



# BTA416Y-600B

## 3Q Hi-Com Triac

Rev. 3 — 27 June 2011

Product data sheet

## 1. Product profile

### 1.1 General description

Planar passivated high commutation three quadrant triac in a SOT78D (TO-220AB) plastic package intended for use in circuits where high static and dynamic  $dV/dt$  and high  $dI/dt$  can occur. This "series B" triac will commute the full RMS current at the maximum rated junction temperature without the aid of a snubber. This device has high junction temperature operating capability and an internally isolated mounting base.

### 1.2 Features and benefits

- 2500 V RMS isolation voltage capability
- 3Q technology for improved noise immunity
- High commutation capability with maximum false trigger immunity
- High immunity to false turn-on by  $dV/dt$
- High junction temperature operating capability
- High surge capability
- High voltage capability
- Internally insulated package
- Internally isolated mounting base
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only

### 1.3 Applications

- Electronic thermostats (heating and cooling)
- High power motor controls e.g. vacuum cleaners
- Rectifier-fed DC inductive loads e.g. DC motors and solenoids

### 1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage		-	-	600	V
$I_{TSM}$	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 20\text{ ms}$ ; see <a href="#">Figure 4</a> ; see <a href="#">Figure 5</a>	-	-	160	A
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 108\text{ °C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a> ; see <a href="#">Figure 3</a>	-	-	16	A

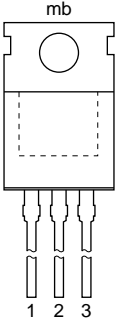



**Table 1. Quick reference data ...continued**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2+ G+;$ $T_j = 25\text{ }^\circ\text{C};$ see <a href="#">Figure 7</a>	2	-	50	mA
		$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2+ G-;$ $T_j = 25\text{ }^\circ\text{C};$ see <a href="#">Figure 7</a>	2	-	50	mA
		$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2- G-;$ $T_j = 25\text{ }^\circ\text{C};$ see <a href="#">Figure 7</a>	2	-	50	mA

## 2. Pinning information

**Table 2. Pinning information**

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	T1	main terminal 1		 sym051
2	T2	main terminal 2		
3	G	gate		
mb	n.c.	mounting base; isolated		

**SOT78D (TO-220AB)**

## 3. Ordering information

**Table 3. Ordering information**

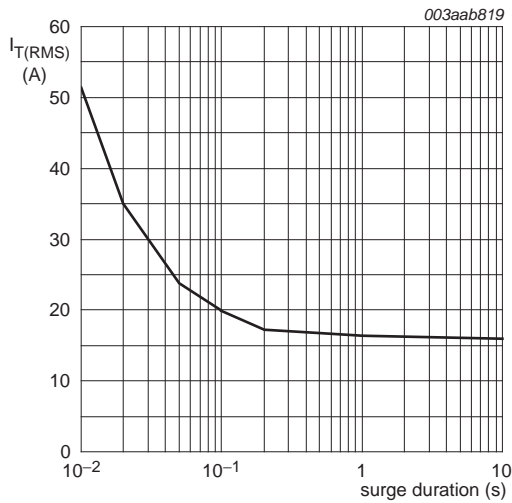
Type number	Package		Version
	Name	Description	
BTA416Y-600B	TO-220AB	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220	SOT78D

