# BTA201 series B, E and ER

## 1 A Three-quadrant triacs high commutation

Rev. 03 — 10 September 2007 Product data sheet

## 1. Product profile

### 1.1 General description

Passivated, guaranteed commutation triacs in a plastic package. The ‘sensitive gate’ E and ER series are intended for interfacing with low power drivers, including microcontrollers. The high commutation B series are designed to commutate the full RMS current at the maximum junction temperature without the aid of a snubber.

### 1.2 Features

- Suitable for interfacing with low power drivers, including microcontrollers
- Reverse pinning option (ER type)

### 1.3 Applications

- Motor controls
- Solenoid drivers

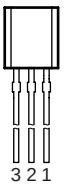
### 1.4 Quick reference data

- $I_{TSM} \leq 12.5$ A
- $V_{DRM} \leq 600$ V (BTA201-600B)
- $V_{DRM} \leq 600$ V (BTA201-600E)
- $V_{DRM} \leq 800$ V (BTA201-800B)
- $V_{DRM} \leq 800$ V (BTA201-800E)
- $V_{DRM} \leq 800$ V (BTA201-800ER)
- $I_{T(RMS)} \leq 1$ A
- $I_{GT} \leq 50$ mA (BTA201-600B)
- $I_{GT} \leq 10$ mA (BTA201-600E)
- $I_{GT} \leq 50$ mA (BTA201-800B)
- $I_{GT} \leq 10$ mA (BTA201-800E)
- $I_{GT} \leq 10$ mA (BTA201-800ER)

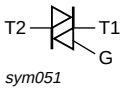
## 2. Pinning information

**Table 1. Pinning**

| Pin | Description | Simplified outline | Symbol |
|---|---|---|---|
| **B and E series** | | | |
| 1 | main terminal 2 (T2) | | |
| 2 | gate (G) | | |
| 3 | main terminal 1 (T1) | | |
| **ER series** | | | |
| 1 | main terminal 1 (T1) | | |
| 2 | gate (G) | | |
| 3 | main terminal 2 (T2) | | |




SOT54 (TO-92)



## 3. Ordering information

**Table 2. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BTA201-600B | TO-92 | plastic single-ended leaded (through hole) package; 3 leads | SOT54 |
| BTA201-600E | | | |
| BTA201-800B | | | |
| BTA201-800E | | | |
| BTA201-800ER | | | |

