

## 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.

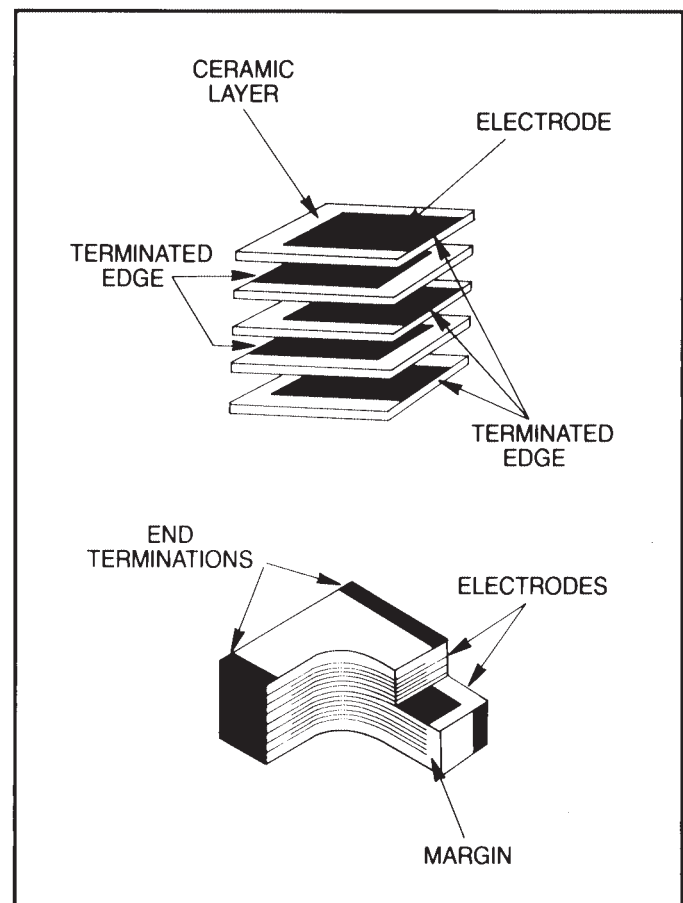
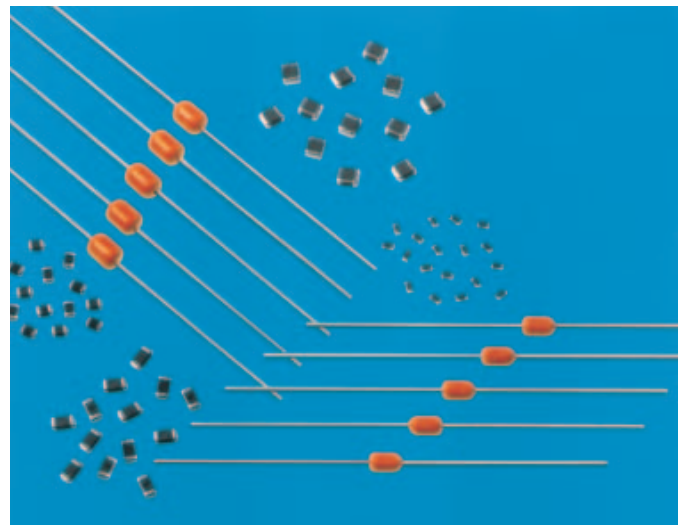
### TRANSQUARD® DESCRIPTION

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.

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)

M = Ni/Sn Pb (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 |

#### 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

#### 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:

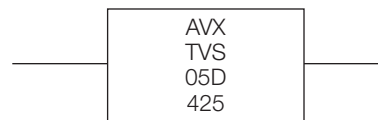
A = Axial

#### 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  
 425 = Three Digit Date Code  
 Where: 4 = Last digit of year (2004)  
 25 = Week of year

## AVX Multilayer Ceramic Transient Voltage Suppressors

### ELECTRICAL CHARACTERISTICS

| AVX Part Number | Working Voltage (DC) | Working Voltage (AC) | Breakdown Voltage | Clamping Voltage | Test Current For $V_c$ | Maximum Leakage Current | Transient Energy Rating | Peak Current Rating | Typical Cap | Frequency | Case Size |
|-----------------|----------------------|----------------------|-------------------|------------------|------------------------|-------------------------|-------------------------|---------------------|-------------|-----------|-----------|
| 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                  | 100         | M         | 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      |
| VC13MA0160KBA   | 16.0                 | 14.0                 | 24.5±10%          | 40               | 2.5                    | 25                      | 1.6                     | 400                 | 1800        | K         | 1210      |
| 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                 | 22.0±10%          | 38               | 1                      | 15                      | 0.5                     | 200                 | 800         | K         | 1206      |
| VC121018J390 __ | 18.0                 | 13.0                 | 25.5±10%          | 42               | 5                      | 10                      | 1.5                     | 500                 | 3100        | K         | 1210      |
| VJ13MC0180KBA   | 18.0                 | 13.0                 | 24.0±10%          | 45               | 10                     | 25                      | 1.5                     | 500                 | 3000        | K         | 1210      |
| VA100018A400 __ | 18.0                 | 13.0                 | 25.5±10%          | 42               | 1                      | 10                      | 0.1                     | 40                  | 350         | K         | 1000      |

