

BTA204X series D, E and F

Three quadrant triacs guaranteed commutation

Rev. 04 — 17 March 2005

Product data sheet

1. Product profile

1.1 General description

Passivated guaranteed commutation triacs in a plastic full pack package. These devices balance the requirements of commutation performance and gate sensitivity. The 'sensitive gate' E series and 'logic level' D series are intended for interfacing with low power drivers, including microcontrollers.

1.2 Features

- Suitable for interfacing with low power drivers, including microcontrollers
- Isolated mounting base

1.3 Applications

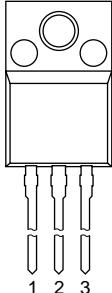

- Motor control
- High inductive loads

1.4 Quick reference data

- $V_{DRM} \leq 600$ V (BTA204X-600D)
- $V_{DRM} \leq 600$ V (BTA204X-600E)
- $V_{DRM} \leq 600$ V (BTA204X-600F)
- $V_{DRM} \leq 800$ V (BTA204X-800E)
- $I_{T(RMS)} \leq 4$ A
- $I_{GT} \leq 5$ mA (BTA204X-600D)
- $I_{GT} \leq 10$ mA (BTA204X-600E)
- $I_{GT} \leq 25$ mA (BTA204X-600F)

2. Pinning information

Table 1: Pinning

Pin	Description	Simplified outline	Symbol
1	main terminal 1 (T1)		
2	main terminal 2 (T2)		
3	gate (G)		
mb	mounting base (isolated)		

SOT186A (TO-220F)

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3. Ordering information

Table 2: Ordering information

Type number	Package		Version
	Name	Description	
BTA204X-600D	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3 lead TO-220 'full pack'	SOT186A
BTA204X-600E			
BTA204X-600F			
BTA204X-800E			

