



# BTA202X-600E

3Q Hi-Com Triac

22 May 2014

Product data sheet

## 1. General description

Planar passivated high commutation three quadrant triac in a SOT186A (TO-220F) "full pack" plastic package. This "series E" triac balances the requirements of commutation performance and gate sensitivity and is intended for interfacing with low power drivers including microcontrollers.

## 2. Features and benefits

- 3Q technology for improved noise immunity
- Direct interfacing with low power drivers and microcontrollers
- Good immunity to false turn-on by dV/dt
- High commutation capability with sensitive gate
- High voltage capability
- Isolated mounting base package
- Planar technology for voltage ruggedness and reliability
- Sensitive gate for easy logic level triggering
- Triggering in three quadrants only

## 3. Applications

- General purpose motor controls
- Large and small appliances (White Goods)
- Loads such as contactors, circuit breakers, valves, dispensers and door locks
- Lower-power highly inductive, resistive and safety loads

## 4. Quick reference data

Table 1. Quick reference data

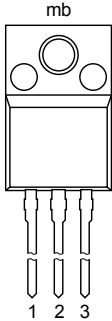
| Symbol                        | Parameter                            | Conditions                                                                                                                                          | Min | Typ | Max | Unit |
|-------------------------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| $V_{\text{DRM}}$              | repetitive peak off-state voltage    |                                                                                                                                                     | -   | -   | 600 | V    |
| $I_{\text{TSM}}$              | 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> | -   | -   | 14  | A    |
| $I_{\text{T(RMS)}}$           | RMS on-state current                 | full sine wave; $T_{\text{h}} \leq 110\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>          | -   | -   | 2   | A    |
| <b>Static characteristics</b> |                                      |                                                                                                                                                     |     |     |     |      |
| $I_{\text{GT}}$               | gate trigger current                 | $V_{\text{D}} = 12\text{ V}$ ; $I_{\text{T}} = 0.1\text{ A}$ ; T2+ G+; $T_{\text{j}} = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>         | 0.5 | -   | 10  | 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> | 0.5 | -   | 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> | 0.5 | -   | 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

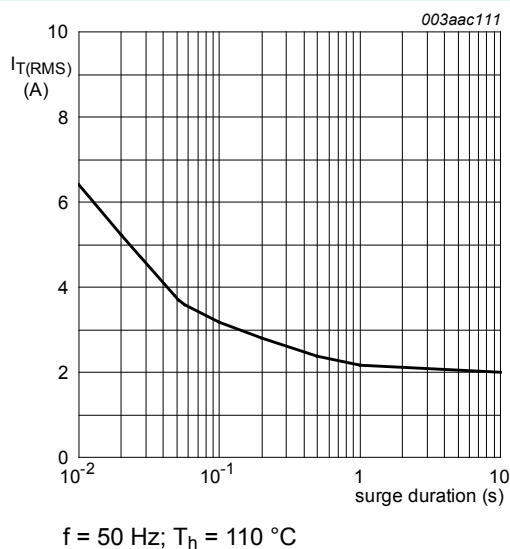
| Type number  | Package |                                                                                                     |         |
|--------------|---------|-----------------------------------------------------------------------------------------------------|---------|
|              | Name    | Description                                                                                         | Version |
| BTA202X-600E | TO-220F | plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack" | SOT186A |

