

# NPN Darlington Power Transistor

$V_{CE0}$  500V,  $I_c$  20A, 175W

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**RoHS  
Compliant**



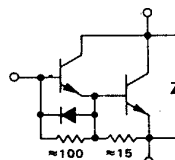
TO-3

## Description

Switch mode series NPN Silicon Power Darling Transistors With Base-Emitter Speedup Diode. This darlington transistors are designed for high-voltage, high-speed, power switching in inductive circuits where fall time is critical. They are particularly suited for line operated switch-mode applications.

## Features

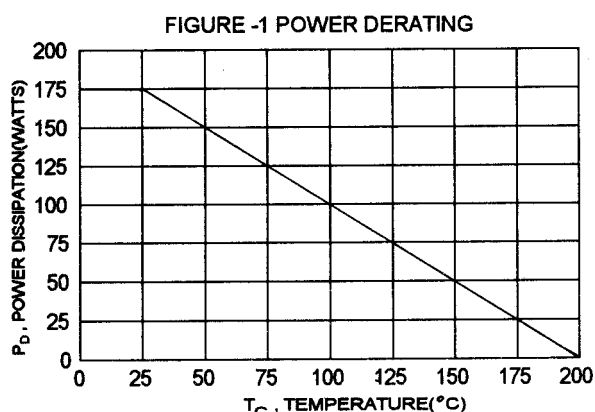
- Continuous Collector Current -  $I_c = 20A$
- Switching Regulators
- Inverters
- Solenoid and Relay Drivers
- Motor Controls



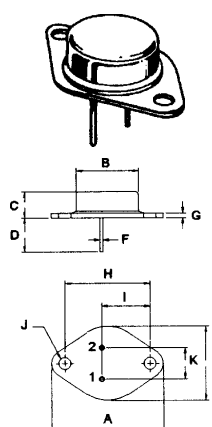
## Maximum Ratings and Thermal Characteristics

Characteristics	Symbol	Values	Unit
Collector-Emitter Voltage	$V_{CEV}$	700	V
Collector-Emitter Voltage	$V_{CEX(SUS)}$	500	
Collector-Emitter Voltage	$V_{CEO(SUS)}$	500	
Emitter-Base Voltage	$V_{EBO}$	8	
Collector Current-Continuous	$I_c$	20	A
Peak	$I_{CM}$	30	
Base Current	$I_B$	2.5	A
Total Power Dissipation @ $T_c = 25^\circ C$	$P_D$	175	W
@ $T_c = 100^\circ C$		100	
Derate above $25^\circ C$		1	W/ $^\circ C$
Operating and Storage Junction Temperature Range	$T_J, T_{STG}$	-65 to +200	$^\circ C$
Thermal Resistance Junction to Case	$R_{\theta jc}$	1	$^\circ C/W$

## Thermal Characteristics



TO-3



Pin

1. Base

2. Emitter

Collector (case)

DIM	MILLIMETRES	
	MIN	MAX
A	38.75	39.96
B	19.28	22.23
C	7.96	9.28
D	11.18	12.19
E	25.2	26.67
F	0.92	1.09
G	1.38	1.62
H	29.9	30.4
I	16.64	17.3
J	3.88	4.36
K	10.67	11.18

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## Electrical Characteristics (T<sub>c</sub> = 25°C Unless otherwise noted)

Characteristics	Symbol	Min	Max	Unit
Off Characteristics				
Collector - Emitter Sustaining Voltage (I <sub>c</sub> = 100mA, I <sub>B</sub> = 0, V <sub>clamp</sub> = Rate V <sub>CEO</sub> )	V <sub>CEO(SUS)</sub>	500	-	V
Collector Cutoff Current (V <sub>CE</sub> = Rated V <sub>CEV</sub> , R <sub>BE</sub> = 50Ω, T <sub>C</sub> = 100°C)	I <sub>CER</sub>	-	5	mA
Collector Cutoff Current (V <sub>CEV</sub> = Rated Value, V <sub>BE(OFF)</sub> = 1.5 V) (V <sub>CEV</sub> = Rated Value, V <sub>BE(OFF)</sub> = 1.5 V, T <sub>C</sub> = 100°C)	I <sub>CEV</sub>	-	0.25 5	
Emitter Cutoff Current (V <sub>EB</sub> = 2V, I <sub>c</sub> = 0)	I <sub>EBO</sub>	-	175	
On Characteristics (1)				
DC Current Gain (I <sub>c</sub> = 5A, V <sub>CE</sub> = 5V) (I <sub>c</sub> = 10A, V <sub>CE</sub> = 5V)	h <sub>FE</sub>	40 30	400 300	-
Collector - Emitter Saturation Voltage (I <sub>c</sub> = 10 , I <sub>B</sub> = 500mA) (I <sub>c</sub> = 20A, I <sub>B</sub> = 2A) (I <sub>c</sub> = 10A, I <sub>B</sub> = 500mA,T <sub>c</sub> = 100°C)	V <sub>CE(sat)</sub>	-	2 3.5 2.5	V
Base - Emitter Saturation Voltage (I <sub>c</sub> = 10A, I <sub>B</sub> = 500mA) (I <sub>c</sub> = 10A, I <sub>B</sub> = 500mA, T <sub>c</sub> = 100°C)	V <sub>BE(sat)</sub>	-	2.5 2.5	
Diode Forward Voltage (I <sub>F</sub> = 10A)	V <sub>F</sub>		5	

