

## Low voltage fast-switching NPN power transistor

### Features

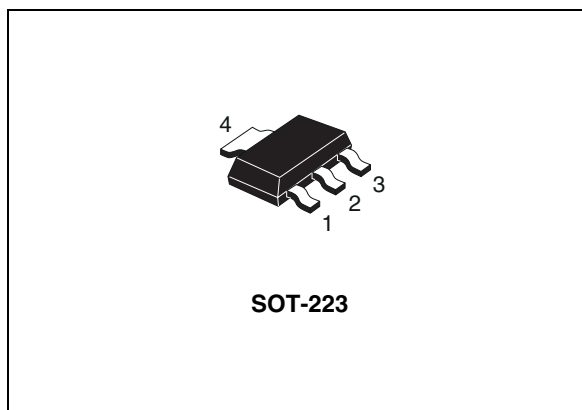
- AEC Q101 compliant
- Very low collector to emitter saturation voltage
- High current gain characteristic
- Fast-switching speed
- Surface-mounting SOT-223 power package in tape and reel

### Applications

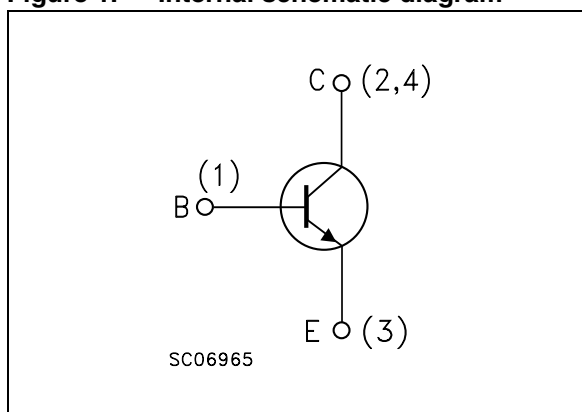
- High efficiency low voltage switching applications

### Description

The device is manufactured in planar technology with "Base Island" layout. The resulting transistor shows exceptional high gain performance coupled with very low saturation voltage.



**Figure 1. Internal schematic diagram**



**Table 1. Device summary**

| Order code | Marking | Package | Packaging     |
|------------|---------|---------|---------------|
| STN851-A   | N851    | SOT-223 | Tape and reel |

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol    | Parameter                               | Value      | Unit |
|-----------|---|------------|------|
| $V_{CBO}$ | Collector-base voltage ( $I_E = 0$ )    | 150        | V    |
| $V_{CEO}$ | Collector-emitter voltage ( $I_B = 0$ ) | 60         | V    |
| $V_{EBO}$ | Emitter-base voltage ( $I_C = 0$ )      | 7          | V    |
| $I_C$     | Collector current                       | 5          | A    |
| $I_{CM}$  | Collector peak current ( $t_P < 5$ ms)  | 10         | A    |
| $I_B$     | Base current                            | 1          | A    |
| $I_{BM}$  | Base peak current ( $t_P < 5$ ms)       | 2          | A    |
| $P_{tot}$ | Total dissipation at $T_{amb} = 25$ °C  | 1.6        | 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 |
|---------------|--|-------|------|
| $R_{thj-amb}$ | Thermal resistance junction-ambient <sup>(1)</sup> | 78    | °C/W |

