



BUL128D-B

HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

- n STMicroelectronics PREFERRED SALES TYPE
- n NPN TRANSISTOR
- n HIGH VOLTAGE CAPABILITY
- n LOW SPREAD OF DYNAMIC PARAMETERS
- n MINIMUM LOT-TO-LOT SPREAD FOR RELIABLE OPERATION
- n VERY HIGH SWITCHING SPEED
- n INTEGRATED ANTIPARALLEL COLLECTOR- EMITTER DIODE

APPLICATIONS

- n ELECTRONIC BALLAST FOR FLUORESCENT LIGHTING
- n 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 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.

Figure 1: Package

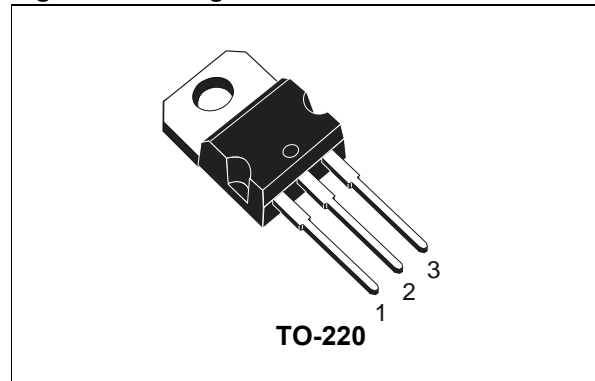


Figure 2: Internal Schematic Diagram

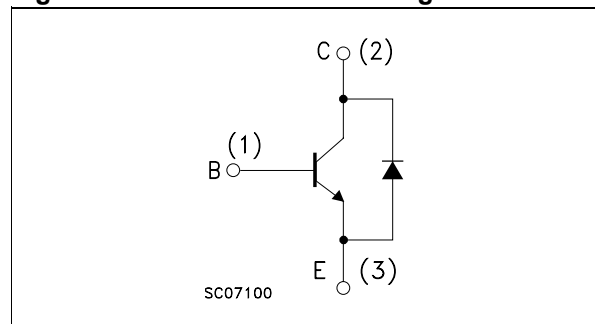


Table 1: Order Codes

| Part Number | Marking | Package | Packaging |
|-------------|-----------|---------|-----------|
| BUL128D-B | BUL128D-B | TO-220 | Tube |

Table 2: 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 ($I_C = 0$, $I_B = 2$ A, $t_p < 10$ μ s, $T_J = 150$ °C) | $V_{(BR)EBO}$ | 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 |

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| Symbol | Parameter | Value | Unit |
|-----------|---|------------|------|
| P_{tot} | Total Dissipation at $T_C = 25\text{ °C}$ | 70 | W |
| T_{stg} | Storage Temperature | -65 to 150 | °C |
| T_J | Max. Operating Junction Temperature | 150 | °C |

Table 3: Thermal Data

| | | | | |
|----------------|-------------------------------------|-----|------|------|
| $R_{thj-case}$ | Thermal Resistance Junction-Case | Max | 1.78 | °C/W |
| $R_{thj-amb}$ | Thermal Resistance Junction-Ambient | Max | 62.5 | °C/W |

