

## High voltage fast-switching NPN power transistor

Preliminary data

### Features

- STI13005-1 is opposite pin out versus standard IPAK package
- High voltage capability
- Low spread of dynamic parameters
- Very high switching speed

### Application

- Switch mode power supplies (AC-DC converters)

### Description

The 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 the wide RBSOA.

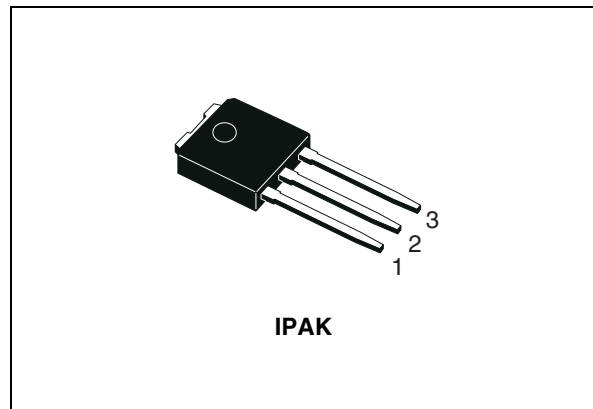


Figure 1. Internal schematic diagram

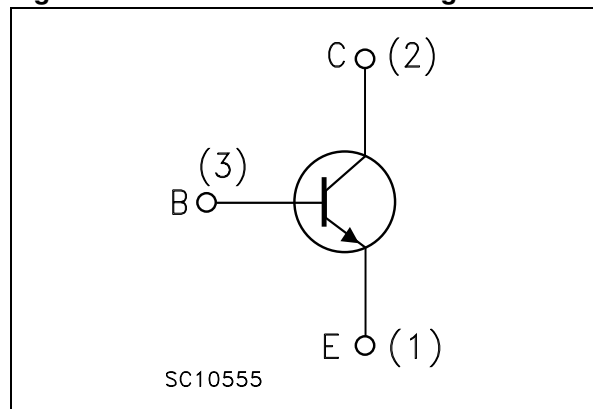


Table 1. Device summary

Order code	Marking	Package	Packaging
STI13005-1	I13005	IPAK	Tube

# 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 ( $I_C = 0$ ; $I_B = 1.5$ A; $t_p < 10$ ms)	$V_{(BR)EBO}$	V
$I_C$	Collector current	3	A
$I_{CM}$	Collector peak current ( $t_p < 5$ ms)	6	A
$I_B$	Base current	1.5	A
$I_{BM}$	Base peak current ( $t_p < 5$ ms)	3	A
$P_{TOT}$	Total dissipation at $T_c = 25$ °C	30	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
$R_{thJC}$	Thermal resistance junction-case max	4.2	°C/W

## 2 Electrical characteristics

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

**Table 4. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{\text{CES}}$	Collector cut-off current ( $V_{\text{BE}} = 0$ )	$V_{\text{CE}} = 700\text{ V}$			1	mA
		$V_{\text{CE}} = 700\text{ V}$ $T_{\text{C}} = 125\text{ °C}$			5	mA
$I_{\text{CEO}}$	Collector-cut-off current ( $I_{\text{B}} = 0$ )	$V_{\text{CE}} = 400\text{ V}$			1	mA
$V_{(\text{BR})\text{EBO}}$	Emitter base breakdown voltage ( $I_{\text{C}} = 0$ )	$I_{\text{E}} = 10\text{ mA}$	9		18	V
$V_{\text{CEO(sus)}}^{(1)}$	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	$I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 200\text{ mA}$			0.5	V
		$I_{\text{C}} = 2\text{ A}$ $I_{\text{B}} = 500\text{ mA}$			0.6	V
		$I_{\text{C}} = 3\text{ A}$ $I_{\text{B}} = 750\text{ mA}$			5	V
$V_{\text{BE(sat)}}^{(1)}$	Base-emitter saturation voltage	$I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 200\text{ mA}$			1.2	V
		$I_{\text{C}} = 2\text{ A}$ $I_{\text{B}} = 500\text{ mA}$			1.6	V
$h_{\text{FE}}^{(1)}$	DC current gain	$I_{\text{C}} = 500\text{ }\mu\text{A}$ $V_{\text{CE}} = 2\text{ V}$	15			
		$I_{\text{C}} = 425\text{ mA}$ $V_{\text{CE}} = 2\text{ V}$	24			
		$I_{\text{C}} = 1\text{ A}$ $V_{\text{CE}} = 5\text{ V}$	10		30	
		$I_{\text{C}} = 2\text{ A}$ $V_{\text{CE}} = 5\text{ V}$	8		24	
$t_{\text{s}}$ $t_{\text{f}}$	Resistive load	$I_{\text{C}} = 2\text{ A}$ $V_{\text{CC}} = 125\text{ V}$ $I_{\text{B1}} = -I_{\text{B2}} = 400\text{ mA}$ $t_{\text{p}} = 30\text{ }\mu\text{s}$		1.65		$\mu\text{s}$
	Storage time			260		ns
$t_{\text{s}}$ $t_{\text{f}}$	Inductive load	$I_{\text{C}} = 1\text{ A}$ $V_{\text{clamp}} = 300\text{ V}$ $I_{\text{B1}} = 200\text{ mA}$ $V_{\text{BE(off)}} = -5\text{ V}$ $L = 50\text{ mH}$ $R_{\text{BB}} = 0$		0.8		$\mu\text{s}$
	Storage time			150		ns
	Fall time					

