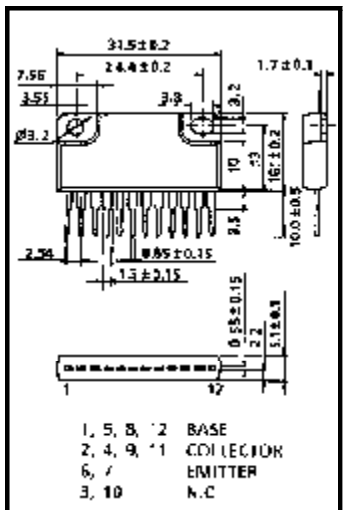
TOSHIBA Power Transistor Module Silicon Triple Diffused Type
(Four Darlington Power Transistors in One)

MP4507

Industrial Applications

High Power Switching Applications
Hammer Drive, Pulse Motor Drive and Inductive Load Switching

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	2-32B1C

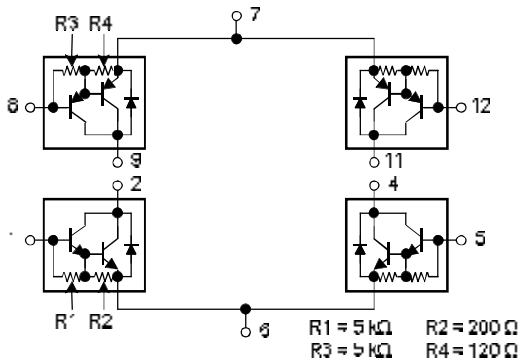
Weight: 6.0 g (typ.)

- Package with heat sink isolated to lead (SIP 12 pins)
- High collector power dissipation (1-device operation)
  : PC = 5 W (Ta = 25°C)
- High collector current: IC (DC) = −5 A (max)
- High DC current gain: hFE = 1000 (min) (VCE = −2 V, IC = −3 A)

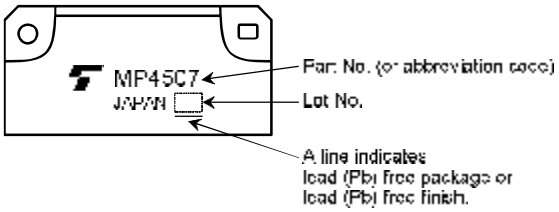
Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating		Unit
			NPN	PNP	
Collector-base voltage		V_{CBO}	100	−100	V
Collector-emitter voltage		V_{CEO}	100	−100	V
Emitter-base voltage		V_{EBO}	5	−5	V
Collector current	DC	I_C	5	−5	A
	Pulse	I_{CP}	8	−8	
Continuous base current		I_B	0.1	−0.1	A
Collector power dissipation (1-device operation)		P_C	3.0		W
Collector power dissipation (4-device operation)	Ta = 25°C	P_C	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 to 150		°C

Array Configuration



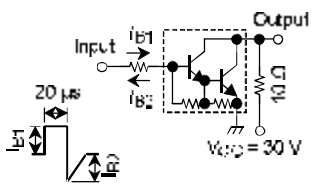
Marking



Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance from channel to ambient (4 devices operation, Ta = 25°C)	$R_{th\ (ch-a)}$	25	°C/W
Thermal resistance from channel to case (4 devices operation, Tc = 25°C)	$R_{th\ (ch-c)}$	5.0	°C/W
Maximum lead temperature for soldering purposes (3.2 mm from case for 10 s)	T_L	260	°C

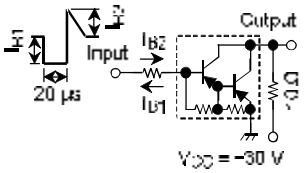
Electrical Characteristics (Ta = 25°C) (NPN transistor)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current		I_{CBO}	V_{CB} = 100 V, I_E = 0 A	—	—	10	μA
Collector cut-off current		I_{CEO}	V_{CE} = 100 V, I_B = 0 A	—	—	10	μA
Emitter cut off current		I_{EBO}	V_{EB} = 5 V, I_C = 0 A	0.3	—	2.0	mA
Collector-base breakdown voltage		$V_{(BR)CBO}$	I_C = 1 mA, I_E = 0 A	100	—	—	V
Collector emitter breakdown voltage		$V_{(BR)CEO}$	I_C = 30 mA, I_B = 0 A	100	—	—	V
DC current gain		$h_{FE\ (1)}$	V_{CE} = 3 V, I_C = 0.5 A	1000	—	—	—
		$h_{FE\ (2)}$	V_{CE} = 3 V, I_C = 3 A	1000	—	—	
Saturation voltage	Collector emitter	$V_{CE\ (sat)}$	I_C = 3 A, I_B = 12 mA	—	—	2.0	V
	Base-emitter	$V_{BE\ (sat)}$	I_C = 3 A, I_B = 12 mA	—	—	2.5	
Transition frequency		f	V_{CE} = 3 V, I_C = 0.5 A	3	—	—	MHz
Collector output capacitance		C_{ob}	V_{CB} = 50 V, I_E = 0 A, f = 1 MHz	—	40	—	pF
Switching time	Turn-on time	t_{on}		—	0.5	—	μs
	Storage time	t_{stg}		—	3.0	—	
	Fall time	t_f	I_{B1} = −I_{B2} = 12 mA, duty cycle ≤ 1%	—	2.0	—	

