



## STN93003

High voltage fast-switching  
PNP power transistor

### General features

- Medium voltage capability
- Low spread of dynamic parameters
- Minimum lot-to-lot spread for reliable operation
- Very high switching speed
- SOT-223 plastic package for surface mounting circuits
- Tape and reel packing

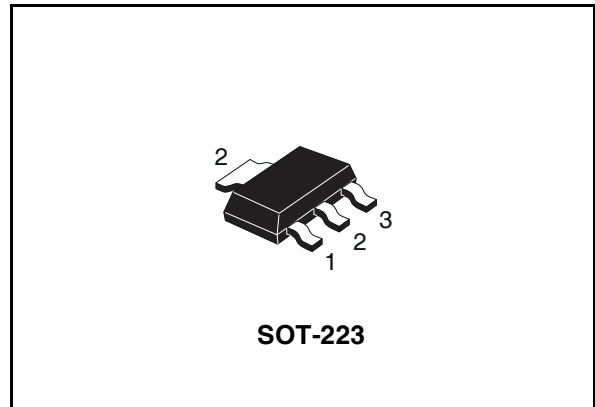
### Applications

- Electronics ballasts for fluorescent lighting
- Switch mode power supplies

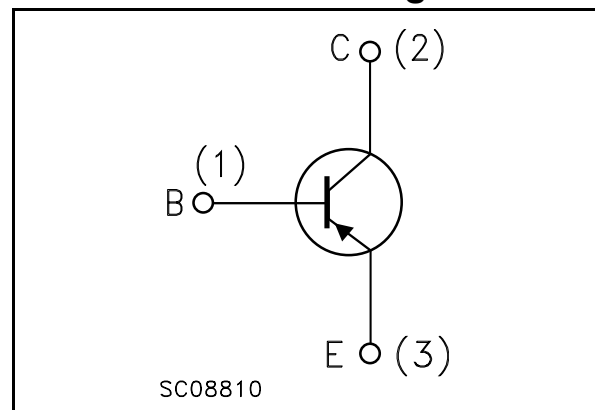
### Description

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 STN93003 is expressly designed for a new solution to be used in compact fluorescent lamps, where it is coupled with the STN83003, its complementary NPN transistor.



### Internal schematic diagram



### Order codes

| Part Number | Marking | Package | Packing     |
|-------------|---------|---------|-------------|
| STN93003    | N93003  | SOT-223 | Tape & reel |

## Contents

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# 1 Electrical ratings

**Table 1. Absolute maximum rating**

| Symbol    | Parameter                                                                                     | Value         | Unit       |
|-----------|-----------------------------------------------------------------------------------------------|---------------|------------|
| $V_{CES}$ | Collector-emitter voltage ( $V_{BE} = 0$ )                                                    | -500          | V          |
| $V_{CEO}$ | Collector-emitter voltage ( $I_B = 0$ )                                                       | -400          | V          |
| $V_{EBO}$ | Emitter-base voltage<br>( $I_C = 0$ , $I_B = 0.75A$ , $t_p < 10\mu s$ , $T_j < 150^\circ C$ ) | $V_{(BR)EBO}$ | V          |
| $I_C$     | Collector current                                                                             | -1.5          | A          |
| $I_{CM}$  | Collector peak current ( $t_p < 5ms$ )                                                        | -3            | A          |
| $I_B$     | Base current                                                                                  | -0.75         | A          |
| $I_{BM}$  | Base peak current ( $t_p < 5ms$ )                                                             | -1.5          | A          |
| $P_{tot}$ | Total dissipation at $T_c = 25^\circ C$                                                       | 1.6           | W          |
| $T_{stg}$ | Storage temperature                                                                           | -65 to 150    | $^\circ C$ |
| $T_J$     | Max. operating junction temperature                                                           | 150           | $^\circ C$ |

**Table 2. Thermal data**

| Symbol        | Parameter                                              | Value | Unit         |
|---------------|--------------------------------------------------------|-------|--------------|
| $R_{thj-amb}$ | Thermal resistance junction-ambient <sup>(1)</sup> max | 78    | $^\circ C/W$ |

