



# BT234X-600D

4Q Triac

24 September 2013

Product data sheet

## 1. General description

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

## 2. Features and benefits

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

## 3. Applications

- General purpose motor control
- General purpose switching

## 4. Quick reference data

Table 1. Quick reference data

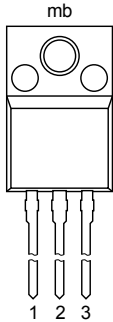

| Symbol                        | Parameter                            | Conditions  | Min | Typ | Max | Unit |
|-------------------------------|--------------------------------------|---|-----|-----|-----|------|
| $V_{DRM}$                     | repetitive peak off-state voltage    |   | -   | -   | 600 | V    |
| $I_{TSM}$                     | non-repetitive peak on-state current | full sine wave; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$ ;<br>$t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> | -   | -   | 35  | A    |
| $I_{T(RMS)}$                  | 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>           | -   | -   | 4   | A    |
| <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>                           | -   | -   | 5   | 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   | mA   |



| Symbol | Parameter | Conditions  | Min | Typ | Max | Unit |
|--------|-----------|---|-----|-----|-----|------|
|        |           | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a> | -   | -   | 5   | 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> | -   | -   | 10  | mA   |

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description             | Simplified outline  | Graphic symbol  |
|-----|--------|-------------------------|---|---|
| 1   | T1     | main terminal 1         |  <p>TO-220F (SOT186A)</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 |
| BT234X-600D | 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                   |
|---------------------|--------------------------------------|---|-----|------|------------------------|
| $V_{\text{DRM}}$    | repetitive peak off-state voltage    |   | -   | 600  | V                      |
| $I_{\text{T(RMS)}}$ | RMS on-state current                 | full sine wave; $T_{\text{h}} \leq 98 \text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>            | -   | 4    | A                      |
| $I_{\text{TSM}}$    | non-repetitive peak on-state current | full sine wave; $T_{\text{j(init)}} = 25 \text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 20 \text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> | -   | 35   | A                      |
|                     |                                      | full sine wave; $T_{\text{j(init)}} = 25 \text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 16.7 \text{ ms}$   | -   | 38.5 | A                      |
| $I^2t$              | $I^2t$ for fusing                    | $t_{\text{p}} = 10 \text{ ms}$ ; SIN  | -   | 6.1  | $\text{A}^2\text{s}$   |
| $di_{\text{T}}/dt$  | rate of rise of on-state current     | $I_{\text{T}} = 7 \text{ A}$ ; $I_{\text{G}} = 0.2 \text{ A}$ ; $di_{\text{G}}/dt = 0.2 \text{ A}/\mu\text{s}$ ; T2+ G+                               | -   | 50   | $\text{A}/\mu\text{s}$ |
|                     |                                      | $I_{\text{T}} = 7 \text{ A}$ ; $I_{\text{G}} = 0.2 \text{ A}$ ; $di_{\text{G}}/dt = 0.2 \text{ A}/\mu\text{s}$ ; T2+ G-                               | -   | 50   | $\text{A}/\mu\text{s}$ |
|                     |                                      | $I_{\text{T}} = 7 \text{ A}$ ; $I_{\text{G}} = 0.2 \text{ A}$ ; $di_{\text{G}}/dt = 0.2 \text{ A}/\mu\text{s}$ ; T2- G-                               | -   | 50   | $\text{A}/\mu\text{s}$ |
|                     |                                      | $I_{\text{T}} = 7 \text{ A}$ ; $I_{\text{G}} = 0.2 \text{ A}$ ; $di_{\text{G}}/dt = 0.2 \text{ A}/\mu\text{s}$ ; T2- G+                               | -   | 10   | $\text{A}/\mu\text{s}$ |
| $I_{\text{GM}}$     | peak gate current                    |   | -   | 2    | A                      |
| $P_{\text{GM}}$     | peak gate power                      |   | -   | 5    | W                      |
| $P_{\text{G(AV)}}$  | average gate power                   | over any 20 ms period   | -   | 0.5  | W                      |
| $T_{\text{stg}}$    | storage temperature                  |   | -40 | 150  | $^{\circ}\text{C}$     |
| $T_{\text{j}}$      | junction temperature                 |   | -   | 125  | $^{\circ}\text{C}$     |

