

### GENERAL DESCRIPTION

TransGuard® multilayer varistors 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.

The increasing use of electronics technologies in all areas require reliable protection against transient voltages that could damage the electronics circuitry as well as EMI/RFI attenuation to prevent signal distortion and to meet regulatory requirements. KYOCERA AVX TransGuard components help achieve both functions with single component.

### GENERAL CHARACTERISTICS

- Operating Temperature: -55°C to +125°C
- Working Voltage: 3.3 - 85Vdc
- Case Size: 0402 - 1812
- Energy: 0.05 - 4.2J
- Peak Current: 20 - 2000A

### FEATURES

- Bi-Directional protection
- Very fast response to ESD strikes
- Multi-strike capability
- High Reliability
- EMI/RFI Filtering
- Wide range of components

### APPLICATIONS

- IC Protection
- Micro Controllers
- Relays
- I/O Ports
- Keyboard Protection
- Portable devices
- Industrial Controllers
- Automation
- Smart Grid
- Telecom
- LED Lights
- Cameras
- Base Stations
- Motion detector
- Alarms
- and more

### HOW TO ORDER

| VC                                        | 1206                                                         | 18                                                                                                                                        | D                                                                                                                          | 400                                                                                                                        | R                                                                                                                  | P                                                                                                                                                                                  |                                                                                                                                                   |                                                                                                                                                |                                                                            |
|-------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| T                                         | T                                                            | T                                                                                                                                         | T                                                                                                                          | T                                                                                                                          | T                                                                                                                  | T                                                                                                                                                                                  |                                                                                                                                                   |                                                                                                                                                |                                                                            |
| Varistor Chip                             | Case Size                                                    | Working Voltage                                                                                                                           | Energy Rating                                                                                                              | Clamping Voltage                                                                                                           | Packaging                                                                                                          | Termination                                                                                                                                                                        |                                                                                                                                                   |                                                                                                                                                |                                                                            |
| VC = Varistor Chip<br>VG = Varistor Glass | 0402<br>0603<br>0805<br>1206<br>1210<br>1812<br>2220<br>3220 | 03 = 3.3Vdc<br>05 = 5.6Vdc<br>09 = 9Vdc<br>12 = 12Vdc<br>14 = 14Vdc<br>16 = 16Vdc<br>18 = 18Vdc<br>22 = 22Vdc<br>26 = 26Vdc<br>30 = 30Vdc | 31 = 31Vdc<br>38 = 38Vdc<br>42 = 42Vdc<br>45 = 45Vdc<br>48 = 48Vdc<br>56 = 56Vdc<br>60 = 60Vdc<br>65 = 65Vdc<br>85 = 85Vdc | X= 0.05J<br>A= 0.1J<br>B= 0.2J<br>C= 0.3J<br>D= 0.4J<br>E= 0.5J<br>F= 0.7J<br>G= 0.9J<br>H= 1.2J<br>J= 1.5-1.6J<br>K= 0.6J | M= 1.0J<br>N= 1.1J<br>P= 2.5-3.7J<br>R= 1.7J<br>L= 0.8J<br>S= 1.9-2.0J<br>U= 4.0-5.0J<br>W= 5.1-6.0J<br>Y= 6.5-12J | 100 = 12V<br>150 = 18V<br>200 = 22V<br>250 = 27V<br>300 = 32V<br>380 = 38V<br>390 = 42V<br>400 = 42V<br>440 = 44V<br>490 = 49V<br>540 = 54V<br>560 = 60V<br>570 = 57V<br>580 = 60V | 620 = 67V<br>650 = 67V<br>770 = 77V<br>800 = 80V<br>900 = 90V<br>101 = 100V<br>111 = 110V<br>121 = 120V<br>131 = 135V<br>151 = 150V<br>161 = 165V | D = 7" (1000)*<br>R = 7" (4000 or 2000)*<br>T = 13" (10,000)*<br>W = 7" (10,000)**<br><br>*Not available for 0402<br>**Only available for 0402 | P = Ni/Sn plated<br>Z = FLEXITERM®*<br>*Only available for VC0603 - VC1210 |

The following series are available with industry proven KYOCERA AVX flexible termination system FLEXITERM®:

VC0603, VC0805, VC1206, VC1210

FLEXITERM® is designed to enhance the mechanical flexure and temperature cycling performance provides up to 5mm of flexure without internal cracks.



