

## AVX Multilayer Ceramic Transient Voltage Suppressors

### GENERAL DESCRIPTION

The AVX TransGuard® Transient Voltage Suppressors (TVS) with unique high-energy multilayer construction represents state-of-the-art overvoltage circuit protection. Monolithic multilayer construction provides protection from voltage transients caused by ESD, lightning, NEMP, inductive switching, etc. True surface mount product is provided in EIA industry standard packages. Thru-hole components are supplied as conformally coated axial devices.

### TRANSQUARD® DESCRIPTION

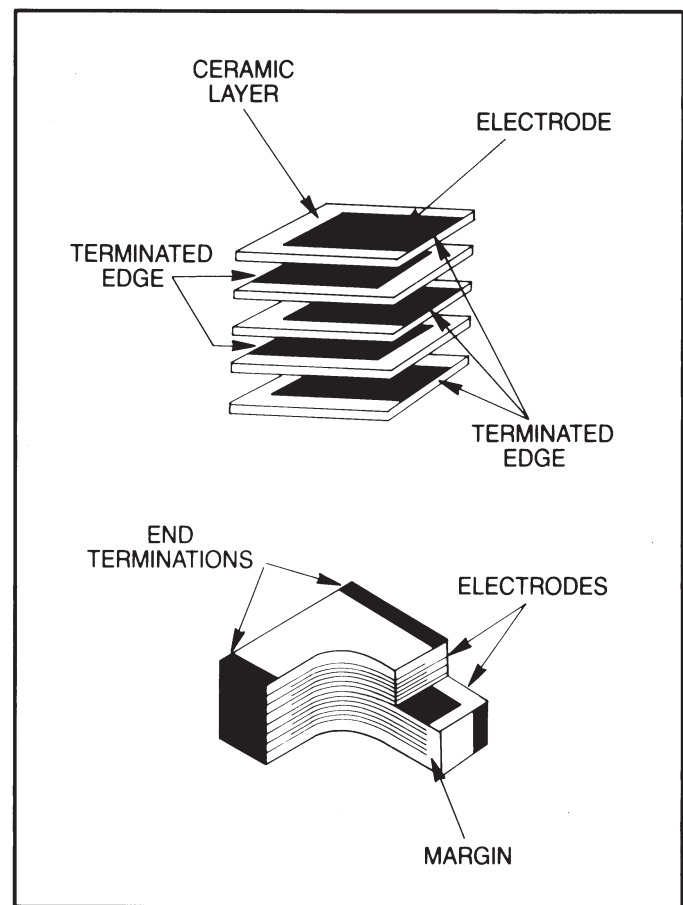
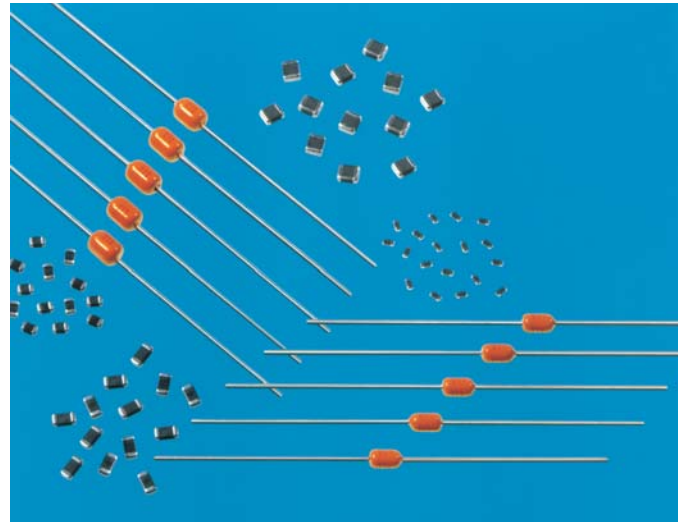
TransGuard® products are zinc oxide (ZnO) based ceramic semiconductor devices with non-linear voltage-current characteristics (bi-directional) similar to back-to-back zener diodes. They have the added advantage of greater current and energy handling capabilities as well as EMI/RFI attenuation. Devices are fabricated by a ceramic sintering process that yields a structure of conductive ZnO grains surrounded by electrically insulating barriers, creating varistor-like behavior.

AVX VG series parts (large case size, high energy) are glass encapsulated. These parts provide the same high reliability as traditional VC series parts. The glass encapsulation provides also enhanced resistance against harsh environment or process such as acids, salts, chlorite flux.

The number of grain-boundary interfaces between conducting electrodes determines "Breakdown Voltage" of the device. High voltage applications such as AC line protection require many grains between electrodes while low voltage requires few grains to establish the appropriate breakdown voltage. Single layer ceramic disc processing proved to be a viable production method for thick cross section devices with many grains, but attempts to address low voltage suppression needs by processing single layer ceramic disc formulations with huge grain sites has had limited success.

AVX, the world leader in the manufacture of multilayer ceramic capacitors, now offers the low voltage transient protection marketplace a true multilayer, monolithic surface mount varistor. Technology leadership in processing thin dielectric materials and patented processes for precise ceramic grain growth have yielded superior energy dissipation in the smallest size. Now a varistor has voltage characteristics determined by design and not just cell sorting whatever falls out of the process.

Multilayer ceramic varistors are manufactured by mixing ceramic powder in an organic binder (slurry) and casting it into thin layers of precision thickness. Metal electrodes are deposited onto the green ceramic layers which are then stacked to form a laminated structure. The metal electrodes are arranged so that their terminations alternate from one end of the varistor to the other. The device becomes a monolithic block during the sintering (firing) cycle providing uniform energy dissipation in a small volume.



## AVX Multilayer Ceramic Transient Voltage Suppressors

### PART NUMBER IDENTIFICATION

#### Surface Mount Devices

**Important: For part number identification only, not for construction of part numbers.**

The information below only defines the numerical value of part number digits, and cannot be used to construct a desired set of electrical limits. Please refer to the TransGuard® part number data for the correct electrical ratings.

**VC 1206 05 D 150 R P**

#### TERMINATION FINISH:

P = Ni/Sn Alloy (Plated)

#### PACKAGING (Pcs/Reel):

| STYLE  | "D"   | "R"   | "T"    | "W"    |
|--------|-------|-------|--------|--------|
| VC0402 | N/A   | N/A   | N/A    | 10,000 |
| VC0603 | 1,000 | 4,000 | 10,000 | N/A    |
| VC0805 | 1,000 | 4,000 | 10,000 | N/A    |
| VC1206 | 1,000 | 4,000 | 10,000 | N/A    |
| VC1210 | 1,000 | 2,000 | 10,000 | N/A    |

#### CLAMPING VOLTAGE:

|        |           |            |
|--------|-----------|------------|
| Where: | 100 = 12V | 500 = 50V  |
|        | 150 = 18V | 560 = 60V  |
|        | 200 = 22V | 580 = 60V  |
|        | 250 = 27V | 620 = 67V  |
|        | 300 = 32V | 650 = 67V  |
|        | 390 = 42V | 101 = 100V |
|        | 400 = 42V | 121 = 120V |

