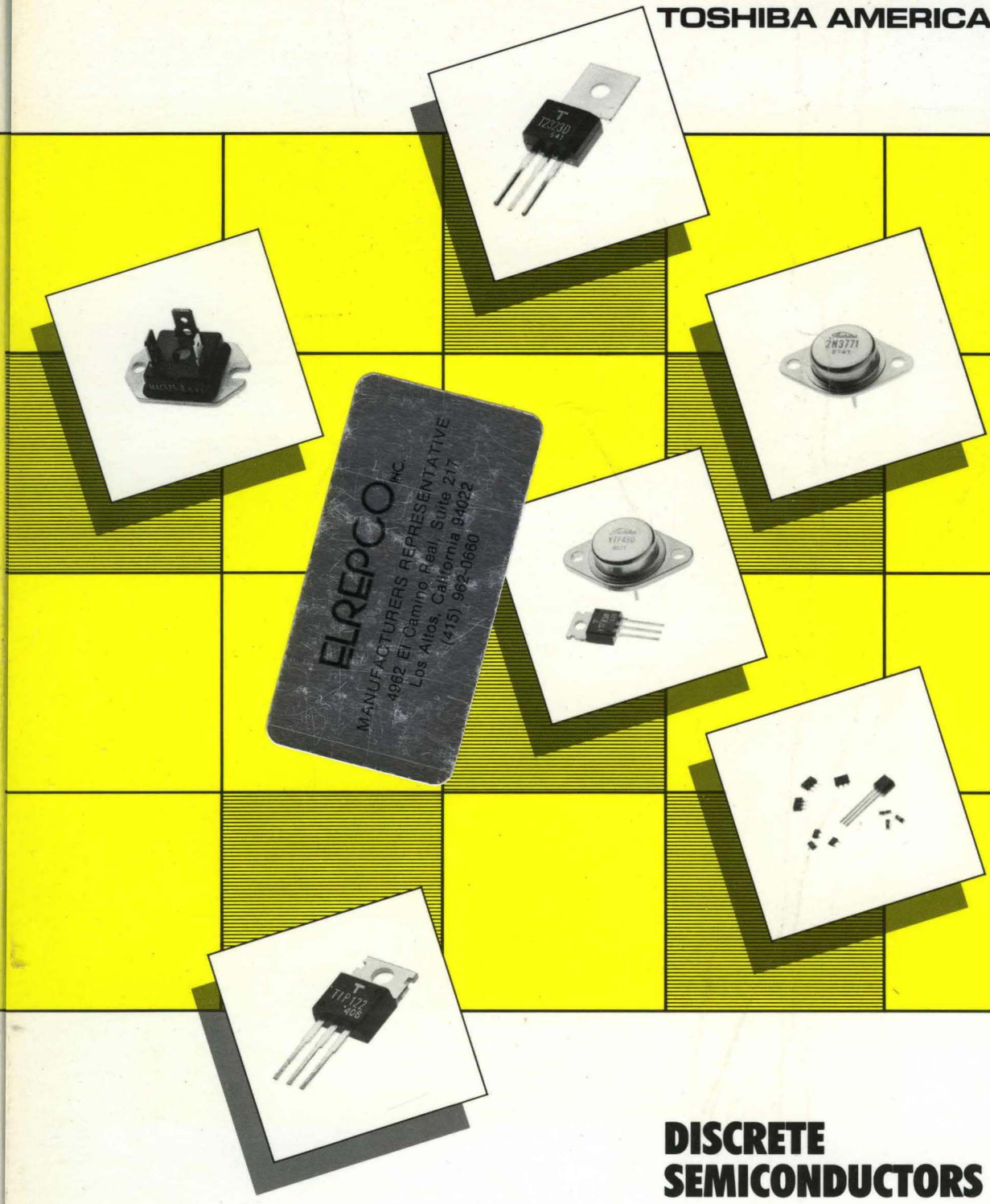
TOSHIBA

DISCRETE SEMICONDUCTORS

TOSHIBA AMERICA, INC.



DISCRETE SEMICONDUCTORS

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BD135 (NP), BD139 (NP), BD139 (NP)
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BF470 (NP), BF472 (NP)

*Contact nearest Toshiba America Sales office for specification information.

PRODUCT SELECTION GUIDE

TRANSISTOR — BIPOLAR
TO-3 CAN PACKAGE SERIES

I_C (A) / V_{CEO} (V)	10	15	16	20	30
40					2N3773 2N4398 2N5301
60	2N3713 2N3715 2N3789 2N3791	2N3055		2N3772	2N4399 2N5302
75				2N5039	
80	2N3714 2N3716 2N3790 2N3792			2N5303	
90				2N5038	
140			2N3773		
200	2N6249				
275	2N6250				
300		2N6546			
350	2N6251				
400		2N6547			

TRANSISTOR — BIPOLAR
TO-220AB PACKAGE SERIES

I_C (A) / V_{CEO} (V)	1-1.5	3-4	5	6-8	10-12
40	TIP29 TIP30	TIP31 TIP32		TIP41 TIP42	
60	TIP29A TIP30A	TIP31A TIP32A	TIP120 TIP125	TIP41A TIP42A	TSB140* TSB145*
80	TIP29B TIP30B	TIP31B TIP32B	TIP121 TIP126	TIP41B TIP42B	TSB141* TSB146*
100	TIP29C TIP30C	TIP31C TIP32C	TIP122 TIP127	TIP41C TIP42C	TSB142* TSB147*
300	MJE13002 (TO-126)	MJE13004		MJE13006	MJE13008
400	MJE13003 (TO-126)	MJE13005		MJE13007	MJE13009

*TSBxxx EQUIVALENT TO TIPxxx SERIES. TO-3P (BS) PACKAGE

TRANSISTOR — BIPOLAR
TO-92MOD PACKAGE SERIES

I_C (mA) / V_{CEO} (V)	200	500	600	800
25	2N4124 2N4126			
30	2N4123 2N4125	MPS-A13 MPS-A14		
40	2N3903 2N3904 2N3905 2N3906		2N4400 2N4401 2N4402 2N4403	MPS2222 MPS2222A
60			MPS2907 MPS2907A	
120			2N5400	
150			2N5401	
160			2N5550	
200		MPS-A43 MPS-A93	2N5551	
300		MPS-A42 MPS-A92		

TRANSISTOR — POWER MOS FET
TO-3 CAN PACKAGE SERIES

I_D (A) \ $V_{(DSS)}$(V)	60	100	150	200	450	500
4			YTF223	TYF222		
5			YTF221	YTF220		
7					YTF443	YTF442
8			YTF233	YTF232	YTF441	YTF440
9			YTF231	YTF230		
12					YTF453	YTF452
13					YTF451	YTF450
33	YTF153	YTF152				
40	YTF151	YTF150				

TRANSISTOR — POWER MOS FET
TO-220AB PACKAGE SERIES

I_D (A) \ $V_{(DSS)}$(V)	60	100	450	500
2 2.5			YTF823 YTF821	YTF822 YTF820
4 4.5			YTF833 YTF831	YTF832 YTF830
7	YTF523	YTF522	YTF443	YTF442
8	YTF521	YTF520	YTF441	YTF440
12 13	YTF533	YTF532	YTF453 YTF451	YTF452 YTF450
14	YTF531	YTF530		
24	YTF543	YTF542		
27	YTF541	YTF540		
33	YTF153	YTF152		
40	YTF151	YTF150		

GENERAL RECTIFIER

$I_{F(AV)}$(A)	1.0				3.0
PACKAGE / V_{RRM} (V)	DO-41	DO-41S	DO-41SS	Glass	Glass
50	1N4001	1N4001A	—	—	—
100	1N4002	1N4002A	1N4002B	—	—
200	1N4003	1N4003A	—	1N5059	1N5624
400	1N4004	1N4004A	1N4003B	1N5060	1N5625
600	1N4005	1N4005A	1N4005B	1N5061	1N5626
800	1N4006	1N4006A	—	1N5062	1N5627
1000	1N4007	1N4007A	1N4007B	—	—

DIODE

I_O(mA) / Vr(V)	150	200
25 (30)	1N4152 1N4154	
50	1N4151 1N4153	1N4150
70		1N4606 1N4607 1N4608
75	1N914,A,B 1N916,A,B 1N4148 1N4149 1N4446 1N4447 1N4448 1N4449	

TRIGGER DEVICES

TYPE			2N6027	2N6028
PACKAGE			TO-92	
CHARACTERISTICS	Ip	*I	2μA MAX	0.15μA MAX
		*II	5μA MAX	1.0μA MAX
	V_T	*I	0.2–1.6 V	0.2–0.6 V
		*II	0.2–0.6 V	0.2–0.6 V
	I_V	*I	50μA MAX	25μA MAX
		*II	70μA MIN	25μA MIN

*I : $R_G = 1M\Omega$
*II: $R_G = 10K\Omega$

THYRISTOR

Type	High-sensitivity Thyristor			General Purpose Thyristor		
$I_{T(RMS)}$ (A)	*1 0.8		4	8	12	16
PACKAGE	TO-92		TO-202	TO-220AB		
~100 V	30 V 60 V	C203Y C203YY	—	—	—	—
100 V	C203A		C106A	C122A	2N6395	2N6401
200 V	C203B		C106B	C122B	2N6396	2N6402
400 V	300 V 400 V	C203C C203D	C106D	C122D	2N6397	2N6403
600 V	—		C106M	C122M	2N6398	2N6404

*1. Center pin gate type

TRIAC

PACKAGE	TO-92 (Center pin gate)		TO-202	TO-220AB			TO-3 FAST ON	
$I_{T(RMS)}$(A) / V_{DRM}(V)	*1 0.8	*2 0.8	2.5	*1 6.0	*1 8.0	*1 12.0	16.0	25.0
200	MAC94A-4	MAC95-4	T2323B	T2500B	MAC222A-4	2N6346A	MAC515-4	MAC525-4
400	MAC94A-6	MAC95-6	T2323D	T2500D	MAC222A-6	2N6347A	MAC515-6	MAC525-6
600	—	—	T2323M	T2500M	MAC222A-8	2N6348A	MAC515-8	MAC525-8

*1. 4 mode trigger type
*2. High-sensitivity trigger type

SURFACE MOUNT DEVICE
TRANSISTOR & DIODE

TRANSISTOR

SUPER MINI TYPE (SOT-23)

I_C (mA) / V_{CEO} (V)	200	600
25	YTS4126	
30	YTS4123 YTS4124 YTS4125	YTS2222
40	YTS3903 YTS3904 YTS3905 YTS3906	YTS2222A YTS2907 YTS4400 YTS4401 YTS4402 YTS4403
60		YTS2907A

LEAD LESS DIODE

I_F (mA) / V_R (V)	450	600
25	DLN4154	
30	DLN4152	
50	DLN4151 DLN4153	DLN4150
70		DLN4607 DLN4608
75	DLN4148 DLN4149 DLN4446 DLN4447 DLN4448 DLN4449 DLN914,A,B DLN916,A,B	

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

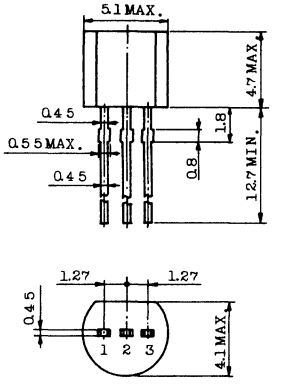
TOSHIBA TRANSISTOR
2N3903
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

. Low Leakage Current
  : I_{CEV}=50nA(Max.), I_{BEV}=-50nA(Max.)
  @ V_{CE}=30V, V_{BE}=-3V
. Excellent DC Current Gain Linearity
. Low Saturation Voltage
  : $V_{CE(sat)}$=0.3V(Max.) @ I_C=50mA, I_B=5mA
. Low Collector Output Capacitance
  : C_{ob}=4pF(Max.) @ V_{CB}=5V
. Complementary to 2N3905

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

Weight : 0.21g

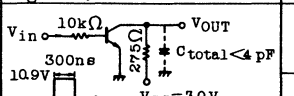
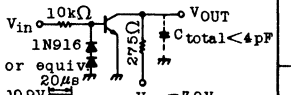
MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	RATING	UNIT
※	Collector-Base Voltage	V_{CBO}	60	V
※	Collector-Emitter Voltage	V_{CEO}	40	V
※	Emitter-Base Voltage	V_{EBO}	6	V
※	Collector Current	I_C	200	mA
	Base Current	I_B	50	mA
※	Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	625	mW
			5.0	mW/°C
※	Collector Power Dissipation (Tc=25°C) Derate Linearly 25°C	P_C	1.5	W
			12	mW/°C
※	Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	200	°C/W
※	Thermal Resistance (Junction to Case)	$R_{th(j-c)}$	83.3	°C/W
※	Junction Temperature	T_j	150	°C
※	Storage Temperature Range	T_{stg}	-55~150	°C

※In accordance with JEDEC registration data.

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current		I_{CEV}	V_{CE}=30V, V_{BE}=-3V	-	-	50	nA
※	Base Cut-off Current		I_{BEV}	V_{CE}=30V, V_{BE}=-3V	-	-	-50	nA
※	Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=10μA, I_E=0	60	-	-	V
※	Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=1mA, I_B=0	40	-	-	V
※	Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=10μA, I_C=0	6	-	-	V
※	DC Current Gain		$h_{FE(1)}$	V_{CE}=1V, I_C=0.1mA	20	-	-	
			$h_{FE(2)}$	V_{CE}=1V, I_C=1mA	35	-	-	
			$h_{FE(3)}$	V_{CE}=1V, I_C=10mA	50	-	150	
			$h_{FE(4)}$	V_{CE}=1V, I_C=50mA	30	-	-	
			$h_{FE(5)}$	V_{CE}=1V, I_C=100mA	15	-	-	
※	Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=10mA, I_B=1mA	-	-	0.2	V
			$V_{CE(sat)2}$	I_C=50mA, I_B=5mA	-	-	0.3	
※	Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=10mA, I_B=1mA	0.65	-	0.85	V
			$V_{BE(sat)2}$	I_C=50mA, I_B=5mA	-	-	0.95	
※	Transition Frequency		f_T	V_{CE}=20V, I_C=10mA f=100MHz	250	-	-	MHz
※	Collector Output Capacitance		C_{ob}	V_{CB}=5V, I_E=0, f=1MHz	-	-	4	pF
※	Input Capacitance		C_{ib}	V_{EB}=0.5V, I_C=0, f=1MHz	-	-	8	pF
※	Input Impedance		h_{ie}	V_{CE}=10V, I_C=1mA f=1kHz	0.5	-	8	kΩ
※	Voltage Feedback Ratio		h_{re}		0.1	-	5	$\times10^{-4}$
※	Small-Signal Current Gain		h_{fe}		50	-	200	
※	Collector Output Admittance		h_{oe}		1	-	40	μS
※	Noise Figure		NF	V_{CE}=5V, I_C=0.1mA R_g=1kΩ, f=10Hz～15.7kHz	-	-	6	dB
※	Switching Time	Delay Time	t_d		-	-	35	ns
		Rise Time	t_r		-	-	35	
		Storage Time	t_{stg}		-	-	175	
		Fall Time	t_f		-	-	50	

※ In accordance with JEDEC registration data.

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
2N3904
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

. Low Leakage Current
: I_{CEV}=50nA(Max.), I_{BEV}=-50nA(Max.)
@ V_{CE}=30V, V_{BE}=-3V

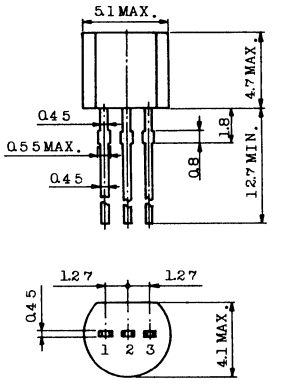
. Excellent DC Current Gain Linearity

. Low Saturation Voltage
: $V_{CE(sat)}$=0.3V(Max.) @ I_C=50mA, I_B=5mA

. Low Collector Output Capacitance
: C_{ob}=4pF(Max.) @ V_{CB}=5V

. Complementary to 2N3906

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

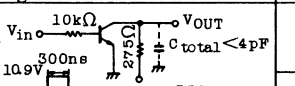
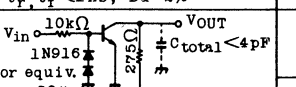
Weight : 0.21g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	RATING	UNIT
※	Collector-Base Voltage	V_{CBO}	60	V
※	Collector-Emitter Voltage	V_{CEO}	40	V
※	Emitter-Base Voltage	V_{EBO}	6	V
※	Collector Current	I_C	200	mA
	Base Current	I_B	50	mA
※	Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	625	mW
			5.0	mW/°C
※	Collector Power Dissipation (Tc=25°C) Derate Linearly 25°C	P_C	1.5	W
			12	mW/°C
※	Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	200	°C/W
※	Thermal Resistance (Junction to Case)	$R_{th(j-c)}$	83.3	°C/W
※	Junction Temperature	T_j	150	°C
※	Storage Temperature Range	T_{stg}	-55~150	°C

※In accordance with JEDEC registration data.

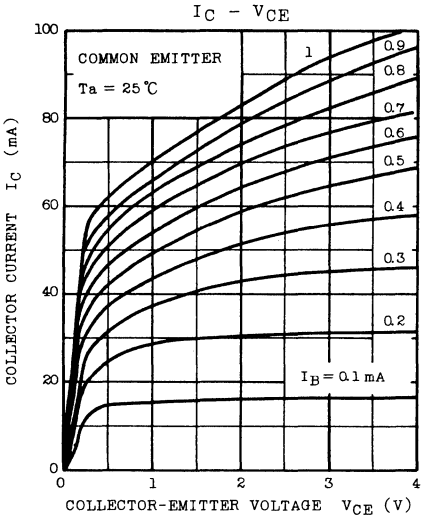
ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current		I_{CEV}	V_{CE}=30V, V_{BE}=-3V	-	-	50	nA
※	Base Cut-off Current		I_{BEV}	V_{CE}=30V, V_{BE}=-3V	-	-	-50	nA
※	Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=10μA, I_E=0	60	-	-	V
※	Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=1mA, I_B=0	40	-	-	V
※	Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=10μA, I_C=0	6	-	-	V
※	DC Current Gain		$h_{FE(1)}$	V_{CE}=1V, I_C=0.1mA	40	-	-	
			$h_{FE(2)}$	V_{CE}=1V, I_C=1mA	70	-	-	
			$h_{FE(3)}$	V_{CE}=1V, I_C=10mA	100	-	300	
			$h_{FE(4)}$	V_{CE}=1V, I_C=50mA	60	-	-	
			$h_{FE(5)}$	V_{CE}=1V, I_C=100mA	30	-	-	
※	Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=10mA, I_B=1mA	-	-	0.2	V
			$V_{CE(sat)2}$	I_C=50mA, I_B=5mA	-	-	0.3	
※	Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=10mA, I_B=1mA	0.65	-	0.85	V
			$V_{BE(sat)2}$	I_C=50mA, I_B=5mA	-	-	0.95	
※	Transition Frequency		f_T	V_{CE}=20V, I_C=10mA f=100MHz	300	-	-	MHz
※	Collector Output Capacitance		C_{ob}	V_{CB}=5V, I_E=0, f=1MHz	-	-	4	pF
※	Input Capacitance		C_{ib}	V_{EB}=0.5V, I_C=0, f=1MHz	-	-	8	pF
※	Input Impedance		h_{ie}	V_{CE}=10V, I_C=1mA f=1kHz	1.0	-	10	kΩ
※	Voltage Feedback Ratio		h_{re}		0.5	-	8	×10-4
※	Small-Signal Current Gain		h_{fe}		100	-	400	
※	Collector Output Admittance		h_{oe}		1.0	-	40	μS
※	Noise Figure		NF	V_{CE}=5V, I_C=0.1mA R_g=1kΩ, f=10Hz～15.7kHz	-	-	5	dB
※	Switching Time	Delay Time	t_d		-	-	35	ns
		Rise Time	t_r		-	-	35	
		Storage Time	t_{stg}		-	-	200	
		Fall Time	t_f		-	-	50	

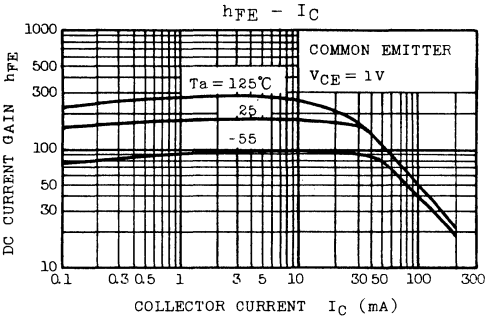
※ In accordance with JEDEC registration data.

TOSHIBA CORPORATION

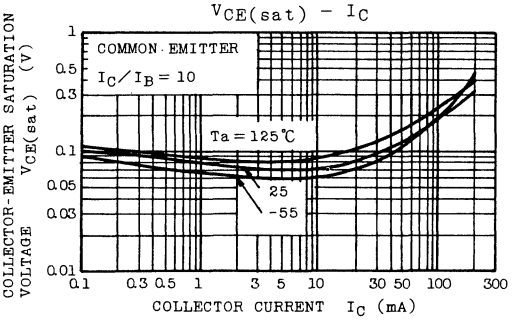
$I_C - V_{CE}$



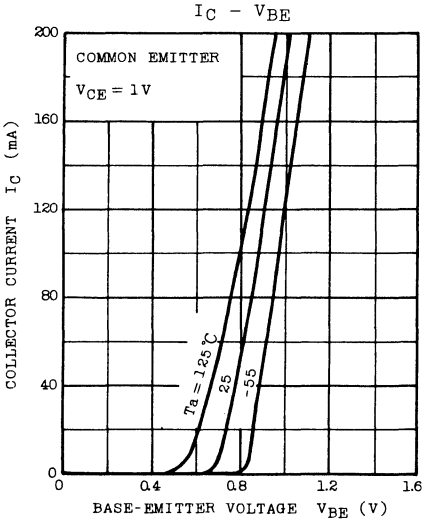
$h_{FE} - I_C$



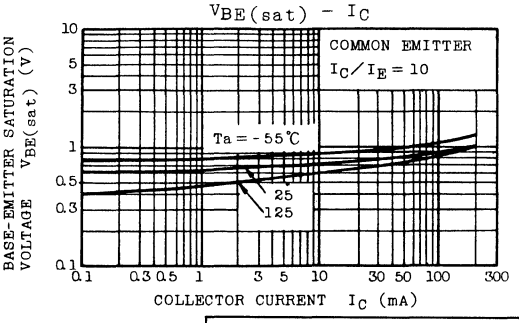
$V_{CE(sat)} - I_C$



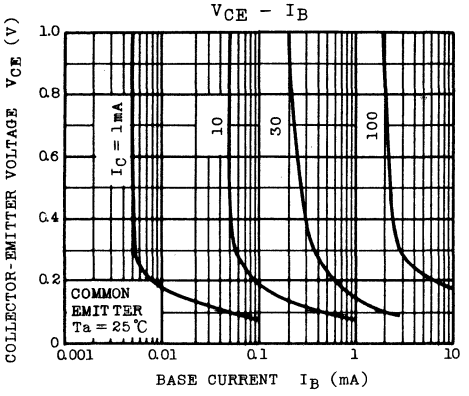
$I_C - V_{BE}$



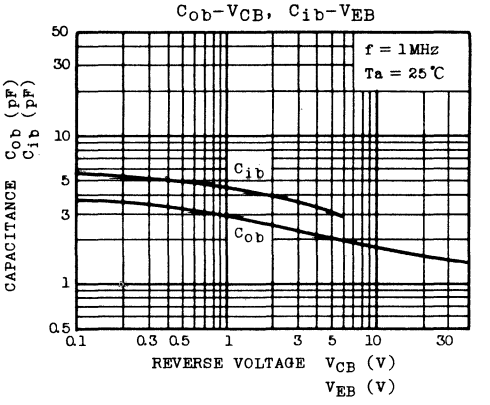
$V_{BE(sat)} - I_C$



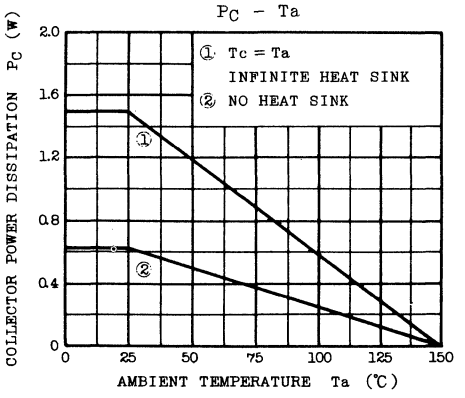
V_{CE} - I_B



C_{ob}-V_{CB}, C_{ib}-V_{EB}



P_C - Ta



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
2N3905
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

. Low Leakage Current
: I_{CEV}=-50nA(Max.), I_{BEV}=50nA(Max.)
@ V_{CE}=-30V, V_{BE}=3V

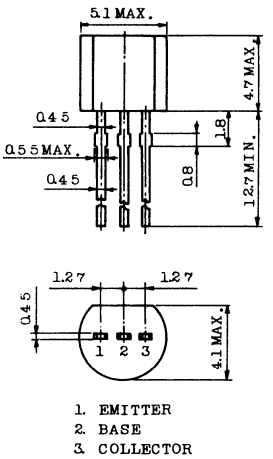
. Excellent DC Current Gain Linearity

. Low Saturation Voltage
: $V_{CE(sat)}$=-0.4V(Max.) @ I_C=-50mA, I_B=-5mA

. Low Collector Output Capacitance
: C_{ob}=4.5pF(Max.) @ V_{CB}=-5V

. Complementary to 2N3903

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

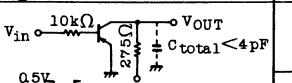
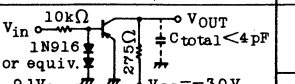
Weight : 0.21g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	RATING	UNIT
※	Collector-Base Voltage	V_{CBO}	-40	V
※	Collector-Emitter Voltage	V_{CEO}	-40	V
※	Emitter-Base Voltage	V_{EBO}	-5	V
※	Collector Current	I_C	-200	mA
	Base Current	I_B	-50	mA
※	Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	625	mW
			5.0	mW/°C
※	Collector Power Dissipation (Tc=25°C) Detate Linearly 25°C	P_C	1.5	W
			12	mW/°C
※	Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	200	°C/W
※	Thermal Resistance (Junction to Case)	$R_{th(j-c)}$	83.3	°C/W
※	Junction Temperature	T_j	150	°C
※	Storage Temperature Range	T_{stg}	-55~150	°C

※In Accordance with JEDEC registration data.

ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current		I_{CEV}	V_{CE}=-30V, V_{BE}=3V	-	-	-50	nA
※	Base Cut-off Current		I_{BEV}	V_{CE}=-30V, V_{BE}=3V	-	-	50	nA
※	Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=-10μA, I_E=0	-40	-	-	V
※	Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-1mA, I_B=0	-40	-	-	V
※	Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=-10μA, I_C=0	-5	-	-	V
※	DC Current Gain		$h_{FE(1)}$	V_{CE}=-1V, I_C=-0.1mA	30	-	-	
			$h_{FE(2)}$	V_{CE}=-1V, I_C=-1mA	40	-	-	
			$h_{FE(3)}$	V_{CE}=-1V, I_C=-10mA	50	-	150	
			$h_{FE(4)}$	V_{CE}=-1V, I_C=-50mA	30	-	-	
			$h_{FE(5)}$	V_{CE}=-1V, I_C=-100mA	15	-	-	
※	Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=-10mA, I_B=-1mA	-	-	-0.25	V
			$V_{CE(sat)2}$	I_C=-50mA, I_B=-5mA	-	-	-0.4	
※	Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=-10mA, I_B=-1mA	-0.65	-	-0.85	V
			$V_{BE(sat)2}$	I_C=-50mA, I_B=-5mA	-	-	-0.95	
※	Transition Frequency		f_T	V_{CE}=-20V, I_C=-10mA f=100MHz	200	-	-	MHz
※	Collector Output Capacitance		C_{ob}	V_{CB}=-5V, I_E=0, f=1MHz	-	-	4.5	pF
※	Input Capacitance		C_{ib}	V_{EB}=-0.5V, I_C=0 f=1MHz	-	-	10	pF
※	Input Impedance		h_{ie}	V_{CE}=-10V, I_C=-1mA f=1kHz	0.5	-	8	kΩ
※	Voltage Feedback Ratio		h_{re}		0.1	-	5	×10-4
※	Small-Signal Current Gain		h_{fe}		50	-	200	
※	Collector Output Admittance		h_{oe}		1.0	-	40	μS
※	Noise Figure		NF	V_{CE}=-5V, I_C=-0.1mA R_g=1kΩ, f=10Hz～15.7kHz	-	-	5	dB
※	Switching Time	Delay Time	$t_{d(ON)}$		-	-	35	ns
		Rise Time	t_r		-	-	35	
		Storage Time	t_{stg}		-	-	200	
		Fall Time	t_f		-	-	60	

In accordance with JEDEC registration data.

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
2N3906
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

. Low Leakage Current
: I_{CEV}=-50nA(Max.), I_{BEV}=50nA(Max.)
@ V_{CE}=-30V, V_{BE}=3V

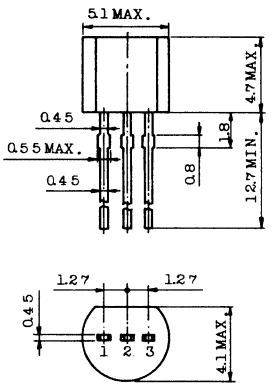
. Excellent DC Current Gain Linearity

. Low Saturation Voltage
: $V_{CE(sat)}$=-0.4V(Max.) @ I_C=-50mA, I_B=-5mA

. Low Collector Output Capacitance
: C_{ob}=4.5pF(Max.) @ V_{CB}=-5V

. Complementary to 2N3904

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

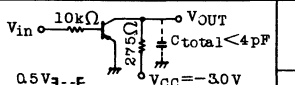
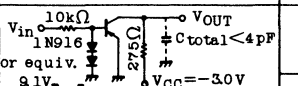
Weight : 0.21g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	RATING	UNIT
※	Collector-Base Voltage	V_{CBO}	-40	V
※	Collector-Emitter Voltage	V_{CEO}	-40	V
※	Emitter-Base Voltage	V_{EBO}	-5	V
※	Collector Current	I_C	-200	mA
	Base Current	I_B	-50	mA
※	Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	625	mW
			5.0	mW/°C
※	Collector Power Dissipation (Tc=25°C) Derate Linearly 25°C	P_C	1.5	W
			12	mW/°C
※	Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	200	°C/W
※	Thermal Resistance (Junction to Case)	$R_{th(j-c)}$	83.3	°C/W
※	Junction Temperature	T_j	150	°C
※	Storage Temperature Range	T_{stg}	-55~150	°C

※In accordance with JEDEC registration data.

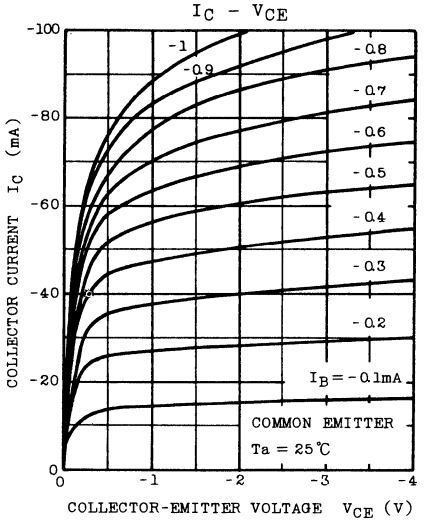
ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current		I_{CEV}	V_{CE}=-30V, V_{BE}=3V	-	-	-50	nA
※	Base Cut-off Current		I_{BEV}	V_{CE}=-30V, V_{BE}=3V	-	-	50	nA
※	Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=-10μA, I_E=0	-40	-	-	V
※	Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-1mA, I_B=0	-40	-	-	V
※	Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=-10μA, I_C=0	-5	-	-	V
※	DC Current Gain		$h_{FE(1)}$	V_{CE}=-1V, I_C=-0.1mA	60	-	-	
			$h_{FE(2)}$	V_{CE}=-1V, I_C=-1mA	80	-	-	
			$h_{FE(3)}$	V_{CE}=-1V, I_C=-10mA	100	-	300	
			$h_{FE(4)}$	V_{CE}=-1V, I_C=-50mA	60	-	-	
			$h_{FE(5)}$	V_{CE}=-1V, I_C=-100mA	30	-	-	
※	Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=-10mA, I_B=-1mA	-	-	-0.25	V
			$V_{CE(sat)2}$	I_C=-50mA, I_B=-5mA	-	-	-0.4	
※	Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=-10mA, I_B=-1mA	-0.65	-	-0.85	V
			$V_{BE(sat)2}$	I_C=-50mA, I_B=-5mA	-	-	-0.95	
※	Transition Frequency		f_T	V_{CE}=-20V, I_C=-10mA f=100MHz	250	-	-	MHz
※	Collector Output Capacitance		C_{ob}	V_{CB}=-5V, I_E=0, f=1MHz	-	-	4.5	pF
※	Input Capacitance		C_{ib}	V_{EB}=-0.5V, I_C=0, f=1MHz	-	-	10	pF
※	Input Impedance		h_{ie}	V_{CE}=-10V, I_C=-1mA f=1kHz	2.0	-	12	kΩ
※	Voltage Feedback Ratio		h_{re}		1.0	-	10	×10-4
※	Small-Signal Current Gain		h_{fe}		100	-	400	
※	Collector Output Admittance		h_{oe}		3.0	-	60	μS
※	Noise Figure		NF	V_{CE}=-5V, I_C=-0.1mA R_g=1kΩ, f=10Hz～15.7kHz	-	-	4	dB
※	Switching Time	Delay Time	t_d		-	-	35	ns
		Rise Time	t_r		-	-	35	
		Storage Time	t_{stg}		-	-	225	
		Fall Time	t_f		-	-	75	

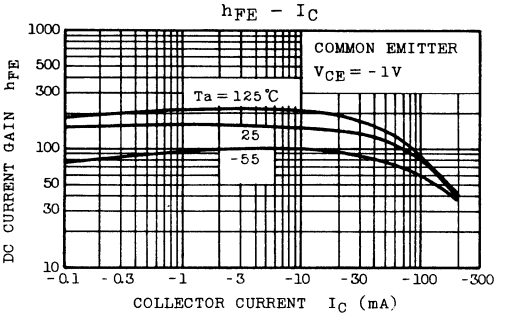
※ In accordance with JEDEC registration data.

TOSHIBA CORPORATION

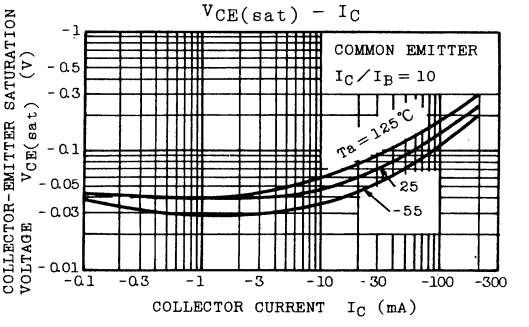
$I_C - V_{CE}$



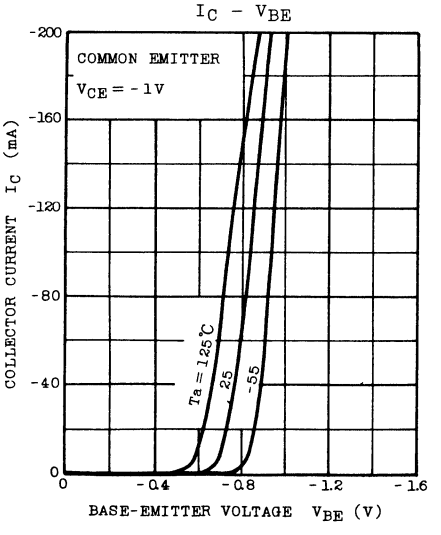
$h_{FE} - I_C$



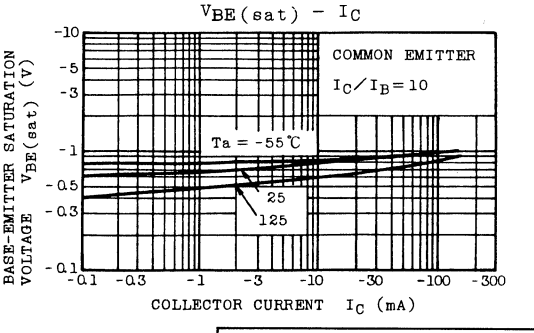
$V_{CE(sat)} - I_C$



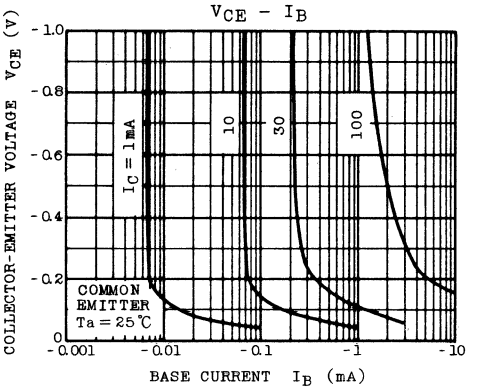
$I_C - V_{BE}$

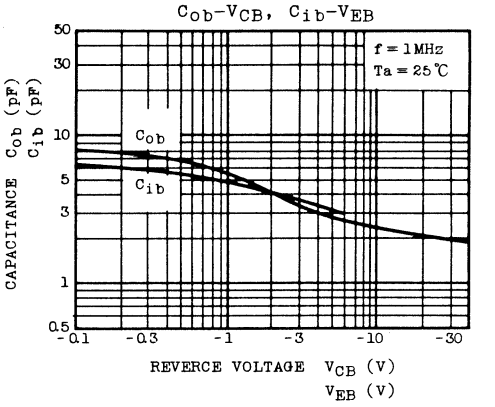


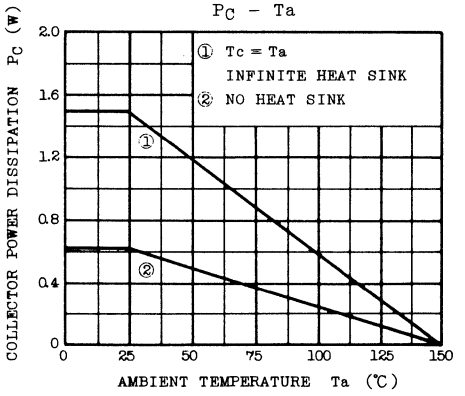
$V_{BE(sat)} - I_C$



TOSHIBA CORPORATION







TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
2N4123
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

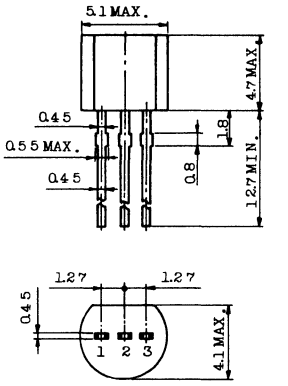
. Low Leakage Current
: I_{CBO}=50nA(Max.) @ V_{CB}=20V
I_{EBO}=50nA(Max.) @ V_{EB}=3V

. Low Saturation Voltage
: $V_{CE(sat)}$=0.3V(Max.) @ I_C=50mA, I_B=5mA

. Low Collector Output Capacitance
: C_{ob}=4pF(Max.) @ V_{CB}=5V

. Complementary to 2N4125

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

Weight : 0.21g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	RATING	UNIT
※	Collector-Base Voltage	V_{CBO}	40	V
※	Collector-Emitter Voltage	V_{CEO}	30	V
※	Emitter-Base Voltage	V_{EBO}	5	V
※	Collector Current	I_C	200	mA
	Base Current	I_B	50	mA
※	Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	625	mW
			5.0	mW/°C
※	Collector Power Dissipation (Tc=25°C) Derate Linearly 25°C	P_C	1.5	W
			12	mW/°C
※	Thermal Reisstance (Junction to Ambient)	$R_{th(j-a)}$	200	°C/W
※	Thermal Resistance (Junction to Case)	$R_{th(j-c)}$	83.3	°C/W
※	Junction Temperature	T_j	150	°C
※	Storage Temperature Range	T_{stg}	-55~150	°C

※In accordance with JEDEC registration data.

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current	I_{CBO}	V_{CB}=20V, I_E=0	-	-	50	nA
※	Emitter Cut-off Current	I_{EBO}	V_{EB}=3V, I_C=0	-	-	50	nA
※	Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C=10μA, I_E=0	40	-	-	V
※	Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=1mA, I_B=0	30	-	-	V
※	Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=10μA, I_C=0	5	-	-	V
※	DC Current Gain	$h_{FE(1)}$	V_{CE}=1V, I_C=2mA	50	-	150	
		$h_{FE(2)}$	V_{CE}=1V, I_C=50mA	25	-	-	
※	Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=50mA, I_B=5mA	-	-	0.3	V
※	Base-Emitter Saturation Voltage	$V_{BE(sat)}$	I_C=50mA, I_B=5mA	-	-	0.95	V
※	Small Signal Forward Current Transfer Ratio	$\|h_{fe}\|$	V_{CE}=20V, I_C=10mA, f=100MHz	2.5	-	-	
※	Transition Frequency	f_T	V_{CE}=20V, I_C=10mA f=100MHz	250	-	-	MHz
※	Collector Output Capacitance	C_{ob}	V_{CB}=5V, I_E=0, f=1MHz	-	-	4	pF
※	Input Capacitance	C_{ib}	V_{EB}=0.5V, I_C=0, f=1MHz	-	-	8	pF
※	Small Siganl Current Gain	h_{fe}	V_{CE}=10V, I_C=2mA, f=1kHz	50	-	200	
※	Noise Figure	NF	V_{CE}=5V, I_C=100μA, Rg=1kΩ, f=10Hz～15.7kHz	-	-	6	dB

※ In accordance with JEDEC registration data.

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
2N4124
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

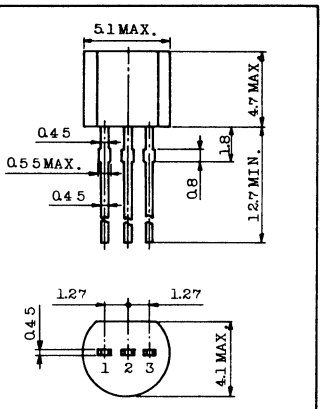
. Low Leakage Current
: I_{CBO}=50nA(Max.) @ V_{CB}=20V
I_{EBO}=50nA(Max.) @ V_{EB}=3V

. Low Saturation Voltage
: $V_{CE(sat)}$=0.3V(Max.) @ I_C=50mA, I_B=5mA

. Low Collector Output Capacitance
: C_{ob}=4pF(Max.) @ V_{CB}=5V

. Complementary to 2N4126

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

Weight : 0.21g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	RATING	UNIT
※	Collector-Base Voltage	V_{CBO}	30	V
※	Collector-Emitter Voltage	V_{CEO}	25	V
※	Emitter-Base Voltage	V_{EBO}	5	V
※	Collector Current	I_C	200	mA
	Base Current	I_B	50	mA
※	Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	625	mW
			5.0	mW/°C
※	Collector Power Dissipation (Tc=25°C) Derate Linearly 25°C	P_C	1.5	W
			12	mW/°C
※	Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	200	°C/W
※	Thermal Reisstance (Junction to Case)	$R_{th(j-c)}$	83.3	°C/W
※	Junction Temperature	T_j	150	°C
※	Storage Temperature Range	T_{stg}	-55~150	°C

※In accordance with JEDEC registration data.

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current	I_{CBO}	V_{CB}=20V, I_E=0	-	-	50	nA
※	Emitter Cut-off Current	I_{EBO}	V_{EB}=3V, I_C=0	-	-	50	nA
※	Collector-Base Breakdwon Voltage	$V_{(BR)CBO}$	I_C=10μA, I_E=0	30	-	-	V
※	Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=1mA, I_B=0	25	-	-	V
※	Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=10μA, I_C=0	5	-	-	V
※	DC Current Gain	$h_{FE(1)}$	V_{CE}=1V, I_C=2mA	120	-	360	
		$h_{FE(2)}$	V_{CE}=1V, I_C=50mA	60	-	-	
※	Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=50mA, I_B=5mA	-	-	0.3	V
※	Base-Emitter Saturation Voltage	$V_{BE(sat)}$	I_C=50mA, I_B=5mA	-	-	0.95	V
※	Small Signal Forward Current Transfer Ratio	$\lvert h_{fe} \rvert$	V_{CE}=20V, I_C=10mA, f=100MHz	3.0	-	-	
※	Transition Frequency	f_T	V_{CE}=20V, I_C=10mA, f=100MHz	300	-	-	MHz
※	Collector Output Capacitance	C_{ob}	V_{CB}=5V, I_E=0, f=1MHz	-	-	4	pF
※	Input Capacitance	C_{ib}	V_{EB}=0.5V, I_C=0, f=1MHz	-	-	8	pF
※	Small Signal Current Gain	h_{fe}	V_{CE}=10V, I_C=2mA, f=1kHz	120	-	480	
※	Noise Figure	NF	V_{CE}=5V, I_C=100μA R_g=1kΩ, f=10Hz~15.7kHz	-	-	5	dB

※ In accordance with JEDEC registration data.

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
2N4125
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

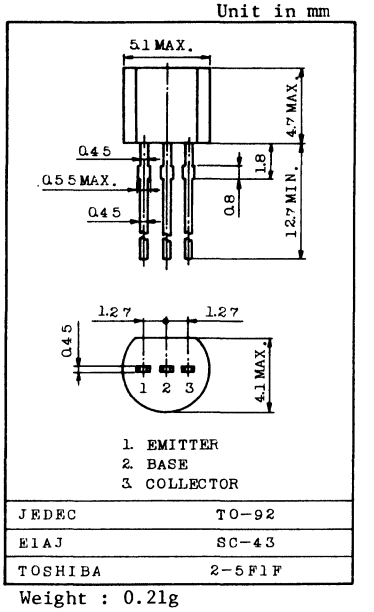
. Low Leakage Current
: I_{CBO}=-50nA(Max.) @ V_{CB}=-20V
I_{EBO}=-50nA(Max.) @ V_{EB}=-3V

. Low Saturation Voltage
: $V_{CE(sat)}$=-0.4V(Max.) @ I_C=-50mA, I_B=-5mA

. Low Collector Output Capacitance
: C_{ob}=4.5pF(Max.) @ V_{CB}=-5V

. Complementary to 2N4123

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

Weight : 0.21g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	RATING	UNIT
※	Collector-Base Voltage	V_{CBO}	-30	V
※	Collector-Emitter Voltage	V_{CEO}	-30	V
※	Emitter-Base Voltage	V_{EBO}	-4	V
※	Collector Current	I_C	-200	mA
	Base Current	I_B	-50	mA
※	Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	625	mW
			5.0	mW/°C
※	Collector Power Dissipation (Tc=25°C) Derate Linearly 25°C	P_C	1.5	W
			12	mW/°C
※	Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	200	°C/W
※	Thermal Resistance (Junction to Case)	$R_{th(j-c)}$	83.3	°C/W
※	Junction Temperature	T_j	150	°C
※	Storage Temperature Range	T_{stg}	-55~150	°C

※In accordance with JEDEC registration data.

ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current	I_{CBO}	V_{CB}=-20V, I_E=0	-	-	-50	nA
※	Emitter Cut-off Current	I_{EBO}	V_{EB}=-3V, I_C=0	-	-	-50	nA
※	Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C=-10μA, I_E=0	-30	-	-	V
※	Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=-1mA, I_B=0	-30	-	-	V
※	Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=-10μA, I_C=0	-4	-	-	V
※	DC Current Gain	$h_{FE(1)}$	V_{CE}=-1V, I_C=-2mA	50	-	150	
		$h_{FE(2)}$	V_{CE}=-1V, I_C=-50mA	25	-	-	
※	Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=-50mA, I_B=-5mA	-	-	-0.4	V
※	Base-Emitter Saturation Voltage	$V_{BE(sat)}$	I_C=-50mA, I_B=-5mA	-	-	-0.95	V
※	Small Signal Forward Current Transfer Ratio	$\lvert h_{fe} \rvert$	V_{CE}=-20V, I_C=-10mA, f=100MHz	2.0	-	-	
※	Transition Frequency	f_T	V_{CE}=-20V, I_C=-10mA, f=100MHz	200	-	-	MHz
※	Collector Output Capacitance	C_{ob}	V_{CB}=-5V, I_E=0, f=1MHz	-	-	4.5	pF
※	Input Capacitance	C_{ib}	V_{EB}=-0.5V, I_C=0, f=1MHz	-	-	10	pF
※	Small Signal Current Gain	h_{fe}	V_{CE}=-10V, I_C=-2mA, f=1kHz	50	-	200	
※	Noise Figure	NF	V_{CE}=-5V, I_C=-100μA R_g=1kΩ, f=10Hz~15.7kHz	-	-	5	dB

※ In accordance with JEDEC registration data.

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
2N4126
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

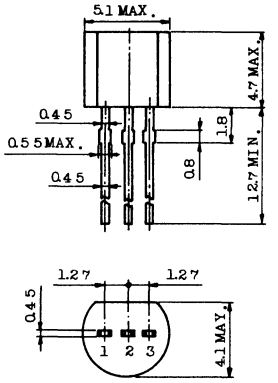
. Low Leakage Current
: I_{CBO}=-50nA(Max.) @ V_{CB}=-20V
I_{EBO}=-50nA(Max.) @ V_{EB}=-3V

. Low Saturation Voltage
: $V_{CE(sat)}$=-0.4V(Max.) @ I_C=-50mA, I_B=-5mA

. Low Collector Output Capacitance
: C_{ob}=4.5pF(Max.) @ V_{CB}=-5V

. Complementary to 2N4124

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

Weight : 0.21g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	RATING	UNIT
※	Collector-Base Voltage	V_{CBO}	-25	V
※	Collector-Emitter Voltage	V_{CEO}	-25	V
※	Emitter-Base Voltage	V_{EBO}	-4	V
※	Collector Current	I_C	-200	mA
	Base Current	I_B	-50	mA
※	Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	625	mW
			5.0	mW/°C
※	Collector Power Dissipation (Tc=25°C) Derate Linearly 25°C	P_C	1.5	W
			12	mW/°C
※	Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	200	°C/W
※	Thermal Resistance (Junction to Case)	$R_{th(j-c)}$	83.3	°C/W
※	Junction Temperature	T_j	150	°C
※	Storage Temperature Range	T_{stg}	-55 ~150	°C

※In accordance with JEDEC registration data.

ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current	I_{CBO}	V_{CB}=-20V, I_E=0	-	-	-50	nA
※	Emitter Cut-off Current	I_{EBO}	V_{EB}=-3V, I_C=0	-	-	-50	nA
※	Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C=-10μA, I_E=0	-25	-	-	V
※	Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=-1mA, I_B=0	-25	-	-	V
※	Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=-10μA, I_C=0	-4	-	-	V
※	DC Current Gain	$h_{FE(1)}$	V_{CE}=-1V, I_C=-2mA	120	-	360	
		$h_{FE(2)}$	V_{CE}=-1V, I_C=-50mA	60	-	-	
※	Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=-50mA, I_B=-5mA	-	-	-0.4	V
※	Base-Emitter Saturation Voltage	$V_{BE(sat)}$	I_C=-50mA, I_B=-5mA	-	-	-0.95	V
※	Small Signal Forward Current Transfer Ratio	h_{fe}	V_{CE}=-20V, I_C=-10mA, f=100MHz	2.5	-	-	
※	Transition Frequency	f_T	V_{CE}=-20V, I_C=-10mA, f=100MHz	250	-	-	MHz
※	Collector Output Capacitance	C_{ob}	V_{CB}=-5V, I_E=0, f=1MHz	-	-	4.5	pF
※	Input Capacitance	C_{ib}	V_{EB}=-0.5V, I_C=0, f=1MHz	-	-	10	pF
※	Small Signal Current Gain	h_{fe}	V_{CE}=-10V, I_C=-2mA, f=1kHz	120	-	480	
※	Noise Figure	NF	V_{CE}=-5V, I_C=-100μA R_g=1kΩ, f=10Hz~15.7kHz	-	-	4	dB

※ In accordance with JEDEC registration data.

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

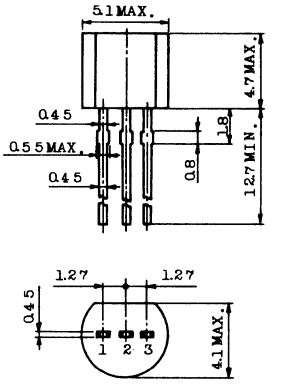
TOSHIBA TRANSISTOR
2N4400
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

. Low Leakage Current
  : I_{CEV}=100nA(Max.), I_{BEV}=-100nA(Max.)
  @ V_{CE}=35V, V_{BE}=-0.4V
. Excellent DC Current Gain Linearity
. Low Saturation Voltage
  : $V_{CE(sat)}$=0.4V(Max.) @ I_C=150mA, I_B=15mA
. Low Collector Output Capacitance
  : C_{ob}=6.5pF(Max.) @ V_{CB}=5V
. Complementary to 2N4402

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

Weight : 0.21g

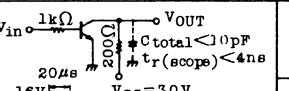
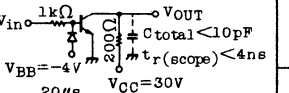
MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	RATING	UNIT
※	Collector-Base Voltage	V_{CBO}	60	V
※	Collector-Emitter Voltage	V_{CEO}	40	V
※	Emitter-Base Voltage	V_{EBO}	6	V
※	Collector Current	I_C	600	mA
	Base Current	I_B	100	mA
※	Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	625	mW
			5.0	mW/°C
※	Collector Power Dissipation (Tc=25°C) Derate Linearly 25°C	P_C	1.5	W
			12	mW/°C
※	Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	200	°C/W
※	Thermal Resistance (Junction to Case)	$R_{th(j-c)}$	83.3	°C/W
※	Junction Temperature	T_j	150	°C
※	Storage Temperature Range	T_{stg}	-55~150	°C

※In accordance with JEDEC registration data.

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current		I_{CEV}	V_{CE}=35V, V_{BE}=-0.4V	-	-	100	nA
※	Base Cut-off Current		I_{BEV}	V_{CE}=35V, V_{BE}=-0.4V	-	-	-100	nA
※	Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=0.1mA, I_E=0	60	-	-	V
※	Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=1mA, I_B=0	40	-	-	V
※	Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=0.1mA, I_C=0	6	-	-	V
※	DC Current Gain		$h_{FE(1)}$	V_{CE}=1V, I_C=1mA	20	-	-	
			$h_{FE(2)}$	V_{CE}=1V, I_C=10mA	40	-	-	
			$h_{FE(3)}$	V_{CE}=1V, I_C=150mA	50	-	150	
			$h_{FE(4)}$	V_{CE}=2V, I_C=500mA	20	-	-	
※	Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=150mA, I_B=15mA	-	-	0.4	V
			$V_{CE(sat)2}$	I_C=500mA, I_B=50mA	-	-	0.75	
※	Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=150mA, I_B=15mA	0.75	-	0.95	V
			$V_{BE(sat)2}$	I_C=500mA, I_B=50mA	-	-	1.2	
※	Transition Frequency		f_T	V_{CE}=10V, I_C=20mA f=100MHz	200	-	-	MHz
※	Collector Output Capacitance		C_{ob}	V_{CB}=5V, I_E=0, f=1MHz	-	-	6.5	pF
※	Input Capacitance		C_{ib}	V_{EB}=0.5V, I_C=0, f=1MHz	-	-	30	pF
※	Input Impedance		h_{ie}	V_{CE}=10V, I_C=1mA f=1kHz	0.5	-	7.5	kΩ
※	Voltage Feedback Ratio		h_{re}		0.1	-	8	×10⁻⁴
※	Small-Signal Current Gain		h_{fe}		20	-	250	
※	Collector Output Admittance		h_{oe}		1.0	-	30	μS
※	Switching Time	Delay Time	t_d		-	-	15	ns
		Rise Time	t_r		-	-	20	
		Storage Time	t_{stg}		-	-	225	
		Fall Time	t_f		-	-	30	

※ In accordance with JEDEC registration data.

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

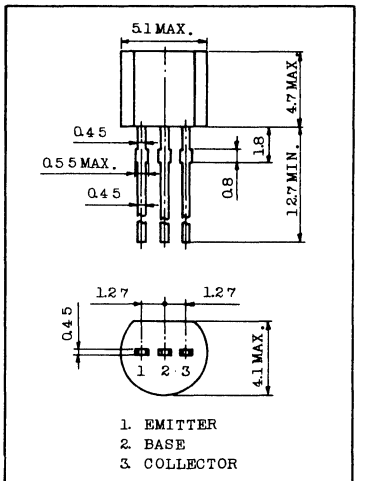
TOSHIBA TRANSISTOR
2N4401
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

. Low Leakage Current
  : I_{CEV}=100nA(Max.), I_{BEV}=-100nA(Max.)
  @ V_{CE}=35V, V_{BE}=-0.4V
. Excellent DC Current Gain Linearity
. Low Saturation Voltage
  : $V_{CE(sat)}$=0.4V(Max.) @ I_C=150mA, I_B=15mA
. Low Collector Output Capacitance
  : C_{ob}=6.5pF(Max.) @ V_{CB}=5V
. Complementary to 2N4403

Unit in mm



JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

Weight : 0.21g

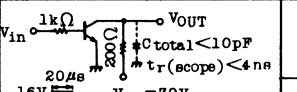
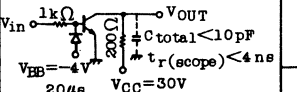
MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	RATING	UNIT
※	Collector-Base Voltage	V_{CBO}	60	V
※	Collector-Emitter Voltage	V_{CEO}	40	V
※	Emitter-Base Voltage	V_{EBO}	6	V
※	Collector Current	I_C	600	mA
	Base Current	I_B	100	mA
※	Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	625	mW
			5.0	mW/°C
※	Collector Power Dissipation (Tc=25°C) Detate Linearly 25°C	P_C	1.5	W
			12	mW/°C
※	Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	200	°C/W
※	Thermal Resistance (Junction to Case)	$R_{th(j-c)}$	83.3	°C/W
※	Junction Temperature	T_j	150	°C
※	Storage Temperature Range	T_{stg}	-55~150	°C

※In accordance with JEDEC registration data.

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current		I_{CEV}	V_{CE}=35V, V_{BE}=-0.4V	-	-	100	nA
※	Base Cut-off Current		I_{BEV}	V_{CE}=35V, V_{BE}=-0.4V	-	-	-100	nA
※	Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=0.1mA, I_E=0	60	-	-	V
※	Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=1mA, I_B=0	40	-	-	V
※	Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=0.1mA, I_C=0	6	-	-	V
※	DC Current Gain		$h_{FE(1)}$	V_{CE}=1V, I_C=0.1mA	20	-	-	
			$h_{FE(2)}$	V_{CE}=1V, I_C=1mA	40	-	-	
			$h_{FE(3)}$	V_{CE}=1V, I_C=10mA	80	-	-	
			$h_{FE(4)}$	V_{CE}=1V, I_C=150mA	100	-	300	
			$h_{FE(5)}$	V_{CE}=2V, I_C=500mA	40	-	-	
※	Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=150mA, I_B=15mA	-	-	0.4	V
			$V_{CE(sat)2}$	I_C=500mA, I_B=50mA	-	-	0.75	
※	Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=150mA, I_B=15mA	0.75	-	0.95	V
			$V_{BE(sat)2}$	I_C=500mA, I_B=50mA	-	-	1.2	
※	Transition Frequency		f_T	V_{CE}=10V, I_C=20mA f=100MHz	250	-	-	MHz
※	Collector Output Capacitance		C_{ob}	V_{CB}=5V, I_E=0, f=1MHz	-	-	6.5	pF
※	Input Capacitance		C_{ib}	V_{EB}=0.5V, I_C=0, f=1MHz	-	-	30	pF
※	Input Impedance		h_{ie}	V_{CE}=10V, I_C=1mA f=1kHz	1.0	-	15	kΩ
※	Voltage Feedback Ratio		h_{re}		0.1	-	8	×10-4
※	Small-Signal Current Gain		h_{fe}		40	-	500	
※	Collector Output Admittance		h_{oe}		1.0	-	30	μS
※	Switching Time	Delay Time	t_d		-	-	15	ns
		Rise Time	t_r		-	-	20	
		Storage Time	t_{stg}		-	-	225	
		Fall Time	t_f		-	-	30	

※ In accordance with JEDEC registration data.

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
2N4402
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

. Low Leakage Current
: I_{CEV}=-100nA(Max.), I_{BEV}=100nA(Max.)
@ V_{CE}=-35V, V_{BE}=0.4V

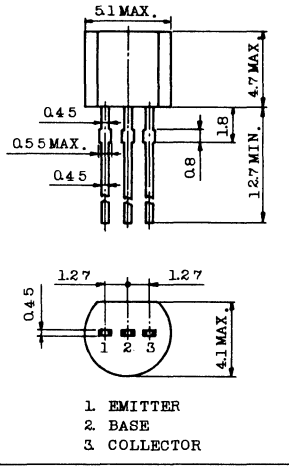
. Excellent DC Current Gain Linearity

. Low Saturation Voltage
: $V_{CE(sat)}$=-0.4V(Max.) @ I_C=-150mA, I_B=-15mA

. Low Collector Output Capacitance
: C_{ob}=8.5pF(Max.) @ V_{CB}=-10V

. Complementary to 2N4400

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

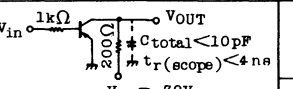
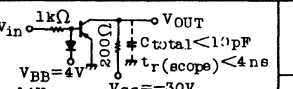
Weight : 0.21g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	RATING	UNIT
※	Collector-Base Voltage	V_{CBO}	-40	V
※	Collector-Emitter Voltage	V_{CEO}	-40	V
※	Emitter-Base Voltage	V_{EBO}	-5	V
※	Collector Current	I_C	-600	mA
	Base Current	I_B	-100	mA
※	Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	625	mW
			5.0	mW/°C
※	Collector Power Dissipation (Tc=25°C) Detate Linearly 25°C	P_C	1.5	W
			12	mW/°C
※	Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	200	°C/W
※	Thermal Resistance (Junction to Case)	$R_{th(j-c)}$	83.3	°C/W
※	Junction Temperature	T_j	150	°C
※	Storage Temperature Range	T_{stg}	-55~150	°C

※In accordance with JEDEC registration data.

ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current		I_{CEV}	V_{CE}=-35V, V_{BE}=0.4V	-	-	-100	nA
※	Base Cut-off Current		I_{BEV}	V_{CE}=-35V, V_{BE}=0.4V	-	-	100	nA
※	Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=-0.1mA, I_E=0	-40	-	-	V
※	Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-1mA, I_B=0	-40	-	-	V
※	Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=-0.1mA, I_C=0	-5	-	-	V
※	DC Current Gain		$h_{FE(1)}$	V_{CE}=-1V, I_C=-1mA	30	-	-	
			$h_{FE(2)}$	V_{CE}=-1V, I_C=-10mA	50	-	-	
			※ $h_{FE(3)}$	V_{CE}=-2V, I_C=-150mA	50	-	150	
			$h_{FE(4)}$	V_{CE}=-2V, I_C=-500mA	20	-	-	
※	Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=-150mA, I_B=-15mA	-	-	-0.4	V
			$V_{CE(sat)2}$	I_C=-500mA, I_B=-50mA	-	-	-0.75	
※	Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=-150mA, I_B=-15mA	-0.75	-	-0.95	V
			$V_{BE(sat)2}$	I_C=-500mA, I_B=-50mA	-	-	-1.3	
※	Transition Frequency		f_T	V_{CE}=-10V, I_C=-20mA f=100MHz	150	-	-	MHz
※	Collector Output Capacitance		C_{ob}	V_{CB}=-10V, I_E=0, f=1MHz	-	-	8.5	pF
※	Input Capacitance		C_{ib}	V_{EB}=-0.5V, I_C=0, f=1MHz	-	-	30	pF
※	Input Impedance		h_{ie}	V_{CE}=-10V, I_C=-1mA f=1kHz	0.75	-	7.5	kΩ
※	Voltage Feedback Ratio		h_{re}		0.1	-	8	×10⁻⁴
※	Small-Signal Current Gain		h_{fe}		30	-	250	
※	Collector Output Admittance		h_{oe}		1.0	-	100	μS
※	Switching Time	Delay Time	t_d		-	-	15	ns
		Rise Time	t_r		-	-	20	
		Storage Time	t_{stg}		-	-	225	
		Fall Time	t_f		-	-	30	

※ In accordance with JEDEC registration data.

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
2N4403
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

. Low Leakage Current
: I_{CEV}=-100nA(Max.), I_{BEV}=100nA(Max.)
@ V_{CE}=-35V, V_{BE}=0.4V

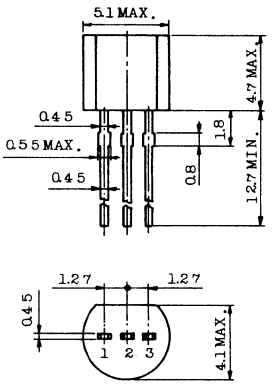
. Excellent DC Current Gain Linearity

. Low Saturation Voltage
: $V_{CE(sat)}$=-0.4V(Max.) @ I_C=-150mA, I_B=-15mA

. Low Collector Output Capacitance
: C_{ob}=8.5pF(Max.) @ V_{CB}=-10V

. Complementary to 2N4401

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

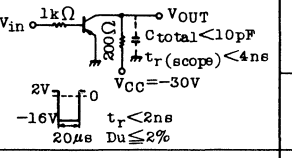
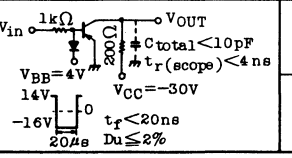
Weight : 0.21g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	RATING	UNIT
※	Collector-Base Voltage	V_{CBO}	-40	V
※	Collector-Emitter Voltage	V_{CEO}	-40	V
※	Emitter-Base Voltage	V_{EBO}	-5	V
※	Collector Current	I_C	-600	mA
	Base Current	I_B	-100	mA
※	Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	625	mW
			5.0	mW/°C
※	Collector Power Dissipation (Tc=25°C) Derate Linearly 25°C	P_C	1.5	W
			12	mW/°C
※	Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	200	°C/W
※	Thermal Resistance (Junction to Case)	$R_{th(j-c)}$	83.3	°C/W
※	Junction Temperature	T_j	150	°C
※	Storage Temperature Range	Tstg	-55~150	°C

※In accordance with JEDEC registration data.

ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current		I_{CEV}	V_{CE}=-35V, V_{BE}=0.4V	-	-	-100	nA
※	Base Cut-off Current		I_{BEV}	V_{CE}=-35V, V_{BE}=0.4V	-	-	100	nA
※	Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=-0.1mA, I_E=0	-40	-	-	V
※	Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-1mA, I_B=0	-40	-	-	V
※	Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=-0.1mA, I_C=0	-5	-	-	V
※	DC Current Gain		$h_{FE(1)}$	V_{CE}=-1V, I_C=-0.1mA	30	-	-	
			$h_{FE(2)}$	V_{CE}=-1V, I_C=-1mA	60	-	-	
			$h_{FE(3)}$	V_{CE}=-1V, I_C=-10mA	100	-	-	
			※ $h_{FE(4)}$	V_{CE}=-2V, I_C=-150mA	100	-	300	
			$h_{FE(5)}$	V_{CE}=-2V, I_C=-500mA	20	-	-	
※	Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=-150mA, I_B=-15mA	-	-	-0.4	V
			$V_{CE(sat)2}$	I_C=-500mA, I_B=-50mA	-	-	-0.75	
※	Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=-150mA, I_B=-15mA	-0.75	-	-0.95	V
			$V_{BE(sat)2}$	I_C=-500mA, I_B=-50mA	-	-	-1.3	
※	Transition Frequency		f_T	V_{CE}=-10V, I_C=-20mA f=100MHz	200	-	-	MHz
※	Collector Output Capacitance		C_{ob}	V_{CB}=-10V, I_E=0, f=1MHz	-	-	8.5	pF
※	Input Capacitance		C_{ib}	V_{EB}=-0.5V, I_C=0, f=1MHz	-	-	30	pF
※	Input Impedance		h_{ie}	V_{CE}=-10V, I_C=-1mA f=1kHz	1.5	-	15	kΩ
※	Voltage Feedback Ratio		h_{re}		0.1	-	8	×10^{-4}
※	Small-Signal Current Gain		h_{fe}		60	-	500	
※	Collector Output Admittance		h_{oe}		1.0	-	100	μS
※	Switching Time	Delay Time	t_d		-	-	15	ns
		Rise Time	t_r		-	-	20	
		Storage Time	t_{stg}		-	-	225	
		Fall Time	t_f		-	-	30	

※ In accordance with JEDEC registration data.

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
2N5400
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE HIGH VOLTAGE AMPLIFIER APPLICATIONS.

FEATURES:

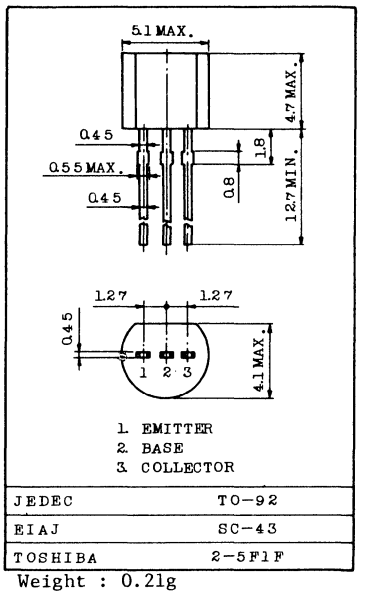
. High Collector Breakdown Voltage
: V_{CBO}=-130V, V_{CEO}=-120V

. Low Leakage Current
: I_{CBO}=-100nA(Max.) @ V_{CB}=-100V

. Low Saturation Voltage
: $V_{CE(sat)}$=-0.5V(Max.) @ I_C=-50mA, I_B=-5mA

. Low Noise : NF=8dB(Max.)

Unit in mm



JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

Weight : 0.21g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	RATING	UNIT
※	Collector-Base Voltage	V_{CBO}	-130	V
※	Collector-Emitter Voltage	V_{CEO}	-120	V
※	Emitter-Base Voltage	V_{EBO}	-5	V
※	Collector Current	I_C	-600	mA
	Base Current	I_B	-100	mA
※	Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	625	mW
			5.0	mW/°C
※	Collector Power Dissipation (Tc=25°C) Derate Linearly 25°C	P_C	1.5	W
			12	mW/°C
※	Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	200	°C/W
※	Thermal Resistance (Junction to Case)	$R_{th(j-c)}$	83.3	°C/W
※	Junction Temperature	T_j	150	°C
※	Storage Temperature Range	T_{stg}	-55~150	°C

※In accordance with JEDEC registration data.

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN	TYP.	MAX.	UNIT
※	Collector Cut-off Current	I_{CBO}	V_{CB}=-100V, I_E=0	-	-	-100	nA
			V_{CB}=-100V, I_E=0, Ta=100°C	-	-	-100	μA
※	Emitter Cut-off Current	I_{EBO}	V_{EB}=-3V, I_C=0	-	-	-50	nA
※	Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C=-0.1mA, I_E=0	-130	-	-	V
※	Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=-1mA, I_B=0	-120	-	-	V
※	Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=-10μA, I_C=0	-5	-	-	V
※	DC Current Gain	$h_{FE(1)}$	V_{CE}=-5V, I_C=-1mA	30	-	-	
		$h_{FE(2)}$	V_{CE}=-5V, I_C=-10mA	40	-	180	
		$h_{FE(3)}$	V_{CE}=-5V, I_C=-50mA	40	-	-	
※	Collector-Emitter Saturation Voltage	$V_{CE(sat)\ 1}$	I_C=-10mA, I_B=-1mA	-	-	-0.2	V
		$V_{CE(sat)\ 2}$	I_C=-50mA, I_B=-5mA	-	-	-0.5	
※	Base-Emitter Saturation Voltage	$V_{BE(sat)\ 1}$	I_C=-10mA, I_B=-1mA	-	-	-1.0	V
		$V_{BE(sat)\ 2}$	I_C=-50mA, I_B=-5mA	-	-	-1.0	
※	Transition Frequency	f_T	V_{CE}=-10V, I_C=-10mA, f=100MHz	100	-	400	MHz
※	Collector Output Capacitance	C_{ob}	V_{CB}=-10V, I_E=0, f=1MHz	-	-	6	pF
※	Small Siganl Current Gain	h_{fe}	V_{CE}=-10V, I_C=-1mA, f=1kHz	30	-	200	
※	Noise Figure	NF	V_{CE}=-5V, I_C=-250μA, R_g=1kΩ, f=10Hz ~ 15.7kHz	-	-	8	dB

※ In accordance with JEDEC registration data.

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
2N5401
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE HIGH VOLTAGE AMPLIFIER APPLICATIONS.

FEATURES:

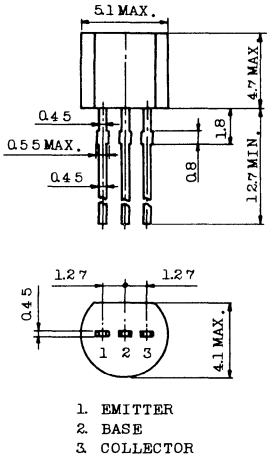
. High Collector Breakdown Voltage
: V_{CBO}=-160V, V_{CEO}=-150V

. Low Leakage Current
: I_{CBO}=-50nA(Max.) @ V_{CB}=-120V

. Low Saturation Voltage
: $V_{CE(sat)}$=-0.5V(Max.) @ I_C=-50mA, I_B=-5mA

. Low Noise : NF=8dB(Max.)

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

Weight : 0.21g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	RATING	UNIT
※	Collector-Base Voltage	V_{CBO}	-160	V
※	Collector-Emitter Voltage	V_{CEO}	-150	V
※	Emitter-Base Voltage	V_{EBO}	-5	V
※	Collector Current	I_C	-600	mA
	Base Current	I_B	-100	mA
※	Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	625	mW
			5.0	mW/°C
※	Collector Power Dissipation (Tc=25°C) Derate Linearly 25°C	P_C	1.5	W
			12	mW/°C
※	Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	200	°C/W
※	Thermal Resistance (Junction to Case)	$R_{th(j-c)}$	83.3	°C/W
※	Junction Temperature	T_j	150	°C
※	Storage Temperature Range	T_{stg}	-55~150	°C

※In accordance with JEDEC registration data.

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current	I_{CBO}	V_{CB}=-120V, I_E=0	-	-	-50	nA
			V_{CB}=-120V, I_E=0, Ta=100°C	-	-	-50	μA
※	Emitter Cut-off Current	I_{EBO}	V_{EB}=-3V, I_C=0	-	-	-50	nA
※	Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C=-0.1mA, I_E=0	-160	-	-	V
※	Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=-1mA, I_B=0	-150	-	-	V
※	Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=-10μA, I_C=0	-5	-	-	V
※	DC Current Gain	$h_{FE(1)}$	V_{CE}=-5V, I_C=-1mA	50	-	-	
		$h_{FE(2)}$	V_{CE}=-5V, I_C=-10mA	60	-	240	
		$h_{FE(3)}$	V_{CE}=-5V, I_C=-50mA	50	-	-	
※	Collector-Emitter Saturation Voltage	$V_{CE(sat)\ 1}$	I_C=-10mA, I_B=-1mA	-	-	-0.2	V
		$V_{CE(sat)\ 2}$	I_C=-50mA, I_B=-5mA	-	-	-0.5	
※	Base-Emitter Saturation Voltage	$V_{BE(sat)\ 1}$	I_C=-10mA, I_B=-1mA	-	-	-1.0	V
		$V_{BE(sat)\ 2}$	I_C=-50mA, I_B=-5mA	-	-	-1.0	
※	Transition Frequency	f_T	V_{CE}=-10V, I_C=-10mA, f=100MHz	100	-	300	MHz
※	Collector Output Capacitance	C_{ob}	V_{CB}=-10V, I_E=0, f=1MHz	-	-	6	pF
※	Small Siganl Current Gain	h_{fe}	V_{CE}=-10V, I_C=-1mA, f=1kHz	40	-	200	
※	Noise Figure	NF	V_{CE}=-5V, I_C=-250μA R_g=1kΩ, f=10Hz~15.7kHz	-	-	8	dB

※ In accordance with JEDEC registration data.

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
2N5550
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE HIGH VOLTAGE AMPLIFIER APPLICATIONS.

FEATURES:

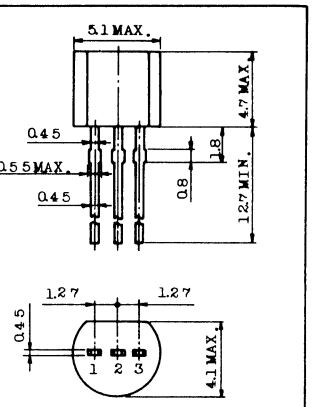
. High Collector Breakdown Voltage
: V_{CBO}=160V, V_{CEO}=140V

. Low Leakage Current
: I_{CBO}=100nA(Max.) @ V_{CB}=100V

. Low Saturation Voltage
: $V_{CE(sat)}$=0.25V(Max.) @ I_C=50mA, I_B=5mA

. Low Noise : NF=10dB(Max.)

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

Weight : 0.21g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	RATING	UNIT
※	Collector-Base Voltage	V_{CBO}	160	V
※	Collector-Emitter Voltage	V_{CEO}	140	V
※	Emitter-Base Voltage	V_{EBO}	6	V
※	Collector Current	I_C	600	mA
	Base Current	I_B	100	mA
※	Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	625	mW
			5.0	mW/°C
※	Collector Power Dissipation (Tc=25°C) Derate Linearly 25°C	P_C	1.5	W
			12	mW/°C
※	Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	200	°C/W
※	Thermal Resistance (Junction to Case)	$R_{th(j-c)}$	83.3	°C/W
※	Junction Temperature	T_j	150	°C
※	Storage Temperature Range	T_{stg}	-55~150	°C

※ In accordance with JEDEC registration data.

ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current	I_{CBO}	V_{CB}=100V, I_E=0	-	-	100	nA
			V_{CB}=100V, I_E=0, Ta=100°C	-	-	100	μA
※	Emitter Cut-off Current	I_{EBO}	V_{EB}=4V, I_C=0	-	-	50	nA
※	Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C=0.1mA, I_E=0	160	-	-	V
※	Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=1mA, I_B=0	140	-	-	V
※	Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=10μA, I_C=0	6	-	-	V
※	DC Current Gain	$h_{FE(1)}$	V_{CE}=5V, I_C=1mA	60	-	-	
		$h_{FE(2)}$	V_{CE}=5V, I_C=10mA	60	-	250	
		$h_{FE(3)}$	V_{CE}=5V, I_C=50mA	20	-	-	
※	Collector-Emitter Saturation Voltage	$V_{CE(sat)\ 1}$	I_C=10mA, I_B=1mA	-	-	0.15	V
		$V_{CE(sat)\ 2}$	I_C=50mA, I_B=5mA	-	-	0.25	
※	Base-Emitter Saturation Voltage	$V_{BE(sat)\ 1}$	I_C=10mA, I_B=1mA	-	-	1.0	V
		$V_{BE(sat)\ 2}$	I_C=50mA, I_B=5mA	-	-	1.2	
※	Transition Frequency	f_T	V_{CE}=10V, I_C=10mA, f=100MHz	100	-	300	MHz
※	Collector Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=1MHz	-	-	6	pF
※	Input Capacitance	C_{ib}	V_{EB}=0.5V, I_C=0, f=1MHz	-	-	30	pF
※	Small Signal Current Gain	h_{fe}	V_{CE}=10V, I_C=1mA, f=1kHz	50	-	200	
※	Noise Figure	NF	V_{CE}=5V, I_C=250μA R_g=1kΩ, f=1oHz ~ 15.7kHz	-	-	10	dB

※ In accordance with JEDEC registration data.

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

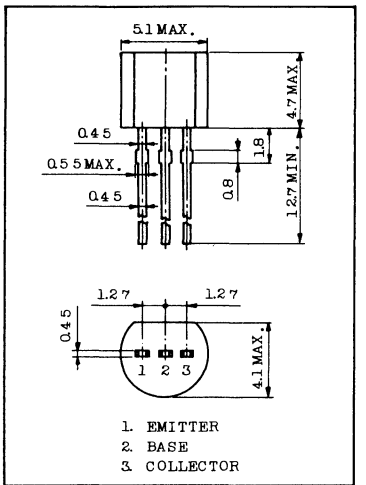
TOSHIBA TRANSISTOR
2N5551
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE HIGH VOLTAGE AMPLIFIER APPLICATIONS.

FEATURES:

. High Collector Breakdown Voltage
  : V_{CBO}=180V, V_{CEO}=160V
. Low Leakage Current
  : I_{CBO}=50nA(Max.) @ V_{CB}=120V
. Low Saturation Voltage
  : $V_{CE(sat)}$=0.2V(Max.) @ I_C=50mA, I_B=5mA
. Low Noise : NF=8dB(Max.)

Unit in mm



JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

Weight : 0.21g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	RATING	UNIT
※	Collector-Base Voltage	V_{CBO}	180	V
※	Collector-Emitter Voltage	V_{CEO}	160	V
※	Emitter-Base Voltage	V_{EBO}	6	V
※	Collector Current	I_C	600	mA
	Base Current	I_B	100	mA
※	Collector Power Dissipation (Ta=25°C) Detate Linearly 25°C	P_C	625	mW
			5.0	mW/°C
※	Collector Power Dissipation (Tc=25°C) Derate Linearly 25°C	P_C	1.5	W
			12	mW/°C
※	Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	200	°C/W
※	Thermal Resistance (Junction to Case)	$R_{th(j-c)}$	83.3	°C/W
※	Junction Temperature	T_j	150	°C
※	Storage Temperature Range	T_{stg}	-55 ~ 150	°C

※ In accordance with JEDEC registration data.

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current	I_{CBO}	V_{CB}=120V, I_E=0	-	-	50	nA
			V_{CB}=120V, I_E=0, Ta=100°C	-	-	50	μA
※	Emitter Cut-off Current	I_{EBO}	V_{EB}=4V, I_C=0	-	-	50	nA
※	Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C=0.1mA, I_E=0	180	-	-	V
※	Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=1mA, I_B=0	160	-	-	V
※	Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=10μA, I_C=0	6	-	-	V
※	DC Current Gain	$h_{FE(1)}$	V_{CE}=5V, I_C=1mA	80	-	-	
		$h_{FE(2)}$	V_{CE}=5V, I_C=10mA	80	-	250	
		$h_{FE(3)}$	V_{CE}=5V, I_C=50mA	30	-	-	
※	Collector-Emitter Saturation Voltage	$V_{CE(sat)\ 1}$	I_C=10mA, I_B=1mA	-	-	0.15	V
		$V_{CE(sat)\ 2}$	I_C=50mA, I_B=5mA	-	-	0.2	
※	Base-Emitter Saturation Voltage	$V_{BE(sat)\ 1}$	I_C=10mA, I_B=1mA	-	-	1.0	V
		$V_{BE(sat)\ 2}$	I_C=50mA, I_B=5mA	-	-	1.0	
※	Transition Frequency	f_T	V_{CE}=10V, I_C=10mA, f=100MHz	100	-	300	MHz
※	Collector Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=1MHz	-	-	6	pF
※	Input Capacitance	C_{ib}	V_{EB}=0.5V, I_C=0, f=1MHz	-	-	20	pF
※	Small Signal Current Gain	h_{fe}	V_{CE}=10V, I_C=1mA, f=1kHz	50	-	200	
※	Noise Figure	NF	V_{CE}=5V, I_C=250μA R_g=1kΩ, f=10Hz ~ 15.7kHz	-	-	8	dB

※ In accordance with JEDEC registration data.

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

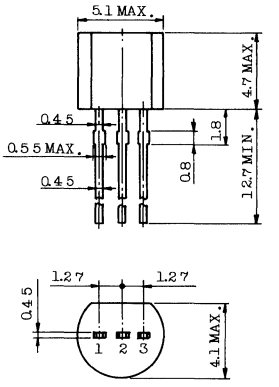
TOSHIBA TANSISTOR
MPS2221, MPS2222
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE
MEDIUM-SPEED SWITCHING AND AUDIO TO
VHF FREQUENCY APPLICATION.

FEATURES:

. DC Current Gain Specified : 0.1 ~ 500mA
. Low Collector-Emitter Saturation Voltage
: $V_{CE(sat)}$=1.6V(Max.) @ I_C=500mA
. High Transition Frequency
: @ I_C=20mA, f_T=250MHz(Min.)
. Complementary to MPS2906, MPS2907.

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

Weight : 0.21g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	600	mA
Base Current	I_B	160	mA
Total Device Dissipation @ Ta=25°C	P_C	625	mW
Derate above 25°C		5.0	mW/°C
Total Device Dissipation @ Tc=25°C	P_C	1.5	W
Derate above 25°C		12	mW/°C
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-55 ~ 150	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C, Unless otherwise noted)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MPS2221		MPS2222		UNIT
			MIN.	MAX.	MIN.	MAX.	
Collector Cut-off Current	I_{CBO}	V_{CB}=50V, I_E=0	-	10	-	10	nA
Collector Cut-off Current	I_{CBO}	V_{CB}=50V, I_E=0, Ta=150°C	-	10	-	10	μA
Emitter Cut-off Current	I_{EBO}	V_{EB}=3V, I_C=0	-	10	-	10	nA
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C=10μA, I_E=0	60	-	60	V	
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=10mA, I_B=0	30	-	30	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=10μA, I_C=0	5	-	5	-	V
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=0.1mA	20	-	35	-	
		V_{CE}=10V, I_C=1.0mA	25	-	50	-	
		V_{CE}=10V, I_C=10mA	35	-	75	-	
		V_{CE}=10V, I_C=150mA	40	120	100	300	
		V_{CE}=10V, I_C=500mA	20	-	30	-	
		V_{CE}=1V, I_C=150mA	20	-	50	-	
		V_{CE}=10V, I_C=10mA Ta=-55°C	15	-	35	-	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=150mA, I_B=15mA	-	0.4	-	0.4	V
		I_C=500mA, I_B=50mA	-	1.6	-	1.6	
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	I_C=150mA, I_B=15mA	0.6	2.0	-	1.3	V
		I_C=500mA, I_B=50mA	-	2.6	-	2.6	
Transition Frequency	f_T	V_{CE}=20V, I_C=20mA, f=100MHz	250	-	250	-	MHz
Collector Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=100kHz	-	8.0	-	8.0	pF
Input Capacitance	C_{ib}	V_{EB}=0.5V, I_C=0, f=100kHz	-	30	-	30	pF

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
MPS2221A, MPS2222A
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE
MEDIUM-SPEED SWITCHING AND AUDIO TO
VHF FREQUENCY APPLICATION.

FEATURES:

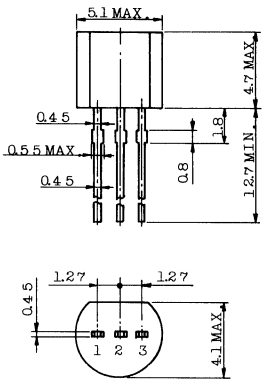
. DC Current Gain Specified : 0.1 ~ 500mA

. Low Collector-Emitter Saturation Voltage
: $V_{CE(sat)}$=1.0V(Max.) @ I_C=500mA

. High Transition Frequency
: @ I_C=20mA MPS2221A ; 250MHz(Min.)
MPS2222A ; 300MHz(Min.)

. Complementary to MPS2906A, MPS2907A.

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

Weight : 0.21g

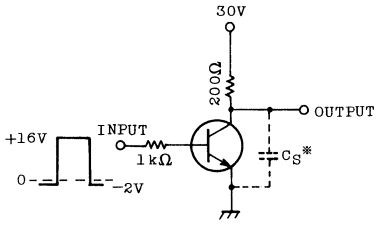
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	75	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	600	mA
Base Current	I_B	160	mA
Total Device Dissipation @ Tc=25°C	P_C	625	mW
Derate above 25°C		5.0	mW/°C
Total Device Dissipation @ Ta=25°C	P_C	1.5	W
Derate above		12	mW/°C
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-55 ~ 150	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C, Unless otherwise noted)

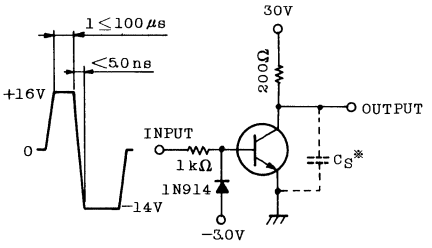
CHARACTERISTIC		SYMBOL	TEST CONDITION	MPS2221A		MPS2222A		UNIT
				MIN.	MAX.	MIN.	MAX.	
Collector Cut-off Current		I_{CBO}	V_{CB}=60V, I_E=0	-	10	-	10	nA
Collector Cut-off Current		I_{CBO}	V_{CB}=60V, I_E=0, Ta=150°C	-	10	-	10	μA
Collector Cut-off Current		I_{CEX}	V_{CE}=60V, V_{BE}=-3V	-	10	-	10	nA
Emitter Cut-off Current		I_{EBO}	V_{EB}=3.0V, I_C=0	-	10	-	10	nA
Base Cut-off Current		I_{BL}	V_{CE}=60V, V_{BE}=-3V	-	20	-	20	nA
Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=10μA, I_E=0	75	-	75	-	V
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=10mA, I_B=0	40	-	40	-	V
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=10μA, I_C=0	6.0	-	6.0	-	V
DC Current Gain		h_{FE}	V_{CE}=10V, I_C=0.1mA	20	-	35	-	
			V_{CE}=10V, I_C=1.0mA	25	-	50	-	
			V_{CE}=10V, I_C=10mA	35	-	75	-	
			V_{CE}=10V, I_C=150mA	40	120	100	300	
			V_{CE}=10V, I_C=500mA	25	-	40	-	
			V_{CE}=1V, I_C=150mA	20	-	50	-	
			V_{CE}=10V, I_C=10mA Ta=-55°C	15	-	35	-	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=150mA, I_B=15mA	-	0.3	-	0.3	V
			I_C=500mA, I_B=50mA	-	1.0	-	1.0	
Base-Emitter Saturation Voltage		$V_{BE(sat)}$	I_C=150mA, I_B=15mA	0.6	1.2	0.6	1.2	V
			I_C=500mA, I_B=50mA	-	2.0	-	2.0	
Transition Frequency		f_T	V_{CE}=20V, I_C=20mA, f=100MHz	250	-	300	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=10V, I_E=0, f=100kHz	-	8.0	-	8.0	pF
Input Capacitance		C_{ib}	V_{EB}=0.5V, I_C=0, f=100kHz	-	25	-	25	pF
Collector-Base Time Constant		$C_c, r_{bb'}$	V_{CB}=20V, I_E=20mA f=31.8MHz	-	150	-	150	pS
Noise Figure		NF	V_{CE}=10V, I_C=100μA R_S=1kΩ, f=1kHz	-	-	-	4.0	dB
Switching Time	Delay Time	t_d	V_{CC}=30V, $V_{BE(off)}$=-0.5V	-	10	-	10	ns
	Rise Time	t_r	I_C=150mA, I_{B1}=15mA Fig. 1	-	25	-	25	
	Storage Time	t_{stg}	V_{CC}=30V, I_C=150mA	-	225	-	225	
	Fall Time	t_f	I_{B1}=-I_{B2}=15mA Fig. 2	-	60	-	60	

Fig. 1 DELAY AND RISE TIME EQUIVALENT TEST CIRCUIT



P_W=1~100μs
DUTY CYCLE=2.0%

Fig. 2 STORAGE TIME AND FALL TIME EQUIVALENT TEST CIRCUIT



DUTY CYCLE=2.0%

SCOPE RISE TIME < 4ns

* C_S : TOTAL SHUNT CAPACITANCE

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

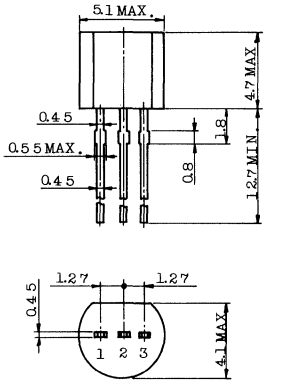
TOSHIBA TRANSISTOR
MPS2906, MPS2907
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR HIGH-SPEED SWITCHING USE
DC TO VHF AMPLIFIER APPLICATIONS AND
COMPLEMENTARY CIRCUITRY.

