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# ST13005

## 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.

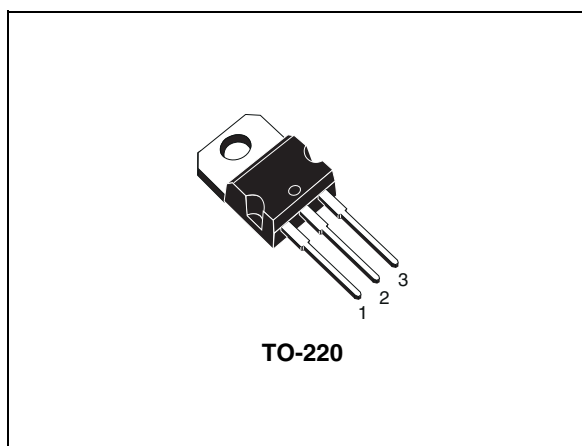


Figure 1. Internal schematic diagram

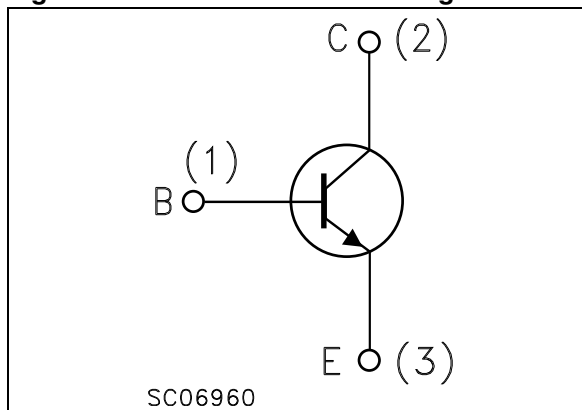


Table 1. Device summary

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

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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Electrical ratings

# 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

**Electrical characteristics**
**ST13005**

## 2 Electrical characteristics

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

**Table 4. Electrical characteristics**

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

 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

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Electrical characteristics

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

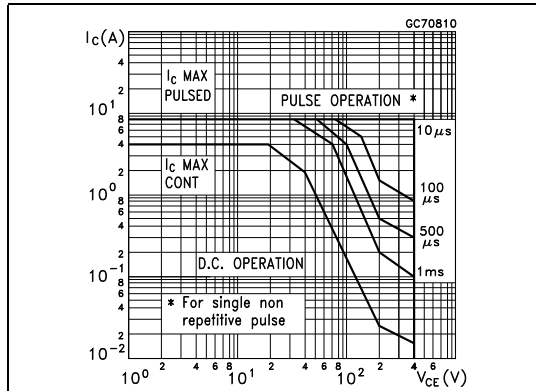


Figure 3. Derating curve

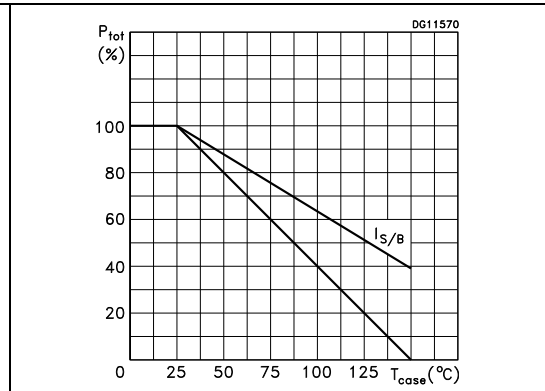


Figure 4. DC current gain ( $V_{CE} = 1.5$  V)

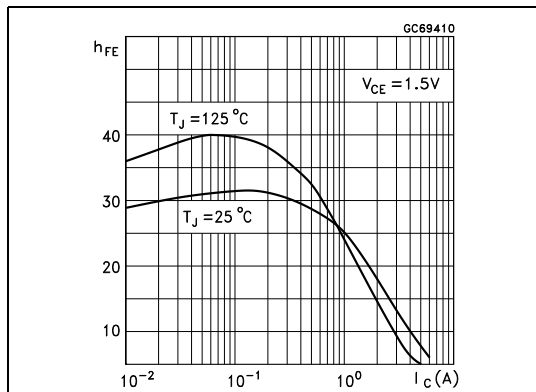


Figure 5. DC current gain ( $V_{CE} = 5$  V)

