

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.

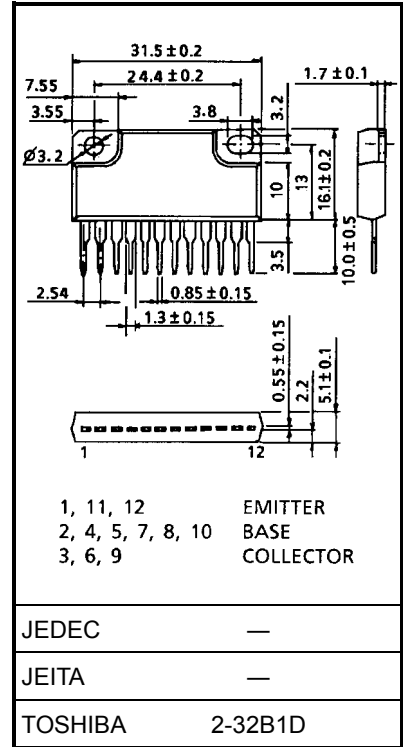
- Package with heat sink isolated to lead (SIP 12 pin)
- High collector power dissipation (6 devices operation)  
:  $P_T = 5 \text{ W}$  ( $T_a = 25^\circ\text{C}$ )
- High collector current:  $I_C \text{ (DC)} = \pm 4 \text{ A}$  (max)
- High DC current gain:  $h_{FE} = 2000$  (min) ( $V_{CE} = \pm 2 \text{ V}$ ,  $I_C = \pm 1 \text{ A}$ )

## Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Rating		Unit
		NPN	PNP	
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)	$T_a = 25^\circ\text{C}$	5.0		W
	$T_c = 25^\circ\text{C}$	25		
Isolation voltage	$V_{isol}$	1000		V
Junction temperature	$T_j$	150		$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-55 to 150		$^\circ\text{C}$

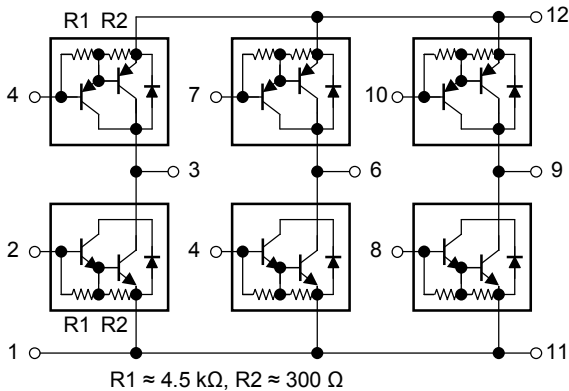
Industrial Applications

Unit: mm



Weight: 6.0 g (typ.)

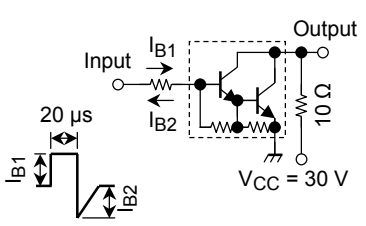
## Array Configuration



## Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance of junction to ambient (6 devices operation, $T_a = 25^\circ\text{C}$ )	$\Sigma R_{th(j-a)}$	25	$^\circ\text{C/W}$
Thermal resistance of junction to case (6 devices operation, $T_c = 25^\circ\text{C}$ )	$\Sigma R_{th(j-c)}$	5.0	$^\circ\text{C/W}$
Maximum lead temperature for soldering purposes (3.2 mm from case for 10 s)	$T_L$	260	$^\circ\text{C}$

