

# 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

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### 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

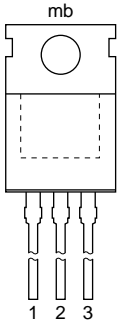

- Heating and cooking appliances
- High power motor control e.g. vacuum cleaners
- Solid state relays
- Non-linear rectifier-fed motor loads
- Electronic thermostats for heating and cooling loads

### 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		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).

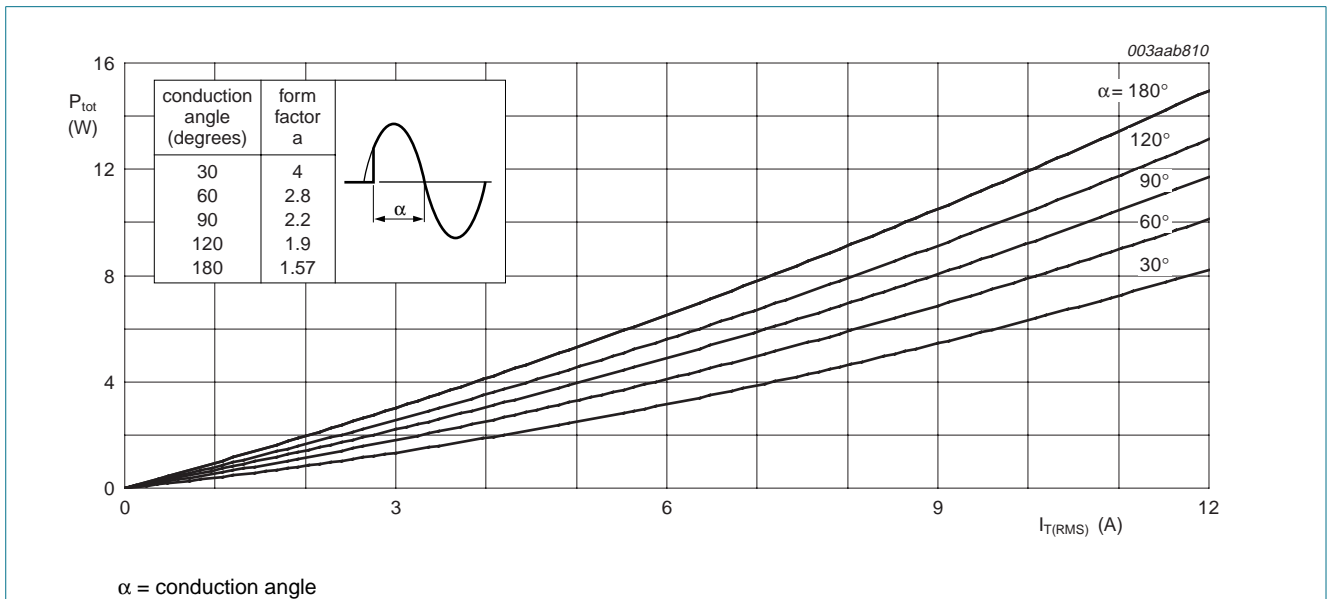
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage	BTA412Y-600B; BTA412Y-600C	[1]	600	V
		BTA412Y-800B; BTA412Y-800C	-	800	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 116\text{ °C}$ ; see <a href="#">Figure 4</a> and <a href="#">5</a>	-	12	A
$I_{TSM}$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

