

High voltage fast-switching NPN power transistor

Features

- Integrated antiparallel collector-emitter diode
- High voltage capability
- Minimum lot-to-lot spread for reliable operation
- Very high switching speed

Applications

- Electronic ballast for fluorescent lighting
- 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.

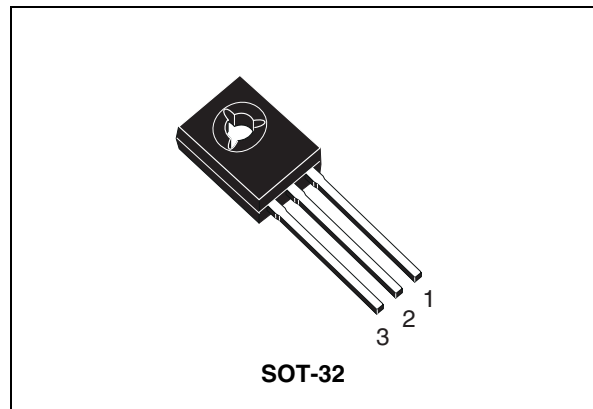


Figure 1. Internal schematic diagram

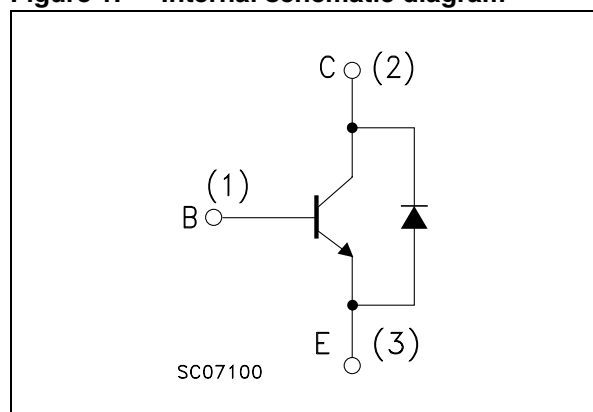


Table 1. Device summary

| Order codes | Marking | Package | Packaging |
|-------------|---------|---------|-----------|
| STT13005D | T13005D | SOT-32 | Tube |
| STT13005D-K | T13005D | 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 ($I_C = 0$) | 9 | V |
| I_C | Collector current | 2 | A |
| I_{CM} | Collector peak current ($t_P < 5$ ms) | 4 | A |
| I_B | Base current | 1 | A |
| I_{BM} | Base peak current ($t_P < 5$ ms) | 2 | A |
| P_{TOT} | Total dissipation at $T_C = 25$ °C | 45 | 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 2.8 | °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 ($V_{\text{BE}} = 0$) | $V_{\text{CE}} = 700\text{ V}$ | | | 100 | μA |
| | | $V_{\text{CE}} = 700\text{ V}$ $T_{\text{C}} = 125\text{ °C}$ | | | 500 | μA |
| I_{CEO} | Collector cut-off current ($I_{\text{B}} = 0$) | $V_{\text{CE}} = 400\text{ V}$ | | | 250 | μA |
| V_{EBO} | Emitter-base voltage ($I_{\text{C}} = 0$) | $I_{\text{E}} = 10\text{ mA}$ | 9 | | | 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 | $I_{\text{C}} = 0.5\text{ A}$ $I_{\text{B}} = 125\text{ mA}$ | | | 0.5 | V |
| | | $I_{\text{C}} = 0.8\text{ A}$ $I_{\text{B}} = 0.2\text{ A}$ | | | 1 | V |
| | | $I_{\text{C}} = 1.6\text{ A}$ $I_{\text{B}} = 0.4\text{ A}$ | | | 1.5 | V |
| $V_{\text{BE(sat)}}^{(1)}$ | Base-emitter saturation voltage | $I_{\text{C}} = 0.5\text{ A}$ $I_{\text{B}} = 125\text{ mA}$ | | | 1 | V |
| | | $I_{\text{C}} = 0.8\text{ A}$ $I_{\text{B}} = 0.2\text{ A}$ | | | 1.3 | V |
| | | $I_{\text{C}} = 1.6\text{ A}$ $I_{\text{B}} = 0.4\text{ A}$ | | | 1.5 | V |
| $h_{\text{FE}}^{(1)}$ | DC current gain | $I_{\text{C}} = 0.5\text{ A}$ $V_{\text{CE}} = 5\text{ V}$ | 10 | | 50 | |
| | | $I_{\text{C}} = 2\text{ A}$ $V_{\text{CE}} = 5\text{ V}$ | 8 | | | |
| t_{r} t_{s} t_{f} | Resistive load Rise time Storage time Fall time | $I_{\text{C}} = 1\text{ A}$ $V_{\text{CC}} = 125\text{ V}$ $I_{\text{B1}} = -I_{\text{B2}} = 0.2\text{ A}$ | | 0.4 | 0.7 | μs |
| | | | | 3.2 | 4.5 | μs |
| | | | | 0.25 | 0.4 | μs |
| t_{s} t_{f} | Inductive load Storage time Fall time | $I_{\text{C}} = 1\text{ A}$ $I_{\text{B1}} = 0.2\text{ A}$ $V_{\text{BE(off)}} = -5\text{ V}$ $L = 50\text{ mH}$ $V_{\text{Clamp}} = 300\text{ V}$ | | 0.8 | | μs |
| | | | | 0.16 | | μs |
| V_{F} | Diode forward voltage | $I_{\text{F}} = 1\text{ A}$ | | | 2.5 | V |

