

# TransGuard® Automotive Series

## Multilayer Varistors for Automotive Applications



### GENERAL DESCRIPTION

The TransGuard Automotive Series are zinc oxide (ZnO) based ceramic semiconductor devices with non-linear, bi-directional voltage-current characteristics.

They have the advantage of offering bi-directional overvoltage protection as well as EMI/RFI attenuation in a single SMT package. The Automotive Series high current and high energy handling capability make them well suited for protection against automotive related transients.

### FEATURES

- High Reliability
- High Energy Absorption (Load Dump)
- High Current Handling
- AEC Q200 Qualified
- Bi-Directional protection
- EMI/RFI attenuation
- Multi-strike capability
- Sub 1nS response to ESD strike

### APPLICATIONS

- Internal Combustion Engine (ICE) Vehicles
- Hybrid Electric Vehicles (HEV)
- Plug-in Hybrid Electric Vehicles (PHEV)
- Commercial Vehicles
  - CAN, LIN, FLEXRAY based modules
  - Sensors
  - Module load dump protection
  - Motor/inductive load transient suppression

### HOW TO ORDER

| VC            | AS                | 1206      | 18              | D             | 400              | R                  | P                |
|---------------|-------------------|-----------|-----------------|---------------|------------------|--------------------|------------------|
| Varistor Chip | Automotive Series | Case Size | Working Voltage | Energy Rating | Clamping Voltage | Package            | Termination      |
|               |                   | 0402      | 16 = 16Vdc      | A = 0.1J      | 380 = 38V        | D = 7" (1000)*     |                  |
|               |                   | 0603      | 18 = 18Vdc      | B = 0.2J      | 390 = 42V        | R = 7" (4000)*     | P = Ni/Sn plated |
|               |                   | 0805      | 26 = 26Vdc      | C = 0.3J      | 400 = 42V        | T = 13" (10,000)*  |                  |
|               |                   | 1206      | 30 = 30Vdc      | D = 0.4J      | 580 = 60V        | W = 13" (10,000)** |                  |
|               |                   | 1210      | 38 = 38Vdc      | E = 0.5J      | 620 = 67V        | 0402 only          |                  |
|               |                   |           | 42 = 42Vdc      | F = 0.7J      | 650 = 67V        |                    |                  |
|               |                   |           | 48 = 48Vdc      | H = 1.2J      | 770 = 77V        |                    |                  |
|               |                   |           | 56 = 56Vdc      | J = 1.5J      | 800 = 80V        |                    |                  |
|               |                   |           | 85 = 85Vdc      | K = 0.6J      | 101 = 100V       |                    |                  |
|               |                   |           |                 | L = 0.8J      | 111 = 110V       |                    |                  |
|               |                   |           |                 | S = 1.9-2.0J  | 151 = 150V       |                    |                  |

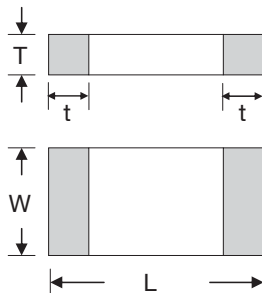
\*Not available for 0402  
\*\*Only available for 0402

**Not RoHS Compliant**



For RoHS compliant products,  
please select correct termination style.

### PHYSICAL DIMENSIONS: mm (inches)



| Size (EIA) | Length (L)                 | Width (W)                  | Max Thickness (T) | Land Length (t)            |
|------------|----------------------------|----------------------------|-------------------|----------------------------|
| 0402       | 1.00±0.10<br>(0.040±0.004) | 0.50±0.10<br>(0.020±0.004) | 0.60<br>(0.024)   | 0.25±0.15<br>(0.010±0.006) |
| 0603       | 1.60±0.15<br>(0.063±0.006) | 0.80±0.15<br>(0.031±0.006) | 0.90<br>(0.035)   | 0.35±0.15<br>(0.014±0.006) |
| 0805       | 2.01±0.20<br>(0.079±0.008) | 1.25±0.20<br>(0.049±0.008) | 1.02<br>(0.040)   | 0.71 max.<br>(0.028 max.)  |
| 1206       | 3.20±0.20<br>(0.126±0.008) | 1.60±0.20<br>(0.063±0.008) | 1.02<br>(0.040)   | 0.94 max.<br>(0.037 max.)  |
| 1210       | 3.20±0.20<br>(0.126±0.008) | 2.49±0.20<br>(0.098±0.008) | 1.70<br>(0.067)   | 0.14 max.<br>(0.045 max.)  |

