PESD3V3MS-SF
Ultra low clamping bidirectional ESD protection diode
27 April 2020
Product data sheet

1. General description

Ultra low clamping bidirectional ElectroStatic Discharge (ESD) protection diode, part of the TrEOS protection family. The device is housed in a DSN0603-2 (SOD962-2) leadless ultra small Surface-Mounted Device (SMD) package 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
- Surge robustness $I_{PPM} = 18$ A according to IEC 61000-4-5
- Low diode capacitance $C_d = 5$ pF
- Ultra low clamping to protect sensitive I/Os
- Extremely low-inductance protection path to ground
- ESD protection up to ± 30 kV according to IEC 61000-4-2
- Ultra small SMD package

3. Applications

- Cellular handsets and accessories
- Portable electronics
- Communication systems
- Computers and peripherals

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></td>
<td>-</td>
<td>-</td>
<td>3.3</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>-</td>
<td>5</td>
<td>pF</td>
</tr>
</tbody>
</table>
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></td>
<td></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>Name</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>PESD3V3MS-SF</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>
<td></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>PESD3V3MS-SF</td>
<td>g</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>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{RWM} )</td>
<td>reverse standoff voltage</td>
<td>-</td>
<td>3.3</td>
</tr>
<tr>
<td>( I_{PPM} )</td>
<td>rated peak pulse current ( t_p = 8/20 \mu s )</td>
<td>[1] [2]</td>
<td>-</td>
</tr>
<tr>
<td>( T_{amb} )</td>
<td>ambient temperature</td>
<td>-40</td>
<td>125</td>
</tr>
<tr>
<td>( T_{stg} )</td>
<td>storage temperature</td>
<td>-65</td>
<td>150</td>
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</table>

**ESD maximum ratings**

<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_{ESD} )</td>
<td>electrostatic discharge voltage</td>
<td>IEC 61000-4-2; contact discharge</td>
<td>[3]</td>
<td>-30</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IEC 61000-4-2; air discharge</td>
<td>[3]</td>
<td>-30</td>
<td>30</td>
</tr>
</tbody>
</table>

[1] Device stressed with 8/20 μs exponential decay waveform according to IEC 61000-4-5.
[2] In positive and negative direction.

---

**Fig. 1.** 8/20 μs pulse waveform according to IEC 61000-4-5 and IEC 61643-321

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

Table 6. Characteristics

$t_{\text{amb}} = 25^\circ\text{C unless otherwise specified.}$

<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>$V_{\text{BR}}$</td>
<td>breakdown voltage</td>
<td>$I_R = 1$ mA</td>
<td>-</td>
<td>7</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$I_{\text{RM}}$</td>
<td>reverse leakage current</td>
<td>$V_{\text{RWM}} = 3.3$ V; $T_{\text{amb}} = 25$ °C</td>
<td>-</td>
<td>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; $T_{\text{amb}} = 25$ °C</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>pF</td>
</tr>
<tr>
<td>$V_{\text{CL}}$</td>
<td>clamping voltage</td>
<td>$I_{\text{PPM}} = 18$ A</td>
<td>[1]</td>
<td>-</td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>$R_{\text{dyn}}$</td>
<td>dynamic resistance</td>
<td>$I_R = 10$ A</td>
<td>[2]</td>
<td>-</td>
<td>0.11</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_R = -10$ A</td>
<td>[2]</td>
<td>-</td>
<td>0.11</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.** Dynamic resistance with positive clamping; typical values

**Fig. 4.** Dynamic resistance with negative clamping; typical values
Ultra low clamping bidirectional ESD protection diode

Fig. 5. Dynamic resistance with positive clamping; typical values

Fig. 6. Dynamic resistance with negative clamping; typical values

Fig. 7. Dynamic resistance with positive clamping; typical values

Fig. 8. Dynamic resistance with negative clamping; typical values
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 uses an advanced clamping structure showing a negative dynamic resistance. This snap-back behavior strongly reduces the clamping voltage to the system behind the ESD protection during an ESD event. Do not connect unlimited DC current sources to the data lines to avoid keeping the ESD protection device in snap-back state after exceeding breakdown voltage (due to an ESD pulse for instance).

![Application diagram](image)

**Fig. 9. 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

![Package Outline Diagram]

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>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>0.15</td>
</tr>
<tr>
<td></td>
<td>nom</td>
<td>0.28</td>
<td>0.23</td>
<td>0.275</td>
<td>0.575</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>min</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.13</td>
</tr>
</tbody>
</table>

Note
1. The marking bar indicates the cathode.

Fig. 10. Package outline DSN0603-2 (SOD962-2)
12. Soldering

**Fig. 11. Reflow soldering footprint for DSN0603-2 (SOD962-2)**

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**Footprint information for reflow soldering of leadless ultra small package; 2 terminals**

**SOD962-2**

- **Occupied area**
- **Solder paste**
- **Solder lands**

Dimensions in mm:
- 0.256
- 0.256
- 0.16
- 0.676
- 0.2
- 0.2
- 0.4
- 0.6
- 0.85
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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<td>PESD3V3MS-SF v.2</td>
<td>20200427</td>
<td>Product data sheet</td>
<td>-</td>
<td>PESD3V3MS-SF v.1</td>
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<td>Modifications:</td>
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<td>Editorial update</td>
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<td>PESD3V3MS-SF v.1</td>
<td>20181129</td>
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Product data sheet 27 April 2020
# 14. Legal information

## Data sheet status

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<tr>
<td>Objective [short] data sheet</td>
<td>Development</td>
<td>This document contains data from the objective specification for product development.</td>
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<tr>
<td>Preliminary [short] data sheet</td>
<td>Qualification</td>
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<tr>
<td>Product [short] data sheet</td>
<td>Production</td>
<td>This document contains the product specification.</td>
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</table>

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Ultra low clamping bidirectional ESD protection diode

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Date of release: 27 April 2020