

# BUJ105AD

Silicon diffused power transistor

Rev. 01 — 14 December 2004

Product data sheet

## 1. Product profile

### 1.1 General description

High-voltage, high-speed planar-passivated NPN power switching transistor in a SOT428 (D-PAK) surface mounted package.

### 1.2 Features

- Low thermal resistance
- Fast switching

### 1.3 Applications

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

### 1.4 Quick reference data

- $V_{CESM} \leq 700 \text{ V}$
- $I_C \leq 8 \text{ A}$
- $P_{tot} \leq 80 \text{ W}$
- $h_{FEsat} = 11 \text{ (typ)}$

## 2. Pinning information

Table 1: Pinning

Pin	Description	Simplified outline	Symbol
1	base	<p>SOT428 (D-PAK)</p>	<p>sym056</p>
2	collector <sup>[1]</sup>		
3	emitter		
mb	mounting base; connected to collector		

[1] It is not possible to make a connection to pin 2 of the SOT428 (D-PAK) package.

### 3. Ordering information

Table 2: Ordering information

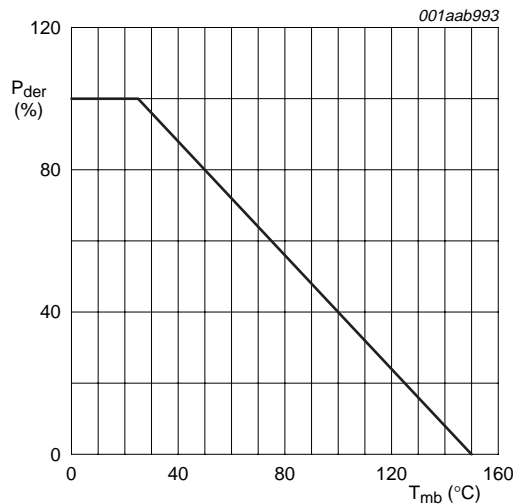
Type number	Package		Version
	Name	Description	
BUJ105AD	D-PAK	plastic single-ended surface mounted package; 3 leads (one lead cropped)	SOT428

### 4. Limiting values

Table 3: Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CESM}$	peak collector-emitter voltage	$V_{BE} = 0\text{ V}$	-	700	V
$V_{CEO}$	collector-emitter voltage	open base	-	400	V
$V_{CBO}$	collector-base voltage	open emitter	-	700	V
$I_C$	collector current (DC)		-	8	A
$I_{CM}$	peak collector current		-	16	A
$I_B$	base current (DC)		-	4	A
$I_{BM}$	peak base current		-	8	A
$P_{tot}$	total power dissipation	$T_{mb} = \leq 25\text{ °C}$ ; see <a href="#">Figure 1</a>	-	80	W
$T_{stg}$	storage temperature		-65	+150	°C
$T_j$	junction temperature		-	150	°C



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

Fig 1. Normalized total power dissipation as a function of mounting base temperature

## 5. Thermal characteristics

Table 4: Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see <a href="#">Figure 2</a>	-	-	1.56	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient		[1]	75	-	K/W