## 4. Limiting values

**Table 4. Limiting values**

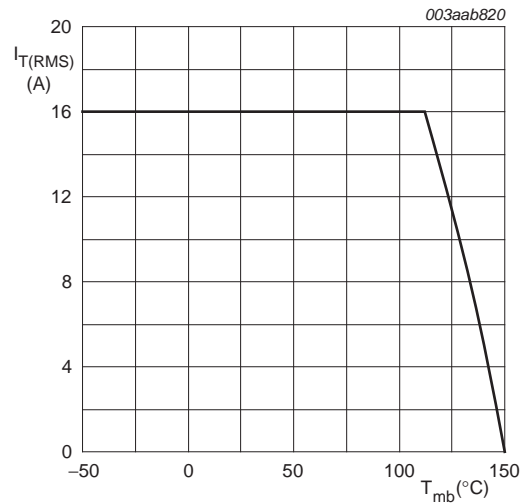
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage		-	600	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 108\text{ °C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a> ; see <a href="#">Figure 3</a>	-	16	A
$I_{TSM}$	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 20\text{ ms}$ ; see <a href="#">Figure 4</a> ; see <a href="#">Figure 5</a>	-	160	A
		full sine wave; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 16.7\text{ ms}$	-	176	A
$I^2t$	$I^2t$ for fusing	$t_p = 10\text{ ms}$ ; sine-wave pulse	-	128	A <sup>2</sup> s
$dl_T/dt$	rate of rise of on-state current	$I_T = 20\text{ A}$ ; $I_G = 0.2\text{ A}$ ; $dl_G/dt = 0.2\text{ A}/\mu\text{s}$	-	100	A/ $\mu\text{s}$
$I_{GM}$	peak gate current		-	4	A
$P_{GM}$	peak gate power		-	5	W
$P_{G(AV)}$	average gate power	over any 20 ms period	-	1	W
$T_{stg}$	storage temperature		-40	150	°C
$T_j$	junction temperature		-	150	°C



$f = 50\text{ Hz}$ ;  
 $T_{mb} = 108\text{ °C}$

**Fig 1. RMS on-state current as a function of surge duration; maximum values**



**Fig 2. RMS on-state current as a function of mounting base temperature; maximum values**

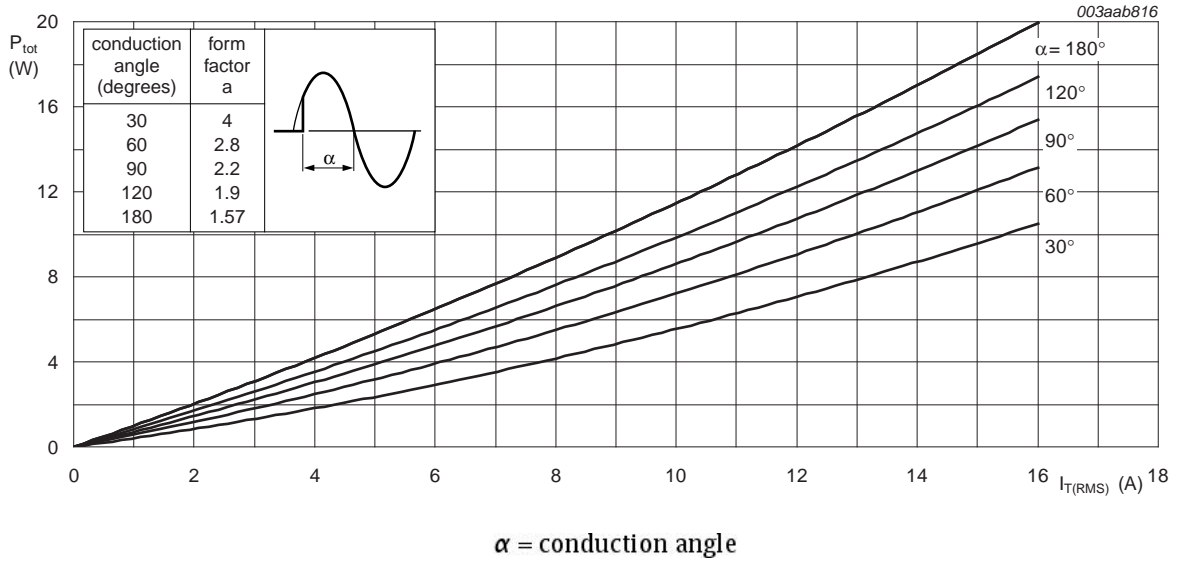


Fig 3. Total power dissipation as a function of RMS on-state current; maximum values

