



## BUL128FP

### 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

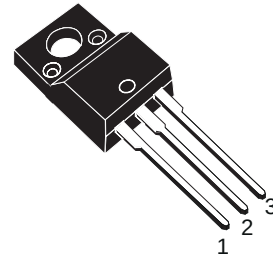
#### APPLICATIONS:

- ELECTRONIC BALLASTS FOR FLUORESCENT LIGHTING

#### DESCRIPTION

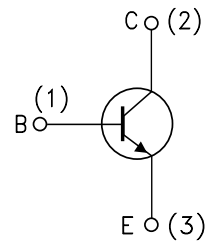
The device is manufactured using high voltage Multi Epitaxial Planar technology for high switching speeds and medium voltage capability. It uses a Cellular Emitter structure with planar edge termination to enhance switching speeds while maintaining the wide RBSOA.

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



TO-220FP

#### 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         | 31         | W    |
| $T_{stg}$ | Storage Temperature                        | -65 to 150 | °C   |
| $T_j$     | Max. Operating Junction Temperature        | 150        | °C   |

## THERMAL DATA

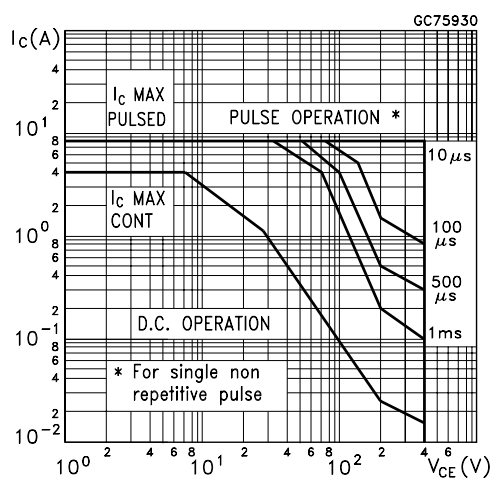
|                       |                                     |     |      |      |
|-----------------------|-------------------------------------|-----|------|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-Case    | Max | 4.1  | °C/W |
| R <sub>thj-amb</sub>  | Thermal Resistance Junction-Ambient | Max | 62.5 | °C/W |

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

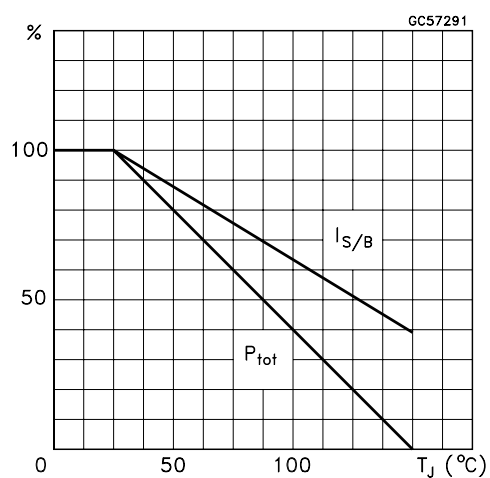
| Symbol                           | Parameter                                                 | Test Conditions                                                                                                                                                                            | Min.           | 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<br>V | 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> = 1 A V <sub>CE</sub> = 5 V<br>I <sub>C</sub> = 2 A V <sub>CE</sub> = 5 V                                                   | 10<br>15<br>14 |            | 45<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)                                                     | 1.9            | 0.2        | 2.9<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 %