## 7. Limiting values

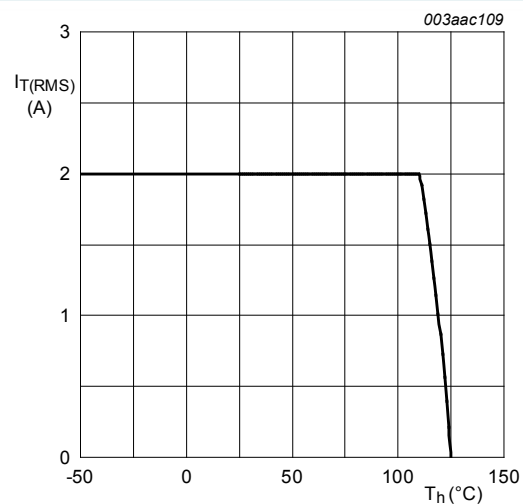
**Table 4. Limiting values**

*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; $T_h \leq 110\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>          | -   | 2    | A                      |
| $I_{\text{TSM}}$    | non-repetitive peak on-state current | full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> | -   | 14   | A                      |
|                     |                                      | full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 16.7\text{ ms}$                                                 | -   | 15.4 | A                      |
| $I^2t$              | $I^2t$ for fusing                    | $t_p = 10\text{ ms}$ ; SIN                                                                                                                 | -   | 0.98 | $\text{A}^2\text{s}$   |
| $dl_{\text{T}}/dt$  | rate of rise of on-state current     | $I_{\text{T}} = 1.5\text{ A}$ ; $I_{\text{G}} = 0.2\text{ A}$ ; $dl_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$                              | -   | 100  | $\text{A}/\mu\text{s}$ |
| $I_{\text{GM}}$     | 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 surge duration; maximum values**