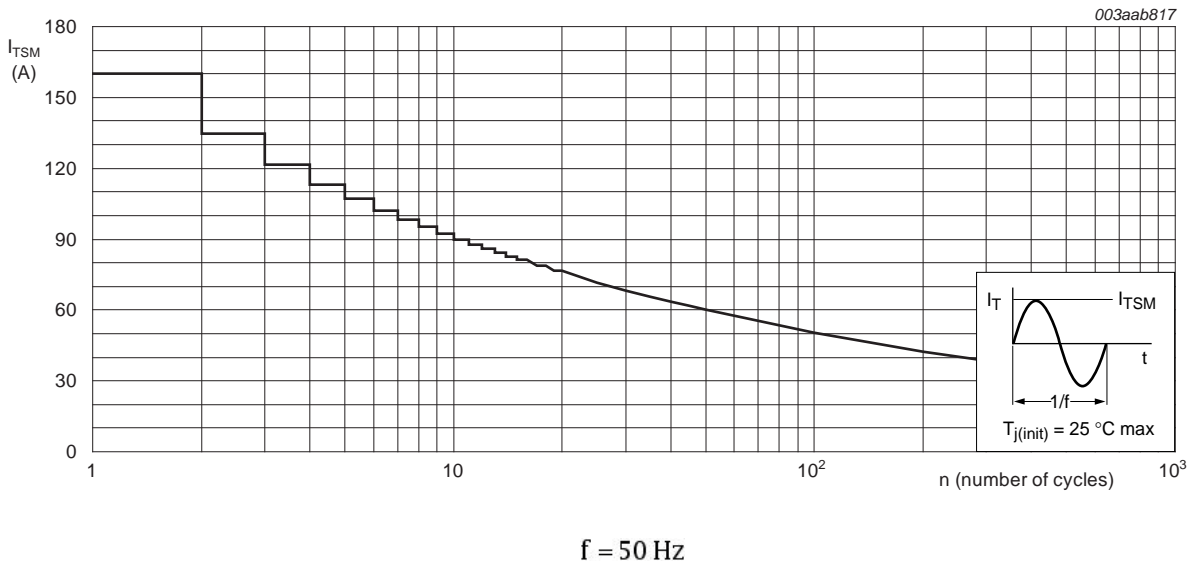
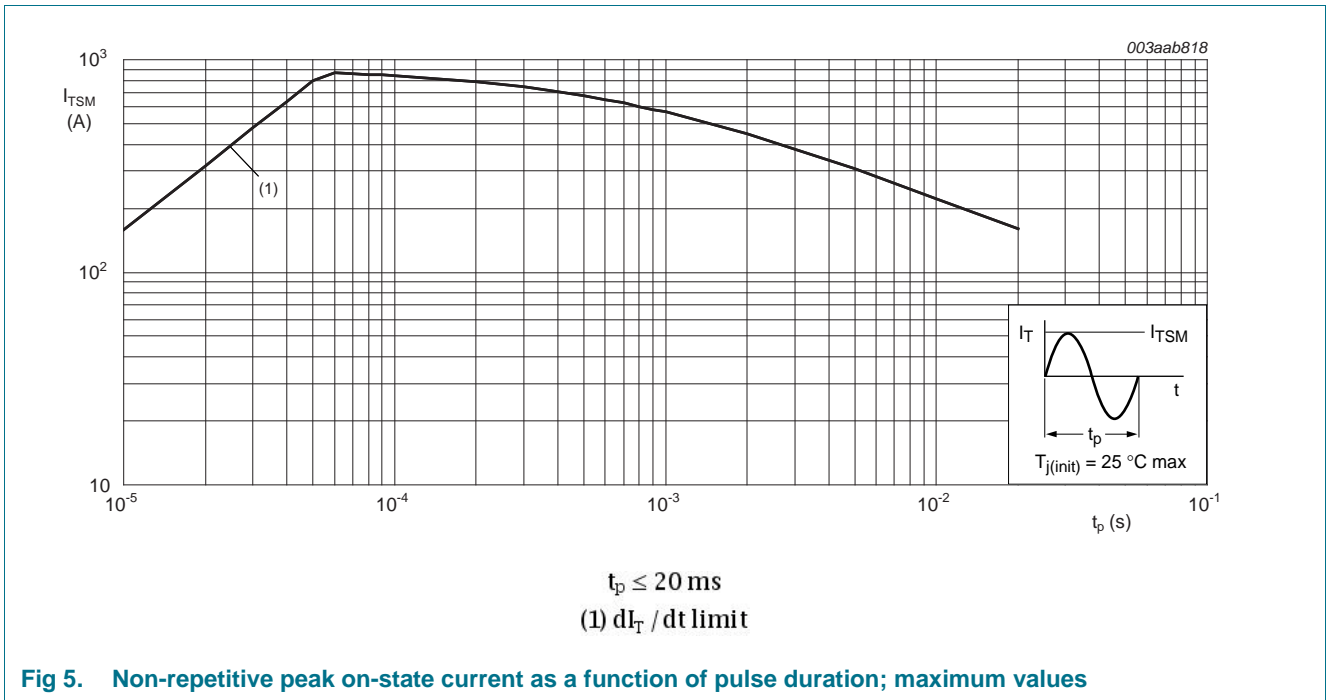