#### ENERGY:

|        |          |          |              |
|--------|----------|----------|--------------|
| Where: | A = 0.1J | J = 1.5J | S = 1.9-2.0J |
|        | B = 0.2J | K = 0.6J | T = 0.01J    |
|        | C = 0.3J | L = 0.8J | U = 4.0-5.0J |
|        | D = 0.4J | M = 1.0J | V = 0.02J    |
|        | E = 0.5J | N = 1.1J | W = 6.0J     |
|        | F = 0.7J | P = 3.0J | X = 0.05J    |
|        | G = 0.9J | Q = 1.3J | Y = 12.0J    |
|        | H = 1.2J | R = 1.7J | Z = 25.0J    |

#### WORKING VOLTAGE:

|        |               |               |
|--------|---------------|---------------|
| Where: | 03 = 3.3 VDC  | 18 = 18.0 VDC |
|        | 05 = 5.6 VDC  | 26 = 26.0 VDC |
|        | 09 = 9.0 VDC  | 30 = 30.0 VDC |
|        | 12 = 12.0 VDC | 48 = 48.0 VDC |
|        | 14 = 14.0 VDC | 60 = 60.0 VDC |
|        |               | 85 = 85.0 VDC |

#### CASE SIZE DESIGNATOR:

| SIZE | LENGTH                      | WIDTH                      |
|------|-----------------------------|----------------------------|
| 0402 | 1.00±0.10mm (0.040"±0.004") | 0.5±0.10mm (0.020"±0.004") |
| 0603 | 1.60±0.15mm (0.063"±0.006") | 0.8±0.15mm (0.032"±0.006") |
| 0805 | 2.01±0.2mm (0.079"±0.008")  | 1.25±0.2mm (0.049"±0.008") |
| 1206 | 3.20±0.2mm (0.126"±0.008")  | 1.60±0.2mm (0.063"±0.008") |
| 1210 | 3.20±0.2mm (0.126"±0.008")  | 2.49±0.2mm (0.098"±0.008") |

#### CASE STYLE:

C = Chip  
G = Chip Glass Encapsulated

#### PRODUCT DESIGNATOR:

V = Varistor

#### MARKING:

All standard surface mount TransGuard® chips will **not** be marked.

#### Axial Leaded Devices

**Important: For part number identification only, not for construction of part numbers.**

The information below only defines the numerical value of part number digits, and cannot be used to construct a desired set of electrical limits. Please refer to the TransGuard® part number data for the correct electrical ratings.

**V A 1000 05 D 150 R L**

#### LEAD FINISH:

Copper clad steel, solder coated

#### PACKAGING (Pcs/Reel):

| STYLE  | "D"   | "R"   | "T"   |
|--------|-------|-------|-------|
| VA1000 | 1,000 | 3,000 | 7,500 |
| VA2000 | 1,000 | 2,500 | 5,000 |

#### CLAMPING VOLTAGE:

|        |           |            |
|--------|-----------|------------|
| Where: | 100 = 12V | 580 = 60V  |
|        | 150 = 18V | 650 = 67V  |
|        | 300 = 32V | 101 = 100V |
|        | 400 = 42V | 121 = 120V |

#### ENERGY:

|        |          |
|--------|----------|
| Where: | A = 0.1J |
|        | D = 0.4J |
|        | K = 2.0J |

#### WORKING VOLTAGE:

|        |               |               |
|--------|---------------|---------------|
| Where: | 03 = 3.3 VDC  | 26 = 26.0 VDC |
|        | 05 = 5.6 VDC  | 30 = 30.0 VDC |
|        | 14 = 14.0 VDC | 48 = 48.0 VDC |
|        | 18 = 18.0 VDC | 60 = 60.0 VDC |

#### CASE SIZE DESIGNATOR:

| SIZE | LENGTH          | DIAMETER        |
|------|-----------------|-----------------|
| 1000 | 4.32mm (0.170") | 2.54mm (0.100") |
| 2000 | 4.83mm (0.190") | 3.56mm (0.140") |

#### CASE STYLE:

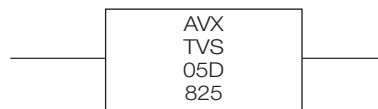
A = Axial

#### PRODUCT DESIGNATOR:

V = Varistor

#### MARKING:

All axial TransGuards® are marked with vendor identification, product identification, voltage/energy rating code and date code (see example below):



Where: AVX = Always AVX (Vendor Identification)  
TVS = Always TVS (Product Identification - Transient Voltage Suppressor)  
05D = Working VDC and Energy Rating (Joules)  
Where: 05 = 5.6 VDC, D = 0.4J  
725 = Three Digit Date Code  
Where: 8 = Last digit of year (2008)  
25 = Week of year

#### Not RoHS Compliant



For RoHS compliant products,  
please select correct termination style.

