

# BTA316 series BT

16 A Three-quadrant triacs high commutation high temperature

Rev. 01 — 3 May 2007

Product data sheet

## 1. Product profile

### 1.1 General description

Passivated, new generation, high commutation triacs in a SOT78 plastic package

### 1.2 Features

- High operating junction temperature
- Very high commutation performance maximized for the gate sensitivity
- High immunity to dV/dt

### 1.3 Applications

- High temperature, high power motor control - e.g. vacuum cleaners
- Refrigeration and air conditioning compressors
- Heating and cooking appliances
- Non-linear rectifier-fed motor loads
- Electronic thermostats for heating and cooling loads
- Solid state relays

### 1.4 Quick reference data

- $V_{DRM} \leq 600 \text{ V}$  (BTA316-600BT)
- $I_{TSM} \leq 140 \text{ A}$  ( $t = 20 \text{ ms}$ )
- $I_{GT} \leq 50 \text{ mA}$  (BTA316-600BT)
- $I_{T(RMS)} \leq 16 \text{ A}$

## 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; main terminal 2 (T2) |                    |        |

SOT78 (TO-220AB)

### 3. Ordering information

Table 2. Ordering information

| Type number  | Package |                                                                                  | Version |
|--------------|---------|----------------------------------------------------------------------------------|---------|
|              | Name    | Description                                                                      |         |
| BTA316-600BT | SC-46   | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78   |

### 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    | BTA316-600BT <a href="#">[1]</a>                                                                                               | -   | 600  | V                      |
| $I_{\text{T(RMS)}}$ | RMS on-state current                 | full sine wave; $T_{\text{mb}} \leq 126\text{ }^{\circ}\text{C}$ ; 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; $T_{\text{j}} = 25\text{ }^{\circ}\text{C}$ prior to surge; see <a href="#">Figure 2</a> and <a href="#">3</a> |     |      |                        |
|                     |                                      | $t = 20\text{ ms}$                                                                                                             | -   | 140  | A                      |
|                     |                                      | $t = 16.7\text{ ms}$                                                                                                           | -   | 150  | A                      |
| $I^2t$              | $I^2t$ for fusing                    | $t = 10\text{ ms}$                                                                                                             | -   | 98   | $\text{A}^2\text{s}$   |
| $di_{\text{T}}/dt$  | 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  | $\text{A}/\mu\text{s}$ |
| $I_{\text{GM}}$     | 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 | $^{\circ}\text{C}$     |
| $T_{\text{j}}$      | junction temperature                 |                                                                                                                                | -   | 150  | $^{\circ}\text{C}$     |

- [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/ $\mu\text{s}$ .

