

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

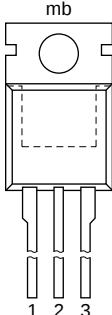
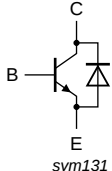
Table 1. Quick reference data

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

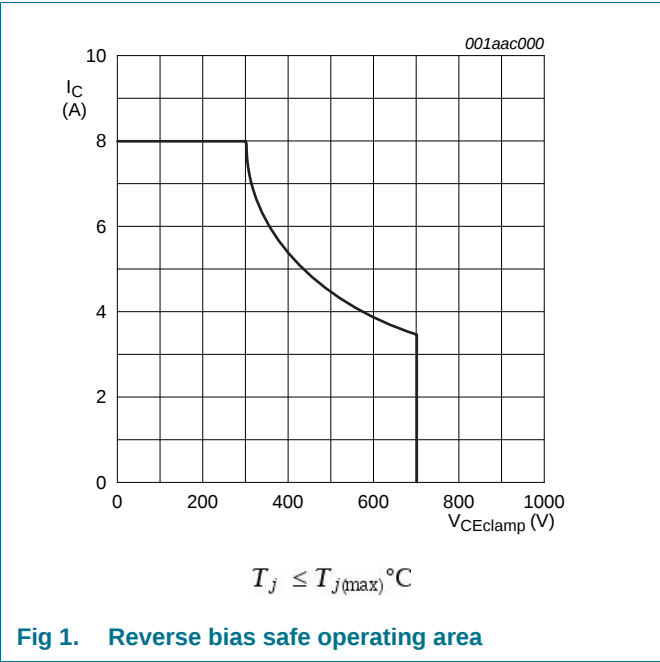


Fig 1. Reverse bias safe operating area

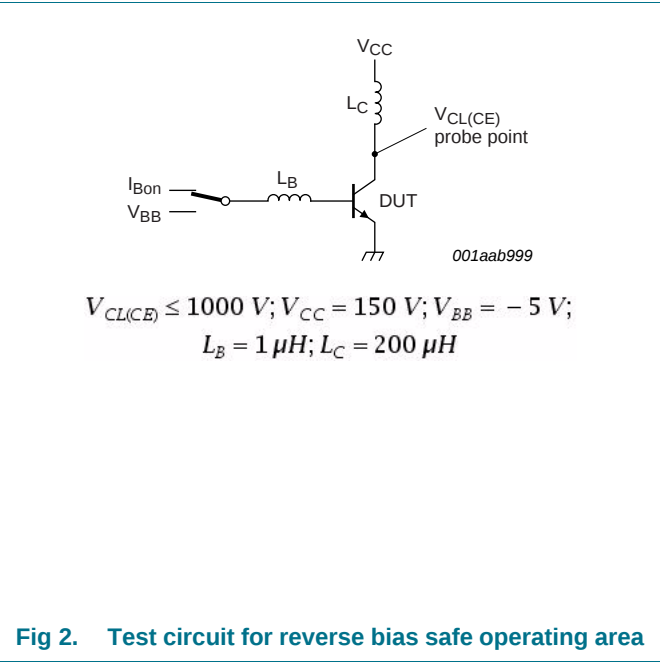
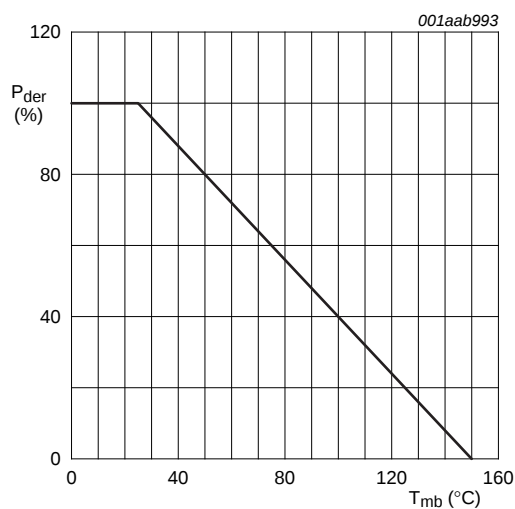
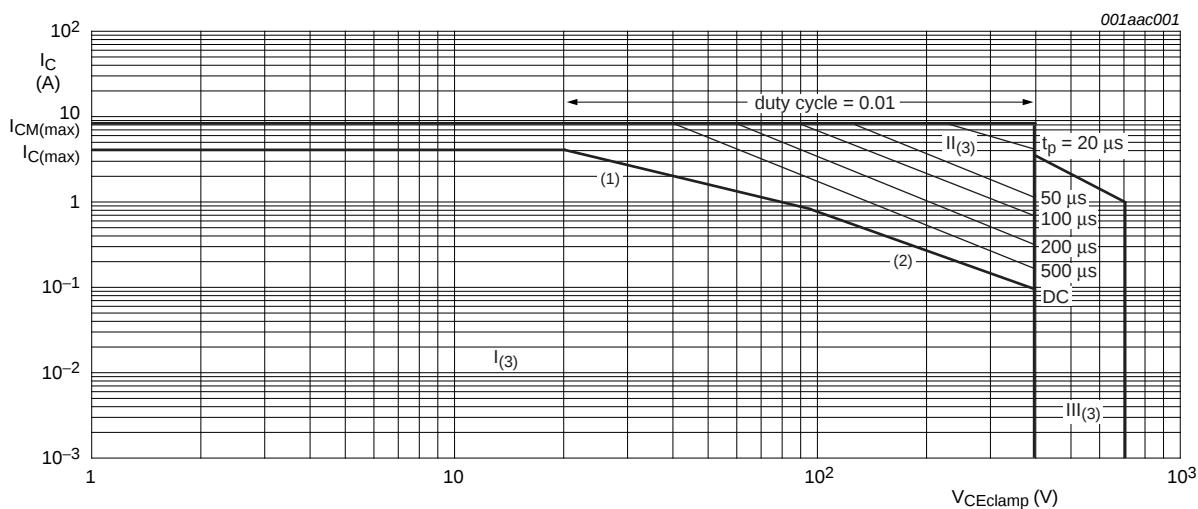


