TOSHIBA POWER TRANSISTOR MODULE SILICON EPITAXIAL TYPE (DARLINGTON POWER TRANSISTOR 6 IN 1)

MP6901

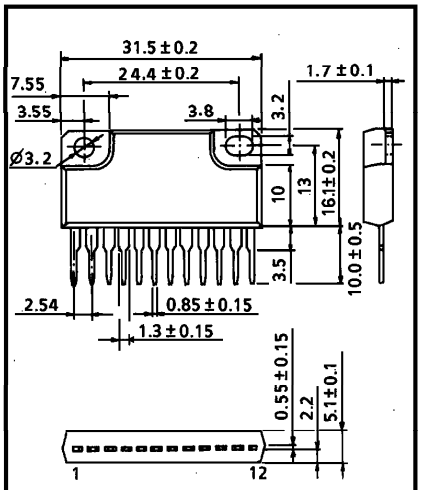
HIGH POWER SWITCHING APPLICATIONS

HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE LOAD SWITCHING

INDUSTRIAL APPLICATIONS

- Package with Heat Sink Isolated to Lead (SIP 12 Pin)
- High Collector Power Dissipation (6 Devices Operation)
  : P_T = 5W (Ta = 25°C)
- High Collector Current : $I_{C\,(DC)}$ = ±4 A (Max.)
- High DC Current Gain : h_{FE} = 2000 (Min.)
  (V_{CE} = ±2 V, I_C = ±1 A)

Unit in mm



1, 11, 12	EMITTER
2, 4, 5, 7, 8, 10	BASE
3, 6, 9	COLLECTOR

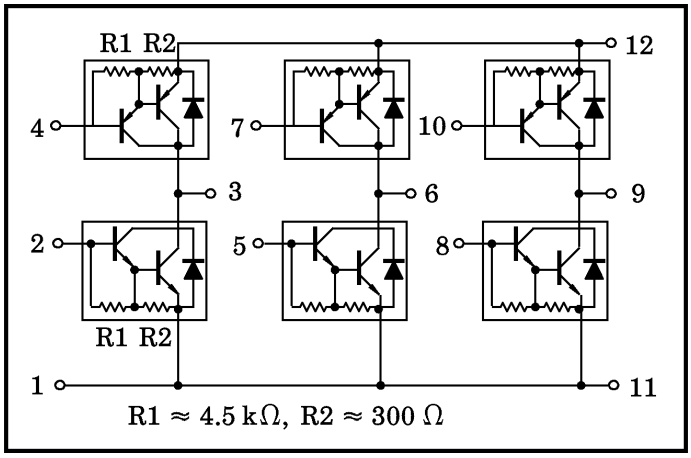
JEDEC	—
EIAJ	—
TOSHIBA	2-32B1D

Weight : 6.0 g

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING NPN	RATING PNP	UNIT
Collector-Base Voltage		V_{CBO}	100	−100	V
Collector-Emitter Voltage		V_{CEO}	80	−80	V
Emitter-Base Voltage		V_{EBO}	5	−5	V
Collector Current		I_C	4	−4	A
		I_{CP}	6	−6	
Continuous Base Current		I_B	0.4	−0.4	A
Collector Power Dissipation (1 Device Operation)		P_C	3.0		W
Collector Power Dissipation (6 Devices Operation)	Ta = 25°C	P_T	5.0		W
	Tc = 25°C		25		
Isolation Voltage		V_{Isol}	1000		V
Junction Temperature		T_j	150		°C
Storage Temperature Range		T_{stg}	−55 ~ 150		°C

