

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

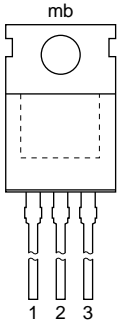

- Heating and cooking appliances
- High power motor control e.g. vacuum cleaners
- Solid state relays
- Non-linear rectifier-fed motor loads
- Electronic thermostats for heating and cooling loads

1.4 Quick reference data

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

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		Version
	Name	Description	
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).

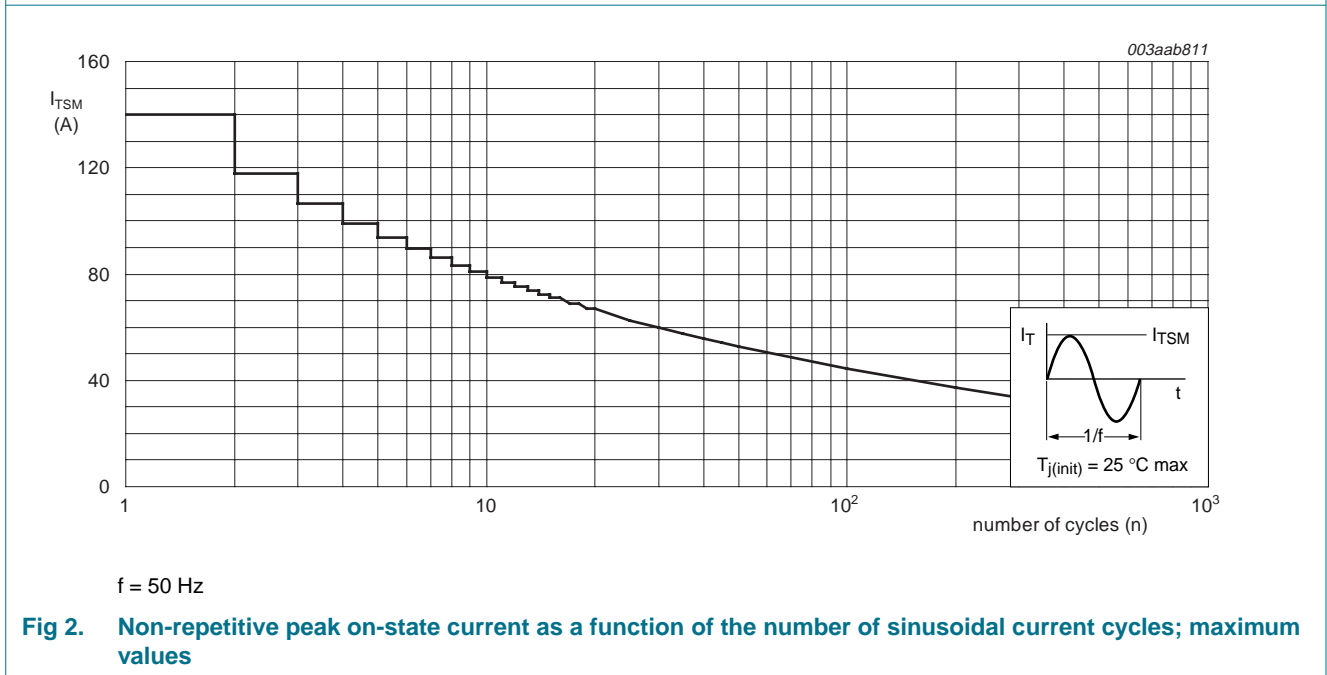
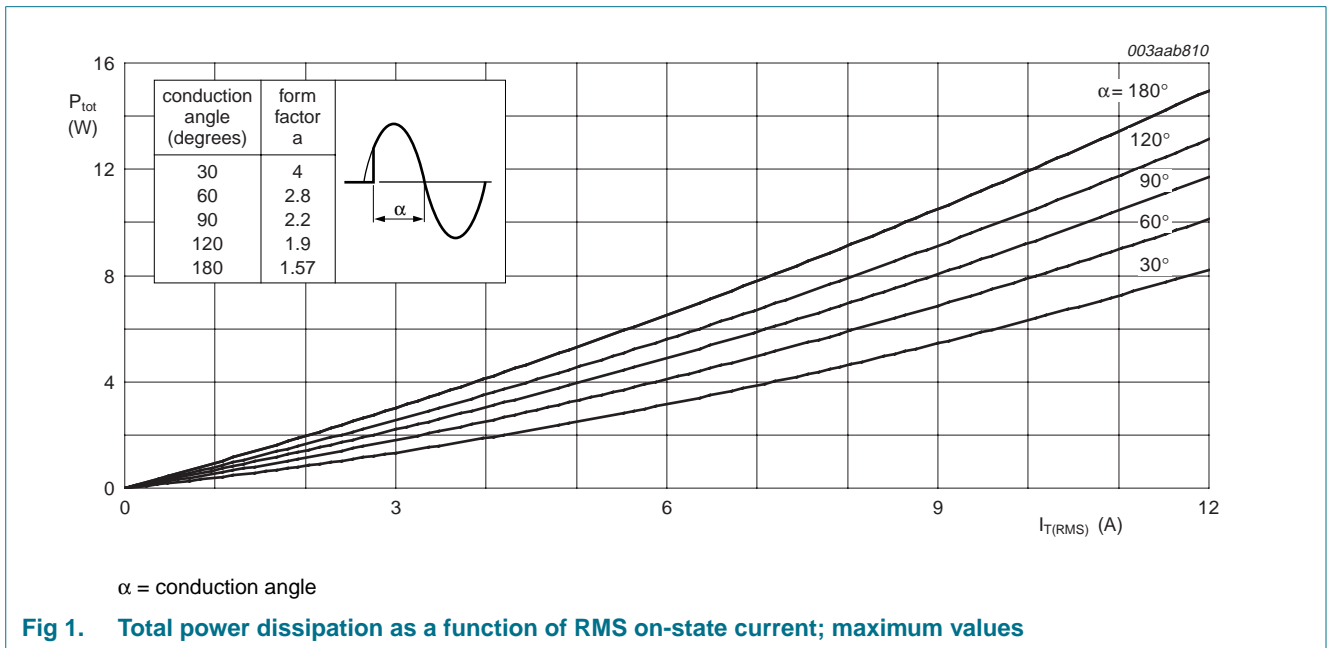
Symbol	Parameter	Conditions	Min	Max	Unit
V_{DRM}	repetitive peak off-state voltage	BTA412Y-600B; BTA412Y-600C	[1]	600	V
		BTA412Y-800B; BTA412Y-800C	-	800	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 116\text{ °C}$; see Figure 4 and 5	-	12	A
I_{TSM}	non-repetitive peak on-state current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

