

High voltage fast-switching NPN power transistor

Features

- High voltage capability
- Low spread of dynamic parameters
- Very high switching speed

Application

- Switch mode power supplies (AC-DC converters)

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.

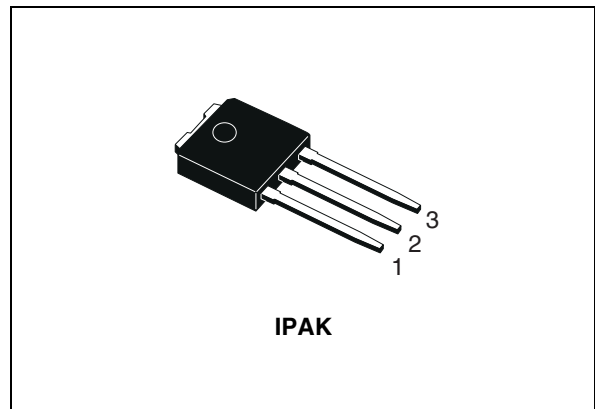


Figure 1. Internal schematic diagram

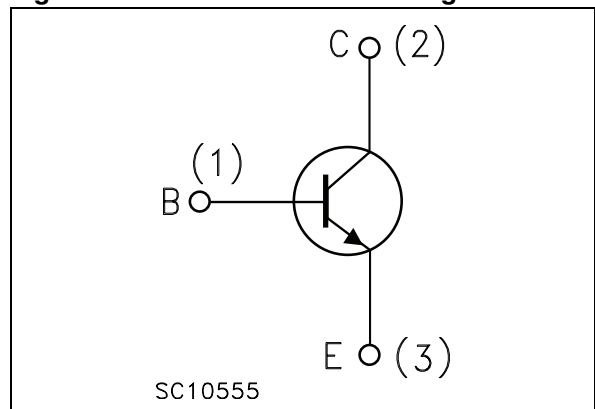


Table 1. Device summary

Order code	Marking	Package	Packaging
STU13005N	13005N	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_{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_{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_{s} t_{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		μs
	Storage time			260		ns
t_{s} t_{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		μs
	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