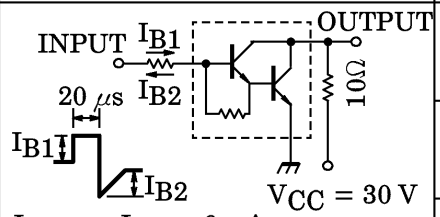
ARRAY CONFIGURATION



THERMAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance of Junction to Ambient (6 Devices Operation, Ta = 25°C)	$\Sigma R_{th\,(j\text{-}a)}$	25	°C / W
Thermal Resistance of Junction to Case (6 Devices Operation, Tc = 25°C)	$\Sigma R_{th\,(j\text{-}c)}$	5.0	°C / W
Maximum Lead Temperature for Soldering Purposes (3.2 mm from Case for 10 s)	T_L	260	°C

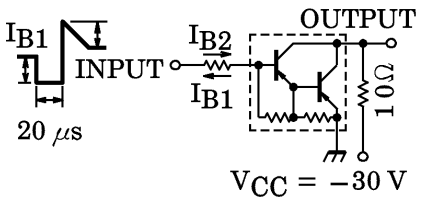
ELECTRICAL CHARACTERISTICS (Ta = 25°C) (NPN TRANSISTOR)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current		I_{CBO}	V_{CB} = 100 V, I_E = 0	—	—	20	μA
Collector Cut-off Current		I_{CEO}	V_{CE} = 80 V, I_B = 0	—	—	20	μA
Emitter Cut-off Current		I_{EBO}	V_{EB} = 5 V, I_C = 0	0.5	—	2.5	mA
Collector-Base Breakdown Voltage		$V_{(BR)\,CBO}$	I_C = 1 mA, I_E = 0	100	—	—	V
Collector-Emitter Breakdown Voltage		$V_{(BR)\,CEO}$	I_C = 10 mA, I_B = 0	80	—	—	V
DC Current Gain		$h_{FE\,(1)}$	V_{CE} = 2 V, I_C = 1 A	2000	—	—	
		$h_{FE\,(2)}$	V_{CE} = 2 V, I_C = 3A	1000	—	—	
Saturation Voltage	Collector-Emitter	$V_{CE\,(sat)}$	I_C = 3 mA, I_B = 6 mA	—	—	1.5	V
	Base-Emitter	$V_{BE\,(sat)}$	I_C = 3 mA, I_B = 6 mA	—	—	2.0	
Transition Frequency		f_T	V_{CE} = 2 V, I_C = 0.5 A	—	60	—	MHz
Collector Output Capacitance		C_{ob}	V_{CB} = 10 V, I_E = 0, f = 1 MHz	—	35	—	pF
Switching Time	Turn-on Time	t_{on}	 $I_{B1} = -I_{B2}$ = 6 mA DUTY CYCLE ≦ 1%	—	0.2	—	μs
	Storage Time	t_{stg}		—	1.5	—	
	Fall Time	t_f		—	0.6	—	

EMITTER-COLLECTOR DIODE RATINGS AND CHARACTERISTICS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Forward Current	I_{FM}	—	—	—	4	A
Surge Current	I_{FSM}	t = 1 s, 1 shot	—	—	6	A
Forward Voltage	V_F	I_F = 1 A, I_B = 0	—	—	2.0	V
Reverse Recovery Time	t_{rr}	I_F = 4 A, V_{BE} = −3 V,	—	1.0	—	μs
Reverse Recovery Charge	Qrr	dI_F/dt = −50 A/μs	—	8	—	μC

ELECTRICAL CHARACTERISTICS (Ta = 25°C) (PNP TRANSISTOR)

