

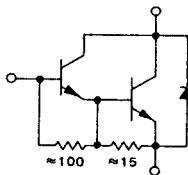
# SWITCHMODE SERIES

## NPN SILICON POWER DARLINGTON TRANSISTORS

The MJ10000 and MJ10001 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 -  $I_C = 20\text{ A}$
- \*Switching Regulators
- \*Inverters
- \*Solenoid and Relay Drivers
- \*Motor Controls



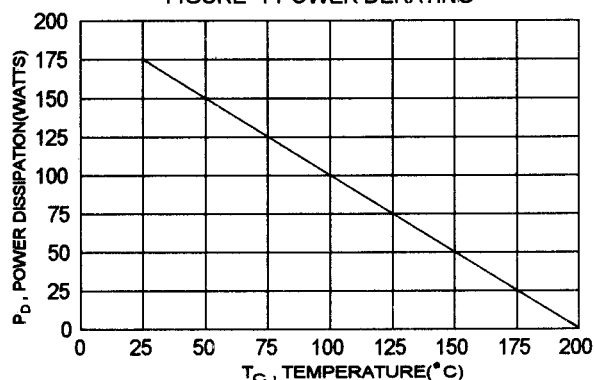
### MAXIMUM RATINGS

| Characteristic                                                                                                | Symbol            | MJ10000           | MJ10001 | Unit                          |
|---------------------------------------------------------------------------------------------------------------|-------------------|-------------------|---------|-------------------------------|
| Collector-Emitter Voltage                                                                                     | $V_{CEV}$         | 450               | 500     | V                             |
| Collector-Emitter Voltage                                                                                     | $V_{CEX(SUS)}$    | 400               | 450     | V                             |
| Collector-Emitter Voltage                                                                                     | $V_{CEO(SUS)}$    | 350               | 400     | V                             |
| Emitter-Base Voltage                                                                                          | $V_{EBO}$         | 8.0               |         | V                             |
| Collector Current-Continuous<br>-Peak                                                                         | $I_C$<br>$I_{CM}$ | 20<br>30          |         | A                             |
| Base current                                                                                                  | $I_B$             | 2.5               |         | A                             |
| Total Power Dissipation @ $T_C=25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ @ $T_C=100^\circ\text{C}$ | $P_D$             | 175<br>100<br>1.0 |         | W<br>W<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                                           | $T_J, T_{STG}$    | - 65 to +200      |         | $^\circ\text{C}$              |

### THERMAL CHARACTERISTICS

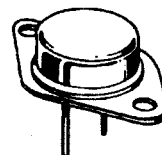
| Characteristic                      | Symbol          | Max | Unit               |
|-------------------------------------|-----------------|-----|--------------------|
| Thermal Resistance Junction to Case | $R_{\theta jc}$ | 1.0 | $^\circ\text{C/W}$ |

FIGURE -1 POWER DERATING

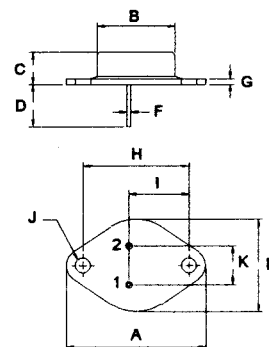


**NPN**  
**MJ10000**  
**MJ10001**

**20 AMPERE**  
**POWER DARLINGTON**  
**TRANSISTORS**  
**350-400 VOLTS**  
**175 WATTS**



**TO-3**



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 |

**Boca Semiconductor Corp.**

**BSC**

<http://www.bocasemi.com>

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

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

**OFF CHARACTERISTICS**

|                                                                                                                                                                                                                   |                       |            |             |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------|-------------|----|
| Collector - Emitter Sustaining Voltage<br>( $I_C = 250\text{ mA}, I_B = 0, V_{\text{clamp}} = \text{Rate } V_{\text{CEO}}$ )<br>MJ10000<br>MJ10001                                                                | $V_{\text{CEO(sus)}}$ | 350<br>400 |             | V  |
| Collector Cutoff Current<br>( $V_{\text{CE}} = \text{Rated } V_{\text{CEV}}, R_{\text{BE}} = 50\text{ ohm}, T_c = 100^\circ\text{C}$ )                                                                            | $I_{\text{CER}}$      |            | 5.0         | mA |
| Collector Cutoff Current<br>( $V_{\text{CEV}} = \text{Rated Value}, V_{\text{BE(off)}} = 1.5\text{ V}$ )<br>( $V_{\text{CEV}} = \text{Rated Value}, V_{\text{BE(off)}} = 1.5\text{ V}, T_c = 100^\circ\text{C}$ ) | $I_{\text{CEV}}$      |            | 0.25<br>5.0 | mA |
| Emitter Cutoff Current<br>( $V_{\text{EB}} = 8.0\text{ V}, I_C = 0$ )                                                                                                                                             | $I_{\text{EBO}}$      |            | 150         | mA |

