



ST13009

High voltage fast-switching NPN power transistor

Features

- Low spread of dynamic parameters
- High voltage capability
- Minimum lot-to-lot spread for reliable operation
- Very high switching speed

Applications

- Switch mode power supplies

Description

The device is manufactured using high voltage multi-epitaxial planar technology for high switching speeds and medium voltage capability. It uses a Hollow emitter structure to enhance switching speeds.

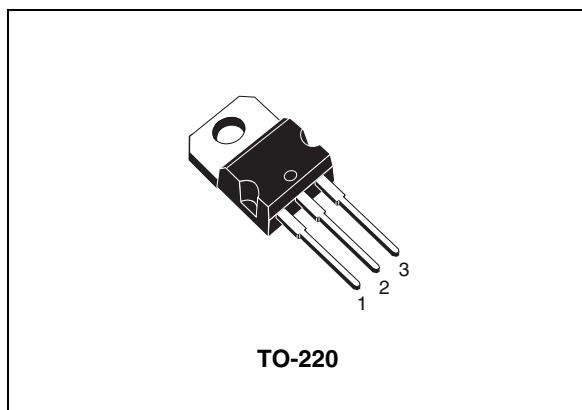


Figure 1. Internal schematic diagram

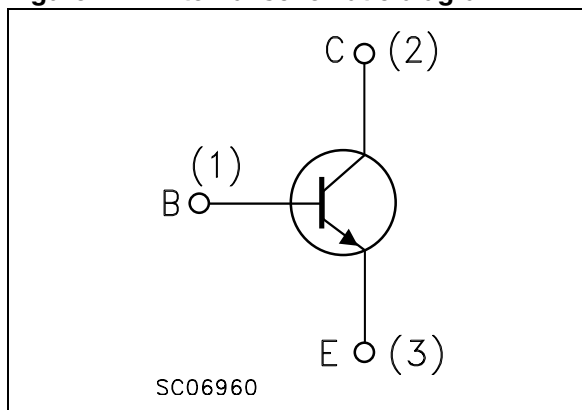


Table 1. Device summary

Order code	Marking ⁽¹⁾	Package	Packaging
ST13009	13009 L 13009 H	TO-220	Tube

1. Product is pre-selected in DC current gain (group L and group H). 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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1 Electrical ratings

Table 2. Absolute maximum rating

Symbol	Parameter	Value	Unit
V_{CEV}	Collector-emitter voltage ($V_{BE} = -1.5\text{ V}$)	700	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	400	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	12	V
I_C	Collector current	12	A
I_{CM}	Collector peak current ($t_P < 5\text{ms}$)	24	A
I_B	Base current	6	A
I_{BM}	Base peak current ($t_P < 5\text{ms}$)	12	A
P_{tot}	Total dissipation at $T_C = 25^\circ\text{C}$	100	W
T_{stg}	Storage temperature	-65 to 150	$^\circ\text{C}$
T_J	Max. operating junction temperature	150	$^\circ\text{C}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case Max	1.25	$^\circ\text{C/W}$

