

## 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.

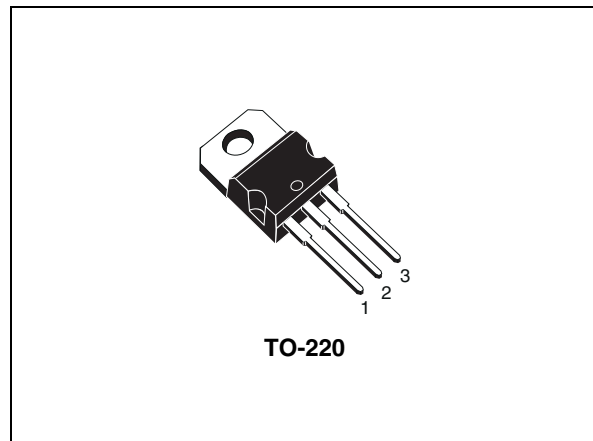


Figure 1. Internal schematic diagram

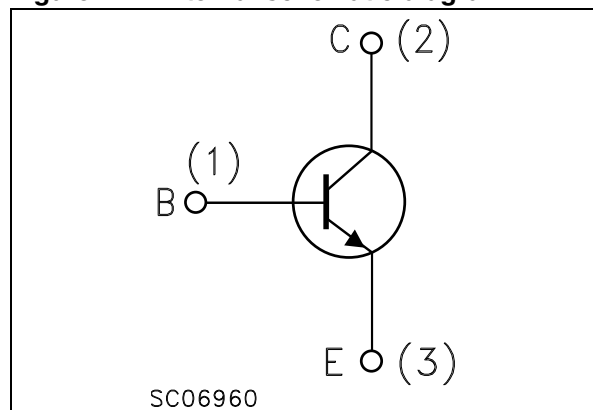


Table 1. Device summary

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.

# Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>3</b>
<b>2</b>	<b>Electrical characteristics</b> .....	<b>4</b>
2.1	Electrical characteristics (curves) .....	5
2.2	Test circuits .....	7
<b>3</b>	<b>Package mechanical data</b> .....	<b>8</b>
<b>4</b>	<b>Revision history</b> .....	<b>11</b>

# 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

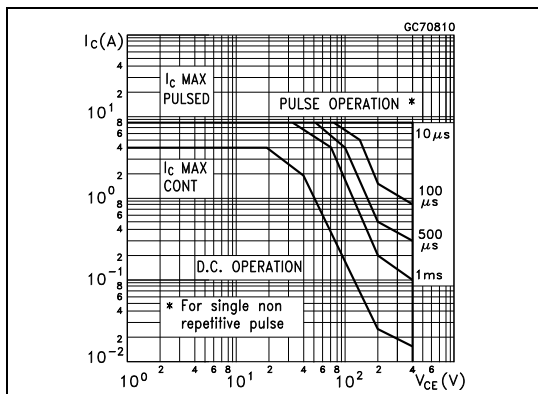


Figure 3. Derating curve

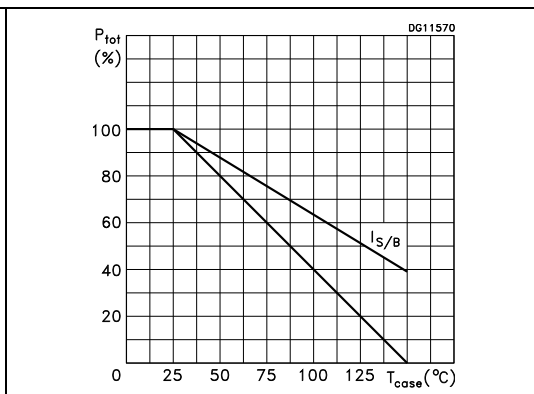


Figure 4. DC current gain ( $V_{CE} = 1.5 V$ )

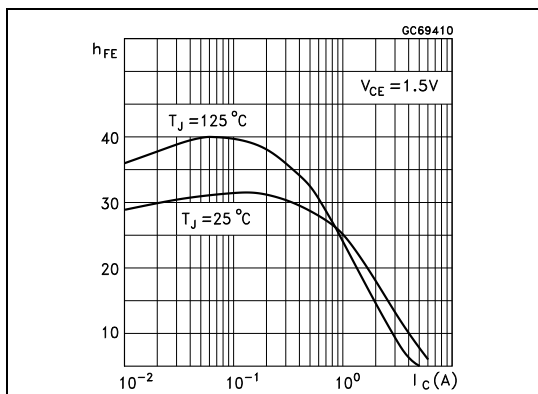


Figure 5. DC current gain ( $V_{CE} = 5 V$ )

