

# BTA204S series D, E and F

Three-quadrant triacs guaranteed commutation

Rev. 05 — 16 February 2006

Product data sheet

## 1. Product profile

### 1.1 General description

Passivated guaranteed commutation triacs in a SOT428 (DPAK) plastic package intended for use in motor control circuits or with other highly inductive loads. These devices balance the requirements of commutation performance and gate sensitivity. The “logic level” D series is intended for interfacing with low power drivers, including microcontrollers.

### 1.2 Features

- High gate sensitivity
- Guaranteed commutation capability

### 1.3 Applications

- Motor control
- Industrial and domestic heating

### 1.4 Quick reference data

- $V_{DRM} \leq 600$  V (BTA204S-600D)
- $V_{DRM} \leq 600$  V (BTA204S-600E)
- $V_{DRM} \leq 600$  V (BTA204S-600F)
- $V_{DRM} \leq 800$  V (BTA204S-800E)
- $I_{TSM} \leq 25$  A ( $t = 20$  ms)
- $I_{T(RMS)} \leq 4$  A
- $I_{GT} \leq 5$  mA (BTA204S-600D)
- $I_{GT} \leq 10$  mA (BTA204S-600E\_800E)
- $I_{GT} \leq 25$  mA (BTA204S-600F)

## 2. Pinning information

Table 1: Pinning

Pin	Description	Simplified outline	Symbol
1	main terminal 1 (T1)	<p>SOT428 (DPAK)</p>	<p>sym051</p>
2	main terminal 2 (T2)		
3	gate (G)		
mb	mounting base <a href="#">[1]</a>		

[1] Connected to main terminal 2 (T2)

### 3. Ordering information

Table 2: Ordering information

Type number	Package		Version
	Name	Description	
BTA204S-600D	DPAK	plastic single-ended surface mounted package (DPAK); 3 leads (one lead cropped)	SOT428
BTA204S-600E			
BTA204S-600F			
BTA204S-800E			