1. Device mounted on PCB area of 1 cm<sup>2</sup>.

## 2 Electrical characteristics

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

**Table 3. Electrical characteristics**

| Symbol                                             | Parameter                                                         | Test Conditions                                                                                                                                                                       | Min.          | Typ.             | Max.         | Unit                                 |
|----------------------------------------------------|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------|--------------|--------------------------------------|
| $I_{\text{CEV}}$                                   | Collector cut-off current<br>( $V_{\text{BE}} = 0$ )              | $V_{\text{CE}} = -500\text{V}$<br>$V_{\text{CE}} = -500\text{V}$ $T_j = 125^{\circ}\text{C}$                                                                                          |               |                  | -1<br>-5     | mA<br>mA                             |
| $V_{(\text{BR})\text{EBO}}$                        | Emitter-base<br>breakdown voltage<br>( $I_{\text{C}} = 0$ )       | $I_{\text{E}} = -10\text{mA}$                                                                                                                                                         | -5            |                  | -10          | V                                    |
| $V_{\text{CE(sus)}}^{(1)}$                         | Collector-emitter<br>sustaining voltage<br>( $I_{\text{B}} = 0$ ) | $I_{\text{C}} = -10\text{mA}$<br>$L = 25\text{mH}$                                                                                                                                    | -400          |                  |              | V                                    |
| $V_{\text{CE(sat)}}^{(1)}$                         | Collector-emitter<br>saturation voltage                           | $I_{\text{C}} = -0.35\text{A}$ $I_{\text{B}} = -50\text{mA}$<br>$I_{\text{C}} = -0.5\text{A}$ $I_{\text{B}} = -0.1\text{A}$                                                           |               |                  | -0.5<br>-0.5 | V<br>V                               |
| $V_{\text{BE(sat)}}^{(1)}$                         | Base-emitter saturation<br>voltage                                | $I_{\text{C}} = -0.5\text{A}$ $I_{\text{B}} = -0.1\text{A}$                                                                                                                           |               |                  | -1           | V                                    |
| $h_{\text{FE}}$                                    | DC current gain                                                   | $I_{\text{C}} = -10\text{mA}$ $V_{\text{CE}} = -5\text{V}$<br>$I_{\text{C}} = -0.35\text{A}$ $V_{\text{CE}} = -5\text{V}$<br>$I_{\text{C}} = -1\text{A}$ $V_{\text{CE}} = -5\text{V}$ | 10<br>16<br>4 | 25               | 32           |                                      |
| $t_{\text{r}}$<br>$t_{\text{s}}$<br>$t_{\text{f}}$ | Resistive load<br>Rise time<br>Storage time<br>Fall time          | $I_{\text{C}} = -0.35\text{A}$ $V_{\text{CC}} = 125\text{V}$<br>$I_{\text{B1}} = -I_{\text{B2}} = -70\text{mA}$<br>$T_{\text{P}} \geq 25\mu\text{s}$ (see figure 10)                  | 1.5           | 90<br>2.2<br>0.1 | 2.9          | ns<br>$\mu\text{s}$<br>$\mu\text{s}$ |
| $t_{\text{s}}$<br>$t_{\text{f}}$                   | Inductive load<br>Storage time<br>Fall time                       | $I_{\text{C}} = -0.5\text{A}$ $I_{\text{B1}} = -0.1\text{A}$<br>$V_{\text{BE(off)}} = 5\text{V}$ $L = 10\text{mH}$<br>$V_{\text{Clamp}} = 300\text{V}$ (see figure 9)                 |               | 400<br>40        |              | ns<br>ns                             |
| $E_{\text{sb}}$<br>$t_{\text{f}}$                  | Avalanche Energy                                                  | $L = 4\text{mH}$ $25^{\circ}\text{C} < T_{\text{C}} < 125^{\circ}\text{C}$<br>$I_{\text{BR}} \leq -2.5\text{A}$ $C = 1.8\text{nF}$                                                    | 12            |                  |              | mJ                                   |

