQ-E10183□ZB	.018		30 (1.181)	10.0 (.394)	21.5 (.846)	12.5 (.492)	0.6 (.0236)
ECQ-E10223□ZB	.022		30 (1.181)	10.0 (.394)	21.5 (.846)	12.5 (.492)	0.6 (.0236)
ECQ-E10273□ZB	.027		36 (1.417)	10.5 (.413)	22.0 (.866)	17.5 (.689)	0.7 (.0276)
ECQ-E10333□ZB	.033		36 (1.417)	10.5 (.413)	22.0 (.866)	17.5 (.689)	0.7 (.0276)
ECQ-E10393□ZB	.039		36 (1.417)	11.0 (.433)	24.0 (.945)	17.5 (.689)	0.7 (.0276)
ECQ-E10473□ZB	.047		36 (1.417)	11.0 (.433)	24.0 (.945)	17.5 (.689)	0.7 (.0276)
ECQ-E10563□ZB	.056		40 (1.575)	11.5 (.453)	26.0 (1.023)	22.5 (.887)	0.8 (.0315)
ECQ-E10683□ZB	.068		40 (1.575)	11.5 (.453)	26.0 (1.023)	22.5 (.887)	0.8 (.0315)
ECQ-E10823□ZB	.082		40 (1.575)	13.0 (.512)	28.0 (1.102)	22.5 (.887)	0.8 (.0315)
ECQ-E10104□ZB	.1		40 (1.575)	13.0 (.512)	28.0 (1.102)	22.5 (.887)	0.8 (.0315)

Type ECQ-H (Z) ECQ-H (ZB)(Radial Lead)



Electrical Specifications

1. Rated Voltage .... 250 V.D.C., 400 V.D.C., 630 V.D.C., 1,000 V.D.C.
2. Capacitance .... See the Standard Products Table on pp. VI-25~28.
3. Capacitance Tolerance.......... ±10%(K), ±20%(M)
4. Insulation Resistance........... Less than 0.33μF >9,000MΩ
   More than 0.33μF ≧3,000MΩ·μF
5. Dissipation Factor .... <1.0% at 1kHz
6. Withstand Voltage .... Rated Voltage x 1.5 (1 min.) max.
7. Operating Temperature .... −25°C~+85°C

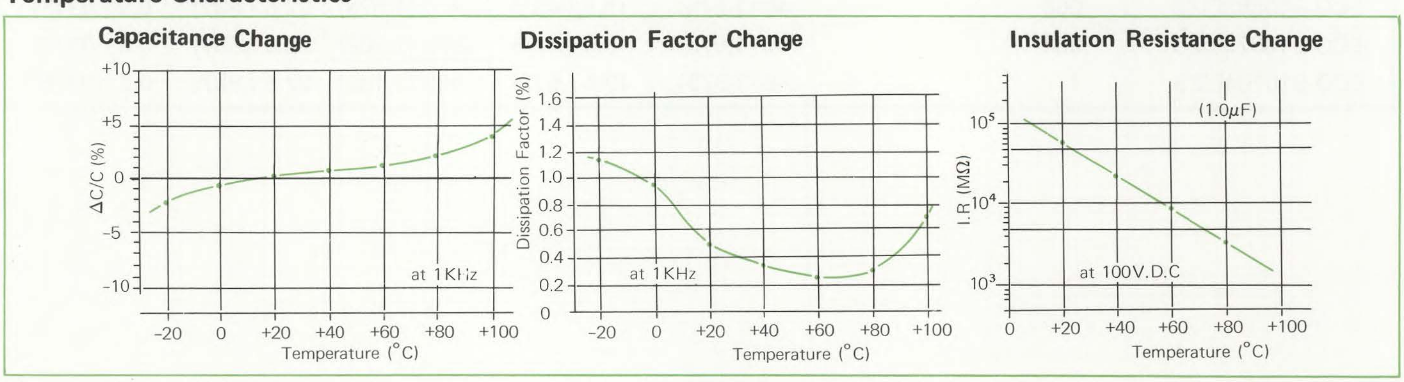
Features

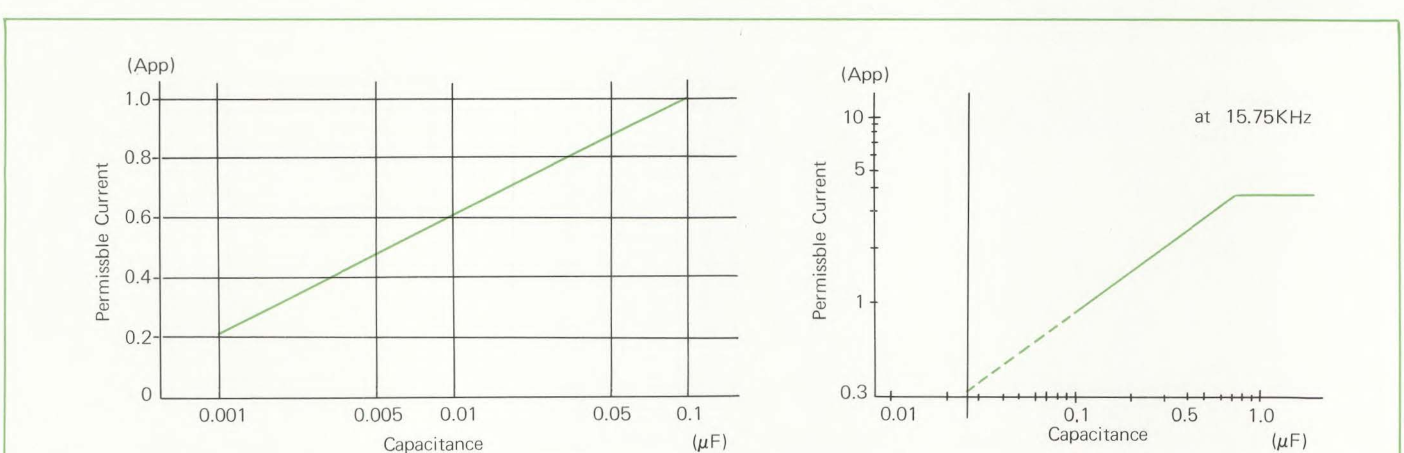
1. The capacitor consists of metalized polyester film (=dielectric), and Durez resin coated.
2. Marking comprises capacitance, capacitance tolerance, rated voltage and manufacturer's name or symbol.
3. Non-inductive and very compact.

Application

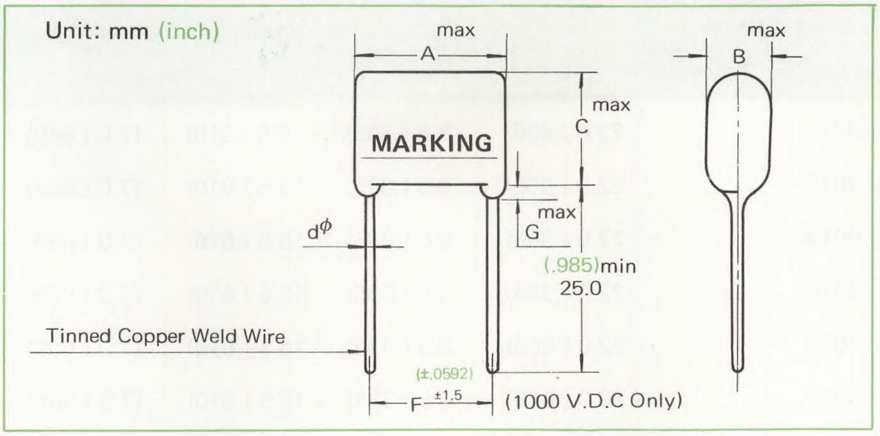
(1) General communication equipment

Temperature Characteristics





ECQ-H (Z) Standard Products Table



250 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)				
	Rated (μF)	Tolerance	A	B	C	G	dϕ
ECQ-H2683□Z	.068		16 (.630)	8.0 (.315)	12.0 (.472)	3 (.118)	0.6 (.0236)
ECQ-H2104□Z	.10		16 (.630)	9.0 (.354)	13.0 (.512)	3 (.118)	0.6 (.0236)
ECQ-H2154□Z	.15		16 (.630)	9.5 (.374)	15.0 (.591)	3 (.118)	0.6 (.0236)
ECQ-H2224□Z	.22		19 (.748)	9.0 (.354)	15.0 (.591)	3 (.118)	0.6 (.0236)
ECQ-H2334□Z	.33		19 (.748)	10.5 (.413)	16.5 (.650)	3 (.118)	0.8 (.0315)
ECQ-H2474□Z	.47	±10% (K)	27 (1.063)	9.5 (.374)	15.5 (.610)	3 (.118)	0.8 (.0315)
ECQ-H2684□Z	.68		27 (1.063)	11.0 (.433)	16.5 (.650)	3 (.118)	0.8 (.0315)
ECQ-H2105□Z	1.0	±20% (M)	32 (1.260)	11.0 (.433)	18.0 (.709)	4 (.157)	0.8 (.0315)
ECQ-H2155□Z	1.5		32 (1.260)	12.5 (.492)	20.0 (.787)	4 (.157)	0.8 (.0315)
ECQ-H2225□Z	2.2		32 (1.260)	14.5 (.571)	23.5 (.906)	4 (.157)	0.8 (.0315)
ECQ-H2335□Z	3.3		45 (1.772)	14.0 (.551)	22.5 (.886)	4 (.157)	0.8 (.0315)
ECQ-H2475□Z	4.7		45 (1.772)	16.5 (.650)	25.0 (.984)	4 (.157)	0.8 (.0315)
ECQ-H2205□Z	2.0		32 (1.260	12.5 (.492)	24.5 (.965)	4 (.157)	0.8 (.0315)

400 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)				
	Rated (μF)	Tolerance	A	B	C	G	dϕ
ECQ-H4683□Z	.068		19 (.748)	9.0 (.354)	13.0 (.512)	3 (.118)	0.6 (.0236)
ECQ-H4104□Z	.10		19 (.748)	9.5 (.374)	15.0 (.591)	3 (.118)	0.6 (.0236)
ECQ-H4154□Z	.15		19 (.748)	11.0 (.433)	16.5 (.650)	3 (.118)	0.8 (.0315)
ECQ-H4224□Z	.22		27 (1.063)	10.0 (.394)	15.5 (.610)	3 (.118)	0.8 (.0315)
ECQ-H4334□Z	.33		27 (1.063)	11.5 (.453)	17.0 (.669)	3 (.118)	0.8 (.0315)
ECQ-H4474□Z	.47	±10% (K)	32 (1.260)	11.0 (.433)	18.5 (.728)	4 (.157)	0.8 (.0315)
ECQ-H4684□Z	.68		32 (1.260)	12.5 (.492)	21.0 (.827)	4 (.157)	0.8 (.0315)
ECQ-H4105□Z	1.0	±20% (M)	32 (1.260)	15.0 (.591)	22.5 (.886)	4 (.157)	0.8 (.0315)
ECQ-H4155□Z	1.5		45 (1.772)	14.5 (.571)	22.0 (.866)	4 (.157)	0.8 (.0315)
ECQ-H4225□Z	2.2		45 (1.772)	16.5 (.650)	25.5 (1.004)	4 (.157)	0.8 (.0315)

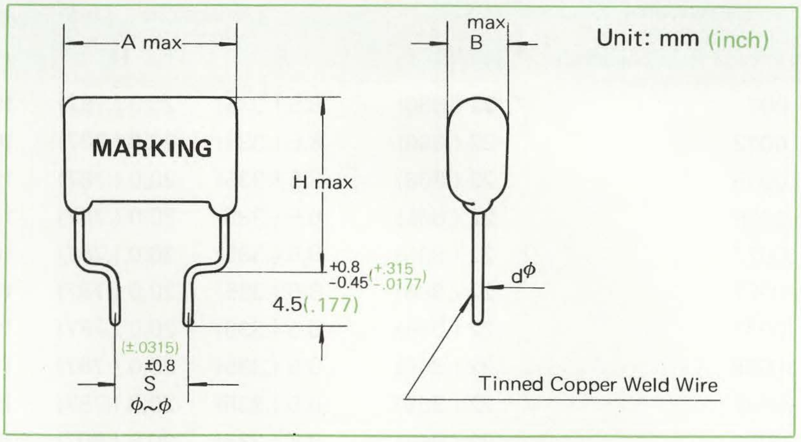
630 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)				
	Rated (μF)	Tolerance	A	B	C	G	dϕ
ECQ-H6153□Z	.015		16 (.630)	7.5 (.295)	11.5 (.453)	3 (.118)	0.6 (.0236)
ECQ-H6223□Z	.022		16 (.630)	8.5 (.335)	12.5 (.492)	3 (.118)	0.6 (.0236)
ECQ-H6333□Z	.033		19 (.748)	8.5 (.335)	12.5 (.492)	3 (.118)	0.6 (.0236)
ECQ-H6473□Z	.047		19 (.748)	9.5 (.374)	13.5 (.531)	3 (.118)	0.6 (.0236)
ECQ-H6683□Z	.068		19 (.748)	10.0 (.394)	15.5 (.610)	3 (.118)	0.6 (.0236)
ECQ-H6104□Z	.10	±10% (K)	27 (1.063)	9.5 (.374)	15.0 (.591)	3 (.118)	0.8 (.0315)
ECQ-H6154□Z	.15		27 (1.063)	10.5 (.413)	16.5 (.650)	3 (.118)	0.8 (.0315)
ECQ-H6224□Z	.22	±20% (M)	32 (1.260)	10.5 (.413)	17.5 (.689)	4 (.157)	0.8 (.0315)
ECQ-H6334□Z	.33		32 (1.260)	12.5 (.492)	19.5 (.768)	4 (.157)	0.8 (.0315)
ECQ-H6474□Z	.47		32 (1.260)	14.0 (.551)	21.5 (.846)	4 (.157)	0.8 (.0315)
ECQ-H6684□Z	.68		45 (1.772)	13.5 (.531)	20.5 (.807)	4 (.157)	0.8 (.0315)
ECQ-H6105□Z	1.0		45 (1.772)	15.0 (.591)	24.0 (.945)	4 (.157)	0.8 (.0315)
ECQ-H6155□Z	1.5		45 (1.772)	18.0 (.709)	27.0 (1.063)	4 (.157)	0.8 (.0315)

1000 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolerance	A	B	C	F	G	dϕ
ECQ-H10102□Z	.001		22.0 (.866)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.236)
ECQ-H10122□Z	.0012		22.0 (.866)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.236)
ECQ-H10152□Z	.0015		22.0 (.866)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.236)
ECQ-H10182□Z	.0018		22.0 (.866)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.236)
ECQ-H10222□Z	.0022		22.0 (.866)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.236)
ECQ-H10272□Z	.0027		22.0 (.866)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.236)
ECQ-H10332□Z	.0033		22.0 (.866)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.236)
ECQ-H10392□Z	.0039		22.0 (.866)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.236)
ECQ-H10472□Z	.0047		22.0 (.866)	8.5 (.335)	15.5 (.610)	17.0 (.669)	3.0 (.118)	0.6 (.236)
ECQ-H10562□Z	.0056		22.0 (.866)	8.5 (.335)	16.0 (.630)	17.0 (.669)	3.0 (.118)	0.6 (.236)
ECQ-H10682□Z	.0068	±10%(K)	22.0 (.866)	9.0 (.354)	16.5 (.650)	17.0 (.669)	3.0 (.118)	0.6 (.236)
ECQ-H10822□Z	.0082		28.0 (1.102)	8.5 (.335)	15.0 (.591)	23.0 (.906)	3.0 (.118)	0.6 (.236)
ECQ-H10103□Z	.01	±20%(M)	28.0 (1.102)	8.5 (.335)	15.5 (.610)	23.0 (.906)	3.0 (.118)	0.6 (.236)
ECQ-H10123□Z	.012		28.0 (1.102)	8.5 (.335)	15.5 (.610)	23.0 (.906)	3.0 (.118)	0.6 (.236)
ECQ-H10153□Z	.015		28.0 (1.102)	8.5 (.335)	16.0 (.630)	23.0 (.906)	3.0 (.118)	0.6 (.236)
ECQ-H10183□Z	.018		28.0 (1.102)	9.0 (.354)	16.5 (.650)	23.0 (.906)	3.0 (.118)	0.6 (.236)
ECQ-H10223□Z	.022		28.0 (1.102)	9.5 (.374)	17.0 (.669)	23.0 (.906)	3.0 (.118)	0.6 (.236)
ECQ-H10273□Z	.027		34.0 (1.339)	9.0 (.354)	16.5 (.650)	28.0 (1.102	4.0 (.157)	0.7 (.0276)
ECQ-H10333□Z	.033		34.0 (1.339)	10.0 (.394)	17.0 (.669)	28.0 (1.102	4.0 (.157)	0.7 (.0276)
ECQ-H10393□Z	.039		34.0 (1.339)	10.0 (.394)	19.0 (.748)	28.0 (1.102	4.0 (.157)	0.7 (.0276)
ECQ-H10473□Z	.047		34.0 (1.339)	10.5 (.413)	19.5 (.768)	28.0 (1.102	4.0 (.157)	0.7 (.0276)
ECQ-H10563□Z	.056		38.0 (1.496)	10.5 (.413)	19.0 (.748)	32.0 (1.260	4.0 (.157)	0.8 (.0315)
ECQ-H10683□Z	.068		38.0 (1.496)	11.0 (.433)	20.0 (.784)	32.0 (1.260	4.0 (.157)	0.8 (.0315)
ECQ-H10823□Z	.082		38.0 (1.496)	11.5 (.453)	22.0 (.866)	32.0 (1.260)	4.0 (.157)	0.8 (.0315)
ECQ-H10104□Z	.1		38.0 (1.496)	12.5 (.492)	23.0 (.906)	32.0 (1.260)	4.0 (.157)	0.8 (.0315)

ECQ-H (ZB) Standard Products Table



250 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)				
	Rated (μF)	Tolerance	A	B	H	S	dϕ
ECQ-H2683□ZB	.068		16 (.630)	8.0 (.315)	17.0 (.670)	7.5 (.295)	0.6 (.0236)
ECQ-H2104□ZB	.10		16 (.630)	9.0 (.354)	18.0 (.730)	7.5 (.295)	0.6 (.0236)
ECQ-H2154□ZB	.15		16 (.630)	9.5 (.374)	20.0 (.788)	7.5 (.295)	0.6 (.0236)
ECQ-H2224□ZB	.22		19 (.748)	9.0 (.354)	20.0 (.788)	10.0 (.394)	0.6 (.0236)
ECQ-H2334□ZB	.33		19 (.748)	10.5 (.413)	22.5 (.887)	10.0 (.394)	0.8 (.0315)
ECQ-H2474□ZB	.47	±10% (K)	27 (.1062)	9.5 (.374)	21.5 (.847)	12.5 (.492)	0.8 (.0315)
ECQ-H2684□ZB	.68		27 (1.062)	11.0 (.433)	22.5 (.887)	12.5 (.492)	0.8 (.0315)
ECQ-H2105□ZB	1.0	±20% (M)	32 (1.260)	11.0 (.433)	24.0 (.946)	17.5 (.689)	0.8 (.0315)
ECQ-H2155□ZB	1.5		32 (1.260)	12.5 (.492)	26.0 (1.023)	17.5 (.689)	0.8 (.0315)
ECQ-H2225□ZB	2.2		32 (1.260)	14.5 (.571)	30.0 (1.182)	17.5 (.689)	0.8 (.0315)
ECQ-H2335□ZB	3.3		45 (1.772)	14.0 (.551)	29.5 (1.161)	27.5 (1.083)	0.8 (.0315)
ECQ-H2475□ZB	4.7		45 (1.772)	16.5 (.650)	31.0 (1.221)	27.5 (1.083)	0.8 (.0315)

400 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)				
	Rated (μF)	Tolerance	A	B	H	S	dϕ
ECQ-H4683□ZB	.068		19 (.748)	9.0 (.354)	18.0 (.730)	10.0 (.394)	0.6 (.0236)
ECQ-H4104□ZB	.10		19 (.748)	9.5 (.374)	20.0 (.788)	10.0 (.394)	0.6 (.0236)
ECQ-H4154□ZB	.15		19 (.748)	11.0 (.433)	22.5 (.887)	10.0 (.394)	0.8 (.0315)
ECQ-H4224□ZB	.22	±10% (K)	27 (1.063)	10.0 (.394)	21.5 (.847)	12.5 (.492)	0.8 (.0315)
ECQ-H4334□ZB	.33		27 (1.063)	11.5 (.453)	23.0 (.907)	12.5 (.492)	0.8 (.0315)
ECQ-H4474□ZB	.47	±20% (M)	32 (1.260)	11.0 (.433)	24.5 (.965)	17.5 (.689)	0.8 (.0315)
ECQ-H4684□ZB	.68		32 (1.260)	12.5 (.492)	26.5 (1.042)	17.5 (.689)	0.8 (.0315)
ECQ-H4105□ZB	1.0		32 (1.260)	15.0 (.591)	28.5 (1.122)	17.5 (.689)	0.8 (.0315)
ECQ-H4155□ZB	1.5		45 (1.770)	14.5 (.571)	28.0 (1.102)	27.5 (1.083)	0.8 (.0315)
ECQ-H4225□ZB	2.2		45 (1.770)	16.5 (.650)	31.5 (1.240)	27.5 (1.083)	0.8 (.0315)

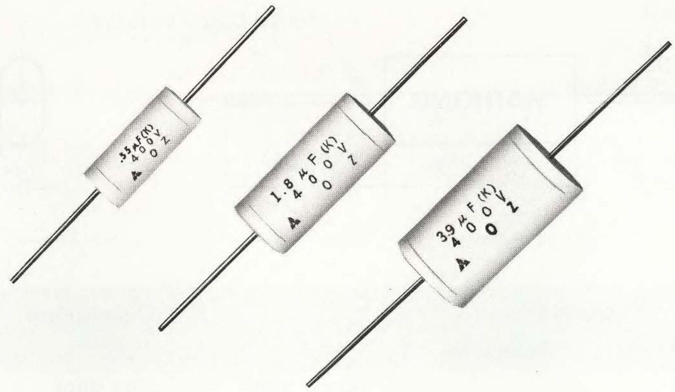
630 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)				
	Rated (μF)	Tolerance	A	B	H	S	dϕ
ECQ-H6153□ZB	.015		16 (.630)	7.5 (.295)	16.5 (.650)	7.5 (.295)	0.6 (.0236)
ECQ-H6223□ZB	.022		16 (.630)	8.5 (.334)	17.5 (.690)	7.5 (.295)	0.6 (.0236)
ECQ-H6333□ZB	.033		19 (.748)	8.5 (.334)	17.5 (.690)	10.0 (.394)	0.6 (.0236)
ECQ-H6473□ZB	.047		19 (.748)	9.5 (.374)	18.5 (.730)	10.0 (.394)	0.6 (.0236)
ECQ-H6683□ZB	.068	±10% (K)	19 (.748)	10.0 (.394)	20.5 (.808)	10.0 (.394)	0.6 (.0236)
ECQ-H6104□ZB	.10		27 (1.062)	9.5 (.374)	21.0 (.828)	12.5 (.492)	0.8 (.0315)
ECQ-H6154□ZB	.15	±20% (M)	27 (1.062)	10.5 (.413)	22.5 (.887)	12.5 (.492)	0.8 (.0315)
ECQ-H6224□ZB	.22		32 (1.260)	10.5 (.413)	23.5 (.927)	17.5 (.689)	0.8 (.0315)
ECQ-H6334□ZB	.33		32 (1.260)	12.5 (.492)	25.5 (1.005)	17.5 (.689)	0.8 (.0315)
ECQ-H6474□ZB	.47		32 (1.260)	14.0 (.551)	27.5 (1.083)	17.5 (.689)	0.8 (.0315)
ECQ-H6684□ZB	.68		45 (1.772)	13.5 (.531)	26.5 (1.042)	27.5 (1.083)	0.8 (.0315)
ECQ-H6105□ZB	1.0		45 (1.772)	15.0 (.591)	30.0 (1.182)	27.5 (1.083)	0.8 (.0315)
ECQ-H6155□ZB	1.5		45 (1.772)	18.0 (.709)	33.0 (1.300)	27.5 (1.083)	0.8 (.0315)

1000 V.D.C

Part No.	Capacitance		Dimensions mm (inch)				
	Rated (μF)	Tolerance	A	B	H	S	dϕ
ECQ-H10102□ZB	.001		22 (.866)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)
ECQ-H10122□ZB	.0012		22 (.866)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)
ECQ-H10152□ZB	.0015		22 (.866)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)
ECQ-H10182□ZB	.0018		22 (.866)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)
ECQ-H10222□ZB	.0022		22 (.866)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)
ECQ-H10272□ZB	.0027		22 (.866)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)
ECQ-H10332□ZB	.0033		22 (.866)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)
ECQ-H10392□ZB	.0039		22 (.866)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)
ECQ-H10472□ZB	.0047		22 (.866)	8.5 (.335)	20.0 (.787)	10.0 (.394)	0.6 (.0236)
ECQ-H10562□ZB	.0056		22 (.866)	8.5 (.335)	20.5 (.807)	10.0 (.394)	0.6 (.0236)
ECQ-H10682□ZB	.0068	±10% (K)	22 (.866)	9.0 (.354)	21.0 (.827)	10.0 (.394)	0.6 (.0236)
ECQ-H10822□ZB	.0082		28 (1.102)	8.5 (.335)	19.5 (.768)	12.5 (.492)	0.6 (.0236)
ECQ-H10103□ZB	.01		28 (1.102)	8.5 (.335)	20.0 (.787)	12.5 (.492)	0.6 (.0236)
ECQ-H10123□ZB	.012	±20% (M)	28 (1.102)	8.5 (.335)	20.0 (.787)	12.5 (.492)	0.6 (.0236)
ECQ-H10153□ZB	.015		28 (1.102)	8.5 (.335)	20.5 (.807)	12.5 (.492)	0.6 (.0236)
ECQ-H10183□ZB	.018		28 (1.102)	9.0 (.354)	21.5 (.846)	12.5 (.492)	0.6 (.0236)
ECQ-H10223□ZB	.022		28 (1.102)	9.5 (.374)	22.0 (.866)	12.5 (.492)	0.6 (.0236)
ECQ-H10273□ZB	.027		34 (1.339)	9.0 (.354)	21.5 (.846)	17.5 (.689)	0.7 (.0276)
ECQ-H10333□ZB	.033		34 (1.339)	10.0 (.394)	22.0 (.866)	17.5 (.689)	0.7 (.0276)
ECQ-H10393□ZB	.039		34 (1.339)	10.0 (.394)	24.0 (.965)	17.5 (.689)	0.7 (.0276)
ECQ-H10473□ZB	.047		34 (1.339)	10.5 (.413)	24.5 (.965)	17.5 (.689)	0.7 (.0276)
ECQ-H10563□ZB	.056		38 (1.496)	10.5 (.413)	24.0 (.965)	22.5 (.886)	0.8 (.0315)
ECQ-H10683□ZB	.068		38 (1.496)	11.0 (.433)	25.0 (.984)	22.5 (.886)	0.8 (.0315)
ECQ-H10823□ZB	.082		38 (1.496)	11.5 (.453)	27.0 (1.063)	22.5 (.886)	0.8 (.0315)
ECQ-H10104□ZB	.1		38 (1.496)	12.5 (.492)	28.0 (1.102)	22.5 (.886)	0.8 (.0315)

Type ECQ-T (Axial Lead)



Electrical Specification

1. Rated Voltage .... 250 V.D.C., 400 V.D.C., 630 V.D.C.
2. Capacitance .... See the Standard Products Table on p. VI-30.
3. Capacitance Tolerance......... ±10%(K), ±20%(M)
4. Insulation Resistance........... Less than 0.33μF >9,000MΩ
More than 0.33μF ≧3,000MΩ·μF
5. Dissipation Factor .... <1.0% at 1kHz.
6. Withstand Voltage .... Rated Voltage x 1.5 (1 min.) max.
7. Operating Temperature......... –25°C~+85°C

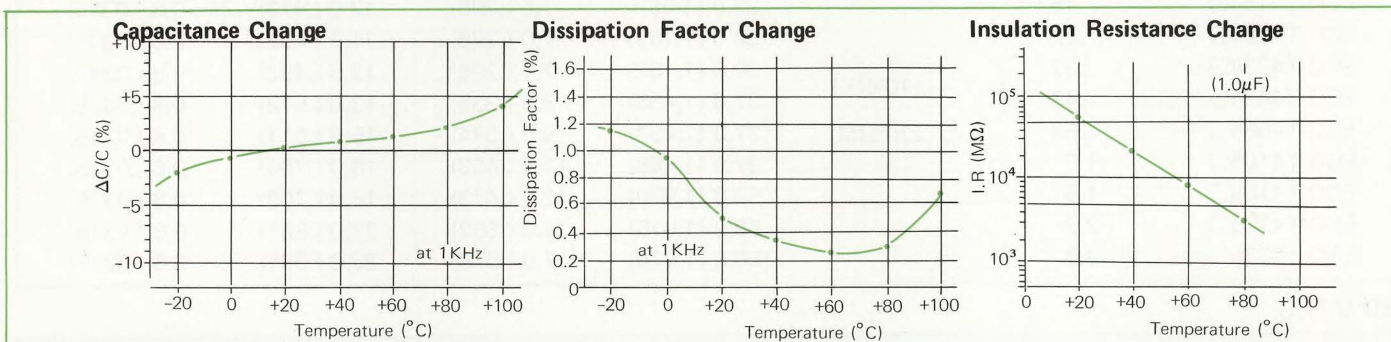
Features

1. The capacitor consists of metalized polyester film (=dielectric), with polyester tape wrapped.
2. Marking comprises capacitance, capacitance tolerance, rated voltage and manufacturer's name or symbol.
3. Non-inductive

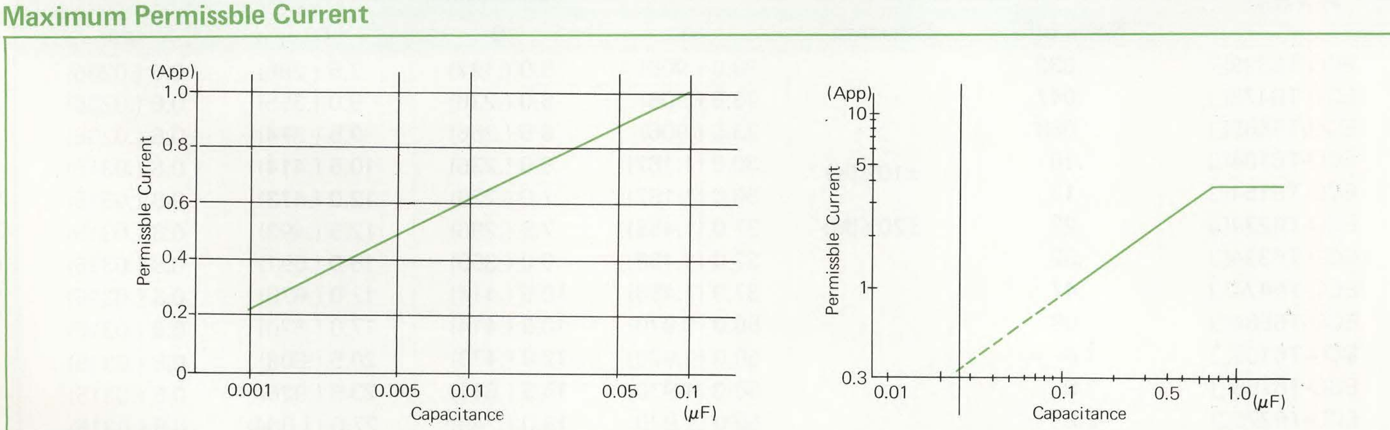
Application

(1) General communication equipment

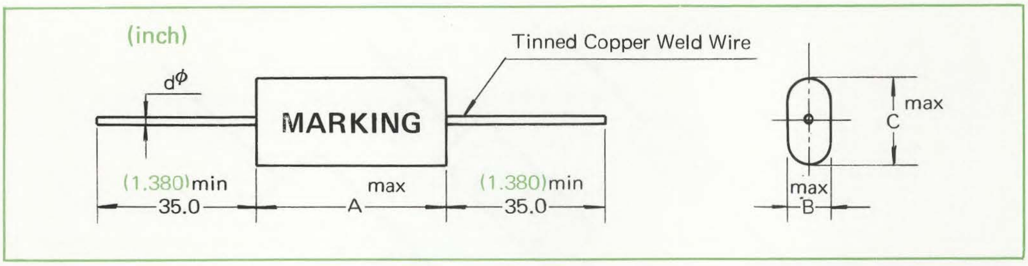
Temperature Characteristics



Maximum Permissble Current



ECQ-T Standard Products Table



250 V.D.C

Part No.	Capacitance		Dimensions mm (inch)			
	Rated (μF)	Tolerance	A	B	C	dφ
ECQ-T2154□	.15	±10%(K) ±20%(M)	20.0 (.788)	6.0 (.236)	10.5 (.414)	0.6 (.0236)
ECQ-T2224□	.22		23.0 (.906)	6.0 (.236)	10.5 (.414)	0.6 (.0236)
ECQ-T2334□	.33		23.0 (.906)	7.0 (.276)	11.5 (.453)	0.8 (.0315)
ECQ-T2474□	.47		30.0 (1.182)	6.5 (.256)	11.0 (.433)	0.8 (.0315)
ECQ-T2684□	.68		30.0 (1.182)	7.0 (.276)	12.0 (.473)	0.8 (.0315)
ECQ-T2105□	1.0		37.0 (1.458)	7.5 (.296)	14.0 (.552)	0.8 (.0315)
ECQ-T2155□	1.5		37.0 (1.458)	9.5 (.374)	15.5 (.611)	0.8 (.0315)
ECQ-T2225□	2.2		37.0 (1.458)	11.5 (.453)	18.0 (.709)	0.8 (.0315)
ECQ-T2335□	3.3		50.0 (1.970)	11.0 (.433)	19.0 (.749)	0.8 (.0315)
ECQ-T2475□	4.7		50.0 (1.970)	13.5 (.532)	21.0 (.827)	0.8 (.0315)
ECQ-T2685□	6.8		50.0 (1.970)	16.5 (.650)	24.5 (.965)	1.0 (.0394)
ECQ-T2106□	10.0		50.0 (1.970)	19.0 (.749)	30.0 (1.182)	1.0 (.0394)

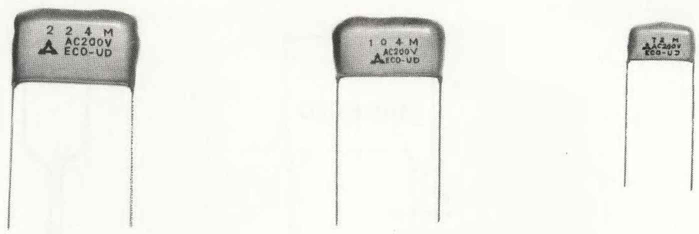
400 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)			
	Rated (μF)	Tolerance	A	B	C	dφ
ECQ-T4683□	.068	±10%(K) ±20%(M)	23.0 (.906)	5.5 (.217)	8.5 (.335)	0.6 (.0236)
ECQ-T4104□	.10		23.0 (.906)	6.5 (.256)	9.5 (.374)	0.6 (.0236)
ECQ-T4154□	.15		23.0 (.906)	7.5 (.296)	12.0 (.473)	0.8 (.0315)
ECQ-T4224□	.22		30.0 (1.182)	7.0 (.276)	11.5 (.453)	0.8 (.0315)
ECQ-T4334□	.33		30.0 (1.182)	7.5 (.296)	12.5 (.493)	0.8 (.0315)
ECQ-T4474□	.47		37.0 (1.458)	8.5 (.335)	13.0 (.512)	0.8 (.0315)
ECQ-T4684□	.68		37.0 (1.458)	9.5 (.374)	15.5 (.611)	0.8 (.0315)
ECQ-T4105□	1.0		37.0 (1.458)	11.5 (.453)	18.0 (.709)	0.8 (.0315)
ECQ-T4155□	1.5		50.0 (1.970)	12.0 (.473)	18.0 (.709)	0.8 (.0315)
ECQ-T4225□	2.2		50.0 (1.970)	14.0 (.552)	22.0 (.867)	0.8 (.0315)
ECQ-T4335□	3.3		50.0 (1.970)	17.0 (.670)	25.0 (.985)	0.8 (.0315)

630 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)			
	Rated (μF)	Tolerance	A	B	C	dφ
ECQ-T6333□	.033	±10%(K) ±20%(M)	23.0 (.906)	5.0 (.197)	7.5 (.296)	0.6 (.0236)
ECQ-T6473□	.047		23.0 (.906)	6.0 (.236)	9.0 (.355)	0.6 (.0236)
ECQ-T6683□	.068		23.0 (.906)	6.5 (.256)	9.5 (.374)	0.6 (.0236)
ECQ-T6104□	.10		30.0 (1.182)	6.0 (.236)	10.5 (.414)	0.8 (.0315)
ECQ-T6154□	.15		30.0 (1.182)	7.0 (.276)	12.0 (.473)	0.8 (.0315)
ECQ-T6224□	.22		37.0 (1.458)	7.5 (.296)	12.5 (.493)	0.8 (.0315)
ECQ-T6334□	.33		37.0 (1.458)	9.0 (.355)	15.0 (.591)	0.8 (.0315)
ECQ-T6474□	.47		37.0 (1.458)	10.5 (.414)	17.0 (.670)	0.8 (.0315)
ECQ-T6684□	.68		50.0 (1.970)	10.5 (.414)	17.0 (.670)	0.8 (.0315)
ECQ-T6105□	1.0		50.0 (1.970)	12.0 (.473)	20.5 (.808)	0.8 (.0315)
ECQ-T6155□	1.5		50.0 (1.970)	15.5 (.611)	23.5 (.926)	0.8 (.0315)
ECQ-T6225□	2.2		50.0 (1.970)	19.0 (.749)	27.0 (1.064)	0.8 (.0315)

UL Listed Type ECQ-UD (Z)(Radial Lead)



Electrical Specifications

1. Rated Voltage 200V.A.C
2. Capacitance .... See the Standard Products Table p.VI-32.
3. Capacitance Tolerance .... ±10%(K), ±20% (M)
4. Insulation Resistance .... ≧10,000 MΩ
5. Dissipation Factor .... <1.0% at 1 kHz.
6. Withstand Voltage .... 1000 V.A.C. (1 min) max.
7. Operating Temperature .... –25°C ~ +85°C

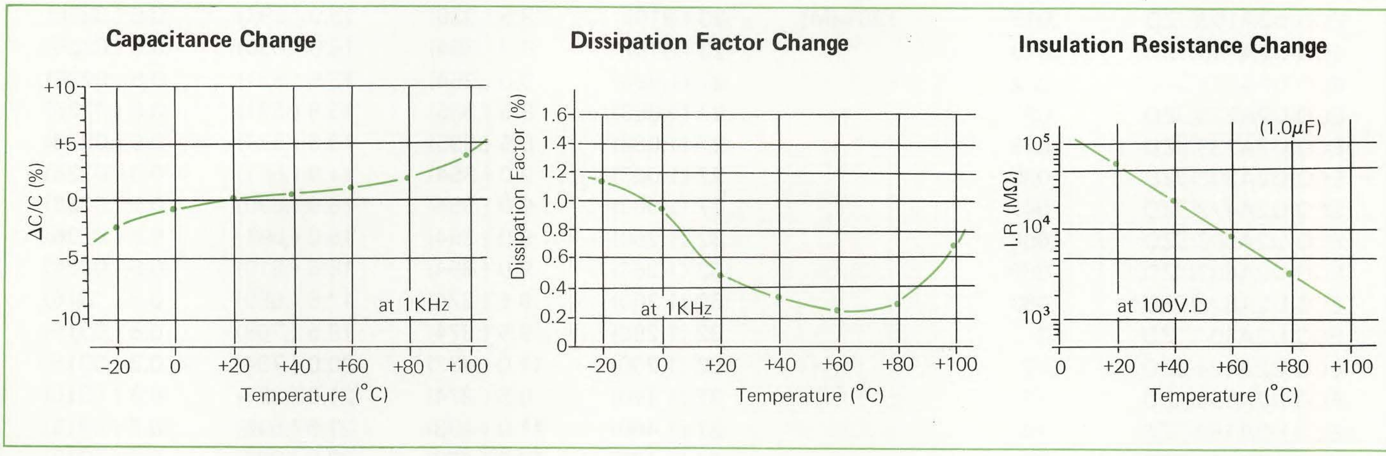
Features

1. The capacitor consists of metalized polyester film and epoxy resin coated.
2. Marking comprises capacitance, capacitance tolerance, rated. voltage, manufacturer's name of symbol and type name.
3. Non-inductive and non-combustible approved by UL.

Application

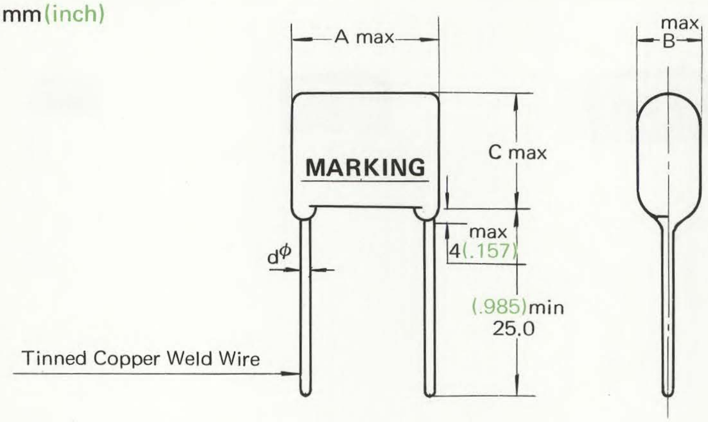
(1) Across - the - line

Temperature Characteristics



ECQ-UD (Z) Standard Products Table

Unit:mm(inch)



200 V.A.C.

Part No.	Capacitance		Dimensions	mm (inch)		
	Rated (μF)	Tolerance	A	B	C	dφ
ECQ-U2A102□ZD	.001		21 (.827)	8.5 (.335)	13.5 (.531)	0.6 (.0236)
ECQ-U2A122□ZD	.0012		21 (.827)	8.5 (.335)	11.5 (.453)	0.6 (.0236)
ECQ-U2A152□ZD	.0015		21 (.827)	8.5 (.335)	11.5 (.453)	0.6 (.0236)
ECQ-U2A182□ZD	.0018		21 (.827)	8.5 (.335)	13.5 (.531)	0.6 (.0236)
ECQ-U2A222□ZD	.0022		21 (.827)	8.5 (.335)	13.5 (.531)	0.6 (.0236)
ECQ-U2A272□ZD	.0027		21 (.827)	8.5 (.335)	14.5 (.571)	0.6 (.0236)
ECQ-U2A332□ZD	.0033		21 (.827)	9.0 (.354)	14.5 (.571)	0.6 (.0236)
ECQ-U2A392□ZD	.0039		21 (.827)	9.0 (.354)	16.0 (.630)	0.6 (.0236)
ECQ-U2A472□ZD	.0047	±10%(K)	23 (.910)	8.5 (.335)	14.5 (.571)	0.6 (.0236)
ECQ-U2A562□ZD	.0056		23 (.910)	8.5 (.335)	15.0 (.591)	0.6 (.0236)
ECQ-U2A682□ZD	.0068		23 (.910)	8.0 (.354)	15.5 (.610)	0.6 (.0236)
ECQ-U2A822□ZD	.0082		23 (.910)	8.0 (.354)	17.0 (.669)	0.6 (.0236)
ECQ-U2A103□ZD	.01		23 (.910)	8.5 (.335)	13.0 (.512)	0.6 (.0236)
ECQ-U2A123□ZD	.012		23 (.910)	8.5 (.335)	15.0 (.591)	0.6 (.0236)
ECQ-U2A153□ZD	.015	±20%(M)	23 (.910)	8.5 (.335)	15.0 (.591)	0.6 (.0236)
ECQ-U2A183□ZD	.018		23 (.910)	9.0 (.354)	16.0 (.630)	0.6 (.0236)
ECQ-U2A223□ZD	.022		27 (1.063)	9.0 (.354)	13.5 (.531)	0.6 (.0236)
ECQ-U2A273□ZD	.027		27 (1.063)	8.5 (.335)	13.5 (.531)	0.6 (.0236)
ECQ-U2A333□ZD	.033		27 (1.063)	8.5 (.335)	13.5 (.531)	0.6 (.0236)
ECQ-U2A393□ZD	.039		27 (1.063)	9.0 (.354)	14.0 (.551)	0.6 (.0236)
ECQ-U2A473□ZD	.047		27 (1.063)	9.0 (.354)	16.0 (.630)	0.6 (.0236)
ECQ-U2A563□ZD	.056		32 (1.260)	9.0 (.354)	15.0 (.591)	0.6 (.0236)
ECQ-U2A683□ZD	.068		32 (1.260)	9.0 (.354)	15.5 (.610)	0.6 (.0236)
ECQ-U2A823□ZD	.082		32 (1.260)	9.5 (.374)	17.5 (.689)	0.8 (.0315)
ECQ-U2A104□ZD	.1		32 (1.260)	9.5 (.374)	19.5 (.768)	0.8 (.0315)
ECQ-U2A124□ZD	.12		32 (1.260)	11.0 (.433)	20.0 (.784)	0.8 (.0315)
ECQ-U2A154□ZD	.15		37 (1.460)	9.5 (.374)	21.0 (.827)	0.8 (.0315)
ECQ-U2A184□ZD	.18		37 (1.460)	11.0 (.433)	21.5 (.846)	0.8 (.0315)
ECQ-U2A224□ZD	.22		37 (1.460)	12.0 (.472)	22.5 (.886)	0.8 (.0315)

METALIZED POLYESTER/ POLYPROPYLENE CAPACITORS

Type ECW-K

Electrical Specifications

1. Rated Voltage .... 330 V.A.C., 360 V.A.C., 380 V.A.C.
2. Capacitance .... See the Standard Products Table on p. VI-34.
3. Capacitance Tolerance .... ±5%(J)
4. Insulation Resistance .... $\geqq$1,000M$\Omega \cdot \mu$F
5. Dissipation Factor .... <0.35% at 60Hz
6. Withstand Voltage .... Rated Voltage x 1.75 (1 sec.) max. at 60Hz
7. Operating Temperature .... -25°C~$+85^\circ$C

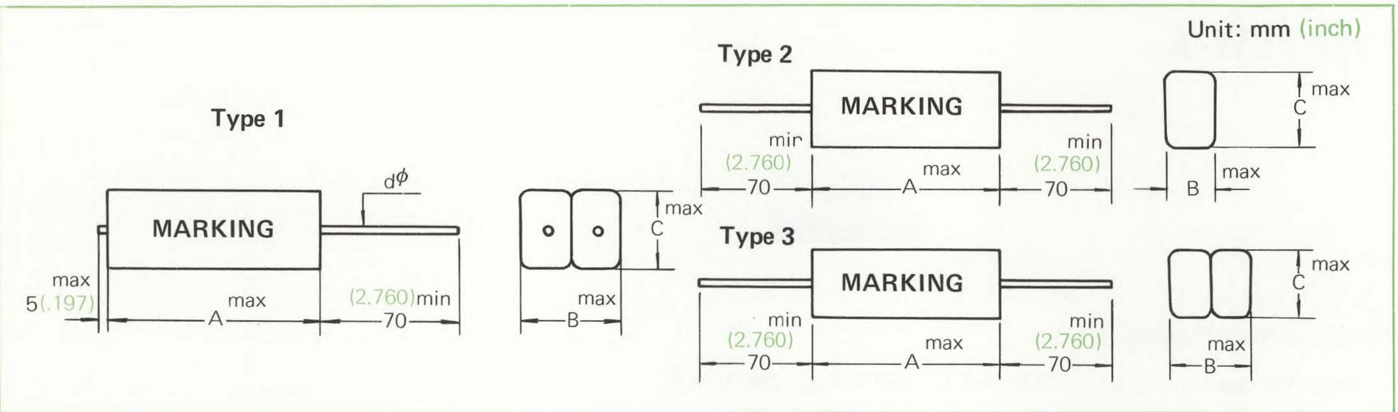
Features

1. The capacitor consists of metalized polyester film, polypropylene film, epoxy resin coating and adhesive tape.
2. Marking comprises capacitance, capacitance tolerance, rated voltage and manufacturer's name or symbol and type name.
3. Non-inductive and used to advance phase (=Power capacitor)
4. The capacitor is compact and has self healing.

Application

(1) Fluorescent light (2) Mercury – vapour lamp (3) motor (Small size)

ECW-K Standard Products Table



330 V.A.C.

Part No.	Capacitance		Dimensions mm (inch)				
	Rated (μF)	Tolerance	A	B	C	dϕ	Type
ECW-K33355JS	3.5	±5% (J)	55 (2.17)	38 (1.496)	27 (1.062)	0.8 (0.0315)	1
ECW-K33425JS	4.2		55 (2.17)	42 (1.654)	29 (1.142)	0.8 (0.0315)	1

360 V.A.C.

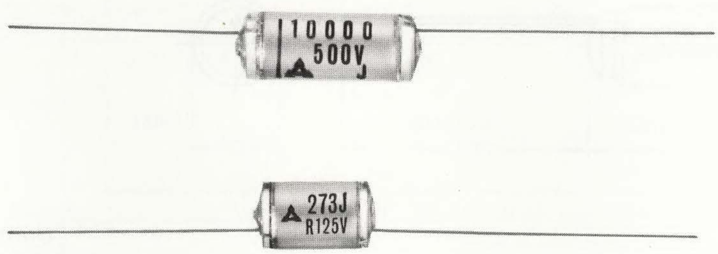
Part No.	Capacitance		Dimenisons mm (inch)				
	Rated (μF)	Tolerance	A	B	C	dϕ	Type
ECW-K36265JP	2.6	±5% (J)	62 (2.44)	25 (.984)	36 (1.417)	0.8 (.0315)	2
ECW-K36345JP	3.4		62 (2.44)	27 (1.063)	38 (1.496)	0.8 (.0315)	2
ECW-K36365JP	3.6		62 (2.44)	30 (1.181)	41 (1.614)	0.8 (.0315)	2
ECW-K36415JP	4.1		62 (2.44)	32 (1.26)	43 (1.693)	0.8 (.0315)	2
ECW-K36435JP	4.3		62 (2.44)	33 (1.299)	44 (1.732)	0.8 (.0315)	2

380 V.A.C.

Part No.	Capacitance		Dimensions mm (inch)				
	Rated (μF)	Tolerance	A	B	C	dϕ	Type
ECW-K38535JP	5.3	±5% (J)	72 (2.835)	58 (2.283)	40 (1.575)	0.8 (.0315)	3
ECW-K38545JP	5.4		72 (2.835)	59 (2.323)	41 (1.614)	0.8 (.0315)	3
ECW-K38585JP	5.8		72 (2.835)	60 (2.36)	41 (1.614)	0.8 (.0315)	3
ECW-K38635JP	6.3		72 (2.835)	64 (2.520)	43 (1.693)	0.8 (.0315)	3
ECW-K38665JP	6.6		72 (2.835)	64 (2.520)	43 (1.693)	0.8 (.0315)	3
ECW-K38685JP	6.8		72 (2.835)	66 (2.520)	44 (1.732)	0.8 (.0315)	3

POLYSTYRENE CAPACITORS

Type ECQ-S (Axial Lead)
ECQ-S (Z)(Radial Lead)



Electrical Characteristics

1. Rated Voltage 125V.D.C 500V.D.C
2. Capacitance .... See the Standard Product Table on p. VI-36, 37.
3. Capacitance Tolerance .... ±5%(J), ±10%(K)
4. Insulation Resistance .... ≧45,000 MΩ
5. Dissipation Factor .... <0.1% at 1 kHz
6. Withstand Voltage .... Rated Voltage x 2.5 (1 sec) max.
7. Operating Temperature −10°C ~ +85°C

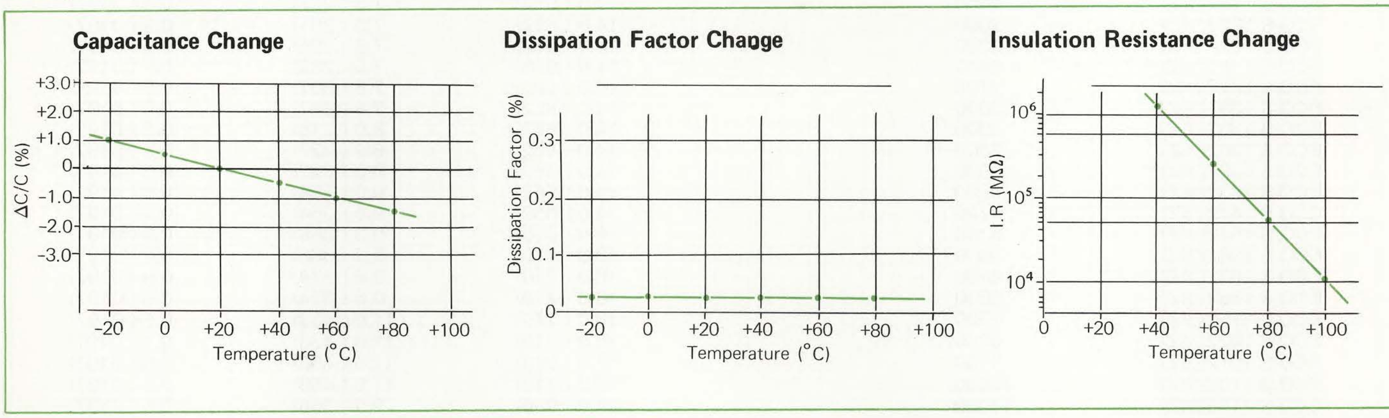
Features

1. The capacitor consists of polystyrene film, aluminum foil.
2. Marking comprises capacitance capacitance tolerance, rated voltage and manufacturers name or symbol.
3. The capacitor is ultra-small size, high insulation resistance and high quality factor.

Application

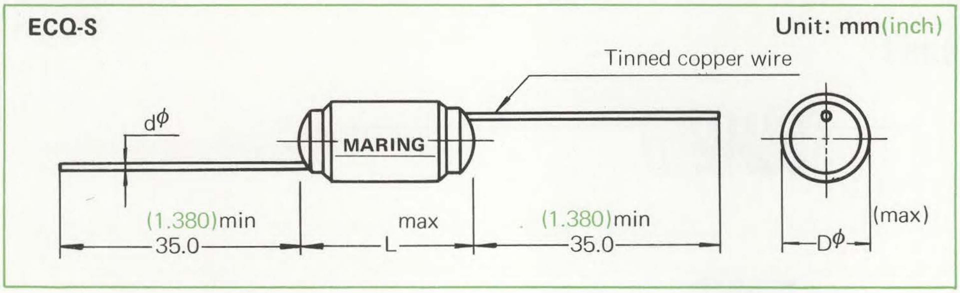
(1) High frequency transisterized general circuits (2) Coupling and oscillating circuits

Temperature Characteristics

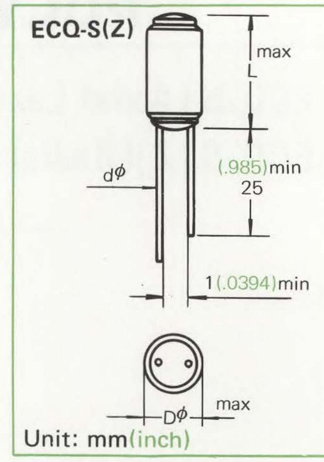


ECQ-S Standard Products Table

X Type



Z Type



125 V.D.C

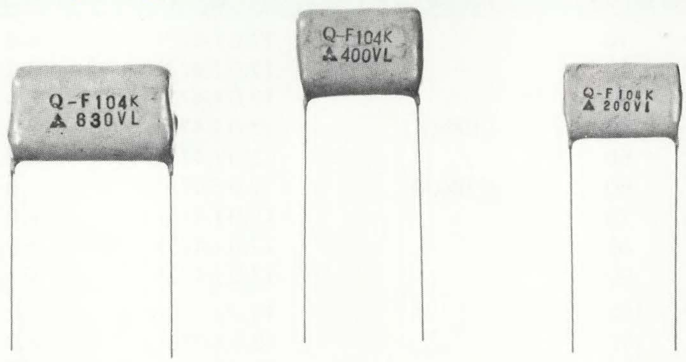
Part No.	Capacitance		Dimensions mm (inch)		
	Rated (PF)	Tolerance	L	Dϕ	dϕ
ECQ-S 1101□(Z)	100		11.0 (.434)	5.0 (.197)	0.4 (.0157)
ECQ-S 1111□(Z)	100		11.0 (.434)	5.0 (.197)	0.4 (.0157)
ECQ-S 1121□(Z)	120		11.0 (.434)	5.0 (.197)	0.4 (.0157)
ECQ-S 1131□(Z)	130		11.0 (.434)	5.0 (.197)	0.4 (.0157)
ECQ-S 1151□(Z)	150		11.0 (.434)	5.0 (.197)	0.4 (.0157)
ECQ-S 1161□(Z)	160		11.0 (.434)	5.0 (.197)	0.4 (.0157)
ECQ-S 1181□(Z)	180		11.0 (.434)	5.0 (.197)	0.4 (.0157)
ECQ-S 1201□(Z)	200		11.0 (.434)	5.0 (.197)	0.4 (.0157)
ECQ-S 1221□(Z)	220		11.5 (.453)	5.5 (.217)	0.4 (.0157)
ECQ-S 1241□(Z)	240		11.5 (.453)	5.5 (.217)	0.4 (.0157)
ECQ-S 1271□(Z)	270		11.5 (.453)	5.5 (.217)	0.4 (.0157)
ECQ-S 1301□(Z)	300		11.5 (.453)	5.5 (.217)	0.4 (.0157)
ECQ-S 1331□(Z)	330		11.5 (.453)	5.5 (.217)	0.4 (.0157)
ECQ-S 1361□(Z)	360		11.5 (.453)	5.5 (.217)	0.4 (.0157)
ECQ-S 1391□(Z)	390		11.5 (.453)	5.5 (.217)	0.4 (.0157)
ECQ-S 1431□(Z)	430		11.5 (.453)	5.5 (.217)	0.4 (.0157)
ECQ-S 1471□(Z)	470		11.5 (.453)	6.0 (.236)	0.4 (.0157)
ECQ-S 1551□(Z)	510		11.5 (.453)	6.0 (.236)	0.4 (.0157)
ECQ-S 1561□(Z)	560		11.5 (.453)	6.0 (.236)	0.4 (.0157)
ECQ-S 1621□(Z)	620		14.0 (.552)	6.0 (.236)	0.4 (.0157)
ECQ-S 1681□(Z)	680		14.0 (.552)	6.0 (.236)	0.4 (.0157)
ECQ-S 1751□(Z)	750		14.0 (.552)	6.0 (.236)	0.4 (.0157)
ECQ-S 1821□(Z)	820		14.0 (.552)	6.0 (.236)	0.4 (.0157)
ECQ-S 1911□(Z)	910		14.0 (.552)	6.5 (.256)	0.4 (.0157)
ECQ-S 1102□(Z)	1000	±5% (J)	14.0 (.552)	6.5 (.256)	0.4 (.0157)
ECQ-S 1112□(Z)	1100		14.0 (.552)	6.5 (.256)	0.4 (.0157)
ECQ-S 1122□(Z)	1200		14.0 (.552)	7.0 (.276)	0.5 (.0197)
ECQ-S 1132□(Z)	1300	±10% (K)	14.0 (.552)	7.0 (.276)	0.5 (.0197)
ECQ-S 1152□(Z)	1500		14.0 (.552)	7.0 (.276)	0.5 (.0197)
ECQ-S 1162□(Z)	1600		14.0 (.552)	7.3 (.287)	0.5 (.0197)
ECQ-S 1182□(Z)	1800		14.0 (.552)	7.3 (.287)	0.5 (.0197)
ECQ-S 1202□(Z)	2000		14.0 (.552)	7.3 (.287)	0.5 (.0197)
ECQ-S 1222□(Z)	2200		14.0 (.552)	7.5 (.295)	0.5 (.0197)
ECQ-S 1242□(Z)	2400		14.0 (.552)	7.5 (.295)	0.5 (.0197)
ECQ-S 1272□(Z)	2700		14.0 (.552)	7.8 (.307)	0.5 (.0197)
ECQ-S 1302□(Z)	3000		14.0 (.552)	7.8 (.307)	0.5 (.0197)
ECQ-S 1332□(Z)	3300		14.0 (.552)	8.0 (.315)	0.5 (.0197)
ECQ-S 1362□(Z)	3600		14.0 (.552)	8.3 (.327)	0.5 (.0197)
ECQ-S 1392□(Z)	3900		14.0 (.552)	8.3 (.327)	0.5 (.0197)
ECQ-S 1432□(Z)	4300		14.0 (.552)	9.0 (.354)	0.5 (.0197)
ECQ-S 1472□(Z)	4700		14.0 (.552)	9.0 (.354)	0.5 (.0197)
ECQ-S 1512□(Z)	5100		18.0 (.710)	9.3 (.366)	0.5 (.0197)
ECQ-S 1562□(Z)	5600		18.0 (.710)	9.3 (.366)	0.5 (.0197)
ECQ-S 1622□(Z)	6200		18.0 (.710)	9.5 (.374)	0.5 (.0197)
ECQ-S 1682□(Z)	6800		18.0 (.710)	9.5 (.374)	0.5 (.0197)
ECQ-S 1752□(Z)	7500		18.0 (.710)	11.0 (.433)	0.5 (.0197)
ECQ-S 1822□(Z)	8200		18.0 (.710)	11.0 (.433)	0.5 (.0197)
ECQ-S 1912□(Z)	9100		18.0 (.710)	11.5 (.453)	0.5 (.0197)
ECQ-S 1103□(Z)	10000		18.0 (.710)	11.5 (.453)	0.5 (.0197)
ECQ-S 1113□(Z)	11000		24.0 (.946)	9.3 (.366)	0.5 (.0197)
ECQ-S 1123□(Z)	12000		24.0 (.946)	9.3 (.366)	0.5 (.0197)
ECQ-S 1133□(Z)	13000		24.0 (.946)	10.0 (.394)	0.5 (.0197)
ECQ-S 1153□(Z)	15000		24.0 (.946)	10.0 (.394)	0.5 (.0197)
ECQ-S 1163□(Z)	16000		24.0 (.946)	10.5 (.413)	0.5 (.0197)
ECQ-S 1183□(Z)	18000		24.0 (.946)	11.0 (.433)	0.5 (.0197)
ECQ-S 1203□(Z)	20000		24.0 (.946)	11.5 (.453)	0.5 (.0197)
ECQ-S 1223□(Z)	22000		24.0 (.946)	12.0 (.473)	0.5 (.0197)
ECQ-S 1243□(Z)	24000		24.0 (.946)	12.3 (.485)	0.5 (.0197)
ECQ-S 1273□(Z)	27000		24.0 (.946)	13.0 (.512)	0.5 (.0197)

500 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)		
	Rated (PF)	Tolerance	L	Dϕ	dϕ
ECQ-S 5100□(Z)	10		12.0 (.473)	6.0 (.236)	0.3 (.0118)
ECQ-S 5200□(Z)	20		12.0 (.473)	6.0 (.236)	0.3 (.0118)
ECQ-S 5300□(Z)	30		12.0 (.473)	6.0 (.236)	0.3 (.0118)
ECQ-S 5400□(Z)	40	±10%(K)	12.0 (.473)	6.0 (.236)	0.3 (.0118)
ECQ-S 5500□(Z)	50		12.0 (.473)	6.0 (.236)	0.3 (.0118)
ECQ-S 5600□(Z)	60	±20%(M)	12.0 (.473)	6.0 (.236)	0.3 (.0118)
ECQ-S 5700□(Z)	70		12.0 (.473)	6.0 (.236)	0.3 (.0118)
ECQ-S 5800□(Z)	80		12.0 (.473)	6.0 (.236)	0.3 (.0118)
ECQ-S 5900□(Z)	90		12.0 (.473)	6.0 (.236)	0.4 (.0118)
ECQ-S 5101□(Z)	100		18.0 (.710)	8.0 (.315)	0.4 (.0157)
ECQ-S 5111□(Z)	110		18.0 (.710)	8.0 (.315)	0.4 (.0157)
ECQ-S 5121□(Z)	120		18.0 (.710)	8.0 (.315)	0.4 (.0157)
ECQ-S 5131□(Z)	130		18.0 (.710)	8.0 (.315)	0.4 (.0157)
ECQ-S 5151□(Z)	150		18.0 (.710)	8.0 (.315)	0.4 (.0157)
ECQ-S 5161□(Z)	160		18.0 (.710)	8.0 (.315)	0.4 (.0157)
ECQ-S 5181□(Z)	180		18.0 (.710)	8.0 (.315)	0.4 (.0157)
ECQ-S 5201□(Z)	200		19.0 (.749)	9.0 (.354)	0.4 (.0157)
ECQ-S 5221□(Z)	220		19.0 (.749)	9.0 (.354)	0.4 (.0157)
ECQ-S 5241□(Z)	240		19.0 (.749)	9.0 (.354)	0.4 (.0157)
ECQ-S 5271□(Z)	270		19.0 (.749)	9.0 (.354)	0.4 (.0157)
ECQ-S 5301□(Z)	300		19.0 (.749)	9.0 (.354)	0.4 (.0157)
ECQ-S 5331□(Z)	330		19.0 (.749)	9.0 (.354)	0.4 (.0157)
ECQ-S 5361□(Z)	360		19.0 (.749)	9.0 (.354)	0.4 (.0157)
ECQ-S 5391□(Z)	390		19.0 (.749)	9.0 (.354)	0.4 (.0157)
ECQ-S 5431□(Z)	430		19.0 (.749)	9.0 (.354)	0.4 (.0157)
ECQ-S 5471□(Z)	470		19.0 (.749)	9.0 (.354)	0.4 (.0157)
ECQ-S 5511□(Z)	510	±5% (J)	19.0 (.749)	9.0 (.354)	0.4 (.0157)
ECQ-S 5561□(Z)	560		19.0 (.749)	9.0 (.354)	0.4 (.0157)
ECQ-S 5621□(Z)	620	±10%(K)	19.0 (.749)	10.0 (.394)	0.4 (.0157)
ECQ-S 5681□(Z)	680		19.0 (.749)	10.0 (.394)	0.4 (.0157)
ECQ-S 5751□(Z)	750		24.0 (.946)	9.0 (.354)	0.4 (.0157)
ECQ-S 5821□(Z)	820		24.0 (.946)	9.0 (.354)	0.4 (.0157)
ECQ-S 5911□(Z)	910		24.0 (.946)	9.0 (.354)	0.5 (.0197)
ECQ-S 5102□(Z)	1000		24.0 (.946)	9.0 (.354)	0.5 (.0197)
ECQ-S 5112□(Z)	1100		24.0 (.946)	9.5 (.374)	0.5 (.0197)
ECQ-S 5122□(Z)	1200		24.0 (.946)	9.5 (.374)	0.5 (.0197)
ECQ-S 5132□(Z)	1300		24.0 (.946)	10.0 (.394)	0.5 (.0197)
ECQ-S 5152□(Z)	1500		24.0 (.946)	10.0 (.394)	0.5 (.0197)
ECQ-S 5162□(Z)	1600		24.0 (.946)	10.0 (.394)	0.5 (.0197)
ECQ-S 5182□(Z)	1800		24.0 (.946)	10.0 (.394)	0.5 (.0197)
ECQ-S 5202□(Z)	2000		24.0 (.946)	11.0 (.433)	0.5 (.0197)
ECQ-S 5222□(Z)	2200		24.0 (.946)	11.0 (.433)	0.5 (.0197)
ECQ-S 5242□(Z)	2400		24.0 (.946)	11.5 (.453)	0.5 (.0197)
ECQ-S 5272□(Z)	2700		24.0 (.946)	11.5 (.453)	0.5 (.0197)
ECQ-S 5302□(Z)	3000		24.0 (.946)	11.5 (.453)	0.5 (.0197)
ECQ-S 5332□(Z)	3300		24.0 (.946)	11.5 (.453)	0.5 (.0197)
ECQ-S 5362□(Z)	3600		24.0 (.946)	12.0 (.473)	0.5 (.0197)
ECQ-S 5392□(Z)	3900		24.0 (.946)	12.0 (.473)	0.5 (.0197)
ECQ-S 5432□(Z)	4300		24.0 (.946)	13.0 (.512)	0.5 (.0197)
ECQ-S 5472□(Z)	4700		24.0 (.946)	13.0 (.512)	0.5 (.0197)
ECQ-S 5512□(Z)	5100		35.0 (1.380)	12.0 (.473)	0.5 (.0197)
ECQ-S 5562□(Z)	5600		35.0 (1.380)	12.0 (.473)	0.5 (.0197)
ECQ-S 5622□(Z)	6200		35.0 (1.380)	12.0 (.473)	0.5 (.0197)
ECQ-S 5682□(Z)	6800		35.0 (1.380)	12.0 (.473)	0.5 (.0197)
ECQ-S 5752□(Z)	7500		35.0 (1.380)	13.0 (.512)	0.5 (.0197)
ECQ-S 5822□(Z)	8200		35.0 (1.380)	13.0 (.512)	0.5 (.0197)
ECQ-S 5912□(Z)	9100		35.0 (1.380)	14.5 (.572)	0.5 (.0197)
ECQ-S 5103□(Z)	10000		35.0 (1.380)	14.5 (.572)	0.6 (.0236)

POLYPRPYLENE CAPACITORS

Type ECQ-F (Z), ECQ-F (ZH)(Radial Lead)



Electrical Specifications

1. Rated Voltage .... 200 V.D.C, 400V.D.C 630 V.D.C.
2. Capacitance .... See the Standard Products Table on pp. VI-39 ~ 41.
3. Capacitance Tolerance .... ±10%(K), ±20%(M)
4. Insulation Resistance .... ≧15,000MΩ
5. Dissipation Factor .... <0.1% at 1 kHz
6. Withstand Voltage .... Rated Voltage x 2.5 (1 sec)max.
7. Operating Temperature .... –25°C ~ +85°C

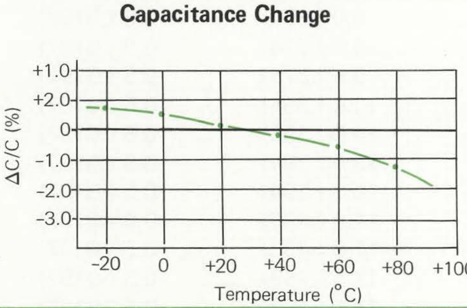
Features

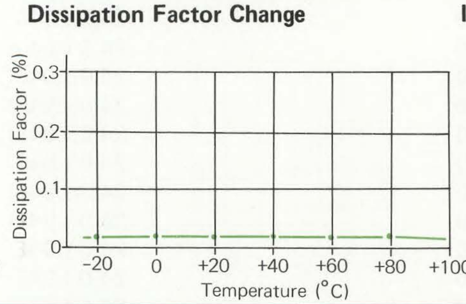
1. The capacitor consists of polypropylene film, aluminum foil and Durez resin coated.
2. Marking comprises capacitance, capacitance tolerance rated. voltage, manufacturer's name or symbol and type name.
3. Non-inductive
4. The capacitor is low cost.

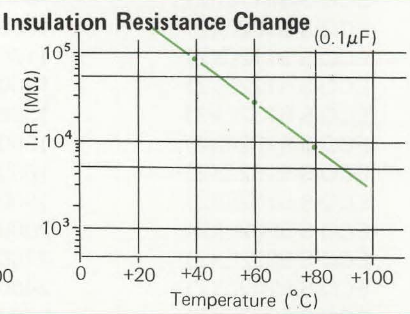
Application

(1) Communication Equipment, (2) Radio, (3) TV

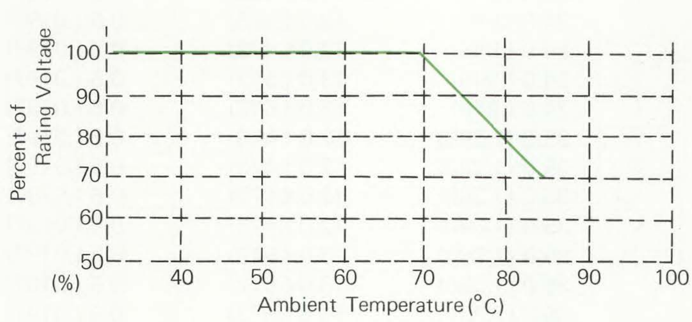
Temperature Characteristics







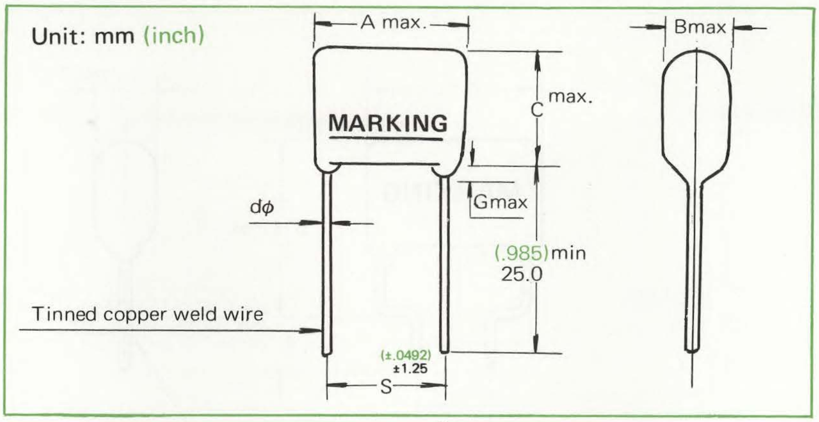
Reduction of Rated Voltage vs. Temperature



*** Reduction of Rated Voltage vs. Capacitance**

Capacitance	Rating Voltage		
0.10	630V	400V	200V
0.12	615	390	195
0.15	600	380	190
0.18	585	370	185
0.22	570	360	180
0.27	---	350	175
0.33	---	340	170
0.39	---	320	165
0.47	---	300	160

ECQ-F(Z) Standard Products Table



200 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolerance	A	B	C	F	G	dϕ
ECQ-F2223□Z	.022		18.5 (.730)	7.5 (.295)	15.0 (.532)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F2273□Z	.027		18.5 (.730)	7.5 (.295)	15.0 (.532)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F2333□Z	.033		18.5 (.730)	8.0 (.315)	15.0 (.532)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F2393□Z	.039		18.5 (.730)	8.0 (.315)	16.0 (.630)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F2473□Z	.047		18.5 (.730)	8.5 (.335)	17.5 (.690)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F2563□Z	.056	±10%(K)	18.5 (.730)	9.0 (.354)	18.0 (.710)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F2683□Z	.068		18.5 (.730)	10.0 (.394)	19.0 (.748)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F2823□Z	.082		24.0 (.946)	8.5 (.335)	17.5 (.690)	19.5 (.768)	3.0 (.118)	0.7 (.0276)
ECQ-F2104□Z	.1		24.0 (.340)	9.0 (.354)	18.0 (.710)	19.5 (.768)	3.0 (.118)	0.7 (.0276)
ECQ-F2124□Z	.12	±20%(M)	24.0 (.340)	9.5 (.354)	18.5 (.730)	19.5 (.768)	3.0 (.118)	0.7 (.0276)
ECQ-F2154□Z	.15		24.0 (.340)	10.5 (.414)	19.5 (.768)	19.5 (.768)	3.0 (.118)	0.7 (.0276)
ECQ-F2184□Z	.18		24.0 (.340)	11.5 (.453)	20.5 (.808)	19.5 (.768)	3.0 (.118)	0.7 (.0276)
ECQ-F2224□Z	.22		24.0 (.340)	12.5 (.492)	21.5 (.848)	19.5 (.768)	3.0 (.118)	0.7 (.0276)
ECQ-F2274□Z	.27		33.0 (1.300)	12.5 (.492)	21.5 (.848)	26.5 (1.044)	3.0 (.118)	0.8 (.0315)
ECQ-F2334□Z	.33		33.0 (1.300)	12.5 (.492)	21.5 (.848)	26.5 (1.044)	3.0 (.118)	0.8 (.0315)
ECQ-F2394□Z	.39		33.0 (1.300)	15.0 (.592)	23.5 (.827)	26.5 (1.044)	3.0 (.118)	0.8 (.0315)
ECQ-F2474□Z	.47		33.0 (1.300)	15.0 (.592)	23.5 (.827)	26.5 (1.044)	3.0 (.118)	0.8 (.0315)

400 V.D.C.

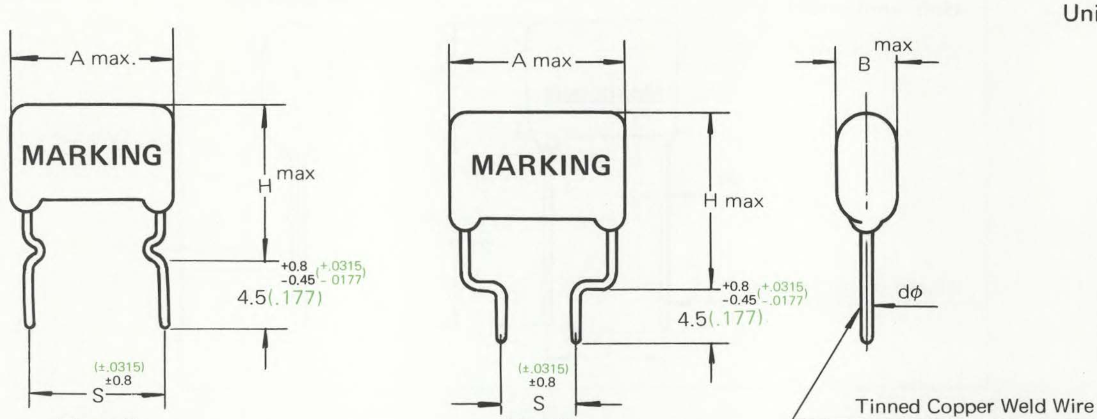
Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolerance	A	B	C	F	G	dϕ
ECQ-F4822□Z	.0082		18.5 (.730)	7.5 (.295)	13.5 (.532)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F4103□Z	.01		18.5 (.730)	7.5 (.295)	15.0 (.592)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F4123□Z	.012		18.5 (.730)	7.5 (.295)	15.0 (.592)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F4153□Z	.015		18.5 (.730)	7.5 (.295)	15.0 (.592)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F4183□Z	.018		18.5 (.730)	7.5 (.295)	15.0 (.592)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F4223□Z	.022	±10%(K)	18.5 (.730)	8.0 (.315)	15.5 (.611)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F4273□Z	.027		18.5 (.730)	8.5 (.335)	17.5 (.690)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F4333□Z	.033		18.5 (.730)	9.0 (.354)	18.0 (.710)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F4393□Z	.039		18.5 (.730)	9.5 (.374)	18.5 (.730)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F4473□Z	.047		18.5 (.730)	10.0 (.394)	19.0 (.748)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F4563□Z	.056		24.0 (.946)	8.5 (.335)	17.5 (.690)	19.5 (.768)	3.0 (.118)	0.6 (.0236)
ECQ-F4683□Z	.068	±20%(M)	24.0 (.946)	9.5 (.374)	18.5 (.730)	19.5 (.768)	3.0 (.118)	0.7 (.0236)
ECQ-F4823□Z	.082		24.0 (.946)	10.0 (.394)	19.0 (.748)	19.5 (.768)	3.0 (.118)	0.7 (.0236)
ECQ-F4104□Z	.1		24.0 (.946)	11.0 (.434)	20.0 (.788)	19.5 (.768)	3.0 (.118)	0.7 (.0236)
ECQ-F4124□Z	.12		24.0 (.946)	12.0 (.473)	21.0 (.828)	19.5 (.768)	3.0 (.118)	0.7 (.0236)
ECQ-F4154□Z	.15		24.0 (.946)	13.0 (.512)	22.0 (.867)	19.5 (.768)	3.0 (.118)	0.7 (.0236)
ECQ-F6183□Z	.18		33.0 (1.300)	13.5 (.532)	22.0 (.867)	26.5 (1.044)	3.0 (.118)	0.8 (.0315)
ECQ-F4224□Z	.22		33.0 (1.300)	13.5 (.532)	22.0 (.867)	26.5 (1.044)	3.0 (.118)	0.8 (.0315)
ECQ-F4274□Z	.27		33.0 (1.300)	16.0 (.630)	25.0 (.985)	26.5 (1.044)	3.0 (.118)	0.8 (.0315)
ECQ-F4334□Z	.33		33.0 (1.300)	16.0 (.630)	25.0 (.985)	26.5 (1.044)	3.0 (.118)	0.8 (.0315)
ECQ-F4394□Z	.39		40.0 (1.576)	17.0 (.670)	25.5 (1.002)	32.5 (1.280)	3.0 (.118)	0.8 (.0315)
ECQ-F4474□Z	.47		40.0 (1.576)	17.0 (.670)	25.5 (1.002)	32.5 (1.280)	3.0 (.118)	0.8 (.0315)

630 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolerance	A	B	C	F	G	dϕ
ECQ-F6102□Z	.001		12.5 (.492)	6.5 (.256)	12.5 (.492)	8.5 (.335)	3.0 (.118)	0.6 (.0236)
ECQ-F6122□Z	.0012		12.5 (.492)	6.5 (.256)	12.5 (.492)	8.5 (.335)	3.0 (.118)	0.6 (.0236)
ECQ-F6152□Z	.0015		12.5 (.492)	6.5 (.256)	12.5 (.492)	8.5 (.335)	3.0 (.118)	0.6 (.0236)
ECQ-F6182□Z	.0018		12.5 (.492)	6.5 (.256)	12.5 (.492)	8.5 (.335)	3.0 (.118)	0.6 (.0236)
ECQ-F6222□Z	.0022		12.5 (.492)	6.5 (.256)	14.0 (.552)	8.5 (.335)	3.0 (.118)	0.6 (.0236)
ECQ-F6272□Z	.0027		12.5 (.492)	7.0 (.276)	14.5 (.572)	8.5 (.335)	3.0 (.118)	0.6 (.0236)
ECQ-F6332□Z	.0033		12.5 (.492)	7.5 (.295)	15.0 (.592)	8.5 (.335)	3.0 (.118)	0.6 (.0236)
ECQ-F6392□Z	.0039		12.5 (.492)	8.0 (.315)	15.5 (.611)	8.5 (.335)	3.0 (.118)	0.6 (.0236)
ECQ-F6472□Z	.0047		18.5 (.730)	7.5 (.295)	13.0 (.512)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F6562□Z	.0056		18.5 (.730)	8.0 (.315)	13.5 (.532)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F6682□Z	.0068	±10%(K)	18.5 (.730)	7.5 (.295)	13.0 (.512)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F6822□Z	.0082		18.5 (.730)	7.5 (.295)	15.0 (.592)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F6103□Z	.01		18.5 (.730)	8.0 (.315)	15.5 (.611)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F6123□Z	.012		18.5 (.730)	8.0 (.315)	17.0 (.670)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F6153□Z	.015		18.5 (.730)	8.5 (.335)	17.5 (.690)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F6183□Z	.018		18.5 (.730)	9.0 (.354)	18.5 (.730)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F6223□Z	.022		18.5 (.730)	10.0 (.394)	19.0 (.748)	13.5 (.532)	3.0 (.118)	0.6 (.0236)
ECQ-F6273□Z	.027		24.0 (.946)	8.5 (.335)	17.5 (.690)	19.5 (.768)	3.0 (.118)	0.7 (.0276)
ECQ-F6333□Z	.033	±20%(M)	24.0 (.946)	9.0 (.354)	18.0 (.710)	19.5 (.768)	3.0 (.118)	0.7 (.0276)
ECQ-F6393□Z	.039		24.0 (.946)	10.0 (.394)	19.0 (.748)	19.5 (.768)	3.0 (.118)	0.7 (.0276)
ECQ-F6473□Z	.047		24.0 (.946)	11.0 (.434)	20.0 (.788)	19.5 (.768)	3.0 (.118)	0.7 (.0276)
ECQ-F6563□Z	.056		24.0 (.946)	11.5 (.453)	20.5 (.808)	19.5 (.768)	3.0 (.118)	0.7 (.0276)
ECQ-F6683□Z	.068		24.0 (.946)	12.5 (.492)	21.5 (.848)	19.5 (.768)	3.0 (.118)	0.7 (.0276)
ECQ-F6823□Z	.082		33.0 (1.300)	12.5 (.492)	21.0 (.828)	26.5 (1.042)	3.0 (.118)	0.8 (.0315)
ECQ-F6104□Z	.1		33.0 (1.300)	12.5 (.492)	21.0 (.828)	26.5 (1.042)	3.0 (.118)	0.8 (.0315)
ECQ-F6124□Z	.12		33.0 (1.300)	15.0 (.592)	24.0 (.946)	26.5 (1.042)	3.0 (.118)	0.8 (.0315)
ECQ-F6154□Z	.15		33.0 (1.300)	15.0 (.592)	24.0 (.946)	26.5 (1.042)	3.0 (.118)	0.8 (.0315)
ECQ-F6184□Z	.18		40.0 (1.576)	16.0 (.630)	24.5 (.965)	32.5 (1.282)	3.0 (.118)	0.8 (.0315)
ECQ-F6224□Z	.22		40.0 (1.576)	16.0 (.630)	24.5 (.965)	32.5 (1.282)	3.0 (.118)	0.8 (.0315)

ECQ-F(ZH) Standard Products Table

Unit: mm(inch)



Type D TypeB

200 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolerance	A	B	H	S	dϕ	Type
ECQ-F2223□ZH	.022		18.5 (.730)	7.5 (.295)	20.0 (.788)	10 (.394)	0.6 (.0236)	B
ECQ-F2273□ZH	.027		18.5 (.730)	7.5 (.295)	20.0 (.788)	10 (.394)	0.6 (.0236)	B
ECQ-F2333□ZH	.033	±20%(M)	18.5 (.730)	8.0 (.315)	20.0 (.788)	10 (.394)	0.6 (.0236)	B
ECQ-F2393□ZH	.039		18.5 (.730)	8.0 (.315)	21.0 (.828)	10 (.394)	0.6 (.0236)	B
ECQ-F2473□ZH	.047		18.5 (.730)	8.5 (.335)	22.5 (.887)	10 (.394)	0.6 (.0236)	B
ECQ-F2563□ZH	.056		18.5 (.730)	9.0 (.354)	23.0 (.907)	15 (.592)	0.6 (.0236)	D
ECQ-F2683□ZH	.068		18.5 (.730)	10.0 (.394)	24.0 (.946)	15 (.592)	0.6 (.0236)	D
ECQ-F2823□ZH	.082		24.0 (.946)	8.5 (.335)	22.5 (.887)	15 (.592)	0.7 (.0276)	B
ECQ-F2104□ZH	.1		24.0 (.946)	9.0 (.354)	23.0 (.907)	15 (.592)	0.7 (.0276)	B
ECQ-F2124□ZH	.12		24.0 (.946)	9.5 (.374)	23.5 (.927)	15 (.592)	0.7 (.0276)	B
ECQ-F2154□ZH	.15		24.0 (.946)	10.5 (.414)	26.5 (1.042)	20 (.788)	0.7 (.0276)	D
ECQ-F2184□ZH	.18		24.0 (.946)	11.5 (.453)	27.5 (.1083)	20 (.788)	0.7 (.0276)	D
ECQ-F2224□ZH	.22		24.0 (.946)	12.5 (.493)	28.5 (1.122)	20 (.788)	0.7 (.0276)	D
ECQ-F2274□ZH	.27		33.0 (1.300)	12.5 (.493)	27.5 (1.083)	20 (.788)	0.8 (.0315)	B
ECQ-F2334□ZH	.33		33.0 (1.300)	12.5 (.493)	27.5 (1.083)	20 (.788)	0.8 (.0315)	B
ECQ-F2394□ZH	.39		33.0 (1.300)	15.0 (.592)	29.5 (1.161)	20 (.788)	0.8 (.0315)	B
ECQ-F2474□ZH	.47		33.0 (1.300)	15.0 (.592)	29.5 (1.161)	20 (.788)	0.8 (.0315)	B

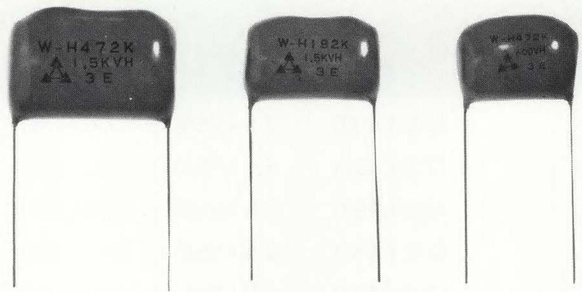
400 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolerance	A	B	H	S	dϕ	Type
ECQ-F4822□ZH	.0082		18.5 (.730)	7.5 (.295)	18.5 (.730)	10.0 (.394)	0.6 (.0236)	B
ECQ-F4123□ZH	.01		18.5 (.730)	7.5 (.295)	20.0 (.788)	10.0 (.394)	0.6 (.0236)	B
ECQ-F4123□ZH	.012	±10%(K)	18.5 (.730)	7.5 (.295)	20.0 (.788)	10.0 (.394)	0.6 (.0236)	B
ECQ-F4153□ZH	.015		18.5 (.730)	7.5 (.295)	20.0 (.788)	10.0 (.394)	0.6 (.0236)	B
ECQ-F4183□ZH	.018		18.5 (.730)	7.5 (.295)	20.0 (.788)	10.0 (.394)	0.6 (.0236)	B
ECQ-F4223□ZH	.022		18.5 (.730)	8.0 (.315)	20.5 (.808)	10.0 (.394)	0.6 (.0236)	B
ECQ-F4273□ZH	.027	±20%(M)	18.5 (.730)	8.5 (.335)	22.5 (.887)	10.0 (.394)	0.6 (.0236)	B
ECQ-F4333□ZH	.033		18.5 (.730)	9.0 (.354)	23.0 (.907)	15.0 (.592)	0.6 (.0236)	D
ECQ-F4393□ZH	.039		18.5 (.730)	9.5 (.374)	23.5 (.927)	15.0 (.592)	0.6 (.0236)	D
ECQ-F4473□ZH	.047		18.5 (.730)	10.0 (.394)	24.0 (.946)	15.0 (.592)	0.6 (.0236)	D
ECQ-F4563□ZH	.056		24.0 (.946)	8.5 (.335)	22.5 (.887)	15.0 (.592)	0.7 (.0276)	B
ECQ-F4683□ZH	.068		24.0 (.946)	9.5 (.374)	23.5 (.927)	15.0 (.592)	0.7 (.0276)	B
ECQ-F4823□ZH	.082		24.0 (.946)	10.0 (.394)	24.0 (.946)	15.0 (.592)	0.7 (.0276)	B
ECQ-F4104□ZH	.1		24.0 (.946)	11.0 (.434)	27.0 (1.062)	20.0 (.788)	0.7 (.0276)	D
ECQ-F4124□ZH	.12		24.0 (.946)	12.0 (.473)	28.0 (1.102)	20.0 (.788)	0.7 (.0276)	D
ECQ-F4154□ZH	.15		24.0 (.946)	13.0 (.512)	29.0 (1.141)	20.0 (.788)	0.7 (.0276)	D
ECQ-F4184□ZH	.18		33.0 (1.300)	13.5 (.532)	28.0 (1.102)	20.0 (.788)	0.8 (.0315)	B
ECQ-F4224□ZH	.22		33.0 (1.300)	13.5 (.532)	28.0 (1.102)	20.0 (.788)	0.8 (.0315)	B
ECQ-F4274□ZH	.27		33.0 (1.300)	16.0 (.630)	31.0 (1.221)	20.0 (.788)	0.8 (.0315)	B
ECQ-F4334□ZH	.33		33.0 (1.300)	16.0 (.630)	31.0 (1.221)	20.0 (.788)	0.8 (.0315)	B
ECQ-F4394□ZH	.39		40.0 (1.576)	17.0 (.670)	31.5 (1.240)	20.0 (.788)	0.8 (.0315)	B
ECQ-F4474□ZH	.47		40.0 (1.576)	17.0 (.670)	31.5 (1.240)	20.0 (.788)	0.8 (.0315)	B

600 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)					
	Rated(μF)	Tolernace	A	B	H	S	dφ	Type
ECQ-F6102□ZH	.001		12.5 (.492)	6.5 (.256)	17.5 (.690)	10.0 (.394)	0.6 (0.236)	D
ECQ-F6122□ZH	.0012		12.5 (.492)	6.5 (.256)	17.5 (.690)	10.0 (.394)	0.6 (.0236)	D
ECQ-F6152□ZH	.0015		12.5 (.492)	6.5 (.256)	17.5 (.690)	10.0 (.394)	0.6 (.0236)	D
ECQ-F6182□ZH	.0018		12.5 (.492)	6.5 (.256)	17.5 (.690)	10.0 (.394)	0.6 (.0236)	D
ECQ-F6222□ZH	.0022		12.5 (.492)	6.5 (.256)	19.0 (.748)	10.0 (.394)	0.6 (.0236)	D
ECQ-F6272□ZH	.0027		12.5 (.492)	7.0 (.276)	19.5 (.768)	10.0 (.394)	0.6 (.0236)	D
ECQ-F6332□ZH	.0033		12.5 (.492)	7.5 (.295)	20.0 (.788)	10.0 (.394)	0.6 (.0236)	D
ECQ-F6392□ZH	.0039		12.5 (.492)	8.0 (.315)	20.5 (.808)	10.0 (.394)	0.6 (.0236)	D
ECQ-F6472□ZH	.0047		18.5 (.730)	7.5 (.295)	18.0 (.710)	10.0 (.394)	0.6 (.0236)	B
ECQ-F6562□ZH	.0056		18.5 (.730)	8.0 (.315)	18.5 (.730)	10.0 (.394)	0.6 (.0236)	B
ECQ-F6682□ZH	.0068	±10%(K)	18.5 (.730)	7.5 (.295)	18.0 (.710)	10.0 (.394)	0.6 (.0236)	B
ECQ-F6822□ZH	.0082		18.5 (.730)	7.5 (.295)	20.0 (.788)	10.0 (.394)	0.6 (.0236)	B
ECQ-F6103□ZH	.01		18.5 (.730)	8.0 (.315)	20.5 (.808)	10.0 (.394)	0.6 (.0236)	B
ECQ-F6123□ZH	.012		18.5 (.730)	8.0 (.315)	22.0 (.867)	10.0 (.394)	0.6 (.0236)	B
ECQ-F6153□ZH	.015		18.5 (.730)	8.5 (.335)	22.5 (.887)	15.0 (.592)	0.6 (.0236)	D
ECQ-F6183□ZH	.018		18.5 (.730)	9.0 (.354)	23.5 (.827)	15.0 (.592)	0.6 (.0236)	D
ECQ-F6223□ZH	.022		18.5 (.730)	10.0 (.394)	24.0 (.946)	15.0 (.592)	0.6 (.0236)	D
ECQ-F6273□ZH	.027		24.0 (.946)	8.5 (.335)	22.5 (.887)	15.0 (.592)	0.7 (.0276)	B
ECQ-F6333□ZH	.033	±20%(M)	24.0 (.946)	9.0 (.354)	23.0 (.907)	15.0 (.592)	0.7 (.0276)	B
ECQ-F6393□ZH	.039		24.0 (.946)	10.0 (.394)	24.0 (.946)	15.0 (.592)	0.7 (.0276)	B
ECQ-F6463□ZH	.047		24.0 (.946)	11.0 (.434)	25.5 (.985)	15.0 (.592)	0.7 (.0276)	B
ECQ-F6563□ZH	.056		24.0 (.946)	11.5 (.453)	27.5 (1.083)	20.0 (.788)	0.7 (.0276)	D
ECQ-F6683□ZH	.068		24.0 (.946)	11.5 (.492)	28.5 (1.122)	20.0 (.788)	0.8 (.0315)	D
ECQ-F6823□ZH	.082		24.0 (.946)	11.5 (.453)	27.5 (1.083)	20.0 (.788)	0.8 (.0315)	B
ECQ-F6104□ZH	1		33.0 (1.300)	12.5 (.453)	27.0 (1.062)	20.0 (.788)	0.8 (.0315)	D
ECQ-F6124□ZH	.12		33.0 (1.300)	15.0 (.592)	30.0 (1.182)	20.0 (.788)	0.8 (.0315)	B
ECQ-F6154□ZH	.15		33.0 (1.300)	15.0 (.592)	30.0 (1.182)	20.0 (.788)	0.8 (.0315)	B
ECQ-F6184□ZH	.18		40.0 (1.576)	16.0 (.630)	30.5 (1.200)	20.0 (.788)	0.8 (.0315)	B
ECQ-F6224□ZH	.22		40.0 (1.576)	16.0 (.630)	30.5 (1.200)	20.0 (.788)	0.8 (.0315)	B

Type ECW-H (=Horizontal Capacitor)



Electrical Specifications

1. Rated Voltage *600V, 1000V, 1200V, 1500V
2. Capacitance .... See the Standard Products Table on p. VI-43, 44.
3. Capacitance Tolerance .... ±5%(T), ±10%(K), ±20%(M)
4. Insulation Resistance .... ≧25,000 MΩ
5. Dissipation Factor .... <0.1% at 1 kHz.
6. Withstand Voltage .... Rated Voltage x 3.0 max.
7. Operating Temperature .... −25°C ~ +85°C

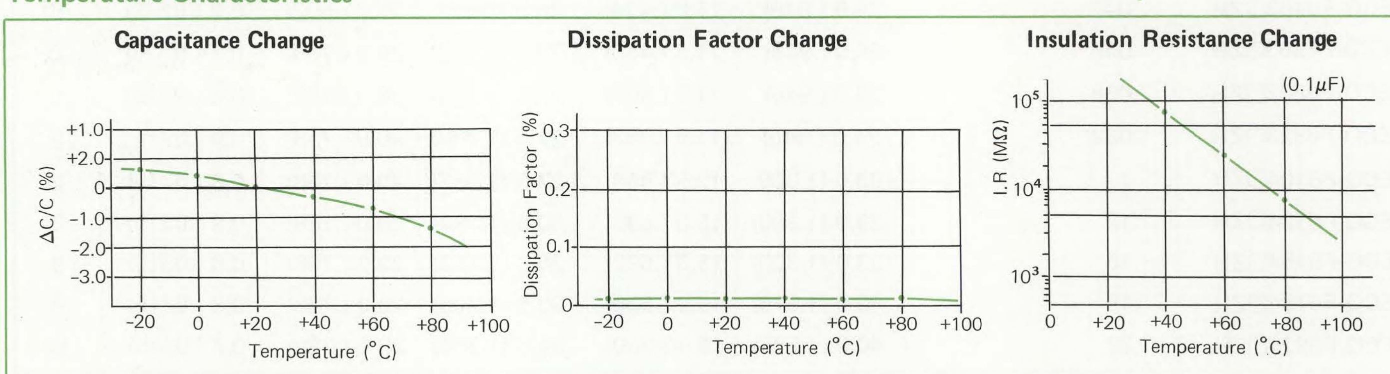
Features

1. The capacitor consists of polypropylene film and aluminum foil and epoxy resin coating.
2. Marking comprises capacitance, capacitance tolerance, rated voltage and manufactures name or symbol.
3. Non-industive and non-combustible.

Application

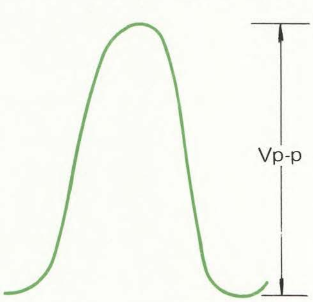
(1) TV. (Horizontal circuit) (2) High frequency circuit

Temperature Characteristics



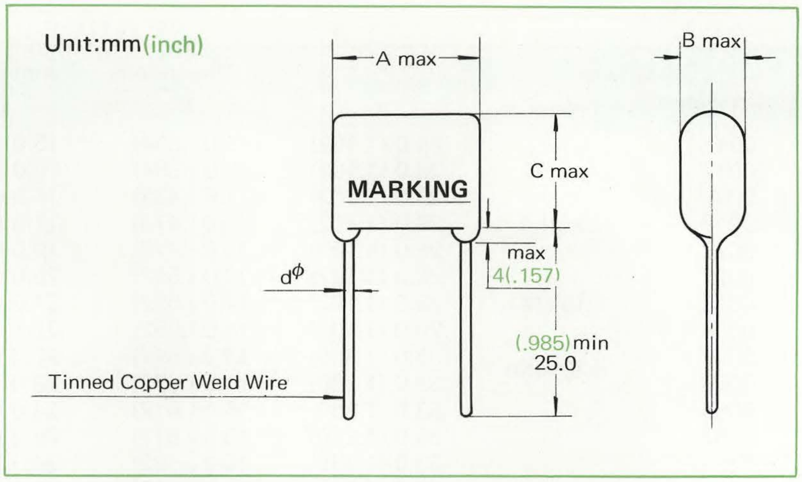
Reduction of Rated Voltage vs. Temperature

* Peak to peak (at 15,75kHz)



Vp-p (V)	Rated Voltage (V)
600	600
1000	1000
1200	1200
1500	1500

ECW-H (Z) Standard Products Table



600 V.D.C.

Part No.	Capacitance		Dimensions		mm (inch)	
	Rared (μF)	Tolerance	A	B	C	dϕ
ECW-H6102□Z	.001		22.0 (.868)	10.0 (.394)	16.0 (.631)	0.8 (.0315)
ECW-H6122□Z	.0012		22.0 (.868)	10.5 (.414)	17.5 (.690)	0.8 (.0315)
ECW-H6152□Z	.0015		22.0 (.868)	11.0 (.433)	18.5 (.730)	0.8 (.0315)
ECW-H6182□Z	.0018	(±5%) (J)	28.0 (1.102)	10.0 (.394)	15.5 (.612)	0.8 (.0315)
ECW-H6222□Z	.0022		28.0 (.102)	10.5 (.414)	16.0 (.631)	0.8 (.0315)
ECW-H6272□Z	.0027		28.0 (.102)	11.0 (.433)	17.5 (.690)	0.8 (.0315)
ECW-H6392□Z	.0033	±10%(K)	28.0 (.102)	12.0 (.473)	18.5 (.730)	0.8 (.0315)
ECW-H6392□Z	.0039		28.0 (.102)	12.5 (.492)	19.0 (.750)	0.8 (.0315)
ECW-H6472□Z	.0047	±20%(M)	28.0 (.102)	13.5 (.532)	20.0 (.788)	0.8 (.0315)
ECW-H6562□Z	.0056		28.0 (.102)	14.0 (.552)	22.0 (.868)	0.8 (.0315)
ECW-H6682□Z	.0068		33.0 (1.300)	13.0 (.512)	21.0 (.828)	0.8 (.0315)
ECW-H6822□Z	.0082		33.0 (1.300)	14.0 (.552)	22.0 (.868)	0.8 (.0315)
ECW-H6103□Z	.01		33.0 (1.300)	15.0 (.592)	23.0 (.907)	0.8 (.0315)
ECW-H6123□Z	.012		33.0 (1.300)	15.5 (.612)	25.0 (.985)	0.8 (.0315)
ECW-H6153□Z	.015		39.0 (1.535)	14.0 (.552)	23.5 (.927)	0.8 (.0315)
ECW-H6183□Z	.018		39.0 (1.535)	15.0 (.592)	24.5 (.966)	0.8 (.0315)
ECW-H6223□Z	.022		39.0 (1.535)	16.5 (.650)	26.0 (1.024)	0.8 (.0315)
ECW-H6273□Z	.027		43.0 (1.695)	16.5 (.650)	26.0 (1.024)	0.8 (.0315)
ECW-H6333□Z	.033		43.0 (1.695)	17.5 (.690)	28.5 (1.122)	1.0 (.0394)
ECW-H6393□Z	.039		43.0 (1.695)	20.0 (.788)	31.0 (1.220)	1.0 (.0394)

1000 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)			
	Rated (μF)	Tolerance	A	B	C	dϕ
ECW-H10102□Z	.001		28.0 (1.102)	9.0 (.354)	15.0 (.592)	0.8 (.0315)
ECW-H10122□Z	.0012		28.0 (1.102)	10.0 (.394)	16.0 (.631)	0.8 (.0315)
ECW-H10152□Z	.0015		28.0 (1.102)	11.0 (.433)	16.5 (.650)	0.8 (.0315)
ECW-H10182□Z	.0018	(±5%) (J)	28.0 (1.102)	12.0 (.473)	17.0 (.670)	0.8 (.0315)
ECW-H10222□Z	.0022		28.0 (1.102)	12.0 (.473)	19.0 (.750)	0.8 (.0315)
ECW-H10272□Z	.0027		28.0 (1.102)	13.0 (.512)	20.0 (.788)	0.8 (.0315)
ECW-H10332□Z	.0033	±10% (K)	28.0 (1.102)	14.0 (.552)	31.0 (.828)	0.8 (.0315)
ECW-H10392□Z	.0039		28.0 (1.102)	14.0 (.552)	22.5 (.888)	0.8 (.0315)
ECW-H10472□Z	.0047	±20% (M)	33.0 (1.300)	13.0 (.512)	22.0 (.868)	0.8 (.0315)
ECW-H10562□Z	.0056		33.0 (1.300)	14.5 (.572)	23.0 (.907)	0.8 (.0315)
ECW-H10682□Z	.0068		33.0 (1.300)	15.5 (.612)	24.0 (.946)	0.8 (.0315)
ECW-H10822□Z	.0082		33.0 (1.300)	15.5 (.612)	26.0 (1.024)	0.8 (.0315)
ECW-H10103□Z	.01		39.0 (1.535)	15.0 (.592)	24.5 (.966)	0.8 (.0315)
ECW-H10123□Z	.012		39.0 (1.535)	15.5 (.612)	26.0 (1.024)	0.8 (.0315)
ECW-H10153□Z	.015		39.0 (1.535)	17.0 (.670)	27.0 (1.062)	0.8 (.0315)
ECW-H10183□Z	.018		43.0 (1.695)	17.0 (.670)	27.0 (1.062)	0.8 (.0315)
ECW-H10223□Z	.022		43.0 (1.695)	18.5 (.730)	29.0 (1.142)	1.0 (.0394)
ECW-H10273□Z	.027		43.0 (1.695)	20.0 (.788)	31.5 (1.240)	1.0 (.0394)

1200 V.D.C.

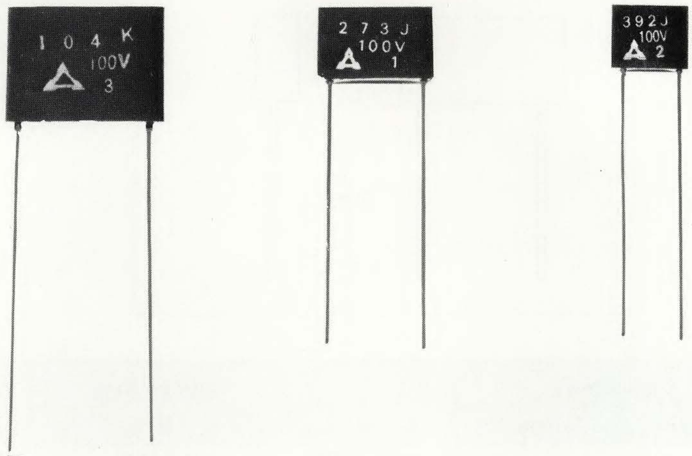
Part No.	Capacitance		Dimensions mm (inch)			
	Rated (μF)	Tolerance	A	B	C	dϕ
ECW-H12102□Z	.001		28.0 (1.102)	11.5 (.453)	18.0 (.710)	0.8 (.0315)
ECW-H12122□Z	.0012		28.0 (1.102)	12.5 (.492)	19.0 (.750)	0.8 (.0315)
ECW-H12152□Z	.0015		28.0 (1.102)	14.0 (.552)	20.0 (.788)	0.8 (.0315)
ECW-H12182□Z	.0018	(±5%) (J)	28.0 (1.102)	14.0 (.552)	22.0 (.868)	0.8 (.0315)
ECW-H12222□Z	.0022		33.0 (1.300)	14.0 (.552)	20.0 (.788)	0.8 (.0315)
ECW-H12272□Z	.0027		33.0 (1.300)	13.0 (.512)	21.5 (.848)	0.8 (.0315)
ECW-H12332□Z	.0033	±10% (K)	33.0 (1.300)	14.0 (.552)	22.5 (.888)	0.8 (.0315)
ECW-H12392□Z	.0039		33.0 (1.300)	15.0 (.592)	23.5 (.927)	0.8 (.0315)
ECW-H12472□Z	.0047	±20% (M)	33.0 (1.300)	15.5 (.612)	25.5 (1.005)	0.8 (.0315)
ECW-H12562□Z	.0056		39.0 (1.535)	14.0 (.552)	24.0 (.946)	0.8 (.0315)
ECW-H12682□Z	.0068		39.0 (1.535)	15.0 (.592)	25.0 (.985)	0.8 (.0315)
ECW-H12822□Z	.0082		39.0 (1.535)	16.5 (.650)	26.0 (1.024)	0.8 (.0315)
ECW-H12103□Z	.01		43.0 (1.695)	16.0 (.631)	26.0 (1.024)	0.8 (.0315)
ECW-H12123□Z	.012		43.0 (1.695)	17.5 (.690)	27.5 (1.084)	0.8 (.0315)
ECW-H12153□Z	.015		43.0 (1.695)	18.5 (.730)	30.0 (1.180)	1.0 (.0394)
ECW-H12183□Z	.018		43.0 (1.695)	20.0 (.788)	32.0 (1.260)	1.0 (.0394)

1500 V.D.C.

	Capacitance		Dimensions mm (inch)			
	Rated (μF)	Tolerance	A	B	C	dϕ
ECW-H15102□Z	.001		33.0 (1.300)	11.0 (.433)	17.5 (.690)	0.8 (.0315)
ECW-H15122□Z	.0012		33.0 (1.300)	11.5 (.453)	18.0 (.710)	0.8 (.0315)
ECW-H15152□Z	.0015		33.0 (1.300)	12.5 (.492)	19.0 (.750)	0.8 (.0315)
ECW-H15182□Z	.0018	(±5%) (J)	33.0 (1.300)	13.0 (.512)	21.0 (.828)	0.8 (.0315)
ECW-H15222□Z	.0022		33.0 (1.300)	14.0 (.552)	22.5 (.888)	0.8 (.0315)
ECW-H15272□Z	.0027		33.0 (1.300)	15.0 (.592)	23.0 (.907)	0.8 (.0315)
ECW-H15332□Z	.0033	±10% (K)	39.0 (1.535)	13.5 (.532)	22.0 (.868)	0.8 (.0315)
ECW-H15392□Z	.0039		39.0 (1.535)	15.0 (.592)	23.5 (.927)	0.8 (.0315)
ECW-H15472□Z	.0047	±20% (M)	39.0 (1.535)	16.0 (.631)	25.5 (1.005)	0.8 (.0315)
ECW-H15562□Z	.0056		39.0 (1.535)	17.0 (.670)	27.0 (1.062)	0.8 (.0315)
ECW-H15682□Z	.0068		43.0 (1.695)	17.0 (.670)	27.0 (1.062)	0.8 (.0315)
ECW-H15822□Z	.0082		43.0 (1.695)	18.5 (.730)	28.5 (1.122)	1.0 (.0394)
ECW-H15103□Z	.01		43.0 (1.695)	20.0 (.788)	31.0 (1.220)	1.0 (.0394)

POLYCARBONATE CAPACITORS

Type ECQ-C (Z)(Radial Lead)



Electrical Specificaitons

1. Rated Voltage 100V.D.C
2. Capacitance .... See the Standard Product Table on p.VI-46.
3. Capacitance Tolerance .... ±5% (J), ±10%(K)
4. Insulation Resistance .... ≧50,000 MΩ
5. Dissipation Factor .... <0,3% at 1 kHz
6. Withstand Voltage .... Rated voltage x 1.55 (1 sec) max.
7. Operating Temperature .... −55°C ~ +85°C

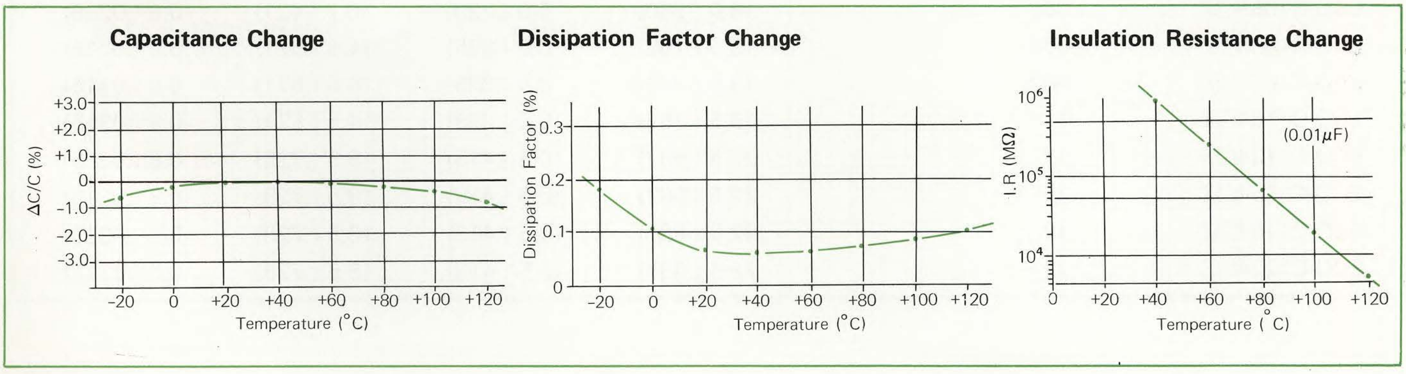
Features

1. The capacitor consists of polycarbonate film, aluminum foil with plastic case.
2. Marking comprises capacitance, capacitance tolerance, rated voltage and manufacturer's name or symbol.
3. Non-industive and covers a wide range and has high reliability.

