



BT139X-600F

4Q Triac

24 October 2013

Product data sheet

1. General description

Planar passivated four quadrant triac in a SOT186A "full pack" plastic package intended for use in applications requiring high bidirectional transient and blocking voltage capability and high thermal cycling performance. Typical applications include motor control, industrial and domestic lighting, heating and static switching.

2. Features and benefits

- High blocking voltage capability
- Isolated package
- Less sensitive gate for improved noise immunity
- Planar passivated for voltage ruggedness and reliability
- Triggering in all four quadrants

3. Applications

- General purpose motor control
- General purpose switching

4. Quick reference data

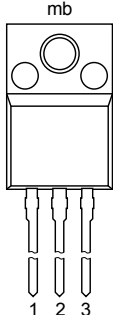

Table 1. Quick reference data

| 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; $T_{\text{J}(\text{init})} = 25\text{ }^{\circ}\text{C}$; $t_{\text{p}} = 20\text{ ms}$; Fig. 4 ; Fig. 5 | - | - | 155 | A |
| $I_{\text{T(RMS)}}$ | RMS on-state current | full sine wave; $T_{\text{h}} \leq 38\text{ }^{\circ}\text{C}$; Fig. 1 ; Fig. 2 ; Fig. 3 | - | - | 16 | A |
| Static characteristics | | | | | | |
| I_{GT} | gate trigger current | $V_{\text{D}} = 12\text{ V}$; $I_{\text{T}} = 0.1\text{ A}$; T2+ G+; $T_{\text{J}} = 25\text{ }^{\circ}\text{C}$; Fig. 7 | - | 5 | 25 | mA |
| | | $V_{\text{D}} = 12\text{ V}$; $I_{\text{T}} = 0.1\text{ A}$; T2- G+; $T_{\text{J}} = 25\text{ }^{\circ}\text{C}$; Fig. 7 | - | 22 | 70 | 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

