

High voltage fast-switching NPN power transistor

Preliminary data

Features

- 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.

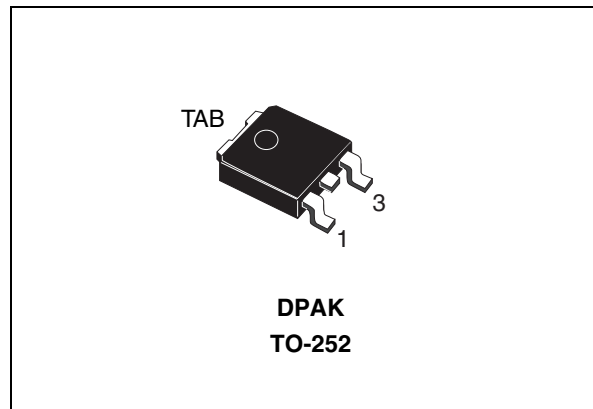


Figure 1. Internal schematic diagram

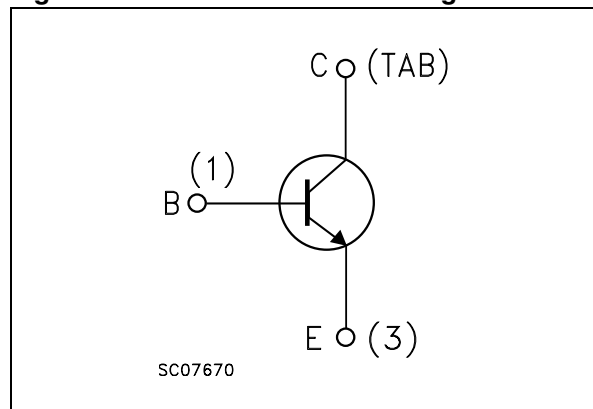


Table 1. Device summary

Order code	Marking	Package	Packaging
STD13005T4	D13005	DPAK	Tape and reel

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

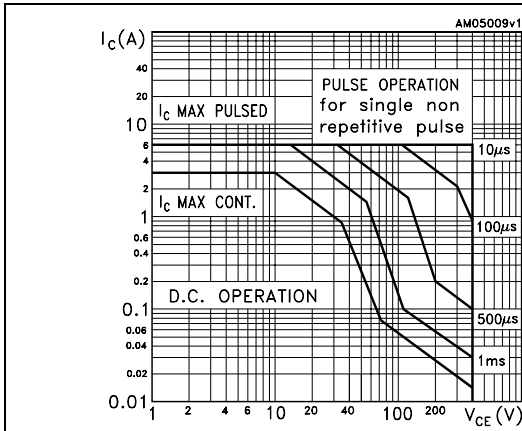


Figure 3. Derating curve

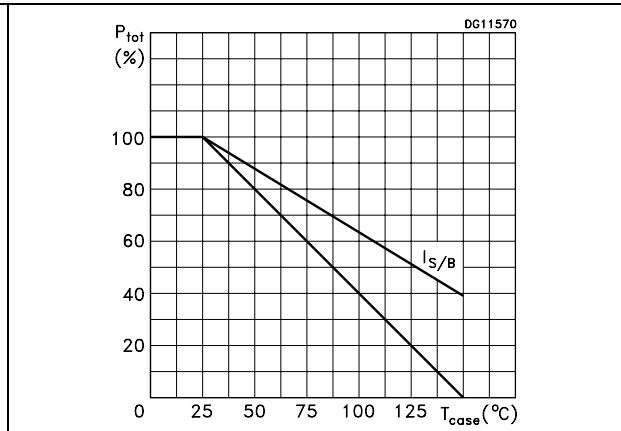


Figure 4. Reverse biased SOA

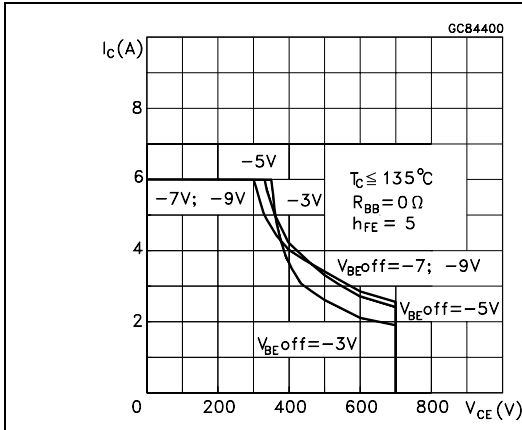


Figure 5. Output characteristics

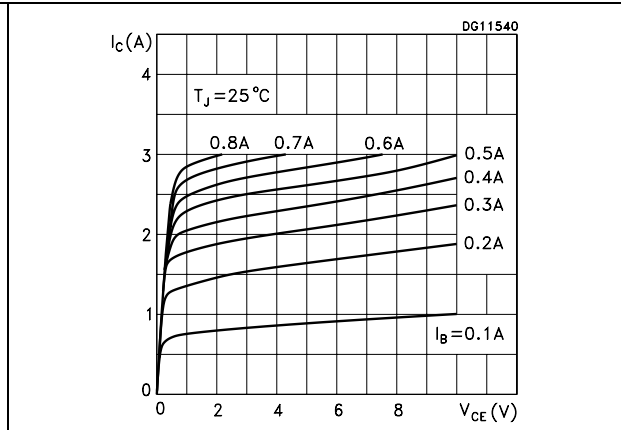


Figure 6. DC current gain ($V_{CE} = 1\text{V}$)

