

1. General description

Planar passivated very sensitive gate four quadrant triac in a SOT54 plastic package intended to be interfaced directly to microcontrollers, logic integrated circuits and other low power gate trigger circuits.

2. Features and benefits

- Direct interfacing to logic level ICs
- Direct interfacing to low power gate drivers and microcontrollers
- High blocking voltage capability
- Planar passivated for voltage ruggedness and reliability
- Triggering in all four quadrants
- Very sensitive gate

3. Applications

- General purpose low power phase control
- General purpose low power switching
- Solid-state relay

4. Quick reference data

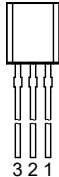
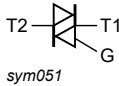
Table 1. Quick reference data

| 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; $T_{lead} \leq 50\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3 | - | - | 0.6 | 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; $T_{j(init)} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$ | - | - | 8.8 | 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 | - | 1 | 5 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 7 | - | 2 | 5 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; Fig. 7 | - | 2 | 5 | 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 | - | 4 | 7 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 9 | - | 1 | 10 | mA |
| V_T | on-state voltage | $I_T = 0.85\text{ A}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 10 | - | 1.4 | 1.9 | 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 | 30 | 45 | - | V/ μs |
| dV_{com}/dt | rate of change of commutating voltage | $V_D = 600\text{ V}$; $T_j = 50\text{ }^\circ\text{C}$; $dI_{com}/dt = 0.3\text{ A/ms}$; $I_T = 0.84\text{ A}$; gate open circuit | - | 5 | - | V/ μs |

5. Pinning information

Table 2. Pinning information

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

6. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|---------|---|---------|
| | Name | Description | Version |
| MAC97A8 | 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 |
|--------------|--------------------------------------|--|-----|------|--------------------|
| V_{DRM} | repetitive peak off-state voltage | | - | 600 | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_{lead} \leq 50\text{ }^{\circ}\text{C}$; Fig. 1; Fig. 2; Fig. 3 | - | 0.6 | A |
| I_{TSM} | non-repetitive peak on-state current | full sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$; $t_p = 20\text{ ms}$; Fig. 4; Fig. 5 | - | 8 | A |
| | | full sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$; $t_p = 16.7\text{ ms}$ | - | 8.8 | A |
| I^2t | I^2t for fusing | $t_p = 10\text{ ms}$; SIN | - | 0.32 | A^2s |
| di_T/dt | rate of rise of on-state current | $I_G = 20\text{ mA}$; T2+ G+ | - | 50 | $A/\mu s$ |
| | | $I_G = 20\text{ mA}$; T2+ G- | - | 50 | $A/\mu s$ |
| | | $I_G = 20\text{ mA}$; T2- G- | - | 50 | $A/\mu s$ |
| | | $I_G = 20\text{ mA}$; T2- G+ | - | 10 | $A/\mu s$ |
| I_{GM} | peak gate current | | - | 1 | A |
| P_{GM} | peak gate power | | - | 5 | W |
| $P_{G(AV)}$ | average gate power | over any 20 ms period | - | 0.1 | W |
| T_{stg} | storage temperature | | -40 | 150 | $^{\circ}\text{C}$ |
| T_j | junction temperature | | - | 125 | $^{\circ}\text{C}$ |