FEATURES:

. High DC Current Gain Specified : -0.1~ -500mA
. High Transition Frequency
  : @ I_C=-50mA, f_T=200MHz(Min.)
. Low Collector-Emitter Satulation Voltage
  : $V_{CE(sat)}$=-1.6V(Max.) @ I_C=-500mA
. Complementary to MPS2221, MPS2222.

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

Weight : 0.21g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	-60	V
Collector-Emitter Voltage	V_{CEO}	-40	V
Emitter-Base Voltage	V_{EBO}	-5	V
Collector Current	I_C	-600	mA
Base Current	I_B	-120	mA
Total Device Dissipation @ Ta=25°C	P_C	625	mW
Derate above 25°C		5.0	mW/°C
Total Device Dissipation @ Tc=25°C	P_C	1.5	W
Derate above 25°C		12	mW/°C
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-55~150	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C, Unless otherwise noted)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MPS2906		MPS2907		UNIT
			MIN.	MAX.	MIN.	MAX.	
Collector Cut-off Current	I_{CBO}	V_{CB}=-50V, I_E=0	-	-20	-	-20	nA
Collector Cut-off Current	I_{CBO}	V_{CB}=-50V, I_E=0, Ta=150°C	-	-20	-	-20	μA
Collector Cut-off Current	I_{CEX}	V_{CE}=-30V, V_{BE}=0.5V	-	-50	-	-50	nA
Base Cut-off Current	I_{BL}	V_{CE}=-30V, V_{BE}=0.5V	-	-50	-	-50	nA
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C=-10μA, I_E=0	-60	-	-60	-	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=-10mA, I_B=0	-40	-	-40	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=-10μA, I_C=0	-5.0	-	-5.0	-	V
DC Current Gain	h_{FE}	V_{CE}=-10V, I_C=-0.1mA	20	-	35	-	
		V_{CE}=-10V, I_C=-1.0mA	25	-	50	-	
		V_{CE}=-10V, I_C=-10mA	35	-	75	-	
		V_{CE}=-10V, I_C=-150mA	40	120	100	300	
		V_{CE}=-10V, I_C=-500mA	20	-	30	-	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=-150mA, I_B=-15mA	-	-0.4	-	-0.4	V
		I_C=-500mA, I_B=-50mA	-	-1.6	-	-1.6	
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	I_C=-150mA, I_B=-15mA	-	-1.3	-	-1.3	V
		I_C=-500mA, I_B=-50mA	-	-2.6	-	-2.6	
Transition Frequency	f_T	V_{CE}=-20V, I_C=-50mA f=100MHz	200	-	200	-	MHz
Collector Output Capacitance	C_{ob}	V_{CB}=-10V, I_E=0, f=100kHz	-	8.0	-	8.0	pF
Input Capacitance	C_{ib}	V_{EB}=-2.0V, I_C=0 f=100kHz	-	30	-	30	pF

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

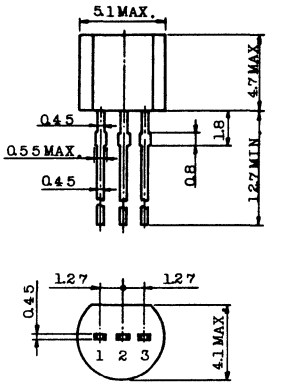
TOSHIBA TRANSISTOR
MPS2906A, MPS2907A
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR HIGH SPEED SWITCHING USE
DC TO VHF AMPLIFIER APPLICATIONS AND
COMPLEMENTARY CIRCUITRY.

FEATURES:

. High DC Current Gain Specified : -0.1~ -500mA
. High Transition Frequency
: @ I_C=-50mA, f_T=200MHz(Min.)
. Low Collector-Emitter Satulation Voltage
: $V_{CE(sat)}$=-1.6V(Max.) @ I_C=-500mA
. Complementary to MPS2221A, MPS2222A.

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

Weight : 0.21g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	-60	V
Collector-Emitter Voltage	V_{CEO}	-60	V
Emitter-Base Voltage	V_{EBO}	-5.0	V
Collector Current	I_C	-600	mA
Base Current	I_B	-120	mA
Total Device Dissipation @ Ta=25°C	P_C	625	mW
Derate above 25°C		5.0	mW/°C
Total Device Dissipation @ Tc=25°C	P_C	1.5	W
Derate above 25°C		12	mW/°C
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-55~150	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C, Unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MPS2906A		MPS2907A		UNIT
				MIN.	MAX.	MIN.	MAX.	
Collector Cut-off Current		I_{CBO}	V_{CB}=-50V, I_E=0	-	-10	-	-10	nA
Collector Cut-off Current		I_{CBO}	V_{CB}=-50V, I_E=0, Ta=150°C	-	-10	-	-10	μA
Collector Cut-off Current		I_{CEX}	V_{CE}=-30V, V_{BE}=0.5V	-	-50	-	-50	nA
Base Cut-off Current		I_{BL}	V_{CE}=-30V, V_{BE}=0.5V	-	-50	-	-50	nA
Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=-10μA, I_E=0	-60	-	-60	-	V
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-10mA, I_B=0	-60	-	-60	-	V
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=-10μA, I_C=0	-5.0	-	-5.0	-	V
DC Current Gain		h_{FE}	V_{CE}=-10V, I_C=-0.1mA	40	-	75	-	
			V_{CE}=-10V, I_C=-1.0mA	40	-	100	-	
			V_{CE}=-10V, I_C=-10mA	40	-	100	-	
			V_{CE}=-10V, I_C=-150mA	40	120	100	300	
			V_{CE}=-10V, I_C=-500mA	40	-	50	-	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=-150mA, I_B=-15mA	-	-0.4	-	-0.4	V
			I_C=-500mA, I_B=-50mA	-	-1.6	-	-1.6	
Base-Emitter Satulation Voltage		$V_{BE(sat)}$	I_C=-150mA, I_B=-15mA	-	-1.3	-	-1.3	V
			I_C=-500mA, I_B=-50mA	-	-2.6	-	-2.6	
Transition Frequency		f_T	V_{CE}=-20V, I_C=-50mA f=100MHz	200	-	200	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=-10V, I_E=0, f=100kHz	-	8.0	-	8.0	pF
Input Capacitance		C_{ib}	V_{BE}=-2.0V, I_C=0 f=100kHz	-	30	-	30	pF
Switching Time	Turn-on Time	t_{on}	V_{CC}=-30V, I_C=-150mA	-	45	-	45	ns
	Delay Time	t_d	I_{B1}=-15mA	-	10	-	10	
	Rise Time	t_r	Fig. 1	-	40	-	40	
	Turn-off Time	t_{off}	V_{CC}=-6.0V, I_C=-150mA	-	100	-	100	
	Storage Time	t_{stg}	$-I_{B1}=I_{B2}$=-15mA	-	80	-	80	
	Fall Time	t_f	Fig. 2	-	30	-	30	

Fig. 1 DELAY AND RISE TIME TEST CIRCUIT

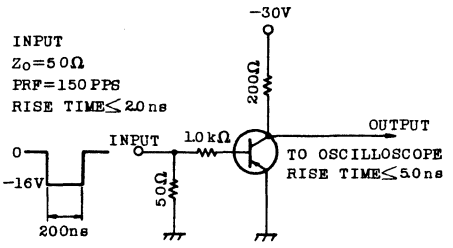
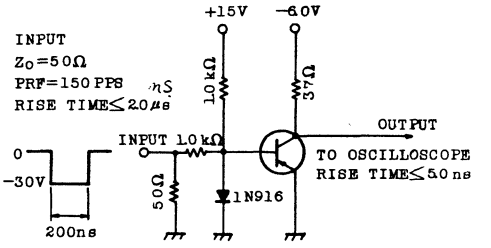


Fig. 2 STORAGE AND FALL TIME TEST CIRCUIT



TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

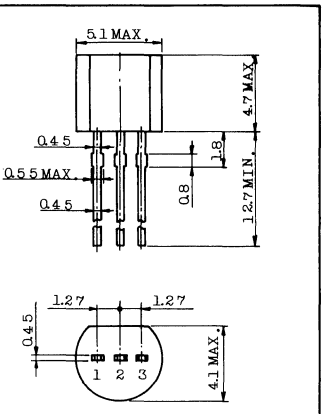
TOSHIBA DARLINGTON TRANSISTOR
MPS-A13, MPS-A14
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR PRINTER DRIVE, CORE DRIVE AND LED DRIVE APPLICATIONS.

FEATURE:

. High DC Current Gain @ I_C=100mA
MPS-A13 h_{FE}=10,000 Min.
MPS-A14 h_{FE}=20,000 Min.

Unit in mm



1. EMITTER
2. BASE
3. COLLECTOR

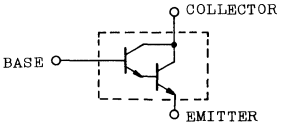
JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1F

Weight : 0.21g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	500	mA
Base Current	I_B	50	mA
Total Device Dissipation Ta=25°C	P_C	625	mW
Derate above 25°C		5.0	mW/°C
Total Device Dissipation Tc=25°C	P_C	1.5	W
Derate above 25°C		12	mW/°C
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-55~150	°C

EQUIVALENT CIRCUIT



TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I_{CBO}	V_{CB}=30V, I_E=0	-	-	100	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=10V, I_C=0	-	-	100	nA
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C=0.1mA, I_E=0	30	-	-	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=0.1mA, I_B=0	30	-	-	V
DC Current Gain	$h_{FE(1)}$ (MPS-A13)	V_{CE}=5.0V, I_C=10mA	5000	-	-	
	$h_{FE(1)}$ (MPS-A14)		10,000	-	-	
	$h_{FE(2)}$ (MPS-A13)	V_{CE}=5.0V, I_C=100mA	10,000	-	-	
	$h_{FE(2)}$ (MPS-A14)		20,000	-	-	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=100mA, I_B=0.1mA	-	-	1.5	V
Base-Emitter On Voltage	$V_{BE(ON)}$	V_{CE}=5V, I_C=100mA	-	-	2.0	V
Transition Frequency	f_T	V_{CE}= 5V, I_C=10mA, f=100MHz	125	500	-	MHz
Collector Output Capacitance	Cob	V_{CB}=10V, I_E=0, f=1MHz	-	3.5	8.0	pF
Noise Figure	NF	V_{CE}=5.0V, I_C=1.0mA R_S=100kΩ, f=1.0kHz	-	2.0	-	dB

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR

2N3055

SILICON NPN TRIPLE DIFFUSED TYPE

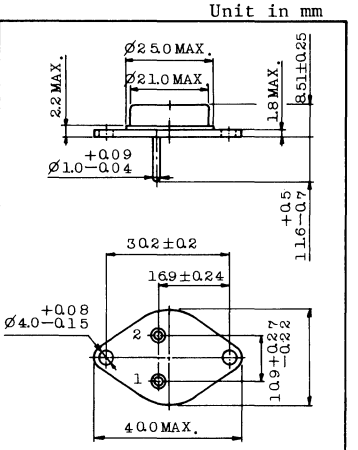
GENERAL PURPOSE POWER TRANSISTOR.

POWER REGULATOR, SWITCHING AND SOLLENOID DRIVES APPLICATIONS.

FEATURES:

. High Gain at High Current
. Low Saturation Voltage : $V_{CE(sat)} < 1.1V$, @I_C=4A, I_B=0.4A
. Excellent Area of Safe Operatings

Unit in mm



1. BASE
2. EMITTER
COLLECTOR (CASE)

JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21D1A

Weight : 12.6g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	RATING	UNIT
*	Collcetor-Base Voltage	V_{CBO}	100	V
*	Collector-Emitter Sustaining Voltage (R_{BE}=100 Ω)	$V_{CER(SUS)}$	70	V
*	Collector-Emitter Sustaining Voltage	$V_{CEO(SUS)}$	60	V
*	Emitter-Base Voltage	V_{EBO}	7	V
*	Collector Current	I_C	15	A
*	Base Current	I_B	7	A
*	Collector Power Dissipation (Tc=25°C) Derate Linearly	P_C	115	W
			0.66	W / °C
*	Junction Temperature	T_j	200	°C
*	Storage Temperature Range	T_{stg}	-65 ~ 200	°C

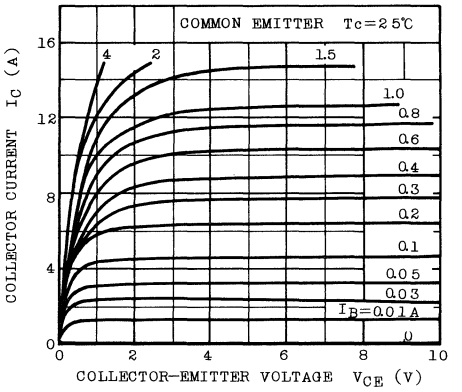
ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
*	Collector Cut-off Current	I_{CEX}	V_{CE}=100V, V_{BE}=-1.5V	-	-	5	mA
*	Collector Cut-off Current	I_{CEX}	V_{CE}=100V, V_{BE}=-1.5V, Tc=150°C	-	-	30	mA
*	Collector Cut-off Current	I_{CEO}	V_{CE}=30V, I_B=0	-	-	0.7	mA
*	Emitter Cut-off Current	I_{EBO}	V_{EB}=7V, I_C=0	-	-	5	mA
*	Collector-Emitter Sustaining Voltage	$V_{CER(SUS)}$ **	I_C=0.2A, R_{BE}=100 Ω	70	-	-	V
*	Collector-Emitter Sustaining Voltage	$V_{CEO(SUS)}$ **	I_C=0.2A, I_B=0	60	-	-	V
*	DC Current Gain	h_{FE}	V_{CE}=4V, I_C=4A	20	-	70	
			V_{CE}=4V, I_C=10A	5	-	-	
*	Base-Emitter Voltage	V_{BE}	V_{CE}=4V, I_C=4A	-	-	1.8	V
*	Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=4A, I_B=0.4A	-	-	1.1	V
			I_C=10A, I_B=3.3A	-	-	8	V
*	Small Signal Current Gain Cut-off Frequency	f_{hfe}	V_{CE}=4V, I_C=1A, f=10kHz	20	-	-	kHz
*	Small Signal Current Gain	$\|h_{fe}\|$	V_{CE}=4V, I_C=1A, f=1MHz	2.5	-	-	
*	Second Breakdown Collector Current (Base Forward Bias)	$I_{s/b}$	V_{CE}=40V, t=1s (non repetitive)	2.87	-	-	A

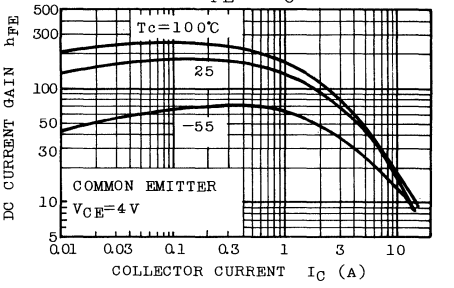
* In Accordance With JEDEC Registration Data.
** The sustaining voltages $V_{CER(SUS)}$ and $V_{CEO(SUS)}$ MUST NOT be measured on a curve tracer.

TOSHIBA CORPORATION

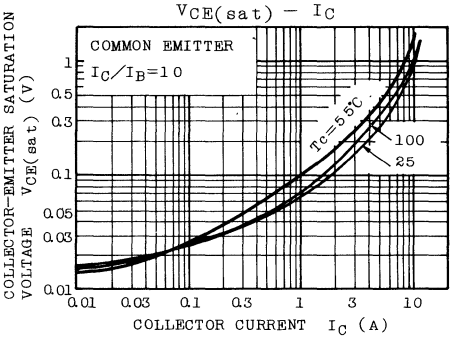
$I_C - V_{CE}$



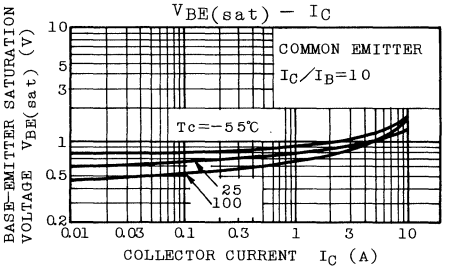
$h_{FE} - I_C$



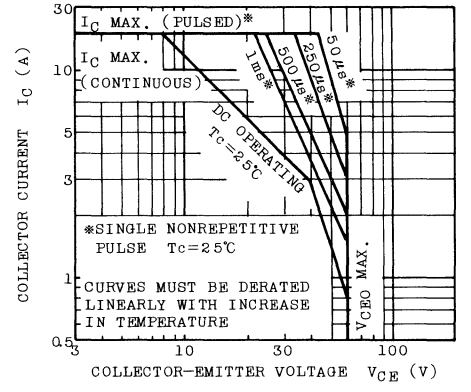
$V_{CE(sat)} - I_C$



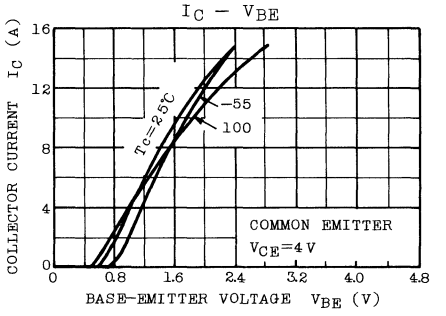
$V_{BE(sat)} - I_C$



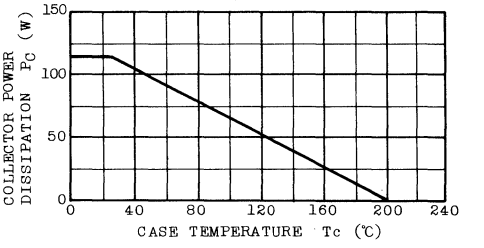
SAFE OPERATING AREA



$I_C - V_{BE}$



$P_C - T_C$



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR

2N3771

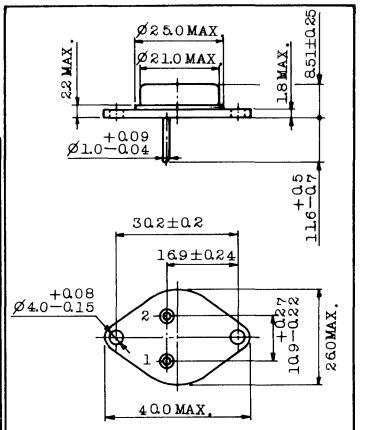
SILICON NPN TRIPLE DIFFUSED TYPE

HIGH POWER AMPLIFIER, POWER SWITCHING,
DC-DC CONVERTER AND REGULATOR APPLICATIONS

FEATURES:

. High Collector Dissipation : P_C=150W (Tc=25°C)
. High Collector Current : I_C=30A (D.C)

Unit in mm



1. BASE
2. EMITTER
COLLECTOR(CASE)

JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21D1A

Weight : 12.6g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC		SYMBOL	RATING	UNIT
※	Collector-Base Voltage		V_{CBO}	50	V
※	Collector-Emitter Voltage (V_{BE}=-1.5V, R_{BE}=100Ω)		V_{CEX}	50	V
※	Collector-Emitter Voltage		V_{CEO}	40	V
※	Emitter-Base Voltage		V_{EBO}	5	V
※	Collector Current	DC	I_C	30	A
		Peak	I_{CM}	30	A
※	Base Current	DC	I_B	7.5	A
		Peak	I_{BM}	15	A
※	Collector Power Dissipation (Tc=25°C)		P_C	150	W
※	Junction Temperature		T_j	200	°C
※	Storage Temperature Range		T_{stg}	-65∼200	°C

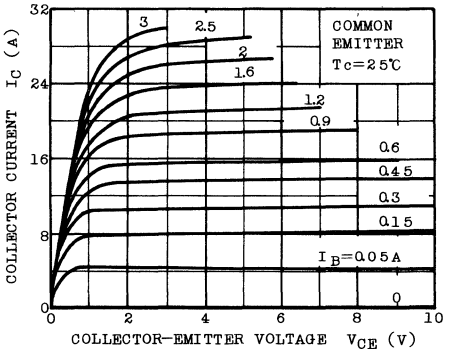
ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current	I_{CBO}	V_{CB}=50V, I_E=0	-	-	2	mA
※	Collector Cut-off Current	I_{CEX}	V_{CE}=50V, V_{BE}=-1.5V	-	-	2	mA
※	Collector Cut-off Current	I_{CEX}	V_{CE}=30V, V_{BE}=-1.5V Tc=150°C	-	-	10	mA
※	Collector Cut-off Current	I_{CEO}	V_{CE}=30V, I_B=0	-	-	10	mA
※	Emitter Cut-off Current	I_{EBO}	V_{EB}=5V, I_C=0	-	-	5	mA
※	Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=200mA, I_B=0	40	-	-	V
※	DC Current Gain	h_{FE}	V_{CE}=4V, I_C=15A	15	-	60	
			V_{CE}=4V, I_C=30A	5	-	-	
※	Base-Emitter Voltage	V_{BE}	V_{CE}=4V, I_C=15A	-	-	2.7	V
※	Collector-Emitter	$V_{CE(sat)}$	I_C=15A, I_B=1.5A	-	-	2	V
			I_C=30A, I_B=6A	-	-	4	V
※	Transition Frequency	f_T	V_{CE}=4V, I_C=1A	0.2	-	-	MHz
※	Small Signal Forward Current Transfer Ratio	h_{fe}	V_{CE}=4V, I_C=1A f=1kHz	40	-	-	

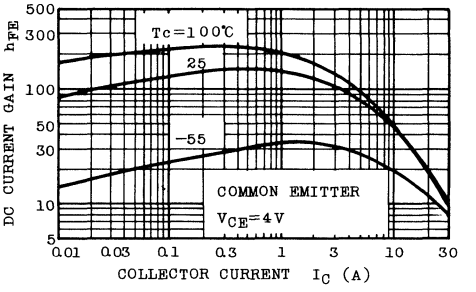
※In Accordance with JEDEC Registration Data.

TOSHIBA CORPORATION

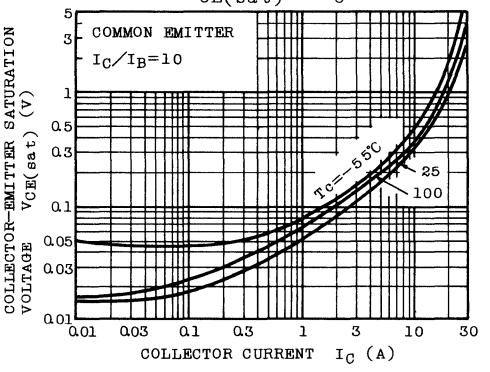
$I_C - V_{CE}$



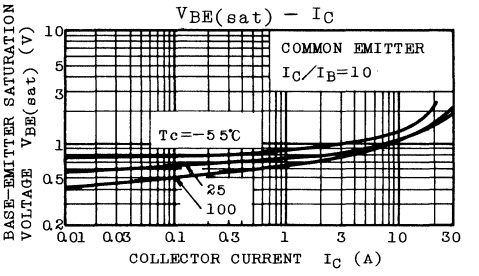
$h_{FE} - I_C$



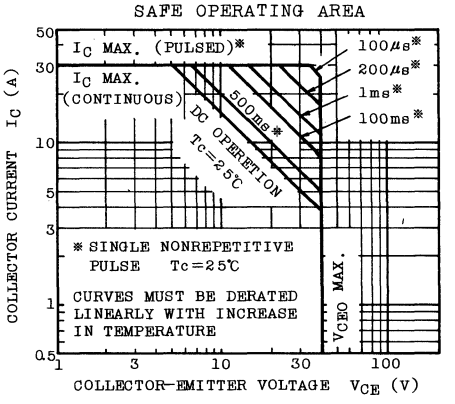
$V_{CE(sat)} - I_C$



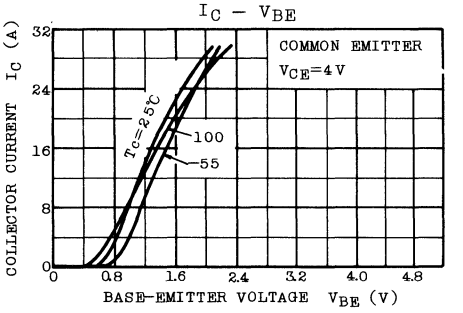
$V_{BE(sat)} - I_C$



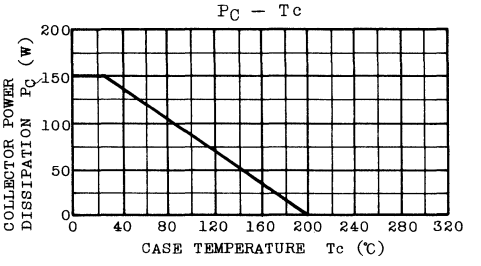
SAFE OPERATING AREA



$I_C - V_{BE}$



$P_C - T_C$



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR

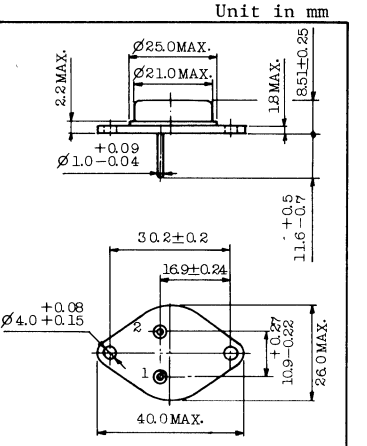
2N3772

SILICON NPN TRIPLE DIFFUSED TYPE

HIGH POWER AMPLIFIER, POWER SWITCHING
DC-DC CONVERTER AND REGULATOR APPLICATIONS

FEATURES:
. High Collector Dissipation : P_C=150W (Tc=25°C)
. High Collector Current : I_C=20A (D.C)

Unit in mm



1. BASE
2. EMITTER
COLLECTOR (CASE)

JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21D1A

Weight : 12.6g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC		SYMBOL	RATING	UNIT
※	Collector-Base Voltage		V_{CBO}	100	V
※	Collector-Emitter Voltage (V_{BE}=-1.5V, R_{BE}=100Ω)		V_{CEX}	100	V
※	Collector-Emitter Voltage		V_{CEO}	60	V
※	Emitter-Base Voltage		V_{EBO}	7	V
※	Collector Current	DC	I_C	20	A
		Peak	I_{CM}	30	A
※	Base Current	DC	I_B	5	A
		Peak	I_{BM}	15	A
※	Collector Power Dissipation (Tc=25°C)		P_C	150	W
※	Junction Temperature		T_j	200	°C
※	Storage Temperature Range		T_{stg}	-65 ∿ 200	°C

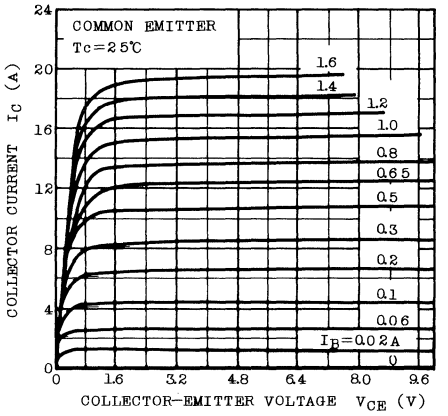
ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current	I_{CBO}	V_{CB}=100V, I_E=0	-	-	5	mA
※	Collector Cut-off Current	I_{CEX}	V_{CE}=100V, V_{BE}=-1.5V	-	-	5	mA
※	Collector Cut-off Current	I_{CEX}	V_{CE}=30V, V_{BE}=-1.5V Tc=150°C	-	-	10	mA
※	Collector Cut-off Current	I_{CEO}	V_{CE}=50V, I_B=0	-	-	10	mA
※	Emitter Cut-off Current	I_{EBO}	V_{EB}=7V, I_C=0	-	-	5	mA
※	Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=200mA, I_B=0	60	-	-	V
※	DC Current Gain	h_{FE}	V_{CE}=4V, I_C=10A	15	-	60	
			V_{CE}=4V, I_C=20A	5	-	-	
※	Base-Emitter Voltage	V_{BE}	V_{CE}=4V, I_C=10A	-	1.0	2.2	V
※	Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=10A, I_B=1A	-	0.3	1.4	V
			I_C=20A, I_B=4A	-	-	4	V
※	Transition Frequency	f_T	V_{CE}=4V, I_C=1A	0.2	-	-	MHz
※	Small Signal Current Gain	$\|h_{fe}\|$	V_{CE}=4V, I_C=1A, f=1kHz	40	-	-	

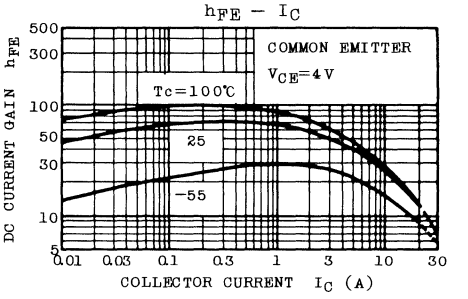
※ In Accordance with JEDEC Registration Data.

TOSHIBA CORPORATION

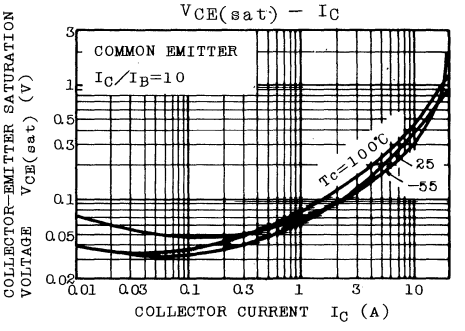
$I_C - V_{CE}$



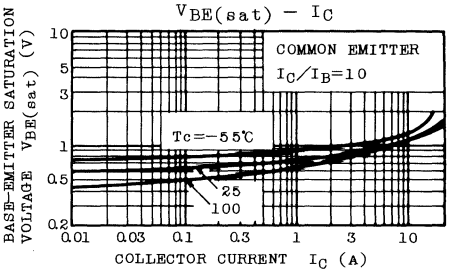
$h_{FE} - I_C$



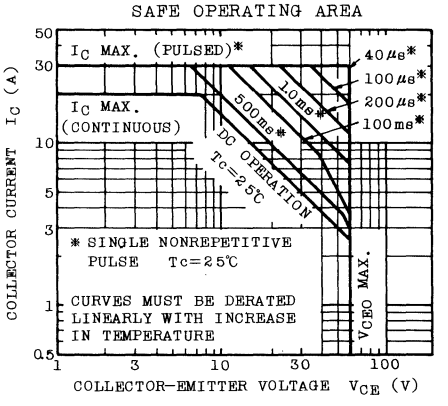
$V_{CE(sat)} - I_C$



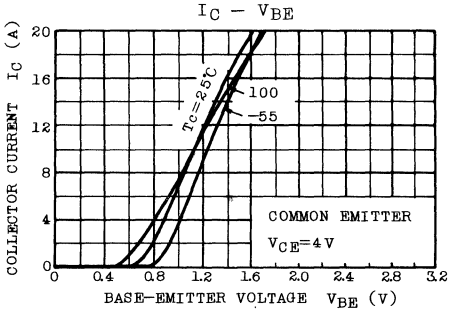
$V_{BE(sat)} - I_C$



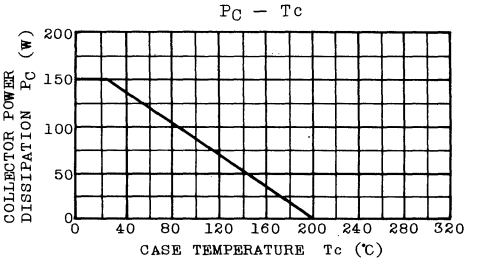
SAFE OPERATING AREA



$I_C - V_{BE}$



$P_C - Tc$



TOSHIBA CORPORATION

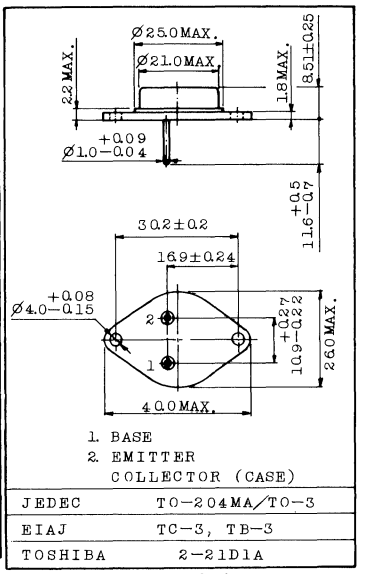
TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
2N3773
SILICON NPN TRIPLE DIFFUSED TYPE

HIGH POWER AMPLIFER, POWER SWITCHING,
DC-DC CONVERTER AND REGULATOR APPLICATIONS

FEATURES:
. High Collector-Emitter Sustaining Voltage:
$V_{CEO(SUS)}$=140V (Min.) @I_C=0.2A, I_B=0
. Excellent Area of Safe Operatings.

Unit in mm



1. BASE
2. EMITTER
COLLECTOR (CASE)

JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21D1A

Weight : 12.6g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC		SYMBOL	RATING	UNIT
※	Collector-Base Voltage		V_{CBO}	160	V
※	Collector-Emitter Voltage		V_{CEX}	160	V
※	Collector-Emitter Voltage		V_{CEO}	140	V
※	Emitter-Base Voltage		V_{EBO}	7	V
※	Collector Current	DC	I_C	16	A
		Peak	I_{CM}	30	A
※	Base Current	DC	I_B	4	A
		Peak	I_{BM}	15	A
※	Collector Power Dissipation (Tc=25°C)		P_C	150	W
	Derate Linearly above 25°C			0.855	W/°C
※	Junction Temperature		T_j	200	°C
※	Storage Temperature		T_{stg}	-65~200	°C

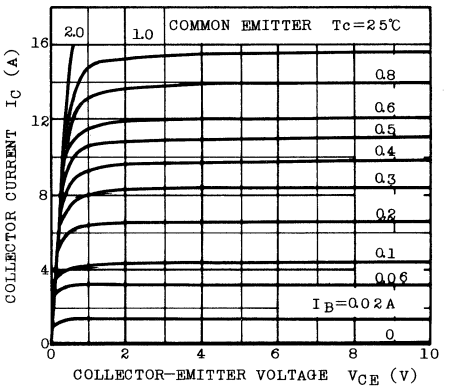
ELECTRICAL CHARACTERISTICS (Ta=25°C)

	CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
※	Collector Cut-off Current	I_{CBO}	V_{CB}=140V, I_E=0	-	-	2.0	mA
※	Collector Cut-off Current	I_{CEX}	V_{CE}=140V, V_{BE}=-1.5V	-	-	2.0	mA
※	Collector Cut-off Current	I_{CEX}	V_{CE}=140V, V_{BE}=-1.5V, Tc=150°C	-	-	10	mA
※	Collector Cut-off Current	I_{CEO}	V_{CE}=120V, I_B=0	-	-	10	mA
※	Emitter Cut-off Current	I_{EBO}	V_{EB}=7V, I_C=0	-	-	5.0	mA
※	Collector-Emitter Sustaining Voltage	$V_{CEX(SUS)}$ ※※	I_C=0.1A, V_{BE}=-1.5V, R_{BE}=100Ω	160	-	-	V
※	Collector-Emitter Sustaining Voltage	$V_{CER(SUS)}$ ※※	I_C=0.2A, R_{BE}=100Ω	150	-	-	V
※	Collector-Emitter Sustaining Voltage	$V_{CEO(SUS)}$ ※※	I_C=0.2A, I_B=0	140	-	-	V
※	DC Current Gain	h_{FE}	V_{CE}=4.0V, I_C=8A	15	-	60	
			V_{CE}=4.0V, I_C=16A	5	-	-	
※	Base-Emitter Voltage	V_{BE}	V_{CE}=4.0V, I_C=8A	-	-	2.2	V
※	Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=8A, I_B=0.8A	-	-	1.4	V
			I_C=16A, I_B=3.2A	-	-	4.0	V
※	Small Signal Current Gain	h_{fe}	V_{CE}=4V, I_C=1.0A, f=1kHz	40	-	-	
※	Small Signal Forward Current Transfer Ratio	$\|h_{fe}\|$	V_{CE}=4V, I_C=1.0A, f=50kHz	4	-	-	

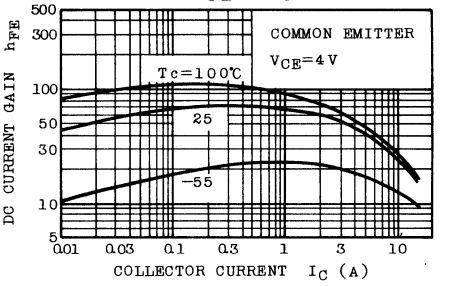
※In Accordance with JEDEC Registration Data.
※※The sustaining voltages $V_{CEX(SUS)}$, $V_{CER(SUS)}$ and $V_{CEO(SUS)}$ MUST NOT be measured on a curve tracer.

TOSHIBA CORPORATION

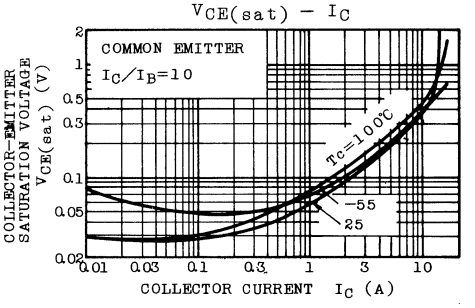
$I_C - V_{CE}$



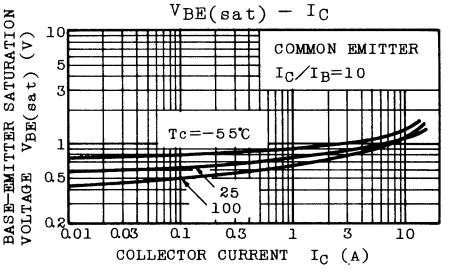
$h_{FE} - I_C$



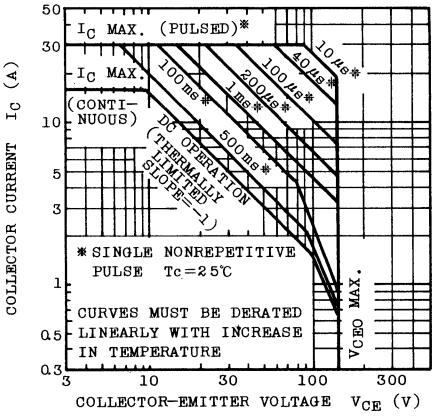
$V_{CE(sat)} - I_C$



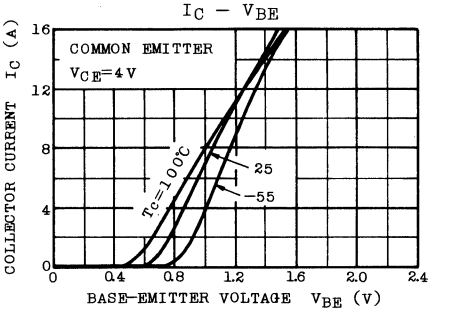
$V_{BE(sat)} - I_C$



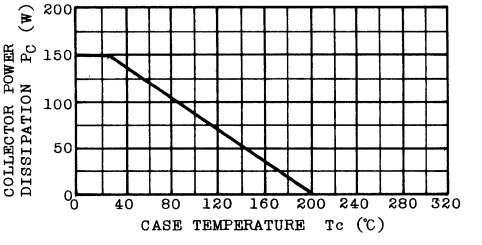
SAFE OPERATING AREA



$I_C - V_{BE}$



$P_C - Tc$



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

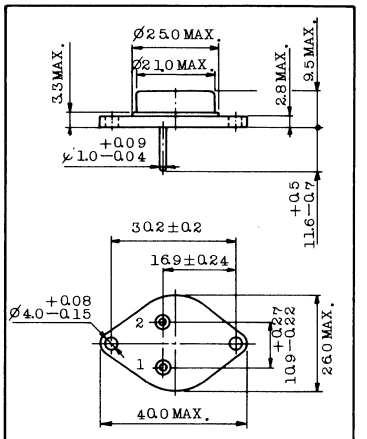
TOSHIBA TRANSISTOR
2N6546
SILICON NPN TRIPLE DIFFUSED TYPE

SWITCHING REGULATOR AND HIGH VOLTAGE SWITCHING APPLICATIONS.
HIGH SPEED DC-DC CONVERTER, RELAY AND SOLENOID DRIVER APPLICATIONS.

FEATURES:

. High Sustaining Voltage : $V_{CEO(SUS)}$=300V (Min.)
. High Collector Current : I_C=15A (Max.)
. Excellent Switching Times

Unit in mm



1. BASE
2. EMITTER
COLLECTOR (CASE)

JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21E1A

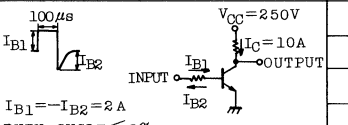
Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC		SYMBOL	RATING	UNIT
	Collector-Base Voltage		V_{CBO}	650	V
*	Collector-Emitter Voltage		V_{CEV}	650	V
*	Collector-Emitter Sustaining Voltage		$V_{CEX(SUS)}$	350	V
*	Collector-Emitter Sustaining Voltage		$V_{CEO(SUS)}$	300	V
*	Emitter-Base Voltage		V_{EBO}	9	V
*	Collector Current	DC	I_C	15	A
		Peak	I_{CM}	30	A
*	Base Current		I_B	10	A
*	Emitter Current		I_E	- 25	A
*	Collector Power Dissipation	Tc=25°C	P_C	175	W
		Tc=100°C		100	W
	Derate Linearly above 25°C			1	W/°C
*	Junction Temperature		T_j	200	°C
*	Storage Temperature Range		T_{stg}	-65 ~ 200	°C
*	Thermal Resistance		θ_{jc}	1	°C/W
*	Lead Temperature (3.17mm from case for 5s)		T_L	275	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

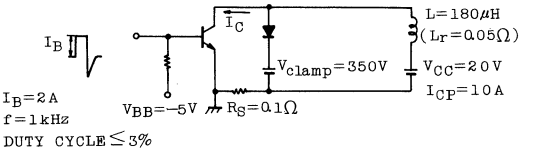
	CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
*	Collector Cut-off Current		I_{CEV}	V_{CE}=650V, V_{BE}=-1.5V	-	-	1	mA
*	Collector Cut-off Current		I_{CEV}	V_{CE}=650V, V_{BE}=-1.5V; Tc=100°C	-	-	4	mA
*	Collector Cut-off Current		I_{CER}	V_{CE}=650V, R_{BE}=50Ω, Tc=100°C	-	-	5	mA
*	Emitter Cut-off Current		I_{EBO}	V_{EB}=9V, I_C=0	-	-	1	mA
*	Collector-Emitter Sustaining Voltage (Note:1)	**	$V_{CEX(SUS)}$	I_C=8A, V_{clamp}=350V, Tc=100°C	350	-	-	V
				I_C=15A, V_{clamp}=200V, Tc=100°C	200	-	-	V
*	Collector-Emitter Sustaining Voltage	**	$V_{CEO(SUS)}$	I_C=0.1A, I_B=0	300	-	-	V
*	DC Current Gain		h_{FE}	V_{CE}=2V, I_C=5A	12	-	60	
				V_{CE}=2V, I_C=10A	6	-	30	
*	Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=10A, I_B=2A	-	-	1.5	V
				I_C=15A, I_B=3A	-	-	5	V
				I_C=10A, I_B=2A, Tc=100°C	-	-	2.5	V
*	Base-Emitter Saturation Voltage		$V_{BE(sat)}$	I_C=10A, I_B=2A	-	-	1.6	V
				I_C=10A, I_B=2A, Tc=100°C	-	-	1.6	V
*	Transition Frequency		f_T	V_{CE}=10V, I_C=0.5A, f=1MHz	6	-	28	MHz
*	Collector Output Capacitance		C_{ob}	V_{CB}=10V, I_E=0, f=1MHz	125	-	500	pF
*	Switching Time	Delay Time	t_d	 I_{B1}=-I_{B2}=2A DUTY CYCLE≤2%	-	-	0.05	μs
		Rise Time	t_r		-	-	1.0	μs
		Storage Time	t_{stg}		-	-	4.0	μs
		Fall Time	t_f		-	-	0.7	μs
		Storage Time	t_{stg}	See Fig.1 Tc=100°C	-	-	5.0	μs
		Fall Time	t_f		-	-	1.5	μs
*	Second Breakdown Collector Current(Base forward biased)		$I_{s/b}$	V_{CE}=100V, t=1s (non repetitive)	0.2	-	-	A

* In Accordance with JEDEC Registration Data.

** The sustaining voltages $V_{CEX(SUS)}$ and $V_{CEO(SUS)}$ MUST NOT be measured on a curve tracer.

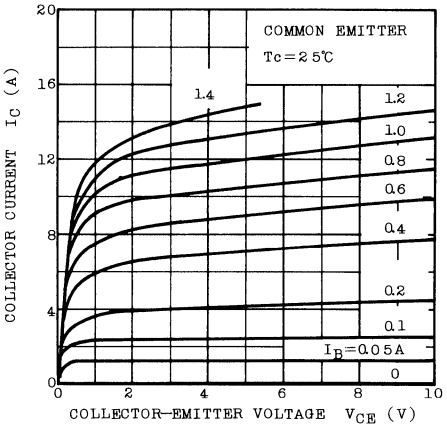
Note 1 : Test condition V_{CC}=20V, L=180μH, (L_r=0.05Ω)

Fig.1 : Inductive Load Switching Time Test Circuit.

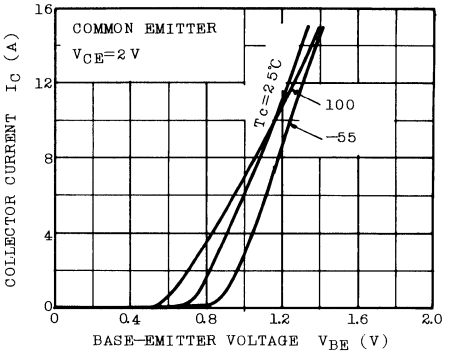


TOSHIBA CORPORATION

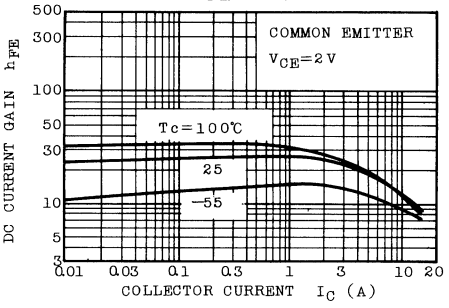
$I_C - V_{CE}$



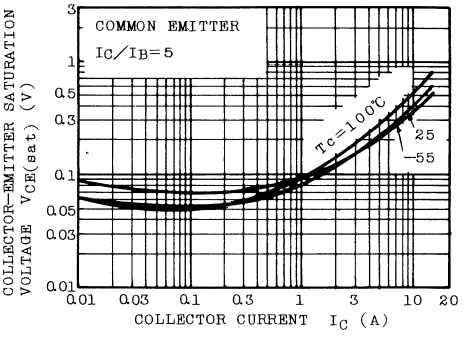
$I_C - V_{BE}$



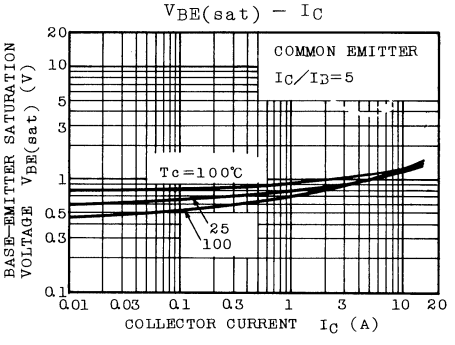
$h_{FE} - I_C$



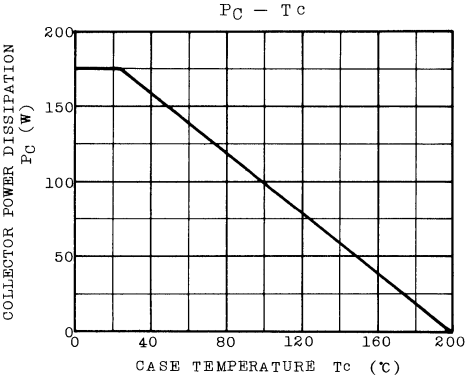
$V_{CE(sat)} - I_C$



$V_{BE(sat)} - I_C$



$P_C - T_C$



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

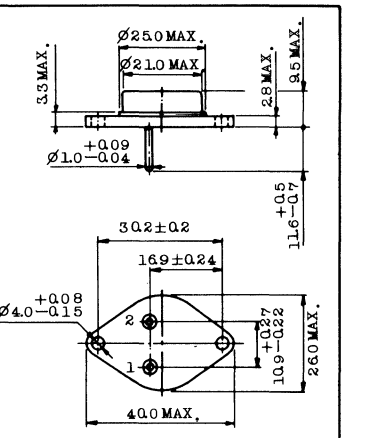
TOSHIBA TRANSISTOR
2N6547
SILICON NPN TRIPLE DIFFUSED TYPE

SWITCHING REGULATOR AND HIGH VOLTAGE SWITCHING APPLICATIONS.
HIGH SPEED DC-DC CONVERTER, RELAY AND SOLENOID DRIVER APPLICATIONS.

FEATURES:

. High Sustaining Voltage : $V_{CEO(SUS)}$=400V (Min.)
. High Collector Current : I_C=15A (Max.)
. Excellent Switching Times

Unit in mm



1. BASE
2. EMITTER
COLLECTOR (CASE)

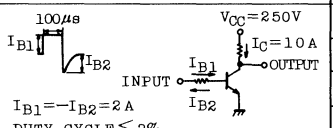
JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21E1A

Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

	CHARACTERISTIC		SYMBOL	RATING	UNIT
	Collector-Base Voltage		V_{CBO}	850	V
*	Collector-Emitter Voltage		V_{CEV}	850	V
*	Collector-Emitter Sustaining Voltage		$V_{CEX(SUS)}$	450	V
*	Collector-Emitter Sustaining Voltage		$V_{CEO(SUS)}$	400	V
*	Emitter-Base Voltage		V_{EBO}	9	V
*	Collector Current	DC	I_C	15	A
		Peak	I_{CM}	30	A
*	Base Current		I_B	10	A
*	Emitter Current		I_E	- 25	A
*	Collector Power Dissipation	Tc=25°C	P_C	175	W
		Tc=100°C		100	W
	Derate Linearly above 25°C			1	W/°C
*	Junction Temperature		T_j	200	°C
*	Storage Temperature Range		T_{stg}	-65 ~ 200	°C
*	Thermal Resistance		θ_{jc}	1	°C/W
*	Lead Temperature (3.17mm from case for 5s)		T_L	275	°C

ELECTRICAL CHARACTERISTICS ($Ta=25^{\circ}C$)

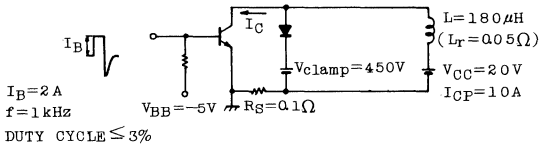
	CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
*	Collector Cut-off Current		I_{CEV}	V_{CE}=850V, V_{BE}=-1.5V	-	-	1	mA
*	Collector Cut-off Current		I_{CEV}	V_{CE}=850V, V_{BE}=-1.5V, Tc=100°C	-	-	4	mA
*	Collector Cut-off Current		I_{CER}	V_{CE}=850V, R_{BE}=50Ω, Tc=100°C	-	-	5	mA
*	Emitter Cut-off Current		I_{EBO}	V_{EB}=9V, I_C=0	-	-	1	mA
*	Collector-Emitter Sustaining Voltage (Note:1)		$V_{CEX(SUS)}$ **	I_C=8A, V_{clamp}=450V, Tc=100°C	450	-	-	V
				I_C=15A, V_{clamp}=300V, Tc=100°C	300	-	-	V
*	Collector-Emitter Sustaining Voltage		$V_{CEO(SUS)}$ **	I_C=0.1A, I_B=0	400	-	-	V
*	DC Current Gain		h_{FE}	V_{CE}=2V, I_C=5A	12	-	60	
				V_{CE}=2V, I_C=10A	6	-	30	
*	Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=10A, I_B=2A	-	-	1.5	V
				I_C=15A, I_B=3A	-	-	5	V
				I_C=10A, I_B=2A, Tc=100°C	-	-	2.5	V
*	Base-Emitter Saturation Voltage		$V_{BE(sat)}$	I_C=10A, I_B=2A	-	-	1.6	V
				I_C=10A, I_B=2A, Tc=100°C	-	-	1.6	V
*	Transition Frequency		f_T	V_{CE}=10V, I_C=0.5A, f=1MHz	6	-	28	MHz
*	Collector Output Capacitance		C_{ob}	V_{CB}=10V, I_E=0, f=1MHz	125	-	500	pF
*	Switching Time	Delay Time	t_d		-	-	0.05	μs
		Rise Time	t_r		-	-	1.0	μs
		Storage Time	t_{stg}		-	-	4.0	μs
		Fall Time	t_f		-	-	0.7	μs
		Storage Time	t_{stg}	See Fig.1 Tc=100°C	-	-	5.0	μs
		Fall Time	t_f		-	-	1.5	μs
*	Second Breakdown Collector Current (Base forward biased)		$I_{s/b}$	V_{CE}=100V, t=1s (non repetitive)	0.2	-	-	A

* In Accordance with JEDEC Registration Data.

** The sustaining voltages $V_{CEX(SUS)}$ and $V_{CEO(SUS)}$ MUST NOT be measured on a curve tracer.

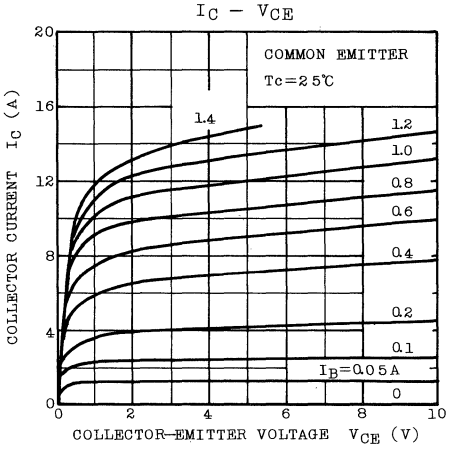
Note.1 : Test condition V_{CC}=20V, L=180μH (L_r=0.05Ω)

Fig. 1 : Inductive Load Switching Time Test Circuit

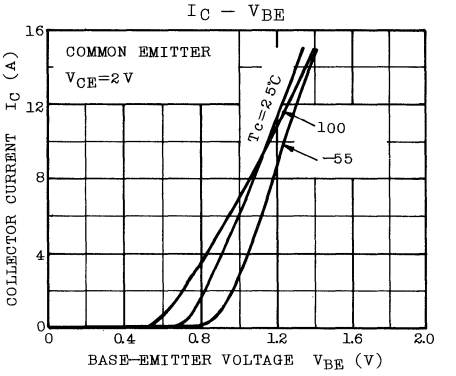


TOSHIBA CORPORATION

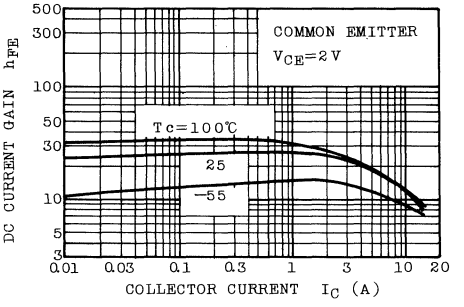
$I_C - V_{CE}$



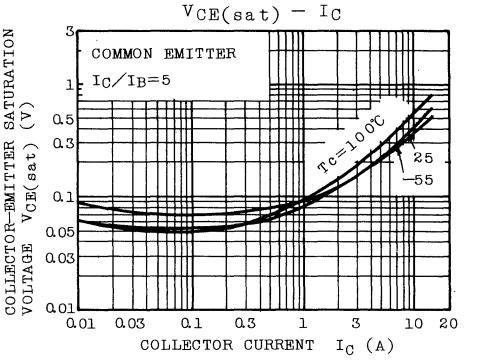
$I_C - V_{BE}$



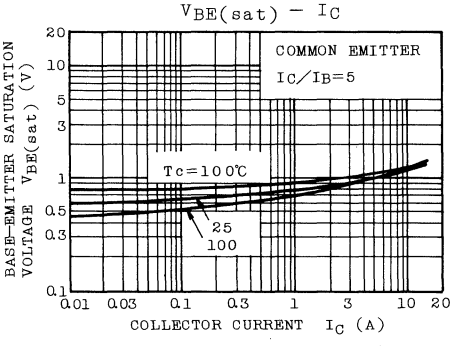
$h_{FE} - I_C$



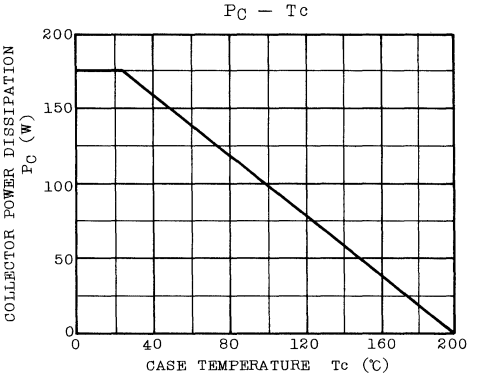
$V_{CE(sat)} - I_C$



$V_{BE(sat)} - I_C$



$P_C - T_C$



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR

BU208

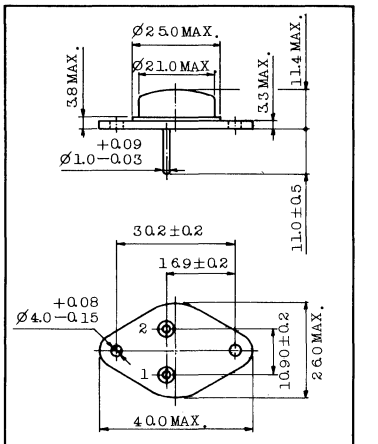
SILICON NPN TRIPLE DIFFUSED MESA TYPE

COLOR TV HORIZONTAL OUTPUT APPLICATIONS.
COLOR TV SWITCHING REGULATOR APPLICATIONS.

FEATURES:

- High Voltage : V_{CES}=1500V
- Low Saturation Voltage : $V_{CE(sat)}$=5V (Max.)
- Fall Time : tf=0.7μs (Typ.)
- Glass Passivated Base-Collector Junction

Unit in mm



1. BASE
2. EMITTER
COLLECTOR (CASE)

JEDEC	TO−3
EIAJ	TC−3, TB−3
TOSHIBA	2−21B1A

Mounting Kit No. AC42C

Weight : 17.0g

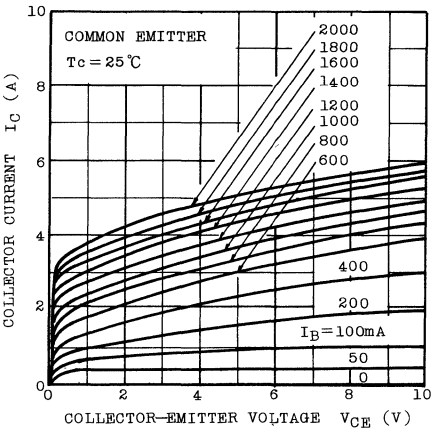
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Emitter Voltage		V_{CES}	1500	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	DC	I_C	5	A
	Peak	I_{CM}	7.5	A
Base Current (Peak)		I_{BM}	4	A
Total Power Dissipation (Tc≦95°C)		P_{tot}	12.5	W
Junction Temperature		T_j	+115	°C
Storage Temperature Range		T_{stg}	-65 ~ 115	°C
Thermal Resistance		$R_{th(j-c)}$	1.6	°C/W

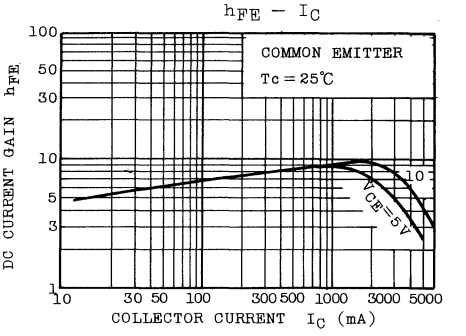
ELECTRICAL CHARACTERISTICS (Tc=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current		I_{CES}	V_{CE}=1500V, V_{BE}=0	-	-	1	mA
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=1mA, I_C=0	5	-	-	V
DC Current Gain		h_{FE}	V_{CE}=5V, I_C=4.5A	2.25	-	-	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=4.5A, I_B=2A	-	-	5	V
Base-Emitter Saturation Voltage		$V_{BE(sat)}$	I_C=4.5A, I_B=2A	-	-	1.5	V
Collector-Emitter Sustaining Voltage		$V_{CEO(SUS)}$	I_C=100mA, I_B=0, L=25mH	700	-	-	V
Transition Frequency		f_T	V_{CE}=5V, I_C=0.1A	-	7	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=10V, I_E=0, f=1MHz	-	125	-	pF
Switching Time	Fall Time	t_f	I_{CM}=4.5A, $I_{B(end)}$=1.8A	-	0.7	-	μs
	Storage Time	t_{stg}	I_{CM}=4.5A, $I_{B(end)}$=1.8A	-	10	-	μs

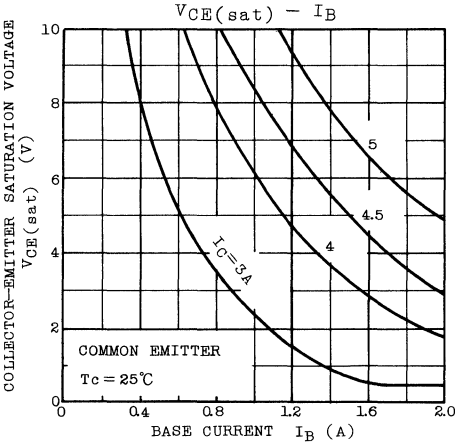
$I_C - V_{CE}$



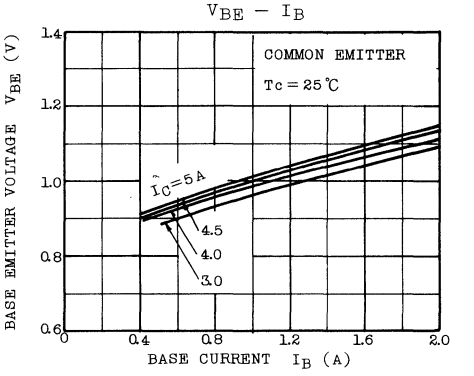
$h_{FE} - I_C$



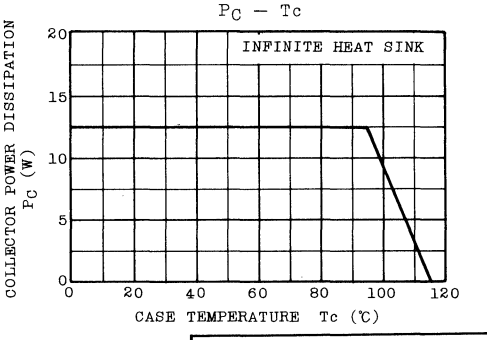
$V_{CE(sat)} - I_B$



$V_{BE} - I_B$



$P_C - T_C$



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR

BU208A

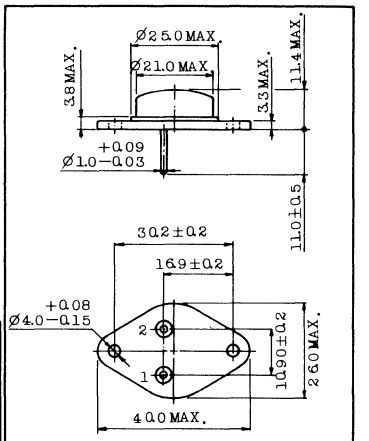
SILICON NPN TRIPLE DIFFUSED MESA TYPE

COLOR TV HORIZONTAL OUTPUT APPLICATIONS.
COLOR TV SWITCHING REGULATOR APPLICATIONS.

FEATURES:

- High Voltage : V_{CES}=1500V
- Low Saturation Voltage : $V_{CE(sat)}$=1V (Max.)
- Fall Time : t_f=0.7μs (Typ.)
- Glass Passivated Collector-Base Junction

Unit in mm



1. BASE
2. EMITTER
COLLECTOR (CASE)

JEDEC	TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21B1A

Mounting Kit No. AC42C

Weight : 17.0g

MAXIMUM RATINGS (Ta=25°C)

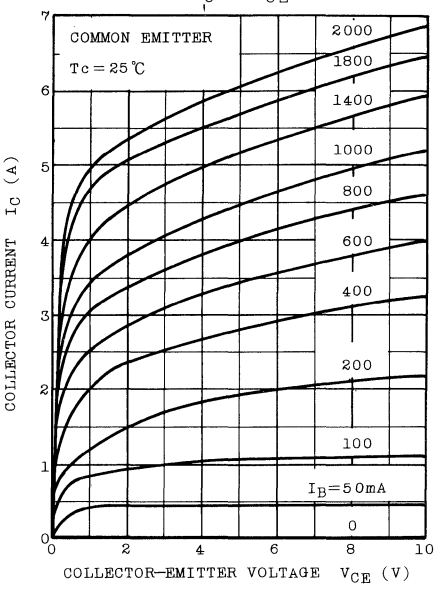
CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Emitter Voltage		V_{CES}	1500	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	DC	I_C	5	A
	Peak	I_{CM}	7.5	A
Base Current (Peak)		I_{BM}	4	A
Total Power Dissipation (Tc≦95°C)		P_{tot}	12.5	W
Junction Temperature		T_j	+115	°C
Storage Temperature Range		T_{stg}	-65~+115	°C
Thermal Resistance		$R_{th(j-c)}$	1.6	°C/W

ELECTRICAL CHARACTERISTICS (Tc=25°C)

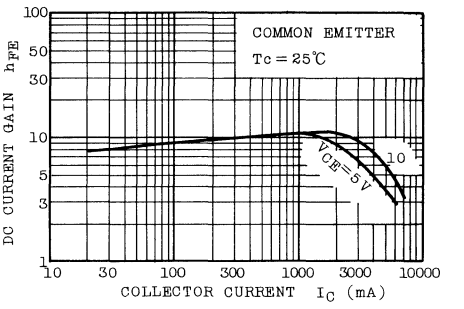
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current		I_{CES}	V_{CE}=1500V, V_{BE}=0	-	-	1	mA
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=1mA, I_C=0	5	-	-	V
DC Current Gain		h_{FE}	V_{CE}=5V, I_C=4.5A	2.25	-	-	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=4.5A, I_B=2A	-	-	1	V
Base-Emitter Saturation Voltage		$V_{BE(sat)}$	I_C=4.5A, I_B=2A	-	-	1.5	V
Collector-Emitter Sustaining Voltage		$V_{CEO(SUS)}$	I_C=100mA, I_B=0 L=25mH	700	-	-	V
Transition Frequency		f_T	V_{CE}=5V, I_C=0.1A	-	7	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=10V, I_E=0, f=1MHz	-	125	-	pF
Switching Time	Fall Time	t_f	I_{CM}=4.5A, $I_{B(end)}$=1.8A	-	0.7	-	μs
	Storage Time	t_{stg}	I_{CM}=4.5A, $I_{B(end)}$=1.8A	-	10	-	μs

TOSHIBA CORPORATION

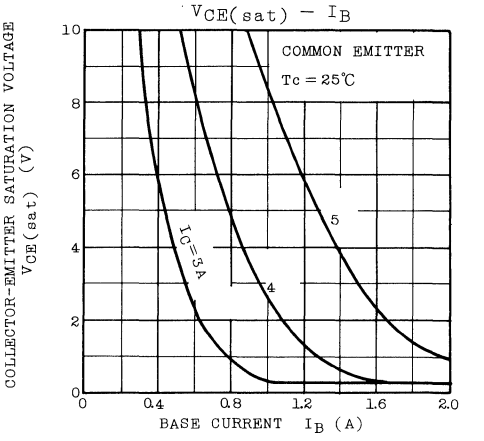
$I_C - V_{CE}$



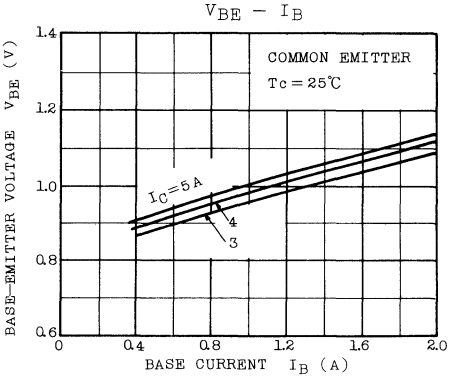
$h_{FE} - I_C$



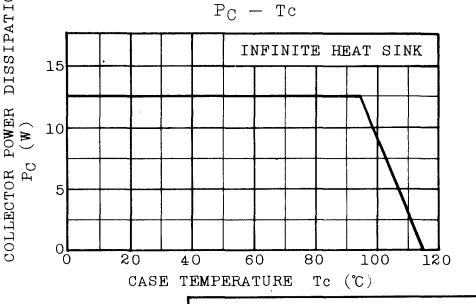
$V_{CE(sat)} - I_B$



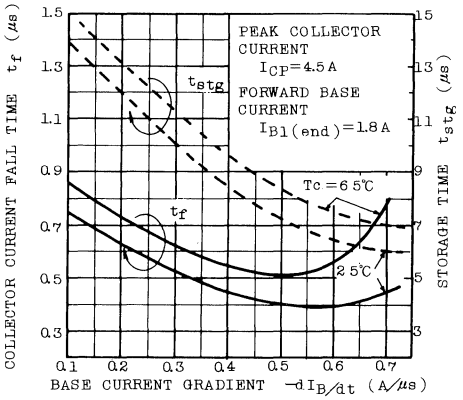
$V_{BE} - I_B$



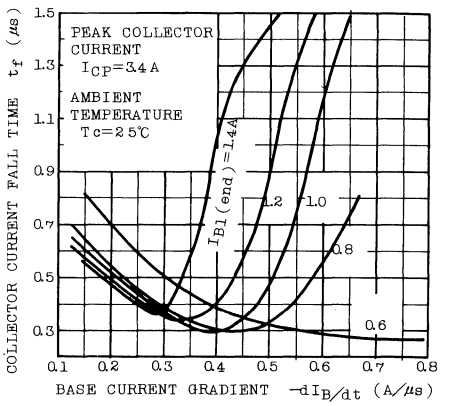
$P_C - T_c$



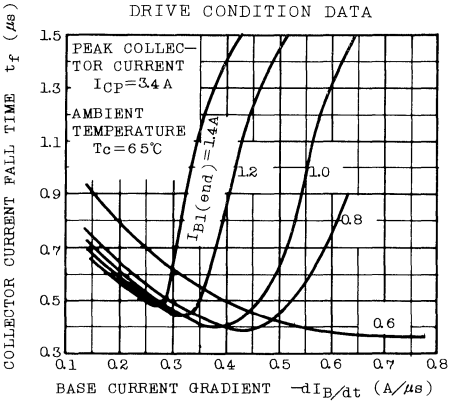
TYPICAL DRIVE CONDITION DATA



DRIVE CONDITION DATA



DRIVE CONDITION DATA



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR

BUY71

SILICON NPN TRIPLE DIFFUSED MESA TYPE

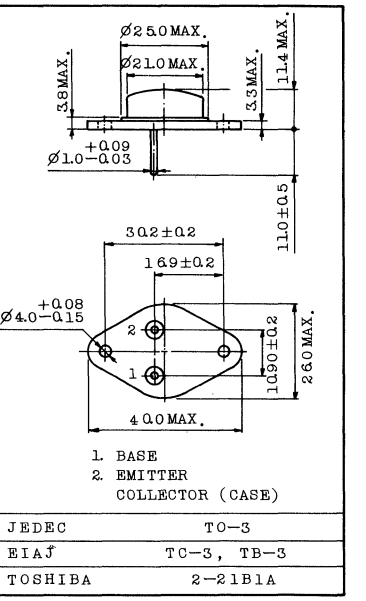
TV HORIZONTAL OUTPUT APPLICATION.

FEATURES:

. High Voltage : V_{CEX}=2200V

. Fast Switching : t_f=0.7μs (Typ.)

Unit in mm



JEDEC	TO−3
EIAJ	TC−3, TB−3
TOSHIBA	2−21B1A

Weight : 17.0g

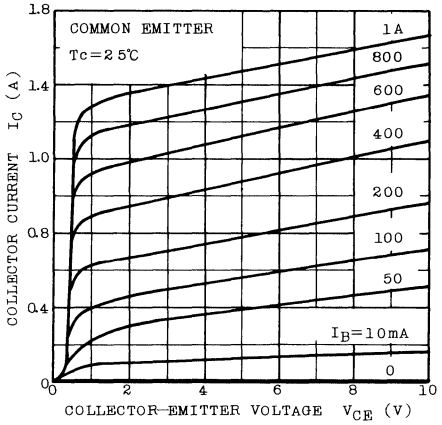
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	2200	V
Peak Collector-Emitter Voltage	V_{CEX}	2200	V
Collector-Emitter Voltage	V_{CEO}	800	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	2	A
Base Current	I_B	2	A
Collector Power Dissipation (Tc≦80°C)	P_C	10	W
Junction Temperature	T_j	100	°C
Storage Temperature Range	T_{stg}	-60 ~ 100	°C

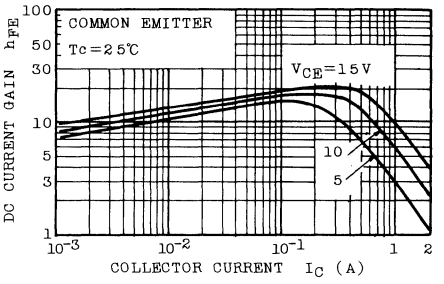
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Cut-off Current	I_{CEX}	V_{CE}=2200V, V_{BE}=-2V	-	-	1	mA
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=100mA, I_C=0	5	-	-	V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=1.5A, I_B=1.5A	-	-	10	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	I_C=1.5A, I_B=1.5A	-	-	1.5	V
Transition Frequency	f_T	V_{CE}=5V, I_C=0.1A	-	4	-	MHz
Collector Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=1.0MHz	-	50	-	pF
Fall Time	t_f	I_{cp}=1.2A $I_{B1(end)}$=0.55A	-	0.7	-	μs

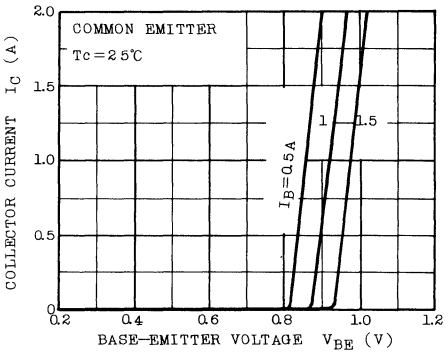
$I_C - V_{CE}$ (LOW VOLTAGE REGION)

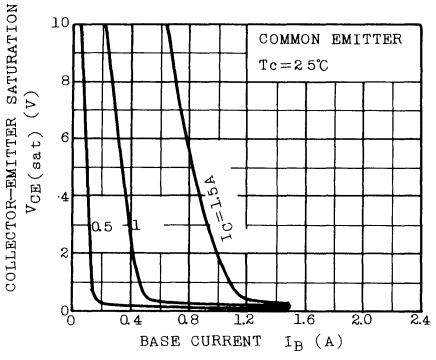


$h_{FE} - I_C$

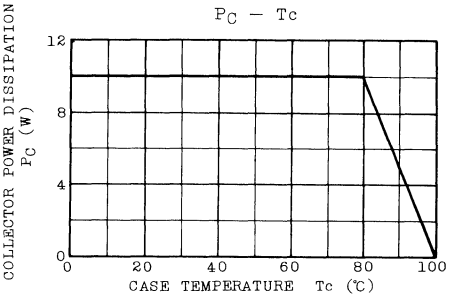


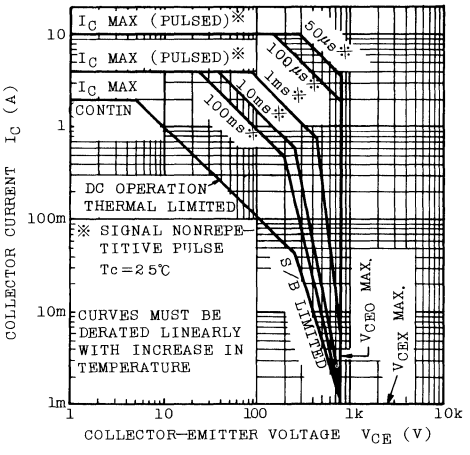
$I_C - V_{BE}$





$P_C - Tc$





TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
MJE13002
SILICON NPN TRIPLE DIFFUSED TYPE

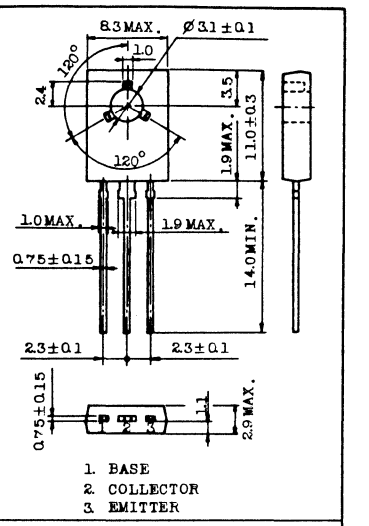
INDUSTRIAL APPLICATIONS

SWITCHING REGULATOR.
DC-DC CONVERTER, AC-DC INVERTER.
HIGH VOLTAGE, HIGH SPEED SWITCHING APPLICATION.

SPECIFICATION FEATURES:

- $V_{CEO(SUS)}$=300V(Min.)
- V_{CEV}=600V Blocking Capability
- Excellent Switching Time : t_r=1μs(Max.), t_f=0.7μs(Max.)

Unit in mm



JEDEC	—
EIAJ	—
TOSHIBA	2-8J1B

Weight: 0.81g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Emitter Voltage		$V_{CEO(SUS)}$	300	V
Collector-Emitter Voltage		V_{CEV}	600	V
Emitter-Base Voltage		V_{EBO}	9	V
Collector Current	DC	I_C	1.5	A
	Pulse	I_{CP}	3	
Base Current	DC	I_B	0.75	A
	Pulse	I_{BP}	1.5	
Emitter Current	DC	I_E	2.25	A
	Pulse	I_{EP}	4.5	
Collector Power Dissipation @Ta=25°C		P_C	1.4	W
	Derate Above 25°C		11.2	mW/°C
Collector Power Dissipation @Ta=25°C		P_C	40	W
	Derate Above 25°C		320	mW/°C
Junction Temperature		Tj	150	°C
Storage Temperature Range		T_{stg}	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.12	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	89	°C/W
Maximum Lead Temperature for Soldering Purposes (0.32mm from case for 5 seconds)	T_L	275	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Tc=25°C Unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Voltage		$V_{CEO(SUS)}$	I_C=10mA, I_B=0	300	-	-	V
Collector Cut-off Current		I_{CEV}	V_{CE}=600V, V_{BE}=-1.5V	-	-	1	mA
			V_{CE}=600V, V_{BE}=-1.5V Tc=100°C	-	-	5	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=9V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=2V, I_C=0.5A	8	-	40	
		$h_{FE(2)}$	V_{CE}=2V, I_C=1A	5	-	25	
Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=0.5A, I_B=0.1A	-	-	0.5	V
		$V_{CE(sat)2}$	I_C=1A, I_B=0.25A	-	-	1	
		$V_{CE(sat)3}$	I_C=1.5A, I_B=0.5A	-	-	3	
		$V_{CE(sat)4}$	I_C=1A, I_B=0.25A Tc=100°C	-	-	1	
Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=0.5A, I_B=0.1A	-	-	1	V
		$V_{BE(sat)2}$	I_C=1A, I_B=0.25A	-	-	1.2	
		$V_{BE(sat)3}$	I_C=1A, I_B=0.25A Tc=100°C	-	-	1.1	
Transition Frequency		f_T	V_{CE}=10V, I_C=100mA, f=1MHz	4	10	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=10V, I_E=0 f=0.1MHz	-	20	-	pF
Second Breakdown Collector Current with Base Forward Biased		$I_{s/b}$	Ref. Figure				
Clamped Inductive SOA with Base Reverse Biased		RBSOA	Ref. Figure				
Switching Time Characteristics (1)	Delay Time	t_d	Resistive Load (V_{CC}=125V, I_C=1A I_{B1}=-I_{B2}=0.2A, t_p=25μs Duty Cycle<1%)	-	-	0.1	μs
	Rise Time	t_r		-	-	1	μs
	Storage Time	t_{stg}		-	-	4	μs
	Fall Time	t_f		-	-	0.7	μs
Switching Time Characteristics (2)	Storage Time	t_{sv}	Inductive Load (I_C=1A, Vclamp=300V I_{B1}=0.2A, $V_{BE(off)}$=-5V Tc=100°C)	-	-	4	μs
	Crossover Time	t_c		-	-	0.75	μs
	Fall Time	t_{fi}		-	0.15	-	μs

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
MJE13003
SILICON NPN TRIPLE DIFFUSED TYPE

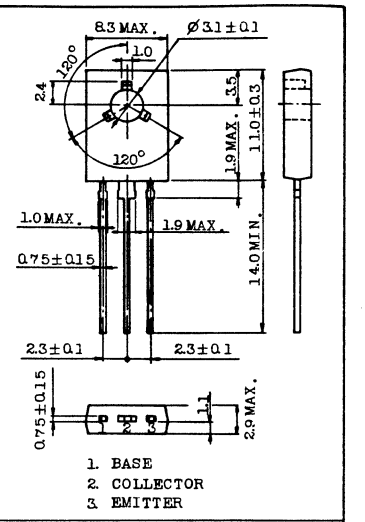
INDUSTRIAL APPLICATIONS

SWITCHING REGULATOR.
DC-DC CONVERTER, AC-DC INVERTER.
HIGH VOLTAGE, HIGH SPEED SWITCHING APPLICATION.

SPECIFICATION FEATURES:

- $V_{CEO(SUS)}$=400V(Min.)
- V_{CEV}=700V Blocking Capability
- Excellent Switching Time : t_r=1μs(Max.), t_f=0.7μs(Max.)

Unit in mm



JEDEC	–
EIAJ	–
TOSHIBA	2-8J1B

Weight: 0.81g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Emitter Voltage		$V_{CEO(SUS)}$	400	V
Collector-Emitter Voltage		V_{CEV}	700	V
Emitter-Base Voltage		V_{EBO}	9	V
Collector Current	DC	I_C	1.5	A
	Pulse	I_{CP}	3	
Base Current	DC	I_B	0.75	A
	Pulse	I_{BP}	1.5	
Emitter Current	DC	I_E	2.25	A
	Pulse	I_{EP}	4.5	
Collector Power Dissipation @Ta=25°C		P_C	1.4	W
	Derate Above 25°C		11.2	mW/°C
Collector Power Dissipation @Ta=25°C		P_C	40	W
	Derate Above 25°C		320	mW/°C
Junction Temperature		Tj	150	°C
Storage Temperature Range		T_{stg}	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.12	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	89	°C/W
Maximum Lead Temperature for Soldering Purposes (0.32mm from case for 5 seconds)	T_L	275	°C

ELECTRICAL CHARACTERISTICS (Tc=25°C Unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Voltage		$V_{CEO(SUS)}$	I_C=10mA, I_B=0	400	-	-	V
Collector Cut-off Current		I_{CEV}	V_{CE}=700V, V_{BE}=-1.5V	-	-	1	mA
			V_{CE}=700V, V_{BE}=-1.5V Tc=100°C	-	-	5	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=9V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=2V, I_C=0.5A	8	-	40	
		$h_{FE(2)}$	V_{CE}=2V, I_C=1A	5	-	25	
Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=0.5A, I_B=0.1A	-	-	0.5	V
		$V_{CE(sat)2}$	I_C=1A, I_B=0.25A	-	-	1	
		$V_{CE(sat)3}$	I_C=1.5A, I_B=0.5A	-	-	3	
		$V_{CE(sat)4}$	I_C=1A, I_B=0.25A Tc=100°C	-	-	1	
Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=0.5A, I_B=0.1A	-	-	1	V
		$V_{BE(sat)2}$	I_C=1A, I_B=0.25A	-	-	1.2	
		$V_{BE(sat)3}$	I_C=1A, I_B=0.25A Tc=100°C	-	-	1.1	
Transition Frequency		f_T	V_{CE}=10V, I_C=100mA, f=1MHz	4	10	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=10V, I_E=0 f=0.1MHz	-	20	-	pF
Second Breakdown Collector Current with Base Forward Biased		$I_{s/b}$	Ref. Figure				
Clamped Inductive SOA with Base Reverse Biased		RBSOA	Ref. Figure				
Switching Time Characteristics (1)	Delay Time	t_d	Resistive Load (V_{CC}=12.5V, I_C=1A I_{B1}=-I_{B2}=0.2A, t_p=25μs Duty Cycle<1%)	-	-	0.1	μs
	Rise Time	t_r		-	-	1	μs
	Storage Time	t_{stg}		-	-	4	μs
	Fall Time	t_f		-	-	0.7	μs
Switching Time Characteristics (2)	Storage Time	t_{sv}	Inductive Load (I_C=1A, Vclamp=300V I_{B1}=0.2A, $V_{BE(off)}$=-5V Tc=100°C)	-	-	4	μs
	Crossover Time	t_c		-	-	0.75	μs
	Fall Time	t_{fi}		-	0.15	-	μs

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
MJE13004
SILICON NPN TRIPLE DIFFUSED TYPE

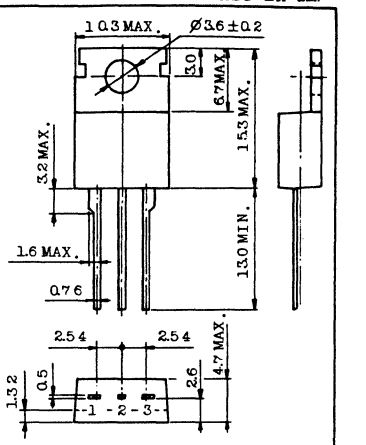
INDUSTRIAL APPLICATIONS

SWITCHING REGULATOR.
DC-DC CONVERTER, AC-DC INVERTER.
HIGH VOLTAGE, HIGH SPEED SWITCHING APPLICATION.

SPECIFICATION FEATURES:

- $V_{CEO(SUS)}$=300V(Min.)
- V_{CEV}=600V Blocking Capability
- Excellent Switching Time : t_r=0.7μs(Max.), t_f=0.9μs(Max.)

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3A

Mounting Kit No. AC75
Weight : 1.8g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Emitter Voltage		$V_{CEO(SUS)}$	300	V
Collector-Emitter Voltage		V_{CEV}	600	V
Emitter-Base Voltage		V_{EBO}	9	V
Collector Current	DC	I_C	4	A
	Pulse	I_{CP}	8	
Base Current	DC	I_B	2	A
	Pulse	I_{BP}	4	
Emitter Current	DC	I_E	6	A
	Pulse	I_{EP}	12	
Collector Power Dissipation @Ta=25°C		P_C	2	W
	Derate Above 25°C		16	mW/°C
Collector Power Dissipation @TA=25°C		P_C	75	W
	Derate Above 25°C		600	mW/°C
Junction Temperature		Tj	150	°C
Storage Temperature Range		Tstg	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (0.32mm from case for 5 seconds)	T_L	275	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Tc=25°C Unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Voltage		$V_{CEO(SUS)}$	I_C=10mA, I_B=0	300	-	-	V
Collector Cut-off Current		I_{CEV}	V_{CE}=600V, V_{BE}=-1.5V	-	-	1	mA
			V_{CE}=600V, V_{BE}=-1.5V Tc=100°C	-	-	5	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=9V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=5V, I_C=1A	10	-	60	
		$h_{FE(2)}$	V_{CE}=5V, I_C=2A	8	-	40	
Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=1A, I_B=0.2A	-	-	0.5	V
		$V_{CE(sat)2}$	I_C=2A, I_B=0.5A	-	-	0.6	
		$V_{CE(sat)3}$	I_C=4A, I_B=1A	-	-	1	
		$V_{CE(sat)4}$	I_C=2A, I_B=0.5A Tc=100°C	-	-	1	
Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=1A, I_B=0.2A	-	-	1.2	V
		$V_{BE(sat)2}$	I_C=2A, I_B=0.5A	-	-	1.6	
		$V_{BE(sat)3}$	I_C=2A, I_B=0.5A Tc=100°C	-	-	1.5	
Transition Frequency		f_T	V_{CE}=10V, I_C=500mA, f=1MHz	4	-	-	MHz
Collector Output Capacitance		Cob	V_{CB}=10V, I_E=0 f=0.1MHz	-	55	-	pF
Second Breakdown Collector Current with Base Forward Biased		$I_{s/b}$	Ref. Figure				
Clamped Inductive SOA with Base Reverse Biased		RBSOA	Ref. Figure				
Switching Time Characteristics (1)	Delay Time	t_d	Resistive Load (V_{CC}=125V, I_C=2A I_{B1}=-I_{B2}=0.4A tp=25μs Duty Cycle<1%)	-	-	0.1	μs
	Rise Time	t_r		-	-	0.7	μs
	Storage Time	t_{stg}		-	-	4	μs
	Fall Time	t_f		-	-	0.9	μs
Switching Time Characteristics (2)	Storage Time	t_{sv}	Inductive Load (I_C=2A, Vclamp=300V I_{B1}=0.4A, $V_{BE(off)}$=-5V Tc=100°C)	-	-	4	μs
	Crossover Time	t_c		-	-	0.9	μs
	Fall Time	t_{fi}		-	0.16	-	μs

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
MJE13005
SILICON NPN TRIPLE DIFFUSED TYPE

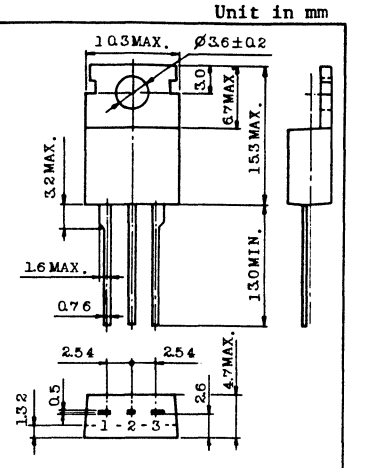
INDUSTRIAL APPLICATIONS

SWITCHING REGULATOR.
DC-DC CONVERTER, AC-DC INVERTER.
HIGH VOLTAGE, HIGH SPEED SWITCHING APPLICATION.

SPECIFICATION FEATURES:

- $V_{CEO(SUS)}$=400V(Min.)
- V_{CEV}=700V Blocking Capability
- Excellent Switching Time : t_r=0.7μs(Max.), t_f=0.9μs(Max.)