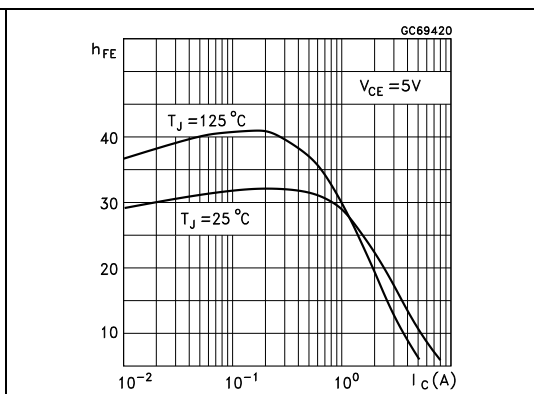


Figure 6. Collector-emitter saturation voltage

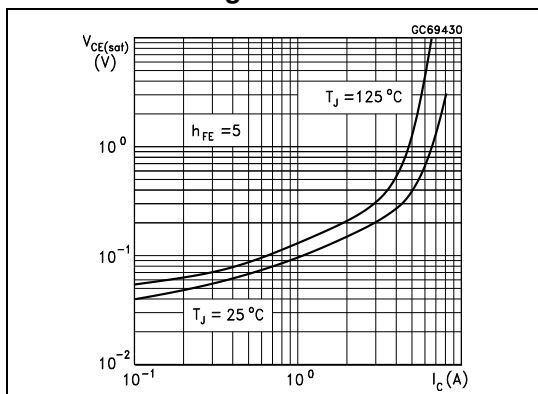


Figure 7. Base-emitter saturation voltage

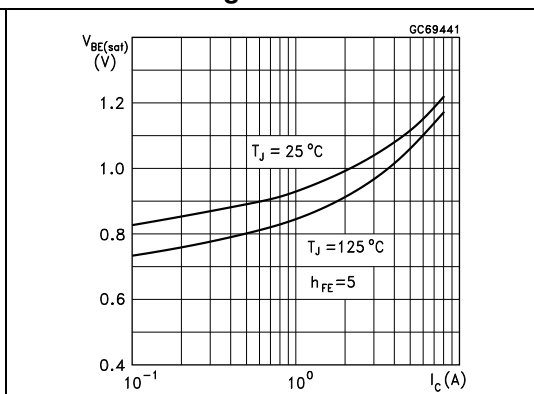


Figure 8. Inductive load fall time

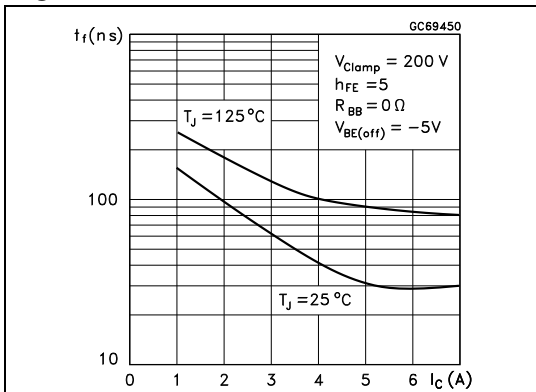


