

## High voltage fast-switching NPN power transistor

### Features

- High voltage capability
- Low spread of dynamic parameters
- Minimum lot-to-lot spread for reliable operation
- Very high switching speed

### Applications

- Compact fluorescent lamps (CFLs)
- 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.

The STX13003G and STX13003G-AP are supplied using halogen-free molding compound.

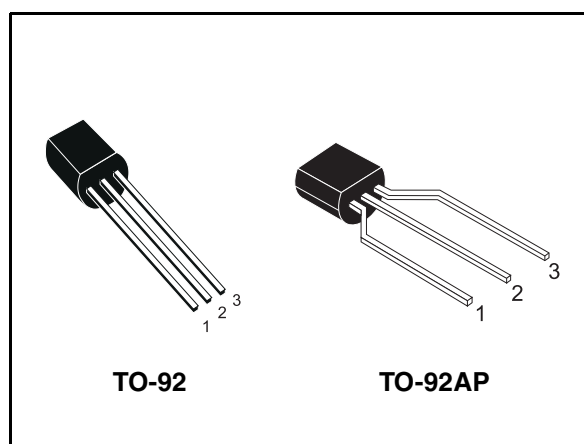


Figure 1. Internal schematic diagram

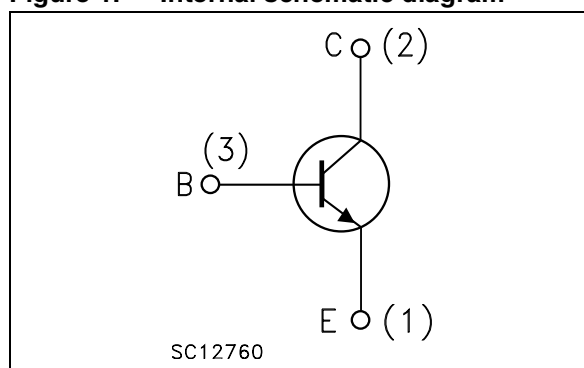


Table 1. Device summary

Order codes	Marking	Package	Packaging
STX13003	X13003	TO-92	Bulk
STX13003G	X13003G	TO-92	Bulk
STX13003-AP	X13003	TO-92AP	Ammopack
STX13003G-AP	X13003G	TO-92AP	Ammopack

# 1 Electrical ratings

**Table 2. Absolute maximum rating**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-emitter voltage ( $V_{BE} = 0$ )	700	V
$V_{CEO}$	Collector-emitter voltage ( $I_B = 0$ )	400	V
$V_{EBO}$	Collector-base voltage ( $I_C = 0$ , $I_B = 0.5A$ , $t_p < 10$ ms)	$V_{(BR)EBO}$	V
$I_C$	Collector current	1	A
$I_{CM}$	Collector peak current ( $t_p < 5$ ms)	3	A
$I_B$	Base current	0.5	A
$I_{BM}$	Base peak current ( $t_p < 5$ ms)	1.5	A
$P_{TOT}$	Total dissipation at $T_c = 25$ °C	1.5	W
$T_{stg}$	Storage temperature	-65 to 150	°C
$T_J$	Max. operating junction temperature	150	

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	83.3	°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 ( $V_{\text{BE}} = 0$ )	$V_{\text{CE}} = 700\text{ V}$			1	mA
		$V_{\text{CE}} = 700\text{ V}$ $T_{\text{C}} = 125\text{ °C}$			5	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	$I_{\text{C}} = 0.5\text{ A}$ $I_{\text{B}} = 100\text{ mA}$			0.5	V
		$I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 250\text{ mA}$			1	V
		$I_{\text{C}} = 1.5\text{ A}$ $I_{\text{B}} = 500\text{ mA}$			1.5	V
$V_{\text{BE(sat)}}^{(1)}$	Base-emitter saturation voltage	$I_{\text{C}} = 0.5\text{ A}$ $I_{\text{B}} = 100\text{ mA}$			1	V
		$I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 250\text{ mA}$			1.2	V
$h_{\text{FE}}$	DC current gain	$I_{\text{C}} = 0.5\text{ A}$ $V_{\text{CE}} = 2\text{ V}$	8		25	
		$I_{\text{C}} = 1\text{ A}$ $V_{\text{CE}} = 2\text{ V}$	5		25	
$t_{\text{r}}$ $t_{\text{s}}$ $t_{\text{f}}$	Resistive load	$I_{\text{C}} = 1\text{ A}$ $t_{\text{p}} = 25\text{ }\mu\text{s}$ $I_{\text{B1}} = -I_{\text{B2}} = 200\text{ mA}$ $V_{\text{CC}} = 125\text{ V}$ <i>Figure 12.</i>			1	$\mu\text{s}$
	Rise time				4	$\mu\text{s}$
	Storage time				0.7	$\mu\text{s}$
$t_{\text{s}}$	Inductive Load Storage time	$I_{\text{C}} = 1\text{ A}$ $V_{\text{clamp}} = 300\text{ V}$ $I_{\text{B1}} = 200\text{ mA}$ $V_{\text{BE(off)}} = -5\text{ V}$ $L = 50\text{ mH}$ $R_{\text{BB}} = 0$ <i>Figure 13.</i>		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 area

