

1. General description

Planar passivated high commutation three quadrant triac in a TO92 plastic package. This triac is intended for use in motor control circuits where very high blocking voltage can occur. It is used in applications where "high junction operating temperature capability ($T_{j(max)} = 150\text{ °C}$)" is required.

2. Features and benefits

- 3Q technology for improved noise immunity
- High junction operating temperature capability ($T_{j(max)} = 150\text{ °C}$)
- Over-voltage withstand capability to IEC 61000-4-5
- Planar passivated for voltage ruggedness and reliability
- High voltage capability
- High immunity to false turn on by dV/dt
- Triggering in three quadrants only

3. Applications

- AC fan, pump and compressor controls
- Highly inductive, resistive and safety loads
- Large and small appliances (White Goods)
- Reversing induction motor controls e.g. vertical axis washing machines

4. Quick reference data

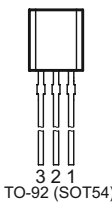
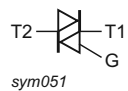
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------|--------------------------------------|---|-----|-----|------|------|
| V_{DRM} | repetitive peak off-state voltage | | - | - | 1000 | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_{lead} \leq 57\text{ °C}$; Fig.1 ; Fig. 2 ; Fig. 3 | - | - | 2 | 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; $T_{j(init)} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$ | - | - | 27.5 | A |
| T_j | junction temperature | | - | - | 150 | °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 |
|--------------------------------|-----------------------------------|---|-----|-----|-----|------------|
| I_H | holding current | $V_D = 12\text{ V}$; $T_J = 25\text{ °C}$; Fig. 9 | - | - | 25 | mA |
| V_T | on-state voltage | $I_T = 3\text{ A}$; $T_J = 25\text{ °C}$; Fig. 10 | - | - | 1.5 | V |
| Dynamic characteristics | | | | | | |
| dV_D/dt | rate of rise of off-state voltage | $V_{DM} = 670\text{ V}$; $T_J = 150\text{ °C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit | 600 | - | - | 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 |
|---------------|--------------|-----------------------|----------------|------------------------|------------------|--------------------|
| BTA202-1000ET | TO92 | BTA202-1000ETEP | Bulk | 1000 | SOT54 | 14-Nov-2013 |
| BTA202-1000ET | TO92 | BTA202-1000ETQP | Tape & Reel | 2000 | SOT54 wide pitch | 14-Nov-2013 |

7. Marking

Table 4. Marking codes

| Type number | Marking codes |
|---------------|---------------|
| BTA202-1000ET | 2-10ET |

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 | | - | 1000 | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_{lead} \leq 57\text{ °C}$; Fig.1 ; Fig. 2 ; Fig. 3 | - | 2 | 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; $T_{j(init)} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$ | - | 27.5 | A |
| I^2t | I^2t for fusing | $t_p = 10\text{ ms}$; sine wave pulse | - | 3.125 | A^2s |
| di_T/dt | rate of rise of on-state current | $I_G = 20\text{ mA}$ | - | 100 | $A/\mu s$ |
| 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 | $^{\circ}C$ |
| T_j | junction temperature | | - | 150 | $^{\circ}C$ |