1. Pulse test: pulse duration $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

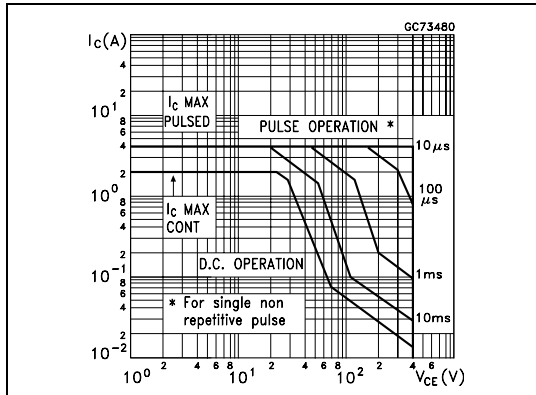


Figure 3. Derating curve

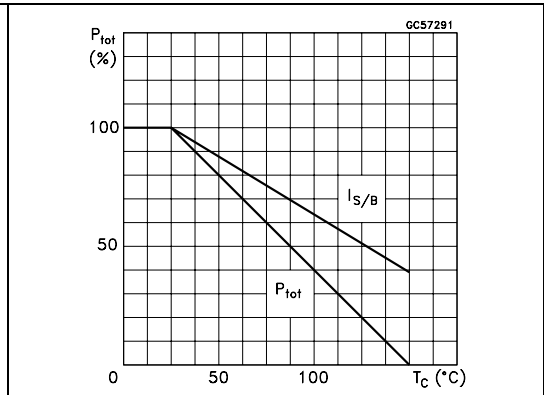


Figure 4. DC current gain ($V_{CE} = 1$ V)

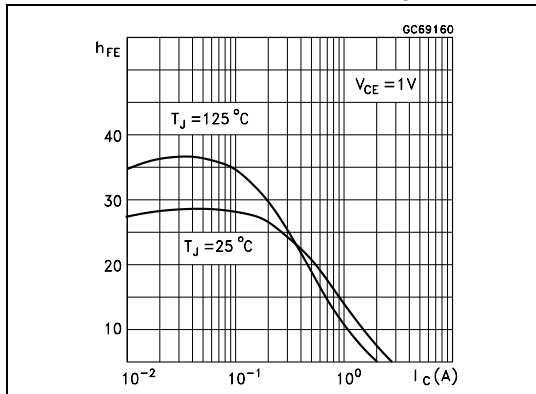


Figure 5. DC current gain ($V_{CE} = 5$ V)

