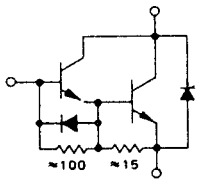
# MOSPEC

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

The MJ10004 and MJ10005 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 oper -ated switch-mode applications such as:

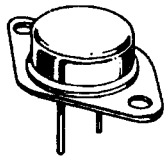
FEATURES:

*Continuous Collector Current - $I_C$ = 20 A
*Switching Regulators
*Inverters
*Solenoid and Relay Drivers
*Motor Controls




**NPN**
**MJ10004**
**MJ10005**

20 AMPERE
POWER DARLINGTON
TRANSISTORS
350-400 VOLTS
175 WATTS



**TO-3**

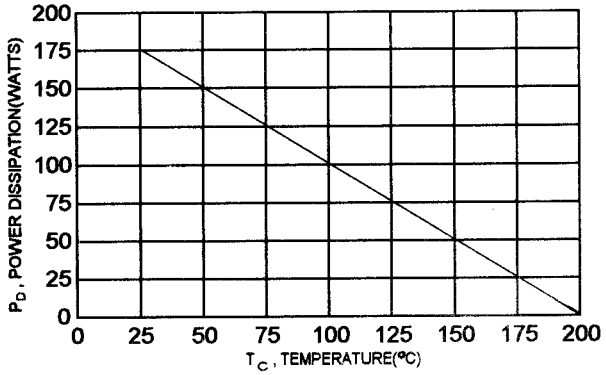
### MAXIMUM RATINGS

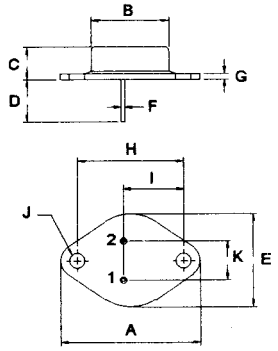
| Characteristic | Symbol | MJ10004 | MJ10005 | Unit |
|---|---|---|---|---|
| Collector-Emitter Voltage | $V_{CEV}$ | 450 | 500 | V |
| Collector-Emitter Voltage | $V_{CEX(SUS)}$ | 400 | 450 | V |
| Collector-Emitter Voltage | $V_{CEO(SUS)}$ | 350 | 400 | V |
| Emitter-Base Voltage | $V_{EBO}$ | 8.0 | | 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°C<br>@$T_C$= 100°C<br>Derate above 25°C | $P_D$ | 175<br>100<br>1.0 | | W<br>W<br>W/°C |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{STG}$ | - 65 to +200 | | °C |

### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance Junction to Case | Rθjc | 1.0 | °C/W |

FIGURE -1 POWER DERATING




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 |

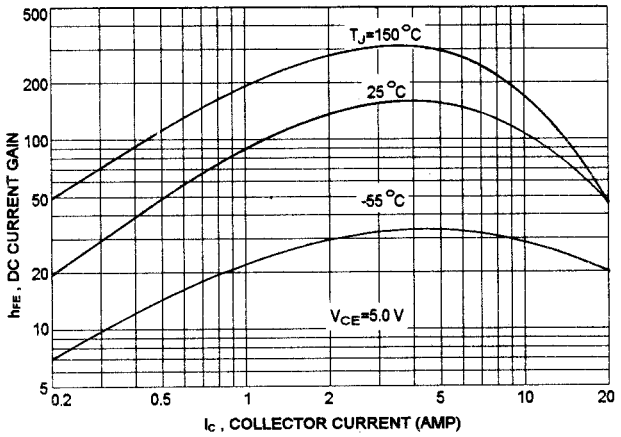
## ELECTRICAL CHARACTERISTICS ( $T_C$ = 25°C unless otherwise noted )

