1. General description

Ultra low capacitance bidirectional ElectroStatic Discharge (ESD) protection diode in a DSN0603-2 (SOD962) leadless ultra small Surface-Mounted Device (SMD) package. The device is designed to protect one signal line from the damage caused by ESD and other transients.

2. Features and benefits

- Bidirectional ESD protection of one line
- Ultra small leadless package with a height of 0.3 mm
- IEC 61000-4-5 (surge): $I_{PPM} = 6.4$ A (average measured)
- Very low clamping voltage: $V_{CL} = 9$ V max for 5.4 A, 8/20 µs pulse
- Ultra low leakage current: $I_{RM} < 1$ nA
- ESD protection up to 20 kV

3. Applications

ESD and surge protection for:
- very sensitive interface lines
- generic interface lines
in portable electronics, communication, consumer and computing devices.

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>$V_{RWM}$</td>
<td>reverse standoff voltage</td>
<td>$T_{amb} = 25$ °C</td>
<td>-</td>
<td>-</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>$C_d$</td>
<td>diode capacitance</td>
<td>$f = 1$ MHz; $V_R = 0$ V; $T_{amb} = 25$ °C</td>
<td>-</td>
<td>5.3</td>
<td>6</td>
<td>pF</td>
</tr>
<tr>
<td>$I_{PPM}$</td>
<td>rated peak pulse current</td>
<td>$t_p = 8/20$ µs</td>
<td>[1]</td>
<td>[2]</td>
<td>-</td>
<td>5.4</td>
</tr>
</tbody>
</table>

[2] Average measured $I_{PPM} = 6.4$ A.
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>K1</td>
<td>cathode (diode 1)</td>
<td>1 2</td>
<td>K1 K2</td>
</tr>
<tr>
<td>2</td>
<td>K2</td>
<td>cathode (diode 2)</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>PESD5V5U1BCSF</td>
<td>DSN0603-2</td>
<td>silicon, leadless ultra small package; 2 terminals; 0.4 mm pitch; 0.6 mm x 0.3 mm x 0.3 mm body</td>
<td>SOD962-2</td>
</tr>
</tbody>
</table>

7. Marking

Table 4. Marking codes

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking code</th>
</tr>
</thead>
<tbody>
<tr>
<td>PESD5V5U1BCSF</td>
<td>F3</td>
</tr>
</tbody>
</table>
8. Limiting values

Table 5. 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>
<tr>
<td>I_{PPM}</td>
<td>rated peak pulse current</td>
<td>t_p = 8/20 μs</td>
<td></td>
<td>5.4</td>
<td>A</td>
</tr>
<tr>
<td>T_j</td>
<td>junction temperature</td>
<td></td>
<td>-</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>T_{amb}</td>
<td>ambient temperature</td>
<td></td>
<td>-40</td>
<td>125</td>
<td>°C</td>
</tr>
<tr>
<td>T_{stg}</td>
<td>storage temperature</td>
<td></td>
<td>-65</td>
<td>150</td>
<td>°C</td>
</tr>
</tbody>
</table>

**ESD maximum ratings**

| V_{ESD} | electrostatic discharge voltage | IEC 61000-4-2; contact discharge | [3] | 20 | kV  |
|         | IEC 61000-4-2; air discharge    |                                       | [3] | 20 | kV  |

[2] Average measured I_{PPM} = 6.4 A.

![Fig. 1. 8/20 μs pulse waveform according to IEC 61000-4-5](image1)

![Fig. 2. ESD pulse waveform according to IEC 61000-4-2](image2)
## 9. 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>$V_{RWM}$</td>
<td>reverse standoff voltage</td>
<td>$T_{amb} = 25$ °C</td>
<td>-</td>
<td>-</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>$V_{BR}$</td>
<td>breakdown voltage</td>
<td>$I_R = 5$ mA; $T_{amb} = 25$ °C</td>
<td>4.5</td>
<td>5.5</td>
<td>8</td>
<td>V</td>
</tr>
<tr>
<td>$V_h$</td>
<td>holding voltage</td>
<td>TLP; 100 ns; $T_{amb} = 25$ °C</td>
<td>-</td>
<td>5.5</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$V_{t1}$</td>
<td>trigger voltage</td>
<td></td>
<td>-</td>
<td>8.2</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$I_{RM}$</td>
<td>reverse leakage current</td>
<td>$V_R = 5.5$ V; $T_{amb} = 25$ °C</td>
<td>-</td>
<td>0.1</td>
<td>50</td>
<td>nA</td>
</tr>
<tr>
<td>$C_d$</td>
<td>diode capacitance</td>
<td>$f = 1$ MHz; $V_R = 0$ V; $T_{amb} = 25$ °C</td>
<td>-</td>
<td>5.3</td>
<td>6</td>
<td>pF</td>
</tr>
<tr>
<td>$V_{CL}$</td>
<td>clamping voltage</td>
<td>$I_{PPM} = 5.4$ A; $t_p = 8/20$ μs; $T_{amb} = 25$ °C</td>
<td>[1]</td>
<td>-</td>
<td>9</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{PP} = 8$ A; $t_p = TLP; T_{amb} = 25$ °C</td>
<td>[2]</td>
<td>7.8</td>
<td>9</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{PP} = 16$ A; $t_p = TLP; T_{amb} = 25$ °C</td>
<td>[2]</td>
<td>9.7</td>
<td>12</td>
<td>V</td>
</tr>
<tr>
<td>$R_{dyn}$</td>
<td>dynamic resistance</td>
<td>$I_R = 10$ A; $T_{amb} = 25$ °C</td>
<td>[2]</td>
<td>-</td>
<td>0.24</td>
<td>Ω</td>
</tr>
</tbody>
</table>

