1. General description

Planar passivated four quadrant triac in a SOT428 (DPAK) surface-mountable plastic package intended for use in general purpose bidirectional switching and phase control applications.

2. Features and benefits

- High blocking voltage capability
- Less sensitive gate for improved noise immunity
- Planar passivated for voltage ruggedness and reliability
- Surface-mountable package
- Triggering in all four quadrants

3. Applications

- General purpose motor controls
- General purpose switching

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>full sine wave; $T_{mb} \leq 102 , ^\circ\text{C}$; Fig. 1; Fig. 2; Fig. 3</td>
<td>-</td>
<td>-</td>
<td>600</td>
<td>V</td>
</tr>
<tr>
<td>$I_{(RMS)}$</td>
<td>RMS on-state current</td>
<td>full sine wave; $T_{j(init)} = 25 , ^\circ\text{C}$; $t_p = 20 , \text{ms}$; Fig. 4; Fig. 5</td>
<td>-</td>
<td>-</td>
<td>8</td>
<td>A</td>
</tr>
<tr>
<td>$I_{TSM}$</td>
<td>non-repetitive peak on-state current</td>
<td>full sine wave; $T_{j(init)} = 25 , ^\circ\text{C}$; $t_p = 16.7 , \text{ms}$</td>
<td>-</td>
<td>-</td>
<td>65</td>
<td>A</td>
</tr>
<tr>
<td>$T_j$</td>
<td>junction temperature</td>
<td></td>
<td>-</td>
<td>-</td>
<td>125</td>
<td>°C</td>
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</table>

**Static 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>$V_D = 12 , \text{V}; I_T = 0.1 , \text{A}; T2^+ , G^+$; $T_j = 25 , ^\circ\text{C}$; Fig. 7</td>
<td>-</td>
<td>5</td>
<td>25</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_D = 12 , \text{V}; I_T = 0.1 , \text{A}; T2^+ , G^-$; $T_j = 25 , ^\circ\text{C}$; Fig. 7</td>
<td>-</td>
<td>8</td>
<td>25</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_D = 12 , \text{V}; I_T = 0.1 , \text{A}; T2^- , G^-; T_j = 25 , ^\circ\text{C}$; Fig. 7</td>
<td>-</td>
<td>11</td>
<td>25</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_D = 12 , \text{V}; I_T = 0.1 , \text{A}; T2^- , G^+; T_j = 25 , ^\circ\text{C}$; Fig. 7</td>
<td>-</td>
<td>30</td>
<td>70</td>
<td>mA</td>
</tr>
<tr>
<td>Symbol</td>
<td>Parameter</td>
<td>Conditions</td>
<td>Min</td>
<td>Typ</td>
<td>Max</td>
<td>Unit</td>
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<td>-----------------------------------------------------------------------------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>------</td>
</tr>
<tr>
<td>$I_H$</td>
<td>holding current</td>
<td>$V_D = 12 \text{ V}; T_j = 25 ^\circ \text{C}; \text{Fig. 9}$</td>
<td>-</td>
<td>5</td>
<td>20</td>
<td>mA</td>
</tr>
<tr>
<td>$V_T$</td>
<td>on-state voltage</td>
<td>$I_T = 10 \text{ A}; T_j = 25 ^\circ \text{C}; \text{Fig. 10}$</td>
<td>-</td>
<td>1.3</td>
<td>1.65</td>
<td>V</td>
</tr>
</tbody>
</table>

### Dynamic characteristics

- **$dV_D/dt$**
  - rate of rise of off-state voltage
  - $V_{DM} = 402 \text{ V}; T_j = 125 ^\circ \text{C}; (V_{DM} = 67\% \text{ of } V_{DRM});$ exponential waveform; gate open circuit
  - $50$ | $250$ | - | V/µs |

- **$dV_{com}/dt$**
  - rate of change of commutating voltage
  - $V_D = 400 \text{ V}; T_j = 95 ^\circ \text{C}; dI_{com}/dt = 3.6 A/\text{ms}; I_T = 8 \text{ A};$ gate open circuit
  - $-20$ | - | V/µs |
7. Limiting values

Table 4. Limiting values
In accordance with the Absolute Maximum Rating System (IEC 60134).

