

# BUJ105AD

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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

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

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### 3. Ordering information

**Table 2: Ordering information**

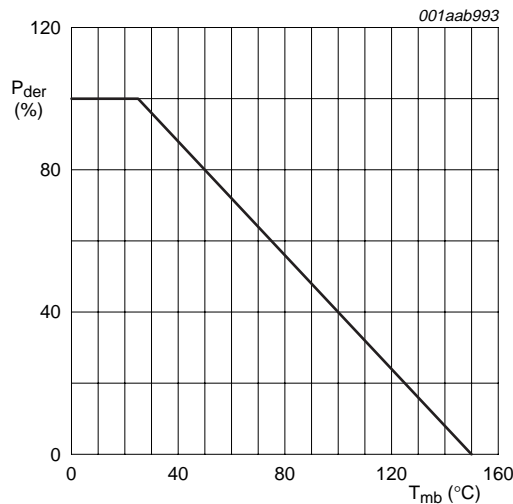
Type number	Package		Version
	Name	Description	
BUJ105AD	D-PAK	plastic single-ended surface mounted package; 3 leads (one lead cropped)	SOT428

### 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	$T_{mb} = \leq 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 1</a>	-	80	W
$T_{stg}$	storage temperature		-65	+150	$^\circ\text{C}$
$T_j$	junction temperature		-	150	$^\circ\text{C}$



