S12MD1V/S12MD3

**Features**
1. High RMS ON-state current \( I_T : \text{MAX. } 200\,\text{mA_{rms}} \)
2. High repetitive peak OFF-state voltage \( V_{DRM} : \text{MIN. } 400\,\text{V} \)
3. Trigger current \( I_{FT} : \text{MAX. } 15\,\text{mA at } R_G = 20\,\text{k}\Omega \)
4. For half-wave control ••• S12MD1V
   For full-wave control ••• S12MD3
5. Recognized by UL, file No. E64380
   \* S12MD1V and S12MD3 are for 100V line

**Applications**
1. ON-OFF operation for a low power load
2. For triggering high power thyristor and triac

**Outline Dimensions**
(Unit: mm)

\[
\begin{align*}
\text{S12MD1V} & : \\
\text{Anode} & : 3.72 \pm 0.3 \\
\text{Cathode} & : 0.9 \pm 0.2 \\
\text{NC} & : 1.2 \pm 0.3 \\
\text{Gate} & : 7.12 \pm 0.5 \\
\theta & : 0 \text{ to } 13^\circ
\end{align*}
\]

\[
\begin{align*}
\text{S12MD3} & : \\
\text{Anode} & : 9.22 \pm 0.5 \\
\text{Cathode} & : 0.85 \pm 0.3 \\
\text{Gate} & : 7.62 \pm 0.3 \\
\text{Anode/cathode} & : 0 \text{ to } 13^\circ
\end{align*}
\]

\* In the absence of confirmation by device specification sheets, SHARP takes no responsibility for any defects that occur in equipment using any of SHARP’s devices, shown in catalogs, data books, etc. Contact SHARP in order to obtain the latest version of the device specification sheets before using any SHARP’s device.
### Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward current</td>
<td>IF</td>
<td>50</td>
<td>mA</td>
</tr>
<tr>
<td>Reverse voltage</td>
<td>VR</td>
<td>6</td>
<td>V</td>
</tr>
<tr>
<td>Output</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RMS ON-state current</td>
<td>IT</td>
<td>200</td>
<td>mA rms</td>
</tr>
<tr>
<td>Repetitive peak OFF-state voltage</td>
<td>IDRM</td>
<td>400</td>
<td>V</td>
</tr>
<tr>
<td>Repetitive peak reverse voltage</td>
<td>VRRM</td>
<td>400</td>
<td>V</td>
</tr>
<tr>
<td>Isolation voltage</td>
<td>Viso</td>
<td>5000</td>
<td>V rms</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Topr</td>
<td>-30 to +100</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>Tstg</td>
<td>-40 to +125</td>
<td>°C</td>
</tr>
<tr>
<td>Soldering temperature</td>
<td>Tsol</td>
<td>260</td>
<td>°C</td>
</tr>
</tbody>
</table>

*1 50Hz, sine wave  
*2 R_G = 20kΩ  
*3 40 to 60% RH, AC for 1 minute  
*4 For 10 seconds