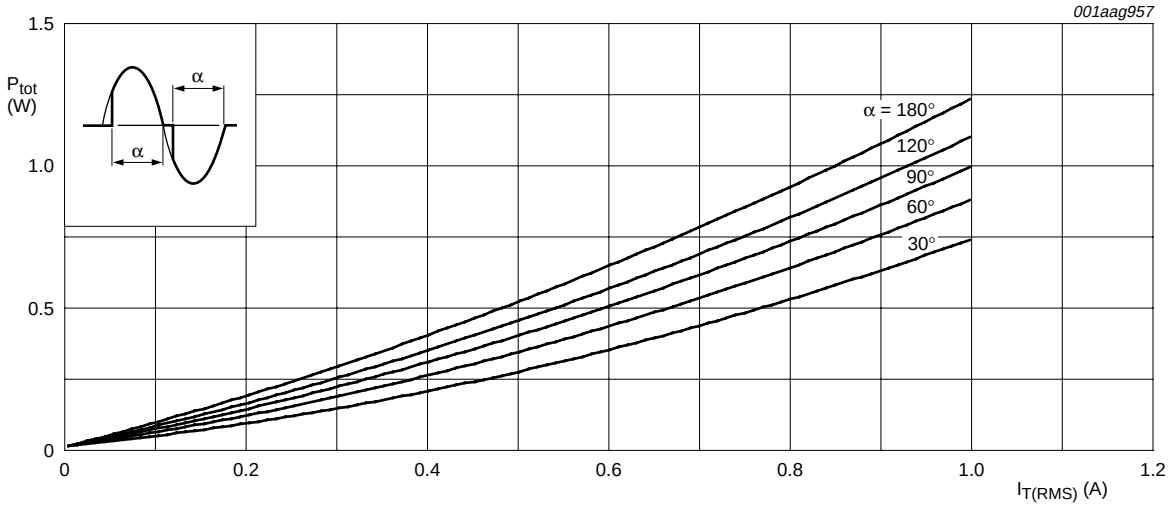
## 4. Limiting values

**Table 3. Limiting values**

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

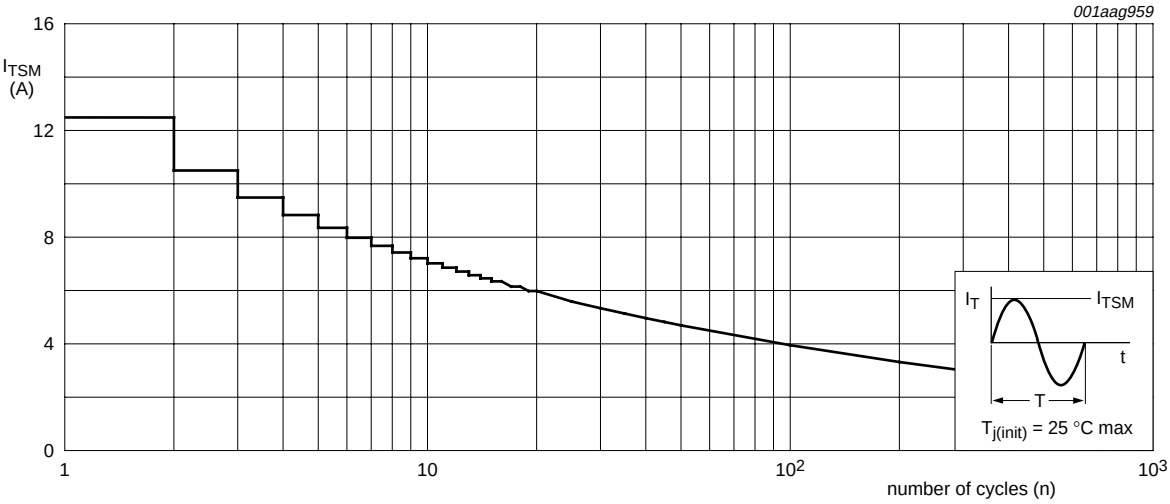
| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{DRM}$ | repetitive peak off-state voltage | | | | | |
| | | BTA201-600B | [1] | - | 600 | V |
| | | BTA201-600E | [1] | - | 600 | V |
| | | BTA201-800B | | - | 800 | V |
| | | BTA201-800E | | - | 800 | V |
| | | BTA201-800ER | | - | 800 | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_{lead} \leq 54.3$ °C; see Figure 4 and 5 | | - | 1 | 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 | | - | 12.5 | A |
| | | t = 16.7 ms | | - | 13.7 | A |
| $I^2t$ | $I^2t$ for fusing | t = 10 ms | | - | 0.78 | $A^2s$ |
| $dI_T/dt$ | 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 |
| $P_{G(AV)}$ | average gate power | over any 20 ms period | | - | 0.1 | 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.