1. Device mounted on a p.c.b. area of 1 cm<sup>2</sup>

## 2 Electrical characteristics

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

**Table 4. Electrical characteristics**

| Symbol  | Parameter  | Test conditions   | Min.                   | Typ.                    | Max.                    | Unit                      |
|---|--|---|------------------------|-------------------------|-------------------------|---------------------------|
| $I_{\text{CBO}}$                                    | Collector cut-off current<br>( $I_{\text{E}} = 0$ )              | $V_{\text{CB}} = 120\text{ V}$<br>$V_{\text{CB}} = 120\text{ V}$ $T_{\text{C}} = 100\text{ }^{\circ}\text{C}$   |                        |                         | 50<br>1                 | nA<br>$\mu\text{A}$       |
| $I_{\text{EBO}}$                                    | Emitter cut-off current<br>( $I_{\text{C}} = 0$ )                | $V_{\text{EB}} = 7\text{ V}$  |                        |                         | 10                      | nA                        |
| $V_{(\text{BR})\text{CBO}}$                         | Collector-base<br>breakdown voltage<br>( $I_{\text{E}} = 0$ )    | $I_{\text{C}} = 100\text{ }\mu\text{A}$   | 150                    |                         |                         | V                         |
| $V_{(\text{BR})\text{CEO}}^{(1)}$                   | Collector-emitter<br>breakdown voltage<br>( $I_{\text{B}} = 0$ ) | $I_{\text{C}} = 10\text{ mA}$   | 60                     |                         |                         | V                         |
| $V_{(\text{BR})\text{EBO}}$                         | Emitter-base breakdown<br>voltage ( $I_{\text{C}} = 0$ )         | $I_{\text{E}} = 100\text{ }\mu\text{A}$   | 7                      |                         |                         | V                         |
| $V_{\text{CE(sat)}}^{(1)}$                          | Collector-emitter<br>saturation voltage                          | $I_{\text{C}} = 100\text{ mA}$ $I_{\text{B}} = 5\text{ mA}$<br>$I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 50\text{ mA}$<br>$I_{\text{C}} = 2\text{ A}$ $I_{\text{B}} = 50\text{ mA}$<br>$I_{\text{C}} = 5\text{ A}$ $I_{\text{B}} = 200\text{ mA}$ |                        | 10<br>70<br>140<br>320  | 50<br>120<br>250<br>500 | mV<br>mV<br>mV<br>mV      |
| $V_{\text{BE(sat)}}^{(1)}$                          | Base-emitter saturation<br>voltage                               | $I_{\text{C}} = 4\text{ A}$ $I_{\text{B}} = 200\text{ mA}$  |                        | 1                       | 1.15                    | V                         |
| $V_{\text{BE(on)}}^{(1)}$                           | Base-emitter on voltage  | $I_{\text{C}} = 4\text{ A}$ $V_{\text{CE}} = 1\text{ V}$  |                        | 0.89                    | 1                       | V                         |
| $h_{\text{FE}}^{(1)}$                               | DC current gain  | $I_{\text{C}} = 10\text{ mA}$ $V_{\text{CE}} = 1\text{ V}$<br>$I_{\text{C}} = 2\text{ A}$ $V_{\text{CE}} = 1\text{ V}$<br>$I_{\text{C}} = 5\text{ A}$ $V_{\text{CE}} = 1\text{ V}$<br>$I_{\text{C}} = 10\text{ A}$ $V_{\text{CE}} = 1\text{ V}$     | 150<br>150<br>90<br>30 | 300<br>270<br>140<br>50 | 350                     |                           |
| $f_{\text{T}}$                                      | Transition frequency   | $V_{\text{CE}} = 10\text{ V}$ $I_{\text{C}} = 100\text{ mA}$  |                        | 130                     |                         | MHz                       |
| $C_{\text{CBO}}$                                    | Collector-base<br>capacitance ( $I_{\text{E}} = 0$ )             | $V_{\text{CB}} = 10\text{ V}$ $f = 1\text{ MHz}$  |                        | 50                      |                         | pF                        |
| $t_{\text{on}}$<br>$t_{\text{s}}$<br>$t_{\text{f}}$ | Resistive load<br>Turn-on time<br>Storage time<br>Fall time      | $I_{\text{C}} = 1\text{ A}$ $V_{\text{CC}} = 10\text{ V}$<br>$I_{\text{B1}} = -I_{\text{B2}} = 0.1\text{ A}$  |                        | 50<br>1.35<br>120       |                         | ns<br>$\mu\text{s}$<br>ns |

