

BUJD203A

NPN power transistor with integrated diode

Rev. 02 — 2 December 2010

Product data sheet

1. Product profile

1.1 General description

High voltage, high speed, planar passivated NPN power switching transistor with integrated anti-parallel E-C diode in a SOT78 (TO220AB) plastic package.

1.2 Features and benefits

- Fast switching
- High voltage capability
- Integrated anti-parallel E-C diode
- Very low switching and conduction losses

1.3 Applications

- DC-to-DC converters
- Electronic lighting ballasts
- Inverters
- Motor control systems

1.4 Quick reference data

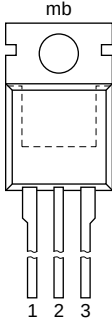
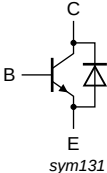
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_C	collector current	see Figure 1 ; see Figure 2 ; DC; see Figure 4	-	-	4	A
P_{tot}	total power dissipation	see Figure 3 ; $T_{mb} \leq 25\text{ °C}$	-	-	80	W
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	-	850	V
Static characteristics						
h_{FE}	DC current gain	$I_C = 500\text{ mA}$; $V_{CE} = 5\text{ V}$; see Figure 11 ; $T_j = 25\text{ °C}$	13	21	32	
		$V_{CE} = 5\text{ V}$; $I_C = 3\text{ A}$; $T_{mb} = 25\text{ °C}$; see Figure 11	-	12.5	-	
V_{CEOsus}	collector-emitter sustaining voltage	$I_B = 0\text{ A}$; $L_C = 25\text{ mH}$; $I_C = 10\text{ mA}$; see Figure 6 ; see Figure 7	400	450	-	V



2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base		
2	C	collector		
3	E	emitter		
mb	C	mounting base; connected to collector		

SOT78 (TO-220AB)

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUJD203A	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

4. Limiting values

Table 4. Limiting values
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	850	V
V_{CBO}	collector-base voltage	$I_E = 0\text{ A}$	-	850	V
V_{CEO}	collector-emitter voltage	$I_B = 0\text{ A}$	-	425	V
I_C	collector current	DC; see Figure 1; see Figure 2; see Figure 4	-	4	A
I_{CM}	peak collector current	see Figure 1; see Figure 2; see Figure 4	-	8	A
I_B	base current	DC	-	2	A
I_{BM}	peak base current		-	4	A
P_{tot}	total power dissipation	$T_{mb} \leq 25\text{ °C}$; see Figure 3	-	80	W
T_{stg}	storage temperature		-65	150	°C
T_j	junction temperature		-	150	°C

