# BTA202X series D and E

## 2 A Three-quadrant triacs high commutation

Rev. 01 — 7 February 2008 Product data sheet

## 1. Product profile

### 1.1 General description

Passivated high commutation triacs in a SOT186A ‘full pack’ plastic package. These triacs balance the requirements of commutation performance and gate sensitivity. The ‘sensitive’ gate E series and ‘logic level’ D series are intended for interfacing with low-power drivers, including microcontrollers.

### 1.2 Features

- Sensitive gate
- Very high commutation performance maximized at each gate sensitivity
- High immunity to dV/dt
- High isolation voltage

### 1.3 Applications

- Motor control
- Solenoid driver

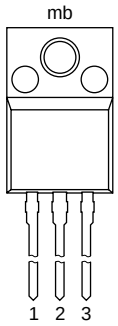
### 1.4 Quick reference data

- $V_{DRM} \leq 600$ V (BTA202X-600D)
- $V_{DRM} \leq 600$ V (BTA202X-600E)
- $V_{DRM} \leq 800$ V (BTA202X-800D)
- $V_{DRM} \leq 800$ V (BTA202X-800E)
- $I_{T(RMS)} \leq 2$ A
- $I_{GT} \leq 5$ mA (BTA202X-600D)
- $I_{GT} \leq 10$ mA (BTA202X-600E)
- $I_{GT} \leq 5$ mA (BTA202X-800D)
- $I_{GT} \leq 10$ mA (BTA202X-800E)

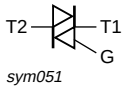
## 2. Pinning information

**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) | | |




SOT186A (TO-220F)




## 3. Ordering information

**Table 2. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BTA202X-600D | TO-220F | plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 'full pack' | SOT186A |
| BTA202X-600E | | | |
| BTA202X-800D | | | |
| BTA202X-800E | | | |

## 4. Limiting values

**Table 3. Limiting values**

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

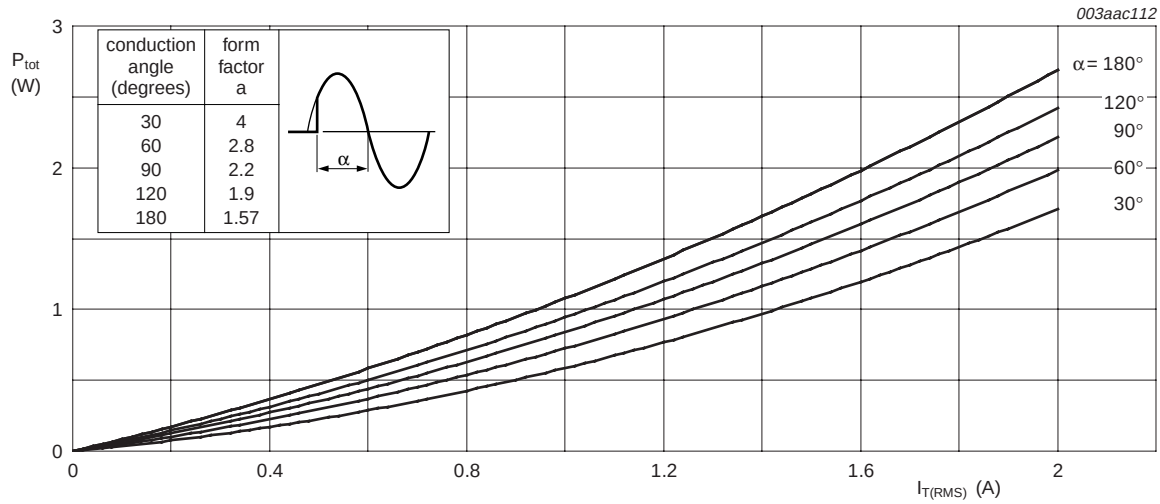
| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{DRM}$ | repetitive peak off-state voltage | BTA202X-600D; BTA202X-600E | [1] | - | 600 | V |
| | | BTA202X-800D; BTA202X-800E | | | 800 | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_h \leq 110$ °C; see Figure 4 and 5 | | - | 2 | A |
| $I_{TSM}$ | non-repetitive peak on-state current | full sine wave; $T_j = 25$ °C prior to surge; see Figure 2 and 3 | | | | |
| | | t = 20 ms | | - | 14 | A |
| | | t = 16.7 ms | | - | 15.4 | A |
| $I^2t$ | $I^2t$ for fusing | $t_p = 10$ ms | | - | 0.98 | $A^2s$ |
| $dI_T/dt$ | rate of rise of on-state current | $I_{TM} = 1.5$ A; $I_G = 0.2$ A; $dI_G/dt = 0.2$ A/µs | | - | 100 | A/µs |
| $I_{GM}$ | peak gate current | | | - | 2 | A |
| $P_{GM}$ | peak gate power | | | - | 5 | W |

