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High voltage fast-switching NPN power transistor

Features

- DC current gain classification
- High voltage capability
- Low spread of dynamic parameters
- Very high switching speed

Applications

- Electronic ballast for fluorescent lighting
- Switch mode power supplies

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.

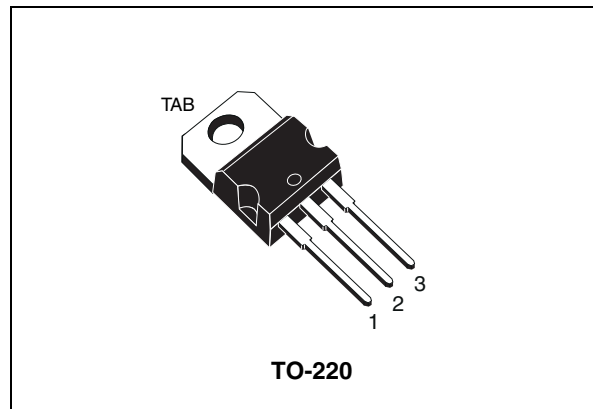


Figure 1. Internal schematic diagram

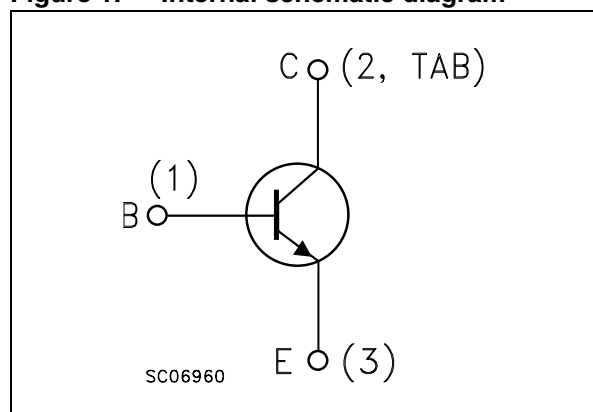


Table 1. Device summary

Order code	Marking ⁽¹⁾	Package	Packaging
ST13007	ST13007A	TO-220	Tube
	ST13007B		

1. The product is classified in DC current gain group A and group B, see [Table 5: hFE classification](#). STMicroelectronics reserves the right to ship from any group according to production availability.

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	8	A
I_{CM}	Collector peak current ($t_P < 5$ ms)	16	A
I_B	Base current	4	A
I_{BM}	Base peak current ($t_P < 5$ ms)	8	A
P_{TOT}	Total dissipation at $T_C = 25$ °C	80	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	1.56	°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 ($V_{\text{BE}} = 0$)	$V_{\text{CE}} = 700\text{ V}$			10	μA
		$V_{\text{CE}} = 700\text{ V}$ $T_{\text{C}} = 125\text{ °C}$			0.5	mA
I_{EBO}	Emitter cut-off current ($I_{\text{C}} = 0$)	$V_{\text{EB}} = 9\text{ V}$			100	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	$I_{\text{C}} = 2\text{ A}$ $I_{\text{B}} = 0.4\text{ A}$			1	V
		$I_{\text{C}} = 5\text{ A}$ $I_{\text{B}} = 1\text{ A}$			2	V
		$I_{\text{C}} = 8\text{ A}$ $I_{\text{B}} = 2\text{ A}$			3	V
		$I_{\text{C}} = 5\text{ A}, I_{\text{B}} = 1\text{ A}, T_{\text{C}} = 100\text{ °C}$			3	V
$V_{\text{BE(sat)}}^{(1)}$	Base-emitter saturation voltage	$I_{\text{C}} = 2\text{ A}$ $I_{\text{B}} = 0.4\text{ A}$			1.2	V
		$I_{\text{C}} = 5\text{ A}$ $I_{\text{B}} = 1\text{ A}$			1.6	V
		$I_{\text{C}} = 5\text{ A}, I_{\text{B}} = 1\text{ A}, T_{\text{C}} = 100\text{ °C}$			1.5	V
h_{FE}	DC current gain	$I_{\text{C}} = 2\text{ A}$ $V_{\text{CE}} = 5\text{ V}$	16		40	
		$I_{\text{C}} = 5\text{ A}$ $V_{\text{CE}} = 5\text{ V}$	5		30	
t_{s} t_{f}	Resistive load Storage time	$V_{\text{CC}} = 300\text{ V}$ $I_{\text{C}} = 2\text{ A}$ $I_{\text{B(on)}} = - I_{\text{B(off)}} = 400\text{ mA}$	3		4.5	μs
	Fall time	$T_{\text{P}} = 30\text{ }\mu\text{s}$			350	ns
t_{s} t_{f}	Inductive load Storage time	$I_{\text{C}} = 5\text{ A}$ $V_{\text{Clamp}} = 250\text{ V}$ $I_{\text{B(on)}} = 1\text{ A}$ $I_{\text{B(off)}} = - 2\text{ A}$		1.5	2.5	μs
	Fall time	$L = 200\text{ }\mu\text{H}$		40	110	ns
t_{s} t_{f}	Inductive load Storage time	$I_{\text{C}} = 5\text{ A}$ $V_{\text{Clamp}} = 250\text{ V}$ $I_{\text{B(on)}} = 1\text{ A}$ $I_{\text{B(off)}} = - 2\text{ A}$		2		μs
	Fall time	$L = 200\text{ }\mu\text{H}$ $T_{\text{C}} = 125\text{ °C}$		70		ns

