

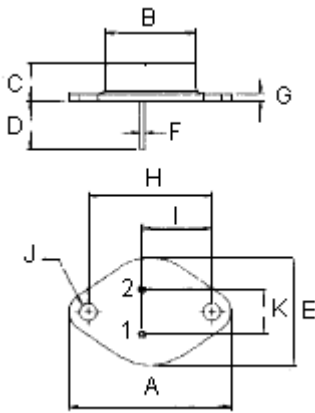


NPN silicon power darlington transistors with base-emitter speedup diode. The MJ1004 darlington transistors are designed for high-voltage, high-speed, power switching in inductive circuits where fall time is critical. They are particularly suited for line operated switch-mode applications.

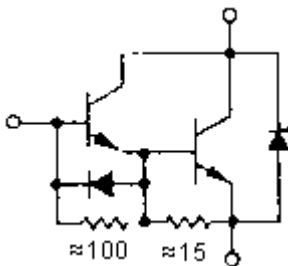
Features:

- Continuous collector current - $I_C = 20A$.
- Switching regulators.
- Inverters.
- Solenoid and relay drivers.
- Motor controls.

TO-3



Pin 1. Base
2. Emitter
Collector (Case)



Dimensions	Minimum	Maximum
A	38.75	39.96
B	19.28	22.23
C	7.96	9.28
D	11.18	12.19
E	25.20	26.67
F	0.92	1.09
G	1.38	1.62
H	29.90	30.40
I	16.64	17.30
J	3.88	4.36
K	10.67	11.18

Dimensions : Millimetres

**NPN
MJ10004**

20 Ampere
Power Darlington
Transistors
350-400 Volts
175 Watts



TO-3

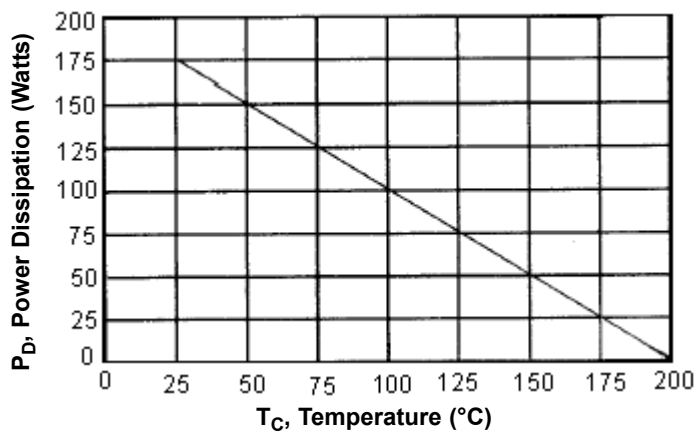
Maximum Ratings

Characteristic	Symbol	MJ10004	Unit
Collector-Emitter Voltage	V_{CEV}	450	V
Collector-Emitter Voltage	$V_{CEX(SUS)}$	400	
Collector-Emitter Voltage	$V_{CEO(SUS)}$	350	
Emitter-Base Voltage	V_{EBO}	80	A
Collector Current-Continuous -Peak	I_C I_{CM}	20 30	
Base Current-Peak	I_B	2.5	
Total Power Dissipation at $T_C = 25^\circ\text{C}$ at $T_C = 100^\circ\text{C}$ Derate above 25°C	P_D	175 100 1.0	W W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-65 to +200	$^\circ\text{C}$

Thermal Characteristics

Characteristic	Symbol	Maximum	Unit
Thermal Resistance Junction to Case	$R_{\theta jc}$	1.0	$^\circ\text{C}/\text{W}$

