



BUJ303AD

NPN power transistor

Rev. 1 — 2 September 2011

Product data sheet

1. Product profile

1.1 General description

High voltage, high speed planar passivated NPN power switching transistor in a SOT428 (DPAK) surface mountable plastic package.

1.2 Features and benefits

- Fast switching
- Low thermal resistance
- Surface mountable package
- 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

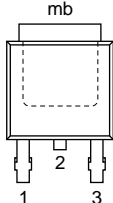
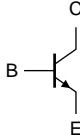
Table 1. Quick reference data

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	-	-	80	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	30	
		$I_C = 500\text{ mA}$; $V_{CE} = 5\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 11	14	25	35	



2. Pinning information

Table 2. Pinning information

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

SOT428 (DPAK)

[1] it is not possible to make a connection to pin 2 of the SOT428 (DPAK) package.

3. Ordering information

Table 3. Ordering information

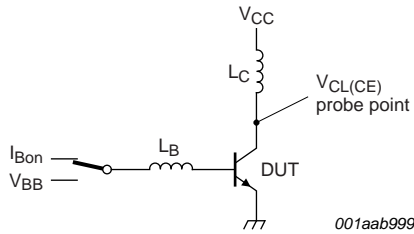
Type number	Package		Version
	Name	Description	
BUJ303AD	DPAK	plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)	SOT428

4. Limiting values

Table 4. Limiting values

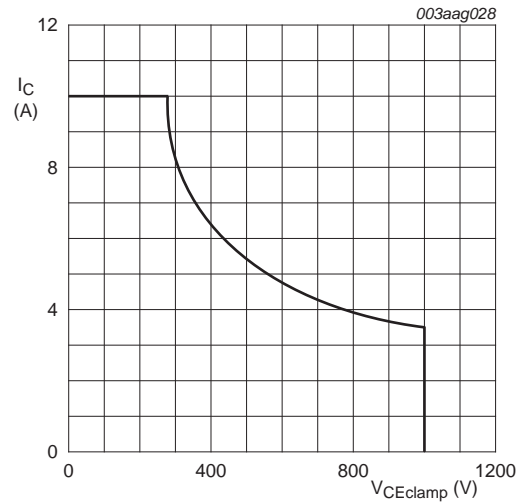
In accordance with the Absolute Maximum Rating System (IEC 60134).

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	-	80	W
T_{stg}	storage temperature		-65	150	°C
T_j	junction temperature		-	150	°C



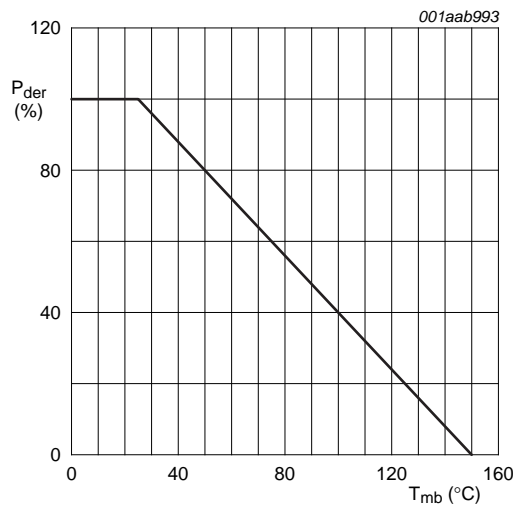
$V_{CL(CE)} \leq 1000 \text{ V}; V_{CC} = 150 \text{ V}; V_{BB} = -5 \text{ V};$
 $L_B = 1 \mu\text{H}; L_C = 200 \mu\text{H}$