[1] Device mounted on a printed-circuit board; minimum footprint

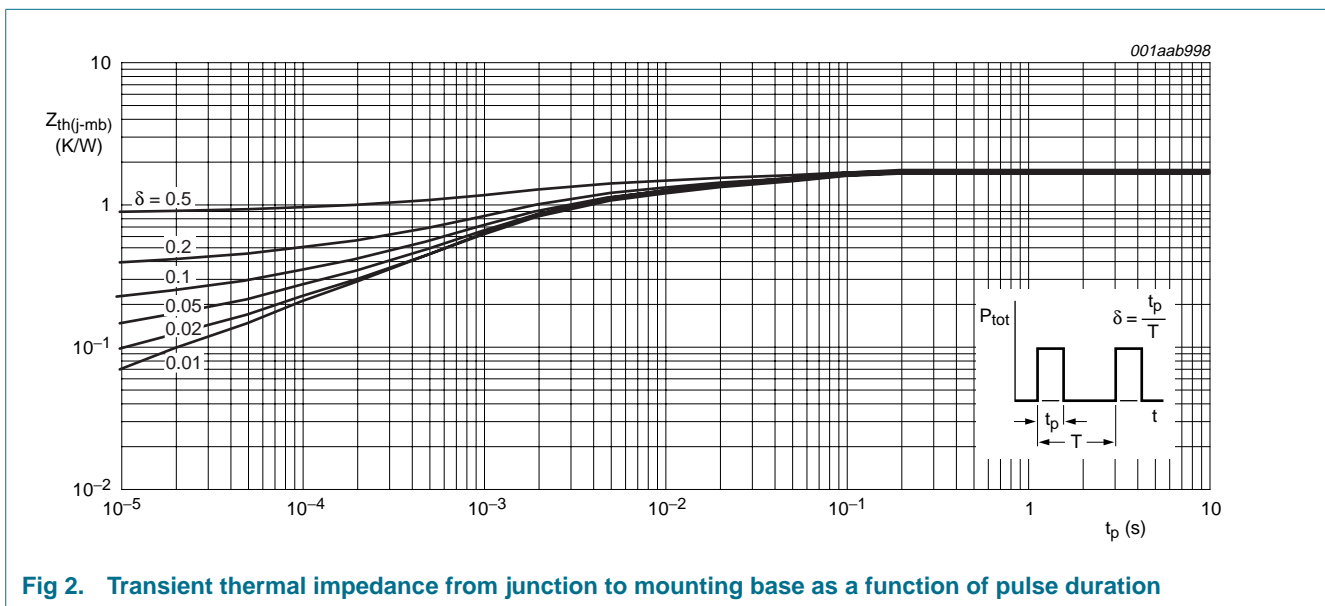


Fig 2. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 6. Characteristics

Table 5: Characteristics

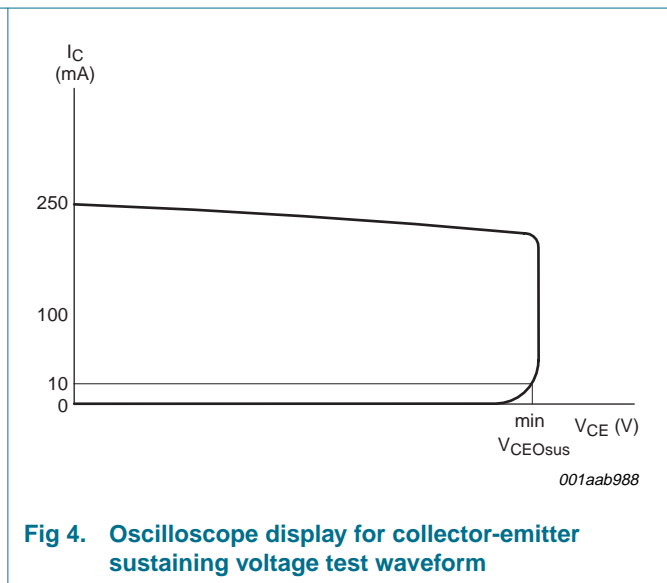
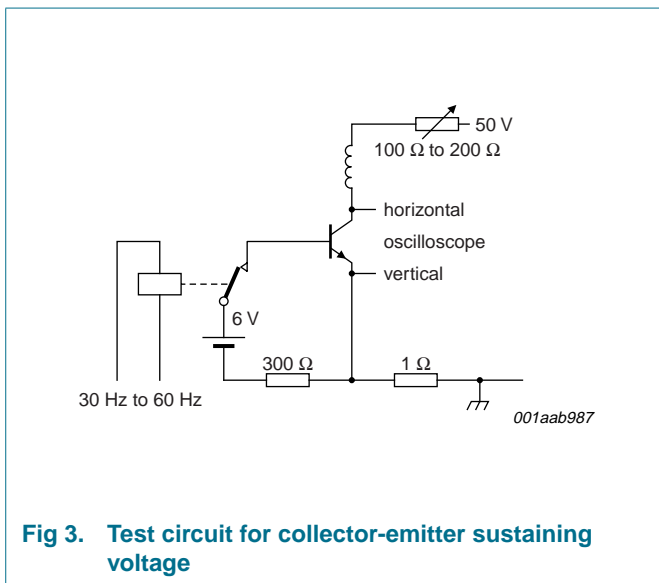
$T_{mb} = 25\text{ }^\circ\text{C}$ ; unless otherwise specified.

