

**BUL310**

## HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

- STMicroelectronics PREFERRED SALESTYPE
- NPN TRANSISTOR
- HIGH VOLTAGE CAPABILITY
- LOW SPREAD OF DYNAMIC PARAMETERS
- MINIMUM LOT-TO-LOT SPREAD FOR RELIABLE OPERATION
- VERY HIGH SWITCHING SPEED
- FULLY CHARACTERISED AT 125°C
- LARGE RBSOA

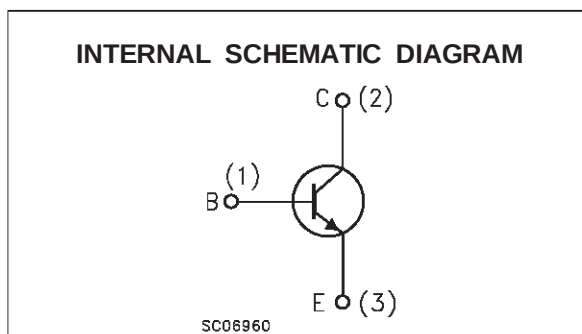
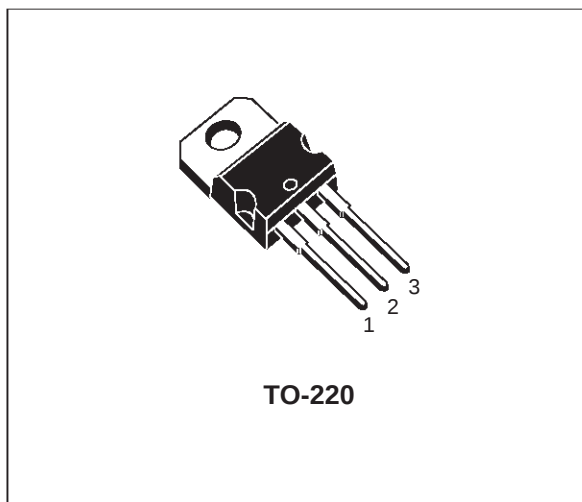
### APPLICATIONS

- ELECTRONIC BALLASTS FOR FLUORESCENT LIGHTING
- FLYBACK AND FORWARD SINGLE TRANSISTOR LOW POWER CONVERTERS

### DESCRIPTION

The device is manufactured using high voltage Multi Epitaxial Planar technology for high switching speeds and high voltage capability. It uses a Cellular Emitter structure with planar edge termination to enhance switching speeds while maintaining a wide RBSOA.

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 ( $V_{BE} = 0$ ) | 1000       | V    |
| $V_{CEO}$ | Collector-Emitter Voltage ( $I_B = 0$ )    | 500        | V    |
| $V_{EBO}$ | Emitter-Base Voltage ( $I_C = 0$ )         | 9          | V    |
| $I_C$     | Collector Current                          | 5          | A    |
| $I_{CM}$  | Collector Peak Current ( $t_p < 5$ ms)     | 10         | A    |
| $I_B$     | Base Current                               | 3          | A    |
| $I_{BM}$  | Base Peak Current ( $t_p < 5$ ms)          | 4          | A    |
| $P_{tot}$ | Total Dissipation at $T_c = 25$ °C         | 75         | W    |
| $T_{stg}$ | Storage Temperature                        | -65 to 150 | °C   |
| $T_j$     | Max. Operating Junction Temperature        | 150        | °C   |

THERMAL DATA

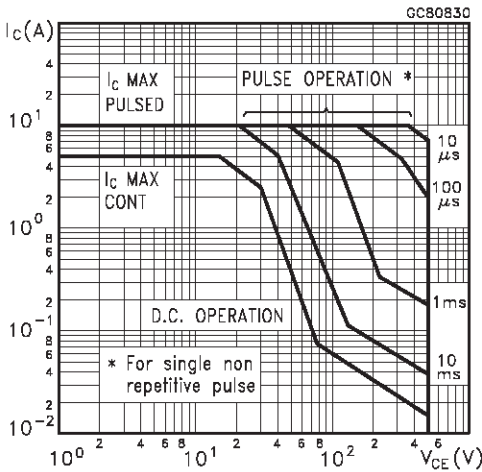
|                       |                                     |     |      |      |
|-----------------------|-------------------------------------|-----|------|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-Case    | Max | 1.65 | °C/W |
| R <sub>thj-amb</sub>  | Thermal Resistance Junction-Ambient | Max | 62.5 | °C/W |

