

# BT151S series L and R

## Thyristors

Rev. 05 — 9 October 2006

Product data sheet

## 1. Product profile

### 1.1 General description

Passivated thyristors in a SOT428 plastic package.

### 1.2 Features

- High thermal cycling performance
- High bidirectional blocking voltage capability
- Surface-mounted package

### 1.3 Applications

- Motor control
- Ignition circuits
- Static switching
- Protection circuits

### 1.4 Quick reference data

- $V_{DRM} \leq 500$  V (BT151S-500L/R)
- $V_{RRM} \leq 500$  V (BT151S-500L/R)
- $V_{DRM} \leq 650$  V (BT151S-650L/R)
- $V_{RRM} \leq 650$  V (BT151S-650L/R)
- $V_{DRM} \leq 800$  V (BT151S-800R)
- $V_{RRM} \leq 800$  V (BT151S-800R)
- $I_{TSM} \leq 120$  A ( $t = 10$  ms)
- $I_{T(RMS)} \leq 12$  A
- $I_{T(AV)} \leq 7.5$  A
- $I_{GT} \leq 5$  mA (BT151S series L)
- $I_{GT} \leq 15$  mA (BT151S series R)

## 2. Pinning information

Table 1. Pinning

Pin	Description	Simplified outline	Symbol
1	cathode (K)	<p style="text-align: center;">SOT428 (DPAK)</p>	
2	anode (A)		
3	gate (G)		
mb	mounting base; connected to anode		

### 3. Ordering information

**Table 2. Ordering information**

Type number	Package		Version
	Name	Description	
BT151S-500L	DPAK	plastic single-ended surface-mounted package; 3 leads (one lead cropped)	SOT428
BT151S-500R			
BT151S-650L			
BT151S-650R			
BT151S-800R			
BT151S-800R			

### 4. Limiting values

**Table 3. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage	BT151S-500L; BT151S-500R	[1] -	500	V
		BT151S-650L; BT151S-650R	[1] -	650	V
		BT151S-800R	-	800	V
$V_{RRM}$	repetitive peak reverse voltage	BT151S-500L; BT151S-500R	[1] -	500	V
		BT151S-650L; BT151S-650R	[1] -	650	V
		BT151S-800R	-	800	V
$I_{T(AV)}$	average on-state current	half sine wave; $T_{mb} \leq 103\text{ °C}$ ; see <a href="#">Figure 1</a>	-	7.5	A
$I_{T(RMS)}$	RMS on-state current	all conduction angles; see <a href="#">Figure 4</a> and <a href="#">5</a>	-	12	A
$I_{TSM}$	non-repetitive peak on-state current	half sine wave; $T_j = 25\text{ °C}$ prior to surge; see <a href="#">Figure 2</a> and <a href="#">3</a>			
		$t = 10\text{ ms}$	-	120	A
		$t = 8.3\text{ ms}$	-	132	A
$I^2t$	$I^2t$ for fusing	$t = 10\text{ ms}$	-	72	A <sup>2</sup> s
$di_T/dt$	rate of rise of on-state current	$I_{TM} = 20\text{ A}$ ; $I_G = 50\text{ mA}$ ; $di_G/dt = 50\text{ mA}/\mu\text{s}$	-	50	A/ $\mu\text{s}$
$I_{GM}$	peak gate current		-	2	A
$V_{RGM}$	peak reverse gate voltage		-	5	V
$P_{GM}$	peak gate power		-	5	W
$P_{G(AV)}$	average gate power	over any 20 ms period	-	0.5	W
$T_{stg}$	storage temperature		-40	+150	°C
$T_j$	junction temperature		-	125	°C

[1] Although not recommended, off-state voltages up to 800 V may be applied without damage, but the thyristor may switch to the on-state. The rate of rise of current should not exceed 15A/ $\mu\text{s}$ .