Table 4: Electrical Characteristics ($T_{case} = 25\text{ °C}$ unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|------------------|--|---|------|------------|------|--------------------------------|
| I_{CES} | Collector Cut-off Current ($V_{BE} = 0\text{ V}$) | $V_{CE} = 700\text{ V}$ | | | 100 | μA |
| | | $V_{CE} = 700\text{ V}$ $T_J = 125\text{ °C}$ | | | 500 | μA |
| I_{CEO} | Collector Cut-off Current ($I_B = 0$) | $V_{CE} = 400\text{ V}$ | | | 250 | μA |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage ($I_C = 0$) | $I_E = 10\text{ mA}$ | 9 | | 18 | V |
| $V_{CEO(sus)}^*$ | Collector-Emitter Sustaining Voltage ($I_B = 0$) | $I_C = 100\text{ mA}$ $L = 25\text{ mH}$ | 400 | | | V |
| $V_{CE(sat)}^*$ | Collector-Emitter Saturation Voltage | $I_C = 0.5\text{ A}$ $I_B = 0.1\text{ A}$ | | | 0.7 | V |
| | | $I_C = 1\text{ A}$ $I_B = 0.2\text{ A}$ | | | 1 | V |
| | | $I_C = 2.5\text{ A}$ $I_B = 0.5\text{ A}$ | | | 1.5 | V |
| | | $I_C = 4\text{ A}$ $I_B = 1\text{ A}$ | | 0.5 | | V |
| $V_{BE(sat)}^*$ | Base-Emitter Saturation Voltage | $I_C = 0.5\text{ A}$ $I_B = 0.1\text{ A}$ | | | 1.1 | V |
| | | $I_C = 1\text{ A}$ $I_B = 0.2\text{ A}$ | | | 1.2 | V |
| | | $I_C = 2.5\text{ A}$ $I_B = 0.5\text{ A}$ | | | 1.3 | V |
| h_{FE}^* | DC Current Gain | $I_C = 10\text{ mA}$ $V_{CE} = 5\text{ V}$ | 10 | | | |
| | | $I_C = 2\text{ A}$ $V_{CE} = 5\text{ V}$ | 12 | | 32 | |
| t_s t_f | RESISTIVE LOAD | $V_{CC} = 200\text{ V}$ $I_C = 2\text{ A}$ | | | | |
| | Storage Time Fall Time | $I_{B1} = 0.4\text{ A}$ $V_{BE(off)} = -5\text{ V}$ $R_{BB} = 0\ \Omega$ $L = 200\ \mu\text{H}$ (see figure 15) | | 0.6 0.1 | | μs μs |
| t_s t_f | INDUCTIVE LOAD | $V_{CC} = 250\text{ V}$ $I_C = 2\text{ A}$ | | | | |
| | Storage Time Fall Time | $I_{B1} = 0.4\text{ A}$ $I_{B2} = -0.4\text{ A}$ $T_p = 30\ \mu\text{s}$ (see figure 14) | 2 | 0.2 | 2.9 | μs μs |

* Pulsed: Pulsed duration = 300 μs , duty cycle $\leq 1.5\%$.

