1. General description

Unidirectional double ElectroStatic Discharge (ESD) protection diodes in a common anode configuration, encapsulated in a SOT23 (TO-236AB) small Surface-Mounted Device (SMD) plastic package. The device is designed for ESD and transient overvoltage protection of up to two signal lines.

2. Features and benefits

- Unidirectional protection of two lines
- Reverse standoff voltage: $V_{\text{RWM}} = 13$ V
- Average measured surge robustness: $I_{\text{PPM}} = 14$ A ($8/20$ $\mu$s) / $I_{\text{PPM}} = 2.54$ A ($10/1000$ $\mu$s)
- Typical reverse leakage current: $I_{\text{RM}} = 0.1$ nA
- Tight breakdown voltage tolerance: $\Delta V_{\text{BR}} \pm 2$
- AEC-Q101 qualified

3. Applications

- Automotive in-vehicle networks protection
- Industrial application
- Power management

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>$V_{\text{RWM}}$</td>
<td>reverse standoff voltage</td>
<td>$T_{j} = 25$ °C</td>
<td>-</td>
<td>-</td>
<td>13</td>
<td>V</td>
</tr>
<tr>
<td>$I_{\text{PPM}}$</td>
<td>rated peak pulse current</td>
<td>$t_{p} = 10/1000$ $\mu$s</td>
<td>[1] [2]</td>
<td>-</td>
<td>1.9</td>
<td>A</td>
</tr>
<tr>
<td>$V_{\text{CL}}$</td>
<td>clamping voltage</td>
<td>$I_{\text{PP}} = 1.7$ A; $t_{p} = 10/1000$ $\mu$s; $T_{j} = 25$ °C</td>
<td>[1] [2]</td>
<td>19.5</td>
<td>23</td>
<td>V</td>
</tr>
</tbody>
</table>

[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</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>K2</td>
<td>cathode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>common anode</td>
<td></td>
<td></td>
</tr>
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</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>MMBZ16VTAL</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>MMBZ16VTAL</td>
<td>%HH</td>
</tr>
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[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&lt;sub&gt;PPM&lt;/sub&gt;</td>
<td>rated peak pulse power</td>
<td>t&lt;sub&gt;p&lt;/sub&gt; = 8/20 µs</td>
<td>-</td>
<td>300</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>t&lt;sub&gt;p&lt;/sub&gt; = 10/1000 µs</td>
<td>[1]</td>
<td>[2]</td>
<td></td>
</tr>
<tr>
<td>I&lt;sub&gt;PPM&lt;/sub&gt;</td>
<td>rated peak pulse current</td>
<td>t&lt;sub&gt;p&lt;/sub&gt; = 8/20 µs</td>
<td>-</td>
<td>11</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>t&lt;sub&gt;p&lt;/sub&gt; = 10/1000 µs</td>
<td>[3]</td>
<td>[2]</td>
<td></td>
</tr>
<tr>
<td>T&lt;sub&gt;j&lt;/sub&gt;</td>
<td>junction temperature</td>
<td></td>
<td>-</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>T&lt;sub&gt;amb&lt;/sub&gt;</td>
<td>ambient temperature</td>
<td></td>
<td>-55</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>T&lt;sub&gt;stg&lt;/sub&gt;</td>
<td>storage temperature</td>
<td></td>
<td>-65</td>
<td>150</td>
<td>°C</td>
</tr>
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ESD maximum ratings

<table>
<thead>
<tr>
<th>V&lt;sub&gt;ESD&lt;/sub&gt;</th>
<th>electrostatic discharge voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IEC 61000-4-2; contact discharge</td>
</tr>
<tr>
<td></td>
<td>IEC 61000-4-2; air discharge</td>
</tr>
</tbody>
</table>

