



**BUL128**

## 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

### APPLICATIONS:

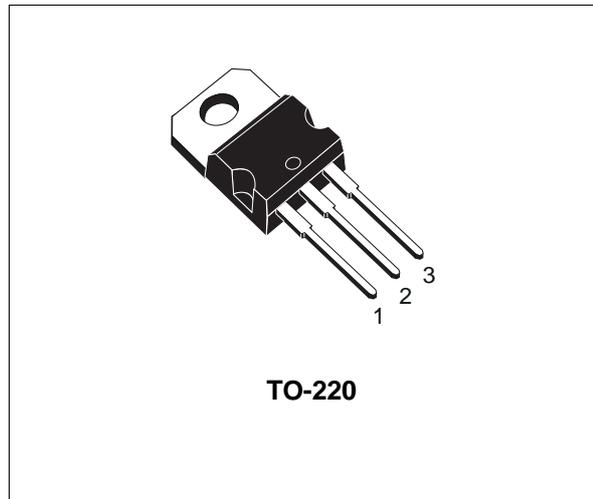
- ELECTRONIC BALLASTS FOR FLUORESCENT LIGHTING

### DESCRIPTION

The device is manufactured using high voltage Multi Epitaxial Planar technology for high switching speeds and medium voltage capability.

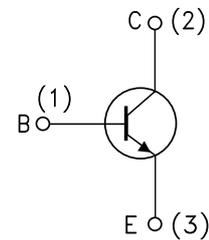
It uses a Cellular Emitter structure with planar edge termination to enhance switching speeds while maintaining the wide RBSOA.

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



TO-220

### INTERNAL SCHEMATIC DIAGRAM



SC06960

### ABSOLUTE MAXIMUM RATINGS

| Symbol    | Parameter                                  | Value      | Unit |
|-----------|--|------------|------|
| $V_{CES}$ | Collector-Emitter Voltage ( $V_{BE} = 0$ ) | 700        | 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                          | 4          | A    |
| $I_{CM}$  | Collector Peak Current ( $t_p < 5$ ms)     | 8          | A    |
| $I_B$     | Base Current                               | 2          | A    |
| $I_{BM}$  | Base Peak Current ( $t_p < 5$ ms)          | 4          | A    |
| $P_{tot}$ | Total Dissipation at $T_C = 25$ °C         | 70         | 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 | 1.78 | °C/W |
| R <sub>thj-amb</sub>  | Thermal Resistance Junction-Ambient | Max | 62.5 | °C/W |

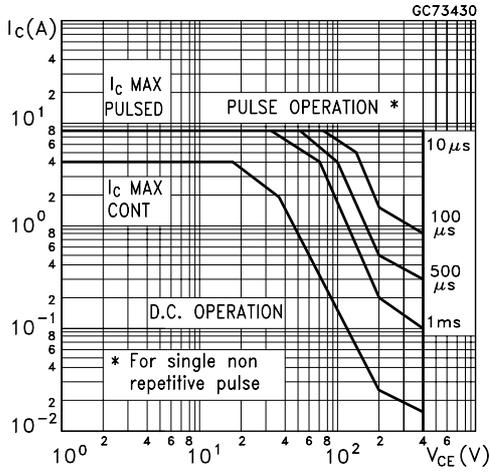
**ELECTRICAL CHARACTERISTICS** (T<sub>case</sub> = 25 °C unless otherwise specified)