Figure 3: Safe Operating Area

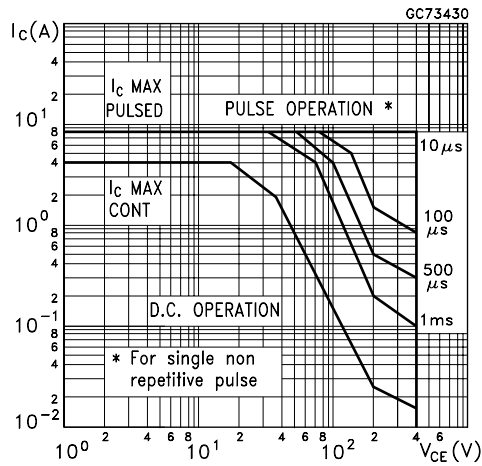


Figure 4: DC Current Gain

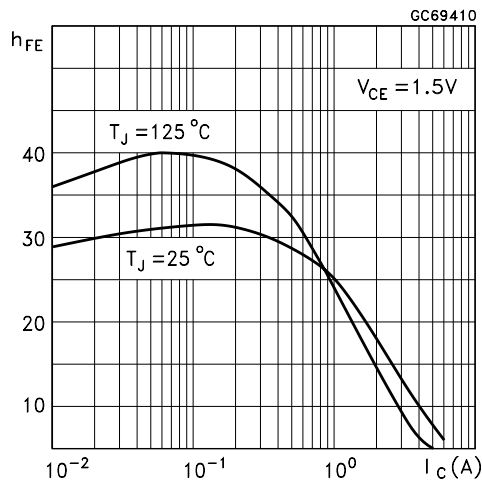


Figure 5: Collector-Emitter Saturation Voltage

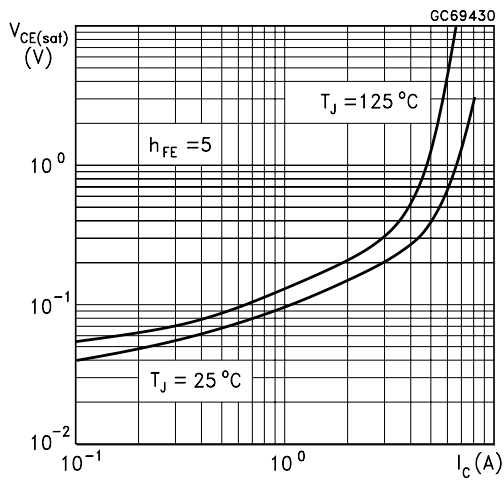


Figure 6: Derating Current

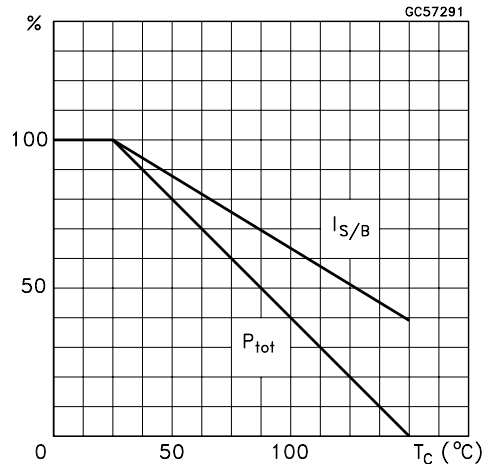


Figure 7: DC Current Gain