**Table 3. Limiting values ...continued**

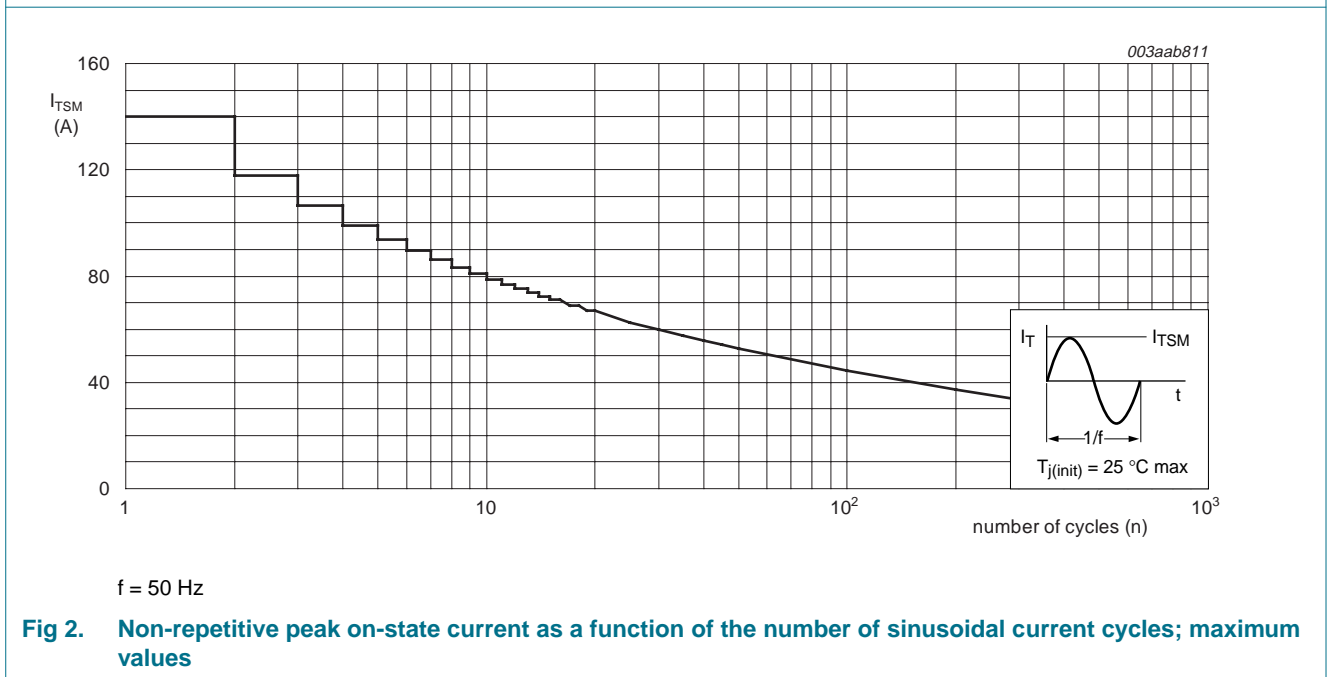
In accordance with the Absolute Maximum Rating System (IEC 60134).

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

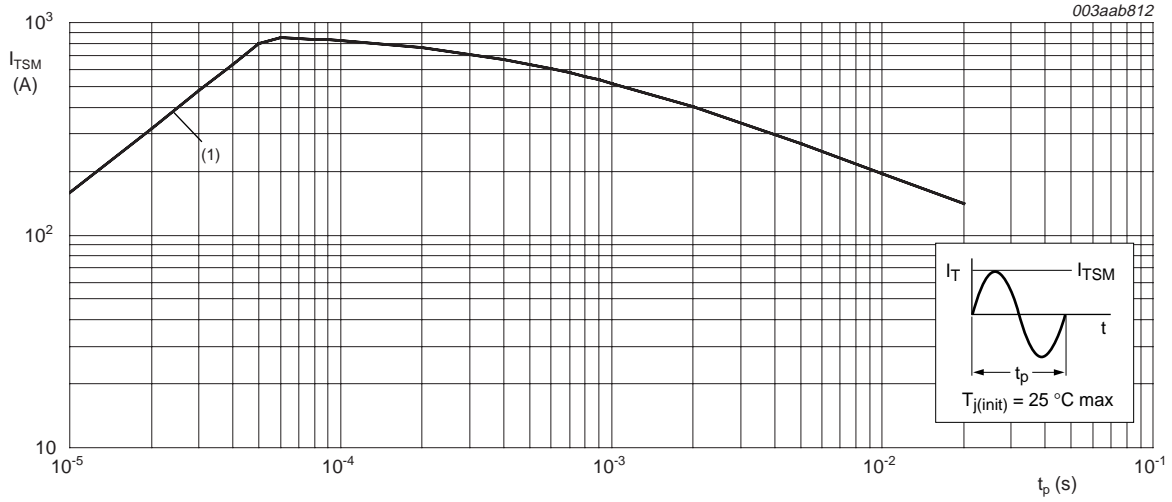
[1] Although not recommended, off-state voltages up to 800 V may be applied without damage, but the triac may switch to the on-state. The rate of rise of current should not exceed 15 A/μs.



