# BTA330X-800CT

## 3Q Hi-Com Triac

Rev.01 - 27 November 2023 Product data sheet

## 1. General description

Planar passivated high commutation three quadrant triac in a SOT186A (TO-220F) "full pack" plastic package intended for use in circuits where high static and dynamic dV/dt and high dI/dt can occur. This "series BT" triac will commutate the full RMS current at the maximum rated junction temperature ($T_{j(max)}$ = 150 °C) without the aid of a snubber. It is used in applications where "high junction operating temperature capability" is required.

## 2. Features and benefits

- 3Q technology for improved noise immunity
- 2500V RMS isolation voltage capability
- High commutation capability with maximum false trigger immunity
- High immunity to false turn-on by dV/dt
- High junction operating temperature capability
- High voltage capability
- High current capability
- Isolated mounting base package
- Least sensitive gate for highest noise immunity
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only
- UL1557 certified (Document number E346397)

## 3. Applications

- Applications subject to high temperature
- Heating controls
- High power motor control
- High power switching

## 4. Quick reference data

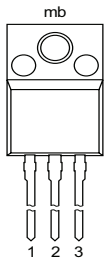
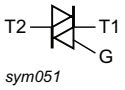
**Table 1. Quick reference data**

| Symbol | Parameter | Conditions | Notes | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| $V_{DRM}$ | repetitive peak off-state voltage | | | 800 | | | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_h \leq 42$ °C; Fig. 1; Fig. 2; Fig. 3 | | 30 | | | A |
| $I_{TSM}$ | non-repetitive peak on-state current | full sine wave; $T_{j(init)}$ = 25 °C; $t_p$ = 20 ms; Fig. 4; Fig. 5 | | 270 | | | A |
| | | full sine wave; $T_{j(init)}$ = 25 °C; $t_p$ = 16.7 ms | | 297 | | | A |
| $T_j$ | junction temperature | | | 150 | | | °C |
| **Symbol** | **Parameter** | **Conditions** | **Notes** | **Min** | **Typ** | **Max** | **Unit** |
| **Static characteristics** | | | | | | | |
| $I_{GT}$ | gate trigger current | $V_D$ = 12 V; $I_T$ = 0.1 A; T2+ G+; $T_j$ = 25 °C; Fig. 7 | | - | - | 35 | mA |
| | | $V_D$ = 12 V; $I_T$ = 0.1 A; T2+ G-; $T_j$ = 25 °C; Fig. 7 | | - | - | 35 | mA |
| | | $V_D$ = 12 V; $I_T$ = 0.1 A; T2- G-; $T_j$ = 25 °C; Fig. 7 | | - | - | 35 | mA |
| $I_H$ | holding current | $V_D$ = 12 V; $T_j$ = 25 °C; Fig. 9 | | - | - | 50 | mA |
| $V_T$ | on-state voltage | $I_T$ = 42 A; $T_j$ = 25 °C; Fig. 10 | | - | 1.20 | 1.55 | V |

| Symbol | Parameter | Conditions | Notes | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Dynamic characteristics** | | | | | | | |
| $dV_D/dt$ | rate of rise of off-state voltage | $V_{DM}$ = 536 V; $T_j$ = 125 °C; ($V_{DM}$ = 67% of $V_{DRM}$); exponential waveform; gate open circuit | | 2000 | - | - | V/µs |
| | | $V_{DM}$ = 536 V; $T_j$ = 150 °C; ($V_{DM}$ = 67% of $V_{DRM}$); exponential waveform; gate open circuit | | 1000 | - | - | V/µs |
| $dI_{com}/dt$ | rate of change of commutating current | $V_D$ = 400 V; $T_j$ = 125 °C; $I_{T(RMS)}$ = 30 A; $dV_{com}/dt$ = 20 V/µs; gate open circuit | | 16 | - | - | A/ms |
| | | $V_D$ = 400 V; $T_j$ = 150 °C; $I_{T(RMS)}$ = 30 A; $dV_{com}/dt$ = 20 V/µs; gate open circuit | | 13 | | - | A/ms |

## 5. Pinning information

**Table 2. Pinning information**

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

## 6. Ordering information

**Table 3. Ordering information**

| Type number | Package Name | Orderable part number | Packing method | Small packing quantity | Package version | Package issue date |
|---|---|---|---|---|---|---|
| BTA330X-800CT | TO220F | BTA330X-800CTQ | Tube | 50 | SOT186A | 14-Nov-2013 |