1. Pulsed duration = 300  $\mu\text{s}$ , duty cycle  $\leq 1.5\%$

## 2.1 Electrical characteristics (curves)

Figure 1. DC Current Gain

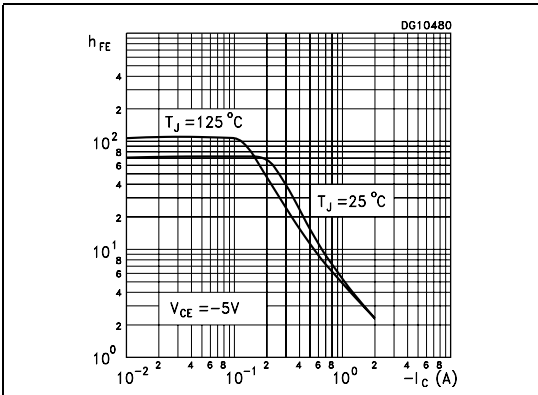


Figure 2. DC Current Gain

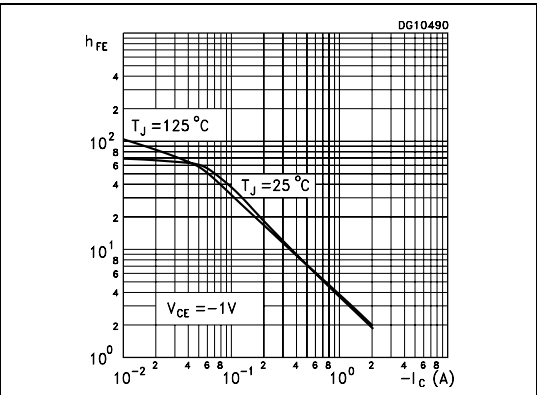


Figure 3. Collector-emitter saturation voltage

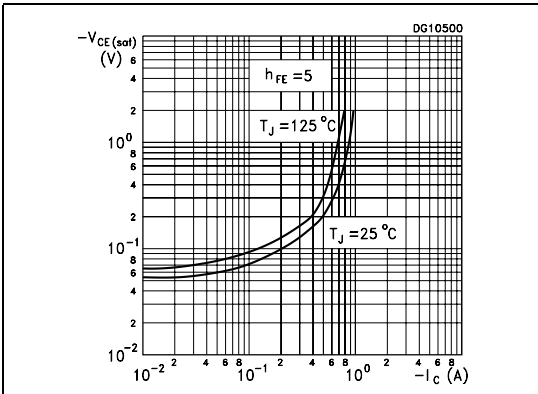