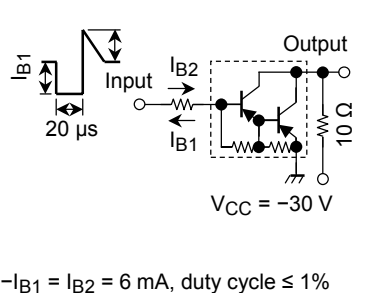
## Electrical Characteristics ( $T_a = 25^\circ\text{C}$ ) (NPN transistor)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current		$I_{CBO}$	$V_{CB} = 100\text{ V}, I_E = 0\text{ A}$	—	—	20	$\mu\text{A}$
Collector cut-off current		$I_{CEO}$	$V_{CE} = 80\text{ V}, I_B = 0\text{ A}$	—	—	20	$\mu\text{A}$
Emitter cut-off current		$I_{EBO}$	$V_{EB} = 5\text{ V}, I_C = 0\text{ A}$	0.5	—	2.5	mA
Collector-base breakdown voltage		$V_{(BR)CBO}$	$I_C = 1\text{ mA}, I_E = 0\text{ A}$	100	—	—	V
Collector-emitter breakdown voltage		$V_{(BR)CEO}$	$I_C = 10\text{ mA}, I_B = 0\text{ A}$	80	—	—	V
DC current gain		$h_{FE(1)}$	$V_{CE} = 2\text{ V}, I_C = 1\text{ A}$	2000	—	—	—
		$h_{FE(2)}$	$V_{CE} = 2\text{ V}, I_C = 3\text{ A}$	1000	—	—	
Saturation voltage	Collector-emitter	$V_{CE(sat)}$	$I_C = 3\text{ mA}, I_B = 6\text{ mA}$	—	—	1.5	V
	Base-emitter	$V_{BE(sat)}$	$I_C = 3\text{ mA}, I_B = 6\text{ mA}$	—	—	2.0	
Transition frequency		$f_T$	$V_{CE} = 2\text{ V}, I_C = 0.5\text{ A}$	—	60	—	MHz
Collector output capacitance		$C_{ob}$	$V_{CB} = 10\text{ V}, I_E = 0\text{ A}, f = 1\text{ MHz}$	—	35	—	pF
Switching time	Turn-on time	$t_{on}$	 <p><math>I_{B1} = -I_{B2} = 6\text{ mA}, \text{duty cycle} \leq 1\%</math></p>	—	0.2	—	$\mu\text{s}$
	Storage time	$t_{stg}$		—	1.5	—	
	Fall time	$t_f$		—	0.6	—	

## Emitter-Collector Diode Ratings and Characteristics ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Forward current	$I_{FM}$	—	—	—	4	A
Surge current	$I_{FSM}$	$t = 1\text{ s}, 1\text{ shot}$	—	—	6	A
Forward voltage	$V_F$	$I_F = 1\text{ A}, I_B = 0\text{ A}$	—	—	2.0	V
Reverse recovery time	$t_{rr}$	$I_F = 4\text{ A}, V_{BE} = -3\text{ V}, dI_F/dt = -50\text{ A}/\mu\text{s}$	—	1.0	—	$\mu\text{s}$
Reverse recovery charge	$Q_{rr}$		—	8	—	$\mu\text{C}$