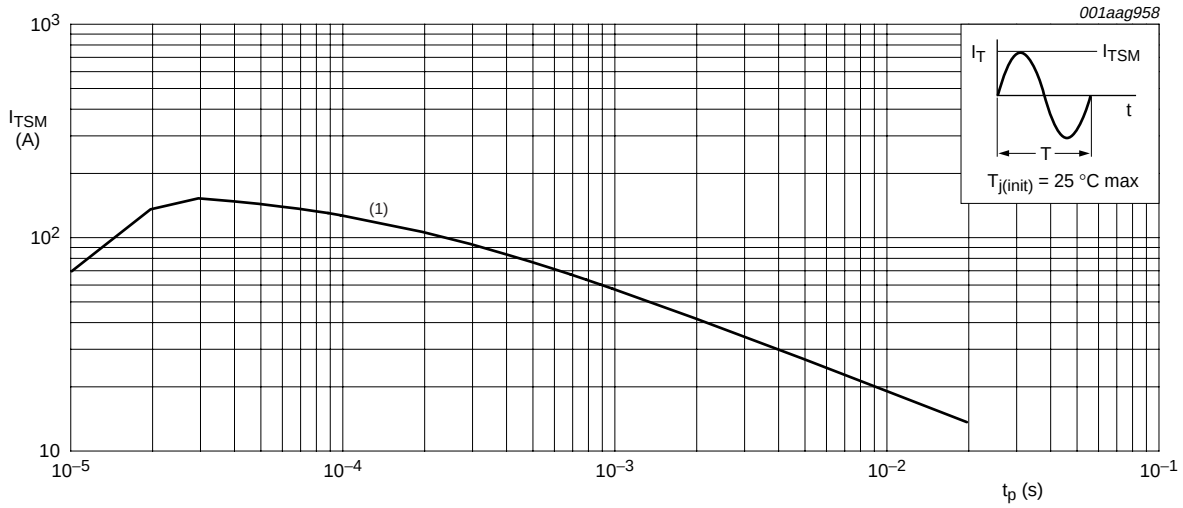

α = conduction angle

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




f = 50 Hz

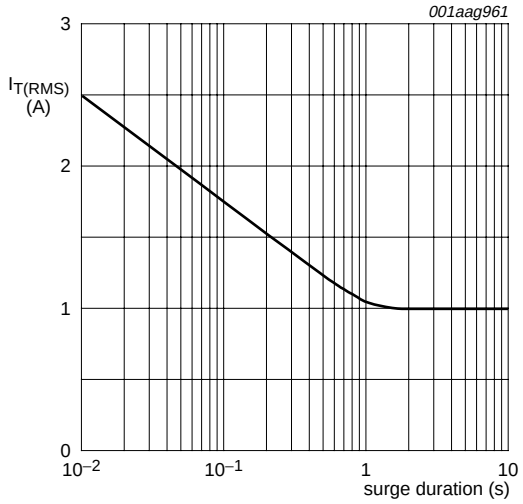
**Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values**




$t_p \leq 20$ 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; $T_{lead} \leq 54.3$ °C