**FLEXITERM®**

### ELECTRICAL CHARACTERISTICS

| Part Number  | V <sub>w</sub> (DC)<br>Vdc | V <sub>w</sub> (AC)<br>Vac | V <sub>B</sub><br>V | V <sub>C</sub><br>V | I <sub>VC</sub><br>A | I <sub>L</sub><br>μA | E <sub>T</sub><br>J | I <sub>p</sub><br>A | Cap<br>pF | 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 |
| 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 |
| 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 |
| VC121016J390 | 16.0                       | 13.0                       | 25.5±10%            | 40                  | 2.5                  | 10                   | 1.6                 | 500                 | 3100      | K    | 1210 |
| VG181216P390 | 16.0                       | 11.0                       | 24.5±10%            | 40                  | 5                    | 15                   | 2.9                 | 1000                | 7000      | K    | 1812 |
| 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 |
| VG121018J380 | 18.0                       | 14.0                       | 22±10%              | 38                  | 2.5                  | 15                   | 1.5                 | 400                 | 2300      | K    | 1210 |
| VC121018J390 | 18.0                       | 13.0                       | 25.5±10%            | 42                  | 5                    | 10                   | 1.6                 | 500                 | 3100      | K    | 1210 |
| VG181218P380 | 18.0                       | 14                         | 22±10%              | 38                  | 5                    | 15                   | 2.3                 | 800                 | 5000      | K    | 1218 |
| VG181218P440 | 18.0                       | 14.0                       | 27.5±10%            | 44                  | 5                    | 15                   | 2.9                 | 800                 | 5000      | K    | 1812 |
| VG222018W380 | 18.0                       | 14.0                       | 22±10%              | 38                  | 10                   | 15                   | 5.8                 | 1200                | 18000     | K    | 2220 |
| VG121022R440 | 22.0                       | 17.0                       | 27±10%              | 44                  | 2.5                  | 15                   | 1.7                 | 400                 | 1600      | K    | 1210 |
| VG222022Y440 | 22.0                       | 17.0                       | 27±10%              | 44                  | 10                   | 15                   | 7.2                 | 1200                | 18000     | K    | 2220 |
| VG222022Y490 | 22.0                       | 17.0                       | 30±10%              | 49                  | 10                   | 15                   | 6.8                 | 1200                | 12000     | K    | 2220 |
| 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 |
| VG121026S540 | 26.0                       | 20.0                       | 33±10%              | 54                  | 2.5                  | 15                   | 1.9                 | 400                 | 1600      | K    | 1210 |
| VG181226P540 | 26.0                       | 20                         | 35±10%              | 54                  | 5                    | 15                   | 3                   | 800                 | 3000      | K    | 1812 |

## ELECTRICAL CHARACTERISTICS

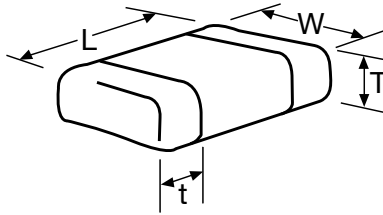
| Part Number  | V <sub>w</sub> (DC) | V <sub>w</sub> (AC) | V <sub>B</sub> | V <sub>C</sub> | I <sub>VC</sub> | I <sub>L</sub> | E <sub>T</sub> | I <sub>P</sub> | Cap   | Freq | Case |
|--------------|---------------------|---------------------|----------------|----------------|-----------------|----------------|----------------|----------------|-------|------|------|
|              | Vdc                 | Vac                 | V              | V              | A               | μA             | J              | A              | pF    |      |      |
| VG181226P570 | 26.0                | 23.0                | 35.0±10%       | 57             | 5               | 15             | 2.5            | 600            | 3000  | K    | 1812 |
| VG181226P540 | 26.0                | 20.0                | 35.0±10%       | 54             | 5               | 15             | 3.0            | 800            | 3000  | K    | 1812 |
| VG222026Y540 | 26.0                | 20.0                | 33.0±10%       | 54             | 10              | 15             | 7.8            | 1200           | 11000 | K    | 2220 |
| VG222026Y570 | 26.0                | 23.0                | 35.0±10%       | 57             | 10              | 15             | 6.8            | 1100           | 7000  | K    | 2220 |
| VG322026N570 | 26.0                | 20.0                | 33.0±10%       | 57             | 10              | 15             | 1.1            | 400            | 5500  | K    | 3220 |
| 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 |
| 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 |
| VG121031R650 | 31.0                | 25.0                | 39.0±10%       | 65             | 2.5             | 15             | 1.7            | 300            | 1200  | K    | 1210 |
| VG181231P650 | 31.0                | 25.0                | 39.0±10%       | 65             | 5               | 15             | 3.7            | 800            | 2600  | K    | 1812 |
| VG222031Y650 | 31.0                | 25.0                | 39.0±10%       | 65             | 10              | 15             | 9.6            | 1200           | 6100  | K    | 2220 |
| 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 |
| VG322038J920 | 38.0                | 30.0                | 47.0±10%       | 92             | 10              | 15             | 1.5            | 400            | 2600  | K    | 3220 |
| 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 |
| VG121045S900 | 45.0                | 35.0                | 56.0±10%       | 90             | 2.5             | 15             | 2              | 300            | 800   | K    | 1210 |
| VG181245U900 | 45.0                | 35.0                | 56.0±10%       | 90             | 5               | 15             | 4.0            | 500            | 1200  | K    | 1812 |
| VG222045Y900 | 45.0                | 35.0                | 56.0±10%       | 90             | 10              | 15             | 12             | 1000           | 5000  | K    | 2220 |
| 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 |
| VC120656F111 | 56.0                | 40.0                | 68.0±10%       | 110            | 1               | 15             | 0.7            | 100            | 180   | K    | 1206 |
| VG121056P111 | 56.0                | 40.0                | 68.0±10%       | 110            | 2.5             | 15             | 2.3            | 250            | 500   | K    | 1210 |
| VG181256U111 | 56.0                | 40.0                | 68.0±10%       | 110            | 5               | 15             | 4.8            | 500            | 800   | K    | 1812 |
| VG222056Y111 | 56.0                | 40.0                | 68.0±10%       | 110            | 10              | 15             | 9              | 1000           | 2000  | K    | 2220 |
| VC121060J121 | 60.0                | 42.0                | 76.0±10%       | 120            | 5               | 10             | 1.5            | 250            | 400   | K    | 1210 |
| 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                | 82.0±10%       | 135            | 2.5             | 15             | 2.7            | 350            | 600   | K    | 1210 |
| VG181265U131 | 65.0                | 50.0                | 82.0±10%       | 135            | 5               | 15             | 4.5            | 400            | 600   | K    | 1812 |
| VG222065Y131 | 65.0                | 50.0                | 82.0±10%       | 135            | 10              | 15             | 6.5            | 800            | 3000  | K    | 2220 |
| VC121085S151 | 85.0                | 60.0                | 100±10%        | 150            | 1               | 35             | 2.0            | 250            | 275   | K    | 1210 |
| VG181285U161 | 85.0                | 60.0                | 100±10%        | 165            | 5               | 15             | 4.5            | 400            | 500   | K    | 1812 |
| VG222085Y161 | 85.0                | 60.0                | 100±10%        | 165            | 10              | 15             | 6.8            | 800            | 1500  | K    | 2220 |