Power Derating



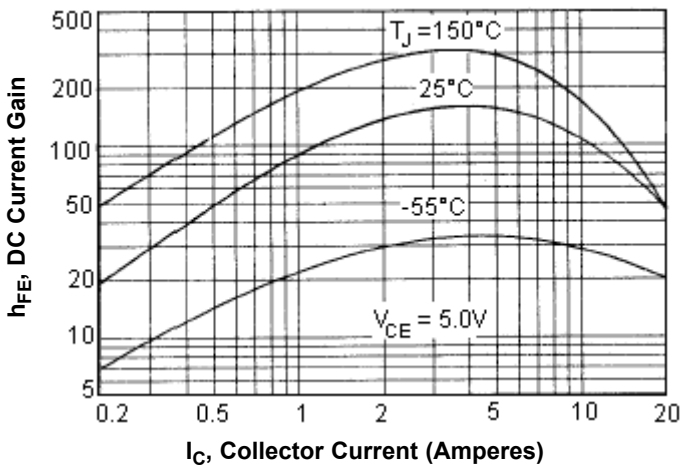
Electrical Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Minimum	Maximum	Unit	
Off Characteristics					
Collector-Emitter Sustaining Voltage ($I_C = 250\text{mA}$, $I_B = 0$, $V_{\text{clamp}} = \text{Rate } V_{\text{CEO}}$)	MJ10004 $V_{\text{CEO (sus)}}$	350	-	V	
Collector Cut off Current ($V_{\text{CE}} = \text{Rated } V_{\text{CEV}}$, $R_{\text{BE}} = 50\Omega$, $T_C = 100^\circ\text{C}$)	V_{CER}	-	5.0		
Collector Cut off Current ($V_{\text{CEV}} = \text{Rated Value}$, $V_{\text{BE (OFF)}} = 1.5\text{V}$) ($V_{\text{CEV}} = \text{Rated Value}$, $V_{\text{BE (OFF)}} = 1.5\text{V}$, $T_C = 100^\circ\text{C}$)	I_{CEV}	-	0.25 5.0	mA	
Emitter Cut off Current ($V_{\text{EB}} = 2.0\text{V}$, $I_C = 0$)	I_{EBO}	-	175		
On Characteristics (1)					
DC Current Gain ($I_C = 5.0\text{A}$, $V_{\text{CE}} = 5.0\text{V}$) ($I_C = 10\text{A}$, $V_{\text{CE}} = 5.0\text{V}$)	h_{FE}	50 40	600 400	-	
Collector-Emitter Saturation Voltage ($I_C = 10\text{A}$, $I_B = 400\text{mA}$) ($I_C = 20\text{A}$, $I_B = 2.0\text{A}$) ($I_C = 10\text{A}$, $I_B = 400\text{mA}$, $T_C = 100^\circ\text{C}$)	$V_{\text{CE (sat)}}$	-	1.9 3.0 2.0	V	
Base-Emitter Saturation Voltage ($I_C = 10\text{A}$, $I_B = 400\text{mA}$) ($I_C = 10\text{A}$, $I_B = 400\text{mA}$, $T_C = 100^\circ\text{C}$)	$V_{\text{BE (sat)}}$	-	2.5 2.5		
Diode Forward Voltage ($I_F = 10\text{A}$)	V_F	-	5.0		
Dynamic Characteristics					
Small-Signal Current Gain (2) ($I_C = 1.0\text{A}$, $V_{\text{CE}} = 10\text{V}$, $f = 1.0\text{MHz}$)	$ h_{\text{fe}} $	10	-	-	
Output Capacitance ($V_{\text{CB}} = 10\text{V}$, $I_E = 0$, $f = 100\text{kHz}$)	C_{ob}	100	-	pF	
Switching Characteristics					
Delay Time	$V_{\text{CC}} = 250\text{V}$, $I_C = 10\text{A}$ $I_{\text{B1}} = 400\text{mA}$, $V_{\text{BE (off)}} = 5.0\text{V}$ $t_p = 50\mu\text{s}$, Duty Cycle $\leq 2\%$	t_d	-	0.2	μs
Rise Time		t_r	-	0.6	
Storage Time		t_s	-	1.5	
Fall Time		t_f	-	0.5	

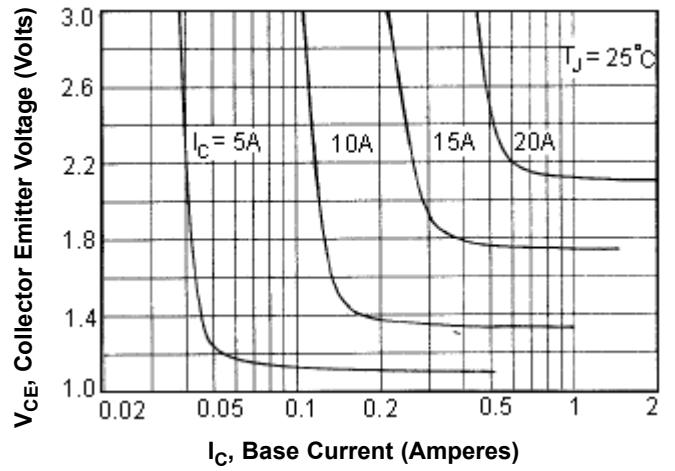
(1) Pulse Test : Pulse Width = $300\mu\text{s}$, Duty Cycle $\leq 2.0\%$.