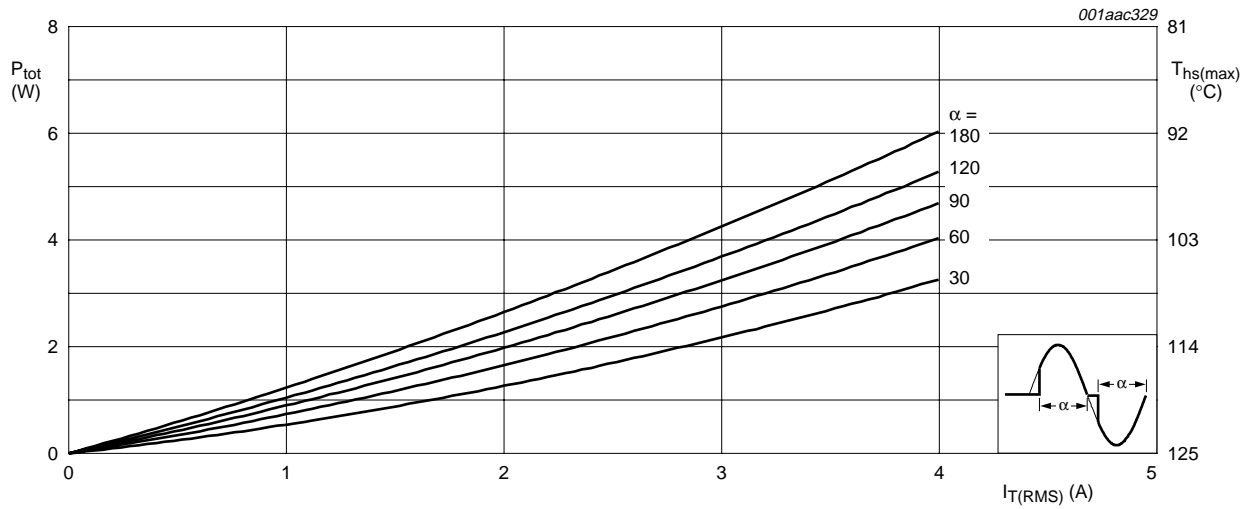
4. Limiting values

Table 3: Limiting values

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

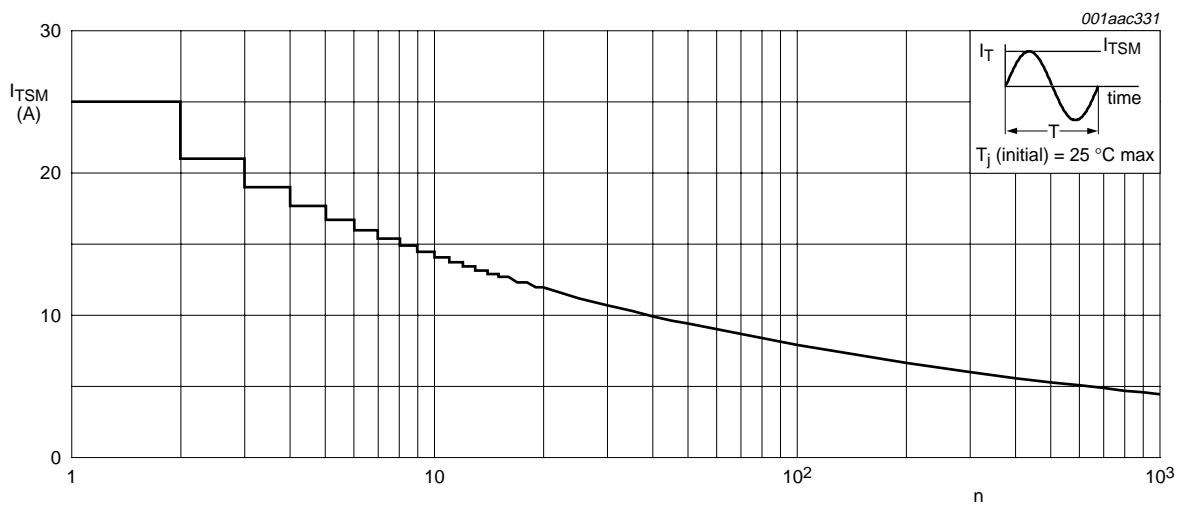
Symbol	Parameter	Conditions	Min	Max	Unit
V _{DRM}	repetitive peak off-state voltage				
	BTA204X-600D		[1] -	600	V
	BTA204X-600E		[1] -	600	V
	BTA204X-600F		[1] -	600	V
	BTA204X-800E		-	800	V
I _{T(RMS)}	RMS on-state current	full sine wave; T _{hs} ≤ 92 °C; Figure 4 and Figure 5	-	4	A
I _{TSM}	non-repetitive peak on-state current	full sine wave; T _j = 25 °C prior to surge; Figure 2 and Figure 3			
		t = 20 ms	-	25	A
		t = 16.7 ms	-	27	A
I ² t	I ² t for fusing	t = 10 ms	-	3.1	A ² S
di _T /dt	repetitive rate of rise of on-state current after triggering	I _{TM} = 6 A; I _G = 0.2 A; di _G /dt = 0.2 A/μs	-	100	A/μs
I _{GM}	peak gate current		-	2	A
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 triac may switch to the on-state. The rate of rise of current should not exceed 6 A/μs.



