

## 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.

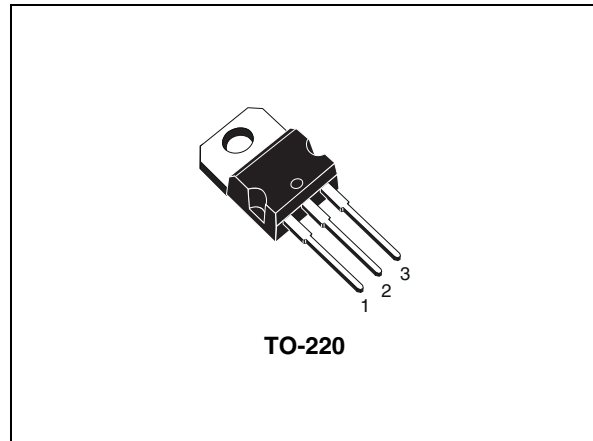


Figure 1. Internal schematic diagram

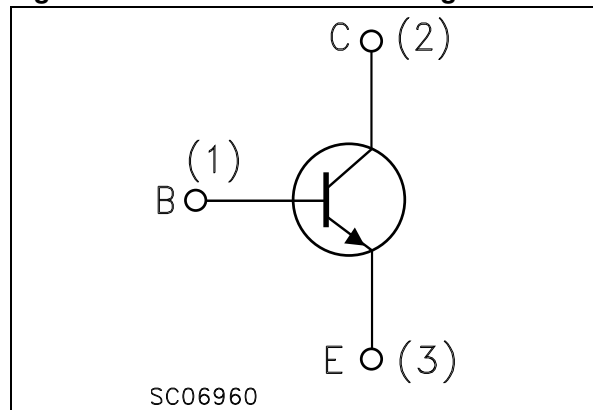


Table 1. Device summary

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

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

**Table 4. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{CES}$	Collector cut-off current ( $V_{BE} = 0$ )	$V_{CE} = 700\text{ V}$			1	mA
		$V_{CE} = 700\text{ V } T_C = 125\text{ °C}$			5	mA
$I_{EBO}$	Emitter cut-off current ( $I_C = 0$ )	$V_{EB} = 9\text{ V}$			1	mA
$V_{CEO(sus)}^{(1)}$	Collector-emitter sustaining voltage ( $I_B = 0$ )	$I_C = 10\text{ mA}$	400			V
$V_{CE(sat)}^{(1)}$	Collector-emitter saturation voltage	$I_C = 1\text{ A } I_B = 0.2\text{ A}$			0.5	V
		$I_C = 2\text{ A } I_B = 0.5\text{ A}$			0.6	V
		$I_C = 4\text{ A } I_B = 1\text{ A}$			1	V
$V_{BE(sat)}^{(1)}$	Base-emitter saturation voltage	$I_C = 1\text{ A } I_B = 0.2\text{ A}$			1.2	V
		$I_C = 2\text{ A } I_B = 0.5\text{ A}$			1.6	V
$h_{FE}^{(1)(2)}$	DC current gain	$I_C = 1\text{ A } V_{CE} = 5\text{ V}$				
		Group A	15		32	
		Group C	16		22	
		Group D	21		27	
		Group E	26		32	
		Group F	31		37	
		$I_C = 2\text{ A } V_{CE} = 5\text{ V}$	8		40	
$t_s$	Resistive load Storage time	$I_C = 2\text{ A } V_{CC} = 125\text{ A}$ $I_{B1} = - I_{B2} = 0.4\text{ A}$	1.5		3	$\mu\text{s}$
$t_f$	Fall time	$t_p = 30\text{ }\mu\text{s}$		0.2		$\mu\text{s}$