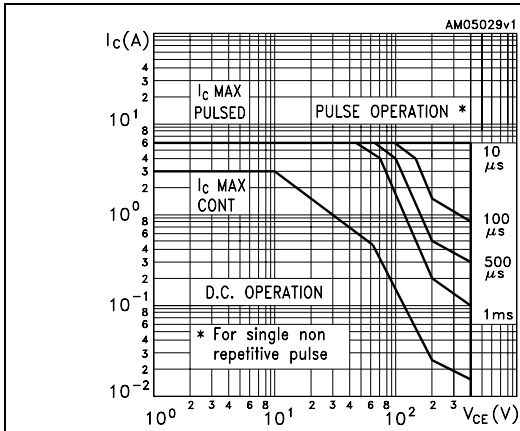


Figure 3. Derating curve

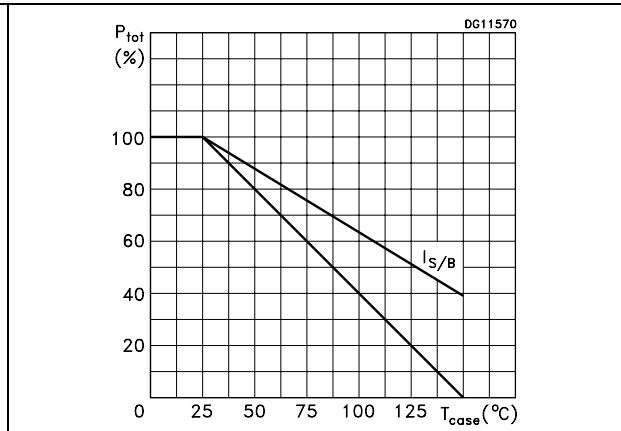


Figure 4. Reverse biased SOA

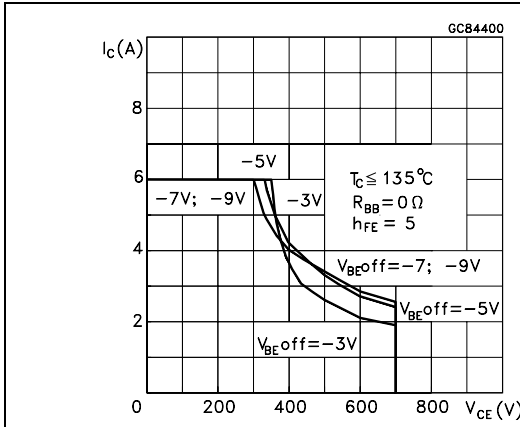


Figure 5. Output characteristics

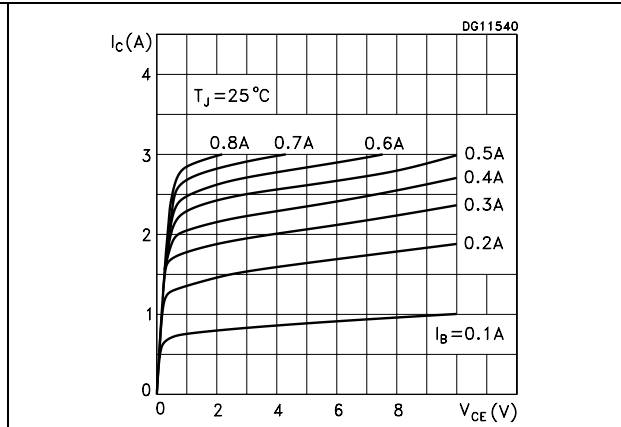


Figure 6. DC current gain ($V_{CE} = 1V$)

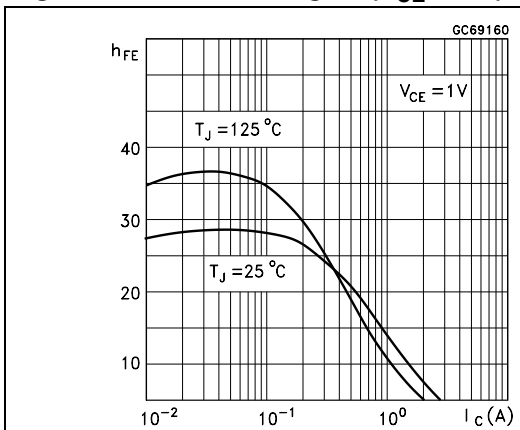


Figure 7. DC current gain ($V_{CE} = 5V$)

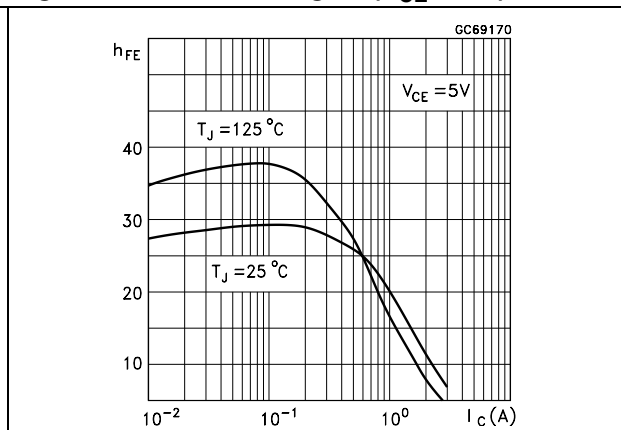


Figure 8. Collector-emitter saturation voltage Figure 9. Base-emitter saturation voltage