Fig 2. Test circuit for reverse bias safe operating area



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

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

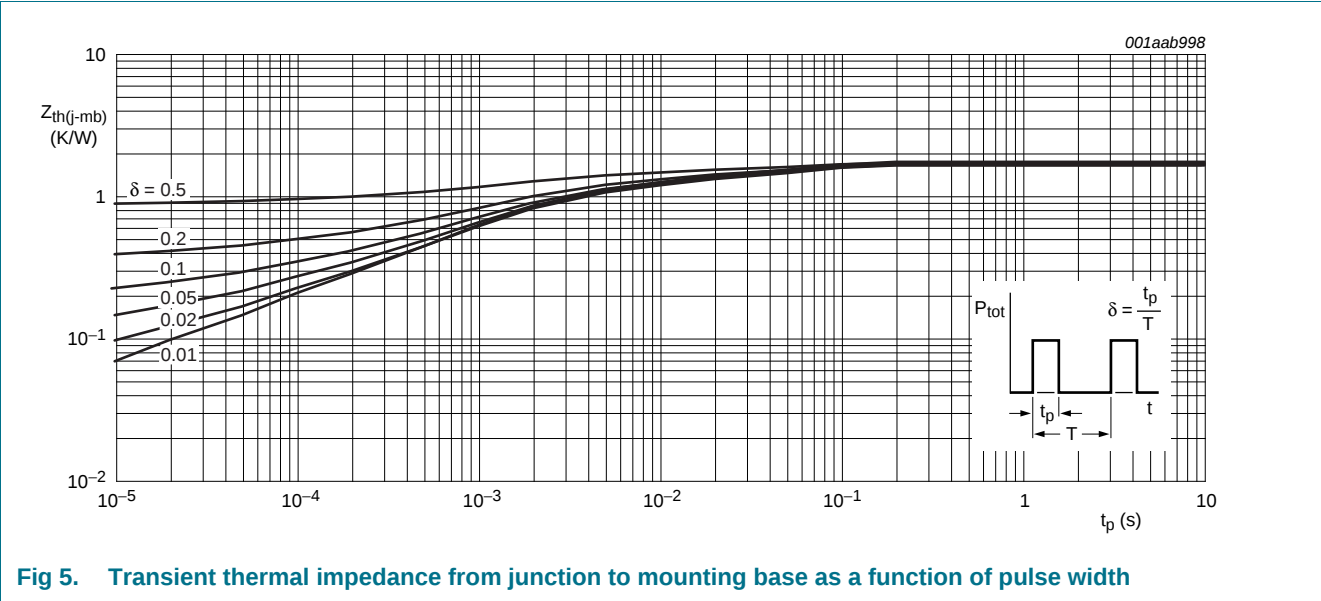


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse width

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)

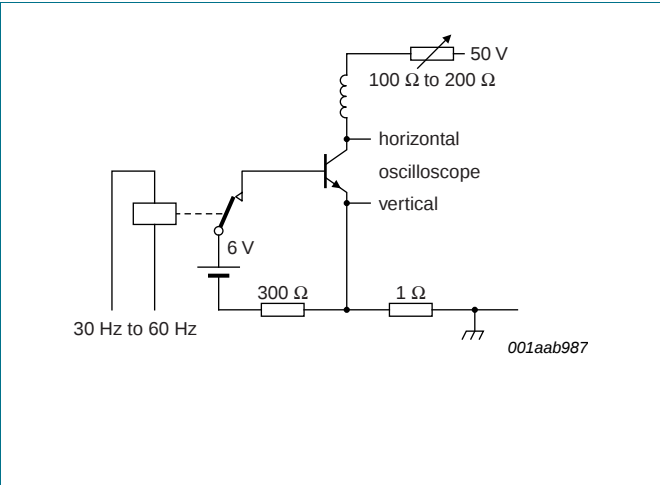


Fig 6. Test circuit for collector-emitter sustaining voltage

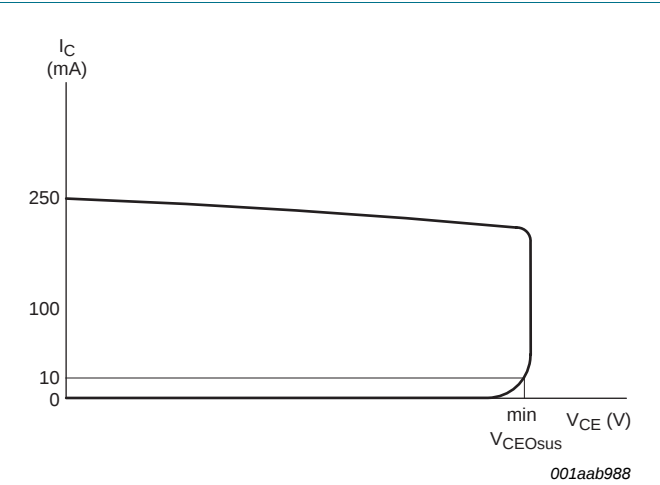


Fig 7. Oscilloscope display for collector-emitter sustaining voltage test waveform

