



BUJ303A

NPN power transistor

Rev. 6 — 8 February 2012

Product data sheet

1. Product profile

1.1 General description

High voltage, high speed planar passivated NPN power switching transistor in a SOT78 (TO-220AB) plastic package.

1.2 Features and benefits

- Fast switching
- Low thermal resistance
- Very high voltage capability
- Very low switching and conduction losses

1.3 Applications

- DC-to-DC converters
- High frequency electronic lighting ballasts
- Inverters
- Motor control systems

1.4 Quick reference data

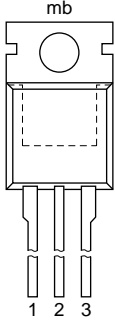
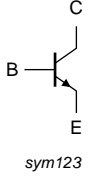
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_C	collector current	see Figure 1 ; see Figure 2 ; see Figure 4	-	-	5	A
P_{tot}	total power dissipation	$T_{mb} \leq 25\text{ °C}$; see Figure 3	-	-	100	W
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	-	1000	V
Static characteristics						
h_{FE}	DC current gain	$I_C = 5\text{ mA}$; $V_{CE} = 5\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 11	10	22	35	
		$I_C = 500\text{ mA}$; $V_{CE} = 5\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 11	14	25	35	



2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base		 sym123
2	C	collector		
3	E	emitter		
mb	C	mounting base; connected to collector		

SOT78 (TO-220AB)

3. Ordering information

Table 3. Ordering information

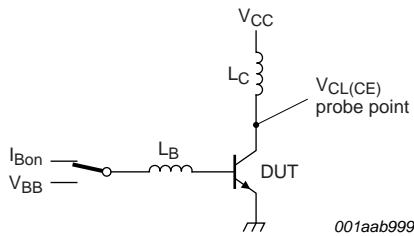
Type number	Package		
	Name	Description	Version
BUJ303A	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

4. Limiting values

Table 4. Limiting values

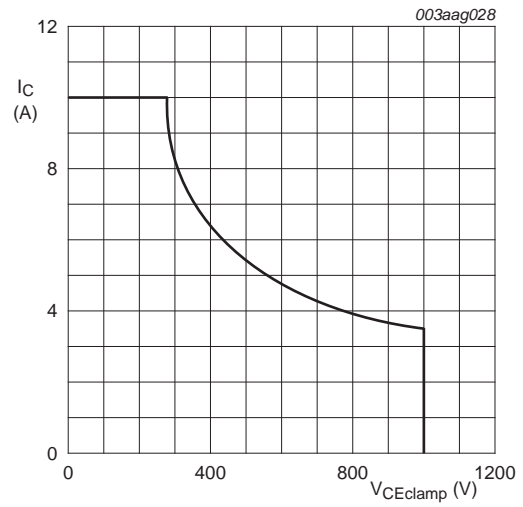
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	1000	V
V_{CEO}	collector-emitter voltage	$I_B = 0\text{ A}$	-	500	V
I_C	collector current	see Figure 1 ; see Figure 2 ; see Figure 4	-	5	A
I_{CM}	peak collector current		-	10	A
I_B	base current		-	2	A
I_{BM}	peak base current		-	4	A
P_{tot}	total power dissipation	$T_{mb} \leq 25\text{ °C}$; see Figure 3	-	100	W
T_{stg}	storage temperature		-65	150	°C
T_j	junction temperature		-	150	°C



$$V_{CL(CE)} \leq 1000 \text{ V}; V_{CC} = 150 \text{ V}; V_{BB} = -5 \text{ V};$$