## 7. Marking

**Table 4. Marking codes**

| Type number | Marking codes |
|---|---|
| BTA330X-800CT | BTA330X<br>800CT |

# 8. Limiting values

**Table 5. Limiting values**

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

| Symbol | Parameter | Conditions | Notes | Values | Unit |
|---|---|---|---|---|---|
| $V_{DRM}$ | repetitive peak off-state voltage | | | 800 | V |
| $V_{RRM}$ | repetitive peak reverse voltage | | | 800 | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_h \leq 42$ °C; Fig. 1; Fig. 2; Fig. 3 | | 30 | A |
| $I_{TSM}$ | non-repetitive peak on-state current | full sine wave; $T_{j(init)} = 25$ °C; $t_p = 20$ ms; Fig 4; Fig 5 | | 270 | A |
| | | full sine wave; $T_{j(init)} = 25$ °C; $t_p = 16.7$ ms | | 297 | A |
| $I^2t$ | $I^2t$ for fusing | $t_p = 10$ ms; SIN | | 364.5 | $A^2s$ |
| $dI_T/dt$ | rate of rise of on-state current | $I_G = 70$ mA | | 100 | A/µs |
| $I_{GM}$ | peak gate current | | | 2 | A |
| $P_{GM}$ | peak gate power | $T_{j(init)} = 25$ °C; $t_p = 20$ µs | | 5 | W |
| $P_{G(AV)}$ | average gate power | over any 20 ms period | | 0.5 | W |
| $T_{stg}$ | storage temperature | | | -40 to 150 | °C |
| $T_j$ | junction temperature | | | 150 | °C |

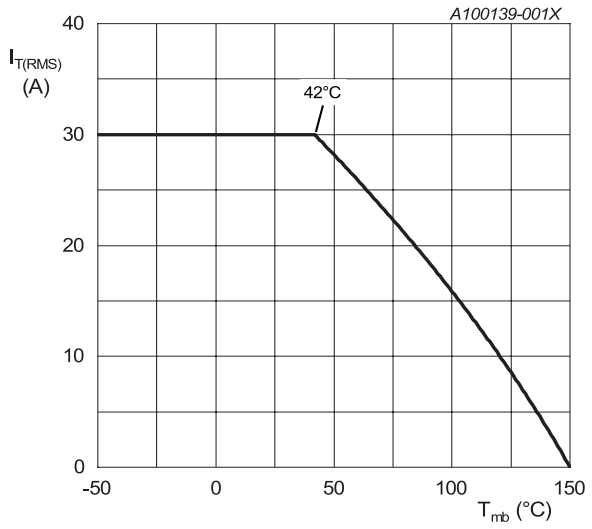
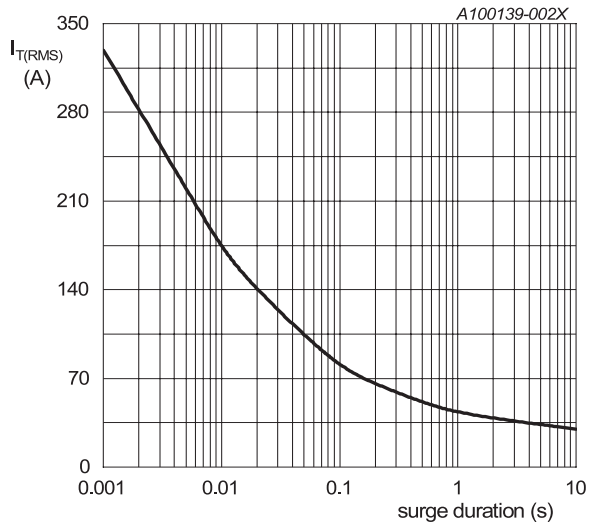
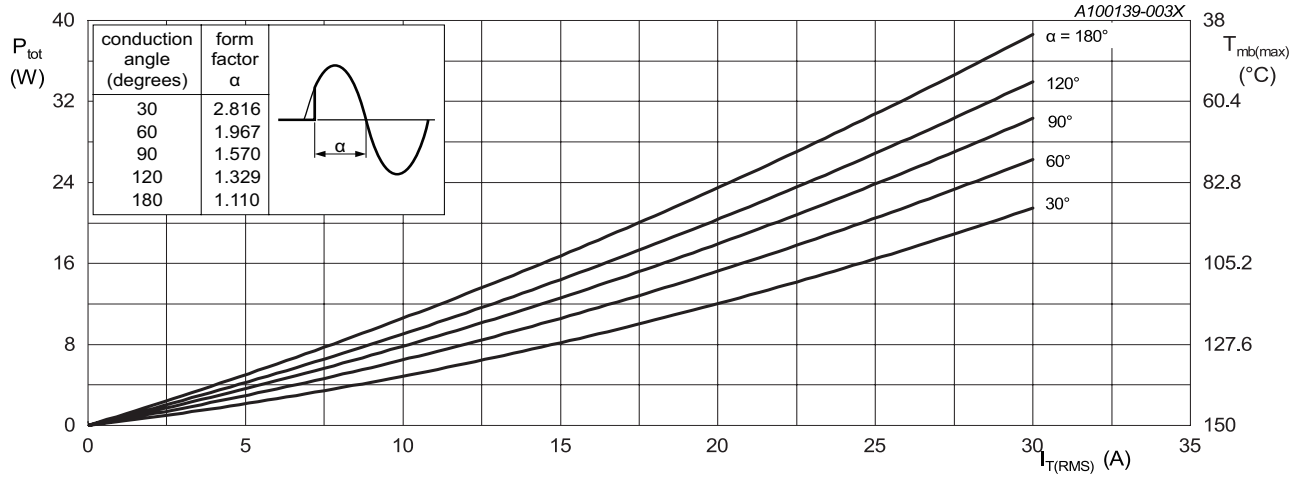



