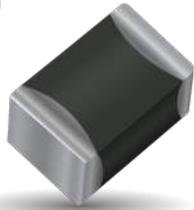


# High Temp. Automotive VT Series

## +150°C and 175°C Rated Varistors



### GENERAL DESCRIPTION

High Temperature 150/175°C Multi-Layer Varistors are designed for underhood and other high temperature automotive or industrial applications. Parts are AEC-Q200 qualified.

They offer bi-directional overvoltage protection as well as EMI/RFI attenuation in a single SMT package. This allows designers the ability to combine the circuit protection and EMI/ RFI attenuation function into a single highly reliable device.

Products have been tested, qualified, and specified to 150/175°C and they do not require any derating over specified operating temperature range.

The 48V System varistors, included in the VT Series, are designed and tested for use in motor vehicles with a 48-volt power supply. This series of parts is test against VDA-320.

### GENERAL DESCRIPTION

- Operating Temp.:
- VTA3: -55 to +150°C  
VTA7: -55 to +175°C
- Working Voltage: 14 - 56Vdc
- Case Size: 0603 - 2220

### FEATURES

- +150/175°C rated, with no derating
- High Reliability
- AEC-Q200 Qualified
- Bi-Directional protection
- EMI/RFI attenuation
- ESD rated to 25kV (HBM ESD Level 6)
- High Flexure Stress

### APPLICATIONS

- Under hood
- Down Hole Drilling
- High temperature Automotive and Industrial Applications
- Electric Vehicles
- EV Charging
- Load Dump
- ESD Protection

### HOW TO ORDER

**VT**  
Varistor Temp Rated

**A7**  
Automotive  
175°C  
A3 = 150°C  
A7 = 175°C

**0603**  
Case Size  
0603  
0805  
1206  
1210  
1812  
2220

**18**  
Working Voltage  
12 = 12Vdc  
14 = 14Vdc  
18 = 18Vdc  
26 = 26Vdc  
31 = 31Vdc  
38 = 38Vdc  
48 = 48Vdc  
56 = 56Vdc

**A**  
Energy Rating  
A = 0.1J  
B = 0.2J  
C = 0.3J  
E = 0.5J  
J = 1.6J  
K = 0.6J  
M = 1.0J  
U = 4.8J  
Y = 9.0J

**400**  
Clamping Voltage  
300 = 32V  
350 = 35V  
400 = 42V  
650 = 65V  
670 = 67V  
101 = 100V  
111 = 110V

**R**  
Package  
D = 7" (1,000)  
R = 7" (4,000)  
T = 13" (10,000)

**P**  
Termination  
P = Ni/Sn plated  
Z = FLEXITERM®

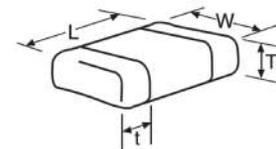


MSL 1  
Pb Free 260°C

### DIMENSIONS

mm(inches)

| Size (EIA) | Length (L)                  | Width (W)                   | Max Thickness (T) | Land Length (t)            |
|------------|-----------------------------|-----------------------------|-------------------|----------------------------|
| 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)   | 1.14 max.<br>(0.045 max.)  |
| 1812       | 4.50±0.030<br>(1.77±0.012)  | 3.20±0.030<br>(0.126±0.012) | 2.00<br>(0.080)   | 1.00 max.<br>(0.039 max.)  |
| 2220       | 5.70±0.040<br>(0.224±0.016) | 5.00±0.040<br>(0.197±0.016) | 2.50<br>(0.098)   | 1.00 max.<br>(0.039 max.)  |