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

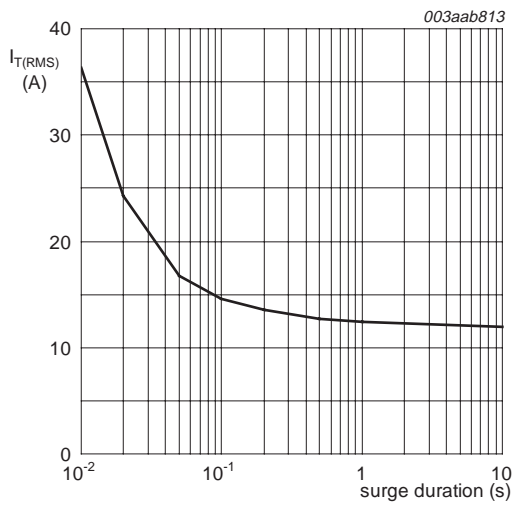


**Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values**



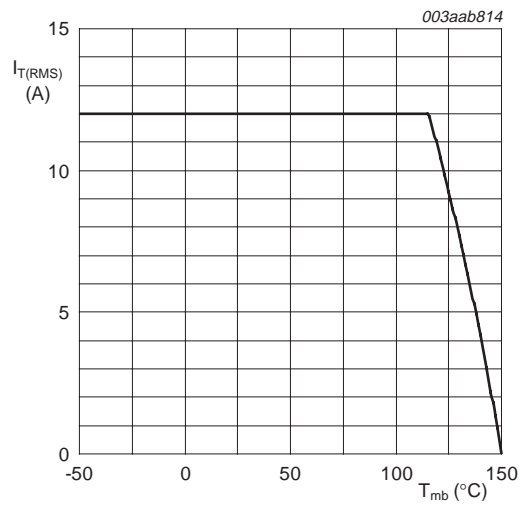
$t_p \leq 20 \text{ ms}$   
 (1)  $di_T/dt$  limit

**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**

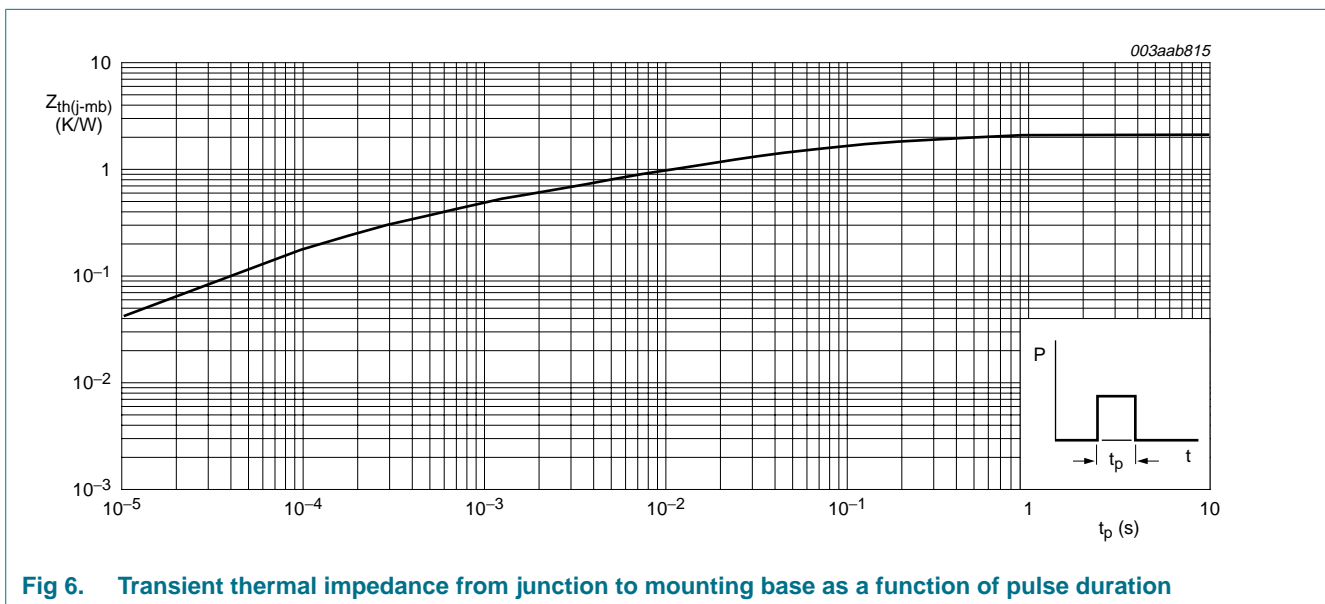


**Fig 5. RMS on-state current as a function of mounting base temperature; maximum values**

## 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 <a href="#">Figure 6</a>	-	-	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 $60\text{ Hz}$ ; 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**