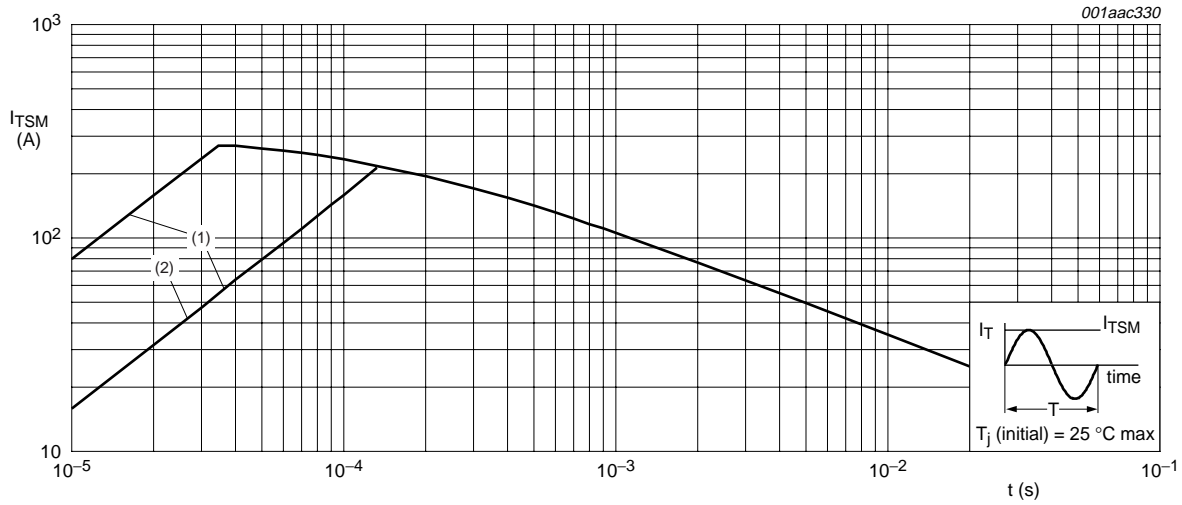
α = conduction angle

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



f = 50 Hz

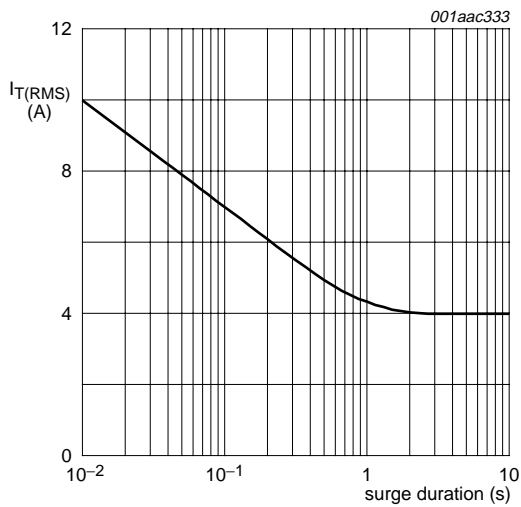
Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