### ELECTRICAL CHARACTERISTICS

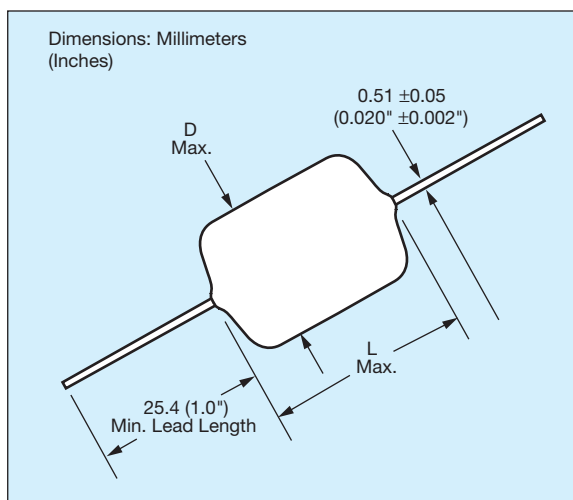
| AVX PN       | V <sub>w</sub> (DC) | V <sub>w</sub> (AC) | V <sub>B</sub> | V <sub>C</sub> | I <sub>VC</sub> | I <sub>L</sub> | E <sub>T</sub> | I <sub>P</sub> | Cap   | Freq | Case |
|--------------|---------------------|---------------------|----------------|----------------|-----------------|----------------|----------------|----------------|-------|------|------|
| VC060303A100 | 3.3                 | 2.3                 | 5.0±20%        | 12             | 1               | 100            | 0.1            | 30             | 1450  | K    | 0603 |
| VC080503A100 | 3.3                 | 2.3                 | 5.0±20%        | 12             | 1               | 100            | 0.1            | 40             | 1400  | K    | 0805 |
| VC080503C100 | 3.3                 | 2.3                 | 5.0±20%        | 12             | 1               | 100            | 0.3            | 120            | 5000  | K    | 0805 |
| VC120603A100 | 3.3                 | 2.3                 | 5.0±20%        | 12             | 1               | 100            | 0.1            | 40             | 1250  | K    | 1206 |
| VC120603D100 | 3.3                 | 2.3                 | 5.0±20%        | 12             | 1               | 100            | 0.4            | 150            | 4700  | K    | 1206 |
| VA100003A100 | 3.3                 | 2.3                 | 5.0±20%        | 12             | 1               | 100            | 0.1            | 40             | 1500  | K    | 1000 |
| VA100003D100 | 3.3                 | 2.3                 | 5.0±20%        | 12             | 1               | 100            | 0.4            | 150            | 4700  | K    | 1000 |
| VC040205X150 | 5.6                 | 4.0                 | 8.5±20%        | 18             | 1               | 35             | 0.05           | 20             | 175   | M    | 0402 |
| VC060305A150 | 5.6                 | 4.0                 | 8.5±20%        | 18             | 1               | 35             | 0.1            | 30             | 750   | K    | 0603 |
| VC080505A150 | 5.6                 | 4.0                 | 8.5±20%        | 18             | 1               | 35             | 0.1            | 40             | 1100  | K    | 0805 |
| VC080505C150 | 5.6                 | 4.0                 | 8.5±20%        | 18             | 1               | 35             | 0.3            | 120            | 3000  | K    | 0805 |
| VC120605A150 | 5.6                 | 4.0                 | 8.5±20%        | 18             | 1               | 35             | 0.1            | 40             | 1200  | K    | 1206 |
| VC120605D150 | 5.6                 | 4.0                 | 8.5±20%        | 18             | 1               | 35             | 0.4            | 150            | 3000  | K    | 1206 |
| VA100005A150 | 5.6                 | 4.0                 | 8.5±20%        | 18             | 1               | 35             | 0.1            | 40             | 1000  | K    | 1000 |
| VA100005D150 | 5.6                 | 4.0                 | 8.5±20%        | 18             | 1               | 35             | 0.4            | 150            | 2800  | K    | 1000 |
| VC040209X200 | 9.0                 | 6.4                 | 12.7±15%       | 22             | 1               | 25             | 0.05           | 20             | 175   | M    | 0402 |
| VC060309A200 | 9.0                 | 6.4                 | 12.7±15%       | 22             | 1               | 25             | 0.1            | 30             | 550   | K    | 0603 |
| VC080509A200 | 9.0                 | 6.4                 | 12.7±15%       | 22             | 1               | 25             | 0.1            | 40             | 750   | K    | 0805 |
| VC080512A250 | 12.0                | 8.5                 | 16±15%         | 27             | 1               | 25             | 0.1            | 40             | 525   | K    | 0805 |
| VC040214X300 | 14.0                | 10.0                | 18.5±12%       | 32             | 1               | 15             | 0.05           | 20             | 85    | K    | 0402 |
| VC060314A300 | 14.0                | 10.0                | 18.5±12%       | 32             | 1               | 15             | 0.1            | 30             | 350   | K    | 0603 |
| VC080514A300 | 14.0                | 10.0                | 18.5±12%       | 32             | 1               | 15             | 0.1            | 40             | 325   | K    | 0805 |
| VC080514C300 | 14.0                | 10.0                | 18.5±12%       | 32             | 1               | 15             | 0.3            | 120            | 900   | K    | 0805 |
| VC120614A300 | 14.0                | 10.0                | 18.5±12%       | 32             | 1               | 15             | 0.1            | 40             | 600   | K    | 1206 |
| VC120614D300 | 14.0                | 10.0                | 18.5±12%       | 32             | 1               | 15             | 0.4            | 150            | 1050  | K    | 1206 |
| VA100014A300 | 14.0                | 10.0                | 18.5±12%       | 32             | 1               | 15             | 0.1            | 40             | 325   | K    | 1000 |
| VA100014D300 | 14.0                | 10.0                | 18.5±12%       | 32             | 1               | 15             | 0.4            | 150            | 1100  | K    | 1000 |
| VC121016J390 | 16.0                | 13.0                | 25.5±10%       | 40             | 2.5             | 10             | 1.6            | 500            | 3100  | K    | 1210 |
| VG181216P400 | 16.0                | 11.0                | 24.5±10%       | 42             | 5               | 10             | 2.9            | 1000           | 5000  | K    | 1812 |
| VG222016Y400 | 16.0                | 11.0                | 24.5±10%       | 42             | 10              | 10             | 7.2            | 1500           | 13000 | K    | 2220 |
| VC040218X400 | 18.0                | 13.0                | 25.5±10%       | 42             | 1               | 10             | 0.05           | 20             | 65    | M    | 0402 |
| VC060318A400 | 18.0                | 13.0                | 25.5±10%       | 42             | 1               | 10             | 0.1            | 30             | 150   | K    | 0603 |
| VC080518A400 | 18.0                | 13.0                | 25.5±10%       | 42             | 1               | 10             | 0.1            | 30             | 225   | K    | 0805 |
| VC080518C400 | 18.0                | 13.0                | 25.5±10%       | 42             | 1               | 10             | 0.3            | 100            | 550   | K    | 0805 |
| VC120618A400 | 18.0                | 13.0                | 25.5±10%       | 42             | 1               | 10             | 0.1            | 30             | 350   | K    | 1206 |
| VC120618D400 | 18.0                | 13.0                | 25.5±10%       | 42             | 1               | 10             | 0.4            | 150            | 900   | K    | 1206 |
| VC120618E380 | 18.0                | 13.0                | 25.5±10%       | 38             | 1               | 15             | 0.5            | 200            | 930   | K    | 1206 |
| VC121018J390 | 18.0                | 13.0                | 25.5±10%       | 42             | 5               | 10             | 1.6            | 500            | 3100  | K    | 1210 |
| VA100018A400 | 18.0                | 13.0                | 25.5±10%       | 42             | 1               | 10             | 0.1            | 40             | 350   | K    | 1000 |
| VA100018D400 | 18.0                | 13.0                | 25.5±10%       | 42             | 1               | 10             | 0.4            | 150            | 900   | K    | 1000 |
| VG121022R440 | 22.0                | 17.0                | 27±10%         | 44             | 2.5             | 10             | 1.7            | 400            | 1600  | K    | 1210 |
| VC060326A580 | 26.0                | 18.0                | 34.5±10%       | 60             | 1               | 10             | 0.1            | 30             | 155   | K    | 0603 |
| VC080526A580 | 26.0                | 18.0                | 34.5±10%       | 60             | 1               | 10             | 0.1            | 30             | 120   | K    | 0805 |
| VC080526C580 | 26.0                | 18.0                | 34.5±10%       | 60             | 1               | 10             | 0.3            | 100            | 250   | K    | 0805 |

