1. General description

Unidirectional ElectroStatic Discharge (ESD) protection diodes in a very small SOD323 Surface-Mounted Device (SMD) plastic package designed to protect one signal line from the damage caused by ESD and transient overvoltage.

2. Features and benefits

- Transient Voltage Suppression (TVS) protection of one line
- Max. peak pulse power: $P_{PP} = 600 \text{ W}$
- Low clamping voltage: $V_{CL} = 27 \text{ V}$
- Low leakage current: $I_{RM} = 1 \text{ nA}$
- ESD protection up to 30 kV
- IEC 61000-4-2; level 4 (ESD)
- IEC 61000-4-5 (surge); $I_{PP} = 22.5 \text{ A}$
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

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

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>$T_{amb} = 25 \degree C$</td>
<td>-</td>
<td>-</td>
<td>12</td>
<td>V</td>
</tr>
<tr>
<td>$C_d$</td>
<td>diode capacitance</td>
<td>$f = 1 \text{ MHz}; V_R = 0 \text{ V}; T_{amb} = 25 \degree C$</td>
<td>-</td>
<td>160</td>
<td>180</td>
<td>pF</td>
</tr>
</tbody>
</table>
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 1[1]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>anode</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[1] The marking band indicates the cathode

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>PESD12VS1UA-Q</td>
<td>SOD323</td>
<td>plastic,</td>
<td>surface-mounted package; 2 leads; 1.3 mm pitch; 1.7 mm x 1.25 mm x 0.95 mm body</td>
<td>SOD323</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>PESD12VS1UA-Q</td>
<td>AW</td>
</tr>
</tbody>
</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>P_{PPM}</td>
<td>rated peak pulse power</td>
<td>( t_p = 8/20 \mu s )</td>
<td></td>
<td>600</td>
<td>W</td>
</tr>
<tr>
<td>I_{PPM}</td>
<td>rated peak pulse current</td>
<td></td>
<td></td>
<td>22.5</td>
<td>A</td>
</tr>
<tr>
<td>P_{tot}</td>
<td>total power dissipation</td>
<td>( T_{amb} \leq 25 \degree C )</td>
<td></td>
<td>360</td>
<td>mW</td>
</tr>
<tr>
<td>T_j</td>
<td>junction temperature</td>
<td></td>
<td></td>
<td>150</td>
<td>\degree C</td>
</tr>
<tr>
<td>T_{amb}</td>
<td>ambient temperature</td>
<td></td>
<td>-55</td>
<td>150</td>
<td>\degree C</td>
</tr>
<tr>
<td>T_{stg}</td>
<td>storage temperature</td>
<td></td>
<td>-65</td>
<td>150</td>
<td>\degree C</td>
</tr>
</tbody>
</table>

ESD maximum ratings

| V_{ESD} | electrostatic discharge voltage | IEC 61000-4-2; contact discharge; \( T_{amb} = 25 \degree C \) | [5] | -   | 30  | kV   |
|         |                                  | IEC 61000-4-2; air discharge                |     |     | 15  | kV   |
|         |                                  | machine model; \( T_{amb} = 25 \degree C \) |     |     | 400 | V    |
|         |                                  | MIL-STD-883 (human body model); \( T_{amb} = 25 \degree C \) |     |     | 16  | kV   |

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

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. Thermal characteristics

Table 6. Thermal 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>$R_{th(j-a)}$</td>
<td>thermal resistance from junction to ambient</td>
<td>in free air</td>
<td>[1]</td>
<td>-</td>
<td>-</td>
<td>345  K/W</td>
</tr>
<tr>
<td>$R_{th(j-sp)}$</td>
<td>thermal resistance from junction to solder point</td>
<td></td>
<td>[2]</td>
<td>-</td>
<td>-</td>
<td>250  K/W</td>
</tr>
<tr>
<td>$R_{th(j-sp)}$</td>
<td>thermal resistance from junction to solder point</td>
<td></td>
<td>[3]</td>
<td>-</td>
<td>-</td>
<td>90   K/W</td>
</tr>
</tbody>
</table>