Fig 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

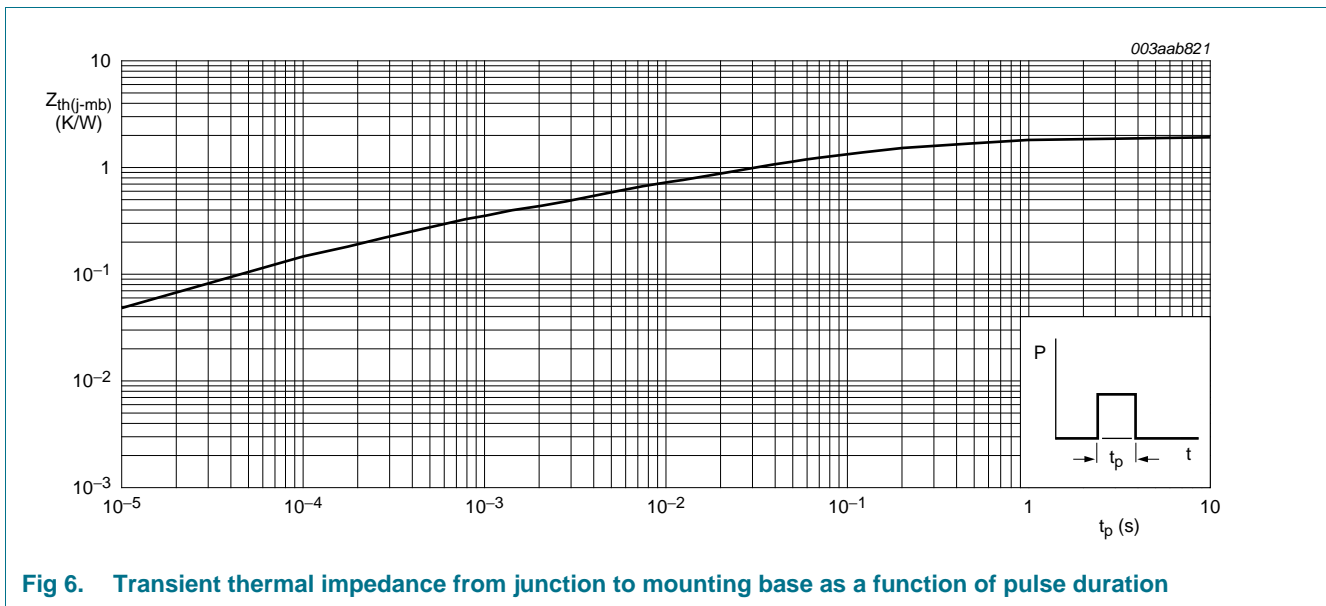


**Fig 5. Non-repetitive peak on-state current as a function of pulse duration; maximum values**

## 5. Thermal characteristics

**Table 5. 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>	-	-	1.9	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