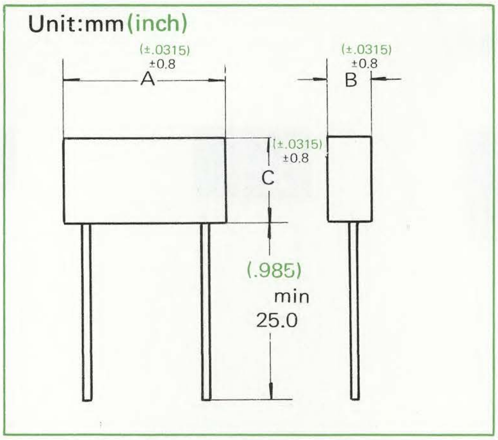
Application

(1) Communication equipment (2) Industrial equipment

Temperature Characteristics



ECQ-C (Z) Standard Products Table

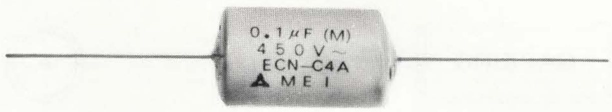


100 V.D.C.

Part No.	Capacitance		Dimensions mm (inch)			
	Rated (μF)	Tolerance	A	B	C	dϕ
ECQ-C1102□Z	.001		9.8 (.386)	4.5 (.177)	8.0 (.315)	0.6 (.0236)
ECQ-C1122□Z	.0012		9.8 (.386)	4.5 (.177)	8.0 (.315)	0.6 (.0236)
ECQ-C1152□Z	.0015		9.8 (.386)	4.5 (.177)	8.0 (.315)	0.6 (.0236)
ECQ-C1182□Z	.0018		9.8 (.386)	4.5 (.177)	8.0 (.315)	0.6 (.0236)
ECQ-C1222□Z	.0022		9.8 (.386)	4.5 (.177)	8.0 (.315)	0.6 (.0236)
ECQ-C1272□Z	.0027		9.8 (.386)	4.5 (.177)	8.0 (.315)	0.6 (.0236)
ECQ-C1332□Z	.0033		9.8 (.386)	4.5 (.177)	8.0 (.315)	0.6 (.0236)
ECQ-C1392□Z	.0039		9.8 (.386)	4.5 (.177)	8.0 (.315)	0.6 (.0236)
ECQ-C1472□Z	.0047		9.8 (.386)	4.5 (.177)	8.0 (.315)	0.6 (.0236)
ECQ-C1562□Z	.0056		9.8 (.386)	4.5 (.177)	8.0 (.315)	0.6 (.0236)
ECQ-C1682□Z	.0068	±10%(K)	9.8 (.386)	5.5 (.217)	9.2 (.362)	0.6 (.0236)
ECQ-C1822□Z	.0082		9.8 (.386)	5.5 (.217)	9.2 (.362)	0.6 (.0236)
ECQ-C1103□Z	.01		9.8 (.386)	5.5 (.217)	9.2 (.362)	0.6 (.0236)
ECQ-C1123□Z	.012		9.8 (.386)	5.5 (.217)	9.2 (.362)	0.6 (.0236)
ECQ-C1153□Z	.015		14.7 (.579)	5.5 (.217)	9.2 (.362)	0.6 (.0236)
ECQ-C1183□Z	.018		14.7 (.579)	5.5 (.217)	9.2 (.362)	0.6 (.0236)
ECQ-C1223□Z	.022		14.7 (.579)	5.5 (.217)	9.2 (.362)	0.6 (.0236)
ECQ-C1273□Z	.027	±20%(M)	14.7 (.579)	5.5 (.217)	9.2 (.362)	0.6 (.0236)
ECQ-C1333□Z	.033		16.0 (.630)	5.6 (.220)	10.7 (.421)	0.6 (.0236)
ECQ-C1393□Z	.039		16.0 (.630)	5.6 (.220)	10.7 (.421)	0.6 (.0236)
ECQ-C1473□Z	.047		16.0 (.630)	5.6 (.220)	10.7 (.421)	0.6 (.0236)
ECQ-C1563□Z	.056		16.0 (.630)	5.6 (.220)	10.7 (.421)	0.6 (.0236)
ECQ-C1683□Z	.068		19.5 (.768)	8.5 (.335)	14.5 (.571)	0.8 (.0315)
ECQ-C1823□Z	.082		19.5 (.768)	8.5 (.335)	14.5 (.571)	0.8 (.0315)
ECQ-C1104□Z	.1		19.5 (.768)	8.5 (.335)	14.5 (.571)	0.8 (.0315)
ECQ-C1124□Z	.12		22.5 (.887)	10.5 (.413)	18.5 (.728)	0.8 (.0315)
ECQ-C1154□Z	.15		22.5 (.887)	10.5 (.413)	18.5 (.728)	0.8 (.0315)
ECQ-C1184□Z	.18		22.5 (.887)	10.5 (.413)	18.5 (.728)	0.8 (.0315)
ECQ-C1224□Z	.22		22.5 (.887)	10.5 (.413)	18.5 (.728)	0.8 (.0315)

OIL PAPER CAPACITORS

Type ECN-C (Axial Lead)



Electrical Specifications

1. Rated Voltage 450V.A.C
2. Capacitance .... See the Standard Products Table on p.VI-48.
3. Capacitance Tolerance .... ±10%(K) ±20% (M)
4. Insulation Resistance .... ≧9000 MΩ
5. Dissipation Factor .... <1.5% at 1 kHz
6. Withstand Voltage .... 2000 V.A.C (1 min) max.
7. Operating Temperature .... −25°C ~ +85°C

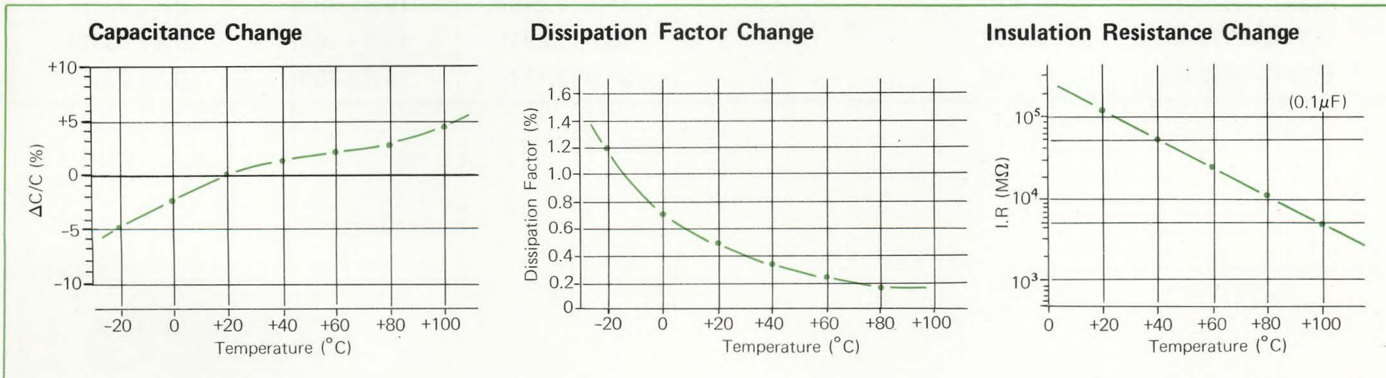
Features

1. The capacitor consists of paper (=dielectric) ceramic case and oil.
2. Marking comprises capacitance capacitance tolerance rated voltage manufacturer's name or symbol and type name
3. Non-inductive and non-combustible

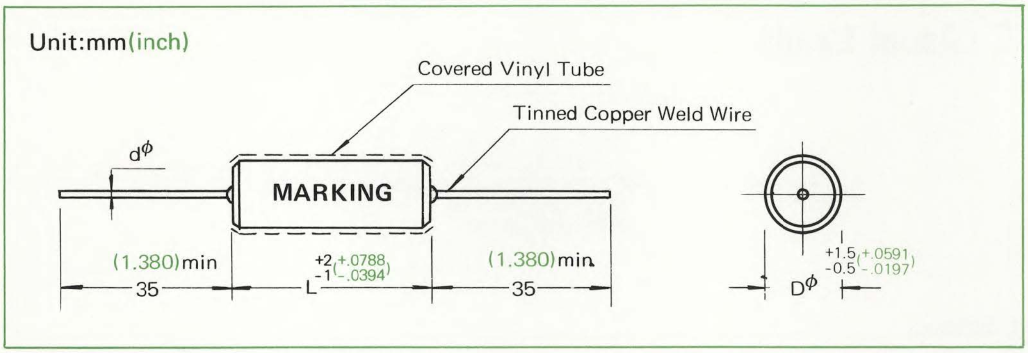
Application

(1) General communication equipment (2) Radio (3) TV (4) Pulse circuit

Temperature Characteristics



ECN-C Standard Products Table



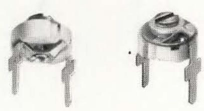
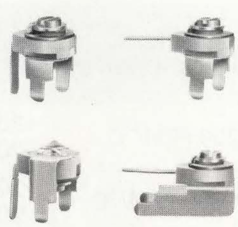
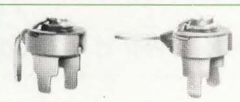
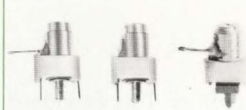
450 V.A.C.

Part No.	Capacitance		Dimensions mm (inch)		
	Rated (μF)	Tolerance	L	Dφ	dφ
ECN-C 4A102□	.001		20.0 (.788)	8.0 (.315)	0.6 (.0236)
ECN-C 4A152□	.0015		20.0 (.788)	8.0 (.315)	0.6 (.0236)
ECN-C 4A222□	.0022		20.0 (.788)	8.0 (.315)	0.6 (.0236)
ECN-C 4A332□	.0033		20.0 (.788)	8.0 (.315)	0.6 (.0236)
ECN-C 4A472□	.0047		20.0 (.788)	9.6 (.378)	0.6 (.0236)
ECN-C 4A682□	.0068	±10%(K)	20.0 (.788)	9.6 (.378)	0.6 (.0236)
ECN-C 4A103□	.01		20.0 (.788)	11.2 (.441)	0.6 (.0236)
ECN-C 4A153□	.015	±20%(M)	28.0 (1.103)	11.2 (.441)	0.7 (.0276)
ECN-C 4A223□	.022		28.0 (1.103)	12.9 (.508)	0.7 (.0276)
ECN-C 4A333□	.033		34.0 (1.340)	12.9 (.508)	0.7 (.0276)
ECN-C 4A473□	.047		34.0 (1.340)	14.3 (.563)	0.7 (.0276)
ECN-C 4A683□	.068		34.0 (1.340)	17.1 (.674)	0.8 (.0315)
ECN-C 4A104□	.1		34.0 (1.340)	19.8 (.780)	0.8 (.0315)
ECN-C 4A154□	.15		48.0 (1.891)	19.8 (.780)	0.8 (.0315)
ECN-C 4A224□	.22		55.0 (2.167)	19.8 (.780)	0.8 (.0315)

VII TRIMMER CAPACITORS AND VARIABLE CAPACITORS

TRIMMER CAPACITORS

Rotary Ceramic Trimmers

Type	Diameter	Shape	Part Number	Capacitance min.	Capacitance max.	Color Code	Page
Rotary Ceramic	5 mmϕ (.197")		ECV-1ZW04X51	1.5pF	4.0pF	Black	VII-2
			ECV-1ZW06X51	2.0pF	6.0pF	Red	
			ECV-1ZW10X51	2.8pF	10.0pF	Nil	
			ECV-1ZW20X51	3.3pF	18.0pF	Blue	
Rotary Ceramic	7 mmϕ (.276")		ECV-1ZW06X	2.0pF	6.0pF	Red	VII-3 ~VII-5
			ECV-1ZW10X	2.0pF	10.0pF	Nil	
			ECV-1ZW20X	2.5pF	20.0pF	Blue	
			ECV-1ZW30X	4.0pF	30.0pF	Orange	
			ECV-1ZW40X	5.1pF	40.0pF	Brown	
			ECV-1ZW50X	5.1pF	50.0pF	Green	
	8 mmϕ (.315")		ECV-1ZW60P	6.0pF	60.0pF	Pink	VII-6 ~VII-7
			ECV-1ZW70P	6.0pF	70.0pF	Gray	
Piston Teflon	10 x 7 mm (.394 x .276")		ECV-1TY10P14	2.0pF	10.0pF	Nil	VII-8 ~VII-9
			ECV-1TY10P15	2.0pF	10.0pF	Nil	
			ECV-1TY10P16	2.0pF	10.0pF	Nil	
Application Circuits							VII-10 ~VII-11

*Teflon trimmers: Please refer to VII-8. ("Teflon" is a registered trademark of Du Pont.)

Part Number Code

E C V – 1 Z W 1 0 X 3 2

- E C V: Common Code
- 1: Gang
- Z: Order of Designing
- W: Char.
- 1 0: Capacity
- X: Insulator & Fixture
- 3 2: Number

	Classification
ECV-1	1 Gang

Capacity is identified by two figures. The unit is 1 pF.

Number classification is made by running number of 2 figures beginning with 11

	Classification
W	Rotary Type
Y	Piston Type

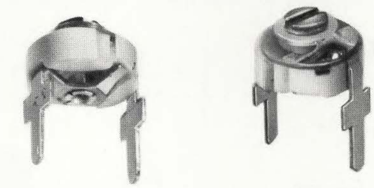
Class	Material	Fixture
P	Steatite	PCB
X	Glass-polyester resin	PCB

5 mo Rel

5mmϕ(.197")SERIES

min order 25K
≈ 190⁰⁰/m

Best applicable for the correction of circuits of consumer and industrial equipment. Especially for adjustment of the time constant and impedance necessitated by advances in IC and modular technology.



Electrical Specifications

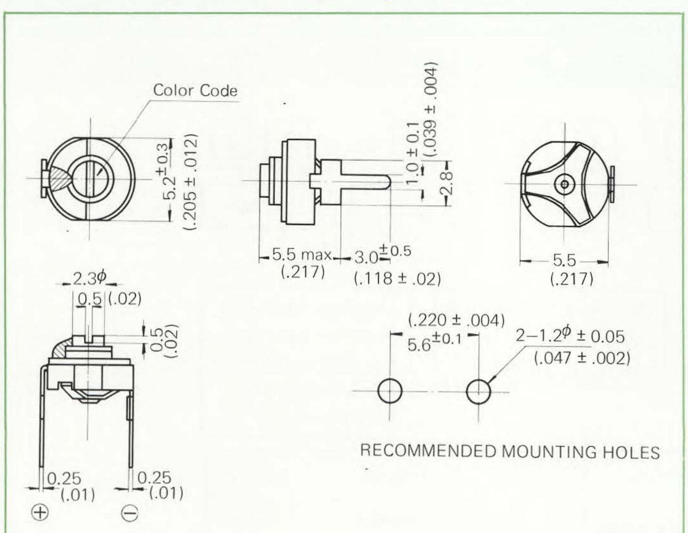
Insulation Resistance:	10,000 MΩ min. at 250VDC
Withstanding Voltage:	500 VDC
Operating Temp. Range:	-25°C to +85°C
Working Voltage:	250 WVDC to +85°C

Part No.	Capacitance		Temp. Coeff. at −20°C to+70°C(PPM/°C)	Q at max. Cap.	Shape
	max.	min.			
ECV-1ZW04X51	More than 4.0pF	Less than 1.5pF	NPO ±250 PPM/°C	300 min. at 10MHz 200 min. at 100MHz	Fig. 1
ECV-1ZW06X51	More than 6pF	Less than 2.0pF	−100 ± 200 PPM/°C	300 min. at 10MHz 200 min. at 100MHz	
ECV-1ZW10X51	More than 10pF	Less than 2.8pF	−600 ± 300 PPM/°C	300 min. at 10MHz 200 min. at 100MHz	
ECV-1ZW20X51	More than 18pF	Less than 3.3pF	−800 ± 300 PPM/°C	300 min. at 10MHz	

Mechanical Specifications

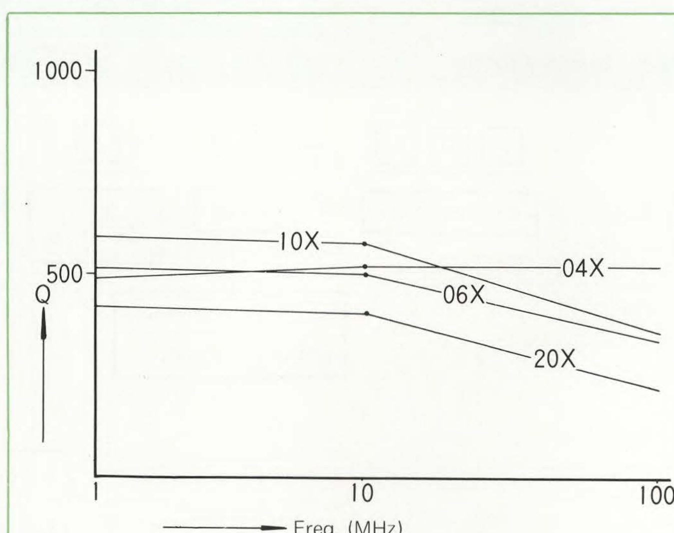
Turning Torque:	0.5 to 2.5 in-oz.
Solderability:	Conform to EIA STANDARD "Solderability Test Standard RS-178-A"
Stator Base Material:	Glass-Polyester resin
Rotor Material:	Ceramic and silver electrode
Ground Lug Material:	Nickel Silver
Anode Terminal:	Nickel Silver
Anode Electrode:	Nickel Silver

Dimensions and Mounting Diagram



Qualification Specifications .... See page VII-12

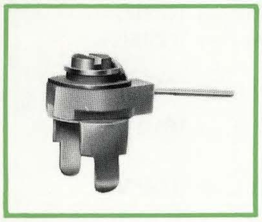
Characteristics



Qualification Specifications .... See page VII-12

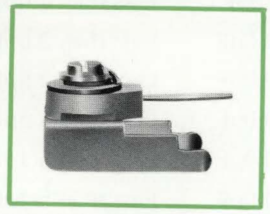
7mmϕ(.276")SERIES

ECV-1ZW 06~50X 31, 32, 40 & 44



X31 Top adjustment
Straight anode terminal

X32 Top adjustment
Bent anode terminal



X40 Side adjustment
Straight anode terminal

X44 Rear adjustment
Bent anode terminal

Insulation Resistance:	10,000 MΩ min. at 250 VDC
Withstanding Voltage:	500 VDC
Operating Temp. Range:	-55°C to + 85°C
Working Voltage:	250 WVDC to + 85°C

Type X31

Part No.	Capacitance		Temp. Coeff. at -20°C to + 70°C(PPM/°C)	Q at max. Cap.	Shape
	max.	min.			
ECV-1ZW06X31	More than 6.0pF	Less than 2.0pF	NPO ± 200	300 min. at 10MHz 200 min. at 100MHz	Fig. 2
〃 1ZW10X31	More than 10.0pF	Less than 2.0pF	NPO ± 200		
〃 1ZW20X31	More than 20.0pF	Less than 2.5pF	-450 ± 200	500 min. at 10MHz	
〃 1ZW30X31	More than 30.0pF	Less than 4.0pF	-750 ± 250	300 min. at 10MHz	
〃 1ZW40X31	More than 40.0pF	Less than 5.1pF	-1400 ± 800	200 min. at 10MHz	
〃 1ZW50X31	More than 50.0pF	Less than 5.1pF	-1400 ± 800		

Type X32

Part No.	Capacitance		Temp. Coeff. at -20°C to + 70°C (PPM/°C)	Q at max. Cap.	Shape
	max.	min.			
ECV-1ZW06X32	More than 6.0pF	Less than 2.0pF	NPO ± 200	300 min. at 10MHz 200 min. at 100MHz	Fig. 3
〃 1ZW10X32	More than 10.0pF	Less than 2.0pF	NPO ± 200		
〃 1ZW20X32	More than 20.0pF	Less than 2.5pF	-450 ± 200	500 min. at 10MHz	
〃 1ZW30X32	More than 30.0pF	Less than 4.0pF	-750 ± 250	300 min. at 10MHz	
〃 1ZW40X32	More than 40.0pF	Less than 5.1pF	-1400 ± 800	200 min. at 10MHz	
〃 1ZW50X32	More than 50.0pF	Less than 5.1pF	-1400 ± 800		

Type X40

Part No.	Capacitance		Temp. Coeff. at -20°C to+ 70°C (PPM/°C)	Q at max. cap.	Shape
	max.	min.			
ECV-1ZW06X40	More than 6.0pF	Less than 2.0pF	NPO ± 200	300 min. at 10MHz 200 min. at 100MHz	Fig. 4
〃 1ZW10X40	More than 10.0pF	Less than 2.0pF	NPO ± 200		
〃 1ZW20X40	More than 20.0pF	Less than 2.5pF	-450 ± 200	500 min. at 10MHz	
〃 1ZW30X40	More than 30.0pF	Less than 4.0pF	-750 ± 250	300 min. at 10MHz	
〃 1ZW40X40	More than 40.0pF	Less than 5.1pF	-1400 ± 800	200 min. at 10MHz	
〃 1ZW50X40	More than 50.0pF	Less than 5.1pF	-1400 ± 800		

Type X44

Part No.	Capacitance max.	Capacitance min.	Temp. Coeff. at -20°C to+ 70°C(PPM/°C)	Q at max. cap.	Shape
ECV-1ZW06X44	More than 6.0pF	Less than 2.0pF	NPO ± 200	300 min. at 10MHz 200 min. at 100MHz	Fig. 5
" 1ZW10X44	More than 10.0pF	Less than 2.0pF	NPO ± 200		
" 1ZW20X44	More than 20.0pF	Less than 2.5pF	-450 ± 200	500 min. at 10MHz	
" 1ZW30X44	More than 30.0pF	Less than 4.0pF	-750 ± 250	300 min. at 10MHz	
" 1ZW40X44	More than 40.0pF	Less than 5.1pF	-1400 ± 800	200 min. at 10MHz	
" 1ZW50X44	More than 50.0pF	Less than 5.1pF	-1400 ± 800		

Mechanical Specifications

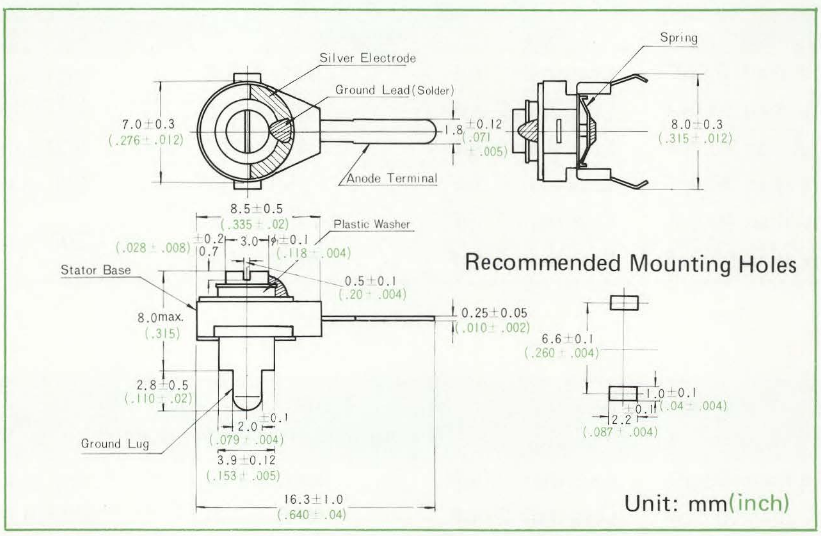
Turning Torque:	0.55 to 2.5 in-oz
Solderability:	Conform to EIA STANDARD "Solderability Test Standard RS-178-A"
Stator Base Material:	Glass-Polyester resin
Rotor Material:	Ceramic and silver electrode
Ground Lug Material:	Brass, silver plated
Anode Terminal:	Nickel Silver
Anode Electrode:	Nickel Silver
Spring Material:	Beryllium copper, silver plated

Qualification Specifications .... See page VII-12

Dimensions

Type X31

Fig. 2



Type X32

Fig. 3

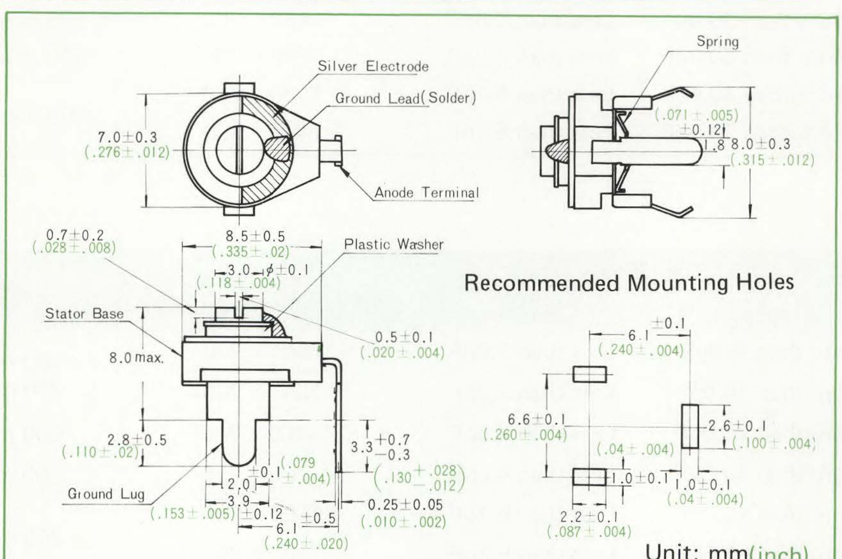


Fig. 3

Type-X40

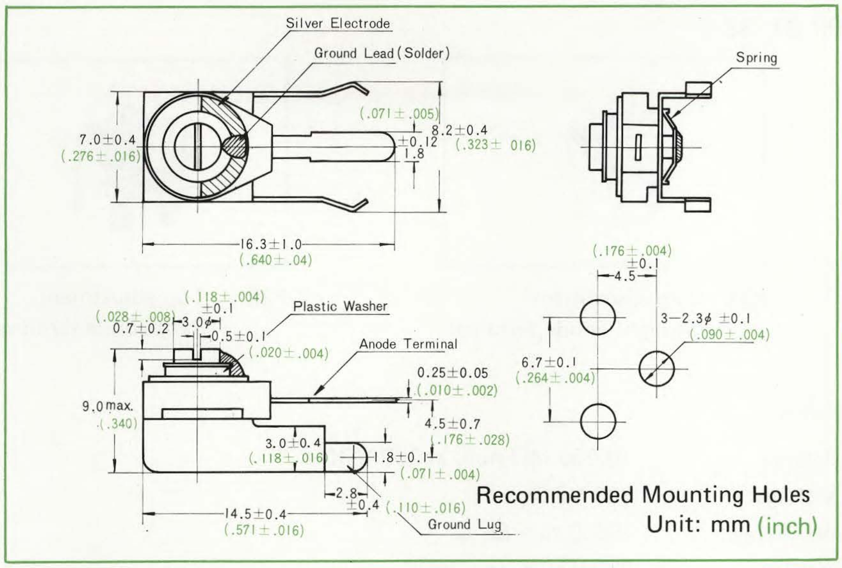


Fig. 4

Type-X44

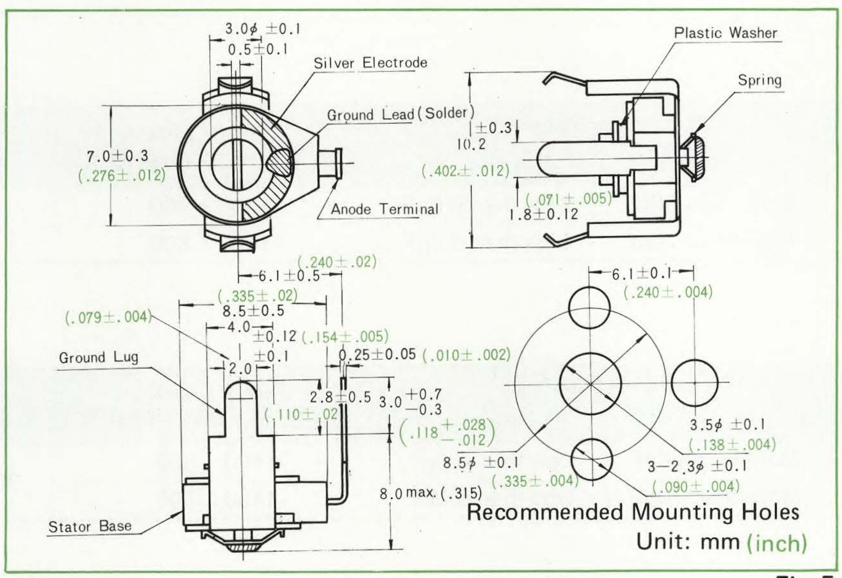
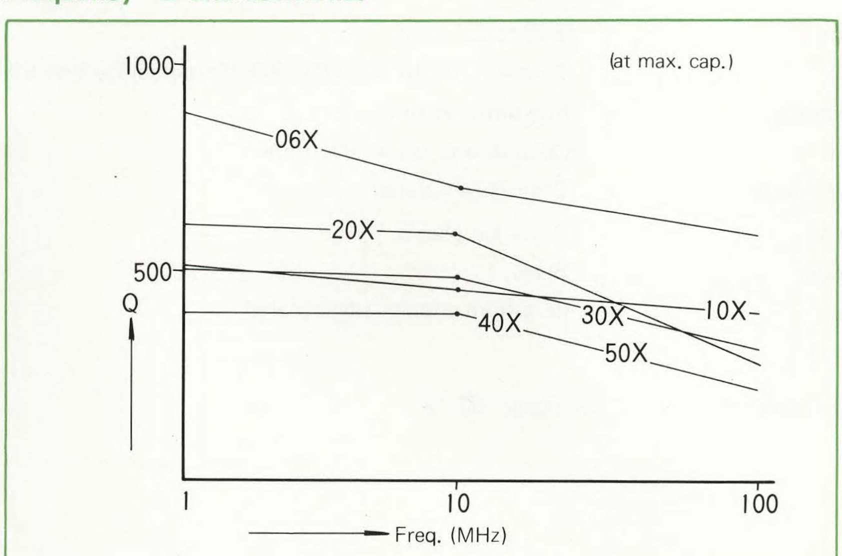


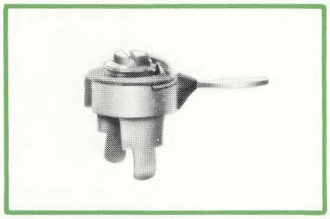
Fig. 5

Frequency—Q Characteristics



8mmϕ(.315") SERIES

ECV-1ZW 60 ~ 70P 31, 32



P31 Top adjustment
Straight anode terminal

P32 Top adjustment
Bent anode terminal

Electrical Specifications

Insulation Resistance:	10,000 MΩ min. at 250 VDC
Withstanding Voltage:	500 VDC
Operating Temp. Range:	-55°C to + 85°C
Working Voltage:	250 WVDC to + 85°C

Type P31

Part No.	Capacitance		Temp. Coeff. at -20°C to + 70°C (PPM/°C)	Q at max. cap.	Shape
	max.	min.			
ECV-1ZW60P31	More than 60pF	Less than 6.0pF	-1400 ± 800	200 min. at 10MHz	Fig. 6
ECV-1ZW70P31	More than 70pF	Less than 6.0pF	-1400 ± 800		

Type P32

Part No.	Capacitance		Temp. Coeff. at -20°C to + 70°C (PPM/°C)	Q at max. cap.	Shape
	max.	min.			
ECV-1ZW60P32	More than 60pF	Less than 6.0pF	-1400 ± 800	200 min. at 10MHz	Fig. 7
ECV-1ZW70P32	More than 70pF	Less than 6.0pF	-1400 ± 800		

Mechanical Specifications:

Turning Torque:	0.55 to 2.5 in-oz
Solderability:	Conform to EIA STANDARD "Solderability Test Standard RS-178-A"
Stator Base Material:	Forsterite ceramic
Rotor Material:	Ceramic and silver electrode
Ground Lug Material:	Brass, silver plated
Anode Terminal:	Brass, tin plated
Anode Electrode:	Brass
Spring Material:	Beryllium copper, silver plated

Qualification Specifications .... See page VII-12.

Dimensions

Type P31

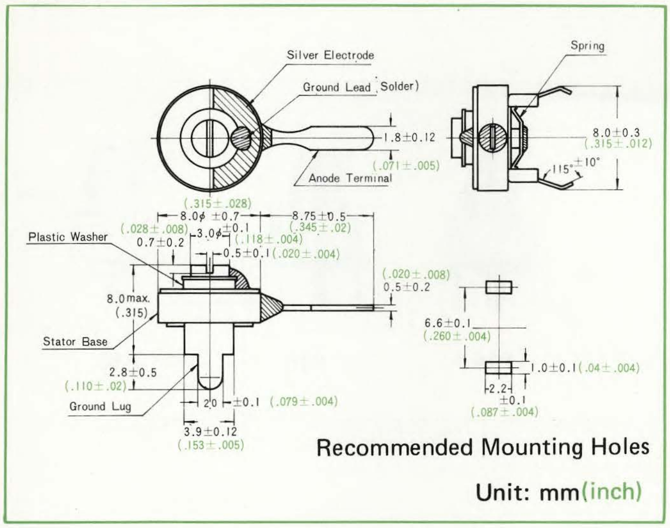


Fig. 6

Type P32

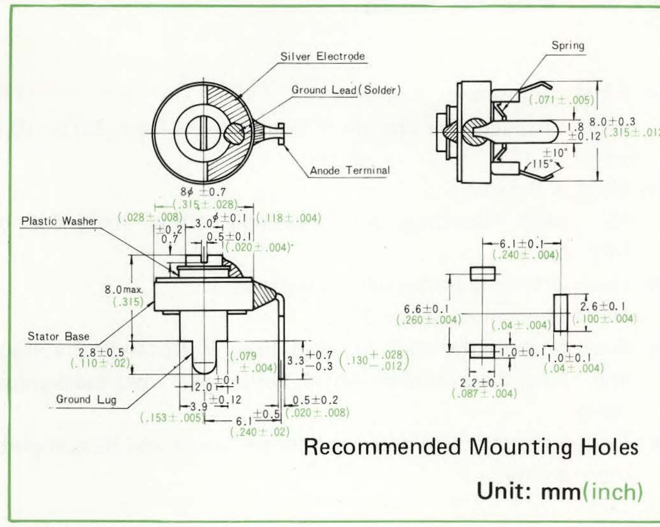
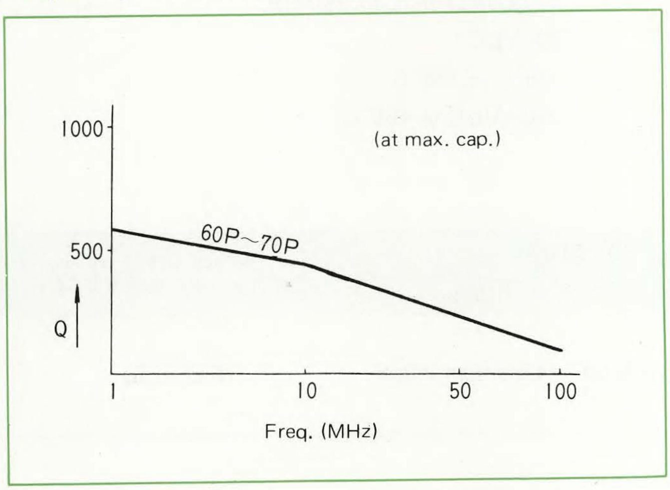


Fig. 7

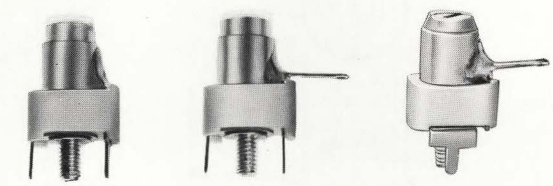
Frequency— Q Characteristics



Teflon* Trimmer Capacitors

ECV-1TY10P14, 15, 16

- Finely adjustable
  Linear capacitance change in twelve turns from 2.0 to 10.0 pF.
- Unique structure
  PC board mounting and adjustable either from top or bottom.
- Excellent temperature characteristics
  Usable continuously at 85°C
- Superb characteristics in insulation, withstanding voltage and Q by the combination of Teflon and rigid mechanical design.
- Linear temperature and capacitance curve and its complete resettability.



P14 P15 P16

Electrical Specifications

Insulation Resistance:	10,000MΩ min. at 250VDC
Withstanding Voltage:	500VDC
Operating Temp. Range:	-25°C to +85°C
Working Voltage:	250WVDC to +85°C

Part No.	Capacitance		Temp. Coeff. at −25°C to +85°C (PPM/°C)	Q at max. Cap.	Shape
	max.	min.			
ECV-1TY10P14	More than 10.0pF	Less than 2.0pF	NPO ±200	1,000 min. at 10MHz 300 min. at 100MHz	Fig. 8
ECV-1TY10P15					Fig. 9
ECV-1TY10P16					Fig. 10

Mechanical Specifications

Turning Torque:	0.42 to 4.9 in-oz.
Solderability:	Conform to EIA STANDARD "Solderability Test Standard RS-178-A"
Stator Base Material:	Steatite ceramic
Rotor Material:	Brass, silver plated
Ground Lug Material:	Nickel silver
Anode Terminal:	Nickel silver
Anode Electrode:	Brass, silver plated

Qualification Specifications .... See page VII-12

* Registered trademark of Du Pont.

Dimensions

Type P14

Unit: mm(inch)

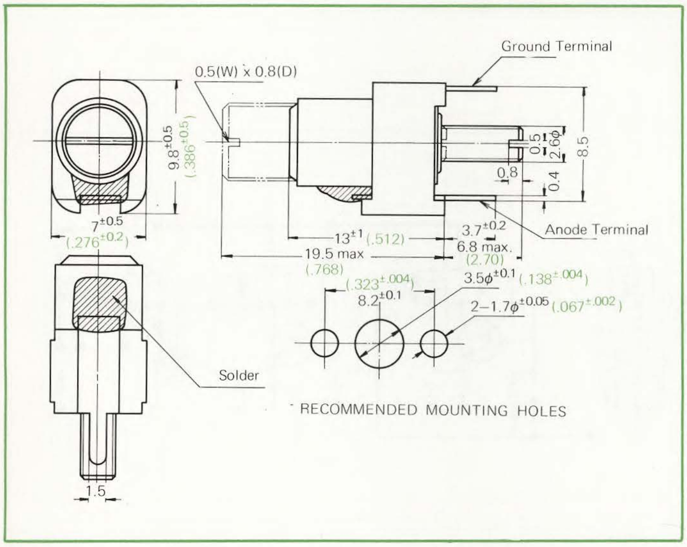


Fig. 8

Type P15

Unit: mm(inch)

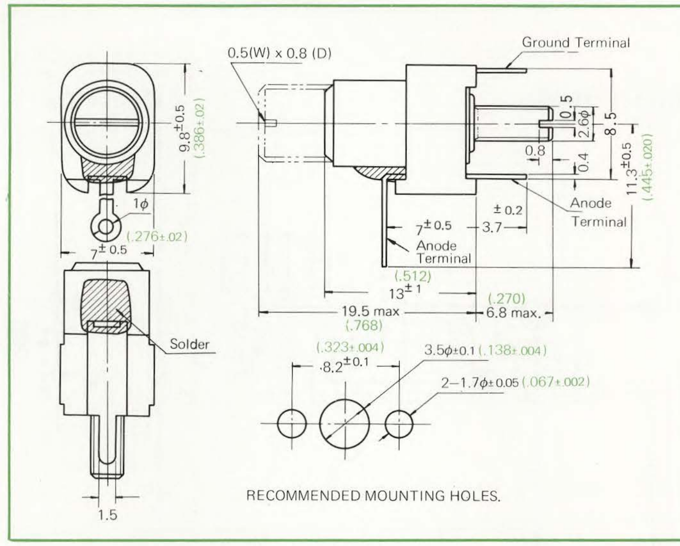


Fig. 9

Type P16

Unit: mm (inch)

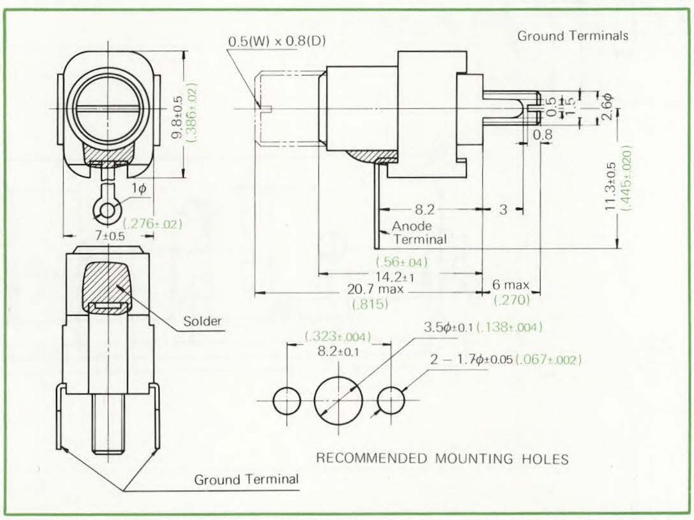


Fig. 10

Frequency-Q Characteristics

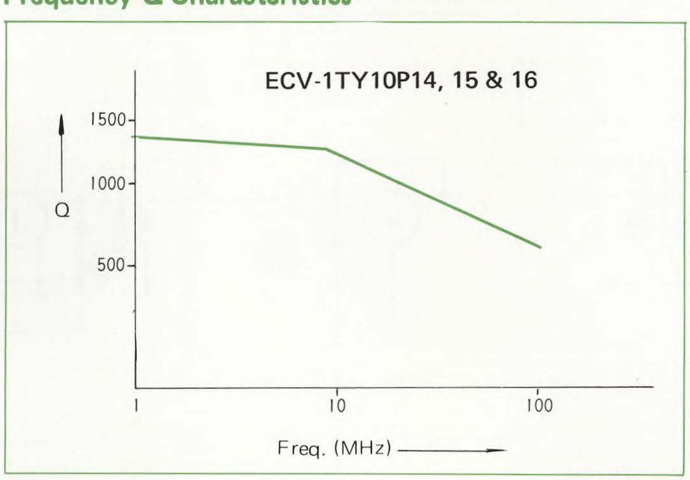


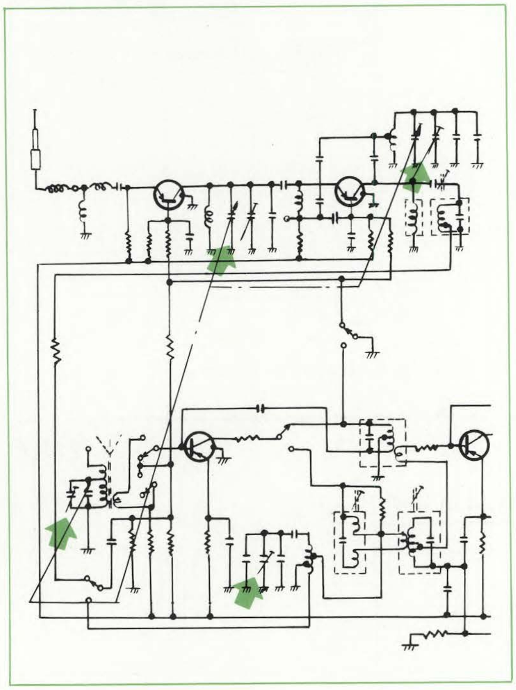
Fig. 11

MATSUSHITA ELECTRIC

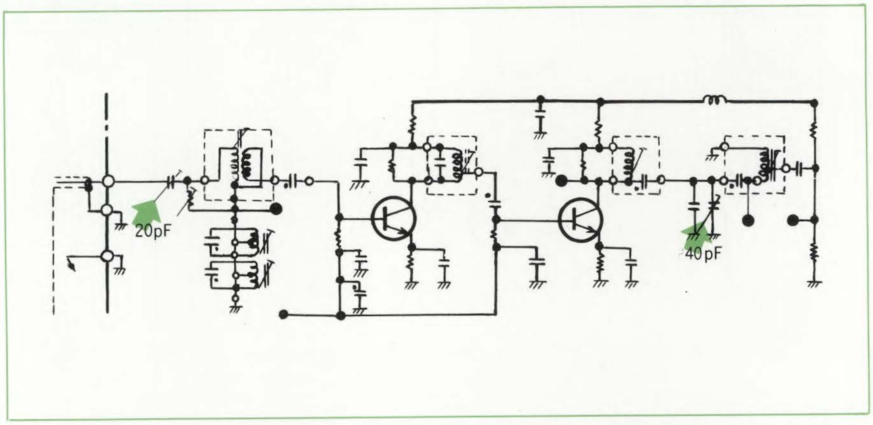
Application Circuits

Rotary Ceramic Trimmers

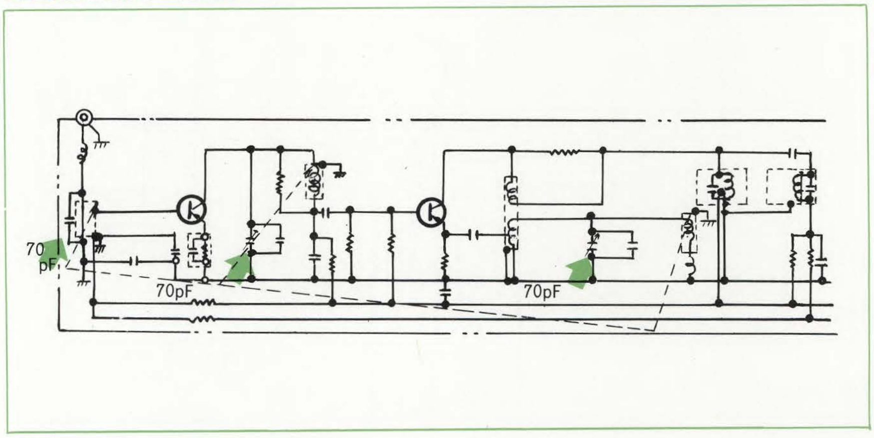
AM/FM Radio



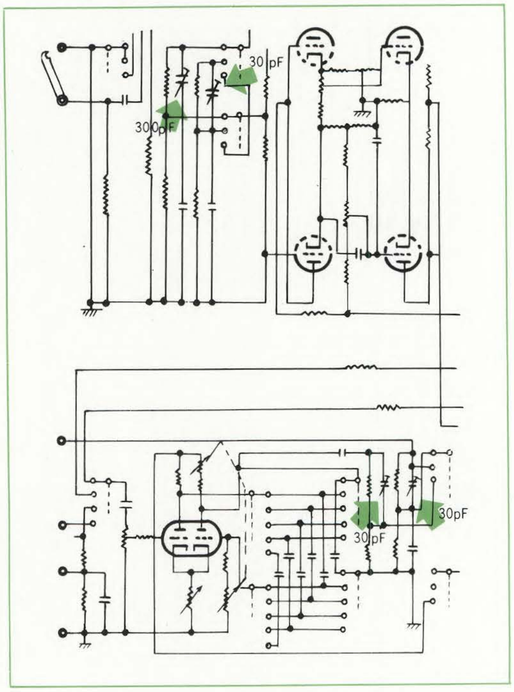
Color TV



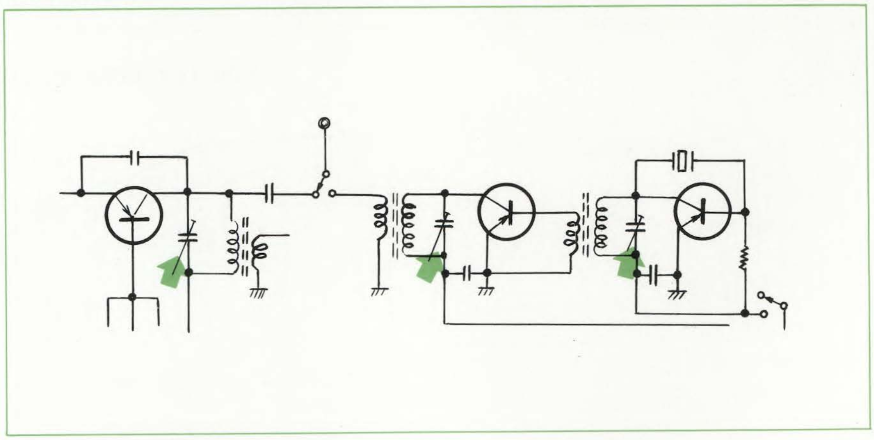
Automobile Radio



Oscilloscope



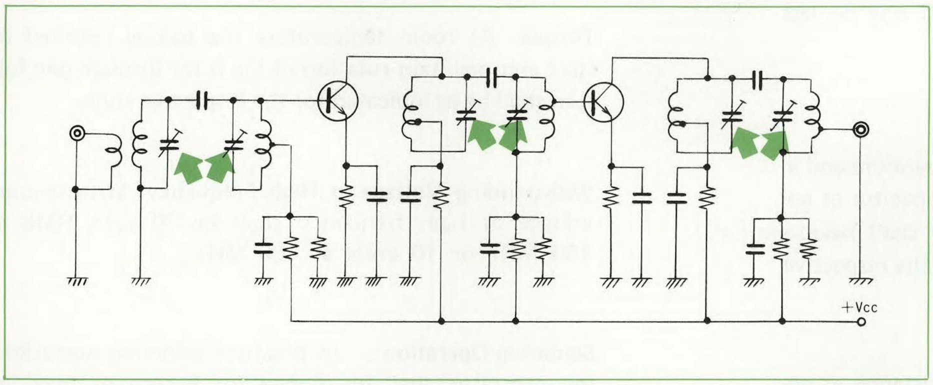
Transceiver



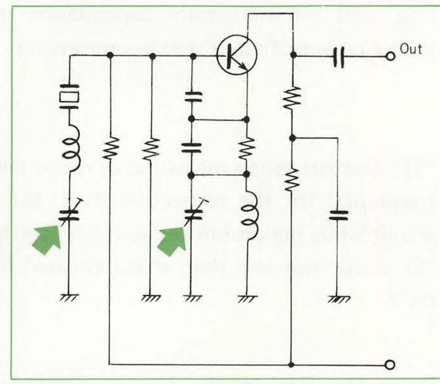
Piston Type

Teflon Trimmers

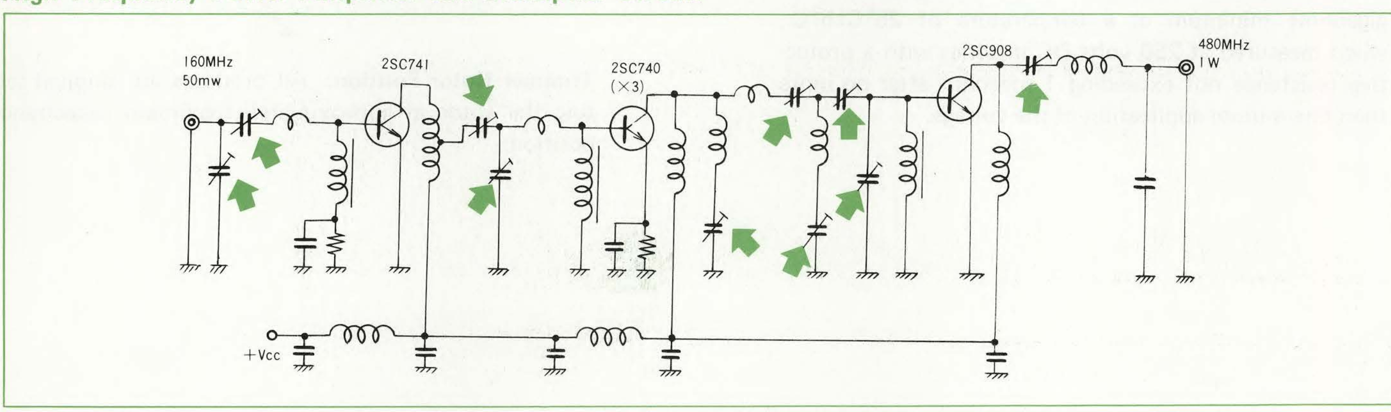
High Frequency Amplifier Circuit of Receivers



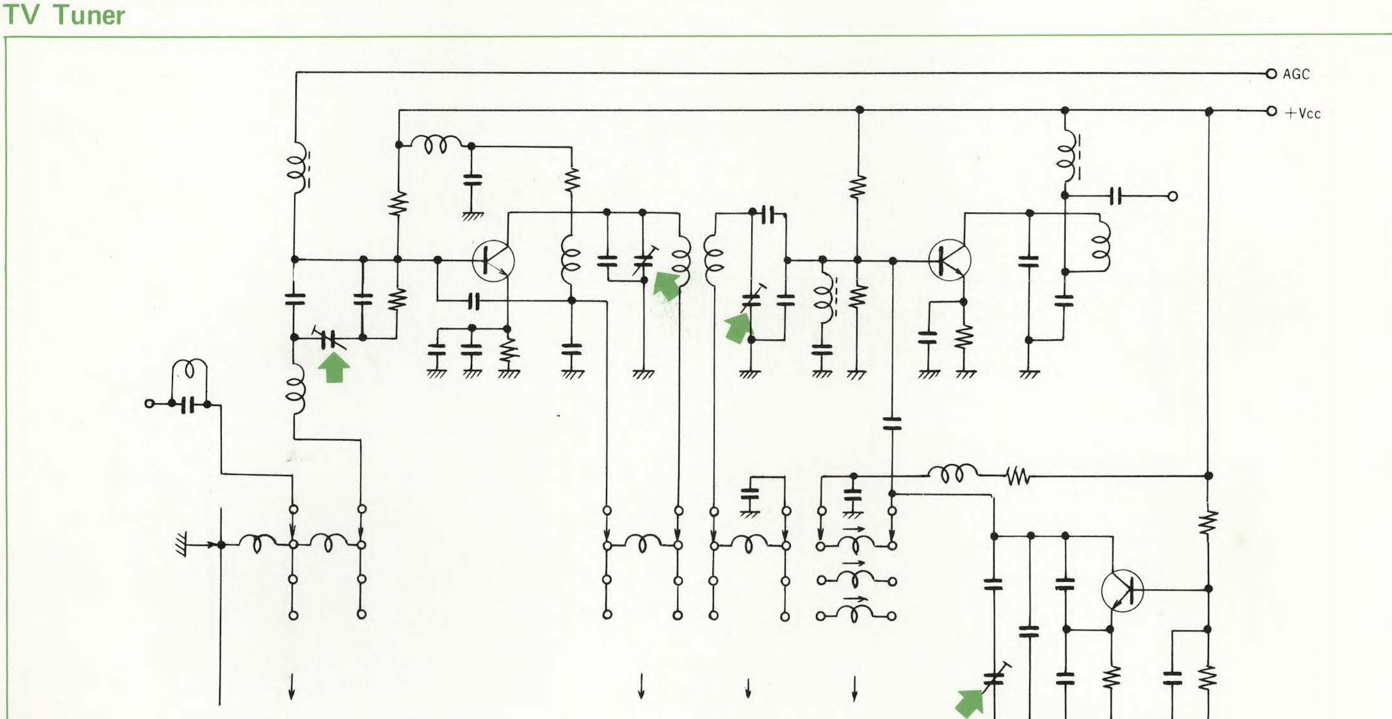
Highly Stable Crystal Oscillator Circuit



High Frequency Power Amplifier and Multiplier Circuit



TV Tuner



Qualification Specifications

Capacitance: When measured at room temperature (25°C ±5°C) and by the substitution method with 2 terminals at frequency of 100 KHz., the minimum capacitance shall not be greater than that specified at minimum setting, and the maximum capacitance shall not be less than that specified at maximum setting.

"Q" Factor: When measured at room temperature and a frequency for the respective style, the capacitor at approximately maximum capacitance setting shall have a "Q" value not less than that indicated for the respective style.

Insulation Resistance: The insulation resistance at approximately maximum capacitance setting shall be 10 gigaohms minimum at a temperature of 25°C±5°C, when measured at 250 volts DC in series with a protective resistance not exceeding 1 megohm after no more than one minute application of the voltage.

Dielectric Strength: The capacitor, set at approximately maximum capacitance, shall withstand 500 VDC. between terminals for 1 to 5 sec.

Torque: At room temperature the torque required to start and maintain rotation of the rotor through one full turn shall be as indicated for the respective style.

Withstanding Voltage at High Frequency: Withstanding voltage at high frequency shall be 30 volts RMS at 100 MHz or 10 volts at 400 MHz.

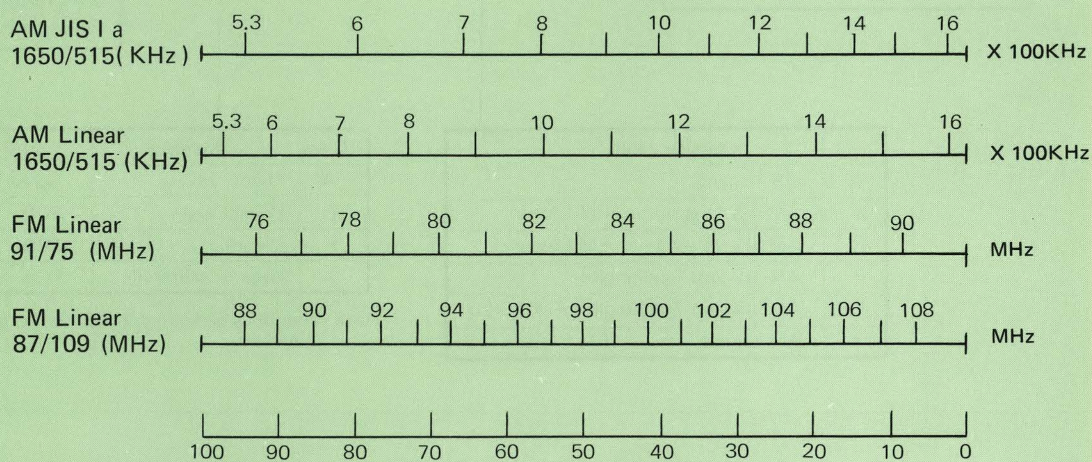
Soldering Operation: In practical soldering operation, the capacitor shall be dipped for 5 seconds max. in solder maintained at 260°C.

Trimmer Rotor Position: All products are shipped setting the rotor at approximately maximum capacitance position.

VARIABLE CAPACITORS

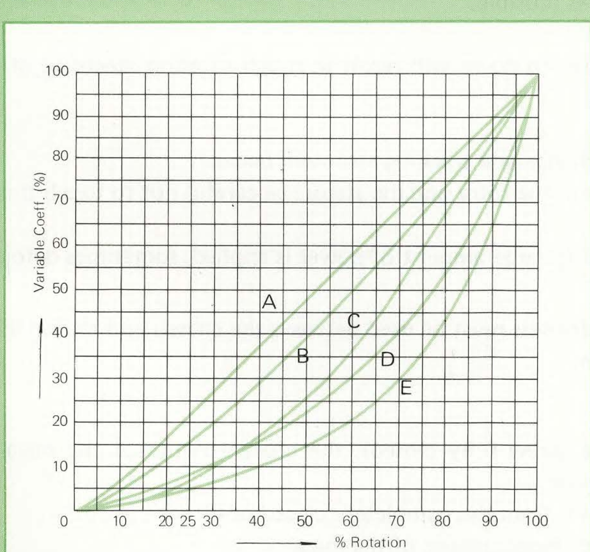
Use	Part Number	Gang	Min. Cap. (pF)	Variable Cap. (pF)	Standard Dial	Trim. Cap. (pF)	Remarks	Page
FM/AM (NEO-AIRPOLY MD SERIES)	ECV-4MD34	4	8.5 8.5	335.0 18.8	AM JIS 1a FM Linear	12.0		VII-20
	ECV-5MD34	5						VII-21
	ECV-6MD34	6						VII-22,23
	ECV-7MD34	7						VII-24
FM/AM (NEO-AIRPOLY MX SERIES)	ECV-5MX25	5	10.0	240 122.5 18.8	AM Linear FM Linear	12.0	Cut plate AM osc. section	VII-25
	ECV-6MX34	6	13 9.0	337. 18.8				VII-26
	ECV-7MX34	7						VII-27

Standard Dial



JIS 1a is equivalent to RTMASTANDARD CLASS B REC. 101

Capacitance Variation Curve



A: Capacitance Linear
B: Linear Frequency of FM Section
C: JIS 1a
D: Linear Frequecny of AM OSC. Section
E: Linear Frequency of AM RF. Section

Notes.
1. Capacitance at 100% ROT.=100% Vasiable Coeff.
2. 180° = 100% ROT.

Part Number Code

E C V — 5 M D 3 4 X 5 0 A

- E C V: Common Code
- 5: Gang
- M: Order of Designing
- D: Char.
- 3 4: Capacity
- X: Insulator & Fixture
- 5 0: Number
- A: Supplement

Gang

	Classification	
2	2 Gang	AM 2
3	3 Gang	AM 3 or FM 3
4	4 Gang	FM 4 or AM 2 FM 2
5	5 Gang	AM 2 FM 3
6	6 Gang	AM 2 FM 4 AM 3 FM 3
7	7 Gang	AM 3 FM 4

Capacity: Capacity is identified by two figures. The unit is 10pF.

Number: Number classification is made by running number of 2 figures beginning with 11.

Supplement: Special construction and form are expressed by one letter, when necessary.

Char.

	Classification	
A	JIS 1a gang	
D	AM JIS 1a gang	FM Linear
N	AM JIS 2a gang	FM Linear
P	AM JIS 2ab Trackingless	
R	AM JIS 2ab Trackingless FM JIS 2b	
X	AM Linear	FM Linear

Insulator & Fixture

Class	Material	Fixture
A	Phenol resin	Screw
B	Phenol resin	PCB
P	Ceramic	PCB
X	Organic Materials	PCB

Note: Phenolics is distinguished from organic materials.

Cautions about use:

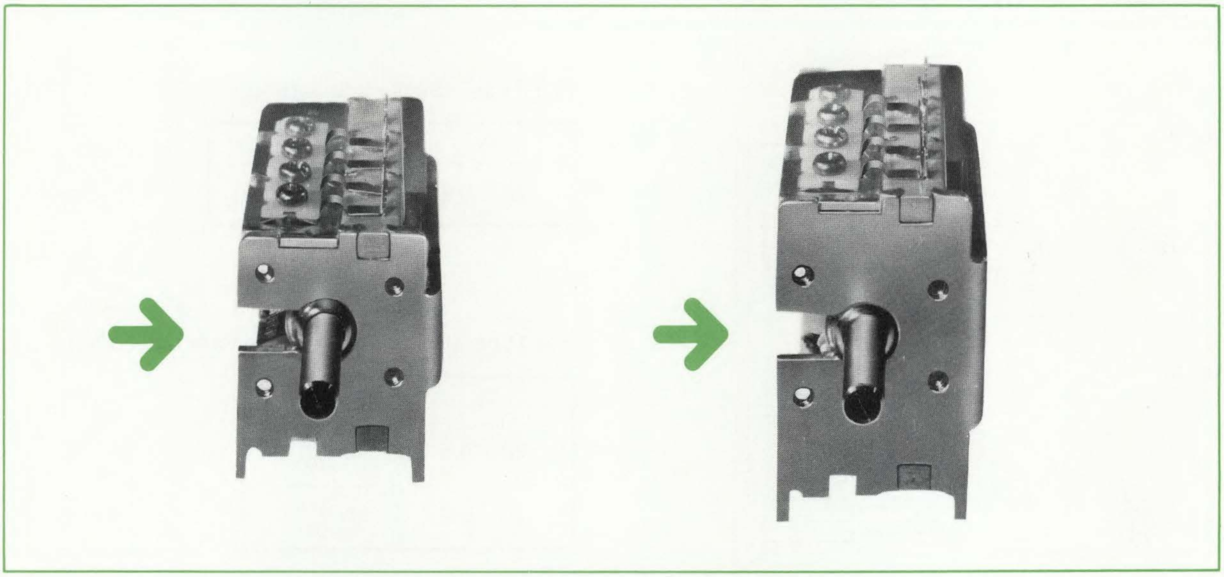
1) Variable capacitors should be installed as far away from the speaker as possible.
2) Protect against humidity and dust.
   Don't keep variable capacitors in highly humid or dusty places because to do so will result in rough rotation, decrease of insulation resistance, drop of Q factor and short-circuiting.
3) Be careful in handling variable capacitors.
   If extra power or shock is applied to the shaft, the capacitance will change and tracking error will occur.
4) The most important factor in a variable capacitor is the air gap between the rotor and the stator; be careful not to touch them.
5) Installation of variable capacitor should be made carefully.
   If a small variable capacitor is installed with a large screwdriver, a fairly large amount of power is applied, sometimes deforming the frame and resulting in capacitance change.

   If installed by screw, a rubber washer of more than 1 mm(.039") thickness must be used between the chassis and the variable capacitor, and the tightening torque should be approximately 3kg-cm.
   We are in preparation to supply a rubber washer.
6) Adjustment of the trimmer capacitor should be made carefully.
   If the trimmer capacitor is adjusted at its maximum capacitance (the screw fully closed), the characteristics of the mica decrease due to temperature and humidity, resulting in a Q factor decrease.
   Adjustment should be made with the screw opened about one full turn from the completely closed position.
   There should be a layer of air above the mica in order to improve the characteristics of the mica.

Bushing part of our all models is cut.

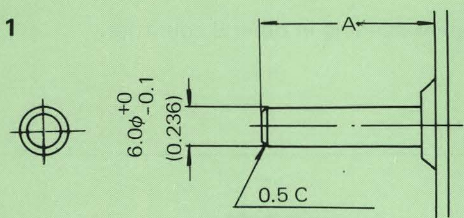
This is because of the adoption of a mechanized assembling process developed by our engineering.
By cutting the bushing part of the front frame, mechanized assembling has become possible resulting in greatly improved productivity and more stable quality.
Our variable capacitors in all models are produced through this mechanized assembling process.

Domestic patent, utility model: 3 items under application.
Overseas patent: Patented in USA, France, Taiwan and Patent pending in other 6 countries.

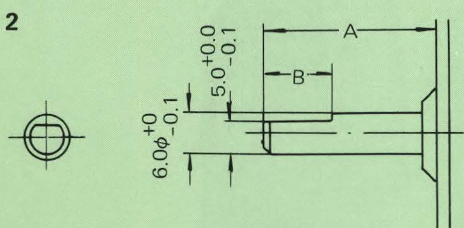


Standard Shaft Dimensions

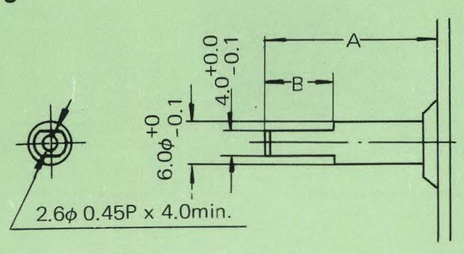
No. 1



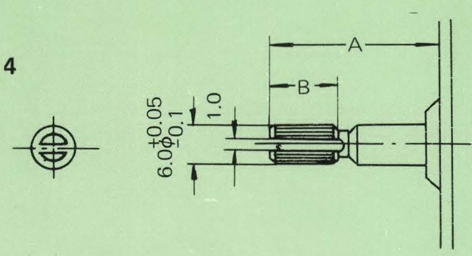
No. 2

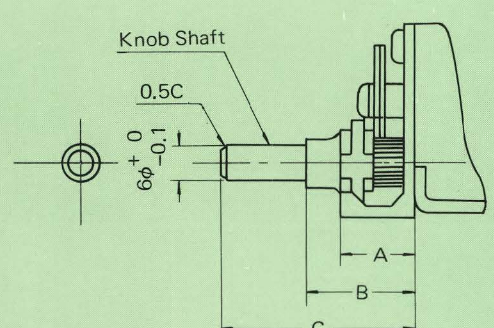


No. 3



No. 4





Round Type

A	
20 ± 0.5	(0.787 ± 0.020)
15 ± 0.5	(0.591 ± 0.020)

Flat Type (Single side cutting)

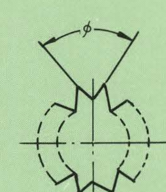
A	B
20 ± 0.5	$10^{+0.5}_{-0.0}$

Flat Type (Double side cutting with tapped hole)

A	B
20 ± 0.5	$10^{+0.5}_{-0.0}$
15 ± 0.5	$10^{+0.5}_{-0.0}$

Knurl Type (With slit)

A	B	φ
20 ± 0.5	10 ± 0.5	18 Knurls φ 90°±3°



Gear Type

A	B	C
11.7 ± 0.5	14.7 ± 0.5	30 ± 0.5

Gear Ratio: 3:1

Applicable Part No.:

ECV-4MD34 ECV-5MD34 ECV-6MD34
ECV-7MD34
ECV-5MX25 ECV-6MX34 ECV-7MX34

NEO-AIRPOLY VARIABLE CAPACITOR,MD AND MX SERIES

WHAT IS A NEO-AIRPOLY VARIABLE CAPACITOR ?

— Compact AM-FM variable capacitor with improved microphonic noise characteristics —

Due to the adoption of a low-pressure polyethylene film in the AM section, as a dielectric, the size of the AM seciton is half that of the conventional units which use air dielectric.

Furthermore, stators are covered with a low-pressure polyethylene film to damp the vibration so that microphonic noise characteristics are greatly improved.

In the FM section, air is used as a dielectric which obtains the highest Q factor for the VHF band.

Sufficient air gap between the stator and the rotor is designed for the best micronhonic noise characteristics and accurate capacity.

Capacity tolerance is ±0.3 pF.

So, it is the most suitable for small sized, highly sensitive radios which need good microphonic noise characteristics.

MX Series: Complete Linear Frequency of AM Section

AM dial calibration becomes most precisely equal in measure when the OSC. band frequency ratio is 2.18. In practical application, band frequency ratios within 2.17 and 2.20 permits equal dial calibration.

Electrostatic Noise:

Although low pressure polyethylene film is used as a dielectric in the AM section, our particular preventive method can completely eliminate electrostatic noise.

Common Impedance:

Because of the perfect shielding and the use of an earth wiper in all sections, all problems, such as image characteristics, radiation and abnormal oscillation caused by common impedance, are eliminated.

Frame Rigidness:

Excellent dynamically designed frame structure, and high quality insulation material, and Premix (glass polyester resin) is adopted as a stator insulator.

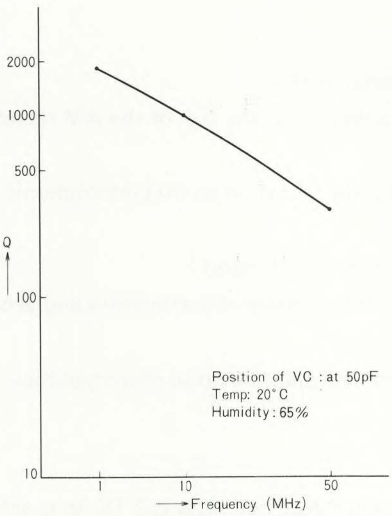
The frame, therefore, had a rigid structure which is not influenced by the shrinkage of pcb when it is mounted.

Representative Specifications:

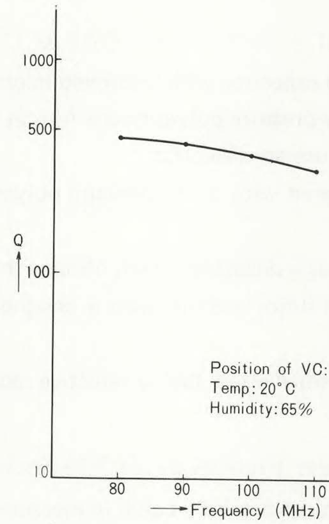
	(AM Section)	(FM Section)
Max. Variable Cap.: Min. Capacitance:	335 pF / 8.5 pF (MD Series); 337pF / 13pF (MX Series)	18.8 pF / 8.5 pF (MD, MX Series)
Variable Cap. Curve:	Frequency linear type (MX Series) JIS 1a (MD Series)	Frequency linear type (Freq. ratio is 1.24) Freq. ratio of 1.22 to 1.26 is almost regarded as a linear.
Q:	500 min. at 10MHz and 50 pF position	200 min. at 100MHz and 10pF positon.
Breakdown Voltage:	200 VAC at 60 Hz RMS	500 VAC at 60 Hz RMS
Insulation Res.:	100 MΩ min. at 100 VDC.	100 MΩ min. at 100 VDC.

Q Characteristics

(AM)

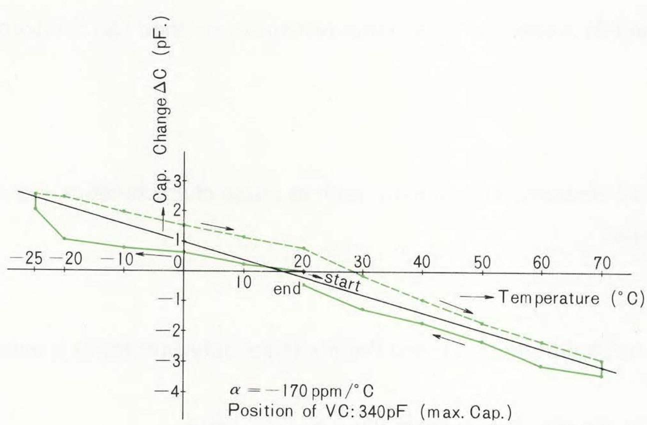


(FM)

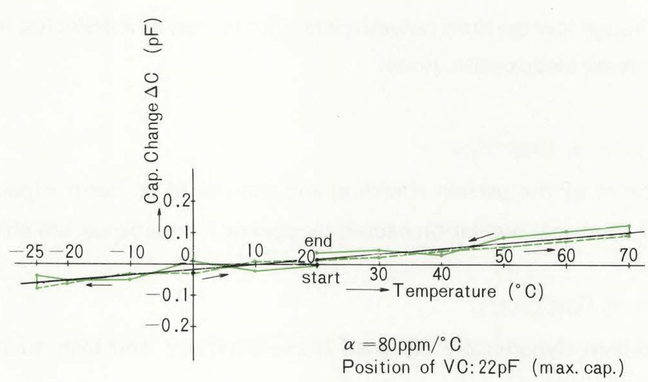


Temperature Characteristics

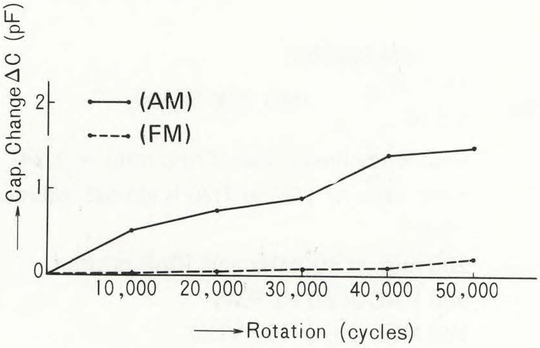
(AM)



(FM)

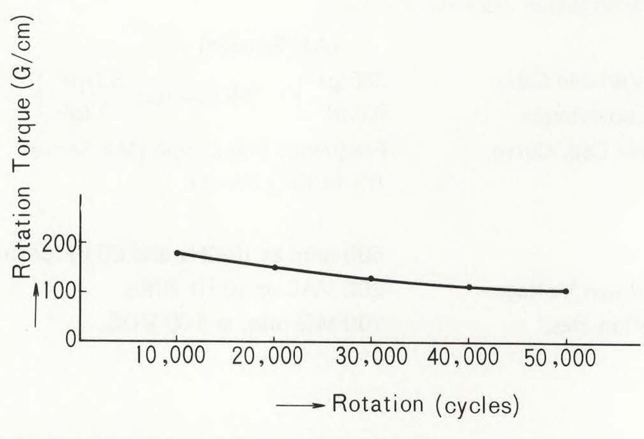


Capacitance Change



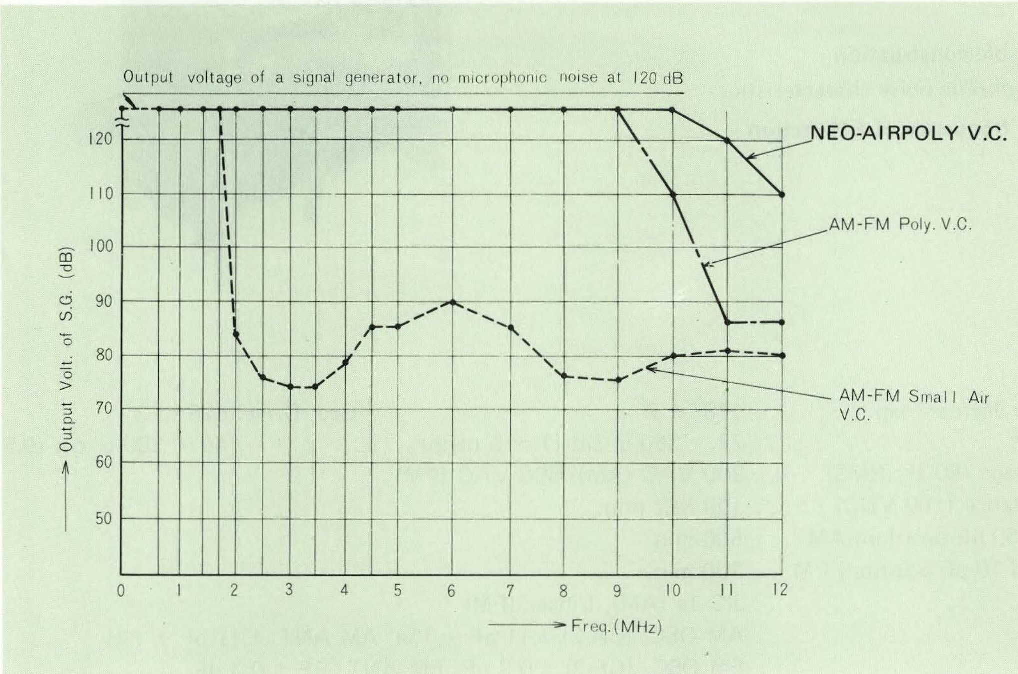
Position of VC (AM): 340pF (max. cap.)
(FM): 22pF (max. cap.)

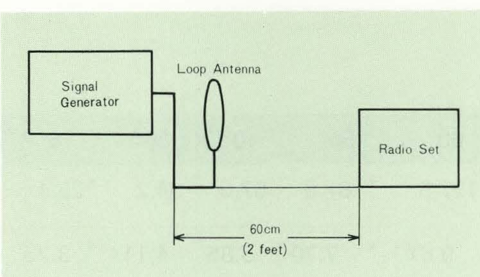
Rotation Torque



Guaranteed rotation is 30,000 cycles. Rotation speed is 10 cycles per minute.
(One cycle is a rotation of 180° and back to 0° again)

Comparison Test of Microphonic Noise Characteristics in Different Models





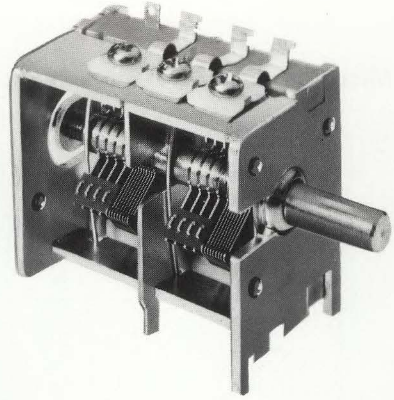
To generate a non-modulated wave from a signal generator, this wave is received by a radio equipped with the test model. Adjust the trimmer capacitor of the radio set at the position of the received frequency to eliminate tracking error.
Next, to read the output voltage of the signal generator when microphonic noise starts to generate while applying mechanical vibration to the radio.
Repeat this test changing the oscillation frequency of the signal generator.

The plastic dust cover is available upon request for MD and MX series.

FM/AM 4 Gang (MD Series)

ECV-4MD34 (340pF)

- Compact and stable construction
- Improved microphonic noise characteristics
- Complete linear frequency of FM section



Specifications

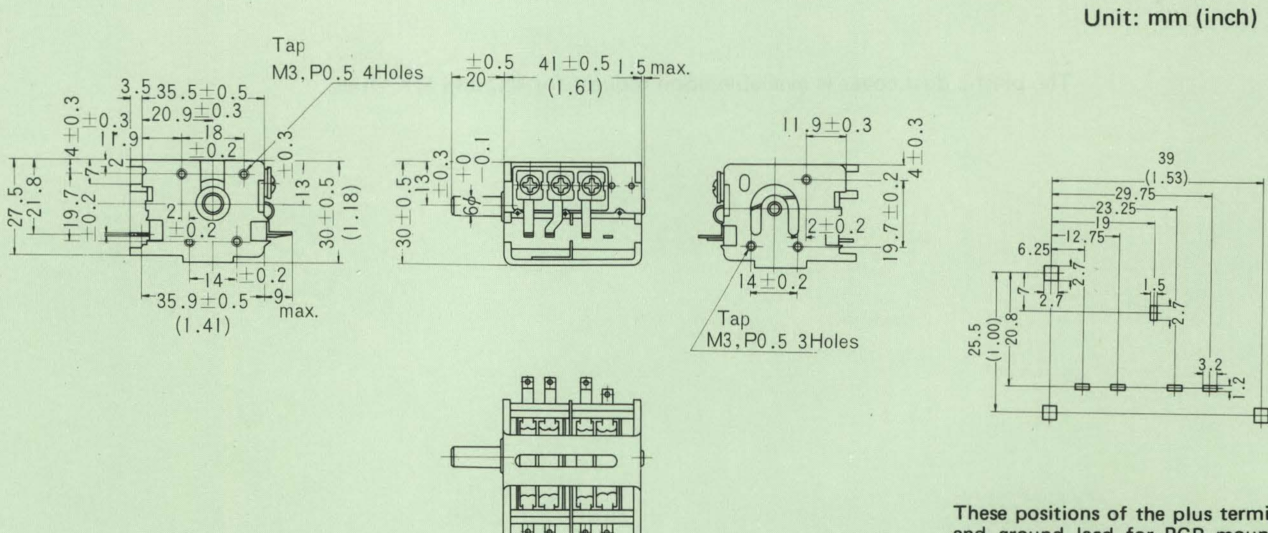
Rotation (CW to decrease cap.) . . . . . . 178° ± 2° Gear Drive: 528° ± 6°
Rotation Torque . . . . 72 ~ 360 gr-cm (1 ~ 5 oz-in), 40 ~ 200 gr-cm (0.56 ~ 2.78 oz-in.)
Breakdown Voltage (60 Hz RMS) . . . . 200 VAC (AM), 500 VAC (FM)
Insulation Resistance (100 VDC) . . . . 100 MΩ min.
Q (10 MHz and 50 pF position) AM . . . 500 min.
(100 MHz and 10 pF position) FM. . . 200 min.
Standard Dial . . . . JIS 1a (AM), Linear (FM)
Tolerance . . . . AM OSC. (CA-2) ± (1 pF + 1%), AM ANT. ± (1 pF + 1%)
FM OSC. (CF-2) ± 0.3 pF, FM ANT. RF ± 0.3 pF
Minimum Capacitance . . . . CA-1 & CA-2: 8.5 pF max., CF-1: 8.0 pF max., CF-2: 6.0 pF max.
Nominal Air Gap . . . . FM: 0.4 mm (0.0157")
Trimmer Cap. (with 2kg-cm tight) . . . . 12 pF min.

Rotation (%)		100	90	80	75	70	60	50	40	35	25	20	10	0
Variable Cap. (pF)	CA-1 CA-2	*335.0	282.7	227.5	*201.0	175.2	127.3	* 87.8	57.0	34.2	*25.4	17.8	5.8	0
	CF-1 CF-2	* 18.80	16.28	13.97	* 12.84	11.77	9.67	* 7.70	5.85	4.11	* 3.25	2.45	0.90	0

* marks show the check points of tolerances.

Dimensions

Unit: mm (inch)

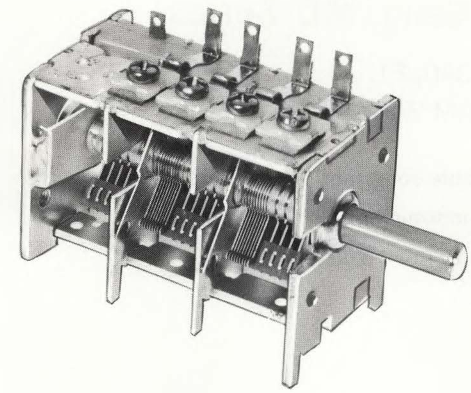


These positions of the plus terminals and ground lead for PCB mounting should be identical to this gauge.

FM/AM 5 Gang (MD Series)

ECV-5MD34X (340pF)

- Compact and stable construction
- Improved microphonic noise characteristics
- Complete linear frequency of FM section



Specifications

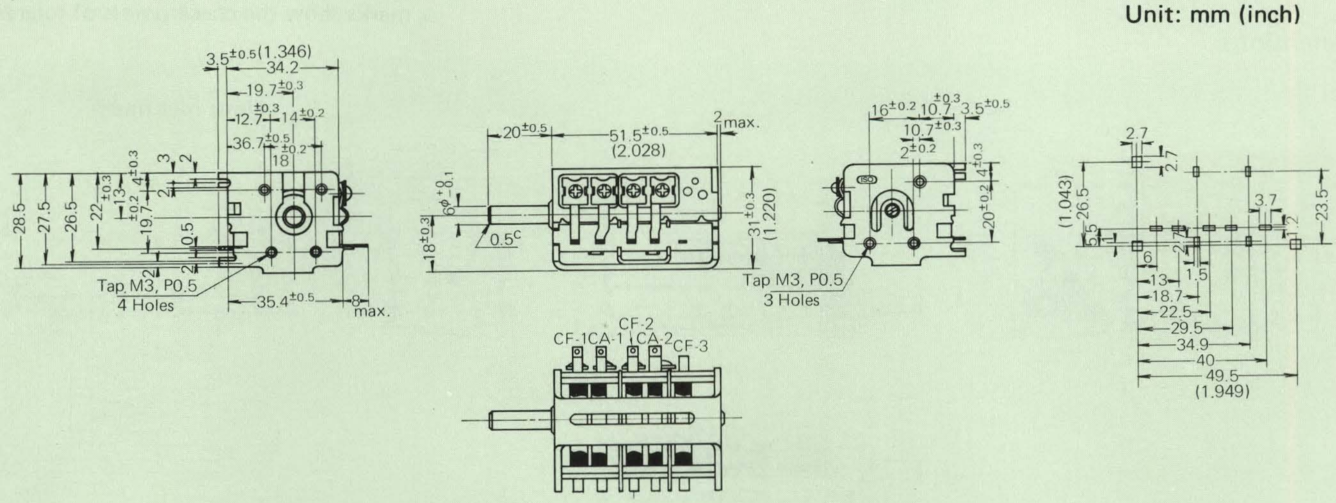
Rotation (CW to decrease cap.)	178° ± 2°	Gear Drive: 528° ± 5°
Rotation Torque	72 ~ 360 gr-cm (1 ~ 5 oz-in)	40 ~ 200 gr-cm (0.56 ~ 2.78 oz-in)
Breakdown Voltage (60 Hz RMS)	200 VAC (AM), 500 VAC (FM)	
Insulation Resistance (100 VDC)	100 MΩ min.	
Q (10 MHz and 50 pF position) AM	500 min.	
(100 MHz and 10 pF position) FM	200 min.	
Standard Dial	JIS 1a (AM), Linear (FM)	
Tolerance	AM OSC. (CA-2) ± (1 pF + 1%), AM ANT. ± (1 pF + 1%) FM OSC. (CF-3) ± 0.3 pF, FM ANT. RF ± 0.3 pF	
Minimum Capacitance	CA-1 & CA-2: 8.5pF max., CF-1: 7.5pF max., CF-2: 8.5pF max., CF-3: 6.0pF max.	
Nominal Air Gap	FM: 0.4mm (0.0157")	
Trimmer Cap. (with 2kg-cm tight)	12 pF min.	

Rotation (%)		100	90	80	75	70	60	50	40	35	25	20	10	0
Variable Cap. (pF)	CA-1 CA-2	*335.0	282.7	227.5	*201.0	175.2	127.3	* 87.8	57.0	34.2	*25.4	17.8	5.8	0
	CF-1 CF-2 CF-3	* 18.80	16.28	13.97	*12.84	11.77	9.67	* 7.70	5.85	4.11	* 3.25	2.45	0.90	0

* marks show the check points of tolerances.

Dimensions

Unit: mm (inch)

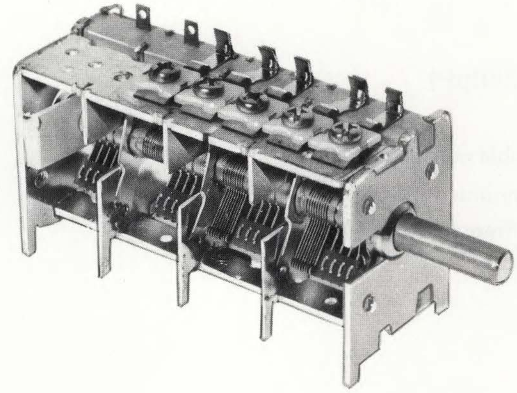


These positions of the plus terminals and ground lead for PCB mounting should be identical to this gauge.

Dust cover is available on request.

FM/AM 6 Gang (MD Series)

ECV-6MD34X (340pF)
Type 12 & 13 (AM 2/FM 4)



- **Compact and stable construction**
- **Improved microphonic noise characteristics**
- **Complete linear frequency of FM section**

Specifications

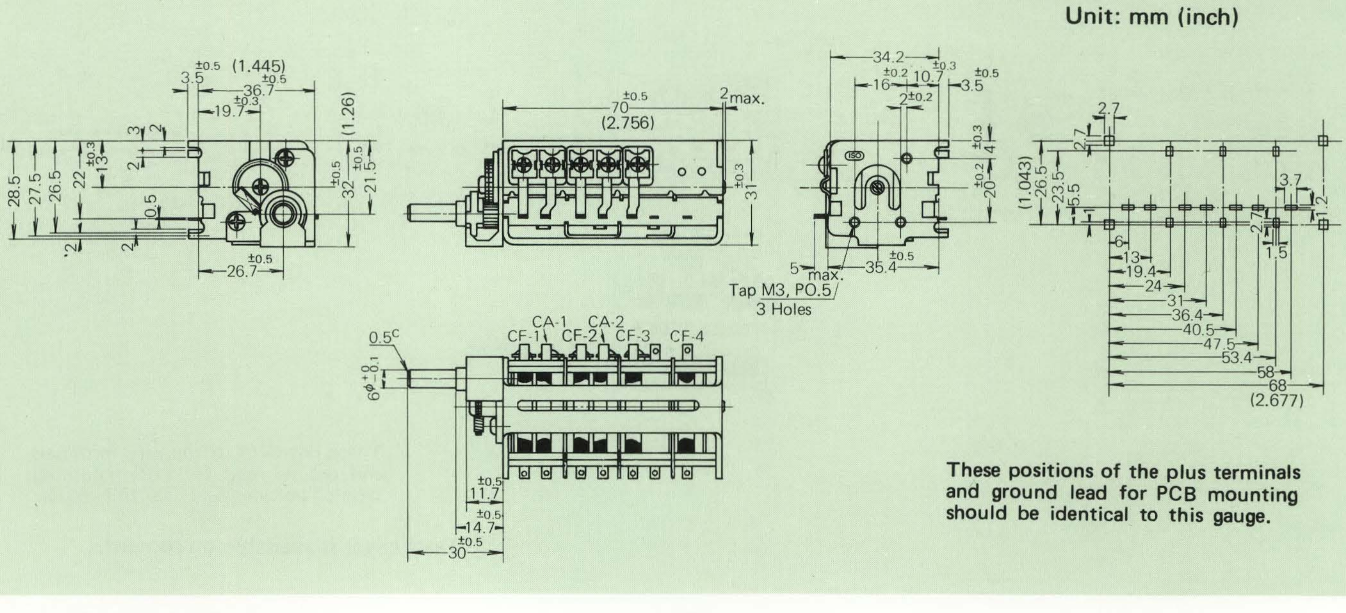
Rotation (CW to decrease cap.)	178° ± 2°	Gear Drive: 528° ± 6°
Rotation Torque	72 ~ 360 gr-cm (1 ~ 5 oz-in),	40 ~ 250 gr-cm (0.55 ~ 3.47 oz-in)
Breakdown Voltage (60 Hz RMS)	200 VAC (AM), 500 VAC (FM)	
Insulation Resistance (100 VDC)	100 MΩ min.	
Q (10 MHz and 50 pF position) AM	500 min.	
(100 MHz and 10 pF position) FM	200 min.	
Standard Dial	JIS 1a (AM), Linear (FM)	
Tolerance	AM OSC. (CA-2) ± (1 pF + 1%), AM ANT. ±(1 pF + 1%) FM OSC. (CF-4) ± 0.3 pF, FM ANT. RF ± 0.3 pF	
Minimum Capacitance	CA-1 & CA-2: 8.5pF max., CF-1: 7.5pF max., CF-2 & CF-3: 8.5pF max., CF-4: 6.0pF max.	
Nominal Air Gap	FM: 0.4 mm (0.0157")	
Trimmer Cap. (with 2kg-cm tight)	12 pF min.	

Rotation (%)		100	90	80	75	70	60	50	40	35	25	20	10	0
Variable Cap. (pF)	CA-1 CA-2	*335.0	282.7	227.5	*201.0	175.2	127.3	* 87.8	57.0	34.2	*25.4	17.8	5.8	0
	CF-1 CF-2 CF-3 CF-4	* 18.80	16.28	13.97	* 12.84	11.77	9.67	* 7.70	5.85	4.11	* 3.25	2.45	0.90	0

* marks show the check points of tolerances.

Dimensions

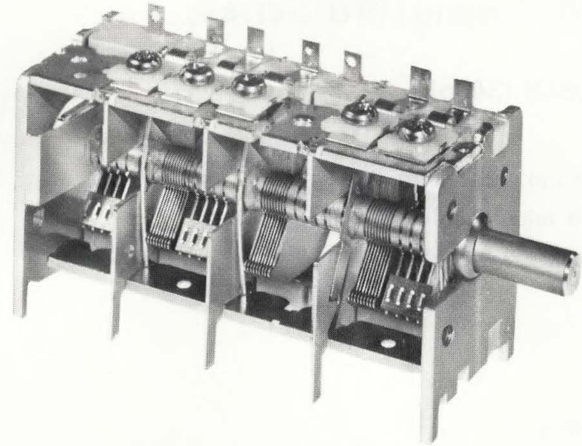
Unit: mm (inch)



These positions of the plus terminals and ground lead for PCB mounting should be identical to this gauge.

FM/AM 6 Gang (MD Series)

ECV-6MD34X (340pF)
Type 52 & 53 (AM3/FM3)



- **Compact and stable construction**
- **Improved microphonic noise characteristics**
- **Complete linear frequency of FM section**

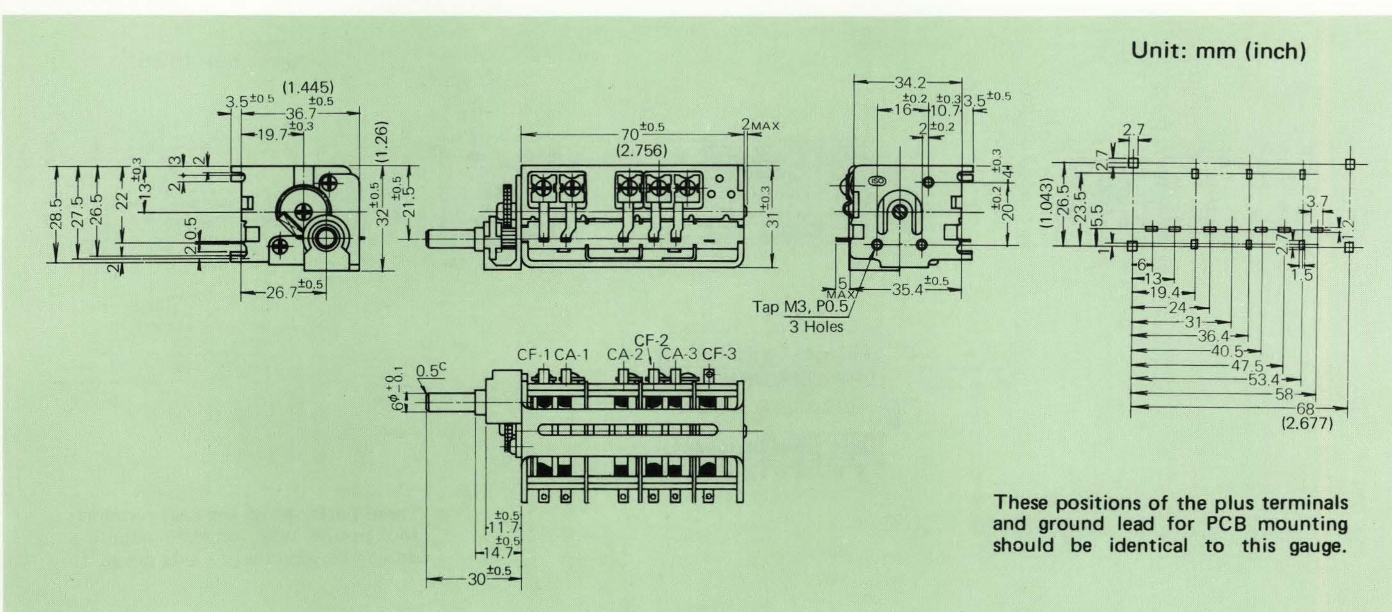
Specifications

Rotation (CW to decrease cap.)	178° ± 2° Gear Drive: 528° ± 6°
Rotation Torque	72 ~ 360 gr-cm (1 ~ 5 oz-in), 40 ~ 250 gr-cm (0.55 ~ 3.47 oz-in)
Breakdown Voltage (60 Hz RMS)	200 VAC (AM), 500 VAC (FM)
Insulation Resistance (100 VDC)	100 MΩ min.
Q (10 MHz and 50 pF position) AM	500 min.
(100 MHz and 10 pF position) FM	200 min.
Standard Dial	JIS1a (AM), Linear (FM)
Tolerance	AM OSC. (CA-3) ± (1 pF + 1%), AM ANT. ± (1 pF + 1%) FM OSC. (CF-3) ± 0.3 pF, FM ANT. RF ± 0.3 pF
Minimum Capacitance	CA-1, CA-2 & CA-3: 8.5pF max., CF-1: 7.5pF max., CF-2: 8.5pF max., CF-3: 6.0pF max.
Nominal Air Gap	FM: 0.4mm (0.0157")
Trimmer Cap. (with 2kg-cm tight)	12 pF min.

Rotation (%)		100	90	80	75	70	60	50	40	35	25	20	10	0
Variable Cap. (pF)	CA-1 CA-2 CA-3	*335.0	282.7	227.5	*201.0	175.2	127.3	* 87.8	57.0	34.2	*25.4	17.8	5.8	0
	CF-1 CF-2 CF-3	* 18.80	16.28	13.97	* 12.84	11.77	9.67	* 7.70	5.85	4.11	* 3.25	2.45	0.90	0

* marks show the check points of tolerances.

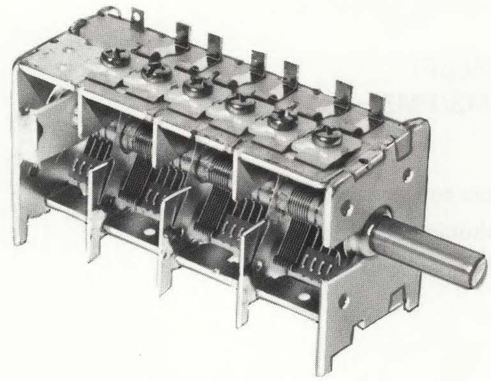
Dimensions



FM/AM 7 Gang (MD Series)

ECV-7MD34X (340pF)

- Compact and stable construction
- Improved microphonic noise characteristics
- Complete linear frequency of FM section



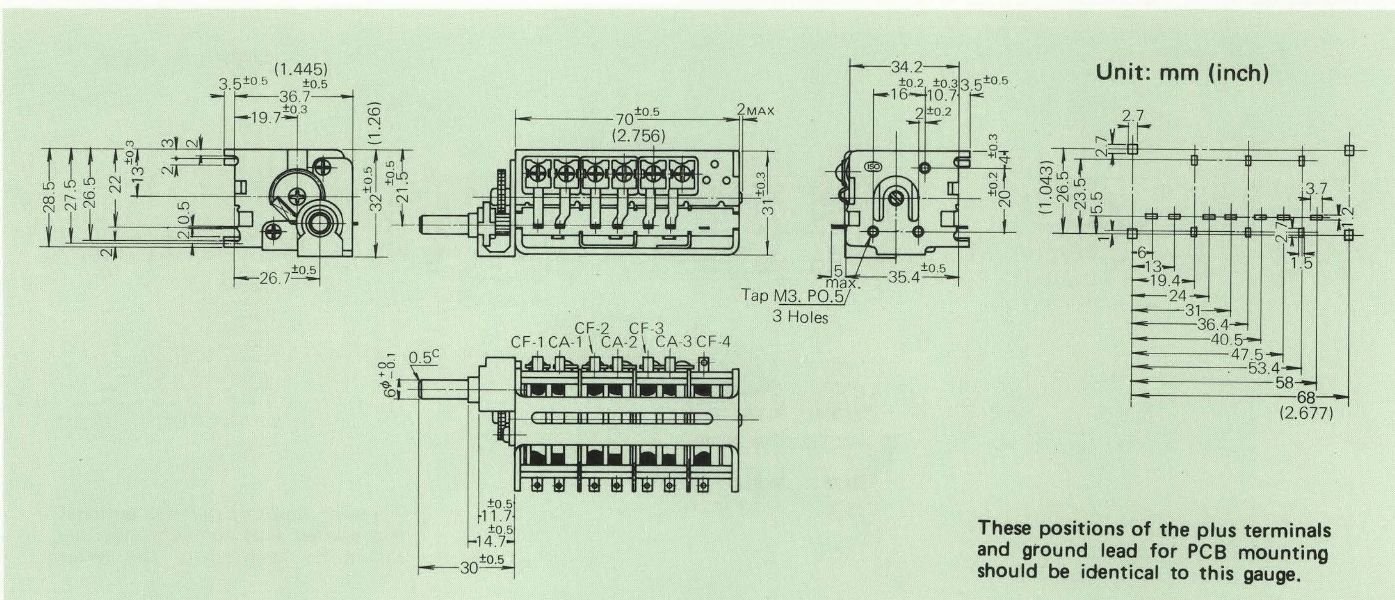
Specifications

Rotation (CW to decrease cap.) .... 178° ± 2° Gear Drive: 528° ± 6°
Rotation Torque .... 72 ~ 360 gr-cm (1 ~ 5 oz-in), 40 ~ 250 gr-cm (0.55 ~ 3.47 oz-in)
Breakdown Voltage (60Hz RMS) .... 200 VAC (AM), 500 VAC (FM)
Insulation Resistance (100 VDC) .... 100 MΩ min.
Q (10 MHz and 50pF position) AM .... 500 min.
(100 MHz and 10pF position) FM .... 200 min.
Standard Dial .... JIS 1a (AM), Linear (FM)
Tolerance .... AM OSC. (CA-3)±(1pF +1%), AM ANT. ±(1 pF +1%)
FM OSC. (CF-4)±0.3pF, FM ANT. RF ±0.3 pF
Minimum Capacitance .... CA-1, CA-2 & CA-3: 8.5pF max., CF-1: 7.5pF max., CF-2 & CF-3: 8.5pF max.
CF-4: 6.0pF max.
Nominal Air Gap .... FM: 0.4 mm (0.0157")
Trimmer Cap. (with 2kg-cm tight)............... 12 pF min.

Rotation (%)		100	90	80	75	70	60	50	40	35	25	20	10	0
Variable Cap. (pF)	CA-1 CA-2 CA-3	*335.0	282.7	227.5	*201.0	175.2	127.3	* 87.8	57.0	34.2	*25.4	17.8	5.8	0
	CF-1 CF-2 CF-3 CF-4	* 18.80	16.28	13.97	* 12.84	11.77	9.67	* 7.70	5.85	4.11	* 3.25	2.45	0.90	0

Dimensions

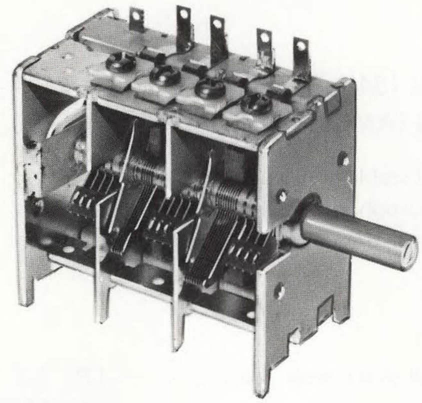
∗ marks show the check points of tolerances.



These positions of the plus terminals and ground lead for PCB mounting should be identical to this gauge.

FM/AM 5 Gang (MX Series)

ECV-5MX25X (250pF)



- Compact and stable construction
- Improved microphonic noise characteristics
- Complete linear frequency of AM and FM sections

Specifications

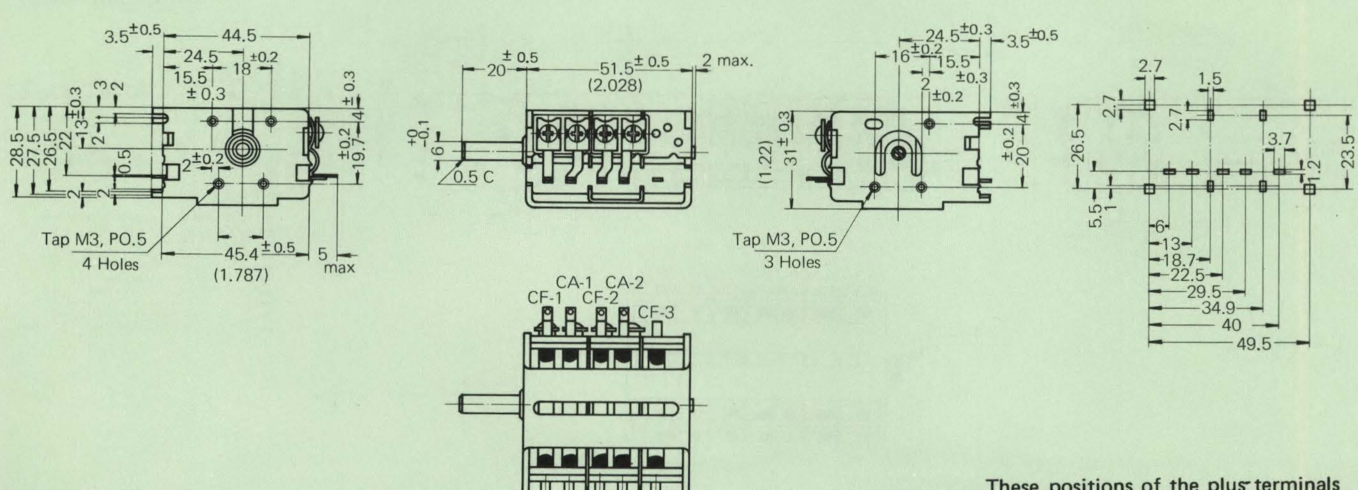
Rotation (CW to decrease cap.)	178° ± 2° Gear Drive: 528° ± 6°
Rotation Torque	72~360 gr-cm (1~5 oz-in) 40~200 gr-cm (0.56~2.78 oz-in)
Breakdown Voltage (60 Hz RMS)	200 VAC (AM), 500 VAC (FM)
Insulation Resistance (100 VDC)	100 MΩ min.
Q (10 MHz and 50pF position) AM	500 min.
(100 MHz and 10pF position) FM	200 min.
Standard Dial	Linear: AM & FM
Tolerance	AM OSC. (CA-2) ± (1 pF + 1%), AM ANT. ± (1 pF + 1%) FM OSC. (CF-3) ± 0.3 pF, FM ANT. RF ± 0.3 pF
Minimum Capacitance	CA-1 & CA-2: 10 pF max., CF-1, CF-2: 8.0pF max., CF-3: 7.0pF max.
Nominal Air Gap	FM: 0.4mm (0.0157")
Trimmer Cap. (with 2kg-cm tight)	12 pF min.
Band Frequency Ratio	AM 2.18, FM 1.24

Rotation (%)		100	90	80	75	70	60	50	40	35	25	20	10	0
Variable Cap. (pF)	CA-1	*240.0	152.6	102.2	*84.6	70.5	49.2	*34.3	23.4	15.2	*11.9	8.9	4.0	0
	CA-2	*122.5	88.8	67.0	*58.3	50.6	38.0	*28.1	20.1	13.7	*10.9	8.3	3.9	0
	CF-1 CF-2 CF-3	* 18.80	16.28	13.97	*12.84	11.77	9.67	* 7.70	5.85	4.11	* 3.25	2.45	0.90	0

* marks show the check points of tolerances.

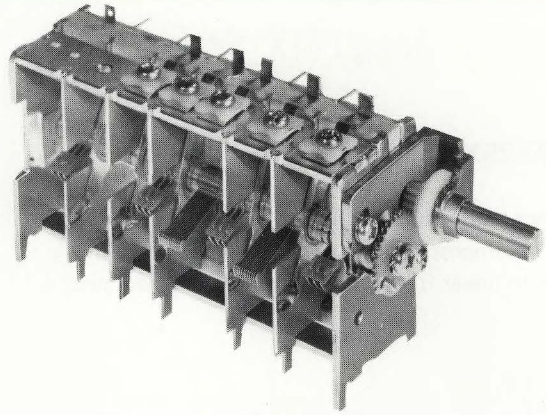
Dimensions

Unit: mm (inch)



These positions of the plus terminals and ground lead for PCB mounting should be identical to this gauge.

FM/AM 6 Gang (MX Series)



ECV-6MX34X (340pF)
Type 12 & 13 (AM 2/FM 4)

- Compact and stable construction
- Improved microphonic noise characteristics
- Complete linear frequency of AM and FM sections

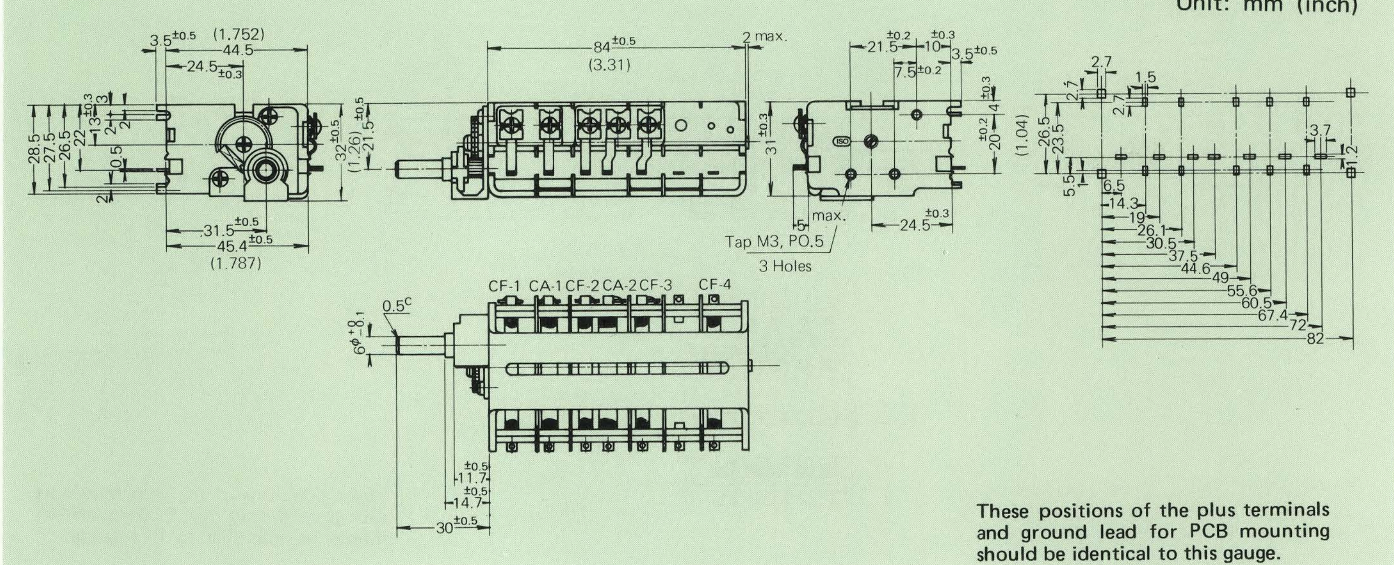
Specifications

Rotation (CW to decrease cap.)	178° ± 2°	Gear Drive: 528° ± 6°
Rotation Torque	72 ~ 360 gr-cm (1 ~ 5 oz-in),	40 ~ 250 gr-cm (0.55 ~ 3.47 oz-in)
Breakdown Voltage (60 Hz RMS)	200 VAC (AM), 500 VAC (FM)	
Insulation Resistance (100 VDC)	100 MΩ min.	
Q (10 MHz and 50 pF position) AM	500 min.	
(100 MHz and 10 pF position) FM	200 min.	
Standard Dial	Linear: AM & FM	
Tolerance	AM OSC. (CA-2) ± (1 pF +1%), AM ANT. ± (1 pF + 1%) FM OSC. (CF-4) ± 0.3 pF, FM ANT. RF ± 0.3 pF	
Minimum Capacitance	CA-1 & CA-2: 13 pF max, CF-1, CF-2 & CF-3: 8.0 pF max., CF-4: 6.0 pF max.	
Nominal Air Gap	FM: 0.4 mm (0.0157")	
Trimmer Cap. (with 2kg-cm tight)	12 pF min.	
Band Frequency Ratio	AM 2.18, FM 1.24	

Rotation (%)		100	90	80	75	70	60	50	40	35	25	20	10	0
Variable Cap. (pF)	CA-1 CA-2	*337.0	211.0	140.5	*116.4	96.9	67.6	*47.1	32.2	20.9	*16.3	12.3	4.7	0
	CF-1 CF-2 CF-3 CF-4	* 18.80	16.28	13.97	* 12.84	11.77	9.67	* 7.70	5.85	4.11	* 3.25	2.45	0.90	0

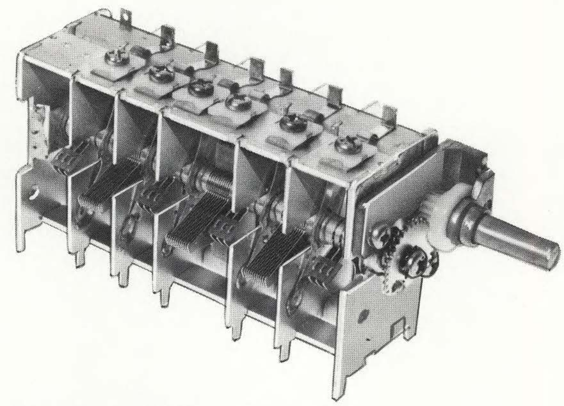
* Marks show the check point of telerances.

Dimensions



These positions of the plus terminals and ground lead for PCB mounting should be identical to this gauge.

