

# BUJD105AD

NPN power transistor with integrated diode

Rev. 02 — 29 July 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
- 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

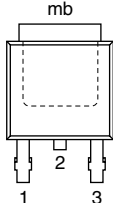
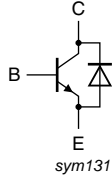
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_C$	collector current	see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a> ; DC	-	-	8	A
$P_{tot}$	total power dissipation	$T_{mb} \leq 25\text{ °C}$ ; see <a href="#">Figure 3</a>	-	-	80	W
$V_{CESM}$	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	-	700	V
<b>Static characteristics</b>						
$h_{FE}$	DC current gain	$V_{CE} = 5\text{ V}$ ; $I_C = 4\text{ A}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 9</a> ; see <a href="#">Figure 10</a>	8	12.5	-	



## 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		

**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

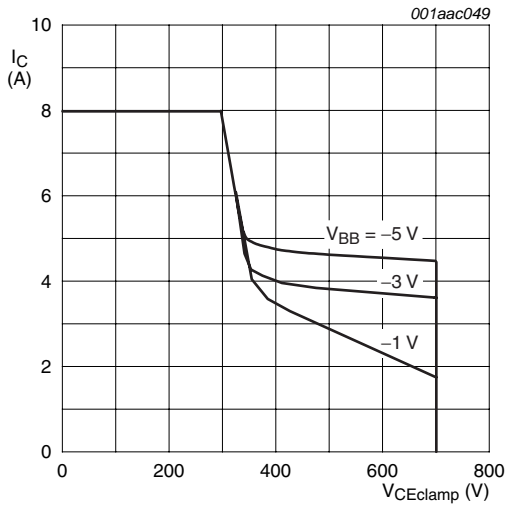
Type number	Package		Version
	Name	Description	
BUJD105AD	DPAK	plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)	SOT428

## 4. Limiting values

Table 4. Limiting values

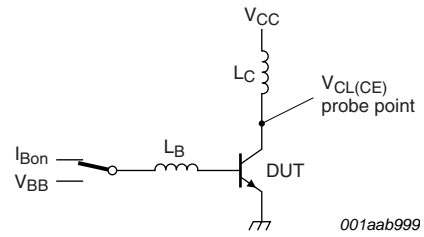
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CESM}$	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	700	V
$V_{CBO}$	collector-base voltage	$I_E = 0\text{ A}$	-	700	V
$V_{CEO}$	collector-emitter voltage	$I_B = 0\text{ A}$	-	400	V
$I_C$	collector current	DC; see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a>	-	8	A
$I_{CM}$	peak collector current	see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a>	-	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 3</a>	-	80	W
$T_{stg}$	storage temperature		-65	150	°C
$T_j$	junction temperature		-	150	°C



$$T_j \leq T_{j(max)} \text{ } ^\circ\text{C}$$

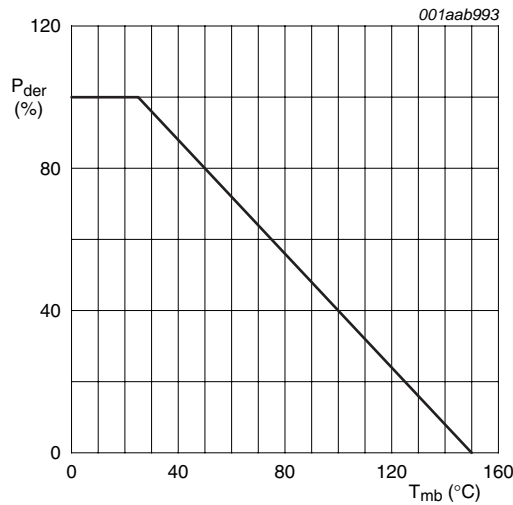
**Fig 1. Reverse bias safe operating area**