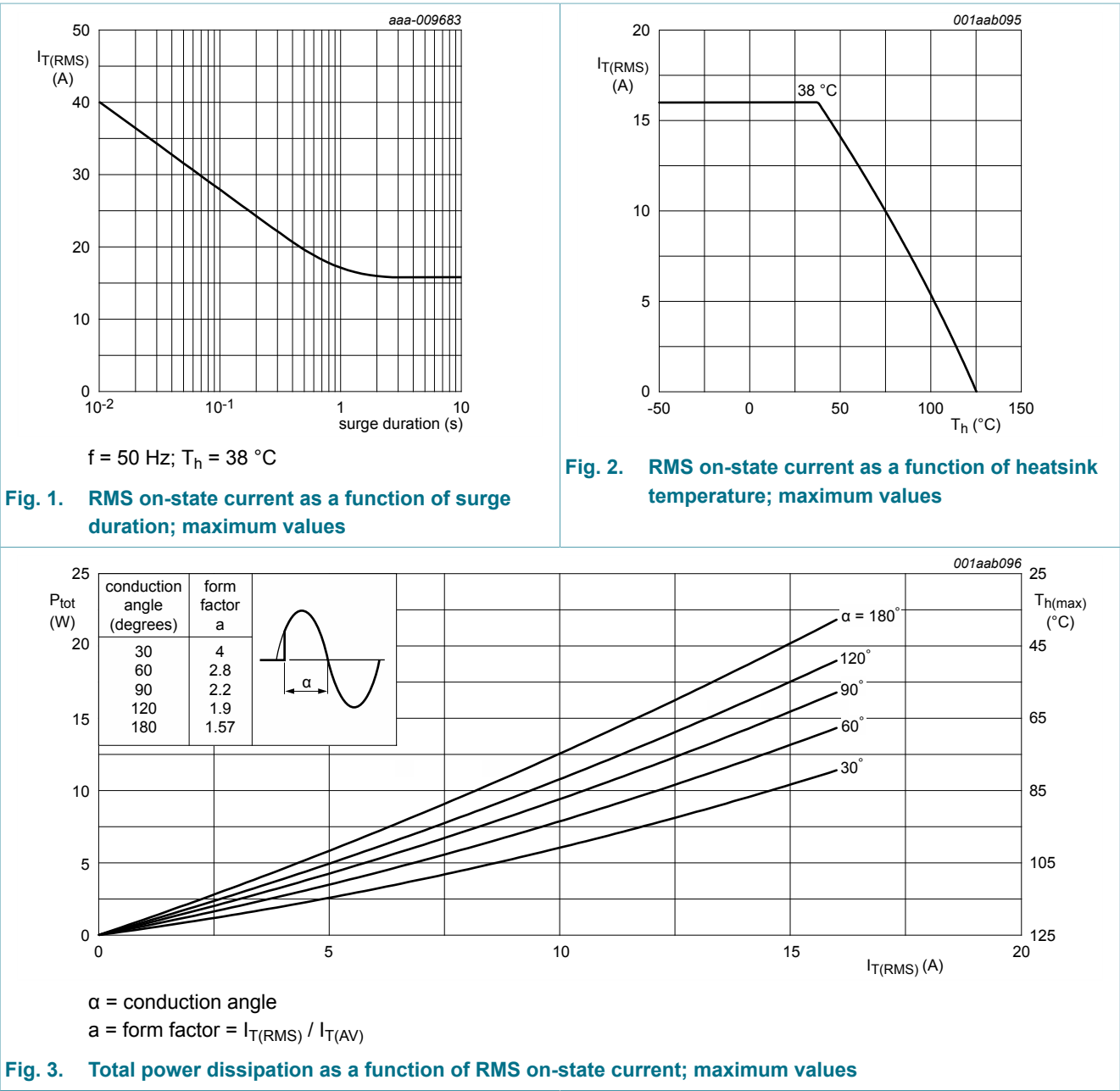
| Type number | Package | | |
|----------------|---------|---|---------|
| | Name | Description | Version |
| BT139X-600F | TO-220F | plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack" | SOT186A |
| BT139X-600F/DG | TO-220F | plastic single-ended package; 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 |
| $I_{\text{T(RMS)}}$ | RMS on-state current | full sine wave; $T_h \leq 38^\circ\text{C}$; Fig. 1 ; Fig. 2 ; Fig. 3 | | - | 16 | A |
| I_{TSM} | non-repetitive peak on-state current | full sine wave; $T_{j(\text{init})} = 25^\circ\text{C}$; $t_p = 20\text{ ms}$; Fig. 4 ; Fig. 5 | | - | 155 | A |
| | | full sine wave; $T_{j(\text{init})} = 25^\circ\text{C}$; $t_p = 16.7\text{ ms}$ | | - | 170 | A |
| I^2t | I^2t for fusing | $t_p = 10\text{ ms}$; SIN | | - | 120 | A^2s |
| di_{T}/dt | rate of rise of on-state current | $I_{\text{T}} = 20\text{ A}$; $I_{\text{G}} = 0.2\text{ A}$; $dI_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$; T2+ G+ | | - | 50 | $\text{A}/\mu\text{s}$ |
| | | $I_{\text{T}} = 20\text{ A}$; $I_{\text{G}} = 0.2\text{ A}$; $dI_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$; T2+ G- | | - | 50 | $\text{A}/\mu\text{s}$ |
| | | $I_{\text{T}} = 20\text{ A}$; $I_{\text{G}} = 0.2\text{ A}$; $dI_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$; T2- G- | | - | 50 | $\text{A}/\mu\text{s}$ |
| | | $I_{\text{T}} = 20\text{ A}$; $I_{\text{G}} = 0.2\text{ A}$; $dI_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$; T2- G+ | | - | 10 | $\text{A}/\mu\text{s}$ |
| I_{GM} | peak gate current | | | - | 2 | A |
| P_{GM} | peak gate power | | | - | 5 | W |
| $P_{\text{G(AV)}}$ | average gate power | over any 20 ms period | | - | 0.5 | W |
| T_{stg} | storage temperature | | | -40 | 150 | $^\circ\text{C}$ |
| T_{j} | junction temperature | | | - | 125 | $^\circ\text{C}$ |



