

## High voltage fast-switching NPN power transistor

### Features

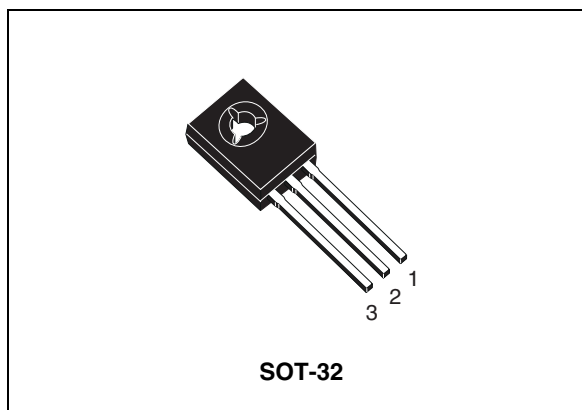
- High voltage capability
- Low spread of dynamic parameters
- Minimum lot-to-lot spread for reliable operation
- Very high switching speed
- Integrated antiparallel collector-emitter diode

### Applications

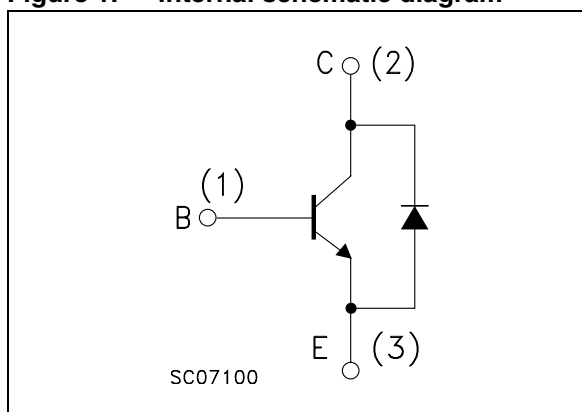
- Electronic ballast for fluorescent lighting

### 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.



**Figure 1. Internal schematic diagram**



**Table 1. Device summary**

| Order code | Marking | Package | Packaging |
|------------|---------|---------|-----------|
| ST13003D-K | 13003D  | 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, $t_P < 10$ $\mu$ 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   |
| $T_J$     | Max. operating junction temperature                                    | 150           | °C   |

