

# USB Series Varistor

## Multilayer Varistors for Universal Serial BUS Protection

### 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.

### 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

### MECHANICAL CHARACTERISTICS

- Available in EIA 0603 (Single), 0405 (Dual) and 0612 (Quad) cases
- Plated Tin over Nickel Barrier
- Packaged in Tape & Reel

### PART NUMBERING

**USB**

Style

**0001**

Case Size

0001 = 0603 (Single)  
0002 = 0405 (2-Element)  
0004 = 0612 (4-Element)  
0005 = 0402 (Single)  
0006 = 0402 (Single)

**D**

Packaging Code  
(Reel Size)

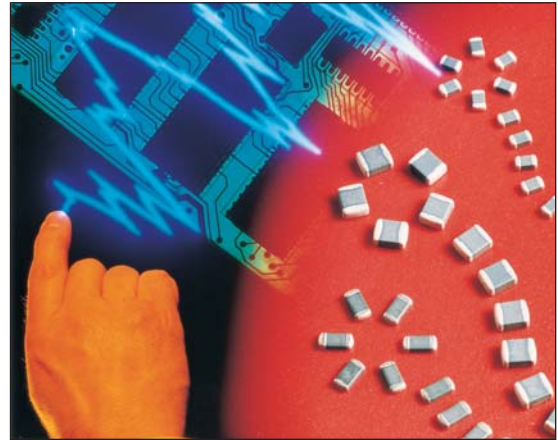
D = 7" (1,000 pcs.)  
R = 7" (4,000 pcs.)  
T = 13" (10,000 pcs.)  
W = 7" (10,000 pcs.  
0402 only)

**P**

Termination  
P = Ni/Sn Alloy (Plated)

### 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

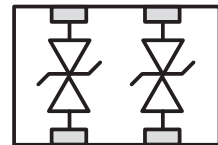


### PINOUT CONFIGURATION

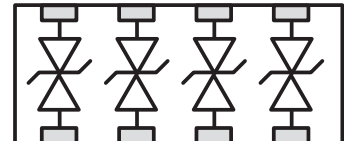
**USB0001/0005/0006  
0603 and 0402 (Single)**



**USB0002  
0405 (Dual)**



**USB0004  
0612  
(Quad)**



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### RATINGS

|                       |                 |
|-----------------------|-----------------|
| Air Discharge ESD     | 15kV            |
| Contact Discharge ESD | 8kV             |
| Operating Temperature | -55°C to +125°C |
| Soldering Temperature | 230°C           |

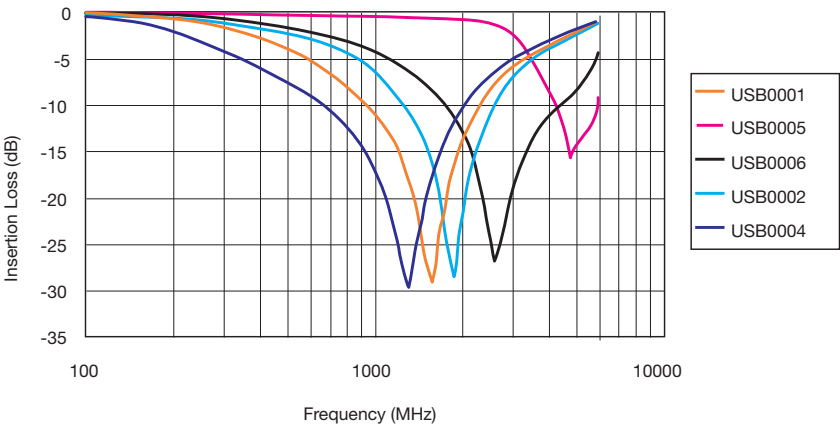
### PERFORMANCE CHARACTERISTICS

| AVX Part No. | V <sub>W</sub> (DC) | V <sub>W</sub> (AC) | V <sub>B</sub> | I <sub>L</sub> | E <sub>T</sub> | I <sub>P</sub> | Cap. | Case Size | Elements |
|--------------|---------------------|---------------------|----------------|----------------|----------------|----------------|------|-----------|----------|
| USB0001__    | ≤18                 | ≤14                 | 120            | 2              | 0.015          | 4              | 10   | 0603      | 1        |
| USB0002__    | ≤18                 | ≤14                 | 70             | 2              | 0.015          | 4              | 10   | 0405      | 2        |
| USB0004__    | ≤18                 | ≤14                 | 100            | 2              | 0.015          | 4              | 10   | 0612      | 4        |
| USB0005__    | ≤18                 | ≤14                 | 300            | 2              | 0.015          | 4              | 3    | 0402      | 1        |
| USB0006__    | ≤18                 | ≤14                 | 65             | 2              | 0.015          | 4              | 6    | 0402      | 1        |

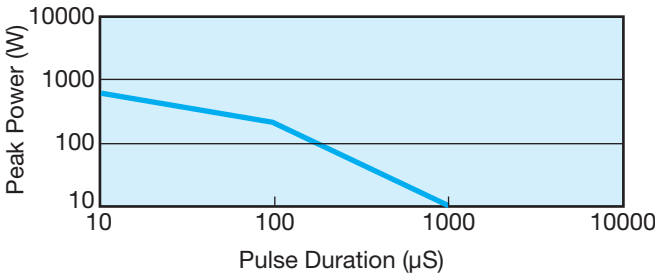
Termination Finish Code  
Packaging Code

