

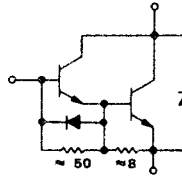
## SWITCHMODE SERIES

### NPN SILICON POWER DARLINGTON TRANSISTORS WITH BASE-EMITTER SPEEDUP DIODE

The MJ10015 and MJ10016 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 such as:

#### FEATURES:

- \*Continuous Collector Current -  $I_C = 50$  A
- \*Switching Regulators
- \*Inverters
- \*Solenoid and Relay Drivers
- \*Motor Controls

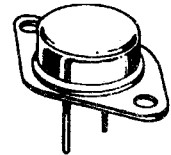


**NPN**  
**MJ10015**  
**MJ10016**

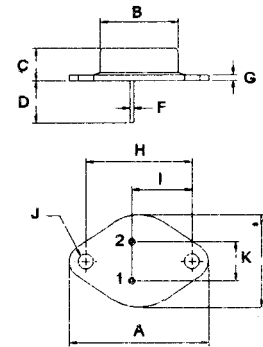
**50 AMPERE**  
**POWER DARLINGTON**  
**TRANSISTORS**  
**400-500 VOLTS**  
**250 WATTS**

#### MAXIMUM RATINGS

Characteristic	Symbol	MJ10015	MJ10016	Unit
Collector-Emitter Voltage	$V_{CEV}$	600	700	V
Collector-Emitter Voltage	$V_{CEO(SUS)}$	400	500	V
Emitter-Base Voltage	$V_{EBO}$	8.0		V
Collector Current-Continuous -Peak	$I_C$ $I_{CM}$	50		A
		75		
Base current	$I_B$	10		A
Total Power Dissipation @ $T_C=25^\circ C$ @ $T_C=100^\circ C$ Derate above $25^\circ C$	$P_D$	250		W W W/ $^\circ C$
		143		
		1.43		
Operating and Storage Junction Temperature Range	$T_J, T_{STG}$	- 65 to +200		$^\circ C$



**TO-3**



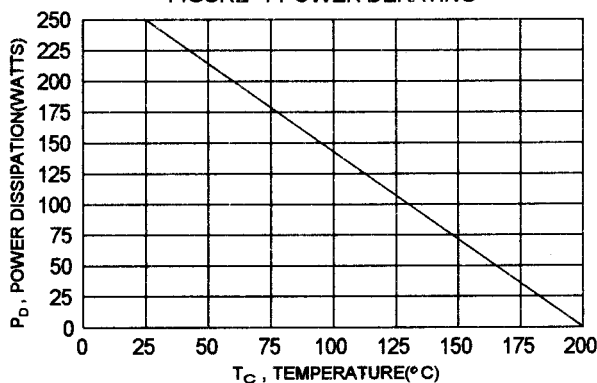
PIN 1. BASE  
2. EMITTER  
COLLECTOR(CASE)

#### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance Junction to Case	$R_{\theta jc}$	0.7	$^\circ C/W$

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	1.46	1.55
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 ( $I_C = 100\text{ mA}, I_B = 0, V_{\text{clamp}} = \text{Rate } V_{\text{CEO}}$ )	MJ10015 MJ10016	$V_{\text{CEO(sus)}}$	400 500	V
Collector Cutoff Current ( $V_{\text{CEV}} = \text{Rated Value}, V_{\text{BE(off)}} = 1.5\text{ V}$ )		$I_{\text{CEV}}$	0.25	mA
Emitter Cutoff Current ( $V_{\text{EB}} = 2.0\text{ V}, I_C = 0$ )		$I_{\text{EBO}}$	350	mA

**ON CHARACTERISTICS (1)**

DC Current Gain ( $I_C = 20\text{ A}, V_{\text{CE}} = 5.0\text{ V}$ ) ( $I_C = 40\text{ A}, V_{\text{CE}} = 5.0\text{ V}$ )		hFE	25 10	
Collector - Emitter Saturation Voltage ( $I_C = 20\text{ A}, I_B = 1.0\text{ A}$ ) ( $I_C = 50\text{ A}, I_B = 10\text{ A}$ )		$V_{\text{CE(sat)}}$	2.2 5.0	V
Base - Emitter Saturation Voltage ( $I_C = 20\text{ A}, I_B = 1.0\text{ A}$ )		$V_{\text{BE(sat)}}$	2.75	V
Diode Forward Voltage ( $I_F = 20\text{ A}$ )		$V_F$	5.0	V

