

High voltage fast-switching NPN power transistor

Features

- High voltage capability
- Low spread of dynamic parameters
- Very high switching speed

Applications

- Electronic ballast for fluorescent lighting (CFL)
- SMPS for battery charger

Description

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

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

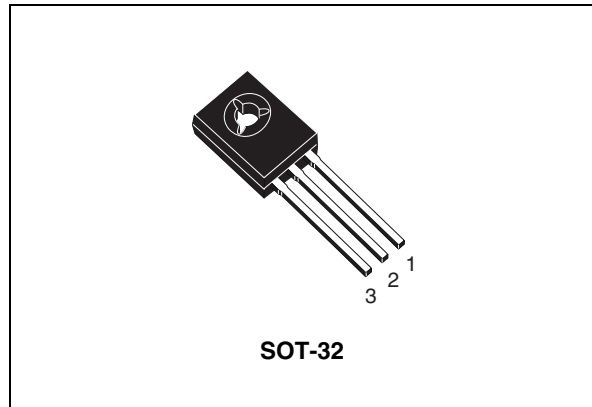


Figure 1. Internal schematic diagram

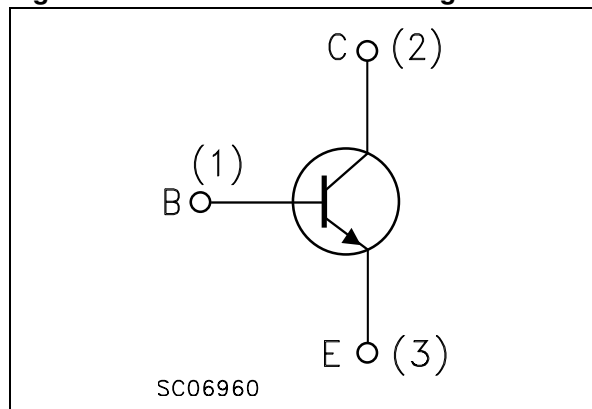


Table 1. Device summary

| Part number | Marking | Package | Packaging |
|-------------|---------|---------|-----------|
| ST13003-K | 13003 | SOT-32 | Bag |

1 Electrical ratings

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 ($I_C = 0$, $I_B = 0.75$ A, $t_P < 10$ μ s) | $V_{(BR)EBO}$ | V |
| I_C | Collector current | 1.5 | A |
| I_{CM} | Collector peak current ($t_P < 5$ ms) | 3 | A |
| I_B | Base current | 0.75 | A |
| I_{BM} | Base peak current ($t_P < 5$ ms) | 1.5 | A |
| P_{TOT} | Total dissipation at $T_C = 25$ °C | 40 | W |
| T_{STG} | Storage temperature | -55 to 150 | °C |
| T_J | Operating junction temperature | -40 to 150 | °C |

Table 3. Thermal data

| Symbol | Parameter | Value | Unit |
|------------|---------------------------------------|-------|------|
| R_{thJC} | Thermal resistance junction-case max. | 3.1 | °C/W |

2 Electrical characteristics

$T_{\text{case}} = 25\text{ °C}$ unless otherwise specified.