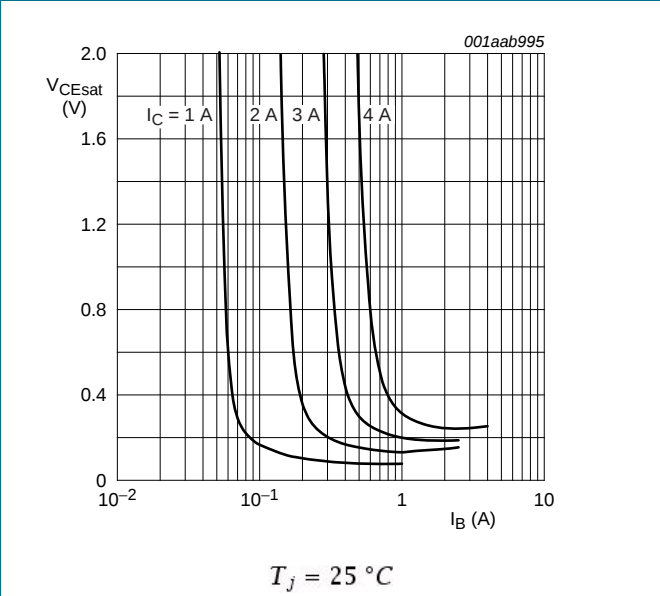


Fig 8. Collector-emitter saturation voltage as a function of base current; typical values

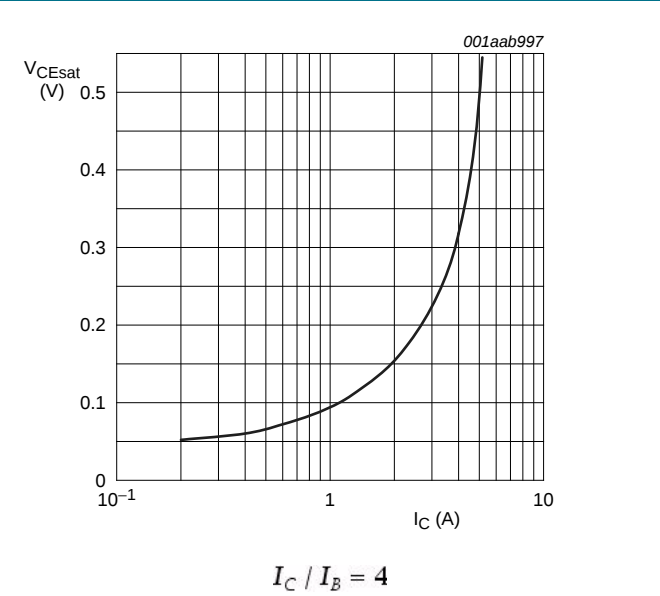


Fig 9. Collector-emitter saturation voltage as a function of collector current; typical values

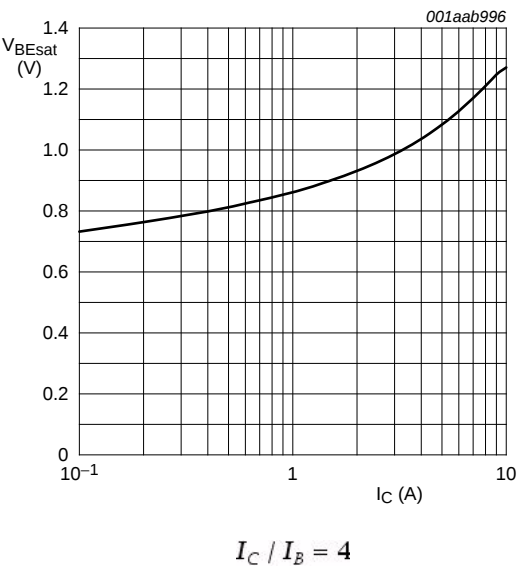


Fig 10. Base-emitter saturation voltage as a function of collector current; typical values