Fig 1. Test circuit for reverse bias safe operating area



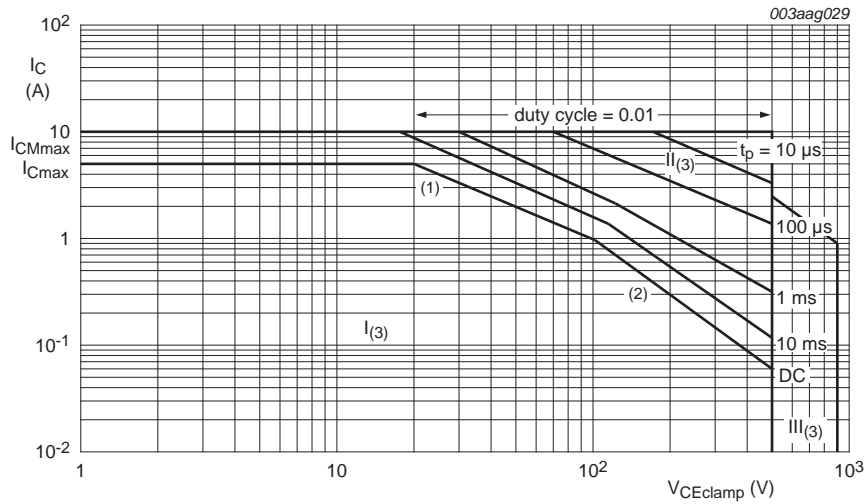
$T_j \leq T_{j(max)}$

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	-	-	1.56	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	printed circuit board (FR4) mounted; minimum footprint	-	75	-	K/W

