

1. General description

Planar passivated very sensitive gate four quadrant triac in a TO92 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

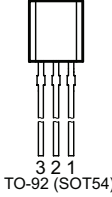
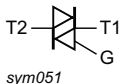
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|--------------------------------------|---|-----|-----|-----|------|
| Absolute maximum rating | | | | | | |
| 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 |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G+; $T_j = 25\text{ °C}$; Fig. 7 | - | 4 | 7 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_j = 25\text{ °C}$; Fig. 9 | - | 1 | 10 | mA |
| V_T | on-state voltage | $I_T = 0.85\text{ A}$; $T_j = 25\text{ °C}$; Fig. 10 | - | 1.4 | 1.9 | V |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|---------------------------------------|--|-----|-----|-----|------------|
| Dynamic characteristics | | | | | | |
| dV_D/dt | rate of rise of off-state voltage | $V_{DM} = 402\text{ V}$; $T_j = 110\text{ °C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit; Fig. 12 | 30 | 45 | - | V/ μ s |
| dV_{com}/dt | rate of change of commutating voltage | $V_D = 600\text{ V}$; $T_j = 50\text{ °C}$; $di_{com}/dt = 0.3\text{ A/ms}$; $I_T = 0.84\text{ A}$; gate open circuit | - | 5 | - | V/ μ s |

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 | Orderable part number | Packing method | Small packing quantity | Package version | Package issue date |
|-------------|--------------|-----------------------|----------------|------------------------|------------------|--------------------|
| MAC97A8 | TO92 | MAC97A8,412 | Bulk | 1000 | SOT54 | 14-Nov-2013 |
| MAC97A8 | TO92 | MAC97A8,116 | Reel | 2000 | SOT54 wide pitch | 14-Nov-2013 |
| MAC97A8/DG | TO92 | MAC97A8/DG,412 | Bulk | 1000 | SOT54 | 14-Nov-2013 |
| MAC97A8/DG | TO92 | MAC97A8/DG,116 | Reel | 2000 | SOT54 wide pitch | 14-Nov-2013 |

7. Marking

Table 4. Marking codes

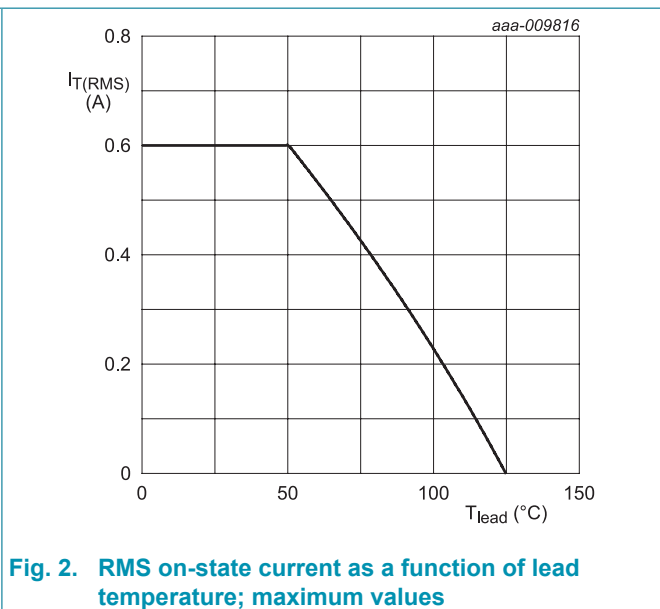
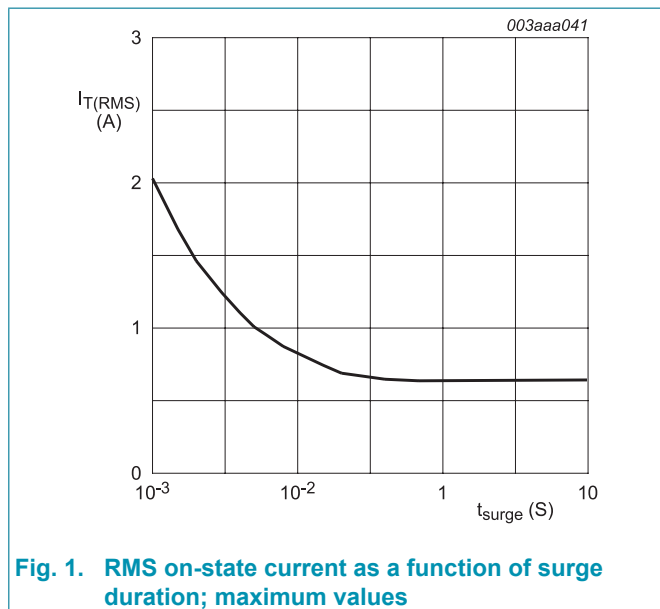
| Type number | Marking codes |
|-------------|---------------|
| MAC97A8 | MAC97A8 |