FM/AM 7 Gang (MX Series)



ECV-7MX34X (340pF)

- Compact and stable construction
- Improved microphonic noise characteristics
- Complete linear frequency of AM and FM sections

Specifications

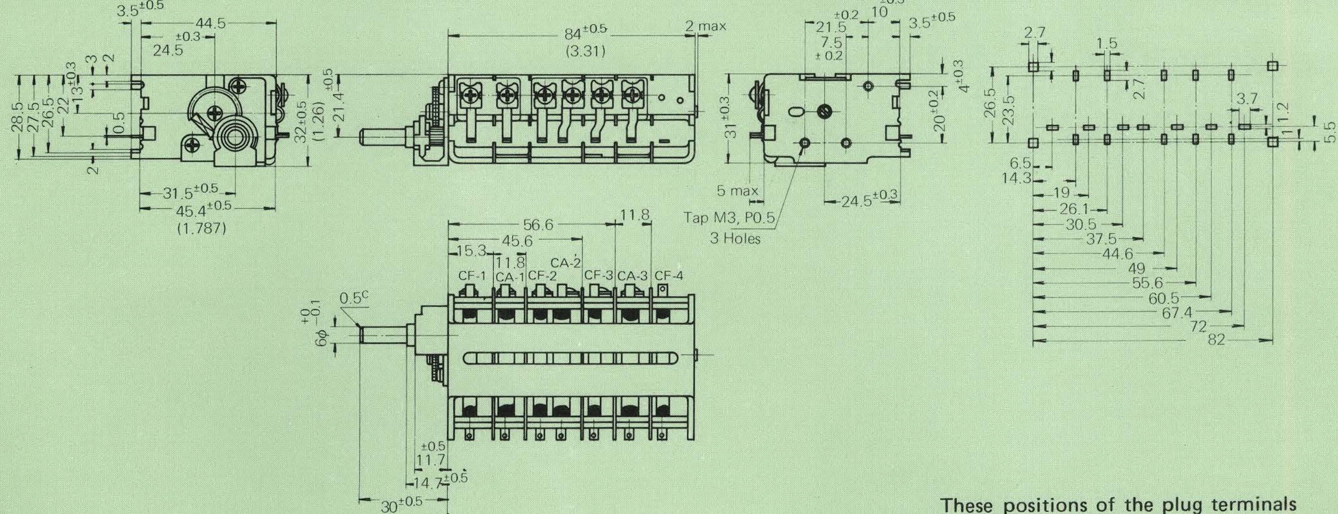
Rotation (CW to decrease cap.) .... 178° ± 2° Gear Drive: 528° ± 6°
Rotation Torque .... 72~360 gr-cm (1~5 oz-in), 40 ~ 250 gr-cm (0.55 ~3.47 oz-in)
Breakdown Voltage (60Hz RMS) .... 200 VAC (AM), 500 VAC (FM)
Insulation Resistance (100 VDC) .... 100 MΩ min.
Q (10 MHz and 50pF position) AM .... 500 min.
(100 MHz and 10pF position) FM ...... 200 min.
Standard Dial .... Linear: AM & FM
Tolerance .... AM OSC. (CA-3) ± (1pF +1%), AM ANT. ± (1 pF + 1%)
FM OSC. (CF-4) ± 0.3 pF, FM ANT. RF ± 0.3 pF
Minimum Capacitance............................ CA-1, CA-2 & CA-3: 13pF max., CF-1, CF-2 & CF-3: 8.0pF max.
CF-4: 6.0pF max.
Nominal Air Gap .... FM: 0.4mm (0.0157")
Trimmer Cap. (with 2 kg-cm tight) .... 12 pF min.
Band Frequency Ratio .... AM 2.18, FM 1.24

Rotation (%)		100	90	80	75	70	60	50	40	35	25	20	10	0
Variable Cap. (pF)	CA-1 CA-2 CA-3	*337.0	211.0	140.5	*116.4	96.9	67.6	*47.1	32.2	20.9	*16.3	12.3	4.7	0
	CF-1 CF-2 CF-3 CF-4	* 18.80	16.28	13.97	* 12.84	11.77	9.67	* 7.70	5.85	4.11	* 3.25	2.45	0.90	0

*Marks show the check point of tolerance.

Dimensions

Unit: mm (inch)



These positions of the plug terminals and ground lead for PCB mounting should be identical to this gauge.

VIII PIEZOELECTRIC CERAMIC APPLICATION

QUICK REFERENCE GUIDE

Reed Filters

Type		Center Frequency	Bandwidth	Selectivity	Page
EFM	R15E	502.5~1147.5 Hz	1.7Hz min. at 3dB	22.5dB min. at ±15Hz	VIII-9
	R15C	288.5~1433.4Hz	1.3~5.0Hz min. at 3dB	Voltage Attenuation at Adjacent Nominal Frequency: 22.5dB min.	
	R1	502.5~1597.5Hz	1.7Hz min. at 3dB	20dB min.	VIII-11
	R2	412.5~1147.5Hz	3.0 to 6.5Hz min. at 6dB	25dB min.	VIII-13
	03	412.5~1147.5Hz	—	—	VIII-15
	R4	502.5~1147.5Hz	1.6Hz min. at 3dB	19dB min.	VIII-16
	R5	502.5~1147.5Hz	1.6Hz min. at 3dB	19dB min.	VIII-18
	R6	997.5~1912.5Hz	1.7Hz min. at 3dB	20dB min.	VIII-19

Ceramic Oscillators

Type	Frequency	Power Supply	Output Voltage	Page
EFO	3.0~80kHz	5.4~12VDC	0.4 and 0.6(Vrms) min.	VIII-20

Ultrasonic Ceramic Microphones

Type	Center Frequency	Bandwidth	Sensitivity	Page
EFR	41±1.0kHz (Transmitter) 40±1.0kHz (Receiver)	3.5kHz min. at -73dB/Volt/volt/μBar	-67dB/Volt/μBar min. -70dB/Volt/μBar min.	VIII-23

Ceramic Pickup Elements

Type	Capacitance	Capacitance Tolerance	Construction	Page
EPB	500~6500pF	±20%, $^{+25}_{-20}$%, $^{+40}_{-10}$%	Series, Series with metal layer, Single, Parallel A, Parallel B	VIII-30
EPB (Special use)	Please ask us whether the requested capacitance is available.		Plate, Disc	VIII-35

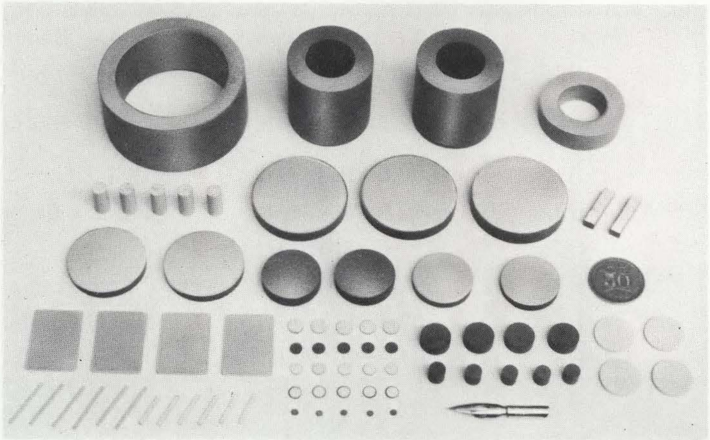
Ultrasonic Transducers

Type	Frequency	Capacitance	Electrodes	Page
EFE	Please ask us whether the requested frequency and capacitance are available.		Split, Overall, Side, Plane	VIII-36

*This chart is intended to serve as a guide only.

PIEZOELECTRIC CERAMIC MATERIALS

Piezoelectric ceramic material is widely utilized in various electronic fields as electrical-mechanical energy conversion elements and oscillation elements.
As conversion elements, its application range covers 1) measuring equipment, 2) sonic conversion devices, 3) ultrasonic wave transducers, 4) high voltage generators and others, and as oscillation elements, 1) piezoelectric oscillators, 2) coupling oscillators, 3) mechanical filters, 4) delay lines. Piezoelectric ceramic material is expected to open further application fields in future.
Matsushita Electric has developed and marketed various types of piezoelectric ceramic material and its application, all of which are characterized by a large electro-mechanical coupling coefficient, a high mechanical quality factor QM, a large dielectric constant and stability over a wide temperature range. Main ingredients are $Pb(Mg_{1/3}Nb_{2/3})O_3$, $PbTiO_3$ and $PbZrO_3$, whose composition varies with its application, being converted with metal oxide additives to $Pb(M_{1/3}Nb_{2/3})O_3$ (M=a dyad). Quite different from conventional solid solution such as $BaTiO_3$ and binary $PbTiO_3$-$PbZrO_3$, Matsushita's ternary PCM can easily provide the performance ideal for each different application.
The basic performance of typical types of material is described below.
PCM-5 ceramic has large voltage constant (g_{33}), dielectric constant and high durability against mechanical shocks and vibrations, and thereby is most suitable for gas igniters and pickup elements. It has a high Curie point of 325°C, providing highly stable characteristics in the temperature range higher than an ordinal room ambient. From standpoints of large dielectric constant, PCM-52 is also recommendable for the same application.
PCM-71 ceramic material exhibits extremely large mechanical quality factor QM, enduring such long-term and large-power oscillation as required in ultrasonic resonators. It is, therefore, most suitable as ultrasonic oscillation elements of sonars. Also suitable material is PCM-9, which has a smaller temperature dependency of dielectric constant, ensuring higher performance. PCM-32 of high QM is also available.



PCM-33A is featured by its large dielectric constant and electromechanical coupling coefficient and small QM, being most ideal for pickup elements. When far larger dielectric constant than this type is required, PCM-34 and PCM-36 are also available.
PCM-18 exhibits excellent stability of resonant frequency either against temperature change or over a long operation period of time, being equivalent to the stability of crystal. Thereby, PCM-18 is most suitable for ceramic filters. If thickness mode is taken into consideration as high frequency filters, PCM-65 is recommendable.
Abovementioned types are only typical examples on market from Matsushita, and any other material composition specified to conform to every application is available upon request.

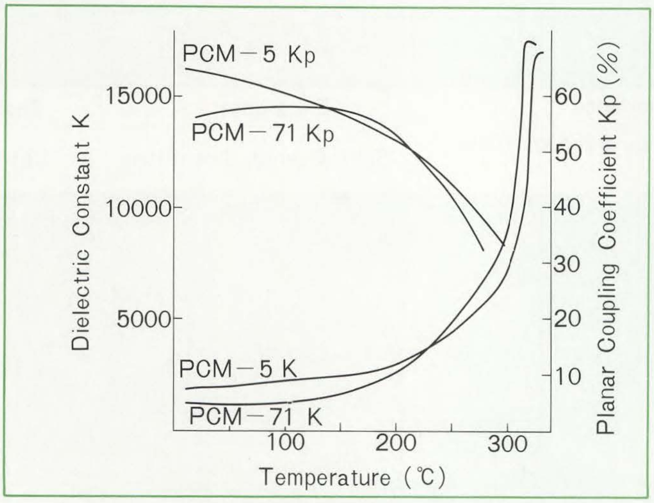


Fig. 1 Temperature Dependence of K and Kp of PCM Ceramics

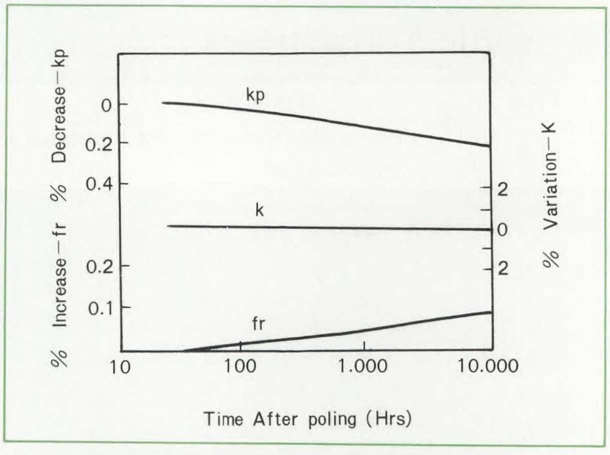


Fig. 2 Aging Characteristics of Resonant Frequency (fr), Dielectric Constant (K) and Planar Coupling Coefficient (kp) of PCM-18

Table 1 Properties of PCM Ceramics

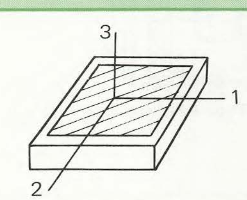
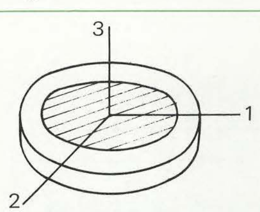
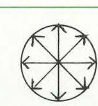
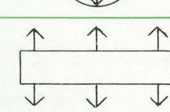
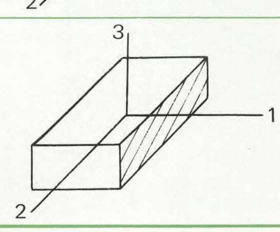
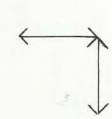
Item	PCM-5	PCM-18	PCM-65	PCM-33A	PCM-52	PCM-9
Coupling Coefficient						
Kp	0.65	0.37	0.53	0.66	0.61	0.60
K_{31}	0.38	0.22	0.31	0.39	0.35	0.33
K_{33}	0.71	0.43	0.61	0.71	0.71	0.69
Piezoelectric Constant						
d_{31} $(\times 10^{-12})$	-186	-79	-99	-262	-186	-123
d_{33} $(\times 10^{-12})$	423	167	206	572	463	318
g_{31} $(\times 10^{-3})$	-12.3	-6.5	-11.1	-9.1	-10.3	-10.0
g_{33} $(\times 10^{-3})$	28.2	11.8	23.1	23.7	25.5	23.5
Free Dielectric Constant K^3	1930	1100	1010	3200	2050	1500
Dissipation Factor	1.42	0.77	1.40	1.70	1.52	0.80
Frequency Constant N_3	1970	2520	2320	1960	2030	2170
Elastic Constants Short Circuit $1/S^E{}_{33} = Y^E{}_{33} (\times 10^{10})$	6.3	9.8	7.9	6.3	6.4	6.4
Density	7700	7700	7750	7700	7700	7700
Mechanical Q	70	2200	500	80	75	1900

Units

Coupling Coefficients...K...dimensionless, Piezoelectric Constants ... d ... meters/volts, g...volt-meters/newton, Frequency Constant ..... N ... cps-meters, Elastic Modulus..... Y^E_{33} ... Newton/meter^2, Density .....kg/meter^3, Dissipation Factor ..... %.

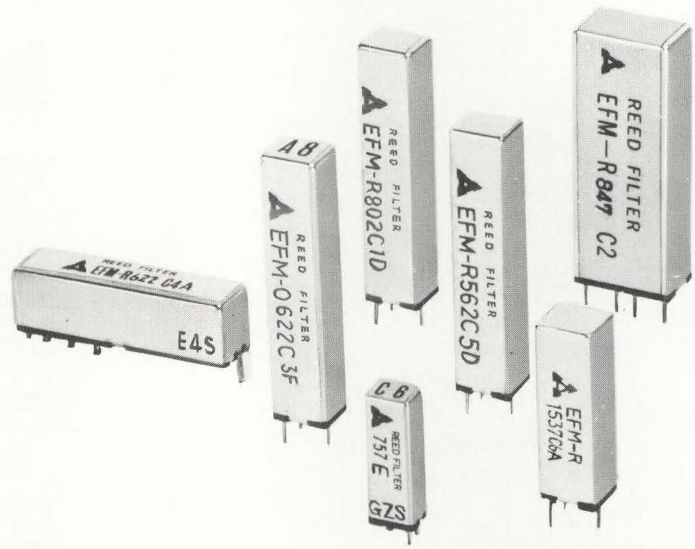
Explanation of Crystal Axes

Piezoelectric ceramic is comprised of small crystals. Polarization, applying high electrostatic energy to both ends of elements, is needed to create piezoelectricity. The direction in which polarization voltage is applied is 3 and the rectangular directions as to it are 1 and 2; hence, K_{33} indicates electro-mechanical coupling coefficient of the same direction to polarization.

Axis	Polarization axis	Dimension of electric field	Distortion	
	$\updownarrow$	$\updownarrow$	$\updownarrow$	d_{33}, g_{33}, k_{33}
	$\updownarrow$	$\updownarrow$	$\leftrightarrow$	d_{31}, g_{31}, k_{31}
	$\updownarrow$	$\updownarrow$		d_{31}, g_{31}, kp
	$\updownarrow$	$\updownarrow$		d_{33}, g_{33}, k_{33}
	$\updownarrow$	$\leftrightarrow$		d_{15}, g_{15}, k_{15}

REED FILTERS

A read filter is an electro-mechanical filter consisting mainly of a tuning fork and piezoelectric elements adhered on the fork. It works as a high selectivity filter or transmitter in the range of audible frequency.

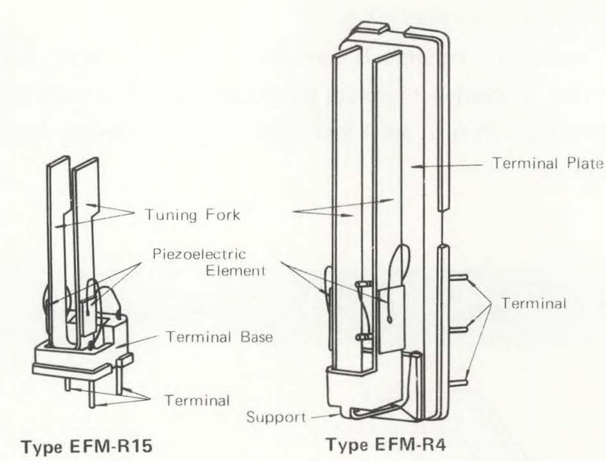


Features

The most important feature of our reed filter lies in the invention that makes a tuning fork and its support a single part, resulting in excellent strength and stability against shock and vibration.

- High Q(200~1,000) and high selectivity because of utilizing mechanical vibration
- Remarkably long life due to contact-free construction
- Stable against aging and environmental changes
- Both a line of filters with constant bandwidth and selectivity and those having constant Q are available.
- The miniature size reed filter (EFM-R15) included

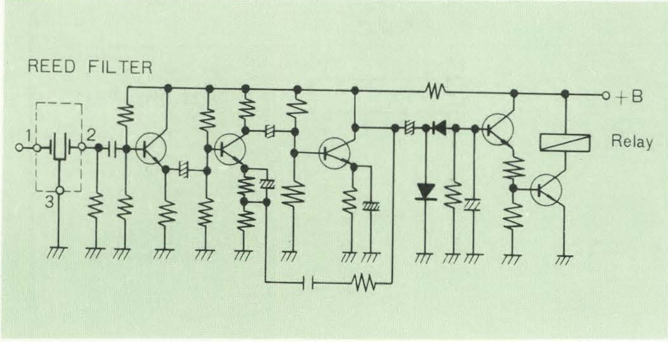
Internal Construction



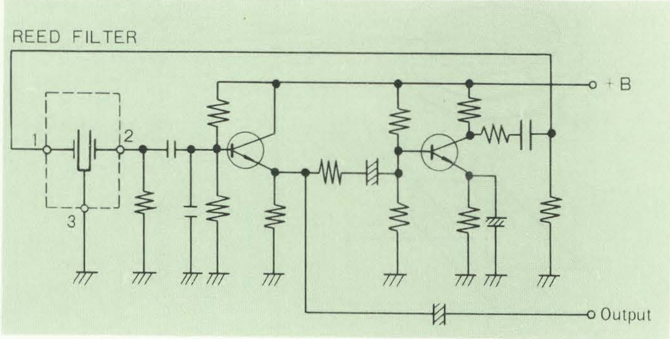
Application

- Pocket paging receivers and transmitters
- Citizen-band transceivers
- Telephones answering equipment
- Traffic signal control systems
- Automatic control equipment
- Radio telemeters and telecontrols
- Other inter-communication systems

Receiver Circuit



Oscillator Circuit



General Ratings

Item	Test Method	Requirement
Center Frequency Oscillating Frequency Voltage Attenuation at Center of Bandwidth Bandwidth (-3dB) Selectivity	Filters shall be tested at 23±2°C in accordance with the rated measuring circuit.	To meet the specified value Center frequency and oscillating frequency is specified in the standard frequency table.
Temperature Characteristics	Filters shall be tested in accordance with the specified measuring circuit after being stored in the specified chamber for more than 30 minutes. Ambient temperature of the measuring circuit should be 23±2°C.	To meet the specified value
Vibration Stability	Filters shall be measured in accordance with the specified measuring circuit after being subjected to the following vibration: Amplitude: 1.5mm(.06") Vibration Freq.: 10~55Hz 1 minute Direction: 3 perpendicular directions Time: 1 hour per one direction (total 3 hours)	To meet the specified value
Shock Stability	Filters shall be measured in accordance with the specified measuring circuit one hour after application of the following shocks. Acceleration: 50G Time per shock: 5~9msec. Direction: 6 perpendicular directions Time: 3 times per direction (total 18 times)	To meet the specified value
Humidity	After being subjected to 90~95%RH at 40±2°C for 100 hours and left at room temperature for 1 hour, filters shall be measured in accordance with the specified measuring circuit.	To meet the specified value

Standard Frequency Table A

	487.5	622.5	772.5	907.5	1057.5		1342.5		1657.5	
		637.5	787.5	922.5	1072.5	1207.5	1357.5	1507.5	1672.5	1807.5
	502.5	652.5		937.5	1087.5	1222.5	1372.5	1523.5	1687.5	1822.5
382.5	517.5	667.5	802.5	952.5		1237.5	1387.5	1537.5		1837.5
397.5	532.5	682.5	817.5	967.5	1102.5	1252.5		1552.5	1702.5	1852.5
	547.5	697.5	832.5	988.5	1117.5	1267.5	1412.5	1567.5	1717.5	1867.5
412.5	562.5		847.5	997.5	1132.5	1282.5	1427.5	1582.5	1732.5	1882.5
442.5	577.5	712.5	862.5		1147.5	1297.5	1442.5	1597.5	1747.5	1897.5
457.5	592.5	727.5	877.5	1012.5	1162.5		1457.5	1612.5	1762.5	
472.5		742.5	892.5	1027.5	1177.5	1318.5	1472.5	1627.5	1777.5	1912.5
472.5	607.5	757.5		1042.5	1192.5	1327.5	1487.5	1642.5	1792.5	

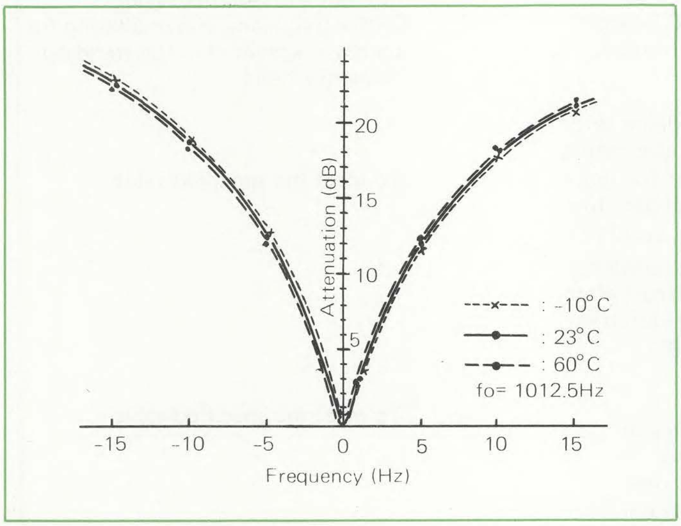
Standard Frequency Table B

	358.6	470.5	600.9	788.5		1285.8
	368.5	483.5	617.4		1006.9	
288.5	378.6	496.8	634.5	810.2	1034.7	1321.2
296.5	389.0		651.9	832.5	1063.2	1357.6
	399.8	510.5	669.9	855.5	1092.4	1395.0
304.7		524.6	688.3	879.0	1122.5	1433.4
313.0	410.8	539.0			1153.4	
321.7	422.1	553.9	707.3	903.2	1185.2	
330.5	433.7	569.1	726.8	928.1		
339.6	445.7	584.8	746.8	953.7	1217.8	
349.0	457.9		767.4	979.9	1251.4	

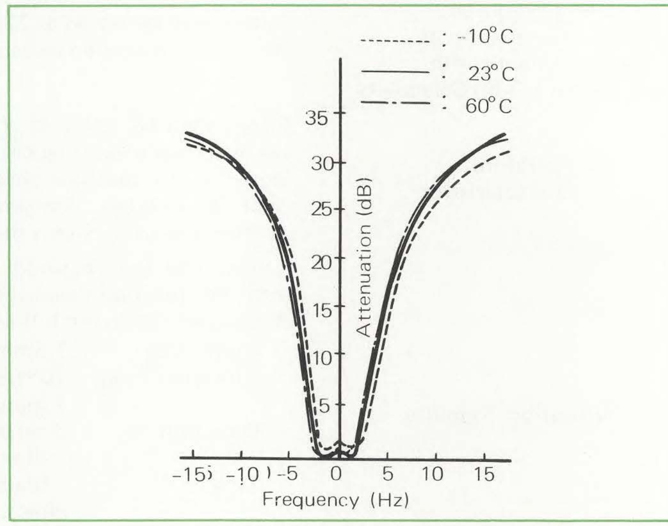
Typical Characteirstics

Temperature Characteristics

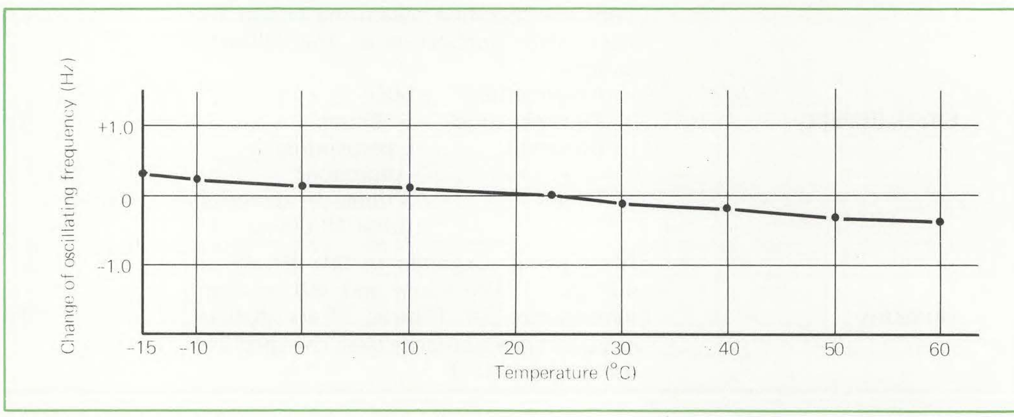
(EFM-R1D, EFM-R4A, EFM-R5D, EFM-R6A, EFM-R15E)



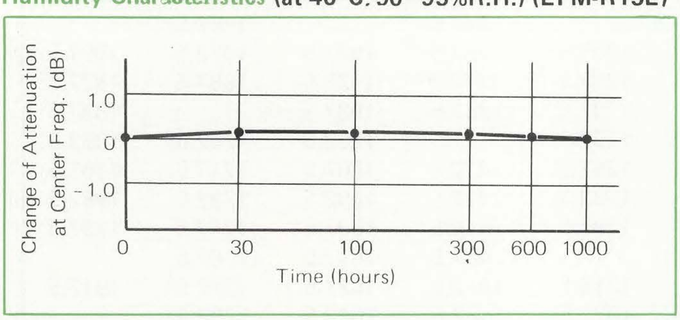
EFM-R2

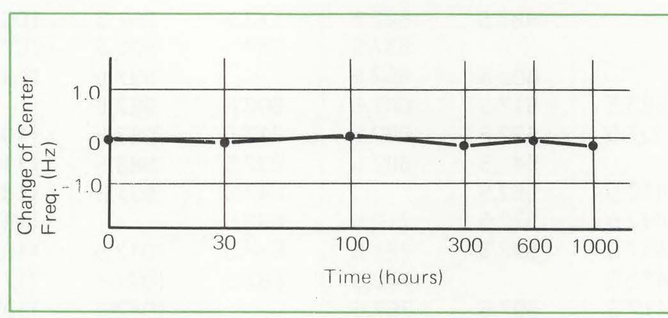


EFM-03F



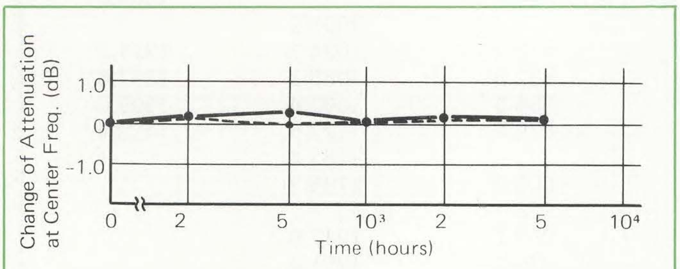
Humidity Characteristics (at 40°C, 90~95%R.H.) (EFM-R15E)

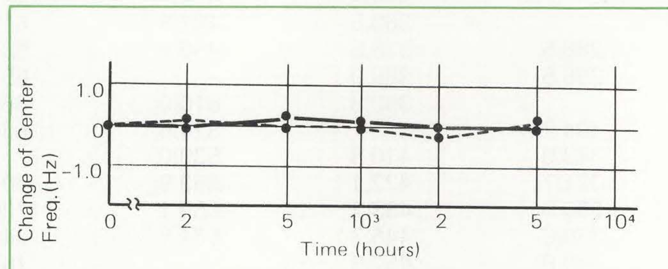




Continuous Operating Test [1] (EFM-R4A)

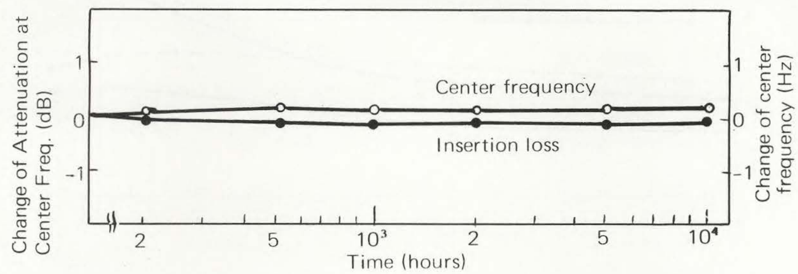
—: at 70°C, -------: at room temperature
Input voltage: 7.0 Vrms, Nominal frequency: 997.5 Hz



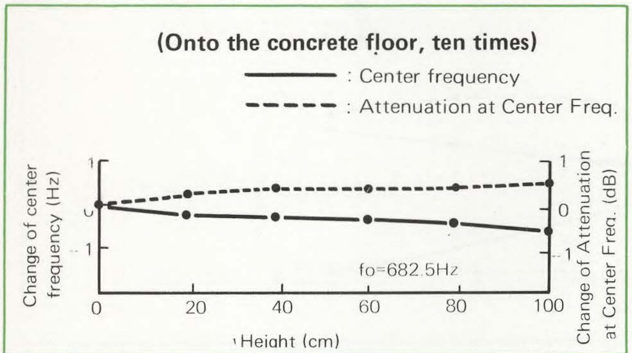


Continuous Operating Test [2] (EFM-R15E)

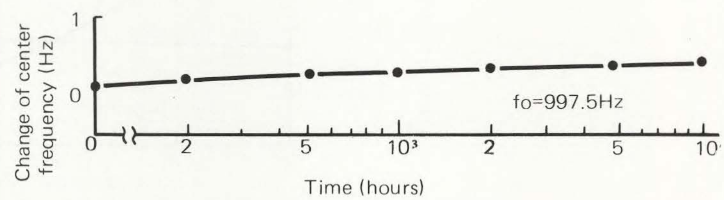
Input voltage 30Vrms, repeating 'on' and 'off' at intervals of 0.5sec.
Nominal frequency: 832.5Hz



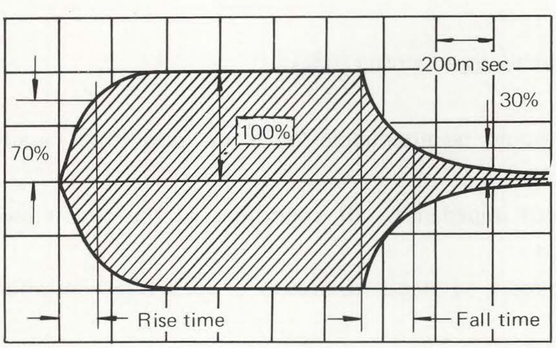
Drop Test (EFM-R4A)



Aging Test

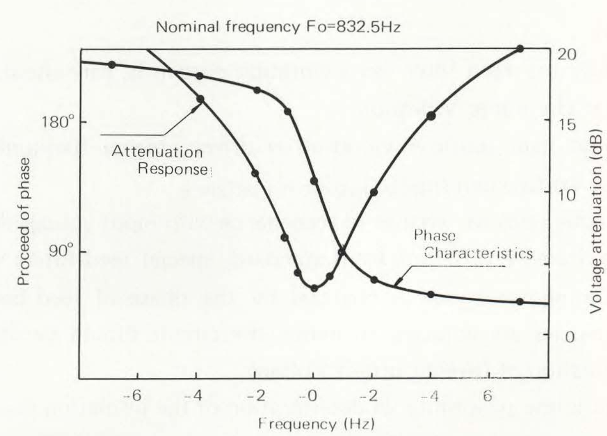


Rise Time/Fall Time (EFM-R15)

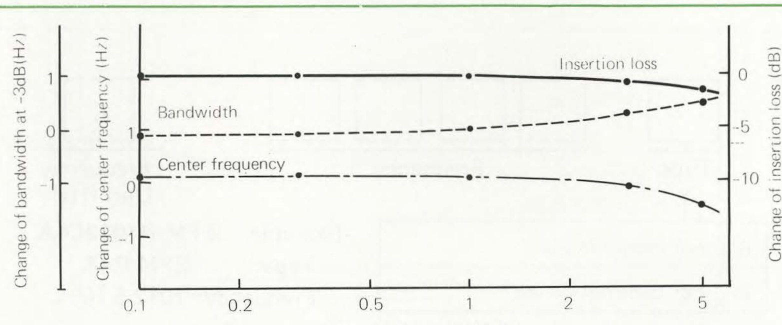


Bandwidth at -3dB: 2.5Hz
Rise time: 160msec.
Fall time: 170msec.

Phase Characteristics (EFM-R15E)

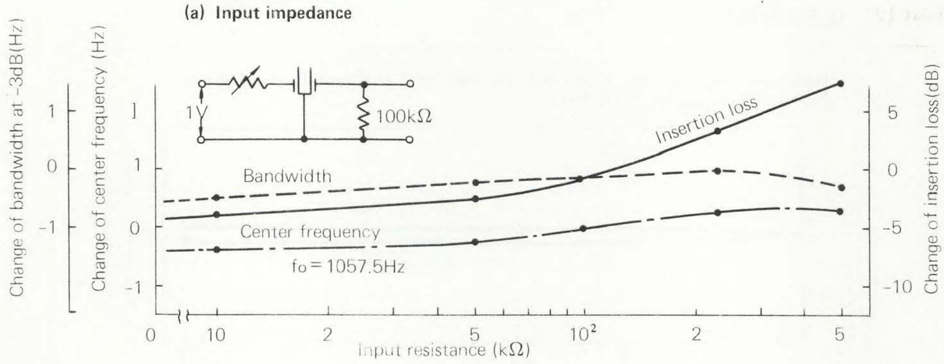


Change of Characteristics Owing to Input Signal Voltage (EFM-R4A)

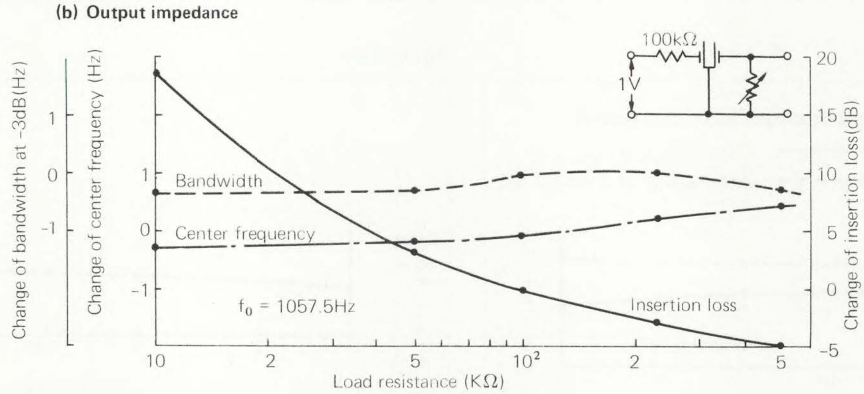


Change of Characteristics Owing to Input/Output Impedance (EFM-R4A)

(a) Input impedance



(b) Output impedance



Suggestions for Handling

1. Shock
   Because the reed filter has a vibration part in it, care should be taken not to apply strong shock.
2. Higher Harmonic Vibration
   Because high spurious vibration is driven, higher harmonic vibration should be attenuated by a low pass filter circuit.
3. Input Voltage and Input/Output Impedance
   Characteristics will change in accordance with input voltage and input/output impedance. If conditions of the circuit used are extremely different from standard, special reed filters should be used.
4. Oscillating frequency is changed by the phase of feed back roop of circuit, so standard circuits or reed filters in which frequencies are adjusted to match the circuit should be used.
5. Application of Direct Current Voltage
   There is the possibility of deterioration of the insulation resistance when applying direct current for long years. Care should be taken not to apply direct current by using capacitors in the circuit.

Part Number Code

E F M	—	☐	☐ ☐ ☐ ☐	C	☐ ☐
Common Code		Type	Freqaency	Frequency Unit (Hz)	Suffix

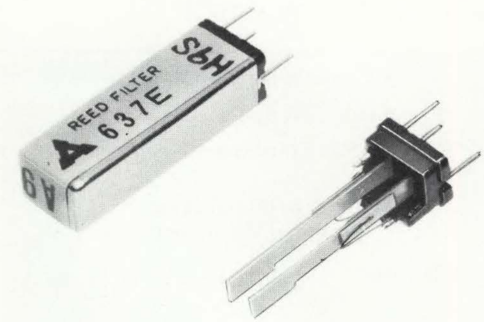
R	For reception use
O	For transmission use

Example: EFM-R1012C4A
Type: EFM-R4A
Frequency: 1012.5 Hz

Type EFM-R15

will price
del 111 days

Features

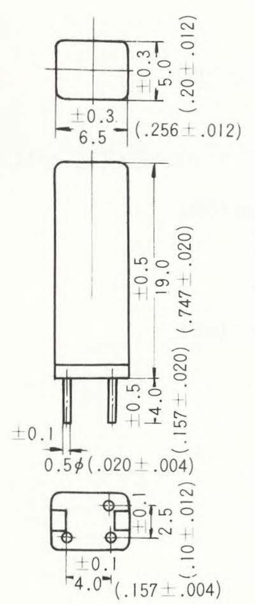


- Miniature size and light weight (typically 1g)
- Constant bandwidth and selectivity regardless of center frequency (EFM-R15E)
- Bandwidth is constant in EFM-R15C regardless of center frequency.

Application

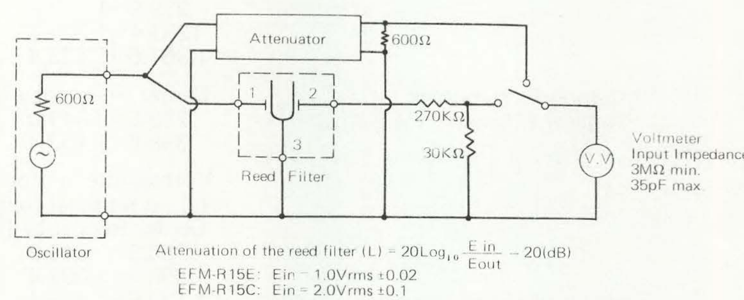
- Individual selective call systems such as bell boy systems
- Pocketable wireless apparatus

Dimensions



Unit: mm (inch)

Measuring Circuit



Specifications (EFM-R15E)

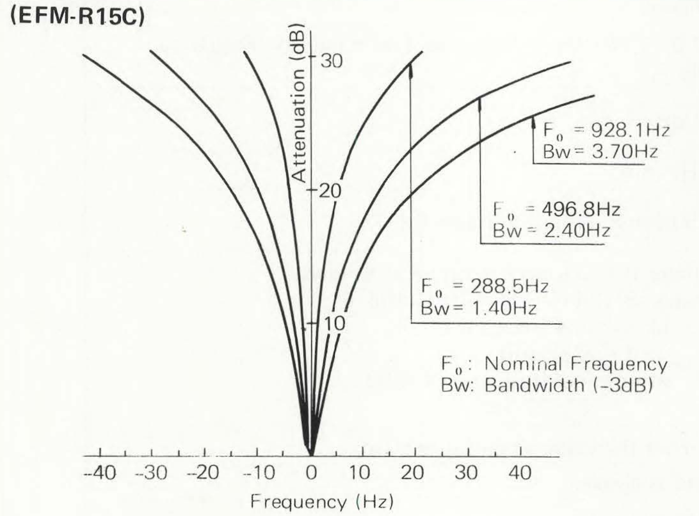
1. Allowable Input Voltage	3.0Vrms
2. Center Frequency	502.5~1,147.5Hz (Refer to the standard frequency table A)
3. Voltage Attenuation at Nominal Frequency	4 ±2dB
4. Bandwidth at 3dB	1.7Hz min.
5. Selectivity at Nominal Frequency ±15Hz	22.5dB min. (Input voltage: 0dB)
6. Temperature Characteristics	Voltage attenuation L shall be as follows between 5°C(41°F) and 40°C(104°F): (a) at nominal frequency $1 \leq L \leq 8$dB (b) at nominal frequency ±15Hz $L \geq 22.5$dB
7. Vibration	To meet the value of 6–(a) and (b)
8. Shock	Same as above
9. Humidity	Same as above

Specifications (EFM-R15C)

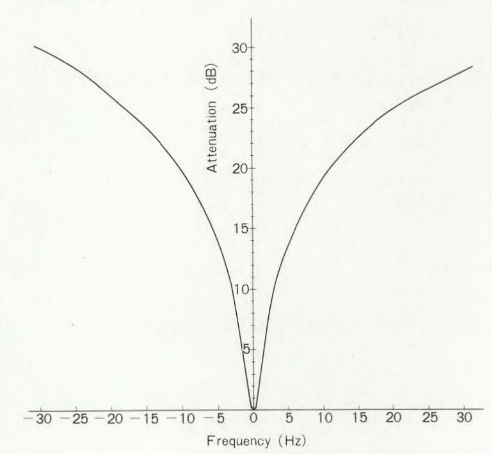
1. Allowable Input Voltage	3.0Vrms
2. Center Frequency	288.5~1,433.4Hz (Refer to the standard frequency table B)
3. Center Frequency Tolerance	±0.08%
4. Voltage Attenuation at Nominal Frequency	Center Frequency (Hz) / Voltage Attenuation (dB) 288.5~ 349.0 — 1.0~8.5 358.6~1,092.4 — 1.0~8.0 1,122.5~1,433.4 — -1.0~8.0
5. Bandwidth at 3dB	Center Frequency (Hz) / Bandwidth (Hz) 288.5~ 349.0 — 1.3 min. 358.6~ 399.8 — 1.5 min. 410.8~ 496.8 — 1.7 min. 510.5~ 584.8 — 2.0 min. 600.9~ 707.3 — 2.5 min. 726.8~ 855.5 — 3.0 min. 879.0~ 953.7 — 3.5 min. 979.9~1,217.8 — 4.0 min. 1251.4~1,321.2 — 4.5 min. 1,357.6~1,433.4 — 5.0 min.
6. Voltage Attenuation at Adjacent Nominal Frequency	Center Frequency (Hz) / Voltage Attenuation (dB) 288.5~ 349.0 — 23.5 min. 358.6~1,433.4 — 22.5 min.
7. Temperature Characteristics	Voltage attenuation shall be as follows between -10°C and 45°C(14° to113° F). (a) at nominal frequency ±0.2Hz: Center frequency (Hz) / Voltage attenuation (dB) 288.5~ 349.9 — 1.0~11.0 358.6~1,092.4 — 1.0~10.0 1,122.5~1,433.4 — 0~10.0 (b) at adjacent nominal frequency: Center frequency (Hz) / Voltage attenuation (dB) 288.5~ 349.0 — 23.5 min. 358.6~1,433.4 — 22.5 min.
8. Vibration	To meet the value of 7 — (a) and (b)
9. Shock	Same as above
10. Humidity	Same as above

Frequency Characteristics

(EFM-R15C)



(EFM-R15E)



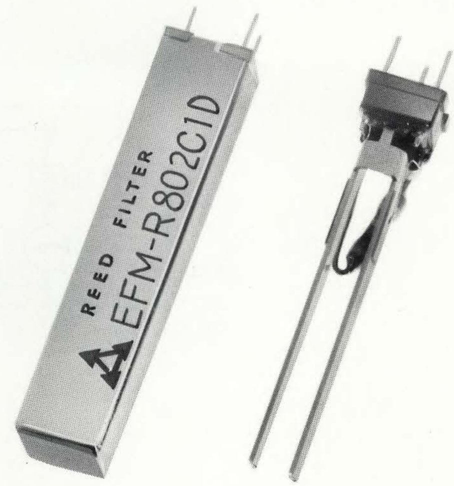
Type EFM-R1

Features

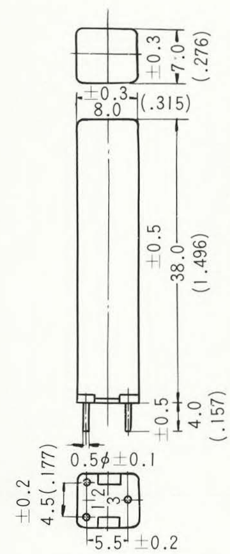
- Constant bandwidth and selectivity regardless of the center frequency (EEM-R1D)
- Q is constant regardless of the center frequency in EFM-R1E.
- Constant insertion loss is realized by employing a resistor having the best resistance value individually.

Application

- Individual selective call systems such as pocket pagers and transceivers
- Communication equipment such as telemeters and telecontrols



Dimensions

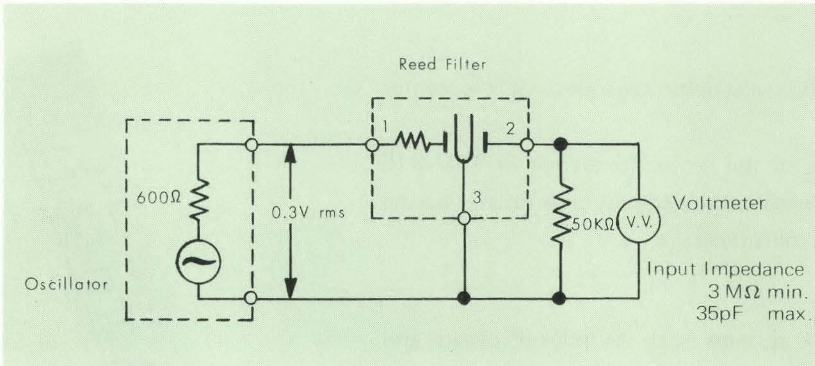


Unit: mm (inch)

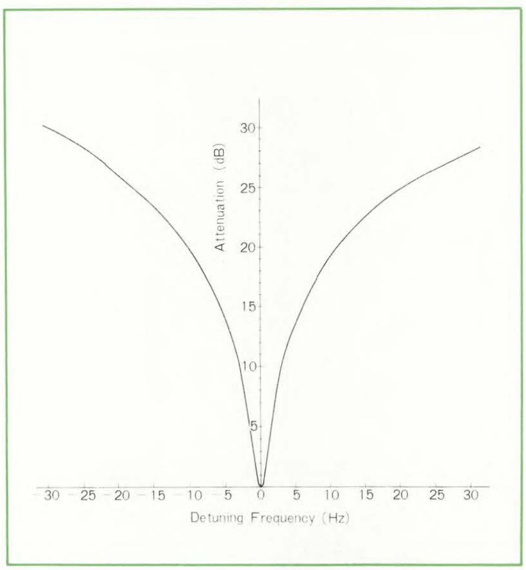
Specifications (EFM-R1D)

1. Allowable Input Voltage	5.0V rms
2. Center Frequency	502.5 ~1,597.5Hz (Refer to the standard frequency table A)
3. Center Freauency Tolerance	±0.5Hz
4. Voltage Attenuation at the Center of Bandwidth	18±1.5dB
5. Bandwidth at 3dB	1.7Hz min.
6. Selectivity (±15Hz)	20 dB min.
7. Temperature Characteristics	Voltage attenuation L shall be as follows between 5°C and 40°C (41 ~ 104°F): (a) at nominal frequency $15.5 \leq L \leq 23$dB (b) at nominal frequency ±15Hz $L \geq 35.5$ dB
8. Vibration	To meet the value of 7—(a) and (B)
9. Shock	Same as above
10. Humidity	Same as above

Measuring Circuit



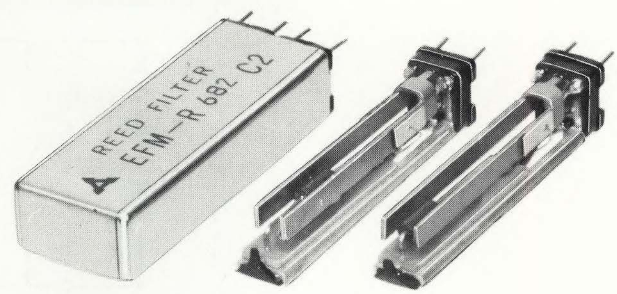
Frequency Characteristics



Type EFM-R2

Features

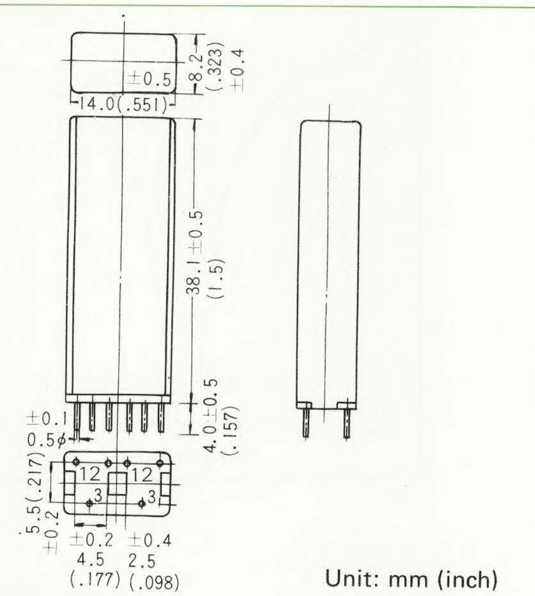
- Broad bandwidth and excellent selectivity due to parallel tuning forks
- Constant bandwidth and selectivity regardless of center frequency
- Because two tuning forks are combined electrically, characteristics are very stable.
- Because of temperature compensation by means of ferrite magnets, it gives excellent temperature characteristics.



Application

- Communication equipment such as telemeters and telecontrols
- Automatic control equipment

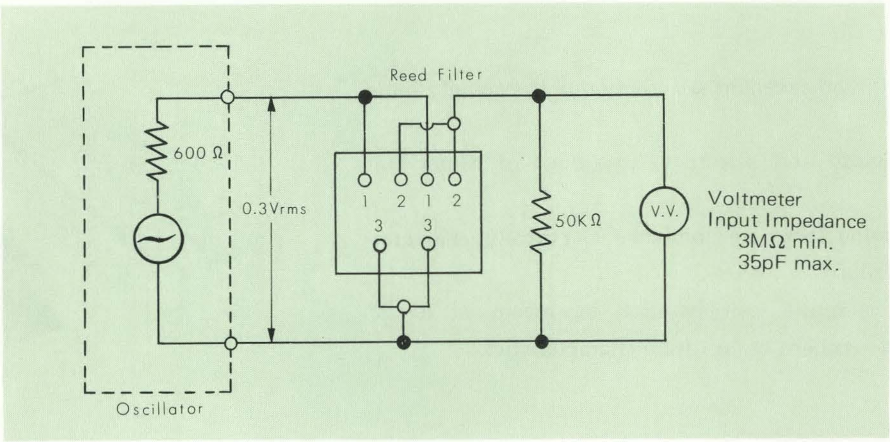
Dimensions



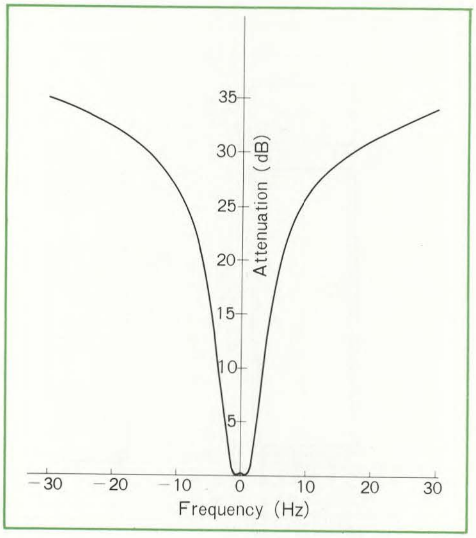
Specifications (EFM-R2)

1. Allowable Input Voltage	5.0 Vrms
2. Center Frequency	412.5 ~ 1.147.5Hz (Refer to the standard frequency table A)
3. Center Frequency Tolerance	±0.5Hz
4. Insertion Loss (Min. value in pass band)	18 ± 2 dB
5. Bandwidth at 6dB	4.0Hz min. (below 487.5Hz: 3.0Hz min.)
6. Ripple in Pass Band	3 dB max.
7. Selectivity (±15 Hz)	25dB min.
8. Temperature Characteristics	Between 0° and 40°C (32~104°F) (Std. temp.: 23°C) Change of center frequency within ±1 Hz Change of insertion loss ±1.5dB

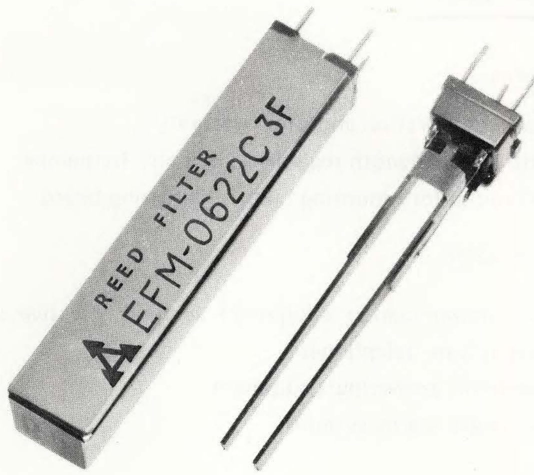
Measuring Circuit



Frequency Characteristics



Type EFM-03



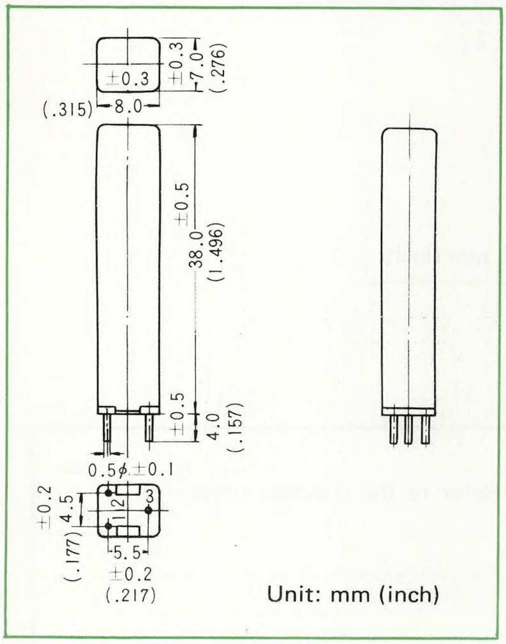
Features

- Superior temperature characteristics
- Stable oscillatory frequency and output voltage

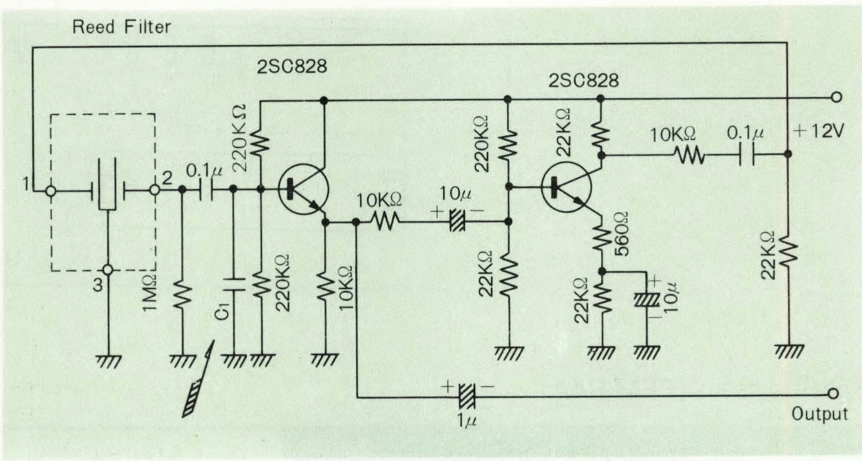
Application

- Oscillators of communication equipment such as telemeters, telecontrols and automatic control equipment by combining with other type of the reed filters

Dimensions



Measuring Circuit



Frequency (Hz)	C1 (PF)
500~820	1,100
820~920	700
920~	—

Specifications (EFM-03F)

1. Center Frequency	412.5~1,147.5Hz (Refer to the standard frequency table A)
2. Center Frequency Tolerance	±0.5Hz
3. Output Voltage	0.2V min.
4. Temperature Characteristics	Temperature coefficient of center frequency shall be as follows between -10° and +50°C(14°~122°F): $\pm 5\times10^{-5}/°C$

Special filters are available whose frequency is adjusted in accordance with the indicated circuit by customers.

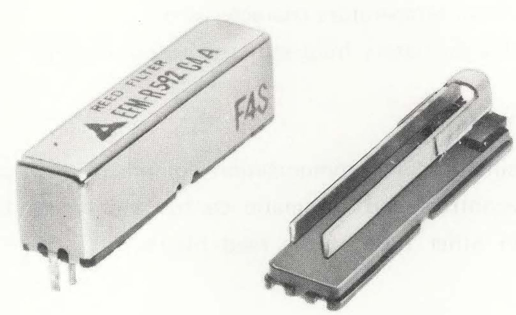
EFM-R4

Features

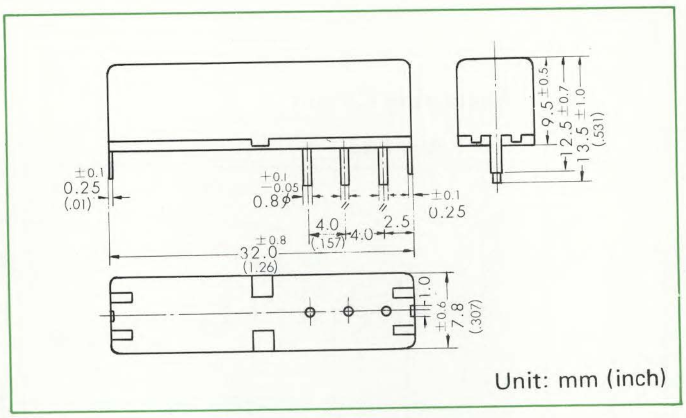
- Excellent vibration and shock stability
- Constant bandwidth regardless of center frequency
- Best suited for mounting on printed wiring board

Application

- For communication equipment such as selective call systems using private telephones
- Telephone answering equipment
- Automatic alarm systems



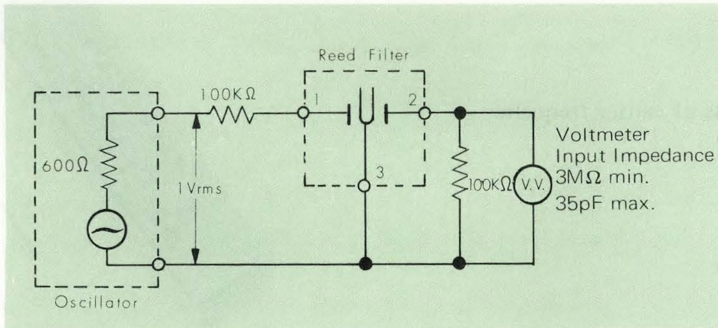
Dimensions



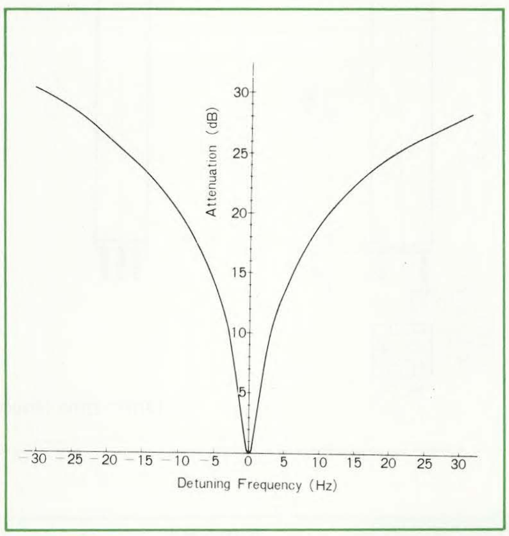
Specifications (EFM-R4A)

1.	Allowable Input Voltage	5.0Vrms
2.	Center Frequency	502.5~1,147.5Hz (Refer to the standard frequency table A)
3.	Center Frequency Tolerance	±0.5Hz
4.	Voltage Attenuation at the Center of Bandwidth	8.0 ~ 13.0dB
5.	Bandwidth at 3dB	1.6Hz min.
6.	Selectivity (±15Hz)	19dB min.
7.	Temperature Characteristics	Temperature coefficient of center frequency shall be as follows between −10° and +50°C(14°~122°F): $\pm 5\times10^{-5}/^{\circ}C$
8.	Vibration	Change of center frequency should be within 0.3Hz and above mentioned 4 through 6 should be satisfied.
9.	Shock	Same as above
10.	Humidity	Change of center frequency should be within 0.8 Hz.

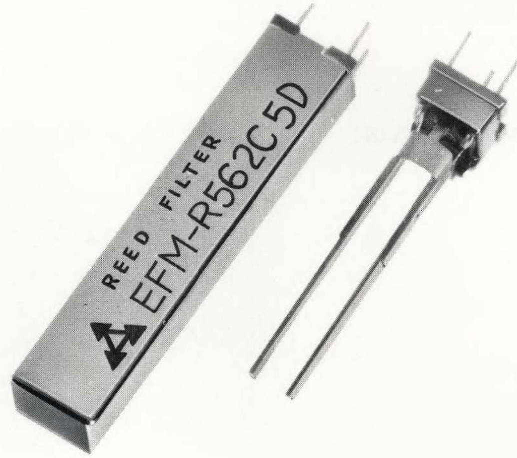
Measuring Circuit



Frequency Characteristics



Type EFM-R5



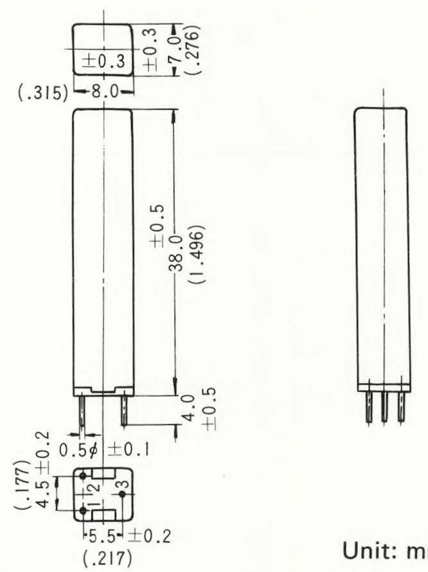
Features

- Constant bandwidth regardless of center frequency

Application

- Paging systems
- Automatic control equipment

Dimensions



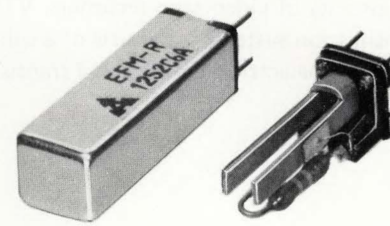
Unit: mm (inch)

Specifications (EFM-R5D)

1.	Allowable Input Voltage	5.0Vrms
2.	Center Frequency	502.5~1,147.5Hz (Refer to the standard frequency table A)
3.	Center Frequency Tolerance	±0.7Hz
4.	Voltage Attenuation at Center of Bandwidth	8.0~13.0dB
5.	Bandwidth at 3dB	1.6Hz min.
6.	Selectivity (±15Hz)	19.0dB min.
7.	Spurious Resonance	Attenuation shall be more than 19dB from the center of pass band between center frequency and 1,500Hz.
8.	Temperature Characteristics	Temperature coefficient of center frequency shall be as follows between 0° and 40°C(32°~104°F): $\pm 5 \times 10^{-5}/^{\circ}C$
9.	Vibration	Change of center frequency shall be within 0.3Hz and above mentioned 4 through 6 should be satisfied.
10.	Shock	Same as above
11.	Humidity	Change of center frequency shall be within 0.8Hz, selectivity more than 17.0dB and above-mentioned 4 and 5 should be satisfied.

Measuring Circuit: See Page VIII-17
Frequency Characteristic: See Page VIII-17

Type EFM-R6



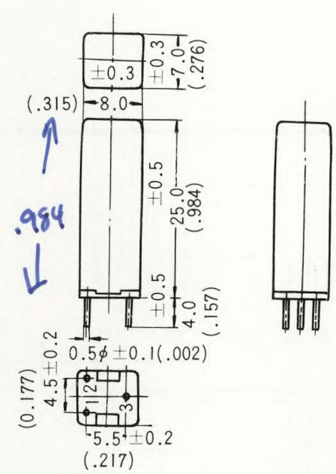
Features

- Constant bandwidth and selectivity regardless of center frequency
- Constant insertion loss is realized by employing a resistor having the best resistance value individually.

Application

- Communication equipment such as transceivers and private call equipment

Dimensions



Unit: mm (inch)

Specifications (EFM-R6A)

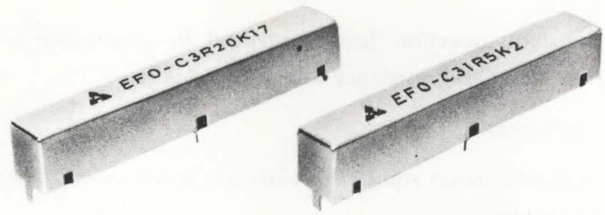
1. Allowable Input Voltage	5.0Vrms
2. Center Frequency	997.5~1,912.5Hz (Refer to the standard frequency table A)
3. Center Frequency Tolerance	±0.7Hz
4. Voltage Attenuation at the Center of Bandwidth	17.5±1.5dB
5. Bandwidth at 3dB	1.7Hz min.
6. Selectivity (±15Hz)	20.0dB min.
7. Temperature Characteristics	Voltage attenuation L shall be as follows between -10° and 50°C(14°~122°F): (a) at nominal frequency $14.5 \leq L \leq 25.0$ dB (b) at nominal frequency ±15Hz $L \geq 35.5$ dB
8. Vibration	To meet the value of 7 – (A) and (B)
9. Shock	Same as above
10. Humidity	Same as above

Measuring Circuit; See Page VIII-12
Frequency Characteristic; See Page VIII-12

CERAMIC OSCILLATORS

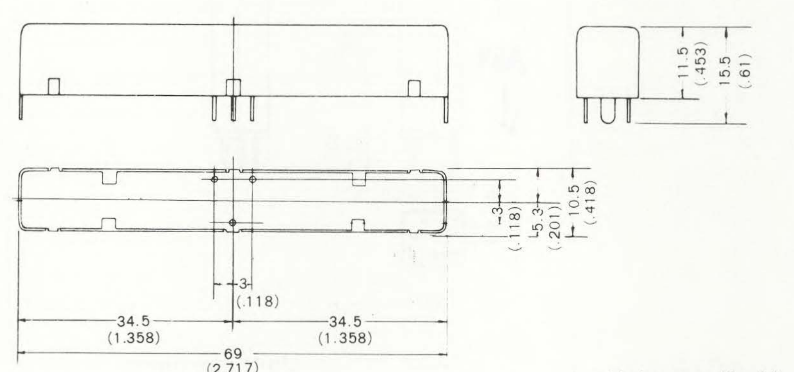
Type EFO

This ceramic oscillator — which was developed for horizontal scanning circuits of video tape recorders, VTR cameras and data transmission systems — consists of a split electrode low frequency piezoelectric element and a transistor circuit.



Features

- High frequency accuracy (±0.1 to 0.2%) in the range from 3.0 to 80kHz
- Little power consumption (20mW, 80mW)



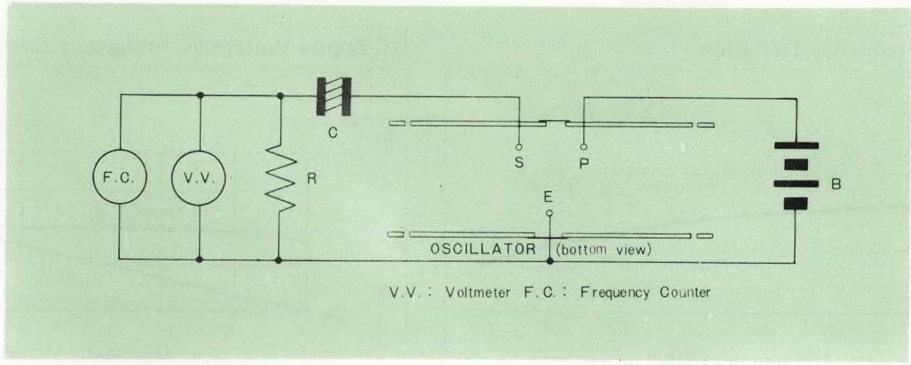
Unit: mm (inch)

Specifications

Part No.	Frequency (kHz)	Accuracy (%)	Power Supply (VDC)	Output Voltage (V.rms) min.	Application
EFO-C3R20K17	3.20	±0.15	6 ~ 8	0.4	Data Transmission
EFO-C4R80K17	4.80	±0.15	6 ~ 8	0.4	"
EFO-C6R40K17	6.40	±0.1	6 ~ 8	0.4	"
EFO-C31R50K2	31.50	±0.2	6 ~ 12	0.4	VTR
EFO-C31R50K3	31.50	±0.1	5.4 ~ 6.6	0.4	"
EFO-C31R50K4	31.50	±0.1	11 ~ 12	0.6	"
EFO-C31R47K4	31.47	±0.1	11 ~ 12	0.6	Color VTR
EFO-C38R40K2	38.40	±0.2	6 ~ 12	0.4	Data Transmission
EFO-C38R40K3	38.40	±0.1	5.4 ~ 6.6	0.4	"
EFO-C38R40K4	38.40	±0.1	11 ~ 12	0.6	"
EFO-C51R20K2	51.20	±0.2	6 ~ 12	0.4	"
EFO-C51R20K3	51.20	±0.1	5.4 ~ 6.6	0.4	"
EFO-C51R20K4	51.20	±0.1	11 ~ 12	0.6	"

Note: Any frequency available besides above listed standard products in the range from 3.0kHz to 80kHz.

Measuring Circuit

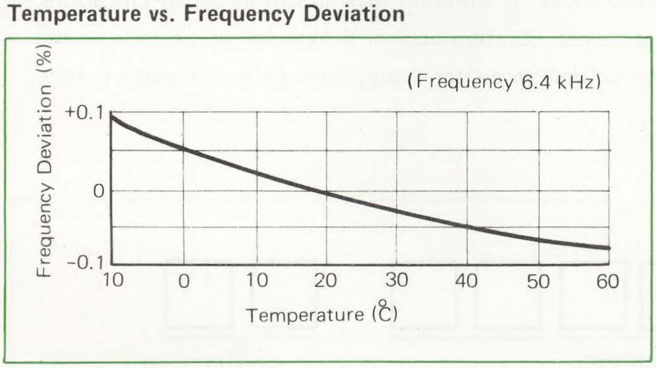


Item	Test Method	Requirement
Temperature Characteristics	The frequency shall be measured after being kept at -5~50°C for 1 hour. The specified voltage should be applied during the test.	To meet the specified value
Humidity	The frequency shall be measured after being subjected to 40°C, 90–95%RH for 48 hours and then stored at the initial temperature for 4 hours.	To meet the specified value
Shock	The frequency shall be measured after specimens are dropped onto the wooden plate of 3cm thickness from the height of 10cm (3.94") for three times.	To meet the specified value

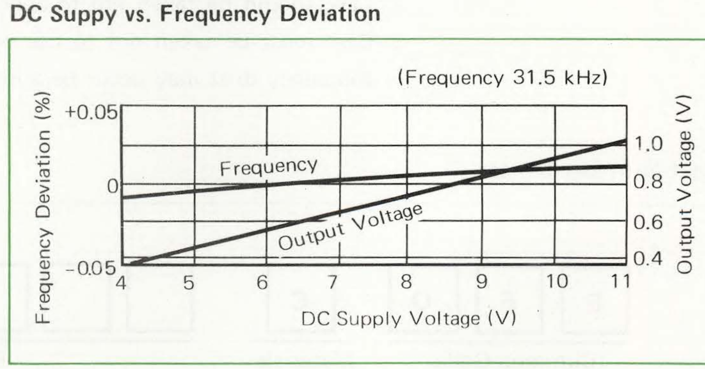
Characteristics

Type 17

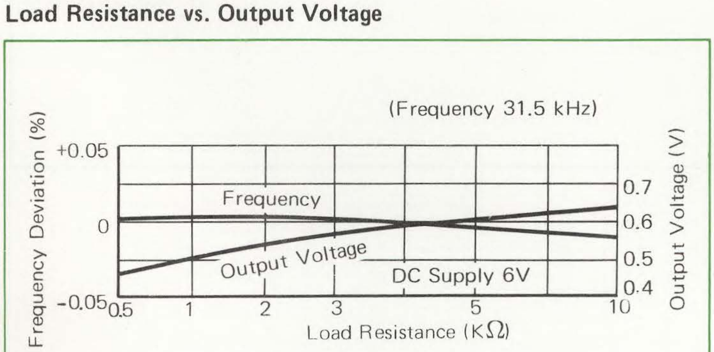
Temperature vs. Frequency Deviation



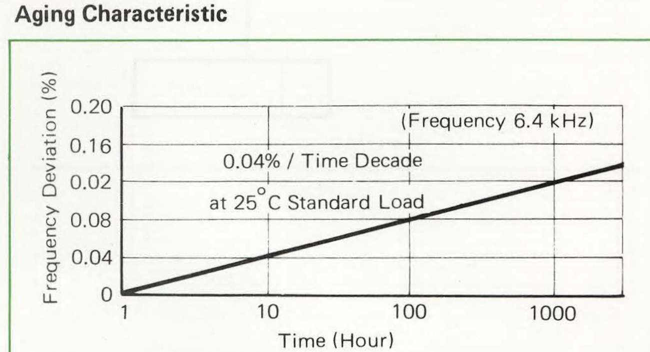
DC Suppy vs. Frequency Deviation



Load Resistance vs. Output Voltage

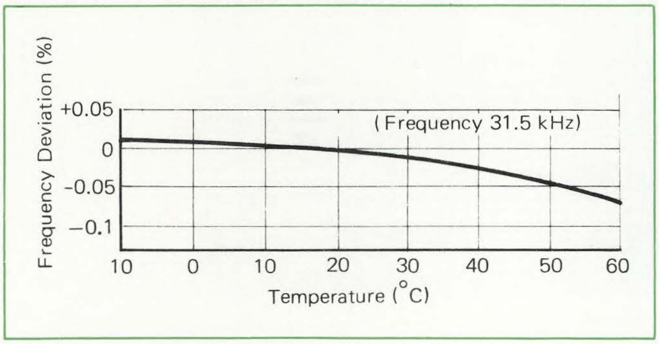


Aging Characteristic

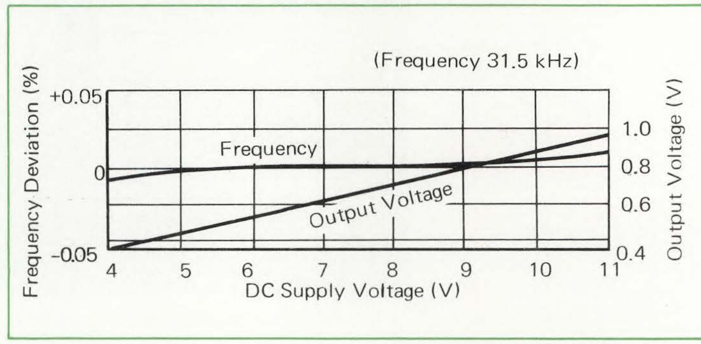


Type 2, 3, 4

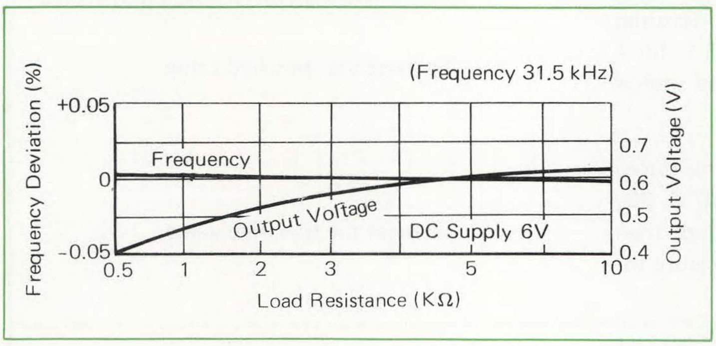
Temperature vs. Frequency Deviation



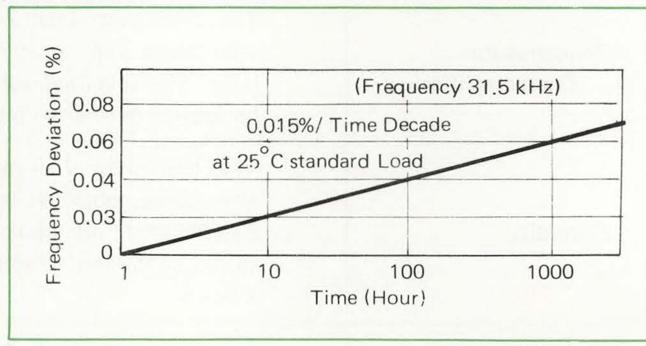
DC Suppy Voltage vs. Frequency Deviation



Load Resistance vs. Output Voltage



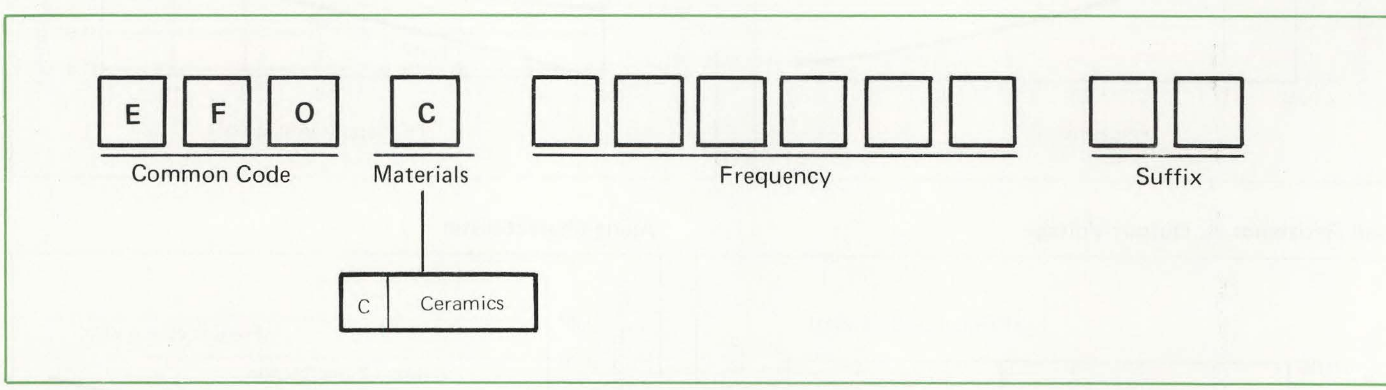
Aging Characteristic



Operation Cautions

1. Care should be taken as to the polarity of the connected capacitance.
   Direction of the polarity of capacitor changes depending upon the potential difference between the electric potential of output side of the oscillators and that of the load side.
2. Care should be taken not to apply more shock or vibration than shown in the specifications.
3. Care must be taken not to use where severe vibration occurs. If external vibration is severe, frequency drift may occur because the ceramic resonator is supported by special construction.

Part Number Code

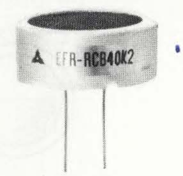


ULTRASONIC CERAMIC MICROPHONES

Type EFR

del 91days

This is a high performance ultrasonic ceramic microphone having, in a sensitive element, quite an unprecedented construction which consists of two PCM piezoelectric ceramic discs and a conical aluminum resonator. An electrical signal is generated when an ultrasonic wave equivalent to the resonance frequency of the element causes a mechanical vibration on it. Recently a new type "T" has made its debut featuring wider band-width besides small size and easy installation.



Patents registered

U.S.A.	3,268,453	France	1,444,001
	3,675,053	England	1,066,752
Canada	896,754	Belgium	71,195
F.R. Germany	1,646,675	Columbia	18,405
	2,025,084	Argentina	173,870
Holland	6,505,389	Chile	24,140
		Hongkong	157

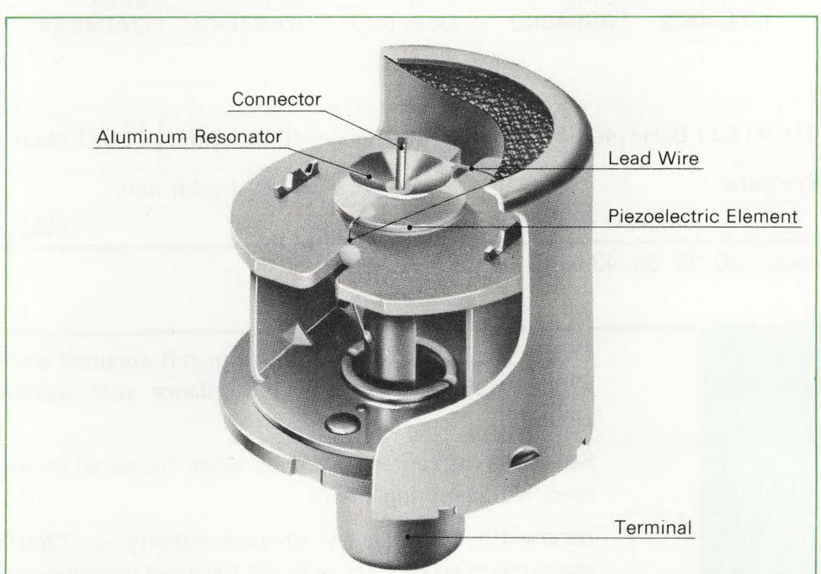
Features

- High sensitivity over – 67 db/V/μBar
- Superb temperature and humidity durability
- Stable electrical and mechnical characteristics
- Small in size especially in type S and T
- Unparalledly broad variety in shape

Application

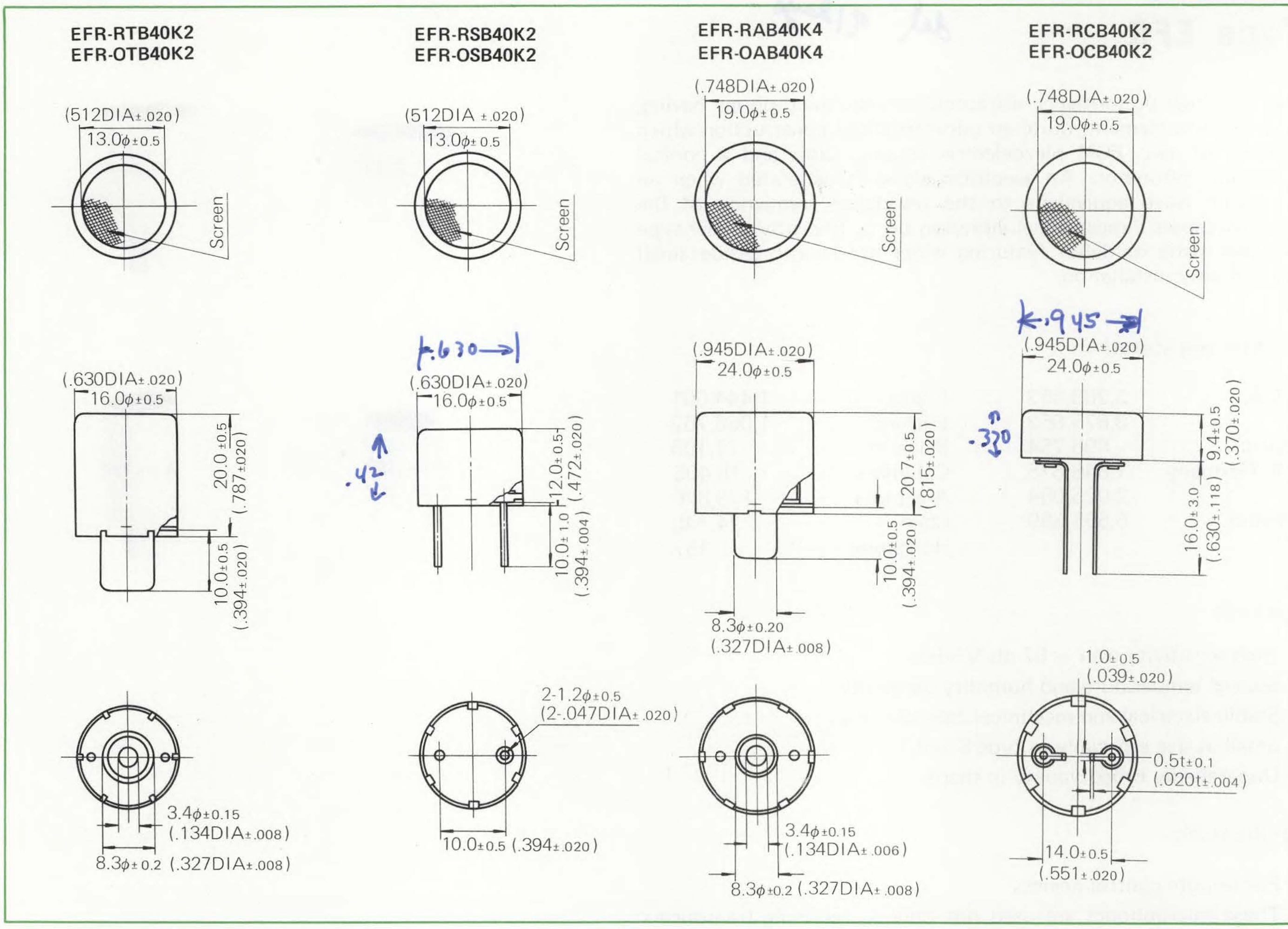
- For remote control devices
  These microphones are used not only as receiving transducers but also as transmitting ones in remote control devices of television sets, stereo sets, tape recorders and other electronic appliances.
- Other interesting examples of application include use in ultrasonic burglar alarm systems and in air tightness checkers.

Construction



Dimensions

Unit: mm(inch)



Specifications

Type	Type T		Type S		Type A		Type C	
Application	Receiver	Transmitter	Receiver	Transmitter	Receiver	Transmitter	Receiver	Transmitter
Part No.	EFR-RTB40K2	EFR-OTB40K2	EFR-RSB40K2	EFR-OSB40K2	EFR-RAB40K4	EFR-OAB40K4	EFR-RCB40K2	EFR-OCB40K2
Max. Input Voltage	20Vrms							
Center Frequency	40.0±1.0kHz	41.0±1.0kHz	40.0±1.0kHz	41.0±1.0kHz	40.0±1.0kHz	41.0±1.0kHz	40.0±1.0kHz	41.0±1.0kHz
Sensitivity	-70dB/V/μBar		-67 dB/V/μBar min.					
Bandwidth	4.0kHz min.				3.5kHz min.			

Note: Other center frequencies; 20, 25, 35, 43.5, 49 kHz are available.

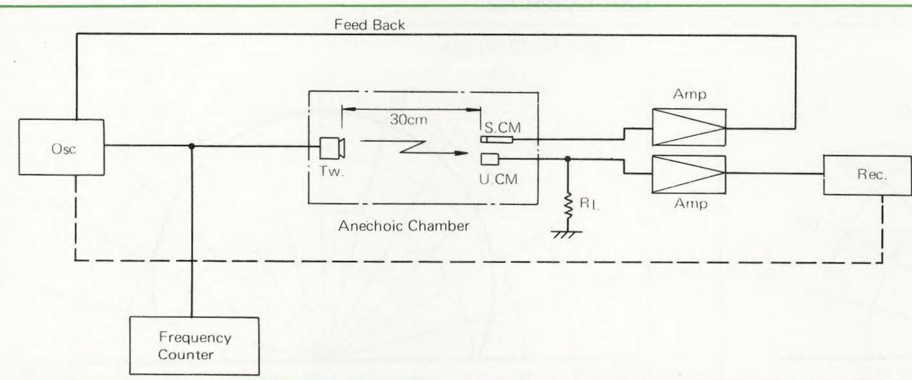
Definition of Terms

Center Frequency	Center frequency of bandwidth which is obtained when sensitivity is -70dB/V/μBar measured in accordance with specified measuring circuit
Sensitivity	Sensitivity at center frequency when measured in accordance with specified measuring circuit
Bandwidth	Bandwidth at frequency where sensitivity is -73dB/V/μBar when measured in accordance with the specified measuring circuit

Ratings

Item	Test Method	Requirement
Temperature Characteristics	Specimen shall be stored at -20°C (-4°F) and +60°C (140°F) respectively for 30 minutes and measured right after it is taken from the constant temperature chamber. The readings shall then be compared with that at +23°C (73.4°F).	Change of center frequency: 3.0KHz max. Sensitivity drop: 10.0dB max.
Humidity	Specimen shall be stored at 40±2°C (104±3.6°F), 90~95%RH for 100 hours and then kept at normal temperature and humidity for 24 hours before measurement.	Sensitivity Drop: 3.0 dB max.
Shock	Specimen shall be measured after impact of 50G is applied as follows: Direction 3 perpendicular directions Time 3 times per direction	Sensitivity drop: 3.0dB max. Bandwidth: To meet the specified value
Vibration	Measurement shall be conducted after following vibration is applied to specimen. Amplitude 1,5mm Number 600~3 300/minute Cycle 1 minute Direction 3 pependicular directions Time 1 hour per direction	Sensitivity drop: 3.0dB max. Bandwidth: To meet the specified value

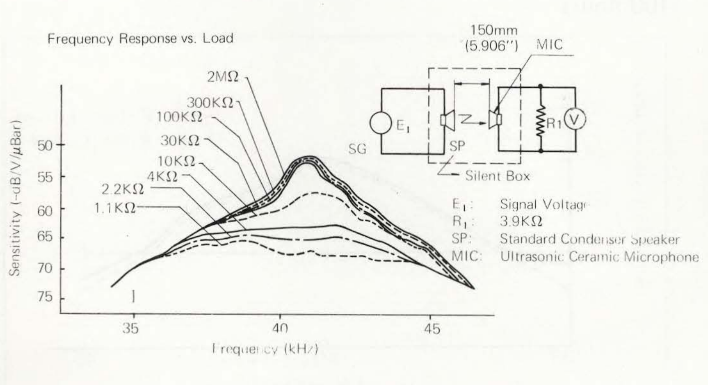
Measuring Circuit



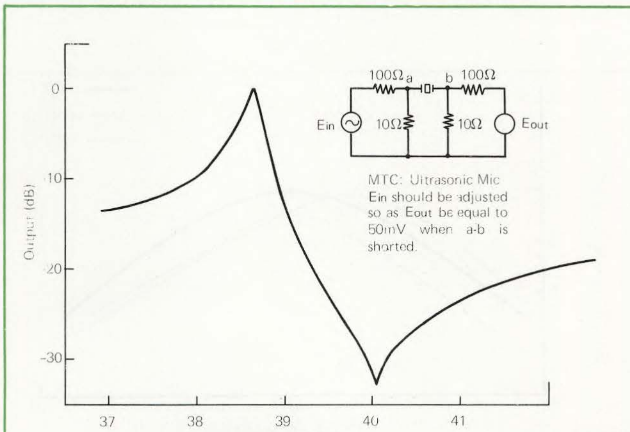
RL: 3.9KΩ
U.C.M.: Ultrasonic Ceramic Microphone
S.C.M.: Standard Condenser Microphone
Amp.: Amplifier
Osc.: Oscillator
Rec.: Recorder
Tw.: Tweeter

Characteristics

Frequency Response vs. Load

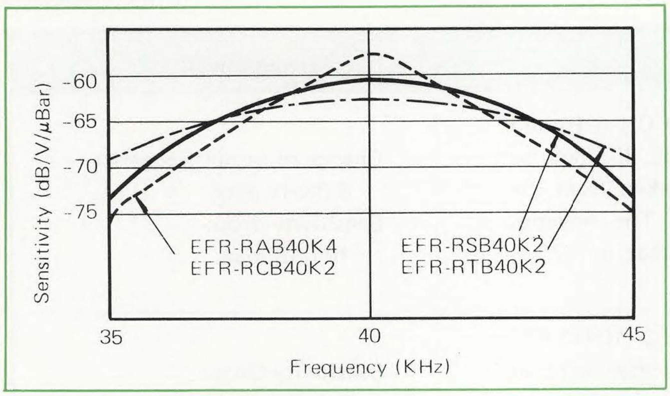


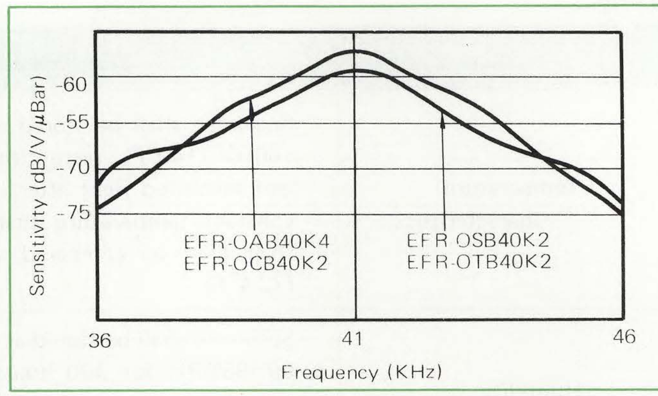
Electrical Frequency Characteristics of Resonator



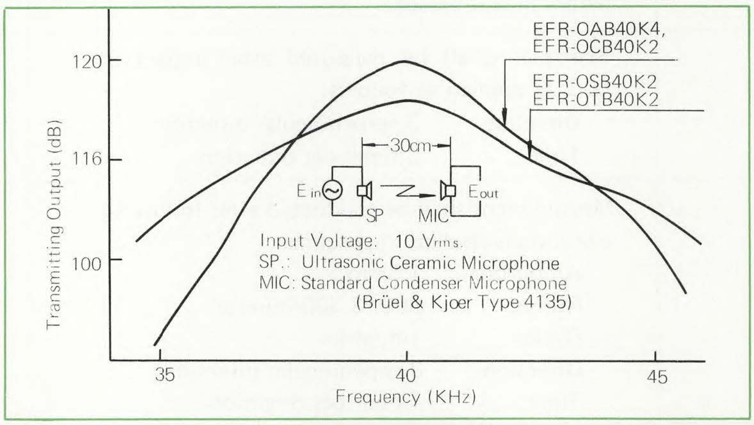
Frequency Characteristics

Receiver Sensitivity



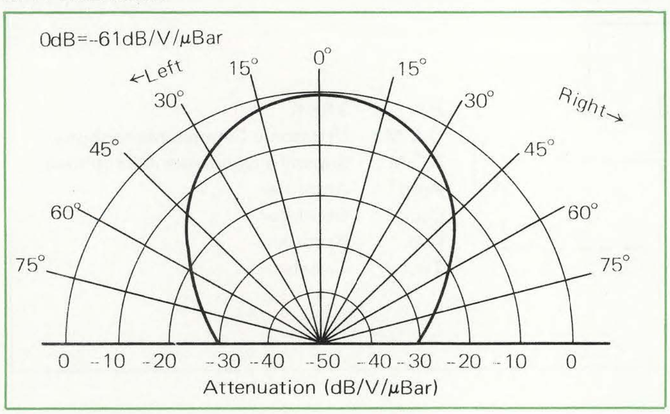


Transmitter Sensitivity

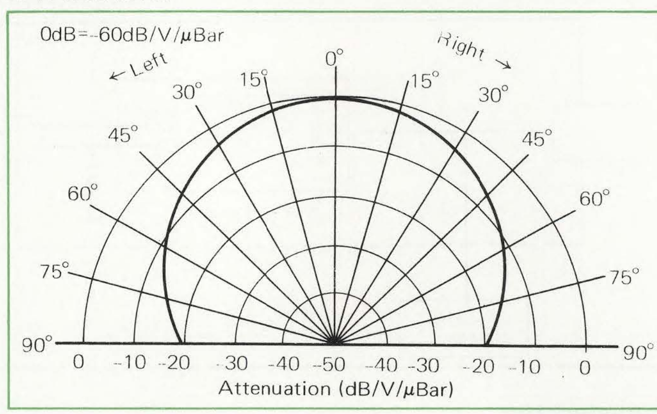


Directivity

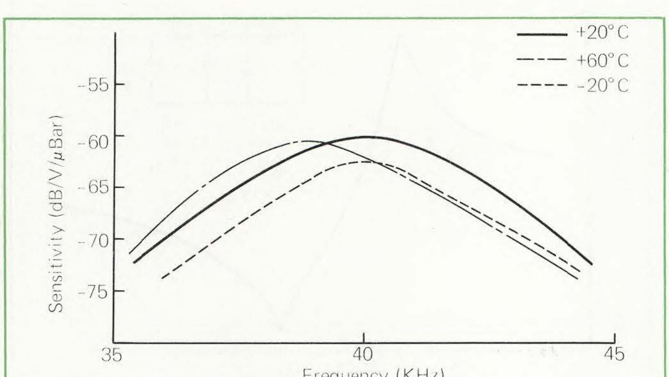
EFR-RTB40K2
EFR-RSB40K2



EFR-RAB40K4
EFR-RCB40K2

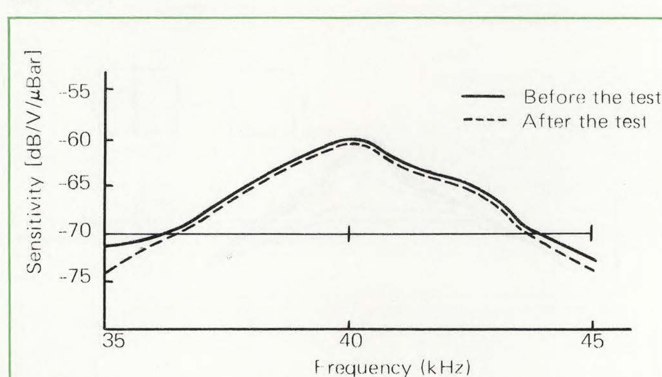


Temperature Characteristics



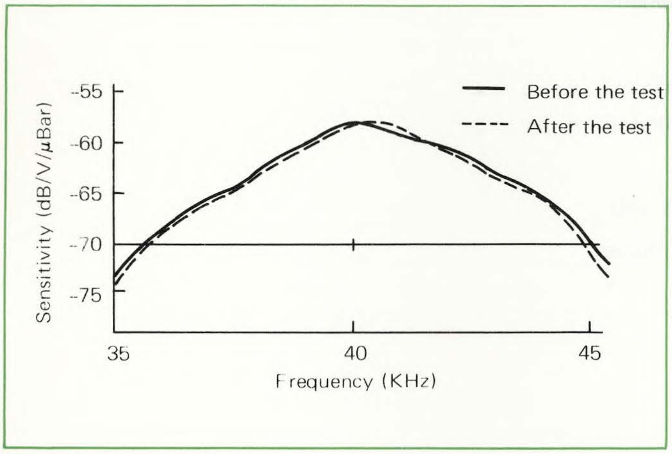
Humidity Characteristics

The test is to be conducted at 40°±2°C, 90~98%RH for 100 hours.



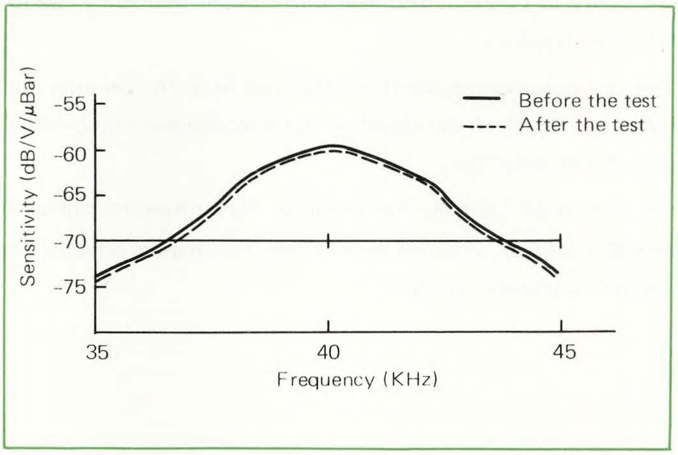
Vibration

Vibration (Amplitude: 1.5mm, period: 1min.) of 600~3300 rpm for 1 hour in each of 3 directions



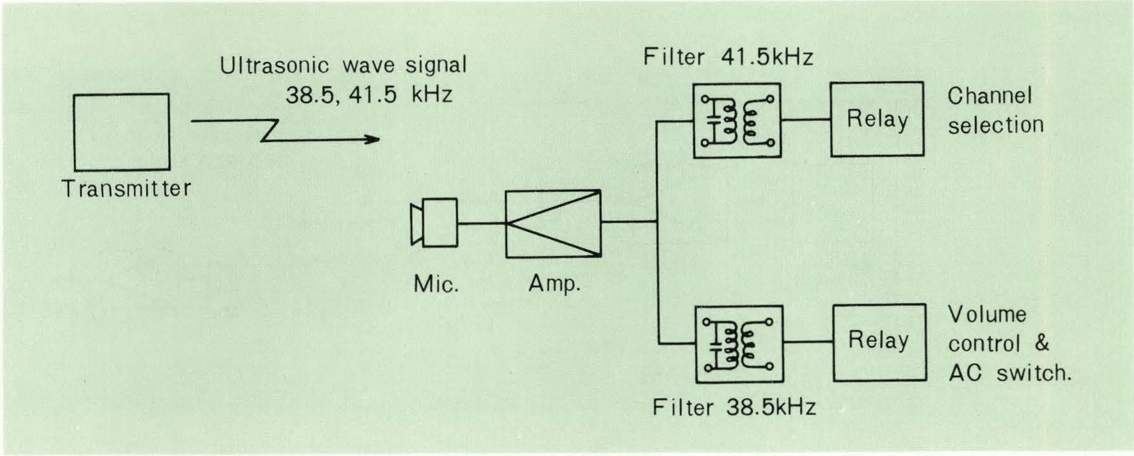
Impact Characteristics

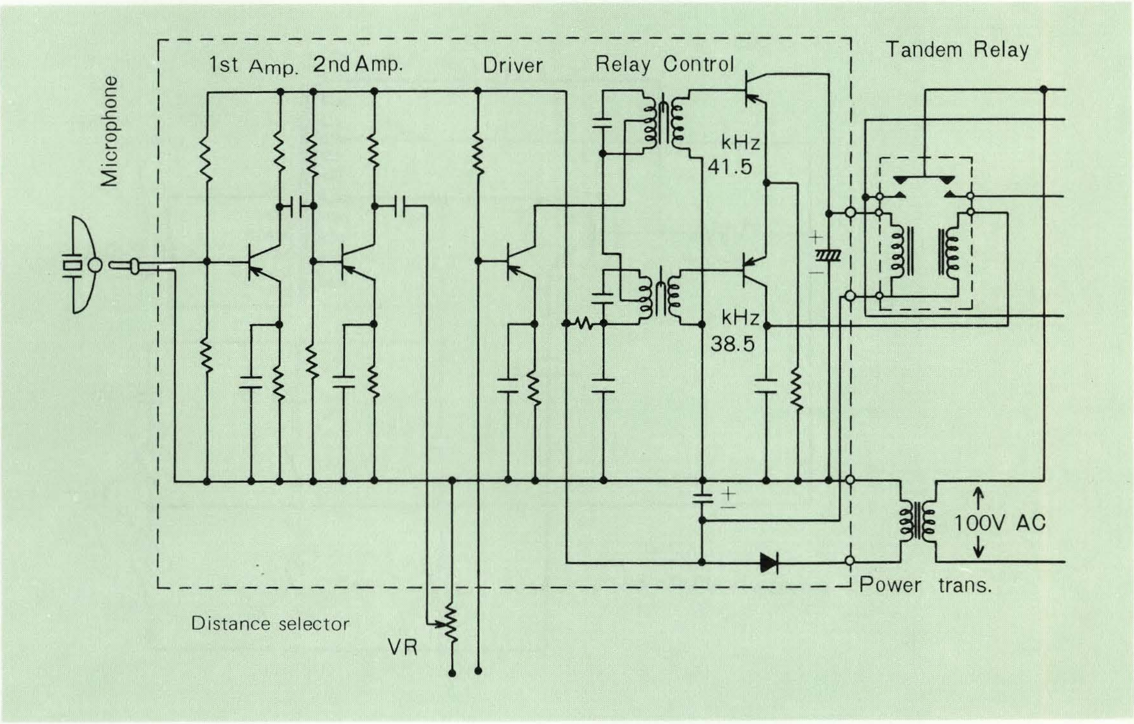
The acceleration of 100G is applied to a sample in 3 directions (3 times per direction)



Application Examples

For receivers



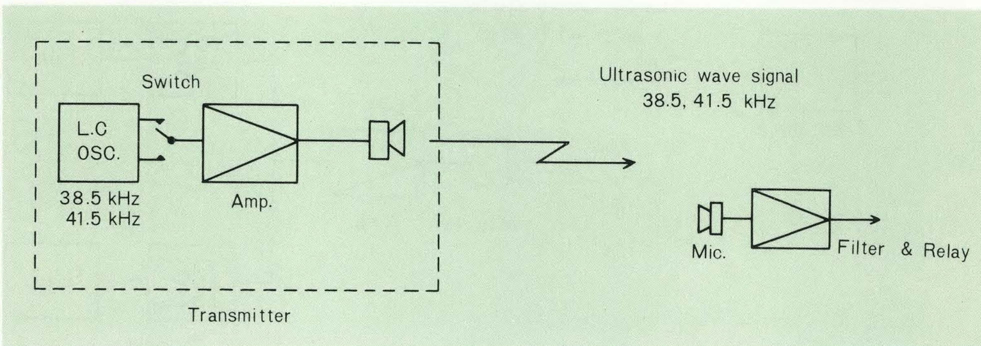


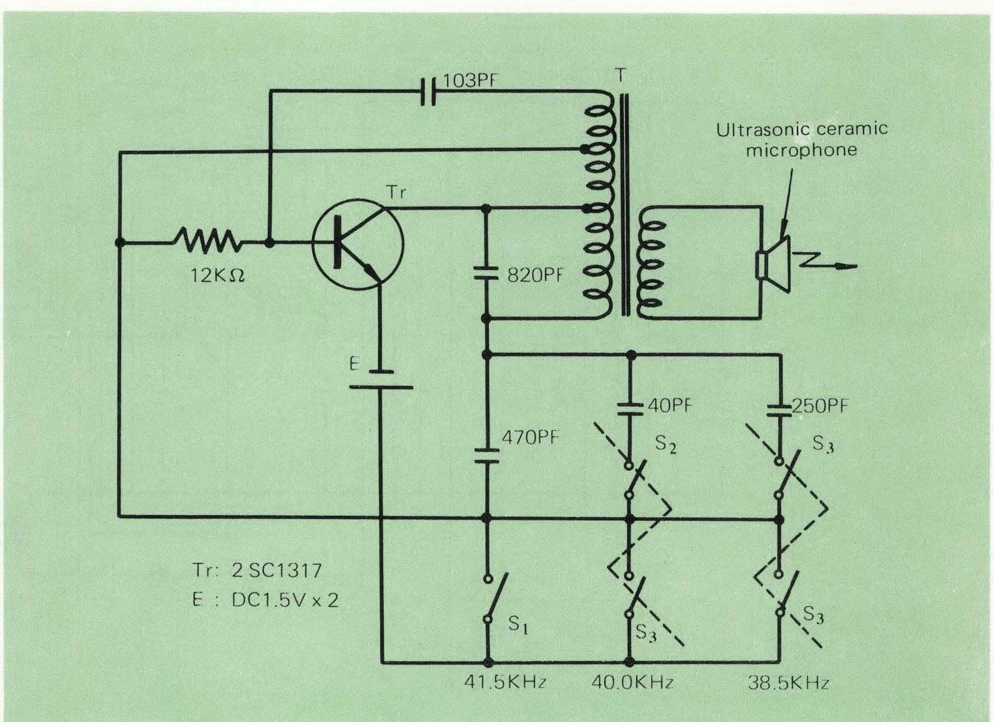
For Transmitters

By employing a ceramic microphone as a transmitter of an ultrasonic remote control instead of a conventional condensor microphone, higher sensitivity can be obtained near the resonant frequency due to its resonant type construction.

The ultrasonic wave signal is generated from the ceramic microphone by inputting the electrical signal to the microphone, combining LC oscillator circuit with amplifier.

For a remote control, for instance, the ultrasonic signals of 41.5 kHz and 38.5 kHz are obtained respectively, for channel selector and for volume and AC line switch control.





1. **Characteristics change owing to load impedance**
   Center frequency and sensitivity change in accordance with load impedance. Therefore, the load characteristics chart should be taken into consideration in designing circuit.

2. **Microphones for transmitting use**
   Specifications of microphones for transmitting use are prescribed in convenience on the assumption that they are used as receivers, but their constructions are different from those for receivers. Thereby they should be used as transmitters only.

3. **Directivity**
   Please be careful enough in deciding the facing position of microphones because of directivity.

4. **Terminal connection**
   The microphone is sealed after connecting a metal case and a ground terminal. Full attention should be paid to the terminal, polarity and connecting method.

5. **Usage Range**
   Because the microphone is designed for use in the air, it can not be used under the water or others.

6. **DC voltage**
   DC voltage must not be applied for long years because insulation resistance may deteriorate.

7. It is advisable to cover a case by means of rubber sheet or other cushions.

8. When used as a transmitter, oscillation may not be taken near the resonant frequency. Please note that the resonant resistance of the microphone is very low as 500Ω.

Part Number Code

E F R – □ □ □ □ □ □ □

Common Code (E F R) — Applications (□) — Type (□) — Construction of Element (□) — Center Frequency (□ □ □) — Suffix (□)

Applications

R	For reception use
O	For transmission use

Type

A	w/sealed terminal
C	Thin type
S	Compact type
T	Compact type w/sealed terminal

Construction of Element

B	Composite type

Center Frequency

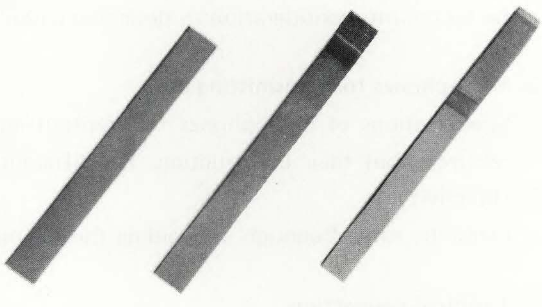
40K	40kHz

CERAMIC PICKUP ELEMENTS

Type EPB

This ceramic pickup element comprises 2 long thin plates utilizing PCM ceramics. Its dimensions are about 0.6mm(.024in.) thick, 1.5mm(.0591in.) wide and 15mm (.591in.) long. This element is a transducer for energy conversion from bending stress to electric signals.

Parallel and series types are classified according to the direction of polarization of the PCM elements, and parallel type is featured by its large electrostatic capacitance and series type by its high sensitivity.