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

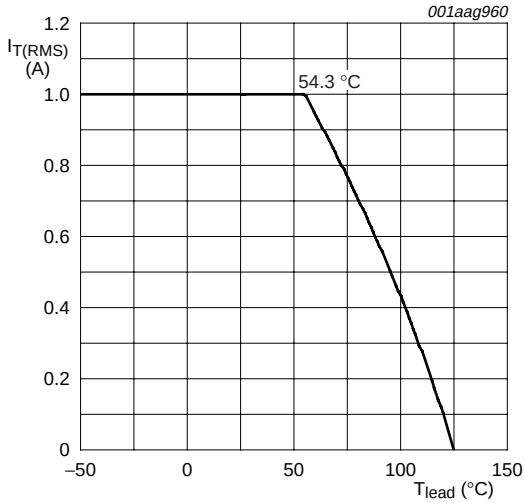
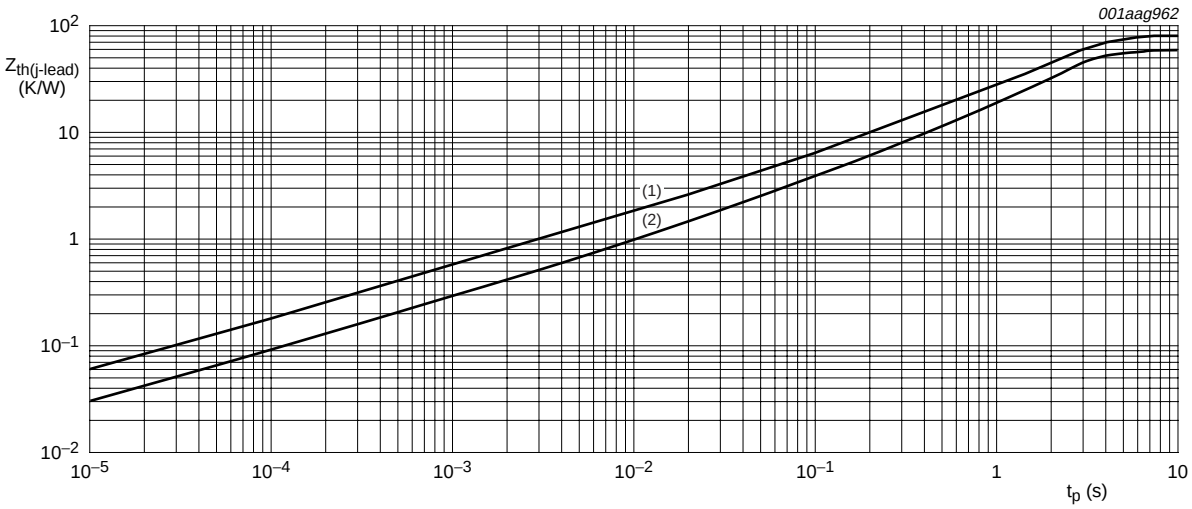



**Fig 5. RMS on-state current as a function of lead temperature; maximum values**

## 5. Thermal characteristics

**Table 4. Thermal characteristics**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $R_{th(j\text{-}lead)}$ | thermal resistance from junction to lead | full cycle; see Figure 6 | - | - | 60 | K/W |
| | | half cycle; see Figure 6 | - | - | 80 | K/W |
| $R_{th(j\text{-}a)}$ | thermal resistance from junction to ambient | printed-circuit board mounted; lead length = 4 mm | - | 150 | - | K/W |




(1) Unidirectional

(2) Bidirectional

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

## 6. Static characteristics

**Table 5. Static characteristics**

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

| Symbol | Parameter | Conditions | BTA201-600B BTA201-800B | | | BTA201-600E BTA201-800E BTA201-800ER | | | 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+ | - | - | 50 | - | - | 10 | mA |
| | | T2+ G– | - | - | 50 | - | - | 10 | mA |
| | | T2– G– | - | - | 50 | - | - | 10 | mA |
| $I_L$ | latching current | $V_D$ = 12 V; $I_{GT}$ = 0.1 A; see Figure 10 | | | | | | | |
| | | T2+ G+ | - | - | 30 | - | - | 12 | mA |
| | | T2+ G– | - | - | 50 | - | - | 20 | mA |
| | | T2– G– | - | - | 30 | - | - | 12 | mA |
| $I_H$ | holding current | $V_D$ = 12 V; $I_{GT}$ = 0.1 A; see Figure 11 | - | - | 30 | - | - | 12 | mA |
| $V_T$ | on-state voltage | $I_T$ = 1.4 A; see Figure 9 | - | 1.2 | 1.5 | - | 1.2 | 1.5 | 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 |

## 7. Dynamic characteristics

**Table 6. Dynamic characteristics**

| Symbol | Parameter | Conditions | BTA201-600B BTA201-800B | | | BTA201-600E BTA201-800E BTA201-800ER | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Typ | Max | |
| $dV_D/dt$ | rate of rise of off-state voltage | $V_{DM}$ = 67 % $V_{DRM(max)}$; $T_j$ = 125 °C; exponential waveform; gate open circuit | 1000 | - | - | 600 | - | - | V/µs |
| $dI_{com}/dt$ | rate of change of commutating current | $V_{DM}$ = 400 V; $T_j$ = 125 °C; $dV_{com}/dt$ = 20 V/µs; gate open circuit | 12 | - | - | 2.5 | - | - | A/ms |
| | | $V_{DM}$ = 400 V; $T_j$ = 125 °C; $dV_{com}/dt$ = 10 V/µs; gate open circuit | 16 | - | - | 3.5 | - | - | 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 |