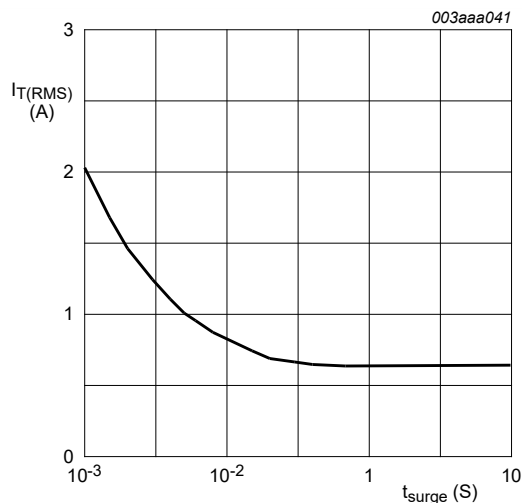


Fig. 1. RMS on-state current as a function of surge duration; maximum values

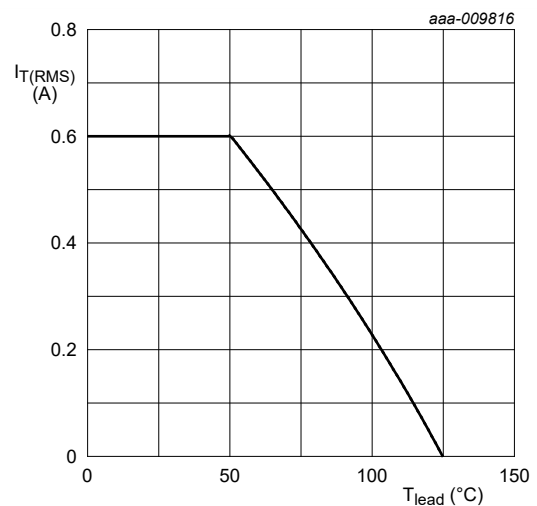


Fig. 2. RMS on-state current as a function of lead temperature; maximum values

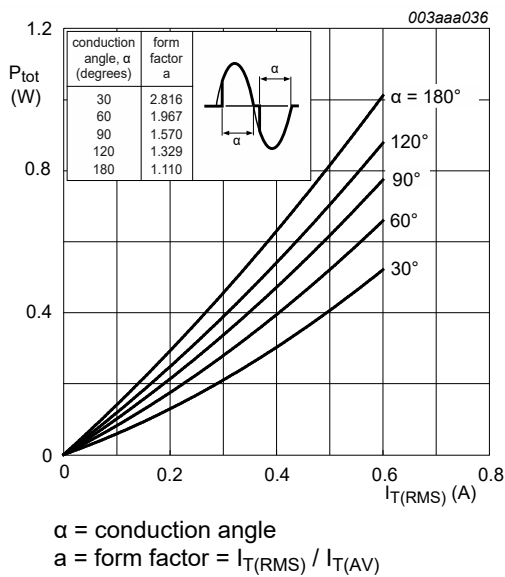


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

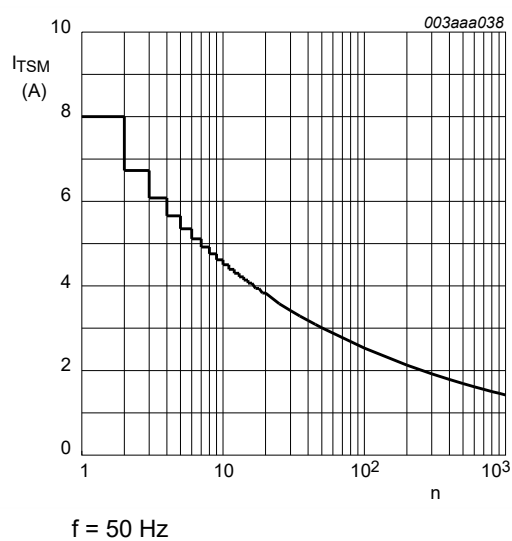
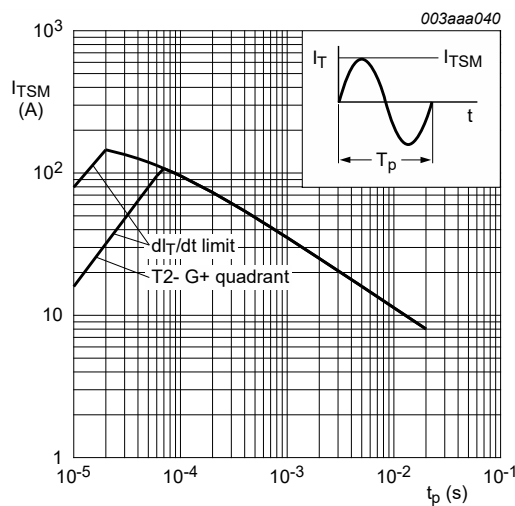