$t_p \leq 20 \text{ ms}$

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

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



$f = 50 \text{ Hz}; T_h \leq 92 \text{ °C}$

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

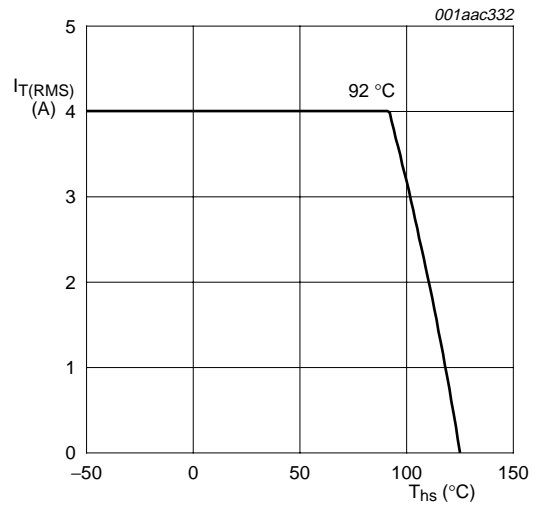
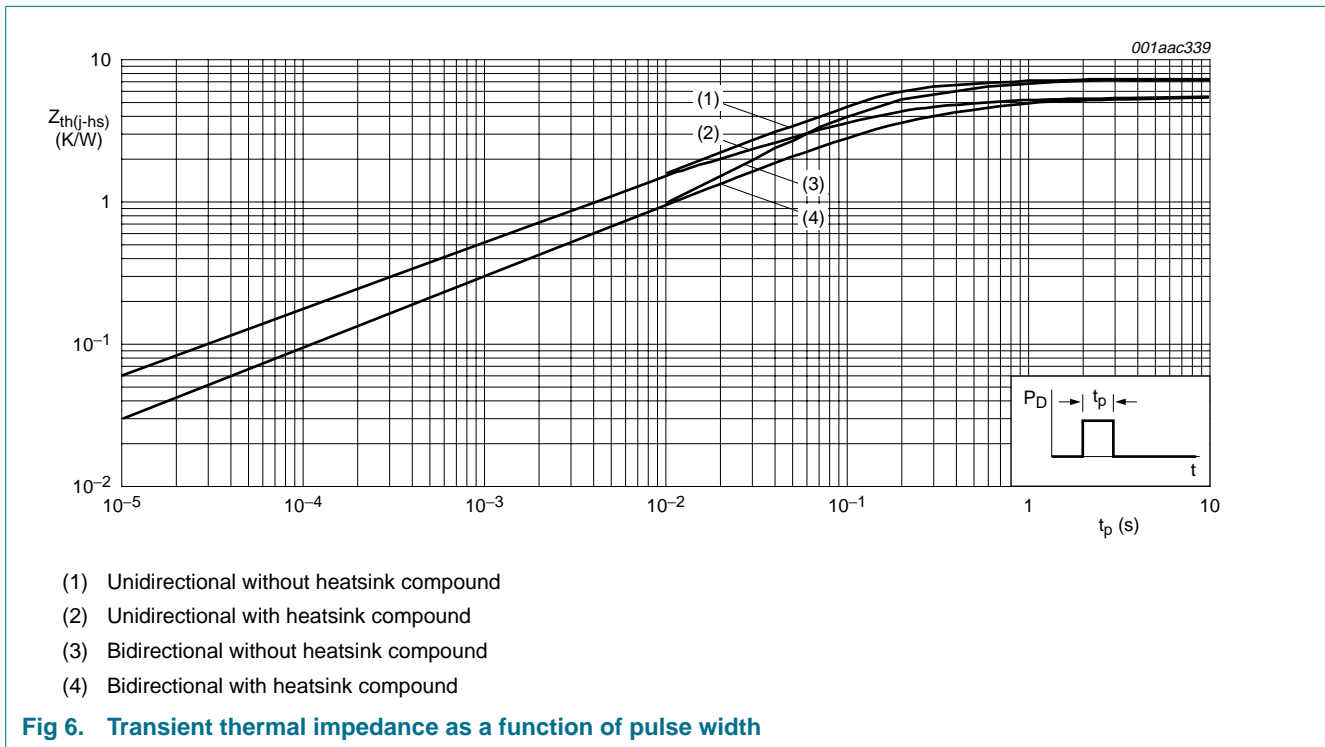


Fig 5. RMS on-state current as a function of heatsink temperature; maximum values

5. Thermal characteristics

Table 4: Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-hs)}$	thermal resistance from junction to heatsink	full or half cycle with heatsink compound; Figure 6	-	-	5.5	K/W
		full or half cycle without heatsink compound; Figure 6	-	-	7.2	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	55	-	K/W



6. Isolation characteristics

Table 5: Isolation limiting values and characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{isol}	RMS isolation voltage from all three terminals to external heatsink	$f = 50\text{ Hz to }60\text{ Hz}$; sinusoidal waveform; R.H. $\leq 65\%$; clean and dust free	-	-	2500	V
C_{isol}	capacitance from pin 2 to external heatsink	$f = 1\text{ MHz}$	-	10	-	pF