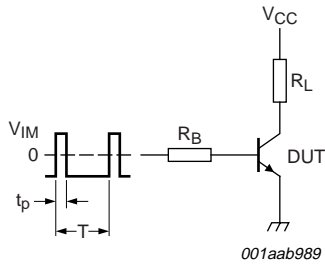
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$I_{CES}$	collector-emitter cut-off current	$V_{BE} = 0\text{ V}; V_{CE} = V_{CESMmax}$	[1]	-	0.2	mA
		$V_{BE} = 0\text{ V}; V_{CE} = V_{CESMmax}; T_j = 125\text{ }^\circ\text{C}$	[1]	-	0.5	mA
$I_{CBO}$	collector-base cut-off current	$V_{BE} = 0\text{ V}; V_{CE} = V_{CESMmax}$	[1]	-	0.2	mA
$I_{CEO}$	collector-emitter cut-off current	$V_{CEO} = V_{CEOMmax} = 400\text{ V}$	[1]	-	0.1	mA
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 9\text{ V}; I_C = 0\text{ A}$	-	-	1	mA
$V_{CE0sus}$	collector-emitter sustaining voltage	$I_B = 0\text{ A}; I_C = 10\text{ mA}; L = 25\text{ mH};$ see <a href="#">Figure 3</a> and <a href="#">4</a>	400	-	-	V
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 4.0\text{ A}; I_B = 0.8\text{ A};$ see <a href="#">Figure 11</a>	-	0.3	1.0	V
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 4.0\text{ A}; I_B = 0.8\text{ A};$ see <a href="#">Figure 12</a>	-	1.0	1.5	V
$h_{FE}$	DC current gain	$I_C = 1\text{ mA}; V_{CE} = 5\text{ V}$	10	14	34	
		$I_C = 500\text{ mA}; V_{CE} = 5\text{ V};$ see <a href="#">Figure 10</a>	13	23	36	
$h_{FEsat}$	DC saturation current gain	$I_C = 4.0\text{ A}; V_{CE} = 5\text{ V}$	8	11	15	

**Table 5: Characteristics ...continued**  
 $T_{mb} = 25\text{ }^\circ\text{C}$ ; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Dynamic characteristics</b>						
Switching times (resistive load); see <a href="#">Figure 5</a> and <a href="#">6</a>						
$t_{on}$	turn-on time	$I_{Con} = 5\text{ A}$ ; $I_{Bon} = -I_{Boff} = 1\text{ A}$ ; $R_L = 75\ \Omega$	-	0.65	1	$\mu\text{s}$
$t_{stg}$	storage time		-	1.8	2.5	$\mu\text{s}$
$t_f$	fall time		-	0.3	0.5	$\mu\text{s}$
Switching times (inductive load); see <a href="#">Figure 7</a> and <a href="#">8</a>						
$t_{stg}$	storage time	$I_{Con} = 5\text{ A}$ ; $I_{Bon} = 1\text{ A}$ ; $L_B = 1\ \mu\text{H}$ ;	-	1.2	1.7	$\mu\text{s}$
$t_f$	fall time	$V_{BB} = -5\text{ V}$	-	20	50	ns
Switching times (inductive load); see <a href="#">Figure 7</a> and <a href="#">8</a>						
$t_{stg}$	storage time	$I_{Con} = 5\text{ A}$ ; $I_{Bon} = 1\text{ A}$ ; $L_B = 1\ \mu\text{H}$ ;	-	1.4	1.9	$\mu\text{s}$
$t_f$	fall time	$V_{BB} = -5\text{ V}$ ; $T_j = 100\text{ }^\circ\text{C}$	-	25	100	ns