Series Parallel A Parallel B

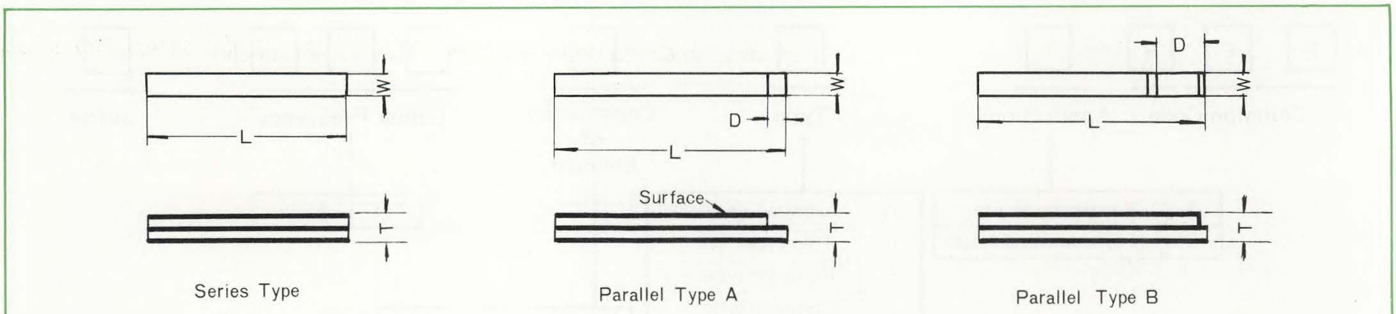
Features

- High sensitivity and high output voltage
- Wide electrostatic capacitance range
- Various electrostatic capacitances are obtainable by properly selecting the best suited kind of PCM ceramics.
- Superb temperature and humidity characteristics

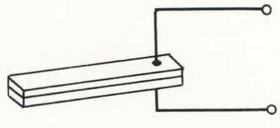
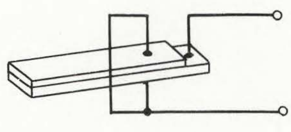
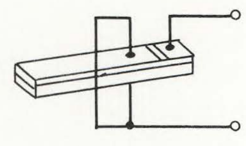
Standard Size Chart

Unit: mm (inch)

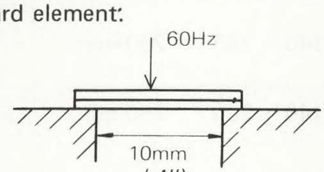
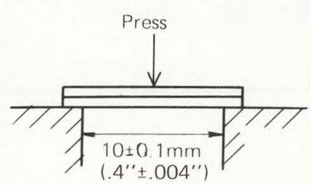
Type	L	W	T	D
Series	10~17 (.394~.669)	1.40~1.80 (.055~.071)	0.55~0.76 (.022~.030)	—
Parallel A	10~17.5 (.394~.689)	1.40~1.80 (.055~.071)	0.55~0.76 (.022~.030)	1.3 (.051)
Parallel B	10~17 (.394~.669)	1.40~1.80 (.055~.071)	0.55~0.76 (.022~.030)	3.0~4.0 (.118~.157)



Test Circuit

Series Type	Parallel Type A	Parallel Type B
		

Specifications

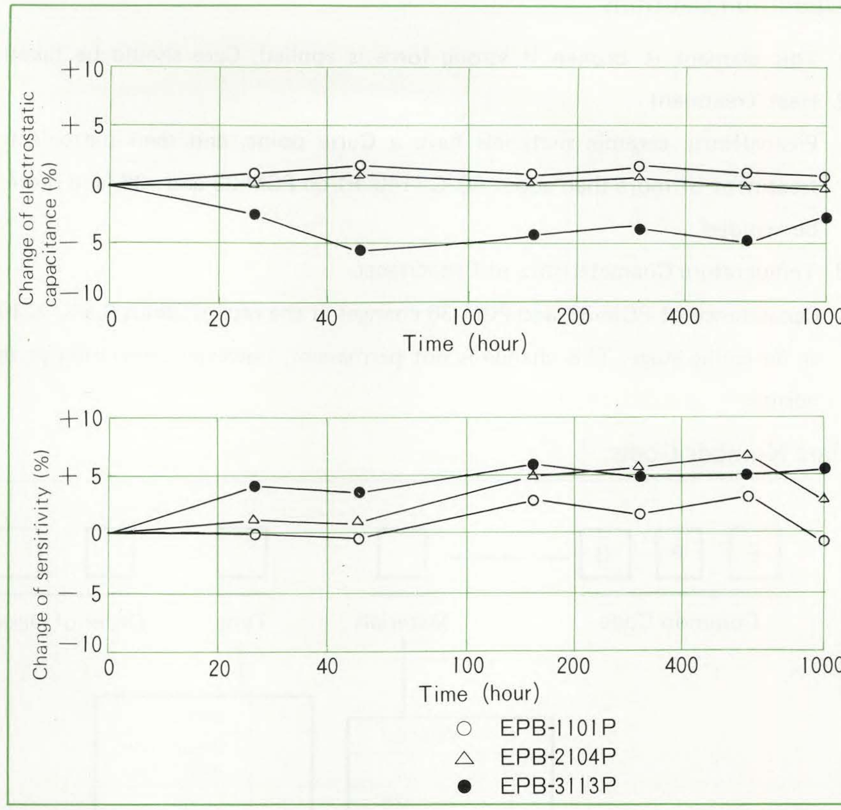
Item	Test Method	Requirement
Electrostatic Capacitance	The electrostatic capacitance shall be measured 20±2°C, 1kHz±10% with the measuring voltage of 1~2 Vrms applied.	To meet the specified value
Sensitivity	The sensitivity obtained under the test conditions illustrated below shall be compared with that of the standard element:  $\frac{\text{Output voltage of specimen}}{\text{Output voltage of standard element}} \times 100(\%)$	To meet the specified value
Insulation Resistance	Measuring voltage 25±2VDC Charge time 0.1~0.2minutes	The value should be more than 30MΩ.
Mechanical Strength	The strength is obtained as the power which destroys the specimen being supported as shown below.  	To meet the specified value

Specifications

Part No.	Type	Electrostatic Capacitance (pF)	Sensitivity (%)	Mechanical Strength(g)	Dimensions mm(inch)		
					Length(L)	Width (W)	Thickness(T)
EPB-1101	Series	600	90 ~ 125	410 min.	15.0(.591)	1.70(.067)	0.76(.030)
EPB-1102	Series	700	120 ~ 160	220 min.	15.[illegible].591)	1.50(.059)	0.60(.024)
EPB-1120	Series	750	140 ~ 190	150 min.	16.0(.630)	1.40(.055)	0.55(.022)
EPB-1108	Series	800	115 ~ 155	230 min.	15.0(.591)	1.70(.067)	0.60(.024)
FPB-3113	Series	$900^{+40\%}_{-10\%}$	140 ~ 198	250 min.	15.0(.591)	1.60(.063)	0.60(.024)
FPB-3120	Series	1000	140 ~ 200	150 min.	16.0(.630)	1.40(.055)	0.55(.022)
EPB-3112	Series	$1050^{+25\%}_{-20\%}$	100 ~ 133	300 min.	16.0(.630)	1.70(.067)	0.66(.026)
EPB-6120	Series	2000	100 ~ 140	150 min.	16.0(.630)	1.40(.055)	0.55(.022)
EPB-1228	Series with brass layer)	1000	107~170	250 min.	15.9(.626)	1.57(.062)	0.53(.021)
EPB-2504	Parallel A	2400	80 ~ 110	300 min.	16.3(.642)	1.70(.067)	0.66(.026)
EPB-1502	Parallel A	2700	49 ~ 72	410 min.	17.5(.689)	1.70(.067)	0.76(.030)
EPB-1701	Parallel B	2400	87 ~ 120	200 min.	16.0(.630)	1.50(.059)	0.60(.024)
EPB-3720	Parallel B	3500	90 ~ 135	150 min.	16.0(.630)	1.40(.055)	0.55(.022)
EPB-6720	Parallel B	6500	55 ~ 95	150 min.	16.0(.630)	1.40(.055)	0.55(.022)
Tolerance	—	±20%	—	—	±0.2(.008)	±0.05(.002)	±0.05(.002)

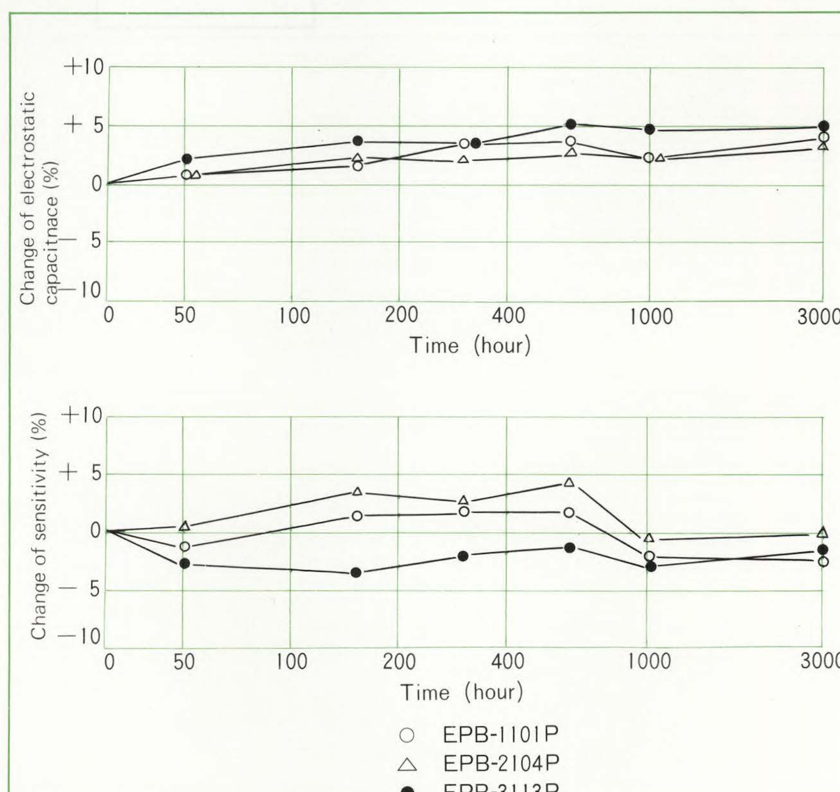
Life Test Without Load

Sample element shall be left at a room temperature for 1,000 hours with no voltage applied. The change of electrostatic capacitance and sensitivity are shown in the right figures. The plots are normalized by initial values respectively.



Humidity Test

Sample elements shall be subjected to 40°C (104°F), 90%RH for 3000 hours. The change of electrostatic capacitance and sensitivity are shown in the right figure. The plots are normalized by their initial value respectively.



Operation Cautions

1. This element is broken if strong force is applied. Care should be taken not to apply strong stress to the element.
2. Heat Treatment

   Piezoelectric ceramic materials have a Curie point, and their piezoelectricity lowers when nearing the Curie point. Heat treatment of more than about 60°C (140°F) on PCM-33 and -36, and more than 150°C (302°F) on PCM-52 and PCM-5 should be avoided.
3. Temperature Characteristics of Capacitance

   Capacitance of PCM-33 and PCM-36 changes at the rate of about 0.4%/°C (0.2%/°F), which should be taken into consideration at designing stage. This change is not permanent, however, recovering to the specified values when the temperature becomes normal.

Part Number Code

E P B — □ □ □ □ □ □

Common Code	Materials	Type	Order of Design	Direction of Polarization	Suffix
E P B	□	□	□ □	□	□

Materials

1	PCM-52
2	5
3	33
6	36

Type

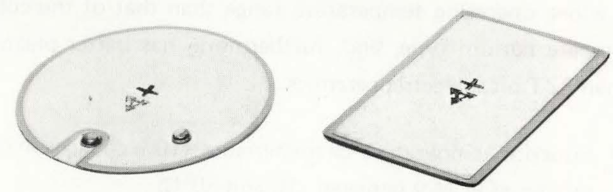
1	Series
2	Series with metal layer
4	Single
5	Parallel A
7	Parallel B

Direction of Polarization

P	Series. . . . . . Center – Parallel. . . . . Surface –
N	Series. . . . . . Center + Parallel. . . . . Surface +

Ceramic Pickup Elements for Special Use

Type EPB



Features

- Various shapes are available upon request.
- High sensitivity elements are available as sensors of acoustic, vibration, stress, etc.

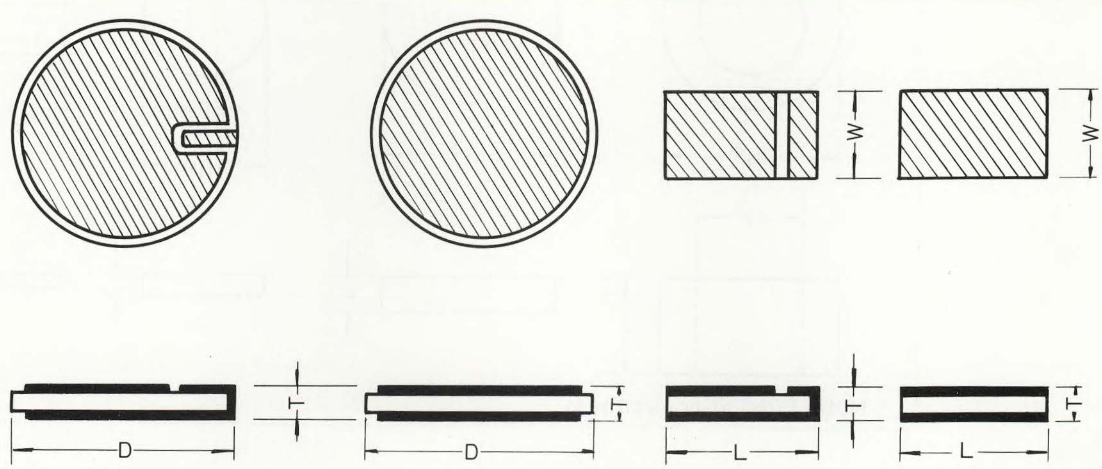
Application

- Measuring equipment, acoustic equipment and other energy conversion equipment as transducers between electric signals and mechanical motion

Standard Size Chart

Unit : mm (inch)

Type	D	L	W	T
Plate	—	10~100 (.394~3.937)	2.0~30 (.078~1.181)	0.20~50 (.008~1.969)
Disk	10~100 (.394~3.937)	—	—	0.20~50 (.008~1.969)



Disc Type

Plate Type

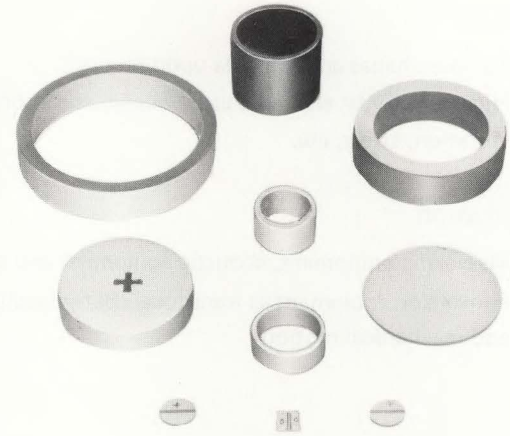
Specifications

Part No.	Type	Dimensions mm (inch)				Capacitance
		Diameter (D)	Length (L)	Width (W)	Thickness (T)	
EPB-2405	Plate	–	25.4 (1.0)	2.29 (.090)	0.24 (.009)	4,000 pF
EPB-2406	Plate	–	13.0 (.512)	7.0 (.276)	1.5 (.059)	850 pF
EPB-2408	Plate	–	30.0 (1.181)	20.0 (.787)	0.5 (.20)	20,000 pF
EPB-2409	Disc	42.0 (1.654)	–	–	0.7 (.028)	30,000 pF
Tolerance		±0.2 (.008)	±0.2 (.008)	±0.2 (.008)	±0.05 (.002)	±20%

ULTRASONIC TRANSDUCERS

Type EFE

This ultrasonic transducer, utilizing PCM piezoelectric ceramics, has a wider operating temperature range than that of the conventional titanate barium type, and, furthermore, has better piezoelectricity than PZT piezoelectric ceramics.

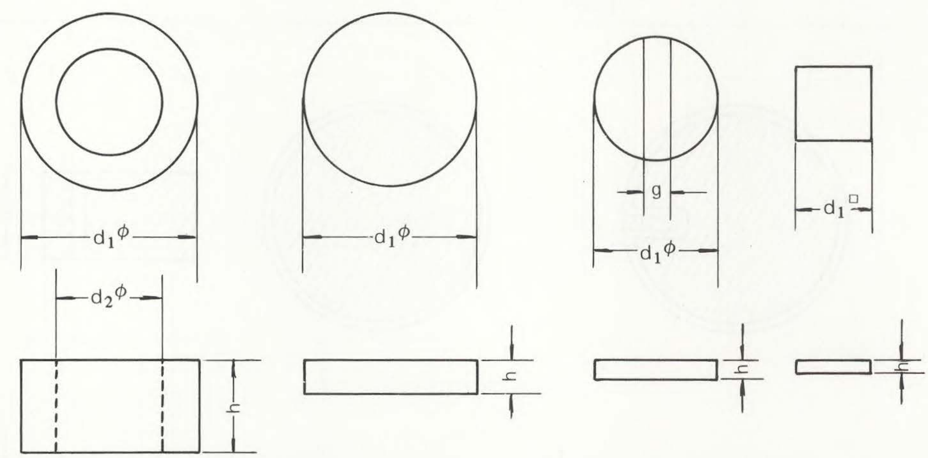


- Superior temperature characteristics (10% changes in capacitance in case of PCM-9 between -10 and 50°C)
- Little self-heating and stable ultrasonic output
- Extremely broad range of frequency from 19 to 500kHz

Application

- Ultrasonic flaw detectors
- Ultrasonic fish detectors
- Underwater ultrasonic microphones
- Ultrasonic washing machines

Dimensions



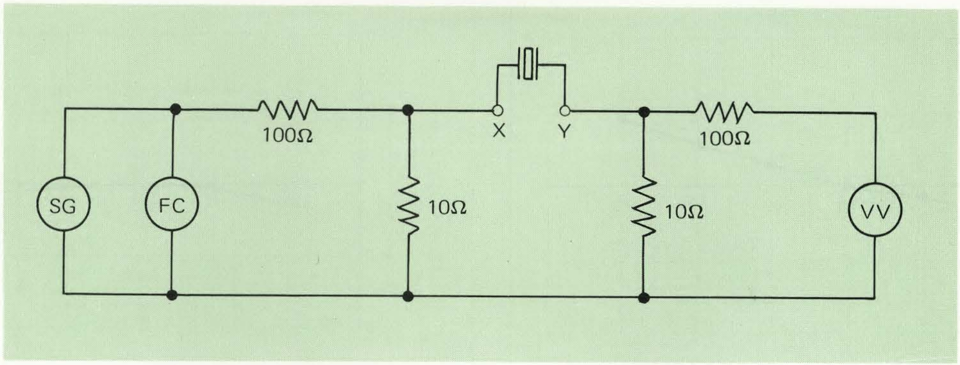
Note: Fired silver electrodes

Specifications

Examples of Ratings

Part No.	fr	K_{31}	Capacitance	Dimensions mm (inches)		
				d_1	d_2	h
EFE-T60T169L1	19 KHz	30% min.	1,040 PF	60.0(2.362)	45.0(1.772)	16.0(0.630)
EFE-T40T107R1	27 KHz	30% min.	6,300 PF	40.0(1.575)	35.0(1.378)	10.0(0.394)
EFE-T35T107R1	30 KHz	30% min.	7,400 PF	35.5(1.399)	31.5(1.241)	10.0(0.394)
EFE-T30T157R1	36 KHz	30% min.	8,600 PF	30.0(1.181)	26.0(1.023)	15.0(0.591)
EFE-T26T107R1	42 KHz	30% min.	5,000 PF	26.0(1.023)	22.0(0.867)	10.0(0.594)
EFE-L12T075S1	122 KHz	—	2,700 PF	12.7(0.500)	—	0.25(0.0100)
EFE-L08T027A2	270 KHz	—	2,300 PF	8.05(0.317)	—	0.27(0.0106)
EFE-R07T027A3	243 KHz	—	2,600 PF	7.62(0.300)	—	0.26(0.0102)

Measuring Circuit



S.G. : Frequency oscillator
F.C. : Frequency counter
V.V. : Vacume tube voltmeter

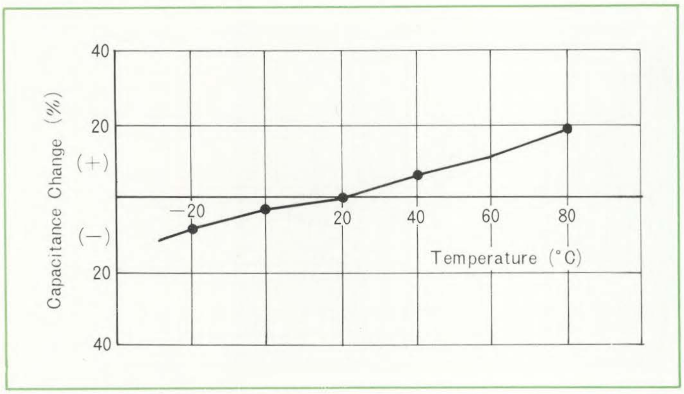
Note:
At first S.G. should be set so that V.V. will indicate 50mV when shorting two terminals X and Y.
fr : the frequency at the point of minimum impedance (maximum deflection point of V.V.)
far: the frequency at the point of maximum impedance (minimum deflection point of V.V.)

Specifications

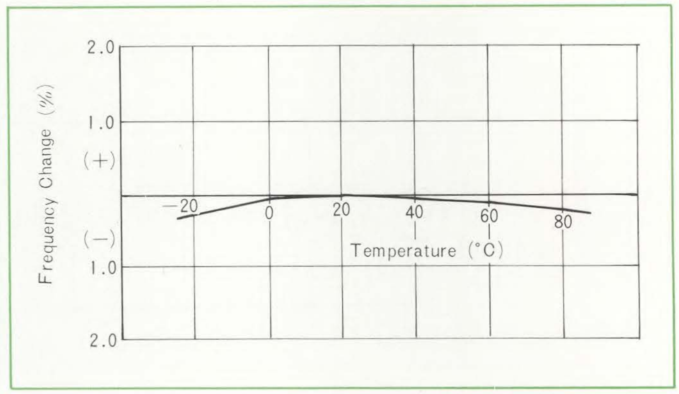
Item	Test Method	Requirement
Temperature Characteristics	The resonant frequency at -20 ~ 60°C measured after being kept at the temperature for 1 hour shall be compared with that at 20°C.	The change should be within ±3%.
Humidity	After being subjected at 40°C, 90~ 95%RH for 48 hours and then stored at a room temperature for 4 hours, resonant frequency as well as insulation resistance shall be measured.	The change of resonant frequency should be within ±1% and insulation resistance more than 100MΩ.
Vibration	The test shall be performed under the following conditions. The resonant frequency after the test shall be compared with the initial value.	The change of resonant frequency should be within ±1%.
Storage	After being subjected to 80°C for 200 hours and then stored at the initial temperature for 4 hours, the change of resonant frequency shall be measured.	The change should be within ±1%.
Aging	The resonant frequency obtained 100 hours after the polarization shall be compared with that after 1,100 hours.	The change of resonant frequency should be within ±0.5%.

Characteristics

Temperature Characteristics (Capacitance)



Temperature Characteristics (Frequency)



Suggestions for Handling

1. The transducers should not be dropped onto the concrete floor or others.
2. The Curie point of the transducer is approximately 300°C and the piezoelectric effect decreases rapidly at high temperature. Both heat treating over 200°C and continuous use over 100°C should be prevented.

Part Number Code

E F E — L □ □ T □ □ □ □ □

Common Code | Dimensions | Thickness (mm) | Material | Construction of Electrode | Suffix

Dimensions:

L	Disk type ... Diameter (mm)
TR	Ring type ... Outside diameter (mm)
RS	Square type ..... Longest length (mm)

Construction of Electrode:

S	Split Electrodes
A	Overall Electrodes
R	Side Electrodes
L	Plane Electrodes

IX PIEZO ELECTRIC GAS IGNITERS "PIEZO-ARC"

QUICK REFERENCE GUIDE

Piezoelectric Gas Ignitors "PIEZO ARC"

Type		Output Voltage	Size	Application	Page
Gas Ignition Unit EFI-E	EA	14.0 KV min.	Standard Type	Home Gap Equipment Camping Gas Appliances Hand-lighters	IX-4
	ED		Compact Type		
Striking Mechanism EFI-A	AA	14.0 KV min.	Standard Type	Home Gas Equipment Camping Gas Appliances Hand-lighters	IX-8
	AD		Compact Type		
	AF	12.0 KV min.	Miniature Type	Cigarette Gas Lighters	IX-15
	AG				
	AL				

* This chart is intended to serve as a guide only.

PIEZOELECTRIC GAS IGNITERS "PIEZO ARC"

Our PIEZO ARC piezoelectric gas ignition system employs the newly developed piezoelectric ceramic material PCM. By introduction of PCM, comprised of $PbTio_3$,$PbZrO_3$ and $Pb(Mg_{1/3}\ Nb_{2/3})O_3$, various kinds of materials are obtainable which are suitable for respective applications due to this wider range of composition.

This PCM piezoelectric ceramic material has been patented in many countries (U.S.A. No. 3,268,453, United Kingdom No.1,066,752, France No.1,444,001, Holland No.6505389, Argentina No.173870. In 1967, furthermore, we made a collaboration agreement with P.R. Mallory, a leading electric components manufacturer in the U.S.A. Our striking mechanism, too, has recently been patented in the U.S.A. (No.3,509,388), in Canada (No.852,820), in France (No.1,565,695), and in United Kingdom (No. 1,220,609), F.R. Germany (No.17630307), Holland (No. 136570) Australia (No.415327). We started studying piezoelectric ceramics for a resonator utilizing titanate barium ceramic and an ultrasonic microphone in 1951. Later we began to produce pickup ceramic elements and cartridges.

In 1960 we developed ceramic filters to replace conventional IFTs for radios, which was followed by ladder filters for communication equipment, reed filters for bell-boy paging systems, ultrasonic ceramic microphones for remote control for TV, ceramic filters for high frequency, etc. basing on the PCM piezoelectric material suited for the respective usage.

On the other hand, we have been studying the application of PCM in other fields besides electronic equipment. The PIEZO ARC is one of the results of this study, and is now manufactured in large volume in the Ceramics Dept. which was awarded the Deming Prize in 1966 for highly advanced quality control.

The ignition system for gas appliances is patented in the U.S.A. by pat. No. 3,200,295, No. 2,649,488 and in Canada by Pat. No. 247,200 and No. 597,217. For this reason, we are licensed with Honeywell, U.S.A., regarding these two countries.

Gas Ignition System By Piezoelectric Ceramics

Output voltage is generated between both ends of a piezoelectric element in proportion to the external impact force applied to it.

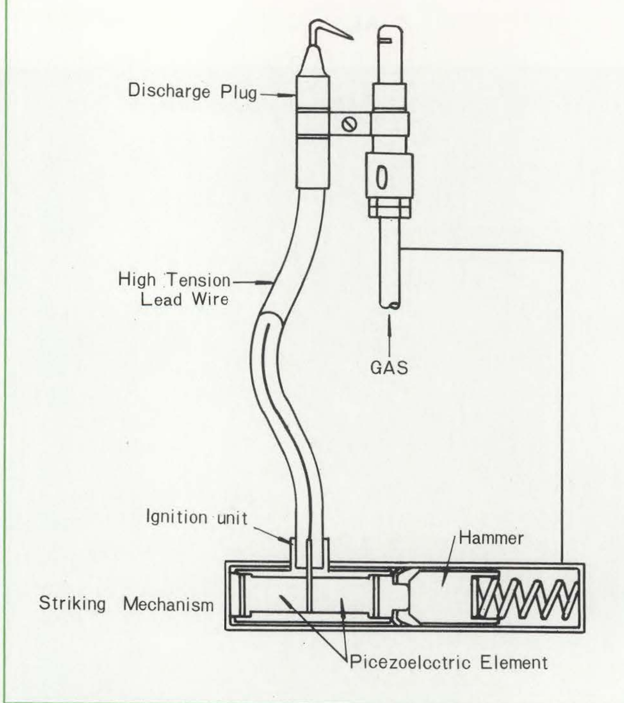
The gas is ignited by the discharge of a high voltage spark generated by impact force or static stress. The generated voltage is shown by the following formula:

$$V = g_{33}\frac{\ell}{S} F$$

where

- V: output voltage
- S: sectional dimensions of the element
- ℓ: length of the piezoelectric element
- g_{33}: piezoelectric constant

Our standard piezoelectric ignition unit is shown in Fig. 1. Two piezoelectric elements in rod form with silver electrodes at the opposite ends are joined end to end, through a center terminal made of iron plate, with the positive electrodes opposing each other. A metal tablet is attached to one of the end electrodes of the joined elements through an ALP spacer while a metal plate is attached to the other electrode also through an ALP spacer. The metal tablet, plate and spacer form part of the electrical conduction circuit along with the piezoelectric elements. Finally with the center terminal connected to a high voltage lead wire, the entire combination is embedded in a high insulation resin case with only the tablet, plate and lead wire left exposed.



The ignition unit is then mounted in a metal case, along with some means of impact as shown in Fig. 1. The above device, comprised of the ignition unit and some means of impact, is hereafter called the "striking mechanism", When the metal tablet receives adequate pressure impact from the spring action trigger, the combined piezoelectric elements are strained, causing them to generate an electrical charge across both surfaces of each element. The electrical charge has positive polarity at the center terminal because of the way in which the piezoelectric elements are combined. The metal tablet and plate attached to the ends of the combined elements are connected to the metal case which is grounded. Thus, a high voltage discharge from the center terminal will arc across the discharge gap positioned in front of the gas nozzle and ignite the gas.

This ignition method absolutely assures ignition of the gas. In addition, the life of our piezoelectric element is semipermanent; there is no need of replacing heaters and dry batteries presently used in more conventional ignition methods.

Basic Features of PCM Material

Item		$7^{\phi}\times15^{mm}$	$5^{\phi}\times10^{mm}$	$3.7^{\phi}\times5^{mm}$	$3.0^{\phi}\times5^{mm}$
Coupling Coefficient	K_{33}	70.8%	69.1%	69.0%	69.0%
Piezoelectric Constant	g_{33}	28.2×10^{-3} Vm/N	30.5×10^{-3} Vm/N	31.0×10^{-3} Vm/N	31.0×10^{-3} Vm/N
	d_{33}	423×10^{-12} m/V	366×10^{-12} m/V	255×10^{-12} m/V	255×10^{-12} m/V
Capacitance	c	48.5pF	25.9pF	19.0pF	12.4pF
Dielectric Constant	ϵ	1930 *	1580 *	930 *	930 *
Density	ρ	7.55 g/cm³	7.61 g/cm³	7.70 g/cm³	7.70 g/cm³
Curie Point	Tc	326°C	310°C	220°C	220°C

* After polarization

Note: K_{33}, d_{33}, and g_{33} are figured out by the characteristics of a piezoelectric element.

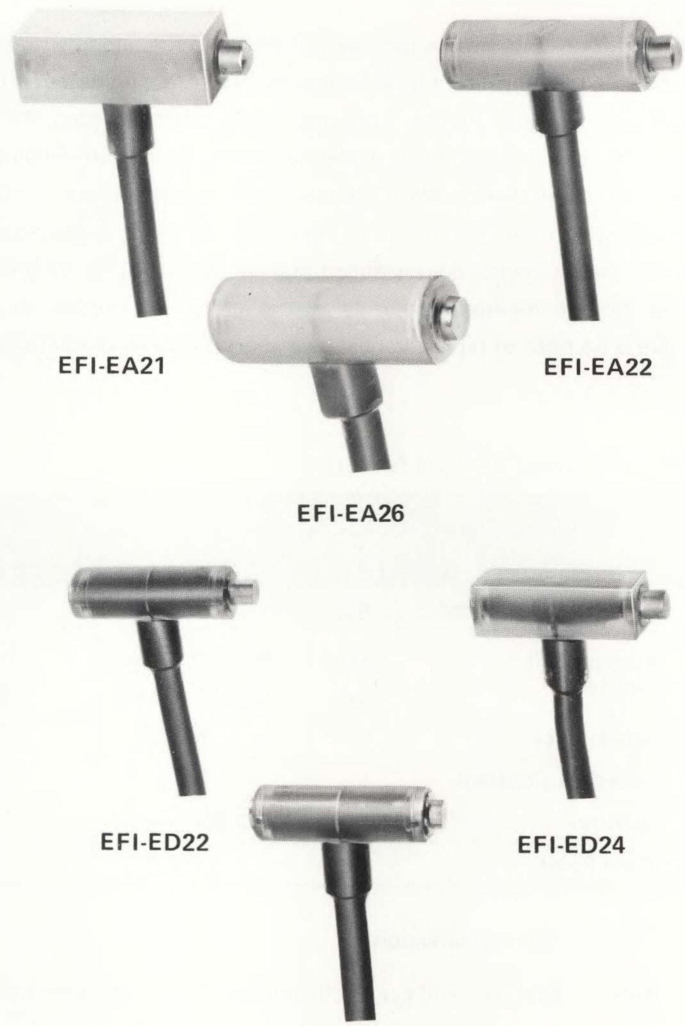
$$K_{33}=\frac{\pi}{2}\frac{f_s}{f_p}-\tan\frac{\pi}{2}\frac{f_p-f_s}{f_p}\ ,\ d_{33}=K_{33}\sqrt{\epsilon^T{}_{33}\frac{1}{1-k_{33}{}^2}\frac{1}{4pf_p{}^2\ell,}}\qquad g_{33}=d_{33}/\epsilon_{33}^T$$

f_s: Resonant frequency f_p: Anti-resonant frequency

ℓ: Length of an element P: Density ϵ_{33}^T : 8.85 xlo

ϵ: Dielectric constant

Standard and Compact Type Ignition Unit



EFI-EA21 EFI-EA22 EFI-EA26 EFI-ED22 EFI-ED24 EFI-ED26

Features

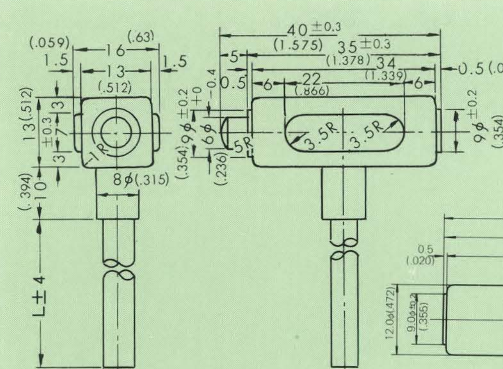
- Stable Output Voltage
  As shown in p.IX-6 the output voltage wave form experiances no sharp rippling. Errorless sparking and gas ignition are thus assured.
- Excellent Durability
  The quality and precision processing of the piezoelectric elements are strictly controlled to produce superior durability in the Ignition Unit. Severe durability tests have resulted in no damage to the piezoelectric elements and no impairment to the output voltage.
- Superior Moisture-Proof Characteristics
  High quality silicon oil makes up the air gap between the elements and the case. Consequently, insulation damping and flashover inside the case have been eliminated even in high humid conditions.

Application

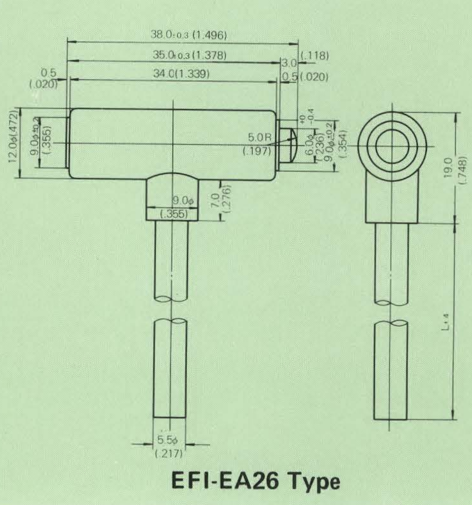
- Various kinds of gas equipment such as gas cookers, water heaters, camping gas appliances, etc.

Dimensions

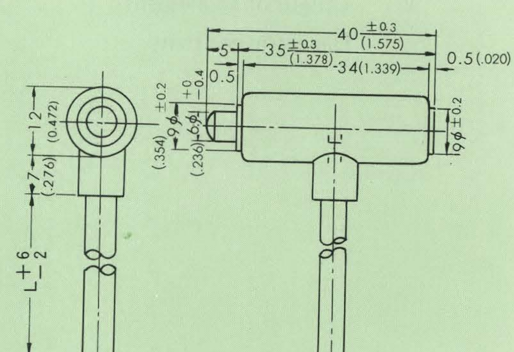
Standard Type Ignition Unit



EFI-EA21 Type



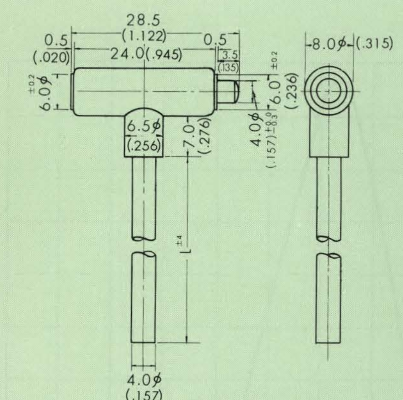
EFI-EA26 Type



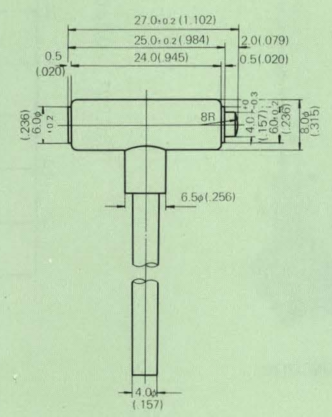
EFI-EA22 Type

Unit: mm(inch)

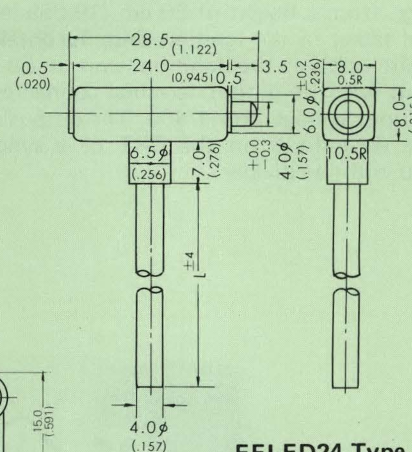
Compact Type Ignition Unit



EFI-ED22 Type



EFI-ED26 Type



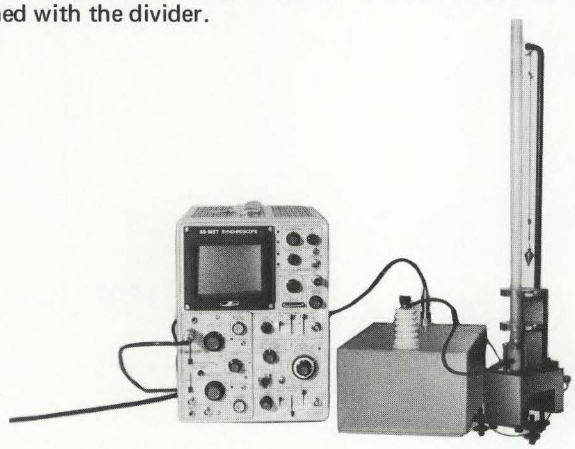
EFI-ED24 Type

Unit: mm(inch)

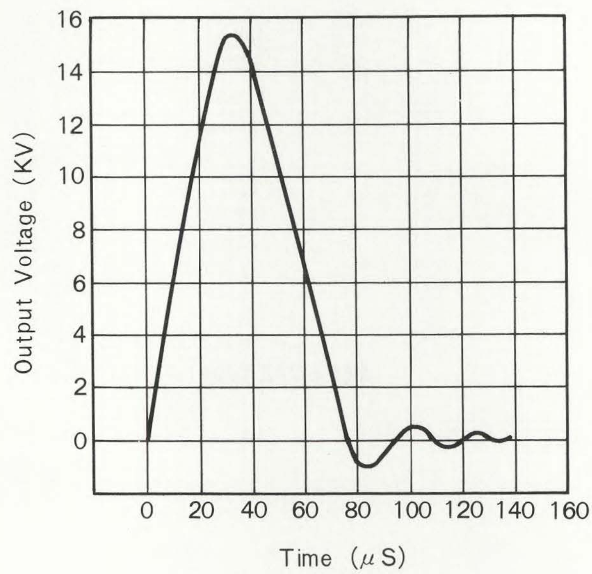
Specifications

Item	Rated Value	Test Condition and Method
Output voltage	Min. 14 KV	Weight of steel ball; 11.8 ± 0.1 gr. (0.026 ± 0.002 lb.) Falling height: 500 ± 5 mm (19.69 ± 0.197 in.) Times of measurement: 10 times, Output voltage: mean of 10 values The measuring must be done after 10 times dropping of the steel ball.
Pull test	Min. 2 Kg	On applying a static load of 2 Kg (4.4 lbs) vertically (axially) to a lead wire of the horizontally fixed ignition unit and then applying the same load with the ignition unit inclined first to the right and then to the left direction at an angle of 45 degrees to the horizon, it is observed whether the lead separates from the ignition unit or not.
Durability	Min. 13.5 KV	Impact force: Impact force to generate the initial output voltage of 16 ± 0.6KV Impact times: 30,000 times at the rate of 60 cycles per minute The output voltage is measured after the test.
Heat resistance	Min. 80% of the initial value	Measuring the output voltage at 120°C (248°F) after subjecting the Ignition Unit to 120°C (248°F) for 1 hour, the voltage shall be compared with that at room temperature.
Insulation	No flashover	Impact force: same as the durability Impact times: 10 times It shall be inspected as to each impact whether any flashover occurs or not inside the case.
Insulation resistance	Min. 100MΩ	The insulation resistance between the high tension lead wire and the ground earth (metal tablet and metal plate) shall be measured at 500V D.C. by a megohmmeter.

Output voltage as a function of impact force is determined by dropping a steel ball with a diameter of 9/16 in. and weight of 11.8 gr. from a height of 50 cm (19.685 in.) to the surface of the metal tablet of the Ignition Unit. To obtain accurate value of the output voltage, the Ignition Unit is set on the measuring equipment with its output terminal connected with a divider to divide output voltage into 1/400. The output voltage is measured from the wave form on the CRT of a synchroscope which is combined with the divider.



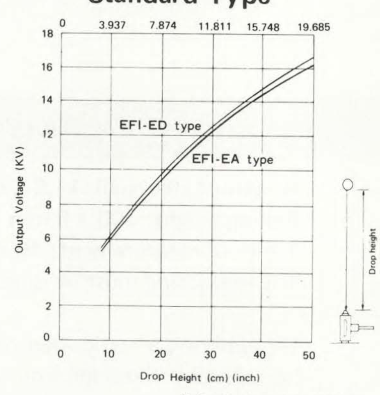
*Output voltage measurement by using synchroscope



Characteristics

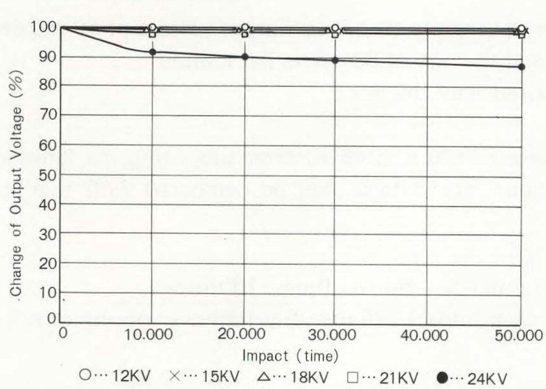
Output Voltage vs Impact

Standard Type

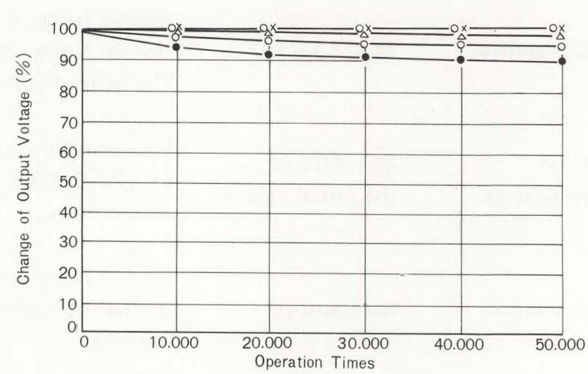


Durability

Standard Type



Compact Type



High Tension Lead Wire

Item \ Type***		E	G	E	G	S
Diameter (mm, inch)		5.5ϕ (.217 dia.)		4.0ϕ (.157 dia.)		
Conducting wire		0.26ϕ (.010 dia.) x 15		0.26ϕ (.010 dia.) x 12		
Operating temperature (°C, °F)		130 (266)	130 (266)	120 (248)	120 (248)	200 (392)
Short-time operating temperature (°C, °F)		190 (374)	200 (392)	180 (356)	190 (374)	250 (482)
Withstanding Voltage (V/60 sec.)		15,000	15,000	10,000	10,000	18,000
Breakdown voltage (V)		27,000	27,000	20,000	20,000	90,000
Insulation resistance (MΩ/Km) (MΩ/3280ft)	at room temperature	2,500	2,100	1,350	1,200	10,000
	at 100°C (212°F)	300	400	150	160	5,000
Pull strength (Kg/cm^2, lbs/in^2)		82 (1,166)	82 (1,166)	82 (1,166)	82 (1,166)	76 (1,080)
Extension (%)		850	850	850	850	250
Winding after heat treatment (hr/°C, hr/°F) *		72/180 (72/356)	72/180 (72/356)	72/180 (72/356)	72/180 (72/356)	72/250 (72/482)
Winding low temperature (°C, °F) **		-30 (-22)	-30 (-22)	-30 (-22)	-30 (-22)	-30 (-22)
Combustion resistance		Self-extinguishable				

After heat treatment the lead shall be wound around a rod with a diameter three times as large as of the lead wire, and then it shall be examined whether there are cracks or not.

After exposing the sample at -30°C (-22°F) for 24 hours, the same test as mentioned above shall be conducted.

Insulation material
E: Ethylenepropylene terpolymer (E.P.T.)
G: E.P.T. (inner) and glass fibre (outer)
S: Silicon rubber

Suggestions for Handling

1. Mount the Ignition Unit Securely
   When assembling a Striking Mechanism using the Ignition Unit, the Unit should be firmly supported; otherwise, the ignition will not give excellent performance.
2. Designing of Impact Force
   The Striking Mechanism should be designed so that it does not generate too much output voltage. These Units are designed to be used with about 15KV.
3. Heat-Treatment at the time of Assembly
   The polypropylene case of the unit will soften at a temperature of 160 to 170°C (328 to 337°F). Piezoelectric ceramic materials have a Curie point which is about 180°C (360°F) and their piezoelectricity lowers when nearing the Curie point. Thus, when applying heat-treatment at the time of assembly of the Striking Mechanism with the Ignition Unit, care should be taken so as not to exceed 90°C (194°F).

E F I — E □ □ □ □□ □□

Common Code | Type | Dimensions of Element | Number of Elements | Order of Design | Lead Wire Length (cm) | Suffix

E	Ignition Unit

A	7ϕx15mm (0.276"DIA.x0.591")
D	5x10 (0.197"DIA'x0.394")

(Home gas equipment only)

Striking Mechanism for Gas Ignition

This is a striking,mechanism which obtains high voltage by applying impact to ignition unit.
The gas is ignited by the discharge of a high voltage.
Patents are registered in the U.S.A., France, Canada and England.

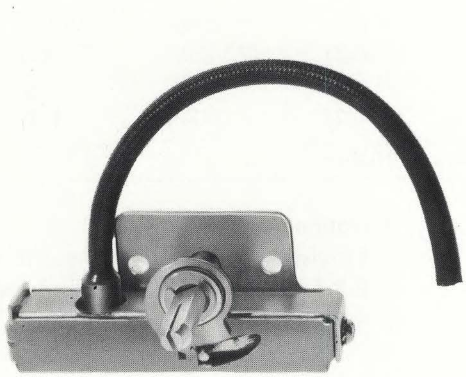
Features

- Can be easily installed in equipment due to compact construction
- Excellent durability due to simple mechanism
- Many types available to meet every need

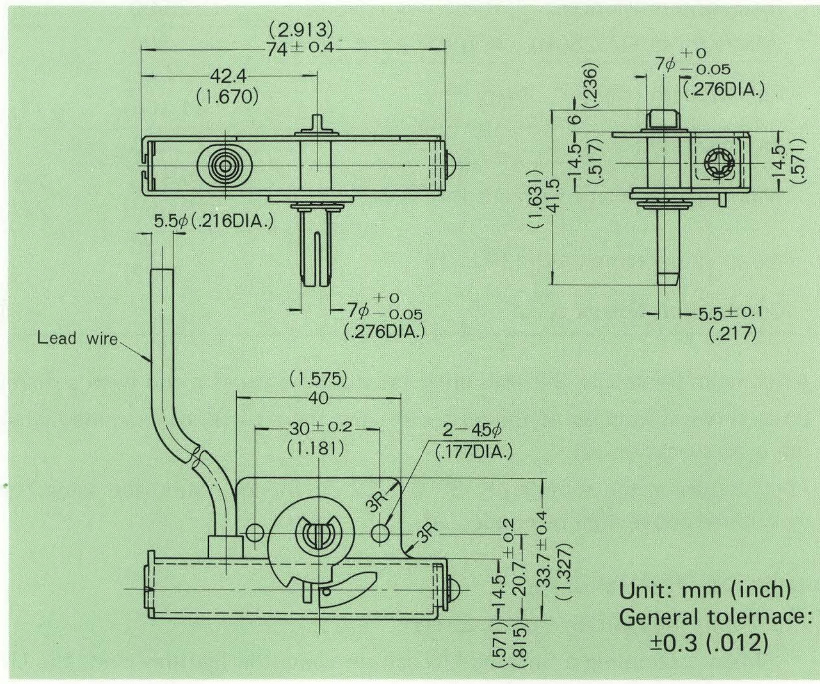
Application

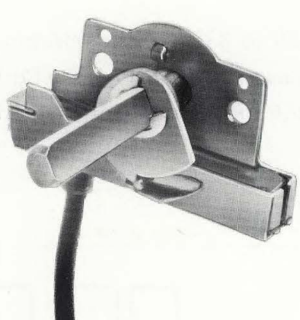
- Various gas equipment such as gas tables, camping tables, etc.
- Hand-lighters

Dimensions

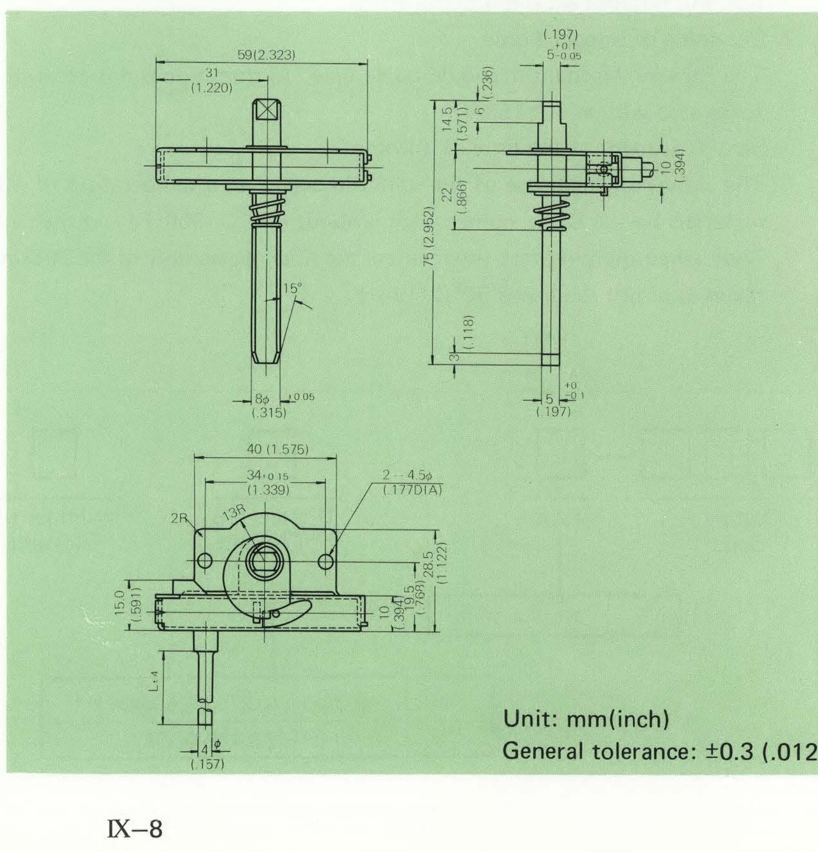


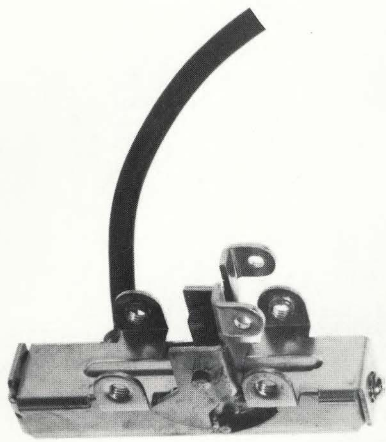
Type EFI-AA23



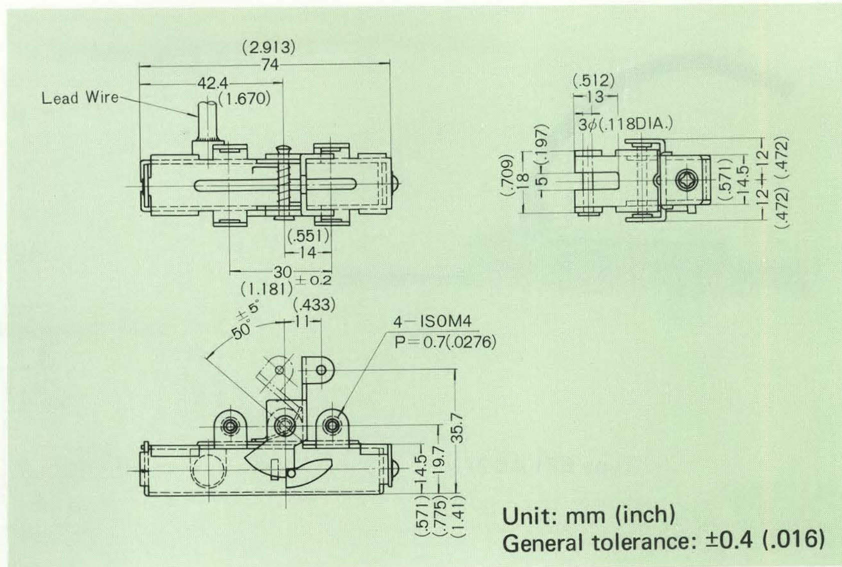


Type EFI-AD22

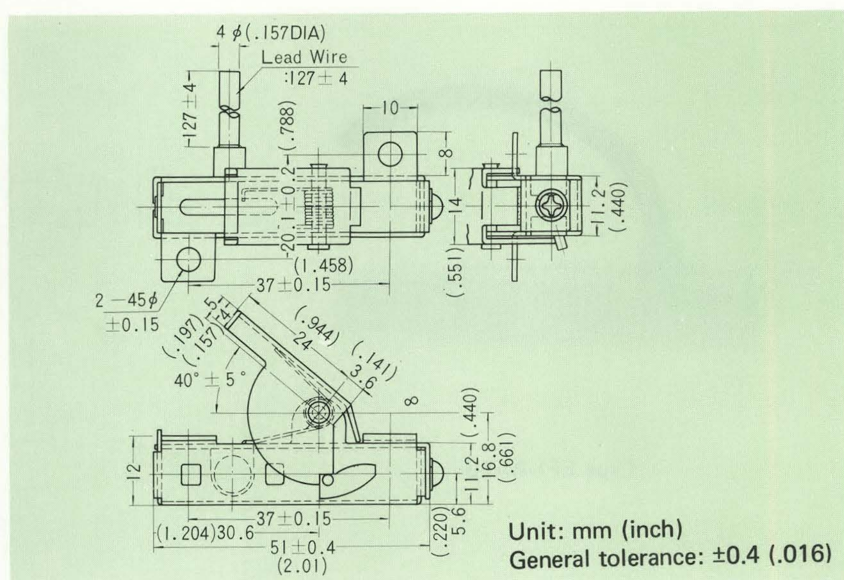


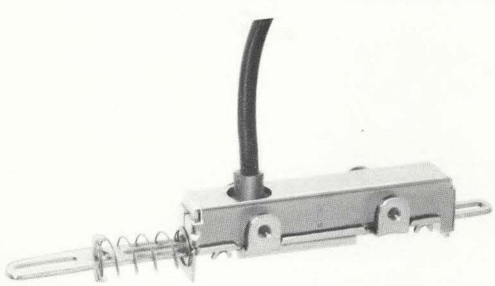


Type EFI-AA26

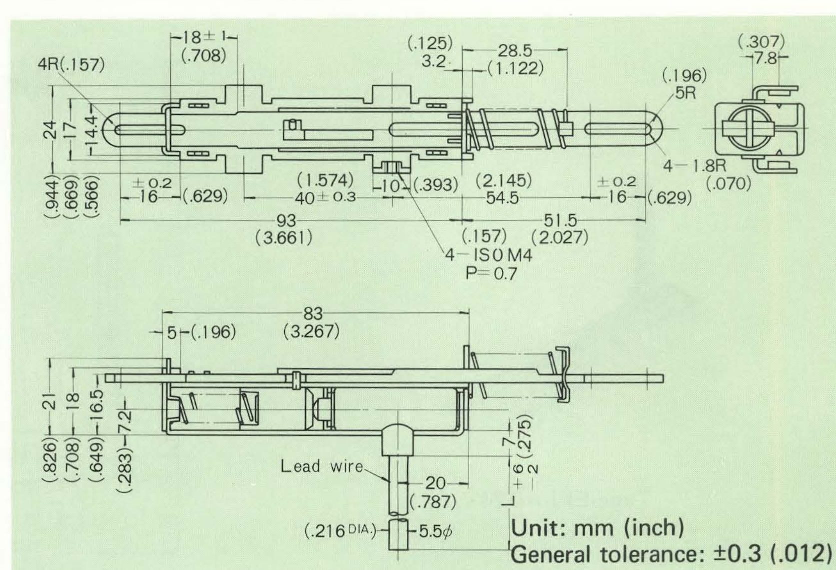


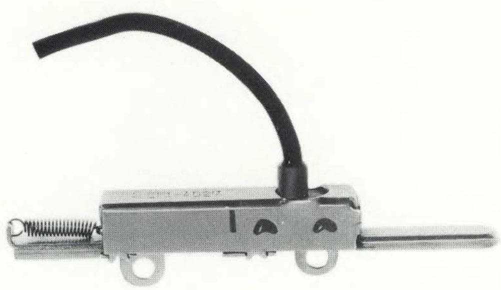
Type EFI-AD25



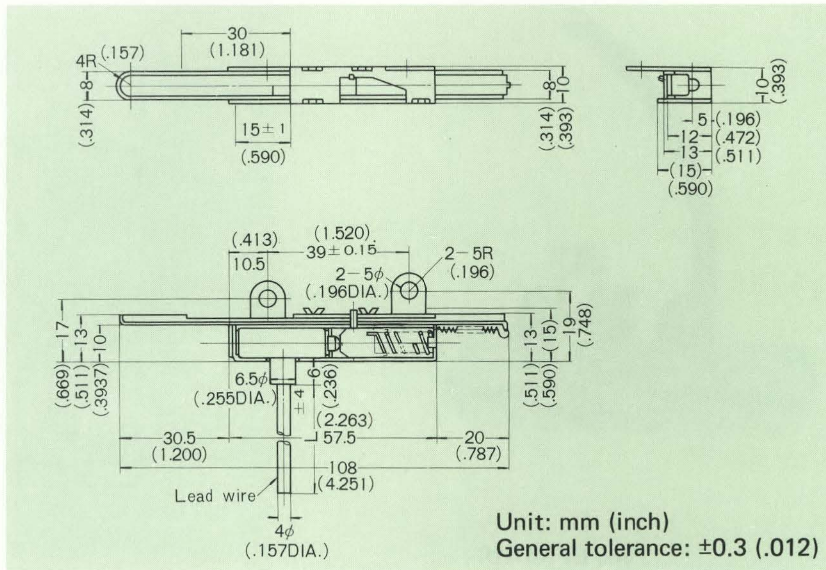


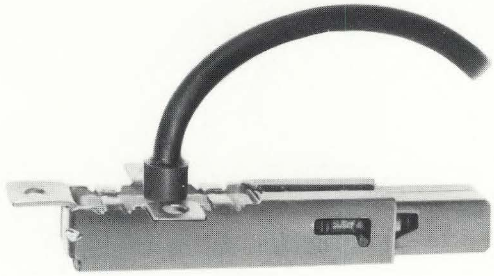
Type EFI-AA27





Type EFI-AD27





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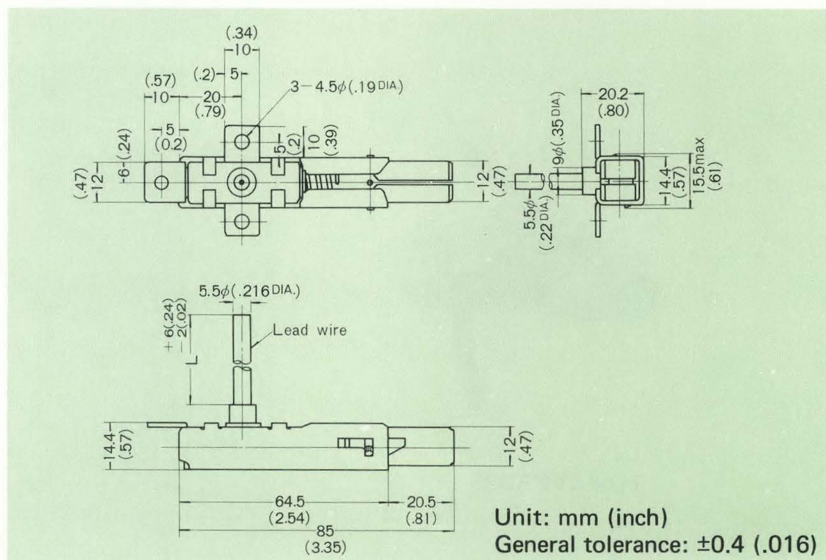
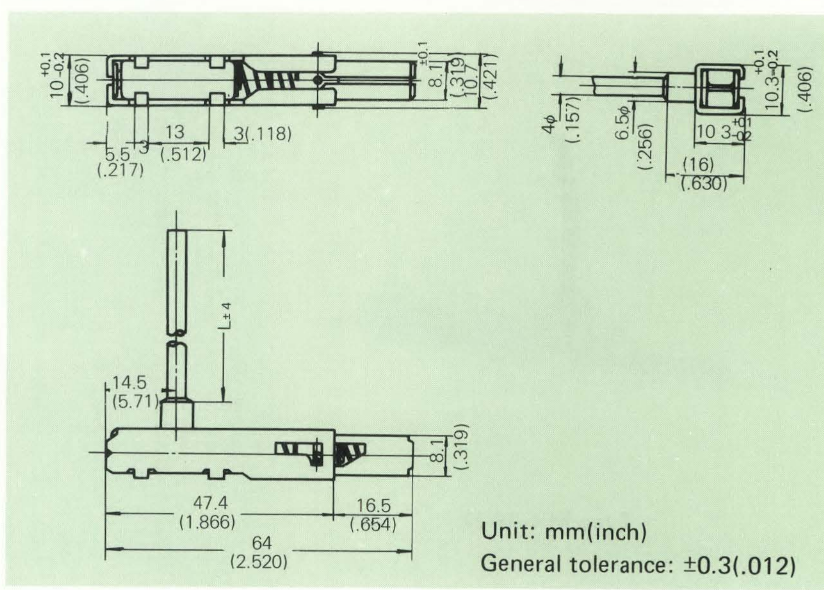
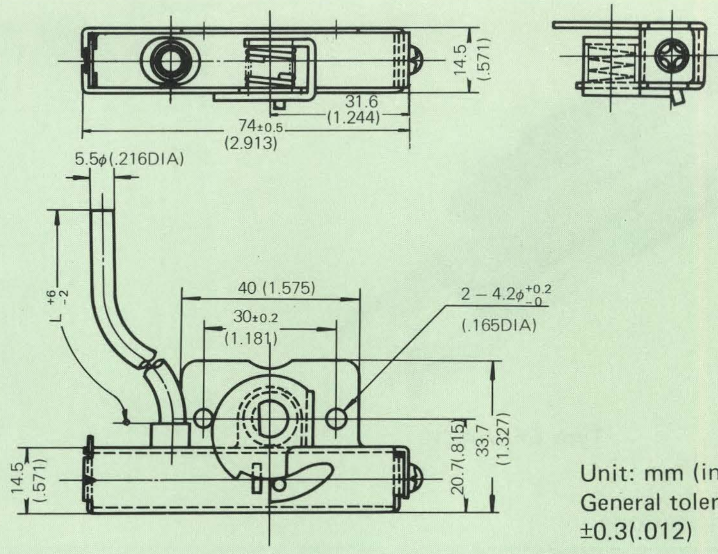


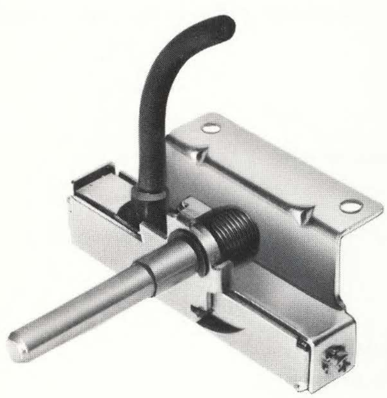
Type EFI-AD24



Type EFI-AA237

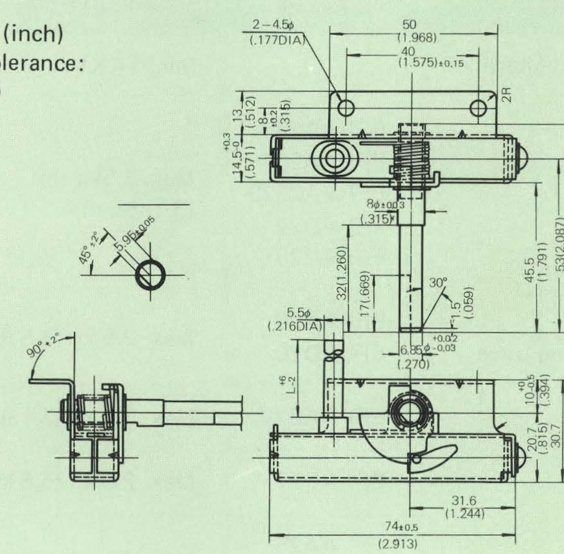


Unit: mm (inch)
General tolerance:
±0.3(.012)



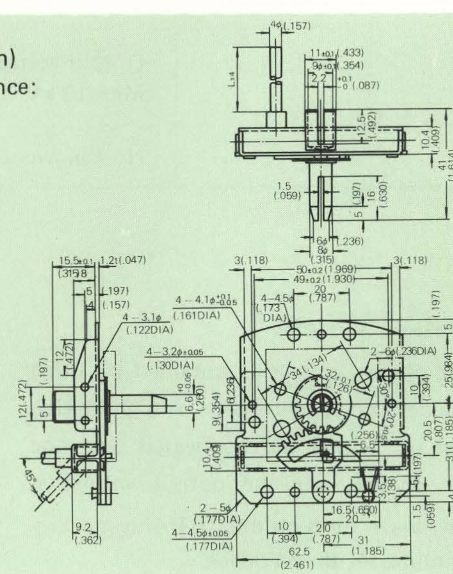
Type EFI-AA2323

Unit: mm (inch)
General tolerance:
±0.3(.012)

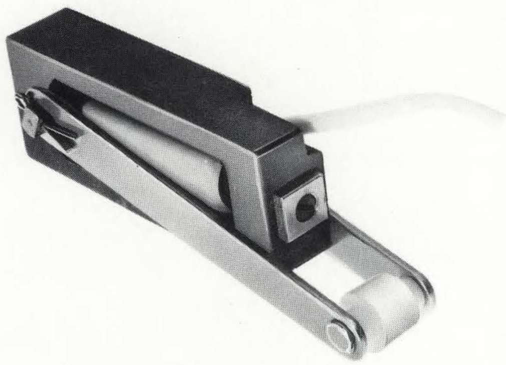


Type EFI-AD281

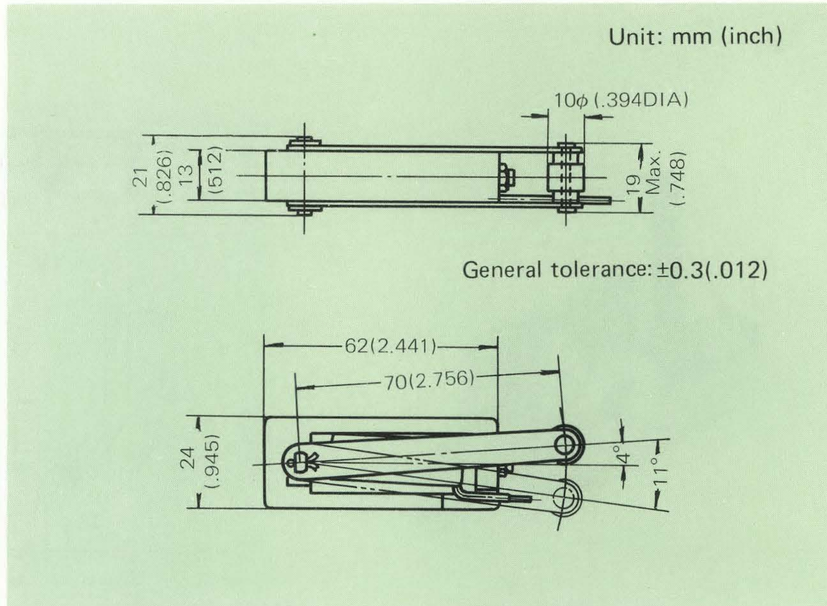
Unit: mm (inch)
General tolerance:
±0.3(.012)



Dimensions



Type EFI-AA210



Specifications

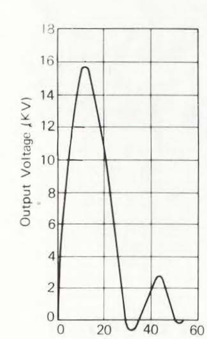
Item	Type No.	Specification	Test method
Output voltage		Min. 14 KV	Synchroscope and divider Mean of 5 measurements
Operating force	EFI-AA23 EFI-AA237 EFI-AA2323 EFI-AD22 EFI-AD281	Max. 3.5kg.cm (3.1 lbs. in)	Torque meter Mean of 5 measurements
	EFI-AA26 EFI-AD25	Max. 2.5 kg (5.5 lbs)	Scale spring balance Mean of 5 measurements
	EFI-AA27	Max. 3.2 kg (7.1 lbs)	
	EFI-AD27	Max. 2.5 kg (5.5 lbs)	
	EFI-AA25 EFI-AD24	Max. 4 kg (8.8 lbs)	
Durability		Output voltage Min. 13 kV	30000 times at the rate of 60 cycles per minute
Humidity		No abnormality	40°C (104°F) 90% RH 100 hours

Characteristics

Measuring of Output Voltage

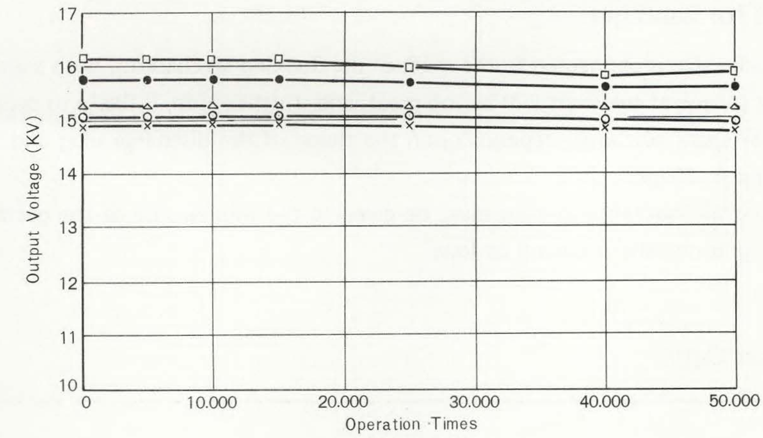
Accurate value of output voltage is obtained by using cutput voltage divider and synchroscope. A high tension lead wire and an earth wire are connected with the terminals of the divider, and the output voltage is measured from the wave form on the CRT of a synchroscope which is combined with the divider.

Output Voltage Wave Form
EFI-AA23 Type



Durability at room temperature

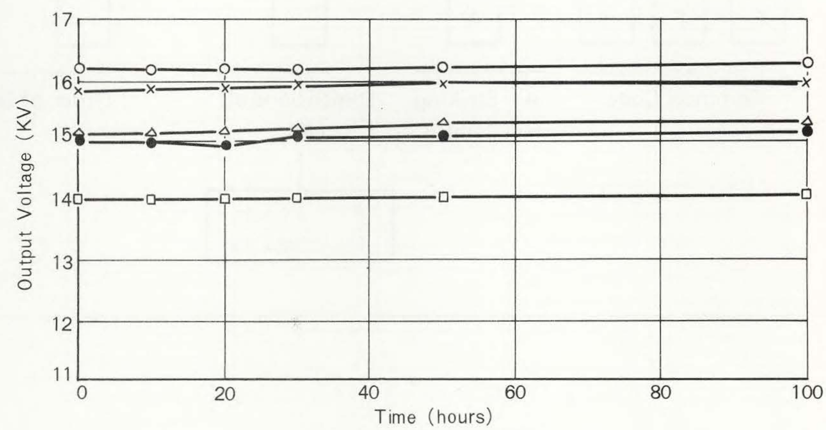
Given right is the charge of the output voltage measured after giving an impact 50,000 times at the rate of 60 cycles per minute. No abnormality was found in performance, torque, etc.



Type EFI—AA23

Humidity Characteristics

While being subjected to 40°C, 90~95% relative humidity for 100 hours, the output voltage and torque of the Striking Mechanism were measured in the course of the test. The results are shown at the right. There appeared no rust to impair performance after the test.



Type EFI—AA23

Salt Spray Test

The salt spray test was conducted in a salt spray test chamber according to JIS Z-2371. Some change of color found after the test did not affect operation.

	Before test			After 1 cycle (24 hrs)			After 3 cycles (72 hrs)		
	Output voltage	Operating force	Insulation resistance	Output voltage	Operating force	Insulation resistance	Output voltage	Operating force	Insulation resistance
1	15.5 KV	3.1 Kg (6.8 lb)	$5\times10^{12}\ \Omega$	16.0 KV	3.1 Kg (6.8 lb)	$5\times10^{12}\ \Omega$	16.6 KV	3.1 Kg (6.8 lb)	$3\times10^{12}\ \Omega$
2	14.2 KV	3.2 Kg (7.1 lb)	$5\times10^{12}\ \Omega$	14.2 KV	3.1 Kg (6.8 lb)	$5\times10^{12}\ \Omega$	14.2 KV	3.3 Kg (7.3 lb)	$5\times10^{12}\ \Omega$
3	15.4 KV	3.1 Kg (6.8 lb)	$5\times10^{12}\ \Omega$	15.4 KV	3.1 Kg (6.8 lb)	$3\times10^{12}\ \Omega$	16.0 KV	3.2 Kg (7.0 lb)	$3\times10^{12}\ \Omega$
4	15.4 KV	3.1 Kg (6.8 lb)	$2\times10^{12}\ \Omega$	15.6 KV	3.1 Kg (6.8 lb)	$1.6\times10^{12}\ \Omega$	16.2 KV	3.2 Kg (7.0 lb)	$2\times10^{12}\ \Omega$
5	15.0 KV	3.0 Kg (6.1 lb)	$3\times10^{12}\ \Omega$	15.0 KV	3.0 Kg (6.1 lb)	$3\times10^{12}\ \Omega$	15.0 KV	3.0 Kg (6.1 lb)	$1.5\times10^{12}\ \Omega$

Test conditions

1. Solution .... 5±1%
2. Gravity .... 1.0268~1.0413
3. PH .... 6.5~7.2
4. Temperature .... 35±2°C (95±36°F)
5. Pressure .... 1 kg/cm^2 (0.306 OZ/in^2)
6. Test time .... One cycle is 8 hours salt spray followed by 16 hours rest.

Suggestions for handling

1. When a cock valve is connected to the shaft of the Striking Mechanism, both axes must be designed to match accurately. If not, the torque of the shaft will be too great, and furthermore, is likely to cause gas leakage.
2. The rate of spark discharge depends upon the shape of the discharge plug and its opposite pole. Care should be taken when determining its shape.
3. In designing the nozzle, attention must be given to the mixing rate of the gas and air. If the gas flow from the pilot nozzle is too great, ignition efficiency will be low.

Part Number Code

E F I	– A	□	□ □	□ □
Common Code	A : Striking Mechanism	Dimensions of Element	Order of Design	Suffix

Dimensions of Element:

A	7φ x 15
D	5φ x 10

Striking Mechanism for Cigarette Lighters

This is a striking mechanism which obtains high voltage by applying impact to ignition unit designed especially for cigarette lighters.

Patents are registered in the following countries:

U.S.A. FRANCE, CANADA, UK, HOLLAND, F.R. GERMANY AUSTRALIA,

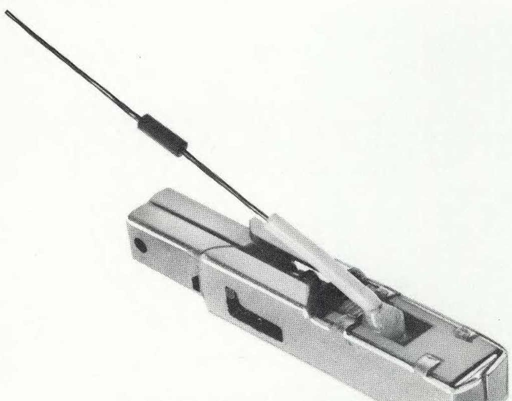
Features

- Can be installed in various kinds of lighters due to very small size and light weight
- Additional fuel tank capacity can be obtained due to small size.
- Excellent durability due to simple mechanism
- Various types are available according to lighter size.

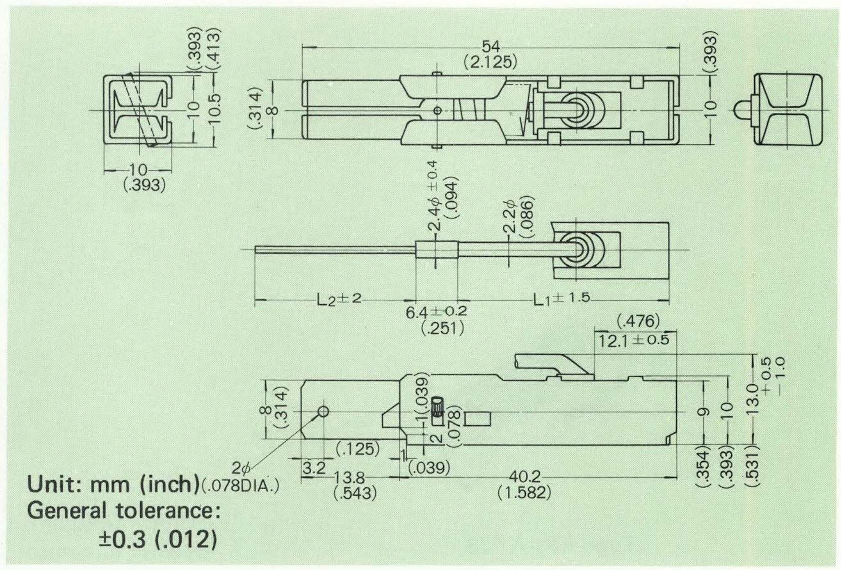
Application

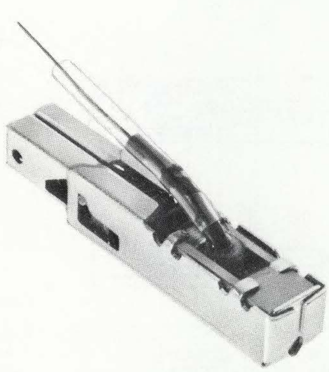
- Pocketable and desk cigarette lighters.

Dimensions

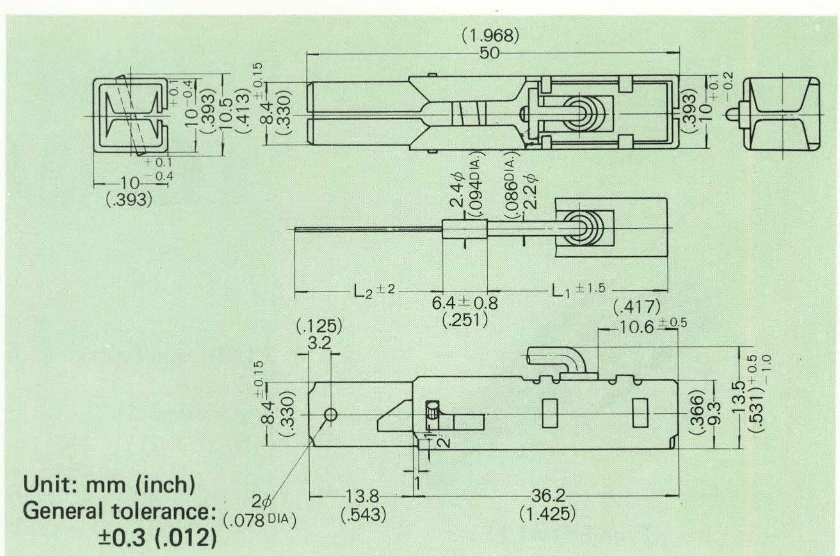


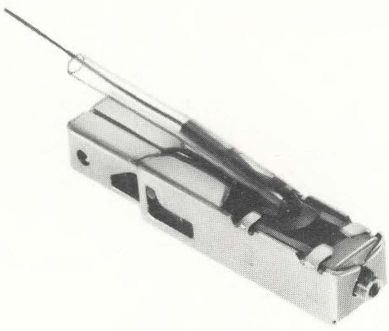
Type EFI-AF22



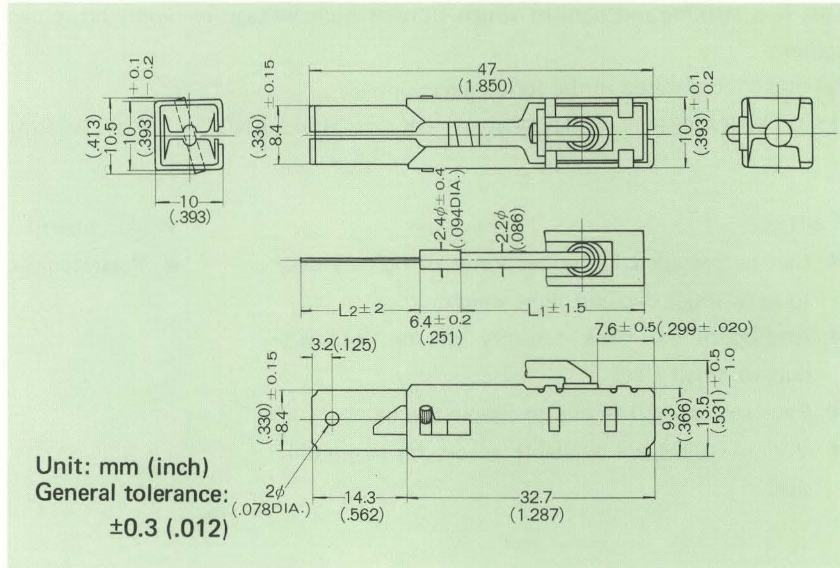


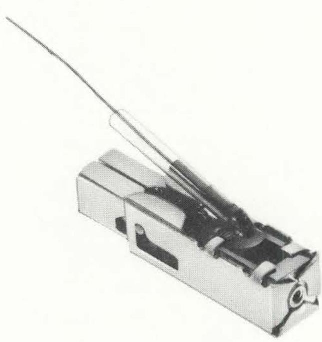
Type EFI-AF21



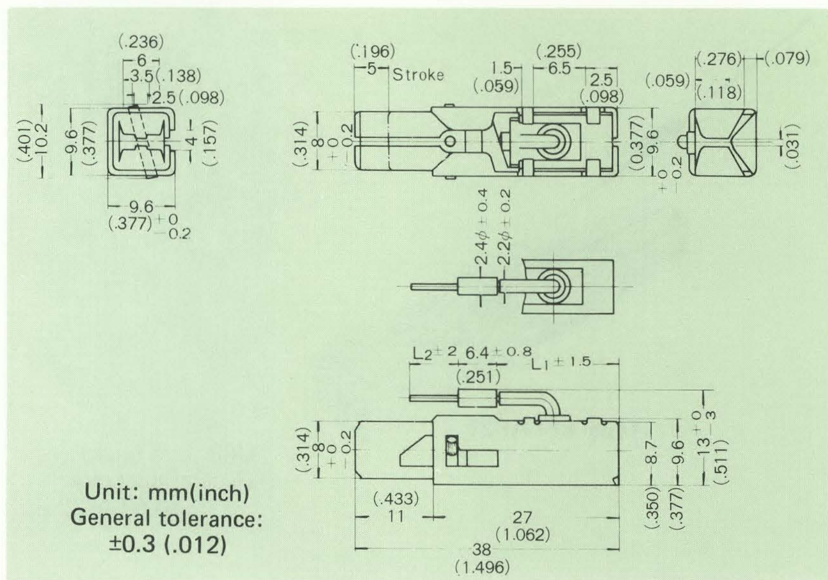


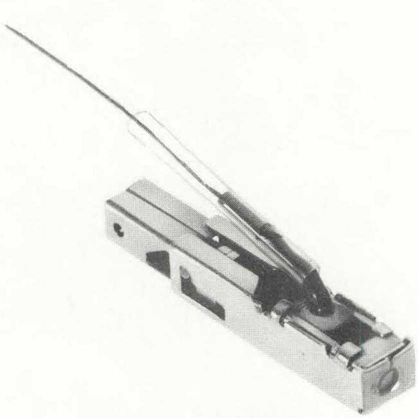
Type EFI-AF27



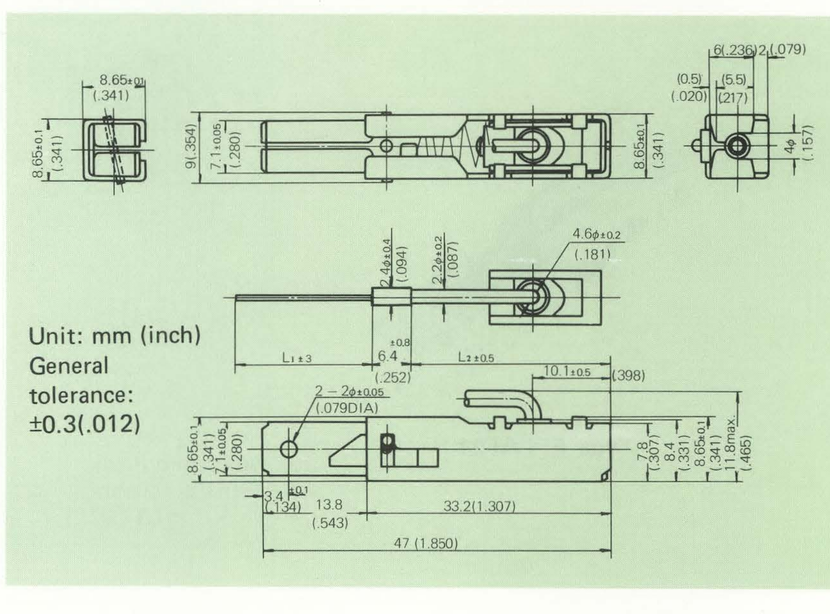


Type EFI-AF28

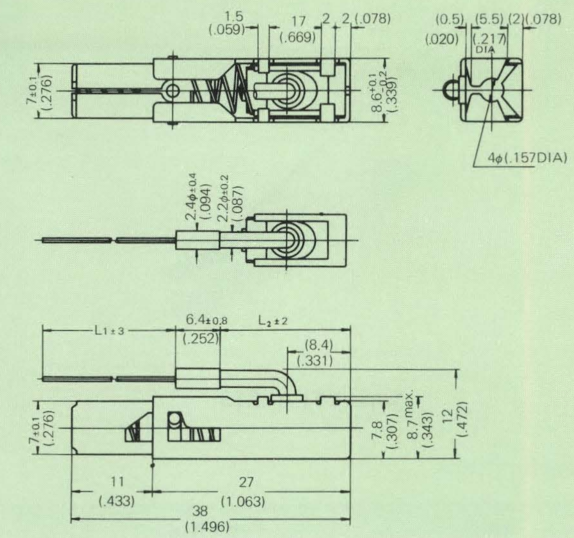




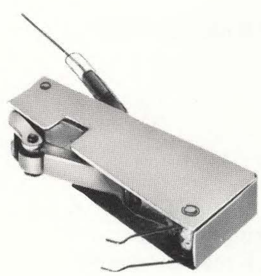
Type EFI-AL21



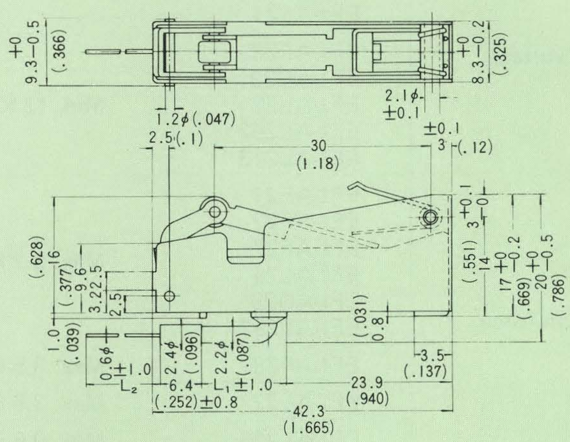
Type EFI-AL22



Unit: mm (inch)
General tolerance:
±0.3(.012)

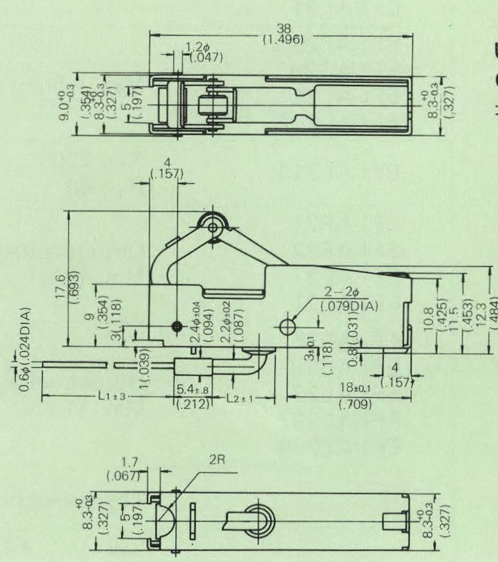


Type EFI-AG29



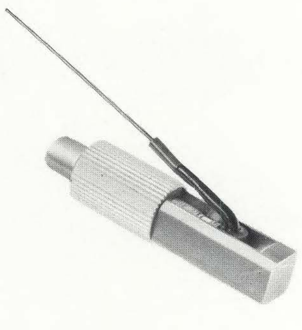
Unit: mm
(inch)
General
tolerance:
±0.3 (.012)

Type EFI-AL292

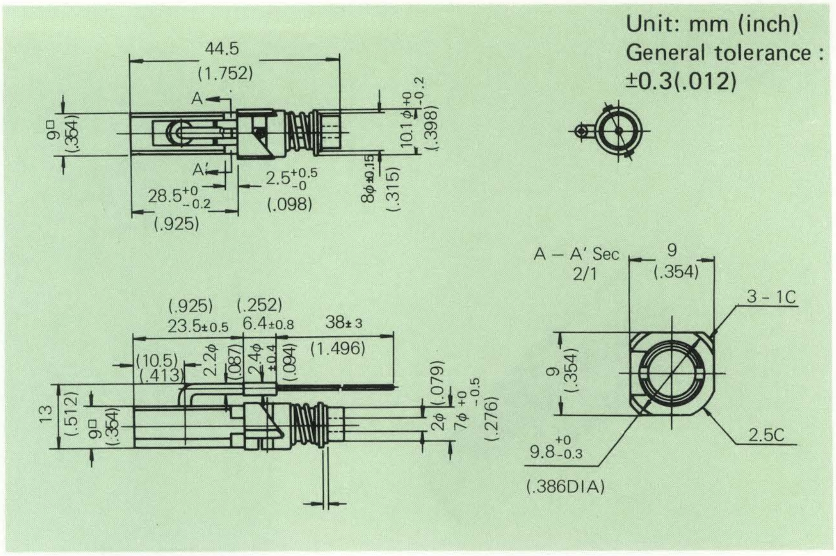


Unit: mm (inch)
General tolerance:
±0.3(.012)

Dimensions



Type EFI-AL213

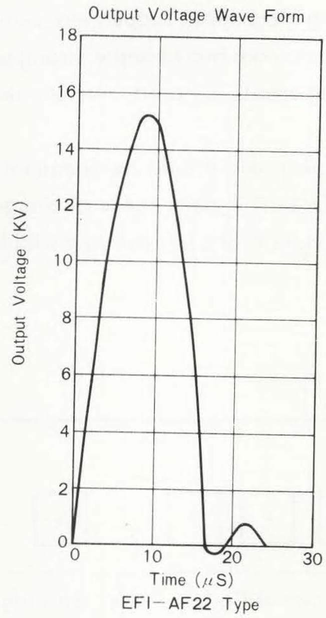


Specifications

Item	Type No.	Rated Value	Test method
Output voltage	EFI-AF21 EFI-AF22 EFI-AF27 EFI-AL21	Min. 13 KV	Synchroscope and divider
	EFI-AF28 EFI-AG29 EFI-AL22 EFI-AL292 EFI-AL213	Min. 12 KV	Mean of 5 measurements
Operation force	EFI-AF21 EFI-AF22 EFI-AF27 EFI-AL21 EFI-AG29 EFI-AL292	Max. 3.2 kg (7.0 lbs)	Scale spring balance Mean of 5 measurements
	EFI-AF28	Max. 3.5 kg	
	EFI-AL22	Max. 3.6 kg	
	EFI-AL213	Max. 0.6 kg	
Operating stroke	EFI-AF21 EFI-AF22 EFI-AF27 EFI-AL21	Max. 6 mm (.236 in)	Venier calipers
	EFI-AF28 EFI-AG29 EFI-AL22 EFI-AL292	Max. 4.5mm (.177 in)	
	EFI-AL213	$R_1 = 120°$ $R_2 = 60°$	
Durability	EFI-AF21 EFI-AF22 EFI-AF27 EFI-AL21	Output voltage Min. 12 KV	Durability test equipment 30,000 times at the rate of cycles per minute Discharge gap is 3mm (.118 in).
	EFI-AF28 EFI-AG29 EFI-AL22 EFI-AL292 EFI-AL293	Output voltage Min. 11 KV	
Flash over		There shall be no flashover	When the striking mechanism is operated through a discharge gap of 3mm (.118 in).
Series resistor		¼W 18KΩ~42KΩ	

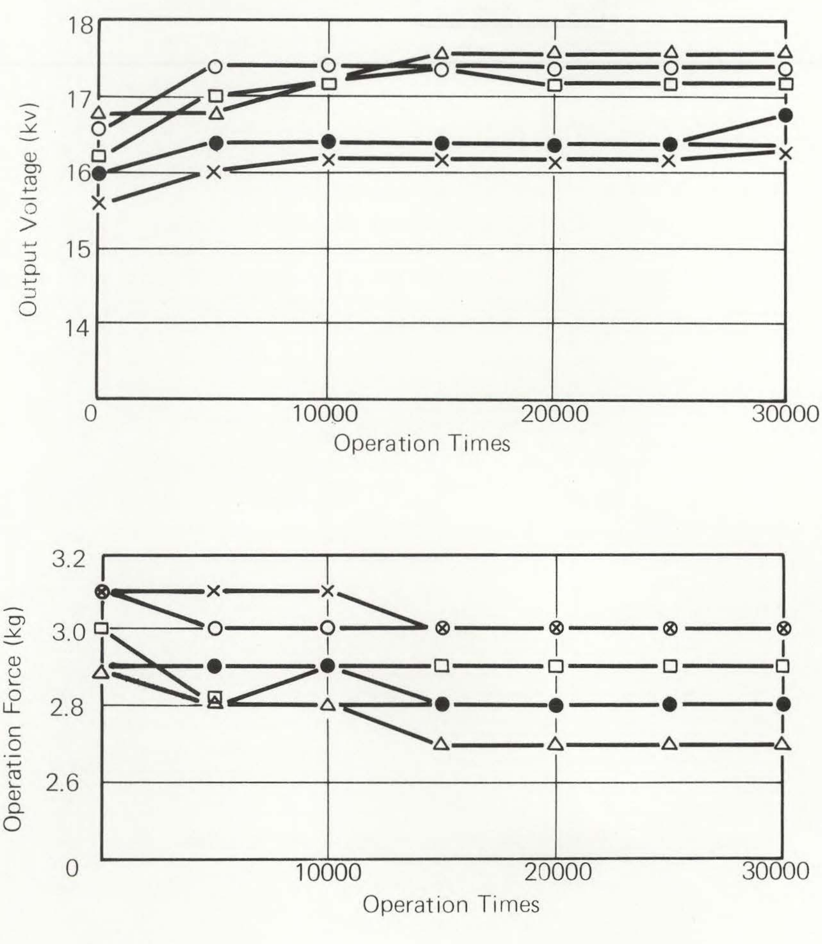
Measuring of Output Voltage

Accurate value of output voltage is obtained by using output voltage divider and synchroscope. A high tension lead wire and an earth wire are connected with the terminals of the divider, and the output voltage is measured from the wave form on the CRT of a synchroscope which is combined with the divider.



Characteristics

Durability (EFI-AF22 Type)



Suggestions for Handling

1. When Striking Mechanism is operated, care should be taken so as to be shorted or to form a discharge gap of 3mm.
2. Care should be taken not to apply strong pulling and bending.
3. When binding agents are used, care should be taken to select those in which the dryness is less than 90°C (194°F) within 15 minutes.
4. Air ventilation holes should be adequate. Lack of air lowers ignition efficiency. Worse still, imperfect combustion produces soot which in turn impairs spark discharge and insulation.
5. External pressure to the sides of the Striking Mechanism should be minimal in order to allow smooth working of the inner metal frame.

Part Number Code

E F I	– A	☐	☐ ☐	☐ ☐
Common Code	A : Striking Mechanism	Dimensions of Element	Order of Design	Suffix

Dimensions of Element:

F	3.7ϕ x 5
G	3.5ϕ x 5
L	3.0ϕ x 5

X TUNERS

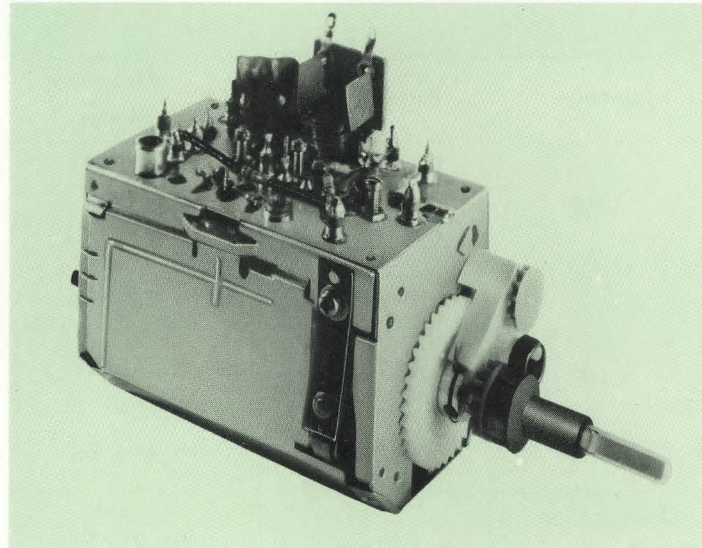
QUICK REFERENCE GUIDE

Function	Part Number	Frequency Range	Video IF	Note	Page
VHF	ENT-6600	ch. 2 – 13	45.75 MHz	Preset Fine Tuning	X-2
	ENT-4680	ch. 2 – 13	45.75 MHz	Miniature Type Preset Fine Tuning	X-4
UHF	ENK-46000E	ch. 14 – 83	45.75 MHz	Single Speed Type	X-6
	ENK-36110	ch. 14 – 83	45.75 MHz	70-Position Detent, Manual Fine Tuning	X-8
	ENK-56000	ch. 14 – 83	45.75 MHz	10-Position Detent, Preset Fine Tuning	X-10
Combination VHF and UHF	ENV-76300E	ch. 2 – 13 ch. 14 – 83	45.75 MHz	Varactor Tuner	X-12
Selection Mechanism	ENN-001	VHF ch. 2 – 13 UHF ch. 14 – 23		VHF: 12 Positions UHF: 8 Positions	X-14
	ENN-1700	VHF ch. 2 – 13 UHF ch. 21 – 69 (CCIR)		7 Positions (Push Button System)	X-16

This chart is intended to serve as a guide only.

New

Solid State
Type ENT-6600



Features

- Low noise and high sensitivity
- Little drift
- Stable against environmental changes
- Excellent durability
- Installed read-out mechanism for channel indication

Application

Frequency Range	Video IF	Devices
Channels 2~13 (USA Standard with UHF IF)	45.75 MHz	TR_1 2SC-683 TR_2 2SC-717 TR_3 2SC-717

Power Supply

	Measuring Condition	Guaranteed Range	Maximum Rating
B^+	11VDC±5%	11VDC±10%	22VDC
AGC	±5% for nominal value	———	3~7VDC
AFC	6VDC±5%	———	6±4VDC

Specifications

Mechanical Specifications

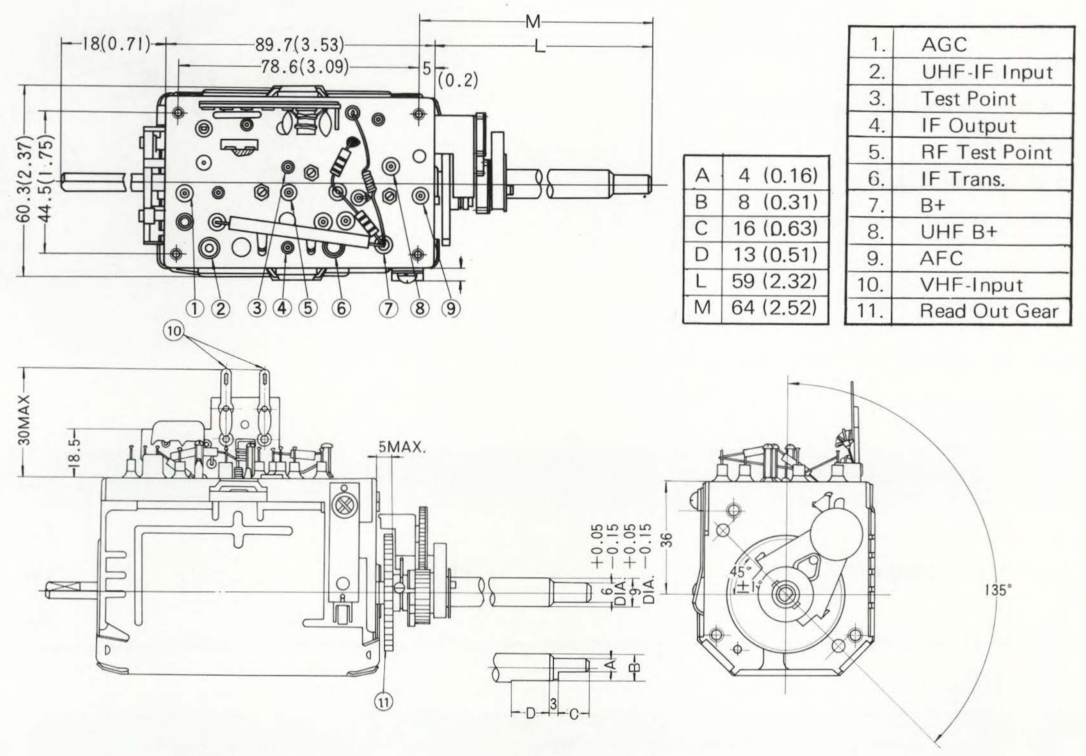
Drum Torque .... 48.6 ~ 90.3 in.-oz.
Fine Tuning Torque .... 11.1 ~ 22.2 in.-oz. max.
Life .... 50,000 cycles min.

Electrical Specifications

Antenna Input .... VHF : 300Ω balanced, UHF-IF : 75Ω unbalanced
VSWR : 4 max.
Noise Figure .... Low channel : 7 dB max., High channel : 9 dB max.
Gain .... VHF : 28 dB min., UHF-IF: 28 dB min.
Oscillator Drift .... Temperature : +100 KHz~ -300 KHz at 25°C
Voltage : ±200 KHz max. at ±10% B^+
Fine Tuning Range .... ±1.5 MHz min., ±7.5 MHz max.
AFC ($\triangle$f/volt.) .... 200 KHz/volt. min.

Dimensions

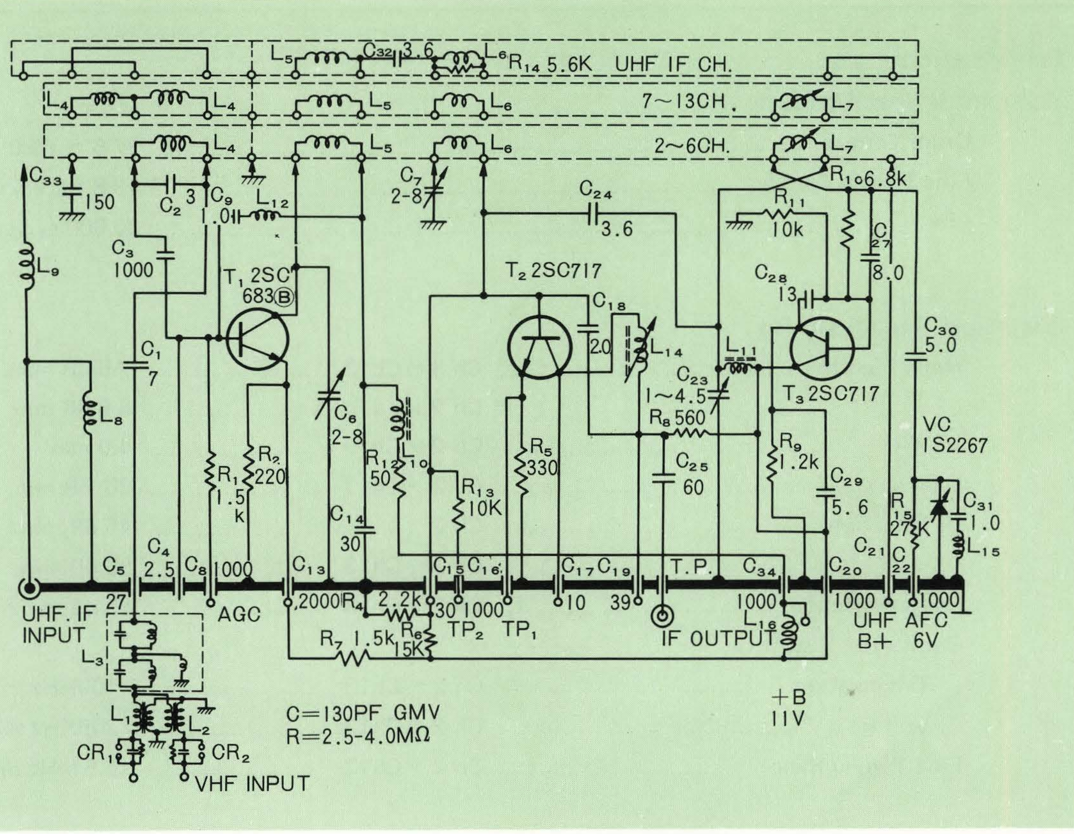
Unit: mm(inch)



A	4 (0.16)	
B	8 (0.31)	
C	16 (0.63)	
D	13 (0.51)	
L	59 (2.32)	
M	64 (2.52)	

1.	AGC
2.	UHF-IF Input
3.	Test Point
4.	IF Output
5.	RF Test Point
6.	IF Trans.
7.	B+
8.	UHF B+
9.	AFC
10.	VHF-Input
11.	Read Out Gear

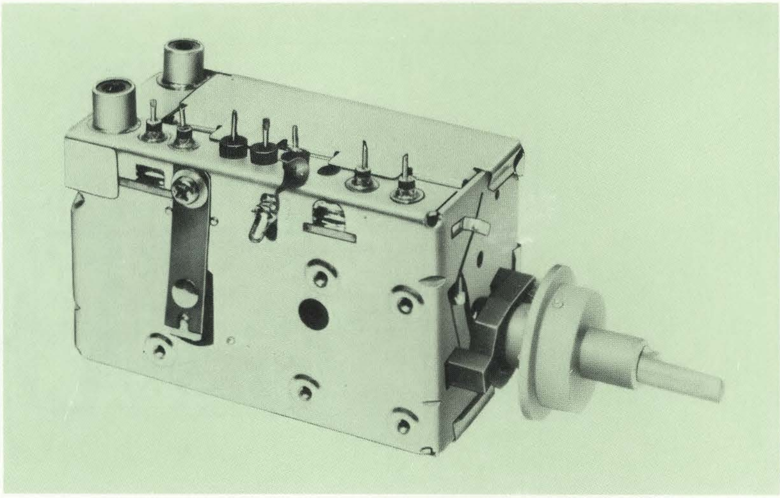
Circuit Diagram



MATSUSHITA ELECTRIC

New

Solid State
Type ENT-4680



Features

- Compact size
- Low noise and high sensitivity
- Little drift
- Excellent durability
- Stable against environmental changes

Application

Frequency Range	Video IF	Devices
Channels 2 ~ 13	45.75 MHz	TR_1 2SC762 TR_2 2SC947 TR_3 2SC1215

Power Supply

	Measuring Condition	Guaranteed Range	Maximum Rating
B+	11VDC ± 5%	11VDC ± 10%	22VDC
AGC	± 5% for nominal value	———	2 ~ 5.5VDC

Specifications

Mechanical Specifications

Drum Torque .... 27.6 ~ 69.0 in.-oz.
Fine Tuning Torque .... 13.8 ~ 27.6 in.-oz.
Life .... 30.000 cycles min.

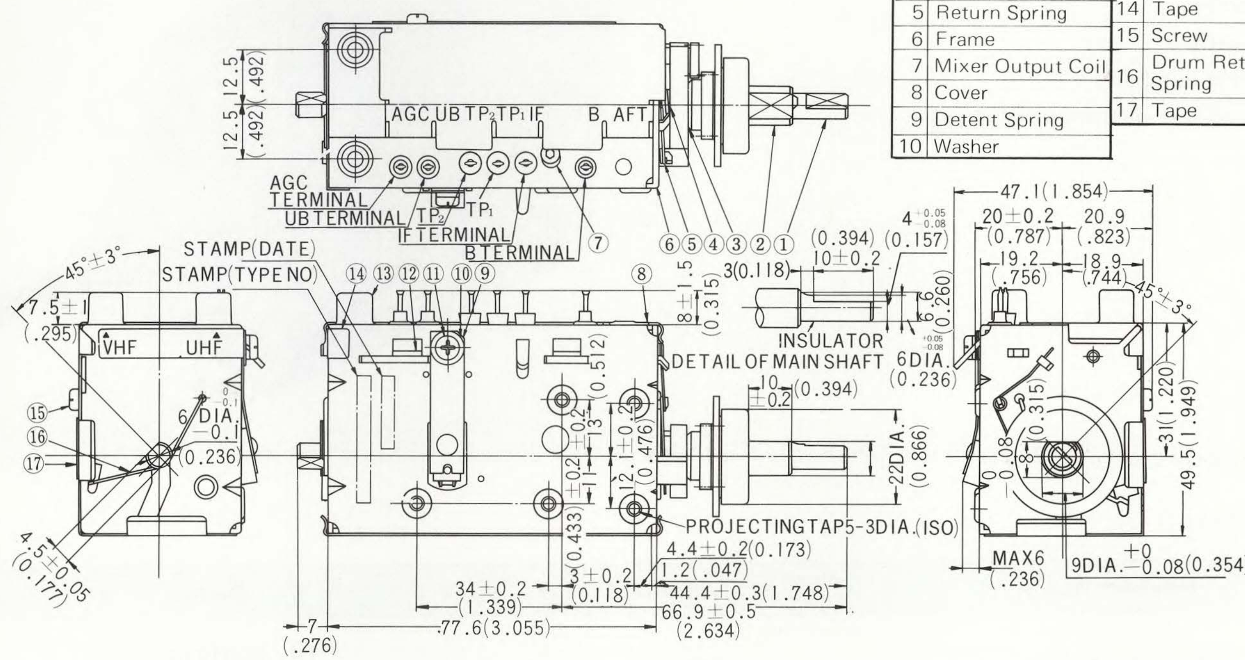
Electrical Specifications

Noise Figure	Ch 3 ~ Ch13	7.5 dB max.
	Ch 2	8.5 dB max.
VSWR	Ch 2 ~ Ch13	4.0 max.
Gain	Ch 2 ~ Ch13	26 dB min.
IF Rejection	Ch 2	45 dB min.
	Ch 3 ~ Ch13	55 dB min.
Image Rejection	Ch 2 ~ Ch13	60 dB min.
Oscillator Stability		
Temperature	Ch 2 ~ Ch13	+100KHz ~ -300KHz at a 25°C rise.
Voltage	Ch 2 ~ Ch13	±200KHz max. at ±10% B+
Fine Tuning Range	Ch 2 ~ Ch13	±1.5 MHz min.

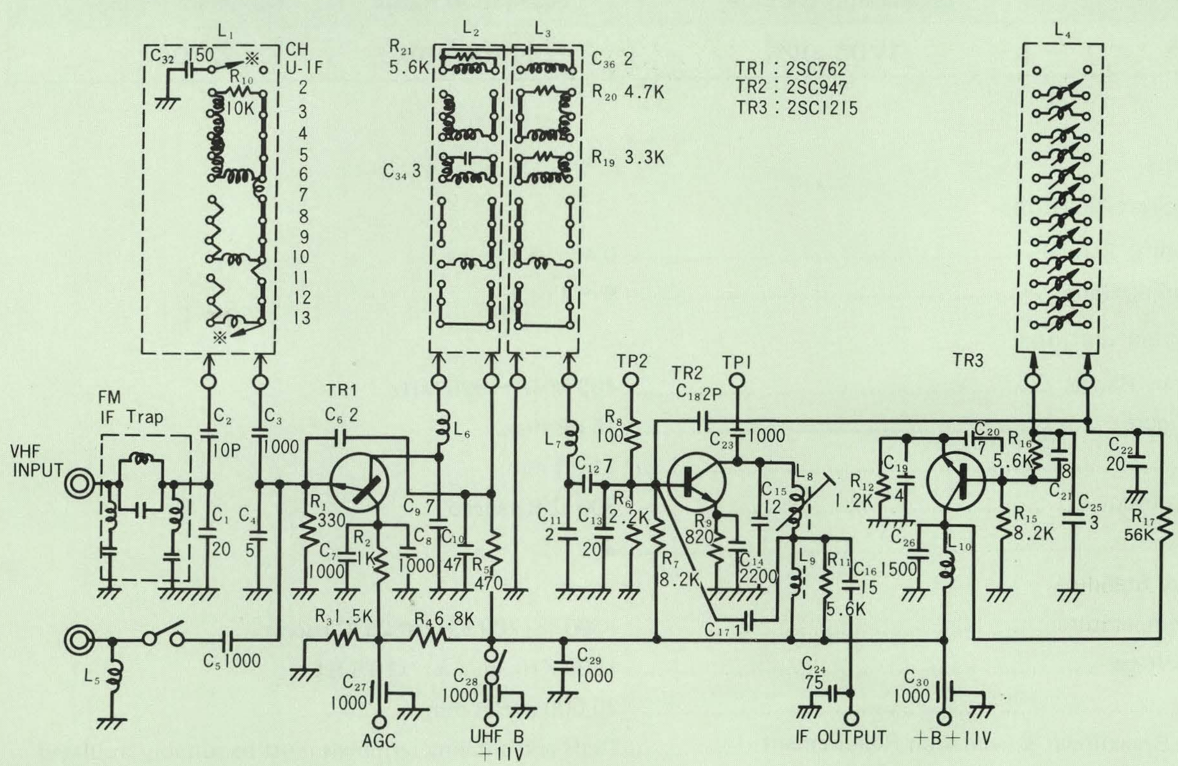
Dimensions

Unit: mm (inch)

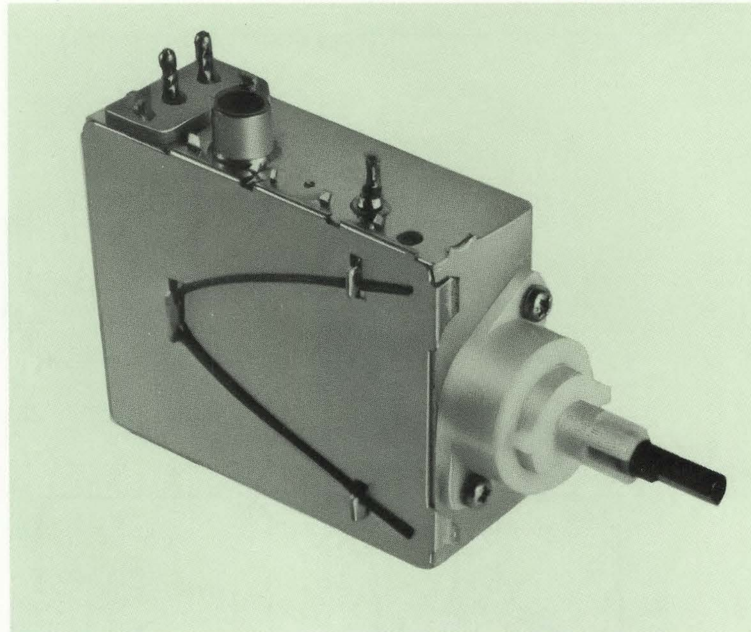
1	Main Shaft	11	Screw
2	Fine Tuning Shaft	12	Chassis Base
3	Slider Ass'y	13	Input (VHF & UHF IF)
4	Coil Spring	14	Tape
5	Return Spring	15	Screw
6	Frame	16	Drum Retaining Spring
7	Mixer Output Coil	16	
8	Cover	17	Tape
9	Detent Spring		
10	Washer		



Circuit Diagram



Solid State UHF Tuners
Type ENK-46000E



Features

- Low noise
- Little drift
- Excellent durability
- Stable against environmental changes

Application

Frequency Range	Video IF	Devices
Channels 14 ~ 83	45.75 MHz	TR_1 2SC1215 D_1 1S1926/1S2198

Power Supply

Terminal	Measuring Condition	Guaranteed Range	Maximum Rating
B^+	11VDC ±10%	11VDC ±10%	22VDC

Specifications

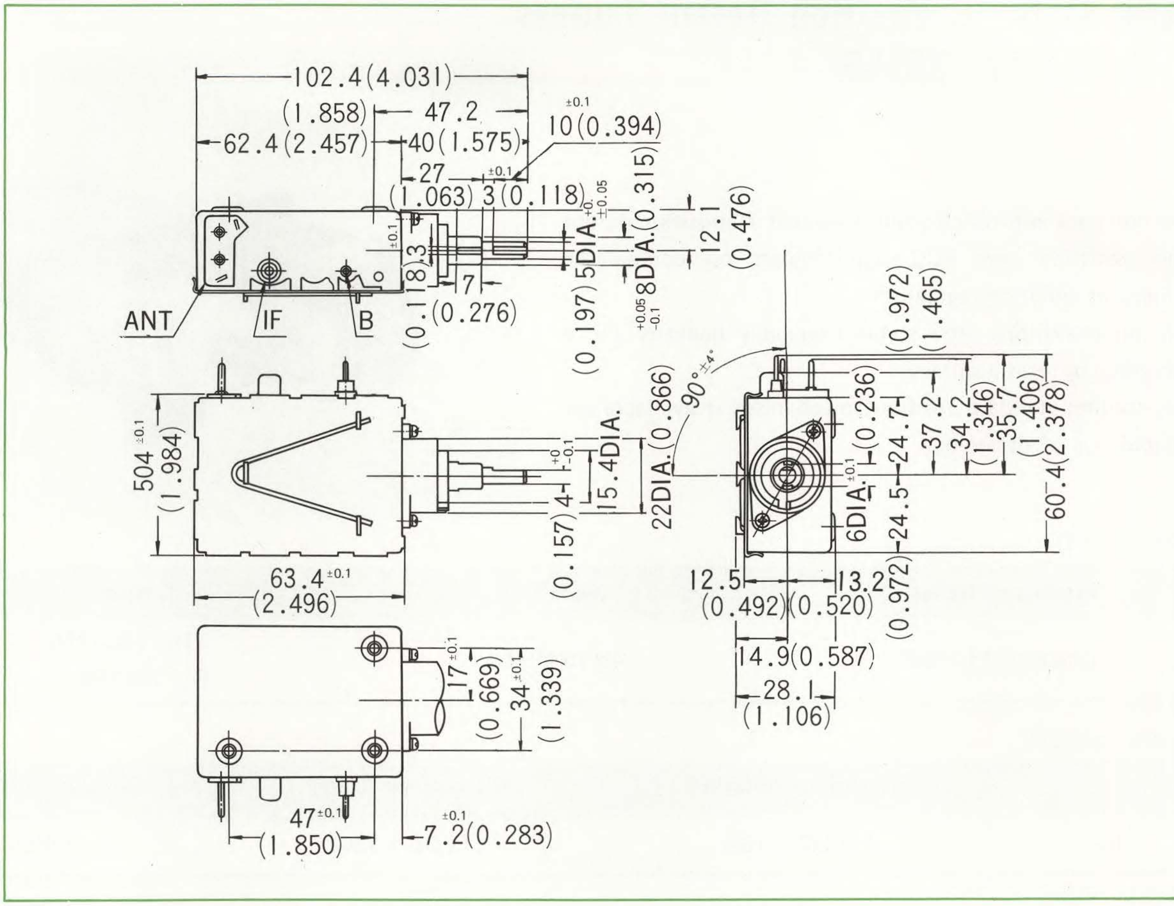
Mechanical Specifications

Fine Tuning Torque .... 0.4 ~ 0.7 in.-oz.
Fine Tuning Ratio .... 9 ~ 11 : 1

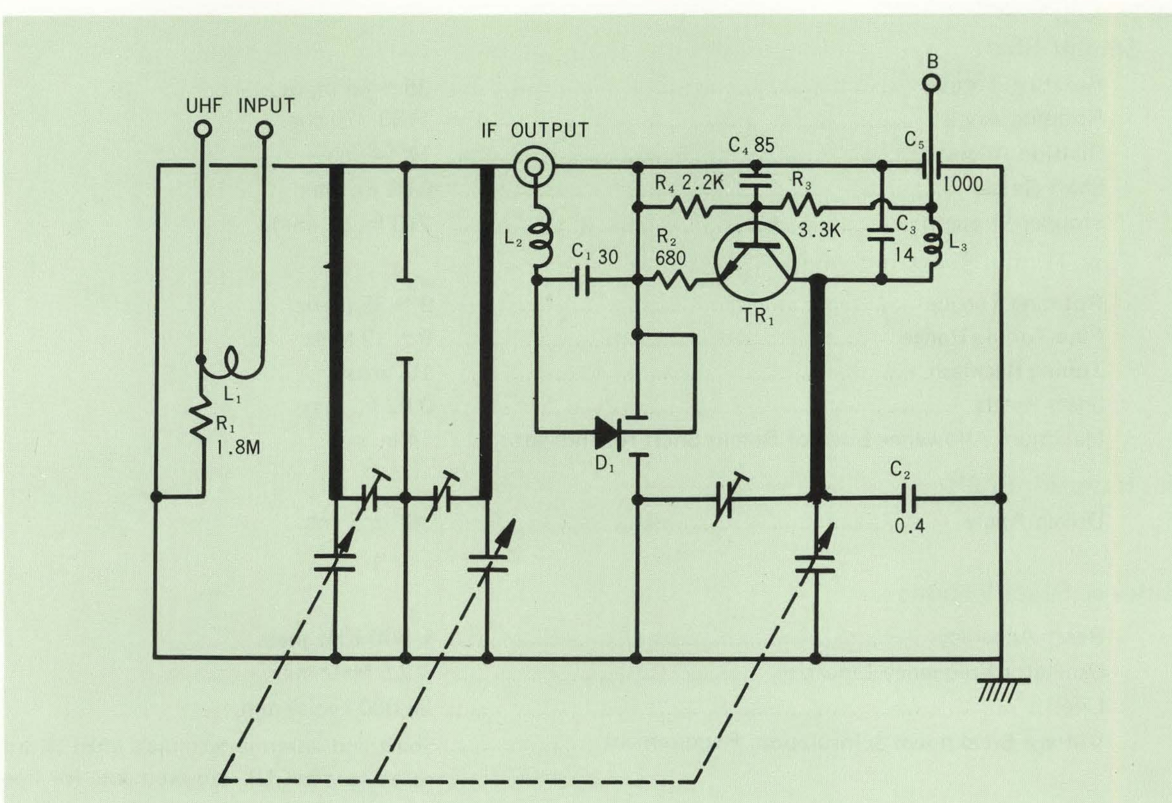
Electrical Specifications

Frequency Range .... 462 MHz ~ 895 MHz
Noise Figure .... 15 dB max.
Gain .... 11 dB min.
Antenna Input .... 300 Ω Balanced
VSWR 3
Oscillator Stability
1) Temperature .... +300 ~ -700 KHz at 25°C rise.
2) Voltage .... ±200 KHz max. at ±10% B±.
Life .... 20,000 cycles min.
Voltage Breakdown & Insulation Requirement .... Shaft and antenna terminals must be suitably insulated so as to meet UL requirements for line-connected TV receivers.