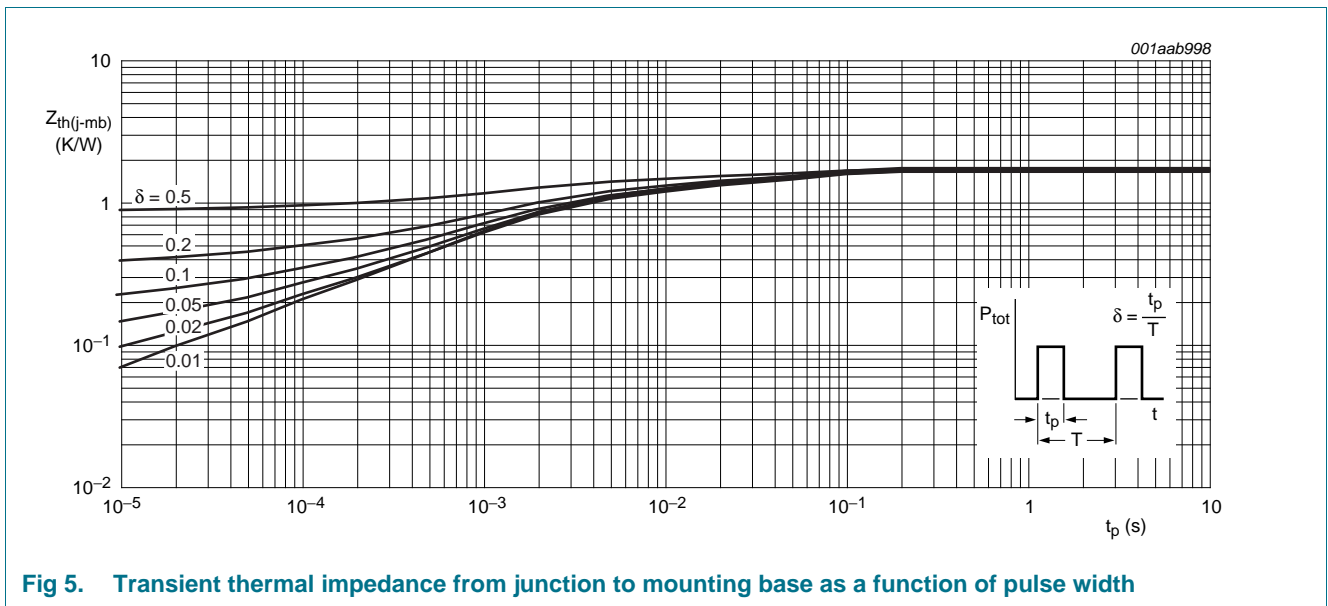


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse width

6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
I_{CES}	collector-emitter cut-off current	$V_{BE} = 0\text{ V}; V_{CE} = 1000\text{ V}; T_{mb} = 25\text{ }^{\circ}\text{C}$	[1] -	-	1	mA
		$V_{BE} = 0\text{ V}; V_{CE} = 1000\text{ V}; T_j = 125\text{ }^{\circ}\text{C}$	[1] -	-	2	mA
I_{CBO}	collector-base cut-off current	$V_{CB} = 1000\text{ V}; I_E = 0\text{ A}; T_{mb} = 25\text{ }^{\circ}\text{C}$	[1] -	-	1	mA
I_{CEO}	collector-emitter cut-off current	$V_{CE} = 500\text{ V}; I_B = 0\text{ A}; T_{mb} = 25\text{ }^{\circ}\text{C}$	[1] -	-	0.1	mA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 9\text{ V}; I_C = 0\text{ A}; T_{mb} = 25\text{ }^{\circ}\text{C}$	-	-	0.1	mA
V_{CE0sus}	collector-emitter sustaining voltage	$I_B = 0\text{ A}; I_C = 100\text{ mA}; L_C = 25\text{ mH}; T_{mb} = 25\text{ }^{\circ}\text{C}$; see Figure 6 ; see Figure 7	500	-	-	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 3\text{ A}; I_B = 0.6\text{ A}; T_{mb} = 25\text{ }^{\circ}\text{C}$; see Figure 8 ; see Figure 9	-	0.25	1.5	V
V_{BEsat}	base-emitter saturation voltage	$I_C = 3\text{ A}; I_B = 0.6\text{ A}; T_{mb} = 25\text{ }^{\circ}\text{C}$; see Figure 10	-	0.97	1.3	V
h_{FE}	DC current gain	$I_C = 5\text{ mA}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ }^{\circ}\text{C}$; see Figure 11	10	22	30	
		$I_C = 500\text{ mA}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ }^{\circ}\text{C}$; see Figure 11	14	25	35	
h_{FEsat}	DC saturation current gain	$I_C = 2.5\text{ A}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ }^{\circ}\text{C}$; see Figure 11	10	13.5	17	
		$I_C = 3\text{ A}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ }^{\circ}\text{C}$; see Figure 11	-	12	-	
Dynamic Characteristics (switching times - resistive load)						
t_s	turn-off delay time	$I_C = 2.5\text{ A}; I_{Bon} = 0.5\text{ A}; I_{Boff} = -0.5\text{ A}; R_L = 75\text{ }\Omega; V_{CC} = 187.5\text{ V}; T_{mb} = 25\text{ }^{\circ}\text{C}$; see Figure 12 ; see Figure 13	-	3.4	4	μs
t_f	fall time		-	0.33	0.45	μs
Dynamic Characteristics (switching times - inductive load)						
t_s	turn-off delay time	$I_C = 2.5\text{ A}; I_{Bon} = 0.5\text{ A}; V_{CC} = 350\text{ V}; V_{BB} = -5\text{ V}; L_B = 1\text{ }\mu\text{H}; T_{mb} = 25\text{ }^{\circ}\text{C}$; see Figure 14 ; see Figure 15	-	1.4	1.6	μs
t_s	turn-off delay time		-	1.7	1.9	μs
t_f	fall time	$I_C = 2.5\text{ A}; I_{Bon} = 0.5\text{ A}; V_{CC} = 350\text{ V}; V_{BB} = -5\text{ V}; L_B = 1\text{ }\mu\text{H}; T_j = 100\text{ }^{\circ}\text{C}$; see Figure 14 ; see Figure 15	-	145	160	ns
			-	160	200	ns