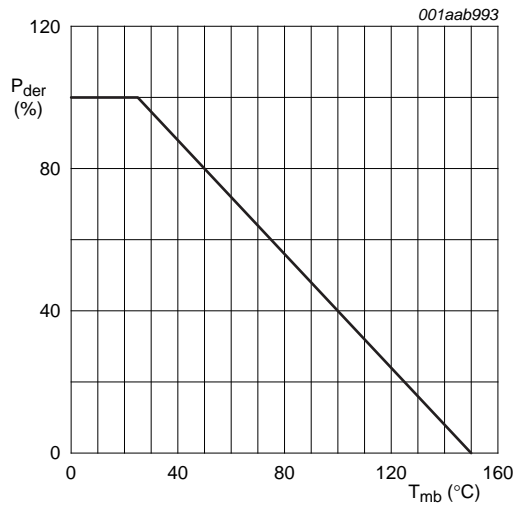
$$L_B = 1 \mu\text{H}; L_C = 200 \mu\text{H}$$



$$T_j \leq T_{j(max)}$$

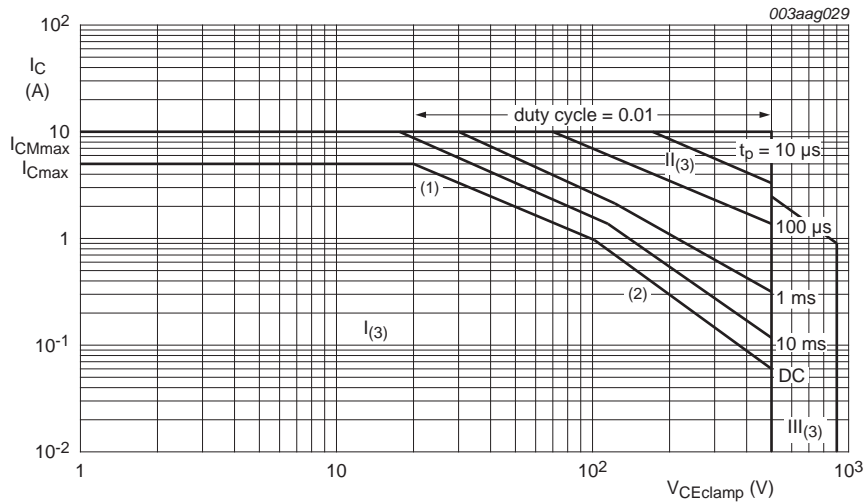
Fig 1. Test circuit for reverse bias safe operating area

Fig 2. 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 $T_{mb} \leq 25 \text{ }^\circ\text{C}$

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	-	-	1.25	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	60	-	K/W

