

## High voltage fast-switching NPN power transistor

Datasheet – production data

### Features

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

### Applications

- Electronic ballast for fluorescent lighting
- Switch mode power supplies

### Description

This 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 a wide RBSOA.

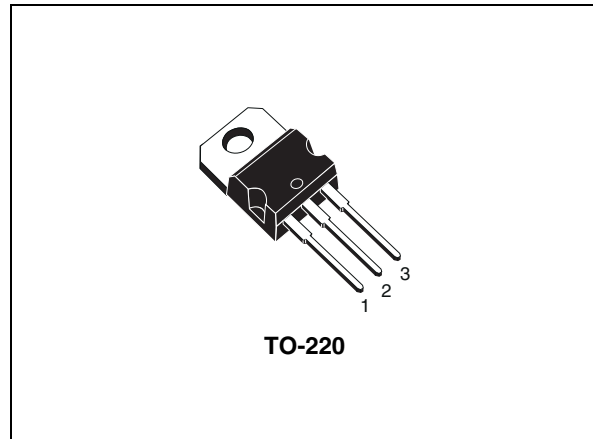


Figure 1. Internal schematic diagram

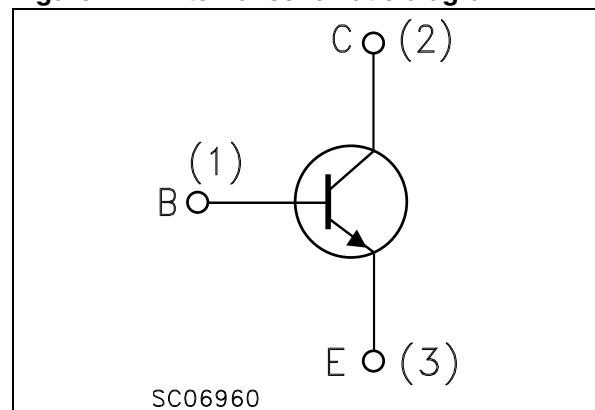


Table 1. Device summary

Order code	Marking <sup>(1)</sup>	Package	Packaging
ST13005	13005 A 13005 C 13005 D 13005 E 13005 F	TO-220	Tube

1. Product is pre-selected in DC current gain (group A, C, D, E and F). STMicroelectronics reserves the right to ship either groups according to production availability. Please contact your nearest STMicroelectronics sales office for delivery details.

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# 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 ( $I_C = 0$ )	9	V
$I_C$	Collector current	4	A
$I_{CM}$	Collector peak current ( $t_P < 5$ ms)	8	A
$I_B$	Base current	2	A
$I_{BM}$	Base peak current ( $t_P < 5$ ms)	4	A
$P_{TOT}$	Total dissipation at $T_c \leq 25$ °C	75	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
$R_{thj-case}$	Thermal resistance junction-case max	1.7	°C/W
$R_{thj-amb}$	Thermal resistance junction-amb max	62.5	°C/W

## 2 Electrical characteristics

T<sub>case</sub> = 25 °C unless otherwise specified.

**Table 4. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I <sub>CES</sub>	Collector cut-off current (V <sub>BE</sub> = 0)	V <sub>CE</sub> = 700 V			1	mA
		V <sub>CE</sub> = 700 V T <sub>C</sub> = 125 °C			5	mA
I <sub>EBO</sub>	Emitter cut-off current (I <sub>C</sub> = 0)	V <sub>EB</sub> = 9 V			1	mA
V <sub>CEO(sus)</sub> (1)	Collector-emitter sustaining voltage (I <sub>B</sub> = 0)	I <sub>C</sub> = 10 mA	400			V
V <sub>CE(sat)</sub> (1)	Collector-emitter saturation voltage	I <sub>C</sub> = 1 A I <sub>B</sub> = 0.2 A			0.5	V
		I <sub>C</sub> = 2 A I <sub>B</sub> = 0.5 A			0.6	V
		I <sub>C</sub> = 4 A I <sub>B</sub> = 1 A			1	V
V <sub>BE(sat)</sub> (1)	Base-emitter saturation voltage	I <sub>C</sub> = 1 A I <sub>B</sub> = 0.2 A			1.2	V
		I <sub>C</sub> = 2 A I <sub>B</sub> = 0.5 A			1.6	V
h <sub>FE</sub> (1)(2)	DC current gain	I <sub>C</sub> = 1 A V <sub>CE</sub> = 5 V				
		Group A	15		32	
		Group C	16		22	
		Group D	21		27	
		Group E	26		32	
		Group F	31		37	
		I <sub>C</sub> = 2 A V <sub>CE</sub> = 5 V	8		40	
t <sub>s</sub>	Resistive load Storage time	I <sub>C</sub> = 2 A V <sub>CC</sub> = 125 A	1.5	0.2	3	μs
t <sub>f</sub>	Fall time	I <sub>B1</sub> = - I <sub>B2</sub> = 0.4 A t <sub>p</sub> = 30 μs				μs

