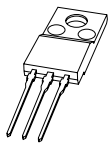


BTA204X series D, E and F

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

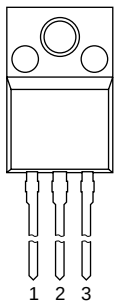
1.4 Quick reference data

- $V_{DRM} \leq 600$ 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)

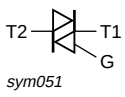
2. Pinning information

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)



sym051

PHILIPS

3. Ordering information

Table 2: Ordering information

Type number	Package		
	Name	Description	Version
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			

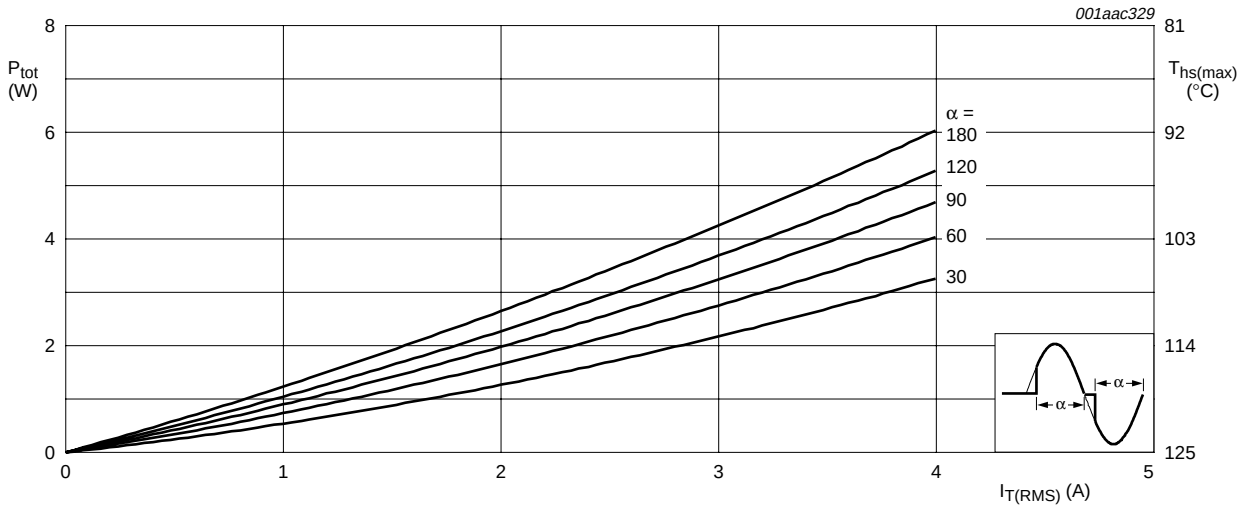
4. Limiting values

Table 3: Limiting values

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

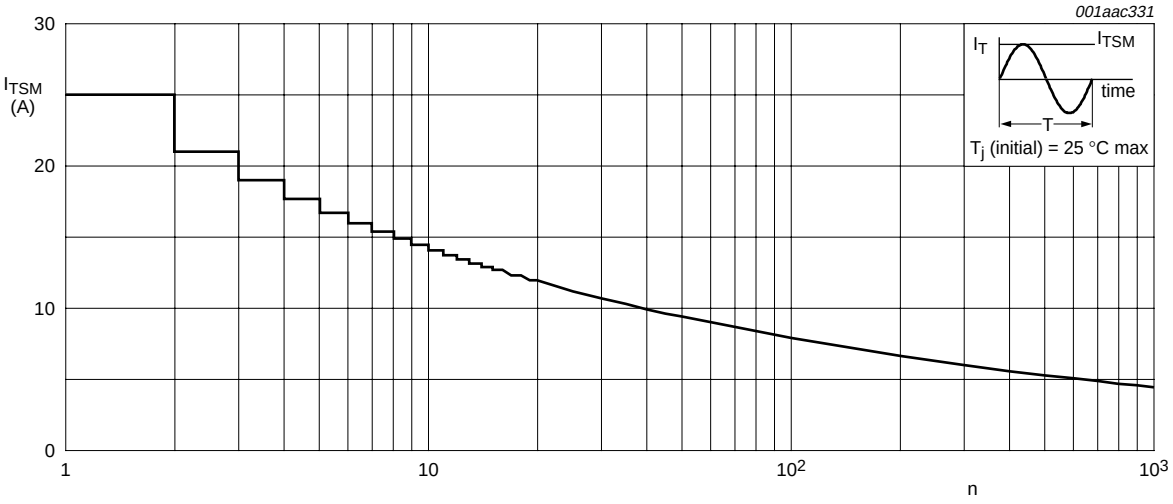
Symbol	Parameter	Conditions		Min	Max	Unit
V_{DRM}	repetitive peak off-state voltage					
	BTA204X-600D		[1]	-	600	V
	BTA204X-600E		[1]	-	600	V
	BTA204X-600F		[1]	-	600	V
	BTA204X-800E			-	800	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{hs} \leq 92$ °C; Figure 4 and Figure 5		-	4	A
I_{TSM}	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^2t	I^2t for fusing	t = 10 ms		-	3.1	A^2S
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.