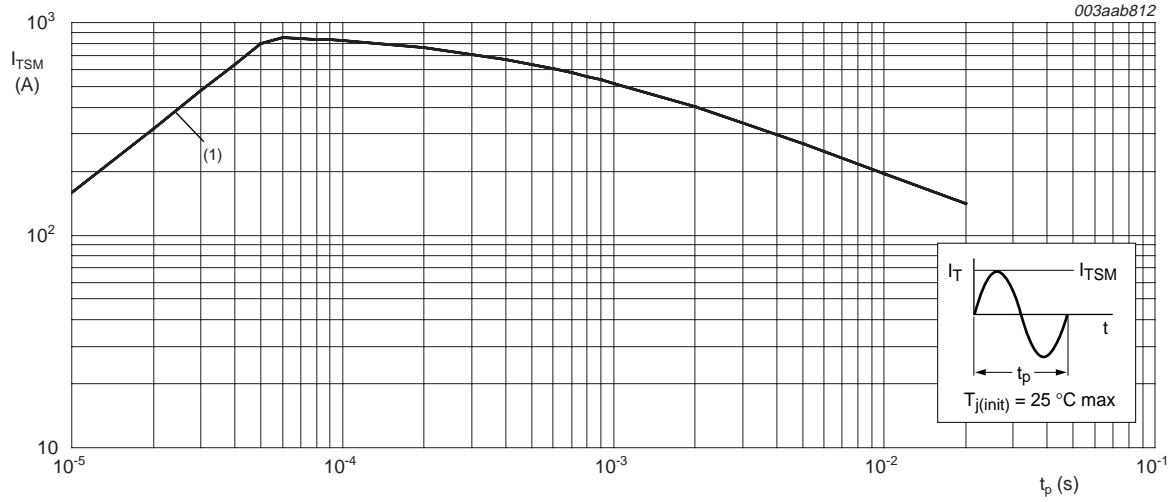
Table 3. Limiting values ...continued

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

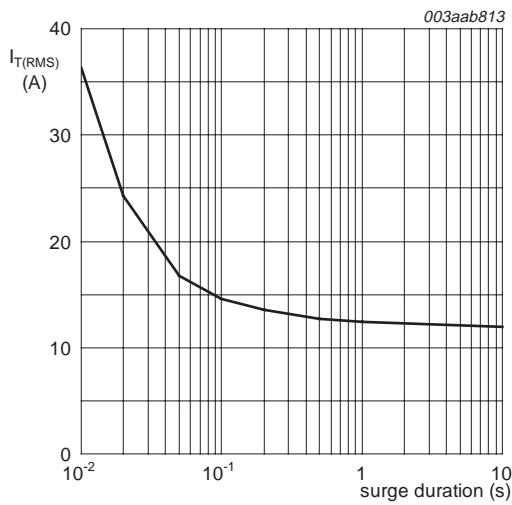
[1] Although not recommended, off-state voltages up to 800 V may be applied without damage, but the triac may switch to the on-state. The rate of rise of current should not exceed 15 A/ μ s.





$t_p \leq 20 \text{ ms}$
 (1) di_T/dt limit

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



$f = 50 \text{ Hz}$
 $T_{mb} = 116 \text{ °C}$

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

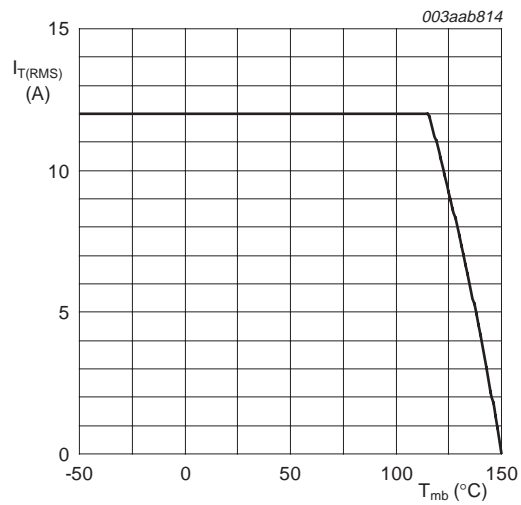


Fig 5. RMS on-state current as a function of mounting base temperature; maximum values