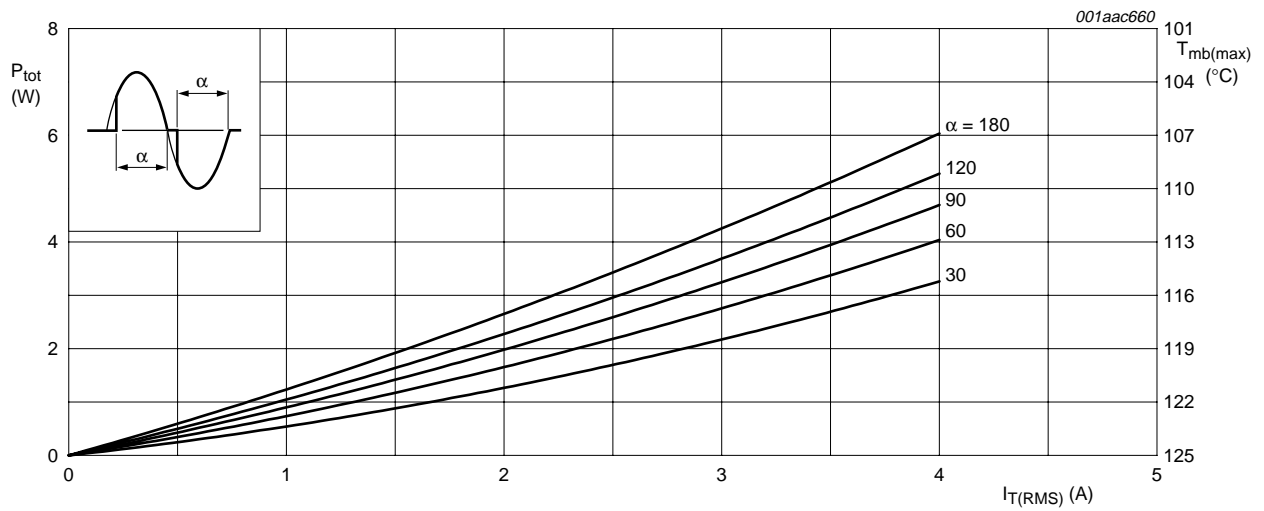
### 4. Limiting values

Table 3: Limiting values

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

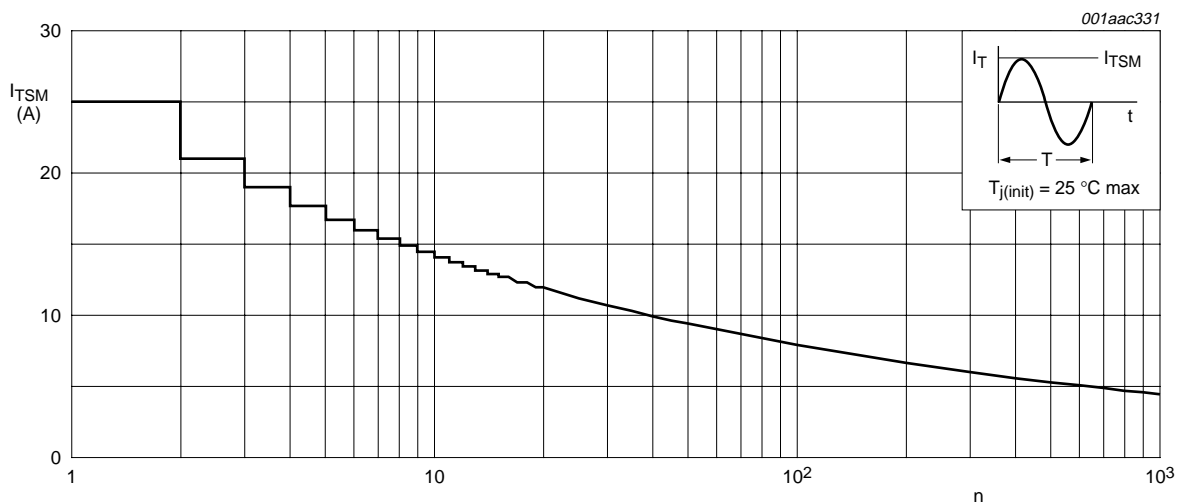
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{\text{DRM}}$	repetitive peak off-state voltage	BTA204S-600D	[1] -	600	V
		BTA204S-600E	[1] -	600	V
		BTA204S-600F	[1] -	600	V
		BTA204S-800E	-	800	V
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_{\text{mb}} \leq 107\text{ °C}$ ; see <a href="#">Figure 4</a> and <a href="#">5</a>	-	4	A
$I_{\text{TSM}}$	non-repetitive peak on-state current	full sine wave; $T_{\text{j}} = 25\text{ °C}$ prior to surge; see <a href="#">Figure 2</a> and <a href="#">3</a>	-	-	-
		$t = 20\text{ ms}$	-	25	A
		$t = 16.7\text{ ms}$	-	27	A
$I^2t$	$I^2t$ for fusing	$t = 10\text{ ms}$	-	3.1	$\text{A}^2\text{s}$
$di_{\text{T}}/dt$	rate of rise of on-state current	$I_{\text{TM}} = 6\text{ A}$ ; $I_{\text{G}} = 0.2\text{ A}$ ; $di_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$	-	100	$\text{A}/\mu\text{s}$
$I_{\text{GM}}$	peak gate current		-	2	A
$V_{\text{GM}}$	peak gate voltage		-	5	V
$P_{\text{GM}}$	peak gate power		-	5	W
$P_{\text{G(AV)}}$	average gate power	over any 20 ms period	-	0.5	W
$T_{\text{stg}}$	storage temperature		-40	+150	$^{\circ}\text{C}$
$T_{\text{j}}$	junction temperature		-	125	$^{\circ}\text{C}$

[1] Although not recommended, off-state voltages up to 800 V may be applied without damage, but the triac may switch to the on-state. The rate of rise of current should not exceed 6 A/ $\mu\text{s}$ .