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

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

**Fig 2. Test circuit for reverse bias safe operating area**



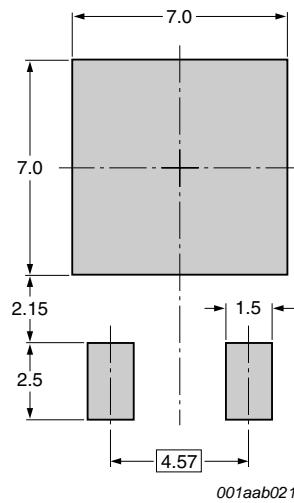
$$P_{der} = \frac{P_{tot}}{P_{tot(25^\circ\text{C})}} \times 100 \%$$

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

## 5. Thermal characteristics

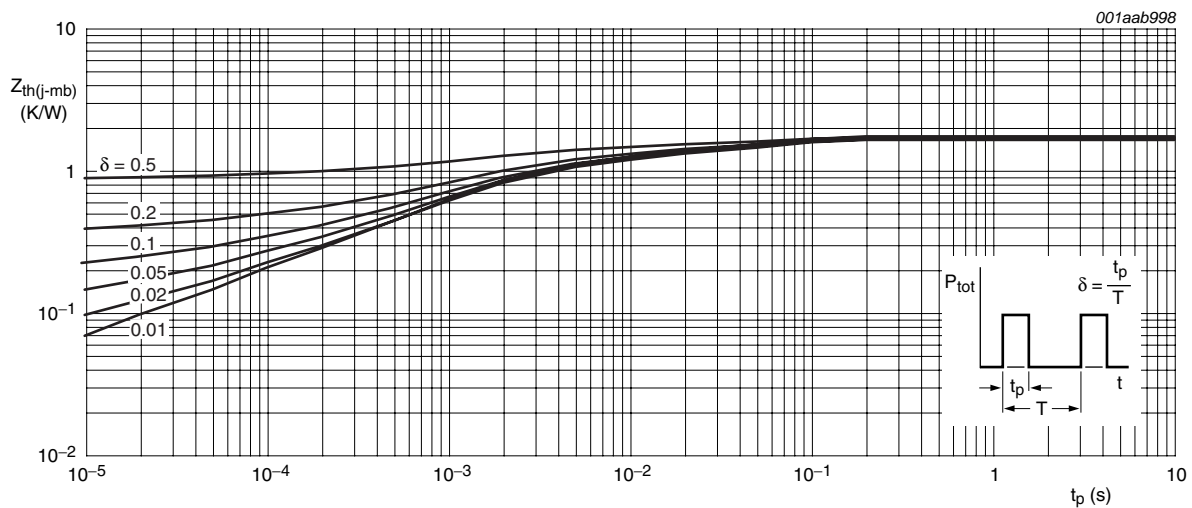
**Table 5. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see <a href="#">Figure 5</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 4</a>	-	75	-	K/W



all dimensions are in mm

**Fig 4. Minimum footprint SOT428**



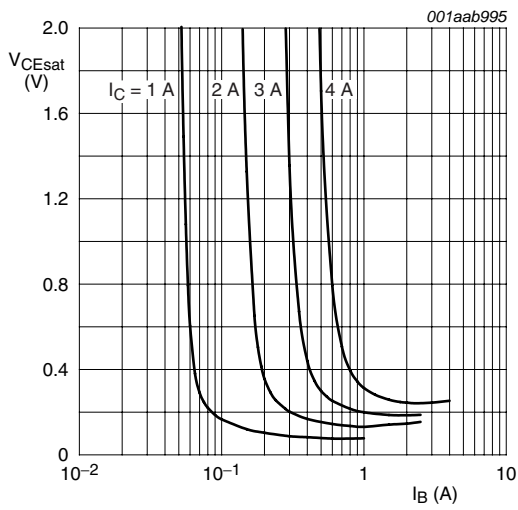
**Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse width**