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

Table 5. h_{FE} classification

Symbol	Parameter	Group	Min.	Max.	Unit
h_{FE}	DC current gain $I_{\text{C}} = 2\text{ A}, V_{\text{CE}} = 5\text{ V}$	A	16	30	
		B	26	40	

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

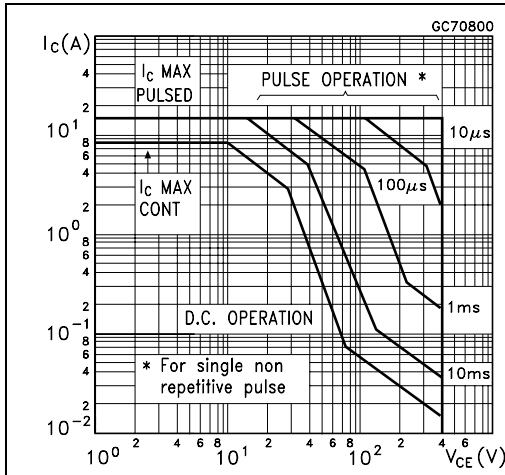


Figure 3. Derating curve

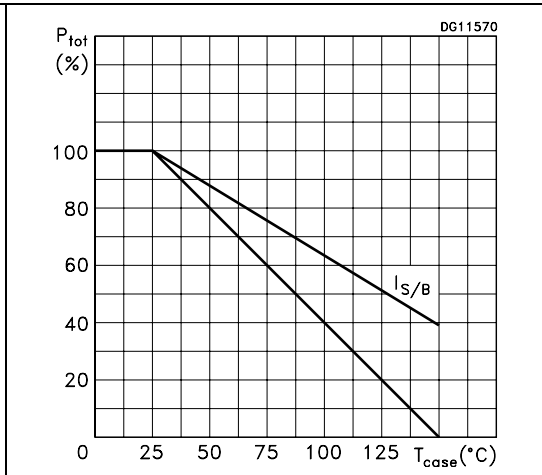


Figure 4. DC current gain ($V_{CE} = 2V$)