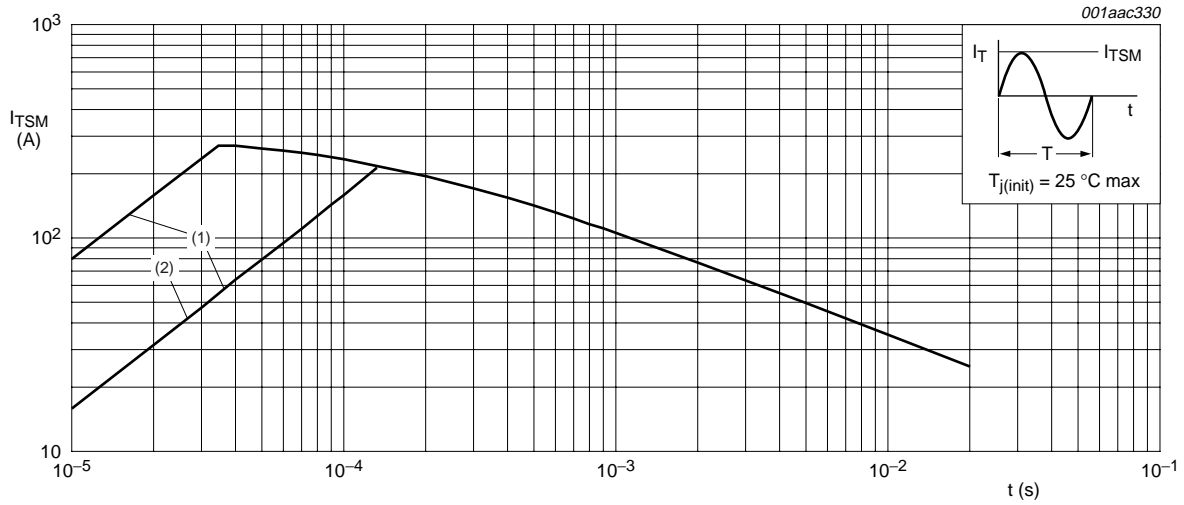
$\alpha$  = conduction angle

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



$f = 50$  Hz

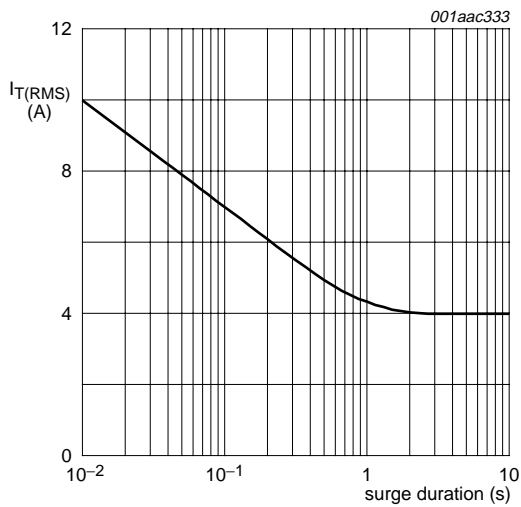
**Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values**



$t_p \leq 20 \text{ ms}$

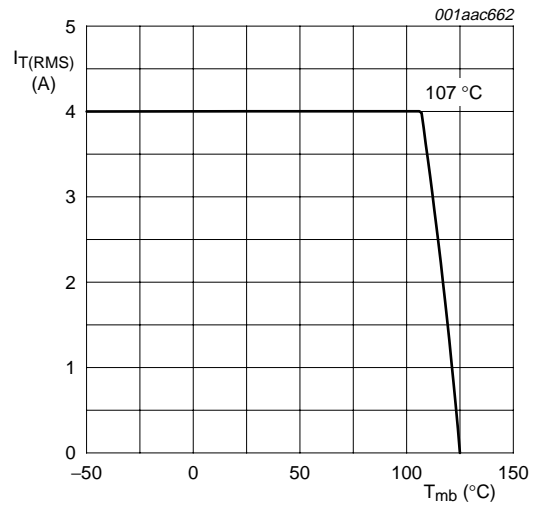
- (1)  $dl_T/dt$  limit
- (2) T2- G+ quadrant