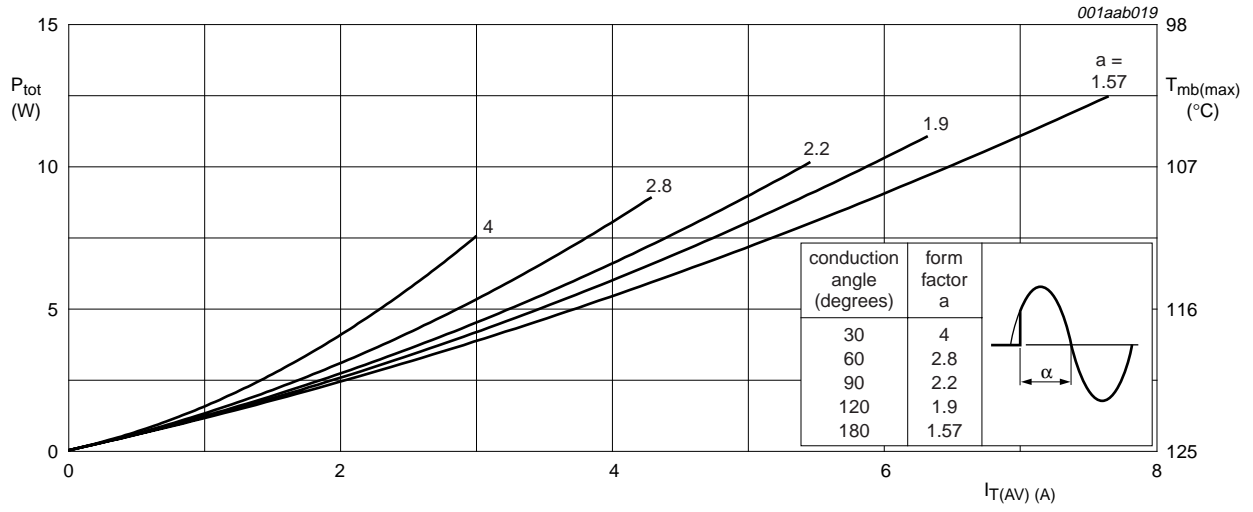


Fig 1. Total power dissipation as a function of average on-state current; maximum values