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### 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> | E <sub>LD</sub> | I <sub>P</sub> | Cap  | Freq | V <sub>Jump</sub> | P <sub>Diss. Max</sub> |
|-------------------|---------------------|---------------------|----------------|----------------|-----------------|----------------|----------------|-----------------|----------------|------|------|-------------------|------------------------|
| VCAS040205X150 __ | 5.6                 | 4.0                 | 8.5±20%        | 18             | 1               | 35             | 0.05           | -               | 20             | 175  | M    | -                 | 0.001                  |
| VCAS060305A150 __ | 5.6                 | 4.0                 | 8.5±20%        | 18             | 1               | 35             | 0.1            | -               | 30             | 750  | K    | -                 | 0.001                  |
| VCAS080505A150 __ | 5.6                 | 4.0                 | 8.5±20%        | 18             | 1               | 35             | 0.1            | -               | 40             | 1100 | K    | -                 | 0.001                  |
| VCAS080505C150 __ | 5.6                 | 4.0                 | 8.5±20%        | 18             | 1               | 35             | 0.3            | -               | 120            | 3000 | K    | -                 | 0.005                  |
| VCAS120605A150 __ | 5.6                 | 4.0                 | 8.5±20%        | 18             | 1               | 35             | 0.1            | -               | 40             | 1200 | K    | -                 | 0.002                  |
| VCAS120605D150 __ | 5.6                 | 4.0                 | 8.5±20%        | 18             | 1               | 35             | 0.4            | -               | 150            | 3000 | K    | -                 | 0.008                  |
| VCAS040209X200 __ | 9                   | 6.4                 | 12.7±15%       | 22             | 1               | 25             | 0.05           | -               | 20             | 175  | M    | -                 | 0.001                  |
| VCAS060309A200 __ | 9                   | 6.4                 | 12.7±15%       | 22             | 1               | 25             | 0.1            | -               | 30             | 550  | K    | -                 | 0.002                  |
| VCAS080509A200 __ | 9                   | 6.4                 | 12.7±15%       | 22             | 1               | 25             | 0.1            | -               | 40             | 750  | K    | -                 | 0.002                  |
| VCAS080512A250 __ | 12                  | 8.5                 | 16±15%         | 27             | 1               | 25             | 0.1            | -               | 40             | 525  | K    | -                 | 0.002                  |
| VCAS040214X300 __ | 14                  | 10                  | 18.5±12%       | 32             | 1               | 15             | 0.05           | -               | 20             | 85   | M    | 16                | 0.001                  |
| VCAS060314A300 __ | 14                  | 10                  | 18.5±12%       | 32             | 1               | 15             | 0.1            | -               | 30             | 350  | K    | 16                | 0.002                  |
| VCAS080514A300 __ | 14                  | 10                  | 18.5±12%       | 32             | 1               | 15             | 0.1            | -               | 40             | 325  | K    | 16                | 0.002                  |
| VCAS080514C300 __ | 14                  | 10                  | 18.5±12%       | 32             | 1               | 15             | 0.3            | -               | 120            | 900  | K    | 20                | 0.006                  |
| VCAS120614A300 __ | 14                  | 10                  | 18.5±12%       | 32             | 1               | 15             | 0.1            | -               | 40             | 600  | K    | 20                | 0.002                  |
| VCAS120614D300 __ | 14                  | 10                  | 18.5±12%       | 32             | 1               | 15             | 0.4            | -               | 150            | 1050 | K    | 20                | 0.008                  |
| VCAS060316B400 __ | 16                  | 11                  | 25.5±10%       | 42             | 1               | 10             | 0.2            | 0.25            | 30             | 150  | K    | 27.5              | 0.003                  |
