1. General description

Ultra low capacitance double rail-to-rail ElectroStatic Discharge (ESD) protection diode in a small SOT457 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: \( C_D = 2 \text{ pF} \)
- ISO 10605 (330 pF, 2 kΩ) up to 23 kV
- ESD protection up to 12 kV (IEC61000-4-2)
- 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>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_{R\text{W}} )</td>
<td>reverse standoff voltage</td>
<td>( T_{\text{amb}} = 25 \degree \text{C} )</td>
<td>-</td>
<td>-</td>
<td>5.5</td>
<td>V</td>
</tr>
</tbody>
</table>

**Zener diode**

\( C_D \) diode capacitance

\( f = 1 \text{ MHz}; \ V_R = 0 \text{ V}; \ T_{\text{amb}} = 25 \degree \text{C} \)

[1] Measured from pin 5 to ground.

**Per channel**

\( C_D \) diode capacitance

\( f = 1 \text{ MHz}; \ V_R = 0 \text{ V}; \ T_{\text{amb}} = 25 \degree \text{C} \)

[2] Measured from pin 4 or 6 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>I/O 1</td>
<td>input/output 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>ground</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>I/O 2</td>
<td>input/output 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>V_CC</td>
<td>supply voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>I/O 1</td>
<td>input/output 1</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>PESD2ETH-AD</td>
<td>TSOP6</td>
<td>plastic, surface-mounted package (SC-74)</td>
<td>SOT457</td>
<td></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>PESD2ETH-AD</td>
<td>L9</td>
</tr>
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</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>[1]</td>
<td>3.5</td>
<td>A</td>
</tr>
<tr>
<td>T_{amb}</td>
<td>ambient temperature</td>
<td></td>
<td>-55</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>T_{stg}</td>
<td>storage temperature</td>
<td>IEC 61000-4-2; contact discharge</td>
<td>[3]</td>
<td>-</td>
<td>12 kV</td>
</tr>
<tr>
<td>V_{ESD}</td>
<td>electrostatic discharge voltage</td>
<td>MIL-STD-883 (human body model)</td>
<td>[2]</td>
<td>-</td>
<td>10 kV</td>
</tr>
</tbody>
</table>

[2] Measured from pin 1,3,4 or 6 to GND.

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>$T_{amb} = 25 , ^\circ C$</td>
<td>-</td>
<td>-</td>
<td>5.5</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>-</td>
<td>0.7</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$I_{RM}$</td>
<td>reverse leakage current</td>
<td>$V_R = 5.5 , V; \ T_{amb} = 25 , ^\circ C$</td>
<td>[1]</td>
<td>1</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>$V_{CL}$</td>
<td>clamping voltage</td>
<td>$I_{PPM} = 3.5 , A; \ 8/20 , \mu s; \ T_{amb} = 25 , ^\circ C$</td>
<td>[1]</td>
<td>12.3</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$R_{dyn}$</td>
<td>dynamic resistance</td>
<td>$I_R = 10 , A; \ T_{amb} = 25 , ^\circ C$</td>
<td>[1] [2]</td>
<td>0.83</td>
<td>-</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zener diode</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{BR}$</td>
<td>breakdown voltage</td>
<td>$I_R = 1 , mA; \ T_{amb} = 25 , ^\circ C$</td>
<td>[3]</td>
<td>6</td>
<td>9</td>
<td>V</td>
</tr>
<tr>
<td>$C_d$</td>
<td>diode capacitance</td>
<td>$f = 1 , MHz; \ V_R = 0 , V; \ T_{amb} = 25 , ^\circ C$</td>
<td>[3]</td>
<td>20</td>
<td>-</td>
<td>pF</td>
</tr>
<tr>
<td>Per channel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></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>[4]</td>
<td>2</td>
<td>2.3</td>
<td>pF</td>
</tr>
</tbody>
</table>

[1] Measured from pin 1,3,4 or 6 to GND.
[2] Non-repetitive current pulse, Transmission Line Pulse (TLP) $t_p = 100 \, ns$; square pulse; ANSI / ESD STM5.5.1-2008.
[3] Measured from pin 5 to ground.
[4] Measured from pin 4 or 6 to ground.

---

**Fig. 3.** Input/output to ground capacitance as a function of reverse voltage

**Fig. 4.** Dynamic resistance with positive clamping; typical values; Input/output to ground
**Fig. 5. Dynamic resistance with negative clamping; typical values; Input/output to ground**

**Fig. 6. ESD clamping test setup and waveforms**
10. 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.

Fig. 9. Application diagram: BroadR-Reach PHY / 100BASE-T1
11. Test information

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.
12. Package outline

Plastic surface-mounted package (TSOP6); 6 leads

**Fig. 10. Package outline TSOP6 (SOT457)**
13. Soldering

Fig. 11. Reflow soldering footprint for TSOP6 (SOT457)

Fig. 12. Wave soldering footprint for TSOP6 (SOT457)
14. 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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<tr>
<td>PESD2ETH-AD v.1</td>
<td>20171214</td>
<td>Product data sheet</td>
<td>-</td>
<td>-</td>
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15. Legal information

Data sheet status

<table>
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<tr>
<th>Document status</th>
<th>Product status</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1][2]</td>
<td>[3]</td>
<td>This document contains data from the objective specification for product development.</td>
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<td>Objective [short] data sheet</td>
<td>Development</td>
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<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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