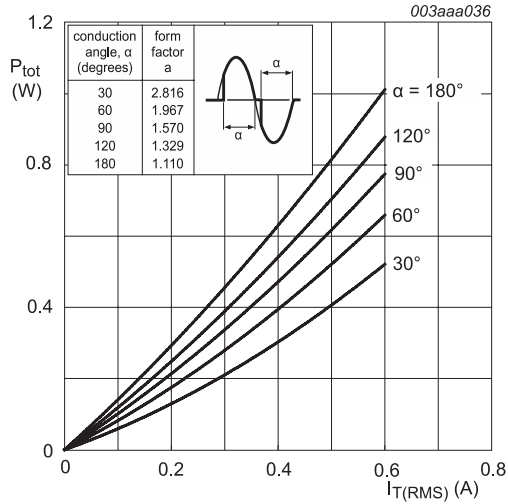
8. Limiting values

Table 5. Limiting values

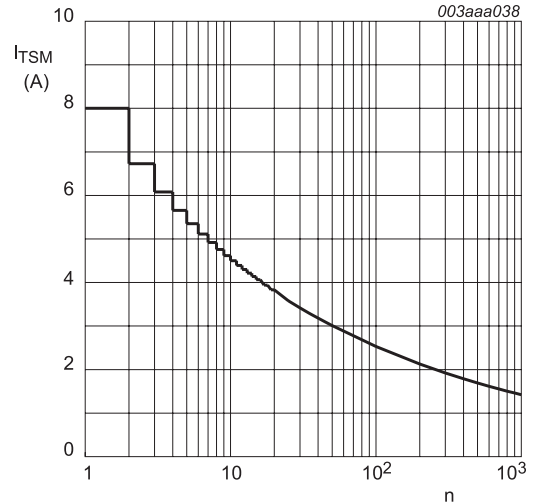
In accordance with the Absolute Maximum Rating System (IEC 60134).

| 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; $T_{lead} \leq 50\text{ °C}$; 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 |
| I^2t | I^2t for fusing | $t_p = 10\text{ ms}$; sine-wave pulse | - | 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 | $^{\circ}C$ |
| T_j | junction temperature | | - | 125 | $^{\circ}C$ |

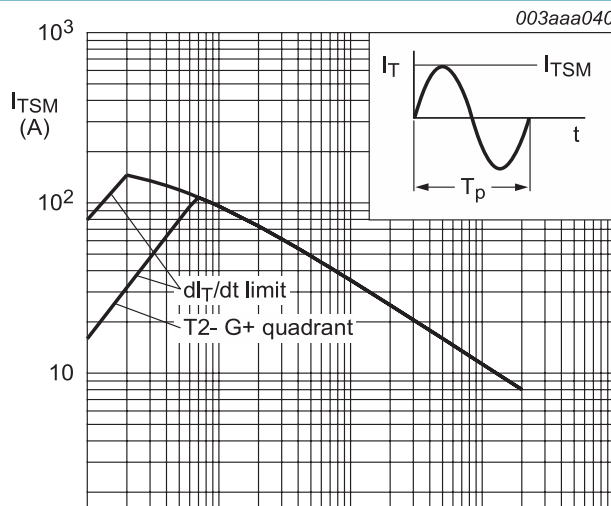




α = conduction angle
 a = form factor = $I_{T(RMS)} / I_{T(AV)}$
Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values