[1] Device stressed with 8/20 μs exponential decay waveform according to IEC 61000-4-5.


### Fig. 3. V-I characteristics for a bidirectional ESD diode

### Fig. 4. Diode capacitance as a function of reverse voltage; typical values
Ultra low clamping bidirectional ESD protection diode

$t_p = 100$ ns; Transmission Line Pulse (TLP)

*Fig. 5. Positive clamping voltage (TLP); typical values*

*Fig. 6. Negative clamping voltage (TLP); typical values*

*Fig. 7. ESD clamping test setup and waveforms*
Ultra low clamping bidirectional ESD protection diode

Fig. 8. Clamped +8 kV pulse waveform (IEC 61000-4-2 network)

Fig. 9. Clamped -8 kV pulse waveform (IEC 61000-4-2 network)
10. Application information

The device is designed for the protection of one bidirectional data line from surge pulses and ESD
damage. The device is suitable on lines where the signal polarities are both positive and negative
with respect to ground. The device is not designed to be used on lines connected to a DC supply.

Fig. 10. Application diagram

Circuit board layout and protection device placement

Circuit board layout is critical for the suppression of ESD, Electrical Fast Transient (EFT) and surge
transients. The following guidelines are recommended:

1. Place the device as close to the input terminal or connector as possible.
2. Minimize the path length between the device and the protected line.
3. Keep parallel signal paths to a minimum.
4. Avoid running protected conductors in parallel with unprotected conductors.
5. Minimize all Printed-Circuit Board (PCB) conductive loops including power and ground loops.
6. Minimize the length of the transient return path to ground.
7. Avoid using shared transient return paths to a common ground point.
8. Use ground planes whenever possible. For multilayer PCBs, use ground vias.
11. Package outline

Leadless ultra small package; 2 terminals; body 0.6 x 0.3 x 0.3 mm  

SOD962-2

Dimensions (mm are the original dimensions)

<table>
<thead>
<tr>
<th>Unit</th>
<th>A</th>
<th>A₁</th>
<th>b</th>
<th>D</th>
<th>E</th>
<th>e₁</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>max</td>
<td>0.32</td>
<td>0.03</td>
<td>0.25</td>
<td>0.325</td>
<td>0.625</td>
<td>0.15</td>
</tr>
<tr>
<td>nom</td>
<td>0.28</td>
<td>0.23</td>
<td>0.275</td>
<td>0.575</td>
<td>0.4</td>
<td>0.13</td>
<td></td>
</tr>
</tbody>
</table>

Note
1. The marking bar indicates the cathode.

Fig. 11. Package outline DSN0603-2 (SOD962-2)
12. Soldering

Fig. 12. Reflow soldering footprint for DSN0603-2 (SOD962-2)
13. Revision history

Table 7. Revision history

<table>
<thead>
<tr>
<th>Data sheet ID</th>
<th>Release date</th>
<th>Data sheet status</th>
<th>Change notice</th>
<th>Supersedes</th>
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<tbody>
<tr>
<td>PESD5V5U1BCSF v.1</td>
<td>20200716</td>
<td>Product data sheet</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Ultra low clamping bidirectional ESD protection diode

14. Legal information

Data sheet status

<table>
<thead>
<tr>
<th>Document status</th>
<th>Product status</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preliminary</td>
<td>Qualification</td>
<td>This document contains data from the preliminary specification.</td>
</tr>
<tr>
<td>Development</td>
<td></td>
<td>This document contains data from the product development.</td>
</tr>
<tr>
<td>Production</td>
<td></td>
<td>This document contains the product specification.</td>
</tr>
</tbody>
</table>

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