**ON CHARACTERISTICS (1)**

|                                                                                                                                                                                                                |                      |          |                   |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------|-------------------|---|
| DC Current Gain<br>( $I_C = 5.0\text{ A}, V_{\text{CE}} = 5.0\text{ V}$ )<br>( $I_C = 10\text{ A}, V_{\text{CE}} = 5.0\text{ V}$ )                                                                             | $h_{\text{FE}}$      | 50<br>40 | 600<br>400        |   |
| Collector - Emitter Saturation Voltage<br>( $I_C = 10\text{ A}, I_B = 400\text{ mA}$ )<br>( $I_C = 20\text{ A}, I_B = 1.0\text{ A}$ )<br>( $I_C = 10\text{ A}, I_B = 400\text{ mA}, T_c = 100^\circ\text{C}$ ) | $V_{\text{CE(sat)}}$ |          | 1.9<br>3.0<br>2.0 | V |
| Base - Emitter Saturation Voltage<br>( $I_C = 10\text{ A}, I_B = 400\text{ mA}$ )<br>( $I_C = 10\text{ A}, I_B = 400\text{ mA}, T_c = 100^\circ\text{C}$ )                                                     | $V_{\text{BE(sat)}}$ |          | 2.5<br>2.5        | V |
| Diode Forward Voltage<br>( $I_F = 10\text{ A}$ )                                                                                                                                                               | $V_F$                |          | 5.0               | V |

**DYNAMIC CHARACTERISTICS**

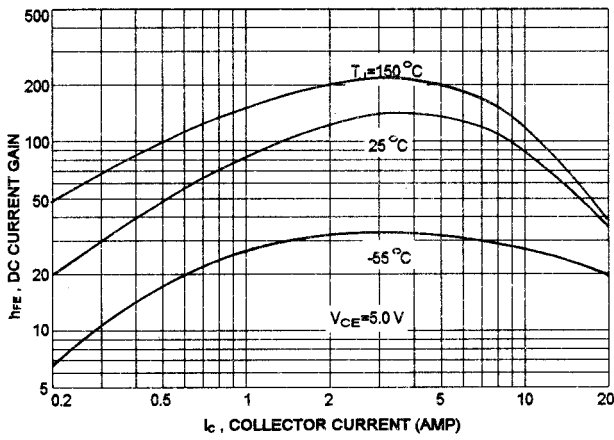
|                                                                                                           |                   |     |  |    |
|-----------------------------------------------------------------------------------------------------------|-------------------|-----|--|----|
| Small-Signal Current Gain(2)<br>( $I_C = 1.0\text{ A}, V_{\text{CE}} = 10\text{ V}, f = 1.0\text{ MHz}$ ) | $ h_{\text{fe}} $ | 10  |  |    |
| Output Capacitance<br>( $V_{\text{CB}} = 10\text{ V}, I_E = 0, f = 100\text{ kHz}$ )                      | $C_{\text{ob}}$   | 100 |  | pF |