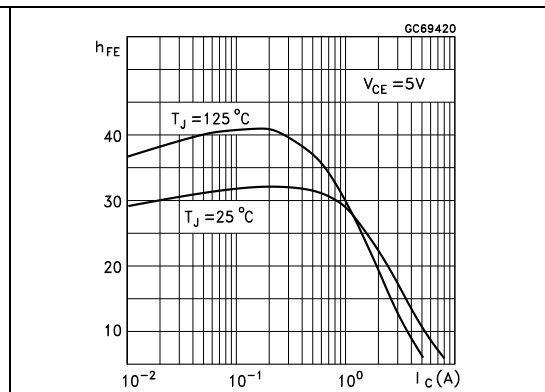


Figure 6. Collector-emitter saturation voltage

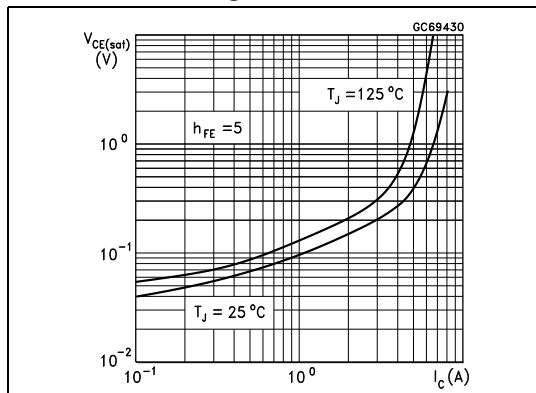
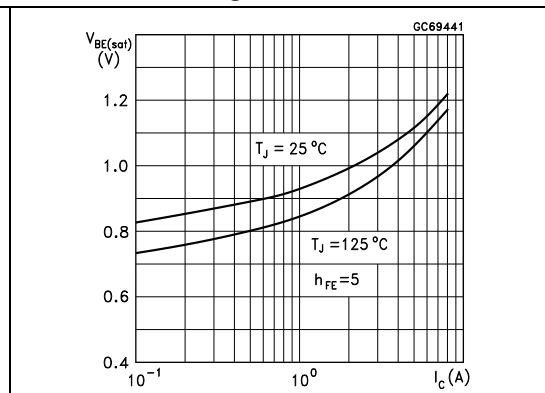


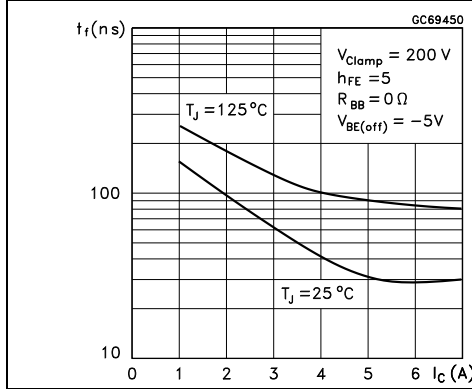
Figure 7. Base-emitter saturation voltage



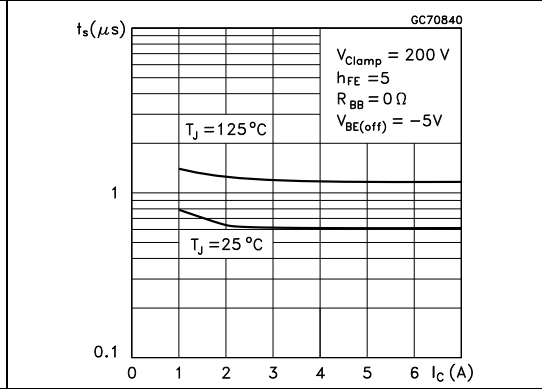
**Electrical characteristics**

**ST13005**

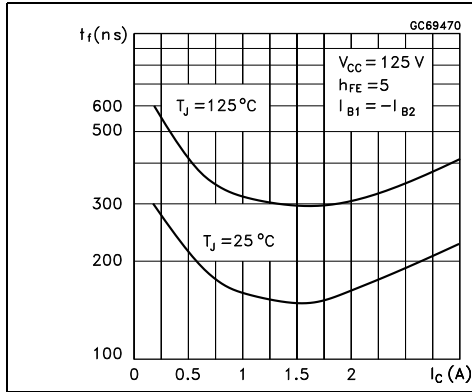
**Figure 8. Inductive load fall time**



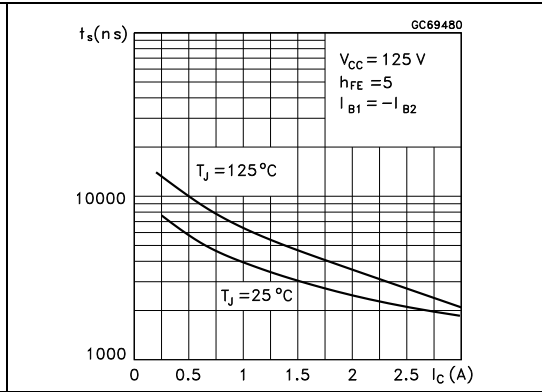
**Figure 9. Inductive load storage time**