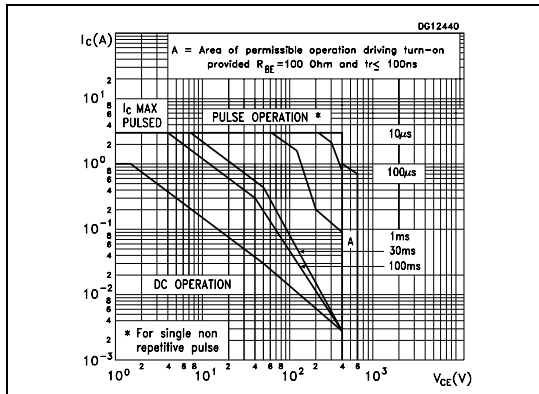


Figure 3. Derating curve

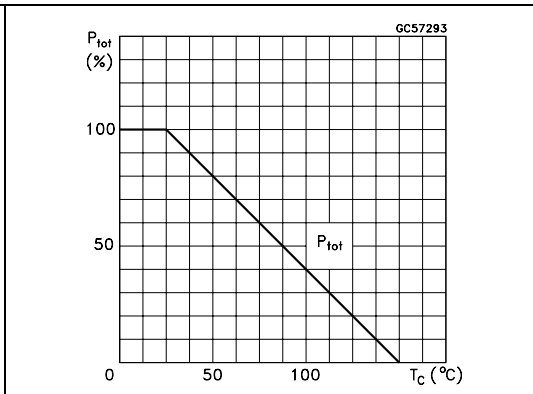


Figure 4. Output characteristics

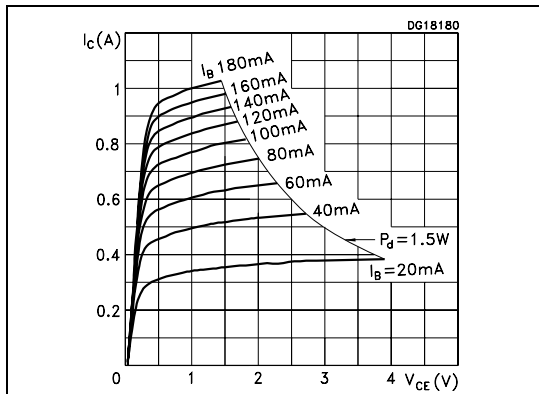


Figure 5. Reverse biased safe operating area

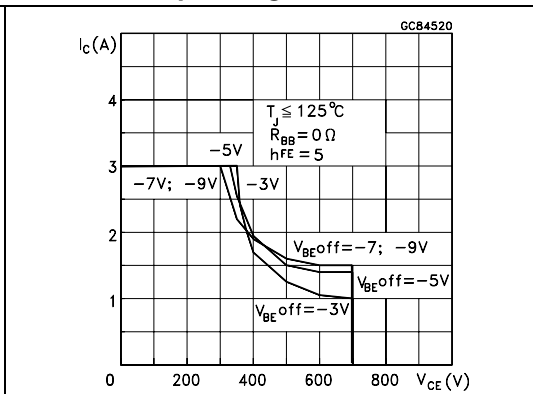


Figure 6. DC current gain

