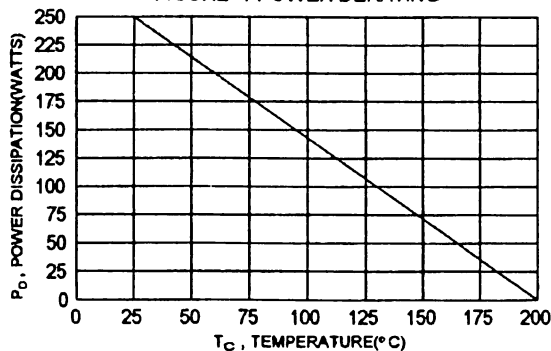




**ELECTRICAL CHARACTERISTICS** (  $T_c = 25^\circ\text{C}$  unless otherwise noted )

| Characteristic | Symbol | Min | Max | Unit |
|----------------|--------|-----|-----|------|
|----------------|--------|-----|-----|------|

**OFF CHARACTERISTICS**

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

**ON CHARACTERISTICS (1)**

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

**DYNAMIC CHARACTERISTICS**

|                                                                                            |                 |  |     |    |
|--------------------------------------------------------------------------------------------|-----------------|--|-----|----|
| Output Capacitance<br>( $V_{\text{CB}} = 10\text{ V}$ , $I_E = 0$ , $f = 100\text{ kHz}$ ) | $C_{\text{ob}}$ |  | 750 | pF |
|--------------------------------------------------------------------------------------------|-----------------|--|-----|----|

**SWITCHING CHARACTERISTICS**

|              |                                                                                                                                                                               |       |     |    |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----|----|
| Delay Time   | $V_{\text{CC}} = 250\text{ V}$ , $I_C = 20\text{ A}$<br>$I_{\text{B1}} = 1.0\text{ A}$ , $V_{\text{BE(off)}} = 5.0\text{ V}$<br>$t_p = 25\mu\text{s}$ , 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

