



# IMPORTANT NOTICE

10 December 2015

## 1. Global joint venture starts operations as WeEn Semiconductors

Dear customer,

As from November 9th, 2015 NXP Semiconductors N.V. and Beijing JianGuang Asset Management Co. Ltd established Bipolar Power joint venture (JV), **WeEn Semiconductors**, which will be used in future Bipolar Power documents together with new contact details.

In this document where the previous NXP references remain, please use the new links as shown below.

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Thank you for your cooperation and understanding,

WeEn Semiconductors





# BTA410X-600CT

3Q Hi-Com Triac

28 May 2014

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 CT" triac will commute the full RMS current at the maximum rated junction temperature ( $T_{j(max)} = 150\text{ }^{\circ}\text{C}$ ) 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

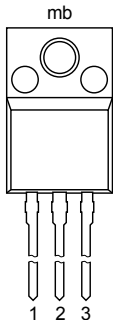
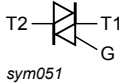
| Symbol       | Parameter                            | Conditions   | Min | Typ | Max | Unit               |
|--------------|--------------------------------------|--|-----|-----|-----|--------------------|
| $V_{DRM}$    | repetitive peak off-state voltage    |  | -   | -   | 600 | V                  |
| $I_{TSM}$    | non-repetitive peak on-state current | full sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$ ;<br>$t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> | -   | -   | 100 | A                  |
| $T_j$        | junction temperature                 |  | -   | -   | 150 | $^{\circ}\text{C}$ |
| $I_{T(RMS)}$ | RMS on-state current                 | full sine wave; $T_h \leq 98\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ;<br><a href="#">Fig. 3</a>    | -   | -   | 10  | A                  |



| Symbol                         | Parameter                             | Conditions   | Min | Typ | Max | Unit |
|--------------------------------|---------------------------------------|--|-----|-----|-----|------|
| <b>Static characteristics</b>  |                                       |  |     |     |     |      |
| I <sub>GT</sub>                | gate trigger current                  | V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2+ G-;<br>T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>   | 2   | -   | 35  | mA   |
|                                |                                       | V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2+ G+;<br>T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>   | 2   | -   | 35  | mA   |
|                                |                                       | V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2- G-;<br>T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>   | 2   | -   | 35  | mA   |
| <b>Dynamic characteristics</b> |                                       |  |     |     |     |      |
| dV <sub>D</sub> /dt            | rate of rise of off-state voltage     | V <sub>DM</sub> = 402 V; T <sub>j</sub> = 150 °C; (V <sub>DM</sub> = 67% of V <sub>DRM</sub> ); exponential waveform; gate open circuit                  | 500 | -   | -   | V/μs |
| dI <sub>com</sub> /dt          | rate of change of commutating current | V <sub>D</sub> = 400 V; T <sub>j</sub> = 150 °C; I <sub>T(RMS)</sub> = 10 A; dV <sub>com</sub> /dt = 20 V/μs; (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         |  <p>TO-220F (SOT186A)</p> |  <p>sym051</p> |
| 2   | T2     | main terminal 2         |  |   |
| 3   | G      | gate                    |  |   |
| mb  | n.c.   | mounting base; isolated |  |   |

## 6. Ordering information

Table 3. Ordering information

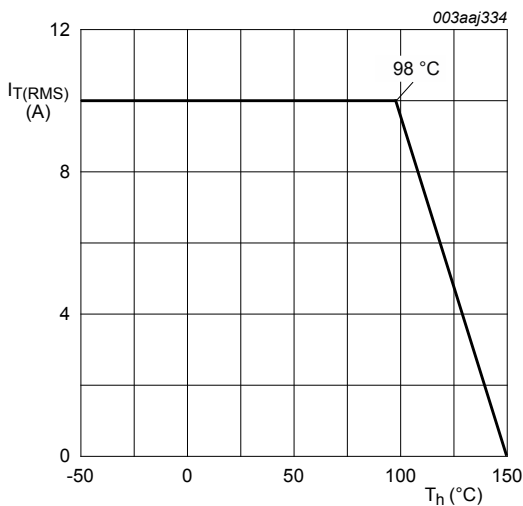
| Type number   | Package |   |         |
|---------------|---------|---|---------|
|               | Name    | Description   | Version |
| BTA410X-600CT | TO-220F | plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack" | SOT186A |