1. Pulse test: pulse duration = 300 μs, duty cycle ≤ 2 %.
2. Product is pre-selected in DC current gain (group A, C, D, E and F). STMicroelectronics reserves the right to ship either groups according to production availability. Please contact your nearest STMicroelectronics sales office for delivery details

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

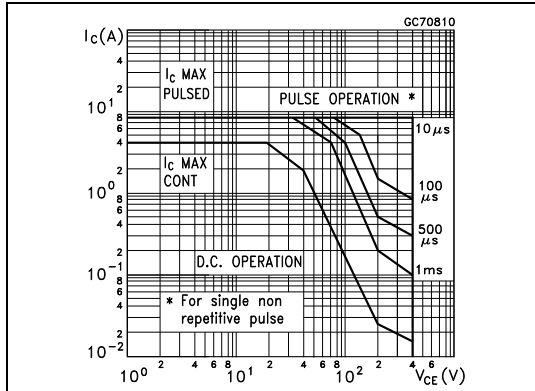


Figure 3. Derating curve

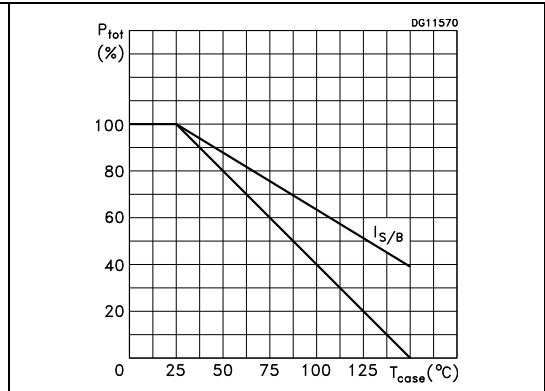


Figure 4. DC current gain ( $V_{CE} = 1.5 V$ )

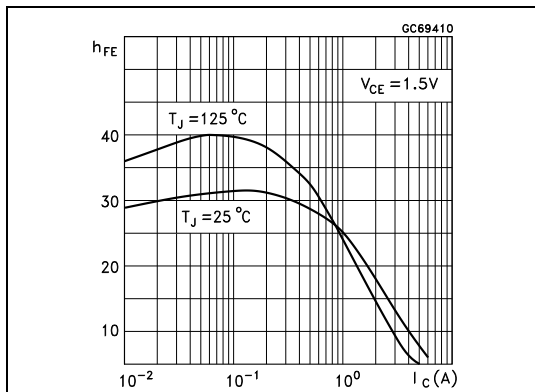


Figure 5. DC current gain ( $V_{CE} = 5 V$ )