Figure 9. Inductive load storage time

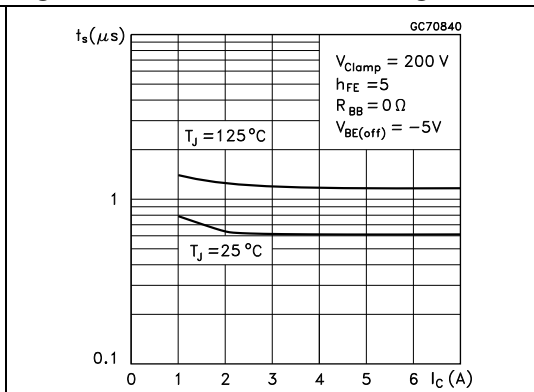


Figure 10. Resistive load fall time

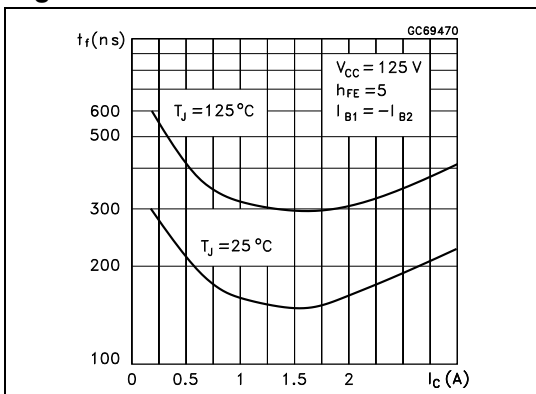


Figure 11. Resistive load storage time

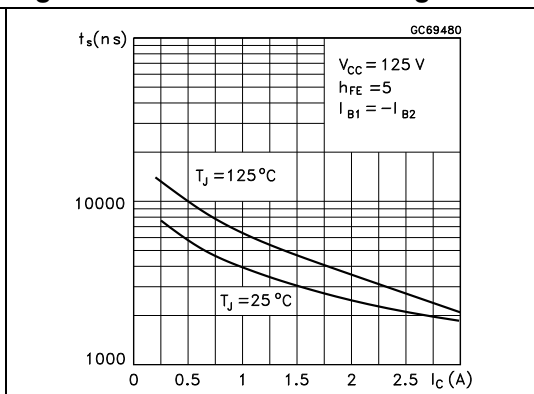
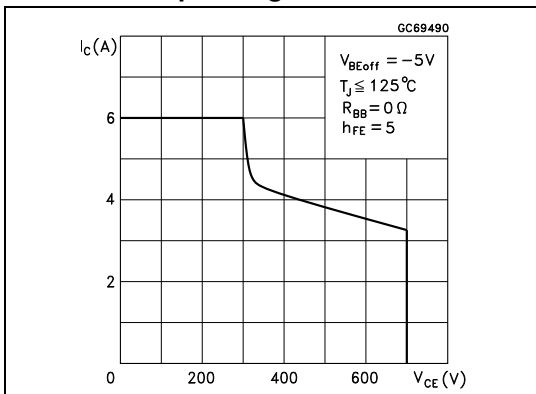
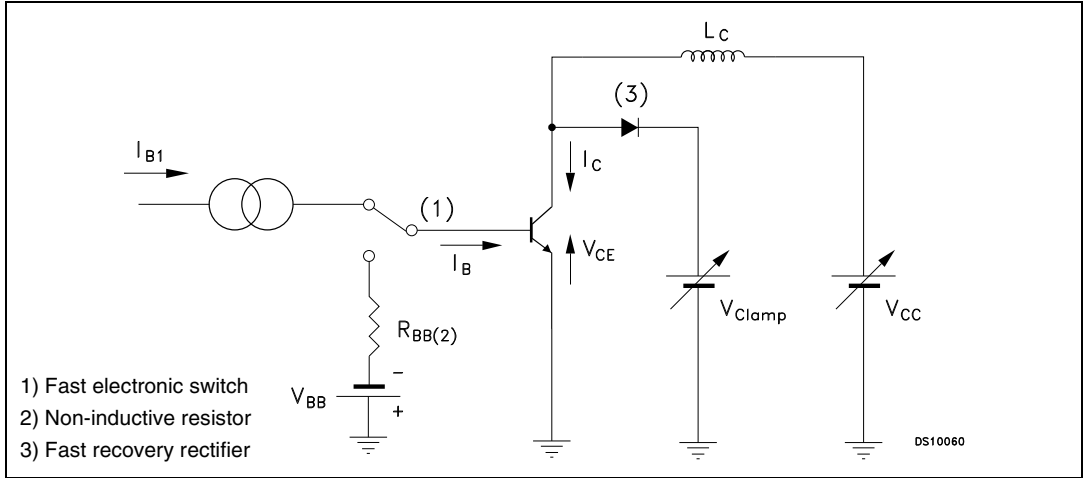