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

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

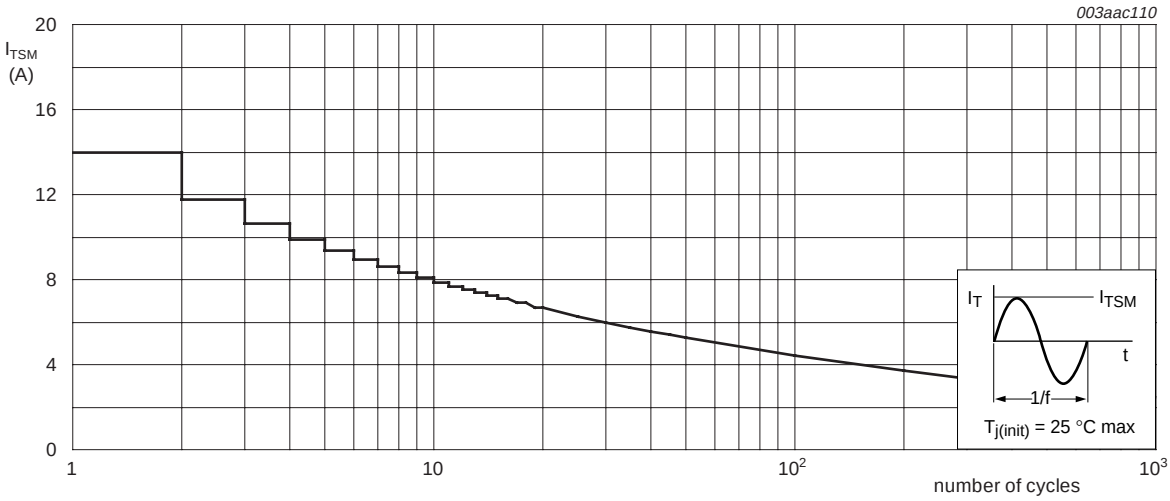
| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $P_{G(AV)}$ | average gate power | over any 20 ms period | - | 0.5 | W |
| $T_{stg}$ | storage temperature | | –40 | +150 | °C |
| $T_j$ | junction temperature | | - | 125 | °C |

[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 6 A/µs.



