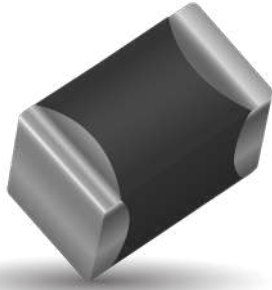


# TransGuard® Automotive Series

## 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.

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

Operating Temperature: -55°C to +125°C

### 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
- ISO 7637-2:2004
- JASO D001 1994

### 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                                                                                                                                         |                                                                               |
| VC = Varistor Chip<br>VG = Varistor Glass Encapsulated Chip |                   | 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>34 = 34Vdc<br>38 = 38Vdc<br>42 = 42Vdc<br>45 = 45Vdc<br>48 = 48Vdc<br>56 = 56Vdc<br>60 = 60Vdc<br>65 = 65Vdc<br>85 = 85Vdc | A = 0.1J<br>B = 0.2J<br>C = 0.3J<br>D = 0.4J<br>E = 0.5J<br>F = 0.7J<br>H = 1.2J<br>J = 1.5J<br>K = 0.6J<br>L = 0.8J<br>S = 1.9-2.0J<br>X = 0.05J<br>M = 1J<br>N = 1.1J<br>U = 4.0-5.0J<br>P = 2.5-3.7J<br>Y = 6.5-12J<br>Z = 13J | 140 = 14V<br>150 = 18V<br>220 = 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>570 = 57V<br>580 = 60V<br>620 = 67V<br>650 = 67V<br>770 = 77V<br>800 = 80V<br>900 = 90V<br>101 = 100V<br>111 = 110V<br>131 = 135V<br>151 = 150V | D = 7" (1000)*<br>R = 7" (4000)*<br>T = 13" (10,000)*<br>W = 7" (10,000)**<br>0402 only<br><br>*Not available for 0402<br>**Only available for 0402 | P = Ni/Sn plated<br>Z = FLEXITERM®*<br><br>*Only available for 0603-1210 case |

# TransGuard® Automotive Series

## Multilayer Varistors for Automotive Applications



### 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> | E <sub>LD</sub> | I <sub>P</sub> | Cap   | Freq | V <sub>Jump</sub> | P <sub>Diss. Max</sub> |
|-------------------|---------------------|---------------------|----------------|----------------|-----------------|----------------|----------------|-----------------|----------------|-------|------|-------------------|------------------------|
|                   | Vdc                 | Vac                 | V              | V              | A               | μA             | J              | J               | A              | pF    | V    | W                 |                        |
| VCAS060303A140    | 3.3                 | 2.3                 | 6.0±20%        | 14             | 1               | 50             | 0.1            | -               | 30             | 1450  | K    | -                 | 0.002                  |
| VCAS080503A140    | 3.3                 | 2.3                 | 6.0±20%        | 14             | 1               | 50             | 0.1            | -               | 40             | 1000  | K    | -                 | 0.002                  |
| VCAS080503C140    | 3.3                 | 2.3                 | 6.0±20%        | 14             | 1               | 50             | 0.3            | -               | 120            | 4500  | K    | -                 | 0.006                  |
| VCAS120603A140    | 3.3                 | 2.3                 | 6.0±20%        | 14             | 1               | 50             | 0.1            | -               | 40             | 1500  | K    | -                 | 0.002                  |
| VCAS120603D140    | 3.3                 | 2.3                 | 6.0±20%        | 14             | 1               | 50             | 0.4            | -               | 150            | 4000  | K    | -                 | 0.009                  |
| VCAS040205X150 __ | 5.6                 | 4                   | 8.5±20%        | 18             | 1               | 35             | 0.05           | -               | 20             | 175   | M    | -                 | 0.001                  |
| VCAS060305A150 __ | 5.6                 | 4                   | 8.5±20%        | 18             | 1               | 35             | 0.1            | -               | 30             | 750   | K    | -                 | 0.001                  |
| VCAS080505A150 __ | 5.6                 | 4                   | 8.5±20%        | 18             | 1               | 35             | 0.1            | -               | 40             | 1100  | K    | -                 | 0.001                  |
| VCAS080505C150 __ | 5.6                 | 4                   | 8.5±20%        | 18             | 1               | 35             | 0.3            | -               | 120            | 3000  | K    | -                 | 0.005                  |
| VCAS120605A150 __ | 5.6                 | 4                   | 8.5±20%        | 18             | 1               | 35             | 0.1            | -               | 40             | 1200  | K    | -                 | 0.002                  |
| VCAS120605D150 __ | 5.6                 | 4                   | 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    | K    | 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%       | 38             | 1               | 10             | 0.6            | 1.5             | 200            | 930   | K    | 27.5              | 0.01                   |
| VCAS121016J390 __ | 16                  | 11                  | 25.5±10%       | 42             | 5               | 10             | 1.6            | 3               | 500            | 3100  | K    | 27.5              | 0.03                   |
| VGAS121016S390    | 16                  | 14                  | 24.5±10%       | 40             | 2.5             | 15             | 2              | 5               | 500            | 3000  | K    | 27.5              | 0.01                   |
| VGAS181216P390    | 16                  | 11                  | 24.5±10%       | 40             | 5               | 15             | 2.9            | 10              | 1000           | 7000  | K    | 27.5              | 0.07                   |
| VCAS222016Y390    | 16                  | 11                  | 24.5±10%       | 40             | 10              | 15             | 10.2           | 37              | 2000           | 2500  | K    | 27.5              | 10.2                   |
| VGAS222016Y390    | 16                  | 11                  | 24.5±10%       | 40             | 10              | 15             | 10.2           | 37              | 2000           | 2500  | K    | 27.5              | 0.08                   |
| VGAS181216P400 __ | 16                  | 11                  | 24.5±10%       | 42             | 5               | 10             | 2.9            | 10              | 1000           | 5000  | K    | 27.5              | 0.07                   |
| VCAS222016W400    | 16                  | 11                  | 24.5±10%       | 42             | 10              | 15             | 7.6            | 20              | 2000           | 2000  | K    | 27.5              | 7.6                    |
| VGAS222016W400    | 16                  | 11                  | 24.5±10%       | 42             | 10              | 15             | 7.6            | 20              | 2000           | 2000  | K    | 27.5              | 7.6                    |
| VGAS222016Y400    | 16                  | 11                  | 24.5±10%       | 42             | 10              | 10             | 7.2            | 25              | 1500           | 13000 | K    | 25.5              | 0.1                    |
| VCAS222016Z400    | 16                  | 11                  | 24.5±10%       | 42             | 10              | 15             | 16             | 45              | 2000           | 2800  | K    | 27.5              | 16                     |
| VGAS222016Z400    | 16                  | 11                  | 24.5±10%       | 42             | 10              | 15             | 16             | 45              | 2000           | 2800  | K    | 27.5              | 16                     |
| 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            | 0.3             | 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%       | 38             | 1               | 10             | 0.5            | 1.5             | 200            | 930   | K    | 27.5              | 0.01                   |
| VCAS121018J390 __ | 18                  | 13                  | 25.5±10%       | 42             | 5               | 10             | 1.6            | 3               | 500            | 3100  | K    | 27.5              | 0.03                   |
| VGAS181218P440    | 18                  | 14                  | 27.5±10%       | 44             | 5               | 15             | 2.9            | 6               | 800            | 5000  | K    | 27.5              | 0.05                   |
| VGAS222022Y490    | 22                  | 17                  | 30±10%         | 49             | 10              | 15             | 6.8            | 25              | 1200           | 12000 | K    | 27.5              | 0.03                   |
| 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                  |
| VGAS181226P570    | 26                  | 23                  | 35.0±10%       | 57             | 5               | 15             | 2.5            | 8               | 600            | 3000  | K    | 30                | 0.015                  |
| VGAS222026Y570    | 26                  | 23                  | 35±10%         | 57             | 10              | 15             | 6.8            | 25              | 1100           | 7000  | K    | 30                | 0.03                   |
| VGAS322026Z570    | 26                  | 23                  | 35±10%         | 57             | 10              | 15             | 13             | 50              | 1800           | 15000 | K    | 30                | 0.04                   |
| 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    | 30                | 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                  |

