

## High voltage fast-switching NPN power transistor

Datasheet - production data

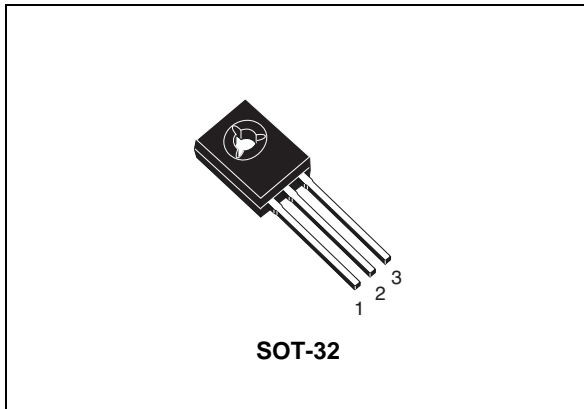
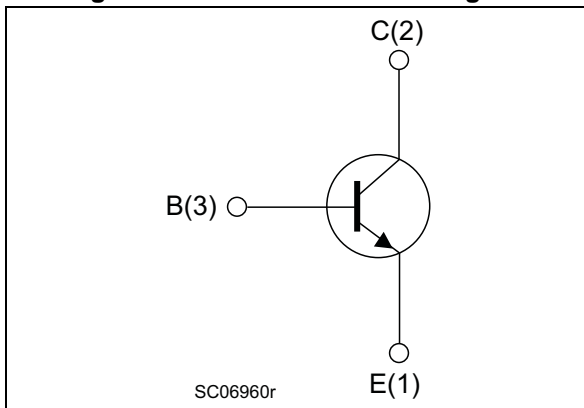


Figure 1. Internal schematic diagram



### Features

- High voltage capability
- Low spread of dynamic parameters
- Very high switching speed

### Applications

- Electronic ballast for fluorescent lighting (CFL)
- SMPS for battery charger

### Description

The device is manufactured using high voltage multi-epitaxial planar technology for high switching speeds and high voltage capability.

It uses a cellular emitter structure with planar edge termination to enhance switching speeds while maintaining the wide RBSOA.

Table 1. Device summary

Part number	Marking	Package	Packaging
ST13003	13003	SOT-32	Tube
ST13003-K	13003	SOT-32	Bag

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-emitter voltage ( $V_{BE} = 0$ )	700	V
$V_{CEO}$	Collector-emitter voltage ( $I_B = 0$ )	400	V
$V_{EBO}$	Emitter-base voltage ( $I_C = 0$ , $I_B = 0.75$ A, $t_P < 10$ $\mu$ s)	$V_{(BR)EBO}$	V
$I_C$	Collector current	1.5	A
$I_{CM}$	Collector peak current ( $t_P < 5$ ms)	3	A
$I_B$	Base current	0.75	A
$I_{BM}$	Base peak current ( $t_P < 5$ ms)	1.5	A
$P_{TOT}$	Total dissipation at $T_C = 25$ °C	40	W
$T_{STG}$	Storage temperature	-55 to 150	°C
$T_J$	Operating junction temperature	-40 to 150	°C

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance junction-case max.	3.1	°C/W

