

# BTA416Y series B and C

16 A Three-quadrant triacs, insulated, high commutation, high temperature

Rev. 01 — 3 October 2007

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 (BTA416Y-600B and C)
- $V_{DRM} \leq 800$  V (BTA416Y-800B and C)
- $I_{TSM} \leq 160$  A ( $t = 20$  ms)
- $I_{GT} \leq 50$  mA (BTA416Y series B)
- $I_{GT} \leq 35$  mA (BTA416Y series C)
- $I_{T(RMS)} \leq 16$  A

## 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		

SOT78D (TO-220)

### 3. Ordering information

**Table 2.** Ordering information

Type number	Package		
	Name	Description	Version
BTA416Y-600B	TO-220	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220	SOT78D
BTA416Y-600C			
BTA416Y-800B			
BTA416Y-800C			

### 4. Limiting values

**Table 3.** Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{\text{DRM}}$	repetitive peak off-state voltage	BTA416Y-600B; BTA416Y-600C	[1] -	600	V
		BTA416Y-800B; BTA416Y-800C	-	800	V
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_{\text{mb}} \leq 108\text{ °C}$ ; see <a href="#">Figure 4</a> and <a href="#">5</a>	-	16	A
$I_{\text{TSM}}$	non-repetitive peak on-state current	full sine wave; $T_{\text{j}} = 25\text{ °C}$ prior to surge; see <a href="#">Figure 2</a> and <a href="#">3</a>			
		$t = 20\text{ ms}$	-	160	A
		$t = 16.7\text{ ms}$	-	176	A
$I^2t$	$I^2t$ for fusing	$t = 10\text{ ms}$	-	128	A <sup>2</sup> s
$di_{\text{T}}/dt$	rate of rise of on-state current	$I_{\text{TM}} = 20\text{ A}$ ; $I_{\text{G}} = 0.2\text{ A}$ ; $di_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$	-	100	A/ $\mu\text{s}$
$I_{\text{GM}}$	peak gate current		-	2	A
$P_{\text{GM}}$	peak gate power		-	5	W
$P_{\text{G(AV)}}$	average gate power	over any 20 ms period	-	0.5	W
$T_{\text{stg}}$	storage temperature		-40	+150	°C
$T_{\text{j}}$	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/ $\mu\text{s}$ .

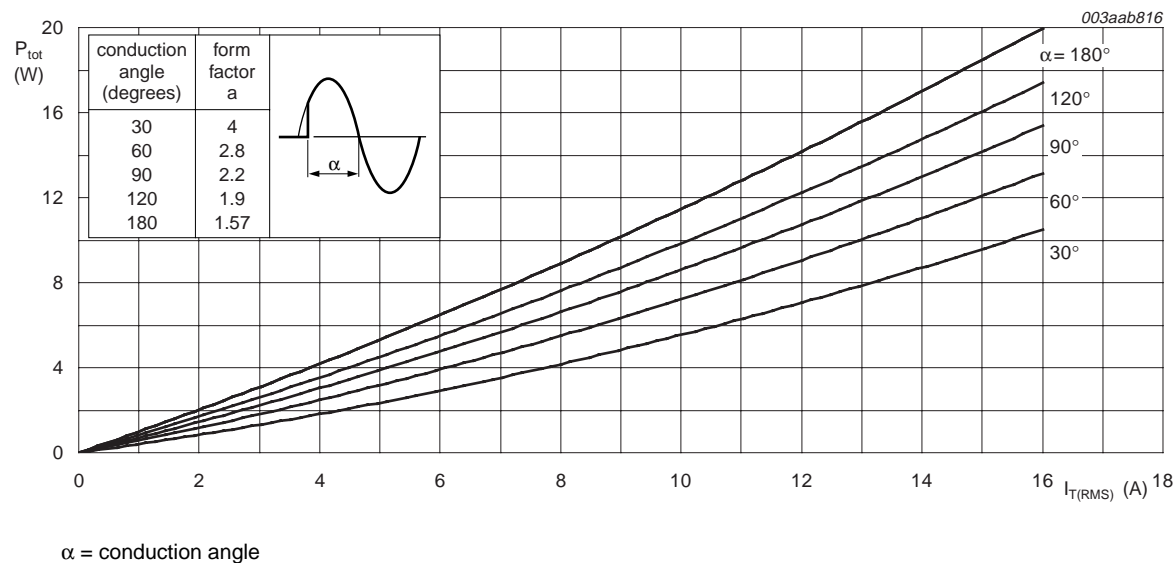


Fig 1. Total power dissipation as a function of RMS on-state current; maximum values