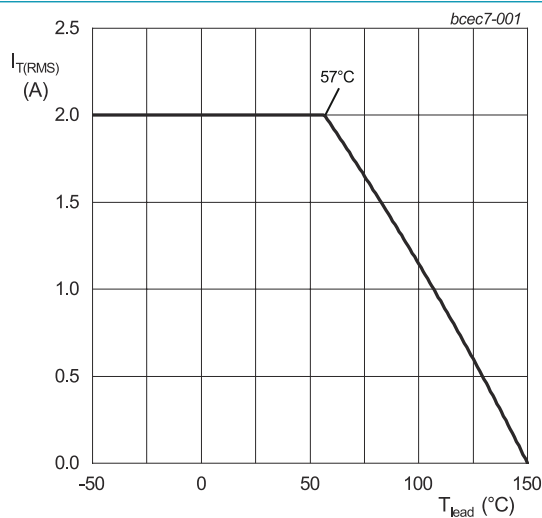
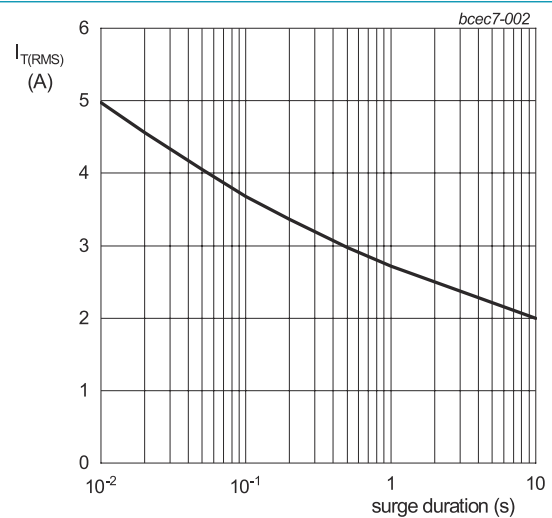
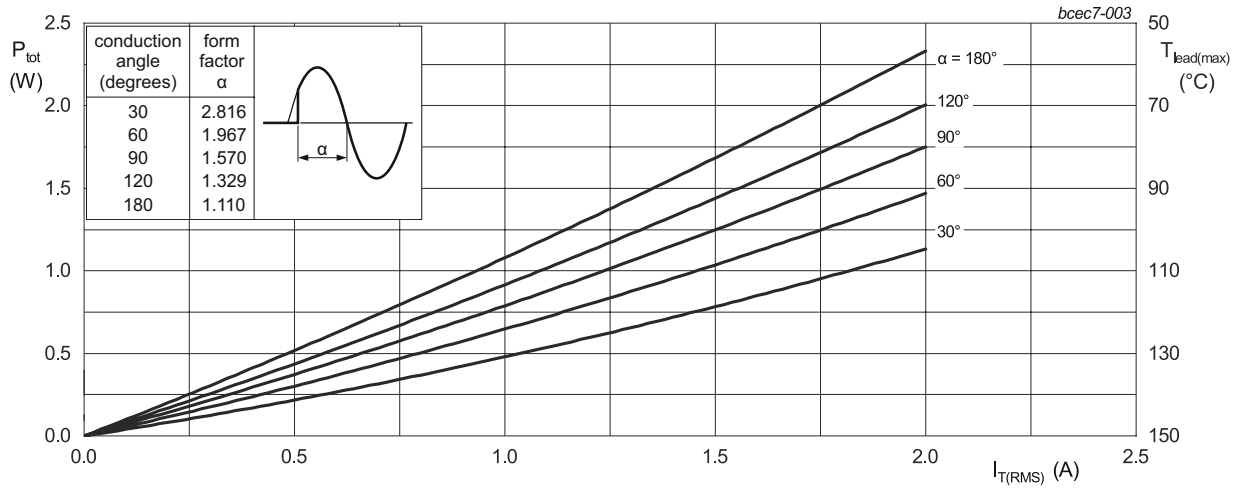


Fig. 1. RMS on-state current as a function of heatsink temperature; maximum values

