

1. General description

Planar passivated sensitive gate four quadrant triac in a SOT54 (TO-92) plastic package intended for use in applications requiring direct interfacing to logic ICs and low power gate drivers.

2. Features and benefits

- Direct interfacing to logic level ICs
- Direct interfacing to low power gate drive circuits
- High blocking voltage capability
- Planar passivated for voltage ruggedness and reliability
- Sensitive gate in four quadrants
- Triggering in all four quadrants

3. Applications

- General purpose low power motor control
- Home appliances
- Industrial process control
- Low power AC Fan controllers

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; $T_{lead} \leq 45\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3 | - | - | 1 | 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 | - | - | 8 | A |
| | | full sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$ | - | - | 8.5 | 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 | - | - | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 7 | - | - | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; Fig. 7 | - | - | 10 | mA |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|---------------------------------------|--|-----|-----|-----|------------------|
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G+; $T_j = 25\text{ }^\circ\text{C}$; Fig. 7 | - | - | 10 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 9 | - | - | 10 | mA |
| V_T | on-state voltage | $I_T = 1\text{ A}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 10 | - | 1.3 | 1.6 | V |
| Dynamic characteristics | | | | | | |
| dV_D/dt | rate of rise of off-state voltage | $V_{DM} = 402\text{ V}$; $T_j = 110\text{ }^\circ\text{C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit; Fig. 12 | 50 | - | - | V/ μs |
| dV_{com}/dt | rate of change of commutating voltage | $V_D = 400\text{ V}$; $T_j = 110\text{ }^\circ\text{C}$; $dI_{com}/dt = 0.44\text{ A/ms}$; $I_T = 1\text{ A}$; gate open circuit | 2 | - | - | V/ μs |

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-----------------|---|--|
| 1 | T2 | main terminal 2 |  <p>TO-92 (SOT54)</p> |  <p>sym051</p> |
| 2 | G | gate | | |
| 3 | T1 | main terminal 1 | | |

6. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|---------|---|---------|
| | Name | Description | Version |
| Z0109MA | TO-92 | plastic single-ended leaded (through hole) package; 3 leads | SOT54 |