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

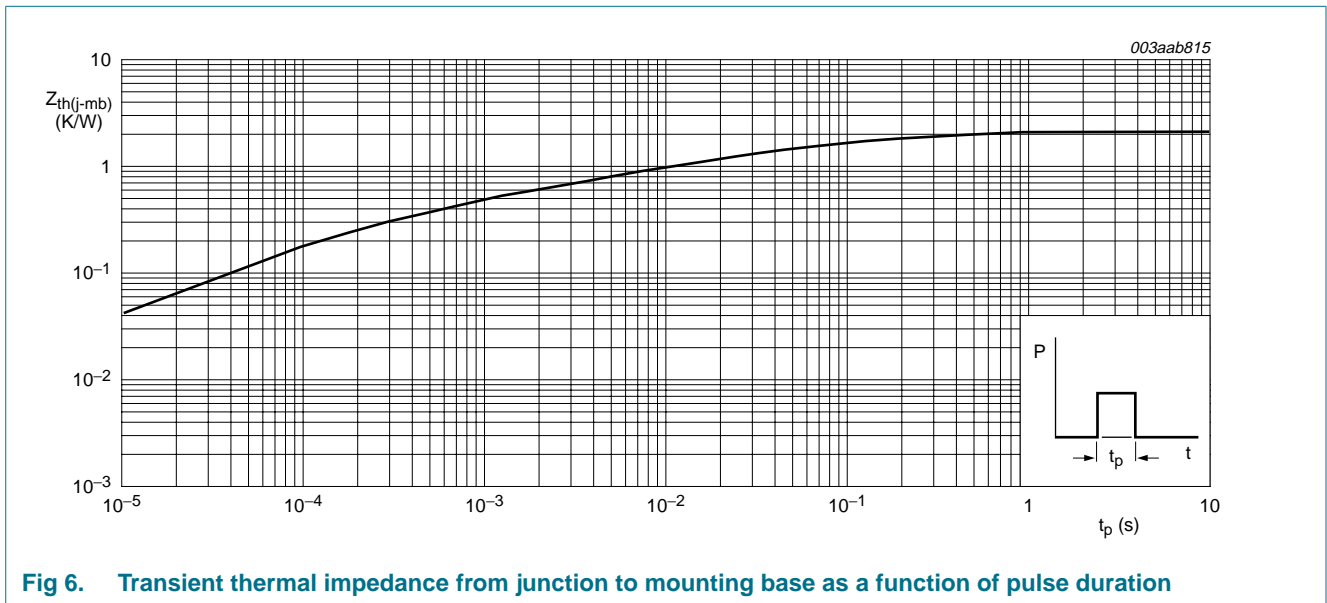


Fig 6. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Isolation characteristics

Table 5. Isolation limiting values and characteristics

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

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

7. Static characteristics

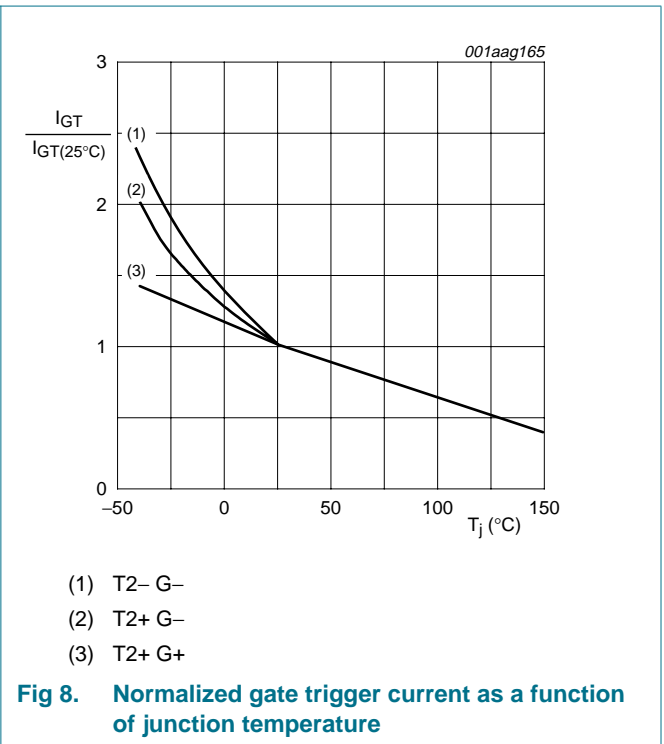
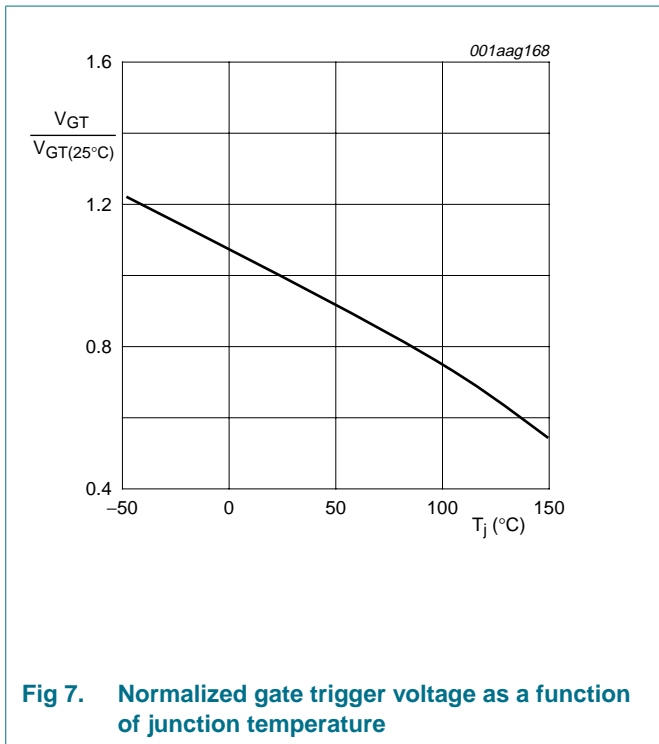
Table 6. Static characteristics
T_j = 25 °C unless otherwise specified.