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

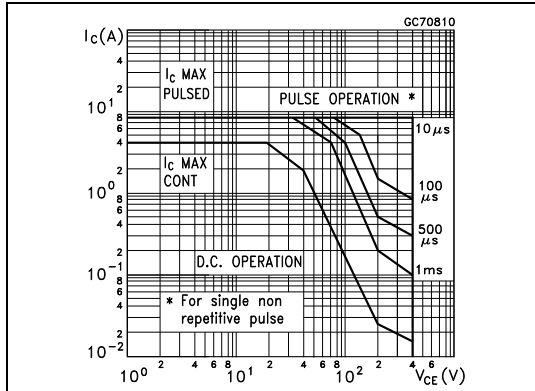


Figure 3. Derating curve

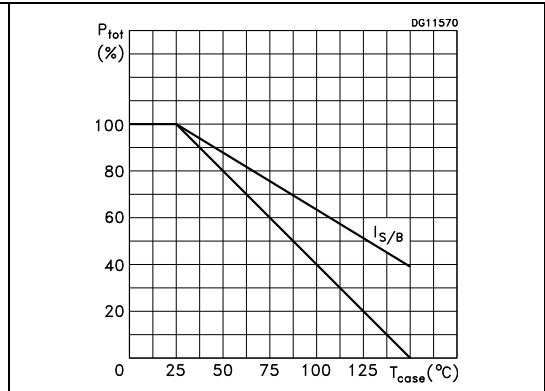


Figure 4. DC current gain ( $V_{CE} = 1.5 V$ )

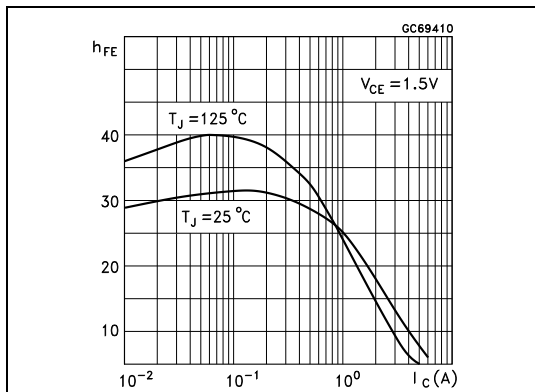


Figure 5. DC current gain ( $V_{CE} = 5 V$ )