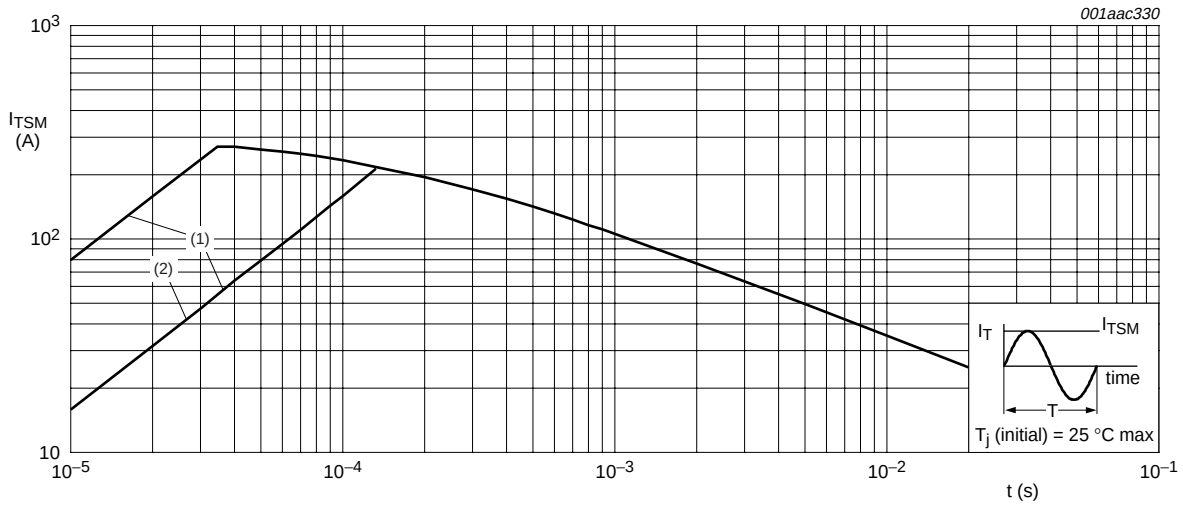
α = conduction angle

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

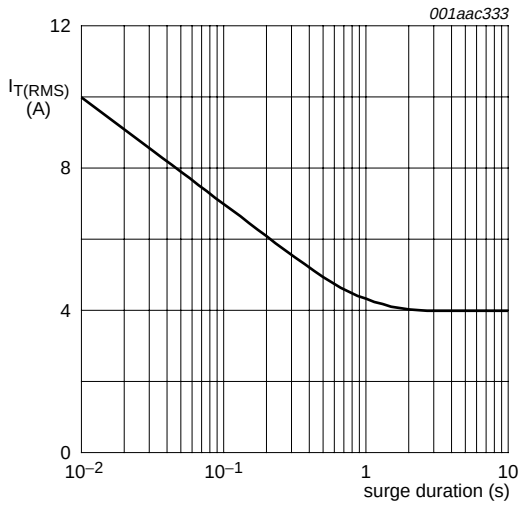


$t_p \leq 20$ ms

(1) dI_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 Hz; $T_h \leq 92$ °C