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



$t_p \leq 20 \text{ ms}$

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 |
|------------------|--|---|-----|-----|-----|------|
| $R_{th(j-lead)}$ | thermal resistance from junction to lead | full cycle; Fig. 6 | - | - | 60 | K/W |
| | | half cycle | - | - | 80 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient free air | printed circuit board mounted: lead length = 4 mm | - | 150 | - | K/W |

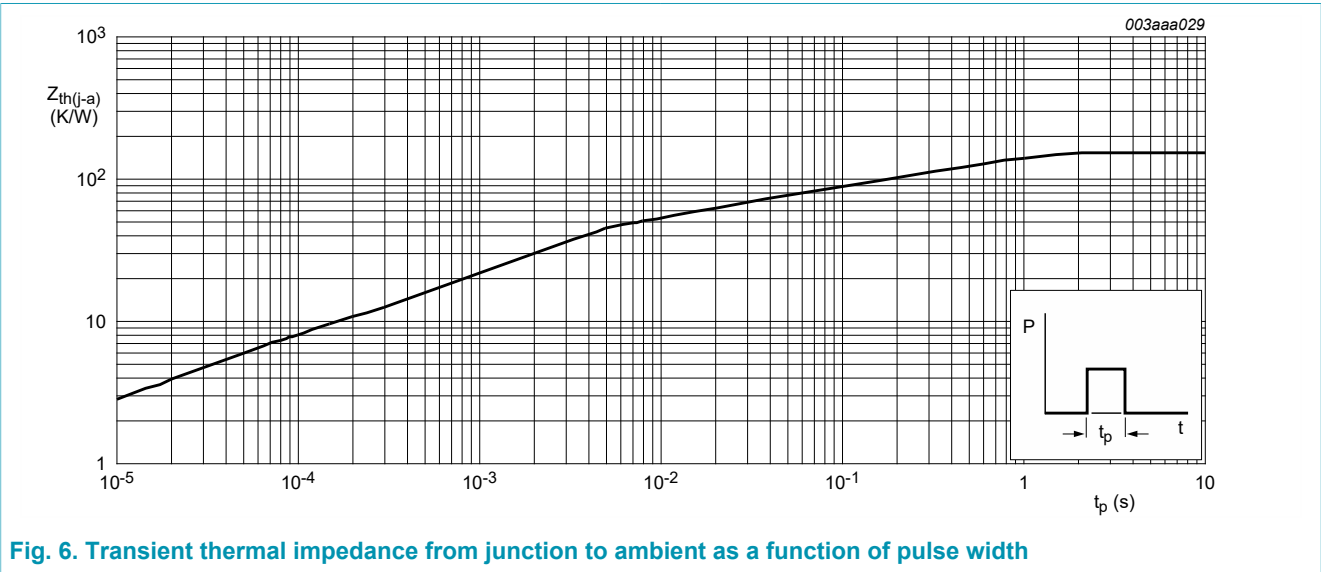
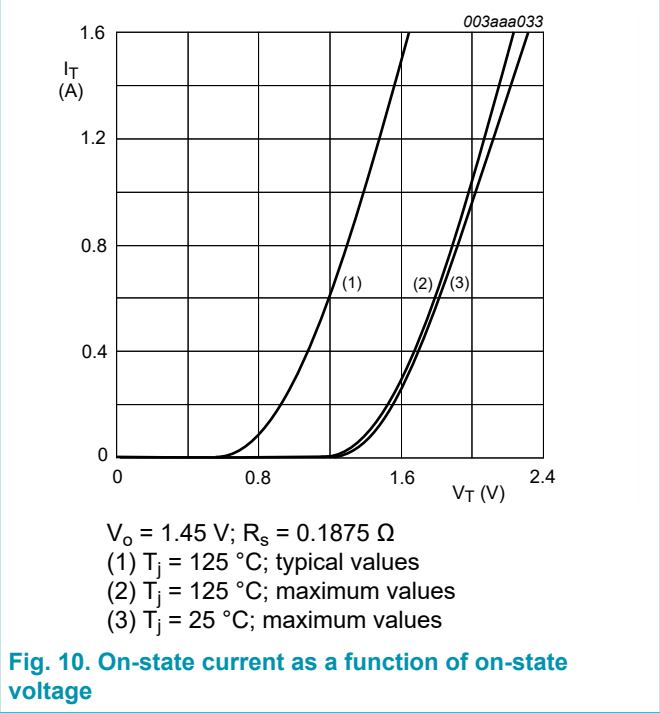
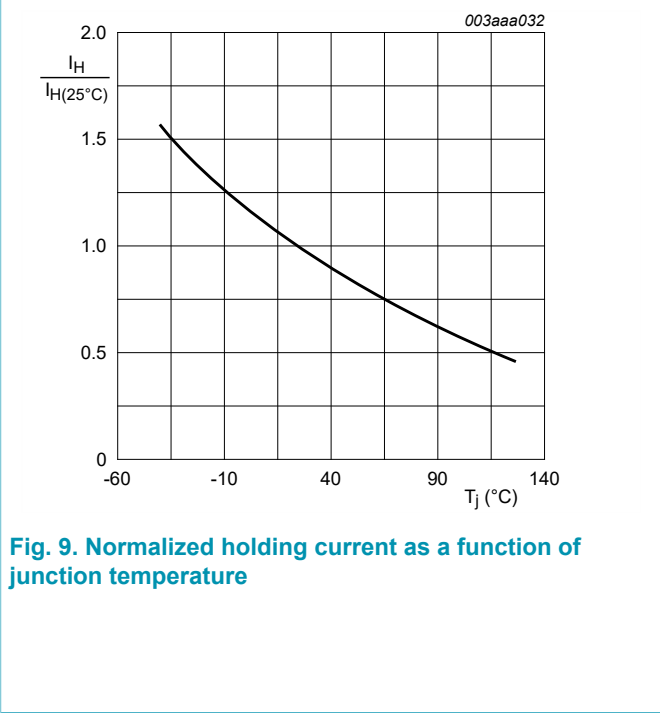
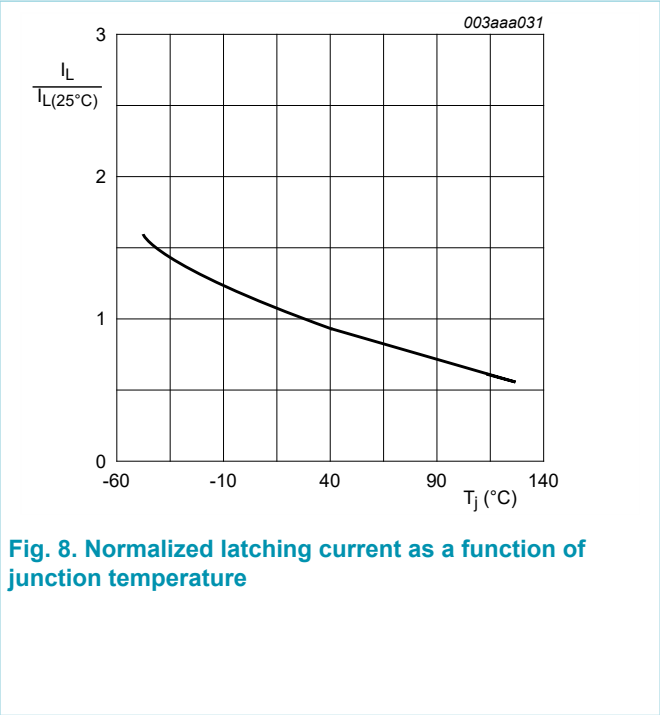
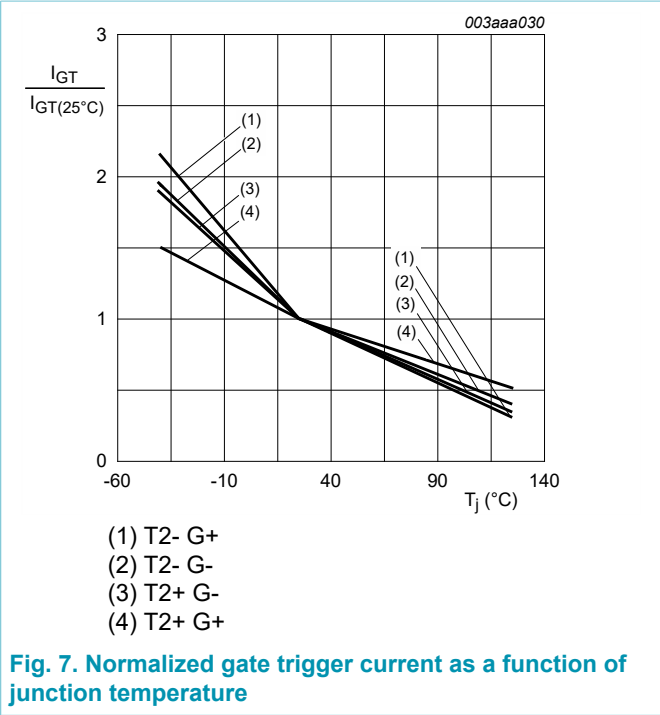