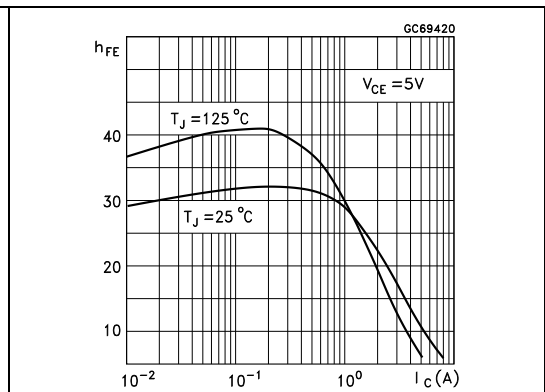


Figure 6. Collector-emitter saturation voltage

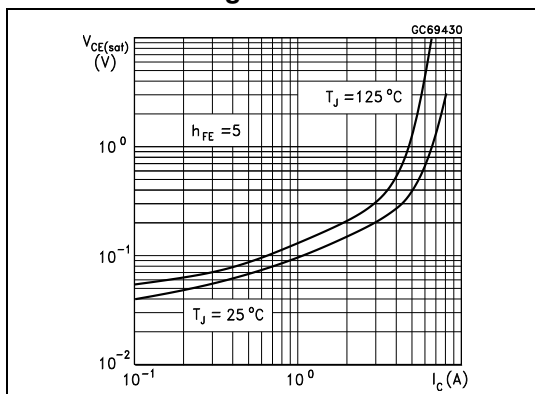
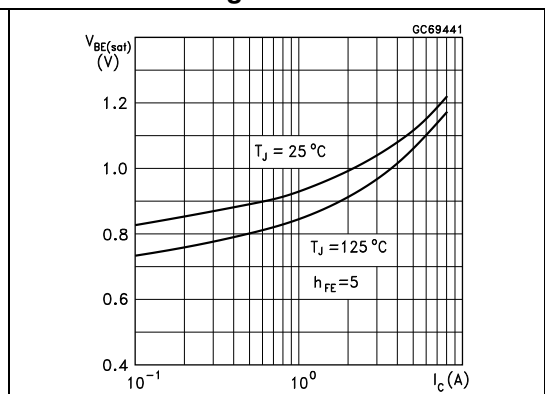
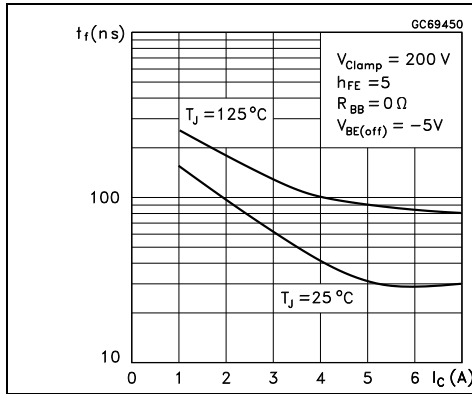


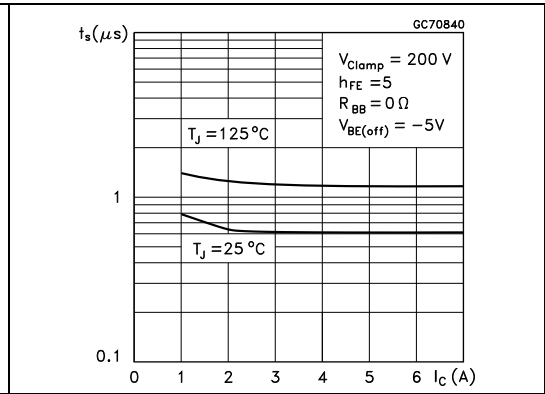
Figure 7. Base-emitter saturation voltage



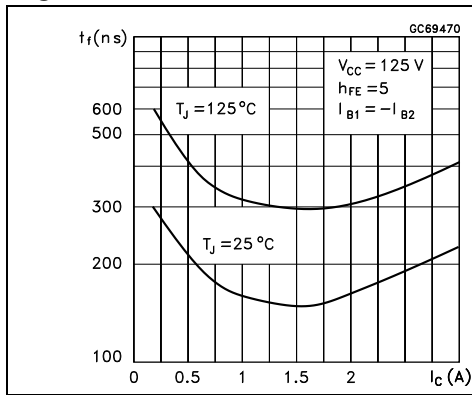
**Figure 8. Inductive load fall time**



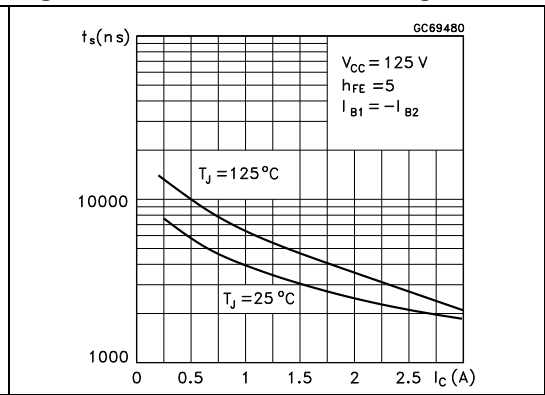
**Figure 9. Inductive load storage time**