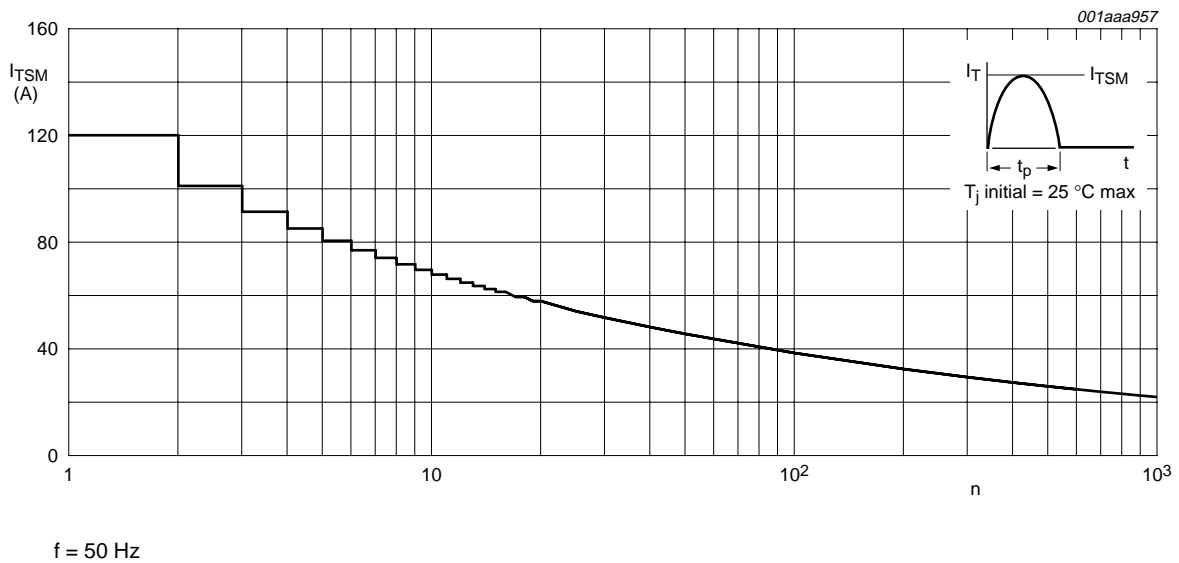
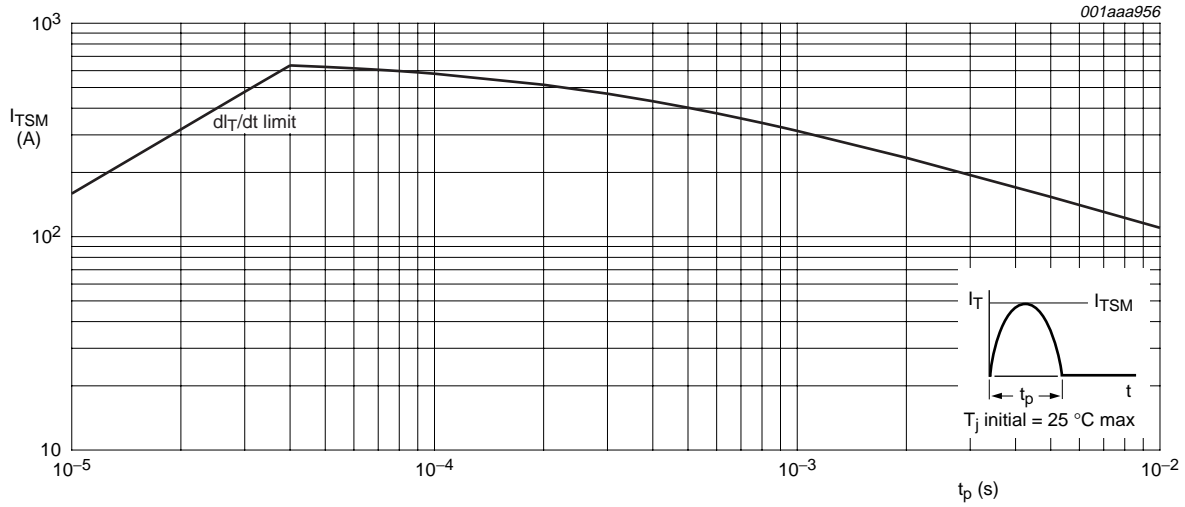
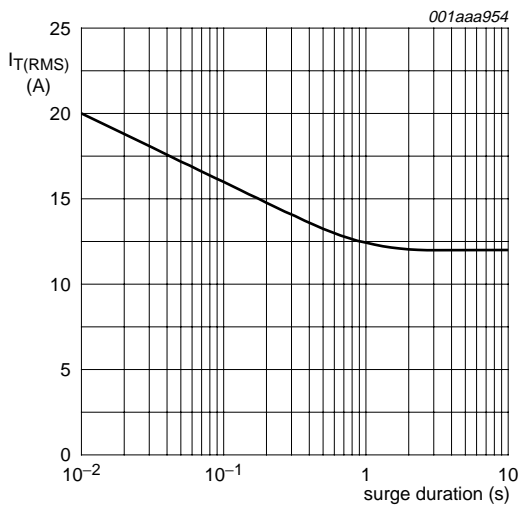


Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



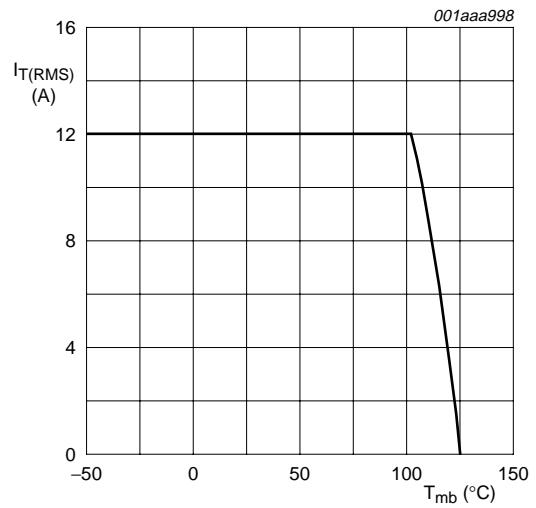
$t_p \leq 10$  ms

**Fig 3. Non-repetitive peak on-state current as a function of pulse width for sinusoidal currents; maximum values**



$f = 50$  Hz;  $T_{mb} \leq 103$  °C

**Fig 4. RMS on-state current as a function of surge duration; maximum values**



**Fig 5. RMS on-state current as a function of mounting base temperature; maximum values**

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 6</a>	-	-	1.8	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	mounted on an FR4 printed-circuit board; see <a href="#">Figure 14</a>	-	75	-	K/W

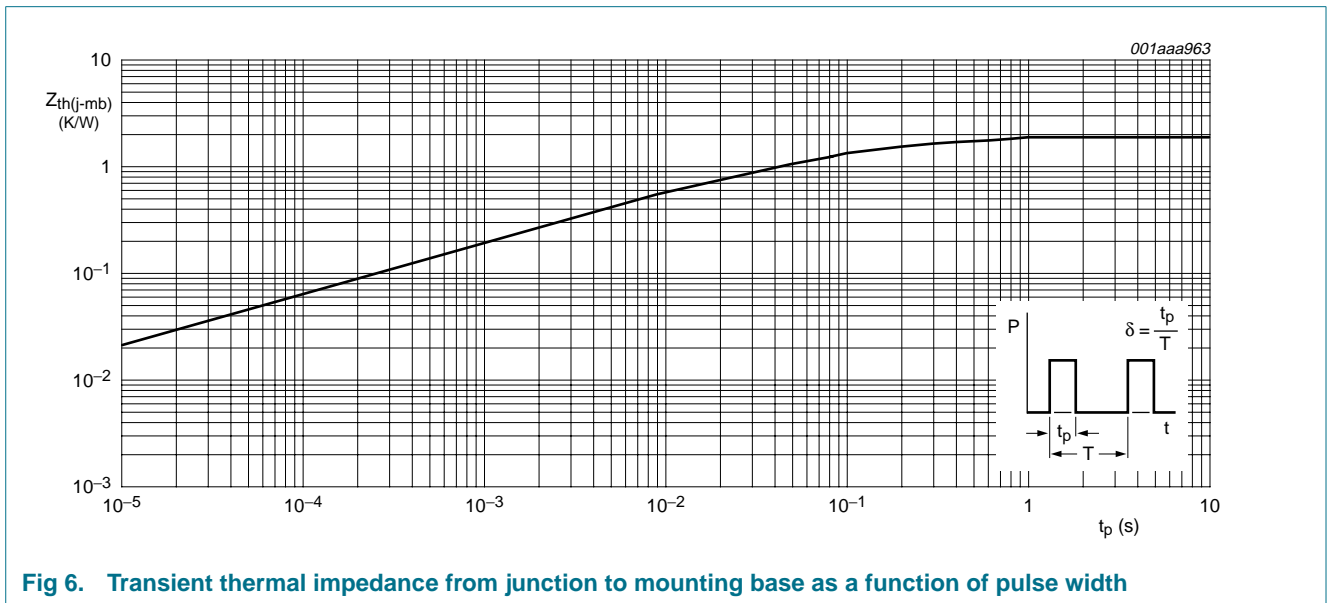


Fig 6. Transient thermal impedance from junction to mounting base as a function of pulse width