Figure 4. Base-emitter saturation voltage

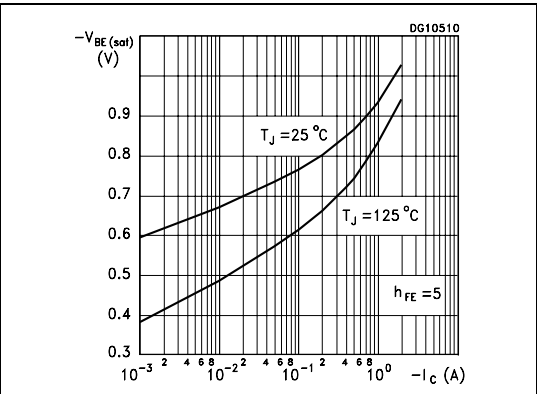


Figure 5. Resistive load fall time

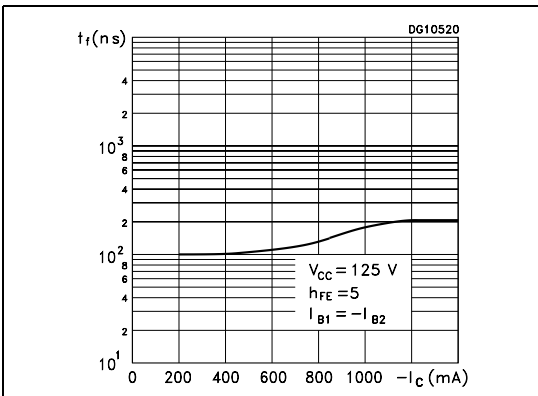


Figure 6. Resistive load storage time

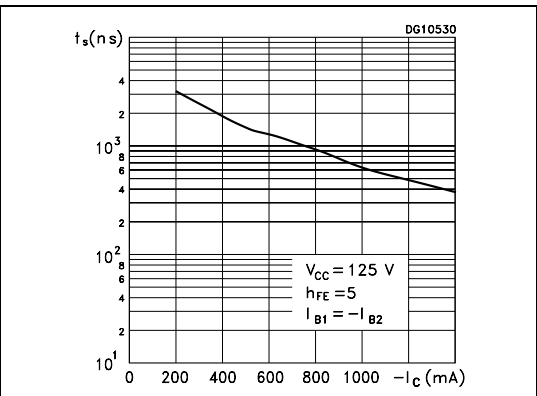


Figure 7. Inductive load fall time

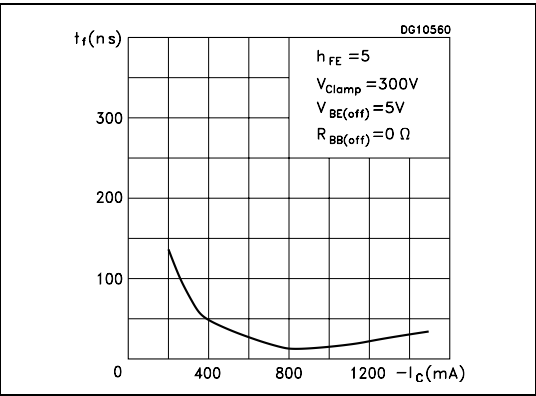
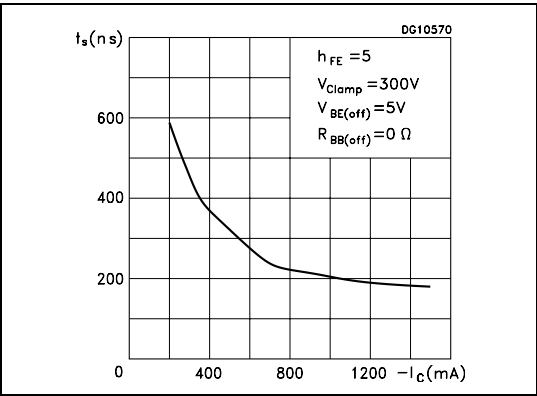