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
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<td>V_{DRM}</td>
<td>repetitive peak off-state</td>
<td>voltage</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; $T_{mb} \leq 102 , ^\circ C$; Fig. 1; Fig. 2; Fig. 3</td>
<td>-</td>
<td>8</td>
<td>A</td>
</tr>
<tr>
<td>I_{TSM}</td>
<td>non-repetitive peak on-state</td>
<td>current</td>
<td>-</td>
<td>65</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>current</td>
<td>full sine wave; $T_{j(init)} = 25 , ^\circ C$; $t_p = 20 , ms$; Fig. 4; Fig. 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>full sine wave; $T_{j(init)} = 25 , ^\circ C$; $t_p = 16.7 , ms$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I'^2t</td>
<td>$I'^2t$ for fusing</td>
<td>$t_p = 10 , ms$; SIN</td>
<td>-</td>
<td>21</td>
<td>A²s</td>
</tr>
<tr>
<td>dI/tdt</td>
<td>rate of rise of on-state current</td>
<td>$I_G = 150 , mA$</td>
<td>-</td>
<td>50</td>
<td>A/µs</td>
</tr>
<tr>
<td>I_{GM}</td>
<td>peak gate current</td>
<td></td>
<td>-</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>P_{GM}</td>
<td>peak gate power</td>
<td></td>
<td>-</td>
<td>5</td>
<td>W</td>
</tr>
<tr>
<td>P_{G(AV)}</td>
<td>average gate power</td>
<td>over any 20 ms period</td>
<td>-</td>
<td>0.5</td>
<td>W</td>
</tr>
<tr>
<td>T_{stg}</td>
<td>storage temperature</td>
<td></td>
<td>-40</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>T_{j}</td>
<td>junction temperature</td>
<td></td>
<td>-</td>
<td>125</td>
<td>°C</td>
</tr>
</tbody>
</table>

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

Fig. 2. RMS on-state current as a function of surge duration; maximum values
Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

\[ \alpha = \text{conduction angle} \]
\[ a = \text{form factor} = \frac{I_{T(RMS)}}{I_{T(AV)}} \]

Fig. 4. Non-repetitive peak on-state current as a function of pulse width; maximum values

\[ t_p \leq 20 \text{ ms} \]
(1) \( \frac{dI_T}{dt} \) limit
(2) T2- G+ quadrant limit
Fig. 5. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

\[ f = 50 \text{ Hz} \]
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>$R_{th(j-mb)}$</td>
<td>thermal resistance from junction to mounting base</td>
<td>half cycle; <strong>Fig. 6</strong></td>
<td>-</td>
<td>-</td>
<td>2.4</td>
<td>K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>full cycle; <strong>Fig. 6</strong></td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>K/W</td>
</tr>
<tr>
<td>$R_{th(j-a)}$</td>
<td>thermal resistance from junction to ambient free air</td>
<td>PCB (FR4) mounted; minimum pad sizes</td>
<td>-</td>
<td>75</td>
<td>-</td>
<td>K/W</td>
</tr>
</tbody>
</table>

![Graph](image)