## 6. Characteristics

**Table 5. Characteristics**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; see <a href="#">Figure 8</a>				
		BT151S-500L	-	2	5	mA
		BT151S-500R	-	2	15	mA
		BT151S-650L	-	2	5	mA
		BT151S-650R	-	2	15	mA
		BT151S-800R	-	2	15	mA
$I_L$	latching current	$V_D = 12\text{ V}$ ; $I_{GT} = 100\text{ mA}$ ; see <a href="#">Figure 10</a>	-	10	40	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $I_{GT} = 100\text{ mA}$ ; see <a href="#">Figure 11</a>	-	7	20	mA
$V_T$	on-state voltage	$I_T = 23\text{ A}$ ; see <a href="#">Figure 9</a>	-	1.4	1.75	V
$V_{GT}$	gate trigger voltage	$I_T = 100\text{ mA}$ ; $V_D = 12\text{ V}$ ; see <a href="#">Figure 7</a>	-	0.6	1.5	V
		$I_T = 100\text{ mA}$ ; $V_D = V_{DRM(max)}$ ; $T_j = 125\text{ °C}$	0.25	0.4	-	V
$I_D$	off-state current	$V_D = V_{DRM(max)}$ ; $T_j = 125\text{ °C}$	-	0.1	0.5	mA
$I_R$	reverse current	$V_R = V_{RRM(max)}$ ; $T_j = 125\text{ °C}$	-	0.1	0.5	mA
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 0.67 \times V_{DRM(max)}$ ; $T_j = 125\text{ °C}$ ; exponential waveform; see <a href="#">Figure 12</a>				
		$R_{GK} = 100\ \Omega$	200	1000	-	V/ $\mu$ s
		gate open circuit	50	130	-	V/ $\mu$ s
$t_{gt}$	gate-controlled turn-on time	$I_{TM} = 40\text{ A}$ ; $V_D = V_{DRM(max)}$ ; $I_G = 100\text{ mA}$ ; $dl_G/dt = 5\text{ A}/\mu\text{s}$	-	2	-	$\mu$ s
$t_q$	commutated turn-off time	$V_{DM} = 0.67 \times V_{DRM(max)}$ ; $T_j = 125\text{ °C}$ ; $I_{TM} = 20\text{ A}$ ; $V_R = 25\text{ V}$ ; $(dl_T/dt)_M = 30\text{ A}/\mu\text{s}$ ; $dV_D/dt = 50\text{ V}/\mu\text{s}$ ; $R_{GK} = 100\ \Omega$	-	70	-	$\mu$ s

