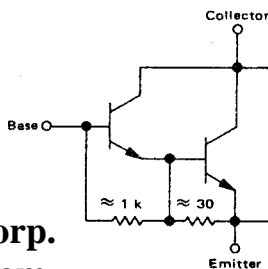


# NPN SILICON POWER DARLINGTON TRANSISTORS

The MJ10012 is a high voltage, high-current darlington transistor designed for automotive ignition, switching regulator and motor control applications.

## FEATURES:

- \*Continuous Collector Current -  $I_C = 10\text{ A}$
- \*Collector-Emitter Sustaining Voltage-  
 $V_{CEO(sus)} = 400\text{V (Min)}$
- \*Automotive Function Tests



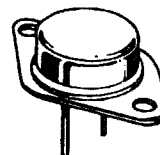
Boca Semiconductor Corp.

MAXIMUM RATINGS <http://www.bocasemi.com>

**NPN**  
**MJ10012**

**10 AMPERE**  
**POWER DARLINGTON**  
**TRANSISTORS**  
**400 VOLTS**  
**175 WATTS**

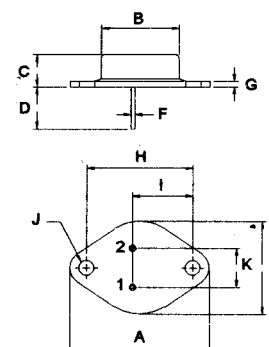
Characteristic	Symbol	MJ10012	Unit
Collector-Base Voltage	$V_{CBO}$	600	V
Collector-Emitter Voltage ( $R_{BE} = 27\Omega$ )	$V_{CER}$	550	V
Collector-Emitter Voltage	$V_{CEO(sus)}$	400	V
Emitter-Base Voltage	$V_{EBO}$	8.0	V
Collector Current-Continuous	$I_C$	10	A
-Peak	$I_{CM}$	15	
Base current	$I_B$	2	A
Total Power Dissipation @ $T_C = 25^\circ\text{C}$	$P_D$	175	W
@ $T_C = 100^\circ\text{C}$		100	W
Derate above $25^\circ\text{C}$		1.0	W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	- 65 to +200	$^\circ\text{C}$



TO-3

## THERMAL CHARACTERISTICS

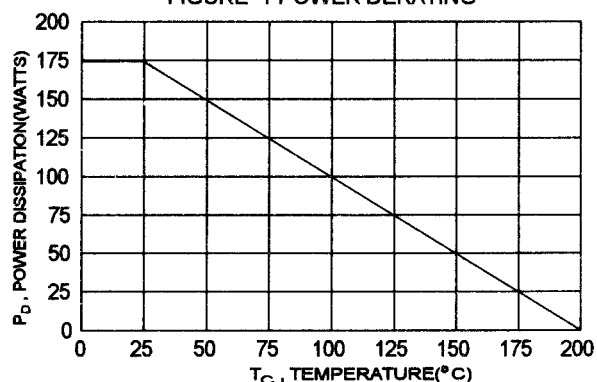
Characteristic	Symbol	Max	Unit
Thermal Resistance Junction to Case	$R_{\theta jc}$	1.0	$^\circ\text{C/W}$



PIN 1. BASE  
2. EMITTER  
COLLECTOR (CASE)

DIM	MILLIMETERS	
	MIN	MAX
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

FIGURE -1 POWER DERATING



**ELECTRICAL CHARACTERISTICS** (  $T_c = 25^\circ\text{C}$  unless otherwise noted )

Characteristic	Symbol	Min	Max	Unit
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**OFF CHARACTERISTICS**

Collector - Emitter Sustaining Voltage ( $I_C = 200\text{ mA}, I_B = 0, V_{\text{clamp}} = \text{Rate } V_{\text{CEO}}$ )	$V_{\text{CEO(sus)}}$	400		V
Collector - Emitter Sustaining Voltage ( $I_C = 200\text{ mA}, I_B = 0, R_{\text{BE}} = 27\text{ ohm}, V_{\text{clamp}} = \text{Rate } V_{\text{CER}}$ )	$V_{\text{CER(sus)}}$	425		V
Collector Cutoff Current ( Rated $V_{\text{CER}}, R_{\text{BE}} = 27\text{ ohm}$ )	$I_{\text{CER}}$		1.0	mA
Collector Cutoff Current ( Rated $V_{\text{CBO}}, I_E = 0$ )	$I_{\text{CBO}}$		1.0	mA
Emitter Cutoff Current ( $V_{\text{EB}} = 6.0\text{ V}, I_C = 0$ )	$I_{\text{EBO}}$		40	mA