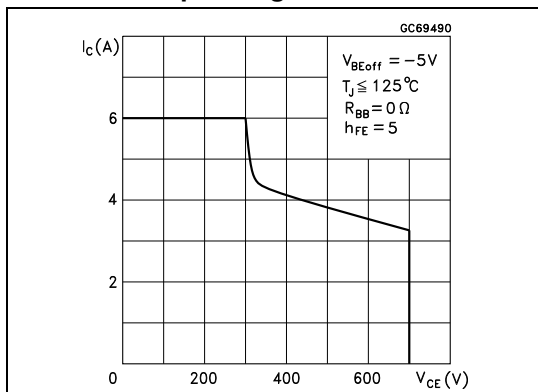
**Figure 10. Resistive load fall time**



**Figure 11. Resistive load storage time**

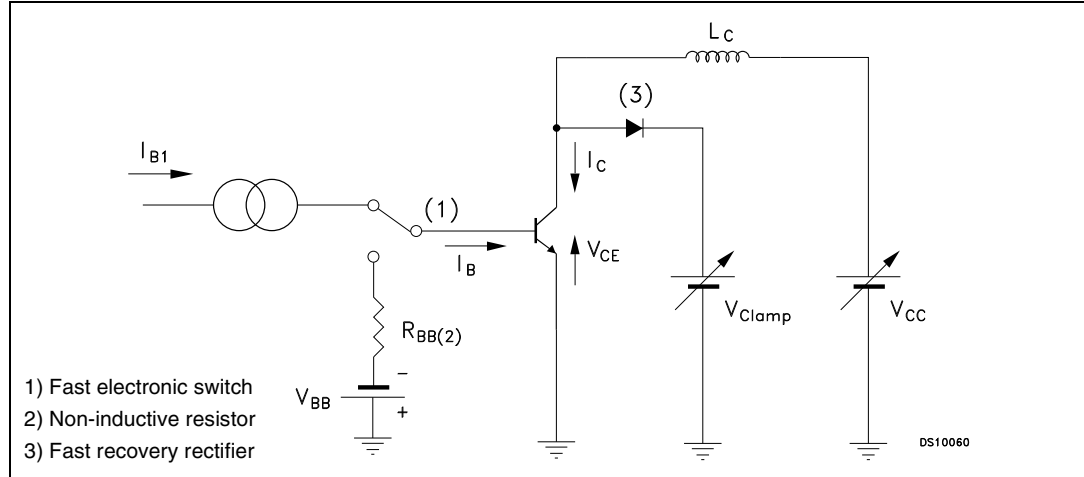


**Figure 12. Reverse biased safe operating area**

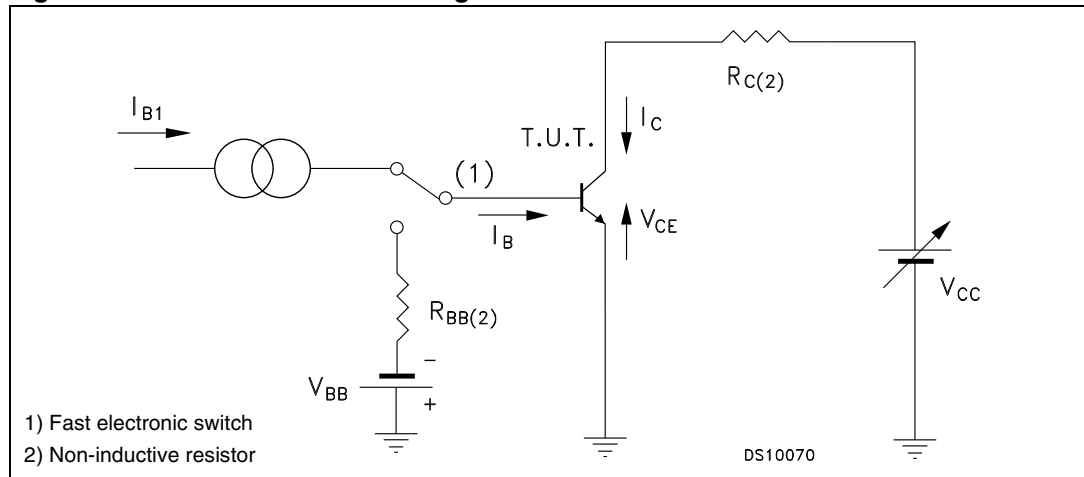


## 2.2 Test circuits

**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.

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**Package mechanical data**