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>)V<sub>C</sub> Clamping Voltage (V @ I<sub>VC</sub>)I<sub>VC</sub> Test Current for V<sub>C</sub> (A, 8x20μS)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) @ frequency specified and 0.5 V<sub>RMS</sub>

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

# TransGuard®

## Multilayer Ceramic Transient Voltage Suppressors



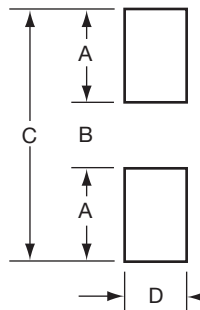
### DIMENSIONS:

mm (inches)

| Style             |          | 0402                       | 0603                       | 0805                       | 1206                                                                     | 1210                       | 1812                       | 2220                       | 3220                       |
|-------------------|----------|----------------------------|----------------------------|----------------------------|--------------------------------------------------------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| (L) Length        | mm (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) | 8.20±0.40<br>(0.323±0.016) |
| (W) Width         | mm (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) | 5.00±0.40<br>(0.197±0.016) |
| (T) Max Thickness | mm (in.) | 0.6<br>(0.024)             | 0.9<br>(0.035)             | 1.02<br>(0.040)            | 1.02 (0.040)<br>1.27 (0.050) <sup>1)</sup><br>1.70 (0.067) <sup>2)</sup> | 1.70<br>(0.067)            | 2.00<br>(0.080)            | 2.50<br>(0.098)            | 2.50 max. (0.098 max.)     |
| (t) Land Length   | mm (in.) | 0.25±0.15<br>(0.010±0.006) | 0.35±0.15<br>(0.014±0.006) | 0.71 max. (0.028 max.)     | 0.94 max. (0.037 max.)                                                   | 1.14 max. (0.045 max.)     | 1.00 max. (0.039 max.)     | 1.00 max. (0.039 max.)     | 1.30 max. (0.051 max.)     |

1) Applicable for: VC120618E380

2) Applicable for: VC120626F540, VC120631M650, VC120638N770, VC120642L800, VC120645K900, VC120656F111, VC120660M131



### SOLDERING PAD:

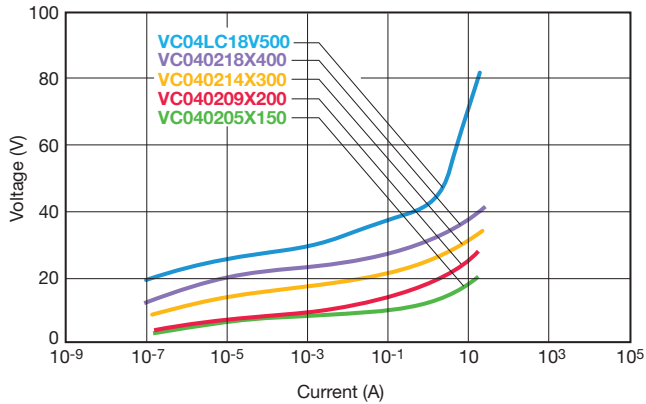
mm (inches)

