

# BUJD203AD

## NPN power transistor with integrated diode

Rev. 01 — 27 September 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 SOT428 (DPAK) surface-mountable plastic package.

### 1.2 Features and benefits

- Fast switching
- High voltage capability
- Integrated anti-parallel E-C diode
- Surface-mountable package
- 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

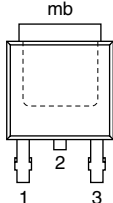
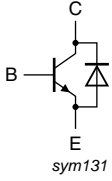
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_C$	collector current	see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a> ; DC; see <a href="#">Figure 4</a>	-	-	4	A
$P_{tot}$	total power dissipation	see <a href="#">Figure 3</a> ; $T_{mb} \leq 25\text{ °C}$	-	-	80	W
$V_{CESM}$	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	-	850	V
<b>Static characteristics</b>						
$h_{FE}$	DC current gain	$I_C = 500\text{ mA}$ ; $V_{CE} = 5\text{ V}$ ; see <a href="#">Figure 12</a> ; $T_{mb} = 25\text{ °C}$	13	21	32	
		$V_{CE} = 5\text{ V}$ ; $I_C = 3\text{ A}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 12</a>	-	12.5	-	
$V_{CEOsus}$	collector-emitter sustaining voltage	$I_B = 0\text{ A}$ ; $L_C = 25\text{ mH}$ ; $I_C = 10\text{ mA}$ ; see <a href="#">Figure 7</a> ; see <a href="#">Figure 8</a>	400	450	-	V



## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base		
2	C	collector <sup>[1]</sup>		
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		
	Name	Description	Version
BUJD203AD	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	$V_{BE} = 0\text{ V}$	-	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 <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a> ; see <a href="#">Figure 4</a>	-	4	A
$I_{CM}$	peak collector current	see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a> ; see <a href="#">Figure 4</a>	-	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 <a href="#">Figure 3</a>	-	80	W
$T_{stg}$	storage temperature		-65	150	°C
$T_j$	junction temperature		-	150	°C

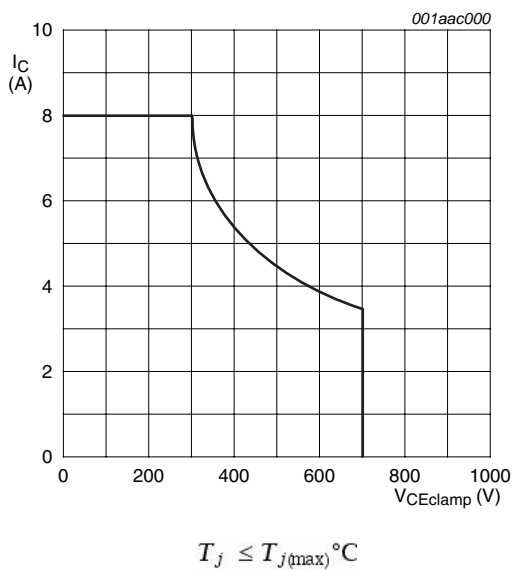
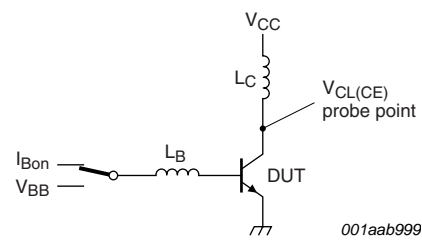
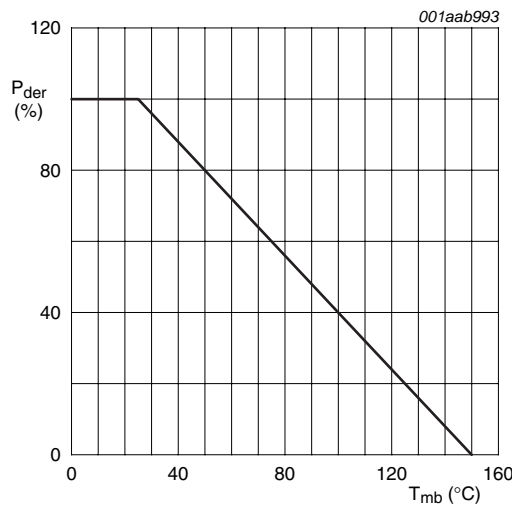