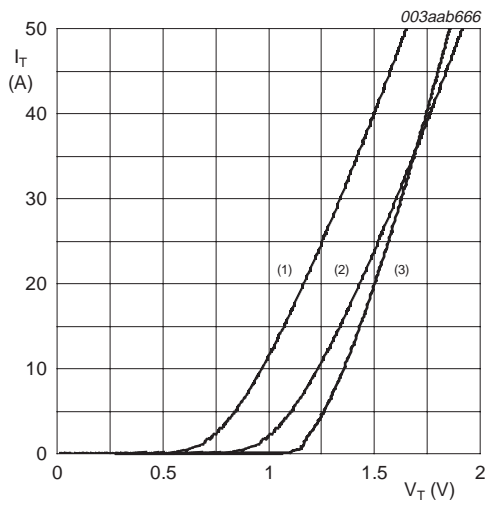
Symbol	Parameter	Conditions	BTA412Y-600B BTA412Y-800B			BTA412Y-600C BTA412Y-800C			Unit
			Min	Typ	Max	Min	Typ	Max	
I _{GT}	gate trigger current	V _D = 12 V; I _T = 0.1 A; see Figure 8							
		T2+ G+	2	-	50	2	-	35	mA
		T2+ G-	2	-	50	2	-	35	mA
I _L	latching current	V _D = 12 V; I _G = 0.1 A; see Figure 10							
		T2+ G+	-	-	60	-	-	50	mA
		T2+ G-	-	-	90	-	-	60	mA
I _H	holding current	V _D = 12 V; I _G = 0.1 A; see Figure 11	-	-	60	-	-	35	mA
		T2- G-	-	-	60	-	-	50	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								
			$T_j = 125\text{ }^\circ\text{C}$	1000	-	-	500	-	-	V/ μs
			$T_j = 150\text{ }^\circ\text{C}$	600	-	-	300	-	-	V/ μs
di_{com}/dt	rate of change of commutating current	$V_{DM} = 400\text{ V}$; $I_{T(RMS)} = 12\text{ A}$; without snubber; gate open circuit								
			$T_j = 125\text{ }^\circ\text{C}$	20	-	-	15	-	-	A/ms
			$T_j = 150\text{ }^\circ\text{C}$	8	-	-	6	-	-	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	-	μs	





$V_o = 1.024 \text{ V}$
 $R_s = 0.021 \text{ } \Omega$
 (1) $T_j = 150 \text{ } ^\circ\text{C}$; typical values
 (2) $T_j = 150 \text{ } ^\circ\text{C}$; maximum values
 (3) $T_j = 25 \text{ } ^\circ\text{C}$; maximum values