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3A

Mounting Kit No. AC75
Weight : 1.8g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Emitter Voltage		$V_{CEO(SUS)}$	400	V
Collector-Emitter Voltage		V_{CEV}	700	V
Emitter-Base Voltage		V_{EBO}	9	V
Collector Current	DC	I_C	4	A
	Pulse	I_{CP}	8	
Base Current	DC	I_B	2	A
	Pulse	I_{BP}	4	
Emitter Current	DC	I_E	6	A
	Pulse	I_{EP}	12	
Collector Power Dissipation @Ta=25°C		P_C	2	W
	Derate Above 25°C		16	mW/°C
Collector Power Dissipation @Ta=25°C		P_C	75	W
	Derate Above 25°C		600	mW/°C
Junction Temperature		Tj	150	°C
Storage Temperature Range		Tstg	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (0.32mm from case for 5 seconds)	T_L	275	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Tc=25°C Unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Voltage		$V_{CEO(SUS)}$	I_C=10mA, I_B=0	400	-	-	V
Collector Cut-off Current		I_{CEV}	V_{CE}=700V, V_{BE}=-1.5V	-	-	1	mA
			V_{CE}=700V, V_{BE}=-1.5V Tc=100°C	-	-	5	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=9V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=5V, I_C=1A	10	-	60	
		$h_{FE(2)}$	V_{CE}=5V, I_C=2A	8	-	40	
Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=1A, I_B=0.2A	-	-	0.5	V
		$V_{CE(sat)2}$	I_C=2A, I_B=0.5A	-	-	0.6	
		$V_{CE(sat)3}$	I_C=4A, I_B=1A	-	-	1	
		$V_{CE(sat)4}$	I_C=2A, I_B=0.5A Tc=100°C	-	-	1	
Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=1A, I_B=0.2A	-	-	1.2	V
		$V_{BE(sat)2}$	I_C=2A, I_B=0.5A	-	-	1.6	
		$V_{BE(sat)3}$	I_C=2A, I_B=0.5A Tc=100°C	-	-	1.5	
Transition Frequency		f_T	V_{CE}=10V, I_C=500mA, f=1MHz	4	-	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=10V, I_E=0 f=0.1MHz	-	55	-	pF
Second Breakdown Collector Current with Base Forward Biased		$I_{s/b}$	Ref. Figure				
Clamped Inductive SOA with Base Reverse Biased		RBSOA	Ref. Figure				
Switching Time Characteristics (1)	Delay Time	t_d	Resistive Load (V_{CC}=125V, I_C=2A I_{B1}=-I_{B2}=0.4A tp=25μs Duty Cycle <1%)	-	-	0.1	μs
	Rise Time	t_r		-	-	0.7	μs
	Storage Time	t_{stg}		-	-	4	μs
	Fall Time	t_f		-	-	0.9	μs
Switching Time Characteristics (2)	Storage Time	t_{sv}	Inductive Load (I_C=2A, Vclamp=300V I_{B1}=0.4A, $V_{BE(off)}$=-5V Tc=100°C)	-	-	4	μs
	Crossover Time	t_c		-	-	0.9	μs
	Fall Time	t_{fi}		-	0.16	-	μs

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
MJE13006
SILICON NPN TRIPLE DIFFUSED TYPE

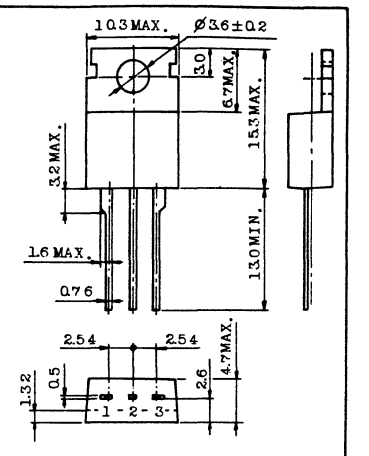
INDUSTRIAL APPLICATIONS

SWITCHING REGULATOR.
DC-DC CONVERTER, AC-DC INVERTER.
HIGH VOLTAGE, HIGH SPEED SWITCHING APPLICATION.

SPECIFICATION FEATURES:

- $V_{CEO(SUS)}$=300V(Min.)
- V_{CEV}=600V Blocking Capability
- Excellent Switching Time : t_r=1.5μs(Max.), t_f=0.7μs(Max.)

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3A

Mounting Kit No. AC75
Weight : 1.8g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Emitter Voltage		$V_{CEO(SUS)}$	300	V
Collector-Emitter Voltage		V_{CEV}	600	V
Emitter-Base Voltage		V_{EBO}	9	V
Collector Current	DC	I_C	8	A
	Pulse	I_{CP}	16	
Base Current	DC	I_B	4	A
	Pulse	I_{BP}	8	
Emitter Current	DC	I_E	12	A
	Pulse	I_{EP}	24	
Collector Power Dissipation @Ta=25°C		P_C	2	W
	Derate Above 25°C		16	mW/°C
Collector Power Dissipation @Ta=25°C		P_C	80	W
	Derate Above 25°C		640	mW/°C
Junction Temperature		Tj	150	°C
Storage Temperature Range		T_{stg}	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.56	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (0.32mm from case for 5 seconds)	T_L	275	°C

ELECTRICAL CHARACTERISTICS (Tc=25°C Unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Voltage		$V_{CEO(SUS)}$	I_C=10mA, I_B=0	300	-	-	V
Collector Cut-off Current		I_{CEV}	V_{CE}=600V, V_{BE}=-1.5V	-	-	1	mA
			V_{CE}=600V, V_{BE}=-1.5V Tc=100°C	-	-	5	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=9V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=5V, I_C=2A	8	-	60	
		$h_{FE(2)}$	V_{CE}=5V, I_C=5A	5	-	30	
Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=2A, I_B=0.4A	-	-	1	V
		$V_{CE(sat)2}$	I_C=5A, I_B=1A	-	-	2	
		$V_{CE(sat)3}$	I_C=8A, I_B=2A	-	-	3	
		$V_{CE(sat)4}$	I_C=5A, I_B=1A Tc=100°C	-	-	3	
Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=2A, I_B=0.4A	-	-	1.2	V
		$V_{BE(sat)2}$	I_C=5A, I_B=1A	-	-	1.6	
		$V_{BE(sat)3}$	I_C=5A, I_B=1A Tc=100°C	-	-	1.5	
Transition Frequency		f_T	V_{CE}=10V, I_C=500mA, f=1MHz	4	-	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=10V, I_E=0 f=0.1MHz	-	90	-	pF
Second Breakdown Collector Current with Base Forward Biased		$I_{s/b}$	Ref. Figure				
Clamped Inductive SOA with Base Reverse Biased		RBSOA	Ref. Figure				
Switching Time Characteristics (1)	Delay Time	t_d	Resistive Load (V_{CC}=125V, I_C=5A I_{B1}=-I_{B2}=1A, t_p=25μs Duty Cycle<1%)	-	-	0.1	μs
	Rise Time	t_r		-	-	1.5	μs
	Storage Time	t_{stg}		-	-	3	μs
	Fall Time	t_f		-	-	0.7	μs
Switching Time Characteristics (2)	Storage Time	t_{sv}	Inductive Load (I_C=5A, Vclamp=300V I_{B1}=1A, $V_{BE(off)}$=-5V Tc=100°C)	-	-	2.3	μs
	Crossover Time	t_c		-	-	0.7	μs

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
MJE13007
SILICON NPN TRIPLE DIFFUSED TYPE

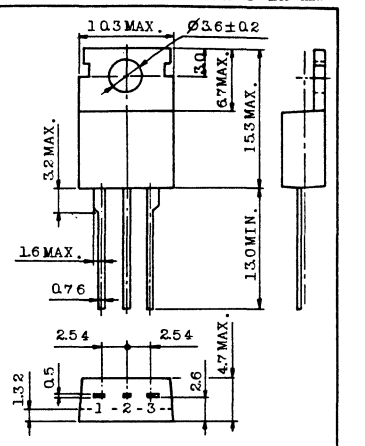
INDUSTRIAL APPLICATIONS

SWITCHING REGULATOR.
DC-DC CONVERTER, AC-DC INVERTER.
HIGH VOLTAGE, HIGH SPEED SWITCHING APPLICATION.

SPECIFICATION FEATURES:

- $V_{CEO(SUS)}$=400V(Min.)
- V_{CEV}=700V Blocking Capability
- Excellent Switching Time : t_r=1.5μs(Max.)
  t_f=0.7μs(Max.)

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3A

Mounting Kit No. AC75
Weight : 1.8g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Emitter Voltage		$V_{CEO(SUS)}$	400	V
Collector-Emitter Voltage		V_{CEV}	700	V
Emitter-Base Voltage		V_{EBO}	9	V
Collector Current	DC	I_C	8	A
	Pulse	I_{CP}	16	
Base Current	DC	I_B	4	A
	Pulse	I_{BP}	8	
Emitter Current	DC	I_E	12	A
	Pulse	I_{EP}	24	
Collector Power Dissipation @Ta=25°C		P_C	2	W
	Derate Above 25°C		16	mW/°C
Collector Power Dissipation @Ta=25°C		P_C	80	W
	Derate Above 25°C		640	mW/°C
Junction Temperature		Tj	150	°C
Storage Temperature Range		T_{stg}	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.56	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (0.32mm from case for 5 seconds)	T_L	275	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Tc=25°C Unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Voltage		$V_{CEO(SUS)}$	I_C=10mA, I_B=0	400	-	-	V
Collector Cut-off Current		I_{CEV}	V_{CE}=700V, V_{BE}=-1.5V	-	-	1	mA
			V_{CE}=700V, V_{BE}=-1.5V Tc=100°C	-	-	5	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=9V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE}(1)$	V_{CE}=5V, I_C=2A	8	-	60	
		$h_{FE}(2)$	V_{CE}=5V, I_C=5A	5	-	30	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}1$	I_C=2A, I_B=0.4A	-	-	1	V
		$V_{CE(sat)}2$	I_C=5A, I_B=1A	-	-	2	
		$V_{CE(sat)}3$	I_C=8A, I_B=2A	-	-	3	
		$V_{CE(sat)}4$	I_C=5A, I_B=1A Tc=100°C	-	-	3	
Base-Emitter Saturation Voltage		$V_{BE(sat)}1$	I_C=2A, I_B=0.4A	-	-	1.2	V
		$V_{BE(sat)}2$	I_C=5A, I_B=1A	-	-	1.6	
		$V_{BE(sat)}3$	I_C=5A, I_B=1A Tc=100°C	-	-	1.5	
Transition Frequency		f_T	V_{CE}=10V, I_C=500mA, f=1MHz	4	-	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=10V, I_E=0 f=0.1MHz	-	90	-	pF
Second Breakdown Collector Current with Base Forward Biased		$I_{s/b}$	Ref. Figure				
Clamped Inductive SOA with Base Reverse Biased		RBSOA	Ref. Figure				
Switching Time Characteristics (1)	Delay Time	t_d	Resistive Load (V_{CC}=125V, I_C=5A I_{B1}=-I_{B2}=1A, t_p=25μs Duty Cycle<1%)	-	-	0.1	μs
	Rise Time	t_r		-	-	1.5	μs
	Storage Time	t_{stg}		-	-	3	μs
	Fall Time	t_f		-	-	0.7	μs
Switching Time Characteristics (2)	Storage Time	t_{sv}	Inductive Load (I_C=5A, Vclamp=300V, I_{B1}=1A, $V_{BE(off)}$=-5V Tc=100°C)	-	-	2.3	μs
	Crossover Time	t_c		-	-	0.7	μs

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
MJE13008
SILICON NPN TRIPLE DIFFUSED TYPE

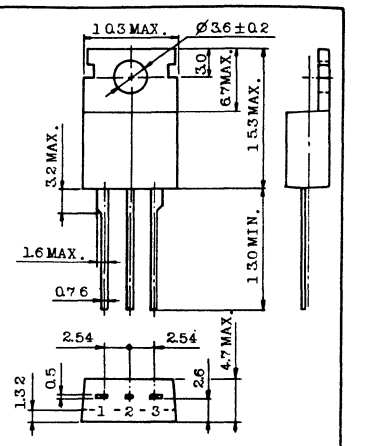
INDUSTRIAL APPLICATIONS

SWITCHING REGULATOR.
DC-DC CONVERTER, AC-DC INVERTER.
HIGH VOLTAGE, HIGH SPEED SWITCHING APPLICATION.

SPECIFICATION FEATURES:

- $V_{CEO(SUS)}$=300V(Min.)
- V_{CEV}=600V Blockng Capability
- Excellent Switching Time : t_r=1μs(Max.), t_f=0.7μs(Max.)

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3A

Mounting Kit No. AC75
Weight : 1.8g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Emitter Voltage		$V_{CEO(SUS)}$	300	V
Collector-Emitter Voltage		V_{CEV}	600	V
Emitter-Base Voltage		V_{EBO}	9	V
Collector Current	DC	I_C	12	A
	Pulse	I_{CP}	24	
Base Current	DC	I_B	6	A
	Pulse	I_{BP}	12	
Emitter Current	DC	I_E	18	A
	Pulse	I_{EP}	36	
Collector Power Dissipation @Ta=25°C		P_C	2	W
	Derate Above 25°C		16	mW/°C
Collector Power Dissipation @Ta=25°C		P_C	100	W
	Derate Above 25°C		800	mW/°C
Junction Temperature		Tj	150	°C
Storage Temperature Range		Tstg	-65～150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.25	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (0.32mm from case for 5 seconds)	T_L	275	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Tc=25°C Unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Voltage		$V_{CEO(SUS)}$	I_C=10mA, I_B=0	300	-	-	V
Collector Cut-off Current		I_{CEV}	V_{CE}=600V, V_{BE}=-1.5V	-	-	1	mA
			V_{CE}=600V, V_{BE}=-1.5V Tc=100°C	-	-	5	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=9V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=5V, I_C=5A	8	-	40	
		$h_{FE(2)}$	V_{CE}=5V, I_C=8A	6	-	30	
Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=5A, I_B=1A	-	-	1	V
		$V_{CE(sat)2}$	I_C=8A, I_B=1.6A	-	-	1.5	
		$V_{CE(sat)3}$	I_C=12A, I_B=3A	-	-	3	
		$V_{CE(sat)4}$	I_C=8A, I_B=1.6A Tc=100°C	-	-	2	
Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=5A, I_B=1A	-	-	1.2	V
		$V_{BE(sat)2}$	I_C=8A, I_B=1.6A	-	-	1.6	
		$V_{BE(sat)3}$	I_C=8A, I_B=1.6A Tc=100°C	-	-	1.5	
Transition Frequency		f_T	V_{CE}=10V, I_C=500mA, f=1MHz	4	-	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=10V, I_E=0 f=0.1MHz	-	130	-	pF
Second Breakdown Collector Current with Base Forward Biased		$I_{s/b}$	Ref. Figure				
Clamped Inductive SOA with Base Reverse Biased		RBSOA	Ref. Figure				
Switching Time Characteristics (1)	Delay Time	t_d	Resistive Load (V_{CC}=125V, I_C=8A I_{B1}=-I_{B2}=1.6A, t_p=25μs Duty Cycle <1%)	-	-	0.1	μs
	Rise Time	t_r		-	-	1	μs
	Storage Time	t_{stg}		-	-	3	μs
	Fall Time	t_f		-	-	0.7	μs
Switching Time Characteristics (2)	Storage Time	t_{sv}	Inductive Load (I_C=8A, Vclamp=300V, I_{B1}=1.6A, $V_{BE(off)}$=-5V Tc=100°C)	-	-	2.3	μs
	Crossover Time	t_c		-	-	0.7	μs

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
MJE13009
SILICON NPN TRIPLE DIFFUSED TYPE

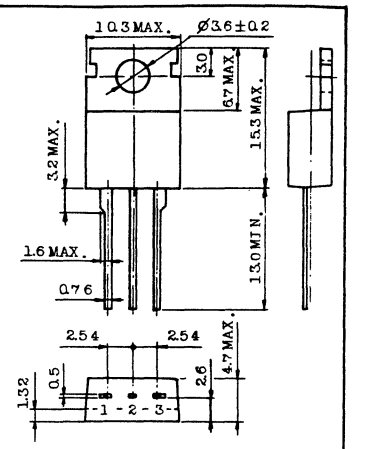
INDUSTRIAL APPLICATIONS

SWITCHING REGULATOR.
DC-DC CONVERTER, AC-DC INVERTER.
HIGH VOLTAGE, HIGH SPEED SWITCHING APPLICATION.

SPECIFICATION FEATURES:

- $V_{CEO(SUS)}$=400V(Min.)
- V_{CEV}=700V Blocking Capability
- Excellent Switching Time : t_r=1μs(Max.), t_f=0.7μs(Max.)

Unit in mm



1. BASE
2. COLLECTOR (HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3A

Mounting Kit No. AC75
Weight : 1.8g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Emitter Voltage		$V_{CEO(SUS)}$	400	V
Collector-Emitter Voltage		V_{CEV}	700	V
Emitter-Base Voltage		V_{EBO}	9	V
Collector Current	DC	I_C	12	A
	Pulse	I_{CP}	24	
Base Current	DC	I_B	6	A
	Pulse	I_{BP}	12	
Emitter Current	DC	I_E	18	A
	Pulse	I_{EP}	36	
Collector Power Dissipation @Ta=25°C		P_C	2	W
	Derate Above 25°C		16	mW/°C
Collector Power Dissipation @Ta=25°C		P_C	100	W
	Derate Above 25°C		800	mW/°C
Junction Temperature		Tj	150	°C
Storage Temperature Range		T_{stg}	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.25	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (0.32mm from case for 5 seconds)	T_L	275	°C

ELECTRICAL CHARACTERISTICS (Tc=25°C Unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Voltage		$V_{CEO(SUS)}$	I_C=10mA, I_B=0	400	-	-	V
Collector Cut-off Current		I_{CEV}	V_{CE}=700V, V_{BE}=-1.5V	-	-	1	mA
			V_{CE}=700V, V_{BE}=-1.5V Tc=100°C	-	-	5	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=9V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=5V, I_C=5A	8	-	40	
		$h_{FE(2)}$	V_{CE}=5V, I_C=8A	6	-	30	
Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=5A, I_B=1A	-	-	1	V
		$V_{CE(sat)2}$	I_C=8A, I_B=1.6A	-	-	1.5	
		$V_{CE(sat)3}$	I_C=12A, I_B=3A	-	-	3	
		$V_{CE(sat)4}$	I_C=8A, I_B=1.6A Tc=100°C	-	-	2	
Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=5A, I_B=1A	-	-	1.2	V
		$V_{BE(sat)2}$	I_C=8A, I_B=1.6A	-	-	1.6	
		$V_{BE(sat)3}$	I_C=8A, I_B=1.6A Tc=100°C	-	-	1.5	
Transition Frequency		f_T	V_{CE}=10V, I_C=500mA, f=1MHz	4	-	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=10V, I_E=0 f=0.1MHz	-	130	-	pF
Second Breakdown Collector Current with Base Forward Biased		$I_{s/b}$	Ref. Figure				
Clamped Inductive SOA with Base Reverse Biased		RBSOA	Ref. Figure				
Switching Time Characteristics (1)	Dealy Time	t_d	Resistive Load (V_{CC}=125V, I_C=8A I_{B1}=-I_{B2}=1.6A, t_p=25μs Duty Cycle<1%)	-	-	0.1	μs
	Rise Time	t_r		-	-	1	μs
	Storage Time	t_{stg}		-	-	3	μs
	Fall Time	t_f		-	-	0.7	μs
Switching Time Characteristics (2)	Storage Time	t_{sv}	Inductive Load (I_C=8A, Vclamp=300V, I_{B1}=1.6A, $V_{BE(off)}$=-5V Tc=100°C)	-	-	2.3	μs
	Crossover Time	t_c		-	-	0.7	μs

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR

T I P 2 9

SILICON NPN TRIPLE DIFFUSED TYPE

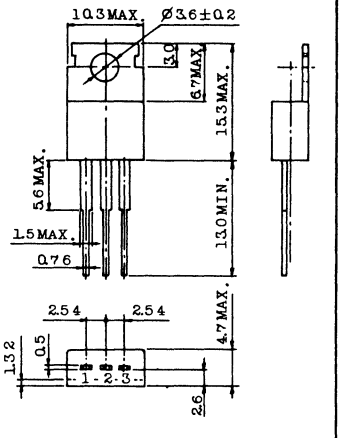
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

- High Collector Power Dissipation : P_C=30W @Tc=25°C
- High Collector Current : $I_{C(DC)}$=1A(Max.)
- High DC Current Gain : h_{FE}=40(Min.) @V_{CE}=4V, I_C=0.2A
- Complementary to TIP30

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	40	V
Collector-Emitter Voltage		V_{CEO}	40	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	DC	I_C	1	A
	Pulse	I_{CP}	3	
Continuous Base Current		I_B	0.4	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		30	
Unclamped Inductive Load Energy		$E_{S/B}$	32	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65 ~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	Rth(j-c)	4.17	°C/W
Thermal Resistance, Junction to Ambient	Rth(j-a)	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=30mA, I_B=0	40	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=30V, I_B=0	-	-	0.3	mA
Collector Cut-off Current		I_{CES}	V_{CE}=40V, V_{BE}=0	-	-	0.2	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=5V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=4V, I_C=0.2A	40	-	-	
		$h_{FE(2)}$	V_{CE}=4V, I_C=1A	15	-	75	
Base-Emitter Voltage		V_{BE}	V_{CE}=4V, I_C=1A	-	-	1.3	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=1A, I_B=125mA	-	-	0.7	V
Small-Signal Current Gain		h_{fe}	V_{CE}=10V, I_C=0.2A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=10V, I_C=0.2A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=1A, I_{B1}=-I_{B2}=100mA	-	0.5	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=-4.3V, R_L=30Ω	-	2.0	-	

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 2 9 A
SILICON NPN TRIPLE DIFFUSED TYPE

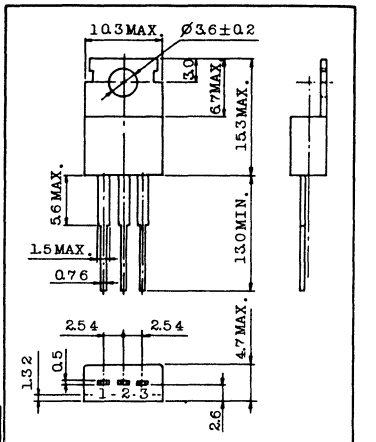
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=30W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=1A(Max.)
. High DC Current Gain : h_{FE}=40(Min.) @V_{CE}=4V, I_C=0.2A
. Complementary to TIP30A

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	60	V
Collector-Emitter Voltage		V_{CEO}	60	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	DC	I_C	1	A
	Pulse	I_{CP}	3	
Continuous Base Current		I_B	0.4	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		30	
Unclamped Inductive Load Energy		$E_{S/B}$	32	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	4.17	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=30mA, I_B=0	60	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=30V, I_B=0	-	-	0.3	mA
Collector Cut-off Current		I_{CES}	V_{CE}=60V, V_{BE}=0	-	-	0.2	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=5V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=4V, I_C=0.2A	40	-	-	
		$h_{FE(2)}$	V_{CE}=4V, I_C=1A	15	-	75	
Base-Emitter Voltage		V_{BE}	V_{CE}=4V, I_C=1A	-	-	1.3	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=1A, I_B=125mA	-	-	0.7	V
Small-Signal Current Gain		h_{fe}	V_{CE}=10V, I_C=0.2A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=10V, I_C=0.2A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=1A, I_{B1}=-I_{B2}=100mA	-	0.5	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=-4.3V, R_L=30Ω	-	2.0	-	

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR

T I P 2 9 B

SILICON NPN TRIPLE DIFFUSED TYPE

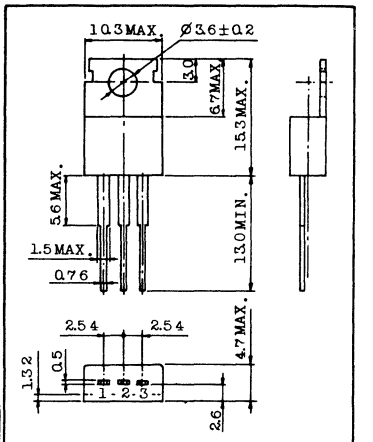
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=30W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=1A(Max.)
. High DC Current Gain : h_{FE}=40(Min.) @V_{CE}=4V, I_C=0.2A
. Complementary to TIP30B

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	80	V
Collector-Emitter Voltage		V_{CEO}	80	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	DC	I_C	1	A
	Pulse	I_{CP}	3	
Continuous Base Current		I_B	0.4	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		30	
Unclamped Inductive Load Energy		$E_{S/B}$	32	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	4.17	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=30mA, I_B=0	80	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=60V, I_B=0	-	-	0.3	mA
Collector Cut-off Current		I_{CES}	V_{CE}=80V, V_{BE}=0	-	-	0.2	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=5V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=4V, I_C=0.2A	40	-	-	
		$h_{FE(2)}$	V_{CE}=4V, I_C=1A	15	-	75	
Base-Emitter Voltage		V_{BE}	V_{CE}=4V, I_C=1A	-	-	1.3	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=1A, I_B=125mA	-	-	0.7	V
Small-Signal Current Gain		h_{fe}	V_{CE}=10V, I_C=0.2A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=10V, I_C=0.2A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=1A, I_{B1}=-I_{B2}=100mA	-	0.5	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=-4.3V, R_L=30Ω	-	2.0	-	

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 2 9 C
SILICON NPN TRIPLE DIFFUSED TYPE

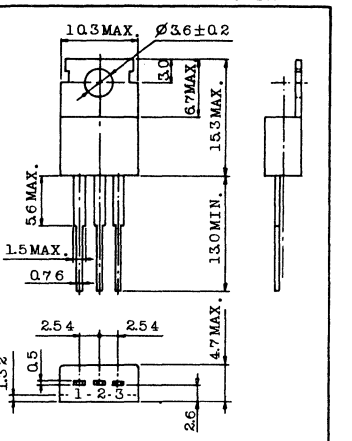
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=30W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=1A(Max.)
. High DC Current Gain : h_{FE}=40(Min.) @V_{CE}=4V, I_C=0.2A
. Complementary to TIP30C

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	100	V
Collector-Emitter Voltage		V_{CEO}	100	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	DC	I_C	1	A
	Pulse	I_{CP}	3	
Continuous Base Current		I_B	0.4	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		30	
Unclamped Inductive Load Energy		$E_{S/B}$	32	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	4.17	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=30mA, I_B=0	100	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=60V, I_B=0	-	-	0.3	mA
Collector Cut-off Current		I_{CES}	V_{CE}=100V, V_{BE}=0	-	-	0.2	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=5V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=4V, I_C=0.2A	40	-	-	
		$h_{FE(2)}$	V_{CE}=4V, I_C=1A	15	-	75	
Base-Emitter Voltage		V_{BE}	V_{CE}=4V, I_C=1A	-	-	1.3	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=1A, I_B=125mA	-	-	0.7	V
Small-Signal Current Gain		h_{fe}	V_{CE}=10V, I_C=0.2A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=10V, I_C=0.2A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=1A, I_{B1}=-I_{B2}=100mA	-	0.5	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=-4.3V, R_L=30Ω	-	2.0	-	

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 3 0
SILICON PNP TRIPLE DIFFUSED TYPE

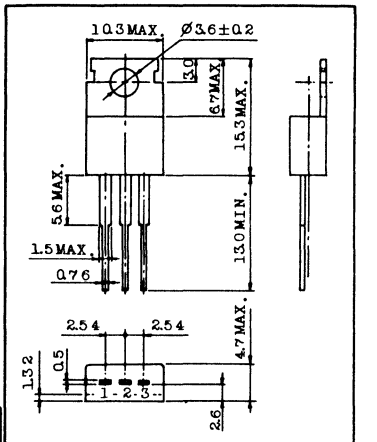
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

- High Collector Power Dissipation : P_C=30W @Tc=25°C
- High Collector Current : $I_{C(DC)}$=-1A(Max.)
- High DC Current Gain : h_{FE}=40(Min.) @V_{CE}=-4V, I_C=-0.2A
- Complementary to TIP29

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	-40	V
Collector-Emitter Voltage		V_{CEO}	-40	V
Emitter-Base Voltage		V_{EBO}	-5	V
Collector Current	DC	I_C	-1	A
	Pulse	I_{CP}	-3	
Continuous Base Current		I_B	-0.4	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		30	
Unclamped Inductive Load Energy		$E_{S/B}$	32	mJ
Junction Temperature		Tj	150	°C
Storage Temperature Range		T_{stg}	-65 ~ 150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	4.17	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-30mA, I_B=0	-40	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=-30V, I_B=0	-	-	-0.3	mA
Collector Cut-off Current		I_{CES}	V_{CE}=-40V, V_{BE}=0	-	-	-0.2	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=-5V, I_C=0	-	-	-1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=-4V, I_C=-0.2A	40	-	-	
		$h_{FE(2)}$	V_{CE}=-4V, I_C=-1A	15	-	75	
Base-Emitter Voltage		V_{BE}	V_{CE}=-4V, I_C=-1A	-	-	-1.3	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=-1A, I_B=-125mA	-	-	-0.7	V
Small-Signal Current Gain		h_{fe}	V_{CE}=-10V, I_C=-0.2A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=-10V, I_C=-0.2A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=-1A, I_{B1}=-I_{B2}=-100mA	-	0.3	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=4.3V, R_L=30Ω	-	1.0	-	

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 3 0 A
SILICON PNP TRIPLE DIFFUSED TYPE

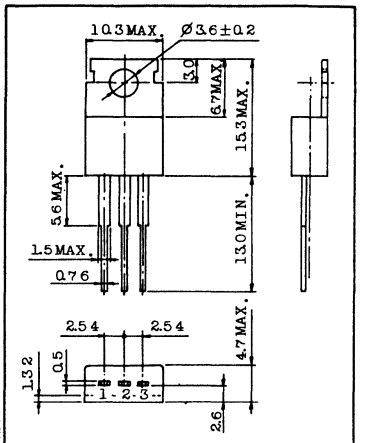
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=30W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=-1A(Max.)
. High DC Current Gain : h_{FE}=40(Min.) @V_{CE}=-4V, I_C=-0.2A
. Complementary to TIP29A

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	-60	V
Collector-Emitter Voltage		V_{CEO}	-60	V
Emitter-Base Voltage		V_{EBO}	-5	V
Collector Current	DC	I_C	-1	A
	Pulse	I_{CP}	-3	
Continuous Base Current		I_B	-0.4	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		30	
Unclamped Inductive Load Energy		$E_{S/B}$	32	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65 ~ 150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	Rth(j-c)	4.17	°C/W
Thermal Resistance, Junction to Ambient	Rth(j-a)	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-30mA, I_B=0	-60	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=-30V, I_B=0	-	-	-0.3	mA
Collector Cut-off Current		I_{CES}	V_{CE}=-60V, V_{BE}=0	-	-	-0.2	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=-5V, I_C=0	-	-	-1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=-4V, I_C=-0.2A	40	-	-	
		$h_{FE(2)}$	V_{CE}=-4V, I_C=-1A	15	-	75	
Base-Emitter Voltage		V_{BE}	V_{CE}=-4V, I_C=-1A	-	-	-1.3	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=-1A, I_B=-125mA	-	-	-0.7	V
Small-Signal Current Gain		h_{fe}	V_{CE}=-10V, I_C=-0.2A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=-10V, I_C=-0.2A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=-1A, I_{B1}=-I_{B2}=-100mA	-	0.3	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=4.3V, R_L=30Ω	-	1.0	-	

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR

T I P 3 0 B

SILICON PNP TRIPLE DIFFUSED TYPE

INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.

HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

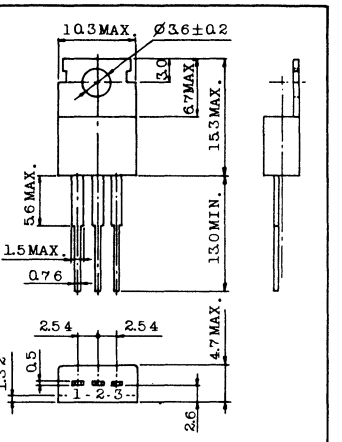
. High Collector Power Dissipation : P_C=30W @Tc=25°C

. High Collector Current : $I_{C(DC)}$=-1A(Max.)

. High DC Current Gain : h_{FE}=40(Min.) @V_{CE}=-4V, I_C=-0.2A

. Complementary to TIP29B

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	-80	V
Collector-Emitter Voltage		V_{CEO}	-80	V
Emitter-Base Voltage		V_{EBO}	-5	V
Collector Current	DC	I_C	-1	A
	Pulse	I_{CP}	-3	
Continuous Base Current		I_B	-0.4	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		30	
Unclamped Inductive Load Energy		$E_{S/B}$	32	mJ
Junction Temperature		Tj	150	°C
Storage Temperature Range		Tstg	-65 ~ 150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	4.17	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-30mA, I_B=0	-80	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=-60V, I_B=0	-	-	-0.3	mA
Collector Cut-off Current		I_{CES}	V_{CE}=-80V, V_{BE}=0	-	-	-0.2	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=-5V, I_C=0	-	-	-1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=-4V, I_C=-0.2A	40	-	-	
		$h_{FE(2)}$	V_{CE}=-4V, I_C=-1A	15	-	75	
Base-Emitter Voltage		V_{BE}	V_{CE}=-4V, I_C=-1A	-	-	-1.3	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=-1A, I_B=-125mA	-	-	-0.7	V
Small-Signal Current Gain		h_{fe}	V_{CE}=-10V, I_C=-0.2A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=-10V, I_C=-0.2A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=-1A, I_{B1}=-I_{B2}=-100mA	-	0.3	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=4.3V, R_L=30Ω	-	1.0	-	

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 3 0 C
SILICON PNP TRIPLE DIFFUSED TYPE

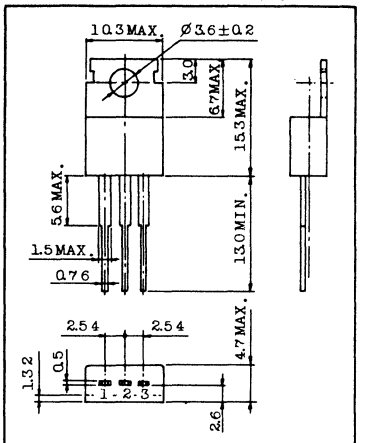
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=30W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=-1A(Max.)
. High DC Current Gain : h_{FE}=40(Min.) @V_{CE}=-4V, I_C=-0.2A
. Complementary to TIP29C

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	-100	V
Collector-Emitter Voltage		V_{CEO}	-100	V
Emitter-Base Voltage		V_{EBO}	-5	V
Collector Current	DC	I_C	-1	A
	Pulse	I_{CP}	-3	
Continuous Base Current		I_B	-0.4	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		30	
Unclamped Inductive Load Energy		$E_{S/B}$	32	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	4.17	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-30mA, I_B=0	-100	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=-60V, I_B=0	-	-	-0.3	mA
Collector Cut-off Current		I_{CES}	V_{CE}=-100V, V_{BE}=0	-	-	-0.2	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=-5V, I_C=0	-	-	-1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=-4V, I_C=-0.2A	40	-	-	
		$h_{FE(2)}$	V_{CE}=-4V, I_C=-1A	15	-	75	
Base-Emitter Voltage		V_{BE}	V_{CE}=-4V, I_C=-1A	-	-	-1.3	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=-1A, I_B=-125mA	-	-	-0.7	V
Small-Signal Current Gain		h_{fe}	V_{CE}=-10V, I_C=-0.2A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=-10V, I_C=-0.2A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=-1A, I_{B1}=-I_{B2}=-100mA	-	0.3	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=4.3V, R_L=30Ω	-	1.0	-	

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 3 1
SILICON NPN TRIPLE DIFFUSED TYPE

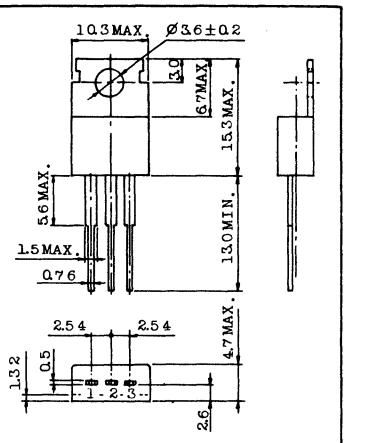
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=40W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=3A(Max.)
. High DC Current Gain : h_{FE}=25(Min.) @V_{CE}=4V, I_C=1A
. Complementary to TIP32

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	40	V
Collector-Emitter Voltage		V_{CEO}	40	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	DC	I_C	3	A
	Pulse	I_{CP}	5	
Continuous Base Current		I_B	1	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		40	
Unclamped Inductive Load Energy		$E_{S/B}$	32	mJ
Junction Temperature		Tj	150	°C
Storage Temperature Range		Tstg	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.125	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=30mA, I_B=0	40	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=30V, I_B=0	-	-	0.3	mA
Collector Cut-off Current		I_{CES}	V_{CE}=40V, V_{BE}=0	-	-	0.2	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=5V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=4V, I_C=1A	25	-	-	
		$h_{FE(2)}$	V_{CE}=4V, I_C=3A	10	-	50	
Base-Emitter Voltage		V_{BE}	V_{CE}=4V, I_C=3A	-	-	1.8	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=3A, I_B=375mA	-	-	1.2	V
Small-Signal Current Gain		h_{fe}	V_{CE}=10V, I_C=0.5A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=10V, I_C=0.5A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=1A, I_{B1}=-I_{B2}=100mA	-	0.5	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=-4.3V, R_L=30Ω	-	2.0	-	

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 3 1 A
SILICON NPN TRIPLE DIFFUSED TYPE

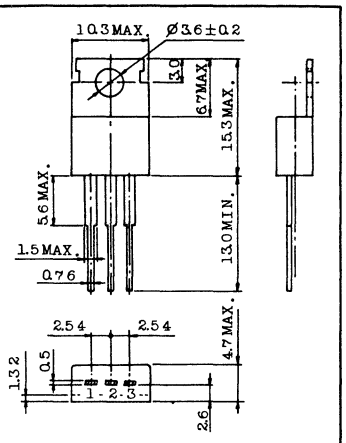
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=40W, @Tc=25°C
. High Collector Current : $I_{C(DC)}$=3A(Max.)
. High DC Current Gain : h_{FE}=25(Min.) @V_{CE}=4V, I_C=1A
. Complementary to TIP32A

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	60	V
Collector-Emitter Voltage		V_{CEO}	60	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	DC	I_C	3	A
	Pulse	I_{CP}	5	
Continuous Base Current		I_B	1	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		40	
Unclamped Inductive Load Energy		$E_{S/B}$	32	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65 ~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.125	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=30mA, I_B=0	60	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=30V, I_B=0	-	-	0.3	mA
Collector Cut-off Current		I_{CES}	V_{CE}=60V, V_{BE}=0	-	-	0.2	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=5V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=4V, I_C=1A	25	-	-	
		$h_{FE(2)}$	V_{CE}=4V, I_C=3A	10	-	50	
Base-Emitter Voltage		V_{BE}	V_{CE}=4V, I_C=3A	-	-	1.8	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=3A, I_B=375mA	-	-	1.2	V
Small-Signal Current Gain		h_{fe}	V_{CE}=10V, I_C=0.5A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=10V, I_C=0.5A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=1A, I_{B1}=-I_{B2}=100mA	-	0.5	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=-4.3V, R_L=30Ω	-	2.0	-	

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 3 1 B
SILICON NPN TRIPLE DIFFUSED TYPE

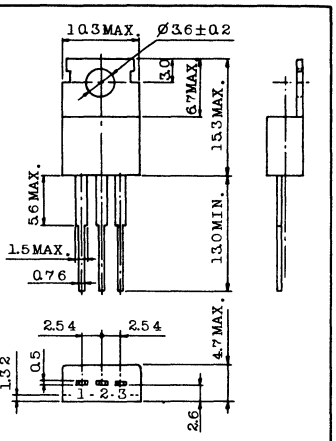
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

- High Collector Power Dissipation : P_C=40W @Tc=25°C
- High Collector Current : $I_{C(DC)}$=3A(Max.)
- High DC Current Gain : h_{FE}=25(Min.) @V_{CE}=4V, I_C=1A
- Complementary to TIP32B

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	80	V
Collector-Emitter Voltage		V_{CEO}	80	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	DC	I_C	3	A
	Pulse	I_{CP}	5	
Continuous Base Current		I_B	1	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		40	
Unclamped Inductive Load Energy		$E_{S/B}$	32	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65 ~ 150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.125	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=30mA, I_B=0	80	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=60V, I_B=0	-	-	0.3	mA
Collector Cut-off Current		I_{CES}	V_{CE}=80V, V_{BE}=0	-	-	0.2	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=5V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=4V, I_C=1A	25	-	-	
		$h_{FE(2)}$	V_{CE}=4V, I_C=3A	10	-	50	
Base-Emitter Voltage		V_{BE}	V_{CE}=4V, I_C=3A	-	-	1.8	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=3A, I_B=375mA	-	-	1.2	V
Small-Signal Current Gain		h_{fe}	V_{CE}=10V, I_C=0.5A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=10V, I_C=0.5A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=1A, I_{B1}=-I_{B2}=100mA	-	0.5	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=-4.3V, R_L=30Ω	-	2.0	-	

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 3 1 C
SILICON NPN TRIPLE DIFFUSED TYPE

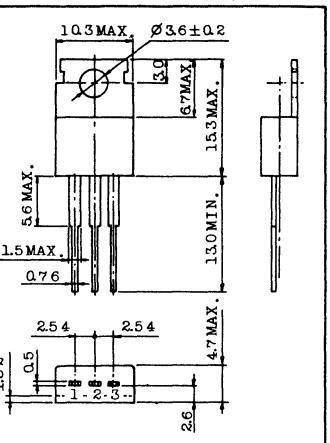
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=40W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=3A(Max.)
. High DC Current Gain : h_{FE}=25(Min.) @V_{CE}=4V, I_C=1A
. Complementary to TIP32C

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	100	V
Collector-Emitter Voltage		V_{CEO}	100	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	DC	I_C	3	A
	Pulse	I_{CP}	5	
Continuous Base Current		I_B	1	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		40	
Unclamped Inductive Load Energy		$E_{S/B}$	32	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.125	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=30mA, I_B=0	100	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=60V, I_B=0	-	-	0.3	mA
Collector Cut-off Current		I_{CES}	V_{CE}=100V, V_{BE}=0	-	-	0.2	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=5V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=4V, I_C=1A	25	-	-	
		$h_{FE(2)}$	V_{CE}=4V, I_C=3A	10	-	50	
Base-Emitter Voltage		V_{BE}	V_{CE}=4V, I_C=3A	-	-	1.8	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=3A, I_B=375mA	-	-	1.2	V
Small-Signal Current Gain		h_{fe}	V_{CE}=10V, I_C=0.5A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=10V, I_C=0.5A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=1A, I_{B1}=-I_{B2}=100mA	-	0.5	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=-4.3V, R_L=30Ω	-	2.0	-	

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 3 2
SILICON PNP TRIPLE DIFFUSED TYPE

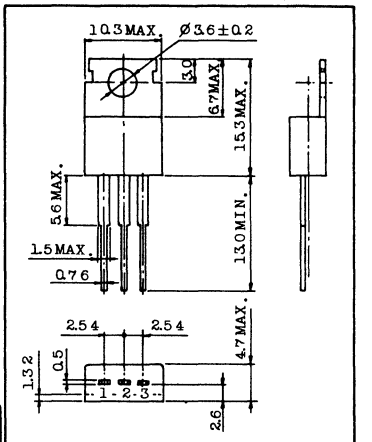
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=40W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=-3A(Max.)
. High DC Current Gain : h_{FE}=25(Min.) @V_{CE}=-4V, I_C=-1A
. Complementary to TIP31

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	-40	V
Collector-Emitter Voltage		V_{CEO}	-40	V
Emitter-Base Voltage		V_{EBO}	-5	V
Collector Current	DC	I_C	-3	A
	Pulse	I_{CP}	-5	
Continuous Base Current		I_B	-1	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		40	
Unclamped Inductive Load Energy		$E_{S/B}$	32	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.125	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-30mA, I_B=0	-40	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=-30V, I_B=0	-	-	-0.3	mA
Collector Cut-off Current		I_{CES}	V_{CE}=-40V, V_{BE}=0	-	-	-0.2	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=-5V, I_C=0	-	-	-1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=-4V, I_C=-1A	25	-	-	
		$h_{FE(2)}$	V_{CE}=-4V, I_C=-3A	10	-	50	
Base-Emitter Voltage		V_{BE}	V_{CE}=-4V, I_C=-3A	-	-	-1.8	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=-3A, I_B=-375mA	-	-	-1.2	V
Small-Signal Current Gain		h_{fe}	V_{CE}=-10V, I_C=-0.5A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=-10V, I_C=-0.5A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=-1A, I_{B1}=-I_{B2}=-100mA	-	0.3	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=4.3V, R_L=30Ω	-	1.0	-	

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 3 2 A
SILICON PNP TRIPLE DIFFUSED TYPE

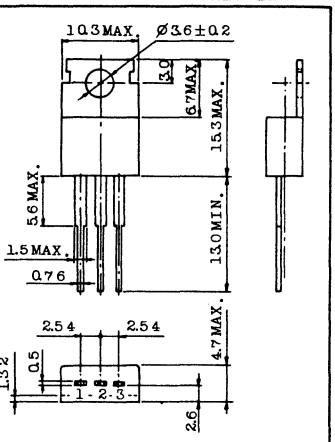
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=40W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=-3A(Max.)
. High DC Current Gain : h_{FE}=25(Min.) @V_{CE}=-4V, I_C=-1A
. Complementary to TIP31A

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	-60	V
Collector-Emitter Voltage		V_{CEO}	-60	V
Emitter-Base Voltage		V_{EBO}	-5	V
Collector Current	DC	I_C	-3	A
	Pulse	I_{CP}	-5	
Continuous Base Current		I_B	-1	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		40	
Unclamped Inductive Load Energy		$E_{S/B}$	32	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65 ~ 150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.125	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-30mA, I_B=0	-60	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=-30V, I_B=0	-	-	-0.3	mA
Collector Cut-off Current		I_{CES}	V_{CE}=-60V, V_{BE}=0	-	-	-0.2	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=-5V, I_C=0	-	-	-1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=-4V, I_C=-1A	25	-	-	
		$h_{FE(2)}$	V_{CE}=-4V, I_C=-3A	10	-	50	
Base-Emitter Voltage		V_{BE}	V_{CE}=-4V, I_C=-3A	-	-	-1.8	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=-3A, I_B=-375mA	-	-	-1.2	V
Small-Signal Current Gain		h_{fe}	V_{CE}=-10V, I_C=-0.5A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=-10V, I_C=-0.5A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=-1A, I_{B1}=-I_{B2}=-100mA	-	0.3	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=4.3V, R_L=30Ω	-	1.0	-	

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 3 2 B
SILICON PNP TRIPLE DIFFUSED TYPE

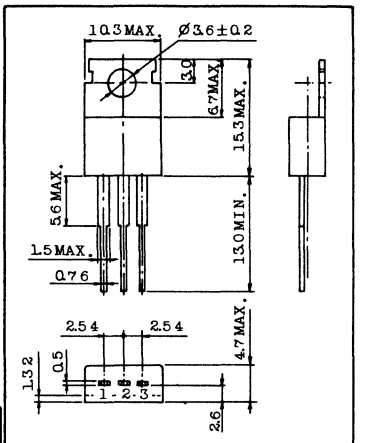
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=40W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=-3A(Max.)
. High DC Current Gain : h_{FE}=25(Min.) @V_{CE}=-4V, I_C=-1A
. Complementary to TIP31B

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	-80	V
Collector-Emitter Voltage		V_{CEO}	-80	V
Emitter-Base Voltage		V_{EBO}	-5	V
Collector Current	DC	I_C	-3	A
	Pulse	I_{CP}	-5	
Continuous Base Current		I_B	-1	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		40	
Unclamped Inductive Load Energy		$E_{S/B}$	32	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65 ~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.125	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-30mA, I_B=0	-80	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=-60V, I_B=0	-	-	-0.3	mA
Collector Cut-off Current		I_{CES}	V_{CE}=-80V, V_{BE}=0	-	-	-0.2	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=-5V, I_C=0	-	-	-1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=-4V, I_C=-1A	25	-	-	
		$h_{FE(2)}$	V_{CE}=-4V, I_C=-3A	10	-	50	
Base-Emitter Voltage		V_{BE}	V_{CE}=-4V, I_C=-3A	-	-	-1.8	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=-3A, I_B=-375mA	-	-	-1.2	V
Small-Signal Current Gain		h_{fe}	V_{CE}=-10V, I_C=-0.5A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=-10V, I_C=-0.5A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=-1A, I_{B1}=-I_{B2}=-100mA	-	0.3	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=4.3V, R_L=30Ω	-	1.0	-	

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 3 2 C
SILICON PNP TRIPLE DIFFUSED TYPE

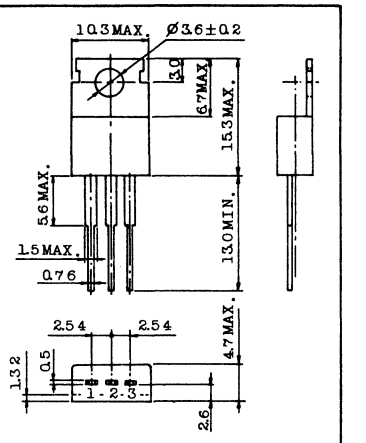
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=40W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=-3A(Max.)
. High DC Current Gain : h_{FE}=25(Min.) @V_{CE}=-4V, I_C=-1A
. Complementary to TIP31C

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	-100	V
Collector-Emitter Voltage		V_{CEO}	-100	V
Emitter-Base Voltage		V_{EBO}	-5	V
Collector Current	DC	I_C	-3	A
	Pulse	I_{CP}	-5	
Continuous Base Current		I_B	-1	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		40	
Unclamped Inductive Load Energy		$E_{S/B}$	32	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65 ~ 150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.125	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-30mA, I_B=0	-100	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=-60V, I_B=0	-	-	-0.3	mA
Collector Cut-off Current		I_{CES}	V_{CE}=-100V, V_{BE}=0	-	-	-0.2	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=-5V, I_C=0	-	-	-1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=-4V, I_C=-1A	25	-	-	
		$h_{FE(2)}$	V_{CE}=-4V, I_C=-3A	10	-	50	
Base-Emitter Voltage		V_{BE}	V_{CE}=-4V, I_C=-3A	-	-	-1.8	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=-3A, I_B=-375mA	-	-	-1.2	V
Small-Signal Current Gain		h_{fe}	V_{CE}=-10V, I_C=-0.5A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=-10V, I_C=-0.5A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=-1A, I_{B1}=-I_{B2}=-100mA	-	0.3	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=4.3V, R_L=30Ω	-	1.0	-	

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 4 1
SILICON NPN TRIPLE DIFFUSED TYPE

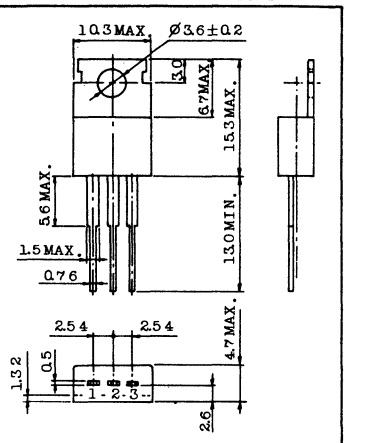
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=65W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=6A(Max.)
. High DC Current Gain : h_{FE}=15(Min.) @V_{CE}=4V, I_C=3A
. Complementary to TIP42

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	40	V
Collector-Emitter Voltage		V_{CEO}	40	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	DC	I_C	6	A
	Pulse	I_{CP}	10	
Continuous Base Current		I_B	3	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		65	
Unclamped Inductive Load Energy		$E_{S/B}$	62.5	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.92	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=30mA, I_B=0	40	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=30V, I_B=0	-	-	0.7	mA
Collector Cut-off Current		I_{CES}	V_{CE}=40V, V_{BE}=0	-	-	0.4	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=5V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=4V, I_C=0.3A	30	-	-	
		$h_{FE(2)}$	V_{CE}=4V, I_C=3A	15	-	75	
Base-Emitter Voltage		V_{BE}	V_{CE}=4V, I_C=6A	-	-	2.0	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=6A, I_B=0.6A	-	-	1.5	V
Small-Signal Current Gain		h_{fe}	V_{CE}=10V, I_C=0.5A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=10V, I_C=0.5A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=6A, I_{B1}=-I_{B2}=0.6A	-	0.6	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=-4V, R_L=5Ω	-	1.0	-	

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 4 1 A
SILICON NPN TRIPLE DIFFUSED TYPE

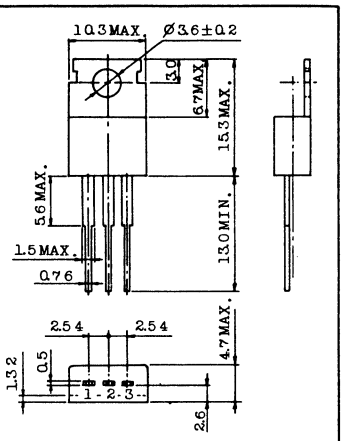
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=65W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=6A(Max.)
. High DC Current Gain : h_{FE}=15(Min.) @V_{CE}=4V, I_C=3A
. Complementary to TIP42A

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	60	V
Collector-Emitter Voltage		V_{CEO}	60	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	DC	I_C	6	A
	Pulse	I_{CP}	10	
Continuous Base Current		I_B	3	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		65	
Unclamped Inductive Load Energy		$E_{S/B}$	62.5	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65 ~ 150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	Rth(j-c)	1.92	°C/W
Thermal Resistance, Junction to Ambient	Rth(j-a)	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=30mA, I_B=0	60	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=30V, I_B=0	-	-	0.7	mA
Collector Cut-off Current		I_{CES}	V_{CE}=60V, V_{BE}=0	-	-	0.4	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=5V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=4V, I_C=0.3A	30	-	-	
		$h_{FE(2)}$	V_{CE}=4V, I_C=3A	15	-	75	
Base-Emitter Voltage		V_{BE}	V_{CE}=4V, I_C=6A	-	-	2.0	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=6A, I_B=0.6A	-	-	1.5	V
Small-Signal Current Gain		h_{fe}	V_{CE}=10V, I_C=0.5A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=10V, I_C=0.5A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=6A, I_{B1}=-I_{B2}=0.6A	-	0.6	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=-4V, R_L=5Ω	-	1.0	-	

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 4 1 B
SILICON NPN TRIPLE DIFFUSED TYPE

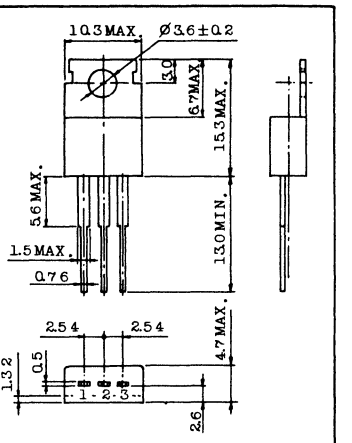
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=65W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=6A(Max.)
. High DC Current Gain : h_{FE}=15(Min.) @V_{CE}=4V, I_C=3A
. Complementary to TIP42B

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	80	V
Collector-Emitter Voltage		V_{CEO}	80	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	DC	I_C	6	A
	Pulse	I_{CP}	10	
Continuous Base Current		I_B	3	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		65	
Unclamped Inductive Load Energy		$E_{S/B}$	62.5	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.92	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case 10 seconds)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=30mA, I_B=0	80	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=60V, I_B=0	-	-	0.7	mA
Collector Cut-off Current		I_{CES}	V_{CE}=80V, V_{BE}=0	-	-	0.4	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=5V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=4V, I_C=0.3A	30	-	-	
		$h_{FE(2)}$	V_{CE}=4V, I_C=3A	15	-	75	
Base-Emitter Voltage		V_{BE}	V_{CE}=4V, I_C=6A	-	-	2.0	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=6A, I_B=0.6A	-	-	1.5	V
Small-Signal Current Gain		h_{fe}	V_{CE}=10V, I_C=0.5A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=10V, I_C=0.5A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=6A, I_{B1}=-I_{B2}=0.6A	-	0.6	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=-4V, R_L=5Ω	-	1.0	-	

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 4 1 C
SILICON NPN TRIPLE DIFFUSED TYPE

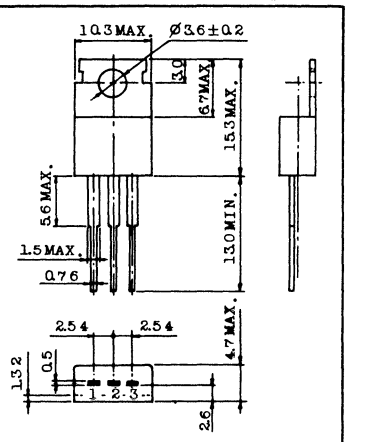
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

- High Collector Power Dissipation : P_C=65W @Tc=25°C
- High Collector Current : $I_{C(DC)}$=6A(Max.)
- High DC Current Gain : h_{FE}=15(Min.) @V_{CE}=4V, I_C=3A
- Complementary to TIP42C

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	100	V
Collector-Emitter Voltage		V_{CEO}	100	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	DC	I_C	6	A
	Pulse	I_{CP}	10	
Continuous Base Current		I_B	3	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		65	
Unclamped Inductive Load Energy		$E_{S/B}$	62.5	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.92	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=30mA, I_B=0	100	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=60V, I_B=0	-	-	0.7	mA
Collector Cut-off Current		I_{CES}	V_{CE}=100V, V_{BE}=0	-	-	0.4	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=5V, I_C=0	-	-	1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=4V, I_C=0.3A	30	-	-	
		$h_{FE(2)}$	V_{CE}=4V, I_C=3A	15	-	75	
Base-Emitter Voltage		V_{BE}	V_{CE}=4V, I_C=6A	-	-	2.0	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=6A, I_B=0.6A	-	-	1.5	V
Small-Signal Current Gain		h_{fe}	V_{CE}=10V, I_C=0.5A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=10V, I_C=0.5A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=6A, I_{B1}=-I_{B2}=0.6A	-	0.6	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=-4V, R_L=5Ω	-	1.0	-	

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 4 2
SILICON PNP TRIPLE DIFFUSED TYPE

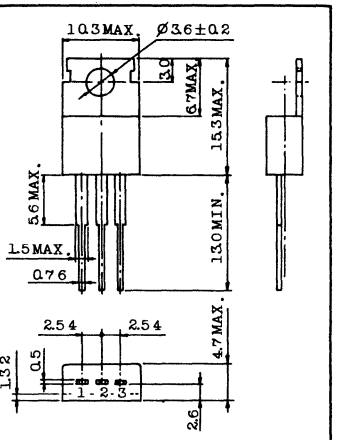
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=65W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=-6A(Max.)
. High DC Current Gain : h_{FE}=15(Min.) @V_{CE}=-4V, I_C=-3A
. Complementary to TIP41

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	-40	V
Collector-Emitter Voltage		V_{CEO}	-40	V
Emitter-Base Voltage		V_{EBO}	-5	V
Collector Current	DC	I_C	-6	A
	Pulse	I_{CP}	-10	
Continuous Base Current		I_B	-3	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		65	
Unclamped Inductive Load Energy		$E_{S/B}$	62.5	mJ
Junction Temperature		Tj	150	°C
Storage Temperature Range		Tstg	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	Rth(j-c)	1.92	°C/W
Thermal Resistance, Junction to Ambient	Rth(j-a)	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-30mA, I_B=0	-40	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=-30V, I_B=0	-	-	-0.7	mA
Collector Cut-off Current		I_{CES}	V_{CE}=-40V, V_{BE}=0	-	-	-0.4	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=-5V, I_C=0	-	-	-1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=-4V, I_C=-0.3A	30	-	-	
		$h_{FE(2)}$	V_{CE}=-4V, I_C=-3A	15	-	75	
Base-Emitter Voltage		V_{BE}	V_{CE}=-4V, I_C=-6A	-	-	-2.0	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=-6A, I_B=-0.6A	-	-	-1.5	V
Small-Signal Current Gain		h_{fe}	V_{CE}=-10V, I_C=-0.5A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=-10V, I_C=-0.5A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=-6A, I_{B1}=-I_{B2}=-0.6A	-	0.4	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=4V, R_L=5Ω	-	0.7	-	

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 4 2 A
SILICON PNP TRIPLE DIFFUSED TYPE

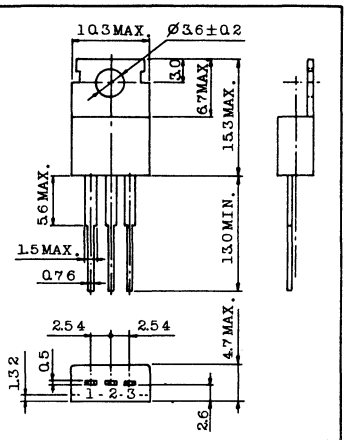
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=65W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=-6A(Max.)
. High DC Current Gain : h_{FE}=15(Min.) @V_{CE}=-4V, I_C=-3A
. Complementary to TIP41A

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	-60	V
Collector-Emitter Voltage		V_{CEO}	-60	V
Emitter-Base Voltage		V_{EBO}	-5	V
Collector Current	DC	I_C	-6	A
	Pulse	I_{CP}	-10	
Continuous Base Current		I_B	-3	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		65	
Unclamped Inductive Energy		$E_{S/B}$	62.5	mJ
Junction Temperature		Tj	150	°C
Storage Temperature Range		T_{stg}	-65 ~ 150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	Rth(j-c)	1.92	°C/W
Thermal Resistance, Junction to Ambient	Rth(j-a)	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-30mA, I_B=0	-60	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=-30V, I_B=0	-	-	-0.7	mA
Collector Cut-off Current		I_{CES}	V_{CE}=-60V, V_{BE}=0	-	-	-0.4	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=-5V, I_C=0	-	-	-1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=-4V, I_C=-0.3A	30	-	-	
		$h_{FE(2)}$	V_{CE}=-4V, I_C=-3A	15	-	75	
Base-Emitter Voltage		V_{BE}	V_{CE}=-4V, I_C=-6A	-	-	-2.0	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=-6A, I_B=-0.6A	-	-	-1.5	V
Small-Signal Current Gain		h_{fe}	V_{CE}=-10V, I_C=-0.5A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=-10V, I_C=-0.5A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=-6A, I_{B1}=-I_{B2}=-0.6A	-	0.4	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=4V, R_L=5Ω	-	0.7	-	

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 4 2 B
SILICON PNP TRIPLE DIFFUSED TYPE

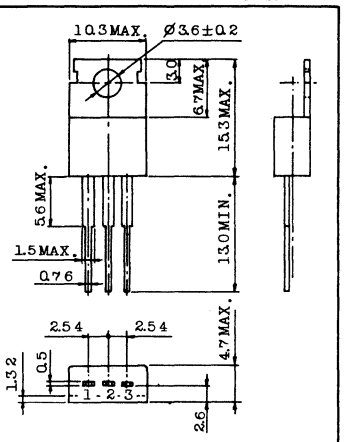
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=65W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=-6A(Max.)
. High DC Current Gain : h_{FE}=15(Min.) @V_{CE}=-4V, I_C=-3A
. Complementary to TIP41B

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	-80	V
Collector-Emitter Voltage		V_{CEO}	-80	V
Emitter-Base Voltage		V_{EBO}	-5	V
Collector Current	DC	I_C	-6	A
	Pulse	I_{CP}	-10	
Continuous Base Current		I_B	-3	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		65	
Unclamped Inductive Load Energy		$E_{S/B}$	62.5	mJ
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	-65~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.92	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-30mA, I_B=0	-80	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=-60V, I_B=0	-	-	-0.7	mA
Collector Cut-off Current		I_{CES}	V_{CE}=-80V, V_{BE}=0	-	-	-0.4	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=-5V, I_C=0	-	-	-1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=-4V, I_C=-0.3A	30	-	-	
		$h_{FE(2)}$	V_{CE}=-4V, I_C=-3A	15	-	75	
Base-Emitter Voltage		V_{BE}	V_{CE}=-4V, I_C=-6A	-	-	-2.0	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=-6A, I_B=-0.6A	-	-	-1.5	V
Small-Signal Current Gain		h_{fe}	V_{CE}=-10V, I_C=-0.5A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=-10V, I_C=-0.5A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=-6A, I_{B1}=-I_{B2}=-0.6A	-	0.4	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=4V, R_L=5Ω	-	0.7	-	

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 4 2 C
SILICON PNP TRIPLE DIFFUSED TYPE

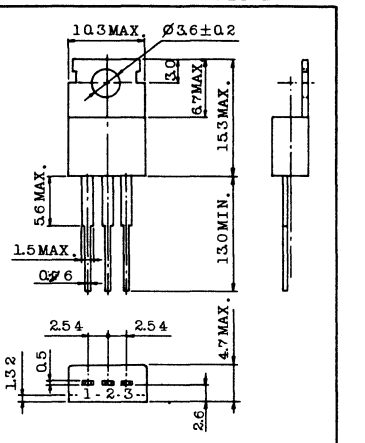
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING.

FEATURES:

. High Collector Power Dissipation : P_C=65W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=-6A(Max.)
. High DC Current Gain : h_{FE}=15(Min.) @V_{CE}=-4V, I_C=-3A
. Complementary to TIP41C

Unit in mm



1. BASE
2. COLLECTOR(HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Weiget : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	-100	V
Collector-Emitter Voltage		V_{CEO}	-100	V
Emitter-Base Voltage		V_{EBO}	-5	V
Collector Current	DC	I_C	-6	A
	Pulse	I_{CP}	-10	
Continuous Base Current		I_B	-3	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		65	
Unclamped Inductive Load Energy		$E_{S/B}$	62.5	mJ
Junction Temperature		Tj	150	°C
Storage Temperature Range		Tstg	-65 ~ 150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	Rth(j-c)	1.92	°C/W
Thermal Resistance, Junction to Ambient	Rth(j-a)	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

ELECTRICAL CHARACTERISTICS

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-30mA, I_B=0	-100	-	-	V
Collector Cut-off Current		I_{CEO}	V_{CE}=-60V, I_B=0	-	-	-0.7	mA
Collector Cut-off Current		I_{CES}	V_{CE}=-100V, V_{BE}=0	-	-	-0.4	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=-5V, I_C=0	-	-	-1	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=-4V, I_C=-0.3A	30	-	-	
		$h_{FE(2)}$	V_{CE}=-4V, I_C=-3A	15	-	75	
Base-Emitter Voltage		V_{BE}	V_{CE}=-4V, I_C=-6A	-	-	-2.0	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=-6A, I_B=-0.6A	-	-	-1.5	V
Small-Signal Current Gain		h_{fe}	V_{CE}=-10V, I_C=-0.5A f=1kHz	20	-	-	
Small-Signal Current Gain		$\|h_{fe}\|$	V_{CE}=-10V, I_C=-0.5A f=1MHz	3	-	-	
Switching Time	Turn-on Time	t_{on}	I_C=-6A, I_{B1}=-I_{B2}=-0.6A	-	0.4	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=4V, R_L=5Ω	-	0.7	-	

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR

T I P 1 2 0

SILICON NPN TRIPLE DIFFUSED TYPE
(DARLINGTON POWER)

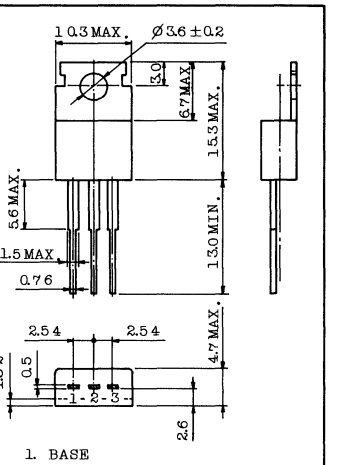
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD DRIVE APPLICATIONS.

FEATURES:

. High Collector Power Dissipation : P_C=65W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=5A(Max.)
. High DC Current Gain: h_{FE}=1000(Min.) @V_{CE}=3V, I_C=3A
. Complementary to TIP125

Unit in mm



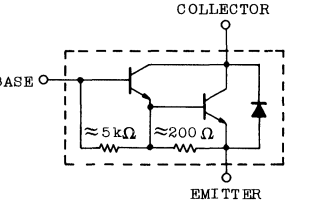
JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Mounting Kit No. AC75
Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	60	V
Collector-Emitter Voltage		V_{CEO}	60	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	DC	I_C	5	A
	Pulse	I_{CP}	8	
Continuous Base Current		I_B	0.1	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		65	
Unclamped Inductive Load Energy		$E_{S/B}$	50	mJ
Junction Temperature		Tj	150	°C
Storage Temperature Range		Tstg	-65~150	°C

EQUIVALENT CIRCUIT



THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	Rth(j-c)	1.92	°C/W
Thermal Resistance, Junction to Ambient	Rth(j-a)	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

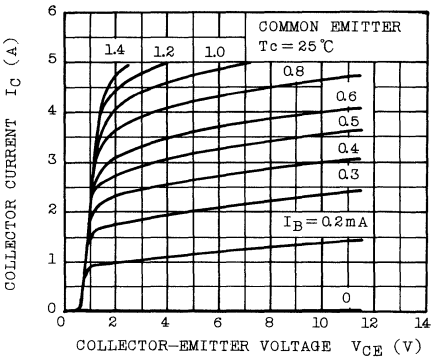
TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

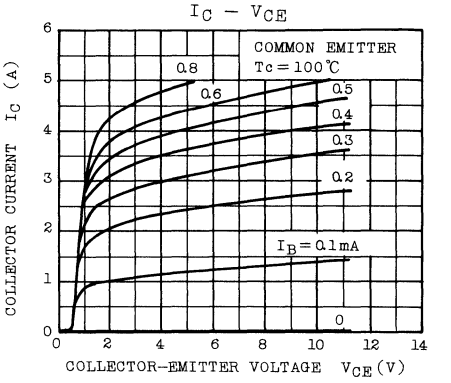
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{BR(CEO)}$	I_C=30mA, I_B=0	60	-	-	V
Collector Cut-off Current		I_{CBO}	V_{CB}=60V, I_E=0	-	-	200	μA
Collector Cut-off Current		I_{CEO}	V_{CE}=30V, I_B=0	-	-	0.5	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=5V, I_C=0	-	-	2	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=3V, I_C=0.5A	1000	-	-	
		$h_{FE(2)}$	V_{CE}=3V, I_C=3A	1000	-	-	
Base-Emitter Voltage		V_{BE}	V_{CE}=3V, I_C=3A	-	-	2.5	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)(1)}$	I_C=3A, I_B=12mA	-	-	2	V
		$V_{CE(sat)(2)}$	I_C=5A, I_B=20mA	-	-	4	
Switching Time	Turn-on Time	t_{on}	I_C=3A I_{B1}=-I_{B2}=12mA	-	1.5	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=-5V R_L=10Ω	-	8.5	-	μs

TOSHIBA CORPORATION

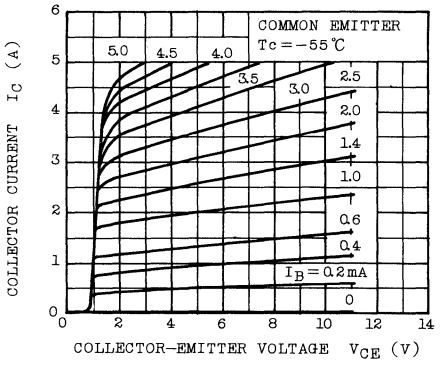
$I_C - V_{CE}$



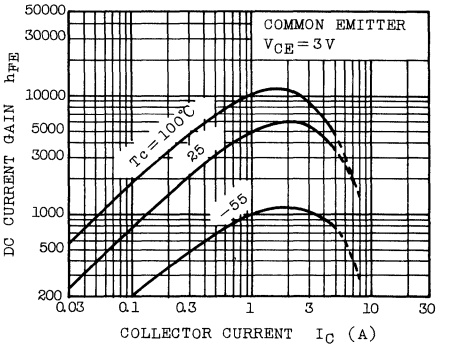
$I_C - V_{CE}$



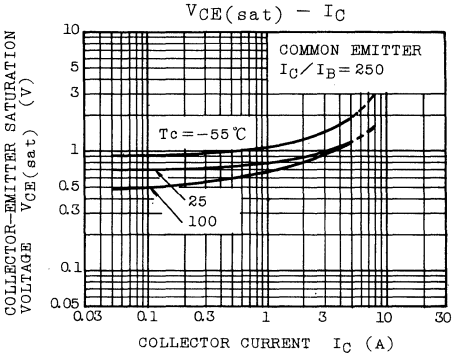
$I_C - V_{CE}$



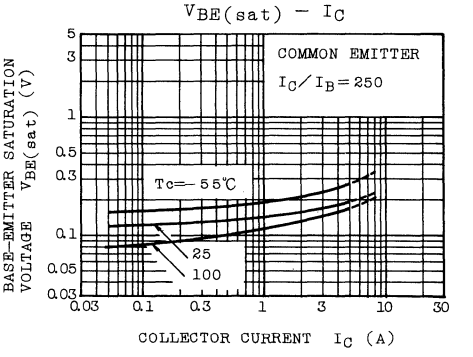
$h_{FE} - I_C$



$V_{CE(sat)} - I_C$

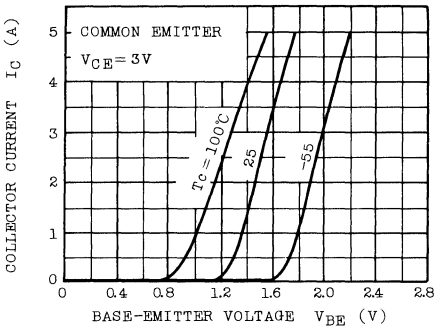


$V_{BE(sat)} - I_C$

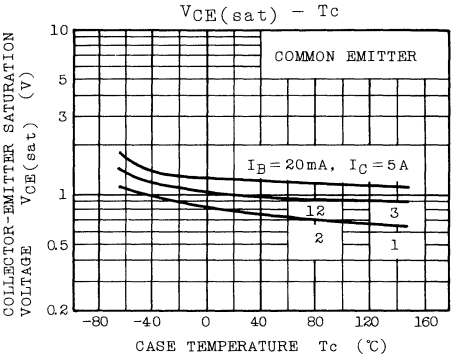


TOSHIBA CORPORATION

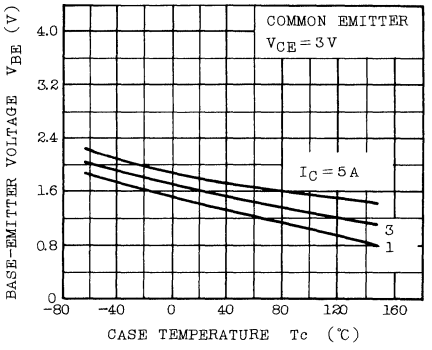
$I_C - V_{BE}$



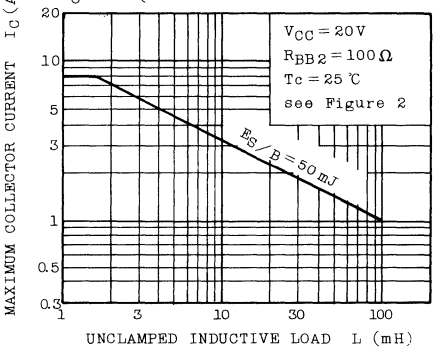
$V_{CE(sat)} - Tc$



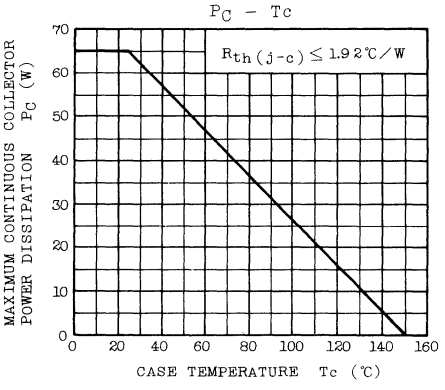
$V_{BE} - Tc$



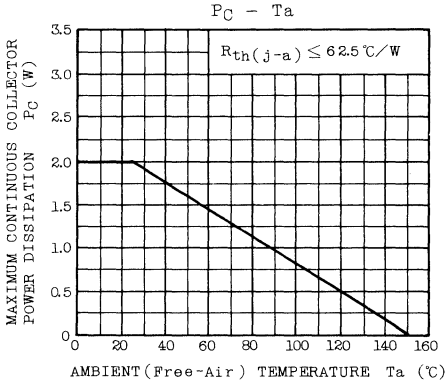
$I_C - L$ (UNCLAMPED INDUCTIVE LOAD)



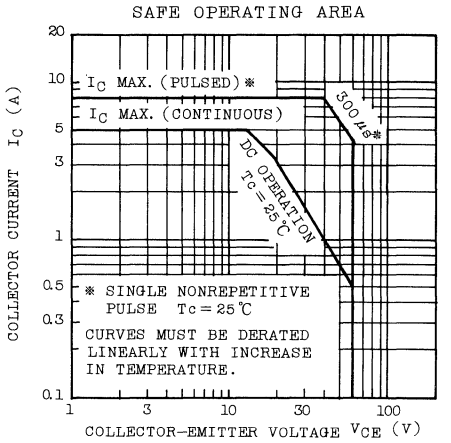
$P_C - Tc$

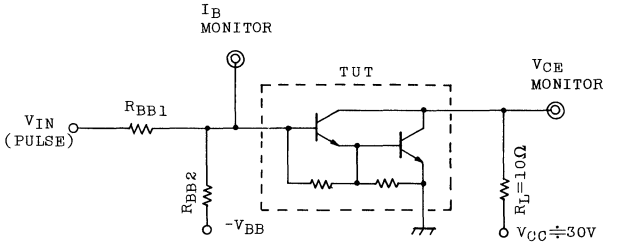


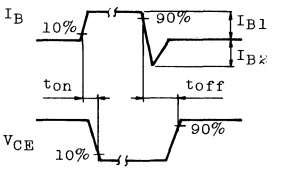
$P_C - Ta$



TOSHIBA CORPORATION



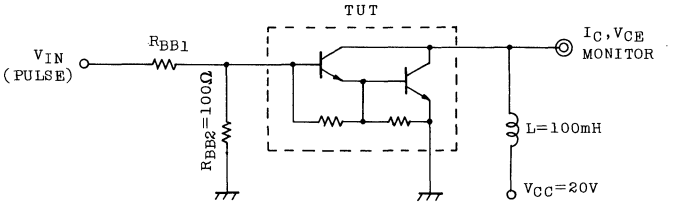


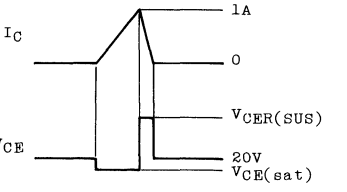


(A) The V_{IN} waveform is obtained by using amplifier circuit and the signal source is supplied by generator with the following characteristics:
t_r, t_f <15ns, t_w=20μs, Du ≤1%

(B) V_{IN}, R_{BB1} and R_{BB2} are varied to obtain desired base current levels.

Figure 1. SWITCHING TIME MEASUREMENT CIRCUIT





Input pulse width is increased until I_{CP}=1A.

Figure 2. INDUCTIVE LOAD SWITCHING TEST

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR

T I P 1 2 1

SILICON NPN TRIPLE DIFFUSED TYPE
(DARLINGTON POWER)

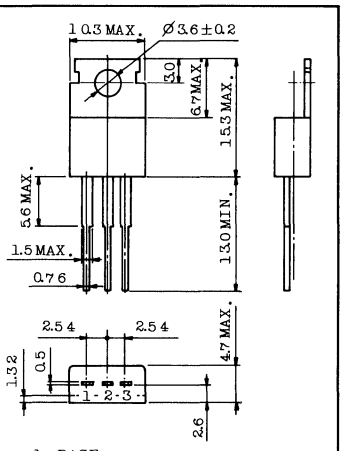
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD DRIVE APPLICATIONS.

FEATURES:

. High Collector Power Dissipation : P_C=65W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=5A(Max.)
. High DC Current Gain: h_{FE}=1000(Min.) @V_{CE}=3V, I_C=3A
. Complementary to TIP126

Unit in mm



1. BASE
2. COLLECTOR (HEAT SINK)
3. EMITTER

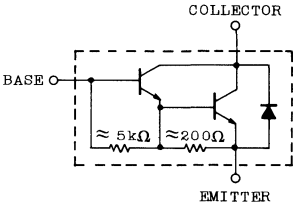
JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Mounting Kit No. AC75
Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	80	V
Collector-Emitter Voltage		V_{CEO}	80	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	DC	I_C	5	A
	Pulse	I_{CP}	8	
Continuous Base Current		I_B	0.1	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		65	
Unclamped Inductive Load Energy		$E_{S/B}$	50	mJ
Junction Temperature		Tj	150	°C
Storage Temperature Range		T_{stg}	-65 ~ 150	°C

EQUIVALENT CIRCUIT



THERMAL CHARACTERISTICS

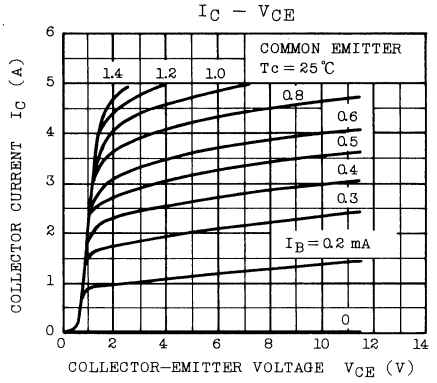
CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.92	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

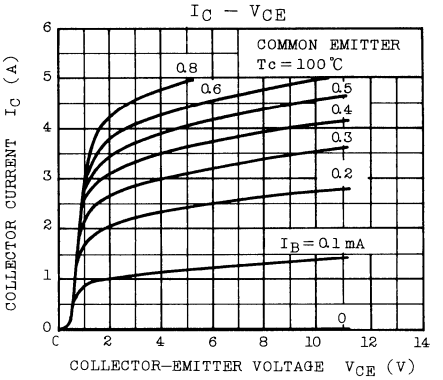
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{BR(CEO)}$	I_C=30mA, I_B=0	80	-	-	V
Collector Cut-off Current		I_{CBO}	V_{CB}=80V, I_E=0	-	-	200	μA
Collector Cut-off Current		I_{CEO}	V_{CE}=40V, I_B=0	-	-	0.5	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=5V, I_C=0	-	-	2	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=3V, I_C=0.5A	1000	-	-	
		$h_{FE(2)}$	V_{CE}=3V, I_C=3A	1000	-	-	
Base-Emitter Voltage		V_{BE}	V_{CE}=3V, I_C=3A	-	-	2.5	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)(1)}$	I_C=3A, I_B=12mA	-	-	2	V
		$V_{CE(sat)(2)}$	I_C=5A, I_B=20mA	-	-	4	
Switching Time	Turn-on Time	t_{on}	I_C=3A I_{B1}=-I_{B2}=12mA	-	1.5	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=-5V R_L=10Ω	-	8.5	-	μs

TOSHIBA CORPORATION

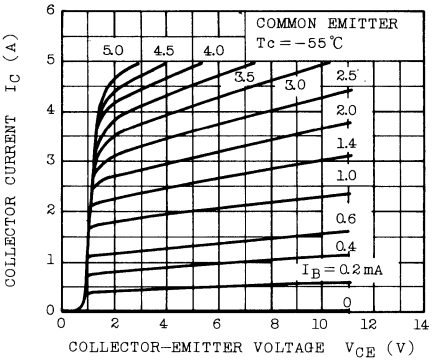
$I_C - V_{CE}$



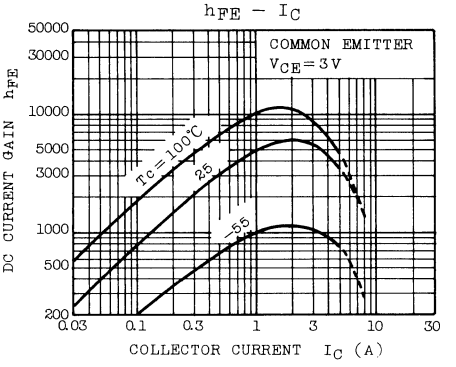
$I_C - V_{CE}$



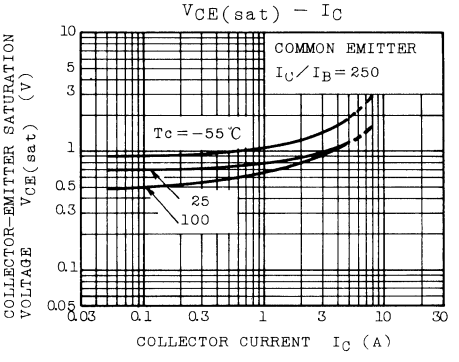
$I_C - V_{CE}$



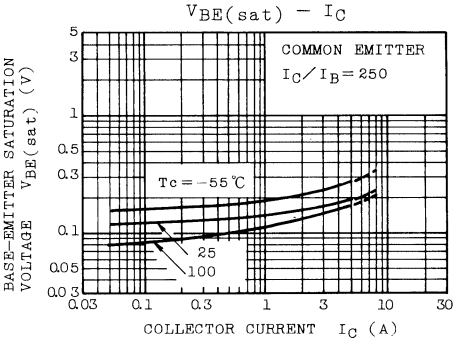
$h_{FE} - I_C$



$V_{CE(sat)} - I_C$

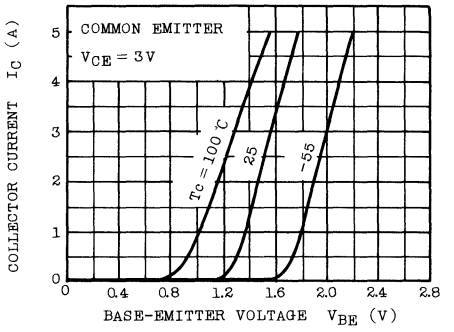


$V_{BE(sat)} - I_C$

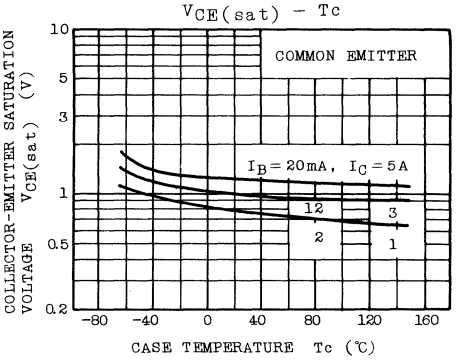


TOSHIBA CORPORATION

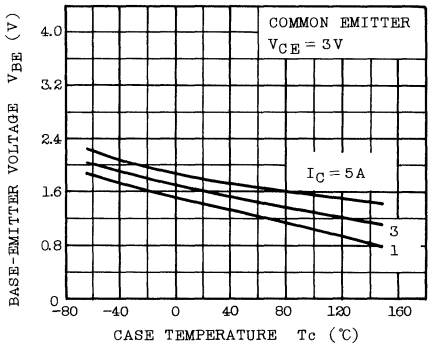
$I_C - V_{BE}$



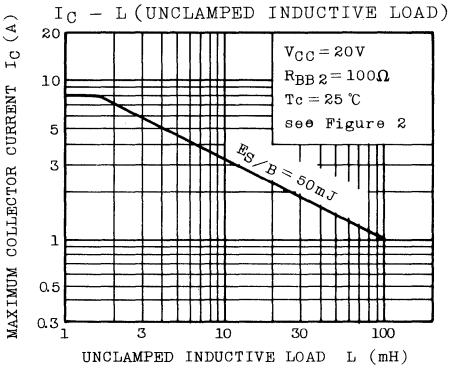
$V_{CE(sat)} - T_C$



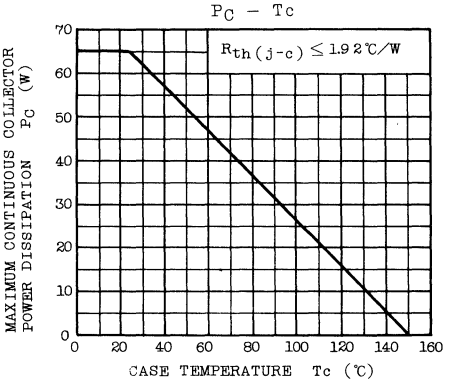
$V_{BE} - T_C$



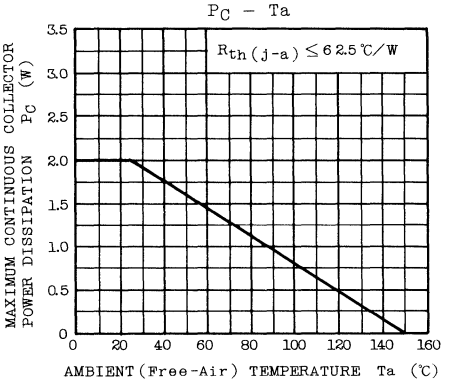
I_C – L (UNCLAMPED INDUCTIVE LOAD)



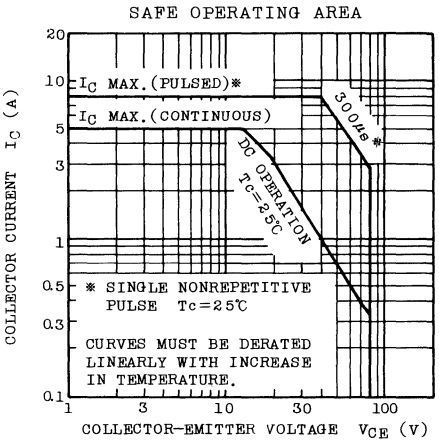
$P_C - T_C$

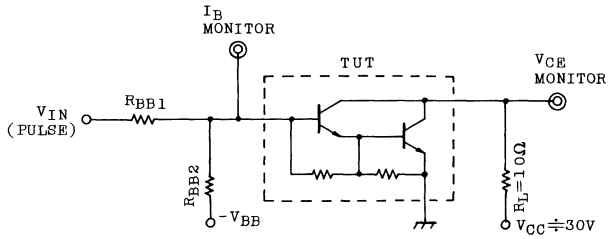


P_C – Ta



TOSHIBA CORPORATION

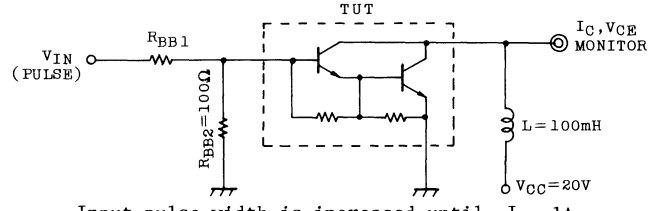




(A) The V_{IN} waveform is obtained by using amplifier circuit and the signal source is supplied by generator with the following characteristics:
$t_r, t_f < 15ns$, $t_w = 20\mu s$, Du ≤ 1%

(B) V_{IN}, R_{BB1} and R_{BB2} are varied to obtain desired base current levels.

Figure 1. SWITCHING TIME MEASUREMENT CIRCUIT



Input pulse width is increased until I_{CP}=1A.

Figure 2. INDUCTIVE LOAD SWITCHING TEST

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR

T I P 1 2 2

SILICON NPN TRIPLE DIFFUSED TYPE
(DARLINGTON POWER)

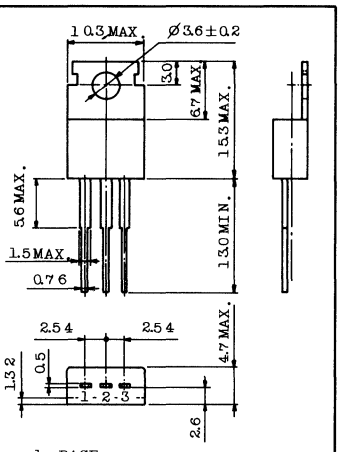
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD DRIVE APPLICATIONS.