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

2.1 Electrical characteristics (curves)

Figure 2. Derating curve

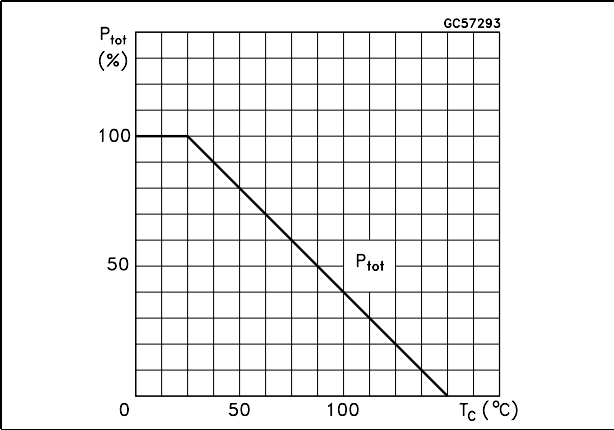


Figure 3. DC current gain

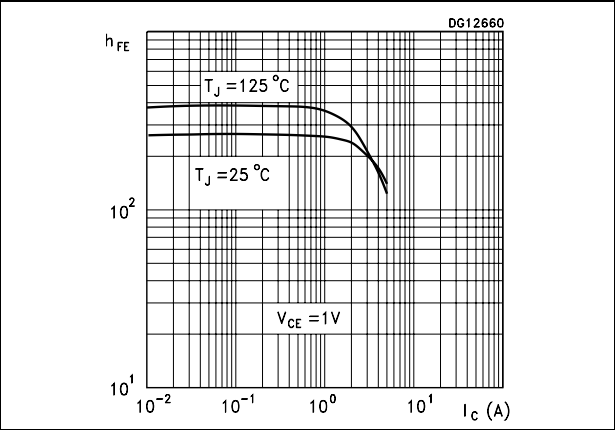


Figure 4. Collector-emitter saturation voltage

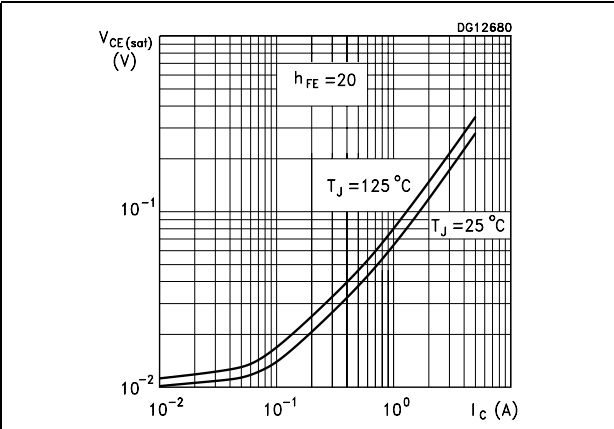