- V<sub>W</sub> (DC) DC Working Voltage (V)
- V<sub>W</sub> (AC) AC Working Voltage (V)
- V<sub>B</sub> Typical Breakdown Voltage (V @ 1mA<sub>DC</sub>)
- I<sub>L</sub> Maximum Leakage Current at the Working Voltage (μA)
- E<sub>T</sub> Transient Energy Rating (J, 10x1000μS)
- I<sub>P</sub> Peak Current Rating (A, 8x20μS)
- Cap Typical Capacitance (pF) @ 1 MHz and 0.5Vrms

### USB TYPICAL S21 CHARACTERISTICS



### Typical Pulse Rating Curve



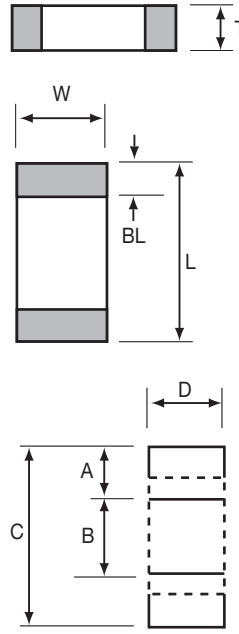
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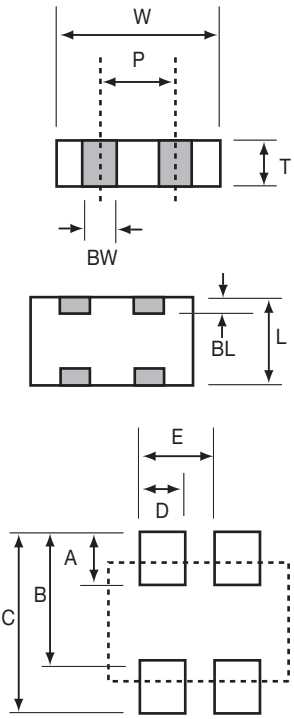
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### PHYSICAL DIMENSIONS AND PAD LAYOUT

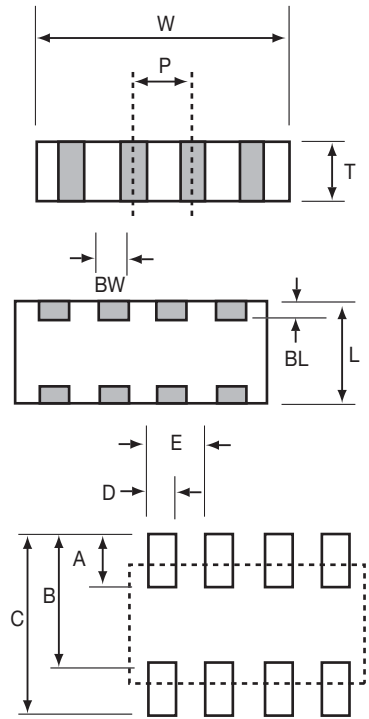
**USB0001/5/6 (Single)**



**USB0002 (Dual)**



**USB0004 (Quad)**



| mm (inches)                |                            |                          |                            |                                                                 |                         |
|----------------------------|----------------------------|--------------------------|----------------------------|-----------------------------------------------------------------|-------------------------|
| L                          | W                          | T                        | BW                         | BL                                                              | P                       |
| <b>USB0001</b>             |                            |                          |                            |                                                                 |                         |
| 1.60±.15<br>(0.063±0.006)  | 0.80±0.15<br>(0.032±0.006) | 0.90 Max<br>(0.035 Max.) | N/A                        | 0.35±0.15<br>(0.014±0.006)                                      | N/A                     |
| <b>USB0002</b>             |                            |                          |                            |                                                                 |                         |
| 1.00±0.15<br>(0.039±0.006) | 1.37±0.15<br>(0.054±0.006) | 0.66 Max<br>(0.026 Max.) | 0.36±0.10<br>(0.014±0.004) | 0.20±0.10<br>(0.008±0.004)                                      | 0.64 REF<br>(0.025 REF) |
| <b>USB0004</b>             |                            |                          |                            |                                                                 |                         |
| 1.60±0.20<br>(0.063±0.008) | 3.20±0.20<br>(0.126±0.008) | 1.22 Max<br>(0.048 Max.) | 0.41±0.10<br>(0.016±0.004) | 0.18 <sup>+0.25/-0.08</sup><br>(0.007 <sup>+0.01/-0.003</sup> ) | 0.76 REF<br>(0.030 REF) |
| <b>USB0005 / USB0006</b>   |                            |                          |                            |                                                                 |                         |
| 1.0±0.10<br>(0.040±0.004)  | 0.50±0.10<br>(0.020±0.004) | 0.60 Max<br>(0.024 Max.) | N/A                        | 0.25±0.15<br>(0.010±0.006)                                      | N/A                     |

| mm (inches)              |                 |                 |                 |                 |
|--------------------------|-----------------|-----------------|-----------------|-----------------|
| A                        | B               | C               | D               | E               |
| <b>USB0001</b>           |                 |                 |                 |                 |
| 0.89<br>(0.035)          | 0.76<br>(0.030) | 2.54<br>(0.100) | 0.76<br>(0.030) | N/A             |
| <b>USB0002</b>           |                 |                 |                 |                 |
| 0.46<br>(0.018)          | 0.74<br>(0.029) | 1.20<br>(0.047) | 0.30<br>(0.012) | 0.64<br>(0.025) |
| <b>USB0004</b>           |                 |                 |                 |                 |
| 0.89<br>(0.035)          | 1.65<br>(0.065) | 2.54<br>(0.100) | 0.46<br>(0.018) | 0.76<br>(0.030) |
| <b>USB0005 / USB0006</b> |                 |                 |                 |                 |
| 0.61<br>(0.024)          | 0.51<br>(0.020) | 1.70<br>(0.067) | 0.51<br>(0.020) | N/A             |



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### APPLICATIONS

