

# BYQ28 series E and ED

Rectifier diodes ultrafast, rugged

Rev. 04 — 5 December 2007

Product data sheet

## 1. Product profile

### 1.1 General description

Ultrafast, dual common cathode, epitaxial rectifier diodes in a SOT78 (TO-220AB) and a SOT428 (DPAK) plastic package.

### 1.2 Features

- Fast switching
- Soft recovery characteristic
- Reverse surge capability
- Low thermal resistance
- Low forward voltage drop
- High thermal cycling performance

### 1.3 Applications

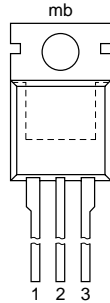
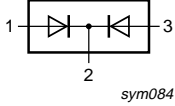
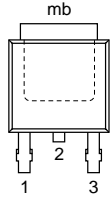
- Output rectifiers in high-frequency switched-mode power supplies

### 1.4 Quick reference data

- $V_{RRM} \leq 200$  V
- $V_F \leq 0.895$  V
- $I_{O(AV)} \leq 10$  A
- $t_{rr} = 10$  ns (typ)

## 2. Pinning information

Table 1. Pinning

Pin	Description	Simplified outline	Symbol
1	anode 1		
2	cathode <sup>[1]</sup>		
3	anode 2		
mb	mounting base; cathode	 SOT428 (DPAK)	<i>sym084</i>
		SOT78 (3-lead TO-220AB)	

[1] It is not possible to connect to pin 2 of the SOT428 package.

### 3. Ordering information

Table 2. Ordering information

Type number	Package		Version
	Name	Description	
BYQ28E-200	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78
BYQ28ED-200	DPAK	plastic single-ended surface-mounted package (DPAK); 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
$V_{RRM}$	repetitive peak reverse voltage		-	200	V
$V_{RWM}$	crest working reverse voltage		-	200	V
$V_R$	reverse voltage	square waveform; $\delta = 1.0$	-	200	V
$I_{O(AV)}$	average output current	square waveform; $\delta = 0.5$ ; $T_{mb} \leq 119\text{ }^\circ\text{C}$ ; both diodes conducting	-	10	A
$I_{FRM}$	repetitive peak forward current	$t_p = 25\text{ }\mu\text{s}$ ; square waveform; $\delta = 0.5$ ; $T_{mb} \leq 119\text{ }^\circ\text{C}$ ; per diode	-	10	A
$I_{FSM}$	non-repetitive peak forward current	$t = 10\text{ ms}$ ; sinusoidal waveform; per diode	-	50	A
		$t = 8.3\text{ ms}$ ; sinusoidal waveform; per diode	-	55	A
$I_{RM}$	peak reverse recovery current	$t_p = 2\text{ }\mu\text{s}$ ; $\delta = 0.001$	-	0.2	A
$I_{RSM}$	non-repetitive peak reverse current	$t_p = 100\text{ }\mu\text{s}$	-	0.2	A
$T_{stg}$	storage temperature		-40	+150	$^\circ\text{C}$
$T_j$	junction temperature		-	150	$^\circ\text{C}$
<b>Electrostatic discharge</b>					
$V_{ESD}$	electrostatic discharge voltage	all pins; human body model; $C = 250\text{ pF}$ ; $R = 1.5\text{ k}\Omega$	-	8	kV

### 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	with heatsink compound; per diode; see <a href="#">Figure 1</a>	-	-	4.5	K/W
		with heatsink compound; both diodes conducting	-	-	3	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air; SOT78	-	60	-	K/W
		SOT428	[1]	50	-	K/W