Fig 1. Reverse bias safe operating area



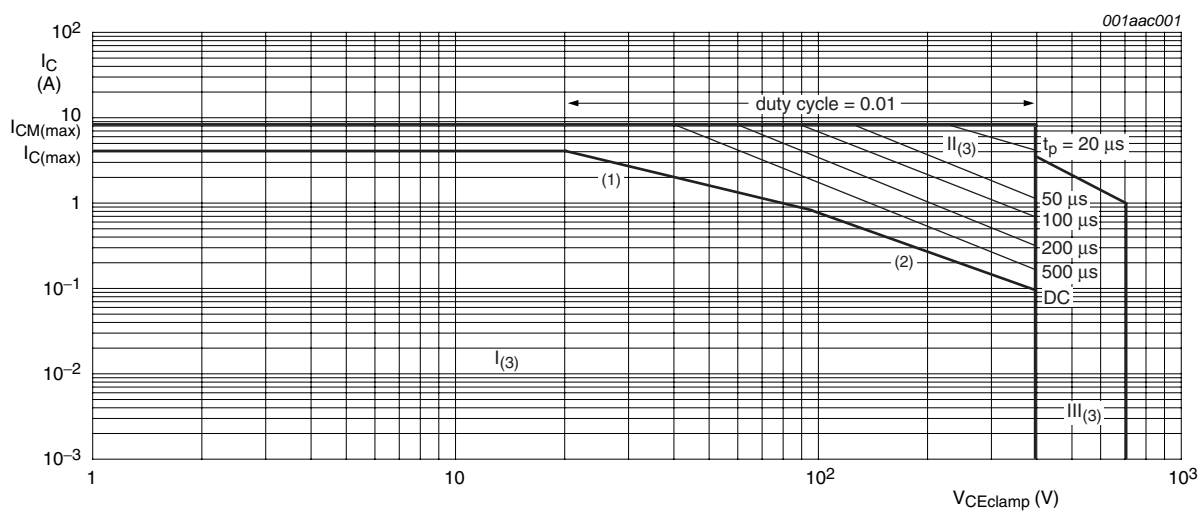
$V_{CL(CE)} \leq 1000 \text{ V}; V_{CC} = 150 \text{ V}; V_{BB} = -5 \text{ V};$   
 $L_B = 1 \mu\text{H}; L_C = 200 \mu\text{H}$

Fig 2. Test circuit for reverse bias safe operating area



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

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



- 1)  $P_{\text{tot}}$  maximum and  $P_{\text{tot}}$  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  $R_{\text{BE}} \leq 100 \Omega$  and  $t_p \leq 0.6 \mu\text{s}$

**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 <a href="#">Figure 6</a>	-	-	1.56	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	printed-circuit-board mounted; minimum footprint; see <a href="#">Figure 5</a>	-	75	-	K/W