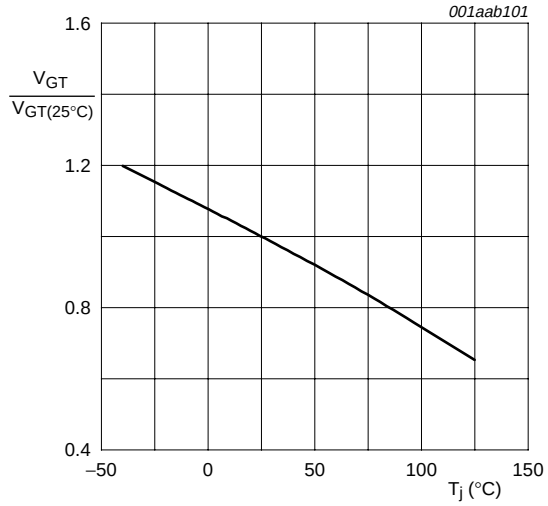
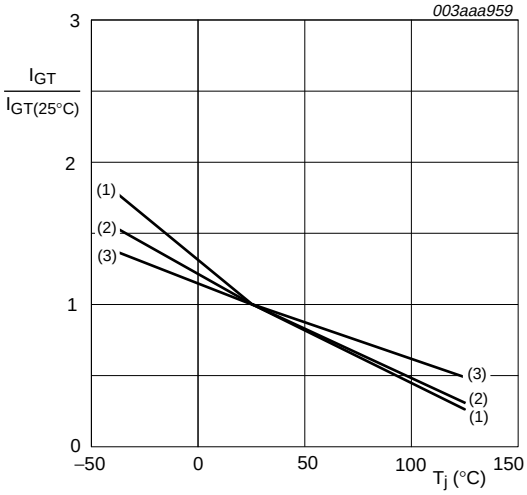



**Fig 7. Normalized gate trigger voltage as a function of junction temperature**

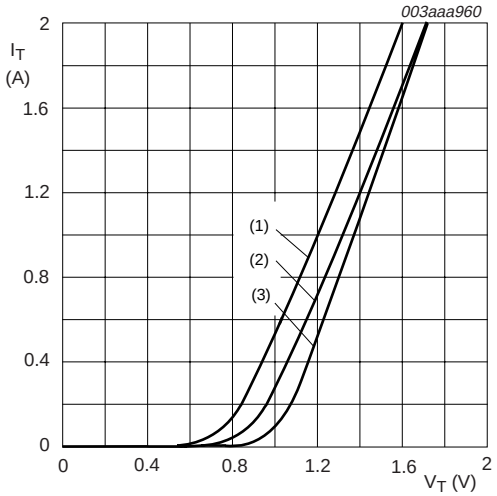



(1) T2– G–

(2) T2+ G–

(3) T2+ G+

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




$V_o$ = 1.02 V; $R_s$ = 0.358 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**