FEATURES:

. High Collector Power Dissipation : P_C=65W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=5A(Max.)
. High DC Current Gain: h_{FE}=1000(Min.) @V_{CE}=3V. I_C=3A
. Complementary to TIP127

Unit in mm



1. BASE
2. COLLECTOR (HEAT SINK)
3. EMITTER

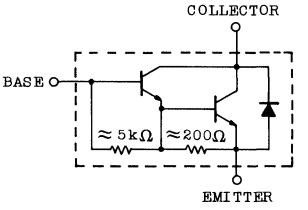
JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Mounting Kit No. AC75
Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	100	V
Collector-Emitter Voltage		V_{CEO}	100	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	DC	I_C	5	A
	Pulse	I_{CP}	8	
Continuous Base Current		I_B	0.1	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		65	
Unclamped Inductive Load Energy		$E_{S/B}$	50	mJ
Junction Temperature		Tj	150	°C
Storage Temperature Range		Tstg	-65~150	°C

EQUIVALENT CIRCUIT



THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.92	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

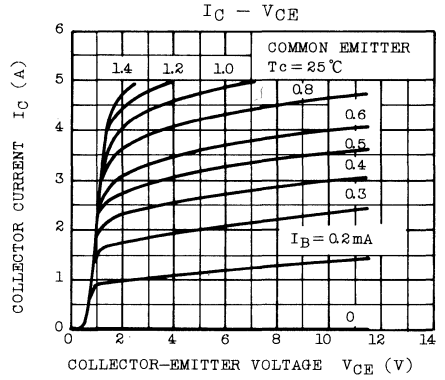
TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

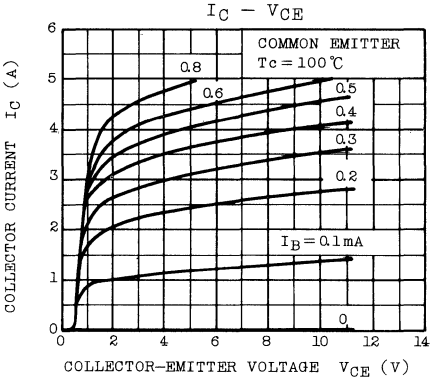
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{BR(CEO)}$	I_C=30mA, I_B=0	100	-	-	V
Collector Cut-off Current		I_{CBO}	V_{CB}=100V, I_E=0	-	-	200	μA
Collector Cut-off Current		I_{CEO}	V_{CE}=50V, I_B=0	-	-	0.5	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=5V, I_C=0	-	-	2	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=3V, I_C=0.5A	1000	-	-	
		$h_{FE(2)}$	V_{CE}=3V, I_C=3A	1000	-	-	
Base-Emitter Voltage		V_{BE}	V_{CE}=3V, I_C=3A	-	-	2.5	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)(1)}$	I_C=3A, I_B=12mA	-	-	2	V
		$V_{CE(sat)(2)}$	I_C=5A, I_B=20mA	-	-	4	
Switching Time	Turn-on Time	t_{on}	I_C=3A I_{B1}=-I_{B2}=12mA	-	1.5	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=-5V R_L=10Ω	-	8.5	-	μs

TOSHIBA CORPORATION

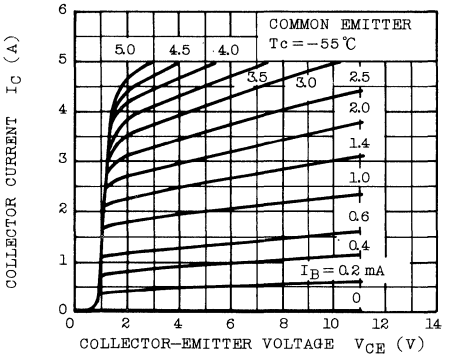
$I_C - V_{CE}$



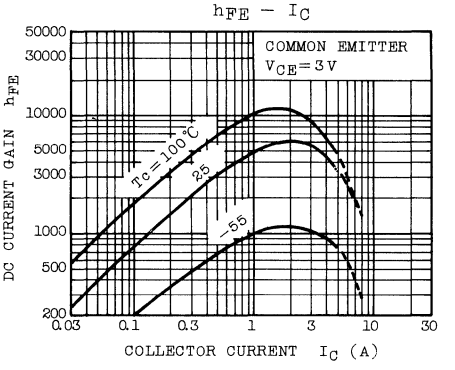
$I_C - V_{CE}$



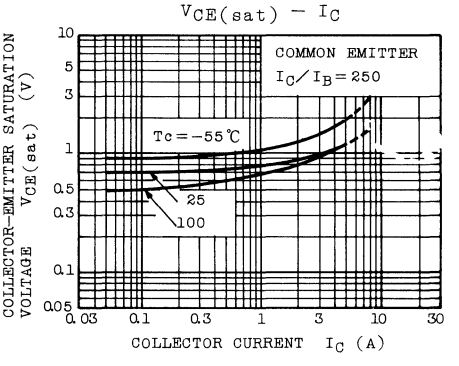
$I_C - V_{CE}$



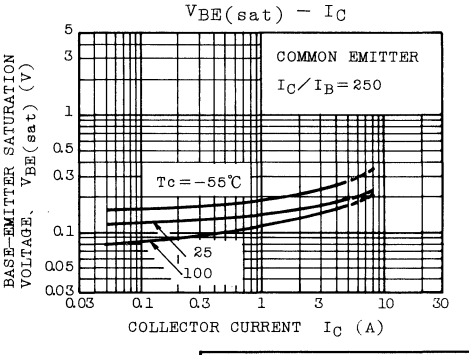
$h_{FE} - I_C$



$V_{CE(sat)} - I_C$

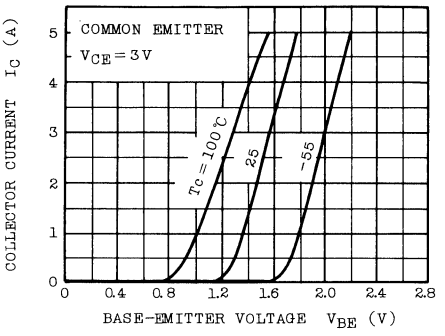


$V_{BE(sat)} - I_C$

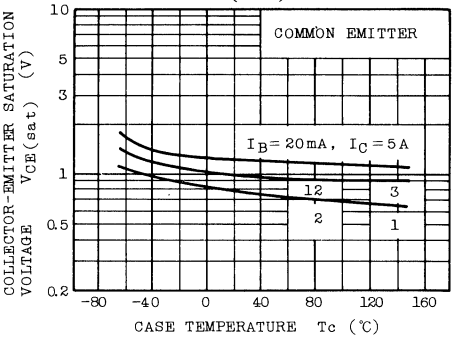


TOSHIBA CORPORATION

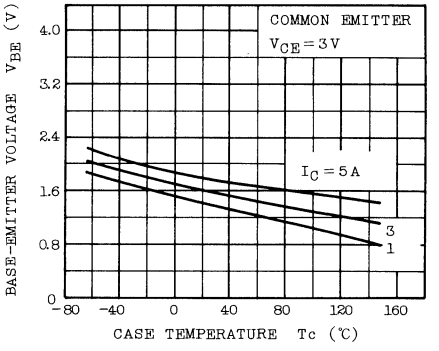
$I_C - V_{BE}$



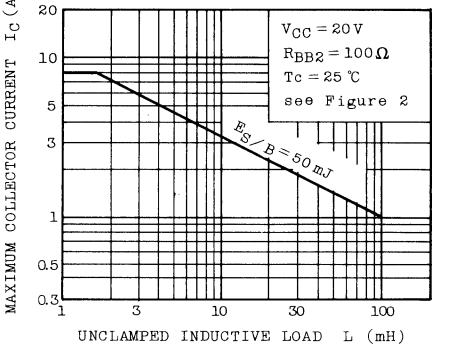
$V_{CE(sat)} - T_C$



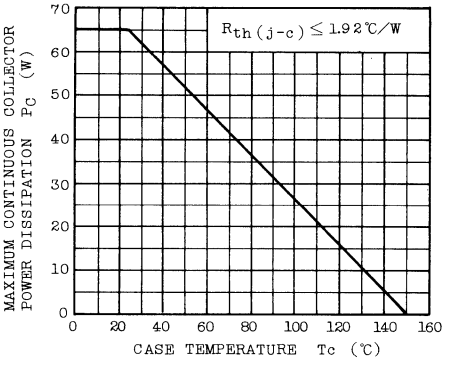
$V_{BE} - T_C$



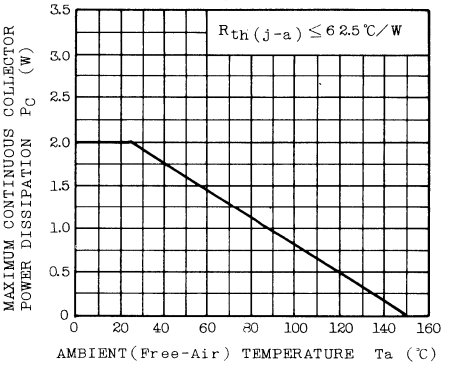
$I_C - L$ (UNCLAMPED INDUCTIVE LOAD)



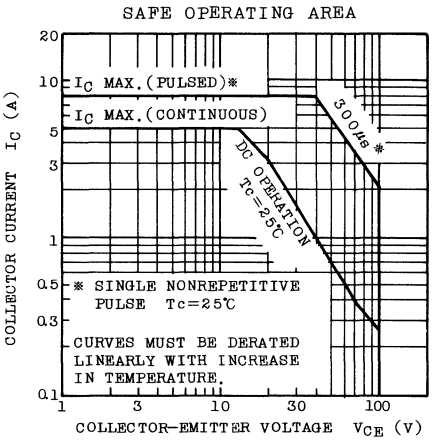
$P_C - T_C$

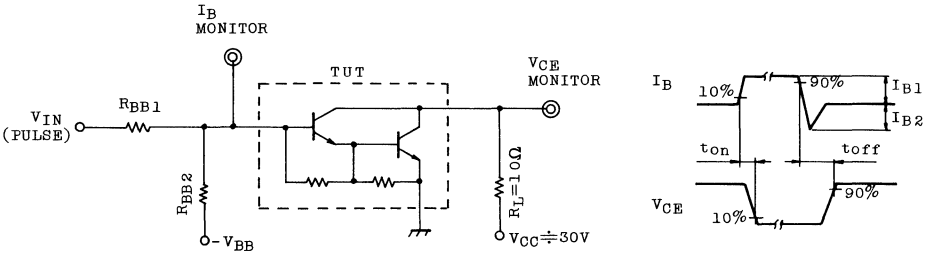


$P_C - T_a$



TOSHIBA CORPORATION

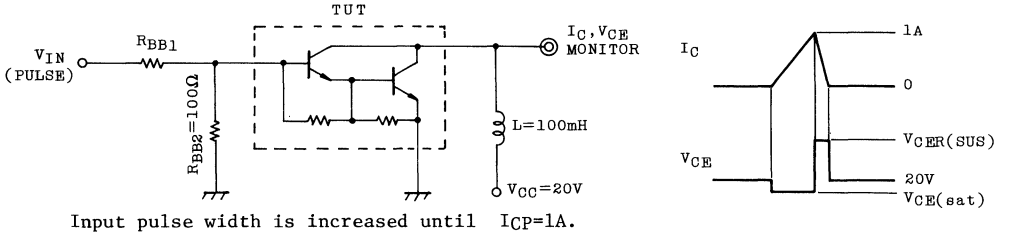




(A) The V_{IN} waveform is obtained by using amplifier circuit and the signal source is supplied by generator with the following characteristics:
t_r, t_f <15ns, t_w=20μs, Du ≤1%

(B) V_{IN}, R_{BB1} and R_{BB2} are varied to obtain desired base current levels.

Figure 1. SWITCHING TIME MEASUREMENT CIRCUIT



Input pulse width is increased until I_{CP}=1A.

Figure 2. INDUCTIVE LOAD SWITCHING TEST

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR

T I P 1 2 5

SILICON PNP TRIPLE DIFFUSED TYPE
(DARLINGTON POWER)

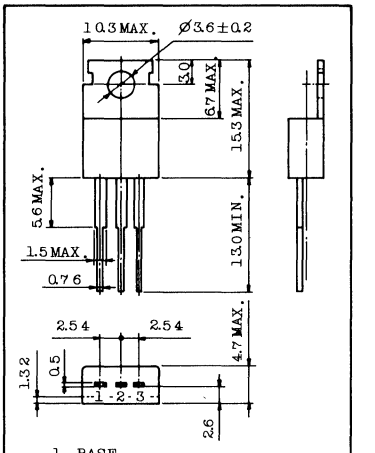
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD DRIVE APPLICATIONS.

FEATURES:

. High Collector Power Dissipation : P_C=65W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=-5A(Max.)
. High DC Current Gain: h_{FE}=1000(Min.) @V_{CE}=-3V, I_C=-3A
. Complementary to TIP120

Unit in mm



1. BASE
2. COLLECTOR (HEAT SINK)
3. EMITTER

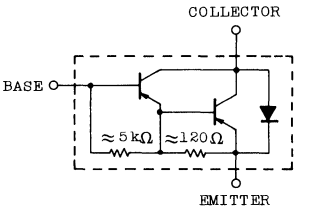
JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Mounting Kit No. AC75
Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	-60	V
Collector-Emitter Voltage		V_{CEO}	-60	V
Emitter-Base Voltage		V_{EBO}	-5	V
Collector Current	DC	I_C	-5	A
	Pulse	I_{CP}	-8	
Continuous Base Current		I_B	-0.1	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		65	
Unclamped Inductive Load Energy		$E_{S/B}$	50	mJ
Junction Temperature		Tj	150	°C
Storage Temperature Range		Tstg	-65~150	°C

EQUIVALENT CIRCUIT



THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.92	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

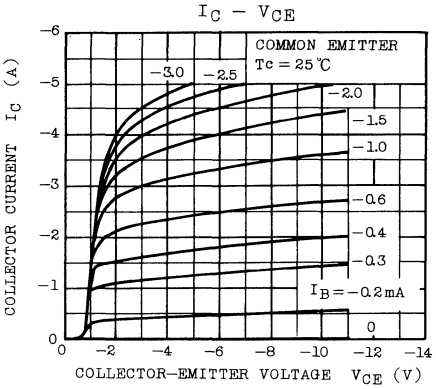
TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

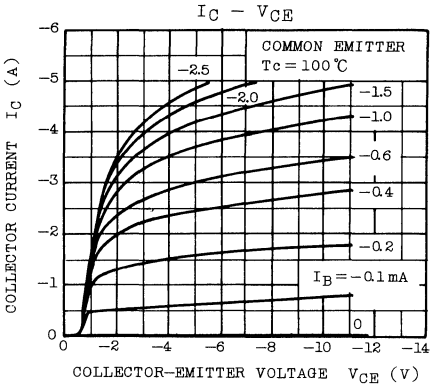
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{BR(CEO)}$	I_C=-30mA, I_B=0	-60	-	-	V
Collector Cut-off Current		I_{CBO}	V_{CB}=-60V, I_E=0	-	-	-200	μA
Collector Cut-off Current		I_{CEO}	V_{CE}=-30V, I_B=0	-	-	-0.5	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=-5V, I_C=0	-	-	-2	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=-3V, I_C=-0.5A	1000	-	-	
		$h_{FE(2)}$	V_{CE}=-3V, I_C=-3A	1000	-	-	
Base-Emitter Voltage		V_{BE}	V_{CE}=-3V, I_C=-3A	-	-	-2.5	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)(1)}$	I_C =-3A, I_B=-12mA	-	-	-2	V
		$V_{CE(sat)(2)}$	I_C=-5A, I_B=-20mA	-	-	-4	
Switching Time	Turn-on Time	t_{on}	I_C=-3A I_{B1}=-I_{B2}=-12mA $V_{BE(off)}$=5V R_L=10Ω	-	1.5	-	μs
	Turn-off Time	t_{off}		-	8.5	-	μs

TOSHIBA CORPORATION

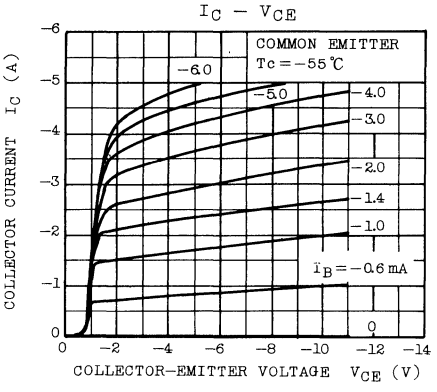
$I_C - V_{CE}$



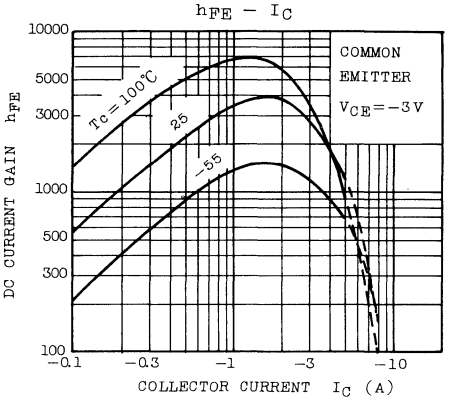
$I_C - V_{CE}$



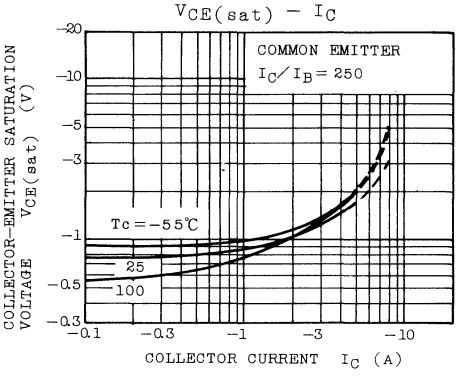
$I_C - V_{CE}$



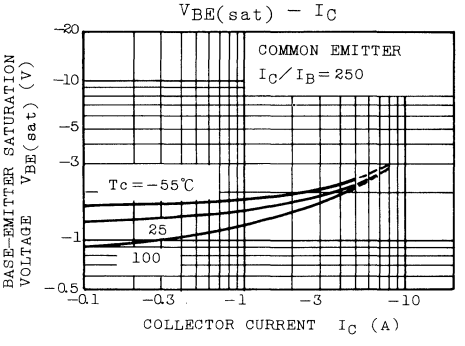
$h_{FE} - I_C$



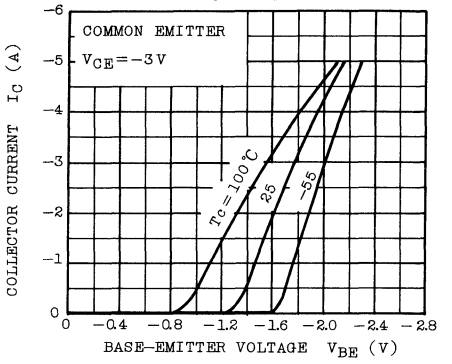
$V_{CE(sat)} - I_C$



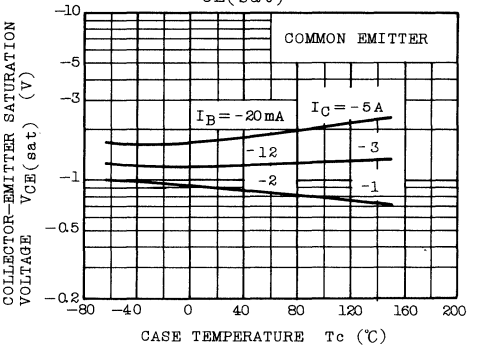
$V_{BE(sat)} - I_C$



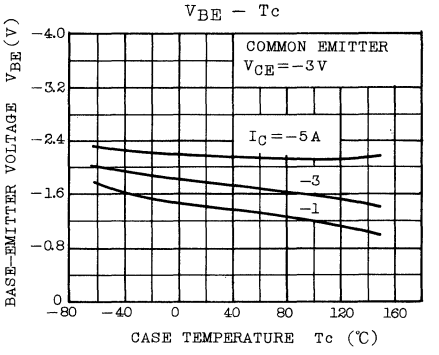
$I_C - V_{BE}$



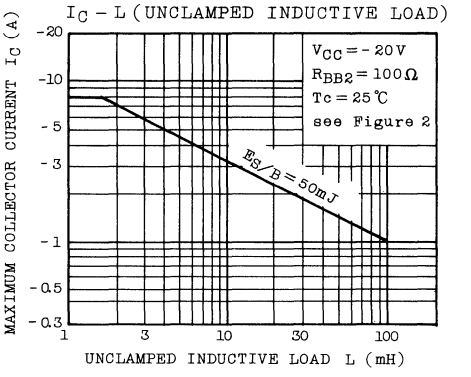
$V_{CE(sat)} - T_C$



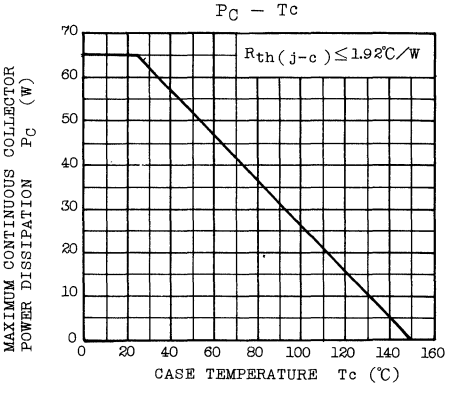
$V_{BE} - T_C$



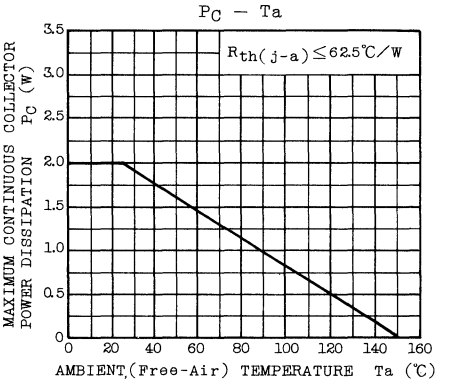
$I_C - L$ (UNCLAMPED INDUCTIVE LOAD)



$P_C - T_C$

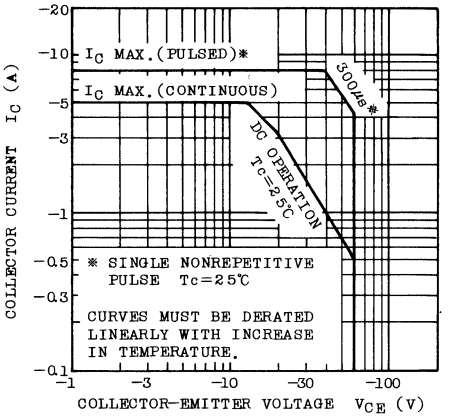


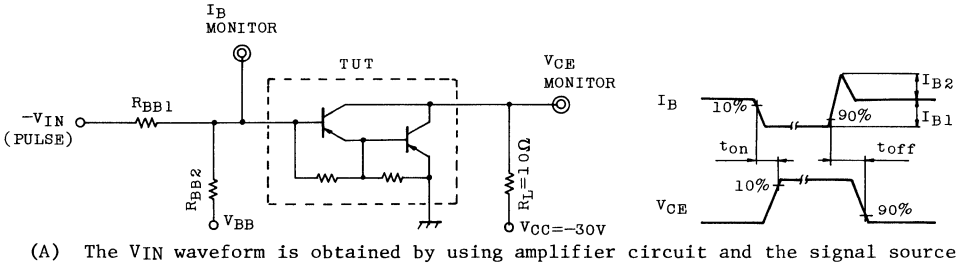
$P_C - T_a$



TOSHIBA CORPORATION

SAFE OPERATING AREA

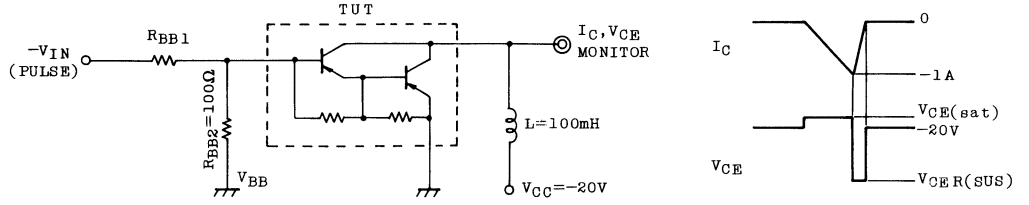




(A) The V_{IN} waveform is obtained by using amplifier circuit and the signal source is supplied by generator with the following characteristics:
t_r, t_f <15ns, t_w=20μs, Du ≤1%

(B) $-V_{IN}$, R_{BB1} and R_{BB2} are varied to obtain desired base current levels.

Figure 1. SWITCHING TIME MEASUREMENT CIRCUIT



Input pulse width is increased until I_{CP}=-1A.

Figure 2. INDUCTIVE LOAD SWITCHING TEST

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
T I P 1 2 6
SILICON PNP TRIPLE DIFFUSED TYPE
(DARLINGTON POWER)

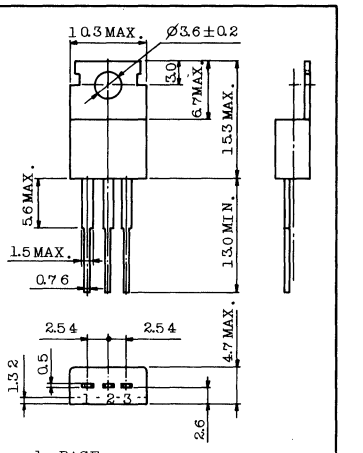
INDUSTRIAL APPLICATIONS

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD DRIVE APPLICATIONS.

FEATURES:

. High Collector Power Dissipation : P_C=65W @Tc=25°C
. High Collector Current : $I_{C(DC)}$=-5A(Max.)
. High DC Current Gain : h_{FE}=1000(Min.) @V_{CE}=-3V, I_C=-3A
. Complementary to TIP121

Unit in mm



1. BASE
2. COLLECTOR (HEAT SINK)
3. EMITTER

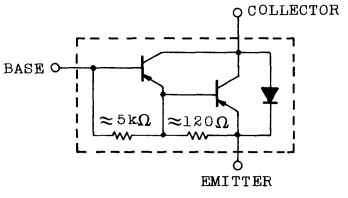
JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Mounting Kit No. AC75
Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	-80	V
Collector-Emitter Voltage		V_{CEO}	-80	V
Emitter-Base Voltage		V_{EBO}	-5	V
Collector Current	DC	I_C	-5	A
	Pulse	I_{CP}	-8	
Continuous Base Current		I_B	-0.1	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		65	
Unclamped Inductive Load Energy		$E_{S/B}$	50	mJ
Junction Temperature		Tj	150	°C
Storage Temperature Range		Tstg	-65 ~ 150	°C

EQUIVALENT CIRCUIT



THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	Rth(j-c)	1.92	°C/W
Thermal Resistance, Junction to Ambient	Rth(j-a)	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

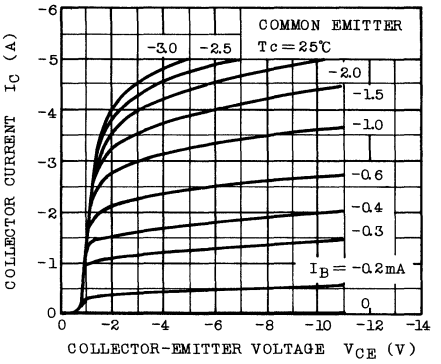
TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

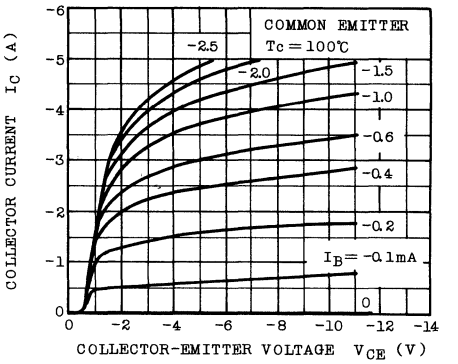
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{BR(CEO)}$	I_C=-30mA, I_B=0	-80	-	-	V
Collector Cut-off Current		I_{CBO}	V_{CB}=-80V, I_E=0	-	-	-200	μA
Collector Cut-off Current		I_{CEO}	V_{CE}=-40V, I_B=0	-	-	-0.5	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=-5V, I_C=0	-	-	-2	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=-3V, I_C=-0.5A	1000	-	-	
		$h_{FE(2)}$	V_{CE}=-3V, I_C=-3A	1000	-	-	
Base-Emitter Voltage		V_{BE}	V_{CE}=-3V, I_C=-3A	-	-	-2.5	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)(1)}$	I_C=-3A, I_B=-12mA	-	-	-2	V
		$V_{CE(sat)(2)}$	I_C=-5A, I_B=-20mA	-	-	-4	
Switching Time	Turn-on Time	t_{on}	I_C=-3A I_{B1}=-I_{B2}=-12mA	-	1.5	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=5V R_L=10Ω	-	8.5	-	μs

TOSHIBA CORPORATION

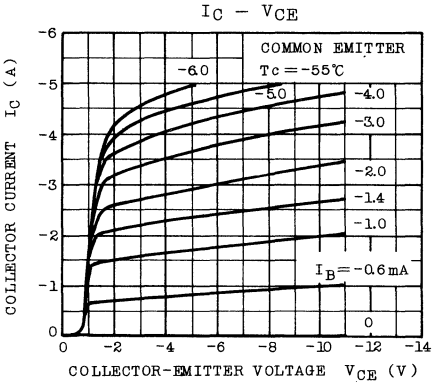
$I_C - V_{CE}$



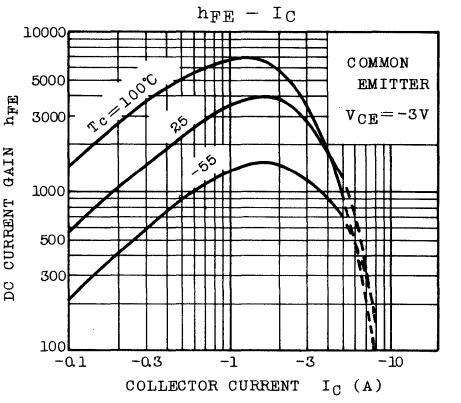
$I_C - V_{CE}$



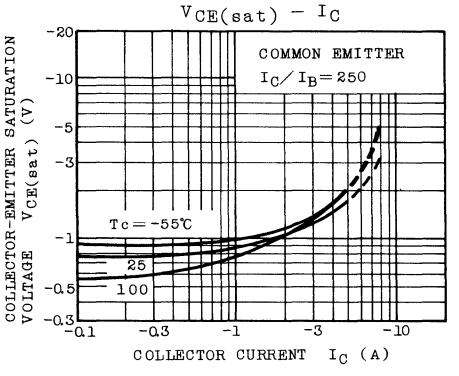
$I_C - V_{CE}$



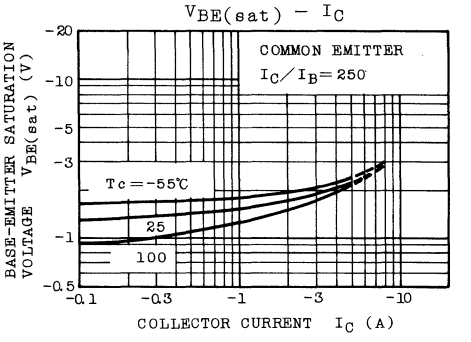
$h_{FE} - I_C$



$V_{CE(sat)} - I_C$

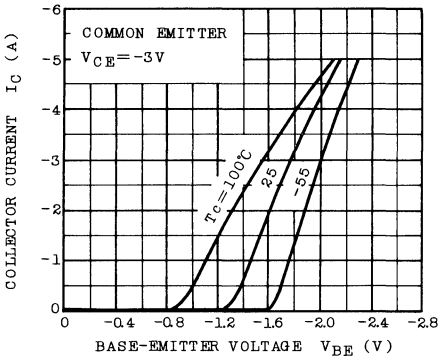


$V_{BE(sat)} - I_C$

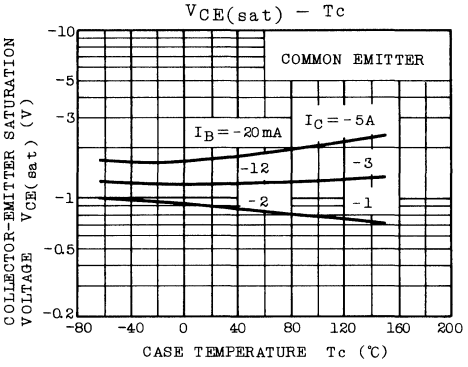


TOSHIBA CORPORATION

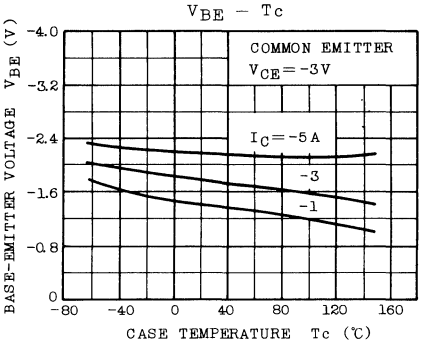
$I_C - V_{BE}$



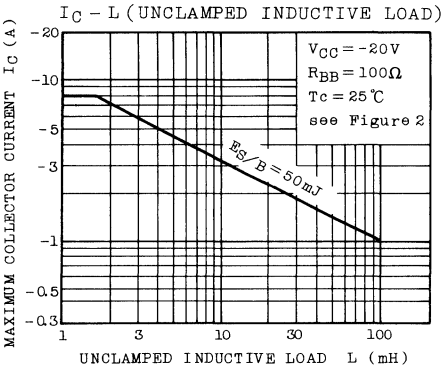
$V_{CE(sat)} - Tc$



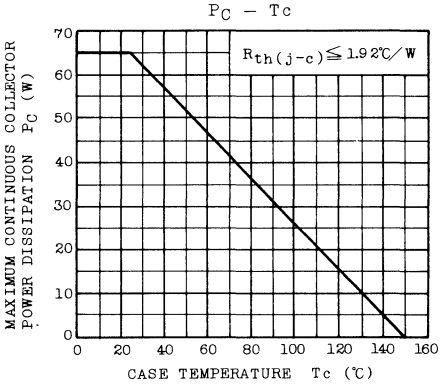
$V_{BE} - Tc$



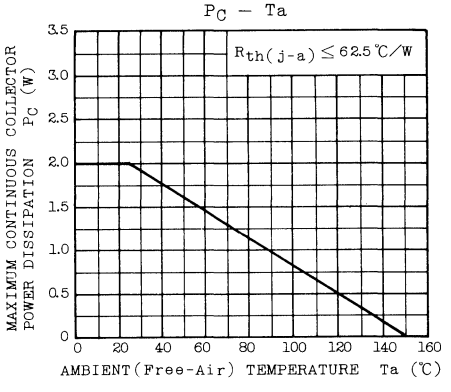
$I_C - L$ (UNCLAMPED INDUCTIVE LOAD)

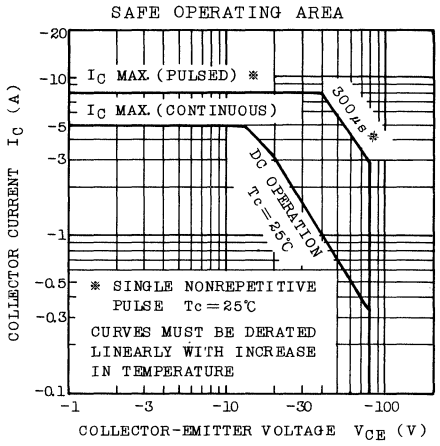


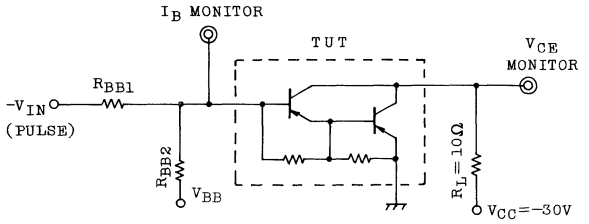
$P_C - Tc$

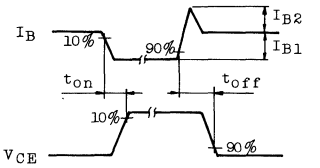


$P_C - Ta$





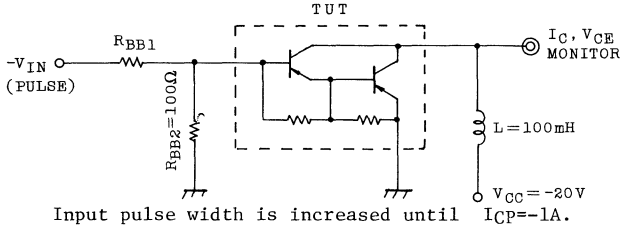


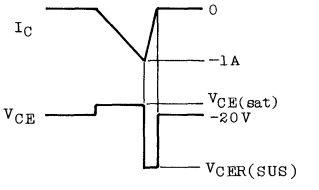


(A) The V_{IN} waveform is obtained by using amplifier circuit and the signal source is supplied by generator with the following characteristics:
$t_r, t_f < 15ns$, $t_w=20\mu s$, $Du \leq 1\%$

(B) $-V_{IN}$, R_{BB1} and R_{BB2} are varied to obtain desired base current levels.

Figure 1. SWITCHING TIME MEASUREMENT CIRCUIT





Input pulse width is increased until $I_{CP}=-1A$.

Figure 2. INDUCTIVE LOAD SWITCHING TEST

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR

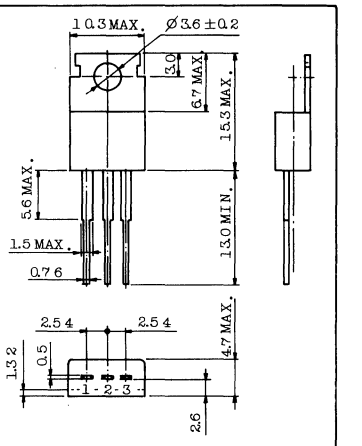
TIP127

SILICON PNP TRIPLE DIFFUSED TYPE
(DARLINGTON POWER)

HIGH POWER SWITCHING APPLICATIONS.
HAMMER DRIVE, PULSE MOTOR DRIVE
AND INDUCTIVE LOAD DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

Unit in mm



1. BASE
2. COLLECTOR (HEAT SINK)
3. EMITTER

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A1A

Mounting Kit No. AC75
Weight : 1.9g

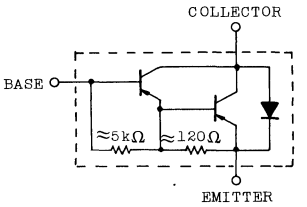
FEATURES:

- High Collector Power Dissipation : P_C=65W @Tc=25°C
- High Collector Current : $I_{C(DC)}$=-5A(Max.)
- High DC Current Gain : h_{FE}=1000(Min.) @V_{CE}=-3V, I_C=-3A
- Complementary to TIP122

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	-100	V
Collector-Emitter Voltage		V_{CEO}	-100	V
Emitter-Base Voltage		V_{EBO}	-5	V
Collector Current	DC	I_C	-5	A
	Pulse	I_{CP}	-8	
Continuous Base Current		I_B	-0.1	A
Collector Power Dissipation	Ta=25°C	P_C	2	W
	Tc=25°C		65	
Unclamped Inductive Load Energy		$E_{S/B}$	50	mJ
Junction Temperature		Tj	150	°C
Storage Temperature Range		T_{stg}	-65 ~ 150	°C

EQUIVALENT CIRCUIT



THERMAL CHARACTERISTICS

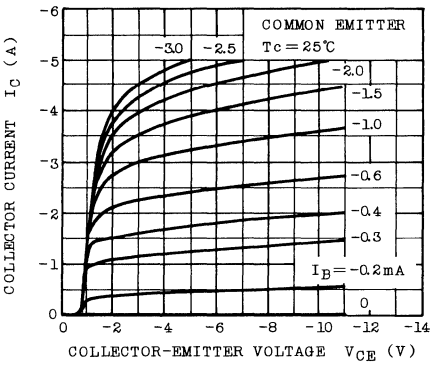
CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.92	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes (3.2mm from case for 10 seconds)	T_L	260	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

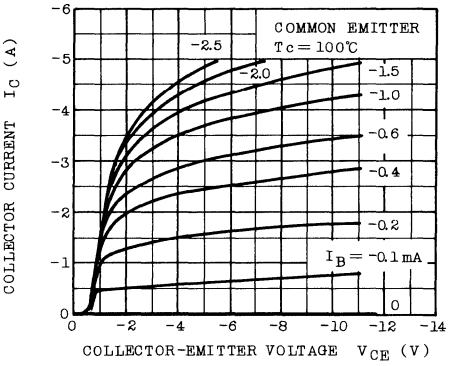
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector-Emitter Breakdown Voltage		$V_{BR(CEO)}$	I_C=-30mA, I_B=0	-100	-	-	V
Collector Cut-off Current		I_{CBO}	V_{CB}=-100V, I_E=0	-	-	-200	μA
Collector Cut-off Current		I_{CEO}	V_{CE}=-50V, I_B=0	-	-	-0.5	mA
Emitter Cut-off Current		I_{EBO}	V_{EB}=-5V, I_C=0	-	-	-2	mA
DC Current Gain		$h_{FE(1)}$	V_{CE}=-3V, I_C=-0.5A	1000	-	-	
		$h_{FE(2)}$	V_{CE}=-3V, I_C=-3A	1000	-	-	
Base-Emitter Voltage		V_{BE}	V_{CE}=-3V, I_C=-3A	-	-	-2.5	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)(1)}$	I_C=-3A, I_B=-12mA	-	-	-2	V
		$V_{CE(sat)(2)}$	I_C=-5A, I_B=-20mA	-	-	-4	
Switching Time	Turn-on Time	t_{on}	I_C=-3A I_{B1}=-I_{B2}=-12mA	-	1.5	-	μs
	Turn-off Time	t_{off}	$V_{BE(off)}$=5V R_L=10Ω	-	8.5	-	μs

TOSHIBA CORPORATION

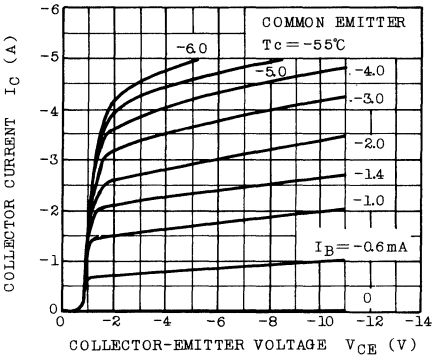
$I_C - V_{CE}$



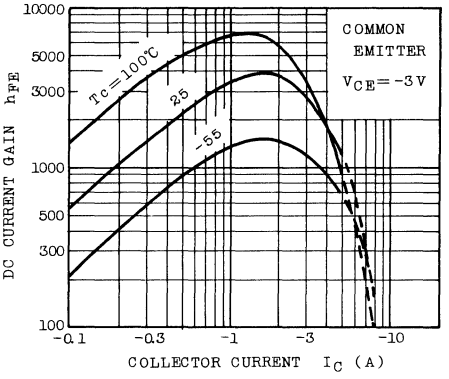
$I_C - V_{CE}$



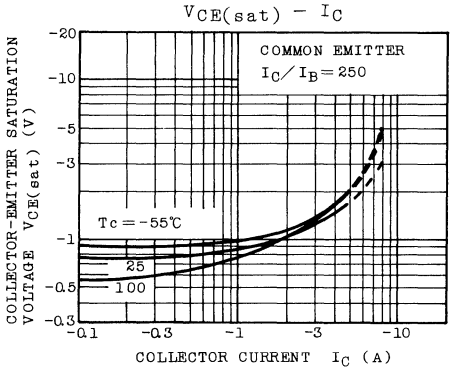
$I_C - V_{CE}$



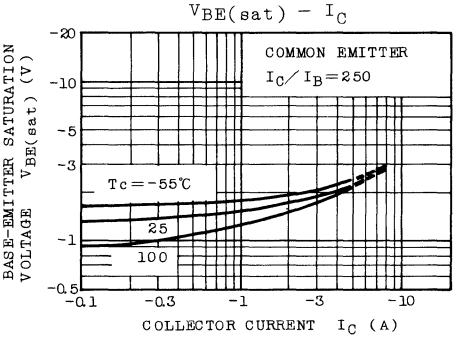
$h_{FE} - I_C$



$V_{CE(sat)} - I_C$

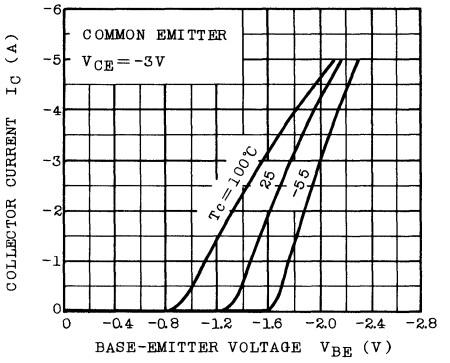


$V_{BE(sat)} - I_C$

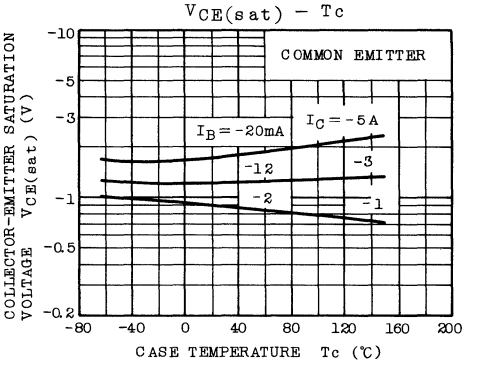


TOSHIBA CORPORATION

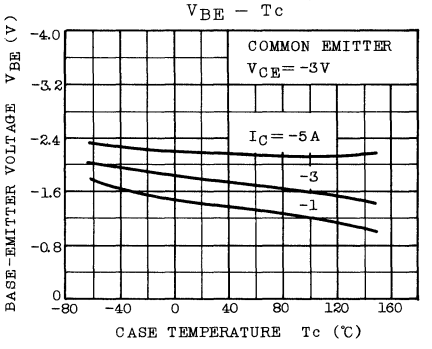
$I_C - V_{BE}$



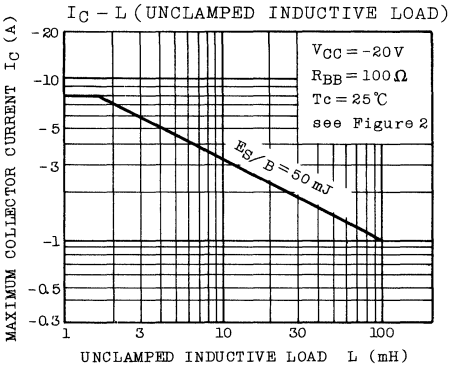
$V_{CE(sat)} - T_C$



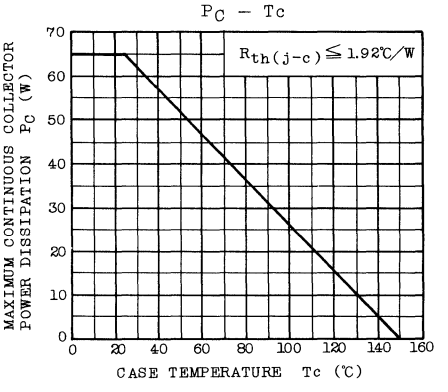
$V_{BE} - T_C$



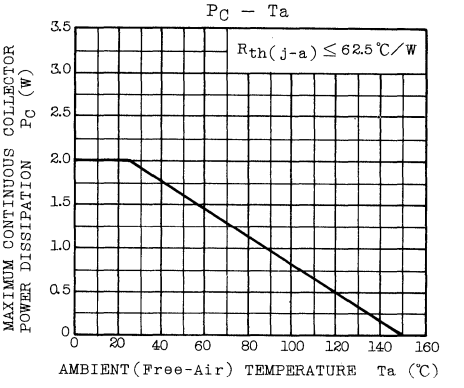
$I_C - L$ (UNCLAMPED INDUCTIVE LOAD)



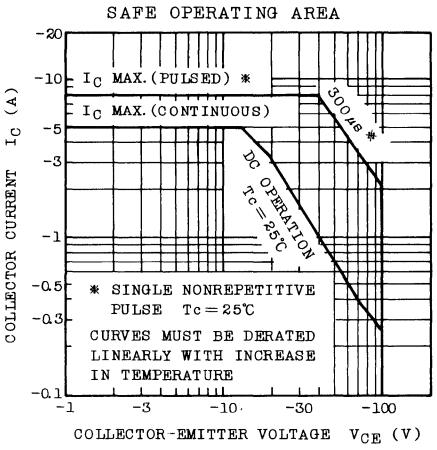
$P_C - T_C$

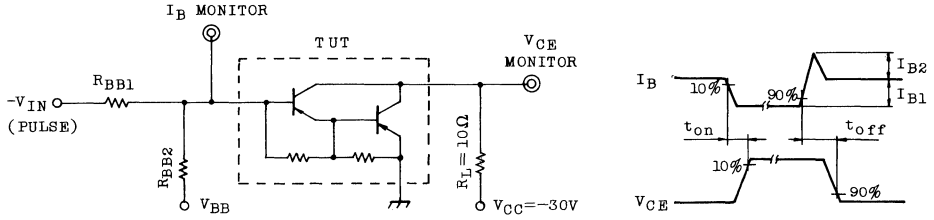


$P_C - T_a$



TOSHIBA CORPORATION

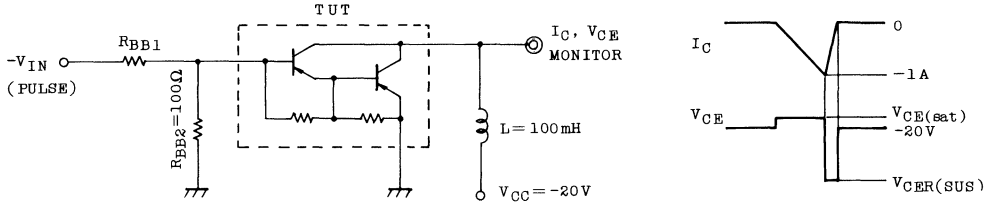




(A) The V_{IN} waveform is obtained by using amplifier circuit and the signal source is supplied by generator with the following characteristics:
$t_r, t_f < 15ns$, $t_w = 20\mu s$, $Du \leq 1\%$

(B) $-V_{IN}$, R_{BB1} and R_{BB2} are varied to obtain desired base current levels.

Figure 1. SWITCHING TIME MEASUREMENT CIRCUIT



Input pulse width is increased until I_{CP}=-1A.

Figure 2. INDUCTIVE LOAD SWITCHING TEST

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 1 5 0
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.045Ω(Typ.)

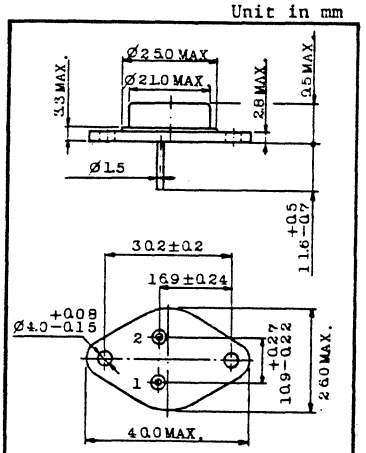
. High Forward Transfer Admittance : $|Yfs|$= 11S (Typ.)

. Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
I_{DSS}= 250μA(Max.) @ V_{DS}=100V

. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



JEDEC	TO-204AE/TO-3
EIAJ	
TOSHIBA	

Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

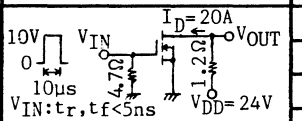
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	100	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	100	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	40	A
	DC(Tc=100°C)	I_D	25	
	Pulse	I_{DP}	160	
Inductive Current (Clamped)		I_{LP}	160	A
Drain Power Dissipation (Tc=25°C)		P_D	150	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	0.83	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=100V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=80V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	100	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=20A	9	11	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	40	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=20A, V_{GS}=10V	-	0.045	0.055	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=40A, V_{GS}=10V	-	2.0		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		3000	pF
Reverse Transfer Capacitance		C_{rss}		-		500	pF
Output Capacitance		C_{oss}		-		1500	pF
Switching Time	Rise Time	t_r		-		100	ns
	Turn-on Time	t_{on}		-		135	ns
	Fall Time	t_f		-		100	ns
	Turn-off Time	t_{off}		-		225	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=50A, V_{DS}=80V	-	63	120	nC
Gate Source Charge		Q_{gs}		-	27	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	36	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	40	A
Pulse Source Current	I_{SP}	—	-	-	160	A
Diode Forward Voltage	V_{SD}	I_S=40A, V_{GS}=0V, Tc=25°C	-	-	2.5	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=40A, dI$_F$/dt=100A/μs	-	600	-	ns
Reverse Recovered Charge	Q_{rr}		-	3.3	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 1 5 1
SILICON N CHANNEL MOS TYPE
(π-MOS)

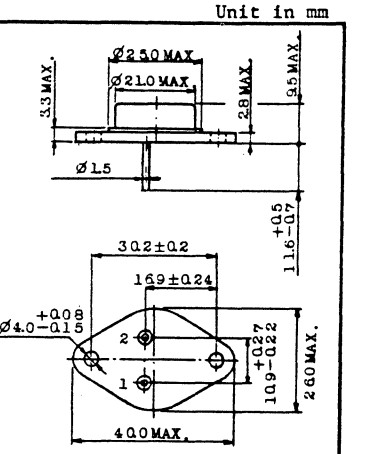
HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.045Ω(Typ.)
. High Forward Transfer Admittance : $|Yfs|$= 11S (Typ.)
. Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
I_{DSS}= 250μA(Max.) @ V_{DS}=60V
. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-204AE/TO-3
EIAJ	
TOSHIBA	

Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

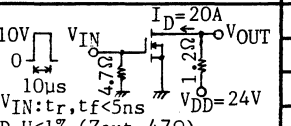
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	60	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	60	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	40	A
	DC(Tc=100°C)	I_D	25	
	Pulse	I_{DP}	160	
Inductive Current (Clamped)		I_{LP}	160	A
Drain Power Dissipation (Tc=25°C)		P_D	150	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	0.83	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=60V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=48V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	60	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=20A	9	11	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	40	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=20A, V_{GS}=10V	-	0.045	0.055	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=40A, V_{GS}=10V	-	2.0		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		3000	pF
Reverse Transfer Capacitance		C_{rss}		-		500	pF
Output Capacitance		C_{oss}		-		1500	pF
Switching Time	Rise Time	t_r		-		100	ns
	Turn-on Time	t_{on}		-		135	ns
	Fall Time	t_f		-		100	ns
	Turn-off Time	t_{off}		-		225	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=50A, V_{DS}=48V	-	63	120	nC
Gate Source Charge		Q_{gs}		-	27	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	36	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	40	A
Pulse Source Current	I_{SP}	—	-	-	160	A
Diode Forward Voltage	V_{SD}	I_S=40A, V_{GS}=0V, Tc=25°C	-	-	2.5	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=40A,	-	600	-	ns
Reverse Recovered Charge	Q_{rr}	dI_F/dt=100A/μs	-	3.3	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 1 5 2
SILICON N CHANNEL MOS TYPE
(π-MOS)

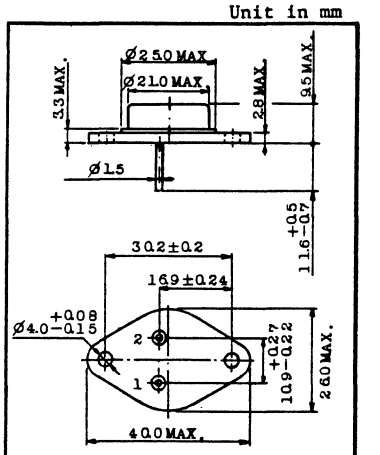
HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.06Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=11S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=100V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-204AE/TO-3
EIAJ	
TOSHIBA	

Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

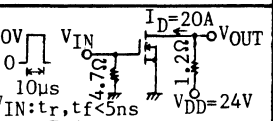
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	100	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	100	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	33	A
	DC(Tc=100°C)	I_D	20	
	Pulse	I_{DP}	132	
Inductive Current (Clamped)		I_{LP}	132	A
Drain Power Dissipation (Tc=25°C)		P_D	150	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	0.83	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=100V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}= 80V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	100	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=20A	9	11	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	33	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=20A , V_{GS}=10V	-	0.06	0.08	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=33A , V_{GS}=10V	-	2.2		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		3000	pF
Reverse Transfer Capacitance		C_{rss}		-		500	pF
Output Capacitance		C_{oss}		-		1500	pF
Switching Time	Rise Time	t_r		-		100	ns
	Turn-on Time	t_{on}		-		135	ns
	Fall Time	t_f		-		100	ns
	Turn-off Time	t_{off}		-		225	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=50A, V_{DS}=80V	-	63	120	nC
Gate Source Charge		Q_{gs}		-	27	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	36	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	33	A
Pulse Source Current	I_{SP}	—	-	-	132	A
Diode Forward Voltage	V_{SD}	I_S=33A , V_{GS}=0V, Tc=25°C	-	-	2.3	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=40A, dI_F/dt=100A/μs	-	600	-	ns
Reverse Recovered Charge	Q_{rr}		-	3.3	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 1 5 3
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.06Ω (Typ.)

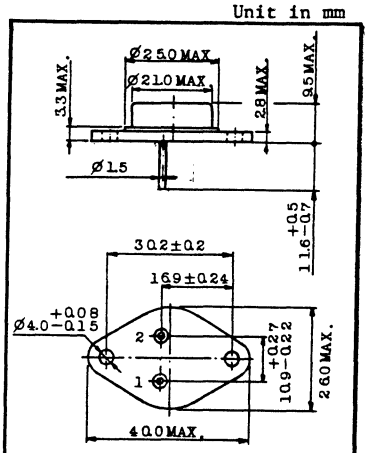
. High Forward Transfer Admittance : |Yfs|=11S (Typ.)

. Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
I_{DSS}= 250μA(Max.) @ V_{DS}=60V

. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



JEDEC	TO-204AE/TO-3
EIAJ	
TOSHIBA	

Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

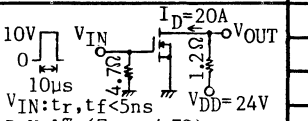
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	60	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	60	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	33	A
	DC(Tc=100°C)	I_D	20	
	Pulse	I_{DP}	132	
Inductive Current (Clamped)		I_{LP}	132	A
Drain Power Dissipation (Tc=25°C)		P_D	150	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	0.83	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=60V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=48V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	60	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=20A	9	11	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	33	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=20A, V_{GS}=10V	-	0.06	0.08	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=33A, V_{GS}=10V	-	2.2		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		3000	pF
Reverse Transfer Capacitance		C_{rss}		-		500	pF
Output Capacitance		C_{oss}		-		1500	pF
Switching Time	Rise Time	t_r		-		100	ns
	Turn-on Time	t_{on}		-		135	ns
	Fall Time	t_f		-		100	ns
	Turn-off Time	t_{off}		-		225	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=50A, V_{DS}=48V	-	63	120	nC
Gate Source Charge		Q_{gs}		-	27	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	36	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	33	A
Pulse Source Current	I_{SP}	—	-	-	132	A
Diode Forward Voltage	V_{SD}	I_S=33A, V_{GS}=0V, Tc=25°C	-	-	2.3	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=40A, dI_F/dt=100A/μs	-	600	-	ns
Reverse Recovered Charge	Q_{rr}		-	3.3	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 2 2 0
SILICON N CHANNEL MOS TYPE
(π-MOS)

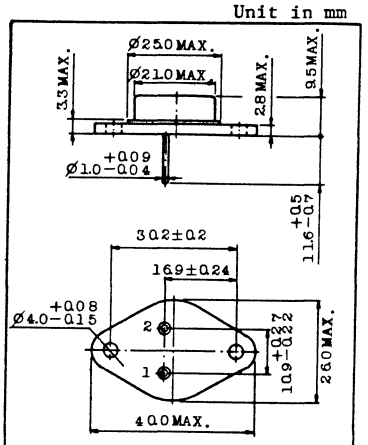
HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.5Ω (Typ.)
. High Forward Transfer Admittance : $|Yfs|$=2.5S (Typ.)
. Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
I_{DSS}= 250μA(Max.) @ V_{DS}=200V
. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS
Unit in mm



JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21E1B

Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

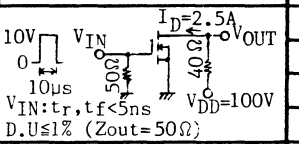
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	200	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	200	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	5	A
	DC(Tc=100°C)	I_D	3	
	Pulse	I_{DP}	20	
Inductive Current (Clamped)		I_{LP}	20	A
Drain Power Dissipation (Tc=25°C)		P_D	40	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.12	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=200V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=160V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	200	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=2.5A	1.3	2.5	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	5	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=2.5A, V_{GS}=10V	-	0.5	0.8	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D= 5A , V_{GS}=10V	-	2.7		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		600	pF
Reverse Transfer Capacitance		C_{rss}		-		80	pF
Output Capacitance		C_{oss}		-		300	pF
Switching Time	Rise Time	t_r		-		60	ns
	Turn-on Time	t_{on}		-		100	ns
	Fall Time	t_f		-		60	ns
	Turn-off Time	t_{off}		-		160	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=6A, V_{DS}=160V	-	11	15	nC
Gate Source Charge		Q_{gs}		-	5	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	6	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	5	A
Pulse Source Current	I_{SP}	—	-	-	20	A
Diode Forward Voltage	V_{SD}	I_S= 5A , V_{GS}=0V, Tc=25°C	-	-	2.0	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=5A,	-	350	-	ns
Reverse Recovered Charge	Q_{rr}	dI_F/dt=100A/μs	-	2.3	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 2 2 1
SILICON N CHANNEL MOS-TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.5Ω (Typ.)

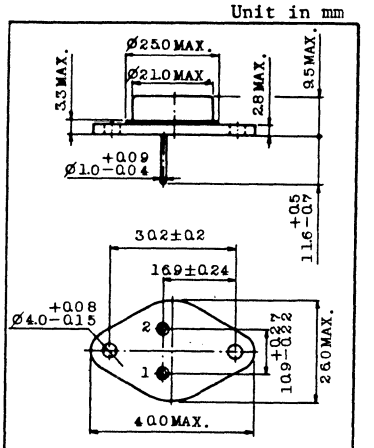
. High Forward Transfer Admittance : $|Yfs|$=2.5S (Typ.)

. Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
I_{DSS}= 250μA(Max.) @ V_{DS}=150V

. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



1. GATE
2. SOURCE
DRAIN (CASE)

JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21E1B

Weight : 15.8g

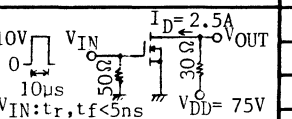
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	150	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	150	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	5	A
	DC(Tc=100°C)	I_D	3	
	Pulse	I_{DP}	20	
Inductive Current (Clamped)		I_{LP}	20	A
Drain Power Dissipation (Tc=25°C)		P_D	40	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.12	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=150V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=120V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	150	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		$\|Yfs\|$	V_{DS}=10V, I_D=2.5A	1.3	2.5	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	5	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=2.5A, V_{GS}=10V	-	0.5	0.8	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D= 5A , V_{GS}=10V	-	2.7		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		600	pF
Reverse Transfer Capacitance		C_{rss}		-		80	pF
Output Capacitance		C_{oss}		-		300	pF
Switching Time	Rise Time	t_r		-		60	ns
	Turn-on Time	t_{on}		-		100	ns
	Fall Time	t_f		-		60	ns
	Turn-off Time	t_{off}		-		160	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D= 6A, V_{DS}=120V	-	11	15	nC
Gate Source Charge		Q_{gs}		-	5	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	6	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	5	A
Pulse Source Current	I_{SP}	—	-	-	20	A
Diode Forward Voltage	V_{SD}	I_S=5A , V_{GS}=0V, Tc=25°C	-	-	2.0	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=5A, dI_F/dt=100A/μs	-	350	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.3	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 2 2 2
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

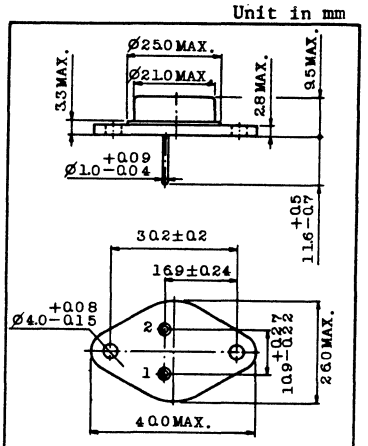
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.8Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=2.5S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=200V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



1. GATE
2. SOURCE
DRAIN (CASE)

JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21E1B

Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

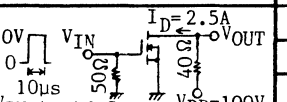
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	200	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	200	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	4	A
	DC(Tc=100°C)	I_D	2.5	
	Pulse	I_{DP}	16	
Inductive Current (Clamped)		I_{LP}	16	A
Drain Power Dissipation (Tc=25°C)		P_D	40	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.12	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=200V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=160V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	200	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=2.5A	1.3	2.5	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	4	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=2.5A, V_{GS}=10V	-	0.8	1.2	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D= 4A , V_{GS}=10V	-	3.5		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		600	pF
Reverse Transfer Capacitance		C_{rss}		-		80	pF
Output Capacitance		C_{oss}		-		300	pF
Switching Time	Rise Time	t_r		-		60	ns
	Turn-on Time	t_{on}		-		100	ns
	Fall Time	t_f		-		60	ns
	Turn-off Time	t_{off}		-		160	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D= 6A, V_{DS}=160V	-	11	15	nC
Gate Source Charge		Q_{gs}		-	5	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	6	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	4	A
Pulse Source Current	I_{SP}	—	-	-	16	A
Diode Forward Voltage	V_{SD}	I_S= 4A , V_{GS}=0V, Tc=25°C	-	-	1.8	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=5A, dIF/dt=100A/μs	-	350	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.3	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 2 2 3
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.8Ω (Typ.)

. High Forward Transfer Admittance : $|Yfs|$=2.5S (Typ.)

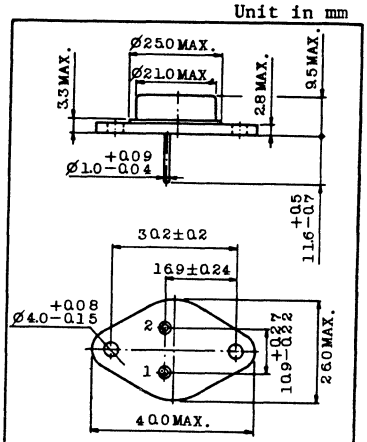
. Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V

I_{DSS}= 250μA(Max.) @ V_{DS}=150V

. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21E1B

Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

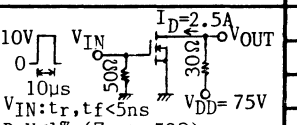
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	150	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	150	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	4	A
	DC(Tc=100°C)	I_D	2.5	
	Pulse	I_{DP}	16	
Inductive Current (Clamped)		I_{LP}	16	A
Drain Power Dissipation (Tc=25°C)		P_D	40	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	Rth(j-c)	3.12	°C/W
Thermal Resistance, Junction to Ambient	Rth(j-a)	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=150V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=120V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	150	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=2.5A	1.3	2.5	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	4	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=2.5A, V_{GS}=10V	-	0.8	1.2	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D= 4A , V_{GS}=10V	-	3.5		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		600	pF
Reverse Transfer Capacitance		C_{rss}		-		80	pF
Output Capacitance		C_{oss}		-		300	pF
Switching Time	Rise Time	t_r		-		60	ns
	Turn-on Time	t_{on}		-		100	ns
	Fall Time	t_f		-		60	ns
	Turn-off Time	t_{off}		-		160	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=6A, V_{DS}=120V	-	11	15	nC
Gate Source Charge		Q_{gs}		-	5	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	6	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	4	A
Pulse Source Current	I_{SP}	—	-	-	16	A
Diode Forward Voltage	V_{SD}	I_S= 4A , V_{GS}=0V, Tc=25°C	-	-	1.8	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=5A, dI_F/dt=100A/μs	-	350	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.3	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 2 3 0
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

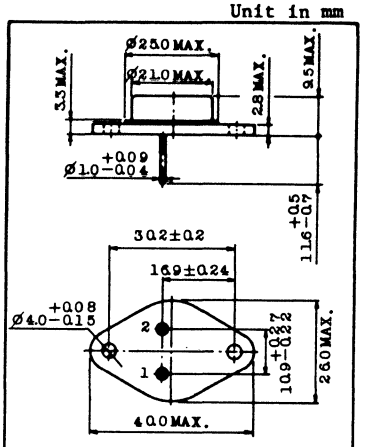
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.25Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=4.8S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=200V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

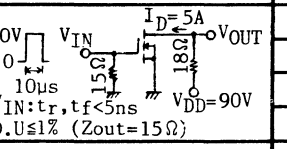
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	200	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	200	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	9	A
	DC(Tc=100°C)	I_D	6	
	Pulse	I_{DP}	36	
Inductive Current (Clamped)		I_{LP}	36	A
Drain Power Dissipation (Tc=25°C)		P_D	75	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=200V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=160V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	200	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=5A	3.0	4.8	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	9	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=5A , V_{GS}=10V	-	0.25	0.40	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=9A , V_{GS}=10V	-	2.5		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		800	pF
Reverse Transfer Capacitance		C_{rss}		-		150	pF
Output Capacitance		C_{oss}		-		450	pF
Switching Time	Rise Time	t_r		-		50	ns
	Turn-on Time	t_{on}		-		80	ns
	Fall Time	t_f		-		40	ns
	Turn-off Time	t_{off}		-		90	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=12A, V_{DS}=160V	-	19	30	nC
Gate Source Charge		Q_{gs}		-	10	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	9	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	9	A
Pulse Source Current	I_{SP}	—	-	-	36	A
Diode Forward Voltage	V_{SD}	I_S=9A , V_{GS}=0V, Tc=25°C	-	-	2.0	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=9A, dI_F/dt=100A/μs	-	450	-	ns
Reverse Recovered Charge	Q_{rr}		-	3.0	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 2 3 1
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

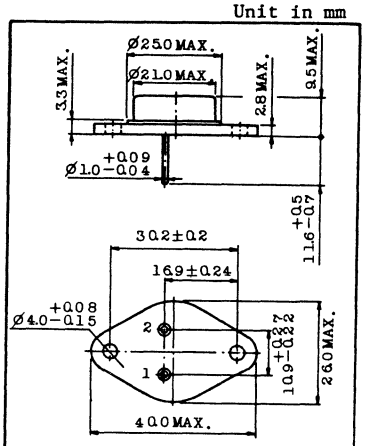
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.25Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=4.8S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=150V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21E1B

Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

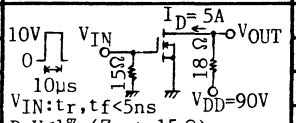
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	150	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	150	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	9	A
	DC(Tc=100°C)	I_D	6	
	Pulse	I_{DP}	36	
Inductive Current (Clamped)		I_{LP}	36	A
Drain Power Dissipation (Tc=25°C)		P_D	75	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=150V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=120V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	150	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=5A	3.0	4.8	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	9	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D= 5A , V_{GS}=10V	-	0.25	0.40	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D= 9A , V_{GS}=10V	-	2.5		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		800	pF
Reverse Transfer Capacitance		C_{rss}		-		150	pF
Output Capacitance		C_{oss}		-		450	pF
Switching Time	Rise Time	t_r		-		50	ns
	Turn-on Time	t_{on}		-		80	ns
	Fall Time	t_f		-		40	ns
	Turn-off Time	t_{off}		-		90	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=12A, V_{DS}=120V	-	19	30	nC
Gate Source Charge		Q_{gs}		-	10	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	9	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	9	A
Pulse Source Current	I_{SP}	—	-	-	36	A
Diode Forward Voltage	V_{SD}	I_S=9A , V_{GS}=0V, Tc=25°C	-	-	2.0	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=9A, dI_F/dt=100A/μs	-	450	-	ns
Reverse Recovered Charge	Q_{rr}		-	3.0	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 2 3 2
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

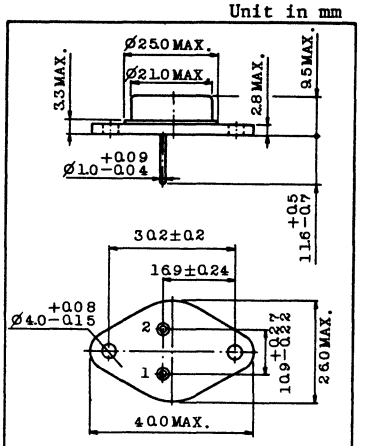
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.4Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=4.8S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=200V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



1. GATE
2. SOURCE
DRAIN (CASE)

JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21E1B

Weight : 15.8g

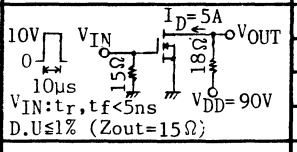
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	200	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	200	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	8	A
	DC(Tc=100°C)	I_D	5	
	Pulse	I_{DP}	32	
Inductive Current (Clamped)		I_{LP}	32	A
Drain Power Dissipation (Tc=25°C)		P_D	75	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=200V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=160V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	200	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=5A	3.0	4.8	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	8	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D= 5A , V_{GS}=10V	-	0.4	0.6	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D= 8A , V_{GS}=10V	-	3.5		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		800	pF
Reverse Transfer Capacitance		C_{rss}		-		150	pF
Output Capacitance		C_{oss}		-		450	pF
Switching Time	Rise Time	t_r		-		50	ns
	Turn-on Time	t_{on}		-		80	ns
	Fall Time	t_f		-		40	ns
	Turn-off Time	t_{off}		-		90	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=12A, V_{DS}=160V	-	19	30	nC
Gate Source Charge		Q_{gs}		-	10	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	9	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	8	A
Pulse Source Current	I_{SP}	—	-	-	32	A
Diode Forward Voltage	V_{SD}	I_S=8A , V_{GS}=0V, Tc=25°C	-	-	1.8	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=9A, dI_F/dt=100A/μs	-	450	-	ns
Reverse Recovered Charge	Q_{rr}		-	3.0	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 2 3 3
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

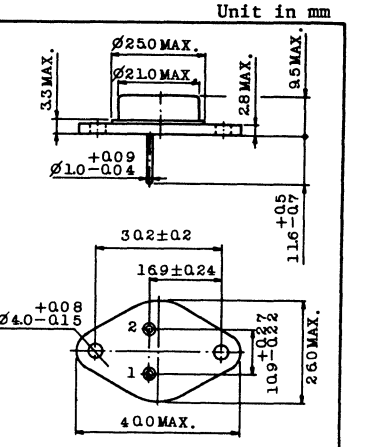
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.4Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=4.8S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=150V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



1. GATE
2. SOURCE
   DRAIN (CASE)

JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21E1B

Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

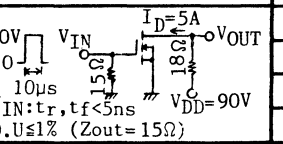
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	150	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	150	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	8	A
	DC(Tc=100°C)	I_D	5	
	Pulse	I_{DP}	32	
Inductive Current (Clamped)		I_{LP}	32	A
Drain Power Dissipation (Tc=25°C)		P_D	75	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=150V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=120V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	150	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=5A	3.0	4.8	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	8	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D= 5A , V_{GS}=10V	-	0.4	0.6	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D= 8A , V_{GS}=10V	-	3.5		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		800	pF
Reverse Transfer Capacitance		C_{rss}		-		150	pF
Output Capacitance		C_{oss}		-		450	pF
Switching Time	Rise Time	t_r		-		50	ns
	Turn-on Time	t_{on}		-		80	ns
	Fall Time	t_f		-		40	ns
	Turn-off Time	t_{off}		-		90	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=12A, V_{DS}=120V	-	19	30	nC
Gate Source Charge		Q_{gs}		-	10	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	9	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	8	A
Pulse Source Current	I_{SP}	—	-	-	32	A
Diode Forward Voltage	V_{SD}	I_S=8A , V_{GS}=0V, Tc=25°C	-	-	1.8	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=9A, dI_F/dt=100A/μs	-	450	-	ns
Reverse Recovered Charge	Q_{rr}		-	3.0	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
YTF240
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

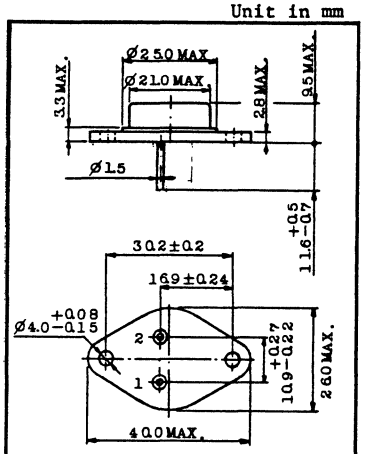
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.14Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=9.0S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=200V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



JEDEC	TO-204AE/TO-3
EIAJ	
TOSHIBA	

Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

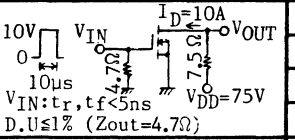
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	200	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	200	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	18	A
	DC(Tc=100°C)	I_D	11	
	Pulse	I_{DP}	72	
Inductive Current (Clamped)		I_{LP}	72	A
Drain Power Dissipation (Tc=25°C)		P_D	125	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.0	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=200V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=160V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	200	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		Yfs	V_{DS}=10V, I_D=10A	6	9	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	18	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=10A , V_{GS}=10V	-	0.14	0.18	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=18A , V_{GS}=10V	-	2.8		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		1600	pF
Reverse Transfer Capacitance		C_{rss}		-		300	pF
Output Capacitance		C_{oss}		-		750	pF
Switching Time	Rise Time	t_r		-		60	ns
	Turn-on Time	t_{on}		-		90	ns
	Fall Time	t_f		-		60	ns
	Turn-off Time	t_{off}		-		140	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D= 22A, V_{DS}=160V	-	43	60	nC
Gate Source Charge		Q_{gs}		-	16	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	27	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	18	A
Pulse Source Current	I_{SP}	—	-	-	72	A
Diode Forward Voltage	V_{SD}	I_S=18A , V_{GS}=0V, Tc=25°C	-	-	2.0	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=18A, dI_F/dt=100A/μs	-	650	-	ns
Reverse Recovered Charge	Q_{rr}		-	4.1	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 2 4 1
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

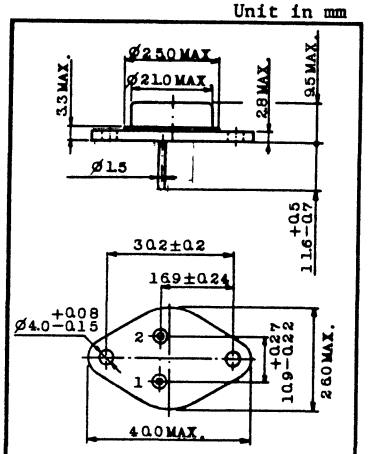
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.14Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=9.0S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=150V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



JEDEC	TO-204AE/TO-3
EIAJ	
TOSHIBA	

Weight : 15.8g

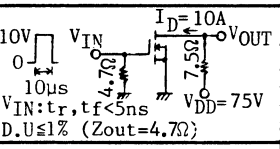
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	150	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	150	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	18	A
	DC(Tc=100°C)	I_D	11	
	Pulse	I_{DP}	72	
Inductive Current (Clamped)		I_{LP}	72	A
Drain Power Dissipation (Tc=25°C)		P_D	125	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.0	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=150V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=120V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	150	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=10A	6	9	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	18	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=10A, V_{GS}=10V	-	0.14	0.18	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=18A, V_{GS}=10V	-	2.8		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		1600	pF
Reverse Transfer Capacitance		C_{rss}		-		300	pF
Output Capacitance		C_{oss}		-		750	pF
Switching Time	Rise Time	t_r		-		60	ns
	Turn-on Time	t_{on}		-		90	ns
	Fall Time	t_f		-		60	ns
	Turn-off Time	t_{off}		-		140	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=22A, V_{DS}=120V	-	43	60	nC
Gate Source Charge		Q_{gs}		-	1.6	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	27	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	18	A
Pulse Source Current	I_{SP}	—	-	-	72	A
Diode Forward Voltage	V_{SD}	I_S=18A, V_{GS}=0V, Tc=25°C	-	-	2.0	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=18A, dI_F/dt=100A/μs	-	650	-	ns
Reverse Recovered Charge	Q_{rr}		-	4.1	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 2 4 2
SILICON N CHANNEL MOS-TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

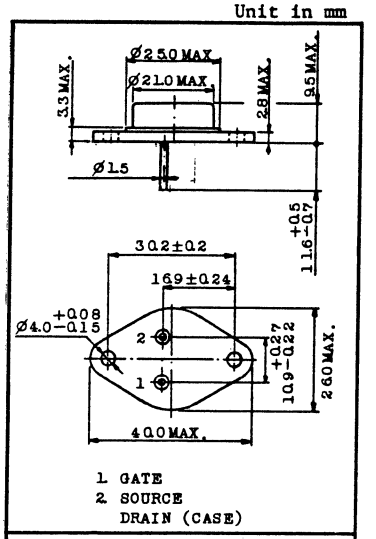
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.20Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=9.0S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=200V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-204AE/TO-3
EIAJ	
TOSHIBA	

Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

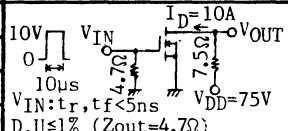
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	200	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	200	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	16	A
	DC(Tc=100°C)	I_D	10	
	Pulse	I_{DP}	64	
Inductive Current (Clamped)		I_{LP}	64	A
Drain Power Dissipation (Tc=25°C)		P_D	125	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.0	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=200V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=160V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	200	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=10A	6	9	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	16	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=10A , V_{GS}=10V	-	0.20	0.22	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=16A , V_{GS}=10V	-	3.5		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		1600	pF
Reverse Transfer Capacitance		C_{rss}		-		300	pF
Output Capacitance		C_{oss}		-		750	pF
Switching Time	Rise Time	t_r		-		60	ns
	Turn-on Time	t_{on}		-		90	ns
	Fall Time	t_f		-		60	ns
	Turn-off Time	t_{off}		-		140	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=22A, V_{DS}=160V	-	43	60	nC
Gate Source Charge		Q_{gs}		-	16	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	27	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	16	A
Pulse Source Current	I_{SP}	—	-	-	64	A
Diode Forward Voltage	V_{SD}	I_S=16A , V_{GS}=0V, Tc=25°C	-	-	1.9	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=18A, dI_F/dt=100A/μs	-	650	-	ns
Reverse Recovered Charge	Q_{rr}		-	4.1	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 2 4 3
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

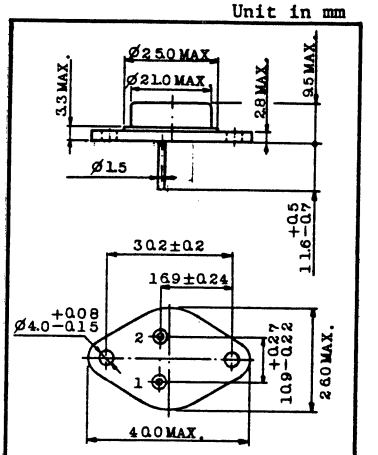
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.20Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=9.0S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=150V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



1. GATE
2. SOURCE
DRAIN (CASE)

JEDEC	TO-204AE/TO-3
EIAJ	
TOSHIBA	

Weight : 15.8g

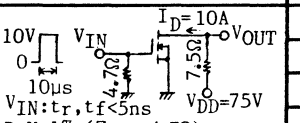
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	150	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	150	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	16	A
	DC(Tc=100°C)	I_D	10	
	Pulse	I_{DP}	64	
Inductive Current (Clamped)		I_{LP}	64	A
Drain Power Dissipation (Tc=25°C)		P_D	125	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.0	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=150V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=120V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	150	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=10A	6	9	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	16	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=10A, V_{GS}=10V	-	0.20	0.22	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=16A, V_{GS}=10V	-	3.5		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		1600	pF
Reverse Transfer Capacitance		C_{rss}		-		300	pF
Output Capacitance		C_{oss}		-		750	pF
Switching Time	Rise Time	t_r		-		60	ns
	Turn-on Time	t_{on}		-		90	ns
	Fall Time	t_f		-		60	ns
	Turn-off Time	t_{off}		-		140	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=22A, V_{DS}=120V	-	43	60	nC
Gate Source Charge		Q_{gs}		-	16	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	27	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	16	A
Pulse Source Current	I_{SP}	—	-	-	64	A
Diode Forward Voltage	V_{SD}	I_S=16A, V_{GS}=0V, Tc=25°C	-	-	1.9	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=18A, dI_F/dt=100A/μs	-	650	-	ns
Reverse Recovered Charge	Q_{rr}		-	4.1	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 2 5 0
SILICON N CHANNEL MOS TYPE
(π-MOS)

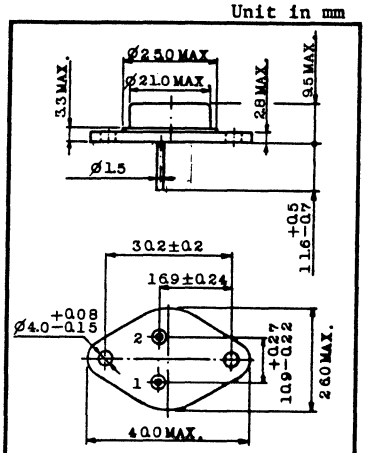
HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.07Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=14S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=200V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-204AE/TO-3
EIAJ	
TOSHIBA	

Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

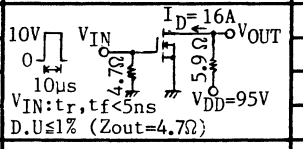
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	200	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	200	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	30	A
	DC(Tc=100°C)	I_D	19	
	Pulse	I_{DP}	120	
Inductive Current (Clamped)		I_{LP}	120	A
Drain Power Dissipation (Tc=25°C)		P_D	150	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	0.83	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=200V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=160V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	200	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=16A	8	14	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	30	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=16A, V_{GS}=10V	-	0.070	0.085	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=30A, V_{GS}=10V	-	2.3		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		3000	pF
Reverse Transfer Capacitance		C_{rss}		-		500	pF
Output Capacitance		C_{oss}		-		1200	pF
Switching Time	Rise Time	t_r		-		100	ns
	Turn-on Time	t_{on}		-		135	ns
	Fall Time	t_f		-		100	ns
	Turn-off Time	t_{off}		-		225	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=38A, V_{DS}=160V	-	79	120	nC
Gate Source Charge		Q_{gs}		-	37	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	42	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	30	A
Pulse Source Current	I_{SP}	—	-	-	120	A
Diode Forward Voltage	V_{SD}	I_S=30A, V_{GS}=0V, Tc=25°C	-	-	2.0	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=30A, dI_F/dt=100A/μs	-	750	-	ns
Reverse Recovered Charge	Q_{rr}		-	4.7	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 2 5 1
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

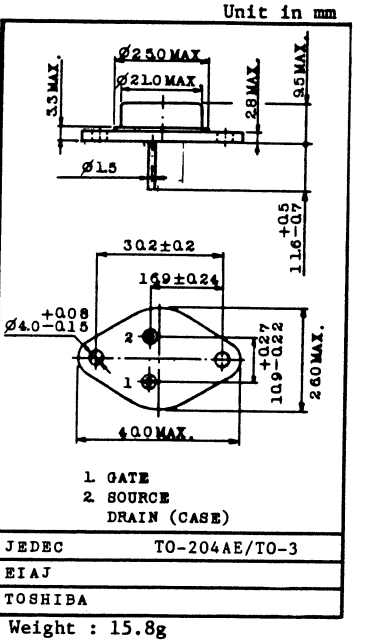
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.07Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=14S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=150V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-204AE/TO-3
EIAJ	
TOSHIBA	

Weight : 15.8g

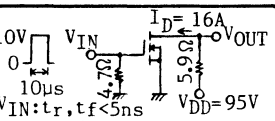
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	150	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	150	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	30	A
	DC(Tc=100°C)	I_D	19	
	Pulse	I_{DP}	120	
Inductive Current (Clamped)		I_{LP}	120	A
Drain Power Dissipation (Tc=25°C)		P_D	150	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	0.83	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=150V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=120V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	150	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=16A	8	14	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	30	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=16A , V_{GS}=10V	-	0.070	0.085	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=30A , V_{GS}=10V	-	2.3		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		3000	pF
Reverse Transfer Capacitance		C_{rss}		-		500	pF
Output Capacitance		C_{oss}		-		1200	pF
Switching Time	Rise Time	t_r		-		100	ns
	Turn-on Time	t_{on}		-		135	ns
	Fall Time	t_f		-		100	ns
	Turn-off Time	t_{off}		-		225	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=38A, V_{DS}=120V	-	79	120	nC
Gate Source Charge		Q_{gs}		-	37	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	42	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	30	A
Pulse Source Current	I_{SP}	—	-	-	120	A
Diode Forward Voltage	V_{SD}	I_S=30A , V_{GS}=0V, Tc=25°C	-	-	2.0	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=30A, dI_F/dt=100A/μs	-	750	-	ns
Reverse Recovered Charge	Q_{rr}		-	4.7	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 2 5 2
SILICON N CHANNEL MOS TYPE
(π-MOS)

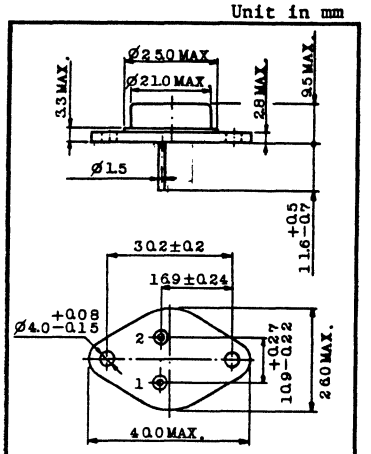
HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.09Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=14S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=200V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-204AE/TO-3
EIAJ	
TOSHIBA	

Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

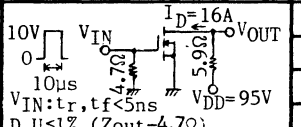
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	200	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	200	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	25	A
	DC(Tc=100°C)	I_D	16	
	Pulse	I_{DP}	100	
Inductive Current (Clamped)		I_{LP}	100	A
Drain Power Dissipation (Tc=25°C)		P_D	150	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	0.83	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=200V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=160V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	200	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=16A	8	14	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	25	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=16A, V_{GS}=10V	-	0.09	0.12	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=25A, V_{GS}=10V	-	2.5		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		3000	pF
Reverse Transfer Capacitance		C_{rss}		-		500	pF
Output Capacitance		C_{oss}		-		1200	pF
Switching Time	Rise Time	t_r		-		100	ns
	Turn-on Time	t_{on}		-		135	ns
	Fall Time	t_f		-		100	ns
	Turn-off Time	t_{off}		-		225	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=38A, V_{DS}=160V	-	79	120	nC
Gate Source Charge		Q_{gs}		-	39	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	42	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	25	A
Pulse Source Current	I_{SP}	—	-	-	100	A
Diode Forward Voltage	V_{SD}	I_S=25A, V_{GS}=0V, Tc=25°C	-	-	1.8	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=30A, dI_F/dt=100A/μs	-	750	-	ns
Reverse Recovered Charge	Q_{rr}		-	4.7	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 2 5 3
SILICON N CHANNEL MOS TYPE
(π-MOS)

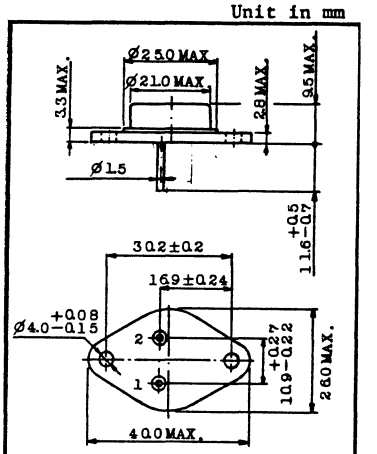
HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.09Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=14S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=150V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-204AE/TO-3
EIAJ	
TOSHIBA	

Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

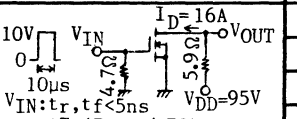
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	150	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	150	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	25	A
	DC(Tc=100°C)	I_D	16	
	Pulse	I_{DP}	100	
Inductive Current (Clamped)		I_{LP}	100	A
Drain Power Dissipation (Tc=25°C)		P_D	150	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	0.83	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Maximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=150V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=120V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	150	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=16A	8	14	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	25	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=16A, V_{GS}=10V	-	0.09	0.12	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=25A, V_{GS}=10V	-	2.5		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		3000	pF
Reverse Transfer Capacitance		C_{rss}		-		500	pF
Output Capacitance		C_{oss}		-		1200	pF
Switching Time	Rise Time	t_r		-		100	ns
	Turn-on Time	t_{on}		-		135	ns
	Fall Time	t_f		-		100	ns
	Turn-off Time	t_{off}		-		225	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=38A, V_{DS}=120V	-	79	120	nC
Gate Source Charge		Q_{gs}		-	37	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	42	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	25	A
Pulse Source Current	I_{SP}	—	-	-	100	A
Diode Forward Voltage	V_{SD}	I_S=25A, V_{GS}=0V, Tc=25°C	-	-	1.8	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=30A, dI_F/dt=100A/μs	-	750	-	ns
Reverse Recovered Charge	Q_{rr}		-	4.7	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 4 4 0
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

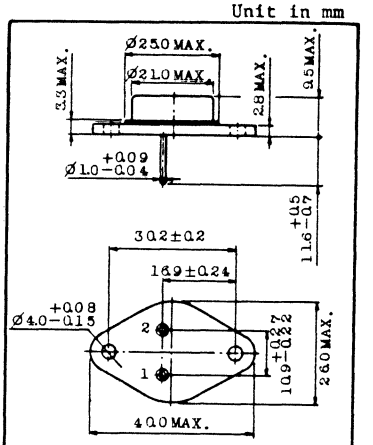
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.8Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=6.5S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=500V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21E1B

Weight : 15.8g

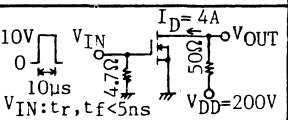
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	500	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	500	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	8	A
	DC(Tc=100°C)	I_D	5	
	Pulse	I_{DP}	32	
Inductive Current (Clamped)		I_{LP}	32	A
Drain Power Dissipation (Tc=25°C)		P_D	125	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.0	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=500V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=400V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	500	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=4A	4	6.5	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	8	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=4A , V_{GS}=10V	-	0.8	0.85	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=8A , V_{GS}=10V	-	7.0		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		1600	pF
Reverse Transfer Capacitance		C_{rss}		-		150	pF
Output Capacitance		C_{oss}		-		350	pF
Switching Time	Rise Time	t_r		-		15	ns
	Turn-on Time	t_{on}		-		50	ns
	Fall Time	t_f		-		30	ns
	Turn-off Time	t_{off}		-		120	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=10A, V_{DS}=400V	-	42	60	nC
Gate Source Charge		Q_{gs}		-	20	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	22	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	8	A
Pulse Source Current	I_{SP}	—	-	-	32	A
Diode Forward Voltage	V_{SD}	I_S=8A , V_{GS}=0V, Tc=25°C	-	-	2.0	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=8A, dI_F/dt=100A/μs	-	1100	-	ns
Reverse Recovered Charge	Q_{rr}		-	6.4	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 4 4 1
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.8Ω (Typ.)