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

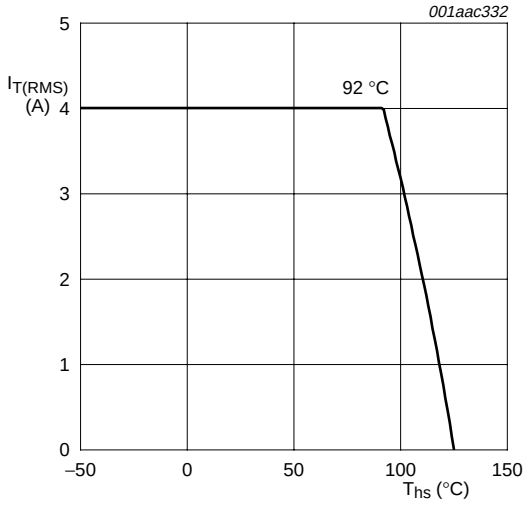
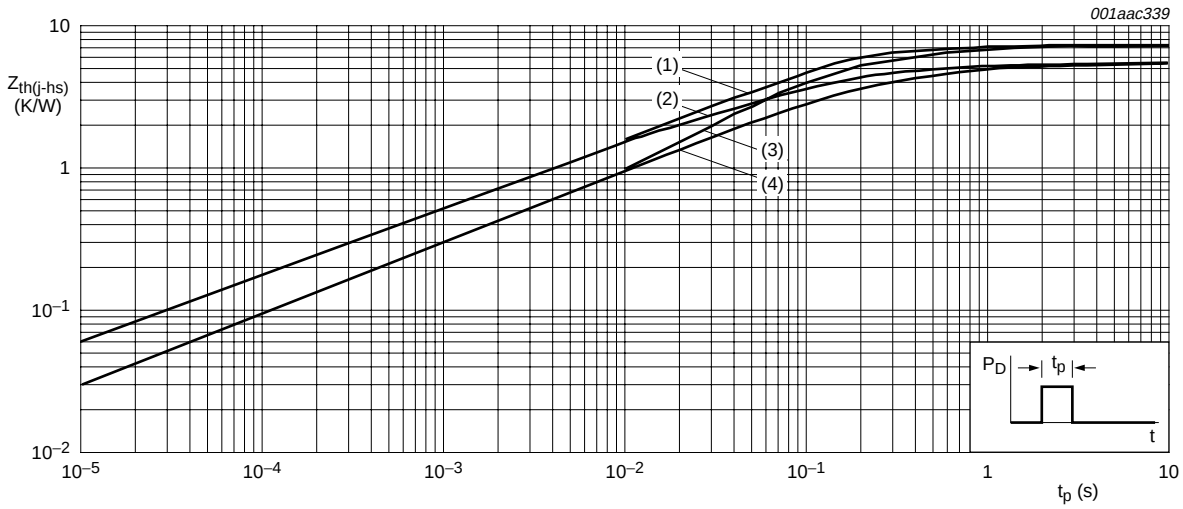


Fig 5. RMS on-state current as a function of heatsink temperature; maximum values

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



(1) Unidirectional without heatsink compound
(2) Unidirectional with heatsink compound
(3) Bidirectional without heatsink compound
(4) Bidirectional with heatsink compound

Fig 6. Transient thermal impedance as a function of pulse width

6. Isolation characteristics

Table 5: Isolation limiting values and characteristics

T_{hs} = 25 °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 Hz to 60 Hz; sinusoidal waveform; R.H. ≤ 65 %; clean and dust free	-	-	2500	V
C_{isol}	capacitance from pin 2 to external heatsink	f = 1 MHz	-	10	-	pF

7. Static characteristics

Table 6: Static characteristics

T_j = 25 °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 V; I_T = 0.1 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 V; I_{GT} = 0.1 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 V; I_{GT} = 0.1 A; Figure 11	-	-	6	-	-	12	-	-	20	mA
V_T	on-state voltage	I_T = 5 A; Figure 9	-	1.4	1.7	-	1.4	1.7	-	1.4	1.7	V
V_{GT}	gate trigger voltage	V_D = 12 V; I_T = 0.1 A; Figure 7	-	0.7	1.5	-	0.7	1.5	-	0.7	1.5	V
		V_D = 400 V; I_T = 0.1 A; T_j = 125 °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 °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 °C; exponential waveform; gate open circuit	20	-	-	30	-	-	50	-	-	V/µs
dI_{com}/dt	critical rate of change of commutating current	V_{DM} = 400 V; T_j = 125 °C; $I_{T(RMS)}$ = 4 A; dV_{com}/dt = 10 V/µs; gate open circuit	1.1	-	-	2.1	-	-	3	-	-	A/ms
		V_{DM} = 400 V; T_j = 125 °C; $I_{T(RMS)}$ = 4 A; dV_{com}/dt = 0.1 V/µs; gate open circuit	4.5	-	-	8	-	-	15	-	-	A/ms
t_{gt}	gate controlled turn-on time	I_{TM} = 20 A; V_D = $V_{DRM(max)}$; I_G = 0.1 A; dI_G/dt = 5 A/µs	-	2	-	-	2	-	-	2	-	µs