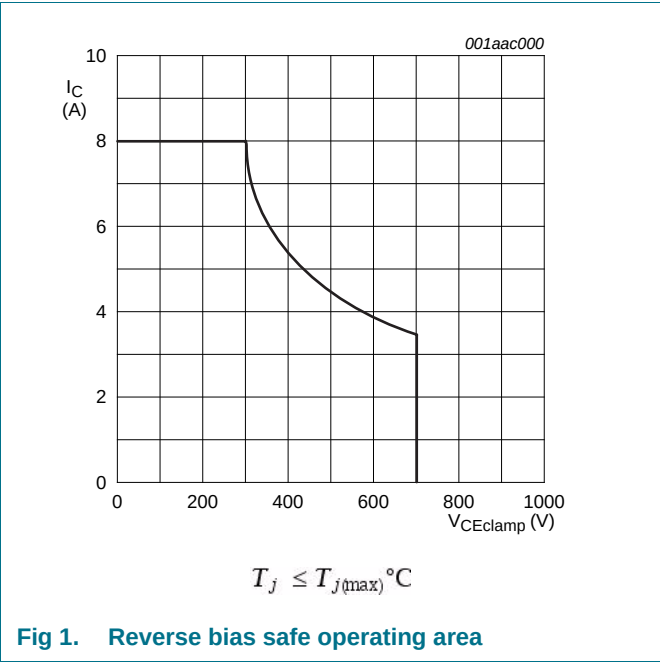


Fig 1. Reverse bias safe operating area

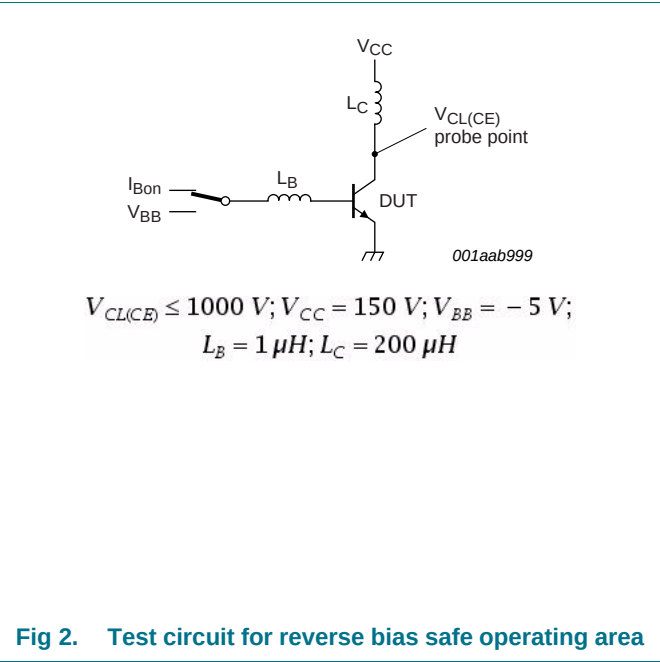
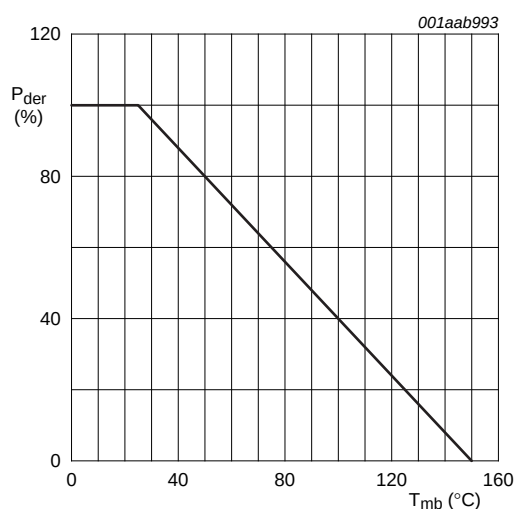
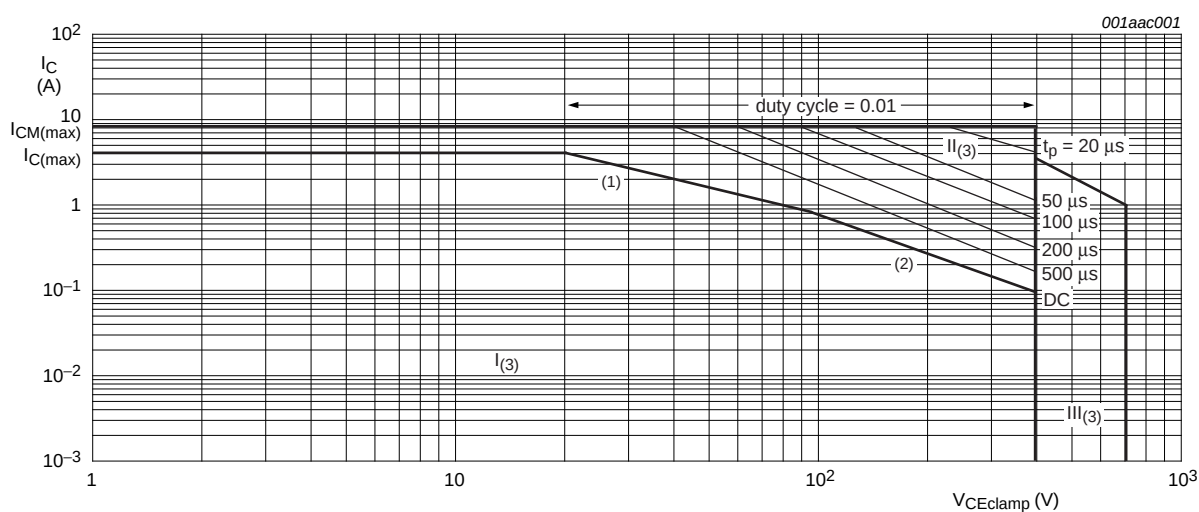


Fig 2. Test circuit for reverse bias safe operating area



$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}\text{C})}} \times 100\%$$

Fig 3. Normalized total power dissipation as a function of mounting base temperature



