

## 1. General description

Planar passivated sensitive gate four quadrant triac in a SOT186A (TO-220F) plastic package intended for use in general purpose bidirectional switching and phase control applications. This sensitive gate "series E" triac is intended to be interfaced directly to microcontrollers, logic integrated circuits and other low power gate trigger circuits.

## 2. Features and benefits

- High blocking voltage capability
- Planar passivated for voltage ruggedness and reliability
- Sensitive gate
- Triggering in all four quadrants
- Isolated package
- Direct triggering from low power drivers and logic ICs
- Low holding current for small load currents and lowest EMI at commutation

## 3. Applications

- General purpose motor control
- General purpose switching

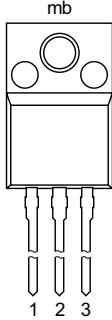

## 4. Quick reference data

Table 1. Quick reference data

| Symbol                         | Parameter                            | Conditions  | Values |     |     | Unit |
|--------------------------------|--------------------------------------|---|--------|-----|-----|------|
| <b>Absolute maximum rating</b> |                                      |   |        |     |     |      |
| $V_{DRM}$                      | repetitive peak off-state voltage    |   | 600    |     |     | V    |
| $I_{T(RMS)}$                   | RMS on-state current                 | full sine wave; $T_h \leq 92\text{ }^\circ\text{C}$ ;<br><a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>       | 4      |     |     | A    |
| $I_{TSM}$                      | non-repetitive peak on-state current | full sine wave; $T_{j(initial)} = 25\text{ }^\circ\text{C}$ ;<br>$t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> | 25     |     |     | A    |
| Symbol                         | Parameter                            | Conditions  | Min    | Typ | Max | Unit |
| <b>Static characteristics</b>  |                                      |   |        |     |     |      |
| $I_{GT}$                       | gate trigger current                 | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G+;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                       | -      | 2.5 | 10  | mA   |
|                                |                                      | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                       | -      | 4   | 10  | mA   |
|                                |                                      | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                       | -      | 5   | 10  | mA   |
|                                |                                      | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G+;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                       | -      | 11  | 25  | mA   |
| $I_H$                          | holding current                      | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>   | -      | 2.2 | 15  | 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 |
| BT136X-600E | TO-220F | plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack" | SOT186A |

## 7. Marking

Table 4. Marking codes

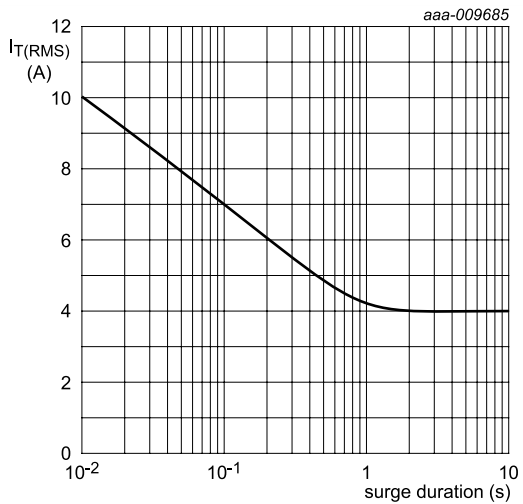
| Type number | Marking codes |
|-------------|---------------|
| BT136X-600E | BT136X-600E   |