## 6. Characteristics

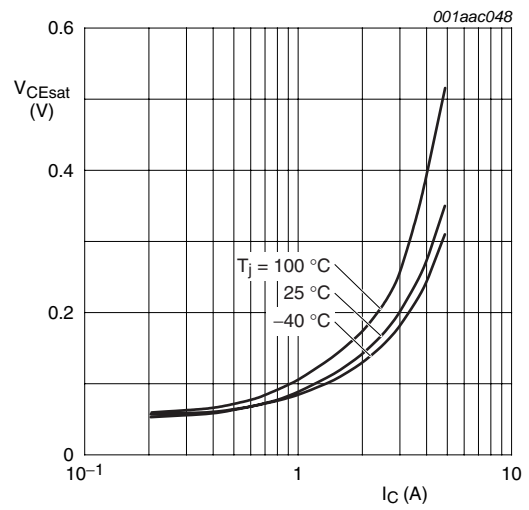
Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>Static characteristics</b>							
$I_{CES}$	collector-emitter cut-off current	$V_{BE} = 0\text{ V}; V_{CE} = 700\text{ V}; T_j = 25\text{ }^\circ\text{C}$	[1]	-	-	0.2	mA
		$V_{BE} = 0\text{ V}; V_{CE} = 700\text{ V}; T_j = 125\text{ }^\circ\text{C}$	[1]	-	-	0.5	mA
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 700\text{ V}; I_E = 0\text{ A}$	[1]	-	-	0.2	mA
$I_{CEO}$	collector-emitter cut-off current	$V_{CE} = 400\text{ V}; I_B = 0\text{ A}$	[1]	-	-	0.1	mA
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 9\text{ V}; I_C = 0\text{ A}$	-	-	10	mA	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 4\text{ A}; I_B = 0.8\text{ A}$ ; see <a href="#">Figure 6</a> ; see <a href="#">Figure 7</a>	-	0.35	1	V	
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 4\text{ A}; I_B = 0.8\text{ A}$ ; see <a href="#">Figure 8</a>	-	1	1.5	V	
$V_F$	forward voltage	$I_F = 4\text{ A}; T_j = 25\text{ }^\circ\text{C}$	-	1.07	1.5	V	
$h_{FE}$	DC current gain	$I_C = 4\text{ A}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 9</a> ; see <a href="#">Figure 10</a>	8	12.5	-		
		$I_C = 1\text{ mA}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ }^\circ\text{C}$	10	17	34		
		$I_C = 500\text{ mA}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ }^\circ\text{C}$	13	22	36		
<b>Dynamic characteristics</b>							
$t_{on}$	turn-on time	$I_C = 5\text{ A}; I_{Bon} = 1\text{ A}; I_{Boff} = -1\text{ A}$ ; $R_L = 75\text{ }\Omega; T_j = 25\text{ }^\circ\text{C}$ ; resistive load; see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a>	-	0.65	1	$\mu\text{s}$	
$t_s$	storage time	$I_C = 5\text{ A}; I_{Bon} = 1\text{ A}; V_{BB} = -5\text{ V}$ ; $L_B = 1\text{ }\mu\text{H}; T_j = 25\text{ }^\circ\text{C}$ ; inductive load; see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	1.8	2.5	$\mu\text{s}$	
		$I_C = 5\text{ A}; I_{Bon} = 1\text{ A}; V_{BB} = -5\text{ V}$ ; $L_B = 1\text{ }\mu\text{H}; T_j = 25\text{ }^\circ\text{C}$ ; inductive load; see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	1.2	1.7	$\mu\text{s}$	
		$I_C = 5\text{ A}; I_{Bon} = 1\text{ A}; V_{BB} = -5\text{ V}$ ; $L_B = 1\text{ }\mu\text{H}; T_j = 100\text{ }^\circ\text{C}$ ; inductive load; see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	1.4	1.9	$\mu\text{s}$	
$t_f$	fall time	$I_C = 5\text{ A}; I_{Bon} = 1\text{ A}; V_{BB} = -5\text{ V}$ ; $L_B = 1\text{ }\mu\text{H}; T_{mb} = 25\text{ }^\circ\text{C}$ ; inductive load; see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	0.02	0.05	$\mu\text{s}$	
		$I_C = 5\text{ A}; I_{Bon} = 1\text{ A}; V_{BB} = -5\text{ V}$ ; $L_B = 1\text{ }\mu\text{H}; T_{mb} = 100\text{ }^\circ\text{C}$ ; inductive load; see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	0.025	0.1	$\mu\text{s}$	
		$I_C = 5\text{ A}; I_{Bon} = 1\text{ A}; I_{Boff} = -1\text{ A}$ ; $R_L = 75\text{ }\Omega; T_j = 25\text{ }^\circ\text{C}$ ; resistive load; see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a>	-	0.3	0.5	$\mu\text{s}$	

