1. General description

PESD1FLEX in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package designed to protect two automotive FlexRay bus lines from the damage caused by ElectroStatic Discharge (ESD) and other transients.

2. Features and benefits

- Due to the integrated diode structure only one small SOT23 package is needed to protect two FlexRay bus lines
- Max. peak pulse power: $P_{PPM} = 200 \text{ W}$ at $t_p = 8/20 \mu\text{s}$
- Low clamping voltage: $V_{CL} = 40 \text{ V}$ at $I_{PP} = 1 \text{ A}$
- Ultra low leakage current: $I_{RM} = 1 \text{ nA}$
- Typ. diode capacitance matching: $\Delta C_d/C_d = 0.1 \%$
- ESD protection up to 23 kV
- IEC 61000-4-2, level 4 (ESD)
- IEC 61000-4-5 (surge): $I_{PPM} = 3 \text{ A}$ at $t_p = 8/20 \mu\text{s}$
- Small SMD plastic package
- AEC-Q101 qualified

3. Applications

- FlexRay bus protection
- Automotive applications

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>$T_{amb} = 25 ^\circ \text{C}$</td>
<td>[1]</td>
<td>-</td>
<td>24</td>
<td>V</td>
</tr>
<tr>
<td>$C_d$</td>
<td>diode capacitance</td>
<td>$f = 1 \text{ MHz}; V_R = 0 \text{ V}; T_{amb} = 25 ^\circ \text{C}$</td>
<td>[1]</td>
<td>11</td>
<td>17</td>
<td>pF</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 (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>
<tr>
<td>3</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</th>
<th>Name</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>PESD1FLEX</td>
<td>SOT23</td>
<td></td>
<td>plastic, surface-mounted package; 3 terminals; 1.9 mm pitch; 2.9 mm x 1.3 mm x 1 mm body</td>
<td>SOT23</td>
</tr>
</tbody>
</table>

7. Marking

Table 4. Marking codes

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking code[1]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PESD1FLEX</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

[1] % = placeholder for manufacturing site code
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>( P_{PPM} )</td>
<td>rated peak pulse power ( t_p = 8/20 \mu s )</td>
<td></td>
<td></td>
<td></td>
<td>W</td>
</tr>
<tr>
<td>( I_{PPM} )</td>
<td>rated peak pulse current</td>
<td></td>
<td></td>
<td>3</td>
<td>A</td>
</tr>
<tr>
<td>( T_j )</td>
<td>junction temperature</td>
<td></td>
<td>-150</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>( T_{amb} )</td>
<td>ambient temperature</td>
<td></td>
<td>-65</td>
<td>150</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>IEC 61000-4-2; contact discharge</td>
<td></td>
<td>23</td>
<td>kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MIL-STD-883; human body model (HBM)</td>
<td></td>
<td>10</td>
<td>kV</td>
</tr>
</tbody>
</table>

[1] Non-repetitive current pulse 8/20 \( \mu s \) exponential decay waveform according to IEC 61000-4-5.

[2] Measured from pin 1 or 2 to pin 3.


Fig. 1. **8/20 \( \mu s \) 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>$T_{\text{amb}} = 25 , ^\circ \text{C}$</td>
<td>[1]</td>
<td>-</td>
<td>-</td>
<td>24</td>
</tr>
<tr>
<td>$V_{BR}$</td>
<td>breakdown voltage</td>
<td>$I_R = 5 , \text{mA}; \ T_{\text{amb}} = 25 , ^\circ \text{C}$</td>
<td>[1]</td>
<td>25.4</td>
<td>27.8</td>
<td>30.3</td>
</tr>
<tr>
<td>$I_{R_{\text{RM}}}$</td>
<td>reverse leakage current</td>
<td>$V_{RWM} = 24 , \text{V}; \ T_{\text{amb}} = 25 , ^\circ \text{C}$</td>
<td>[1]</td>
<td>-</td>
<td>1</td>
<td>50</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>[1]</td>
<td>-</td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>$\Delta C_d/C_d$</td>
<td>diode capacitance matching</td>
<td>$f = 1 , \text{MHz}; \ V_R = 2.5 , \text{V}; \ T_{\text{amb}} = 25 , ^\circ \text{C}$</td>
<td>[2]</td>
<td>-</td>
<td>0.1</td>
<td>-</td>
</tr>
<tr>
<td>$V_{CL}$</td>
<td>clamping voltage</td>
<td>$I_{PP} = 1 , \text{A}; \ t_p = 8/20 , \mu\text{s}; \ T_{\text{amb}} = 25 , ^\circ \text{C}$</td>
<td>[3] [1]</td>
<td>-</td>
<td>-</td>
<td>40</td>
</tr>
<tr>
<td>$R_{\text{diff}}$</td>
<td>differential resistance</td>
<td>$I_R = 1 , \text{mA}; \ T_{\text{amb}} = 25 , ^\circ \text{C}$</td>
<td>[1]</td>
<td>-</td>
<td>-</td>
<td>300</td>
</tr>
</tbody>
</table>

[1] Measured from pin 1 or 2 to pin 3.
[2] $\Delta C_d$ is the difference of the capacitance measured between pin 1 and pin 3 and the capacitance measured between pin 2 and pin 3.
[3] Non-repetitive current pulse 8/20 µs exponential decay waveform according to IEC 61000-4-5.

![Fig. 3. Peak pulse power as a function of exponential pulse duration; typical values](006aa257)

![Fig. 4. Relative variation of peak pulse power as a function of junction temperature; typical values](007aa193)
Fig. 5. Diode capacitance as a function of reverse voltage; typical values

\[ f = 1 \text{ MHz}; \quad T_{\text{amb}} = 25 \degree \text{C} \]

Fig. 6. V-I characteristics for a bidirectional ESD protection diode
10. Application information

The device is designed for the protection of two automotive FlexRay data lines from the damage caused by ESD and surge pulses. The device supports a FlexRay data rate of 10 Mbit/s and provides a surge capability of up to 200 W per line for an 8/20 µs waveform.

![Diagram of FlexRay bus ESD protection diode](image)

**Fig. 7. Typical application: ESD protection of two automotive FlexRay data lines**

**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

Plastic surface-mounted package; 3 leads

SOT23

Fig. 8. Package outline SOT23
12. Soldering

Fig. 9. Reflow soldering footprint for SOT23

Fig. 10. Wave soldering footprint for SOT23
## 13. 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>20211107</td>
<td>Product data sheet</td>
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<td>PESD1FLEX v.2</td>
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**Modifications:**
- Chapter "Limiting values": removed the table for ESD standards compliance
- Chapter "Quick reference data": typo correction at parameter $C_d$
- Chapter "Characteristics": typo correction at parameter $C_d$
- Chapter "Characteristics": removed the figure "ESD clamping test setup and waveforms"
- Chapter "Packing information" removed

<table>
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<td>Product data sheet</td>
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14. Legal information

Data sheet status

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<tr>
<td>Objective [short] data sheet</td>
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<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 https://www.nexperia.com.

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