

## Low voltage fast-switching NPN power transistor

### Features

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

### Applications

- Voltage regulators
- High efficiency low voltage switching applications

### Description

The device is a low voltage NPN transistor with exceptional high gain performance coupled with very low saturation voltage. It is designed in planar technology with "base island" layout.

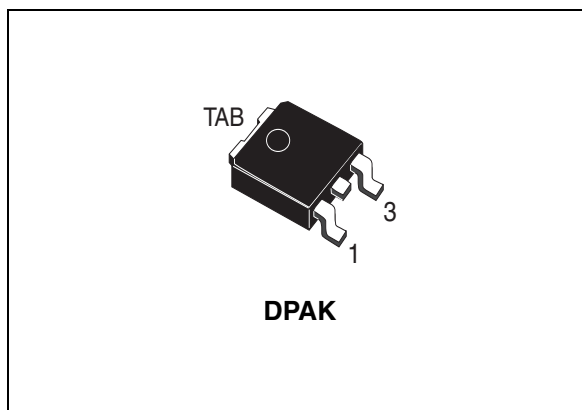


Figure 1. Internal schematic diagram

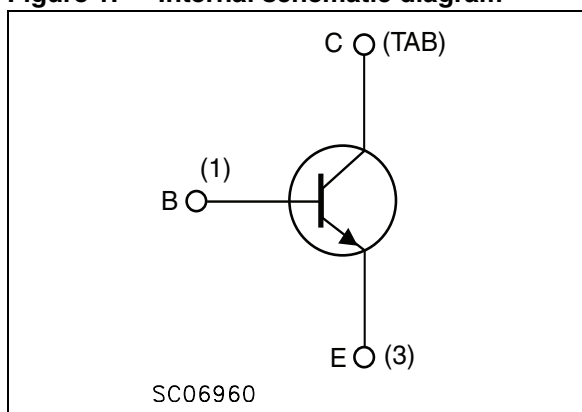


Table 1. Device summary

Order code	Marking	Packages	Packaging
2STD1665T4	D1665	DPAK	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 ( $I_B = 0$ )	65	V
$V_{EBO}$	Emitter-base voltage ( $I_C = 0$ )	7	V
$I_C$	Collector current	6	A
$I_{CM}$	Collector peak current ( $t_P < 5\text{ms}$ )	20	A
$I_B$	Base current	1	A
$P_{tot}$	Total dissipation at $T_a = 25\text{ °C}$	15	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
$R_{thj-a}^{(1)}$	Thermal resistance junction-ambient	max 8.33	°C/W

1. Device mounted on a PCB area of  $1\text{ cm}^2$

## 2 Electrical characteristics

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

**Table 4. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{\text{CBO}}$	Collector cut-off current ( $I_{\text{E}} = 0$ )	$V_{\text{CB}} = 120 \text{ V}$ $V_{\text{CB}} = 120 \text{ V}$ $T_{\text{C}} = 100^{\circ}\text{C}$			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
$V_{(\text{BR})\text{CBO}}^{(1)}$	Collector-base breakdown voltage ( $I_{\text{E}} = 0$ )	$I_{\text{C}} = 100 \mu\text{A}$	150			V
$V_{(\text{BR})\text{CEO}}^{(1)}$	Collector-emitter breakdown voltage ( $I_{\text{B}} = 0$ )	$I_{\text{C}} = 10 \text{ mA}$	65			V
$V_{(\text{BR})\text{EBO}}^{(1)}$	Emitter-base breakdown voltage ( $I_{\text{C}} = 0$ )	$I_{\text{E}} = 100 \mu\text{A}$	7			V
$V_{\text{CE}(\text{sat})}^{(1)}$	Collector-emitter saturation voltage	$I_{\text{C}} = 100 \text{ mA}$ $I_{\text{B}} = 5 \text{ mA}$ $I_{\text{C}} = 1 \text{ A}$ $I_{\text{B}} = 50 \text{ mA}$ $I_{\text{C}} = 2 \text{ A}$ $I_{\text{B}} = 50 \text{ mA}$ $I_{\text{C}} = 6 \text{ A}$ $I_{\text{B}} = 150 \text{ mA}$ $I_{\text{C}} = 6 \text{ A}$ $I_{\text{B}} = 300 \text{ mA}$		50 100 260 230	120 200 600 380	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	$I_{\text{C}} = 4 \text{ A}$ $V_{\text{CE}} = 1 \text{ V}$		0.85	1	V
$h_{\text{FE}}$	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	320 310 175 65	350	
$C_{\text{CBO}}$	Collector-base capacitance ( $I_{\text{E}}=0$ )	$V_{\text{CB}} = 10 \text{ V}$ $f = 1 \text{ MHz}$		45		pF
$t_{\text{on}}$ $t_{\text{s}}$ $t_{\text{f}}$	Resistive load Turn-on time Storage time Fall time	$I_{\text{C}} = 3 \text{ A}$ $V_{\text{CC}} = 10 \text{ V}$ $I_{\text{B}(\text{on})} = -I_{\text{B}(\text{off})} = 300 \text{ mA}$ $V_{\text{BB}(\text{off})} = -5 \text{ V}$		90 800 90		ns ns ns