Dimensions

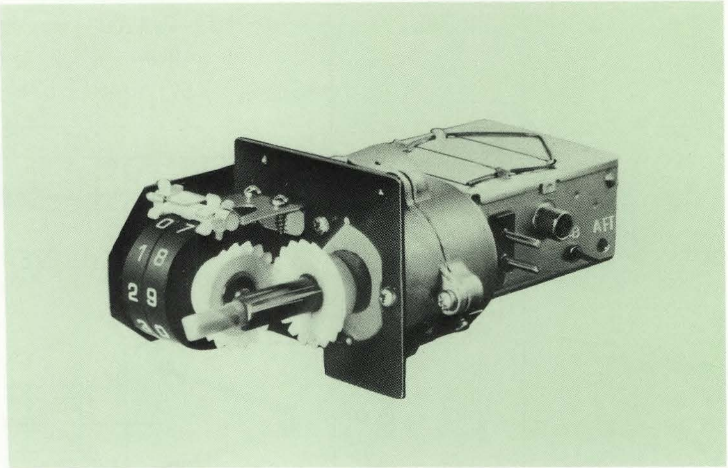


Circuit Diagram



DETENT TUNERS

Solid State 70-Position Detent Tuners
Type ENK 36110



This compact and functionally designed 70-position detent tuner satisfies new FCC requirements on comparable tuning and radiation regulation.
This tuner exhibits ultra stable frequency linearity and a high grade of reset accuracy.
Easy-reading standard read-out mechanism is available for convenience of designing.

Application

Frequency Range	Video IF	Devices
Channels 14 ~ 83	45.75 MHz	TR_1 2SC1215 D_1 1S2198

Power Supply

	Measuring Condition	Guaranteed Range	Maximum Rating
B+	11VDC ± 10%	11VDC ± 10%	22VDC

Specifications
Mechanical Specifications
Detent Shaft

Rotating Torque .... 35 ~ 65 in.-oz.
Rotating Angle .... 1183°/70 chs.
Division Angle .... 17.14°/ch.
Shaft Rattle .... 0.02 in. max.
Stopper Strength .... 210 in.-oz. min.

Fine Tuning Shaft

Rotating Torque .... 9 ~ 35 in.-oz.
Fine Tuning Range .... 8 ~ 12 MHz
Tuning Backlash .... 15° max.
Shaft Rattle .... 0.02 in. max.
Maximum Allowance Load of Detent Shaft for Indicator ..... 14 in.-oz.

Indicator Shaft

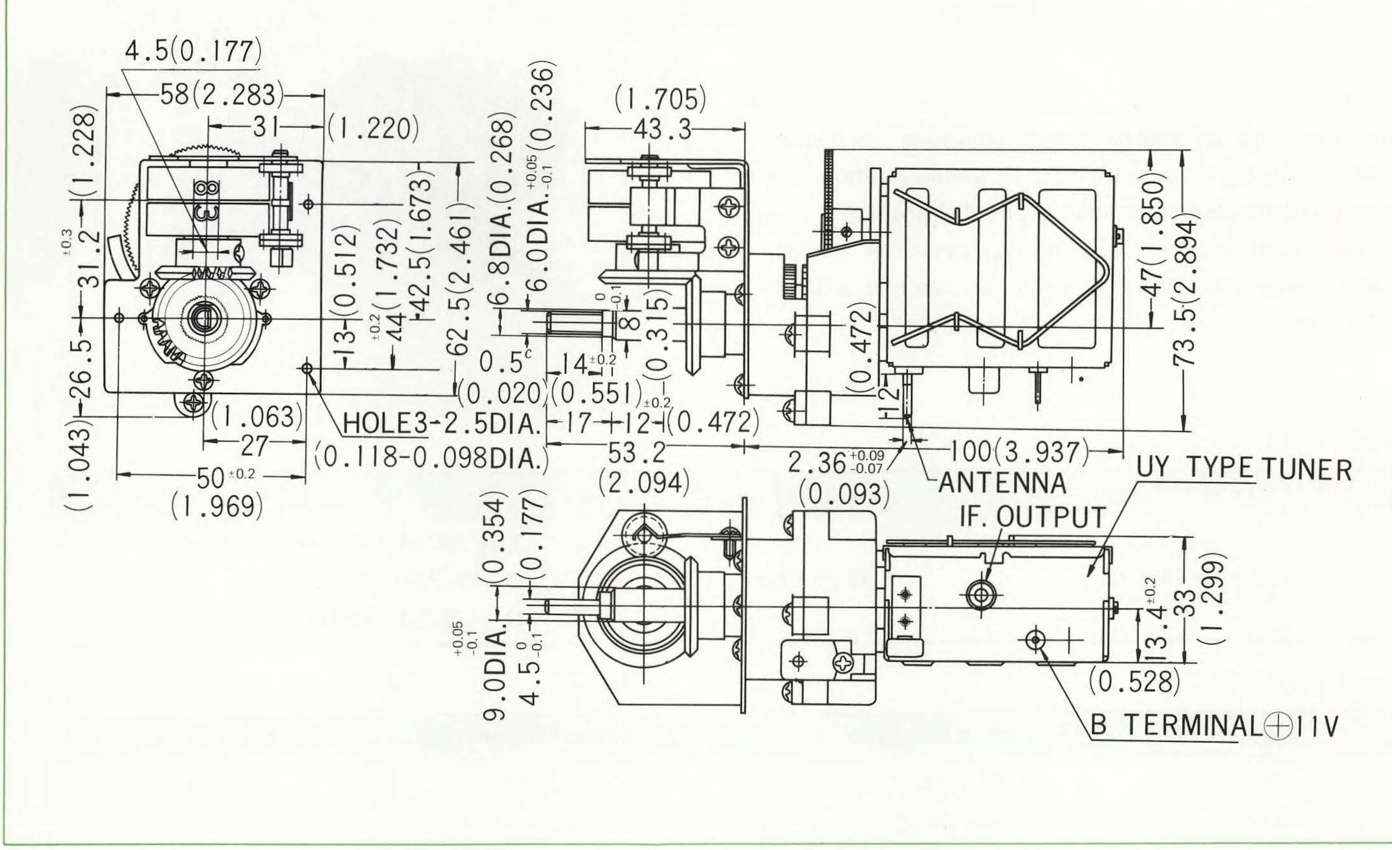
Driven Angle .... 36° ± 3°/ch.

Electrical Specifications

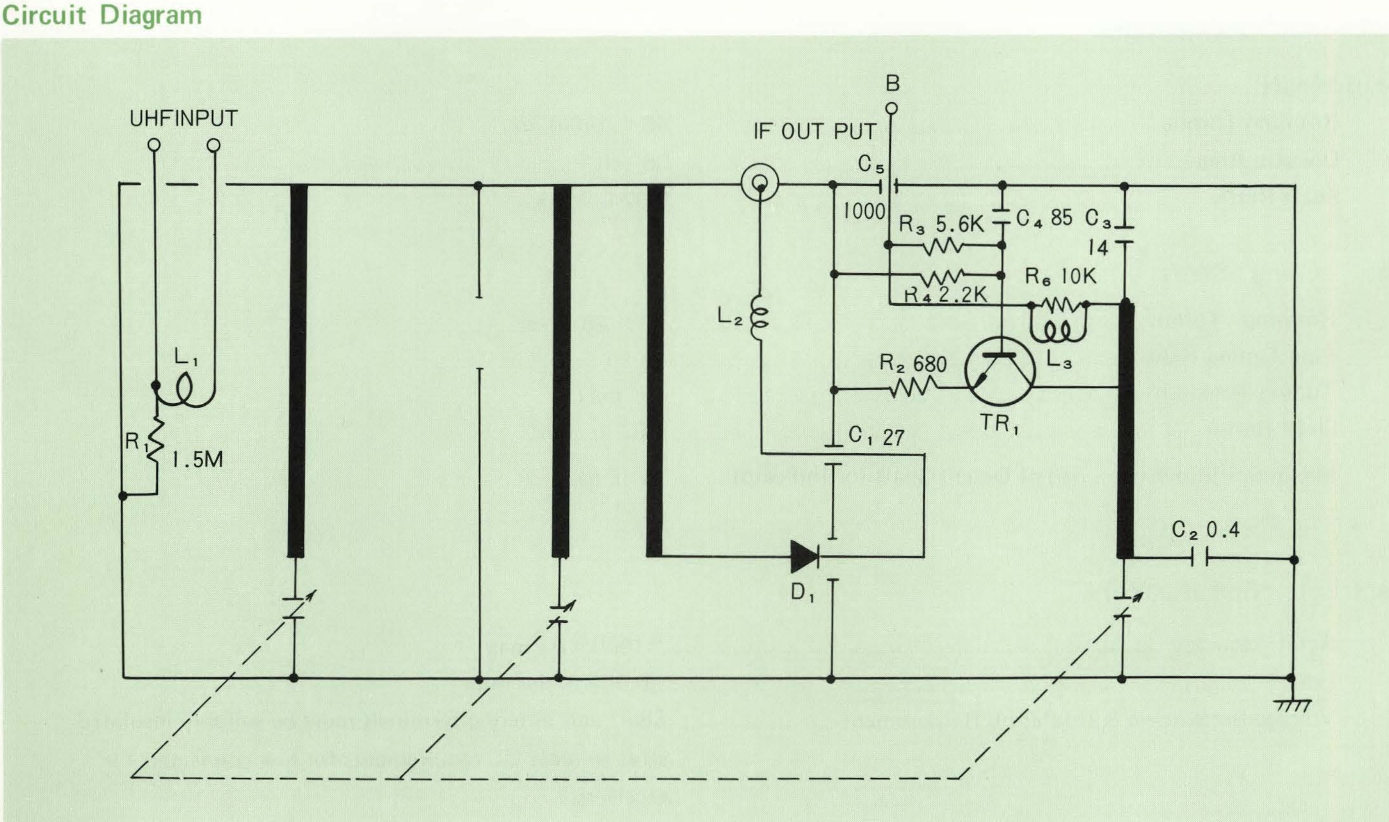
Reset Accuracy .... ± 500 KHz max.
Oscillator Frequency Linearity .... ± 2.5 MHz max.
Life .... 30,000 cycles min.
Voltage Breakdown & Insulation Requirement .... Shaft and antenna terminals must be suitably insulated so as to meet UL requirements for line-connected TV receivers.

Dimensions

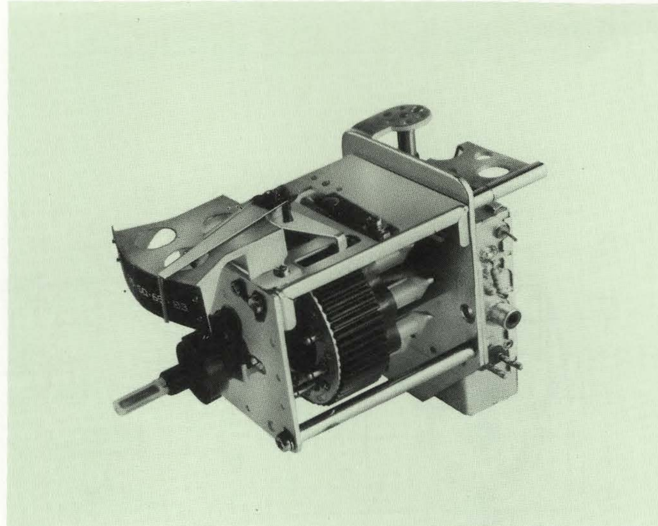
Unit:mm(inch)



Circuit Diagram



Solid State Detent Preset
Type ENK-56000



Features

This tuner has an endless detent presetting mechanism which is capable of presetting to 10 tuning positions for selection of the desired channel at any dial position.
At each position, the presetting rod can cover the all-channel range (70 channels) within the limit of a 0.590 inch-stroke.

Application

Frequency Range	Video IF	Devices
Channels 14 ~ 83	45.75 MHz	TR_1 2SC948/2SC684/2SC1215 D_1 1S1926/1S2198 D_2 1S2268/1S2339/1S2087A

Power Supply

	Measuring Condition	Guaranteed Range	Maximum Rating
B+	11.6V ± 0.6VDC	11.6V ± 0.6VDC	22VDC
AFC	6V ± 4VDC	———	———

Specifications

Mechanical Specifications

Detent Shaft

Rotating Torque .... 40 ~ 140in.-oz.
Division Angle .... 36°/ch.
Shaft Rattle .... 0.02 in. max.

Fine Tuning Shaft

Rotating Torque .... 13 ~ 28 in.-oz
Fine Tuning Ratio .... 45 : 1
Tuning Backlash .... 45° max.
Shaft Rattle .... 0.02 in. max.

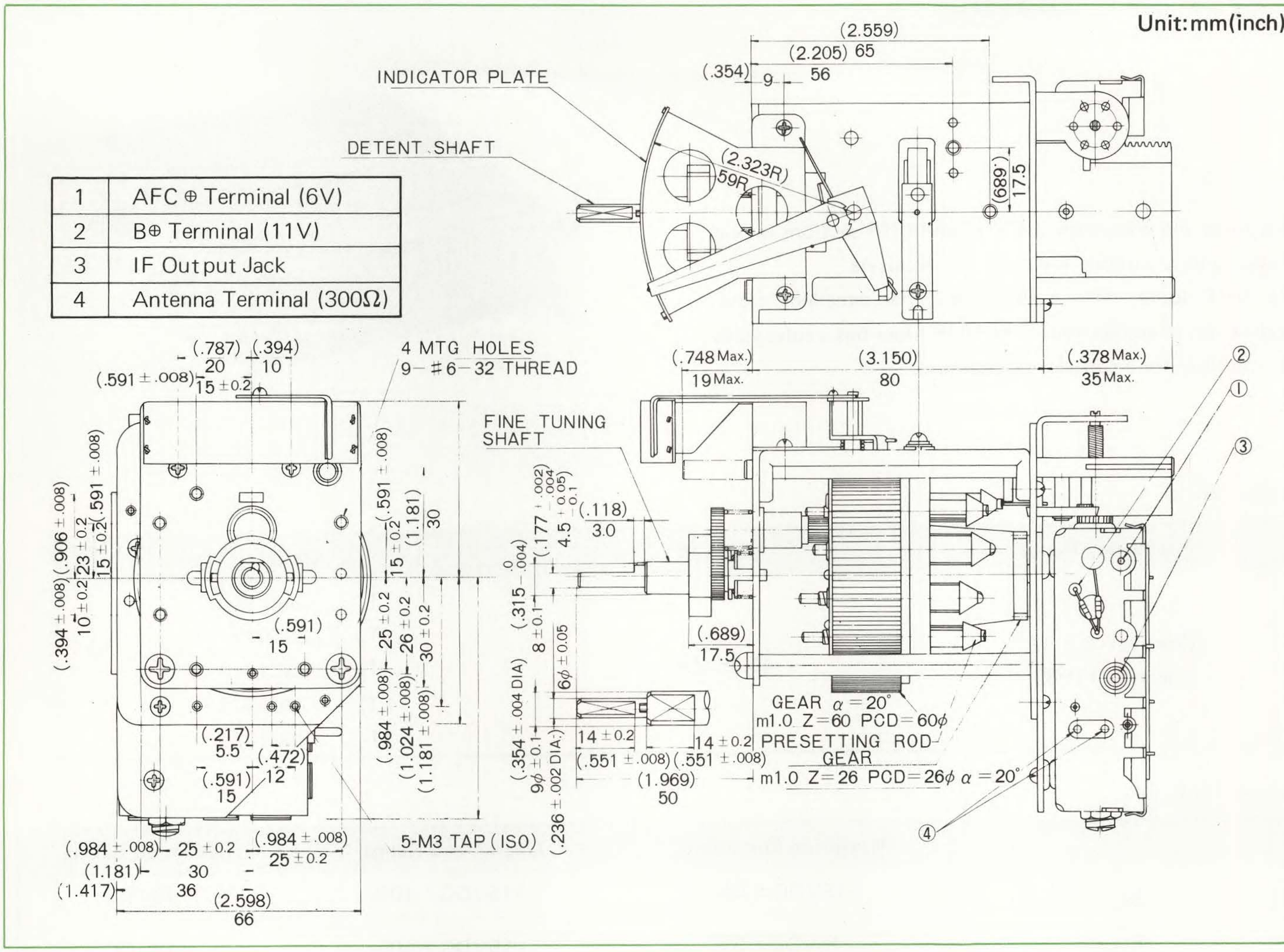
Maximum Allowance Load of Detent Shaft for Indicator .... 14 in.-oz.

Electrical Specifications

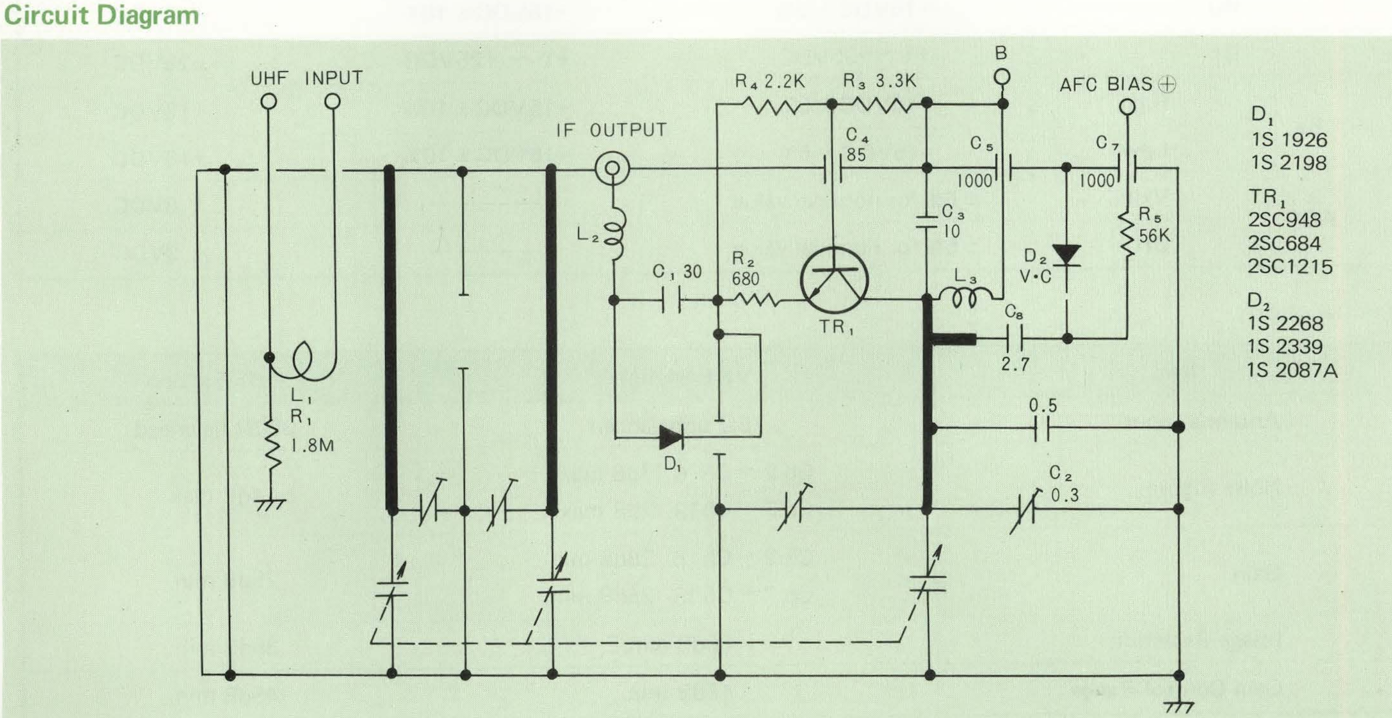
Reset Accuracy .... ±1000 KHz max.
Life .... 30,000 cycles min.
Voltage Breakdown & Insulation Requirement .... Shaft and antenna terminals must be suitably insulated so as to meet UL requirements for line-connected TV receivers.

Dimensions

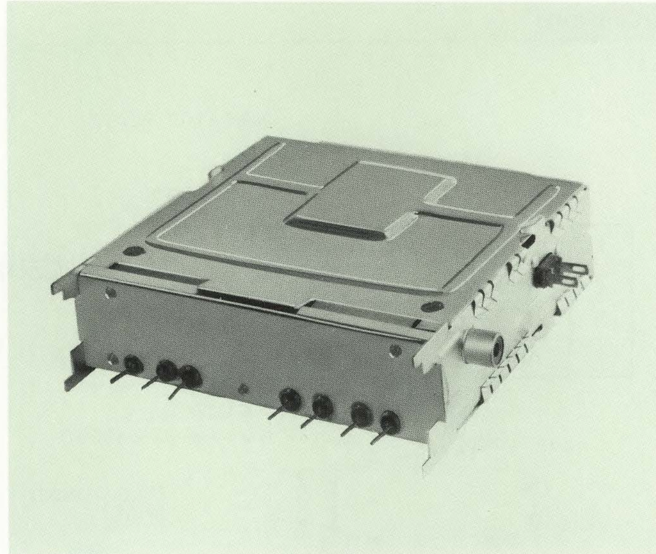
1	AFC ⊕ Terminal (6V)
2	B⊕ Terminal (11V)
3	IF Output Jack
4	Antenna Terminal (300Ω)



Circuit Diagram



New
Varactor Diode Type ENV-76300E



Features

This tuner includes both the VHF and UHF sections in one chassis, and is suitable for color TV receivers.
The VHF tuner, with a MOS FET, has excellent cross-modulation characteristics. The UHF tuner has a solid-state RF amplifier for a superior noise figure.

Application

Frequency Range	Video IF	Devices
Channels 2 ~ 13 Channels 14~83	45.75 MHz	T_1 3SK39 E T_2, T_3, T_4 2SC947 T_5 2SC1070 T_6 2SC1215 T_7 2SC1070

Power Supply

		Measuring Condition	Guaranteed Range	Maximum Rating
B_V		+15VDC ± 5%	+15VDC ± 10%	+18VDC
B_M		+15VDC ± 5%	+15VDC ± 10%	+18VDC
B_U		+15VDC ± 5%	+15VDC ± 10%	+18VDC
B_T		+1 ~ +25VDC	+1 ~ +25VDC	+28VDC
Bs	High	+15VDC ± 5%	+15VDC ± 10%	+18VDC
	Low	−15VDC ± 5%	−15VDC ± 10%	+18VDC
AGC	VHF	± 5% for nominal value	————	± 8VDC
	UHF	± 5% for nominal value	————	+ 9VDC

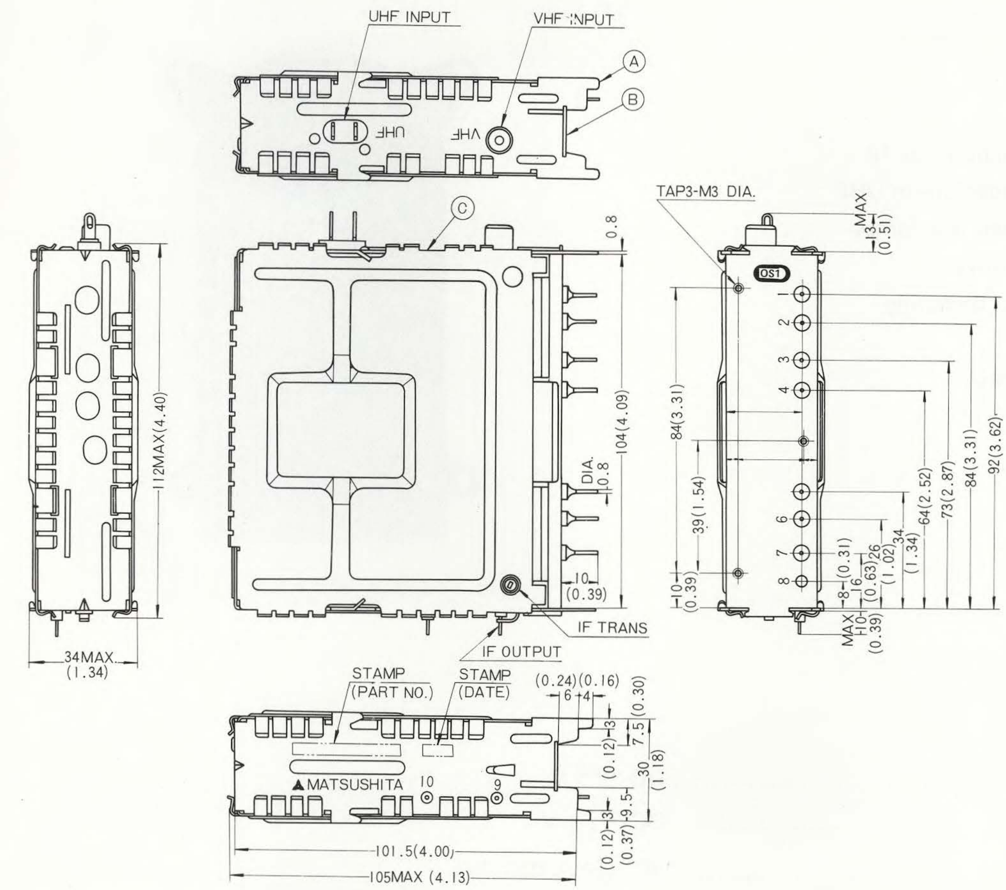
Specifications

Item	VHF Section	UHF Section
Antenna Input	75Ω unbalanced	300Ω balanced
Noise Figure	Ch 2 ~ Ch 6 7dB max. Ch 7 ~ Ch13 7dB max.	14dB max.
Gain	Ch 2 ~ Ch 6 28dB min. Ch 7 ~ Ch13 25dB min.	25dB min.
Image Rejection	50dB min.	35dB min.
Gain Control Range	45dB min.	45dB min.

NEW

Dimensions

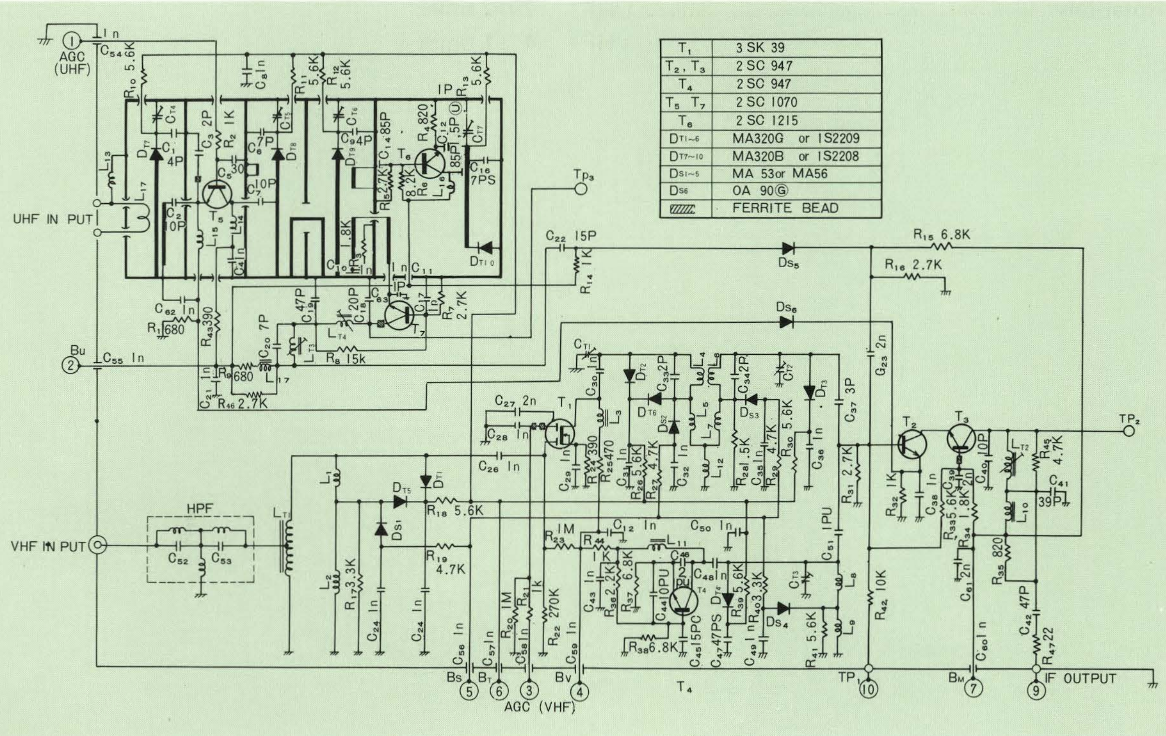
Unit:mm(inch)



SYMBOL	DESCRIPTION
A	FRAME
B	TERMINAL PLATE
C	COVER

NO.	TERMINAL NAME
1	AGC (UHF)
2	BU
3	AGC (VHF)
4	B_V
5	B_S
6	B_T
7	BM
8	—
9	IF OUT PUT
10	TP_1

Circuit Diagram

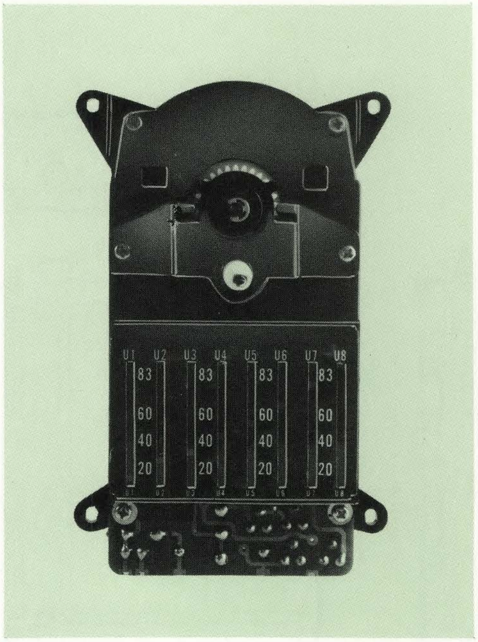


T_1	3 SK 39
T_2, T_3	2 SC 947
T_4	2 SC 947
T_5 T_7	2 SC 1070
T_6	2 SC 1215
D_{T1-6}	MA320G or 1S2209
D_{T7-10}	MA320B or 1S2208
D_{S1-5}	MA 53or MA56
D_{S6}	OA 90Ⓖ
(hatched)	FERRITE BEAD

MATSUSHITA ELECTRIC

New

Selection Mechanism Type ENN-001



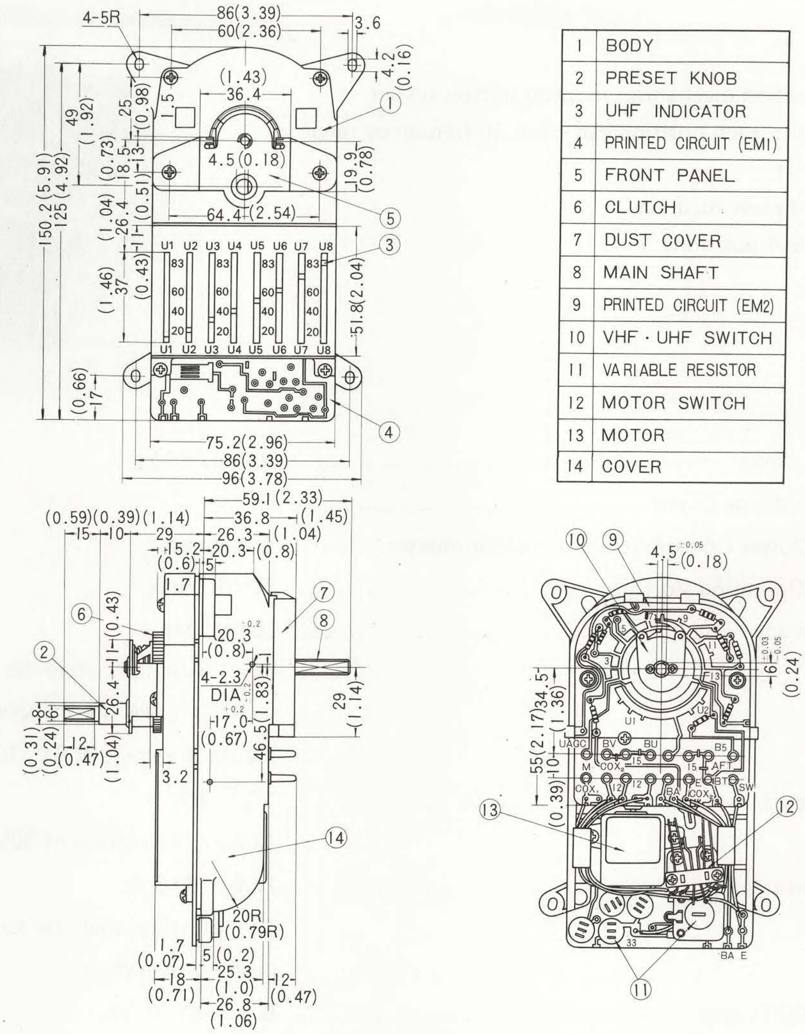
Features

- Presetting selection mechanism for 12 positions in VHF and 8 positions in UHF
- Selection of preset channels is accomplished by means of motor drive.
- Channel selection without switching VHF and UHF
- Available for remote control
- Excellent reset accuracy
- Unique design

Specifications

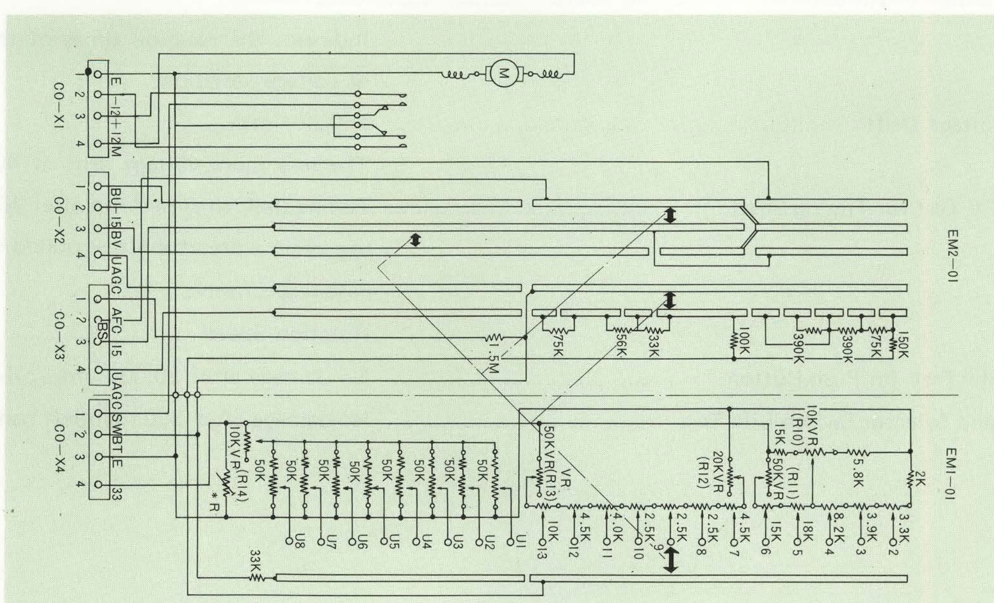
Rated Power Voltage	DC $32^{\pm 2}$ V
Rated Motor Voltage	DC $7^{+1}_{-1.5}$ V
Rated Motor Current	45^{+50}_{-10} mA (DC 7V)
Reset Accuracy	UHF ±4mV (equivalent to ±100KHz) VHF ±18mV (equivalent to ±100KHz)
Preset Shaft Rotating Torque	16.6 ~ 27.6 in.-oz.
Preset Shaft Rotations	UHF: 20±2 times VHF: 4 ±1 times

Dimensions



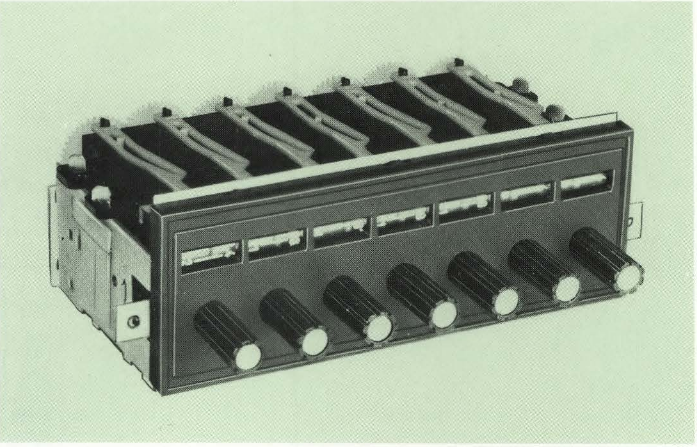
1	BODY
2	PRESET KNOB
3	UHF INDICATOR
4	PRINTED CIRCUIT (EM1)
5	FRONT PANEL
6	CLUTCH
7	DUST COVER
8	MAIN SHAFT
9	PRINTED CIRCUIT (EM2)
10	VHF · UHF SWITCH
11	VARIABLE RESISTOR
12	MOTOR SWITCH
13	MOTOR
14	COVER

Circuit Diagram



New

Selection Mechanism Type ENN-1700



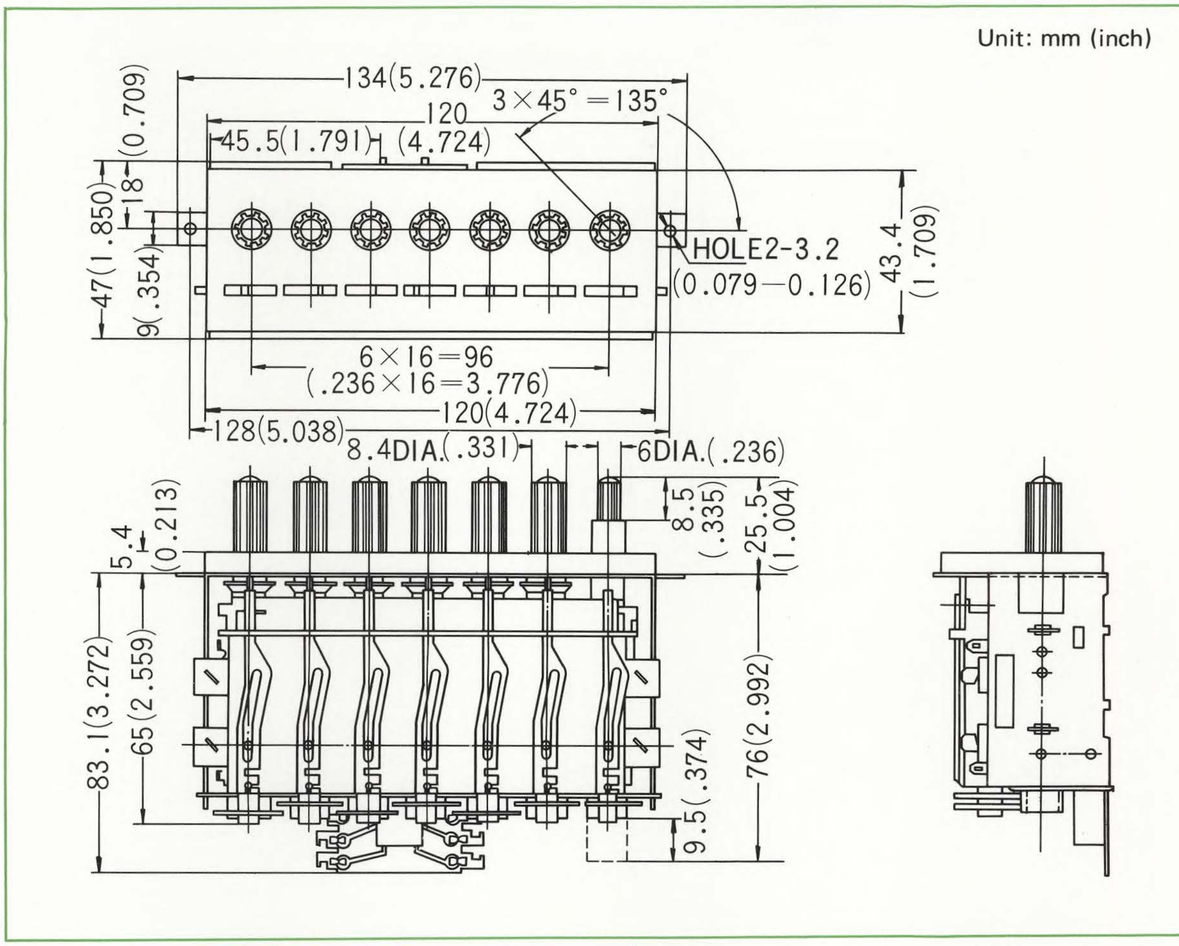
Features

- New selection mechanism in push-button system
- 7 positions, each position can cover all frequency range
- Little drift
- Excellent reset accuracy
- Available 4 positions

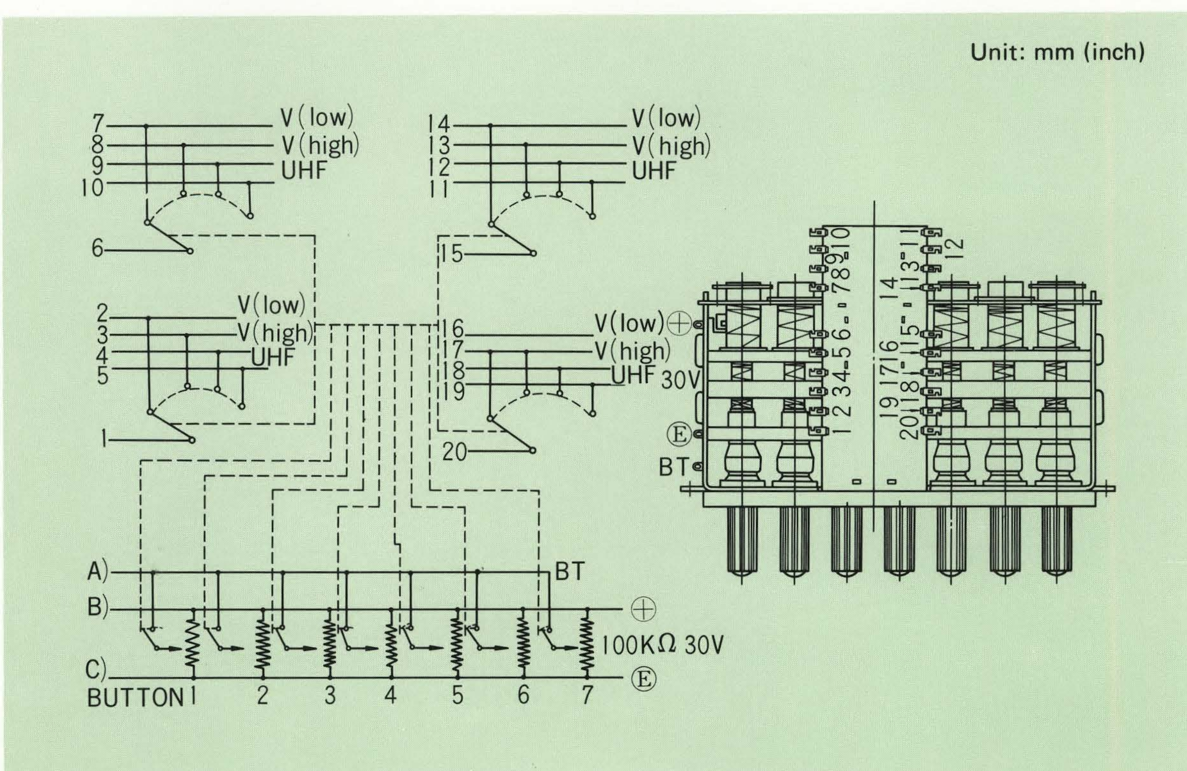
Specifications

Resistance Value	100KΩ ±30%
Change of Voltage Curve	Linear
Maximum Power Consumption for Potentiometer	50mW max.
Maximum Operating Voltage	32VDC max.
Reset Accuracy	20mV max. Reset Accuracy shall be measured with a supply voltage of 30V, at each 10 times on-off operation of each push button as to each of the 3 output voltage of 5V, 10V and 20V.
Voltage Range	1.2 ~ 26V At a supply voltage of 30V
Push Pressure	17.6 ~ 63.5 oz. The pressure shall be large enough to lock the push button at each pushing operation.
Fine Tuning Torque	0.7 ~ 4.1 in.-oz.
Band Selector Switch Rotating Torque	1.4 ~ 11.0 in.-oz.
Number of Rotation of Fine Tuning Shaft	46±3 times Indicates the rotation times of the fine tuning shaft within the range of voltage variation.
Voltage Drift	±50 mV max. The maximum voltage drift at 40°C rise.
Life Test for Tuning Shaft	Tuning shaft shall perform after 200 cycles slide. In a cycle, a preset shaft is rotated 46 times clockwise and counterclock-wise respectively. Rotation Speed .... 40 ~ 50 times per minute
Life Test for Push Button	No damage after 20,000 times on-off operation as to each push button.
Band Selector Switch Life Test	No damage after 300 right-left band switching operation.

Dimensions



Circuit Diagram



XI SWITCHES AND PRINTED WIRING BOARD

QUICK REFERENCE GUIDE

Switches

	Classification	Type	No. of Poles	Throw or Position	Rating (AC)	Remarks	Page
Power Switches	Push Button	ESB-70	1 ~ 2	1 ~ 2	TV-3 3A250V 3(3)A250V	UL Listed, CSA Pending UL Listed SEMKO Microgap–Switches Class I Listed	XI–5
		ESB-1150	2	1 ~ 2	3A125V	UL·CSA (TV-3) Listed	XI–6
		ESB-1134, 1137	1	1 ~ 2	3A125V 6A125V	UL Listed (except TV-Rating)	XI–7
		ESB-1130, 1133	2	1 ~ 2	3A125V 6A125V	UL Listed (except TV-Rating)	XI–8
		ESB-1140	1 ~ 2	1 ~ 2	2A250V		XI–9
	Rocker	EST-15	1 ~ 2	1 ~ 2	TV-3 3A250V 3(3)A250V	UL Listed, CSA Pending UL Listed SEMKO Microgap–Switches Class I Listed	XI–10
		EST-1060	1	1 ~ 2	3A125V	UL·CSA(TV-3) Listed	11
		EST-1030	1	1 ~ 2	3A125V 1.5A125V	UL Listed (except TV-Rating)	12
		EST-1017	2	1 ~ 2	3A125V 1.5A125V	UL Listed (except TV-Rating)	
	Slide	ESD-39	1 ~ 2	1 ~ 2	TV-3 3A250V 3(3)A250V 4A250V	UL Listed, CSA Pending UL Listed SEMKO Microgap–Switches Class I Listed SEMKO Microgap–Switches for TV use	XI–13
		ESD-27	1 ~ 2	2	3A125V 1.5A250V	UL Listed (except TV-Rating)	XI–14
		ESD-28D	2	3	3A125V 1.5A250V	UL Listed (except TV-Rating)	
	Lever	ESL-21	1 ~ 2	1 ~ 2	TV-3 3A250V 3(3)A250V	UL Listed, CSA Pending UL Listed SEMKO Microgap–Switches Class I Listed	XI–15
	Rotary	ESE-25	1 ~ 2	1 ~ 2	6A125V	UL Listed (except TV-Rating)	XI–16~ XI–17
Signal & Function Switches	Push Button	ESB-71	2	2			XI–18 ~ XI–19
		ESB-72	4	2			
		ESB-73	6	2			
		ESB-74	8	2			
	Rocker	EST-121	2	2			XI–20
	Slide	ESD-44	4	2		For PWB Mounting	XI–21
		ESD-45	6	2			
		ESD-46	6	2		For PWB Mounting	
		ESD-47	6	2			
		ESD-123	6, 9, 12	2		For PWB Mounting	XI–22
	Lever	ESL-19	1 ~ 4	3			XI–23
	Rotary	ESR-E	1 ~ 18	2~7, 12		Miniature Size	XI–25~ XI–27
						Miniature Size for PWB	XI–28
		ESR-C	1 ~ 18	2~7, 11		Common Size	XI–29

General Information

Switch Terminology

Circuitry

S.P.S.T. (Single-Pole, Single-Throw): A two-terminal switch which either opens or closes one circuit. Circuit may be N.O. (Normally Open) or N.C. (Normally Closed)

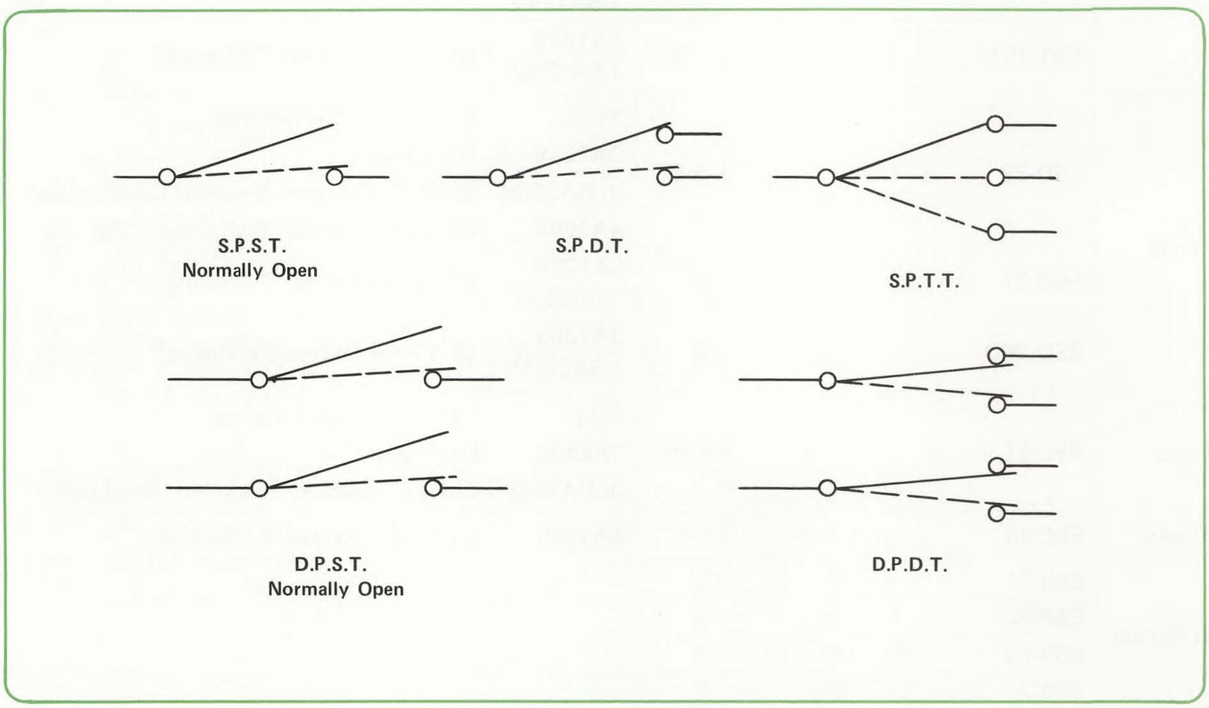
N.O. Type — Circuit is open when the switch is not operated. Actuator closes the circuit.

N.C. Type — Circuit is closed when the switch is not operated. Actuator opens the circuit.

S.P.D.T. (Single-Pole, Double-Throw): A three-terminal switch which connects a circuit to either one of two alternate connections

D.P.S.T. (Double-Pole, Single-Throw): A four-terminal switch which opens or closes two separate circuits simultaneously

D.P.D.T. (Double-Pole, Double-Throw): A six-terminal switch which connects one pair of terminals to either of two other pair of terminals



Switching Mode

Shorting: "Make-before-break" circuit. A moving switch contact establishes a new circuit before disrupting the old one.

Non-shorting: "Break-before-Make" circuit. A moving switch contact disrupts the old circuit before establishing a new one.

Mechanical Functions

Non-Lock: In this type of operation the button remains in only as long as it is pressed, and it returns to its original position as soon as the pressure is released. The switching function is maintained by pressure on the button.

Push-Push: In this type of operation the button remains in when pressed and must be pressed again to return it to its original position. The switching function continues as long as the button is engaged.

Interlock: In this type of operation, when any button of the interlocking group is pressed, it automatically disengages the function of any other button in the group.

Others

Section: Same as "station". A location for an individual switch in a larger assembly of switches.

P.W.B.: Printed Wiring Board or Printed Circuit Board (P.C.B.)

C.C.W.: Counterclockwise rotary position

Note for Usage

- Don't use power switches for low current operation (10mA max.). When this is done, it may cause a faulty contact due to not being able to break down the film on the surface of the contact.
- Care should be taken with the temperature and time for soldering.
  Temp.; 240°C max. Time; 3 sec. max.
- Solder at terminals and lugs of the frame avoiding the top and the side.
- Care should be taken with regard to inrush current when using power swithces.

Part Number Code

Switches execpt Rotary Switch

E S	D	4 6	1	B
Common Code	Classification	Type	Serial No.	Special Parts

Classification:

B	Push
D	Slide
T	Rocker
L	Lever
E	Special

Type: Design No. by 2 digits.

Rotary Switch

E S R	E	3	9	4	K	2 0	Z	
Common Code	Shape	No. of Section	No. of Circuit	No. of Position	Shaft Shape	Shaft Length	Serial No.	Special Parts

Shape — Symbol of Shape:

C··· 32 mm (1.260") Mounting Pitch
E··· 21 mm (0.827") Mounting Pitch

No. of Circuit — But. 2-digit numbers as follows:

10	A
11	B
12	C
⋮	⋮
18	I

Shaft Shape:

F	Flat
R	Round
S	Slotted
L	22 teeth knurl & slot
K	18 teeth knurl & slot

No. of Position — But. 2-digit numbers as follows:

10	A
11	B
12	C
⋮	⋮
27	R

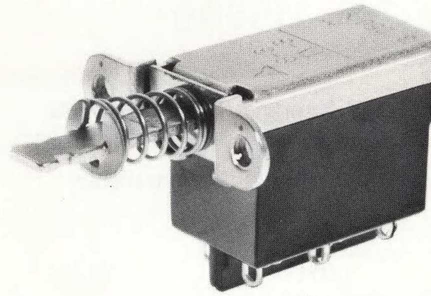
Shaft Length — Length from mounting plane to shaft end.

POWER SWITCHES

Universal Rating Push Button Swithes

ESB-70

- Conform to the world main safety standards:
  UL: TV-3, 3A250VAC Listed (File No. E36636)
  CSA: TV-3 Pending
  SEMKO (CEE): 3 (3)A 250VAC Microgap-Switches
  Class I Listed
  VDE: 3A250VAC pending
- Hermetically sealed. Free from troubles caused by arc leakage or dust.
- Compact and improved click action.



ESB-70

- Circuitry

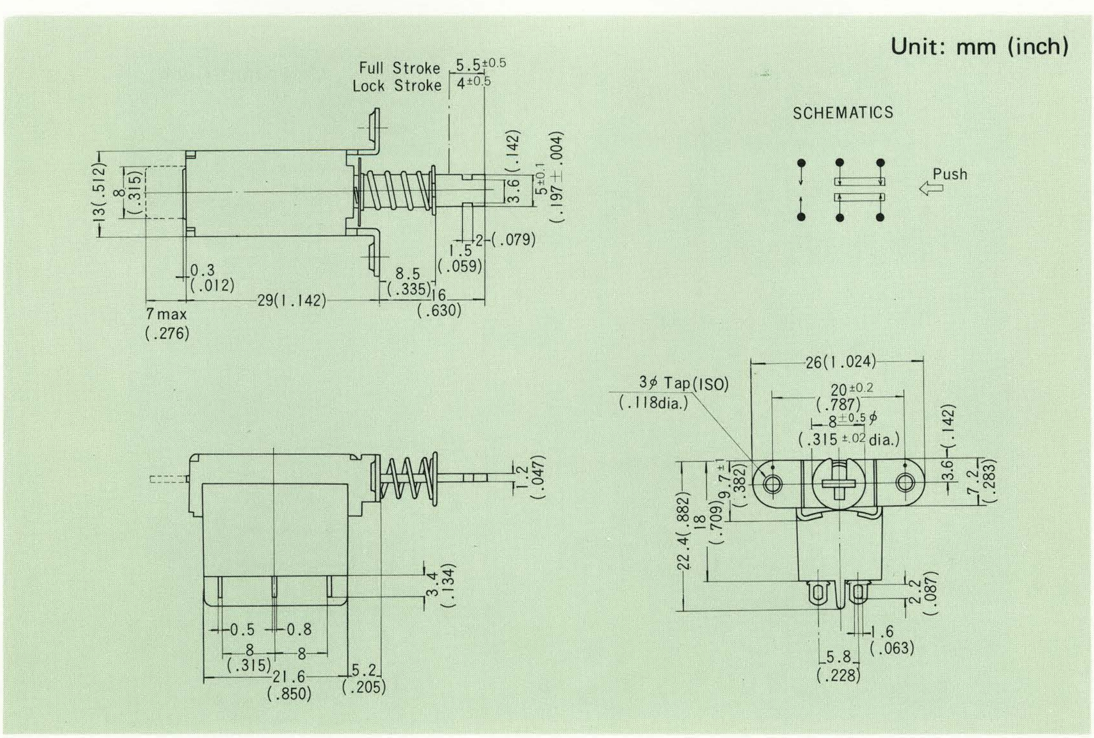
	DPDT	DPST	SPDT	SPST
Part No.	ESB701T	ESB702T	ESB703T	ESB704T

Specifications

Mechanical Characteristics	Stroke	Lock: 4.0 ± 0.5mm (.157 ± .020″) Full: 5.5 ± 0.5mm (.217 ± .020″)
	Operating Force	600g to 1,200g (21.2oz to 42.4oz)
Electrical Characteristics	Contact Resistance	50mΩ max. at 1A 5VDC (initial value)
	Dielectric Strength	Terminal-terminal: 2,000 VAC Terminal-frame: 4,000 VAC (50 or 60Hz for 1 minute)
	Insulation Resistance	100MΩ min. at 500VDC (initial value)
	Insulation Clearance	Terminal-terminal: 4mm (.157″) min. Terminal-frame: 4mm (.157″) min. Contact-contact: 1.5mm (.059″) min.

Electrical Characteristics	Humidity	1 hour after being subjected to 40° ± 2°C, 90 - 95% RH for 96 hrs; Dielectric Strength: as shown above Insulation Resistance: 10MΩ min. at 500VDC
	Rating	TV-3(UL, CSA), 3A 250V AC (UL) 3(3)A 250VAC (SEMKO)
	Life	TV-3: 25,000 cycles (TV-3 load test in accordance with UL20) 3A 250V AC: 50,000 cycles (resistance load or inductive load)

Dimensions



UL·CSA (TV-3) Rating Push Button Switches
ESB-1150DS, 1150DD

- UL Listed: TV-3 Rating (File No.E36636)
  CSA Listed: TV-3 Rating (File No.LR29638)
- Lock type and non-lock type are available.
- Circuitry

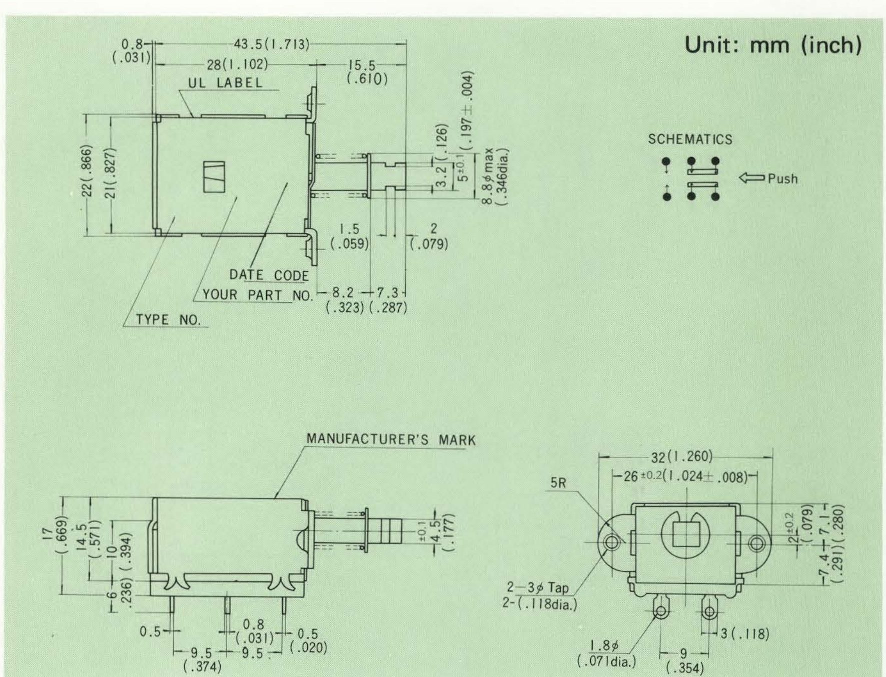
DPST	DPDT
ESB-1150DST	ESB-1150 DDT

ESB-1150

Specifications

Mechanical Characteristics	Shaft Strength	To withstand 5kg push applied along the shaft for 1 minute.	Life	Be satisfied all requirements in the standard of TV-3 Rating of UL 20 and 492 issued April 2, April 3, 1970. **(Reference)** Overload Test: Steady state currents 4.5amp (rms), minimum inrush currents 71 amp (peak) with tungsten-filament-lamp load for 50 cycles. Endurance Test: Steady state currents 3 amp (rms), minimum inrush currents 51 amp (peak) for 10,000 cycles. Temperature Rise: 30°C max. at 3 amp. Withstanding Voltage: 900VAC (60 Hz) for 1 minute. Continued Endurance Test: With the same conditions, for 15,000 cycles additional test, capable of making and breaking and the same withstanding voltage check.
	Stroke	Lock: 4±0.5 mm (.157±.020") Full: $5.5^{+1}_{-0.5}$ mm ($.217^{+.040"}_{-.020"}$)		
	Operating Force	600g to 1300g (21.2 oz to 45.9 oz)		
Electrical Characteristics	Contact Resistance	After several times no-load operations: 25mΩ max. at 1A DC		
	Insulation Resistance	500MΩ min. at 500VDC		
	Humidity	30 minutes after being subjected to 40°±2°C; 90~95% RH for 48 hrs.; Withstanding Voltage: 1,000VAC for 1 minute Insulation Res.: 10MΩ min. at 500VDC		

Dimensions

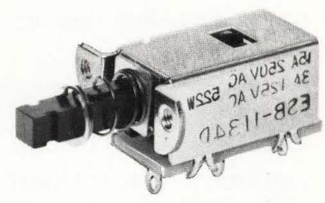


UL Listed Single Pole Push Button Switches
ESB-1137, 1134

- UL Listed: UL20-1967 (File No.E36636)
- Circuitry

SPDT	SPST
ESB-1137DU	ESB-1137SU
ESB-1134DU	ESB-1134SU

ESB-1137



ESB-1134

Specifications

Mechanical Characteristics	Shaft Strength	To withstand 5kg push applied along the lever.
	Stroke	Lock: 4.0±0.5mm (0.157±0.020") Full: 5.5±0.5mm (0.217±0.020")
	Operating Force	1,000g (35.3 oz) max.
	Terminals	To withstand 500g (17.7 oz) pull applied to the end of terminals in any direction
	Switch Timing	Break before make

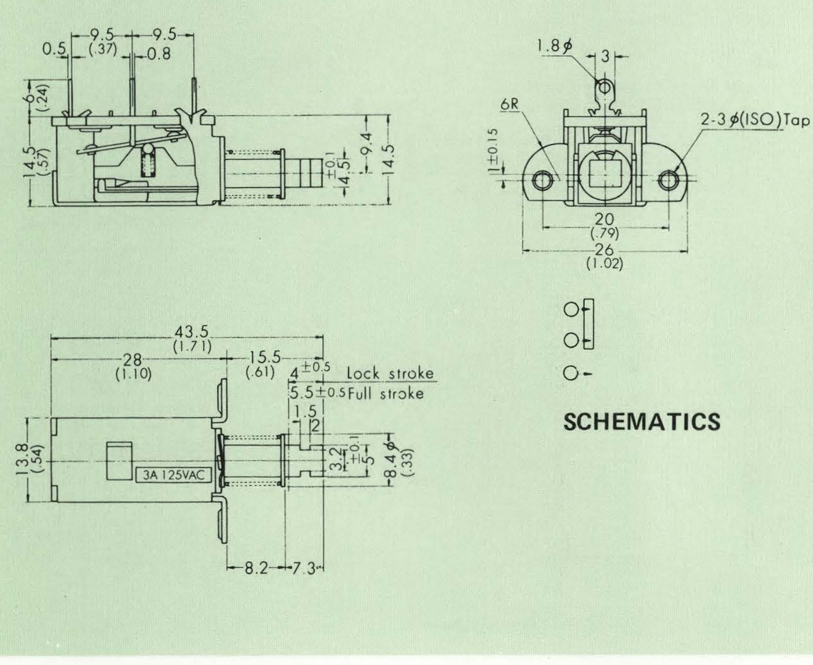
Electrical Characteristics	Contact Resistance	After several times of no-load operations: 25mΩ max. between each terminal
	Dielectric Strength	1,000 VAC for 1 minute
	Insulation Resistance	100MΩ min. at 500V DC
	Humidity	30 minutes after being subjected to 40°± 2°C, 90~95%RH for 24 hours; Withstanding Voltage: 1,000 VAC for 1 min. Insulation Res.: 10MΩ min. at 500 VDC
	Life	After 30,000 times of no-load operations with synthetic loads at rated voltage and current shown at left (cosϕ = 0.75~0.80) at a speed of 10~15 operations per minute; Contact Resistance: 30mΩ max. Insulation Resistance: 10MΩ min.

Rating

ESB-1137	6A, 125VAC
ESB-1134	3A, 125VAC

Dimensions

ESB-1137 & 1134

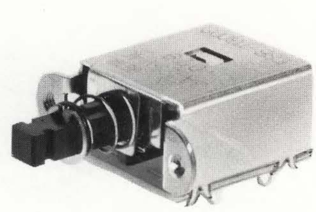


SCHEMATICS

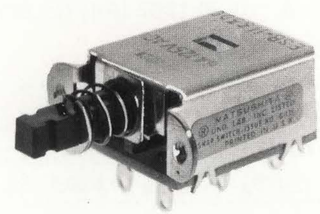
UL Listed Double Pole Push Button Switches
ESB-1130, 1133

- UL Listed: UL20-1967 (File No.E36636)
- Lock type and non-lock type are available.
- Circuitry

DPDT	DPST
ESB-1130DDU	ESB-1130DSU
ESB-1133DDU	ESB-1133DSU



ESB-1130



ESB-1133

Specifications

Mechanical Characteristics	Shaft Strength	To withstand 5kg push applied along the lever.
	Stroke	Lock: 4.0±0.5mm (0.157±0.020") Full: 5.5±0.5mm (0.217±0.020")
	Operating Force	1,000 g max.
	Terminals	To withstand 500g pull applied to the end of terminals in any direction
	Switch Timing	Break before make

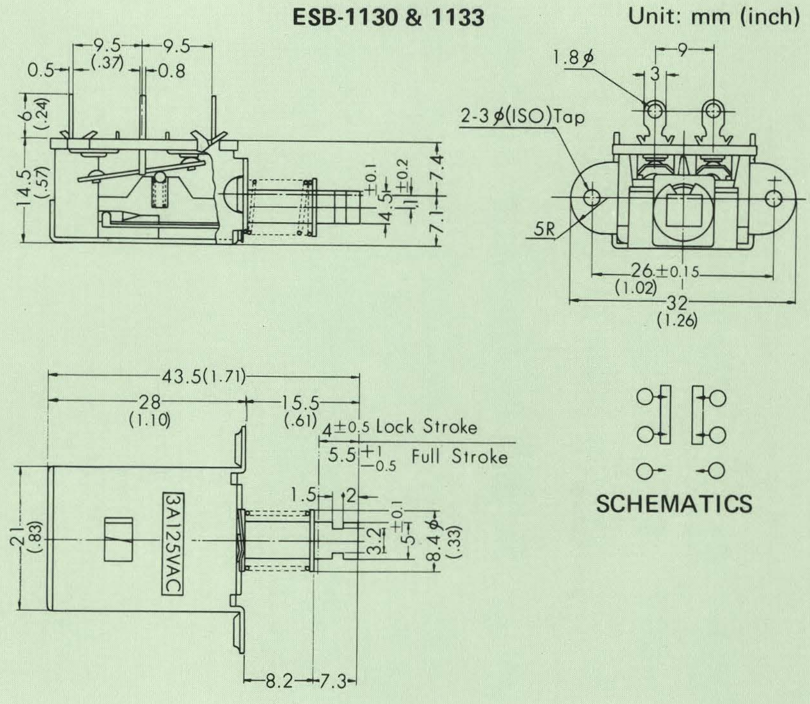
Electrical Characteristics	Contact Resistance	After several times of no-load operations: 25mΩ max. between each terminal
	Dielectric Strength	1,000 VAC for 1 minute
	Insulation Resistance	100MΩ min. at 500V DC
	Humidity	30 minutes after being subjected to 40°± 2°C, 90~95%RH for 24 hours; Withstanding Voltage: 1,000 VAC for 1 min. Insulation Res.: 10MΩ min. at 500 VDC
	Life	After 30,000 times of no-load operations with synthetic loads at rated voltage and current shown at left (cosϕ = 0.75~0.80) at a speed of 10~15 operations per minute; Contact Resistance: 30mΩ max. Insulation Resistance: 10MΩ min.

Rating

ESB-1130	3A, 125VAC
ESB-1133	6A, 125VAC

Dimensions

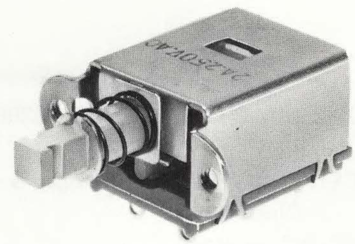
ESB-1130 & 1133 Unit: mm (inch)



2A 250V, Push Button Switches
ESB-1140

- Conform to SEMKO Standard
- Lock type and non-lock type are available.
- Circuitry

	DPDT	DPST	SPDT	SPST
Part No.	ESB-1140DD	ESB-1140DS	ESB-1140SD	ESB-1140SS



ESB-1140

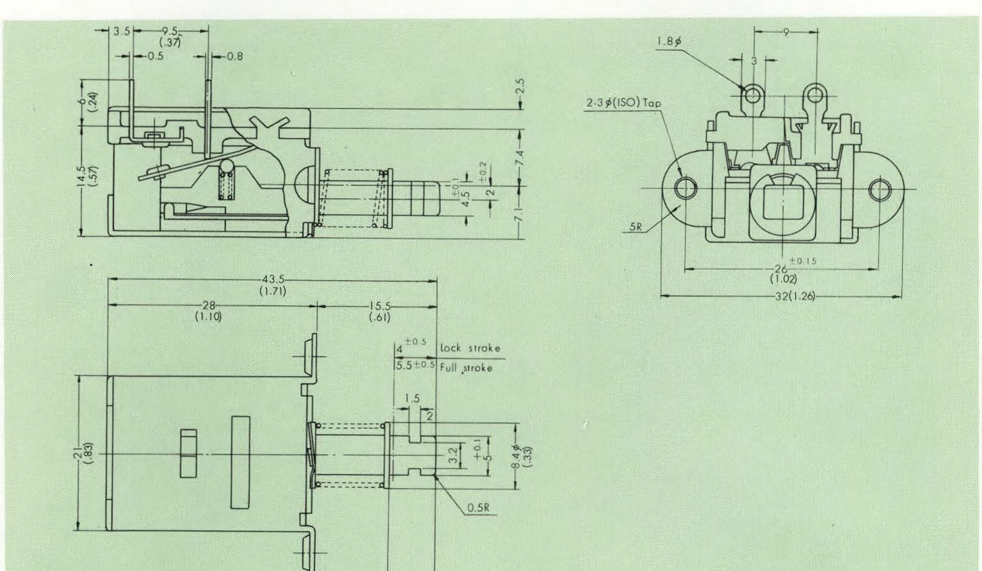
- Conform to SEMKO Standard
- Lock type and non-lock type are available.
- SPST, SPDT, DPST and DPDT

Specifications

Mechanical Characteristics	Shaft Strength	To withstand 5kg push applied along the shaft
	Stroke	Lock: 4±0.5mm(0.157±0.020") Full: 5.5±0.5mm(0.217±0.020")
	Operating Force	1,000g max.
Electrical Characteristics	Dielectric Strength	2,000VAC for 1 minute
	Insulation Resistance	500MΩ min. at 500VDC
	Humidity	30 minutes after being subjected to $40^\circ \pm 2^\circ$C, 90~95% RH for 24 hours; Withstanding Voltage: 2,000VAC for 1 min. Insulation Res: 10MΩ min. at 500VDC

Life	After 50,000 no-load operations at a speed of 30 operations per minute; Contact Resistance: 75mΩ max. Insulation Resistance: 10MΩ max. Withstanding Voltage: To withstand for 1 minute Temperature Rise: 55°C max. (after applying 250VAC, 2A for 1 hour at room temperature.)
Temperature Rise	45°C max. (after applying 250VAC, 3A for 4 hours at room temperature.)
Breaking Capacity	After 200 times of loaded (275VAC, 2.5A, cos ϕ = 0.7) operations at a speed of 30 operations per minute; Contact Resistance: 50 mΩ max. No continuous arc should be occured during above operations.

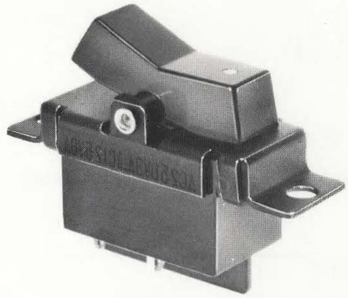
Dimensions



Unit:.mm (inch)

Universal Rating Rocker Switches
EST-15

- Conform to the world main safety standards;
  UL: TV-3, 3A250VAC Listed (File No. E36636)
  CSA: TV-3 Pending
  SEMKO (CEE): 3(3)A 250VAC Microgap-Switches Class I Listed
  VDE: 3A250VAC pending
- Hermetically sealed. Free from troubles caused by arc leakage or dust.
- Compact and improved click action.



EST-15

- Circuitry

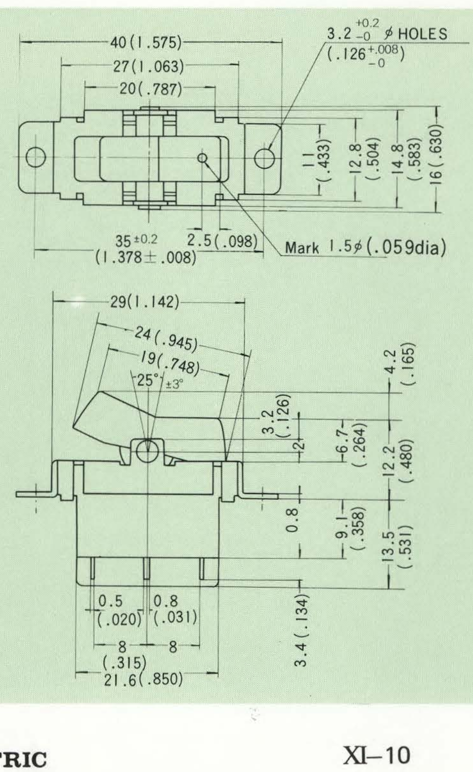
	DPDT	DPST	SPDT	SPST
Part No.	EST-151T	EST-152T	EST-153T	EST-154T

Specifications

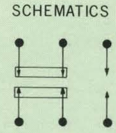
Mechanical Characteristics	Index Angle	25° ± 3°
	Operating Force	200g to 1,000g (7.05oz to 35.3oz)
Electrical Characteristics	Contact Resistance	50mΩ max. at 1A 5VDC (initial value)
	Dielectric Strength	Terminal-terminal: 2,000V AC Terminal-frame: 4,000 V AC (50 or 60Hz for 1 minute)
	Insulation Resistance	100MΩ min. at 500V DC (initial value)
	Insulation Clearance	Terminal-terminal: 4mm(.157") min. Terminal-frame: 4mm(.157") min. Contact-contact: 1.5mm(.059") min.
Electrical Characteristics	Humidity	1 hour after being subjected to 40°±2°C, 90 - 95%RH for 96 hrs; Dielectric Strength: as shown above Insulation Resistance: 10MΩ min. at 500V DC.
	Rating	TV-3 (UL, CSA), 3A 250V AC (UL) 3(3)A250V AC (SEMKO)
	Life	TV-3: 25,000 cycles (TV-3 load test in accordance with UL20) 3A 250V AC: 50,000 cycles (resistance load or inductive load)

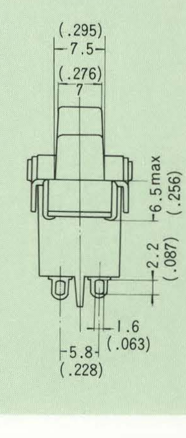
Dimensions

Unit: mm (inch)



SCHEMATICS



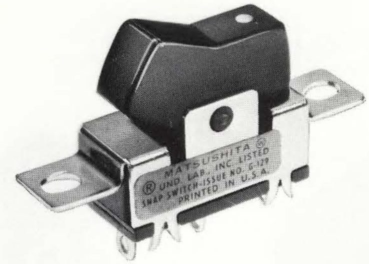


UL·CSA (TV-3) Rating Rocker Switches

EST-1060

- UL Listed: TV-3 Rating (File No.E36636)
  CSA Listed: TV-3 Rating (File No.LR29638)
- Good snap action
- Circuitry

	SPDT	SPST
Part No.	EST-1060DT	EST-1060T

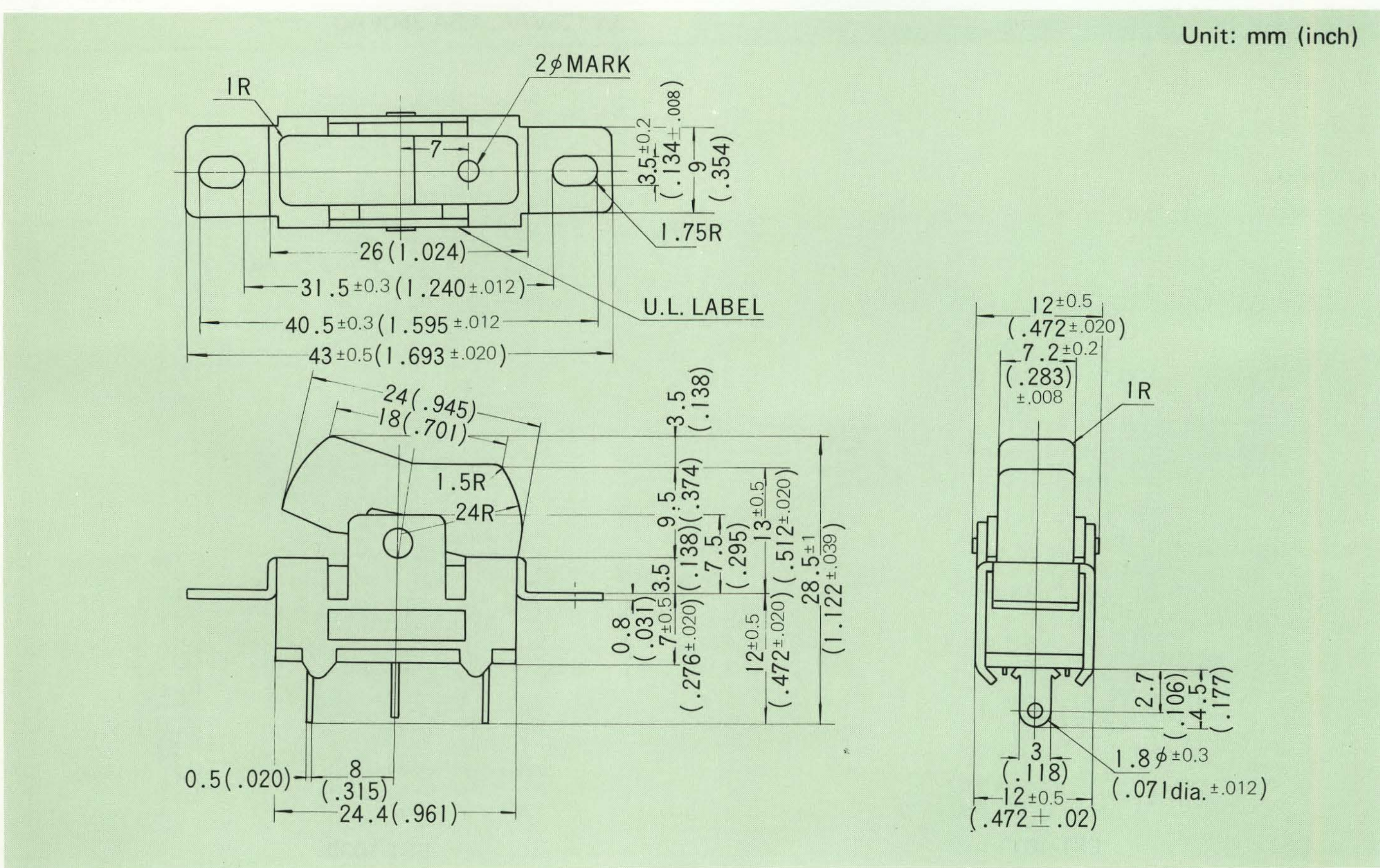


EST-1060

Specifications

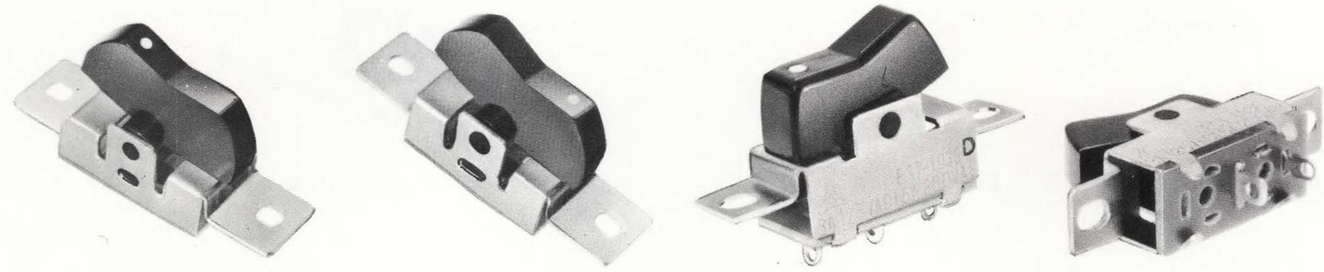
Mechanical Characteristics	Lever Strength	To withstand 2kg (4.4 lbs) push applied to the rocker arm
Mechanical Characteristics	Operating Force	300g to 1,000g (10.6 oz to 35.3oz)
Electrical Characteristics	Contact Resistance	25mΩ max. at 1A DC
Electrical Characteristics	Dielectric Strength	Terminal-Frame: 1,000V AC (50 or 60Hz for 1 minute)
Electrical Characteristics	Insulation Resistance	100MΩ min. at 500V DC
Electrical Characteristics	Humidity	30 minutes after being subjected to 40°±20°C, 90 - 95%RH for 48 hrs; Withstanding Voltage: 1,000V AC for 1 minute Insulation Resistance: 10MΩ min. at 500V DC
Electrical Characteristics	Rating	TV-3 (UL, CSA), 3A 125V AC
Electrical Characteristics	Life	TV-3: 25,000 cycles

Dimensions



UL Listed Rocker Switches
EST-1017, 1030

- UL Listed File No. E36636



EST-1017 EST-1030

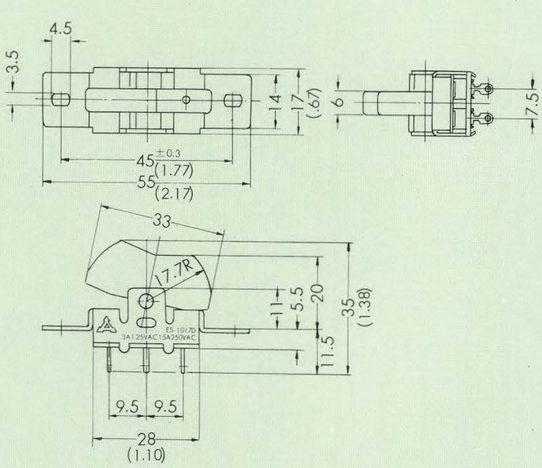
- Circuitry

	DPDT	DPST	SPDT	SPST
Part No.	EST-1017DAU	EST-1017AU	EST-1030DU	EST-1030U

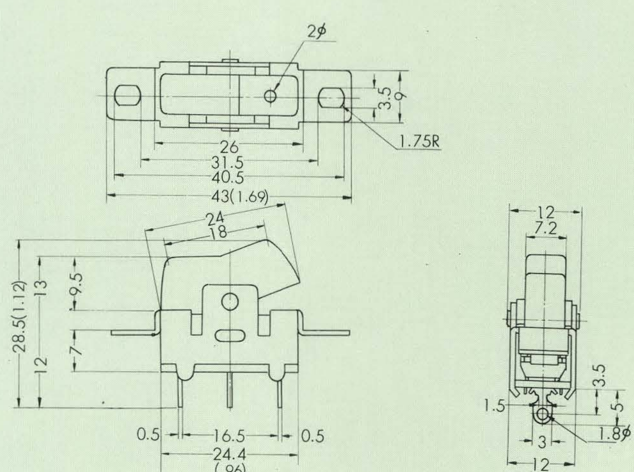
Specifications

Mechanical Characteristics	Lever Strength	To withstand 2kg push applied to the rocker arm
	Operating Force	700~1,400g (EST-1017), 300~1,000g(EST-1030)
Electrical Characteristics	Contact Resistance	25mΩ max. at 1A DC
	Dielectric Strength	1,000VAC (50~60Hz) for 1 minute
	Insulation Resistance	100MΩ min. at 500VDC
Rating		3A 125VAC, 1.5A 250VAC

Dimensions



EST-1017

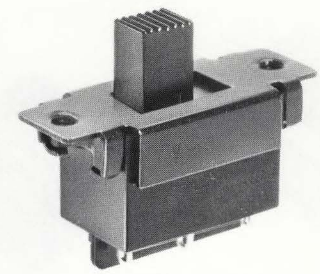


EST-1030

Universal Rating Slide Switches
ESD-39

- Conform to the world main safety standards;

  UL: TV-3, 3A250VAC Listed (File No. E36636)
  CSA: TV-3 Pending
  SEMKO (CEE): 3 (3)A250VAC Microgap-Switches Class I Listed
  4A 250VAC Microgap-Switches for TV use Listed
  VDE: 3A 250V Pending
- Hermetically sealed. Free from troubles caused by arc leakage or dust.
- Compact and improved click action.



ESD-39

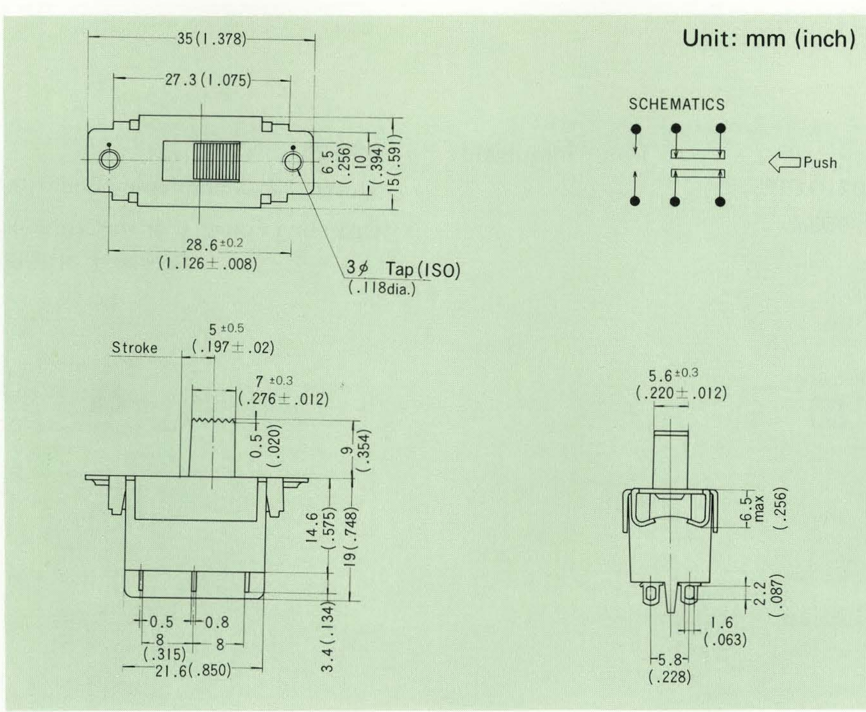
- Circuitry

	DPDT	DPST	SPDT	SPST
Part No.	ESD-391T	ESD-392T	ESD-393T	ESD-394T

Specifications

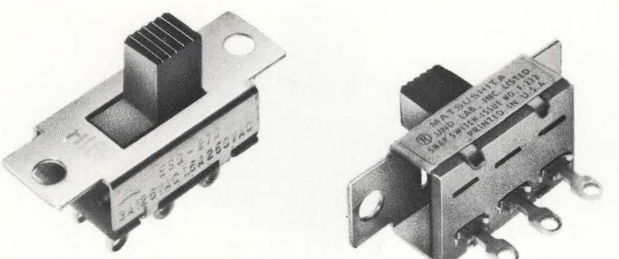
Mechanical Characteristics	Stroke	5 ± 0.5mm (.197 ± .020")
Mechanical Characteristics	Operating Force	200g to 600g (7.05oz to 21.2oz)
Electrical Characteristics	Contact Resistance	50mΩ max. at 1A 5VDC (initial value)
Electrical Characteristics	Dielectric Strength	Terminal-terminal: 2,000V AC Terminal-frame: 4,000V AC (50 or 60Hz for 1 minute)
Electrical Characteristics	Insulation Resistance	100MΩ min. at 500V DC (initial value)
Electrical Characteristics	Insulation Clearance	Terminal-terminal: 4mm(.157") min. Terminal-frame: 4mm(.157") min. Contact-contact: 1.5mm(.059") min.
Electrical Characteristics	Humidity	1 hour after being subjected to 40°±2°C, 90 - 95%RH for 96 hrs; Dielectric Strength: as shown above Insulation Resistance: 10MΩ min. at 500V DC
Electrical Characteristics	Rating	TV-3 (UL, CSA), 3A 250V AC (UL) 3(3)A 250V AC ,4A250VAC (SEMKO)
Electrical Characteristics	Life	TV-3: 25,000 cycles (TV-3 load test in accordance with UL20) 3A 250V AC: 50,000 cycles (resistance load or inductive load)

Dimensions



UL Listed Slide Switches

■ UL Listed File No. E36636



ESD-27

ESD-28D

Specifications

Mechanical Characteristics	Lever Strength	To withstand 3kg push applied in any direction.
	Terminal Strength	To withstand 1kg pull applied to the end of terminals in any direction.
	Switch Timing	Break before make
Electrical Characteristics	Contact Resistance	After several times of no-load operations; 25mΩ max. at DC 1A
	Dielectric Strength	1,000VAC for 1 minute
	Insulation Resistance	100MΩ min. at 500VDC

Humidity	30 minutes after being subjected to 40°±2°C, 90~95% RH for 24 hours; Withstanding Voltage: 1,000VAC for 1 minute Insulation Res.: 10MΩ min. at 500VDC
Life	After 6,000 operations with synthetic loads at rated current and voltage shown below ($\cos\phi$ = 0.75~0.80), Temperature Rise: 30°C max.
Rating	3A 125VAC 1.5A 250VAC

Length of Lever

Part No.	Lever Length	Schematics
ESD-271U	$9^{+0}_{-0.3}$mm ($0.35^{+0}_{-0.012}$")	SPDT
ESD-272U	$16^{+0}_{-0.3}$mm ($0.63^{+0}_{-0.012}$")	SPDT
ESD-271DU	$9^{+0}_{-0.3}$mm ($0.35^{+0}_{-0.012}$")	DPDT
ESD-272DU	$16^{+0}_{-0.3}$mm ($0.63^{+0}_{-0.012}$")	DPDT

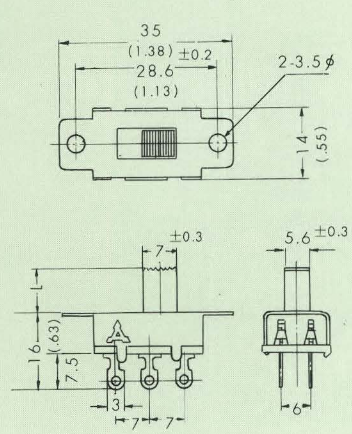
Part. No.	Lever Length	Schematics
ESD-281DU	$8^{+0}_{-0.3}$mm ($0.315^{+0}_{-0.012}$)	DPTT
ESD-282DU	$15^{+0}_{-0.3}$mm ($0.591^{+0}_{-0.012}$")	DPTT

Dimensions

ESD-27 Unit : mm (inch)

Stroke: 5±0.3mm(0.192±0.012")

Operating Force: 400~900g

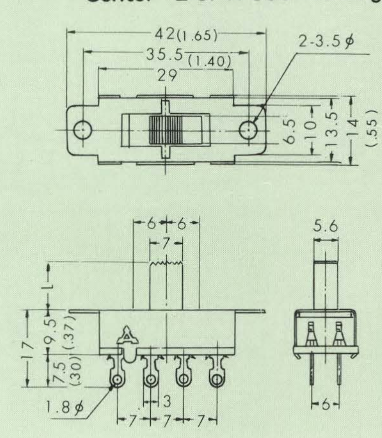


ESD-28

Stroke: 12±0.5mm(6mm+6mm) (0.47±0.020")

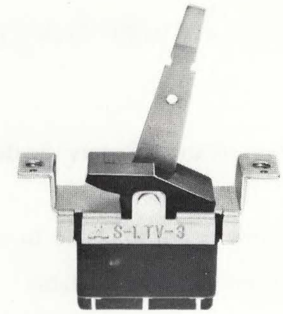
Operating Force: L or R→Center 400~1100 g

Center→L or R 600~1000 g



Universal Rating Lever Switches
ESL-21

- Conform to the world main safety standards;
  UL: TV-3, 3A250VAC Listed (Fine No. E36636)
  CSA: TV-3 Pending
  SEMKO (CEE): 3 (3) A250VAC Microgap-Switches
  Class I Listed
  VDE: 3A 250V Pending
- Hermetically sealed. Free from troubles caused by arc leakage or dust.
- Compact and improved click action.



ESL-21

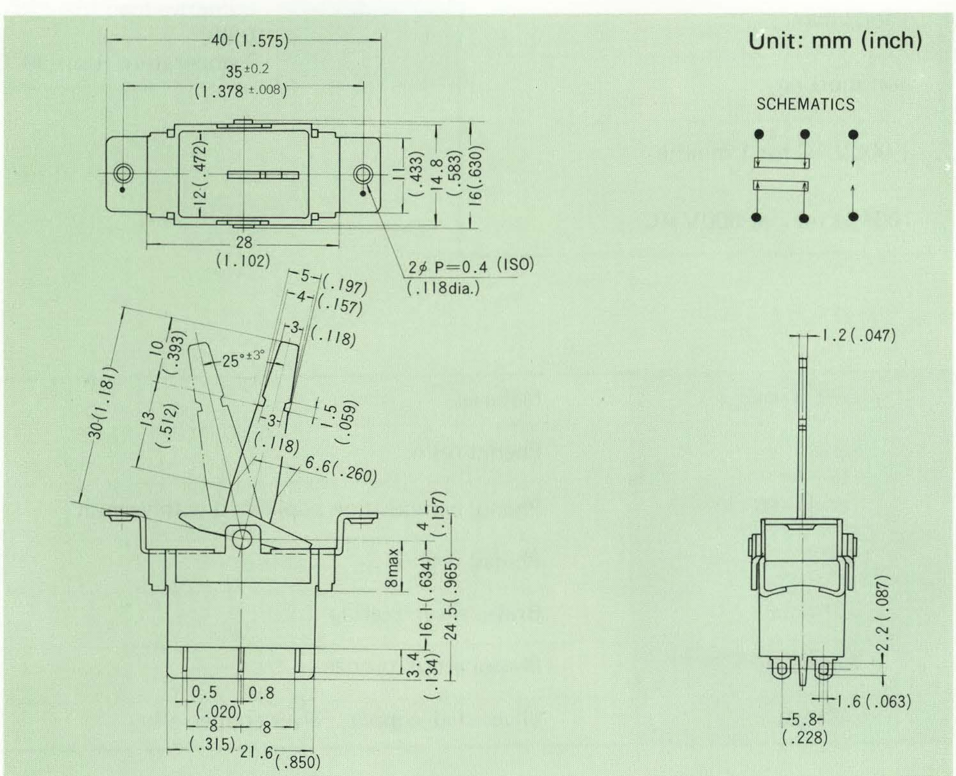
- Circuitry

	DPDT	DPST	SPDT	SPST
Part No.	ESL-211T	ESL-212T	ESL-213T	ESL-214T

Specifications

Mechanical Characteristics	Index Angle	25° ± 3°
Mechanical Characteristics	Operating Force	00g (14.1 oz) max.
Electrical Characteristics	Contact Resistance	50mΩ max. at 1A 5V DC (initial value)
Electrical Characteristics	Dielectric Strength	Terminal-terminal: 2,000V AC Terminal-frame: 4,000V AC (50 or 60Hz for 1 minute)
Electrical Characteristics	Insulation Resistance	100MΩ min. at 500V DC (initial value)
Electrical Characteristics	Insulation Clearance	Terminal-terminal: 4mm (.157″) min. Terminal-frame: 4mm (.157″) min. Contact-contact: 1.5mm (.059″) min.
Electrical Characteristics	Humidity	1 hour after being subjected to 40°± 2°C, 90 - 95%RH for 96 hrs; Dielectric Strength: as shown above Insulation Resistance: 10MΩ min. at 500V DC
Electrical Characteristics	Rating	TV-3 (UL, CSA) 3A250V AC (UL) 3(3)A250V AC (SEMKO)
Electrical Characteristics	Life	TV-3: 25,000 cycles (TV-3 load test in accordance with UL20) 3A250V AC: 50,000 cycles (resistance load or inductive load)

Dimensions

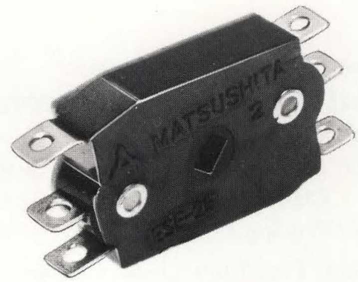


MATSUSHITA ELECTRIC

Cassette Type Power Switches

ESE-25

- Easy combination with a Rotary Switch or Lever Switch
- Four types of circuits are available to one cassette.
- 1-Section or 2-Section is most available.
- UL Listed: UL20-1967 (File No.E36636, Assignment No.69ME3117)



ESE-25

Part No.

Circuitry \ Rating	6A 125V AC	3A 125V AC
DPDT	ESE – 251 DD	ESE – 252 DD
DPST	ESE – 251 DS	ESE – 252 DS
SPDT	ESE – 251 SD	ESE – 252 SD
SPST	ESE – 251 SS	ESE – 252 SS

Specifications

Mechanical Characteristics	Terminal Strength	To withstand 400g (14.1 oz) pull in any direction for 1 minute without damage and loosening
	Rotation Torque	Refer to the next page
	Operating Force	Refer to the next page
Electrical Characteristics	Contact Resistance	15mΩ max.
	Switching Mode	non-shorting
	Dielectric Strength	1,000VAC for 1 minute
	Insulation Resistance	100MΩ min. at 500V AC

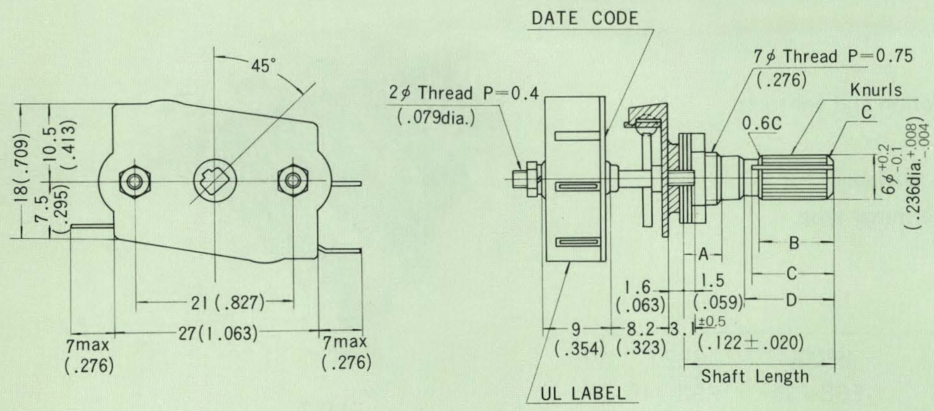
Electrical Characteristics	Humidity	30 minutes after being subjected to 40°±2°C, 90 - 95% RH for 10 hrs; Withstanding Voltage: 1,000VAC for 1 miunte Insulation Resistance: 10MΩ min. at 500VDC
	Life	After 10,000 rotations at a speed of 15 to 20 operations per minute with inductive load (6A 125VAC cosϕ=0.75~0.80); Temperature Rise: 30°C max.