## 8. Limiting values

**Table 5. Limiting values**

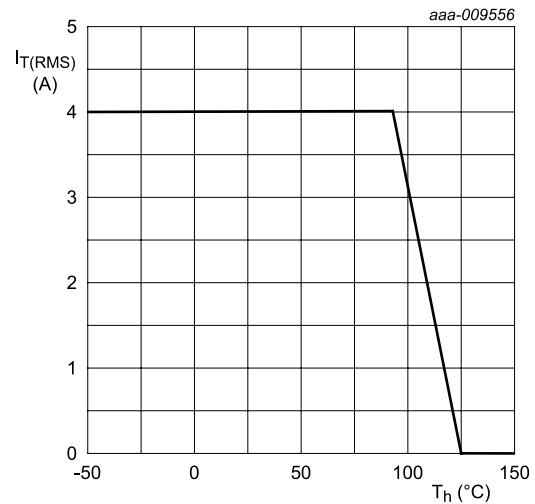
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol       | Parameter                            | Conditions  | Values     | Unit             |
|--------------|--------------------------------------|---|------------|------------------|
| $V_{DRM}$    | repetitive peak off-state voltage    |   | 600        | V                |
| $I_{T(RMS)}$ | RMS on-state current                 | full sine wave; $T_h \leq 92\text{ °C}$ ;<br><a href="#">Fig 1</a> ; <a href="#">Fig 2</a> ; <a href="#">Fig 3</a>            | 4          | A                |
| $I_{TSM}$    | non-repetitive peak on-state current | full sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 20\text{ ms}$ ;<br><a href="#">Fig 4</a> ; <a href="#">Fig 5</a> | 25         | A                |
|              |                                      | full sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 16.7\text{ ms}$  | 27         | A                |
| $I^2t$       | $I^2t$ for fusing                    | $t_p = 10\text{ ms}$ ; SIN  | 3.1        | A <sup>2</sup> s |
| $dl_T/dt$    | rate of rise of on-state current     | $I_G = 20\text{ mA}$ ; T2+ G+   | 50         | A/ $\mu$ s       |
|              |                                      | $I_G = 20\text{ mA}$ ; T2+ G-   | 50         | A/ $\mu$ s       |
|              |                                      | $I_G = 20\text{ mA}$ ; T2- G-   | 50         | A/ $\mu$ s       |
|              |                                      | $I_G = 50\text{ mA}$ ; T2- G+   | 10         | A/ $\mu$ 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 to 150 | °C               |
| $T_j$        | junction temperature                 |   | 125        | °C               |