- 1) P_{tot} maximum and P_{tot} peak maximum lines
 - 2) Second breakdown limits
 - 3) I = Region of permissible DC operation
 - II = Extension for repetitive pulse operation
 - III = Extension during turn-on in single transistor converters
- provided that $R_{BE} \leq 100 \Omega$ and $t_p \leq 0.6 \mu s$

Fig 4. Forward bias safe operating area for $T_{mb} \leq 25^{\circ}\text{C}$

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see Figure 5	-	-	1.56	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	60	-	K/W

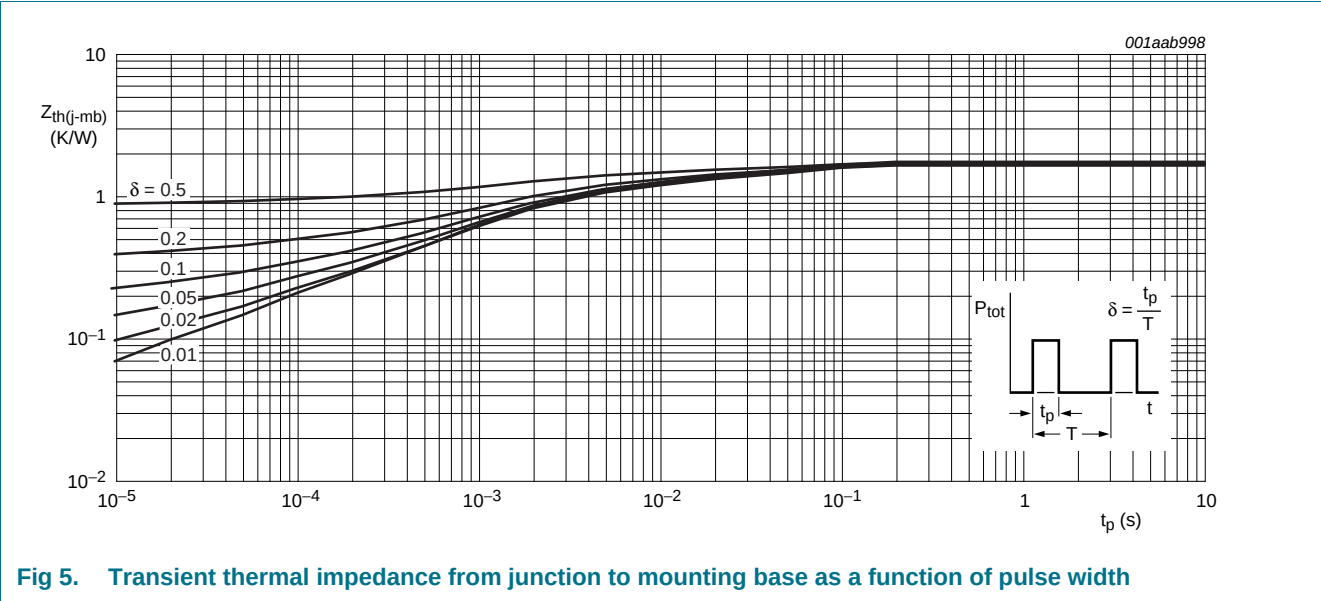


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse width

6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
I _{CES}	collector-emitter cut-off current	V _{BE} = 0 V; V _{CE} = 850 V; T _j = 125 °C [1]	-	-	2	mA
		V _{BE} = 0 V; V _{CE} = 850 V; T _j = 25 °C [1]	-	-	1	mA
I _{CBO}	collector-base cut-off current	V _{CB} = 850 V; I _E = 0 A [1]	-	-	1	mA
I _{CEO}	collector-emitter cut-off current	V _{CE} = 425 V; I _B = 0 A [1]	-	-	0.1	mA
I _{EBO}	emitter-base cut-off current	V _{EB} = 7 V; I _C = 0 A	-	-	10	mA
V _{CE0sus}	collector-emitter sustaining voltage	I _B = 0 A; I _C = 10 mA; L _C = 25 mH; see Figure 6 ; see Figure 7	400	450	-	V
V _{CEsat}	collector-emitter saturation voltage	I _C = 3 A; I _B = 0.6 A; see Figure 8 ; see Figure 9	-	0.29	1	V
V _{BEsat}	base-emitter saturation voltage	I _C = 3 A; I _B = 0.6 A; see Figure 10	-	0.99	1.5	V
V _F	forward voltage	I _F = 2 A; T _j = 25 °C	-	1.04	1.5	V
h _{FE}	DC current gain	I _C = 1 mA; V _{CE} = 5 V; T _{mb} = 25 °C; see Figure 11	10	15	32	
		I _C = 500 mA; V _{CE} = 5 V; T _j = 25 °C; see Figure 11	13	21	32	
		I _C = 2 A; V _{CE} = 5 V; T _{mb} = 25 °C; see Figure 11	11	16	22	