Material

Part Name	Material
Case	Phenol resin
Insulating Plate	Phenol composition applicated with varnish
Cam	Phenol resin
Terminal	Brass, silver plating
Actuator	Phosphereous bronze
Contact	Silver-clad copper, Silver-copper alloy

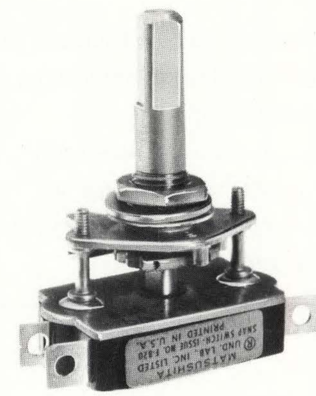
Applications and Dimensions

Unit: mm (inch)



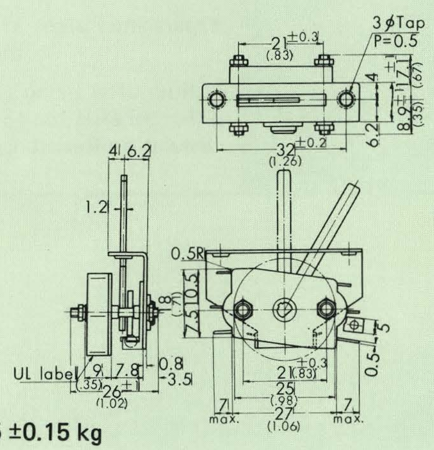
Ratation Torque: 1.2 ± 0.5 kg-cm

A, B, C, D: Available upon request

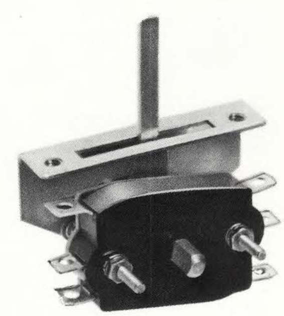


ESR-E type

Unit: mm (inch)

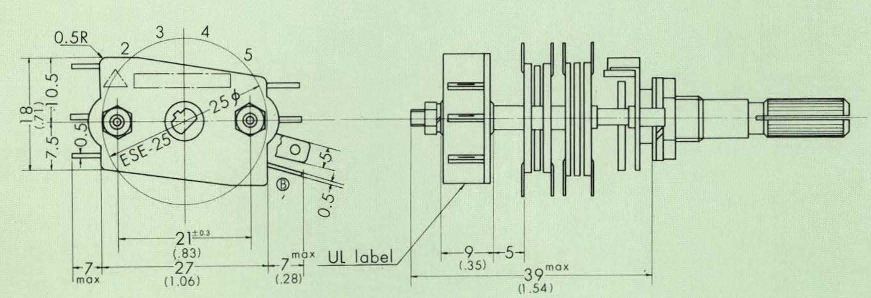


Operating Force: 0.35 ±0.15 kg



ESL-18 type

Unit: mm (inch)



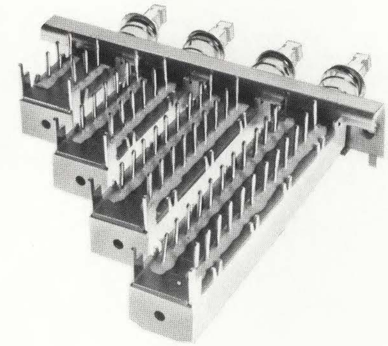
Operating Force: 1.4 ± 0.5 kg-cm

ESR-E type

Multiple Station Push Button Switches

ESB-7

- 20 Stations to be manufactured.
- High reliability of interlocking, release action and contacts.
- Good click action
- Shorting type and non-shorting type are available.
- PC board mounting type and lead wire terminal type.
- Lock (push-push), non-lock, interlock.
- Circuitry



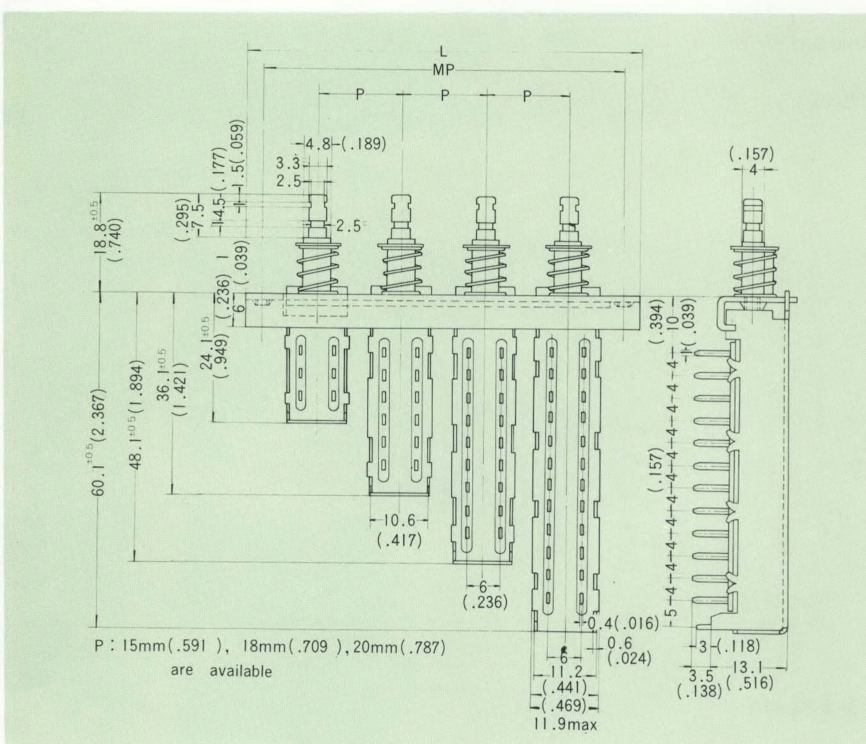
ESB-7

	2PDT	4PDT	6PDT	8PDT
Part No.	ESB-715	ESB-725	ESB-735	ESB-745
Operating Force g (oz)	600 ± 250 (21.2 ± 8.8)	600 ± 250 (21.2 ± 8.8)	800 ± 250 (28.2 ± 8.8)	800 ± 250 (28.2 ± 8.8)

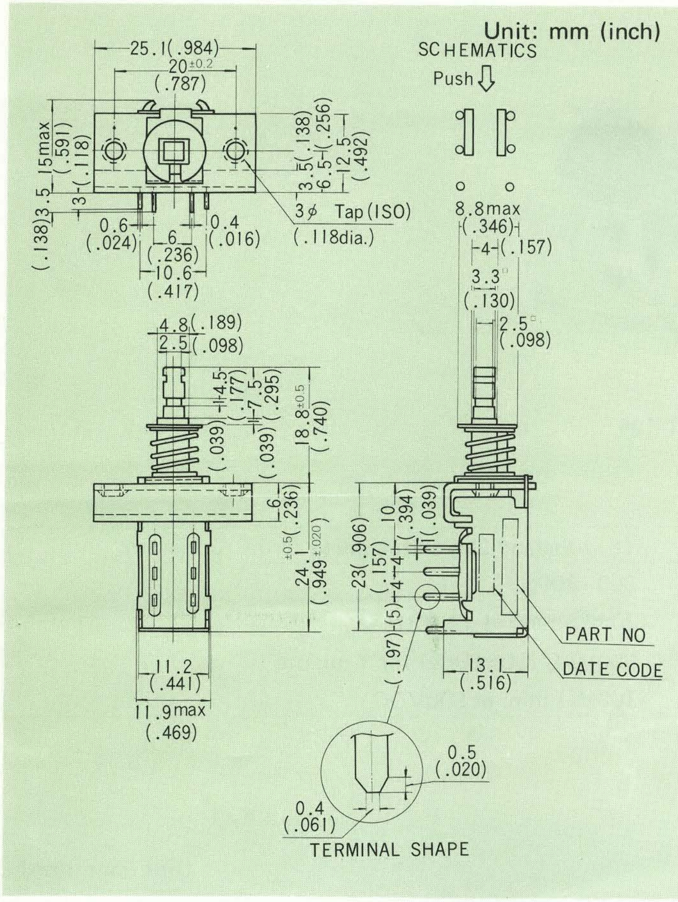
Specifications

Electrical Characteristics	Stroke	Lock: 4±0.5mm (.157±.020") Full: 5.5±0.5mm (.217±.020")
	Contact Resistance	20mΩ max. initial
	Dielectric Strength	Terminal — terminal: 500V AC Terminal — frame: 500V AC (50 Hz or 60 Hz for 1 minute)
	Insulation Resistance	100MΩ min. at 500VDC
Electrical Characteristics	Life	After 10,000 no-load operations Contact Resistance: 40mΩ max. Dielectric Strength: 500VAC for 1 minute Operating Force: Within +20%, -30% of the initial value
	Humidity	1 hour after being subjected to 40° ± 2°C, 90 ~ 95%RH for 48 hours; Insulation Resistance: 10MΩ min. at 500V DC

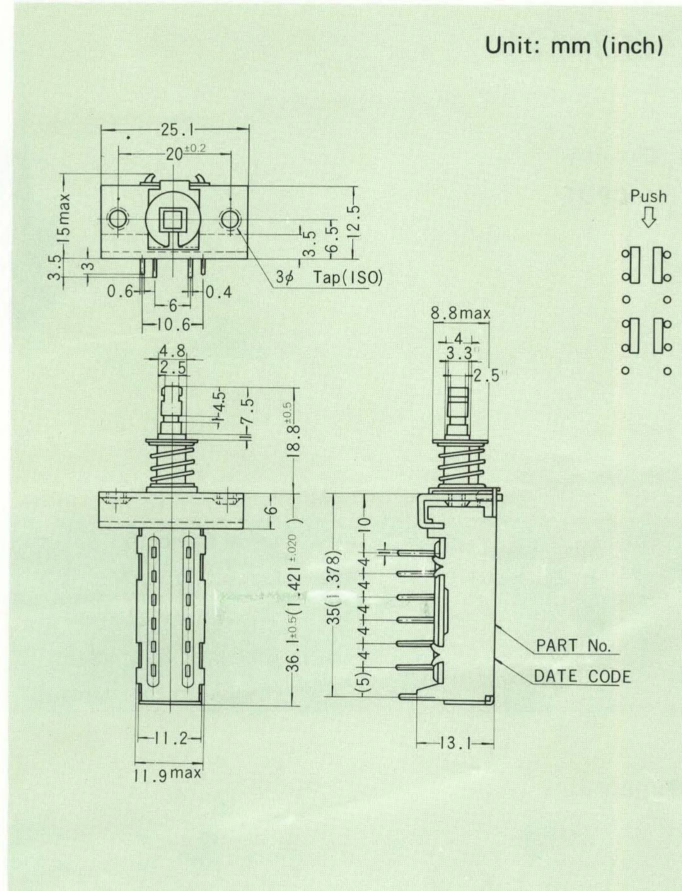
Dimensions



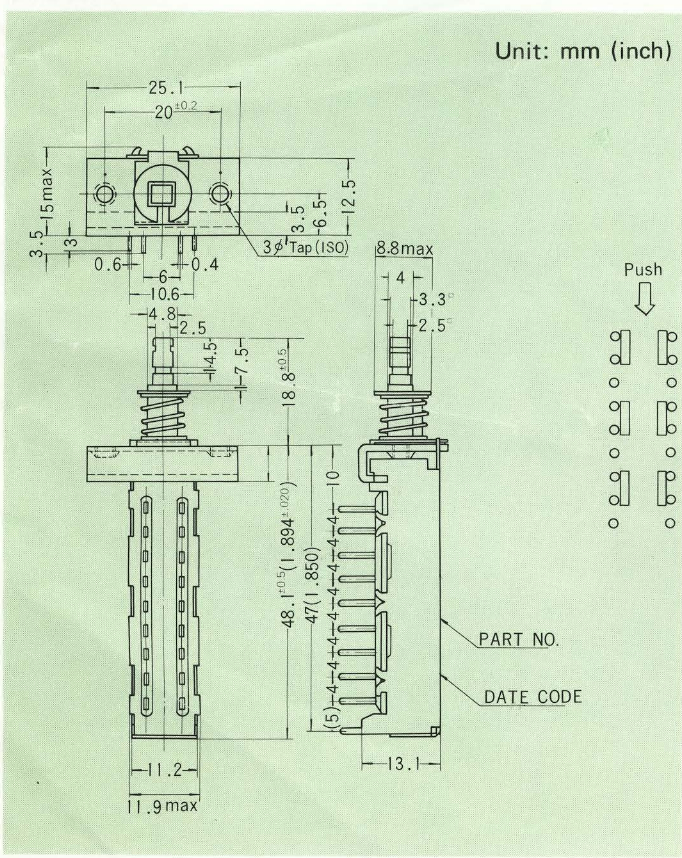
ESB-715



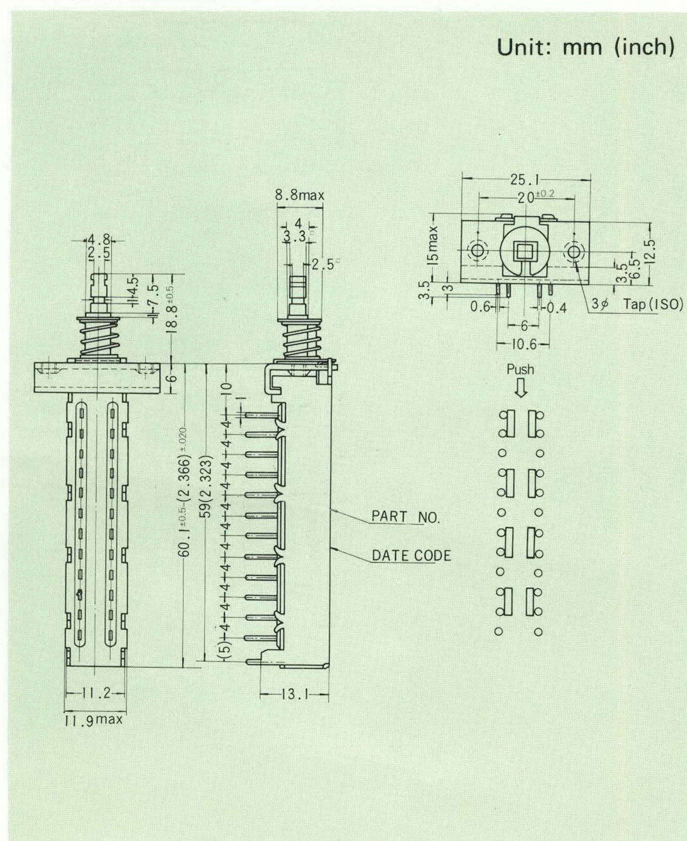
ESB-725



ESB-735

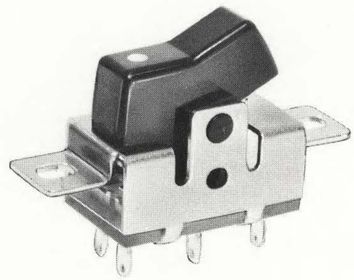


ESB-745



Rocker Switch
EST-121

- Circuitry
  DPDT

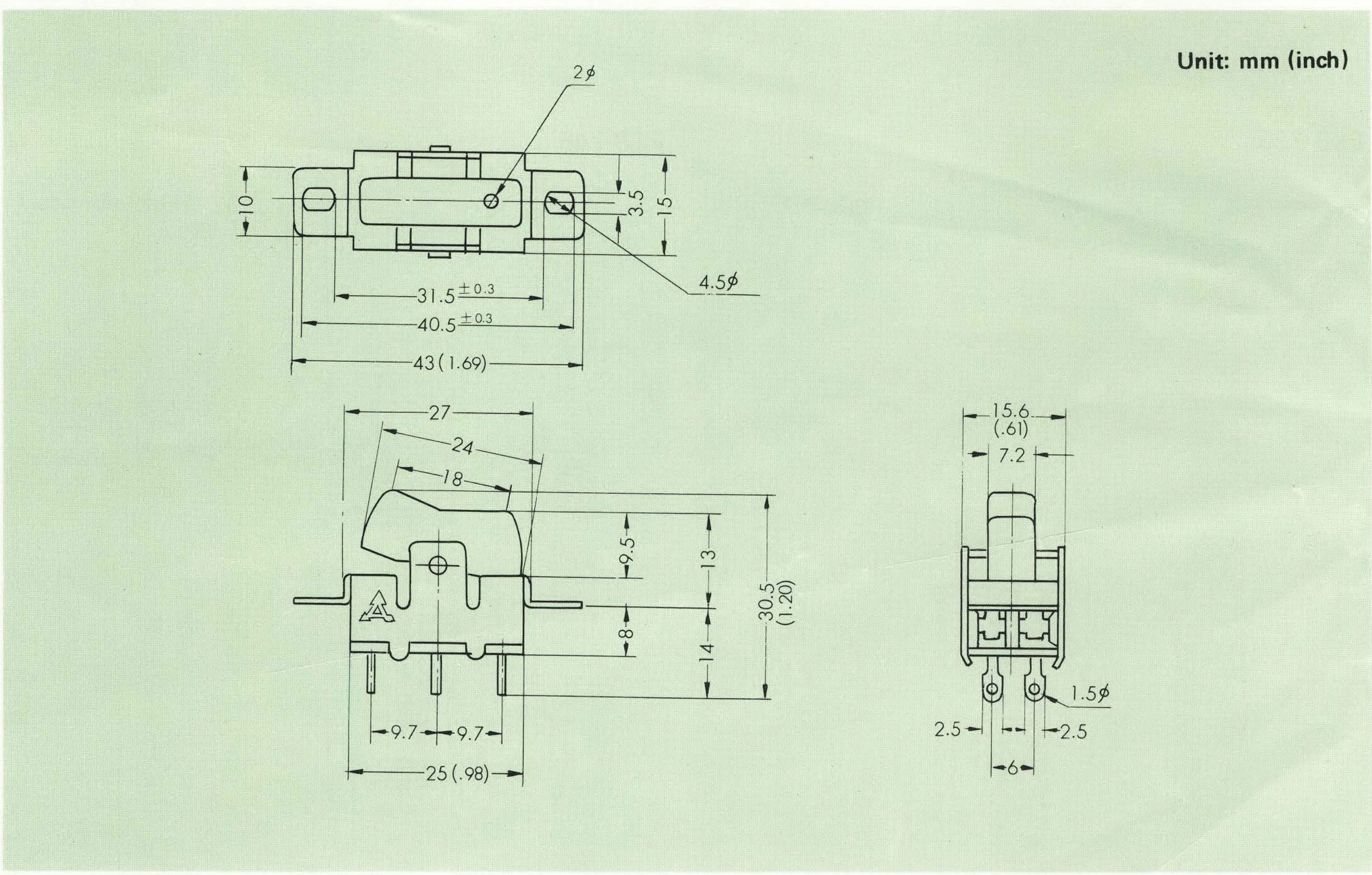


EST-121

Specifications

Mechanical Characteristics	Lever Strength	To withstand 2kg push applied to the rocker arm
	Operating Force	300~800g
Electrical Characteristics	Contact Resistance	20mΩ max. at IA DC
	Dielectric Strength	500VAC (50~60Hz) for 1 minute
	Insulation Resistance	100MΩ min. at 500VDC

Dimensions



Slide Switches Double Throw Type

ESD-44, 45, 46, 47

- Detachable knob.
- Standard heights of knobs are 6, 7, 9, 12 and 14mm (0.24, 0.28, 0.35, 0.47 and 0.55 inches)
- Standard knob colors are black or ivory.

Specifications

Item	Specification
Lever Strength	To withstand 3kg push applied in any direction for 15 seconds when mounted on PWB
Contact Resistance	After several times of no-load operations 20mΩ max: Between each terminal 5mΩ max: Variation by vibration
Dielectric strength	500VAC for 1 minute
Insulation Resistance	100MΩ min. at 500VDC
Humidity	30 minutes after being subjected to 40°±2°C, 90~95 RH for 10 hours; Dielectric strength: 500V AC for 1 minute Insulation Res: 10MΩ min. at 500VDC
Life	After 10,000 no-load operations at a speed of 15 operations per minute; Contact Resistance: 40mΩ max. Operating Forces: Within ±30% of the initial value

Dimensions

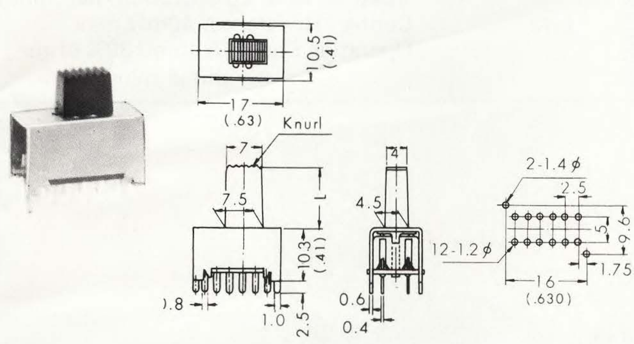
Stroke .... 2.5±0.3mm (0.098±0.012") for ESD-44, ESD-46
3.0±0.3mm (0.118±0.012") for ESD-45, ESD-47

Operating Force .... 200 to 600g (7.1 to 21.2 oz)

Traveling Distance .... 10mm (0.394") for ESD-44, ESD-46
10.5mm (0.413") for ESD-45, ESD-47

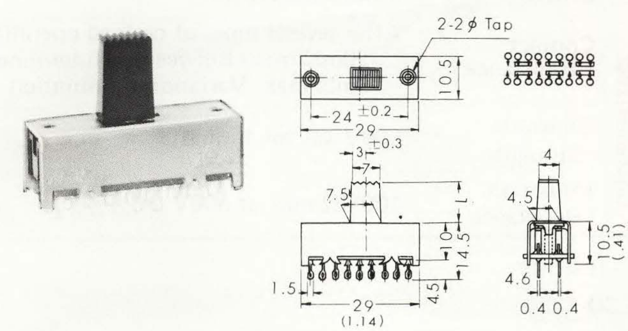
ESD-44 (Four Pole Double Throw) For PWB Mounting

Unit: mm (inch)



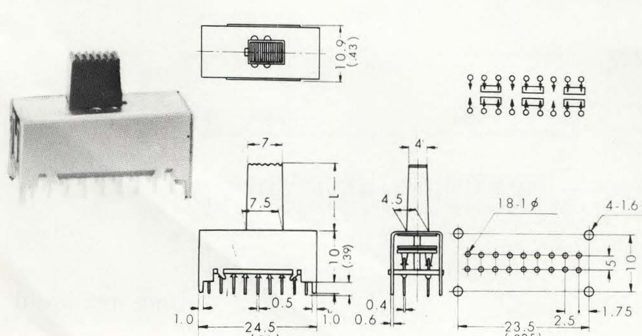
ESD-45 (Six Pole Double Throw) For Lead Wiring

Unit: mm (inch)



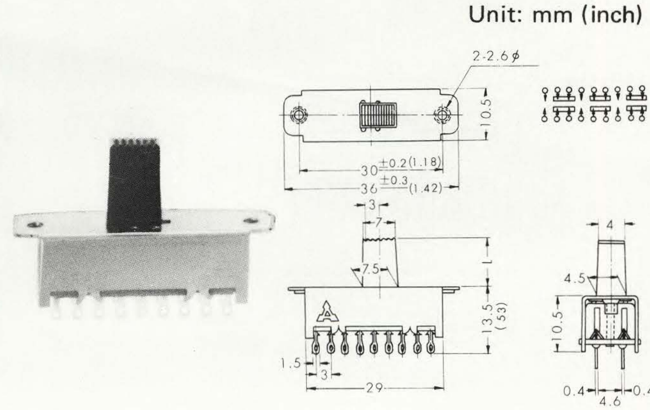
ESD-46 (Six Pole Double Throw) For PWB Mounting

Unit: mm (inch)

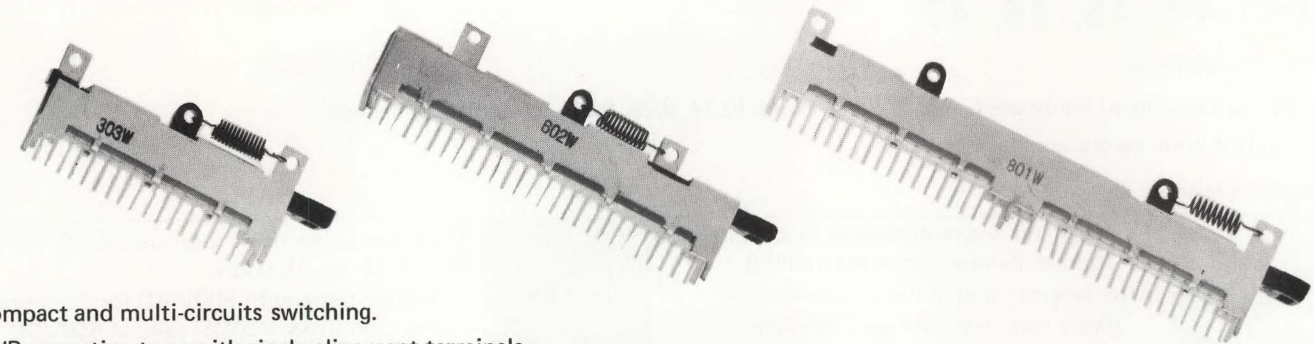


ESD-47 (Six Pole Double Throw) For Lead Wiring

Unit: mm (inch)



Single Alignment Terminals



- Compact and multi-circuits switching.
- PWB mounting type with single alignment terminals.
- Usable for push type or pull type by changing spring connection.

Standard Products

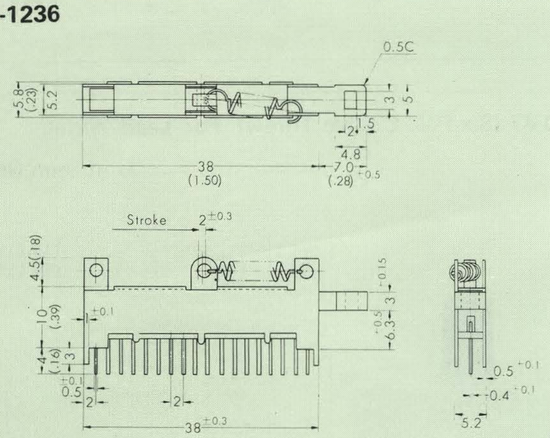
Part Number	Circuitry	Operating Force
ESD-1236S	6 Pole Double Throw	600 g max.
ESD-1234S	9 Pole Double Throw	1,000 g max.
ESD-1237S	12 Pole Double Throw	1,000 g max.

Specifications

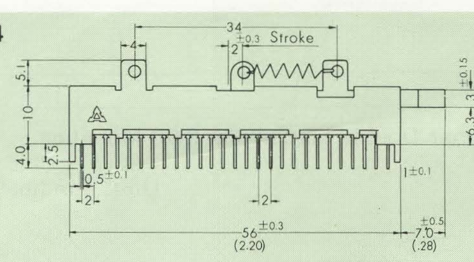
Mechanical Characteristics	Lever Strength	To withstand 3 kg push applied in any direction for 15 seconds when mounted on PWB.
	Stroke	2±0.3mm (0.079±0.012″)
	Terminal Strength	To withstand 500g pull applied to the end of terminals in any direction for 1 minute
	Switch Timing	Make before break
Electrical Characteristics	Contact Resistance	After several times of no-load operations; 20mΩ max: Between each terminal 5mΩ max: Variation by vibration
	Dielectric Strength	500V AC for 1 minute
	Insulation Resistance	100MΩ min. at 500V DC
Electrical Characteristics	Humidity	30 minutes after being subjected to 40°± 2°C. 90~95% RH for 10 hours; Withstanding Voltage: 500V AC for 1 minute Insulation Res.: 10MΩ min. at 500V DC
	Life	After 10,000 no-load operations at a speed of 15 to 20 operations per minute; Contact Resistance: 40mΩ max. Operating Force: Within ±30% of the initial value

Dimensions

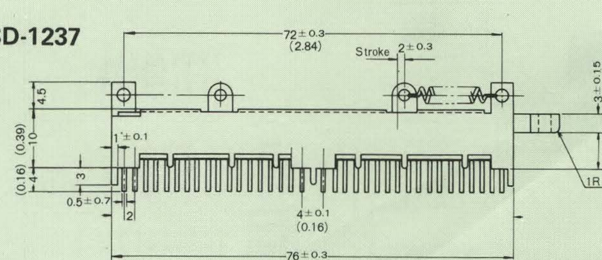
ESD-1236



ESD-1234



ESD-1237

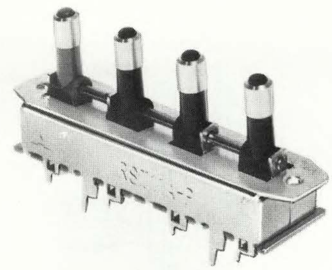


Unit: mm (inch)

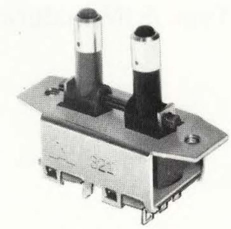
Lever Switch

ESL-19

- A good click action miniature type.
- Long life and complete connection.
- Red and black lever color with metallic hairline cap.
- 1 to 4 sections are available.
- PC board mounting type and lead wire lug type are available.
- Lever pitch is 15mm(.591) and 12mm(.472).
- S.P.D.T.(each section), non-shorting



ESL-193A



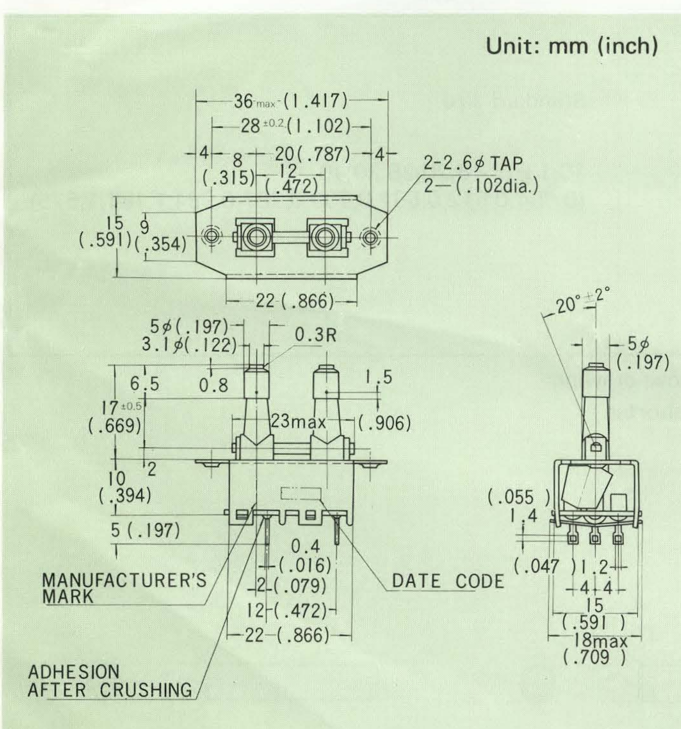
ESL-197A

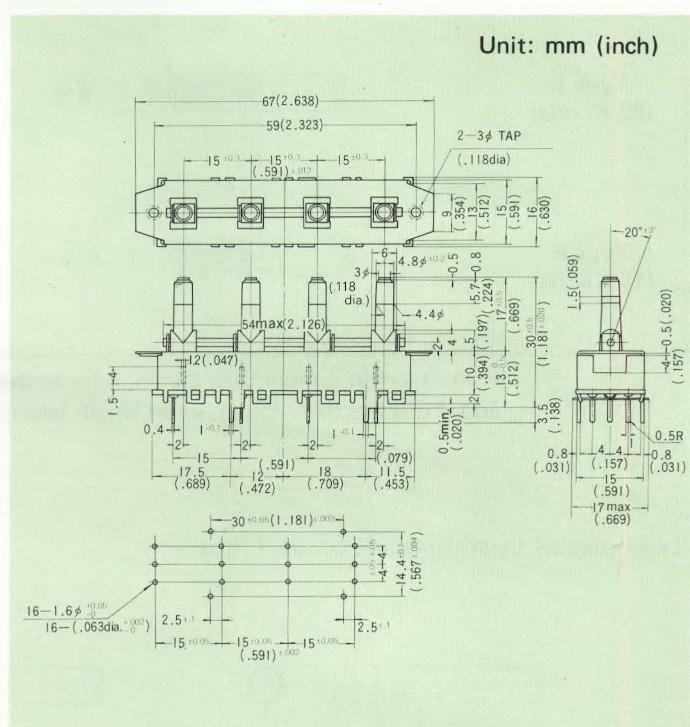
Specifications

Mechanical Characteristics	Lever Strength	To withstand 4kg (8.8 lbs) push applied in switching direction for 10 seconds.
	Terminal Strength	To withstand 1kg(2.205lbs) pull applied in any direction for 1 minute.
	Cap Strength	To withstand more than 3.5kg pull
	Index Angle	20° ± 2°
	Operating Force	250 ± 150g (8.8 ± 5.3 oz)
Electrical Characteristics	Contact Resistance	After serveral cycles of no-load operations; 20mΩ max.
	Dielectric Strength	500VAC(60 Hz) for 1 minute
	Insulation Resistance	100MΩ min. at 500V DC

Electrical Characteristics	Humidity	30 minutes after being subjected to 40° 2°C, 90~95% RH for 10 hours; Dielectric Strength: 500VAC for 1 minute. Insulation Resistance: 10MΩ min. at 500VDC
	Life	After 30,000 no-load operations at a speed of 15 operations per minute; Contact Resistance: 40mΩ max. Operating Forces: Within ±30% of the initial value

Dimensions



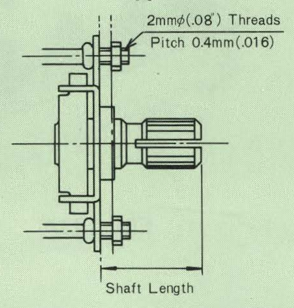


Rotary Switches

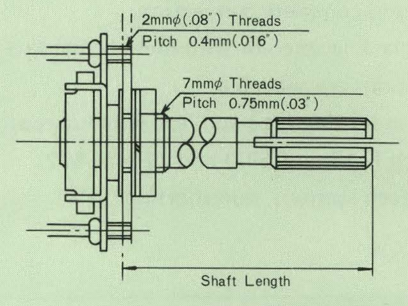
Standard Mounting

Type E (Miniature Size)

Type S

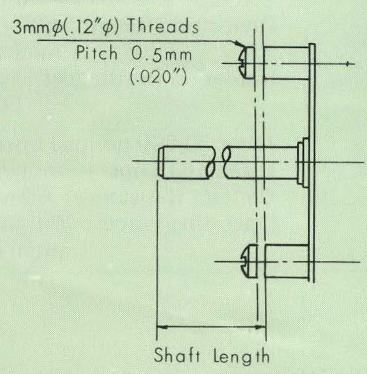


Type N

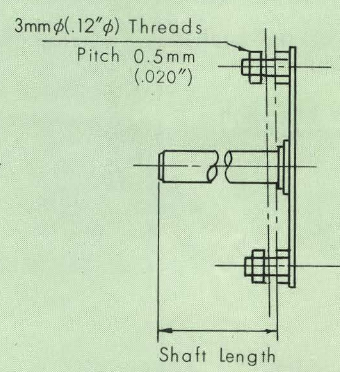


Type C (Common Size)

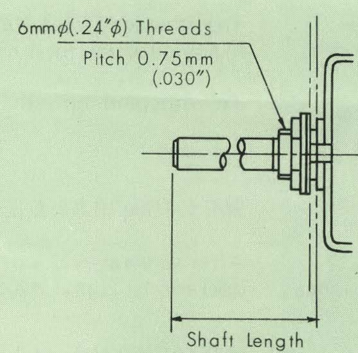
Type L



Type S

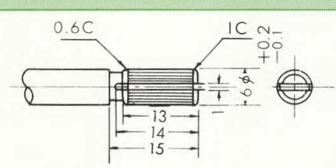
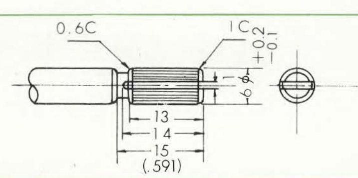


Type N



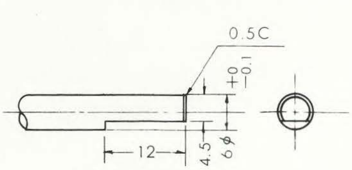
Shaft Length: Length from mounting plane to shaft end.

Standard Trims and Shaft Length

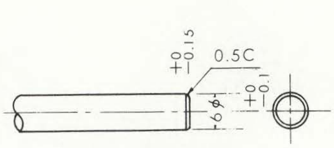
Type	Trim: mm (inch)	Shaft Length: mm (inch)
Type L (22 Knurls)		Standard size 10,13,15,18,20,25,30,40 (0.394,0.512,0.591,0.709,0.787,0.984,1.181,1.575)
Type K (18 Knurls)		

If shaft length is more than 25mm, refer to the above drawing; and if it is less than 25mm, knurl length becomes shorter.

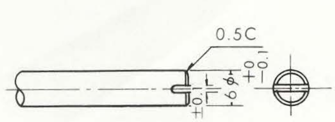
Examples of Custom-made Shaft Trims



Type F

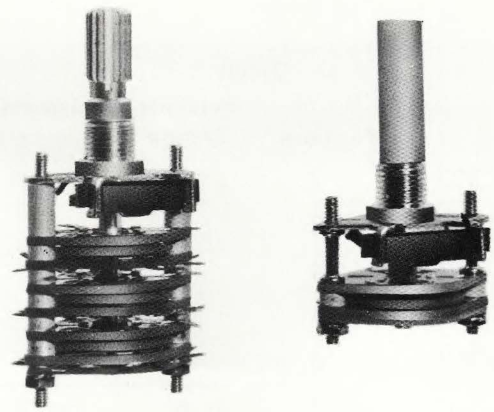


Type R



Type S

Miniature Rotary Switches (Type E)

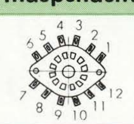
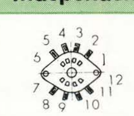
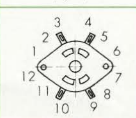
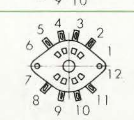
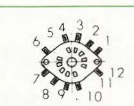
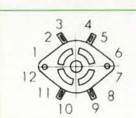
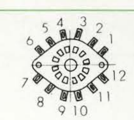
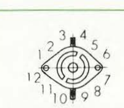
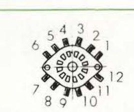
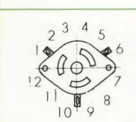
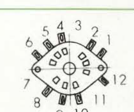
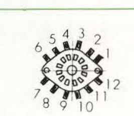
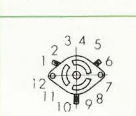
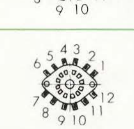


- Compact size, excellent momentary action.
- Ideally suited for use in band switching for portable radios.
- Available in switches from 1 to 7 sections

Specifications

Contact Resistance	15mΩ max.
Dielectric Strength	500VAC (60Hz) for 1 minute
Insulation Resistance	100MΩ min. at 500VDC
Humidity	30 minutes after being subjected to 40°±2°C, 90~95% RH for 10 hours; Withstanding Voltage: 500VAC, 1 minute Insulation Resistance: 10MΩ min. at 500VDC
Stopper Strength	10kg-cm for 15 seconds
Index Angle	30°
Rotation Tolerance	±3° measured from the 1st position
Rotation Torque	1 Section Type 1.1±0.3kg-cm 2 〃 1.2±0.3kg-cm 3 〃 1.3±0.5kg-cm 4 〃 1.5±0.5kg-cm 5~7 Section Type 1.8±0.8kg-cm
Terminal and Stator Strength	To withstand 400g pull in any direction for 1 minute without damage and loosening
Life	After 10,000 times of no-load operations: Contact Resistance: 20mΩ max. Rotation Torque Change: +10% -30%

Standard Circuit and Contact Arrangement

Code	No. of Position	Poles per Section	Terminal Location		Code	No. of Position	Poles per Section	Terminal Location	
			Common	Independent				Common	Independent
A	2	6			F	4	2		
B	2	4			G	5	2		
C	3	4			H	6	2		
D	3	3			I	12	1		
E	4	3							

Standard Products

	Part No.	Circuit: No. of Positions	Circuit: Poles per Section	Dimensions	*Trim.	Shield Plate	Shaft Length (mm)	Mounting
1 Section	ESR-E 162K□□Z	2	6	Fig. 1	Type K	Not Provided		
	ESR-E 143K□□Z	3	4	"	"	"		
	ESR-E 134K□□Z	4	3	"	"	"		
	ESR-E 125K□□Z	5	2	"	"	"		
	ESR-E 126K□□Z	6	2	"	"	"	Less than 10	......Type S
2 Sections	ESR-E 2C2K□□Z	2	6	Fig. 2	"	"		
	ESR-E 283K□□Z	3	4	"	"	"		
	ESR-E 264K□□Z	4	3	"	"	"		
	ESR-E 245K□□Z	5	2	"	"	"		
	ESR-E 246K□□Z	6	2	"	"	"		
	ESR-E 22CK□□Z	12	1	"	"	"		
	ESR-E 2C2K□□Y	2	6	Fig. 3	"	Provided (1pc.)		
	ESR-E 283K□□Y	3	4	"	"	"		
	ESR-E 264K□□Y	4	3	"	"	"		
	ESR-E 245K□□Y	5	2	"	"	"	13,15,18,20, 25,30,40	......Type N
	ESR-E 246K□□Y	6	2	"	"	"		
	ESR-E 22CK□□Y	12	1	"	"	"		
3 Sections	ESR-E 3J2K□□Z	2	6	Fig. 4	"	Not Provided		
	ESR-E 3C3K□□Z	3	4	"	"	"		
	ESR-E 394K□□Z	4	3	"	"	"		
	ESR-E 365K□□Z	5	2	"	"	"		
	ESR-E 366K□□Z	6	2	"	"	"		
	ESR-E 33CK□□Z	12	1	"	"	"		
	ESR-E 3J2K□□Y	2	6	Fig. 5	"	Provided (2pcs.)		
	ESR-E 3C3K□□Y	3	4	"	"	"		
	ESR-E 394K□□Y	4	3	"	"	"		
	ESR-E 365K□□Y	5	2	"	"	"		
	ESR-E 366K□□Y	6	2	"	"	"		
	ESR-E 33CK□□Y	12	1	"	"	"		

4 to 7 sections types are also available for standard products.

* Type L is available for standard trim.

Mounting: Refer to page 3. (I) Type L and N for 13~40mm shaft.

(II) Type S for 10mm shaft.

Standard Size

Unit: mm(inch)

1–Section

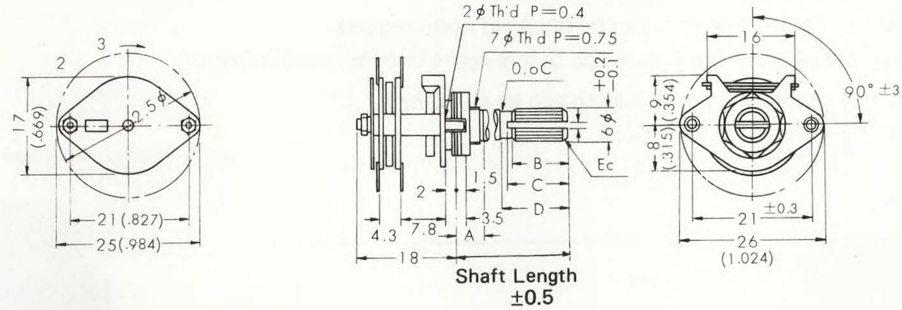
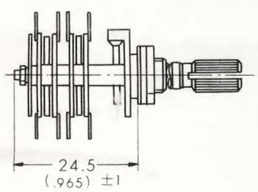
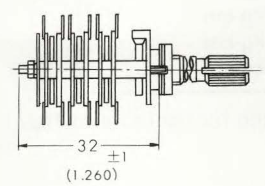


Fig. 1

2–Section

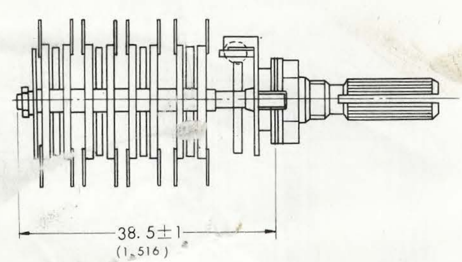


3–Section

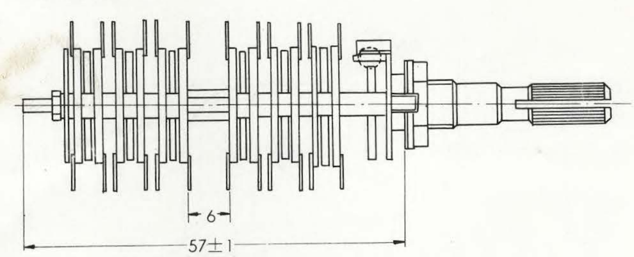


Shaft Length	A	B	C	D	E
13	5	6	7	7	0.5
15	5	8	9	9	0.5
18	5	10	11	12	1
20	5	10	11	12	1
25	8	13	14	15	1
30	8	13	14	15	1
40	8	13	14	15	1

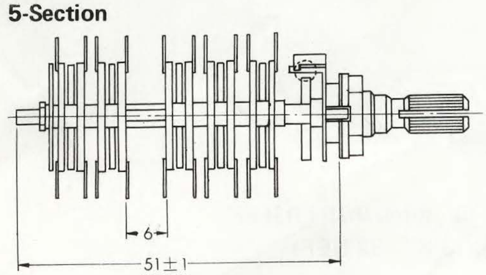
4-Section



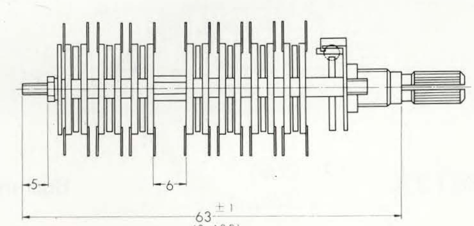
6-Section



5-Section



7-Section



If shaft length is 10mm (0.394"), installation fittings are located at the two side. Those between 13~40mm (0.512~1.575") are available with the installation fittings either at the two sides or at the center.

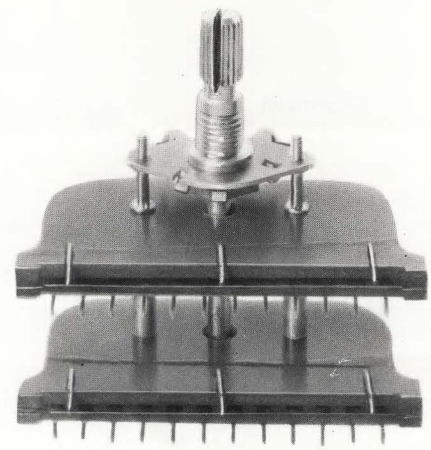
Type E For PWB Mounting

This is a variation of the type E rotary switch, which has soldered pins.

Advantages

- Best soldering and connections to PWB circuit.
- Various printed stator patterns can be designed upon request.
- Permitting make-before-break or break-before-make circuits in combination.

Available in 1~4 sections, a power switch can be combined.
Available in 1~6 poles, 2~12 positions.



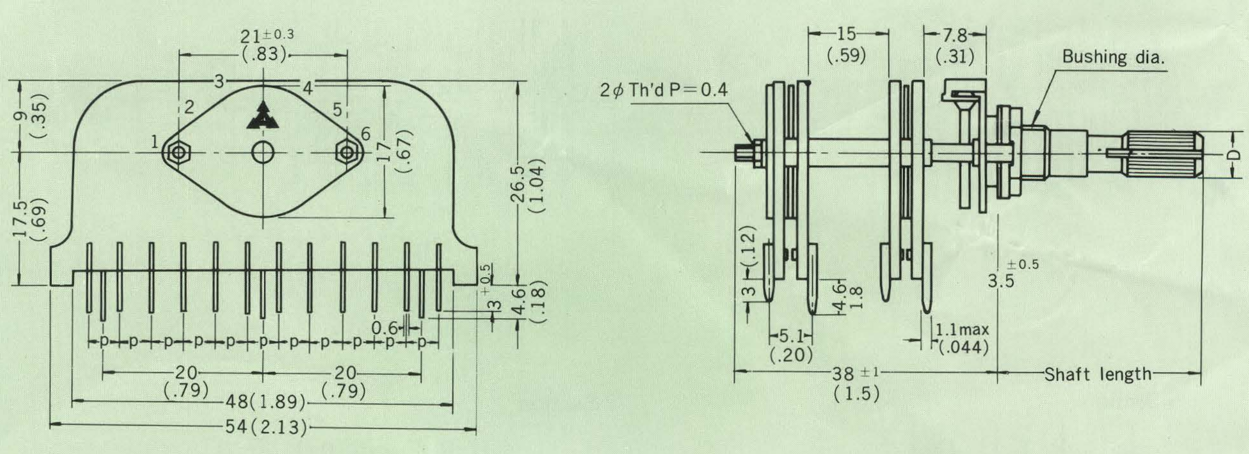
Specifications

Contact Resistance	50mΩ max.
Switching timing	Make-before-break or break-before-make
Life	After 10,000 no-load operations: Contact Resistance = 100mΩ max. Rotation Torque Change = +10%, -30%
Rotation Torque	1-section type 1.1 ± 0.5 kg-cm 2-section type 1.2 ± 0.5 kg-cm 3-section type 1.3 ± 0.7 kg-cm 4-section type 1.5 ± 0.7 kg-cm

(Pleasr refer to specifications of E-type rotary switch for other items.)

Dimensions

Unit: mm (inch)



Shaft dia. (D): 6ϕ (.236) $^{+0.2\,(.008)}_{-0.1\,(.004)}$
or
6.35ϕ (.250) $^{+0.2\,(.008)}_{-0.1\,(.004)}$

Bushing dia: 7ϕ (.275), pitch 0.75 (.03) or
9.525ϕ (3/8" - 32 NEF)

Standard pitch (P) for PWB: 4mm (.157)

Rotary Switches (Type C)

Type C

Type C
with Power Switch

Stable contact mechanism. Available in a wide selection, to meet requirements of virtually any circuit.
1 to 6 Sections are available.

Standard Mounting: See page 24
Standard Trims and Shaft Length : See page 24
Standard Circuit : Available in a maximum of 4 poles and 2 positions per wafer.

Specifications

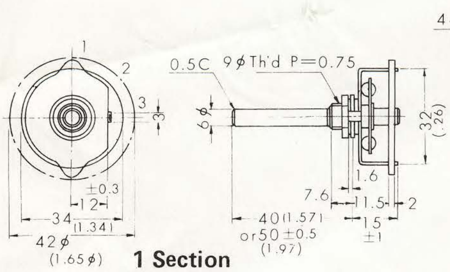
Contact Resistance	15mΩ max.
Dielectric Strength	500 VAC (60Hz) for 1 minute
Insulation Resistance	100MΩ min. at 500VDC
Humidity	30 minutes after being subjected to 40° ±2°C, 90~95% RH for 10 hours, Withstanding Voltage: 500VAC 1minute Insulation Res.: 10MΩmin. at 500V DC
Stopper Strength	15kg-cm for 15 seconds
Index Angle	30°
Rotation Tolerance	±3° measured from the 1st position

Rotation Torque	1 Section Type 1.5±0.5 kg-cm 2 Section Type 2.5±0.5kg-cm 3 Section Type 2.7±0.7 kg-cm 4 Section Type 2.8±0.7 kg-cm
Terminal and Stator Strength	To withstand 1kg pull in any direction for 1 minute without damage and loosening
Switch Timing	Break before make or make before break
Life	After 10,000 times of no-load operations Contact Res.: 20mΩ max. Rotation Torque Change: +10% -30%
Power Switch	SPST, SPDT, DPST, DPDT

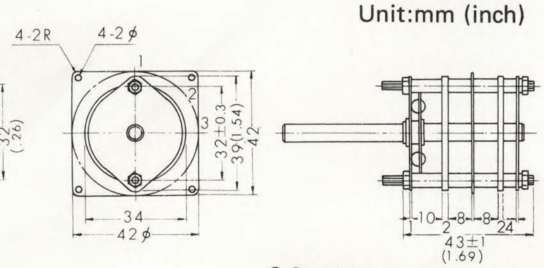
Demensions

Type C

Unit:mm (inch)

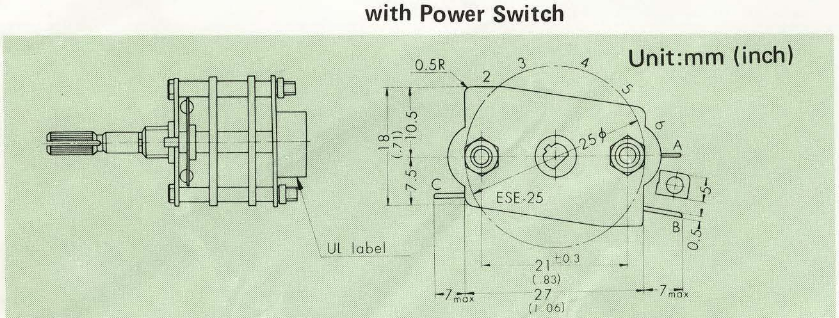


1 Section



2 Section

with Power Switch



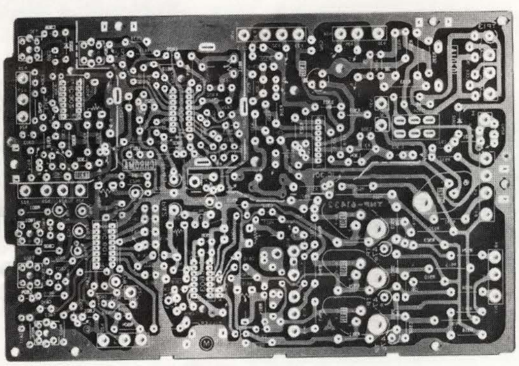
PRINTED WIRING BOARDS

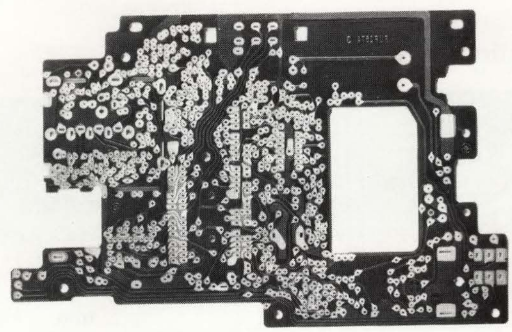
■ The types included in this catalog cover the general purpose boards most commonly used. We supply as well specially processed circuitry boards to meet exacting specifications for specialized needs. We offer this same service to meet your requirements, without obligation.

■ We manufacture from the raw material to the finished product thereby guaranteeing uniform quality. We laminate our own insulating board and apply the copper clad. In addition, our mass production plant for chemical and electro-plating processes is one of the world's finest.

■ We assure high accuracy, the finest techniques, the best material available in compounds and pure copper, and skilled automated processing. We offer you the best printed circuit boards available for use in transistorized circuitry for radios, TV's, electronic computers, and instruments and measuring panelings.

Copper Clad Laminated PWB

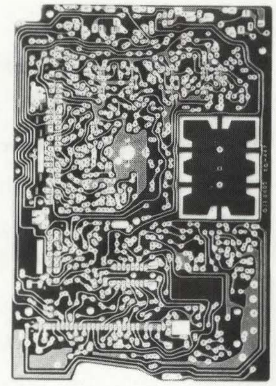


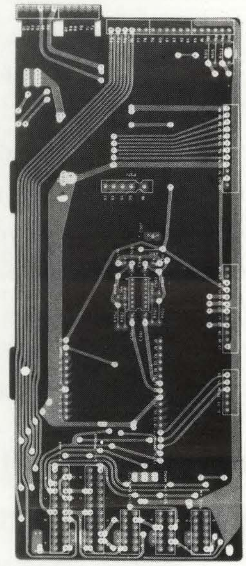


Specifications

Items / NEMA Grade	Com-position	Thickness		Peeling Strength	Soldering Limit	Surface I.R. (MΩ)		Q at 20MHz		Operating Temperature
		Board mm (inch)	Copper Foil (μ)	90° Direction (kg/cm)	at 260°C (sec.)	Normal Conditions	C-96/40/90	Normal Conditions	C-96/40/90	
XPC	Paper-base Phenolic	1.6 (.063)	33	1.2 min.	5 min.	10^4 min.	10^3 min.	15 min.	10 min.	105°C (221°F) min.
XXP	Paper-base Phenolic	1.6 (.063)	33	1.2 min.	5 min.	10^5 min.	10^4 min.	20 min.	15 min.	105°C (221°F) min.
XXXPC	Paper-base Phenolic	1.6 (0.63)	33	1.2 min.	5 min.	10^6 min.	10^5 min.	30 min.	20 min.	105°C (221°F) min.
FR-2	Paper-base Phenolic	1.6 (.063)	33	1.2 min.	5 min.	10^6 min.	10^5 min.	30 min.	20 min.	105°C (221°F) min.
FR-3	Paper-base Epoxy	1.6 (.063)	33	1.4 min.	10 min.	10^6 min.	10^5 min.	30 min.	20 min.	105°C (221°F) min.
G-10	Glass-base Epoxy	1.6 (.063)	33	1.4 min.	20 min.	10^6 min.	10^5 min.	40 min.	30 min.	105°C (221°F) min.
FR-4	Glass-base Epoxy	1.6 (.063)	33	1.4 min.	20 min.	10^6 min.	10^5 min.	40 min.	30 min.	105°C (221°F) min.

"Duston" Plated Through-Hole PCB





This wiring board was recently developed by MATSUSHITA ELECTRIC and marketed under the name "DUSTON". This name was chosen because of the new process employed in the manufacture of the board.

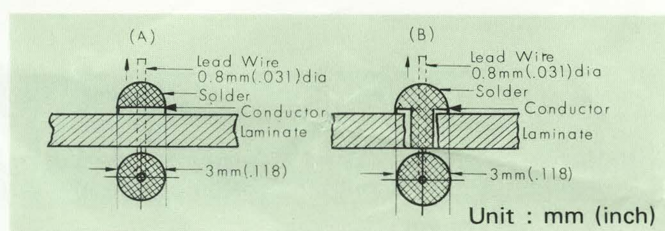
Powdered copper is fixed with adhesive ink to an insulated board which has a wiring pattern already printed on it. Then, electroless copper plating is applied over the fixed copper powder. In addition, this process makes it possible to plate the through-hole easily.

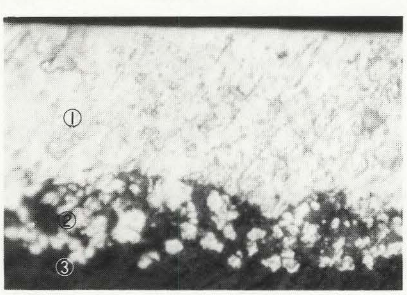
- Through-hole plating provides better solderability and, consequently, higher soldering reliability.
- No rework is needed after dip or flow soldering.
- UL listed. File No. E-36779

Specifications

Items / NEMA Grade	Com-position	Thickness		Pull Strength	Soldering Limit	Surface I.R. (MΩ)		Q at 20MHz		Operating Temperature
		Board mm (inch)	Copper Foil (μ)	kg (lbs)	at 260°C (sec.)	Normal Conditions	C-96/40/90	Normal Conditions	C-96/40/90	
XPC	Paper-base Phenolic	1.5 (.059)	20 min.	A: 4 (8.8) min.	5 min.	10^4 min.	10^3 min.	15 min.	10 min.	105°C (221°F) min.
XXP	Paper-base Phenolic	1.5 (.059)	20 min.	B: 8 (17.6) min.	5 min.	10^5 min.	10^4 min.	20 min.	15 min.	105°C (221°F) min.
XXXPC	Paper-base Phenolic	1.5 (.059)	20 min.		5 min.	10^5 min.	10^5 min.	30 min.	20 min.	105°C (221°F) min.

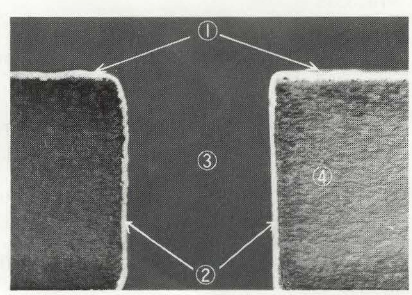
Note: Pull strength tests are conducted as described right.





Cross-section of conductor

① Conductor layer with electroless copper plating.
② Layer of copper powder and adhesive.
③ Insulation layer (Laminate)

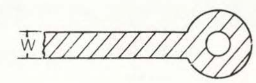
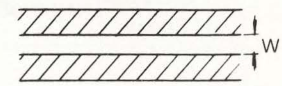
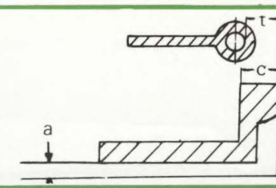
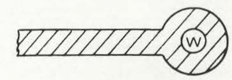
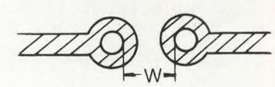


Cross-section of through-hole plating

① Conductor
② Electroless copper plated through hole
③ Components lead-wire insertion hole
④ Laminate

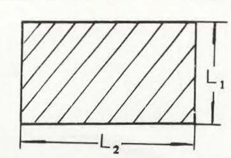
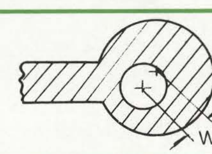
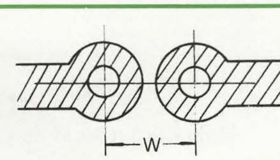
Minimum Dimensions and Tolerances

Unit: mm(inch)

	CCL	Duston	
Conductor Width Tolerance	0.5 (.020) ±0.2 (.008)	0.5 (.020) ±0.2 (.008)	
Conductor Spacing Tolerance	0.5 (.020) ±0.2 (.008)	0.5 (.020) ±0.2 (.008)	
Spacing Along Board Edge (t)	t: More than board thickness	t: More than board thickness	
Edge Conductor Width (C)	Refer to UL Listed	Refer to UL Listed	
Hole Diameter Tolerance	±0.1 (.004)	±0.2 (.008)	
Spacing Between Hole Edges	More than board thickness	More than board thickness	

UL Listed	(CCL)	(Duston)
Conductor Width:	0.5 (.020) min.	0.8 (.031) min.
Unpierced Conductor Diameter:	15 (.591) max.	20 (.787) max.
Edge Conductor Width:	1.5 (.059) min.	2.4 (.094) min.

Tolerances

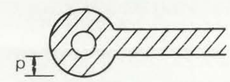
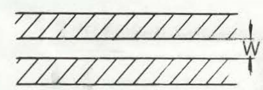
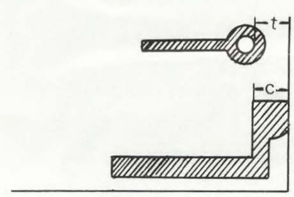
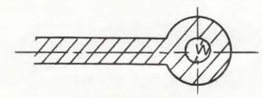
Hole Location Allowance	0.3 (.012) max.	0.3 (.012) max.	
Overall Dimensions	±0.5	±0.5	
Hole Center to Hole Center	±0.3 (.012)	±0.3 (.012)	

Plated Through Hole PWB

Specifications

Items / NEMA Grade	Composition	Thickness		Peeling Strength	Soldering Limit	Surface I.R. (MΩ)		Q at 20 MHz		Operating Temperature
		Board mm (inch)	Copper Foil (μ)	90° Direction (kg/cm)	at 260°C (sec.)	Normal Conditions	C-96/40/90	Normal Conditions	C-96/40/90	
FR-3	Glass-base Epoxy	1.6 (.063)	33 min.	1.4 min.	10 min.	10^6 min.	10^5 min.	30 min.	20 min.	105°C (221°F) min.
G-10	Glass-base Epoxy	1.6 (.063)	33 min.	1.4 min.	20 min.	10^6 min.	10^5 min.	40 min.	30 min.	105°C (221°F) min.

Unit: mm(inch)

Conductor Width		0.3 (.012)	
	Tolerance	±0.2 (.008)	
Conductor Spacing		0.3 (.012)	
	Tolerance	±0.2 (.008)	
Spacing Along Board Edge (t)		More than board thickness	
Edge Conductor Width (c)		Refer to UL Listed	
Hole Diameter Tolerance		±0.1 (.004)	

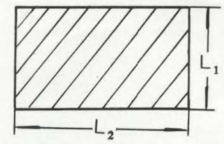
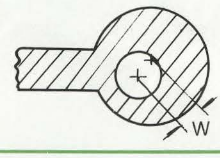
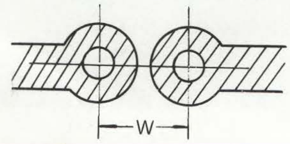
UL Listed

Conductor Width: 0.25 (.098) min.

Unpierced Conductor Diameter: 15 (.591)

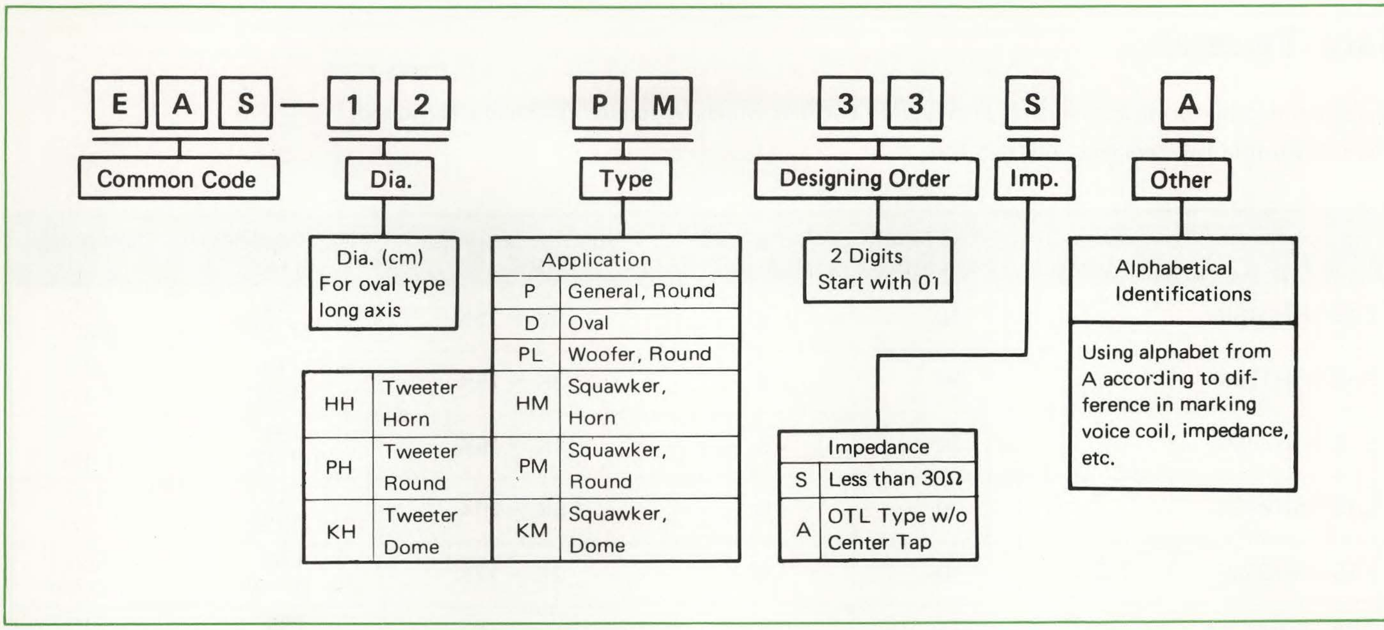
Edge Conductor Width: c – 0.76 (.030) min.

Tolerances

Overall Dimensions	±0.5 (.020")	
Hole Location Allowance	±0.3 (.012) max.	
Hole Center to Hole Center	±0.3 (0.12)	

XII SPEAKERS

Part Number Code



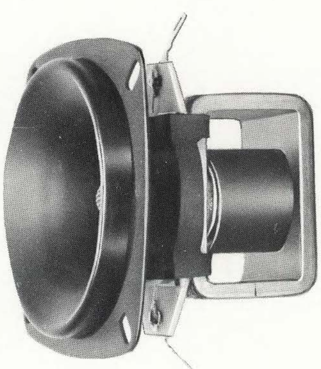
TWEETERS

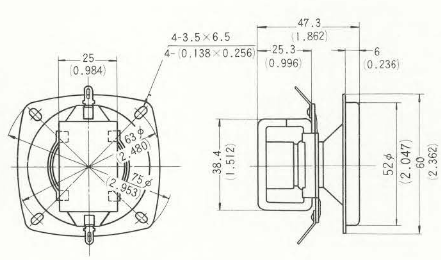
Horn Tweeters

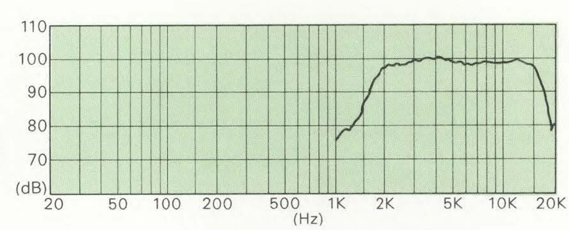
Realistic stereo performance demands high-quality tweeters which reproduce crisp and clear sound.
These Matsushita tweeters meet this demand.

Part No.	Dia. cm (inch)	Max. Input Power (W)	Voice Coil Imp. (Ω)	Frequency Response (Hz)	Magnet Weight g (oz)	Net Weight g (oz)
EAS-5HH31SB	5 (2)	10	8	5K ~ 15K	36 (1.27)	136 (4.80)
EAS-5HH17SM	5 (2)	20	8	3K ~ 15K	36 (1.27)	210 (7.41)
EAS-5HH39SC	5 (2)	20	8	4K ~ 15K	36 (1.27)	186 (7.41)
EAS-8HH21SA	8 (3)	20	8	1.5K ~ 20K	31 (1.09)	172 (7.07)
EAS-8HH55SC	8 (3)	40	8	2K ~ 17K	145 (5.12)	550 (19.42)
EAS-15HH51SA	15 x 5 (6 x 2)	10	8	1K ~ 12K	36 (1.27)	310 (10.95)

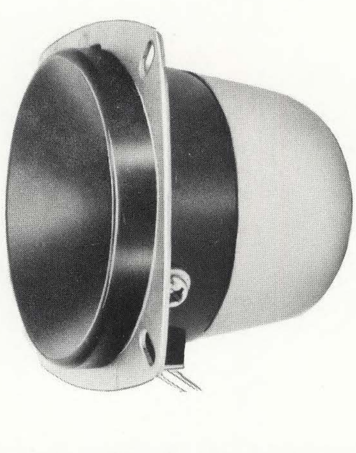
EAS-5HH31SB

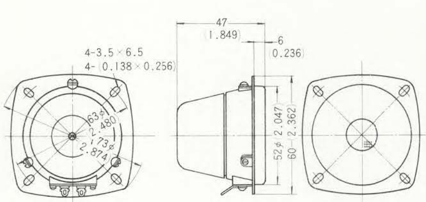


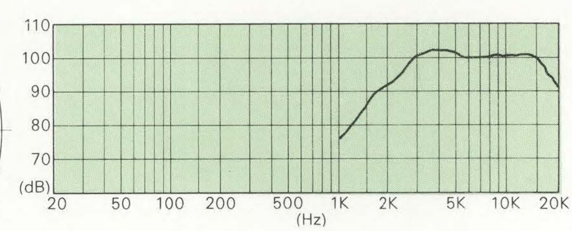




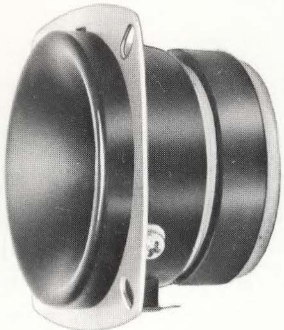
EAS-5HH17SM

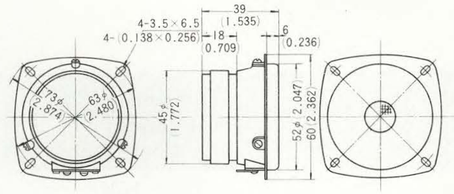


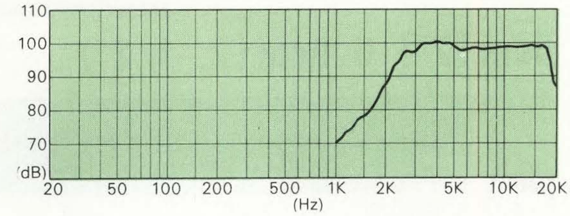




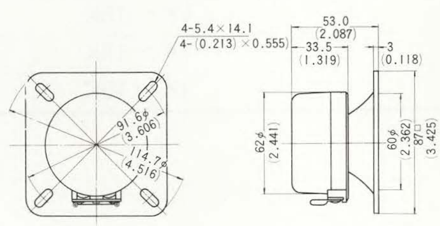
EAS-5HH39SC

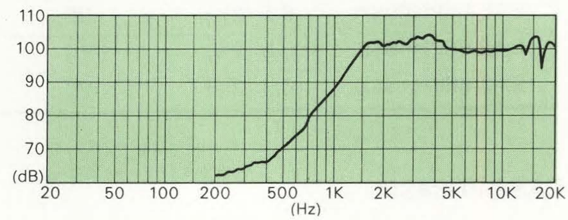




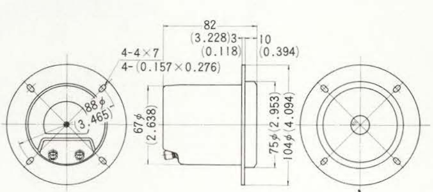


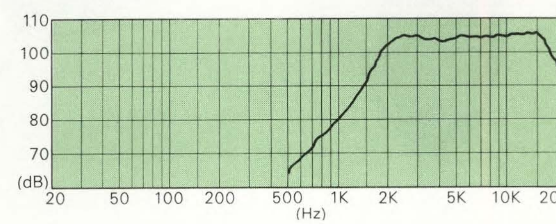
EAS-8HH21SA



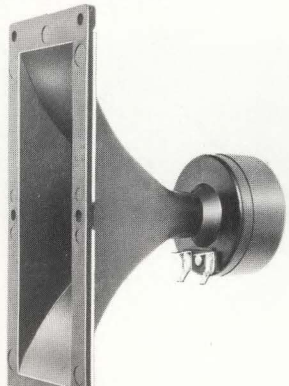


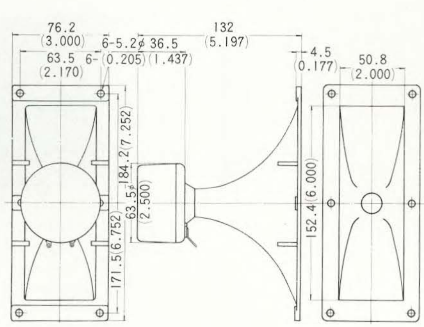
EAS-8HH55SC

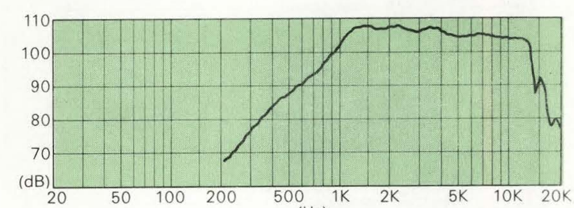




EAS-15HH51SA







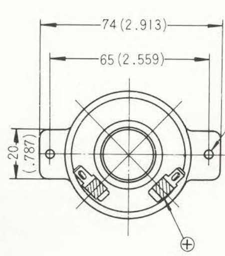
Cone Tweeters

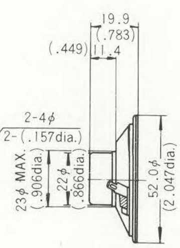
These economically produced cone tweeters reproduce softer and clearer sound than dome or horn type tweeters. This group of tweeters can also be most effectively combined with our woofers, providing high-quality sound reproduction.

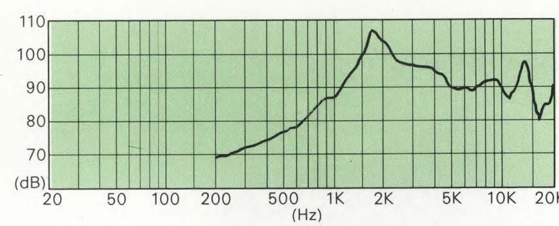
5cm (2"), 6.5cm (2–1/2")

Part No.	Dia. cm (inch)	Rated Power (W)	Voice Coil Imp. (Ω)	Frequency Response (Hz)	Magnet Weight g (oz)	Net Weight g (oz)
EAS-5PH34SD	5 (2)	3	8	4K ~ 15K	10 (.35)	45 (1.59)
EAS-5PH05S	5 (2)	6	8	2K ~ 20K	31 (1.09)	105 (.371)
EAS-5PH15SC	5 (2)	15	8	1.5K ~ 15K	12 (0.42)	60 (2.12)
EAS-5PH18SF	5 (2)	22	8	1.5K ~ 20K	42 (1.48)	140 (4.94)
EAS-65PH20S	6.5 (2½)	4	8	2K ~ 12K	10 (.35)	60 (2.12)
EAS-65PH14S	6.5 (2½)	4	8	2K ~ 12K	12 (.42)	60 (2.12)
EAS-65PH15SA	6.5 (2½)	3	8	1.3K ~ 15K	15 (.53)	73 (2.58)
EAS-65PH05SA	6.5 (2½)	25	8	5K ~ 15K	42 (1.48)	130 (4.59)
EAS-65PH16SB	6.5 (2½)	10	8	2K ~ 15K	31 (1.09)	170 (6.00)
EAS-65PH13SD	6.5 (2½)	20	8	1K ~ 15K	36 (1.27)	135 (4.76)

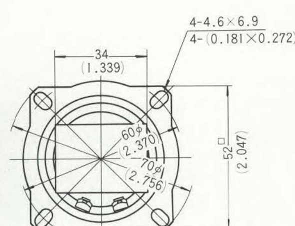
EAS-5PH34SD

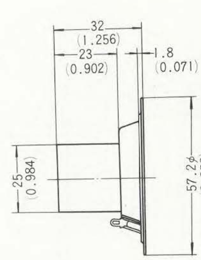


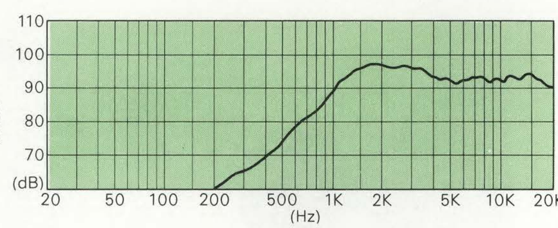




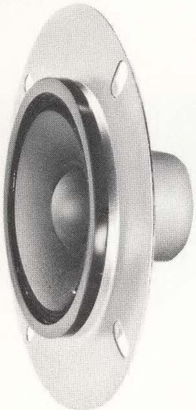
EAS-5PH05S

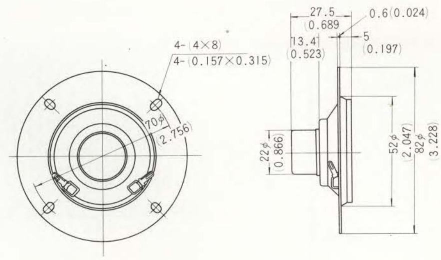


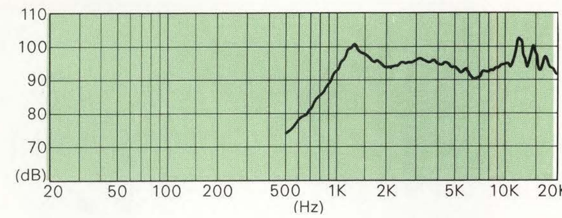




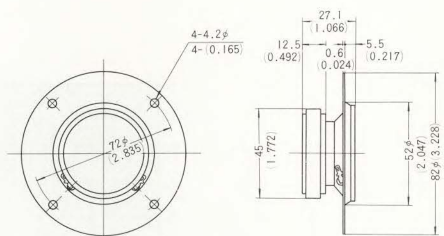
EAS-5PH15SC

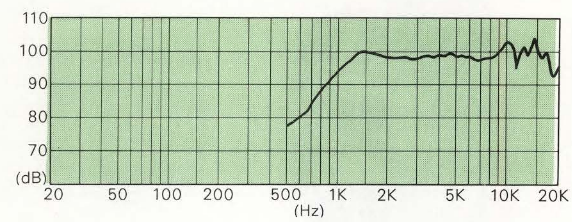






EAS-5PH18SF





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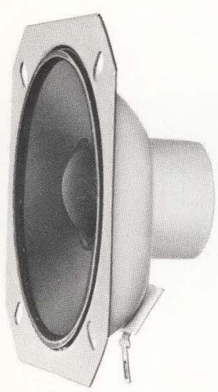
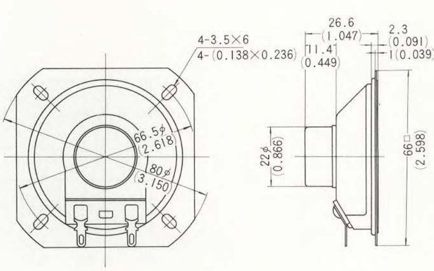
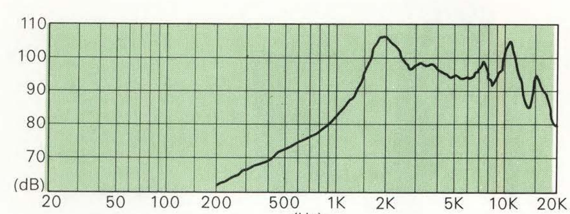
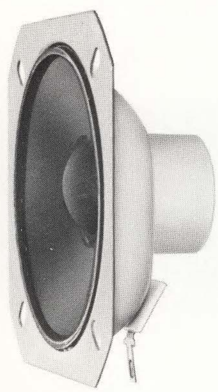
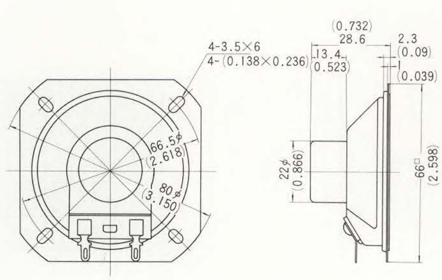


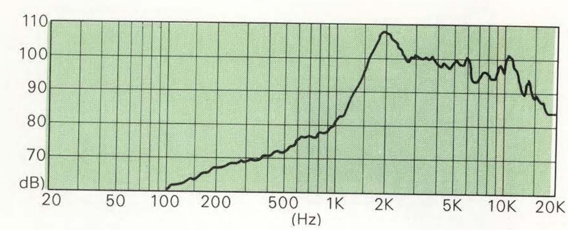




EAS-65PH14S







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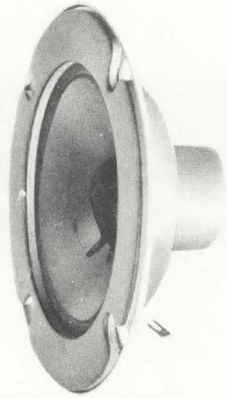
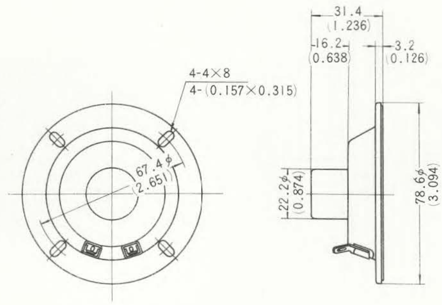
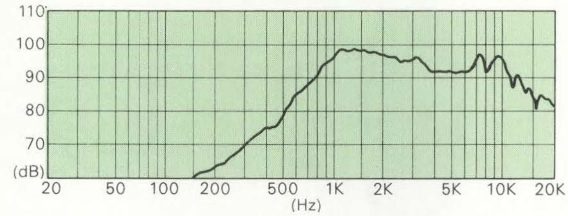
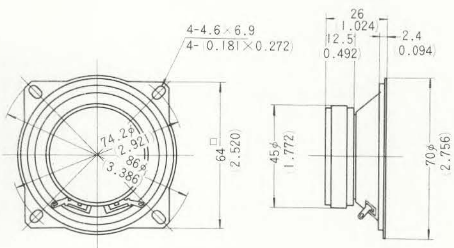
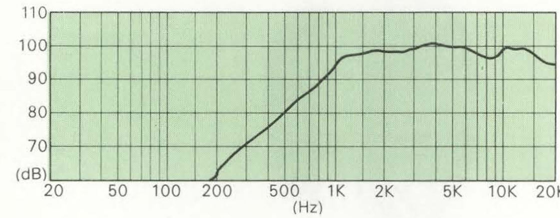




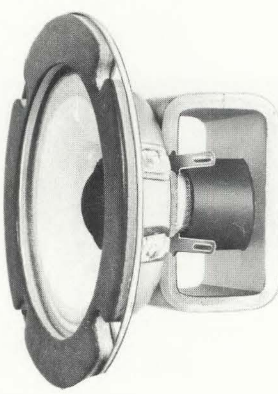


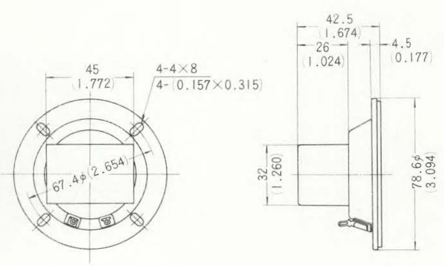
EAS-65PH05SA

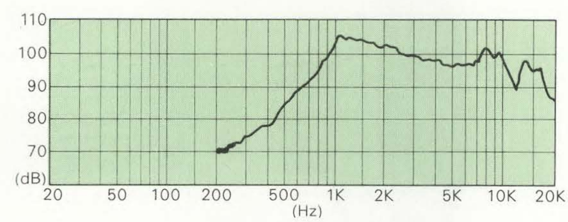




EAS-65PH16SB







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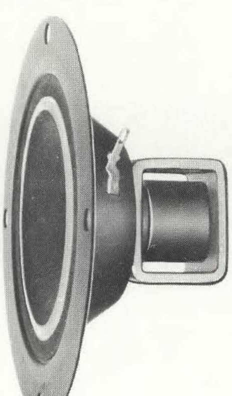
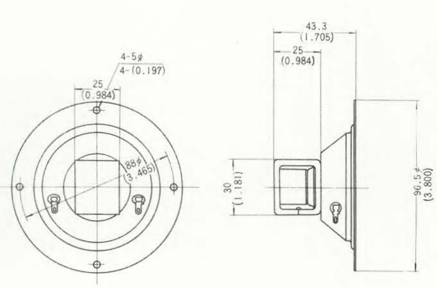
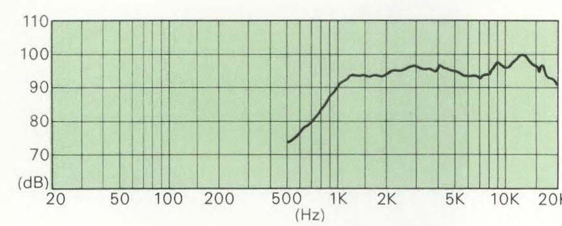


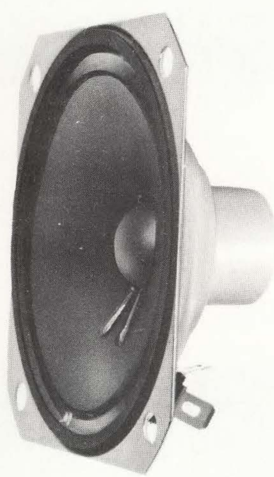


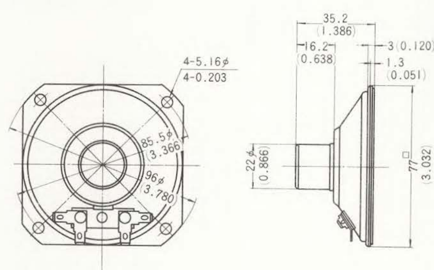


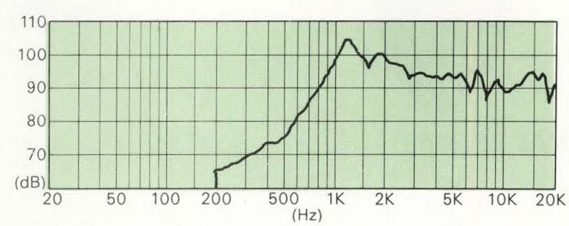
8cm (3"), 9cm (3-1/2"), 10cm (4")

Part No.	Dia. cm (inch)	Rated Power (W)	Voice Coil Imp. (Ω)	Frequency Response (Hz)	Magnet Weight g (oz)	Net Weight g (oz)
EAS-8PH35SB	8 (3)	4	8	2K ~ 12K	15 (.53)	87 (3.07)
EAS-8PH33SA	8 (3)	10	8	3K ~ 15K	16 (.56)	97 (3.42)
EAS-8PH25SB	8 (3)	5	8	3K ~ 15K	85 (3.00)	158 (5.58)
EAS-9PH38SA	9 (3½)	4	8	2K ~ 10K	12 (.42)	70 (2.47)
EAS-9PH44S	9 (3½)	18	8	1K ~ 12K	29 (1.02)	170 (6.00)
EAS-10PH29SG	10 (4)	3	8	3K ~ 10K	20 (.71)	170 (6.00)

EAS-8PH35SB







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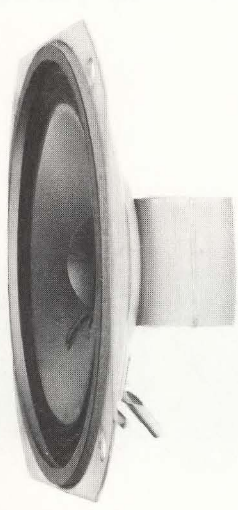

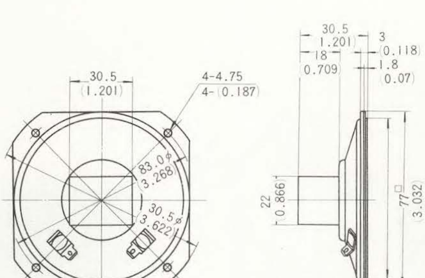

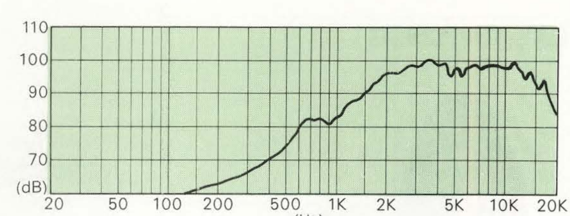

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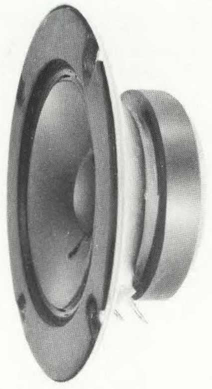

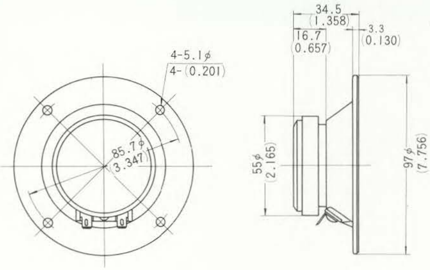

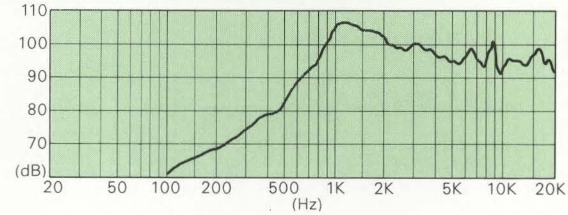

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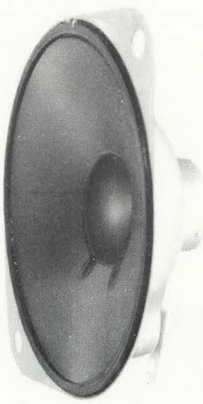

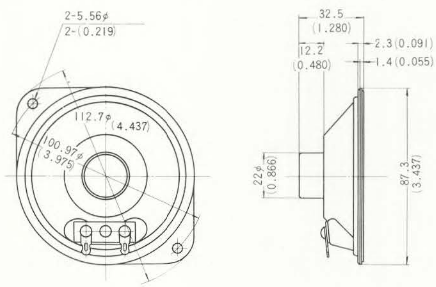

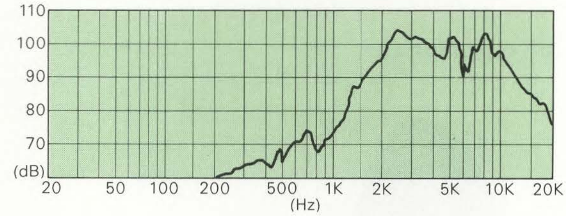

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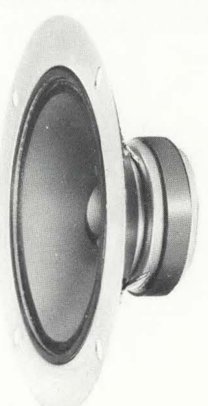

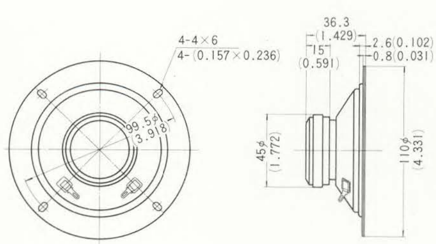

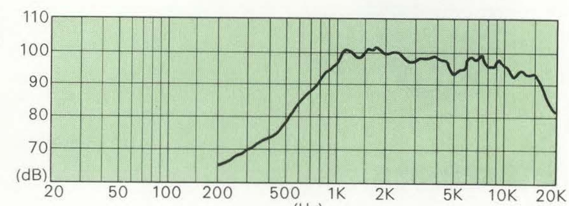

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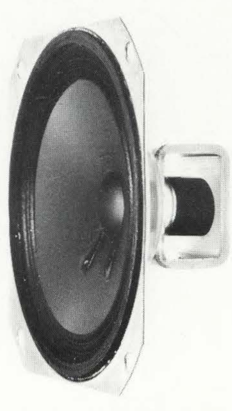
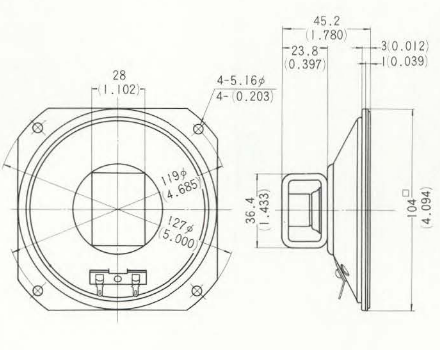
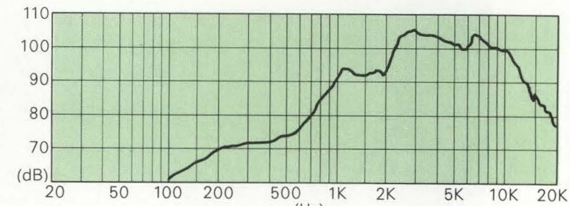


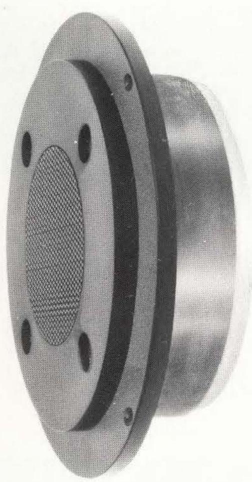


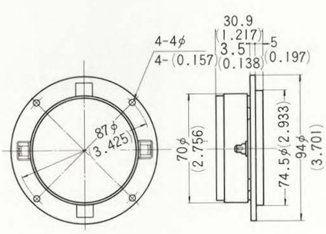


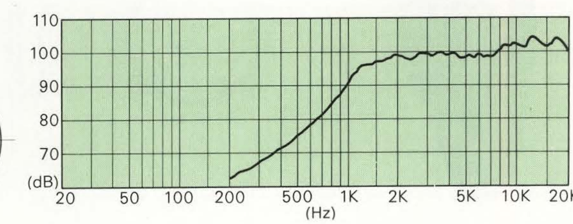
Dome Tweeters

Part No.	Dia. cm (inch)	Max. Input Power (W)	Voice Coil Imp. (Ω)	Frequency Response(Hz)	Magnet Weight g (oz)	Net Weight kg (lbs)
EAS-9KH05S	9 (3½)	40	8	1K ~ 20K	226 (7.98)	0.50 (1.10)
EAS-10KH05S	10 (4)	20	8	1.5K ~ 12K	60 (2.12)	0.19 (.42)
EAS-10KH10S	10 (4)	20	8	1.5K ~ 12K	85 (3.00)	0.24 (.53)
EAS-10KH15S	10 (4)	20	8	1.5K ~ 12K	105 (3.71)	0.27 (.60)
EAS-10KH03S	10 (4)	30	8	2K ~ 20K	103 (3.63)	0.3 (10.58)
EAS-13KH01S	12 (5)	40	8	0.9K ~ 20K	342 (12.06)	1.3 (45.85)

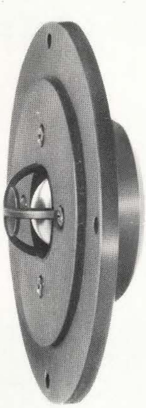
EAS-9KH05S

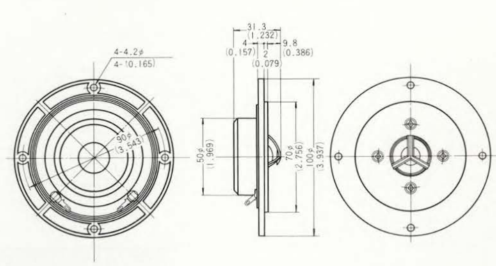


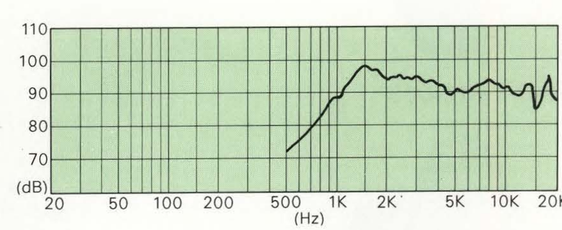




EAS-10KH05S







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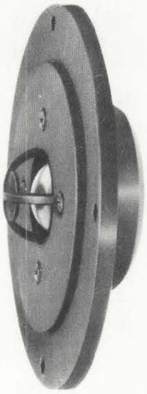
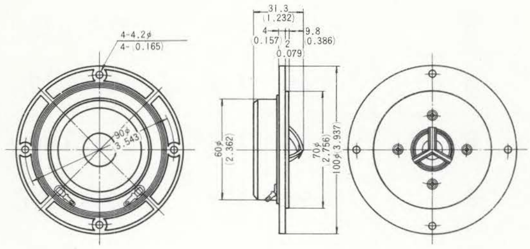
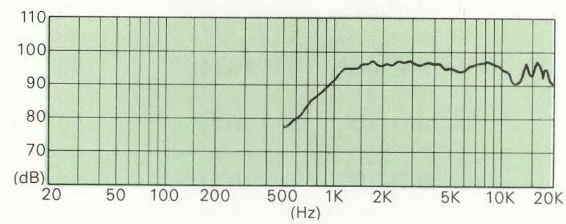
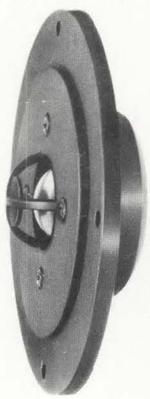
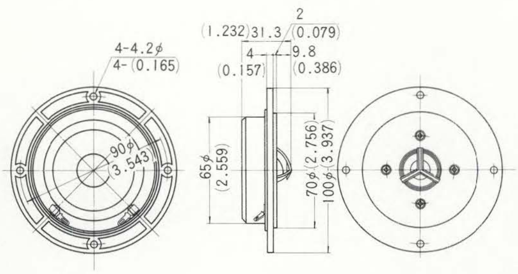


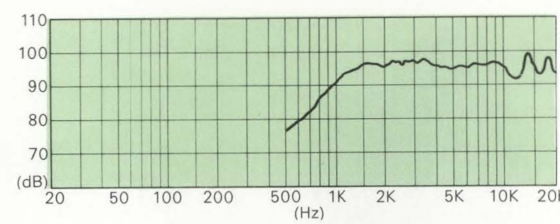




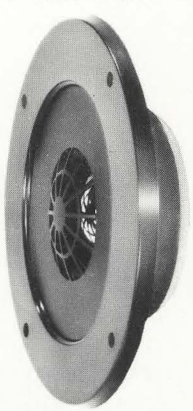
EAS-10KH15S

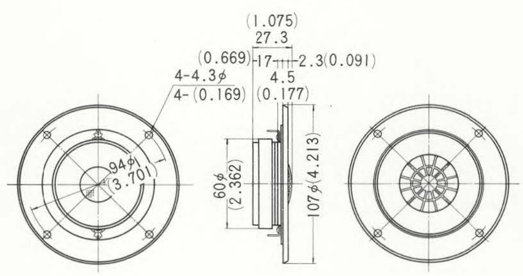


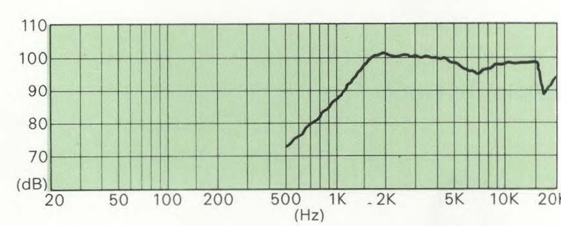




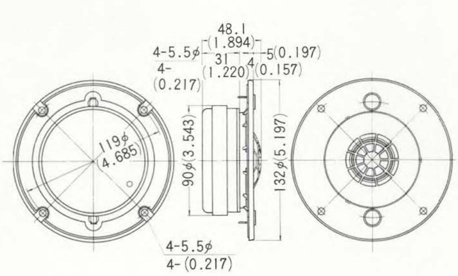
EAS-10KH03S

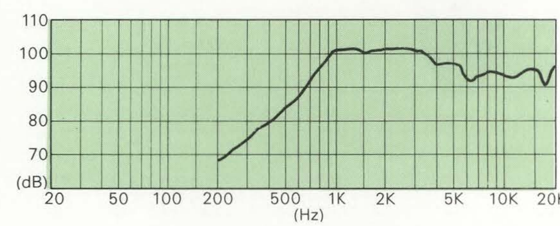






EAS-13KH01S



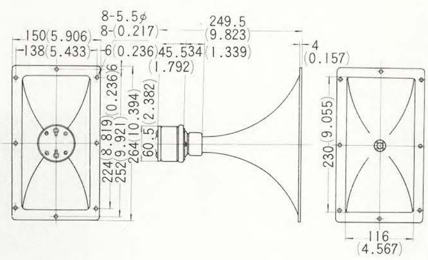


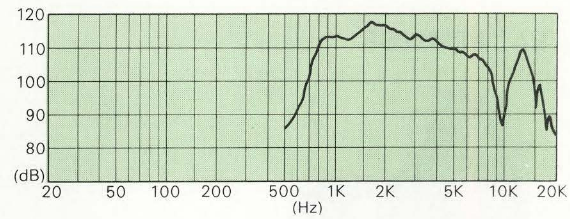
SQUAWKERS (MID RANGE)

Horn Squawkers, Dome Squatkers

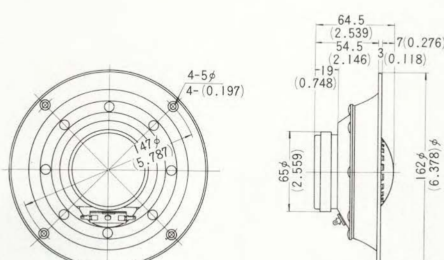
Part No.	Dia. cm (inch)	Max. Input Power (W)	Voice Coil Imp. (Ω)	Frequency Response (Hz)	Magnet Weight g (oz)	Net Weight kg (lbs)
EAS-23HM02SD	23 x 15 (10 x 6)	40	8	800 ~ 6K	110 (3.88)	1.50 (3.31)
EAS-16KM02S	15 (6)	20	8	550 ~ 5K	113 (4.00)	0.49 (1.10)
EAS-15KM02S	15 (6)	20	8	360 ~ 5K	178 (6.27)	0.80 (1.76)

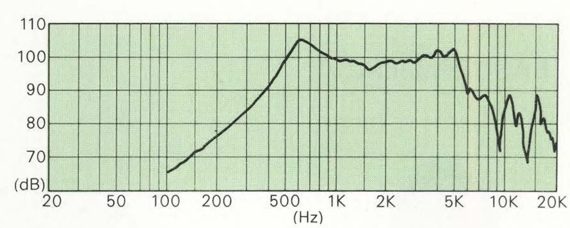
EAS-23HM02SD



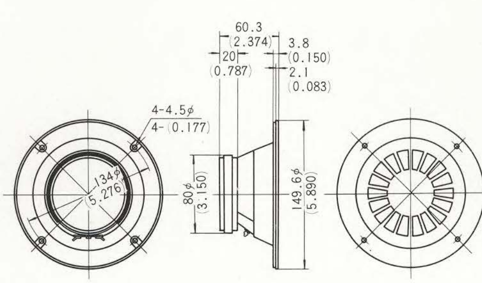


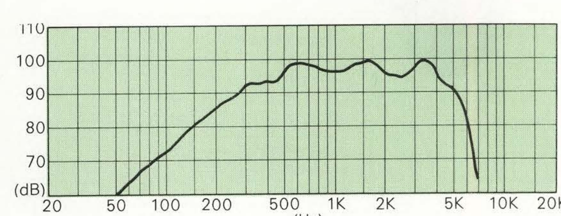
EAS-16KM02S





EAS-15KM02S

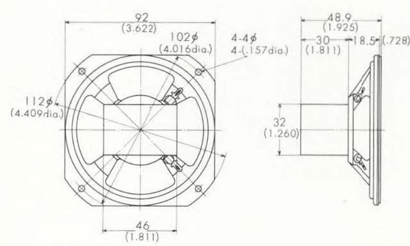


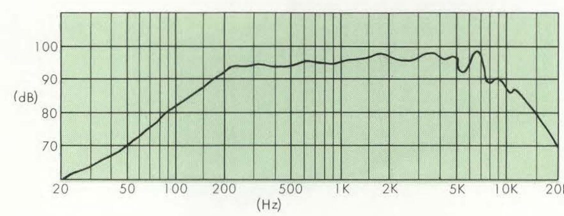


Cone Squawkers

Part No.	Dia. cm (inch)	Max. Input Power (W)	Voice Coil Imp. (Ω)	Frequency Response (Hz)	Magnet Weight g (oz)	Net Weight kg (lbs)
EAS-9PM58SF	9 (3½)	10	8	0.2K ~ 5K	36 (1.27)	0.53 (1.17)
EAS-12PM30SC	12 (5)	15	8	0.7K ~ 5K	113 (3.99)	0.70 (1.54)
EAS-12PM33SA	12 (5)	15	8	1K ~ 5K	84 (2.97)	0.38 (0.84)
EAS-12PM90SA	12 (5)	30	8	0.2K ~ 5K	178 (6.28)	0.80 (1.76)
EAS-16PM45SD	16 (6½)	60	8	0.6K ~ 10K	263 (9.28)	1.40 (3.09)

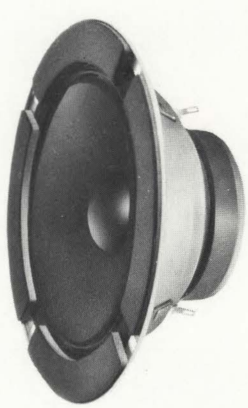
EAS-9PM58SF

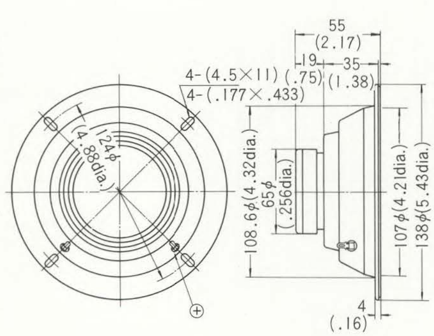


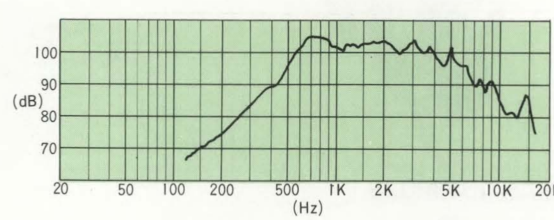


*9PM58SB: Voice Coil Imp. 16Ω

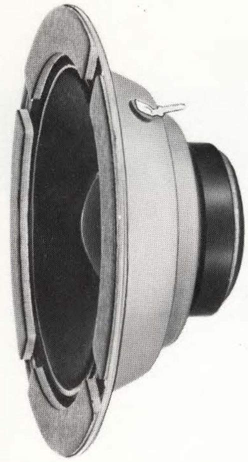
EAS-12PM30SC

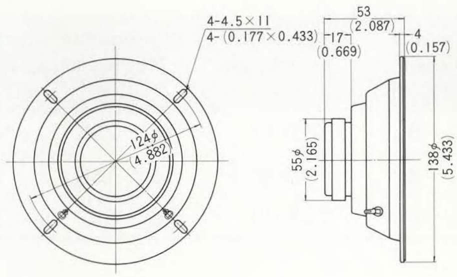


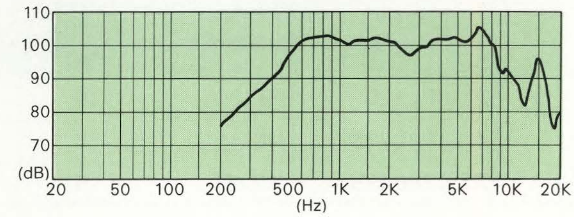




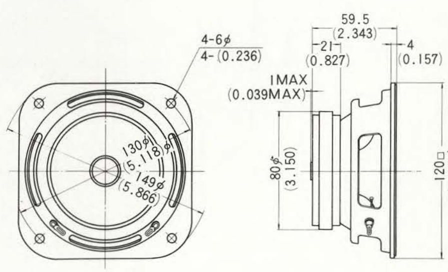
EAS-12PM33SA

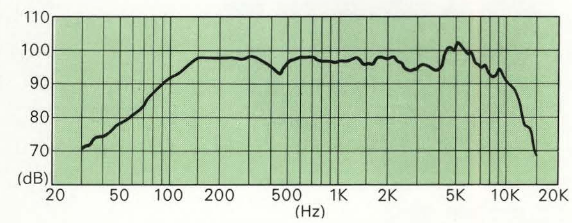




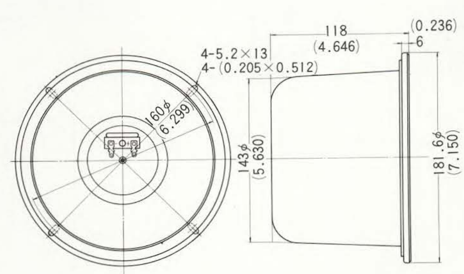


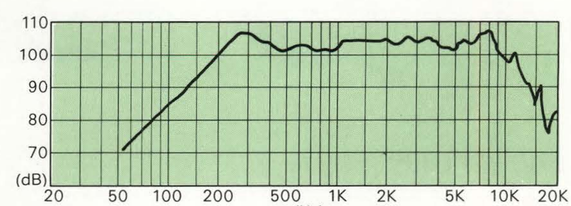
EAS-12PM90SA





EAS-16PM45SD





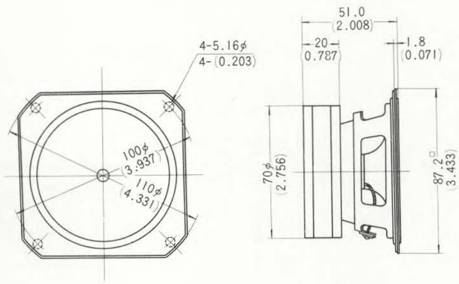
WOOFERS

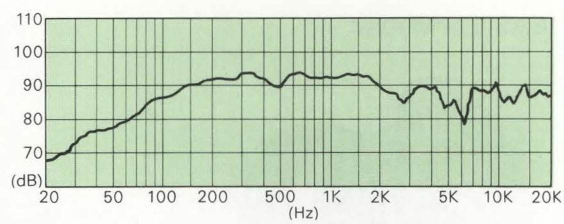
These woofers, tailored to optimum listening requirements, insure smooth even coverage of the entire bass specturm and include the latest developments in the electro-acoustic art.

