# STN851

## Low voltage fast-switching NPN power transistor

## Features

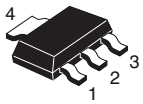
- Very low collector to emitter saturation voltage
- High current gain characteristic
- Fast-switching speed

## Applications

- Emergency lighting
- Voltage regulators
- Relay drivers
- 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.




**SOT-223**

**Figure 1. Internal schematic diagram**

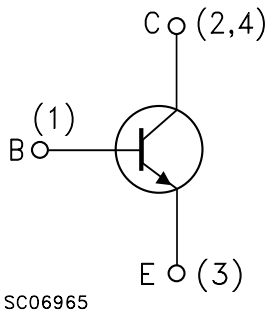



**Table 1. Device summary**

| Order code | Marking | Package | Packaging |
|---|---|---|---|
| STN851 | 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 |
|---|---|---|---|
| $R_{thj\text{-}amb}$ | Thermal resistance junction-ambient (1) | 78 | °C/W |

1. Device mounted on a p.c.b. area of 1 $cm^2$

# 2 Electrical characteristics

($T_{case}$ = 25 °C unless otherwise specified)

**Table 4. Electrical characteristics**

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

1. Pulse duration = 300 µs, duty cycle ≤ 1.5%

## 2.1 Electrical characteristics (curves)

**Figure 2. Derating curve**

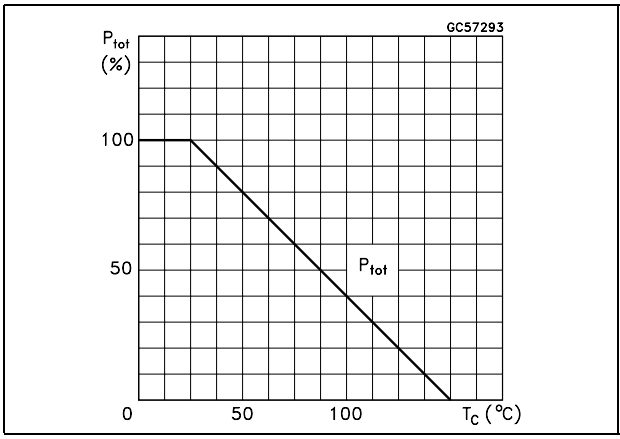



**Figure 3. DC current gain**

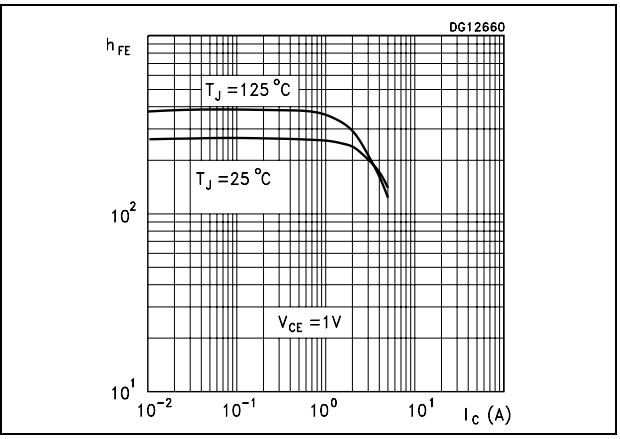



**Figure 4. Collector-emitter saturation voltage**

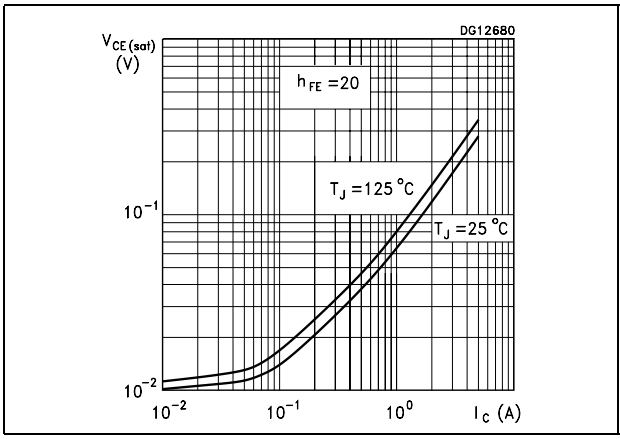