. High Forward Transfer Admittance : $|Yfs|$=6.5S (Typ.)

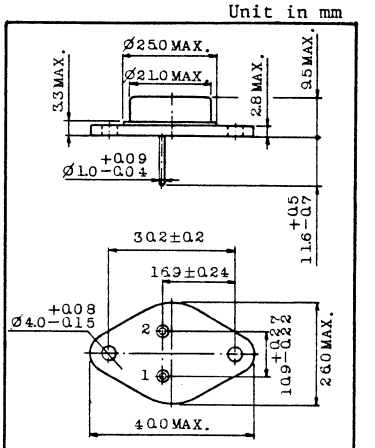
. Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V

I_{DSS}= 250μA(Max.) @ V_{DS}=450V

. Enhancement-Mode : V_{th}=2.0~4.0V @ $V_{DS}=V_{GS}$, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21E1B

Weight : 15.8g

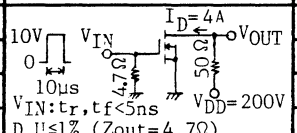
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	450	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	450	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	8	A
	DC(Tc=100°C)	I_D	5	
	Pulse	I_{DP}	32	
Inductive Current (Clamped)		I_{LP}	32	A
Drain Power Dissipation (Tc=25°C)		P_D	125	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	−55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.0	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=450V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=360V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	450	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		$\|Yfs\|$	V_{DS}=10V, I_D=4A	4	6.5	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	8	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=4A , V_{GS}=10V	-	0.8	0.85	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=8A , V_{GS}=10V	-	7.0		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		1600	pF
Reverse Transfer Capacitance		C_{rss}		-		150	pF
Output Capacitance		C_{oss}		-		350	pF
Switching Time	Rise Time	t_r		-		15	ns
	Turn-on Time	t_{on}		-		50	ns
	Fall Time	t_f		-		30	ns
	Turn-off Time	t_{off}		-		120	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=10A, V_{DS}=360V	-	42	60	nC
Gate Source Charge		Q_{gs}		-	20	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	22	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	8	A
Pulse Source Current	I_{SP}	—	-	-	32	A
Diode Forward Voltage	V_{SD}	I_S=8A , V_{GS}=0V, Tc=25°C	-	-	2.0	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=8A,	-	1100	-	ns
Reverse Recovered Charge	Q_{rr}	dI_F/dt=100A/μs	-	6.4	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR

Y T F 4 4 2

SILICON N CHANNEL MOS TYPE

(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

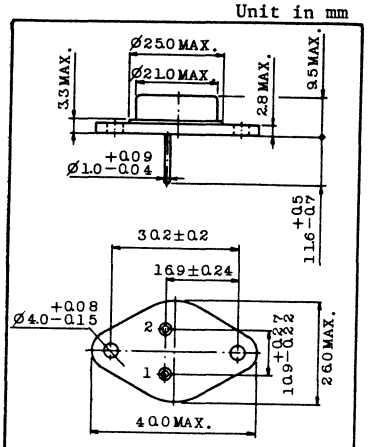
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.8Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=6.5S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=500V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



1. GATE
2. SOURCE
DRAIN (CASE)

JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21E1B

Weight : 15.8g

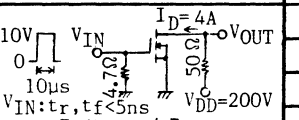
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	500	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	500	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	7	A
	DC(Tc=100°C)	I_D	4	
	Pulse	I_{DP}	28	
Inductive Current (Clamped)		I_{LP}	28	A
Drain Power Dissipation (Tc=25°C)		P_D	125	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.0	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=500V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=400V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	500	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D= 4A	4.0	6.5	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	7	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D= 4A , V_{GS}=10V	-	1.0	1.1	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D= 7A , V_{GS}=10V	-	7.7		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		1600	pF
Reverse Transfer Capacitance		C_{rss}		-		150	pF
Output Capacitance		C_{oss}		-		350	pF
Switching Time	Rise Time	t_r		-		15	ns
	Turn-on Time	t_{on}		-		50	ns
	Fall Time	t_f		-		30	ns
	Turn-off Time	t_{off}		-		120	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=10A, V_{DS}=400V	-	42	60	nC
Gate Source Charge		Q_{gs}		-	20	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	22	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	7	A
Pulse Source Current	I_{SP}	—	-	-	28	A
Diode Forward Voltage	V_{SD}	I_S=7A , V_{GS}=0V, Tc=25°C	-	-	1.9	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=8A, dI_F/dt=100A/μs	-	1100	-	ns
Reverse Recovered Charge	Q_{rr}		-	6.4	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 4 4 3
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

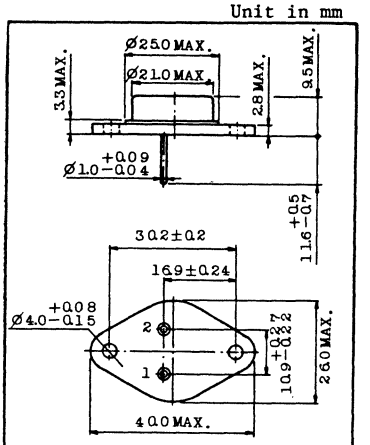
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.8Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=6.5S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=450V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



1. GATE
2. SOURCE
DRAIN (CASE)

JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21E1B

Weight : 15.8g

MAXIMUM RATINGS (Ta=25°C)

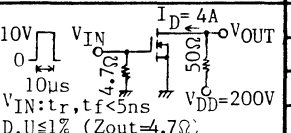
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	450	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	450	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	7	A
	DC(Tc=100°C)	I_D	4	
	Pulse	I_{DP}	28	
Inductive Current (Clamped)		I_{LP}	28	A
Drain Power Dissipation (Tc=25°C)		P_D	125	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.0	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=450V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=360V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	450	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=4A	4.0	6.5	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	7	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=4A , V_{GS}=10V	-	1.0	1.1	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=7A , V_{GS}=10V	-	7.7		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		1600	pF
Reverse Transfer Capacitance		C_{rss}		-		150	pF
Output Capacitance		C_{oss}		-		350	pF
Switching Time	Rise Time	t_r		-		15	ns
	Turn-on Time	t_{on}		-		50	ns
	Fall Time	t_f		-		30	ns
	Turn-off Time	t_{off}		-		120	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=10A, V_{DS}=360V	-	42	60	nC
Gate Source Charge		Q_{gs}		-	20	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	22	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	7	A
Pulse Source Current	I_{SP}	—	-	-	28	A
Diode Forward Voltage	V_{SD}	I_S=7A , V_{GS}=0V, Tc=25°C	-	-	1.9	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=8A, dI$_F$/dt=100A/μs	-	1100	-	ns
Reverse Recovered Charge	Q_{rr}		-	6.4	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 4 5 0
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.3Ω (Typ.)

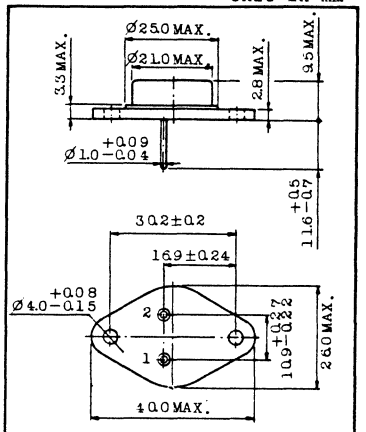
. High Forward Transfer Admittance : $|Yfs|$=11S (Typ.)

. Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
I_{DSS}= 250μA(Max.) @ V_{DS}=500V

. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



1. GATE
2. SOURCE
DRAIN (CASE)

JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21E1B

Weight : 15.8g

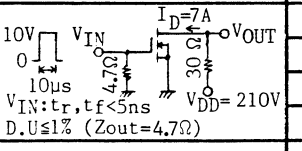
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	500	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	500	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	13	A
	DC(Tc=100°C)	I_D	8	
	Pulse	I_{DP}	52	
Inductive Current (Clamped)		I_{LP}	52	A
Drain Power Dissipation (Tc=25°C)		P_D	150	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	0.83	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=500V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=400V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	500	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		$\|Yfs\|$	V_{DS}=10V, I_D=7A	6	11	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	13	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=7A , V_{GS}=10V	-	0.3	0.4	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=13A , V_{GS}=10V	-	4.3		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		3000	pF
Reverse Transfer Capacitance		C_{rss}		-		200	pF
Output Capacitance		C_{oss}		-		600	pF
Switching Time	Rise Time	t_r		-		50	ns
	Turn-on Time	t_{on}		-		85	ns
	Fall Time	t_f		-		70	ns
	Turn-off Time	t_{off}		-		220	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=16A, V_{DS}=400V	-	82	120	nC
Gate Source Charge		Q_{gs}		-	40	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	42	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	13	A
Pulse Source Current	I_{SP}	—	-	-	52	A
Diode Forward Voltage	V_{SD}	I_S=13A , V_{GS}=0V, Tc=25°C	-	-	1.4	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=13A, dI_F/dt=100A/μs	-	1300	-	ns
Reverse Recovered Charge	Q_{rr}		-	7.4	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 4 5 1
SILICON N CHANNEL MOS TYPE
(π-MOS)

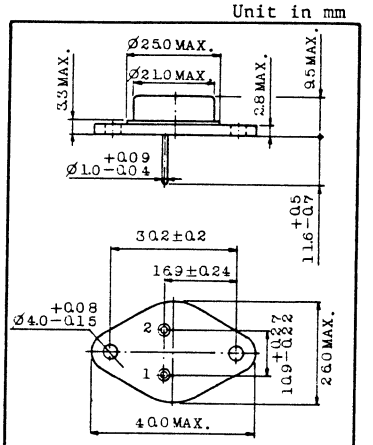
HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.3Ω (Typ.)
- High Forward Transfer Admittance : |Yfs|=11S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=450V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21E1B

Weight : 15.8g

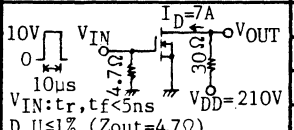
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	450	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	450	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	13	A
	DC(Tc=100°C)	I_D	8	
	Pulse	I_{DP}	52	
Inductive Current (Clamped)		I_{LP}	52	A
Drain Power Dissipation (Tc=25°C)		P_D	150	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	0.83	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=450V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=360V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	450	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		$\|Yfs\|$	V_{DS}=10V, I_D=7A	6	11	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	13	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=7A , V_{GS}=10V	-	0.3	0.4	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=13A , V_{GS}=10V	-	4.3		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		3000	pF
Reverse Transfer Capacitance		C_{rss}		-		200	pF
Output Capacitance		C_{oss}		-		600	pF
Switching Time	Rise Time	t_r		-		50	ns
	Turn-on Time	t_{on}		-		85	ns
	Fall Time	t_f		-		70	ns
	Turn-off Time	t_{off}		-		220	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=16A, V_{DS}=360V	-	82	120	nC
Gate Source Charge		Q_{gs}		-	40	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	42	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	13	A
Pulse Source Current	I_{SP}	—	-	-	52	A
Diode Forward Voltage	V_{SD}	I_S=13A , V_{GS}=0V, Tc=25°C	-	-	1.4	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=13A, dI_F/dt=100A/μs	-	1300	-	ns
Reverse Recovered Charge	Q_{rr}		-	7.4	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 4 5 2
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

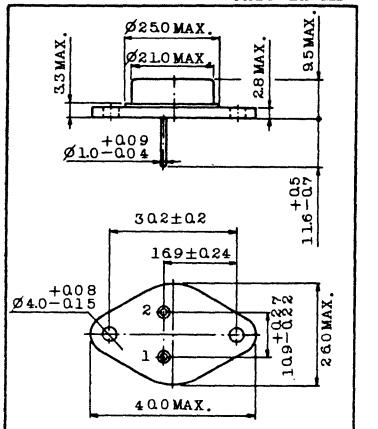
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.4Ω (Typ.)
. High Forward Transfer Admittance : $|Yfs|$=11S (Typ.)
. Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=500V
. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21E1B

Weight : 15.8g

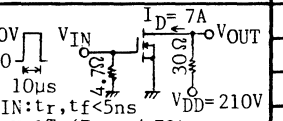
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	500	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	500	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	12	A
	DC(Tc=100°C)	I_D	7	
	Pulse	I_{DP}	48	
Inductive Current (Clamped)		I_{LP}	48	A
Drain Power Dissipation (Tc=25°C)		P_D	150	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	0.83	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=500V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=400V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	500	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=7A	6	11	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	12	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D= 7A , V_{GS}=10V	-	0.4	0.5	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=12A , V_{GS}=10V	-	5.3		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		3000	pF
Reverse Transfer Capacitance		C_{rss}		-		200	pF
Output Capacitance		C_{oss}		-		600	pF
Switching Time	Rise Time	t_r		-		50	ns
	Turn-on Time	t_{on}		-		85	ns
	Fall Time	t_f		-		70	ns
	Turn-off Time	t_{off}		-		220	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=16A, V_{DS}=400V	-	82	120	nC
Gate Source Charge		Q_{gs}		-	40	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	42	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	12	A
Pulse Source Current	I_{SP}	—	-	-	48	A
Diode Forward Voltage	V_{SD}	I_S=12A , V_{GS}=0V, Tc=25°C	-	-	1.3	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=13A, dI_F/dt=100A/μs	-	1300	-	ns
Reverse Recovered Charge	Q_{rr}		-	7.4	-	μC

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 4 5 3
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

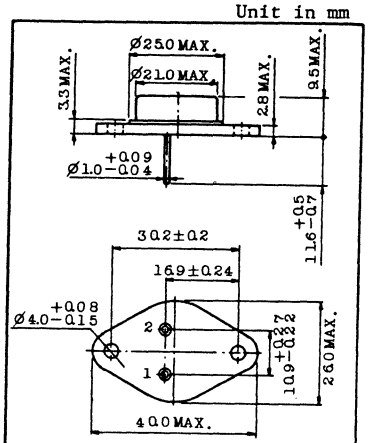
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.4Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=11S (Typ.)
- Low Leakage Current : I_{GSS}=±100nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=450V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



JEDEC	TO-204MA/TO-3
EIAJ	TC-3, TB-3
TOSHIBA	2-21E1B

Weight : 15.8g

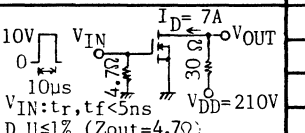
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	450	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	450	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	12	A
	DC(Tc=100°C)	I_D	7	
	Pulse	I_{DP}	48	
Inductive Current (Clamped)		I_{LP}	48	A
Drain Power Dissipation (Tc=25°C)		P_D	150	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	0.83	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	30	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=450V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=360V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	450	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=7A	6	11	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	12	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D= 7A , V_{GS}=10V	-	0.4	0.5	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=12A , V_{GS}=10V	-	5.3		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		3000	pF
Reverse Transfer Capacitance		C_{rss}		-		200	pF
Output Capacitance		C_{oss}		-		600	pF
Switching Time	Rise Time	t_r		-		50	ns
	Turn-on Time	t_{on}		-		85	ns
	Fall Time	t_f		-		70	ns
	Turn-off Time	t_{off}		-		220	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=16A, V_{DS}=360V	-	82	120	nC
Gate Source Charge		Q_{gs}		-	40	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	42	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	12	A
Pulse Source Current	I_{SP}	—	-	-	48	A
Diode Forward Voltage	V_{SD}	I_S=12A , V_{GS}=0V, Tc=25°C	-	-	1.3	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=13A, dI$_F$/dt=100A/μs	-	1300	-	ns
Reverse Recovered Charge	Q_{rr}		-	7.4	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

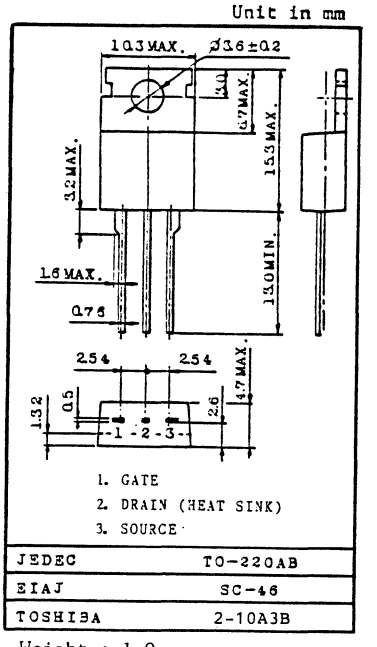
TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 5 2 0
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.25Ω (Typ.)
. High Forward Transfer Admittance : $|Yfs|$=2.9S (Typ.)
. Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=100V
. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS
Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weight : 1.9g

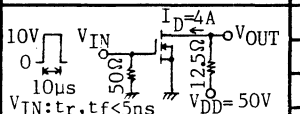
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	100	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	100	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	8	A
	DC(Tc=100°C)	I_D	5	
	Pulse	I_{DP}	32	
Inductive Current (Clamped)		I_{LP}	32	A
Drain Power Dissipation (Tc=25°C)		P_D	40	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.12	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=100V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=80V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	100	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		$\|Yfs\|$	V_{DS}=10V, I_D=4A	1.5	2.9	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	8	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=4A, V_{GS}=10V	-	0.25	0.30	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=8A, V_{GS}=10V	-	2.2		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		600	pF
Reverse Transfer Capacitance		C_{rss}		-		100	pF
Output Capacitance		C_{oss}		-		400	pF
Switching Time	Rise Time	t_r		-		70	ns
	Turn-on Time	t_{on}		-		110	ns
	Fall Time	t_f		-		70	ns
	Turn-off Time	t_{off}		-		170	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=10A, V_{DS}=80V	-	10	15	nC
Gate Source Charge		Q_{gs}		-	6	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	4	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	8	A
Pulse Source Current	I_{SP}	—	-	-	32	A
Diode Forward Voltage	V_{SD}	I_S=8A, V_{GS}=0V, Tc=25°C	-	-	2.5	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=8A, dI_F/dt=100A/μs	-	280	-	ns
Reverse Recovered Charge	Q_{rr}		-	1.6	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 5 2 1
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

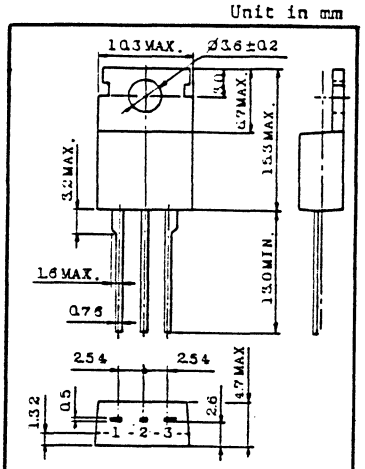
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.25Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=2.9S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=60V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weight : 1.9g

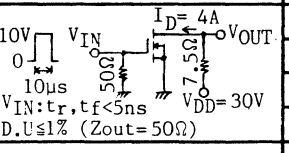
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	60	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	60	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	8	A
	DC(Tc=100°C)	I_D	5	
	Pulse	I_{DP}	32	
Inductive Current (Clamped)		I_{LP}	32	A
Drain Power Dissipation (Tc=25°C)		P_D	40	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.12	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=60V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=48V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	60	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		$\|Yfs\|$	V_{DS}=10V, I_D=4A	1.5	2.9	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	8	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=4A, V_{GS}=10V	-	0.25	0.30	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=8A, V_{GS}=10V	-	2.2		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		600	pF
Reverse Transfer Capacitance		C_{rss}		-		100	pF
Output Capacitance		C_{oss}		-		400	pF
Switching Time	Rise Time	t_r		-		70	ns
	Turn-on Time	t_{on}		-		110	ns
	Fall Time	t_f		-		70	ns
	Turn-off Time	t_{off}		-		170	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=10A, V_{DS}=48V	-	10	15	nC
Gate Source Charge		Q_{gs}		-	6	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	4	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	8	A
Pulse Source Current	I_{SP}	—	-	-	32	A
Diode Forward Voltage	V_{SD}	I_S=8A, V_{GS}=0V, Tc=25°C	-	-	2.5	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=8A, dI_F/dt=100A/μs	-	280	-	ns
Reverse Recovered Charge	Q_{rr}		-	1.6	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 5 2 2
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

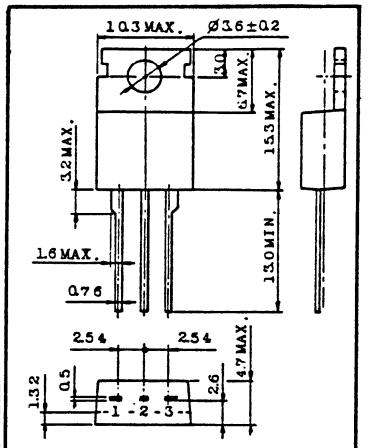
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.30Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=2.9S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=100V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

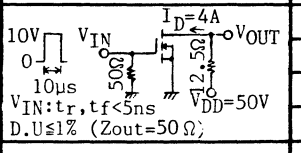
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	100	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	100	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	7	A
	DC(Tc=100°C)	I_D	4	
	Pulse	I_{DP}	28	
Inductive Current (Clamped)		I_{LP}	28	A
Drain Power Dissipation (Tc=25°C)		P_D	40	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.12	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=100V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=80V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	100	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=4A	1.5	2.9	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	7	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=4A, V_{GS}=10V	-	0.3	0.4	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=7A, V_{GS}=10V	-	2.3		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		600	pF
Reverse Transfer Capacitance		C_{rss}		-		100	pF
Output Capacitance		C_{oss}		-		400	pF
Switching Time	Rise Time	t_r		-		70	ns
	Turn-on Time	t_{on}		-		110	ns
	Fall Time	t_f		-		70	ns
	Turn-off Time	t_{off}		-		170	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=10A, V_{DS}=80V	-	10	15	nC
Gate Source Charge		Q_{gs}		-	6	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	4	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	7	A
Pulse Source Current	I_{SP}	—	-	-	28	A
Diode Forward Voltage	V_{SD}	I_S=8A, V_{GS}=0V, Tc=25°C	-	-	2.3	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=8A, dI_F/dt=100A/μs	-	280	-	ns
Reverse Recovered Charge	Q_{rr}		-	1.6	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 5 2 3
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

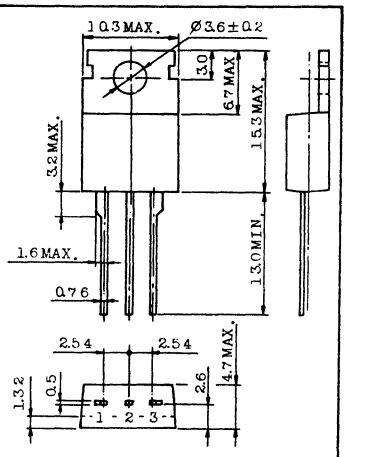
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.3Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=2.9S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}= 60V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

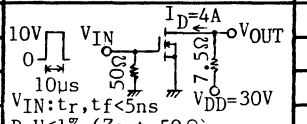
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	60	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	60	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	7	A
	DC(Tc=100°C)	I_D	4	
	Pulse	I_{DP}	28	
Inductive Current (Clamped)		I_{LP}	28	A
Drain Power Dissipation (Tc=25°C)		P_D	40	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.12	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}= 60V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}= 48V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	60	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=4A	1.5	2.9	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	7	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=4A , V_{GS}=10V	-	0.3	0.4	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=7A , V_{GS}=10V	-	2.3		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		600	pF
Reverse Transfer Capacitance		C_{rss}		-		100	pF
Output Capacitance		C_{oss}		-		400	pF
Switching Time	Rise Time	t_r		-		70	ns
	Turn-on Time	t_{on}		-		110	ns
	Fall Time	t_f		-		70	ns
	Turn-off Time	t_{off}		-		170	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D= 10A, V_{DS}=48V	-	10	15	nC
Gate Source Charge		Q_{gs}		-	6	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	4	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	7	A
Pulse Source Current	I_{SP}	—	-	-	28	A
Diode Forward Voltage	V_{SD}	I_S=7A , V_{GS}=0V, Tc=25°C	-	-	2.3	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=8A,	-	280	-	ns
Reverse Recovered Charge	Q_{rr}	dI_F/dt=100A/μs	-	1.6	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 5 3 0
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

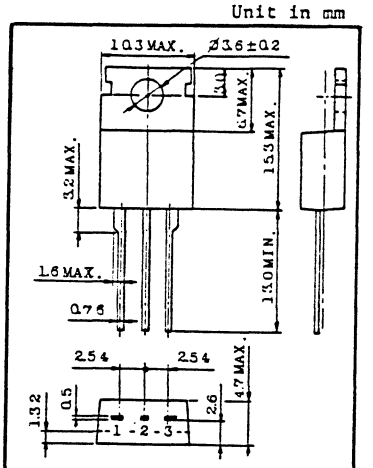
. Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.14Ω (Typ.)

. High Forward Transfer Admittance : $|Yfs|$=5.5S (Typ.)

. Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
I_{DSS}= 250μA(Max.) @ V_{DS}=100V

. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weight : 1.9g

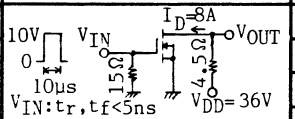
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	100	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	100	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	14	A
	DC(Tc=100°C)	I_D	9	
	Pulse	I_{DP}	56	
Inductive Current (Clamped)		I_{LP}	56	A
Drain Power Dissipation (Tc=25°C)		P_D	75	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=100V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=80V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	100	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=8A	4.0	5.5	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	14	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=8A, V_{GS}=10V	-	0.14	0.18	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=14A, V_{GS}=10V	-	2.2		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		800	pF
Reverse Transfer Capacitance		C_{rss}		-		150	pF
Output Capacitance		C_{oss}		-		500	pF
Switching Time	Rise Time	t_r		-		75	ns
	Turn-on Time	t_{on}		-		105	ns
	Fall Time	t_f		-		45	ns
	Turn-off Time	t_{off}		-		85	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=18A, V_{DS}=80V	-	18	30	nC
Gate Source Charge		Q_{gs}		-	9	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	9	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	14	A
Pulse Source Current	I_{SP}	—	-	-	56	A
Diode Forward Voltage	V_{SD}	I_S=14A, V_{GS}=0V, Tc=25°C	-	-	2.5	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=14A, dI_F/dt=100A/μs	-	360	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.1	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 5 3 1
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.14Ω (Typ.)

. High Forward Transfer Admittance : $|Yfs|$=5.5S (Typ.)

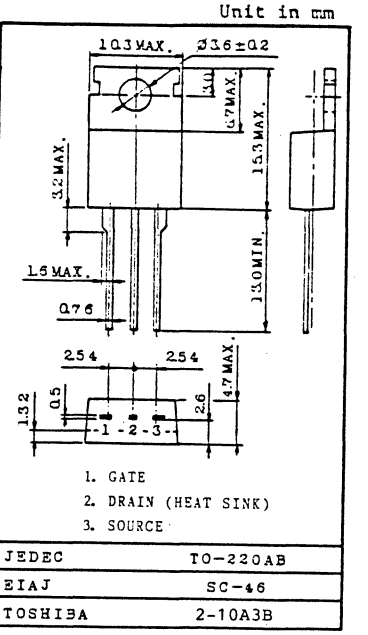
. Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V

I_{DSS}= 250μA(Max.) @ V_{DS}=60V

. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weight : 1.9g

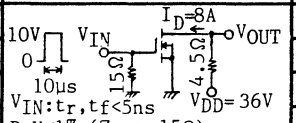
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	60	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	60	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	14	A
	DC(Tc=100°C)	I_D	9	
	Pulse	I_{DP}	56	
Inductive Current (Clamped)		I_{LP}	56	A
Drain Power Dissipation (Tc=25°C)		P_D	75	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=60V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=48V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	60	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=8A	4.0	5.5	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	14	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=8A, V_{GS}=10V	-	0.14	0.18	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=14A, V_{GS}=10V	-	2.2		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		800	pF
Reverse Transfer Capacitance		C_{rss}		-		150	pF
Output Capacitance		C_{oss}		-		500	pF
Switching Time	Rise Time	t_r		-		75	ns
	Turn-on Time	t_{on}		-		105	ns
	Fall Time	t_f		-		45	ns
	Turn-off Time	t_{off}		-		85	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=18A, V_{DS}=48V	-	18	30	nC
Gate Source Charge		Q_{gs}		-	9	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	9	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	14	A
Pulse Source Current	I_{SP}	—	-	-	56	A
Diode Forward Voltage	V_{SD}	I_S=14A, V_{GS}=0V, Tc=25°C	-	-	2.5	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=14A, dI_F/dt=100A/μs	-	360	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.1	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR

Y T F 5 3 2

SILICON N CHANNEL MOS TYPE

(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.2Ω (Typ.)

. High Forward Transfer Admittance : $|Yfs|$=5.5S (Typ.)

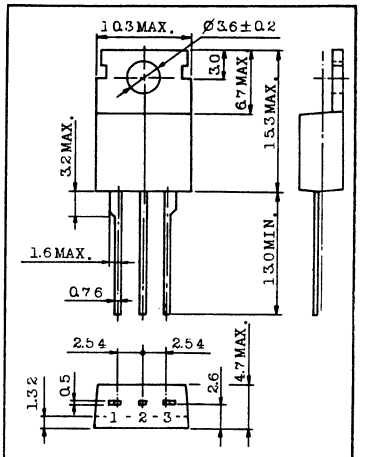
. Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V

I_{DSS}= 250μA(Max.) @ V_{DS}=100V

. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



1. GATE
2. DRAIN (HEAT SINK)
3. SOURCE

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

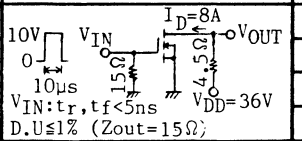
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	100	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	100	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	12	A
	DC(Tc=100°C)	I_D	8	
	Pulse	I_{DP}	48	
Inductive Current (Clamped)		I_{LP}	48	A
Drain Power Dissipation (Tc=25°C)		P_D	75	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=100V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}= 80V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	100	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=8A	4.0	5.5	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	12	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D= 8A , V_{GS}=10V	-	0.2	0.25	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=12A , V_{GS}=10V	-	2.6		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		800	pF
Reverse Transfer Capacitance		C_{rss}		-		150	pF
Output Capacitance		C_{oss}		-		500	pF
Switching Time	Rise Time	t_r		-		75	ns
	Turn-on Time	t_{on}		-		105	ns
	Fall Time	t_f		-		45	ns
	Turn-off Time	t_{off}		-		85	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=18A, V_{DS}=80A	-	18	30	nC
Gate Source Charge		Q_{gs}		-	9	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	9	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	12	A
Pulse Source Current	I_{SP}	—	-	-	48	A
Diode Forward Voltage	V_{SD}	I_S=12A , V_{GS}=0V, Tc=25°C	-	-	2.3	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=14A, dI$_F$/dt=100A/μs	-	360	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.1	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 5 3 3
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

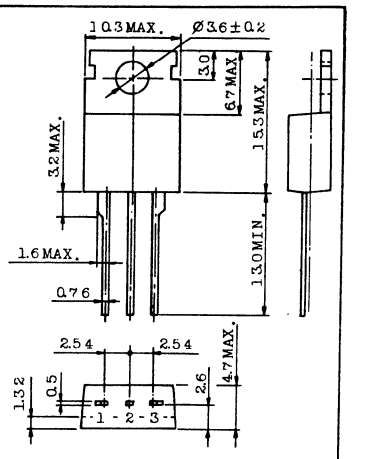
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.2Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=5.5S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}= 60V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

MAXIMUM RATINGS (Ta=25°C)

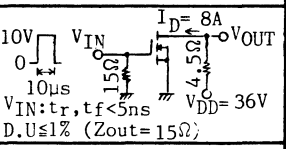
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	60	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	60	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	12	A
	DC(Tc=100°C)	I_D	8	
	Pulse	I_{DP}	48	
Inductive Current (Clamped)		I_{LP}	48	A
Drain Power Dissipation (Tc=25°C)		P_D	75	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}= 60V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}= 48V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	60	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=8A	4.0	5.5	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	12	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D= 8A , V_{GS}=10V	-	0.20	0.25	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=12A , V_{GS}=10V	-	2.6		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		800	pF
Reverse Transfer Capacitance		C_{rss}		-		150	pF
Output Capacitance		C_{oss}		-		500	pF
Switching Time	Rise Time	t_r		-		75	ns
	Turn-on Time	t_{on}		-		105	ns
	Fall Time	t_f		-		45	ns
	Turn-off Time	t_{off}		-		85	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=18A, V_{DS}=48V	-	18	30	nC
Gate Source Charge		Q_{gs}		-	9	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	9	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	12	A
Pulse Source Current	I_{SP}	—	-	-	48	A
Diode Forward Voltage	V_{SD}	I_S=12A , V_{GS}=0V, Tc=25°C	-	-	2.3	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=14A, dI_F/dt=100A/μs	-	360	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.1	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 5 4 0
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

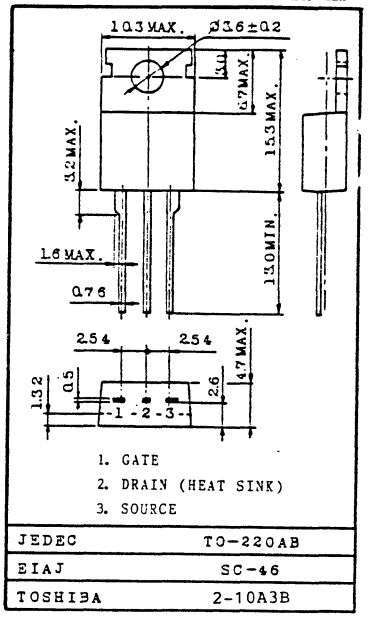
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.07Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=10S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=100V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weight : 1.9g

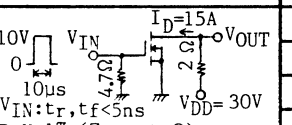
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	100	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	100	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	27	A
	DC(Tc=100°C)	I_D	17	
	Pulse	I_{DP}	108	
Inductive Current (Clamped)		I_{LP}	108	A
Drain Power Dissipation (Tc=25°C)		P_D	125	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.0	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=100V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=80V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	100	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		$\|Yfs\|$	V_{DS}=10V, I_D=15A	6	10	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	27	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=15A, V_{GS}=10V	-	0.07	0.085	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=27A, V_{GS}=10V	-	2.1		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		1600	pF
Reverse Transfer Capacitance		C_{rss}		-		300	pF
Output Capacitance		C_{oss}		-		800	pF
Switching Time	Rise Time	t_r		-		60	ns
	Turn-on Time	t_{on}		-		90	ns
	Fall Time	t_f		-		30	ns
	Turn-off Time	t_{off}		-		110	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=34A, V_{DS}=80V	-	38	60	nC
Gate Source Charge		Q_{gs}		-	17	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	21	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	27	A
Pulse Source Current	I_{SP}	—	-	-	108	A
Diode Forward Voltage	V_{SD}	I_S=27A, V_{GS}=0V, Tc=25°C	-	-	2.5	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=27A, dIF/dt=100A/μs	-	500	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.9	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 5 4 1
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

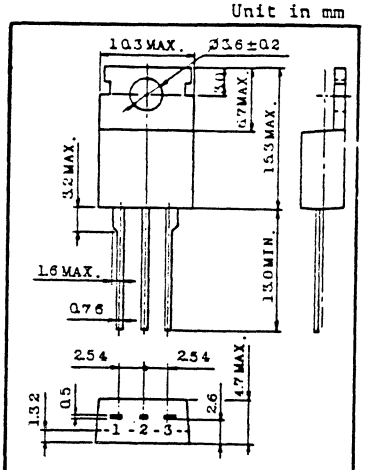
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.07Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=10S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=60V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weight : 1.9g

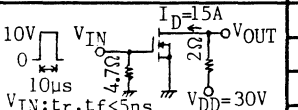
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	60	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	60	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	27	A
	DC(Tc=100°C)	I_D	17	
	Pulse	I_{DP}	108	
Inductive Current (Clamped)		I_{LP}	108	A
Drain Power Dissipation (Tc=25°C)		P_D	125	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.0	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=60V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=48V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	60	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		$\|Yfs\|$	V_{DS}=10V, I_D=15A	6	10	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	27	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=15A, V_{GS}=10V	-	0.07	0.085	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=27A, V_{GS}=10V	-	2.1		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		1600	pF
Reverse Transfer Capacitance		C_{rss}		-		300	pF
Output Capacitance		C_{oss}		-		800	pF
Switching Time	Rise Time	t_r		-		60	ns
	Turn-on Time	t_{on}		-		90	ns
	Fall Time	t_f		-		30	ns
	Turn-off Time	t_{off}		-		110	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=34A, V_{DS}=48V	-	38	60	nC
Gate Source Charge		Q_{gs}		-	17	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	21	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	27	A
Pulse Source Current	I_{SP}	—	-	-	108	A
Diode Forward Voltage	V_{SD}	I_S=27A, V_{GS}=0V, Tc=25°C	-	-	2.5	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=27A, dI$_F$/dt=100A/μs	-	500	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.9	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 5 4 2
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.09Ω (Typ.)

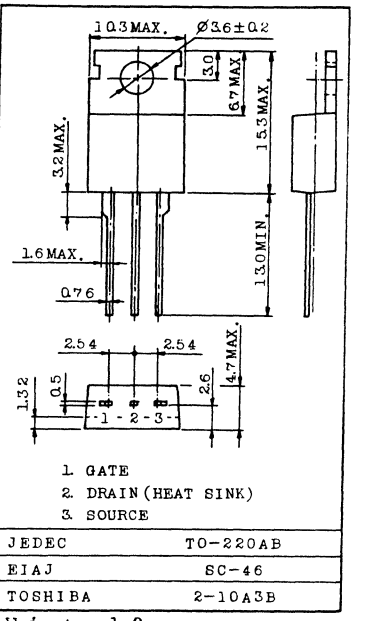
. High Forward Transfer Admittance : $|Yfs|$=10S (Typ.)

. Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V

I_{DSS}= 250μA(Max.) @ V_{DS}=100V

. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

MAXIMUM RATINGS (Ta=25°C)

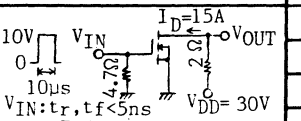
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	100	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	100	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	24	A
	DC(Tc=100°C)	I_D	15	
	Pulse	I_{DP}	96	
Inductive Current (Clamped)		I_{LP}	96	A
Drain Power Dissipation (Tc=25°C)		P_D	125	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.0	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=100V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}= 80V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	100	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=15A	6	10	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	24	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=15A , V_{GS}=10V	-	0.09	0.11	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=24A , V_{GS}=10V	-	2.4		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		1600	pF
Reverse Transfer Capacitance		C_{rss}		-		300	pF
Output Capacitance		C_{oss}		-		800	pF
Switching Time	Rise Time	t_r		-		60	ns
	Turn-on Time	t_{on}		-		90	ns
	Fall Time	t_f		-		30	ns
	Turn-off Time	t_{off}		-		110	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D= 34A, V_{DS}= 80V	-	38	60	nC
Gate Source Charge		Q_{gs}		-	17	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	21	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	24	A
Pulse Source Current	I_{SP}	—	-	-	96	A
Diode Forward Voltage	V_{SD}	I_S= 24A , V_{GS}=0V, Tc=25°C	-	-	2.5	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=27A	-	500	-	ns
Reverse Recovered Charge	Q_{rr}	dI_F/dt=100A/μs	-	2.9	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 5 4 3
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

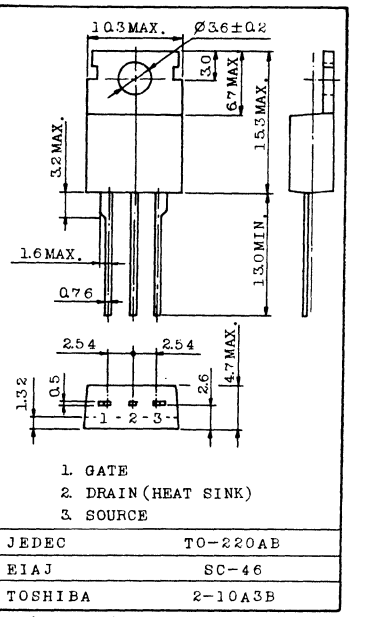
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.09Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=10S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}= 60V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

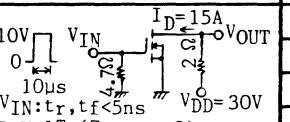
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	60	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	60	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	24	A
	DC(Tc=100°C)	I_D	15	
	Pulse	I_{DP}	96	
Inductive Current (Clamped)		I_{LP}	96	A
Drain Power Dissipation (Tc=25°C)		P_D	125	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.0	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=60V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=48V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	60	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=15A	6	10	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	24	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=15A, V_{GS}=10V	-	0.09	0.11	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=24A, V_{GS}=10V	-	2.4		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		1600	pF
Reverse Transfer Capacitance		C_{rss}		-		300	pF
Output Capacitance		C_{oss}		-		800	pF
Switching Time	Rise Time	t_r		-		60	ns
	Turn-on Time	t_{on}		-		90	ns
	Fall Time	t_f		-		30	ns
	Turn-off Time	t_{off}		-		110	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=34A, V_{DS}=48V	-	38	60	nC
Gate Source Charge		Q_{gs}		-	17	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	21	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	24	A
Pulse Source Current	I_{SP}	—	-	-	96	A
Diode Forward Voltage	V_{SD}	I_S=24A, V_{GS}=0V, Tc=25°C	-	-	2.5	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=27A, dI_F/dt=100A/μs	-	500	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.9	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 6 1 0
SILICON N CHANNEL MOS TYPE
(π-MOS)

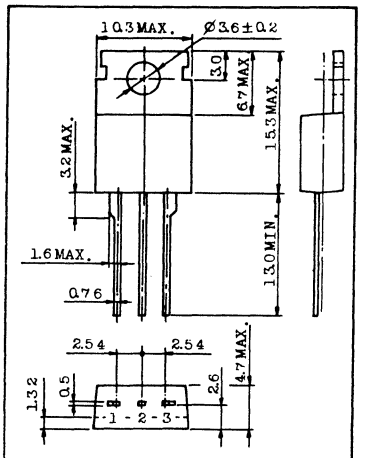
HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=1.0Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=1.3S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=200V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

MAXIMUM RATINGS (Ta=25°C)

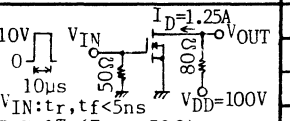
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	200	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	200	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	2.5	A
	DC(Tc=100°C)	I_D	1.5	
	Pulse	I_{DP}	10	
Inductive Current (Clamped)		I_{LP}	10	A
Drain Power Dissipation (Tc=25°C)		P_D	20	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	6.4	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=200V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=160V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	200	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=1.25A	0.8	1.3	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	2.5	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=1.25A, V_{GS}=10V	-	1.0	1.5	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=2.5A, V_{GS}=10V	-	2.7		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		150	pF
Reverse Transfer Capacitance		C_{rss}		-		25	pF
Output Capacitance		C_{oss}		-		80	pF
Switching Time	Rise Time	t_r		-		25	ns
	Turn-on Time	t_{on}		-		40	ns
	Fall Time	t_f		-		15	ns
	Turn-off Time	t_{off}		-		30	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=3A, V_{DS}=160V	-	5	7.5	nC
Gate Source Charge		Q_{gs}		-	2	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	3	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	2.5	A
Pulse Source Current	I_{SP}	—	-	-	10	A
Diode Forward Voltage	V_{SD}	I_S=2.5A, V_{GS}=0V, Tc=25°C	-	-	2.0	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=2.5A, dI_F/dt=100A/μs	-	290	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.0	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

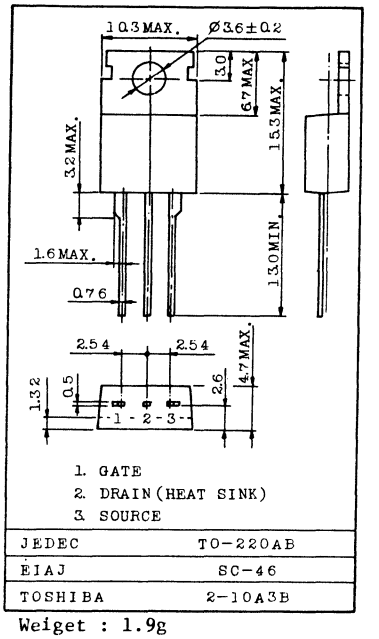
TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 6 1 1
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=1.0Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=1.3S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=150V
- Enhancement-Mode : V_{th}=2.0~4.0V @ $V_{DS}=V_{GS}$, I_D=250μA

MAXIMUM RATINGS (Ta=25°C)

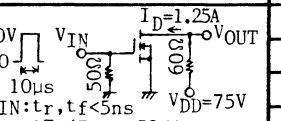
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	150	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	150	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	2.5	A
	DC(Tc=100°C)	I_D	1.5	
	Pulse	I_{DP}	10	
Inductive Current (Clamped)		I_{LP}	10	A
Drain Power Dissipation (Tc=25°C)		P_D	20	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	6.4	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=150V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=120V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	150	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		$\|Yfs\|$	V_{DS}=10V, I_D=1.25A	0.8	1.3	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	2.5	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=1.25A, V_{GS}=10V	-	1.0	1.5	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=2.5A, V_{GS}=10V	-	2.7		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		150	pF
Reverse Transfer Capacitance		C_{rss}		-		25	pF
Output Capacitance		C_{oss}		-		80	pF
Switching Time	Rise Time	t_r		-		25	ns
	Turn-on Time	t_{on}		-		40	ns
	Fall Time	t_f		-		15	ns
	Turn-off Time	t_{off}		-		30	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=3A, V_{DS}=120V	-	5	7.5	nC
Gate Source Charge		Q_{gs}		-	2	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	3	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	2.5	A
Pulse Source Current	I_{SP}	—	-	-	10	A
Diode Forward Voltage	V_{SD}	I_S=2.5A, V_{GS}=0V, Tc=25°C	-	-	2.0	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=2.5A, dI_F/dt=100A/μs	-	290	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.0	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 6 1 2
SILICON N CHANNEL MOS TYPE
(π-MOS)

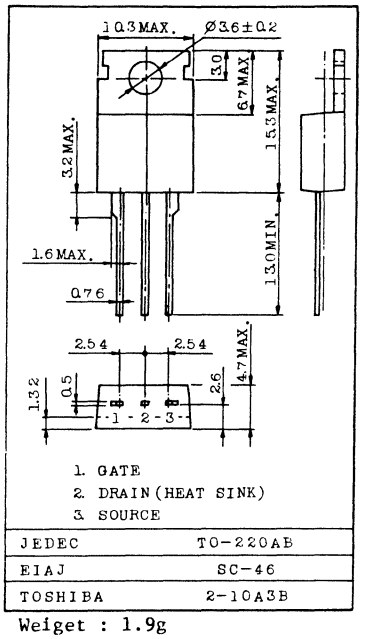
HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=1.5Ω (Typ.)
. High Forward Transfer Admittance : $|Yfs|$=1.3S (Typ.)
. Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
I_{DSS}= 250μA(Max.) @ V_{DS}=200V
. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS
Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

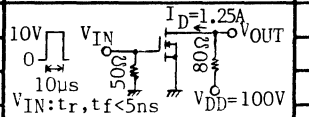
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	200	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	200	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	2	A
	DC(Tc=100°C)	I_D	1.25	
	Pulse	I_{DP}	8	
Inductive Current (Clamped)		I_{LP}	8	A
Drain Power Dissipation (Tc=25°C)		P_D	20	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	6.4	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=200V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=160V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	200	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		$\|Yfs\|$	V_{DS}=10V, I_D=1.25A	0.8	1.3	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	2	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=1.25A, V_{GS}=10V	-	1.5	2.4	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=2A , V_{GS}=10V	-	3.3		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		150	pF
Reverse Transfer Capacitance		C_{rss}		-		25	pF
Output Capacitance		C_{oss}		-		80	pF
Switching Time	Rise Time	t_r		-		25	ns
	Turn-on Time	t_{on}		-		40	ns
	Fall Time	t_f		-		15	ns
	Turn-off Time	t_{off}		-		30	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=3A, V_{DS}=160V	-	5	7.5	nC
Gate Source Charge		Q_{gs}		-	2	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	3	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	2	A
Pulse Source Current	I_{SP}	—	-	-	8	A
Diode Forward Voltage	V_{SD}	I_S=2A , V_{GS}=0V, Tc=25°C	-	-	1.8	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=2.5A, dI_F/dt=100A/μs	-	290	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.0	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 6 1 3
SILICON N CHANNEL MOS-TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=1.5Ω (Typ.)

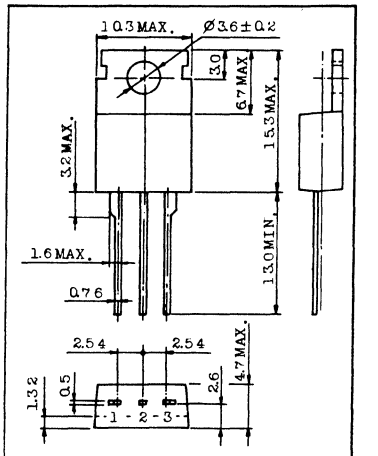
. High Forward Transfer Admittance : $|Yfs|$=1.3S (Typ.)

. Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V

I_{DSS}= 250μA(Max.) @ V_{DS}=150V

. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

MAXIMUM RATINGS (Ta=25°C)

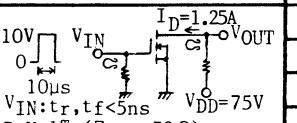
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	150	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	150	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	2	A
	DC(Tc=100°C)	I_D	1.25	
	Pulse	I_{DP}	8	
Inductive Current (Clamped)		I_{DR}	8	A
Drain Power Dissipation (Tc=25°C)		P_D	20	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	6.4	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=150V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=120V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	150	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=1.25A	0.8	1.3	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	2	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=1.25A, V_{GS}=10V	-	1.5	2.4	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=2A , V_{GS}=10V	-	3.3		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		150	pF
Reverse Transfer Capacitance		C_{rss}		-		25	pF
Output Capacitance		C_{oss}		-		80	pF
Switching Time	Rise Time	t_r		-		25	ns
	Turn-on Time	t_{on}		-		40	ns
	Fall Time	t_f		-		15	ns
	Turn-off Time	t_{off}		-		30	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=3A, V_{DS}=120V	-	5	7.5	nC
Gate Source Charge		Q_{gs}		-	2	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	3	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	2	A
Pulse Source Current	I_{SP}	—	-	-	8	A
Diode Forward Voltage	V_{SD}	I_S=2A , V_{GS}=0V, Tc=25°C	-	-	1.8	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=2.5A, dI_F/dt=100A/μs	-	290	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.0	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 6 2 0
SILICON N CHANNEL MOS TYPE
(π-MOS)

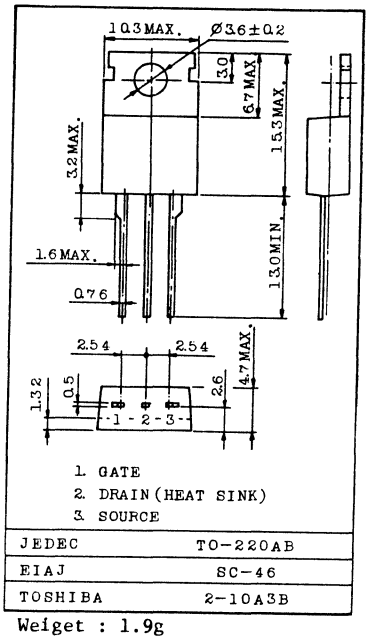
HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.5Ω (Typ.)
. High Forward Transfer Admittance : $|Yfs|$=2.5S (Typ.)
. Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
I_{DSS}= 250μA(Max.) @ V_{DS}=200V
. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS
Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

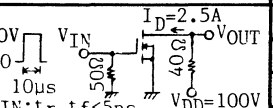
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	200	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	200	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	5	A
	DC(Tc=100°C)	I_D	3	
	Pulse	I_{DP}	20	
Inductive Current (Clamped)		I_{LP}	20	A
Drain Power Dissipation (Tc=25°C)		P_D	40	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.12	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=200V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=160V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	200	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=2.5A	1.3	2.5	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	5	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=2.5A, V_{GS}=10V	-	0.5	0.8	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=5A , V_{GS}=10V	-	2.7		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		600	pF
Reverse Transfer Capacitance		C_{rss}		-		80	pF
Output Capacitance		C_{oss}		-		300	pF
Switching Time	Rise Time	t_r		-		60	ns
	Turn-on Time	t_{on}		-		100	ns
	Fall Time	t_f		-		60	ns
	Turn-off Time	t_{off}		-		160	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=6A, V_{DS}=160V	-	11	15	nC
Gate Source Charge		Q_{gs}		-	5	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	6	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	5	A
Pulse Source Current	I_{SP}	—	-	-	20	A
Diode Forward Voltage	V_{SD}	I_S= 5A , V_{GS}=0V, Tc=25°C	-	-	2.0	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=5A, dI_F/dt=100A/μs	-	350	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.3	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 6 2 1
SILICON N CHANNEL MOS TYPE
(π-MOS)

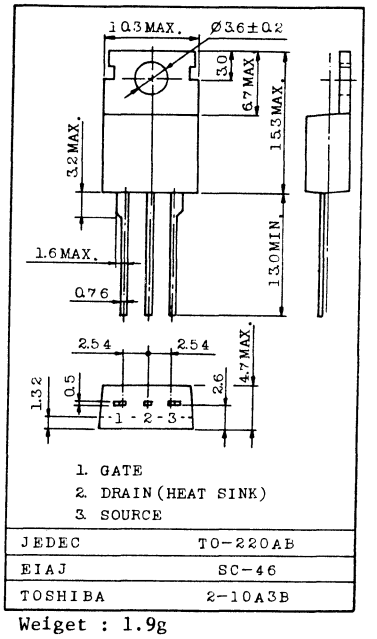
HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.5Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=2.5S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=150V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS
Unit in mm



Weiget : 1.9g

MAXIMUM RATINGS (Ta=25°C)

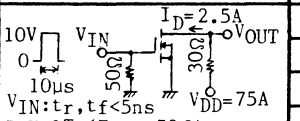
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	150	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	150	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	5	A
	DC(Tc=100°C)	I_D	3	
	Pulse	I_{DP}	20	
Inductive Current (Clamped)		I_{LP}	20	A
Drain Power Dissipation (Tc=25°C)		P_D	40	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.12	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Maximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=150V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=120V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	150	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=2.5A	1.3	2.5	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	5	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=2.5A, V_{GS}=10V	-	0.5	0.8	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=5A , V_{GS}=10V	-	2.7		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		600	pF
Reverse Transfer Capacitance		C_{rss}		-		80	pF
Output Capacitance		C_{oss}		-		300	pF
Switching Time	Rise Time	t_r		-		60	ns
	Turn-on Time	t_{on}		-		100	ns
	Fall Time	t_f		-		60	ns
	Turn-off Time	t_{off}		-		160	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=6A, V_{DS}=120V	-	11	15	nC
Gate Source Charge		Q_{gs}		-	5	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	6	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	5	A
Pulse Source Current	I_{SP}	—	-	-	20	A
Diode Forward Voltage	V_{SD}	I_S=5A , V_{GS}=0V, Tc=25°C	-	-	2.0	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=5A, dI_F/dt=100A/μs	-	350	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.3	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

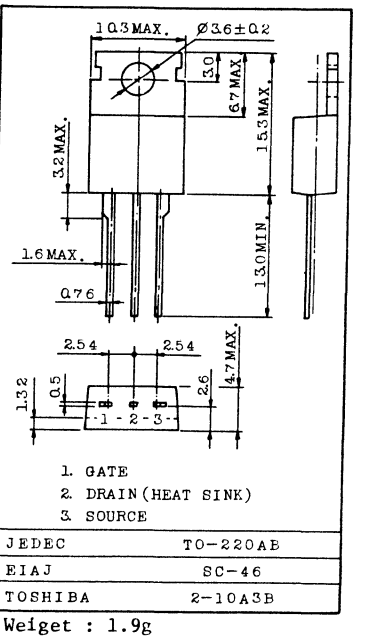
TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 6 2 2
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.8Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=2.5S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=200V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

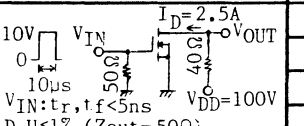
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	200	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	200	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	4	A
	DC(Tc=100°C)	I_D	2.5	
	Pulse	I_{DP}	16	
Inductive Current (Clamped)		I_{LP}	16	A
Drain Power Dissipation (Tc=25°C)		P_D	40	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.12	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=200V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=160V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	200	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=2.5A	1.3	2.5	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	4	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=2.5A, V_{GS}=10V	-	0.8	1.2	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=4A , V_{GS}=10V	-	3.5		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		600	pF
Reverse Transfer Capacitance		C_{rss}		-		80	pF
Output Capacitance		C_{oss}		-		300	pF
Switching Time	Rise Time	t_r		-		60	ns
	Turn-on Time	t_{on}		-		100	ns
	Fall Time	t_f		-		60	ns
	Turn-off Time	t_{off}		-		160	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=6A, V_{DS}=160V	-	11	15	nC
Gate Source Charge		Q_{gs}		-	5	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	6	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	4	A
Pulse Source Current	I_{SP}	—	-	-	16	A
Diode Forward Voltage	V_{SD}	I_S=4A , V_{GS}=0V, Tc=25°C	-	-	1.8	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=5A, dI$_F$/dt=100A/μs	-	350	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.3	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 6 2 3
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

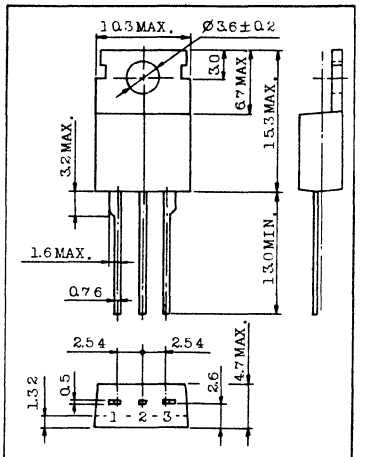
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.8Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=2.5S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=150V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

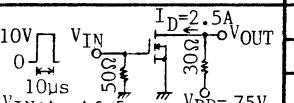
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	150	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	150	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	4	A
	DC(Tc=100°C)	I_D	2.5	
	Pulse	I_{DP}	16	
Inductive Current (Clamped)		I_{LP}	16	A
Drain Power Dissipation (Tc=25°C)		P_D	40	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.12	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=150V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=120V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	150	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		$\|Yfs\|$	V_{DS}=10V, I_D=2.5A	1.3	2.5	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	4	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=2.5A, V_{GS}=10V	-	0.8	1.2	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=4A , V_{GS}=10V	-	3.5		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		600	pF
Reverse Transfer Capacitance		C_{rss}		-		80	pF
Output Capacitance		C_{oss}		-		300	pF
Switching Time	Rise Time	t_r		-		60	ns
	Turn-on Time	t_{on}		-		100	ns
	Fall Time	t_f		-		60	ns
	Turn-off Time	t_{off}		-		160	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=6A, V_{DS}=120V	-	11	15	nC
Gate Source Charge		Q_{gs}		-	5	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	6	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	4	A
Pulse Source Current	I_{SP}	—	-	-	16	A
Diode Forward Voltage	V_{SD}	I_S=4A , V_{GS}=0V, Tc=25°C	-	-	1.8	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=5A, dI_F/dt=100A/μs	-	350	-	ns
Reverse Recovered Charge	Q_{rr}		-	2.3	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 6 3 0
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.25Ω (Typ.)

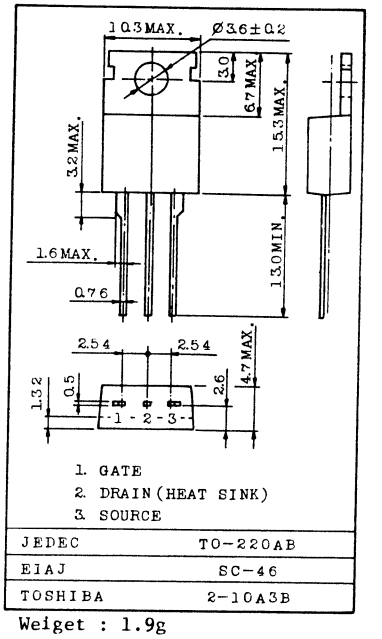
. High Forward Transfer Admittance : $|Yfs|$=4.8S (Typ.)

. Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
I_{DSS}= 250μA(Max.) @ V_{DS}=200V

. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



Weiget : 1.9g

MAXIMUM RATINGS (Ta=25°C)

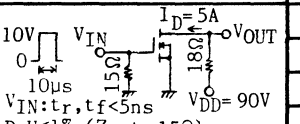
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	200	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	200	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	9	A
	DC(Tc=100°C)	I_D	6	
	Pulse	I_{DP}	36	
Inductive Current (Clamped)		I_{LP}	36	A
Drain Power Dissipation (Tc=25°C)		P_D	75	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=200V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=160V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	200	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=5A	3.0	4.8	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	9	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=5A , V_{GS}=10V	-	0.25	0.40	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=9A , V_{GS}=10V	-	2.5		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		800	pF
Reverse Transfer Capacitance		C_{rss}		-		150	pF
Output Capacitance		C_{oss}		-		450	pF
Switching Time	Rise Time	t_r		-		50	ns
	Turn-on Time	t_{on}		-		80	ns
	Fall Time	t_f		-		40	ns
	Turn-off Time	t_{off}		-		90	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=12A, V_{DS}=160V	-	19	30	nC
Gate Source Charge		Q_{gs}		-	10	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	9	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	9	A
Pulse Source Current	I_{SP}	—	-	-	36	A
Diode Forward Voltage	V_{SD}	I_S=9A , V_{GS}=0V, Tc=25°C	-	-	3.0	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=9A, dI$_F$/dt=100A/μs	-	450	-	ns
Reverse Recovered Charge	Q_{rr}		-	3.0	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 6 3 1
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

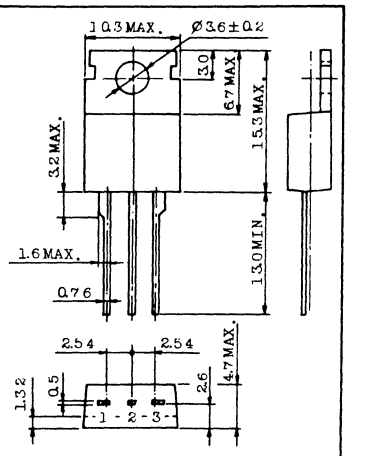
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.25Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=4.8S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=150V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

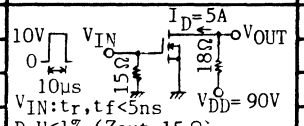
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	150	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	150	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	9	A
	DC(Tc=100°C)	I_D	6	
	Pulse	I_{DP}	36	
Inductive Current (Clamped)		I_{LP}	36	A
Drain Power Dissipation (Tc=25°C)		P_D	75	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=150V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=120V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	150	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=5A	3.0	4.8	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	9	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=5A , V_{GS}=10V	-	0.25	0.40	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=9A , V_{GS}=10V	-	2.5		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		800	pF
Reverse Transfer Capacitance		C_{rss}		-		150	pF
Output Capacitance		C_{oss}		-		450	pF
Switching Time	Rise Time	t_r		-		50	ns
	Turn-on Time	t_{on}		-		80	ns
	Fall Time	t_f		-		40	ns
	Turn-off Time	t_{off}		-		90	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=12A, V_{DS}=120V	-	19	30	nC
Gate Source Charge		Q_{gs}		-	10	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	9	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	9	A
Pulse Source Current	I_{SP}	—	-	-	36	A
Diode Forward Voltage	V_{SD}	I_S=9A , V_{GS}=0V, Tc=25°C	-	-	2.0	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=9A, dI$_F$/dt=100A/μs	-	450	-	ns
Reverse Recovered Charge	Q_{rr}		-	3.0	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 6 3 2
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

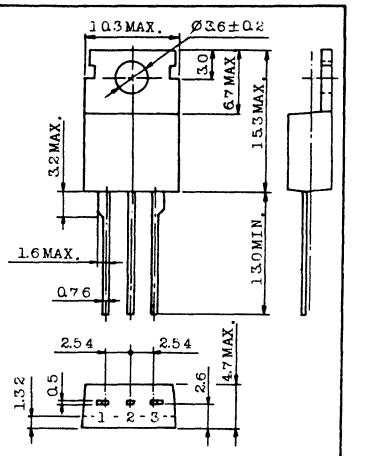
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.4Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=4.8S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=200V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

MAXIMUM RATINGS (Ta=25°C)

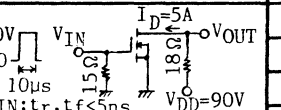
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	200	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	200	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	8	A
	DC(Tc=100°C)	I_D	5	
	Pulse	I_{DP}	32	
Inductive Current (Clamped)		I_{LP}	32	A
Drain Power Dissipation (Tc=25°C)		P_D	75	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=200V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=160V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	200	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=5A	3.0	4.8	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	8	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=5A , V_{GS}=10V	-	0.4	0.6	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=8A , V_{GS}=10V	-	3.5		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		800	pF
Reverse Transfer Capacitance		C_{rss}		-		150	pF
Output Capacitance		C_{oss}		-		450	pF
Switching Time	Rise Time	t_r		-		50	ns
	Turn-on Time	t_{on}		-		80	ns
	Fall Time	t_f		-		40	ns
	Turn-off Time	t_{off}		-		90	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=12A, V_{DS}=160V	-	19	30	nC
Gate Source Charge		Q_{gs}		-	10	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	9	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	8	A
Pulse Source Current	I_{SP}	—	-	-	32	A
Diode Forward Voltage	V_{SD}	I_S=8A , V_{GS}=0V, Tc=25°C	-	-	1.8	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=9A, dI_F/dt=100A/μs	-	450	-	ns
Reverse Recovered Charge	Q_{rr}		-	3.0	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 6 3 3
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

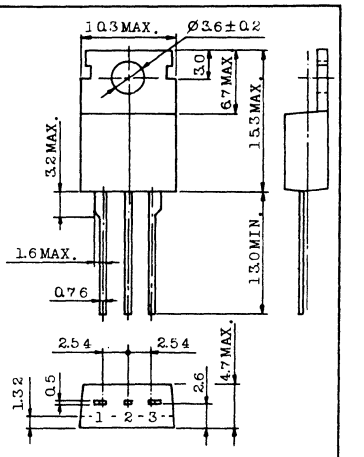
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=0.4Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=4.8S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=150V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

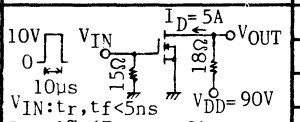
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	150	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	150	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	8	A
	DC(Tc=100°C)	I_D	5	
	Pulse	I_{DP}	32	
Inductive Current (Clamped)		I_{LP}	32	A
Drain Power Dissipation (Tc=25°C)		P_D	75	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Maximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=150V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=120V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	150	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=5A	3.0	4.8	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	8	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=5A , V_{GS}=10V	-	0.4	0.6	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=8A , V_{GS}=10V	-	3.5		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		800	pF
Reverse Transfer Capacitance		C_{rss}		-		150	pF
Output Capacitance		C_{oss}		-		450	pF
Switching Time	Rise Time	t_r		-		50	ns
	Turn-on Time	t_{on}		-		80	ns
	Fall Time	t_f		-		40	ns
	Turn-off Time	t_{off}		-		90	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=12A, V_{DS}=120V	-	19	30	nC
Gate Source Charge		Q_{gs}		-	10	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	9	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	8	A
Pulse Source Current	I_{SP}	—	-	-	32	A
Diode Forward Voltage	V_{SD}	I_S= 8A , V_{GS}=0V, Tc=25°C	-	-	1.8	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=9A, dI_F/dt=100A/μs	-	450	-	ns
Reverse Recovered Charge	Q_{rr}		-	3.0	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 8 2 0
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=2.5Ω (Typ.)

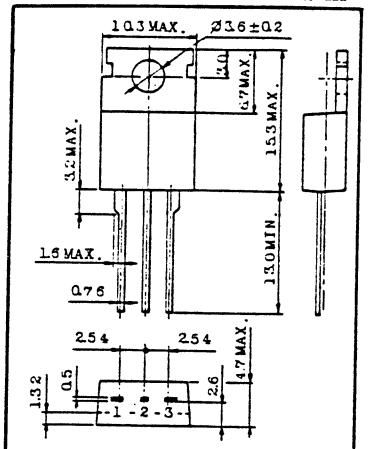
. High Forward Transfer Admittance : $|Yfs|$=1.75S (Typ.)

. Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V

I_{DSS}= 250μA(Max.) @ V_{DS}=500V

. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

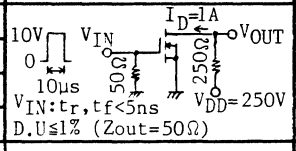
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	500	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	500	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	2.5	A
	DC(Tc=100°C)	I_D	1.5	
	Pulse	I_{DP}	10	
Inductive Current (Clamped)		I_{LP}	10	A
Drain Power Dissipation (Tc=25°C)		P_D	40	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.12	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=500V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=400V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	500	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=1A	1.0	1.75	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	2.5	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=1A , V_{GS}=10V	-	2.5	3.0	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=2.5A, V_{GS}=10V	-	6.9		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		400	pF
Reverse Transfer Capacitance		C_{rss}		-		40	pF
Output Capacitance		C_{oss}		-		150	pF
Switching Time	Rise Time	t_r		-		50	ns
	Turn-on Time	t_{on}		-		110	ns
	Fall Time	t_f		-		30	ns
	Turn-off Time	t_{off}		-		90	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=3A, V_{DS}=400V	-	11	15	nC
Gate Source Charge		Q_{gs}		-	5	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	6	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	2.5	A
Pulse Source Current	I_{SP}	—	-	-	10	A
Diode Forward Voltage	V_{SD}	I_S=2.5A, V_{GS}=0V, Tc=25°C	-	-	1.6	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=2.5A, dI$_F$/dt=100A/μs	-	600	-	ns
Reverse Recovered Charge	Q_{rr}		-	3.5	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 8 2 1
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

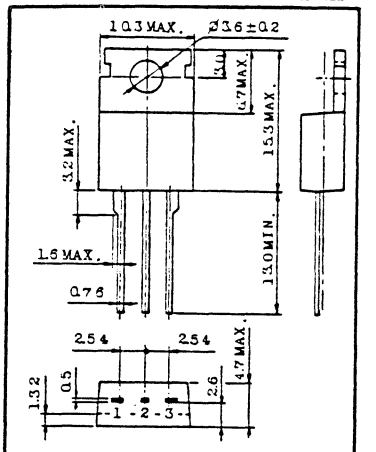
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=2.5Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=1.75S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=450V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

INDUSTRIAL APPLICATIONS

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

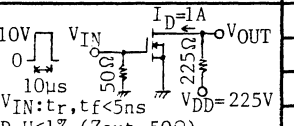
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	450	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	450	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	2.5	A
	DC(Tc=100°C)	I_D	1.5	
	Pulse	I_{DP}	10	
Inductive Current (Clamped)		I_{LP}	10	A
Drain Power Dissipation (Tc=25°C)		P_D	40	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.12	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=450V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=360V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	450	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=1A	1.0	1.75	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	2.5	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=1A , V_{GS}=10V	-	2.5	3.0	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=2.5A, V_{GS}=10V	-	6.9		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		400	pF
Reverse Transfer Capacitance		C_{rss}		-		40	pF
Output Capacitance		C_{oss}		-		150	pF
Switching Time	Rise Time	t_r		-		50	ns
	Turn-on Time	t_{on}		-		110	ns
	Fall Time	t_f		-		30	ns
	Turn-off Time	t_{off}		-		90	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=3A, V_{DS}=360V	-	11	15	nC
Gate Source Charge		Q_{gs}		-	5	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	6	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	2.5	A
Pulse Source Current	I_{SP}	—	-	-	10	A
Diode Forward Voltage	V_{SD}	I_S=2.5A, V_{GS}=0V, Tc=25°C	-	-	1.6	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=2.5A, dI_F/dt=100A/μs	-	600	-	ns
Reverse Recovered Charge	Q_{rr}		-	3.5	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 8 2 2
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

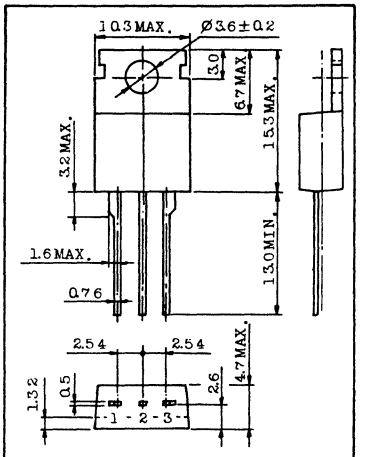
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=3.0Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=1.75S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=500V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

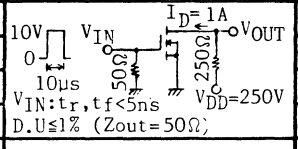
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	500	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	500	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	2	A
	DC(Tc=100°C)	I_D	1	
	Pulse	I_{DP}	8	
Inductive Current (Clamped)		I_{LP}	8	A
Drain Power Dissipation (Tc=25°C)		P_D	40	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.12	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=500V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=400V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	500	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=1A	1.0	1.75	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	2.0	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D= 1A , V_{GS}=10V	-	3.0	4.0	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D= 2A , V_{GS}=10V	-	6.6		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		400	pF
Reverse Transfer Capacitance		C_{rss}		-		40	pF
Output Capacitance		C_{oss}		-		150	pF
Switching Time	Rise Time	t_r		-		50	ns
	Turn-on Time	t_{on}		-		110	ns
	Fall Time	t_f		-		30	ns
	Turn-off Time	t_{off}		-		90	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D= 3A, V_{DS}=400V	-	11	15	nC
Gate Source Charge		Q_{gs}		-	5	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	6	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	2	A
Pulse Source Current	I_{SP}	—	-	-	8	A
Diode Forward Voltage	V_{SD}	I_S=2A , V_{GS}=0V, Tc=25°C	-	-	1.5	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=2.5A, dI_F/dt=100A/μs	-	600	-	ns
Reverse Recovered Charge	Q_{rr}		-	3.5	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 8 2 3
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

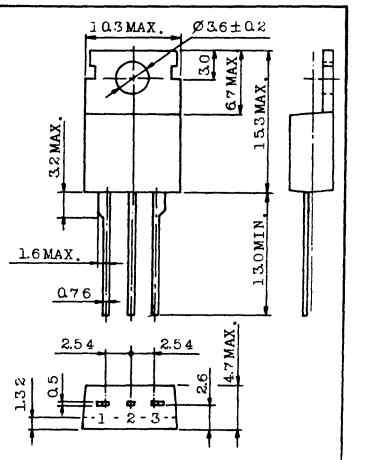
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=3.0Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=1.75S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=450V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

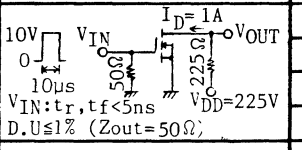
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	450	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	450	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	2	A
	DC(Tc=100°C)	I_D	1	
	Pulse	I_{DP}	8	
Inductive Current (Clamped)		I_{LP}	8	A
Drain Power Dissipation (Tc=25°C)		P_D	40	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.12	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Maximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=450V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=360V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	450	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		$\|Yfs\|$	V_{DS}=10V, I_D=1A	1.0	1.75	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	2.0	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=1A , V_{GS}=10V	-	3.0	4.0	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=2A , V_{GS}=10V	-	6.6		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		400	pF
Reverse Transfer Capacitance		C_{rss}		-		40	pF
Output Capacitance		C_{oss}		-		150	pF
Switching Time	Rise Time	t_r		-		50	ns
	Turn-on Time	t_{on}		-		110	ns
	Fall Time	t_f		-		30	ns
	Turn-off Time	t_{off}		-		90	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=3A, V_{DS}=360V	-	11	15	nC
Gate Source Charge		Q_{gs}		-	5	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	6	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	2	A
Pulse Source Current	I_{SP}	—	-	-	8	A
Diode Forward Voltage	V_{SD}	I_S=2A , V_{GS}=0V, Tc=25°C	-	-	1.5	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=2.5A, dI_F/dt=100A/μs	-	600	-	ns
Reverse Recovered Charge	Q_{rr}		-	3.5	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 8 3 0
SILICON N CHANNEL MOS TYPE
(π-MOS)

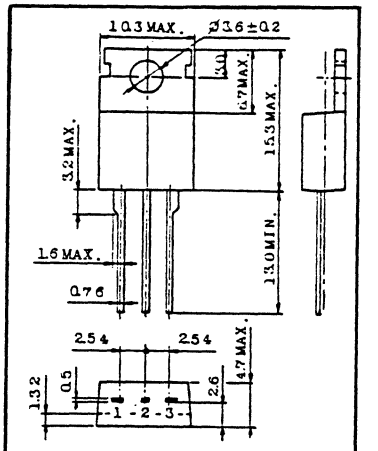
HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=1.3Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=3.25S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=500V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

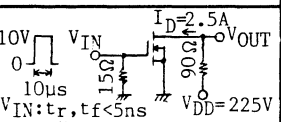
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	500	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	500	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	4.5	A
	DC(Tc=100°C)	I_D	3	
	Pulse	I_{DP}	18	
Inductive Current (Clamped)		I_{LP}	18	A
Drain Power Dissipation (Tc=25°C)		P_D	75	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=500V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=400V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	500	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=2.5A	2.5	3.25	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	4.5	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=2.5A, V_{GS}=10V	-	1.3	1.5	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=4.5A, V_{GS}=10V	-	6.4		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		800	pF
Reverse Transfer Capacitance		C_{rss}		-		60	pF
Output Capacitance		C_{oss}		-		200	pF
Switching Time	Rise Time	t_r	 V_{IN}:t_r,t_f<5ns D.U≦1% (Zout=15Ω)	-		30	ns
	Turn-on Time	t_{on}		-		60	ns
	Fall Time	t_f		-		30	ns
	Turn-off Time	t_{off}		-		85	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=6A, V_{DS}=400V	-	22	30	nC
Gate Source Charge		Q_{gs}		-	11	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	11	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	4.5	A
Pulse Source Current	I_{SP}	—	-	-	18	A
Diode Forward Voltage	V_{SD}	I_S=4.5A, V_{GS}=0V, Tc=25°C	-	-	1.6	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=4.5A, dI_F/dt=100A/μs	-	800	-	ns
Reverse Recovered Charge	Q_{rr}		-	4.6	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 8 3 1
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

. Low Drain-Source ON Resistance : $R_{DS(ON)}$=1.3Ω (Typ.)

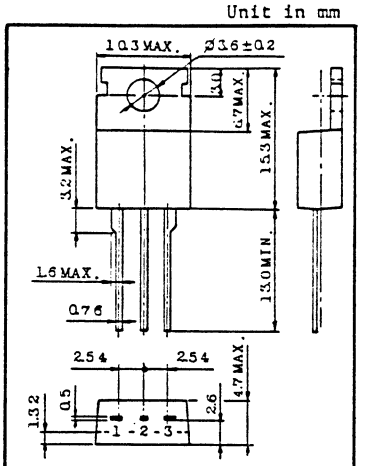
. High Forward Transfer Admittance : $|Yfs|$=3.25S (Typ.)

. Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V

I_{DSS}= 250μA(Max.) @ V_{DS}=450V

. Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weight : 1.9g

MAXIMUM RATINGS (Ta=25°C)

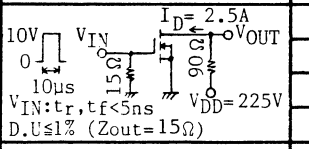
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	450	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	450	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	4.5	A
	DC(Tc=100°C)	I_D	3	
	Pulse	I_{DP}	18	
Inductive Current (Clamped)		I_{LP}	18	A
Drain Power Dissipation (Tc=25°C)		P_D	75	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=450V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=360V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	450	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=2.5A	2.5	3.25	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	4.5	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=2.5A, V_{GS}=10V	-	1.3	1.5	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=4.5A, V_{GS}=10V	-	6.4		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		800	pF
Reverse Transfer Capacitance		C_{rss}		-		60	pF
Output Capacitance		C_{oss}		-		200	pF
Switching Time	Rise Time	t_r		-		30	ns
	Turn-on Time	t_{on}		-		60	ns
	Fall Time	t_f		-		30	ns
	Turn-off Time	t_{off}		-		85	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=6A, V_{DS}=360V	-	22	30	nC
Gate Source Charge		Q_{gs}		-	11	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	11	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	4.5	A
Pulse Source Current	I_{SP}	—	-	-	18	A
Diode Forward Voltage	V_{SD}	I_S=4.5A, V_{GS}=0V, Tc=25°C	-	-	1.6	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=4.5A, dIF/dt=100A/μs	-	800	-	ns
Reverse Recovered Charge	Q_{rr}		-	4.6	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR
Y T F 8 3 2
SILICON N CHANNEL MOS TYPE
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

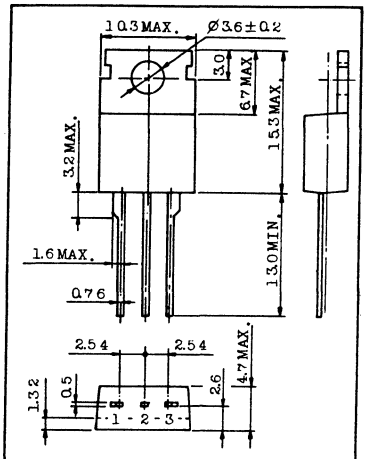
CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$=1.5Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$=3.25S (Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=500V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

MAXIMUM RATINGS (Ta=25°C)

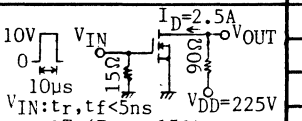
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	500	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	500	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	4	A
	DC(Tc=100°C)	I_D	2.5	
	Pulse	I_{DP}	16	
Inductive Current (Clamped)		I_{LP}	16	A
Drain Power Dissipation (Tc=25°C)		P_D	75	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=500V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=400V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	500	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		|Yfs|	V_{DS}=10V, I_D=2.5A	2.5	3.25	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	4	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=2.5A, V_{GS}=10V	-	1.5	2.0	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=4.5A, V_{GS}=10V	-	7.4		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		800	pF
Reverse Transfer Capacitance		C_{rss}		-		60	pF
Output Capacitance		C_{oss}		-		200	pF
Switching Time	Rise Time	t_r		-		30	ns
	Turn-on Time	t_{on}		-		60	ns
	Fall Time	t_f		-		30	ns
	Turn-off Time	t_{off}		-		85	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D=6A, V_{DS}=400V	-	22	30	nC
Gate Source Charge		Q_{gs}		-	11	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	11	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	4	A
Pulse Source Current	I_{SP}	—	-	-	16	A
Diode Forward Voltage	V_{SD}	I_S=4A, V_{GS}=0V, Tc=25°C	-	-	1.5	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F=4.5A, dI_F/dt=100A/μs	-	800	-	ns
Reverse Recovered Charge	Q_{rr}		-	4.6	-	μC

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA FIELD EFFECT TRANSISTOR

Y T F 8 3 3

SILICON N CHANNEL MOS TYPE

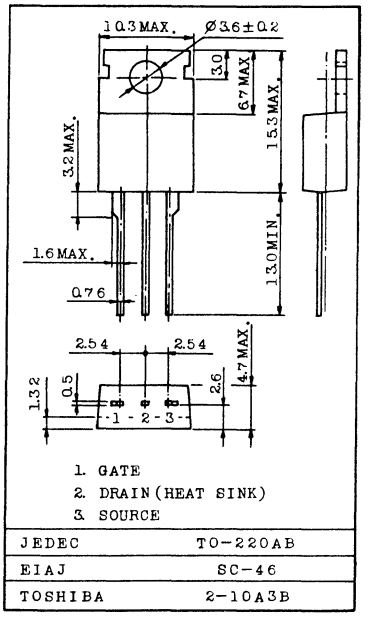
(π-MOS)

HIGH SPEED, HIGH CURRENT SWITCHING APPLICATIONS.

CHOPPER REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS.

INDUSTRIAL APPLICATIONS

Unit in mm



1. GATE
2. DRAIN (HEAT SINK)
3. SOURCE

JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	2-10A3B

Weiget : 1.9g

FEATURES:

- Low Drain-Source ON Resistance : $R_{DS(ON)}$= 1.5Ω (Typ.)
- High Forward Transfer Admittance : $|Yfs|$= 3.25S(Typ.)
- Low Leakage Current : I_{GSS}=±500nA(Max.) @ V_{GS}=±20V
  I_{DSS}= 250μA(Max.) @ V_{DS}=450V
- Enhancement-Mode : V_{th}=2.0~4.0V @ V_{DS}=V_{GS}, I_D=250μA

MAXIMUM RATINGS (Ta=25°C)

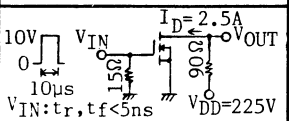
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V_{DSX}	450	V
Drain-Gate Voltage (R_{GS}=1MΩ)		V_{DGR}	450	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	DC(Tc=25°C)	I_D	4	A
	DC(Tc=100°C)	I_D	2.5	
	Pulse	I_{DP}	16	
Inductive Current (Clamped)		I_{LP}	16	A
Drain Power Dissipation (Tc=25°C)		P_D	75	W
Channel Temperature		T_{ch}	150	°C
Storage Temperature Range		T_{stg}	-55~150	°C

THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-a)}$	80	°C/W
Muximum Lead Temperature for Soldering Purposes (1.6mm from case for 10 seconds)	T_L	300	°C

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±500	nA
Drain Cut-off Current		I_{DSS}	V_{DS}=450V, V_{GS}=0V, Tc=25°C	-	-	250	μA
			V_{DS}=360V, V_{GS}=0V, Tc=125°C	-	-	1000	μA
Drain-Source Breakdown Voltage		$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	450	-	-	V
Gate Threshold Voltage		V_{th}	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Forward Transfer Admittance		$\|Yfs\|$	V_{DS}=10V, I_D=2.5A	2.5	3.25	-	S
On-State Drain Current		$I_{D(ON)}$	V_{DS}=10V, V_{GS}=10V	4	-	-	A
Drain-Source ON Resistance		$R_{DS(ON)}$	I_D=2.5A, V_{GS}=10V	-	1.5	2.0	Ω
Drain-Source ON Voltage		$V_{DS(ON)}$	I_D=4.5A, V_{GS}=10V	-	7.4		V
Input Capacitance		C_{iss}	V_{DS}=25V, V_{GS}=0V, f=1MHz	-		800	pF
Reverse Transfer Capacitance		C_{rss}		-		60	pF
Output Capacitance		C_{oss}		-		200	pF
Switching Time	Rise Time	t_r		-		30	ns
	Turn-on Time	t_{on}		-		60	ns
	Fall Time	t_f		-		30	ns
	Turn-off Time	t_{off}		-		85	ns
Total Gate Charge (Gate-Source Plus Gate-Drain)		Q_g	V_{GS}=10V, I_D= 6A, V_{DS}=360V	-	22	30	nC
Gate Source Charge		Q_{gs}		-	11	-	nC
Gate-Drain ("Miller") Charge		Q_{gd}		-	11	-	nC

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Continuous Source Current	I_S	—	-	-	4	A
Pulse Source Current	I_{SP}	—	-	-	16	A
Diode Forward Voltage	V_{SD}	I_S= 4A , V_{GS}=0V, Tc=25°C	-	-	1.5	V
Reverse Recovery Time	t_{rr}	Tj=150°C, I_F= 4.5A,	-	800	-	ns
Reverse Recovered Charge	Q_{rr}	dI_F/dt=100A/μs	-	4.6	-	μC

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA DIODE

1N914, 1N914A, 1N914B

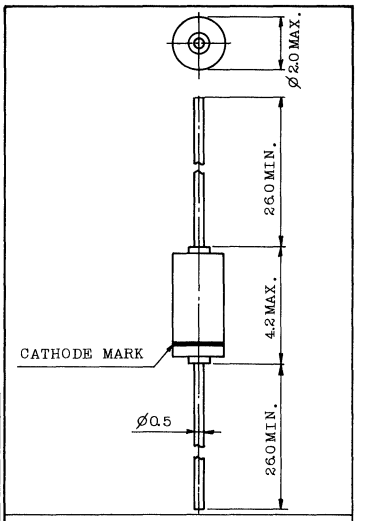
SILICON EPITAXIAL PLANAR

COMMUNICATION AND INDUSTRIAL APPLICATIONS.
HIGH VOLTAGE, ULTRA HIGH SPEED SWITCHING APPLICATIONS.

FEATURES:

- Low Forward Voltage : V_F=1.0V (Max.)
- Small Total Capacitance : C_T=4pF (Max.)
- Fast Reverse Recovery Time : t_{rr}=4ns (Max.)
- Hermetically Sealded Miniature Glass Package.