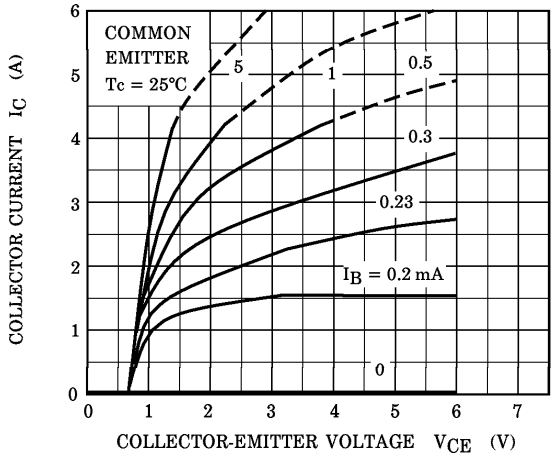
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current		I_{CBO}	$V_{CB} = -100$ V, $I_E = 0$	—	—	−20	μA
Collector Cut-off Current		I_{CEO}	$V_{CE} = -80$ V, $I_B = 0$	—	—	−20	μA
Emitter Cut-off Current		I_{EBO}	$V_{EB} = -5$ V, $I_C = 0$	−0.5	—	−2.5	mA
Collector-Base Breakdown Voltage		$V_{(BR)\,CBO}$	$I_C = -1$ mA, $I_E = 0$	−100	—	—	V
Collector-Emitter Breakdown Voltage		$V_{(BR)\,CEO}$	$I_C = -10$ mA, $I_B = 0$	−80	—	—	V
DC Current Gain		$h_{FE\,(1)}$	$V_{CE} = -2$ V, $I_C = -1$ A	2000	—	—	
		$h_{FE\,(2)}$	$V_{CE} = -2$ V, $I_C = -3$ A	1000	—	—	
Saturation Voltage	Collector-Emitter	$V_{CE\,(sat)}$	$I_C = -3$ A, $I_B = -6$ mA	—	—	−1.5	V
	Base-Emitter	$V_{BE\,(sat)}$	$I_C = -3$ A, $I_B = -6$ mA	—	—	−2.0	
Transition Frequency		f_T	$V_{CE} = -2$ V, $I_C = -0.5$ A	—	40	—	MHz
Collector Output Capacitance		C_{ob}	$V_{CB} = -10$ V, $I_E = 0$, f = 1 MHz	—	60	—	pF
Switching Time	Turn-on Time	t_{on}		—	0.15	—	μs
	Storage Time	t_{stg}		—	0.80	—	
	Fall Time	t_f	$-I_{B1} = I_{B2} = 6$ mA, DUTY CYCLE ≦ 1%	—	0.40	—	

EMITTER-COLLECTOR DIODE RATINGS AND CHARACTERISTICS (Ta = 25°C)

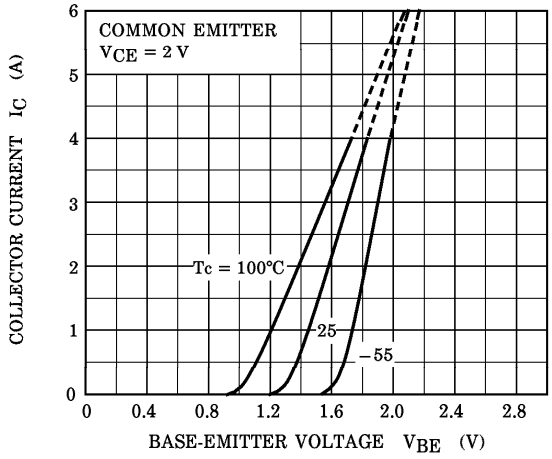
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Forward Current	I_{FM}	—	—	—	4	A
Surge Current	I_{FSM}	t = 1 s, 1 shot	—	—	6	A
Forward Voltage	V_F	$I_F = 1$ A, $I_B = 0$	—	—	2.0	V
Reverse Recovery Time	t_{rr}	$I_F = 4$ A, $V_{BE} = 3$ V, $dI_F / dt = -50$ A / μs	—	1.0	—	μs
Reverse Recovery Charge	Qrr		—	8	—	μC

(NPN TRANSISTOR)

