



**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

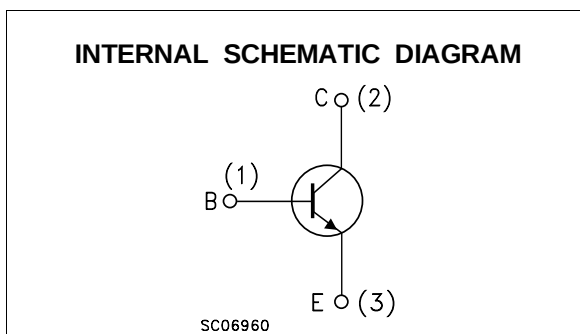
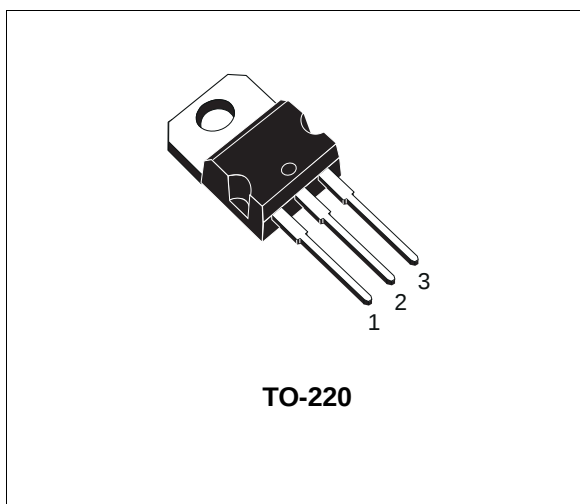
### APPLICATIONS

- 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

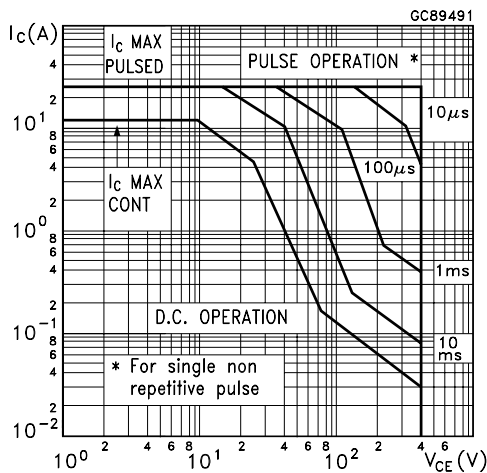
|                       |                                  |     |      |      |
|-----------------------|----------------------------------|-----|------|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-Case | Max | 1.14 | °C/W |
|-----------------------|----------------------------------|-----|------|------|

