BTA412Y series B and C

12 A three-quadrant triacs, insulated, high commutation, high temperature

Rev. 02 — 11 March 2008 Product data sheet

1. Product profile

1.1 General description

Passivated, new generation, high commutation triacs in an internally insulated TO-220 plastic package.

1.2 Features

- Very high commutation performance
- Isolated mounting base
- High operating junction temperature
- High immunity to dV/dt
- 2500 V RMS isolation voltage

1.3 Applications

- Heating and cooking appliances
- High power motor control e.g. vacuum cleaners
- Solid state relays
- Non-linear rectifier-fed motor loads
- Electronic thermostats for heating and cooling loads

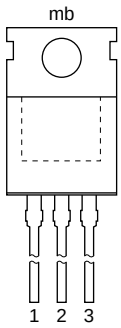
1.4 Quick reference data

- $V_{DRM} \leq 600$ V (BTA412Y-600B/C)
- $V_{DRM} \leq 800$ V (BTA412Y-800B/C)
- $I_{T(RMS)} \leq 12$ A
- $I_{GT} \leq 50$ mA (BTA412Y series B)
- $I_{GT} \leq 35$ mA (BTA412Y series C)
- $I_{TSM} \leq 140$ A (t = 20 ms)

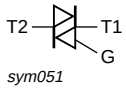
2. Pinning information

Table 1. Pinning

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



SOT78D (TO-220)



3. Ordering information

Table 2. Ordering information

Type number	Package		
	Name	Description	Version
BTA412Y-600B	TO-220	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220	SOT78D
BTA412Y-600C			
BTA412Y-800B			
BTA412Y-800C			

4. Limiting values

Table 3. Limiting values

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

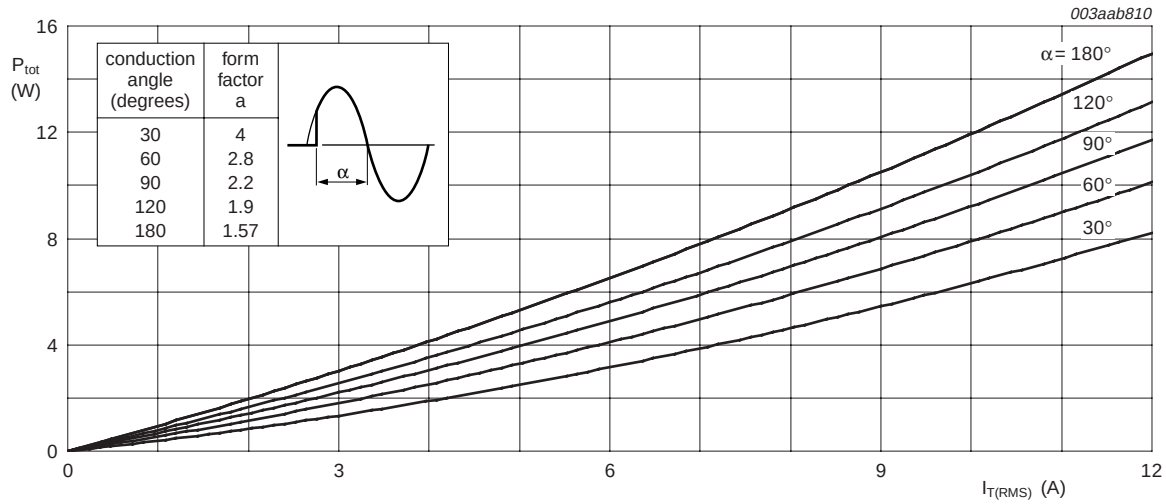
Symbol	Parameter	Conditions		Min	Max	Unit
V_{DRM}	repetitive peak off-state voltage	BTA412Y-600B; BTA412Y-600C	[1]	-	600	V
		BTA412Y-800B; BTA412Y-800C		-	800	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 116$ °C; see Figure 4 and 5		-	12	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_j = 25$ °C prior to surge; see Figure 2 and 3				
		t = 20 ms		-	140	A
		t = 16.7 ms		-	153	A
I^2t	I^2t for fusing	$t_p = 10$ ms		-	98	A^2s
dI_T/dt	rate of rise of on-state current	$I_{TM} = 20$ A; $I_G = 0.2$ A; $dI_G/dt = 0.2$ A/µs		-	100	A/µs
I_{GM}	peak gate current			-	4	A
P_{GM}	peak gate power			-	5	W