└ Termination/Lead Finish Code  
└ Packaging Code

## AVX Multilayer Ceramic Transient Voltage Suppressors

### ELECTRICAL CHARACTERISTICS

| AVX Part Number | Working Voltage (DC) | Working Voltage (AC) | Breakdown Voltage | Clamping Voltage | Test Current For $V_c$ | Maximum Leakage Current | Transient Energy Rating | Peak Current Rating | Typical Cap | Frequency | Case Size |
|-----------------|----------------------|----------------------|-------------------|------------------|------------------------|-------------------------|-------------------------|---------------------|-------------|-----------|-----------|
| VA100018D400 __ | 18.0                 | 13.0                 | 25.5±10%          | 42               | 1                      | 10                      | 0.4                     | 150                 | 900         | K         | 1000      |
| 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      |
| 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      |
| VJ13MC0260KBA   | 26.0                 | 18.0                 | 33.0±10%          | 62               | 10                     | 25                      | 1.2                     | 300                 | 1120        | 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      |
| 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      |
| VJ13MC0300KBA   | 30.0                 | 21.0                 | 39.0±10%          | 73               | 10                     | 25                      | 0.9                     | 220                 | 1020        | K         | 1210      |
| VJ13PC0300KBA   | 30.0                 | 21.0                 | 39.0±10%          | 73               | 10                     | 25                      | 1.2                     | 280                 | 1150        | K         | 1210      |
| VA100030D650 __ | 30.0                 | 21.0                 | 41.0±10%          | 67               | 1                      | 10                      | 0.4                     | 120                 | 550         | K         | 1000      |
| VC120631M650 __ | 31.0                 | 25.0                 | 39.0±10%          | 65               | 1                      | 15                      | 1.0                     | 200                 | 500         | K         | 1206      |
| VC120638N770 __ | 38.0                 | 30.0                 | 47.0±10%          | 77               | 1                      | 15                      | 1.1                     | 200                 | 350         | K         | 1206      |
| VC121038S770 __ | 38.0                 | 30.0                 | 47.0±10%          | 77               | 2.5                    | 15                      | 2.0                     | 300                 | 750         | K         | 1210      |
| VC181238U770 __ | 38.0                 | 30.0                 | 47.0±10%          | 77               | 5                      | 15                      | 4.2                     | 800                 | 1700        | K         | 1812      |
| VC120645K900 __ | 45.0                 | 35.0                 | 56.0±10%          | 90               | 1                      | 15                      | 0.6                     | 200                 | 260         | K         | 1206      |
| VC181245U900 __ | 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      |
| VJ13MC0480KBA   | 48.0                 | 34.0                 | 60.5±10%          | 110              | 10                     | 25                      | 0.9                     | 220                 | 800         | K         | 1210      |
| VJ13PC0480KBA   | 48.0                 | 34.0                 | 60.5±10%          | 110              | 10                     | 25                      | 1.2                     | 250                 | 840         | 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      |
| VJ13MC0600KBA   | 60.0                 | 42.0                 | 75.0±10%          | 126              | 10                     | 25                      | 1.5                     | 250                 | 600         | 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                 | 120         | K         | 1206      |

Termination/Lead Finish Code

Packaging Code

$V_w$  (DC)

$V_w$  (AC)

$V_b$

$V_b$  Tol

$V_c$

DC Working Voltage (V)

AC Working Voltage (V)

Typical Breakdown Voltage (V @ 1mA<sub>DC</sub>)

$V_b$  Tolerance is ± from Typical Value

Clamping Voltage (V @  $I_{c1}$ )

$I_{c1}$

$I_L$

$E_T$

$I_P$

Cap

Freq

Test Current for  $V_c$  (A, 8x20μS)

