

1. General description

Planar passivated high commutation three quadrant triac in a SOT186A "full pack" plastic package. This triac is intended for use in motor control circuits where very high blocking voltage, high static and dynamic dV/dt as well as high dI_{comm}/dt can occur. This "series C" triac will commutate the full rated RMS current at the maximum rated junction temperature without the aid of a snubber.

2. Features and benefits

- 3Q technology for improved noise immunity
- High commutation capability with maximum false trigger immunity
- High immunity to false turn on by dV/dt
- Isolated mounting base package
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only
- Very high voltage capability

3. Applications

- Compressor starting controls
- General purpose motor controls
- Reversing induction motor control e.g. window shutters, blinds and sun shades

4. Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------|--------------------------------------|---|-----|-----|------|------|
| V_{DRM} | repetitive peak off-state voltage | | - | - | 1000 | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_h \leq 92\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3 | - | - | 4 | A |
| I_{TSM} | non-repetitive peak on-state current | full sine wave; $T_{j(initial)} = 25\text{ °C}$; $t_p = 20\text{ ms}$; Fig. 4 ; Fig. 5 | - | - | 25 | A |
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
| Static characteristics | | | | | | |
| I_{GT} | gate trigger current | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ °C}$; Fig. 7 | 2 | 6 | 35 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 7 | 2 | 8 | 35 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; Fig. 7 | 2 | 20 | 35 | mA |

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

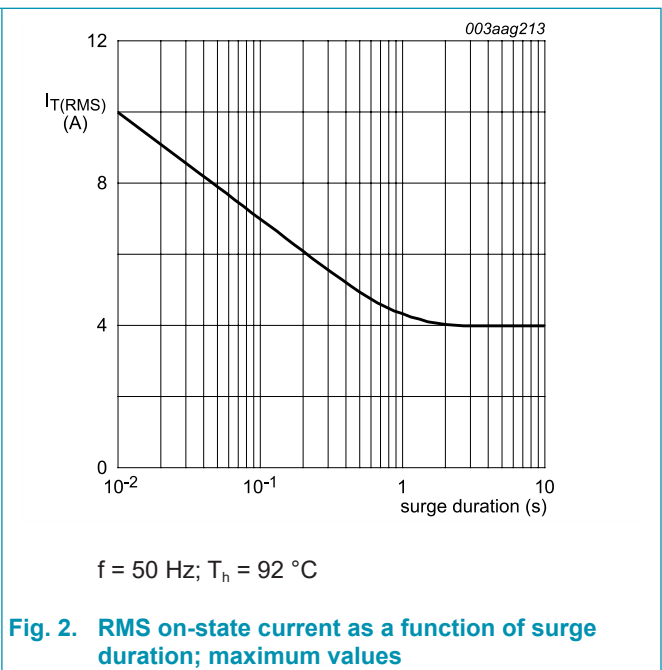
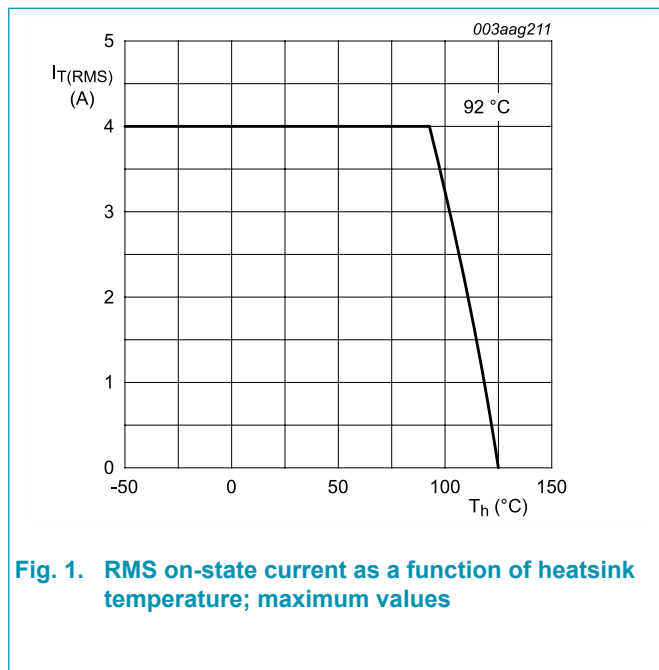
| Type number | Package | | |
|---------------|---------|---|---------|
| | Name | Description | Version |
| BTA204X-1000C | TO-220F | plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack" | SOT186A |

