

1. General description

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

2. Features and benefits

- 3Q technology for improved noise immunity
- Direct triggering from low power drivers and logic ICs
- High commutation capability with maximum false trigger immunity
- High voltage capability
- Intermediate sensitivity for maximum noise immunity and logic level triggering
- Isolated mounting base package
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only

3. Applications

- AC solenoids
- General purpose motor control circuits
- Home appliances

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 |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_h \leq 92\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3 | - | - | 4 | A |
| I_{TSM} | non-repetitive peak on-state current | full sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 20\text{ ms}$; Fig. 4 ; Fig. 5 | - | - | 25 | A |
| | | full sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$ | - | - | 27 | A |
| T_j | junction temperature | | - | - | 125 | °C |
| Static characteristics | | | | | | |
| I_{GT} | gate trigger current | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ °C}$; Fig. 7 | - | - | 25 | mA |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|---------------------------------------|---|-----|-----|-----|------------------|
| | | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2+ \text{ G-}; T_j = 25\text{ }^\circ\text{C}; \text{Fig. 7}$ | - | - | 25 | mA |
| | | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2- \text{ G-}; T_j = 25\text{ }^\circ\text{C}; \text{Fig. 7}$ | - | - | 25 | mA |
| I_H | holding current | $V_D = 12\text{ V}; T_j = 25\text{ }^\circ\text{C}; \text{Fig. 9}$ | - | - | 30 | mA |
| V_T | on-state voltage | $I_T = 5\text{ A}; T_j = 25\text{ }^\circ\text{C}; \text{Fig. 10}$ | - | 1.4 | 1.7 | V |
| Dynamic characteristics | | | | | | |
| dV_D/dt | rate of rise of off-state voltage | $V_{DM} = 402\text{ V}; T_j = 125\text{ }^\circ\text{C}; (V_{DM} = 67\% \text{ of } V_{DRM}); \text{exponential waveform; gate open circuit}$ | 50 | - | - | V/ μs |
| dI_{com}/dt | rate of change of commutating current | $V_D = 400\text{ V}; T_j = 125\text{ }^\circ\text{C}; I_{T(RMS)} = 4\text{ A}; dV_{com}/dt = 20\text{ V}/\mu\text{s}; (\text{snubberless condition}); \text{gate open circuit}$ | 2.5 | - | - | 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 |
| BTA204X-600F | 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; $T_h \leq 92\text{ }^\circ\text{C}$; Fig. 1 ; Fig. 2 ; Fig. 3 | - | 4 | A |
| I_{TSM} | non-repetitive peak on-state current | full sine wave; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$; $t_p = 20\text{ ms}$; Fig. 4 ; Fig. 5 | - | 25 | A |
| | | full sine wave; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$; $t_p = 16.7\text{ ms}$ | - | 27 | A |
| I^2t | I^2t for fusing | $t_p = 10\text{ ms}$; SIN | - | 3.1 | A^2s |
| di_T/dt | rate of rise of on-state current | $I_G = 0.2\text{ A}$ | - | 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 | | - | 125 | $^\circ\text{C}$ |



Fig. 1. RMS on-state current as a function of surge duration; maximum values

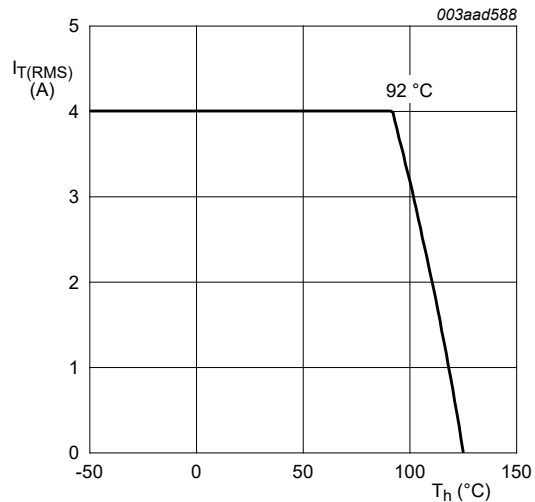


Fig. 2. RMS on-state current as a function of heatsink temperature; maximum values