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

**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

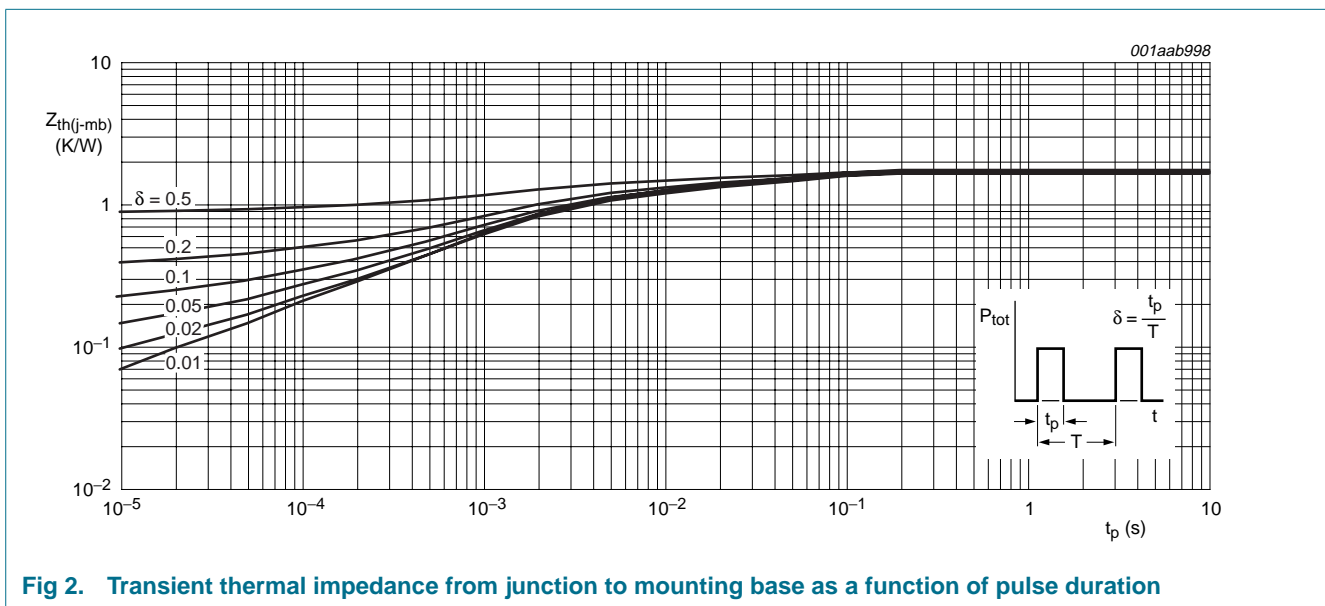


Fig 2. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 6. Characteristics

Table 5: Characteristics

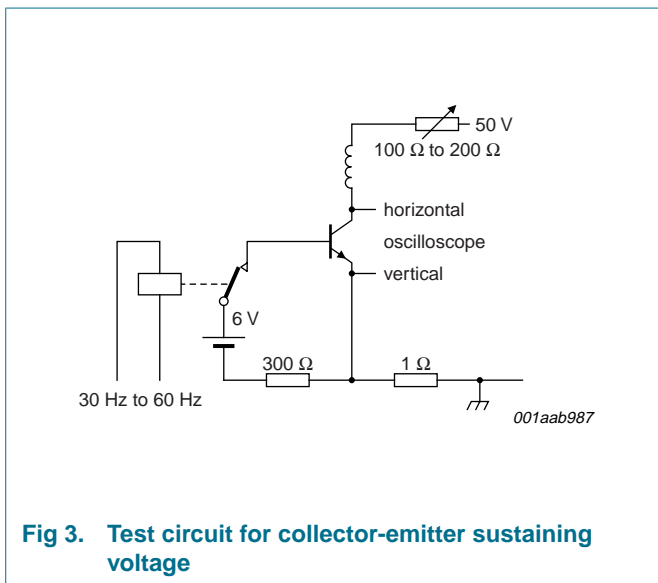
$T_{mb} = 25\text{ }^\circ\text{C}$ ; unless otherwise specified.

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	

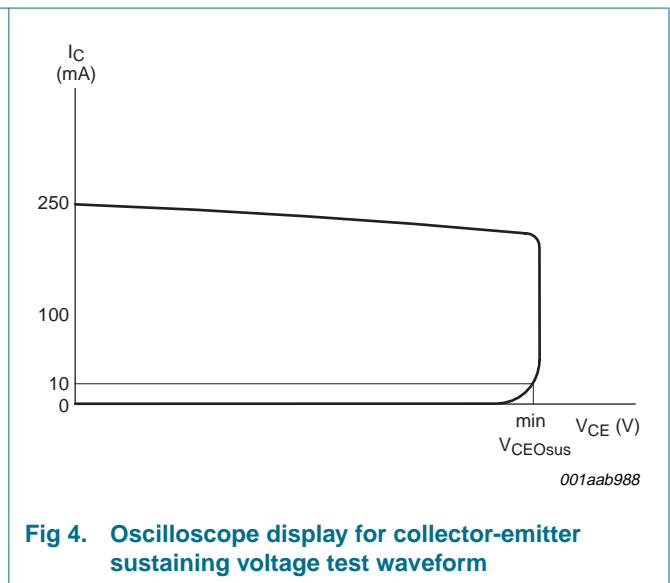
**Table 5: Characteristics ...continued**  
 $T_{mb} = 25\text{ }^\circ\text{C}$ ; unless otherwise specified.

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

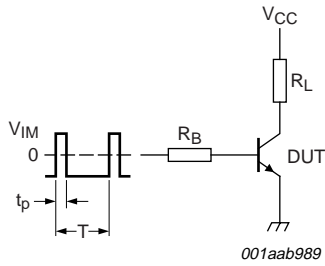
[1] Measured with half sine-wave voltage (curve tracer).