Unit in mm



JEDEC	DO-35
EIAJ	SC-40
TOSHIBA	1-2A1A

Weight : 0.14g

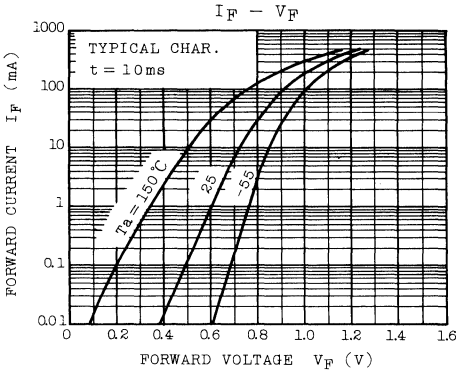
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Maximum (Peak) Reverse Voltage	V_{RM}	100	V
Reverse Voltage	V_R	75	V
Maximum (Peak) Forward Current	I_{FM}	450	mA
Average Forward Current	I_O	150	mA
Surge Current (1μs)	I_{FSM}	2	A
Power Dissipation	P	500	mW
Junction Temperature	T_j	200	°C
Storage Temperature Range	T_{stg}	-65 ~ 200	°C

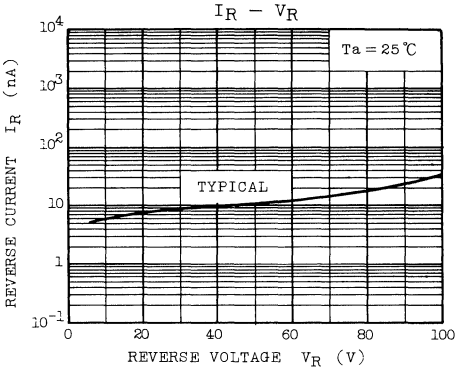
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Forward Voltage	1N914	$V_{F(1)}$	I_F=10mA	-	0.75	1.0	V
	1N914A	$V_{F(2)}$	I_F=20mA	-	0.79	1.0	V
	1N914B	$V_{F(3)}$	I_F=5mA	0.62	0.67	0.72	V
		$V_{F(4)}$	I_F=100mA, t=10ms	-	0.9	1.0	V
Reverse Current		$I_{R(1)}$	V_R=20V	-	-	25	nA
		$I_{R(2)}$	V_R=20V, Ta=150°C	-	-	50	μA
		$I_{R(3)}$	V_R=75V	-	-	5	μA
Total Capacitance		C_T	V_R=0, f=1MHz	-	0.9	4.0	pF
Reverse Recovery Time		t_{rr}	I_F=10mA, V_R=6V, R_L=100Ω, I_{rr}=1mA	-	2.0	4.0	ns

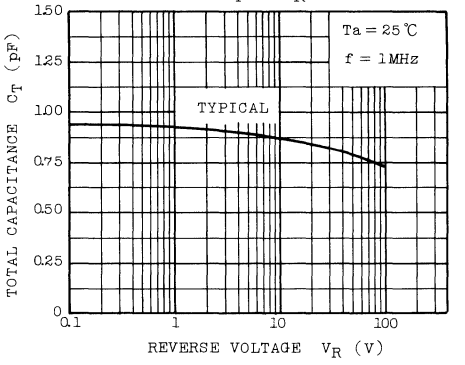
$I_F - V_F$



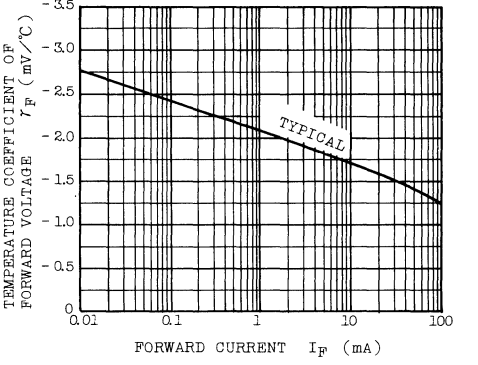
$I_R - V_R$



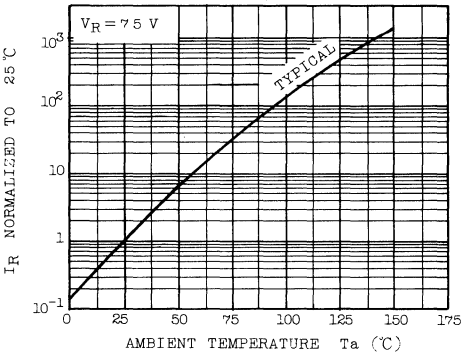
$C_T - V_R$



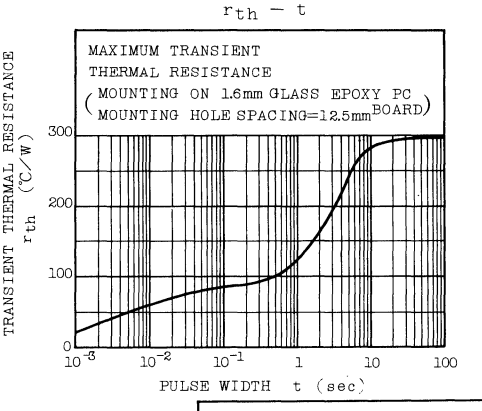
$r_F - I_F$



$I_{R(Temp.)} / I_{R(25℃)} - Ta$



$r_{th} - t$



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

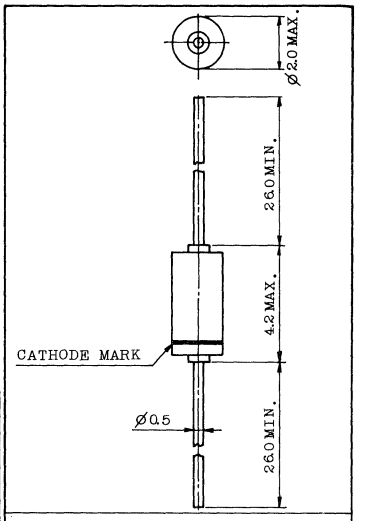
TOSHIBA DIODE
1N916, 1N916A, 1N916B
SILICON EPITAXIAL PLANAR

COMMUNICATION AND INDUSTRIAL APPLICATIONS.
HIGH VOLTAGE, ULTRA HIGH SPEED SWITCHING APPLICATIONS.

FEATURES:

- Low Forward Voltage : V_F=1.0V (Max.)
- Small Total Capacitance : C_T=2pF (Max.)
- Fast Reverse Recovery Time : t_{rr}=4ns (Max.)
- Hermetically Sealded Miniature Glass Package.

Unit in mm



JEDEC	DO-35
EIAJ	SC-40
TOSHIBA	1-2A1A

Weight : 0.14g

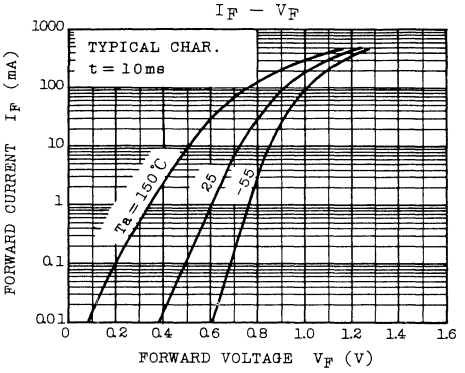
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Maximum (peak) Reverse Voltage	V_{RM}	100	V
Reverse Voltage	V_R	75	V
Maximum (Peak) Forward Current	I_{FM}	450	mA
Average Forward Current	I_O	150	mA
Surge Current (1μs)	I_{FSM}	2	A
Power Dissipation	P	500	mW
Junction Temperature	T_j	200	°C
Storage Temperature Range	T_{stg}	-65 ~ 200	°C

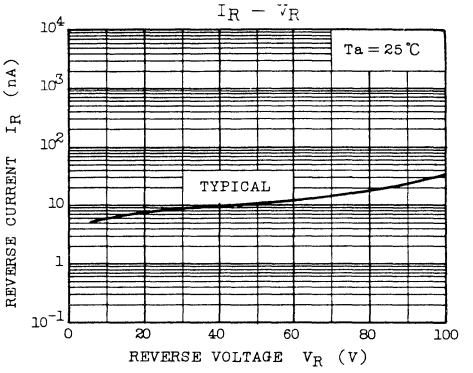
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Forward Voltage	1N916	$V_F(1)$	I_F=10mA	-	0.75	1.0	V
	1N916A	$V_F(2)$	I_F=20mA	-	0.79	1.0	V
	1N916B	$V_F(3)$	I_F=5mA	0.63	0.68	0.73	V
		$V_F(4)$	I_F=30mA	-	0.81	1.0	V
Reverse Current		$I_R(1)$	V_R=20V	-	-	25	nA
		$I_R(2)$	V_R=20V, Ta=150°C	-	-	50	μA
		$I_R(3)$	V_R=75V	-	-	5	μA
Total Capacitance		C_T	V_R=0, f=1MHz	-	0.9	2.0	pF
Reverse Recovery Time		t_{rr}	I_F=10mA, V_R=6V R_L=100Ω, I_{rr}=1mA	-	2	4	ns

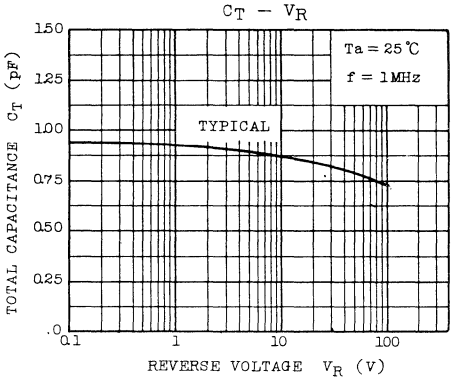
$I_F - V_F$



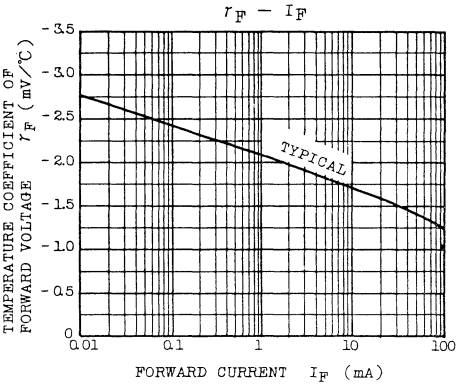
$I_R - V_R$



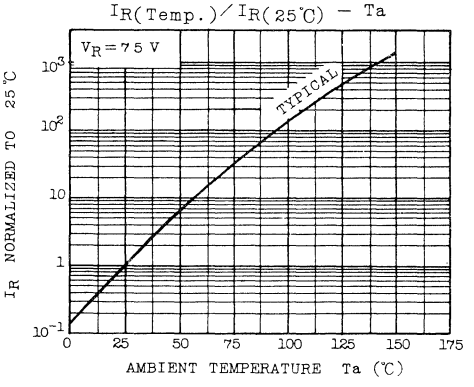
$C_T - V_R$



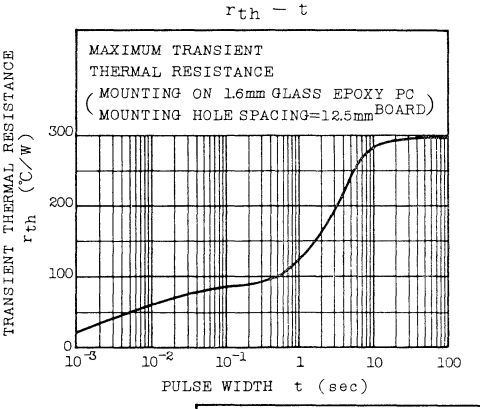
$r_F - I_F$



$I_{R(Temp.)} / I_{R(25℃)} - Ta$



$r_{th} - t$



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA DIODE

1N4148

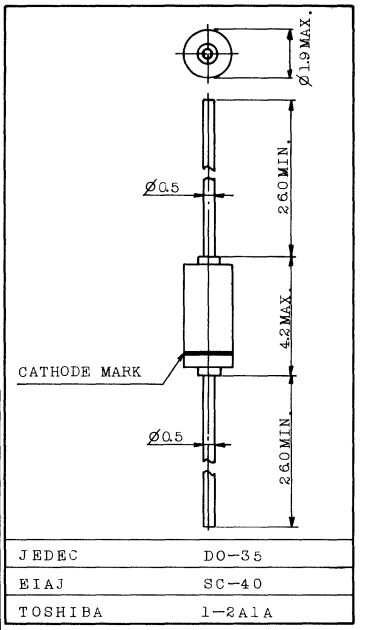
SILICON EPITAXIAL PLANAR TYPE

HIGH VOLTAGE, ULTRA HIGH SPEED SWITCHING APPLICATIONS.

FEATURES:

. Low Forward Voltage : V_F=1.2V (Max.)
. Small Total Capacitance : C_T=3pF (Max.)
. Fast Reverse Recovery Time : t_{rr}=4ns (Max.)
. Hermetically Sealded Miniature Glass Package.

Unit in mm



JEDEC	DO-35
EIAJ	SC-40
TOSHIBA	1-2A1A

Weight : 0.14g

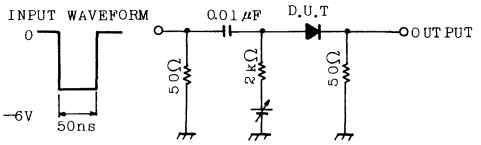
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Maximum (Peak) Reverse Voltage	V_{RM}	100	V
Reverse Voltage	V_R	75	V
Maximum (Peak) Forward Current	I_{FM}	500	mA
Average Forward Current	I_O	200	mA
Surge Current (1 sec)	I_{FSM}	700	mA
Power Dissipation	P	500	mW
Junction Temperature	T_j	175	°C
Storage Temperature Range	T_{stg}	-65~175	°C

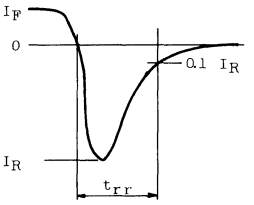
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Forward Voltage	$V_F(1)$	I_F=10mA	-	0.75	1.0	V
	$V_F(2)$	I_F=100mA	-	0.95	1.2	V
Reverse Current	$I_R(1)$	V_R=20V	-	-	25	nA
	$I_R(2)$	V_R=75V	-	-	0.1	μA
Total Capacitance	C_T	V_R=0, f=1MHz	-	1.5	3.0	pF
Reverse Recovery Time	t_{rr}	V_R=6V, I_F=10mA, R_L=100Ω (Fig.)	-	2.0	4.0	ns

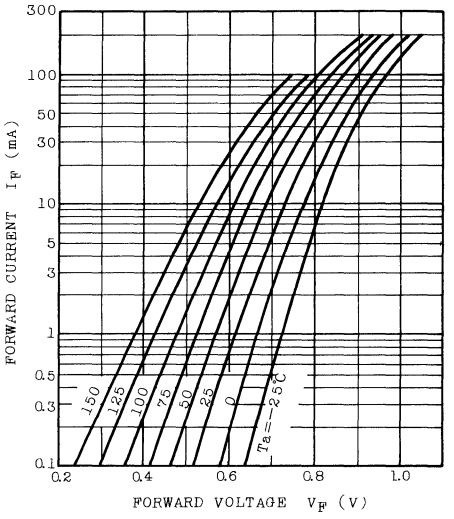
Fig. t_{rr} TEST CIRCUIT



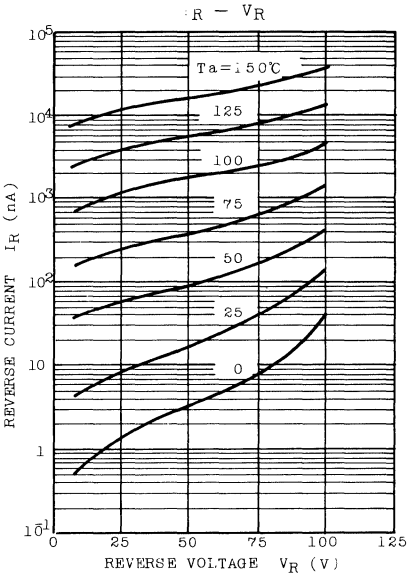
OUTPUT WAVEFORM



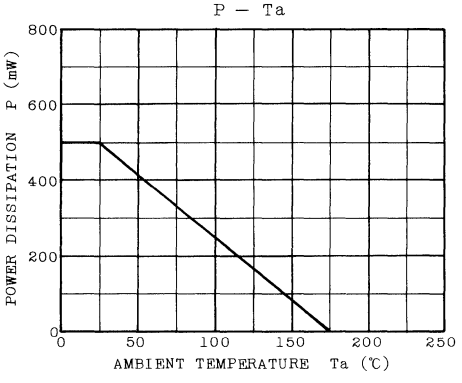
$I_F - V_F$



$I_R - V_R$



P — Ta



TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

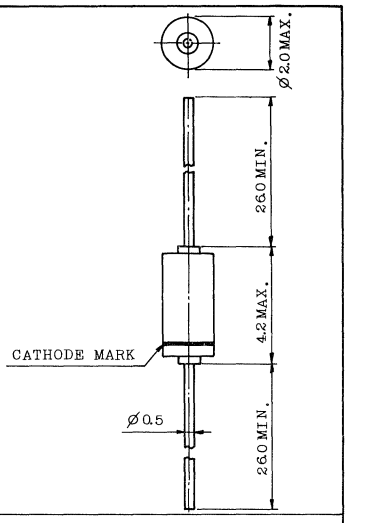
TOSHIBA DIODE
1N4149
SILICON EPITAXIAL PLANAR

COMMUNICATION AND INDUSTRIAL APPLICATIONS.
HIGH VOLTAGE, ULTRA HIGH SPEED SWITCHING APPLICATIONS.

FEATURES:

. Low Forward Voltage : V_F=1.2V (Max.)
. Small Total Capacitance : C_T=2pF (Max.)
. Fast Reverse Recovery Time : t_{rr}=4ns (Max.)
. Hermetically Sealded Miniature Glass Package.

Unit in mm



JEDEC	DO-35
EIAJ	SC-40
TOSHIBA	1-2A1A

Weight : 0.14g

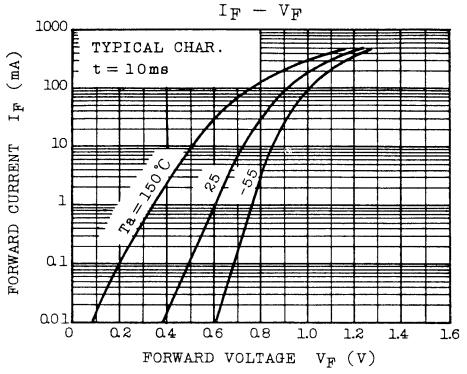
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Maximum (Peak) Reverse Voltage	V_{RM}	100	V
Reverse Voltage	V_R	75	V
Maximum (Peak) Forward Current	I_{FM}	450	mA
Average Forward Current	I_O	150	mA
Surge Current (1μs)	I_{FSM}	2	A
Power Dissipation	P	500	mW
Junction Temperature	T_j	200	°C
Storage Temperature Range	T_{stg}	-65 ~ 200	°C

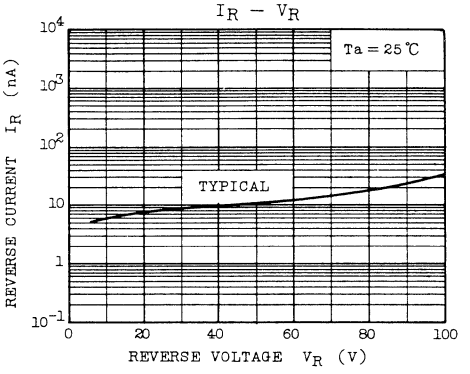
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Forward Voltage	$V_F(1)$	I_F=10mA	-	0.75	1.0	V
	$V_F(2)$	I_F=100mA, t=10ms	-	0.95	1.2	V
Reverse Current	$I_R(1)$	V_R=20V	-	-	25	nA
	$I_R(2)$	V_R=20V, Ta=150°C	-	-	50	μA
	$I_R(3)$	V_R=75V	-	-	5	μA
Total Capacitance	C_T	V_R=0, f=1MHz	-	0.9	2.0	pF
Reverse Recovery Time	t_{rr}	V_R=6V, I_F=10mA R_L=100Ω, I_{rr}=1mA	-	2.0	4.0	ns

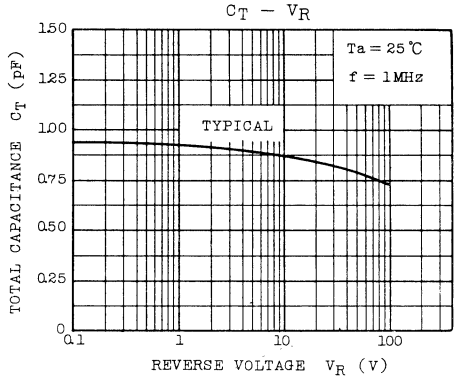
$I_F - V_F$



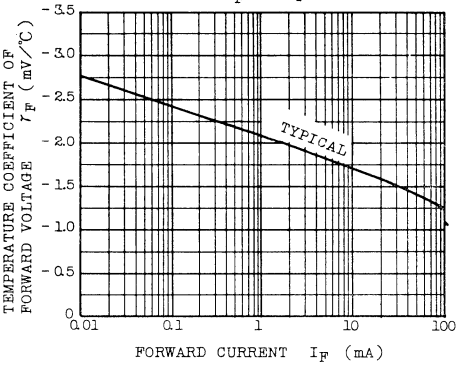
$I_R - V_R$



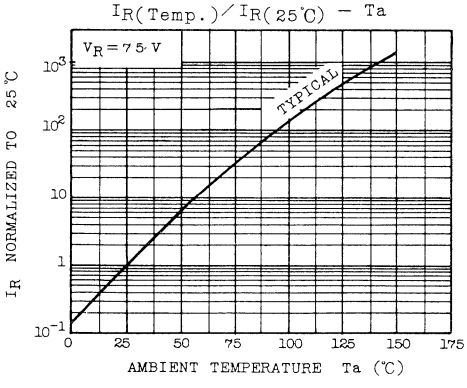
$C_T - V_R$



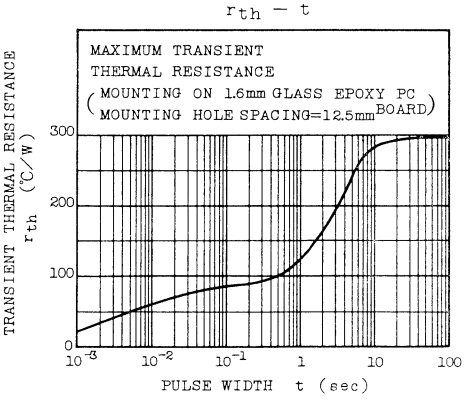
$r_F - I_F$



$I_{R(Temp.)} / I_{R(25℃)} - Ta$



$r_{th} - t$



TOSHIBA CORPORATION

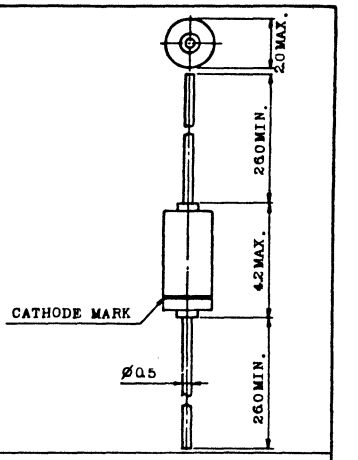
TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA DIODE
1N4150
SILICON EPITAXIAL PLANAR

TENTATIVE

COMMUNICATION AND INDUSTRIAL APPLICATIONS.
HIGH VOLTAGE, ULTRA HIGH SPEED SWITCHING APPLICATIONS.

Unit in mm



JEDEC	DO-35
EIAJ	SC-40
TOSHIBA	1-2A1A

Weight : 0.14g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Maximum (Peak) Reverse Voltage	V_{RM}	75	V
Reverse Voltage	V_R	50	V
Maximum (Peak) Forward Current	I_{FM}	600	mA
Average Forward Current	I_O	200	mA
Surge Current (1 μs)	I_{FSM}	4	A
Power Dissipation	P	500	mW
Junction Temperature	T_j	200	°C
Storage Temperature Range	T_{stg}	-65~200	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Forward Voltage	$V_F(1)$	I_F=1mA	0.54	0.58	0.62	V
	$V_F(2)$	I_F=10mA	0.66	0.70	0.74	V
	$V_F(3)$	I_F=50mA	0.76	0.81	0.86	V
	$V_F(4)$	I_F=100mA	0.82	0.87	0.92	V
	$V_F(5)$	I_F=200mA	0.87	0.94	1.00	V
Breakdown Voltage	V_{BR}	I_R=100μA	75	-	-	V
Reverse Current	$I_R(1)$	V_R=50V	-	-	100	nA
	$I_R(2)$	V_R=50V, Ta=150°C	-	-	100	μA
Total Capacitance	C_T	V_R=0, f=1MHz	-	-	2.5	pF
Reverse Recovery Time	$t_{rr}(1)$	I_F=I_R=10~200mA I_{rr}=0.1 I_F	-	-	4	ns
	$t_{rr}(2)$	I_F=I_R=200~400mA I_{rr}=0.1 I_F	-	-	6	ns
	$t_{rr}(3)$	I_F=10mA, I_R=1mA I_{rr}=0.1mA	-	-	6	ns

TOSHIBA CORPORATION

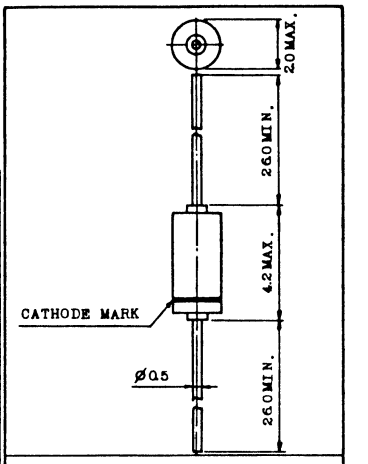
TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA DIODE
1N4151, 1N4152, 1N4153
SILICON EPITAXIAL PLANAR

TENTATIVE

Unit in mm

COMMUNICATION AND INDUSTRIAL APPLICATIONS.
HIGH VOLTAGE, ULTRA HIGH SPEED SWITCHING APPLICATIONS.



JEDEC	DO-35
EIAJ	ST-40
TOSHIBA	1-2A1A

Weight : 0.14g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Maximum (Peak) Reverse Voltage	1N4151/3	V_{RM}	75	V
	1N4152	V_{RM}	40	V
Reverse Voltage	1N4151/3	V_R	50	V
	1N4152	V_R	30	V
Maximum (Peak) Forward Current		I_{FM}	450	mA
Average Forward Current		I_O	150	mA
Surge Current (1 μs)		I_{FSM}	2	A
Power Dissipation		P	500	mW
Junction Temperature		T_j	200	°C
Storage Temperature Range		T_{stg}	-65~200	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Breakdown Voltage	1N4151/3	$V_{BR(1)}$	I_R=5μA	75	-	-	V
	1N4152	$V_{BR(2)}$	I_R=5μA	40	-	-	V
Forward Voltage	1N4152/3	$V_{F(1)}$	I_F=100μA	0.49	0.52	0.55	V
		$V_{F(2)}$	I_F=250μA	0.53	0.56	0.59	V
		$V_{F(3)}$	I_F=1mA	0.59	0.63	0.67	V
		$V_{F(4)}$	I_F=2mA	0.62	0.66	0.70	V
		$V_{F(5)}$	I_F=10mA	0.70	0.76	0.81	V
		$V_{F(6)}$	I_F=20mA	0.74	0.81	0.88	V
	1N4151	$V_{F(7)}$	I_F=50mA	-	-	1.00	V
Reverse Current	1N4152	$I_{R(1)}$	V_R=30V	-	-	50	nA
		$I_{R(2)}$	V_R=30V, Ta=150°C	-	-	50	μA
	1N4151/3	$I_{R(3)}$	V_R=50V	-	-	50	nA
		$I_{R(4)}$	V_R=50V, Ta=150°C	-	-	50	μA
Total Capacitance		C_T	V_R=0, f=1MHz	-	-	2	pF
Reverse Recovery Time		$t_{rr(1)}$	I_F=I_R=10mA, I_{rr}=1mA	-	-	4	ns
		$t_{rr(2)}$	I_F=10mA, V_R=6V, I_{rr}=1mA	-	-	2	ns

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

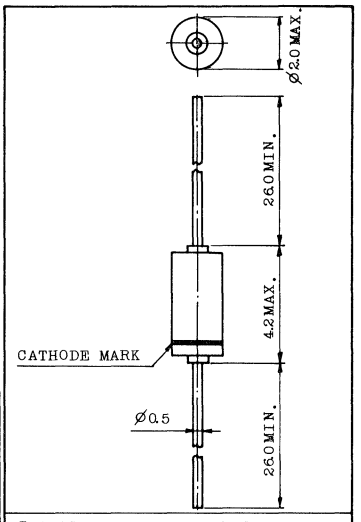
TOSHIBA DIODE
1N4154
SILICON EPITAXIAL PLANAR

COMMUNICATION AND INDUSTRIAL APPLICATIONS.
ULTRA HIGH SPEED SWITCHING APPLICATIONS.

FEATURES:

. Low Forward Voltage : V_F=1.0V (Max.)
. Small Total Capacitance : C_T=4pF (Max.)
. Fast Reverse Recovery Time : t_{rr}=2ns(Max.)
. Hermetically Sealded Miniature Glass Package.

Unit in mm



JEDEC	DO-35
EIAJ	SC-40
TOSHIBA	1-2A1A

Weight : 0.14g

MAXIMUM RATINGS (Ta=25°C)

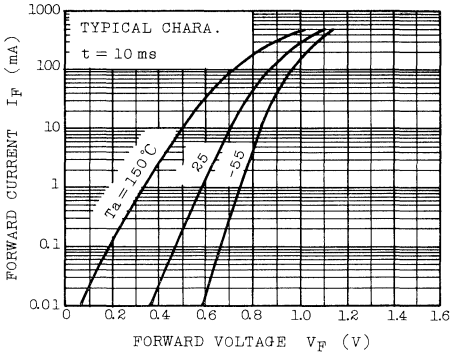
CHARACTERISTIC	SYMBOL	RATING	UNIT
Maximum (peak) Reverse Voltage	V_{RM}	35	V
Reverse Voltage	V_R	25	V
Maximum (Peak) Forward Current	I_{FM}	450	mA
Average Forward Current	I_O	150	mA
Surge Current (1 μs)	I_{FSM}	2	A
Power Dissipation	P	500	mW
Junction Temperature	T_j	200	°C
Storage Temperature Range	T_{stg}	-65 ~ 200	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

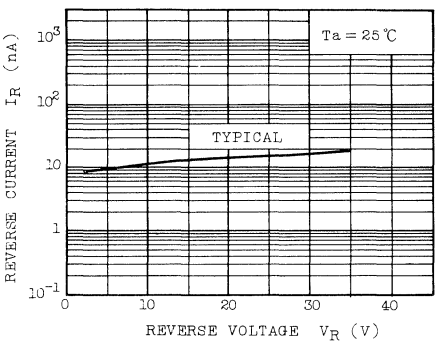
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Forward Voltage	$V_{F(1)}$	I_F=30mA	-		1.0	V
	$V_{F(2)}$	I_F=100mA	-		1.2	V
Reverse Current	$I_{R(1)}$	V_R=25V	-	-	100	nA
	$I_{R(2)}$	V_R=25V, Ta=150°C	-	-	100	μA
Total Capacitance	C_T	V_R=0, f=1MHz	-		4.0	pF
Reverse Recovery Time	t_{rr}	V_R=6V, I_F=10mA R_L=100Ω	-		2.0	ns

TOSHIBA CORPORATION

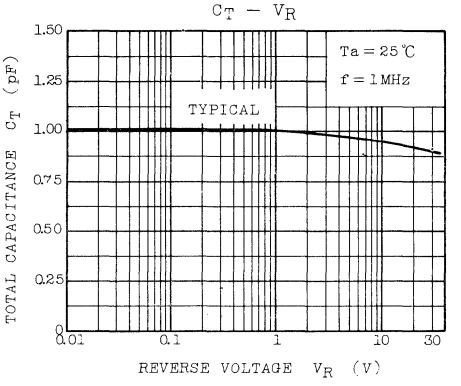
$I_F - V_F$



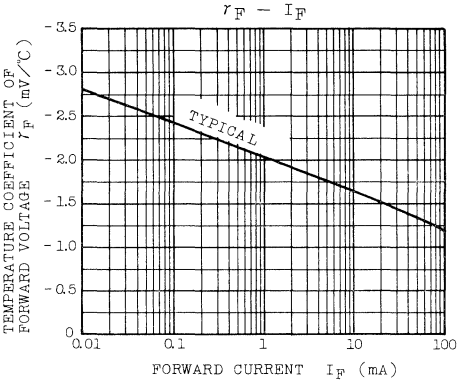
$I_R - V_R$



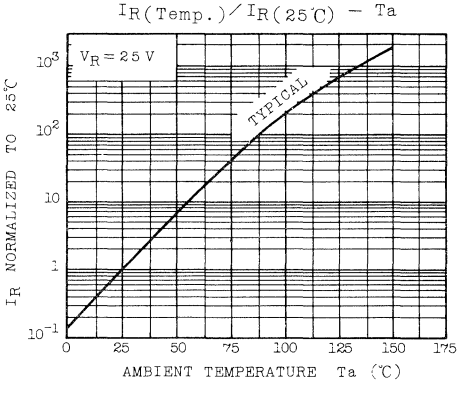
$C_T - V_R$



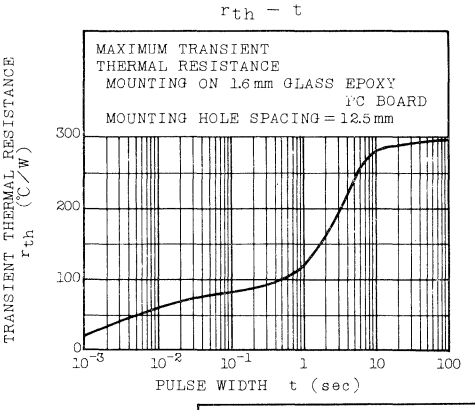
$r_F - I_F$



$I_{R(Temp.)} / I_{R(25℃)} - Ta$



$r_{th} - t$



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

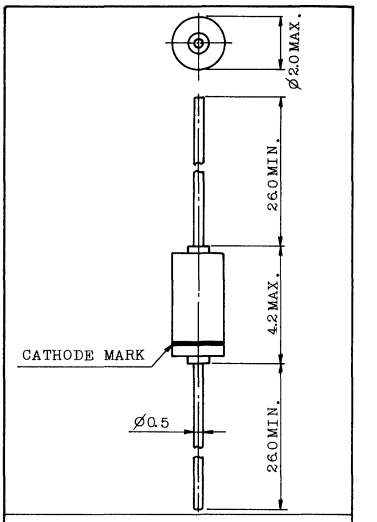
TOSHIBA DIODE
1N4446, 1N4447, 1N4448, 1N4449
SILICON EPITAXIAL PLANAR

COMMUNICATION AND INDUSTRIAL APPLICATIONS.
HIGH VOLTAGE, ULTRA HIGH SPEED SWITCHING APPLICATIONS.

FEATURES:

. Low Forward Voltage : V_F=1.0V (Max.)
. Small Total Capacitance : C_T=4pF (Max.)
. Fast Reverse Recovery Time : t_{rr}=4ns (Max.)
. Hermetically Sealded Miniature Glass Package.

Unit in mm



JEDEC	DO-35
EIAJ	SC-40
TOSHIBA	1-2A1A

Weight : 0.14g

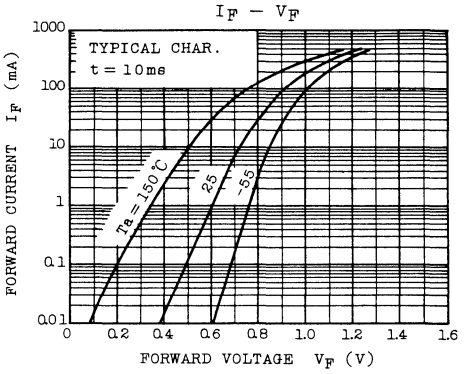
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Maximum (Peak) Reverse Voltage	V_{RM}	100	V
Reverse Voltage	V_R	75	V
Maximum (Peak) Forward Current	I_{FM}	450	mA
Average Forward Current	I_O	150	mA
Surge Current (1μs)	I_{FSM}	2	A
Power Dissipation	P	500	mW
Junction Temperature	T_j	200	°C
Storage Temperature Range	T_{stg}	-65 ~ 200	°C

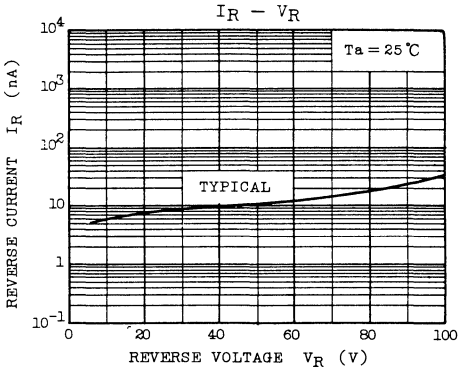
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Forward Voltage	1N4446/7	$V_{F(1)}$	I_F=20mA	-	0.79	1.0	V
	1N4448	$V_{F(2)}$	I_F=5mA	0.62	0.67	0.72	V
		$V_{F(3)}$	I_F=100mA, t=10ms	-	0.9	1.0	V
	1N4449	$V_{F(4)}$	I_F=5mA	0.63	0.68	0.73	V
		$V_{F(5)}$	I_F=30mA	-	0.8	1.0	V
Reverse Current		$I_{R(1)}$	V_R=20V	-	-	25	nA
		$I_{R(2)}$	V_R=20V, Ta=150°C	-	-	50	μA
		$I_{R(3)}$	V_R=75V	-	-	5	μA
Total Capacitance	1N4446/8	$C_{T(1)}$	V_R=0, f=1MHz	-	0.9	4.0	pF
	1N4447/9	$C_{T(2)}$	V_R=0, f=1MHz	-	0.9	2.0	pF
Reverse Recovery Time		t_{rr}	I_F=10mA, V_R=6V, R_L=100Ω, I_{rr}=1mA	-	2	4	ns

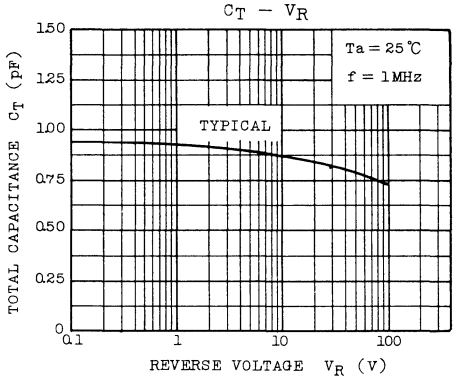
$I_F - V_F$



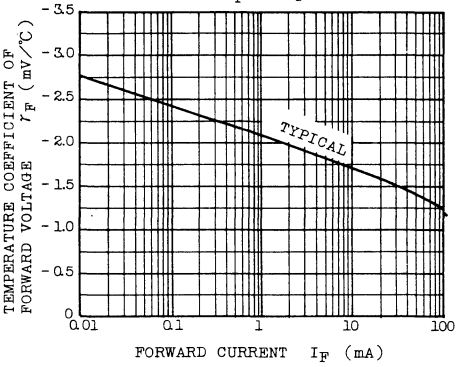
$I_R - V_R$



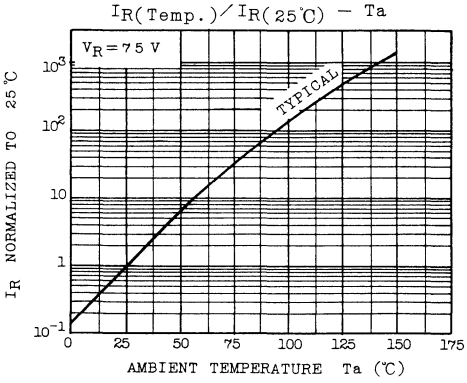
$C_T - V_R$



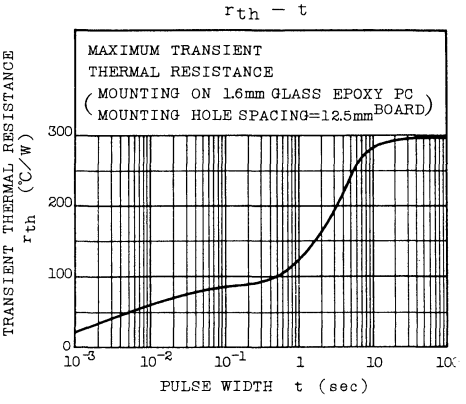
$r_F - I_F$



$I_{R(Temp.)} / I_{R(25℃)} - Ta$



$r_{th} - t$



TOSHIBA CORPORATION

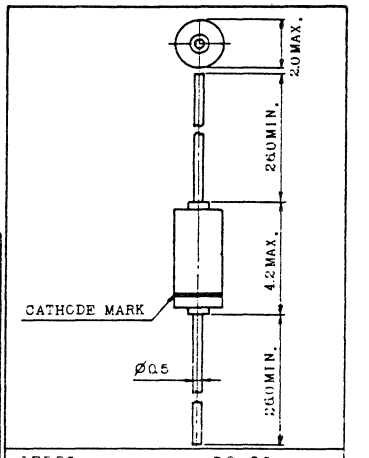
TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA DIODE
1N4606
SILICON EPITAXIAL PLANAR

TENTATIVE

Unit in mm

COMMUNICATION AND INDUSTRIAL APPLICATIONS.
HIGH VOLTAGE, ULTRA HIGH SPEED SWITCHING APPLICATIONS.



JEDEC	DO-35
EIAJ	SC-40
TOSHIBA	1-2A1A

Weight : 0.14g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Maximum (Peak) Reverse Voltage	V_{RM}	85	V
Reverse Voltage	V_R	70	V
Maximum (Peak) Forward Current	I_{FM}	600	mA
Average Forward Current	I_O	200	mA
Surge Current (1 μs)	I_{FSM}	4	A
Power Dissipation	P	500	mW
Junction Temperature	T_j	200	°C
Storage Temperature Range	T_{stg}	-65 ~ 200	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Breakdown Voltage	V_{BR}	I_R=100μA	85	-	-	V
Forward Voltage	$V_{F(1)}$	I_F=100μA	0.54	0.60	0.66	V
	$V_{F(2)}$	I_F=1mA	0.65	0.71	0.77	V
	$V_{F(3)}$	I_F=10mA	0.74	0.80	0.86	V
	$V_{F(4)}$	I_F=100mA	0.79	0.86	0.92	V
	$V_{F(5)}$	I_F=200mA	0.86	0.93	1.00	V
	$V_{F(6)}$	I_F=250mA	-	-	1.10	V
Reverse Current	$I_{R(1)}$	V_R=50V	-	-	100	nA
	$I_{R(2)}$	V_R=50V, Ta=100°C	-	-	25	μA
	$I_{R(3)}$	V_R=70V	-	-	250	nA
Total Capacitance	C_T	V_R=0, f=1MHz	-	-	2.5	pF
Reverse Recovery Time	$t_{rr(1)}$	I_F=I_R=10mA, I_{rr}=1mA	-	-	6	ns
	$t_{rr(2)}$	I_F=I_R=10 ~ 200mA I_{rr}=0.1 I_F	-	-	4	ns
	$t_{rr(3)}$	I_F=I_R=200 ~ 400mA I_{rr}=0.1 I_F	-	-	6	ns

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

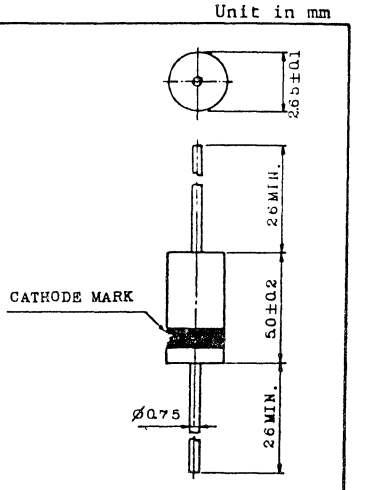
TOSHIBA RECTIFIER
1N4001 ~ 1N4007
SILICON DIFFUSED TYPE

GENERAL PURPOSE RECTIFIER APPLICATIONS.

FEATURES:

. Average Forward Current : $I_{F(AV)}$=1A
. Repetitive Peak Reverse Voltage : V_{RM}=50 ~ 1000V
. Small Epoxy Molded Package
. Insulated Case

Unit in mm



JEDEC	DO-41
EIAJ	–
TOSHIBA	3-3D1A

Weight : 0.3g

MAXIMUM RATINGS

CHARACTERISTIC		SYMBOL	RATING	UNIT
Peak Reverse Voltage (T_j up to 175°C)	1N4001	V_{RM}	50	V
	1N4002		100	
	1N4003		200	
	1N4004		400	
	1N4005		600	
	1N4006		800	
	1N4007		1000	
Non-Repetitive Peak Reverse Voltage	1N4001	V_{RSM}	100	V
	1N4002		200	
	1N4003		300	
	1N4004		500	
	1N4005		750	
	1N4006		1000	
	1N4007		1200	
Average Forward Current		$I_{F(AV)}$	1	A
Peak Surge Current Non-Repetitive		I_{surge}	33(60Hz)	A
Storage Temperature		Tstg	-65 ~ 175	°C

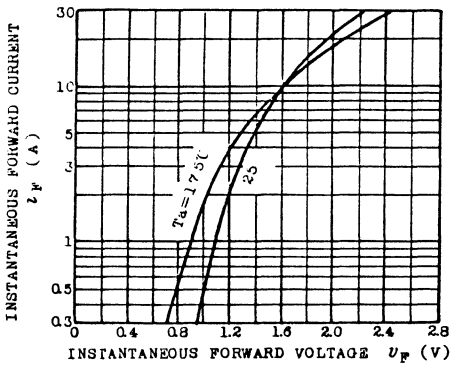
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	MAX.	UNIT
Peak Forward Voltage	V_F	I_F=1.0A	-	1.1	V
Repetitive Peak Reverse Current	I_R	V_{RM}=Rated -	-	10	μA

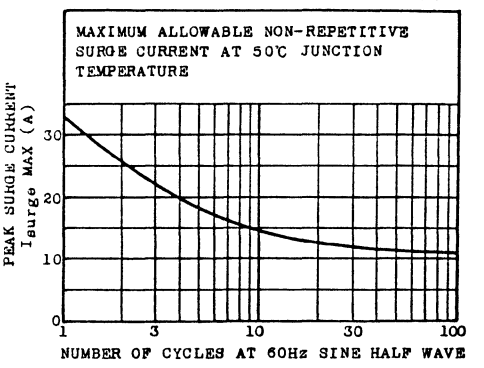
Note 1. Soldering : 5mm is the minimum to be kept between case and soldering part.
2. Lead Bending : 5mm is the minimum to be kept between case and lead bending point.

TOSHIBA CORPORATION

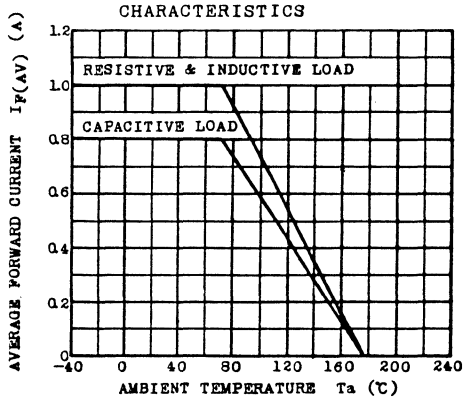
$i_F - v_F$



SURGE CURRENT CHARACTERISTICS



AVERAGE FORWARD CURRENT CHARACTERISTICS



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA RECTIFIER
1N4001A ~ 1N4007A
SILICON DIFFUSED TYPE

TENTATIVE

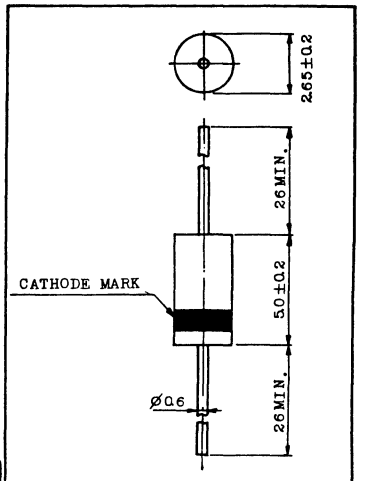
GENERAL PURPOSE RECTIFIER APPLICATIONS

TOSHIBA RECTIFIER 1N4001A series are designed for automatic insertion. (Suffix "A" means aut-insertion type.) Their leads dia is φ0.6mm and they are obtained in radial or axial taping form.

FEATURES:

. Average Forward Current : $I_{F(AV)}$=1.0A
. Repetitive Peak Reverse Voltage : V_{RM}=50~1000V
. Plastic Mold Type.

Unit in mm



JEDEC	DO-41
EIAJ	–
TOSHIBA	3-3E1A

Weight : 0.225g

MAXIMUM RATINGS

CHARACTERISTIC		SYMBOL	RATING	UNIT
Peak Reverse Voltage (T_j up to 175°C)	1N4001A	V_{RM}	50	V
	1N4002A		100	
	1N4003A		200	
	1N4004A		400	
	1N4005A		600	
	1N4006A		800	
	1N4007A		1000	
Average Forward Current (See Note 1)		$I_{F(AV)}$	1	A
Peak Surge Current		I_{surge}	30(50Hz)	A
			33(60Hz)	
Storage Temperature		T_{stg}	-40~175	°C
Junction Temperature		T_j	-40~175	°C

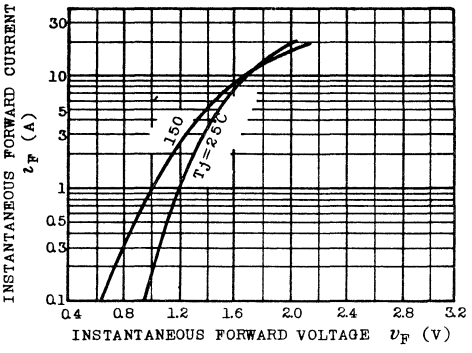
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	MAX.	UNIT
Peak Forward Voltage	V_{FM}	I_{FM}=1.0A	-	1.2	V
Repetitive Peak Reverse Current	I_{RM}	V_{RM}=Rated	-	10	μA

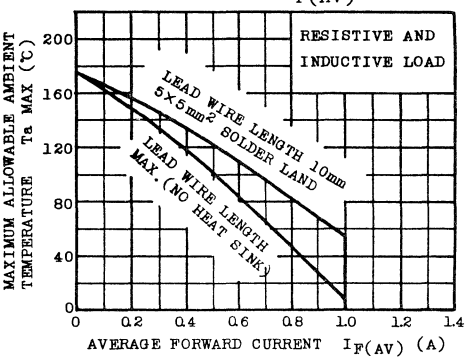
Note 1 : Resistive or inductive load, 50Hz single phase half wave. Lead wire length 10mm × 5 × 5mm² solder land, Ta=55°C

TOSHIBA CORPORATION

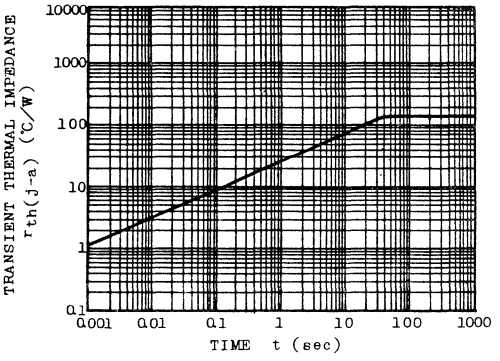
$i_F - v_F$



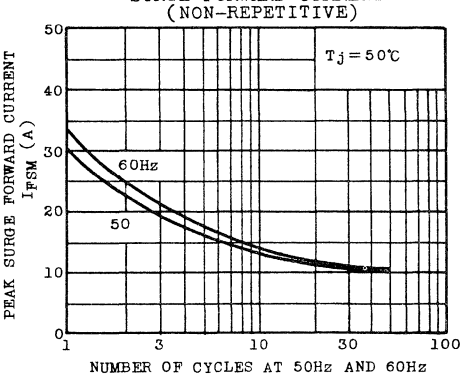
Ta MAX − $I_{F(AV)}$



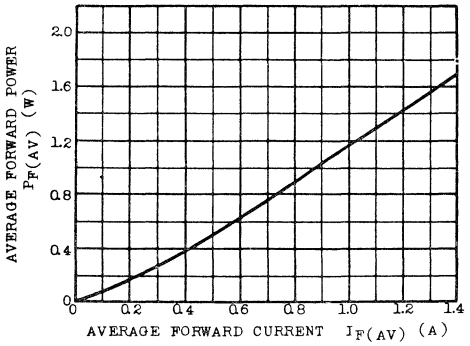
TRANSIENT THERMAL IMPEDANCE (JUNCTION TO AMBIENT)



SURGE FORWARD CURRENT (NON-REPETITIVE)

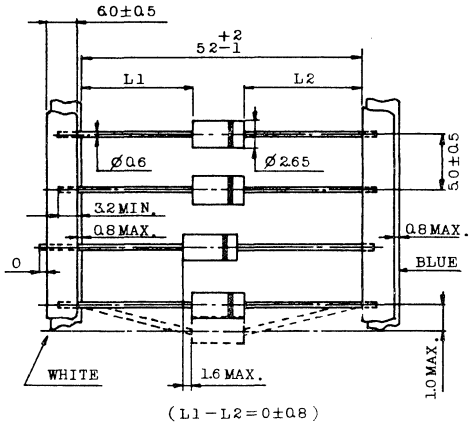


$P_{F(AV)} - I_{F(AV)}$

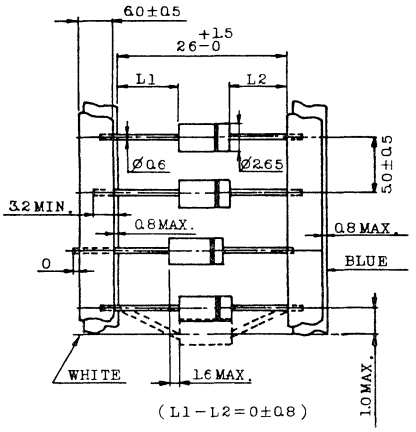


TOSHIBA CORPORATION

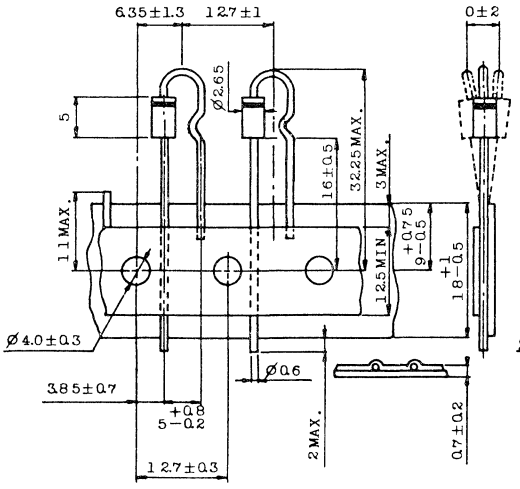
(a) Axial Lead Component Type
(TPA1) ... Reel
(TPA2) ... Winding



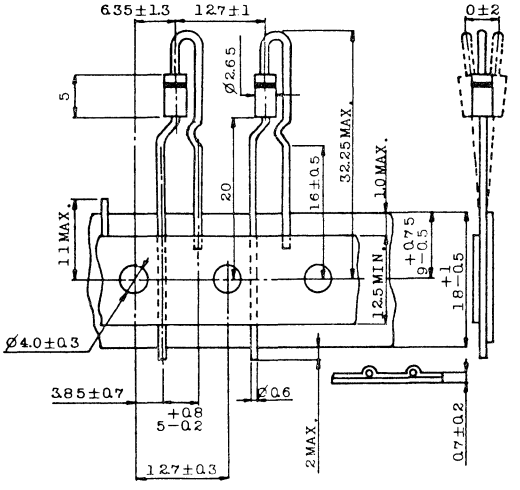
(b) Axial Lead Component Type
(TPA3) ... Winding



(c) Radial Lead Component Type
(TPB1) ... Reel



(d) Radial Lead Component Type
(TPB2) ... Winding



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA RECTIFIER
1N4002-B ~ 1N4007-B
SILICON DIFFUSED TYPE

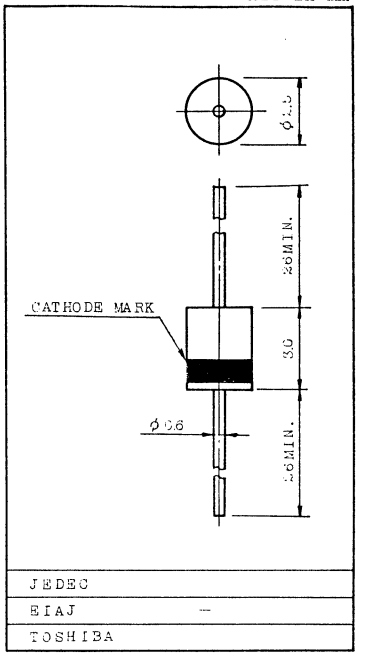
(TENTATIVE)

GENERAL PURPOSE RECTIFIER APPLICATIONS.

FEATURES:

- Average Forward Current : $I_{F(AV)}$=1.0A
- Repetitive Peak Reverse Voltage: V_{RRM}=100 ∿ 1000V
- Plastic Mold Type.

Unit in mm



JEDEC	
EIAJ	—
TOSHIBA	

Weight: 0.137g

MAXIMUM RATINGS

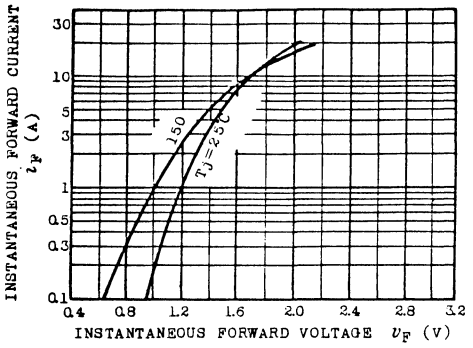
CHARACTERISTIC		COLOR CODE	SYMBOL	RATING	UNIT
Repetitive Peak Reverse Voltage	1N4002-B	White	V_{RRM}	100	V
	1N4004-B	Blue		400	
	1N4005-B	Yellow		600	
	1N4007-B	Green		1000	
Average Forward Current (Ta=25°C)			$I_{F(AV)}$	1.0	A
Peak Surge Current Non-Repetitive			Isurge	33(60Hz)	A
Junction Temperature			T_j	-65 ∿ 175	°C
Storage Temperature Range			T_{stg}	-65 ∿ 175	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

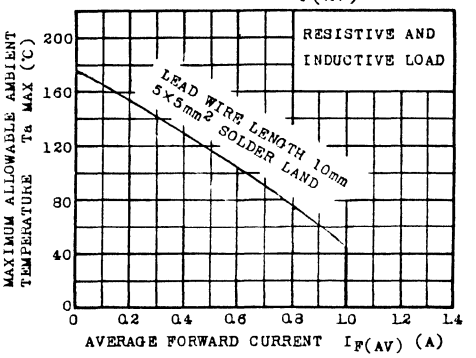
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	MAX.	UNIT
Peak Forward Voltage	V_{FM}	I_{FM}=1.0A	-	1.1	V
Repetitive Peak Reverse Current	I_{RRM}	V_{RRM}=Rated	-	10	μA

(TENTATIVE)

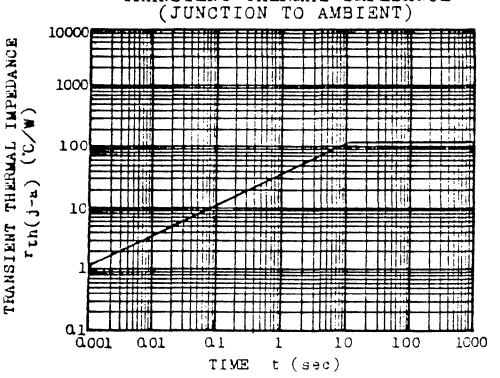
$i_F - v_F$



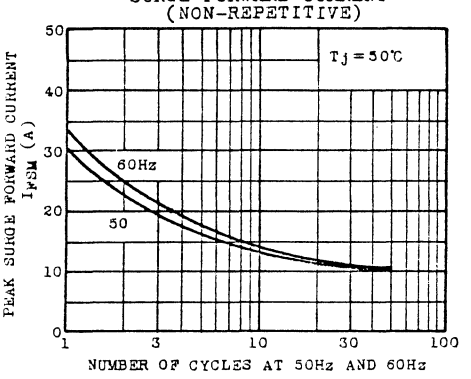
Ta MAX - $I_{F(AV)}$



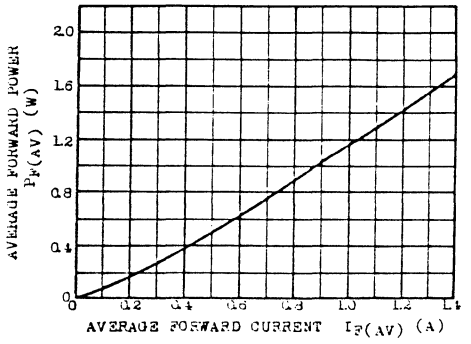
TRANSIENT THERMAL IMPEDANCE
(JUNCTION TO AMBIENT)



SURGE FORWARD CURRENT
(NON-REPETITIVE)



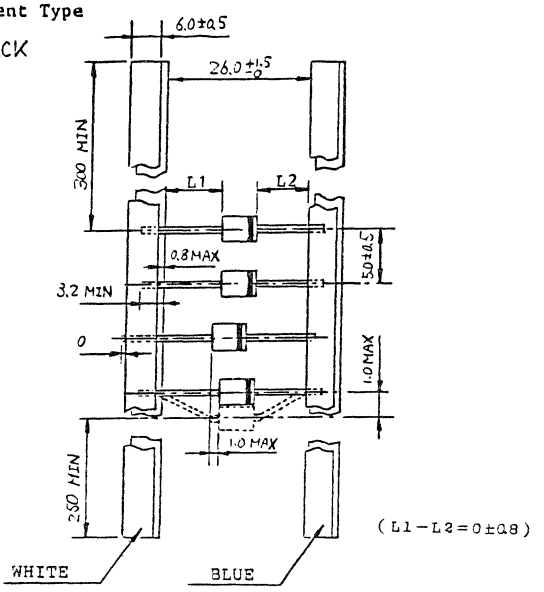
$P_{F(AV)} - I_{F(AV)}$



(TENTATIVE)

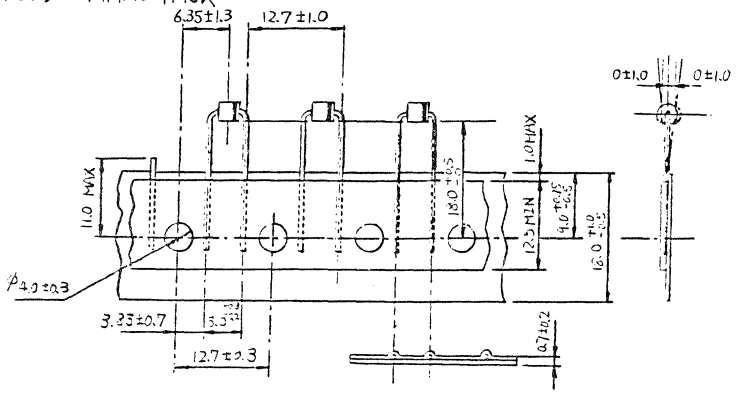
(a) Axial Lead Component Type

(TPA3)... AMMO PACK



(c) Radial Lead Component Type

(TP85)... AMMO PACK



TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA RECTIFIER
1N5059, 1N5060, 1N5061, 1N5062
SILICON DIFFUSED TYPE

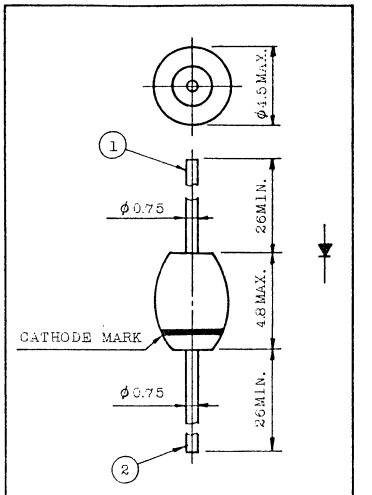
(TENTATIVE)

GENERAL PURPOSE RECTIFIER APPLICATIONS.

FEATURES:

- Average Forward Current : $I_{F(AV)}$=1.0A
- Repetitive Peak Reverse Voltage: V_{RRM}=200 ∿ 800V
- Glass Passivated Rectifier.

Unit in mm



JEDEC	-
EIAJ	-
TOSHIBA	3 - 5A1A

Weight: 0.45g

MAXIMUM RATINGS

CHARACTERISTIC		SYMBOL	RATING	UNIT
Repetitive Peak Reverse Voltage	1N5059	V_{RRM}	200	V
	1N5060		400	
	1N5061		600	
	1N5062		800	
Average Forward Current		$I_{F(AV)}$	1.0	A
Peak One Cycle Surge Forward Current (Non-Repetitive)		I_{FSM}	45 (50Hz)	A
			50 (60Hz)	
Junction Temperature		T_j	-65 ∿ 175	°C
Storage Temperature Range		T_{stg}	-65 ∿ 175	°C

ELECTRICAL CHARACTERISTICS

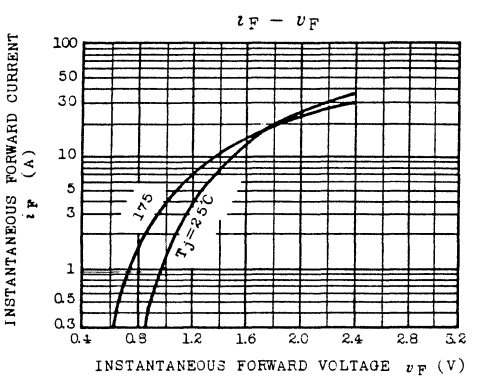
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	MAX.	UNIT
Peak Forward Voltage	V_{FM}	I_{FM}=1.0A	-	1.0	V
Repetitive Peak Reverse Current	I_{RRM}	V_{RRM}=Rated	-	5.0	μA

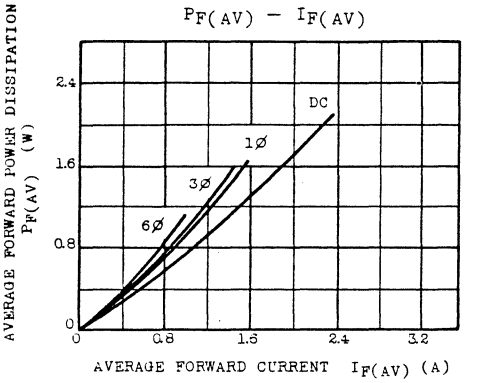
Note 1. Soldering: 5mm is the minimum to be kept between case and soldering part.

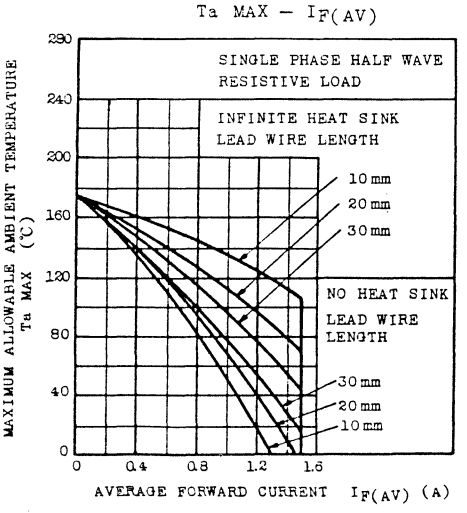
2. Lead Bending: 5mm is the minimum to be kept from the case when bend the lead wire.

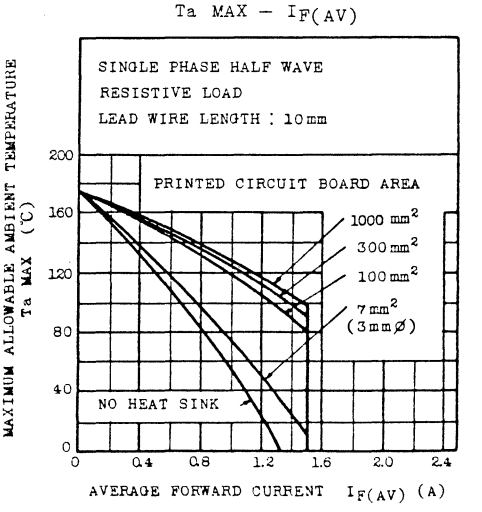
TOSHIBA CORPORATION

(TENTATIVE)

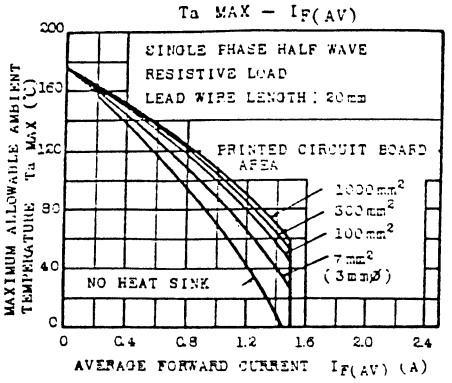


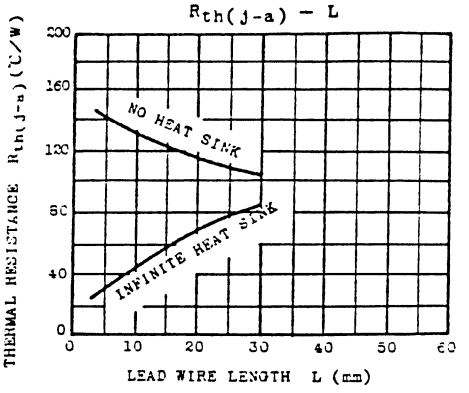


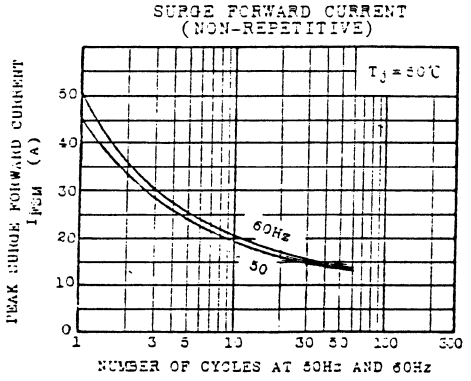




(TENTATIVE)







TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA RECTIFIER
1N5624, 1N5625, 1N5626, 1N5627
SILICON DIFFUSED TYPE

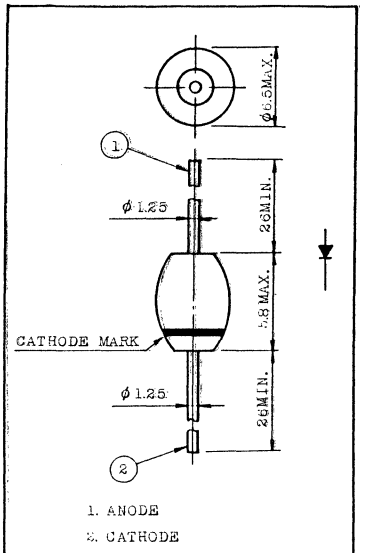
(TENTATIVE)

GENERAL PURPOSE RECTIFIER APPLICATIONS.

FEATURES:

- Average Forward Current ; $I_{F(AV)}$=3.0A
- Repetitive Peak Reverse Voltage: V_{RRM}=200 ∿ 800V
- Glass Passivated Rectifier.

Unit in mm



JEDEC	-
EIAJ	-
TOSHIBA	3 - 7C1A

Weight: 1.1g

MAXIMUM RATINGS

CHARACTERISTIC		SYMBOL	RATING	UNIT
Repetitive Peak Reverse Voltage	1N5624	V_{RRM}	200	V
	1N5625		400	
	1N5626		600	
	1N5627		800	
Average Forward Current		$I_{F(AV)}$	3.0	A
Peak One Cycle Surge Forward Current (Non-Repetitive)		I_{FSM}	100 (50Hz)	A
			110 (60Hz)	
Junction Temperature		T_j	-65 ∿ 175	°C
Storage Temperature Range		T_{stg}	-65 ∿ 175	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

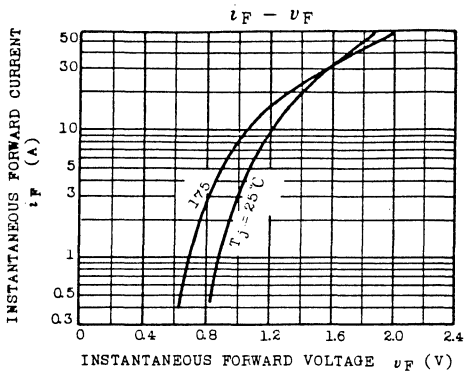
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	MAX.	UNIT
Peak Forward Voltage	V_{FM}	I_{FM}=3.0A	-	1.0	V
Repetitive Peak Reverse Current	I_{RRM}	V_{RRM}=Rated	-	5.0	μA

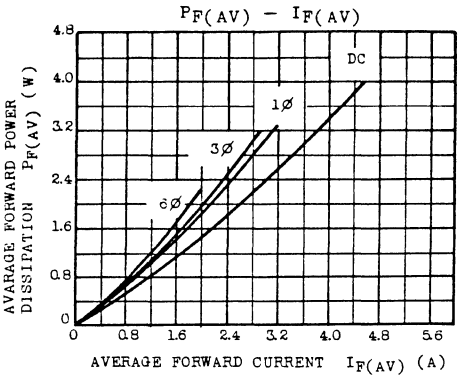
Note 1. Soldering: 5mm is the minimum to be kept between case and soldering part.

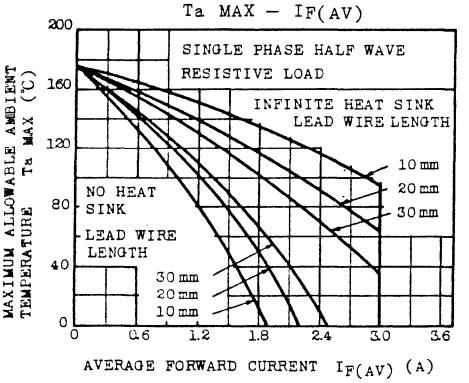
2. Lead Bending: 5mm is the minimum to be kept from the case when bend the lead wire.

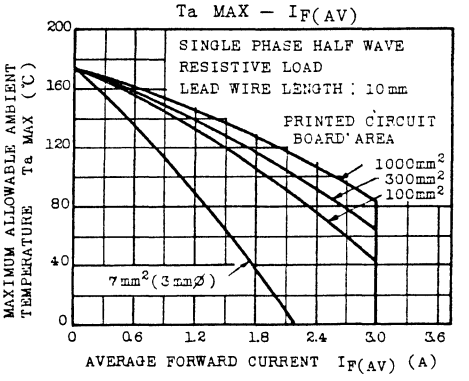
TOSHIBA CORPORATION

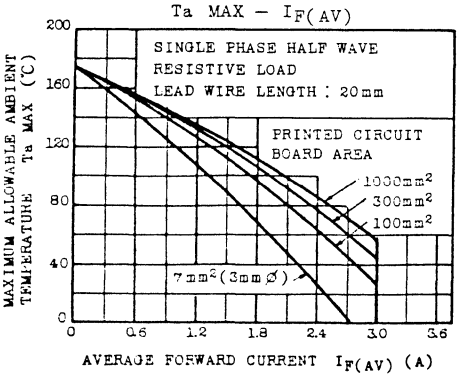
(TENTATIVE)

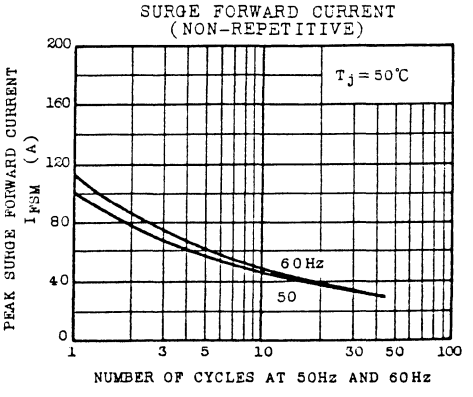












TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

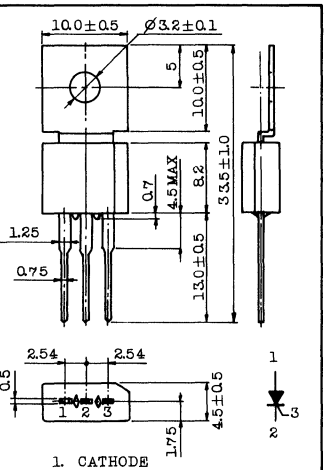
TOSHIBA THYRISTOR

C106A, C106B, C106D, C106M

SILICON PLANAR TYPE

LOW POWER SWITCHING AND CONTROL APPLICATIONS.

Unit in mm



JEDEC	—
EIAJ	—
TOSHIBA	13-10A1A

Weight : 1.5g

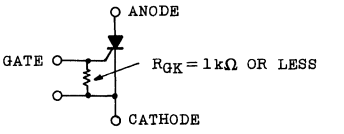
FEATURES:

- Repetitive Peak Off-State Voltage : V_{DRM} } =100~600V
  Repetitive Peak Reverse Voltage : V_{RRM}
- Average On-State Current : $I_{T(AV)}$=2.5A
- Plastic Mold Type

MAXIMUM RATINGS

CHARACTERISTIC		SYMBOL	RATING	UNIT
Repetitive Peak Off-State Voltage and Repetitive Peak Reverse Voltage (R_{GK}=1kΩ)	C106A	V_{DRM} V_{RRM}	100	V
	C106B		200	
	C106D		400	
	C106M		600	
Non-Repetitive Peak Reverse Voltage (Non-Repetitive <5ms, R_{GK}=1kΩ, Tj=0~110°C)	C106A	V_{RSM}	150	V
	C106B		300	
	C106D		500	
	C106M		720	
Average On-State Current (Half Sine Waveform Tc=32°C)		$I_{T(AV)}$	2.5	A
R.M.S On-State Current		$I_{T(RMS)}$	4	A
Peak One Cycle Surge On-State Current (Non-Repetitive)		I_{TSM}	18.2(50Hz)	A
			20(60Hz)	
I^2t Limit Value (t=1~10ms)		I^2t	1.6	A^2s
Peak Gate Power Dissipation		P_{GM}	0.5	W
Average Gate Power Dissipation		$P_{G(AV)}$	0.1	W
Peak Forward Gate Voltage		V_{FGM}	5	V
Peak Reverse Gate Voltage		V_{RGM}	-6	V
Peak Forward Gate Current		I_{GM}	200	mA
Junction Temperature		Tj	-40~110	°C
Storage Temperature Range		Tstg	-40~150	°C

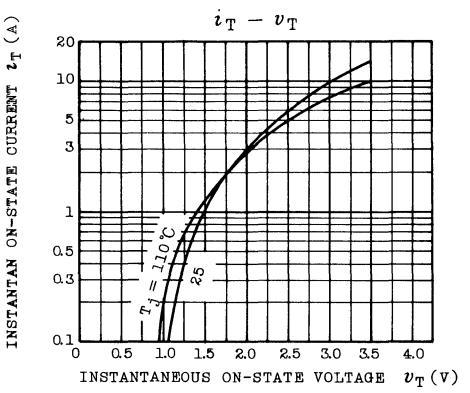
Note: Should be used with gate resistance as follows.

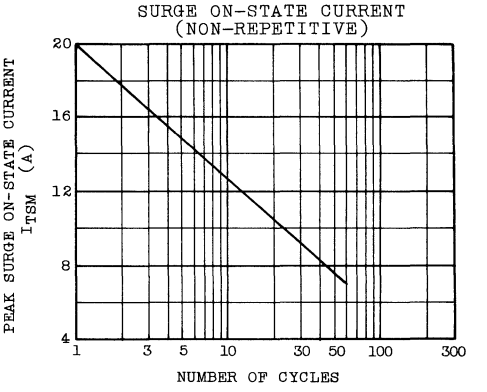


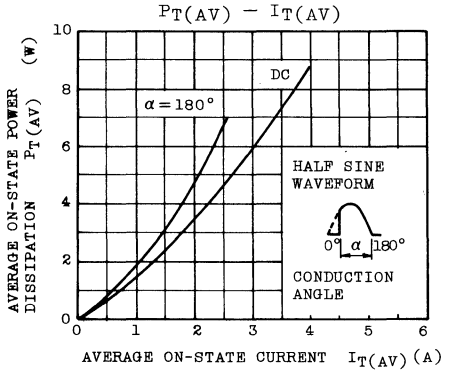
ELECTRICAL CHARACTERISTICS (Ta=25°C)

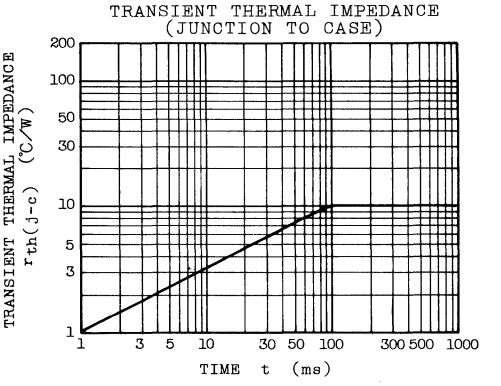
CHARACTERISTIC	SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Repetitive Peak Off-State Current and Repetitive Peak Reverse Current	I_{DRM} I_{RRM}	$V_{DRM}=V_{RRM}$=Rated Tj=110°C, R_{GK}=1kΩ		-	10	100	μA
Peak On-State Voltage	V_{TM}	I_{TM}=4A		-	1.8	2.2	V
Gate Trigger Voltage	V_{GT}	V_D=6V, R_L=100Ω		0.4	0.5	0.8	V
		R_{GK}=1kΩ	Ta=-40°C	0.5	0.7	1.0	
Gate Trigger Current	I_{GT}	V_D=6V, R_L=100Ω		-	30	200	μA
		R_{GK}=1kΩ	Ta=-40°C	-	75	500	
Gate Non-Trigger Voltage	V_{GD}	V_D=Rated, R_{GK}=1kΩ Tc=110°C		0.2	-	-	V
Critical Rate of Rise of Off-State Voltage	dv/dt	V_{DRM}=Rated, R_{GK}=1kΩ Tc=110°C Exponential Rise			15 *10	-	V/μs
Holding Current	I_H	V_D=12V R_{GK}=1kΩ		0.3	1.0	3.0	mA
			Ta=-40°C	0.4	2.0	6.0	
			Ta=110°C	0.14	0.6	2.0	
Latching Current	I_L	V_D=12V R_{GK}=1kΩ		0.3	1.5	4.0	mA
			Ta=-40°C	0.4	3.0	8.0	
Turn-Off Time	tq	di/dt<10A/μs -di/dt<5A/μs I_T=1A, f=60Hz V_D=Rated, V_R≧15V dv/dt=5V/μs, V_{RRM}=Rated Ta=110°C, Gate Bias=0V 100Ω		-	40	100	μs
Thermal Resistance	$R_{th(j-c)}$	Junction to Case		-	-	10	°C/W

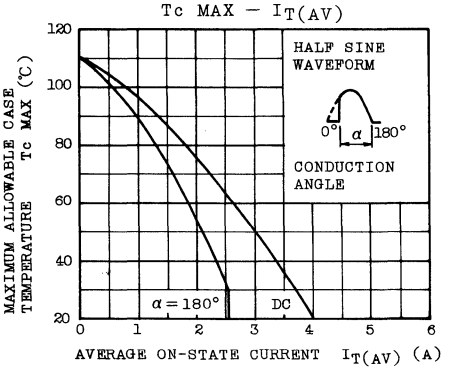
* C106M











EGD-C106A-3

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

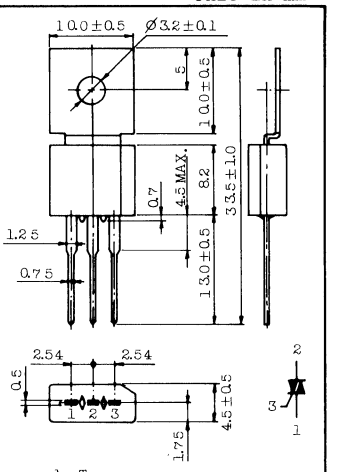
TOSHIBA BI-DIRECTIONAL TRIODE THYRISTOR
T2323B, T2323D, T2323M
SILICON DIFFUSED TYPE

AC POWER CONTROL APPLICATIONS.

FEATURES:

- Repetitive Peak Off-State Voltage : V_{DRM}=200~600V
- R.M.S On-State Current : $I_{T(RMS)}$=2.5A
- 4 Trigger Mode Guarantee
- High Commutating (dv/dt)
- High Sensitivity Type

Unit in mm



JEDEC	—
EIAJ	—
TOSHIBA	13-10A1B

Weight : 1.5g

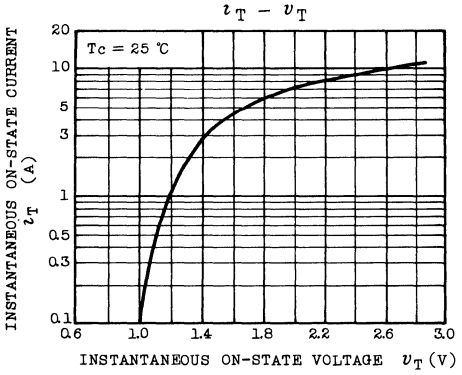
MAXIMUM RATINGS

CHARACTERISTIC		SYMBOL	RATING	UNIT
Repetitive Peak Off-State Voltage	T2323B	V_{DRM}	200	V
	T2323D		400	
	T2323M		600	
R.M.S On-State Current (Full Sine Waveform Tc=65°C)		$I_{T(RMS)}$	2.5	A
Peak One Cycle Surge On-State Current (Non-Repetitive)		I_{TSM}	23.5(50Hz)	A
			25(60Hz)	
I^2t Limit Value (t=1~20ms)		I^2t	3.4	A^2s
Peak Gate Power Dissipation		P_{GM}	10	W
Average Gate Power Dissipation		$P_{G(AV)}$	0.1	W
Peak Gate Voltage		V_{GM}	10	V
Peak Gate Current		I_{GM}	1	A
Junction Temperature		Tj	-40~100	°C
Storage Temperature Range		Tstg	-40~150	°C

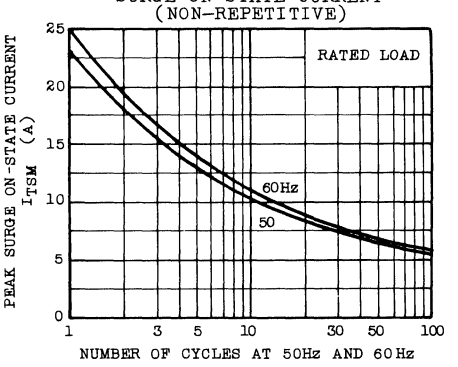
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION		MIN.	MAX.	UNIT
Repetitive Peak Off-State Current		I_{DRM}	V_{DRM}=Rated V_{DRM}, Tj=100°C		-	0.75	mA
Gate Trigger Voltage	I	V_{GT}	V_D=12V, R_L=30Ω	T2(+), Gate(+)	-	2.2	V
	II			T2(+), Gate(-)	-	2.2	
	III			T2(-), Gate(-)	-	2.2	
	IV			T2(-), Gate(+)	-	2.2	
Gate Trigger Current	I	I_{GT}		T2(+), Gate(+)	-	25	mA
	II			T2(+), Gate(-)	-	40	
	III			T2(-), Gate(-)	-	25	
	IV			T2(-), Gate(+)	-	40	
Peak On-State Voltage		V_{TM}	I_{TM}=10A		-	2.6	V
Gate Non-Trigger Voltage		V_{GD}	V_D=Rated V_{DRM}, Tc=100°C		0.15	-	V
Holding Current		I_H	V_D=12V, Gate Open		-	30	mA
Critical Rate of Rise of Off-State Voltage		dv/dt	V_D=Rated V_{DRM}, Tc=100°C Exponential Rise		10	-	V/μs
Critical Rate of Rise of Off-State Voltage at Commutation		(dv/dt)c	V_D=Rated V_{DRM}, Tc=90°C Tj=100°C, (di/dt)c=-1.33A/ms		1	-	V/μs
Gate Controlled Turn-on Time		tgt	V_D=Rated V_{DRM}, i_T=10A(Peak) I_{GT}=60mA, t_r=0.1μs, Tc=25°C		-	2.5	μs
Thermal Resistance		$R_{th(j-c)}$	Junction to Case		-	8	°C/W
Thermal Resistance		$R_{th(j-a)}$	Junction to Ambient		-	80	°C/W

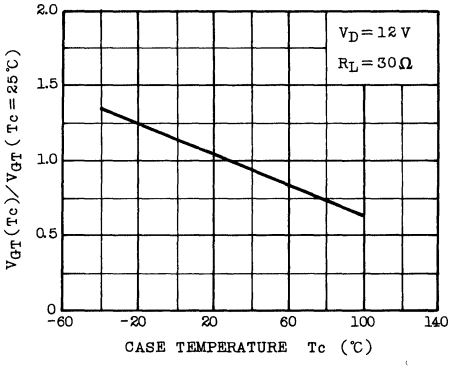
$i_T - v_T$



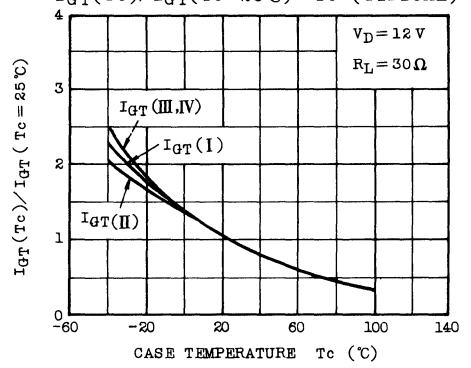
SURGE ON-STATE CURRENT (NON-REPETITIVE)



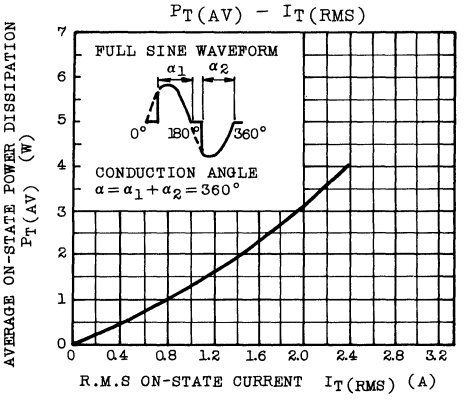
$V_{GT}(Tc)/V_{GT}(Tc=25℃) - Tc$ (TYPICAL)



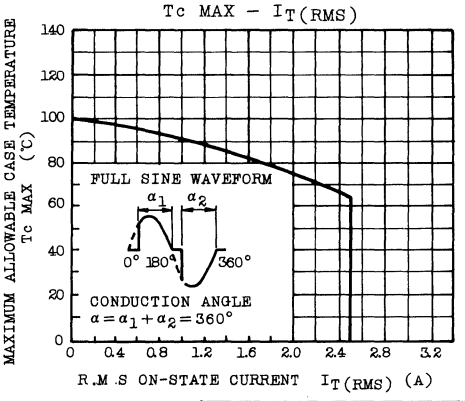
$I_{GT}(Tc)/I_{GT}(Tc=25℃) - Tc$ (TYPICAL)



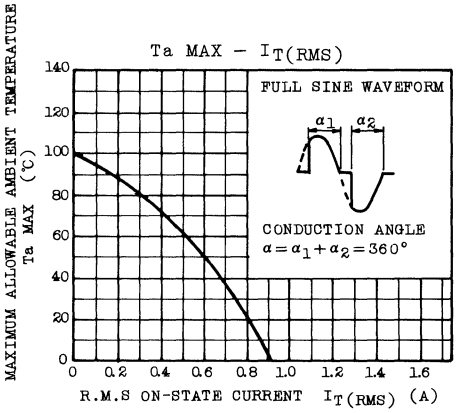
$P_{T(AV)} - I_{T(RMS)}$



Tc MAX - $I_{T(RMS)}$



TOSHIBA CORPORATION



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA THYRISTOR

C122A, C122B, C122D, C122M

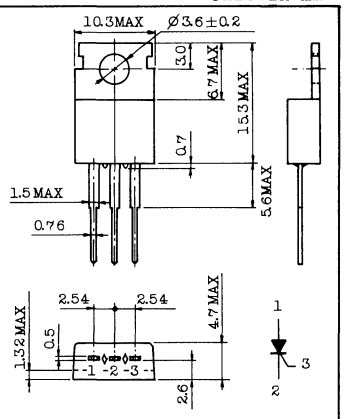
SILICON DIFFUSED TYPE

MEDIUM POWER CONTROL APPLICATIONS.