Table 3. Limiting values *...continued*

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

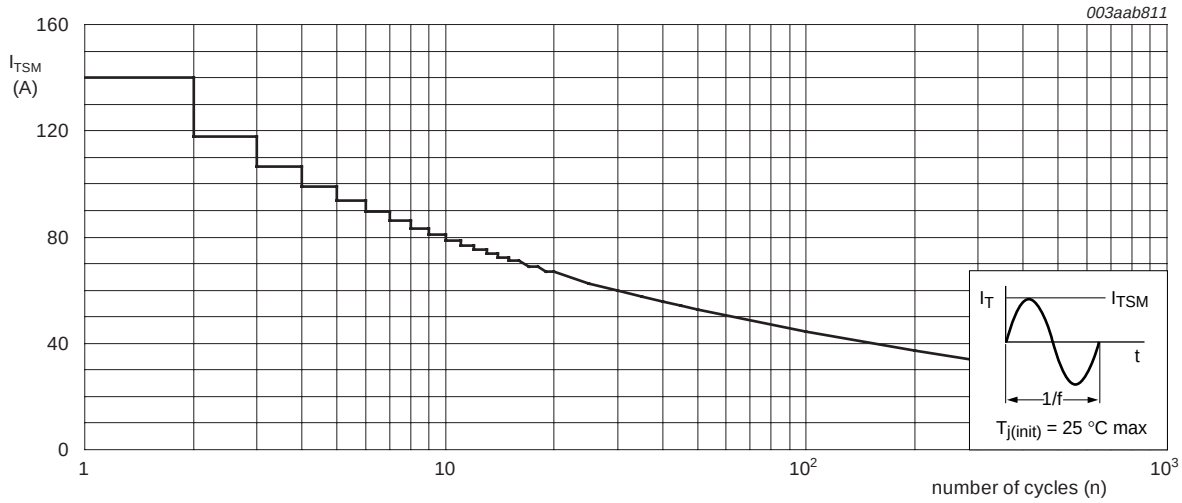
Symbol	Parameter	Conditions	Min	Max	Unit
$P_{G(AV)}$	average gate power	over any 20 ms period	-	1	W
T_{stg}	storage temperature		–40	+150	°C
T_j	junction temperature		-	150	°C

[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 15 A/µs.