$f = 50$ Hz
Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

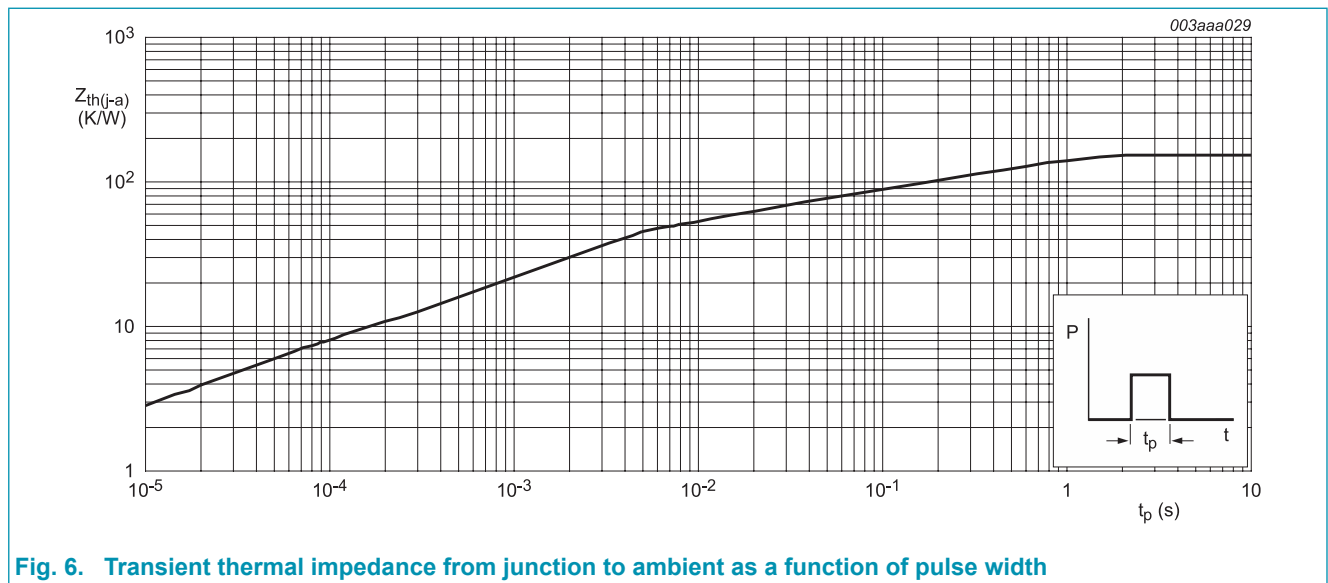


$t_p \leq 20$ ms
Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values

9. Thermal characteristics

Table 6. 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 |



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 | - | 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 |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G+; $T_j = 25\text{ °C}$; Fig. 7 | - | 4 | 7 | mA |
| I_L | latching current | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ °C}$; Fig. 8 | - | 1 | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 8 | - | 5 | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; Fig. 8 | - | 1 | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G+; $T_j = 25\text{ °C}$; Fig. 8 | - | 2 | 10 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_j = 25\text{ °C}$; Fig. 9 | - | 1 | 10 | mA |
| V_T | on-state voltage | $I_T = 0.85\text{ A}$; $T_j = 25\text{ °C}$; Fig. 10 | - | 1.4 | 1.9 | V |
| V_{GT} | gate trigger voltage | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 25\text{ °C}$; Fig. 11 | - | 0.9 | 1.5 | V |
| | | $V_D = 400\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 110\text{ °C}$ | 0.1 | 0.7 | - | V |
| I_D | off-state current | $V_D = 600\text{ V}$; $T_j = 110\text{ °C}$ | - | 3 | 100 | μA |
| Dynamic characteristics | | | | | | |
| dV_D/dt | rate of rise of off-state voltage | $V_{DM} = 402\text{ V}$; $T_j = 110\text{ °C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit; Fig. 12 | 30 | 45 | - | $\text{V}/\mu\text{s}$ |
| dV_{com}/dt | rate of change of commutating voltage | $V_D = 600\text{ V}$; $T_j = 50\text{ °C}$; $dI_{com}/dt = 0.3\text{ A/ms}$; $I_T = 0.84\text{ A}$; gate open circuit | - | 5 | - | $\text{V}/\mu\text{s}$ |
| 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 |