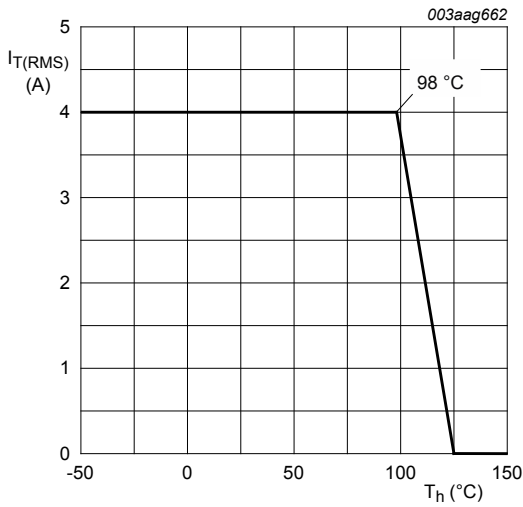
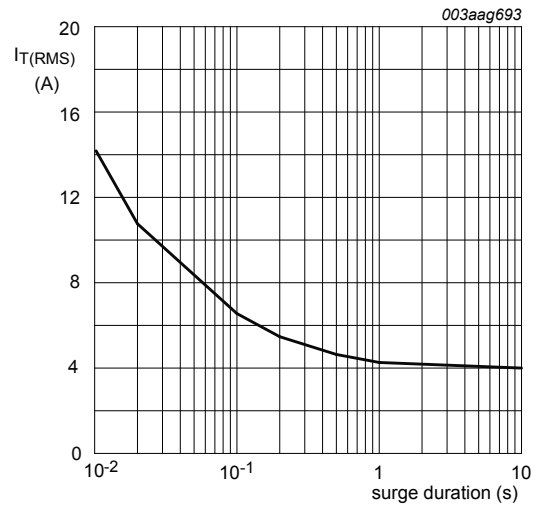


Fig. 1. RMS on-state current as a function of heatsink temperature; maximum values