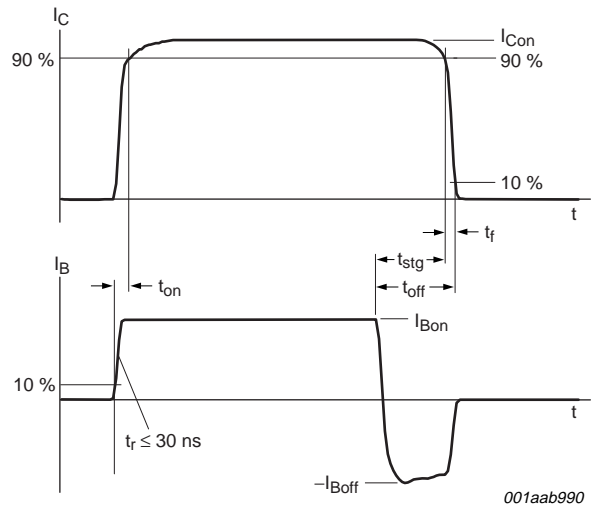
[1] Measured with half sine-wave voltage (curve tracer).



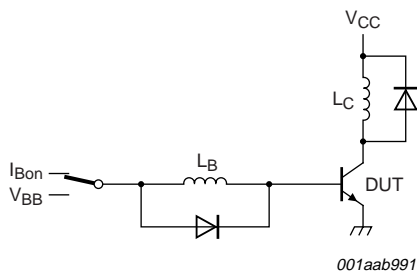


$V_{IM} = -6\text{ V to }+8\text{ V}$ ;  $V_{CC} = 250\text{ V}$ ;  $t_p = 20\text{ }\mu\text{s}$ ;  
 $\delta = t_p/T = 0.01$ .  
 $R_B$  and  $R_L$  calculated from  $I_{Con}$  and  $I_{Bon}$  requirements.

**Fig 5. Test circuit for resistive load switching**

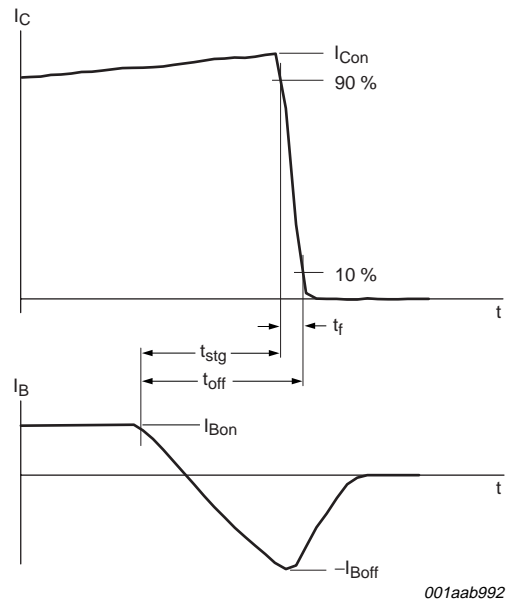


**Fig 6. Switching times waveforms for resistive load**



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

**Fig 7. Test circuit for inductive load switching**



**Fig 8. Switching times waveforms for inductive load**

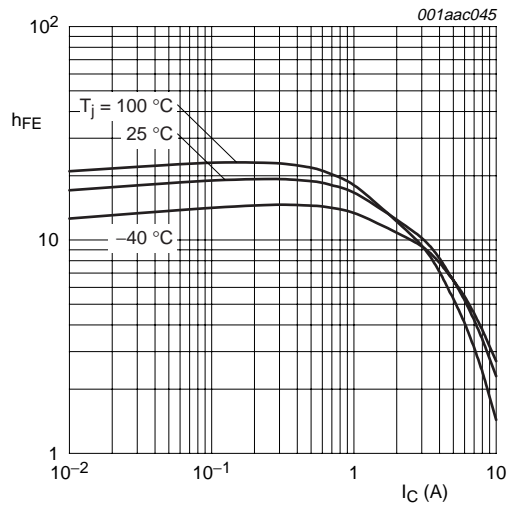


Fig 9. DC current gain as a function of collector current; typical values at  $V_{CE} = 1\text{ V}$