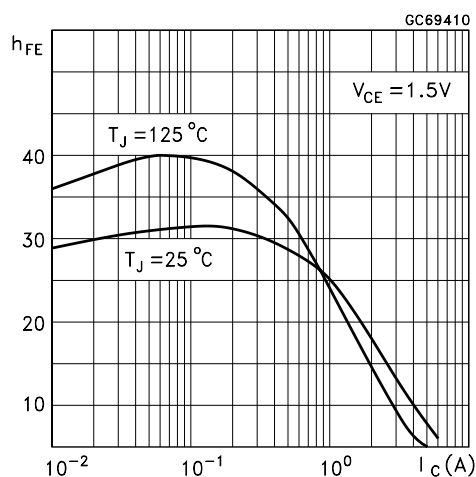
Safe Operating Areas



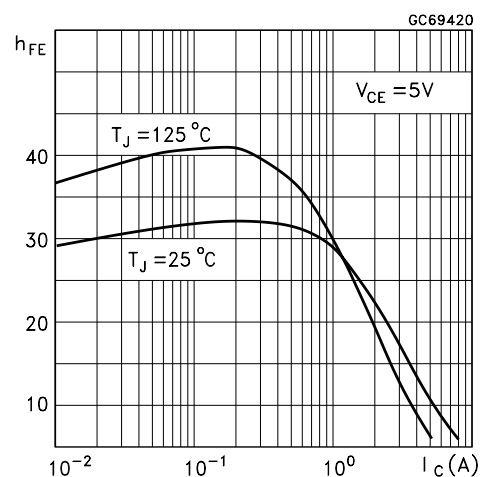
Derating Curve



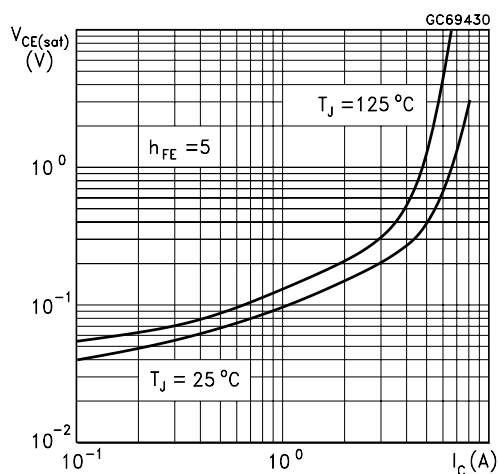
DC Current Gain



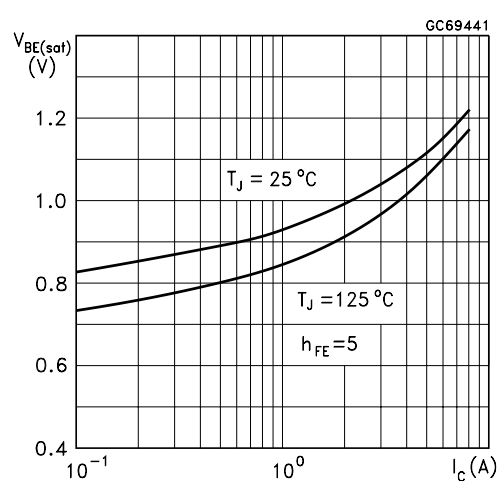
DC Current Gain



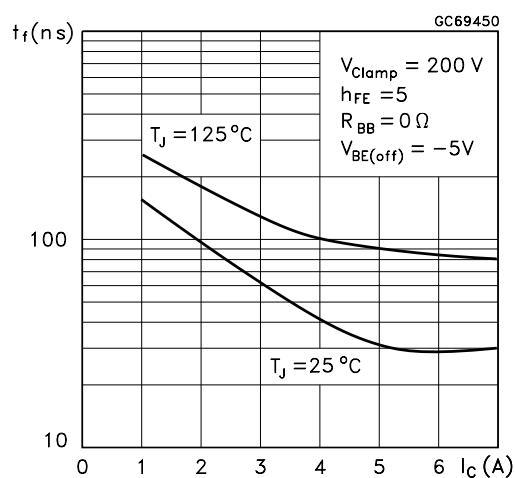
Collector Emitter Saturation Voltage



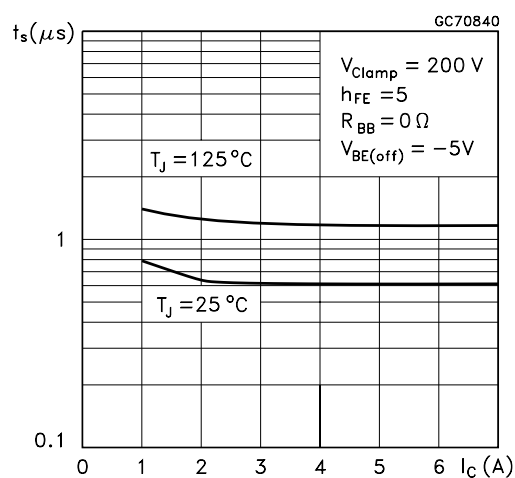
Base Emitter Saturation Voltage



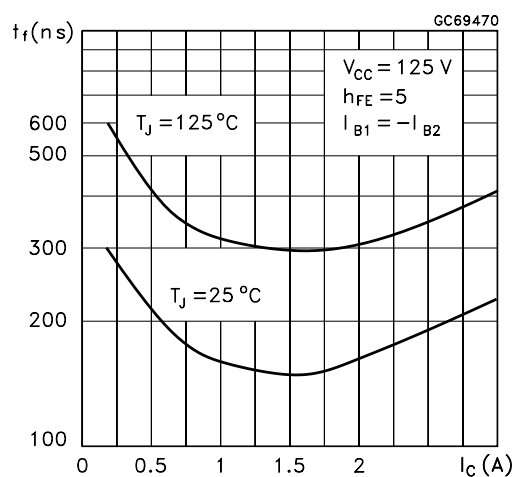
### Inductive Fall Time



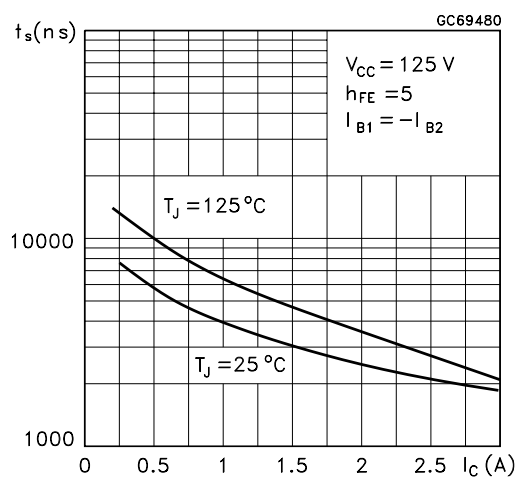