# ELECTRICAL CHARACTERISTICS (T<sub>case</sub> = 25 °C unless otherwise specified)

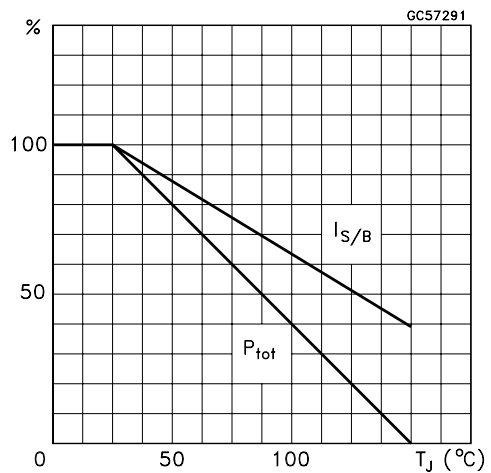
| Symbol                           | Parameter                                                 | Test Conditions                                                                                                                                                                      | Min.     | Typ.      | Max.          | Unit        |
|----------------------------------|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------|---------------|-------------|
| I <sub>CES</sub>                 | Collector Cut-off Current (V <sub>BE</sub> = 0)           | V <sub>CE</sub> = 850 V<br>V <sub>CE</sub> = 850 V T <sub>j</sub> = 125 °C                                                                                                           |          |           | 100<br>500    | μA<br>μA    |
| I <sub>CEO</sub>                 | Collector Cut-off Current (I <sub>B</sub> = 0)            | V <sub>CE</sub> = 400 V                                                                                                                                                              |          |           | 100           | μA          |
| V <sub>CEO(sus)*</sub>           | Collector-Emitter Sustaining Voltage (I <sub>B</sub> = 0) | I <sub>C</sub> = 10 mA L = 25 mH                                                                                                                                                     | 400      |           |               | V           |
| V <sub>EBO</sub>                 | Emitter-Base Voltage (I <sub>C</sub> = 0)                 | I <sub>E</sub> = 10 mA                                                                                                                                                               | 9        |           |               | V           |
| V <sub>CE(sat)*</sub>            | Collector-Emitter Saturation Voltage                      | I <sub>C</sub> = 5 A I <sub>B</sub> = 1 A<br>I <sub>C</sub> = 8 A I <sub>B</sub> = 1.6 A<br>I <sub>C</sub> = 12 A I <sub>B</sub> = 2.4 A                                             |          |           | 1<br>1.5<br>5 | V<br>V<br>V |
| V <sub>BE(sat)*</sub>            | Base-Emitter Saturation Voltage                           | I <sub>C</sub> = 5 A I <sub>B</sub> = 1 A<br>I <sub>C</sub> = 8 A I <sub>B</sub> = 1.6 A                                                                                             |          |           | 1.3<br>1.6    | V<br>V      |
| h <sub>FE</sub> *                | DC Current Gain                                           | I <sub>C</sub> = 5 A V <sub>CE</sub> = 5 V<br>I <sub>C</sub> = 10 mA V <sub>CE</sub> = 5 V                                                                                           | 10<br>10 |           | 40            |             |
| t <sub>s</sub><br>t <sub>f</sub> | INDUCTIVE LOAD<br>Storage Time<br>Fall Time               | I <sub>C</sub> = 8 A I <sub>B1</sub> = 1.6 A<br>V <sub>BE(off)</sub> = -5 V R <sub>BB</sub> = 0 Ω<br>V <sub>CL</sub> = 350 V L = 200 μH<br>(see figure 1)                            |          | 1.5<br>55 | 2.3<br>110    | μs<br>ns    |
| t <sub>s</sub><br>t <sub>f</sub> | INDUCTIVE LOAD<br>Storage Time<br>Fall Time               | I <sub>C</sub> = 8 A I <sub>B1</sub> = 1.6 A<br>V <sub>BE(off)</sub> = -5 V R <sub>BB</sub> = 0 Ω<br>V <sub>CL</sub> = 350 V L = 200 μH<br>T <sub>j</sub> = 100 °C<br>(see figure 1) |          | 1.9<br>80 |               | μs<br>ns    |