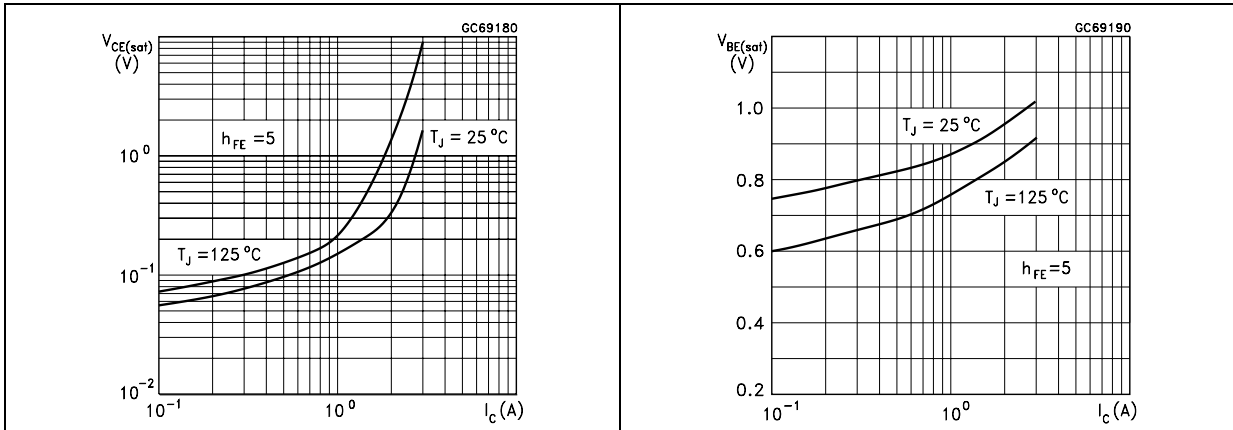


Figure 10. Inductive load fall time Figure 11. Inductive load storage time