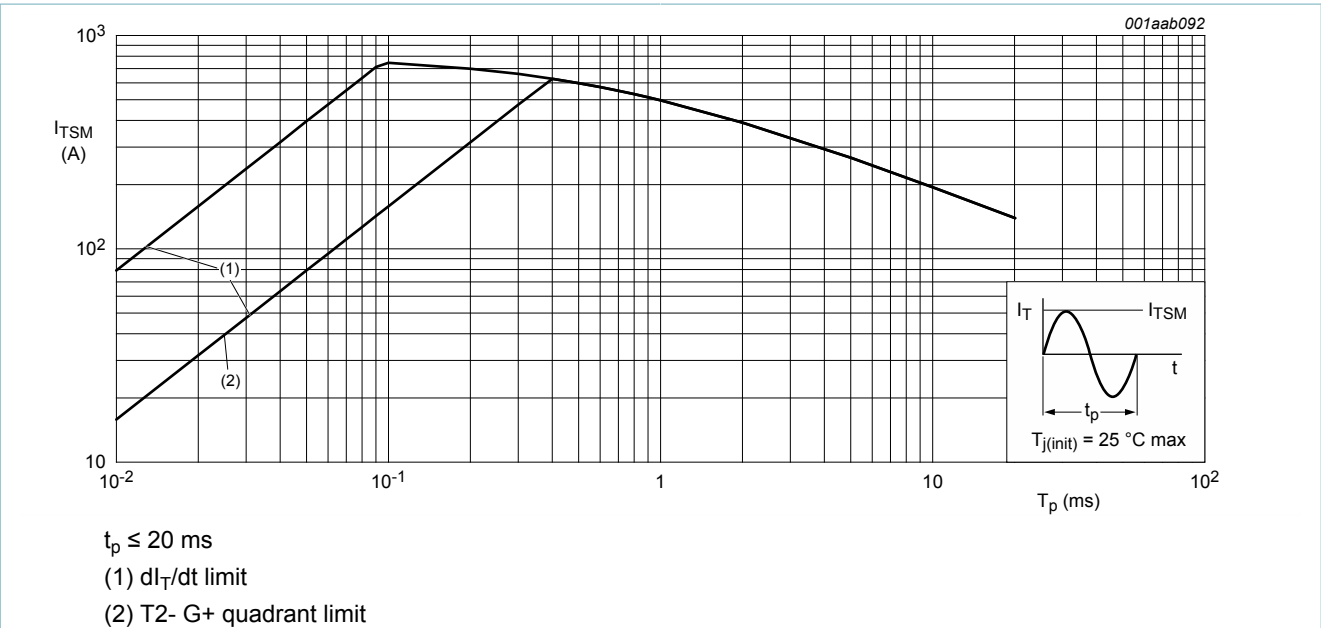


Fig. 4. Non-repetitive peak on-state current as a function of pulse width; maximum values