## AVX Multilayer Ceramic Transient Voltage Suppressors

### ELECTRICAL CHARACTERISTICS

| AVX PN       | V <sub>W</sub> (DC) | V <sub>W</sub> (AC) | V <sub>B</sub> | V <sub>C</sub> | I <sub>VC</sub> | I <sub>L</sub> | E <sub>T</sub> | I <sub>P</sub> | Cap  | Freq | Case |
|--------------|---------------------|---------------------|----------------|----------------|-----------------|----------------|----------------|----------------|------|------|------|
| VC120626D580 | 26.0                | 18.0                | 34.5±10%       | 60             | 1               | 10             | 0.4            | 120            | 500  | K    | 1206 |
| VC120626F540 | 26.0                | 20.0                | 33.0±10%       | 54             | 1               | 15             | 0.7            | 200            | 600  | K    | 1206 |
| VC121026H560 | 26.0                | 18.0                | 34.5±10%       | 60             | 5               | 10             | 1.2            | 300            | 2150 | K    | 1210 |
| VC181226P540 | 26.0                | 20.0                | 33.0±10%       | 54             | 5               | 15             | 3.0            | 800            | 3000 | K    | 1812 |
| VA100026D580 | 26.0                | 18.0                | 34.5±10%       | 60             | 1               | 10             | 0.4            | 120            | 650  | K    | 1000 |
| VC060330A650 | 30.0                | 21.0                | 41.0±10%       | 67             | 1               | 10             | 0.1            | 30             | 125  | K    | 0603 |
| VC080530A650 | 30.0                | 21.0                | 41.0±10%       | 67             | 1               | 10             | 0.1            | 30             | 90   | M    | 0805 |
| VC080530C650 | 30.0                | 21.0                | 41.0±10%       | 67             | 1               | 10             | 0.3            | 80             | 250  | K    | 0805 |
| VC120630D650 | 30.0                | 21.0                | 41.0±10%       | 67             | 1               | 10             | 0.4            | 120            | 400  | K    | 1206 |
| VC121030G620 | 30.0                | 21.0                | 41.0±10%       | 67             | 5               | 10             | 0.9            | 220            | 1750 | K    | 1210 |
| VC121030H620 | 30.0                | 21.0                | 41.0±10%       | 67             | 5               | 10             | 1.2            | 280            | 1850 | K    | 1210 |
| VC121030S620 | 30.0                | 21.0                | 41.0±10%       | 67             | 5               | 10             | 1.9            | 300            | 1500 | K    | 1210 |
| VA100030D650 | 30.0                | 21.0                | 41.0±10%       | 67             | 1               | 10             | 0.4            | 120            | 550  | K    | 1000 |
| VC080531C650 | 31.0                | 25.0                | 39.0±10%       | 65             | 1               | 10             | 0.3            | 80             | 250  | K    | 0805 |
| VC120631M650 | 31.0                | 25.0                | 39.0±10%       | 65             | 1               | 15             | 1.0            | 200            | 500  | K    | 1206 |
| VC080538C770 | 38.0                | 30.0                | 47.0±10%       | 77             | 1               | 10             | 0.3            | 80             | 200  | K    | 0805 |
| VC120638N770 | 38.0                | 30.0                | 47.0±10%       | 77             | 1               | 15             | 1.1            | 200            | 400  | K    | 1206 |
| VG121038S770 | 38.0                | 30.0                | 47.0±10%       | 77             | 2.5             | 15             | 2.0            | 400            | 1000 | K    | 1210 |
| VG181238U770 | 38.0                | 30.0                | 47.0±10%       | 77             | 5               | 15             | 4.2            | 800            | 1300 | K    | 1812 |
| VG222038Y770 | 38.0                | 30.0                | 47.0±10%       | 77             | 10              | 15             | 12             | 2000           | 4200 | K    | 2220 |
| VC120642L800 | 42.0                | 32.0                | 51.0±10%       | 80             | 1               | 15             | 0.8            | 180            | 600  | K    | 1206 |
| VC120645K900 | 45.0                | 35.0                | 56.0±10%       | 90             | 1               | 15             | 0.6            | 200            | 260  | K    | 1206 |
| VG181245U900 | 45.0                | 35.0                | 56.0±10%       | 90             | 5               | 15             | 4.0            | 500            | 1200 | K    | 1812 |
| VC120648D101 | 48.0                | 34.0                | 62.0±10%       | 100            | 1               | 10             | 0.4            | 100            | 225  | K    | 1206 |
| VC121048G101 | 48.0                | 34.0                | 62.0±10%       | 100            | 5               | 10             | 0.9            | 220            | 450  | K    | 1210 |
| VC121048H101 | 48.0                | 34.0                | 62.0±10%       | 100            | 5               | 10             | 1.2            | 250            | 500  | K    | 1210 |
| VA100048D101 | 48.0                | 34.0                | 62.0±10%       | 100            | 1               | 10             | 0.4            | 100            | 200  | K    | 1000 |
| VC120656F111 | 56.0                | 40.0                | 68.0±10%       | 110            | 1               | 15             | 0.7            | 100            | 180  | K    | 1206 |
| VC181256U111 | 56.0                | 40.0                | 68.0±10%       | 110            | 5               | 15             | 4.8            | 500            | 800  | K    | 1812 |
| VC121060J121 | 60.0                | 42.0                | 76.0±10%       | 120            | 5               | 10             | 1.5            | 250            | 400  | K    | 1210 |
| VA200060K121 | 60.0                | 42.0                | 76.0±10%       | 120            | 1               | 10             | 2.0            | 300            | 400  | K    | 2000 |
| VC120665L131 | 65.0                | 50.0                | 82.0±10%       | 135            | 1               | 15             | 0.8            | 100            | 250  | K    | 1206 |
| VC120665M131 | 65.0                | 50.0                | 82.0±10%       | 135            | 1               | 15             | 1.0            | 150            | 250  | K    | 1206 |
| VG121065P131 | 65.0                | 50.0                | 82±10%         | 135            | 2.5             | 15             | 2.7            | 350            | 600  | K    | 1210 |
| VC121085S151 | 85.0                | 60.0                | 100±10%        | 150            | 1               | 35             | 2.0            | 250            | 275  | K    | 1210 |

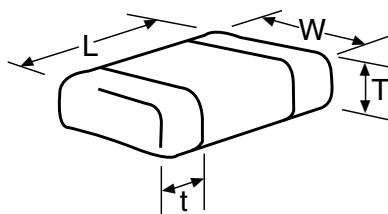
|                     |                                                    |                |                                                                         |
|---------------------|----------------------------------------------------|----------------|-------------------------------------------------------------------------|
| 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> ) | E <sub>T</sub> | Transient Energy Rating (J, 10x1000µS)                                  |
| V <sub>B</sub> Tol  | V <sub>B</sub> Tolerance is ± from Typical Value   | I <sub>P</sub> | Peak Current Rating (A, 8x20µS)                                         |
| V <sub>C</sub>      | Clamping Voltage (V @ I <sub>VC</sub> )            | Cap            | Typical Capacitance (pF) @ frequency specified and 0.5 V <sub>RMS</sub> |
| I <sub>VC</sub>     | Test Current for V <sub>C</sub> (A, 8x20µS)        | Freq           | Frequency at which capacitance is measured (K = 1kHz, M = 1MHz)         |
| I <sub>L</sub>      | Maximum Leakage Current at the                     |                |                                                                         |



## DIMENSIONS: mm (inches)

| AVX Style        |             | VA1000          | VA2000          |
|------------------|-------------|-----------------|-----------------|
| (L) Max Length   | mm<br>(in.) | 4.32<br>(0.170) | 4.83<br>(0.190) |
| (D) Max Diameter | mm<br>(in.) | 2.54<br>(0.100) | 3.56<br>(0.140) |