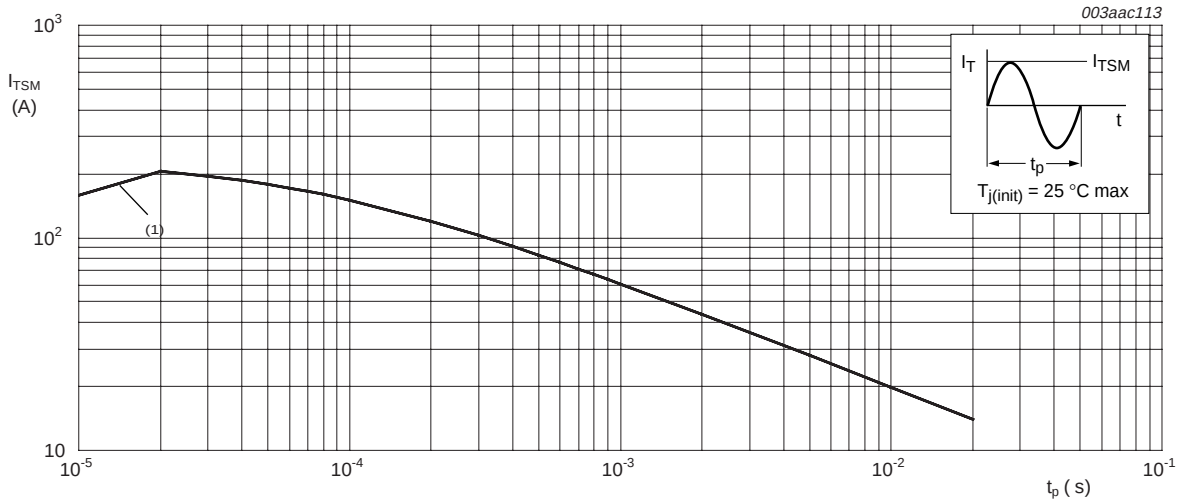

α = conduction angle

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




f = 50 Hz

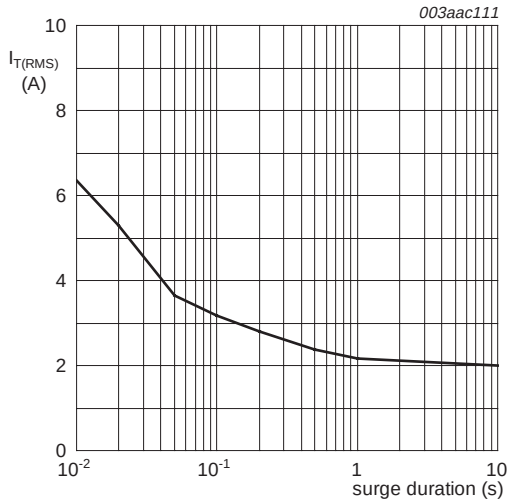
**Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values**




$t_p \leq 20$ ms

(1) $dI_T/dt$ limit

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




f = 50 Hz; $T_h$ = 110 °C

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

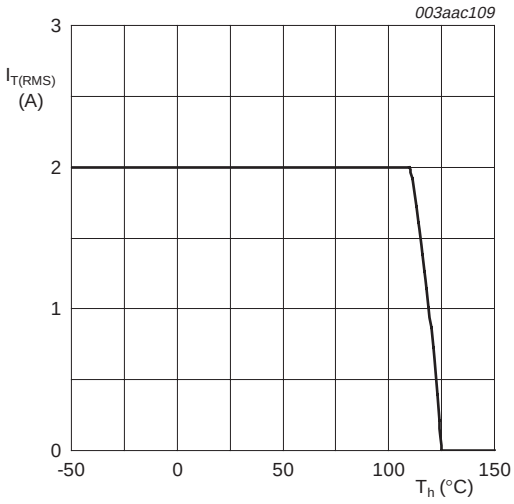



**Fig 5. RMS on-state current as a function of heatsink temperature; maximum values**

## 5. Thermal characteristics

**Table 4. Thermal characteristics**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $R_{th(j-h)}$ | thermal resistance from junction to heatsink | bidirectional; see Figure 6 | - | - | 5.5 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | - | 55 | - | K/W |

