AVX has combined the best electrical characteristics of its TransGuard® Transient Voltage Suppressors (TVS) and its Feedthru Capacitors into a single chip for state-of-the-art overvoltage circuit protection and EMI reduction over a broad range of frequencies. This unique combination of multilayer ceramic construction in a feedthru configuration gives the circuit designer a single 0805 chip that responds to transient events faster than any TVS device on the market today, and provides significant EMI attenuation when in the off-state.

The reduction in parallel inductance, typical of the feedthru chip construction when compared to the construction of standard TVS or ceramic capacitor chips, gives the TransFeed product two very important electrical advantages: (1) faster “turn-on” time. Calculated response times of <200 pSec are not unusual with this device, and measured response times range from 200 – 250 pSec. The TransFeed “turn-on” characteristic is less than half that of an equivalent TransGuard® part — and TransGuards® clamp transient voltages faster than any other bipolar TVS solution such as diodes; (2) the second electrical advantage of lower parallel inductance, coupled with optimal series inductance, is the enhanced attenuation characteristics of the TransFeed product. Not only is there significantly greater attenuation at a higher self-resonance frequency, but the roll-off characteristic becomes much flatter, resulting in EMI filtering over a much broader frequency spectrum. Typical applications include filtering/protection on Microcontroller I/O Lines, Interface I/O Lines, Power Line Conditioning and Power Regulation.

**GENERAL CHARACTERISTICS**
- Operating Temperature: -55°C to +125°C
- Working Voltage: 5.6Vdc - 26 Vdc
- Case Size: 0805, 0612 4xArray
- Energy Rating: 0.05 - 0.3J
- Current: 15 - 120A
- Max Feedthru Current: 0.2 - 1A

**TYPICAL APPLICATIONS**
- Fingerprint ID Circuit
- Magnetic Field Circuit
- LCD Dashboard Driver

Where designers are concerned with both transient voltage protection and EMI attenuation, either due to the electrical performance of their circuits or due to required compliance to specific EMC regulations, the TransFeed product is an ideal choice.

**APPLICATIONS**
- Bi-directional TVS
- Narrow band, high attenuation filter
- EMI Filtering over broader frequency range
- Fastest Response Time to ESD Strikes
# AVX Multilayer Ceramic Transient Voltage Suppressors

## TVS Protection and EMI Attenuation in a Single Chip

### HOW TO ORDER

<table>
<thead>
<tr>
<th>V</th>
<th>F</th>
<th>05</th>
<th>A</th>
<th>150</th>
<th>Y</th>
<th>E</th>
<th>D</th>
<th>P</th>
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</thead>
<tbody>
<tr>
<td>Varistor</td>
<td>Feedthru</td>
<td>Capacitor</td>
<td>Voltage</td>
<td>DC</td>
<td>AC</td>
<td>Voltage</td>
<td>Clamping Voltage</td>
<td>DC Resistance</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>05</td>
<td>A</td>
<td>150</td>
<td>Y</td>
<td>E</td>
<td>D</td>
<td>P</td>
</tr>
<tr>
<td>V2F105A150Y2E</td>
<td>_</td>
<td>_</td>
<td>5.6</td>
<td>4.0</td>
<td>8.5±20%</td>
<td>18</td>
<td>35</td>
<td>0.10</td>
</tr>
<tr>
<td>V2F105C150Y1F</td>
<td>_</td>
<td>_</td>
<td>5.6</td>
<td>4.0</td>
<td>8.5±20%</td>
<td>18</td>
<td>35</td>
<td>0.30</td>
</tr>
<tr>
<td>V2F109A200Y2E</td>
<td>_</td>
<td>_</td>
<td>9.0</td>
<td>6.4</td>
<td>12.7±15%</td>
<td>22</td>
<td>25</td>
<td>0.10</td>
</tr>
<tr>
<td>V2F109C200Y1F</td>
<td>_</td>
<td>_</td>
<td>9.0</td>
<td>6.4</td>
<td>12.7±15%</td>
<td>22</td>
<td>25</td>
<td>0.30</td>
</tr>
<tr>
<td>V2F114A300Y2E</td>
<td>_</td>
<td>_</td>
<td>14.0</td>
<td>10.0</td>
<td>18.5±12%</td>
<td>32</td>
<td>15</td>
<td>0.10</td>
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<tr>
<td>V2F114C300Y1F</td>
<td>_</td>
<td>_</td>
<td>14.0</td>
<td>10.0</td>
<td>18.5±12%</td>
<td>32</td>
<td>15</td>
<td>0.30</td>
</tr>
<tr>
<td>V2F118A400Y2E</td>
<td>_</td>
<td>_</td>
<td>18.0</td>
<td>13.0</td>
<td>25.5±10%</td>
<td>42</td>
<td>10</td>
<td>0.10</td>
</tr>
<tr>
<td>V2F118C400Y1F</td>
<td>_</td>
<td>_</td>
<td>18.0</td>
<td>13.0</td>
<td>25.5±10%</td>
<td>42</td>
<td>10</td>
<td>0.30</td>
</tr>
<tr>
<td>V2F118X500Y3D</td>
<td>_</td>
<td>_</td>
<td>18.0</td>
<td>13.0</td>
<td>25.5±10%</td>
<td>50</td>
<td>10</td>
<td>0.05</td>
</tr>
<tr>
<td>V3F18A400Y3G</td>
<td>_</td>
<td>_</td>
<td>18.0</td>
<td>13.0</td>
<td>25.5±10%</td>
<td>42</td>
<td>10</td>
<td>0.10</td>
</tr>
<tr>
<td>V3F18X500Y3G</td>
<td>_</td>
<td>_</td>
<td>18.0</td>
<td>13.0</td>
<td>25.5±10%</td>
<td>50</td>
<td>10</td>
<td>0.05</td>
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<tr>
<td>V2F126C600Y1F</td>
<td>_</td>
<td>_</td>
<td>26.0</td>
<td>18.0</td>
<td>34.5±10%</td>
<td>60</td>
<td>10</td>
<td>0.3</td>
</tr>
</tbody>
</table>

