



**THE DATASHEET OF  
BTA410X-800CT,127**



## 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 CT" triac will commute the full RMS current at the maximum rated junction temperature ( $T_{j(max)} = 150\text{ °C}$ ) 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
- 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
- Isolated mounting base package
- Less sensitive gate for high noise immunity
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only

## 3. Applications

- Applications subject to high temperature
- Industrial and domestic heating circuits
- Motor controls e.g. washing machines and vacuum cleaners
- Rectifier-fed DC inductive loads e.g. DC motors and solenoids

## 4. Quick reference data

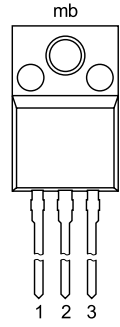
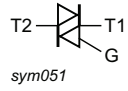
Table 1. Quick reference data

| Symbol       | Parameter                            | Conditions   | Min | Typ | Max | Unit |
|--------------|--------------------------------------|--|-----|-----|-----|------|
| $V_{DRM}$    | repetitive peak off-state voltage    |  | -   | -   | 800 | V    |
| $I_{T(RMS)}$ | RMS on-state current                 | full sine wave; $T_h \leq 98\text{ °C}$ ;<br><a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>    | -   | -   | 10  | A    |
| $I_{TSM}$    | non-repetitive peak on-state current | full sine wave; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 20\text{ ms}$ ;<br><a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> | -   | -   | 100 | A    |
| $T_j$        | junction temperature                 |  | -   | -   | 150 | °C   |

| 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   | -   | 35  | 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>  | 2   | -   | 35  | 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>  | 2   | -   | 35  | mA         |
| <b>Dynamic characteristics</b> |                                       |   |     |     |     |            |
| $dV_D/dt$                      | rate of rise of off-state voltage     | $V_{DM} = 536\text{ V}; T_j = 150\text{ }^\circ\text{C};$ ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit                                     | 500 | -   | -   | V/ $\mu$ s |
| $dI_{com}/dt$                  | rate of change of commutating current | $V_D = 400\text{ V}; T_j = 150\text{ }^\circ\text{C}; I_{T(RMS)} = 10\text{ A};$<br>$dV_{com}/dt = 20\text{ V}/\mu\text{s};$ (snubberless condition); gate open circuit | 8   | -   | -   | A/ms       |

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description             | Simplified outline  | Graphic symbol  |
|-----|--------|-------------------------|---|---|
| 1   | T1     | main terminal 1         |  | <br>sym051 |
| 2   | T2     | main terminal 2         |   |   |
| 3   | G      | gate                    |   |   |
| mb  | n.c.   | mounting base; isolated |   |   |

## 6. Ordering information

Table 3. Ordering information

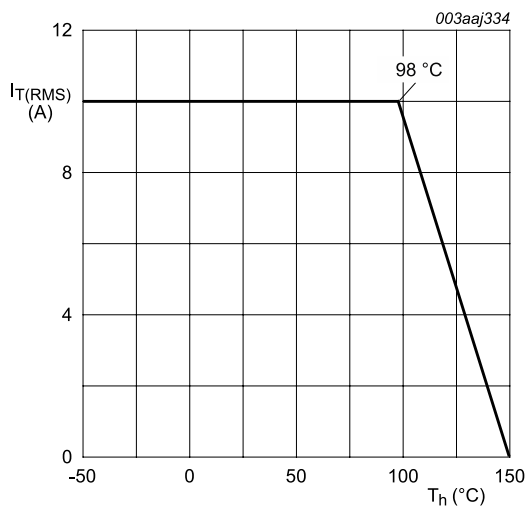
| Type number   | Package |   | Version |
|---------------|---------|---|---------|
|               | Name    | Description   |         |
| BTA410X-800CT | TO-220F | plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack" | SOT186A |