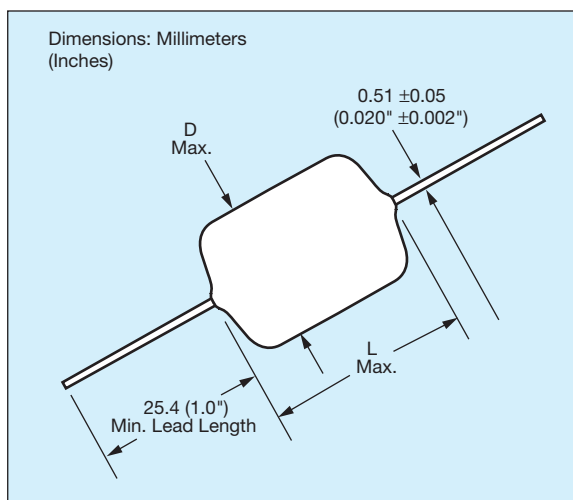
Maximum Leakage Current at the Working Voltage (μA)

Transient Energy Rating (J, 10x1000μS)

Peak Current Rating (A, 8x20μS)

Typical Capacitance (pF) @ frequency specified and 0.5 V<sub>RMS</sub>

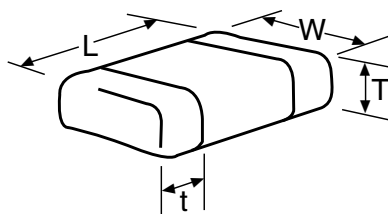
Frequency at which capacitance is measured (K = 1kHz, M = 1MHz)



## 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)

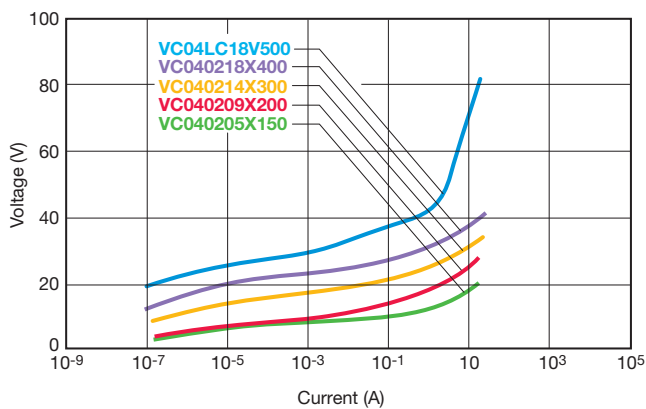
| AVX Style         |             | 0402                                   | 0603                                   | 0805                                   | 1206                                   | 1210                                   | 1812                                   | 2220                                   |
|-------------------|-------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|
| (L) Length        | mm<br>(in.) | 1.00 $\pm$ 0.10<br>(0.040 $\pm$ 0.004) | 1.60 $\pm$ 0.15<br>(0.063 $\pm$ 0.006) | 2.01 $\pm$ 0.20<br>(0.079 $\pm$ 0.008) | 3.20 $\pm$ 0.20<br>(0.126 $\pm$ 0.008) | 3.20 $\pm$ 0.20<br>(0.126 $\pm$ 0.008) | 4.50 $\pm$ 0.20<br>(0.177 $\pm$ 0.008) | 5.70 $\pm$ 0.20<br>(0.224 $\pm$ 0.008) |
| (W) Width         | mm<br>(in.) | 0.50 $\pm$ 0.10<br>(0.020 $\pm$ 0.004) | 0.80 $\pm$ 0.15<br>(0.031 $\pm$ 0.006) | 1.25 $\pm$ 0.20<br>(0.049 $\pm$ 0.008) | 1.60 $\pm$ 0.20<br>(0.063 $\pm$ 0.008) | 2.49 $\pm$ 0.20<br>(0.098 $\pm$ 0.008) | 3.20 $\pm$ 0.20<br>(0.126 $\pm$ 0.008) | 5.00 $\pm$ 0.20<br>(0.197 $\pm$ 0.008) |
| (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)                        | 1.70<br>(0.067)                        | 1.70<br>(0.067)                        |
| (t) Land Length   | mm<br>(in.) | 0.25 $\pm$ 0.15<br>(0.010 $\pm$ 0.006) | 0.35 $\pm$ 0.15<br>(0.014 $\pm$ 0.006) | 0.71 max.<br>(0.028 max.)              | 0.71 max.<br>(0.028 max.)              | 0.71 max.<br>(0.028 max.)              | 0.50 $\pm$ 0.25<br>(0.020 $\pm$ 0.010) | 0.50 $\pm$ 0.25<br>(0.020 $\pm$ 0.010) |

