

High performance low voltage NPN transistor

Features

- Very low collector to emitter saturation voltage
- DC current gain, $h_{FE} > 100$
- 3 A continuous collector current
- 40 V breakdown voltage $V_{(BR)CER}$
- SOT-223 plastic package for surface mounting circuits in tape and reel packaging

Applications

- Power management in portable equipment
- Voltage regulation in bias supply circuits
- Switching regulator in battery charger applications
- Heavy load driver

Description

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

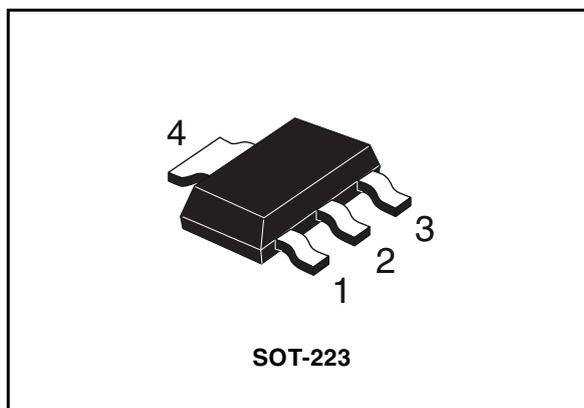


Figure 1. Internal schematic diagram

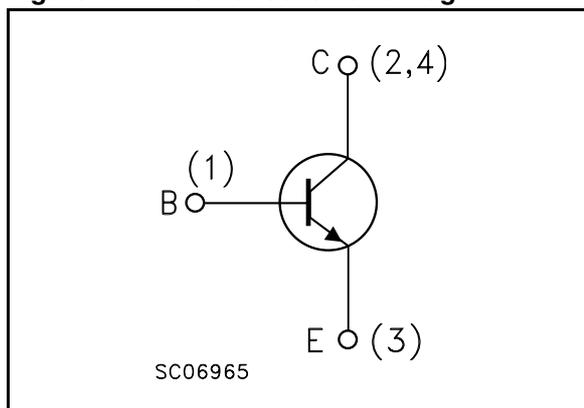


Table 1. Device summary

Order code	Marking	Package	Packaging
STN690A	N690A	SOT-223	Tape and reel

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CBO}	Collector-base voltage ($I_E = 0$)	40	V
V_{CER}	Collector-emitter voltage ($R_{BE} = 47 \Omega$)	40	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	30	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5	V
I_C	Collector current	3	A
I_{CM}	Collector peak current ($t_p < 5$ ms)	6	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-amb ⁽¹⁾ max	78	°C/W