f = 50 Hz; T<sub>h</sub> = 98 °C

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

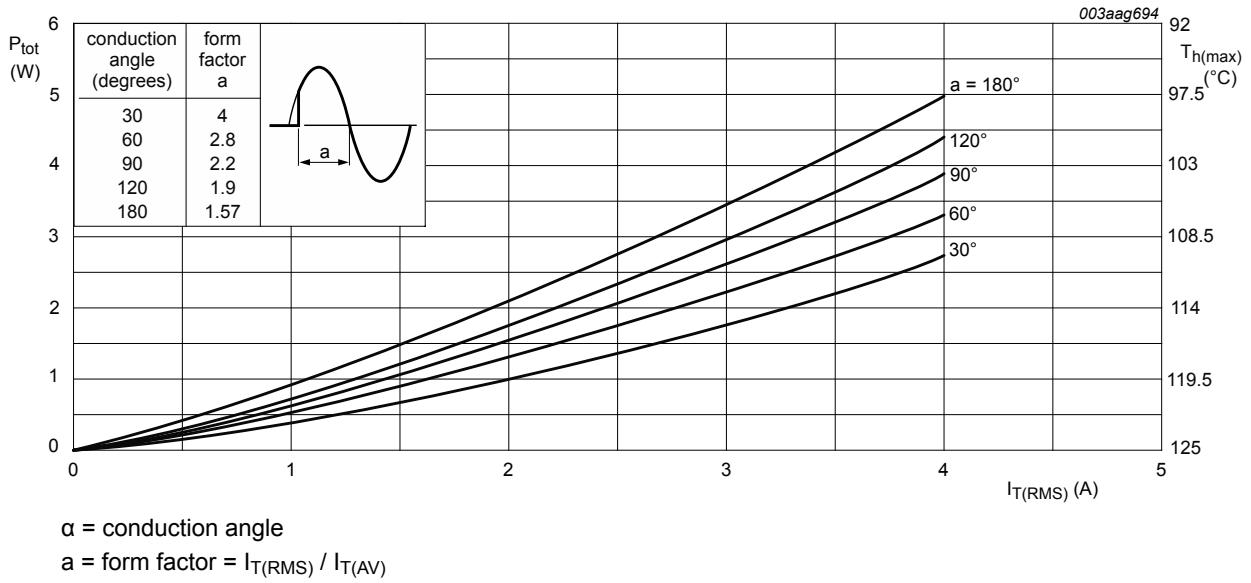