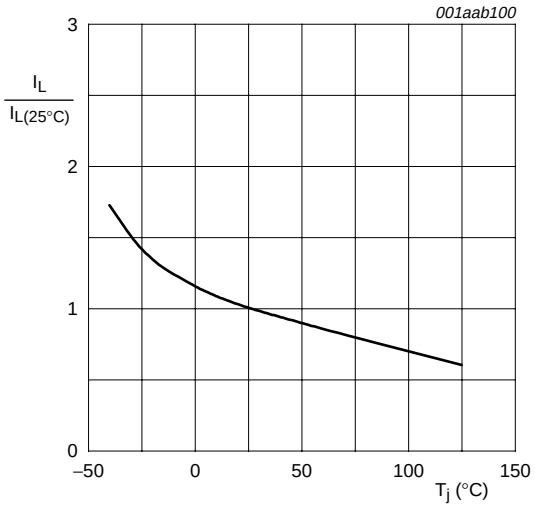



**Fig 10. Normalized latching current as a function of junction temperature**

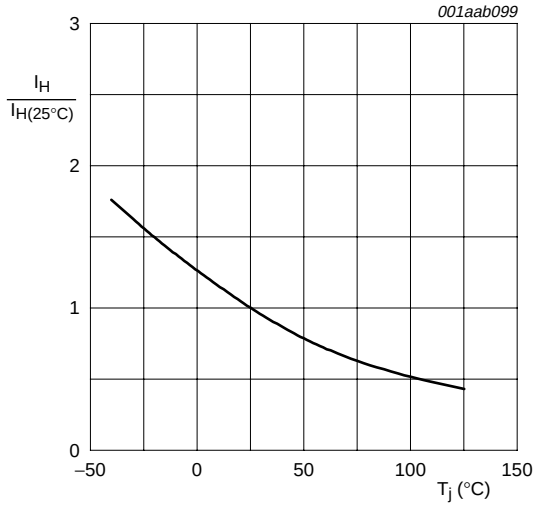
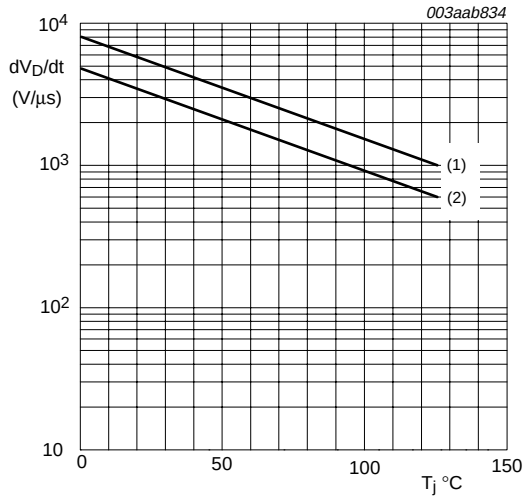