### TRANSFEED ELECTRICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>AVX Part Number</th>
<th>Working Voltage (DC)</th>
<th>Working Voltage (AC)</th>
<th>Breakdown Voltage</th>
<th>Clamping Voltage</th>
<th>Maximum Leakage Current</th>
<th>Transient Energy Rating</th>
<th>Peak Current Rating</th>
<th>Typical Cap</th>
<th>DC Resistance</th>
<th>Maximum Feedthru Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>V2F105A150Y2E</td>
<td>5.6</td>
<td>4.0</td>
<td>8.5±20%</td>
<td>18</td>
<td>35</td>
<td>0.10</td>
<td>30</td>
<td>800</td>
<td>0.200</td>
<td>0.75</td>
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<tr>
<td>V2F105C150Y1F</td>
<td>5.6</td>
<td>4.0</td>
<td>8.5±20%</td>
<td>18</td>
<td>35</td>
<td>0.30</td>
<td>120</td>
<td>2500</td>
<td>0.150</td>
<td>1.00</td>
</tr>
<tr>
<td>V2F109A200Y2E</td>
<td>9.0</td>
<td>6.4</td>
<td>12.7±15%</td>
<td>22</td>
<td>25</td>
<td>0.10</td>
<td>30</td>
<td>575</td>
<td>0.200</td>
<td>0.75</td>
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<tr>
<td>V2F109C200Y1F</td>
<td>9.0</td>
<td>6.4</td>
<td>12.7±15%</td>
<td>22</td>
<td>25</td>
<td>0.30</td>
<td>120</td>
<td>1800</td>
<td>0.150</td>
<td>1.00</td>
</tr>
<tr>
<td>V2F114A300Y2E</td>
<td>14.0</td>
<td>10.0</td>
<td>18.5±12%</td>
<td>32</td>
<td>15</td>
<td>0.10</td>
<td>30</td>
<td>300</td>
<td>0.200</td>
<td>0.75</td>
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<tr>
<td>V2F114C300Y1F</td>
<td>14.0</td>
<td>10.0</td>
<td>18.5±12%</td>
<td>32</td>
<td>15</td>
<td>0.30</td>
<td>120</td>
<td>900</td>
<td>0.150</td>
<td>1.00</td>
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<tr>
<td>V2F118A400Y2E</td>
<td>18.0</td>
<td>13.0</td>
<td>25.5±10%</td>
<td>42</td>
<td>10</td>
<td>0.10</td>
<td>30</td>
<td>200</td>
<td>0.200</td>
<td>0.75</td>
</tr>
<tr>
<td>V2F118C400Y1F</td>
<td>18.0</td>
<td>13.0</td>
<td>25.5±10%</td>
<td>42</td>
<td>10</td>
<td>0.30</td>
<td>120</td>
<td>500</td>
<td>0.150</td>
<td>1.00</td>
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<tr>
<td>V2F118X500Y3D</td>
<td>18.0</td>
<td>13.0</td>
<td>25.5±10%</td>
<td>50</td>
<td>10</td>
<td>0.05</td>
<td>20</td>
<td>75</td>
<td>0.250</td>
<td>0.50</td>
</tr>
<tr>
<td>V3F18A400Y3G</td>
<td>18.0</td>
<td>13.0</td>
<td>25.5±10%</td>
<td>42</td>
<td>10</td>
<td>0.10</td>
<td>20</td>
<td>150</td>
<td>0.200</td>
<td>0.30</td>
</tr>
<tr>
<td>V3F18X500Y3G</td>
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<td>50</td>
<td>10</td>
<td>0.05</td>
<td>15</td>
<td>65</td>
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<td>0.20</td>
</tr>
<tr>
<td>V2F126C600Y1F</td>
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<td>18.0</td>
<td>34.5±10%</td>
<td>60</td>
<td>10</td>
<td>0.3</td>
<td>80</td>
<td>250</td>
<td>0.15</td>
<td>1.00</td>
</tr>
</tbody>
</table>