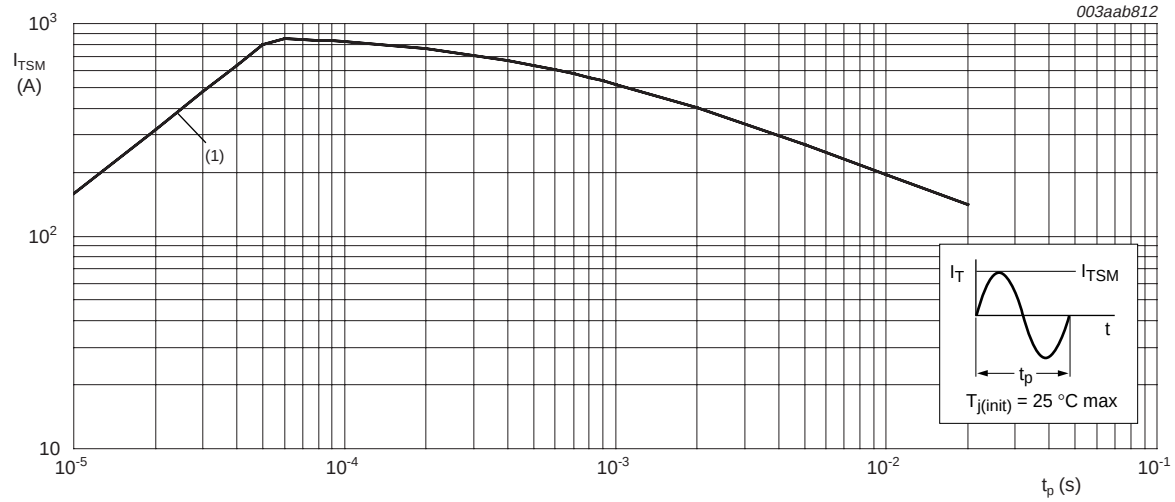
α = conduction angle

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



f = 50 Hz

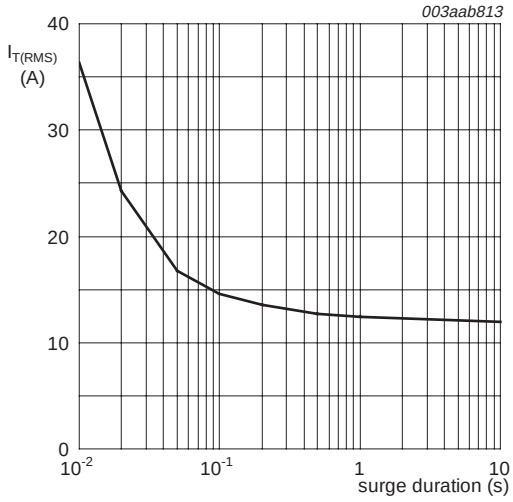
Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



$t_p \leq 20$ ms

(1) dI_T/dt limit

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



f = 50 Hz

T_{mb} = 116 °C

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

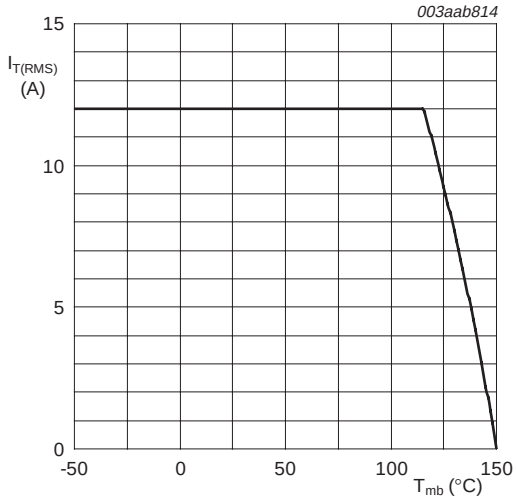


Fig 5. RMS on-state current as a function of mounting base temperature; maximum values

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	full cycle; see Figure 6	-	-	2.1	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	60	-	K/W