Lead Finish: Copper Clad Steel, Solder Coated



## DIMENSIONS: mm (inches)

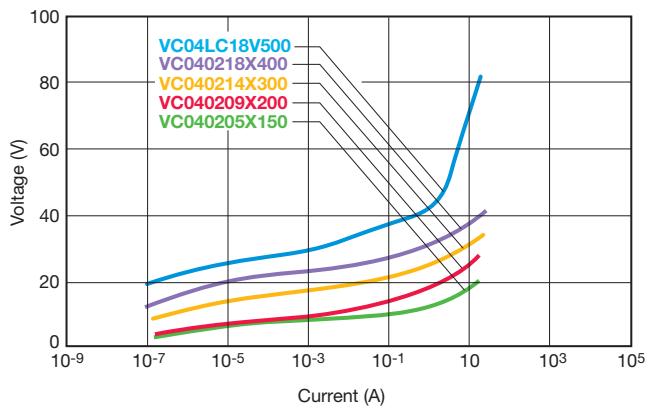
| AVX Style         |             | 0402                       | 0603                       | 0805                       | 1206                       | 1210                       | 1812                       | 2220                       |
|-------------------|-------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| (L) Length        | mm<br>(in.) | 1.00±0.10<br>(0.040±0.004) | 1.60±0.15<br>(0.063±0.006) | 2.01±0.20<br>(0.079±0.008) | 3.20±0.20<br>(0.126±0.008) | 3.20±0.20<br>(0.126±0.008) | 4.50±0.30<br>(0.177±0.012) | 5.70±0.40<br>(0.224±0.016) |
| (W) Width         | mm<br>(in.) | 0.50±0.10<br>(0.020±0.004) | 0.80±0.15<br>(0.031±0.006) | 1.25±0.20<br>(0.049±0.008) | 1.60±0.20<br>(0.063±0.008) | 2.49±0.20<br>(0.098±0.008) | 3.20±0.30<br>(0.126±0.012) | 5.00±0.40<br>(0.197±0.016) |
| (T) Max Thickness | mm<br>(in.) | 0.6<br>(0.024)             | 0.9<br>(0.035)             | 1.02<br>(0.040)            | 1.02<br>(0.040)            | 1.70<br>(0.067)            | 2.00<br>(0.080)            | 2.50<br>(0.098)            |
| (t) Land Length   | mm<br>(in.) | 0.25±0.15<br>(0.010±0.006) | 0.35±0.15<br>(0.014±0.006) | 0.71 max.<br>(0.028 max.)  | 0.94 max.<br>(0.037 max.)  | 1.14 max.<br>(0.045 max.)  | 1.00 max.<br>(0.039 max.)  | 1.00 max.<br>(0.039 max.)  |

## AVX Multilayer Ceramic Transient Voltage Suppressors

### TYPICAL PERFORMANCE CURVES (0402 CHIP SIZE)

#### VOLTAGE/CURRENT CHARACTERISTICS

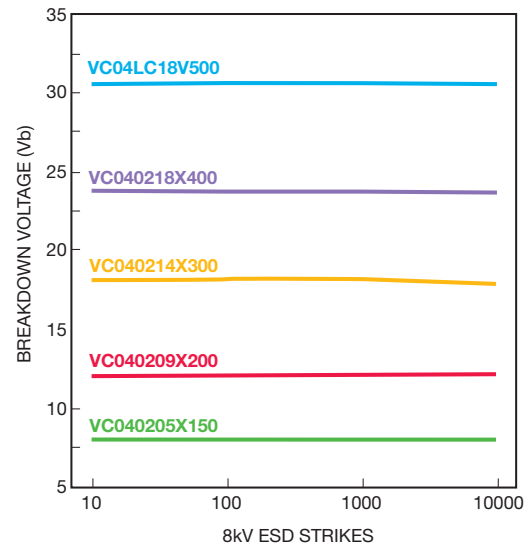
Multilayer construction and improved grain structure result in excellent transient clamping characteristics up to 20 amps peak current, while maintaining very low leakage currents under DC operating conditions. The VI curves below show the voltage/current characteristics for the 5.6V, 9V, 14V, 18V and low capacitance StaticGuard parts with currents ranging from parts of a micro amp to tens of amps.



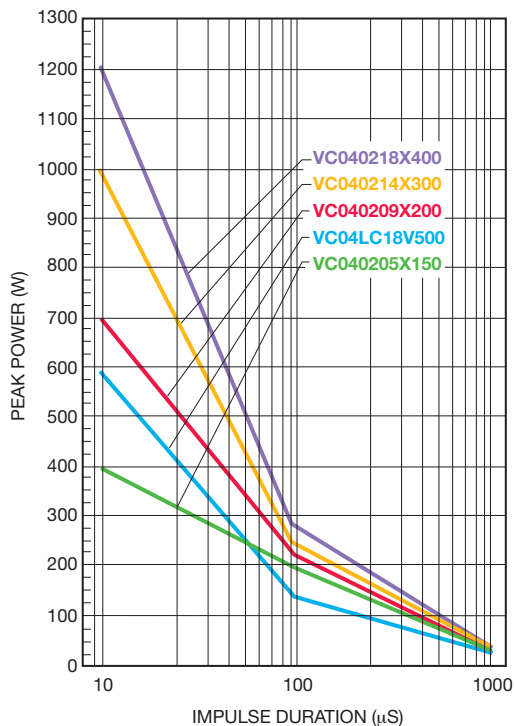
#### PULSE DEGRADATION

Traditionally varistors have suffered degradation of electrical performance with repeated high current pulses resulting in decreased breakdown voltage and increased leakage current. It has been suggested that irregular intergranular boundaries and bulk material result in restricted current paths and other non-Schottky barrier paralleled conduction paths in the ceramic. Repeated pulsing of TransGuard® transient voltage suppressors with 150Amp peak  $8 \times 20\mu\text{S}$  waveforms shows negligible degradation in breakdown voltage and minimal increases in leakage current. This does not mean that TransGuard® suppressors do not suffer degradation, but it occurs at much higher current.

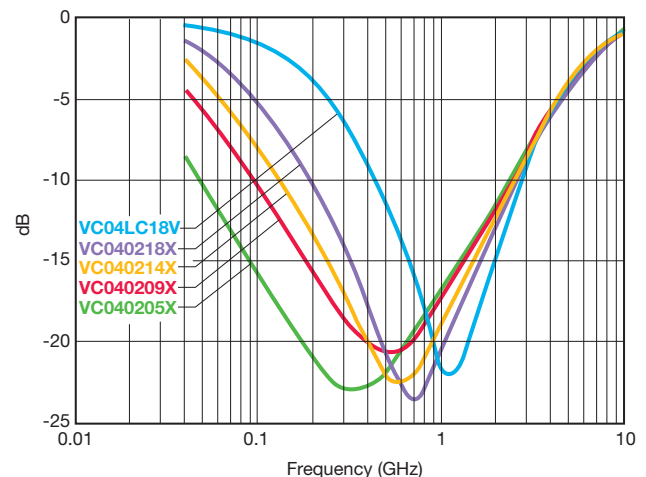
#### ESD TEST OF 0402 PARTS



#### PEAK POWER VS PULSE DURATION



#### INSERTION LOSS CHARACTERISTICS



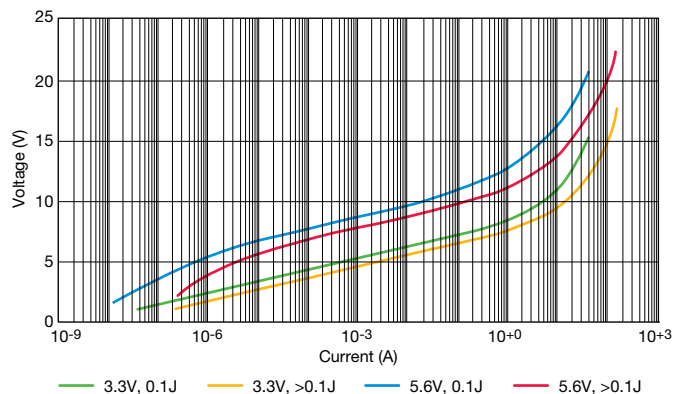
## AVX Multilayer Ceramic Transient Voltage Suppressors