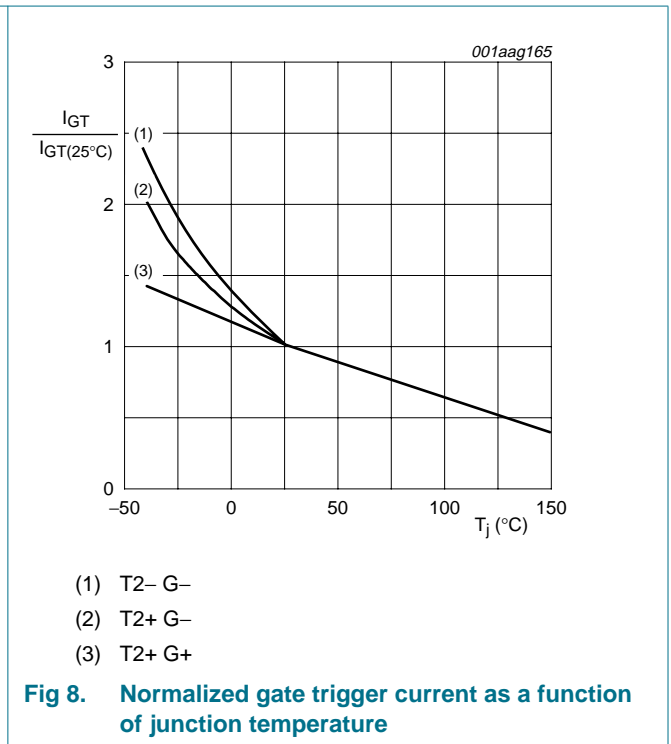
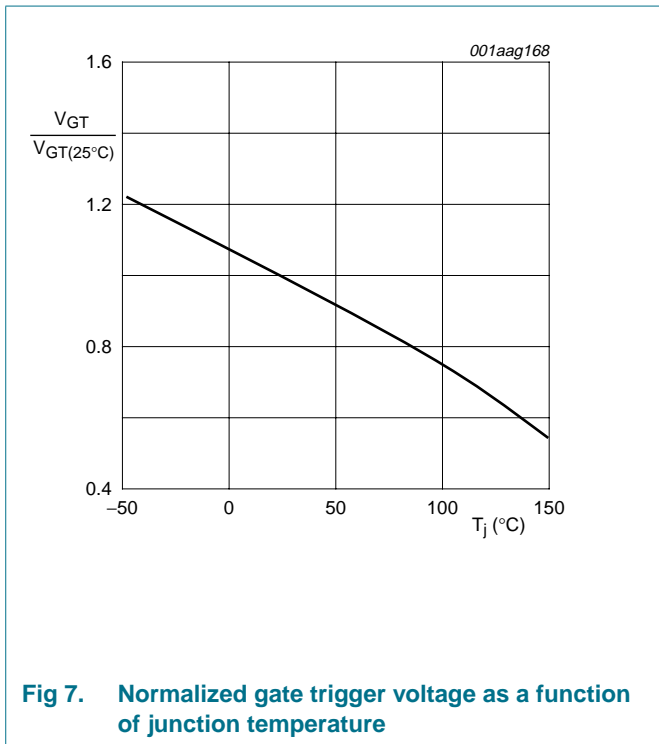
$T_j = 25\text{ °C}$  unless otherwise specified.

