

High voltage fast-switching NPN power transistor

Features

- High voltage capability
- 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.

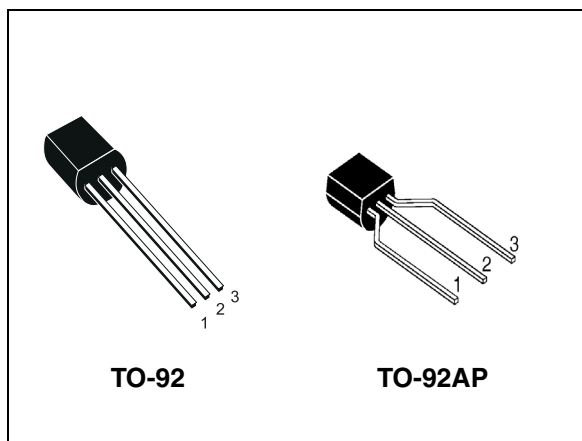


Figure 1. Internal schematic diagram

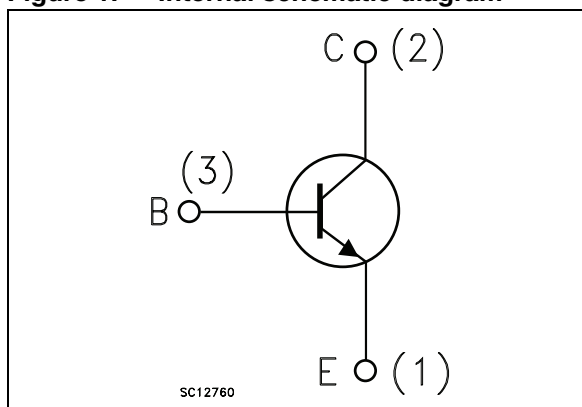


Table 1. Device summary ⁽¹⁾

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

1. The letter "G" in the order code suffix identifies the product as ECOPACK®2 grade. Please see Section 3 for details.

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 ($I_C = 0$, $I_B = 0.5$ A, $t_P < 10$ 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_{thJC}	Thermal resistance junction-case max	83	°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_{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	$I_{\text{C}} = 0.5\text{ A}$ $I_{\text{B}} = 100\text{ mA}$ $I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 250\text{ mA}$ $I_{\text{C}} = 1.5\text{ A}$ $I_{\text{B}} = 500\text{ mA}$			0.5 1 1.5	V V V
$V_{\text{BE(sat)}}^{(1)}$	Base-emitter saturation voltage	$I_{\text{C}} = 0.5\text{ A}$ $I_{\text{B}} = 100\text{ mA}$ $I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 250\text{ mA}$			1 1.2	V V
h_{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		25 25	
t_{r} t_{s} t_{f}	Resistive load Rise time Storage time Fall time	$I_{\text{C}} = 1\text{ A}$ $t_{\text{p}} = 25\text{ }\mu\text{s}$ $I_{\text{B1}} = -I_{\text{B2}} = 200\text{ mA}$ $V_{\text{CC}} = 125\text{ V}$ <i>Figure 12</i>			1 4 0.7	μs μs μs
t_{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		μs