9cm (3 1/2") 10cm (4") 12cm (5")

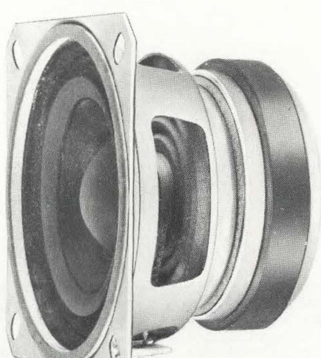
Part No.	Dia. cm (inch)	Rated Power (W)	Voice Coil Imp.(Ω)	Resonant Frequency (Hz)	Frequency Response (Hz)	Magnet Weight g (oz)	Net Weight kg (lbs)
EAS-9PL12S	9 (3½)	16	8	85±17	fo ~ 20K	177 (6.24)	0.70 (1.54)
EAS-10PL72S	10(4)	5	8	90±18	fo ~ 15K	85 (3.00)	0.33 (0.73)
EAS-12PL43S	12 (5)	5	8	110±20	fo ~ 6K	85 (3.00)	0.34 (0.75)

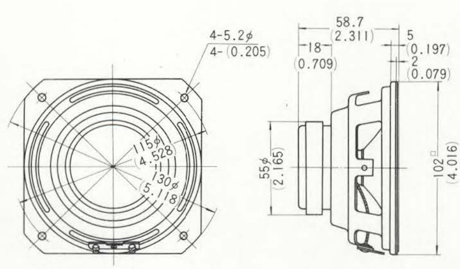
EAS-9PL12S

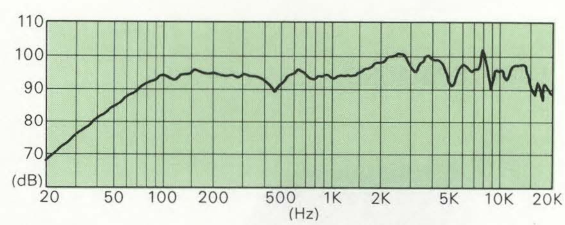




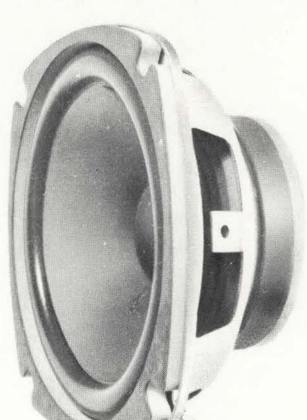
EAS-10PL72S

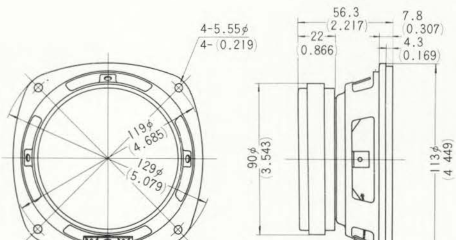


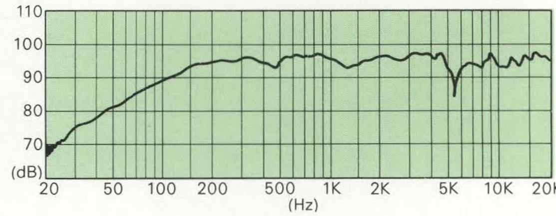




EAS-12PL43S



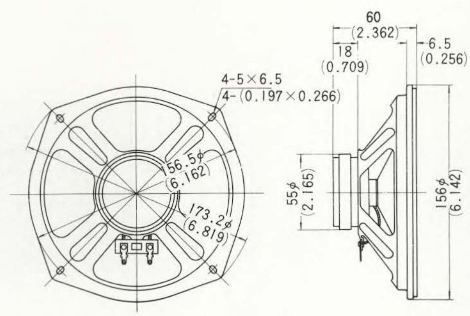


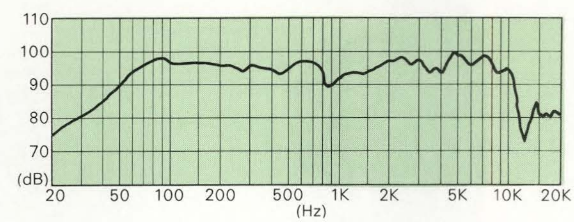


16cm (6-1/2"), 18cm (7")

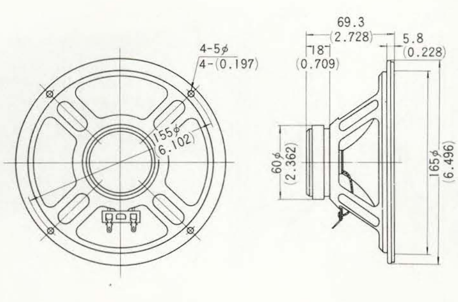
Part No.	Dia. cm (inch)	Rated Power (W)	Voice Coil Imp.(Ω)	Resonant Frequency (Hz)	Frequency Response (Hz)	Magnet Weight g(oz)	Net Weight kg(lbs)
EAS-16PL84SA	16 (6½)	6	8	70±15	fo ~ 10K	84 (2.97)	0.35 (0.77)
EAS-16PL33SG	16 (6½)	10	8	57±9	fo ~ 8K	110 (3.88)	0.37 (0.82)
EAS-16PL56S	16 (6½)	15	8	50±8	fo ~ 12K	177 (6.24)	0.70 (1.54)
EAS-16PL32SB	16 (6½)	10	8	55±10	fo ~ 12K	110 (3.88)	0.62 (1.37)
EAS-18PL55S	18 (7)	3	8	50±15	fo ~ 8K	113 (3.99)	0.53 (1.17)

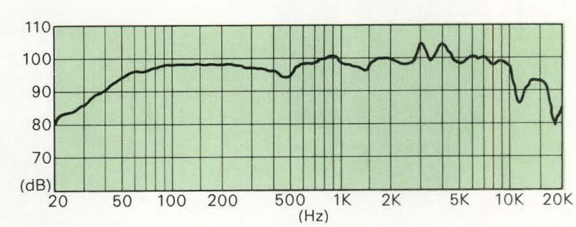
EAS-16PL84SA



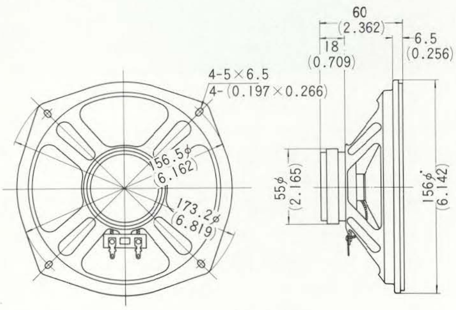


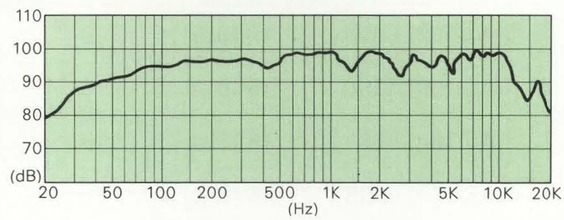
EAS-16PL33SG



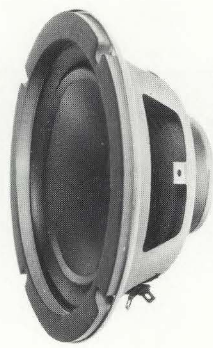


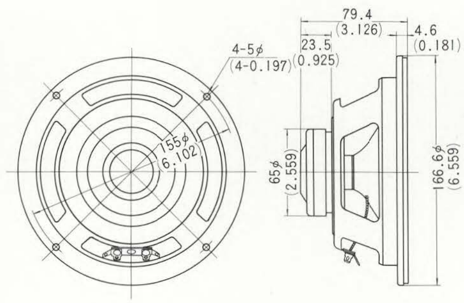
EAS-16PL56S

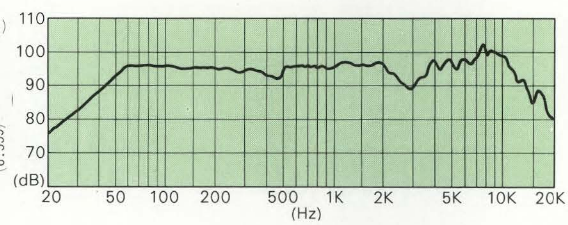




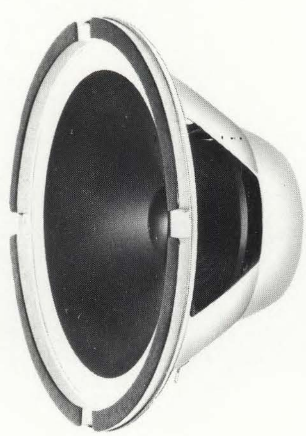
EAS-16PL32SB

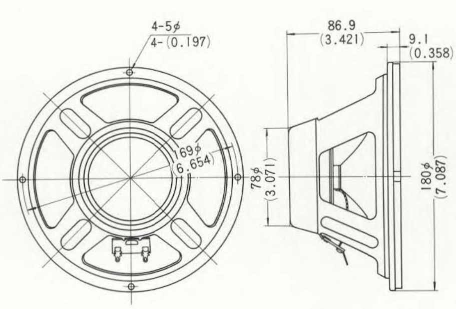


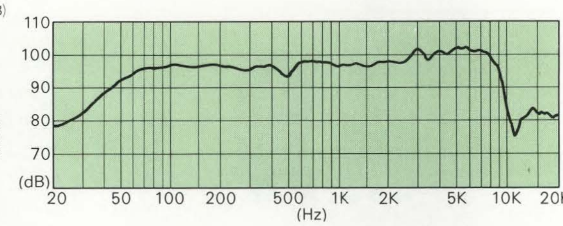




EAS-18PL55S



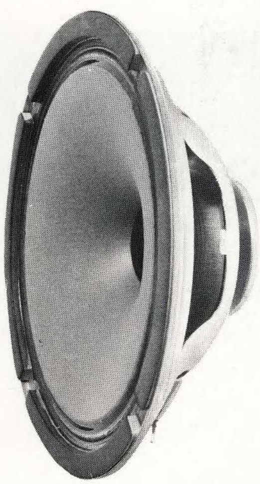


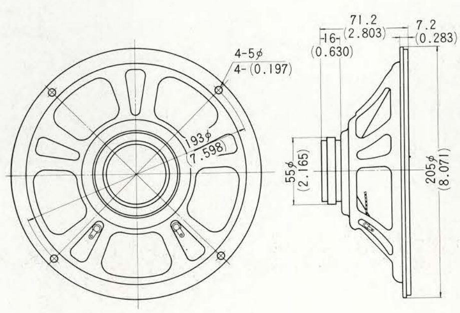


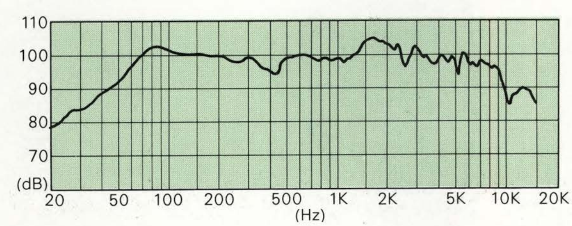
20cm (8")

Part No.	Dia. cm (inch)	Rated Power (W)	Voice Coil Imp.(Ω)	Resonant Frequency (Hz)	Frequency Response (Hz)	Magnet Weight g (oz)	Net Weight kg(lbs)
EAS-20PL83SA	20 (8)	5	8	80±15	fo ~ 5K	113 (3.99)	0.70 (1.54)
EAS-20PL52SA	20 (8)	20	8	60±10	fo ~ 5K	138 (4.87)	0.73 (1.61)
EAS-20PL56S	20 (8)	5	8	60±15	fo ~ 5K	152 (5.37)	0.70 (1.54)
EAS-20PL58SB	20 (8)	10	8	65±10	fo ~ 6.5K	102 (3.60)	0.54 (1.19)
EAS-20PL23SC	20 (8)	17	8	65±13	fo ~ 5K	180 (6.35)	1.00 (2.21)
EAS-20P37SA	20 (8)	15	8	80±10	fo ~ 5K	113 (3.99)	0.65 (1.43)

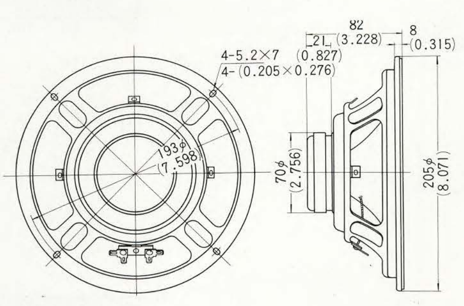
EAS-20PL83SA

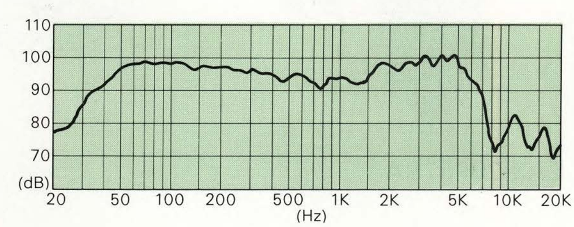




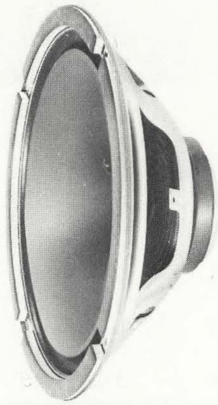


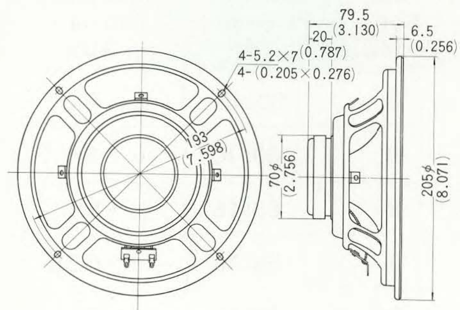
EAS-20PL52SA

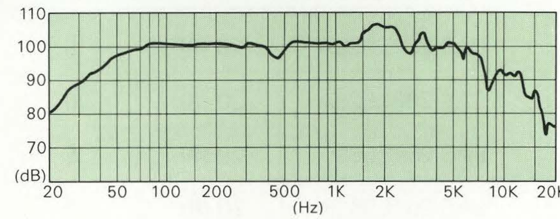




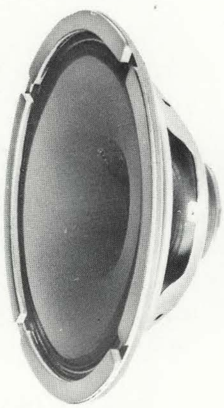
EAS-20PL56S

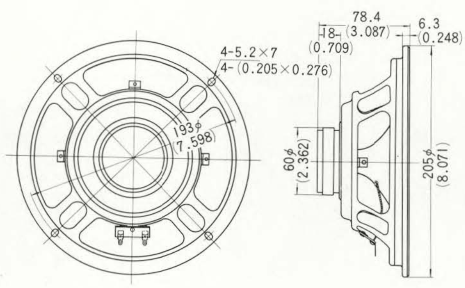


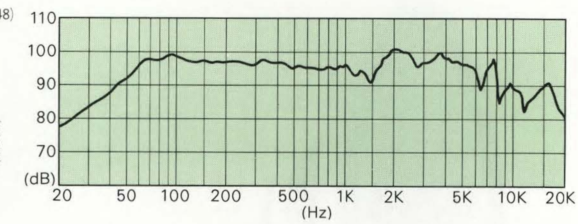




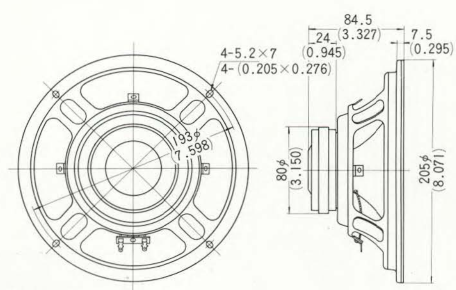
EAS-20PL58SB

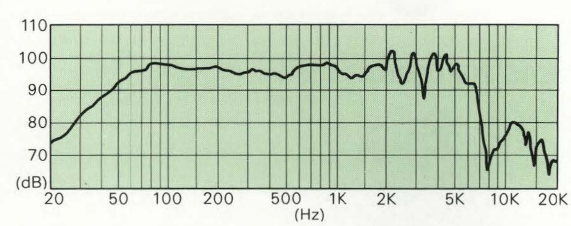




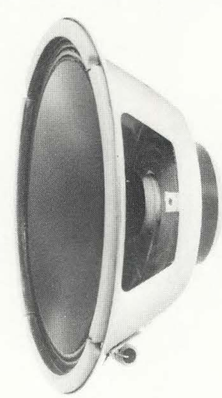


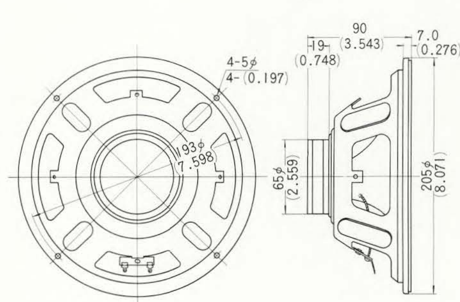
EAS-20PL23SC

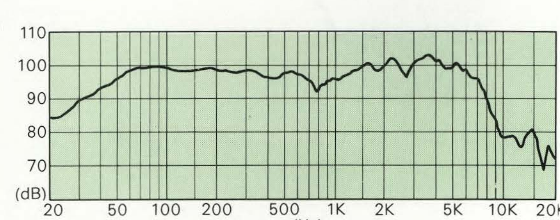




EAS-20P37SA



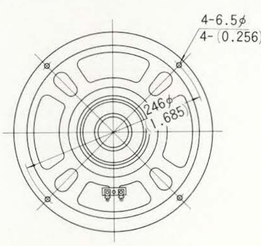


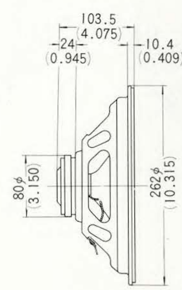


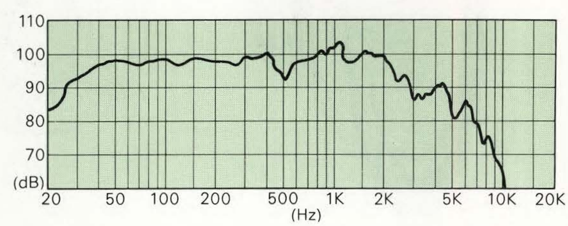
25cm (10"), 30cm (12")

Part No.	Dia. cm (inch)	Rated Power (W)	Voice Coil Imp.(Ω)	Resonant Frequency (Hz)	Frequency Response (Hz)	Magnet Weight g(oz)	Net Weight kg(lbs)
EAS-25PL14SA	25 (10)	20	8	39±6	fo ~ 2K	178 (6.28)	1.15 (2.53)
EAS-25PL25SB	25 (10)	20	8	55±10	fo ~ 4K	180 (6.35)	0.96 (2.12)
EAS-25PL27SA	25 (10)	25	4	35±10	fo ~ 1.5K	342 (12.08)	1.60 (3.52)
EAS-25PL45SA	25 (10)	25	8	27±5	fo ~ 3K	330 (11.66)	1.60 (3.52)
EAS-30PL28SA	30 (12)	30	8	40±8	fo ~ 1K	515 (18.18)	4.80 (10.58)
EAS-30PL12S	30 (12)	20	8	40±8	fo ~ 1K	343 (12.11)	1.90 (4.19)
EAS-30PL36S	30 (12)	45	8	20±5	fo ~ 1.5K	1000 (35.34)	3.60 (7.92)
EAS-30PL37S	30 (12)	20	8	38±8	fo ~ 1.5K	263 (9.28)	1.68 (3.70)

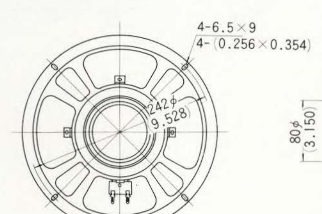
EAS-25PL14SA (AF Cone)

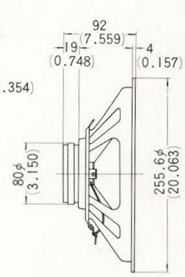


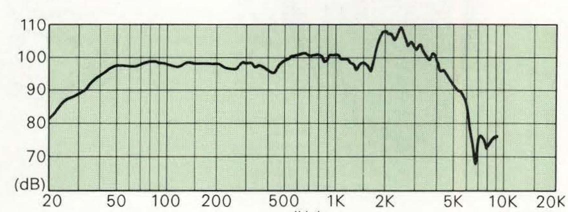




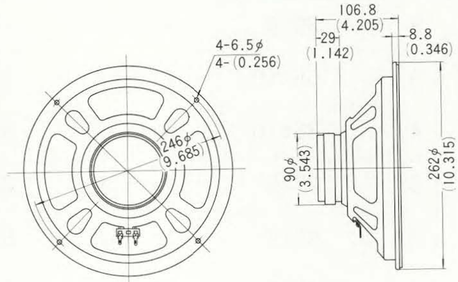
EAS-25PL25SB

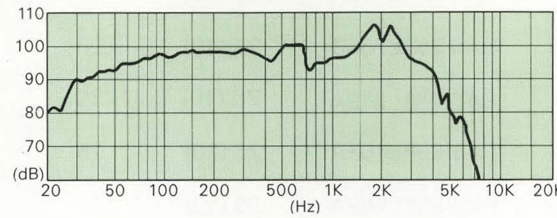




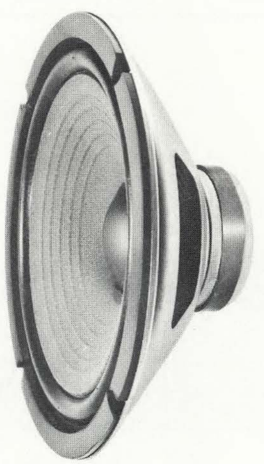


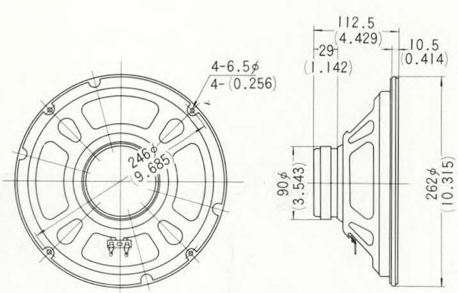
EAS-25PL27SA

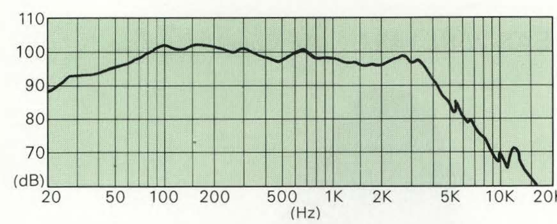




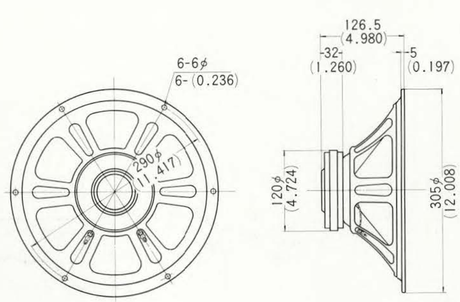
EAS-25PL45SA

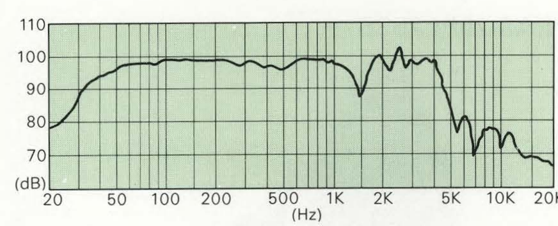




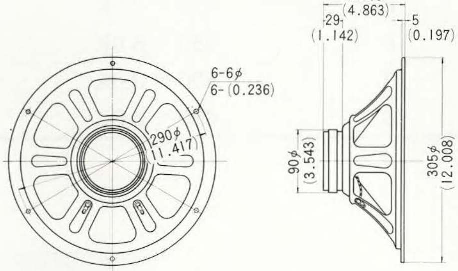


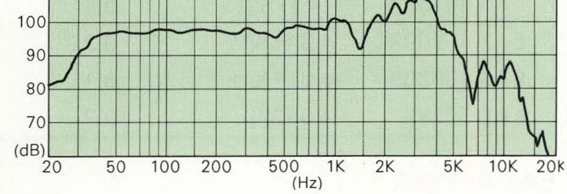
EAS-30PL28SA



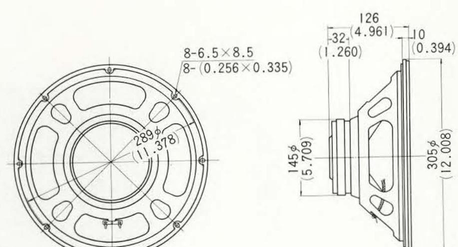


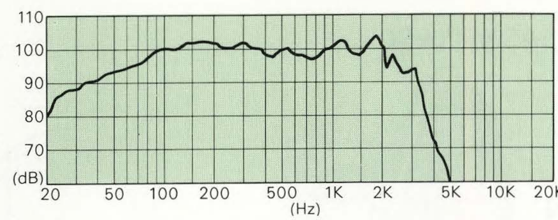
EAS-30PL12S





EAS-30PL36S





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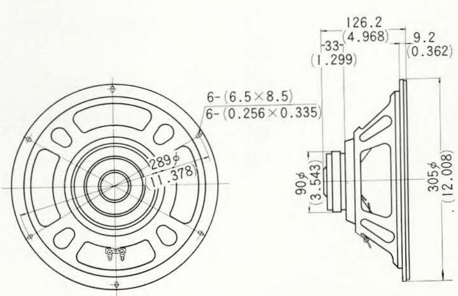
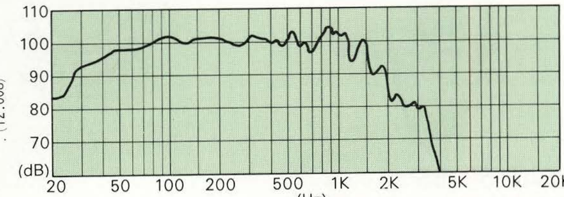




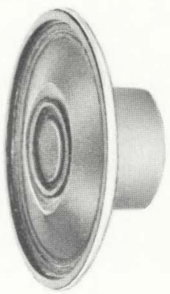
ROUND SPEAKERS

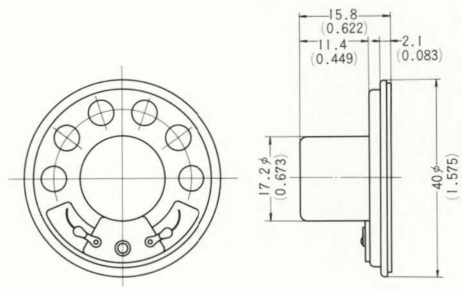
4cm (1-1/2") 4.5cm (1-3/4") 5cm (2")

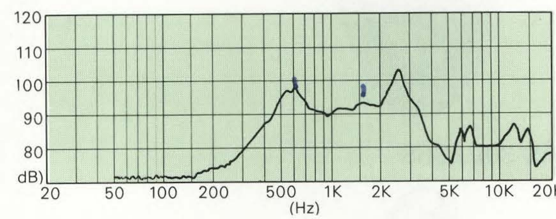
Part No.	Dia. cm (inch)	Rated Power (W)	Voice Coil Imp. (Ω)	Frequency Response (Hz)	Magnet Weight g (oz)	Net Weight g (oz)
EAS-4P15SA	4 (1½")	0.1	8	530 ~ 2.5K	7.7 (0.27)	25 (0.88)
EAS-45P09SC	4.5 (1¾")	0.3	8	550 ~ 8.0K	7.7 (0.56)	68 (2.40)
EAS-45P30S	4.5 (1¾")	0.1	8	500 ~ 3.0K	7.7 (0.27)	20 (0.71)
EAS-5P78S	5 (2")	0.2	8	430 ~ 3.0K	7.7 (0.27)	26 (0.92)

EAS-4P15SA

1½"

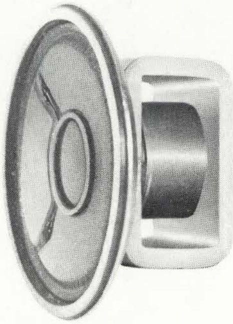


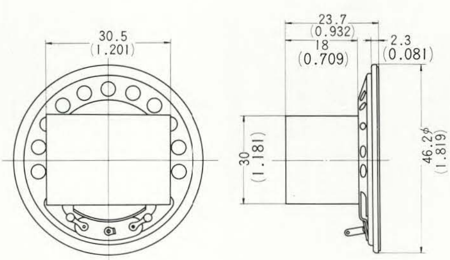


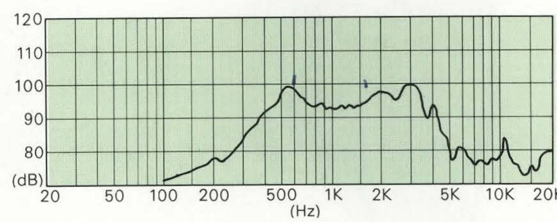


EAS-45P09SC

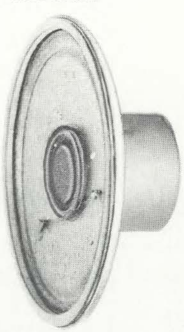
1¾

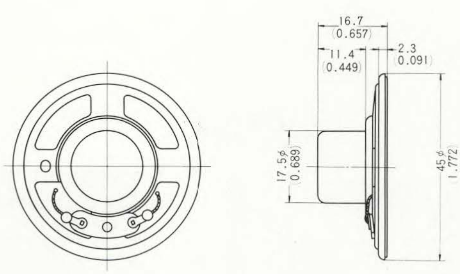


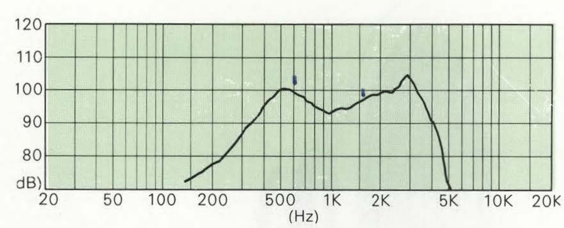




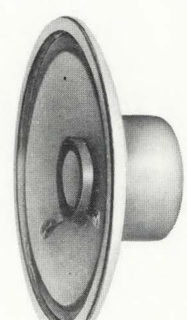
EAS-45P30S

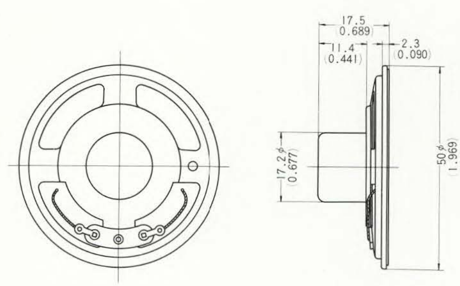


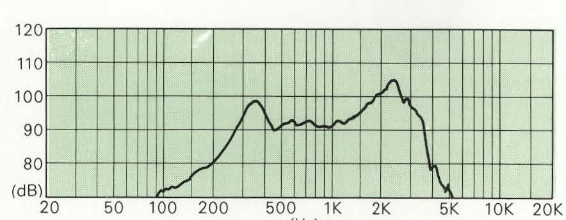




EAS-5P78S



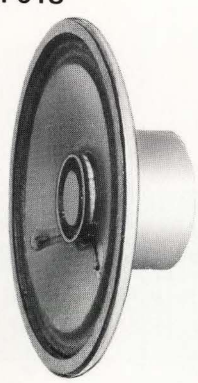
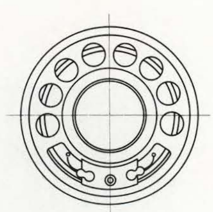
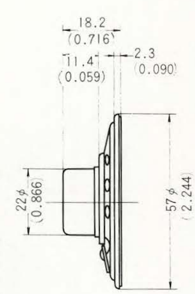


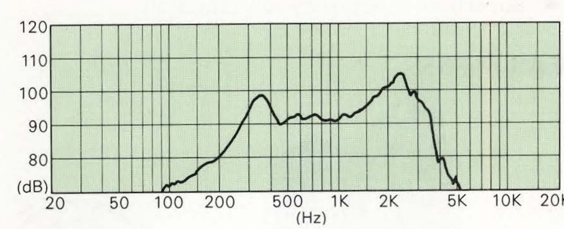


6cm (2-1/4") 6.5cm (2-1/2") 8cm (3") 9cm (3-1/2")

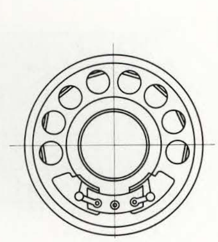
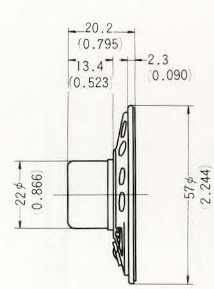
Part No.	Dia. cm (inch)	Rated Power (W)	Voice Coil (Ω)	Frequency Response (Hz)	Magnet Weight g (oz)	Net Weight g (oz)
EAS-6P01S	6 (2¼)	0.25	8	400 ~ 3.5K	10 (.35)	40 (1.41)
EAS-6P75SG	6 (2¼)	0.25	8	370 ~ 2.5K	12 (.42)	49 (1.73)
EAS-6P60S	6 (2¼)	0.63	8	700 ~ 2.5K	24 (.85)	85 (3.00)
EAS-6P05SA	6 (2¼)	0.25	8	370 ~ 3.5K	12 (.42)	38 (1.34)
EAS-65P65S	6.5 (2½)	1.5	8	180 ~ 4K	42 (1.48)	158 (5.58)
EAS-65P01S	6.5 (2½)	0.25	8	330 ~ 3.5K	10 (.35)	45 (1.59)
EAS-65P76SJ	6.5 (2½)	0.25	8	330 ~ 3.5K	12 (.42)	50 (1.77)
EAS-8P01S	8 (3)	0.63	8	250 ~ 4K	10 (.35)	50 (1.77)
EAS-8P65S	8 (3)	0.63	8	250 ~ 4K	12 (.42)	58 (2.01)
EAS-8P79S	8 (3)	1	8	350 ~ 3.5K	15 (.53)	71 (2.51)
EAS-8P70S	8 (3)	0.63	8	280 ~ 3.5K	24 (.85)	93 (3.28)
EAS-8P80S	8 (3)	1	8	250 ~ 5.0K	47 (1.66)	170 (6.0)
EAS-85P02SC	9 (3½)	1.5	8	220 ~ 7.0K	15 (0.53)	83 (2.93)
EAS-9P01SB	9 (3½)	0.63	8	200 ~ 4K	12 (0.42)	57 (2.01)
EAS-9P06S	9 (3½)	1	8	220 ~ 7K	20 (.71)	138 (4.87)
EAS-9P64S	9 (3½)	1	8	230 ~ 7K	15 (.53)	83 (2.93)
EAS-9P66S	9 (3½)	0.63	8	230 ~ 4K	12 (.42)	64 (2.26)
EAS-9P70S	9 (3½)	0.63	8	230 ~ 4K	24 (.85)	105 (3.71)
EAS-9P62SC	9 (3½)	1	8	160 ~ 2K	36 (1.27)	130 (4.59)
EAS-9P67SA	9 (3½)	2	8	170 ~ 5K	42 (1.48)	180 (6.35)

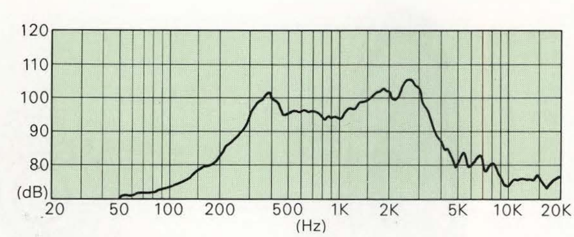
EAS-6P01S

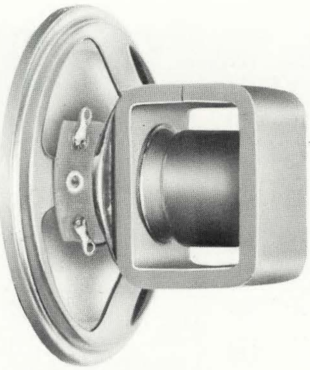


EAS-6P75SG

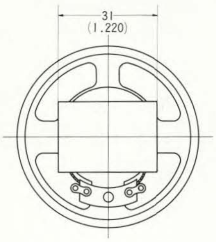




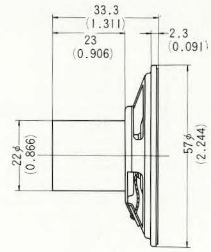


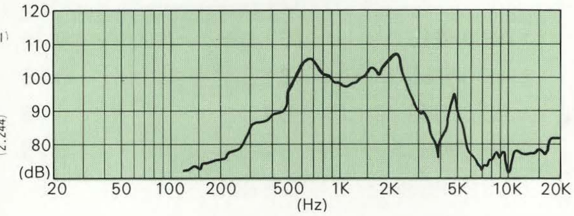
EAS-6P60S



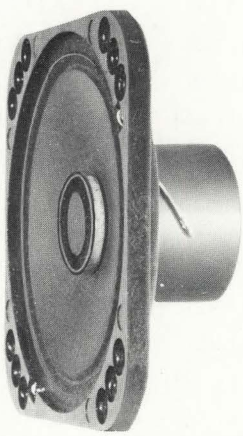
Cone and suspension of this speakers are processed to prevent moisture absorption in areas of high humidity, by using polyester materials.



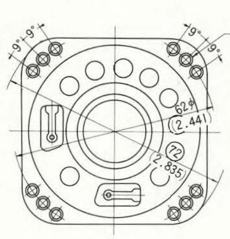


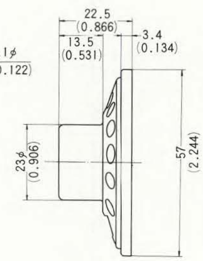


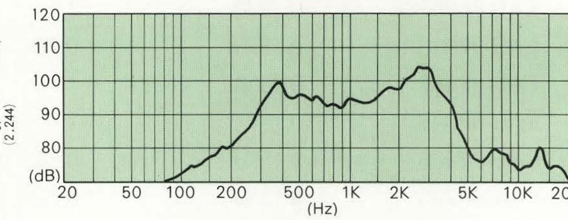
EAS-6P05SA



The frame of the speaker is made of plastic and by adopting fixed taps to the cabinet of the set, installation screws become unnecessary because the speaker is attached by radio frequency spattering.



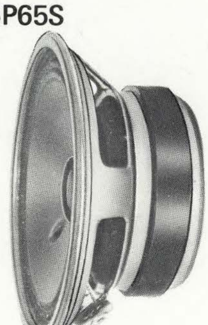


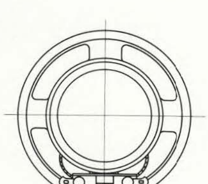


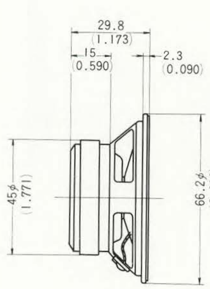
The edge portion of this cone is unit-formed with the remaining cone being made thinner by using stronger fiber. The plastic resin coated over the edge improves resistance against temperature and humidity.

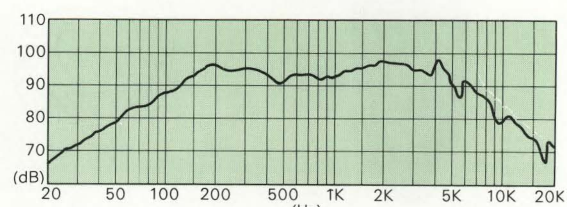
- UF cone for added reliability
- High handling power
- Superb low frequency reproduction

EAS-65P65S

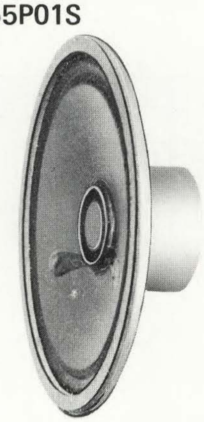


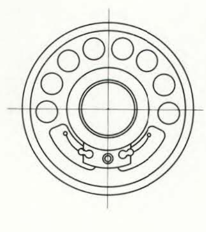


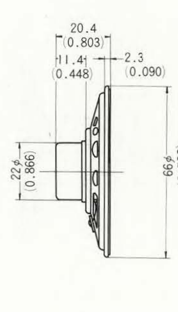


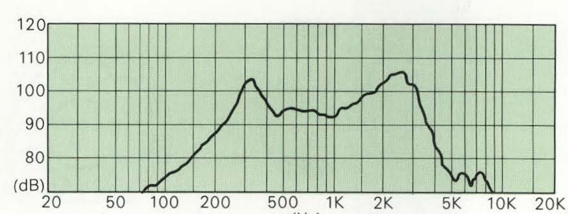


EAS-65P01S

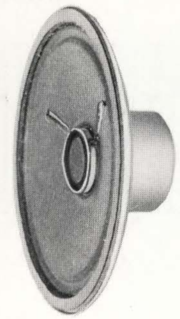


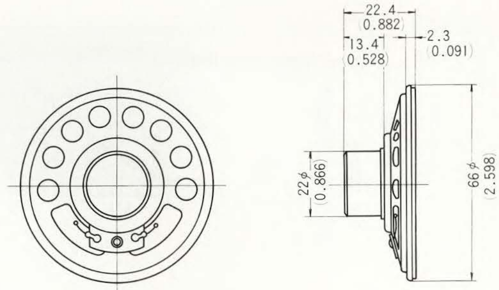


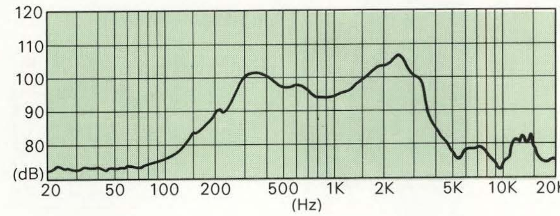




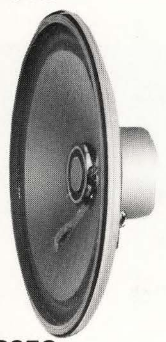
EAS-65P76SJ

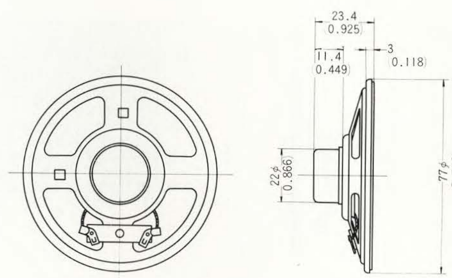


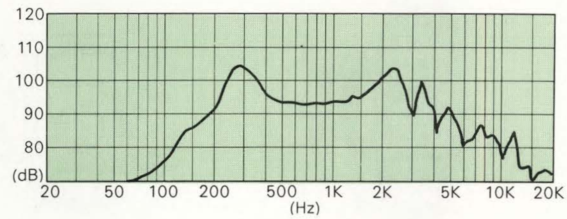




EAS-8P01S







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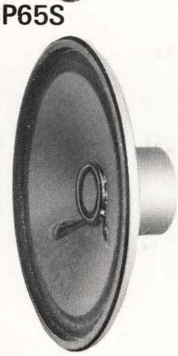

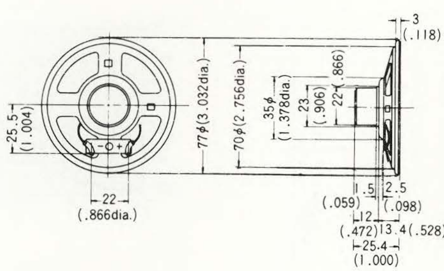

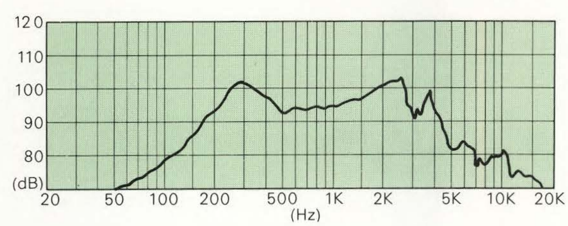

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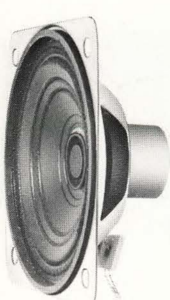

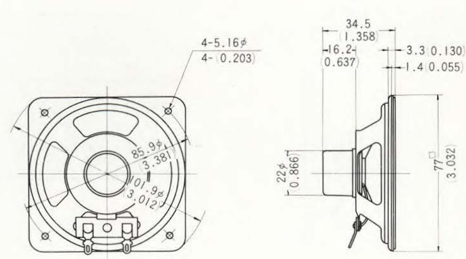

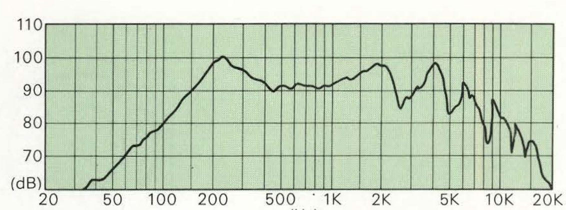

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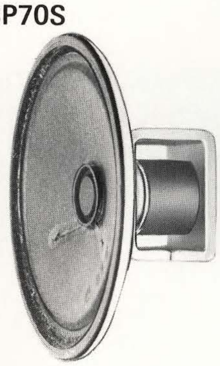

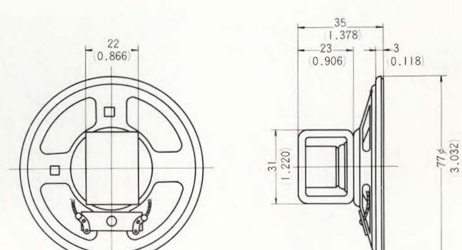

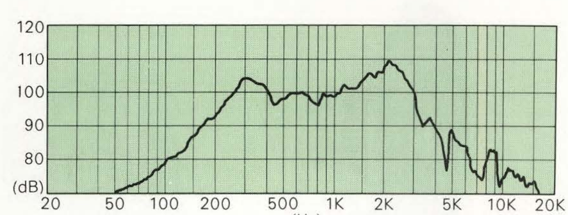

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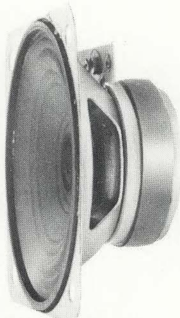
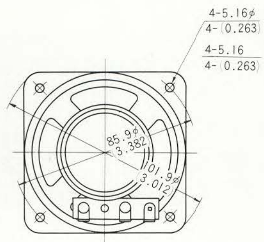

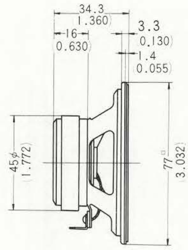

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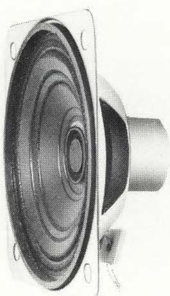
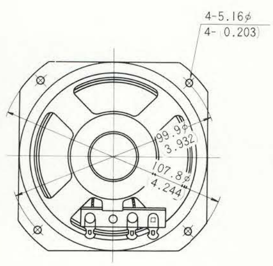
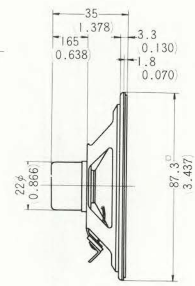
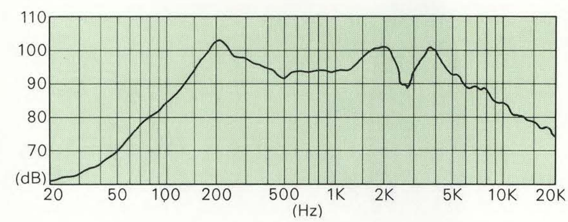
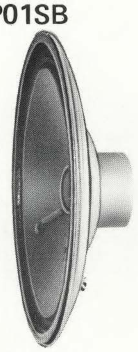
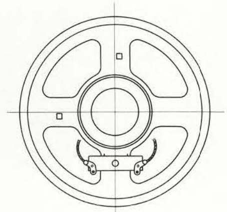
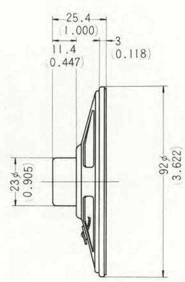
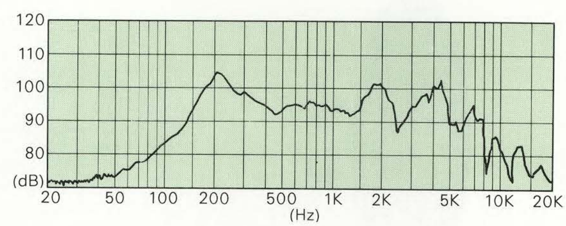







EAS-9P01SB



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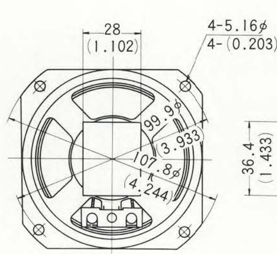

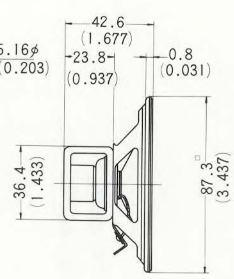

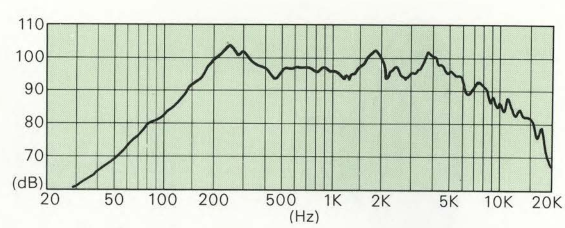

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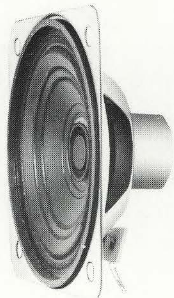
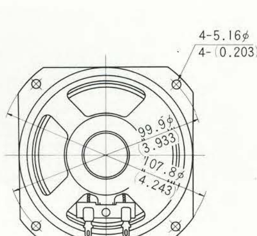

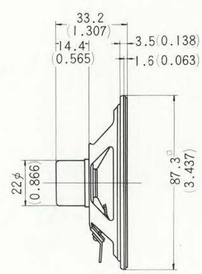

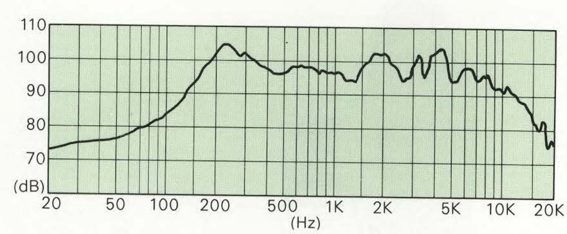

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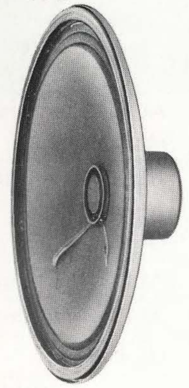

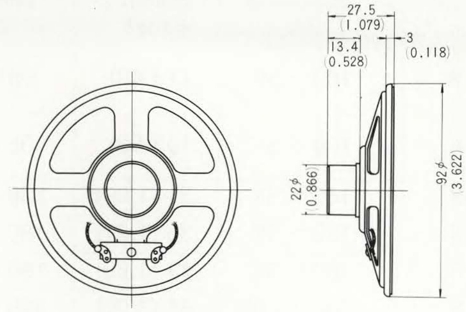

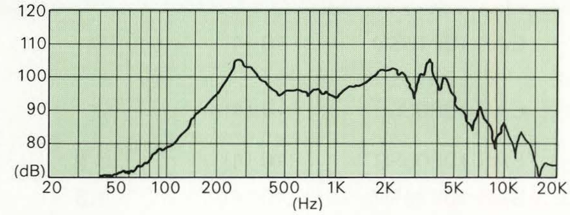

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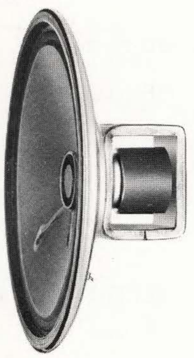
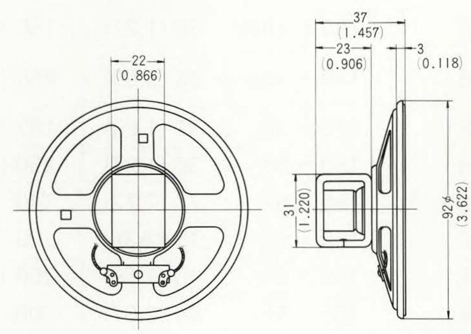
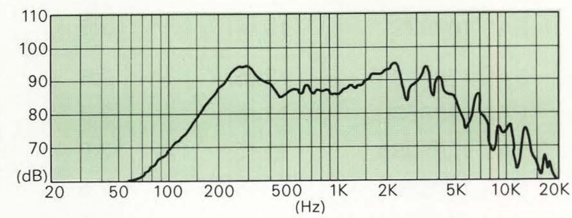
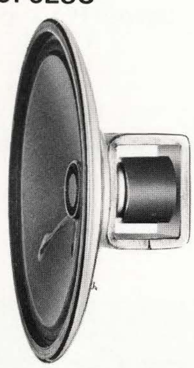
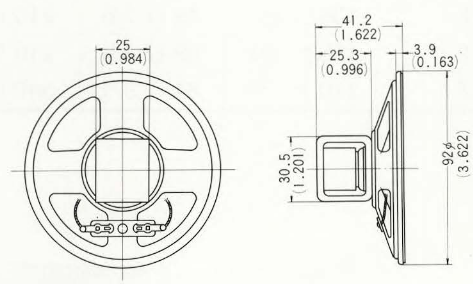


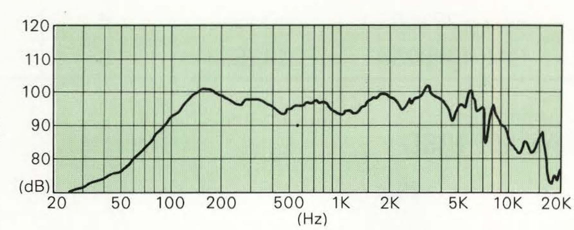




EAS-9P62SC



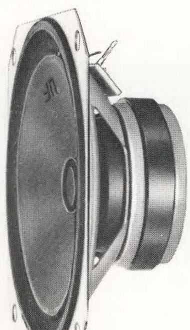


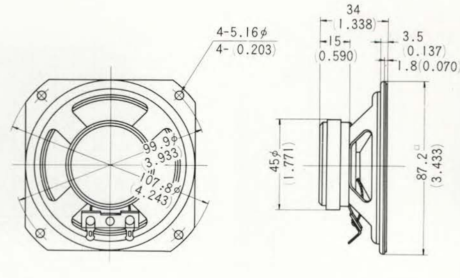


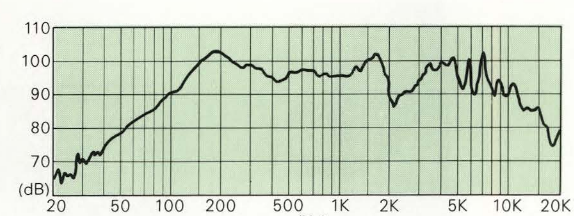
The edge portion of this cone is unit-formed with the remaining cone being made thinner by using stronger fiber.
The plastic resin coated over the edge improves resistance against temperature and humidity.

- UF cone for added reliability
- High handling power
- Superb low frequency reproduction

EAS-9P67SA



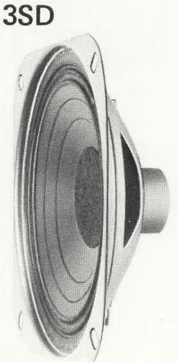


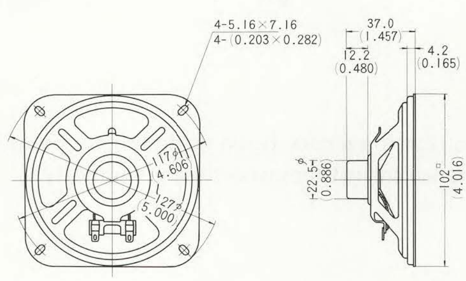


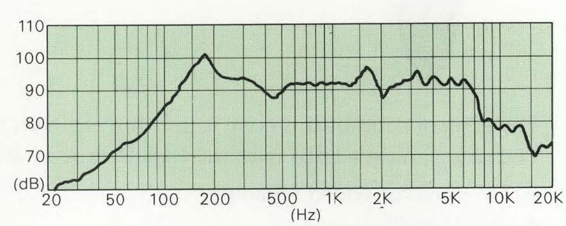
10cm (4") 12cm (5") 14cm (5 1/4")

Part No.	Dia. cm (inch)	Rated Power (W)	Voice Coil Imp.(Ω)	Frequency Response (Hz)	Magnet Weight g (oz)	Net Weight g (oz)	Other
EAS-10P13SD	10 (4)	2	8	180 ~ 5K	11 (.40)	95 (3.35)	ALCON terminal w/o gasket
EAS-10P03SF	10 (4)	2	8	180 ~ 5K	15 (.53)	95 (3.35)	ALCON terminal w/o gasket
EAS-10P05SB	10 (4)	1.6	8	165 ~ 5K	31 (1.09)	130 (4.59)	UF cone
EAS-10P75SM	10 (4)	1.6	8	180 ~ 5K	36 (1.27)	180 (6.35)	ALCON terminal
EAS-10P81SD	10 (4)	1.6	8	180 ~ 5K	48 (1.69)	190 (6.71)	ALCON terminal
EAS-10P84SD	10 (4)	1.6	8	160 ~ 10K	85 (3.00)	265 (9.35)	UF cone
EAS-10P16SF	10 (4)	2	8	140 ~ 10K	57 (2.01)	255 (9.00)	
EAS-10P23SD	10 (4)	2	8	180 ~ 8K	17 (0.60)	95 (3.35)	
EAS-10P75SR	10 (4)	1.6	8	170 ~ 10K	36 (1.27)	180 (6.35)	DL cone
EAS-10P92S	10 (4)	2.5	8	160 ~ 10K	85 (3.00)	250 (8.82)	UF cone
EAS-12P71SA	12 (5)	2.5	8	170 ~ 5K	31 (1.09)	187 (6.60)	
EAS-12P65SC	12 (5)	2.5	8	150 ~ 5K	36 (1.27)	230 (8.12)	
EAS-12P70SA	12 (5)	2.5	8	150 ~ 5K	77 (2.72)	340 (12.00)	
EAS-12P55S	12 (5)	2.5	8	160 ~ 5K	15 (.53)	105 (3.71)	
EAS-12P58SA	12 (5)	2.5	8	140 ~ 8K	48 (1.69)	200 (7.06)	ALCON terminal
EAS-12P18SA	12 (5)	7	8	165 ~ 5K	84 (2.97)	300 (10.59)	UF cone
EAS-12P81SA	12 (5)	5	8	80 ~ 5K	141 (5.00)	520 (18.34)	UF cone
EAS-12P105SA	12 (5)	2	8	110 ~ 10K	30 (1.06)	185 (6.53)	Shilded Pot Type
EAS-12P91SB	12 (5)	5	8	135 ~ 7K	49 (1.73)	210 (7.41)	
EAS-12P100SA	12 (5)	4	8	135 ~ 10K	69 (2.43)	210 (7.41)	
EAS-14P02SA	14 (5¼)	5	8	110 ~ 6K	84 (2.97)	340 (12.01)	

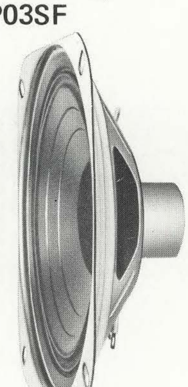
EAS-10P13SD

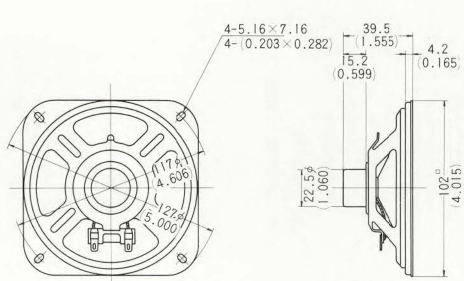


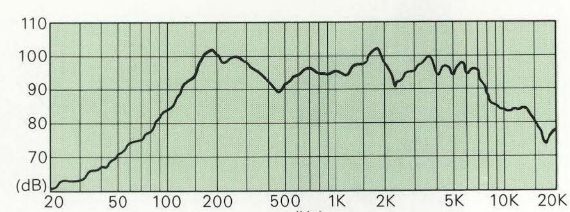




EAS-10P03SF



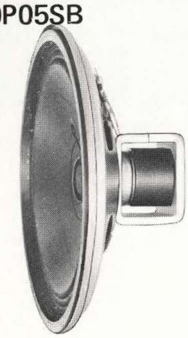


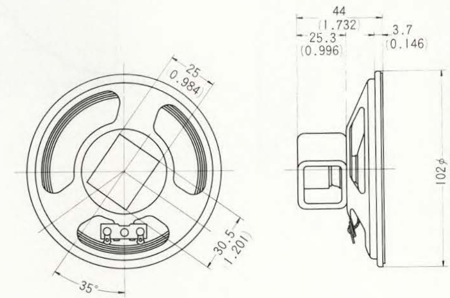


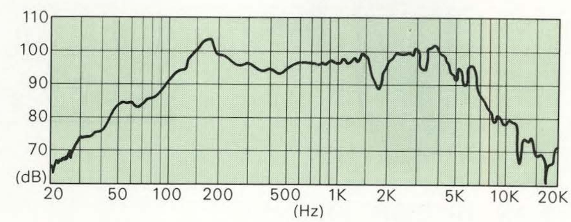
The edge portion of this cone is unit-formed with the remaining cone being made thinner by using stronger fiber. The plastic resin coated over the edge improves resistance against temperature and humidity.

- UF cone for added reliability
- High handling power
- Superb low frequency reproduction

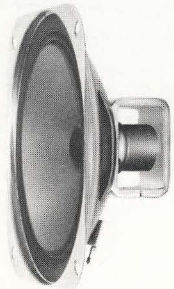
EAS-10P05SB

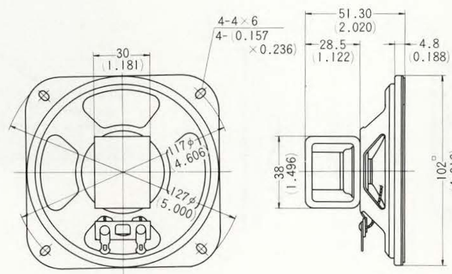


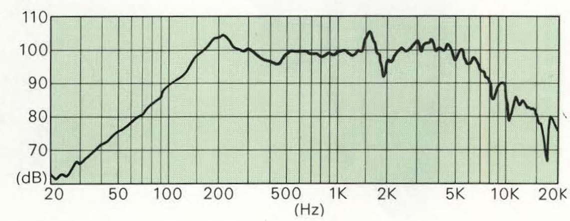




EAS-10P75SM







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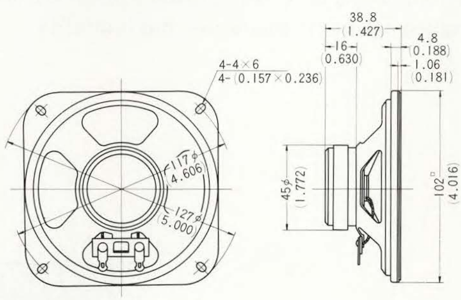
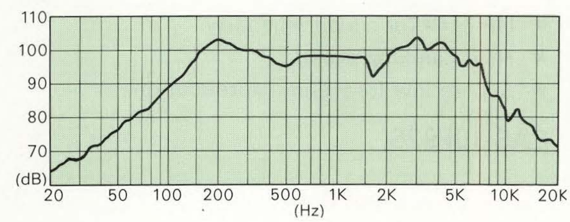
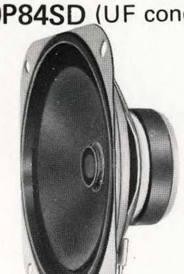
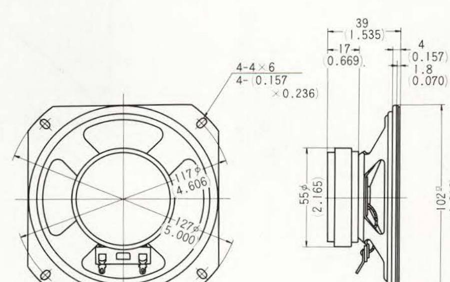
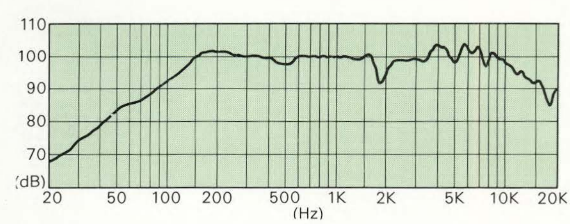




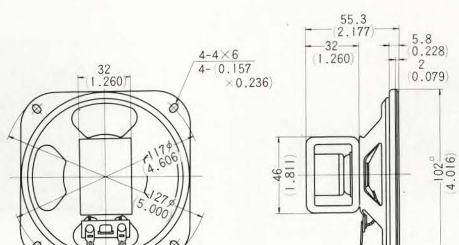
EAS-10P84SD (UF cone)

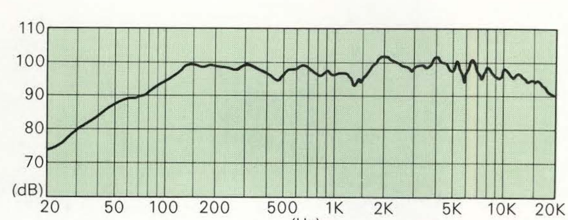




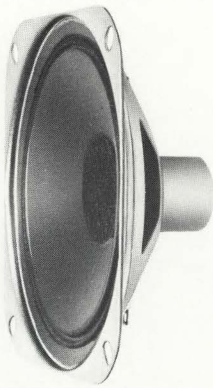


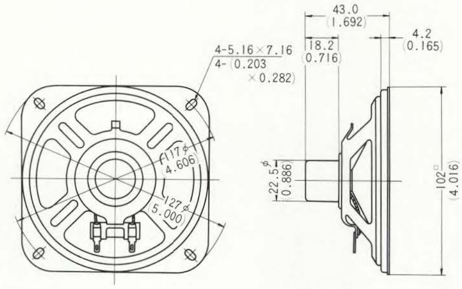
EAS-10P16SF

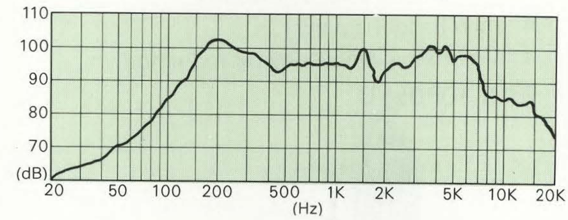




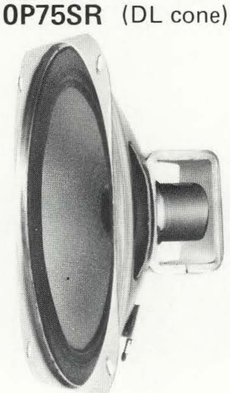
EAS-10P23SD

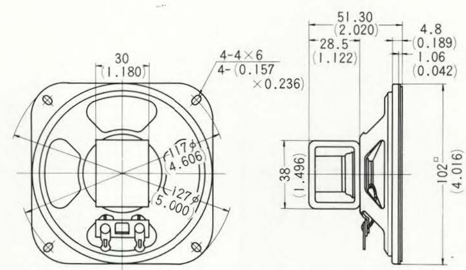


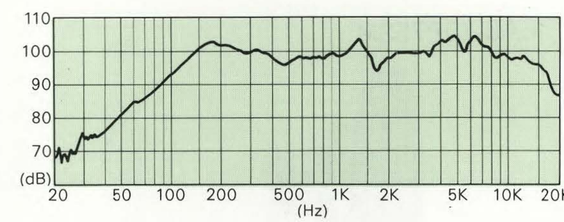




EAS-10P75SR (DL cone)







The edge portion of this cone is unit-formed with the remaining cone being made thinner by using stronger fiber.
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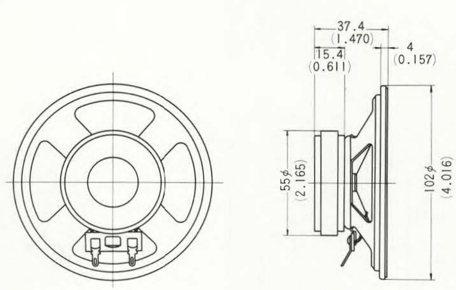
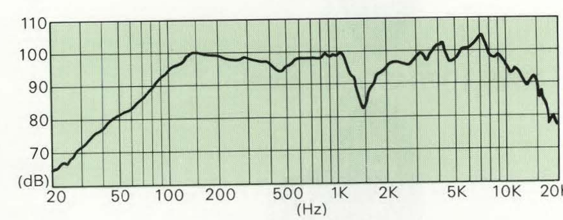
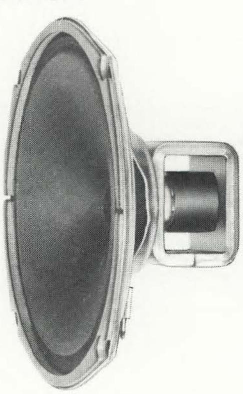
- UF cone for added reliability
- High handling power
- Superb low frequency reproduction

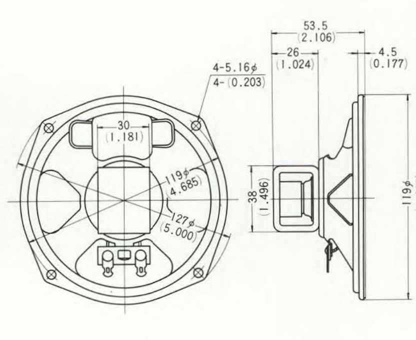
EAS-10P92S

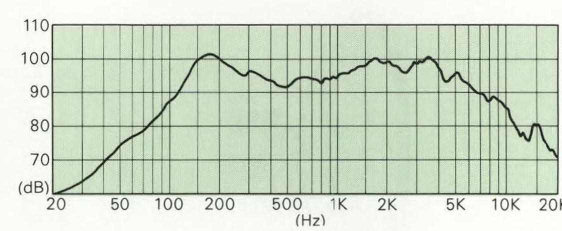




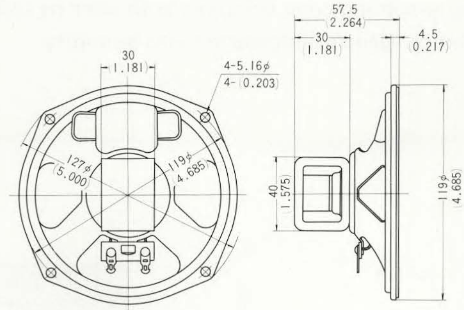
EAS-12P71SA

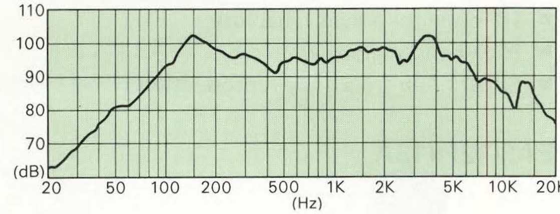




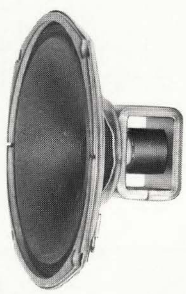


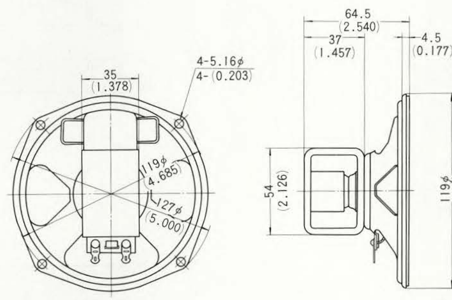
EAS-12P65SC

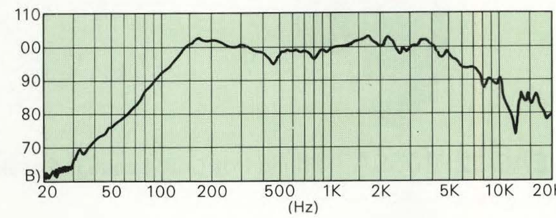




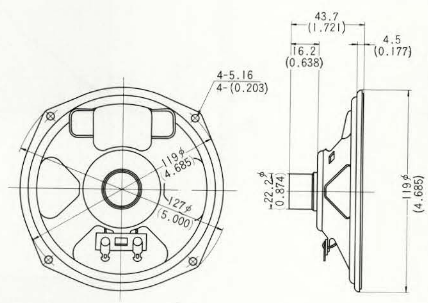
EAS-12P70SA

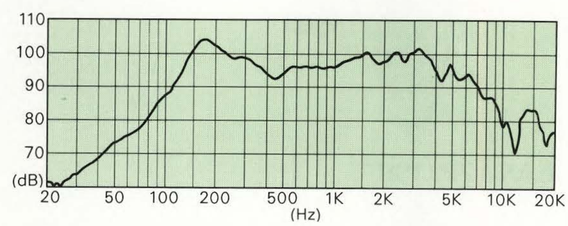




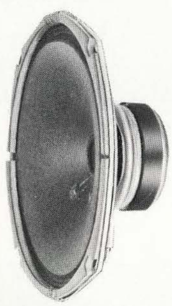


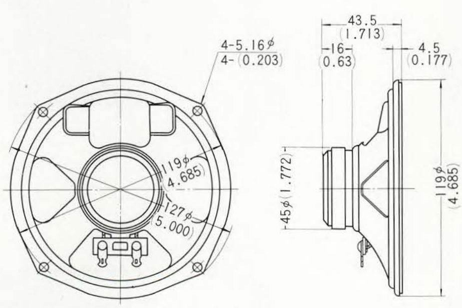
EAS-12P55S

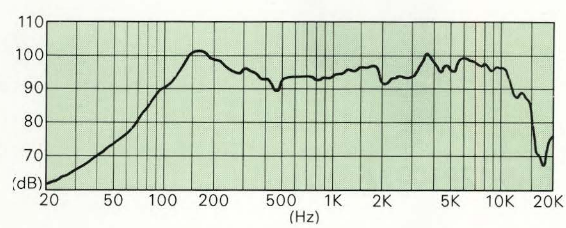




EAS-12P58SA



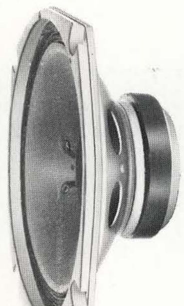


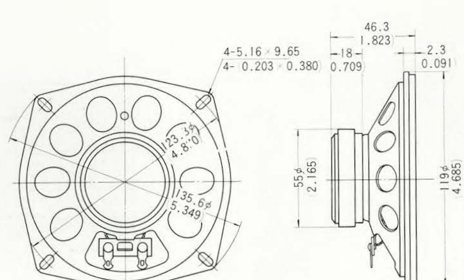


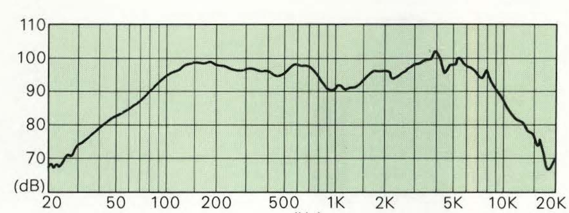
The edge portion of this cone is unit-formed with the remaining cone being made thinner by using stronger fiber.
The plastic resin coated over the edge improves resistance against temperature and humidity.

- UF cone for added reliability
- High handling power
- Superb low frequency reproduction

EAS-12P18SA



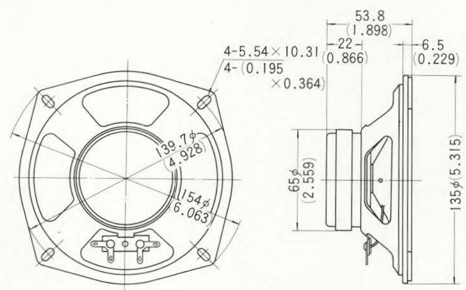


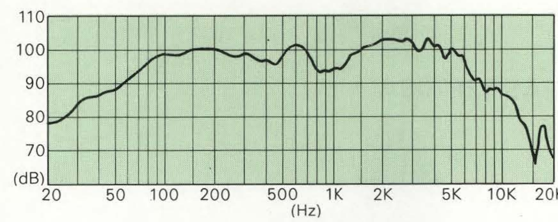


The edge portion of this cone is unit-formed with the remaining cone being made thinner by using stronger fiber. The plastic resin coated over the edge improves resistance against temperature and humidity.

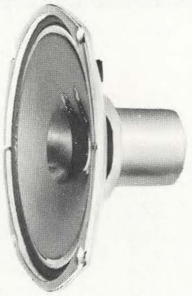
- UF cone for added reliability
- High handling power
- Superb low frequency reproduction

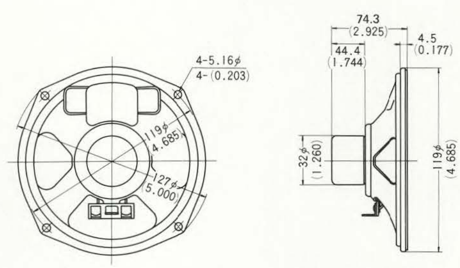
EAS-12P81SA

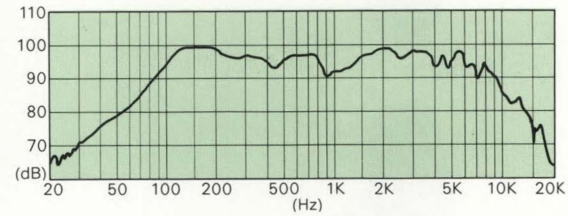




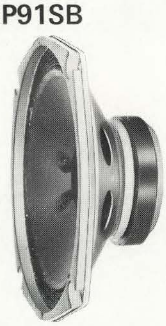
EAS-12P105SA (Shield Pot Low Leakage Speaker)

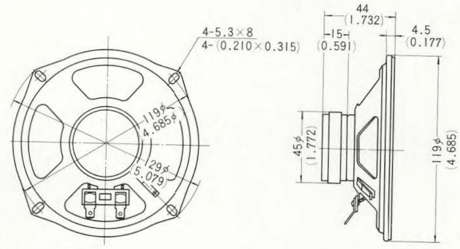


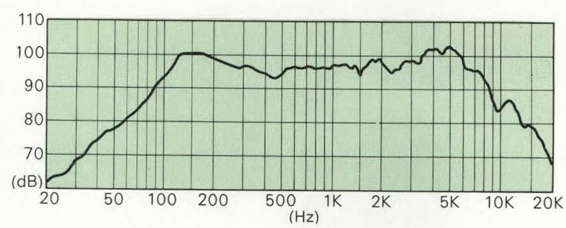




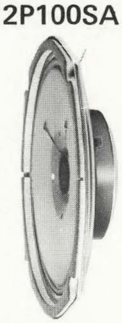
EAS-12P91SB

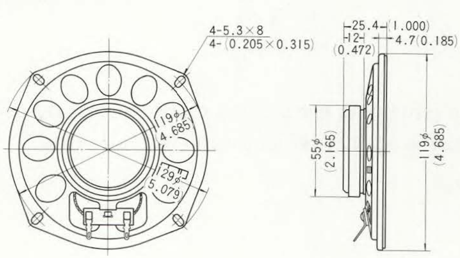


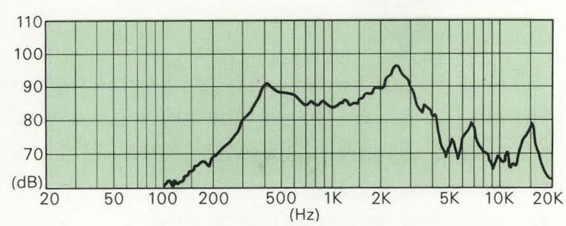




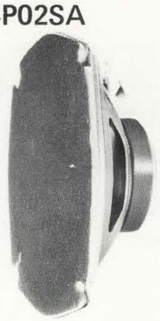
EAS-12P100SA

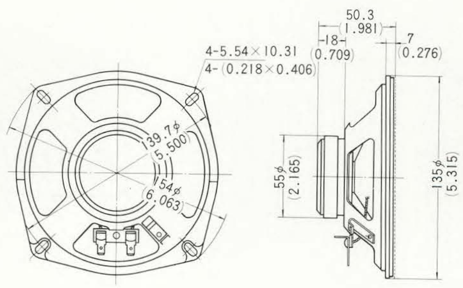


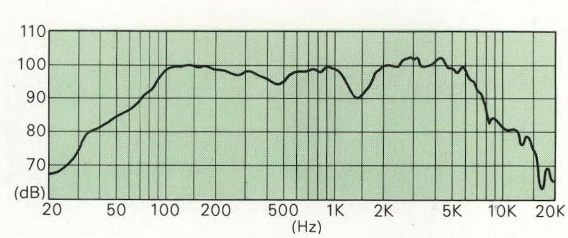




EAS-14P02SA



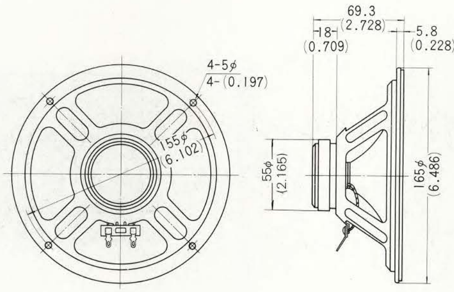


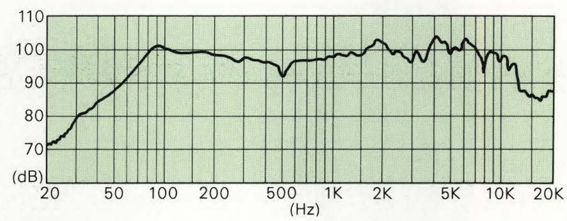


16cm (6-1/2") 18cm (7")

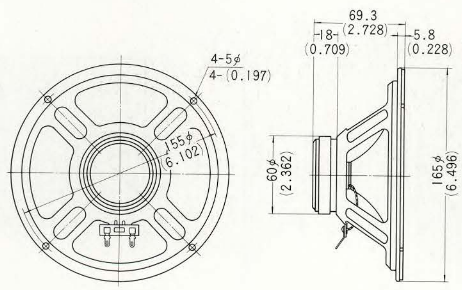
Part No.	Dia. cm (inch)	Rated Power (W)	Voice Coil Imp. (Ω)	Frequency Response (Hz)	Magnet Weight g (oz)	Net Weight kg (oz)
EAS-16P24SD	16 (6½)	6	8	90 ~ 10K	84 (2.97)	0.35 (12.35)
EAS-16P33GD	16 (6½)	5	8	110 ~ 10K	110 (3.88)	0.37 (13.05)
EAS-16P33SK	16 (6½)	3.5	8	105 ~ 9K	103 (3.63)	0.37 (13.05)
EAS-16P47SC	16 (6½)	3.5	8	180 ~ 10K	48 (1.69)	0.26 (8.17)
EAS-16P46SA	16 (6½)	3	8	100 ~ 10K	84 (2.97)	0.40 (14.13)
EAS-16P62S	16 (6½)	3	8	110 ~ 7K	42 (1.48)	0.23 (8.11)
EAS-18P46S	18 (7")	3	8	80 ~ 8K	84 (2.97)	0.46 (16.25)

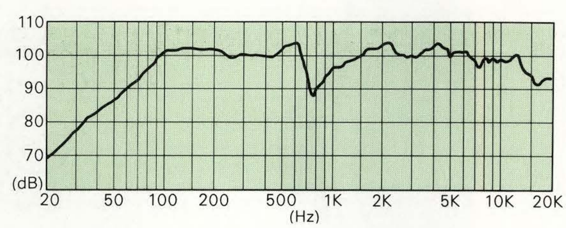
EAS-16P24SD



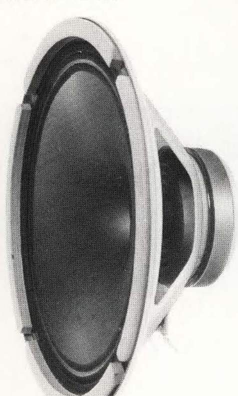


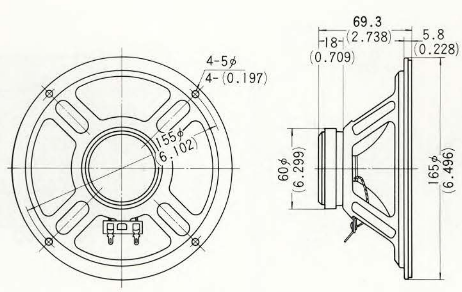
EAS-16P33GD

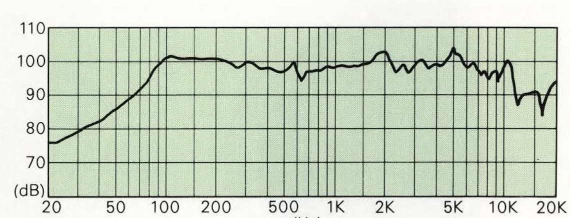




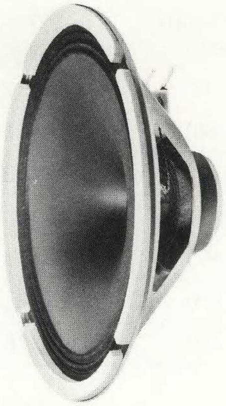
EAS-16P33SK

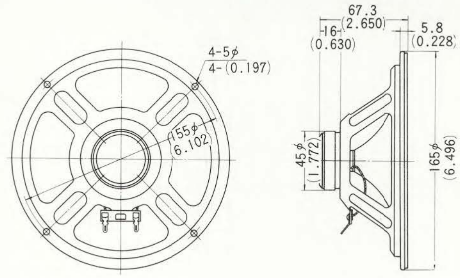


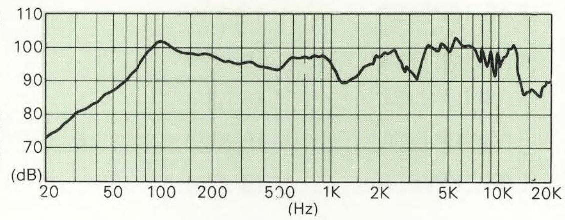




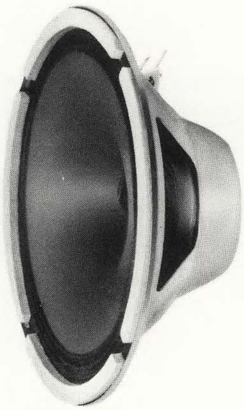
EAS-16P47SC

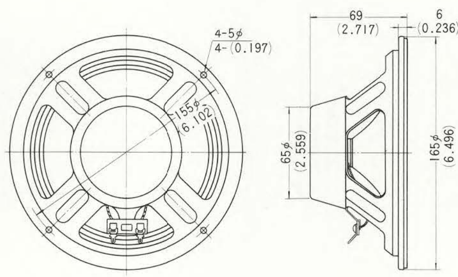


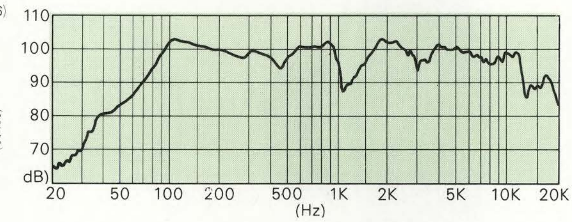




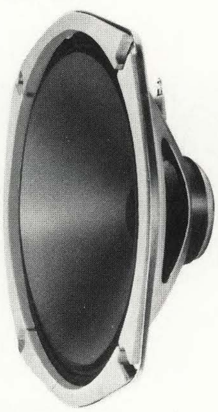
EAS-16P46SA

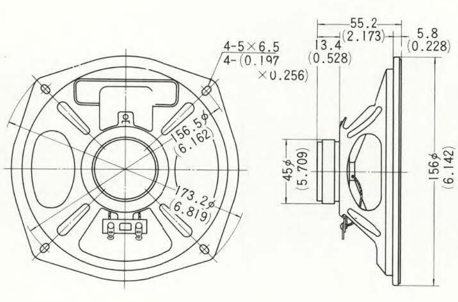


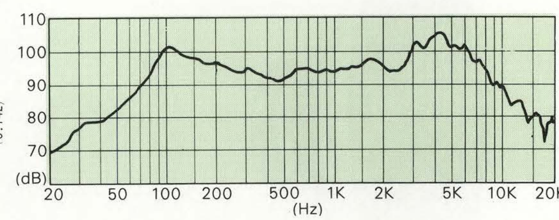




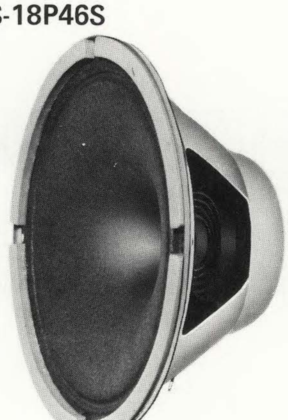
EAS-16P62S

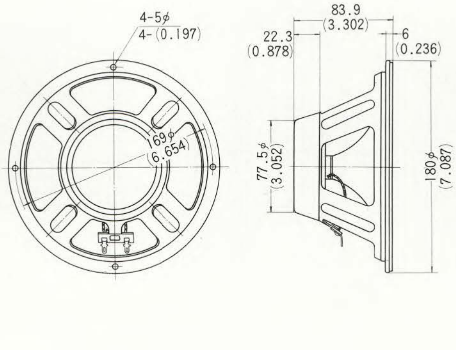


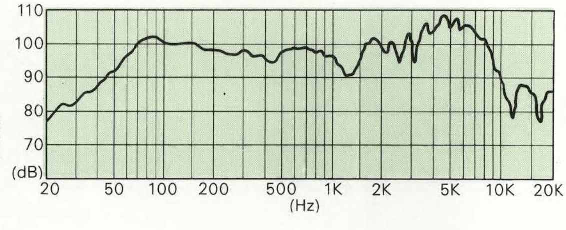




EAS-18P46S



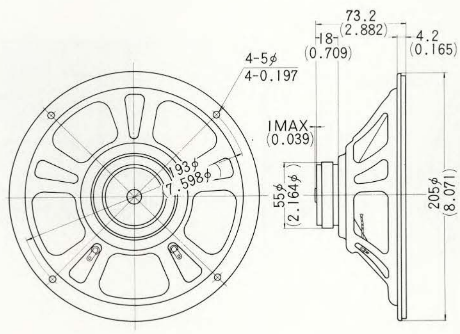


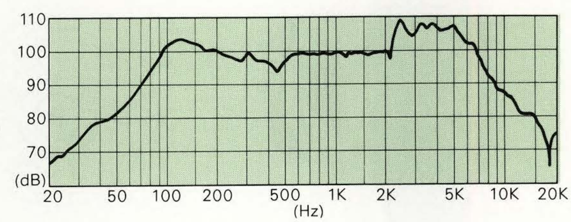


20cm (8") 25cm (10") 30cm (12") 38cm (15")

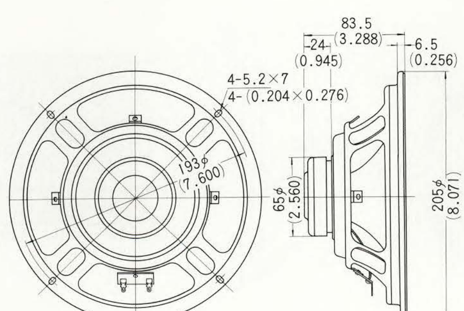
Part No.	Dia. cm (inch)	Rated Power (W)	Coil Voice Imp.(Ω)	Frequency Response (Hz)	Magnet Weight g (oz)	Net Weight kg (lbs)	Other
EAS-20P21SD	20 (8)	10	8	110 ~ 7K	84 (2.97)	0.47 (1.04)	ALCON terminal (Double)
EAS-20P28SB	20 (8)	5	8	110 ~ 7K	65 (2.29)	0.26 (.57)	
EAS-25P08SB	25 (10)	10	8	100 ~ 5K	152 (5.36)	1.0 (2.20)	
EAS-30P09SF	30 (12)	30	8	95 ~ 5K	343 (12.10)	1.8 (3.96)	
EAS-30P26SA	30 (12)	50	8	86 ~ 5K	630 (22.22)	2.8 (6.16)	
EAS-38P22S	38 (15)	50	8	60 ~ 4K	1800 (63.49)	8.9 (19.58)	
EAS-38P23S	38 (15)	30	8	65 ~ 4K	630 (22.22)	3.9 (8.58)	

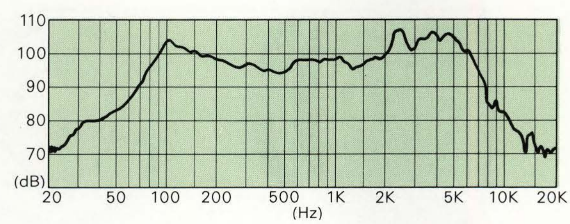
EAS-20P21SD

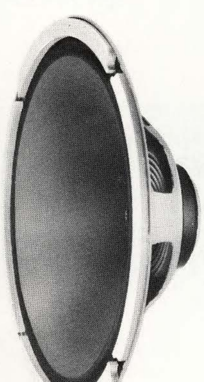
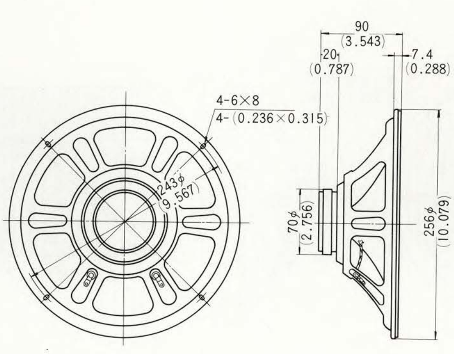


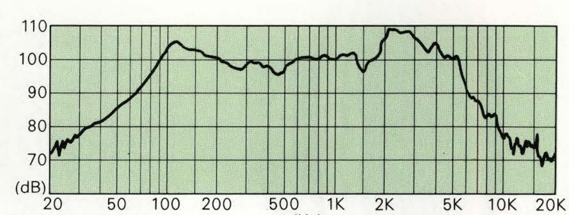
EAS-20P28SB

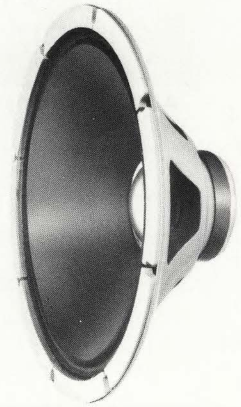


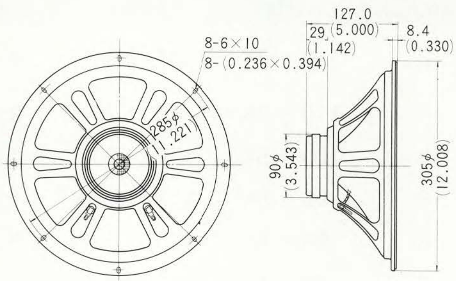
EAS-25P08SB

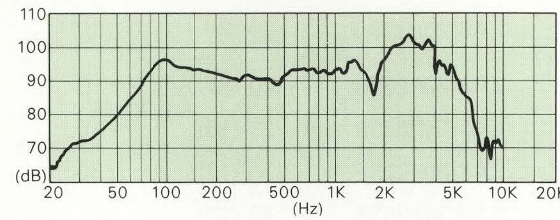





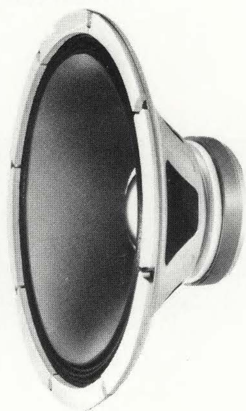
EAS-30P09SF

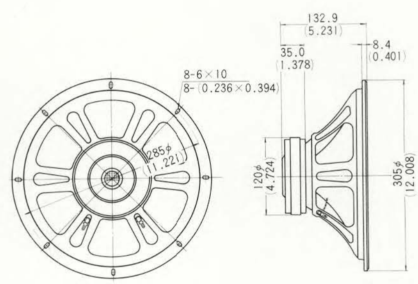


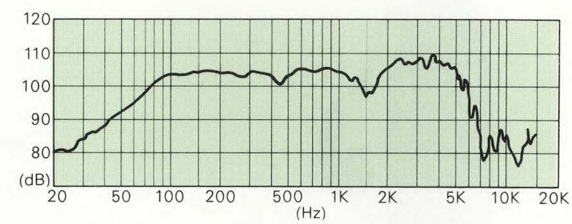




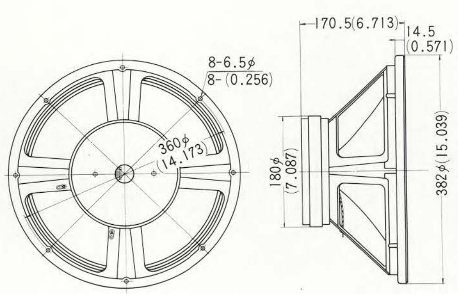
EAS-30P26SA

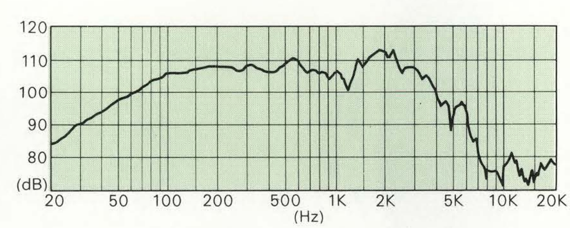




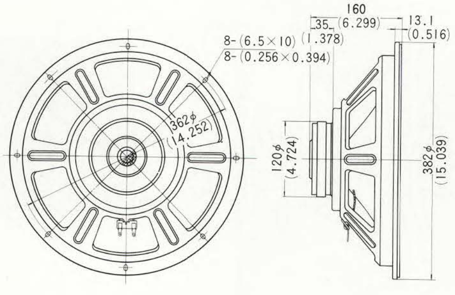


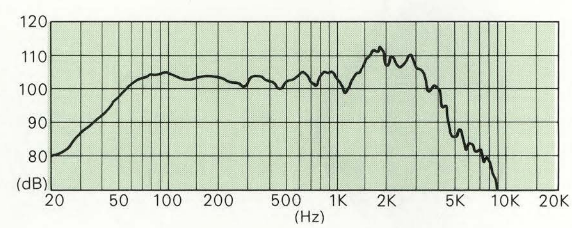
EAS-38P22S





EAS-38P23S



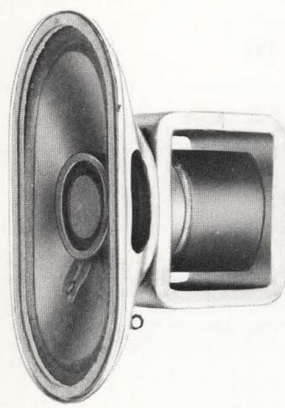


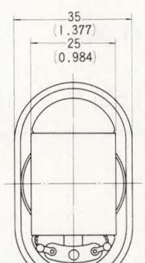
OVAL SPEAKERS

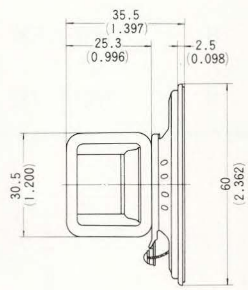
6 x 3.5cm (2-1/4 x 1-1/4")   10 x 6.5cm (4 x 2-1/2")

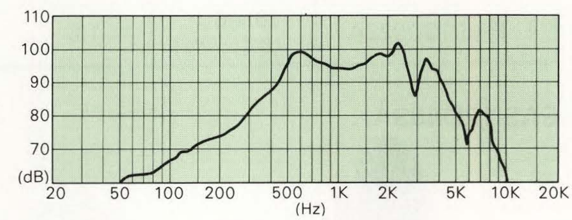
Part No.	Dia. cm (inch)	Rated Power (W)	Voice Coil Imp. (Ω)	Frequency Response (Hz)	Magnet Weight g (oz)	Net Weight g (oz)
EAS-6D01S	6 x 3.5 (2¼ x 1¼)	1	8	590 ~ 3K	31 (1.09)	100 (3.53)
EAS-10D57SC	10 x 6.5 (4 x 2½)	0.63	8	270 ~ 4K	12 (.42)	62 (2.19)
EAS-10D48SB	10 x 6.5 (4 x 2½)	0.3	8	190 ~ 4K	24 (.85)	108 (3.81)

EAS-6D01S

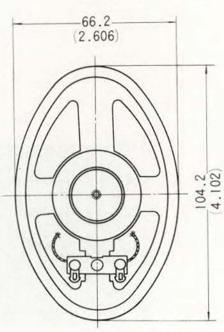


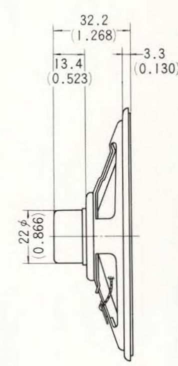


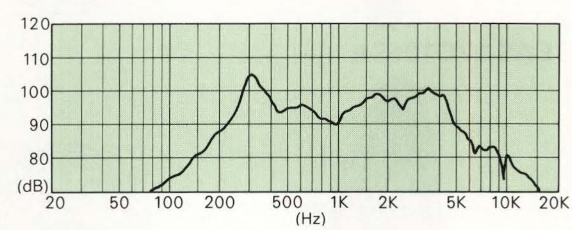




EAS-10D57SC







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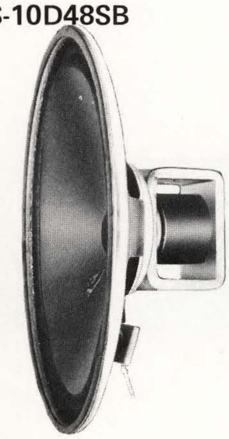
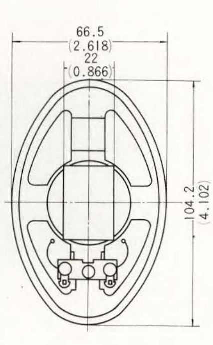
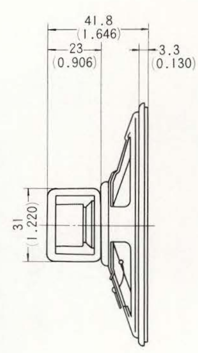
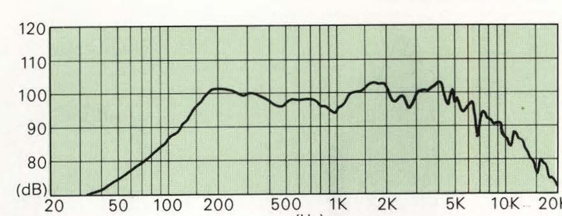




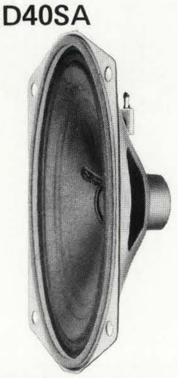
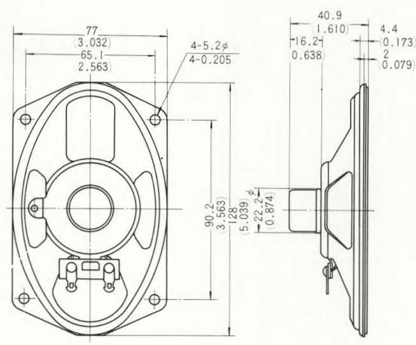
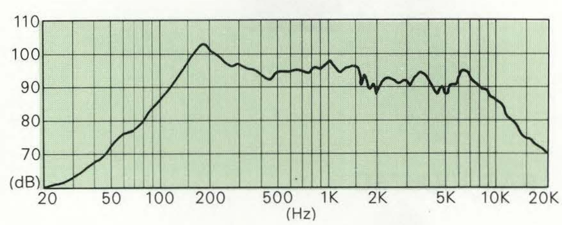




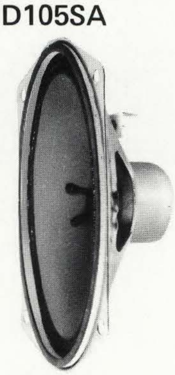
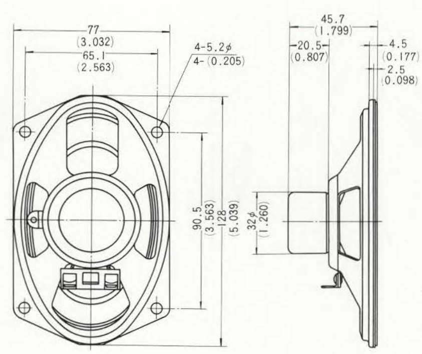
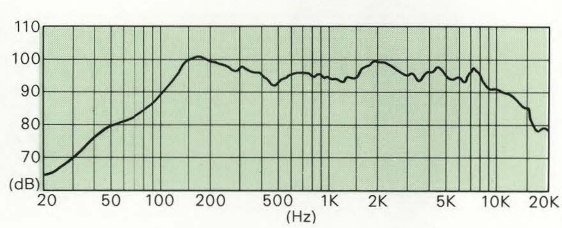
12 x 8cm (5 x 3") 16 x 6 (6-1/2 x 2-1/4")

Part No.	Dia. cm (inch)	Rated Power (W)	Voice Coil Imp.(Ω)	Frequency Response (Hz)	Magnet Weight g (oz)	Net Weight g (oz)	Other
EAS-12D40SA	12 x 8 (5 x 3)	1.5	8	180 ~ 10K	15 (.53)	100 (3.53)	
EAS-12D105SA	12 x 8 (5 x 3)	1.5	8	140 ~ 10K	19 (.67)	168 (5.93)	Shield Pot type
EAS-12D23SF	12 x 8 (5 x 3)	2.5	8	170 ~ 7K	24 (.85)	172 (6.07)	
EAS-12D41SD	12 x 8 (5 x 3)	1.5	8	165 ~ 5K	31 (1.09)	210 (7.41)	
EAS-12D69S	12 x 8 (5 x 3)	3	8	175 ~ 8K	48 (1.69)	200 (7.06)	ALCON terminal (Double)
EAS-12D60S	12 x 8 (5 x 3)	1	8	155 ~ 10K	31 (1.09)	170 (5.99)	
EAS-16D72SA	16 x 6 (6½ x 2¼)	1.6	8	180 ~ 5K	31 (1.09)	210 (7.41)	
EAS-16D92SA	16 x 6 (6½ x 2¼)	1.6	8	180 ~ 7K	15 (.53)	100 (3.53)	

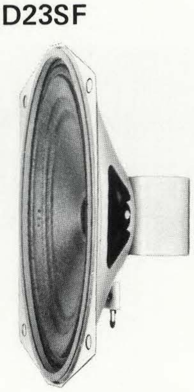
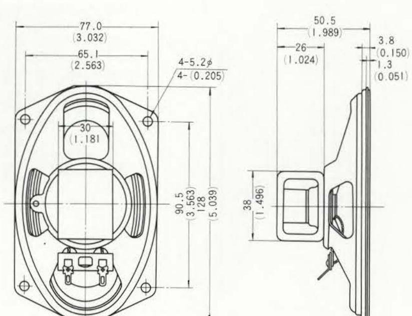
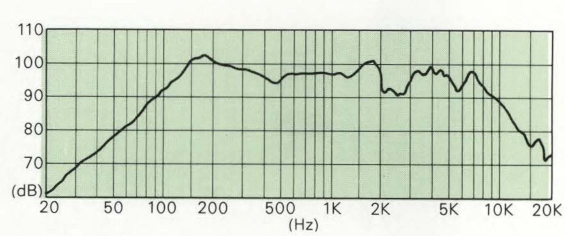
EAS-12D40SA

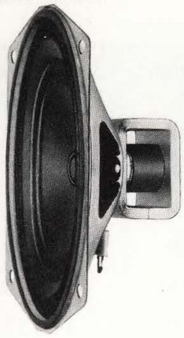
EAS-12D105SA

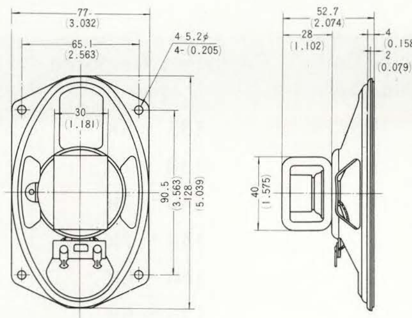




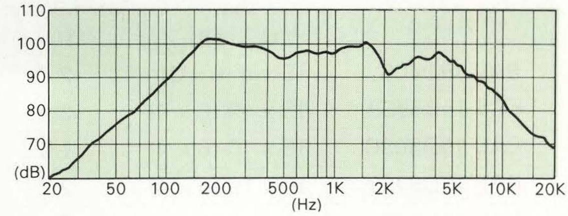
EAS-12D23SF

EAS-12D41SD







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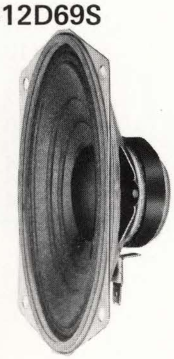
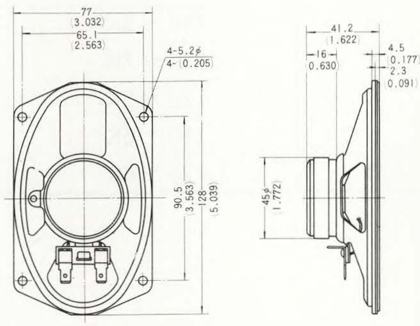
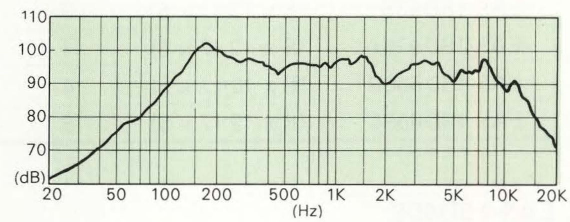
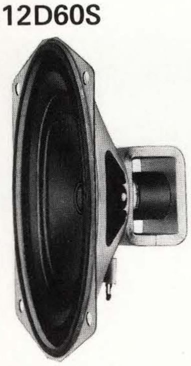
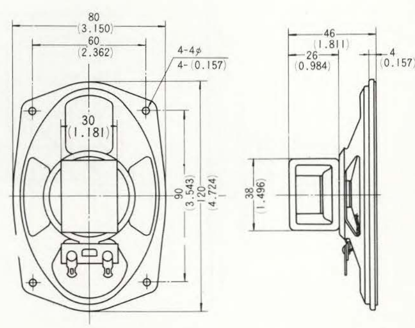


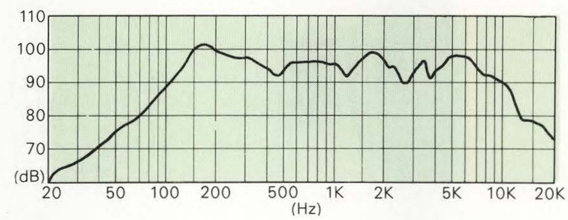




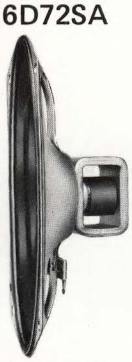
EAS-12D60S

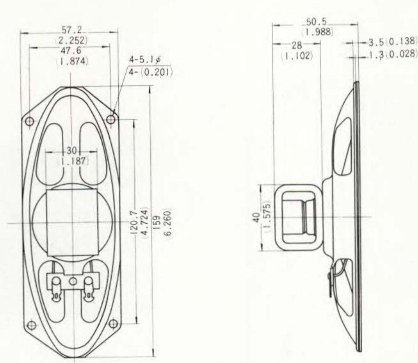


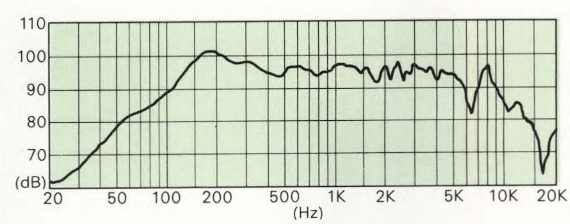




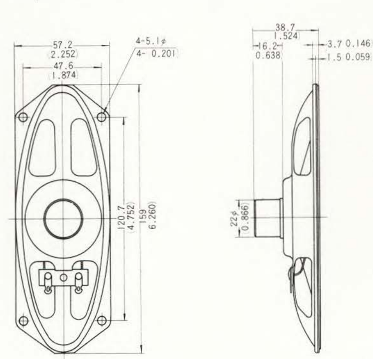
EAS-16D72SA

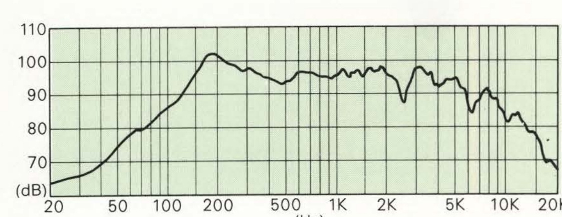






EAS-16D92SA

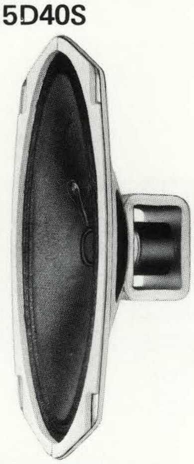


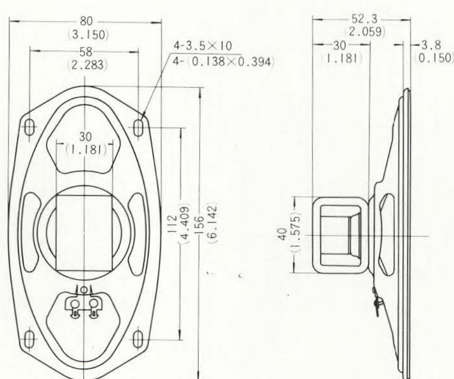


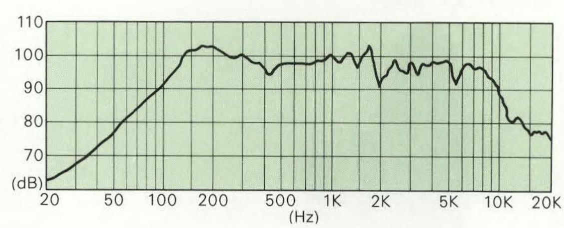
15 x 8 (6 x 3") 15 x 10 (6 x 4") 18 x 12 (7 x 5")

Part No.	Dia. cm (inch)	Rated Power (W)	Voice Coil Imp. (Ω)	Frequency Response (Hz)	Magnet Weight g (oz)	Net Weight g (oz)
EAS-15D40S	15 x 8 (6 x 3)	2	8	135 ~ 5K	56 (1.98)	230 (8.12)
EAS-15D55SB	15 x 10 (6 x 4)	3	8	130 ~ 7K	84 (2.99)	385 (13.60)
EAS-15D80SC	15 x 10 (6 x 4)	1.5	8	140 ~ 7K	36 (1.27)	238 (8.40)
EAS-15D87SJ	15 x 10 (6 x 4)	2	8	140 ~ 7K	48 (1.69)	225 (7.94)
EAS-15D86S	15 x 10 (6 x 4)	2	8	140 ~ 5K	48 (1.69)	198 (6.98)
EAS-15D95SA	15 x 10 (6 x 4)	3	8	125 ~ 5K	84 (2.99)	325 (11.46)
EAS-15D105SA	15 x 10 (6 x 4)	2.5	8	165 ~ 5K	30 (1.06)	210 (7.41)
EAS-18D29SS	18 x 12 (7 x 5)	3	8	110 ~ 5K	36 (1.27)	300 (10.59)
EAS-18D43S	18 x 12 (7 x 5)	3	8	145 ~ 7K	84 (2.99)	380 (13.4)
EAS-18D42SA	18 x 12 (7 x 5)	4	8	120 ~ 5K	70 (2.47)	300 (10.59)
EAS-18D55SB	18 x 12 (7 x 5)	4	8	110 ~ 5K	84 (2.99)	400 (14.11)
EAS-18D85SC	18 x 12 (7 x 5)	5	8	120 ~ 6K	46 (1.62)	412 (14.53)

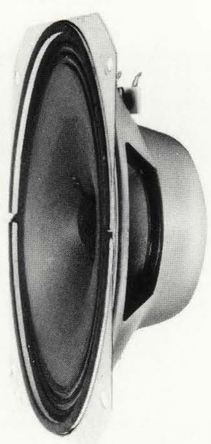
EAS-15D40S

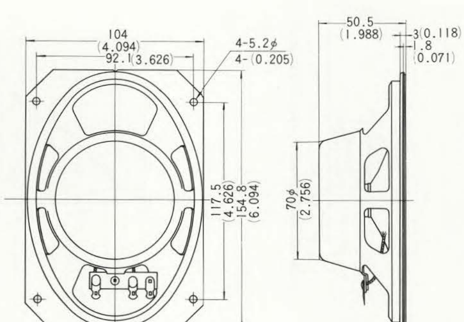


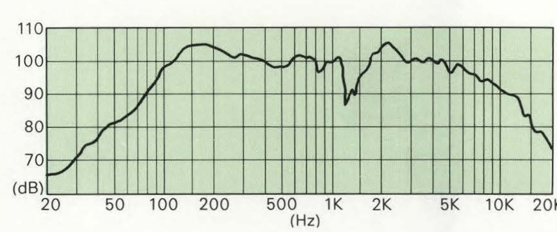




EAS-15D55SB







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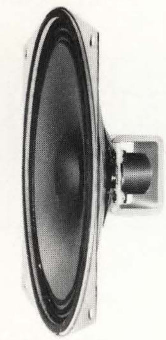
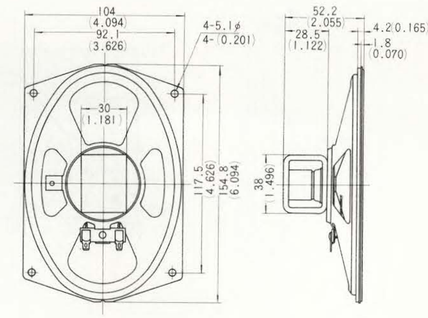
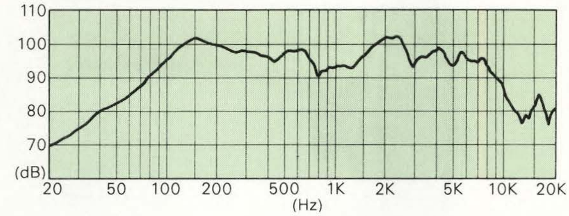
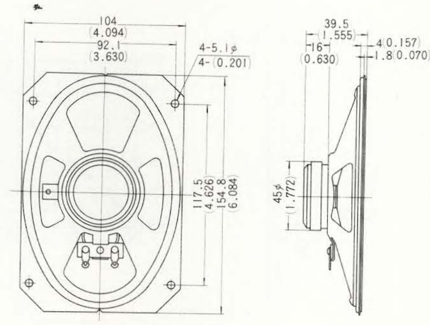
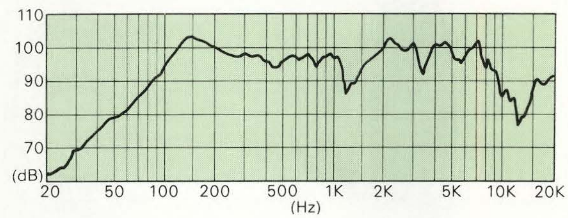






EAS-15D87SJ





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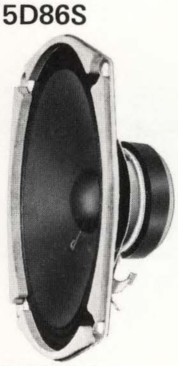

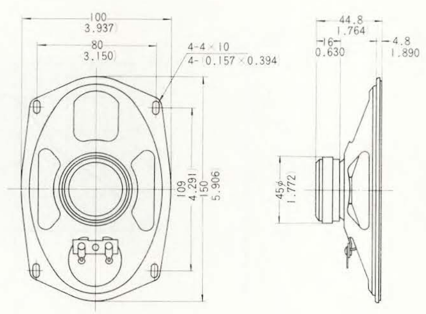

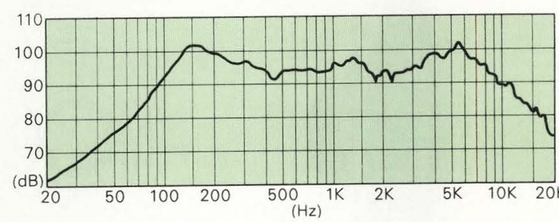

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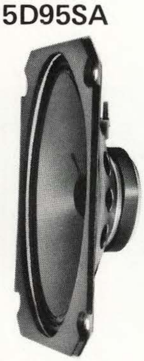
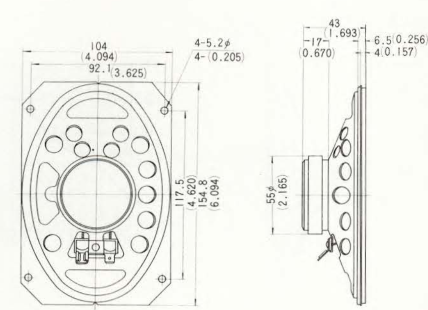
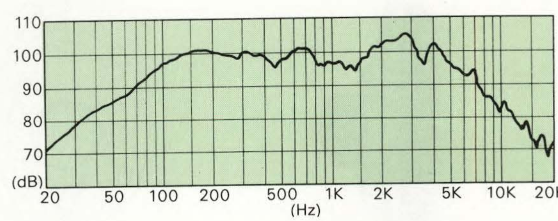
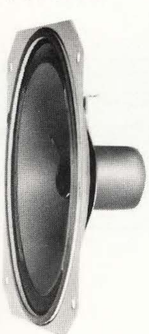
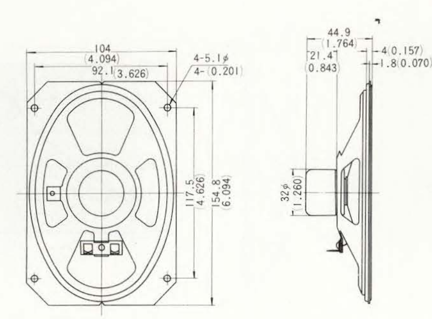


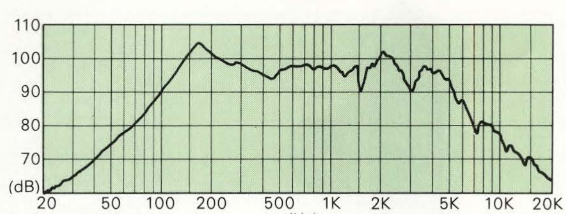




EAS-15105SA







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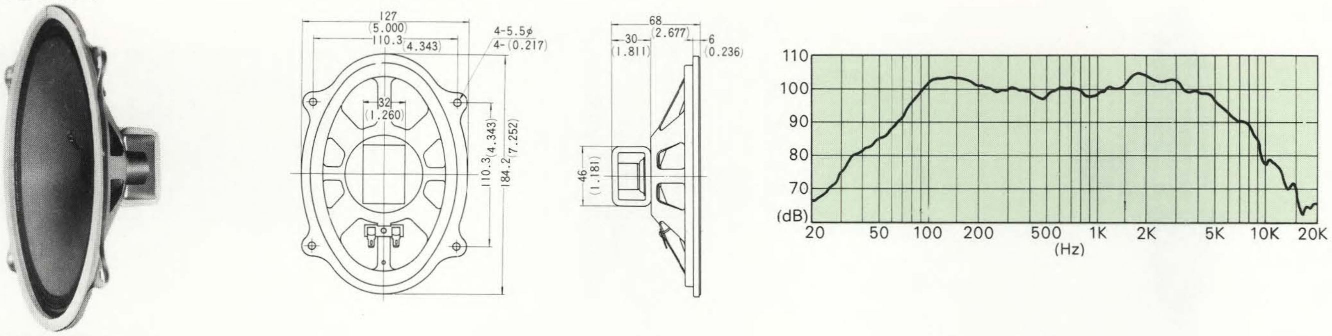

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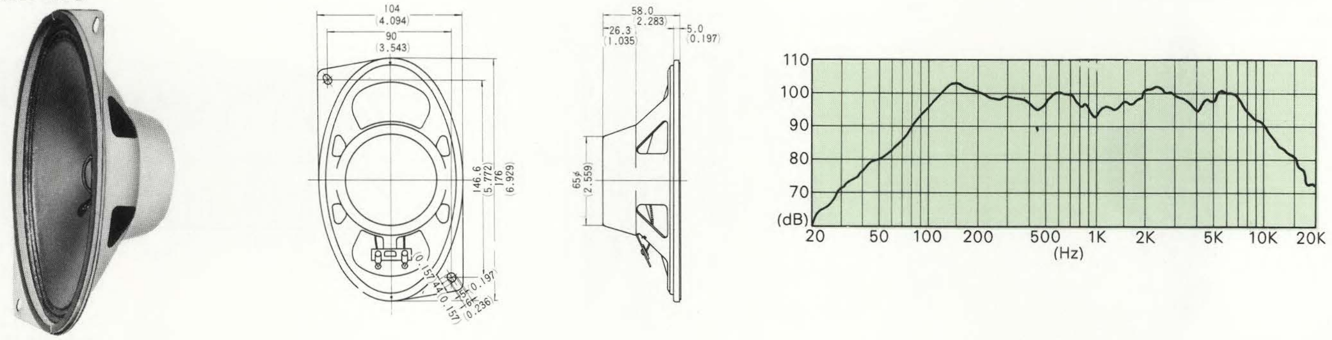

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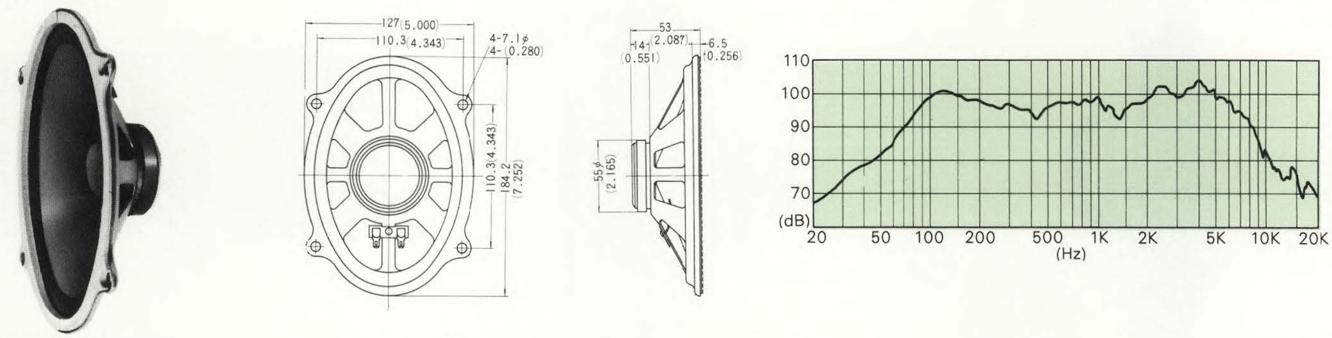
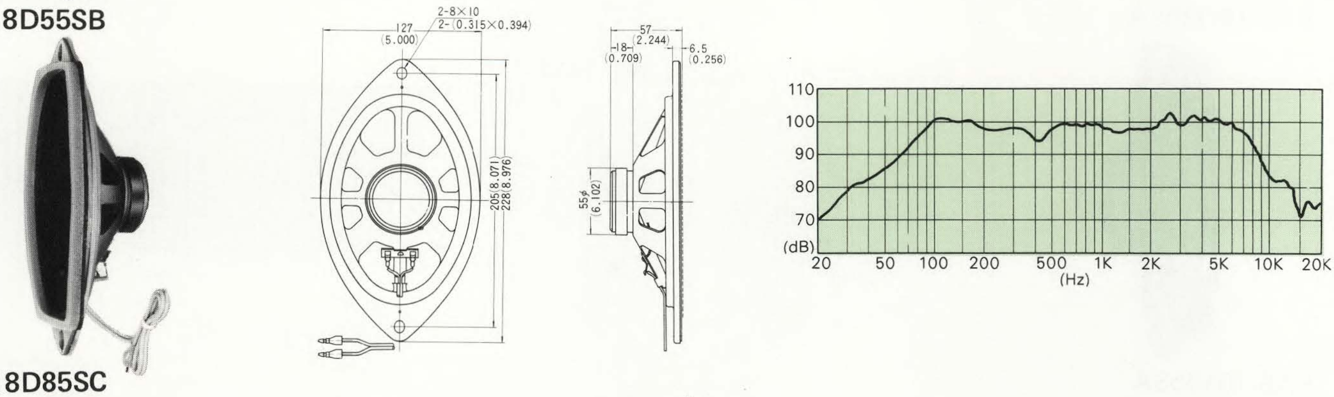
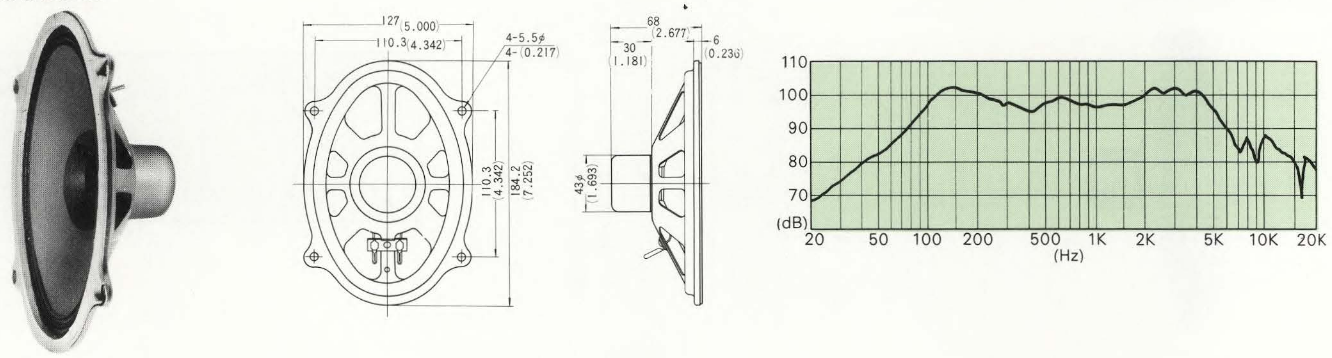


EAS-18D55SB



EAS-18D85SC



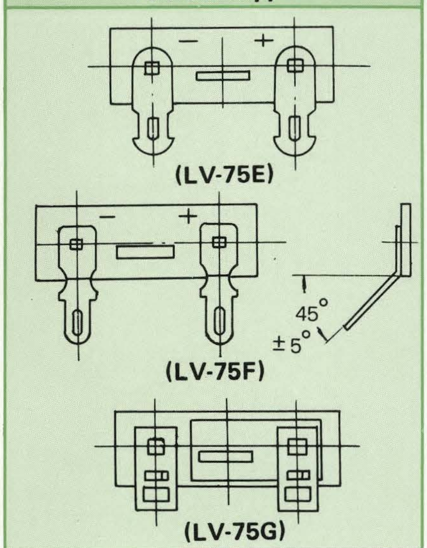
STANDARD TERMINALS

Lug Name

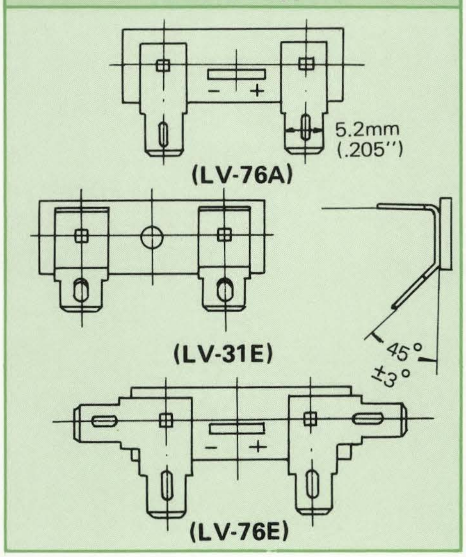
Terminal No.	Lug No.	Type	Terminal No.	Lug No.	Type
LV-75E	E-S06KC	SOLDER	LV-74M	E-J19K, E-J13KA	FASTON#250
LV-75F	E-J06KC	〃	LV-75H	E-W01K	KELERWRAP
LV-75G	E-S18K	〃	LV-76C	E-J08K	#86-270
LV-76A	E-J02K	ALCON#3-1184	LV-75N	E-J01K	MALE
LV-31E	E-J10K	ALCON#3-1185	LV-25J	E-S06KC	SOLDER
LV-76E	E-J03K	ALCON#3-1183	LV-25B	E-J03K, E-J02K	ALCON
LV-76B	E-J13K	FASTON#250	LV-25A	E-J01K, E-J11K	MALE
LV-76D	E-J12K	〃	LV-91A	E-J16K, E-J02KD	

We are able to supply many kinds of terminals. These, listed here, are our representative terminals for export, and other types of terminals are available upon request.
All the terminals have 19 mm (.748") clearance between their two lugs.

