

High voltage fast-switching NPN power transistor

Features

- High voltage capability
- Low spread of dynamic parameters
- Minimum lot-to-lot spread for reliable operation
- Very high switching speed
- High ruggedness
- Fully characterized at 125 °C
- Integrated antiparallel collector-emitter diode

Applications

- Electronic transformers for halogen lamps
- Switch mode power supplies

Description

The BUL38D is manufactured using high voltage multi epitaxial planar technology for high switching speeds and high voltage capability.

The device is designed for use in electronic transformer for halogen lamps.

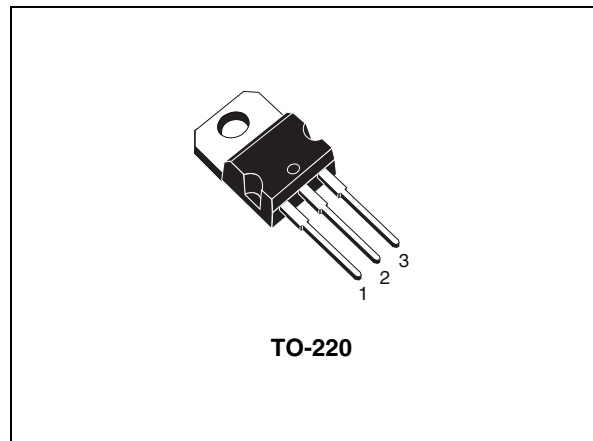


Figure 1. Internal schematic diagram

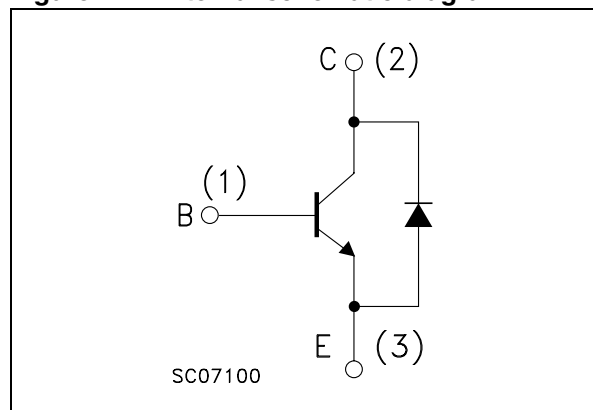


Table 1. Device summary

| Order code | Marking ⁽¹⁾ | Package | Packaging |
|------------|----------------------------|---------|-----------|
| BUL38D | BUL38D A or BUL38D B | TO-220 | Tube |

1. 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.

1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|-----------|--|------------|------|
| V_{CES} | Collector-emitter voltage ($V_{BE} = 0$) | 800 | V |
| V_{CEO} | Collector-emitter voltage ($I_B = 0$) | 450 | 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 | 2 | A |
| I_{BM} | Base peak current ($t_P < 5$ ms) | 4 | A |
| P_{tot} | Total dissipation at $T_c \leq 25$ °C | 80 | W |
| T_{stg} | Storage temperature | -65 to 150 | °C |
| T_J | Max. operating junction temperature | 150 | °C |

Table 3. Thermal data

| Symbol | Parameter | Value | Unit |
|------------|---|-------|------|
| R_{thJC} | Thermal resistance junction-case max | 1.56 | °C/W |
| R_{thJA} | Thermal resistance junction-ambient max | 62.5 | °C/W |

2 Electrical characteristics

($T_{\text{case}} = 25^{\circ}\text{C}$ unless otherwise specified)