Fig. 6. Transient thermal impedance from junction to ambient as a function of pulse width

9. Characteristics

Table 6. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|---------------------------------------|--|-----|-----|-----|------------------|
| Static characteristics | | | | | | |
| I_{GT} | gate trigger current | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ }^\circ\text{C}$; Fig. 7 | - | 1 | 5 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ }^\circ\text{C}$; Fig. 7 | - | 2 | 5 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ }^\circ\text{C}$; Fig. 7 | - | 2 | 5 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G+; $T_j = 25\text{ }^\circ\text{C}$; Fig. 7 | - | 4 | 7 | 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 | - | 1 | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ }^\circ\text{C}$; Fig. 8 | - | 5 | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ }^\circ\text{C}$; Fig. 8 | - | 1 | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G+; $T_j = 25\text{ }^\circ\text{C}$; Fig. 8 | - | 2 | 10 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 9 | - | 1 | 10 | mA |
| V_T | on-state voltage | $I_T = 0.85\text{ A}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 10 | - | 1.4 | 1.9 | 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 | - | 0.9 | 1.5 | V |
| | | $V_D = 400\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 110\text{ }^\circ\text{C}$; Fig. 11 | 0.1 | 0.7 | - | V |
| I_D | off-state current | $V_D = 600\text{ V}$; $T_j = 110\text{ }^\circ\text{C}$ | - | 3 | 100 | μA |
| 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 | 30 | 45 | - | V/ μs |
| dV_{com}/dt | rate of change of commutating voltage | $V_D = 600\text{ V}$; $T_j = 50\text{ }^\circ\text{C}$; $dI_{com}/dt = 0.3\text{ A/ms}$; $I_T = 0.84\text{ A}$; gate open circuit | - | 5 | - | V/ μs |
| t_{gt} | gate-controlled turn-on time | $I_{TM} = 1\text{ A}$; $V_D = 600\text{ V}$; $I_G = 25\text{ mA}$; $dI_G/dt = 5\text{ A}/\mu\text{s}$ | - | 2 | - | μs |