# TransGuard® Automotive Series

## Multilayer Varistors for Automotive Applications



### 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> | E <sub>LD</sub> | I <sub>P</sub> | Cap   | Freq | V <sub>Jump</sub> | P <sub>Diss. Max</sub> |
|-------------------|---------------------|---------------------|----------------|----------------|-----------------|----------------|----------------|-----------------|----------------|-------|------|-------------------|------------------------|
|                   | Vdc                 | Vac                 | V              | V              | A               | μA             | J              | J               | A              | pF    | V    | W                 |                        |
| VGAS121031R650    | 31                  | 25                  | 39±10%         | 65             | 2.5             | 15             | 1.7            | 4.5             | 300            | 1200  | K    | 30                | 0.05                   |
| VGAS181231P650    | 31                  | 25                  | 39.0±10%       | 65             | 5               | 15             | 3.7            | 8               | 800            | 2600  | K    | 30                | 0.06                   |
| VGAS222031Y650    | 31                  | 25                  | 39±10%         | 65             | 10              | 15             | 9.6            | 23              | 1200           | 6100  | K    | 30                | 0.03                   |
| VCAS120634N770 __ | 34                  | 30                  | 47.0±10%       | 77             | 1               | 15             | 1.1            | 1.5             | 200            | 400   | K    | 48                | 0.008                  |
| VGAS121034S770 __ | 34                  | 30                  | 47.0±10%       | 77             | 2.5             | 15             | 2              | 3               | 400            | 1000  | K    | 48                | 0.04                   |
| VGAS181234U770 __ | 34                  | 30                  | 47.0±10%       | 77             | 5               | 15             | 5              | 6.1             | 800            | 1500  | K    | 48                | 0.08                   |
| VGAS222034Y770    | 34                  | 30                  | 47.0±10%       | 77             | 10              | 15             | 12             | 25              | 2000           | 6300  | K    | 48                | 0.240                  |
| VGAS322034Z770    | 34                  | 30                  | 47±10%         | 77             | 10              | 15             | 13             | 50              | 2000           | 18000 | K    | 48                | 0.26                   |
| 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               | 15             | 0.8            | -               | 180            | 600   | K    | 48                | 0.016                  |
| VCAS120642K900    | 42                  | 32                  | 56±10%         | 90             | 1               | 15             | 0.6            | -               | 200            | 260   | K    | 48                | 0.012                  |
| VGAS181242U900    | 42                  | 35                  | 56.0±10%       | 90             | 5               | 15             | 4.0            | 6               | 500            | 1200  | K    | 48                | 0.015                  |
| VGAS222042Y900    | 42                  | 37                  | 56±10%         | 90             | 10              | 15             | 12             | 24              | 1000           | 5000  | K    | 48                | 0.06                   |
| VCAS120645K900    | 45                  | 35                  | 56±10%         | 90             | 1               | 25             | 0.6            | -               | 200            | 260   | K    | 48                | 0.012N                 |
| 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                  |
| VGAS181256U111    | 56                  | 40                  | 68±10%         | 110            | 5               | 15             | 4.8            | -               | 500            | 1100  | K    | 48                | 0.04                   |
| 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                   |
| VGAS121065P131    | 65                  | 50                  | 82±10%         | 135            | 2.5             | 15             | 2.7            | -               | 350            | 600   | K    | 48                | 0.05                   |
| VGAS181265U131    | 65                  | 50                  | 82±10%         | 135            | 5               | 15             | 4.5            | -               | 400            | 800   | K    | 48                | 0.03                   |
| VGAS222065Y131    | 65                  | 50                  | 82±10%         | 135            | 10              | 15             | 6.5            | -               | 1100           | 3000  | K    | 48                | 0.06                   |
| VCAS121085S151 __ | 85                  | 60                  | 100.0±10%      | 150            | 1               | 35             | 2              | -               | 250            | 275   | K    | 48                | 0.040                  |
| VGAS181285U161    | 85                  | 60                  | 100±10%        | 165            | 5               | 15             | 4.5            | -               | 400            | 500   | K    | 48                | 0.04                   |