Figure 8. Inductive load storage time



2.2 Test circuits

Figure 9. Inductive load switching test circuit

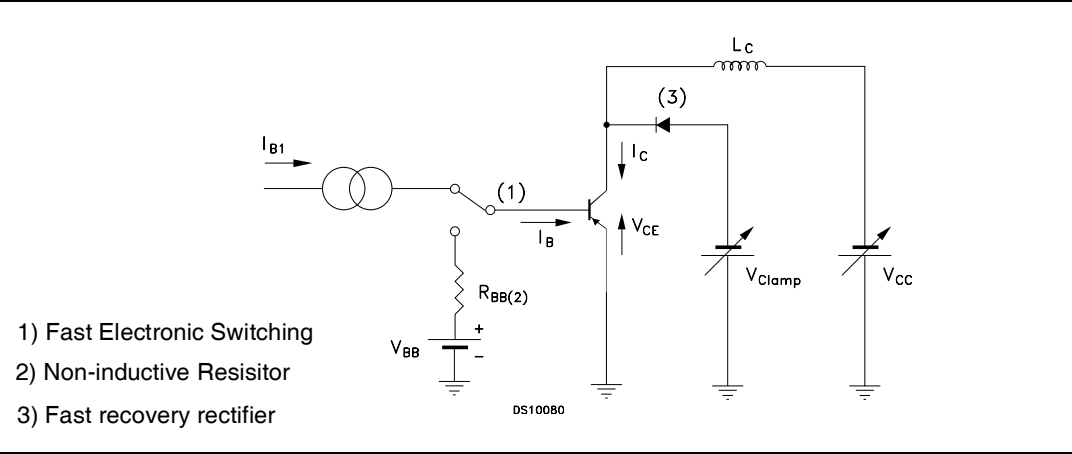
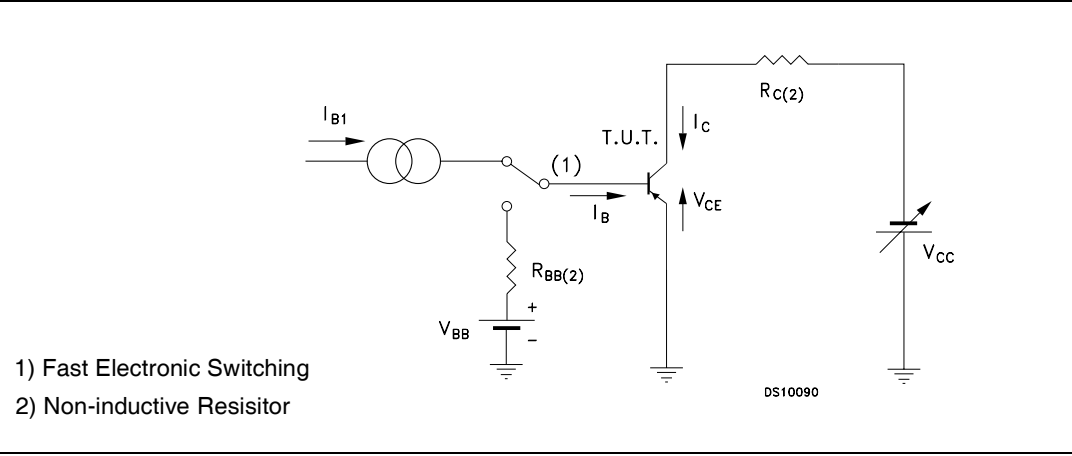


Figure 10. Resistive load switching test circuit



### 3      **Package mechanical data**

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

| SOT-223 MECHANICAL DATA |      |      |      |       |       |       |
|-------------------------|------|------|------|-------|-------|-------|
| DIM.                    | mm   |      |      | inch  |       |       |
|                         | MIN. | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A                       |      |      | 1.80 |       |       | 0.071 |
| B                       | 0.60 | 0.70 | 0.80 | 0.024 | 0.027 | 0.031 |
| B1                      | 2.90 | 3.00 | 3.10 | 0.114 | 0.118 | 0.122 |
| c                       | 0.24 | 0.26 | 0.32 | 0.009 | 0.010 | 0.013 |
| D                       | 6.30 | 6.50 | 6.70 | 0.248 | 0.256 | 0.264 |
| e                       |      | 2.30 |      |       | 0.090 |       |
| e1                      |      | 4.60 |      |       | 0.181 |       |
| E                       | 3.30 | 3.50 | 3.70 | 0.130 | 0.138 | 0.146 |
| H                       | 6.70 | 7.00 | 7.30 | 0.264 | 0.276 | 0.287 |
| V                       |      |      | 10°  |       |       | 10°   |
| A1                      |      | 0.02 |      |       |       |       |

The image contains three mechanical drawings of the SOT-223 package. The top-left drawing is a top view showing dimensions A (total width), A1 (lead width), B (lead spacing), B1 (body width), c (lead thickness), and e1 (body width). The top-right drawing is a side view showing dimension c (lead thickness). The bottom drawing is a bottom view showing dimensions D (total length), B1 (body width), E (body height), H (total height), e (lead spacing), and pin numbers 1, 2, and 3. The package is shown with a 10-degree lead angle V.

P008B

## Revision history

**Table 4. Revision history**

| <b>Date</b> | <b>Revision</b> | <b>Changes</b>   |
|-------------|-----------------|------------------|
| 11-May-2006 | 1               | Initial release. |

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