

**BUL416**

HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

- n STMicroelectronics PREFERRED SALES TYPE
- n NPN TRANSISTOR
- n HIGH VOLTAGE CAPABILITY
- n VERY HIGH SWITCHING SPEED
- n FULLY CHARACTERISEZ AT 125 °C
- n LOW SPREAD OF DYNAMIC PARAMETERS

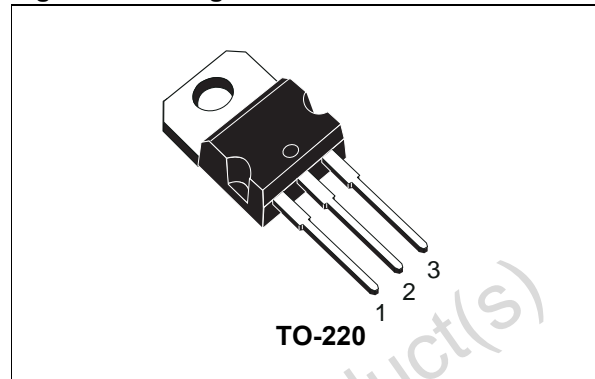
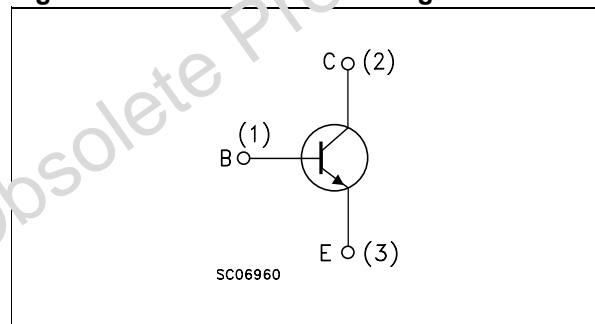
APPLICATIONS

- n ELECTRONIC BALLAST FOR FLUORESCENT LIGHTING
- n SWITCH MODE POWER SUPPLIES

DESCRIPTION

The device is manufactured using high voltage Multi-Epitaxial 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.

Figure 1: Package**Figure 2: Internal Schematic Diagram****Table 1: Order Codes**

| Part Number | Marking | Package | Packaging |
|-------------|------------------------------|---------|-----------|
| BUL416 | BUL416A or (#) BUL416B | TO-220 | Tube |

See note on page 2

Table 2: Absolute Maximum Ratings

| Symbol | Parameter | Value | Unit |
|-----------|--|------------|------|
| V_{CES} | Collector-Emitter Voltage ($V_{BE} = 0$) | 1600 | V |
| V_{CEO} | Collector-Emitter Voltage ($I_B = 0$) | 800 | V |
| V_{EBO} | Emitter-Base Voltage ($I_C = 0$) | 9 | V |
| I_C | Collector Current | 6 | A |
| I_{CM} | Collector Peak Current ($t_p < 5ms$) | 9 | A |
| I_B | Base Current | 5 | A |
| I_{BM} | Base Peak Current ($t_p < 5ms$) | 8 | A |
| P_{tot} | Total Dissipation at $T_C = 25\text{ °C}$ | 110 | W |
| T_{stg} | Storage Temperature | -65 to 150 | °C |

| Symbol | Parameter | Value | Unit |
|--------|-------------------------------------|-------|------|
| T_J | Max. Operating Junction Temperature | 150 | °C |