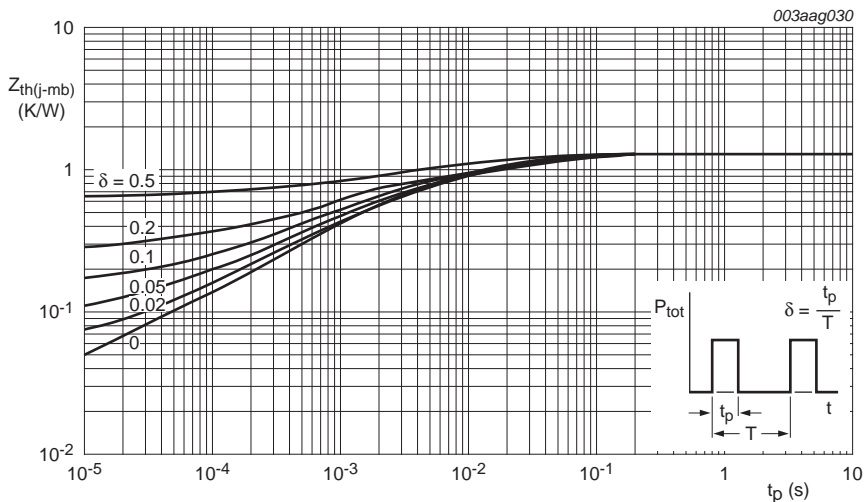


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse width

6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
I_{CES}	collector-emitter cut-off current	$V_{BE} = 0\text{ V}$; $V_{CE} = 1000\text{ V}$; $T_{mb} = 25\text{ °C}$; Measured with half-sine wave voltage (curve tracer)	-	-	1	mA
		$V_{BE} = 0\text{ V}$; $V_{CE} = 1000\text{ V}$; $T_j = 125\text{ °C}$; Measured with half-sine wave voltage (curve tracer)	-	-	2	mA
I_{CBO}	collector-base cut-off current	$V_{CB} = 1000\text{ V}$; $I_E = 0\text{ A}$; $T_{mb} = 25\text{ °C}$; Measured with half-sine wave voltage (curve tracer)	-	-	1	mA
I_{CEO}	collector-emitter cut-off current	$V_{CE} = 500\text{ V}$; $I_B = 0\text{ A}$; $T_{mb} = 25\text{ °C}$; Measured with half-sine wave voltage (curve tracer)	-	-	0.1	mA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 9\text{ V}$; $I_C = 0\text{ A}$; $T_{mb} = 25\text{ °C}$	-	-	0.1	mA
V_{CE0sus}	collector-emitter sustaining voltage	$I_B = 0\text{ A}$; $I_C = 100\text{ mA}$; $L_C = 25\text{ mH}$; $T_{mb} = 25\text{ °C}$; see Figure 6 ; see Figure 7	500	-	-	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 3\text{ A}$; $I_B = 0.6\text{ A}$; $T_{mb} = 25\text{ °C}$; see Figure 8 ; see Figure 9	-	0.35	1.5	V
V_{BEsat}	base-emitter saturation voltage	$I_C = 3\text{ A}$; $I_B = 0.6\text{ A}$; $T_{mb} = 25\text{ °C}$; see Figure 10	-	1.01	1.3	V
h_{FE}	DC current gain	$I_C = 5\text{ mA}$; $V_{CE} = 5\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 11	10	22	35	
		$I_C = 500\text{ mA}$; $V_{CE} = 5\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 11	14	25	35	
h_{FEsat}	DC saturation current gain	$I_C = 2.5\text{ A}$; $V_{CE} = 5\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 11	10	13.5	17	
		$I_C = 3\text{ A}$; $V_{CE} = 5\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 11	-	11	-	
Dynamic Characteristics (switching times - resistive load)						
t_s	turn-off delay time	$I_C = 2.5\text{ A}$; $I_{Bon} = 0.5\text{ A}$; $I_{Boff} = -0.5\text{ A}$; $R_L = 75\text{ }\Omega$; $T_{mb} = 25\text{ °C}$; see Figure 12 ; see Figure 13	-	3.3	4	μs
t_f	fall time		-	0.33	0.45	μs
Dynamic Characteristics (switching times - inductive load)						
t_s	turn-off delay time	$I_C = 2.5\text{ A}$; $I_{Bon} = 0.5\text{ A}$; $V_{BB} = -5\text{ V}$; $L_B = 1\text{ }\mu\text{H}$; $T_{mb} = 25\text{ °C}$; see Figure 14 ; see Figure 15	-	1.4	1.6	μs
t_s	turn-off delay time	$I_C = 2.5\text{ A}$; $I_{Bon} = 0.5\text{ A}$; $V_{BB} = -5\text{ V}$; $L_B = 1\text{ }\mu\text{H}$; $T_j = 100\text{ °C}$; see Figure 14 ; see Figure 15	-	1.7	1.9	μs
t_f	fall time	$I_C = 2.5\text{ A}$; $I_{Bon} = 0.5\text{ A}$; $V_{BB} = -5\text{ V}$; $L_B = 1\text{ }\mu\text{H}$; $T_{mb} = 25\text{ °C}$; see Figure 14 ; see Figure 15	-	145	160	ns
		$I_C = 2.5\text{ A}$; $I_{Bon} = 0.5\text{ A}$; $V_{BB} = -5\text{ V}$; $L_B = 1\text{ }\mu\text{H}$; $T_j = 100\text{ °C}$; see Figure 14 ; see Figure 15	-	160	200	ns