**Fig 3. Test circuit for collector-emitter sustaining voltage**

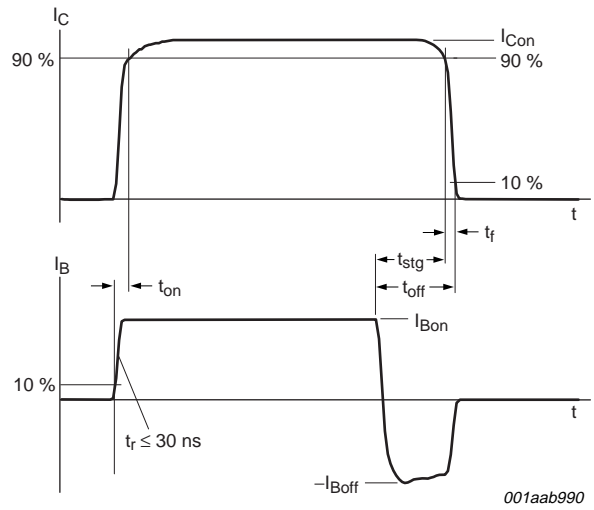


**Fig 4. Oscilloscope display for collector-emitter sustaining voltage test waveform**

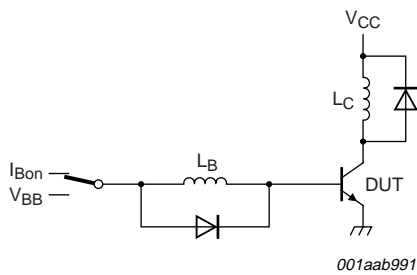


$V_{IM} = -6\text{ V to }+8\text{ V}$ ;  $V_{CC} = 250\text{ V}$ ;  $t_p = 20\text{ }\mu\text{s}$ ;  
 $\delta = t_p/T = 0.01$ .  
 $R_B$  and  $R_L$  calculated from  $I_{Con}$  and  $I_{Bon}$  requirements.

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

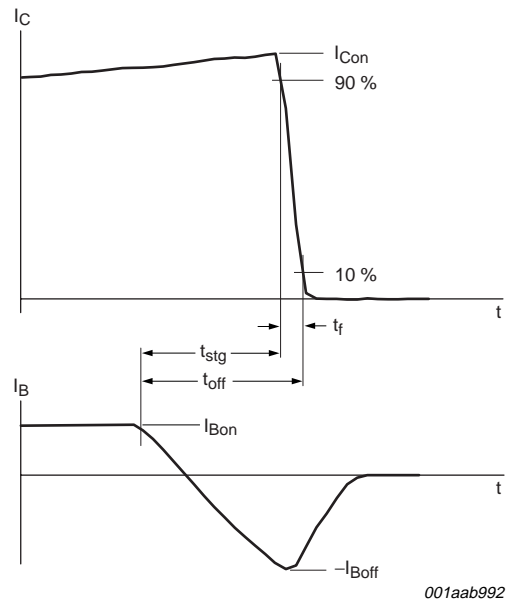


**Fig 6. Switching times waveforms for resistive load**

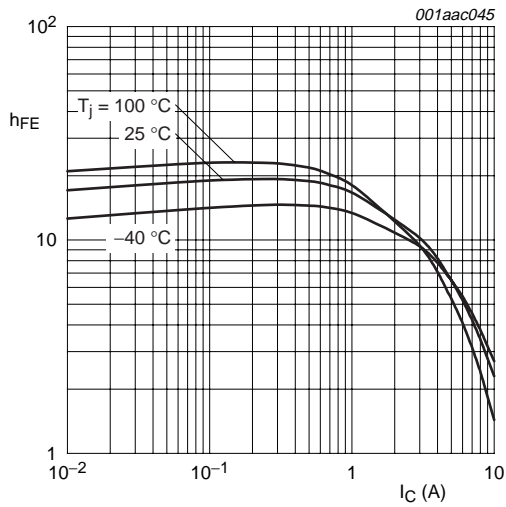


$V_{CC} = 300\text{ V}$ ;  $V_{BB} = -5\text{ V}$ ;  $L_C = 200\text{ }\mu\text{H}$ ;  $L_B = 1\text{ }\mu\text{H}$ .