(2) $f_T = |h_{\text{fe}}| \cdot f_{\text{test}}$

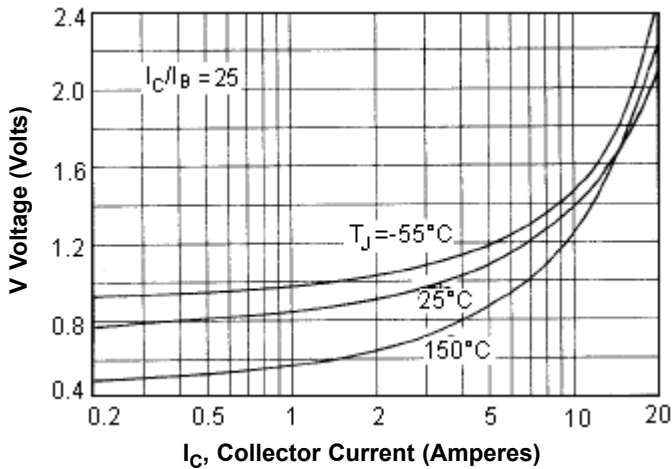
DC Current Gain



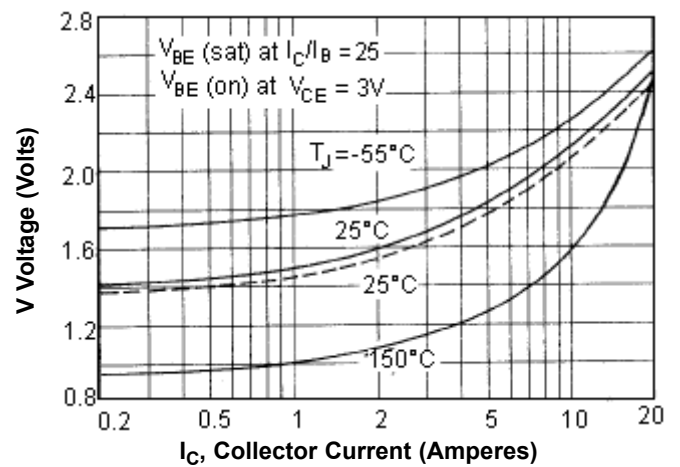
Collector Saturation Region



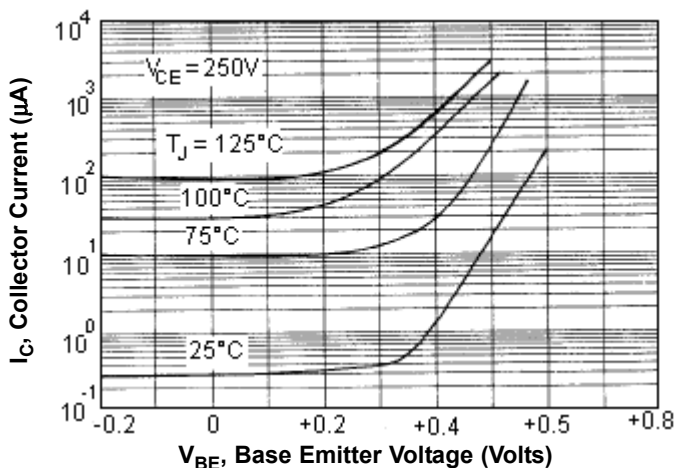
Collector-Emitter Saturation Voltage



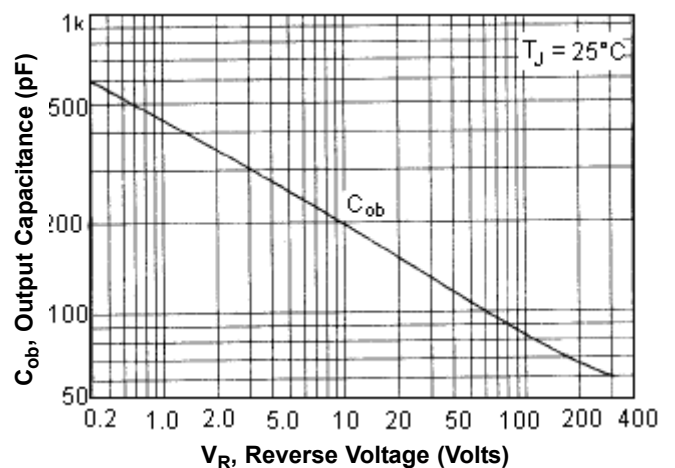
Base-Emitter Voltage



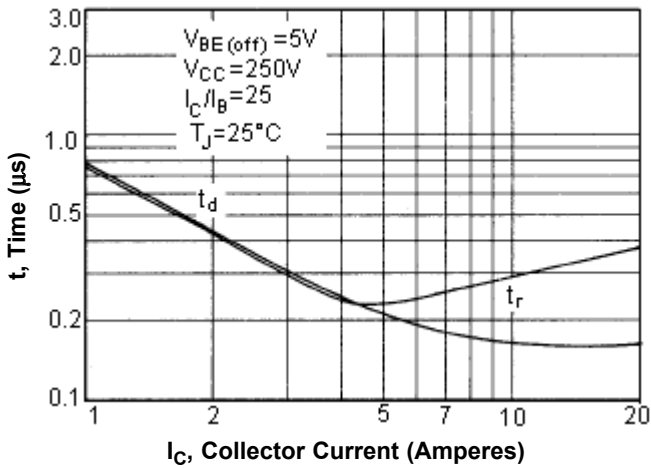
Collector Cut-Off Region