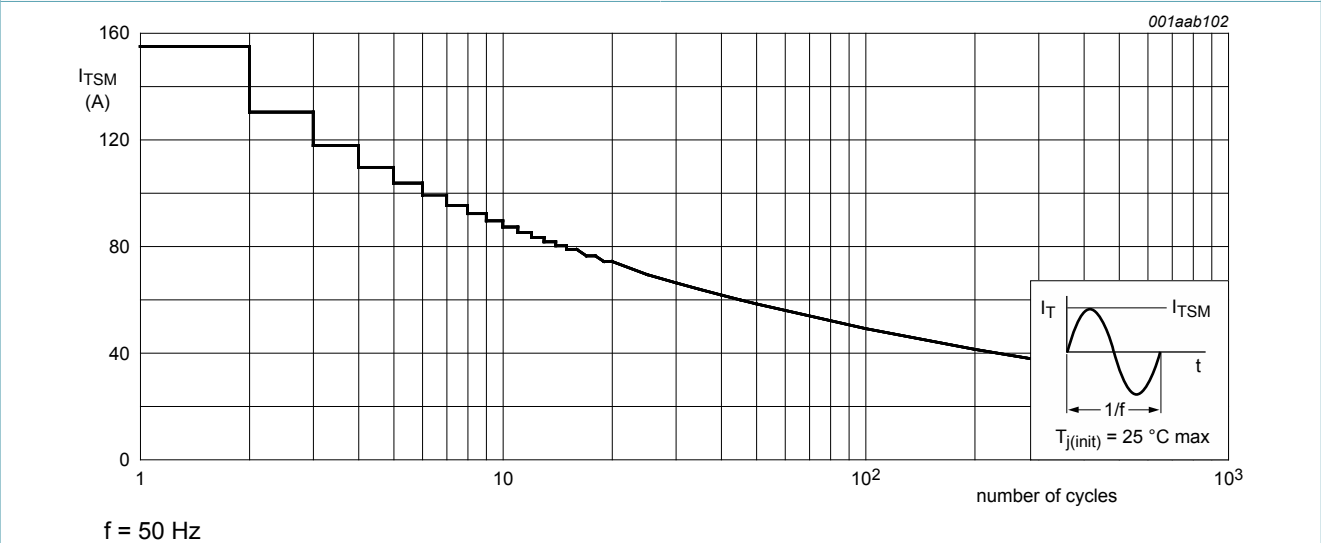
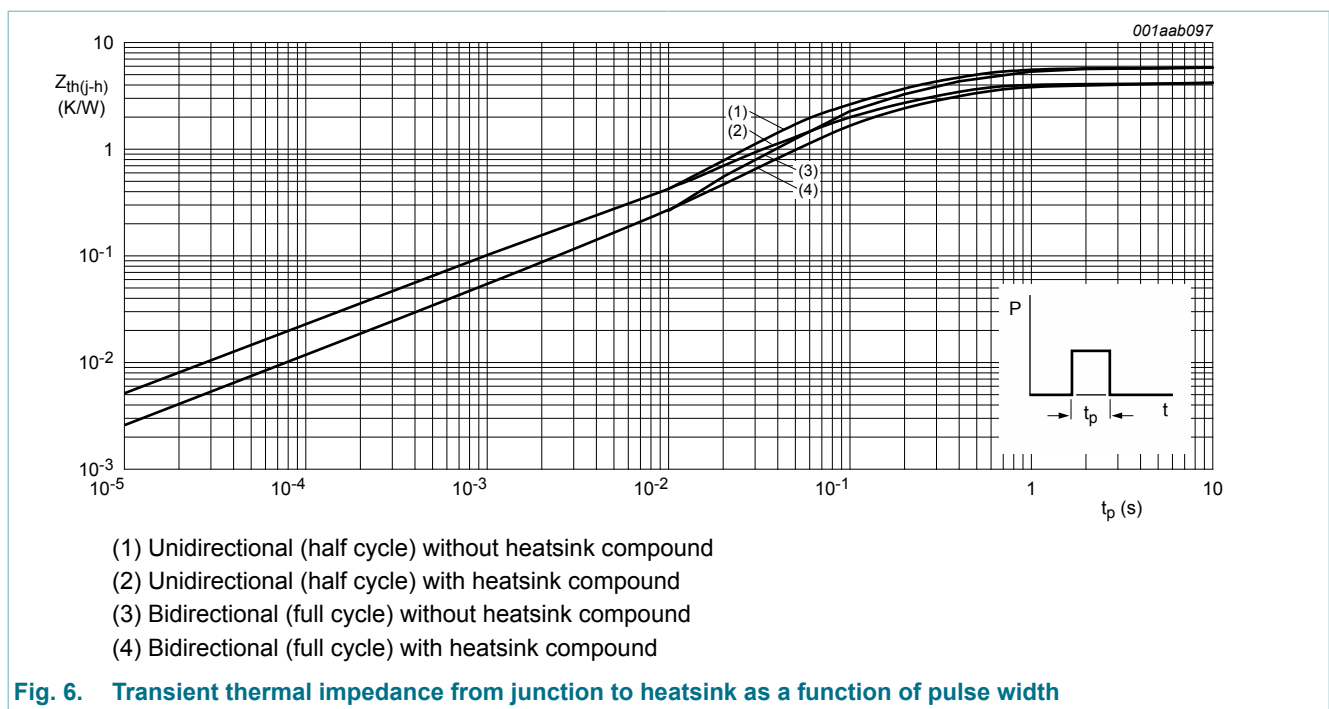


Fig. 5. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

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; Fig. 6 | - | - | 1.2 | K/W |
| | | half cycle; Fig. 6 | - | - | 1.7 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | - | 60 | - | K/W |