**ON CHARACTERISTICS (1)**

DC Current Gain ( $I_C = 3.0\text{ A}, V_{\text{CE}} = 6.0\text{ V}$ ) ( $I_C = 6.0\text{ A}, V_{\text{CE}} = 6.0\text{ V}$ ) ( $I_C = 10\text{ A}, V_{\text{CE}} = 6.0\text{ V}$ )	hFE	300 100 20	2000	
Collector - Emitter Saturation Voltage ( $I_C = 3.0\text{ A}, I_B = 300\text{ mA}$ ) ( $I_C = 6.0\text{ A}, I_B = 600\text{ mA}$ ) ( $I_C = 10\text{ A}, I_B = 2.0\text{ A}$ )	$V_{\text{CE(sat)}}$		1.5 2.0 2.5	V
Base - Emitter Saturation Voltage ( $I_C = 6.0\text{ A}, I_B = 600\text{ mA}$ ) ( $I_C = 10\text{ A}, I_B = 2.0\text{ A}$ )	$V_{\text{BE(sat)}}$		2.5 3.0	V
Base - Emitter On Voltage ( $I_C = 10\text{ A}, V_{\text{CE}} = 6.0\text{ V}$ )	$V_{\text{BE(on)}}$		2.8	V
Diode Forward Voltage ( $I_F = 10\text{ A}$ )	$V_F$		3.5	V

**DYNAMIC CHARACTERISTICS**

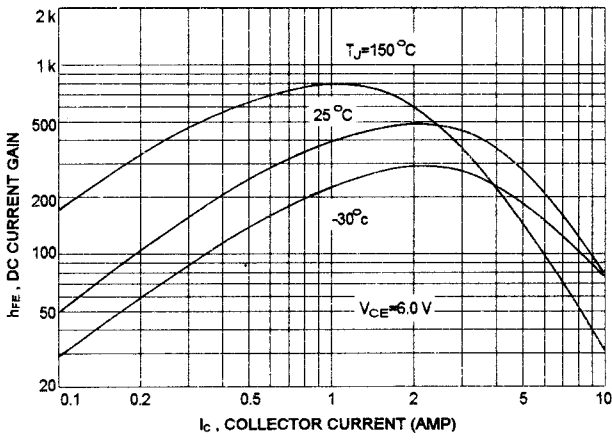
Output Capacitance ( $V_{\text{CB}} = 10\text{ V}, I_E = 0, f = 100\text{ kHz}$ )	$C_{\text{ob}}$		350	pF
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**SWITCHING CHARACTERISTICS**

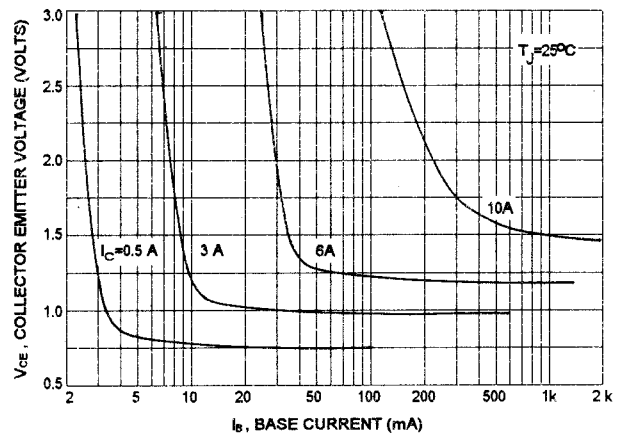
Storage Time	$V_{\text{CC}} = 12\text{ V}, I_C = 6.0\text{ A}$ $I_{\text{B1}} = -I_{\text{B2}} = 0.3\text{ A}$ $t_p = 25\text{ us}, \text{Duty Cycle} \leq 2\%$	$t_s$	15	us
Fall Time		$t_f$	15	us