$f = 50\text{ Hz}$ ;  $T_h = 92\text{ °C}$

**Fig. 1. RMS on-state current as a function of surge duration; maximum values**



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

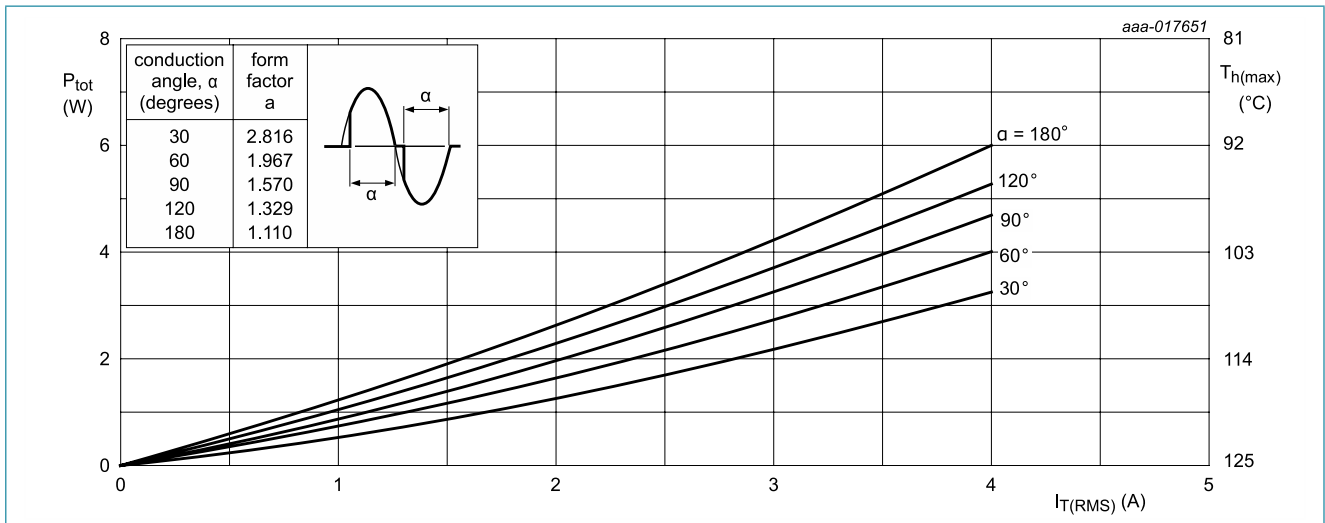


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

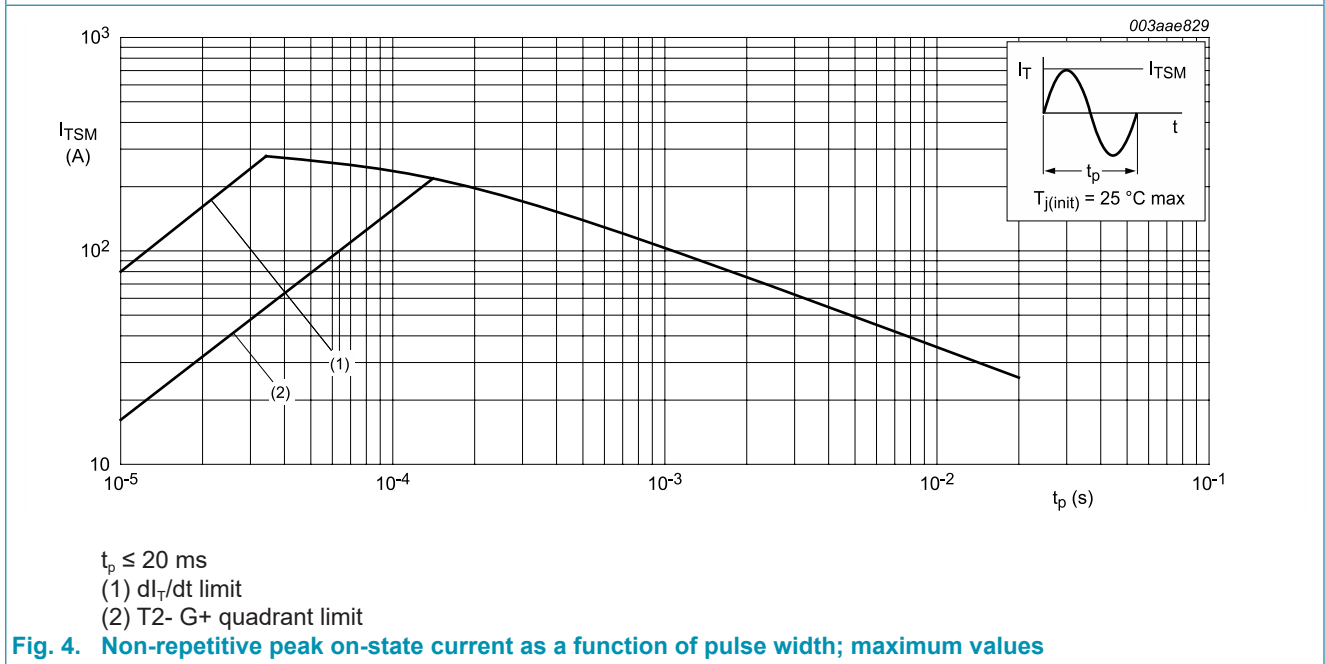
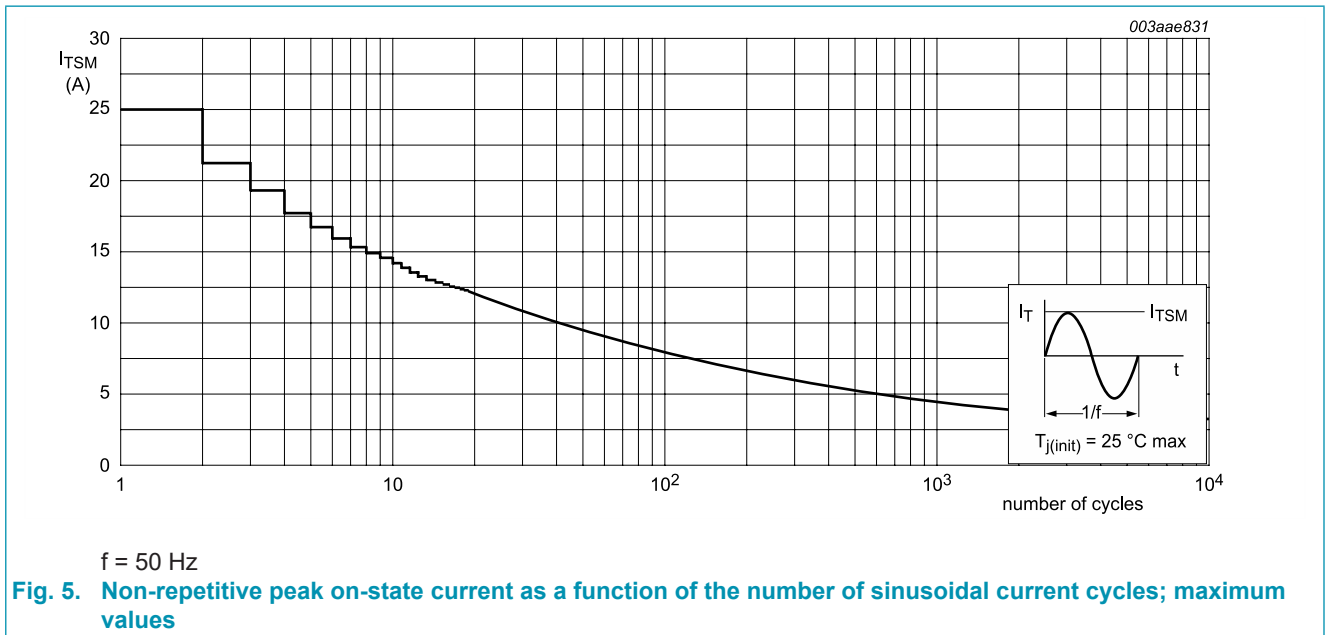