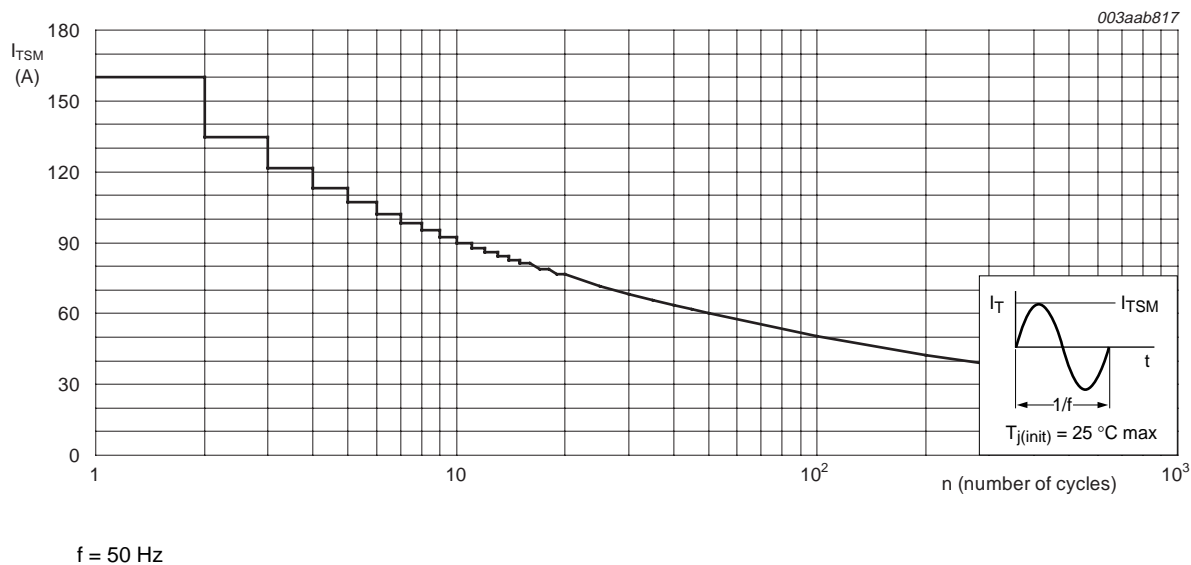
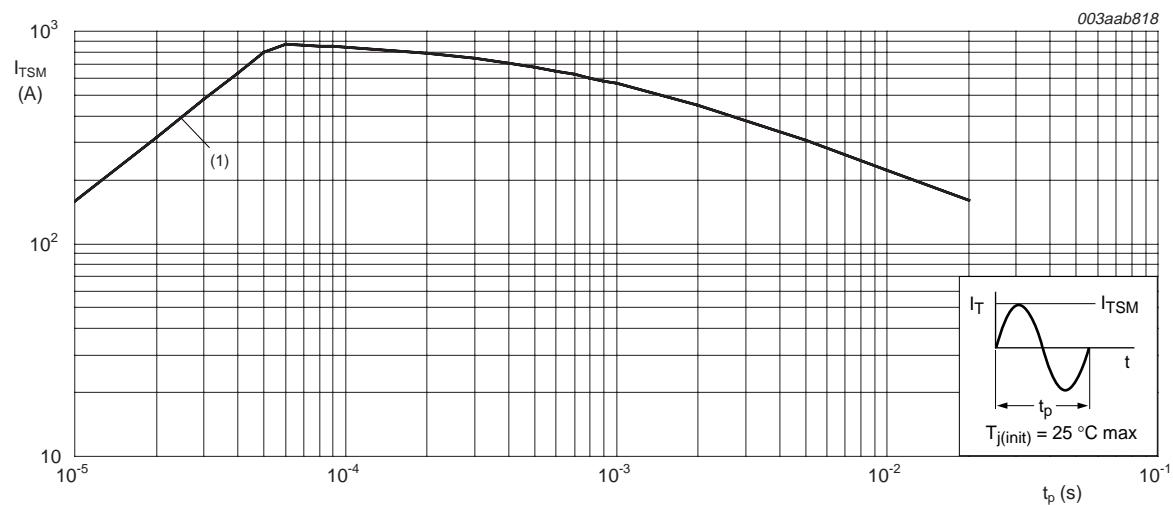
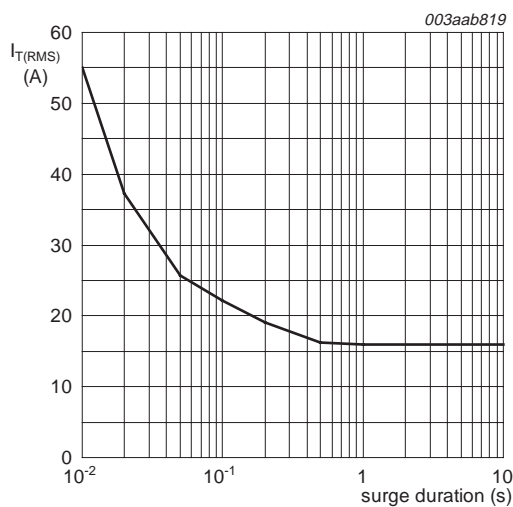


Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



$t_p \leq 20$  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;  
 $T_{mb} = 108^\circ\text{C}$

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

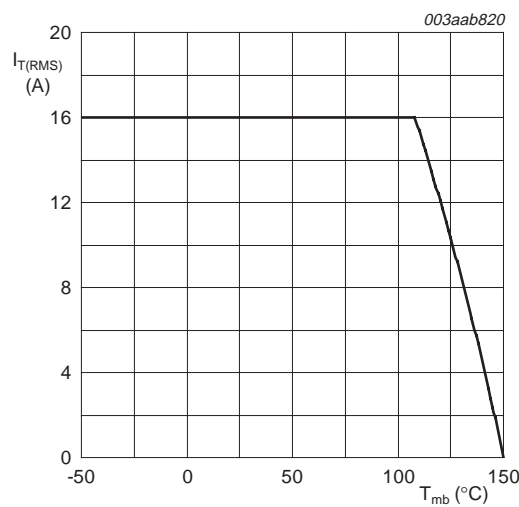


Fig 5. RMS on-state current as a function of mounting base temperature; maximum values

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>	-	-	1.9	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	60	-	K/W

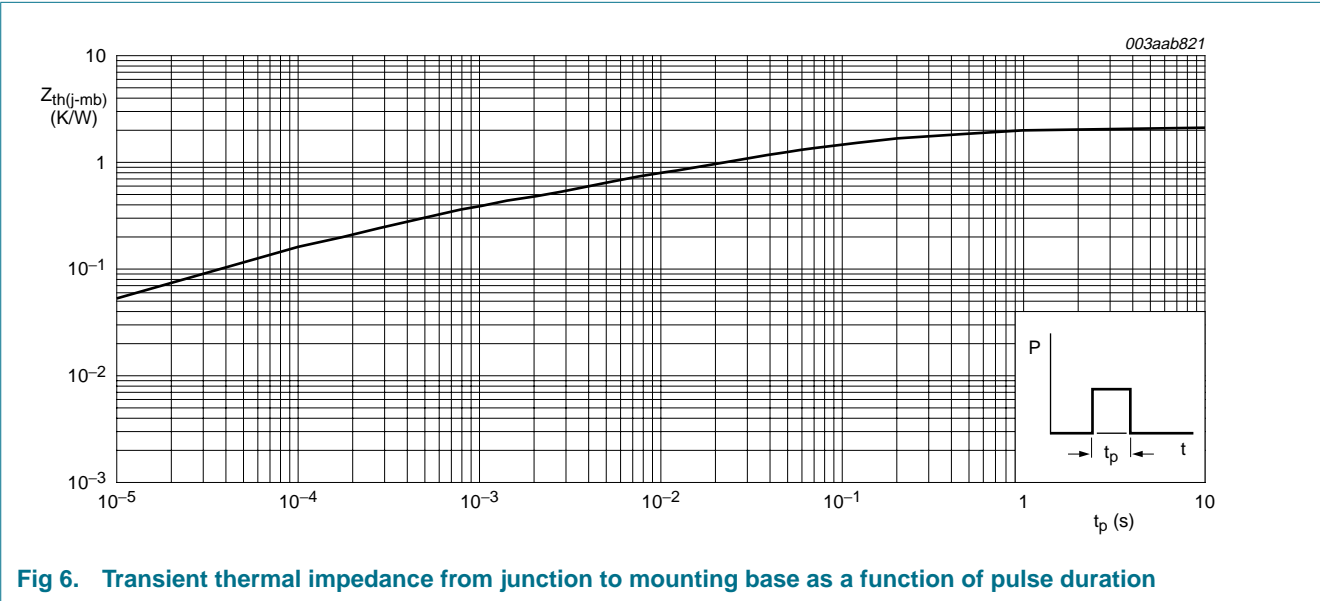


Fig 6. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Isolation characteristics