(1) Pulse Test: Pulse width = 300 us , Duty Cycle  $\leq 2.0\%$

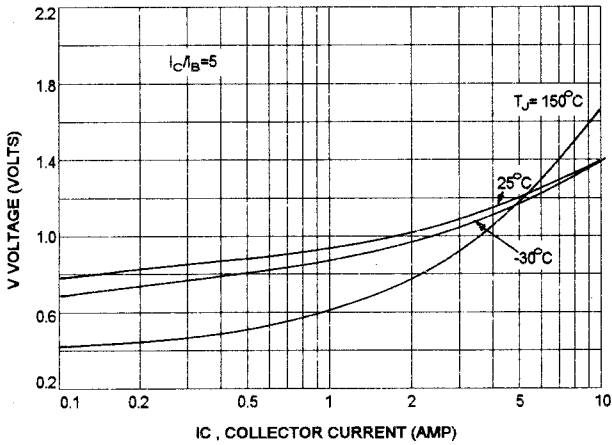
DC CURRENT GAIN



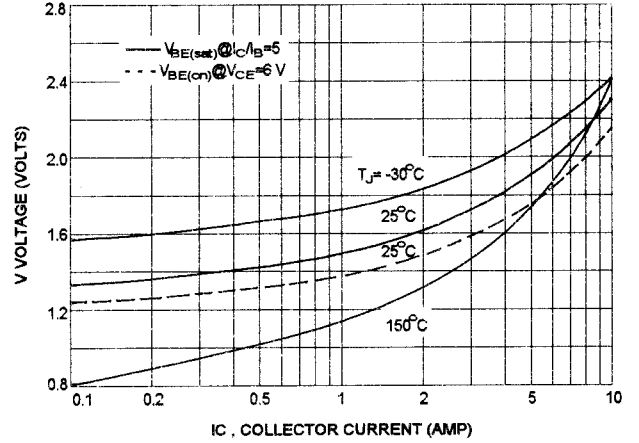
COLLECTOR SATURATION REGION



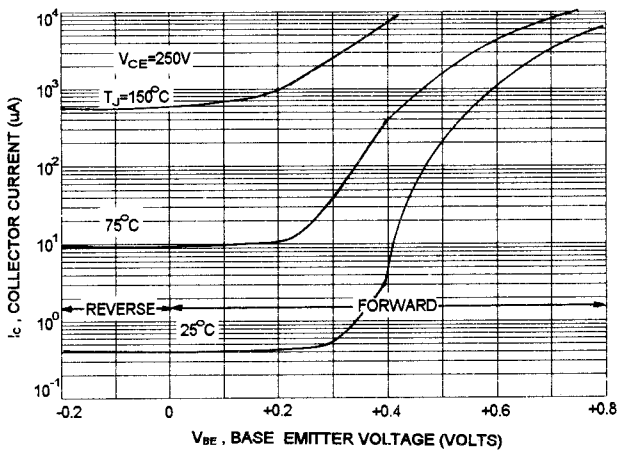
COLLECTOR-EMITTER SATURATION VOLTAGE



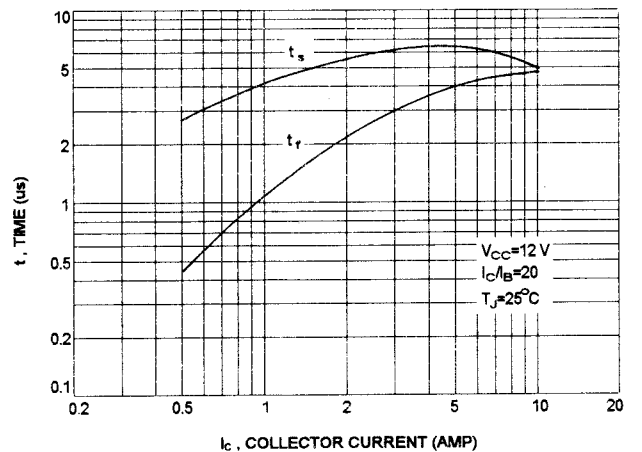
BASE-EMITTER VOLTAGE



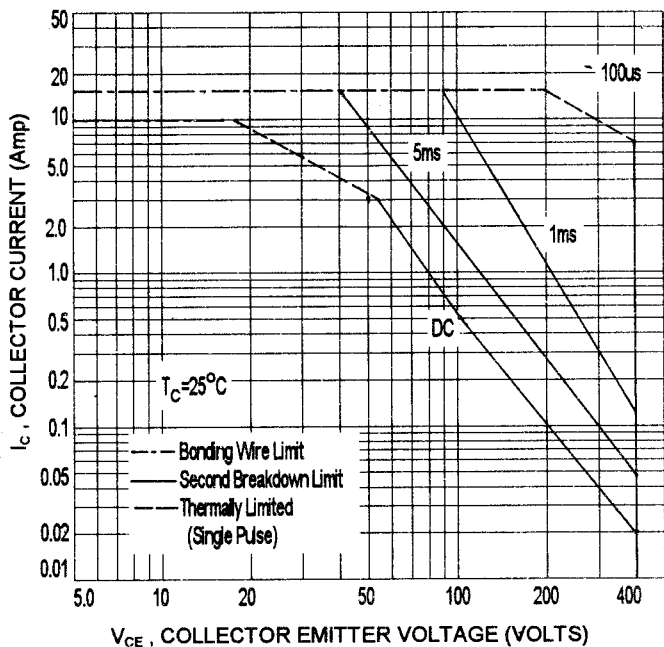
COLLECTOR CUT-OFF REGION



TURN-OFF TIME



ACTIVE-REGION SAFE OPERATING AREA (SOA)



There are two limitation on the power handling ability of a transistor: average junction temperature and second breakdown safe operating area curves indicate  $I_c$ - $V_{CE}$  limits of the transistor that must be observed for reliable operation i.e., the transistor must not be subjected to greater dissipation than curves indicate.

The data of SOA curves is base on  $T_{J(PK)} = 200^\circ\text{C}$ ;  $T_c$  is variable depending on conditions. At high case temperatures, thermal limitation will reduce the power that can be handled to values less than the limitations imposed by second breakdown.