1. General description

Two bidirectional ElectroStatic Discharge (ESD) protection diodes designed to protect two signal lines from the damage caused by ESD and other transients.

The device is housed in a leadless ultra small DFN1010D-3 (SOT1215) Surface-Mounted Device (SMD) plastic package with visible and solderable side pads.

2. Features and benefits

- Bidirectional ESD protection of two lines
- Ultra small SMD plastic package
- ESD protection up to 30 kV
- AEC-Q101 qualified
- IEC 61000-4-5 (surge): $I_{PPM} = 14$ A
- IEC 61000-4-5 (surge): $I_{PPM} = 28$ A combined lines
- Ultra low leakage current: $I_{RM} = 1$ nA

3. Applications

- Computers and peripherals
- Audio and video equipment
- Cellular handsets and accessories
- Communication systems
- Portable electronics

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>$T_{amb} = 25$ °C</td>
<td>-</td>
<td>-</td>
<td>5</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; single line</td>
<td>[1]</td>
<td>-</td>
<td>35</td>
<td>45</td>
</tr>
</tbody>
</table>

[1] Measured from pin 1 or 2 to pin 3.
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</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>K2</td>
<td>cathode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>CC</td>
<td>common cathode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>CC</td>
<td>common cathode</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Ordering information

Table 3. Ordering information

<table>
<thead>
<tr>
<th>Type number</th>
<th>Package Name</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>PESD5V0S2BQA</td>
<td>DFN1010D-3</td>
<td>DFN1010D-3: plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body 1.1 x 1.0 x 0.37 mm</td>
<td>SOT1215</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>PESD5V0S2BQA</td>
<td>00 01 10</td>
</tr>
</tbody>
</table>

Fig. 1. DFN1010D-3 (SOT1215) binary marking code description
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>peak pulse current</td>
<td>(t_p = 8/20 , \mu s;) single line</td>
<td>[1][2]</td>
<td>-</td>
<td>14 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(t_p = 8/20 , \mu s;) combined lines</td>
<td>[1][3]</td>
<td>-</td>
<td>28 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(t_p = 8/20 , \mu s;) average measured; single line</td>
<td>[1][2]</td>
<td>-</td>
<td>17.5 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(t_p = 8/20 , \mu s;) average measured; combined lines</td>
<td>[1][3]</td>
<td>-</td>
<td>35 A</td>
</tr>
<tr>
<td>(T_j)</td>
<td>junction temperature</td>
<td></td>
<td>-</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>(T_{amb})</td>
<td>ambient temperature</td>
<td></td>
<td>-55</td>
<td>125</td>
<td>°C</td>
</tr>
<tr>
<td>(T_{stg})</td>
<td>storage temperature</td>
<td></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>contact discharge</td>
<td>[4][2]</td>
<td>-</td>
<td>30 kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>air discharge</td>
<td>[4][2]</td>
<td>-</td>
<td>30 kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>human body model (MIL-STD-883)</td>
<td></td>
<td>-</td>
<td>10 kV</td>
</tr>
</tbody>
</table>

[1] Device stressed with non-repetitive current pulses (8/20 \, \mu s exponential decay waveform according to IEC 61000-4-5).
[2] Measured from pin 1 or 2 to pin 3.

![Fig. 2. 8/20 \, \mu s pulse waveform according to IEC 61000-4-5](image)