Table 3: Thermal Data

| | | | | |
|----------------|-------------------------------------|-----|------|------|
| $R_{thj-case}$ | Thermal Resistance Junction-Case | Max | 1.14 | °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 ($V_{BE} = 0\text{ V}$) | $V_{CE} = 1600\text{ V}$ | | | | 100 | μA |
| | | $V_{CE} = 1600\text{ V}$ | $T_J = 125\text{ °C}$ | | | 500 | μA |
| I_{CEO} | Collector Cut-off Current ($I_B = 0$) | $V_{CE} = 800\text{ V}$ | | | | 250 | μA |
| $V_{CEO(sus)}^*$ | Collector-Emitter Sustaining Voltage ($I_B = 0$) | $I_C = 100\text{ mA}$ | $L = 25\text{ mH}$ | 800 | | | V |
| V_{EBO} | Emitter-Base Voltage ($I_C = 0$) | $I_E = 10\text{ mA}$ | | 9 | | | V |
| $V_{CE(sat)}^*$ | Collector-Emitter Saturation Voltage | $I_C = 2\text{ A}$ | $I_B = 0.4\text{ A}$ | | | 1.5 | V |
| | | $I_C = 4\text{ A}$ | $I_B = 1.33\text{ A}$ | | | 3 | V |
| $V_{BE(sat)}^*$ | Base-Emitter Saturation Voltage | $I_C = 2\text{ A}$ | $I_B = 0.4\text{ A}$ | | | 1.2 | V |
| | | $I_C = 4\text{ A}$ | $I_B = 1.33\text{ A}$ | | | 1.5 | V |
| h_{FE}^* | DC Current Gain | $I_C = 10\text{ mA}$ | $V_{CE} = 5\text{ V}$ | 10 | | | |
| | | $I_C = 0.7\text{ A}$ | $V_{CE} = 5\text{ V}$ | 12 | | 27 | |
| | | Group A | | 25 | | 40 | |
| t_s t_f | INDUCTIVE LOAD Storage Time | $I_C = 3\text{ A}$ | $I_{B1} = 1\text{ A}$ | | 2.3 | | μs |
| | Fall Time | $V_{BE(off)} = -5\text{ V}$ $V_{clamp} = 200\text{ V}$ (see figure 12) | $R_{BB} = 0\ \Omega$ $L = 200\ \mu\text{H}$ | | 650 | | ns |
| t_s t_f | INDUCTIVE LOAD Storage Time | $I_C = 3\text{ A}$ | $I_{B1} = 1\text{ A}$ | | 3 | | μs |
| | Fall Time | $V_{BE(off)} = -5\text{ V}$ $V_{clamp} = 200\text{ V}$ $T_J = 100\text{ °C}$ (see figure 12) | $R_{BB} = 0\ \Omega$ $L = 200\ \mu\text{H}$ | | 680 | | ns |

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

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.