### TYPICAL PERFORMANCE CURVES (0603, 0805, 1206 & 1210 CHIP SIZES)

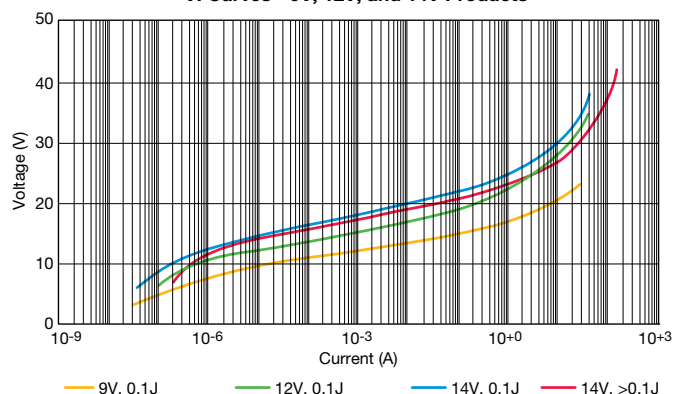
#### VOLTAGE/CURRENT CHARACTERISTICS

Multilayer construction and improved grain structure result in excellent transient clamping characteristics up to 500 amps peak current, depending on case size and energy rating, while maintaining very low leakage currents under DC operating conditions. The VI curve below shows the voltage/current characteristics for the 3.3V, 5.6V, 12V, 14V, 18V, 26V, 30V, 48V and 60VDC parts with currents ranging from parts of a micro amp to tens of amps.

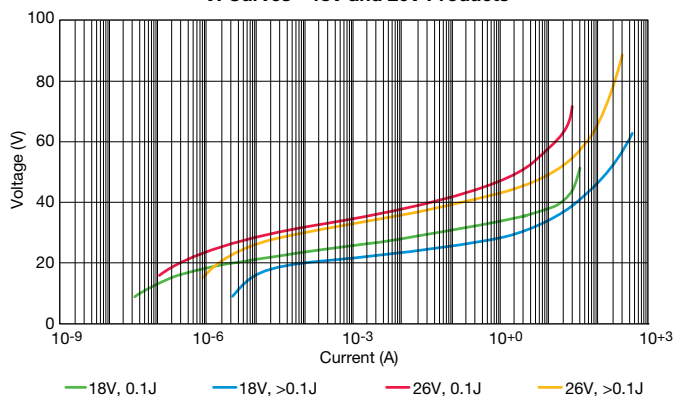
VI Curves - 3.3V and 5.6V Products



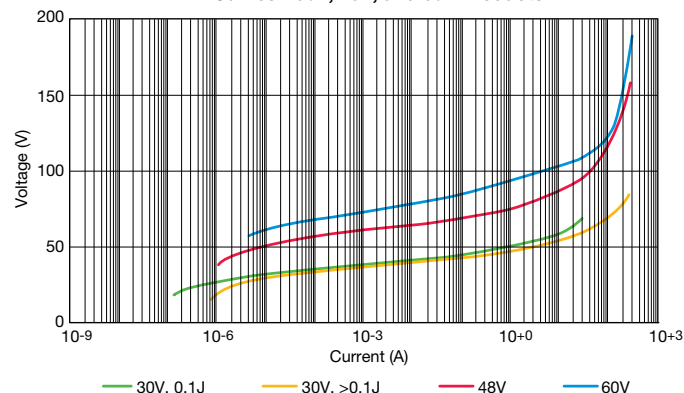
VI Curves - 9V, 12V, and 14V Products



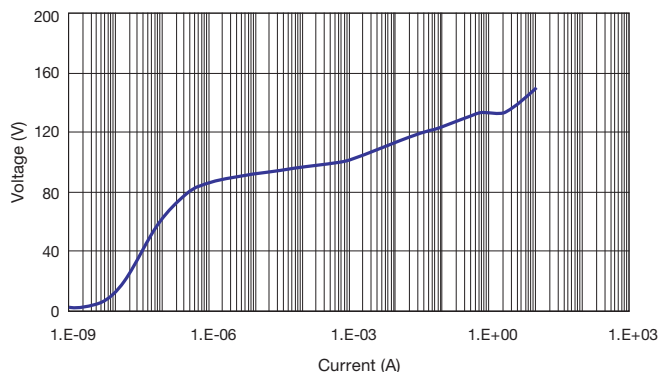
VI Curves - 18V and 26V Products



VI Curves - 30V, 48V, and 60V Products

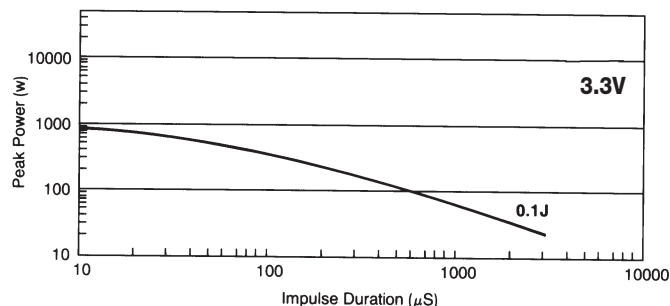


VI Curve - 85V Product

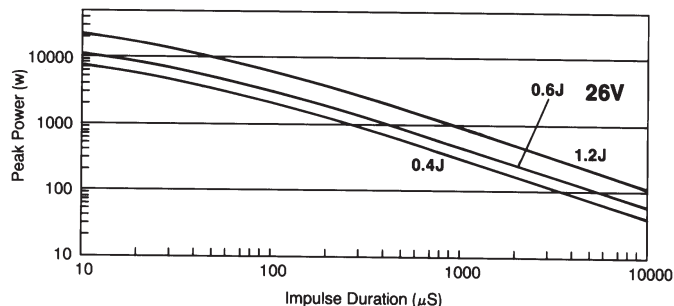


### TYPICAL PERFORMANCE CURVES (0603, 0805, 1206 & 1210 CHIP SIZES)

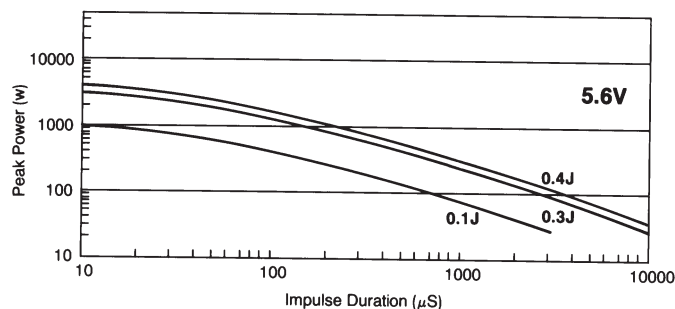
TYPICAL PULSE RATING CURVE  
3.3V MULTILAYER TRANSGUARD®