- **V** = 2 = 0805
- **F** = 3 = 0612
- **05** = No. of Elements
- **A** = Energy Rating
  - X = 0.05J
  - A = 0.1J
  - C = 0.3J
- **150** = Capacitance Tolerance
  - Y = +100/-50%
- **D** = Feedthru Current
  - D = 500 mA
  - E = 750 mA
  - F = 1.0 Amp

**HOW TO ORDER**

- **Termination Finish Code**
  - P = Ni/Sn Alloy (Plated)
- **Packaging Code**
  - D = 1,000
  - R = 4,000
  - T = 10,000

**Notation**

- $V_v$ (DC) = DC Working Voltage (V)
- $V_v$ (AC) = AC Working Voltage (V)
- $V_b$ = Typical Breakdown Voltage (V @ 1mA$_{in}$)
- $V_b$ Tol = $V_b$ Tolerance is ± from Typical Value
- $V_c$ = Clamping Voltage (V @ 1A 8x20μS)
- $I_L$ = 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) @ 1MHz and 0.5 V
- DCR = DC Resistance (Ohms)
- $I_{FT}$ = Maximum Feedthru Current (A)
AVX Multilayer Ceramic Transient Voltage Suppressors
TVS Protection and EMI Attenuation in a Single Chip

**DIMENSIONS**

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>W</th>
<th>T</th>
<th>BW</th>
<th>BL</th>
<th>EW</th>
<th>X</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>0805</td>
<td>2.01 ± 0.20</td>
<td>1.25 ± 0.20</td>
<td>1.143 Max.</td>
<td>0.46 ± 0.10</td>
<td>0.18 + 0.25 - 0.08</td>
<td>0.25 ± 0.13</td>
<td>1.02 ± 0.10</td>
<td>0.23 ± 0.05</td>
</tr>
<tr>
<td></td>
<td>(0.079 ± 0.008)</td>
<td>(0.049 ± 0.008)</td>
<td>(0.045 Max.)</td>
<td>(0.018 ± 0.004)</td>
<td>(0.007 + 0.010 - 0.003)</td>
<td>(0.010 ± 0.005)</td>
<td>(0.040 ± 0.004)</td>
<td>(0.009 ± 0.002)</td>
</tr>
</tbody>
</table>

**RECOMMENDED SOLDER PAD LAYOUT** (Typical Dimensions)

<table>
<thead>
<tr>
<th></th>
<th>T</th>
<th>P</th>
<th>S</th>
<th>W</th>
<th>L</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0805</td>
<td>3.45 (0.136)</td>
<td>0.51 (0.020)</td>
<td>0.76 (0.030)</td>
<td>1.27 (0.050)</td>
<td>1.02 (0.040)</td>
<td>0.46 (0.018)</td>
</tr>
</tbody>
</table>

**dB Attenuation vs Frequency**

**4 Pad Layout**
TransFeed Array - V3F4 Series

TVS Protection and EMI Attenuation in a 4-Element Array

**DIMENSIONS**

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>W</td>
<td>T</td>
<td>BW</td>
<td>BL</td>
<td>ES</td>
<td>P</td>
</tr>
<tr>
<td>1.60 ± 0.20</td>
<td>3.25 ± 0.15</td>
<td>1.22 Max.</td>
<td>0.41 ± 0.10</td>
<td>0.18 ± 0.25 - 0.08</td>
<td>0.41 ± 0.10</td>
<td>0.76 REF</td>
</tr>
<tr>
<td>(0.063 ± 0.008)</td>
<td>(0.128 ± 0.006)</td>
<td>(0.048 Max.)</td>
<td>(0.016 ± 0.004)</td>
<td>(0.007 ± 0.010 - 0.003)</td>
<td>(0.016 ± 0.004)</td>
<td>(0.030 REF)</td>
</tr>
</tbody>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>0.60 (0.024)</td>
<td>1.60 (0.064)</td>
<td>2.20 (0.088)</td>
<td>0.35 (0.014)</td>
<td>0.76 (0.030)</td>
</tr>
</tbody>
</table>

Downloaded from Arrow.com.
PERFORMANCE CHARACTERISTICS

INSERTION LOSS COMPARISON
(TransFeed vs TransGuard®)