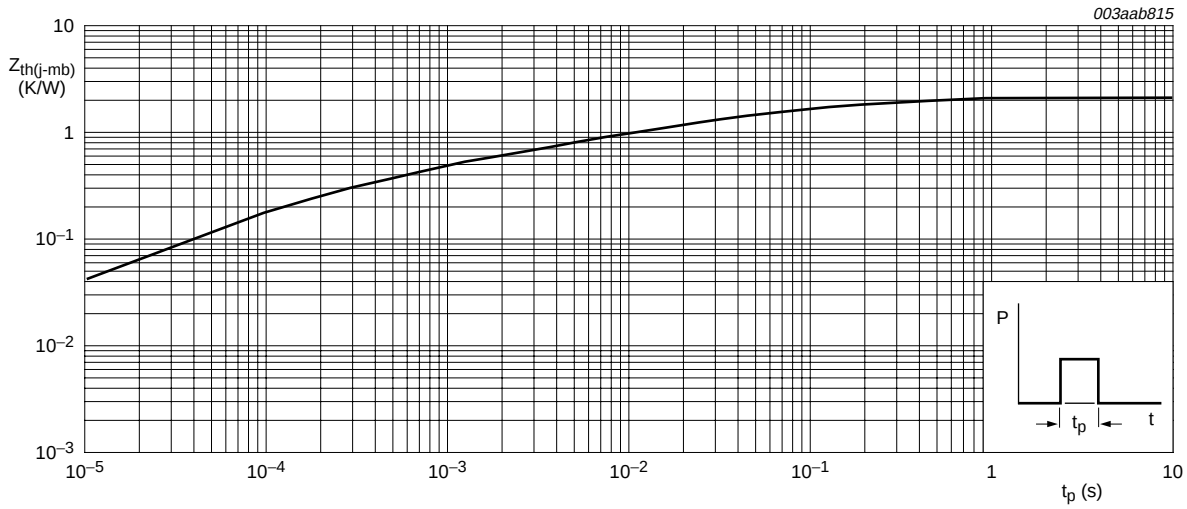


Fig 6. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Isolation characteristics

Table 5. Isolation limiting values and characteristics

T_h = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	from all three terminals to external heatsink; f = 50 Hz to 60 Hz; sinusoidal waveform; RH ≤ 65 %; clean and dust free	-	-	2500	V
C_{isol}	isolation 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	BTA412Y-600B BTA412Y-800B			BTA412Y-600C BTA412Y-800C			Unit
			Min	Typ	Max	Min	Typ	Max	
I_{GT}	gate trigger current	V_D = 12 V; I_T = 0.1 A; see Figure 8							
		T2+ G+	2	-	50	2	-	35	mA
		T2+ G–	2	-	50	2	-	35	mA
		T2– G–	2	-	50	2	-	35	mA
I_L	latching current	V_D = 12 V; I_G = 0.1 A; see Figure 10							
		T2+ G+	-	-	60	-	-	50	mA
		T2+ G–	-	-	90	-	-	60	mA
		T2– G–	-	-	60	-	-	50	mA
I_H	holding current	V_D = 12 V; I_G = 0.1 A; see Figure 11	-	-	60	-	-	35	mA
V_T	on-state voltage	I_T = 18 A; see Figure 9	-	1.3	1.5	-	1.3	1.5	V
V_{GT}	gate trigger voltage	V_D = 12 V; I_T = 0.1 A; see Figure 7	-	0.8	1.5	-	0.8	1.5	V
		V_D = 400 V; I_T = 0.1 A; T_j = 150 °C	0.25	0.4	-	0.25	0.4	-	V
I_D	off-state current	$V_D = V_{DRM(max)}$; T_j = 125 °C	-	0.1	0.5	-	0.1	0.5	mA
		$V_D = V_{DRM(max)}$; T_j = 150 °C	-	0.4	2	-	0.4	2	mA

8. Dynamic characteristics

Table 7. Dynamic characteristics

Symbol	Parameter	Conditions	BTA412Y-600B BTA412Y-800B			BTA412Y-600C BTA412Y-800C			Unit
			Min	Typ	Max	Min	Typ	Max	
dV_D/dt	rate of rise of off-state voltage	$V_{DM} = 0.67 \times V_{DRM(max)}$; exponential waveform; gate open circuit							
		T_j = 125 °C	1000	-	-	500	-	-	V/µs
		T_j = 150 °C	600	-	-	300	-	-	V/µs
dI_{com}/dt	rate of change of commutating current	V_{DM} = 400 V; $I_{T(RMS)}$ = 12 A; without snubber; gate open circuit							
		T_j = 125 °C	20	-	-	15	-	-	A/ms
		T_j = 150 °C	8	-	-	6	-	-	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	-	µs