**Fig 3. Non-repetitive peak on-state current as a function of pulse duration; maximum values**



$f = 50 \text{ Hz}; T_{mb} \leq 107 \text{ °C}$

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



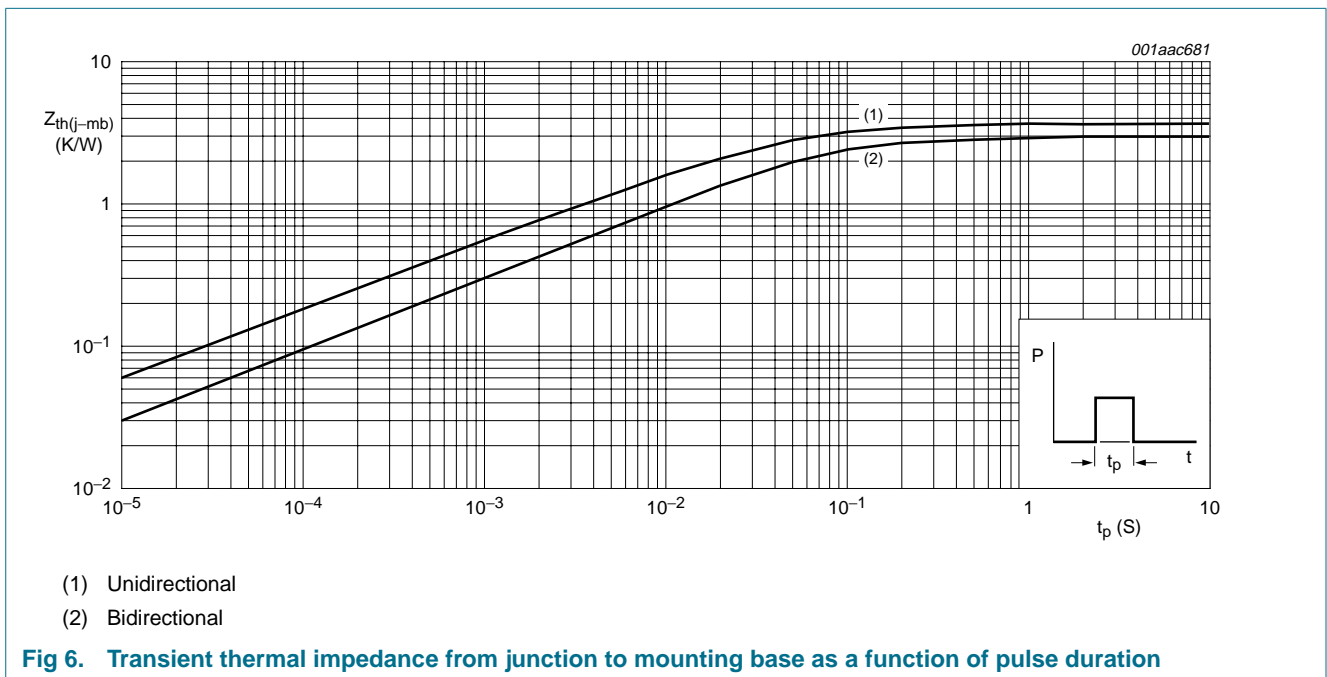
(1)  $T_{mb} \leq 107 \text{ °C}$

**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	full cycle; see <a href="#">Figure 6</a>	-	-	3.0	K/W
		half cycle; see <a href="#">Figure 6</a>	-	-	3.7	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	printed-circuit board (FR4) mounted; see <a href="#">Figure 13</a>	-	75	-	K/W