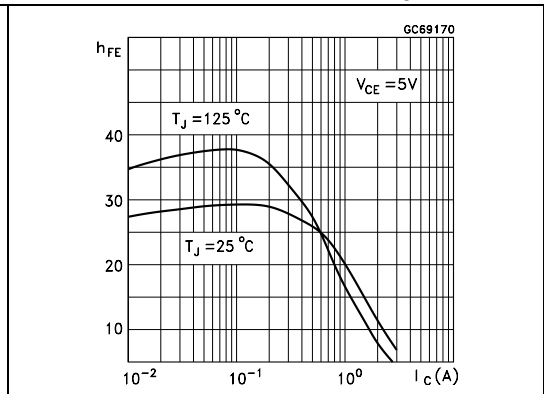


Figure 6. Collector-emitter saturation voltage

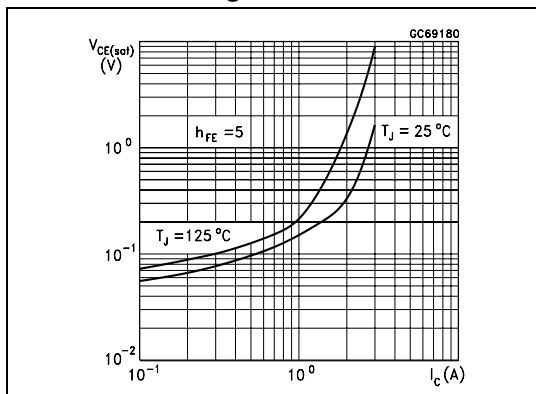


Figure 7. Base-emitter saturation voltage

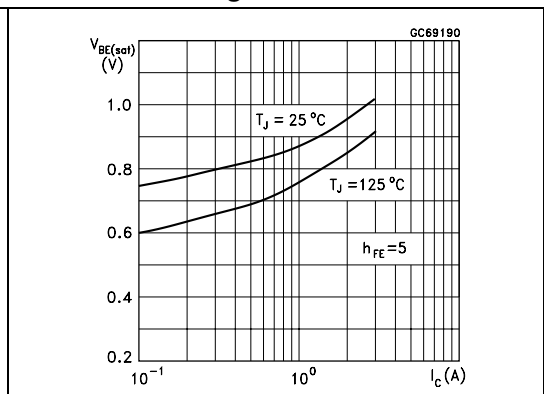


Figure 8. Inductive load fall time

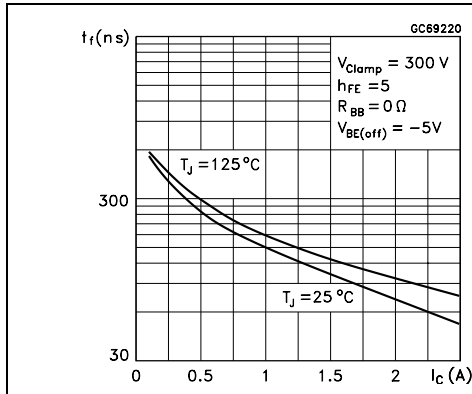


