1. General description

ESD protection device in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package designed to protect two automotive In-vehicle network bus lines from the damage caused by ElectroStatic discharge (ESD) and other transients.

2. Features and benefits

- Reverse stand-off voltage: $V_{RWM} = 27$ V
- Low clamping voltage: $V_{CL} = 36$ V at $I_{PP} = 3$ A
- Typ. diode capacitance matching: $\Delta C_d/C_d = 0.1\%$
- ESD protection up to 30 kV (IEC 61000-4-2)
- ESD protection up to 30 kV (ISO 10605; $C = 330$ pF, $R = 330$ Ω)
- ISO 7637-3: Pulse a: $V_S = -150$ V / Pulse b: $V_S = +100$ V
- Ultra low leakage current: $I_{RM} < 1$ nA
- Qualified according to AEC-Q101 / Automotive grade

3. Applications

ESD protection for In-vehicle network lines in automotive enviroments
- CAN
- LIN
- FlexRay
- SENT

4. Quick reference data

Table 1. 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>27</td>
<td>V</td>
</tr>
<tr>
<td>$I_{PPM}$</td>
<td>rated peak pulse current</td>
<td>$t_p = 8/20$ µs</td>
<td></td>
<td>[1]</td>
<td>[2]</td>
<td>A</td>
</tr>
<tr>
<td>$V_{CL}$</td>
<td>clamping voltage</td>
<td>$I_{PPM} = 3$ A; $t_p = 8/20$ µs; $T_{amb} = 25$ °C</td>
<td></td>
<td>[1]</td>
<td>[2]</td>
<td>V</td>
</tr>
</tbody>
</table>

[1] Device stressed with 8/20 µs exponential decay waveform according to IEC 61000-4-5.
[2] 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>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>PESD2IVN27-T</td>
<td>TO-236AB</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>PESD2IVN27-T</td>
<td>T3%</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>I_{PPM}</td>
<td>rated peak pulse current</td>
<td>( t_p = 8/20 \mu s )</td>
<td>[1]</td>
<td>3</td>
<td>A</td>
</tr>
<tr>
<td>( T_j )</td>
<td>junction temperature</td>
<td>-</td>
<td>150</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>( T_{\text{amb}} )</td>
<td>ambient temperature</td>
<td>-55</td>
<td>150</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>( T_{\text{stg}} )</td>
<td>storage temperature</td>
<td>-65</td>
<td>150</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>
ESD protection for In-vehicle networks

<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></td>
<td>electrostatic discharge</td>
<td>IEC 61000-4-2; contact discharge</td>
<td>[2]</td>
<td>[3]</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>voltage</td>
<td>ISO 10605; contact discharge; C = 330 pF,</td>
<td></td>
<td></td>
<td>30 kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R = 330 Ω</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ISO 10605; contact discharge; C = 150 pF,</td>
<td></td>
<td></td>
<td>30 kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R = 330 Ω</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[1] Device stressed with 8/20 μs exponential decay waveform according to IEC 61000-4-5.
[2] Measured from pin 1 or 2 to pin 3.

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>27</td>
<td>V</td>
</tr>
<tr>
<td>$V_{BR}$</td>
<td>breakdown voltage</td>
<td>$I_R = 10 , mA; , T_{amb} = 25 , ^\circ C$</td>
<td>[1]</td>
<td>28</td>
<td>33</td>
<td>38</td>
</tr>
<tr>
<td>$I_{RM}$</td>
<td>reverse leakage current</td>
<td>$V_{RWM} = 27 , V; , T_{amb} = 25 , ^\circ C$</td>
<td>[1]</td>
<td>-</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>$C_d$</td>
<td>diode capacitance</td>
<td>$f = 1 , MHz; , V_R = 0 , V; , T_{amb} = 25 , ^\circ C$</td>
<td>[1]</td>
<td>13</td>
<td>17</td>
<td>pF</td>
</tr>
<tr>
<td>$\Delta C_d/C_d$</td>
<td>diode capacitance matching</td>
<td>$f = 1 , MHz; , V_R = 2.5 , V; , T_{amb} = 25 , ^\circ C$</td>
<td>[2]</td>
<td>-</td>
<td>0.1</td>
<td>-</td>
</tr>
<tr>
<td>$V_{CL}$</td>
<td>clamping voltage</td>
<td>$I_{PPM} = 1 , A; , t_p = 8/20 , \mu s; , T_{amb} = 25 , ^\circ C$</td>
<td>[3]</td>
<td>34</td>
<td>43</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{PPM} = 3 , A; , t_p = 8/20 , \mu s; , T_{amb} = 25 , ^\circ C$</td>
<td>[3]</td>
<td>36</td>
<td>45</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{PP} = 16 , A; , t_p = TLP; , T_{amb} = 25 , ^\circ C$</td>
<td>[4]</td>
<td>35</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>[4]</td>
<td>0.25</td>
<td>-</td>
<td>Ω</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] Device stressed with 8/20 μs exponential decay waveform according to IEC 61000-4-5.
[4] Non-repetitive current pulse, Transmission Line Pulse (TLP); square pulse; ANSI / ESD STM5.5.1-2008
ESD protection for In-vehicle networks

**Fig. 5.** Positive clamping voltage (TLP); typical values

**Fig. 6.** Negative clamping voltage (TLP); typical values

**Fig. 7.** Peak pulse power as a function of exponential pulse duration; typical values

**Fig. 8.** Relative variation of peak pulse power as a function of junction temperature; typical values
ESD TESTER

\[ R_d \]

\[ C_s \]

DUT (DEVICE UNDER TEST)

RG 223/U 50 Ω coax

40 dB ATTENUATOR

50 Ω

IEC 61000-4-2 ed.2

\[ C_s = 150 \text{ pF}; \quad R_d = 330 \Omega \]

4 GHz DIGITAL OSCILLOSCOPE

Fig. 9. ESD clamping test setup and waveforms

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

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

Fig. 10. Clamped +8 kV pulse waveform (IEC 61000-4-2 network)

Fig. 11. Clamped -8 kV pulse waveform (IEC 61000-4-2 network)
10. Application information

The device is designed for the protection of two automotive IVN bus line from the damage caused by ESD and surge pulses.

Fig. 12. Typical application: ESD protection of two automotive CAN bus 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. 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; 3 leads

Fig. 13. Package outline TO-236AB (SOT23)
13. Soldering

Fig. 14. Reflow soldering footprint for TO-236AB (SOT23)

Fig. 15. Wave soldering footprint for TO-236AB (SOT23)
# 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>PESD2IVN27-T v.1</td>
<td>20180306</td>
<td>Product data sheet</td>
<td>-</td>
<td>-</td>
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15. Legal information

Data sheet status

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<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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