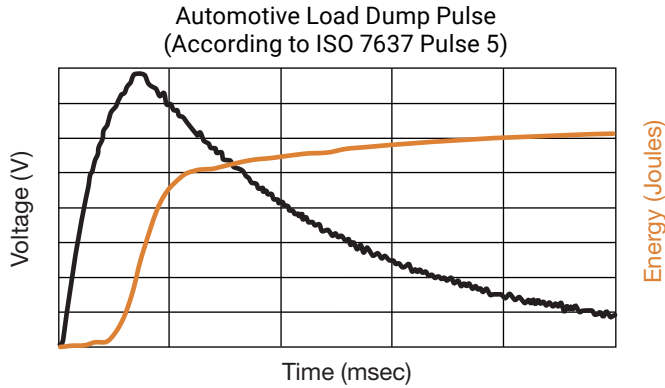
|                     |                                                           |                   |                                                                                |
|---------------------|-----------------------------------------------------------|-------------------|--------------------------------------------------------------------------------|
| V <sub>w</sub> (DC) | DC Working Voltage (V)                                    | E <sub>T</sub>    | Transient Energy Rating (J, 10x1000μs)                                         |
| V <sub>w</sub> (AC) | AC Working Voltage (V)                                    | I <sub>P</sub>    | Peak Current Rating (A, 8x20μs)                                                |
| V <sub>B</sub>      | Typical Breakdown Voltage (V @ 1mA <sub>DC</sub> )        | Cap               | Typical Capacitance (pF) @ frequency specified and 0.5 V <sub>RMS</sub> , 25°C |
| V <sub>C</sub>      | Clamping Voltage [V @ I <sub>IV</sub> ]                   | V <sub>Jump</sub> | Jump Start (V)                                                                 |
| I <sub>VC</sub>     | Test Current for V <sub>C</sub>                           | P                 | Power Dissipation (W)                                                          |
| I <sub>L</sub>      | Maximum Leakage Current at the working voltage, 25°C (μA) |                   |                                                                                |

# TransGuard® Automotive Series

## Multilayer Varistors for Automotive Applications



### AUTOMOTIVE SERIES – LOAD DUMP TEST ACCORDING TO ISO DP7637 REV 2 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.

### LOAD DUMP LIBRARY TYPICAL MAX VZ VERSUS PULSE DURATION AND RI

#### 12V SYSTEMS

| VCAS060316B400 | 0.5Ω | 1Ω | 4Ω  |
|----------------|------|----|-----|
| 100ms          | 37   | 38 | 42  |
| 200ms          | 36   | 37 | 41  |
| 400ms          | 35   | 36 | 39  |
| VCAS120616K380 | 0.5Ω | 1Ω | 4Ω  |
| 100ms          | 42   | 45 | 55  |
| 200ms          | 40   | 43 | 50  |
| 400ms          | 39   | 40 | 45  |
| VCAS121016J390 | 0.5Ω | 1Ω | 4Ω  |
| 100ms          | 48   | 53 | 74  |
| 200ms          | 46   | 50 | 64  |
| 400ms          | 43   | 46 | 56  |
| VGAS181216P400 | 0.5Ω | 1Ω | 4Ω  |
| 100ms          | 46   | 52 | 72  |
| 200ms          | 37   | 41 | 59  |
| 400ms          | 32   | 35 | 51  |
| VGAS222016Y400 | 0.5Ω | 1Ω | 4Ω  |
| 100ms          | 53   | 60 | 77  |
| 200ms          | 50   | 55 | 73  |
| 400ms          | 47   | 50 | 66  |
| VCAS040218X400 | 0.5Ω | 1Ω | 4Ω  |
| 100ms          | 38   | 39 | 40  |
| 200ms          | 37   | 37 | 38  |
| 400ms          | 34   | 35 | 36  |
| VCAS060318A400 | 0.5Ω | 1Ω | 4Ω  |
| 100ms          | 37   | 38 | 42  |
| 200ms          | 36   | 37 | 41  |
| 400ms          | 35   | 36 | 39  |
| VCAS080518A400 | 0.5Ω | 1Ω | 4Ω  |
| 100ms          | 37   | 39 | 40  |
| 200ms          | 35   | 38 | 39  |
| 400ms          | 33   | 37 | 38  |
| VCAS080518C400 | 0.5Ω | 1Ω | 4Ω  |
| 100ms          | 40   | 41 | 48  |
| 200ms          | 39   | 40 | 45  |
| 400ms          | 38   | 39 | 42  |
| VCAS120618A400 | 0.5Ω | 1Ω | 4Ω  |
| 100ms          | 43   | 45 | 55  |
| 200ms          | 41   | 43 | 48  |
| 400ms          | 40   | 41 | 45  |
| VCAS120618D400 | 0.5Ω | 1Ω | 4Ω  |
| 100ms          | 42   | 45 | 55  |
| 200ms          | 40   | 42 | 50  |
| 400ms          | 39   | 40 | 45  |
| VCAS120618E380 | 0.5Ω | 1Ω | 4Ω  |
| 100ms          | 42   | 45 | 55  |
| 200ms          | 40   | 43 | 50  |
| 400ms          | 39   | 40 | 45  |
| VCAS121018J390 | 0.5Ω | 1Ω | 4Ω  |
| 100ms          | 48   | 53 | 74  |
| 200ms          | 46   | 50 | 64  |
| 400ms          | 43   | 46 | 56  |
| VCAS222016W400 | 0.5Ω | 1Ω | 4Ω  |
| 100ms          | 62   | 80 | 172 |
| 400ms          | 48   |    | 90  |

#### 12V SYSTEMS (continued)

| VCAS222016Y390 | 0.5Ω | 1Ω  | 4Ω  |
|----------------|------|-----|-----|
| 100ms          | 78   | 105 | 213 |
| 400ms          | 51   |     | 128 |
| VCAS222016Z400 | 0.5Ω | 1Ω  | 4Ω  |
| 100ms          | 82   | 110 | 213 |
| 400ms          | 55   |     | 134 |