2 Electrical characteristics

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

Table 4. Electrical characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cut-off current ($V_{\text{BE}} = -1.5 \text{ V}$)	$V_{\text{CE}} = 700 \text{ V}$ $V_{\text{CE}} = 700 \text{ V}$ $T_{\text{C}} = 100^{\circ}\text{C}$			10 500	μA μA
I_{EBO}	Emitter cut-off current ($I_{\text{C}} = 0$)	$V_{\text{EB}} = 10 \text{ V}$			10	μA
$V_{\text{CEO(sus)}}^{(1)}$	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	$I_{\text{C}} = 4 \text{ A}$ $I_{\text{B}} = 0.8 \text{ A}$ $I_{\text{C}} = 5 \text{ A}$ $I_{\text{B}} = 1 \text{ A}$ $I_{\text{C}} = 8 \text{ A}$ $I_{\text{B}} = 1.6 \text{ A}$ $I_{\text{C}} = 12 \text{ A}$ $I_{\text{B}} = 3 \text{ A}$			0.85 0.9 1.25 2.5	V V V V
$V_{\text{BE(sat)}}^{(1)}$	Base-emitter saturation voltage	$I_{\text{C}} = 5 \text{ A}$ $I_{\text{B}} = 1 \text{ A}$ $I_{\text{C}} = 8 \text{ A}$ $I_{\text{B}} = 1.6 \text{ A}$			1.2 1.6	V V
$h_{\text{FE}}^{(1)(2)}$	DC current gain	$I_{\text{C}} = 5 \text{ A}$ $V_{\text{CE}} = 5 \text{ V}$ Group L Group H $I_{\text{C}} = 8 \text{ A}$ $V_{\text{CE}} = 5 \text{ V}$	15 26 10		28 39 30	
t_{s} t_{f}	Inductive load Storage time Fall time	$I_{\text{C}} = 5 \text{ A}$ $V_{\text{CC}} = 250 \text{ V}$ $I_{\text{B1}} = 1 \text{ A}$ $I_{\text{B2}} = -2 \text{ A}$ $L = 200 \mu\text{H}$ see Figure 9		1.6 60	2.5 110	μs ns
t_{s} t_{f}	Inductive load Storage time Fall time	$I_{\text{C}} = 5 \text{ A}$ $V_{\text{CC}} = 125 \text{ V}$ $I_{\text{B1}} = -I_{\text{B2}} = 1.6 \text{ A}$ $L = 200 \mu\text{H}$ $t_{\text{c}} = 125^{\circ}\text{C}$ see Figure 9		2.3 110		μs ns

1. Pulsed duration = 300 ms, duty cycle $\leq 2\%$

2. Product is pre-selected in DC current gain (group L and group H). 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