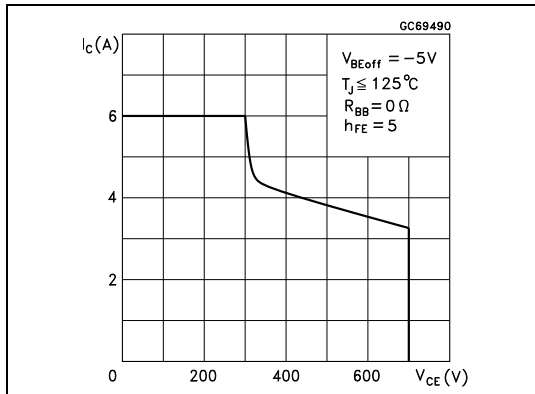
**Figure 10. Resistive load fall time**



**Figure 11. Resistive load storage time**



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



## 2.2 Test circuits

Figure 13. Inductive load switching test circuit

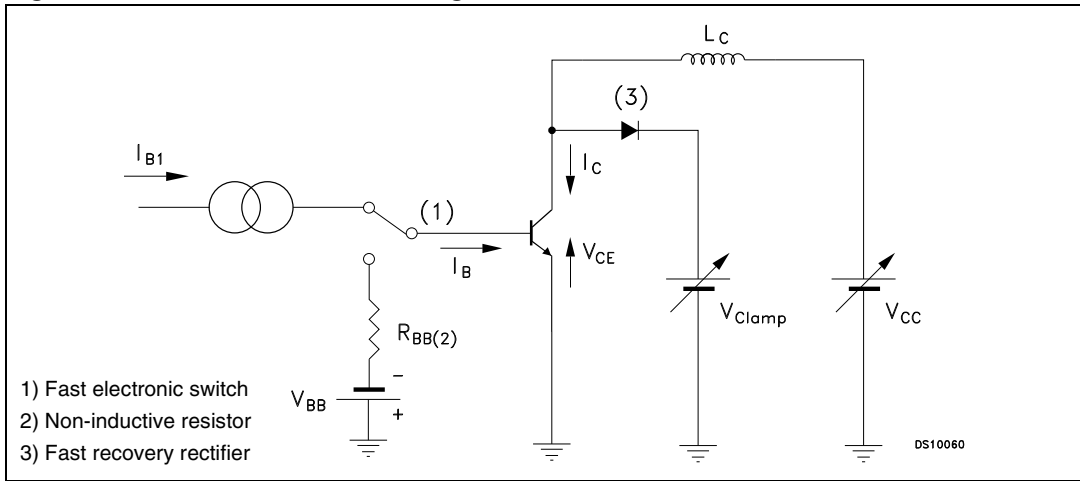
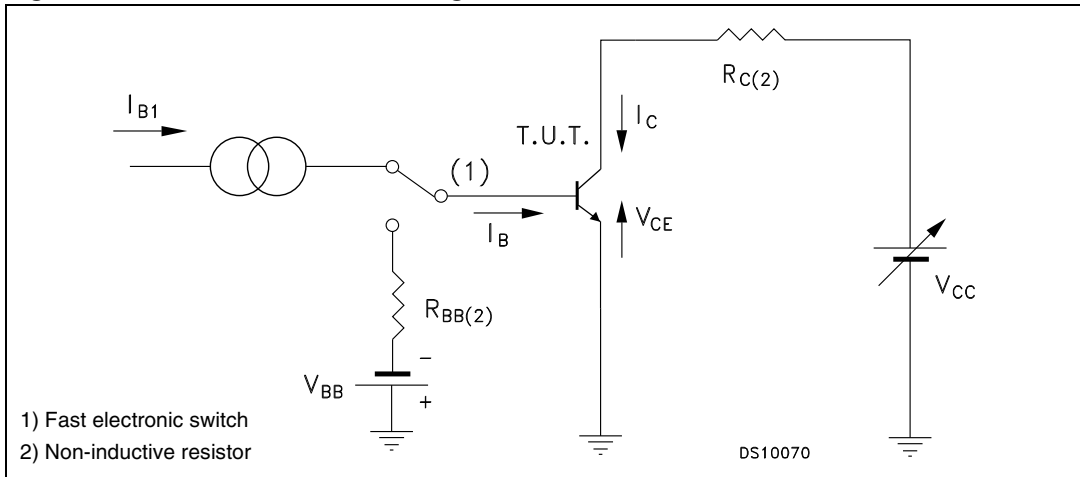