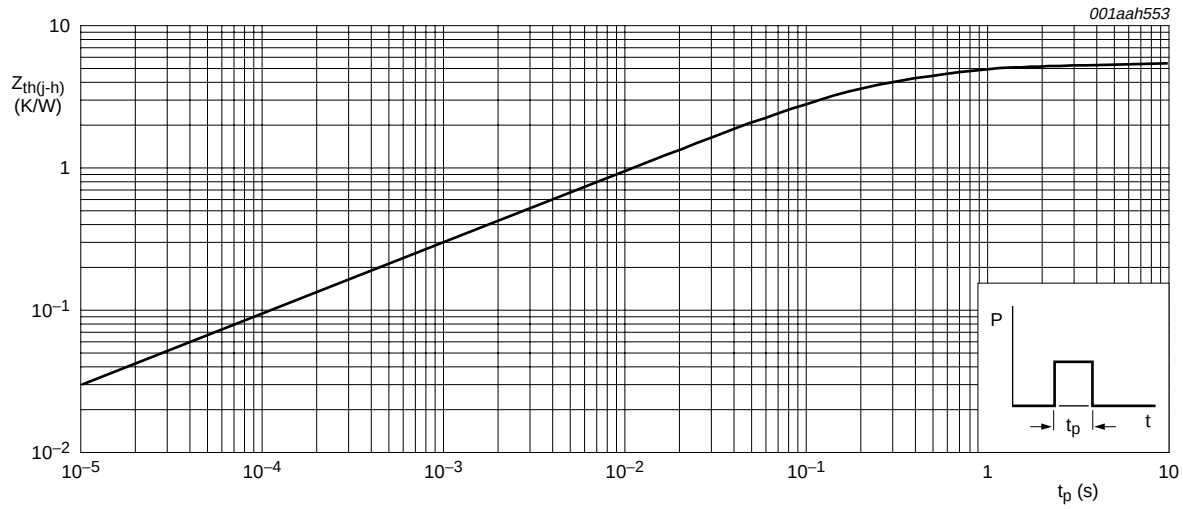



**Fig 6. Transient thermal impedance from junction to heatsink as a function of pulse width**

## 6. Isolation characteristics

**Table 5. Isolation limiting values and characteristics**

*$T_h$ = 25 °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 Hz to 60 Hz; sinusoidal waveform; RH ≤ 65 %; clean and dust free | - | - | 2500 | V |
| $C_{isol}$ | isolation capacitance | from pin 2 to external heatsink; f = 1 MHz | - | 10 | - | pF |

## 7. Static characteristics

**Table 6. Static characteristics**

*$T_j$ = 25 °C unless otherwise specified.*

| Symbol | Parameter | Conditions | BTA202X-600D BTA202X-800D | | | BTA202X-600E BTA202X-800E | | | 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+ | 0.25 | - | 5 | 0.5 | - | 10 | mA |
| | | T2+ G– | 0.25 | - | 5 | 0.5 | - | 10 | mA |
| | | T2– G– | 0.25 | - | 5 | 0.5 | - | 10 | mA |
| $I_L$ | latching current | $V_D$ = 12 V; $I_{GT}$ = 0.1 A; see Figure 10 | | | | | | | |
| | | T2+ G+ | - | - | 5 | - | - | 12 | mA |
| | | T2+ G– | - | - | 10 | - | - | 20 | mA |
| | | T2– G– | - | - | 5 | - | - | 12 | mA |
| $I_H$ | holding current | $V_D$ = 12 V; $I_{GT}$ = 0.1 A; see Figure 11 | - | - | 5 | - | - | 12 | mA |
| $V_T$ | on-state voltage | $I_T$ = 3 A; see Figure 9 | - | 1.63 | 2 | - | 1.63 | 2 | V |
| $V_{GT}$ | gate trigger voltage | $V_D$ = 12 V; $I_T$ = 0.1 A; see Figure 7 | - | 0.7 | 1.5 | - | 0.7 | 1.5 | V |
| | | $V_D$ = 400 V; $I_T$ = 0.1 A; $T_j$ = 125 °C | 0.2 | 0.3 | - | 0.2 | 0.3 | - | V |
| $I_D$ | off-state current | $V_D = V_{DRM(max)}$; $T_j$ = 125 °C | - | 0.1 | 0.5 | - | 0.1 | 0.5 | mA |

## 8. Dynamic characteristics

**Table 7. Dynamic characteristics**

| Symbol | Parameter | Conditions | BTA202X-600D BTA202X-800D | | | BTA202X-600E BTA202X-800E | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Typ | Max | |
| $dV_D/dt$ | rate of rise of off-state voltage | $V_{DM} = 0.67 \times V_{DRM(max)}$; $T_j$ = 125 °C; exponential waveform; $R_{(G-MT1)}$ = 220 Ω | - | 350 | - | - | 500 | - | V/µs |
| $dI_{com}/dt$ | rate of change of commutating current | $V_{DM}$ = 400 V; $T_j$ = 125 °C; $I_{T(RMS)}$ = 2 A; $dV_{com}/dt$ = 20 V/µs; gate open circuit | 1.0 | - | - | 2.0 | - | - | A/ms |
| | | $V_{DM}$ = 400 V; $T_j$ = 125 °C; $I_{T(RMS)}$ = 2 A; $dV_{com}/dt$ = 10 V/µs; gate open circuit | 1.2 | - | - | 2.3 | - | - | A/ms |
| $t_{gt}$ | gate-controlled turn-on time | $I_{TM}$ = 20 A; $V_D = V_{DRM(max)}$; $I_G$ = 0.1 A; $dI_G/dt$ = 5 A/µs | - | 2 | - | - | 2 | - | µs |