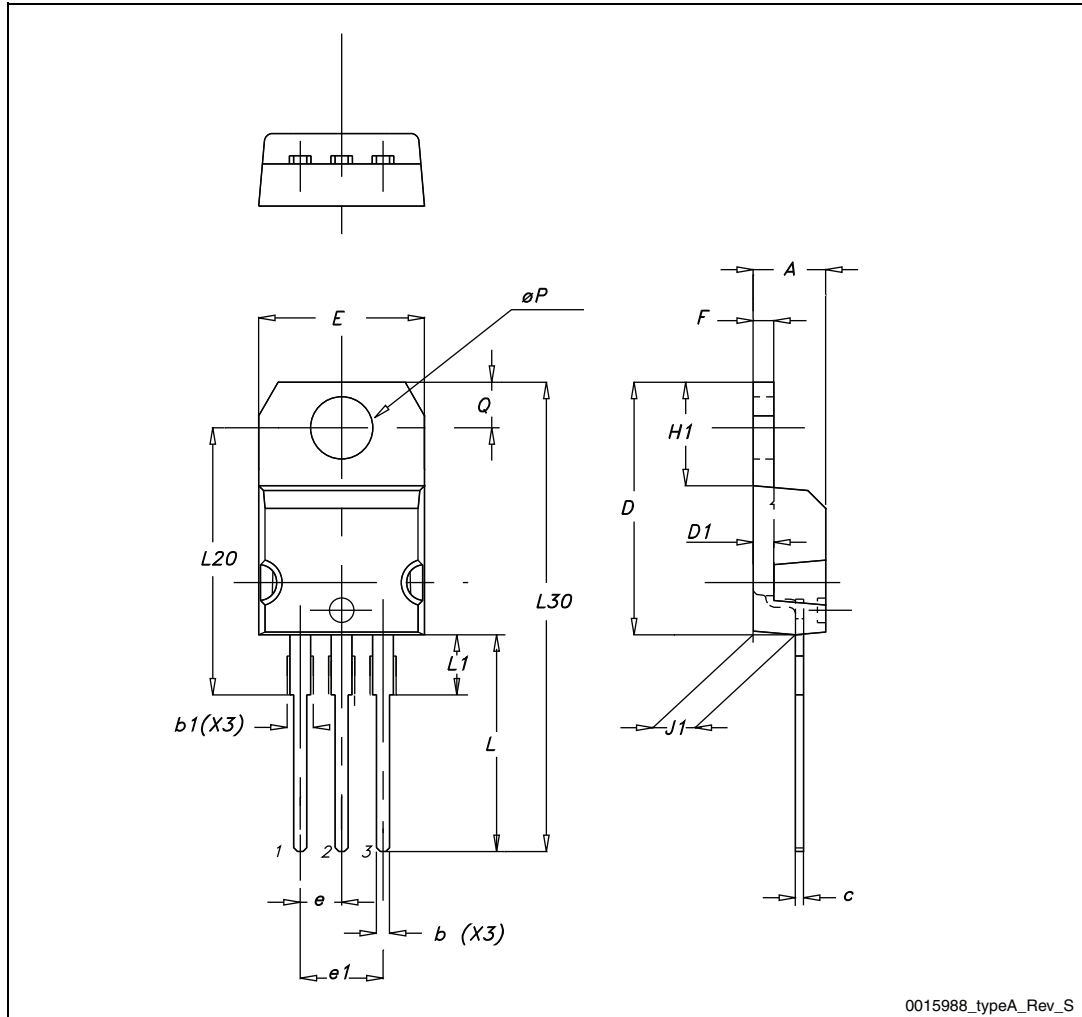
**Table 5. TO-220 type A mechanical data**

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

**Package mechanical data**

**ST13005**

**Figure 15. TO-220 type A drawing**



0015988\_typeA\_Rev\_S

## 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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