1. Device mounted on PCB area of 1 cm².

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_{CBO}	Collector cut-off current ($I_{\text{E}} = 0$)	$V_{\text{CB}} = 30\text{ V}$			10	μA
		$V_{\text{CB}} = 30\text{ V}; T_{\text{C}} = 100\text{ °C}$			100	μA
I_{EBO}	Emitter cut-off current ($I_{\text{C}} = 0$)	$V_{\text{EB}} = 4\text{ V}$			10	μA
$V_{(\text{BR})\text{CEO}}^{(1)}$	Collector-emitter breakdown voltage ($I_{\text{B}} = 0$)	$I_{\text{C}} = 10\text{ mA}$	30			V
$V_{(\text{BR})\text{CER}}^{(1)}$	Collector-emitter breakdown voltage ($R_{\text{BE}} = 47\ \Omega$)	$I_{\text{C}} = 10\text{ mA}$	40			V
$V_{(\text{BR})\text{CBO}}$	Collector-base breakdown voltage ($I_{\text{E}} = 0$)	$I_{\text{C}} = 100\ \mu\text{A}$	40			V
$V_{(\text{BR})\text{EBO}}$	Emitter-base breakdown voltage ($I_{\text{C}} = 0$)	$I_{\text{E}} = 100\ \mu\text{A}$	5			V
$V_{\text{CE}(\text{sat})}^{(1)}$	Collector-emitter saturation voltage	$I_{\text{C}} = 0.5\text{ A}$ $I_{\text{B}} = 5\text{ mA}$		0.08	0.15	V
		$I_{\text{C}} = 1.2\text{ A}$ $I_{\text{B}} = 20\text{ mA}$		0.1	0.22	V
		$I_{\text{C}} = 2\text{ A}$ $I_{\text{B}} = 20\text{ mA}$		0.175	0.35	V
		$I_{\text{C}} = 3\text{ A}$ $I_{\text{B}} = 100\text{ mA}$		0.2	0.4	V
		$I_{\text{C}} = 3\text{ A}$ $I_{\text{B}} = 100\text{ mA}$ $T_{\text{C}} = 100\text{ °C}$		0.3		V
$V_{\text{BE}(\text{sat})}^{(1)}$	Base-emitter saturation voltage	$I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 10\text{ mA}$		0.8	1	V
$V_{\text{BE}(\text{on})}^{(1)}$	Base-emitter on voltage	$I_{\text{C}} = 1\text{ A}$ $V_{\text{CE}} = 2\text{ V}$		0.8	1	V
$h_{\text{FE}}^{(1)}$	DC current gain	$I_{\text{C}} = 10\text{ mA}$ $V_{\text{CE}} = 2\text{ V}$	100	200	400	
		$I_{\text{C}} = 500\text{ mA}$ $V_{\text{CE}} = 2\text{ V}$	100	200	400	
		$I_{\text{C}} = 1\text{ A}$ $V_{\text{CE}} = 2\text{ V}$	100			
		$I_{\text{C}} = 2\text{ A}$ $V_{\text{CE}} = 1\text{ V}$	100	160		
		$I_{\text{C}} = 3\text{ A}$ $V_{\text{CE}} = 1\text{ V}$	90	130		

Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
f_t	Transition frequency	$I_C = 50 \text{ mA}$ $V_{CE} = 5 \text{ V}$ $f = 50 \text{ MHz}$		100		MHz
t_d	Resistive load Delay time	$I_C = 3 \text{ A}$ $V_{CC} = 20 \text{ V}$		50		ns
t_r	Rise time	$I_{B1} = -I_{B2} = 60 \text{ mA}$		120		ns
t_s	Storage time	see Figure 8		465		ns
t_f	Fall time			80		ns