# High Temp. Automotive VT Series

+150°C and 175°C Rated Varistors

## ELECTRICAL CHARACTERISTICS VTA3 (150°C)

| 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                      |
| VTA3040205X150  | 5.6                 | 4                   | 8.5±20%        | 18             | 1               | 10             | 0.05           | -               | 20             | 200   | K    | -                 | 0.001                  |
| VTA3080505C150  | 5.6                 | 4                   | 8.5±20%        | 18             | 1               | 10             | 0.5            | -               | 200            | 3000  | K    | -                 | 0.01                   |
| VTA3080512D250  | 12                  | 8.5                 | 16±15%         | 27             | 1               | 10             | 0.4            | -               | 200            | 900   | K    | -                 | 0.008                  |
| VTA3080514C300  | 14                  | 10                  | 18.5±12%       | 32             | 1               | 10             | 0.3            | 0.7             | 120            | 900   | K    | 20                | 0.006                  |
| VTA3120614E300  | 14                  | 10                  | 18.5±12%       | 32             | 1               | 10             | 0.5            | 1.3             | 200            | 1400  | K    | 20                | 0.01                   |
| VTA3121014J300  | 14                  | 10                  | 18.5±12%       | 32             | 1               | 10             | 1.6            | 3               | 500            | 5000  | K    | 20                | 0.03                   |
| VTA3222014Y350  | 14                  | 10                  | 20.5±10%       | 35             | 5               | 15             | 7.5            | 35              | 2000           | 55000 | K    | 20                | 0.15                   |
| VTA30402018X400 | 18                  | 13                  | 25.5±10%       | 42             | 1               | 10             | 0.05           | -               | 20             | 60    | K    | 27.5              | 0.001                  |
| VTA3120618K390  | 18                  | 13                  | 24.5±10%       | 40             | 1               | 10             | 0.6            | 1.5             | 200            | 1500  | K    | 27.5              | 0.012                  |
| VTA3121018J390  | 18                  | 13                  | 25.5±10%       | 42             | 5               | 10             | 1.6            | 3               | 500            | 2200  | K    | 27.5              | 0.03                   |
| VTA3060322C400  | 22                  | 17                  | 27±10%         | 44             | 1               | 10             | 0.3            | -               | 30             | 500   | K    | 27.5              | 0.011                  |
| VTA3120626F540  | 26                  | 18                  | 33±10%         | 54             | 1               | 10             | 0.7            | 1.5             | 200            | 600   | K    | 27.5              | 0.014                  |
| VTA3121026H560  | 26                  | 18                  | 34.5±10%       | 60             | 5               | 10             | 1.2            | 3               | 2150           | 300   | K    | 27.5              | 0.02                   |
| VTA3120631M650  | 31                  | 25                  | 39±10%         | 65             | 1               | 10             | 1              | 2               | 200            | 1100  | K    | 29                | 0.02                   |
| VTA3121031R650  | 31                  | 25                  | 39±10%         | 65             | 2.5             | 10             | 1.7            | 4.5             | 300            | 1500  | K    | 29                | 0.03                   |
| VTA3080538E770  | 38                  | 30                  | 47±10%         | 77             | 1               | 10             | 0.5            | 1               | 120            | 275   | K    | 48                | 0.01                   |
| VTA3120642R800  | 42                  | 32                  | 51±10%         | 80             | 1               | 10             | 1.7            | 2               | 250            | 750   | K    | 48                | 0.003                  |
| VTA3080556B111  | 56                  | 40                  | 68 ± 10%       | 110            | 1               | 10             | 0.2            | 0.25            | 30             | 80    | K    | 48                | 0.004                  |
| VTA3120656K101  | 56                  | 40                  | 68 ± 10%       | 100            | 1               | 10             | 0.6            | 0.8             | 200            | 200   | K    | 48                | 0.014                  |
| VTA3120656M101  | 56                  | 40                  | 68 ± 10%       | 100            | 1               | 10             | 1.0            | 5               | 200            | 500   | K    | 48                | 0.018                  |
| VTA3121056S111  | 56                  | 40                  | 68 ± 10%       | 110            | 2.5             | 10             | 2.0            | 2.5             | 250            | 600   | K    | 48                | 0.030                  |
| VTA3181256U111  | 56                  | 40                  | 68 ± 10%       | 110            | 5               | 10             | 4.8            | 5               | 1500           | 1500  | K    | 48                | 0.080                  |
| VTA3222056Y111  | 56                  | 40                  | 68 ± 10%       | 110            | 10              | 10             | 9.0            | 14              | 1000           | 2800  | K    | 48                | 0.150                  |