| Symbol                           | Parameter   | Test Conditions   | Min.           | Typ.       | Max.              | Unit             |
|----------------------------------|---|---|----------------|------------|-------------------|------------------|
| I <sub>CES</sub>                 | Collector Cut-off Current (V <sub>BE</sub> = -1.5 V)      | V <sub>CE</sub> = 700 V<br>V <sub>CE</sub> = 700 V      T <sub>j</sub> = 125 °C   |                |            | 100<br>500        | μA<br>μA         |
| V <sub>EBO</sub>                 | Emitter-Base Voltage (I <sub>C</sub> = 0)                 | I <sub>E</sub> = 10 mA  | 9              |            |                   | V                |
| V <sub>CEO(sus)*</sub>           | Collector-Emitter Sustaining Voltage (I <sub>B</sub> = 0) | I <sub>C</sub> = 100 mA      L = 25 mH  | 400            |            |                   | V                |
| I <sub>CEO</sub>                 | Collector Cut-Off Current (I <sub>B</sub> = 0)            | V <sub>CE</sub> = 400 V   |                |            | 250               | μA               |
| V <sub>CE(sat)*</sub>            | Collector-Emitter Saturation Voltage                      | I <sub>C</sub> = 0.5 A      I <sub>B</sub> = 0.1 A<br>I <sub>C</sub> = 1 A          I <sub>B</sub> = 0.2 A<br>I <sub>C</sub> = 2.5 A        I <sub>B</sub> = 0.5 A<br>I <sub>C</sub> = 4 A           I <sub>B</sub> = 1 A |                | 0.5        | 0.7<br>1<br>1.5   | V<br>V<br>V<br>V |
| V <sub>BE(sat)*</sub>            | Base-Emitter Saturation Voltage                           | I <sub>C</sub> = 0.5 A      I <sub>B</sub> = 0.1 A<br>I <sub>C</sub> = 1 A          I <sub>B</sub> = 0.2 A<br>I <sub>C</sub> = 2.5 A        I <sub>B</sub> = 0.5 A  |                |            | 1.1<br>1.2<br>1.3 | 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> = 2 A          V <sub>CE</sub> = 5 V<br>Group A<br>Group B  | 10<br>14<br>25 |            | 28<br>40          |                  |
| t <sub>s</sub><br>t <sub>f</sub> | RESISTIVE LOAD<br>Storage Time<br>Fall Time               | V <sub>CC</sub> = 125 V      I <sub>C</sub> = 2 A<br>I <sub>B1</sub> = 0.4 A      I <sub>B2</sub> = -0.4 A<br>T <sub>p</sub> = 30 μs      (see fig.2)   | 1.5            | 0.2        | 3<br>0.4          | μs<br>μs         |
| 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>clamp</sub> = 200 V      (see fig.1)  |                | 0.6<br>0.1 | 1<br>0.2          | μs<br>μs         |

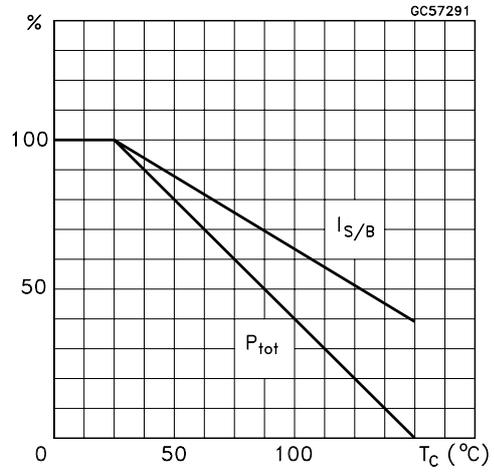
\* Pulsed: Pulse duration = 300 μs, duty cycle 1.5 %

Note : Product is pre-selected in DC current gain (GROUP A and GROUP B). STMicroelectronics reserves the right to ship either groups according to production availability. Please contact your nearest STMicroelectronics sales office for delivery details.