| Pad Layout | 0402         | 0603         | 0805         | 1206         | 1210         | 1812         | 2220         | 3220          |
|------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|
| A          | 1.61 (0.024) | 0.89 (0.035) | 1.02 (0.040) | 1.02 (0.040) | 1.02 (0.040) | 1.00 (0.039) | 1.00 (0.039) | 2.21 (0.087)  |
| B          | 1.51 (0.020) | 0.76 (0.030) | 1.02 (0.040) | 2.03 (0.080) | 2.03 (0.080) | 3.60 (0.142) | 4.60 (0.18)  | 5.79 (0.228)  |
| C          | 1.70 (0.067) | 2.54 (0.100) | 3.05 (0.120) | 4.06 (0.160) | 4.06 (0.160) | 5.60 (0.220) | 6.60 (0.26)  | 10.21 (0.402) |
| D          | 1.51 (0.020) | 0.76 (0.030) | 1.27 (0.050) | 1.65 (0.065) | 2.54 (0.100) | 3.00 (0.118) | 5.00 (0.20)  | 5.50 (0.217)  |

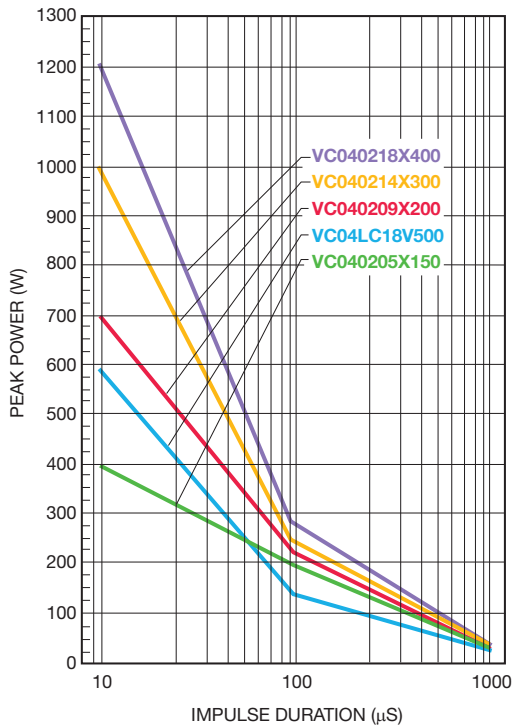
### TYPICAL PERFORMANCE CURVES (0402 CHIP SIZE)

#### 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.



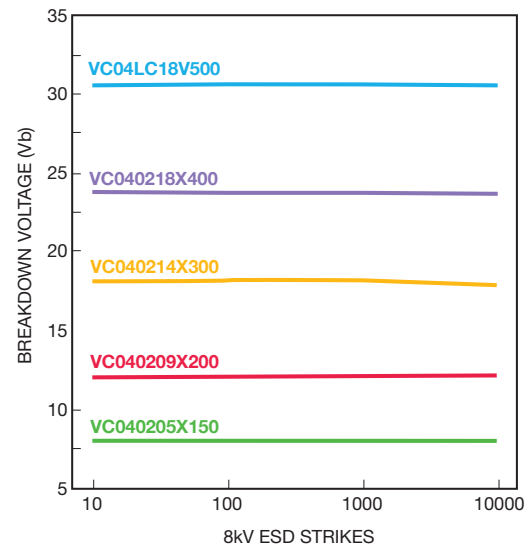
#### PEAK POWER VS PULSE DURATION



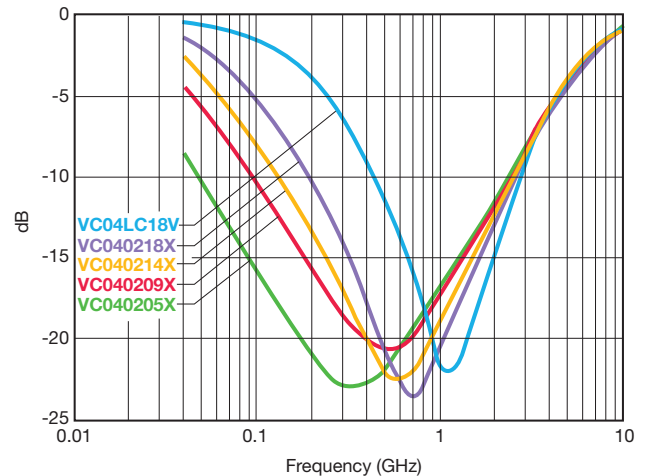
#### PULSE DEGRADATION

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.