Figure 9. Inductive load storage time

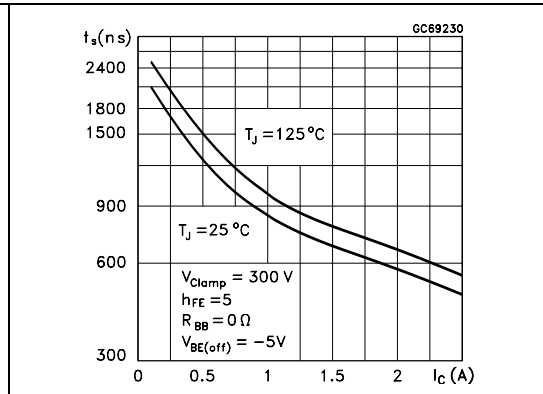


Figure 10. Resistive load fall time

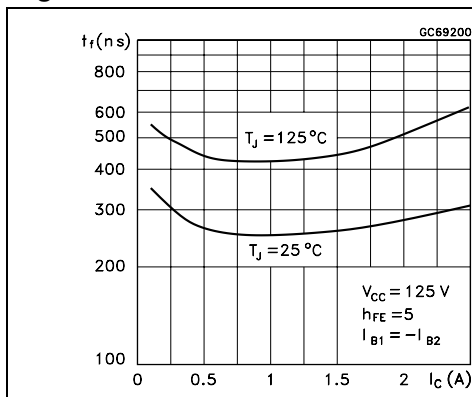


Figure 11. Resistive load storage time

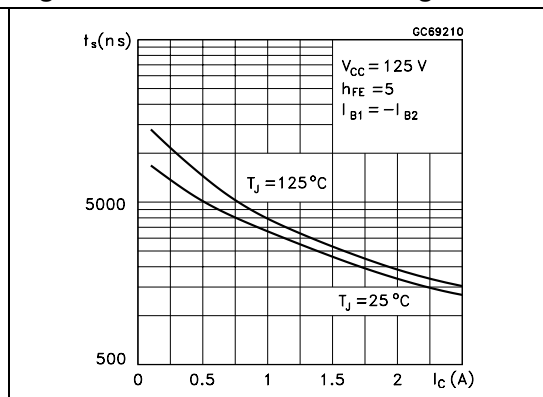
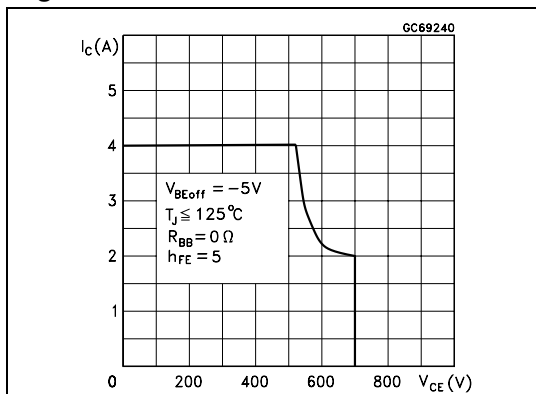
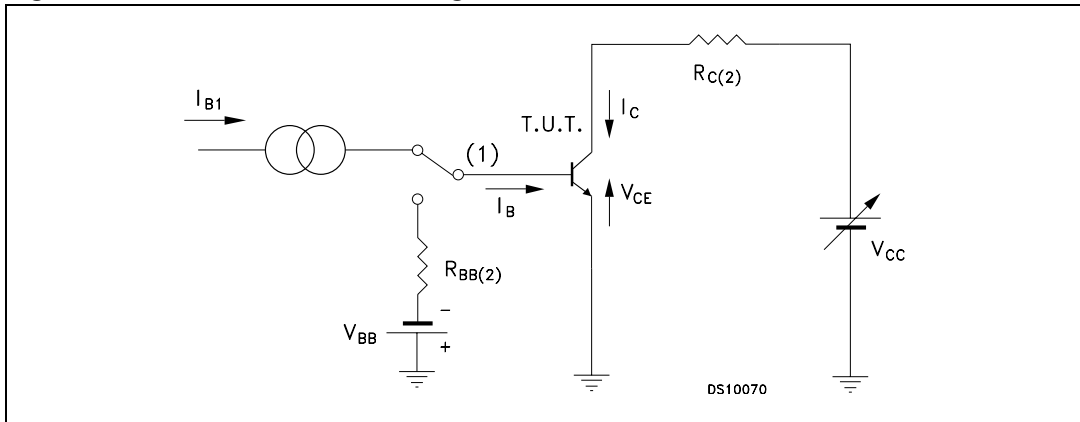