| Characteristic | | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector - Emitter Sustaining Voltage ( $I_C$ = 250 mA, $I_B$ = 0, $V_{clamp}$=Rate $V_{CEO}$ ) | MJ10004<br>MJ10005 | $V_{CEO(SUS)}$ | 350<br>400 | | V |
| Collector Cutoff Current ( $V_{CE}$= Rated $V_{CEV}$, $R_{BE}$=50 ohm, $T_C$=100°C) | | $I_{CER}$ | | 5.0 | mA |
| Collector Cutoff Current ( $V_{CEV}$= Rated Value, $V_{BE(OFF)}$=1.5 V )<br>( $V_{CEV}$= Rated Value, $V_{BE(OFF)}$=1.5 V, $T_C$=100°C) | | $I_{CEV}$ | | 0.25<br>5.0 | mA |
| Emitter Cutoff Current ( $V_{EB}$ = 2.0 V , $I_C$ = 0 ) | | $I_{EBO}$ | | 175 | mA |
| **ON CHARACTERISTICS** (1) | | | | | |
| DC Current Gain ( $I_C$ = 5.0 A , $V_{CE}$ = 5.0 V )<br>( $I_C$ = 10 A, $V_{CE}$ = 5.0 V ) | | hFE | 50<br>40 | 600<br>400 | |
| Collector - Emitter Saturation Voltage ( $I_C$ = 10 A , $I_B$ = 400mA )<br>( $I_C$ = 20 A, $I_B$ = 2.0 A )<br>( $I_C$ = 10 A, $I_B$ = 400 mA, $T_C$=100°C ) | | $V_{CE(sat)}$ | | 1.9<br>3.0<br>2.0 | V |
| Base - Emitter Saturation Voltage ( $I_C$ = 10 A, $I_B$ = 400 mA )<br>( $I_C$ = 10 A, $I_B$ =400 mA, $T_C$=100°C ) | | $V_{BE(sat)}$ | | 2.5<br>2.5 | V |
| Diode Forward Voltage ( $I_F$ = 10 A ) | | $V_F$ | | 5.0 | V |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Small-Signal Current Gain(2) ( $I_C$ = 1.0 A, $V_{CE}$ = 10 V, f = 1.0 MHz ) | | $\lvert h_{fe} \rvert$ | 10 | | |
| Output Capacitance ($V_{CB}$=10 V, $I_E$=0, f =100 kHz ) | | $C_{ob}$ | 100 | | pF |
| **SWITCHING CHARACTERISTICS** | | | | | |
| Delay Time | $V_{CC}$ = 250 V, $I_C$ = 10 A<br>$I_{B1}$ = 400 mA, $V_{BE(off)}$=5.0V<br>tp = 50 us, Duty Cycle ≦ 2% | $t_d$ | | 0.2 | us |
| Rise Time | | $t_r$ | | 0.6 | us |
| Storage Time | | $t_s$ | | 1.5 | us |
| Fall Time | | $t_f$ | | 0.5 | us |

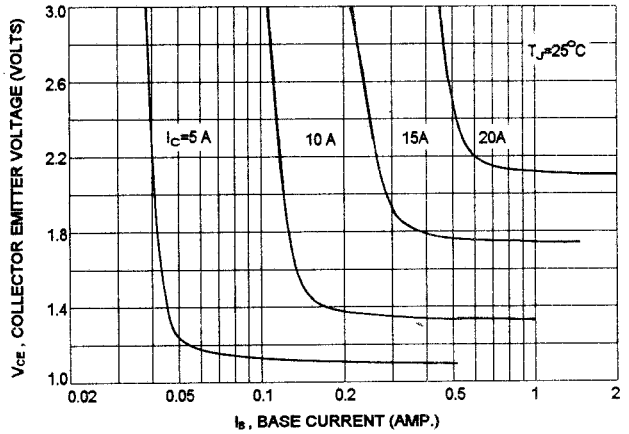
(1) Pulse Test: Pulse width = 300 us , Duty Cycle ≦ 2.0%