10. Characteristics

Table 7. 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>$T_{amb} = 25 °C$</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>12   V</td>
</tr>
<tr>
<td>$V_{BR}$</td>
<td>breakdown voltage</td>
<td>$I_R = 5$ mA; $T_{amb} = 25 °C$</td>
<td>13.3</td>
<td>14.5</td>
<td>15.75 V</td>
<td></td>
</tr>
<tr>
<td>$I_{RM}$</td>
<td>reverse leakage current</td>
<td>$V_{RWM} = 12$ V; $T_{amb} = 25 °C$</td>
<td>-</td>
<td>1</td>
<td>100  nA</td>
<td></td>
</tr>
<tr>
<td>$C_d$</td>
<td>diode capacitance</td>
<td>$f = 1$ MHz; $V_R = 0$ V; $T_{amb} = 25 °C$</td>
<td>-</td>
<td>160</td>
<td>180  pF</td>
<td></td>
</tr>
<tr>
<td>$V_{CL}$</td>
<td>clamping voltage</td>
<td>$I_{PPM} = 22.5$ A; $T_{amb} = 25 °C$</td>
<td>[1]</td>
<td>-</td>
<td>-</td>
<td>27   V</td>
</tr>
<tr>
<td>$I_{PP}$</td>
<td>reverse leakage current</td>
<td>$I_{PP} = 15$ A; $T_{amb} = 25 °C$</td>
<td>[1]</td>
<td>-</td>
<td>-</td>
<td>23.5 V</td>
</tr>
<tr>
<td>$R_{diff}$</td>
<td>differential resistance</td>
<td>$I_R = 5$ mA; $T_{amb} = 25 °C$</td>
<td>[1]</td>
<td>-</td>
<td>-</td>
<td>19   V</td>
</tr>
</tbody>
</table>

[1] Non-repetitive current pulse 8/20 μs exponential decay waveform according to IEC 61000-4-5.
Unidirectional ESD protection for transient voltage suppression

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

\[ f = 1 \text{ MHz}; \ T_{\text{amb}} = 25 \ ^\circ\text{C} \]

Fig. 6. Reverse leakage current as a function of ambient temperature; typical values

Fig. 7. V-I characteristics for a unidirectional ESD protection diode
Fig. 8. ESD clamping test setup and waveforms
11. Application information

The device is designed for protection of one unidirectional data or signal line from surge pulses and ESD damage. The device is suitable on lines where the signal polarities are either positive or negative with respect to ground.

![Application diagram](image)

**Fig. 9. 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.

12. 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.
13. Package outline

Plastic surface-mounted package; 2 leads

Fig. 10. Package outline SOD323

DIMENSIONS (mm are the original dimensions)

<table>
<thead>
<tr>
<th>UNIT</th>
<th>A</th>
<th>A1 max</th>
<th>b_p</th>
<th>c</th>
<th>D</th>
<th>E</th>
<th>H_D</th>
<th>L_P</th>
<th>Q</th>
<th>v</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>1.1</td>
<td>0.8</td>
<td>0.40</td>
<td>0.25</td>
<td>1.8</td>
<td>1.35</td>
<td>2.7</td>
<td>0.45</td>
<td>0.25</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Note
1. The marking bar indicates the cathode

Fig. 10. Package outline SOD323
14. Soldering

Fig. 11. Reflow soldering footprint for SOD323

Fig. 12. Wave soldering footprint for SOD323
15. Revision history

Table 8. 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>
</thead>
<tbody>
<tr>
<td>PESD12VS1UA-Q v.1</td>
<td>20220613</td>
<td>Product data sheet</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
16. Legal information

Data sheet status

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<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 https://www.nexperia.com.

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