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

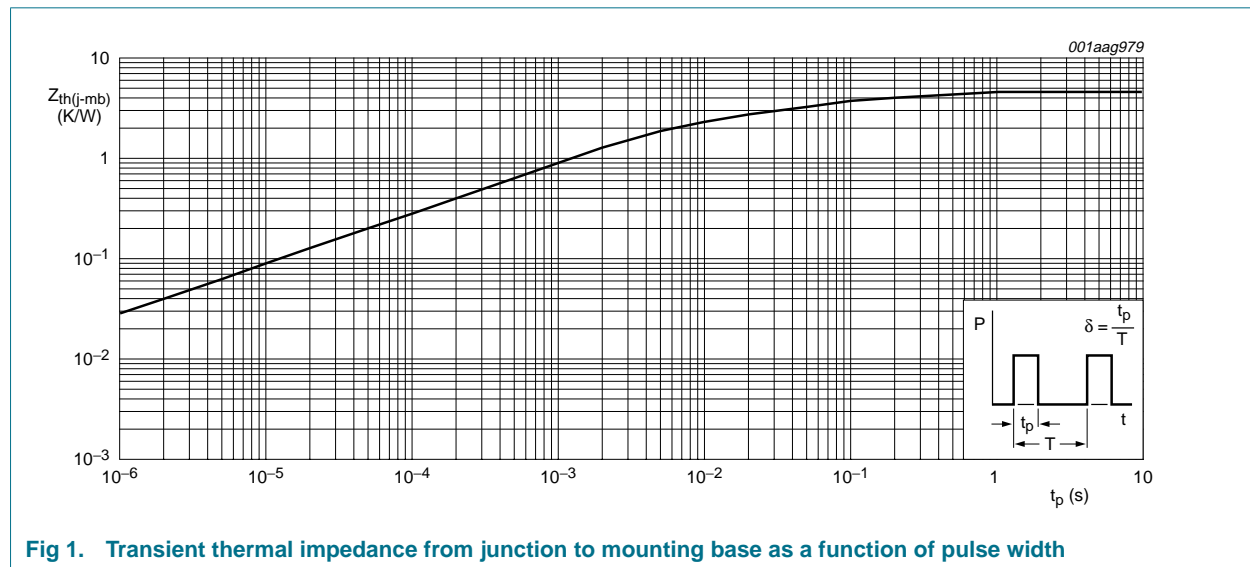


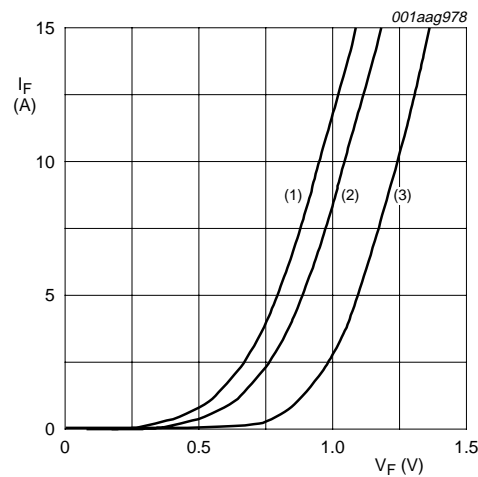
Fig 1. Transient thermal impedance from junction to mounting base as a function of pulse width

## 6. Characteristics

**Table 5. Characteristics**

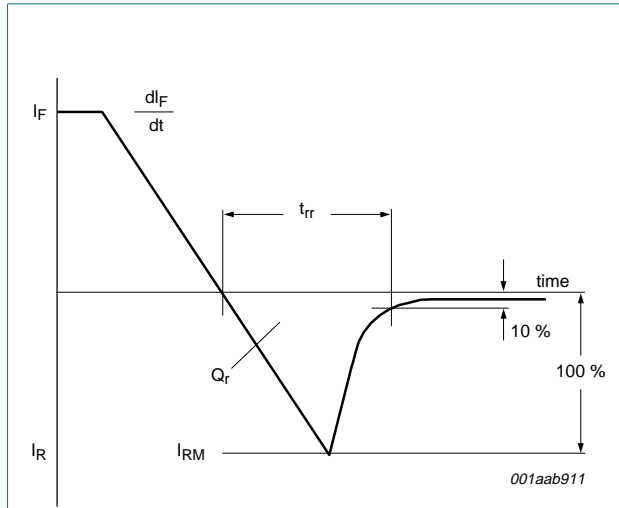
$T_j = 25\text{ °C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_F$	forward voltage	$I_F = 5\text{ A}$ ; $T_j = 150\text{ °C}$ ; see <a href="#">Figure 2</a>	-	0.8	0.895	V
		$I_F = 5\text{ A}$ ; see <a href="#">Figure 2</a>	-	0.95	1.1	V
		$I_F = 10\text{ A}$ ; see <a href="#">Figure 2</a>	-	1.1	1.25	V
$I_R$	reverse current	$V_R = 200\text{ V}$	-	2	10	$\mu\text{A}$
		$V_R = 200\text{ V}$ ; $T_j = 100\text{ °C}$	-	0.1	0.2	mA
<b>Dynamic characteristics</b>						
$Q_r$	recovered charge	$I_F = 2\text{ A}$ to $V_R \geq 30\text{ V}$ ; $di_F/dt = 20\text{ A}/\mu\text{s}$ ; see <a href="#">Figure 3</a>	-	4	9	nC
$t_{rr}$	reverse recovery time	ramp recovery; $I_F = 1\text{ A}$ to $V_R \geq 30\text{ V}$ ; $di_F/dt = 100\text{ A}/\mu\text{s}$ ; see <a href="#">Figure 3</a>	-	15	25	ns
		step recovery; when switched from $I_F = 0.5\text{ A}$ to $I_R = 1\text{ A}$ ; measured at $I_R = 0.25\text{ A}$	-	10	20	ns
$I_{RM}$	peak reverse recovery current	$I_F = 5\text{ A}$ to $V_R \geq 30\text{ V}$ ; $di_F/dt = 50\text{ A}/\mu\text{s}$ ; see <a href="#">Figure 3</a>	-	0.5	0.7	A
$V_{FR}$	forward recovery voltage	$I_F = 1\text{ A}$ ; $di_F/dt = 10\text{ A}/\mu\text{s}$ ; see <a href="#">Figure 4</a>	-	1	-	V