Table 4. Electrical characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------------------------|--|---|------|------|------|---------------|
| I_{CES} | Collector cut-off current ($V_{\text{BE}} = 0$) | $V_{\text{CE}} = 800 \text{ V}$ | | | 100 | μA |
| | | $V_{\text{CE}} = 800 \text{ V}$ $T_{\text{c}} = 125^{\circ}\text{C}$ | | | 500 | μA |
| I_{CEO} | Collector cut-off current ($I_{\text{B}} = 0$) | $V_{\text{CE}} = 450 \text{ V}$ | | | 250 | μA |
| $V_{\text{CEO(sus)}}^{(1)}$ | Collector-emitter sustaining voltage ($I_{\text{B}} = 0$) | $I_{\text{C}} = 100 \text{ mA}$ | 450 | | | V |
| V_{EBO} | Emitter-base voltage ($I_{\text{C}} = 0$) | $I_{\text{E}} = 10 \text{ mA}$ | 9 | | | V |
| $V_{\text{CE(sat)}}^{(1)}$ | Collector-emitter saturation voltage | $I_{\text{C}} = 1 \text{ A}$ $I_{\text{B}} = 0.2 \text{ A}$ | | | 0.5 | V |
| | | $I_{\text{C}} = 2 \text{ A}$ $I_{\text{B}} = 0.4 \text{ A}$ | | | 0.7 | V |
| | | $I_{\text{C}} = 3 \text{ A}$ $I_{\text{B}} = 0.75 \text{ A}$ | | | 1.1 | V |
| $V_{\text{BE(sat)}}^{(1)}$ | Base-emitter saturation voltage | $I_{\text{C}} = 1 \text{ A}$ $I_{\text{B}} = 0.2 \text{ A}$ | | | 1.1 | V |
| | | $I_{\text{C}} = 2 \text{ A}$ $I_{\text{B}} = 0.4 \text{ A}$ | | | 1.2 | V |
| $h_{\text{FE}}^{(1)(2)}$ | DC current gain | $I_{\text{C}} = 10 \text{ mA}$ $V_{\text{CE}} = 5 \text{ V}$ | 10 | | | |
| | | $I_{\text{C}} = 0.5 \text{ A}$ $V_{\text{CE}} = 5 \text{ V}$ | | | 60 | |
| | | $I_{\text{C}} = 2 \text{ A}$ $V_{\text{CE}} = 5 \text{ V}$ | | | | |
| | | Group A | 13 | | 23 | |
| | Group B | 22 | | 32 | | |
| t_{s} t_{f} | Resistive load Storage time | $V_{\text{CC}} = 150 \text{ V}$ $I_{\text{C}} = 2.5 \text{ A}$ $I_{\text{B(on)}} = -I_{\text{B(off)}} = 0.5 \text{ A}$ | 1 | | 2.2 | μs |
| | Fall time | $t_{\text{p}} = 30 \mu\text{s}$ | | | 0.8 | μs |
| t_{s} t_{f} | Inductive load Storage time | $I_{\text{C}} = 2 \text{ A}$ $I_{\text{B(on)}} = 0.4 \text{ A}$ $V_{\text{BE(off)}} = -5 \text{ V}$ $R_{\text{BB(off)}} = 0$ | | 1 | 1.8 | μs |
| | Fall time | $V_{\text{CL}} = 250 \text{ V}$ $L = 200 \mu\text{H}$ | | 55 | 100 | ns |
| t_{s} t_{f} | Inductive load Storage time | $I_{\text{C}} = 2 \text{ A}$ $I_{\text{B(on)}} = 0.4 \text{ A}$ $V_{\text{BE(off)}} = -5 \text{ V}$ $R_{\text{BB(off)}} = 0$ | | 1.3 | | μs |
| | Fall time | $V_{\text{CL}} = 250 \text{ V}$ $L = 200 \mu\text{H}$ $T_{\text{C}} = 125^{\circ}\text{C}$ | | 100 | | ns |
| V_{F} | Diode forward voltage | $I_{\text{F}} = 2 \text{ A}$ | | | 1.5 | V |