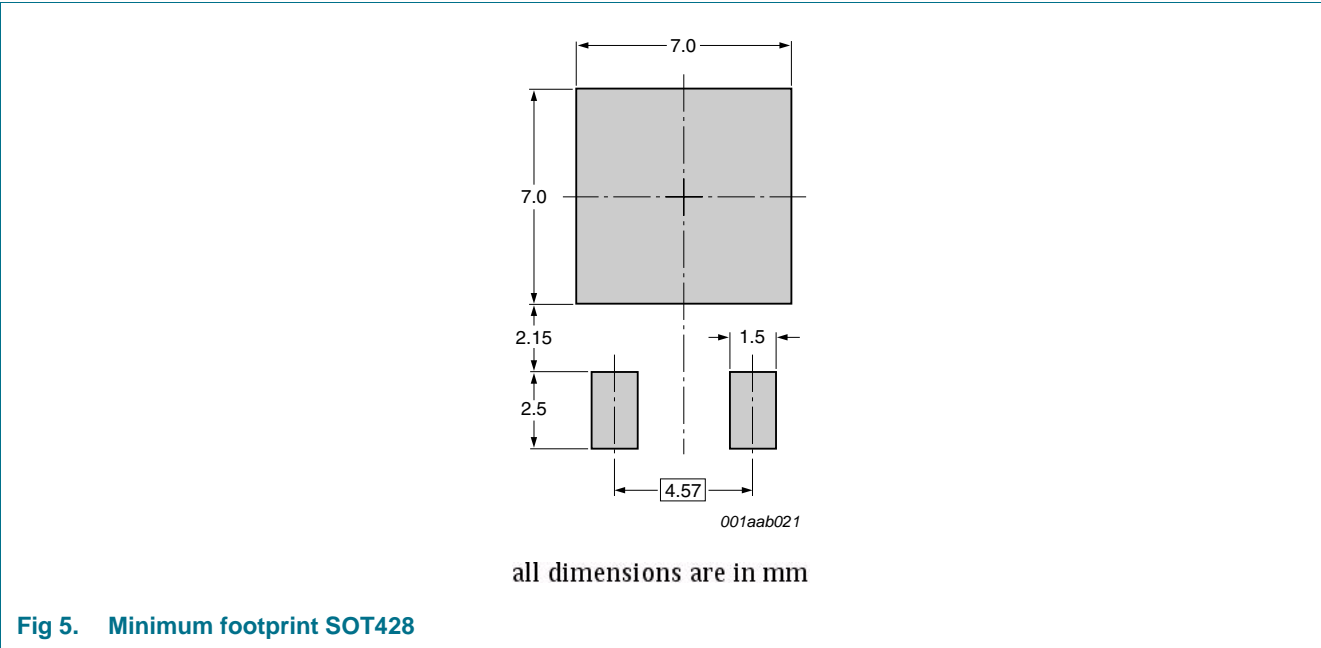


Fig 5. Minimum footprint SOT428

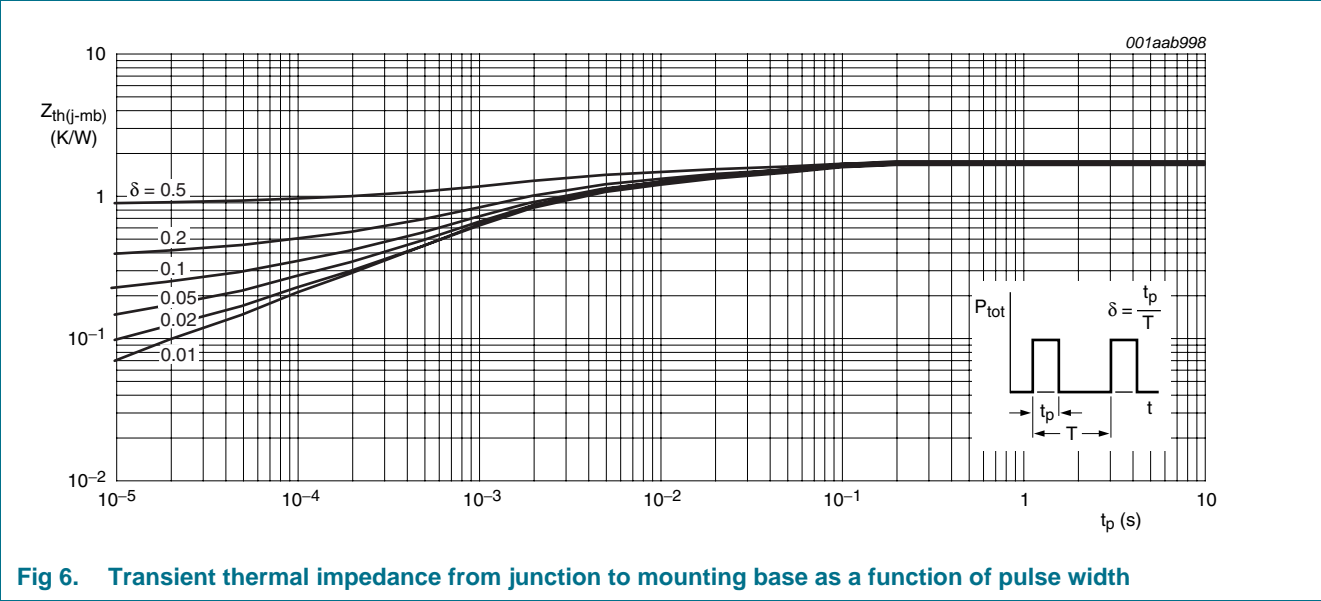


Fig 6. Transient thermal impedance from junction to mounting base as a function of pulse width