## 2 Electrical characteristics

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

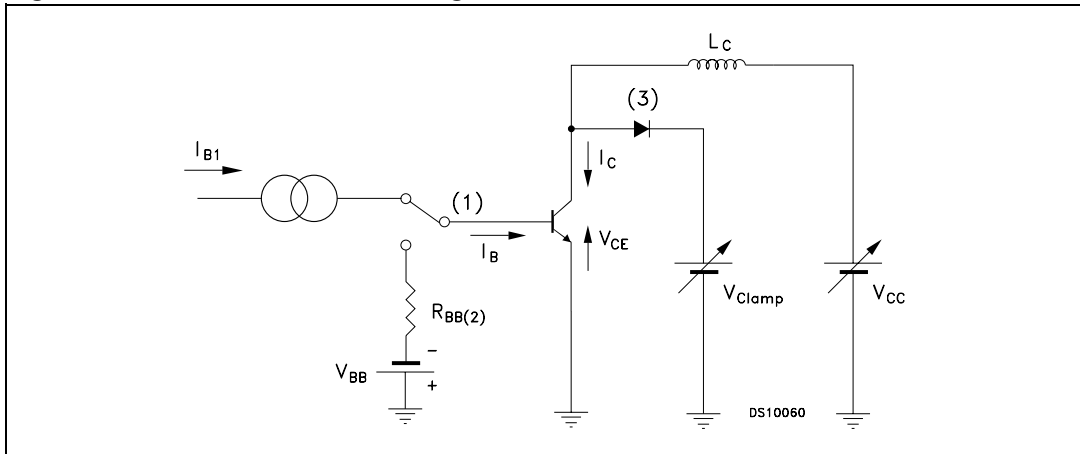
**Table 3. Electrical characteristics**

| Symbol   | Parameter  | Test conditions  | Min.   | Typ. | Max.          | Unit  |
|--|--|--|--------|------|---------------|---|
| $I_{\text{CES}}$                                   | Collector cut-off current<br>( $V_{\text{BE}} = 0$ )           | $V_{\text{CE}} = 700\text{ V}$<br>$V_{\text{CE}} = 700\text{ V}$ $T_{\text{c}} = 125\text{ °C}$  |        |      | 1<br>5        | mA<br>mA  |
| $V_{(\text{BR})\text{EBO}}$                        | Emitter-Base breakdown<br>voltage ( $I_{\text{C}} = 0$ )       | $I_{\text{E}} = 10\text{ mA}$  | 9      |      | 18            | V   |
| $V_{\text{CEO(sus)}}^{(1)}$                        | Collector-emitter<br>sustaining voltage ( $I_{\text{B}} = 0$ ) | $I_{\text{C}} = 10\text{ mA}$  | 400    |      |               | V   |
| $V_{\text{CE(sat)}}^{(1)}$                         | Collector-emitter<br>saturation voltage                        | $I_{\text{C}} = 0.5\text{ A}$ $I_{\text{B}} = 0.1\text{ A}$<br>$I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 0.25\text{ A}$<br>$I_{\text{C}} = 1.5\text{ A}$ $I_{\text{B}} = 0.5\text{ A}$ |        |      | 0.5<br>1<br>3 | V<br>V<br>V                                     |
| $V_{\text{BE(sat)}}^{(1)}$                         | Base-emitter saturation<br>voltage                             | $I_{\text{C}} = 0.5\text{ A}$ $I_{\text{B}} = 0.1\text{ A}$<br>$I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 0.25\text{ A}$  |        |      | 1<br>1.2      | V<br>V  |
| $h_{\text{FE}}$                                    | DC current gain  | $I_{\text{C}} = 0.5\text{ A}$ $V_{\text{CE}} = 2\text{ V}$<br>$I_{\text{C}} = 1\text{ A}$ $V_{\text{CE}} = 2\text{ V}$   | 8<br>5 |      | 20<br>25      |   |
| $t_{\text{r}}$<br>$t_{\text{s}}$<br>$t_{\text{f}}$ | Resistive load<br>Rise time<br>Storage time<br>Fall time       | $V_{\text{CC}} = 125\text{ V}$ $I_{\text{C}} = 1\text{ A}$<br>$I_{\text{B1}} = 0.2\text{ A}$ $I_{\text{B2}} = -0.2\text{ A}$<br>$T_{\text{p}} = 25\text{ }\mu\text{s}$                   |        |      | 1<br>4<br>0.7 | $\mu\text{s}$<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| $t_{\text{s}}$                                     | Inductive load<br>Storage time                                 | $I_{\text{C}} = 1\text{ A}$ $I_{\text{B1}} = 0.2\text{ A}$<br>$V_{\text{BE}} = -5\text{ V}$ $L = 50\text{ mH}$<br>$V_{\text{Clamp}} = 300\text{ V}$                                      |        | 0.8  |               | $\mu\text{s}$                                   |
| $V_{\text{F}}$                                     | Diode forward voltage  | $I_{\text{F}} = 0.5\text{ A}$  |        |      | 1.5           | V   |