FEATURES:

- Repetitive Peak Off-State Voltage : V_{DRM} } =100~600V
  Repetitive Peak Reverse Voltage : V_{RRM}
- Average On-State Current : $I_{T(AV)}$=5.1A
- JEDEC TO-220AB Package

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	13-10B1A

Weight : 2g

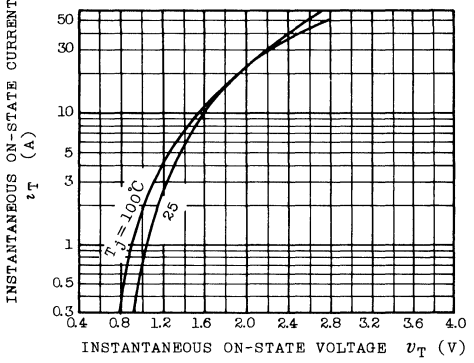
MAXIMUM RATINGS

CHARACTERISTIC		SYMBOL	RATING	UNIT
Repetitive Peak Off-State Voltage and Repetitive Peak Reverse Voltage	C122A	V_{DRM} V_{RRM}	100	V
	C122B		200	
	C122D		400	
	C122M		600	
Non-Repetitive Peak Reverse Voltage (Non-Repetitive <5ms, Tj=0~125°C)	C122A	V_{RSM}	200	V
	C122B		300	
	C122D		500	
	C122M		720	
Average On-State Current (Half Sine Waveform Tc=77°C)		$I_{T(AV)}$	5.1	A
R.M.S On-State Current		$I_{T(RMS)}$	8	A
Peak One Cycle Surge On-State Current (Non-Repetitive)		I_{TSM}	82 (50Hz)	A
			90 (60Hz)	
I^2t Limit Value (t=1~10ms)		I^2t	34	A^2s
Peak Gate Power Dissipation		P_{GM}	5	W
Average Gate Power Dissipation		$P_{G(AV)}$	0.5	W
Peak Forward Gate Voltage		V_{FGM}	10	V
Peak Reverse Gate Voltage		V_{RGM}	-5	V
Peak Forward Gate Current		I_{GM}	2.8	A
Junction Temperature		Tj	-40~100	°C
Storage Temperature Range		T_{stg}	-40~125	°C

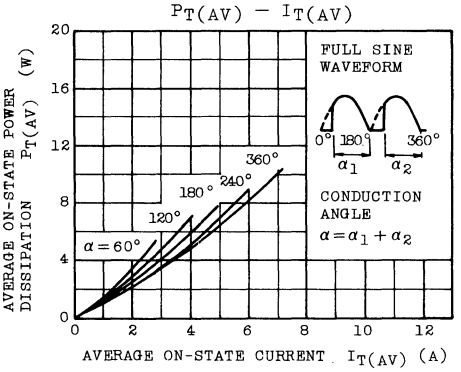
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Repetitive Peak Off-State Current and Repetitive Peak Reverse Current	I_{DRM} I_{RRM}	$V_{DRM}=V_{RRM}$=Rated Tj=100°C		-	-	0.5	mA
Peak On-State Voltage	V_{TM}	I_{TM}=16A		-	-	1.83	V
Gate Trigger Voltage	V_{GT}	V_D=6V R_L=45Ω		-	-	1.5	V
			Ta=-40°C	-	-	2.0	
Gate Trigger Current	I_{GT}	V_D=6V R_L=45Ω		-	-	25	mA
			Ta=-40°C	-	-	40	
Gate Non-Trigger Voltage	V_{GD}	V_D=Rated × 2/3, Tc=100°C		0.2	-	-	V
Critical Rate of Rise of Off-State Voltage	dv/dt	V_{DRM}=Rated, Tc=100°C Exponential Rise		30	-	-	V/μs
Holding Current	I_H	V_D=24V		-	-	30	mA
			Ta=-40°C	-	-	60	
Latching Current	I_L	V_D=24V		-	-	60	mA
		V_{GK}=15V, 100Ω	Ta=-40°C	-	-	120	
Thermal Resistance	$R_{th(j-c)}$	Junction to Case		-	-	1.8	°C/W

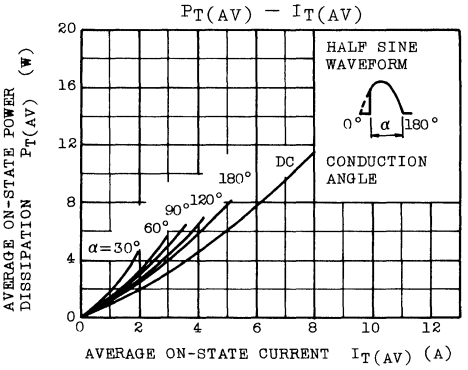
$i_T - v_T$



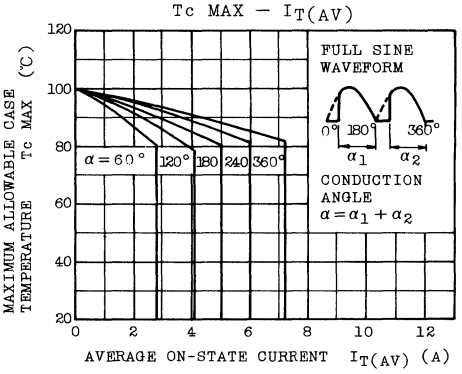
$P_{T(AV)} - I_{T(AV)}$



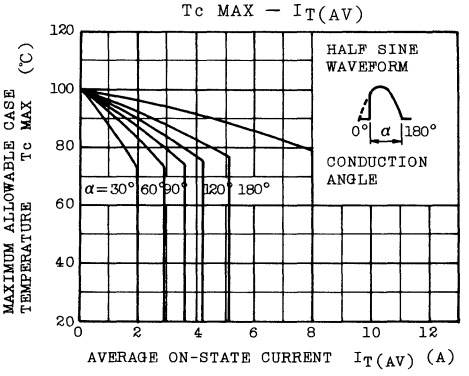
$P_{T(AV)} - I_{T(AV)}$



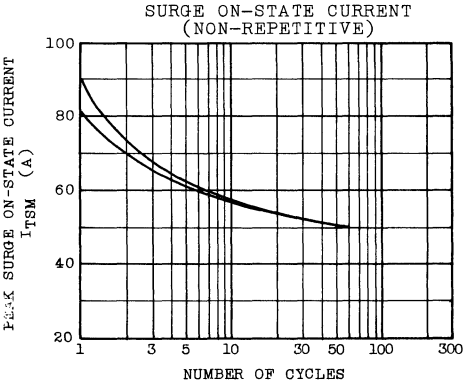
Tc MAX — $I_{T(AV)}$



Tc MAX — $I_{T(AV)}$

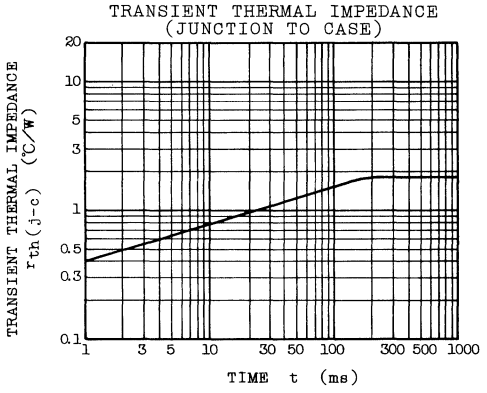


SURGE ON-STATE CURRENT (NON-REPETITIVE)



EGD-C122A-3

TOSHIBA CORPORATION


TRANSIENT THERMAL IMPEDANCE
(JUNCTION TO CASE)
TRANSIENT THERMAL IMPEDANCE
$r_{th(j-c)}$ (℃/W)
20
10
5
3
1
0.5
0.3
0.1
1
3
5
10
30
50
100
300
500
1000
TIME t (ms)

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA THYRISTOR

C203Y, C203YY, C203A, C203B, C203C, C203D

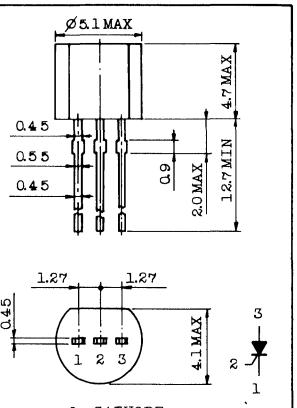
SILICON PLANAR TYPE

LOW POWER SWITCHING AND CONTROL APPLICATIONS.

FEATURES:

- Repetitive Peak Off-State Voltage : V_{DRM} } 30~400V
  Repetitive Peak Reverse Voltage : V_{RRM}
- Average On-State Current : $I_{T(AV)}$=500mA
- JEDEC TO-92 Package

Unit in mm



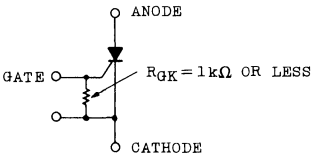
JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	13-5A1D

Weight : 0.2g

MAXIMUM RATINGS

CHARACTERISTIC		SYMBOL	RATING	UNIT
Repetitive Peak Off-State Voltage and Repetitive Peak Reverse Voltage (R_{GK}=1kΩ)	C203Y	V_{DRM} V_{RRM}	30	V
	C203YY		60	
	C203A		100	
	C203B		200	
	C203C		300	
	C203D		400	
Non-Repetitive Peak Reverse Voltage (Non-Repetitive <5ms, Tj=0~125°C, R_{GK}=1kΩ)	C203Y	V_{RSM}	45	V
	C203YY		90	
	C203A		150	
	C203B		300	
	C203C		450	
	C203D		500	
Average On-State Current (Half Sine Waveform)		$I_{T(AV)}$	500	mA
R.M.S On-State Current		$I_{T(RMS)}$	800	mA
Peak One Cycle Surge On-State Current (Non-Repetitive)		I_{TSM}	7 (50Hz)	A
			8 (60Hz)	
I^2t Limit Value (t=1~10ms)		I^2t	0.25	A^2s
Peak Gate Power Dissipation		P_{GM}	1	W
Average Gate Power Dissipation		$P_{G(AV)}$	0.01	W
Peak Forward Gate Voltage		V_{FGM}	8	V
Peak Reverse Gate Voltage		V_{RGM}	-5	V
Peak Forward Gate Current		I_{GM}	500	mA
Junction Temperature		Tj	-65~125	°C
Storage Temperature Range		Tstg	-65~150	°C

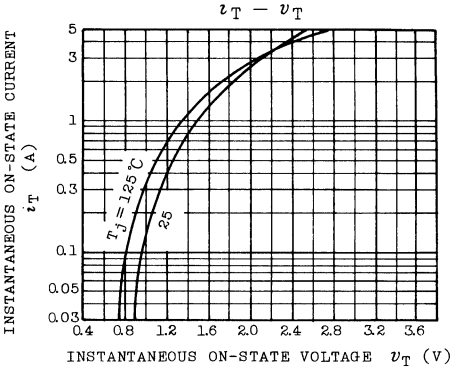
Note: Should be used with gate resistance as follows.



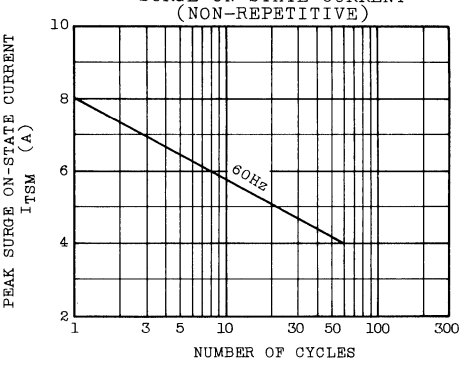
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Repetitive Peak Off-State Current and Repetitive Peak Reverse Current	I_{DRM} I_{RRM}	$V_{DRM}=V_{RRM}$=Rated R_{GK}=1kΩ, Tj=125°C		-	-	50	μA
Peak On-State Voltage	V_{TM}	I_{TM}=1A		-	-	1.5	V
Gate Trigger Voltage	V_{GT}	V_D=6V		-	-	0.8	V
		R_L=100Ω	Ta=-65°C	-	-	1.0	
Gate Trigger Current	I_{GT}	V_D=6V		-	-	200	μA
		R_L=100Ω	Ta=-65°C	-	-	500	
Gate Non-Trigger Voltage	V_{GD}	V_D=Rated, R_{GK}=1kΩ Ta=125°C		0.2	-	-	V
Holding Current	I_H	V_D=12V		-	-	5.0	mA
		R_{GK}=1kΩ	Ta=-65°C	-	-	10.0	
Thermal Resistance	Rth(j-c)	Junction to Case		-	-	125	°C/W
	Rth(j-a)	Junction to Ambient		-	-	230	

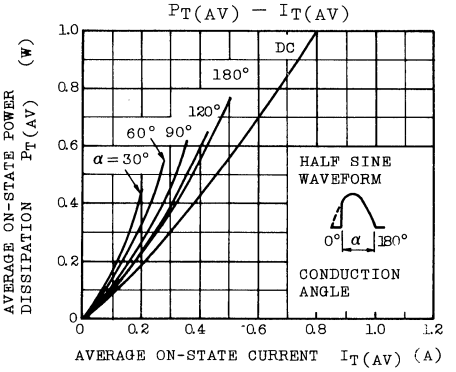
$i_T - v_T$



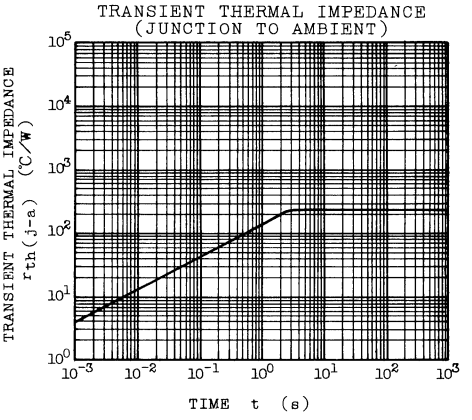
SURGE ON-STATE CURRENT
(NON-REPETITIVE)



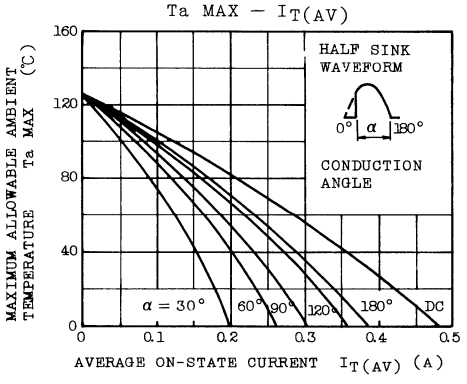
$P_{T(AV)} - I_{T(AV)}$



TRANSIENT THERMAL IMPEDANCE
(JUNCTION TO AMBIENT)



Ta MAX — $I_{T(AV)}$



EGD-C203Y-3

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

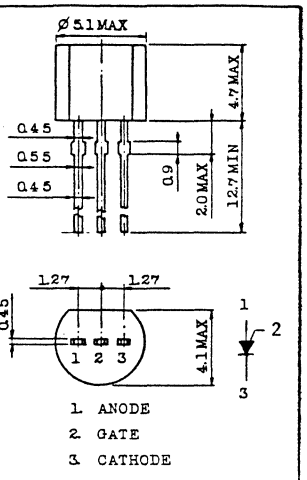
TOSHIBA PROGRAMMABLE UNIJUNCTION TRANSISTOR
2N6027, 2N6028
SILICON PLANAR TYPE

THYRISTOR-TRIGGER, RELAXATION OSCILLATOR,
PULSER AND TIMMER APPLICATIONS.

FEATURES:

- Programmable Item : R_{BB}, η, I_V and I_P
- Low Leakage Current : I_{GAO}=10nA(Max.)
  I_{GKS}= 50nA(Max.)
- High Pulse Output Voltage : V_O= 11V(Typ.)
- Low Peak Current
  : Ip=2μA(Max.) 2N6027 (R_G=1MΩ)
  Ip=0.15μA(Max.)2N6028 (R_G=1MΩ)

Unit in mm



JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	13-5A1C

Weight : 0.2g

MAXIMUM RATINGS

CHARACTERISTIC		SYMBOL	RATING	UNIT
Gate-Cathode Forward Voltage		V_{GKF}	40	V
Gate-Cathode Reverse Voltage		V_{GKR}	-5	V
Gate-Anode Reverse Voltage		V_{GAR}	40	V
Anode-Cathode Voltage		V_{AK}	±40	V
DC Anode Current (Note 1)		I_T	150	mA
Repetitive Peak Forward Current (1% Duty Cycle)	t_w=100μs	I_{TRM}	1	A
	t_w=20μs		2	
Non-Repetitive Peak Forward Current (t_w=10μs)		I_{TSM}	5	A
DC Gate Current (Note 1)		I_G	±50	mA
Capacitive Discharge Energy (Note 2)		E	250	μJ
Power Dissipation (Note 1)		P	300	mW
Operating Temperature		T_{opr}	-50~100	°C
Junction Temperature		Tj	-50~100	°C
Storage Temperature Range		T_{stg}	-55~150	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	FIGURE No. and CONDITION	2N6027			2N6028			UNIT
				MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Peak Current (V_S=10V)	R_G=1MΩ	I_P	1,2,3	-	1.25	2	-	0.08	0.15	μA
	R_G=10kΩ			-	4	5	-	0.7	1.0	
Offset Voltage (V_S=10V)	R_G=1MΩ	V_T	1,2,3	0.2	0.7	1.6	0.2	0.5	0.6	V
	R_G=10kΩ			0.2	0.35	0.6	0.2	0.35	0.6	
Valley Current	R_G=1MΩ	I_V	1,2,3	-	18	50	-	18	25	μA
	R_G=10kΩ			70	270	-	25	270	-	
Gate-Anode Leakage Current		I_{GAO}	4, V_S=40V	-	1.0	10	-	1.0	10	nA
Gate-Cathode Leakage Current		I_{GKS}	5, V_S=40V	-	5.0	50	-	5.0	50	nA
Forward Voltage		V_F	I_F=50mA	-	0.8	1.5	-	0.8	1.5	V
Pulse Output Voltage		V_O	6,7	6	11	-	6	11	-	V
Pulse Voltage Rise Time		t_r	6,7	-	40	80	-	40	80	ns

Note 1 : Derate linearly current and powers 1%/°C above 25°C.

2 : E=0.5·CV2 capacitor discharge energy limiting resistor and repetition.

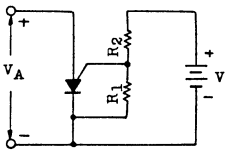


Fig.1 PROGRAMMABLE UJT WITH PROGRAM RESISTORS R1 AND R2

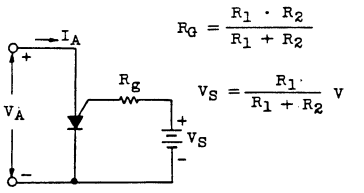


Fig.2 EQIVALENT TEST CIRCUIT FOR FIGURE 1 USED FOR ELECTRICAL CHARACTERISTIC TESTING

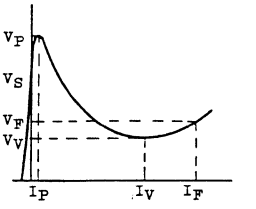


Fig.3 V-I ELECTRICAL CHARACTERISTICS

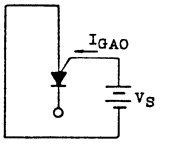


Fig.4 I_{GAO} TEST CIRCUIT

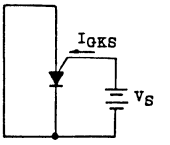


Fig.5 I_{GKS} TEST CIRCUIT

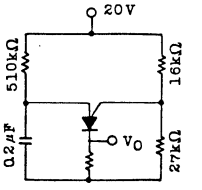


Fig.6 V_O AND t_r TEST CIRCUIT

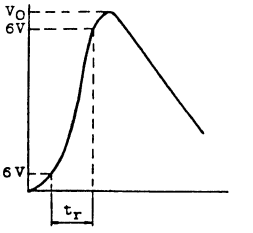
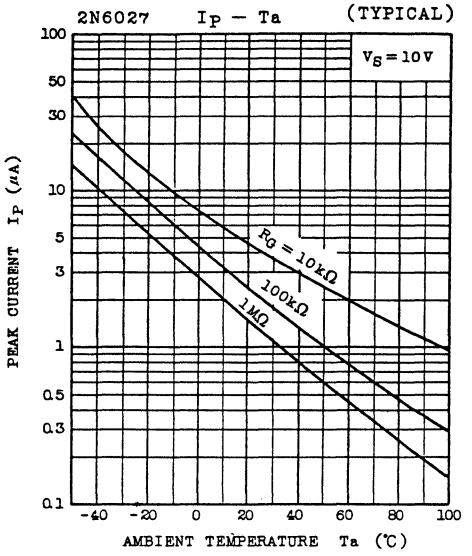
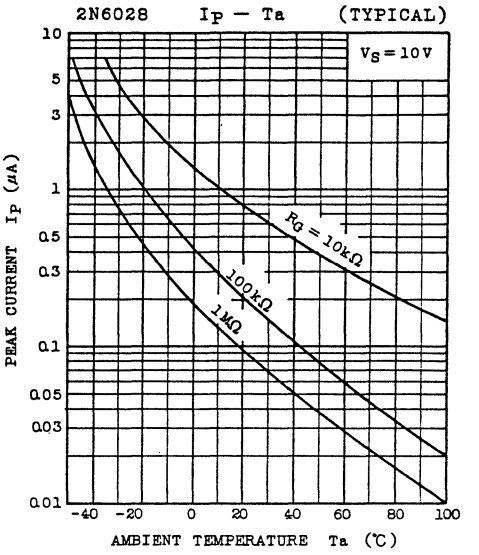


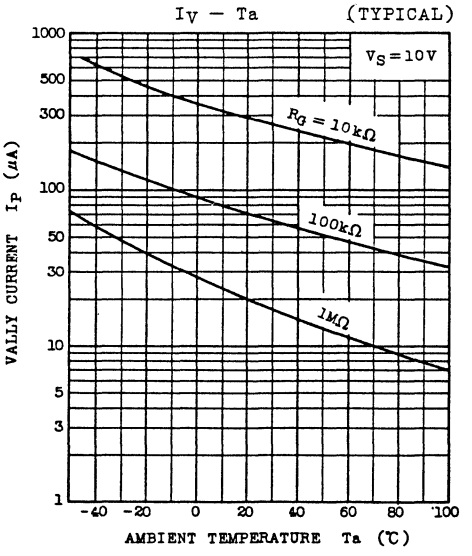
Fig.7 WAVEFORM OF V_O AND t_r

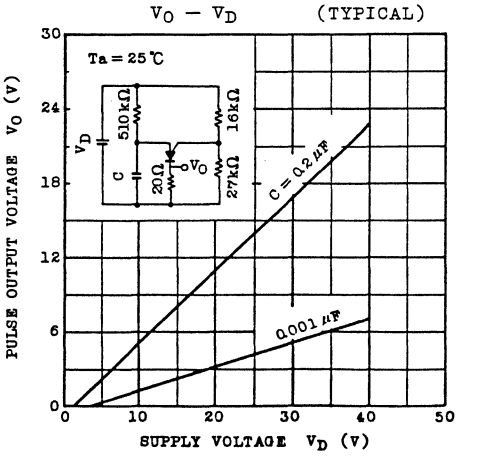
EGV-2N6027-2

TOSHIBA CORPORATION









TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

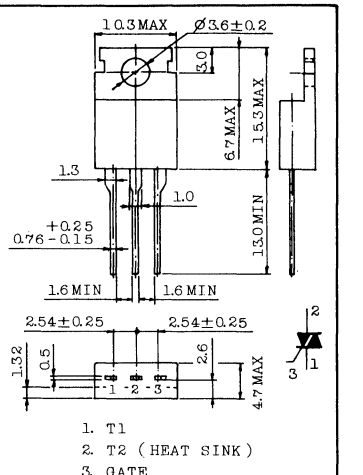
TOSHIBA BI-DIRECTIONAL TRIODE THYRISTOR
2N6346A, 2N6347A, 2N6348A
SILICON DIFFUSED TYPE

AC POWER CONTROL APPLICATIONS

FEATURES:

. Repetitive Peak Off-State Voltage : V_{DRM}=200~600V
. R.M.S On-State Current : $I_{T(RMS)}$=12A
. 4 Trigger Mode Guarantee
. High Commutating (dv/dt)

Unit in mm



JEDEC	TO-220AB
EIAJ	-
TOSHIBA	13-10E1A

Weight : 1.8g

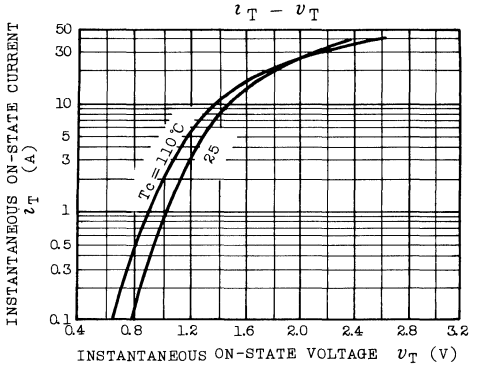
MAXIMUM RATINGS

CHARACTERISTIC		SYMBOL	RATING	UNIT
Repetitive Peak Off-State Voltage	2N6346A	V_{DRM}	200	V
	2N6347A		400	
	2N6348A		600	
R.M.S On-State Current (Full Sine Waveform Tc=80°C)		$I_{T(RMS)}$	12	A
Peak One Cycle Surge On-State Current (Non-Repetitive)		I_{TSM}	113(50Hz)	A
			120(60Hz)	
I^2t Limit Value (t=1~10ms)		I^2t	64	A^2s
Peak Gate Power Dissipation		P_{GM}	20	W
Average Gate Dissipation		$P_{G(AV)}$	0.5	W
Peak Gate Voltage		V_{GM}	10	V
Peak Gate Current		I_{GM}	2	A
Junction Temperature		Tj	-40~125	°C
Storage Temperature Range		Tstg	-40~150	°C

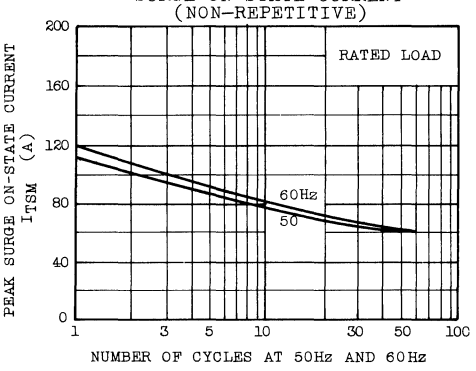
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION		MIN.	MAX.	UNIT
Repetitive Peak Off-State Current		I_{DRM}	V_{DRM}=Rated V_{DRM}, Tj=110°C		-	2	mA
Gate Trigger Voltage	I	V_{GT}	V_D=12V R_L=100Ω	T2(+), Gate(+)	-	2	V
	II			T2(+), Gate(-)	-	2.5	
	III			T2(-), Gate(-)	-	2	
	IV			T2(-), Gate(+)	-	2.5	
Gate Trigger Current	I	I_{GT}		T2(+), Gate(+)	-	50	mA
	II			T2(+), Gate(-)	-	75	
	III			T2(-), Gate(-)	-	50	
	IV			T2(-), Gate(-)	-	75	
Peak On-State Voltage		V_{TM}	I_{TM}=17A		-	1.75	V
Gate Non-Trigger Voltage		V_{GD}	V_D=Rated V_{DRM}, Tj=110°C		0.2	-	V
Holding Current		I_H	V_D=12V, Gate open		-	40	mA
Critical Rate of Rise of Off-State Voltage		dv/dt	V_D=Rated V_{DRM}, Tc=100°C Exponential Rise		100	-	V/μs
Thermal Resistance		$R_{th(j-c)}$	Junction to Case, AC		-	2.0	°C/W
Critical Rate of Rise of Off-State Voltage at Commutation		(dv/dt)c	V_D=Rated V_{DRM}, Tc=80°C (di/dt)c=-6.5A/ms		5	-	V/μs
Turn-on Time		t_{gt}	V_D=Rated V_{DRM}, I_{TM}=17A I_{GT}=170mA, t_r=0.1μs		-	2	μs

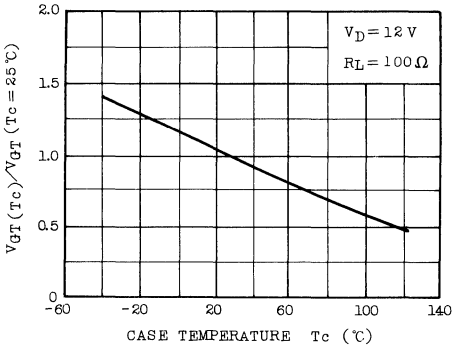
$i_T - v_T$



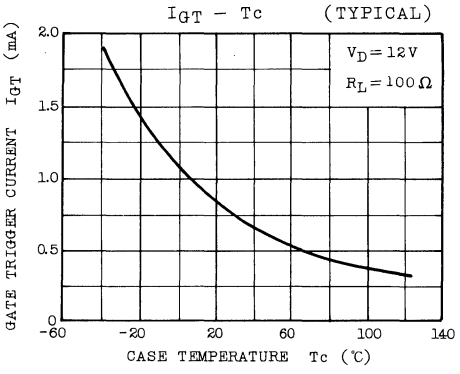
SURGE ON-STATE CURRENT
(NON-REPETITIVE)



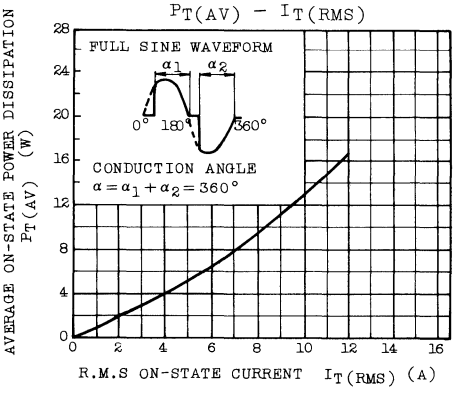
$V_{GT}(Tc)/V_{GT}(Tc=25℃) - Tc$ (TYPICAL)



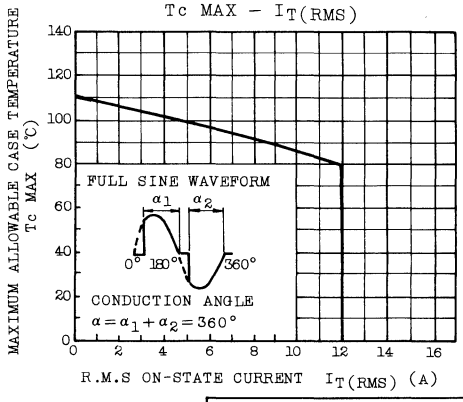
$I_{GT} - Tc$ (TYPICAL)



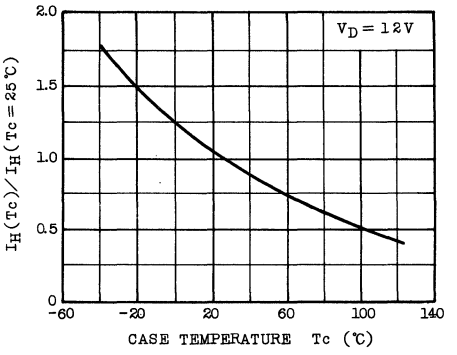
$P_{T(AV)} - I_{T(RMS)}$



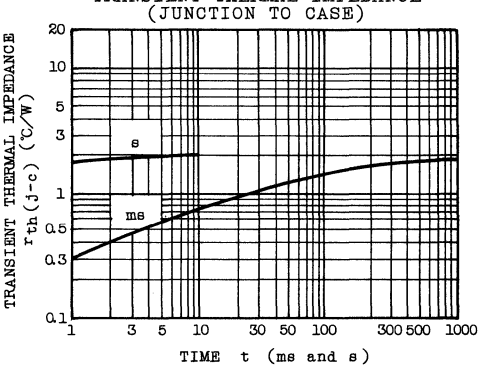
Tc MAX − $I_{T(RMS)}$



$I_H(Tc)/I_H(Tc=25°C)-Tc$ (TYPICAL)



TRANSIENT THERMAL IMPEDANCE (JUNCTION TO CASE)



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

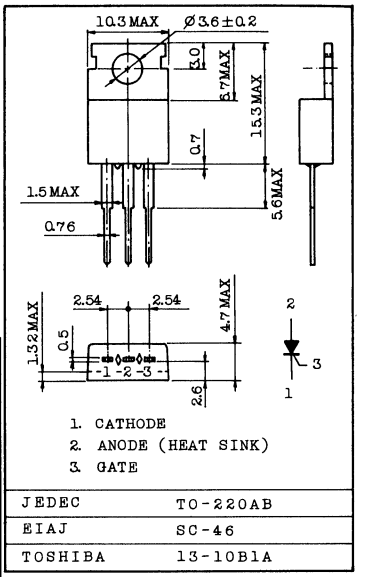
TOSHIBA THYRISTOR

2N6395, 2N6396, 2N6397, 2N6398

SILICON DIFFUSED TYPE

MEDIUM POWER CONTROL APPLICATIONS.

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	13-10B1A

Weight : 2g

FEATURES:

- Repetitive Peak Off-State Voltage : V_{DRM} } =100~600V
  Repetitive Peak Reverse Voltage : V_{RRM}
- Average On-State Current : $I_{T(AV)}$=7.6A
- JEDEC TO-220AB Package

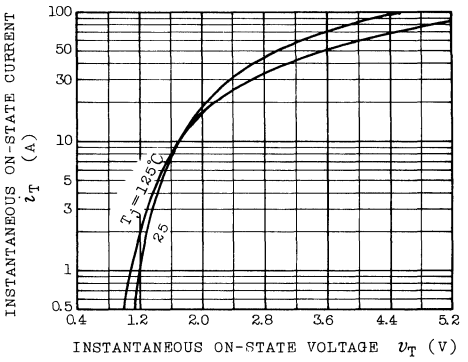
MAXIMUM RATINGS

CHARACTERISTIC		SYMBOL	RATING	UNIT
Repetitive Peak Off-State Voltage and Repetitive Peak Reverse Voltage	2N6395	V_{DRM} V_{RRM}	100	V
	2N6396		200	
	2N6397		400	
	2N6398		600	
Non-Repetitive Peak Reverse Voltage (Non-Repetitive <5ms, Tj=0~125°C)	2N6395	V_{RSM}	150	V
	2N6396		300	
	2N6397		500	
	2N6398		720	
Average On-State Current (Half Sine Waveform Tc=90°C)		$I_{T(AV)}$	7.6	A
R.M.S On-State Current		$I_{T(RMS)}$	12	A
Peak One Cycle Surge On-State Current (Non-Repetitive)		I_{TSM}	91 (50Hz)	A
			100 (60Hz)	
I^2t Limit Value (t=1~10ms)		I^2t	72	A^2s
Peak Gate Power Dissipation		P_{GM}	20	W
Average Gate Power Dissipation		$P_{G(AV)}$	0.5	W
Peak Forward Gate Voltage		V_{FGM}	10	V
Peak Reverse Gate Voltage		V_{RGM}	-5	V
Peak Forward Gate Current		I_{GM}	2	A
Junction Temperature		Tj	-40~125	°C
Storage Temperature Range		T_{stg}	-40~150	°C

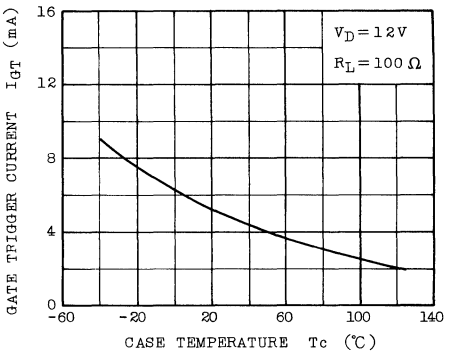
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Repetitive Peak Off-State Current and Repetitive Peak Reverse Current	I_{DRM} I_{RRM}	$V_{DRM}=V_{RRM}$=Rated Tj=125°C	-	-	2	mA
Peak On-State Voltage	V_{TM}	I_{TM}=24A	-	1.7	2.2	V
Gate Trigger Voltage	V_{GT}	V_D=12V, R_L=100Ω	-	0.7	1.5	V
Gate Trigger Current	I_{GT}		-	-	30	mA
Gate Non-Trigger Voltage	V_{GD}	V_D=Rated, Tc=125°C	0.2	-	-	V
Critical Rate of Rise of Off-State Voltage	dv/dt	V_{DRM}=Rated, Tc=125°C Exponential Rise	30	-	-	V/μs
Holding Current	I_H	V_D=12V	-	6	40	mA
Gate Turn-On Time	t_{gt}	I_{TM}=12A, I_G=40mA V_D=Rated	-	1.0	2.0	μs
Turn-Off Time	t_g	I_{TM}=12A, I_R=12A V_D=Rated	-	15	-	μs
		I_{TM}=12A, I_R=12A V_D=Rated, Tj=125°C	-	35	-	
Thermal Resistance	$R_{th(j-c)}$	Junction to Case	-	-	2	°C/W

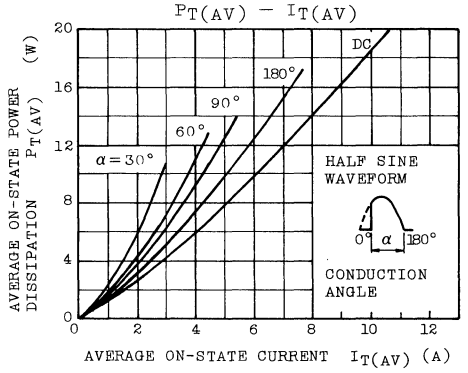
$i_T - v_T$



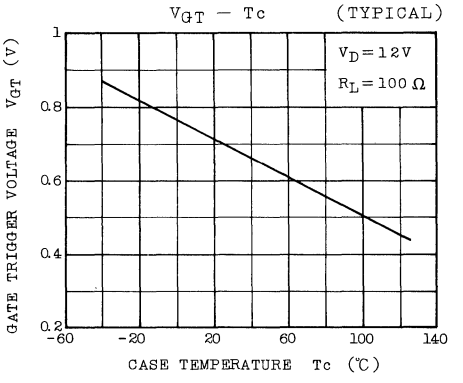
I_{GT} — Tc (TYPICAL)



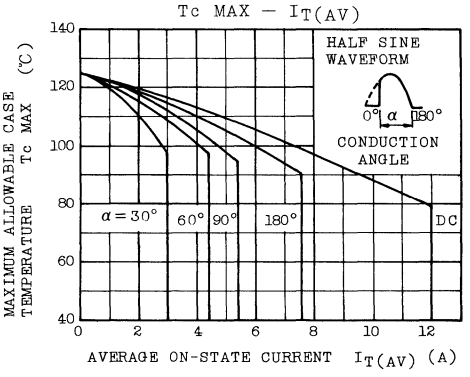
$P_{T(AV)} - I_{T(AV)}$



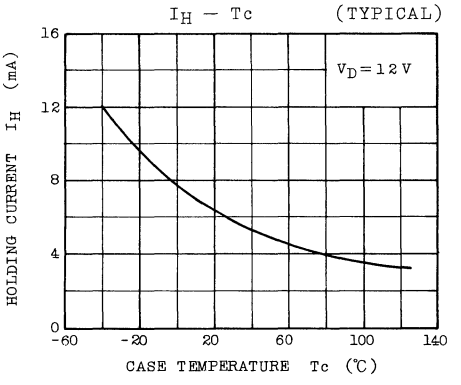
V_{GT} — Tc (TYPICAL)



Tc MAX — $I_{T(AV)}$



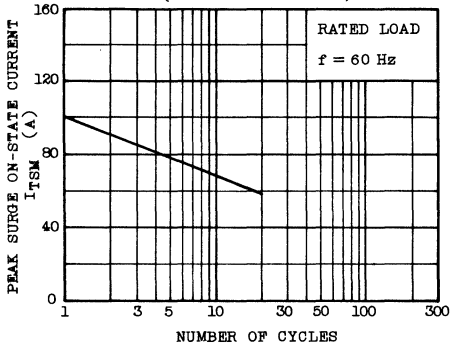
I_H — Tc (TYPICAL)



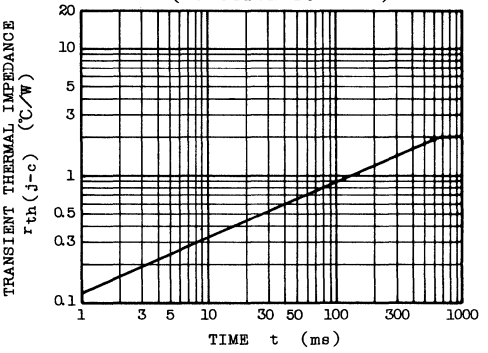
EGD-2N6395-3

TOSHIBA CORPORATION

SURGE ON-STATE CURRENT
(NON-REPFTITIVE)



TRANSIENT THERMAL IMPEDANCE
(JUNCTION TO CASE)



EGD-2N6395-4

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

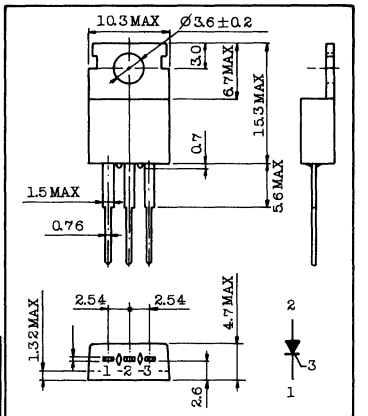
TOSHIBA THYRISTOR

2N6401, 2N6402, 2N6403, 2N6404

SILICON DIFFUSED TYPE

MEDIUM POWER CONTROL APPLICATIONS.

Unit in mm



JEDEC	TO-220AB
EIAJ	SC-46
TOSHIBA	13-10B1A

Weight : 2g

FEATURES:

- Repetitive Peak Off-State Voltage : V_{DRM} } =100~600V
  Repetitive Peak Reverse Voltage : V_{RRM}
- Average On-State Current : $I_{T(AV)}$=10A
- JEDEC TO-220AB Package

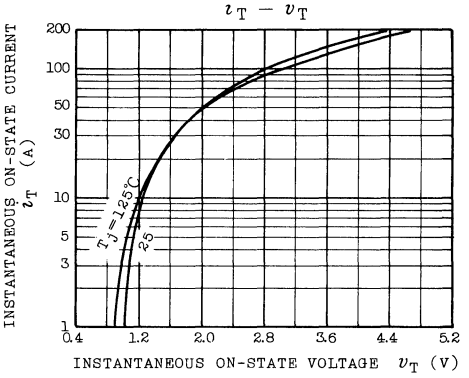
MAXIMUM RATINGS

CHARACTERISTIC		SYMBOL	RATING	UNIT
Repetitive Peak Off-State Voltage and Repetitive Peak Reverse Voltage	2N6401	V_{DRM} V_{RRM}	100	V
	2N6402		200	
	2N6403		400	
	2N6404		600	
Non-Repetitive Peak Reverse Voltage (Non-Repetitive <5ms, Tj=0~125°C)	2N6401	V_{RSM}	150	V
	2N6402		300	
	2N6403		500	
	2N6404		720	
Average On-State Current (Half Sine Waveform Tc=100°C)		$I_{T(AV)}$	10	A
R.M.S On-State Current		$I_{T(RMS)}$	16	A
Peak One Cycle Surge On-State Current (Non-Repetitive)		I_{TSM}	145 (50Hz)	A
			160 (60Hz)	
I^2t Limit Value (t=1~10ms)		I^2t	125	A^2s
Peak Gate Power Dissipation		P_{GM}	20	W
Average Gate Power Dissipation		$P_{G(AV)}$	0.5	W
Peak Forward Gate Voltage		V_{FGM}	10	V
Peak Reverse Gate Voltage		V_{RGM}	-5	V
Peak Forward Gate Current		I_{GM}	2	A
Junction Temperature		Tj	-40~125	°C
Storage Temperature Range		Tstg	-40~150	°C

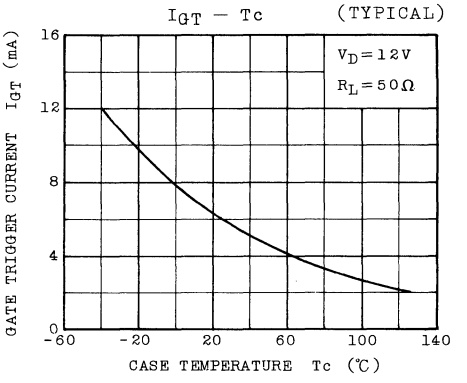
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Repetitive Peak Off-State Current and Repetitive Peak Reverse Current	I_{DRM} I_{RRM}	$V_{DRM}=V_{RRM}$=Rated, Tj=125°C	-	-	2	mA
Peak On-State Voltage	V_{TM}	I_{TM}=32A	-	-	1.7	V
Gate Trigger Voltage	V_{GT}	V_D=12V	-	0.7	1.5	V
		R_L=50Ω, Ta=-40°C	-	-	2.5	
Gate Trigger Current	I_{GT}	V_D=12V, R_L=50Ω	-	5	30	mA
Gate Non-Trigger Voltage	V_{GD}	V_D=Rated, Tc=125°C	0.2	-	-	V
Holding Current	I_H	V_D=12V	-	6.0	40	mA
		Ta=-40°C	-	-	60	
Thermal Resistance	$R_{th(j-c)}$	Junction to Case	-	-	1.5	°C/W

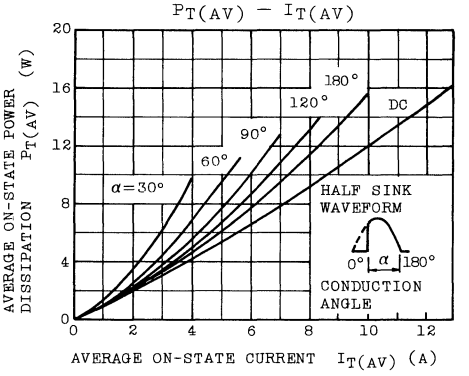
$i_T - v_T$



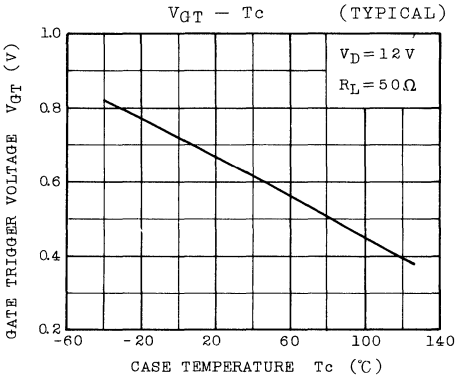
I_{GT} — Tc (TYPICAL)



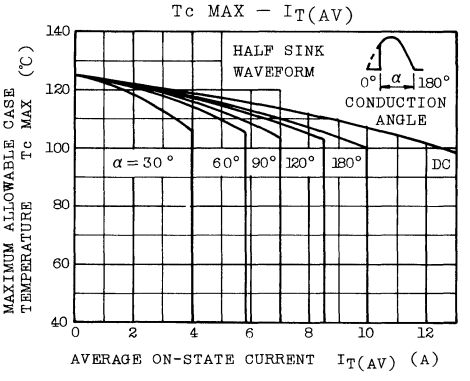
$P_{T(AV)} - I_{T(AV)}$



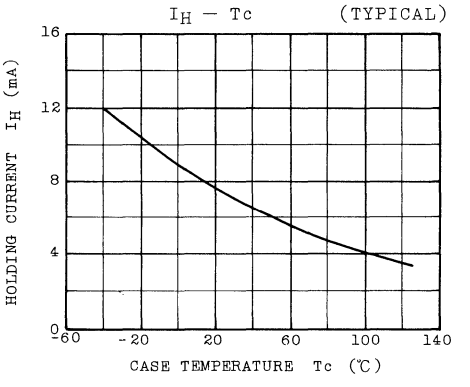
V_{GT} — Tc (TYPICAL)



Tc MAX — $I_{T(AV)}$



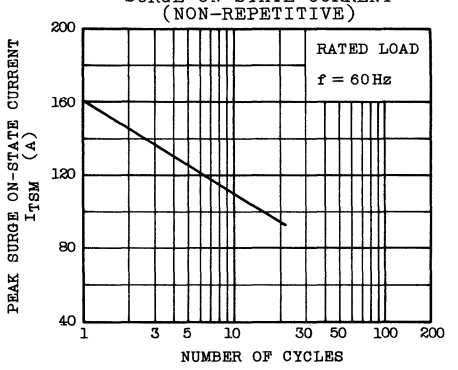
I_H — Tc (TYPICAL)



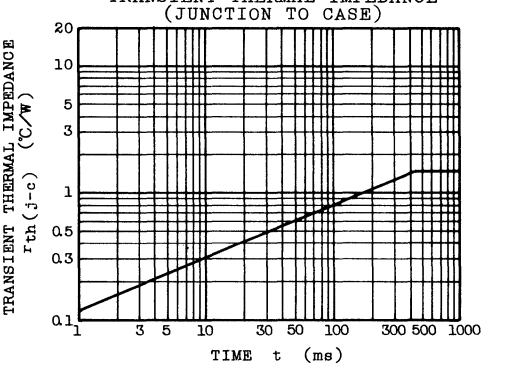
EGD-2N6401-3

TOSHIBA CORPORATION

SURGE ON-STATE CURRENT
(NON-REPETITIVE)



TRANSIENT THERMAL IMPEDANCE
(JUNCTION TO CASE)



EGD-2N6401-4

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA BI-DIRECTIONAL TRIODE THYRISTOR

MAC222A-4, MAC222A-6, MAC222A-8

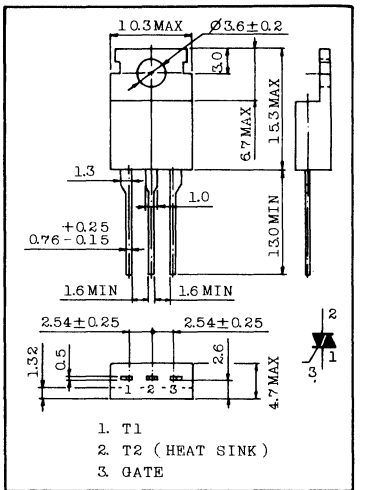
SILICON DIFFUSED TYPE

AC POWER CONTROL APPLICATIONS

FEATURES:

- Repetitive Peak Off-State Voltage : V_{DRM}=200~600V
- R.M.S On-State Current : $I_{T(RMS)}$=8A
- 4 Trigger Mode Guarantee
- High Commutating (dv/dt)

Unit in mm



1. T1
2. T2 (HEAT SINK)
3. GATE

JEDEC	TO-220AB
EIAJ	-
TOSHIBA	13-10E1A

Weight : 1.8g

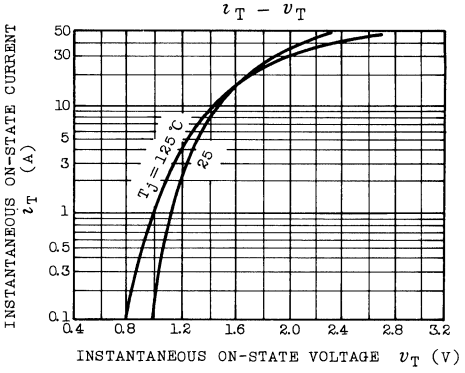
MAXIMUM RATINGS

CHARACTERISTIC		SYMBOL	RATING	UNIT
Repetitive Peak Off-State Voltage	MAC222A-4	V_{DRM}	200	V
	MAC222A-6		400	
	MAC222A-8		600	
R.M.S On-State Current (Full Sine Waveform Tc=90°C)		$I_{T(RMS)}$	8	A
Peak One Cycle Surge On-State Current (Non-Repetitive)		I_{TSM}	73(50Hz)	A
			80(60Hz)	
I^2t Limit Value (t=1~10ms)		I^2t	40	A^2s
Peak Gate Power Dissipation		P_{GM}	20	W
Average Gate Power Dissipation		$P_{G(AV)}$	0.5	W
Peak Gate Voltage		V_{GM}	10	V
Peak Gate Current		I_{GM}	2	A
Junction Temperature		Tj	-40~125	°C
Storage Temperature Range		Tstg	-40~150	°C

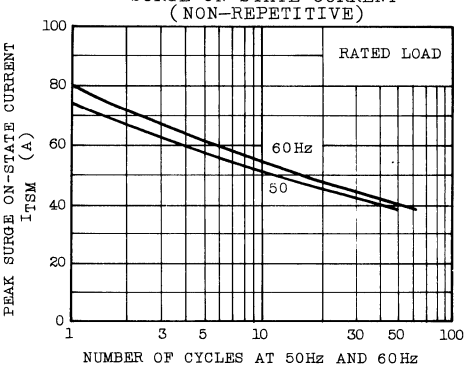
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION		MIN.	MAX.	UNIT
Repetitive Peak Off-State Current		I_{DRM}	V_{DRM}=Rated V_{DRM}, Tj=125°C		-	2	mA
Gate Trigger Voltage	I	V_{GT}	V_D=12V, R_L=100Ω	T2(+), Gate(+)	-	2	V
	II			T2(+), Gate(-)	-	2	
	III			T2(-), Gate(-)	-	2	
	IV			T2(-), Gate(+)	-	2.5	
Gate Trigger Current	I	I_{GT}		T2(+), Gate(+)	-	50	mA
	II			T2(+), Gate(-)	-	50	
	III			T2(-), Gate(-)	-	50	
	IV			T2(-), Gate(+)	-	75	
Peak On-State Voltage		V_{TM}	I_{TM}=11A		-	1.55	V
Gate Non-Trigger Voltage		V_{GD}	V_D=Rated V_{DRM}, Tj=125°C		0.2	-	V
Holding Current		I_H	V_D=12V, Gate open		-	40	mA
Critical Rate of Rise of Off-State Voltage		dv/dt	V_D=Rated V_{DRM}, Tc=125°C Exponential Rise		10	2.2	V/μs
Thermal Resistance		$R_{th(j-c)}$	Junction to case, AC		-	2.2	°C/W
Critical Rate of Rise of Off-State Voltage at Commoutation		(dv/dt)c	V_D=Rated V_{DRM}, Tc=90°C (di/dt)c=-4.3A/ms		5	-	V/μs

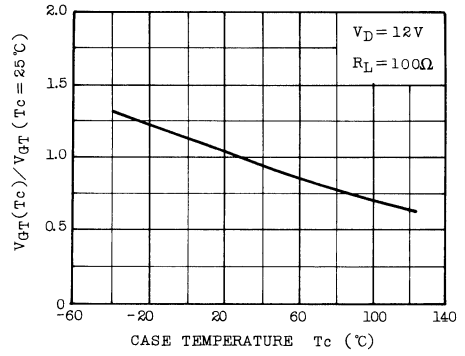
$i_T - v_T$



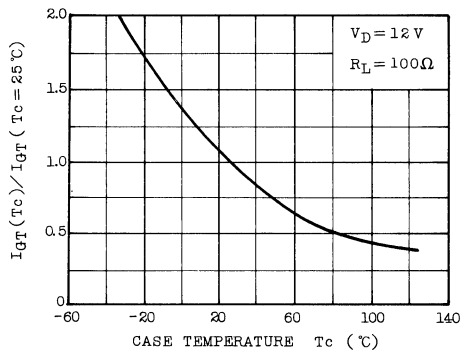
SURGE ON-STATE CURRENT
(NON-REPETITIVE)



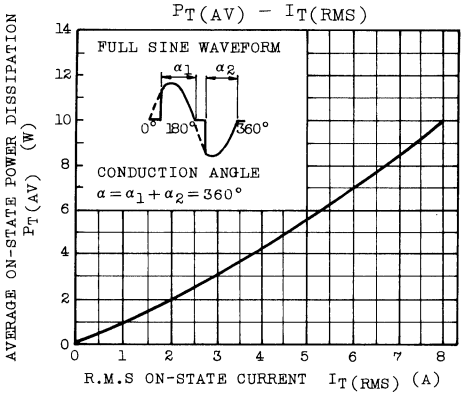
$V_{GT}(Tc)/V_{GT}(Tc=25℃) - Tc$ (TYPICAL)



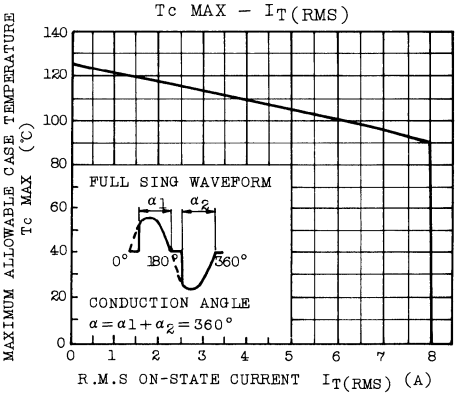
$I_{GT}(Tc)/I_{GT}(Tc=25℃) - Tc$ (TYPICAL)

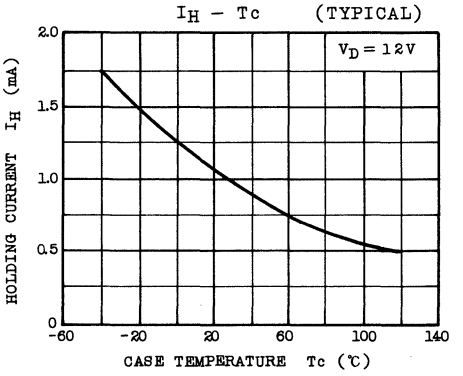


$P_{T(AV)} - I_{T(RMS)}$



Tc MAX - $I_{T(RMS)}$




I_H – Tc (TYPICAL)
V_D = 12V
HOLDING CURRENT I_H (mA)
2.0
1.5
1.0
0.5
0
-60
-20
20
60
100
140
CASE TEMPERATURE Tc (°C)

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

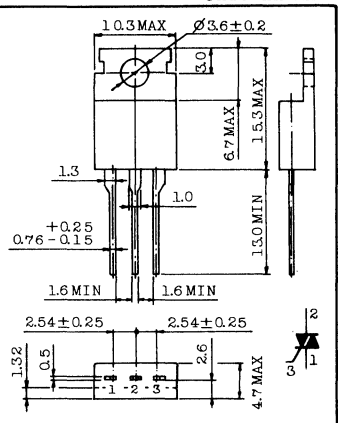
TOSHIBA BI-DIRECTIONAL TRIODE THYRISTOR
T2500B, T2500D, T2500M
SILICON DIFFUSED TYPE

AC POWER CONTROL APPLICATIONS

FEATURES:

- Repetitive Peak Off-State Voltage : V_{DRM}=200~600V
- R.M.S On-State Current : $I_{T(RMS)}$=6A
- 4 Tirgger Mode Guarantee
- High Commutating (dv/dt)

Unit in mm



1. T1
2. T2 (HEAT SINK)
3. GATE

JEDEC	TO-220AB
EIAJ	-
TOSHIBA	13-10E1A

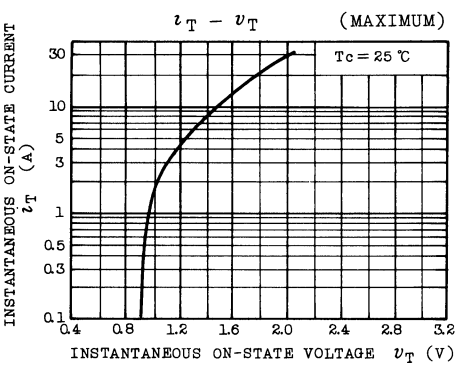
Weight : 1.8g

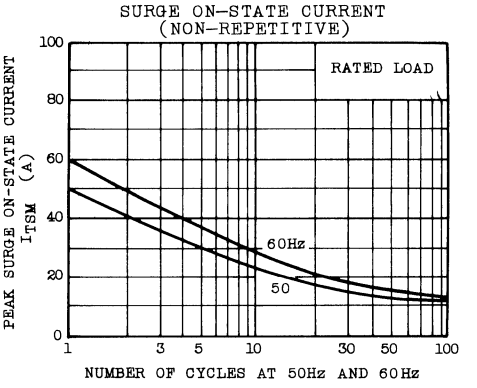
MAXIMUM RATINGS

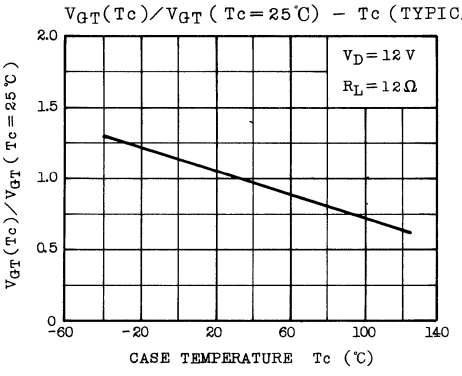
CHARACTERISTIC		SYMBOL	RATING	UNIT
Repetitive Peak Off-State Voltage	T2500B	V_{DRM}	200	V
	T2500D		400	
	T2500M		600	
R.M.S On-State Current (Full Sine Waveform Tc=80°C)		$I_{T(RMS)}$	6	A
Peak One Cycle Surge On-State Current (Non-Repetitive)		I_{TSM}	50(50Hz)	A
			60(60Hz)	
I^2t Limit Value (t=1~10ms)		I^2t	18	A^2s
Peak Gate Power Dissipation		P_{GM}	16	W
Average Gate Power Dissipation		$P_{G(AV)}$	0.2	W
Peak Gate Voltage		V_{GM}	10	V
Peak Gate Current		I_{GM}	4	A
Junction Temperature		T_j	-40~100	°C
Storage Temperature Range		T_{stg}	-40~150	°C

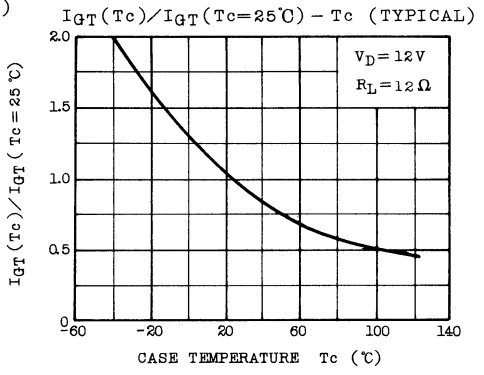
ELECTRICAL CHARACTERISTICS (Ta=25°C)

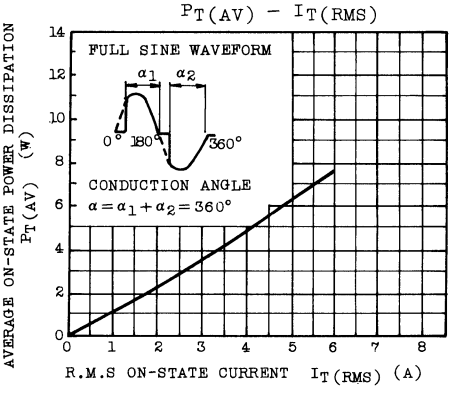
CHARACTERISTIC		SYMBOL	TEST CONDITION		MIN.	MAX.	UNIT
Repetitive Peak Off-State Current		I_{DRM}	V_{DRM}=Rated V_{DRM}, Tj=100°C		-	2	mA
Gate Trigger Voltage	I	V_{GT}	V_D=12V, R_L=12Ω	T2(+), Gate(+)	-	2.5	V
	II			T2(+), Gate(-)	-	2.5	
	III			T2(-), Gate(-)	-	2.5	
	IV			T2(-), Gate(+)	-	2.5	
Gate Trigger Current	I	I_{GT}		T2(+), Gate(+)	-	25	mA
	II			T2(+), Gate(-)	-	60	
	III			T2(-), Gate(-)	-	25	
	IV			T2(-), Gate(+)	-	60	
Peak On-State Voltage		V_{TM}	I_{TM}=30A		-	2	V
Gate Non-Trigger Voltage		V_{GD}	V_D=Rated V_{DRM}, Tc=100°C		0.2	-	V
Holding Current		I_H	V_D=12V, Gate open		-	30	mA
Critical Rate of Rise of Off-State Voltage		dv/dt	V_D=Rated V_{DRM}, Tc=100°C Exponential Rise		100	-	V/μs
Thermal Resistance		$R_{th(j-c)}$	Junction to case, AC		-	2.7	°C/W
Critical Rate of Rise of Off-State Voltage at Commutation		(dv/dt)c	V_D=Rated V_{DRM}, Tc=80°C (di/dt)c=-3.2A/ms		4	-	V/μs

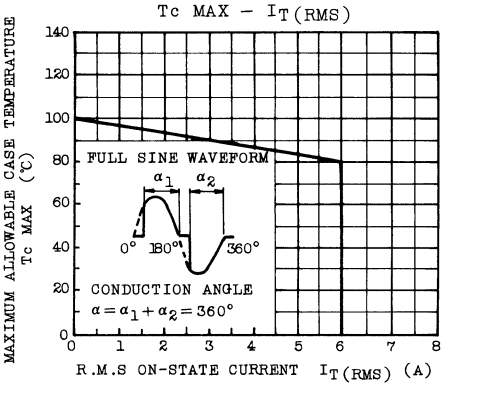

$i_T - v_T$ (MAXIMUM)
Tc = 25 ℃
INSTANTANEOUS ON-STATE CURRENT i_T (A)
INSTANTANEOUS ON-STATE VOLTAGE v_T (V)


SURGE ON-STATE CURRENT
(NON-REPETITIVE)
RATED LOAD
60Hz
50
PEAK SURGE ON-STATE CURRENT I_{TSM} (A)
NUMBER OF CYCLES AT 50Hz AND 60Hz

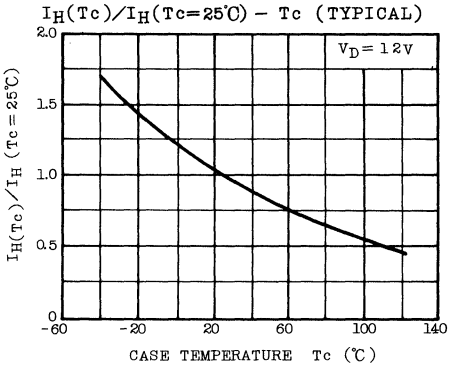

$V_{GT}(Tc)/V_{GT}(Tc=25℃)$ – Tc (TYPICAL)
V_D = 12 V
R_L = 12 Ω
$V_{GT}(Tc)/V_{GT}(Tc=25℃)$
CASE TEMPERATURE Tc (℃)


$I_{GT}(Tc)/I_{GT}(Tc=25℃)$ – Tc (TYPICAL)
V_D = 12 V
R_L = 12 Ω
$I_{GT}(Tc)/I_{GT}(Tc=25℃)$
CASE TEMPERATURE Tc (℃)


$P_{T(AV)}$ – $I_{T(RMS)}$
FULL SINE WAVEFORM
α_1 α_2
0° 180° 360°
CONDUCTION ANGLE
$\alpha = \alpha_1 + \alpha_2 = 360°$
AVERAGE ON-STATE POWER DISSIPATION $P_{T(AV)}$ (W)
R.M.S ON-STATE CURRENT $I_{T(RMS)}$ (A)


Tc MAX – $I_{T(RMS)}$
FULL SINE WAVEFORM
α_1 α_2
0° 180° 360°
CONDUCTION ANGLE
$\alpha = \alpha_1 + \alpha_2 = 360°$
MAXIMUM ALLOWABLE CASE TEMPERATURE Tc MAX (℃)
R.M.S ON-STATE CURRENT $I_{T(RMS)}$ (A)

$I_H(Tc)/I_H(Tc=25℃)$ – Tc (TYPICAL)

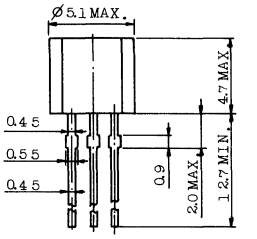


TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA BI-DIRECTIONAL TRIODE THYRISTOR
MAC94A-4, MAC94A-6
SILICON DIFFUSED TYPE

AC POWER CONTROL APPLICATIONS.

Unit in mm



1. T_1
2. GATE
3. T_2

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	13-5A1E

Weight : 0.2g

FEATURES:

- Repetitive Peak Off-State Voltage : V_{DRM}=200, 400V
- R.M.S On-State Current : $I_{T(RMS)}$=0.8A
- 4 Trigger Mode Guarantee
- High Commutating (dv/dt)

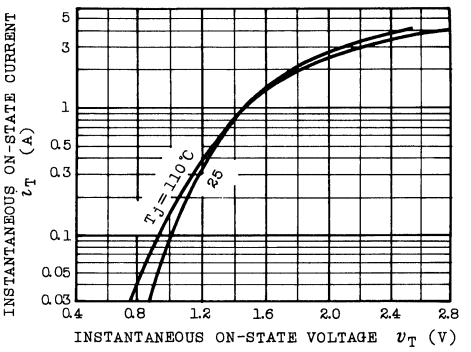
MAXIMUM RATINGS

CHARACTERISTIC		SYMBOL	RATING	UNIT
Repetitive Peak Off-State Voltage	MAC94A-4	V_{DRM}	200	V
	MAC94A-6		400	
R.M.S On-State Current (Full Sine Waveform Tc=60°C)		$I_{T(RMS)}$	0.8	A
Peak One Cycle Surge On-State Current (Non-Repetitive)		I_{TSM}	7.3(50Hz)	A
			8 (60Hz)	
I^2t Limit Value (t=1~10ms)		I^2t	0.26	A^2s
Peak Gate Power Dissipation		P_{GM}	5	W
Average Gate Power Dissipation		$P_{G(AV)}$	0.1	W
Peak Gate Voltage		V_{GM}	5	V
Peak Gate Current		I_{GM}	1	A
Junction Temperature		Tj	-40~110	°C
Storage Temperature Range		Tstg	-40~150	°C

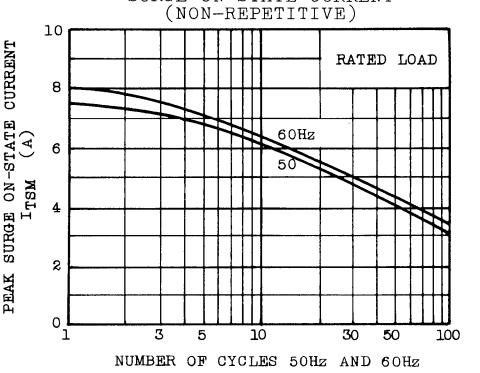
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION		MIN.	MAX.	UNIT
Repetitive Peak Off-State Current		I_{DRM}	V_{DRM}=Rated V_{DRM}, Tj=110°C		-	0.5	mA
Gate Trigger Voltage	I	V_{GT}	V_D=12V, R_L=100Ω	T2(+), Gate(+)	-	2	V
	II			T2(+), Gate(-)	-	2	
	III			T2(-), Gate(-)	-	2	
	IV			T2(-), Gate(+)	-	2.5	
Gate Trigger Current	I	I_{GT}		T2(+), Gate(+)	-	10	mA
	II			T2(+), Gate(-)	-	10	
	III			T2(-), Gate(-)	-	10	
	IV			T2(-), Gate(+)	-	10	
Peak On-State Voltage		V_{TM}	I_{TM}=1.12A		-	1.5	V
Gate Non-Trigger Voltage		V_{GD}	V_D=Rated V_{DRM}, Tj=110°C		0.2	-	V
Holding Current		I_H	V_D=12V, Gate open		-	20	mA
Critical Rate of Rise of Off-State Voltage		dv/dt	V_D=Rated V_{DRM}, Tc=110°C Exponential Rise		5	-	V/μs
Critical Rate of Rise of Off-State Voltage at Commutation		(dv/dt)c	V_D=Rated V_{DRM}, Tc=60°C (di/dt)c=-0.43A/ms		2	-	V/μs
Thermal Resistance		$R_{th(j-c)}$	Junction to Case		-	75	°C/W
Thermal Resistance		$R_{th(j-a)}$	Junction to Ambient		-	200	°C/W

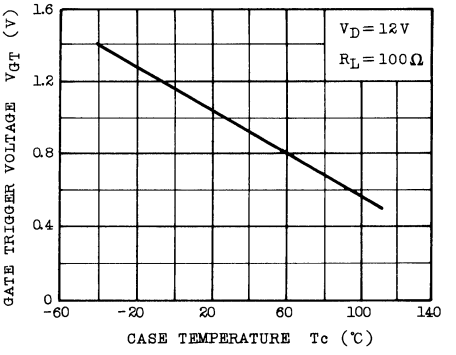
$i_T - v_T$



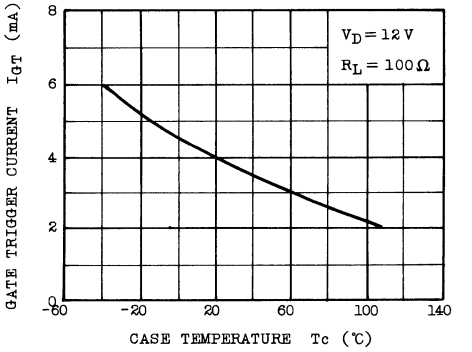
SURGE ON-STATE CURRENT
(NON-REPETITIVE)



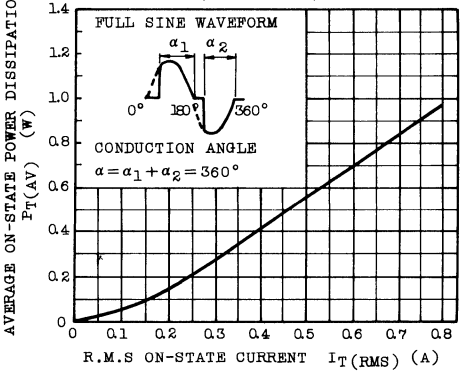
V_{GT} - Tc (TYPICAL)



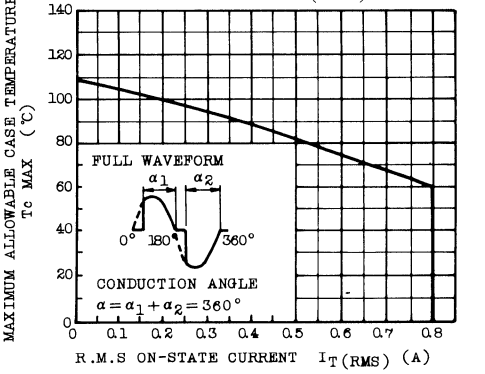
I_{GT} - Tc (TYPICAL)



$P_{T(AV)}$ - $I_{T(RMS)}$

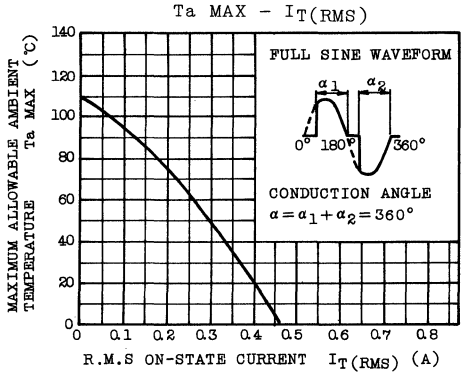


Tc MAX - $I_{T(RMS)}$

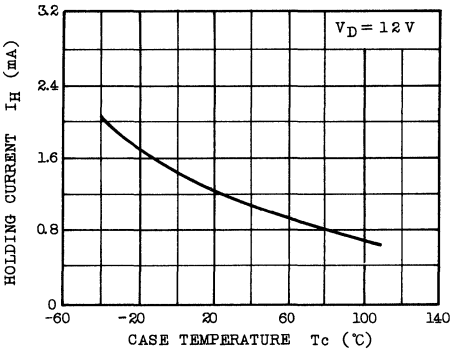


TOSHIBA CORPORATION

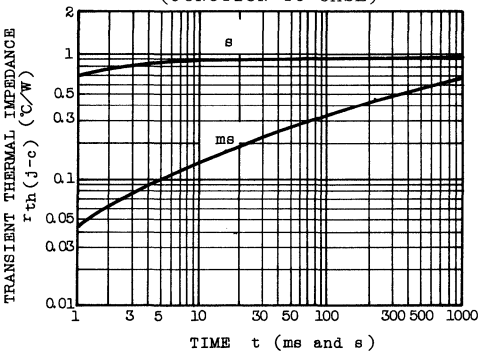
Ta MAX - $I_{T(RMS)}$



I_H - Tc (TYPICAL)



TRANSIENT THERMAL IMPEDANCE (JUNCTION TO CASE)



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA BI-DIRECTIONAL TRIODE THYRISTOR

MAC95-4, MAC95-6

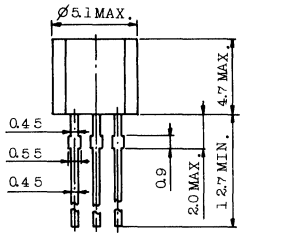
SILICON DIFFUSED TYPE

AC POWER CONTROL APPLICATIONS.

FEATURES:

- Repetitive Peak Off-State Voltage : V_{DRM}=200, 400V
- R.M.S On-State Current : $I_{T(RMS)}$=0.8A
- High Commutating (dv/dt)
- High Sensitivity Type

Unit in mm



1. T_1
2. GATE
3. T_2

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	13-5A1E

Weight : 0.2g

MAXIMUM RATINGS

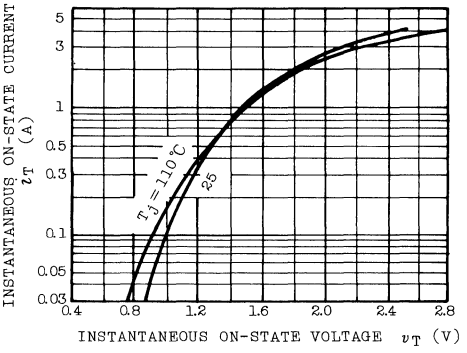
CHARACTERISTIC		SYMBOL	RATING	UNIT
Repetitive Peak Off-State Voltage	MAC95-4	V_{DRM}	200	V
	MAC95-6		400	
R.M.S On-State Current (Full Sine Waveform Tc=60°C)		$I_{T(RMS)}$	0.8	A
Peak One Cycle Surge On-State Current (Non-Repetitive)		I_{TSM}	7.3(50Hz)	A
			8 (60Hz)	
I^2t Limit Value (t=1~10ms)		I^2t	0.26	A^2s
Peak Gate Power Dissipation		P_{GM}	5	W
Average Gate Power Dissipation		$P_{G(AV)}$	0.1	W
Peak Gate Voltage		V_{GM}	5	V
Peak Gate Current		I_{GM}	1	A
Junction Temperature		Tj	-40~110	°C
Storage Temperature Range		Tstg	-40~150	°C

TOSHIBA CORPORATION

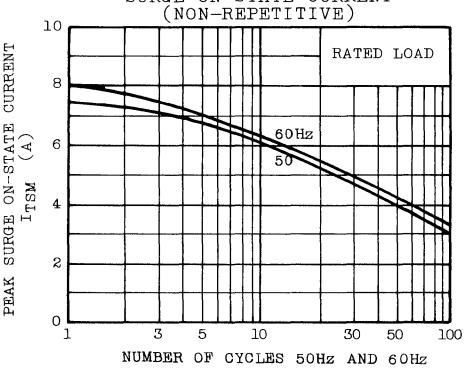
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION		MIN.	MAX.	UNIT
Repetitive Peak Off-State Current		I_{DRM}	V_{DRM}=Rated V_{DRM}, Tj=110°C		-	0.5	mA
Gate Trigger Voltage	I	V_{GT}	V_D=12V, R_L=100Ω	T2(+), Gate(+)	-	2	V
	II			T2(+), Gate(-)	-	2	
	III			T2(-), Gate(-)	-	2	
Gate Trigger Current	I	I_{GT}		T2(+), Gate(+)	-	5	mA
	II			T2(+), Gate(-)	-	5	
	III			T2(-), Gate(-)	-	5	
Peak On-State Voltage		V_{TM}	I_{TM}=1.12A		-	1.5	V
Gate Non-Trigger Voltage		V_{GD}	V_D=Rated V_{DRM}, Tj=110°C		0.2	-	V
Holding Current		I_H	V_D=12V, Gate open		-	20	mA
Critical Rate of Rise of Off-State Voltage		dv/dt	V_D=Rated V_{DRM}, Tc=110°C Exponential Rise		5	-	V/μs
Critical Rate of Rise of Off-State Voltage at Commutation		(dv/dt)c	V_D=Rated V_{DRM}, Tc=60°C (di/dt)c=-0.43A/ms		2	-	V/μs
Thermal Resistance		$R_{th(j-c)}$	Junction to Case		-	75	°C/W
Thermal Resistance		$R_{th(j-a)}$	Junction to Ambient		-	200	°C/W

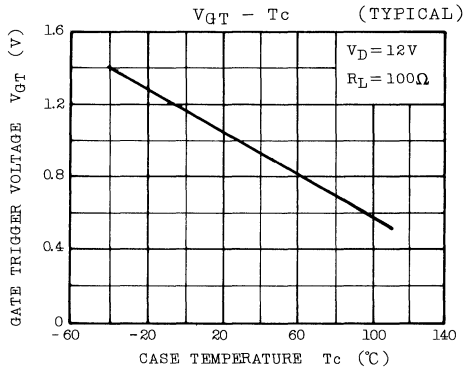
$i_T - v_T$



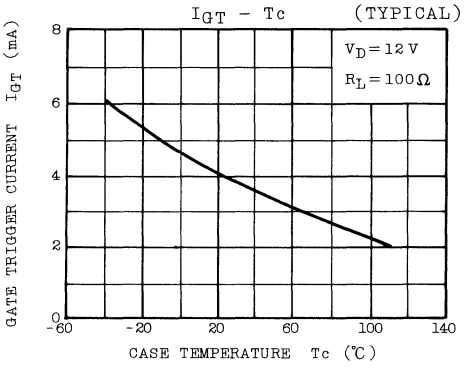
SURGE ON-STATE CURRENT
(NON-REPETITIVE)



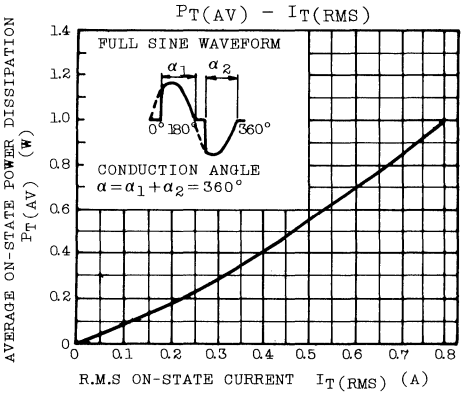
V_{GT} - Tc (TYPICAL)



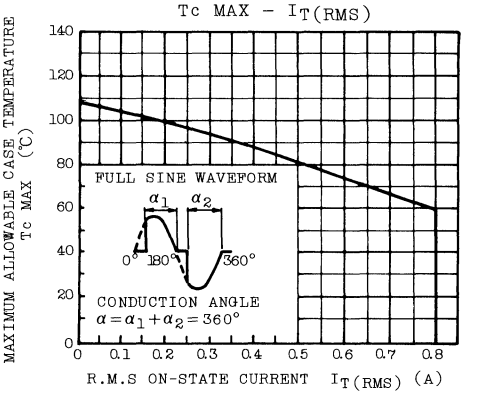
I_{GT} - Tc (TYPICAL)



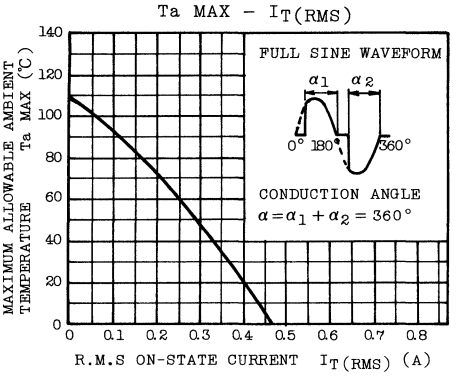
$P_{T(AV)}$ - $I_{T(RMS)}$



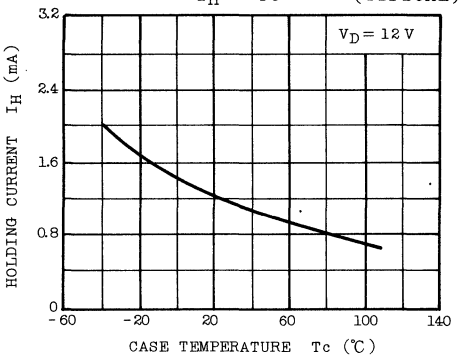
Tc MAX - $I_{T(RMS)}$



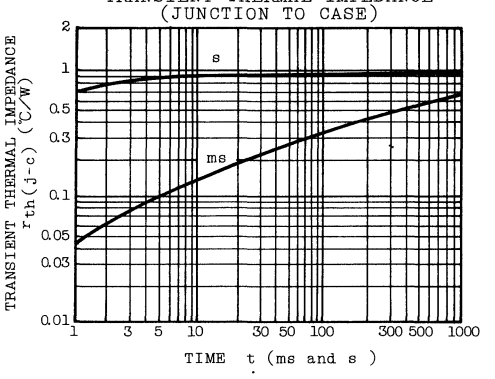
Ta MAX - $I_{T(RMS)}$



I_H - Tc (TYPICAL)



TRANSIENT THERMAL IMPEDANCE (JUNCTION TO CASE)



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA BI-DIRECTIONAL TRIODE THYRISTOR

MAC515-4, MAC515-6, MAC515-8

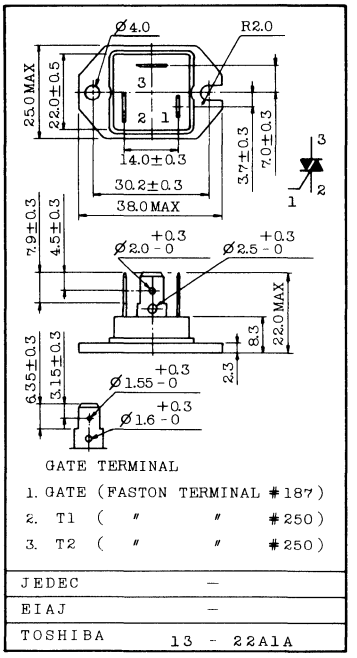
SILICON DIFFUSED TYPE

AC POWER CONTROL APPLICATIONS

FEATURES:

- Internally Isolated Type
- Repetitive Peak Off-State Voltage : V_{DRM}=200~600V
- R.M.S On-State Current : $I_{T(RMS)}$=15A
- Isolation Voltage : V_{ISOL}=2500V AC
- Recognized Under the Compornent Program of Underwrites Laboratries Inc. (UL File No. E87989)

Unit in mm



Weight : 21g

MAXIMUM RATINGS

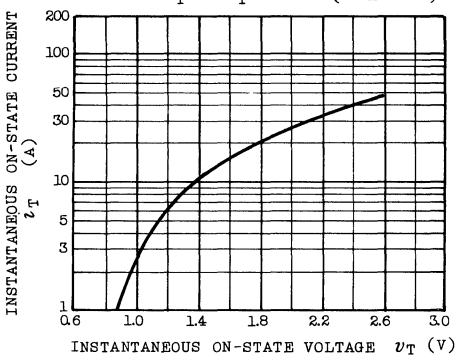
CHARACTERISTIC		SYMBOL	RATING	UNIT
Repetitive Peak Off-State Voltage	MAC515-4	V_{DRM}	200	V
	MAC515-6		400	
	MAC515-8		600	
R.M.S On-State Current (Full Sine Waveform Tc=80°C)		$I_{T(RMS)}$	15	A
Peak One Cycle Surge On-State Current (Non-Repetitive)		I_{TSM}	140(50Hz)	A
			150(60Hz)	
I^2t Limit Value (t=1~10ms)		I^2t	110	A^2s
Peak Gate Power Dissipation		P_{GM}	20	W
Average Gate Power Dissipation		$P_{G(AV)}$	0.5	W
Peak Gate Voltage		V_{GM}	10	V
Peak Gate Current		I_{GM}	2	A
Junction Temperature		T_j	-40~125	°C
Storage Temperature Range		T_{stg}	-40~150	°C
Isolation Voltage(AC, t=1 min.)		V_{ISOL}	2500	V

ELECTRICAL CHARACTERISTICS (Ta=25°C)

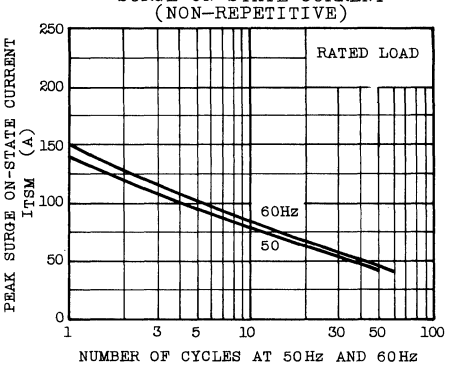
CHARACTERISTIC		SYMBOL	TEST CONDITION		MIN.	MAX.	UNIT
Repetitive Peak Off-State Current		I_{DRM}	V_{DRM}=Rated V_{DRM}	Tc=125°C	-	2	mA
				Tc=25°C	-	0.1	μA
Gate Trigger Voltage	I	V_{GT}	V_D=12V, R_L=100Ω	T2(+), Gate(+)	-	2	V
	II			T2(+), Gate(-)	-	2	
	III			T2(-), Gate(-)	-	2	
Gate Trigger Current	I	I_{GT}		T2(+), Gate(+)	-	50	mA
	II			T2(+), Gate(-)	-	50	
	III			T2(-), Gate(-)	-	50	
Peak On-State Voltage		V_{TM}	I_{TM}=21A		-	1.8	V
Gate Non-Trigger Voltage		V_{GD}	V_D=Rated V_{DRM}, Tc=125°C		0.2	-	V
Holding Current		I_H	V_D=12V, Gate open		-	40	mA
Thermal Resistance		$R_{th(j-c)}$	Junction to case, AC		-	2	°C/W
Critical Rate of Rise of Off-State Voltage at Commutation		(dv/dt)c	Tc=100°C, V_D=Rated V_{DRM}, -di/dt=-8A/ms		5	-	V/μs

TOSHIBA CORPORATION

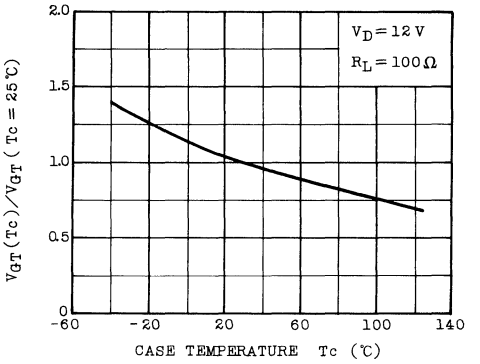
$i_T - v_T$ (MAXIMUM)



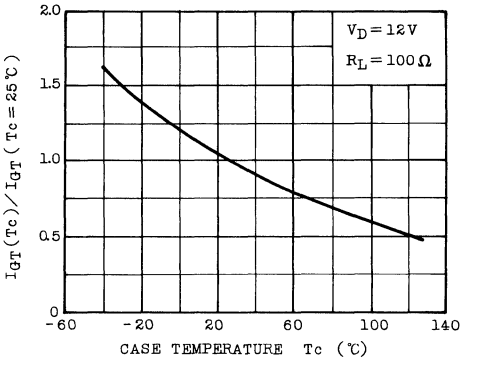
SURGE ON-STATE CURRENT (NON-REPETITIVE)



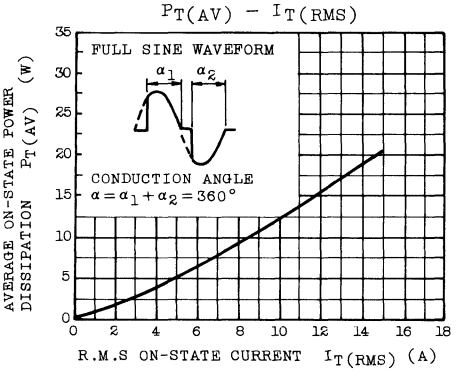
$V_{GT}(Tc)/V_{GT}(Tc=25°C) - Tc$ (TYPICAL)