Fig. 4. Non-repetitive peak on-state current as a function of pulse width; maximum values



## 9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol        | Parameter                                    | Conditions   | Min | Typ | Max | Unit |
|---------------|--|--|-----|-----|-----|------|
| $R_{th(j-h)}$ | thermal resistance from junction to heatsink | full or half cycle; with heatsink compound; Fig 6    | -   | -   | 5.5 | K/W  |
|               |  | full 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  |

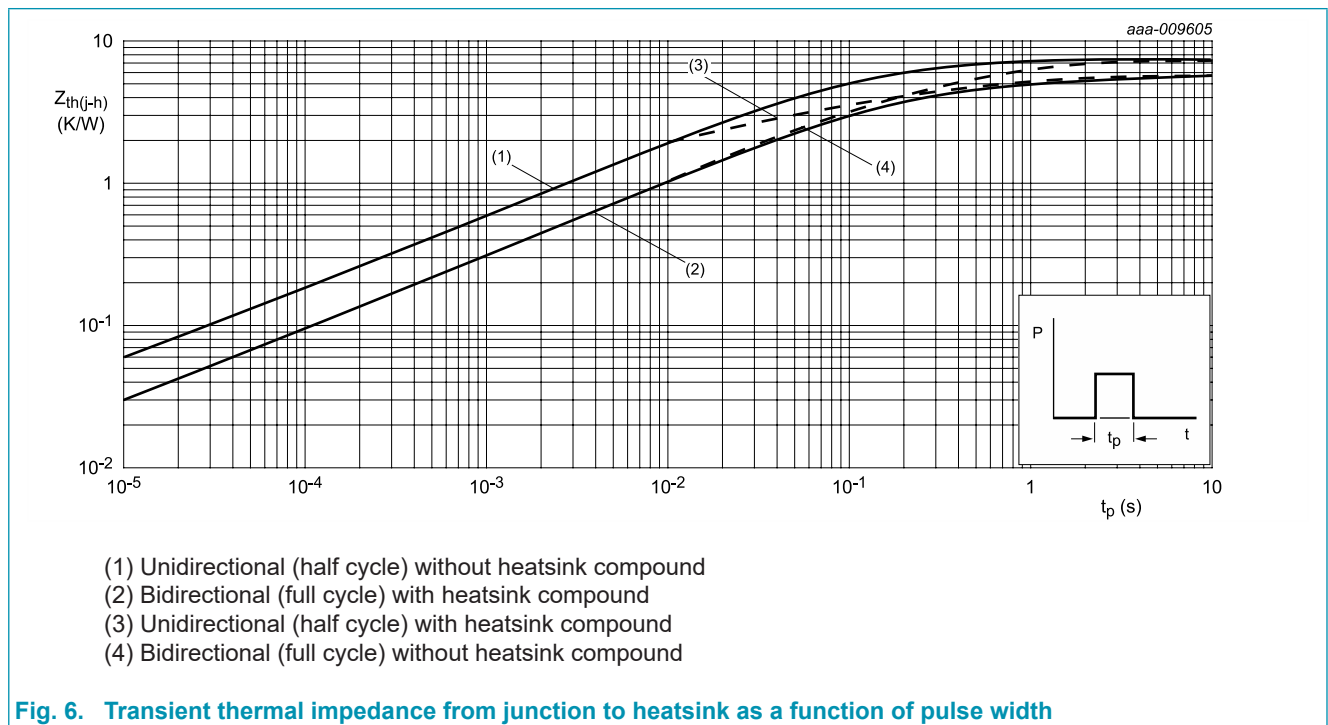


Fig. 6. Transient thermal impedance from junction to heatsink as a function of pulse width