**Fig. 1. RMS on-state current as a function of mounting base temperature; maximum values**




f = 50 Hz; $T_{mb}$ = 42 °C

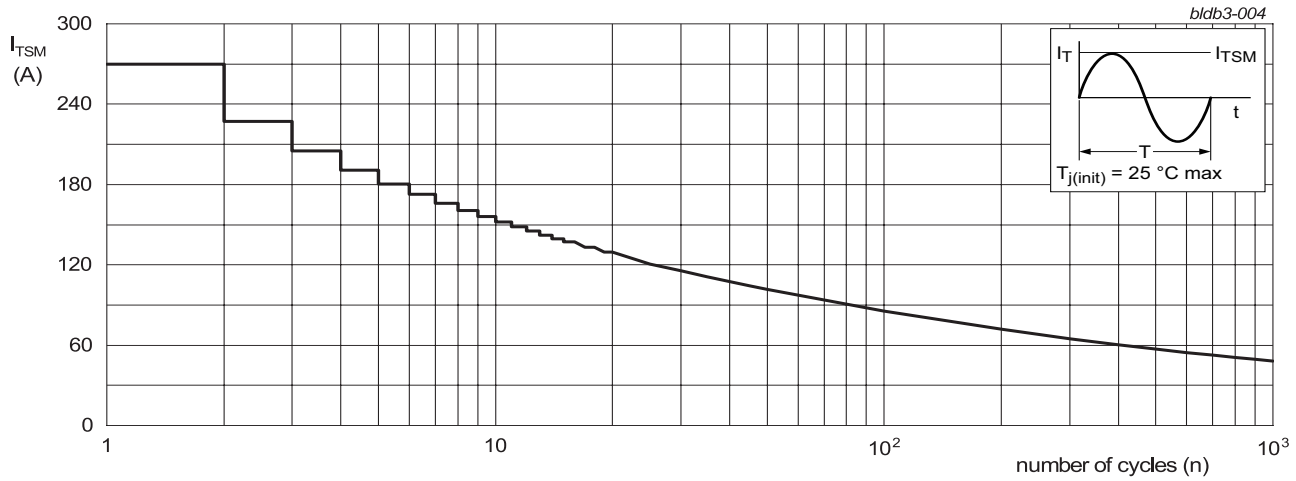
**Fig. 2. RMS on-state current as a function of surge duration; maximum values**