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

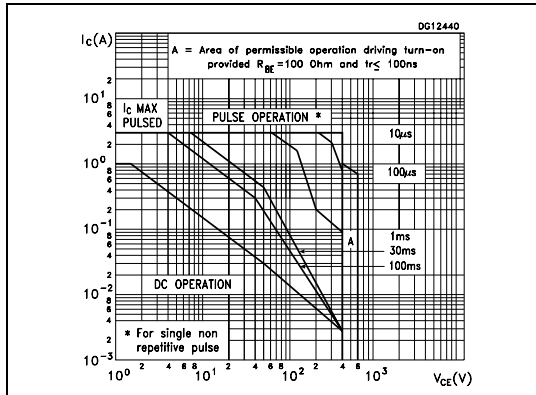


Figure 3. Derating curve

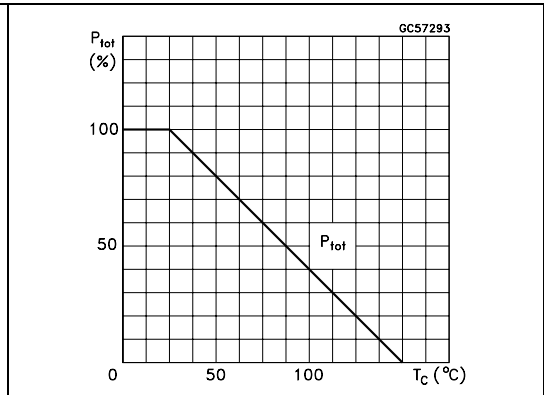


Figure 4. Output characteristics

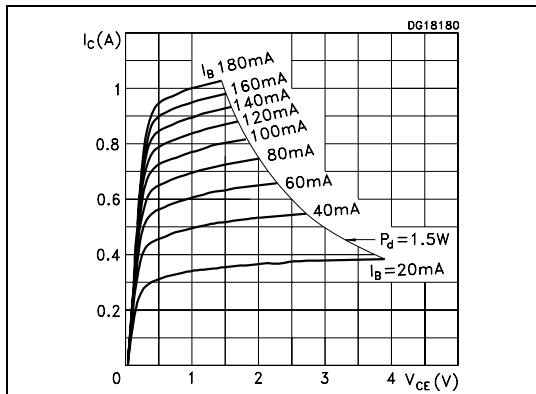


Figure 5. Reverse biased safe operating area

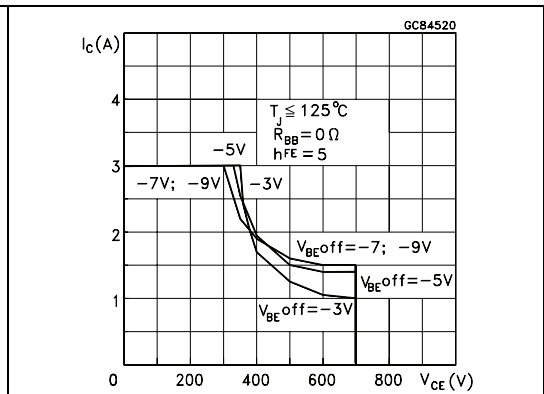


Figure 6. DC current gain ($V_{CE} = 1\text{ V}$)

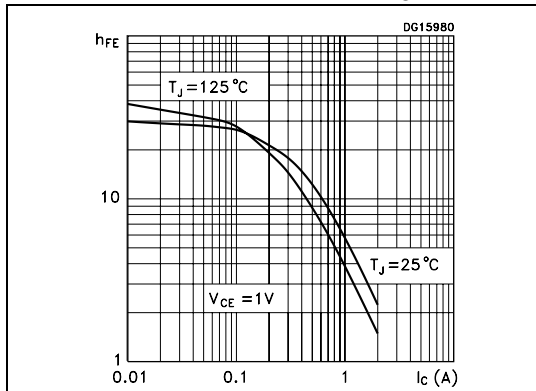


Figure 7. DC current gain ($V_{CE} = 5\text{ V}$)

