1. General description

Extremely low capacitance bidirectional ElectroStatic Discharge (ESD) protection diode, part of the TrEOS protection family. This 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
- \( V_{RWM} = 30 \text{ V} \)
- Extremely low diode capacitance \( C_d = 0.19 \text{ pF} \) typical
- Extremely low clamping voltage to protect sensitive I/Os
- Extremely low-inductance protection path to ground
- ESD protection up to ±10 kV according to IEC 61000-4-2
- Ultra small SMD package

3. Applications

- Cellular handsets and accessories
- Portable electronics
- Communication systems
- Computers and peripherals
- Antenna protection
- USB3.2 and HDMI2.0 data lines

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>-30</td>
<td>-</td>
<td>30</td>
<td>V</td>
</tr>
<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>0.19</td>
<td>0.23</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>PESD30VF1BSF</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>PESD30VF1BSF</td>
<td>E1</td>
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</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>VRWM</td>
<td>reverse standoff voltage</td>
<td>IEC 61000-4-2; contact discharge</td>
<td>-30</td>
<td>30</td>
<td>V</td>
</tr>
<tr>
<td>T_{amb}</td>
<td>ambient temperature</td>
<td>IEC 61000-4-2; contact discharge</td>
<td>-40</td>
<td>125</td>
<td>°C</td>
</tr>
<tr>
<td>T_{stg}</td>
<td>storage temperature</td>
<td>IEC 61000-4-2; air discharge</td>
<td>-65</td>
<td>150</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>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>-10</td>
<td>10</td>
<td>kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IEC 61000-4-2; air discharge</td>
<td>-10</td>
<td>10</td>
<td>kV</td>
</tr>
</tbody>
</table>


Fig. 1. ESD pulse waveform according to IEC 61000-4-2

Fig. 2. V-I characteristics for a bidirectional ESD protection diode
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>$V_{\text{RWM}}$</td>
<td>reverse standoff voltage</td>
<td>$T_{\text{amb}} = 25 , {^\circ}\text{C}$</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>V</td>
</tr>
<tr>
<td>$V_{\text{BR}}$</td>
<td>breakdown voltage</td>
<td>$I_R = 1 , \text{mA}; \ T_{\text{amb}} = 25 , {^\circ}\text{C}$</td>
<td>31</td>
<td>35</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$I_{\text{RM}}$</td>
<td>reverse leakage current</td>
<td>$V_R = 30 , \text{V}; \ T_{\text{amb}} = 25 , {^\circ}\text{C}$</td>
<td>-</td>
<td>1</td>
<td>30</td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_R = -30 , \text{V}; \ T_{\text{amb}} = 25 , {^\circ}\text{C}$</td>
<td>-1</td>
<td>-1</td>
<td>-30</td>
<td>nA</td>
</tr>
<tr>
<td>$C_d$</td>
<td>diode capacitance</td>
<td>$f = 1 , \text{MHz}; \ V_R = 0 , \text{V}; \ T_{\text{amb}} = 25 , {^\circ}\text{C}$</td>
<td>-</td>
<td>0.19</td>
<td>0.23</td>
<td>pF</td>
</tr>
<tr>
<td>$V_{\text{CL}}$</td>
<td>clamping voltage</td>
<td>$I_{\text{TLP}} = 8 , \text{A}; \ T_{\text{amb}} = 25 , {^\circ}\text{C}$</td>
<td>[1]</td>
<td>18</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{\text{TLP}} = 16 , \text{A}; \ T_{\text{amb}} = 25 , {^\circ}\text{C}$</td>
<td>[1]</td>
<td>20.5</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$R_{\text{dyn}}$</td>
<td>dynamic resistance</td>
<td>$I_R = 7.5 , \text{A}; \ T_{\text{amb}} = 25 , {^\circ}\text{C}$</td>
<td>[1]</td>
<td>0.8</td>
<td>-</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_R = -7.5 , \text{A}; \ T_{\text{amb}} = 25 , {^\circ}\text{C}$</td>
<td>[1]</td>
<td>0.8</td>
<td>-</td>
<td>Ω</td>
</tr>
</tbody>
</table>

[1] Non-repetitive current pulse, Transmission Line Pulse (TLP); square pulse; ANSI / ESD STM5.5.1-2008

Fig. 3. Insertion loss; typical values

Fig. 4. Capacitance as a function of reverse standoff voltage; typical values
Exremely low capacitance bidirectional ESD protection diode

Fig. 5. Dynamic resistance with positive clamping; typical values
Transmission Line Pulse (TLP); $t_p = 100$ ns; $t_r = 1$ ns

Fig. 6. Dynamic resistance with negative clamping; typical values
Transmission Line Pulse (TLP); $t_p = 100$ ns; $t_r = 1$ ns

Fig. 7. Dynamic resistance with positive clamping; typical values
Very-Fast Transmission Line Pulse (VF-TLP); $t_p = 5$ ns; $t_r = 600$ ps

Fig. 8. Dynamic resistance with negative clamping; typical values
Very-Fast Transmission Line Pulse (VF-TLP); $t_p = 5$ ns; $t_r = 600$ ps
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).

---

**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

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>0.32</td>
<td>0.325</td>
<td>0.325</td>
<td>0.625</td>
<td>0.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nom</td>
<td>0.28</td>
<td>0.275</td>
<td>0.275</td>
<td>0.575</td>
<td>0.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>min</td>
<td>0.23</td>
<td>0.23</td>
<td>0.23</td>
<td>0.4</td>
<td>0.13</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note
1. The marking bar indicates the cathode.

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

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

SOD962-2

![Footprint diagram]

- Occupied area
- Solder lands

Dimensions in mm:
- 0.28
- 0.16
- 0.256
- 0.85
- 0.6
- 0.4
- 0.2

Recommended stencil thickness: 0.1 mm

Fig. 11. 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>
</tr>
</thead>
<tbody>
<tr>
<td>PESD30VF1BSF v.1</td>
<td>20230621</td>
<td>Product data sheet</td>
<td>-</td>
<td>-</td>
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</table>
Nexperia

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><a href="f">1</a></td>
<td>[2]</td>
<td>[3]</td>
</tr>
</tbody>
</table>

Objective (short) data sheet
Development
This document contains data from the respective 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.

[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".
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 Extremely low capacitance bidirectional ESD protection diode

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