9. Isolation characteristics

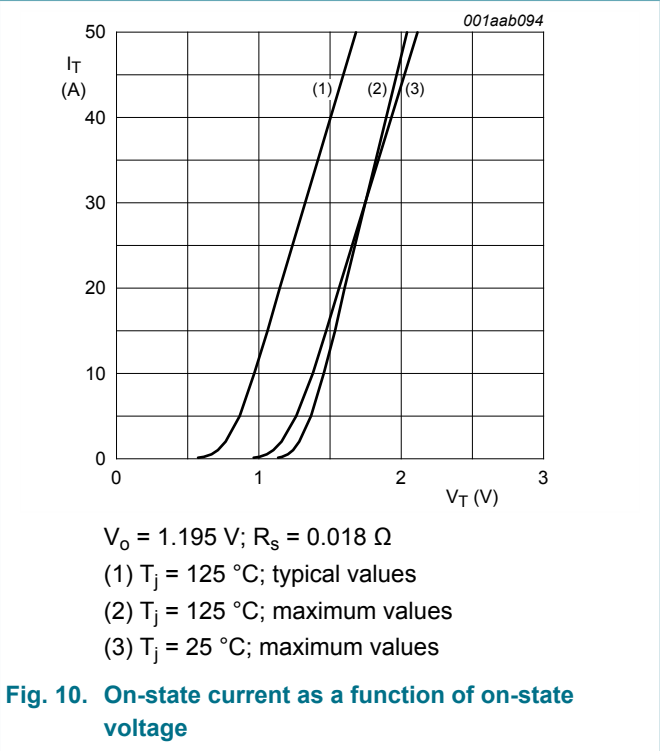
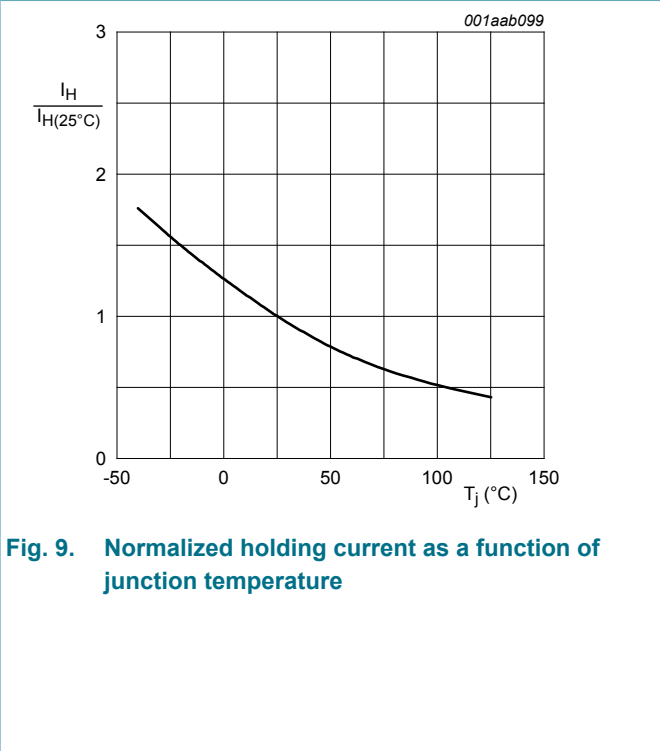
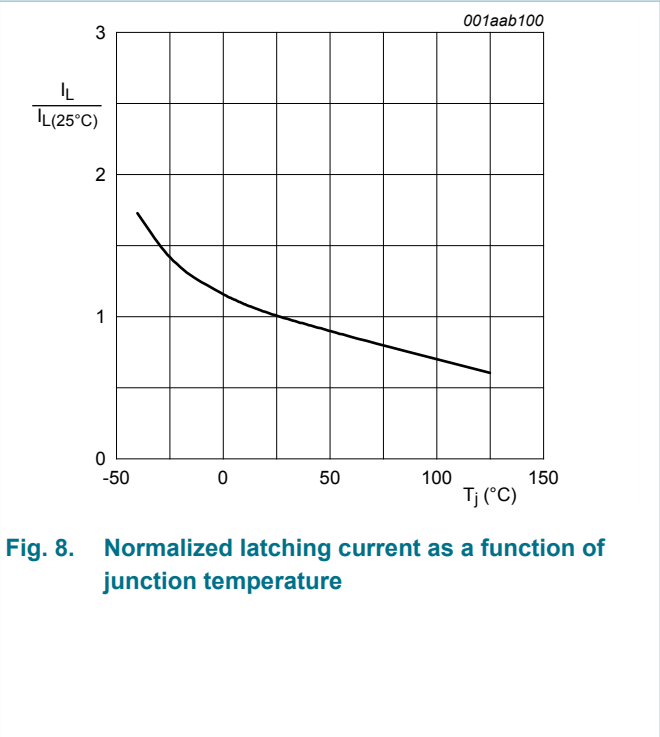
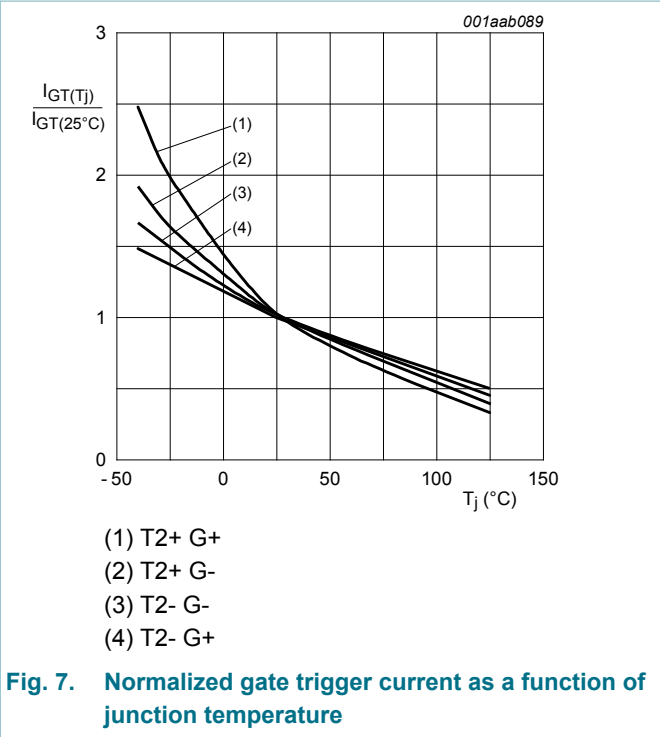
Table 6. Isolation characteristics