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

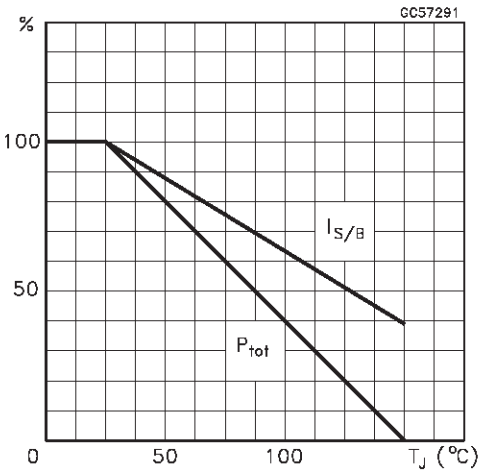
| Symbol                           | Parameter                                       | Test Conditions                                                                                                                                                   | Min. | Typ.       | Max.              | Unit        |
|----------------------------------|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------|-------------------|-------------|
| I <sub>CES</sub>                 | Collector Cut-off Current (V <sub>BE</sub> = 0) | V <sub>CE</sub> = 1000 V<br>V <sub>CE</sub> = 1000 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>EC</sub> = 400 V                                                                                                                                           |      |            | 250               | μA          |
| V <sub>CEO(sus)</sub>            | Collector-Emitter Sustaining Voltage            | I <sub>C</sub> = 100 mA L = 25 mH                                                                                                                                 | 500  |            |                   | 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> = 1 A I <sub>B</sub> = 0.2 A<br>I <sub>C</sub> = 2 A I <sub>B</sub> = 0.4 A<br>I <sub>C</sub> = 3 A I <sub>B</sub> = 0.6 A                         |      |            | 0.5<br>0.7<br>1.1 | V<br>V<br>V |
| V <sub>BE(sat)*</sub>            | Base-Emitter Saturation Voltage                 | I <sub>C</sub> = 1 A I <sub>B</sub> = 0.2 A<br>I <sub>C</sub> = 2 A I <sub>B</sub> = 0.4 A<br>I <sub>C</sub> = 3 A I <sub>B</sub> = 0.6 A                         |      |            | 1<br>1.1<br>1.2   | V<br>V<br>V |
| h <sub>FE*</sub>                 | DC Current Gain                                 | I <sub>C</sub> = 10 mA V <sub>CE</sub> = 5 V<br>I <sub>C</sub> = 3 A V <sub>CE</sub> = 2.5 V                                                                      | 10   | 10         |                   |             |
| t <sub>s</sub><br>t <sub>f</sub> | INDUCTIVE LOAD<br>Storage Time<br>Fall Time     | I <sub>C</sub> = 2 A I <sub>B1</sub> = 0.4 A<br>V <sub>BE(off)</sub> = -5 V R <sub>BB</sub> = 0 Ω<br>V <sub>CL</sub> = 250 V L = 200 μH                           |      | 1.2<br>80  | 1.9<br>160        | μs<br>ns    |
| t <sub>s</sub><br>t <sub>f</sub> | INDUCTIVE LOAD<br>Storage Time<br>Fall Time     | I <sub>C</sub> = 2 A I <sub>B1</sub> = 0.4 A<br>V <sub>BE(off)</sub> = -5V R <sub>BB</sub> = 0 Ω<br>V <sub>CL</sub> = 250 V L = 200 μH<br>T <sub>j</sub> = 125 °C |      | 1.8<br>150 |                   | μs<br>ns    |