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

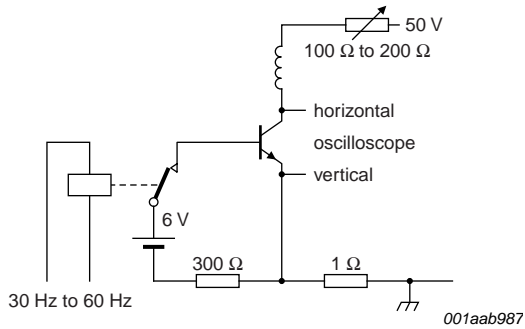


Fig 6. Test circuit for collector-emitter sustaining voltage

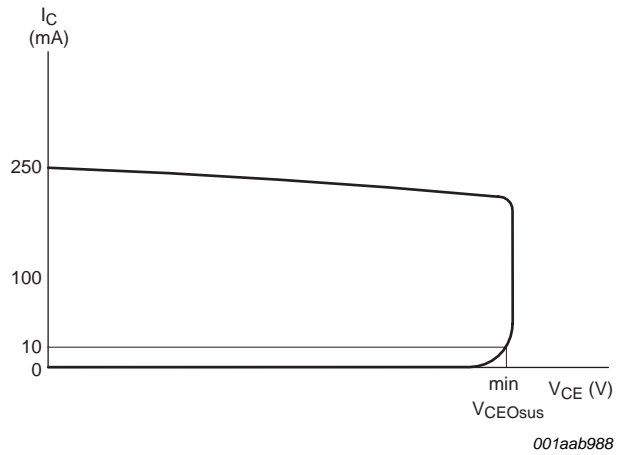


Fig 7. Oscilloscope display for collector-emitter sustaining voltage test waveform

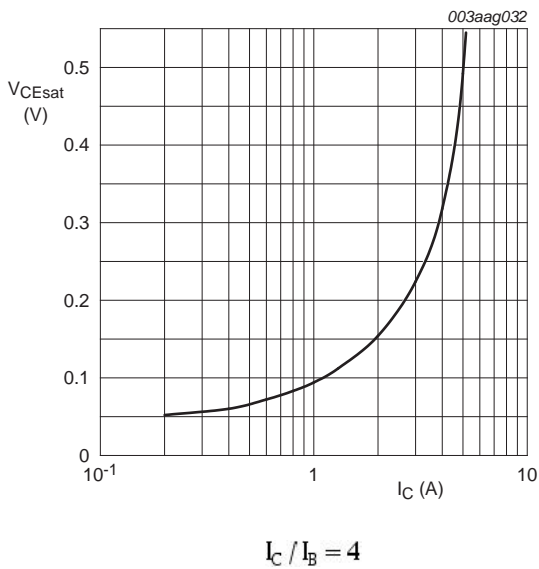


Fig 8. Collector-emitter saturation voltage as a function of collector current; typical values

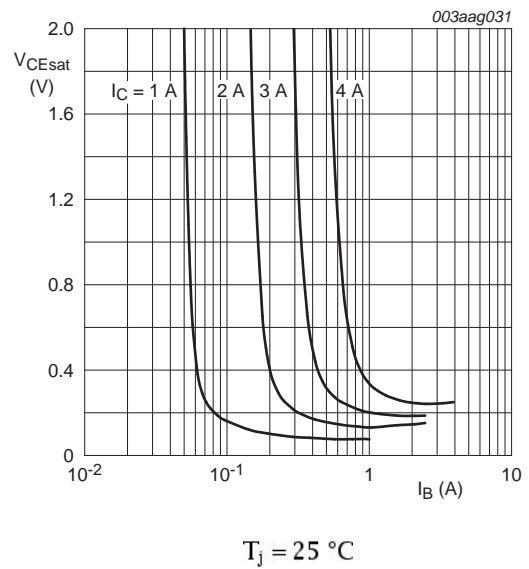


Fig 9. Collector-emitter saturation voltage as a function of base current; typical values

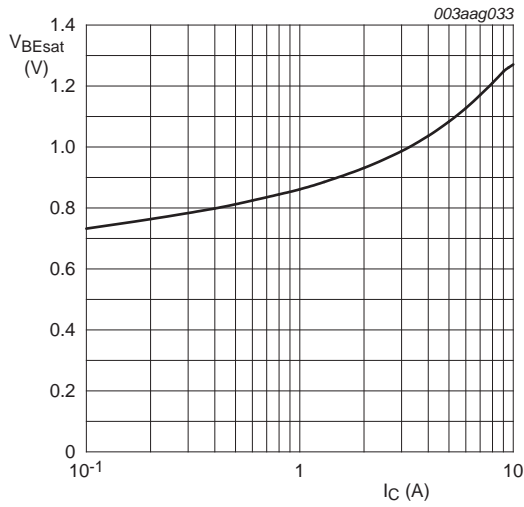


Fig 10. Base-emitter saturation voltage as a function of collector current; typical values