## 7. Limiting values

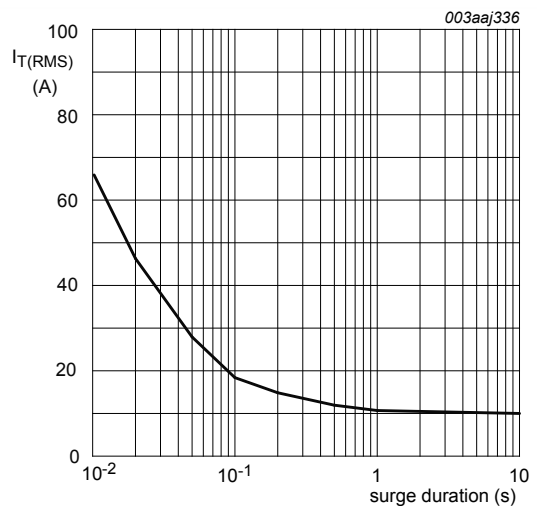
**Table 4. Limiting values**

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

| Symbol       | Parameter                            | Conditions   | Min | Max | Unit                   |
|--------------|--------------------------------------|--|-----|-----|------------------------|
| $V_{DRM}$    | repetitive peak off-state voltage    |  | -   | 600 | V                      |
| $I_{T(RMS)}$ | RMS on-state current                 | full sine wave; $T_h \leq 98\text{ }^\circ\text{C}$ ; <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; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$ ; $t_p = 20\text{ ms}$ ; <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     | $I_T = 20\text{ A}$ ; $I_G = 0.2\text{ A}$ ; $di_G/dt = 0.2\text{ A}/\mu\text{s}$  | -   | 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**