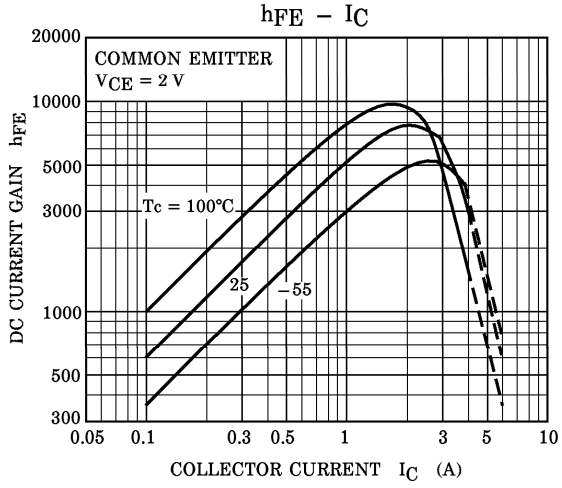
I_C – V_{CE}



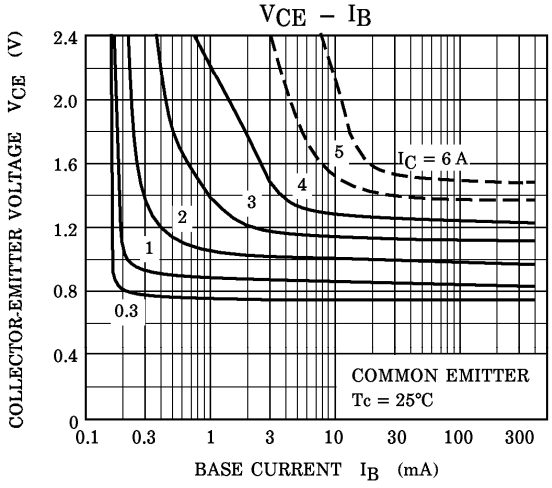
I_C – V_{BE}



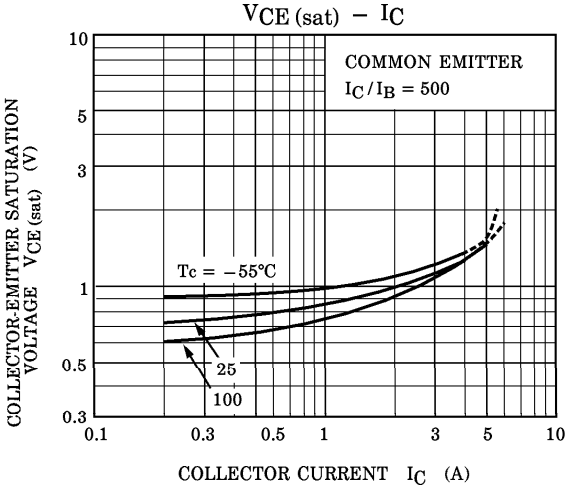
h_{FE} – I_C



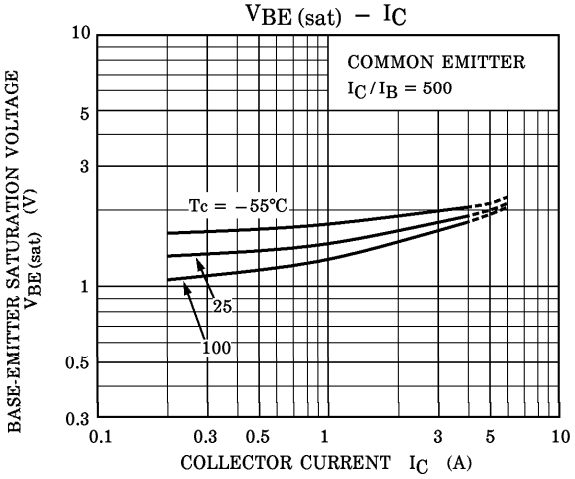
V_{CE} – I_B



$V_{CE\,(sat)}$ – I_C

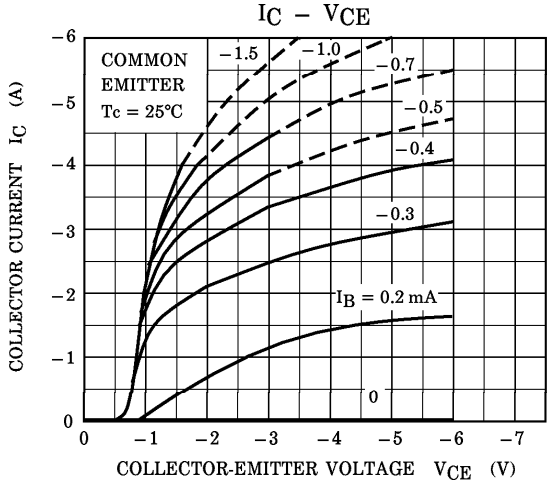


$V_{BE\,(sat)}$ – I_C

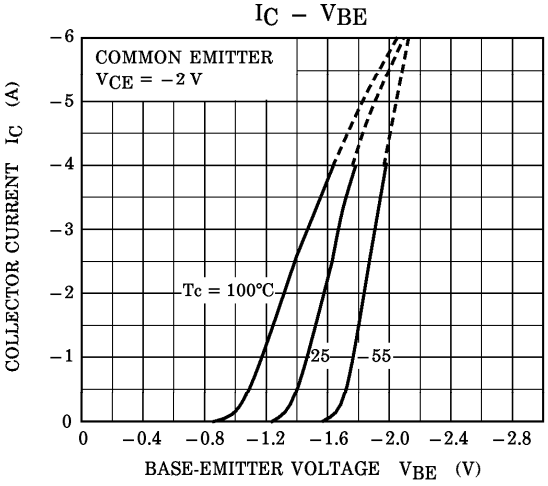


(PNP TRANSISTOR)