α = conduction angle

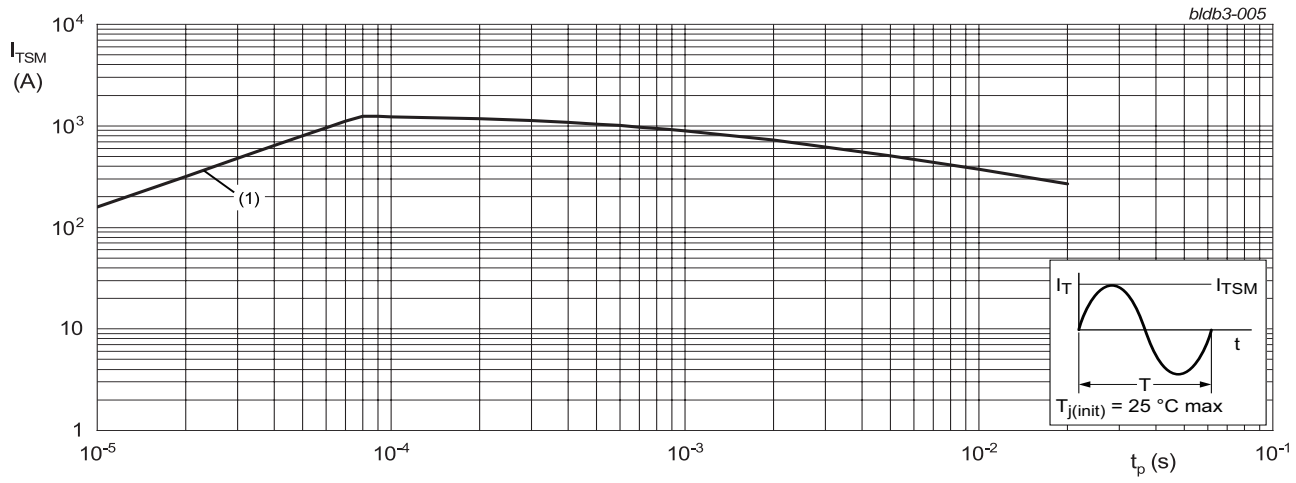
a = form factor = $I_{T(RMS)}$ / $I_{T(AV)}$

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




f = 50 Hz

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




$t_p$ ≤ 20 ms

(1) $dI_T/dt$ limit

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

# 9. Thermal characteristics

**Table 6. Thermal characteristics**

| Symbol | Parameter | Conditions | Notes | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j-mb)}$ | thermal resistance from junction to heatsink | Fig. 6 | | - | - | 2.8 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | | - | 55 | - | K/W |