## 6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
I <sub>CES</sub>	collector-emitter cut-off current	V <sub>BE</sub> = 0 V; V <sub>CE</sub> = 850 V; T <sub>j</sub> = 125 °C	[1]	-	2	mA
		V <sub>BE</sub> = 0 V; V <sub>CE</sub> = 850 V; T <sub>j</sub> = 25 °C	[1]	-	1	mA
I <sub>CBO</sub>	collector-base cut-off current	V <sub>CB</sub> = 850 V; I <sub>E</sub> = 0 A	[1]	-	1	mA
I <sub>CEO</sub>	collector-emitter cut-off current	V <sub>CE</sub> = 425 V; I <sub>B</sub> = 0 A	[1]	-	0.1	mA
I <sub>EBO</sub>	emitter-base cut-off current	V <sub>EB</sub> = 7 V; I <sub>C</sub> = 0 A	-	-	10	mA
V <sub>CEOsus</sub>	collector-emitter sustaining voltage	I <sub>B</sub> = 0 A; I <sub>C</sub> = 10 mA; L <sub>C</sub> = 25 mH; see <a href="#">Figure 7</a> ; see <a href="#">Figure 8</a>	400	450	-	V
V <sub>CEsat</sub>	collector-emitter saturation voltage	I <sub>C</sub> = 3 A; I <sub>B</sub> = 0.6 A; see <a href="#">Figure 9</a> ; see <a href="#">Figure 10</a>	-	0.29	1	V
V <sub>BEsat</sub>	base-emitter saturation voltage	I <sub>C</sub> = 3 A; I <sub>B</sub> = 0.6 A; see <a href="#">Figure 11</a>	-	0.99	1.5	V
V <sub>F</sub>	forward voltage	I <sub>F</sub> = 2 A; T <sub>j</sub> = 25 °C	-	1.04	1.5	V
h <sub>FE</sub>	DC current gain	I <sub>C</sub> = 1 mA; V <sub>CE</sub> = 5 V; T <sub>mb</sub> = 25 °C; see <a href="#">Figure 12</a>	10	15	32	
		I <sub>C</sub> = 500 mA; V <sub>CE</sub> = 5 V; T <sub>mb</sub> = 25 °C; see <a href="#">Figure 12</a>	13	21	32	
		I <sub>C</sub> = 2 A; V <sub>CE</sub> = 5 V; T <sub>mb</sub> = 25 °C; see <a href="#">Figure 12</a>	11	16	22	
		I <sub>C</sub> = 3 A; V <sub>CE</sub> = 5 V; T <sub>mb</sub> = 25 °C; see <a href="#">Figure 12</a>	-	12.5	-	
Dynamic characteristics						
t <sub>on</sub>	turn-on time	I <sub>C</sub> = 2.5 A; I <sub>Bon</sub> = 0.5 A; I <sub>Boff</sub> = -0.5 A; R <sub>L</sub> = 75 Ω; T <sub>j</sub> = 25 °C; resistive load; see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	0.52	0.6	μs
t <sub>s</sub>	storage time	I <sub>C</sub> = 2.5 A; I <sub>Bon</sub> = 0.5 A; I <sub>Boff</sub> = -0.5 A; R <sub>L</sub> = 75 Ω; T <sub>j</sub> = 25 °C; resistive load; see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	2.7	3.3	μs
		I <sub>C</sub> = 2 A; I <sub>Bon</sub> = 0.4 A; V <sub>BB</sub> = -5 V; L <sub>B</sub> = 1 μH; T <sub>j</sub> = 25 °C; inductive load; see <a href="#">Figure 15</a> ; see <a href="#">Figure 16</a>	-	1.2	1.4	μs
		I <sub>C</sub> = 2 A; I <sub>Bon</sub> = 0.4 A; V <sub>BB</sub> = -5 V; L <sub>B</sub> = 1 μH; T <sub>j</sub> = 100 °C; inductive load; see <a href="#">Figure 15</a> ; see <a href="#">Figure 16</a>	-	-	1.8	μs
t <sub>f</sub>	fall time	I <sub>C</sub> = 2.5 A; I <sub>Bon</sub> = 0.5 A; I <sub>Boff</sub> = -0.5 A; R <sub>L</sub> = 75 Ω; T <sub>j</sub> = 25 °C; resistive load; see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	0.3	0.35	μs
		I <sub>C</sub> = 2 A; I <sub>Bon</sub> = 0.4 A; V <sub>BB</sub> = -5 V; L <sub>B</sub> = 1 μH; T <sub>j</sub> = 100 °C; inductive load; see <a href="#">Figure 15</a> ; see <a href="#">Figure 16</a>	-	-	0.12	μs
		I <sub>C</sub> = 2 A; I <sub>Bon</sub> = 0.4 A; V <sub>BB</sub> = -5 V; L <sub>B</sub> = 1 μH; T <sub>j</sub> = 25 °C; inductive load; see <a href="#">Figure 15</a> ; see <a href="#">Figure 16</a>	-	0.03	0.06	μs