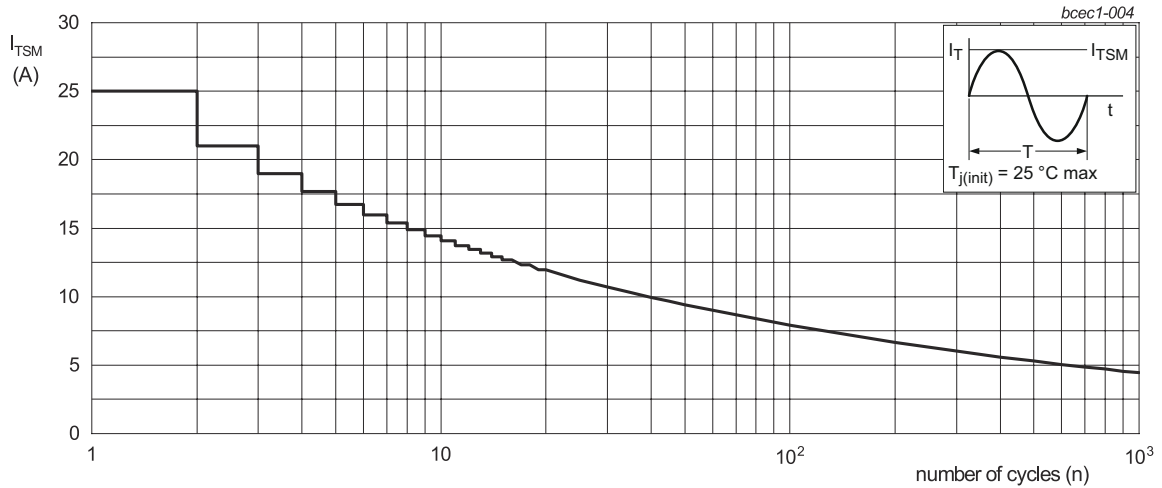


$f = 50\text{ Hz}$; $T_{lead} = 57\text{ °C}$
Fig. 2. RMS on-state current as a function of surge duration; maximum values



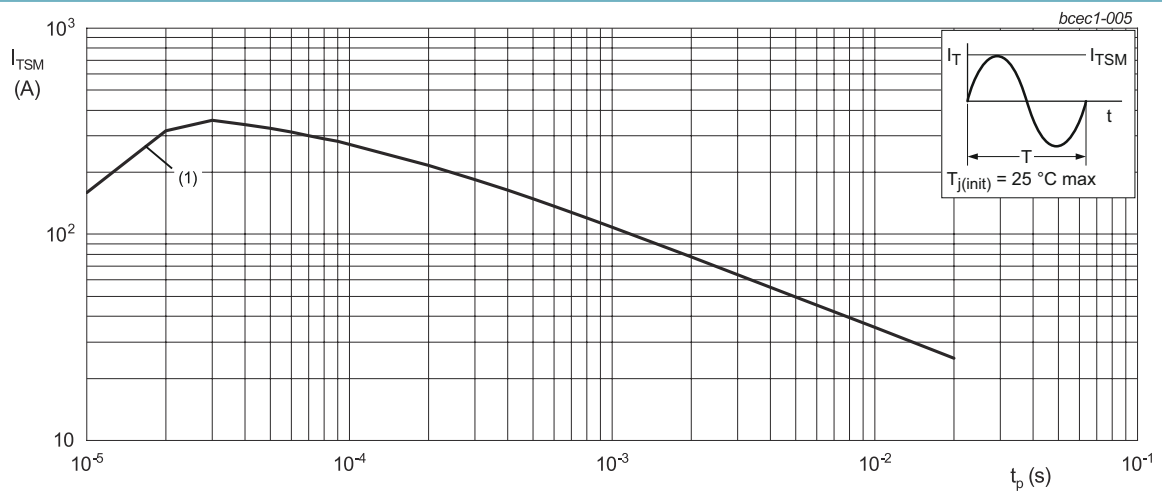
$a = \text{form factor} = I_{T(RMS)} / I_{T(AV)}$
 $\alpha = \text{conduction angle}$

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



$f = 50 \text{ Hz}$

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



$t_p \leq 20 \text{ ms}$
 (1) di_T/dt limit

Fig. 5. Non-repetitive peak on-state current as a function of pulse duration; 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 | Fig. 6 | - | - | 40 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | - | 150 | - | K/W |