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

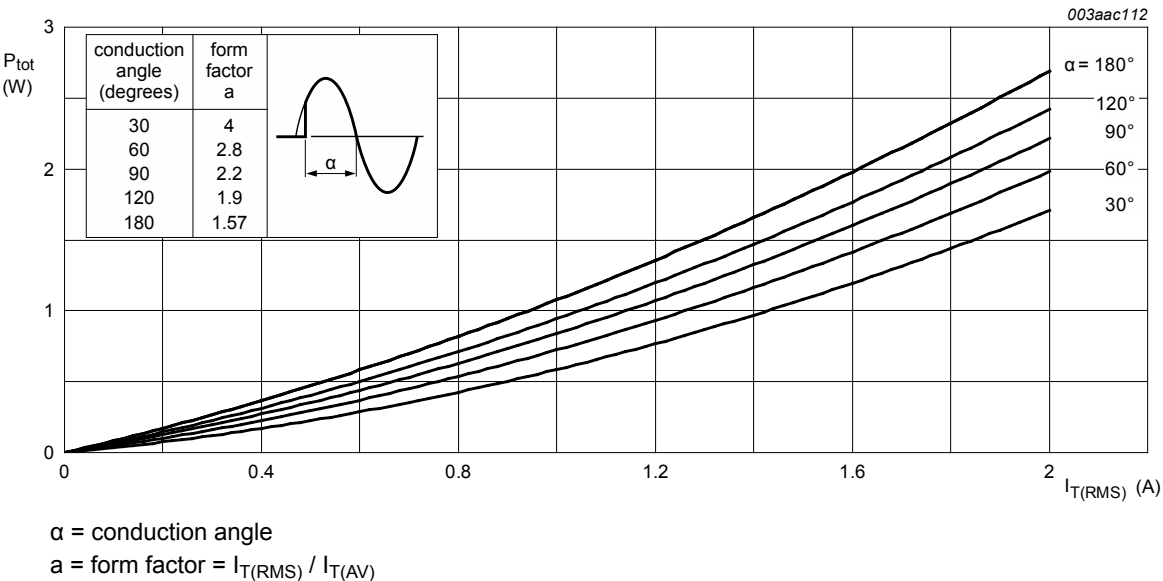


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

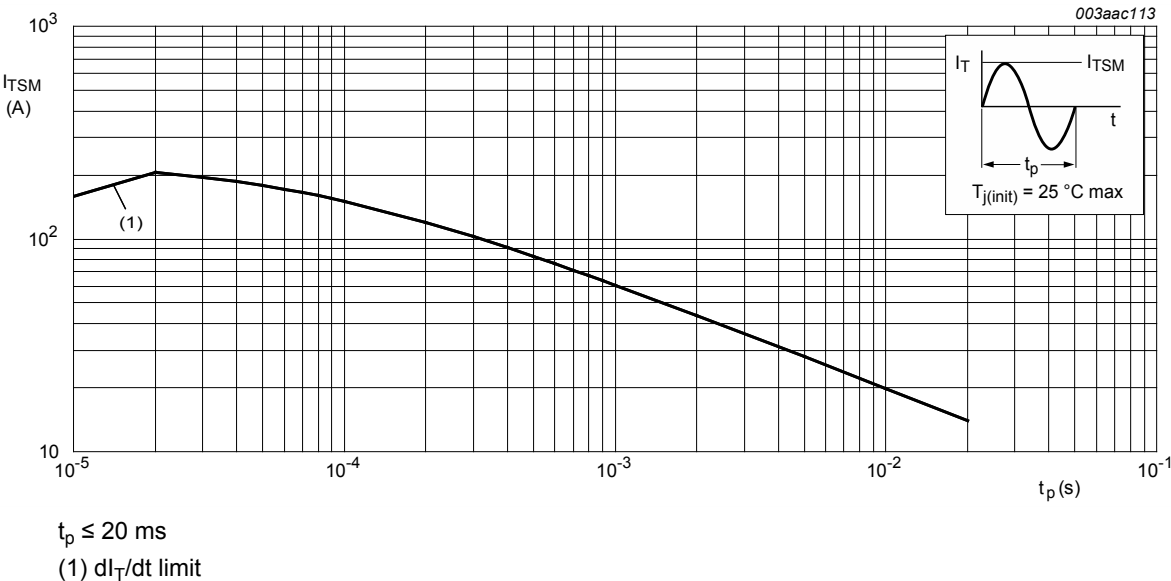
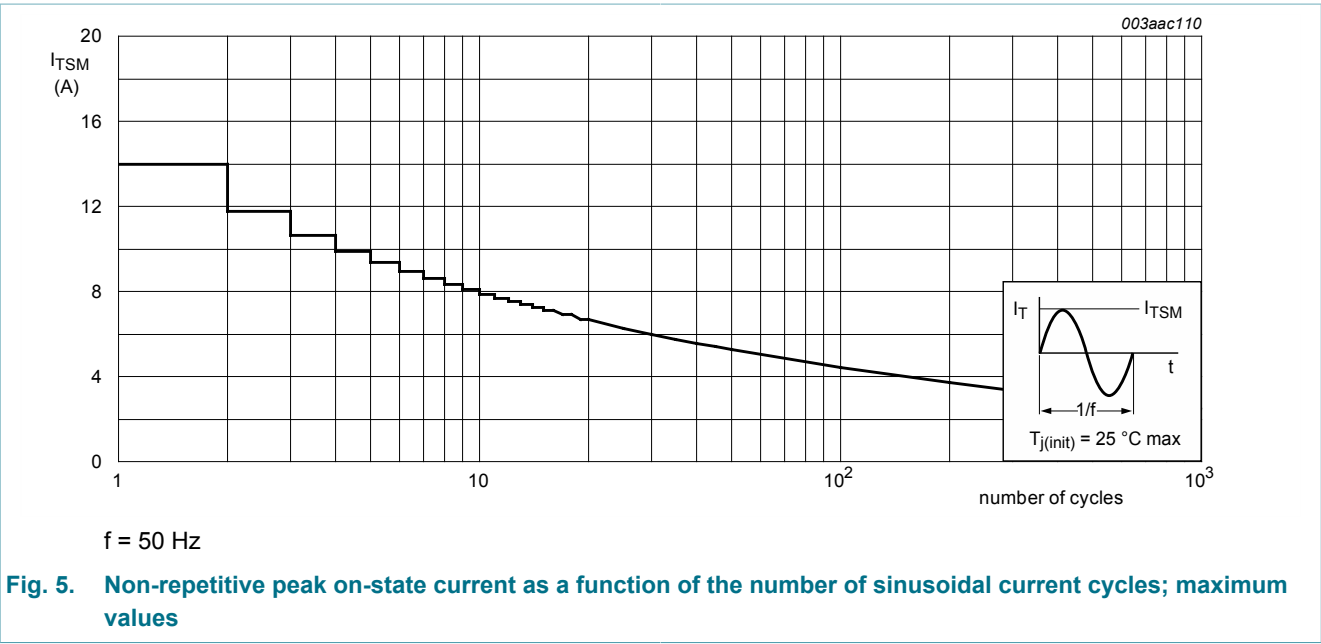