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

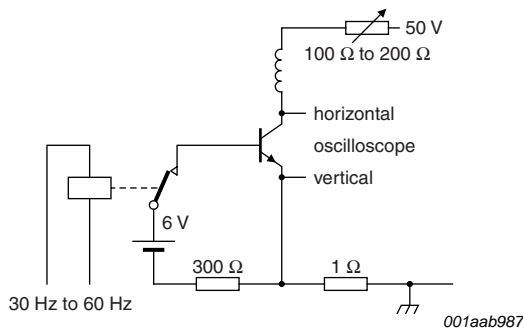


Fig 7. Test circuit for collector-emitter sustaining voltage

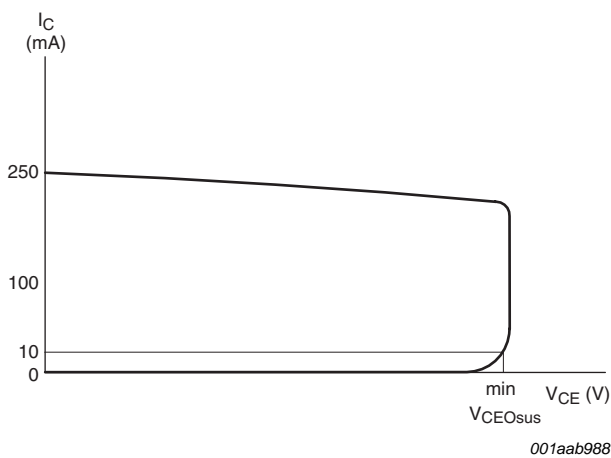


Fig 8. Oscilloscope display for collector-emitter sustaining voltage test waveform

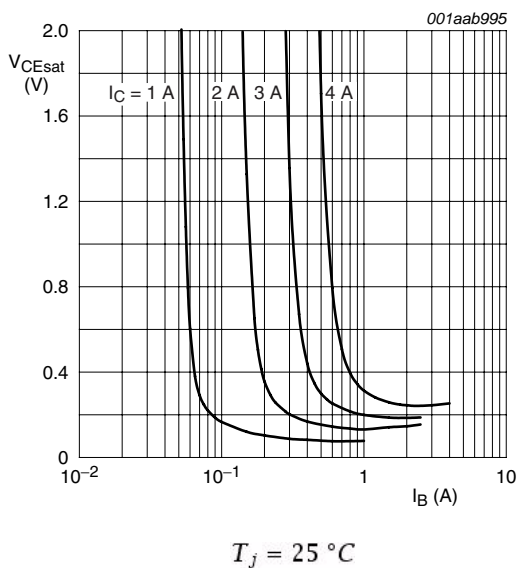


Fig 9. Collector-emitter saturation voltage as a function of base current; typical values