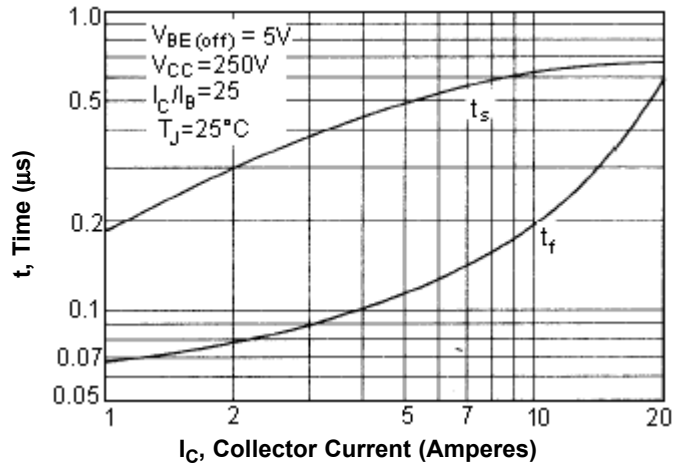
Output Capacitances



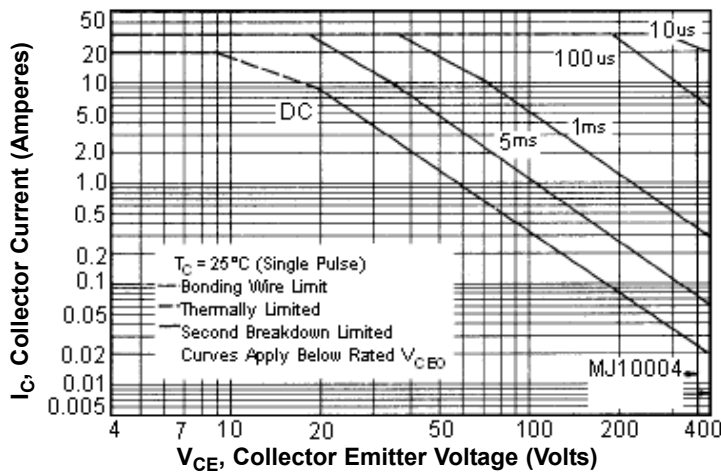
Turn-On Time



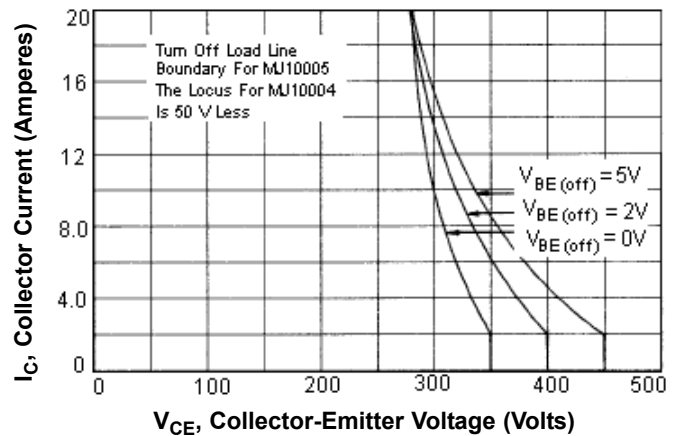
Turn-Off Time



Active Region Safe Operating Area



Reverse Bias Switching Safe Operating Area



Part Number Table

Description	Part Number
Darlington Transistor, TO-3	MJ10004

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