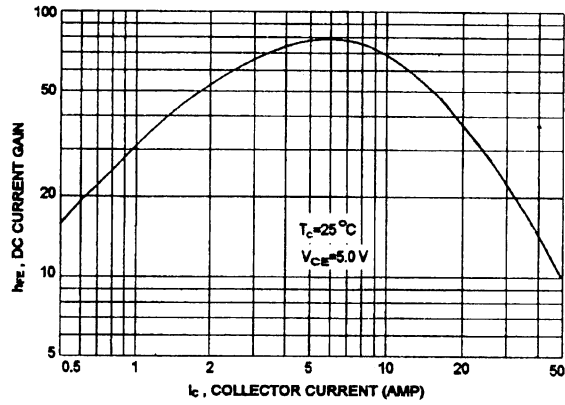


FIG-3 COLLECTOR EMITTER SATURATION VOLTAGE

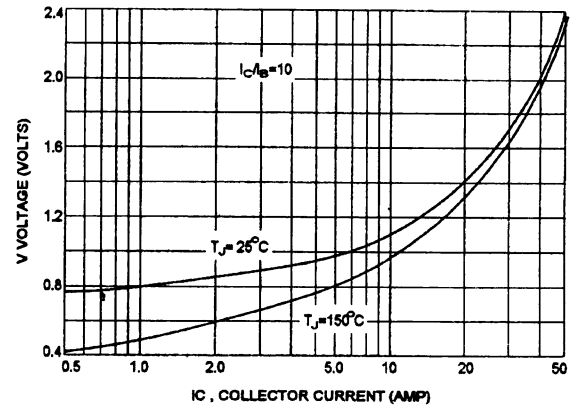


FIG-4 OUTPUT CAPACITANCES

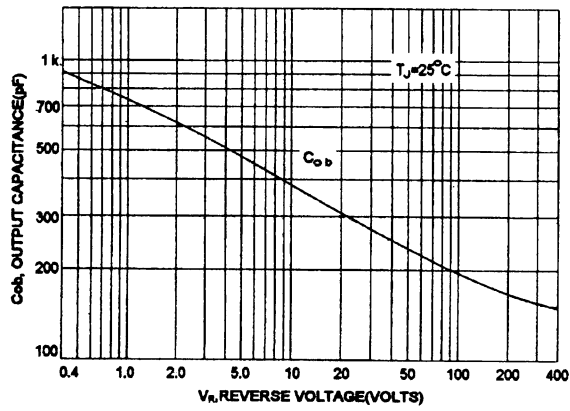


FIG-5 BASE-EMITTER SATURATION VOLTAGE

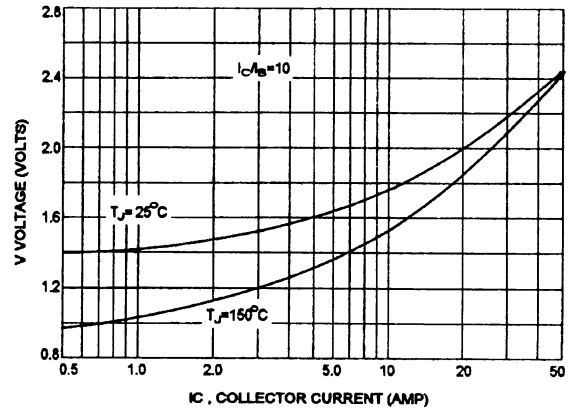


FIG-6 COLLECTOR CUT-OFF REGION

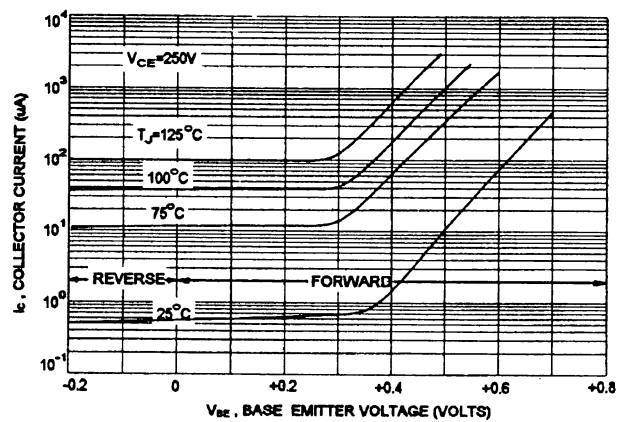
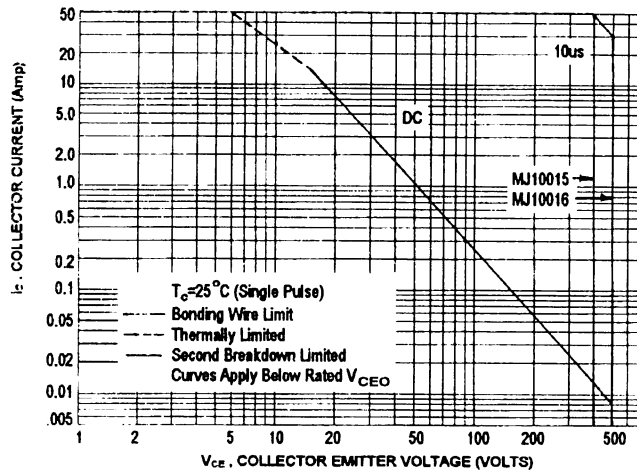


FIG-7 FORWARD BIAS SAFE OPERATING AREA

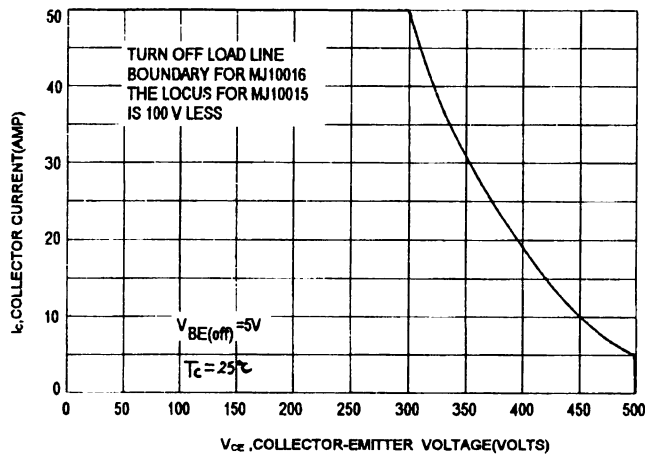


## FORWARD BIAS

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 based on  $T_C = 25^\circ\text{C}$ ;  $T_{JPK}$  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.