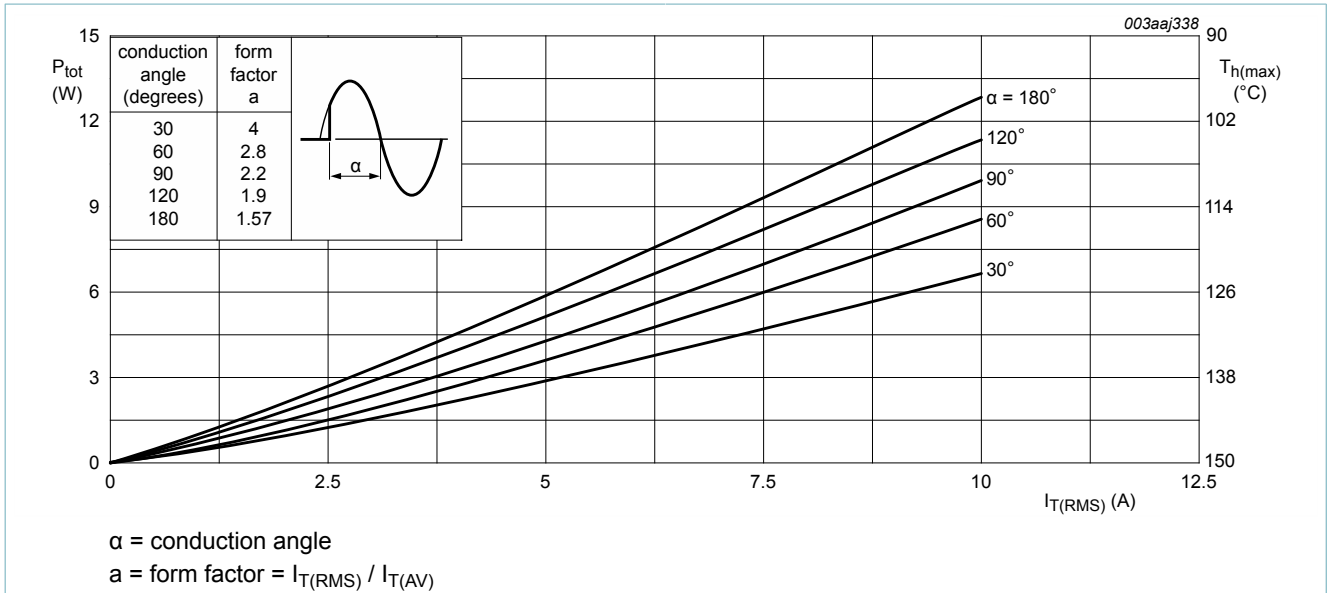


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