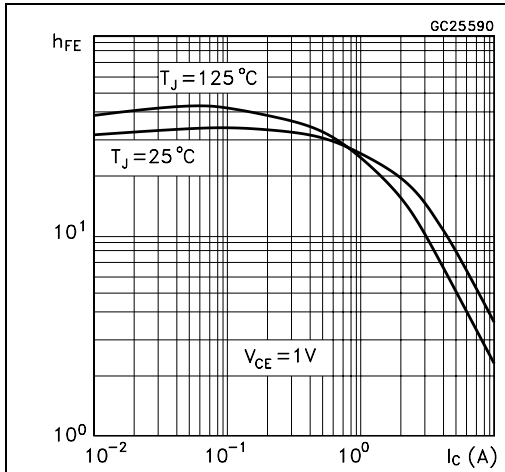


Figure 5. DC current gain ($V_{CE} = 5V$)

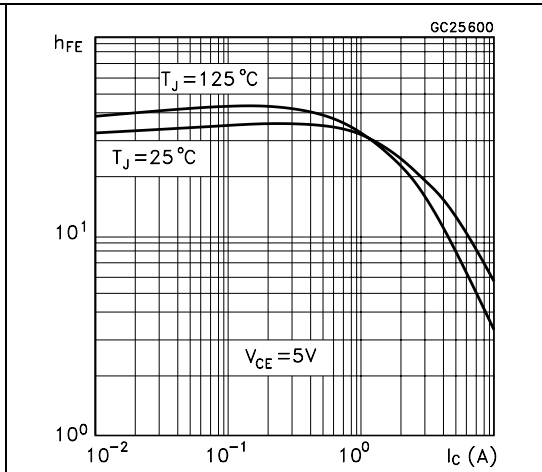


Figure 6. Collector-emitter saturation voltage

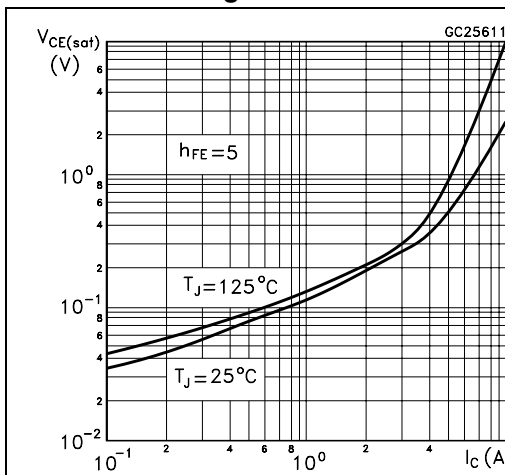


Figure 7. Base-emitter saturation voltage