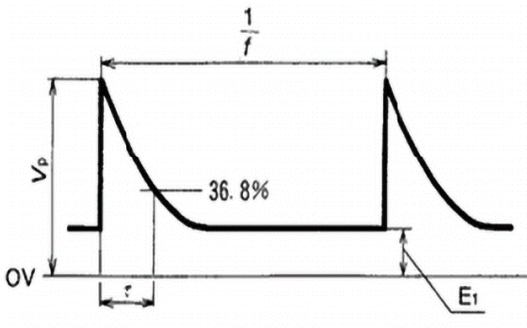
#### 24V SYSTEMS

| VCAS060326A580 | 1Ω  | 4Ω  | 8Ω  |
|----------------|-----|-----|-----|
| 100ms          | 51  | 56  | 58  |
| 200ms          | 50  | 54  | 56  |
| 400ms          | 49  | 51  | 53  |
| VCAS080526A580 | 1Ω  | 4Ω  | 8Ω  |
| 100ms          | 51  | 53  | 59  |
| 200ms          | 49  | 51  | 57  |
| 400ms          | 48  | 50  | 51  |
| VCAS080526C580 | 1Ω  | 4Ω  | 8Ω  |
| 100ms          | 51  | 54  | 62  |
| 200ms          | 49  | 51  | 56  |
| 400ms          | 48  | 49  | 51  |
| VCAS120626D580 | 1Ω  | 4Ω  | 8Ω  |
| 100ms          | 52  | 60  | 68  |
| 200ms          | 50  | 57  | 65  |
| 400ms          | 47  | 54  | 61  |
| VCAS121026H560 | 1Ω  | 4Ω  | 8Ω  |
| 100ms          | 61  | 74  | 91  |
| 200ms          | 59  | 69  | 82  |
| 400ms          | 55  | 64  | 70  |
| VCAS060330A650 | 1Ω  | 4Ω  | 8Ω  |
| 100ms          | 57  | 59  | 63  |
| 200ms          | 56  | 58  | 61  |
| 400ms          | 54  | 57  | 58  |
| VCAS080530A650 | 1Ω  | 4Ω  | 8Ω  |
| 100ms          | 58  | 62  | 66  |
| 200ms          | 56  | 61  | 64  |
| 400ms          | 53  | 57  | 61  |
| VCAS080530C650 | 1Ω  | 4Ω  | 8Ω  |
| 100ms          | 58  | 61  | 63  |
| 200ms          | 57  | 58  | 62  |
| 400ms          | 55  | 56  | 59  |
| VCAS120630D650 | 1Ω  | 4Ω  | 8Ω  |
| 100ms          | 61  | 70  | 75  |
| 200ms          | 57  | 66  | 69  |
| 400ms          | 56  | 62  | 64  |
| VCAS121030H620 | 1Ω  | 4Ω  | 8Ω  |
| 100ms          | 70  | 77  | 98  |
| 200ms          | 64  | 70  | 89  |
| 400ms          | 56  | 65  | 70  |
| VGAS181234U770 | 1Ω  | 4Ω  | 8Ω  |
| 100ms          | 87  | 110 | 125 |
| 200ms          | 82  | 97  | 114 |
| 400ms          | 75  | 85  | 95  |
| VGAS222034Y770 | 1Ω  | 4Ω  | 8Ω  |
| 100ms          | 100 | 125 | 165 |
| 200ms          | 91  | 115 | 155 |
| 400ms          | 84  | 104 | 120 |

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Multilayer Varistors for Automotive Applications



LOAD DUMP TEST – JASO D001-1994



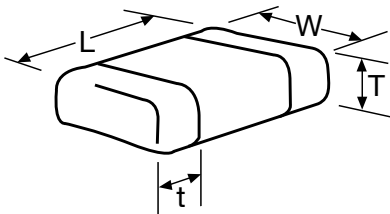
| Type of Test |     | Test Conditions |         |        |                    |          |                                      | Number of Pulses |
|--------------|-----|-----------------|---------|--------|--------------------|----------|--------------------------------------|------------------|
|              |     | $V_p$ (V)       | t (s)   | f (Hz) | $R_l$ ( $\Omega$ ) | Waveform | Transient Voltage Generating Circuit |                  |
| TypeA        | A-1 | 70              | 200,000 | -      | 0.8                | Fig. 4   | Fig. 5 & Fig. 6                      | 1                |
|              | A-2 | 110             | 2.5     | 1/30   | 0.4                |          | Fig. 6                               | 10               |
| TypeB        | B-1 | 80              | 60,000  |        | 8                  | Fig. 7   | Fig. 8                               | 100              |
|              | B-2 | -260            | 2,000   |        | 80                 |          |                                      |                  |

LOAD DUMP LIBRARY
QUALIFIED TO JASO D001-1994

| VCAS222016Z400 | 0.5 $\Omega$ | 1 $\Omega$ | 4 $\Omega$ |
|----------------|--------------|------------|------------|
| 100ms          | 82           | 110        | 213        |
| 400ms          | 55           |            | 134        |

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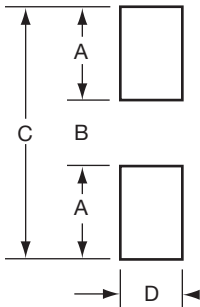
Multilayer Varistors for Automotive Applications



