# ACT108-600E

## AC Thyristor power switch

22 September 2016 **Product data sheet**

## 1. General description

AC Thyristor power switch in a SOT54 plastic package with self-protective capabilities against low and high energy transients

## 2. Features and benefits

- Exclusive negative gate triggering
- Full cycle AC conduction
- Remote gate separates the gate driver from the effects of the load current
- Very high noise immunity
- Safe clamping of low energy over-voltage transients
- Self-protective turn-on during high energy voltage transients

## 3. Applications

- Fan motor circuits
- Pump motor circuits
- Lower-power highly inductive, resistive and safety loads

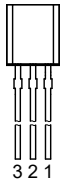
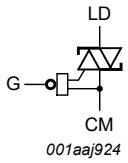
## 4. Quick reference data

**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; $T_{lead} \leq 71$ °C; Fig. 1 | | - | - | 0.8 | A |
| **Static characteristics** | | | | | | | |
| $I_{GT}$ | gate trigger current | $V_D$ = 12 V; $I_T$ = 100 mA; LD+ G-; $T_j$ = 25 °C; Fig. 6 | | 1 | - | 10 | mA |
| | | $V_D$ = 12 V; $I_T$ = 100 mA; LD- G-; $T_j$ = 25 °C; Fig. 6 | | 1 | - | 10 | mA |

## 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | CM | common |   TO-92 (SOT54) |   |
| 2 | G | gate | | |
| 3 | LD | load | | |

## 6. Ordering information

**Table 3. Ordering information**

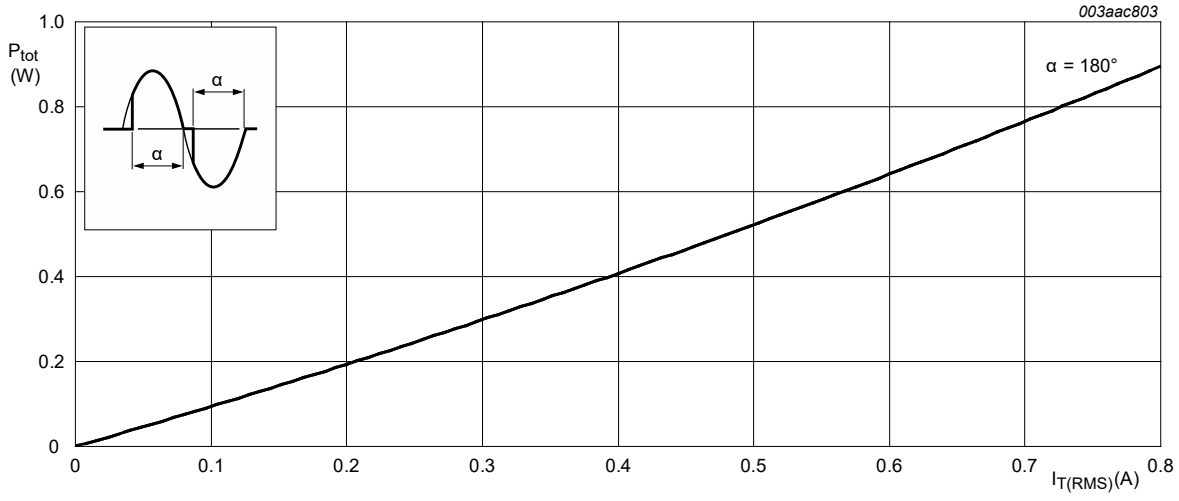
| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| ACT108-600E | TO-92 | plastic single-ended leaded (through hole) package; 3 leads | SOT54 |