## 6. Static characteristics

**Table 5: Static characteristics**

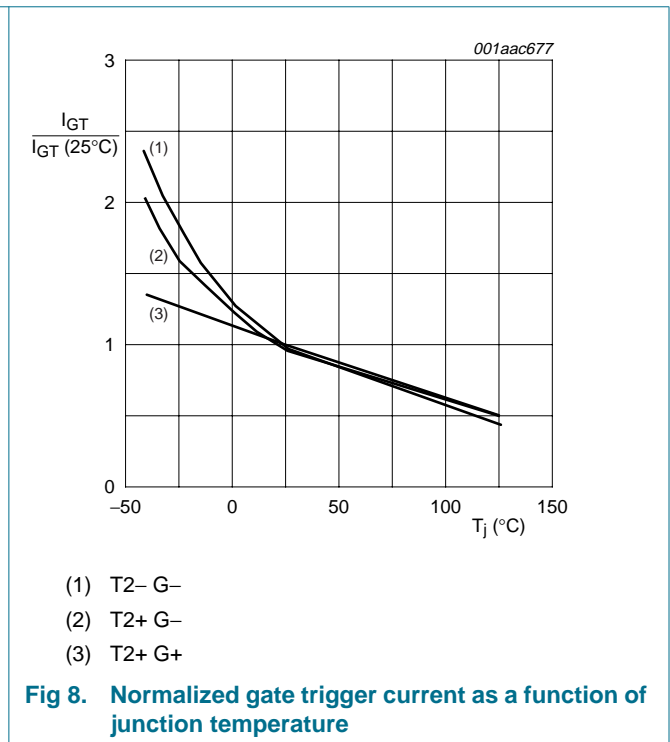
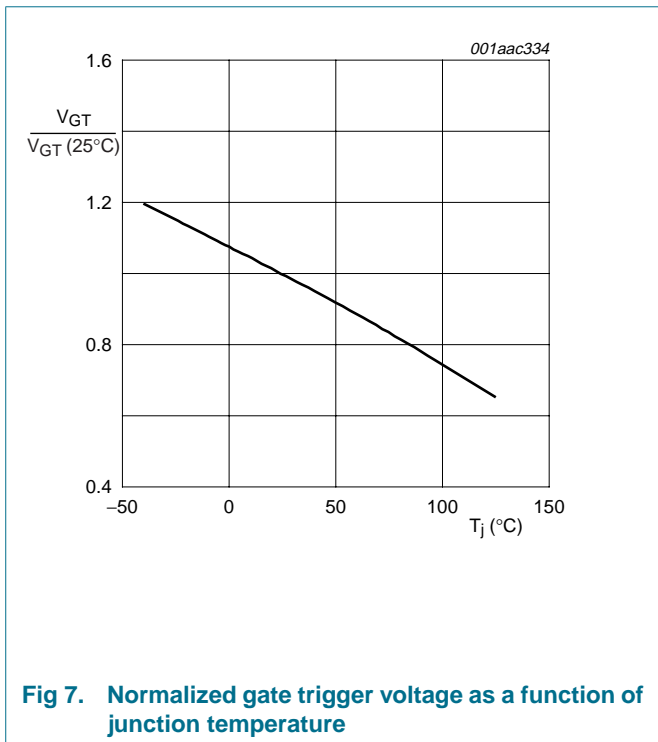
$T_j = 25\text{ °C}$  unless otherwise specified.