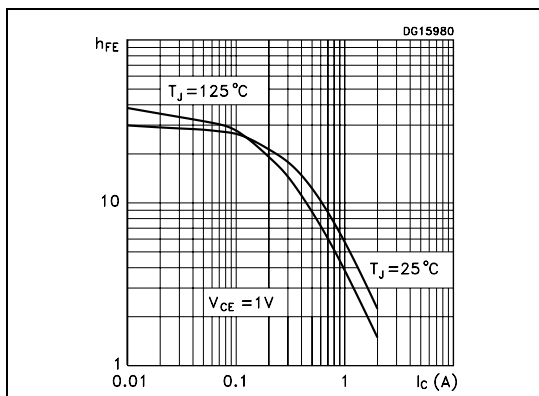
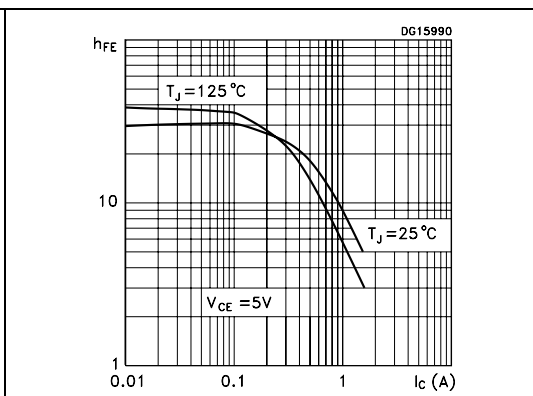
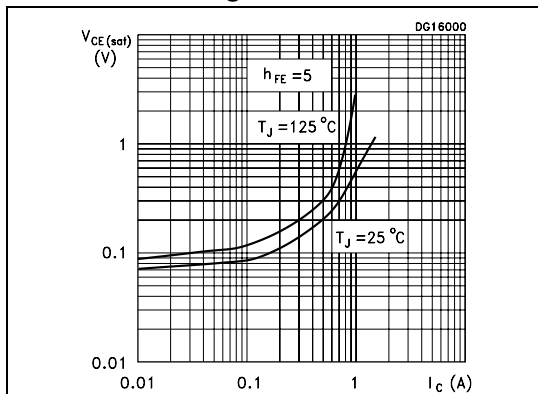


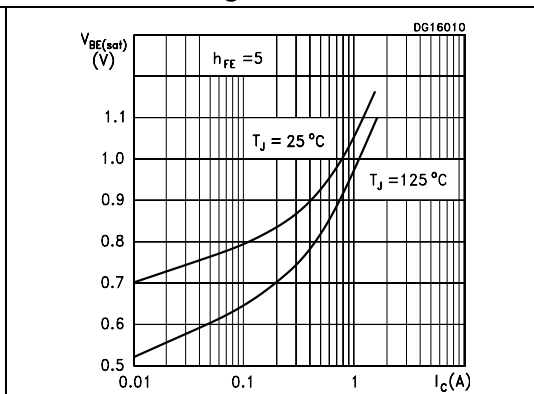
Figure 7. DC current gain



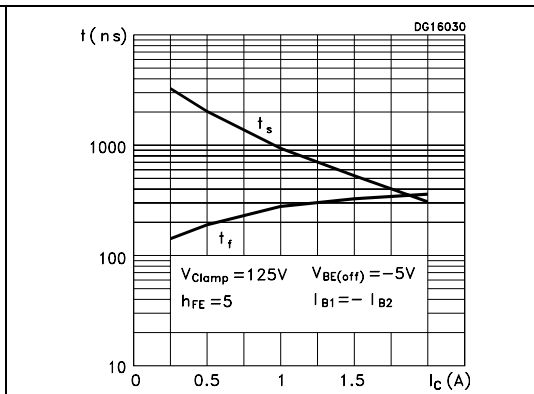
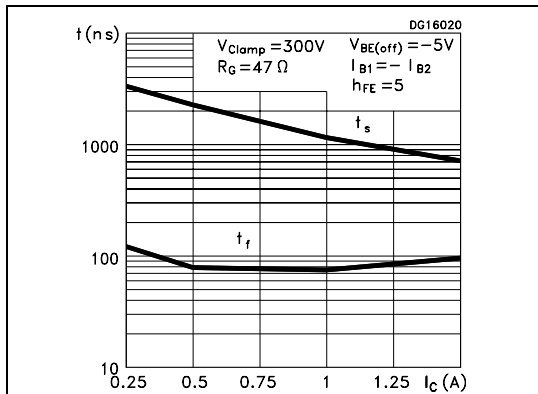
**Figure 8. Collector-emitter saturation voltage**