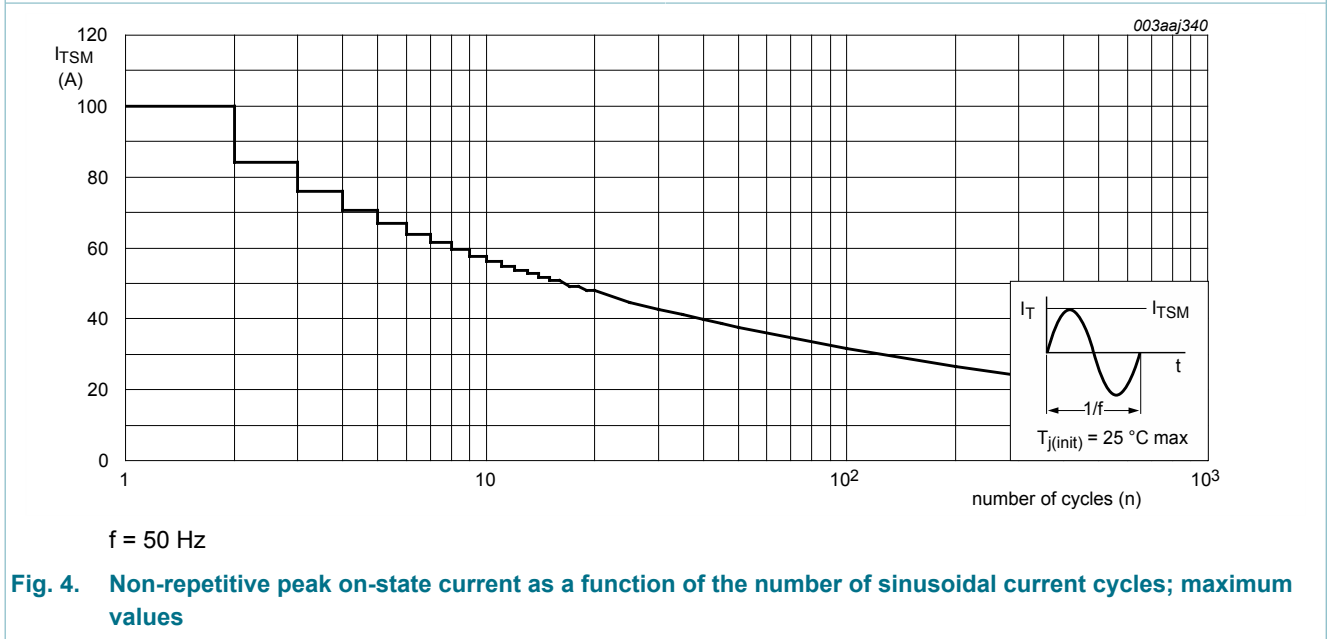
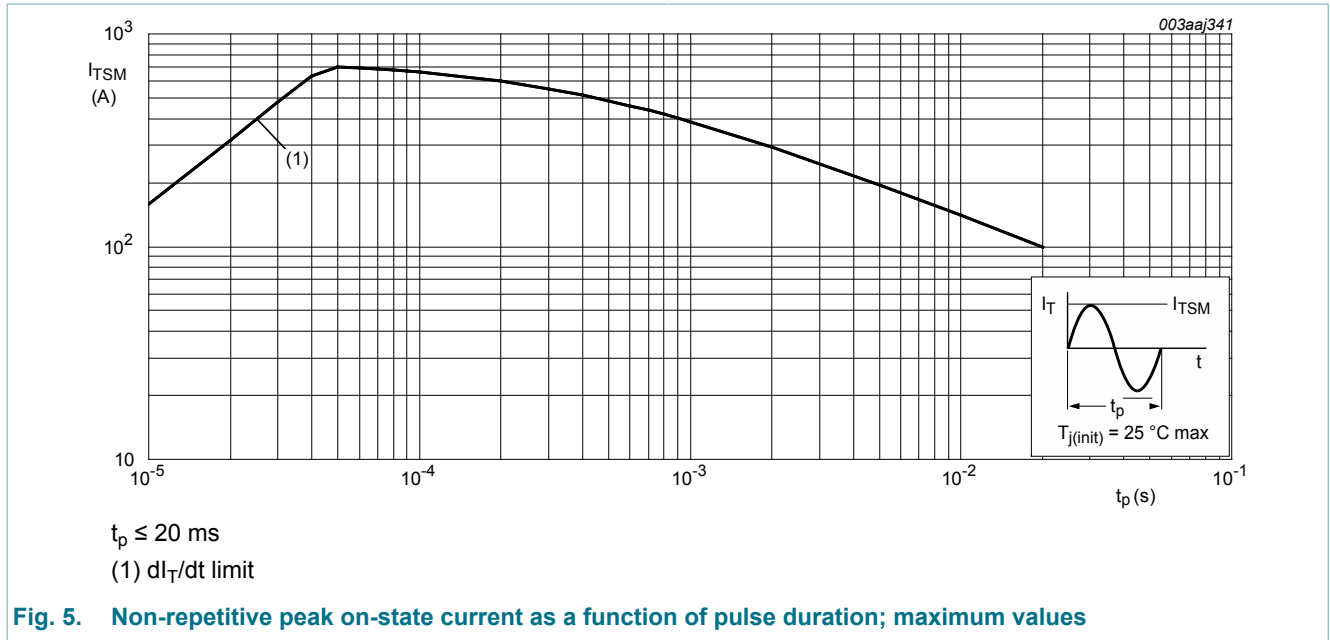