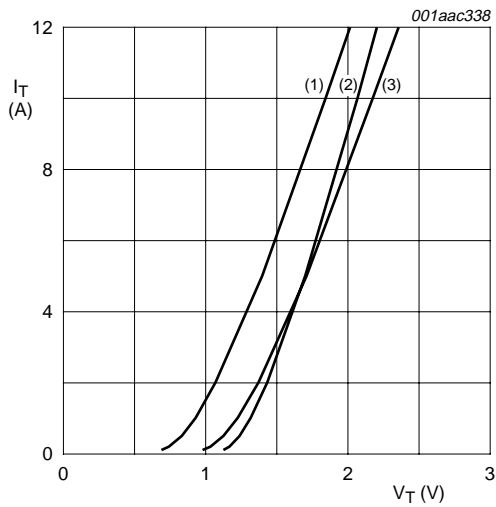
Symbol	Parameter	Conditions	BTA204S-600D			BTA204S-600E BTA204S-800E			BTA204S-600F			Unit	
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
$I_{GT}$	gate trigger current	$V_D = 12\text{ V};$ $I_T = 0.1\text{ A};$ see <a href="#">Figure 8</a>	T2+ G+	-	-	5	-	-	10	-	-	25	mA
			T2+ G-	-	-	5	-	-	10	-	-	25	mA
			T2- G-	-	-	5	-	-	10	-	-	25	mA
$I_L$	latching current	$V_D = 12\text{ V};$ $I_{GT} = 0.1\text{ A};$ see <a href="#">Figure 10</a>	T2+ G+	-	-	6	-	-	12	-	-	20	mA
			T2+ G-	-	-	9	-	-	18	-	-	30	mA
			T2- G-	-	-	6	-	-	12	-	-	20	mA
$I_H$	holding current	$V_D = 12\text{ V};$ $I_{GT} = 0.1\text{ A};$ see <a href="#">Figure 11</a>	-	-	6	-	-	12	-	-	20	mA	
$V_T$	on-state voltage	$I_T = 5\text{ A};$ see <a href="#">Figure 9</a>	-	1.4	1.7	-	1.4	1.7	-	1.4	1.7	V	
$V_{GT}$	gate trigger voltage	$V_D = 12\text{ V};$ $I_T = 0.1\text{ A};$ see <a href="#">Figure 7</a>	-	0.7	1.5	-	0.7	1.5	-	0.7	1.5	V	
		$V_D = 400\text{ V};$ $I_T = 0.1\text{ A};$ $T_j = 125\text{ °C}$	0.25	0.4	-	0.25	0.4	-	0.25	0.4	-	V	
$I_D$	off-state current	$V_D = V_{DRM(max)};$ $T_j = 125\text{ °C}$	-	0.1	0.5	-	0.1	0.5	-	0.1	0.5	mA	

**7. Dynamic characteristics**

**Table 6: Dynamic characteristics**

Symbol	Parameter	Conditions	BTA204S-600D			BTA204S-600E BTA204S-800E			BTA204S-600F			Unit
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 0.67V_{DRM(max)}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; exponential waveform; gate open circuit	20	-	-	30	-	-	50	-	-	V/ $\mu\text{s}$
$dl_{com}/dt$	rate of change of commutating current	$V_{DM} = 400\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 4\text{ A}$ ; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$ ; gate open circuit	1.1	-	-	2.1	-	-	3	-	-	A/ms
		$V_{DM} = 400\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 4\text{ A}$ ; $dV_{com}/dt = 0.1\text{ V}/\mu\text{s}$ ; gate open circuit	4.5	-	-	8	-	-	15	-	-	A/ms
$t_{gt}$	gate-controlled turn-on time	$I_{TM} = 12\text{ A}$ ; $V_D = V_{DRM(max)}$ ; $I_G = 0.1\text{ A}$ ; $dl_G/dt = 5\text{ A}/\mu\text{s}$	-	2	-	-	2	-	-	2	-	$\mu\text{s}$