(2) $f_T = \lvert h_{fe} \rvert \cdot f_{test}$

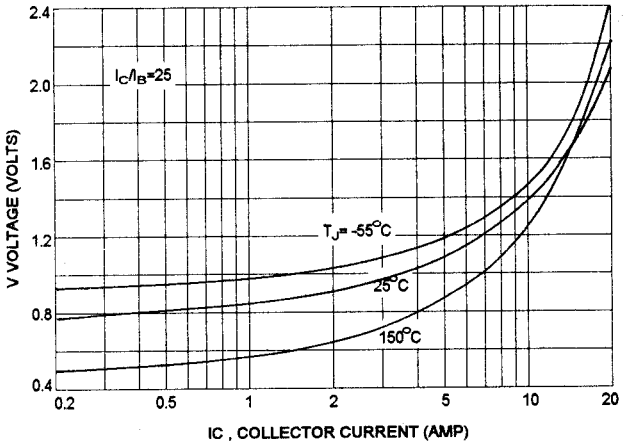
DC CURRENT GAIN



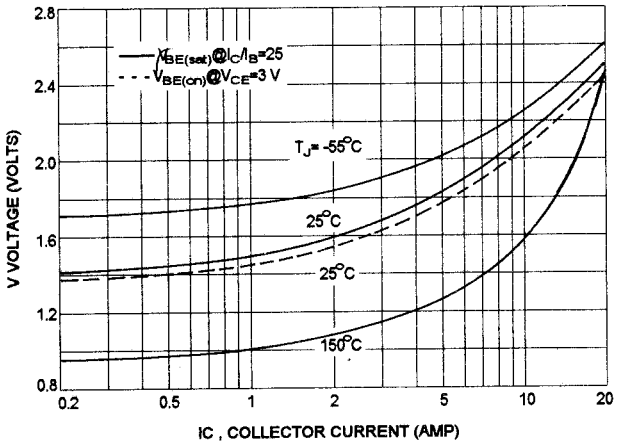

COLLECTOR SATURATION REGION



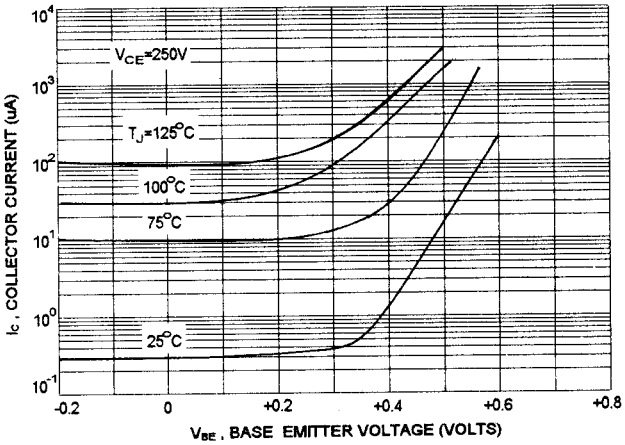

COLLECTOR EMITTER SATURATION VOLTAGE



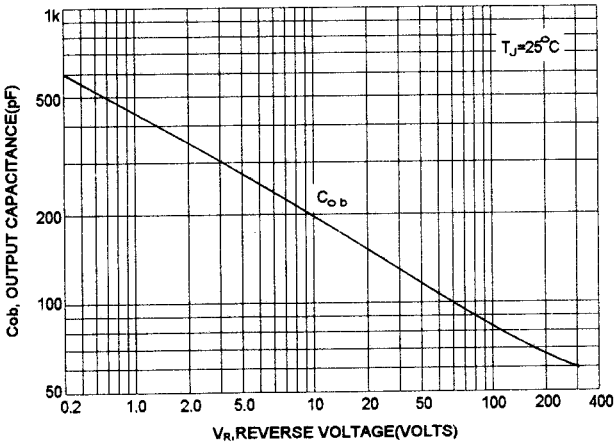

BASE EMITTER VOLTAGE



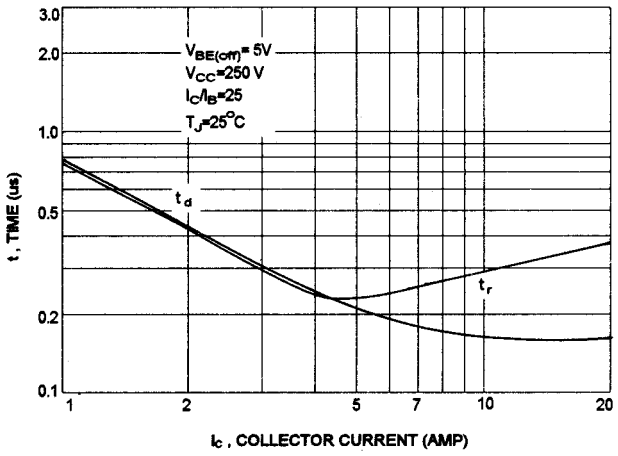

COLLECTOR CUT-OFF REGION



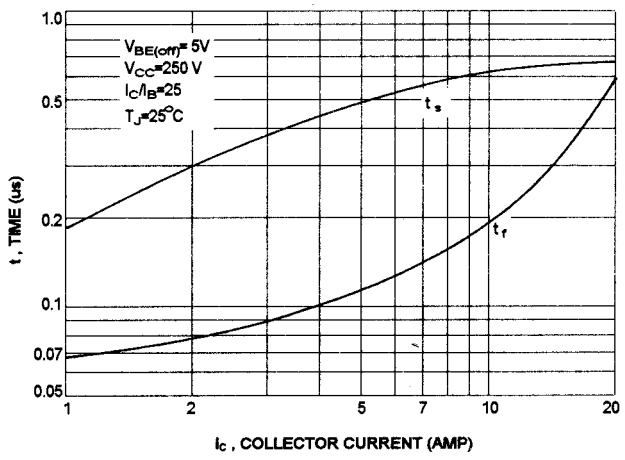

OUTPUT CAPACITANCES



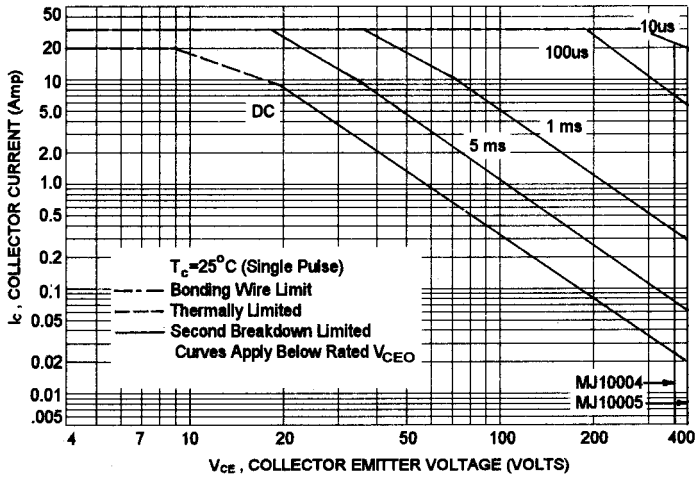
TURN-ON TIME




TURN-OFF TIME




ACTIVE REGION SAFE OPERATING AREA




REVERSE BIAS SWITCHING SAFE OPERATING AREA