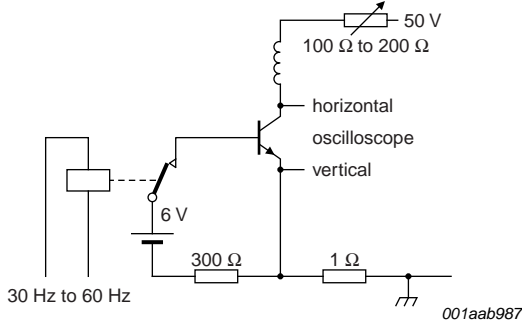


Fig 6. Test circuit for collector-emitter sustaining voltage

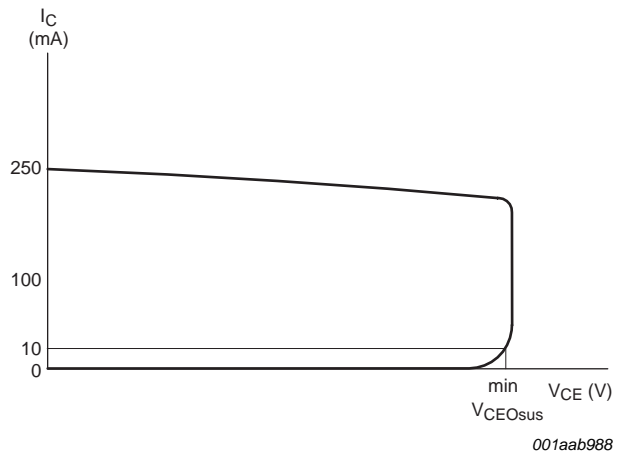


Fig 7. Oscilloscope display for collector-emitter sustaining voltage test waveform

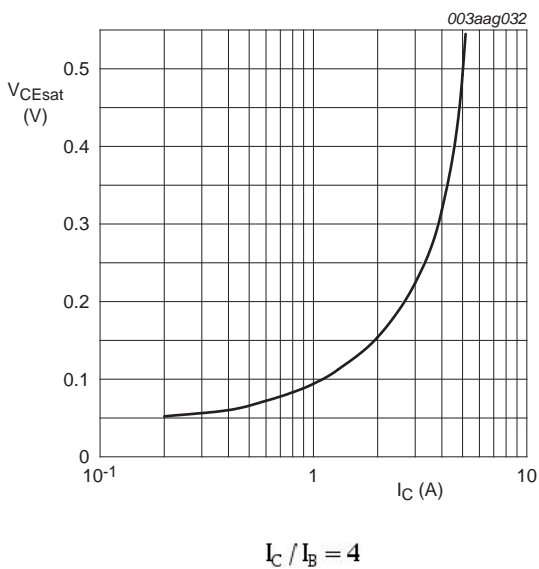


Fig 8. Collector-emitter saturation voltage as a function of collector current; typical values

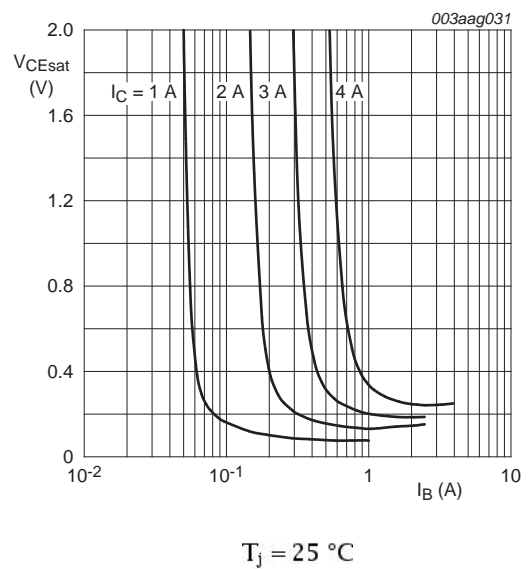
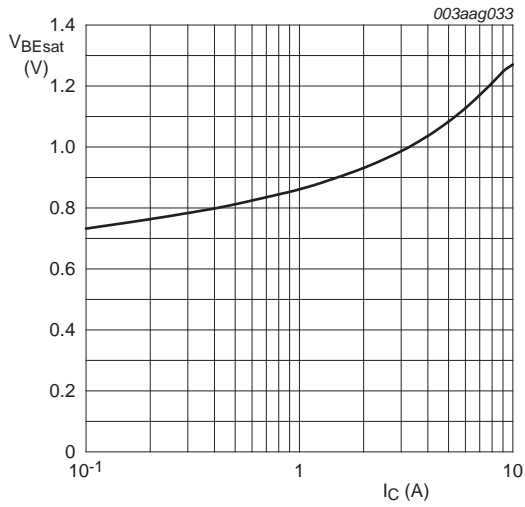
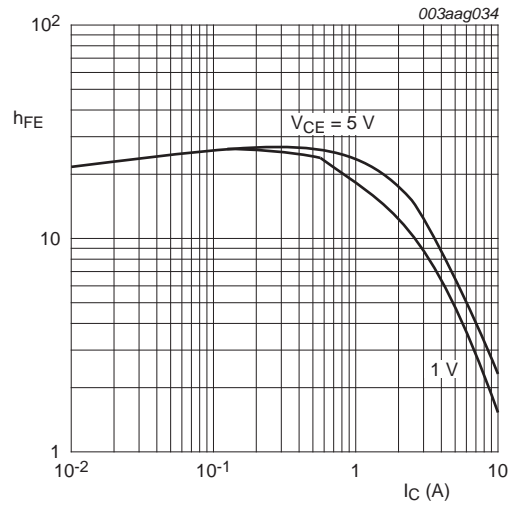