**Figure 5. Collector-emitter saturation voltage**

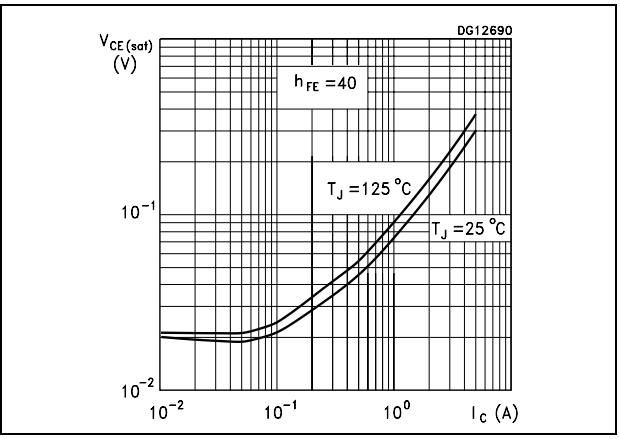



**Figure 6. Base-emitter saturation voltage**

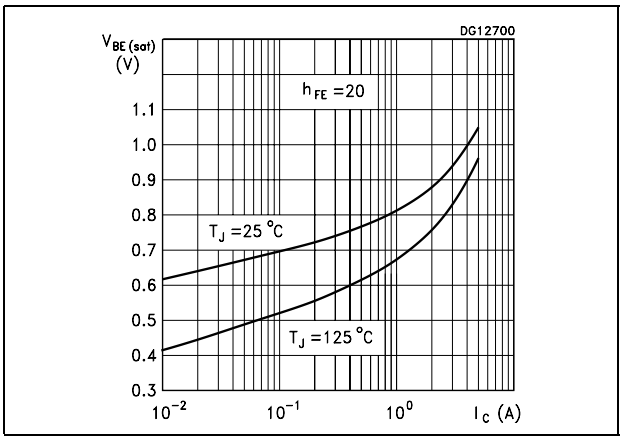



**Figure 7. Base-emitter on voltage**

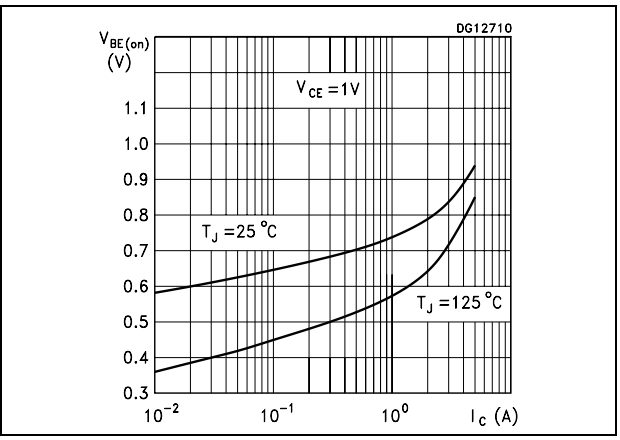


**Figure 8. Resistive load switching time**

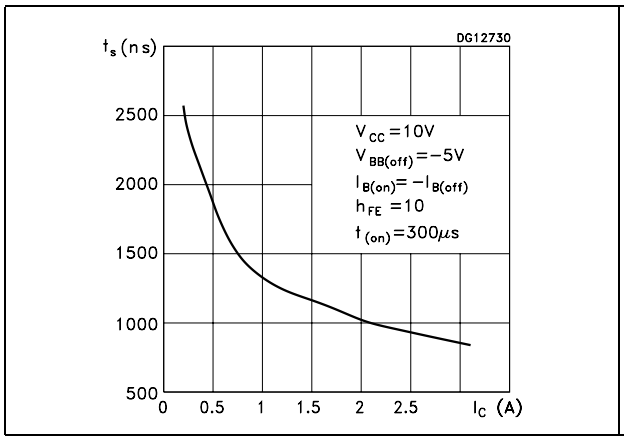



**Figure 9. Resistive load switching time**

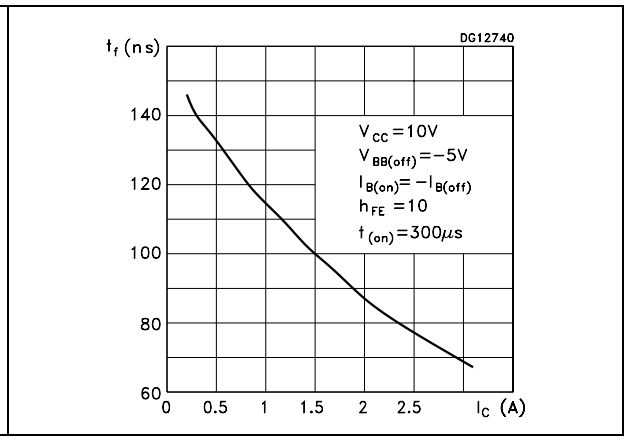



**Figure 10. Resistive load switching time**

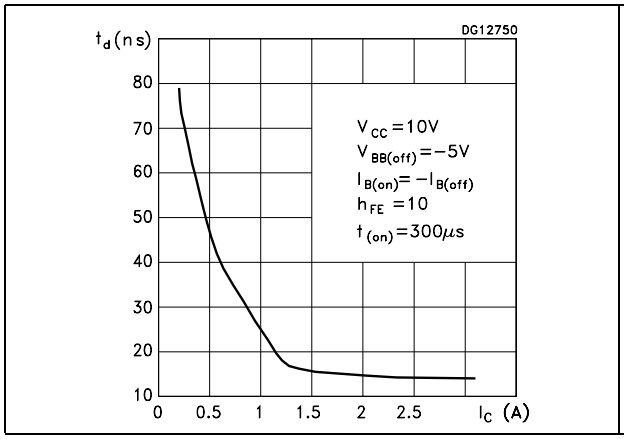



**Figure 11. Inductive load switching time**

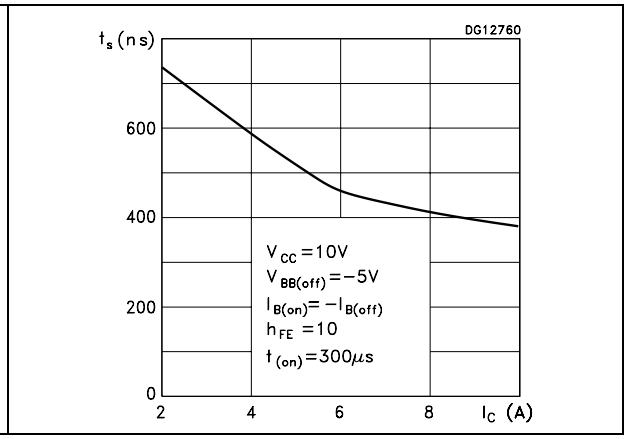
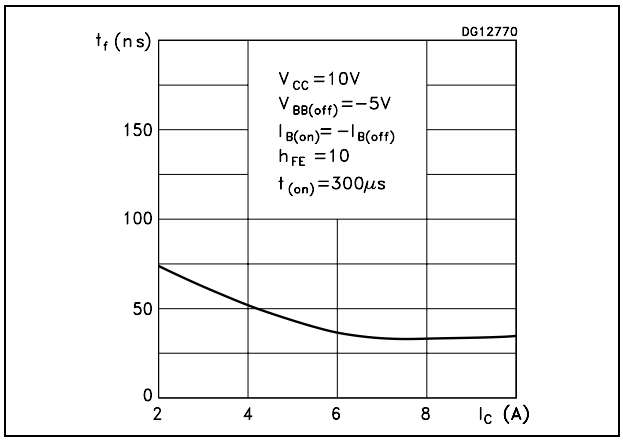
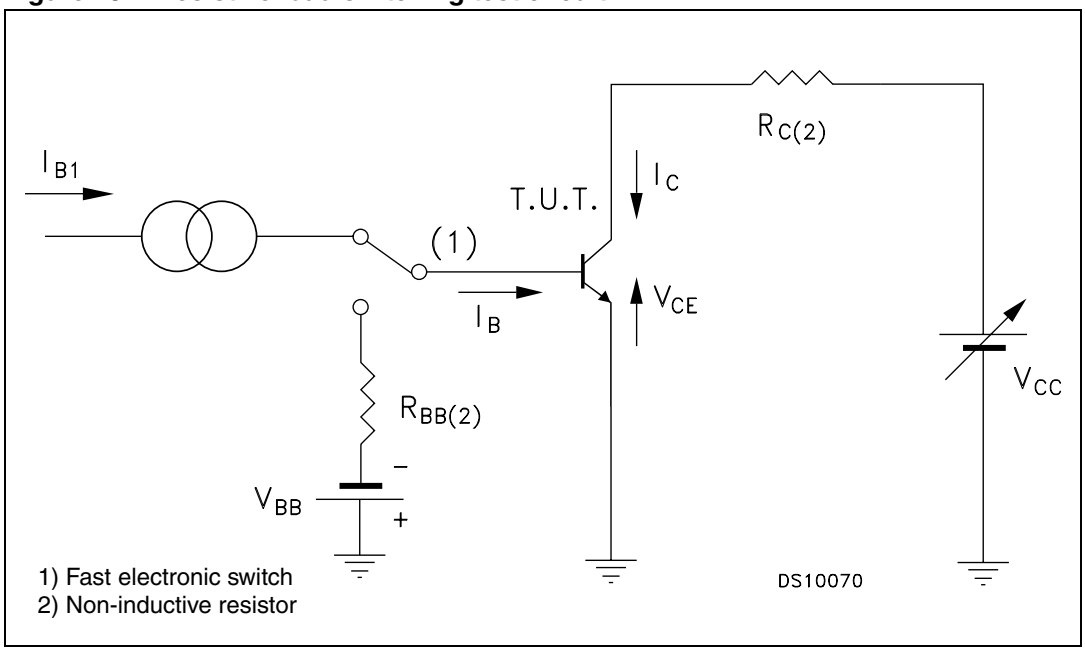