Figure 5. Collector-emitter saturation voltage

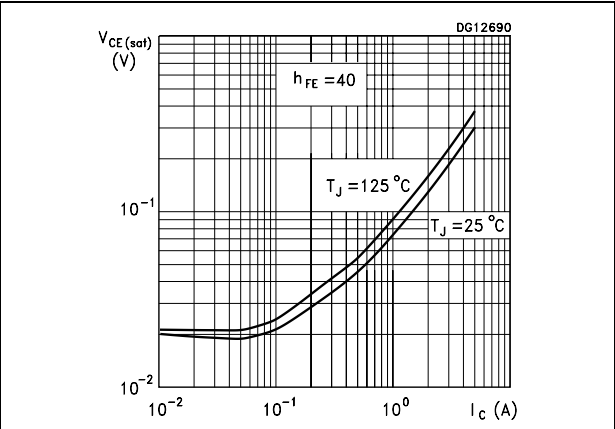


Figure 6. Base-emitter saturation voltage

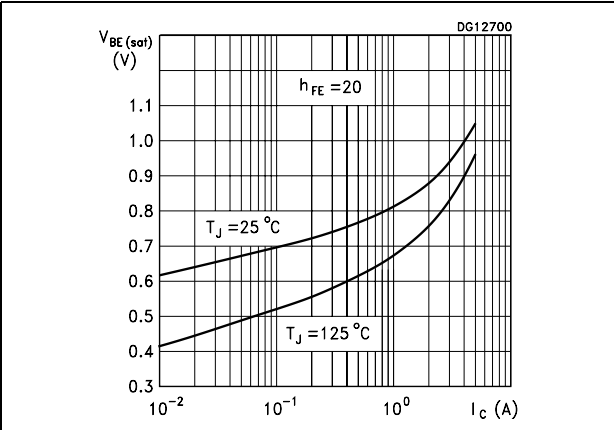


Figure 7. Base-emitter on voltage

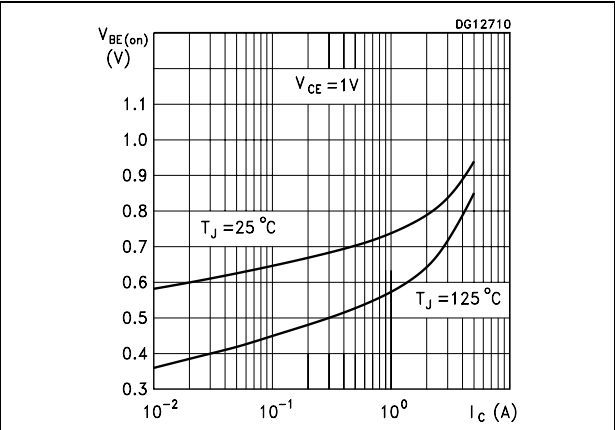


Figure 8. Resistive load switching time

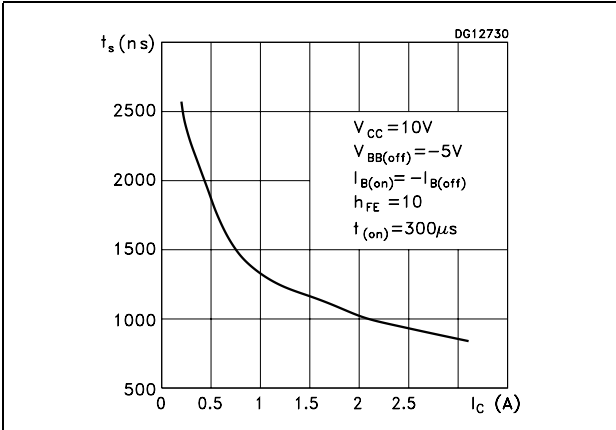