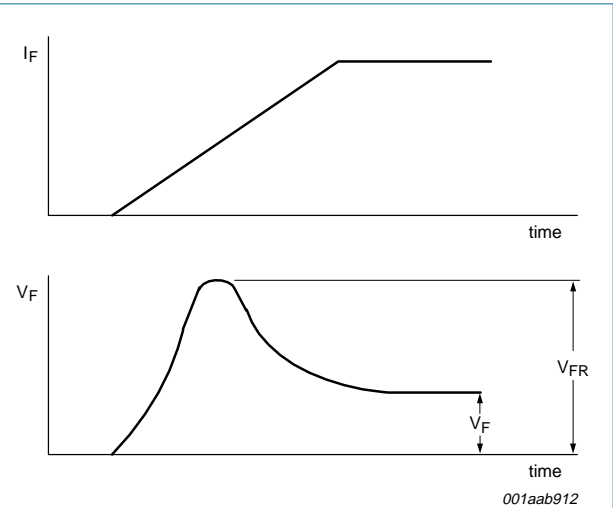


- (1)  $T_j = 150\text{ °C}$ ; typical values
- (2)  $T_j = 150\text{ °C}$ ; maximum values
- (3)  $T_j = 25\text{ °C}$ ; maximum values

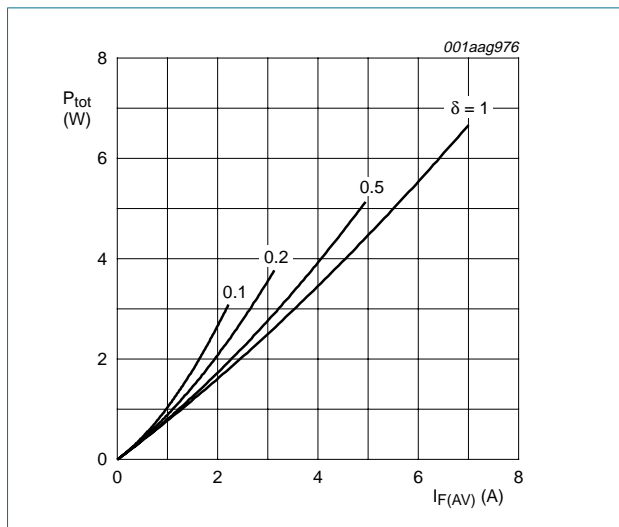
**Fig 2. Forward current as a function of forward voltage**