# 7. Limiting values

**Table 4. Limiting values**

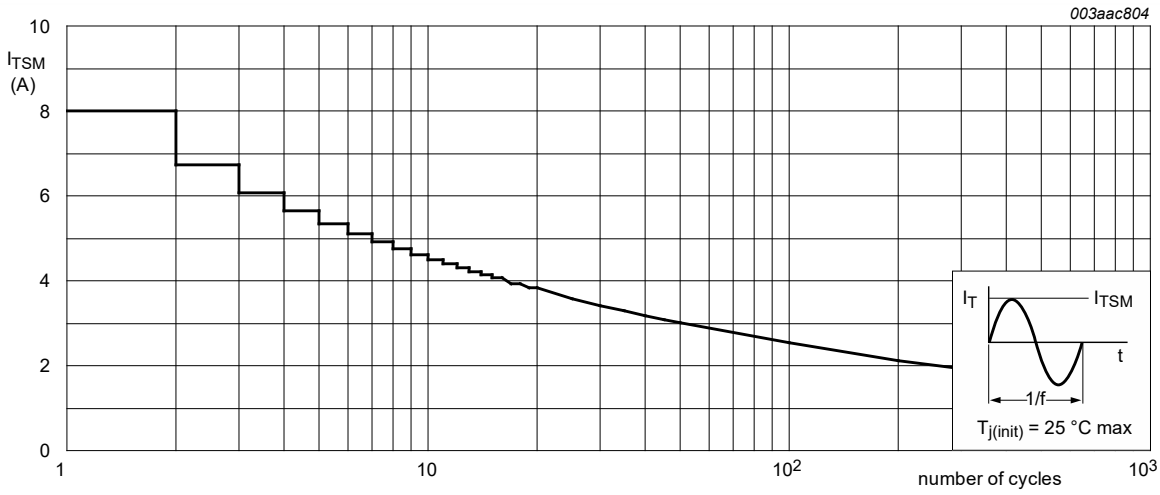
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| 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; $T_{lead} \leq$ 71 °C; Fig. 1 | | - | 0.8 | A |
| $I_{TSM}$ | non-repetitive peak on-state current | full sine wave; $T_{j(init)}$ = 25 °C; $t_p$ = 20 ms; Fig. 2; Fig. 3 | | - | 13 | A |
| | | full sine wave; $T_{j(init)}$ = 25 °C; $t_p$ = 16.7 ms | | - | 14.3 | A |
| $I^2t$ | $I^2t$ for fusing | $t_p$ = 10 ms; SIN | | - | 0.32 | A²s |
| $dI_T/dt$ | rate of rise of on-state current | $I_G$ = 20 mA | | - | 100 | A/µs |
| $I_{GM}$ | peak gate current | t = 20 µs | | - | 1 | A |
| $V_{GM}$ | peak gate voltage | positive applied gate voltage | | - | 15 | V |
| $P_{G(AV)}$ | average gate power | over any 20 ms period | | - | 0.1 | W |
| $T_{stg}$ | storage temperature | | | -40 | 150 | °C |
| $T_j$ | junction temperature | | | - | 125 | °C |
| $V_{PP}$ | peak pulse voltage | $T_j$ = 25 °C; non-repetitive, off-state; ten pulses on each voltage polarity; 20s or more between successive pulses;; Fig. 4 | | - | 2.5 | kV |