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

2. The 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.

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

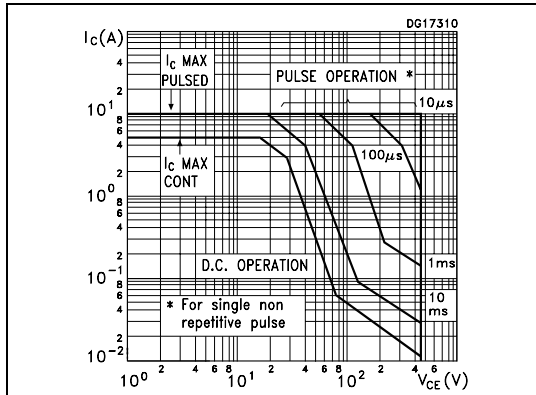


Figure 3. Derating curves

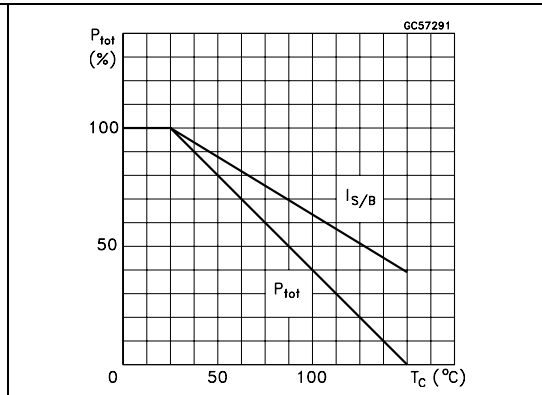


Figure 4. Output characteristics

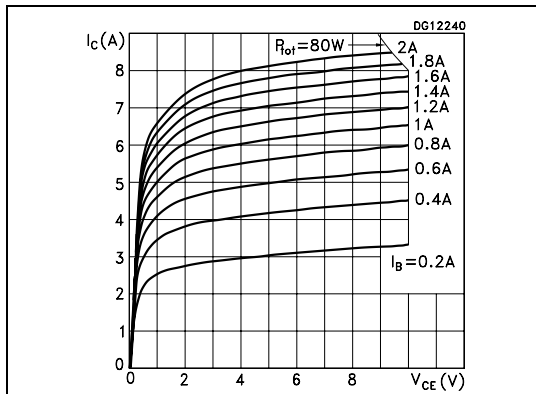


Figure 5. Reverse biased safe operating area

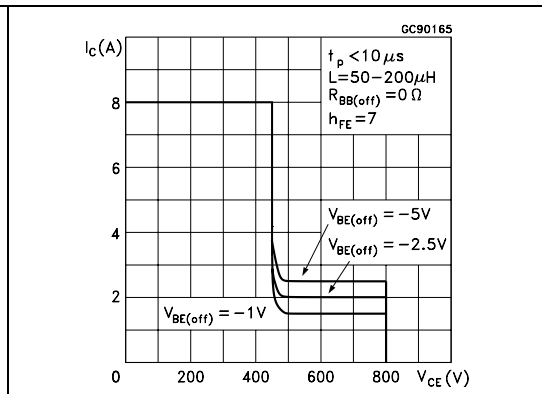


Figure 6. DC current gain ($V_{CE} = 1.5V$)

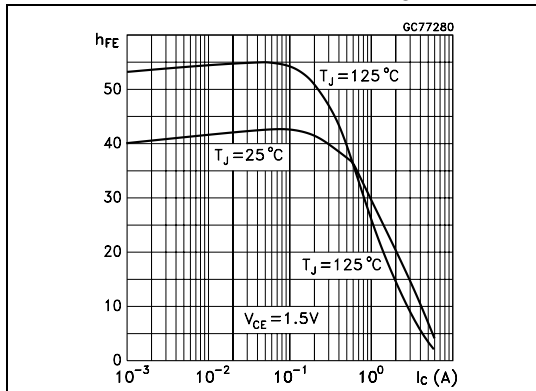


Figure 7. DC current gain ($V_{CE} = 5V$)