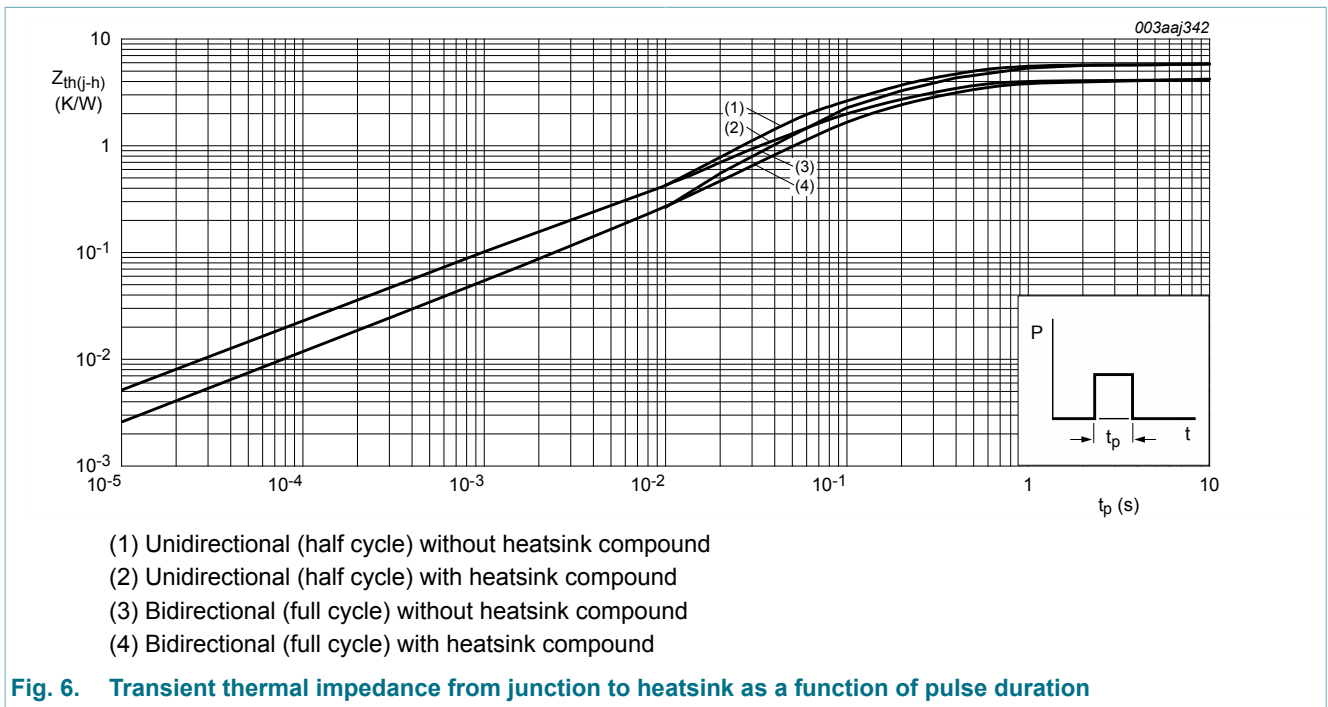
Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