## 10. Isolation characteristics

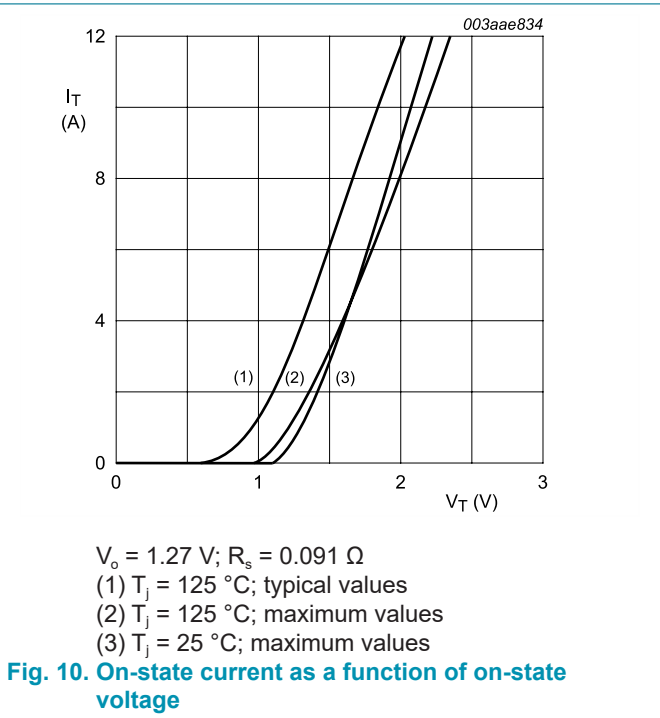
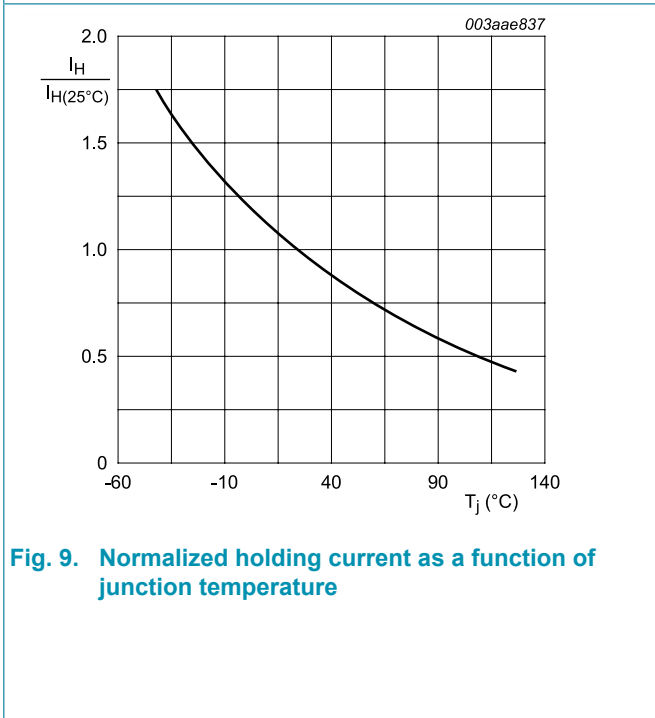
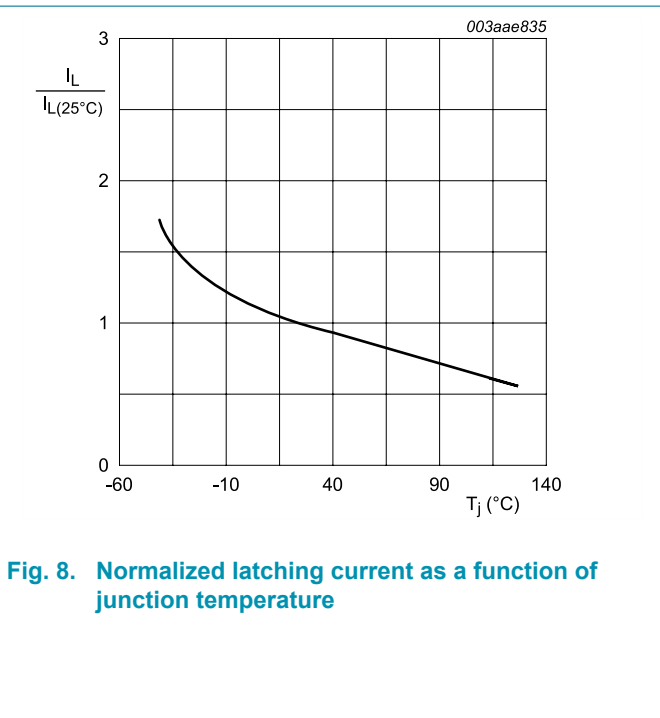
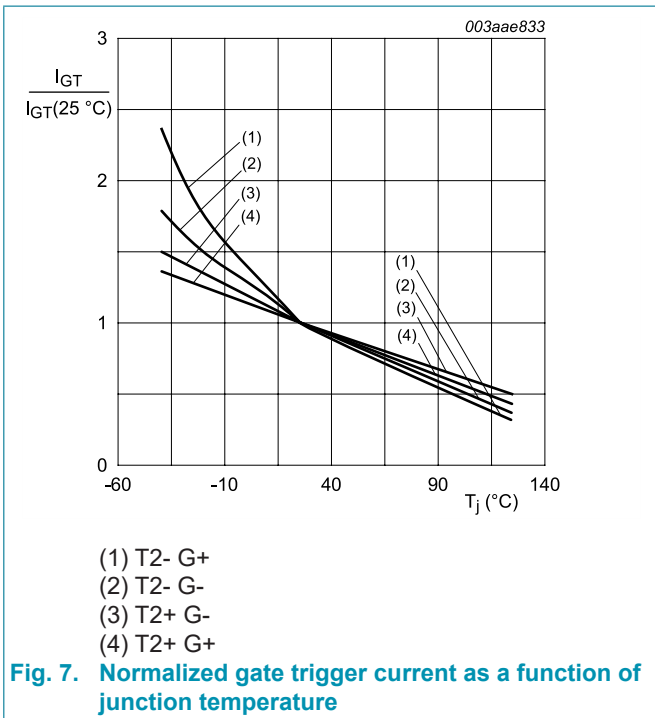
Table 7. Isolation characteristics