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

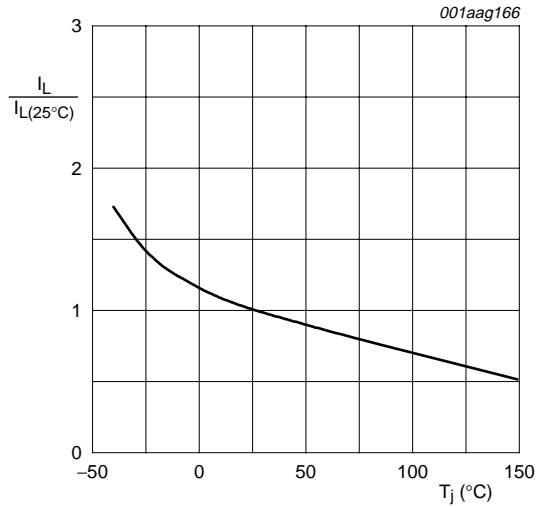


Fig 10. Normalized latching current as a function of junction temperature

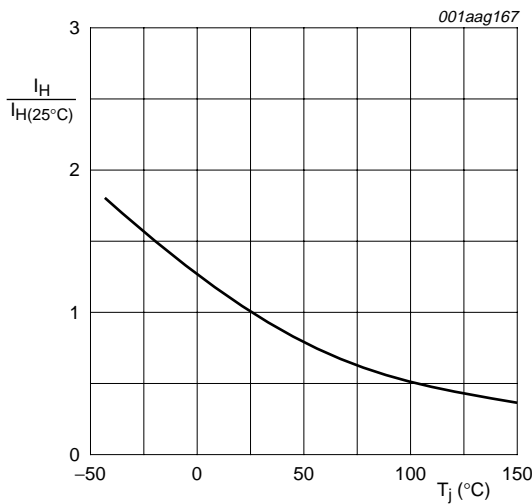


Fig 11. Normalized holding current as a function of junction temperature

9. Package outline

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

SOT78D

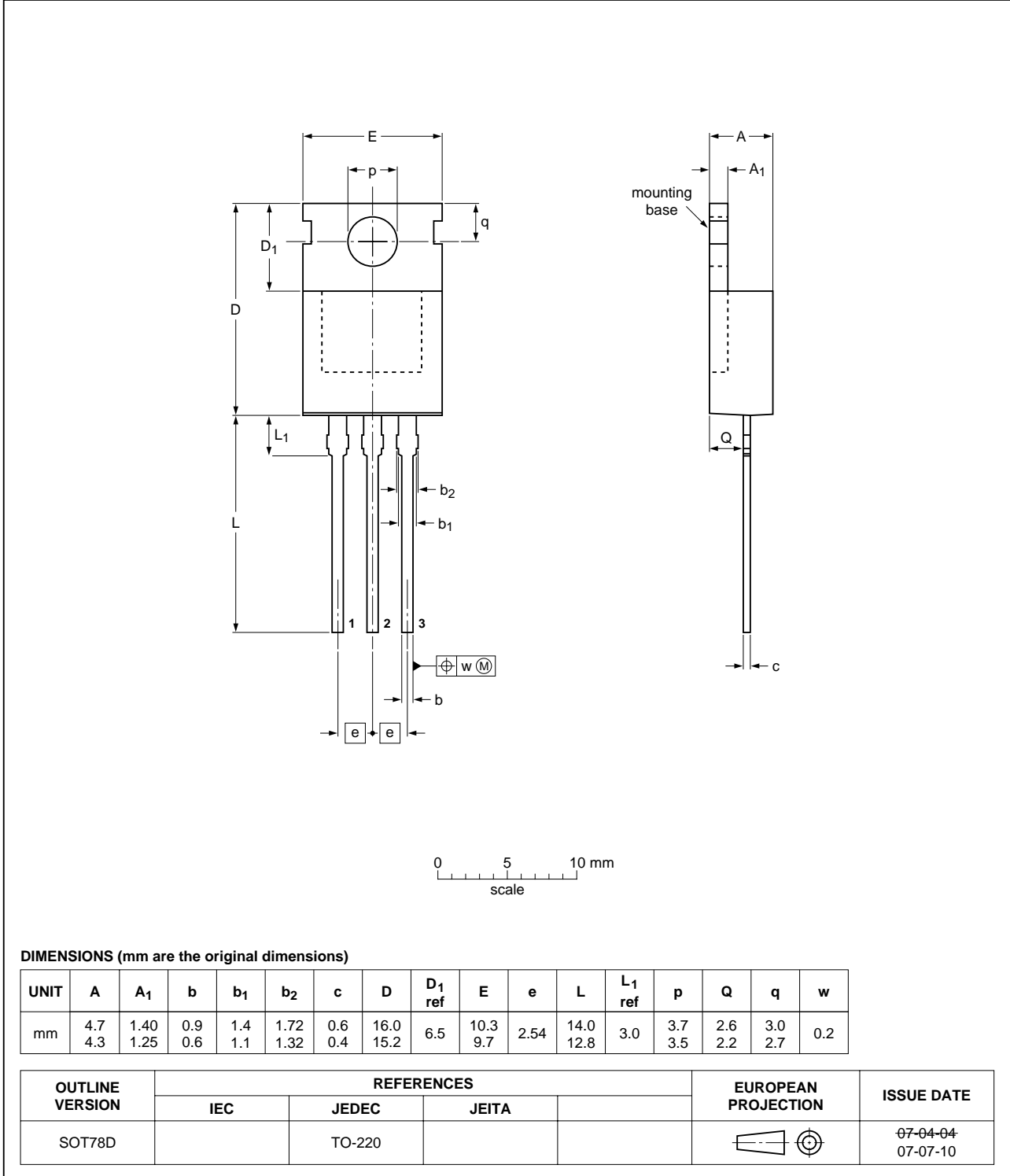


Fig 12. Package outline SOT78D (TO-220)

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:	<ul style="list-style-type: none"> • Table 3 “Limiting values” updated 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	-	-

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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.
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[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".

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