7. Limiting values

Table 4. 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 | | - | 1000 | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_h \leq 92\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3 | - | 4 | A |
| I_{TSM} | non-repetitive peak on-state current | full sine wave; $T_{j(initial)} = 25\text{ °C}$; $t_p = 20\text{ ms}$; Fig 4 ; Fig 5 | - | 25 | A |
| | | full sine wave; $T_{j(initial)} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$ | - | 27 | A |
| I^2t | I^2t for fusing | $t_p = 10\text{ ms}$; SIN | - | 3.1 | A ² s |
| di_T/dt | rate of rise of on-state current | $I_G = 70\text{ mA}$ | - | 100 | A/ μ s |
| 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 | - | 0.5 | W |
| T_{stg} | storage temperature | | -40 | 150 | °C |
| T_j | junction temperature | | - | 125 | °C |



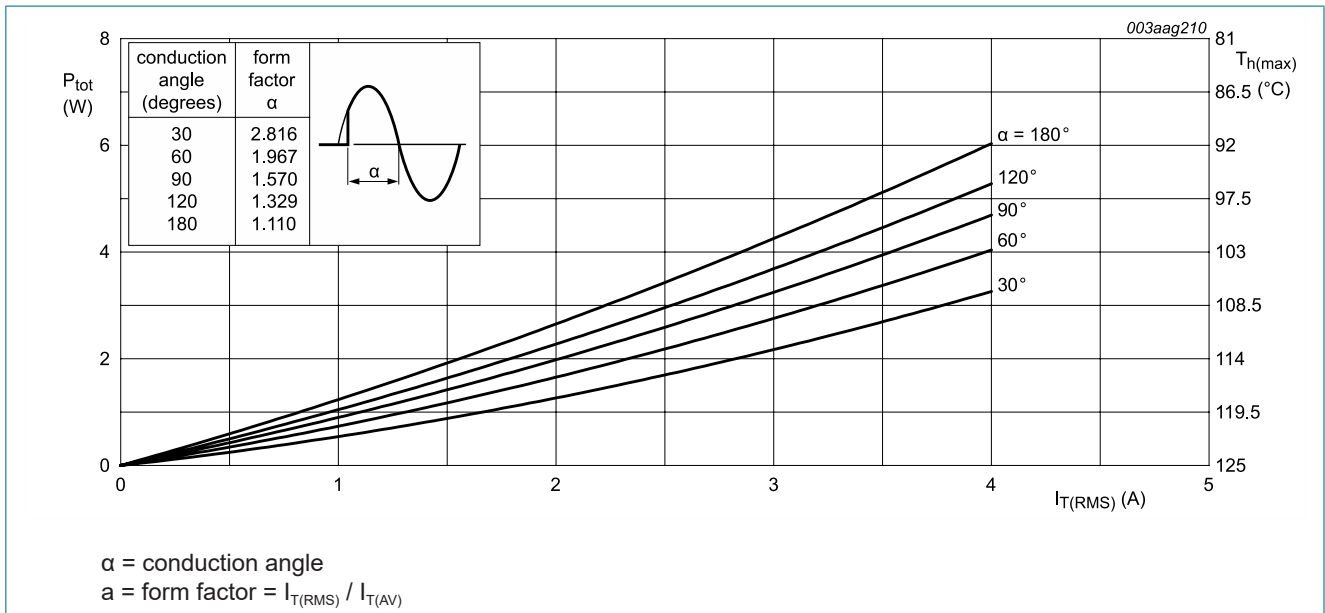


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

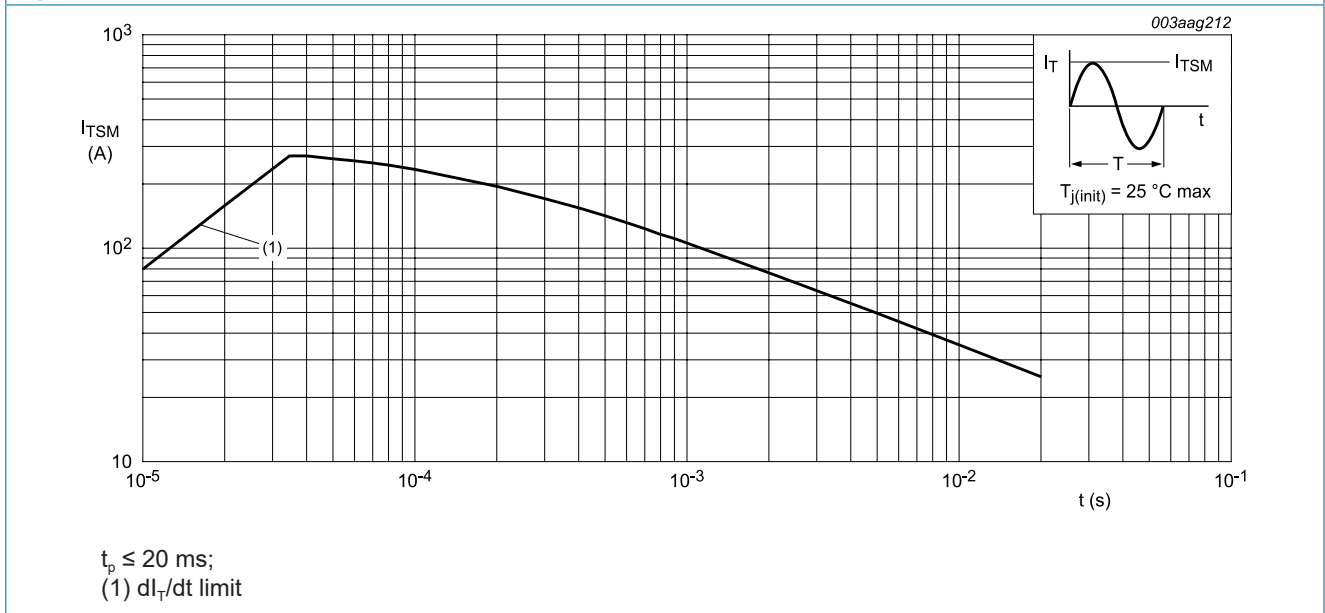
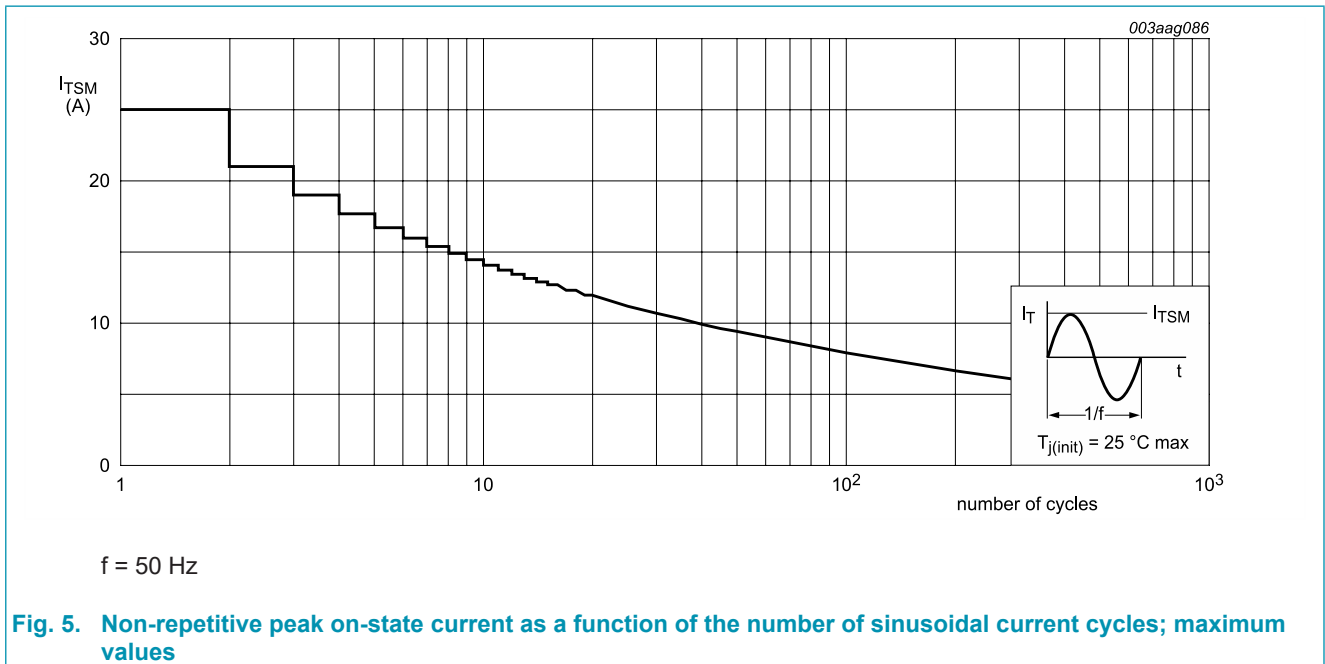


