



**BUL89**

## HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

- HIGH VOLTAGE CAPABILITY
- MINIMUM LOT-TO-LOT SPREAD FOR RELIABLE OPERATION
- LOW BASE-DRIVE REQUIREMENTS
- VERY HIGH SWITCHING SPEED
- FULLY CHARACTERIZED AT 125°C

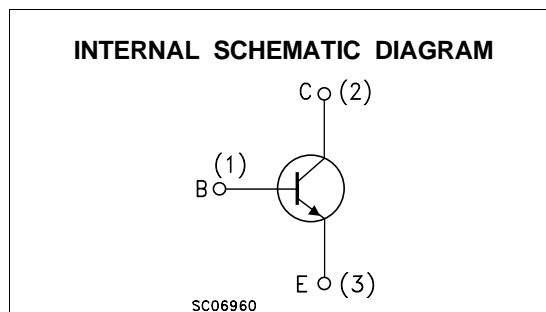
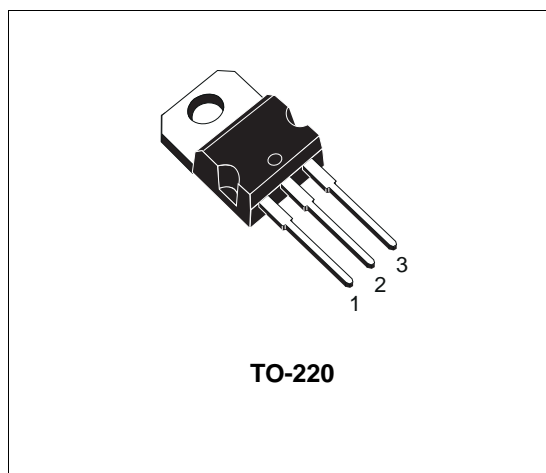
### APPLICATIONS

- ELECTRONIC TRANSFORMER FOR HALOGEN LAMPS
- SWITCH MODE POWER SUPPLIES

### DESCRIPTION

The BUL89 is manufactured using high voltage Multiepitaxial Mesa technology for cost-effective high performance. It uses a Hollow Emitter structure to enhance switching speeds.

The BUL series is designed for use in lighting applications and low cost switch-mode power supplies.



### ABSOLUTE MAXIMUM RATINGS

| Symbol    | Parameter                                  | Value      | Unit |
|-----------|--|------------|------|
| $V_{CES}$ | Collector-Emitter Voltage ( $V_{BE} = 0$ ) | 850        | V    |
| $V_{CEO}$ | Collector-Emitter Voltage ( $I_B = 0$ )    | 400        | V    |
| $V_{EBO}$ | Emitter-Base Voltage ( $I_C = 0$ )         | 9          | V    |
| $I_C$     | Collector Current                          | 12         | A    |
| $I_{CM}$  | Collector Peak Current ( $t_p < 5$ ms)     | 25         | A    |
| $I_B$     | Base Current                               | 6          | A    |
| $I_{BM}$  | Base Peak Current ( $t_p < 5$ ms)          | 12         | A    |
| $P_{tot}$ | Total Dissipation at $T_c = 25$ °C         | 110        | W    |
| $T_{stg}$ | Storage Temperature                        | -65 to 150 | °C   |
| $T_j$     | Max. Operating Junction Temperature        | 150        | °C   |

**THERMAL DATA**

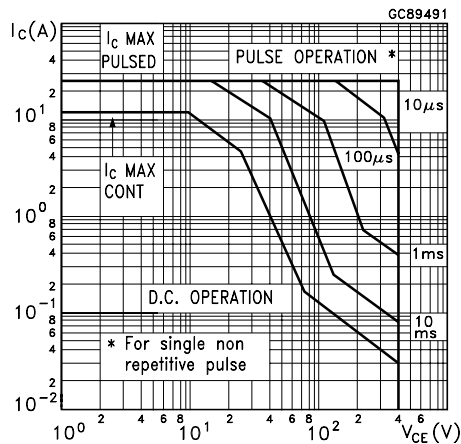
|                |                                  |     |      |      |
|----------------|----------------------------------|-----|------|------|
| $R_{thj-case}$ | Thermal Resistance Junction-Case | Max | 1.14 | °C/W |
|----------------|----------------------------------|-----|------|------|