| VCAS120616K380 __ | 16                  | 11                  | 25.5±10%       | 42             | 1               | 10             | 0.6            | 1.5             | 200            | 930  | K    | 27.5              | 0.010                  |
| VCAS121016J390 __ | 16                  | 11                  | 25.5±10%       | 42             | 5               | 10             | 1.6            | 3               | 500            | 3100 | K    | 27.5              | 0.030                  |
| VCAS181216P400 __ | 16                  | 11                  | 24.5±10%       | 42             | 5               | 10             | 2.9            | 10              | 1000           | 5000 | K    | 27.5              | 0.07                   |
| VCAS040218X400 __ | 18                  | 13                  | 25.5±10%       | 42             | 1               | 10             | 0.05           | 0.05            | 20             | 65   | M    | 27.5              | 0.001                  |
| VCAS060318A400 __ | 18                  | 13                  | 25.5±10%       | 42             | 1               | 10             | 0.1            | 0.25            | 30             | 150  | K    | 27.5              | 0.003                  |
| VCAS080518A400 __ | 18                  | 13                  | 25.5±10%       | 42             | 1               | 10             | 0.1            | 0.1             | 30             | 225  | K    | 27.5              | 0.002                  |
| VCAS080518C400 __ | 18                  | 13                  | 25.5±10%       | 42             | 1               | 10             | 0.3            | 1               | 120            | 550  | K    | 27.5              | 0.007                  |
| VCAS120618A400 __ | 18                  | 13                  | 25.5±10%       | 42             | 1               | 10             | 0.1            | 0.5             | 30             | 350  | K    | 27.5              | 0.002                  |
| VCAS120618D400 __ | 18                  | 13                  | 25.5±10%       | 42             | 1               | 10             | 0.4            | 1.5             | 150            | 900  | K    | 27.5              | 0.008                  |
| VCAS120618E380 __ | 18                  | 13                  | 25.5±10%       | 42             | 1               | 10             | 0.5            | 1.5             | 200            | 930  | K    | 27.5              | 0.010                  |
| VCAS121018J390 __ | 18                  | 13                  | 25.5±10%       | 42             | 5               | 10             | 1.6            | 3               | 500            | 3100 | K    | 27.5              | 0.030                  |
| VCAS060326A580 __ | 26                  | 18                  | 34.5±10%       | 60             | 1               | 10             | 0.1            | 0.1             | 30             | 155  | K    | 27.5              | 0.002                  |
| VCAS080526A580 __ | 26                  | 18                  | 34.5±10%       | 60             | 1               | 10             | 0.1            | 0.15            | 30             | 120  | K    | 27.5              | 0.002                  |
| VCAS080526C580 __ | 26                  | 18                  | 34.5±10%       | 60             | 1               | 10             | 0.3            | 0.5             | 100            | 250  | K    | 27.5              | 0.006                  |
| VCAS120626D580 __ | 26                  | 18                  | 34.5±10%       | 60             | 1               | 10             | 0.4            | 1               | 120            | 500  | K    | 27.5              | 0.008                  |
| VCAS120626F540 __ | 26                  | 18                  | 33.0±10%       | 54             | 1               | 15             | 0.7            | 1.5             | 200            | 600  | K    | 27.5              | 0.008                  |
| VCAS121026H560 __ | 26                  | 18                  | 34.5±10%       | 60             | 5               | 10             | 1.2            | 3               | 300            | 2150 | K    | 27.5              | 0.018                  |
| VCAS060330A650 __ | 30                  | 21                  | 41.0±10%       | 67             | 1               | 10             | 0.1            | 0.15            | 30             | 125  | K    | 29                | 0.002                  |
| VCAS080530A650 __ | 30                  | 21                  | 41.0±10%       | 67             | 1               | 10             | 0.1            | 0.15            | 30             | 90   | M    | 29                | 0.002                  |
| VCAS080530C650 __ | 30                  | 21                  | 41.0±10%       | 67             | 1               | 10             | 0.3            | 0.5             | 80             | 250  | K    | 29                | 0.005                  |