**Fig 3. Reverse recovery definitions**

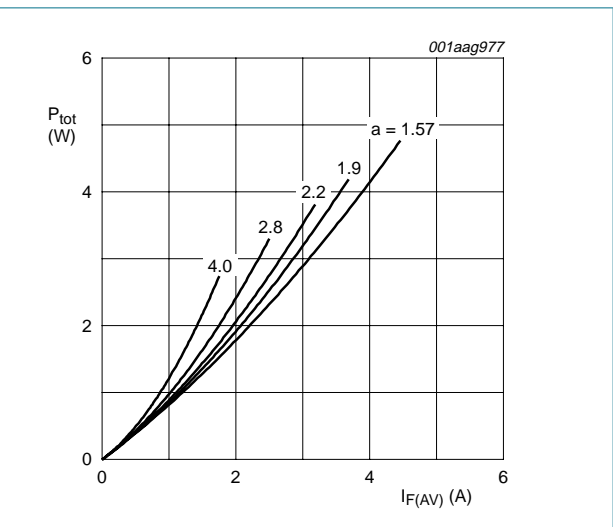


**Fig 4. Forward recovery definitions**



$$I_{F(AV)} = I_{F(RMS)} \times \sqrt{\delta}$$

**Fig 5. Forward power dissipation as a function of average forward current; square waveform; maximum values**



$$a = \text{form factor} = I_{F(RMS)} / I_{F(AV)}$$

**Fig 6. Forward power dissipation as a function of average forward current; sinusoidal waveform; maximum values**

**7. Package outline**

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB

SOT78

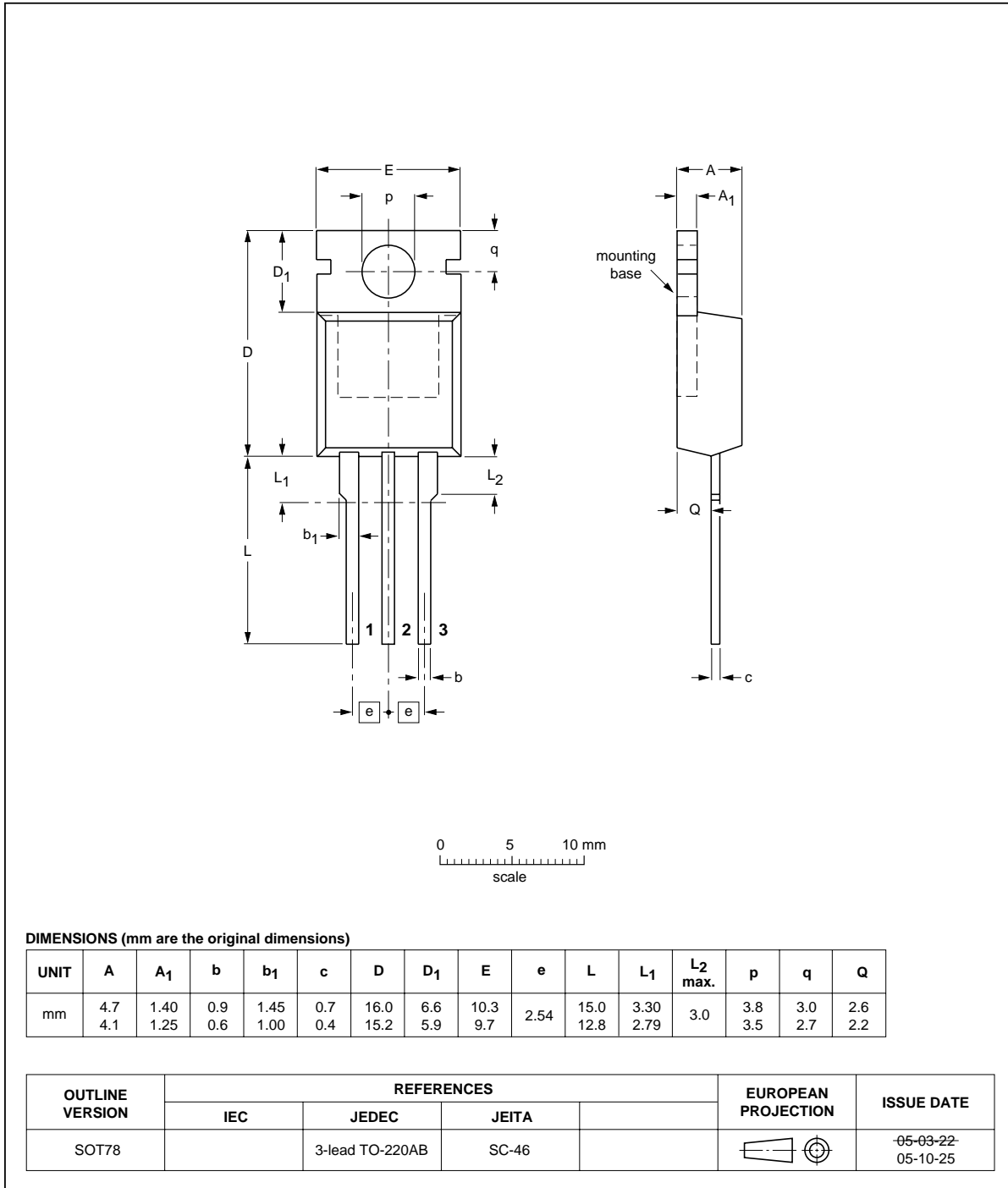


Fig 7. Package outline SOT78 (TO-220AB)