Fig. 4. Non-repetitive peak on-state current as a function of pulse width; maximum values



## 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; with 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  |

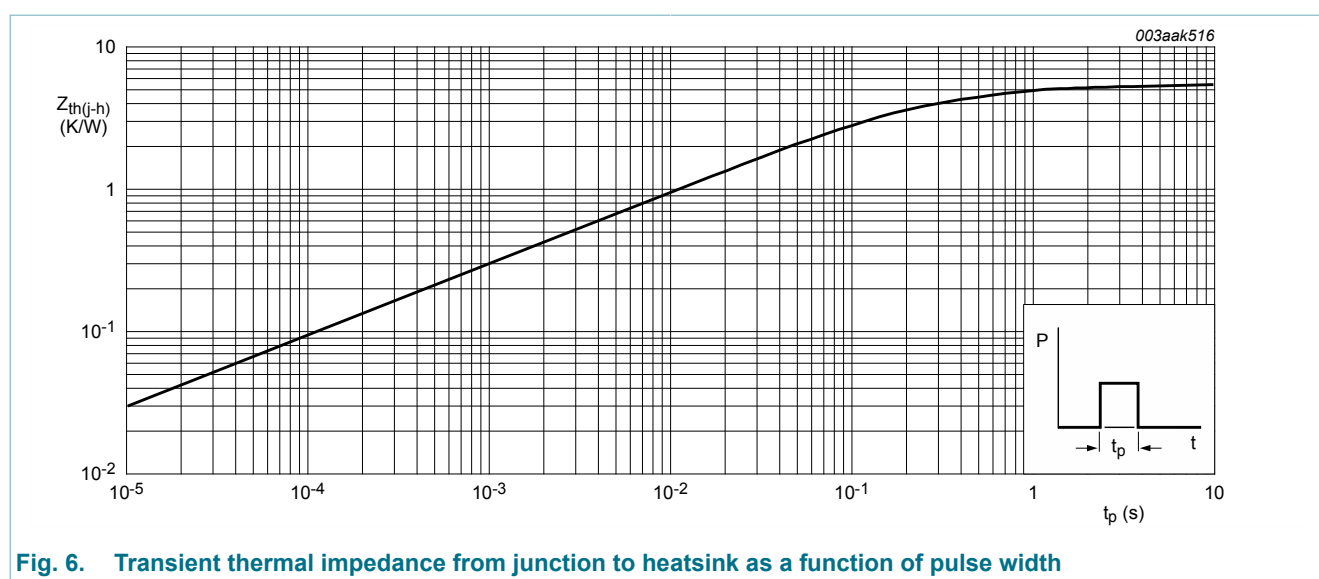


Fig. 6. Transient thermal impedance from junction to heatsink as a function of pulse width