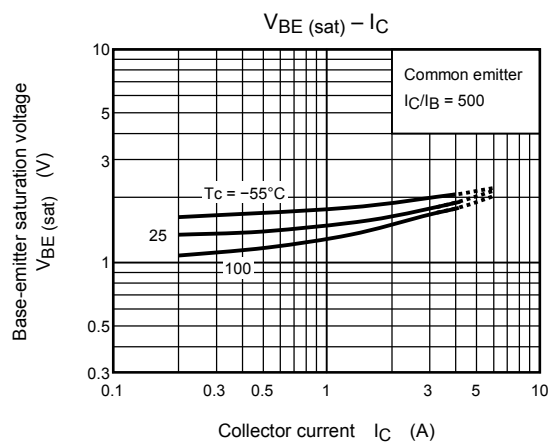
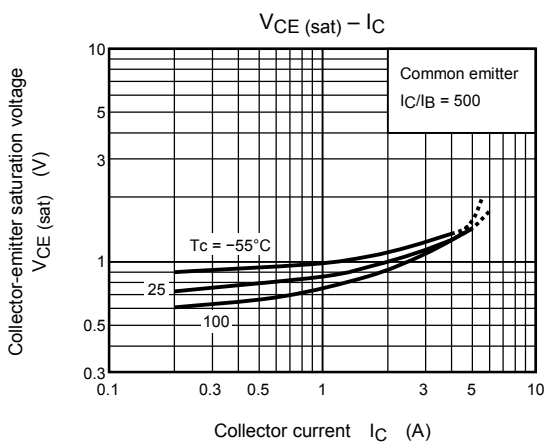
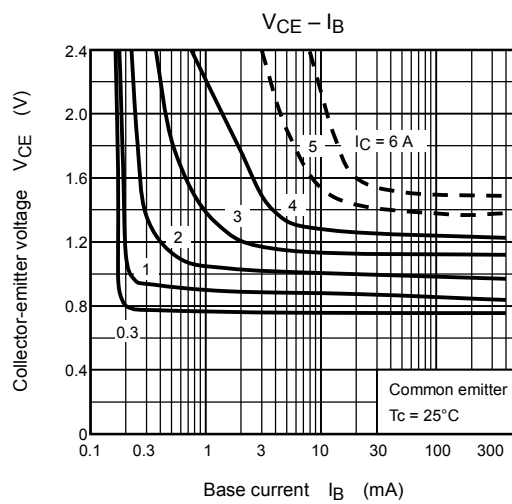
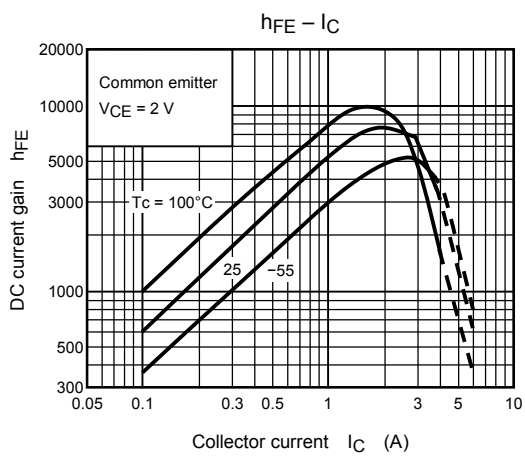
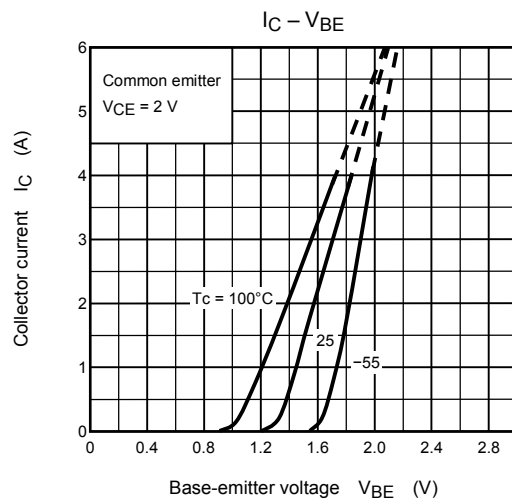
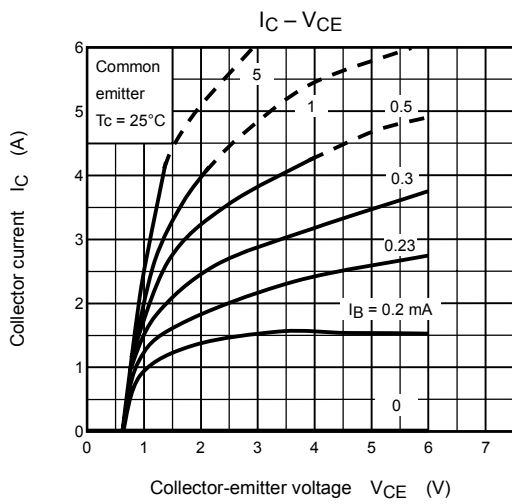
## Electrical Characteristics (Ta = 25°C) (PNP transistor)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current		$I_{CBO}$	$V_{CB} = -100\text{ V}, I_E = 0\text{ A}$	—	—	-20	$\mu\text{A}$
Collector cut-off current		$I_{CEO}$	$V_{CE} = -80\text{ V}, I_B = 0\text{ A}$	—	—	-20	$\mu\text{A}$
Emitter cut-off current		$I_{EBO}$	$V_{EB} = -5\text{ V}, I_C = 0\text{ A}$	-0.5	—	-2.5	mA
Collector-base breakdown voltage		$V_{(BR)CBO}$	$I_C = -1\text{ mA}, I_E = 0\text{ A}$	-100	—	—	V
Collector-emitter breakdown voltage		$V_{(BR)CEO}$	$I_C = -10\text{ mA}, I_B = 0\text{ A}$	-80	—	—	V