Table 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**

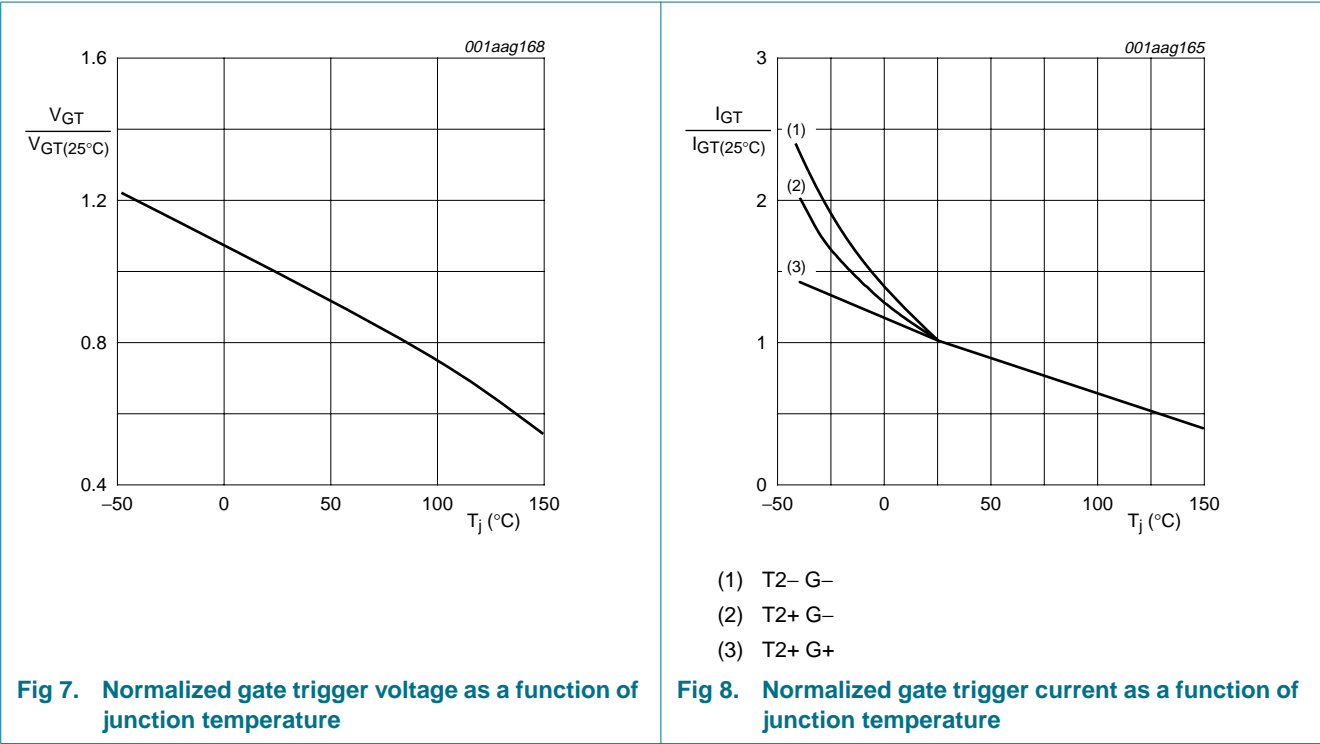
$T_j = 25\text{ °C}$  unless otherwise specified.

