1. General description

Ultra low capacitance double rail-to-rail ElectroStatic Discharge (ESD) protection diode in a small SOT143B Surface-Mounted Device (SMD) plastic package.

The device is designed to protect two high-speed data lines or high-frequency signal lines from the damage caused by ESD and other transients.

The device integrates two ultra low capacitance rail-to-rail diodes and one additional ESD protection diode to ensure signal line protection even if no supply voltage is available.

2. Features and benefits

- ESD protection of two high-speed data lines
- Ultra low capacitance: $C_d = 1\ \text{pF}$
- IEC 61000-4-2 up to 8 kV
- Very low reverse current
- AEC-Q101 qualified

3. Applications

- 100BASE-T1 / OPEN Alliance BroadR-Reach automotive Ethernet
- Low-Voltage Differential Signaling (LVDS) automotive
- USB 2.0 automotive

4. Quick reference data

<table>
<thead>
<tr>
<th>Table 1. Quick reference data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>Per diode</td>
</tr>
<tr>
<td>$C_d$</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>$V_{\text{RWM}}$</td>
</tr>
</tbody>
</table>

[1] Measured from pin 2 and 3 to ground.
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>GND</td>
<td>ground</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I/O 1</td>
<td>input/output 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>I/O 2</td>
<td>input/output 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>V CC</td>
<td>supply line</td>
<td></td>
<td></td>
</tr>
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</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>PESD2ETH-X</td>
<td>SOT143B</td>
<td>SOT143B</td>
<td>plastic surface-mounted package; 4 leads</td>
<td>SOT143B</td>
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</tbody>
</table>

Table 4. Marking codes

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking code</th>
<th>[1]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PESD2ETH-X</td>
<td>2B%</td>
<td></td>
</tr>
</tbody>
</table>

[1] % = placeholder for manufacturing site code
7. 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>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>-55</td>
<td>125</td>
<td>°C</td>
</tr>
<tr>
<td>V_{ESD}</td>
<td>electrostatic discharge voltage</td>
<td>IEC 61000-4-2; level 4; contact discharge</td>
<td>-</td>
<td>8</td>
<td>kV</td>
</tr>
</tbody>
</table>

![Fig. 1. ESD pulse waveform according to IEC 61000-4-2](image-url)
8. 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>$T_{amb} = 25 , ^\circ C$</td>
<td>-</td>
<td>-</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>$V_{BR}$</td>
<td>breakdown voltage</td>
<td>$I_R = 1 , mA; \ T_{amb} = 25 , ^\circ C$</td>
<td>[1] 6</td>
<td>-</td>
<td>9</td>
<td>V</td>
</tr>
<tr>
<td>$V_F$</td>
<td>forward voltage</td>
<td>$I_F = 1 , mA; \ T_{amb} = 25 , ^\circ C$</td>
<td>[2] -</td>
<td>0.7</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$I_R$</td>
<td>reverse current</td>
<td>$V_R = 3 , V; \ T_{amb} = 25 , ^\circ C$</td>
<td>[3] -</td>
<td>1</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>$C_d$</td>
<td>diode capacitance</td>
<td>$f = 1 , MHz; \ V_R = 0 , V; \ T_{amb} = 25 , ^\circ C$</td>
<td>[2] -</td>
<td>1</td>
<td>1.5</td>
<td>pF</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[4] -</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[1] -</td>
<td>16</td>
</tr>
</tbody>
</table>

[1] Measured from pin 4 to ground.
[3] Measured from pin 2, 3 and 4 to ground.

Fig. 2. Diode capacitance as a function of reverse voltage; typical values

Fig. 3. Diode capacitance as a function of reverse voltage; typical values

f = 1 MHz; $T_{amb} = 25 \, ^\circ C$

Measured from pin 2 and 3 to ground.

f = 1 MHz; $T_{amb} = 25 \, ^\circ C$

Measured from pin 2 to pin 3.
Fig. 4. ESD clamping test setup and waveforms

Fig. 5. Clamped +8 kV pulse waveform (IEC 61000-4-2 network)

Fig. 6. Clamped -8 kV pulse waveform (IEC 61000-4-2 network)
9. Application information

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.

10. Test information

10.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - Stress test qualification for discrete semiconductors, and is suitable for use in automotive applications.
11. Package outline

Fig. 8. Package outline SOT143B

12. Soldering

Fig. 9. Reflow soldering footprint for SOT143B
Ultra low capacitance double rail-to-rail ESD protection diode

Fig. 10. Wave soldering footprint for SOT143B
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>PESD2ETH-X v.1</td>
<td>20160224</td>
<td>Product data sheet</td>
<td>-</td>
<td>-</td>
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</tbody>
</table>
14. Legal information

14.1 Data sheet status

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

[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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nexperia.com.

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