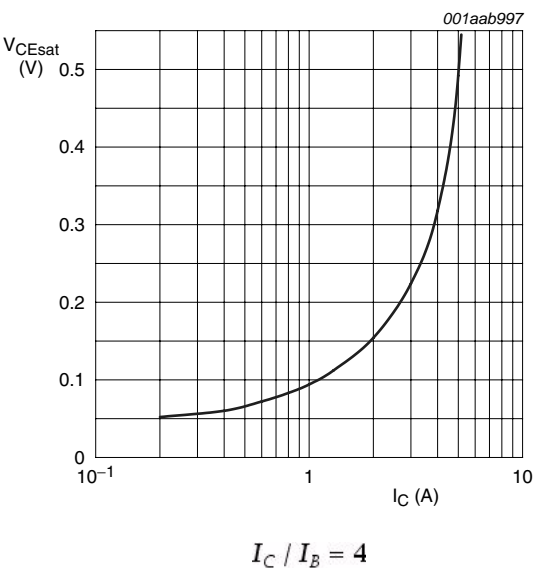


Fig 10. Collector-emitter saturation voltage as a function of collector current; typical values

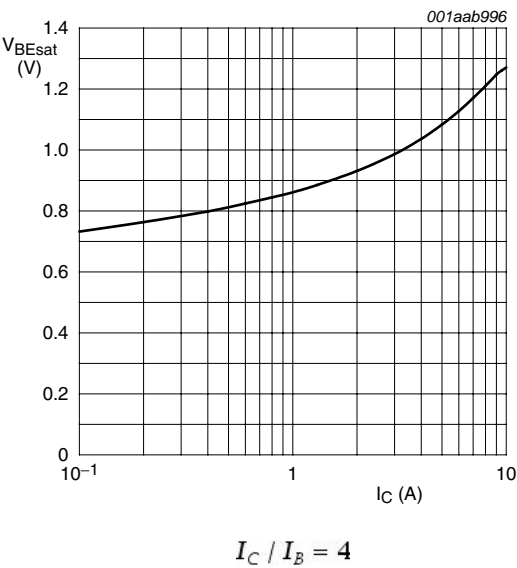


Fig 11. Base-emitter saturation voltage as a function of collector current; typical values

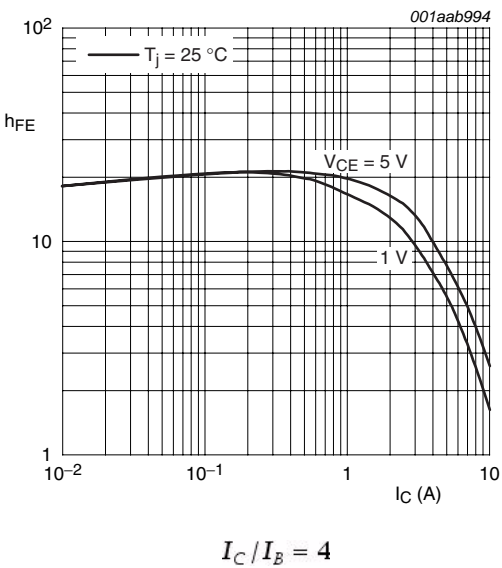
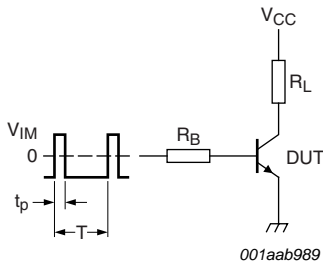