1. Pulse test: pulse duration  $\leq 300 \mu\text{s}$ , duty cycle  $\leq 2\%$

## 2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

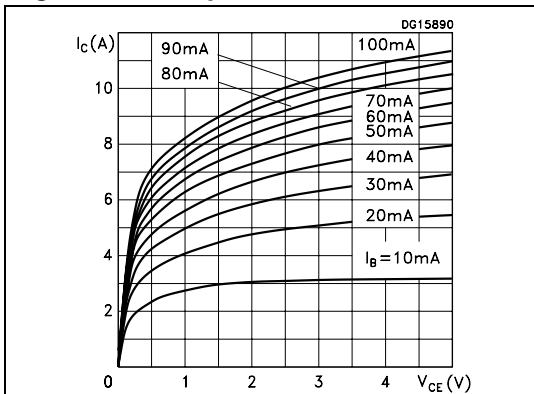


Figure 3. DC current gain

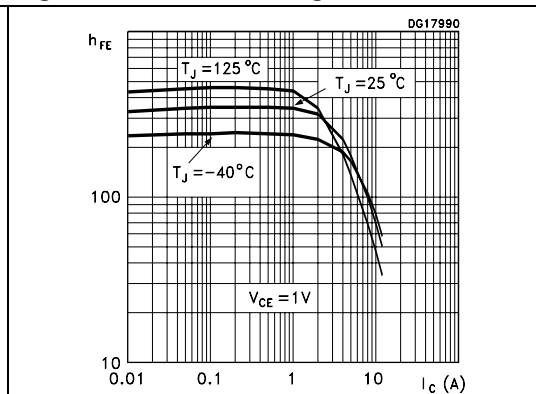


Figure 4. Collector-emitter saturation voltage - ( $h_{FE} = 20$ )

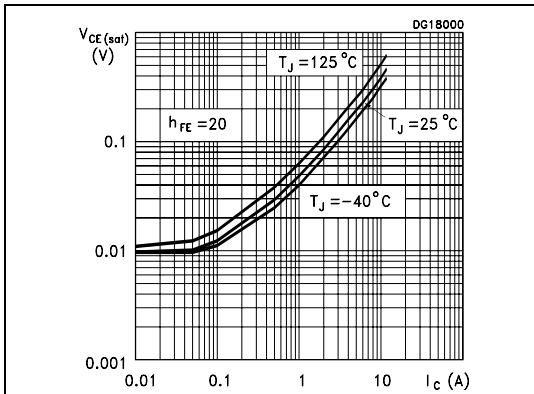


Figure 5. Collector-emitter saturation voltage - ( $h_{FE} = 40$ )