#### ESD TEST OF 0402 PARTS



#### INSERTION LOSS CHARACTERISTICS

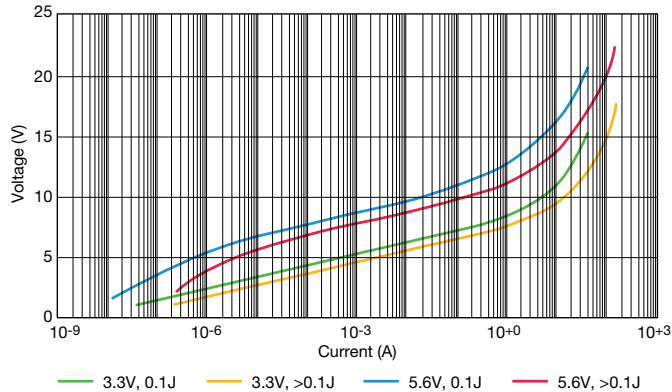


### TYPICAL PERFORMANCE CURVES (0603, 0805, 1206 & 1210 CHIP SIZES)

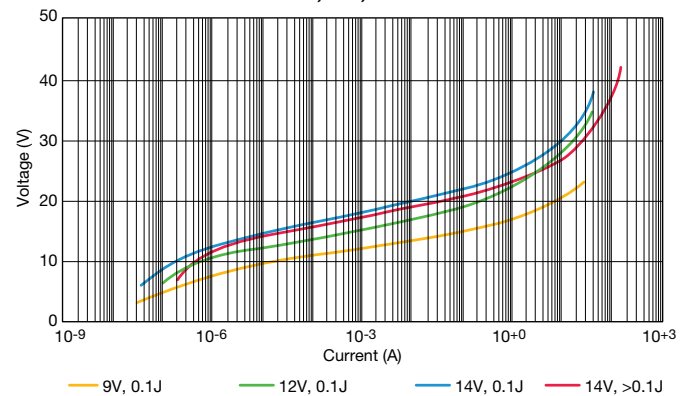
#### VOLTAGE/CURRENT CHARACTERISTICS

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.