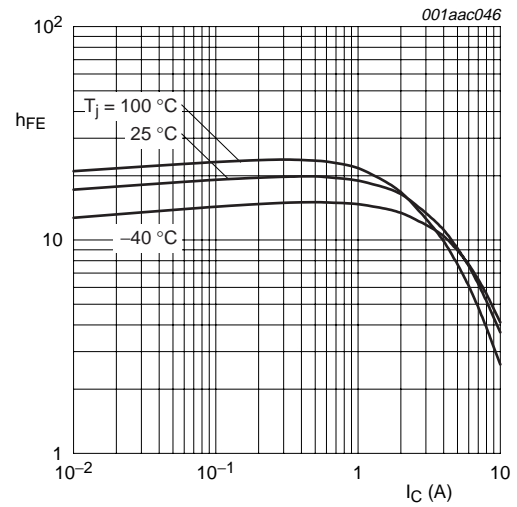


Fig 10. DC current gain as a function of collector current; typical values at  $V_{CE} = 5\text{ V}$

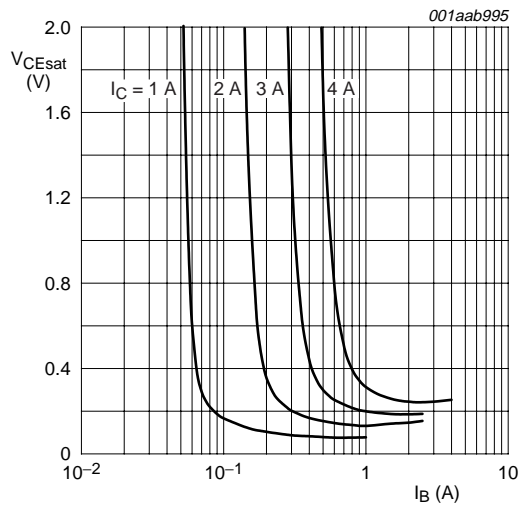


Fig 11. Collector-emitter saturation voltage as a function of base current; typical values  
 $T_j = 25\text{ °C}$ .

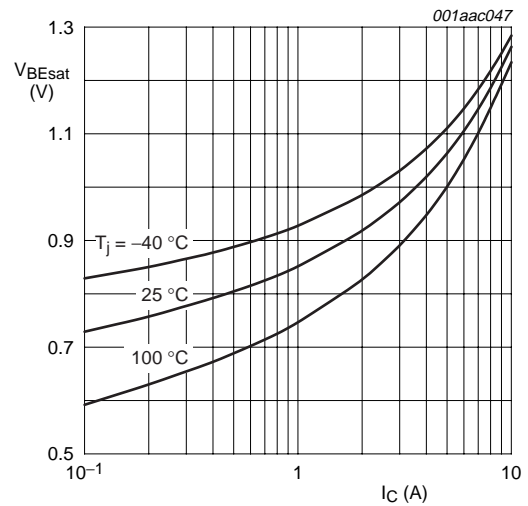
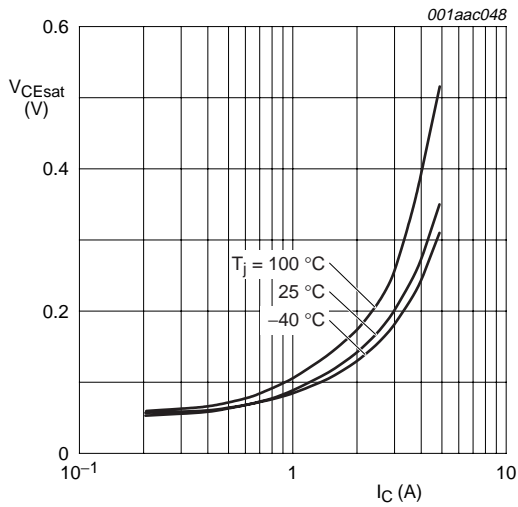
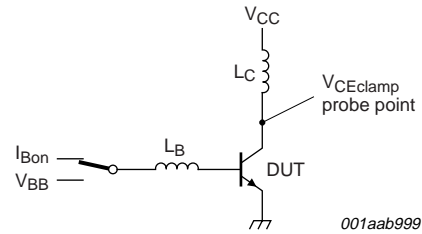


Fig 12. Base-emitter saturation voltage as a function of collector current; typical values  
 $I_C/I_B = 4$ .



