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
- High noise immunity
- Remote gate separates the gate driver from the effects of the load current
- Very sensitive gate for lowest gate trigger current
- 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>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{DRM}$</td>
<td>repetitive peak off-state voltage</td>
<td></td>
<td>-</td>
<td>-</td>
<td>600</td>
<td>V</td>
</tr>
<tr>
<td>$I_{T(RMS)}$</td>
<td>RMS on-state current</td>
<td>full sine wave; $T_{lead} \leq 71 , ^\circ C$; Fig. 1</td>
<td>-</td>
<td>-</td>
<td>0.8</td>
<td>A</td>
</tr>
</tbody>
</table>

**Static characteristics**

| $I_{GT}$ | gate trigger current | $V_D = 12 \, V$; $I_T = 100 \, mA$; LD+ G-; $T_j = 25 \, ^\circ C$; Fig. 6 | 0.5 | -   | 5   | mA   |
| $I_{GT}$ | gate trigger current | $V_D = 12 \, V$; $I_T = 100 \, mA$; LD- G-; $T_j = 25 \, ^\circ C$; Fig. 6 | 0.5 | -   | 5   | mA   |
5. Pinning information

Table 2. Pinning information

<table>
<thead>
<tr>
<th>Pin</th>
<th>Symbol</th>
<th>Description</th>
<th>Simplified outline</th>
<th>Graphic symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CM</td>
<td>common</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>G</td>
<td>gate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>LD</td>
<td>load</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Ordering information

Table 3. Ordering information

<table>
<thead>
<tr>
<th>Type number</th>
<th>Package</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT108-600D</td>
<td>TO-92</td>
<td>plastic single-ended leaded (through hole) package; 3 leads</td>
<td>SOT54</td>
</tr>
<tr>
<td>ACT108-600D/DG</td>
<td>TO-92</td>
<td>plastic single-ended leaded (through hole) package; 3 leads</td>
<td>SOT54</td>
</tr>
</tbody>
</table>
# Limiting values

Table 4. Limiting values

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{DRM}$</td>
<td>repetitive peak off-state voltage</td>
<td>-</td>
<td>600</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$I_{T(RMS)}$</td>
<td>RMS on-state current</td>
<td>full sine wave; $T_{lead} \leq 71 , ^\circ C$; [Fig. 1]</td>
<td>-</td>
<td>0.8</td>
<td>A</td>
</tr>
<tr>
<td>$I_{TSM}$</td>
<td>non-repetitive peak on-state current</td>
<td>full sine wave; $T_{j(init)} = 25 , ^\circ C$; $t_p = 16.7 , ms$</td>
<td>-</td>
<td>8.8</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>full sine wave; $T_{j(init)} = 25 , ^\circ C$; $t_p = 20 , ms$; [Fig. 2; Fig. 3]</td>
<td>-</td>
<td>8</td>
<td>A</td>
</tr>
<tr>
<td>$I^2t$</td>
<td>$I^2t$ for fusing</td>
<td>$t_p = 10 , ms$; SIN</td>
<td>-</td>
<td>0.32</td>
<td>A²s</td>
</tr>
<tr>
<td>$dI_T/dt$</td>
<td>rate of rise of on-state current</td>
<td>$I_G = 10 , mA$</td>
<td>-</td>
<td>50</td>
<td>A/µs</td>
</tr>
<tr>
<td>$I_{GM}$</td>
<td>peak gate current</td>
<td>$t = 20 , µs$</td>
<td>-</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>$V_{GM}$</td>
<td>peak gate voltage</td>
<td>-</td>
<td>15</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$P_{G(AV)}$</td>
<td>average gate power</td>
<td>over any 20 ms period</td>
<td>-</td>
<td>0.1</td>
<td>W</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>storage temperature</td>
<td>-40°</td>
<td>150°</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>$T_j$</td>
<td>junction temperature</td>
<td>-</td>
<td>125°</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>$V_{PP}$</td>
<td>peak pulse voltage</td>
<td>$T_j = 25 , ^\circ C$; non-repetitive, off-state; [Fig. 4]</td>
<td>-</td>
<td>2</td>
<td>kV</td>
</tr>
</tbody>
</table>

![Total power dissipation as a function of RMS on-state current](image)

Fig. 1. Total power dissipation as a function of RMS on-state current; maximum values
Fig. 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

\[ f = 50 \text{ Hz} \]

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

\[ t_p \leq 20 \text{ ms} \]

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

Table 5. Thermal characteristics

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

![Graph showing transient thermal impedance from junction to lead as a function of pulse width](image)