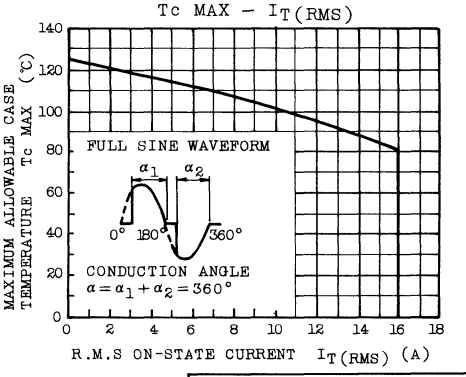
$I_{GT}(Tc)/I_{GT}(Tc=25°C) - Tc$ (TYPICAL)



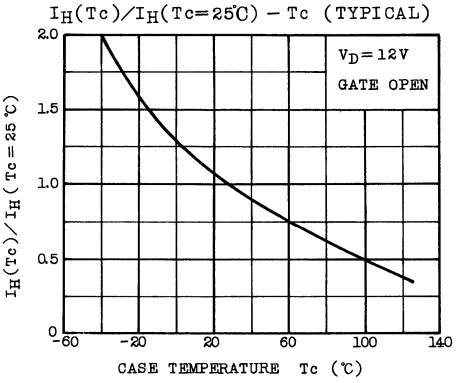
$P_{T(AV)} - I_{T(RMS)}$



Tc MAX - $I_{T(RMS)}$



TOSHIBA CORPORATION


$I_H(Tc)/I_H(Tc=25℃)$ – Tc (TYPICAL)
V_D = 12V
GATE OPEN
$I_H(Tc)/I_H(Tc=25℃)$
2.0
1.5
1.0
0.5
0
-60
-20
20
60
100
140
CASE TEMPERATURE Tc (℃)

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

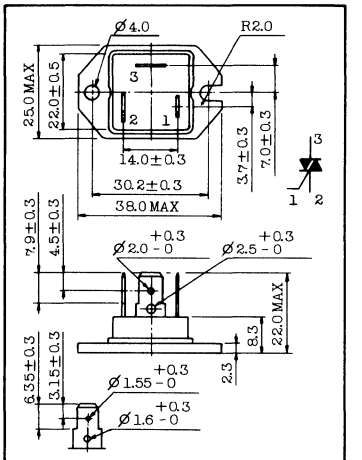
TOSHIBA BI-DIRECTIONAL TRIODE THYRISTOR
MAC525-4, MAC525-6, MAC525-8
SILICON DIFFUSED TYPE

AC POWER CONTROL APPLICATIONS

FEATURES:

- Internally Isolated Type
- Repetitive Peak Off-State Voltage : V_{DRM}=200~600V
- R.M.S On-State Current : $I_{T(RMS)}$=25A
- Isolation Voltage : V_{ISOL}=2500V AC
- Recognized Under the Component Program of Underwrites Laboratries Inc. (UL File No. E87989)

Unit in mm



Weight : 21g

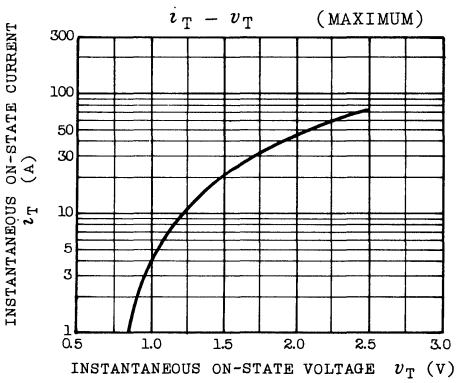
MAXIMUM RATINGS

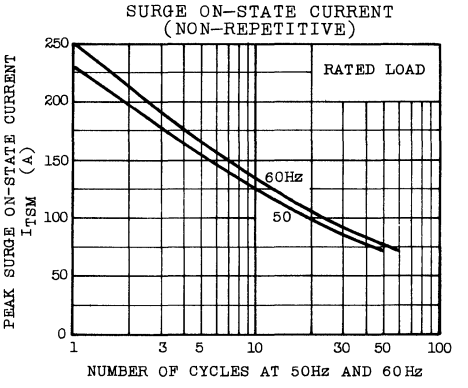
CHARACTERISTIC		SYMBOL	RATING	UNIT
Repetitive Peak Off-State Voltage	MAC525-4	V_{DRM}	200	V
	MAC525-6		400	
	MAC525-8		600	
R.M.S On-State Current (Full Sine Waveform Tc=80°C)		$I_{T(RMS)}$	25	A
Peak One Cycle Surge On-State Current (Non-Repetitive)		I_{TSM}	230(50Hz)	A
			250(60Hz)	
I^2t Limit Value (t=1~10ms)		I^2t	260	A^2s
Peak Gate Power Dissipation		P_{GM}	20	W
Average Gate Power Dissipation		$P_{G(AV)}$	0.5	W
Peak Gate Voltage		V_{GM}	10	V
Peak Gate Current		I_{GM}	2	A
Junction Temperature		T_j	-40~125	°C
Storage Temperature Range		T_{stg}	-40~150	°C
Isolation Voltage(AC, t=1 min.)		V_{ISOL}	2500	V

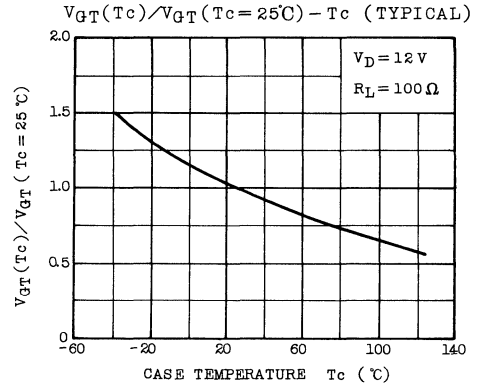
ELECTRICAL CHARACTERISTICS (Ta=25°C)

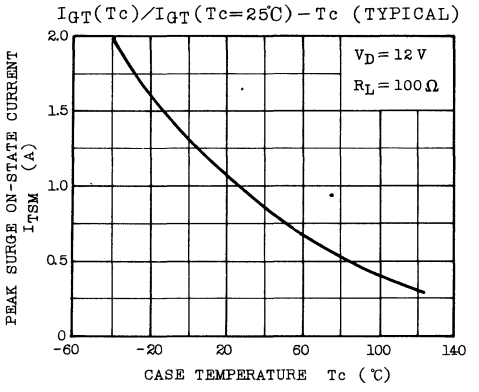
CHARACTERISTIC		SYMBOL	TEST CONDITION		MIN.	MAX.	UNIT
Repetitive Peak Off-State Current		I_{DRM}	V_{DRM}=Rated V_{DRM}	Tc=125°C	-	2	mA
				Tc=25°C	-	0.1	μA
Gate Trigger Voltage	I	V_{GT}	V_D=12V, R_L=100Ω	T2(+), Gate(+)	-	2	V
	II			T2(+), Gate(-)	-	2	
	III			T2(-), Gate(-)	-	2	
Gate Trigger Current	I	I_{GT}		T2(+), Gate(+)	-	50	mA
	II			T2(+), Gate(-)	-	50	
	III			T2(-), Gate(-)	-	50	
Peak On-State Voltage		V_{TM}	I_{TM}=35A		-	1.75	V
Gate Non-Trigger Voltage		V_{GD}	V_D=Rated V_{DRM}, Tc=125°C		0.2	-	V
Holding Current		I_H	V_D=12V, Gate open		-	50	mA
Thermal Resistance		$R_{th(j-c)}$	Junction to case, AC		-	1.5	°C/W
Critical Rate of Rise of Off-State Voltage at Commutation		(dv/dt)c	Tc=90°C, V_D=Rated V_{DRM}, -di/dt=-16A/ms		5	-	V/μs

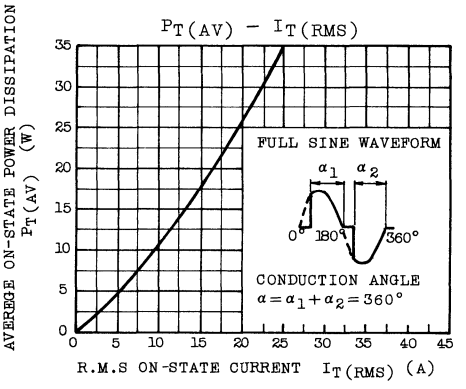
TOSHIBA CORPORATION

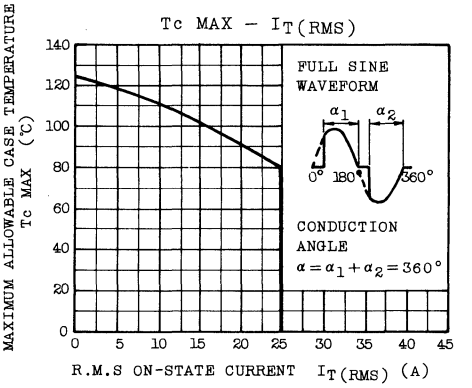

$i_T - v_T$ (MAXIMUM)
INSTANTANEOUS ON-STATE CURRENT i_T (A)
300
100
50
30
10
5
3
1
0.5
1.0
1.5
2.0
2.5
3.0
INSTANTANEOUS ON-STATE VOLTAGE v_T (V)

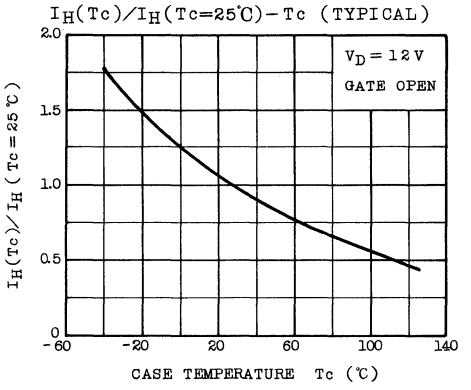

SURGE ON-STATE CURRENT
(NON-REPETITIVE)
PEAK SURGE ON-STATE CURRENT I_{TSM} (A)
250
200
150
100
50
0
RATED LOAD
60Hz
50
1
3
5
10
30
50
100
NUMBER OF CYCLES AT 50Hz AND 60Hz


$V_{GT}(Tc)/V_{GT}(Tc=25℃) - Tc$ (TYPICAL)
$V_{GT}(Tc)/V_{GT}(Tc=25℃)$
2.0
1.5
1.0
0.5
0
$V_D = 12$ V
$R_L = 100\,\Omega$
-60
-20
20
60
100
140
CASE TEMPERATURE Tc (℃)


$I_{GT}(Tc)/I_{GT}(Tc=25℃) - Tc$ (TYPICAL)
PEAK SURGE ON-STATE CURRENT I_{TSM} (A)
2.0
1.5
1.0
0.5
0
$V_D = 12$ V
$R_L = 100\,\Omega$
-60
-20
20
60
100
140
CASE TEMPERATURE Tc (℃)


$P_{T(AV)} - I_{T(RMS)}$
AVERAGE ON-STATE POWER DISSIPATION $P_{T(AV)}$ (W)
35
30
25
20
15
10
5
0
FULL SINE WAVEFORM
α_1
α_2
0°
180°
360°
CONDUCTION ANGLE
$\alpha = \alpha_1 + \alpha_2 = 360°$
0
5
10
15
20
25
30
35
40
45
R.M.S ON-STATE CURRENT $I_{T(RMS)}$ (A)


$Tc\ MAX - I_{T(RMS)}$
MAXIMUM ALLOWABLE CASE TEMPERATURE Tc MAX (℃)
140
120
100
80
60
40
20
0
FULL SINE WAVEFORM
α_1
α_2
0°
180°
360°
CONDUCTION ANGLE
$\alpha = \alpha_1 + \alpha_2 = 360°$
0
5
10
15
20
25
30
35
40
45
R.M.S ON-STATE CURRENT $I_{T(RMS)}$ (A)


$I_H(Tc)/I_H(Tc=25℃)-Tc$ (TYPICAL)
$V_D = 12V$
GATE OPEN
$I_H(Tc)/I_H(Tc=25℃)$
2.0
1.5
1.0
0.5
0
-60
-20
20
60
100
140
CASE TEMPERATURE Tc (℃)

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
YTS2221, YTS2222
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE
MIDIUM-SPEED SWITCHING AND AUDIO TO
VHF FREQUENCY APPLICATION

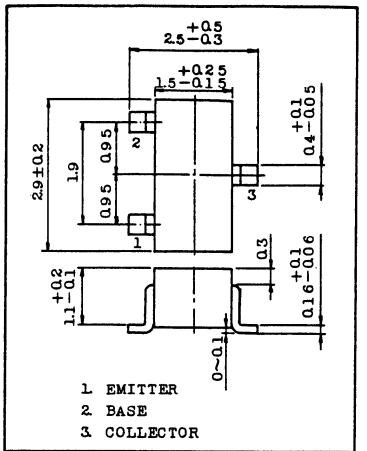
FEATURES:

. DC Current Gain Specified : 0.1~500mA

. Low Collector-Emitter Saturation Voltage
: $V_{CE(sat)}$=1.6V(Max.) @ I_C=500mA, I_B=50mA

. Complementary to YTS2906, YTS2907

Unit in mm



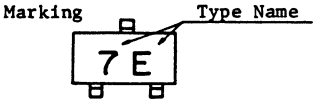
JEDEC	—
EIAJ	SC-59
TOSHIBA	2-3F1A

Weight : 0.012g

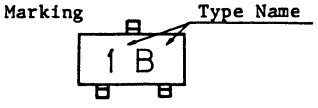
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	600	mA
Base Current	I_B	160	mA
Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	200	mW
		1.6	mW/°C
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-55 ~ 150	°C

YTS2221



YTS2222



TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C, Unless otherwise noted)

CHARACTERISTIC	SYMBOL	TEST CONDITION	YTS2221		YTS2222		UNIT
			MIN.	MAX.	MIN.	MAX.	
Collector Cut-off Current	I_{CBO}	V_{CB}=50V, I_E=0	-	10	-	10	nA
Collector Cut-off Current	I_{CBO}	V_{CB}=50V, I_E=0, Ta=150°C	-	10	-	10	μA
Emitter Cut-off Cu-rent	I_{EBO}	V_{EB}=3V, I_C=0	-	10	-	10	nA
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C=10μA, I_E=0	60	-	60	-	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=10mA, I_B=0	30	-	30	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=10μA, I_C=0	5	-	5	-	V
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=0.1mA	20	-	35	-	
		V_{CE}=10V, I_C=1.0mA	25	-	50	-	
		V_{CE}=10V, I_C=10mA	35	-	75	-	
		V_{CE}=10V, I_C=150mA	40	120	100	300	
		V_{CE}=10V, I_C=500mA	20	-	30	-	
		V_{CE}=1V, I_C=150mA	20	-	50	-	
		V_{CE}=10V, I_C=10mA Ta=-55°C	15	-	35	-	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=150mA, I_B=15mA	-	0.4	-	0.4	V
		I_C=500mA, I_B=50mA	-	1.6	-	1.6	
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	I_C=150mA, I_B=15mA	0.6	2.0	-	1.3	V
		I_C=500mA, I_B=50mA	-	2.6	-	2.6	
Transition Frequency	f_T	V_{CE}=20V, I_C=20mA, f=100MHz	250	-	250	-	MHz
Collector Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=100kHz	-	8.0	-	8.0	pF
Input Capacitance	C_{ib}	V_{EB}=0.5V, I_C=0, f=100kHz	-	30	-	30	pF

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
YTS2221A, YTS2222A
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PUROSE USE
MEDIUM-SPEED SWITCHING AND AUDIO TO
VHF FREQUENCY APPLICATION

FEATURES:

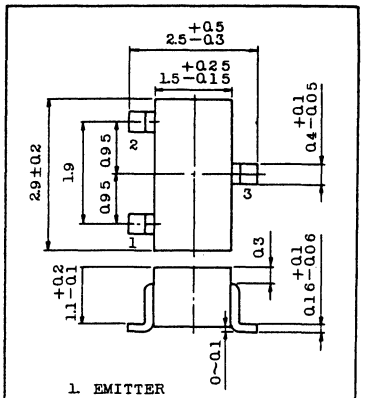
. DC Current Gain Specified : 0.1~500mA

. Low Collector-Emitter Saturation Voltage
: $V_{CE(sat)}$=1.0V(Max.) @ I_C=500mA, I_B=50mA

. High Transition Frequency
: @ I_C=20mA YTS2221A ; 250MHz(Min.)
YTS2222A ; 300MHz(Min.)

. Complementary to YTS2906A, YTS2907A.

Unit in mm



JEDEC	—
EIAJ	SC-59
TOSHIBA	2-3F1A

Weight : 0.012g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	75	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	600	mA
Base Current	I_B	160	mA
Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	200	mW
		1.6	mW/°C
Junction Temperature	Tj	150	°C
Storage Temperature Range	Tstg	-55 ~ 150	°C

YTS2221A
Marking Type Name
7 F

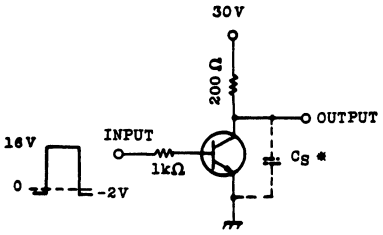
YTS2222A
Marking Type Name
1 P

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C, Unless otherwise noted)

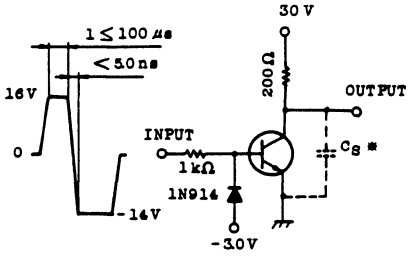
CHARACTERISTIC		SYMBOL	TEST CONDITION	YTS2221A		YTS2222A		UNIT
				MIN.	MAX.	MIN.	MAX.	
Collector Cut-off Current		I_{CBO}	V_{CB}=60V, I_E=0	-	10	-	10	nA
Collector Cut-off Current		I_{CBO}	V_{CB}=60V, I_E=0, Ta=150°C	-	10	-	10	μA
Collector Cut-off Current		I_{CEX}	V_{CE}=60V, V_{BE}=-3V	-	10	-	10	nA
Emitter Cut-off Current		I_{EBO}	V_{EB}=3.0V, I_C=0	-	10	-	10	nA
Base Cut-off Current		I_{BL}	V_{CE}=60V, V_{BE}=-3V	-	20	-	20	nA
Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=10μA, I_E=0	75	-	75	-	V
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=10mA, I_B=0	40	-	40	-	V
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=10μA, I_C=0	6.0	-	6.0	-	V
DC Current Gain		h_{FE}	V_{CE}=10V, I_C=0.1mA	20	-	35	-	
			V_{CE}=10V, I_C=1.0mA	25	-	50	-	
			V_{CE}=10V, I_C=10mA	35	-	75	-	
			V_{CE}=10V, I_C=150mA	40	120	100	300	
			V_{CE}=10V, I_C=500mA	25	-	40	-	
			V_{CE}=1V, I_C=150mA	20	-	50	-	
			V_{CE}=10V, I_C=10mA Ta=-55°C	15	-	35	-	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=150mA, I_B=15mA	-	0.3	-	0.3	V
			I_C=500mA, I_B=50mA	-	1.0	-	1.0	
Base-Emitter Saturation Voltage		$V_{BE(sat)}$	I_C=150mA, I_B=15mA	0.6	1.2	0.6	1.2	V
			I_C=500mA, I_B=50mA	-	2.0	-	2.0	
Transition Frequency		f_T	V_{CE}=20V, I_C=20mA, f=100MHz	250	-	300	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=10V, I_E=0, f=100kHz	-	8.0	-	8.0	pF
Input Capacitance		C_{ib}	V_{EB}=0.5V, I_C=0, f=100kHz	-	25	-	25	pF
Collector-Base Time Constant		C_c, r_{bb}'	V_{CB}=20V, I_E=20mA f=31.8MHz	-	150	-	150	pS
Noise Figure		NF	V_{CE}=10V, I_C=100μA R_S=1kΩ, f=1kHz	-	-	-	4.0	dB
Switching Time	Delay Time	t_d	V_{CC}=30V, $V_{BE(off)}$=-0.5V I_C=150mA, I_{B1}=15mA Fig.1	-	10	-	10	ns
	Rise Time	t_r		-	25	-	25	
	Storage Time	t_{stg}	V_{CC}=30V, I_C=150mA I_{B1}=-I_{B2}=15mA Fig.2	-	225	-	225	
	Fall Time	t_f		-	60	-	60	

Fig. 1 DELAY AND RISE TIME EQUIVALENT TEST CIRCUIT



P_W = 1 ~ 100 μs
DUTY CYCLE = 2.0 %

Fig. 2 STORAGE TIME AND FALL TIME EQUIVALENT TEST CIRCUIT



DUTY CYCLE = 2.0 %

SCOPE RISE TIME < 4ns

* C_S : TOTAL SHUNT CAPACITANCE

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
YTS2906, YTS2907
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR HIGH-SPEED SWITCHING USE
DC TO VHF AMPLIFIER APPLICATIONS AND
COMPLEMENTARY CIRCUITRY

FEATURES:

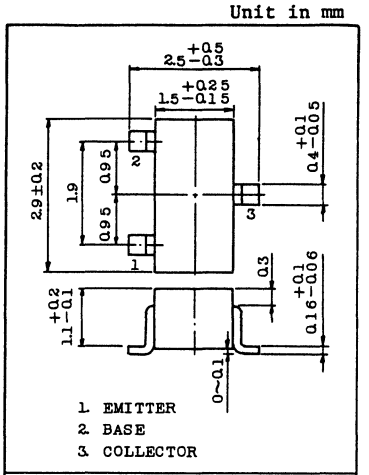
. High DC Current Gain Specified : -0.1~-500mA

. High Transition Frequency
: @ I_C=-50mA, f_T=200MHz(Min.)

. Low Collector-Emitter Saturation Voltage
: $V_{CE(sat)}$=-1.6V(Max.) @ I_C=-500mA, I_B=-50mA

. Complementary to YTS2221, YTS2222

Unit in mm



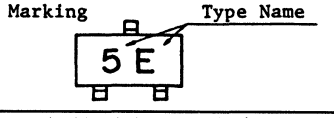
JEDEC	-
EIAJ	SC-59
TOSHIBA	2-3F1A

Weight : 0.012g

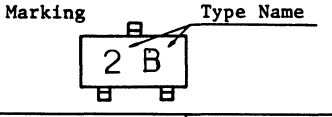
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	-60	V
Collector-Emitter Voltage	V_{CEO}	-40	V
Emitter-Base Voltage	V_{EBO}	-5	V
Collector Current	I_C	-600	mA
Base Current	I_B	-120	mA
Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	200	mW
		1.6	mW/°C
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-55~150	°C

YTS2906



YTS2907



TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C, Unless otherwise noted)

CHARACTERISTIC	SYMBOL	YEST CONDITION	YTS2906		YTS2907		UNIT
			MIN.	MAX.	MIN.	MAX.	
Collector Cut-off Current	I_{CBO}	V_{CB}=-50V, I_E=0	-	-20	-	-20	nA
Collector Cut-off Current	I_{CBO}	V_{CB}=-50V, I_E=0, Ta=150°C	-	-20	-	-20	μA
Collector Cut-off Current	I_{CEX}	V_{CE}=-30V, V_{BE}=0.5V	-	-50	-	-50	nA
Base Cut-off Current	I_{BL}	V_{CE}=-30V, V_{BE}=0.5V	-	-50	-	-50	nA
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C=-10μA, I_E=0	-60	-	-60	-	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=-10mA, I_B=0	-40	-	-40	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=-10μA, I_C=0	-5.0	-	-5.0	-	V
DC Current Gain	h_{FE}	V_{CE}=-10V, I_C=-0.1mA	20	-	35	-	
		V_{CE}=-10V, I_C=-1.0mA	25	-	50	-	
		V_{CE}=-10V, I_C=-10mA	35	-	75	-	
		V_{CE}=-10V, I_C=-150mA	40	120	100	300	
		V_{CE}=-10V, I_C=-500mA	20	-	30	-	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=-150mA, I_B=-15mA	-	-0.4	-	-0.4	V
		I_C=-500mA, I_B=-50mA	-	-1.6	-	-1.6	
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	I_C=-150mA, I_B=-15mA	-	-1.3	-	-1.3	V
		I_C=-500mA, I_B=-50mA	-	-2.6	-	-2.6	
Transition Frequency	f_T	V_{CE}=-20V, I_C=-50mA f=100MHz	200	-	200	-	MHz
Collector Output Capacitance	C_{ob}	V_{CB}=-10V, I_E=0, f=100kHz	-	8.0	-	8.0	pF
Input Capacitance	C_{ib}	V_{EB}=-2.0V, I_C=0 f=100kHz	-	30	-	30	pF

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
YTS2906A, YTS2907A
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR HIGH SPEED SWITCHING USE
DC TO VHF AMPLIFIER APPLICATIONS AND
COMPLEMENTARY CIRCUITRY

FEATURES:

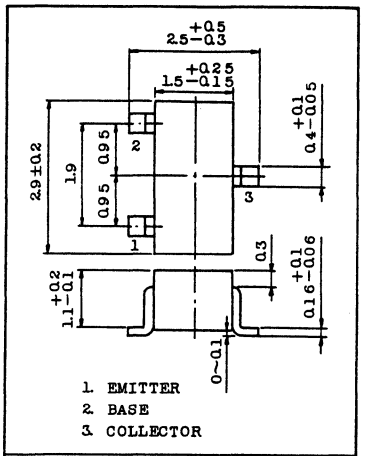
. High DC Current Gain Specified : -0.1~ -500mA

. High Transition Frequency
: @ I_C=-50mA, f_T=200MHz(Min.)

. Low Collector-Emitter Saturation Voltage
: $V_{CE(sat)}$=-1.6V(Max.) @ I_C=-500mA, I_B=-50mA

. Complementary to YTS2221A, YTS2222A

Unit in mm



JEDEC	—
EIAJ	SC-59
TOSHIBA	2-3F1A

Weight : 0.012g

MAXIMUM RATINGS (Ta=25°C)

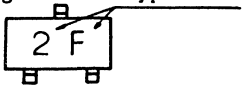
CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	-60	V
Collector-Emitter Voltage	V_{CEO}	-60	V
Emitter-Base Voltage	V_{EBO}	-5	V
Collector Current	I_C	-600	mA
Base Current	I_B	-120	mA
Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	200	mW
		1.6	mW/°C
Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	625	°C/W
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-55~150	°C

YTS2906A

Marking — Type Name

YTS2907A

Marking — Type Name



TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C, Unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CONDITION	YTS2906A		YTS2907A		UNIT
				MIN.	MAX.	MIN.	MAX.	
Collector Cut-off Current		I_{CBO}	V_{CB}=-50V, I_E=0	-	-10	-	-10	nA
Collector Cut-off Current		I_{CBO}	V_{CB}=-50V, I_E=0, Ta=150°C	-	-10	-	-10	μA
Collector Cut-off Current		I_{CEX}	V_{CE}=-30V, V_{BE}=0.5V	-	-50	-	-50	nA
Base Cut-off Current		I_{BL}	V_{CE}=-30V, V_{BE}=0.5V	-	-50	-	-50	nA
Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=-10μA, I_E=0	-60	-	-60	-	V
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-10mA, I_B=0	-60	-	-60	-	V
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=-10μA, I_C=0	-5.0	-	-5.0	-	V
DC Current Gain		h_{FE}	V_{CE}=-10V, I_C=-0.1mA	40	-	75	-	
			V_{CE}=-10V, I_C=-1.0mA	40	-	100	-	
			V_{CE}=-10V, I_C=-10mA	40	-	100	-	
			V_{CE}=-10V, I_C=-150mA	40	120	100	300	
			V_{CE}=-10V, I_C=-500mA	40	-	50	-	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=-150mA, I_B=-15mA	-	-0.4	-	-0.4	V
			I_C=-500mA, I_B=-50mA	-	-1.6	-	-1.6	
Base-Emitter Saturation Voltage		$V_{BE(sat)}$	I_C=-150mA, I_B=-15mA	-	-1.3	-	-1.3	V
			I_C=-500mA, I_B=-50mA	-	-2.6	-	-2.6	
Transition Frequency		f_T	V_{CE}=-20V, I_C=-50mA f=100MHz	200	-	200	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=-10V, I_E=0, f=100kHz	-	8.0	-	8.0	pF
Input Capacitance		C_{ib}	V_{BE}=-2.0V, I_C=0 f=100kHz	-	30	-	30	pF
Switching Time	Turn-on Time	t_{on}	V_{CC}=-30V, I_C=-150mA	-	45	-	45	ns
	Delay Time	t_d	I_{B1}=-15mA	-	10	-	10	
	Rise Time	t_r	Fig. 1	-	40	-	40	
	Turn-off Time	t_{off}	V_{CC}=-6.0V, I_C=-150mA	-	100	-	100	
	Storage Time	t_{stg}	-I_{B1}=I_{B2}=-15mA	-	80	-	80	
	Fall Time	t_f	Fig. 2	-	30	-	30	

Fig. 1 DELAY AND RISE TIME TEST CIRCUIT

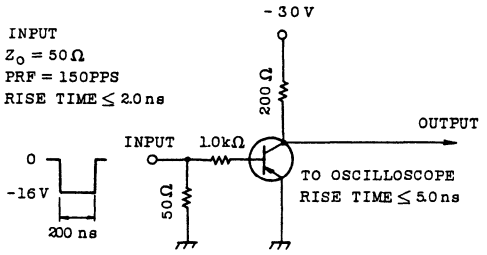
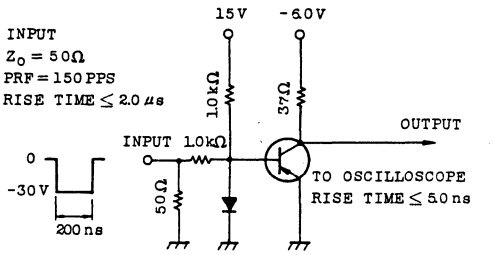


Fig. 2 STORAGE AND FALL TIME TEST CIRCUIT



TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
YTS3903
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

. Low Leakage Current
: I_{CEV}=50nA(Max.), I_{EBV}=-50nA(Max.)
@ V_{CE}=30V, V_{BE}=-3V

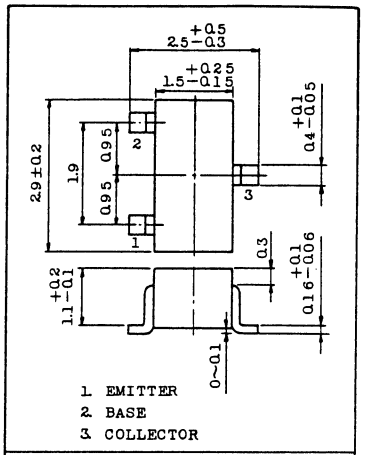
. Excellent DC Current Gain Linearity

. Low Saturation Voltage
: $V_{CE(sat)}$=0.3V(Max.) @ I_C=50mA, I_B=5mA

. Low Collector Output Capacitance
: C_{ob}=4pF(Max.) @ V_{CB}=5V

. Complementary to YTS3905

Unit in mm

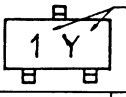


JEDEC	—
EIAJ	SC-59
TOSHIBA	2-3F1A

MAXIMUM RATINGS (Ta=25°C)

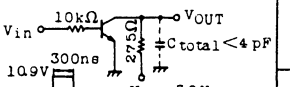
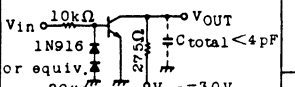
CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	200	mA
Base Current	I_B	50	mA
Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	200	mW
		1.6	mW/°C
Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	625	°C/W
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-55 ~ 150	°C

Marking



Type Name

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current		I_{CEV}	V_{CE}=30V, V_{BE}=-3V	-	-	50	nA
Base Cut-off Current		I_{BEV}	V_{CE}=30V, V_{BE}=-3V	-	-	-50	nA
Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=10μA, I_E=0	60	-	-	V
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=1mA, I_B=0	40	-	-	V
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=10μA, I_C=0	6	-	-	V
DC Current Gain		$h_{FE(1)}$	V_{CE}=1V, I_C=0.1mA	20	-	-	
		$h_{FE(2)}$	V_{CE}=1V, I_C=1mA	35	-	-	
		$h_{FE(3)}$	V_{CE}=1V, I_C=10mA	50	-	150	
		$h_{FE(4)}$	V_{CE}=1V, I_C=50mA	30	-	-	
		$h_{FE(5)}$	V_{CE}=1V, I_C=100mA	15	-	-	
Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=10mA, I_B=1mA	-	-	0.2	V
		$V_{CE(sat)2}$	I_C=50mA, I_B=5mA	-	-	0.3	
Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=10mA, I_B=1mA	0.65	-	0.85	V
		$V_{BE(sat)2}$	I_C=50mA, I_B=5mA	-	-	0.95	
Transition Frequency		f_T	V_{CE}=20V, I_C=10mA f=100MHz	250	-	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=5V, I_E=0, f=1MHz	-	-	4	pF
Input Capacitance		C_{ib}	V_{EB}=0.5V, I_C=0, f=1MHz	-	-	8	pF
Input Impedance		h_{ie}	V_{CE}=10V, I_C=1mA f=1kHz	0.5	-	8	kΩ
Voltage Feedback Ratio		h_{re}		0.1	-	5	×10-4
Small-Signal Current Gain		h_{fe}		50	-	200	
Collector Output Admittance		h_{oe}		1	-	40	μS
Noise Figure		NF	V_{CE}=-5V, I_C=0.1mA R_g=1kΩ, f=10Hz ~ 15.7kHz	-	-	6	dB
Switching Time	Delay Time	t_d		-	-	35	ns
	Rise Time	t_r		-	-	35	
	Storage Time	t_{stg}		-	-	175	
	Fall Time	t_f		-	-	50	

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
YTS3904
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

. Low Leakage Current
: I_{CEV}=50nA(Max.), I_{BEV}=50nA(Max.)
@ V_{CE}=30V, V_{BE}=3V

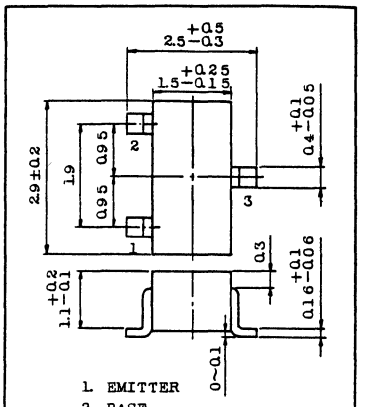
. Excellent DC Current Gain Linearity

. Low Saturation Voltage
: $V_{CE(sat)}$=0.3V(Max.) @ I_C=50mA, I_B=5mA

. Low Collector Output Capacitance
: C_{ob}=4pF(Max.) @ V_{CB}=5V

. Complementare to YTS3906

Unit in mm



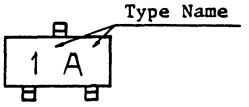
JEDEC	—
EIAJ	SC-59
TOSHIBA	2-3F1A

Weight : 0.012g

MAXIMUM RATINGS (Ta=25°C)

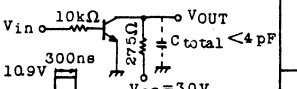
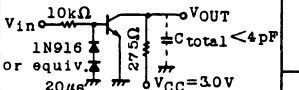
CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	200	mA
Base Current	I_B	50	mA
Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	625	mW
		1.6	mW/°C
Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	625	°C/W
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	-55 ~ 150	°C

Marking



TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current		I_{CEV}	V_{CE}=30V, V_{BE}=-3V	-	-	50	nA
Base Cut-off Current		I_{BEV}	V_{CE}=30V, V_{BE}=-3V	-	-	-50	nA
Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=10μA, I_E=0	60	-	-	V
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=1mA, I_B=0	40	-	-	V
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=10μA, I_C=0	6	-	-	V
DC Current Gain		$h_{FE(1)}$	V_{CE}=1V, I_C=0.1mA	40	-	-	
		$h_{FE(2)}$	V_{CE}=1V, I_C=1mA	70	-	-	
		$h_{FE(3)}$	V_{CE}=1V, I_C=10mA	100	-	300	
		$h_{FE(4)}$	V_{CE}=1V, I_C=50mA	60	-	-	
		$h_{FE(5)}$	V_{CE}=1V, I_C=100mA	30	-	-	
Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=10mA, I_B=1mA	-	-	0.2	V
		$V_{CE(sat)2}$	I_C=50mA, I_B=5mA	-	-	0.3	
Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=10mA, I_B=1mA	0.65	-	0.85	V
		$V_{BE(sat)2}$	I_C=50mA, I_B=5mA	-	-	0.95	
Transition Frequency		f_T	V_{CE}=20V, I_C=10mA f=100MHz	300	-	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=5V, I_E=0, f=1MHz	-	-	4	pF
Input Capacitance		C_{ib}	V_{EB}=0.5V, I_C=0, f=1MHz	-	-	8	pF
Input Impedance		h_{ie}	V_{CE}=10V, I_C=1mA f=1kHz	1.0	-	10	kΩ
Voltage Feedback Ratio		h_{re}		0.5	-	8	×10-4
Small-Signal Current Gain		h_{fe}		100	-	400	
Collector Output Admittance		h_{oe}		1.0	-	40	μS
Noise Figure		NF	V_{CE}=5V, I_C=0.1mA R_g=1kΩ, f=10Hz~15.7kHz	-	-	5	dB
Switching Time	Delay Time	t_d		-	-	35	ns
	Rise Time	t_r		-	-	35	
	Storage Time	t_{stg}		-	-	200	
	Fall Time	t_f		-	-	50	

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
YTS3905
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

. Low Leakage Current
: I_{CEV}=-50nA(Max.), I_{BEV}=-50nA(Max.)
@ V_{CB}=-30V, V_{BE}=3V

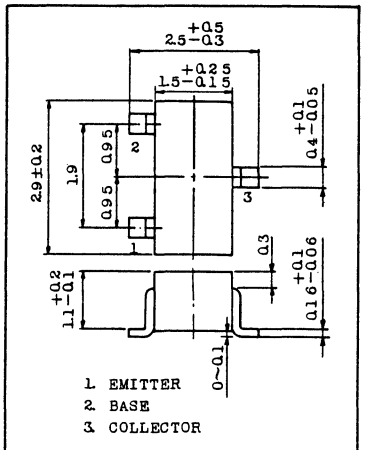
. Excellent DC Current Gain Linearity

. Low Saturation Voltage
: $V_{CE(sat)}$=-0.4V(Max.) @ I_C=-50mA, I_B=-5mA

. Low Collector Output Capacitance
: C_{ob}=4.5pF(Max.) @ V_{CB}=-5V

. Complementary to YTS3903

Unit in mm



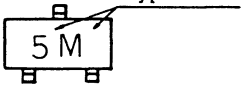
JEDEC	–
EIAJ	SC-59
TOSHIBA	2-3F1A

Weight : 0.012g

MAXIMUM RATINGS (Ta=25°C)

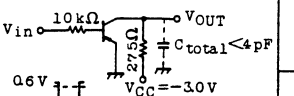
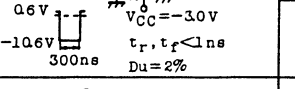
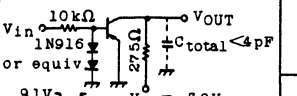
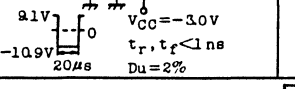
CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	-40	V
Collector-Emitter Voltage	V_{CEO}	-40	V
Emitter-Base Voltage	V_{EBO}	-5	V
Collector Current	I_C	-200	mA
Base Current	I_B	-50	mA
Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	200	mW
		1.6	mW/°C
Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	625	°C/W
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	-55 ~ 150	°C

Marking



TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current		I_{CEV}	V_{CE}=-30V, V_{BE}=3V	-	-	-50	nA
Base Cut-off Current		I_{BEV}	V_{CE}=-30V, V_{BE}=3V	-	-	50	nA
Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=-10μA, I_E=0	-40	-	-	V
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-1mA, I_B=0	-40	-	-	V
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=-10μA, I_C=0	-5	-	-	V
DC Current Gain		$h_{FE(1)}$	V_{CE}=-1V, I_C=-0.1mA	30	-	-	
		$h_{FE(2)}$	V_{CE}=-1V, I_C=-1mA	40	-	-	
		$h_{FE(3)}$	V_{CE}=-1V, I_C=-10mA	50	-	150	
		$h_{FE(4)}$	V_{CE}=-1V, I_C=-50mA	30	-	-	
		$h_{FE(5)}$	V_{CE}=-1V, I_C=-100mA	15	-	-	
Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=-10mA, I_B=-1mA	-	-	-0.25	V
		$V_{CE(sat)2}$	I_C=-50mA, I_B=-5mA	-	-	-0.4	
Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=-10mA, I_B=-1mA	-0.65	-	-0.85	V
		$V_{BE(sat)2}$	I_C=-50mA, I_B=-5mA	-	-	-0.95	
Transition Frequency		f_T	V_{CE}=-20V, I_C=-10mA f=100MHz	200	-	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=-5V, I_E=0, f=1MHz	-	-	4.5	pF
Input Capacitance		C_{ib}	V_{EB}=-0.5V, I_C=0, f=1MHz	-	-	10	pF
Input Impedance		h_{ie}	V_{CE}=-10V, I_C=-1mA f=1kHz	0.5	-	8	kΩ
Voltage Feedback Ratio		h_{re}		0.1	-	5	×10⁻⁴
Small-Siganl Current Gain		h_{fe}		50	-	200	
Collector Output Admittance		h_{oe}		1.0	-	40	μS
Noise Figure		NF	V_{CE}=-5V, I_C=-0.1mA R_g=1kΩ, f=10Hz ~ 15.7kHz	-	-	5	dB
Switching Time	Delay Time	$t_{d(ON)}$		-	-	35	ns
	Rise Time	t_r		-	-	35	
	Storage Time	t_{stg}		-	-	200	
	Fall Time	t_f		-	-	60	

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
YTS3906
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

. Low Leakage Current
: I_{CEV}=-50nA(Max.), I_{BEV}=50nA(Max.)
@ V_{CE}=-30V, V_{BE}=3V

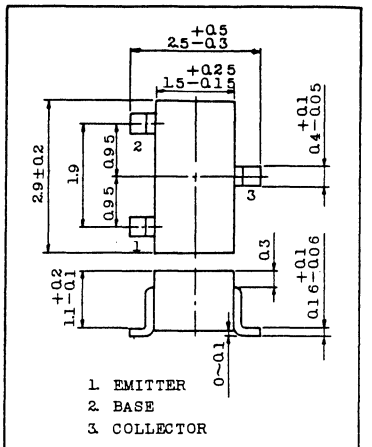
. Excellent DC Current Gain Linearity

. Low Saturation Voltage
: $V_{CE(sat)}$=-0.4V(Max.) @ I_C=-50mA, I_B=5mA

. Low Collector Output Capacitance
: C_{ob}=4.5pF(Max.) @ V_{CB}=-5V

. Complementary to YTS3904

Unit in mm



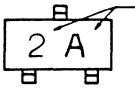
JEDEC	—
EIAJ	SC-59
TOSHIBA	2-3F1A

Weight : 0.012g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	-40	V
Collector-Emitter Voltage	V_{CEO}	-40	V
Emitter-Base Voltage	V_{EBO}	-5	V
Collector Current	I_C	-200	mA
Base Current	I_B	-50	mA
Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	200	mW
		1.6	°C/W
Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	625	°C/W
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-55 ~ 150	°C

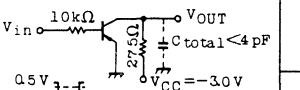
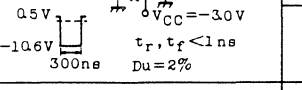
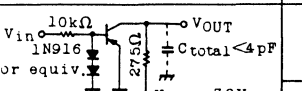
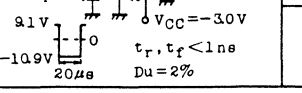
Marking



Type Name

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current		I_{CEV}	V_{CE}=-30V, V_{BE}=3V	-	-	-50	nA
Base Cut-off Current		I_{BEV}	V_{CE}=-30V, V_{BE}=3V	-	-	50	nA
Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=-10μA, I_E=0	-40	-	-	V
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-1mA, I_B=0	-40	-	-	V
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=-10μA, I_C=0	-5	-	-	V
DC Current Gain		$h_{FE(1)}$	V_{CE}=-1V, I_C=-0.1mA	60	-	-	
		$h_{FE(2)}$	V_{CE}=-1V, I_C=-1mA	80	-	-	
		$h_{FE(3)}$	V_{CE}=-1V, I_C=-10mA	100	-	300	
		$h_{FE(4)}$	V_{CE}=-1V, I_C=-50mA	60	-	-	
		$h_{FE(5)}$	V_{CE}=-1V, I_C=-100mA	30	-	-	
Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=-10mA, I_B=-1mA	-	-	-0.25	V
		$V_{CE(sat)2}$	I_C=-50mA, I_B=-5mA	-	-	-0.4	
Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=-10mA, I_B=-1mA	-0.65	-	-0.85	V
		$V_{BE(sat)2}$	I_C=-50mA, I_B=-5mA	-	-	-0.95	
Transition Frequency		f_T	V_{CE}=-20V, I_C=-10mA f=100MHz	250	-	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=-5V, I_E=0, f=1MHz	-	-	4.5	pF
Input Capacitance		C_{ib}	V_{EB}=-0.5V, I_C=0, f=1MHz	-	-	10	pF
Input Impedance		h_{ie}	V_{CE}=-10V, I_C=-1mA f=1kHz	2.0	-	12	kΩ
Voltage Feedback Ratio		h_{re}		1.0	-	10	×10-4
Small-Signal Current Gain		h_{fe}		100	-	400	
Collector Output Admittance		h_{oe}		3.0	-	60	μS
Noise Figure		NF	V_{CE}=-5V, I_C=-0.1mA R_g=1kΩ, f=10Hz ~ 15.7kHz	-	-	4	dB
Switching Time	Delay Time	t_d		-	-	35	ns
	Rise Time	t_r		-	-	35	
	Storage Time	t_{stg}		-	-	225	
	Fall Time	t_f		-	-	75	

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
YTS4123
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

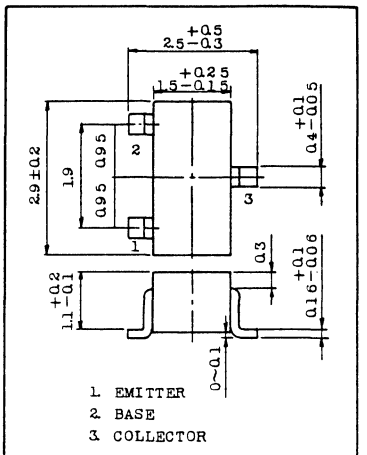
. Low Leakage Current : I_{CBO}=50nA(Max.) @ V_{CB}=20V
I_{EBO}=50nA(Max.) @ V_{EB}=3V

. Low Saturation Voltage
: $V_{CE(sat)}$=0.3V(Max.) @ I_C=50mA, I_B=5mA

. Low Collector Output Capacitance
: C_{ob}=4pF(Max.) @ V_{CB}=5V

. Complementary to YTS4125

Unit in mm



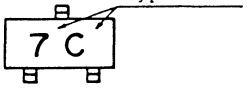
JEDEC	–
EIAJ	SC-59
TOSHIBA	2-3F1A

Weight : 0.012g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	30	V
Base-Emitter Voltage	V_{EBO}	5	V
Collector Current	I_C	200	mA
Base Current	I_B	50	mA
Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	200	mW
		1.6	mW/°C
Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	625	°C/W
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-55~150	°C

Marking



Type Name

TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I_{CBO}	V_{CB}=20V, I_E=0	-	-	50	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=3V, I_C=0	-	-	50	nA
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C=10μA, I_E=0	40	-	-	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=1mA, I_B=0	30	-	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=10μA, I_C=0	5	-	-	V
DC Current Gain	$h_{FE(1)}$	V_{CE}=1V, I_C=2mA	50	-	150	
	$h_{FE(2)}$	V_{CE}=1V, I_C=50mA	25	-	-	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=50mA, I_B=5mA	-	-	0.3	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	I_C=50mA, I_B=5mA	-	-	0.95	V
Small Signal Forward Current Transfer Ratio	$\|h_{fe}\|$	V_{CE}=20V, I_C=10mA f=100MHz	2.5	-	-	
Transition Frequency	f_T	V_{CE}=20V, I_C=10mA f=100MHz	250	-	-	MHz
Collector Output Capacitance	C_{ob}	V_{CB}=5V, I_E=0, f=1MHz	-	-	4	pF
Input Capacitance	C_{ib}	V_{EB}=0.5V, I_C=0, f=1MHz	-	-	8	pF
Small Signal Current Gain	h_{fe}	V_{CE}=10V, I_C=2mA, f=1kHz	50	-	200	
Noise Figure	NF	V_{CE}=5V, I_C=100μA R_g=1kΩ, f=10Hz ~ 15.7kHz	-	-	6	dB

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
YTS4124
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

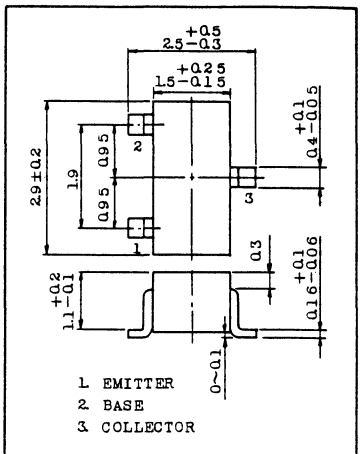
. Low Leakage Current : I_{CBO}=50nA(Max.) @ V_{CB}=20V
I_{EBO}=50nA(Max.) @ V_{EB}=3V

. Low Saturation Voltage
: $V_{CE(sat)}$=0.3V(Max.) @ I_C=50mA, I_B=5mA

. Low Collector Output Capacitance
: C_{ob}=4pF(Max.) @ V_{CB}=5V

. Complementary to YTS4126

Unit in mm



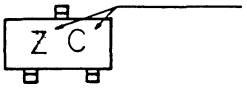
JEDEC	—
EIAJ	SC-59
TOSHIBA	2-3F1A

Weight : 0.012g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	200	mA
Base Current	I_B	50	mA
Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	200	mW
		1.6	mW/°C
Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	625	°C/W
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-55 ~ 150	°C

Marking



TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I_{CBO}	V_{CB}=20V, I_E=0	-	-	50	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=3V, I_C=0	-	-	50	nA
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C=10μA, I_E=0	30	-	-	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=1mA, I_B=0	25	-	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=10μA, I_C=0	5	-	-	V
DC Current Gain	$h_{FE(1)}$	V_{CE}=1V, I_C=2mA	120	-	360	
	$h_{FE(2)}$	V_{CE}=1V, I_C=50mA	60	-	-	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=50mA, I_B=5mA	-	-	0.3	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	I_C=50mA, I_B=5mA	-	-	0.95	V
Small Signal Forward Current Transfer Ratio	$\|h_{fe}\|$	V_{CE}=20V, I_C=10mA f=100MHz	3.0	-	-	
Transition Frequency	f_T	V_{CE}=20V, I_C=10mA f=100MHz	300	-	-	MHz
Collector Output Capacitance	C_{ob}	V_{CB}=5V, I_E=0, f=1MHz	-	-	4	pF
Input Capacitance	C_{ib}	V_{EB}=0.5V, I_C=0, f=1MHz	-	-	8	pF
Small Signal Current Gain	h_{fe}	V_{CE}=10V, I_C=2mA, f=1kHz	120	-	480	
Noise Figure	NF	V_{CE}=5V, I_C=100μA R_g=1kΩ, f=10Hz ~ 15.7kHz	-	-	5	dB

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
YTS4125
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

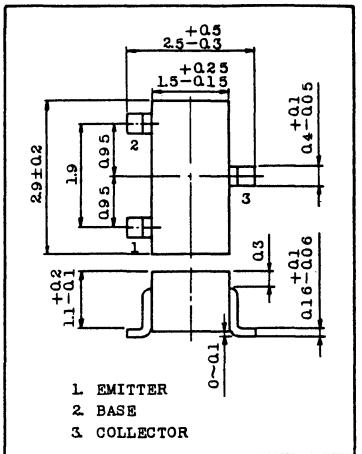
. Low Leakage Current : I_{CBO}=-50nA(Max.) @ V_{CB}=-20V
I_{EBO}=-50nA(Max.) @ V_{EB}=-3V

. Low Saturation Voltage
: $V_{CE(sat)}$=-0.4V(Max.) @ I_C=-50mA, I_B=-5mA

. Low Collector Output Capacitance
: C_{ob}=4.5pF(Max.) @ V_{CB}=-5V

. Complementary to YTS4123

Unit in mm



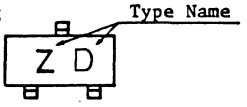
JEDEC	—
EIAJ	SC-59
TOSHIBA	2-3F1A

Weight : 0.012g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	-30	V
Collector-Emitter Voltage	V_{CEO}	-30	V
Emitter-Base Voltage	V_{EBO}	-4	V
Collector Current	I_C	-200	mA
Base Current	I_B	-50	mA
Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	200	mW
		1.6	mW/°C
Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	625	°C/W
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-55~150	°C

Marking



TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I_{CBO}	V_{CB}=-20V, I_E=0	-	-	-50	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=-3V, I_C=0	-	-	-50	nA
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C=-10μA, I_E=0	-30	-	-	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=-1mA, I_B=0	-30	-	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=-10μA, I_C=0	-4	-	-	V
DC Current Gain	$h_{FE(1)}$	V_{CE}=-1V, I_C=-2mA	50	-	150	
	$h_{FE(2)}$	V_{CE}=-1V, I_C=-50mA	25	-	-	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=-50mA, I_B=-5mA	-	-	-0.4	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	I_C=-50mA, I_B=-5mA	-	-	-0.95	V
Small Signal Forward Current Transfer Ratio	$\|h_{fe}\|$	V_{CE}=-20V, I_C=-10mA f=100MHz	2.0	-	-	
Transition Frequency	f_T	V_{CE}=-20V, I_C=-10mA f=100MHz	200	-	-	MHz
Collector Output Capacitance	C_{ob}	V_{CB}=-5V, I_E=0, f=1MHz	-	-	4.5	pF
Input Capacitance	C_{ib}	V_{EB}=-0.5V, I_C=0, f=1MHz	-	-	10	pF
Small Signal Current Gain	h_{fe}	V_{CE}=-10V, I_C=-2mA, f=1kHz	50	-	200	
Noise Figure	NF	V_{CE}=-5V, I_C=-100μA R_g=1kΩ, f=10Hz ~ 15.7kHz	-	-	5	dB

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
YTS4126
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

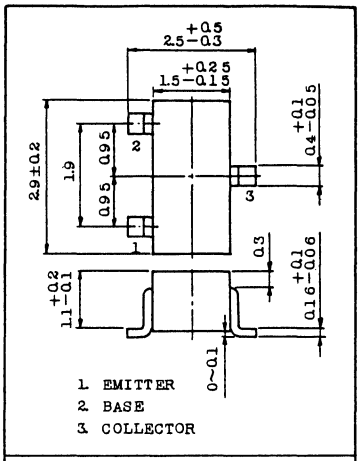
. Low Leakage Current : I_{CBO}=-50nA(Max.) @ V_{CB}=-20V
I_{EBO}=-50nA(Max.) @ V_{EB}=-3V

. Low Saturation Voltage
: $V_{CE(sat)}$=-0.4V(Max.) @ I_C=-50mA, I_B=-5mA

. Low Collector Output Capacitance
: C_{ob}=4.5pF(Max.) @ V_{CB}=-5V

. Complementary to YTS4124

Unit in mm



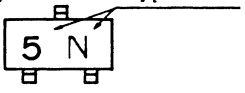
JEDEC	—
EIAJ	SC-59
TOSHIBA	2-3F1A

Weight : 0.012g

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	-25	V
Collector-Emitter Voltage	V_{CEO}	-25	V
Emitter-Base Voltage	V_{EBO}	-4	V
Collector Current	I_C	-200	mA
Base Current	I_B	-50	mA
Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	200	mW
		1.6	mW/°C
Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	625	°C/W
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-55 ~ 150	°C

Marking



TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I_{CBO}	V_{CB}=-20V, I_E=0	-	-	-50	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=-3V, I_C=0	-	-	-50	nA
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C=-10μA, I_E=0	-25	-	-	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=-1mA, I_B=0	-25	-	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=-10μA, I_C=0	-4	-	-	V
DC Current Gain	$h_{FE(1)}$	V_{CE}=-1V, I_C=-2mA	120	-	360	
	$h_{FE(2)}$	V_{CE}=-1V, I_C=-50mA	60	-	-	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=-50mA, I_B=-5mA	-	-	-0.4	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	I_C=-50mA, I_B=-5mA	-	-	-0.95	V
Small Signal Forward Current Transfer Ratio	$\|h_{fe}\|$	V_{CE}=-20V, I_C=-10mA f=100MHz	2.5	-	-	
Transition Frequency	f_T	V_{CE}=-20V, I_C=-10mA f=100MHz	250	-	-	MHz
Collector Output Capacitance	C_{ob}	V_{CB}=-5V, I_E=0, f=1MHz	-	-	4.5	pF
Input Capacitance	C_{ib}	V_{EB}-0.5V, I_C=0, f=1MHz	-	-	10	pF
Small Signal Current Gain	h_{fe}	V_{CE}=-10V, I_C=-2mA, f=1kHz	120	-	480	
Noise Figure	NF	V_{CE}=-5V, I_C=-100μA R_g=1kΩ, f=10Hz ~ 15.7kHz	-	-	4	dB

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
YTS4400
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

. Low Leakage Current
: I_{CEV}=100nA(Max.), I_{BEV}=-100nA(Max.)
@ V_{CE}=35V, V_{BE}=-0.4V

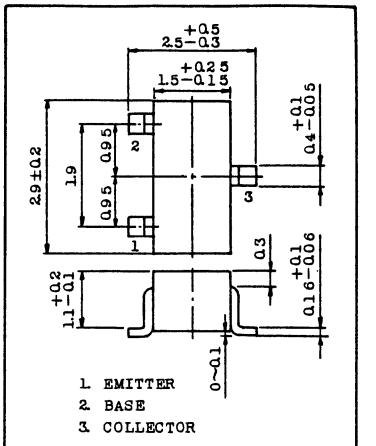
. Excellent DC Current Gain Linearity

. Low Saturation Voltage
: $V_{CE(sat)}$=0.4V(Max.) @ I_C=150mA, I_B=15mA

. Low Collector Output Capacitance
: C_{ob}=6.5pF(Max.) @ V_{CB}=5V

. Complementary to YTS4402

Unit in mm



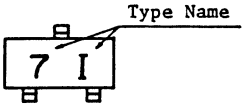
JEDEC	—
EIAJ	SC-59
TOSHIBA	2-3F1A

Weight : 0.012g

MAXIMUM RATINGS (Ta=25°C)

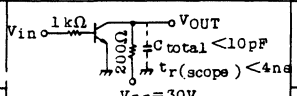
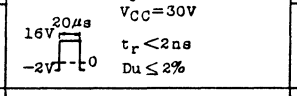
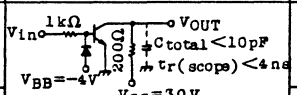
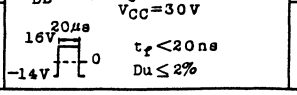
CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	600	mA
Base Current	I_B	100	mA
Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	200	mW
		1.6	mW/°C
Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	625	°C/W
Junction Temperature	Tj	150	°C
Storage Temperature Range	Tstg	-55 ~ 150	°C

Marking



TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current		I_{CEV}	V_{CE}=35V, V_{BE}=-0.4V	-	-	100	nA
Base Cut-off Current		I_{BEV}	V_{CE}=35V, V_{BE}=-0.4V	-	-	-100	nA
Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=0.1mA, I_E=0	60	-	-	V
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=1mA, I_B=0	40	-	-	V
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=0.1mA, I_C=0	6	-	-	V
DC Current Gain		$h_{FE(1)}$	V_{CE}=1V, I_C=1mA	20	-	-	
		$h_{FE(2)}$	V_{CE}=1V, I_C=10mA	40	-	-	
		$h_{FE(3)}$	V_{CE}=1V, I_C=150mA	50	-	150	
		$h_{FE(4)}$	V_{CE}=2V, I_C=500mA	20	-	-	
Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=150mA, I_B=15mA	-	-	0.4	V
		$V_{CE(sat)2}$	I_C=500mA, I_B=50mA	-	-	0.75	
Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=150mA, I_B=15mA	0.75	-	0.95	V
		$V_{BE(sat)2}$	I_C=500mA, I_B=50mA	-	-	1.2	
Transition Frequency		f_T	V_{CE}=10V, I_C=20mA f=100MHz	200	-	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=5V, I_E=0, f=1MHz	-	-	6.5	pF
Input Capacitance		C_{ib}	V_{EB}=0.5V, I_C=0, f=1MHz	-	-	30	pF
Input Impedance		h_{ie}	V_{CE}=10V, I_C=1mA f=1kHz	0.5	-	7.5	kΩ
Voltage Feedback Ratio		h_{re}		0.1	-	8	×10-4
Small-Signal Current Gain		h_{fe}		20	-	250	
Collector Output Admittance		h_{oe}		1.0	-	30	μS
Switching Time	Delay Time	t_d		-	-	15	ns
	Rise Time	t_r		-	-	20	
	Storage Time	t_{stg}		-	-	225	
	Fall Time	t_f		-	-	30	

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
YTS4401
SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

. Low Leakage Current
: I_{CEV}=100nA(Max.), I_{BEV}=-100nA(Max.)
@ V_{CE}=35V, V_{BE}=-0.4V

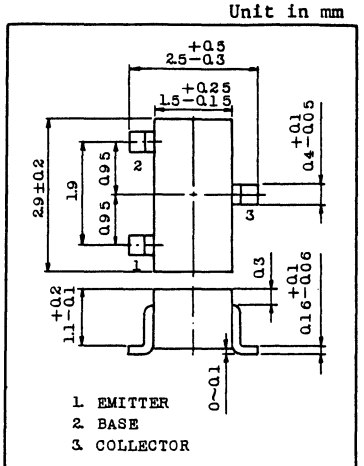
. Excellent DC Current Gain Linearity

. Low Saturation Voltage
: $V_{CE(sat)}$=0.4V(Max.) @ I_C=150mA, I_B=15mA

. Low Collector Output Capacitance
: C_{ob}=6.5pF(Max.) @ V_{CB}=5V

. Complementary to YTS4403

Unit in mm



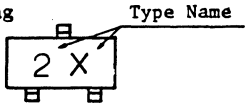
JEDEC	—
EIAJ	SC-59
TOSHIBA	2-3F1A

Weight : 0.012g

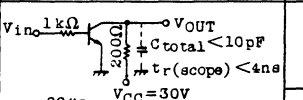
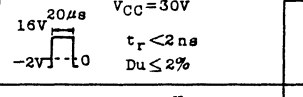
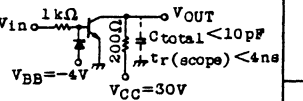
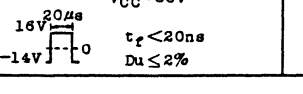
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	600	mA
Base Current	I_B	100	mA
Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	200	mW
		1.6	mW/°C
Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	625	°C/W
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-55~150	°C

Marking



ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current		I_{CEV}	V_{CE}=35V, V_{BE}=-0.4V	-	-	100	nA
Base Cut-off Current		I_{BEV}	V_{CE}=35V, V_{BE}=-0.4V	-	-	-100	nA
Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=0.1mA, I_E=0	60	-	-	V
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=1mA, I_B=0	40	-	-	V
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=0.1mA, I_C=0	6	-	-	V
DC Current Gain		$h_{FE(1)}$	V_{CE}=1V, I_C=0.1mA	20	-	-	
		$h_{FE(2)}$	V_{CE}=1V, I_C=1mA	40	-	-	
		$h_{FE(3)}$	V_{CE}=1V, I_C=10mA	80	-	-	
		$h_{FE(4)}$	V_{CE}=1V, I_C=150mA	100	-	300	
		$h_{FE(5)}$	V_{CE}=2V, I_C=500mA	40	-	-	
Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=150mA, I_B=15mA	-	-	0.4	V
		$V_{CE(sat)2}$	I_C=500mA, I_B=50mA	-	-	0.75	
Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=150mA, I_B=15mA	0.75	-	0.95	V
		$V_{BE(sat)2}$	I_C=500mA, I_B=50mA	-	-	1.2	
Transition Frequency		f_T	V_{CE}=10V, I_C=20mA f=100MHz	250	-	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=5V, I_E=0, f=1MHz	-	-	6.5	pF
Input Capacitance		C_{ib}	V_{EB}=0.5V, I_C=0, f=1MHz	-	-	30	pF
Input Impedance		h_{ie}	V_{CE}=10V, I_C=1mA f=1kHz	1.0	-	15	kΩ
Voltage Feedback Ratio		h_{re}		0.1	-	8	$\times 10^{-4}$
Small-Signal Current Gain		h_{fe}		40	-	500	
Collector Output Admittance		h_{oe}		1.0	-	30	μS
Switching Time	Delay Time	t_d		-	-	15	ns
	Rise Time	t_r		-	-	20	
	Storage Time	t_{stg}		-	-	225	
	Fall Time	t_f		-	-	30	

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

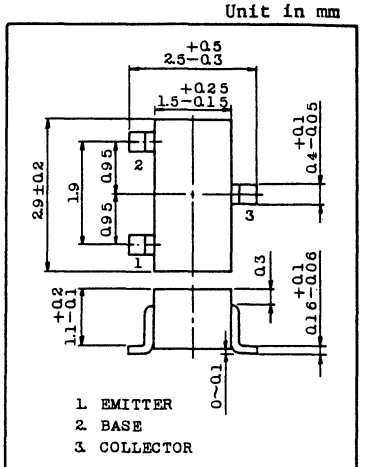
TOSHIBA TRANSISTOR
YTS4402
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

. Low Leakage Current
: I_{CEV}=-100nA(Max.), I_{BEV}=100nA(Max.)
. Excellent DC Current Gain Linearity
. Low Saturation Voltage
: $V_{CE(sat)}$=-0.4V(Max.) @ I_C=-150mA, I_B=-15mA
. Low Collector Output Capacitance
: C_{ob}=8.5pF(Max.) @ V_{CB}=-10V
. Complementary to YTS4400

Unit in mm



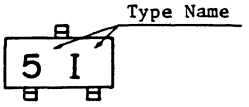
JEDEC	–
EIAJ	SC-59
TOSHIBA	2-3F1A

Weight : 0.012g

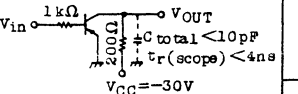
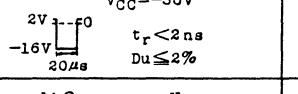
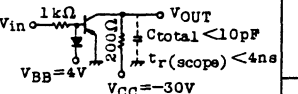
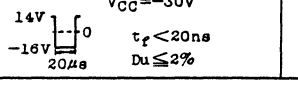
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	-40	V
Collector-Emitter Voltage	V_{CEO}	-40	V
Emitter-Base Voltage	V_{EBO}	-5	V
Collector Current	I_C	-600	mA
Base Current	I_B	-100	mA
Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	200	mW
		1.6	mW/°C
Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	625	°C/W
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-55 ~ 150	°C

Marking



ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current		I_{CEV}	V_{CE}=-35V, V_{BE}=0.4V	-	-	-100	nA
Base Cut-off Current		I_{BEV}	V_{CE}=-35V, V_{BE}=0.4V	-	-	100	nA
Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=-0.1mA, I_E=0	-40	-	-	V
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-1mA, I_B=0	-40	-	-	V
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=-0.1mA, I_C=0	-5	-	-	V
DC Current Gain		$h_{FE(1)}$	V_{CE}=-1V, I_C=-1mA	30	-	-	
		$h_{FE(2)}$	V_{CE}=-1V, I_C=-10mA	50	-	-	
		$h_{FE(3)}$	V_{CE}=-1V, I_C=-150mA	50	-	150	
		$h_{FE(4)}$	V_{CE}=-2V, I_C=-500mA	20	-	-	
Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=-150mA, I_B=-15mA	-	-	-0.4	V
		$V_{CE(sat)2}$	I_C=-500mA, I_B=-50mA	-	-	-0.75	
Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=-150mA, I_B=-15mA	-0.75	-	-0.95	V
		$V_{BE(sat)2}$	I_C=-500mA, I_B=-50mA	-	-	-1.3	
Transition Frequency		f_T	V_{CE}=-10V, I_C=-20mA f=100MHz	150	-	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=-10V, I_E=0, f=1MHz	-	-	8.5	pF
Input Capacitance		C_{ib}	V_{EB}=-0.5V, I_C=0, f=1MHz	-	-	30	pF
Input Impedance		h_{ie}	V_{CE}=-10V, I_C=-1mA f=1kHz	0.75	-	7.5	kΩ
Voltage Feedback Ratio		h_{re}		0.1	-	8	×10-4
Small-Signal Current Gain		h_{fe}		30	-	250	
Collector Output Admittance		h_{oe}		1.0	-	100	μS
Switching Time	Delay Time	t_d		-	-	15	ns
	Rise Time	t_r		-	-	20	
	Storage Time	t_{stg}		-	-	225	
	Fall Time	t_f		-	-	30	

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA TRANSISTOR
YTS4403
SILICON PNP EPITAXIAL TYPE (PCT PROCESS)

FOR GENERAL PURPOSE USE SWITCHING AND AMPLIFIER APPLICATIONS.

FEATURES:

. Low Leakage Current
: I_{CEV}=-100nA(Max.), I_{BEV}=100nA(Max.)
@ V_{CE}=-35V, V_{BE}=0.4V

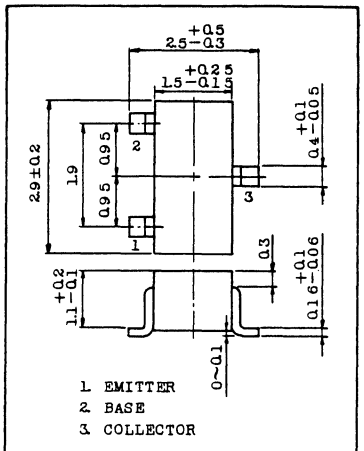
. Excellent DC Current Gain Linearity

. Low Saturation Voltage
: $V_{CE(sat)}$=-0.4V(Max.) @ I_C=-150mA, I_B=15mA

. Low Collector Output Capacitance
: C_{ob}=8.5pF(Max.) @ V_{CB}=-10V

. Complementary to YTS4401

Unit in mm



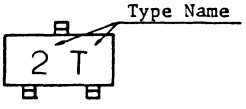
JEDEC	–
EIAJ	SC-59
TOSHIBA	2-3F1A

Weight : 0.012g

MAXIMUM RATINGS (Ta=25°C)

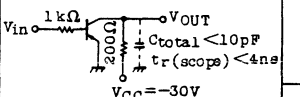
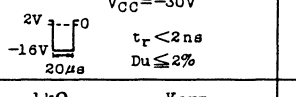
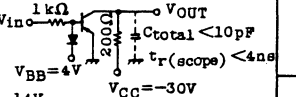
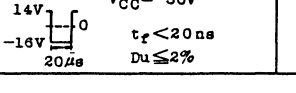
CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	-40	V
Collector-Emitter Voltage	V_{CEO}	-40	V
Emitter-Base Voltage	V_{EBO}	-5	V
Collector Current	I_C	-600	mA
Base Current	I_B	-100	mA
Collector Power Dissipation (Ta=25°C) Derate Linearly 25°C	P_C	200	mW
		1.6	mW/°C
Thermal Resistance (Junction to Ambient)	$R_{th(j-a)}$	625	°C/W
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-55 ~ 150	°C

Marking



TOSHIBA CORPORATION

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current		I_{CEV}	V_{CE}=-35V, V_{BE}=0.4V	-	-	-100	nA
Base Cut-off Current		I_{BEV}	V_{CE}=-35V, V_{BE}=0.4V	-	-	100	nA
Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=-0.1mA, I_E=0	-40	-	-	V
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=-1mA, I_B=0	-40	-	-	V
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=-0.1mA, I_C=0	-5	-	-	V
DC Current Gain		$h_{FE(1)}$	V_{CE}=-1V, I_C=-0.1mA	30	-	-	
		$h_{FE(2)}$	V_{CE}=-1V, I_C=-1mA	60	-	-	
		$h_{FE(3)}$	V_{CE}=-1V, I_C=-10mA	100	-	-	
		$h_{FE(4)}$	V_{CE}=-1V, I_C=-150mA	100	-	300	
		$h_{FE(5)}$	V_{CE}=-2V, I_C=-500mA	20	-	-	
Collector-Emitter Saturation Voltage		$V_{CE(sat)1}$	I_C=-150mA, I_B=-15mA	-	-	-0.4	V
		$V_{CE(sat)2}$	I_C=-500mA, I_B=-50mA	-	-	-0.75	
Base-Emitter Saturation Voltage		$V_{BE(sat)1}$	I_C=-150mA, I_B=-15mA	-0.75	-	-0.95	V
		$V_{BE(sat)2}$	I_C=-500mA, I_B=-50mA	-	-	-1.3	
Transition Frequency		f_T	V_{CE}=-10V, I_C=-20mA f=100MHz	200	-	-	MHz
Collector Output Capacitance		C_{ob}	V_{CB}=-10V, I_E=0, f=1MHz	-	-	8.5	pF
Input Capacitance		C_{ib}	V_{EB}=-0.5V, I_C=0, f=1MHz	-	-	30	pF
Input Impedance		h_{ie}	V_{CE}=-10V, I_C=-1mA f=1kHz	1.5	-	15	kΩ
Voltage Feedback Ratio		h_{re}		0.1	-	8	×10-4
Small-Signal Current Gain		h_{fe}		60	-	500	
Collector Output Admittance		h_{oe}		1.0	-	100	μS
Switching Time	Delay Time	t_d		-	-	15	ns
	Rise Time	t_r		-	-	20	
	Storage Time	t_{stg}		-	-	225	
	Fall Time	t_f		-	-	30	

TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA DIODE

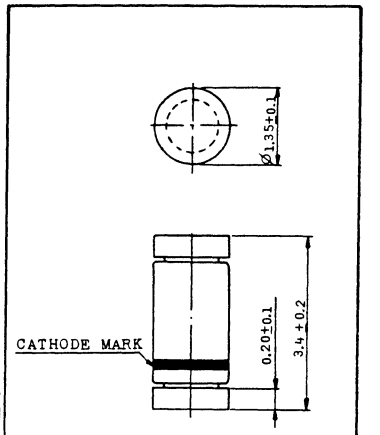
DLN914, DLN914A, DLN914B
SILICON EPITAXIAL PLANAR

COMMUNICATION AND INDUSTRIAL APPLICATIONS.
HIGH VOLTAGE, ULTRA HIGH SPEED SWITCHING APPLICATIONS.

FEATURES:

- Low Forward Voltage : V_F=1.0V (Max.)
- Small Total Capacitance : C_T=4pF (Max.)
- Fast Reverse Recovery Time : t_{rr}=4ns (Max.)
- Hermetically Sealded Miniature Lead Less Glass Package.

Unit in mm



JEDEC	–
EIAJ	–
TOSHIBA	1-1D1A

Weight : 0.029g

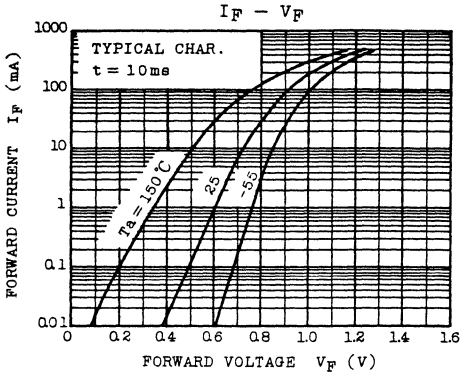
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Maximum (Peak) Reverse Voltage	V_{RM}	100	V
Reverse Voltage	V_R	75	V
Maximum (Peak) Forward Current	I_{FM}	450	mA
Average Forward Current	I_O	150	mA
Surge Current (1μs)	I_{FSM}	2	A
Power Dissipation	P	300	mW
Junction Temperature	T_j	200	°C
Storage Temperature Range	T_{stg}	-65 ~ 200	°C

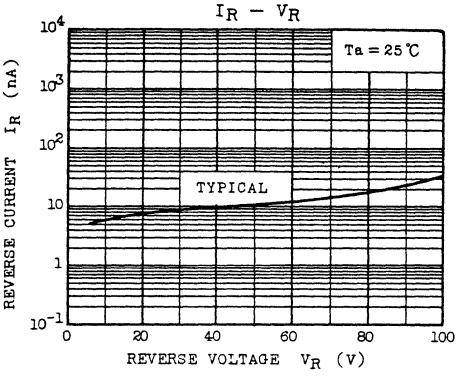
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Forward Voltage	DLN914	$V_{F(1)}$	I_F=10mA	–	0.75	1.0	V
	DLN914A	$V_{F(2)}$	I_F=20mA	–	0.79	1.0	V
	DLN914B	$V_{F(3)}$	I_F=5mA	0.62	0.67	0.72	V
		$V_{F(4)}$	I_F=100mA, t=10ms	–	0.9	1.0	V
Reverse Current		$I_{R(1)}$	V_R=20V	–	–	25	nA
		$I_{R(2)}$	V_R=20V, Ta=150°C	–	–	50	μA
		$I_{R(3)}$	V_R=75V	–	–	5	μA
Total Capacitance		C_T	V_R=0, f=1MHz	–	0.9	4.0	pF
Reverse Recovery Time		t_{rr}	I_F=10mA, V_R=6V R_L=100Ω, I_{rr}=1mA	–	2.0	4.0	ns

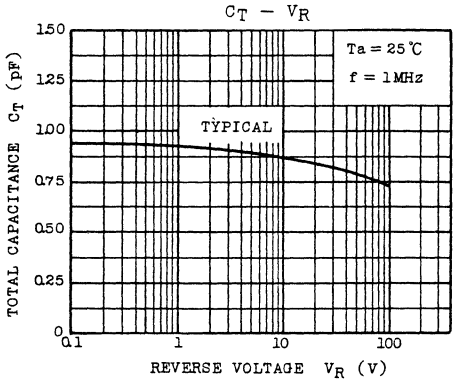
$I_F - V_F$



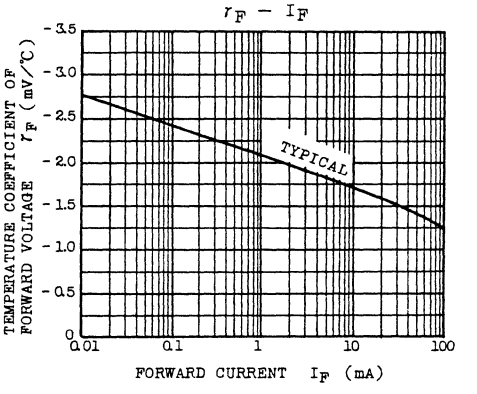
$I_R - V_R$



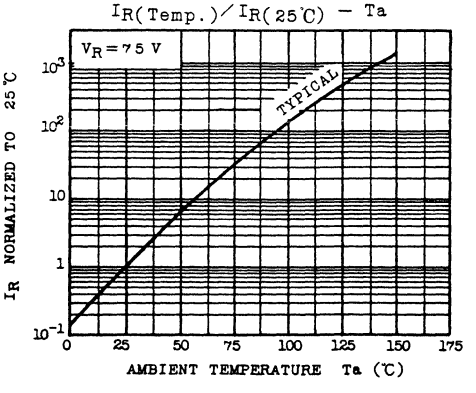
$C_T - V_R$



$r_F - I_F$



$I_{R(Temp.)} / I_{R(25℃)} - Ta$



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

TOSHIBA DIODE

DLN4148

SILICON EPITAXIAL PLANAR

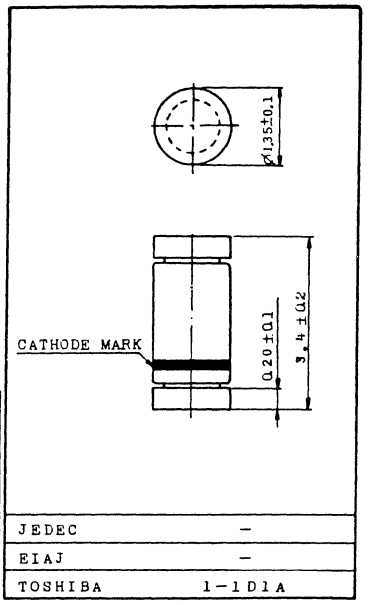
COMMUNICATION AND INDUSTRIAL APPLICATIONS.

HIGH VOLTAGE, ULTRA HIGH SPEED SWITCHING APPLICATIONS.

FEATURES:

- Low Forward Voltage : V_F=1.2V (Max.)
- Small Total Capacitance : C_T=3pF (Max.)
- Fast Reverse Recovery Time : t_{rr}=4ns (Max.)
- Hermetically Sealded Miniature Lead Less Glass Package.

Unit in mm



JEDEC	–
EIAJ	–
TOSHIBA	1-1D1A

Weight : 0.029g

MAXIMUM RATINGS (Ta=25°C)

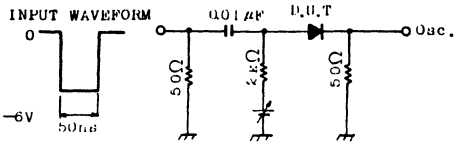
CHARACTERISTIC	SYMBOL	RATING	UNIT
Maximum (Peak) Reverse Voltage	V_{RM}	100	V
Reverse Voltage	V_R	75	V
Maximum (Peak) Forward Current	I_{FM}	500	mA
Average Forward Current	I_O	200	mA
Surge Current (1 sec)	I_{FSM}	700	mA
Power Dissipation	P	300	mW
Junction Temperature	T_j	175	°C
Storage Temperature Range	T_{stg}	-65~175	°C

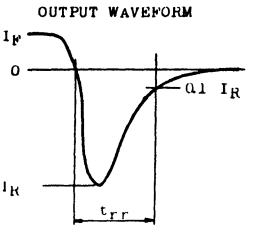
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Forward Voltage	$V_{F(1)}$	I_F=10mA	–	0.75	1.0	V
	$V_{F(2)}$	I_F=100mA	–	0.95	1.2	V
Reverse Current	$I_{R(1)}$	V_R=20V	–	–	25	nA
	$I_{R(2)}$	V_R=75V	–	–	0.1	μA
Total Capacitance	C_T	V_R=0, f=1MHz	–	1.5	3.0	pF
Reverse Recovery Time	t_{rr}	V_R=6V, I_F=10mA R_L=100Ω (Fig.)	–	2.0	4.0	ns

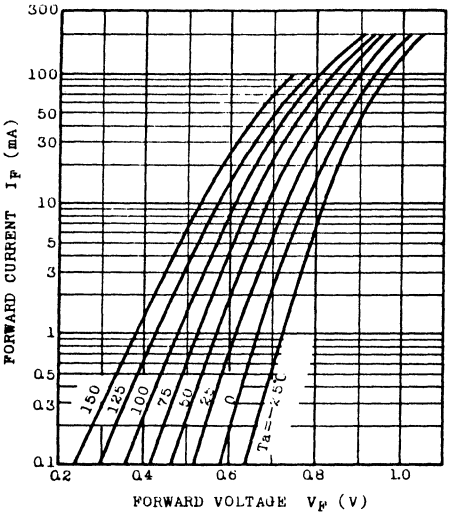
TOSHIBA CORPORATION

Fig. t_{rr} TEST CIRCUIT

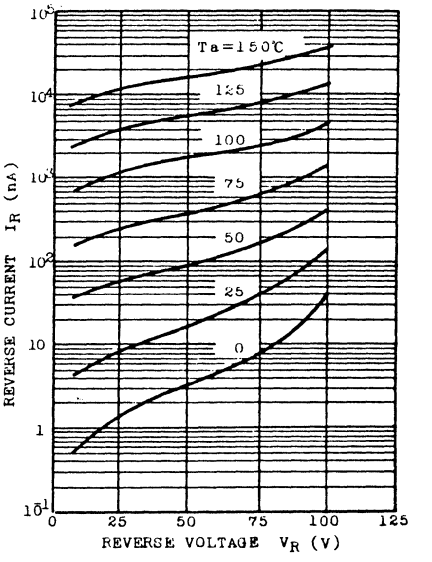




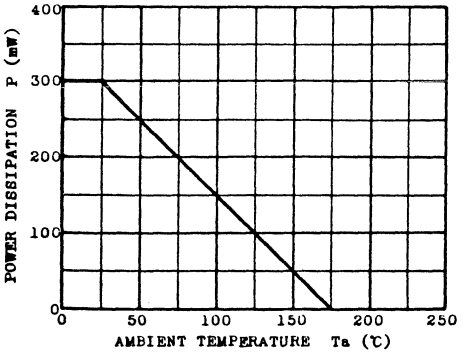
$I_F - V_F$



$I_R - V_R$



P — Ta



TOSHIBA CORPORATION

TOSHIBA SEMICONDUCTOR
TECHNICAL DATA

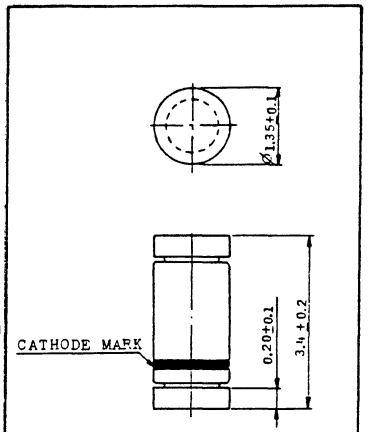
TOSHIBA DIODE
DLN4446, DLN4447, DLN4448, DLN4449
SILICON EPITAXIAL PLANAR

COMMUNICATION AND INDUSTRIAL APPLICATIONS.
HIGH VOLTAGE, ULTRA HIGH SPEED SWITCHING APPLICATIONS.

FEATURES:

. Low Forward Voltage : V_F=1.0V (Max.)
. Small Total Capacitance : C_T=4pF (Max.)
. Fast Reverse Recovery Time : t_{rr}=4ns (Max.)
. Hermetically Sealded Miniature Lead Less Glass Package.

Unit in mm



JEDEC	–
EIAJ	–
TOSHIBA	1-1D1A

Weight : 0.029g

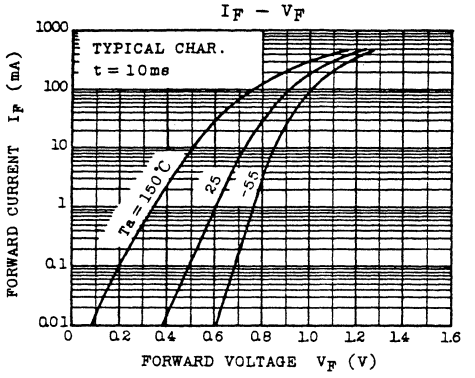
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Maximum (Peak) Reverse Voltage	V_{RM}	100	V
Reverse Voltage	V_R	75	V
Maximum (Peak) Forward Current	I_{FM}	450	mA
Average Forward Current	I_O	150	mA
Surge Current (1μs)	I_{FSM}	2	A
Power Dissipation	P	300	mW
Junction Temperature	T_j	200	°C
Storage Temperature Range	T_{stg}	-65 ~ 200	°C

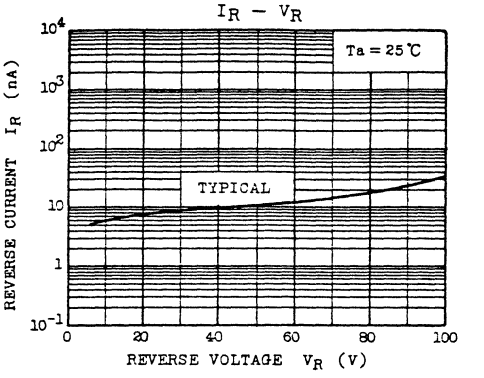
ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Forward Voltage	DLN4446/7	$V_{F(1)}$	I_F=20mA	–	0.79	1.0	V
	DLN4448	$V_{F(2)}$	I_F=5mA	0.62	0.67	0.72	V
		$V_{F(3)}$	I_F=100mA, t=10ms	–	0.9	1.0	V
	DLN4449	$V_{F(4)}$	I_F=5mA	0.63	0.68	0.73	V
		$V_{F(5)}$	I_F=30mA	–	0.8	1.0	V
Reverse Current		$I_{R(1)}$	V_R=20V	–	–	25	nA
		$I_{R(2)}$	V_R=20V, Ta=150°C	–	–	50	μA
		$I_{R(3)}$	V_R=75V	–	–	5	μA
Total Capacitance	DLN4446/8	$C_{T(1)}$	V_R=0, f=1MHz	–	0.9	4.0	pF
	DLN4447/9	$C_{T(2)}$	V_R=0, f=1MHz	–	0.9	2.0	pF
Reverse Recovery Time		t_{rr}	I_F=10mA, V_R=6V, R_L=100Ω, I_{rr}=1mA	–	2	4	ns

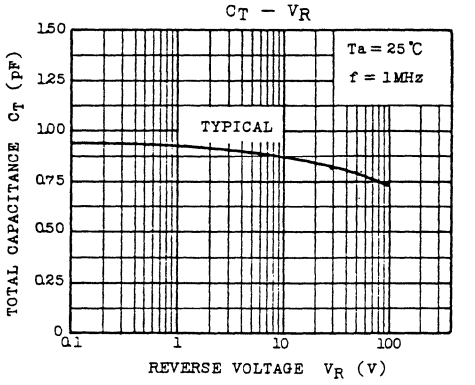
$I_F - V_F$



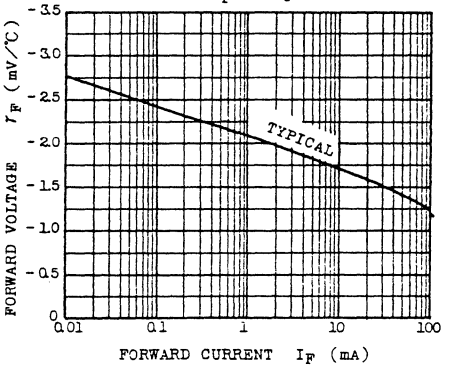
$I_R - V_R$



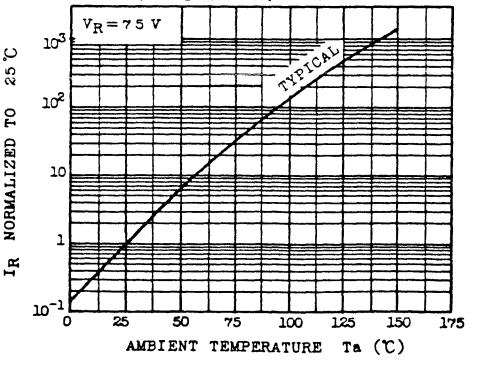
$C_T - V_R$



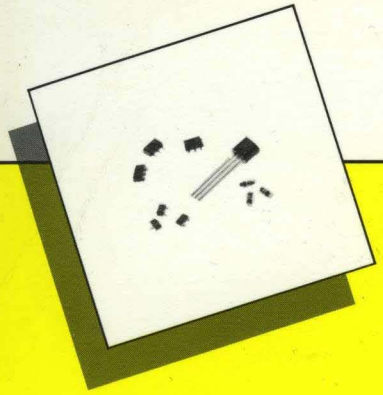
$r_F - I_F$



$I_{R(Temp.)} / I_{R(25℃)} - Ta$



TOSHIBA CORPORATION



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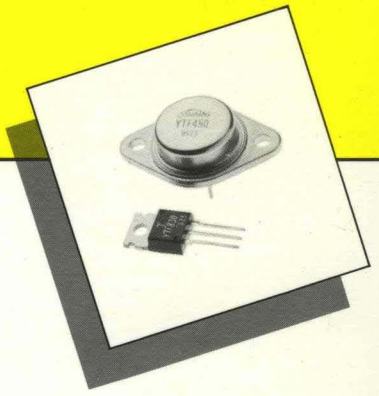

TOSHIBA

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