Fig. 4. Non-repetitive peak on-state current as a function of pulse width; maximum values



8. Thermal characteristics

Table 5. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------|--|--|-----|-----|-----|------|
| $R_{th(j-h)}$ | thermal resistance from junction to heatsink | full cycle or half cycle; with heatsink compound; Fig 6 | - | - | 5.5 | K/W |
| | | full cycle or half cycle; without heatsink compound; Fig 6 | - | - | 7.2 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | - | 55 | - | K/W |

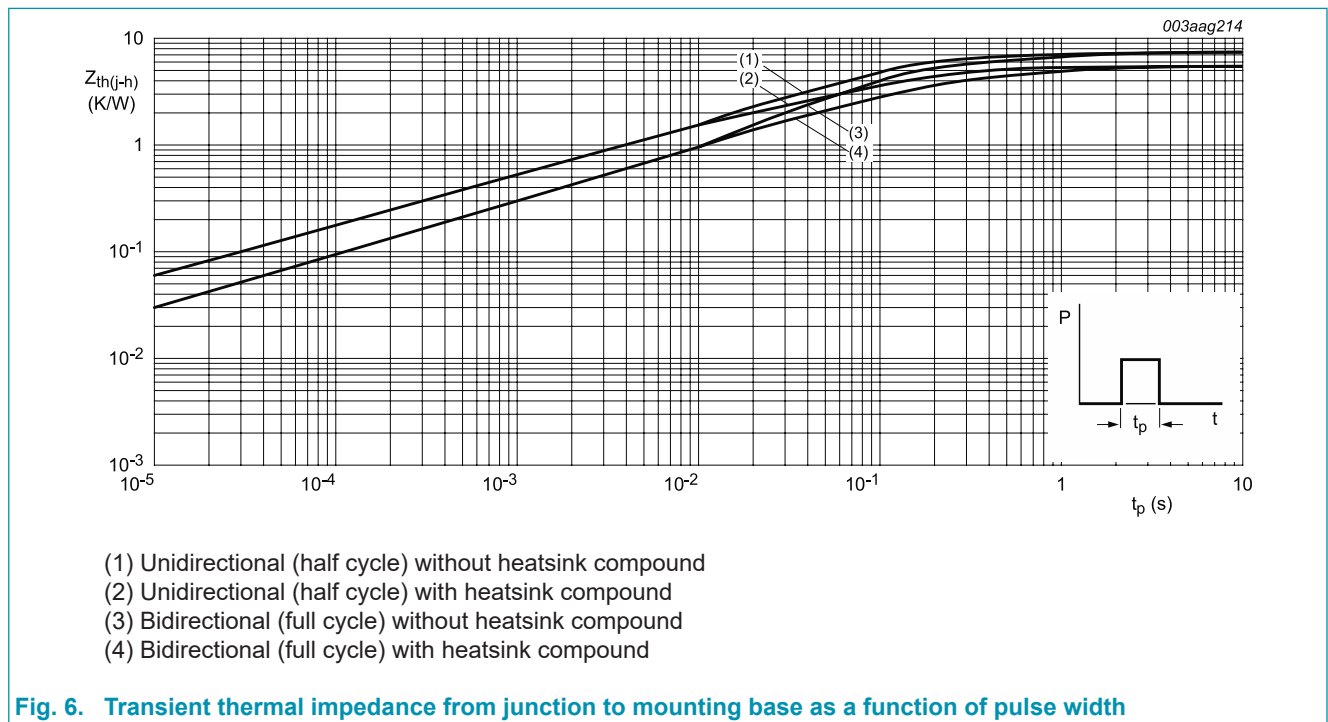


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse width

9. Isolation Characteristics

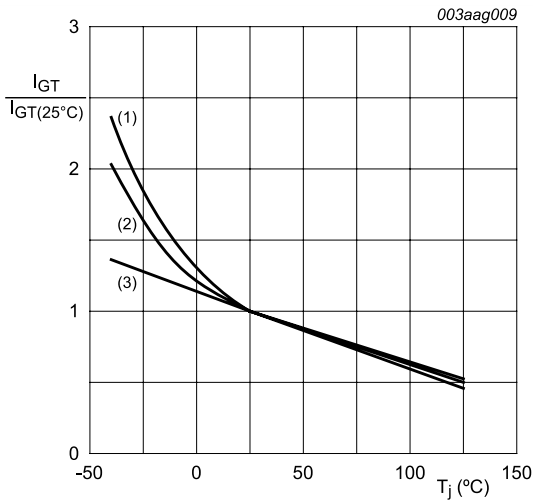
Table 6. Isolation Characteristics

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

10. Characteristics

Table 6. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|---------------------------------------|--|------|-----|-----|------------|
| Static characteristics | | | | | | |
| I_{GT} | gate trigger current | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G+; $T_J = 25\text{ °C}$; Fig. 7 | 2 | 6 | 35 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_J = 25\text{ °C}$; Fig. 7 | 2 | 8 | 35 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_J = 25\text{ °C}$; Fig. 7 | 2 | 20 | 35 | mA |