1. Pulse duration = 300 μs , duty cycle $\leq 1.5\%$

2.1 Electrical characteristics (curves)

Figure 2. DC current gain

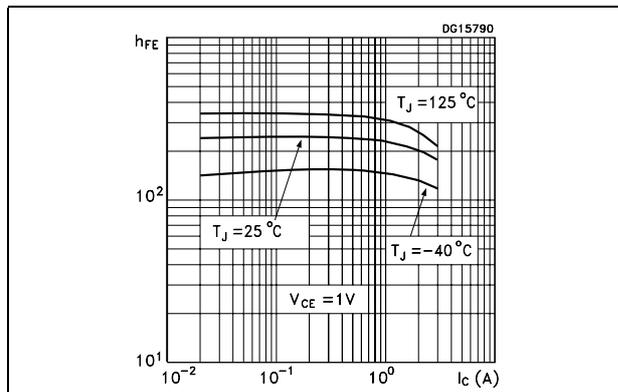


Figure 3. DC current gain

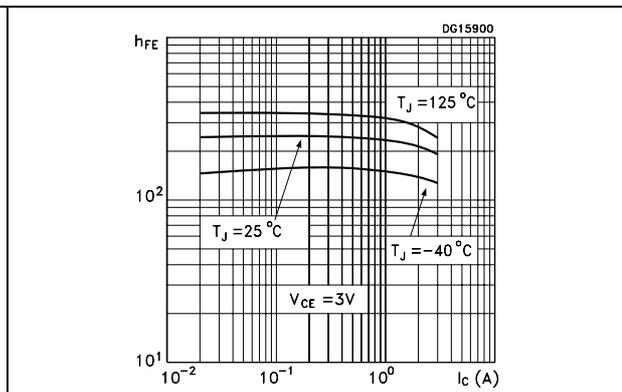


Figure 4. Collector-emitter saturation voltage

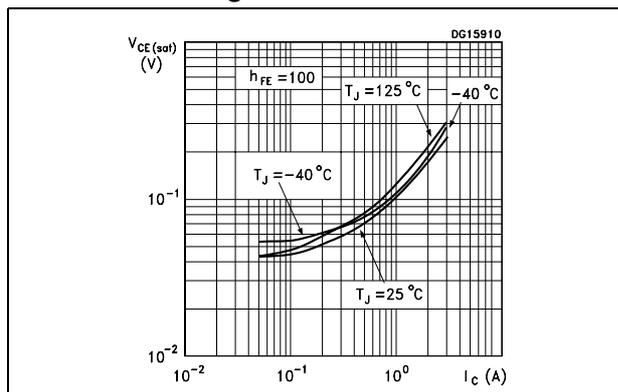


Figure 5. Base-emitter saturation voltage

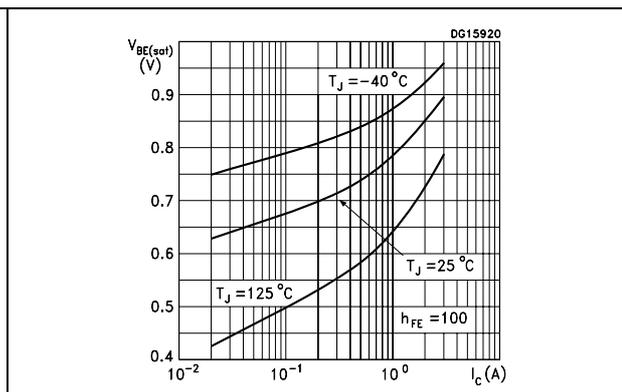
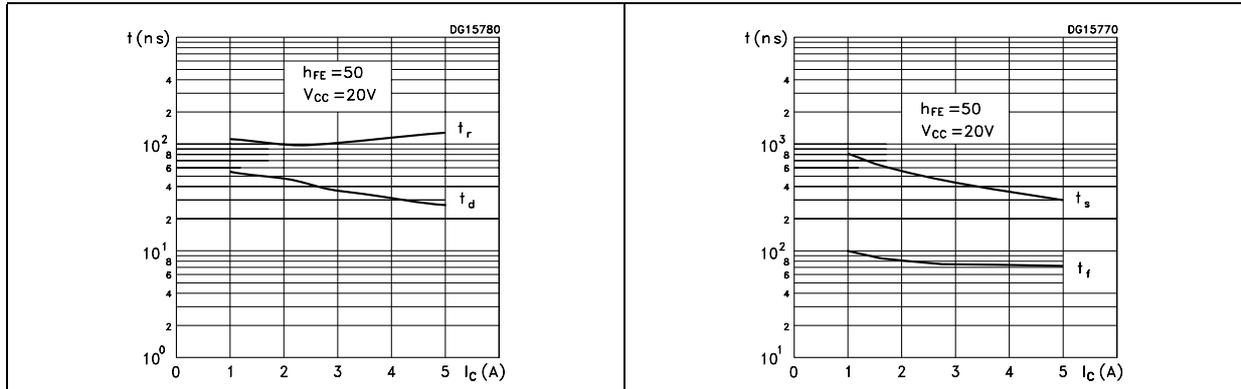