## 7. Limiting values

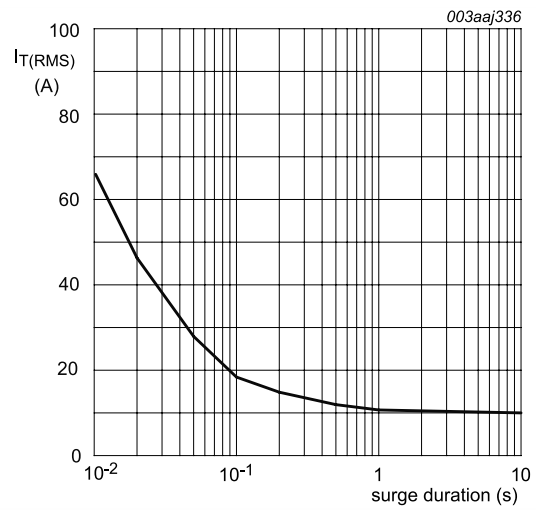
**Table 4. Limiting values**

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

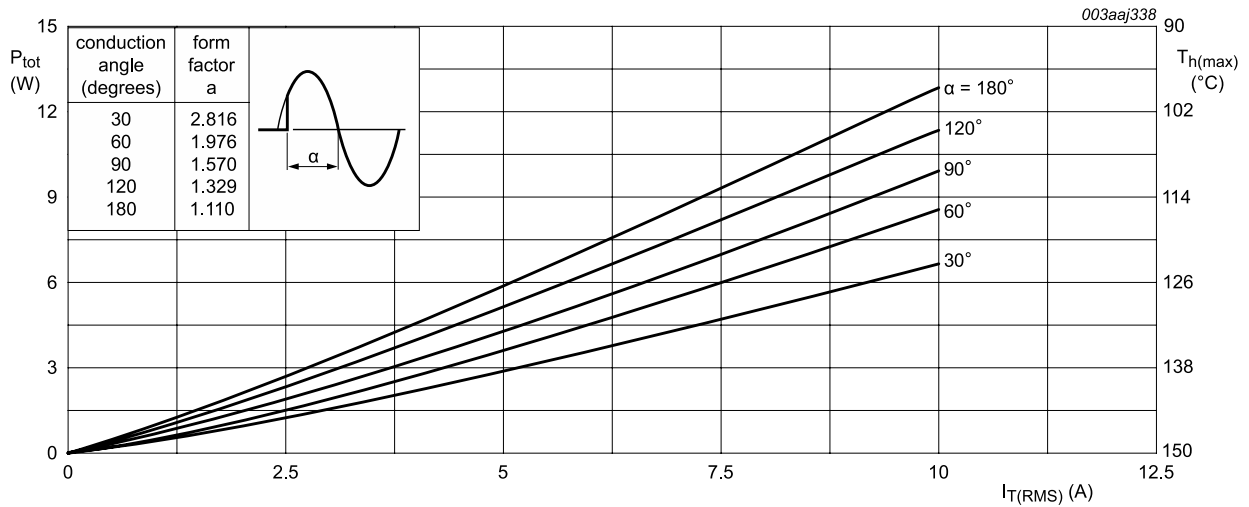
| Symbol       | Parameter                            | Conditions  | Min | Max | Unit                   |
|--------------|--------------------------------------|---|-----|-----|------------------------|
| $V_{DRM}$    | repetitive peak off-state voltage    |   | -   | 800 | V                      |
| $I_{T(RMS)}$ | RMS on-state current                 | full sine wave; $T_h \leq 98\text{ }^\circ\text{C}$ ;<br><a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>         | -   | 10  | A                      |
| $I_{TSM}$    | non-repetitive peak on-state current | full sine wave; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$ ; $t_p = 20\text{ ms}$ ;<br><a href="#">Fig 4</a> ; <a href="#">Fig 5</a> | -   | 100 | A                      |
|              |                                      | full sine wave; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$ ; $t_p = 16.7\text{ ms}$  | -   | 110 | A                      |
| $I^2t$       | $I^2t$ for fusing                    | $t_p = 10\text{ ms}$ ; sine-wave pulse  | -   | 50  | $\text{A}^2\text{s}$   |
| $di_T/dt$    | rate of rise of on-state current     | $I_G = 70\text{ mA}$  | -   | 100 | $\text{A}/\mu\text{s}$ |
| $I_{GM}$     | 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 | $^\circ\text{C}$       |
| $T_j$        | junction temperature                 |   | -   | 150 | $^\circ\text{C}$       |