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

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

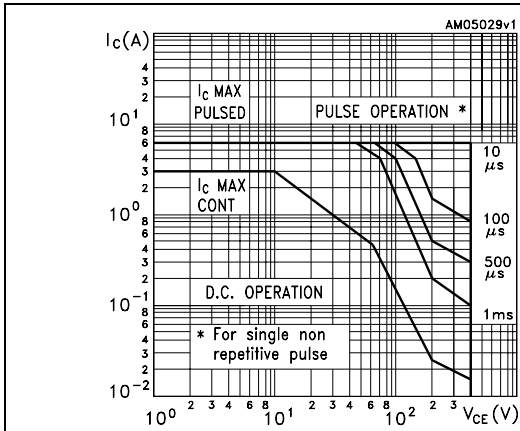


Figure 3. Derating curve

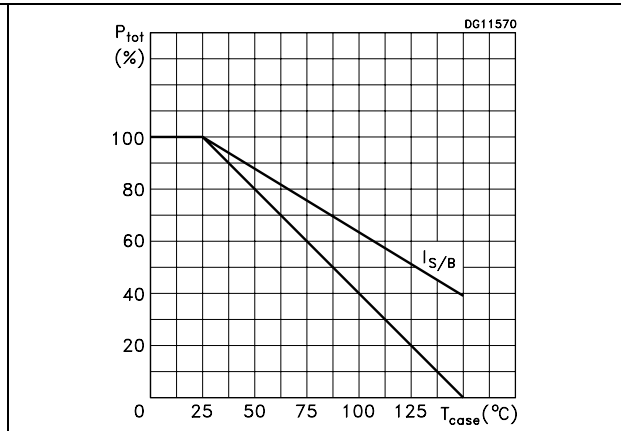


Figure 4. Reverse biased SOA

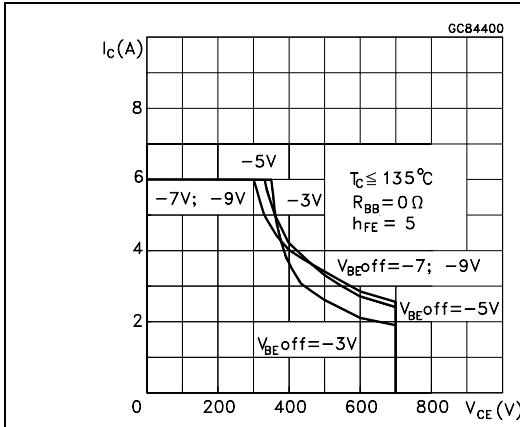


Figure 5. Output characteristics

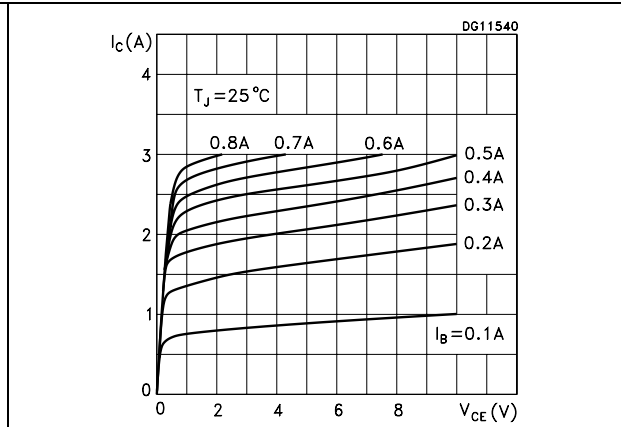


Figure 6. DC current gain ( $V_{CE} = 1V$ )