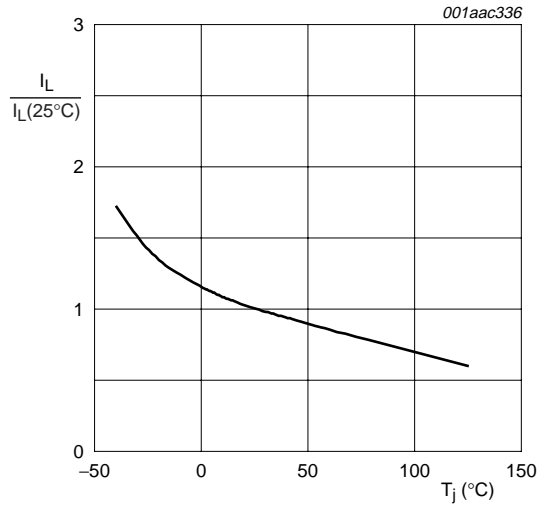




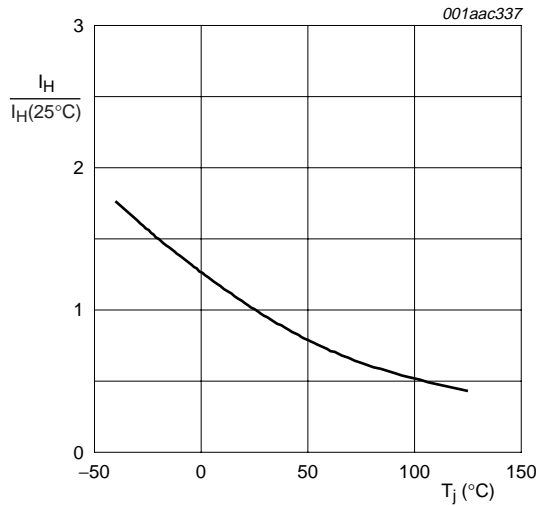
$V_o = 1.27\text{ V}$   
 $R_s = 0.091\ \Omega$

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

## 8. Package information

Refer to mounting instructions for SOT428 (DPAK) packages. Epoxy meets UL94 V-0 at 1/8 inch.



