

## 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.

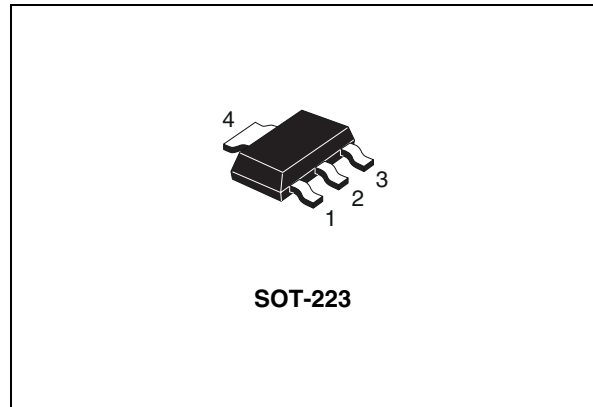


Figure 1. Internal schematic diagram

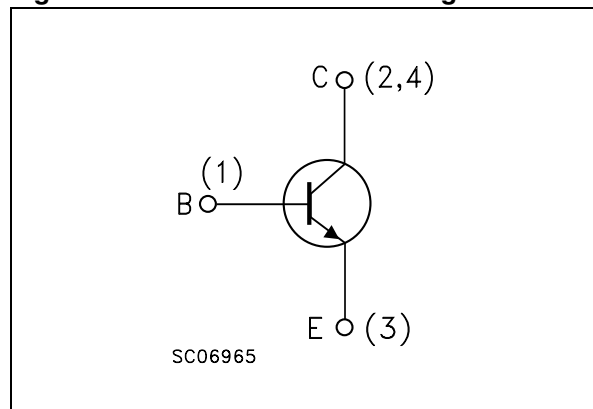


Table 1. Device summary

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

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

**Table 4. Electrical characteristics**

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

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