**ELECTRICAL CHARACTERISTICS** ( $T_{case} = 25\text{ °C}$  unless otherwise specified)

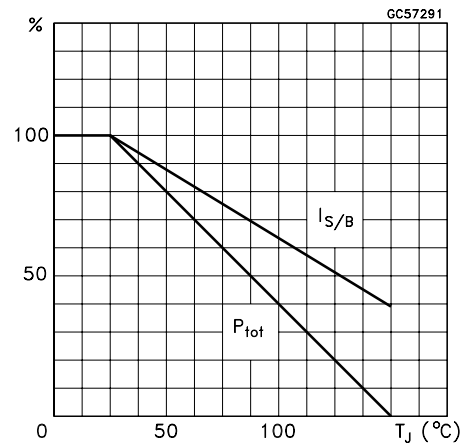
| Symbol          | Parameter  | Test Conditions  | Min.     | Typ.      | Max.          | Unit                           |
|-----------------|--|--|----------|-----------|---------------|--------------------------------|
| $I_{CES}$       | Collector Cut-off Current ( $V_{BE} = 0$ )         | $V_{CE} = 850\text{ V}$<br>$V_{CE} = 850\text{ V}$ $T_j = 125\text{ °C}$   |          |           | 100<br>500    | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{CEO}$       | Collector Cut-off Current ( $I_B = 0$ )            | $V_{CE} = 400\text{ V}$  |          |           | 100           | $\mu\text{A}$                  |
| $V_{CEO(sus)*}$ | Collector-Emitter Sustaining Voltage ( $I_B = 0$ ) | $I_C = 10\text{ mA}$ $L = 25\text{ mH}$  | 400      |           |               | V                              |
| $V_{EBO}$       | Emitter-Base Voltage ( $I_C = 0$ )                 | $I_E = 10\text{ mA}$   | 9        |           |               | V                              |
| $V_{CE(sat)*}$  | Collector-Emitter Saturation Voltage               | $I_C = 5\text{ A}$ $I_B = 1\text{ A}$<br>$I_C = 8\text{ A}$ $I_B = 1.6\text{ A}$<br>$I_C = 12\text{ A}$ $I_B = 2.4\text{ A}$   |          |           | 1<br>1.5<br>5 | V<br>V<br>V                    |
| $V_{BE(sat)*}$  | Base-Emitter Saturation Voltage                    | $I_C = 5\text{ A}$ $I_B = 1\text{ A}$<br>$I_C = 8\text{ A}$ $I_B = 1.6\text{ A}$   |          |           | 1.3<br>1.6    | V<br>V                         |
| $h_{FE*}$       | DC Current Gain                                    | $I_C = 5\text{ A}$ $V_{CE} = 5\text{ V}$<br>$I_C = 10\text{ mA}$ $V_{CE} = 5\text{ V}$   | 10<br>10 |           | 40            |                                |
| $t_s$<br>$t_f$  | INDUCTIVE LOAD<br>Storage Time<br>Fall Time        | $I_C = 8\text{ A}$ $I_{B1} = 1.6\text{ A}$<br>$V_{BE(off)} = -5\text{ V}$ $R_{BB} = 0\ \Omega$<br>$V_{CL} = 350\text{ V}$ $L = 200\ \mu\text{H}$<br>(see figure 1)                       |          | 1.5<br>55 | 2.3<br>110    | $\mu\text{s}$<br>ns            |
| $t_s$<br>$t_f$  | INDUCTIVE LOAD<br>Storage Time<br>Fall Time        | $I_C = 8\text{ A}$ $I_{B1} = 1.6\text{ A}$<br>$V_{BE(off)} = -5\text{ V}$ $R_{BB} = 0\ \Omega$<br>$V_{CL} = 350\text{ V}$ $L = 200\ \mu\text{H}$<br>$T_j = 100\text{ °C}$ (see figure 1) |          | 1.9<br>80 |               | $\mu\text{s}$<br>ns            |

\* Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

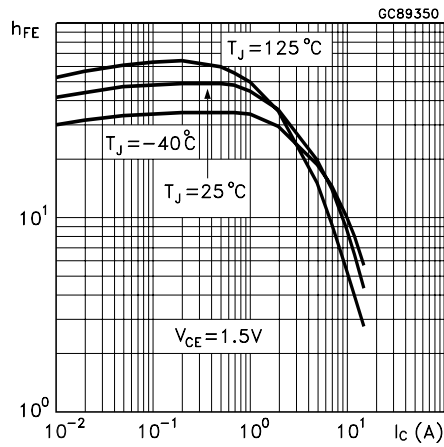
**Safe Operating Area**



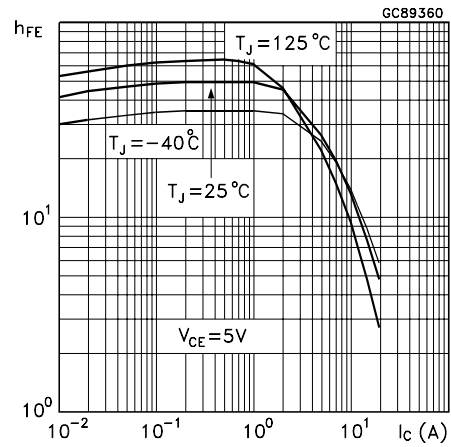
**Derating Curve**



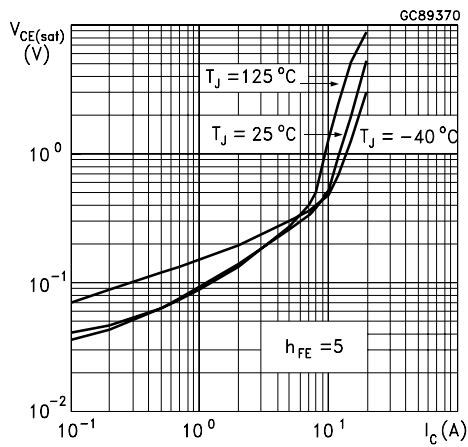
DC Current Gain



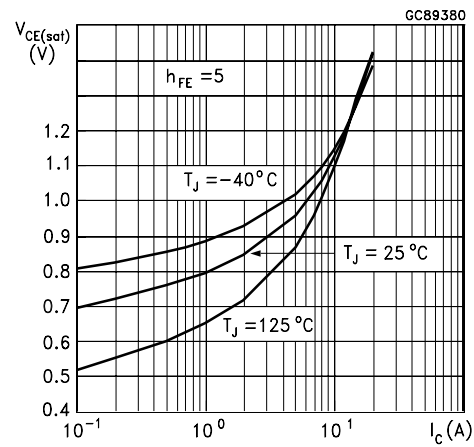
DC Current Gain



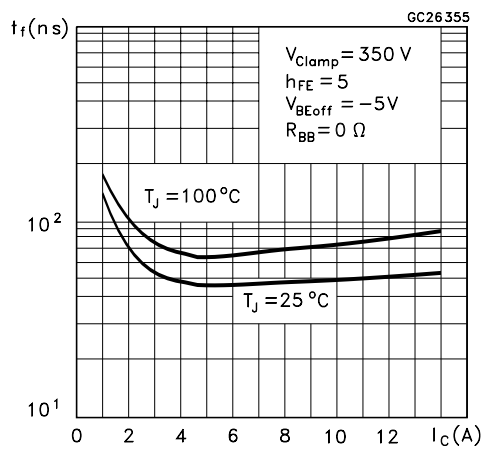