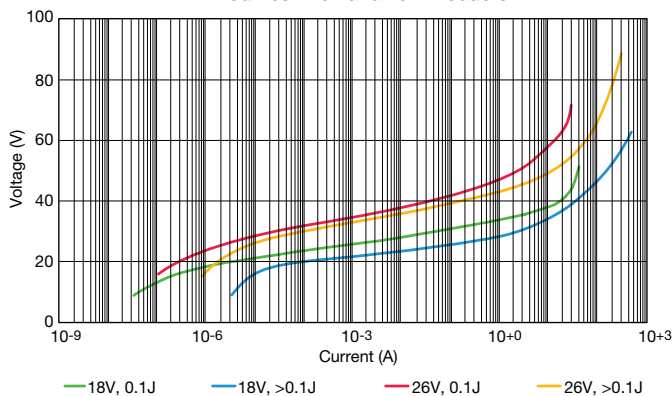
VI Curves - 3.3V and 5.6V Products



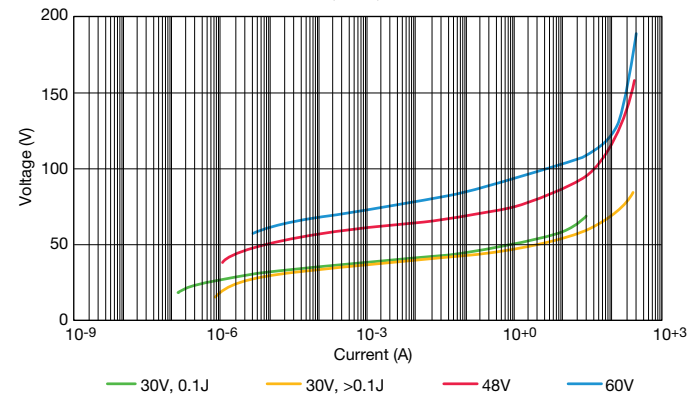
VI Curves - 9V, 12V, and 14V Products



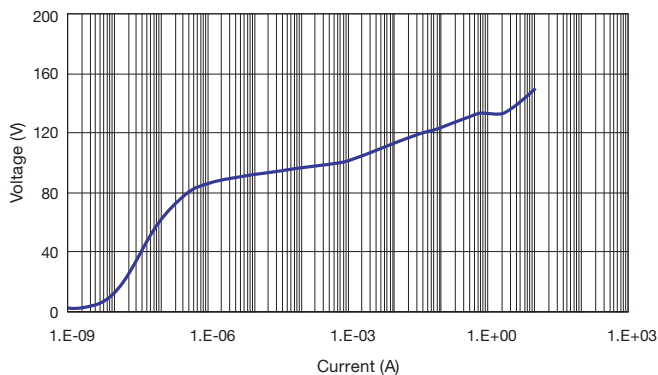
VI Curves - 18V and 26V Products



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

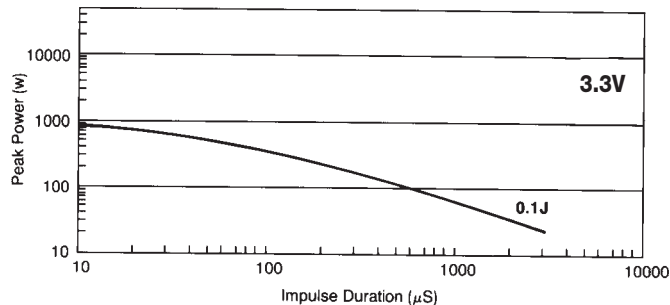


VI Curve - 85V Product

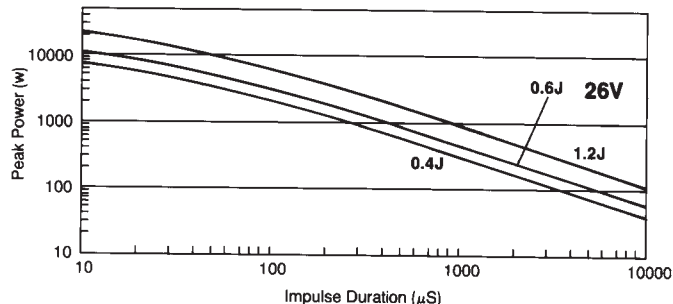


### TYPICAL PERFORMANCE CURVES (0603, 0805, 1206 & 1210 CHIP SIZES)

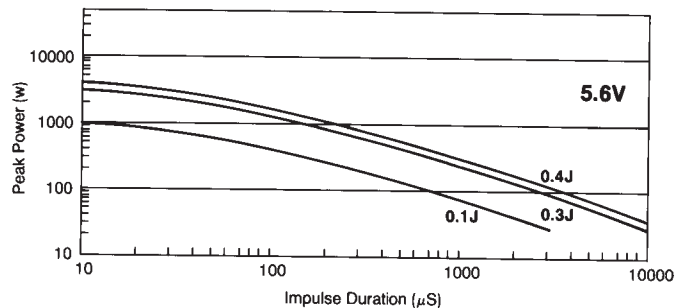
TYPICAL PULSE RATING CURVE  
3.3V MULTILAYER TRANSGUARD®



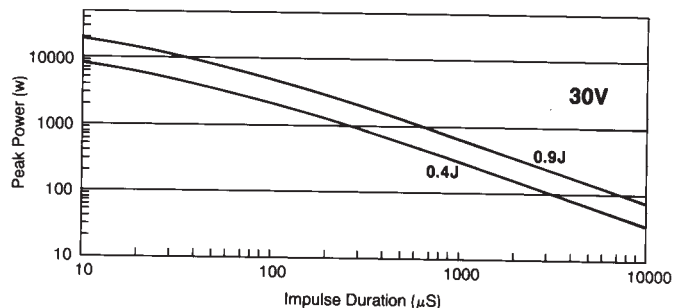
TYPICAL PULSE RATING CURVE  
26V MULTILAYER TRANSGUARD®



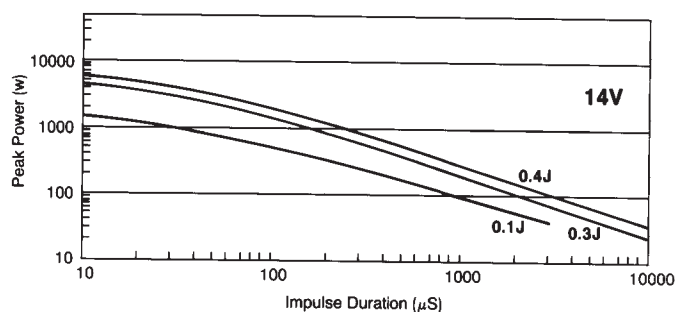
TYPICAL PULSE RATING CURVE  
5.6V MULTILAYER TRANSGUARD®



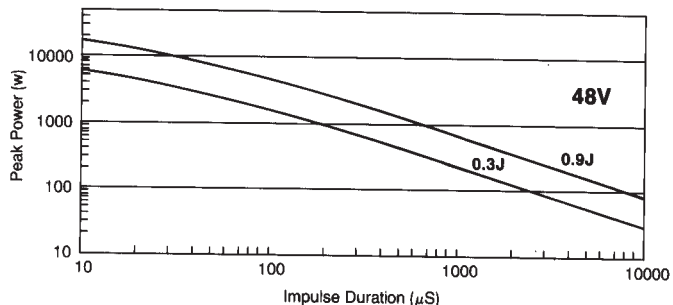
TYPICAL PULSE RATING CURVE  
30V MULTILAYER TRANSGUARD®



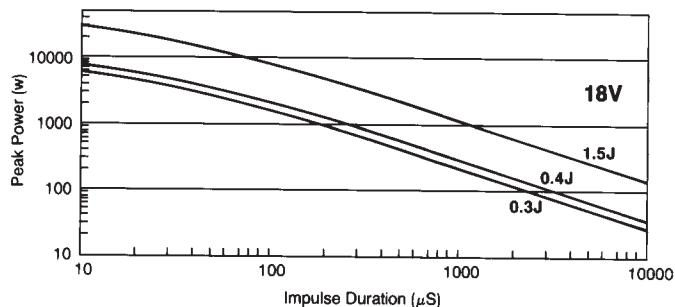
TYPICAL PULSE RATING CURVE  
14V MULTILAYER TRANSGUARD®