## Dynamic Characteristics

Characteristics	Symbol	Min	Max	Unit
Small-Signal Current Gain (2) (I <sub>c</sub> = 1A, V <sub>CE</sub> = 10V, f = 1MHz)	h <sub>fe</sub>	8	-	-
Output Capacitance (V <sub>CB</sub> = 10V, I <sub>E</sub> = 0, f = 100kHz)	C <sub>ob</sub>	100	-	pF

## Switching Characteristics

Characteristics	Symbol	Min	Max	Unit
Delay Time	t <sub>d</sub>	-	0.25	μs
Rise Time	t <sub>r</sub>		1.5	
Storage Time	t <sub>s</sub>		2	
Fall Time	t <sub>f</sub>		0.6	

**Note:** (1) Pulse Test - Pulse width = 300μs, Duty Cycle ≤ 2%

(2) f<sub>T</sub> = |h<sub>fe</sub>|°f<sub>test</sub>

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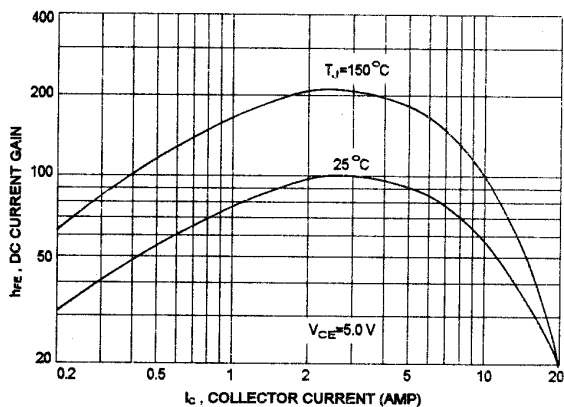
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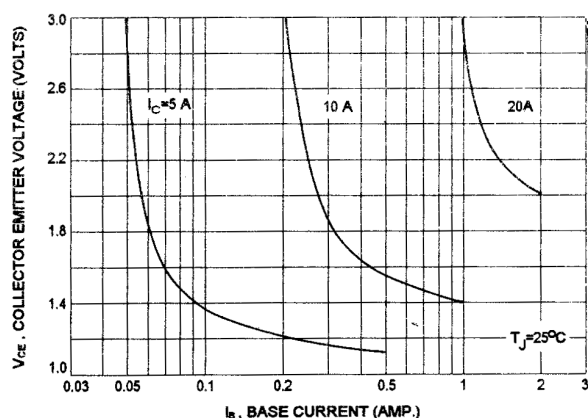
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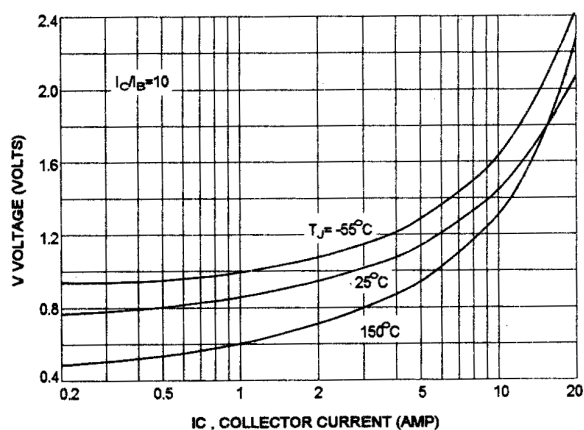
DC CURRENT GAIN