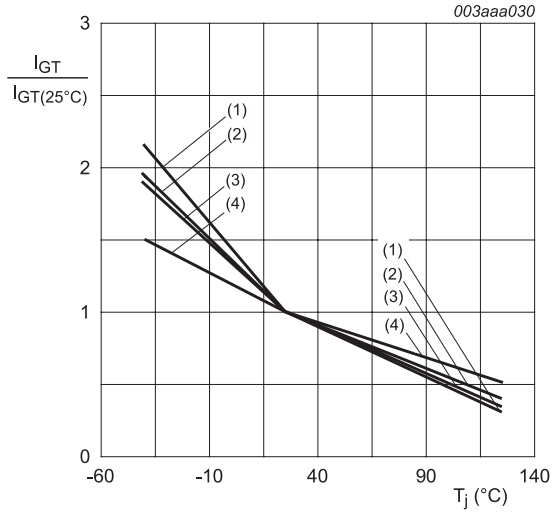


Fig. 7. Normalized gate trigger current as a function of junction temperature

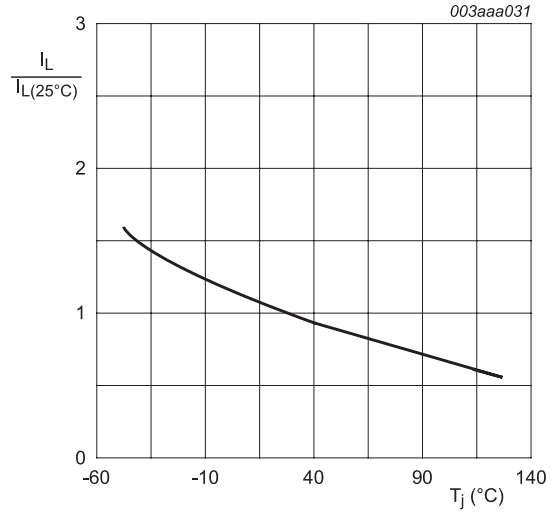


Fig. 8. Normalized latching current as a function of junction temperature

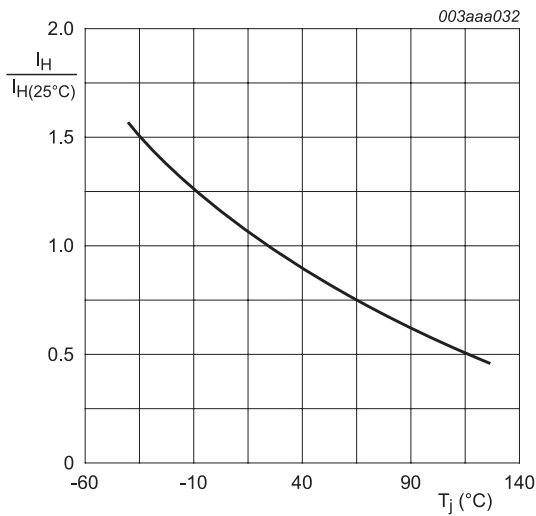


Fig. 9. Normalized holding current as a function of junction temperature