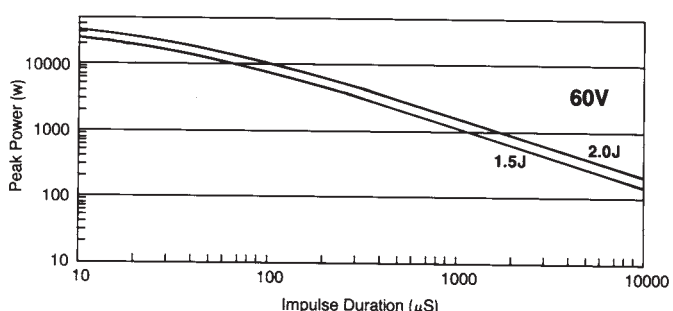
TYPICAL PULSE RATING CURVE  
48V MULTILAYER TRANSGUARD®



TYPICAL PULSE RATING CURVE  
18V MULTILAYER TRANSGUARD®



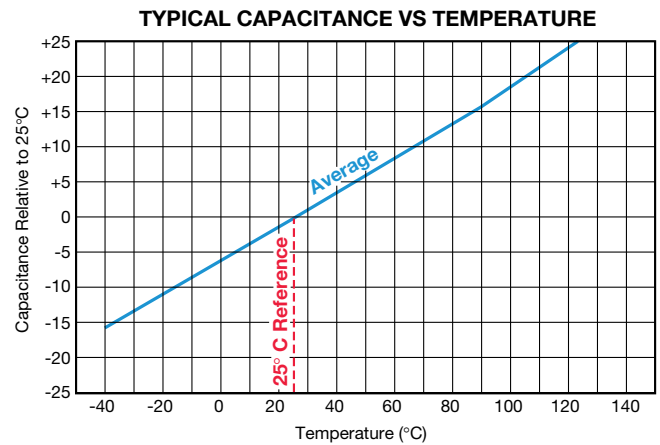
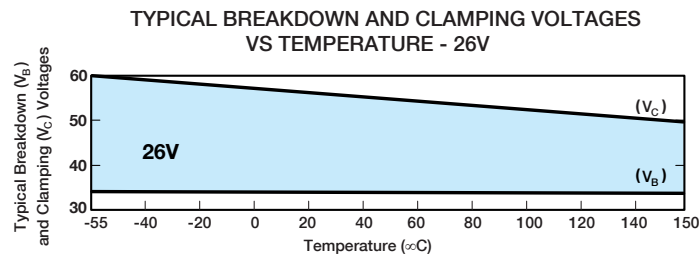
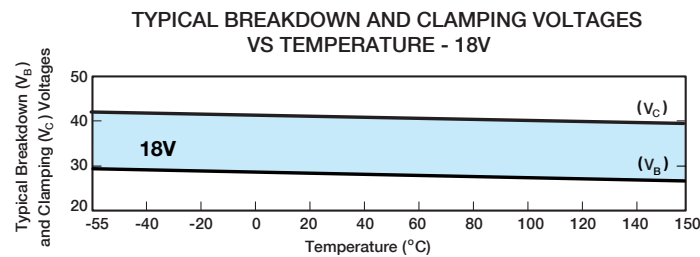
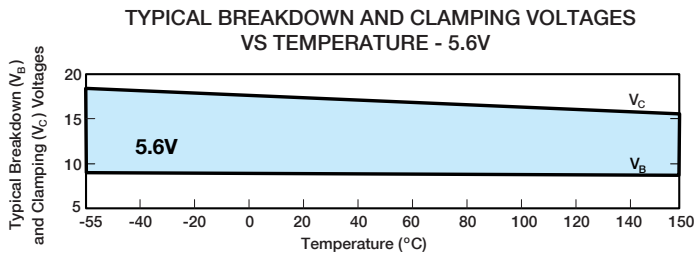
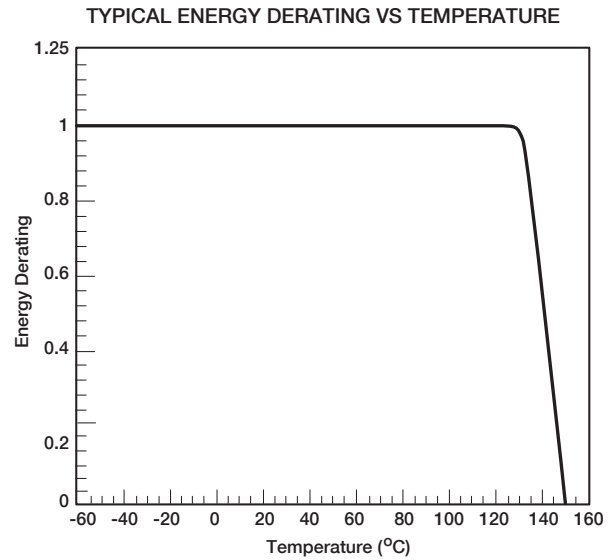
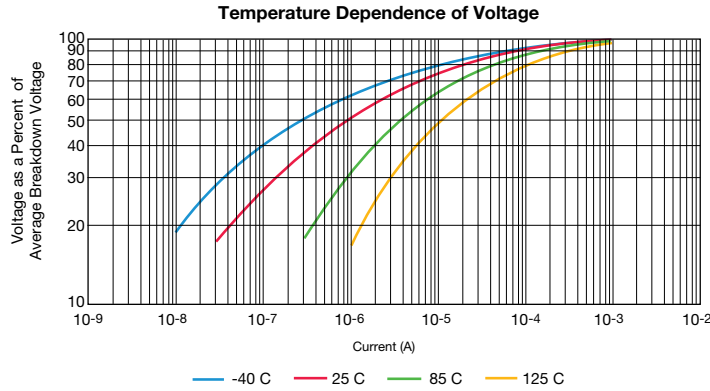
TYPICAL PULSE RATING CURVE  
60V MULTILAYER TRANSGUARD®



### 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. The plots of typical breakdown voltage vs number of 150A pulses are shown below.