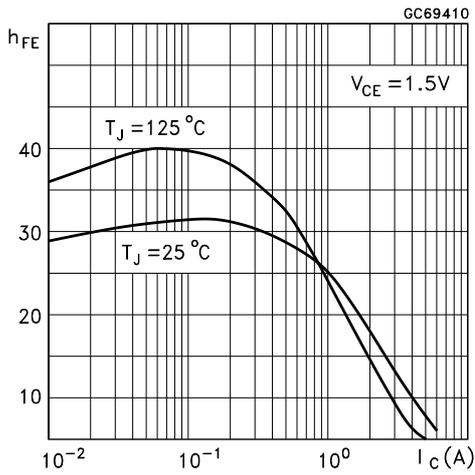
Safe Operating Areas



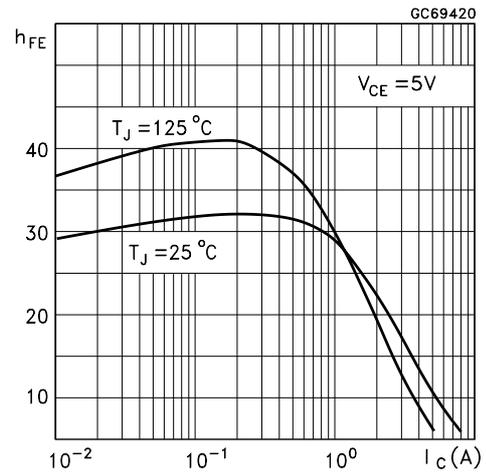
Derating Curve



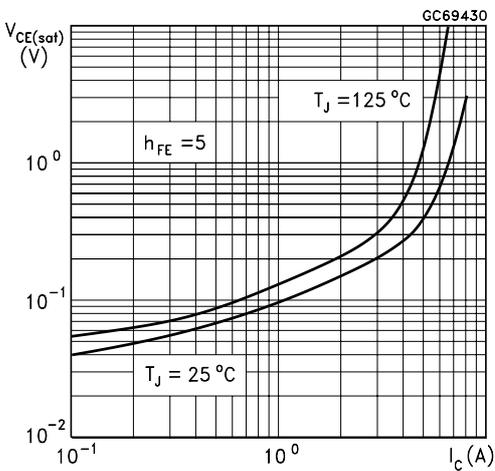
DC Current Gain



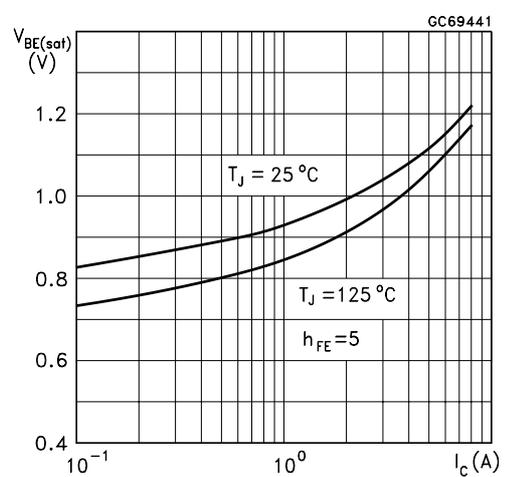
DC Current Gain



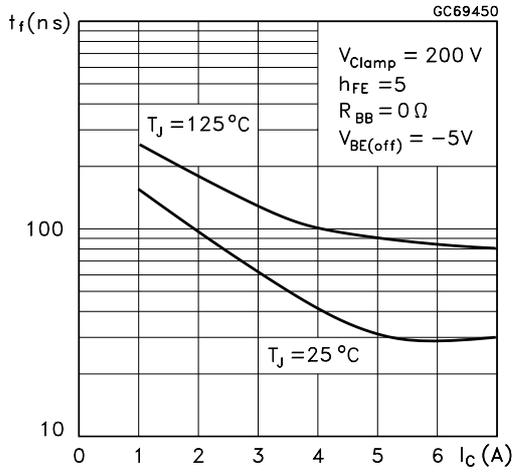
Collector Emitter Saturation Voltage



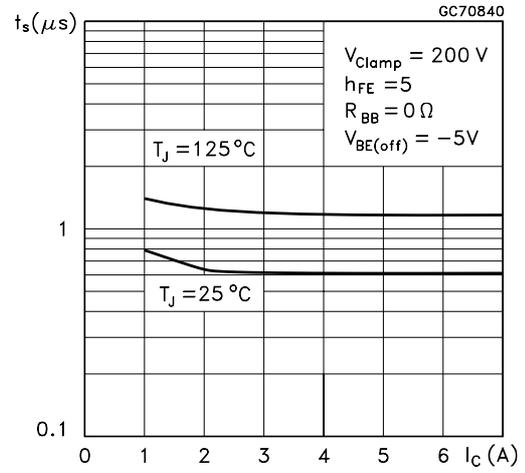