![Fig. 3. ESD pulse waveform according to IEC 61000-4-2](image)
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>$T_{\text{amb}} = 25 , ^\circ C$</td>
<td></td>
<td></td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>$V_{BR}$</td>
<td>breakdown voltage</td>
<td>$I_R = 5 , mA; \ T_{\text{amb}} = 25 , ^\circ C$</td>
<td>5.5</td>
<td>7</td>
<td>9.5</td>
<td>V</td>
</tr>
<tr>
<td>$I_{RM}$</td>
<td>reverse leakage current</td>
<td>$V_R = 5 , V; \ T_{\text{amb}} = 25 , ^\circ C$</td>
<td></td>
<td>1</td>
<td>50</td>
<td>nA</td>
</tr>
<tr>
<td>$C_d$</td>
<td>diode capacitance</td>
<td>$f = 1 , MHz; \ V_R = 0 , V; \ T_{\text{amb}} = 25 , ^\circ C$; single line</td>
<td></td>
<td>35</td>
<td>45</td>
<td>pF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$f = 1 , MHz; \ V_R = 0 , V; \ T_{\text{amb}} = 25 , ^\circ C$; combined lines</td>
<td></td>
<td>70</td>
<td>90</td>
<td>pF</td>
</tr>
<tr>
<td>$V_{CL}$</td>
<td>clamping voltage</td>
<td>$I_{PP} = 1 , A; \ T_{\text{amb}} = 25 , ^\circ C; \ t_p = 8/20 , \mu s$; single line</td>
<td></td>
<td>6.5</td>
<td>8.5</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{PPM} = 14 , A; \ T_{\text{amb}} = 25 , ^\circ C; \ t_p = 8/20 , \mu s$; single line</td>
<td></td>
<td>6.5</td>
<td>11.5</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{PPM} = 28 , A; \ T_{\text{amb}} = 25 , ^\circ C; \ t_p = 8/20 , \mu s$; combined lines</td>
<td></td>
<td>11.5</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{PPM} = 16 , A; \ T_{\text{amb}} = 25 , ^\circ C; \ t_p = \text{TLP}$; single line</td>
<td></td>
<td>8.5</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{PPM} = 16 , A; \ T_{\text{amb}} = 25 , ^\circ C; \ t_p = \text{TLP}$; combined lines</td>
<td></td>
<td>7.6</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$R_{\text{dyn}}$</td>
<td>dynamic resistance</td>
<td>$I_R = 10 , A; \ T_{\text{amb}} = 25 , ^\circ C$; single line</td>
<td></td>
<td>0.12</td>
<td>-</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_R = 10 , A; \ T_{\text{amb}} = 25 , ^\circ C$; combined lines</td>
<td></td>
<td>0.07</td>
<td>-</td>
<td>Ω</td>
</tr>
</tbody>
</table>

[1] Measured from pin 1 or 2 to pin 3.
[3] Device stressed with 8/20 \, \mu s exponential decay waveform according to IEC 61000-4-5.
Fig. 4. V-I characteristics for a bidirectional ESD protection diode

Fig. 5. Relative variation of reverse leakage current as a function of ambient temperature; typical values

Fig. 6. Diode capacitance as a function of reverse voltage; typical values

Fig. 7. Dynamic resistance with positive clamping voltage; typical values
Protection against high surge currents in ultra small DFN1010D-3 package

**Fig. 8. Dynamic resistance with negative clamping voltage; typical values**

\[ V_{CL} (V) \]

- Single line: \( R_{dyn} = 0.12 \, \Omega \)
- Combined lines: \( R_{dyn} = 0.05 \, \Omega \)

\[ t_p = 100 \, ns; \text{ Transmission Line Pulse (TLP)} \]

**Fig. 9. Dynamic resistance with positive clamping voltage; typical values**

\[ V_{CL} (V) \]

- Single line
- Combined lines

\[ t_p = 8/20 \, \mu s; \text{ according to IEC 61000-4-5} \]

**Fig. 10. Dynamic resistance with negative clamping voltage; typical values**

\[ V_{CL} (V) \]

- Single line
- Combined lines

\[ t_p = 8/20 \, \mu s; \text{ according to IEC 61000-4-5} \]
Protection against high surge currents in ultra small DFN1010D-3 package

Fig. 11. ESD clamping test setup and waveforms

**Fig. 11. ESD clamping test setup and waveforms**

- **Fig. 12. Clamped +8 kV pulse waveform** (IEC 61000-4-2 network)
- **Fig. 13. Clamped -8 kV pulse waveform** (IEC 61000-4-2 network)
10. Application information

The device is designed for the protection of up to two bidirectional data lines from surge pulses and ESD damage.

![Application diagram]

Fig. 14. 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. 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

Fig. 15. Package outline DFN1010D-3 (SOT1215)
13. Soldering

Footprint information for reflow soldering of DFN1010D-3 package

Fig. 16. Reflow soldering footprint for DFN1010D-3 (SOT1215)
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>
</tr>
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<tbody>
<tr>
<td>PESD5V0S2BQA v.1</td>
<td>20160601</td>
<td>Product data sheet</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
15. Legal information

Data sheet status

<table>
<thead>
<tr>
<th>Document status</th>
<th>Product status</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1][2]</td>
<td></td>
<td>This document contains data from the objective specification for product development.</td>
</tr>
<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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Protection against high surge currents in ultra small DFN1010D-3 package

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For sales office addresses, please send an email to: salesaddresses@nexperia.com
Date of release: 01 June 2016