## ELECTRICAL CHARACTERISTICS VTA7 (175°C)

| 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                      |
| VTA7060314A300 | 14                  | 10                  | 18.5±12%       | 32             | 1               | 10             | 0.1            | -               | 50             | 400 | K    | 20                | 0.003                  |
| VTA7060314E350 | 14                  | 10                  | 20.5±10%       | 35             | 1               | 10             | 0.5            | -               | 120            | 900 | K    | 20                | 0.01                   |
| VTA7060318A400 | 18                  | 13                  | 23±10%         | 42             | 1               | 10             | 0.1            | 0.25            | 30             | 275 | K    | 27.5              | 0.003                  |
| VTA7080518C400 | 18                  | 13                  | 25.5±10%       | 42             | 1               | 10             | 0.3            | 1               | 120            | 450 | K    | 27.5              | 0.006                  |
| VTA7080526D580 | 26                  | 18                  | 34.5±10%       | 60             | 1               | 10             | 0.1            | 0.25            | 30             | 155 | K    | 27.5              | 0.002                  |
| VTA7080526D580 | 26                  | 18                  | 34.5±10%       | 60             | 1               | 10             | 0.4            | 0.6             | 100            | 275 | K    | 29                | 0.008                  |
| VTA7120630M650 | 30                  | 21                  | 41±10%         | 67             | 1               | 10             | 1              | 1               | 200            | 800 | K    | 29                | 0.02                   |
| VTA7060331A670 | 31                  | 25                  | 39±10%         | 67             | 1               | 10             | 0.1            | 0.25            | 30             | 90  | M    | 29                | 0.003                  |
| VTA7080531C650 | 31                  | 25                  | 39±10%         | 65             | 1               | 10             | 0.3            | 1               | 80             | 275 | K    | 29                | 0.006                  |
| VTA7120648M101 | 48                  | 34                  | 62±10%         | 100            | 1               | 10             | 1.0            | 1.5             | 200            | 300 | K    | 48                | 0.02                   |

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>L</sub>]

I<sub>VC</sub> Test Current for V<sub>C</sub>

I<sub>L</sub> Maximum leakage current at the working voltage, 25°C [μA]

E<sub>T</sub> Transient Energy Rating [J, 10x1000μs]

E<sub>LD</sub> Load Dump Energy (x10)

I<sub>P</sub> Peak Current Rating [A, 8x20μs]

Cap Typical capacitance [pF] @ frequency specified and 0.5V<sub>RMS</sub>, 25°C

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

P<sub>Diss. Max</sub> Power Dissipation (W)