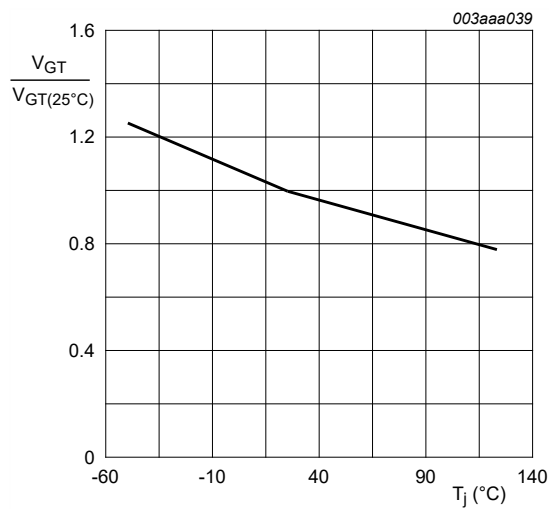


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

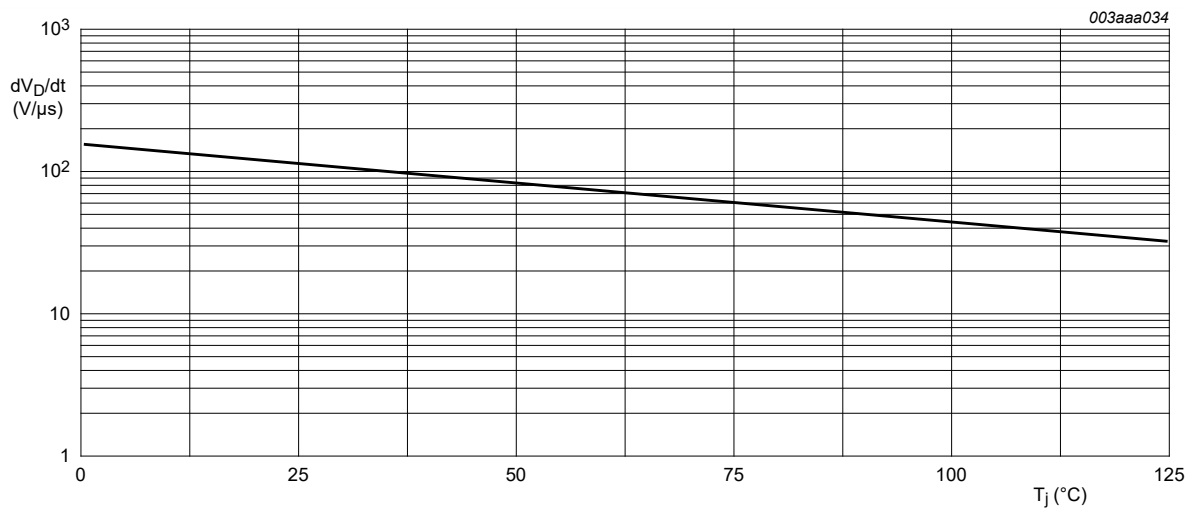


Fig. 12. Critical rate of rise of off-state voltage as a function of junction temperature; typical values