## AVX Multilayer Ceramic Transient Voltage Suppressors

### TYPICAL PERFORMANCE CURVES (0402 CHIP SIZE)

#### VOLTAGE/CURRENT CHARACTERISTICS

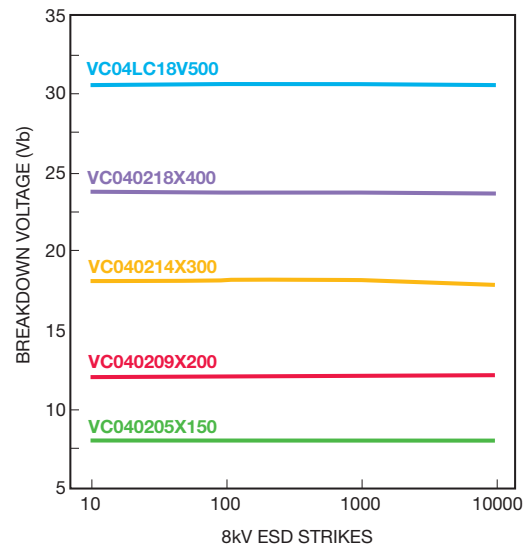
Multilayer construction and improved grain structure result in excellent transient clamping characteristics up to 20 amps peak current, while maintaining very low leakage currents under DC operating conditions. The VI curves below show the voltage/current characteristics for the 5.6V, 9V, 14V, 18V and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



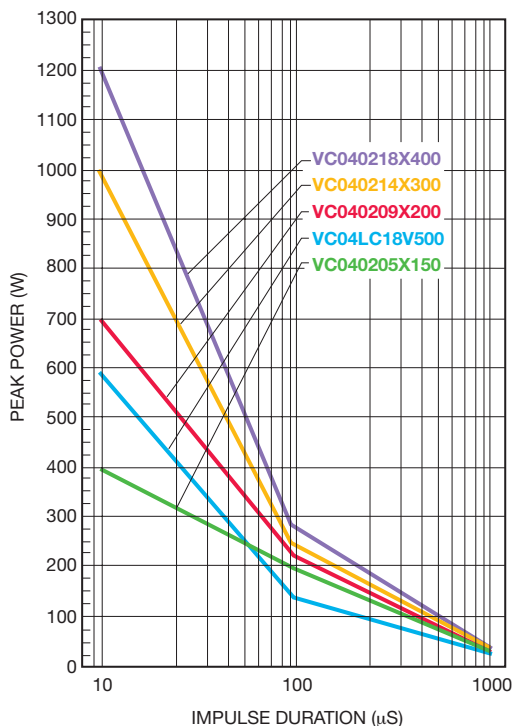
#### PULSE DEGRADATION

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 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.