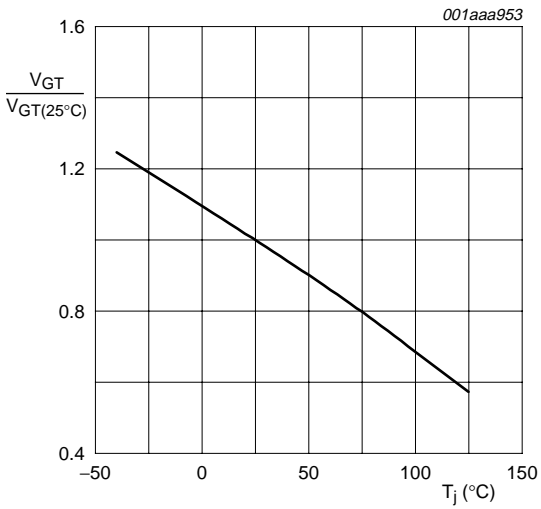


Fig 7. Normalized gate trigger voltage as a function of junction temperature

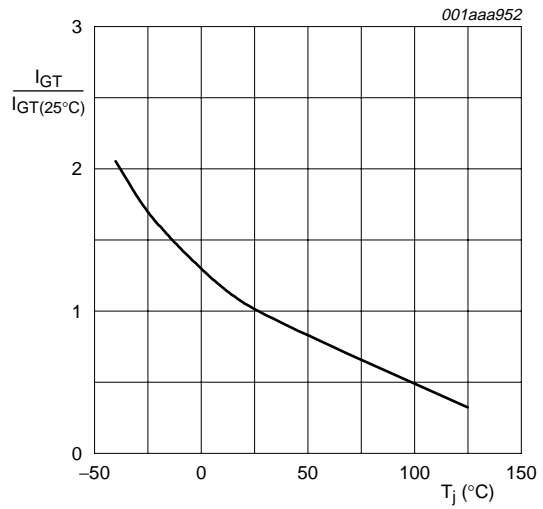
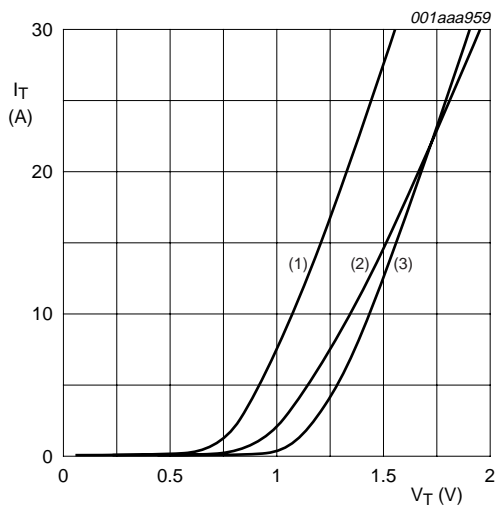


Fig 8. Normalized gate trigger current as a function of junction temperature



$V_o = 1.06 \text{ V}$   
 $R_s = 0.0304 \text{ } \Omega$

- (1)  $T_j = 125 \text{ } ^\circ\text{C}$ ; typical values
- (2)  $T_j = 125 \text{ } ^\circ\text{C}$ ; maximum values
- (3)  $T_j = 25 \text{ } ^\circ\text{C}$ ; maximum values

Fig 9. On-state current as a function of on-state voltage

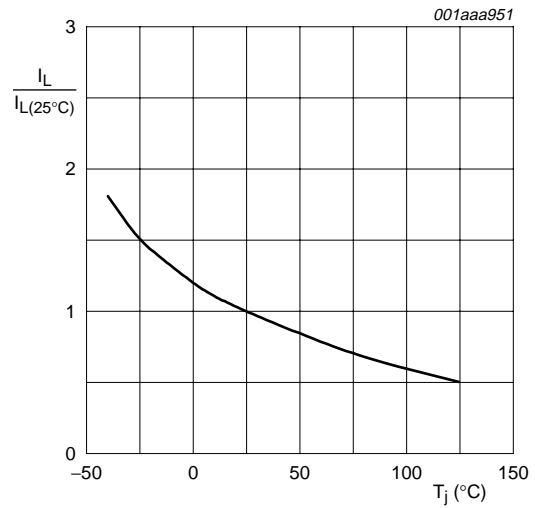


Fig 10. Normalized latching current as a function of junction temperature

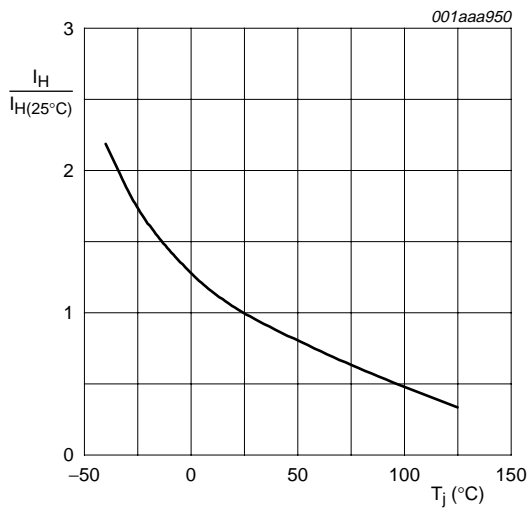
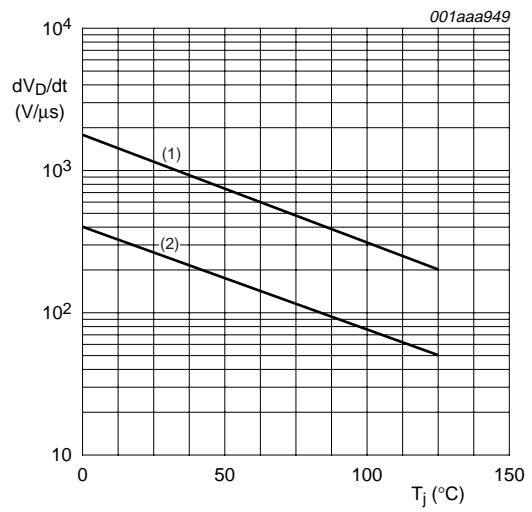