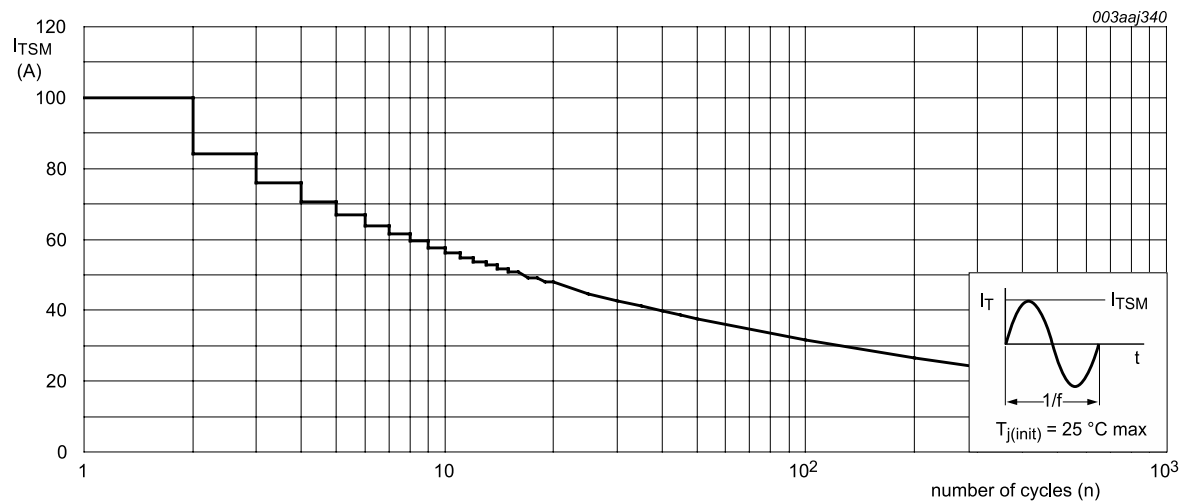
**Fig. 1. RMS on-state current as a function of heatsink temperature; maximum values**



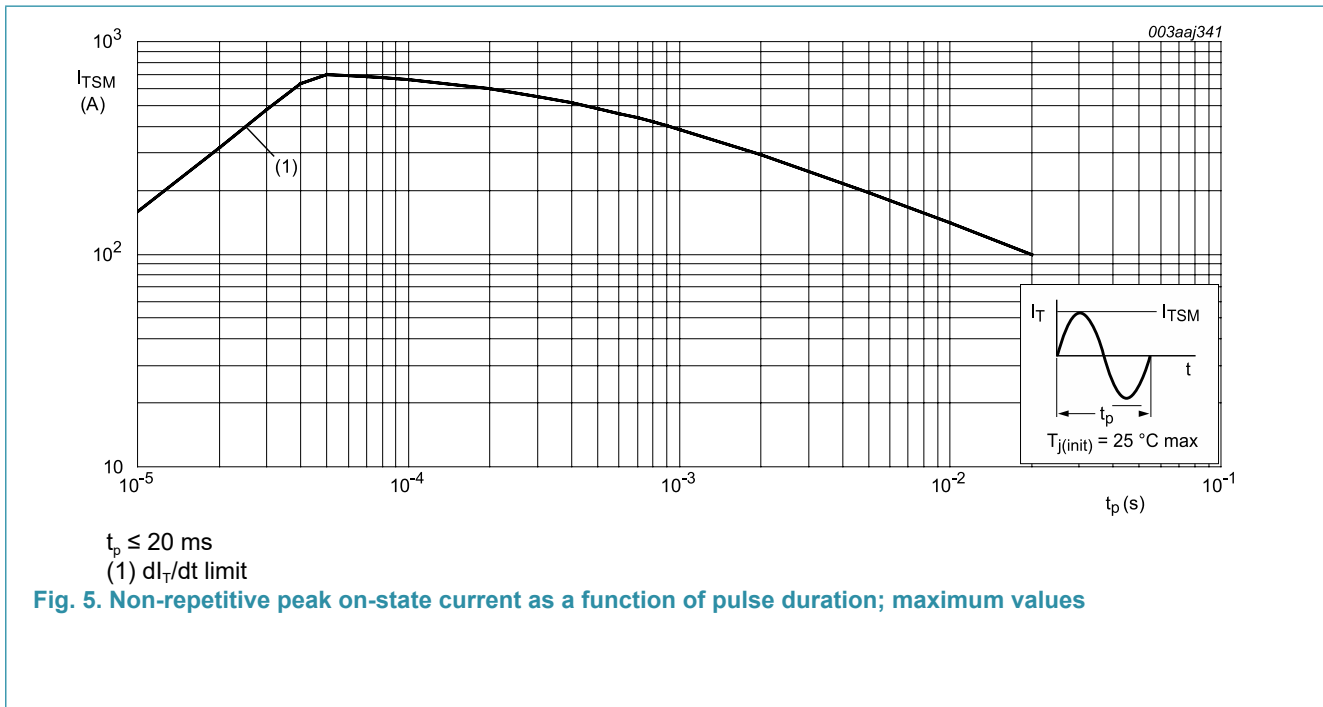
$f = 50\text{ Hz}$ ;  $T_h = 98\text{ }^\circ\text{C}$   
**Fig. 2. RMS on-state current as a function of surge duration; maximum values**