Fig 9. Collector-emitter saturation voltage as a function of base current; typical values



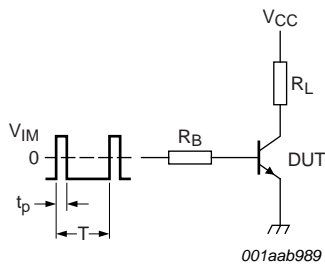
$I_C / I_B = 4$

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



$T_j = 25\text{ }^\circ\text{C}$

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



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

Fig 12. Test circuit for resistive load switching

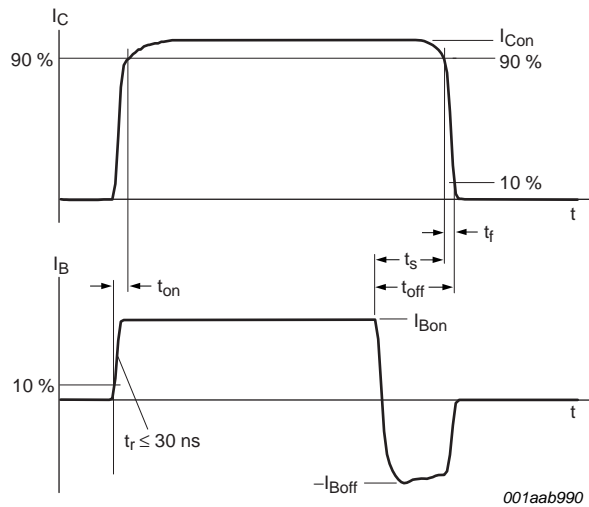
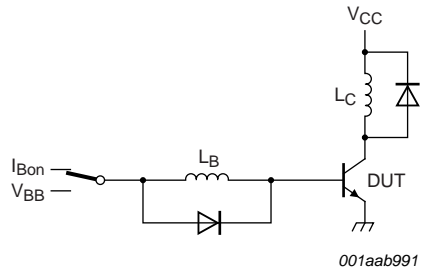