\* Pulsed: Pulse duration = 300 μs, duty cycle 1.5 %

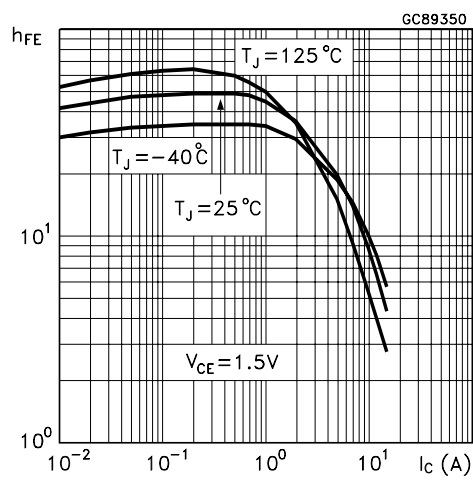
## Safe Operating Area



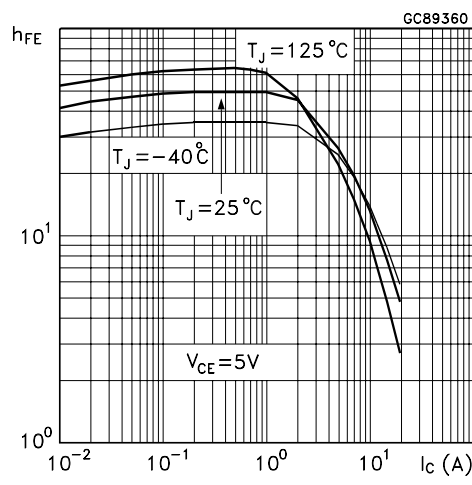
## Derating Curve



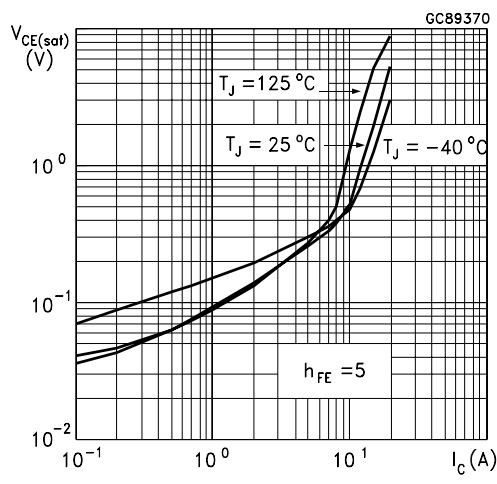
DC Current Gain



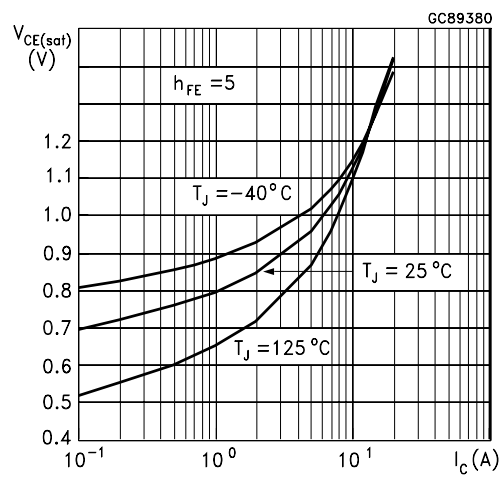
DC Current Gain



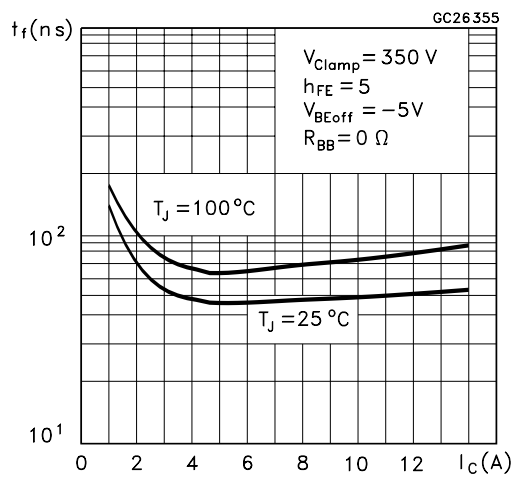
Collector Emitter Saturation Voltage



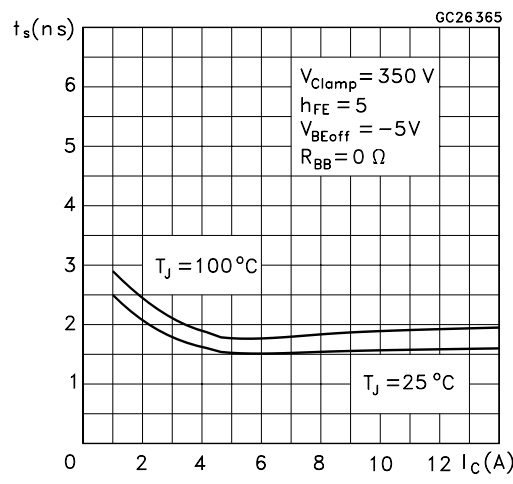