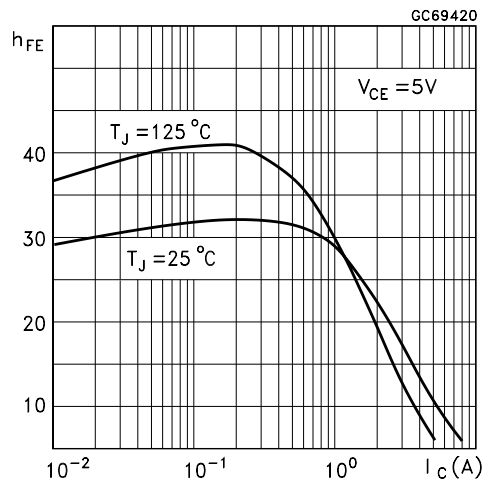


Figure 8: Base-Emitter Saturation Voltage

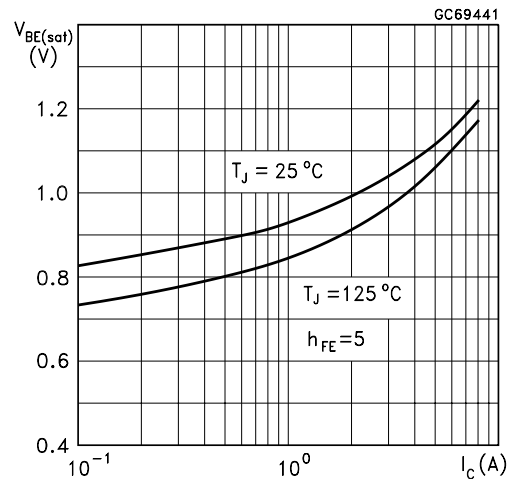


Figure 9: Inductive Load Fall Time

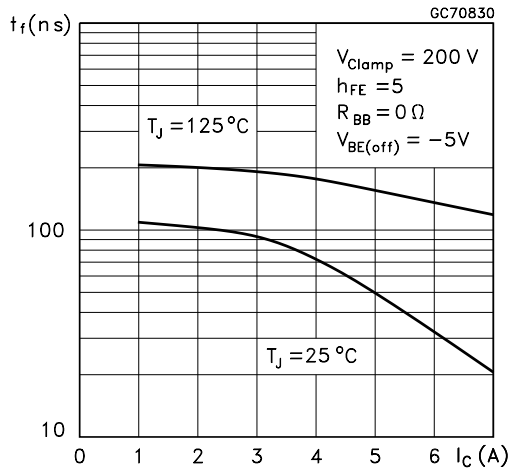


Figure 10: Resistive Load Fall Time

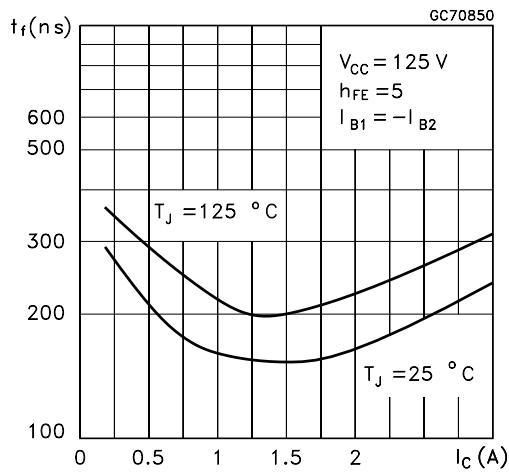


Figure 11: Reverse Biased Operating Area