0805 – dB vs Frequency

TransFeed
AVX Multilayer Ceramic Transient Voltage Suppressors
TVS Protection and EMI Attenuation in a Single Chip

Downloaded from Arrow.com.
PERFORMANCE CHARACTERISTICS

CURRENT vs TEMPERATURE

0805 – 0.1 Joule

0805 – 0.3 Joule

TransFeed
AVX Multilayer Ceramic Transient Voltage Suppressors
TVS Protection and EMI Attenuation in a Single Chip

Note: Dashed Portions Not Guaranteed

Component Temperature (°C)

Current (Amps)
PERFORMANCE CHARACTERISTICS

FEEDTHRU VARISTORS

AVX Multilayer Feedthru Varistors (MLVF) are an ideal choice for system designers with transient strike and broadband EMI/RFI concerns.

Feedthru Varistors utilize a ZnO varistor material and the electrode pattern of a feedthru capacitor. This combination allows the package advantage of the feedthru and material advantages of the ZnO dielectric to be optimized.

ZnO MLV Feedthrus exhibit electrical and physical advantages over standard ZnO MLVs. Among them are:

1. Faster Turn on Time
2. Broadband EMI attenuation
3. Small size (relative to discrete MLV and EMI filter schemes)

The electrical model for a ZnO MLV and a ZnO Feedthru MLV are shown below. The key difference in the model for the Feedthru is a transformation in parallel to series inductance. The added series inductance helps lower the injected transient peak current (by 2πfL) resulting in an additional benefit of a lower clamping voltage. The lowered parallel inductance decreases the turn on time for the varistor to <250ps.

Discrete MLV Model

![Discrete MLV Model Diagram]

Where:  
- $R_V$ = Voltage Variable resistance (per VI curve)
- $R_p \geq 10^{12} \Omega$
- $C$ = defined by voltage rating and energy level
- $R_{on}$ = turn on resistance
- $L_p$ = parallel body inductance

Discrete MLVF Model

![Discrete MLVF Model Diagram]

Where:  
- $R_V$ = Voltage Variable resistance (per VI curve)
- $R_p$ = Body IR
- $C$ = defined by voltage rating and energy level
- $R_{on}$ = turn on resistance
- $L_p$ = minimized parallel body inductance
- $L_s$ = series body inductance
**APPLICATIONS**

- EMI Suppression
- Broadband I/O Filtering
- Vcc Line Conditioning

**FEATURES**

- Small Size
- Low ESR
- Ultra-fast Response Time
- Broad S21 Characteristics

**MARKET SEGMENTS**

- Computers
- Automotive
- Power Supplies
- Multimedia Add-On Cards
- Bar Code Scanners
- Remote Terminals
- Medical Instrumentation
- Test Equipment
- Transceivers
- Cellular Phones / Pagers

**PERFORMANCE CHARACTERISTICS**

**APPLICATIONS**

- EMI Suppression
- Broadband I/O Filtering
- Vcc Line Conditioning

**FEATURES**

- Small Size
- Low ESR
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**TYPICAL CIRCUITS REQUIRING TRANSIENT VOLTAGE PROTECTION AND EMI FILTERING**

The following applications and schematic diagrams show where TransFeed TVS/ EMI filtering devices might be used:

- System Board Level Interfaces: (Fig. 1)
  - Digital to RF
  - Analog to Digital
  - Digital to Analog
- Voltage Regulation (Fig. 2)
- Power Conversion Circuits (Fig. 3)
- GaAs FET Protection (Fig. 4)

**SPECIFICATION COMPARISON**

<table>
<thead>
<tr>
<th>MLVF 0805</th>
<th>PARAMETER</th>
<th>MLV 0805</th>
</tr>
</thead>
<tbody>
<tr>
<td>5ph</td>
<td>L_s typical</td>
<td>N/A</td>
</tr>
<tr>
<td>&lt;600nh</td>
<td>L_p typical</td>
<td>&lt;1.5nh</td>
</tr>
<tr>
<td>&lt;0.025Ω</td>
<td>R_on typical</td>
<td>&lt;0.1Ω</td>
</tr>
<tr>
<td>100pf to 2.5nf</td>
<td>C typical</td>
<td>100pf to 5.5nf</td>
</tr>
<tr>
<td>see VI curves</td>
<td>R_V typical</td>
<td>see VI curves</td>
</tr>
<tr>
<td>&gt;0.25 x 10^{12}Ω</td>
<td>R_p typical</td>
<td>&gt;1 x 10^{12}Ω</td>
</tr>
<tr>
<td>&lt;250ps</td>
<td>Typical turn on time</td>
<td>&lt;500ps</td>
</tr>
<tr>
<td></td>
<td>Typical frequency response</td>
<td></td>
</tr>
</tbody>
</table>

A comparison table showing typical element parameters and resulting performance features for MLV and MLVF is shown above.