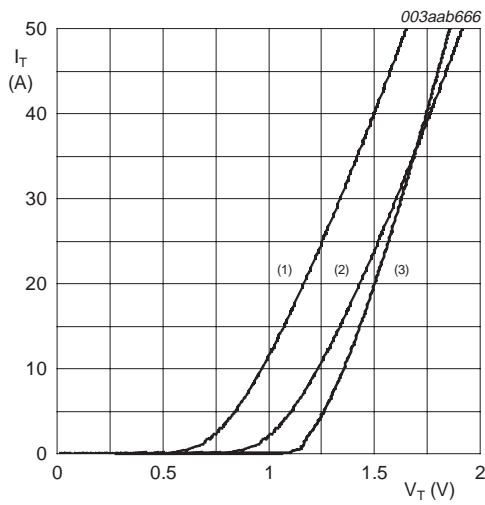
Symbol	Parameter	Conditions	BTA412Y-600B BTA412Y-800B			BTA412Y-600C BTA412Y-800C			Unit
			Min	Typ	Max	Min	Typ	Max	
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; see <a href="#">Figure 8</a>							
		T2+ G+	2	-	50	2	-	35	mA
		T2+ G-	2	-	50	2	-	35	mA
$I_L$	latching current	$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; see <a href="#">Figure 10</a>							
		T2+ G+	-	-	60	-	-	50	mA
		T2+ G-	-	-	90	-	-	60	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; see <a href="#">Figure 11</a>	-	-	60	-	-	35	mA
		T2- G-	-	-	60	-	-	50	mA
$V_T$	on-state voltage	$I_T = 18\text{ A}$ ; see <a href="#">Figure 9</a>	-	1.3	1.5	-	1.3	1.5	V
$V_{GT}$	gate trigger voltage	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; see <a href="#">Figure 7</a>	-	0.8	1.5	-	0.8	1.5	V
		$V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 150\text{ °C}$	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	mA
		$V_D = V_{DRM(max)}$ ; $T_j = 150\text{ °C}$	-	0.4	2	-	0.4	2	mA

**8. Dynamic characteristics**

**Table 7. Dynamic characteristics**

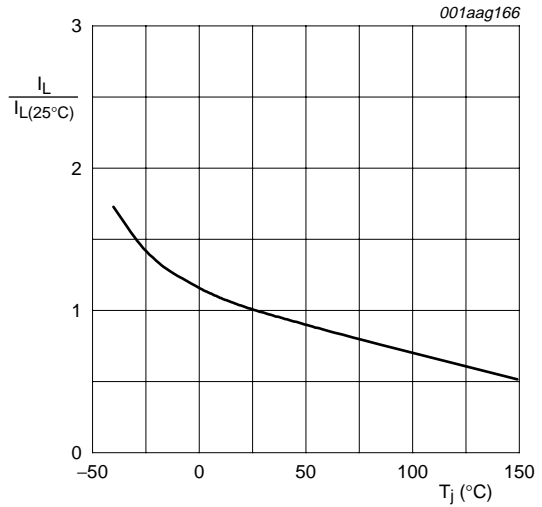
Symbol	Parameter	Conditions	BTA412Y-600B BTA412Y-800B			BTA412Y-600C BTA412Y-800C			Unit	
			Min	Typ	Max	Min	Typ	Max		
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 0.67 \times V_{DRM(max)}$ ; exponential waveform; gate open circuit								
			$T_j = 125\text{ }^\circ\text{C}$	1000	-	-	500	-	-	V/ $\mu\text{s}$
			$T_j = 150\text{ }^\circ\text{C}$	600	-	-	300	-	-	V/ $\mu\text{s}$
$di_{com}/dt$	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	-	$\mu\text{s}$	



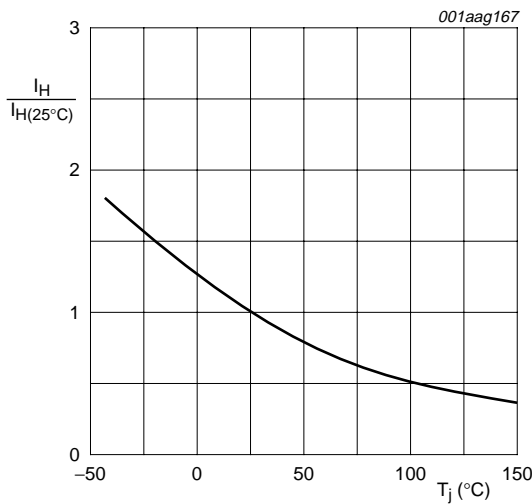


$V_o = 1.024 \text{ V}$   
 $R_s = 0.021 \text{ } \Omega$   
 (1)  $T_j = 150 \text{ } ^\circ\text{C}$ ; typical values  
 (2)  $T_j = 150 \text{ } ^\circ\text{C}$ ; maximum values  
 (3)  $T_j = 25 \text{ } ^\circ\text{C}$ ; maximum values