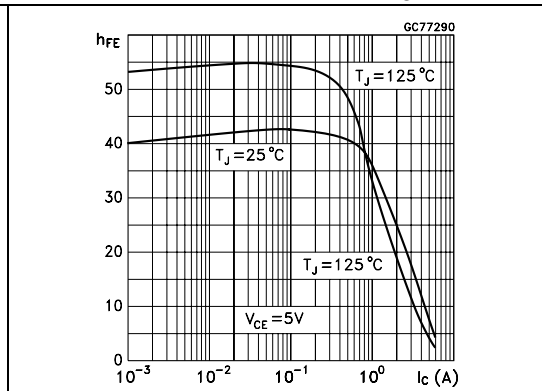


Figure 8. Collector-emitter saturation Voltage

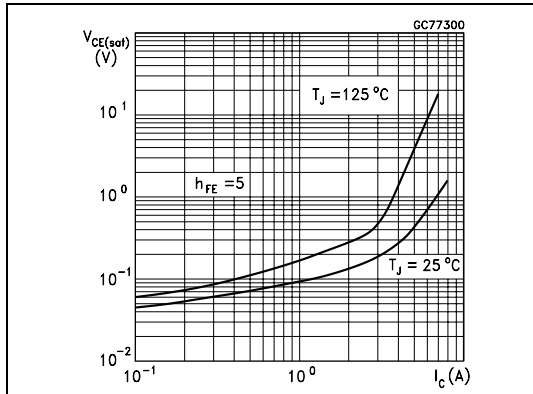


Figure 9. Base-emitter saturation voltage

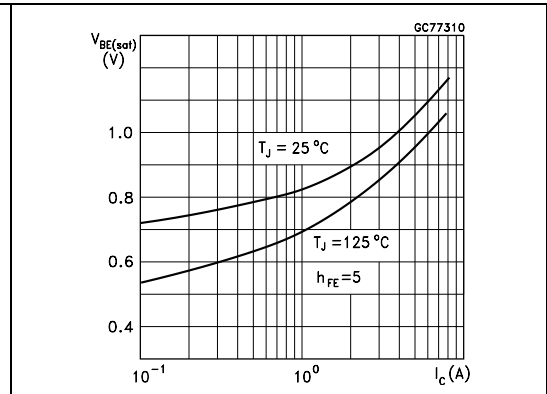


Figure 10. Inductive load storage time

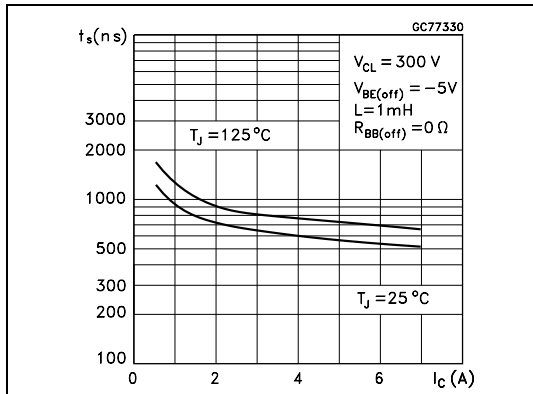
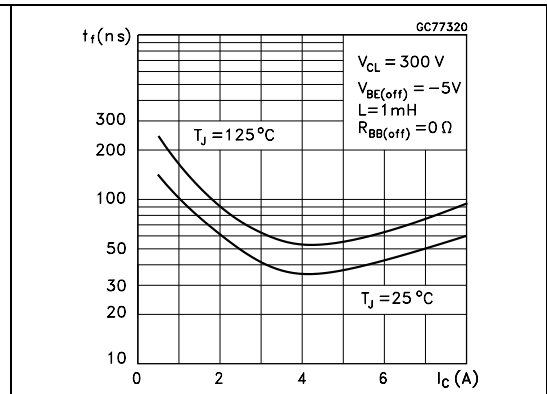
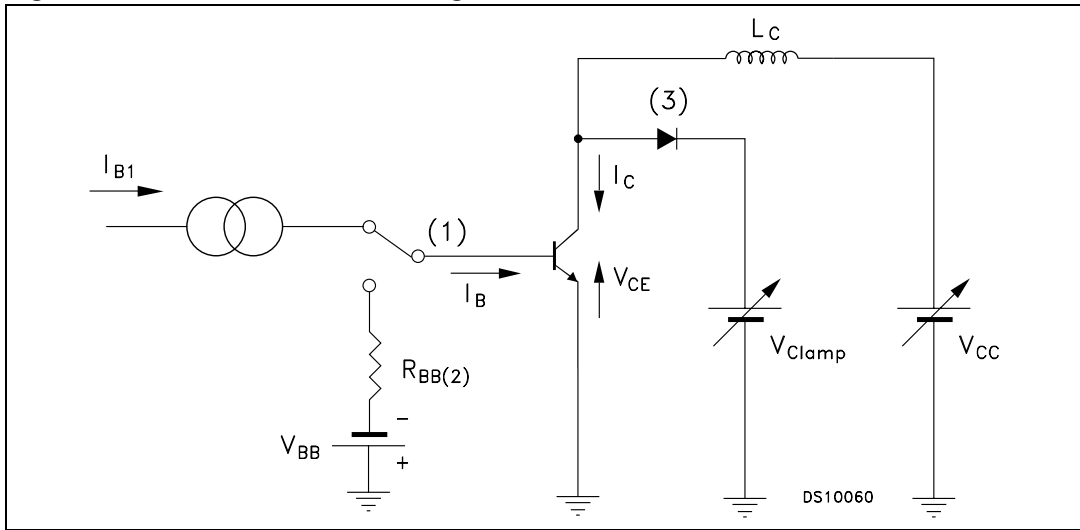