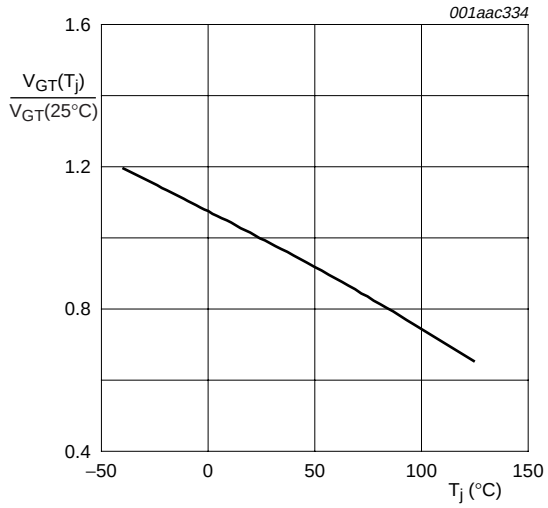
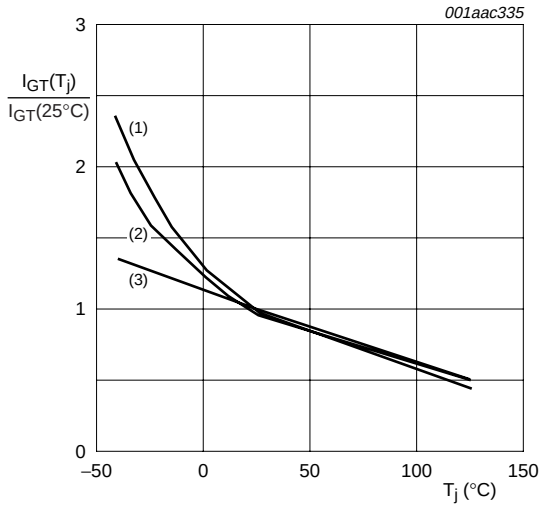
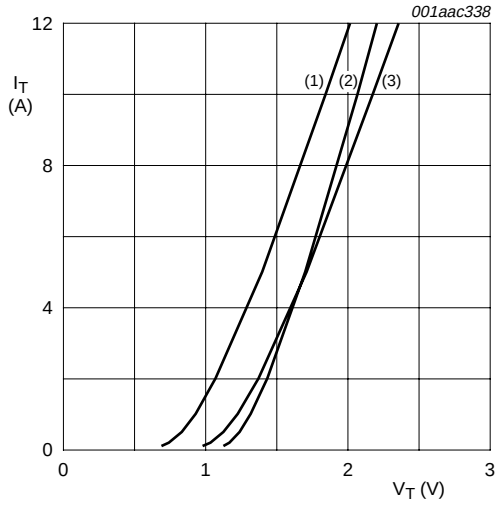