## 2 Electrical characteristics

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

**Table 4. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{\text{CES}}$	Collector cut-off current ( $V_{\text{BE}} = 0$ )	$V_{\text{CE}} = 700\text{ V}$ $V_{\text{CE}} = 700\text{ V}$ $T_{\text{C}} = 125\text{ °C}$			1 5	mA mA
$V_{(\text{BR})\text{EBO}}$	Emitter-Base breakdown voltage ( $I_{\text{C}} = 0$ )	$I_{\text{E}} = 10\text{ mA}$	9		18	V
$V_{\text{CEO(sus)}}^{(1)}$	Collector-emitter sustaining voltage ( $I_{\text{B}} = 0$ )	$I_{\text{C}} = 10\text{ mA}$	400			V
$V_{\text{CE(sat)}}^{(1)}$	Collector-emitter saturation voltage	$I_{\text{C}} = 0.5\text{ A}$ $I_{\text{B}} = 0.1\text{ A}$ $I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 0.25\text{ A}$ $I_{\text{C}} = 1.5\text{ A}$ $I_{\text{B}} = 0.5\text{ A}$			0.5 1 1.5	V V V
$V_{\text{BE(sat)}}^{(1)}$	Base-emitter saturation voltage	$I_{\text{C}} = 0.5\text{ A}$ $I_{\text{B}} = 0.1\text{ A}$ $I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 0.25\text{ A}$			1 1.2	V V
$h_{\text{FE}}$	DC current gain	$I_{\text{C}} = 0.5\text{ A}$ $V_{\text{CE}} = 2\text{ V}$ $I_{\text{C}} = 1\text{ A}$ $V_{\text{CE}} = 2\text{ V}$	8 5		20 25	
$t_{\text{r}}$ $t_{\text{s}}$ $t_{\text{f}}$	Resistive load Rise time Storage time Fall time	$V_{\text{CC}} = 125\text{ V}$ $I_{\text{C}} = 1\text{ A}$ $I_{\text{B1}} = 0.2\text{ A}$ $I_{\text{B2}} = -0.2\text{ A}$ $t_{\text{p}} = 25\text{ }\mu\text{s}$			1 4 0.7	$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
$t_{\text{s}}$	Inductive load Storage time	$I_{\text{C}} = 1\text{ A}$ $I_{\text{B1}} = 0.2\text{ A}$ $V_{\text{BE}} = -5\text{ V}$ $L = 50\text{ mH}$ $V_{\text{Clamp}} = 300\text{ V}$		0.8		$\mu\text{s}$

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

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating areas

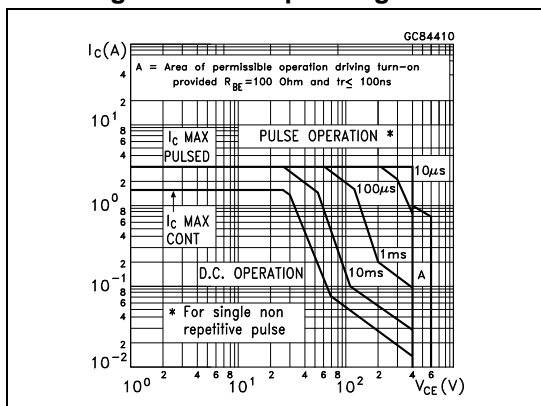


Figure 3. Derating curve

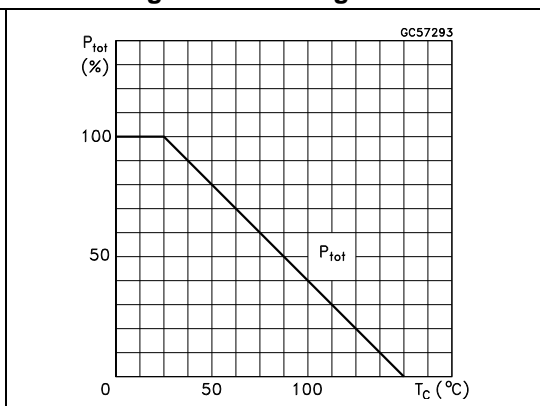


Figure 4. Output characteristics

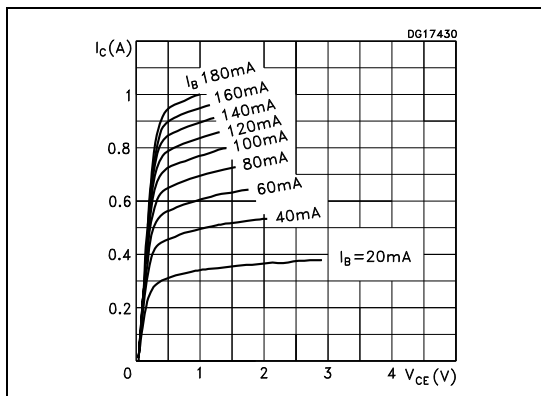


Figure 5. Reverse biased safe operating areas

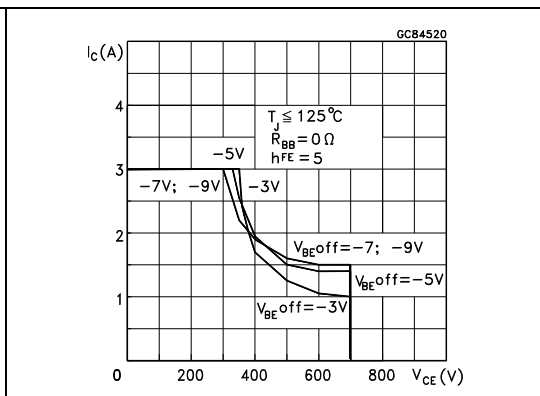


Figure 6. DC current gain ( $V_{CE} = 1\ \text{V}$ )