## 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; Fig. 6    | -   | -   | 4   | K/W  |
|               |  | full cycle or half cycle; without heatsink compound; Fig. 6 | -   | -   | 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

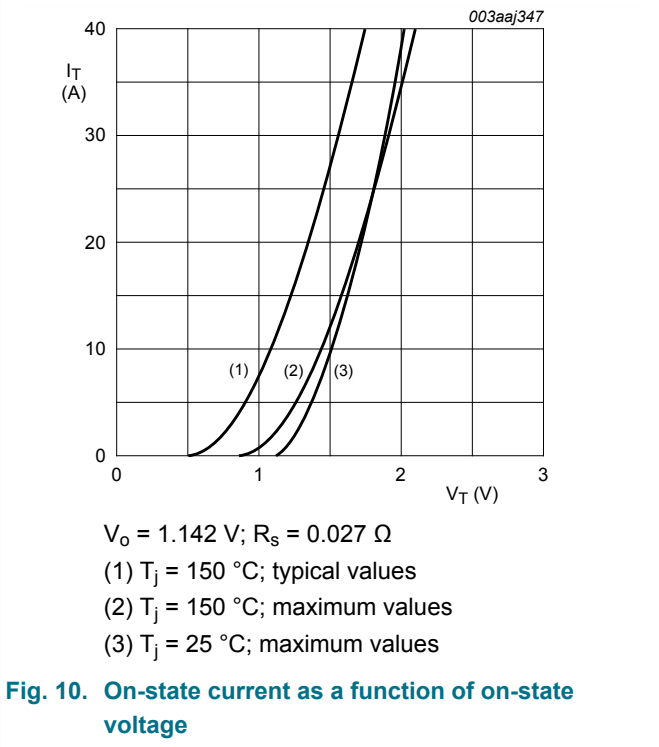
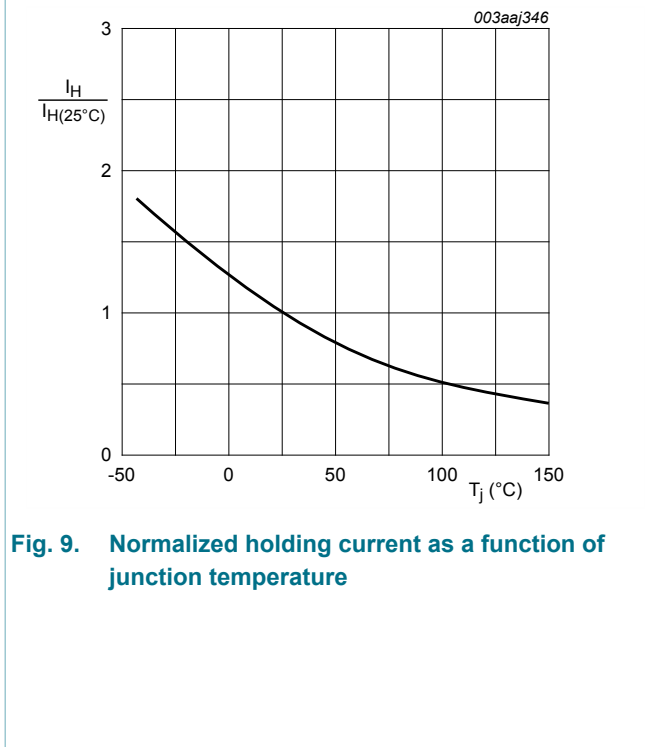
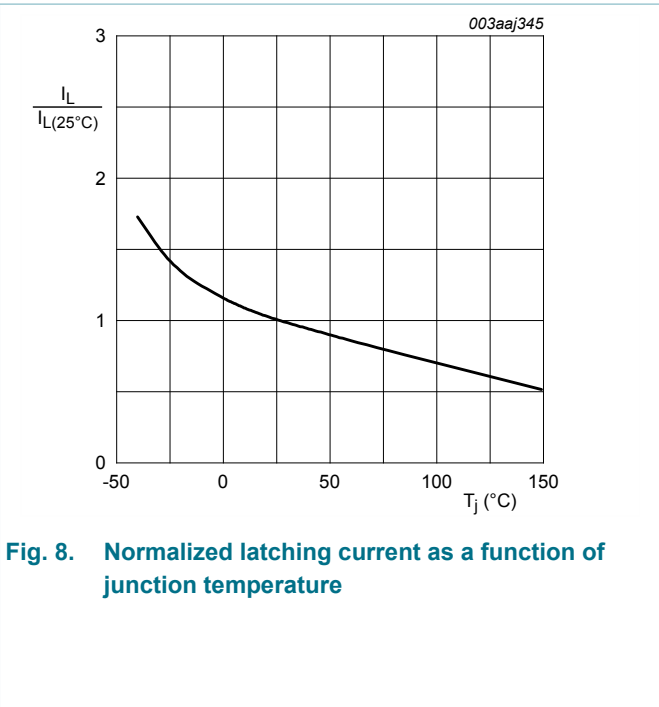
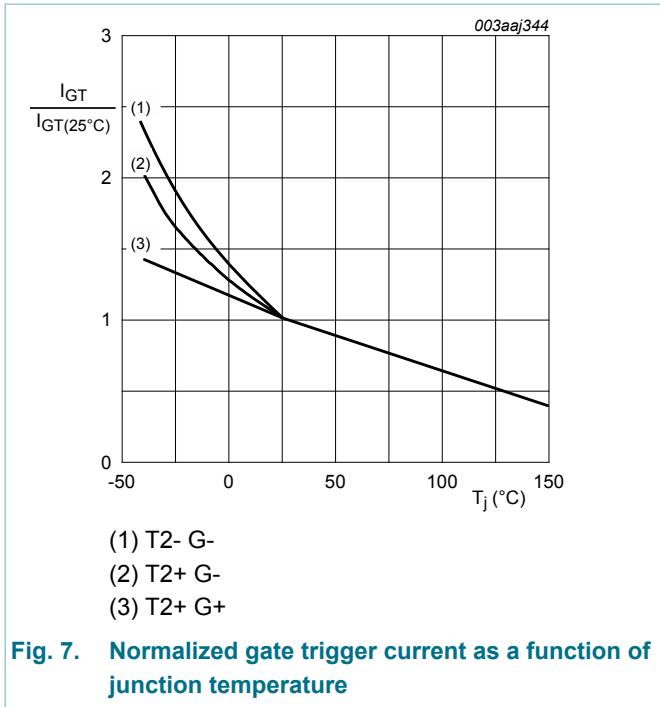
| Symbol          | Parameter             | Conditions   | Min | Typ | Max  | Unit |
|-----------------|-----------------------|--|-----|-----|------|------|
| $V_{isol(RMS)}$ | RMS isolation voltage | from all terminals to external heatsink; sinusoidal waveform; clean and dust free; $50\text{ Hz} \leq f \leq 60\text{ Hz}$ ; $RH \leq 65\%$ ; $T_h = 25\text{ }^\circ\text{C}$ | -   | -   | 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 <sub>GT</sub>                | gate trigger current                  | V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2+ G-;<br>T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>   | 2    | -   | 35  | mA   |
|                                |                                       | V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2+ G+;<br>T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>   | 2    | -   | 35  | mA   |
|                                |                                       | V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2- G-;<br>T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>   | 2    | -   | 35  | mA   |
| I <sub>L</sub>                 | latching current                      | V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2+ G+;<br>T <sub>j</sub> = 25 °C; <a href="#">Fig. 8</a>   | -    | -   | 50  | mA   |
|                                |                                       | V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2+ G-;<br>T <sub>j</sub> = 25 °C; <a href="#">Fig. 8</a>   | -    | -   | 60  | mA   |
|                                |                                       | V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2- G-;<br>T <sub>j</sub> = 25 °C; <a href="#">Fig. 8</a>   | -    | -   | 50  | mA   |