Figure 9. Resistive load switching time

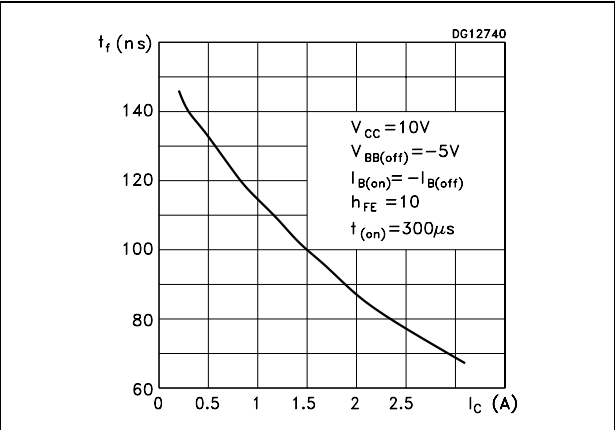


Figure 10. Resistive load switching time

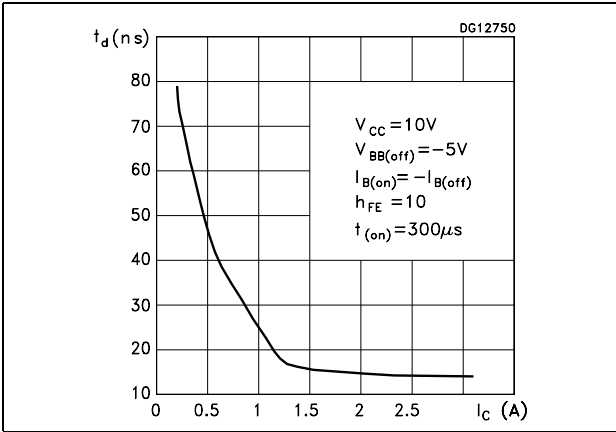


Figure 11. Inductive load switching time

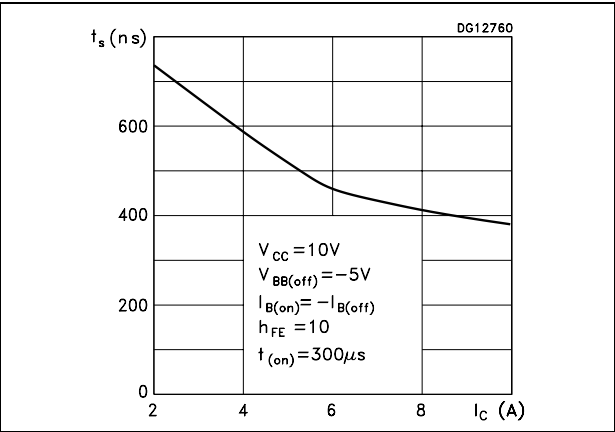
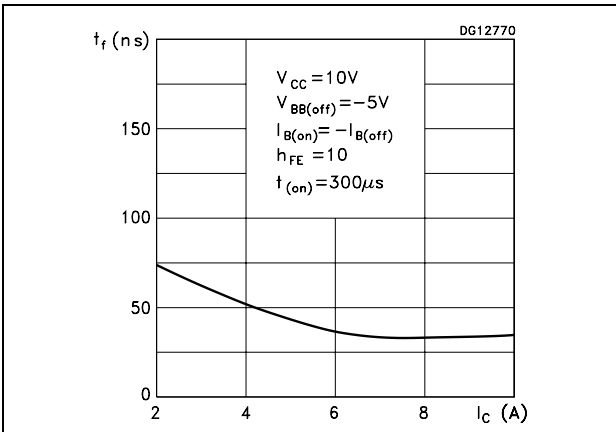
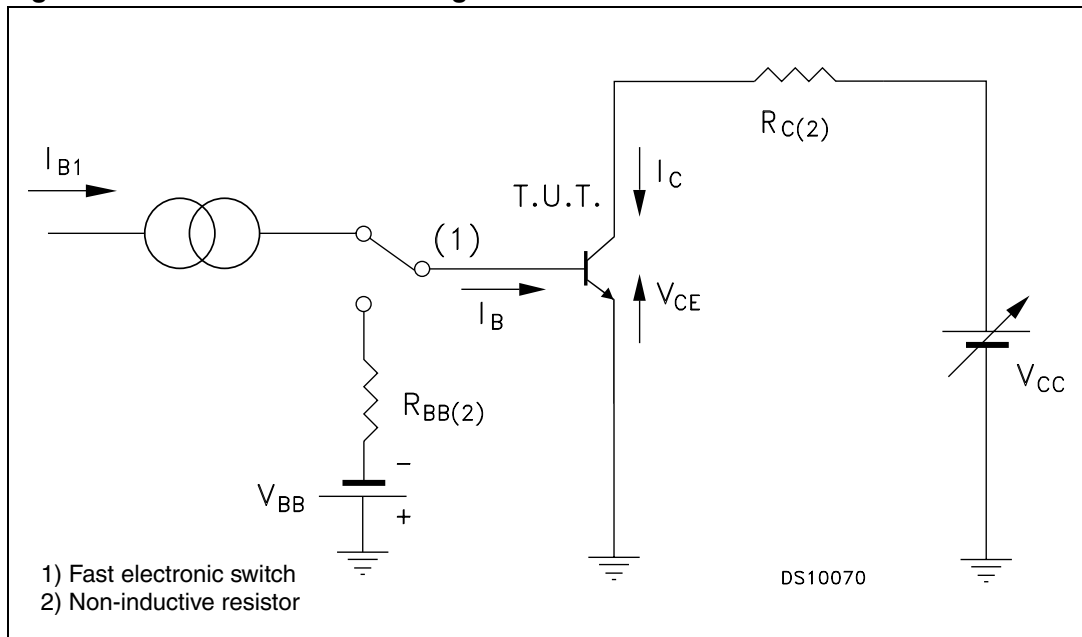