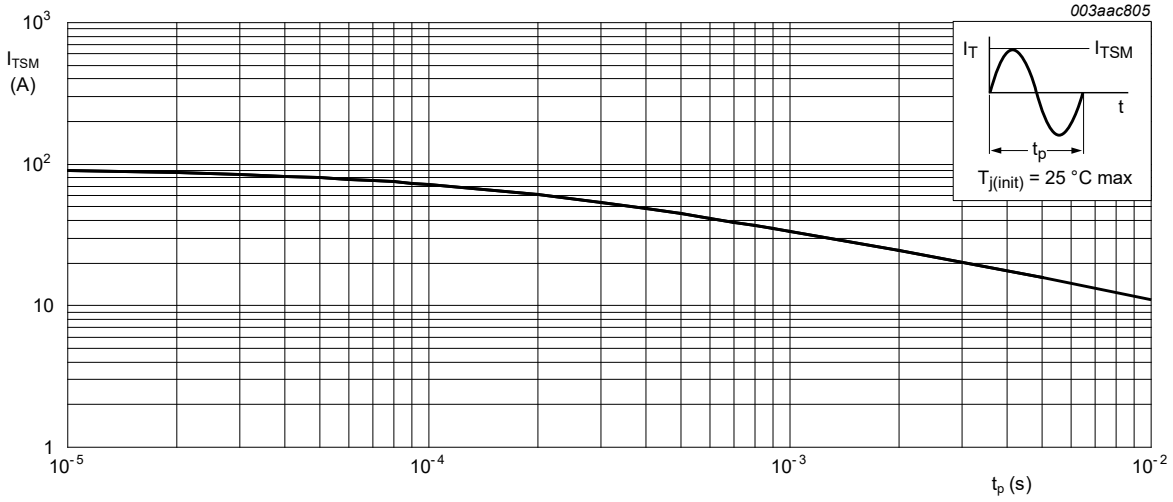

α = conduction angle

**Fig. 1. Total power dissipation as a function of RMS on-state current; maximum values**




f = 50 Hz

**Fig. 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values**




$t_p \leq 20$ ms

**Fig. 3. Non-repetitive peak on-state current as a function of pulse width; maximum values**

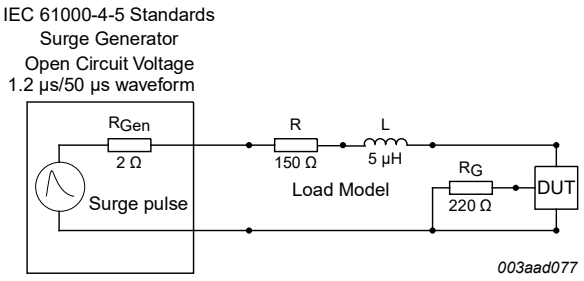



**Fig. 4. Test circuit for inductive and resistive loads with conditions equivalent to IEC 61000-4-5**

# 8. Thermal characteristics

**Table 5. Thermal characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j\text{-}lead)}$ | thermal resistance from junction to lead | full cycle with heatsink compound; Fig. 5 | | - | - | 60 | K/W |
| $R_{th(j\text{-}a)}$ | thermal resistance from junction to ambient free air | full cycle; printed-circuit board mounted; lead length 4 mm | | - | 150 | - | K/W |

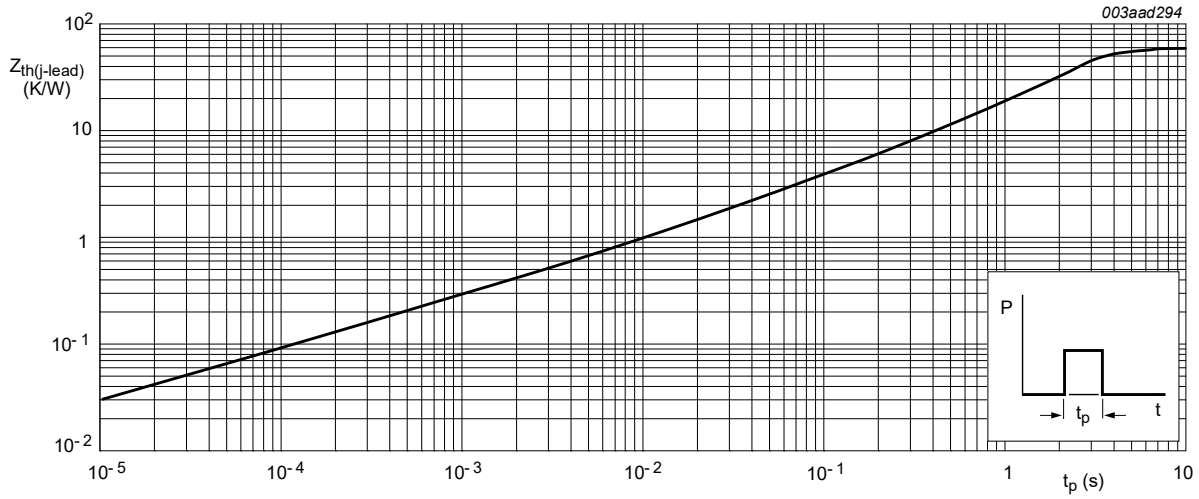
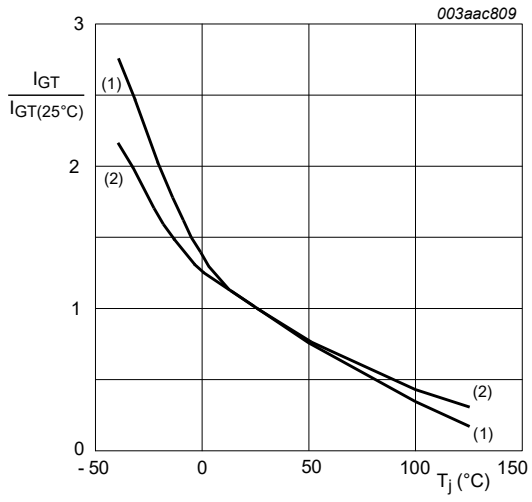