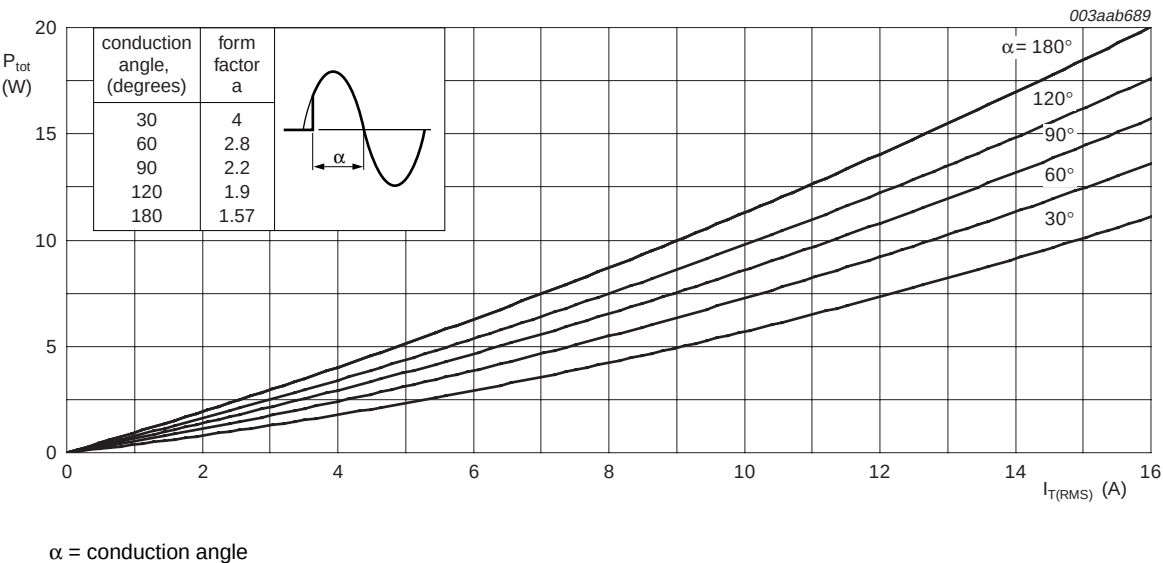


Fig 1. Total power dissipation as a function of RMS on-state current; maximum values