7. Static characteristics

Table 6: Static characteristics

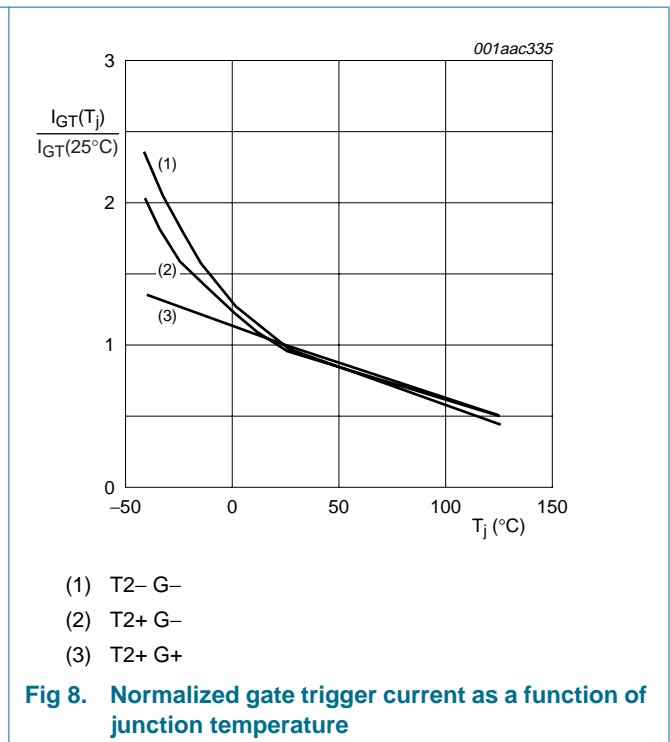
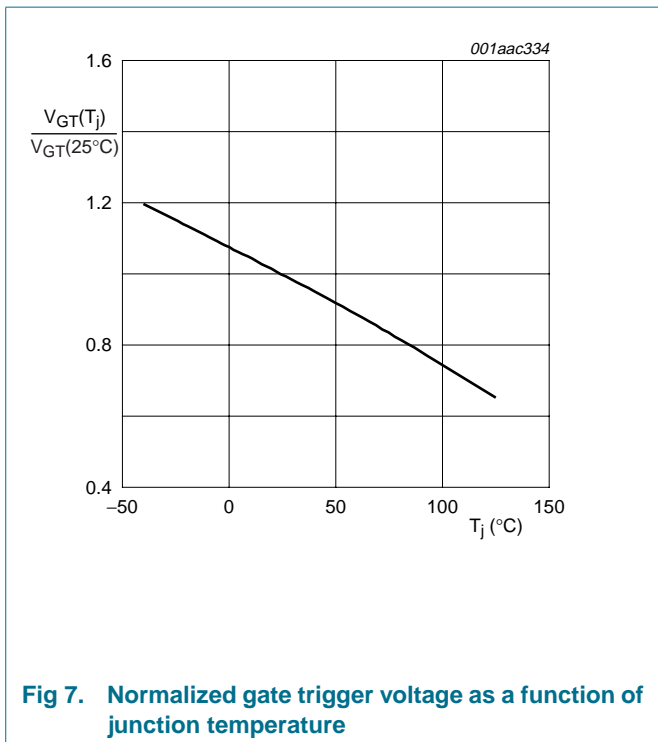
$T_j = 25\text{ °C}$ unless otherwise specified.

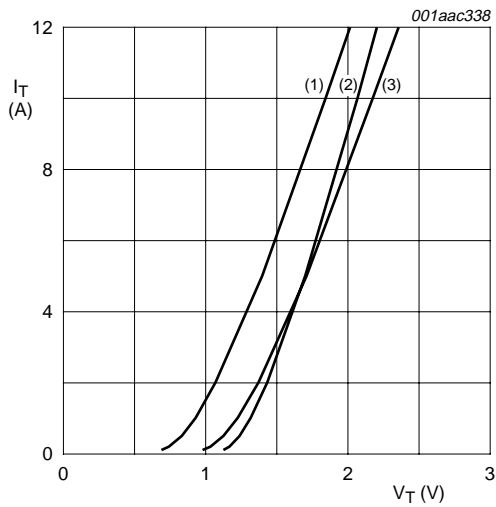
Symbol	Parameter	Conditions	BTA204X-600D			BTA204X-600E			BTA204X-600F			Unit
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{GT}	gate trigger current	$V_D = 12\text{ V};$ $I_T = 0.1\text{ A};$ Figure 8										
		T2+ G+	-	-	5	-	-	10	-	-	25	mA
		T2+ G-	-	-	5	-	-	10	-	-	25	mA
		T2- G-	-	-	5	-	-	10	-	-	25	mA
I_L	latching current	$V_D = 12\text{ V};$ $I_{GT} = 0.1\text{ A};$ Figure 10										
		T2+ G+	-	-	6	-	-	12	-	-	20	mA
		T2+ G-	-	-	9	-	-	18	-	-	30	mA
		T2- G-	-	-	6	-	-	12	-	-	20	mA
I_H	holding current	$V_D = 12\text{ V};$ $I_{GT} = 0.1\text{ A};$ Figure 11	-	-	6	-	-	12	-	-	20	mA
V_T	on-state voltage	$I_T = 5\text{ A};$ Figure 9	-	1.4	1.7	-	1.4	1.7	-	1.4	1.7	V
V_{GT}	gate trigger voltage	$V_D = 12\text{ V};$ $I_T = 0.1\text{ A};$ Figure 7	-	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 leakage current	$V_D = V_{DRM(max)};$ $T_j = 125\text{ °C}$	-	0.1	0.5	-	0.1	0.5	-	0.1	0.5	mA