Fig 11. Normalized holding current as a function of junction temperature



- (1)  $R_{GK} = 100 \Omega$
- (2) Gate open circuit

Fig 12. Critical rate of rise of off-state voltage as a function of junction temperature; minimum values



7. Package outline

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

SOT428

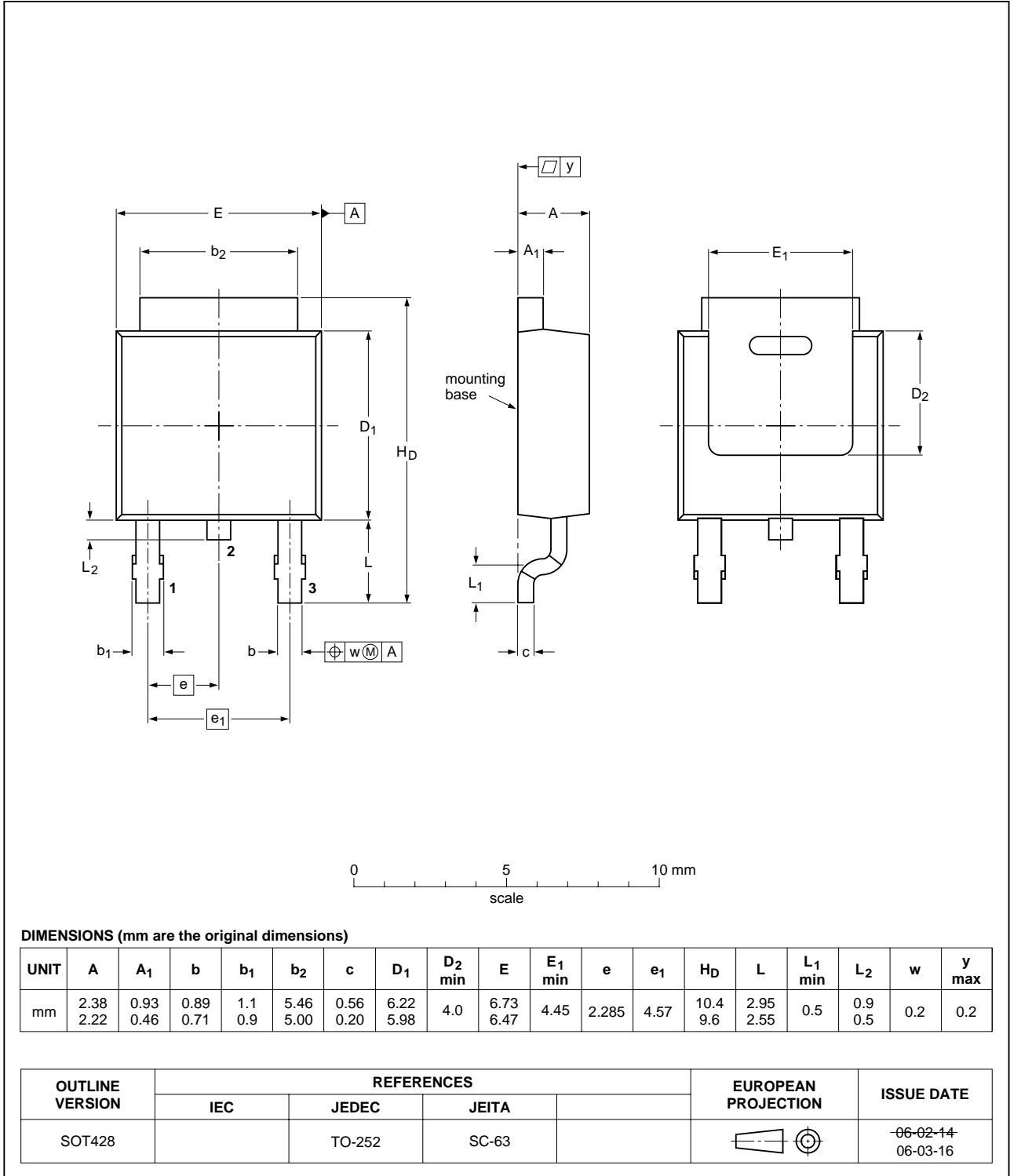
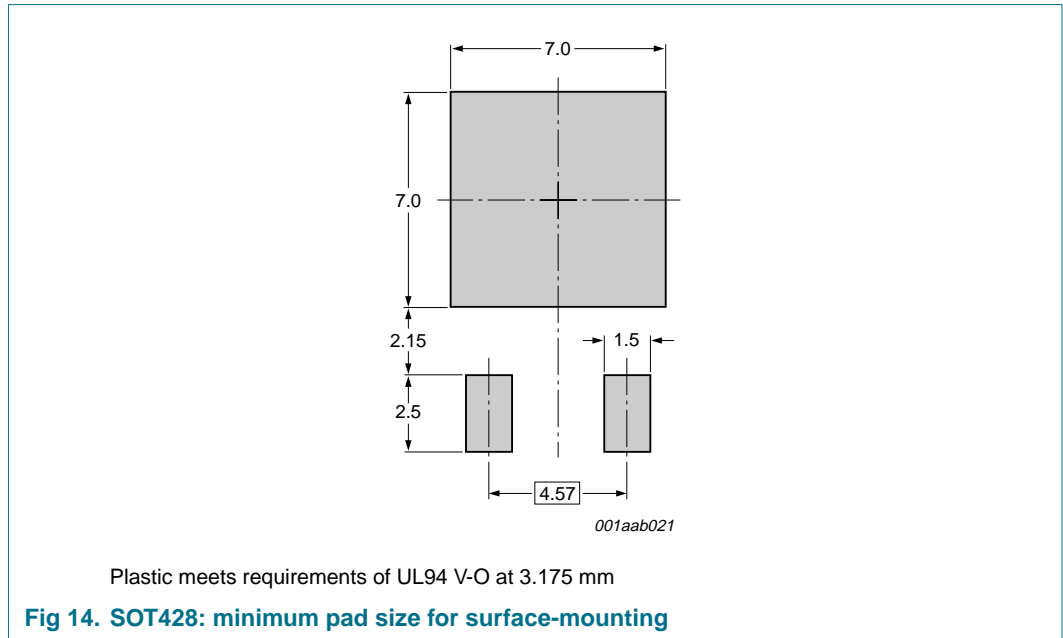


Fig 13. Package outline SOT428 (DPAK)

8. Mounting



## 9. Revision history

**Table 6. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
BT151S_SER_L_R_5	20061009	Product data sheet	-	BT151S_SERIES_4
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>• Added type numbers BT151S-500L and BT151S-650L</li></ul>		
BT151S_SERIES_4 (9397 750 13161)	20040609	Product specification	-	BT151S_SERIES_3
BT151S_SERIES_3	20020101	Product specification	-	BT151S_SERIES_2
BT151S_SERIES_2	19990601	Product specification	-	BT151S_SERIES_1
BT151S_SERIES_1	19970901	Product specification	-	-

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### 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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