$\alpha$  = 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**



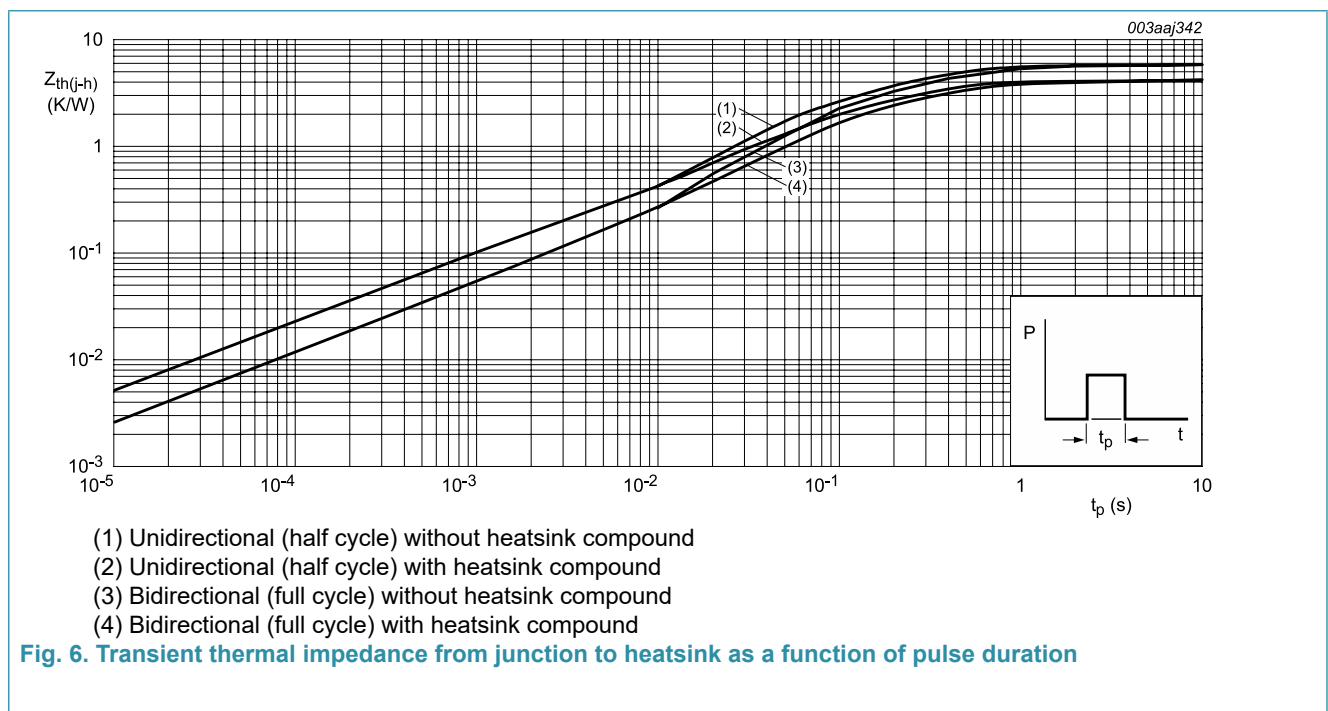
$f = 50\text{ Hz}$   
**Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values**