**SWITCHING CHARACTERISTICS**

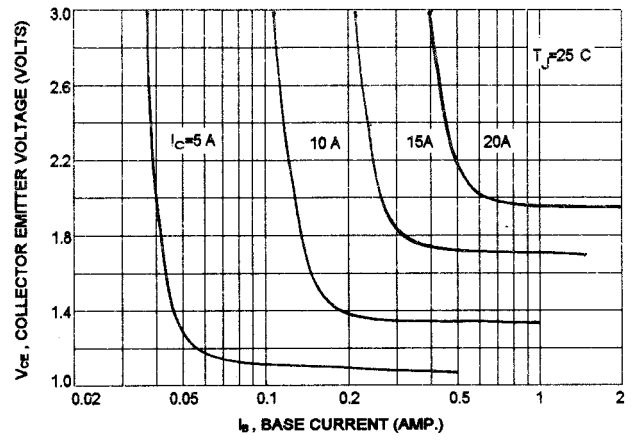
|              |                                                                                                                                                                             |       |  |     |    |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--|-----|----|
| Delay Time   | $V_{\text{CC}} = 250\text{ V}, I_C = 10\text{ A}$<br>$I_{\text{B1}} = 400\text{ mA}, V_{\text{BE(off)}} = 5.0\text{ V}$<br>$t_p = 50\text{ us}, \text{Duty Cycle} \leq 2\%$ | $t_d$ |  | 0.2 | us |
| Rise Time    |                                                                                                                                                                             | $t_r$ |  | 0.6 | us |
| Storage Time |                                                                                                                                                                             | $t_s$ |  | 3.5 | us |
| Fall Time    |                                                                                                                                                                             | $t_f$ |  | 2.4 | us |

(1) Pulse Test: Pulse width = 300 us , Duty Cycle  $\leq 2.0\%$ (2)  $f_T = |h_{\text{fe}}| \cdot f_{\text{test}}$