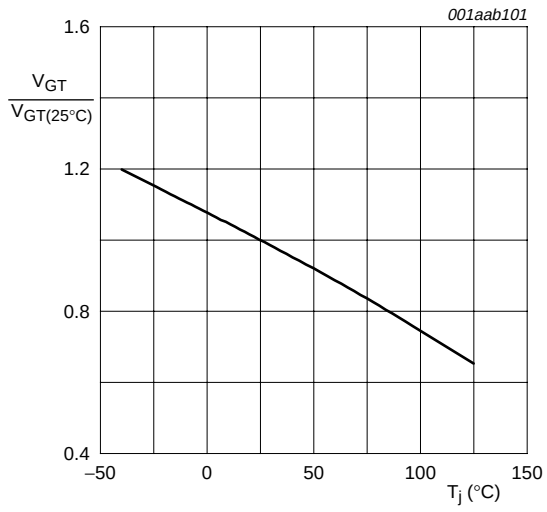
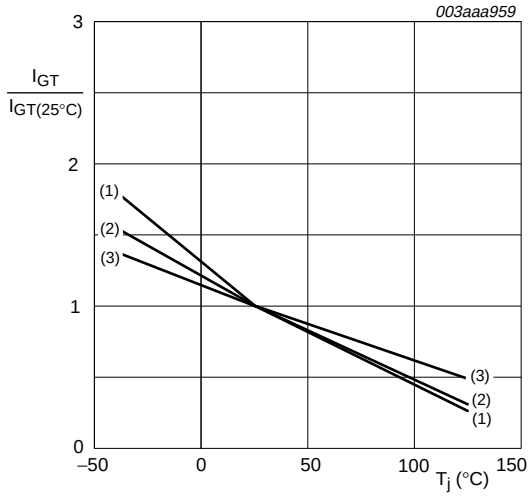
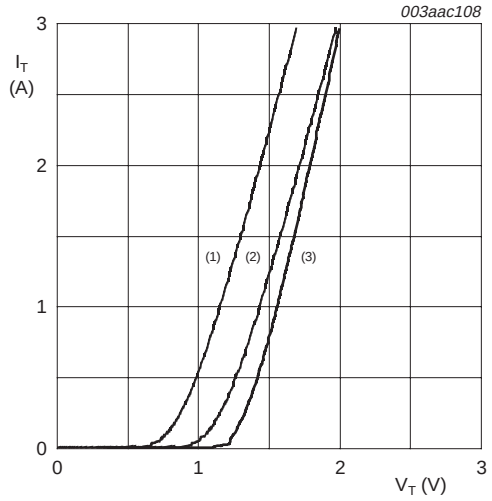