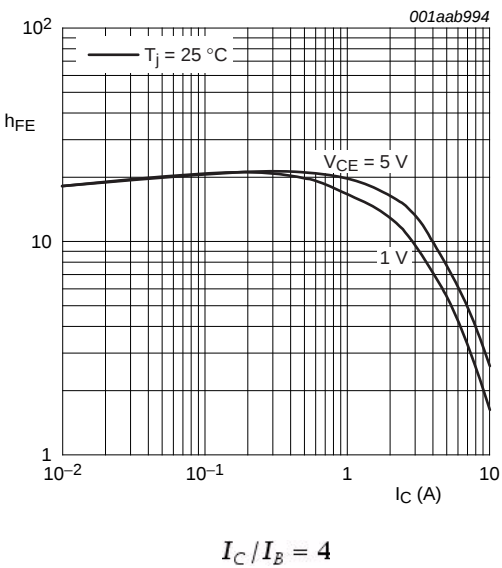
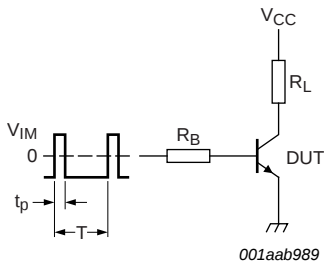


Fig 11. DC current gain as a function of collector current; typical values



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

Fig 12. Test circuit for resistive load switching

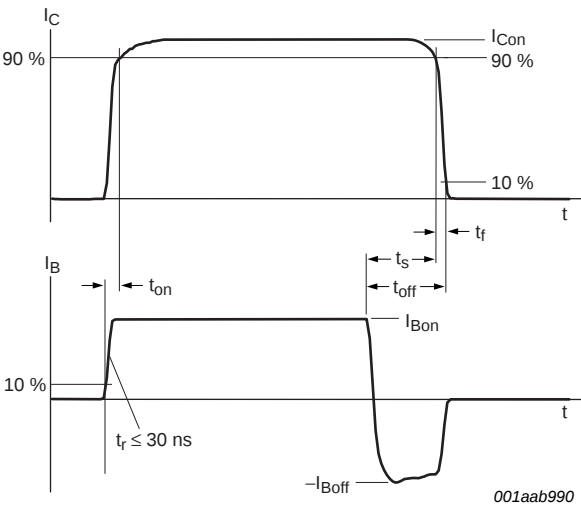
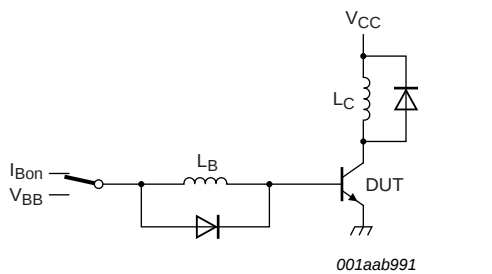


Fig 13. Switching times waveforms for resistive load



$V_{CC} = 300\text{ V}; V_{BB} = -5\text{ V}; L_C = 200\text{ }\mu\text{H}; L_B = 1\text{ }\mu\text{H}$