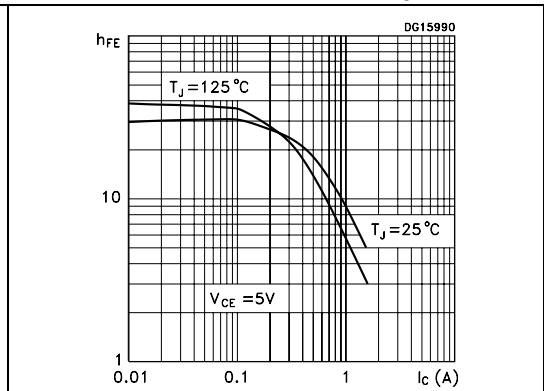


Figure 8. Collector-emitter saturation voltage

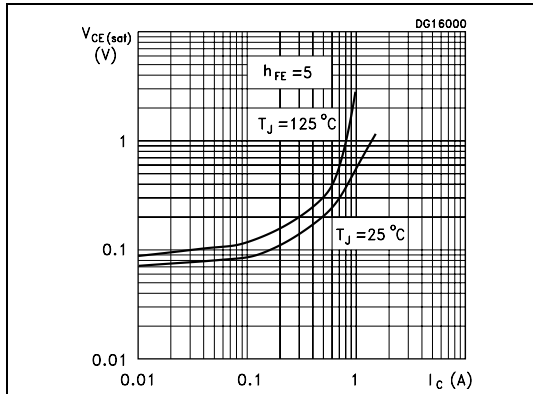


Figure 9. Base-emitter saturation voltage

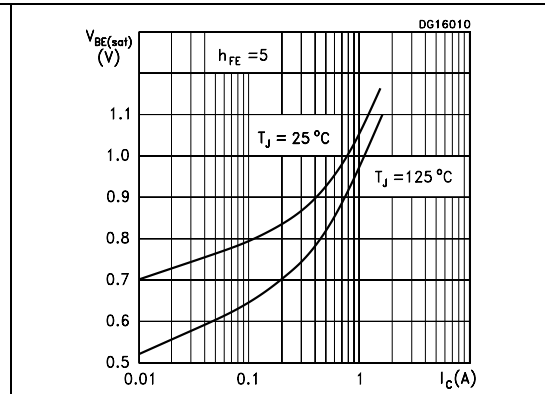


Figure 10. Inductive load switching time

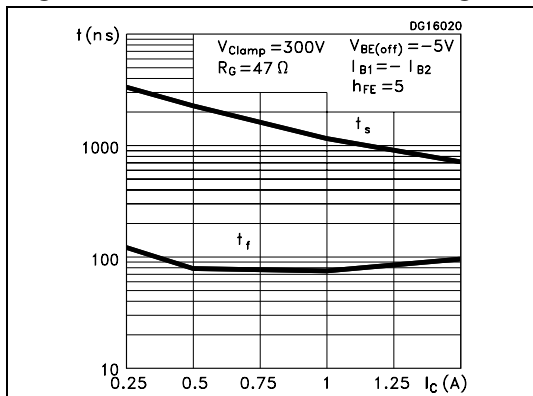
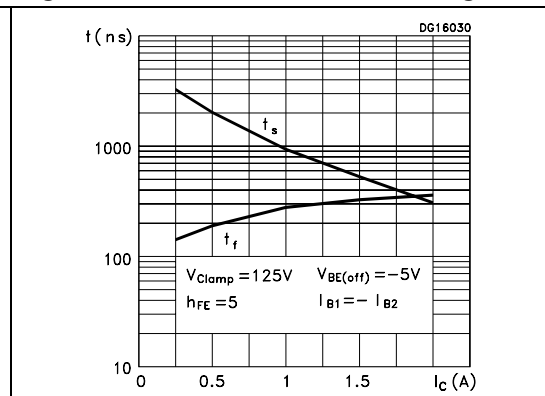
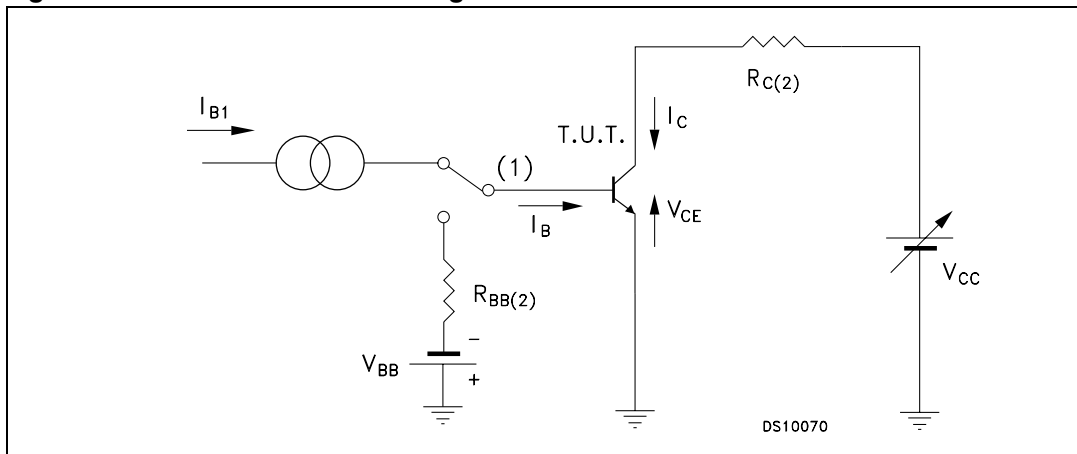