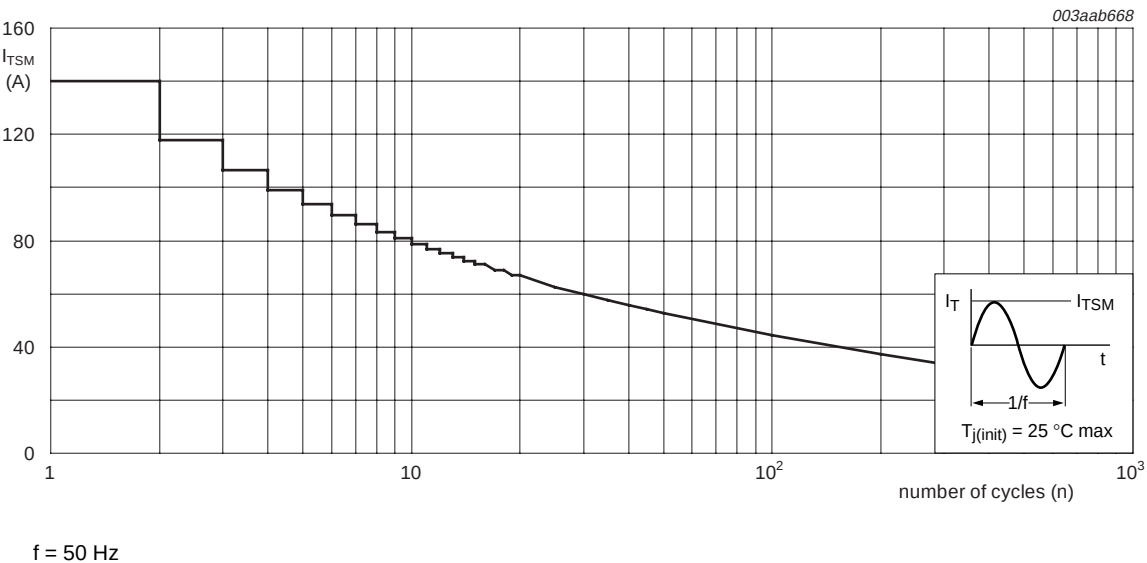
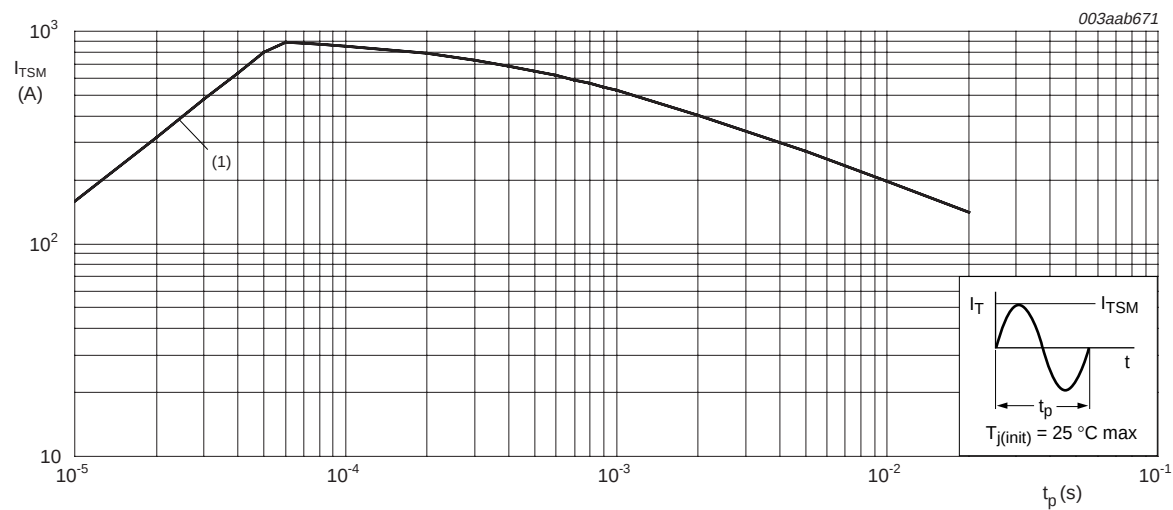
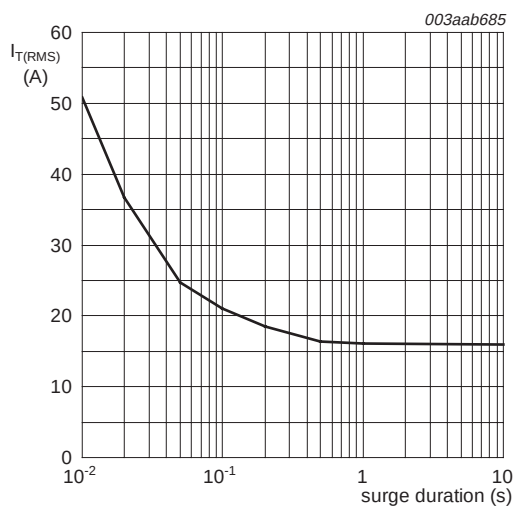


Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



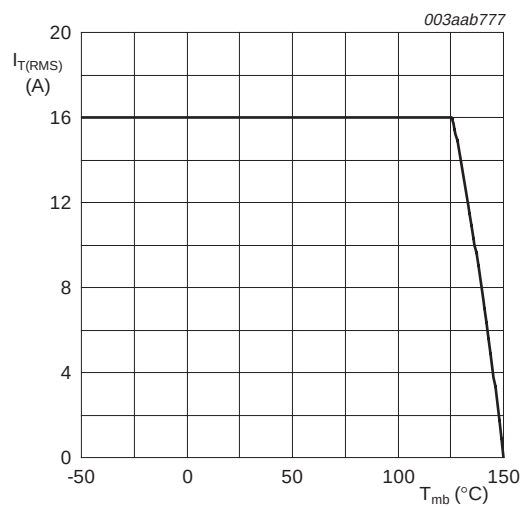
$t_p \leq 20$  ms  
 (1)  $di_T/dt$  limit

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



$f = 50$  Hz;  
 $T_{mb} = 126$  °C

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

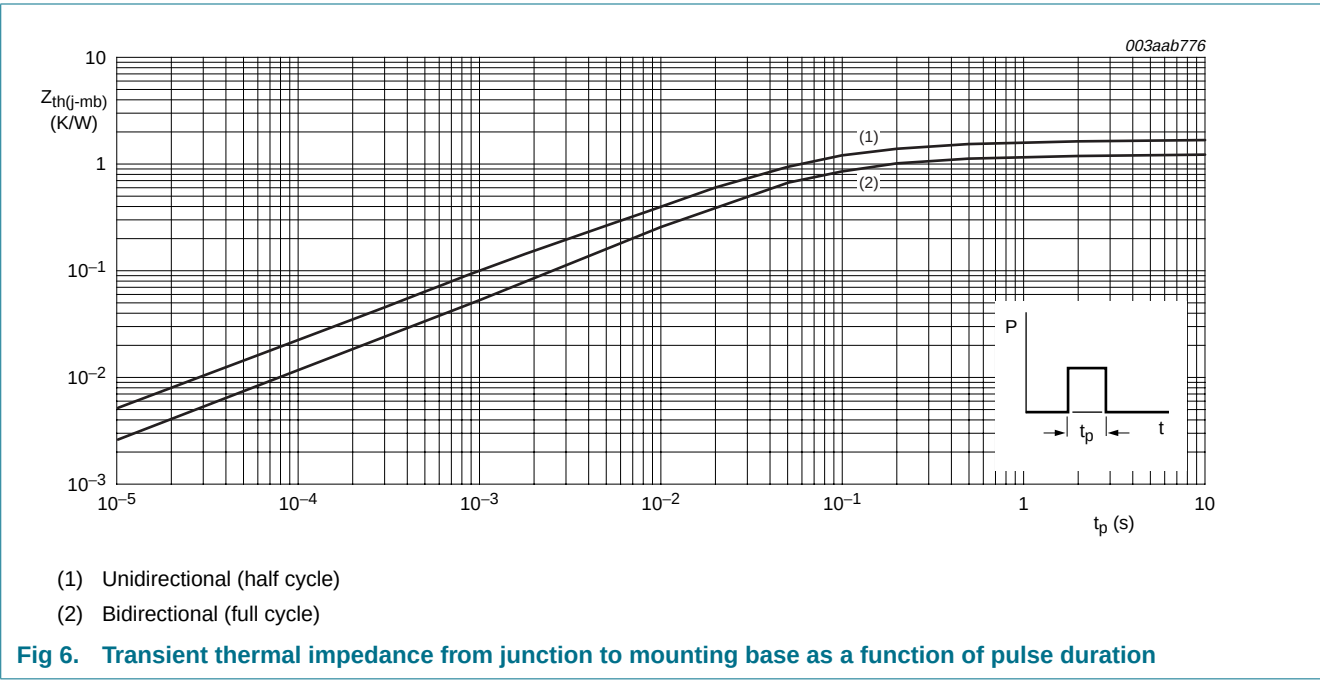


**Fig 5. RMS on-state current as a function of mounting base temperature; maximum values**

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 | half cycle; see <a href="#">Figure 6</a> | -   | -   | 1.7 | K/W  |
|                |                                                   | full cycle; see <a href="#">Figure 6</a> | -   | -   | 1.2 | K/W  |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient       | in free air                              | -   | 60  | -   | K/W  |