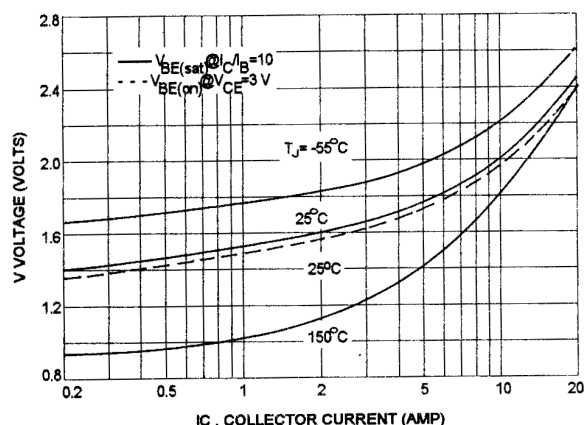
COLLECTOR SATURATION REGION



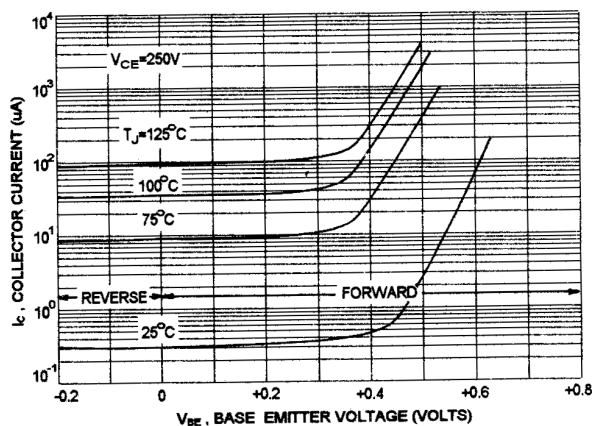
COLLECTOR EMITTER SATURATION VOLTAGE



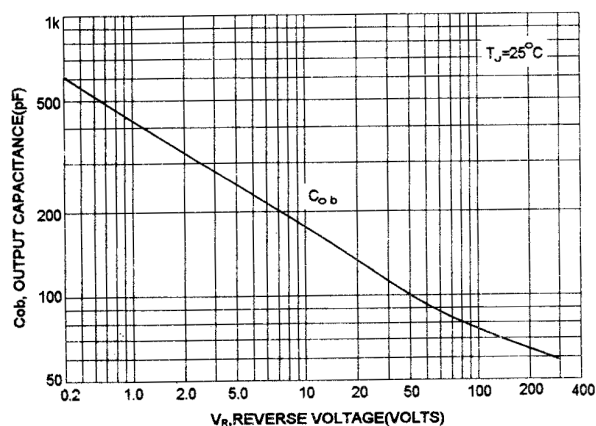
BASE EMITTER VOLTAGE



COLLECTOR CUT-OFF REGION



OUTPUT CAPACITANCES

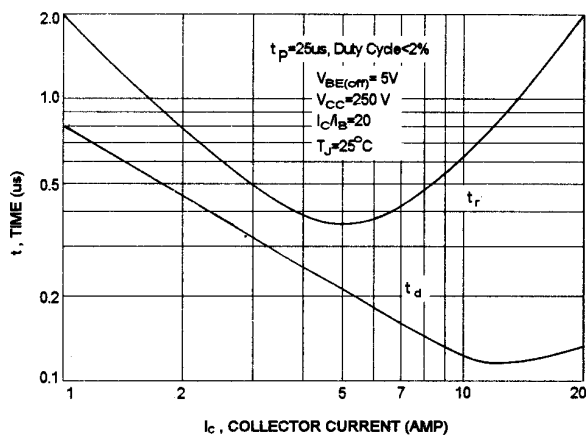


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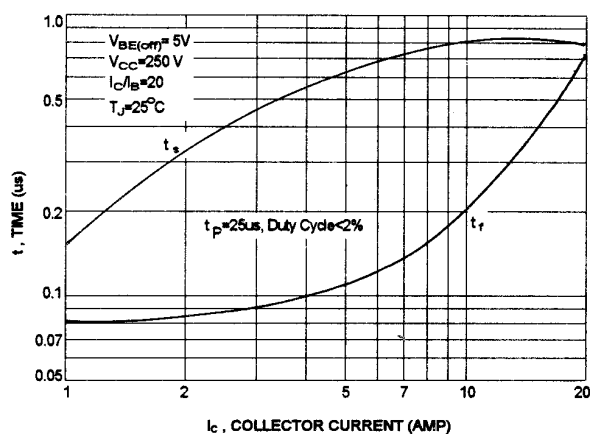
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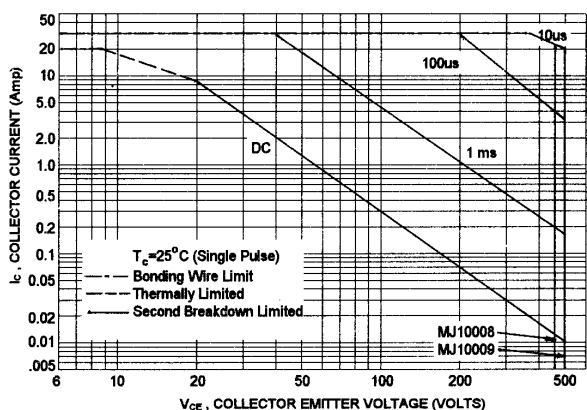
TURN-ON TIME



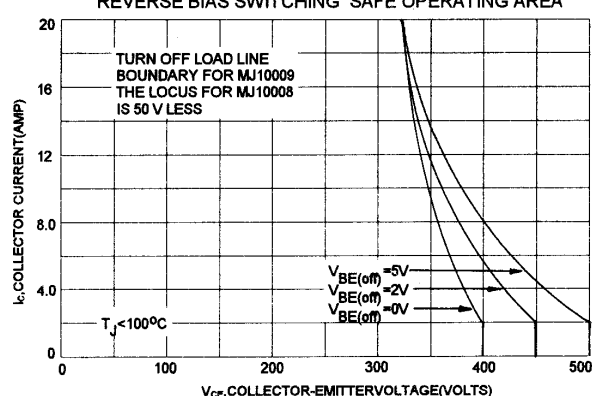
TURN-OFF TIME



ACTIVE REGION SAFE OPERATING AREA



REVERSE BIAS SWITCHING SAFE OPERATING AREA



## Part Number Table

Description	Part Number
NPN Darlington Transistor, 500V, 20A, 175W, TO-3	MJ10009

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