Fig 12. DC current gain as a function of collector current; typical values



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

Fig 13. Test circuit for resistive load switching

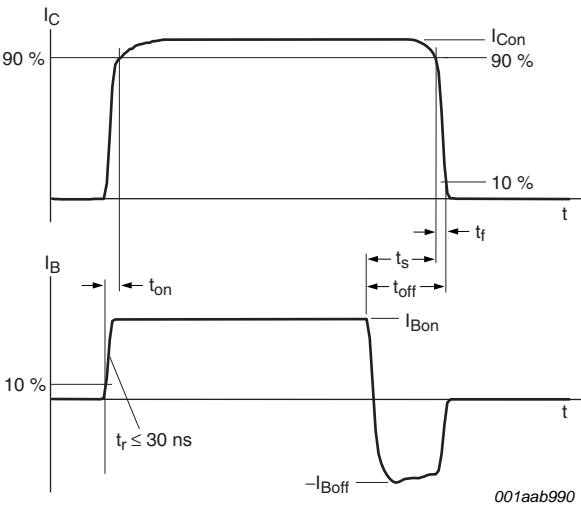


Fig 14. Switching times waveforms for resistive load



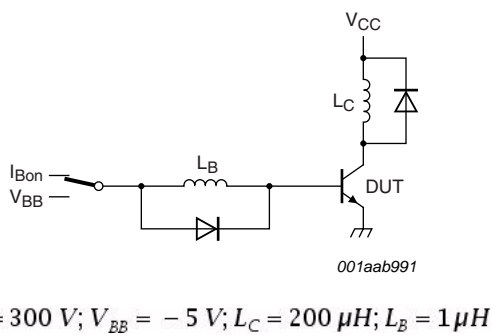


Fig 15. Test circuit for inductive load switching

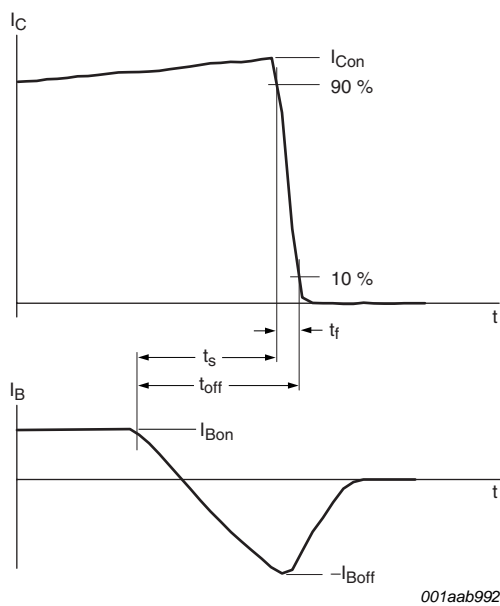


Fig 16. Switching times waveforms for inductive load

7. Package outline