## 2.1 Electrical characteristics (curves)

Figure 2. Derating curve

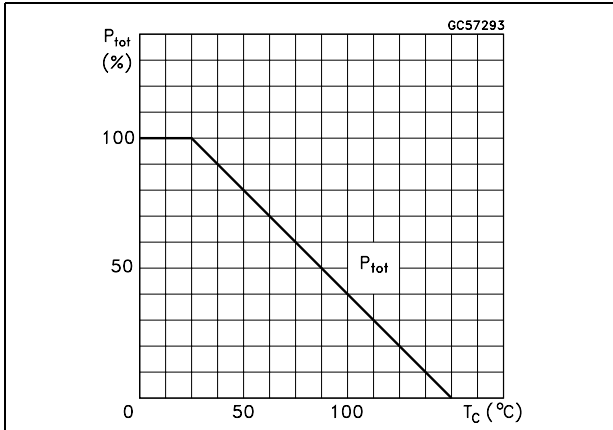


Figure 3. DC current gain

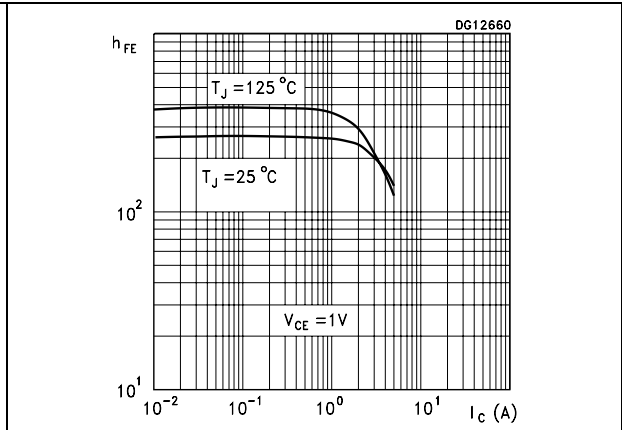


Figure 4. Collector-emitter saturation voltage

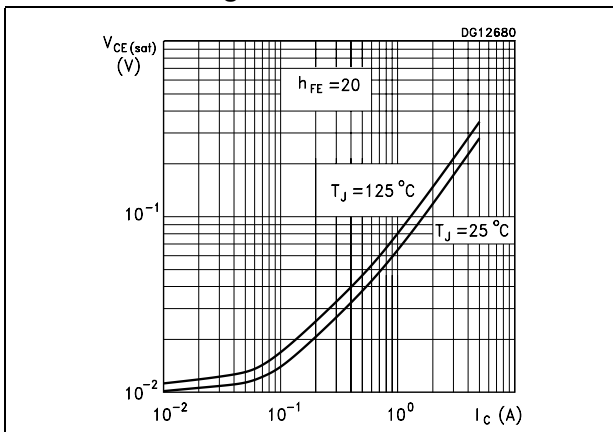


Figure 5. Collector-emitter saturation voltage

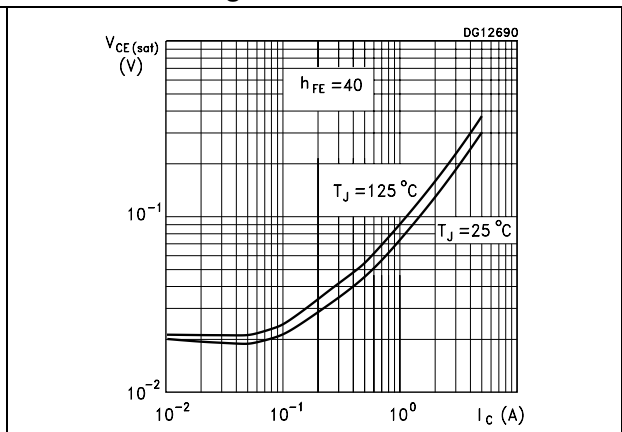


Figure 6. Base-emitter saturation voltage

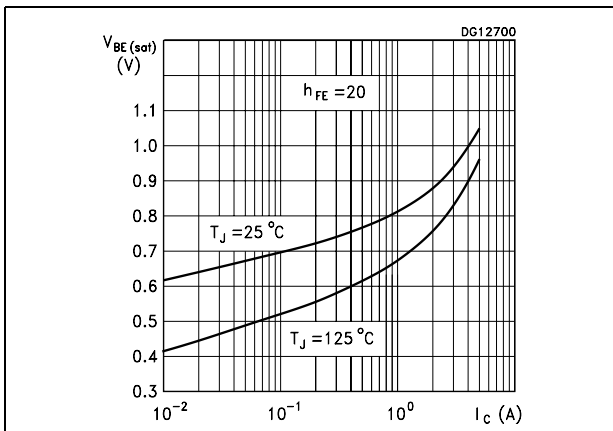


Figure 7. Base-emitter on voltage