| I_L | latching current | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G+; $T_J = 25\text{ °C}$; Fig. 8 | - | - | 20 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G-; $T_J = 25\text{ °C}$; Fig. 8 | - | - | 30 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G-; $T_J = 25\text{ °C}$; Fig. 8 | - | - | 20 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_J = 25\text{ °C}$; Fig. 9 | - | - | 20 | mA |
| V_T | on-state voltage | $I_T = 5\text{ A}$; $T_J = 25\text{ °C}$; Fig. 10 | - | 1.4 | 1.7 | V |
| V_{GT} | gate trigger voltage | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; $T_J = 25\text{ °C}$; Fig. 11 | - | 0.7 | 1.5 | V |
| | | $V_D = 400\text{ V}$; $I_T = 0.1\text{ A}$; $T_J = 125\text{ °C}$; | 0.25 | 0.4 | - | V |
| I_D | off-state current | $V_D = 1000\text{ V}$; $T_J = 125\text{ °C}$ | - | 0.1 | 0.5 | mA |
| Dynamic characteristics | | | | | | |
| dV_D/dt | rate of rise of off-state voltage | $V_{DM} = 670\text{ V}$; $T_J = 125\text{ °C}$; exponential waveform; gate open circuit | 1000 | 500 | - | V/ μ s |
| dI_{com}/dt | rate of change of commutating current | $V_D = 400\text{ V}$; $T_J = 125\text{ °C}$; $I_{T(RMS)} = 4\text{ A}$; $dV_{com}/dt = 20\text{ V}/\mu$ s; (without snubber condition); gate open circuit | 3 | 30 | - | A/ms |
| t_{gt} | gate-controlled turn-on time | $I_{TM} = 12\text{ A}$; $V_D = 1000\text{ V}$; $I_G = 0.1\text{ A}$; $dI_G/dt = 5\text{ A}/\mu$ s | - | 2 | - | μ s |