Figure 14. Resistive load switching test circuit



### 3 Package mechanical data

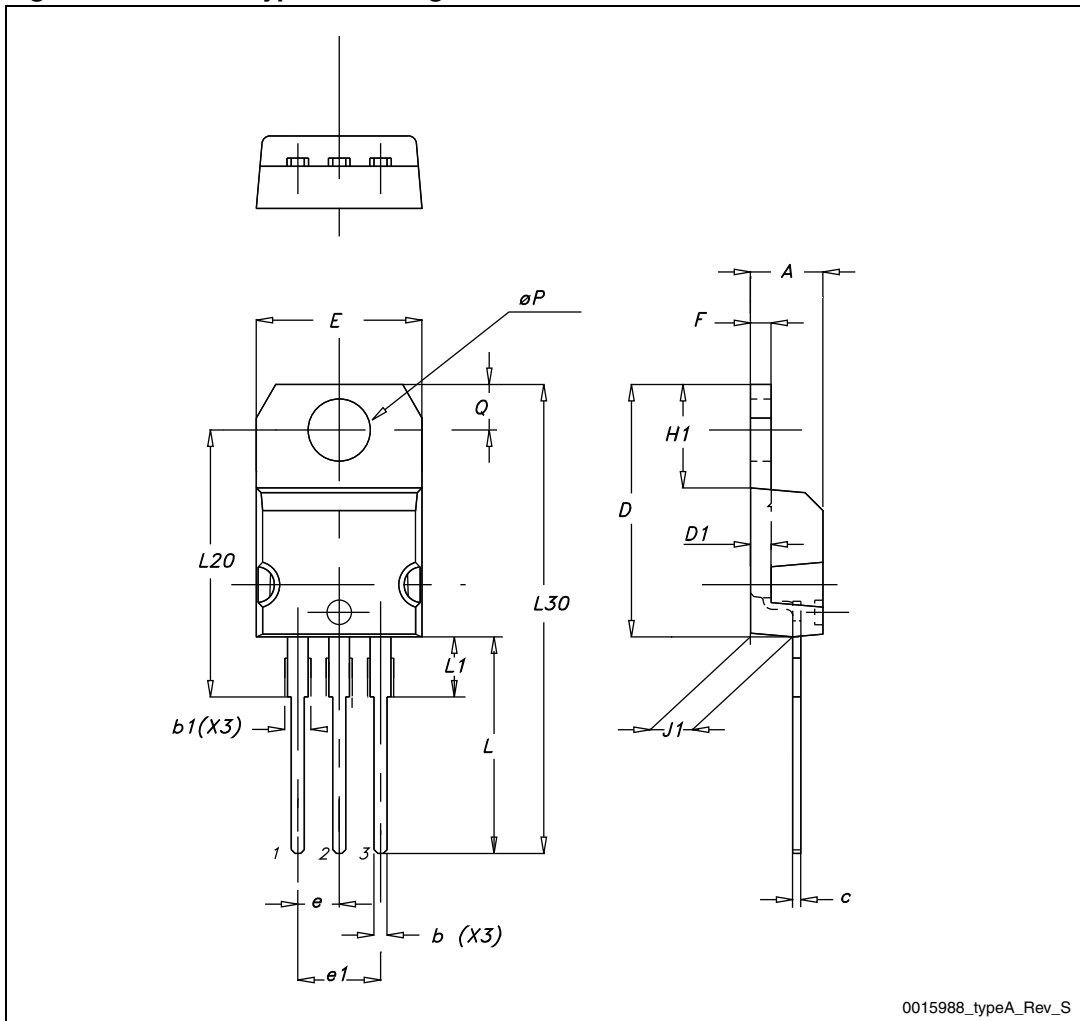
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK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