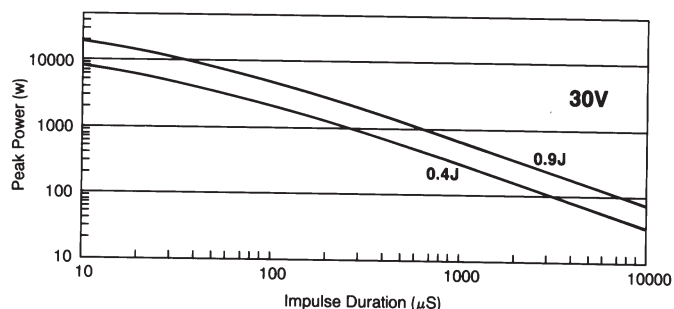
TYPICAL PULSE RATING CURVE  
26V MULTILAYER TRANSGUARD®



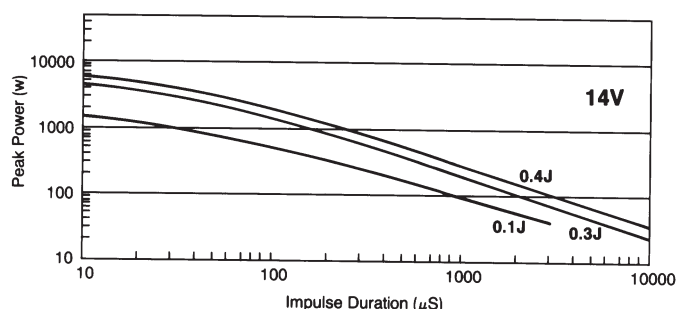
TYPICAL PULSE RATING CURVE  
5.6V MULTILAYER TRANSGUARD®



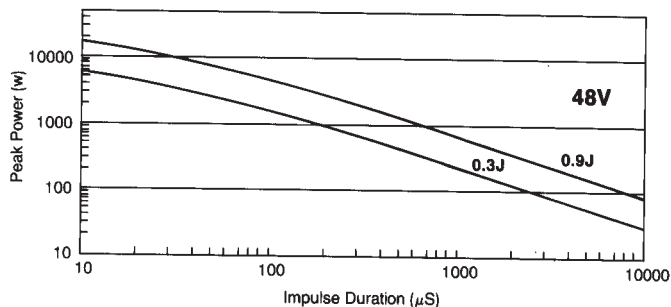
TYPICAL PULSE RATING CURVE  
30V MULTILAYER TRANSGUARD®



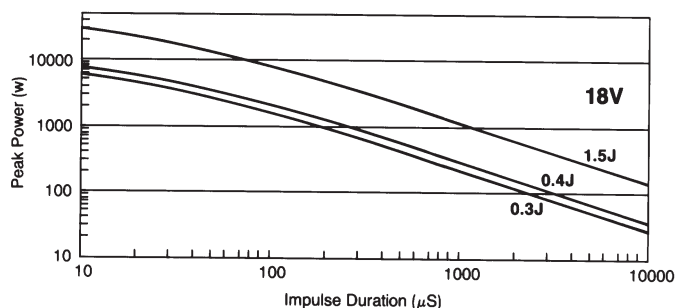
TYPICAL PULSE RATING CURVE  
14V MULTILAYER TRANSGUARD®



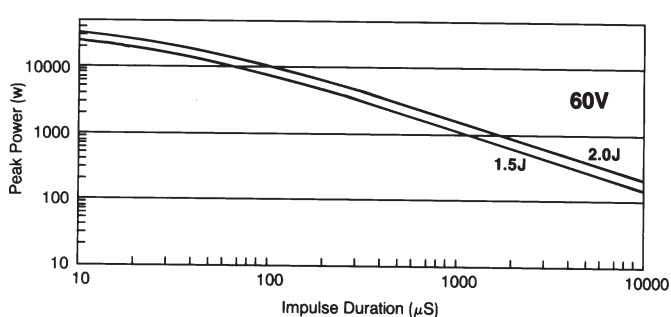
TYPICAL PULSE RATING CURVE  
48V MULTILAYER TRANSGUARD®



TYPICAL PULSE RATING CURVE  
18V MULTILAYER TRANSGUARD®



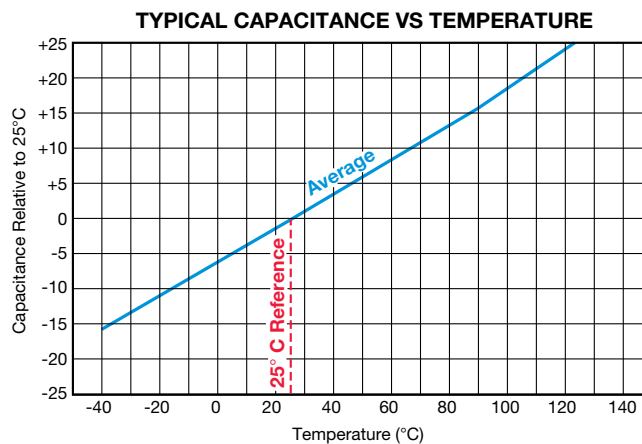
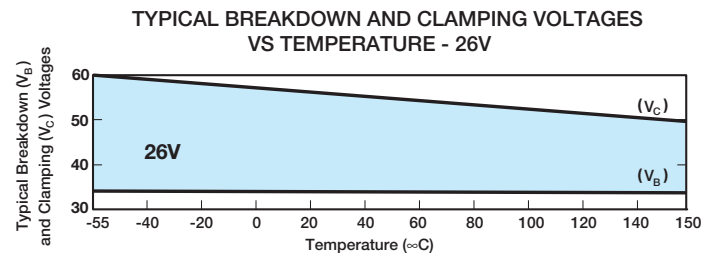
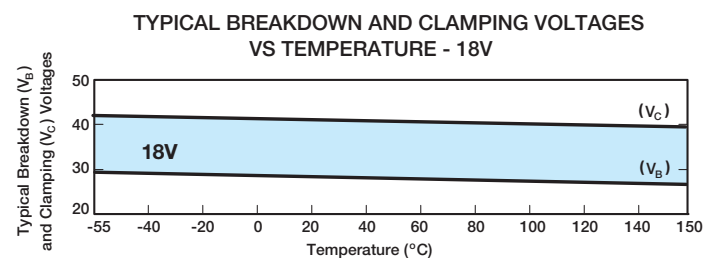
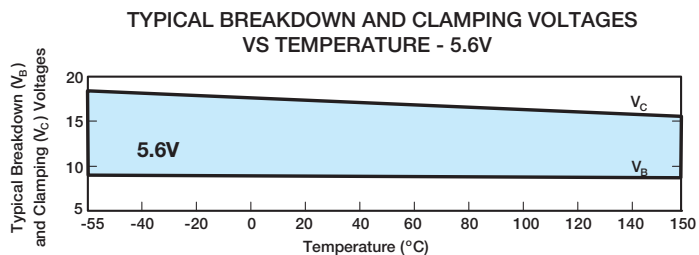
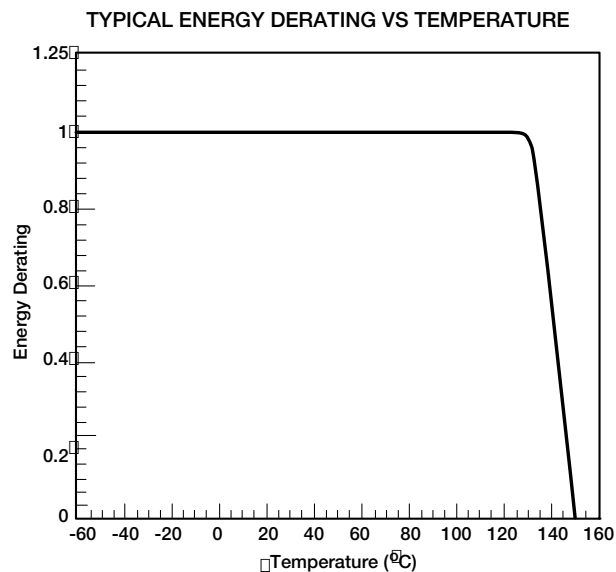
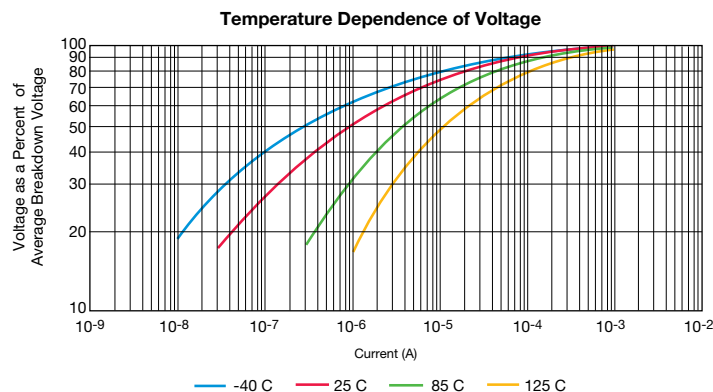
TYPICAL PULSE RATING CURVE  
60V MULTILAYER TRANSGUARD®