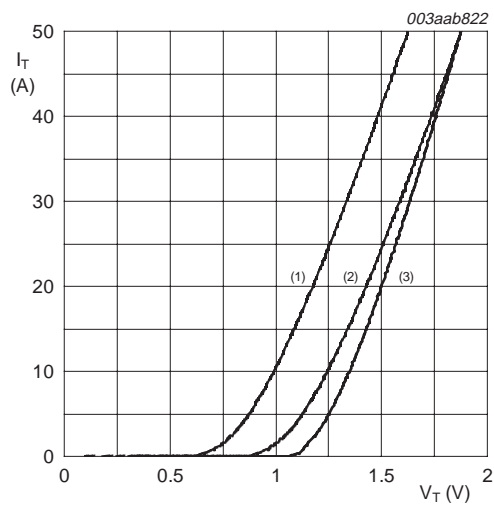
Symbol	Parameter	Conditions	BTA416Y-600B BTA416Y-800B			BTA416Y-600C BTA416Y-800C			Unit
			Min	Typ	Max	Min	Typ	Max	
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; see <a href="#">Figure 8</a>							
		T2+ G+	2	-	50	2	-	35	mA
		T2+ G-	2	-	50	2	-	35	mA
		T2- G-	2	-	50	2	-	35	mA
$I_L$	latching current	$V_D = 12\text{ V}$ ; $I_{GT} = 0.1\text{ A}$ ; see <a href="#">Figure 10</a>							
		T2+ G+	-	-	60	-	-	50	mA
		T2+ G-	-	-	90	-	-	60	mA
		T2- G-	-	-	60	-	-	50	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $I_{GT} = 0.1\text{ A}$ ; see <a href="#">Figure 11</a>	-	-	60	-	-	35	mA
$V_T$	on-state voltage	$I_T = 20\text{ A}$ ; see <a href="#">Figure 9</a>	-	1.2	1.5	-	1.2	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>	-	0.7	1.5	-	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	-	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	BTA416Y-600B BTA416Y-800B			BTA416Y-600C BTA416Y-800C			Unit
			Min	Typ	Max	Min	Typ	Max	
dV <sub>D</sub> /dt	rate of rise of off-state voltage	V <sub>DM</sub> = 0.67 × V <sub>DRM(max)</sub> ; exponential waveform; gate open circuit							
		T <sub>j</sub> = 125 °C	1000	-	-	500	-	-	V/μs
		T <sub>j</sub> = 150 °C	600	-	-	300	-	-	V/μs
di <sub>com</sub> /dt	rate of change of commutating current	V <sub>DM</sub> = 400 V; I <sub>T(RMS)</sub> = 16 A; without snubber; gate open circuit							
		T <sub>j</sub> = 125 °C	15	-	-	10	-	-	A/ms
		T <sub>j</sub> = 150 °C	6	-	-	4	-	-	A/ms
t <sub>gt</sub>	gate-controlled turn-on time	I <sub>TM</sub> = 20 A; V <sub>D</sub> = V <sub>DRM(max)</sub> ; I <sub>G</sub> = 0.1 A; di <sub>G</sub> /dt = 5 A/μs	-	2	-	-	2	-	μs