Figure 3: Safe Operating Area

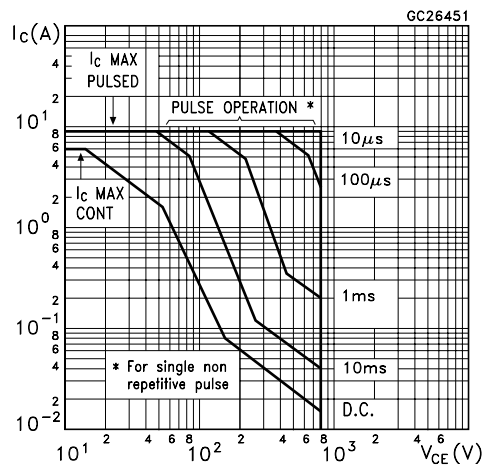


Figure 4: DC Current Gain

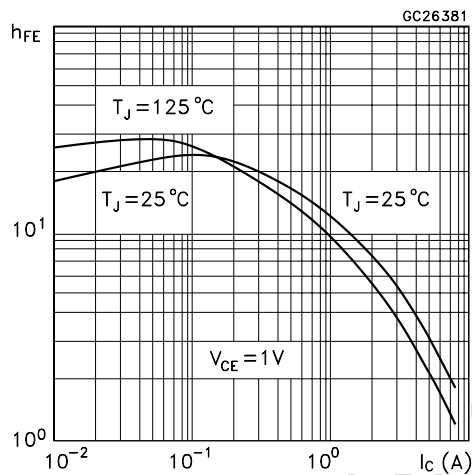


Figure 5: Collector-Emitter Saturation Voltage

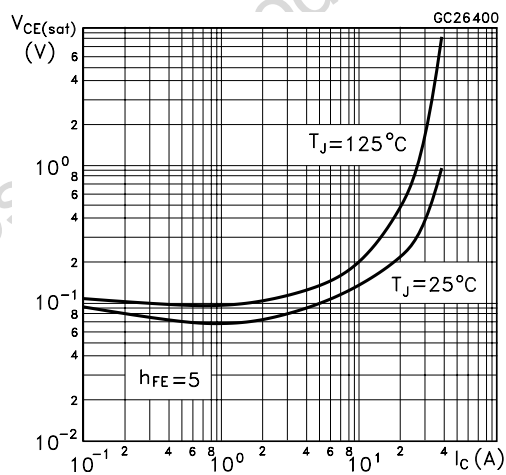


Figure 6: Derating Curve

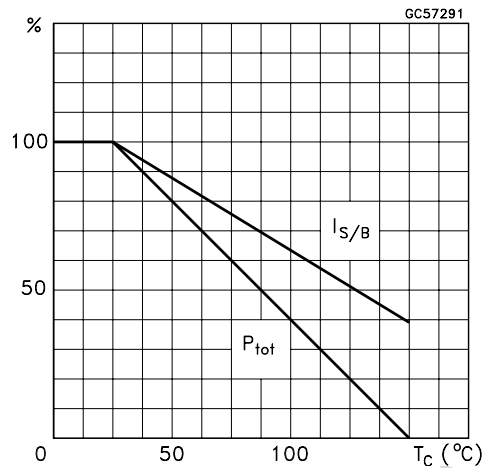


Figure 7: DC Current Gain

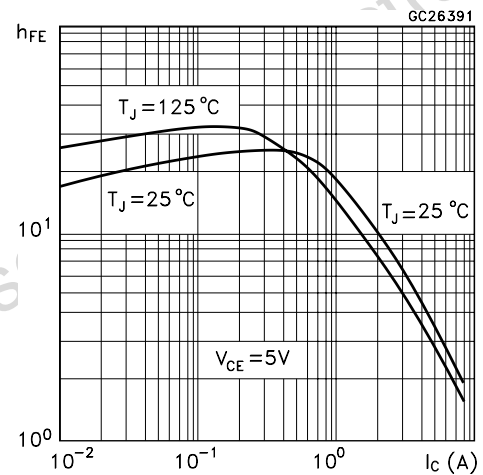


Figure 8: Base-Emitter Saturation Voltage

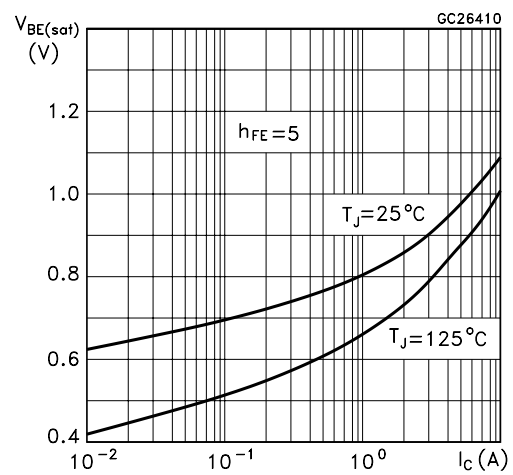


Figure 9: Inductive Load Fall Time

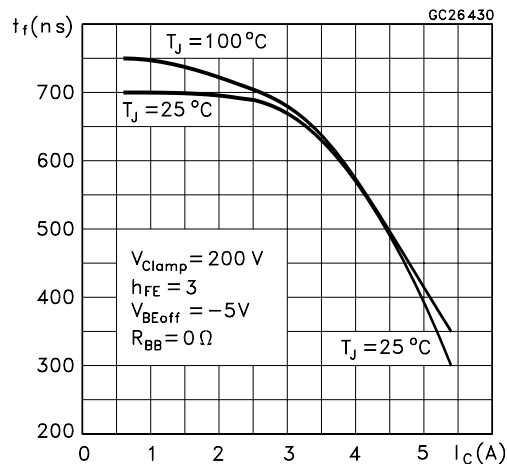


Figure 11: Resistive Load Storage Time

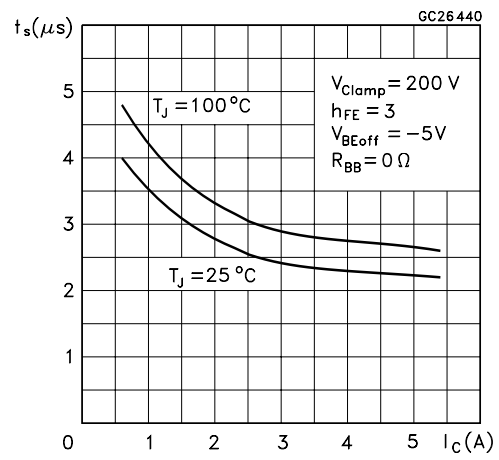


Figure 10: Reverse Biased SOA