| 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 Hz ≤ f ≤ 60 Hz; RH ≤ 65 %; T <sub>h</sub> = 25 °C | -   | -   | 2500 | V    |
| $C_{isol}$      | isolation capacitance | from main terminal 2 to external heatsink; f = 1 MHz; T <sub>h</sub> = 25 °C  | -   | 10  | -    | pF   |

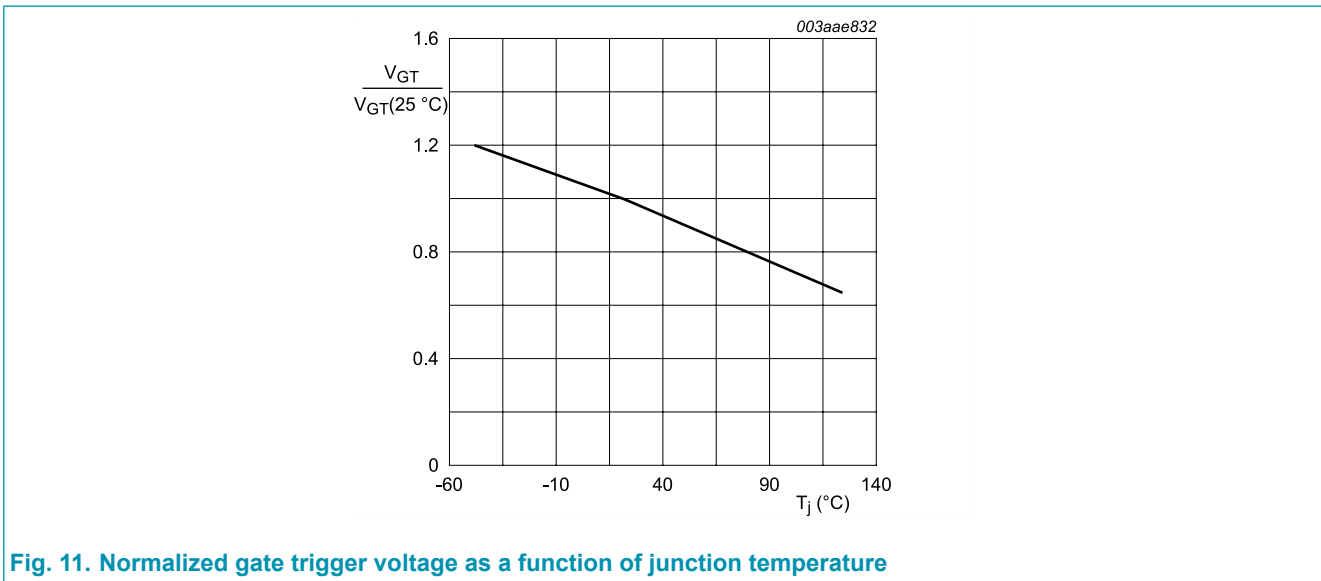
## 11. Characteristics

Table 8. Characteristics

| Symbol                         | Parameter                         | Conditions  | Min  | Typ | Max | Unit             |
|--------------------------------|-----------------------------------|---|------|-----|-----|------------------|
| <b>Static characteristics</b>  |                                   |   |      |     |     |                  |
| $I_{GT}$                       | gate trigger current              | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2+ G+;$<br>$T_J = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 7</a>                          | -    | 2.5 | 10  | mA               |
|                                |                                   | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2+ G-;$<br>$T_J = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 7</a>                          | -    | 4   | 10  | mA               |
|                                |                                   | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2- G-;$<br>$T_J = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 7</a>                          | -    | 5   | 10  | mA               |
|                                |                                   | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2- G+;$<br>$T_J = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 7</a>                          | -    | 11  | 25  | mA               |
| $I_L$                          | latching current                  | $V_D = 12\text{ V}; I_G = 0.1\text{ A}; T2+ G+;$<br>$T_J = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 8</a>                          | -    | 3   | 15  | mA               |
|                                |                                   | $V_D = 12\text{ V}; I_G = 0.1\text{ A}; T2+ G-;$<br>$T_J = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 8</a>                          | -    | 10  | 20  | mA               |
|                                |                                   | $V_D = 12\text{ V}; I_G = 0.1\text{ A}; T2- G-;$<br>$T_J = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 8</a>                          | -    | 2.5 | 15  | mA               |
|                                |                                   | $V_D = 12\text{ V}; I_G = 0.1\text{ A}; T2- G+;$<br>$T_J = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 8</a>                          | -    | 4   | 20  | mA               |
| $I_H$                          | holding current                   | $V_D = 12\text{ V}; T_J = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 9</a>   | -    | 2.2 | 15  | mA               |
| $V_T$                          | on-state voltage                  | $I_T = 5\text{ A}; T_J = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 10</a>   | -    | 1.4 | 1.7 | V                |
| $V_{GT}$                       | gate trigger voltage              | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_J = 25\text{ }^\circ\text{C};$<br><a href="#">Fig. 11</a>                                   | -    | 0.7 | 1   | V                |
|                                |                                   | $V_D = 400\text{ V}; I_T = 0.1\text{ A}; T_J = 125\text{ }^\circ\text{C};$<br><a href="#">Fig. 11</a>                                 | 0.25 | 0.4 | -   | V                |
| $I_D$                          | off-state current                 | $V_D = 600\text{ V}; T_J = 125\text{ }^\circ\text{C}$   | -    | 0.1 | 0.5 | mA               |
| <b>Dynamic characteristics</b> |                                   |   |      |     |     |                  |
| $dV_D/dt$                      | rate of rise of off-state voltage | $V_{DM} = 402\text{ V}; T_J = 125\text{ }^\circ\text{C}; (V_{DM} = 67\%$<br>of $V_{DRM});$ exponential waveform; gate<br>open circuit | -    | 50  | -   | V/ $\mu\text{s}$ |
| $t_{gt}$                       | gate-controlled turn-on time      | $V_D = 600\text{ V}; I_{TM} = 6\text{ A}; I_G = 0.1\text{ A};$<br>$dI_G/dt = 5\text{ A}/\mu\text{s}$                                  | -    | 2   | -   | $\mu\text{s}$    |