Collector Emitter Saturation Voltage



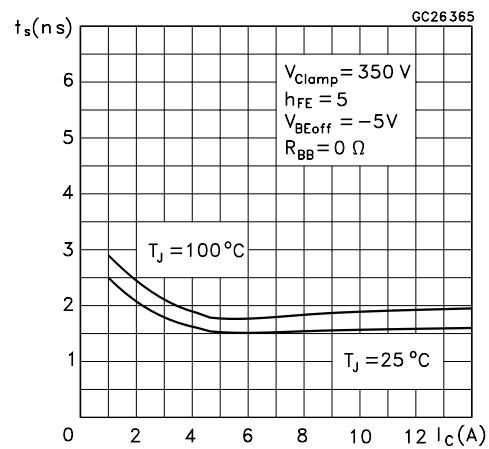
Base Emitter Saturation Voltage



Inductive Load Fall Time



Inductive Load Storage Time



Reverse Biased SOA

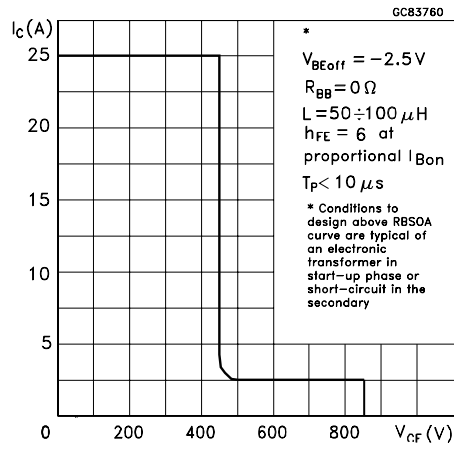
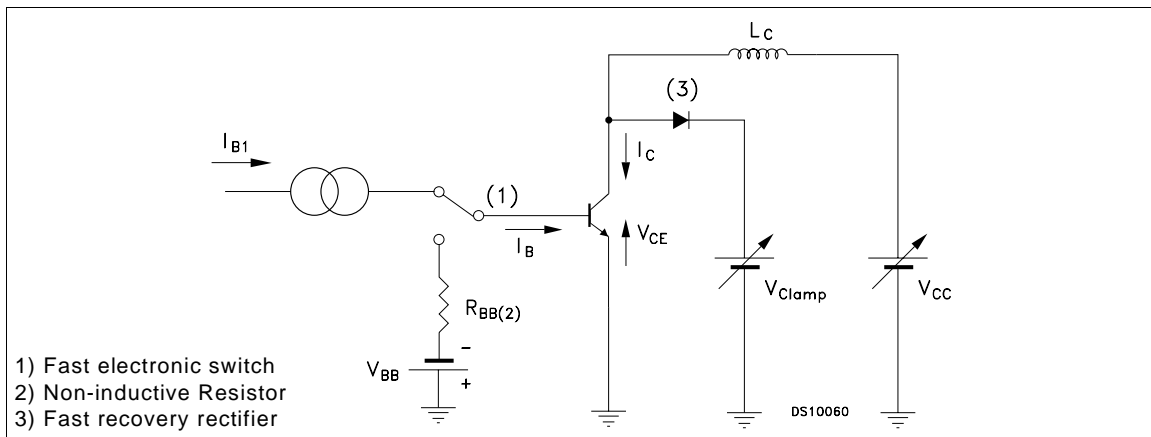
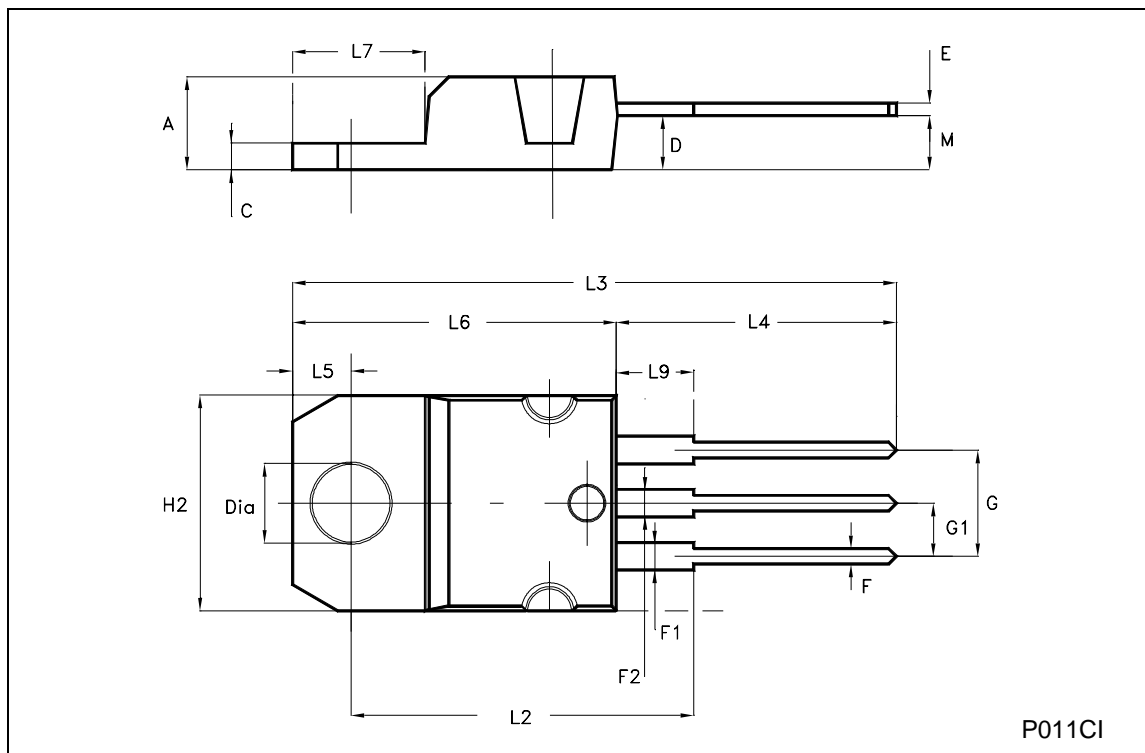