Base Emitter Saturation Voltage



Inductive Load Fall Time



Inductive Load Storage Time



Reverse Biased SOA

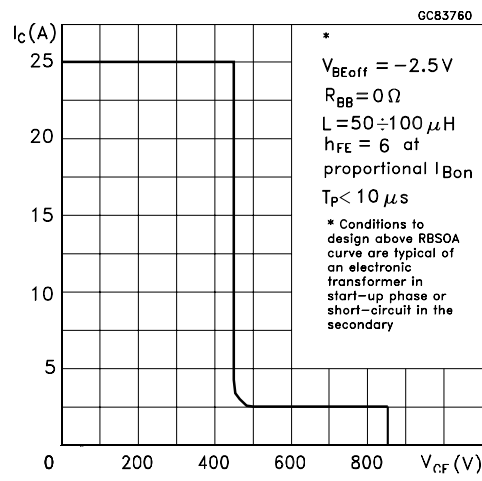
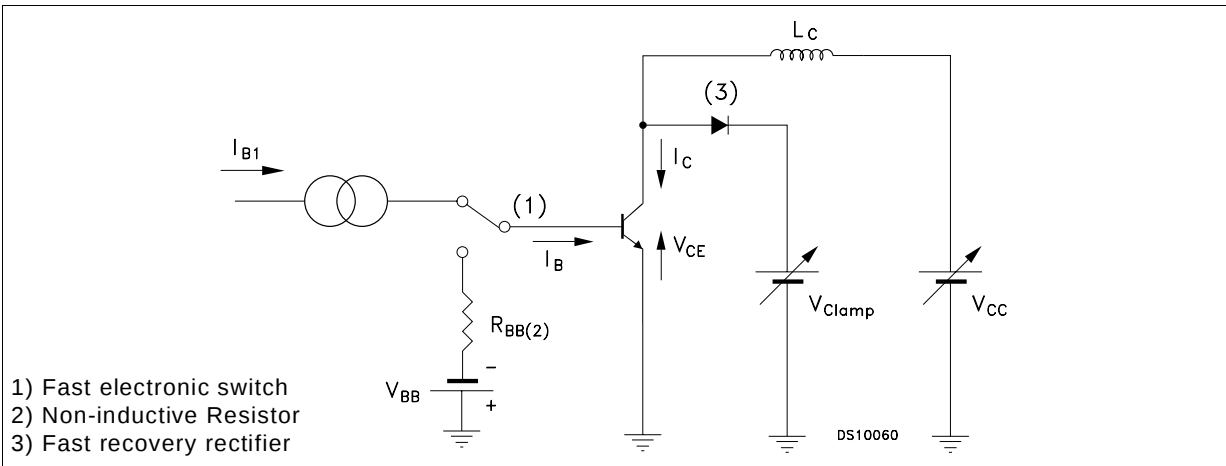
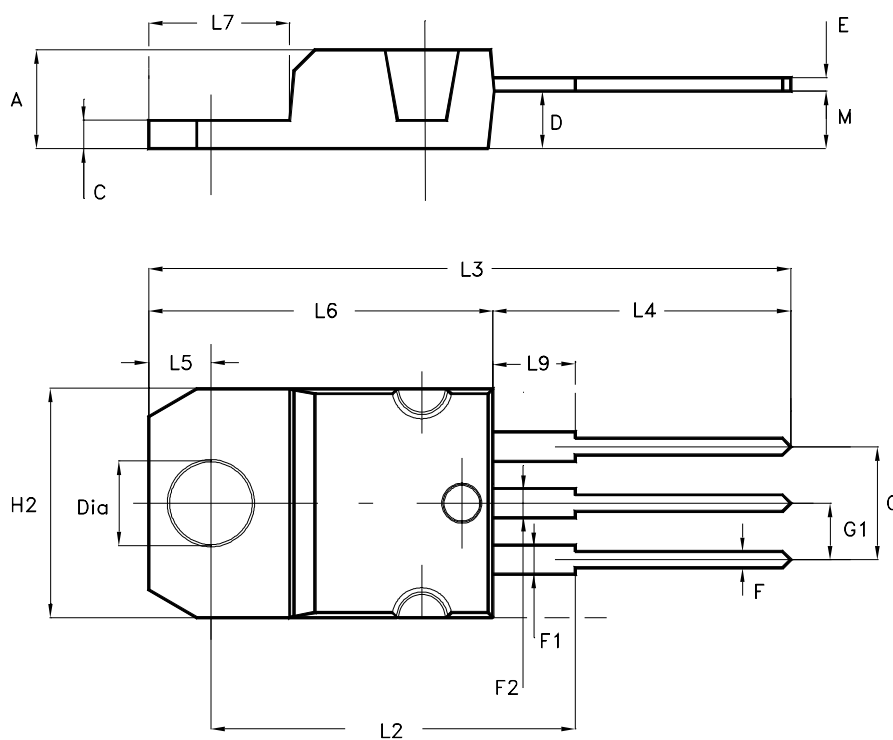


Figure 1: Inductive Load Switching Test Circuit



## 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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