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): \( I_{PPM} = 8.3 \text{ A} \) (average measured)
- Very low clamping voltage: \( V_{CL} = 8.9 \text{ V} \) max for 7.1 A, 8/20 µs pulse
- Ultra low leakage current: \( I_{RM} < 1 \text{ nA} \)
- ESD protection up to 27 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 Descriptions</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(C_d)</td>
<td>diode capacitance</td>
<td>( f = 1 \text{ MHz}; V_R = 0 \text{ V}; T_{amb} = 25 \text{ °C} )</td>
<td>-</td>
<td>8.5</td>
<td>10</td>
<td>pF</td>
</tr>
<tr>
<td>(I_{PPM})</td>
<td>rated peak pulse current</td>
<td>( t_p = 8/20 \mu\text{s} )</td>
<td>[1]</td>
<td>-</td>
<td>7.1</td>
<td>A</td>
</tr>
<tr>
<td>(V_{RWM})</td>
<td>reverse standoff voltage</td>
<td>( T_{amb} = 25 \text{ °C} )</td>
<td>-</td>
<td>-</td>
<td>3.3</td>
<td>V</td>
</tr>
</tbody>
</table>

[2] Average measured \( I_{PPM} = 8.3 \text{ A} \).
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><img src="image1" alt="Simplified outline" /></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>K2</td>
<td>cathode (diode 2)</td>
<td></td>
<td></td>
</tr>
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6. Ordering information

Table 3. Ordering information

<table>
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<tr>
<th>Type number</th>
<th>Package Name</th>
<th>Description</th>
<th>Version</th>
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</thead>
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<tr>
<td>PESD3V3V1BCSF</td>
<td>DSN0603-2</td>
<td>Leadless ultra small package; 2 terminals; body 0.6 x 0.3 x 0.3 mm</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>
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<tbody>
<tr>
<td>PESD3V3V1BCSF</td>
<td>T</td>
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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>Typ</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>[1][2]</td>
<td>-</td>
<td>7.1</td>
<td>A</td>
</tr>
<tr>
<td>T_j</td>
<td>junction temperature</td>
<td></td>
<td>-</td>
<td>150</td>
<td>-</td>
<td>°C</td>
</tr>
<tr>
<td>T_{amb}</td>
<td>ambient temperature</td>
<td></td>
<td>-40</td>
<td>125</td>
<td>-</td>
<td>°C</td>
</tr>
<tr>
<td>T_{stg}</td>
<td>storage temperature</td>
<td></td>
<td>-65</td>
<td>150</td>
<td>-</td>
<td>°C</td>
</tr>
</tbody>
</table>

ESD maximum ratings

<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_{ESD}</td>
<td>electrostatic discharge voltage</td>
<td>IEC 61000-4-2; contact discharge</td>
<td>[3]</td>
<td>-</td>
<td>27</td>
<td>kV</td>
</tr>
<tr>
<td></td>
<td>IEC 61000-4-2; air discharge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[2] Average measured \(I_{PPM} = 8.3\) A.

Fig. 1. 8/20 µs pulse waveform according to IEC 61000-4-5

Fig. 2. ESD pulse waveform according to IEC 61000-4-2

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>V_{RWM}</td>
<td>reverse standoff voltage</td>
<td>(T_{amb} = 25) °C</td>
<td>-</td>
<td>-</td>
<td>3.3</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>I_{RM}</td>
<td>reverse leakage current</td>
<td>(V_R = 3.3) 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>8.5</td>
<td>10</td>
<td>pF</td>
</tr>
</tbody>
</table>
Ultra low clamping bidirectional ESD protection diode

<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_CL</td>
<td>clamping voltage</td>
<td>$I_{PPM} = 7.1\ A; t_p = 8/20\ \mu s; T_{amb} = 25\ ^\circ C$</td>
<td>[1]</td>
<td>-</td>
<td>-</td>
<td>8.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{PP} = 8\ A; t_p = TLP; T_{amb} = 25\ ^\circ C$</td>
<td>-</td>
<td>-</td>
<td>5.5</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{PP} = 16\ A; t_p = TLP; T_{amb} = 25\ ^\circ C$</td>
<td>[2]</td>
<td>-</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>R_dyn</td>
<td>dynamic resistance</td>
<td>$I_R = 10\ A; T_{amb} = 25\ ^\circ C$</td>
<td>[2]</td>
<td>-</td>
<td>0.17</td>
<td>-</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 protection diode

Fig. 4. Diode capacitance as a function of reverse voltage; typical values

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

Fig. 6. Negative clamping voltage (TLP); typical values
Fig. 7. ESD clamping test setup and waveforms

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.

![Application diagram](image)

**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**

![Package outline](image)

**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>
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<tr>
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<th>Data sheet status</th>
<th>Change notice</th>
<th>Supersedes</th>
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<td>PESD3V3V1BCSF v.1</td>
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<td>• Table 5 Limiting values: $V_{ESD}$ maximum robustness (contact and air discharge) changed to 27 kV.</td>
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14. Legal information

Data sheet status

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Objective [short] data sheet: Development

This document contains data from the objective specification for product development.

Preliminary [short] data sheet: Qualification

This document contains data from the preliminary specification.

Product [short] data sheet: Production

This document contains the product specification.

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