Figure 12. Reverse biased safe operating area

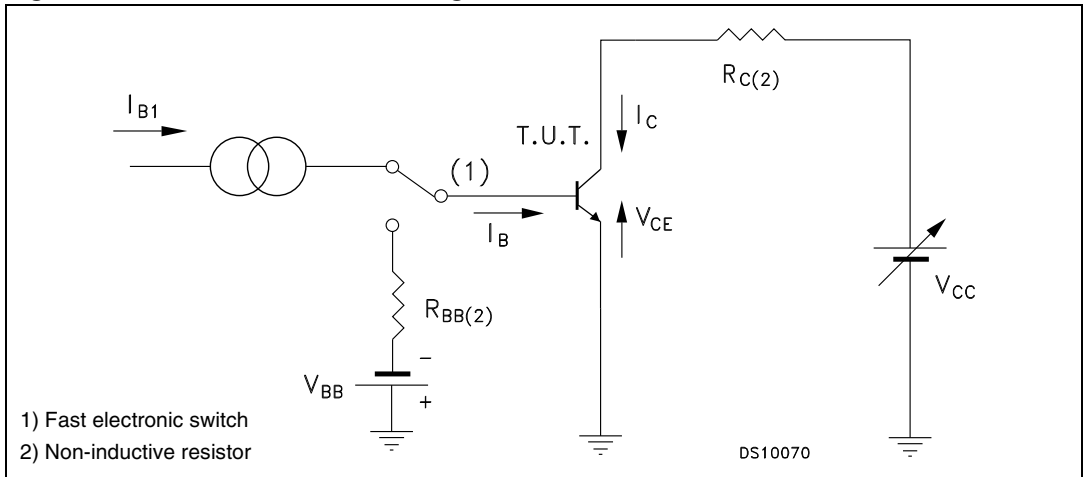


## 2.2 Test circuits

**Figure 13. Inductive load switching test circuit**



**Figure 14. Resistive load switching test circuit**



### 3 Package mechanical data

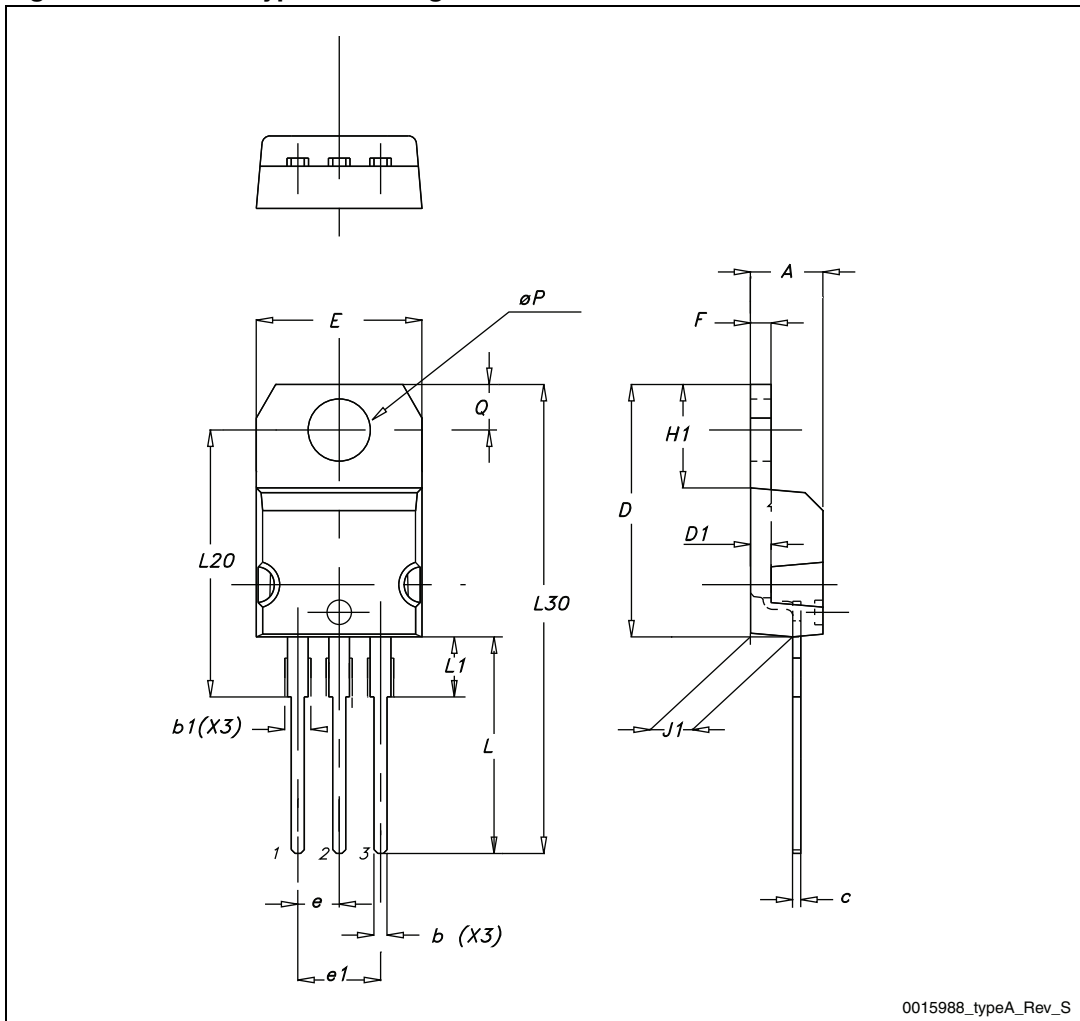
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK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