## 6. Static characteristics

**Table 5. Static characteristics**

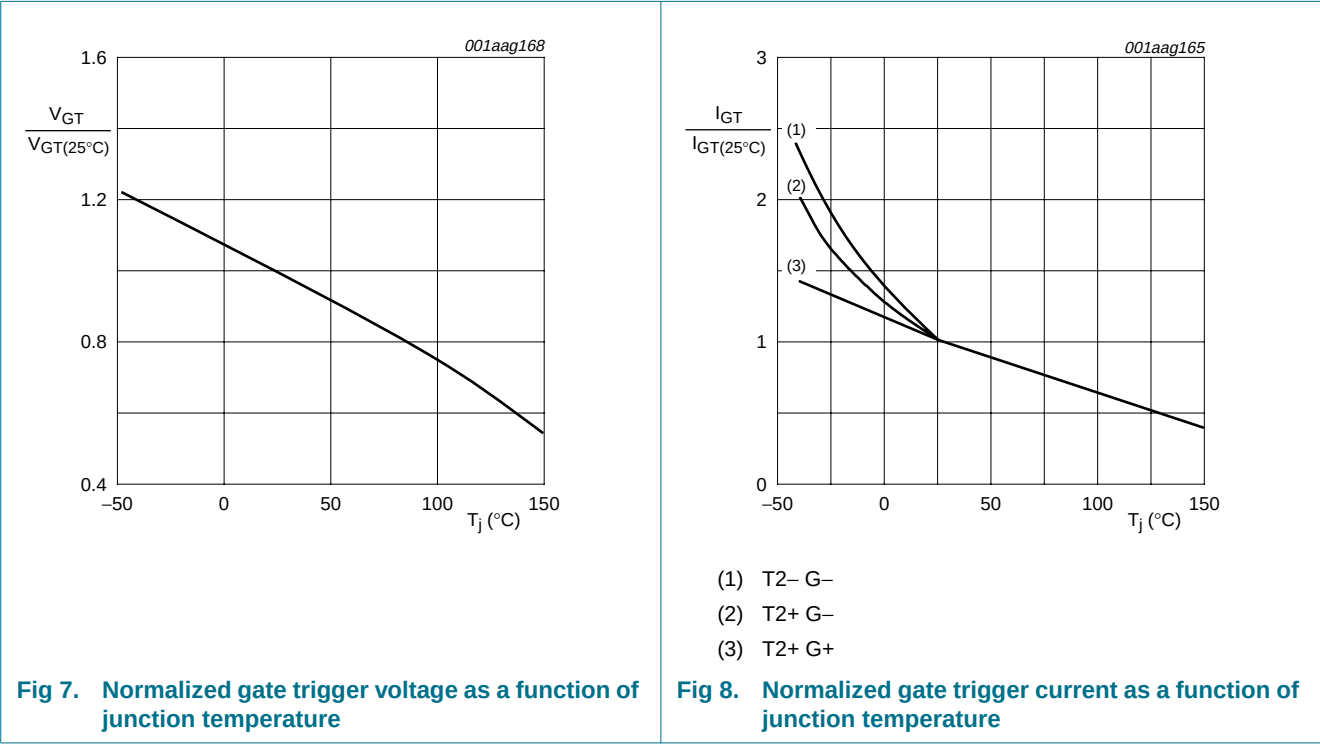
$T_j = 25\text{ °C}$  unless otherwise specified.

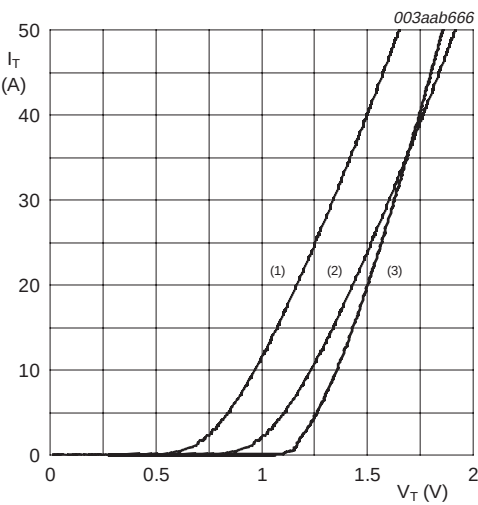
| Symbol   | Parameter            | Conditions                                                                       | Min  | Typ  | Max | Unit |
|----------|----------------------|----------------------------------------------------------------------------------|------|------|-----|------|
| $I_{GT}$ | gate trigger current | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ;<br>see <a href="#">Figure 8</a>     |      |      |     |      |
|          |                      | T2+ G+                                                                           | 2    | -    | 50  | mA   |
|          |                      | T2+ G-                                                                           | 2    | -    | 50  | mA   |
|          |                      | T2- G-                                                                           | 2    | -    | 50  | mA   |
| $I_L$    | latching current     | $V_D = 12\text{ V}$ ; $I_{GT} = 0.1\text{ A}$ ;<br>see <a href="#">Figure 10</a> |      |      |     |      |
|          |                      | T2+ G+                                                                           | -    | -    | 60  | mA   |
|          |                      | T2+ G-                                                                           | -    | -    | 90  | mA   |
|          |                      | T2- G-                                                                           | -    | -    | 60  | mA   |
| $I_H$    | holding current      | $V_D = 12\text{ V}$ ; $I_{GT} = 0.1\text{ A}$ ;<br>see <a href="#">Figure 11</a> | -    | -    | 60  | mA   |
| $V_T$    | on-state voltage     | $I_T = 18\text{ A}$ ; see <a href="#">Figure 9</a>                               | -    | 1.3  | 1.5 | V    |
| $V_{GT}$ | gate trigger voltage | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ;<br>see <a href="#">Figure 7</a>     | -    | 0.8  | 1.5 | V    |
|          |                      | $V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ;<br>$T_j = 150\text{ °C}$           | 0.25 | 0.4  | -   | V    |
| $I_D$    | off-state current    | $V_D = V_{DRM(max)}$ ; $T_j = 150\text{ °C}$                                     | -    | 0.24 | 1.2 | mA   |