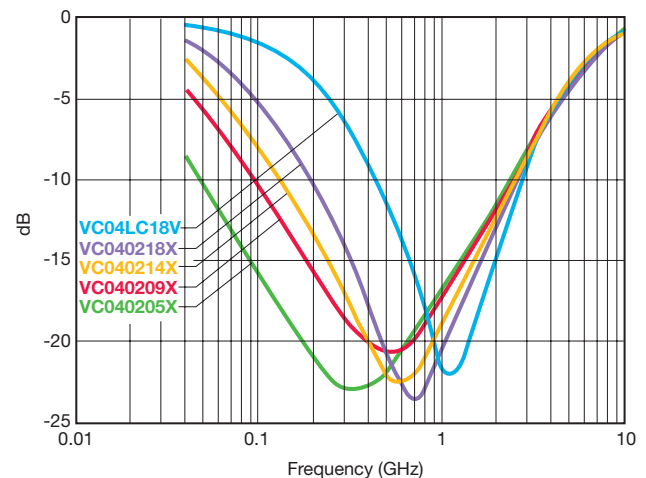
#### ESD TEST OF 0402 PARTS



#### PEAK POWER VS PULSE DURATION



#### INSERTION LOSS CHARACTERISTICS

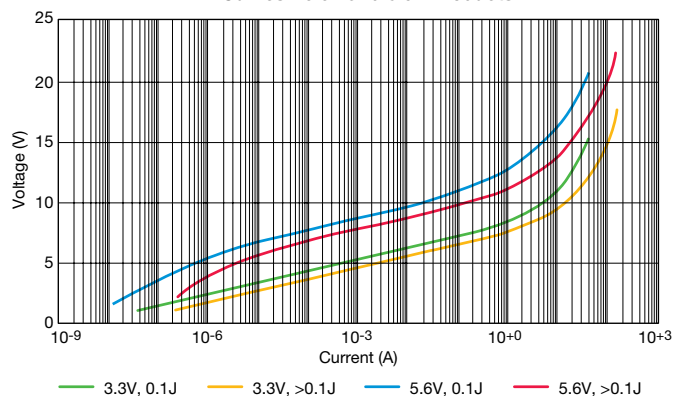


### TYPICAL PERFORMANCE CURVES (0603, 0805, 1206 & 1210 CHIP SIZES)

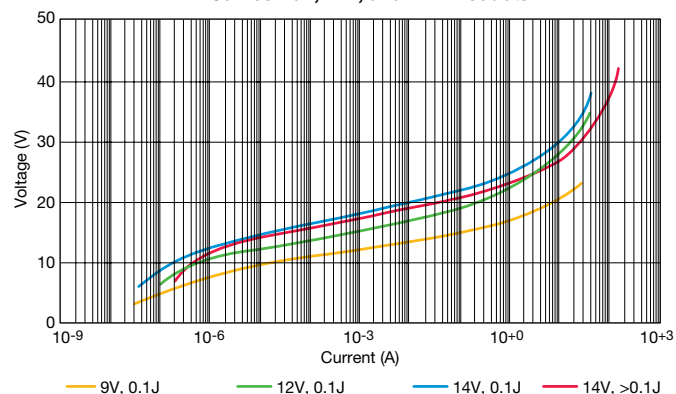
#### VOLTAGE/CURRENT CHARACTERISTICS

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.