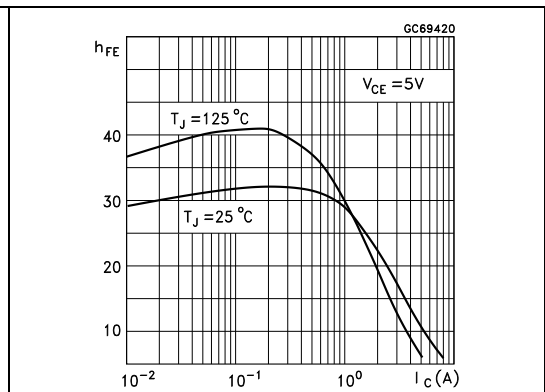


Figure 6. Collector-emitter saturation voltage

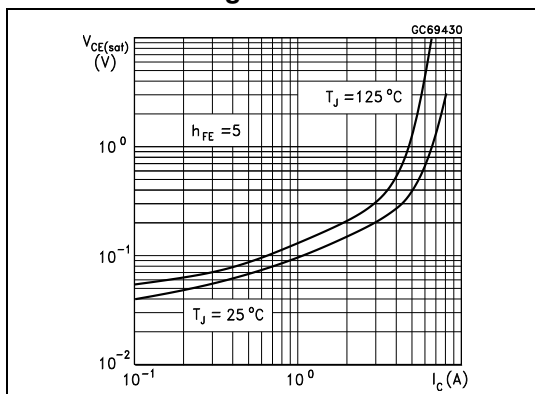
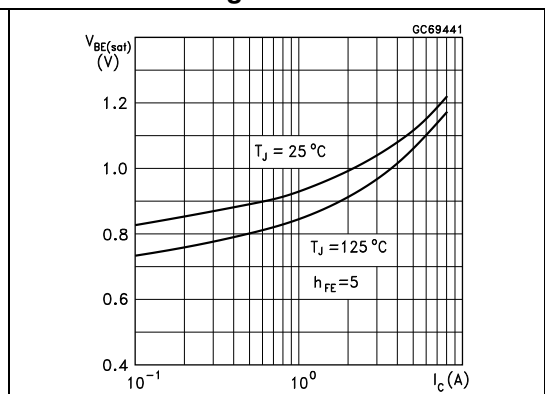
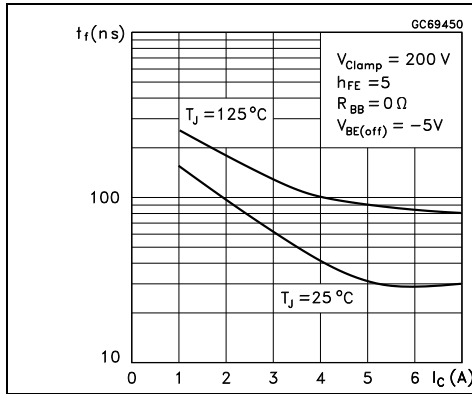


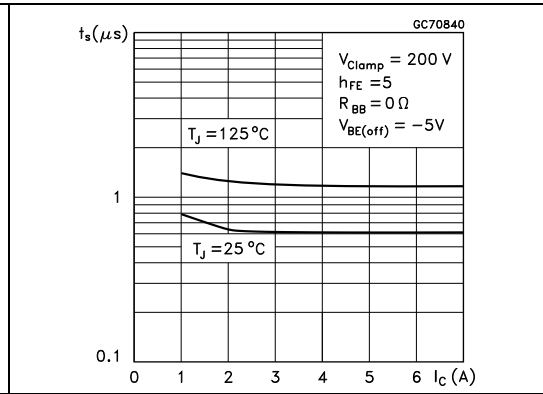
Figure 7. Base-emitter saturation voltage



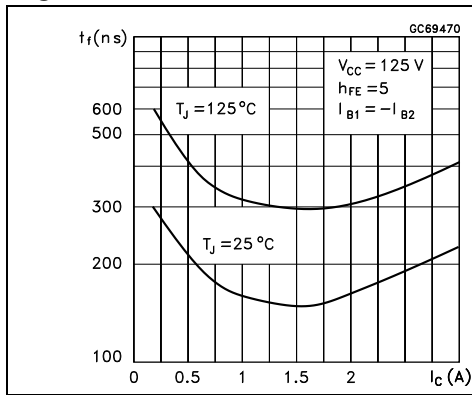
**Figure 8. Inductive load fall time**



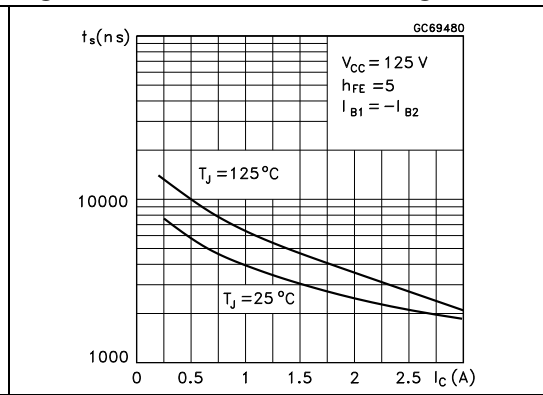
**Figure 9. Inductive load storage time**