| VCAS120630D650 __ | 30                  | 21                  | 41.0±10%       | 67             | 1               | 10             | 0.4            | 1               | 120            | 400  | K    | 29                | 0.008                  |
| VCAS121030H620 __ | 30                  | 21                  | 41.0±10%       | 67             | 5               | 10             | 1.2            | 3               | 280            | 1850 | K    | 29                | 0.018                  |
| VCAS121030S620 __ | 30                  | 21                  | 41.0±10%       | 67             | 5               | 10             | 1.9            | 3               | 300            | 1500 | K    | 29                | 0.038                  |
| VCAS080531C650 __ | 31                  | 25                  | 39.0±10%       | 65             | 1               | 10             | 0.3            | 0.5             | 80             | 250  | K    | 29                | 0.005                  |
| VCAS120631M650 __ | 31                  | 25                  | 39.0±10%       | 65             | 1               | 15             | 1              | 1.5             | 200            | 500  | K    | 29                | 0.008                  |
| VCAS120634N770 __ | 34                  | 30                  | 47.0±10%       | 77             | 1               | 15             | 1.1            | 1.5             | 200            | 400  | K    | 48                | 0.008                  |
| VCAS121034S770 __ | 34                  | 30                  | 47.0±10%       | 77             | 2.5             | 15             | 2              | 3.5             | 400            | 1500 | K    | 48                | 0.04                   |
| VCAS181234U770 __ | 34                  | 30                  | 47.0±10%       | 77             | 5               | 15             | 5              | 6.1             | 800            | 1500 | K    | 48                | 0.08                   |
| VCAS080538C770 __ | 38                  | 30                  | 47.0±10%       | 77             | 1               | 10             | 0.3            | -               | 80             | 200  | K    | 48                | 0.006                  |
| VCAS120642L800 __ | 42                  | 32                  | 51.0±10%       | 80             | 1               | 35             | 0.8            | -               | 180            | 600  | K    | 48                | 0.016                  |
| VCAS120642K900 __ | 42                  | 32                  | 56±10%         | 90             | 1               | 15             | 0.6            | -               | 200            | 260  | K    | 48                | 0.012                  |
| VCAS120645K900 __ | 45                  | 35                  | 56±10%         | 90             | 1               | 25             | 0.6            | -               | 200            | 260  | K    | 48                | 0.012                  |
| VCAS120648D101 __ | 48                  | 34                  | 62.0±10%       | 100            | 1               | 10             | 0.4            | -               | 100            | 225  | K    | 48                | 0.008                  |
| VCAS121048H101 __ | 48                  | 34                  | 62.0±10%       | 100            | 1               | 10             | 1.2            | -               | 250            | 500  | K    | 48                | 0.022                  |
| VCAS120656F111 __ | 56                  | 40                  | 68.0±10%       | 110            | 1               | 15             | 0.7            | -               | 100            | 180  | K    | 48                | 0.014                  |
| VCAS120660M131 __ | 60                  | 50                  | 82.0±10%       | 135            | 1               | 15             | 1              | -               | 150            | 250  | K    | 48                | 0.008                  |
| VCAS121060J121 __ | 60                  | 42                  | 76±10%         | 120            | 5               | 10             | 1.5            | -               | 250            | 400  | K    | 48                | 0.03                   |
| VCAS121065P131 __ | 65                  | 50                  | 82±10%         | 135            | 2.5             | 15             | 2.7            | -               | 350            | 600  | K    | 48                | 0.05                   |
| VCAS121085S151 __ | 85                  | 60                  | 100.0±10%      | 150            | 1               | 35             | 2              | -               | 250            | 275  | K    | 48                | 0.040                  |