| 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 |
|--------------------------------|---------------------------------------|---|--|------|-----|-----|------------------|
| Static characteristics | | | | | | | |
| I_{GT} | gate trigger current | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ }^\circ\text{C}$; Fig. 7 | | - | 5 | 25 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ }^\circ\text{C}$; Fig. 7 | | - | 8 | 25 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ }^\circ\text{C}$; Fig. 7 | | - | 10 | 25 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G+; $T_j = 25\text{ }^\circ\text{C}$; Fig. 7 | | - | 22 | 70 | mA |
| I_L | latching current | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ }^\circ\text{C}$; Fig. 8 | | - | 7 | 40 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ }^\circ\text{C}$; Fig. 8 | | - | 20 | 60 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ }^\circ\text{C}$; Fig. 8 | | - | 8 | 40 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G+; $T_j = 25\text{ }^\circ\text{C}$; Fig. 8 | | - | 10 | 60 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 9 | | - | 6 | 45 | mA |
| V_T | on-state voltage | $I_T = 20\text{ A}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 10 | | - | 1.2 | 1.6 | V |
| V_{GT} | gate trigger voltage | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 11 | | - | 0.7 | 1 | V |
| | | $V_D = 400\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 125\text{ }^\circ\text{C}$; Fig. 11 | | 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 |
| Dynamic characteristics | | | | | | | |
| dV_D/dt | rate of rise of off-state voltage | $V_{DM} = 402\text{ V}$; $T_j = 125\text{ }^\circ\text{C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit | | 50 | 250 | - | V/ μs |
| dV_{com}/dt | rate of change of commutating voltage | $V_D = 400\text{ V}$; $T_j = 95\text{ }^\circ\text{C}$; $dI_{com}/dt = 7.2\text{ A/ms}$; $I_T = 16\text{ A}$; gate open circuit | | - | 20 | - | V/ μs |
| t_{gt} | gate-controlled turn-on time | $I_{TM} = 20\text{ A}$; $V_D = 600\text{ V}$; $I_G = 0.1\text{ A}$; $dI_G/dt = 5\text{ A}/\mu\text{s}$ | | - | 2 | - | μs |



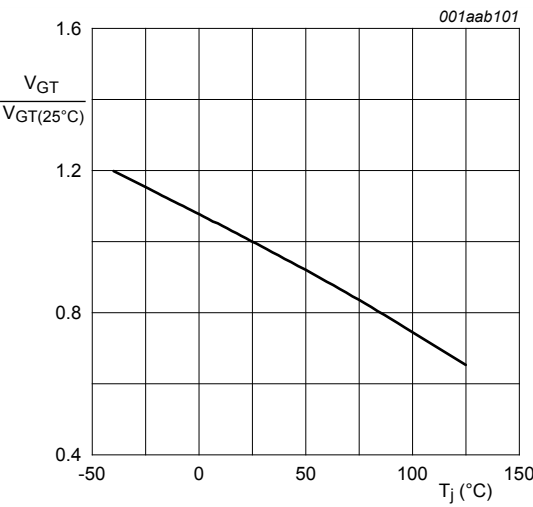


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

11. Package outline



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

12. Legal information

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|--------------------------------|--------------------|---|
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