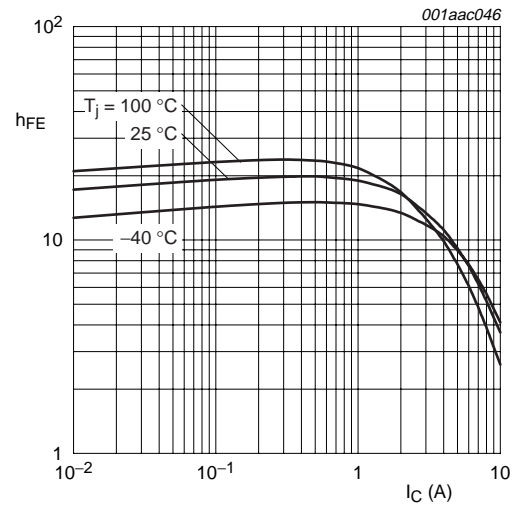
**Fig 7. Test circuit for inductive load switching**



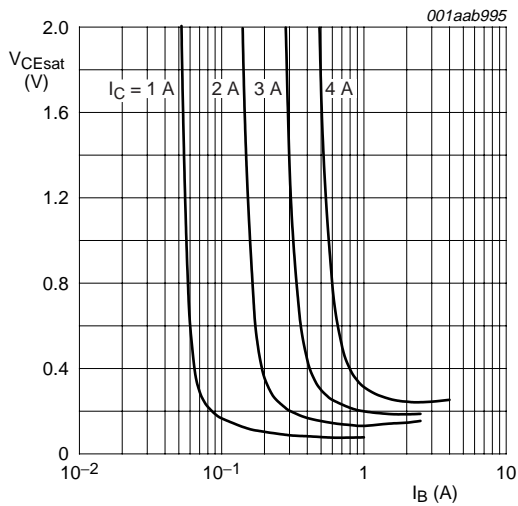
**Fig 8. Switching times waveforms for inductive load**



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

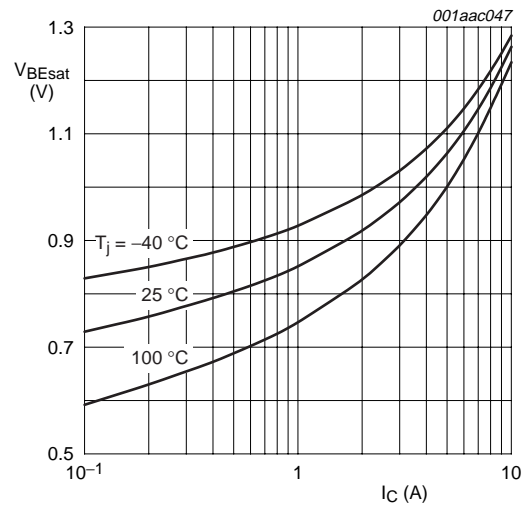


**Fig 10. DC current gain as a function of collector current; typical values at  $V_{CE} = 5\text{ V}$**



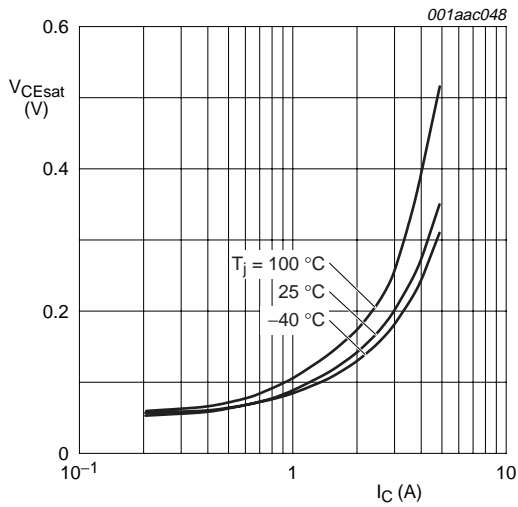
$T_j = 25\text{ °C}$ .