**Fig 7. Normalized gate trigger voltage as a function of junction temperature**




(1) T2– G–
(2) T2+ G–
(3) T2+ G+

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




$V_o$ = 0.9 V

$R_s$ = 0.267 Ω

(1) $T_j$ = 125°C; typical values

(2) $T_j$ = 125 °C; maximum values

(3) $T_j$ = 25 °C; maximum values

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

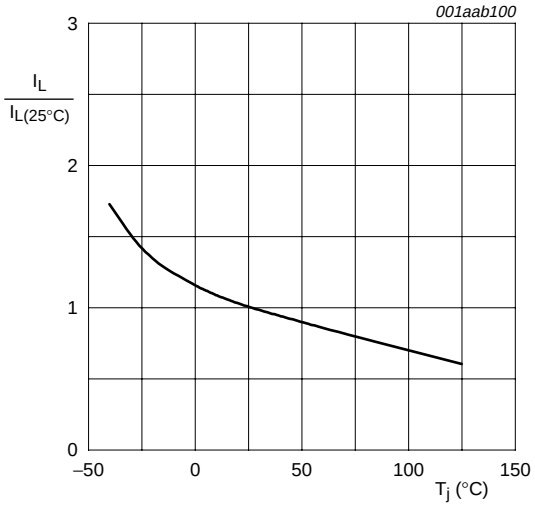



**Fig 10. Normalized latching current as a function of junction temperature**

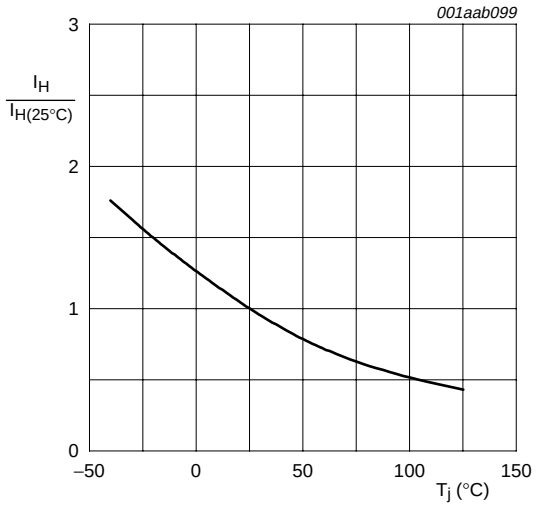



**Fig 11. Normalized holding current as a function of junction temperature**

## 9. Package information

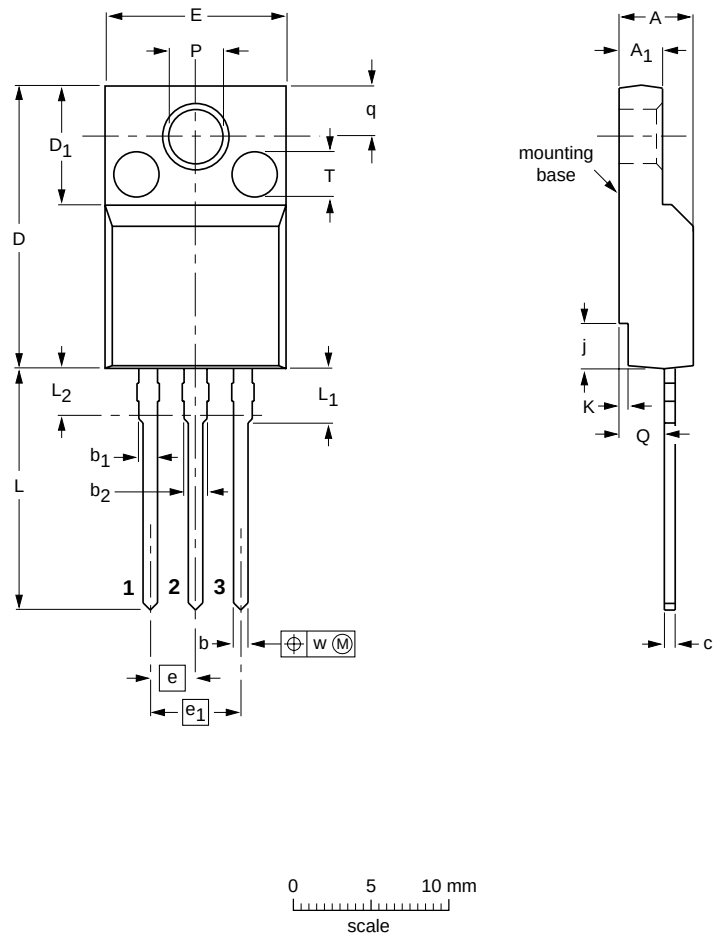
Refer to mounting instructions for F-pack packages.

Epoxy meets UL94 V-0 at 3.175 mm.

## 10. Package outline

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

**SOT186A**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A | $A_1$ | b | $b_1$ | $b_2$ | c | D | $D_1$ | E | e | $e_1$ | j | K | L | $L_1$ | $L_2$ (1) max. | P | Q | q | T (2) | w |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 4.6<br>4.0 | 2.9<br>2.5 | 0.9<br>0.7 | 1.1<br>0.9 | 1.4<br>1.0 | 0.7<br>0.4 | 15.8<br>15.2 | 6.5<br>6.3 | 10.3<br>9.7 | 2.54 | 5.08 | 2.7<br>1.7 | 0.6<br>0.4 | 14.4<br>13.5 | 3.30<br>2.79 | 3 | 3.2<br>3.0 | 2.6<br>2.3 | 3.0<br>2.6 | 2.5 | 0.4 |

**Notes**

1. Terminal dimensions within this zone are uncontrolled.
2. Both recesses are ∅ 2.5 × 0.8 max. depth

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT186A | | 3-lead TO-220F | | | | ~~02-04-09~~<br>06-02-14 |

**Fig 12. Package outline SOT186A (3-lead TO-220F)**

## 11. Revision history

**Table 8. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BTA202X_SER_D_E_1 | 20080207 | Product data sheet | - | - |

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| 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. |
| 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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