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

SOT428

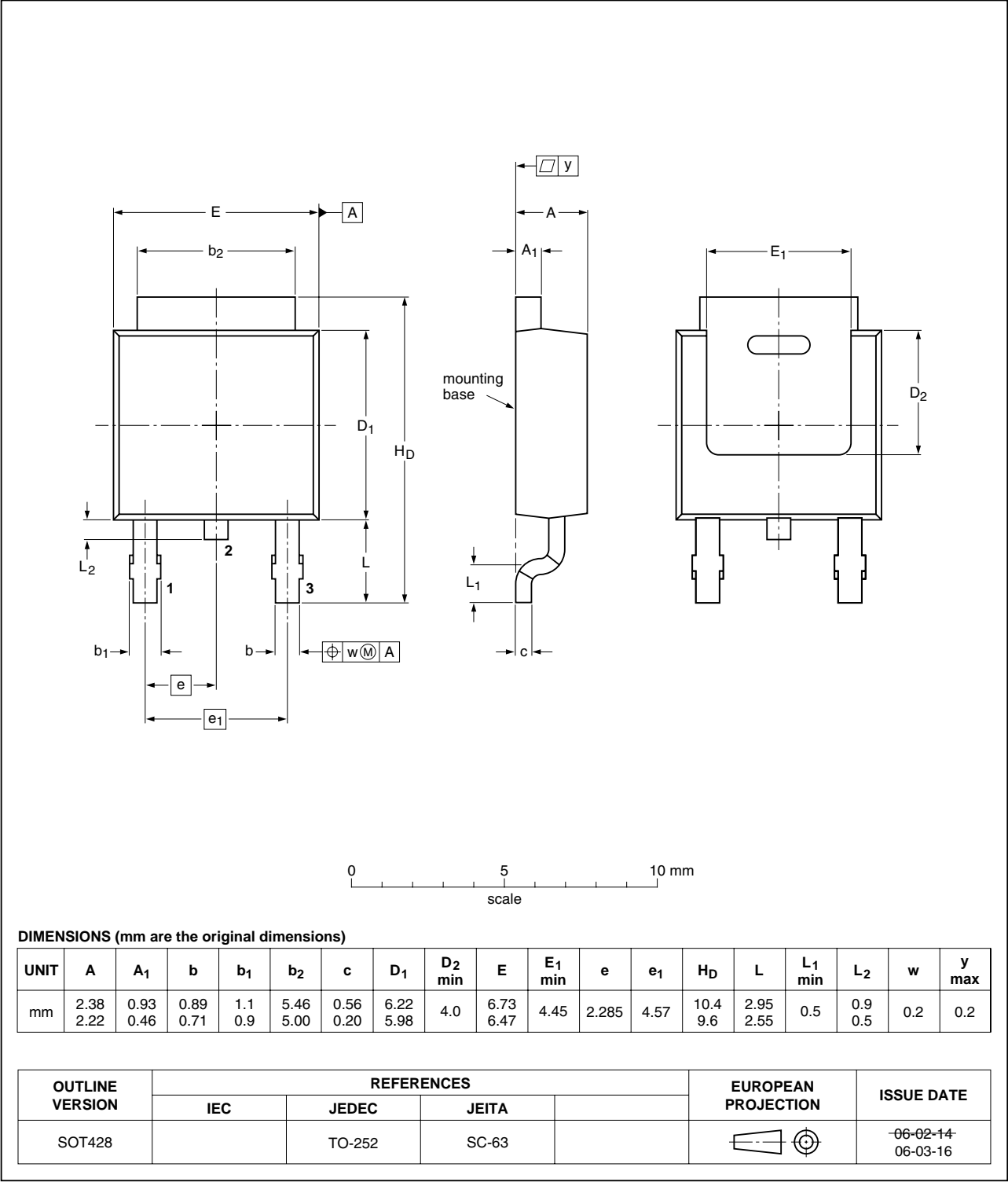


Fig 17. Package outline SOT428 (DPAK)

8. Soldering

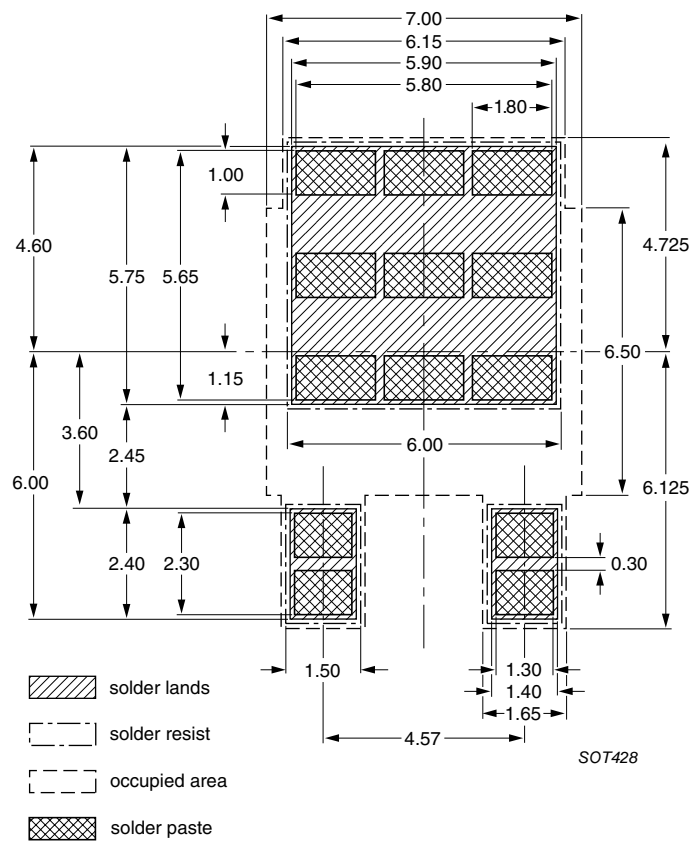


Fig 18. Reflow soldering footprint for SOT428 (DPAK)

## 9. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUJD203AD v.1	20100927	Product data sheet	-	-

## 10. Legal information

### 10.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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