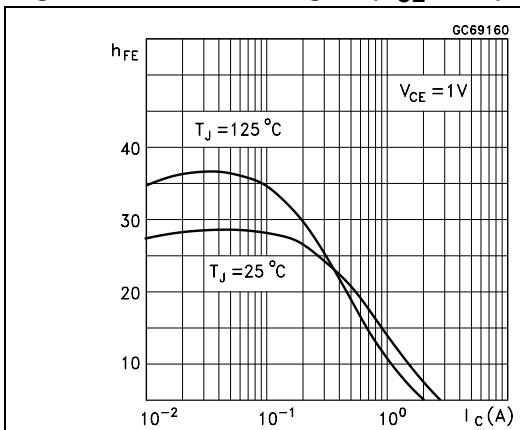


Figure 7. DC current gain ( $V_{CE} = 5V$ )

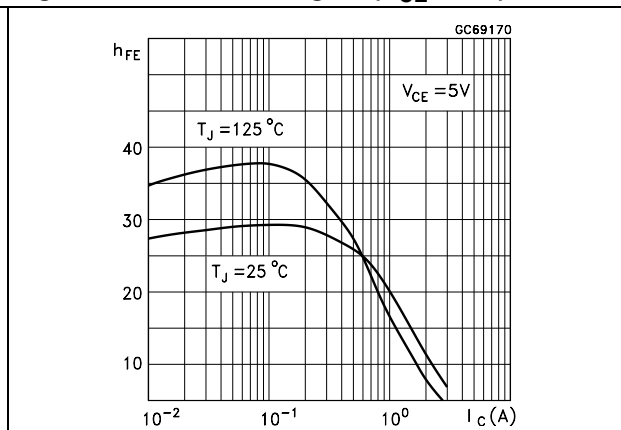


Figure 8. Collector-emitter saturation voltage Figure 9. Base-emitter saturation voltage