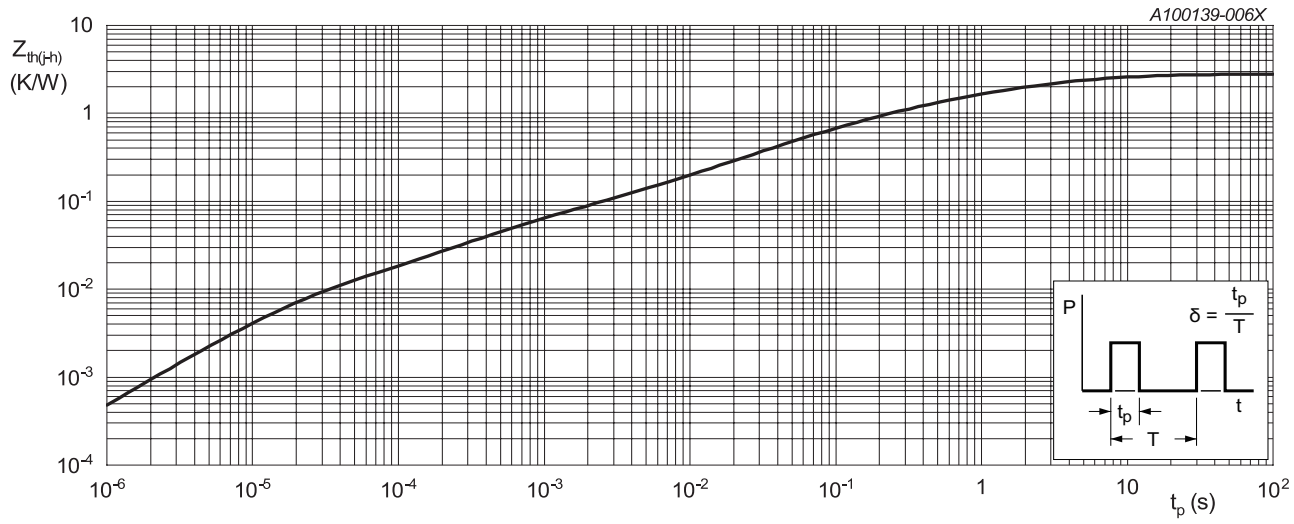



**Fig. 6. Transient thermal impedance from junction to heatsink as a function of pulse duration; maximum values**

# 10. Isolation characteristics

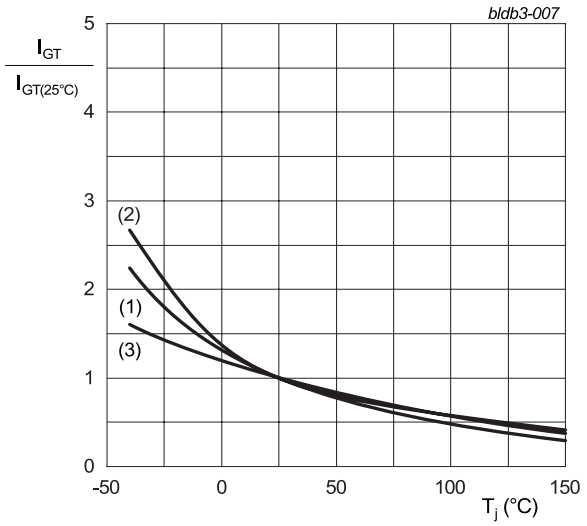
**Table 7. Isolation characteristics**

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

# 11. Characteristics

**Table 8. Characteristics**

| Symbol | Parameter | Conditions | Notes | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | | |
| $I_{GT}$ | gate trigger current | $V_D$ = 12 V; $I_T$ = 0.1 A; T2+ G+; $T_j$ = 25 °C; Fig. 7 | | - | - | 35 | mA |
| | | $V_D$ = 12 V; $I_T$ = 0.1 A; T2+ G-; $T_j$ = 25 °C; Fig. 7 | | - | - | 35 | mA |
| | | $V_D$ = 12 V; $I_T$ = 0.1 A; T2- G-; $T_j$ = 25 °C; Fig. 7 | | - | - | 35 | mA |
| $I_L$ | latching current | $V_D$ = 12 V; $I_G$ = 0.1 A; T2+ G+; $T_j$ = 25 °C; Fig. 8 | | - | - | 70 | mA |
| | | $V_D$ = 12 V; $I_G$ = 0.1 A; T2+ G-; $T_j$ = 25 °C; Fig. 8 | | - | - | 80 | mA |
| | | $V_D$ = 12 V; $I_G$ = 0.1 A; T2- G-; $T_j$ = 25 °C; Fig. 8 | | - | - | 70 | mA |
| $I_H$ | holding current | $V_D$ = 12 V; $T_j$ = 25 °C; Fig. 9 | | - | - | 50 | mA |
| $V_T$ | on-state voltage | $I_T$ = 42 A; $T_j$ = 25 °C; Fig. 10 | | - | 1.20 | 1.55 | V |
| $V_{GT}$ | gate trigger voltage | $V_D$ = 12 V; $I_T$ = 0.1 A; $T_j$ = 25 °C; Fig. 11 | | - | 0.9 | 1.3 | V |
| | | $V_D$ = 400 V; $I_T$ = 0.1 A; $T_j$ = 150 °C | | 0.20 | 0.45 | - | V |
| $I_D$ | off-state current | $V_D$ = 800 V; $T_j$ = 25 °C | | - | - | 10 | µA |
| | | $V_D$ = 800 V; $T_j$ = 150 °C | | - | 0.4 | 2 | mA |
| $I_R$ | reverse current | $V_R$ = 800 V; $T_j$ = 25 °C | | - | - | 10 | µA |
| | | $V_R$ = 800 V; $T_j$ = 150 °C | | - | 0.4 | 2 | mA |
| **Dynamic characteristics** | | | | | | | |
| $dV_D/dt$ | rate of rise of off-state voltage | $V_{DM}$ = 536 V; $T_j$ = 125 °C; ($V_{DM}$ = 67% of $V_{DRM}$); exponential waveform; gate open circuit | | 2000 | - | - | V/µs |
| | | $V_{DM}$ = 536 V; $T_j$ = 150 °C; ($V_{DM}$ = 67% of $V_{DRM}$); exponential waveform; gate open circuit | | 1000 | - | - | V/µs |
| $dI_{com}/dt$ | rate of change of commutating current | $V_D$ = 400 V; $T_j$ = 125 °C; $I_{T(RMS)}$ = 30 A; $dV_{com}/dt$ = 20 V/µs; gate open circuit | | 16 | - | - | A/ms |
| | | $V_D$ = 400 V; $T_j$ = 150 °C; $I_{T(RMS)}$ = 30 A; $dV_{com}/dt$ = 20 V/µs; gate open circuit | | 13 | | - | A/ms |