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

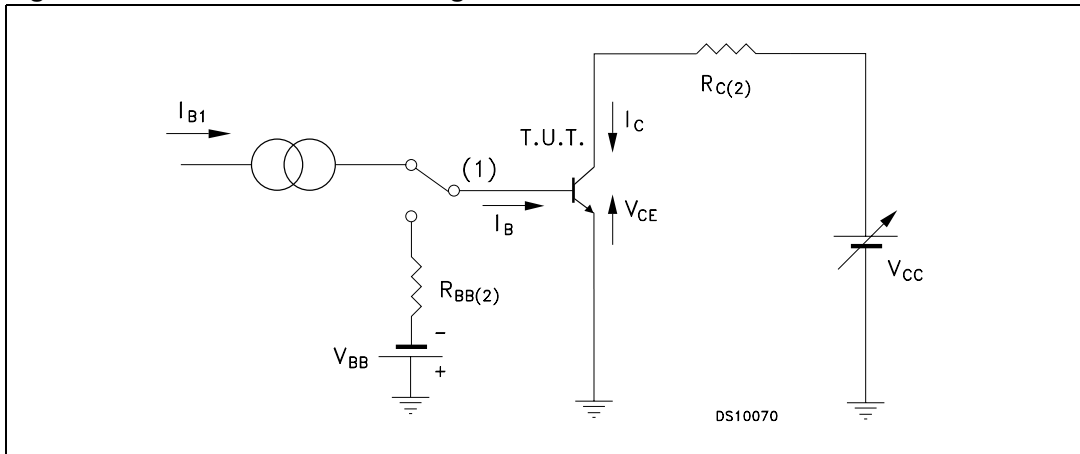
## 2.1 Test circuits

**Figure 2. Inductive load switching test circuit**



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

**Figure 3. Resistive load switching test circuit**



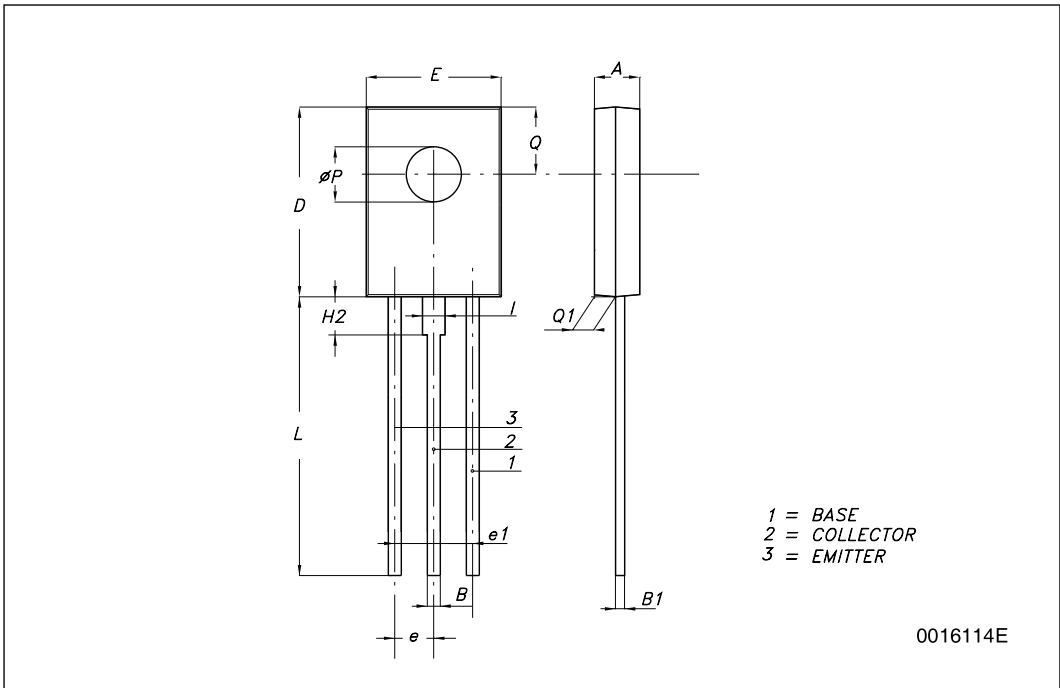
1. Fast electronic switch
2. Non-inductive resistor

### 3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> 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 4. Document revision history**

| Date        | Revision | Changes   |
|-------------|----------|---|
| 15-Nov-2007 | 1        | Initial release.  |
| 08-Sep-2009 | 2        | Updated packaging information <a href="#">Table 1 on page 1</a> . |

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