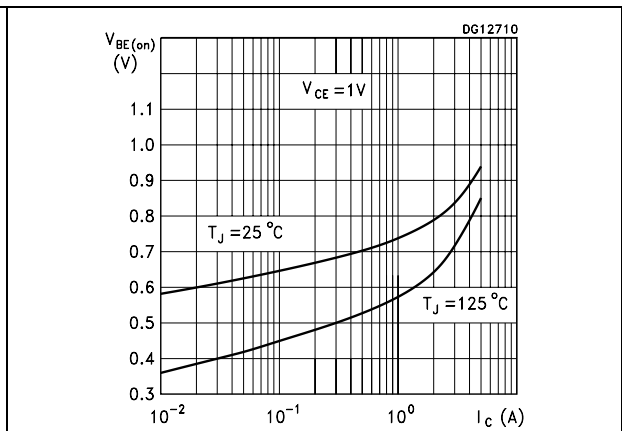


Figure 8. Resistive load switching time

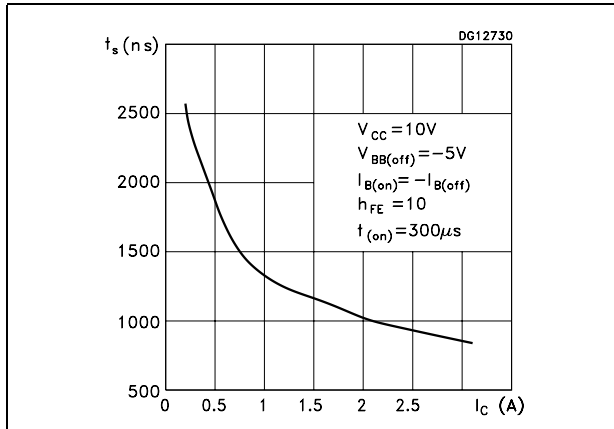


Figure 9. Resistive load switching time

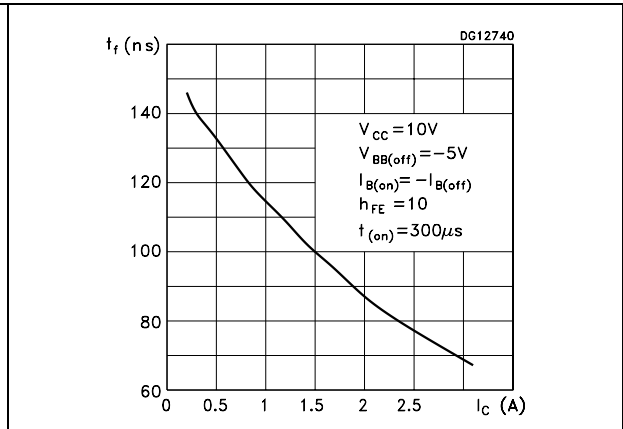


Figure 10. Resistive load switching time

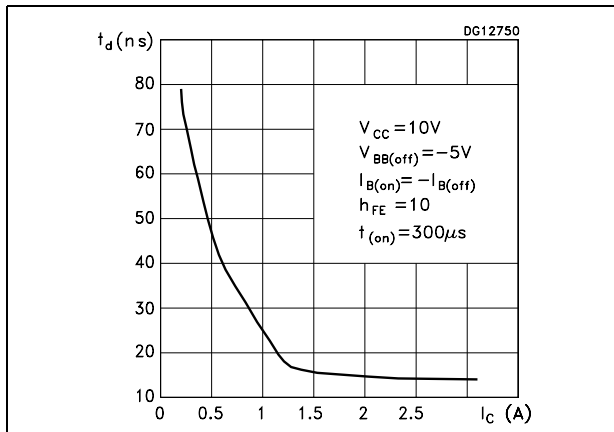


Figure 11. Inductive load switching time

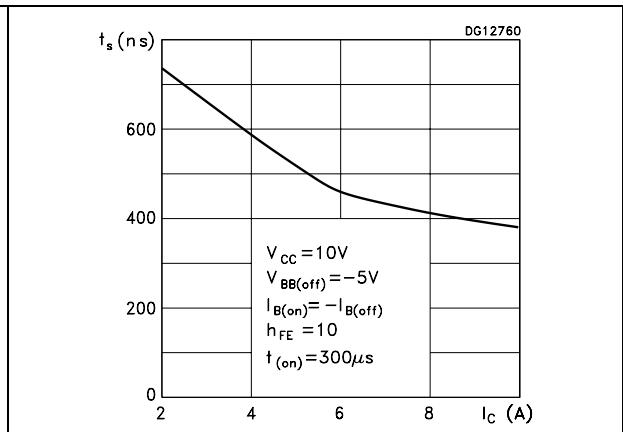
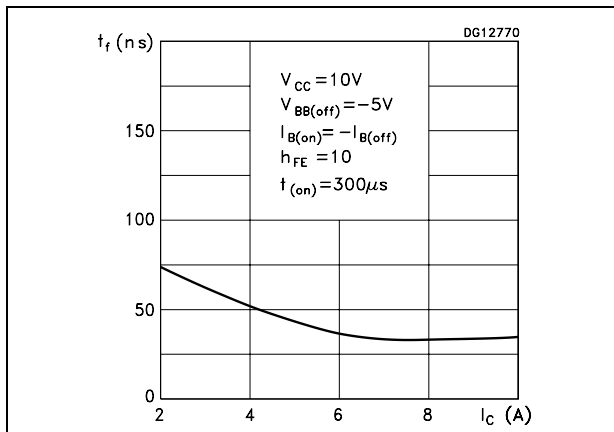
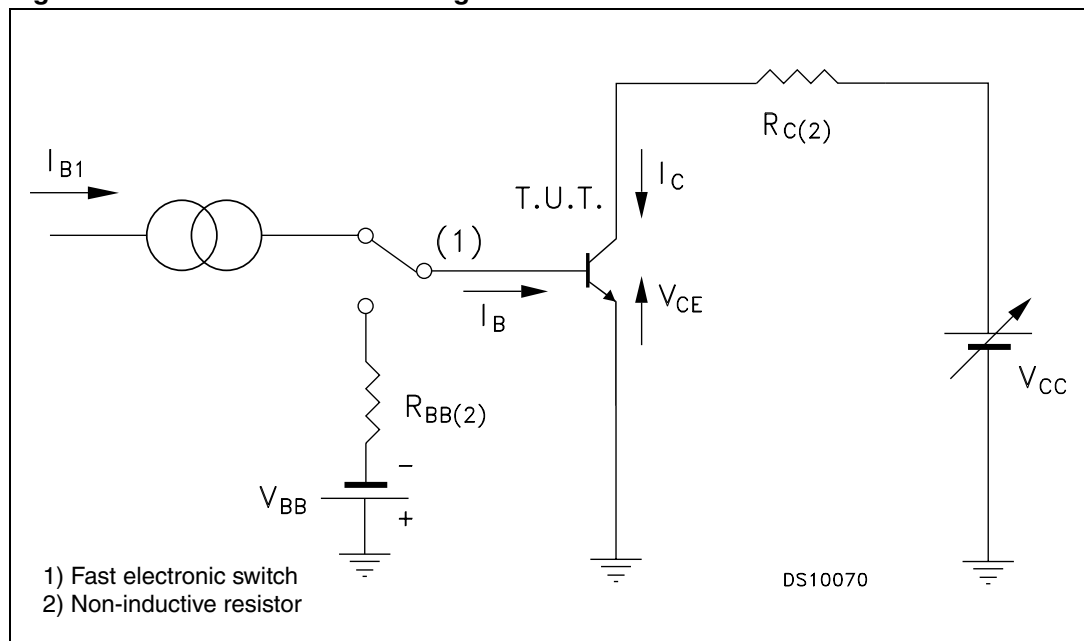