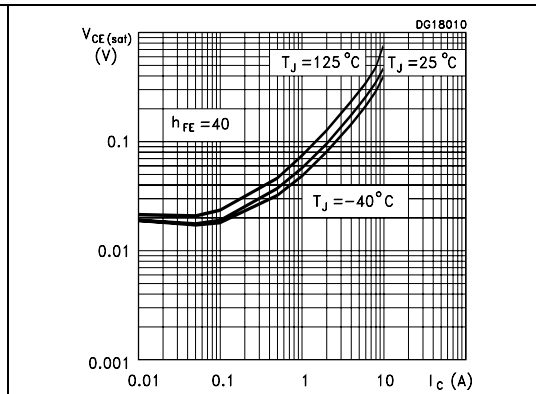


Figure 6. Base-emitter saturation voltage

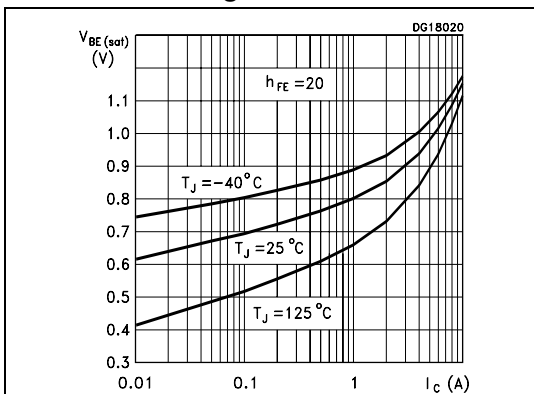
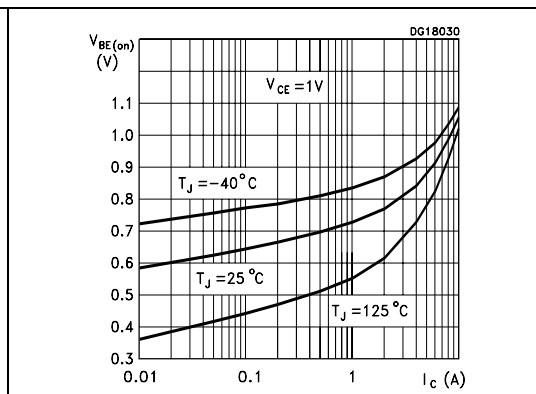
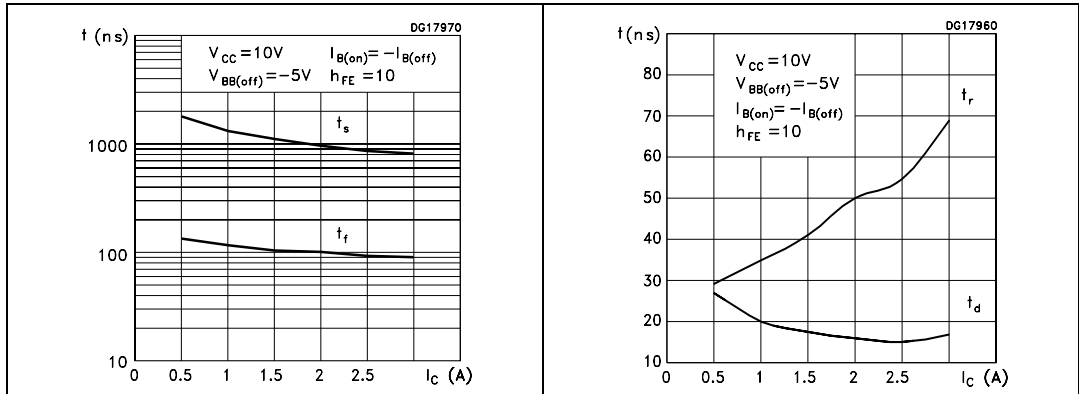