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.)     |

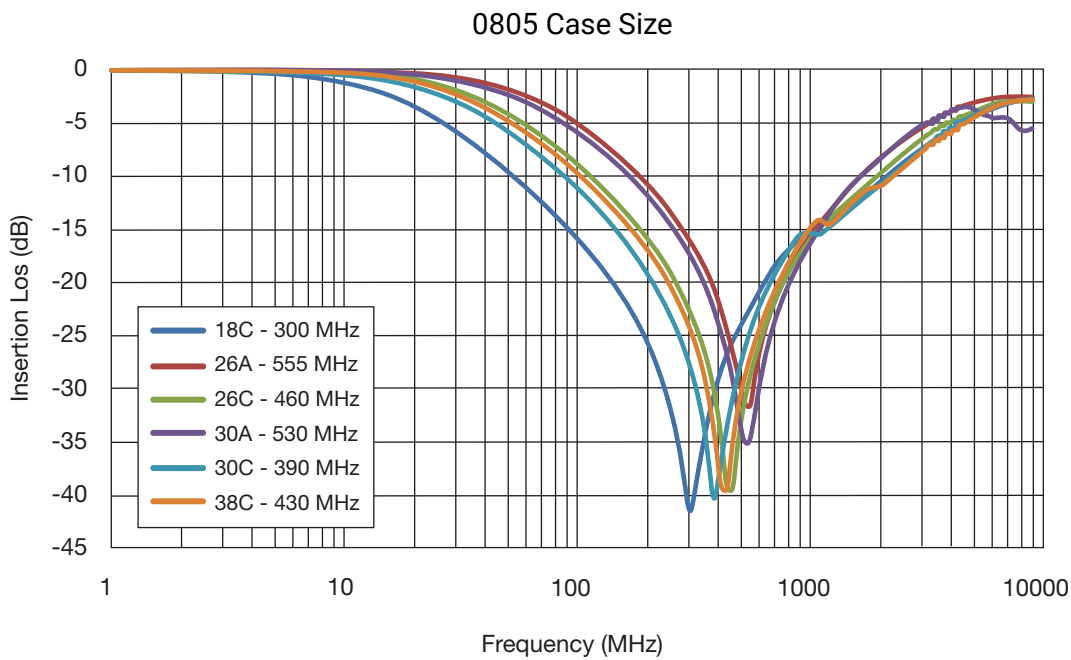
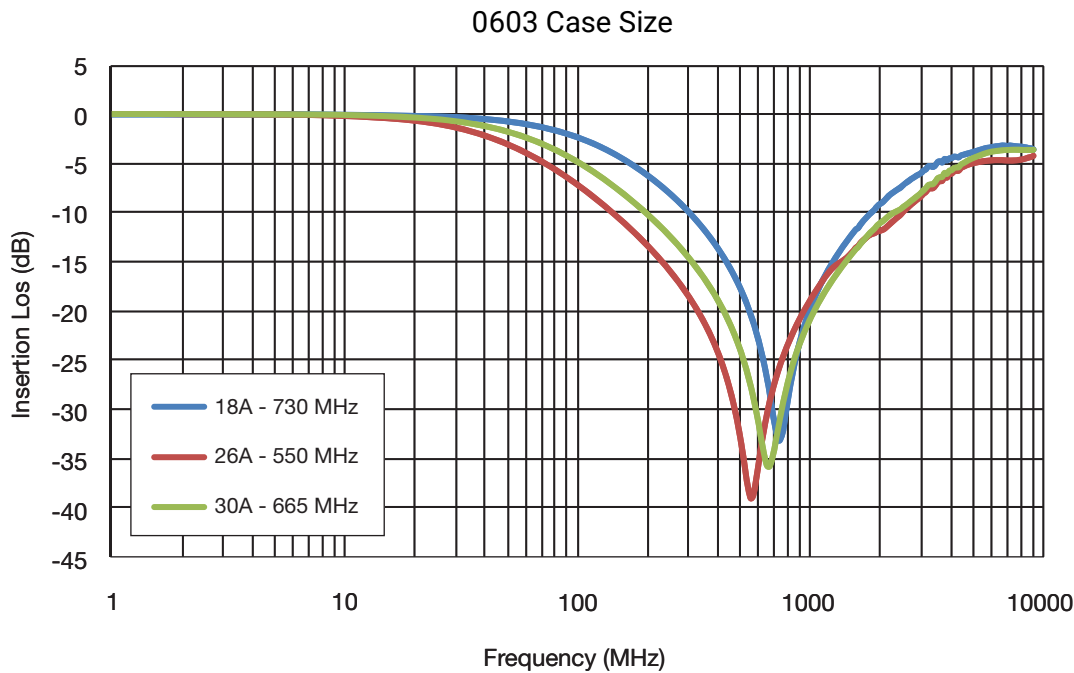
1) Applicable for: VCAS120618E380  
2) Applicable for: VCAS120626F540, VCAS120631M650, VCAS120638N770, VCAS120642L800, VCAS120645K900, VCAS120656F111, VCAS120660M131



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)  |

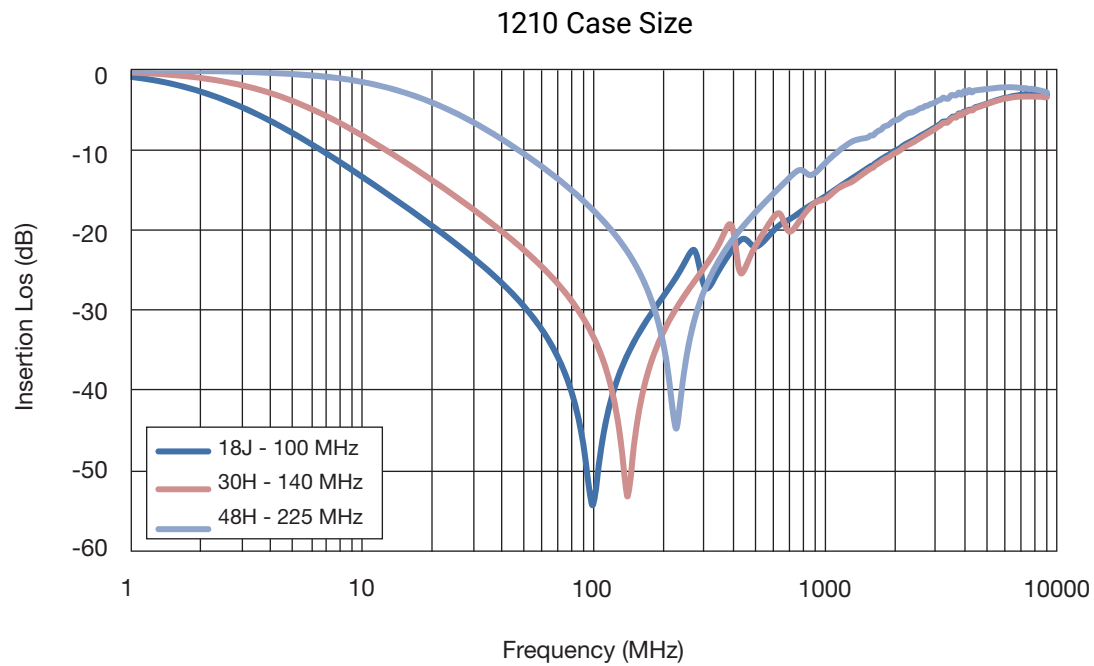
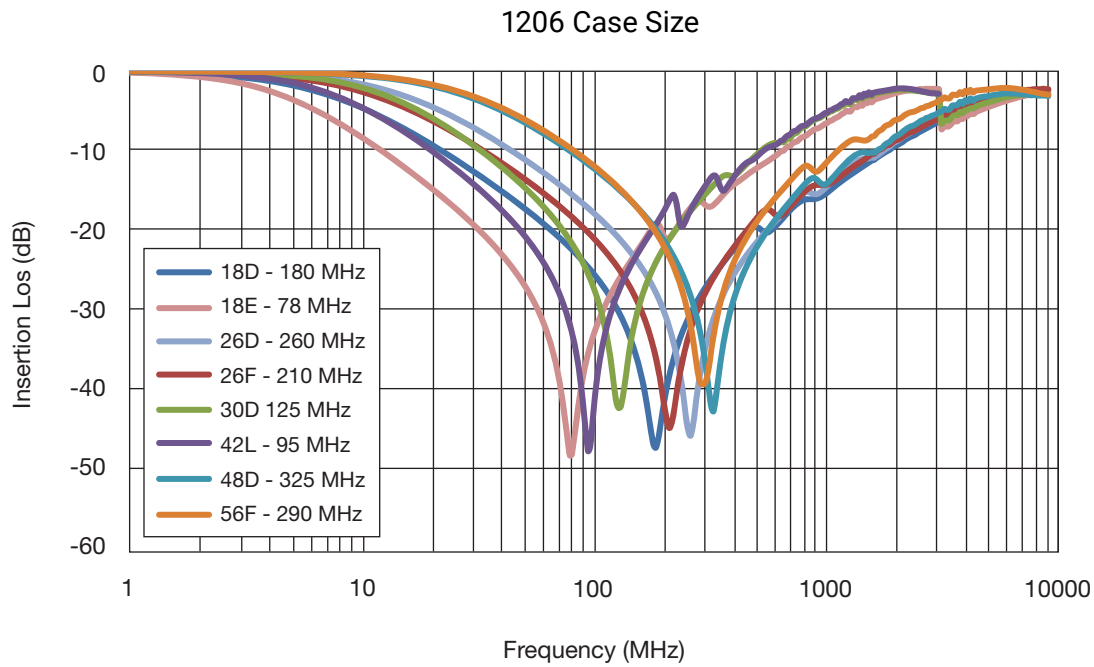
FORWARD TRANSMISSION CHARACTERISTICS (S21)