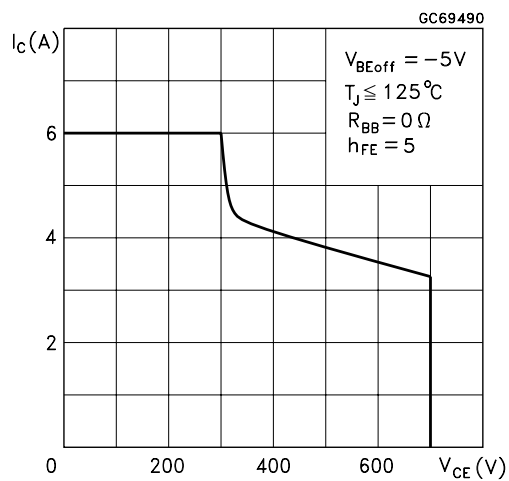


Figure 12: Inductive Load Storage Time

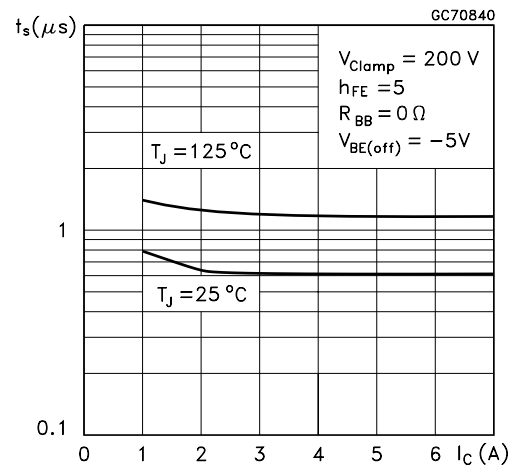


Figure 13: Resistive Load Storage Time

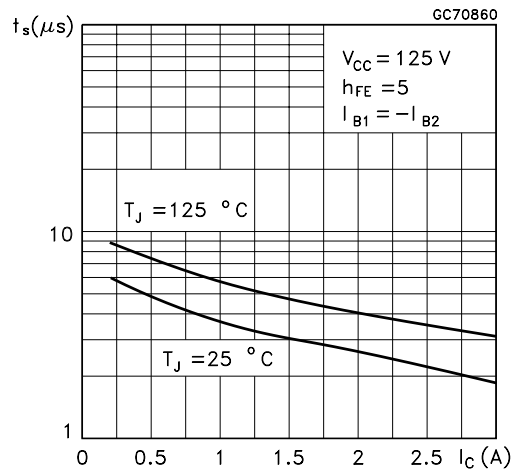


Figure 14: Inductive Load Switching Test Circuit

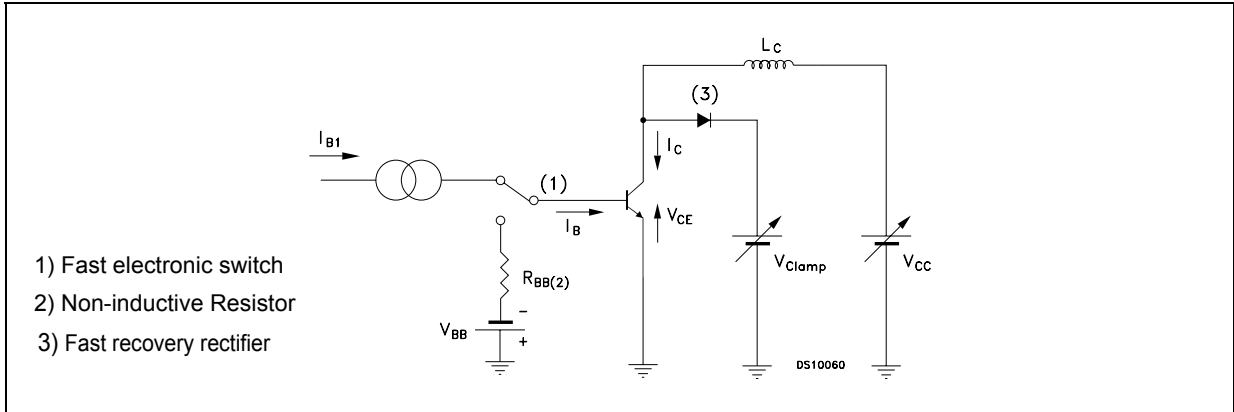
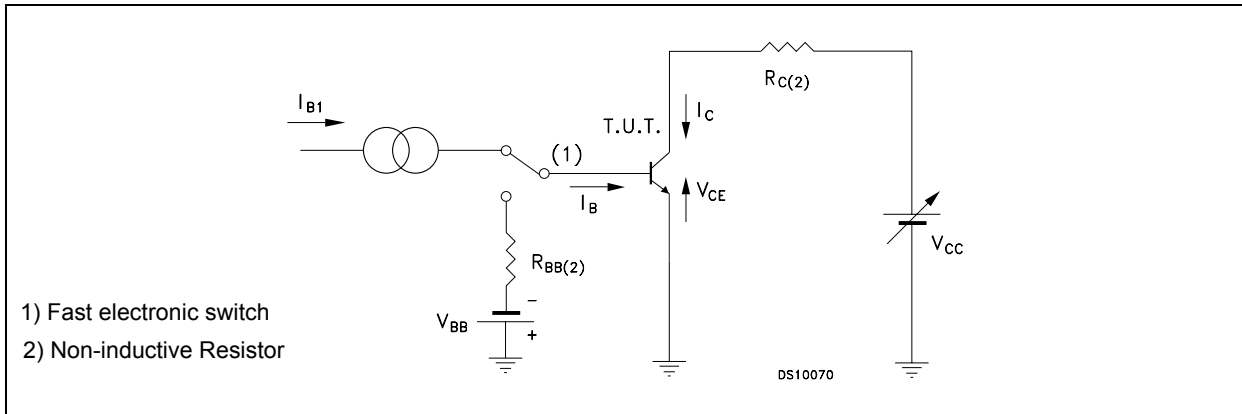