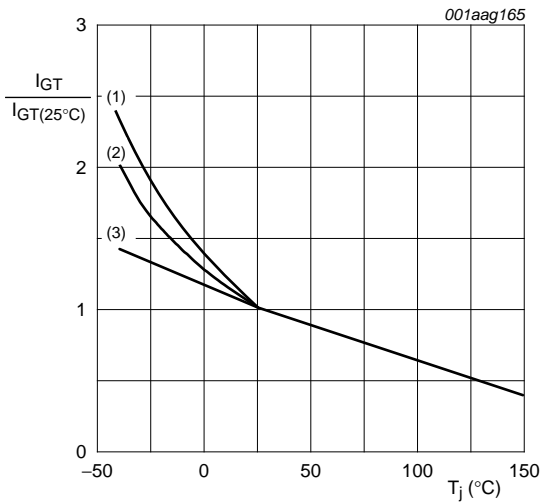
**Table 6. Isolation characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	from all terminals to external heatsink; sinusoidal waveform; clean and dust free ; 50 Hz ≤ f ≤ 60 Hz; RH ≤ 65 %; $T_{mb} = 25\text{ °C}$	-	-	2500	V
$C_{isol}$	isolation capacitance	from main terminal 2 to external heatsink ; f = 1 MHz; $T_{mb} = 25\text{ °C}$	-	10	-	pF

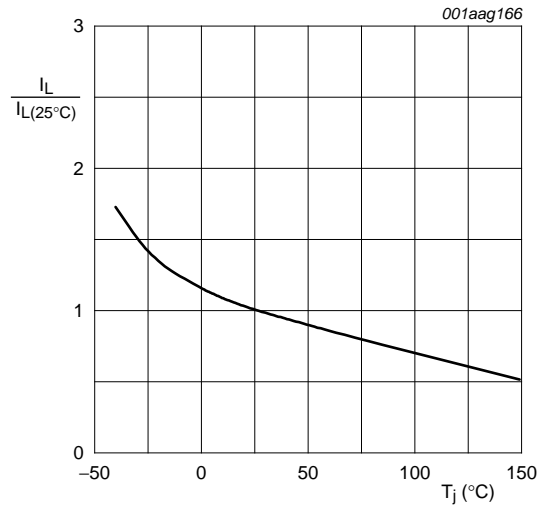
## 7. Characteristics

Table 7. Characteristics

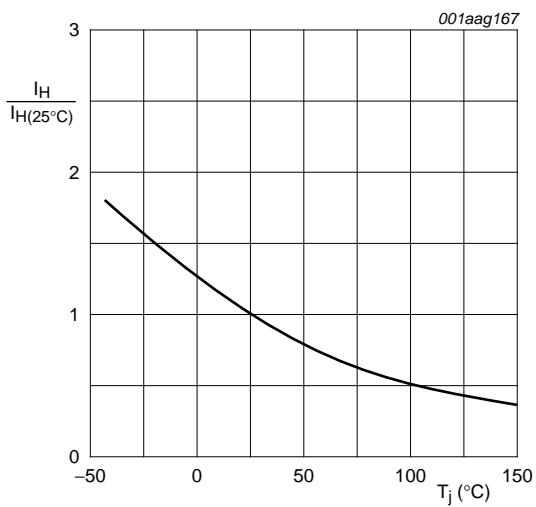
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G+; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 7</a>	2	-	50	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 7</a>	2	-	50	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 7</a>	2	-	50	mA
$I_L$	latching current	$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G+; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 8</a>	-	-	60	mA
		$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G-; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 8</a>	-	-	90	mA
		$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G-; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 8</a>	-	-	60	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 9</a>	-	-	60	mA
$V_T$	on-state voltage	$I_T = 20\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 10</a>	-	1.2	1.5	V
$V_{GT}$	gate trigger voltage	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 11</a>	-	0.7	1.5	V
		$V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 150\text{ °C}$	0.25	0.4	-	V
$I_D$	off-state current	$V_D = 600\text{ V}$ ; $T_j = 125\text{ °C}$	-	0.1	0.5	mA
		$V_D = 600\text{ V}$ ; $T_j = 150\text{ °C}$	-	0.4	2	mA
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 402\text{ V}$ ; $T_j = 125\text{ °C}$ ; exponential waveform; gate open circuit	1000	-	-	V/ $\mu$ s
		$V_{DM} = 402\text{ V}$ ; $T_j = 150\text{ °C}$ ; exponential waveform; gate open circuit	600	-	-	V/ $\mu$ s
$dI_{com}/dt$	rate of change of commutating current	$V_D = 400\text{ V}$ ; $T_j = 125\text{ °C}$ ; $I_{T(RMS)} = 16\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (without snubber condition); gate open circuit	15	-	-	A/ms
		$V_D = 400\text{ V}$ ; $T_j = 150\text{ °C}$ ; $I_{T(RMS)} = 16\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (without snubber condition); gate open circuit	6	-	-	A/ms
$t_{gt}$	gate-controlled turn-on time	$I_{TM} = 20\text{ A}$ ; $V_D = 600\text{ V}$ ; $I_G = 100\text{ mA}$ ; $dI_G/dt = 5\text{ A}/\mu\text{s}$	-	2	-	$\mu$ s