Emitter-Collector Diode Ratings and Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Forward current	I_{FM}	—	—	—	5	A
Surge current	I_{FSM}	t = 1 s, 1 shot	—	—	8	A
Forward voltage	V_F	i_F = 1 A, I_B = 0 A	—	—	2.0	V
Reverse recovery time	t_{rr}	i_F = 5 A, V_{BE} = −3 V, di_F/dt = −50 A/μs	—	1.0	—	μs
Reverse recovery charge	Q_{rr}		—	8	—	μC

Electrical Characteristics (Ta = 25°C) (PNP transistor)

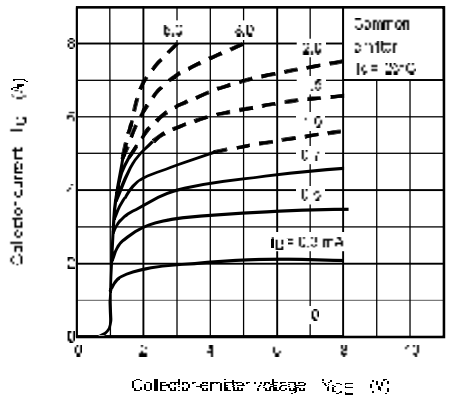
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current		I_{CBO}	V_{CB} = −100 V, I_E = 0 A	—	—	−10	μA
Collector cut off current		I_{CEO}	V_{CE} = −100 V, I_B = 0 A	—	—	−10	μA
Emitter cut-off current		I_{EBO}	V_{EB} = −5 V, I_C = 0 A	−0.3	—	−2.0	mA
Collector-base breakdown voltage		$V_{(BR)CBO}$	I_C = −1 mA, I_E = 0 A	−100	—	—	V
Collector-emitter breakdown voltage		$V_{(BR)CEO}$	I_C = −30 mA, I_B = 0 A	−100	—	—	V
DC current gain		h_{FE} (1)	V_{CE} = −3 V, I_C = −0.5 A	1000	—	—	—
		h_{FE} (2)	V_{CE} = −3 V, I_C = −3 A	1000	—	—	
Saturation voltage	Collector-emitter	$V_{CE\ (sat)}$	I_C = −3 A, I_B = −12 mA	—	—	−2.0	V
	Base-emitter	$V_{BE\ (sat)}$	I_C = −3 A, I_B = −12 mA	—	—	−2.5	
Transition frequency		f_T	V_{CE} = −3 V, I_C = −0.5 A	3	—	—	MHz
Collector output capacitance		C_{ob}	V_{CB} = −50 V, I_E = 0 A, f = 1 MHz	—	40	—	pF
Switching time	Turn on time	t_{on}	 $-I_{B1} = I_{B2}$ = 12 mA, duty cycle ≤ 1%	—	0.5	—	μs
	Storage time	t_{stg}		—	3.0	—	
	Fall time	t_f		—	2.0	—	

Emitter-Collector Diode Ratings and Characteristics (Ta = 25°C)

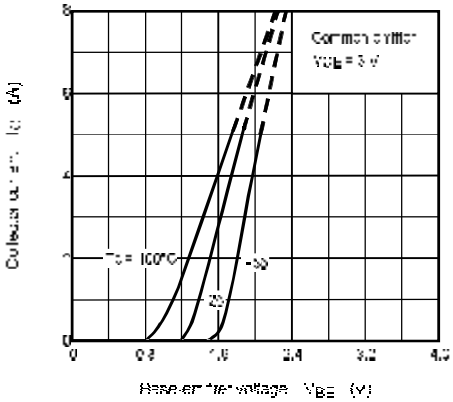
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Forward current	I_{FM}	—	—	—	5	A
Surge current	I_{FSM}	t = 1 s, 1 shot	—	—	8	A
Forward voltage	V_F	i_F = 1 A, I_B = 0 A	—	—	2.0	V
Reverse recovery time	t_{rr}	i_F = 5 A, V_{BE} = 3 V, di_F/dt = −50 A/μs	—	1.0	—	μs
Reverse recovery charge	Q_{rr}		—	8	—	μC