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

SOT428

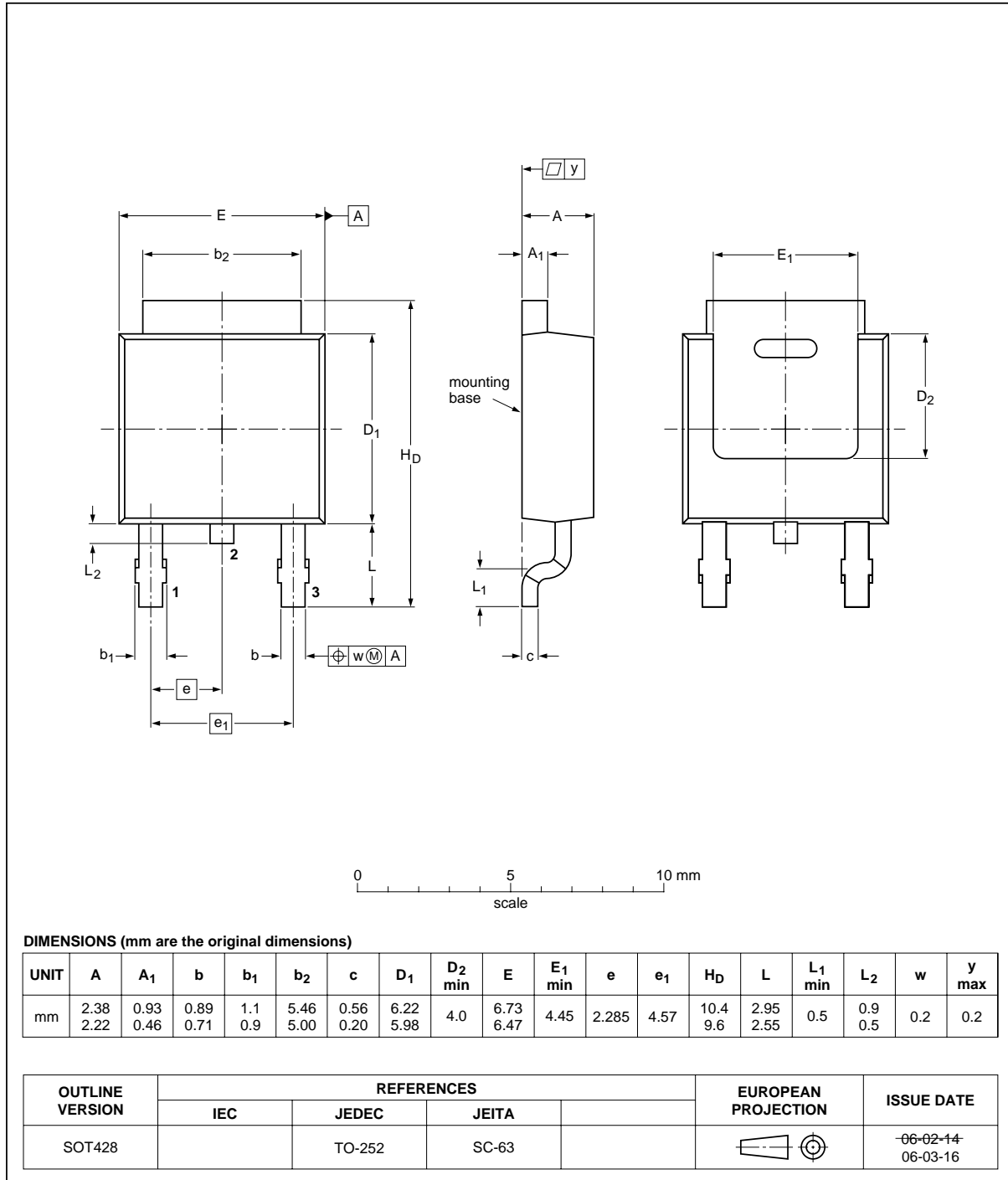


Fig 8. Package outline SOT428 (TO-252)

## 8. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BYQ28_SER_E_ED_4	20071205	Product data sheet	-	BYQ28E_SERIES_3
Modifications:		<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Limiting values table: some parameter descriptions amended to conform to latest standards; <math>I_{FRM}</math> conditions amended; <math>V_{ESD}</math> row added.</li> <li>Characteristics: <math>Q_{rr}</math> changed to <math>Q_r</math> 'recovered charge'; <math>t_{rr1}</math> and <math>t_{rr2}</math> changed to <math>t_{rr}</math> with 'ramp recovery' and 'step recovery' added to conditions.</li> </ul>		
BYQ28E_SERIES_3	19981001	Product specification	-	BYQ28E_SERIES_2
BYQ28E_SERIES_2	19980701	Product specification	-	BYQ28E_SERIES_1; BYQ28EB_SERIES_1
BYQ28E_SERIES_1; BYQ28EB_SERIES_1	19960801	Product specification	-	-



## 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.

[1] Please consult the most recently issued document before initiating or completing a design.

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

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