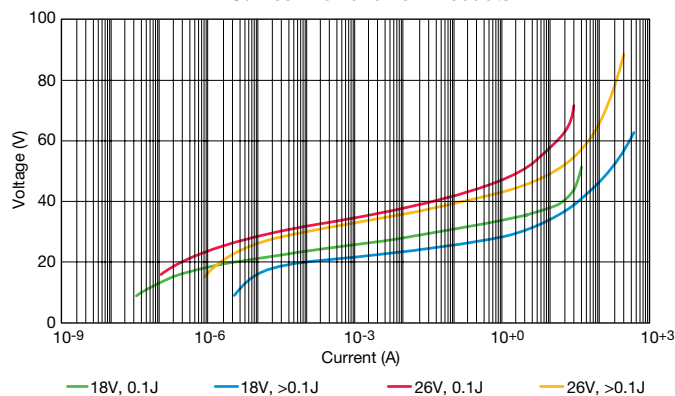
VI Curves - 3.3V and 5.6V Products



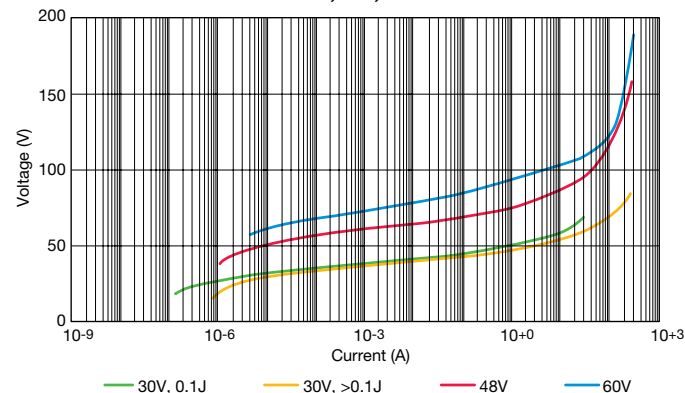
VI Curves - 9V, 12V, and 14V Products



VI Curves - 18V and 26V Products

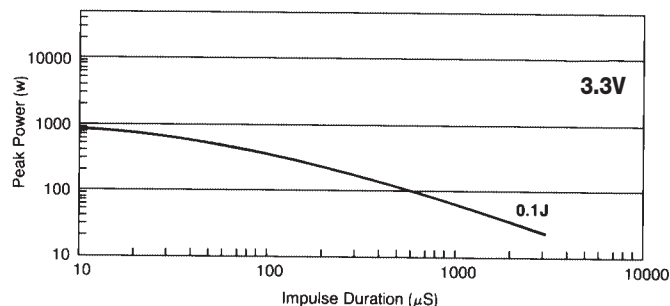


VI Curves - 30V, 48V, and 60V Products

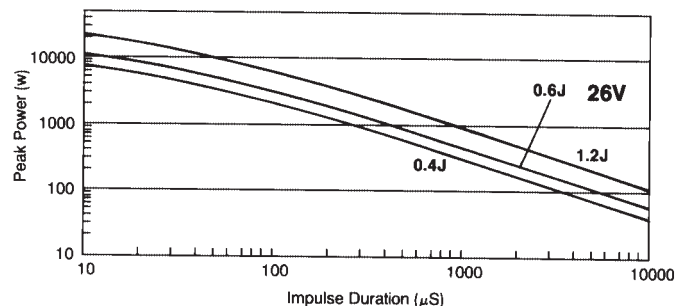


### TYPICAL PERFORMANCE CURVES (0603, 0805, 1206 & 1210 CHIP SIZES)

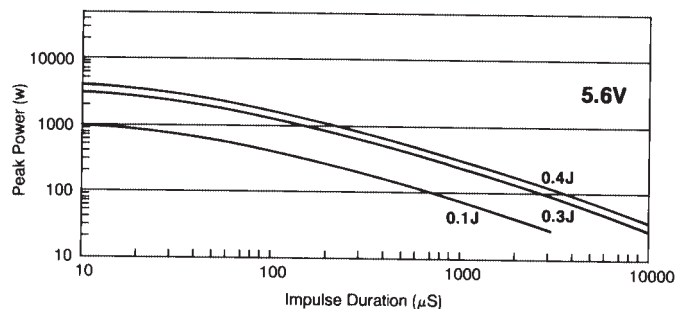
TYPICAL PULSE RATING CURVE  
3.3V MULTILAYER TRANSGUARD®



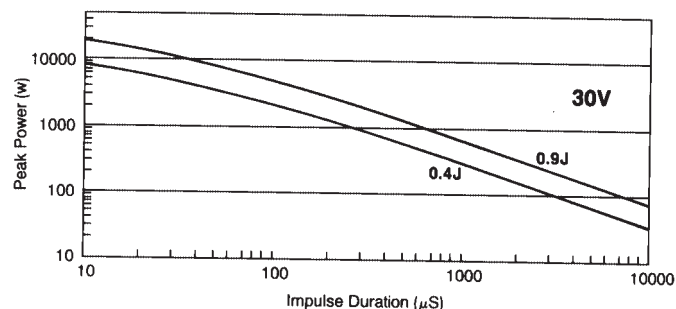
TYPICAL PULSE RATING CURVE  
26V MULTILAYER TRANSGUARD®



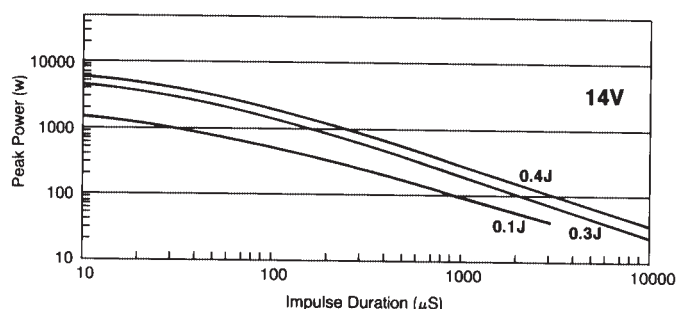
TYPICAL PULSE RATING CURVE  
5.6V MULTILAYER TRANSGUARD®



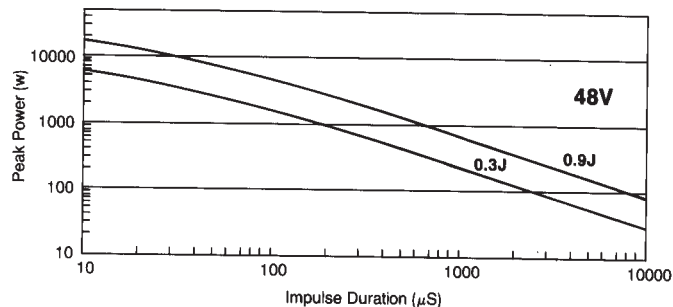
TYPICAL PULSE RATING CURVE  
30V MULTILAYER TRANSGUARD®



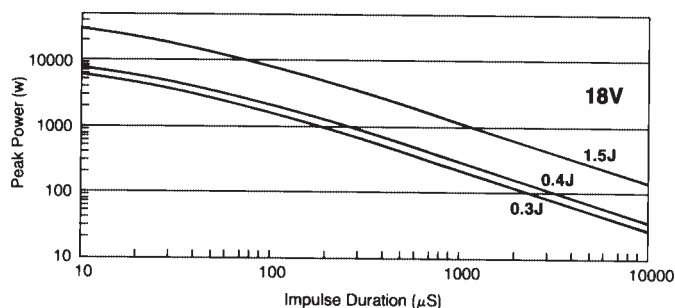
TYPICAL PULSE RATING CURVE  
14V MULTILAYER TRANSGUARD®



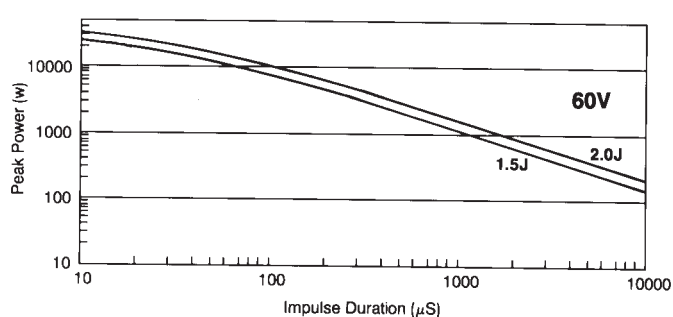
TYPICAL PULSE RATING CURVE  
48V MULTILAYER TRANSGUARD®