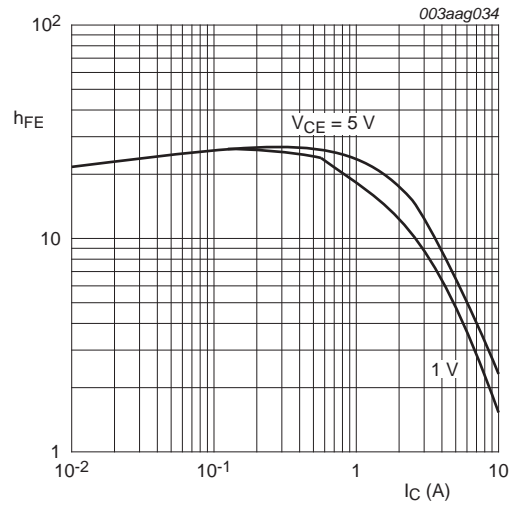
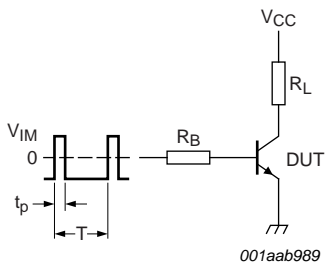


Fig 11. DC current gain as a function of collector current; typical values



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

Fig 12. Test circuit for resistive load switching

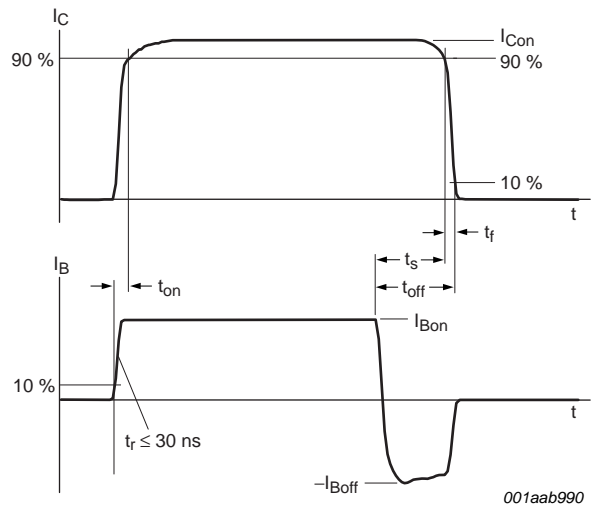
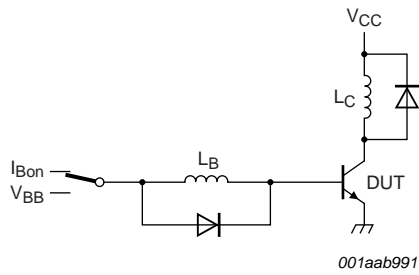


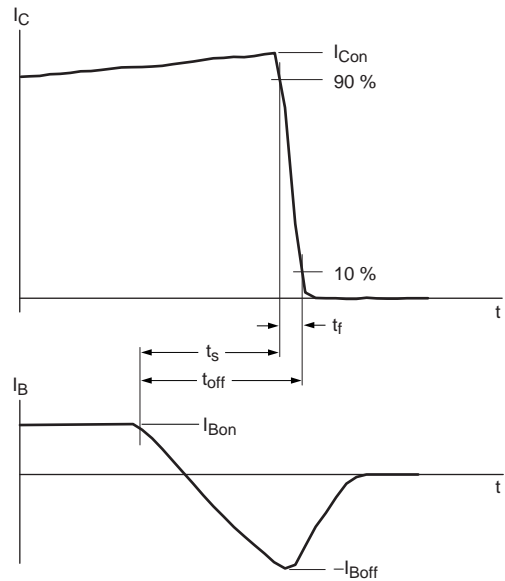
Fig 13. Switching times waveforms for resistive load



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

Fig 14. Test circuit for inductive load switching



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Fig 15. Switching times waveforms for inductive load