**9. Package outline**

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

SOT428

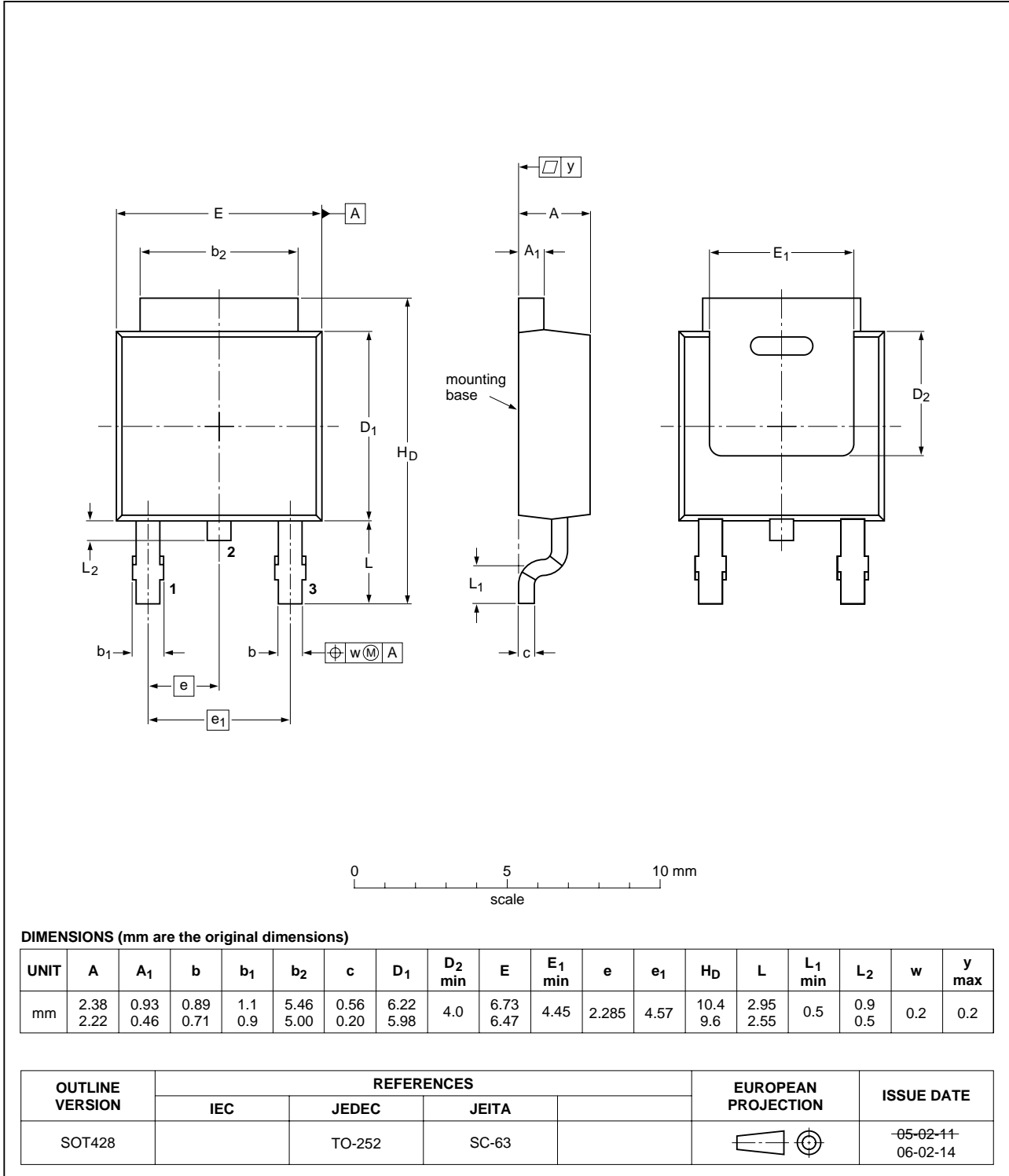
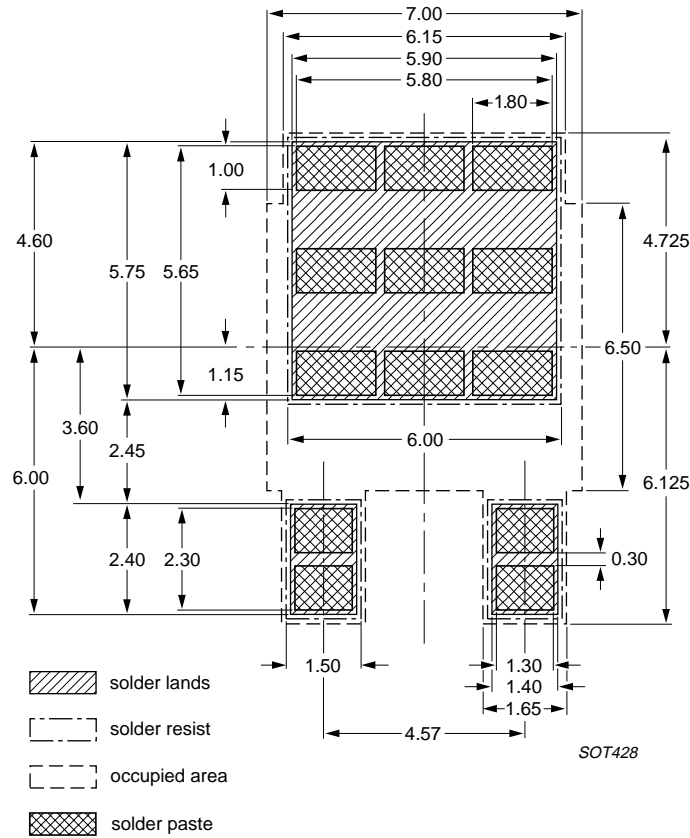


Fig 12. Package outline SOT428 (DPAK)

**10. Mounting**



All dimensions are in mm

**Fig 13. Reflow soldering footprint SOT428 (DPAK)**

## 11. Revision history

Table 7: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
BTA204S_SER_D_E_F_5	20060216	Product data sheet	-	-	BTA204S_SER_D_E_F_4
Modifications:					
<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors.</li> <li>Addition of BTA204S-800E</li> </ul>					
BTA204S_SER_D_E_F_4	20030501	Product specification	-	-	BTA204S_SER_D_E_F_3
BTA204S_SER_D_E_F_3	19981201	Product specification	-	9397 750 06619	BTA204S_SER_D_E_F_2
BTA204S_SER_D_E_F_2	19981201	Product specification	-	-	BTA204S_SER_D_E_F_1
BTA204S_SER_D_E_F_1	19970901	Objective specification	-	-	-

## 12. Data sheet status

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