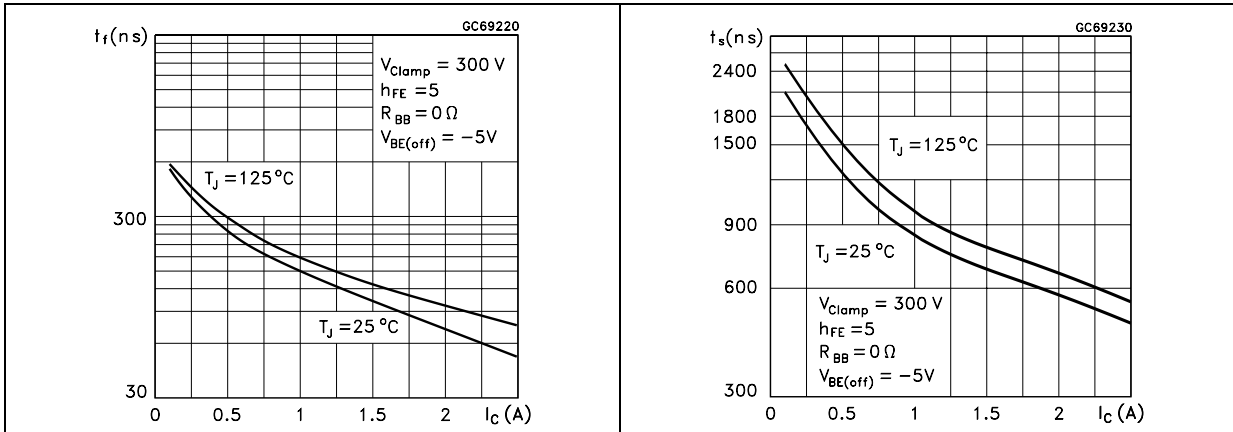
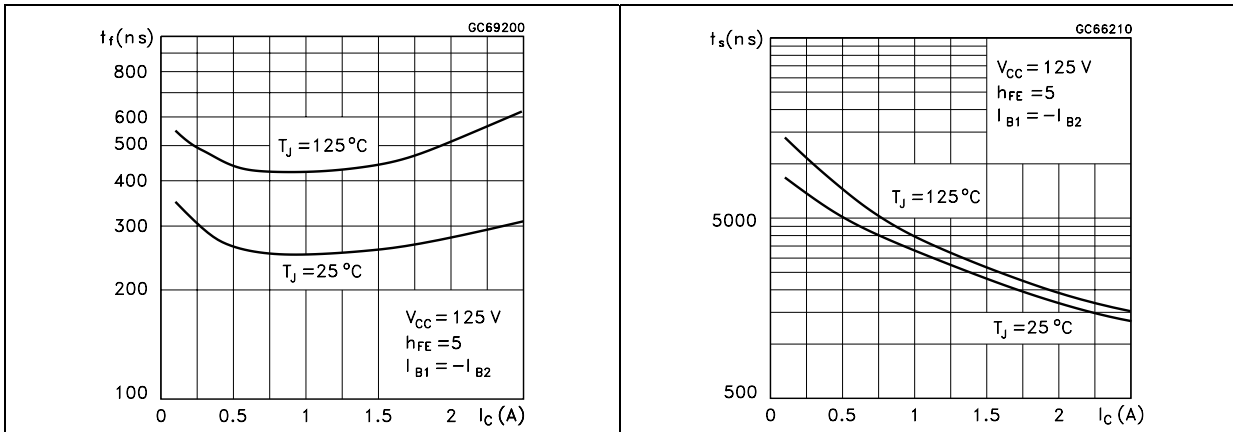
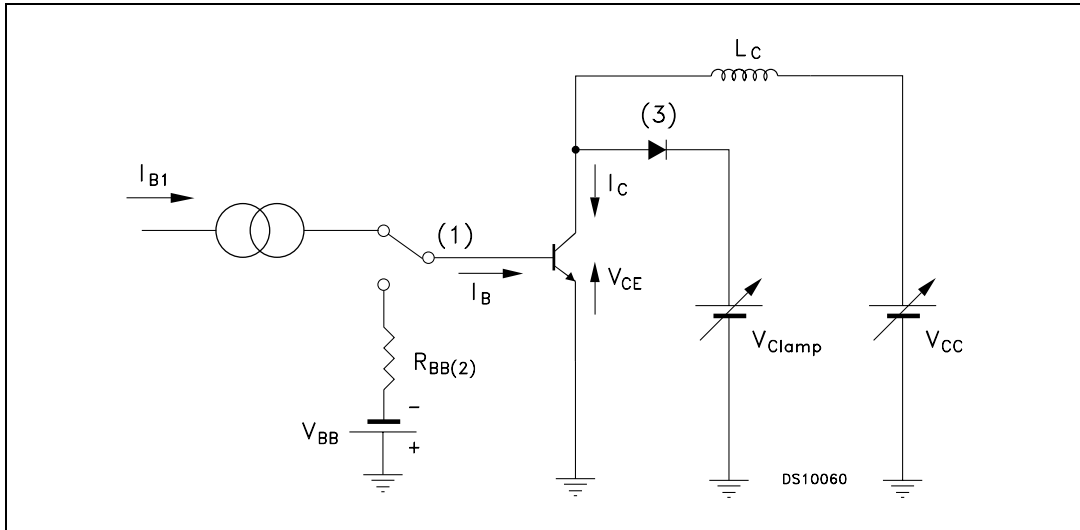