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Multilayer Varistors for Automotive Applications

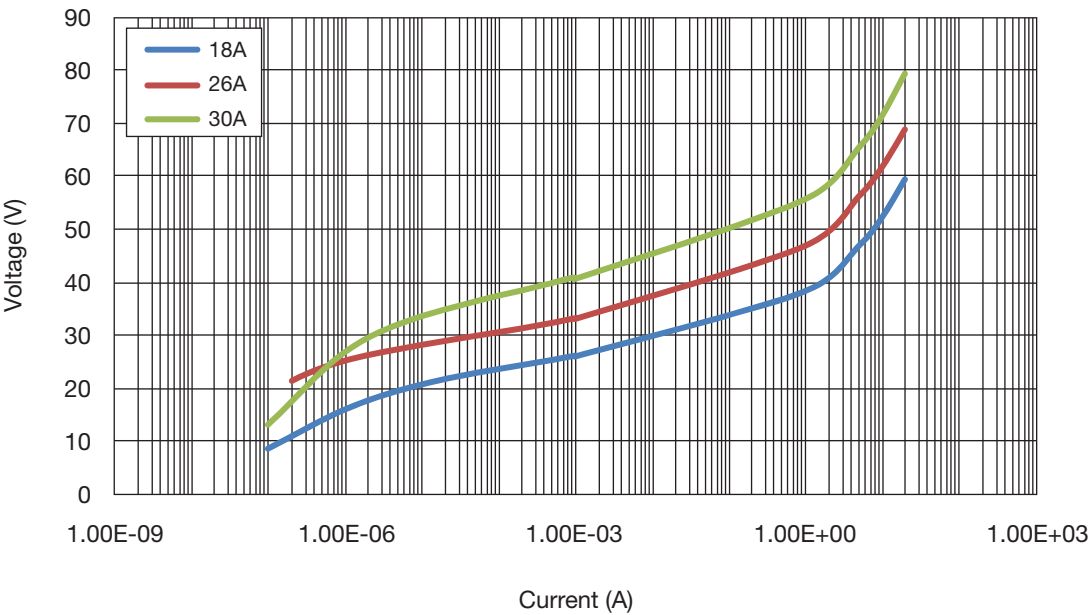


FORWARD TRANSMISSION CHARACTERISTICS (S21)