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

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

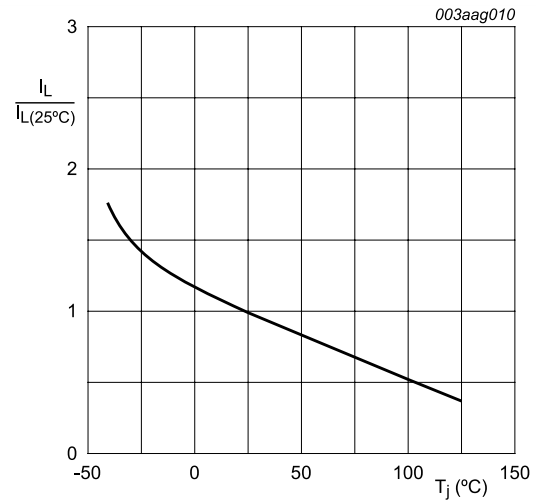


Fig. 8. Normalized latching current as a function of junction temperature

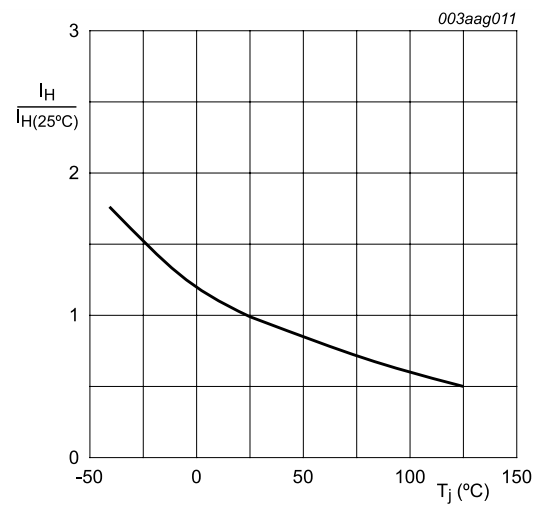
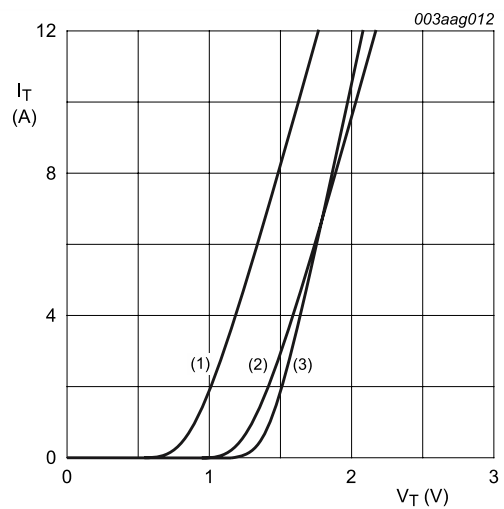


Fig. 9. Normalized holding current as a function of junction temperature



- $V_o = 1.22 \text{ V}; R_s = 0.04 \Omega$
- (1) $T_j = 125 \text{ }^\circ\text{C}$; typical values
 - (2) $T_j = 125 \text{ }^\circ\text{C}$; maximum values
 - (3) $T_j = 25 \text{ }^\circ\text{C}$; maximum values