7. Limiting values

Table 4. Limiting values

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

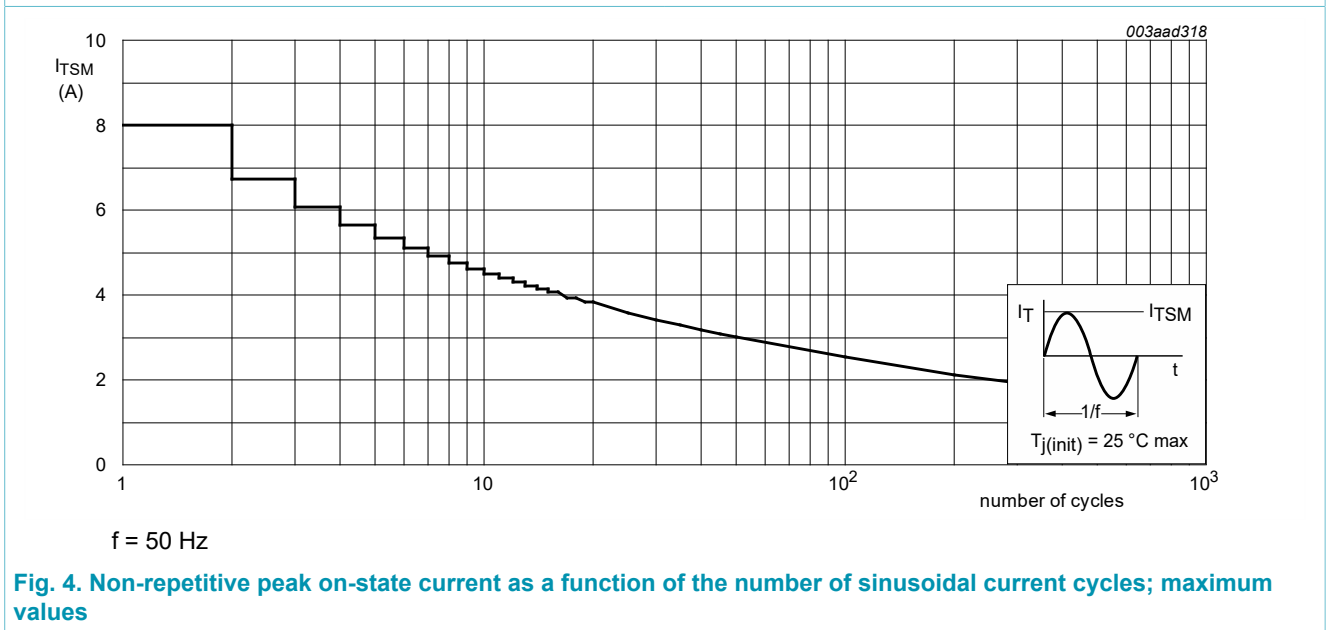
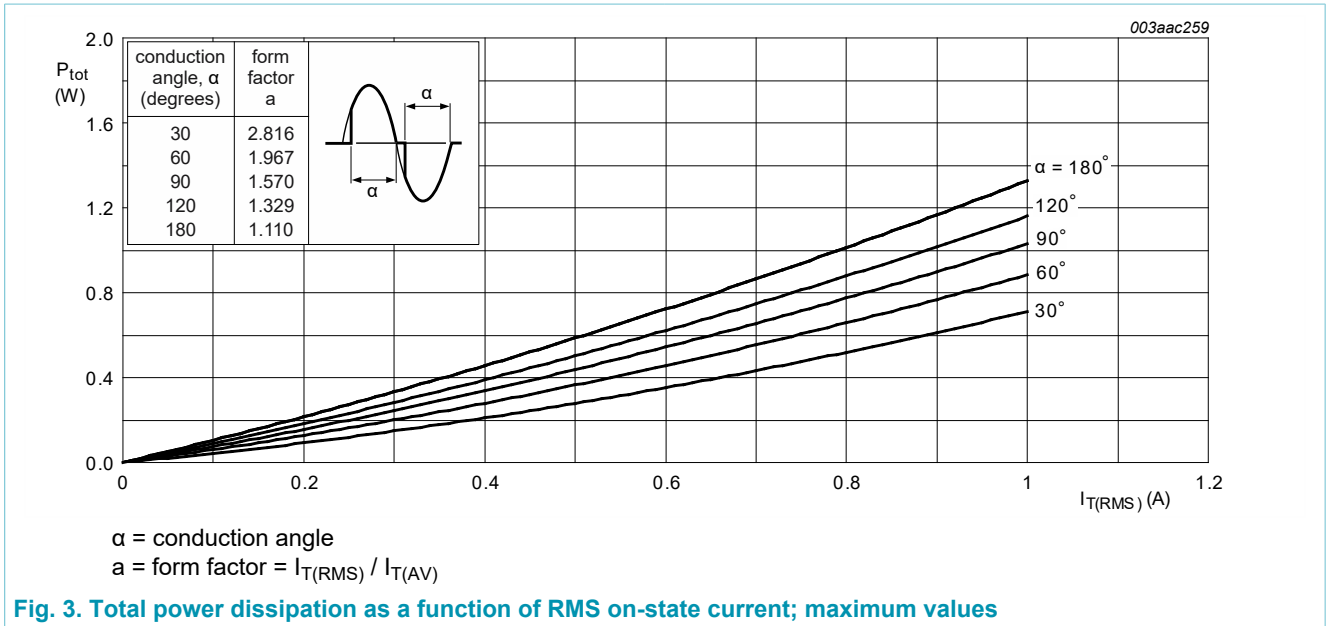
| Symbol | Parameter | Conditions | Min | Max | Unit |
|--------------|--------------------------------------|---|-----|------|------------------|
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| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_{lead} \leq 45\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3 | - | 1 | 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 | - | 8 | A |
| | | full sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$ | - | 8.5 | A |
| I^2t | I^2t for fusing | $t_p = 10\text{ ms}$; SIN | - | 0.32 | A ² s |
| di_T/dt | rate of rise of on-state current | $I_G = 20\text{ mA}$; T2+ G+ | - | 50 | A/ μ s |
| | | $I_G = 20\text{ mA}$; T2+ G- | - | 50 | A/ μ s |
| | | $I_G = 20\text{ mA}$; T2- G- | - | 50 | A/ μ s |
| | | $I_G = 20\text{ mA}$; T2- G+ | - | 20 | A/ μ s |
| I_{GM} | peak gate current | | - | 1 | A |
| P_{GM} | peak gate power | | - | 2 | W |
| $P_{G(AV)}$ | average gate power | over any 20 ms period | - | 0.1 | W |
| T_{stg} | storage temperature | | -40 | 150 | °C |
| T_j | junction temperature | | - | 125 | °C |