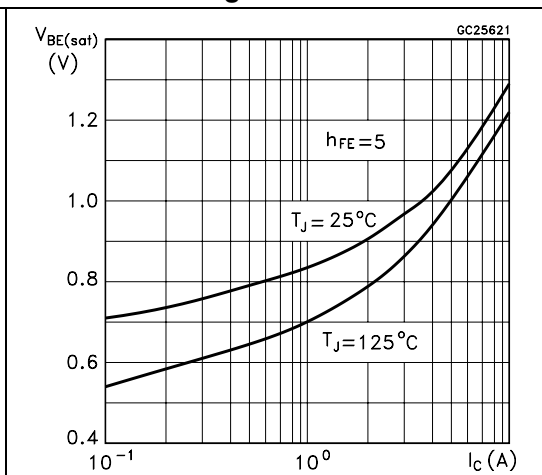


Figure 8. Inductive fall time

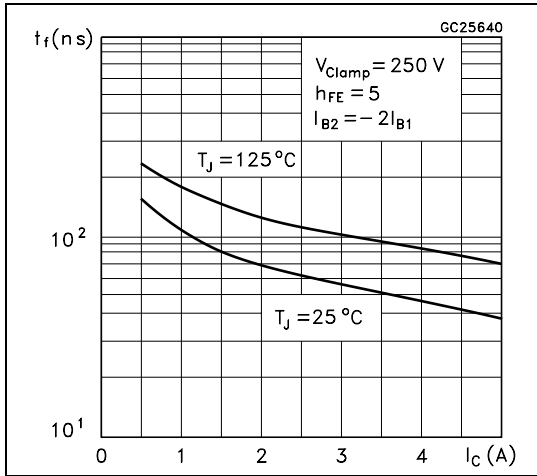


Figure 9. Inductive storage time

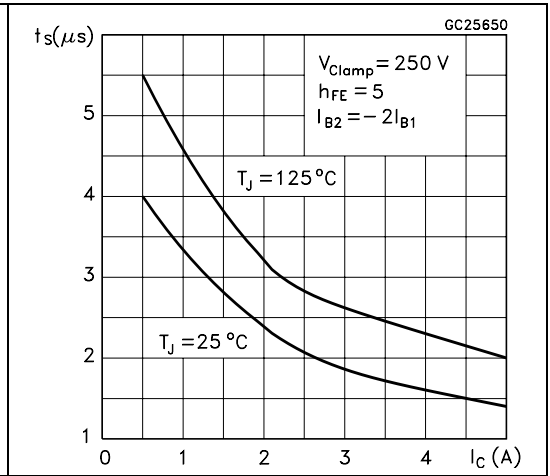
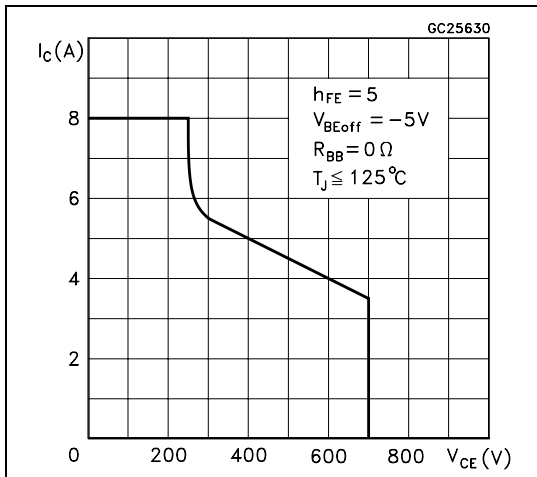
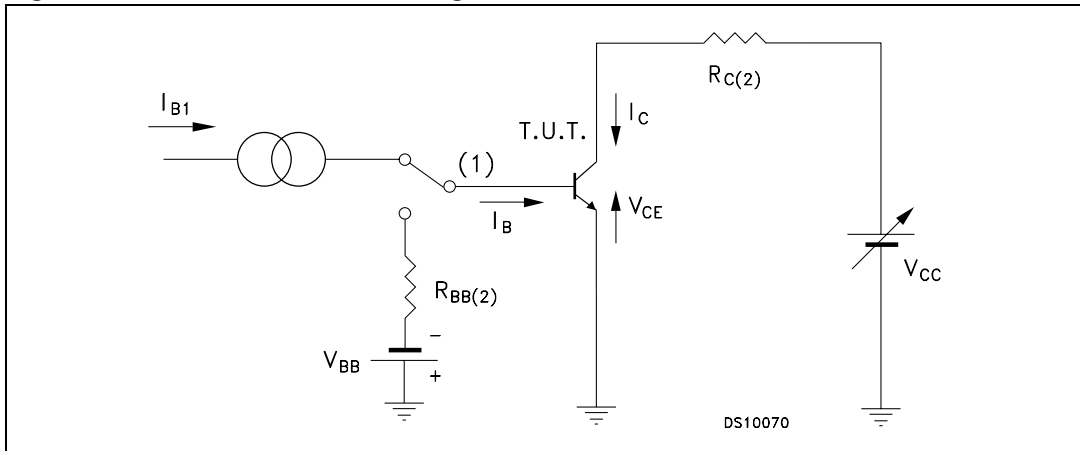