		I _C = 3 A; V _{CE} = 5 V; T _{mb} = 25 °C; see Figure 11	-	12.5	-	
Dynamic characteristics						
t _{on}	turn-on time	I _C = 2.5 A; I _{Bon} = 0.5 A; I _{Boff} = -0.5 A; R _L = 75 Ω; T _j = 25 °C; resistive load; see Figure 12 ; see Figure 13	-	0.52	0.6	μs
t _s	storage time	I _C = 2.5 A; I _{Bon} = 0.5 A; I _{Boff} = -0.5 A; R _L = 75 Ω; T _j = 25 °C; resistive load; see Figure 12 ; see Figure 13	-	2.7	3.3	μs
		I _C = 2 A; I _{Bon} = 0.4 A; V _{BB} = -5 V; L _B = 1 μH; T _j = 25 °C; inductive load; see Figure 14 ; see Figure 15	-	1.2	1.4	μs
		I _C = 2 A; I _{Bon} = 0.4 A; V _{BB} = -5 V; L _B = 1 μH; T _j = 100 °C; inductive load; see Figure 14 ; see Figure 15	-	-	1.8	μs

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_f	fall time	$I_C = 2.5\text{ A}$; $I_{B\text{on}} = 0.5\text{ A}$; $I_{B\text{off}} = -0.5\text{ A}$; $R_L = 75\text{ }\Omega$; $T_j = 25\text{ }^\circ\text{C}$; resistive load; see Figure 12 ; see Figure 13	-	0.3	0.35	μs
		$I_C = 2\text{ A}$; $I_{B\text{on}} = 0.4\text{ A}$; $V_{BB} = -5\text{ V}$; $L_B = 1\text{ }\mu\text{H}$; $T_j = 100\text{ }^\circ\text{C}$; inductive load; see Figure 14 ; see Figure 15	-	-	0.12	μs
		$I_C = 2\text{ A}$; $I_{B\text{on}} = 0.4\text{ A}$; $V_{BB} = -5\text{ V}$; $L_B = 1\text{ }\mu\text{H}$; $T_j = 25\text{ }^\circ\text{C}$; inductive load; see Figure 14 ; see Figure 15	-	0.03	0.06	μs

[1] Measured with half-sine wave voltage (curve tracer)

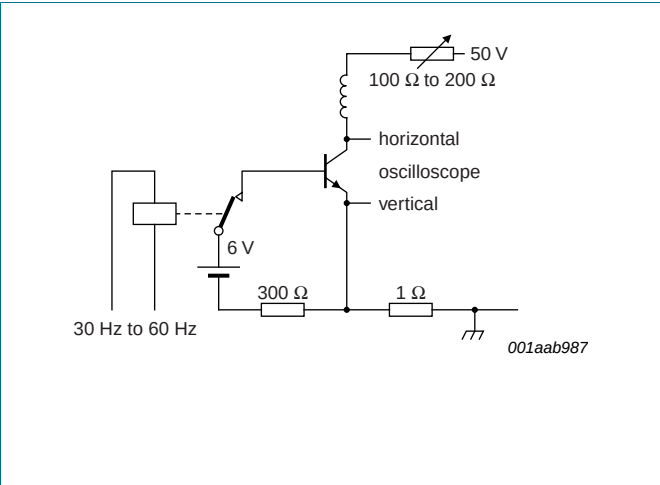


Fig 6. Test circuit for collector-emitter sustaining voltage

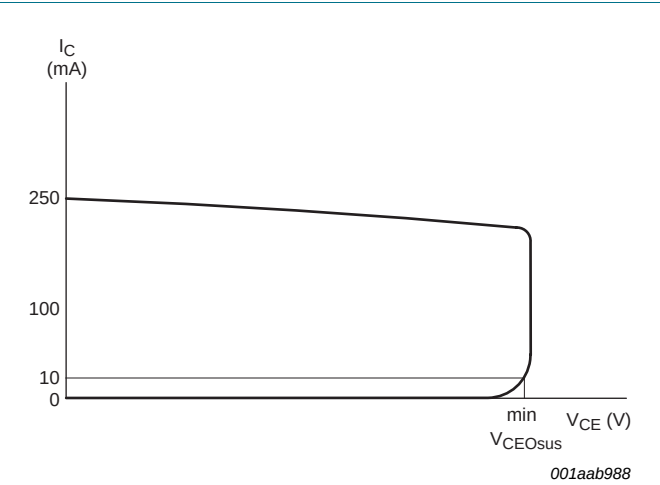


Fig 7. Oscilloscope display for collector-emitter sustaining voltage test waveform