**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

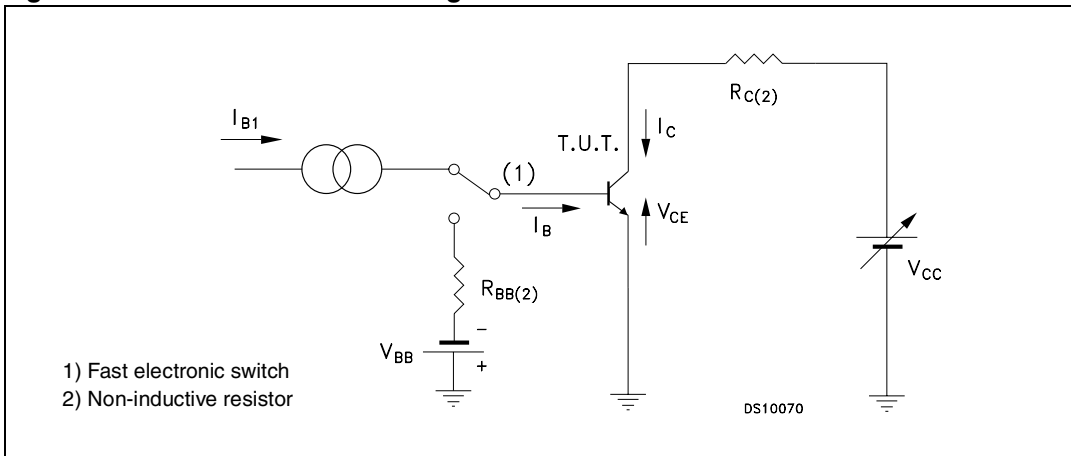
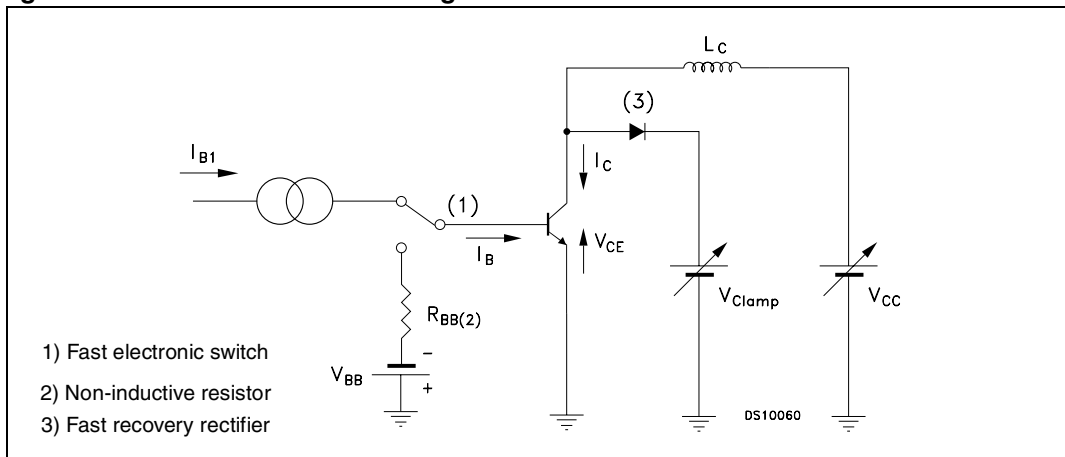