DC current gain		$h_{FE(1)}$	$V_{CE} = -2\text{ V}, I_C = -1\text{ A}$	2000	—	—	—
		$h_{FE(2)}$	$V_{CE} = -2\text{ V}, I_C = -3\text{ A}$	1000	—	—	
Saturation voltage	Collector-emitter	$V_{CE(sat)}$	$I_C = -3\text{ A}, I_B = -6\text{ mA}$	—	—	-1.5	V
	Base-emitter	$V_{BE(sat)}$	$I_C = -3\text{ A}, I_B = -6\text{ mA}$	—	—	-2.0	
Transition frequency		$f_T$	$V_{CE} = -2\text{ V}, I_C = -0.5\text{ A}$	—	40	—	MHz
Collector output capacitance		$C_{ob}$	$V_{CB} = -10\text{ V}, I_E = 0\text{ A}, f = 1\text{ MHz}$	—	60	—	pF
Switching time	Turn-on time	$t_{on}$	 <p style="text-align: center;"><math>V_{CC} = -30\text{ V}</math></p> <p style="text-align: center;"><math>-I_{B1} = I_{B2} = 6\text{ mA}, \text{ duty cycle} \leq 1\%</math></p>	—	0.15	—	$\mu\text{s}$
	Storage time	$t_{stg}$		—	0.80	—	
	Fall time	$t_f$		—	0.40	—	