8. Dynamic characteristics

Table 7: Dynamic characteristics

Symbol	Parameter	Conditions	BTA204X-600D			BTA204X-600E			BTA204X-600F			Unit
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
dV_D/dt	critical rate of rise of off-state voltage	$V_{DM} = 67\%$ $V_{DRM(max)}$; $T_j = 125\text{ }^\circ\text{C}$; exponential waveform; gate open circuit	20	-	-	30	-	-	50	-	-	V/ μs
dI_{com}/dt	critical 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	$I_{TM} = 20\text{ A}$; $V_D = V_{DRM(max)}$; $I_G = 0.1\text{ A}$; $dI_G/dt = 5\text{ A}/\mu\text{s}$	-	2	-	-	2	-	-	2	-	μs





$V_O = 1.27\text{ V}$

$R_S = 0.091\ \Omega$

- (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

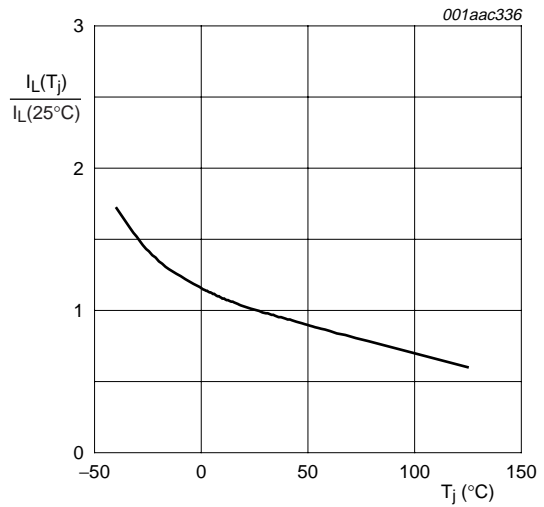


Fig 10. Normalized latching current as a function of junction temperature

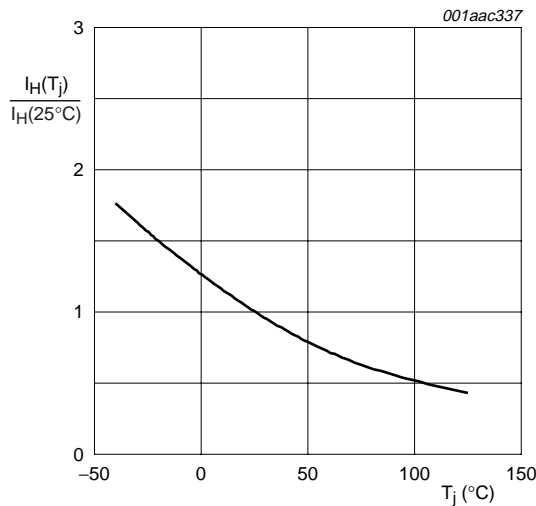


Fig 11. Normalized holding current as a function of junction temperature

9. Package information

Refer to mounting instructions for F-pack packages. Epoxy meets UL94 V-0 at 1/8 inch.

10. Package outline

Plastic single-ended package; isolated heatsink mounted;
1 mounting hole; 3 lead TO-220 'full pack'