## 9. Isolation characteristics

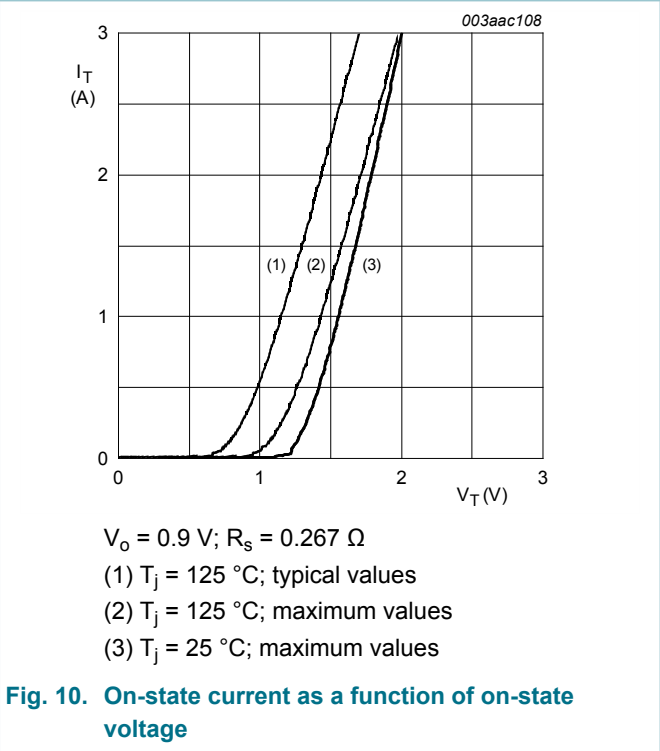
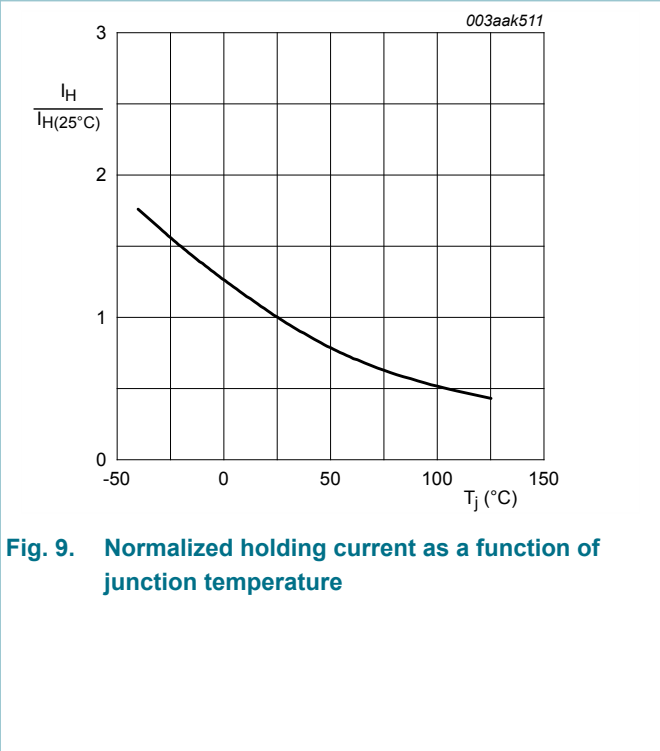
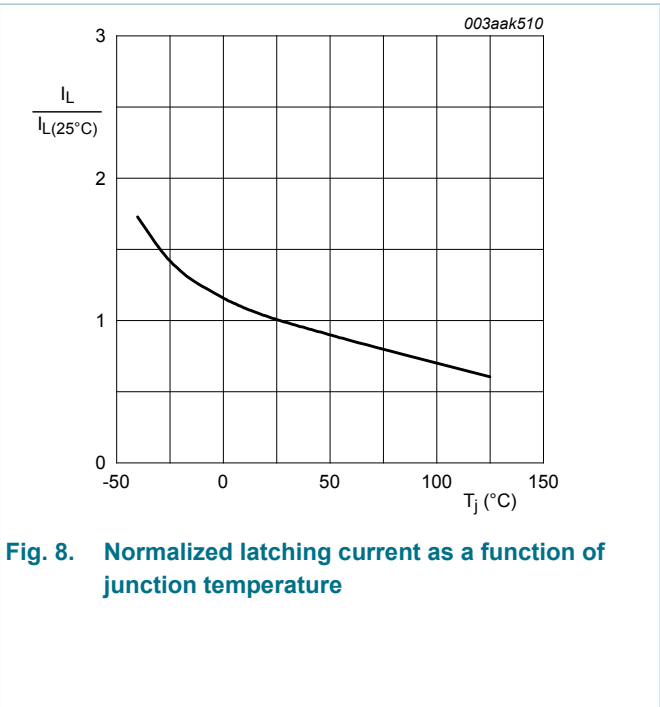
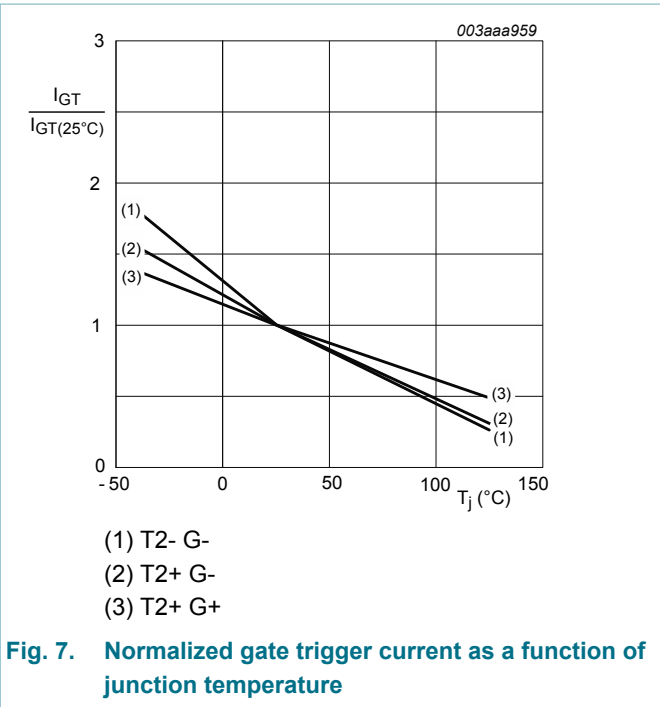
Table 6. Isolation characteristics