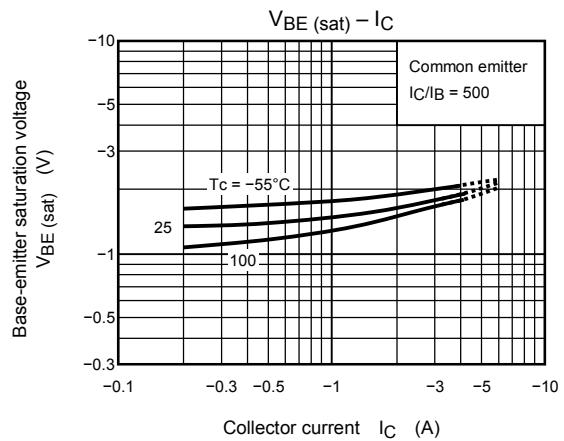
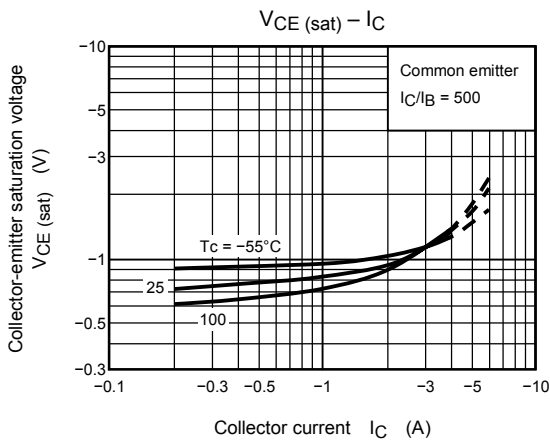
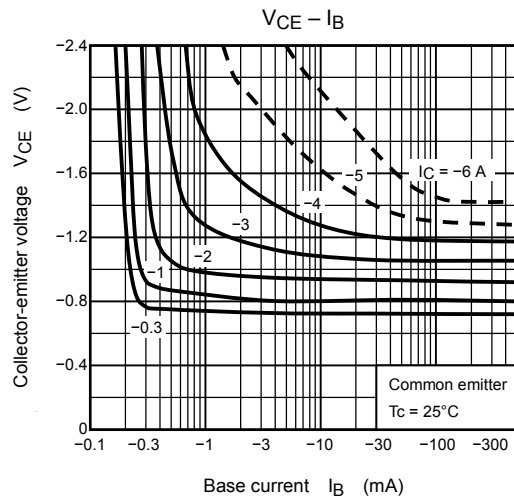
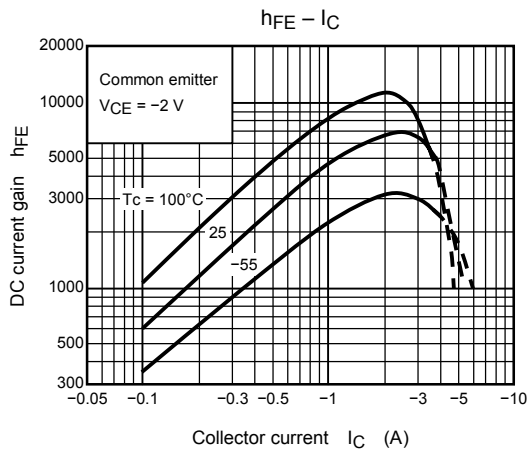
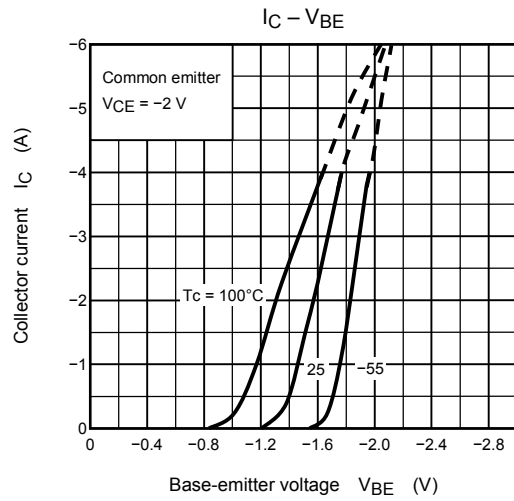
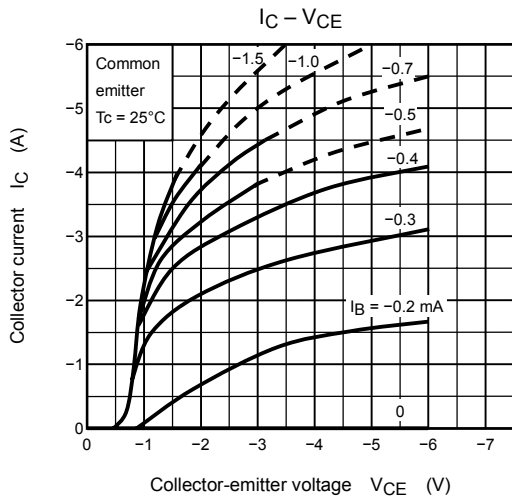
## Emitter-Collector Diode Ratings and Characteristics (Ta = 25°C)

