

# STX13005

### High voltage fast-switching NPN power transistor

#### Features

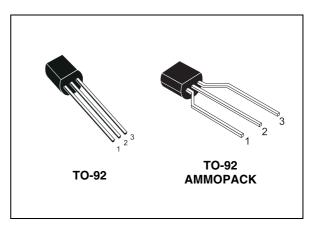
- High voltage capability
- Low spread of dynamic parameters
- Minimum lot-to-lot spread for reliable operation
- Very high switching speed

### **Applications**

- Compact fluorescent lamp (CFL)
- Switch mode power supplies (AC-DC converters)

### Description

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

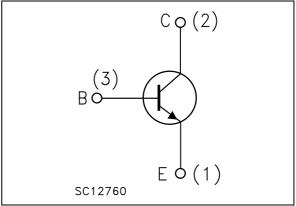


Table 1.	Device summary <sup>(1)</sup>
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Order code	Marking	Package	Packaging
STX13005	X13005		Bulk
STX13005G	X13005G	TO-92	Duik
STX13005-AP	X13005		Ammonook
STX13005G-AP	X13005G		Ammopack

1. The letter "G" in the order code suffix identifies the product as ECOPACK<sup>®</sup>2 grade. Please see Section 4 for details.

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## 1 Electrical ratings

Table 2.	Absolute	maximum	ratings
	/		

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-emitter voltage (V <sub>BE</sub> = 0)	700	V
V <sub>CEO</sub>	Collector-emitter voltage (I <sub>B</sub> = 0)	400	V
V <sub>EBO</sub>	Emitter-base voltage ( $I_C = 0$ ; $I_B = 1.5$ A; $t_p < 10$ ms)	V <sub>(BR)EBO</sub>	V
Ι <sub>C</sub>	Collector current	3	Α
I <sub>CM</sub>	Collector peak current (t <sub>P</sub> < 5ms)	6	Α
I <sub>B</sub>	Base current	1.5	А
I <sub>BM</sub>	Base peak current (t <sub>P</sub> < 5ms)	3	А
P <sub>tot</sub>	Total dissipation at $T_c = 25^{\circ}C$	2.8	W
T <sub>stg</sub>	Storage temperature	-65 to 150	°C
TJ	Max. operating junction temperature	150	°C

#### Table 3. Thermal data

Symbol	Parameter	Value	Unit
R <sub>thj-c</sub>	Thermal resistance junction-case max	45	°C/W



## 2 Electrical characteristics

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

Table 4.						
Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
	Collector cut-off current	V <sub>CE</sub> =700 V			1	mA
I <sub>CES</sub>	(V <sub>BE</sub> =0)	$V_{CE} = 700 V T_{C} = 125^{\circ}C$			5	mA
I <sub>CEO</sub>	Collector-cut-off current $(I_B = 0)$	V <sub>CE</sub> = 400 V			1	mA
V <sub>(BR)EBO</sub>	Emitter base breakdown voltage $(I_{C} = 0)$	I <sub>E</sub> = 10 mA	9		18	v
V <sub>CEO(sus)</sub> <sup>(1)</sup>	Collector-emitter sustaining voltage (I <sub>B</sub> = 0)	I <sub>C</sub> =10 mA	400			v
		I <sub>C</sub> = 1A I <sub>B</sub> = 200 mA			0.5	V
V <sub>CE(sat)</sub> <sup>(1)</sup>	Collector-emitter saturation voltage	$I_{\rm C} = 2A$ $I_{\rm B} = 500  {\rm mA}$			0.6	V
	outer to hage	I <sub>C</sub> = 3A I <sub>B</sub> = 750 mA			5	V
۰ <i>.</i> (1)	Base-emitter saturation	I <sub>C</sub> = 1A I <sub>B</sub> = 200 mA			1.2	V
V <sub>BE(sat)</sub> <sup>(1)</sup>	voltage	$I_{\rm C} = 2A$ $I_{\rm B} = 500  \rm{mA}$			1.6	V
h <sub>FF</sub> <sup>(1)</sup>	DC aurrent agin	$I_{\rm C} = 1  \text{A}$ $V_{\rm CE} = 5  \text{V}$	10		30	
NFE (7	DC current gain	$I_{\rm C} = 2  {\rm A}$ $V_{\rm CE} = 5  {\rm V}$	8		24	
	Resistive load	$I_{\rm C} = 2  {\rm A}$ $V_{\rm CC} = 125  {\rm V}$				
t <sub>s</sub>	Storage time	$I_{B1} = -I_{B2} = 400 \text{ mA}$		1.65		μs
t <sub>f</sub>	Fall time	t <sub>p</sub> = 30 μs		260		ns
	Inductive load	$I_{\rm C} = 1 \text{ A}$ $V_{\rm clamp} = 300 \text{ V}$				
t <sub>s</sub>	Storage time	$I_{B1} = 200 \text{ mA } V_{BE(off)} = -5 \text{ V}$		0.8		μs
t <sub>f</sub>	Fall time	$L = 50 \text{ mH}$ $R_{BB} = 0$		150		ns