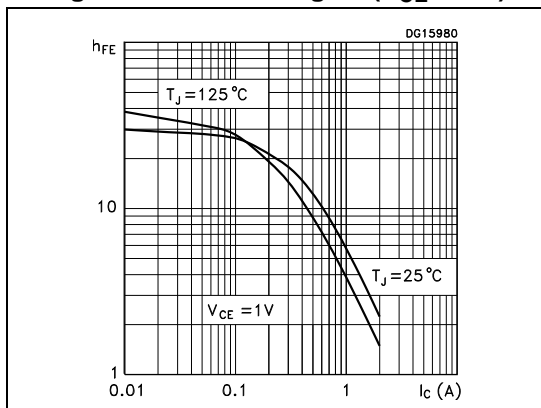


Figure 7. DC current gain ( $V_{CE} = 5\ \text{V}$ )

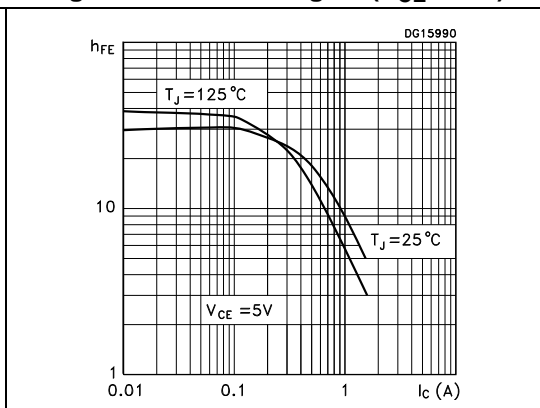


Figure 8. Collector-emitter saturation voltage

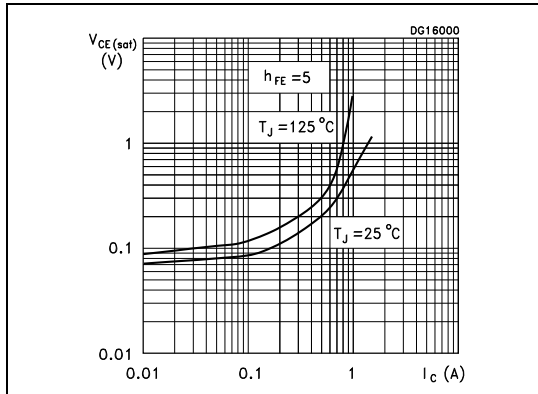


Figure 9. Base-emitter saturation voltage

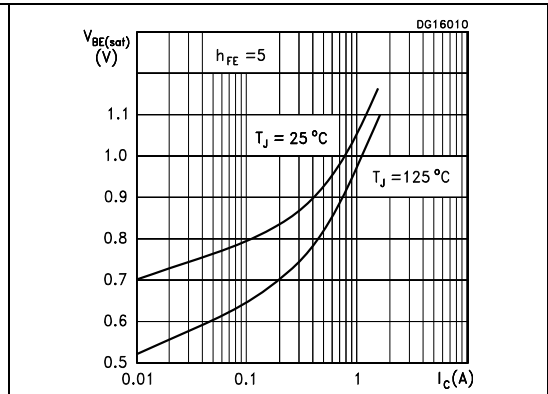


Figure 10. Inductive load switching time

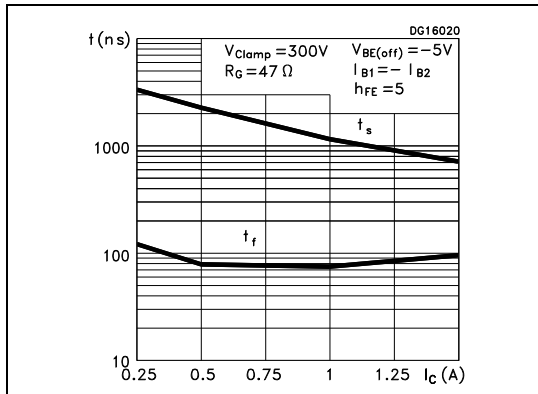