Figure 12. Resistive load fall time Figure 13. Resistive load storage time



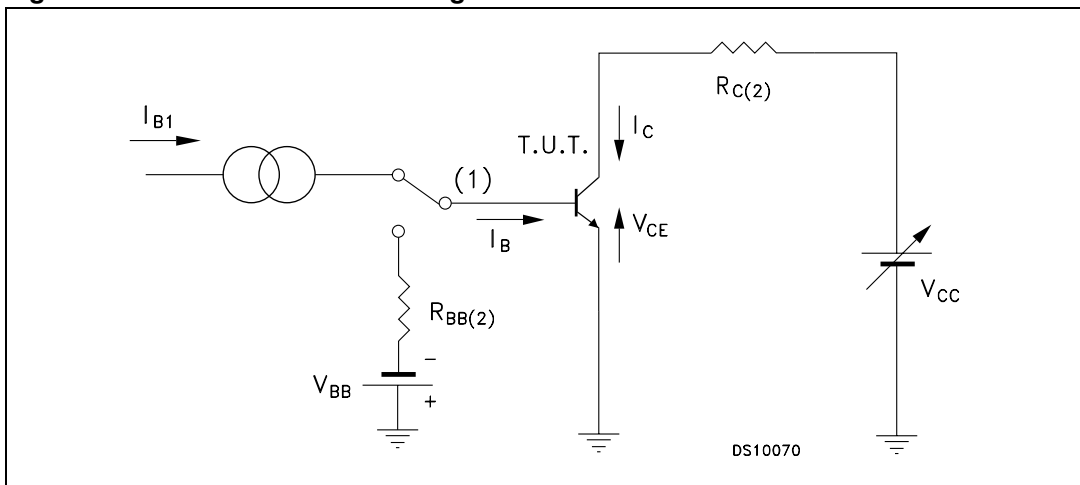
3 Test circuits

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

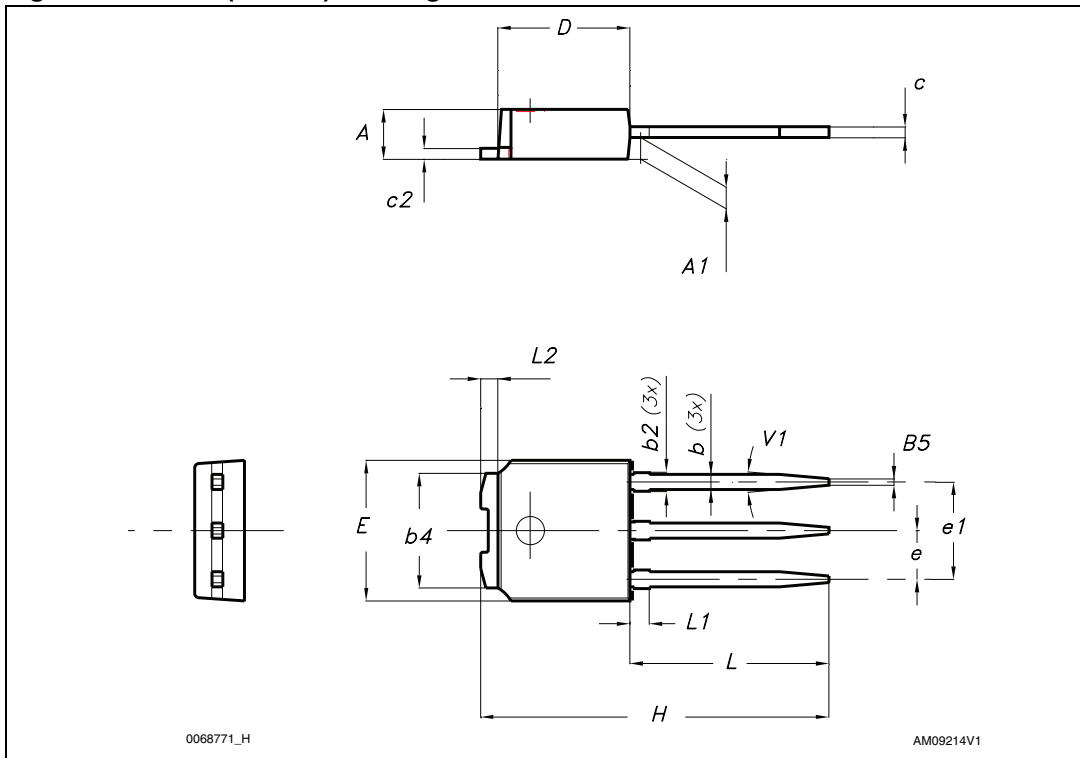
4 Package mechanical data

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Table 5. IPAK (TO-251) 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
B5		0.3	
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	1.00
V1		10 °	

Figure 16. IPAK (TO-251) drawing



5 Revision history

Table 6. Document revision history

Date	Revision	Changes
20-Feb-2012	1	First release.

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Наши контакты:

Телефон: +7 812 627 14 35

Электронная почта: sales@st-electron.ru

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