Figure 11. Resistive load switching time



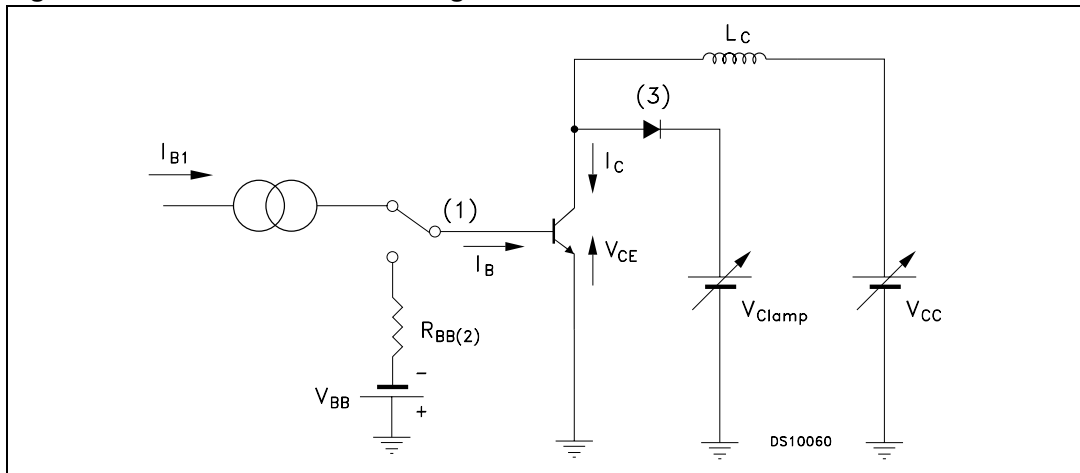
2.2 Test circuits

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

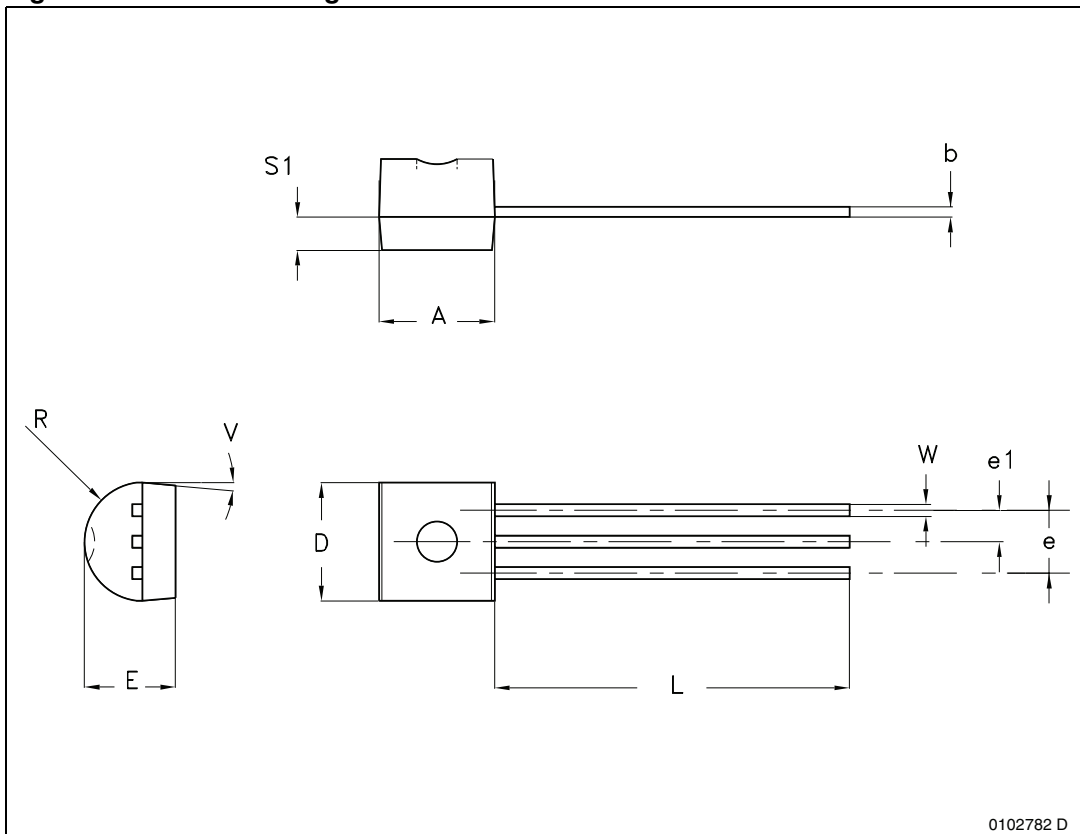
3 Package mechanical data

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

Table 5. TO-92 mechanical data

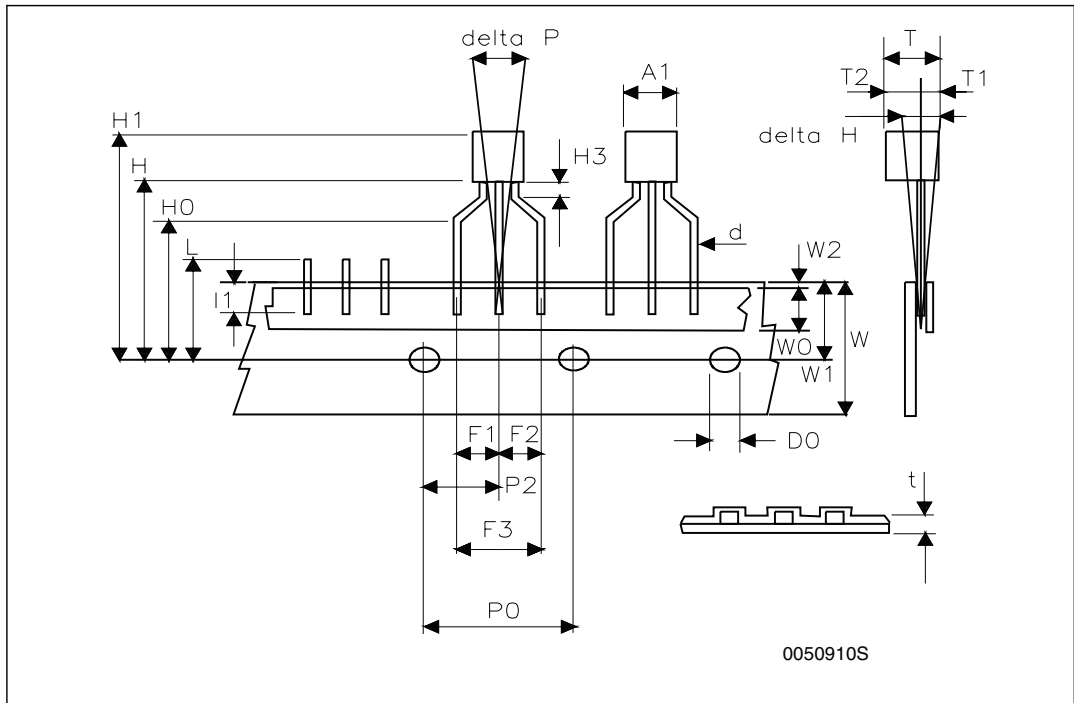
Dim.	mm.		
	Min.	Typ.	Max.
A	4.32		4.95
b	0.36		0.51
D	4.45		4.95
E	3.30		3.94
e	2.41		2.67
e1	1.14		1.40
L	12.70		15.49
R	2.16		2.41
S1	0.92		1.52
W	0.41		0.56
V		5°	

Figure 14. TO-92 drawing



TO-92 ammpack 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 6. Document revision history

Date	Revision	Changes
02-Jul-2008	5	Added halogen-free molding compound package.
06-Dec-2010	6	Added note Table 1 on page 1 .

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