### Inductive Storage Time



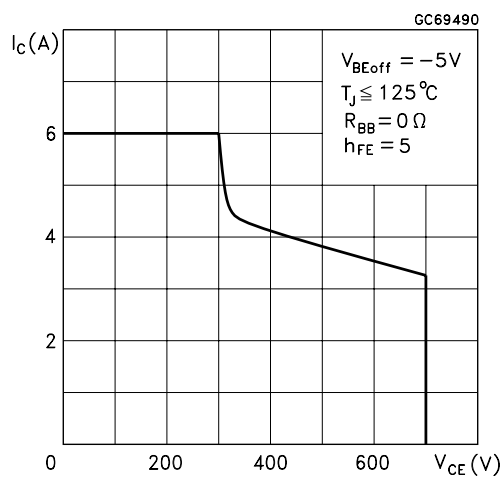
### Resistive Fall Time



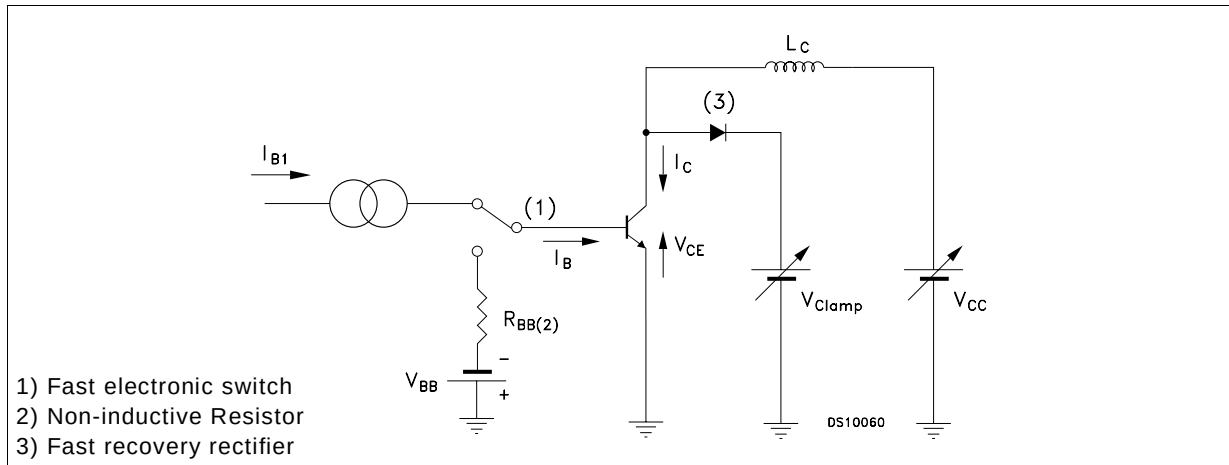
### Resistive Load Storage Time



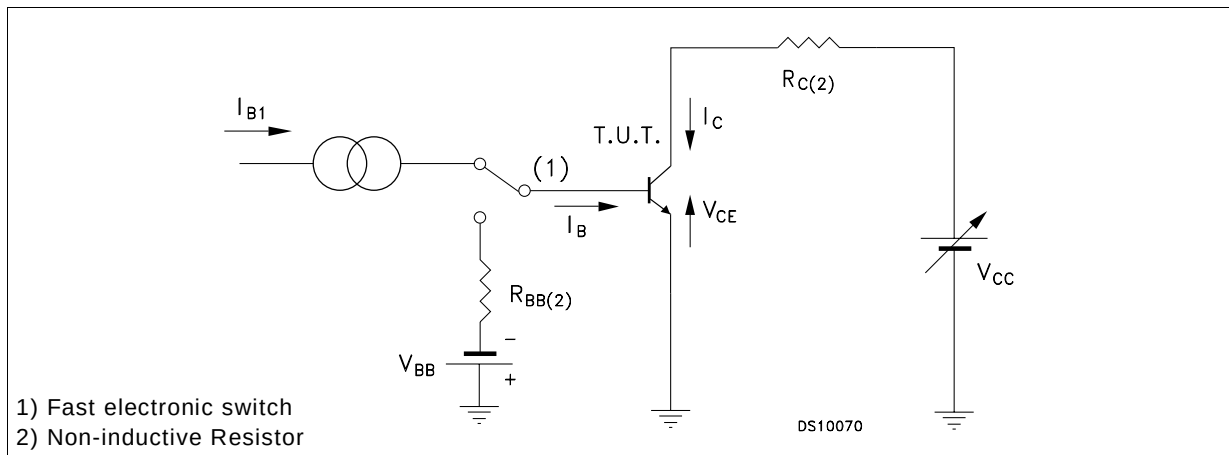
### Reverse Biased SOA



**Figure 1:** Inductive Load Switching Test Circuit.

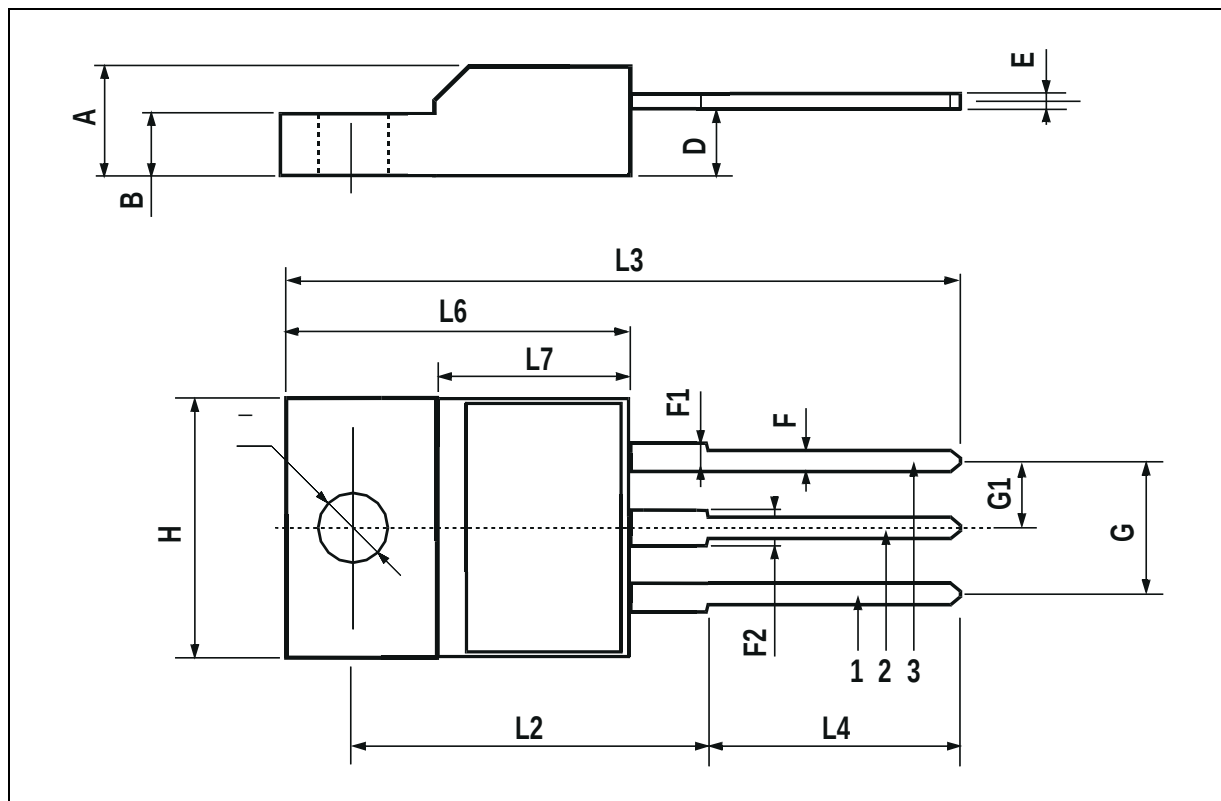


**Figure 2:** Resistive Load Switching Test Circuit.