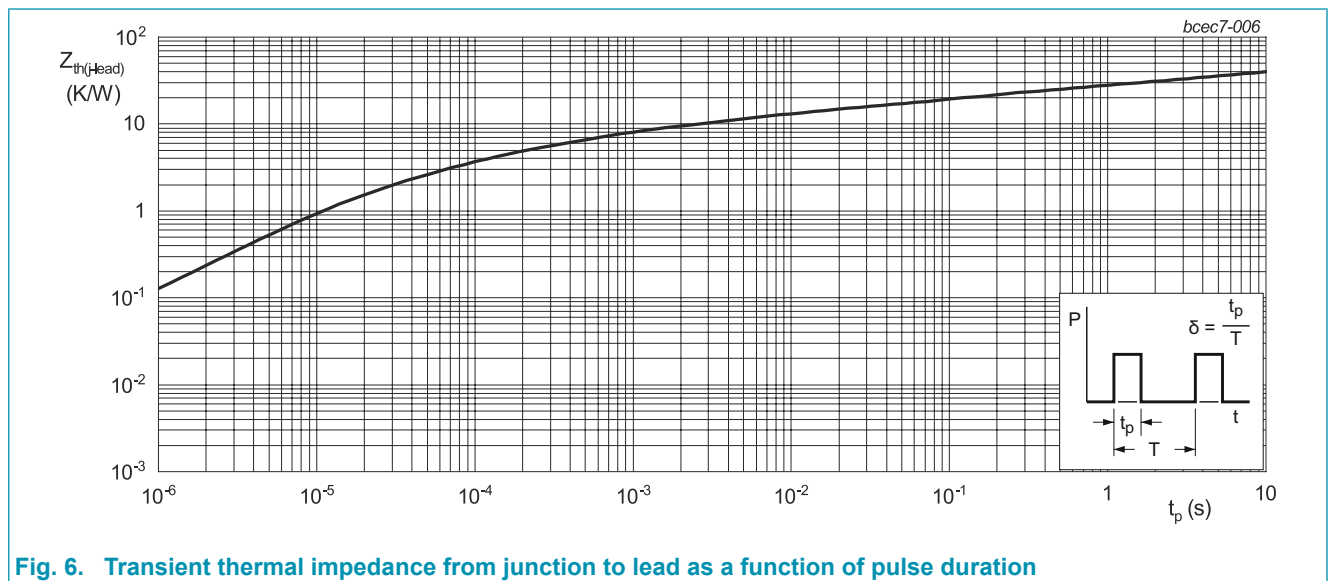
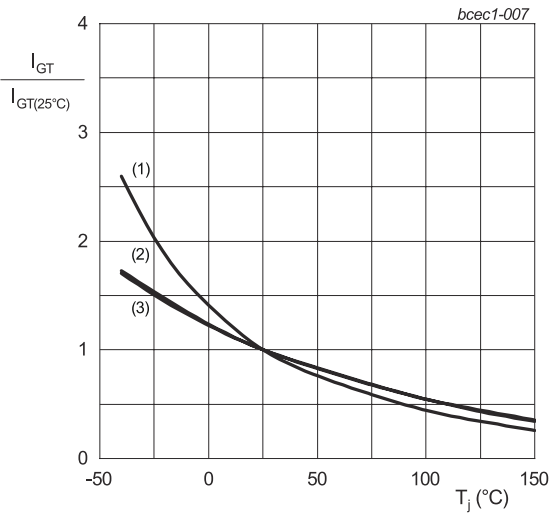


Fig. 6. Transient thermal impedance from junction to lead as a function of pulse duration

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 | - | - | 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 |
| I_L | latching current | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G+; $T_J = 25\text{ °C}$; Fig. 8 | - | - | 40 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G-; $T_J = 25\text{ °C}$; Fig. 8 | - | - | 50 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G-; $T_J = 25\text{ °C}$; Fig. 8 | - | - | 40 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_J = 25\text{ °C}$; Fig. 9 | - | - | 25 | mA |
| V_T | on-state voltage | $I_T = 3\text{ A}$; $T_J = 25\text{ °C}$; Fig. 10 | - | - | 1.5 | V |
| V_{GT} | gate trigger voltage | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; $T_J = 25\text{ °C}$ Fig. 11 | - | 0.8 | 1 | V |
| | | $V_D = 400\text{ V}$; $I_T = 0.1\text{ A}$; $T_J = 150\text{ °C}$ | 0.2 | 0.45 | - | V |
| I_D | off-state current | $V_D = 1000\text{ V}$; $T_J = 25\text{ °C}$ | - | - | 10 | μA |
| | | $V_D = 1000\text{ V}$; $T_J = 150\text{ °C}$ | - | - | 1 | mA |
| I_R | reverse current | $V_R = 1000\text{ V}$; $T_J = 25\text{ °C}$ | - | - | 10 | μA |
| | | $V_R = 1000\text{ V}$; $T_J = 150\text{ °C}$ | - | - | 1 | mA |
| Dynamic characteristics | | | | | | |
| dV_D/dt | rate of rise of off-state voltage | $V_{DM} = 670\text{ V}$; $T_J = 150\text{ °C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit | 600 | - | - | V/ μs |
| dI_{com}/dt | rate of change of commutating current | $V_D = 400\text{ V}$; $T_J = 150\text{ °C}$; $I_{T(RMS)} = 2\text{ A}$; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$; gate open circuit; snubberless condition | 2 | - | - | A/ms |
| | | $V_D = 400\text{ V}$; $T_J = 150\text{ °C}$; $I_{T(RMS)} = 2\text{ A}$; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$; gate open circuit | 3 | - | - | A/ms |
| | | $V_D = 400\text{ V}$; $T_J = 150\text{ °C}$; $I_{T(RMS)} = 2\text{ A}$; $dV_{com}/dt = 1\text{ V}/\mu\text{s}$; gate open circuit | 4 | - | - | A/ms |