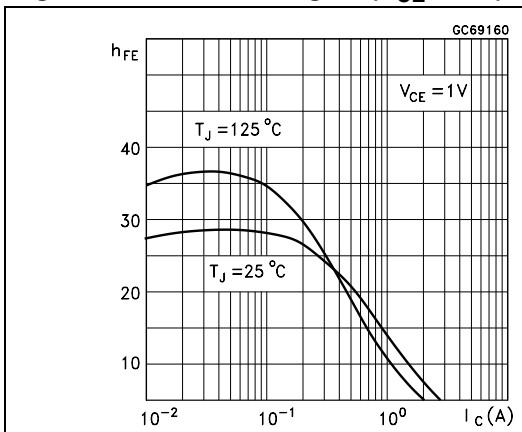


Figure 7. DC current gain ($V_{CE} = 5\text{V}$)

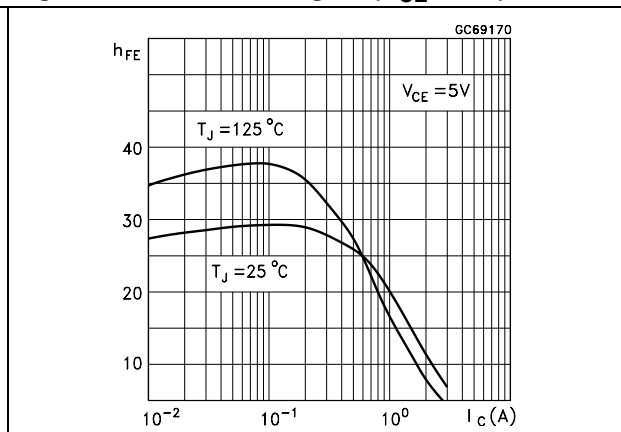


Figure 8. Collector-emitter saturation voltage Figure 9. Base-emitter saturation voltage