Figure 12. Inductive load switching time



## 2.2 Test circuit

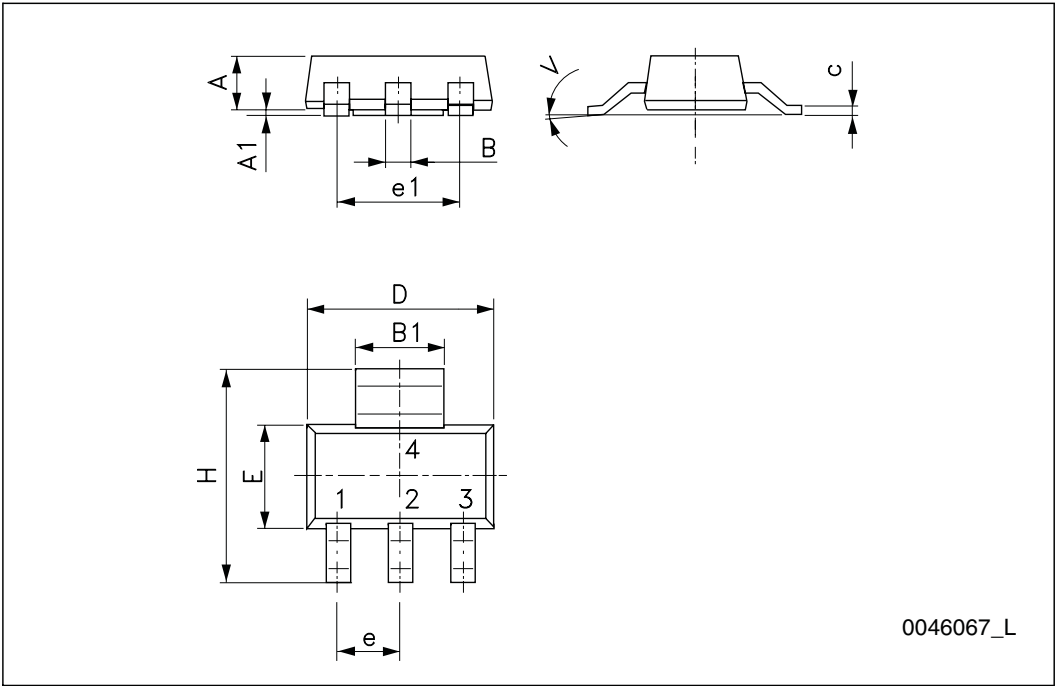
Figure 13. Resistive load switching test circuit



### 3      **Package mechanical data**

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| SOT-223 mechanical data |      |      |      |
|-------------------------|------|------|------|
| DIM.                    | mm.  |      |      |
|                         | min. | typ  | max. |
| A                       |      |      | 1.80 |
| A1                      | 0.02 |      | 0.1  |
| B                       | 0.60 | 0.70 | 0.85 |
| B1                      | 2.90 | 3.00 | 3.15 |
| c                       | 0.24 | 0.26 | 0.35 |
| D                       | 6.30 | 6.50 | 6.70 |
| e                       |      | 2.30 |      |
| e1                      |      | 4.60 |      |
| E                       | 3.30 | 3.50 | 3.70 |
| H                       | 6.70 | 7.00 | 7.30 |
| V                       |      |      | 10 ° |





## 4 Revision history

**Table 5. Document revision history**

| Date        | Revision | Changes     |
|-------------|----------|-------------|
| 16-Mar-2009 | 1        | First issue |

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