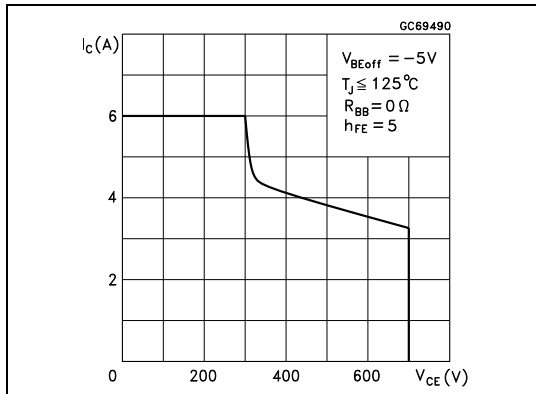
**Figure 10. Resistive load fall time**



**Figure 11. Resistive load storage time**



**Figure 12. Reverse biased safe operating area**



## 2.2 Test circuits

Figure 13. Inductive load switching test circuit

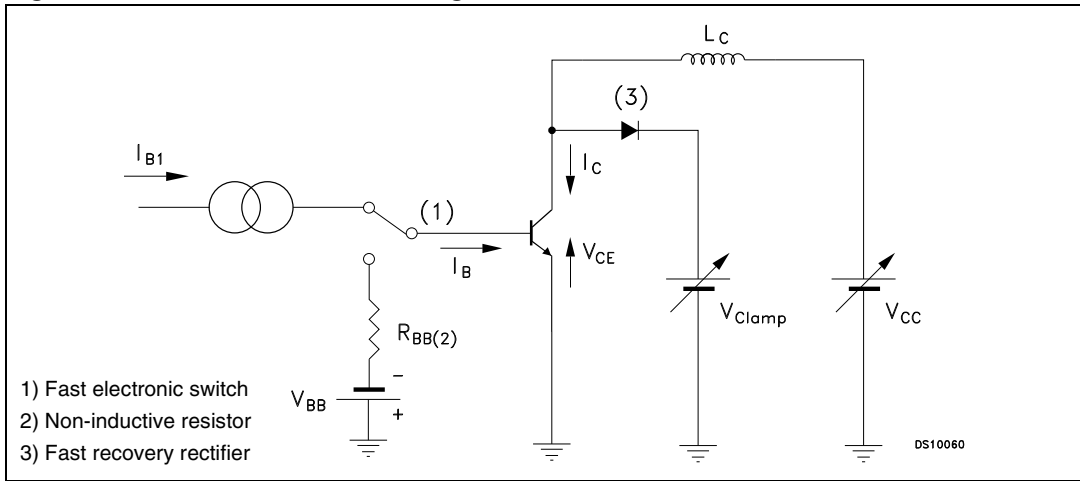
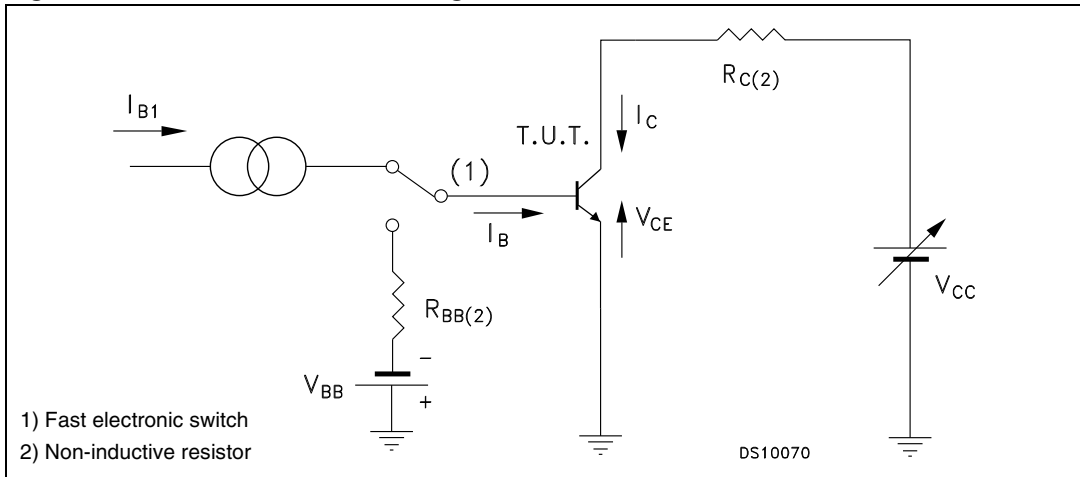