| 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; $50\text{ Hz} \leq f \leq 60\text{ Hz}$ ; $RH \leq 65\%$ ; $T_h = 25\text{ }^\circ\text{C}$ | -   | -   | 2500 | V    |
| $C_{isol}$      | isolation capacitance | from main terminal 2 to external heatsink; $f = 1\text{ MHz}$                                                                                                                  | -   | 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>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                                                              | 0.5 | -    | 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>                                                              | 0.5 | -    | 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>                                                              | 0.5 | -    | 10  | 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>                                                              | -   | -    | 12  | 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>                                                              | -   | -    | 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>                                                              | -   | -    | 12  | mA               |
| $I_H$                          | holding current                       | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>                                                                                                | -   | -    | 10  | mA               |
| $V_T$                          | on-state voltage                      | $I_T = 3\text{ A}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>                                                                                                | -   | 1.63 | 2   | 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>                                                                   | 0.2 | 0.3  | -   | 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     | $V_{DM} = 402\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ;<br>$R_{GT1} = 220\text{ }\Omega$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ );<br>exponential waveform                     | -   | 500  | -   | V/ $\mu\text{s}$ |
| $dI_{com}/dt$                  | rate of change of commutating current | $V_D = 400\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 2\text{ A}$ ;<br>$dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (snubberless condition); gate open circuit | 2   | -    | -   | A/ms             |
|                                |                                       | $V_D = 400\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 2\text{ A}$ ;<br>$dV_{com}/dt = 10\text{ V}/\mu\text{s}$ ; gate open circuit                          | 2.3 | -    | -   | A/ms             |