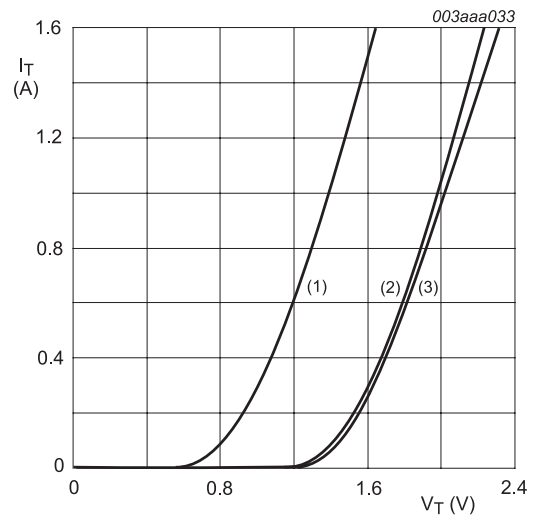


Fig. 10. On-state current as a function of on-state voltage

$V_o = 1.45\text{ V}; R_s = 0.1875\ \Omega$

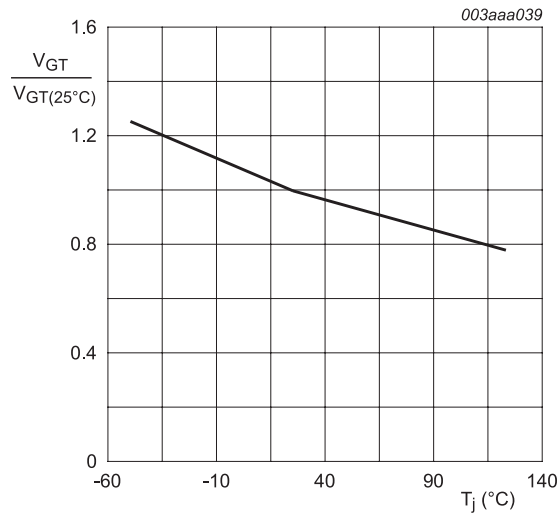


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

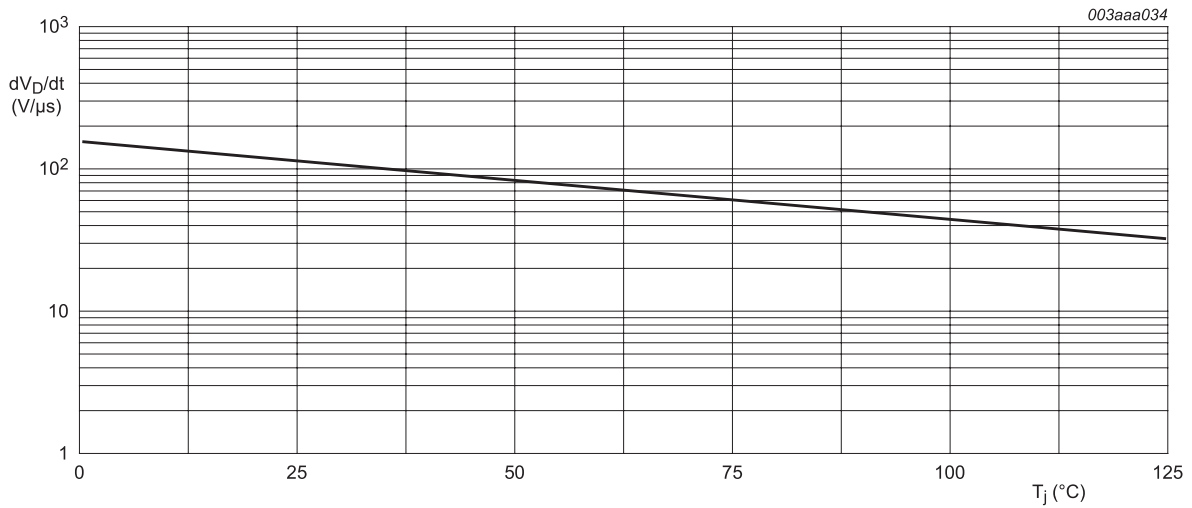
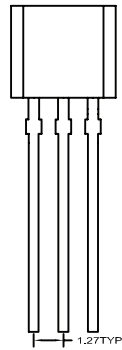