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

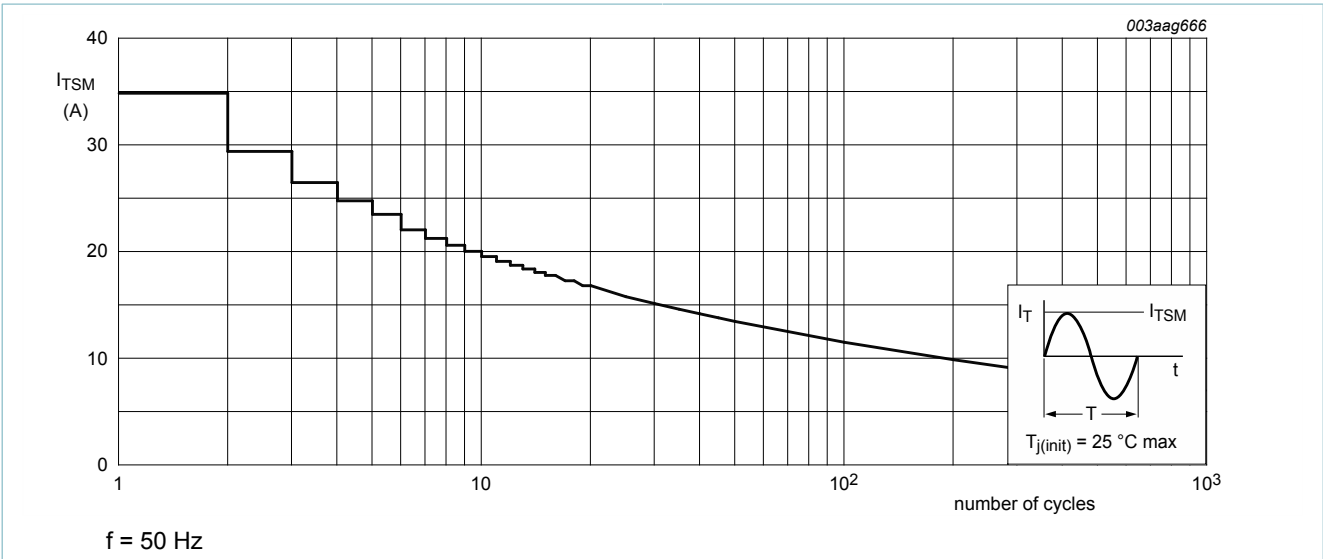