**Fig 11. Normalized holding current as a function of junction temperature**




Gate open circuit

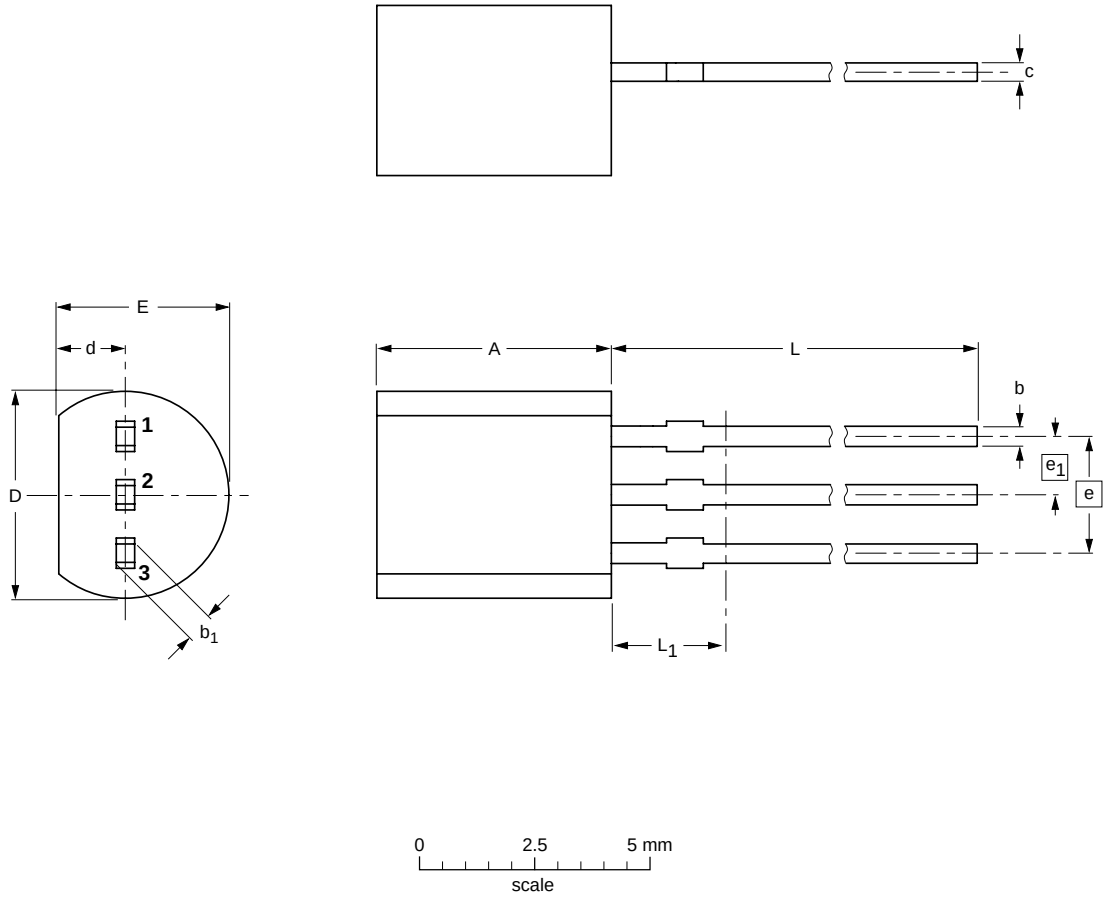
(1) BTA201 series B

(2) BTA201 series E and ER

**Fig 12. Critical rate of rise of off-state voltage as a function of junction temperature; minimum values**

## 8. Package outline

**Plastic single-ended leaded (through hole) package; 3 leads** **SOT54**




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

| UNIT | A | b | $b_1$ | c | D | d | E | e | $e_1$ | L | $L_1$ (1) max. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 5.2<br>5.0 | 0.48<br>0.40 | 0.66<br>0.55 | 0.45<br>0.38 | 4.8<br>4.4 | 1.7<br>1.4 | 4.2<br>3.6 | 2.54 | 1.27 | 14.5<br>12.7 | 2.5 |

**Note**

1. Terminal dimensions within this zone are uncontrolled to allow for flow of plastic and terminal irregularities.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT54 | | TO-92 | SC-43A | | | ~~04-06-28~~<br>04-11-16 |

**Fig 13. Package outline SOT54 (TO-92)**

## 9. Revision history

**Table 7. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BTA201_SER_B_E_ER_3 | 20070910 | Product data sheet | - | BTA201_SER_B_E_ER_2 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.<br>• Legal texts have been adapted to the new company name where appropriate.<br>• Descriptive titles have been corrected.<br>• Table 3 “Limiting values” on page 2: $dI_T/dt$ uprated.<br>• Table 6 “Dynamic characteristics” on page 7: $dV_D/dt$ uprated.<br>• Figure 12 “Critical rate of rise of off-state voltage as a function of junction temperature; minimum values” on page 8: graph updated. | | | |
| BTA201_SER_B_E_ER_2 | 20060113 | Product data sheet | - | BTA201_SER_B_E_ER_1 |
| Modifications: | • Figure 4: Figure note corrected<br>• Table 6 “Dynamic characteristics” on page 7: Units corrected<br>• Figure 12: Figure title corrected | | | |
| BTA201_SER_B_E_ER_1 (9397 750 15154) | 20050825 | Product data sheet | - | - |

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## 10.1 Data sheet status

| 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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