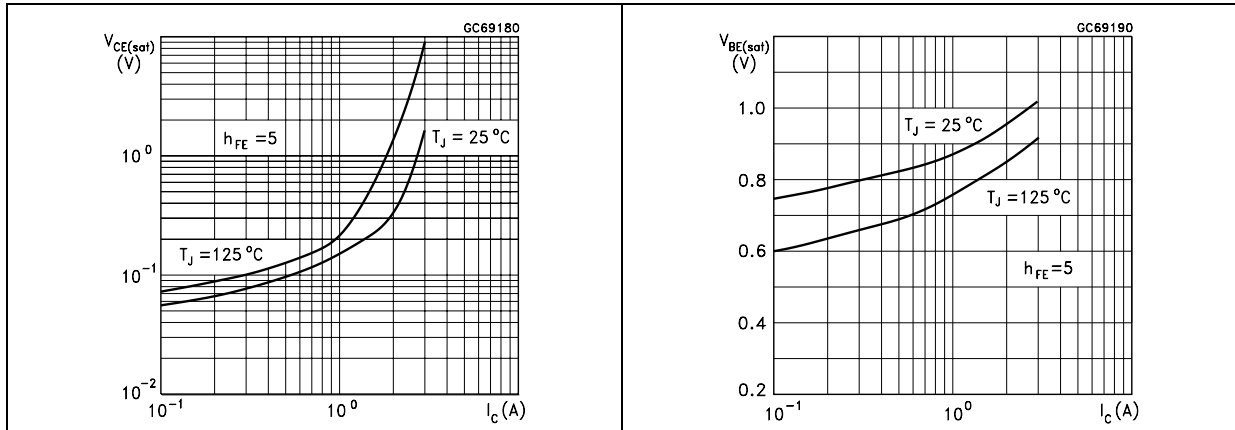


Figure 10. Inductive load fall time Figure 11. Inductive load storage time

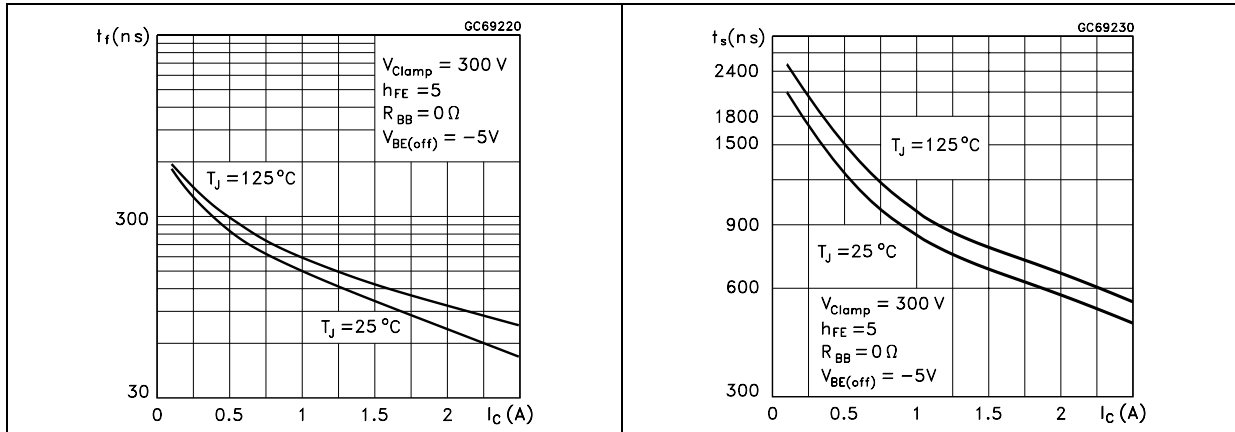
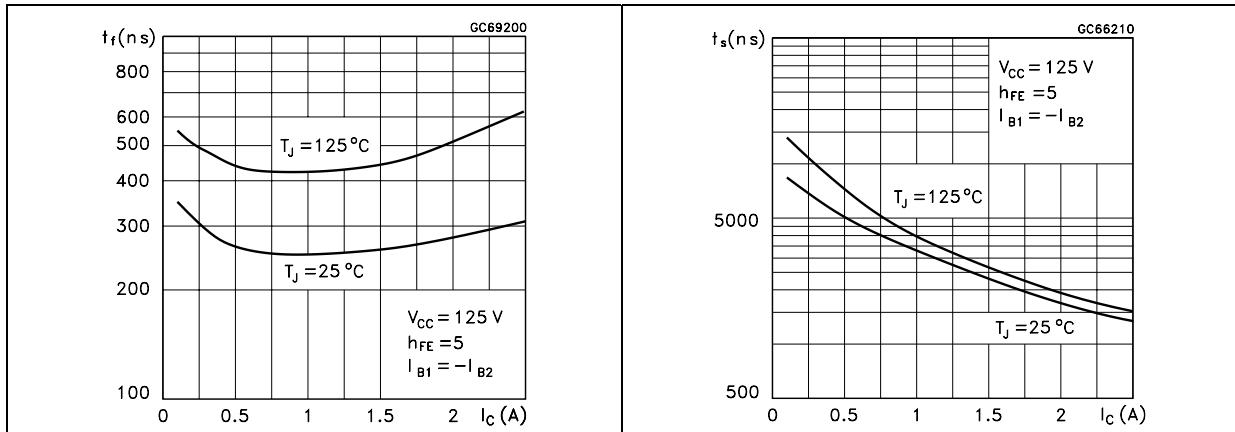
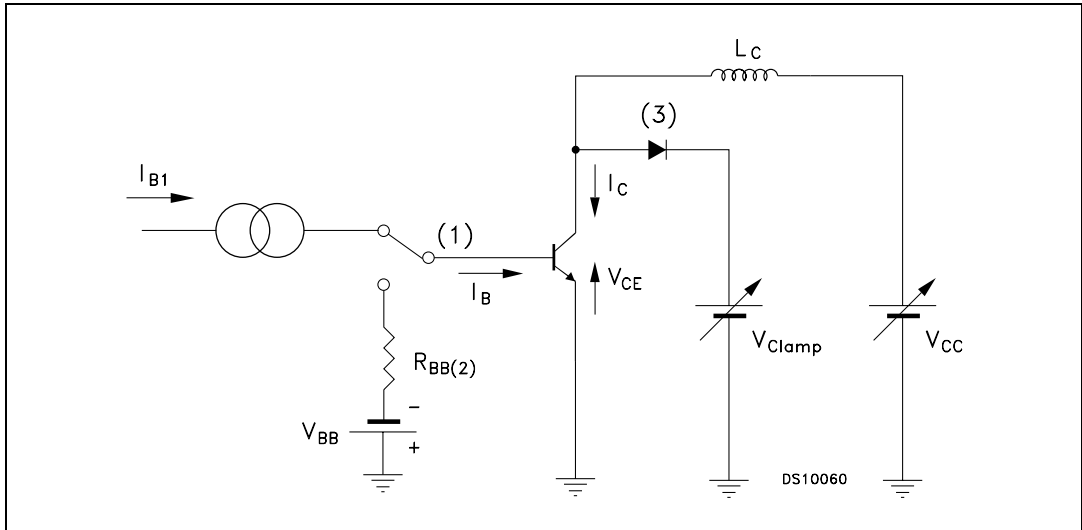