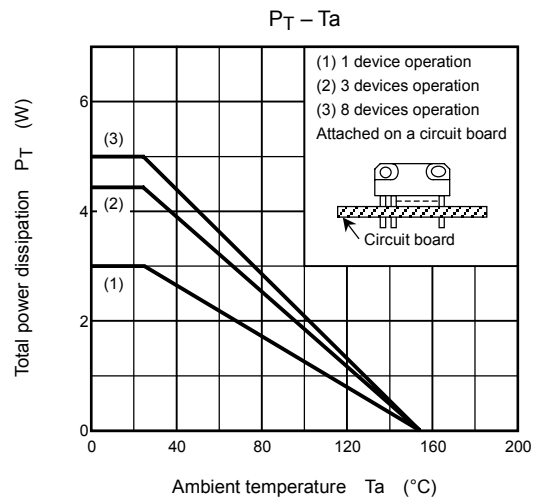
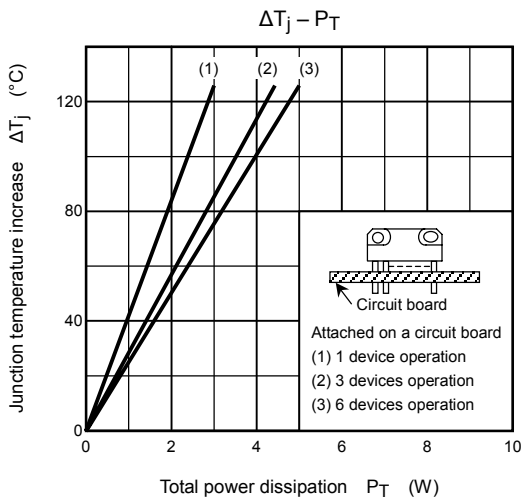
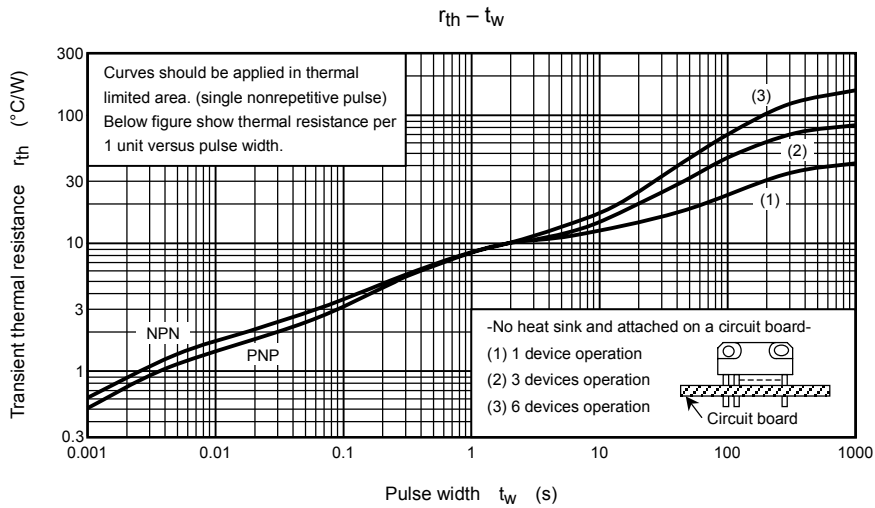
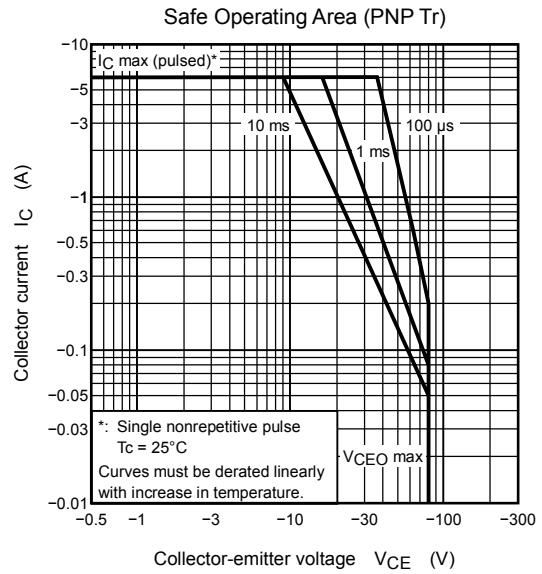
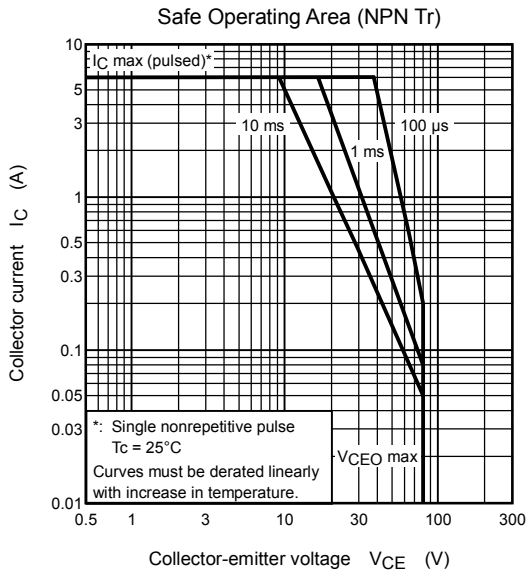
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Surge current	$I_{FSM}$	$t = 1\text{ s}, 1\text{ shot}$	—	—	6	A
Forward voltage	$V_F$	$I_F = 1\text{ A}, I_B = 0\text{ A}$	—	—	2.0	V
Reverse recovery time	$t_{rr}$	$I_F = 4\text{ A}, V_{BE} = 3\text{ V}, dI_F/dt = -50\text{ A}/\mu\text{s}$	—	1.0	—	$\mu\text{s}$
Reverse recovery charge	$Q_{rr}$		—	8	—	$\mu\text{C}$

## (NPN transistor)



## (PNP transistor)





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