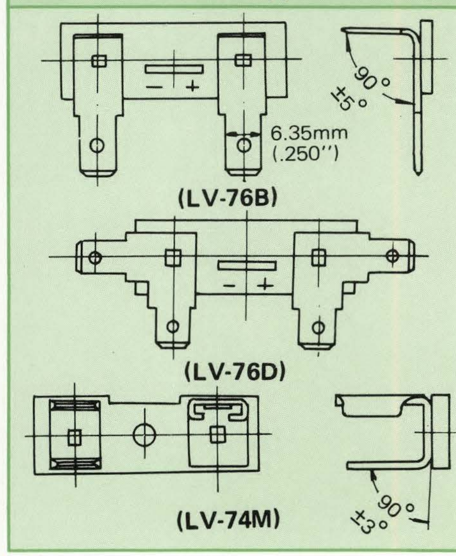
Solder Type



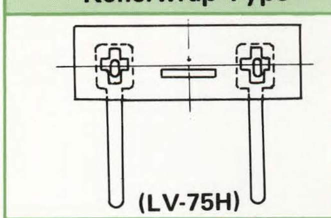
ALCON Type



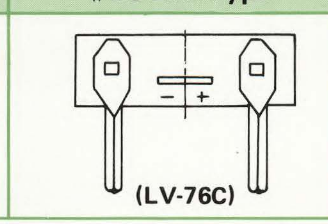
AMP Type



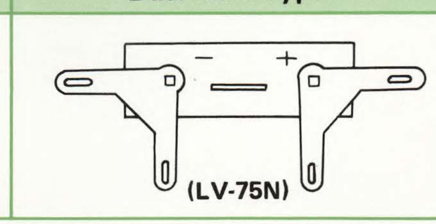
Kellerwrap Type



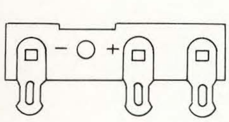
#86-270 Type



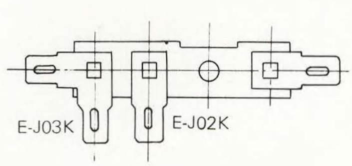
Dual Male Type



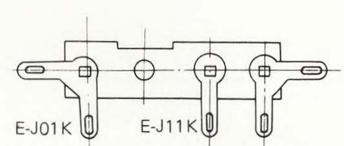
Three Lug Type



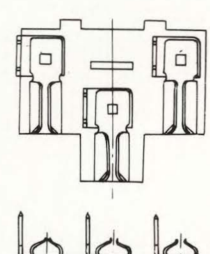
(LV-25J)



(LV-25B)



(LV-25A)



(LV-91A)

XIII INDUCTIVE PARTS

QUICK REFERENCE GUIDE

AF Transformers

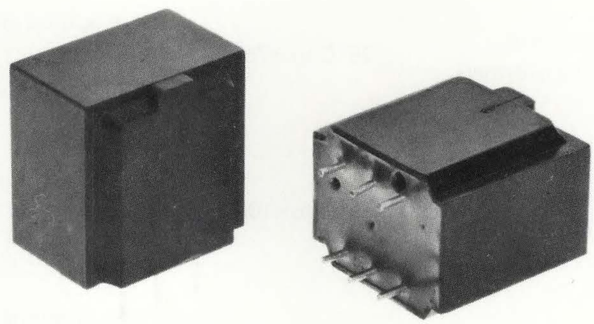
Part Name	Environmental Temperature Range	Characteirstics	Construction	Page
Miniature Transformers	-25°C to +75°C	• Stable against moisture and heat • Handling power: 0.5~2W	• Hermetically sealed • Fixed pin-terminal type • Stable against vibration and shocks • Identification for automatic insertion	XIII-3~XIII-4
Power Transformers	-25°C to+100°C	• Handling power: 1~40VA	• Spool and bobbin type winding cores • Endbell or Endbell-less type	XIII-5~XIII-7
Saturable Rectors	-25°C to +55°C	• Closed magnetic circuit type • For 7" to 25", 90° and 110° CRT	• Encapsulated type utilizing non-flammable resin • PC board mounting • Easy selection of installation location	XIII-8~XIII-10
Horizontal Output Transformers for B/W TV	-10°C to +70°C	• Non-flammable design: conformable to all the necessary safety standards • For 4.5" to 19" CRT	• Special pin terminal type for PC board mounting • Built-in rectifier upon request	XIII-11~XIII-12
Color Convergence Yokes (2 Pole Type)	-25°C to +80°C	• Extremely stable temperature characteristics • High safety due to the use of non-flammable resin • For 9" to 16" CRT	Assembly board	XIII-13~XIII-14

Power Supplies

Low Voltage	-10°C to +50°C	• Handling power: 1~50W • Built-in excessive current protection circuit • Superior voltage regulation and shielding characteristics	• Compact and lightweight with common installation method • Metal case type	XIII-15~XIII-16

HERMETICALLY SEALED MINIATURE TRANSFORMERS

EO Type



■ **Hermetically Sealed**
The encapsulation technique of these transformers not only improved the appearance but also facilitated automatic assembly.

■ **Outstanding environmental characteristics**
The entire encapsulation in silicone resulted in a hermetic seal which is not affected by moisture or environmental temperature changes yielding a transformer with a much longer operating lifetime.

■ **Fixed terminals**
The adoption of special material pin-terminals with excellent solderability characteristics coupled with the spool construction assures fixed terminal positions which provide easy mounting to PC boards.

■ **Shock-proof**
By making the pin-terminals and spool using one construction process, shock-proof and anti-vibration characteristics have greatly improved compared with conventional units. Drastically reduces problems generally associated with mechanical instability.

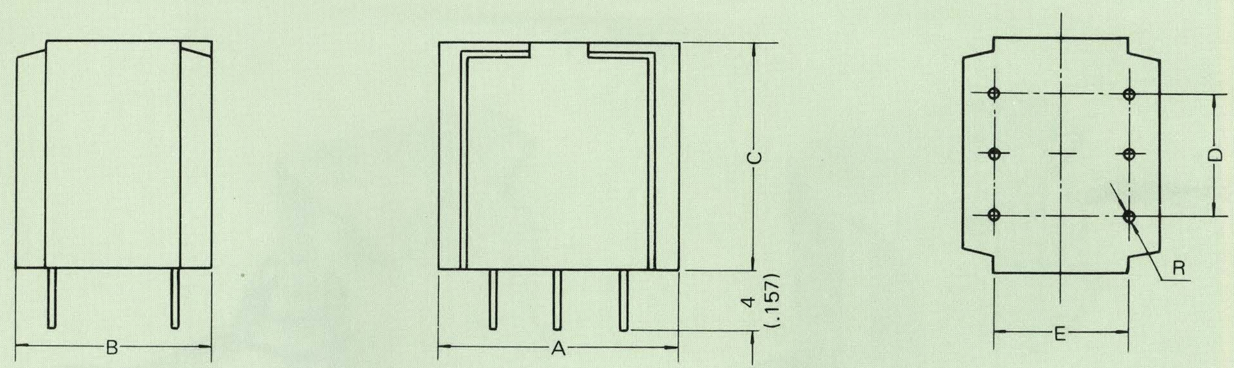
■ **Identification for automatic insertion**
The tab for direction identification greatly facilitates automatic mounting on PC boards.

Examples of Current Products

Core Type	Application	Matching Imp. (Ω)		DC Res. (Ω)		Freq. Characteristics (200~7000Hz) max.	Insertion Loss (1000Hz) max.
		Pri.	Sec.	Pri.	Sec.		
14	Driver	2K	3K	106	205	1.6 dB	2.5 dB
	OPT	600 (CT)	8	37	0.68	2.0	2.3
16	Driver	10K	2K	805	135	2.5	2.3
	OPT	750 (CT)	8	42	0.76	1.8	1.8
19	Driver	7K	4K (CT)	585	350	1.5	1.5
	OPT	240 (CT)	8	13	0.47	1.0	1.6
24	Driver	1.5K	300 x 2	106	90 x 2	1.5	1.7
	OPT	600 (CT)	10	55.6	1.13	2.0	1.5

Core, Capacity and Structure .... See p.XIII-16.

Dimensions



Unit:mm(inch)

Core Type	14	16	19	24
A	15.6 (.614)	17.6 (.693)	21.0 (8.27)	26.0 (1.024)
B	12.6 (.496)	14.6 (.575)	16.0 (.630)	22.0 (.866)
C	15.0 (.591)	18.8 (.740)	20.5 (.807)	24.0 (.945)
D	7.0 (.276)	8.0 (.315)	10.0 (.394)	12.0 (.472)
E	8.0 (.315)	9.0 (.354)	10.0 (.394)	14.0 (.551)
R	0.7^{ϕ}(0.28 dia)	0.7^{ϕ}(.028 dia)	0.7^{ϕ}(.028 dia)	0.8^{ϕ}(.031 dia)

POWER TRANSFORMERS

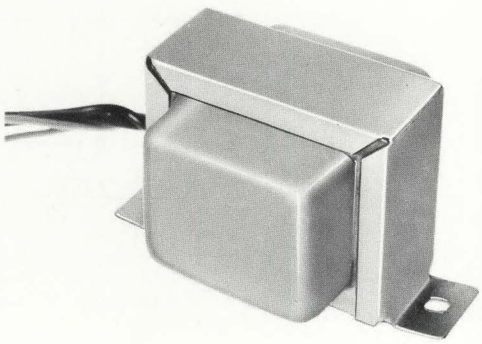


Fig. A

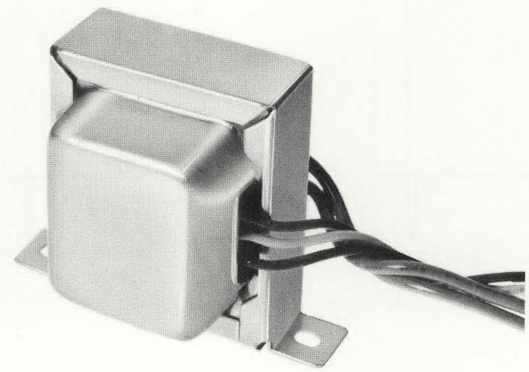


Fig. B

■ **High reliability**

More than 20,000 hours of life under a 40°C environmental temperature, and a voltage which is 10% higher than the rated voltage.

Examples of Current Products

Core Type	Output (VA)	Input (Rating)		Output (Rating)	Ref. Fig.
		Voltage (V)	Frequency (Hz)	Voltage ·Current	
E4815	5.7	100	50, 60	6.3V 0.9A	B
E4819	10.0	120	60	10V 1A	A
E4823	11.5	100	50, 60	15.9V 0.72A	A
E5725	16.0	100	50, 60	8.5V 1.9A	A
E5725	20.7	120	60	12V 1.15A, 6V 1.15A	B
E5730	19.5	220	60	16.7V x 20.6A, 5.55V 0.5A	B
E6030	20.0	120	60	15.2V 0.8A, 6V 1.34A	A
E6628	30.2	100	50, 60	15.5V 1.95A	B

Core, Capacity and Structure ...... See p.XIII-16.

Fig. A

Unit: mm (inch)

Core Type	$A^{\pm1}$	$B^{\pm1}$	$C^{\pm1.5}$	$D^{\pm1}$	$E^{\pm0.5}$	$L^{\pm0.5}$	$S^{\pm1}$	d	t
E4815	42.5 (1.673)	50.0 (1.969)	43.0 (1.693)	17.0 (0.669)	12.0 (0.472)	59.0 (2.323)	70.0 (2.756)	3.5 x 4.5 (0.138) (.0177)	0.8 (0.031)
E4819	42.5 (1.673)	50.0 (1.969)	47.0 (1.850)	21.0 (0.827)	17.0 (0.669)	59.0 (2.323)	70.0 (2.756)	3.5 x 4.5 (0.138) (0.177)	0.8 (0.031)
E4823	42.5 (1.673)	50.0 (1.969)	51.0 (2.008)	25.0 (0.984)	20.0 (0.787)	59.0 (2.323)	70.0 (2.756)	3.5 x 4.5 (0.138) (0.177)	0.8 (0.031)
E5720	50.5 (1.988)	59.5 (2.343)	51.0 (2.008)	22.5 (0.886)	17.0 (0.669)	71.0 (2.795)	82.0 (3.228)	4.5 x 6.5 (0.177) (0.256)	1.0 (0.039)
E5725	50.5 (1.988)	59.5 (2.343)	56.0 (2.205)	27.5 (1.083)	22.0 (0.866)	71.0 (2.795)	82.0 (3.228)	4.5 x 6.5 (0.177) (0.256)	1.0 (0.039)
E5730	50.5 (1.988)	59.5 (2.343)	61.0 (2.402)	32.5 (1.280)	27.0 (1.063)	71.0 (2.795)	82.0 (3.228)	4.5 x 6.5 (0.177) (0.256)	1.0 (0.039)
E6030	53.0 (2.087)	62.5 (2.461)	64.0 (2.520	32.5 (1.280)	27.0 (1.063)	75.0 (2.953)	86.0 (3.386)	4.5 x 6.5 (0.177) (0.256)	1.0 (0.039)
E6628	58.5 (2.303)	68.5 (2.697)	65.0 (2.559)	30.5 (1.201)	25.0 (0.984)	81.0 (3.189)	92.0 (3.622)	4.5 x 6.5 (0.177) (0.256)	1.0 (0.039)
E6635	58.5 (2.303)	68.5 (2.697)	72.0 (2.835)	37.5 (1.476)	32.0 (1.260)	81.0 (3.189)	92.0 (3.622)	4.5 x 6.5 (0.177) (0.256)	1.0 (0.039)

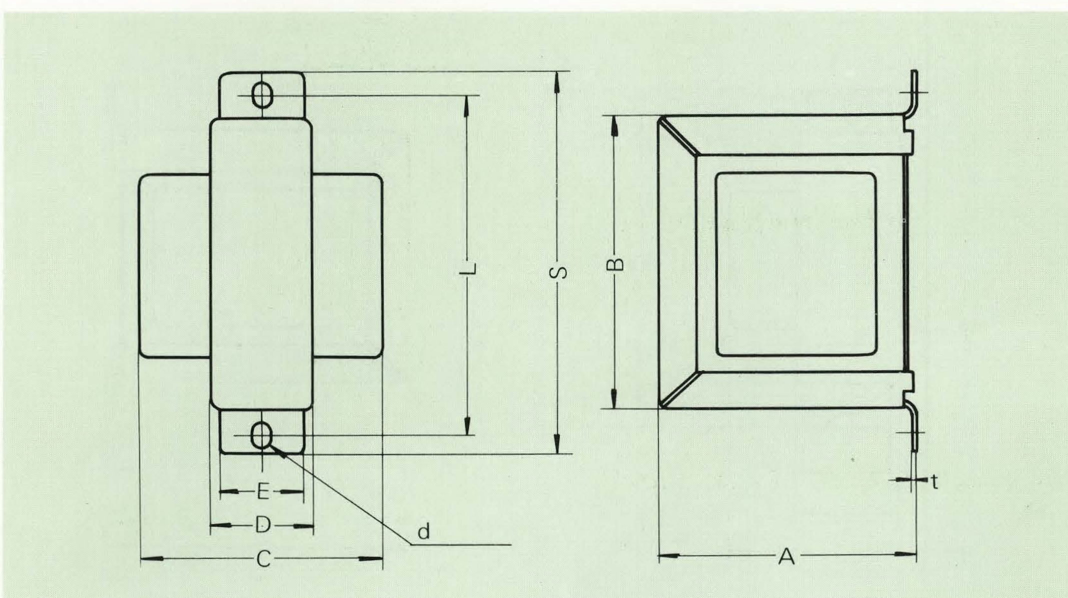
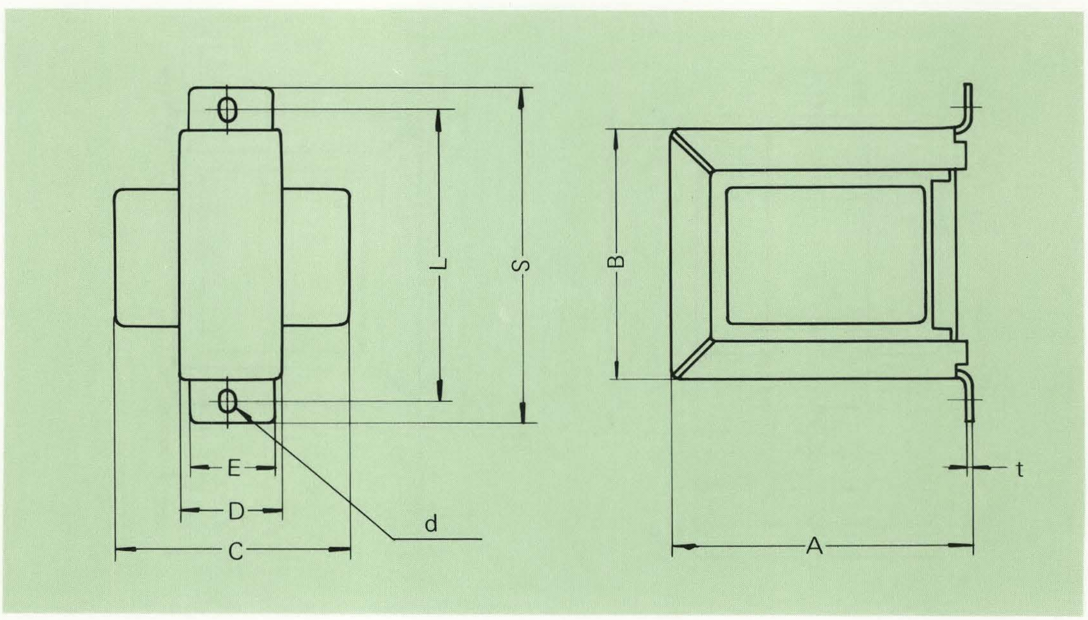


Fig. B

Unit: mm (inch)

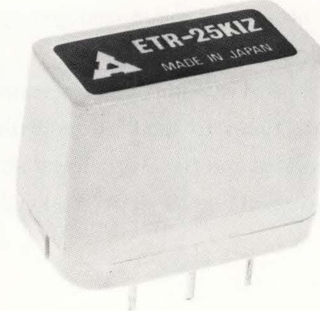
Core Type	$A^{\pm1}$	$B^{\pm1}$	$C^{\pm1.5}$	$D^{\pm1}$	$E^{\pm0.5}$	$L^{\pm0.5}$	$S^{\pm1}$	d	t
E4815	51.0 (2.008)	43.0 (1.693)	43.0 (1.693)	17.0 (0.669)	12.0 (0.472)	51.0 (2.008)	60.0 (2.362)	3.5 x 4.5 (0.138) (0.177)	0.8 (0.031)
E4819	51.0 (2.008)	43.0 (1.693)	47.0 (1.850)	21.0 (0.827)	16.0 (0.630)	51.0 (2.008)	60.0 (2.362)	3.5 x 4.5 (0.138) (0.177)	0.3 (0.031)
E4823	50.0 (2.008)	43.0 (1.693)	51.0 (2.008)	25.0 (0.984)	20.0 (0.787)	51.0 (2.008)	60.0 (2.362)	3.5 x 4.5 (0.138) (0.177)	0.8 (0.031)
E5720	60.5 (2.382)	50.0 (1.969)	51.0 (2.008)	22.5 (0.886)	17.0 (0.669)	61.0 (2.402)	72.0 (2.835)	4.5 x 6.5 (0.177) (0.256)	1.0 (0.039)
E5725	60.5 (2.382)	50.0 (1.969)	56.0 (2.205)	27.5 (1.083)	22.0 (0.866)	61.0 (2.402)	72.0 (2.835)	4.5 x 6.5 (0.177) (0.256)	1.0 (0.039)
E5730	60.5 (2.382)	50.0 (1.969)	61.0 (2.402)	32.5 (1.280)	27.0 (1.063)	61.0 (2.402)	72.0 (2.835)	4.5 x 6.5 (0.177) (0.256)	1.0 (0.039)
E6030	63.5 (2.500)	52.5 (2.067)	64.0 (2.520)	32.5 (1.280)	27.0 (1.063)	63.0 (2.480)	74.0 (2.914)	4.5 x 6.5 (0.177) (0.256)	1.0 (0.039)
E6628	69.5 (2.736)	57.5 (2.264)	65.0 (2.559)	30.5 (1.201)	25.0 (0.984)	71.0 (2.795)	82.0 (3.228)	4.5 x 6.5 (0.177) (0.256)	1.0 (0.039)
E6635	69.5 (2.736)	57.5 (2.264)	72.0 (2.835)	37.5 (1.476)	32.0 (1.260)	71.0 (2.795)	82.0 (3.228)	4.5 x 6.5 (0.177) (0.256)	1.0 (0.039)



SATURABLE REACTORS

For Side Pincushion Correct

- Ideal for pc board mounting and leakage flux minimized due to functional closed magnetic circuit adoption
- Highly reliable due to flame-retardent insulation material
- Excellent in withstanding voltage between the horizontal and vertical windings (ensuring AC 20,000V for a minute)
- Stable against heat, humidity and mechanical shocks
- Minimized in buzz due to adhesive method adoption



Application

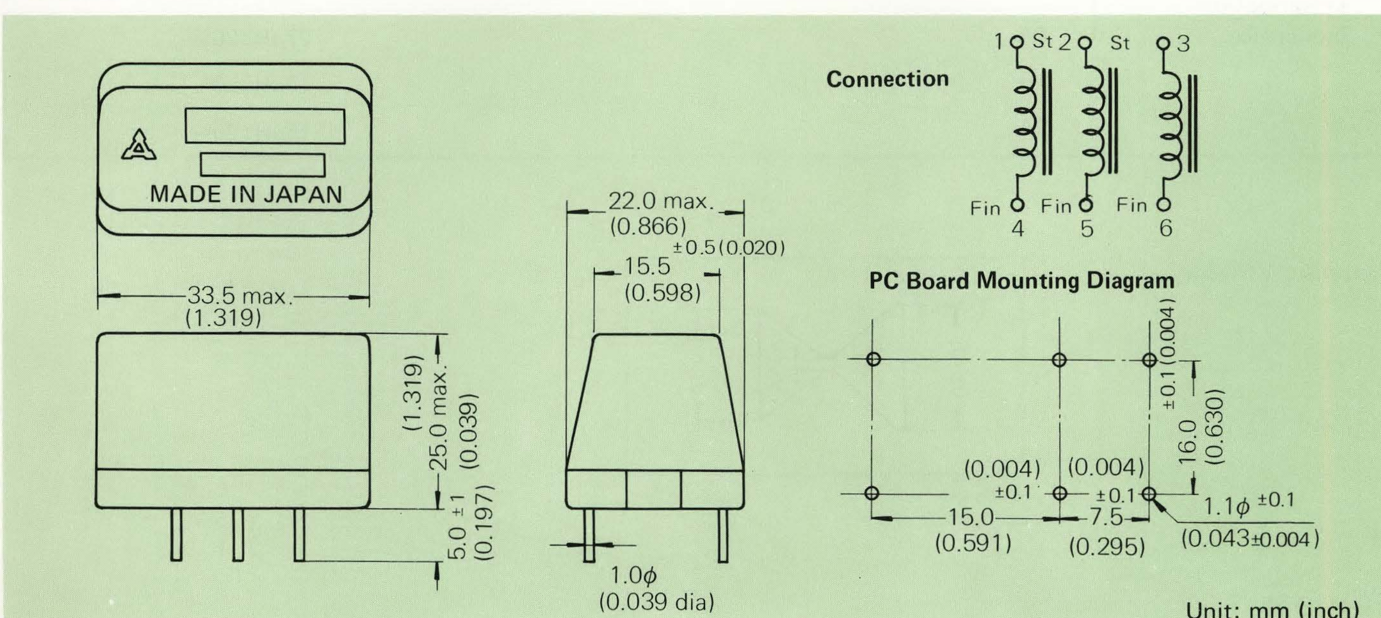
- For side pincushion correct in color TV's

Examples of Current Products

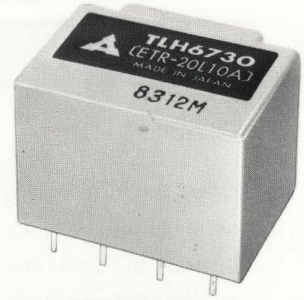
ETR-25K22A (for 90° deflection)
ETR-35KIA (for 110° deflection)

Item		ETR-25K22A	ETR-35KIA
Operating Temperature Range		-25°C ~70°C	-25°C ~ 70°C
Inductance (1,000Hz, 0.1V)	Pri. Winding	85μH min.	119μH ± 23%
	Sec. Winding	3.5H min.	500mH min.
AC Resistance	Pri. Winding	0.2Ω max.	0.1Ω max.
	Sec. Winding	140Ω max.	27Ω max.
Control Characteristics (1,000Hz, 0.1V)		When a current ot 5mA DC is superposed on secondary winding, the inductance of primary winding is 20μH max.	When a current of 60mA DC is superposed on secondary winding, the inductance of primary winding is within 20μH ± 36.5%

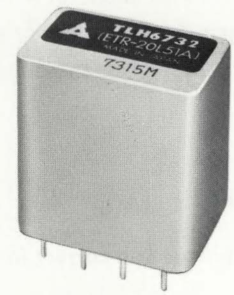
Dimensions



For Top aond Bottom Pincushion Correct



ETR-20L10A



ETR-20L51A

Features

- Compact size and ideal for pc board mounting, being encapsulated in in non-flammable resin case
- Easy mounting and minimized leakage flux due to U type open magnetic circuit adoption
- Small change of dynamic voltage against temperature
- Adjustable types to facilitate adjustment of top and bottom pincushion correct voltage and fixed types available respectively
- Types equipped with linearity coil available

Application

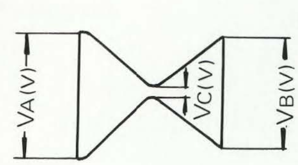
- For top and bottom pincushion correct in color TV's

Examples of Current Products

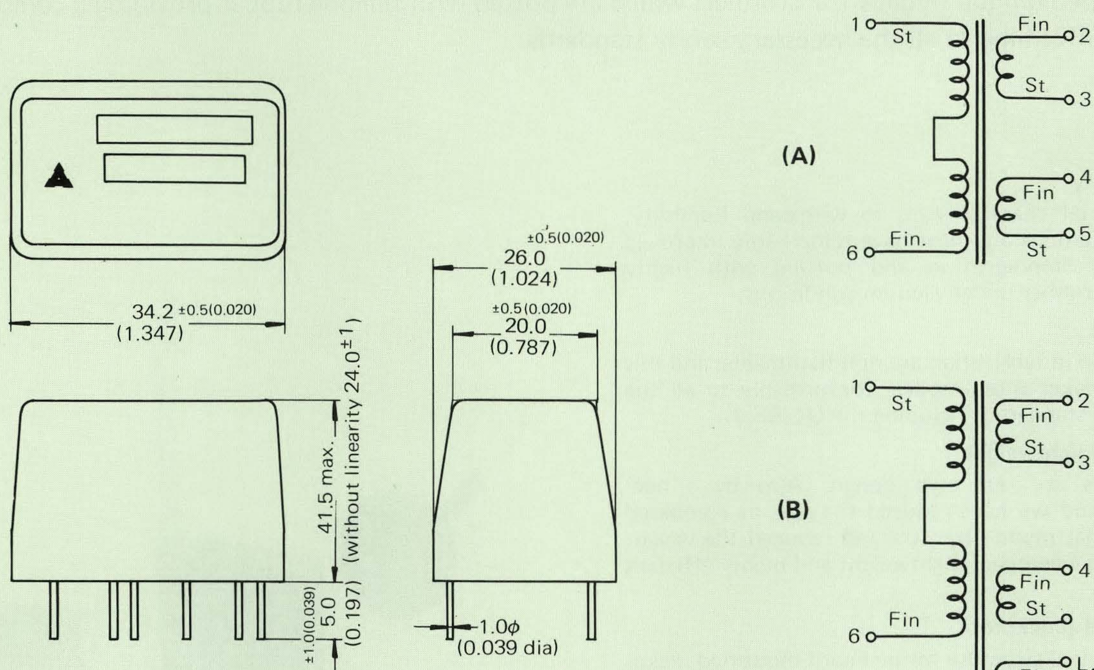
ETR-20L10A (Fixed Type)
ETR-20L51A (Fixed Type with linearity coil)

Item		ETR-20L10A	ETR-20L51A
Operating Temperature Range		-25°C ~ 70°C	-25°C ~ 70°C
Inductance (1,000Hz, 0.1V)	Pri. Winding	430 ~ 700μH	0.93 ~ 3.3mH
	Sec. Winding	420 ~ 690μH	343 ~ 816μH
AC Resistance (at 20°C)	Pri. Winding	1.7Ω ± 10%	6.8Ω ± 10%
	Sec. Winding	0.9Ω ± 10%	0.8Ω ± 10%
Dynamic Voltage	V_A (V)	252 ~ 360V_{p-p}	71 ~ 107V_{p-p}
	V_B (V)	238 ~340V_{p-p}	85 ~127V_{p-p}
	V_C (V)	10V_{p-p} max.	6V_{p-p} max.
Linearity Coil Inductance	-2A		127μH±20%
	-1A		63μH±25%
	0A		27μH±20%
	1A		19μH±20%
	2A		15μH±20%

Dynamic Voltage



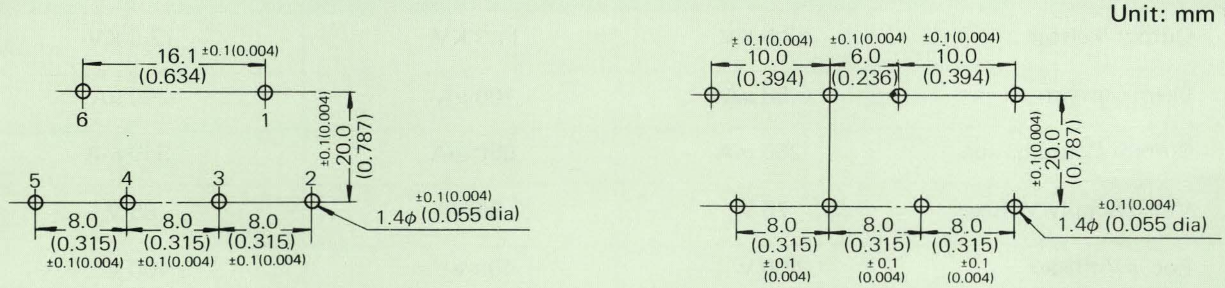
Dimensions and Connection



Terminal 1~6; Pri. winding
Terminal 2~5; Sec. winding
Terminal L_1~L_2; Linearity winding

PC Board Mounting Diagram

Unit: mm (inch)



(A)

(B) (with linearity coil)

HORIZONTAL OUTPUT TRANSFORMERS

Silicon Rubber Potted Flyback Transformers

Newly developed unique flyback transformers which are potted with silicone rubber providing a compact and safe design conforming to all the necessary safety standards.

- **High reliability**

All environmental characteristics to withstand humidity, temperature variations and heat have remarkably improved because of the impregnation and potting with highly reliable silicone rubber under vacuum conditions.

- **Safety design**

All material used in fabrication are non-flammable, and this safety design makes these models conformable to all the necessary safety standards, including the UL(SE-1).

- **Compact and lightweight**

All components are our own design. Also by a new processing method we have reduced the size, as compared with conventional models by 40% and reduced the weight by 60% yielding a compact, lightweight and highly efficient model.

- **Vibration and shockproof**

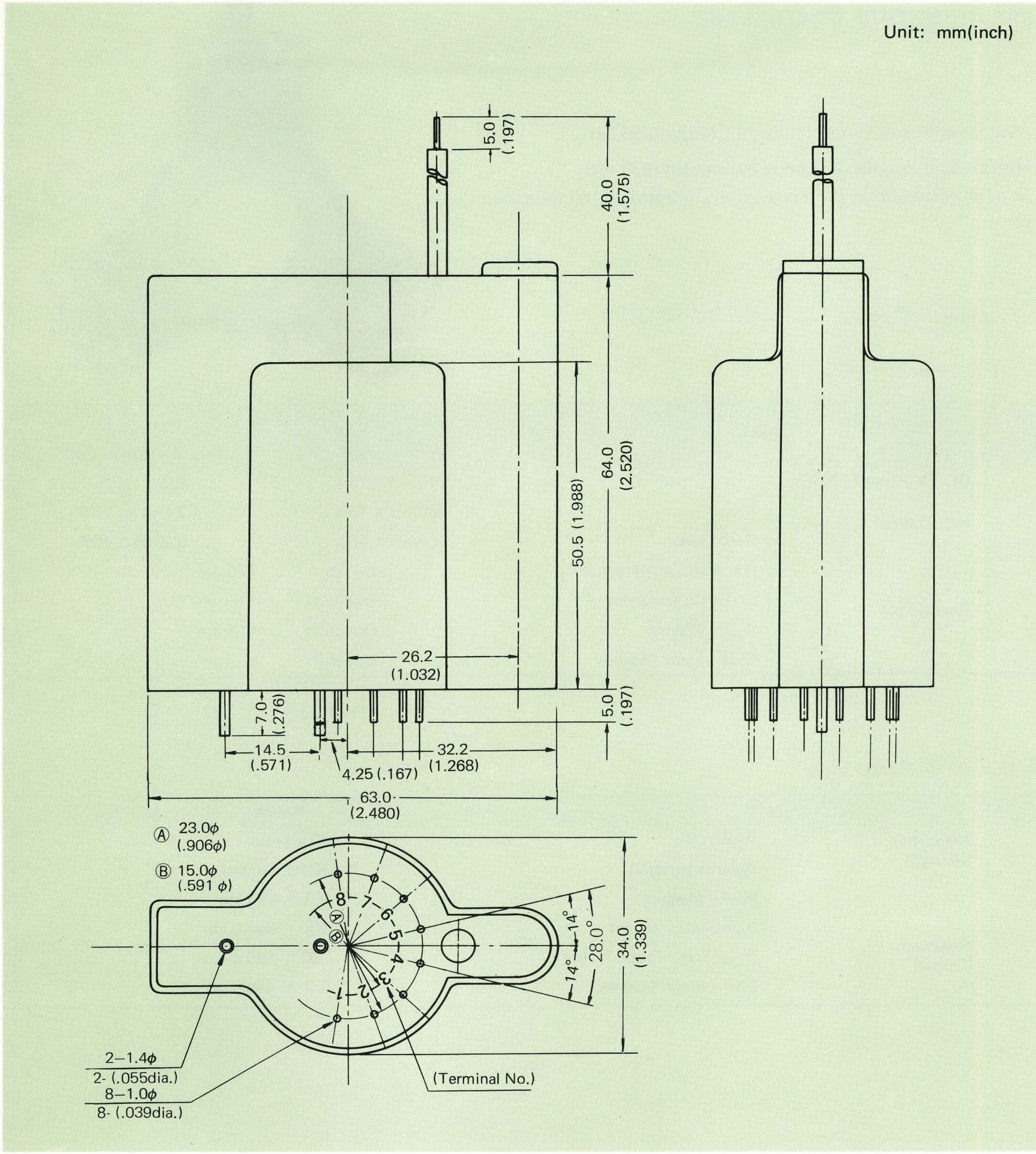
Special pin terminal structure for pc board mounting makes these models strong and stable against vibration and shocks, increasing assembly efficiency.

Typical Ratings

Items \ CRT	For 5"	For 9 – 10"	For 12 – 14"
Output Voltage	7.5 KV	11.3 KV	12.5 KV
Beam Current	50 μA	100 μA	200 μA
Current Consumption	250 mA	650 mA	540 mA
Video Supply Voltage	75 V	85 V	85 V
Focus Voltage	400 V	400 V	400 V
Pulse Width	11.5 μ sec.	11.5 μ sec.	11.5 μ sec.
Power Source Voltage	11.4 V	11.4 V	18.0 V

Electrical characteristics can be changed upon request.

Dimensions and Mounting



CONVERGENCE YOKE

Neck Mounting Board Type

- Ideal for small size TV sets (9" to 16", Neck dia 36.5ϕ)
- High safety due to the use of non-flammable (SE-1) resin
- Same characteristics as the 3 pole system in sensitivity, temperature, etc.

An Example of Current Products (ETC-40U23A)

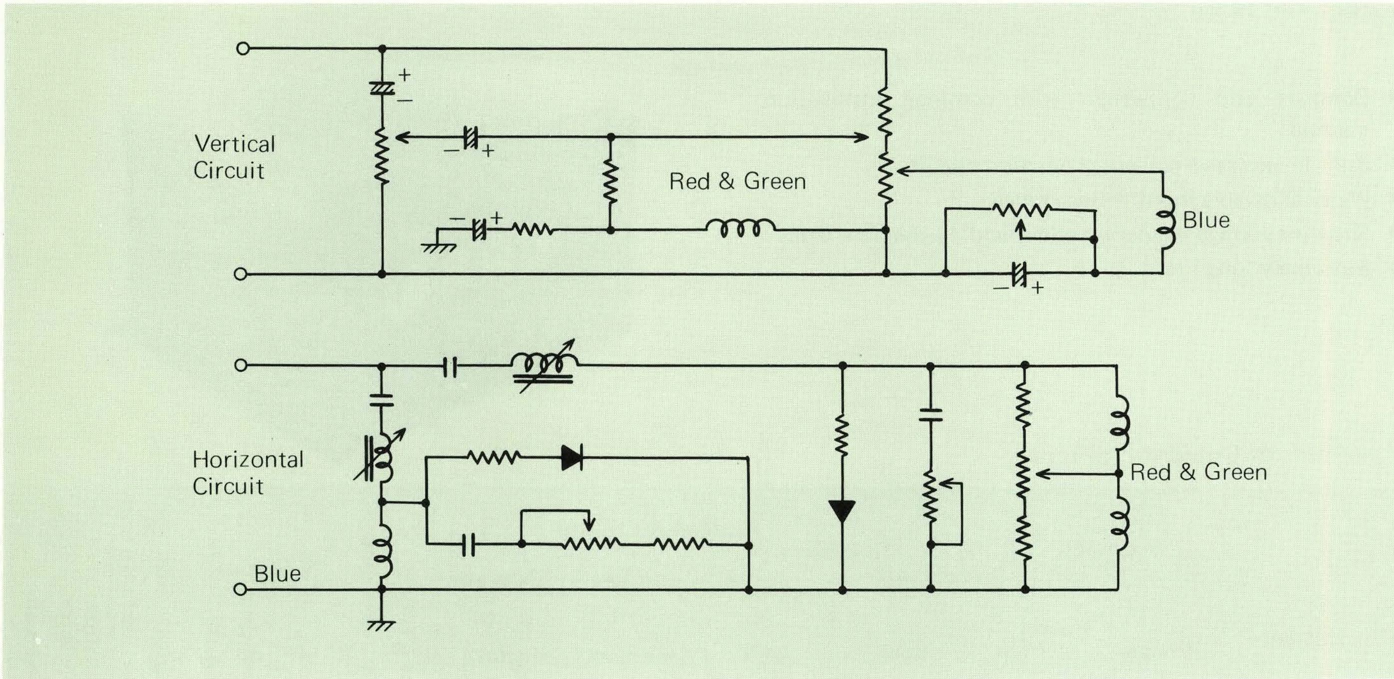
Electrical Characteristics

Item		Rating	
		Vertical Coil	Horizontal Coil
DC Resistance (20°C)		110Ω ± 10%	8.0Ω ± 10%
Inductance	Blue	380mH ± 10%	2.8mH ± 10%
	Red, Green	600mH ± 10%	3.2mH ± 10%
Sensitivity	Dynamic Convergence	Dot shift ±20mm	
	Static Convergence	Dot shift ±15mm	
	Purity Magnet	Dot shift ±15mm	
	Blue-Lateral Magnet	Dot shift ± 7mm	

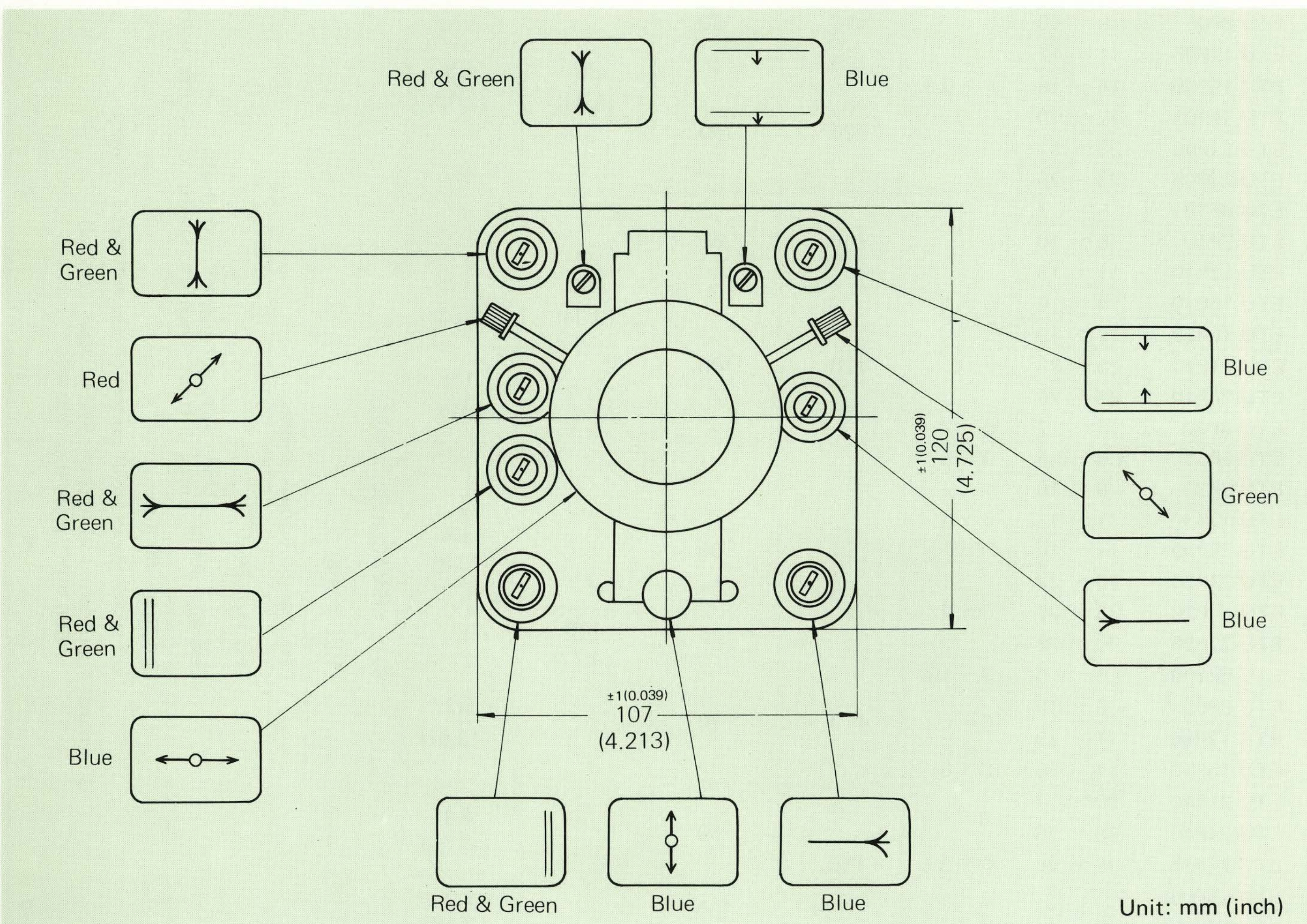
Mechanical Characteristics

Item		Rating
Attaching Strength	Along axis	10 kg min.
	Against rotation	10 kg.cm min.
Rotation Torque	Purity Magnet	0.3 ~ 4 kg. cm
	Blue-Static Magnet	100 ~ 800 g.cm
	Red, Green-Static Magnet	50 ~ 400 g.cm
	Blue-Lateral Magnet	0.3 ~ 4 kg.cm

Standard Circuit



Dimensions and Convergence Adjustment



POWER SUPPLIES

Low Voltage

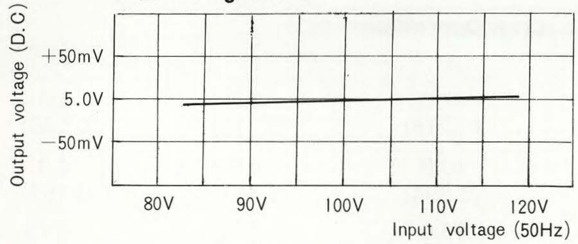
- Compact and lightweight with common installation method
- Built-in excessive current protection circuit
- Wider allowable input voltage range
- Superior voltage regulation and shielding characteristics
- Extremely long life

Examples of Current Products

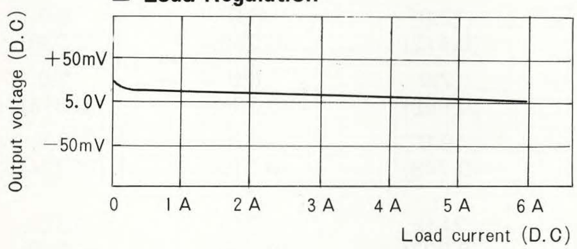
Part Number	Output: Voltage (VDC)	Output: Current (A)	Regulation: Line (mV max.)	Regulation: Load (mV max.)	Height (H) mm (inch)	Approx. Weight kg (lbs)	Input Voltage	Amb. Operation Temp.	Ripple Voltage	Temp. Coefficient	Stability	Transient Response	Overload Protection	Insulation Resistance	Dimensions
ETU-6P05	5 ~ 7	0 ~ 0.5	±10	50	85 (3.34)	1.3 (2.87)	85 ~ 115VAC at 50 or 60Hz	-10°C ~ +50°C	Less than 5mV, peak-to-peak	Less than 2mV/°C	Less than 30mV (Under constant ambient conditions, total drift for 8 hours following 30 minutes warm-up)	Less than 100 μ sec.	Automatic short-circuit protection and automatic recovery	G terminal (input terminal) to G terminal (output terminal) 500 V DC, more than 100 MΩ	A
ETU-9P05	8 ~ 10														
ETU-12P05	11 ~ 13														
ETU-15P05	14 ~ 16		±20	100											
ETU-18P05	17 ~ 19														
ETU-21P05	20 ~ 22														
ETU-24P05	23 ~ 25														
ETU-6P10	5 ~ 7	0 ~ 1	±10	50											
ETU-9P10	8 ~ 10														
ETU-12P10	11 ~ 13				100 (3.94)	1.6 (3.53)									
ETU-15P10	14 ~ 16		±20	100											
ETU-18P10	17 ~ 19														
ETU-21P10	20 ~ 22				120 (4.72)	1.9 (4.19)									
ETU-24P10	23 ~ 25														
ETU-6P20	5 ~ 7	0 ~ 2	±10												
ETU-5P50	4.5 ~ 5.5	0 ~ 5		50		3.3 (7.28)									B
ETU-9P30	8 ~ 10	0 ~ 3													
ETU-12P30	11 ~ 13														
ETU-15P30	14 ~ 16														
ETU-21P20	20 ~ 22	0 ~ 2													
ETU-24P20	23 ~ 25														
ETU-27P20	26 ~ 28														
ETU-5P100Z	4.5 ~ 5.5	0 ~ 10	± 3	20		6.2 (13.67)									C
ETU-9P60	8 ~ 10	0 ~ 6													
ETU-12P60	11 ~ 13														
ETU-15P50	14 ~ 16	0 ~ 5													
ETU-21P40	20 ~ 22	0 ~ 4	±10	50		6.3 (13.89)									
ETU-24P40	23 ~ 25														
ETU-27P35	26 ~ 28	0 ~ 3.5													
ETU-15W10	14 ~ 16 14 ~ 16	0 ~ 1		100		3.3 (7.28)									D
ETU-24W10	23 ~ 25 23 ~ 25	0 ~ 1													

Characteristics

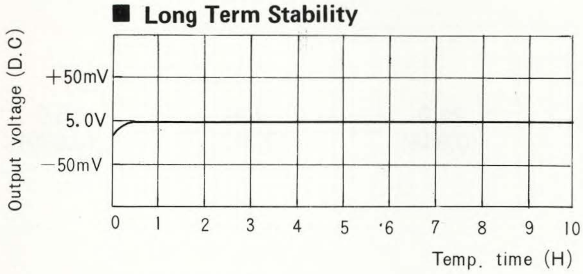
■ Line Regulation



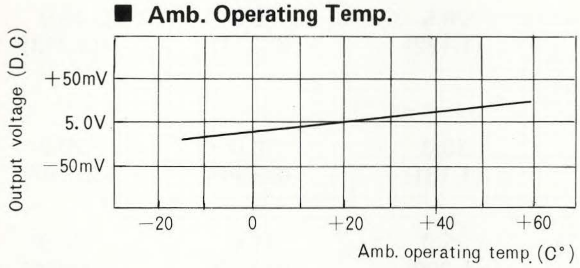
■ Load Regulation



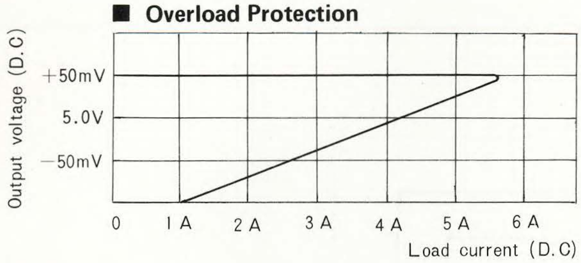
■ Long Term Stability



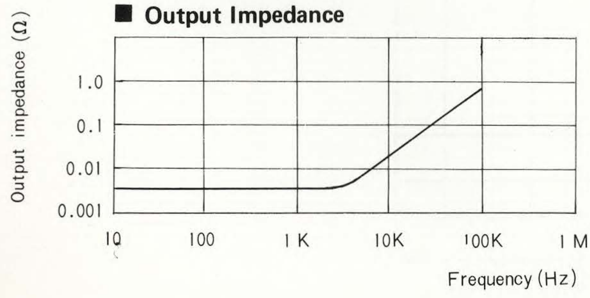
■ Amb. Operating Temp.



■ Overload Protection



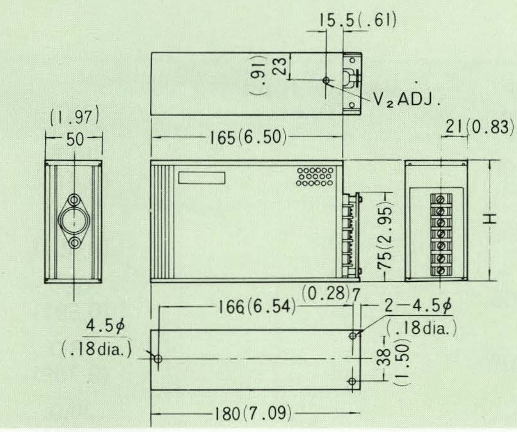
■ Output Impedance



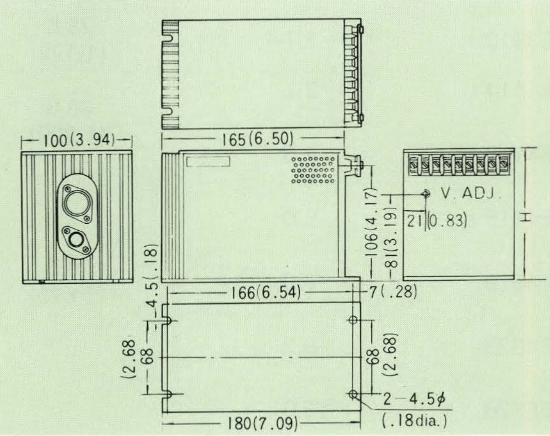
Dimensions

Unit: mm(inch)

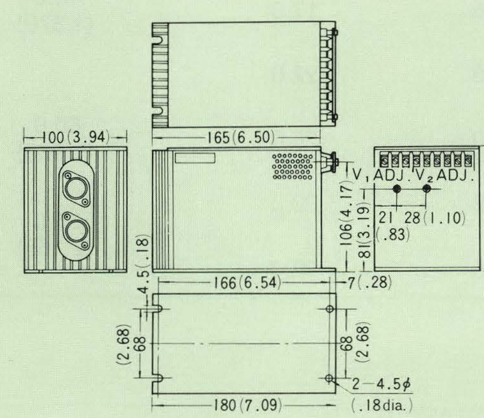
A



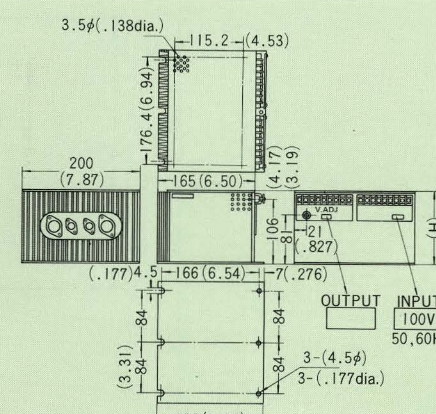
B



C



D

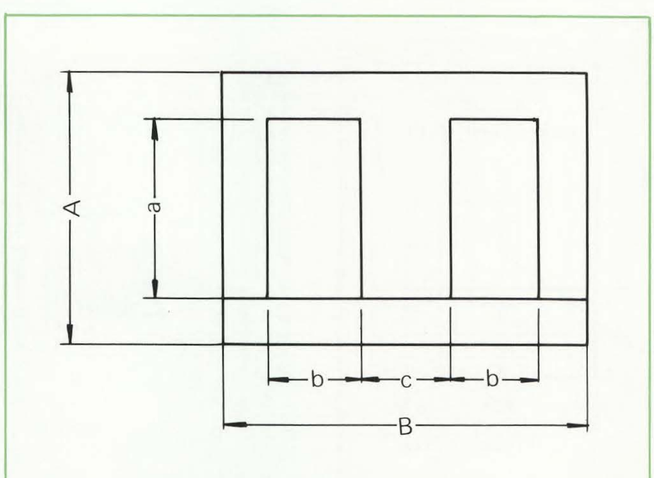


CORE, CAPACITY AND STRUCTURE

Unit: mm (inch)

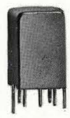
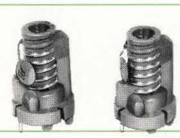
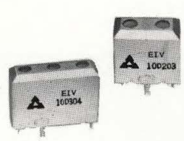
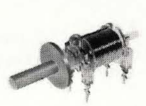
<table>
<tr><th rowspan="2">Core Type</th><th rowspan="2">Capacity (Approx.) (VA)</th><th colspan="5">Core Dimensions</th></tr>
<tr><th>A</th><th>B</th><th>a</th><th>b</th><th>c</th></tr>
<tr><td>E1405</td><td></td><td>10.5 (0.413)</td><td>14.0 (0.551)</td><td>7.0 (0.276)</td><td>3.5 (0.138)</td><td>3.5 (0.138)</td></tr>
<tr><td>E1605</td><td></td><td>14.0 (0.551)</td><td>16.0 (0.629)</td><td>10.0 (0.394)</td><td>4.0 (0.157)</td><td>4.0 (0.157)</td></tr>
<tr><td>E1905</td><td></td><td>15.0 (0.591)</td><td>19.0 (0.748)</td><td>10.0 (0.394)</td><td>4.75 (0.187)</td><td>4.75 (0.187)</td></tr>
<tr><td>E2406</td><td></td><td>18.0 (0.709)</td><td>24.0 (0.945)</td><td>12.0 (0.472)</td><td>6.0 (0.236)</td><td>6.0 (0.236)</td></tr>
<tr><td>E2812</td><td>1.1</td><td>25.0 (0.984)</td><td>28.0 (1.102)</td><td>17.0 (0.669)</td><td>6.0 (0.236)</td><td>8.0 (0.315)</td></tr>
<tr><td>E3512</td><td>1.7</td><td>28.5 (1.122)</td><td>35.0 (1.378)</td><td>19.0 (0.748)</td><td>8.0 (0.315)</td><td>9.5 (0.374)</td></tr>
<tr><td>E4114</td><td>2.7</td><td rowspan="2">33.0 (1.299)</td><td rowspan="2">41.0 (1.614)</td><td rowspan="2">21.0 (0.827)</td><td rowspan="2">8.0 (0.315)</td><td rowspan="2">13.0 (0.512)</td></tr>
<tr><td>E4119</td><td>4.3</td></tr>
<tr><td>E4815</td><td>5.6</td><td rowspan="3">40.0 (1.575)</td><td rowspan="3">48.0 (1.889)</td><td rowspan="3">24.0 (0.945)</td><td rowspan="3">8.0 (0.315)</td><td rowspan="3">16.0 (0.630)</td></tr>
<tr><td>E4819</td><td>7.3</td></tr>
<tr><td>E4823</td><td>9.3</td></tr>
<tr><td>E5720</td><td>13.0</td><td rowspan="3">47.5 (1.870)</td><td rowspan="3">57.0 (2.244)</td><td rowspan="3">28.5 (1.122)</td><td rowspan="3">9.5 (0.374)</td><td rowspan="3">19.0 (0.748)</td></tr>
<tr><td>E5725</td><td>17.0</td></tr>
<tr><td>E5730</td><td>22.0</td></tr>
<tr><td>E6030</td><td>26.0</td><td>50.0 (1.969)</td><td>60.0 (2.362).</td><td>30.0 (1.181)</td><td>10.0 (0.394)</td><td>20.0 (0.787)</td></tr>
<tr><td>E6628</td><td>32.0</td><td rowspan="2">55.0 (2.165)</td><td rowspan="2">66.0 (2.599)</td><td rowspan="2">33.0 (1.299)</td><td rowspan="2">11.0 (0.433)</td><td rowspan="2">22.0 (0.866)</td></tr>
<tr><td>E6635</td><td>38.0</td></tr>
</table>

Core Dimensions

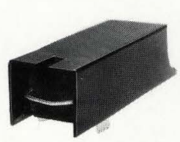


QUICK REFERENCE GUIDE

Coils

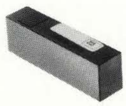
Type	Shape	Size mm (inch)	Inductance (mH)	Typical Current Products	Frequency (MHz) 0.01 0.1 1 10 100	Page
7S		7.6x9.3x12.5 (.299x.366x.492)	0.001~2	IFT: 455KHz 10.7MHz MW, osc		XIII-20
C10S		10.8□x18 (.425□x.709)	1~22	MPX, TV osc. Tape Recorder osc		XIII-21
L12R		12.5φx16 (.492diax.630)	0.5~10	Tape Recorder osc		XIII-22
T10S		10.8□x15 (.425□x.591)	0.1~50 (μH)	IFT: 3.58MHz 4.5MHz 58 MHz Trap		XIII-23
6M		14φx21 (.551dia.x.827)	0.1~0.25 (μH)	TV VIF Trap		XIII-24
10D		22.0x11.3x27.0 (.866x.445x1.06) 32.8x11.3x27.0 (1.291x.445x1.06)		CTV BPF		XIII-25
LHS		18x29x31 (.709x1.14x1.22)	0.01~100	TV Hor. osc		XIII-26

Ferrite Antenna Coil

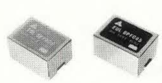
Type	Shape	Size mm (inch)	Inductance (μH)	Use	Frequency (MHz) 0.01 0.1 1 10 100	Page
		26x78x21 (1.02x3.07x.83)	0.06~0.10	FM Radio		XIII-27 XIII-28

These charts are intended to serve as a guide only.

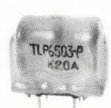
Delay Lines

Type	Shape	Size mm (inch)	Impedance (KΩ)	Delay Time (μ sec)	Amplitude Characteristics (at − 3dB)	Page
SDL		11.5x47.5x15.5 (.453x1.87x.610)	1.8 KΩ	0.9	4MHz	XIII-29
			1.8 KΩ	0.8		
			1.8 KΩ	0.7		

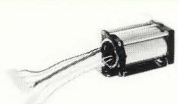
Filter Blocks

Type	Shape	Size mm (inch)	Attenuation (dB)	Use	Frequency (MHz) 0.001 0.01 0.1 1 10	Page
25D		25.5x36.5x21 (1.00x1.44x.827)	50 min	CD-4disc system		XIII-30

Line Filter

Type	Shape	Size mm (inch)	Inductance (mH)	Self-resonant Frequency (MHz)	Use	Page
LF-A		16x31.5x39 (.630x1.24x1.54)	Min 0.43	1.0	TV	XIII-31

Vidicon Deflection Yokes

Type	Shape	Size mm (inch)	Applicable Vidicon	Inductance (mH) Hor.	Inductance (mH) Ver.	DC Resistance (Ω) Hor.	DC Resistance (Ω) Ver.	DC Resistance (Ω) Focus	Focus Current (mA)	Luster Distortion	Use	Page
A		46□x79 (1.81□x3.11)	2/3 Type Electromagnetic focusing structure	1.48 ±10%	38 ±10%	4.2 ±10%	118 ±10%	43.6 ±10%	110	Within ±2%	ITV	XIII-32

Part Number Code

High Frequency Transformers

E L	L	□ 7	S	9 8
Common Code	Classification	Dimensions	Structure	Order of Design

Classification:

C	Convergence Coil
F	Line Filter
H	Horizontal Coil
L	Oscillator Coil
M	FM MPX Coil
R	Rod Type Bar Antenna
T	Standard High Frequency Transformer
Y	Vidicon Deflection Yoke

Dimensions:

Length of one side external form in mm

Length of ferrite core in cm

Diameter of bobbin in mm

Structure:

S	Square shield case
P	Mold bobbin
N	Without shield
B	According to the diameter of core (for round bar antenna coil

IF Transformers

E I	A	□ □	S	6 2 7	A
Common Code	Classification	Dimensions	Structure	Order of Design	Distinction

Classification:

A	AM IFT
F	FM IFT
K	Chroma IFT
V	Video IFT
S	Sound IFT

Dimensions:

Length of one side external form in mm.

Structure:

S	Square type shield case
D	Rectangle type shield case
N	Without shield case

Distinction:

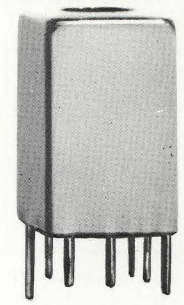
A	For first stage
B	Stage interval
C	Stage interval
D	For detection
E	For others

Filter Blocks

E U L	B P F	O O S
Common Code	Common Code	Order of Design

Type 7S (#700)
IF Transformer

- Design facilitates easy printed circuit board mounting due to the terminal interval with an integral multiple of 2.5mm. Provides further improvement in eliminating foil breakage or bridged solder.
- Up-right orientation when inserted into pc board
- Electrically and mechanically stable due to the improvement of frequency deviation characteristics. This was accomplished by making the core rotation angle linear with respect to inductance.
- Complete temperature compensation
- Excellent temperature and humidity-resistant characteristics because of the unique winding technique, and also due to the core being directly retained by the case.
- Can be pre-set to the required frequency



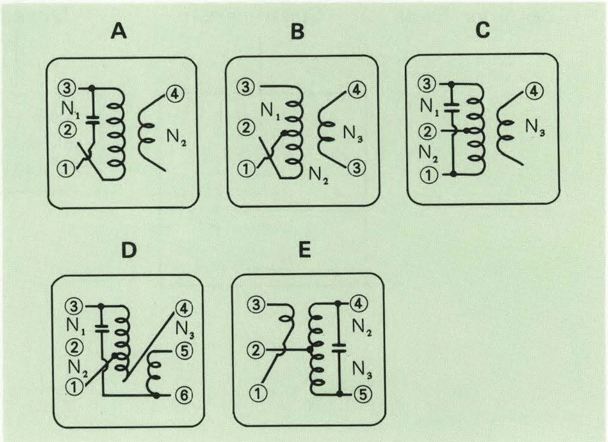
Examples of Current Products

Part No.	Use	Q Unloaded	Frequency (Hz)	Resonant Capacitance(PF)	Winding Turns			Conn.	Color Code
					N_1	N_2	N_3		
EIA-7S751A	AM1stIFT	70	455KHz	200pF	33	152	17	C	Yellow
EIA-7S753B	AM2ndIFT	70	455KHz	200pF	19	166	17	C	White
EIA-7S752D	AM3rdIFT	70	455KHz	200pF	49	136	47	C	Black
EIF-7S751A	FM1stIFT	110	10.7MHz	100pF	5	8	2	C	Purple
EIF-7S751B	FM2ndIFT	110	10.7MHz	50pF	7	11	3	C	Sky
EIF-7S751C	FM3rdIFT	110	10.7MHz	50pF	6	12	2	C	Pink
EIF-7S752D	FMDet.Pri.	110	10.7MHz	50pF	6	11½	5½	D	Brown
EIF-7S751E	FMDet.Pri.	110	10.7MHz	50pF	1	9½	8½	E	Green

Standard Specifications

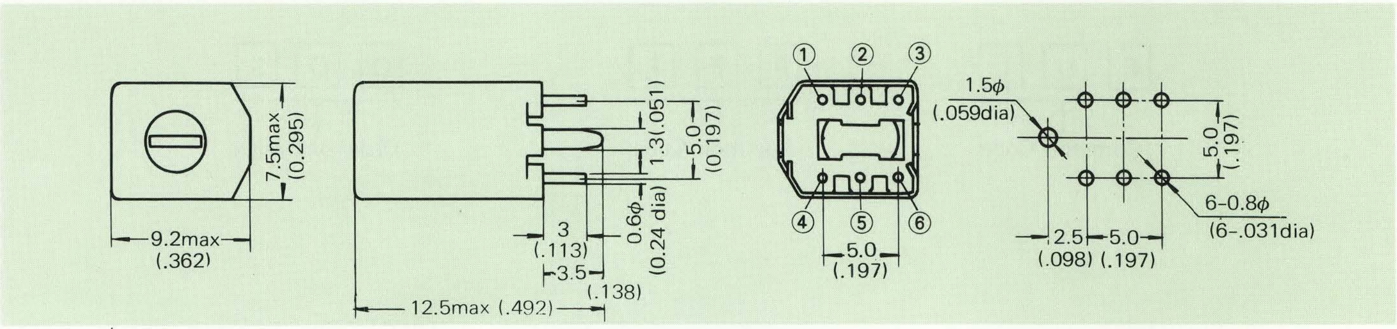
Rated Frequency		455KHz	10.7MHz
Impedance Ratio	Pri.	10KΩ~100KΩ	6KΩ~20KΩ
	Sec.	300Ω~5KΩ	300Ω~4.7KΩ x 2
Q	Unloaded	70, 110	100
	Loaded	35	35
Temperature Characteristies		0± 150PPM (With a temperature compensating capacitor)	
Humidity Characteristics	$\Delta F/F_0$	± 1% max.	
	$\Delta Q/Q_0$	±30% max.	
	Insulation Resistance	50MΩ min.	
Core Rotating Torque		50~450g·cm	

Standard Connection



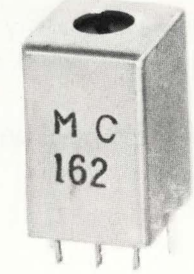
Dimensions and Mounting

Unit:mm(inch)



Type C10S
FM Multiplex Coils

- Built-in capacitor type
- Adjustment completely unnecessary due to the adoption of pre-setting technology
- Higher L and Q are obtained in spite of the miniature size. The characteristic change is extremely small when subjected to violent shocks and severe temperature changes because it is especially designed to have good humidity characteristics and time-lasting stability.
- Improved solderability due to the adoption of brass material earth (grounding) lugs.



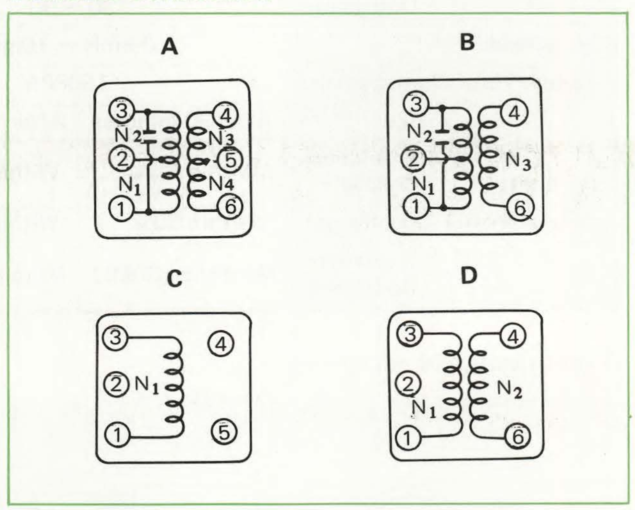
Examples of Current Products

Part No.	Use	Inductance (mH)	Q Unloaded	Frequency (KHz)	Resonant Capacitance (pF)	Winding Turns				Conn.
						N_1	N_2	N_3	N_4	
ELM-10S702B	Switchings	12.2	60 (at 38KHz)	38	4.700	117	147	15	15	A
ELM-10S703	19KHz Amp.	14.8	40 (at 19KHz)	19	4.700	425	135	43	–	B
ELM-10S704A	19KHz Amp.	14.8	50 (at 19KHz)	19	4.700	560	–	–	–	C
ELM-10S704B	38KHz Amp.	11.6	55 (at 38KHz)	38	1.500	500	76	–	–	D

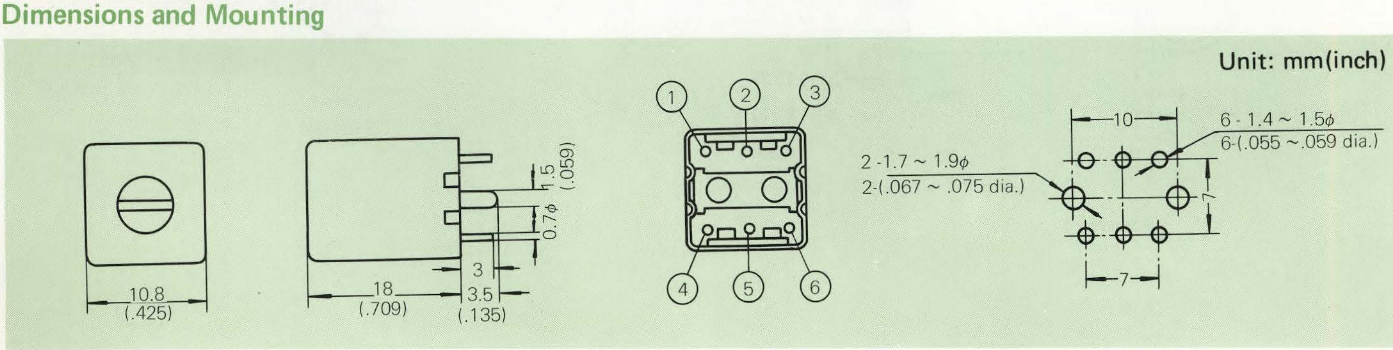
Standard Specifications

Rated Frequency		19KHz	38KHz	67KHz
Q	Unloaded	40	70	120
Inductance		1.0mH ~ 25mH		
Available Capacitor		200pF, 1,500pF, 2,200pF, 4,700pF		
Temperature Characteristics		0 ± 100 PPM		
Humidity Characteristics	ΔF/Fo	± 0.3% max.		
	ΔQ/Qo	± 10% max.		
Core Rotating Torque		70 ~ 500 g · cm		

Standard Connection



Dimensions and Mounting



Type L12R
Oscillators for Tape Recorders

- Higher inductance in spite of the miniature size
- Adjustment completely unnecessary
- Usable at high input level due to the superior magnetic saturation level
- A nine-pin-terminal type is available for use in a push-pull oscillator circuit.

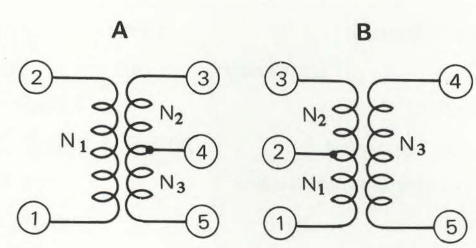
Examples of Current Products

Part No.	Use	Inductance (mH)	Q Unloaded	Frequency (KHz)	Resonant Capacitance (pF)	Winding Turns			Conn.
						N_1	N_2	N_3	
ELL-12R101	Tape Recorder OSC.	5.7	54 (at 40KHz)	40	2.200	340	4.5	36	A
ELL-12R102	Tape Recorder OSC.	1.5	95 (at 60KHz)	60	4.700	25	25	170	B

Standard Specifications

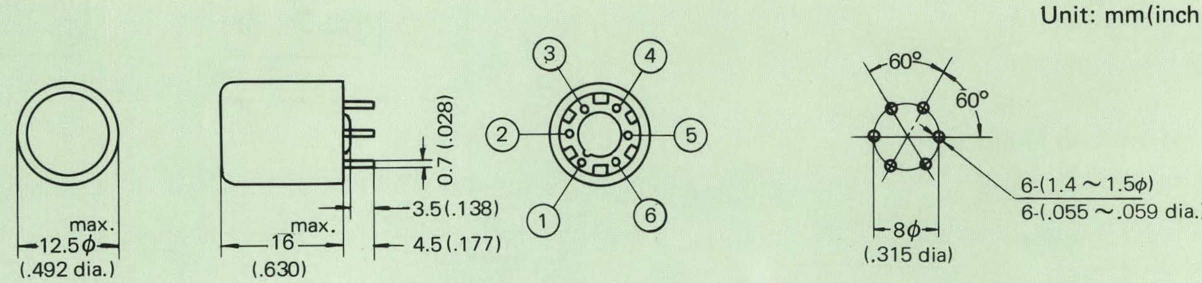
Rated Frequency		10KHz ~ 100KHz	
Q	Unloaded	30 ~ 90	
Inductance		0.5mH ~ 10mH	
Temperature Characteristics		150PPM	
Humidity Characteristics	Items / Time	After 30 minutes	After 16 hours
	Inductance Change	Within 0.5%	Within 0.25%
	Q Change	Within 30%	Within 10%
	Insulation Resistance	More than 50MΩ	More than 200MΩ

Standard Connection



Dimensions and Mounting

Unit: mm(inch)



Type T10S (#500)
IF Transformers for TV's

- Compact size, superior efficiency and higher reliability
- The core is adjustable from top and bottom.
- Built-in capacitor type, up to 82pF, are available.

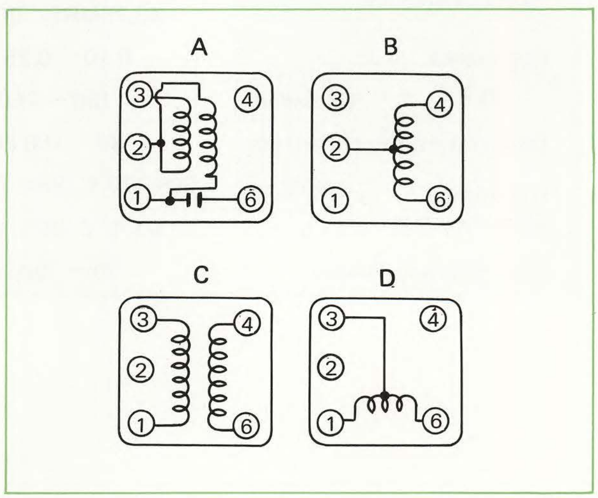
Examples of Current Products

Part No.	Use	Rated Frequency (MHz)	L (μH)	Q Unloaded	Resonant Capacitance (pF)	Winding Turns		Conn.
EIV-10S501A	VIF Input	58.75	0.97	47	18	①–② 4½	②–③ 4½	A
EIV-10S501F	AFC	58.75	0.62	86	–	②–④ 5½	②–⑥ 2	B
EIS-10S541A	SIF Input	4.50	14.4	93	–	①–③ 36½	④–⑥ 8½	C
EIS-10S543G	4.5MHz Trap	4.50	13.9	47	–	①–③ 22	③–⑥ 22	D
EIK-10S571A	Chroma Highpeaker	3.58	3.3	41	–	①–③ 21	④–⑥ 21	C

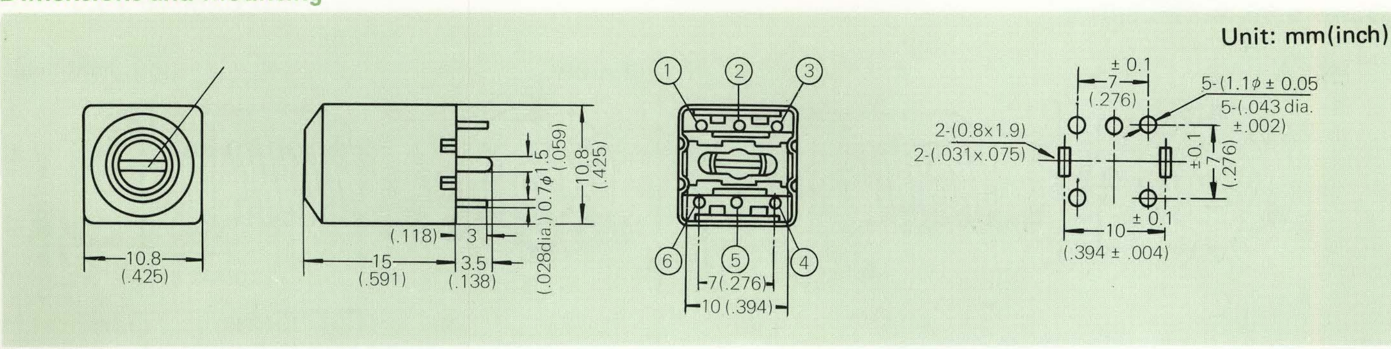
Standard Specifications

Items / Use		VIF	SIF	Chromar IF
Rated Frequency		58.75MHz	4.5 MHz	3.58 MHz
Inductance		0.2 μH ~ 8.0 μH	9.0 μH ~ 15.0 μH	7.0 μH ~ 26.0 μH
Q	Unloaded	40 ~ 100	40 ~ 95	30 ~ 95
Temperature Characteristics		220PPM	150PPM	150PPM
Humidity Characteristics	$\Delta Q/Q_0$	± 30% (70°C, 95%, 96Hrs) max.		
	$\Delta L/L_0$	± 1% (70°C, 95%, 96Hrs) max.		
Core Rotating Torque		30 ~ 350 g · cm		

Standard Connection

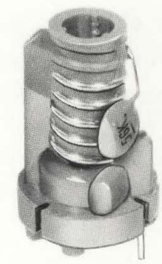


Dimensions and Mounting



Type 6M
VIF Trap Coils

- Highly stable L, Q and resonant impedance
- Versatile design for the mounting location of the tap and capacitance
- Connection coil is formed in a one construction with this model for use as a VIF detector sound trap coil.
- Self-supporting construction for PC board mounting
- Hexagonal and minus screw drivers can be used for core adjustment.
- Color indication of plastic is utilized.



Examples of Current Products

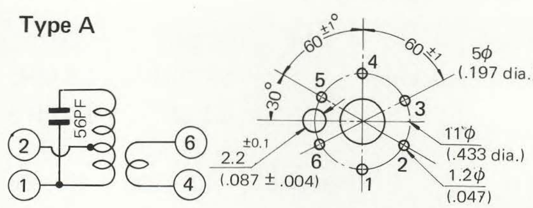
Part No.	Use	Rated Frequency (MHz)	Resonant Capacitance (pF)	Winding Turns			Color	Type
EIV - 6M304A	Adjacent Channel Trap	60.25	56	①—Ⓕ 5	①—③ 4/6		Blue	B
EIV - 6M304B	Sound Trap	54.25	56	①—Ⓕ 5	①—③ 4/6		Green	B
EIV - 6M402D	Detector Sound Trap	54.25	56	①—Ⓕ 5	①—③ 2 4/6	④—⑥ 4/6	Yellow	A

Standard Specifications

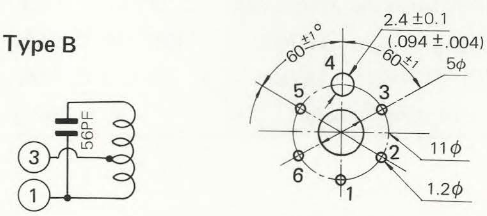
Rated Frequency		41.25MHz, 54.25MHz 45.75MHz, 60.25MHz
Inductance		0.10 ~ 0.25 μH
Q	Unloaded	150 ~ 250
Temperature Characteristics		80 ~ 150 PPM
Humidity Characteristics	ΔQ/Qo	± 30% (70°C, 95%, 96 Hrs.) max.
	ΔL/Lo	± 1% (70°C, 95%, 96 Hrs.) max.
Core Rotating Torque		30 ~ 350g·cm

Standard Connection

Type A



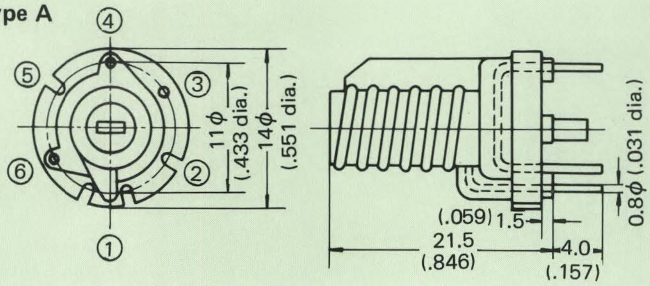
Type B



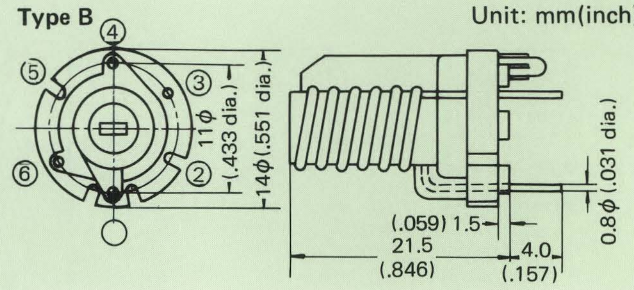
Dimensions and Mounting

Unit: mm(inch)

Type A

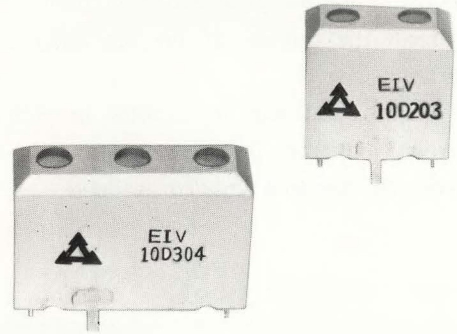


Type B



Type 10D
Helical Filters

- Minimized insertion loss due to the use of a helical resonator
- Versatile design yields flat amplitude and phase characteristics.
- Highly stable temperature characteristics due to the use of a unique ferrite core.
- Mechanical stability provided by unique case construction
- Pre-set type is available.
- Able to combine with a trap coil.



Examples of Current Products

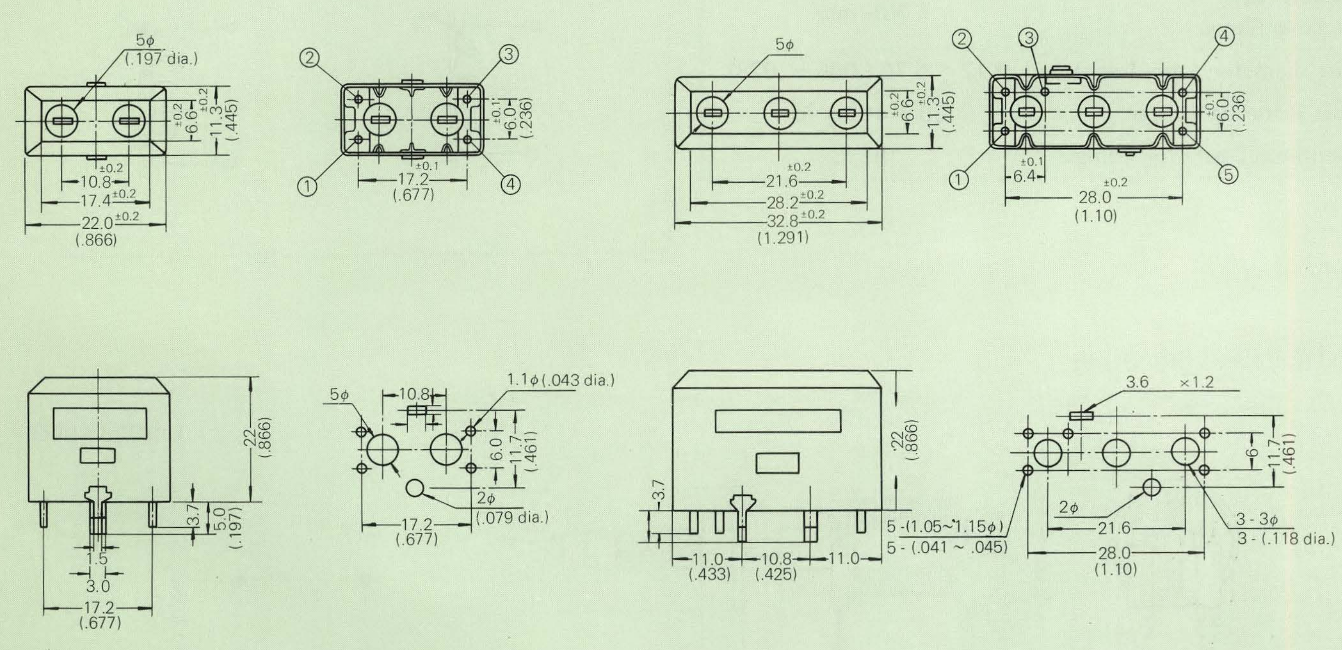
Part No.	Use	Rated Frequency (MHz)	Band Width (MHz) (at −3dB)	Insertion Loss (dB)
EIV - 10D203	Color TV	58.75	3.9	2.0
EIV - 10D304	Color TV	45.75	3.6	2.7

Dimensions and Mounting

2 Elements

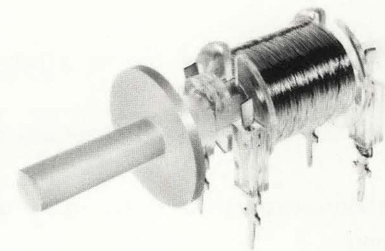
3 Elements

Unit: mm(inch)



Type LH-S
Horizontal Coils

- One-piece construction using polycarbonate resin
- Adjustable from the outside of the set using a core adjusting driver
- Usable as a holizontal coil in a color or B/W TV. Also as a variable inductor
- Non-flammable UL standard types are available.



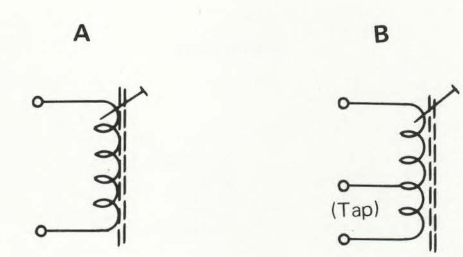
Examples of Current Products

Part No.	Use	Inductance (mH)	Wire dia. mm (inch)	Winding Turns	Conn.
ELH - 7N315	Hor. OSC	55	0.12 (.005)	2,300	A
ELH - 7N317	Hor. OSC	70	0.12 (.005)	2,700	A
ELH - 7N322	Hor. OSC	35	0.12 (.005)	1,700	A
ELH - 7N320	Hor. OSC	90	0.12 (.005)	2,100 (Tap 600)	B

Standard Specifications

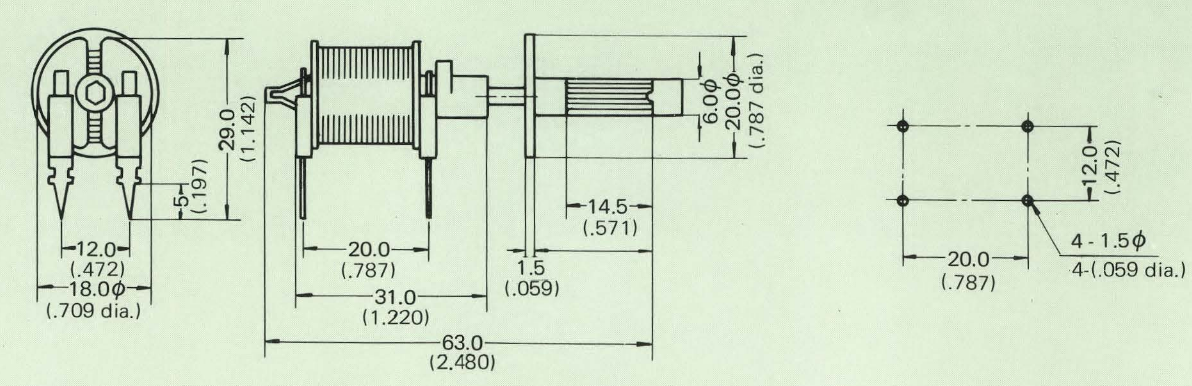
Frequency	5K ~ 500KHz
Inductance	100mH max.
Inductance Variable Range	± 30% min.
Wire diameter mm (inch)	0.12 ~ 0.70 (.005 ~ .028)
Core Rotating Torque	30 ~ 400 g · cm
Maximum Operating Temp.	85°C

Standard Connection



Dimensions and Mounting

Unit: mm(inch)



FM FERRITE ANTENNA COIL

Type ELP-5P9001

■ **Non-directional**

The antenna is non-directional because it receives horizontal waves (vertical magnetic field) and is favorable for FM multi-channels. Since it always receives the wave under optimum conditions, antenna adjustment during channel selection is unnecessary.

■ **Reduction of parts and assembly processes**

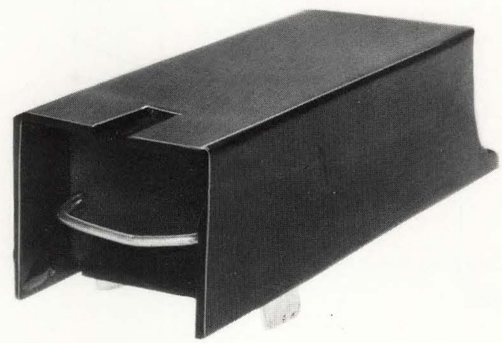
Filter circuits and matching transformers as well as the exterior antenna are unnecessary resulting in a much lower parts inventory and faster assembly.

■ **High selectivity and small spurious radiation**

The advantageous features, as compared with current whip antennas, are obtaining a higher Q for both the loaded and unloaded Q conditions, large noise rejection, small spurious radiation, and no filter circuits required. It has a great effect on the prevention of radio interference from adjacent channels.

■ **All-new design**

Due to the built-in antenna, unique case designs become possible and no longer is antenna damage a potential problem.



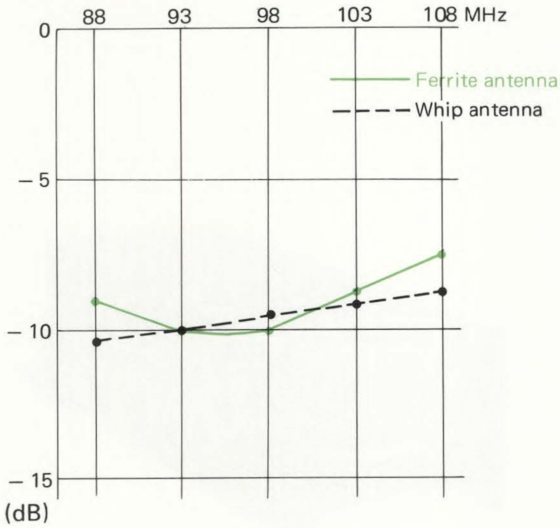
Specifications

Items	Characteristics	Conditions
Operating Frequency	* 88 to 108 MHz	At room temp. and humidity
Available Inductance Range	0.06 to 0.10 μH	〃
Variable Inductance Range	More than ± 5%	〃
Unloaded Q	300 ± 100	〃
Temp. Coeff. of $\triangle L/L$	300 x 10^{-6} /°C max.	−10°C to + 60°C (14°F to 140°F)
Operating Temp. Range	−10°C to + 60°C (14°F to 140°F)	−
Humidity	Q drop within −15%	Measured after 48 hrs. of endurance testing at 40°C (104°F) and 90 to 95%RH.

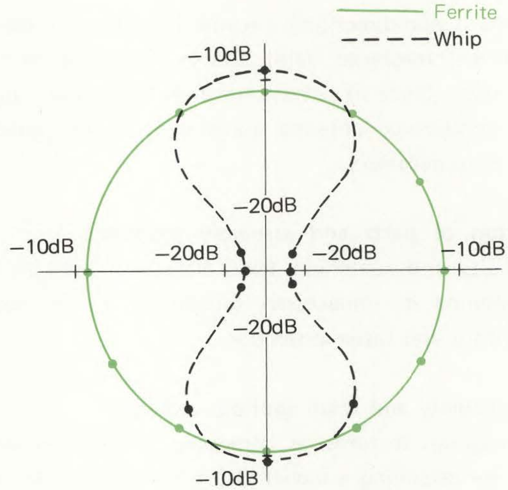
* 76 to 90 MHz also available

Typical Data:

Gain (Dipole antenna: 0 dB)



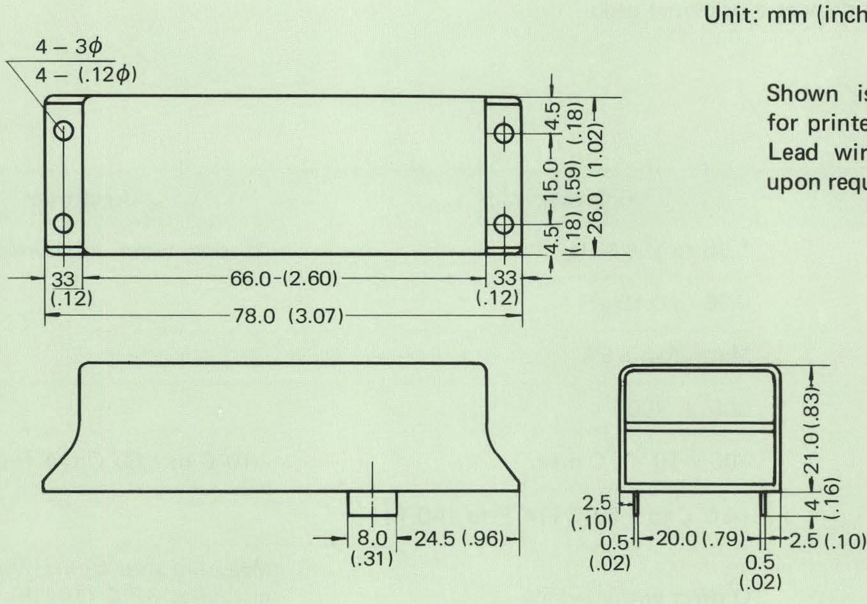
Directivity (Dipole antenna: 0 dB)



(Frequency : 98 MHz)

Dimensions

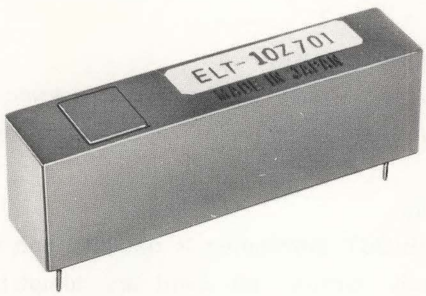
Unit: mm (inch)



Shown is the lead configuration for printed circuit board mounting. Lead wire terminals are available upon request.

Type SDL

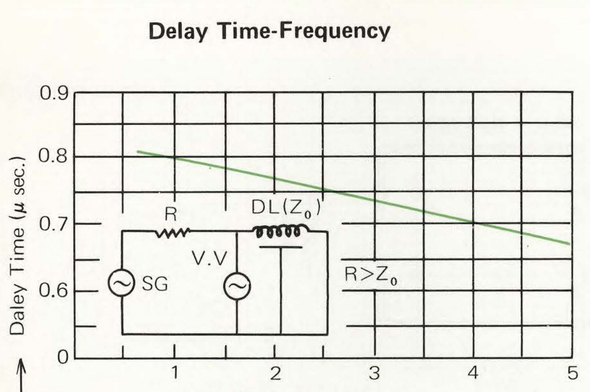
- Compact, and can be mounted to a pc board
- Distributed-constant delay line with excellent transmission characteristics
- Newly-developed, phase compensation type bobbin yields small wave distortion.
- Extremely stable to temperature, humidity and vibration because of our specially engineered, hermetically-sealed structure

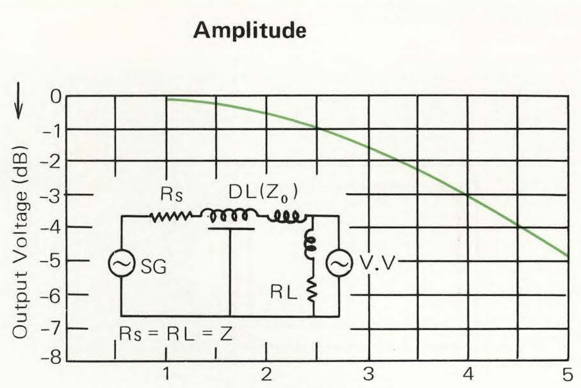


Examples of Current Products

Part No.	Impedance (KΩ)	Delay Time (μ sec.)	Amplitude Characteristics
ELT-10Z 701	1.8	0.9	4 MHz (-3dB)
ELT-10Z 711	1.8	0.9	
ELT-10Z 721	1.8	0.9	

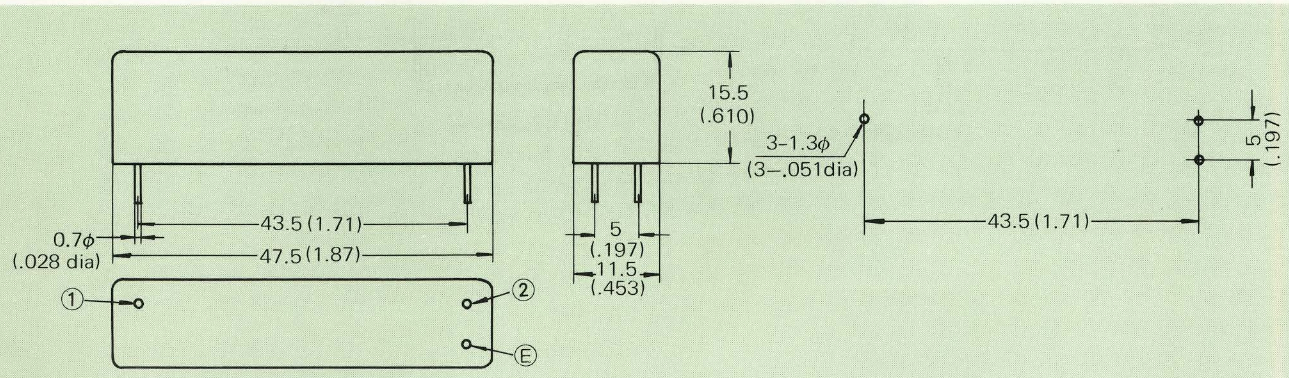
Representative Characteristics





Dimensions and Mounting

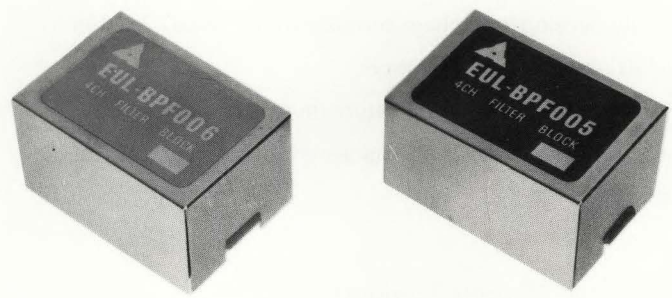
Unit:mm(inch)



Demodulater Filters for CD-4 Disc System

Newly developed low pass and band pass filters which have been adopted in the demodulation circuit of the CD-4 disc system and are designed to provide the most suitable characteristics for that system.

- Excellent Phase Characteristics
  Phase characteristics within the band are superior to traditional active filters composed of capacitors, resistors and transistors.
- Wide Attenuation
  More than 50dB/OCT attenuation is obtained and the unwanted signals outside the band are completely suppressed.
- No Adjustment Required
  Insertion and soldering are the only necessary assembly processes of the sets.

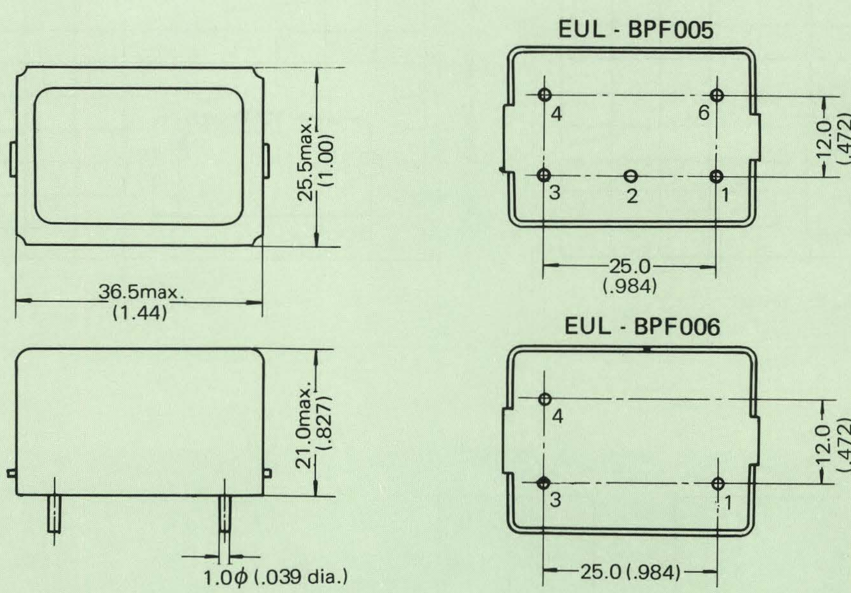


Examples of Current Products

Part No.	Use	Input Imp./Output Imp.	Insertion Loss	Cut-off Freq.
EUL - BPF005	LPF	2.2 KΩ/2.2 KΩ	Within 1dB	15 KHz
EUL - BPF006	BPF	2.2 KΩ/2.2 KΩ	Within 1dB	18.5 KHz, 50 KHz

Dimensions and Mounting

Unit: mm(inch)



EUL - BPF005:
1: I Chan. IN
6: I Chan. OUT
2: Earth
3: II Chan. IN
4: II Chan. OUT

EUL - BPF006:
1 : OUT
3 : Earth
4 : IN

LINE FILTER

Type LF-A

- High noise suppression effect corresponding to UL and CSA standards
- Effective wide frequency range from lower frequency components (approximately 0.3MHz) by thyrister up to about 10 MHz.
- Hermetically-sealed structure provides high stability and reliability.

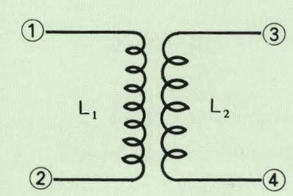
Examples of Current Products

Part No.	Use	Inductance (μH)	DC Resistance (Ω)	Rated Current
ELF - 18D102	TV	430 min.	0.045 max.	2A

Standard Specification

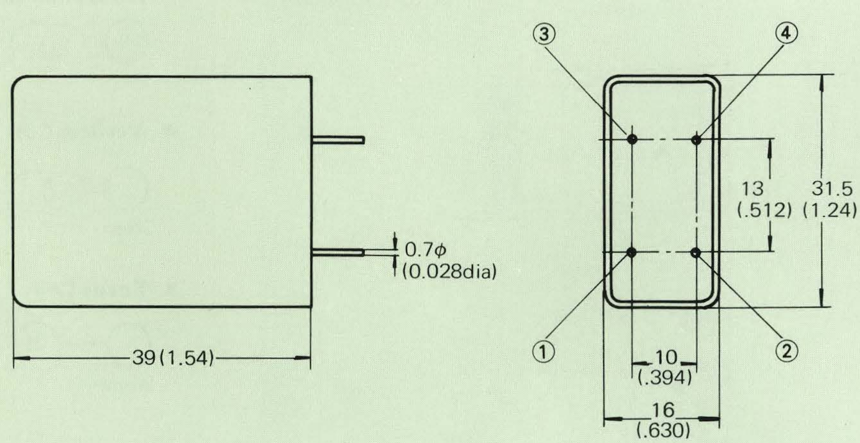
Rated Voltage	150V AC
Rated Current	2A
Withstand Voltage	1KV AC for 1 minute
Operating Temp. Range	-20°C to +70°C

Standard Connection



Dimensions

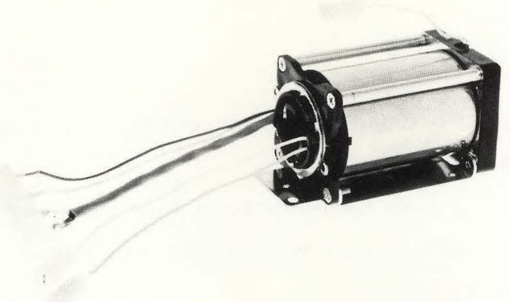
Unit:mm(inch)



VIDICON DEFLECTION YOKE

ELY-18A001

- Inner focus type
- Highly stable due to the elimination of electric conductive paint.
- Prevents out-of-focus problems caused by heat expansion.
- To be attached in the front of a vidicon.
- Compact and light weight.



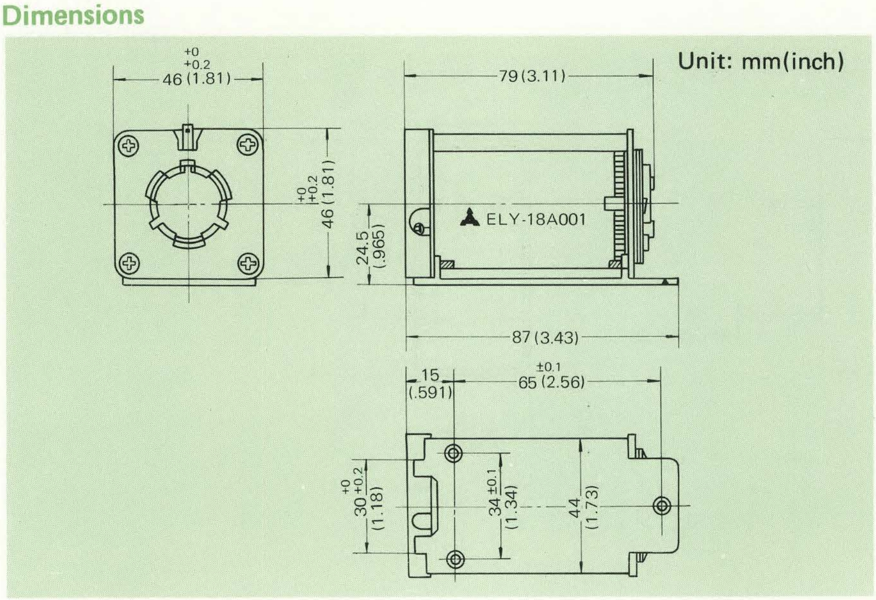
Electrical Characteristics

Inductance (mH)	Horizontal	1.48 ± 10%
	Vertical	38 ± 10%
DC Resistance (Ω) (at 20°C)	Horizontal	4.2 ± 10%
	Vertical	118 ± 10%
	Focus	43.6 ± 10%
Focus Current (mA)		110 (at Eg3 : 250V)
Luster Distortion		Within 2%
Parallelogram Distortion		90 ± 2°
Insulation Resistance		More than 100MΩ at 100VDC (Horizontal coil – Vertical coil; Each coil – ground; Target terminal– ground)
Withstand Voltage		Free from abnormality for 1 minute at 200 VAC (Horizontal coil – Vertical coil; Each coil – ground)
Alignment Center Megnetic Flux Density (gauss)	max.	5 ± 1
	min.	0.2 ± 0.2

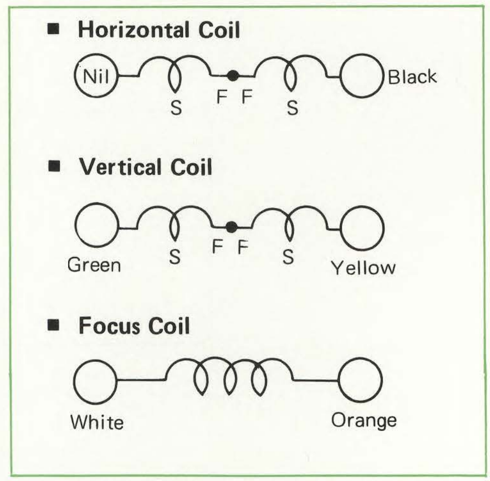
Applicable Vidicon

- 20 PE13A
- 8844

Dimensions



Standard Connection



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*1) Dealing with film capacitors only (See pp. XI-1~48)

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