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



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





8. Thermal characteristics

Table 5. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|------------------|--|---|-----|-----|-----|------|
| $R_{th(j-lead)}$ | thermal resistance from junction to lead | full cycle; Fig. 6 | - | - | 60 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient free air | full cycle; printed-circuit board mounted; lead length = 4 mm | - | 150 | - | K/W |



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

9. Characteristics

Table 6. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|---------------------------------------|---|-----|-----|-----|------------|
| Static characteristics | | | | | | |
| I_{GT} | gate trigger current | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_2+ G+;$ $T_j = 25\text{ }^\circ\text{C};$ Fig. 7 | - | - | 10 | mA |
| | | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_2+ G-;$ $T_j = 25\text{ }^\circ\text{C};$ Fig. 7 | - | - | 10 | mA |
| | | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_2- G-;$ $T_j = 25\text{ }^\circ\text{C};$ Fig. 7 | - | - | 10 | mA |
| | | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_2- G+;$ $T_j = 25\text{ }^\circ\text{C};$ Fig. 7 | - | - | 10 | mA |
| I_L | latching current | $V_D = 12\text{ V}; I_G = 0.1\text{ A}; T_2+ G+;$ $T_j = 25\text{ }^\circ\text{C};$ Fig. 8 | - | - | 15 | mA |
| | | $V_D = 12\text{ V}; I_G = 0.1\text{ A}; T_2+ G-;$ $T_j = 25\text{ }^\circ\text{C};$ Fig. 8 | - | - | 25 | mA |
| | | $V_D = 12\text{ V}; I_G = 0.1\text{ A}; T_2- G-;$ $T_j = 25\text{ }^\circ\text{C};$ Fig. 8 | - | - | 15 | mA |
| | | $V_D = 12\text{ V}; I_G = 0.1\text{ A}; T_2- G+;$ $T_j = 25\text{ }^\circ\text{C};$ Fig. 8 | - | - | 15 | mA |
| I_H | holding current | $V_D = 12\text{ V}; T_j = 25\text{ }^\circ\text{C};$ Fig. 9 | - | - | 10 | mA |
| V_T | on-state voltage | $I_T = 1\text{ A}; T_j = 25\text{ }^\circ\text{C};$ Fig. 10 | - | 1.3 | 1.6 | V |
| V_{GT} | gate trigger voltage | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_j = 25\text{ }^\circ\text{C}$ | - | - | 1 | V |
| | | $V_D = 600\text{ V}; I_T = 0.1\text{ A}; T_j = 125\text{ }^\circ\text{C};$ Fig. 11 | 0.2 | - | - | V |
| I_D | off-state current | $V_D = 600\text{ V}; T_j = 125\text{ }^\circ\text{C}$ | - | - | 0.5 | mA |
| Dynamic characteristics | | | | | | |
| dV_D/dt | rate of rise of off-state voltage | $V_{DM} = 402\text{ V}; T_j = 110\text{ }^\circ\text{C}; (V_{DM} = 67\%$ of $V_{DRM});$ exponential waveform; gate open circuit; Fig. 12 | 50 | - | - | V/ μ s |
| dV_{com}/dt | rate of change of commutating voltage | $V_D = 400\text{ V}; T_j = 110\text{ }^\circ\text{C}; dI_{com}/$ $dt = 0.44\text{ A/ms}; I_T = 1\text{ A};$ gate open circuit | 2 | - | - | V/ μ 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



$V_o = 1.13 \text{ V}$
 $R_s = 0.31 \Omega$
 (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



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



$$A = \frac{dV_D(T_j \text{ } ^{\circ}\text{C}) / dt}{dV_D(25 \text{ } ^{\circ}\text{C}) / dt}$$

Fig. 12. Normalized critical rate of rise of off-state voltage as a function of junction temperature; typical values

10. Package outline



Fig. 13. Package outline TO-92 (SOT54)

11. Legal information

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|--------------------------------|--------------------|---|
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Тел: +7 (812) 336 43 04 (многоканальный)

Email: org@lifeelectronics.ru