Figure 14. Resistive load switching test circuit



### 3 Package mechanical data

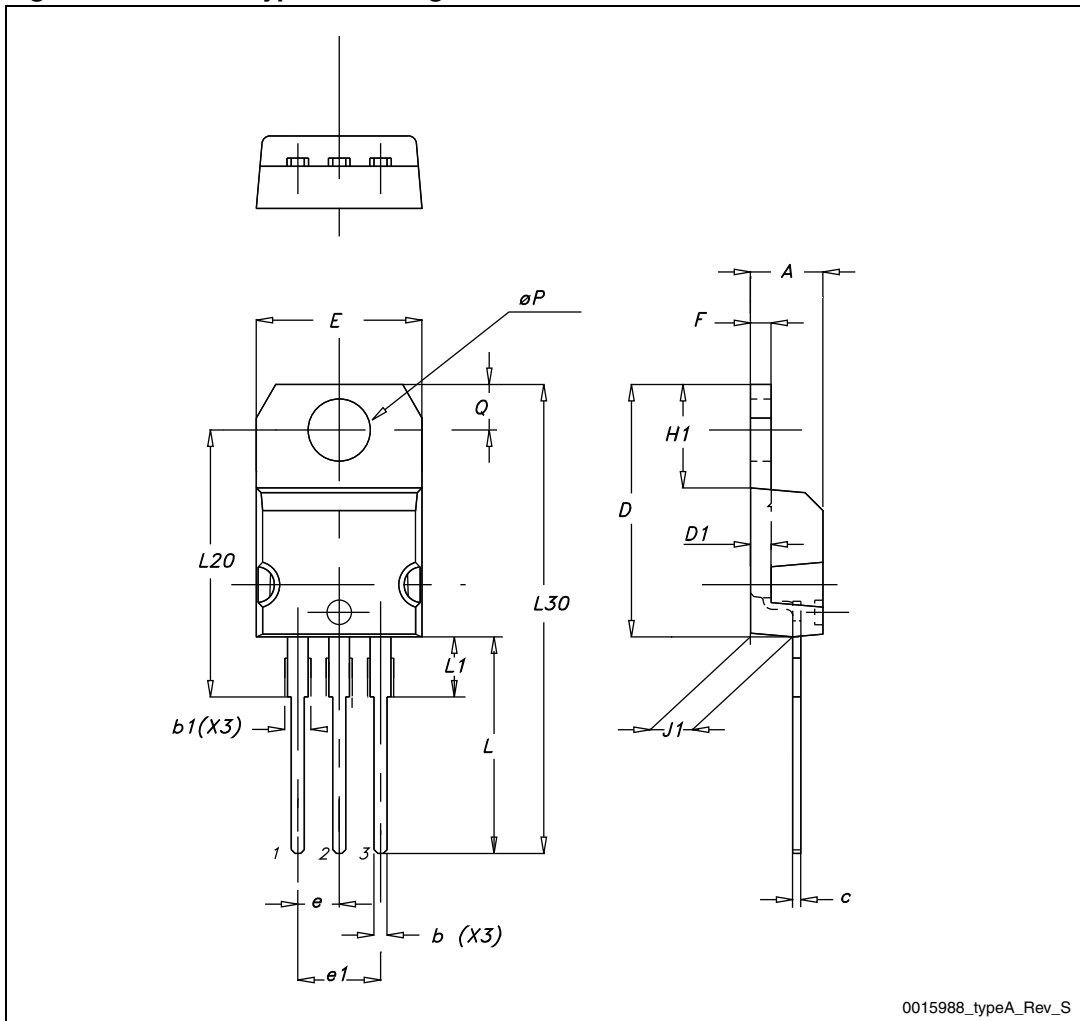
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK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



Table 5. TO-220 type A mechanical data

Dim.	mm.		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95

Figure 15. TO-220 type A drawing



## 4 Revision history

**Table 6. Document revision history**

Date	Revision	Changes
21-Jun-2004	6	
22-Aug-2007	7	Updated mechanical data according to PCN APM-PWR/07/2804
12-Oct-2007	8	Updated marking in <a href="#">Table 1</a>
15-Feb-2012	9	<ul style="list-style-type: none"><li>– Updated marking in <a href="#">Table 1</a></li><li>– Inserted: <a href="#">Table 3</a></li><li>– Modified: <math>h_{FE}</math> in <a href="#">Table 4</a></li><li>– Updated mechanical data</li></ul>
15-May-2012	10	Updated marking in <a href="#">Table 1</a> and <a href="#">4</a>

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### Наши контакты:

**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331