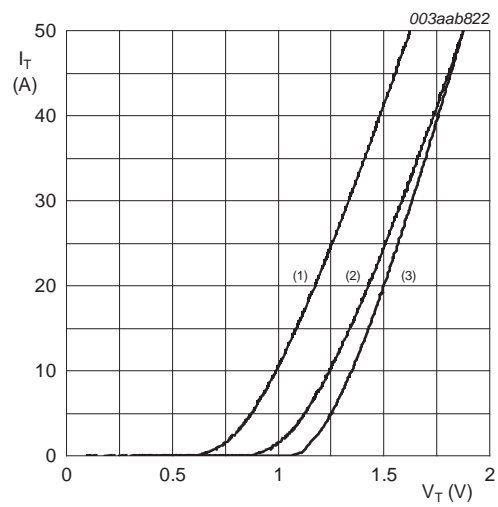
**Fig 7. Normalized gate trigger current as a function of junction temperature**



**Fig 8. Normalized latching current as a function of junction temperature**



**Fig 9. Normalized holding current as a function of junction temperature**



**Fig 10. On-state current as a function of on-state voltage**

$V_o = 1.086 \text{ V}$

$R_s = 0.017 \Omega$

- (1)  $T_j = 150^\circ\text{C}$ ; typical values
- (2)  $T_j = 150^\circ\text{C}$ ; maximum values
- (3)  $T_j = 25^\circ\text{C}$ ; maximum values