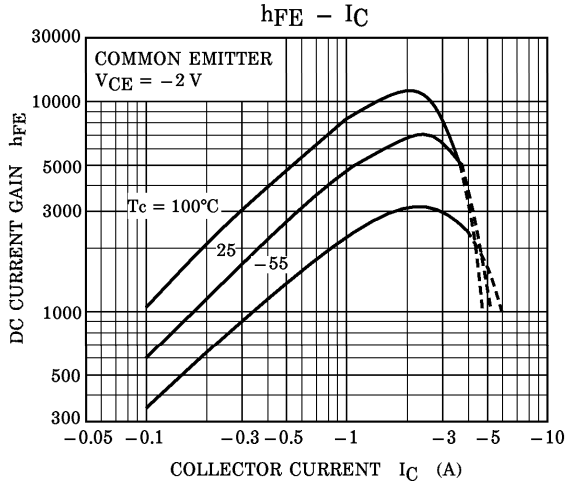
$I_C - V_{CE}$



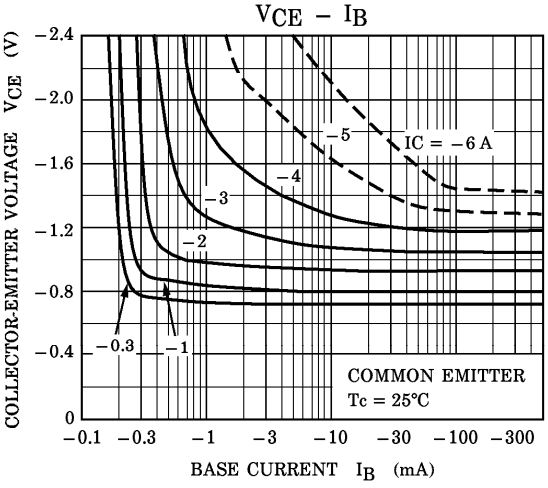
$I_C - V_{BE}$



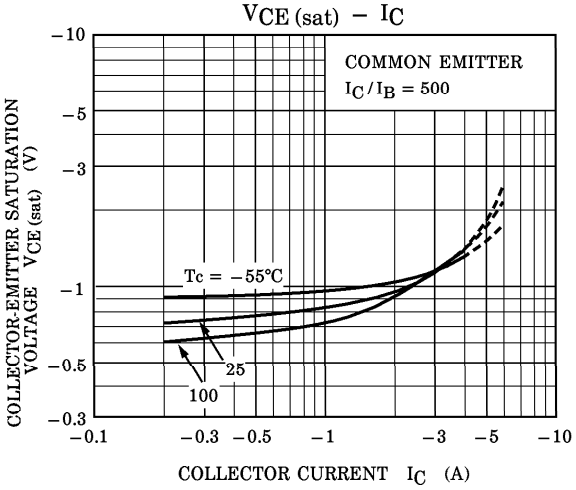
$h_{FE} - I_C$



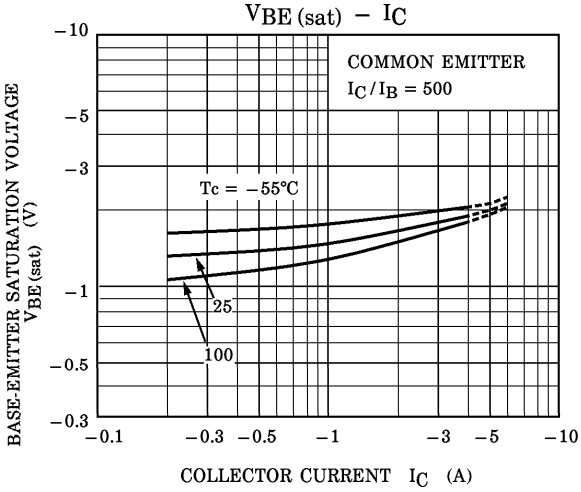
$V_{CE} - I_B$



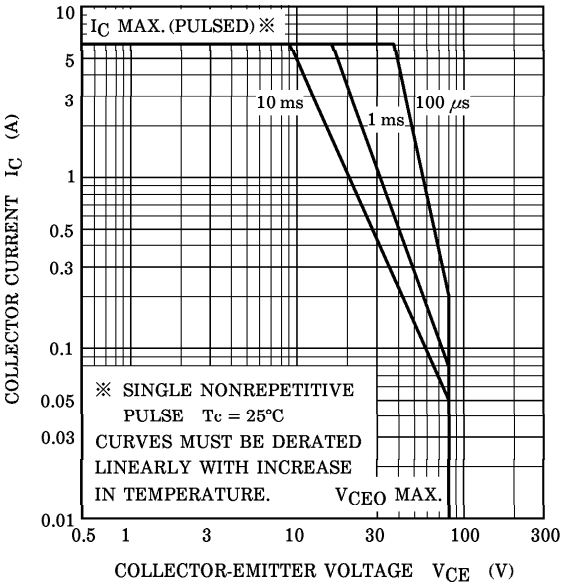
$V_{CE\,(sat)} - I_C$



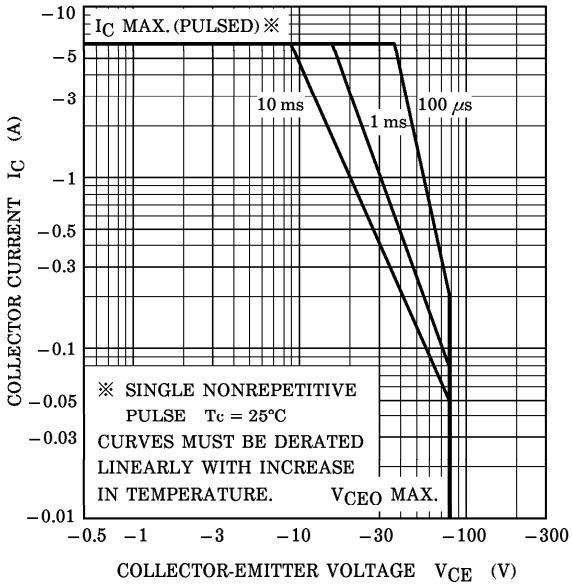