Fig 14. Test circuit for inductive load switching

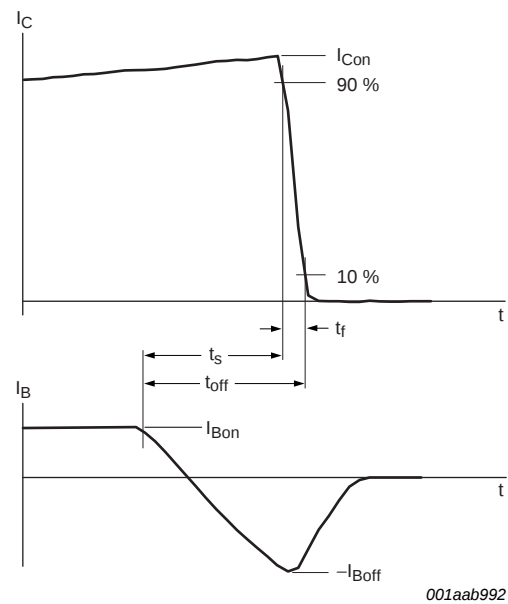


Fig 15. Switching times waveforms for inductive load

7. Package outline

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

SOT78

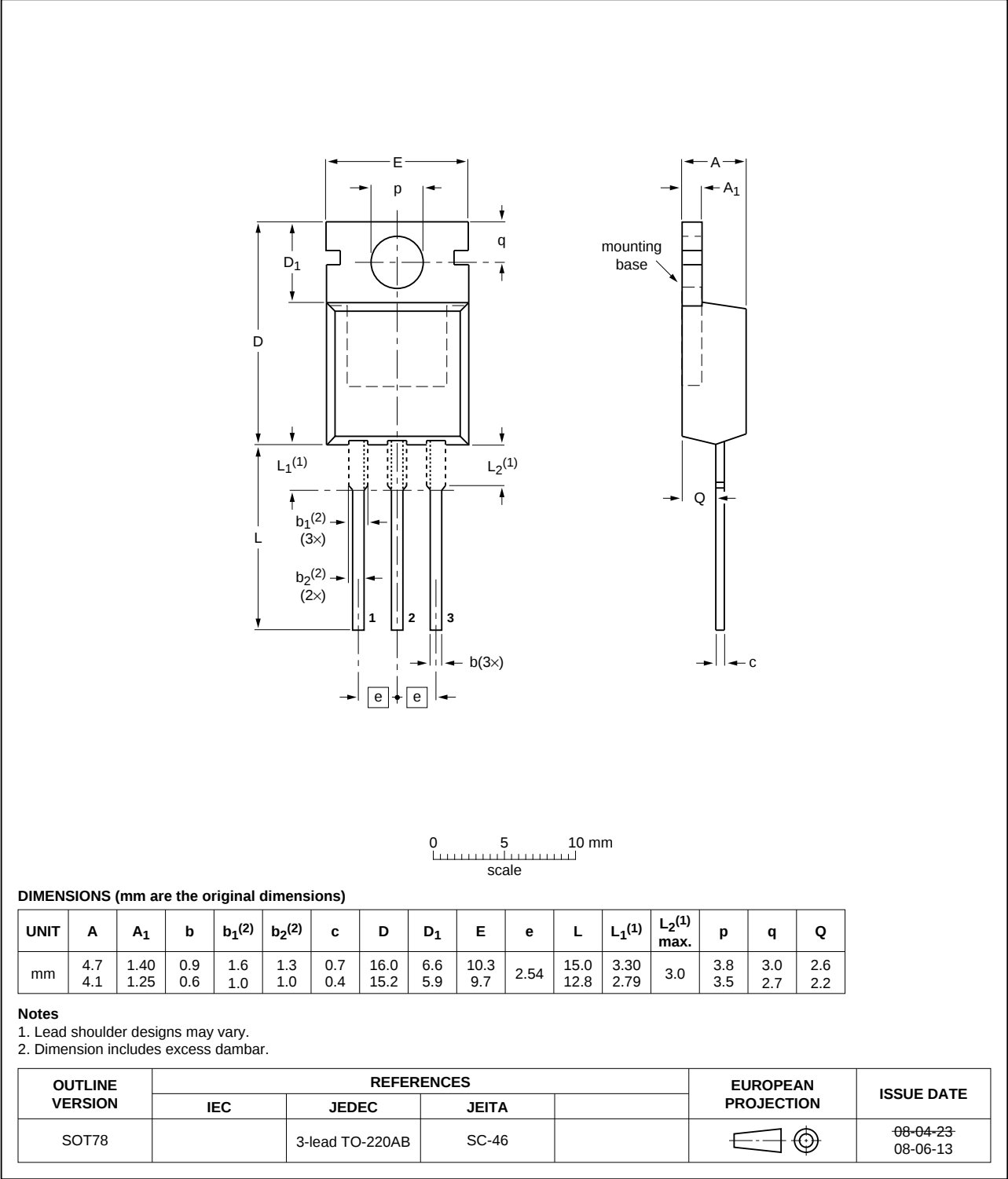


Fig 16. Package outline SOT78 (TO-220AB)

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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Product [short] data sheet	Production	This document contains the product specification.

[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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