SOT186A

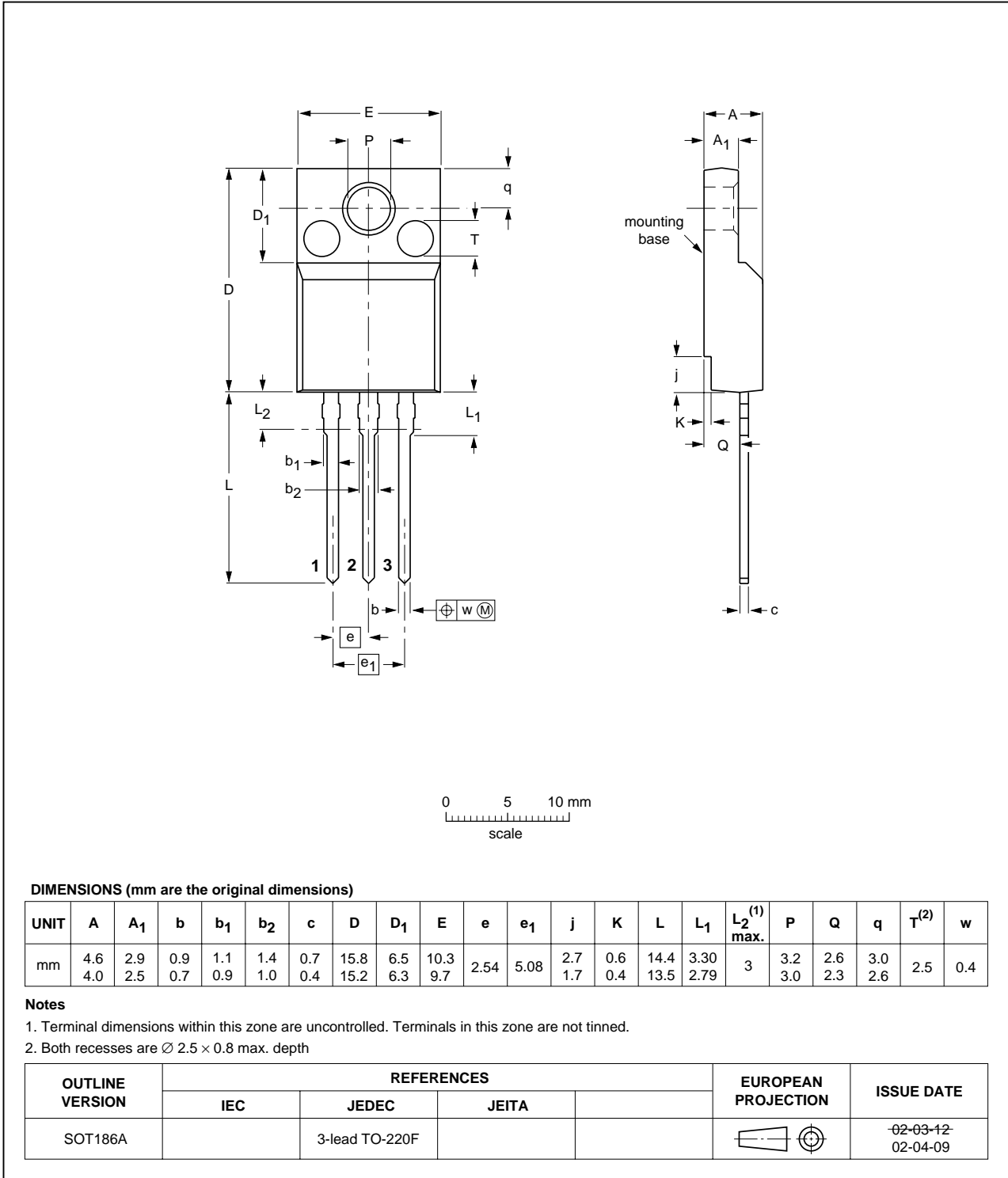


Fig 12. Package outline SOT186A (TO-220F)

11. Revision history

Table 8: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
BTA204X_SER_D_E_F_4	20050317	Product data sheet	-	9397 750 14491	BTA204X_SERIES_D_E_F_3
Modifications:					
			<ul style="list-style-type: none">The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors.		
BTA204X_SERIES_D_E_F_3	20030501	Product specification	-	-	BTA204X_SERIES_D_E_F_2
BTA204X_SERIES_D_E_F_2	19981201	Product specification	-	-	BTA204X_SERIES_D_E_F_1
BTA204X_SERIES_D_E_F_1	19971001	Product specification	-	-	-

12. Data sheet status

Level	Data sheet status ^[1]	Product status ^{[2] [3]}	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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