**DYNAMIC CHARACTERISTICS**

Output Capacitance ( $V_{\text{CB}} = 10\text{ V}, I_E = 0, f = 100\text{ kHz}$ )		$C_{\text{ob}}$	750	pF
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**SWITCHING CHARACTERISTICS**

Delay Time	$V_{\text{CC}} = 250\text{ V}, I_C = 20\text{ A}$ $I_{\text{B1}} = 1.0\text{ A}, V_{\text{BE(off)}} = 5.0\text{ V}$ $t_p = 25\mu\text{s}, \text{Duty Cycle} \leq 2\%$	$t_d$	0.3	us
Rise Time		$t_r$	1.0	us
Storage Time		$t_s$	2.5	us
Fall Time		$t_f$	1.0	us

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

FIG-2 DC CURRENT GAIN

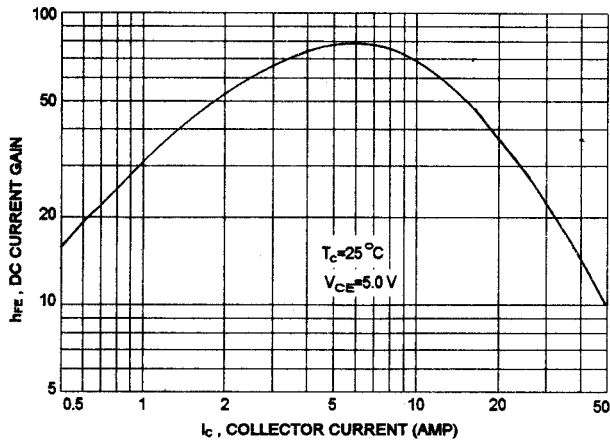


FIG-3 COLLECTOR EMITTER SATURATION VOLTAGE

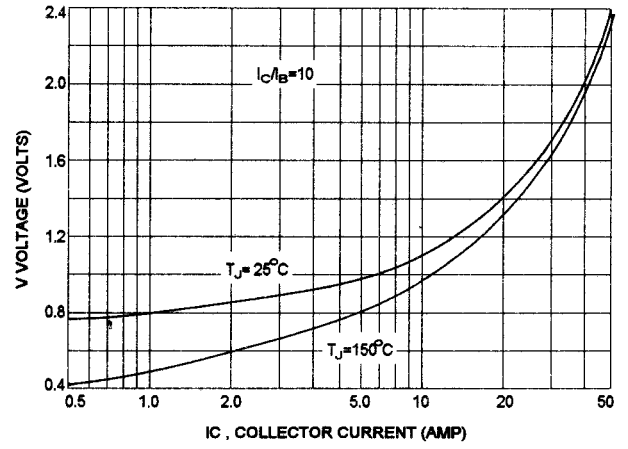


FIG-4 OUTPUT CAPACITANCES

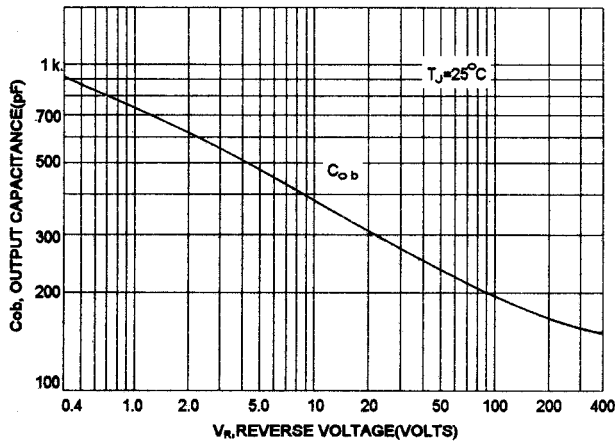


FIG-5 BASE-EMITTER SATURATION VOLTAGE

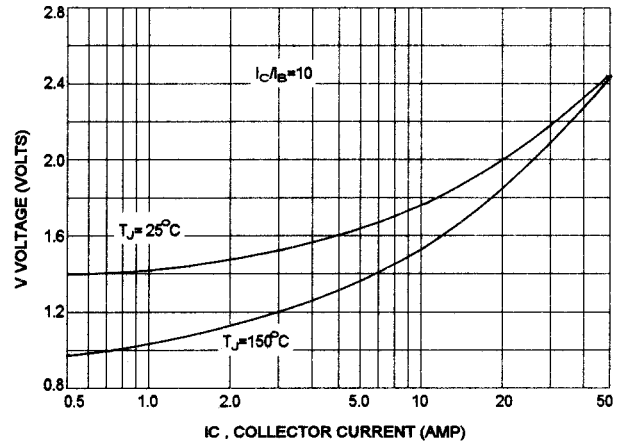


FIG-6 COLLECTOR CUT-OFF REGION

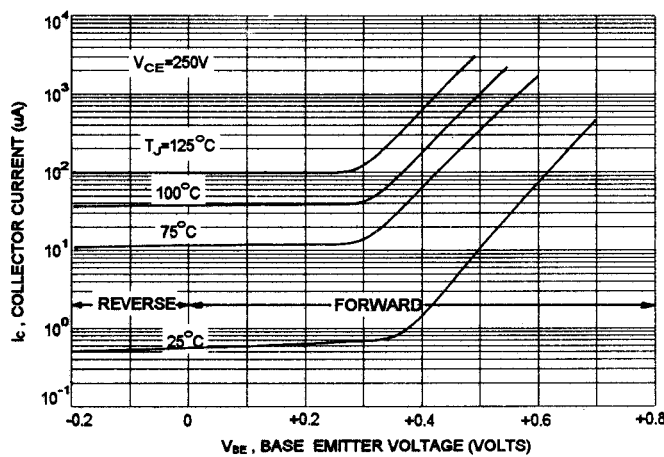
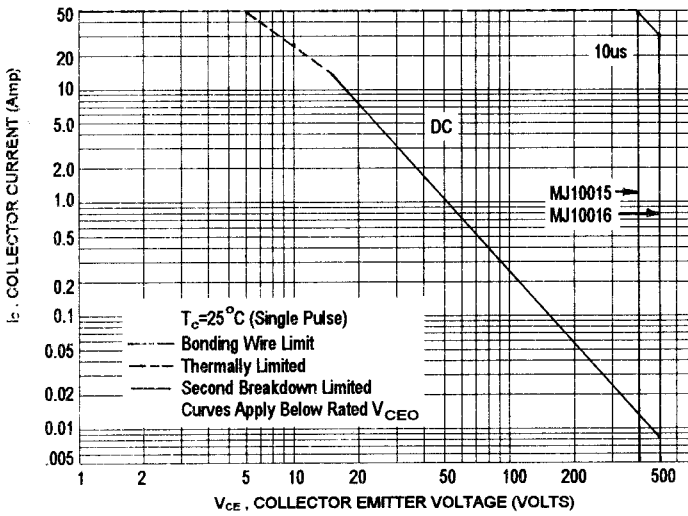


FIG-7 FORWARD BIAS SAFE OPERATING AREA

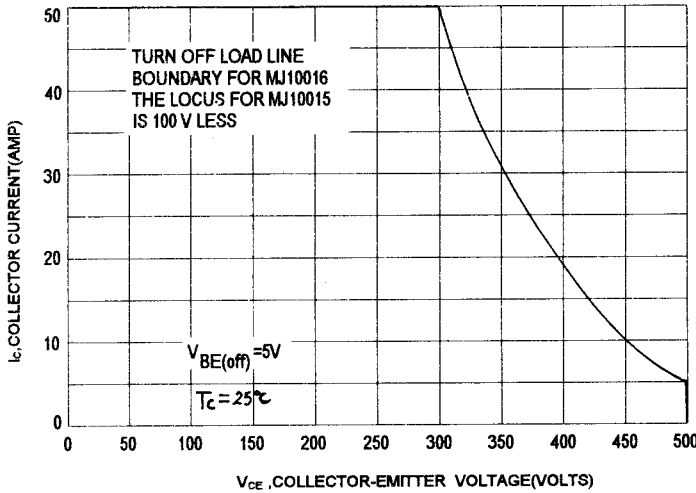


FORWARD BIAS

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 FIG-7 is base on  $T_C = 25^\circ\text{C}$ ;  $T_{J(PK)}$  is variable depending on power level. second breakdown pulse limits are valid for duty cycles to 10% must be derate when  $T_C \geq 25^\circ\text{C}$ , Second breakdown limitations do not derate the same as thermal limitations.

FIG-8 REVERSE BIAS SAFE OPERATING AREA



REVERSE BIAS

For inductive loads, high voltage and high current must be sustained simultaneously during turn-off, in most cases, with the base-to-emitter junction reverse biased. Under these conditions the collector voltage must be held to a safe level at or below a specific value of collector current. This can be accomplished by several means such as active clamping, RC snubbing, load line shaping, etc. the safe level for these devices is specified as Reverse Bias Safe Operating Area and represents the voltage-current condition allowable during reverse biased turn-off. This rating is verified under clamped conditions so that the device is never subjected to an avalanche mode. FIG-8 gives the RBSOA characteristics.