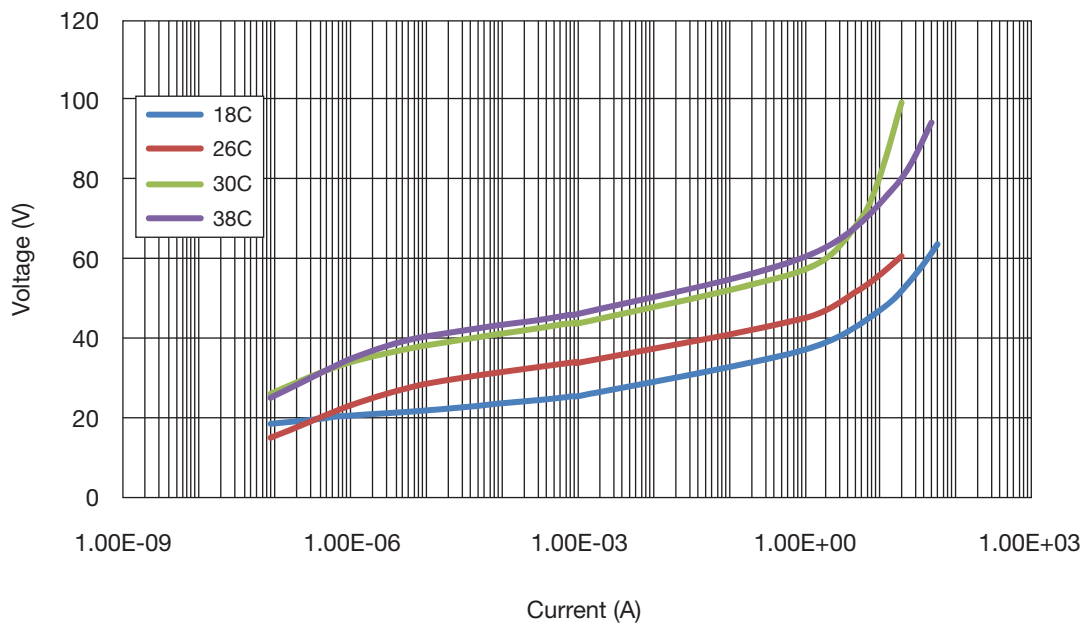


V-I CHARACTERISTICS

0603 Case Size

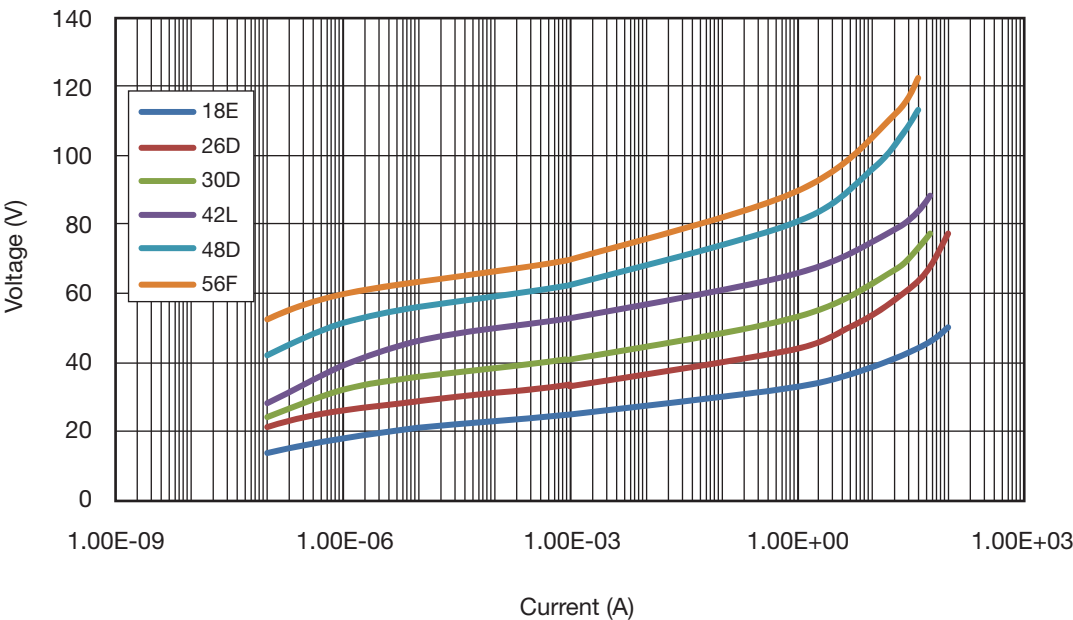


0805 Case Size

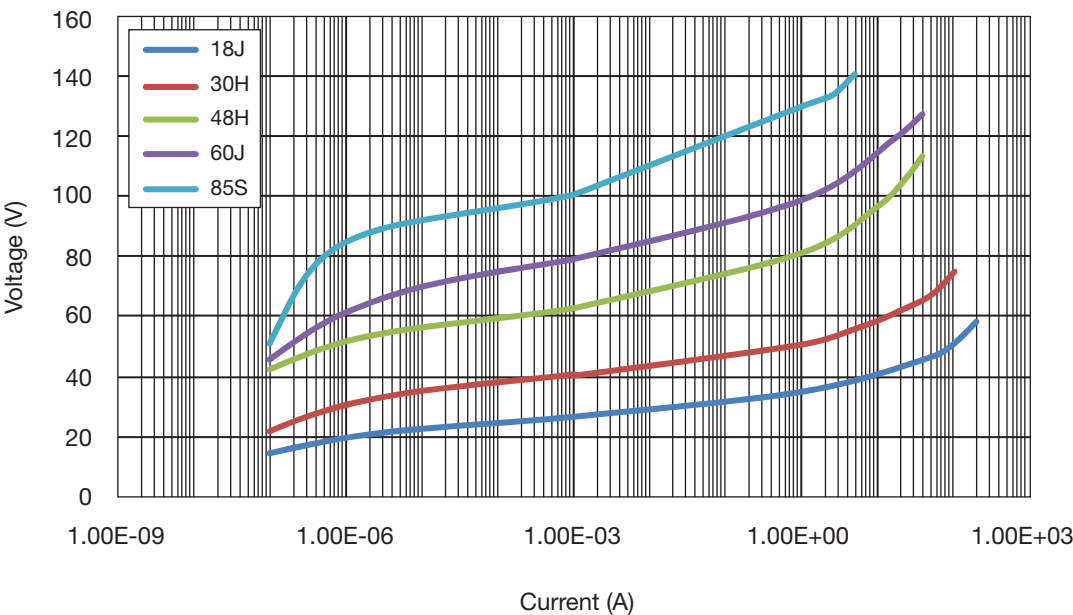


FORWARD TRANSMISSION CHARACTERISTICS (S21)

1206 Case Size



1210 Case Size



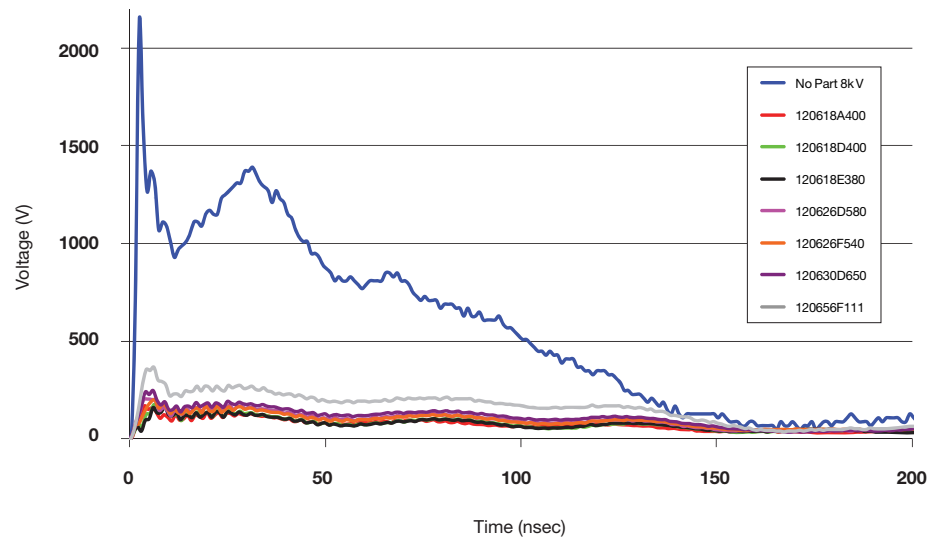
# TransGuard® Automotive Series

## Multilayer Varistors for Automotive Applications



### ESD V-I CHARACTERISTICS

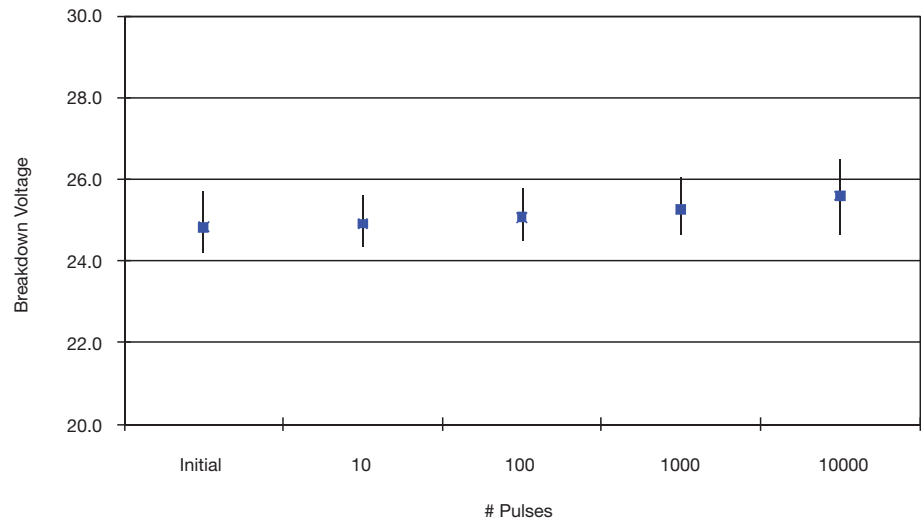
8 kV ESD Vc  
(150pF/300ohm IEC Network)