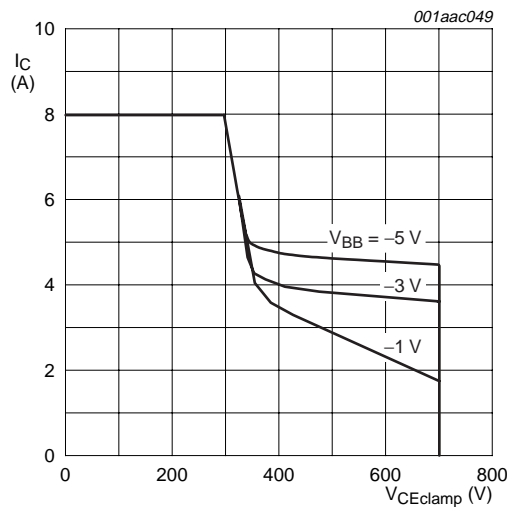
$I_C/I_B = 4$ .

Fig 13. Collector-emitter saturation voltage as a function of collector current; typical values



$V_{CEclamp} < 700\text{ V}$ ;  $V_{CC} = 150\text{ V}$ ;  $V_{BB} = -5\text{ V}$ ,  $-3\text{ V}$  and  $-1\text{ V}$ ;  $L_B = 1\ \mu\text{H}$ ;  $L_C = 200\ \mu\text{H}$ .

Fig 14. Test circuit for reverse bias safe operating area



$T_j < T_{j(max)}$ .

Fig 15. Reverse bias safe operating area

## 7. Package information

Epoxy meets requirements of UL94 V-0 at  $1/8$  inch.