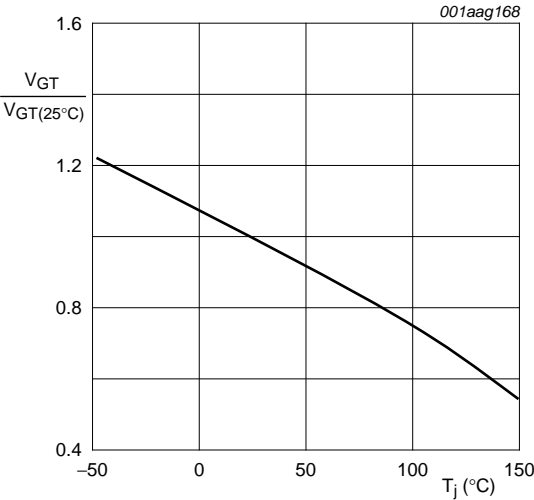


Fig 11. Normalized gate trigger voltage as a function of junction temperature

8. Package outline

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

SOT78D

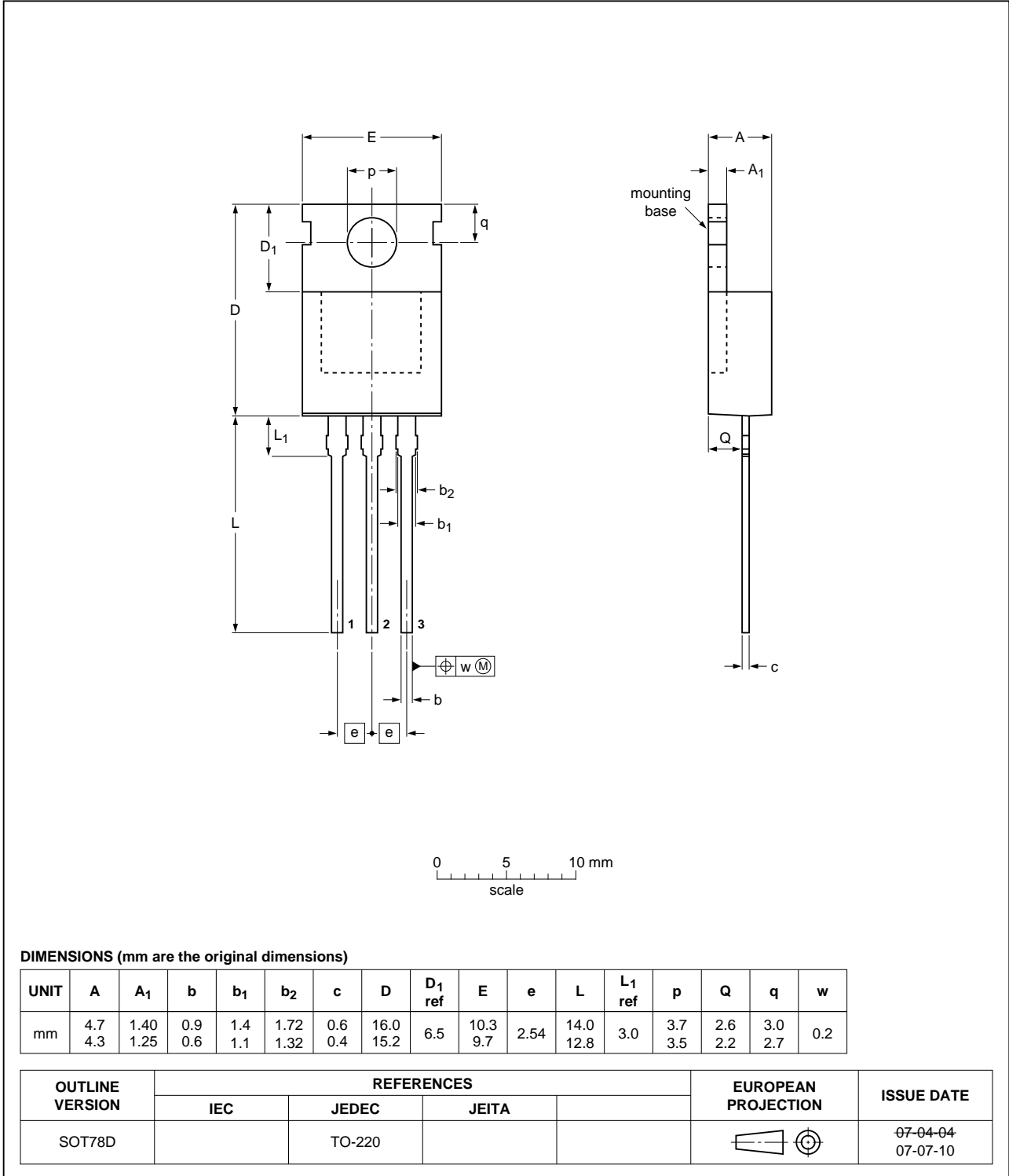


Fig 12. Package outline SOT78D (TO-220AB)

## 9. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BTA416Y-600B v.3	20110627	Product data sheet	-	BTA412Y_SER_B_C v.2
Modifications:	<ul style="list-style-type: none"><li>• Type number BTA416Y-600B separated from data sheet BTA412Y_SER_B_C v.2.</li><li>• Various changes to content.</li></ul>			
BTA412Y_SER_B_C v.2	20080311	Product data sheet	-	-

## 10. Legal information

### 10.1 Data sheet status

Document status <sup>[1]</sup> <sup>[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.

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