### 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                |
| 102626F540                  | 201              | 159              | 84                |
| 120630D650                  | 249              | 177              | 106               |
| 120656F111                  | 366              | 262              | 169               |

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



# Mouser Electronics

Authorized Distributor

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## KYOCERA AVX:

|                                    |                                  |                                  |                                  |                                  |
|------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| <a href="#">VCAS060318A400DP</a>   | <a href="#">VCAS080518C400DP</a> | <a href="#">VCAS120618D400DP</a> | <a href="#">VCAS121018J390DP</a> | <a href="#">VCAS040218X400WP</a> |
| <a href="#">VCAS060316B400DP</a>   | <a href="#">VCAS060316B400RP</a> | <a href="#">VCAS060318A400RP</a> | <a href="#">VCAS060326A580DP</a> | <a href="#">VCAS060326A580RP</a> |
| <a href="#">VCAS060330A650DP</a>   | <a href="#">VCAS060330A650RP</a> | <a href="#">VCAS080518A400DP</a> | <a href="#">VCAS080518A400RP</a> | <a href="#">VCAS080518C400RP</a> |
| <a href="#">VCAS080526A580DP</a>   | <a href="#">VCAS080526A580RP</a> | <a href="#">VCAS080526C580DP</a> | <a href="#">VCAS080526C580RP</a> | <a href="#">VCAS080530A650DP</a> |
| <a href="#">VCAS080530A650RP</a>   | <a href="#">VCAS080530C650DP</a> | <a href="#">VCAS080530C650RP</a> | <a href="#">VCAS080538C770DP</a> | <a href="#">VCAS080538C770RP</a> |
| <a href="#">VCAS120616K380DP</a>   | <a href="#">VCAS120616K380RP</a> | <a href="#">VCAS120618A400DP</a> | <a href="#">VCAS120618A400RP</a> | <a href="#">VCAS120618D400RP</a> |
| <a href="#">VCAS120618E380DP</a>   | <a href="#">VCAS120618E380RP</a> | <a href="#">VCAS120626D580DP</a> | <a href="#">VCAS120626D580RP</a> | <a href="#">VCAS120630D650DP</a> |
| <a href="#">VCAS120630D650RP</a>   | <a href="#">VCAS120642L800DP</a> | <a href="#">VCAS120642L800RP</a> | <a href="#">VCAS120648D101DP</a> | <a href="#">VCAS120648D101RP</a> |
| <a href="#">VCAS120656F111DP</a>   | <a href="#">VCAS120656F111RP</a> | <a href="#">VCAS121016J390DP</a> | <a href="#">VCAS121016J390RP</a> | <a href="#">VCAS121018J390RP</a> |
| <a href="#">VCAS121026H560DP</a>   | <a href="#">VCAS121026H560RP</a> | <a href="#">VCAS121030H620DP</a> | <a href="#">VCAS121030H620RP</a> | <a href="#">VCAS121048H101DP</a> |
| <a href="#">VCAS121048H101RP</a>   | <a href="#">VCAS121085S151DP</a> | <a href="#">VCAS121085S151RP</a> | <a href="#">VCAS06LC18X500TP</a> | <a href="#">VCAS121030S620DP</a> |
| <a href="#">VCAS040214X300WP</a>   | <a href="#">VCAS080514C300DP</a> | <a href="#">VCAS080514A300DP</a> | <a href="#">VCAS120645K900DP</a> | <a href="#">VCAS040205X150WP</a> |
| <a href="#">VCAS121060J121DP</a>   | <a href="#">VCAS040209X200WP</a> | <a href="#">VCAS120631M650DP</a> | <a href="#">VCAS060305A150DP</a> | <a href="#">VCAS120605D150DP</a> |
| <a href="#">VCAS080509A200DP</a>   | <a href="#">VCAS080505A150DP</a> | <a href="#">VCAS080512A250DP</a> | <a href="#">VCAS120605A150DP</a> | <a href="#">VCAS120642K900DP</a> |
| <a href="#">VCAS120660M131DP</a>   | <a href="#">VCAS060309A200DP</a> | <a href="#">VCAS080531C650DP</a> | <a href="#">VCAS120614A300DP</a> | <a href="#">VCAS060314A300DP</a> |
| <a href="#">VCAS120614D300DP</a>   | <a href="#">VCAS080505C150DP</a> | <a href="#">VCAS120626F540DP</a> | <a href="#">VCAS120634N770DP</a> | <a href="#">VCAS060326A580TP</a> |
| <a href="#">VCAS06AG183R0YAT3A</a> | <a href="#">VCAS120618D400TP</a> | <a href="#">VCAS080518A400TP</a> | <a href="#">VCAS060318A400TP</a> | <a href="#">VCAS080518C400TP</a> |
| <a href="#">VCAS060305A150RP</a>   | <a href="#">VCAS120645K900RP</a> | <a href="#">VCAS080514C300RX</a> | <a href="#">VCAS120605D150RP</a> | <a href="#">VCAS080514A300RP</a> |
| <a href="#">VCAS080509A200TP</a>   | <a href="#">VCAS121060J121RP</a> | <a href="#">VCAS080531C650RP</a> | <a href="#">VCAS120630D650TP</a> | <a href="#">VCAS120626F540TP</a> |
| <a href="#">VCAS080514C300RP</a>   | <a href="#">VCAS120660M131RP</a> | <a href="#">VCAS120631M650RP</a> | <a href="#">VCAS080509A200RP</a> | <a href="#">VCAS060314A300RP</a> |