Figure 12. Resistive load fall time Figure 13. Resistive load storage time



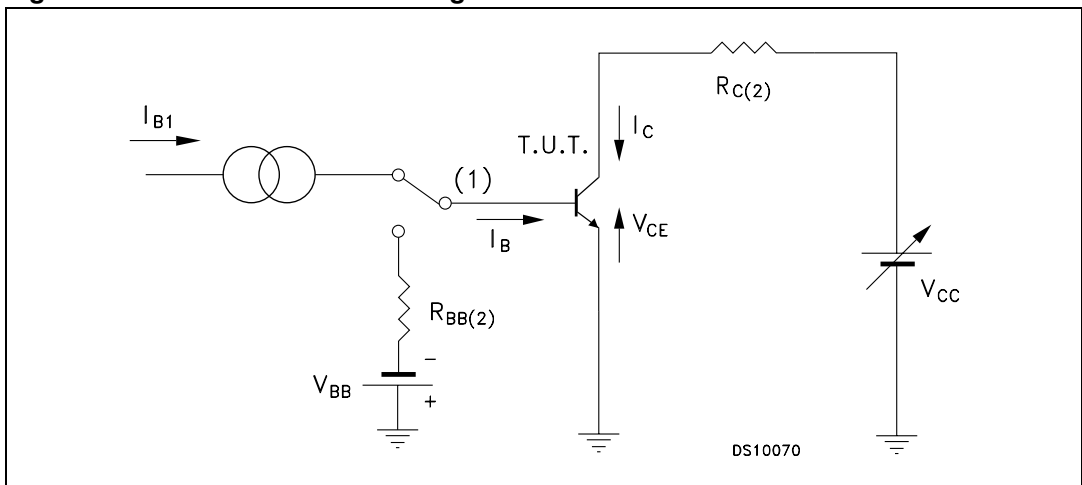
### 3 Test circuits

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



- 1) Fast electronic switch
- 2) Non-inductive resistor
- 3) Fast recovery rectifier

**Figure 15. Resistive load switching test circuit**



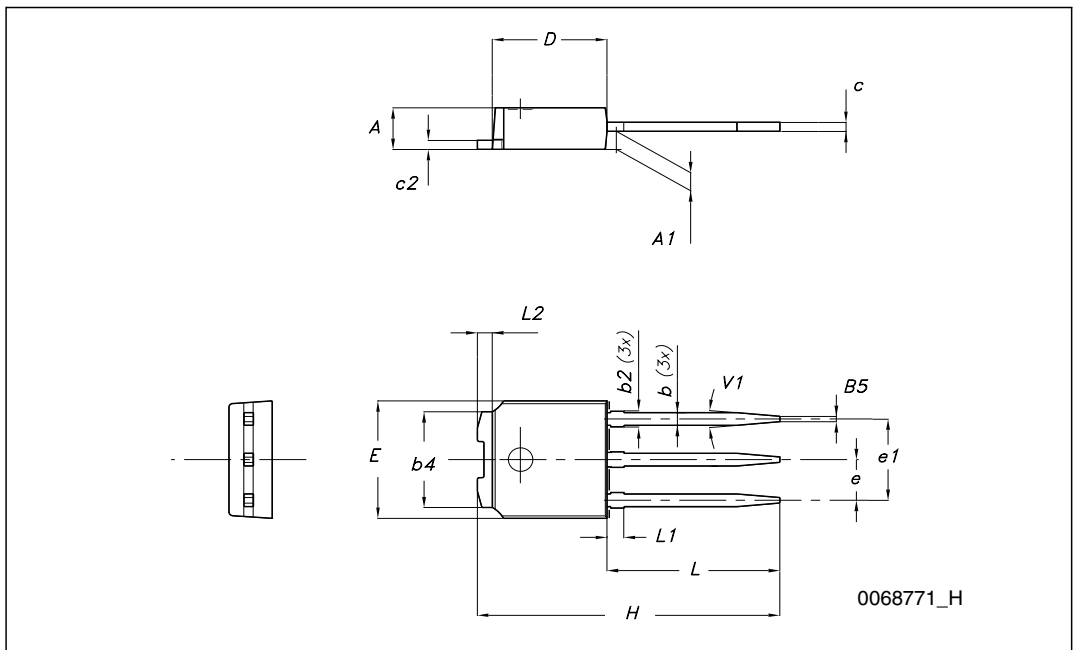
- 1) Fast electronic switch
- 2) Non-inductive resistor

## 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](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

**TO-251 (IPAK) mechanical data**

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
(L1)	0.80		1.20
L2		0.80	
V1		10 <sup>0</sup>	





## 5 Revision history

**Table 5. Document revision history**

Date	Revision	Changes
18-Feb-2010	1	First release.

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