**Fig. 5. Transient thermal impedance from junction to lead as a function of pulse width**

# 9. Characteristics

**Table 6. Characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | | |
| $I_{GT}$ | gate trigger current | $V_D$ = 12 V; $I_T$ = 100 mA; LD+ G-; $T_j$ = 25 °C; Fig. 6 | | 1 | - | 10 | mA |
| | | $V_D$ = 12 V; $I_T$ = 100 mA; LD- G-; $T_j$ = 25 °C; Fig. 6 | | 1 | - | 10 | mA |
| $I_L$ | latching current | $V_D$ = 12 V; $I_G$ = 100 mA; LD+ G-; $T_j$ = 25 °C; Fig. 7 | | - | - | 25 | mA |
| | | $V_D$ = 12 V; $I_G$ = 100 mA; LD- G-; $T_j$ = 25 °C; Fig. 7 | | - | - | 20 | mA |
| $I_H$ | holding current | $V_D$ = 12 V; $T_j$ = 25 °C; Fig. 7 | | - | - | 20 | mA |
| $V_T$ | on-state voltage | $I_T$ = 1.1 A; $T_j$ = 25 °C; Fig. 8 | | - | - | 1.3 | V |
| $V_{GT}$ | gate trigger voltage | $V_D$ = 400 V; $I_T$ = 100 mA; $T_j$ = 125 °C | | 0.15 | - | - | V |
| | | $V_D$ = 12 V; $I_T$ = 100 mA; $T_j$ = 25 °C | | - | - | 1 | V |
| $I_D$ | off-state current | $V_D$ = 600 V; $T_j$ = 25 °C | | - | - | 2 | µA |
| | | $V_D$ = 600 V; $T_j$ = 125 °C | | - | - | 0.2 | mA |
| $V_{CL}$ | clamping voltage | $I_{CL}$ = 0.1 mA; $t_p$ = 1 ms; $T_j$ = 25 °C; Fig. 9 | | 650 | - | - | V |
| **Dynamic characteristics** | | | | | | | |
| $dV_D/dt$ | rate of rise of off-state voltage | $V_{DM}$ = 402 V; $T_j$ = 125 °C; ($V_{DM}$ = 67% of $V_{DRM}$); exponential waveform; gate open circuit; Fig. 10 | | 2000 | - | - | V/µs |
| $dI_{com}/dt$ | rate of change of commutating current | $V_D$ = 400 V; $T_j$ = 125 °C; $I_{T(RMS)}$ = 0.8 A; $dV_{com}/dt$ = 20 V/µs; (snubberless condition); gate open circuit; Fig. 11; Fig. 12 | | 0.5 | - | - | A/ms |




(1) LD+ G-
(2) LD- G-

**Fig. 6. Normalized gate trigger current as a function of junction temperature**

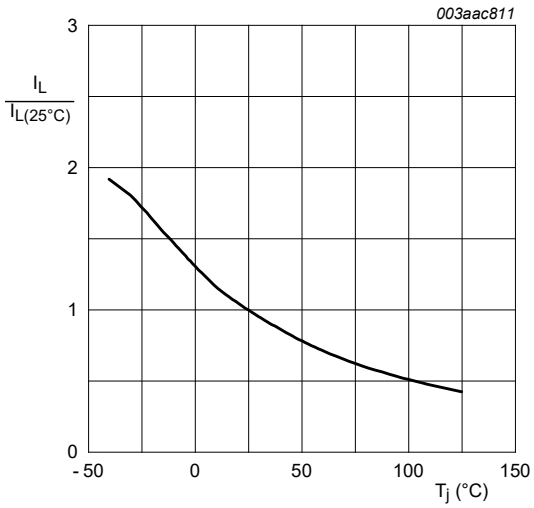
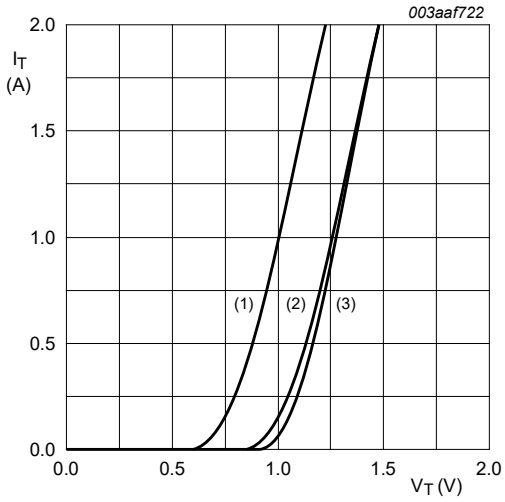