8. Package outline

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

SOT428

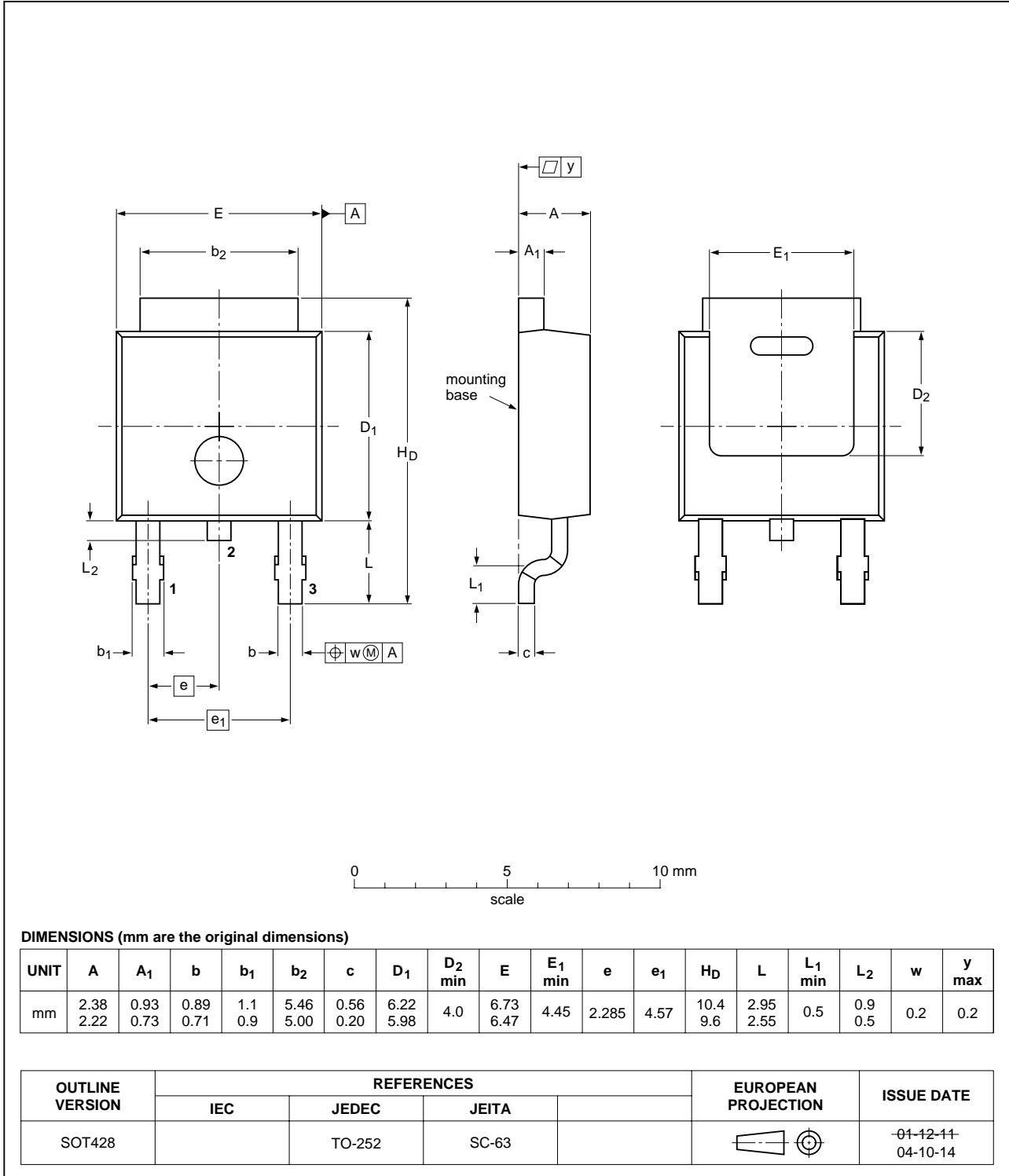
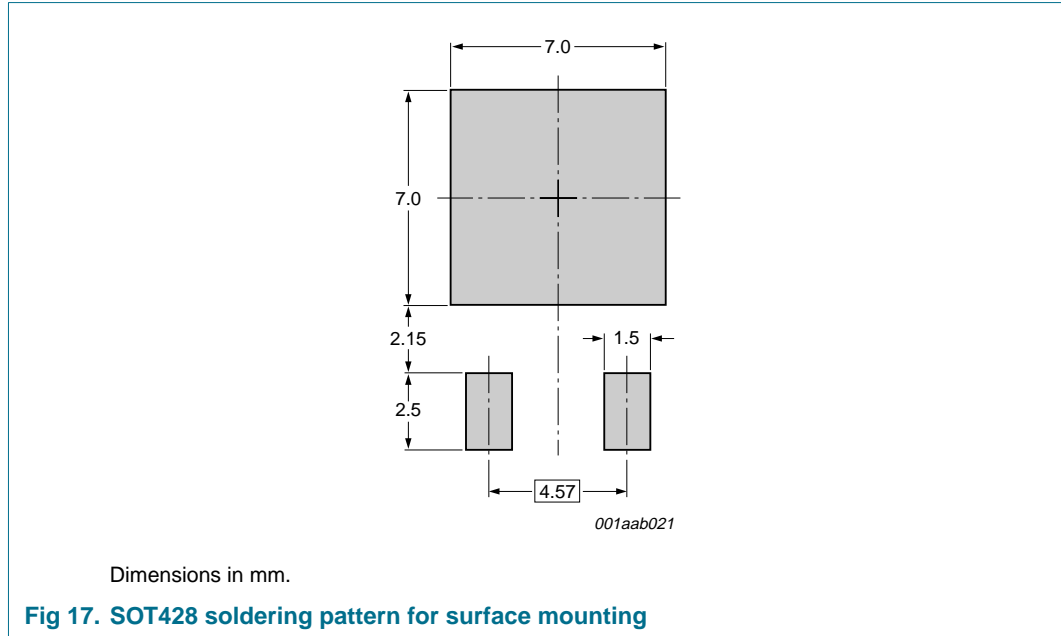


Fig 16. Package outline SOT428 (SC-63)



## 9. Mounting



## 10. Revision history

Table 6: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
BUJ105AD_1	20041214	Product data sheet	-	9397 750 14196	-

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Level	Data sheet status <sup>[1]</sup>	Product status <sup>[2] [3]</sup>	Definition
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