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

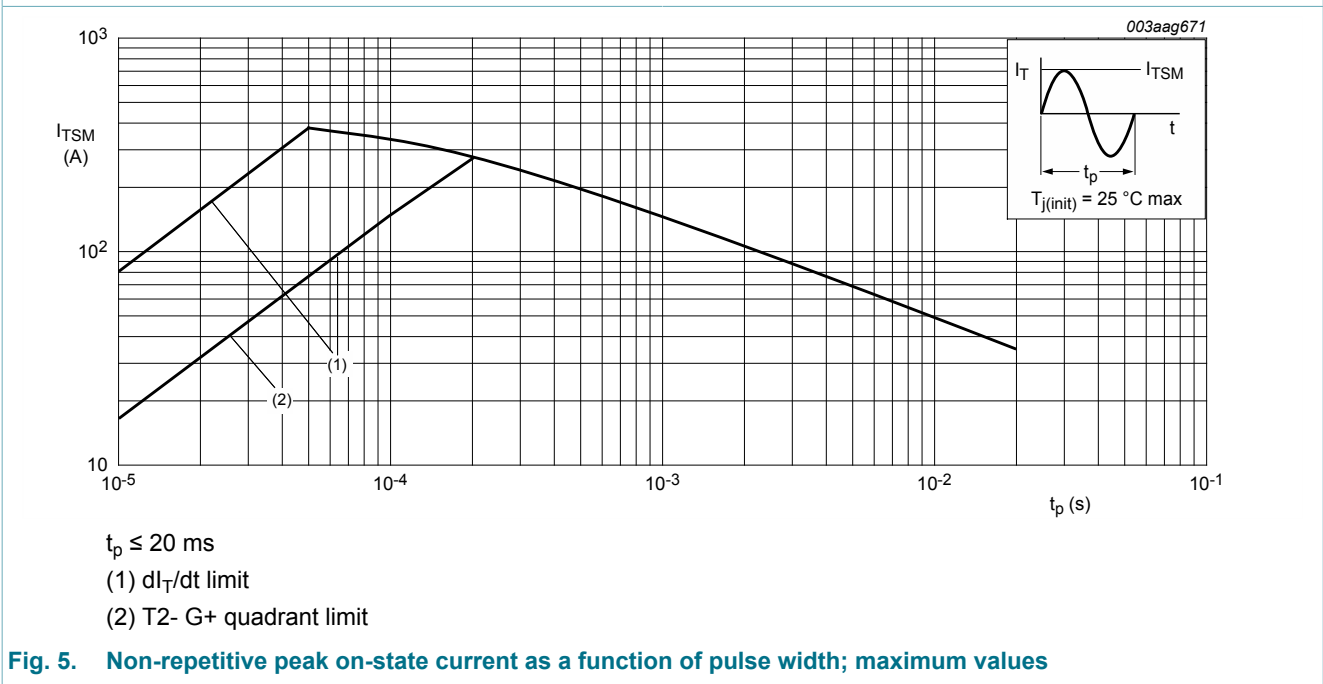
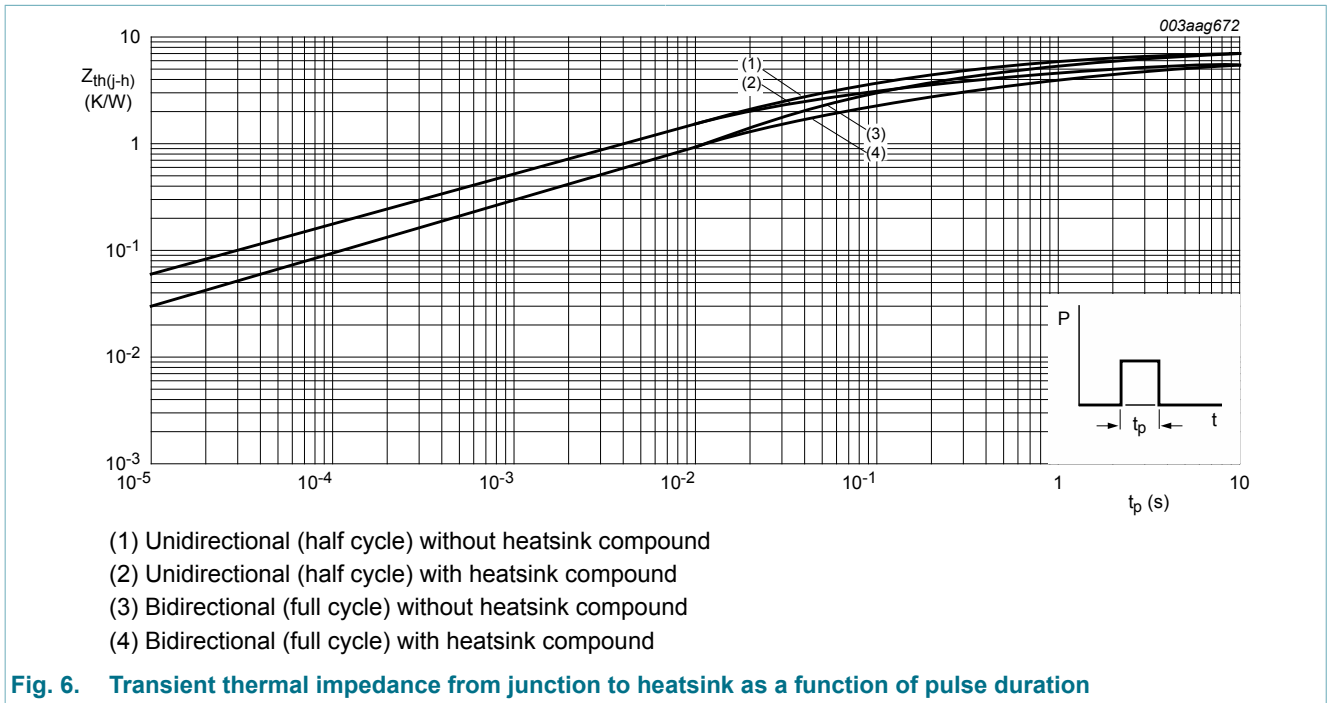


Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values

## 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 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  |



## 9. Isolation characteristics

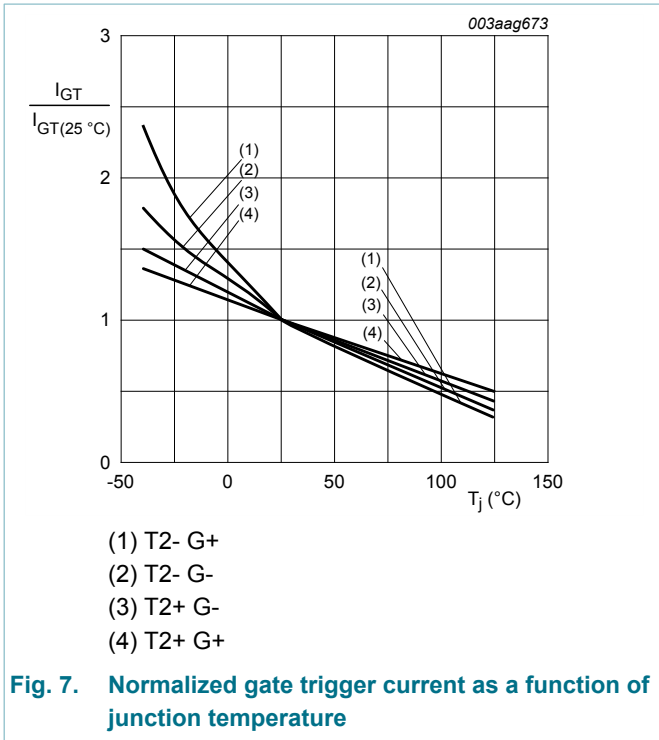
Table 6. Isolation characteristics

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

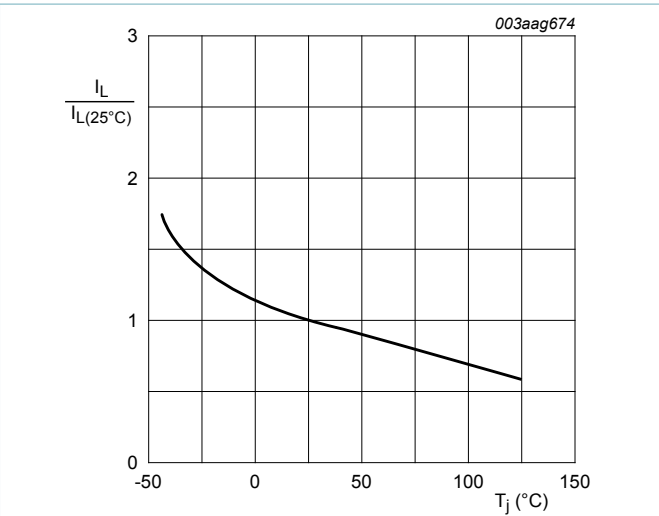
## 10. Characteristics

Table 7. Characteristics

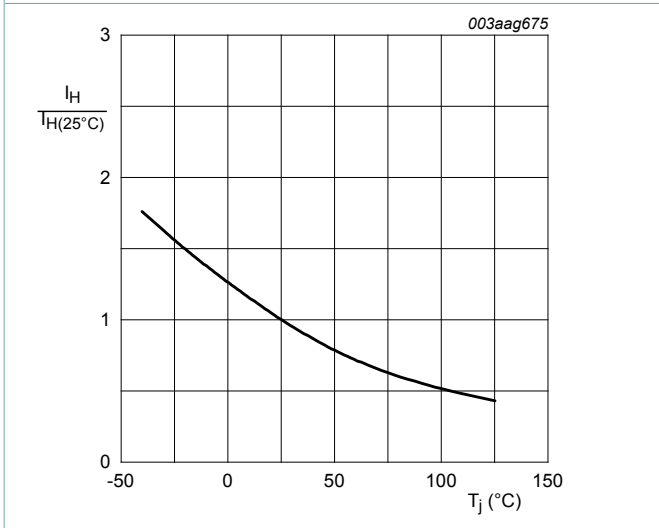
| Symbol                         | Parameter                             | Conditions  | Min  | Typ | Max | Unit       |
|--------------------------------|---------------------------------------|---|------|-----|-----|------------|
| <b>Static characteristics</b>  |                                       |   |      |     |     |            |
| $I_{GT}$                       | 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>                                   | -    | -   | 5   | 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>                                   | -    | -   | 5   | 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>                                   | -    | -   | 5   | 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>                                   | -    | -   | 10  | 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>                                   | -    | -   | 10  | 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>                                   | -    | -   | 15  | 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>                                   | -    | -   | 10  | 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>                                   | -    | -   | 10  | mA         |
| $I_H$                          | holding current                       | $V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 9</a>   | -    | -   | 6   | mA         |
| $V_T$                          | on-state voltage                      | $I_T = 6\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 10</a>   | -    | 1.3 | 1.5 | 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>  | -    | 0.7 | 1   | V          |
|                                |                                       | $V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 125\text{ °C}$ ;<br><a href="#">Fig. 11</a>  | 0.25 | 0.4 | -   | V          |
| $I_D$                          | off-state current                     | $V_D = 600\text{ V}$ ; $T_j = 125\text{ °C}$  | -    | 0.1 | 0.5 | mA         |
| <b>Dynamic characteristics</b> |                                       |   |      |     |     |            |
| $dV_D/dt$                      | rate of rise of off-state voltage     | $V_{DM} = 402\text{ V}$ ; $T_j = 125\text{ °C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit             | -    | 50  | -   | V/ $\mu$ s |
| $dI_{com}/dt$                  | rate of change of commutating current | $V_D = 400\text{ V}$ ; $I_{T(RMS)} = 4\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (snubberless condition); gate open circuit | -    | 1.2 | -   | A/ms       |
| $t_{gt}$                       | gate-controlled turn-on time          | $I_{TM} = 6\text{ A}$ ; $V_D = 600\text{ V}$ ; $I_G = 0.1\text{ A}$ ; $dI_G/dt = 5\text{ A}/\mu\text{s}$                                | -    | 2   | -   | $\mu$ s    |