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

VTA30603, VTA30805, VTA31206, VTA31210

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

VTA70603, VTA70805, VTA71206 series with Flexterm used only up to 150°C



**FLEXITERM**®

# High Temp. Automotive VT Series

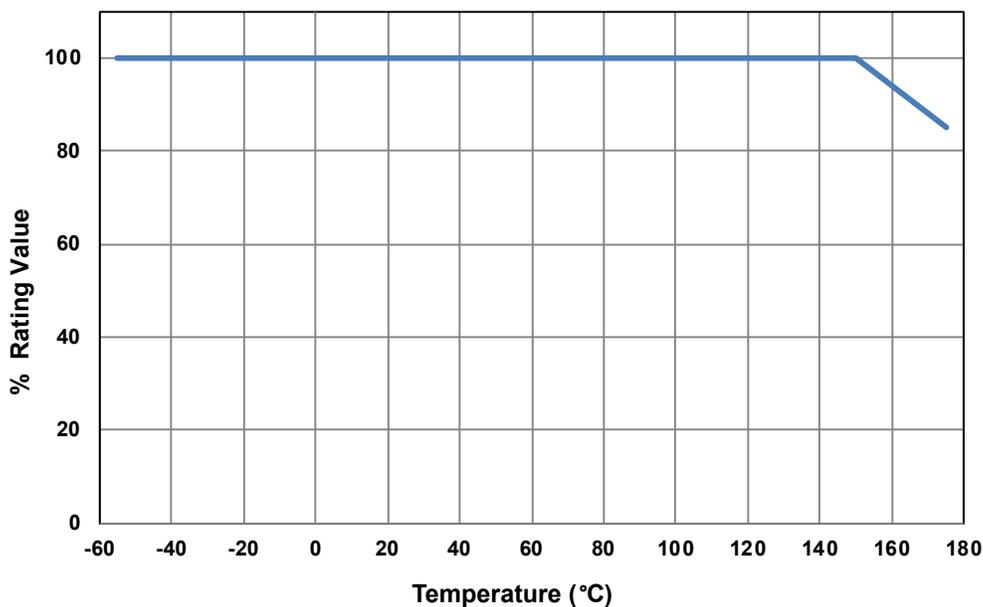
+150°C and 175°C Rated Varistors



## ESD RATING

| Part Number         | IEC 61000-4-2                       | ISO 10605                           |                                      | AEC-Q200 (Lvl.6)                 |
|---------------------|-------------------------------------|-------------------------------------|--------------------------------------|----------------------------------|
|                     | 150 pF / 330 Ω<br>Contact Discharge | 330 pF / 330 Ω<br>Contact Discharge | 330 pF / 2000 Ω<br>Contact Discharge | 150 pF / 2000 Ω<br>Air Discharge |
| <b>VTA3 (150°C)</b> |                                     |                                     |                                      |                                  |
| VTA3080514C300      | 30kV                                | 30kV                                | 30kV                                 | 25kV                             |
| VTA3120614E300      | 30kV                                | 30kV                                | 30kV                                 | 25kV                             |
| VTA3121014J300      | 30kV                                | 30kV                                | 30kV                                 | 25kV                             |
| VTA3121031R650      | 30kV                                | 30kV                                | 30kV                                 | 25kV                             |
| <b>VTA7 (175°C)</b> |                                     |                                     |                                      |                                  |
| VTA7060318A400      | 25 kV                               | 30 kV                               | 30 kV                                | 25 kV                            |
| VTA7080518C400      | 30 kV                               | 30 kV                               | 30 kV                                | 25 kV                            |
| VTA7060331A670      | 30 kV                               | 30 kV                               | 30 kV                                | 25 kV                            |
| VTA7080531C650      | 30 kV                               | 30 kV                               | 30 kV                                | 25 kV                            |