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>

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 0.5V<sub>RMS</sub>

V<sub>Jump</sub> Jump Start (V)

P Power Dissipation (W)

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### AUTOMOTIVE SERIES – LOAD DUMP TEST

According to ISO DP7637 rev 2 Pulse 5

**Automotive Load Dump Pulse  
(According to ISO 7637 Pulse 5)**



When using the test method indicated below, the amount of Energy dissipated by the varistor must not exceed the Load Dump Energy value specified in the product table.

### CONSUMER VEHICLE TESTING (12V Network)

| AVX<br>Part Number | Working<br>Voltage<br>(DC) | Working<br>Voltage<br>(AC) | Transient<br>Energy<br>10 x 1000 us<br>(Joules) | Load Dump<br>Energy<br>(x10)<br>Joules | Typical Vz Max Versus Pulse<br>Duration and Rs |                 |
|--------------------|----------------------------|----------------------------|-------------------------------------------------|----------------------------------------|------------------------------------------------|-----------------|
|                    |                            |                            |                                                 |                                        | 0.5 Ohm<br>100 mS                              | 4 Ohm<br>100 mS |
| VCAS060316B400 __  | 16                         | 11                         | 0.2                                             | 0.25                                   | 35                                             | 40              |
| VCAS120616K380 __  | 16                         | 11                         | 0.6                                             | 1.5                                    | 40                                             | 55              |
| VCAS121016J390 __  | 16                         | 11                         | 1.5                                             | 3                                      | 45                                             | 65              |
| VCSA040218X400 __  | 18                         | 13                         | 0.05                                            | 0.05                                   | 30                                             | 35              |
| VCAS060318A400 __  | 18                         | 13                         | 0.1                                             | 0.25                                   | 35                                             | 40              |
| VCAS080518A400 __  | 18                         | 13                         | 0.1                                             | 0.1                                    | 35                                             | 40              |
| VCAS080518C400 __  | 18                         | 13                         | 0.3                                             | 1                                      | 35                                             | 45              |
| VCAS120618A400 __  | 18                         | 13                         | 0.1                                             | 0.5                                    | 40                                             | 50              |
| VCAS120618D400 __  | 18                         | 13                         | 0.4                                             | 1.5                                    | 40                                             | 55              |
| VCAS120618E380 __  | 18                         | 13                         | 0.5                                             | 1.5                                    | 40                                             | 55              |
| VCAS121018J390 __  | 18                         | 13                         | 1.5                                             | 3                                      | 45                                             | 65              |

### COMMERCIAL VEHICLE TESTING (24V Network)

| AVX<br>Part Number | Working<br>Voltage<br>(DC) | Working<br>Voltage<br>(AC) | Transient<br>Energy<br>10 x 1000 us<br>(Joules) | Load Dump<br>Energy<br>(x10)<br>Joules | Typical Vz Max Versus Pulse<br>Duration and Rs |                 |
|--------------------|----------------------------|----------------------------|-------------------------------------------------|----------------------------------------|------------------------------------------------|-----------------|
|                    |                            |                            |                                                 |                                        | 1 Ohm<br>100 mS                                | 8 Ohm<br>100 mS |
| VCAS060326A580 __  | 26                         | 18                         | 0.1                                             | 0.1                                    | 45                                             | 50              |
| VCAS080526A580 __  | 26                         | 18                         | 0.1                                             | 0.15                                   | 50                                             | 55              |
| VCAS080526C580 __  | 26                         | 18                         | 0.3                                             | 0.5                                    | 50                                             | 60              |
| VCAS120626D580 __  | 26                         | 18                         | 0.4                                             | 1                                      | 50                                             | 60              |
| VCAS121026H560 __  | 26                         | 18                         | 1.2                                             | 3                                      | 55                                             | 80              |
| VCAS060330A650 __  | 30                         | 21                         | 0.1                                             | 0.15                                   | 50                                             | 60              |
| VCAS080530A650 __  | 30                         | 21                         | 0.1                                             | 0.15                                   | 50                                             | 60              |
| VCAS080530C650 __  | 30                         | 21                         | 0.3                                             | 0.5                                    | 55                                             | 65              |
| VCAS120630D650 __  | 30                         | 21                         | 0.4                                             | 1                                      | 60                                             | 70              |
| VCAS121030H620 __  | 30                         | 21                         | 1.2                                             | 3                                      | 60                                             | 90              |