### Electro-optical Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward voltage</td>
<td>VF</td>
<td>IF = 30mA</td>
<td>-</td>
<td>1.2</td>
<td>1.4</td>
<td>V</td>
</tr>
<tr>
<td>Reverse current</td>
<td>IR</td>
<td>VR = 3V</td>
<td>-</td>
<td>-</td>
<td>10^-6</td>
<td>A</td>
</tr>
<tr>
<td>Repetitive peak OFF-state current</td>
<td>IDRM</td>
<td>VRM = Rated, RG = 20kΩ</td>
<td>-</td>
<td>-</td>
<td>10^-6</td>
<td>A</td>
</tr>
<tr>
<td>Repetitive peak reverse voltage</td>
<td>IRRM</td>
<td>VRM = Rated, RG = 20kΩ</td>
<td>-</td>
<td>-</td>
<td>10^-6</td>
<td>A</td>
</tr>
<tr>
<td>ON-state voltage</td>
<td>VT</td>
<td>IT = 200mA</td>
<td>-</td>
<td>1.0</td>
<td>1.4</td>
<td>V</td>
</tr>
<tr>
<td>Holding current</td>
<td>IH</td>
<td>VD = 6V, RG = 20kΩ</td>
<td>-</td>
<td>0.3</td>
<td>1</td>
<td>mA</td>
</tr>
<tr>
<td>Critical rate of rise of OFF-state voltage</td>
<td>dV/dt</td>
<td>VRM = 1/4T Rated, RG = 20kΩ</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>V/μs</td>
</tr>
<tr>
<td>Transfer-characteristics</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum trigger current</td>
<td>IFT</td>
<td>VD = 6V, RL = 100Ω, RG = 20kΩ</td>
<td>-</td>
<td>-</td>
<td>15</td>
<td>mA</td>
</tr>
<tr>
<td>Isolation resistance</td>
<td>RISO</td>
<td>DC500V, 40 to 60% RH</td>
<td>5 x 10^10</td>
<td>10^11</td>
<td>-</td>
<td>Ω</td>
</tr>
<tr>
<td>Turn-on time</td>
<td>ton</td>
<td>VD = 6V, IF = 30mA, RG = 20kΩ, RL = 100Ω</td>
<td>-</td>
<td>10</td>
<td>60</td>
<td>μs</td>
</tr>
</tbody>
</table>

*5 Applies only to S12MD1V

---

**Fig. 1 RMS ON-state Current vs. Ambient Temperature**

**Fig. 2 Forward Current vs. Ambient Temperature**
**Fig. 3 Forward Current vs. Forward Voltage**

- Forward current $I_F$ (mA) vs. Forward voltage $V_F$ (V)
- $T_a = 75^\circ$C, $25^\circ$C, $50^\circ$C, $0^\circ$C, $-25^\circ$C

**Fig. 4 Minimum Trigger Current vs. Ambient Temperature**

- Minimum trigger current $I_{FT}$ (mA) vs. Ambient temperature $T_a$ (°C)
- $V_D = 6V$, $R_L = 100\Omega$

**Fig. 5 Minimum Trigger Current vs. Gate Resistance**

- Minimum trigger current $I_{FT}$ (mA) vs. Gate resistance $R_G$ (KΩ)
- $V_D = 6V$, $R_L = 100\Omega$, $T_a = 25^\circ$C

**Fig. 6 Break Over Voltage vs. Ambient Temperature**

- Break over voltage $V_{BO}$ (V) vs. Ambient temperature $T_a$ (°C)
- $R_G = 10k\Omega$, $20k\Omega$, $50k\Omega$

**Fig. 7 Critical Rate of Rise of OFF-state Voltage vs. Ambient Temperature**

- Critical rate of rise of OFF-state voltage $\frac{\Delta V}{\Delta t}$ (V/µs) vs. Ambient temperature $T_a$ (°C)
- $V_{DRM} = \frac{1}{2} \cdot$ Rated

**Fig. 8 Holding Current vs. Ambient Temperature**

- Holding current $I_H$ (mA) vs. Ambient temperature $T_a$ (°C)
- $V_D = 6V$, $R_G = 10k\Omega$, $20k\Omega$, $50k\Omega$
**Fig. 9 Repetitive Peak OFF-state Current vs. Ambient Temperature**

\[
\begin{array}{|c|c|c|c|c|c|}
\hline
\text{Ambient temperature } T_a \, (\degree C) & 0 & 20 & 40 & 60 & 80 & 100 \\
\hline
\text{Repetitive peak OFF-state current } I_{DRM} & 10^{-9} & 10^{-8} & 10^{-7} & 10^{-6} & 10^{-5} & 10^{-4} \\
\hline
\end{array}
\]

- **Basic Operation Circuit**
  - **S12MD1V**
  - **Medium/High Power Thyristor Drive Circuit**

![Thyristor Drive Circuit Diagram]

- **Medium/High Power Triac Drive Circuit (Zero-cross Operation)**

![Triac Drive Circuit Diagram]
- S12MD3

**Low Power Load Drive Circuit**

[Diagram of Low Power Load Drive Circuit]

**Medium/High Power Triac Drive Circuit**

[Diagram of Medium/High Power Triac Drive Circuit]

- Please refer to the chapter “Precautions for Use” (Page 78 to 93).