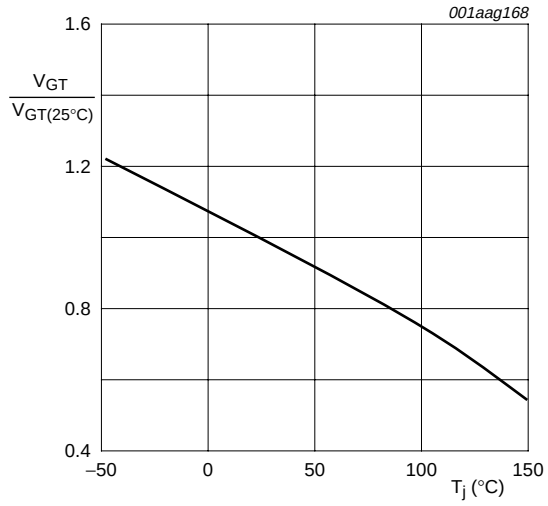
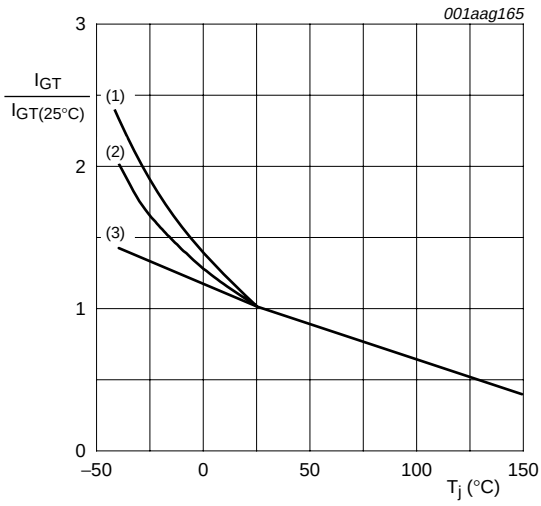
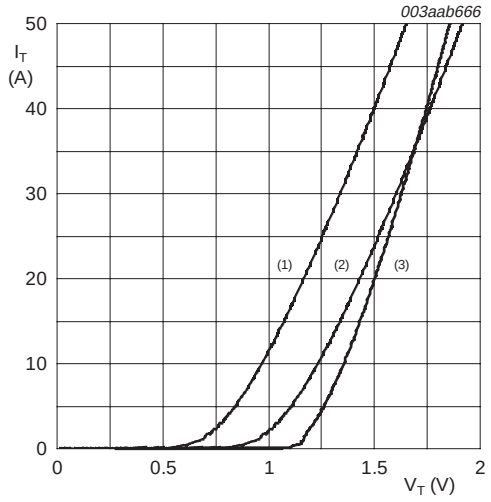