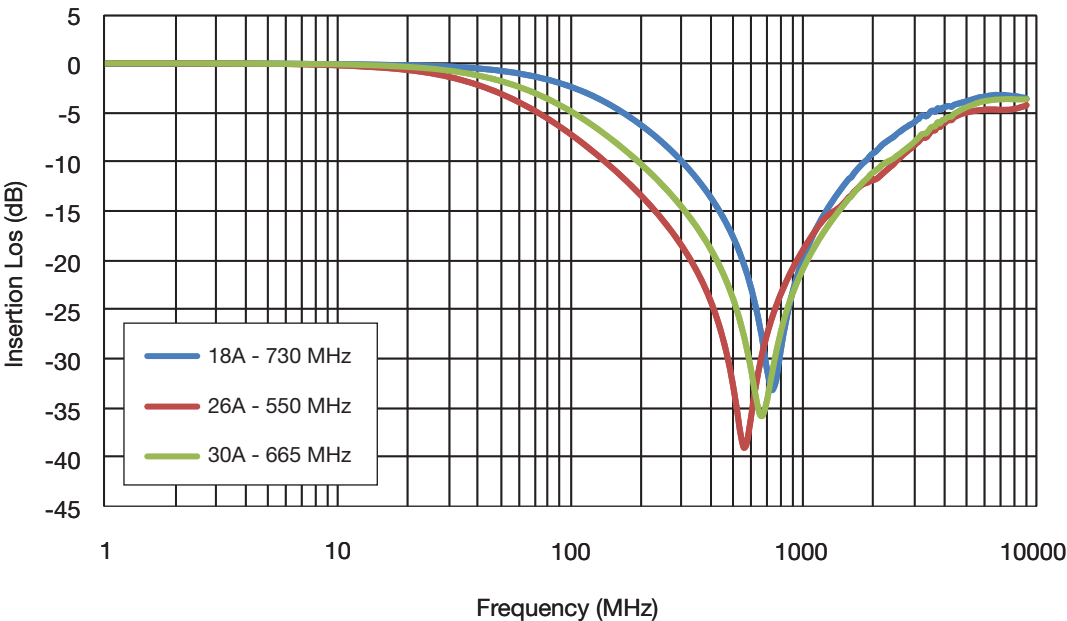
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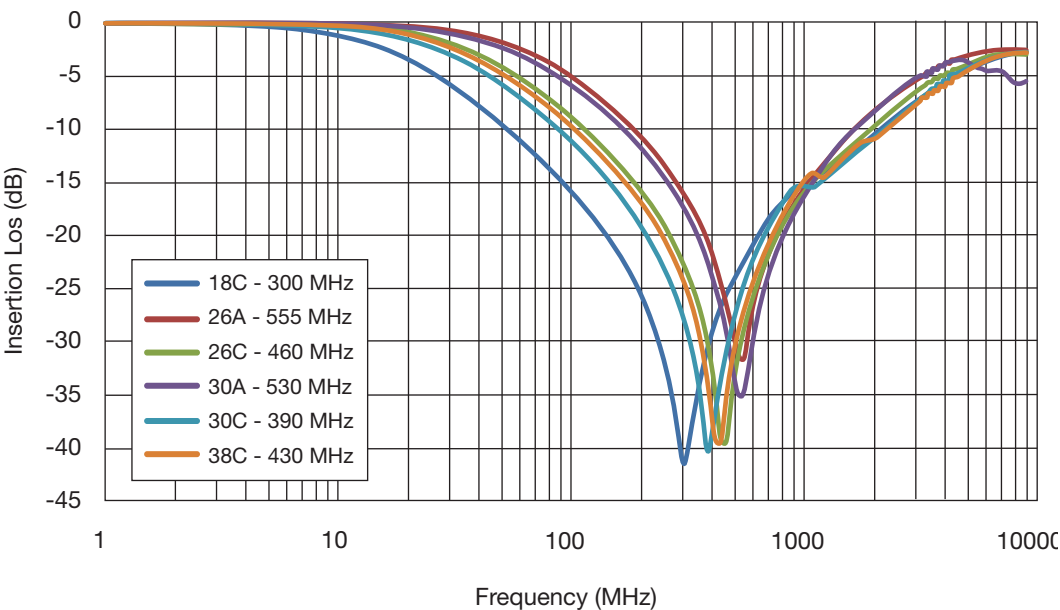
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### FORWARD TRANSMISSION CHARACTERISTICS (S21)