Figure 10. Reverse biased SOA



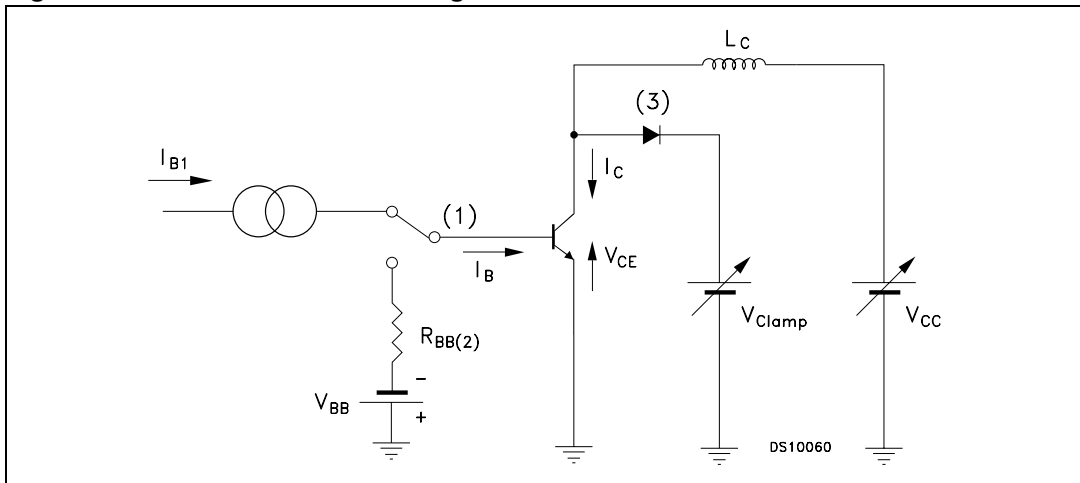
2.2 Test circuits

Figure 11. Resistive load switching test circuit



1. Fast electronic switch
2. Non-inductive resistor

Figure 12. Inductive load switching test circuit



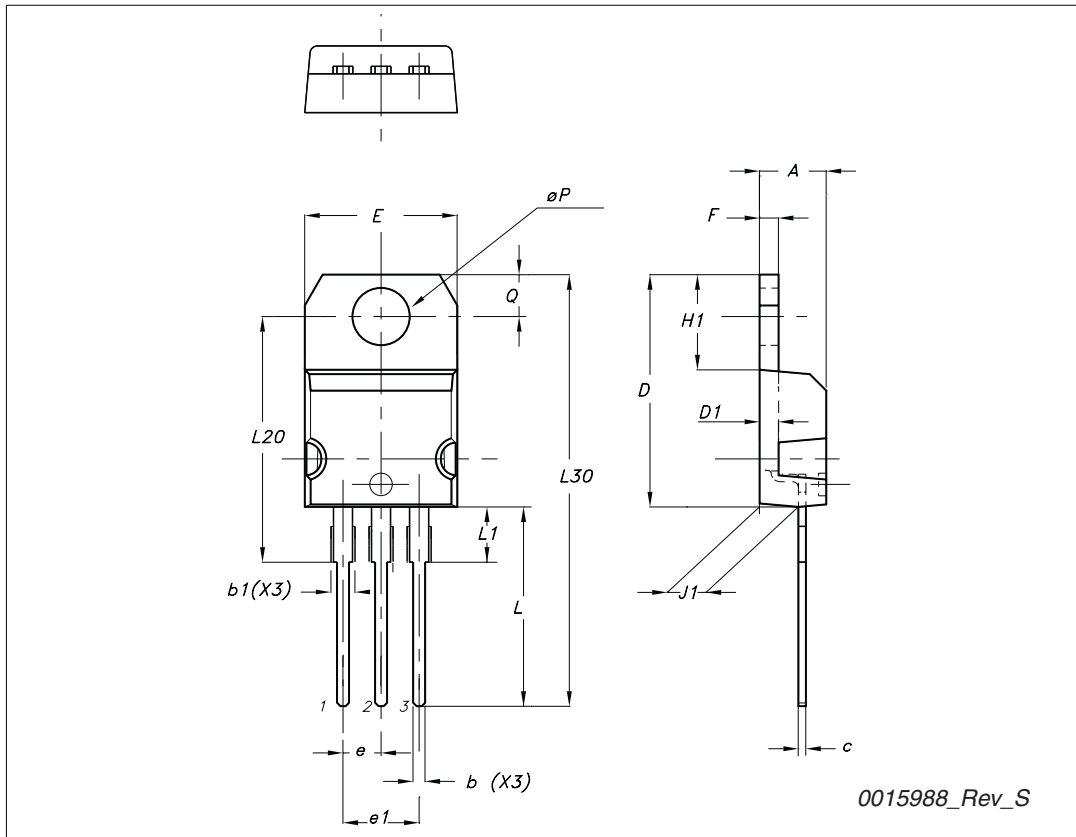
1. Fast electronic switch
2. Non-inductive resistor
3. Fast recovery rectifier