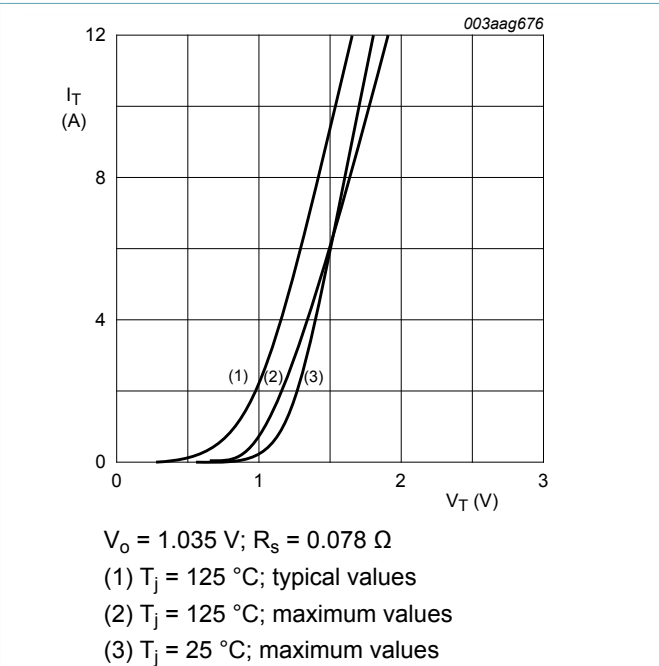
**Fig. 7. Normalized gate trigger current as a function of junction temperature**



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



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



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



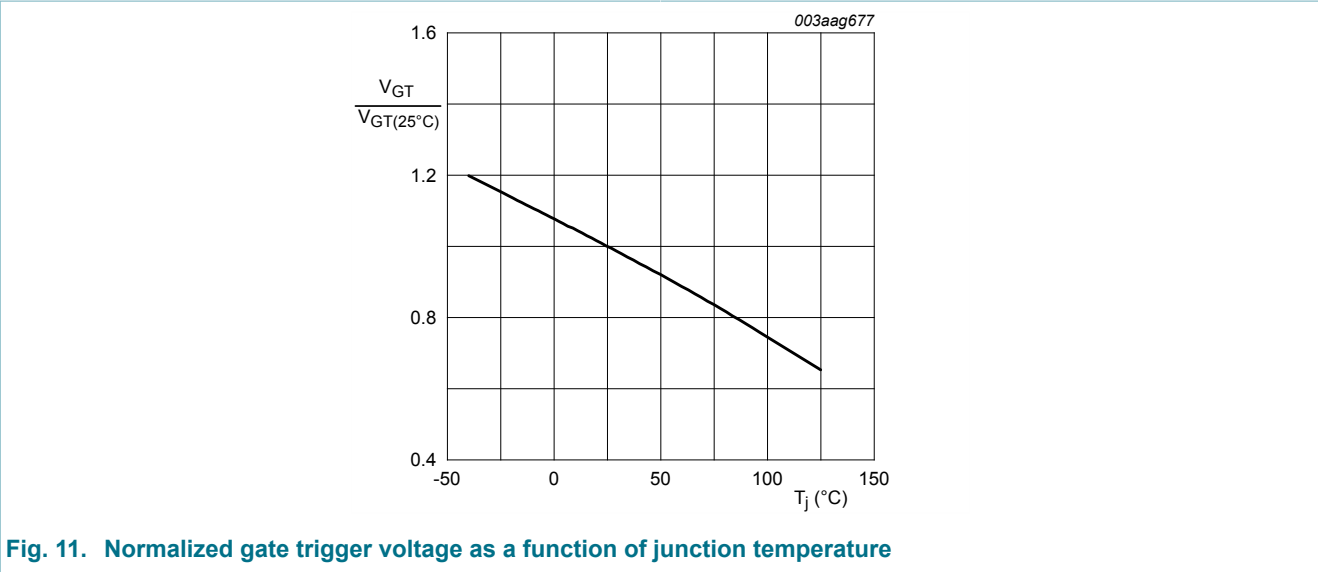


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

### 11. Package outline



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

## 12. Legal information

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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. |
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