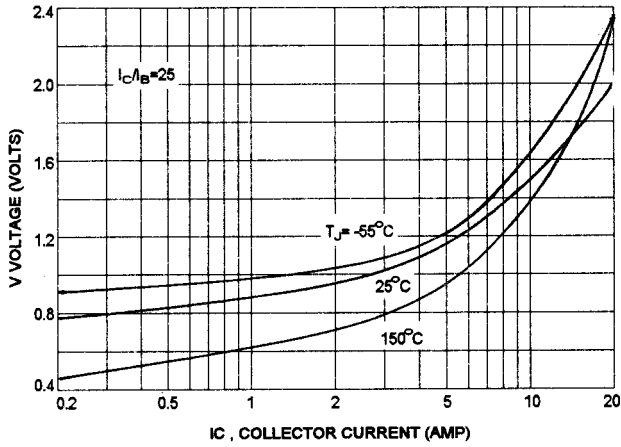
DC CURRENT GAIN



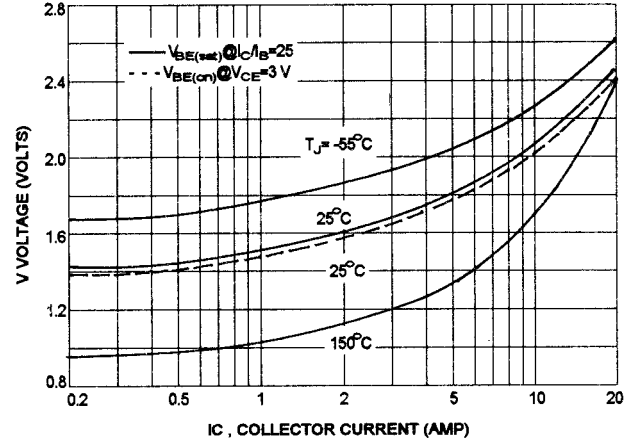
COLLECTOR SATURATION REGION



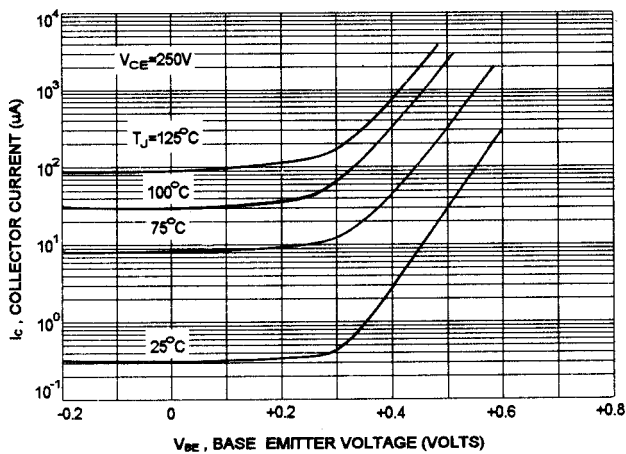
COLLECTOR-EMITTER SATURATION VOLTAGE



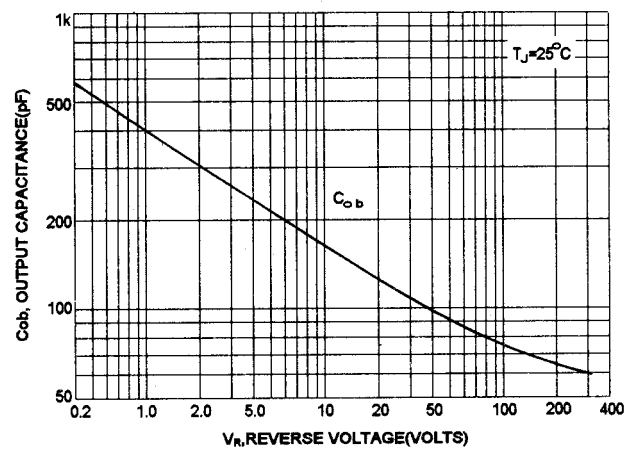
BASE-EMITTER VOLTAGE



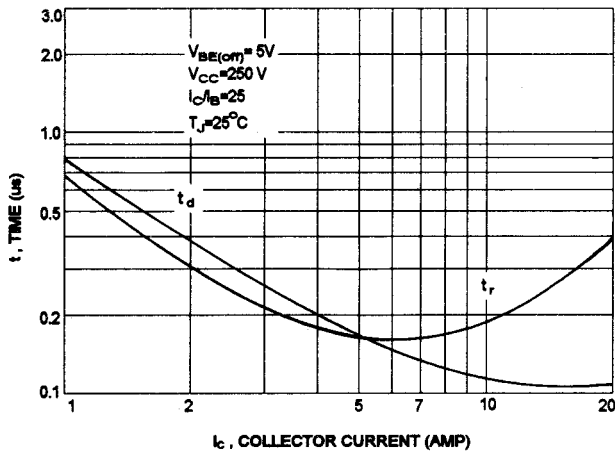
COLLECTOR CUT-OFF REGION



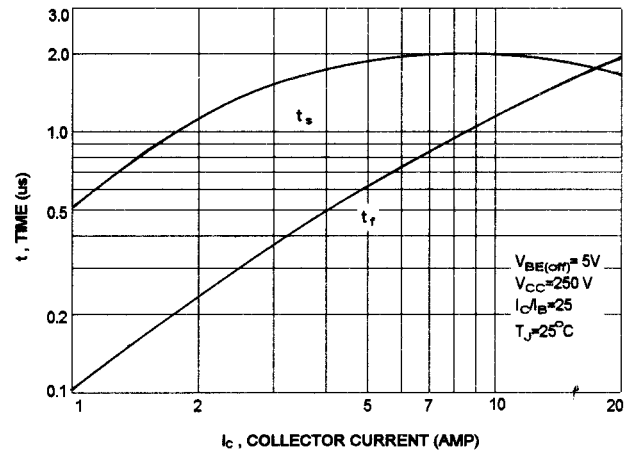
OUTPUT CAPACITANCES



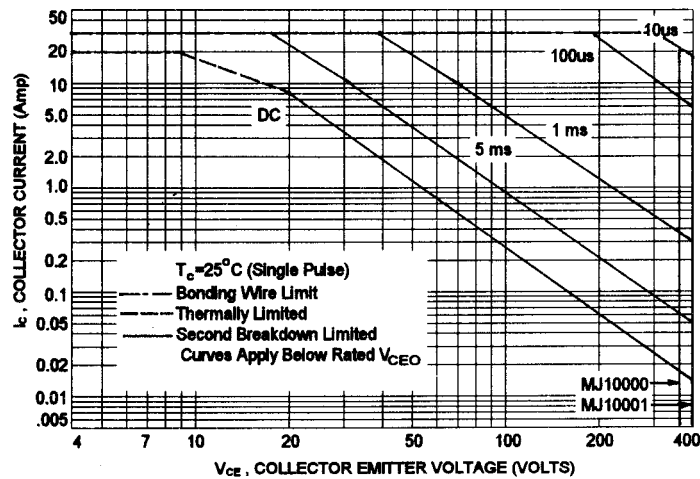
TURN-ON TIME



TURN-OFF TIME



ACTIVE REGION SAFE OPERATING AREA



REVERSE BIAS SWITCHING SAFE OPERATING AREA