## VTA3 (+150°C): POWER DERATING CURVE (CURRENT, ENERGY, POWER)

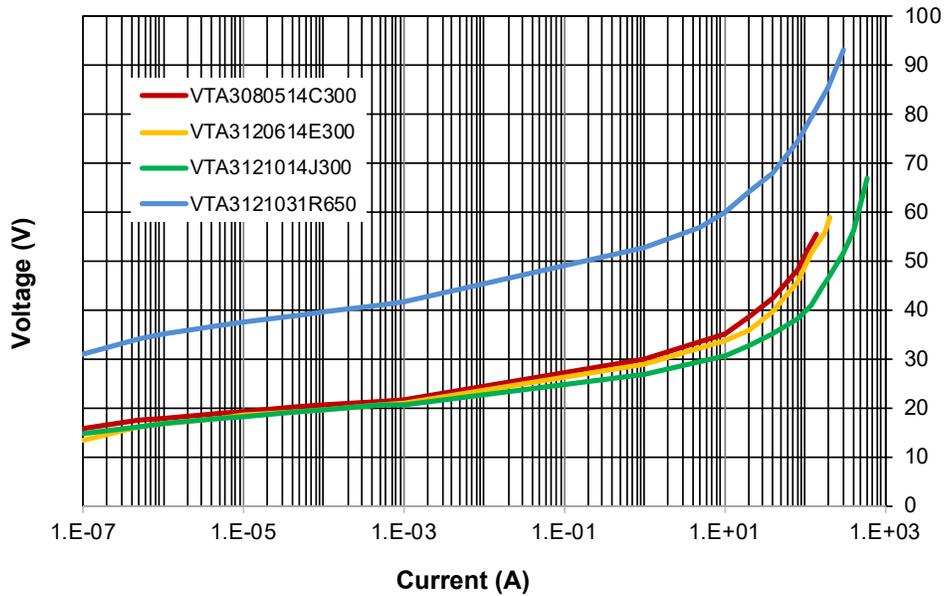


# High Temp. Automotive VT Series

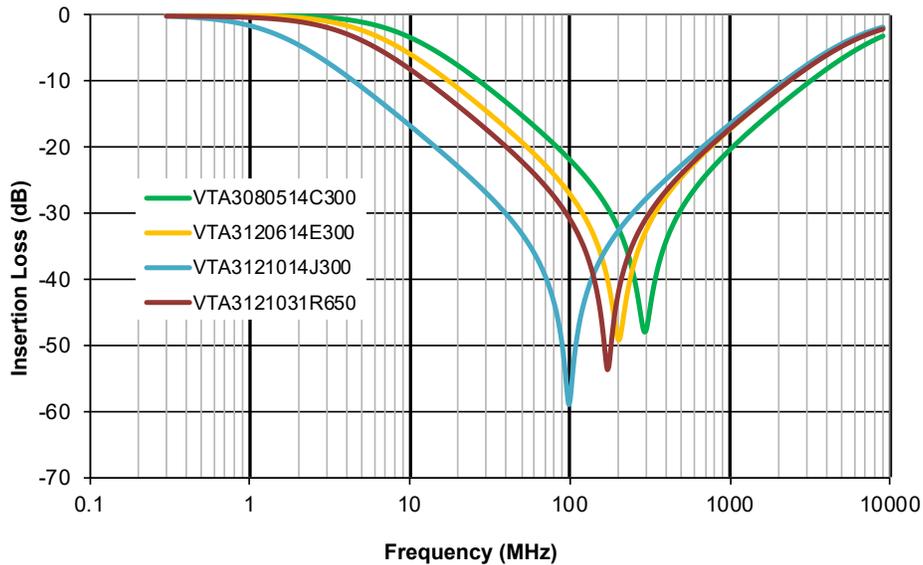
+150°C and 175°C Rated Varistors



## VTA3 (+150°C): V-I CHARACTERISTICS



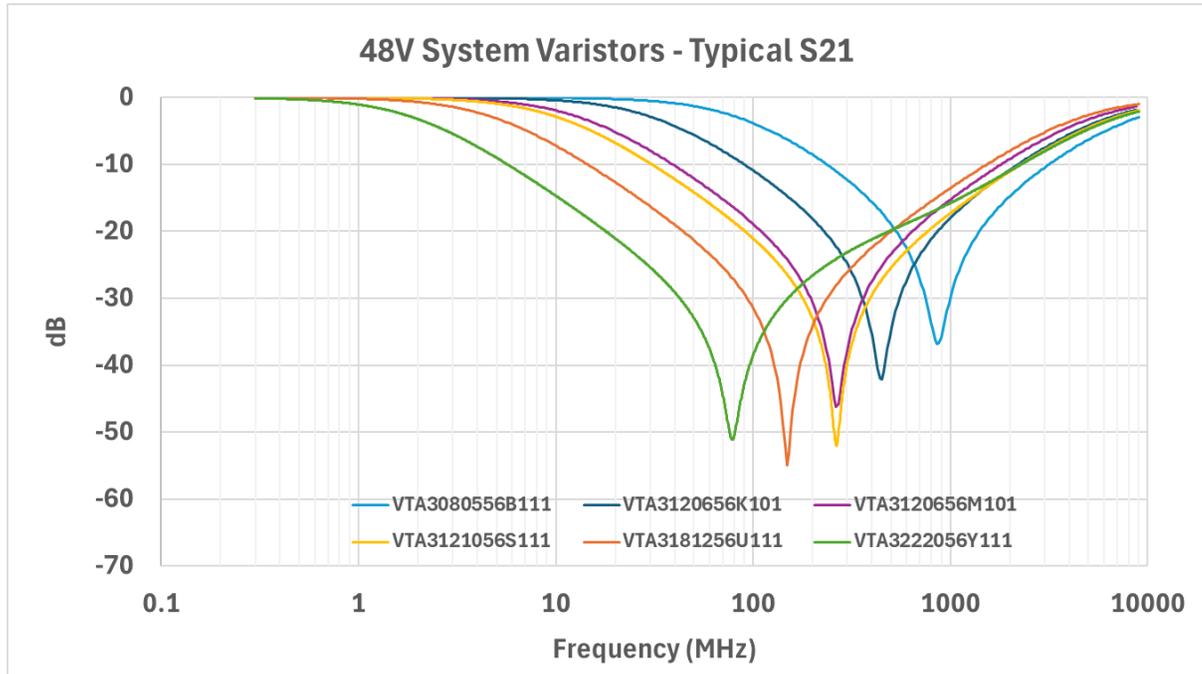
## VTA3 (+150°C): FORWARD TRANSMISSION CHARACTERISTICS (S21)