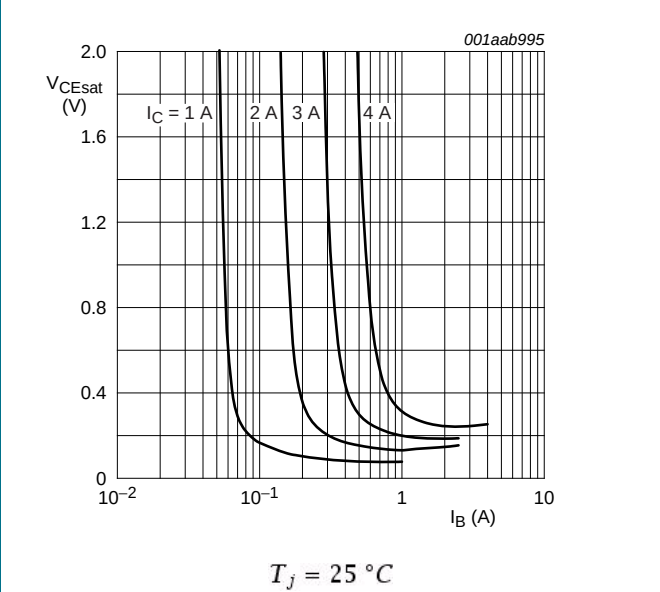


Fig 8. Collector-emitter saturation voltage as a function of base current; typical values

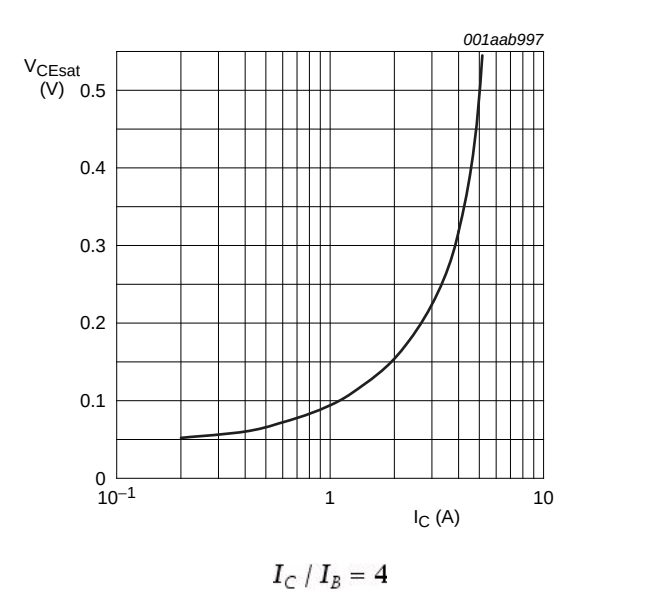


Fig 9. Collector-emitter saturation voltage as a function of collector current; typical values

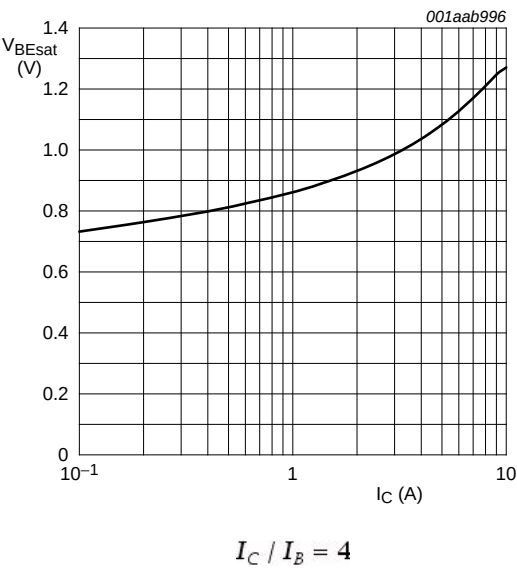


Fig 10. Base-emitter saturation voltage as a function of collector current; typical values