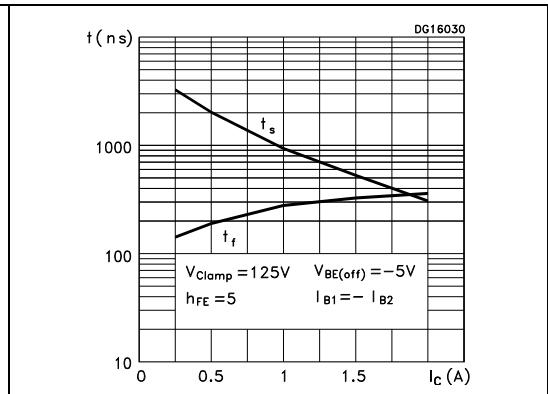
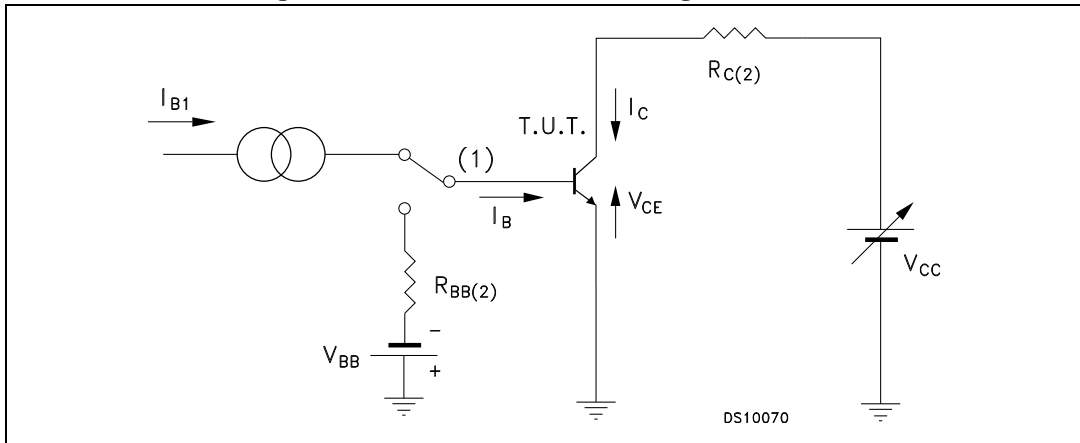


Figure 11. Resistive load switching time



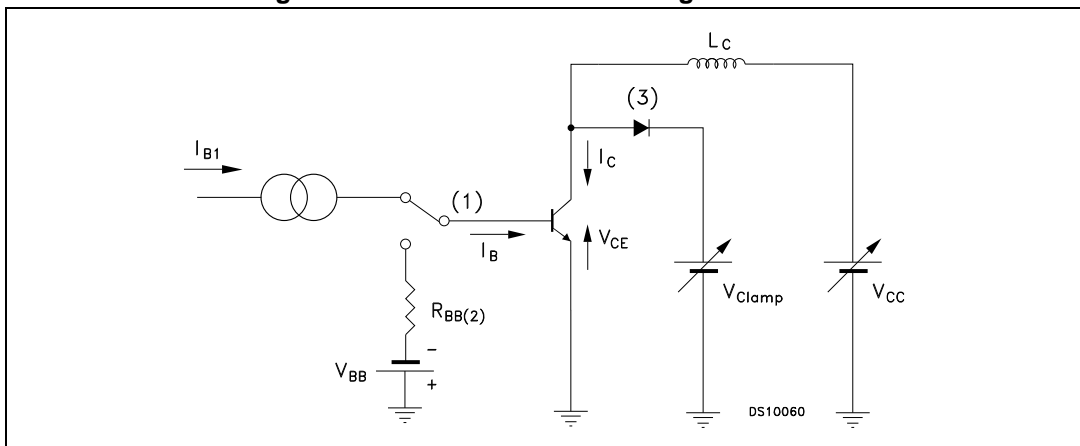
## 2.2 Test circuits

Figure 12. Resistive load switching test circuit



- 1. Fast electronic switch
- 2. Non-inductive resistor

Figure 13. Inductive load switching test circuit



- 1. Fast electronic switch
- 2. Non-inductive resistor
- 3. Fast recovery rectifier