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

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

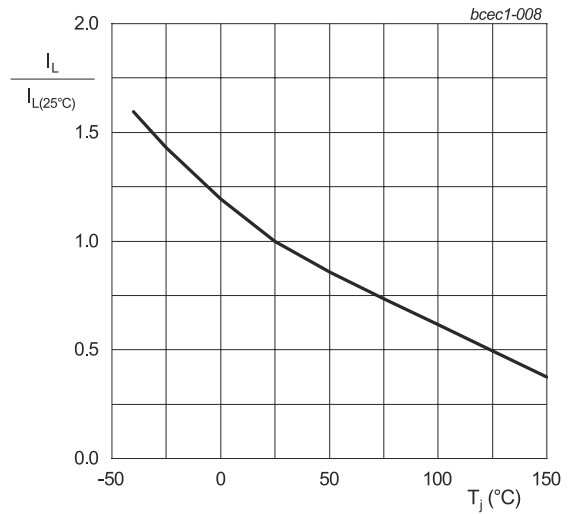


Fig. 8. Normalized latching current as a function of junction temperature

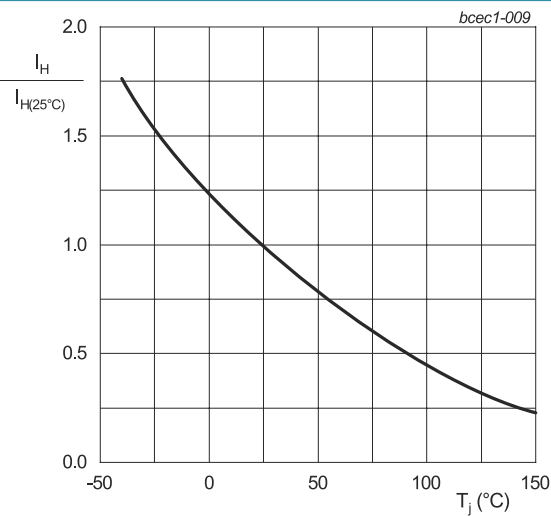
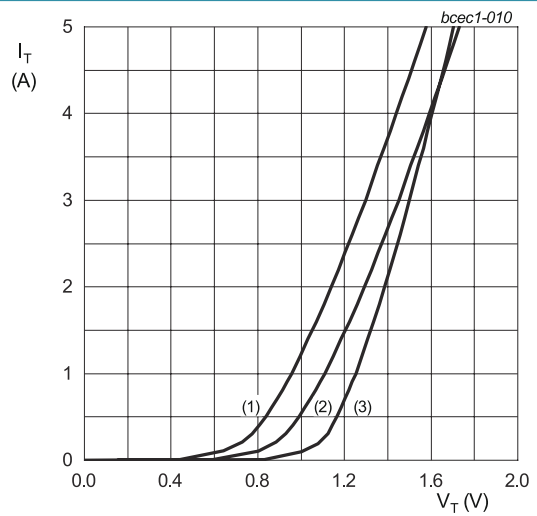


Fig. 9. Normalized holding current as a function of junction temperature



- $V_o = 1.101\text{ V}; R_s = 0.0875\ \Omega$
 (1) $T_j = 150^\circ\text{C}$; typical values
 (2) $T_j = 150^\circ\text{C}$; maximum values
 (3) $T_j = 25^\circ\text{C}$; maximum values