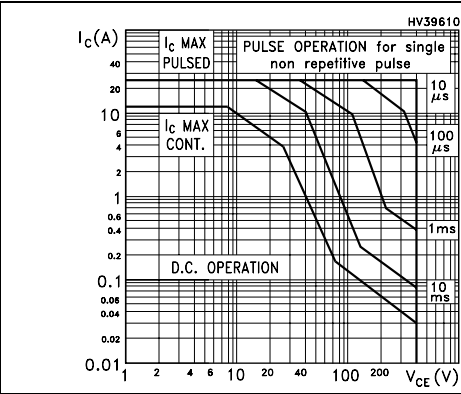


Figure 3. Derating curve

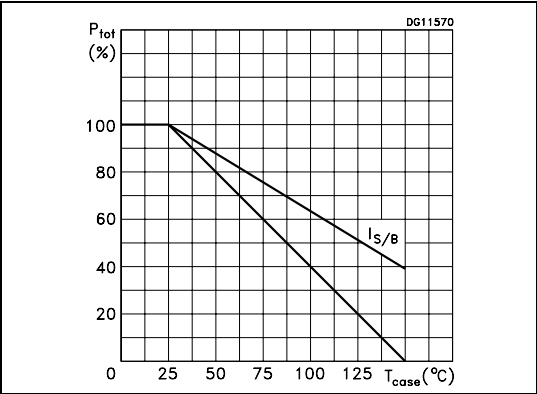


Figure 4. DC current gain

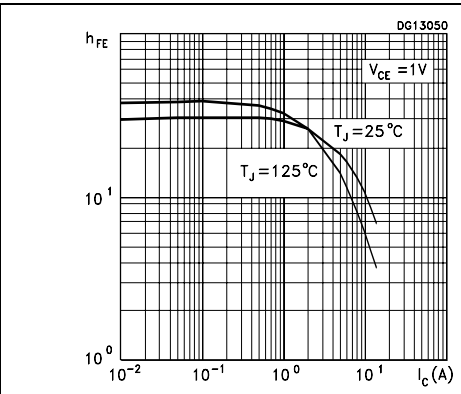


Figure 5. DC current gain

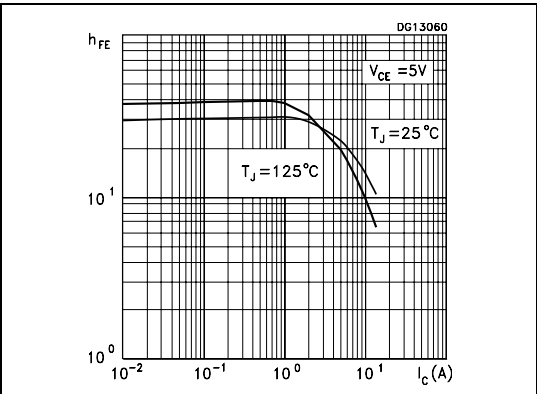


Figure 6. Collector-emitter saturation voltage

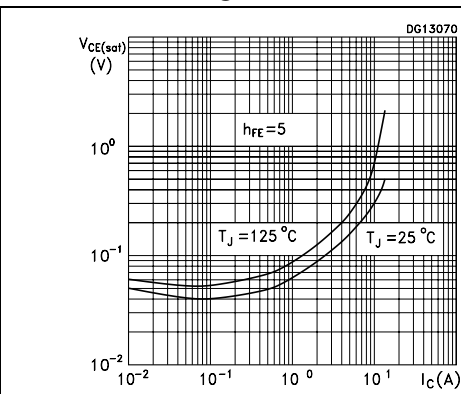


Figure 7. Base-emitter saturation voltage

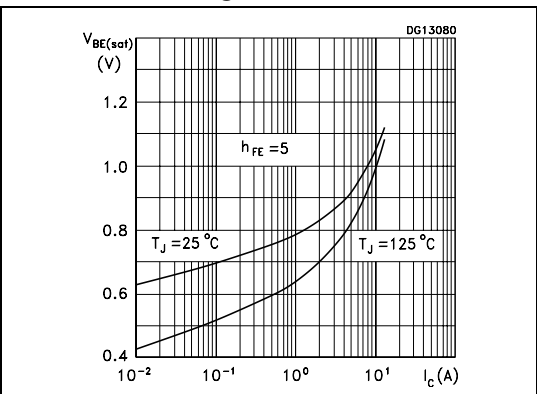
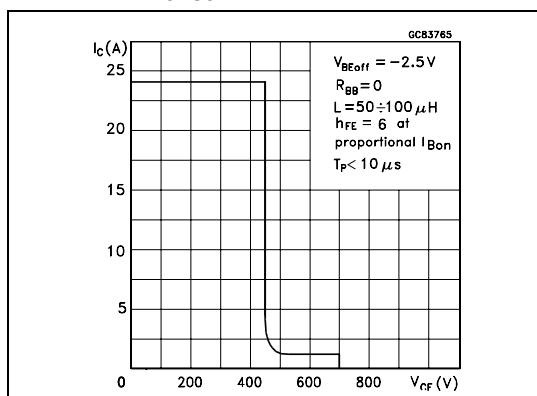
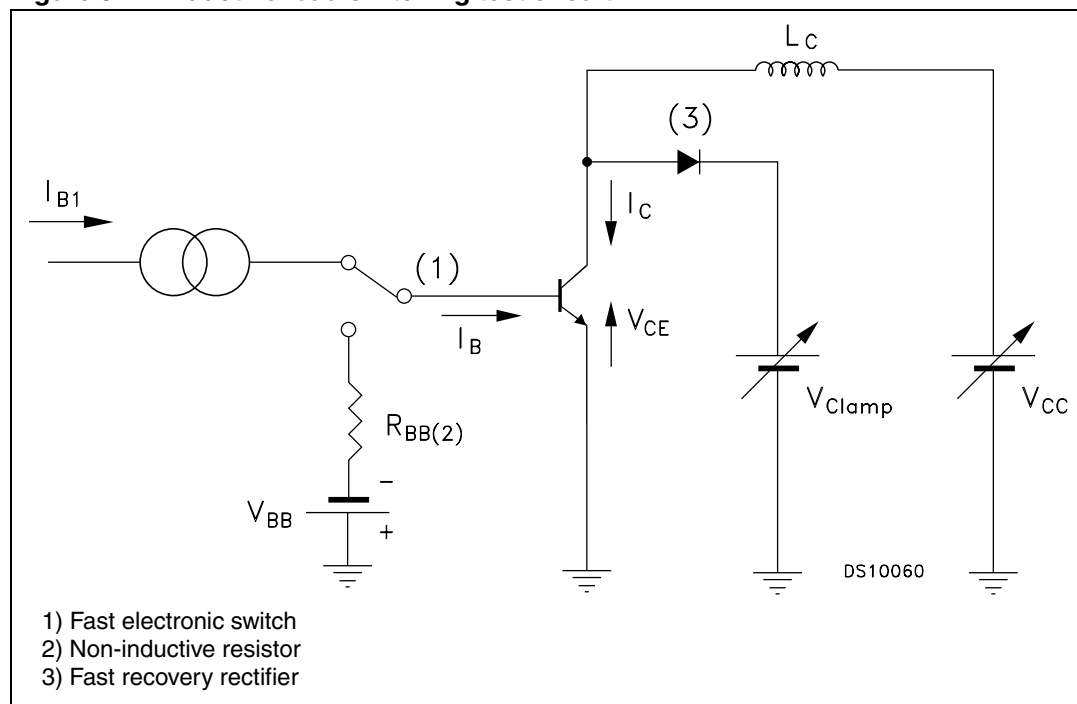