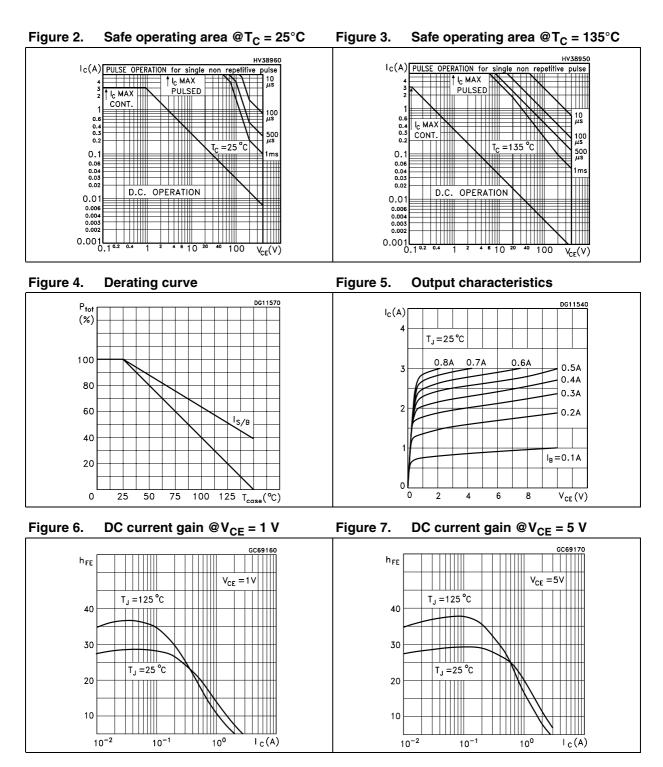
 Table 4.
 Electrical characteristics

1. Pulse test: pulse duration  $\leq$ 300 µs, duty cycle  $\leq$ 2 %

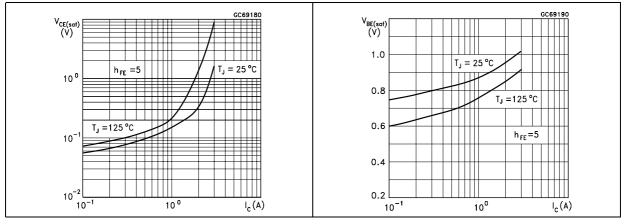


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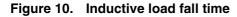
### 2.1 Electrical characteristics (curves)



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#### Figure 8. Collector-emitter saturation voltage Figure 9. **Base-emitter saturation voltage**



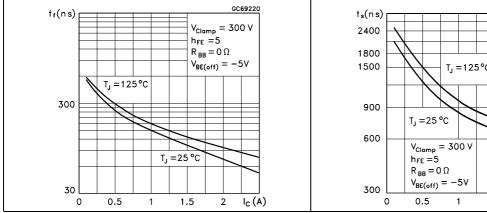
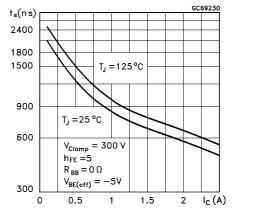
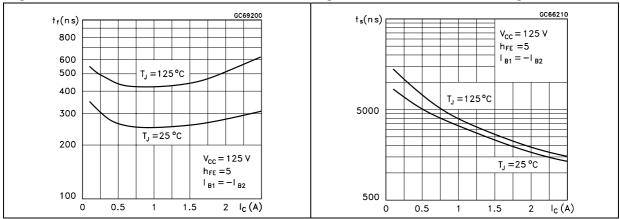