Fig 13. Switching times waveforms for resistive load



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

Fig 14. Test circuit for inductive load switching

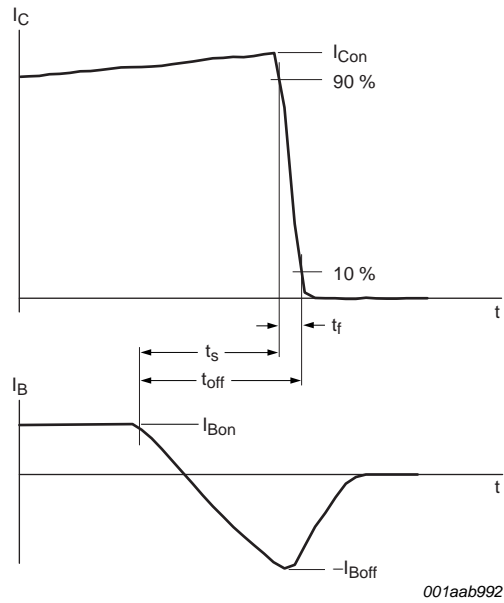


Fig 15. Switching times waveforms for inductive load

7. Package outline

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

SOT78

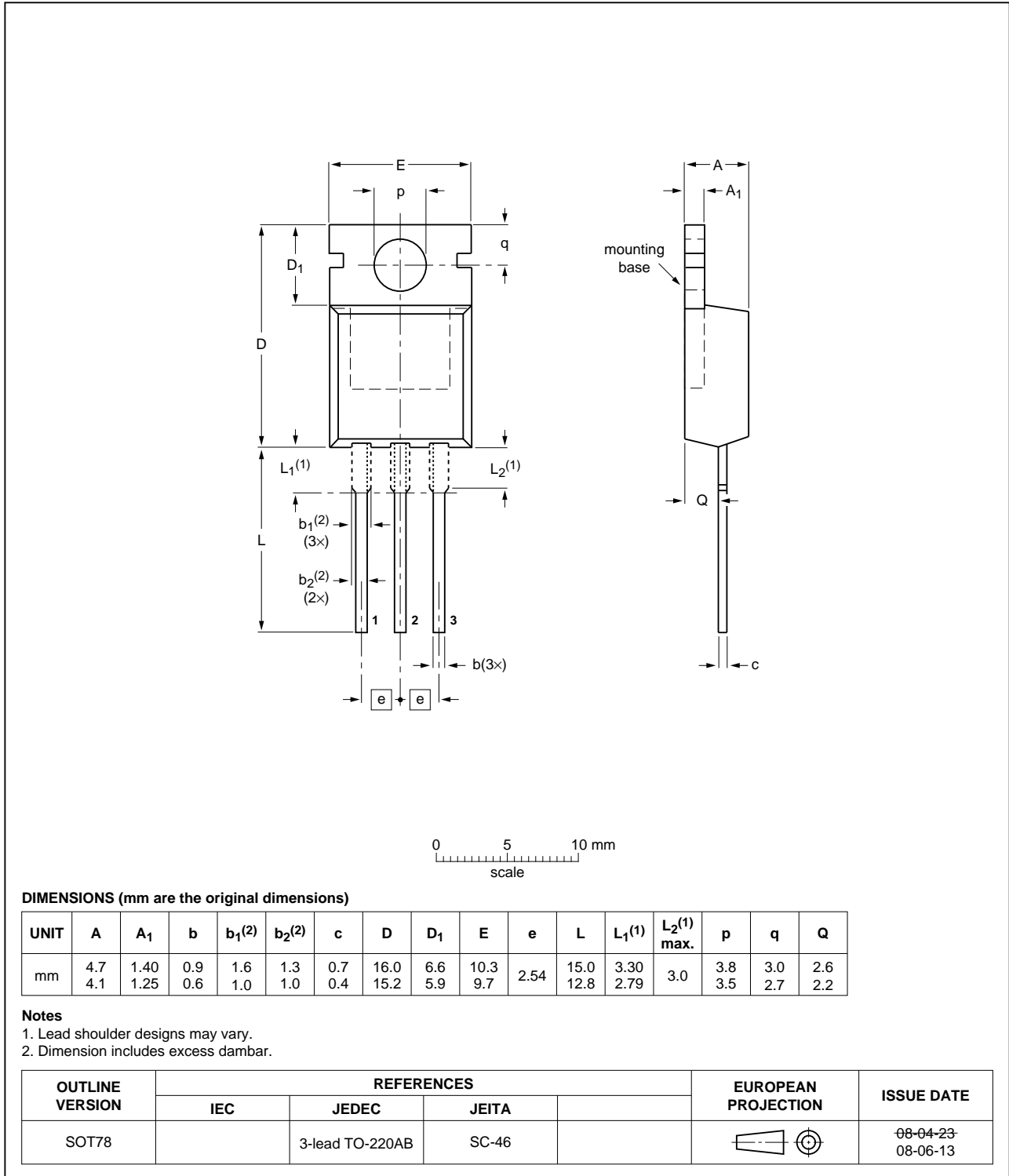


Fig 16. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUJ303A v.6	20120208	Product data sheet	-	BUJ303A v.5
Modifications:	• Various changes to content.			
BUJ303A v.5	20110503	Product data sheet	-	BUJ303A v.4

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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