[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_j = 25 °C</td>
<td>-</td>
<td>-</td>
<td>13</td>
<td>V</td>
</tr>
<tr>
<td>V_BR</td>
<td>breakdown voltage</td>
<td>I_R = 1 mA; T_j = 25 °C</td>
<td>15.68</td>
<td>16</td>
<td>16.32</td>
<td>V</td>
</tr>
<tr>
<td>I_RM</td>
<td>reverse leakage current</td>
<td>V_RWM = 13 V; T_j = 25 °C</td>
<td>-</td>
<td>0.1</td>
<td>5</td>
<td>nA</td>
</tr>
<tr>
<td>C_d</td>
<td>diode capacitance</td>
<td>f = 1 MHz; V_R = 0 V; T_j = 25 °C</td>
<td>-</td>
<td>76</td>
<td>95</td>
<td>pF</td>
</tr>
<tr>
<td>V_CL</td>
<td>clamping voltage</td>
<td>I_{pp} = 11 A; t_p = 8/20 µs; T_j = 25 °C</td>
<td>-</td>
<td>23</td>
<td>28</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I_{pp} = 1.7 A; t_p = 10/1000 µs; T_j = 25 °C</td>
<td>-</td>
<td>19.5</td>
<td>23</td>
<td>V</td>
</tr>
</tbody>
</table>

[1] Measured from pin 1 or 2 to pin 3.
Fig. 4. V-I characteristics for a unidirectional TVS protection diode

Fig. 5. Relative variation of rated peak pulse power as a function of junction temperature; typical values

Fig. 6. Diode capacitance as a function of reverse voltage; typical values

Fig. 7. Rated peak pulse power as a function of a pulse duration; typical values
High surge current unidirectional double ESD protection diodes

\[V_{CL}(V)\]

\[I_{pp}(A)\]

\[V_{CL}(V)\]

\[I_{pp}(A)\]

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

\[V_{CL}(V)\]

\[I_{pp}(A)\]

Fig. 9. Negative clamping voltage (8/20 μs pulse); typical values

\[V_{CL}(V)\]

\[I_{pp}(A)\]

Fig. 10. Positive clamping voltage (10/1000 μs pulse); typical values

\[V_{CL}(V)\]

\[I_{pp}(A)\]

Fig. 11. Negative clamping voltage (10/1000 μs pulse); typical values
High surge current unidirectional double ESD protection diodes

ESD TESTER

Rd

Cs

DUT (DEVICE UNDER TEST)

RG 223/U 50 Ω coax

40 dB ATTENUATOR

50 Ω

IEC 61000-4-2 ed.2
Cs = 150 pF; Rd = 330 Ω

4 GHz DIGITAL OSCILLOSCOPE

Fig. 12. ESD clamping test setup and waveforms

Fig. 13. Clamped +8 kV pulse waveform (IEC61000-4-2 network)

Fig. 14. Clamped -8 kV pulse waveform (IEC61000-4-2 network)
10. Application information

The device is designed for the protection of one bidirectional or up to two unidirectional data or signal lines from the damage caused by ESD and surge pulses.

The devices may be used on lines where the signal polarities are either positive or negative with respect to ground for the unidirectional configuration or both positive and negative for the bidirectional configuration.

![Application diagram](Fig. 15. Application diagram)

11. Package outline

![Package outline TO-236AB (SOT23)](Fig. 16. Package outline TO-236AB (SOT23))
12. Soldering

Fig. 17. Reflow soldering footprint for TO-236AB (SOT23)

Fig. 18. Wave soldering footprint for TO-236AB (SOT23)
13. Revision history

<table>
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<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>MMBZ16VTAL v.1</td>
<td>20171106</td>
<td>Product data sheet</td>
<td>-</td>
<td>-</td>
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14. Legal information

Data sheet status

<table>
<thead>
<tr>
<th>Document status</th>
<th>Product status</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Short</td>
<td>Development</td>
<td>This document contains data from the objective specification for product development.</td>
</tr>
<tr>
<td>Preliminary</td>
<td>Qualification</td>
<td>This document contains data from the preliminary specification.</td>
</tr>
<tr>
<td>Product</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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