Figure 12. Resistive load fall time



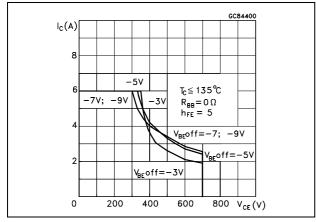








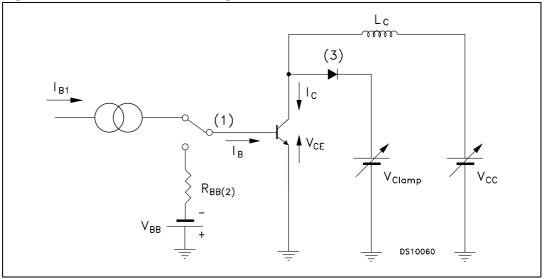
#### Figure 14. Reverse biased SOA





### 3 Test circuits



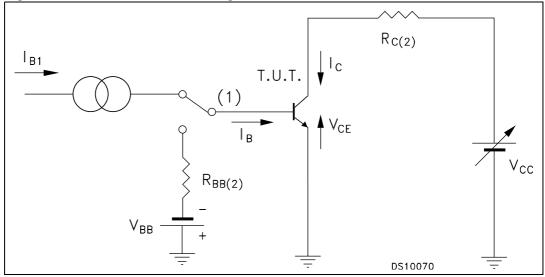


1) Fast electronic switch

2) Non-inductive resistor

3) Fast recovery rectifier

#### Figure 16. Resistive load switching test circuit



1) Fast electronic switch

2) Non-inductive resistor



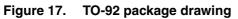
## 4 Package mechanical data

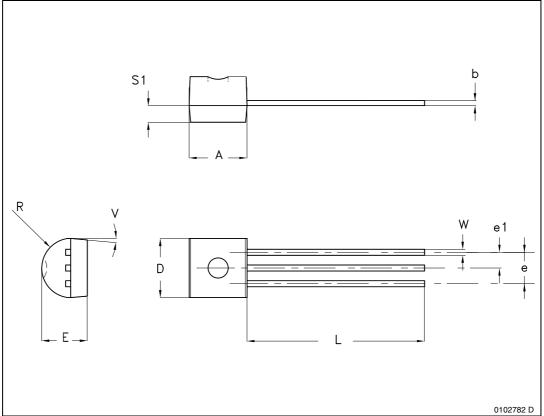
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: www.st.com. ECOPACK<sup>®</sup> is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



Dim.		mm	
Dim.	Min.	Тур.	Max.
A	4.32		4.95
b	0.36		0.51
D	4.45		4.95
E	3.30		3.94
е	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°	

 Table 5.
 TO-92 package mechanical data



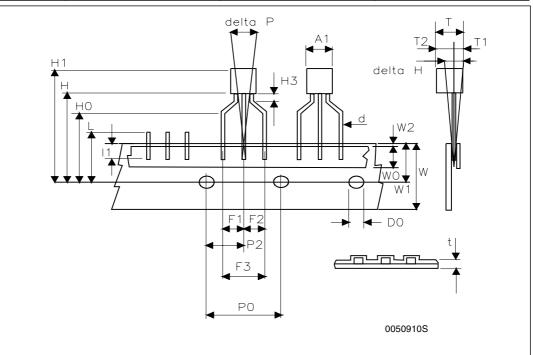




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Dim.		mm	
	Min	Тур	Max
A1			4.80
Т			3.80
T1			1.60
T2			2.30
d			0.48
P0	12.50	12.70	12.90
P2	5.65	6.35	7.05
F1,F2	2.44	2.54	2.94
F3	4.98	5.08	5.48
delta H	-2.00		2.00
W	17.50	18.00	19.00
W0	5.70	6.00	6.30
W1	8.50	9.00	9.25
W2			0.50
Н	18.50		20.50
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
11	3.00		
delta P	-1.00		1.00

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



## 5 Revision history

#### Table 6.Document revision history

Date	Revision	Changes	
01-Jul-2004	1	First release.	
11-Feb-2005	2	New table on page 1	
02-Aug-2007	3	New Figure 3 and updated Figure 14	
28-Sep-2007	4	Updated Figure 2 and Figure 3	
16-Dec-2008	008         5         Added ECOPACK <sup>®</sup> 2 grade products with suffix "G"		
11-Aug-2009	6	Updated TO-92 mechanical data and <i>Figure 1: Internal schematic diagram</i>	



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