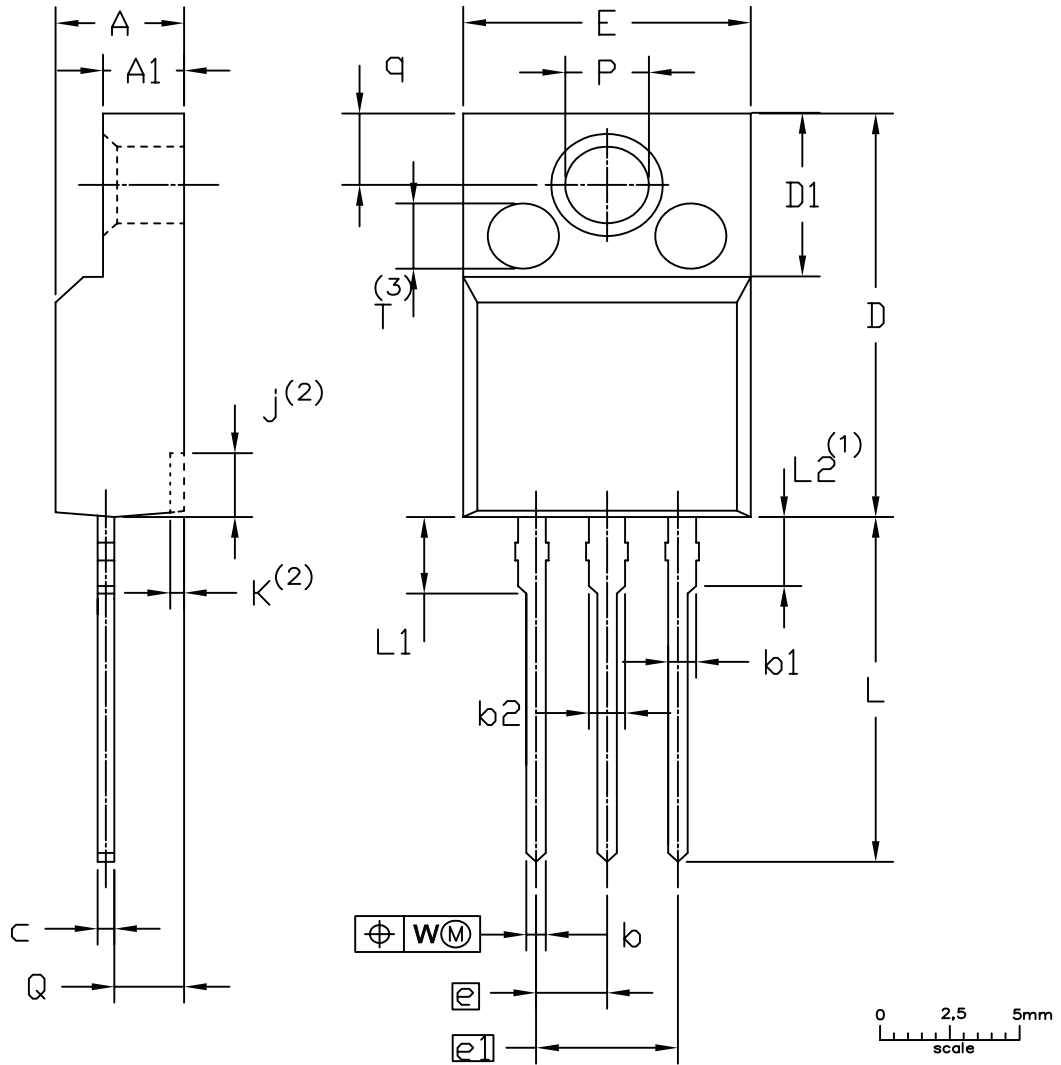




12. Package outline

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

SOT186A



| UNIT | A   | A <sub>1</sub> | b   | b <sub>1</sub> | b <sub>2</sub> | c   | D    | D <sub>1</sub> | E    | e    | e <sub>1</sub> | j <sup>(2)</sup> | k <sup>(2)</sup> | L    | L <sub>1</sub> | L <sub>2</sub> <sup>(1)</sup><br>max. | P   | Q   | q   | W   | T <sup>(3)</sup> |
|------|-----|----------------|-----|----------------|----------------|-----|------|----------------|------|------|----------------|------------------|------------------|------|----------------|---------------------------------------|-----|-----|-----|-----|------------------|
| 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 uncontrolled
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: 17 April 2018

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- Изготовление тестовой платы монтаж и пусконаладочные работы.



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