### TYPICAL PERFORMANCE CURVES (0603, 0805, 1206 & 1210 CHIP SIZES)

#### TEMPERATURE CHARACTERISTICS

TransGuard® suppressors are designed to operate over the full temperature range from -55°C to +125°C. This operating temperature range is for both surface mount and axial leaded products.



### TYPICAL PERFORMANCE CURVES (0603, 0805, 1206 & 1210 CHIP SIZES)

#### PULSE DEGRADATION

Traditionally varistors have suffered degradation of electrical performance with repeated high current pulses resulting in decreased breakdown voltage and increased leakage current. It has been suggested that irregular intergranular boundaries and bulk material result in restricted current paths and other non-Schottky barrier paralleled conduction paths in the ceramic. Repeated pulsing of both 5.6 and 14V TransGuard® transient voltage suppressors with

150 Amp peak 8 x 20µs waveforms shows negligible degradation in breakdown voltage and minimal increases in leakage current. This does not mean that TransGuard® suppressors do not suffer degradation, but it occurs at much higher current. The plots of typical breakdown voltage vs number of 150A pulses are shown below.

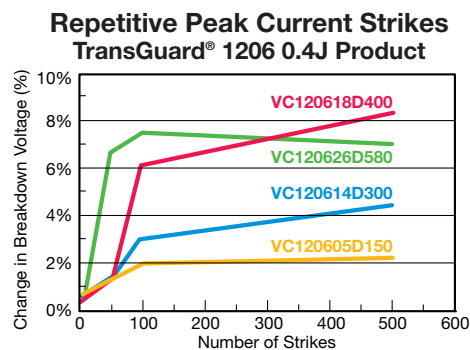


Figure 1

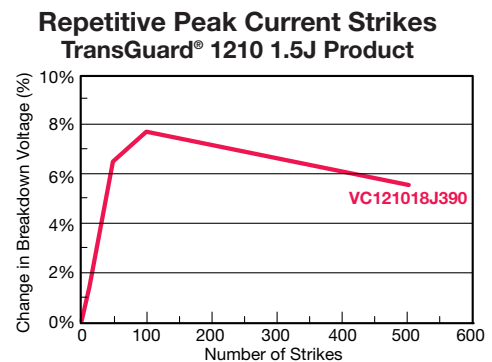


Figure 3

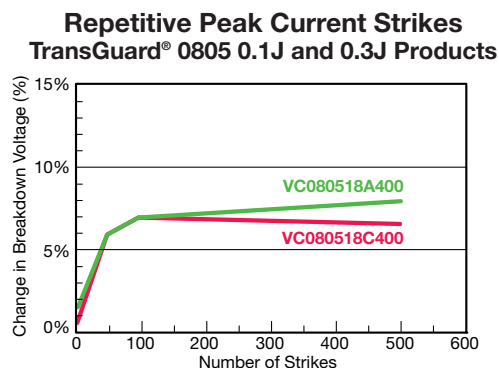


Figure 2

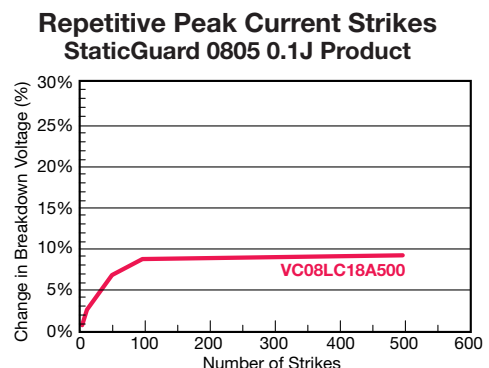
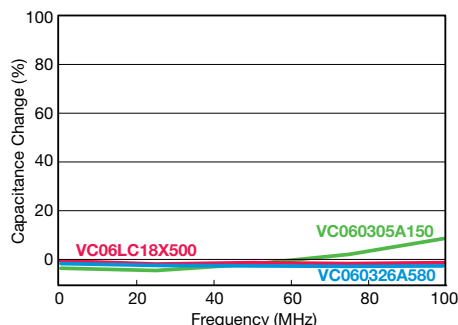


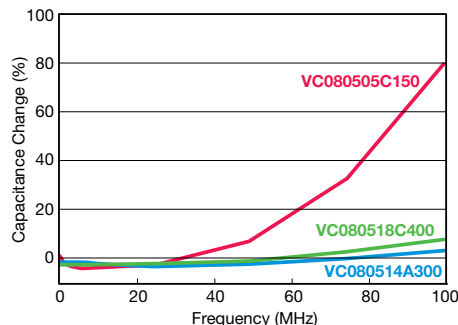
Figure 4

#### CAPACITANCE/FREQUENCY CHARACTERISTICS

TransGuard® Capacitance vs Frequency 0603



TransGuard® Capacitance vs Frequency 0805



TransGuard® Capacitance vs Frequency 1206