Figure 1: Inductive Load Switching Test Circuit



## TO-220 MECHANICAL DATA

| DIM. | mm    |       |       | inch  |       |       |
|------|-------|-------|-------|-------|-------|-------|
|      | MIN.  | TYP.  | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 4.40  |       | 4.60  | 0.173 |       | 0.181 |
| C    | 1.23  |       | 1.32  | 0.048 |       | 0.052 |
| D    | 2.40  |       | 2.72  | 0.094 |       | 0.107 |
| E    | 0.49  |       | 0.70  | 0.019 |       | 0.027 |
| F    | 0.61  |       | 0.88  | 0.024 |       | 0.034 |
| F1   | 1.14  |       | 1.70  | 0.044 |       | 0.067 |
| F2   | 1.14  |       | 1.70  | 0.044 |       | 0.067 |
| G    | 4.95  |       | 5.15  | 0.194 |       | 0.202 |
| G1   | 2.40  |       | 2.70  | 0.094 |       | 0.106 |
| H2   | 10.00 |       | 10.40 | 0.394 |       | 0.409 |
| L2   |       | 16.40 |       |       | 0.645 |       |
| L4   | 13.00 |       | 14.00 | 0.511 |       | 0.551 |
| L5   | 2.65  |       | 2.95  | 0.104 |       | 0.116 |
| L6   | 15.25 |       | 15.75 | 0.600 |       | 0.620 |
| L7   | 6.20  |       | 6.60  | 0.244 |       | 0.260 |
| L9   | 3.50  |       | 3.93  | 0.137 |       | 0.154 |
| M    |       | 2.60  |       |       | 0.102 |       |
| DIA. | 3.75  |       | 3.85  | 0.147 |       | 0.151 |



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