## 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; <a href="#">Fig. 6</a>    | -   | -   | 4   | K/W  |
|               |  | full cycle or half cycle; without heatsink compound; <a href="#">Fig. 6</a> | -   | -   | 5.5 | K/W  |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient  | in free air   | -   | 55  | -   | K/W  |



## 9. Isolation characteristics

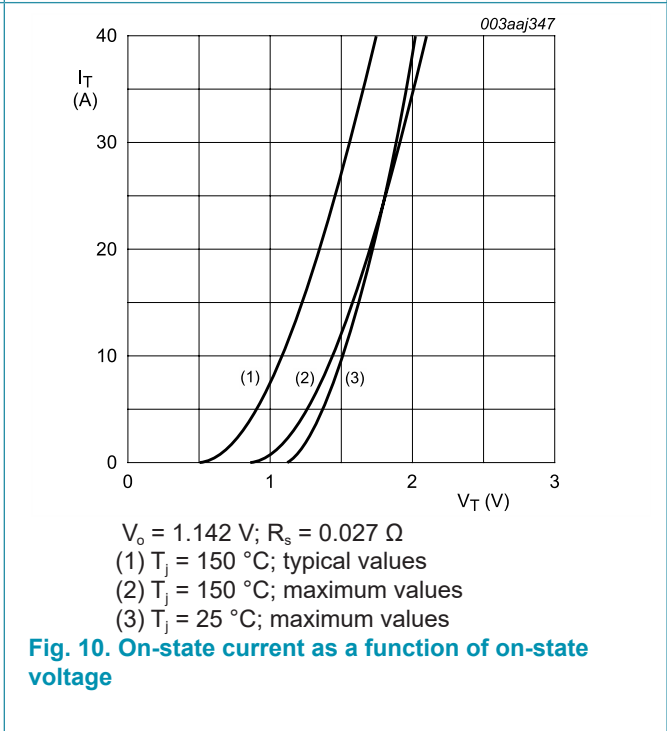
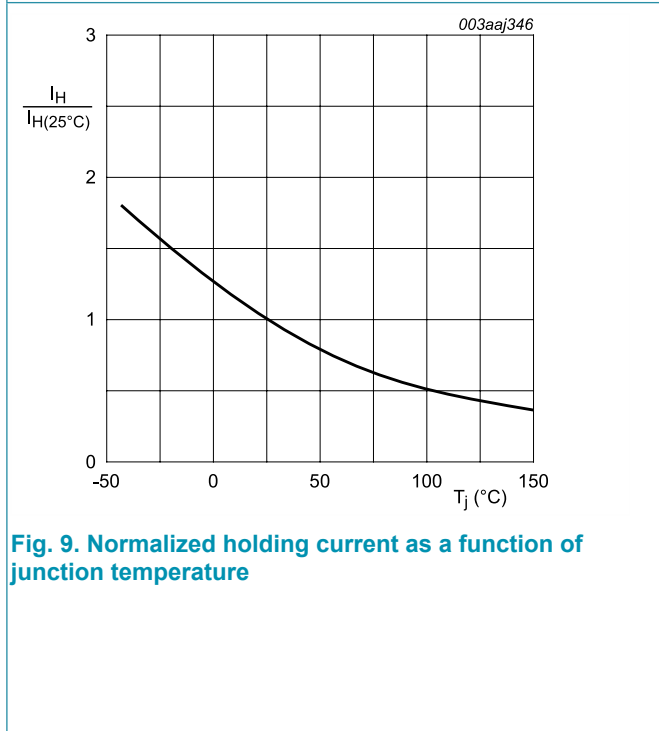