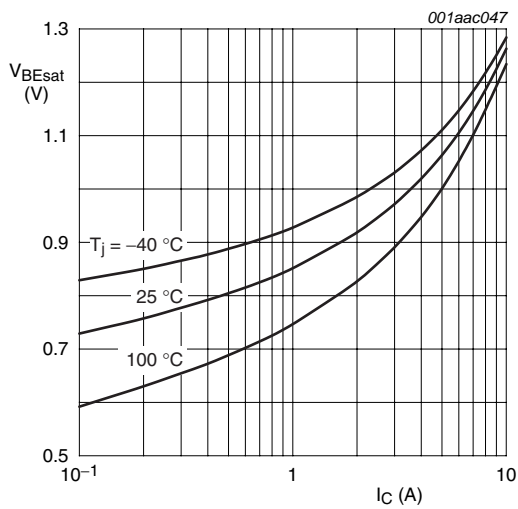
[1] Measured with half-sine wave voltage (curve tracer).



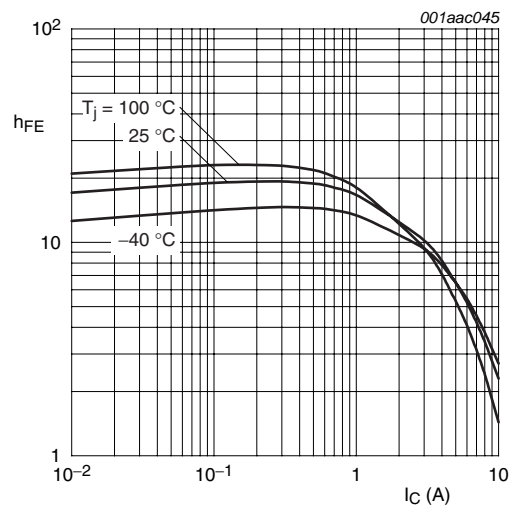
**Fig 6. Collector-emitter saturation voltage as a function of base current; typical values**



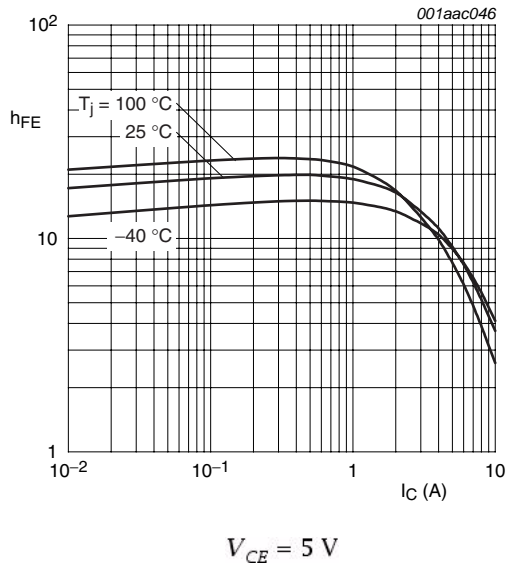
**Fig 7. Collector-emitter saturation voltage as a function of collector current; typical values**