Table 15: Resistive Load Switching Test Circuit



TO-220 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|-------|-------|-------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| b | 0.61 | | 0.88 | 0.024 | | 0.034 |
| b1 | 1.15 | | 1.70 | 0.045 | | 0.066 |
| c | 0.49 | | 0.70 | 0.019 | | 0.027 |
| D | 15.25 | | 15.75 | 0.60 | | 0.620 |
| E | 10 | | 10.40 | 0.393 | | 0.409 |
| e | 2.40 | | 2.70 | 0.094 | | 0.106 |
| e1 | 4.95 | | 5.15 | 0.194 | | 0.202 |
| F | 1.23 | | 1.32 | 0.048 | | 0.052 |
| H1 | 6.20 | | 6.60 | 0.244 | | 0.256 |
| J1 | 2.40 | | 2.72 | 0.094 | | 0.107 |
| L | 13 | | 14 | 0.511 | | 0.551 |
| L1 | 3.50 | | 3.93 | 0.137 | | 0.154 |
| L20 | | 16.40 | | | 0.645 | |
| L30 | | 28.90 | | | 1.137 | |
| øP | 3.75 | | 3.85 | 0.147 | | 0.151 |
| Q | 2.65 | | 2.95 | 0.104 | | 0.116 |

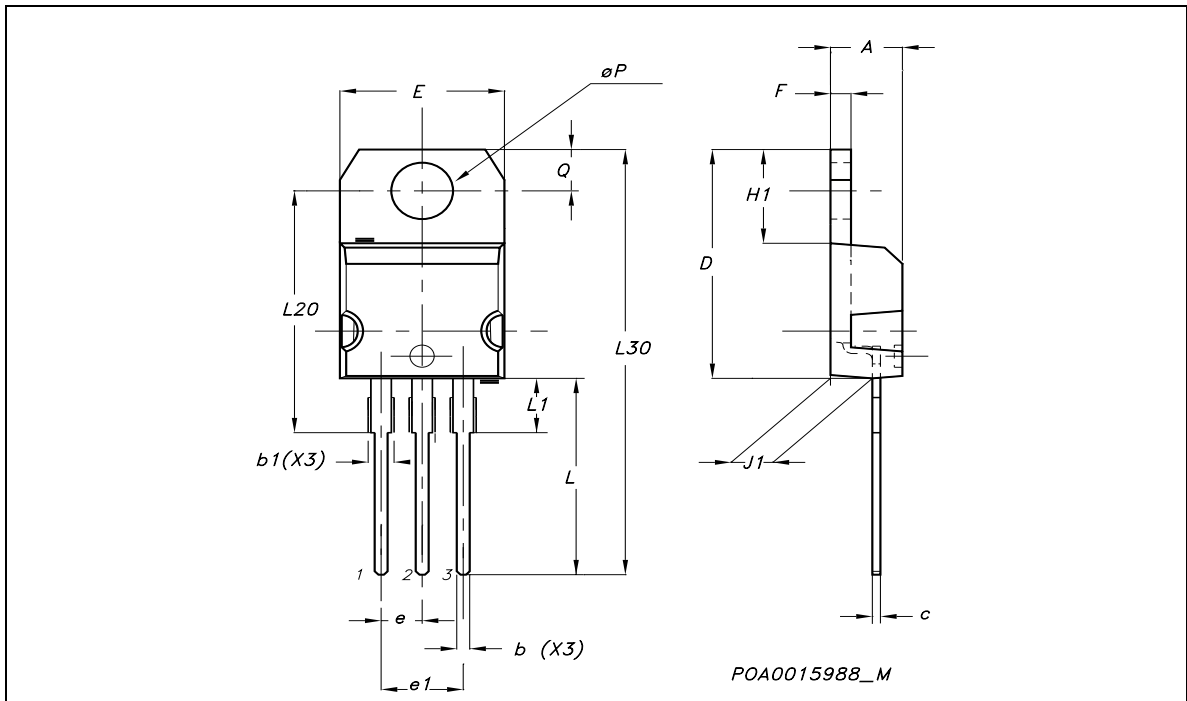


Table 5:

| Version | Release Date | Change Designator |
|----------------|---------------------|--------------------------|
| 01-Oct-2002 | 1 | First Release. |
| 15-Feb-2005 | 1 | Added table 1 on page 1. |

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