| I <sub>H</sub>                 | holding current                       | V <sub>D</sub> = 12 V; T <sub>j</sub> = 25 °C; <a href="#">Fig. 9</a>  | -    | -   | 35  | mA   |
| V <sub>T</sub>                 | on-state voltage                      | I <sub>T</sub> = 15 A; T <sub>j</sub> = 25 °C; <a href="#">Fig. 10</a>   | -    | 1.3 | 1.6 | V    |
| V <sub>GT</sub>                | gate trigger voltage                  | V <sub>D</sub> = 12 V; T <sub>j</sub> = 25 °C; <a href="#">Fig. 11</a>   | -    | 0.8 | 1   | V    |
|                                |                                       | V <sub>D</sub> = 400 V; T <sub>j</sub> = 150 °C; <a href="#">Fig. 11</a>   | 0.25 | 0.4 | -   | V    |
| I <sub>D</sub>                 | off-state current                     | V <sub>D</sub> = 600 V; T <sub>j</sub> = 150 °C  | -    | 0.4 | 2   | mA   |
| <b>Dynamic characteristics</b> |                                       |  |      |     |     |      |
| dV <sub>D</sub> /dt            | rate of rise of off-state voltage     | V <sub>DM</sub> = 402 V; T <sub>j</sub> = 150 °C; (V <sub>DM</sub> = 67% of V <sub>DRM</sub> ); exponential waveform; gate open circuit                  | 500  | -   | -   | V/μs |
| dI <sub>com</sub> /dt          | rate of change of commutating current | V <sub>D</sub> = 400 V; T <sub>j</sub> = 150 °C; I <sub>T(RMS)</sub> = 10 A; dV <sub>com</sub> /dt = 20 V/μs; (snubberless condition); gate open circuit | 8    | -   | -   | A/ms |
|                                |                                       | V <sub>D</sub> = 400 V; T <sub>j</sub> = 150 °C; I <sub>T(RMS)</sub> = 10 A; dV <sub>com</sub> /dt = 10 V/μs; gate open circuit                          | 13   | -   | -   | A/ms |
|                                |                                       | V <sub>D</sub> = 400 V; T <sub>j</sub> = 150 °C; I <sub>T(RMS)</sub> = 10 A; dV <sub>com</sub> /dt = 1 V/μs; gate open circuit                           | 20   | -   | -   | A/ms |





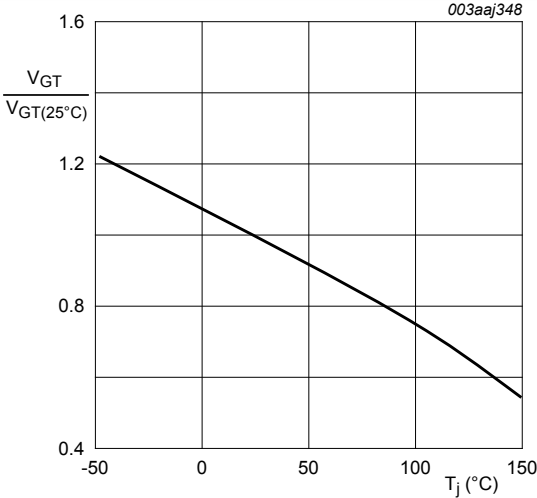


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

### 11. Package outline



Fig. 12. Package outline TO-220F (SOT186A)

## 12. Legal information

### 12.1 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.
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