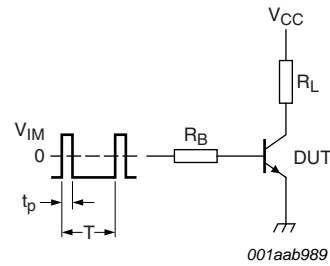
**Fig 8. Base-emitter saturation voltage as a function of collector current; typical values**



**Fig 9. DC current gain as a function of collector current; typical values**

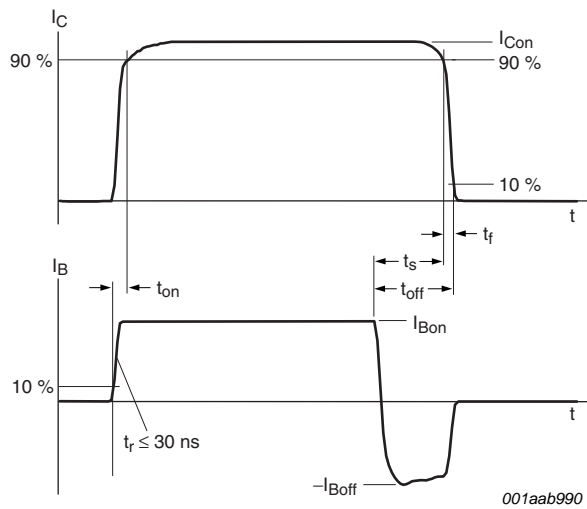


**Fig 10. DC current gain as a function of collector current; typical values**

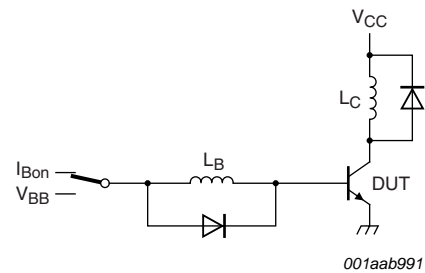


$V_{IM} = -6\text{ to }+8\text{ V}; V_{CC} = 250\text{ V}; t_p = 20\text{ }\mu\text{s}; \delta = \frac{t_p}{T} = 0.01$   
 $R_B$  and  $R_L$  calculated from  $I_{Con}$  and  $I_{Bon}$  requirements.