Table 4. Electrical characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--|--|--|--------|------|-----------------|---|
| I_{CES} | Collector cut-off current ($V_{\text{BE}} = 0$) | $V_{\text{CE}} = 700\text{ V}$ $V_{\text{CE}} = 700\text{ V}$ $T_{\text{C}} = 125\text{ °C}$ | | | 1 5 | mA mA |
| $V_{(\text{BR})\text{EBO}}$ | Emitter-Base breakdown voltage ($I_{\text{C}} = 0$) | $I_{\text{E}} = 10\text{ mA}$ | 9 | | 18 | V |
| $V_{\text{CEO(sus)}}^{(1)}$ | Collector-emitter sustaining voltage ($I_{\text{B}} = 0$) | $I_{\text{C}} = 10\text{ mA}$ | 400 | | | V |
| $V_{\text{CE(sat)}}^{(1)}$ | Collector-emitter saturation voltage | $I_{\text{C}} = 0.5\text{ A}$ $I_{\text{B}} = 0.1\text{ A}$ $I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 0.25\text{ A}$ $I_{\text{C}} = 1.5\text{ A}$ $I_{\text{B}} = 0.5\text{ A}$ | | | 0.5 1 1.5 | V V V |
| $V_{\text{BE(sat)}}^{(1)}$ | Base-emitter saturation voltage | $I_{\text{C}} = 0.5\text{ A}$ $I_{\text{B}} = 0.1\text{ A}$ $I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 0.25\text{ A}$ | | | 1 1.2 | V V |
| h_{FE} | DC current gain | $I_{\text{C}} = 0.5\text{ A}$ $V_{\text{CE}} = 2\text{ V}$ $I_{\text{C}} = 1\text{ A}$ $V_{\text{CE}} = 2\text{ V}$ | 8 5 | | 20 25 | |
| t_{r} t_{s} t_{f} | Resistive load Rise time Storage time Fall time | $V_{\text{CC}} = 125\text{ V}$ $I_{\text{C}} = 1\text{ A}$ $I_{\text{B1}} = 0.2\text{ A}$ $I_{\text{B2}} = -0.2\text{ A}$ $T_{\text{p}} = 25\text{ }\mu\text{s}$ | | | 1 4 0.7 | μs μs μs |
| t_{s} | Inductive load Storage time | $I_{\text{C}} = 1\text{ A}$ $I_{\text{B1}} = 0.2\text{ A}$ $V_{\text{BE}} = -5\text{ V}$ $L = 50\text{ mH}$ $V_{\text{Clamp}} = 300\text{ V}$ | | 0.8 | | μs |

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating areas

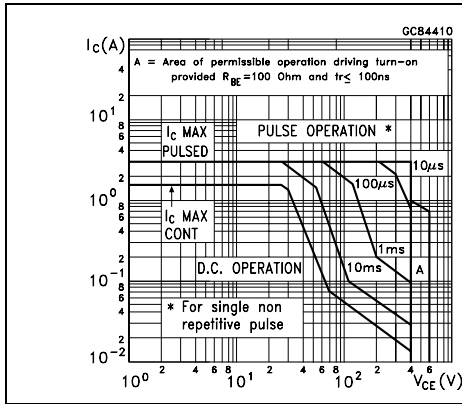


Figure 3. Derating curve

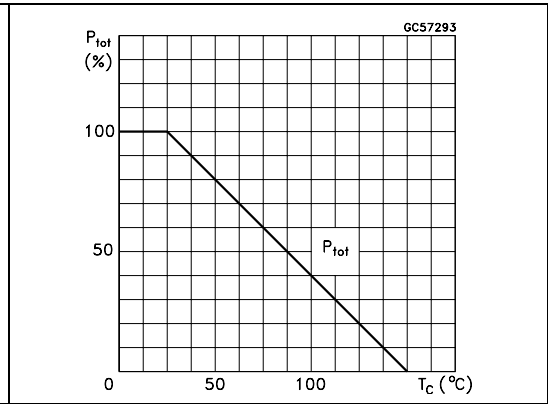


Figure 4. Output characteristics

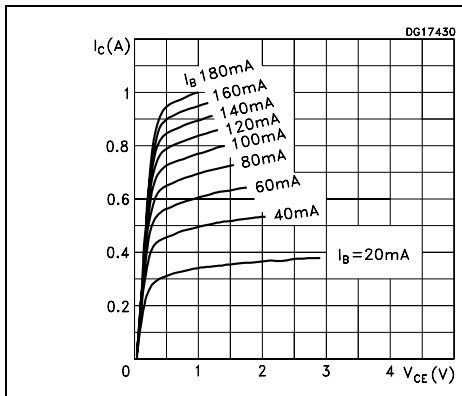


Figure 5. Reverse biased safe operating areas

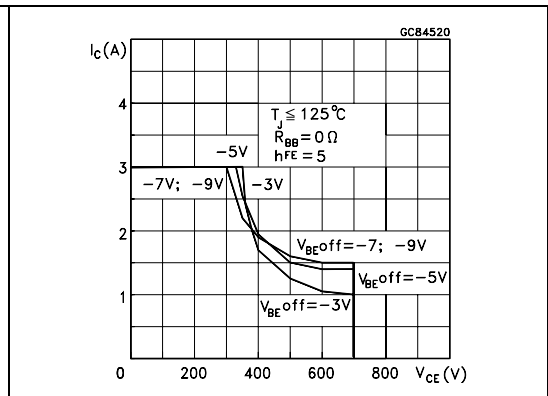


Figure 6. DC current gain ($V_{CE} = 1 \text{ V}$)