$V_{BE\,(sat)} - I_C$



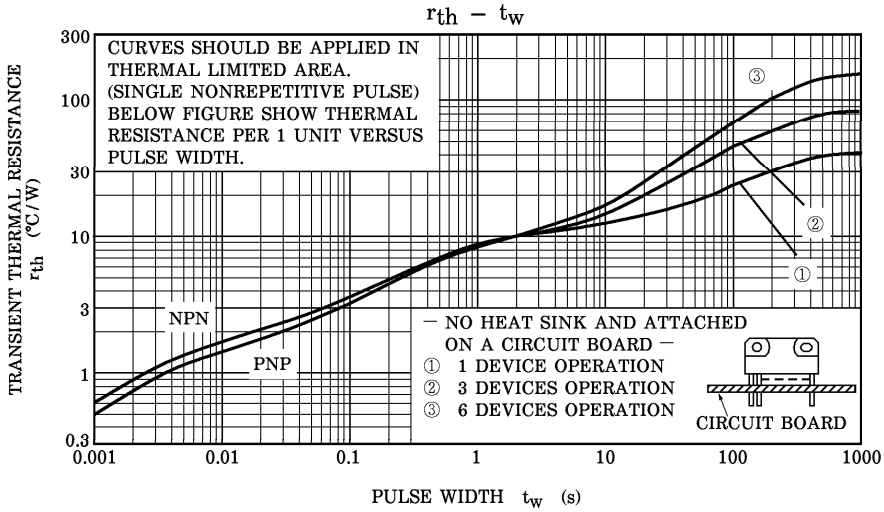
SAFE OPERATING AREA (NPN Tr)

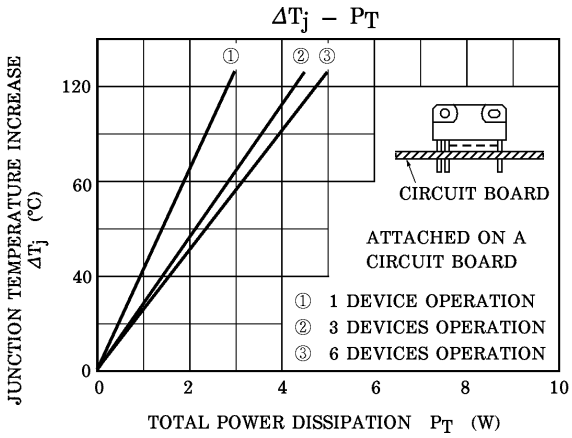


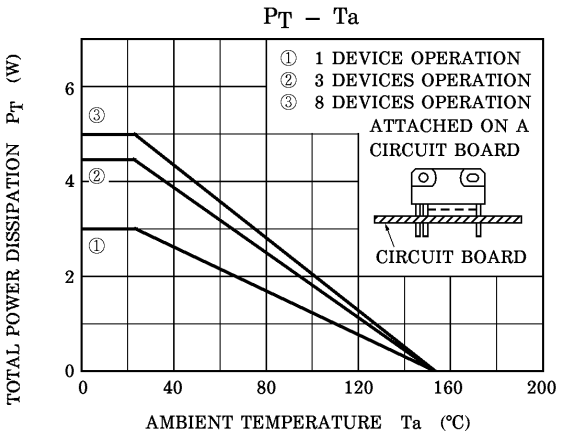
SAFE OPERATING AREA (PNP Tr)



$r_{th} - t_w$




ΔTj – PT
JUNCTION TEMPERATURE INCREASE ΔTj (°C)
120
60
40
0
0
2
4
6
8
10
TOTAL POWER DISSIPATION PT (W)
① 1 DEVICE OPERATION
② 3 DEVICES OPERATION
③ 6 DEVICES OPERATION
ATTACHED ON A CIRCUIT BOARD
CIRCUIT BOARD


PT – Ta
TOTAL POWER DISSIPATION PT (W)
6
4
2
0
0
40
80
120
160
200
AMBIENT TEMPERATURE Ta (°C)
① 1 DEVICE OPERATION
② 3 DEVICES OPERATION
③ 8 DEVICES OPERATION
ATTACHED ON A CIRCUIT BOARD
CIRCUIT BOARD