7. Dynamic characteristics

Table 6. Dynamic characteristics

| Symbol        | Parameter                             | Conditions                                                                                                                         | Min | Typ | Max | Unit                   |
|---------------|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------------------------|
| $dV_D/dt$     | rate of rise of off-state voltage     | $V_{DM} = 0.67 \times V_{DRM(max)}$ ;<br>$T_j = 150\text{ }^{\circ}\text{C}$ ; exponential waveform; gate open circuit             | 600 | -   | -   | $\text{V}/\mu\text{s}$ |
| $dI_{com}/dt$ | rate of change of commutating current | $V_{DM} = 400\text{ V}$ ; $T_j = 150\text{ }^{\circ}\text{C}$ ;<br>$I_{T(RMS)} = 16\text{ A}$ ; without snubber; gate open circuit | 8   | -   | -   | $\text{A/ms}$          |
| $t_{gt}$      | gate-controlled turn-on time          | $I_{TM} = 20\text{ A}$ ; $V_D = V_{DRM(max)}$ ;<br>$I_G = 0.1\text{ A}$ ; $dI_G/dt = 5\text{ A}/\mu\text{s}$                       | -   | 2   | -   | $\mu\text{s}$          |





$V_0 = 1.024 \text{ V}$

$R_s = 0.021 \text{ } \Omega$

- (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

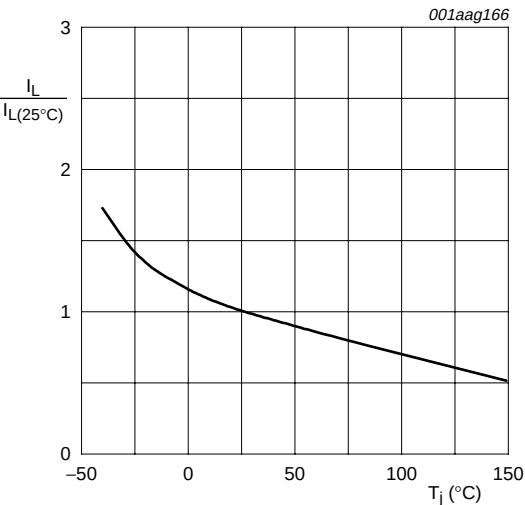


Fig 10. Normalized latching current as a function of junction temperature

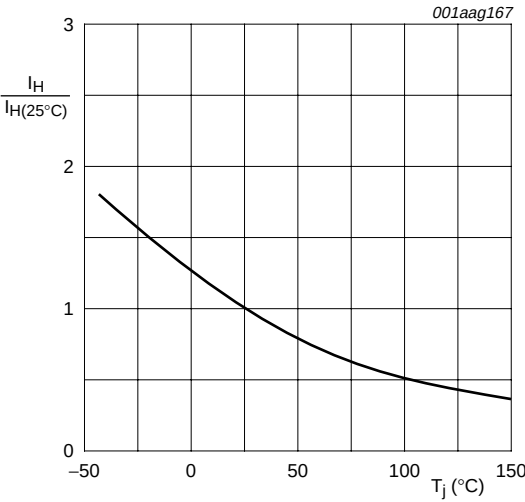


Fig 11. Normalized holding current as a function of junction temperature



8. Package outline

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

SOT78

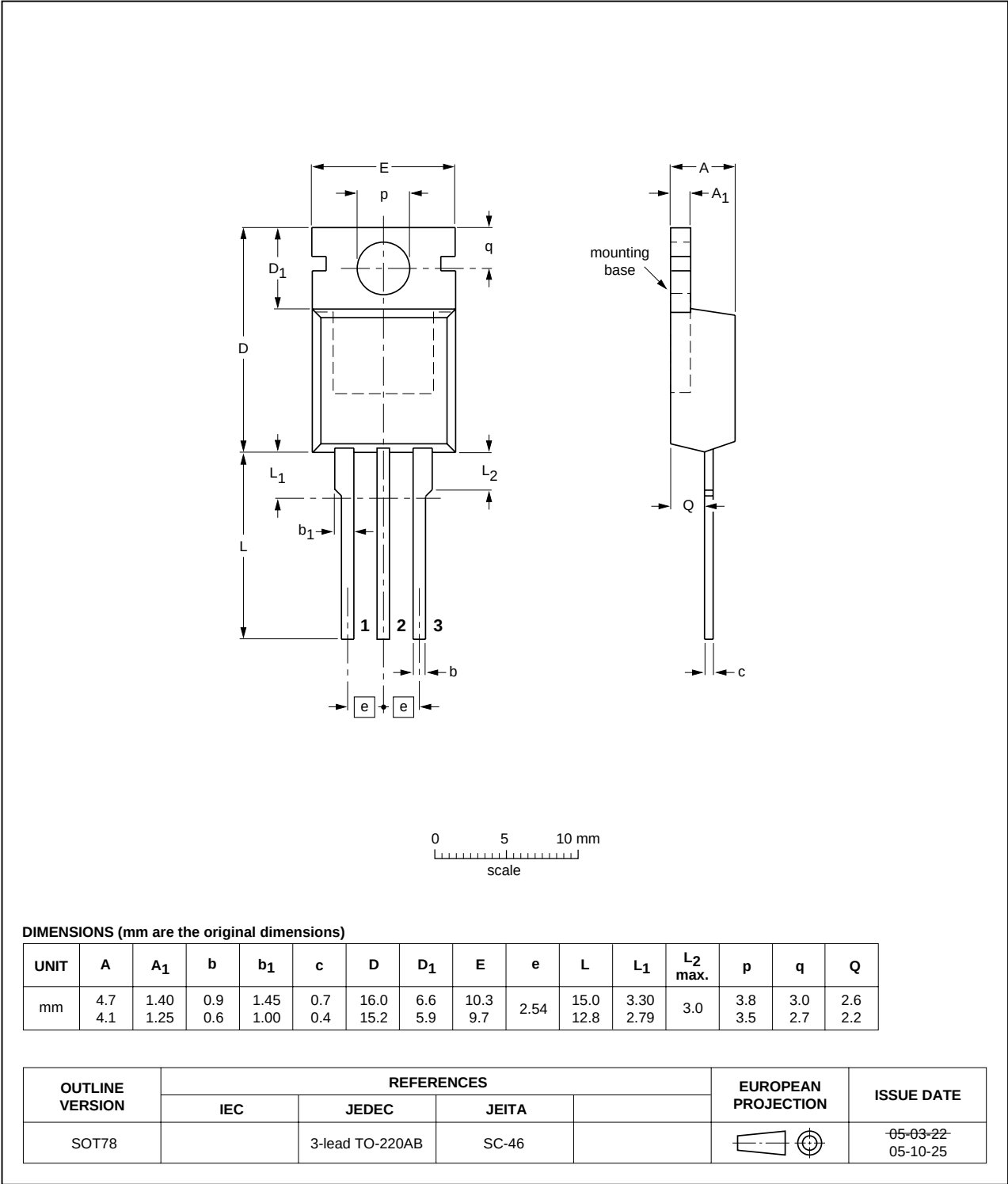


Fig 12. Package outline SOT78 (3-lead TO-220AB)

9. Revision history

Table 7. Revision history

| Document ID     | Release date | Data sheet status  | Change notice | Supersedes |
|-----------------|--------------|--------------------|---------------|------------|
| BTA316_SER_BT_1 | 20070503     | Product data sheet | -             | -          |

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### 10.1 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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