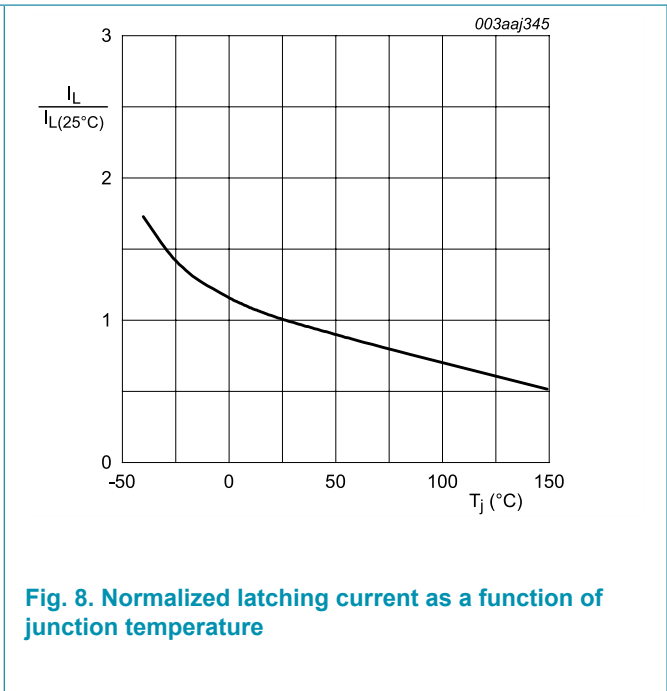
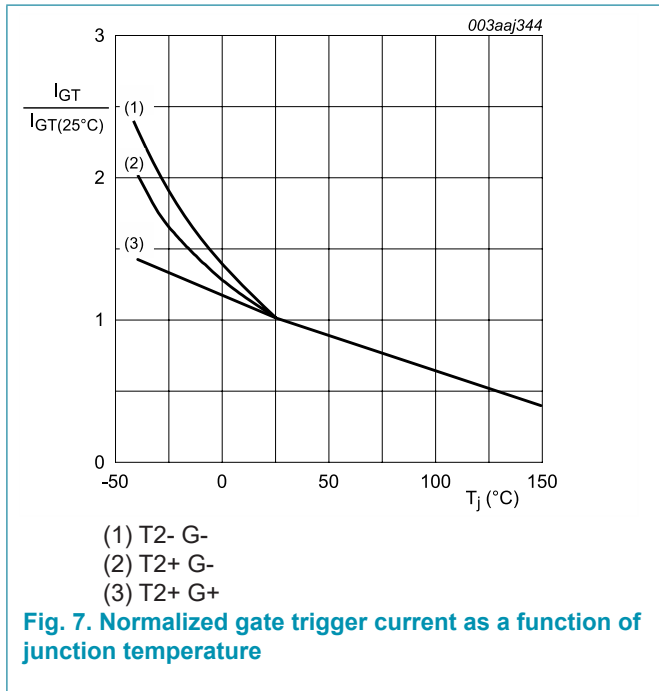
Table 6. Isolation characteristics

| 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; $50\text{ Hz} \leq f \leq 60\text{ Hz}$ ; $RH \leq 65\%$ ; $T_h = 25\text{ }^\circ\text{C}$ | -   | -   | 2500 | V    |
| $C_{isol}$      | isolation capacitance | from main terminal 2 to external heatsink; $f = 1\text{ MHz}$ ; $T_h = 25\text{ }^\circ\text{C}$   | -   | 10  | -    | pF   |