**Fig. 7. Normalized latching current as a function of junction temperature**




$V_o$ = 0.758 V; $R_s$ = 0.263 Ω
(1) $T_j$ = 125 °C; typical values
(2) $T_j$ = 125 °C; maximum values
(3) $T_j$ = 25 °C; maximum values

**Fig. 8. On-state current as a function of on-state voltage**

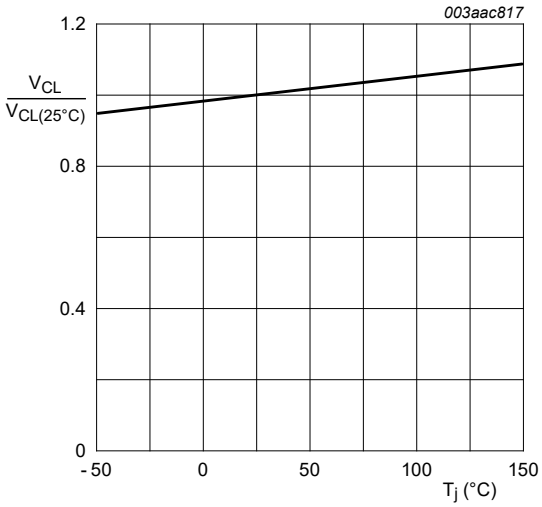
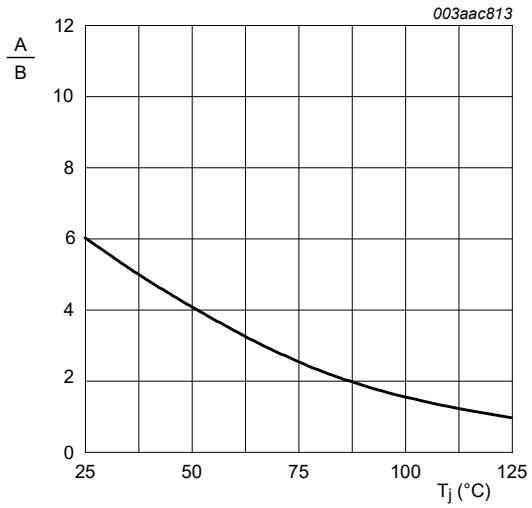
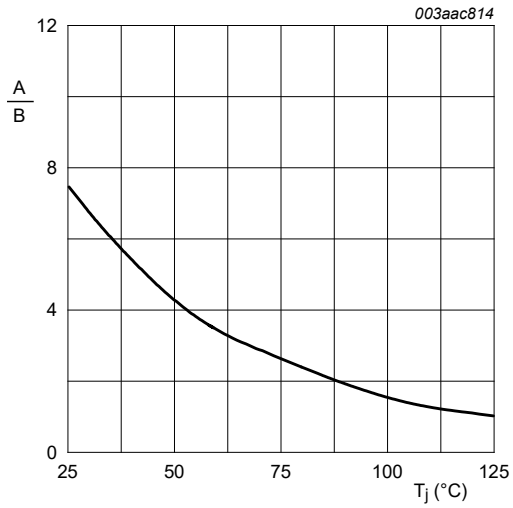



**Fig. 9. Normalized clamping voltage (upper limit) as a function of junction temperature; minimum values**



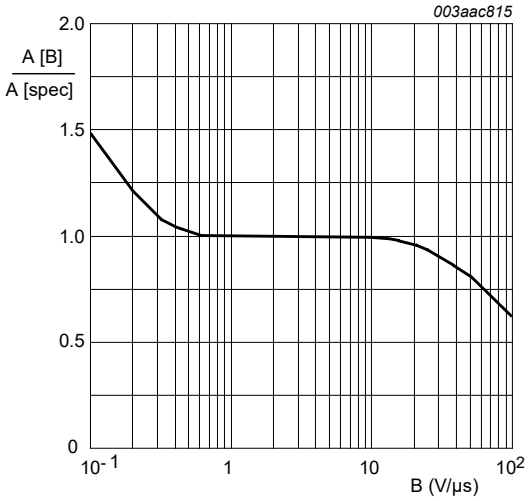

A = $dV_D/dt$ at condition $T_j$ °C
B = $dV_D/dt$ at condition $T_j$ [125] °C

**Fig. 10. Normalized rate of rise of off-state voltage as a function of junction temperature**




A = $dI_{com}/dt$ at condition $T_j$ °C
B = $dI_{com}/dt$ at condition $T_j$ [125] °C
$V_D$ = 400 V