(1) T2- G-
(2) T2+ G-
(3) T2+ G+

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

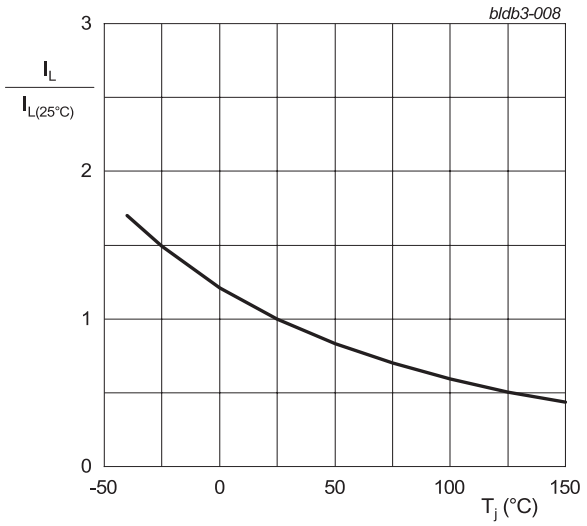



**Fig. 8. Normalized latching current as a function of junction temperature**

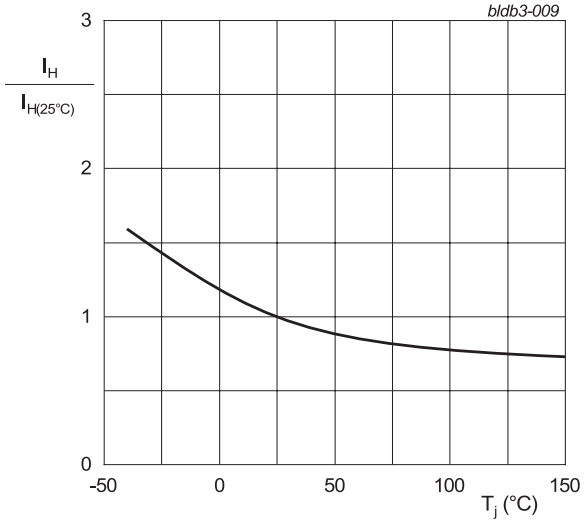
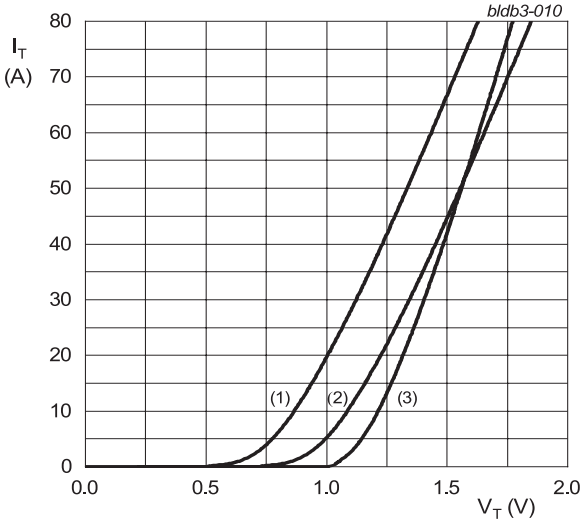



**Fig. 9. Normalized holding current as a function of junction temperature**




$V_o$ = 1.049 V; $R_s$ = 0.0114 Ω
(1) $T_j$ = 150 °C; typical values
(2) $T_j$ = 150 °C; maximum values
(3) $T_j$ = 25 °C; maximum values