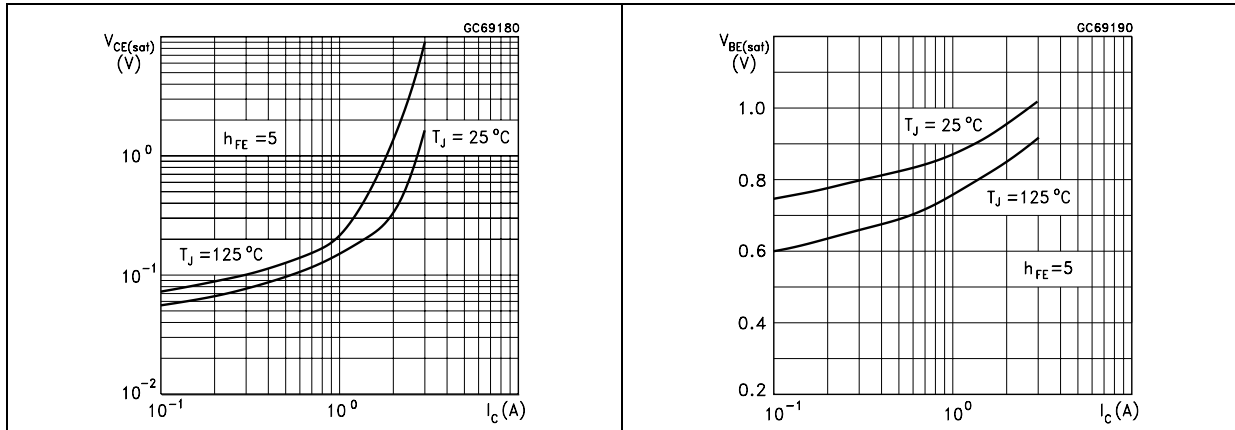


Figure 10. Inductive load fall time Figure 11. Inductive load storage time

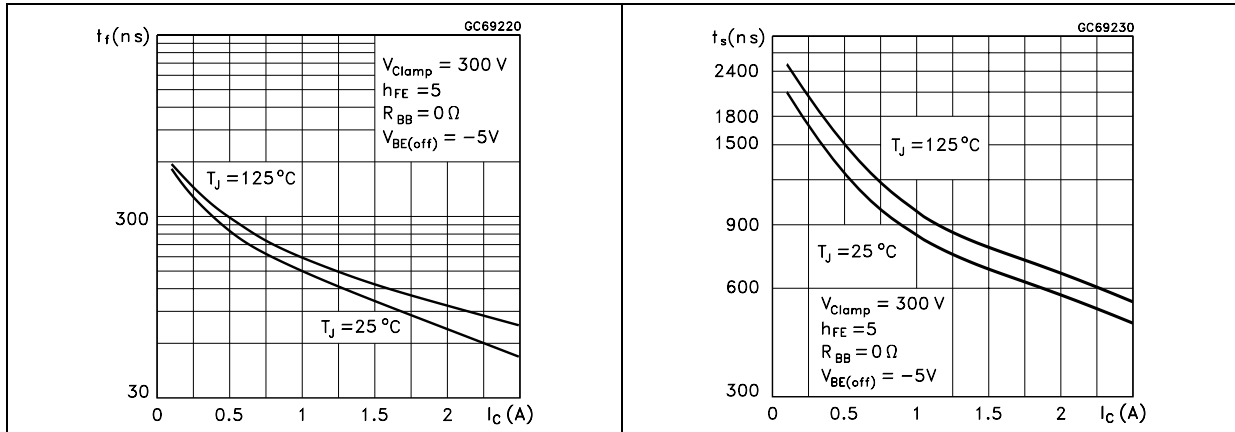
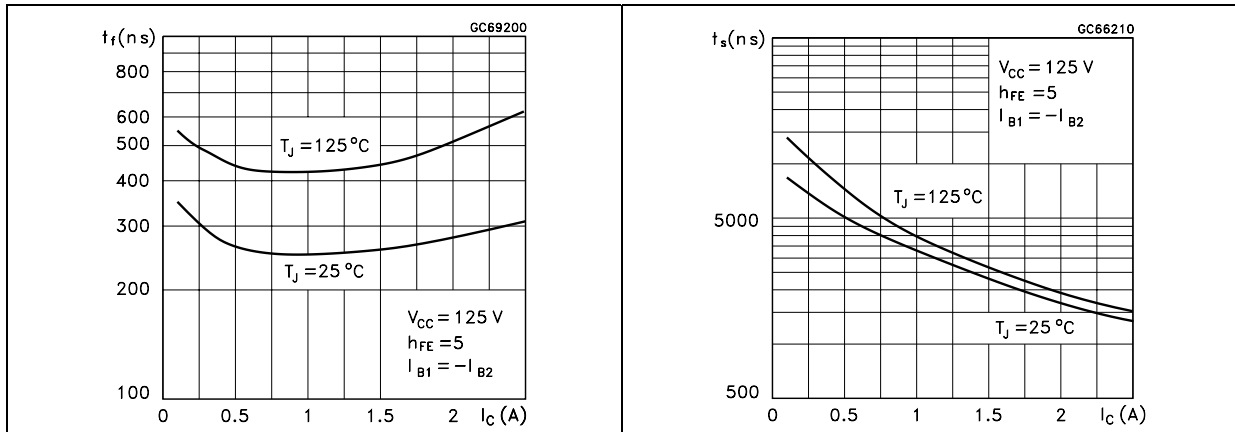
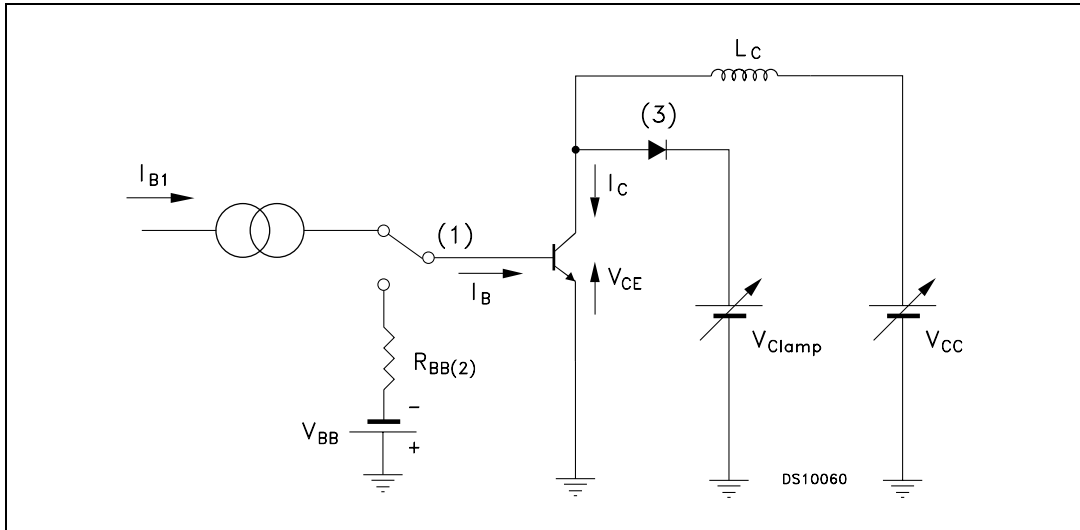