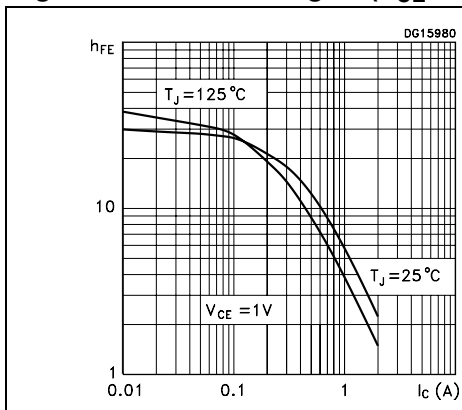


Figure 7. DC current gain ($V_{CE} = 5 \text{ V}$)

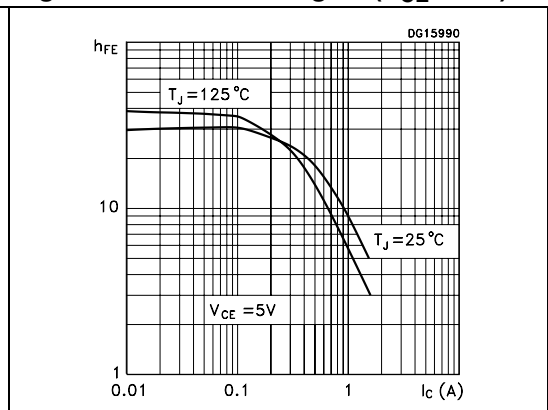


Figure 8. Collector-emitter saturation voltage

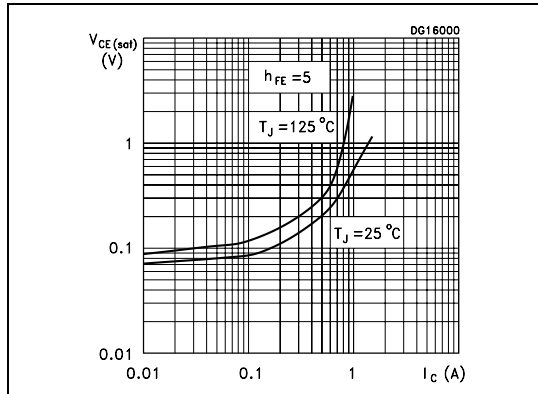