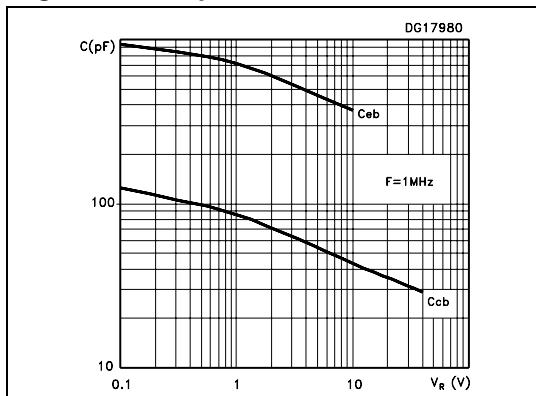
Figure 7. Base-emitter on voltage



**Figure 8. Resistive load switching off**      **Figure 9. Resistive load switching on**

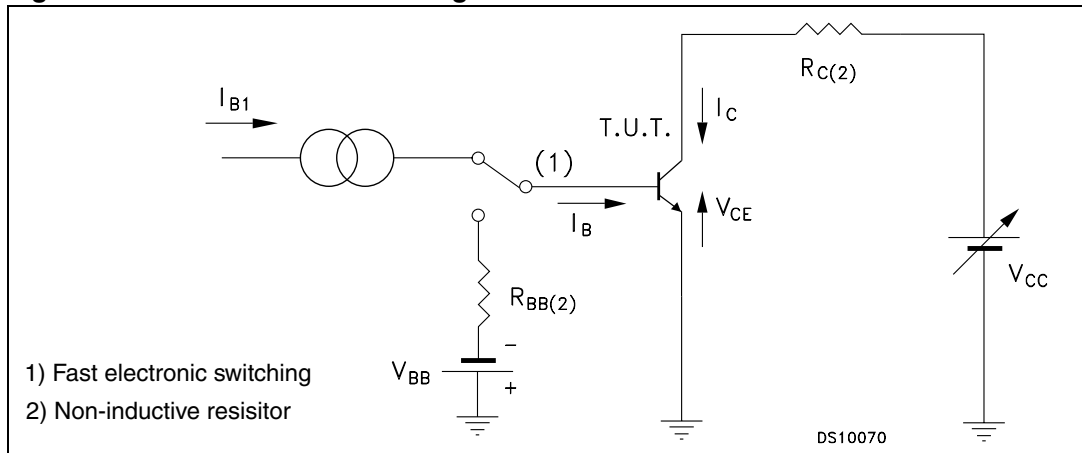


**Figure 10. Capacitance**



## 2.2 Test circuit

**Figure 11. Resistive load switching time**



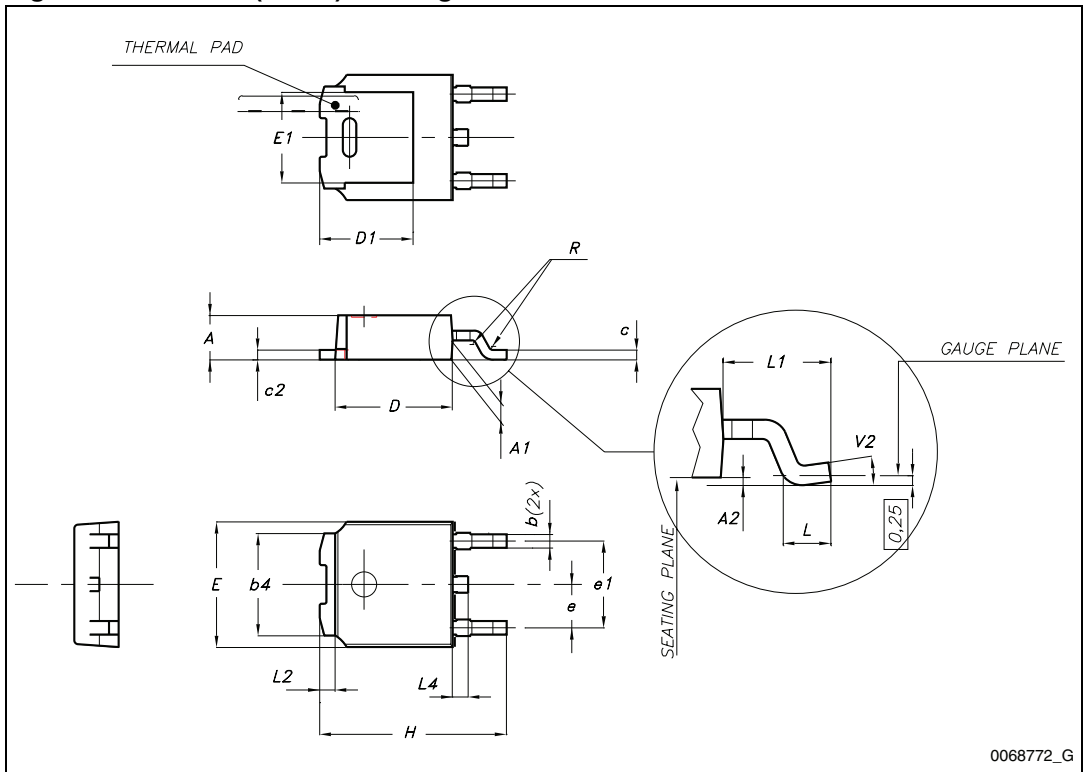
### 3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

Table 5. DPAK (TO-252) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0°		8°

Figure 12. TO-252 (DPAK) drawings





## 4 Revision history

**Table 6. Document revision history**

Date	Revision	Changes
08-May-2006	1	Initial release
27-Mar-2008	2	New graphics
08-Feb-2011	3	Updated <a href="#">Table 2</a> and <a href="#">3</a>

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