Base Emitter Saturation Voltage



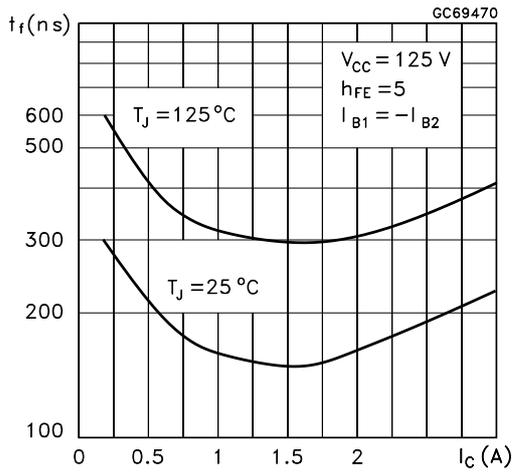
Inductive Load Fall Time



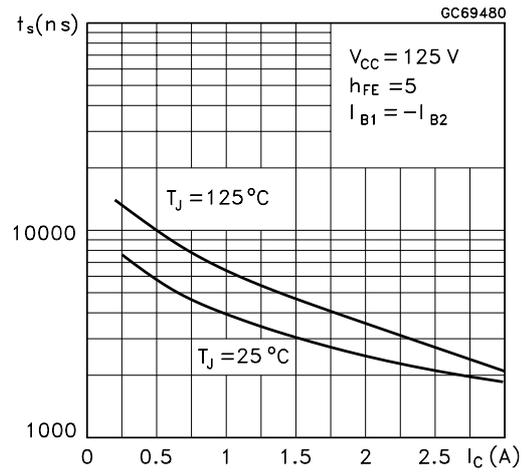
Inductive Load Storage Time



Resistive Load Fall Time



Resistive Load Storage Time



Reverse Biased SOA

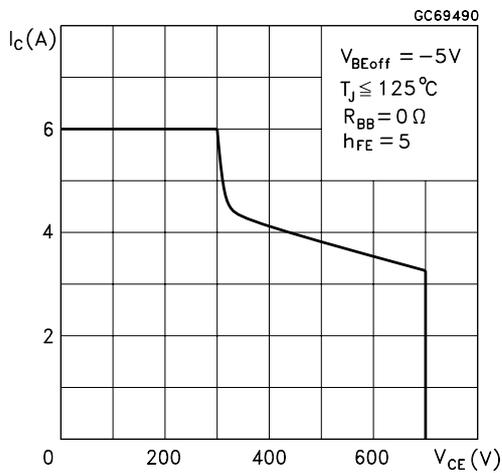


Figure 1: Inductive Load Switching Test Circuit.