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



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



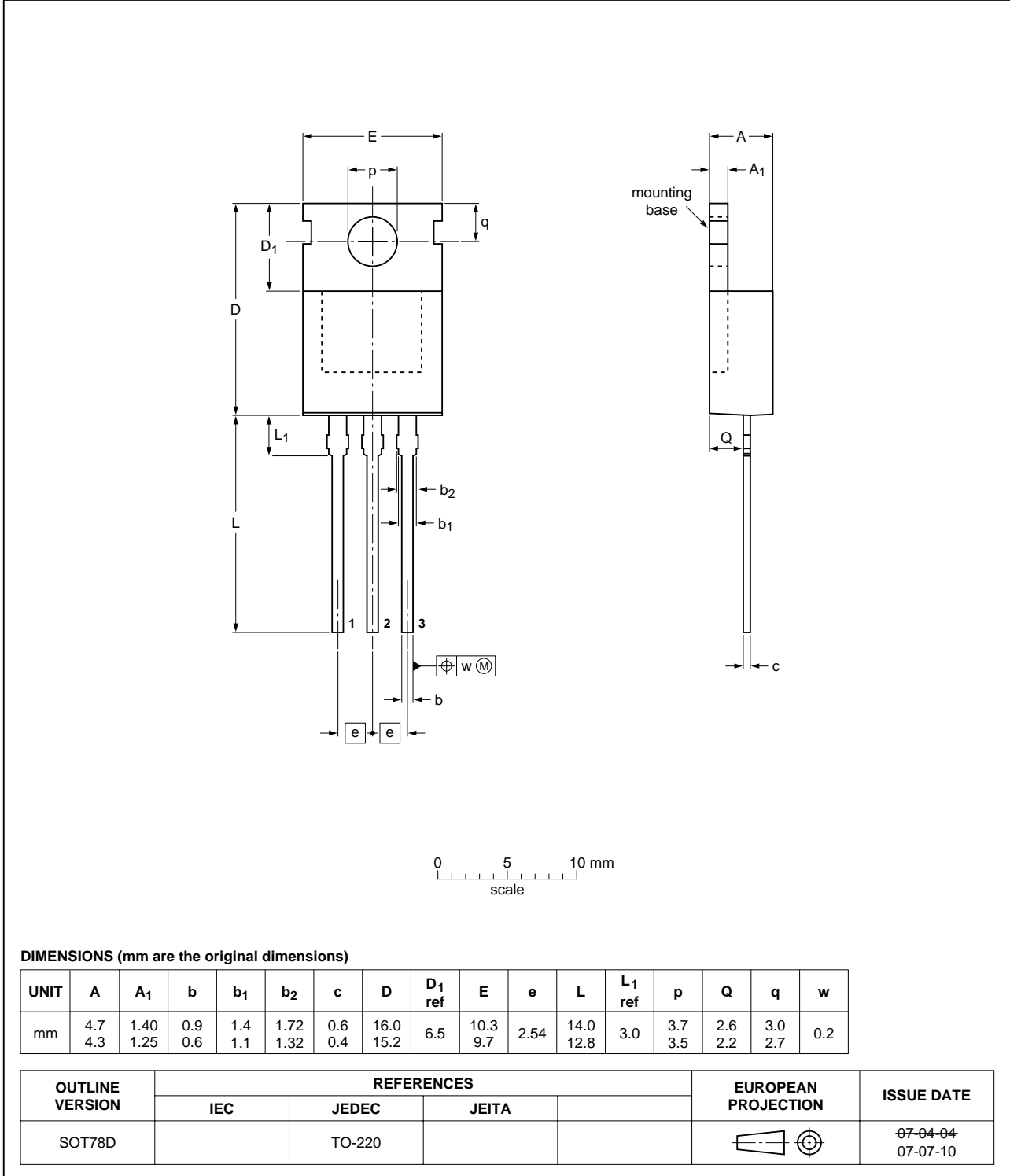
**Fig 11. Normalized holding current as a function of junction temperature**



**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"> <li>• <a href="#">Table 3 “Limiting values”</a> updated values for <math>I_{GM}</math> and <math>P_{G(AV)}</math></li> <li>• <a href="#">Table 3 “Limiting values”</a> updated <math>I^2t</math> condition symbol</li> </ul>			
BTA412Y_SER_B_C_1	20071003	Product data sheet	-	-

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### 11.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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".

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