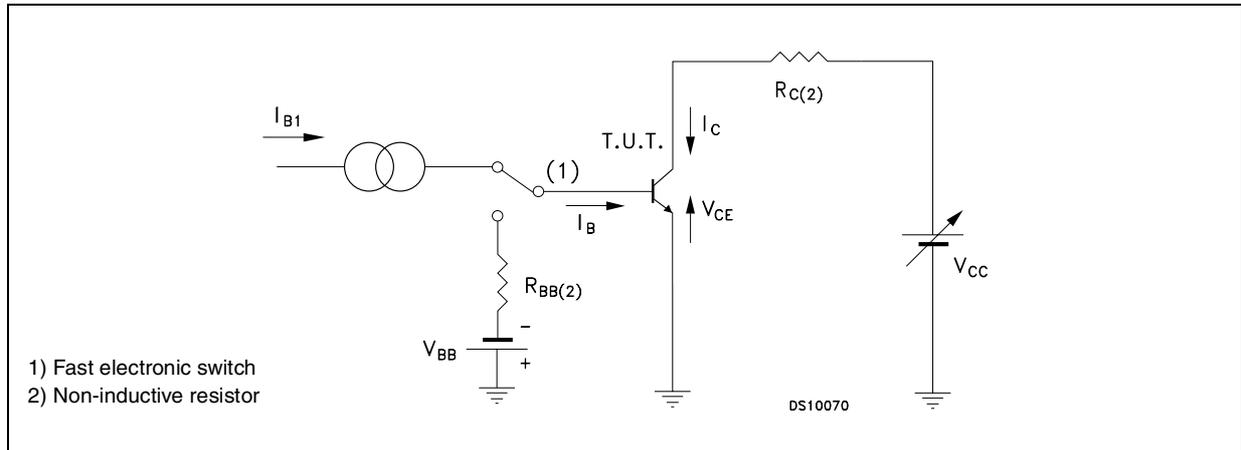
Figure 6. Switching time resistive load

Figure 7. Switching time resistive load



2.2 Test circuit

Figure 8. Resistive load switching test circuit

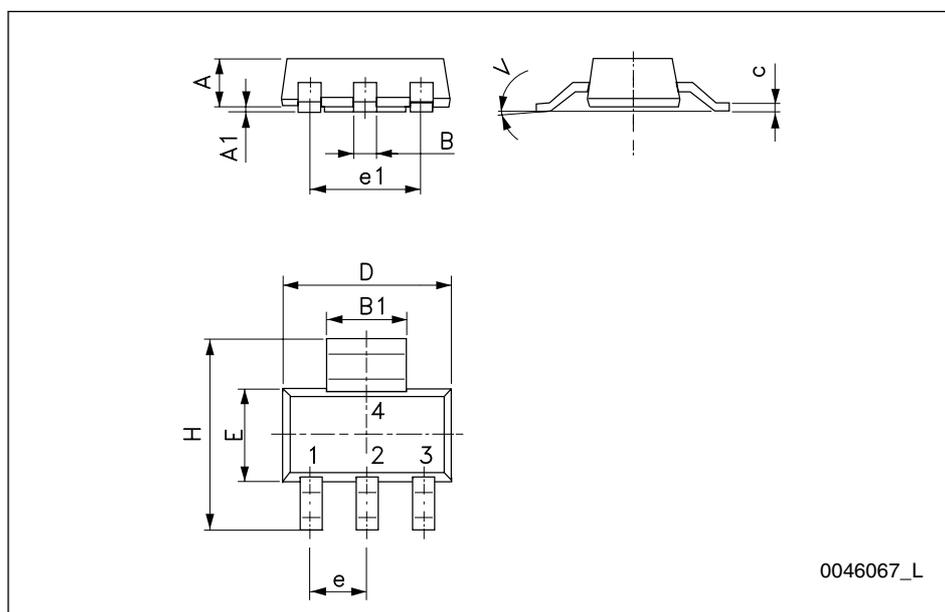


3 Package mechanical data

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°



4 Revision history

Table 5. Document revision history

Date	Revision	Changes
20-Oct-2006	1	Initial release.
10-Feb-2009	2	Updated SOT-223 mechanical data.

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