## 10. Characteristics

Table 7. 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>$T_J = 25\text{ °C}$ ; <a href="#">Fig. 7</a>   | 2    | -   | 35  | mA         |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-;<br>$T_J = 25\text{ °C}$ ; <a href="#">Fig. 7</a>   | 2    | -   | 35  | mA         |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-;<br>$T_J = 25\text{ °C}$ ; <a href="#">Fig. 7</a>   | 2    | -   | 35  | mA         |
| $I_L$                          | latching current                      | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G+;<br>$T_J = 25\text{ °C}$ ; <a href="#">Fig. 8</a>   | -    | -   | 50  | mA         |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G-;<br>$T_J = 25\text{ °C}$ ; <a href="#">Fig. 8</a>   | -    | -   | 60  | mA         |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G-;<br>$T_J = 25\text{ °C}$ ; <a href="#">Fig. 8</a>   | -    | -   | 50  | mA         |
| $I_H$                          | holding current                       | $V_D = 12\text{ V}$ ; $T_J = 25\text{ °C}$ ; <a href="#">Fig. 9</a>   | -    | -   | 35  | mA         |
| $V_T$                          | on-state voltage                      | $I_T = 15\text{ A}$ ; $T_J = 25\text{ °C}$ ; <a href="#">Fig. 10</a>  | -    | 1.3 | 1.6 | V          |
| $V_{GT}$                       | gate trigger voltage                  | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_J = 25\text{ °C}$ ;<br><a href="#">Fig. 11</a>  | -    | 0.8 | 1   | V          |
|                                |                                       | $V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_J = 150\text{ °C}$ ;<br><a href="#">Fig. 11</a>  | 0.25 | 0.4 | -   | V          |
| $I_D$                          | off-state current                     | $V_D = 800\text{ V}$ ; $T_J = 150\text{ °C}$  | -    | 0.4 | 2   | mA         |
| <b>Dynamic characteristics</b> |                                       |   |      |     |     |            |
| $dV_D/dt$                      | rate of rise of off-state voltage     | $V_{DM} = 536\text{ V}$ ; $T_J = 150\text{ °C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit   | 500  | -   | -   | V/ $\mu$ s |
| $dI_{com}/dt$                  | rate of change of commutating current | $V_D = 400\text{ V}$ ; $T_J = 150\text{ °C}$ ; $I_{T(RMS)} = 10\text{ A}$ ;<br>$dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (snubberless condition); gate open circuit | 8    | -   | -   | A/ms       |
|                                |                                       | $V_D = 400\text{ V}$ ; $T_J = 150\text{ °C}$ ; $I_{T(RMS)} = 10\text{ A}$ ;<br>$dV_{com}/dt = 10\text{ V}/\mu\text{s}$ ; gate open circuit                          | 13   | -   | -   | A/ms       |
|                                |                                       | $V_D = 400\text{ V}$ ; $T_J = 150\text{ °C}$ ; $I_{T(RMS)} = 10\text{ A}$ ;<br>$dV_{com}/dt = 1\text{ V}/\mu\text{s}$ ; gate open circuit                           | 20   | -   | -   | A/ms       |