**Fig 11. Test circuit for resistive load switching**



**Fig 12. 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 13. Test circuit for inductive load switching**

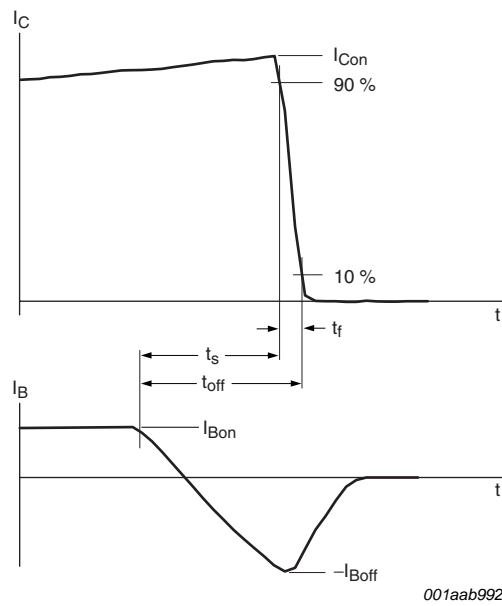


Fig 14. Switching times waveforms for inductive load



**7. Package outline**

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

SOT428

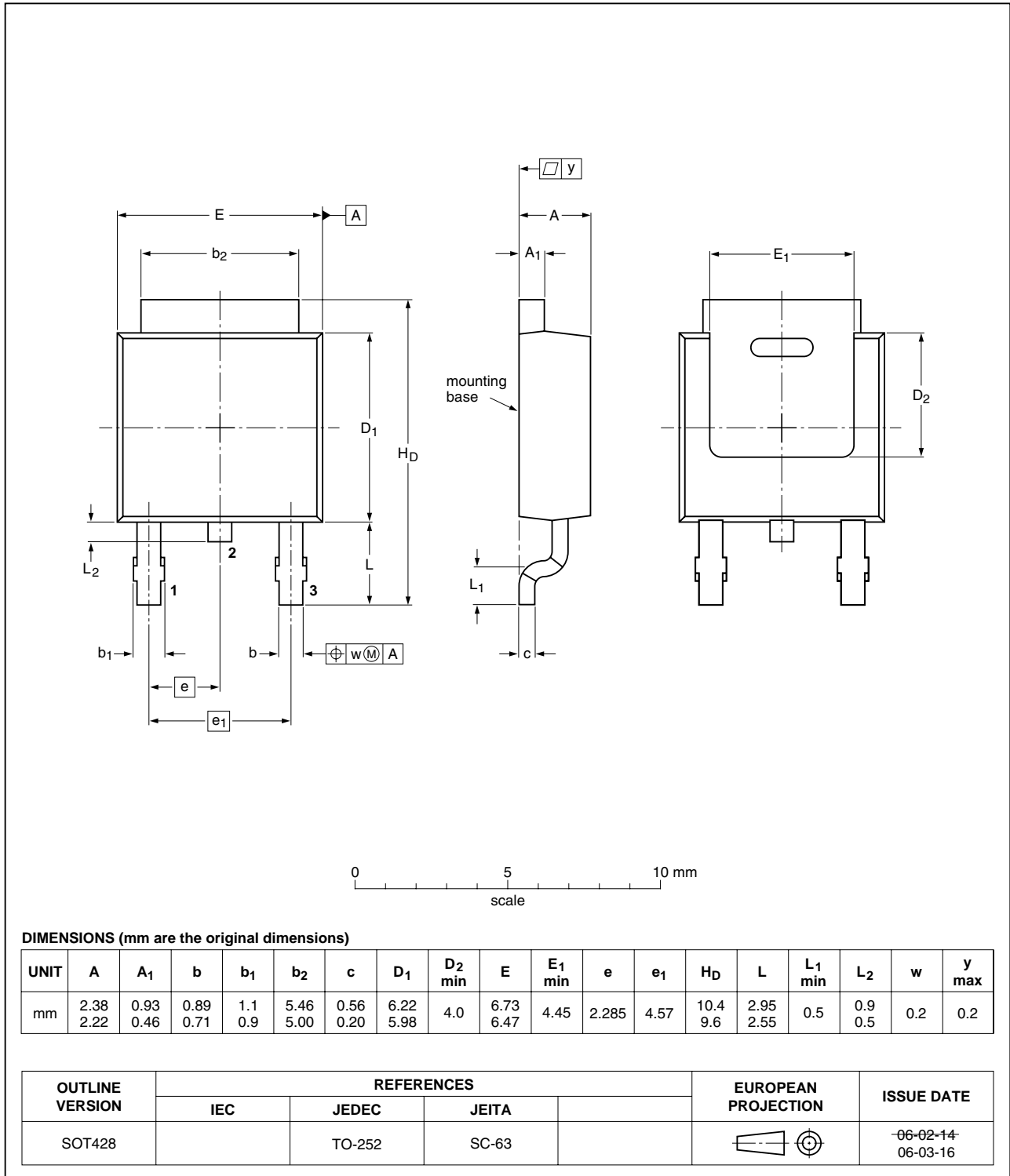


Fig 15. Package outline SOT428 (DPAK)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUJD105AD v.2	20100729	Product data sheet	-	BUJD105AD v.1
Modifications:	• Various changes to content.			
BUJD105AD v.1	20090508	Product data sheet	-	-

## 9. Legal information

### 9.1 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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