$V_o = 1.086 \text{ V}$

$R_s = 0.017 \text{ } \Omega$

- (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

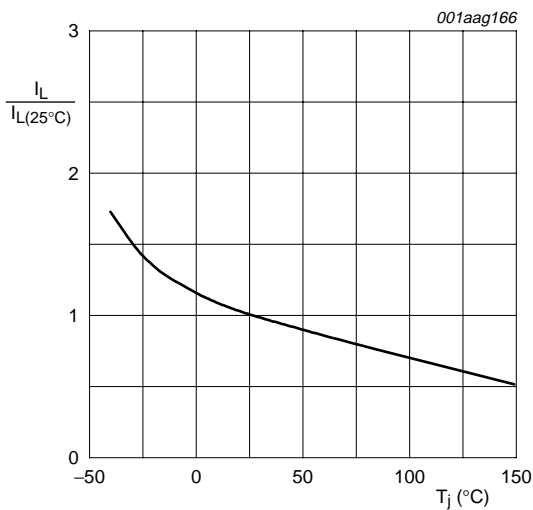


Fig 10. Normalized latching current as a function of junction temperature

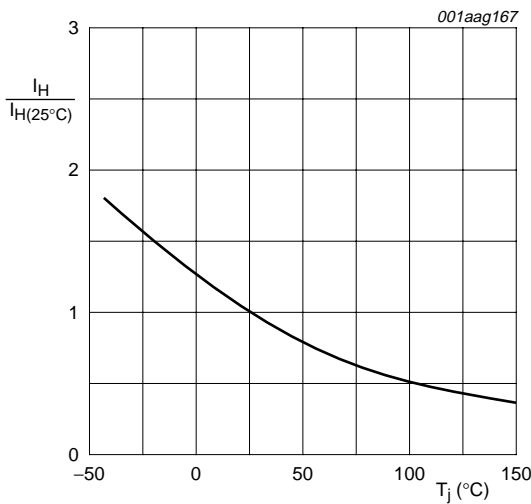


Fig 11. Normalized holding current as a function of junction temperature



9. Package outline

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

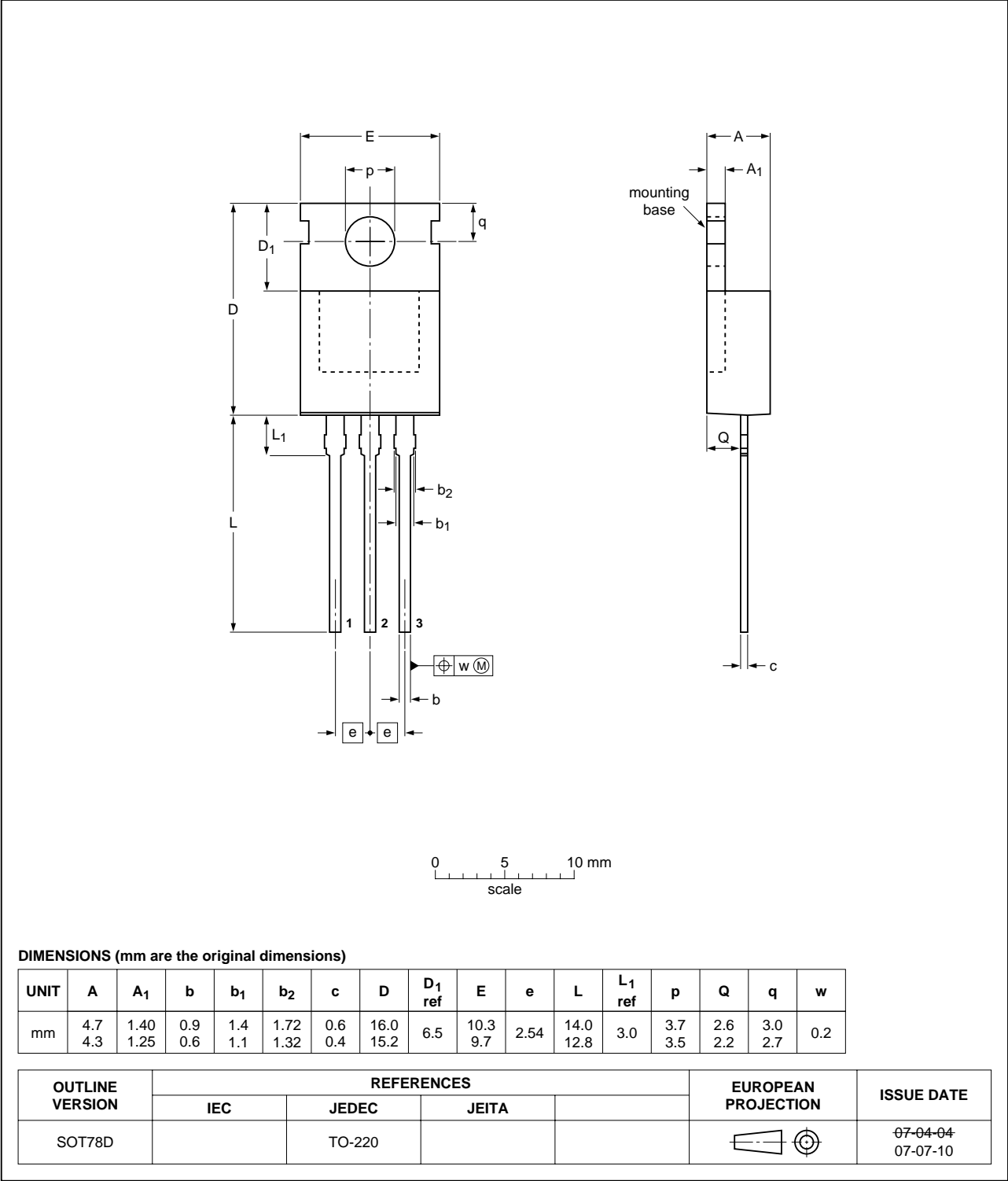


Fig 12. Package outline SOT78D (3-lead TO-220)

10. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BTA416Y_SER_B_C_1	20071003	Product data sheet	-	-

## 11. Legal information

### 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.

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[2] The term 'short data sheet' is explained in section "Definitions".

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