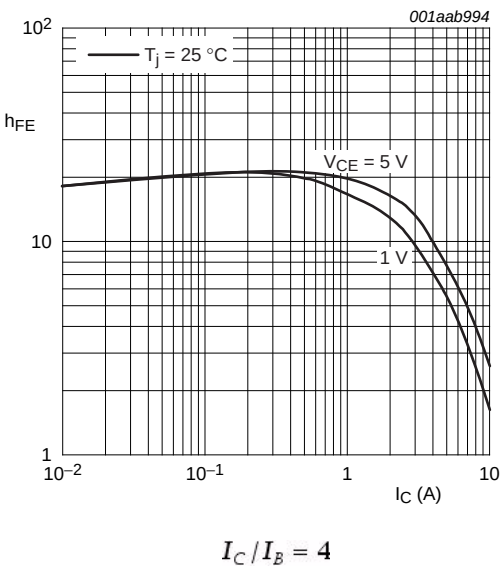
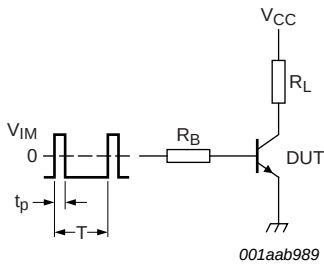


Fig 11. DC current gain as a function of collector current; typical values



$V_{IM} = -6\text{ to }+8\text{ V}$; $V_{CC} = 250\text{ V}$; $t_p = 20\text{ }\mu\text{s}$; $\delta = \frac{t_p}{T} = 0.01$
 R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

