1. Product profile

1.1 General description

PESD2CAN in a small SOT23 Surface-Mounted Device (SMD) plastic package designed to protect two automotive Controller Area Network (CAN) bus lines from the damage caused by ElectroStatic Discharge (ESD) and other transients.

1.2 Features and benefits

- Max. peak pulse power: $P_{pp} = 230 \text{ W at } t_p = 8/20 \mu\text{s}$
- Low clamping voltage: $V_{CL} = 41 \text{ V at } I_{PP} = 5 \text{ A}$
- Ultra low leakage current: $I_{RM} < 1 \text{ nA}$
- ESD protection up to $30 \text{ kV}$
- IEC 61000-4-2, level 4 (ESD)
- IEC 61000-4-5 (surge); $I_{PP} = 5 \text{ A at } t_p = 8/20 \mu\text{s}$
- AEC-Q101 qualified

1.3 Applications

- CAN bus protection
- Automotive applications

1.4 Quick reference data

<table>
<thead>
<tr>
<th>Table 1. Quick reference data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symbol</strong></td>
</tr>
<tr>
<td>Per diode</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

2. Pinning information

<table>
<thead>
<tr>
<th>Table 2. Pinning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pin</strong></td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>
3. 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>PESD2CAN</td>
<td>-</td>
<td>plastic surface-mounted package; 3 leads</td>
<td>SOT23</td>
</tr>
</tbody>
</table>

4. Marking

Table 4. Marking codes

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking code[1]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PESD2CAN</td>
<td>6R*</td>
</tr>
</tbody>
</table>


5. Limiting values

Table 5. Limiting values

<table>
<thead>
<tr>
<th>Per diode</th>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P_{PP}</td>
<td>peak pulse power</td>
<td>t_{p} = 8/20 µs</td>
<td>[1][2]</td>
<td>-</td>
<td>230 W</td>
</tr>
<tr>
<td></td>
<td>I_{PP}</td>
<td>peak pulse current</td>
<td>t_{p} = 8/20 µs</td>
<td>[1][2]</td>
<td>-</td>
<td>5 A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Per device</th>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T_{j}</td>
<td>junction temperature</td>
<td>-</td>
<td>150</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>T_{amb}</td>
<td>ambient temperature</td>
<td>-55</td>
<td>+150</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>T_{stg}</td>
<td>storage temperature</td>
<td>-65</td>
<td>+150</td>
<td></td>
<td>°C</td>
</tr>
</tbody>
</table>

[1] Non-repetitive current pulse 8/20 µs exponential decay waveform according to IEC 61000-4-5.
[2] Measured from pin 1 to 3 or 2 to 3.

Table 6. ESD maximum ratings

<table>
<thead>
<tr>
<th>Per diode</th>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V_{ESD}</td>
<td>electrostatic discharge voltage</td>
<td>IEC 61000-4-2 (contact discharge)</td>
<td>[1][2]</td>
<td>-</td>
<td>30 kV</td>
</tr>
</tbody>
</table>


[2] Measured from pin 1 to 3 or 2 to 3.
Table 7.  ESD standards compliance

<table>
<thead>
<tr>
<th>Standard</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per diode</td>
<td></td>
</tr>
<tr>
<td>IEC 61000-4-2; level 4 (ESD)</td>
<td>&gt; 15 kV (air); &gt; 8 kV (contact)</td>
</tr>
<tr>
<td>MIL-STD-883; class 3B (human body model)</td>
<td>&gt; 8 kV</td>
</tr>
</tbody>
</table>

Fig 1. 8/20 μs pulse waveform according to IEC 61000-4-5

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

Table 8. Characteristics

\[ T_{\text{amb}} = 25 \, ^\circ\text{C} \text{ unless otherwise specified.} \]

<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></td>
<td></td>
<td>Per diode</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_{\text{RWM}} )</td>
<td>reverse standoff voltage</td>
<td>( V_{\text{RWM}} = 24 , \text{V} )</td>
<td>-</td>
<td>-</td>
<td>24</td>
<td>V</td>
</tr>
<tr>
<td>( I_{\text{RM}} )</td>
<td>reverse leakage current</td>
<td>( V_{\text{RWM}} = 24 , \text{V} )</td>
<td>-</td>
<td>&lt; 1</td>
<td>10</td>
<td>nA</td>
</tr>
<tr>
<td>( V_{\text{BR}} )</td>
<td>breakdown voltage</td>
<td>( I_R \approx 1 , \text{mA} )</td>
<td>26.2</td>
<td>28</td>
<td>30.3</td>
<td>V</td>
</tr>
<tr>
<td>( C_d )</td>
<td>diode capacitance</td>
<td>( f = 1 , \text{MHz}; , V_R = 0 , \text{V} )</td>
<td>-</td>
<td>25</td>
<td>30</td>
<td>pF</td>
</tr>
<tr>
<td>( V_{\text{CL}} )</td>
<td>clamping voltage</td>
<td>( I_{\text{PP}} = 1 , \text{A} ) [1][2]</td>
<td>-</td>
<td>-</td>
<td>34</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_{\text{PP}} = 5 , \text{A} ) [1][2]</td>
<td>-</td>
<td>-</td>
<td>41</td>
<td>V</td>
</tr>
<tr>
<td>( r_{\text{dif}} )</td>
<td>differential resistance</td>
<td>( I_R = 1 , \text{mA} )</td>
<td>-</td>
<td>-</td>
<td>300</td>
<td>( \Omega )</td>
</tr>
</tbody>
</table>