Fig 7. Normalized gate trigger voltage as a function of junction temperature



(1) T2– G–
(2) T2+ G–
(3) T2+ G+

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



V_O = 1.27 V

R_S = 0.091 Ω

(1) T_j = 125 °C; typical values

(2) T_j = 25 °C; maximum values

(3) T_j = 125 °C; maximum values

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

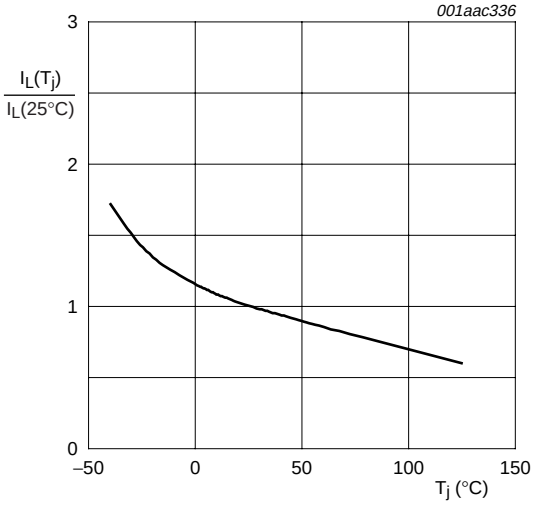


Fig 10. Normalized latching current as a function of junction temperature

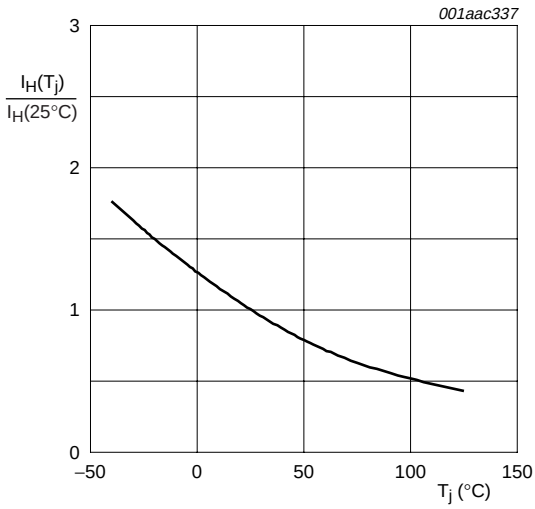


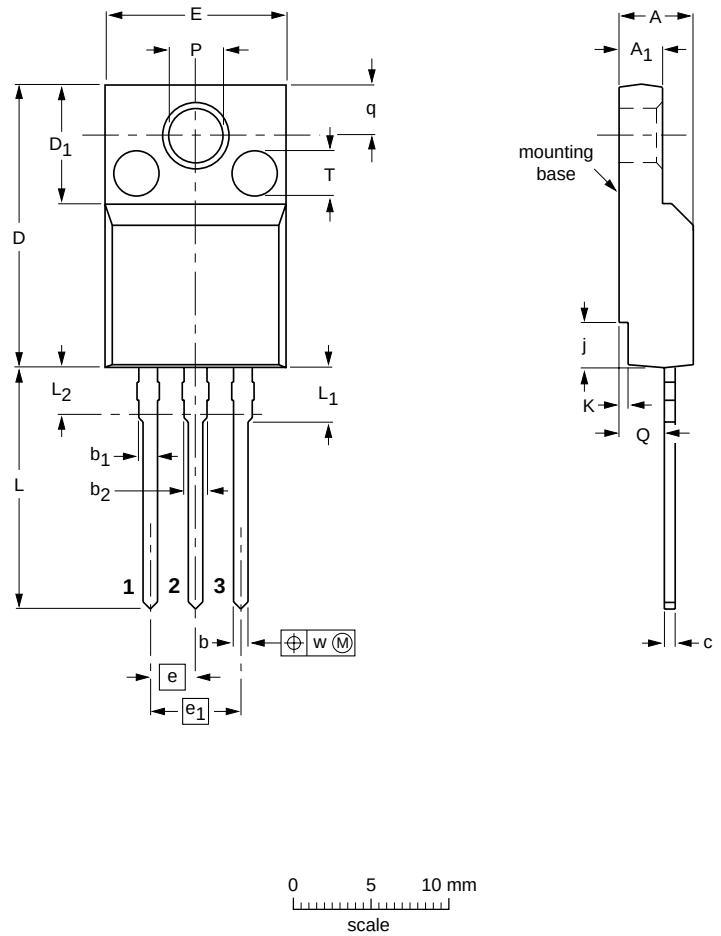
Fig 11. Normalized holding current as a function of junction temperature

9. Package information

Refer to mounting instructions for F-pack packages. Epoxy meets UL94 V-0 at $\frac{1}{8}$ inch.

10. Package outline

Plastic single-ended package; isolated heatsink mounted;
1 mounting hole; 3 lead TO-220 'full pack' **SOT186A**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	b_1	b_2	c	D	D_1	E	e	e_1	j	K	L	L_1	L_2 (1) max.	P	Q	q	T (2)	w
mm	4.6 4.0	2.9 2.5	0.9 0.7	1.1 0.9	1.4 1.0	0.7 0.4	15.8 15.2	6.5 6.3	10.3 9.7	2.54	5.08	2.7 1.7	0.6 0.4	14.4 13.5	3.30 2.79	3	3.2 3.0	2.6 2.3	3.0 2.6	2.5	0.4

Notes

1. Terminal dimensions within this zone are uncontrolled. Terminals in this zone are not tinned.
2. Both recesses are ∅ 2.5 × 0.8 max. depth

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT186A		3-lead TO-220F				~~02-03-12~~ 02-04-09

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:	• 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.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

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

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

13. Definitions

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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16. Contents

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