Figure 8. Reverse biased operating area



3 Test circuit

Figure 9. Inductive load switching test circuit

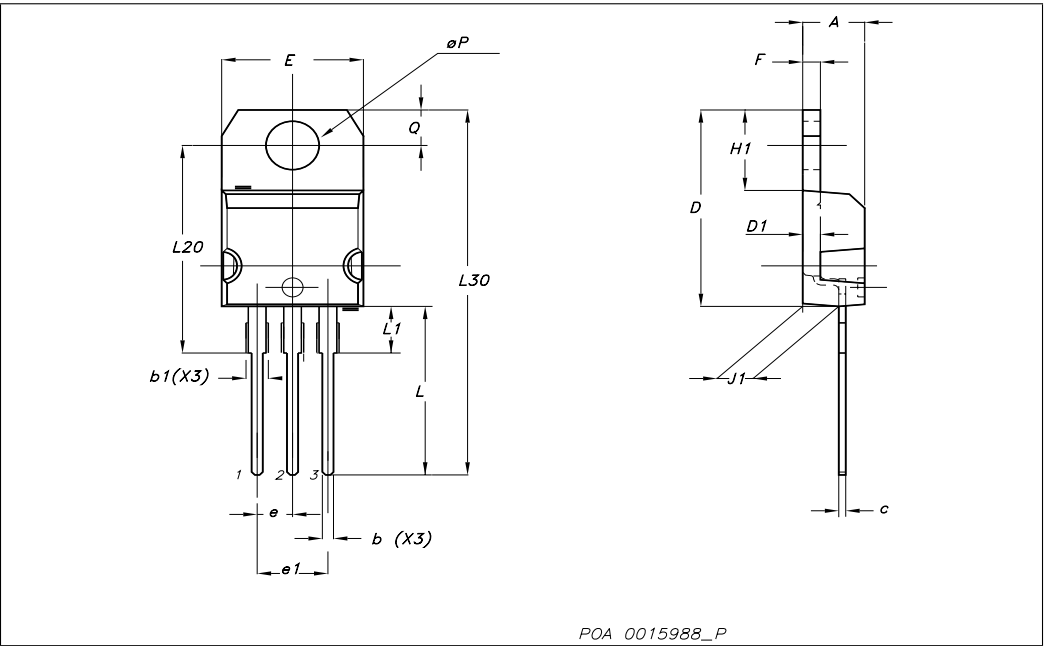


4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com

TO-220 mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.051
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
ØP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



5 Revision history

Table 5. Document revision history

Date	Revision	Changes
12-Jun-2005	1	First version
23-Aug-2007	2	Added figures: 2 , and 3

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