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

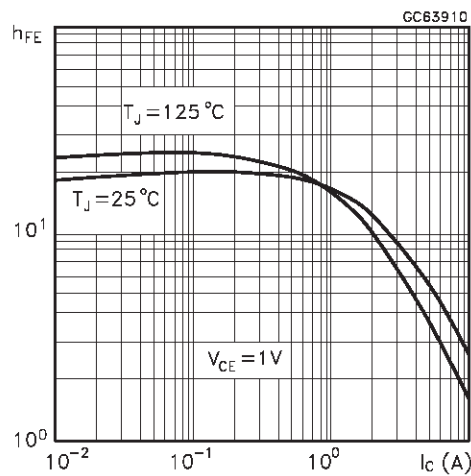
Safe Operating Areas



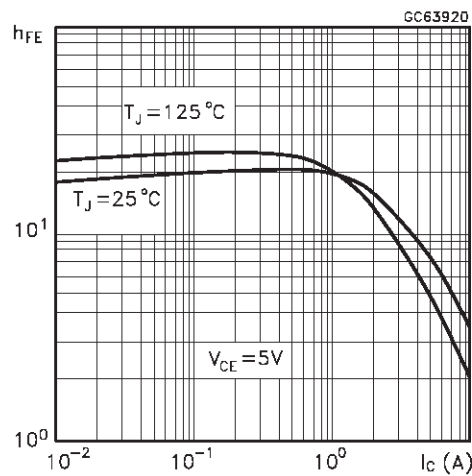
Derating Curve



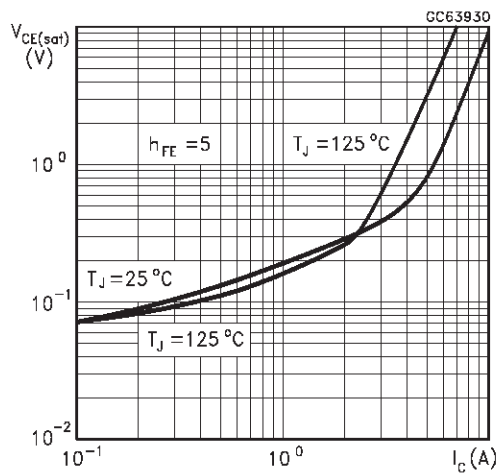
DC Current Gain



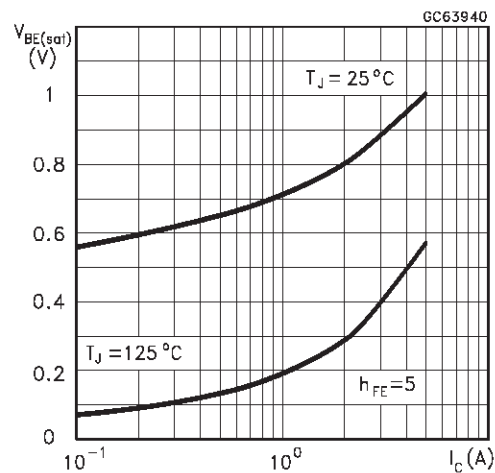
DC Current Gain



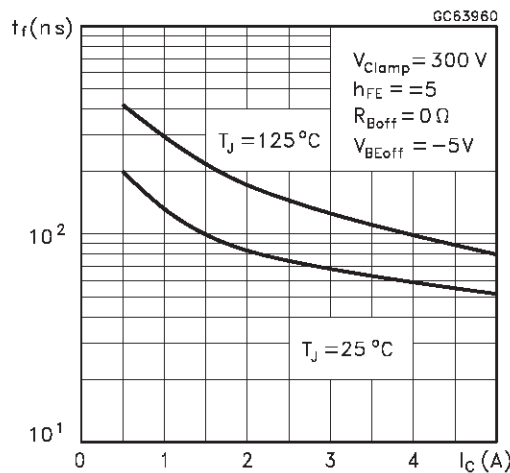
Collector Emitter Saturation Voltage



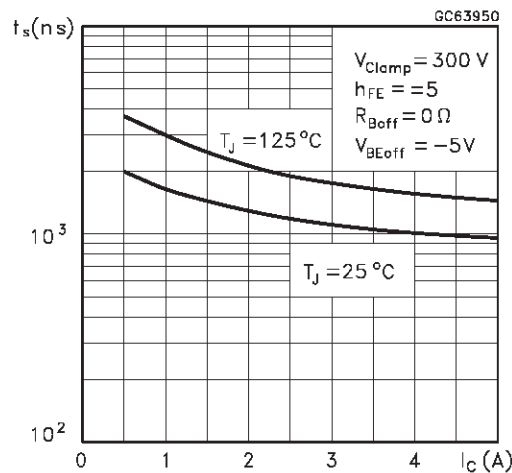
Base Emitter Saturation Voltage



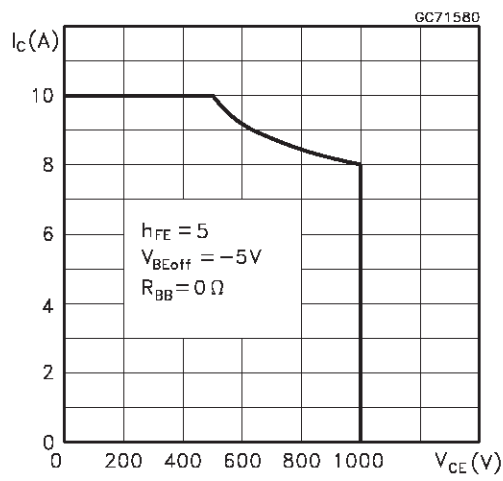
Inductive Fall Time



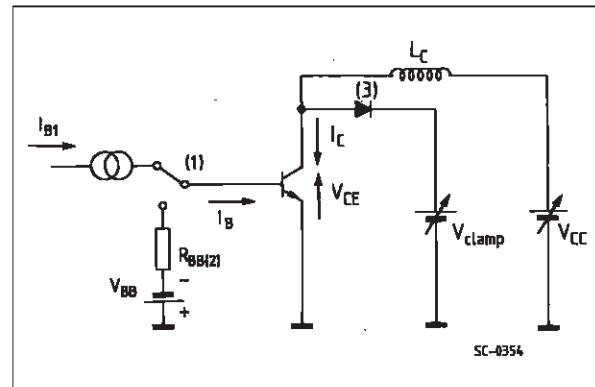
Inductive Storage Time



Reverse Biased SOA



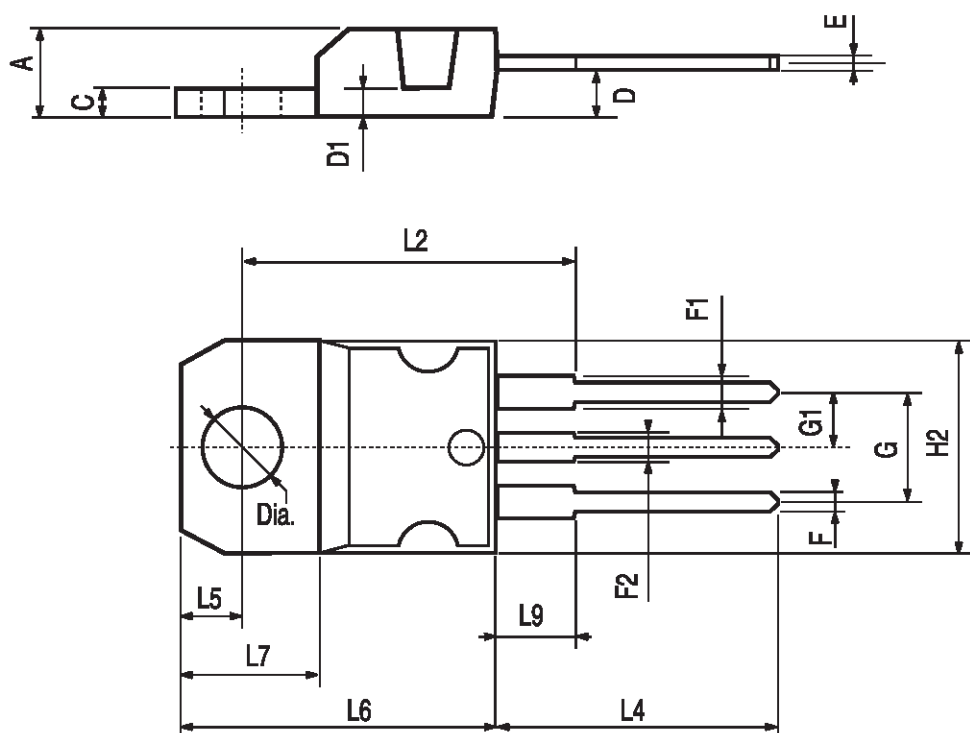
RBSOA and Inductive Load Switching Test Circuit



- (1) Fast electronic switch
- (2) Non-inductive Resistor
- (3) Fast recovery rectifier

## 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 |       | 0.051 |
| D    | 2.40  |      | 2.72  | 0.094 |       | 0.107 |
| D1   |       | 1.27 |       |       | 0.050 |       |
| 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 |       | 0.203 |
| G1   | 2.4   |      | 2.7   | 0.094 |       | 0.106 |
| H2   | 10.0  |      | 10.40 | 0.393 |       | 0.409 |
| L2   |       | 16.4 |       |       | 0.645 |       |
| L4   | 13.0  |      | 14.0  | 0.511 |       | 0.551 |
| L5   | 2.65  |      | 2.95  | 0.104 |       | 0.116 |
| L6   | 15.25 |      | 15.75 | 0.600 |       | 0.620 |
| L7   | 6.2   |      | 6.6   | 0.244 |       | 0.260 |
| L9   | 3.5   |      | 3.93  | 0.137 |       | 0.154 |
| DIA. | 3.75  |      | 3.85  | 0.147 |       | 0.151 |



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