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 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 | - | - | 5.5 | K/W |
| | | full cycle or half cycle; without heatsink compound; Fig. 6 | - | - | 7.2 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient free air | 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 |
|--------------------------------|---------------------------------------|---|------|-----|-----|------------|
| Static characteristics | | | | | | |
| I_{GT} | gate trigger current | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ °C}$; Fig. 7 | - | - | 25 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 7 | - | - | 25 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; Fig. 7 | - | - | 25 | mA |
| I_L | latching current | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ °C}$; Fig. 8 | - | - | 30 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 8 | - | - | 45 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; Fig. 8 | - | - | 30 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_j = 25\text{ °C}$; Fig. 9 | - | - | 30 | mA |
| V_T | on-state voltage | $I_T = 5\text{ A}$; $T_j = 25\text{ °C}$; Fig. 10 | - | 1.4 | 1.7 | V |
| V_{GT} | gate trigger voltage | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 25\text{ °C}$; Fig. 11 | - | 0.7 | 1 | V |
| | | $V_D = 400\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 25\text{ °C}$; Fig. 11 | 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 |
| Dynamic characteristics | | | | | | |
| 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/ μ s |
| dI_{com}/dt | rate of change of commutating current | $V_D = 400\text{ V}$; $T_j = 125\text{ °C}$; $I_{T(RMS)} = 4\text{ A}$; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$; (snubberless condition); gate open circuit | 2.5 | - | - | A/ms |



- (1) T2- G-
- (2) T2+ G-
- (3) T2+ G+

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

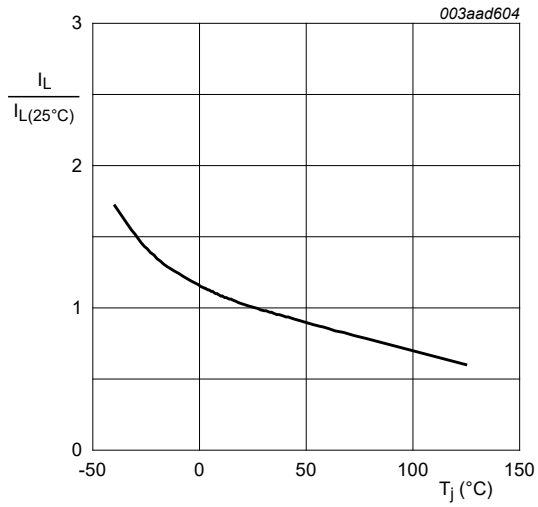
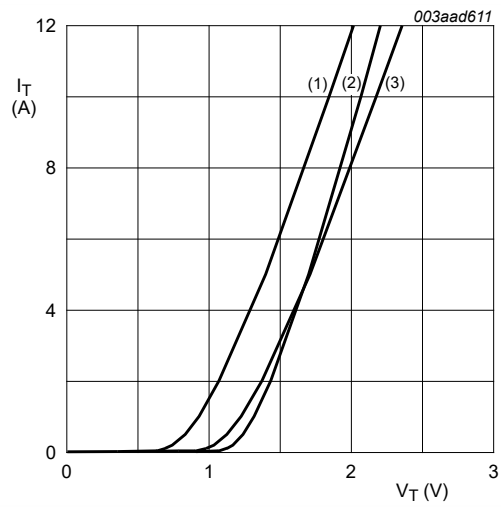


Fig. 8. Normalized latching current as a function of junction temperature



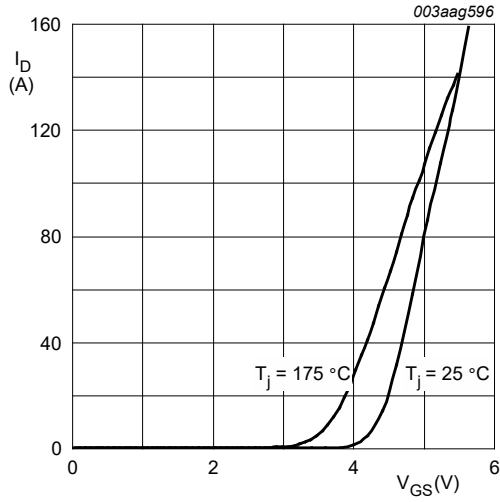
Fig. 9. Normalized holding current as a function of junction temperature



$V_o = 1.27 \text{ V}; R_s = 0.091 \Omega$

- (1) $T_j = 125 \text{ }^\circ\text{C}$; typical values
- (2) $T_j = 125 \text{ }^\circ\text{C}$; maximum values
- (3) $T_j = 25 \text{ }^\circ\text{C}$; maximum values

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



(1) $T_j (init) = 25^\circ\text{C}$; (2) $T_j (init) = 100^\circ\text{C}$

Fig. 11. Single pulse avalanche rating; avalanche current as a function of avalanche time

11. Package outline



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

12. Legal information

Data sheet status

| Document status [1][2] | Product status [3] | Definition |
|--------------------------------|--------------------|---|
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| Product [short] data sheet | Production | This document contains the product specification. |

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- [2] The term 'short data sheet' is explained in section "Definitions".
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