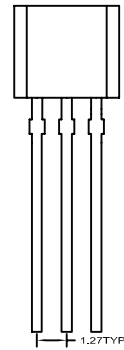
Fig. 12. Critical rate of rise of off-state voltage as a function of junction temperature; typical values

11. Package outline

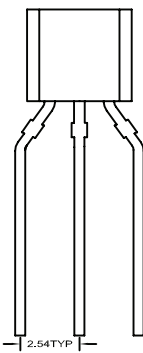
SOT54 PACKAGE OUTLINE



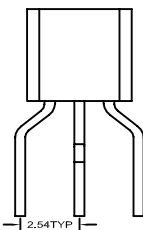
SOT54
Bulk Pack - 412



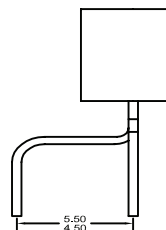
SOT54 LEADS ON CIRCLE
Bulk Pack - 112



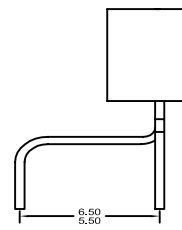
SOT54 WIDE PITCH
Tape/ Reel Pack - 116
Ammo Pack - 126



SOT54 LEAD BEND L01
Bulk Pack - 412



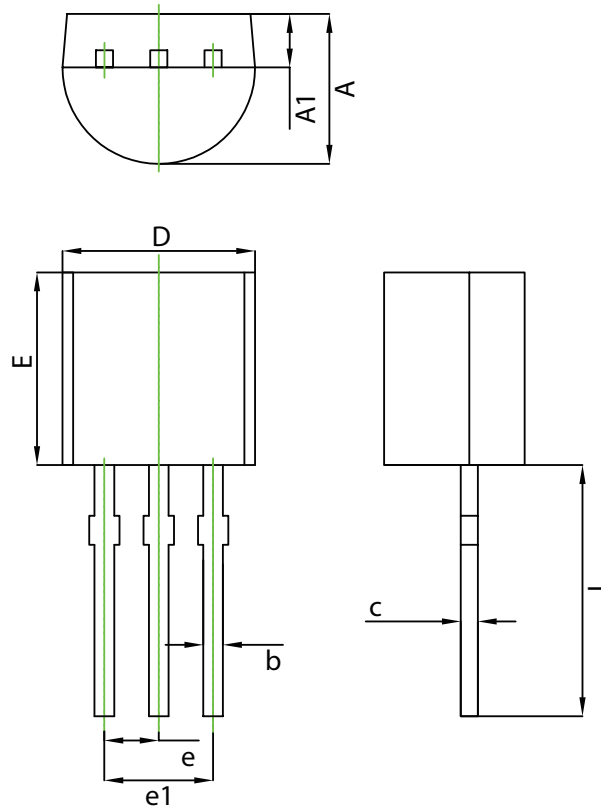
SOT54 LEAD BEND L02
Bulk Pack - 412



Remark: Detailed dimensions refer to POD drawing.

Plastic single-ended leaded(through hole) package; 3 leads

TO92



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|--------|----------------------|-------|
| | Min | Max | Min | Max |
| A | 3.300 | 3.700 | 0.130 | 0.146 |
| A1 | 1.100 | 1.400 | 0.043 | 0.055 |
| b | 0.380 | 0.550 | 0.015 | 0.022 |
| c | 0.360 | 0.510 | 0.014 | 0.020 |
| D | 4.300 | 4.700 | 0.169 | 0.185 |
| E | 4.300 | 4.700 | 0.169 | 0.185 |
| e | 1.270 TYP. | | 0.050 TYP. | |
| e1 | 2.440 | 2.640 | 0.096 | 0.104 |
| L | 14.100 | 14.500 | 0.555 | 0.571 |

12. Legal information

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

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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For more information, please visit: <http://www.ween-semi.com>

For sales office addresses, please send an email to: salesaddresses@ween-semi.com

Date of release: 19 October 2021