0603 Case Size



0805 Case Size



# TransGuard® Automotive Series

## Multilayer Varistors for Automotive Applications



### FORWARD TRANSMISSION CHARACTERISTICS (S21)



# TransGuard® Automotive Series

## Multilayer Varistors for Automotive Applications

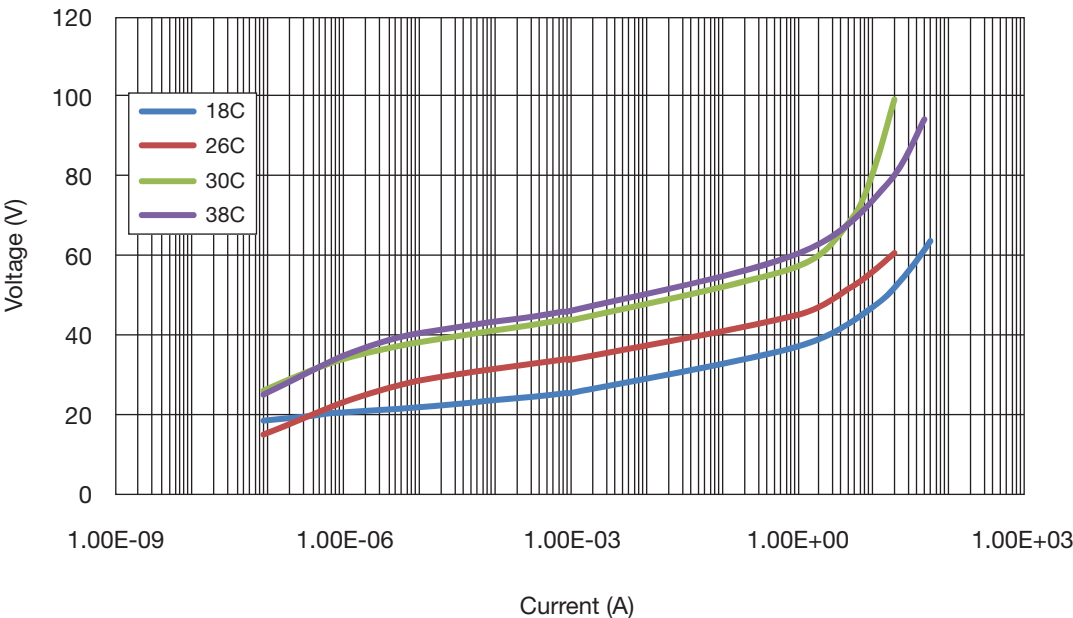


### V-I CHARACTERISTICS

0603 Case Size



0805 Case Size



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## Multilayer Varistors for Automotive Applications