**Fig 11. Collector-emitter saturation voltage as a function of base current; typical values**



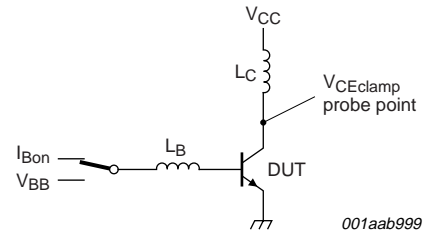
$I_C/I_B = 4$ .

**Fig 12. Base-emitter saturation voltage as a function of collector current; typical values**



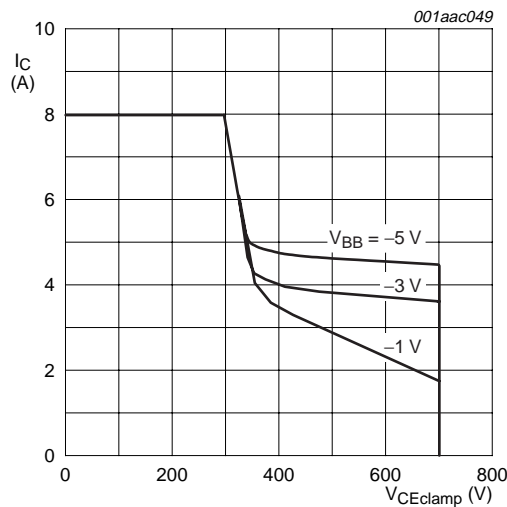
$I_C/I_B = 4$ .