Figure 9. Base-emitter saturation voltage

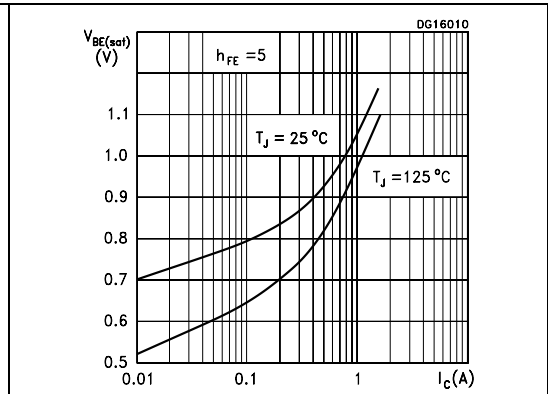


Figure 10. Inductive load switching time

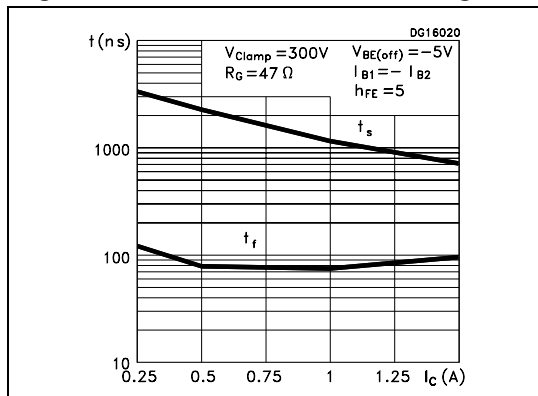
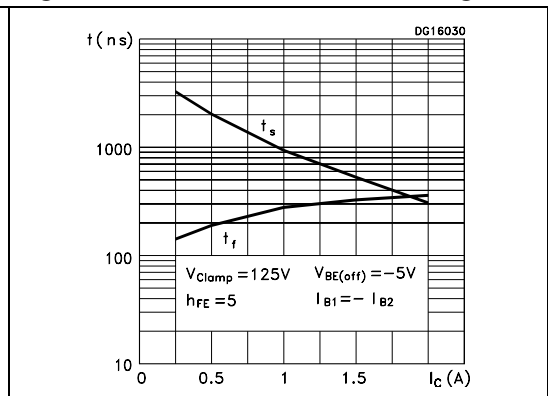
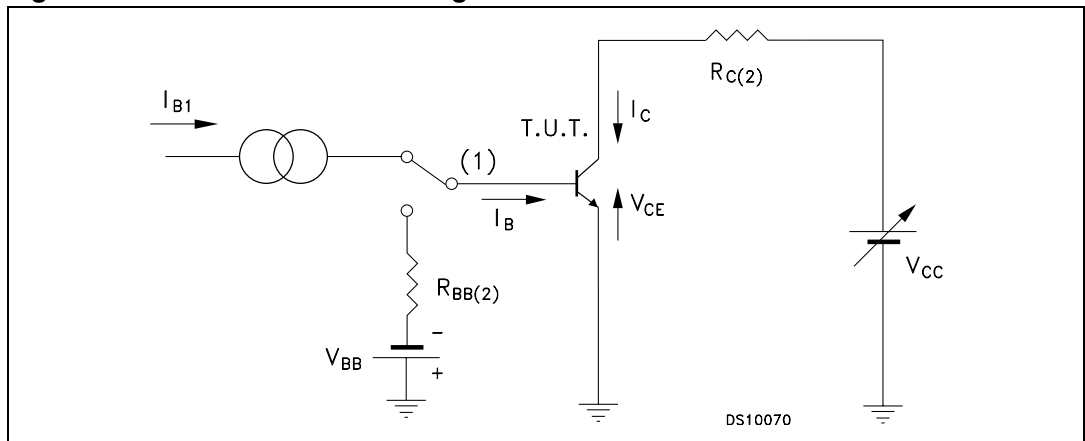