TYPICAL PULSE RATING CURVE  
18V MULTILAYER TRANSGUARD®



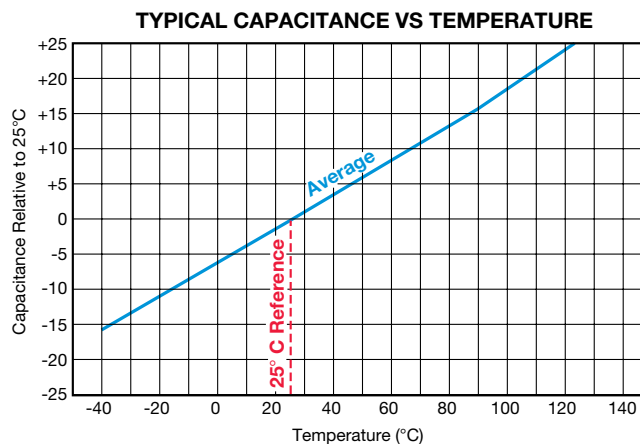
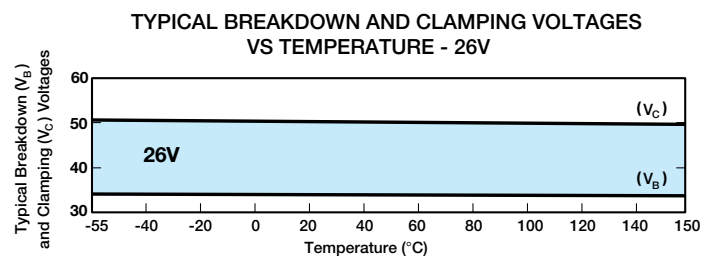
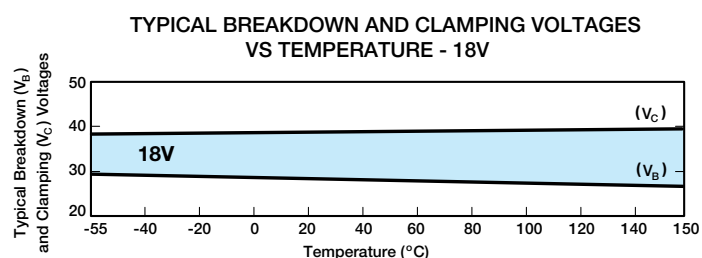
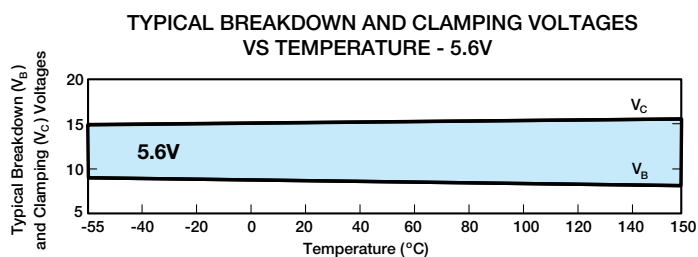
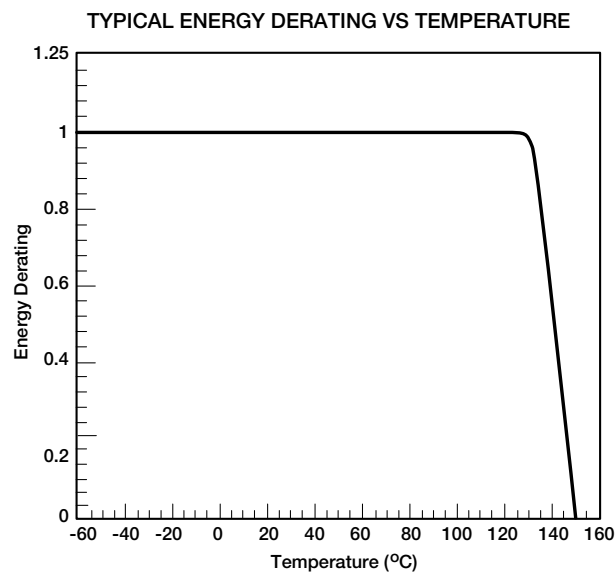
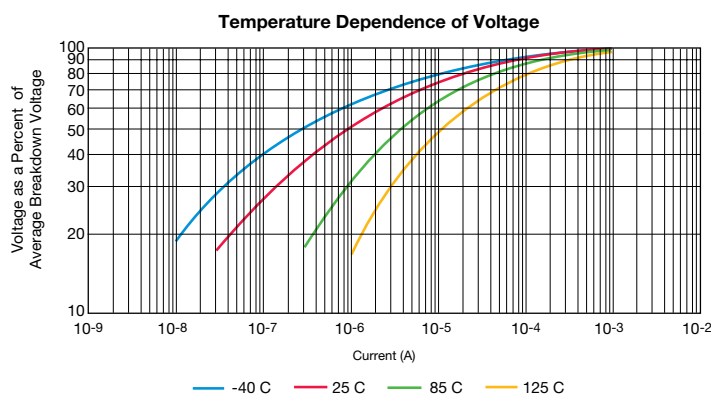
TYPICAL PULSE RATING CURVE  
60V MULTILAYER TRANSGUARD®