Figure 11. Inductive load fall time



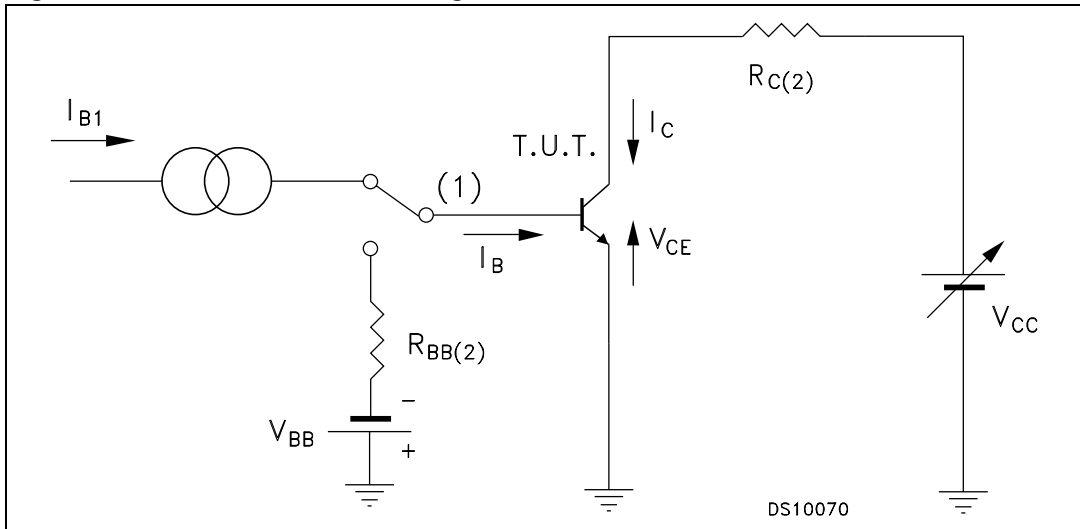
2.2 Test circuits

Figure 12. Inductive load switching test circuit



1. Fast electronic switch
2. Non-inductive resistor
3. Fast recovery rectifier

Figure 13. Resistive load switching test circuit



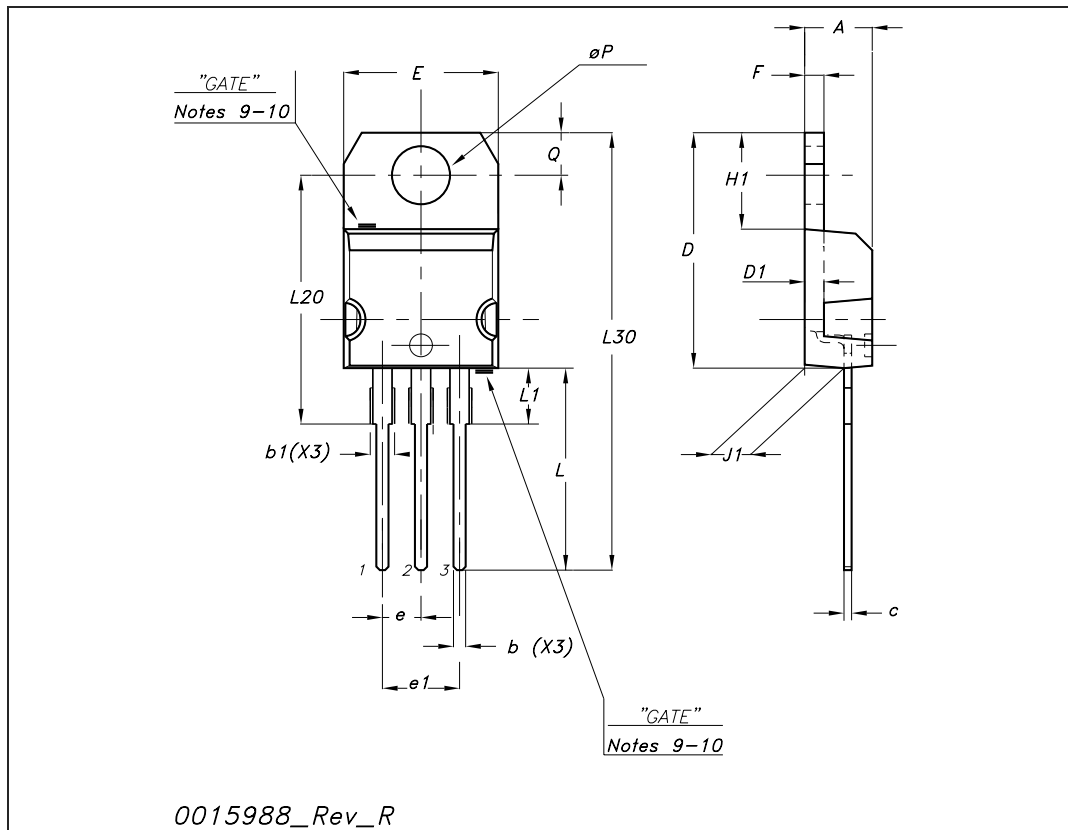
1. Fast electronic switch
2. Non-inductive resistor

3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] packages, depending on their level of environmental compliance. ECOPACK[®] specifications, grade definitions and product status are available at: www.st.com. ECOPACK[®] is an ST trademark.

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 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| c | 0.48 | | 0.70 | 0.019 | | 0.027 |
| D | 15.25 | | 15.75 | 0.6 | | 0.62 |
| D1 | | 1.27 | | | 0.050 | |
| 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 | | 0.051 |
| 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 | |
| ∅P | 3.75 | | 3.85 | 0.147 | | 0.151 |
| Q | 2.65 | | 2.95 | 0.104 | | 0.116 |



4 Revision history

Table 5. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 16-Jun-2004 | 2 | Document migration, no content change. |
| 23-Jun-2009 | 3 | Updated TO-220 mechanical data. |

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