10. Package outline

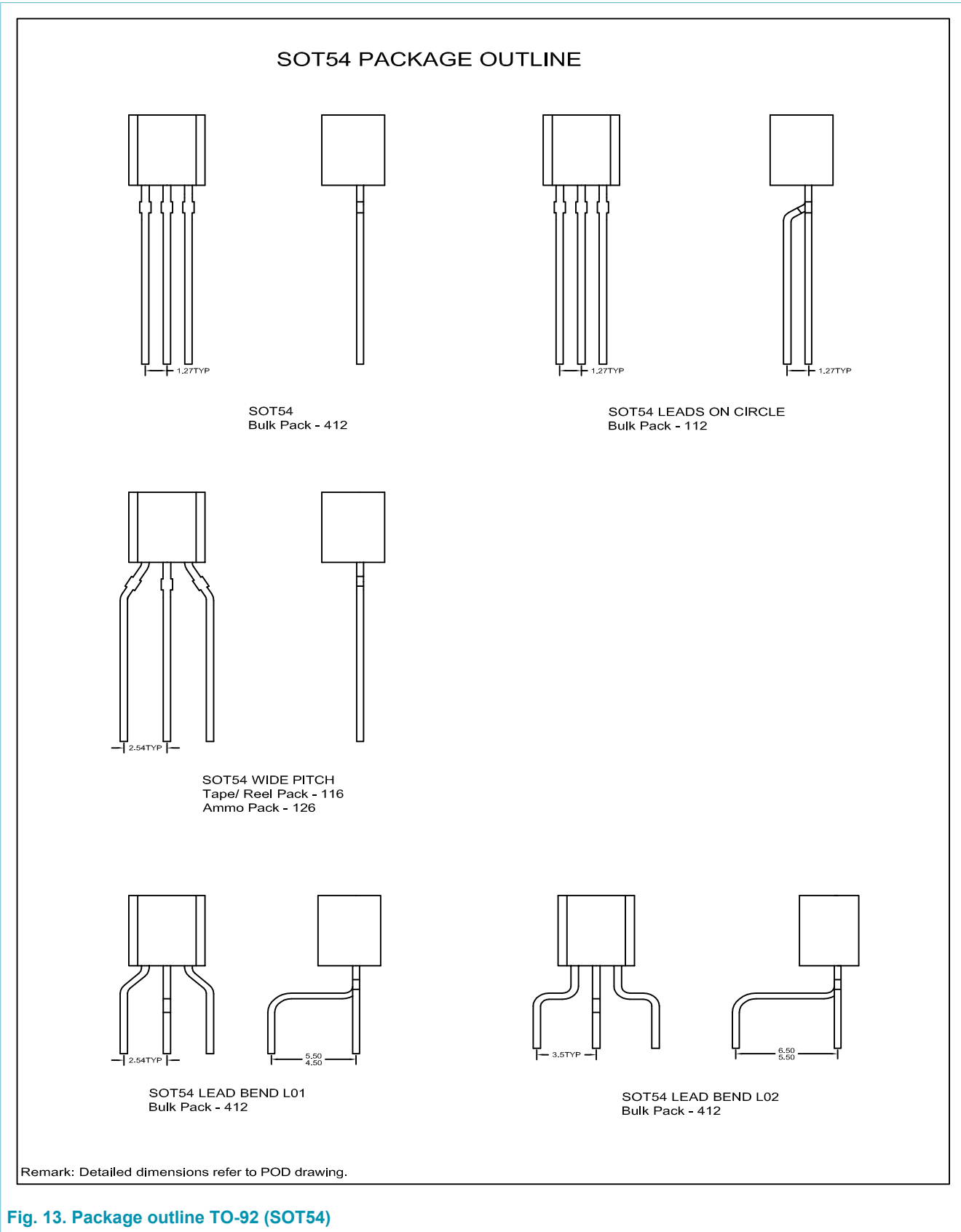


Fig. 13. Package outline TO-92 (SOT54)

11. Legal information

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|--------------------------------|--------------------|---|
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12. Contents

| | |
|---------------------------------|----|
| 1. General description..... | 1 |
| 2. Features and benefits..... | 1 |
| 3. Applications..... | 1 |
| 4. Quick reference data..... | 1 |
| 5. Pinning information..... | 2 |
| 6. Ordering information..... | 2 |
| 7. Limiting values..... | 3 |
| 8. Thermal characteristics..... | 5 |
| 9. Characteristics..... | 6 |
| 10. Package outline..... | 9 |
| 11. Legal information..... | 10 |

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Date of release: 15 September 2018

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