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

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

Fig 3. Peak pulse current as a function of clamping voltage; typical values

Fig 4. Relative variation of peak pulse power as a function of junction temperature; typical values
f = 1 MHz
(1) \( T_{\text{amb}} = 150^\circ \text{C} \)
(2) \( T_{\text{amb}} = 125^\circ \text{C} \)
(3) \( T_{\text{amb}} = 85^\circ \text{C} \)
(4) \( T_{\text{amb}} = 25^\circ \text{C} \)
(5) \( T_{\text{amb}} = -40^\circ \text{C} \)

Fig 5. Diode capacitance as a function of reverse voltage; typical values

\( T_{\text{amb}} = 150^\circ \text{C} \)
\( I_R \) is less than 1 nA at \(-55^\circ \text{C} \) and \( 25^\circ \text{C} \).

Fig 7. Reverse voltage as a function of reverse leakage current; typical values

Fig 6. Reverse current as a function of reverse voltage; typical values

(1) \( T_{\text{amb}} = -55^\circ \text{C} \)
(2) \( T_{\text{amb}} = 25^\circ \text{C} \)
(3) \( T_{\text{amb}} = 150^\circ \text{C} \)

Fig 8. V-I characteristics for a bidirectional ESD protection diode
**Fig 9. ESD clamping test setup and waveforms**

**Unclamped +8 kV ESD pulse waveform (IEC 61000-4-2 network)**

**Clamped +8 kV ESD pulse waveform (IEC 61000-4-2 network), Pin 1 to 3**

**Unclamped -8 kV ESD pulse waveform (IEC 61000-4-2 network)**

**Clamped -8 kV ESD voltage waveform (IEC 61000-4-2 network), Pin 1 to 3**
7. Application information

The PESD2CAN is designed for the protection of two automotive CAN bus lines from the damage caused by ESD and surge pulses. The PESD2CAN can be used for both, high-speed CAN bus and fault-tolerant CAN bus protection. The PESD2CAN provides a surge capability of up to 230 W per line for an 8/20 µs waveform.

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 PESD2CAN as close to the input terminal or connector as possible.
2. Minimize the path length between the PESD2CAN and the protected line.
3. Keep parallel signal paths to a minimum.
4. Avoid running protection 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.

8. Test information

8.1 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.
9. Package outline

![Package outline SOT23 (TO-236AB)](image)

Fig 11. Package outline SOT23 (TO-236AB)

10. Packing information

<table>
<thead>
<tr>
<th>Type number</th>
<th>Package</th>
<th>Description</th>
<th>Packing quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PESD2CAN</td>
<td>SOT23</td>
<td>4 mm pitch, 8 mm tape and reel</td>
<td>3000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-215</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-235</td>
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</tbody>
</table>

[1] For further information and the availability of packing methods, see Section 14.
11. Soldering

**Fig 12.** Reflow soldering footprint SOT23 (TO-236AB)

**Fig 13.** Wave soldering footprint SOT23 (TO-236AB)
## 12. Revision history

<table>
<thead>
<tr>
<th>Document ID</th>
<th>Release date</th>
<th>Data sheet status</th>
<th>Change notice</th>
<th>Supersedes</th>
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<tr>
<td>PESD2CAN v.2</td>
<td>20120927</td>
<td>Product data sheet</td>
<td>-</td>
<td>PESD2CAN v.1</td>
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<tr>
<td>Modifications</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>PESD2CAN v.1</td>
<td>20061222</td>
<td>Product data sheet</td>
<td>-</td>
<td>-</td>
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</table>

**Table 10. Revision history**

- **PESD2CAN v.2**
  - Release date: 20120927
  - Data sheet status: Product data sheet
  - Change notice: -
  - Supersedes: PESD2CAN v.1

**Modifications**:

- **Section 1.2 “Features and benefits”:** updated
- **Table 6 “ESD maximum ratings”:** corrected \( T_{\text{amb}} \) minimum value
- **Table 7 “ESD standards compliance”:** updated
- **Section 8 “Test information”:** added
- **Section 11 “Soldering”:** added
- **Section 13 “Legal information”:** updated

**PESD2CAN v.1**

- Release date: 20061222
- Data sheet status: Product data sheet
- Change notice: -
- Supersedes: -
# 13. Legal information

## 13.1 Data sheet status

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<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](http://www.nexperia.com).

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For sales office addresses, please send an email to: salesaddresses@nexperia.com
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