**Fig. 6.** Transient thermal impedance from junction to mounting base 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></td>
<td>Static characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_{GT} )</td>
<td>gate trigger current</td>
<td>( V_D = 12 \text{ V}; I_T = 0.1 \text{ A}; T_2+ G+; T_j = 25 \text{ °C}; Fig. 7 )</td>
<td>-</td>
<td>5</td>
<td>25</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_D = 12 \text{ V}; I_T = 0.1 \text{ A}; T_2+ G-; T_j = 25 \text{ °C}; Fig. 7 )</td>
<td>-</td>
<td>8</td>
<td>25</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_D = 12 \text{ V}; I_T = 0.1 \text{ A}; T_2- G-; T_j = 25 \text{ °C}; Fig. 7 )</td>
<td>-</td>
<td>11</td>
<td>25</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_D = 12 \text{ V}; I_T = 0.1 \text{ A}; T_2- G+; T_j = 25 \text{ °C}; Fig. 7 )</td>
<td>-</td>
<td>30</td>
<td>70</td>
<td>mA</td>
</tr>
<tr>
<td>( I_L )</td>
<td>latching current</td>
<td>( V_D = 12 \text{ V}; I_G = 0.1 \text{ A}; T_2+ G+; T_j = 25 \text{ °C}; Fig. 8 )</td>
<td>-</td>
<td>7</td>
<td>30</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_D = 12 \text{ V}; I_G = 0.1 \text{ A}; T_2+ G-; T_j = 25 \text{ °C}; Fig. 8 )</td>
<td>-</td>
<td>16</td>
<td>45</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_D = 12 \text{ V}; I_G = 0.1 \text{ A}; T_2- G-; T_j = 25 \text{ °C}; Fig. 8 )</td>
<td>-</td>
<td>5</td>
<td>30</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_D = 12 \text{ V}; I_G = 0.1 \text{ A}; T_2- G+; T_j = 25 \text{ °C}; Fig. 8 )</td>
<td>-</td>
<td>7</td>
<td>45</td>
<td>mA</td>
</tr>
<tr>
<td>( I_H )</td>
<td>holding current</td>
<td>( V_D = 12 \text{ V}; T_j = 25 \text{ °C}; Fig. 9 )</td>
<td>-</td>
<td>5</td>
<td>20</td>
<td>mA</td>
</tr>
<tr>
<td>( V_T )</td>
<td>on-state voltage</td>
<td>( I_T = 10 \text{ A}; T_j = 25 \text{ °C}; Fig. 10 )</td>
<td>-</td>
<td>1.3</td>
<td>1.65</td>
<td>V</td>
</tr>
<tr>
<td>( V_{GT} )</td>
<td>gate trigger voltage</td>
<td>( V_D = 12 \text{ V}; I_T = 0.1 \text{ A}; T_j = 25 \text{ °C}; Fig. 11 )</td>
<td>-</td>
<td>0.7</td>
<td>1</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_D = 400 \text{ V}; I_T = 0.1 \text{ A}; T_j = 125 \text{ °C}; Fig. 11 )</td>
<td>0.25</td>
<td>0.4</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>( I_D )</td>
<td>off-state current</td>
<td>( V_D = 600 \text{ V}; T_j = 125 \text{ °C} )</td>
<td>-</td>
<td>0.1</td>
<td>0.5</td>
<td>mA</td>
</tr>
</tbody>
</table>

| Dynamic characteristics | rate of rise of off-state voltage \( \frac{dV_D}{dt} \) | \( V_D = 402 \text{ V}; T_j = 125 \text{ °C}; \text{V}_{\text{D}} = 67\% \text{ ofV}_{\text{GRM}} \); exponential waveform; gate open circuit | 50   | 250  | -    | V/\mu s |
| Dynamic characteristics | rate of change of commutating voltage \( \frac{dV_{\text{com}}}{dt} \) | \( V_D = 400 \text{ V}; T_j = 95 \text{ °C}; \text{dI}_{\text{com}}/\text{dt} = 3.6 \text{ A/ ms}; I_T = 8 \text{ A}; gate open circuit | -    | 20   | -    | V/\mu s |
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

- $V_o = 1.264 \text{ V}$
- $R_s = 0.038 \text{ Ω}$
- (1) $T_j = 125 \text{ °C}$; typical values
- (2) $T_j = 125 \text{ °C}$; maximum values
- (3) $T_j = 25 \text{ °C}$; maximum values
Fig. 11. Normalized gate trigger voltage as a function of junction temperature
10. Package outline

Plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped) TO252

Recommended Footprint

| Unit  | A   | A1  | b   | b1  | b2  | c   | D1  | D2  | E   | E1  | e   | e1  | Hb  | L   | L1  | L2  | w  | y  |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|
| min   | 2.22| 0.46| 0.71| 0.72| 5.00| 0.20| 5.98| 4.00| 6.47| 4.45| 2.285| 4.57| 9.60| --- | --- | 0.50| 0.50| 0.20| 0.20|
| nom   | 2.38| 0.93| 0.89| 1.10| 5.46| 0.56| 6.22| --- | --- | --- | 2.90 (Ref.) | 0.50 | 0.50 | --- | 0.90 | 0.20 | 0.20 |
| max   | 2.45| 1.45| 2.45| 2.45| 5.92| 0.69| 6.75| 4.57| 5.35| 5.35| 2.90 | 10.40 | --- | 0.90 | 0.20 | 0.20 | 0.20 |

Fig. 12. Package outline DPAK (SOT428)
11. Legal information

Data sheet status

<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
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<tbody>
<tr>
<td>Objective [short] data sheet</td>
<td>Development</td>
<td>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>Product [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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