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

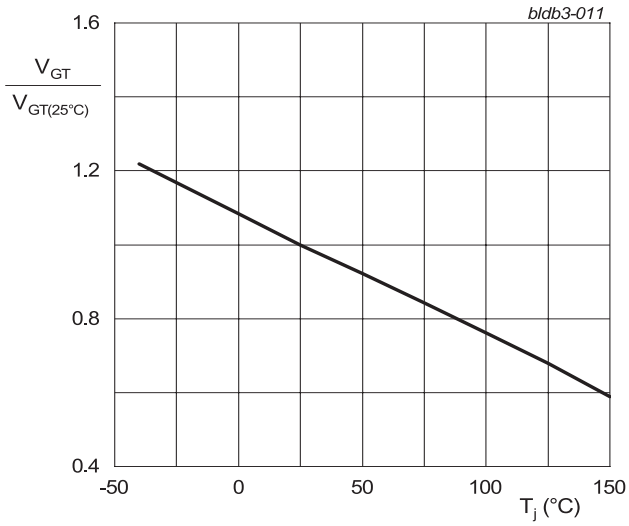
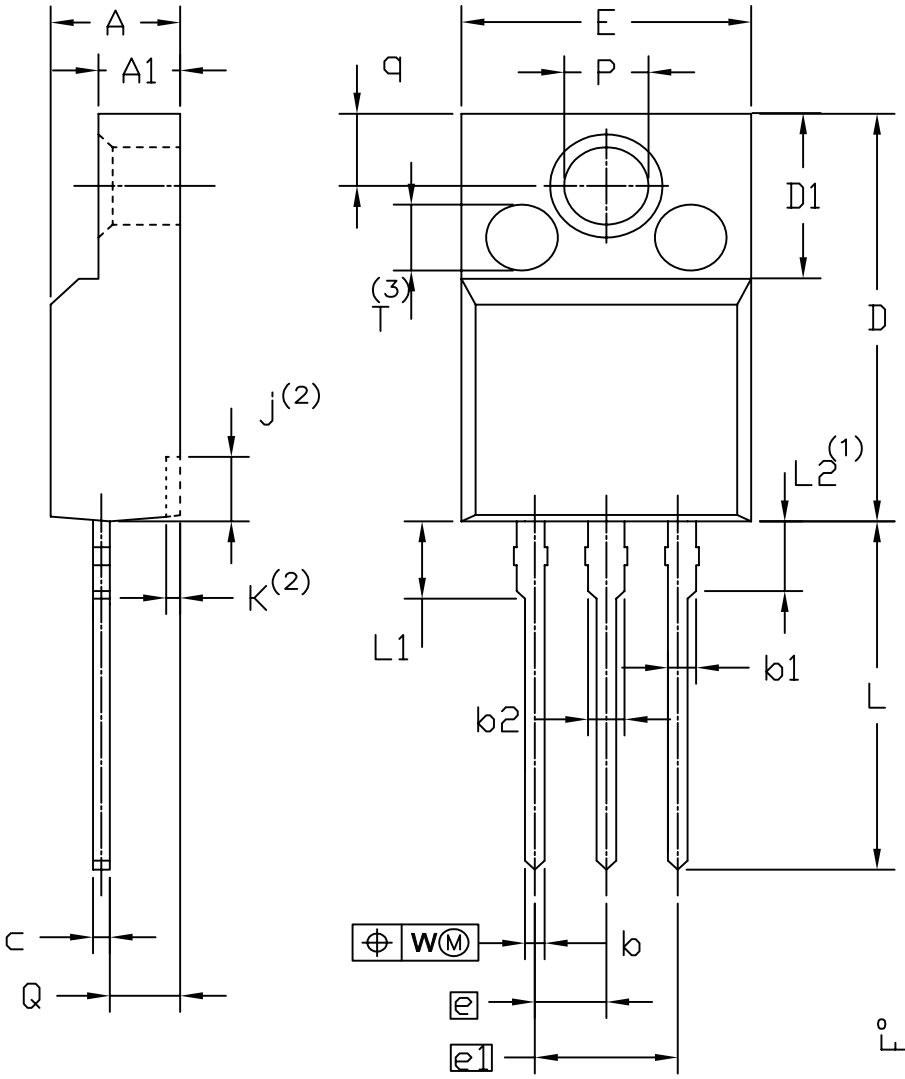



**Fig. 11. Normalized gate trigger voltage as a function of junction temperature**

## 12. Package outline

Plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack" SOT186A




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

Notes
1. Terminal dimensions within this zone are uncotrolled
2. Dot lines area designs may vary
3. Eject pin mark is for reference only

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT186A | | 3 LEADS TO220F | | | | 2013-11-14 |

# 13. Legal information

## 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. |

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[2] The term 'short data sheet' is explained in section "Definitions".
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**Date of release: 27 November 2023**

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