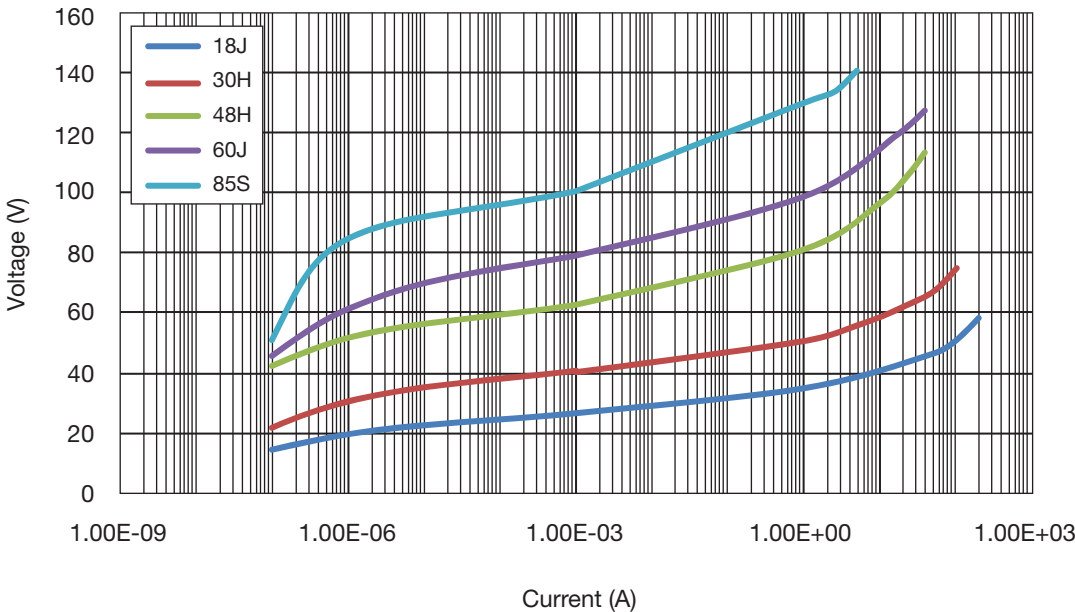


### V-I CHARACTERISTICS

1206 Case Size



1210 Case Size

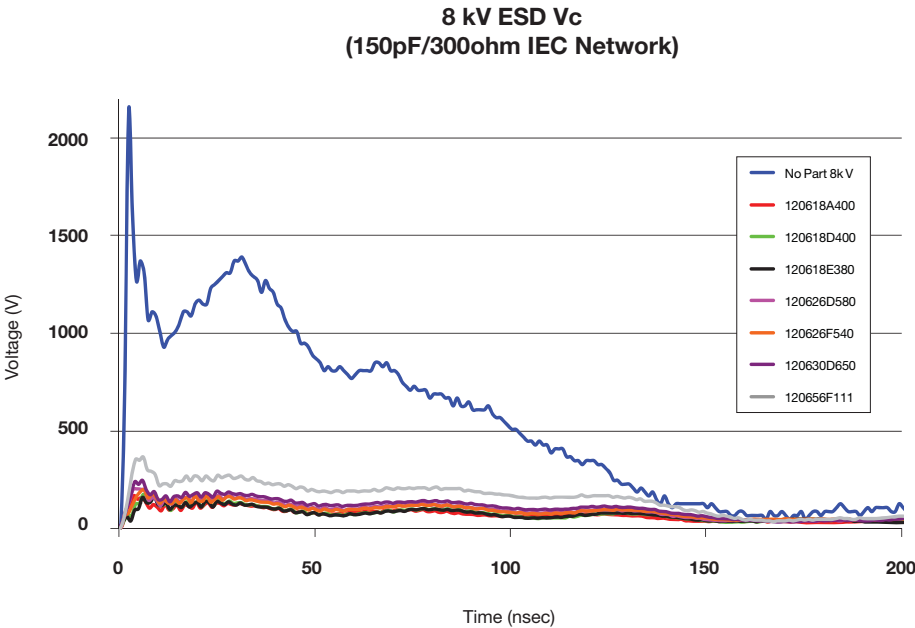


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### ESD V-I CHARACTERISTICS



### TYPICAL VOLTAGE AT 8 KV PULSE

| 8kV Pulse                   | Peak Voltage (V) | 30ns Voltage (V) | 100ns Voltage (V) |
|-----------------------------|------------------|------------------|-------------------|
| No Part<br>(No Suppression) | 2130             | 1370             | 517               |
| 120618A400                  | 171              | 123              | 65                |
| 120618D400                  | 177              | 133              | 66                |
| 120618E380                  | 161              | 121              | 63                |
| 120626D580                  | 203              | 155              | 88                |
| 120626F540                  | 201              | 159              | 84                |
| 120630D650                  | 249              | 177              | 106               |
| 120656F111                  | 366              | 262              | 169               |

**ESD 8 kV IEC 61000-4-2 150pF / 330Ω Resistor**  
**VC060318A400**