Figure 11. Resistive load switching time



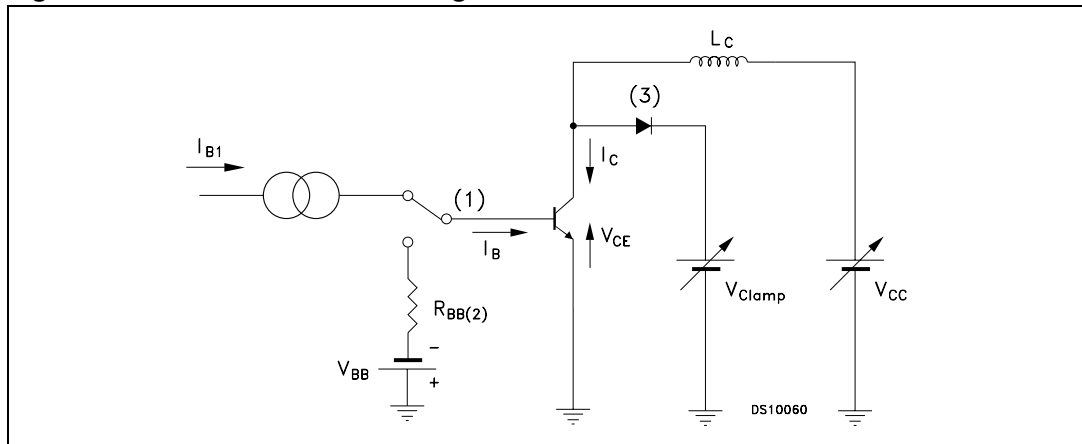
2.2 Test circuits

Figure 12. Resistive load switching test circuit



1. Fast electronic switch
2. Non-inductive resistor

Figure 13. Inductive load switching test circuit



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

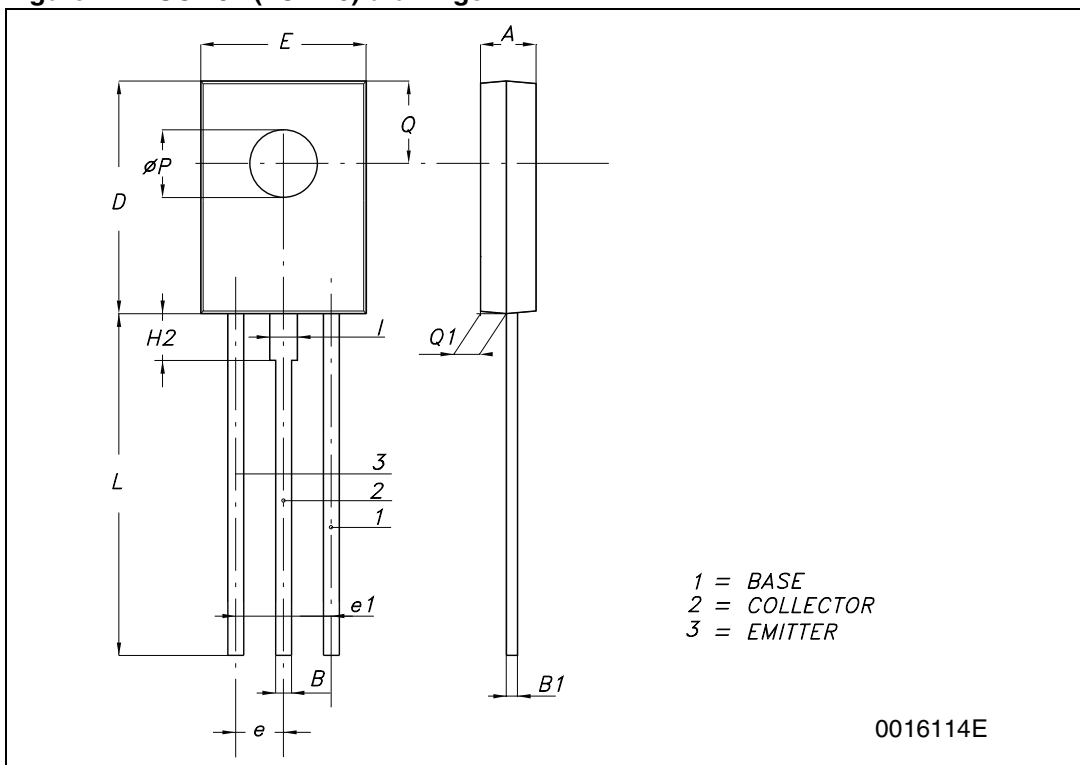
3 Package mechanical data

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.

Table 5. SOT-32 (TO-126) mechanical data

| Dim. | mm. | | |
|------|------|------|-------|
| | Min. | Typ. | Max. |
| A | 2.4 | | 2.9 |
| B | 0.64 | | 0.88 |
| B1 | 0.39 | | 0.63 |
| D | 10.5 | | 11.05 |
| E | 7.4 | | 7.8 |
| e | 2.04 | 2.29 | 2.54 |
| e1 | 4.07 | 4.58 | 5.08 |
| L | 15.3 | | 16 |
| P | 2.9 | | 3.2 |
| Q | | 3.8 | |
| Q1 | 1 | | 1.52 |
| H2 | | 2.15 | |
| I | | 1.27 | |

Figure 14. SOT-32 (TO-126) drawings



4 Revision history

Table 6. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 23-May-2007 | 1 | Initial release. |
| 09-Jul-2008 | 2 | Added Table 1 on page 1 . |
| 15-Dec-2009 | 3 | Added Table 3: Thermal data on page 2 . |
| 15-Jun-2011 | 4 | Modified: Table 2 |

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