Figure 12. Reverse biased SOA



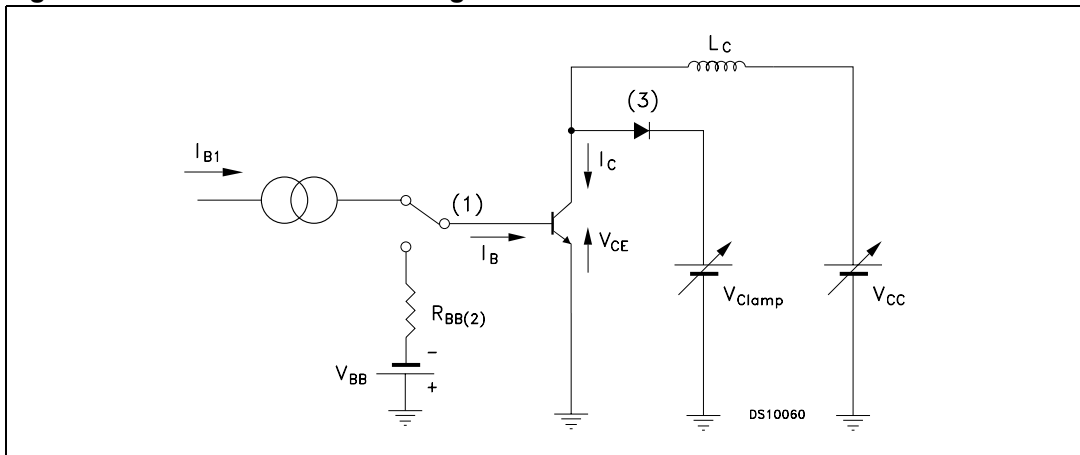
2.2 Test circuits

Figure 13. Resistive load switching test circuit



- 1. Fast electronic switch
- 2. Non-inductive resistor

Figure 14. Inductive load switching test circuit



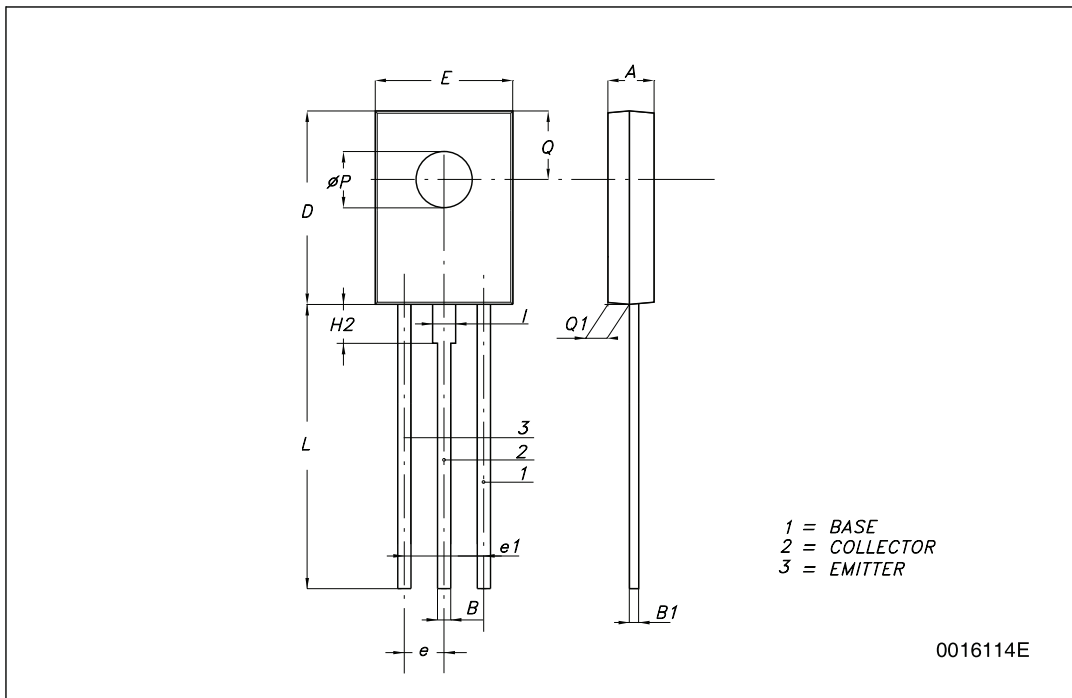
- 1. Fast electronic switch
- 2. Non-inductive resistor
- 3. Fast recovery rectifier

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.

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 | |



4 Revision history

Table 5. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 10-Jul-2008 | 1 | Initial release. |
| 03-Nov-2009 | 2 | Added order code STT13005D-K Table 1 on page 1 . |

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