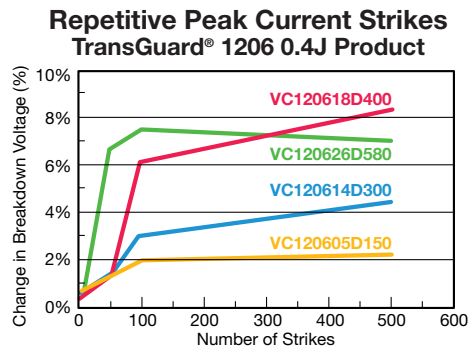


Figure 1

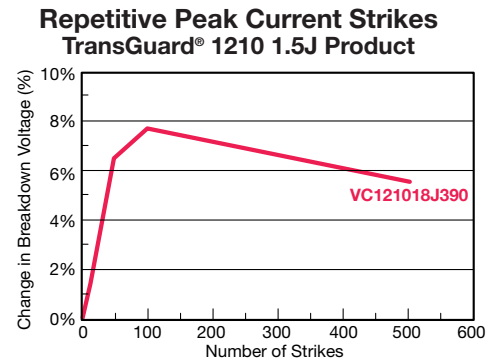


Figure 3

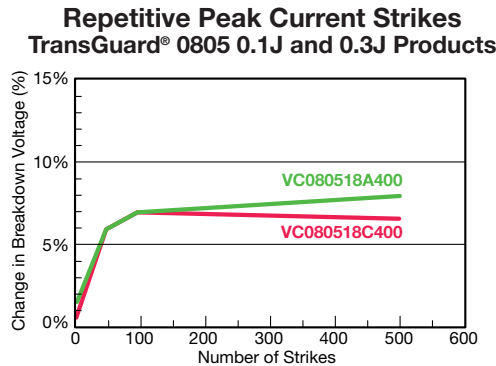


Figure 2

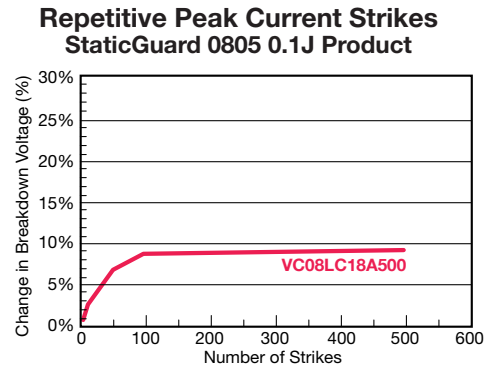
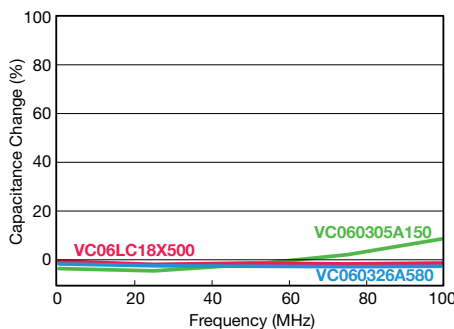


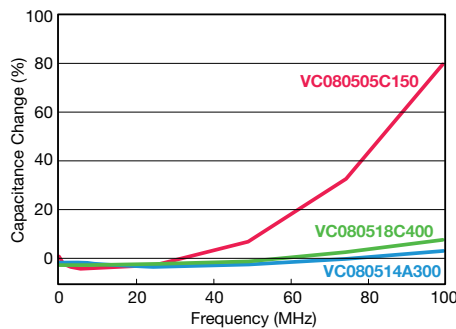
Figure 4

### CAPACITANCE/FREQUENCY CHARACTERISTICS

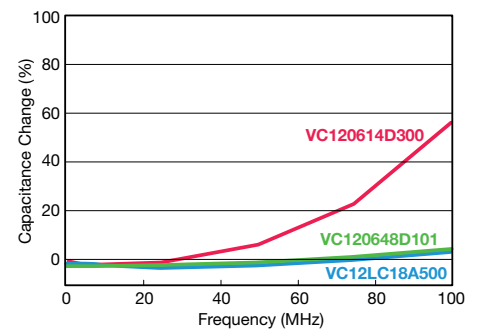
TransGuard® Capacitance vs Frequency 0603



TransGuard® Capacitance vs Frequency 0805



TransGuard® Capacitance vs Frequency 1206



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