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

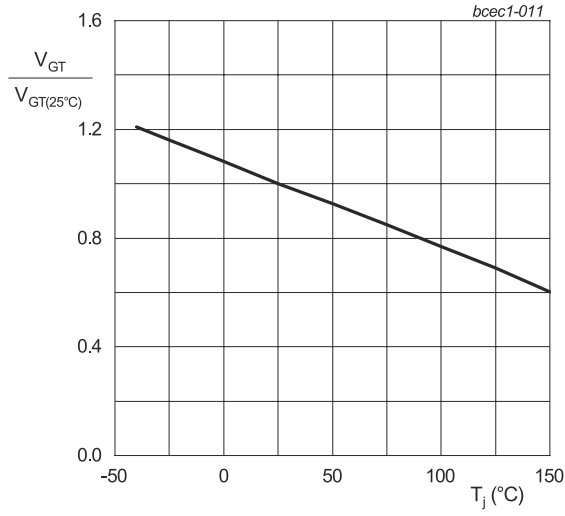
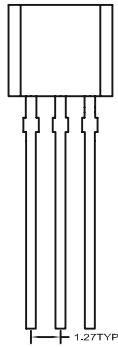


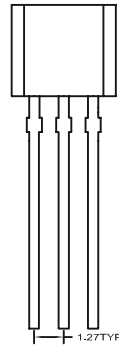
Fig. 11. Normalized gate trigger voltage as a function of junction temperature

11. Package outline

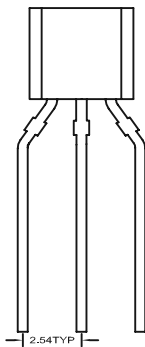
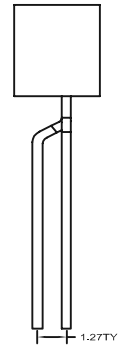
SOT54 PACKAGE OUTLINE



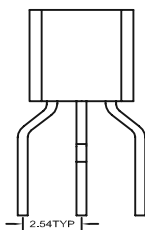
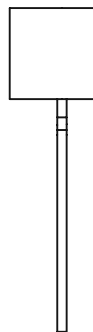
SOT54
Bulk Pack - 412



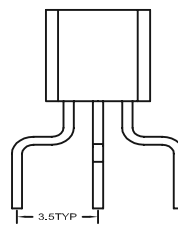
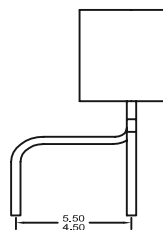
SOT54 LEADS ON CIRCLE
Bulk Pack - 112



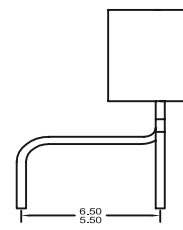
SOT54 WIDE PITCH
Tape/ Reel Pack - 116
Ammo Pack - 126



SOT54 LEAD BEND L01
Bulk Pack - 412



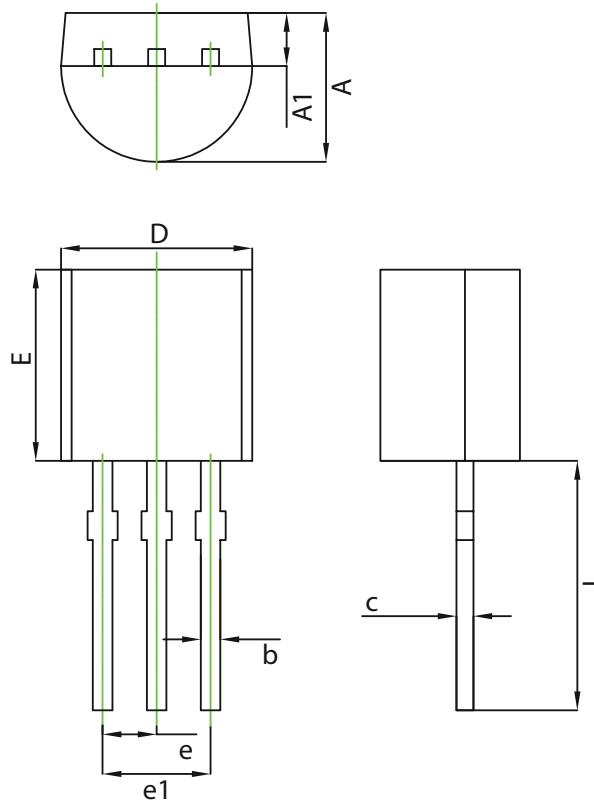
SOT54 LEAD BEND L02
Bulk Pack - 412



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

Data sheet status

| Document status [1][2] | Product status [3] | Definition |
|--------------------------------|--------------------|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| 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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