Fig 12. Test circuit for resistive load switching

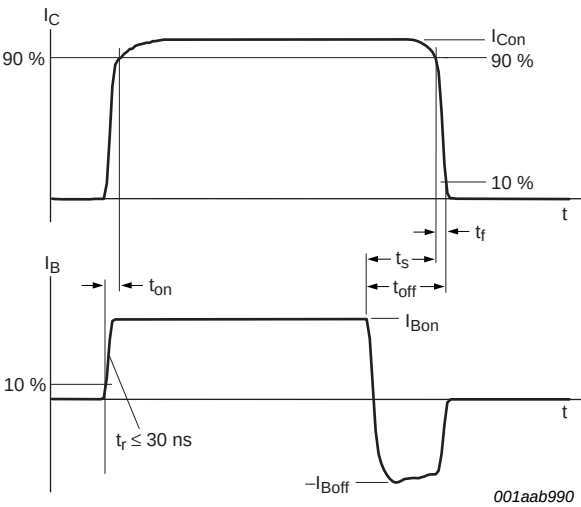


Fig 13. Switching times waveforms for resistive load

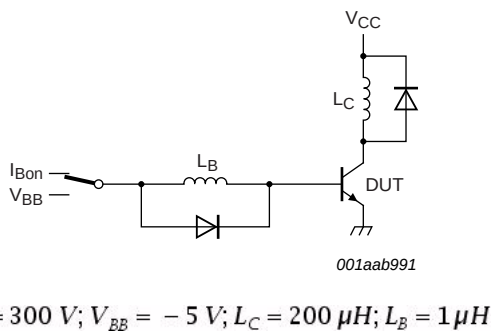


Fig 14. Test circuit for inductive load switching

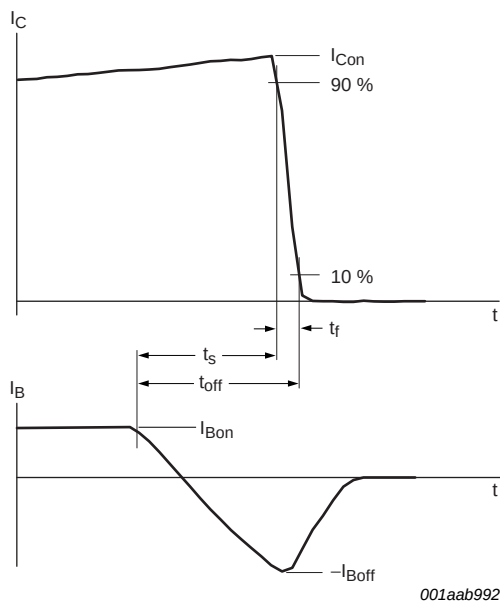


Fig 15. Switching times waveforms for inductive load

7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB SOT78

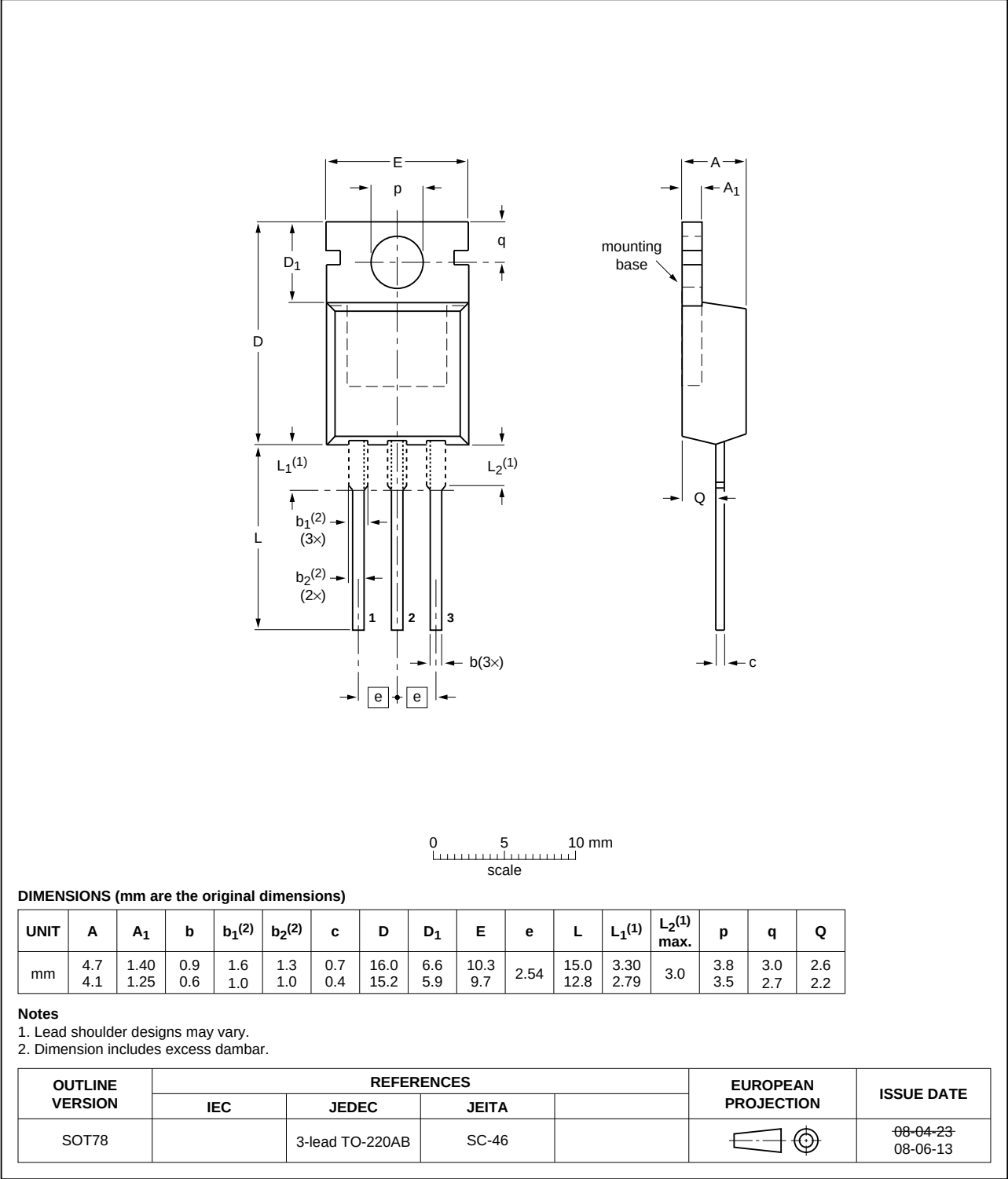


Fig 16. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUJD203A v.2	20101202	Product data sheet	-	BUJD203A v.1
Modifications:	• Data sheet status changed from Preliminary to Product.			
BUJD203A v.1	20100909	Preliminary data sheet	-	-

9. Legal information

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Document status ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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Date of release: 2 December 2010

Document identifier: BUJD203A