Figure 13. Inductive load switching test circuit

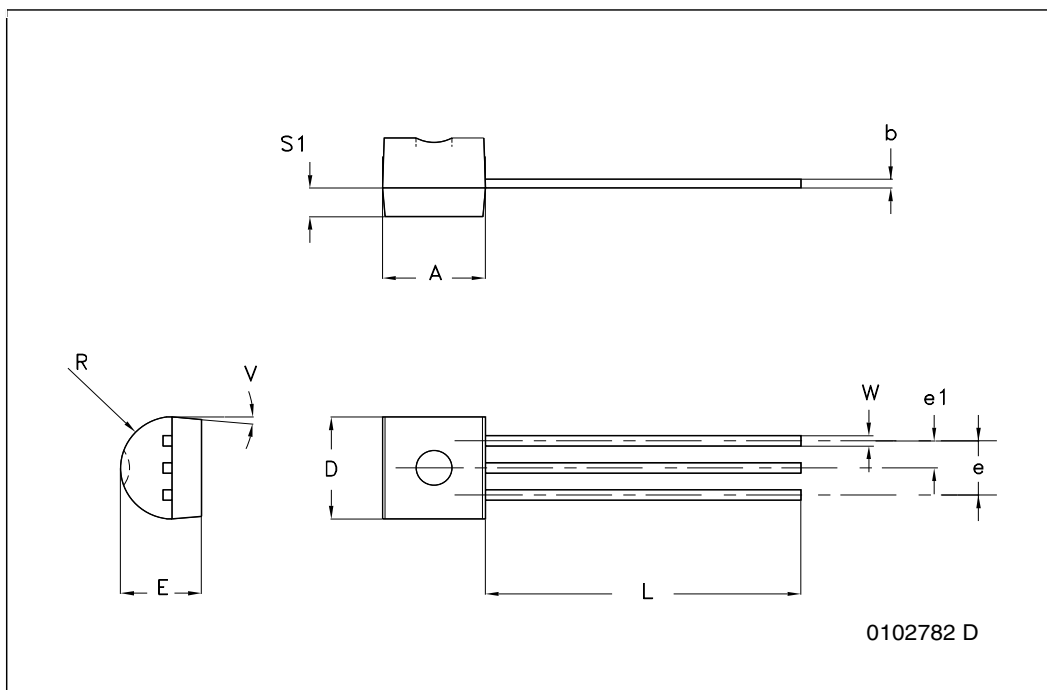


### 3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

**TO-92 bulk shipment mechanical data**

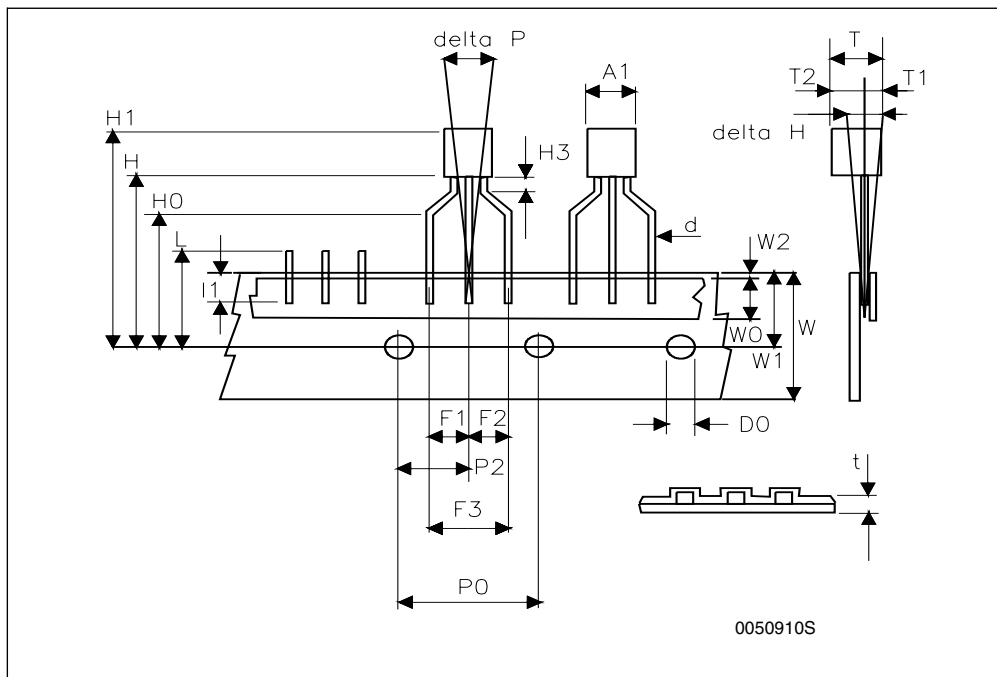
DIM.	mm.		
	MIN.	TYP	MAX.
A	4.32		4.95
b	0.36		0.51
D	4.45		4.95
E	3.30		3.94
e	2.41		2.67
e1	1.14		1.40
L	12.70		15.49
R	2.16		2.41
S1	0.92		1.52
W	0.41		0.56
V		5°	





**TO-92 ammopack shipment (suffix"-AP") mechanical data**

Dim.	mm		
	Min	Typ	Max
A1			4.80
T			3.80
T1			1.60
T2			2.30
d			0.48
P0	12.50	12.70	12.90
P2	5.65	6.35	7.05
F1,F2	2.44	2.54	2.94
F3	4.98	5.08	5.48
delta H	-2.00		2.00
W	17.50	18.00	19.00
W0	5.70	6.00	6.30
W1	8.50	9.00	9.25
W2			0.50
H	18.50		20.50
H3	0.5	1	1.5
H0	15.50	16.00	16.50
H1			25.00
D0	3.80	4.00	4.20
t			0.90
L			11.00
I1	3.00		
delta P	-1.00		1.00



## 4 Revision history

**Table 5. Document revision history**

Date	Revision	Changes
01-Apr-2003	4	
02-Jul-2008	5	Added halogen-free molding compound package.

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