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

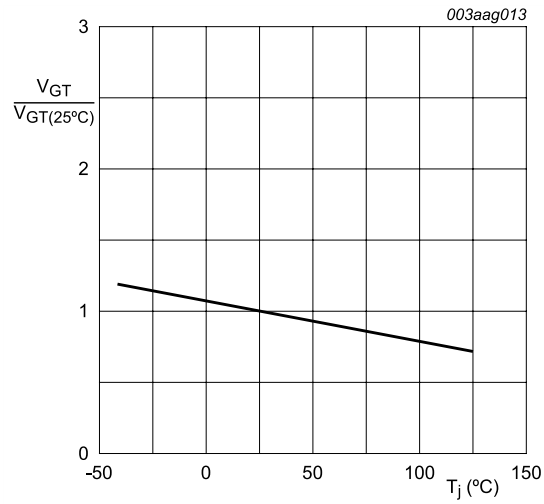
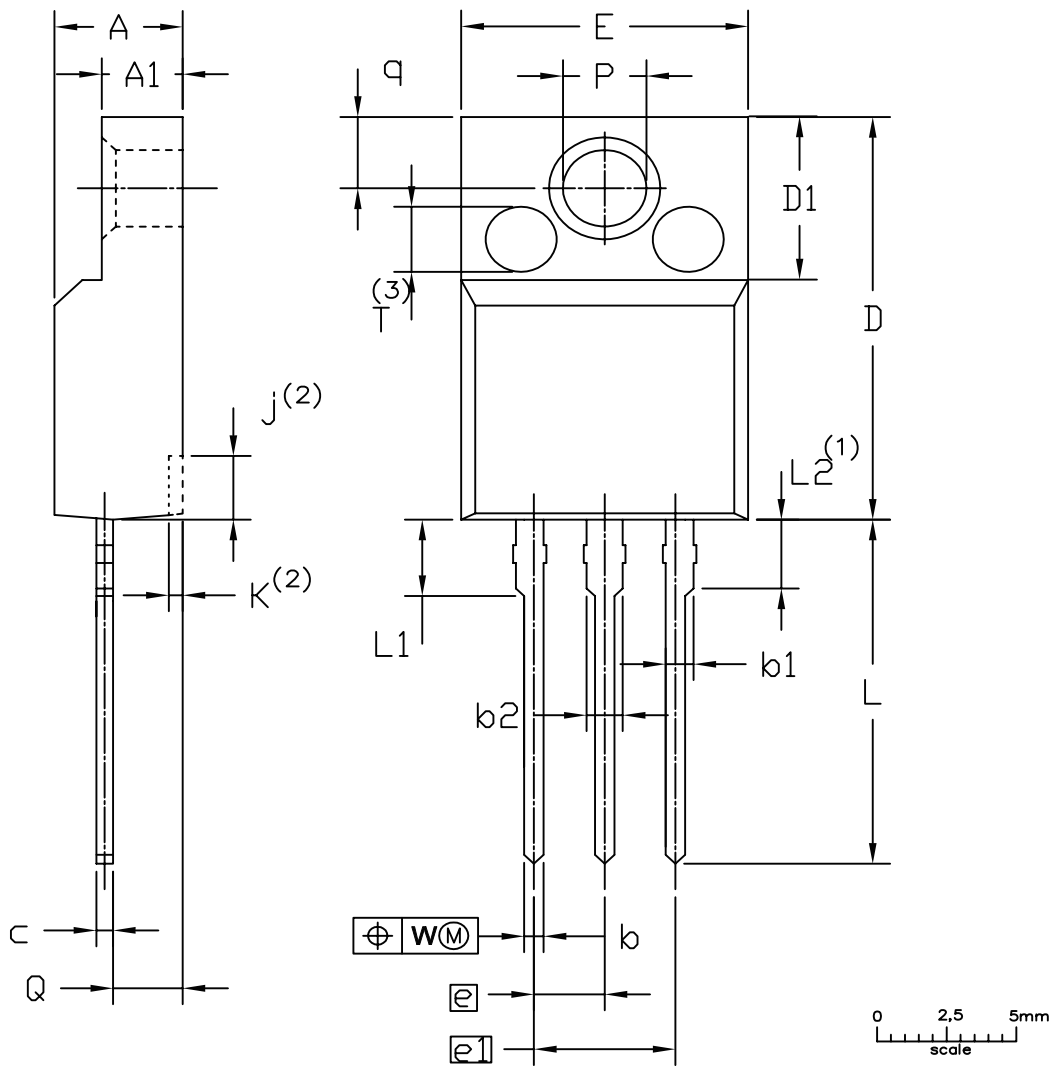


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

11. 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
- Terminal dimensions within this zone are uncontrolled
 - Dot lines area designs may vary
 - Eject pin mark is for reference only

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

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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. |

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