## TO-220FP MECHANICAL DATA

| DIM. | mm   |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    | 4.4  |      | 4.6  | 0.173 |       | 0.181 |
| B    | 2.5  |      | 2.7  | 0.098 |       | 0.106 |
| D    | 2.5  |      | 2.75 | 0.098 |       | 0.108 |
| E    | 0.45 |      | 0.7  | 0.017 |       | 0.027 |
| F    | 0.75 |      | 1    | 0.030 |       | 0.039 |
| F1   | 1.15 |      | 1.7  | 0.045 |       | 0.067 |
| F2   | 1.15 |      | 1.7  | 0.045 |       | 0.067 |
| G    | 4.95 |      | 5.2  | 0.195 |       | 0.204 |
| G1   | 2.4  |      | 2.7  | 0.094 |       | 0.106 |
| H    | 10   |      | 10.4 | 0.393 |       | 0.409 |
| L2   |      | 16   |      |       | 0.630 |       |
| L3   | 28.6 |      | 30.6 | 1.126 |       | 1.204 |
| L4   | 9.8  |      | 10.6 | 0.385 |       | 0.417 |
| L6   | 15.9 |      | 16.4 | 0.626 |       | 0.645 |
| L7   | 9    |      | 9.3  | 0.354 |       | 0.366 |
| Ø    | 3    |      | 3.2  | 0.118 |       | 0.126 |



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