USB Series Varistor
Low Capacitance Multilayer Varistors

GENERAL DESCRIPTION
USB Series varistors are designed to protect the high speed data lines against ESD transients. They have very low capacitance and fast turn on times that make this series ideal for data and transmission lines with high data rates. The unique design enables these devices to meet the rigorous testing criteria of the IEC 61000-4-2 standards. New and improved manufacturing process has created these USB series to be one of the best plated varistors in the market today.

GENERAL CHARACTERISTICS
- Operating Temperature: -55°C to 125°C
- Working Voltage: ≤ 18Vdc
- Case Size: 0402, 0603, 0405 2x array, 0612 4x array
- Typical Capacitance: 3pF, 6pF, 10pF

FEATURES
- Zinc Oxide (ZnO) based ceramic semiconductor devices with non-linear voltage-current characteristics
- Bi-directional device, similar to back-to-back Zener diodes plus an EMC capacitor in parallel
- Entire structure made up of conductive ZnO grains surrounded by electrically insulating barriers, creating varistor-like behavior
- Electrical advantages over Zener diodes are repetitive strike capability, high in rush current capability, fast turn-on-time and EMI attenuation
- Protects against ESD to meet IEC 61000-4-2 15kV (air) and 8kV (contact)
- Low capacitance for high speed data lines
- Available in discrete and array packages (2 and 4 element)
- Low Clamping Voltage
- Low Operating Voltage
- Response time is < 1ns

TYPICAL APPLICATIONS
- USB BUS Lines/Firewire Data BUS Lines
- I/O BUS Lines
- 10/100/1000 Ethernet Transmission Lines
- Video Card Data Lines
- Handheld Devices
- Laptop Computers
- LCD Monitors and more

PART NUMBERING

USB 00001/00005/00006
0603 and 0402 (Single)

USB0002
0405 (Dual)

USB0004
0612 (Quad)

PINOUT CONFIGURATION

RoHS COMPLIANT
USB Series Varistor
Low Capacitance Multilayer Varistors

RATINGS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Discharge ESD</td>
<td>15kV</td>
</tr>
<tr>
<td>Contact Discharge ESD</td>
<td>9kV</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>–55°C to +125°C</td>
</tr>
<tr>
<td>Soldering Temperature</td>
<td>260°C</td>
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PERFORMANCE CHARACTERISTICS

<table>
<thead>
<tr>
<th>AVX Part No.</th>
<th>V_W (DC)</th>
<th>V_W (AC)</th>
<th>V_B</th>
<th>I_L</th>
<th>E_T</th>
<th>I_P</th>
<th>Cap.</th>
<th>Case Size</th>
<th>Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB0001</td>
<td>≤18</td>
<td>≤14</td>
<td>120</td>
<td>2</td>
<td>0.015</td>
<td>4</td>
<td>10</td>
<td>0603</td>
<td>1</td>
</tr>
<tr>
<td>USB0002</td>
<td>≤18</td>
<td>≤14</td>
<td>70</td>
<td>2</td>
<td>0.015</td>
<td>4</td>
<td>10</td>
<td>0405</td>
<td>2</td>
</tr>
<tr>
<td>USB0004</td>
<td>≤18</td>
<td>≤14</td>
<td>100</td>
<td>2</td>
<td>0.015</td>
<td>4</td>
<td>10</td>
<td>0612</td>
<td>4</td>
</tr>
<tr>
<td>USB0005</td>
<td>≤18</td>
<td>≤14</td>
<td>300</td>
<td>2</td>
<td>0.015</td>
<td>4</td>
<td>3</td>
<td>0402</td>
<td>1</td>
</tr>
<tr>
<td>USB0006</td>
<td>≤18</td>
<td>≤14</td>
<td>65</td>
<td>2</td>
<td>0.015</td>
<td>4</td>
<td>6</td>
<td>0402</td>
<td>1</td>
</tr>
</tbody>
</table>

Termination Finish Code
Packaging Code

V_W (DC)  DC Working Voltage (V)
V_W (AC)  AC Working Voltage (V)
V_B  Typical Breakdown Voltage (V @ 1mA_{DC})
I_L  Maximum Leakage Current at the Working Voltage (μA)
E_T  Transient Energy Rating (J, 10x1000μS)
I_P  Peak Current Rating (A, 8x20μS)
Cap  Typical Capacitance (pF) @ 1 MHz and 0.5Vrms

USB TYPICAL S21 CHARACTERISTICS

![USB TYPICAL S21 CHARACTERISTICS graph]

Typical Pulse Rating Curve

![Typical Pulse Rating Curve graph]
# USB Series Varistor

**Low Capacitance Multilayer Varistors**

## PHYSICAL DIMENSIONS AND PAD LAYOUT

### USB0001/5/6 (Single)

![USB0001/5/6 Diagram](image)

### USB0002 (Dual)

![USB0002 Diagram](image)

### USB0004 (Quad)

![USB0004 Diagram](image)

<table>
<thead>
<tr>
<th>L (mm)</th>
<th>W (mm)</th>
<th>T (mm)</th>
<th>BW (mm)</th>
<th>BL (mm)</th>
<th>P (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB0001</td>
<td>1.60±0.15 (0.063±0.006)</td>
<td>0.80±0.15 (0.032±0.006)</td>
<td>0.90 Max</td>
<td>N/A</td>
<td>0.35±0.15 (0.014±0.006)</td>
</tr>
<tr>
<td>USB0002</td>
<td>1.00±0.15 (0.039±0.006)</td>
<td>1.37±0.15 (0.054±0.006)</td>
<td>0.66 Max</td>
<td>0.36±0.10 (0.014±0.004)</td>
<td>0.20±0.10 (0.008±0.004)</td>
</tr>
<tr>
<td>USB0004</td>
<td>1.60±0.20 (0.063±0.008)</td>
<td>3.20±0.20 (0.126±0.008)</td>
<td>1.22 Max</td>
<td>0.41±0.10 (0.016±0.004)</td>
<td>0.18±0.05–0.08 (0.007±0.003)</td>
</tr>
</tbody>
</table>

| USB0005 / USB0006 | 1.0±0.10 (0.040±0.004) | 0.50±0.10 (0.020±0.004) | 0.60 Max | N/A | 0.25±0.15 (0.010±0.006) | N/A |

<table>
<thead>
<tr>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>D (mm)</th>
<th>E (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB0001</td>
<td>0.89 (0.035)</td>
<td>0.76 (0.030)</td>
<td>2.54 (0.100)</td>
<td>0.76 (0.030)</td>
</tr>
<tr>
<td>USB0002</td>
<td>0.46 (0.018)</td>
<td>0.74 (0.029)</td>
<td>1.20 (0.047)</td>
<td>0.20 (0.012)</td>
</tr>
<tr>
<td>USB0004</td>
<td>0.89 (0.035)</td>
<td>1.65 (0.065)</td>
<td>2.54 (0.100)</td>
<td>0.46 (0.018)</td>
</tr>
<tr>
<td>USB0005 / USB0006</td>
<td>0.61 (0.024)</td>
<td>0.51 (0.020)</td>
<td>1.70 (0.067)</td>
<td>0.51 (0.020)</td>
</tr>
</tbody>
</table>
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APPLICATIONS

- USB Port Protection
- Ethernet Port Protection

Diagram showing USB Port Protection and Ethernet Port Protection with USB0002 varistors.