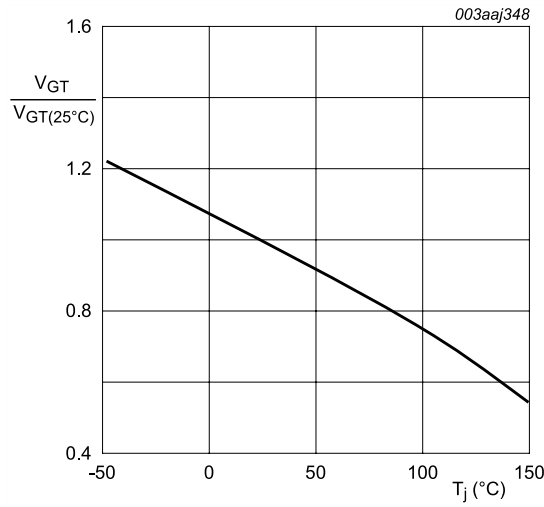
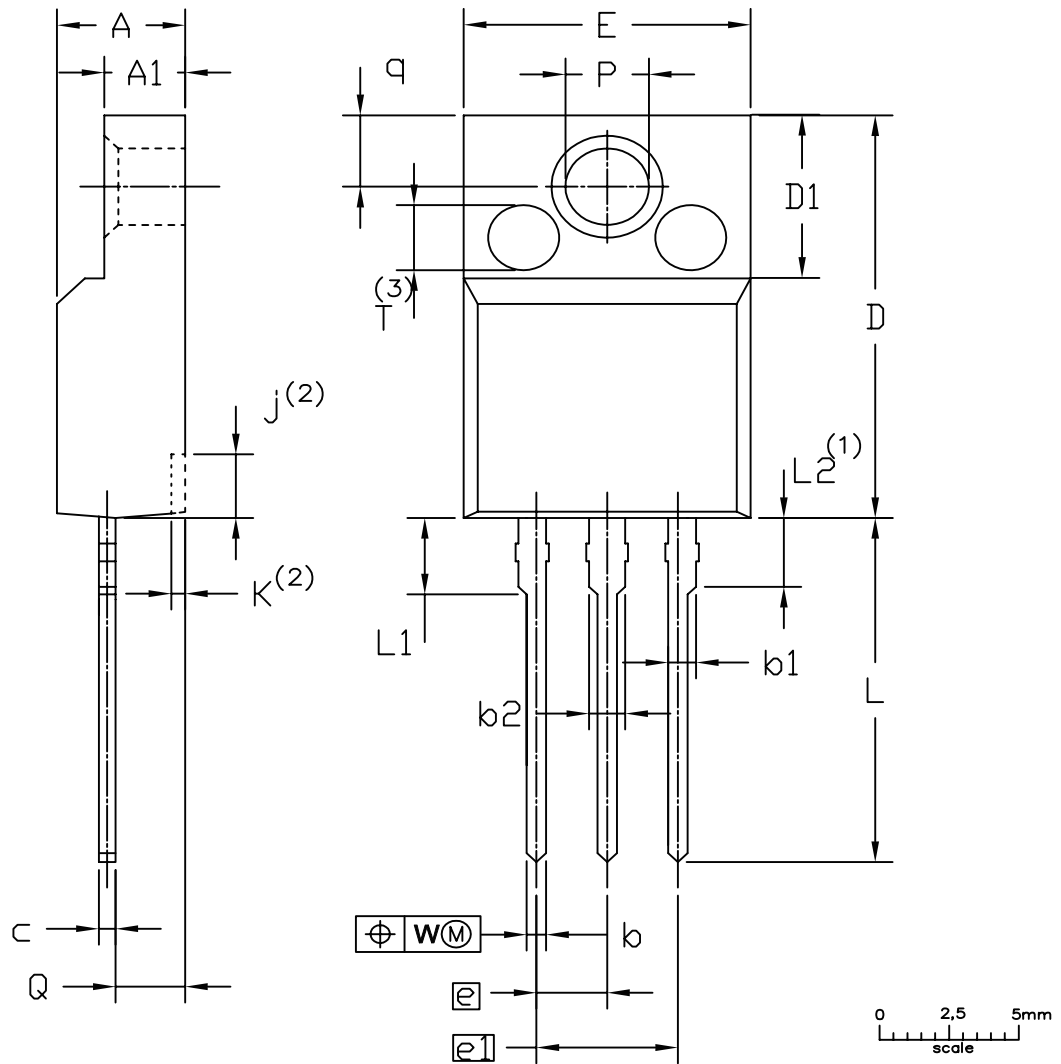


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

### 11. Package outline

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

SOT186A



| UNIT | A   | A <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<br>VERSION | REFERENCES |                |       | EUROPEAN<br>PROJECTION | ISSUE DATE |
|--------------------|------------|----------------|-------|------------------------|------------|
|                    | IEC        | JEDEC          | JEITA |                        |            |
| SOT186A            |            | 3 LEADS TO220F |       |                        | 2013-11-14 |

## 12. 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.                                     |

- [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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Date of release: 1 August 2018

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