Figure 12. Resistive load fall time Figure 13. Resistive load storage time



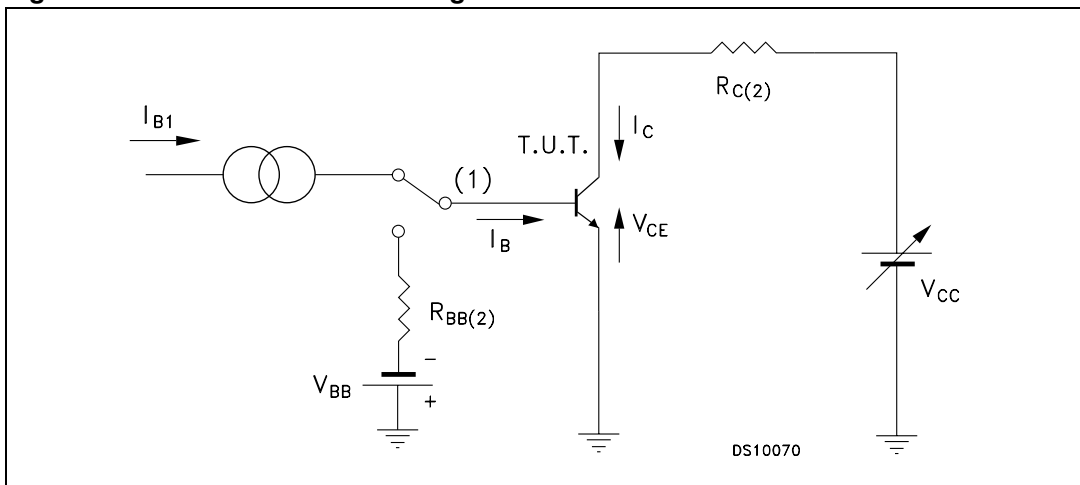
3 Test circuits

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



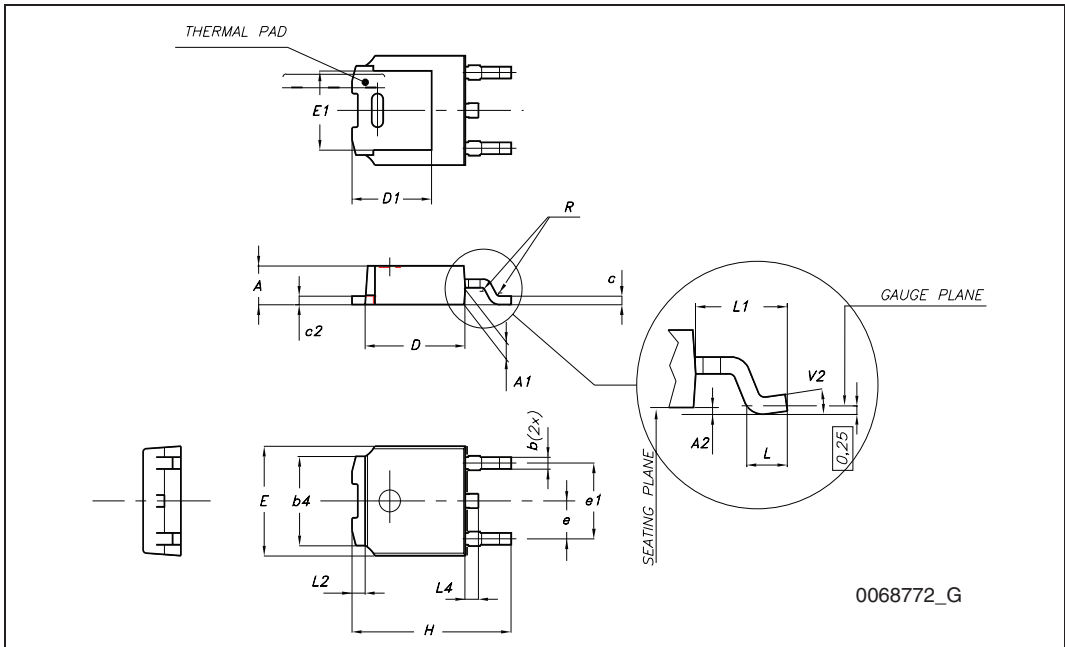
- 1) Fast electronic switch
- 2) Non-inductive resistor

4 Package mechanical data

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TO-252 (DPAK) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0°		8°



5 Revision history

Table 5. Document revision history

Date	Revision	Changes
12-Nov-2009	1	First release.

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