(NPN transistor)

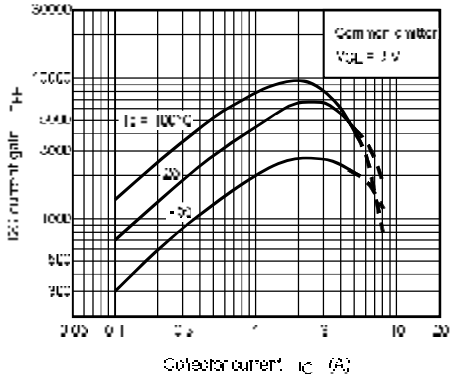
$I_C - V_{CE}$



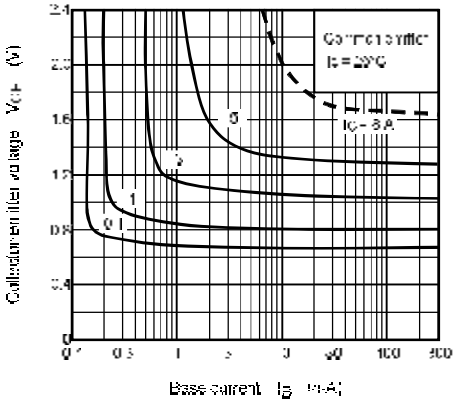
$I_C - V_{BE}$



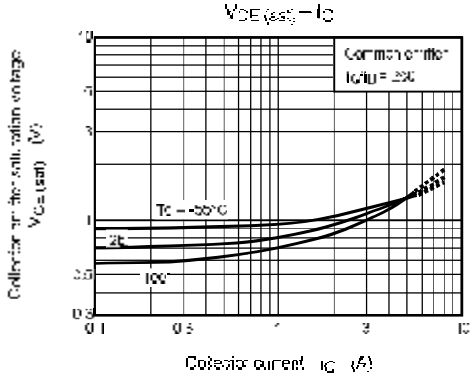
$h_{FE} - I_C$



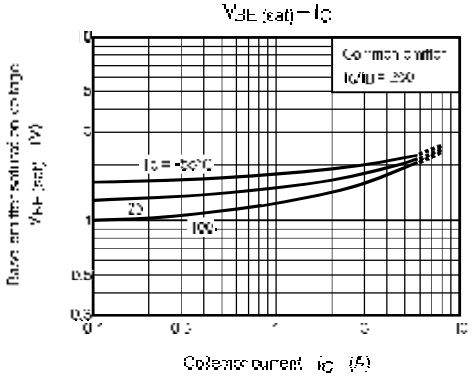
$V_{CE} - I_B$



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

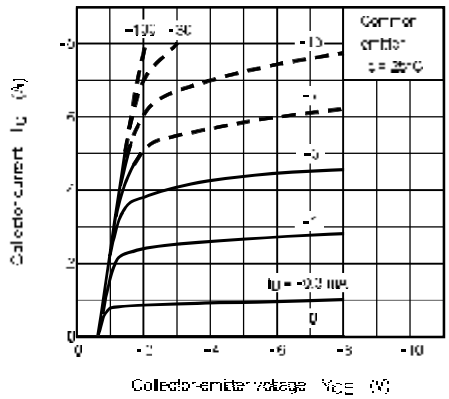


$V_{BE\,(sat)} - I_C$

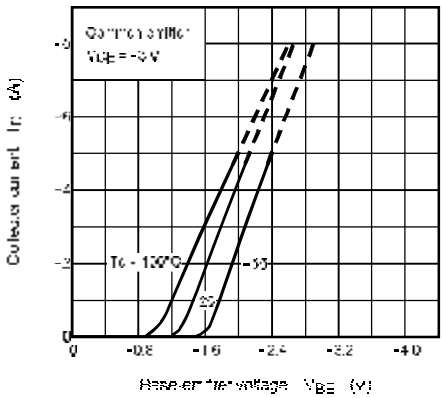


(PNP transistor)