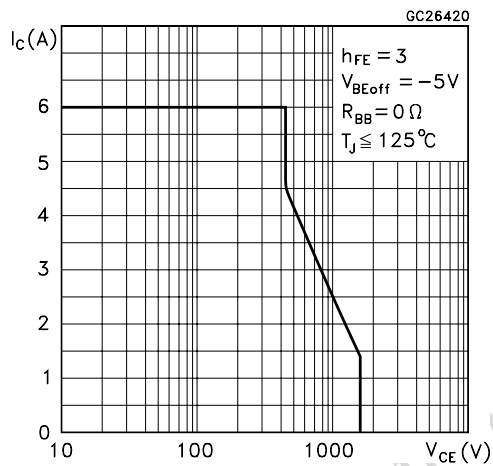
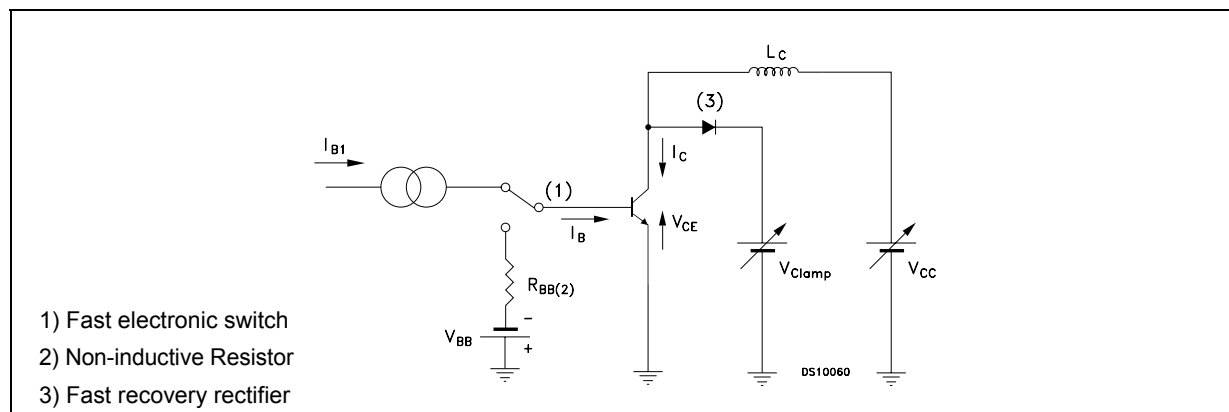


Figure 12: Inductive Load Switching Test Circuit



TO-220 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|-------|-------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| 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 |

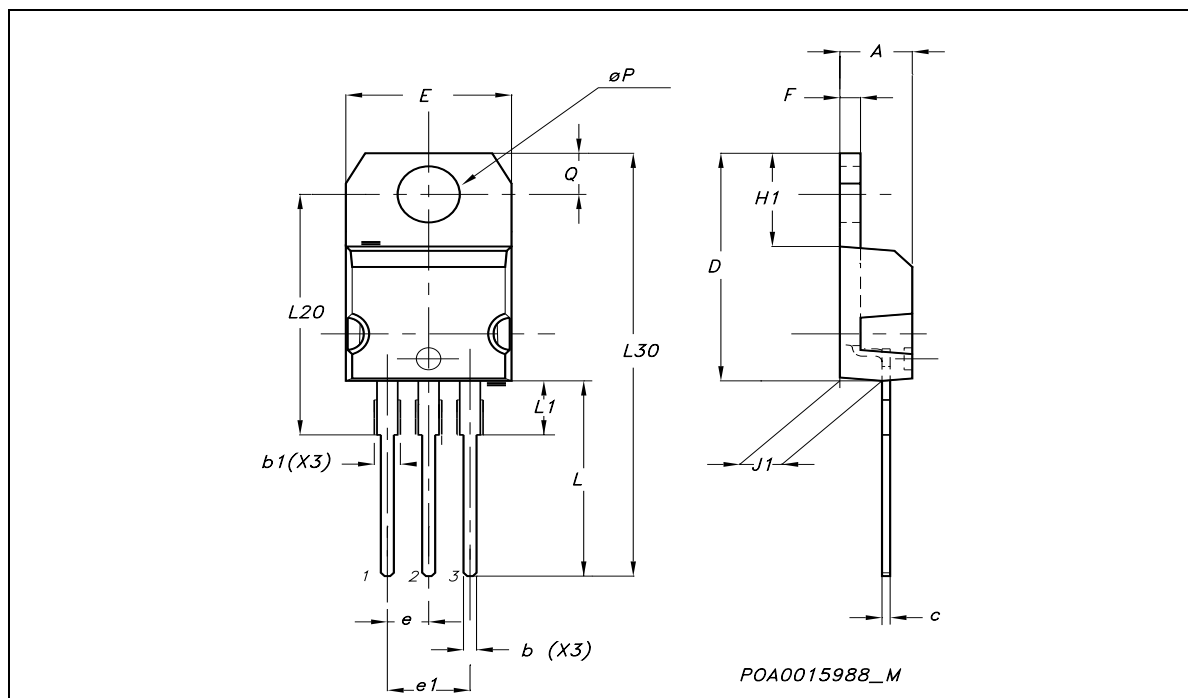


Table 5:

| Version | Release Date | Change Designator |
|-------------|--------------|-------------------|
| 14-Jan-2004 | 1 | First Release. |
| 09-Sep-2004 | 2 | Second Release. |
| 26-Jan-2005 | 3 | Third Release. |

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