7. Package outline

Plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)

SOT428

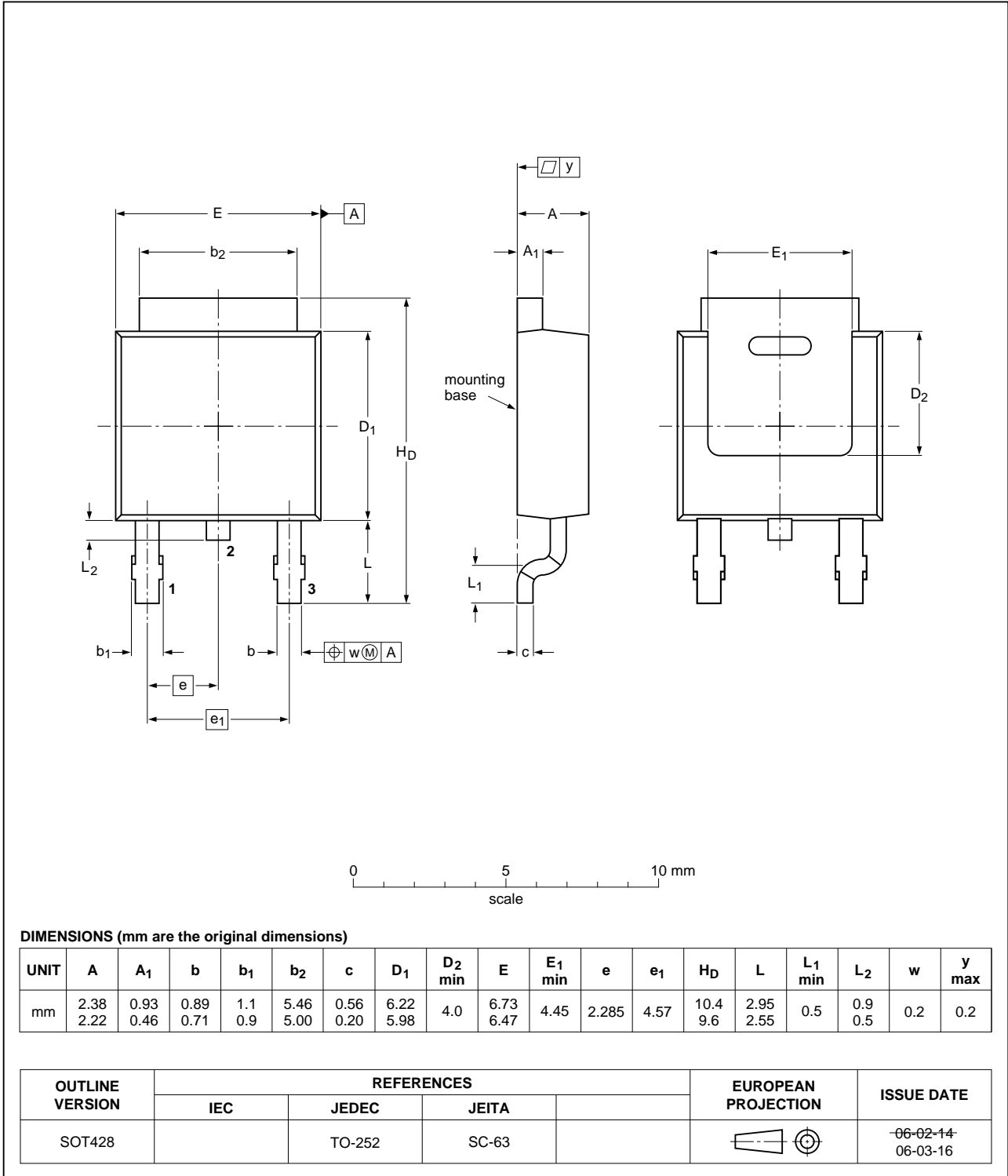


Fig 16. Package outline SOT428 (DPAK)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUJ303AD v.1	20110902	Product data sheet	-	-

9. Legal information

9.1 Data sheet status

Document status ^[1] ^[2]	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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

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