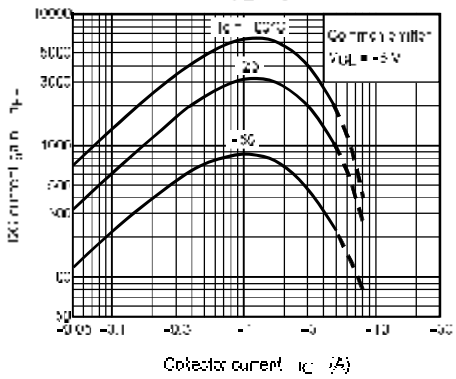
$I_C - V_{CE}$



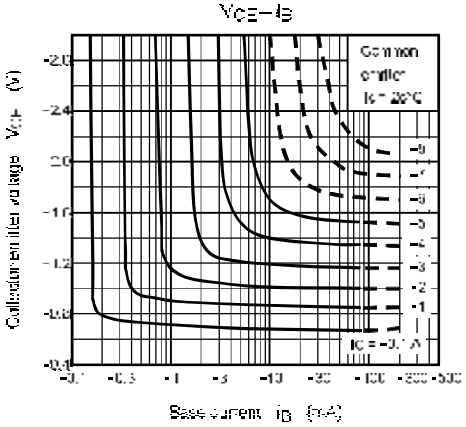
$I_C - V_{BE}$



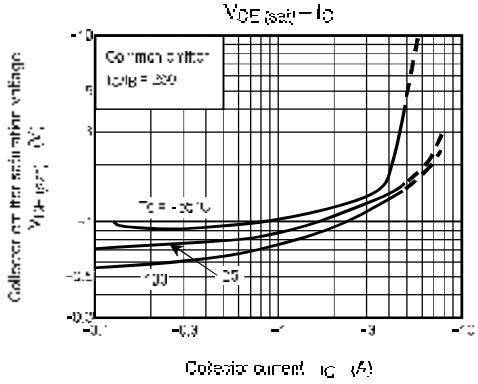
$h_{FE} - I_C$



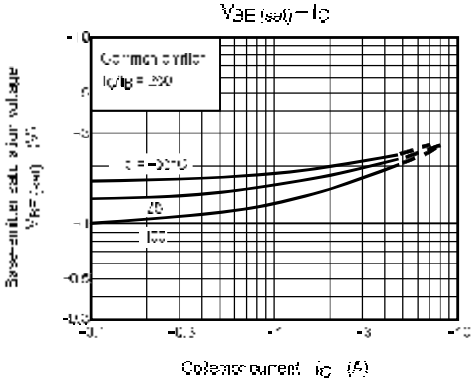
$V_{CE} - I_B$

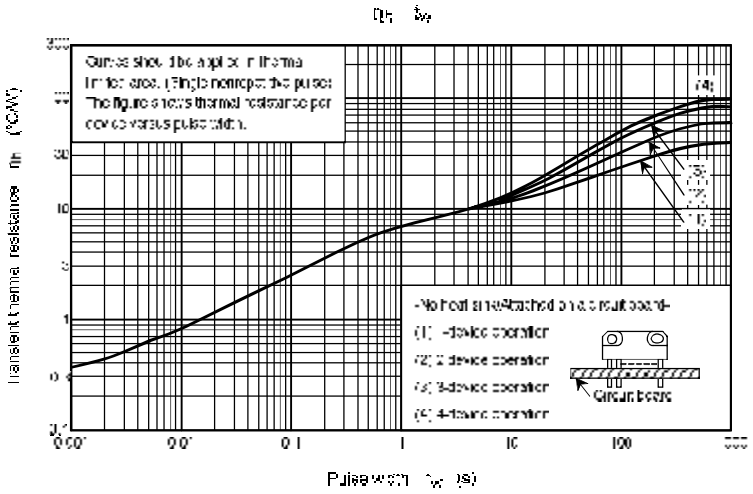


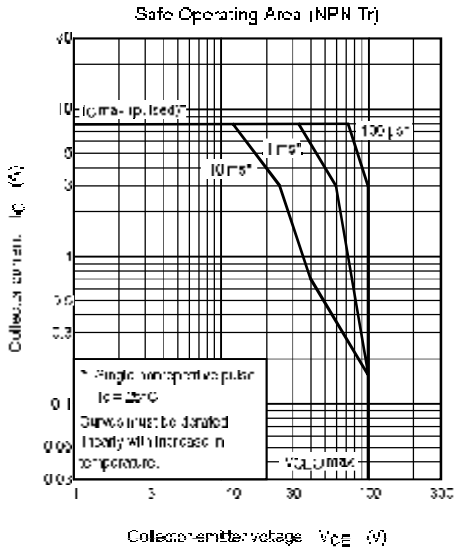
$V_{CE\,(sat)} - I_C$

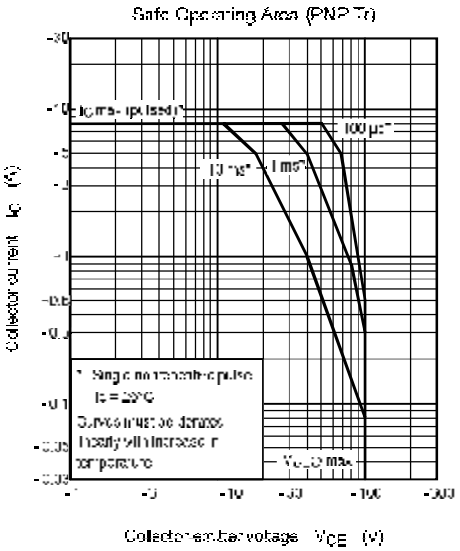


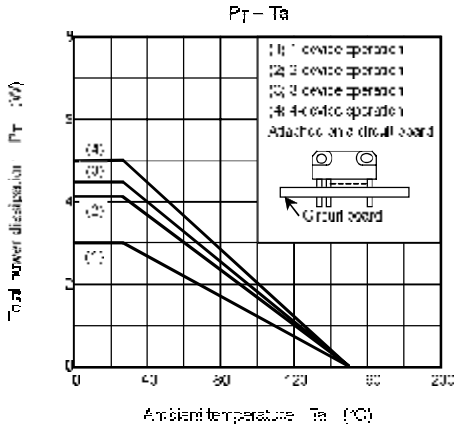
$V_{BE\,(sat)} - I_C$

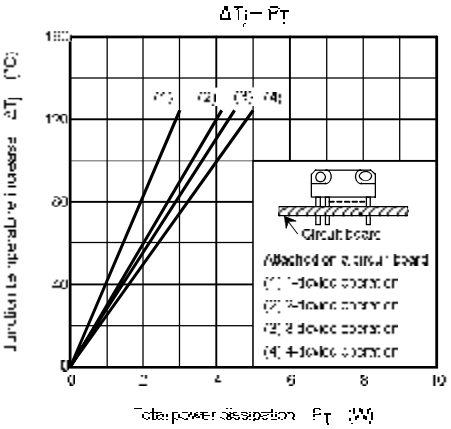



Curves show the applicable thermal limitation area. (Single nonrepetitive pulse) The figure shows thermal resistance per device versus pulse width.
(4)
(3)
(2)
(1)
-No heat sink/Attached on a circuit board-
(1) 1-device operation
(2) 2-device operation
(3) 3-device operation
(4) 4-device operation
Circuit board
Transient thermal resistance rth (°C/W)
Pulse width tw (s)


Safe Operating Area (NPN Tr)
10 ms*
1 ms*
100 μs*
* Single nonrepetitive pulse
Tc = 25°C
Curves must be derated linearly with increase in temperature.
VCEO max
Collector current IC (A)
Collector-emitter voltage VCE (V)


Safe Operating Area (PNP Tr)
10 ms*
1 ms*
100 μs*
* Single nonrepetitive pulse
Tc = 25°C
Curves must be derated linearly with increase in temperature.
VCEO max
Collector current IC (A)
Collector-emitter voltage VCE (V)


PT – Ta
(1) 1-device operation
(2) 2-device operation
(3) 3-device operation
(4) 4-device operation
Attached on a circuit board
Circuit board
Total power dissipation PT (W)
Ambient temperature Ta (°C)


ΔTj – PT
(1)
(2)
(3)
(4)
Circuit board
Attached on a circuit board
(1) 1-device operation
(2) 2-device operation
(3) 3-device operation
(4) 4-device operation
Junction temperature increase ΔTj (°C)
Total power dissipation PT (W)

RESTRICTIONS ON PRODUCT USE

030619EAA

- The information contained herein is subject to change without notice.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of TOSHIBA or others.
- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
  In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- TOSHIBA products should not be embedded to the downstream products which are prohibited to be produced and sold, under any law and regulations.