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

Table 6. Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{GT}$</td>
<td>gate trigger current</td>
<td>$V_D = 12$ V; $I_T = 100$ mA; LD+ G-; $T_j = 25$ °C; [Fig. 6]</td>
<td>$0.5$</td>
<td>-</td>
<td>$5$</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_D = 12$ V; $I_T = 100$ mA; LD- G-; $T_j = 25$ °C; [Fig. 6]</td>
<td>$0.5$</td>
<td>-</td>
<td>$5$</td>
<td>mA</td>
</tr>
<tr>
<td>$I_L$</td>
<td>latching current</td>
<td>$V_D = 12$ V; $I_C = 100$ mA; LD+ G-; $T_j = 25$ °C; [Fig. 7]</td>
<td>-</td>
<td>-</td>
<td>$25$</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_D = 12$ V; $I_C = 100$ mA; LD- G-; $T_j = 25$ °C; [Fig. 7]</td>
<td>-</td>
<td>-</td>
<td>$25$</td>
<td>mA</td>
</tr>
<tr>
<td>$I_H$</td>
<td>holding current</td>
<td>$V_D = 12$ V; $T_j = 25$ °C; [Fig. 8]</td>
<td>-</td>
<td>-</td>
<td>$20$</td>
<td>mA</td>
</tr>
<tr>
<td>$V_T$</td>
<td>on-state voltage</td>
<td>$I_T = 1.1$ A; $T_j = 25$ °C; [Fig. 9]</td>
<td>-</td>
<td>-</td>
<td>$1.3$</td>
<td>V</td>
</tr>
<tr>
<td>$V_{GT}$</td>
<td>gate trigger voltage</td>
<td>$V_D = 400$ V; $I_T = 100$ mA; $T_j = 125$ °C</td>
<td>$0.15$</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$I_D$</td>
<td>off-state current</td>
<td>$V_D = 12$ V; $I_T = 100$ mA; $T_j = 25$ °C</td>
<td>-</td>
<td>-</td>
<td>$0.9$</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_D = 600$ V; $T_j = 25$ °C</td>
<td>-</td>
<td>-</td>
<td>$2$</td>
<td>μA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_D = 600$ V; $T_j = 125$ °C</td>
<td>-</td>
<td>-</td>
<td>$0.2$</td>
<td>mA</td>
</tr>
<tr>
<td>$V_{CL}$</td>
<td>clamping voltage</td>
<td>$I_{CL} = 0.1$ mA; $t_p = 1$ ms; $T_j \leq 125$ °C</td>
<td>$650$</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
</tbody>
</table>

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]
  $300$ | - | - | V/μs |

- $dI_{com}/dt$ rate of change of commutating current
  $V_D = 400$ V; $T_j = 125$ °C; $I_{T(RMS)} = 1$ A; $dV_{com}/dt = 15$ V/μs; gate open circuit; [Fig. 11]; [Fig. 12]
  $0.15$ | - | - | A/ms |

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

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

Fig. 7. Normalized latching current as a function of junction temperature
Fig. 8. Normalized holding current as a function of junction temperature

\[ I_H / I_{H(25\,^\circ C)} \]

\[ T_j \, (^\circ C) \quad -50 \quad 0 \quad 50 \quad 100 \quad 150 \]

\[ 0 \quad 1 \quad 2 \quad 3 \]

Fig. 9. On-state current as a function of on-state voltage

\[ V_T \, (V) \quad 0 \quad 0.5 \quad 1.0 \quad 1.5 \quad 2.0 \]

\[ I_T \, (A) \quad 0.0 \quad 0.5 \quad 1.0 \quad 1.5 \quad 2.0 \]

\[ V_D = 0.758 \, V; \quad R_s = 0.263 \, \Omega \]

(1) \( T_j = 125 \, ^\circ C; \) typical values
(2) \( T_j = 125 \, ^\circ C; \) maximum values
(3) \( T_j = 25 \, ^\circ C; \) maximum values

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

\[ A / B \quad 0 \quad 2 \quad 4 \quad 6 \quad 8 \quad 10 \quad 12 \]

\[ T_j \, (^\circ C) \quad 25 \quad 50 \quad 75 \quad 100 \quad 125 \]

\[ A = dV_D/dt \text{ at condition } T_j \, ^\circ C \]

\[ B = dV_D/dt \text{ at condition } T_j \, [125] \, ^\circ C \]

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

\[ A / B \quad 0 \quad 2 \quad 4 \quad 6 \quad 8 \quad 10 \quad 12 \]

\[ T_j \, (^\circ C) \quad 25 \quad 50 \quad 75 \quad 100 \quad 125 \]

\[ A = dI_{com}/dt \text{ at condition } T_j \, ^\circ C \]

\[ B = dI_{com}/dt \text{ at condition } T_j \, [125] \, ^\circ C \]

\[ V_D = 400 \, V \]
Fig. 12. Normalized critical rate of change of commutating current as a function of critical rate of change of commutating voltage; minimum values

\[ A[B] = \frac{dI_{com}}{dt} \text{ at condition B, } \frac{dV_{com}}{dt} \]

\[ A[\text{spec}] \text{ is the data sheet value for } \frac{dI_{com}}{dt} \]

turn-off time is less than 20 ms
10. Package outline

**SOT54 PACKAGE OUTLINE**

- **SOT54**
  - Bulk Pack - 412

- **SOT54 LEADS ON CIRCLE**
  - Bulk Pack - 112

- **SOT54 WIDE PITCH**
  - Tape/Reel Pack - 116
  - Amico Pack - 126

- **SOT54 LEAD BEND L01**
  - Bulk Pack - 412

- **SOT54 LEAD BEND L02**
  - Bulk Pack - 412

Remark: Detailed dimensions refer to POD drawing.

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

Data sheet status

<table>
<thead>
<tr>
<th>Document status</th>
<th>Product status</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1][2]</td>
<td>[3]</td>
<td>Development This document contains data from the objective specification for product development.</td>
</tr>
<tr>
<td>Preliminary [short] data sheet</td>
<td>Qualification</td>
<td>This document contains data from the preliminary specification.</td>
</tr>
<tr>
<td>[short] data sheet</td>
<td>Production</td>
<td>This document contains the product specification.</td>
</tr>
</tbody>
</table>

[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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.ween-semi.com.

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