1. General description

Transient voltage suppressor in an ultra small and leadless DSN1006-2 (SOD993B) Surface-Mounted Device (SMD) package designed to protect one line against high surge currents and other transients.

2. Features and benefits

- Bidirectional ESD protection of one line
- Very high surge robustness; $I_{PPM} = 82$ A (measured) for 8/20 μs pulse
- Very low clamping voltage: $V_{CL} = 11$ V typ. for 70 A at 8/20μs pulse
- ESD protection up to 30 kV

3. Applications

Surge protection for
- supply and battery lines
- audio interfaces

in portable communication, consumer and computing devices.

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>$T_{amb} = 25 , ^{\circ}C$</td>
<td>-</td>
<td>-</td>
<td>3.3</td>
<td>V</td>
</tr>
<tr>
<td>$I_{PPM}$</td>
<td>rated peak pulse current</td>
<td>$t_p = 8/20 , \mu s; , T_{amb} = 25 , ^{\circ}C$</td>
<td>[1]</td>
<td>-</td>
<td>70</td>
<td>A</td>
</tr>
<tr>
<td>$V_{CL}$</td>
<td>clamping voltage</td>
<td>$I_{PPM} = 70 , A; , t_p = 8/20 , \mu s; , T_{amb} = 25 , ^{\circ}C$</td>
<td>[1]</td>
<td>-</td>
<td>11</td>
<td>13</td>
</tr>
</tbody>
</table>

[1] In accordance with IEC 61000-4-5 (8/20 μs current waveform).
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>
</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>PTVS3V3Z1BSC</td>
<td>DSN1006-2</td>
<td>DSN1006-2, leadless ultra small package; 2 terminals; body 1.0 x 0.6 x 0.27 mm</td>
<td>SOD993B</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>PTVS3V3Z1BSC</td>
<td>S3</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>I_{PPM}</td>
<td>rated peak pulse current</td>
<td>I_{p} = 8/20 µs; T_{amb} = 25 °C</td>
<td>[1]</td>
<td>70</td>
<td>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>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>V_{ESD}</th>
<th>electrostatic discharge voltage</th>
<th>IEC 61000-4-2; contact discharge</th>
<th>[2]</th>
<th>30</th>
<th>kV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>IEC 61000-4-2; air discharge</td>
<td>[2]</td>
<td>30</td>
<td>kV</td>
</tr>
</tbody>
</table>

[1] In accordance with IEC 61000-4-5 (8/20 µs current waveform).
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>3.3</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>3.8</td>
<td>4.9</td>
<td>6.8</td>
<td>V</td>
</tr>
<tr>
<td>$I_{RM}$</td>
<td>reverse leakage current</td>
<td>$V_R = 3.3 V; T_{amb} = 25 ^\circ C$</td>
<td>-</td>
<td>1</td>
<td>100</td>
<td>nA</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>-</td>
<td>180</td>
<td>200</td>
<td>pF</td>
</tr>
<tr>
<td>$V_{CL}$</td>
<td>clamping voltage</td>
<td>$I_{PP} = 1 A; t_p = 8/20 \mu s; T_{amb} = 25 ^\circ C$</td>
<td>[1]</td>
<td>5</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{PPM} = 70 A; t_p = 8/20 \mu s; T_{amb} = 25 ^\circ C$</td>
<td>[1]</td>
<td>11</td>
<td>13</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{PP} = 16 A; I_p = TLP; T_{amb} = 25 ^\circ C$</td>
<td>[2]</td>
<td>5.7</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>[2]</td>
<td>-</td>
<td>0.05</td>
<td>Ω</td>
</tr>
</tbody>
</table>

[1] In accordance with IEC 61000-4-5 (8/20 µs current waveform).
[2] Non-repetitive current pulse, Transmission Line Pulse (TLP); square pulse; ANSI/ESD STM5.5.1-2008
Ultra compact transient voltage suppressor

Fig. 3. V-I characteristics for a bidirectional TVS diode

Fig. 4. Diode capacitance as a function of reverse voltage; typical values

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

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

Fig. 7. Positive clamping voltage (8/20 μs pulse); typical values

Fig. 8. Negative clamping voltage (8/20 μs pulse); typical values
**PTVS3V3Z1BSC**

**Ultra compact transient voltage suppressor**

IEC 61000-4-2 ed.2

- $C_s = 150 \text{ pF}$
- $R_d = 330 \Omega$

**DUT (DEVICE UNDER TEST)**

- RG 223/U 50 Ω coax
- 40 dB ATTENUATOR
- 50 Ω

**ESD TESTER**

- **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)**

- $V_{CL}$ at 30 ns = 5 V

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

- $V_{CL}$ at 30 ns = -5 V
10. Application information

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

![Application diagram](image-url)

**Fig. 12. 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. Package outline

DSN1006-2, leadless ultra small package; 2 terminals; body 1.0 x 0.6 x 0.27 mm

![Package outline diagram](image)

Dimensions (mm are the original dimensions)

<table>
<thead>
<tr>
<th>Unit</th>
<th>A</th>
<th>A₁</th>
<th>b</th>
<th>D</th>
<th>e₁</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>0.30</td>
<td>0.03</td>
<td>0.51</td>
<td>0.65</td>
<td>1.05</td>
<td>0.26</td>
</tr>
<tr>
<td>nom</td>
<td>0.24</td>
<td>0.49</td>
<td>0.55</td>
<td>0.95</td>
<td>0.65</td>
<td>0.24</td>
</tr>
</tbody>
</table>

Note
1. The marking bar indicates the cathode.

Fig. 13. Package outline DSN1006-2 (SOD993B)
12. Soldering

Fig. 14. Reflow soldering footprint for DSN1006-2 (SOD993B)
# 13. Revision history

<table>
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<th>Release date</th>
<th>Data sheet status</th>
<th>Change notice</th>
<th>Supersedes</th>
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<td>Product data sheet</td>
<td>-</td>
<td>PTVS3V3Z1BSC v.1</td>
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<td><strong>Modifications:</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>• Updated document status to &quot;Product data sheet&quot;</td>
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<tr>
<td>PTVS3V3Z1BSC v.1</td>
<td>20190125</td>
<td>Preliminary data sheet</td>
<td>-</td>
<td>-</td>
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14. Legal information

Data sheet status

<table>
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<td>Objective [short] data sheet</td>
<td>Development</td>
<td>This document contains data from the objective specification for product development.</td>
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<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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