3 Package mechanical data

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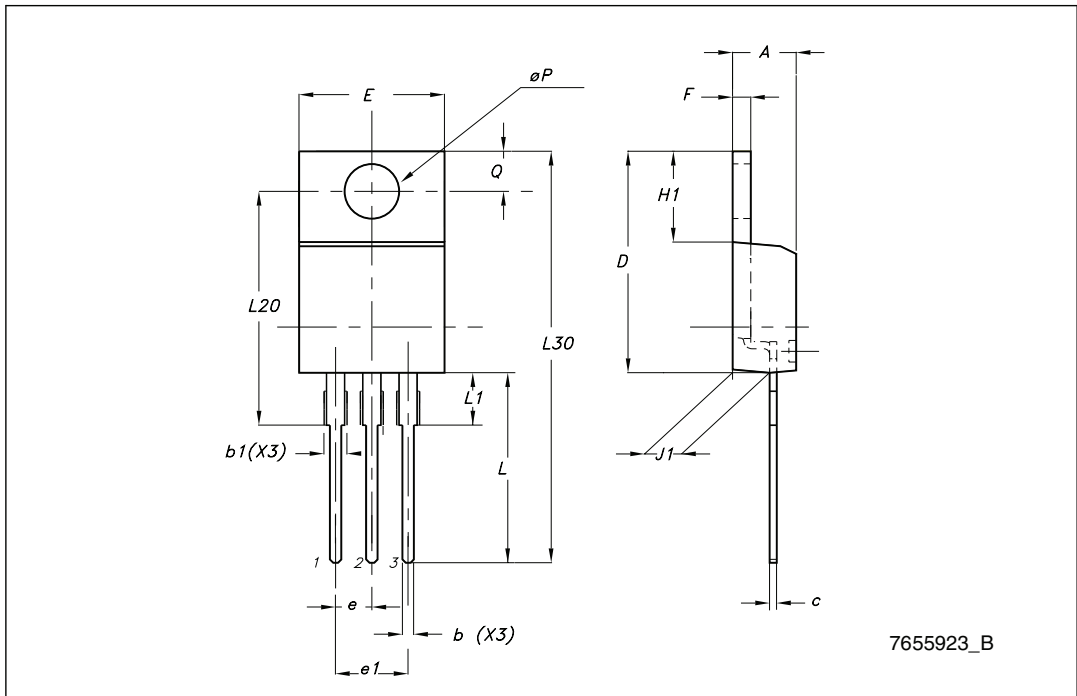
TO-220 type A mechanical data

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	
∅P	3.75		3.85
Q	2.65		2.95



TO-220 type E mechanical data

DIM.	mm.		
	MIN.	TYP	MAX.
A	4.47		4.67
b	0.70		0.91
b1	1.17		1.37
c	0.31		0.53
D	14.60		15.70
E	9.96		10.36
e		2.54	
e1	4.98	5.08	5.18
F	1.17		1.37
H1	6.10		6.80
J1	2.52		2.82
L	12.70		13.80
L1	3.20		3.96
L20	15.21		16.77
øP	3.73		3.94
Q	2.59		2.89



4 Revision history

Table 6. Document revision history

Date	Revision	Changes
21-Jun-2004	3	Document migration, no content change.
16-Dec-2009	4	Updated TO-220 package mechanical data.

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