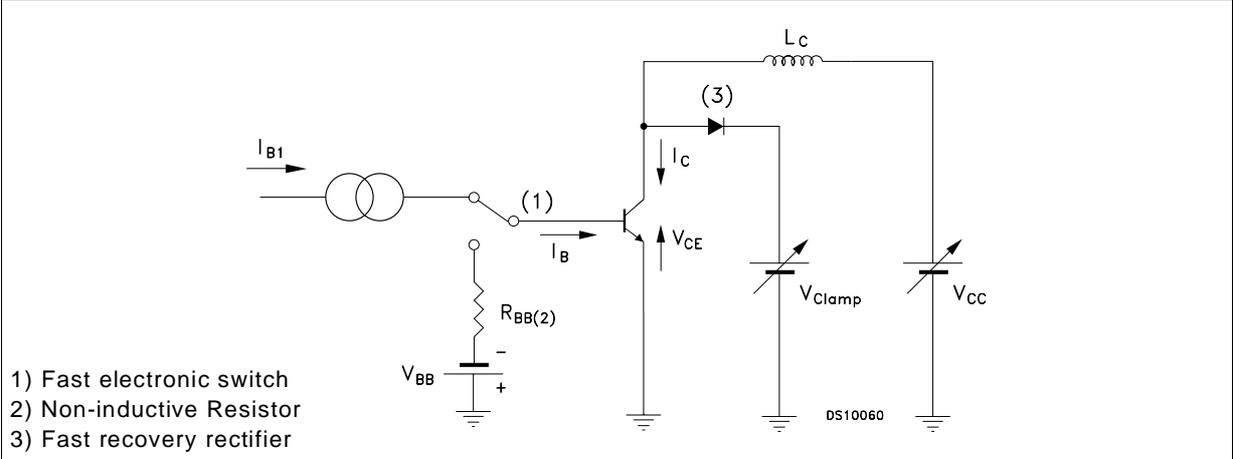
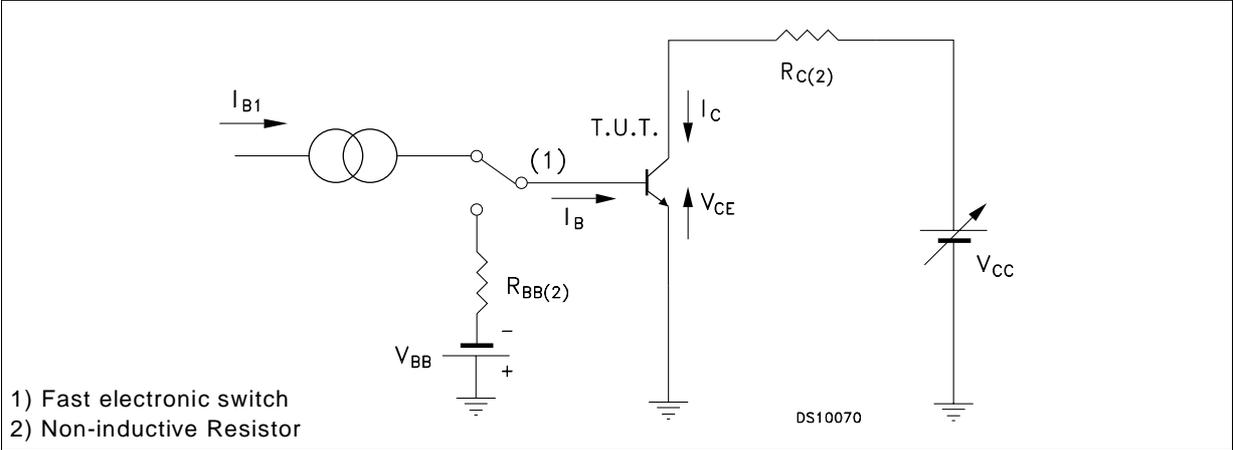
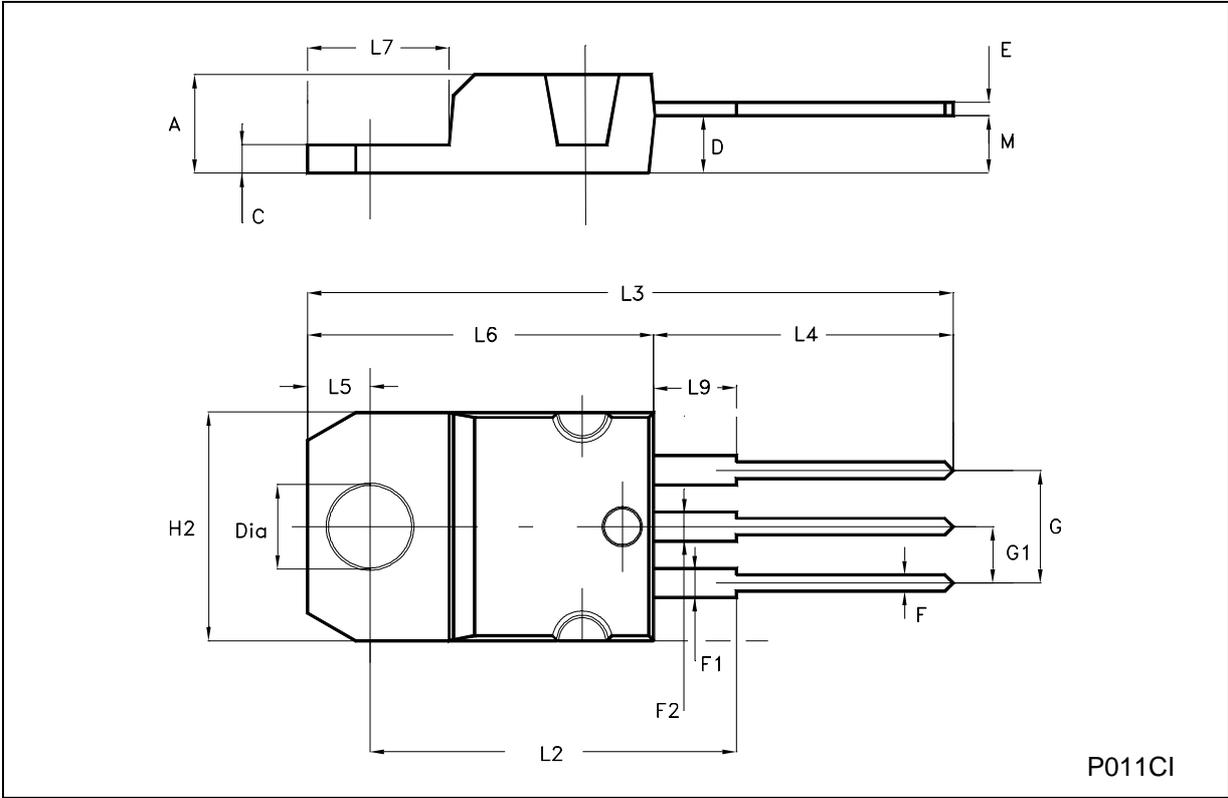


Figure 2: Resistive Load Switching Test Circuit.



**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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