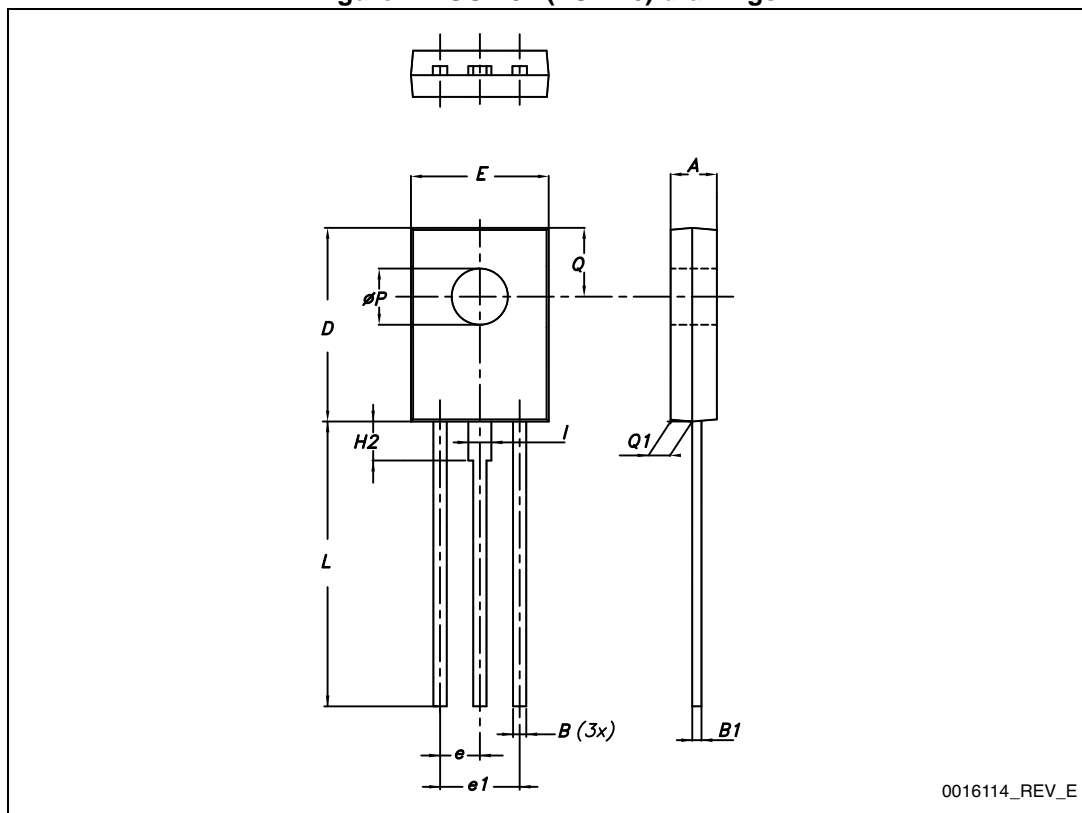
### 3 Package mechanical data

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<sup>®</sup> is an ST trademark.

Table 5. SOT-32 (TO-126) mechanical data

Dim.	mm.		
	Min.	Typ.	Max.
A	2.4		2.9
B	0.64		0.88
B1	0.39		0.63
D	10.5		11.05
E	7.4		7.8
e	2.04	2.29	2.54
e1	4.07	4.58	5.08
L	15.3		16
P	2.9		3.2
Q		3.8	
Q1	1		1.52
H2		2.15	
I		1.27	

Figure 14. SOT-32 (TO-126) drawings



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## 4 Revision history

**Table 6. Document revision history**

Date	Revision	Changes
23-May-2007	1	Initial release.
09-Jul-2008	2	Added <a href="#">Table 1 on page 1</a> .
15-Dec-2009	3	Added <a href="#">Table 3: Thermal data on page 2</a> .
15-Jun-2011	4	Modified: <a href="#">Table 2</a>
18-Jun-2013	5	Added device ST13003.

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