### 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.

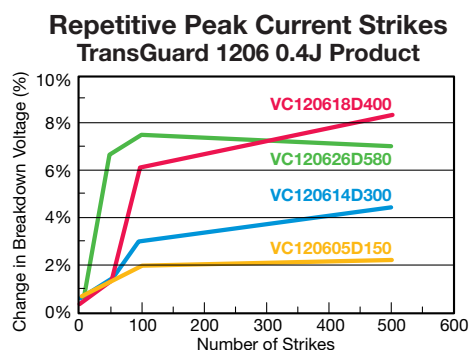


Figure 1

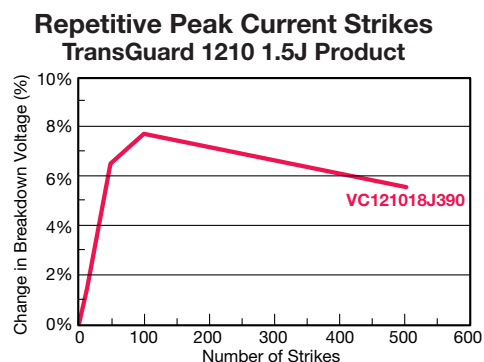


Figure 3

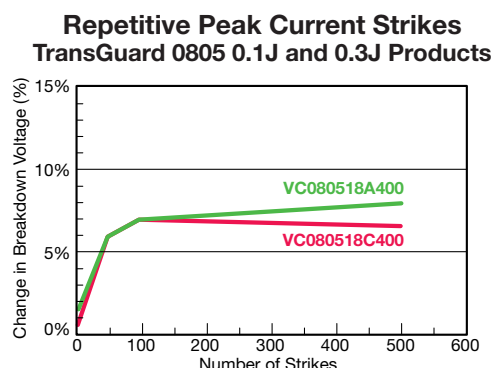


Figure 2

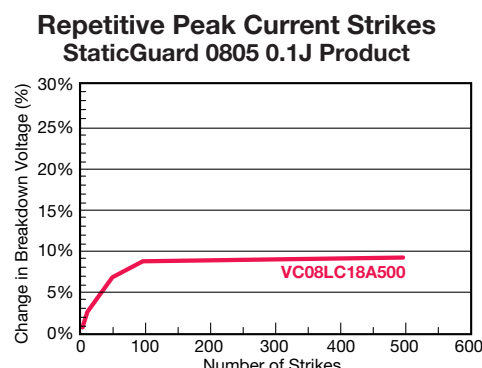
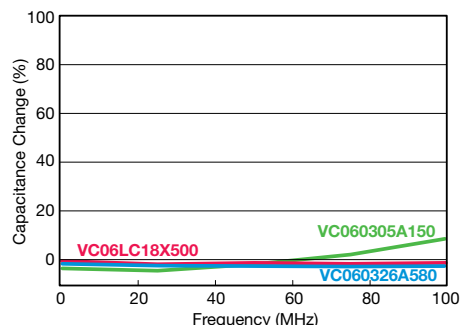


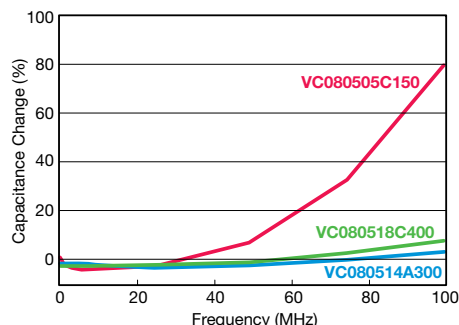
Figure 4

#### CAPACITANCE/FREQUENCY CHARACTERISTICS

TransGuard Capacitance vs Frequency 0603



TransGuard Capacitance vs Frequency 0805



TransGuard Capacitance vs Frequency 1206