Figure 12. Inductive load switching time



## 2.2 Test circuit

Figure 13. Resistive load switching test circuit

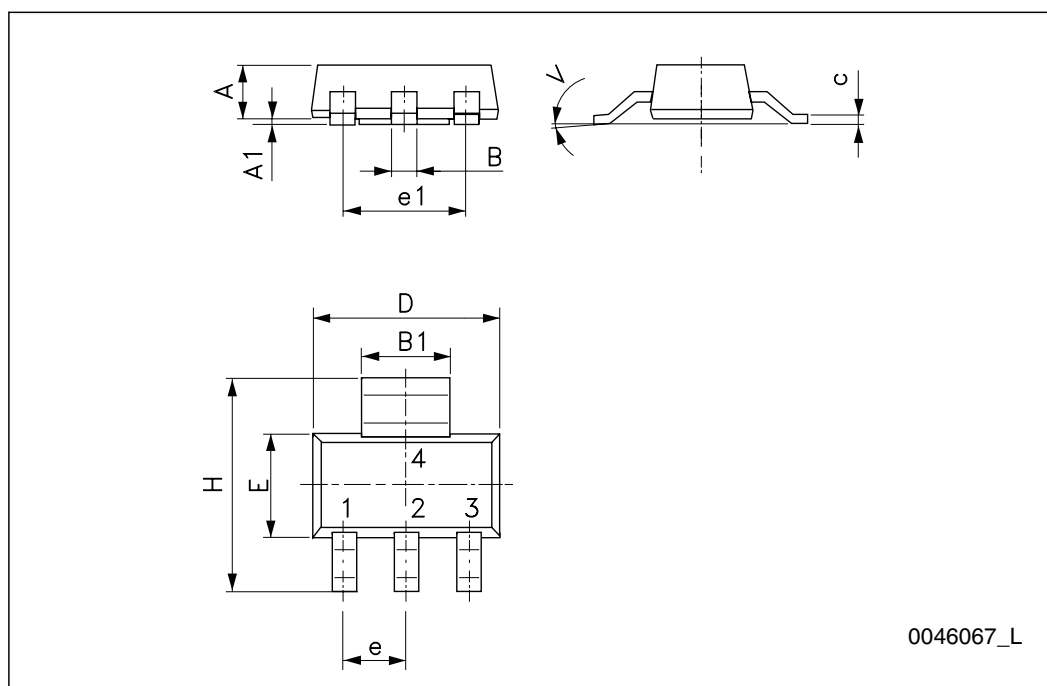


### 3 Package mechanical data

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](http://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 °





## 4 Revision history

Table 5. Document revision history

Date	Revision	Changes
16-Mar-2009	1	First issue

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