**Fig. 11. Normalized critical rate of rise of commutating current as a function of junction temperature**




A [B] = $dI_{com}/dt$ at condition B, $dV_{com}/dt$
A [spec] is the data sheet value for $dI_{com}/dt$
turn-off time is less than 20 ms

**Fig. 12. Normalized critical rate of change of commutating current as a function of critical rate of change of commutating voltage; minimum values**

## 10. Package outline

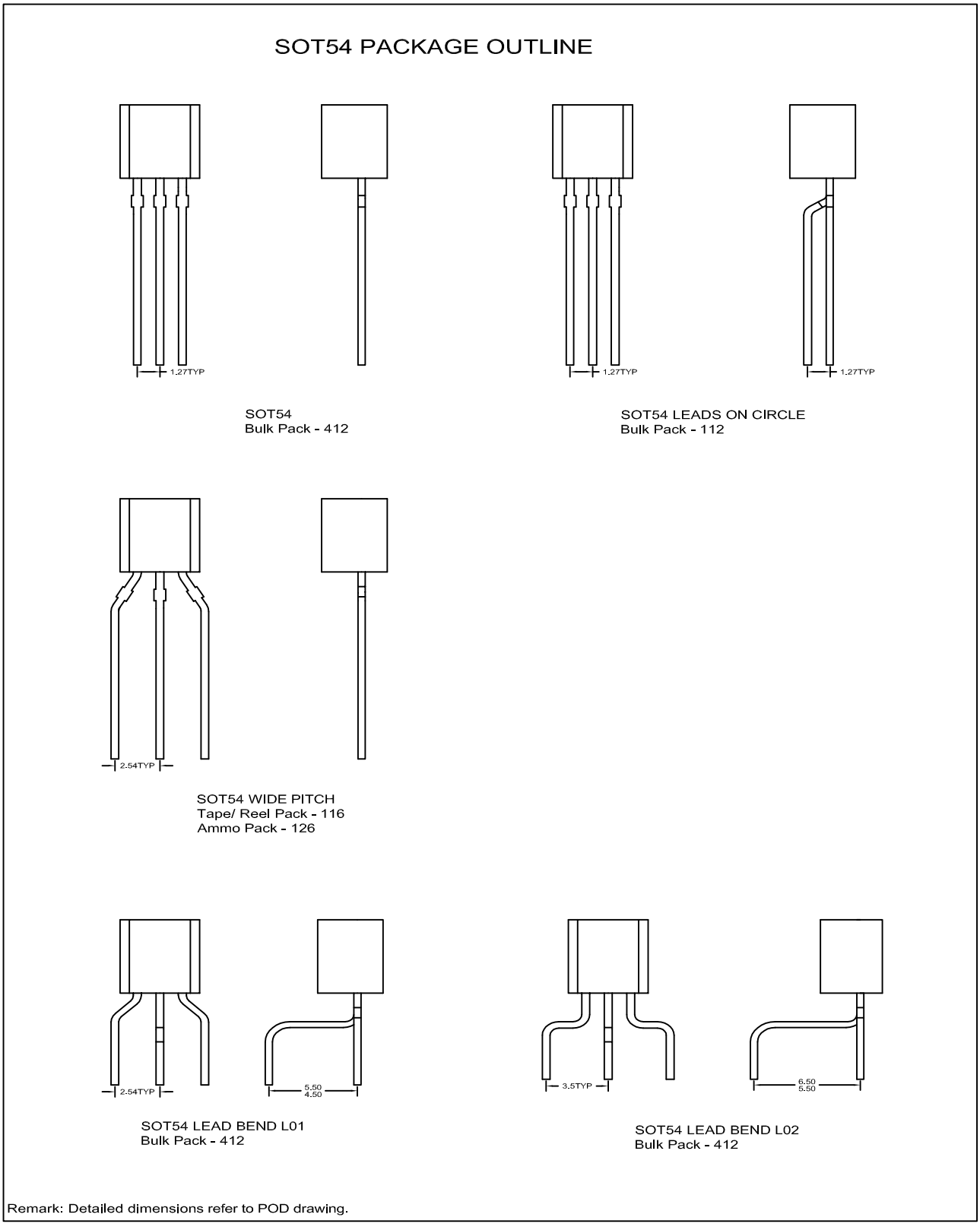



**Fig. 13. Package outline TO-92 (SOT54)**

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|---|---|---|
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