**Figure 12. Inductive load switching time**



## 2.2 Test circuit

**Figure 13. Resistive load switching test circuit**

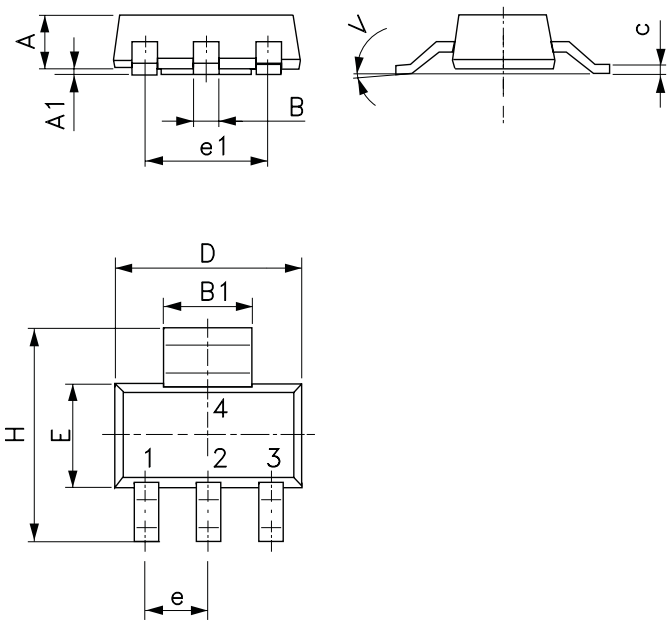


# 3 Package mechanical data

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 products status are available at: www.st.com. ECOPACK is an ST trademark.

## 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 $^{o}$ |



# 4 Revision history

Table 5. Document revision history

| Date | Revision | Changes |
|---|---|---|
| 09-Sep-2003 | 6 | |
| 16-Mar-2009 | 7 | Updated SOT-223 mechanical data |

**Please Read Carefully:**

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST’s terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

**UNLESS OTHERWISE SET FORTH IN ST’S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.**

**UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZE REPRESENTATIVE OF ST, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS, WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS “AUTOMOTIVE GRADE” MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER’S OWN RISK.**

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2009 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

**www.st.com**

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

STMicroelectronics:

STN851