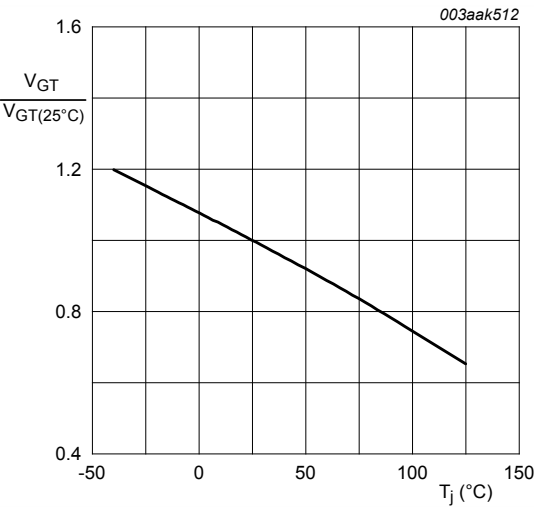


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

11. Package outline

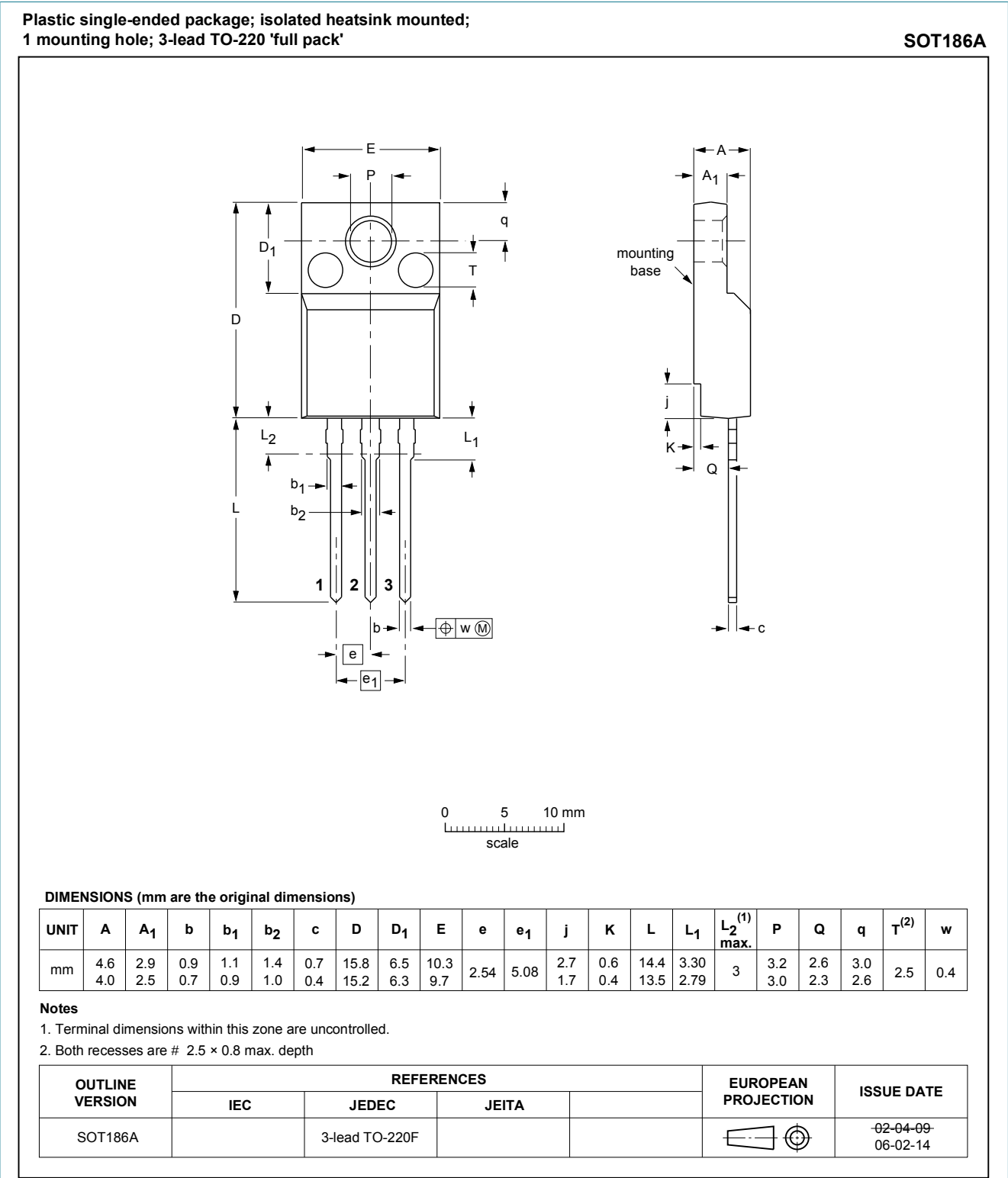


Fig. 12. Package outline TO-220F (SOT186A)

## 12. Legal information

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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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