Fig 7. Normalized gate trigger voltage as a function of junction temperature



(1) T2– G–
(2) T2+ G–
(3) T2+ G+

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



V_o = 1.024 V

R_s = 0.021 Ω

(1) T_j = 150 °C; typical values

(2) T_j = 150 °C; maximum values

(3) T_j = 25 °C; maximum values

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

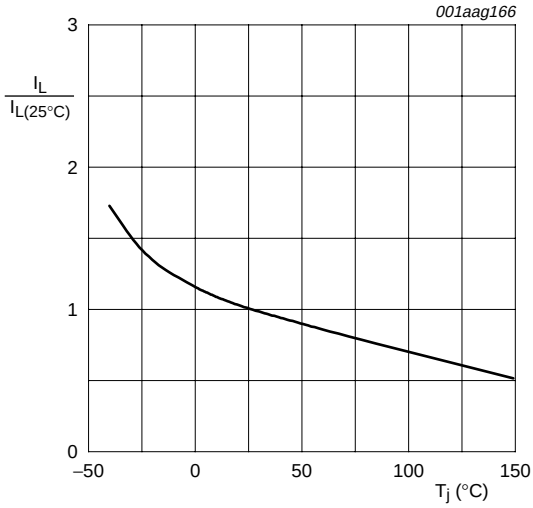


Fig 10. Normalized latching current as a function of junction temperature

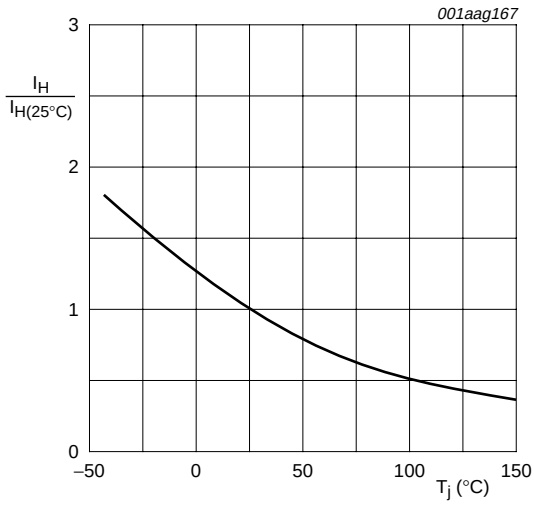
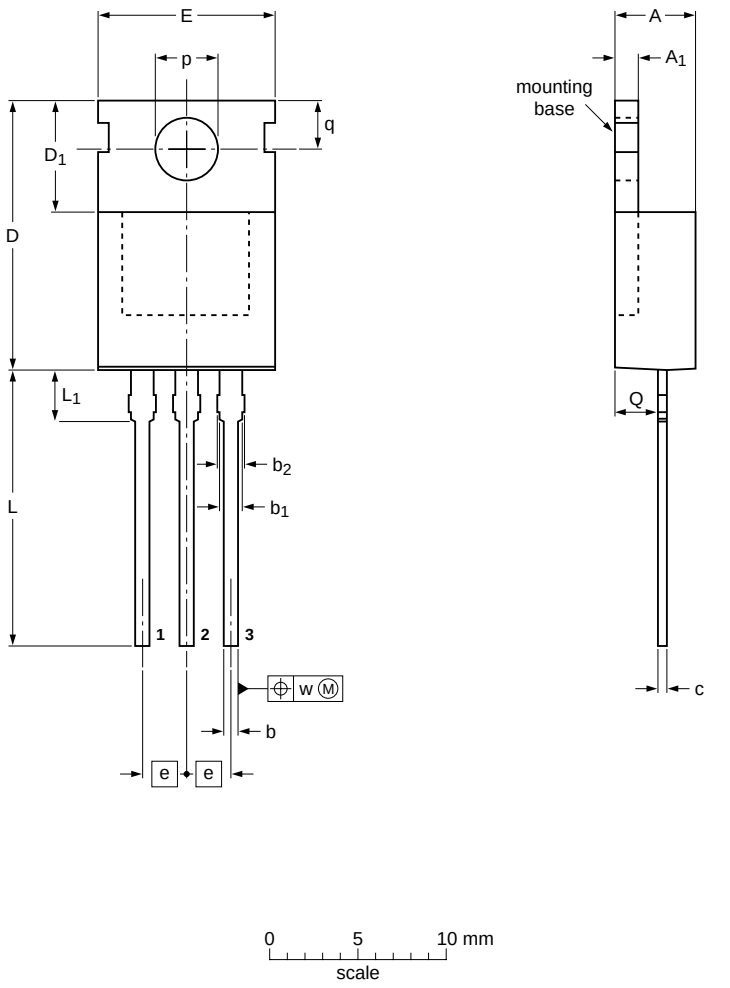


Fig 11. Normalized holding current as a function of junction temperature

9. Package outline

Plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 **SOT78D**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	b_1	b_2	c	D	D_1 ref	E	e	L	L_1 ref	p	Q	q	w
mm	4.7 4.3	1.40 1.25	0.9 0.6	1.4 1.1	1.72 1.32	0.6 0.4	16.0 15.2	6.5	10.3 9.7	2.54	14.0 12.8	3.0	3.7 3.5	2.6 2.2	3.0 2.7	0.2

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78D		TO-220				~~07-04-04~~ 07-07-10

Fig 12. Package outline SOT78D (TO-220)

10. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BTA412Y_SER_B_C_2	20080311	Product data sheet	-	BTA412Y_SER_B_C_1
Modifications:	• Table 3 “Limiting values” uprated values for I_{GM} and $P_{G(AV)}$ • Table 3 “Limiting values” updated I^2t condition symbol			
BTA412Y_SER_B_C_1	20071003	Product data sheet	-	-

11. Legal information

11.1 Data sheet status

Document status[1][2]	Product status[3]	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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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13. Contents

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Date of release: 11 March 2008

Document identifier: BTA412Y_SER_B_C_2