**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

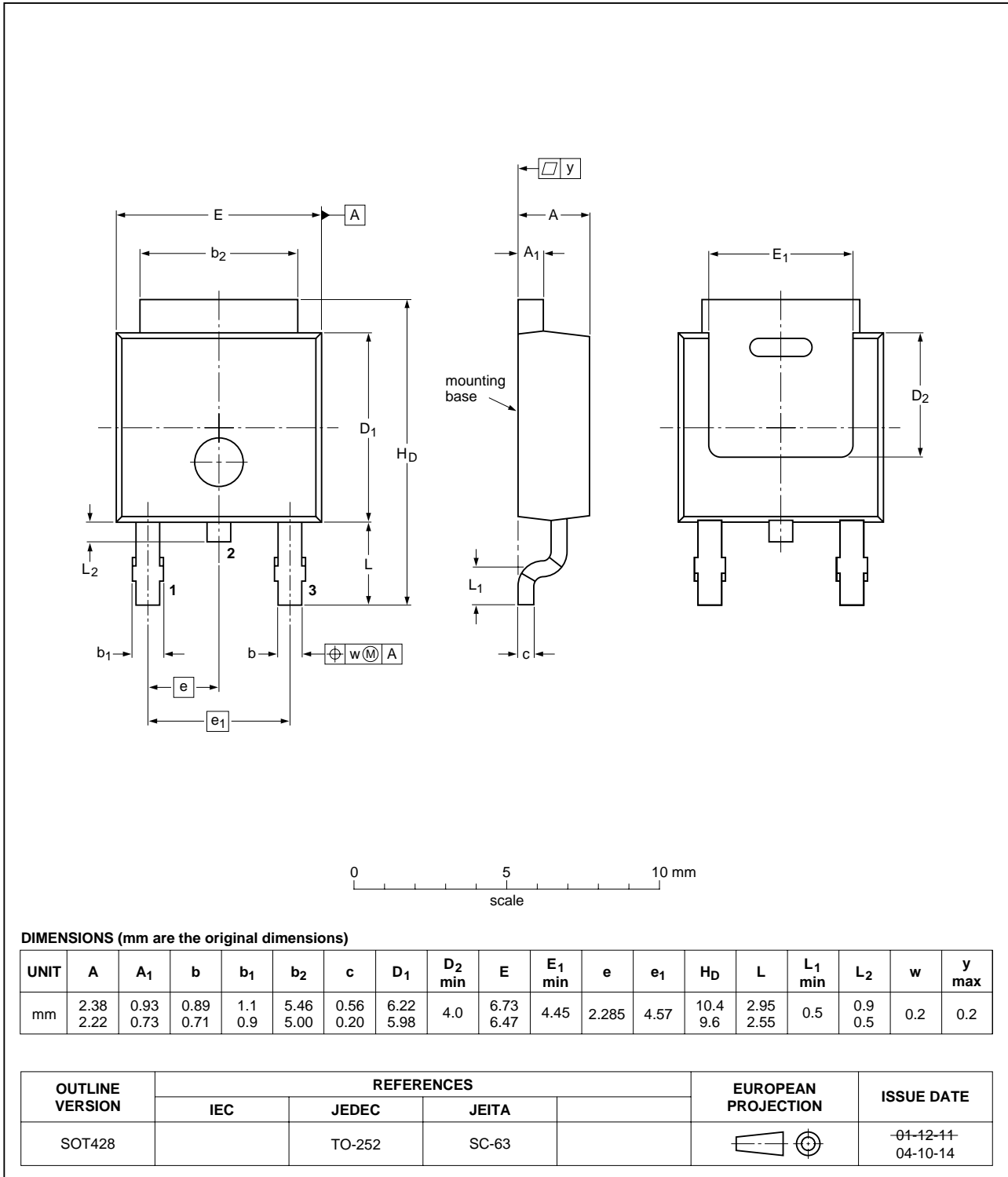
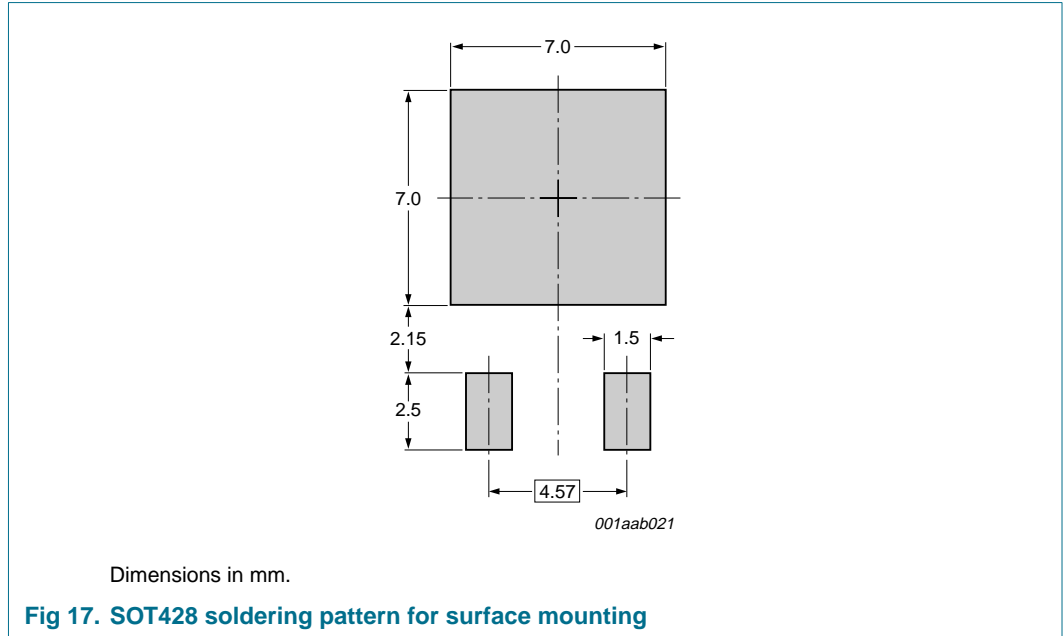


Fig 16. Package outline SOT428 (SC-63)



## 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	-

## 11. Data sheet status

Level	Data sheet status <sup>[1]</sup>	Product status <sup>[2]</sup> <sup>[3]</sup>	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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