# High Temp. Automotive VT Series

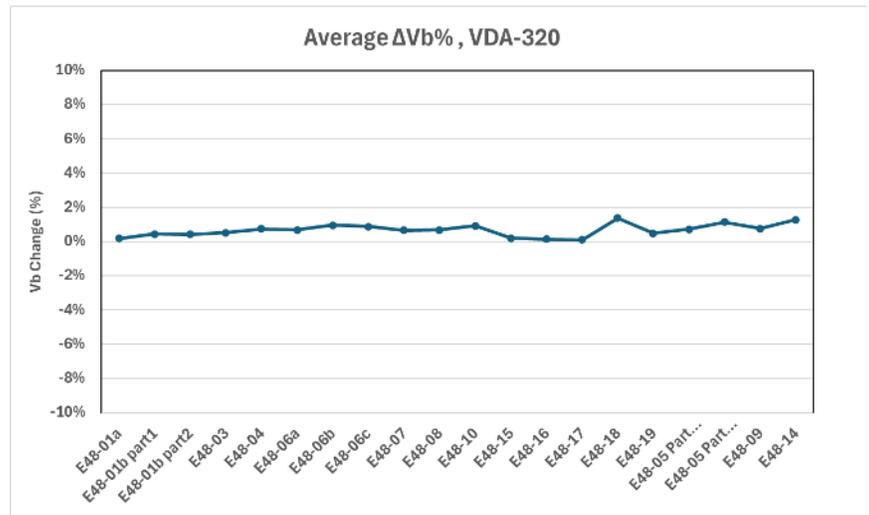
+150°C and 175°C Rated Varistors

## 48V SYSTEM VARISTORS S21 (VTA3 +150°C)



## 48V SYSTEM VARISTORS VDA-320 TESTING (VTA3 +150°C)

| Test Pulse | Name  |
|------------|---|
| E48-01a    | Long-term Overvoltage                                     |
| E48-01b    | Overvoltage with Components that Return Electrical Energy |
| E48-02     | Transient Overvoltage                                     |
| E48-03     | Transient Event in Lower Limited Operation Range          |
| E48-04     | Recuperation  |
| E48-05a    | Superimposed Alternating Voltage, part 1                  |
| E48-05b    | Superimposed Alternating Voltage, part 2                  |
| E48-06a    | Slow Decrease and Increase of the Supply Voltage          |
| E48-06b    | Operation with Storage, part 1                            |
| E48-06c    | Operation with Storage, part 2                            |
| E48-07     | Slow Decrease and Abrupt Increase of the Supply Voltage   |
| E48-08     | Reset Behaviour   |
| E48-09     | Brief Interruptions                                       |
| E48-10     | Starting Pulses   |
| E48-14     | Standby Current   |
| E48-15     | Operation in Unlimited Operation Range                    |
| E48-16     | Operation in Upper Limited Operation Range                |
| E48-17     | Operation in Lower Limited Operation Range                |
| E48-18     | Overvoltage Range   |
| E48-19     | Undervoltage Range  |

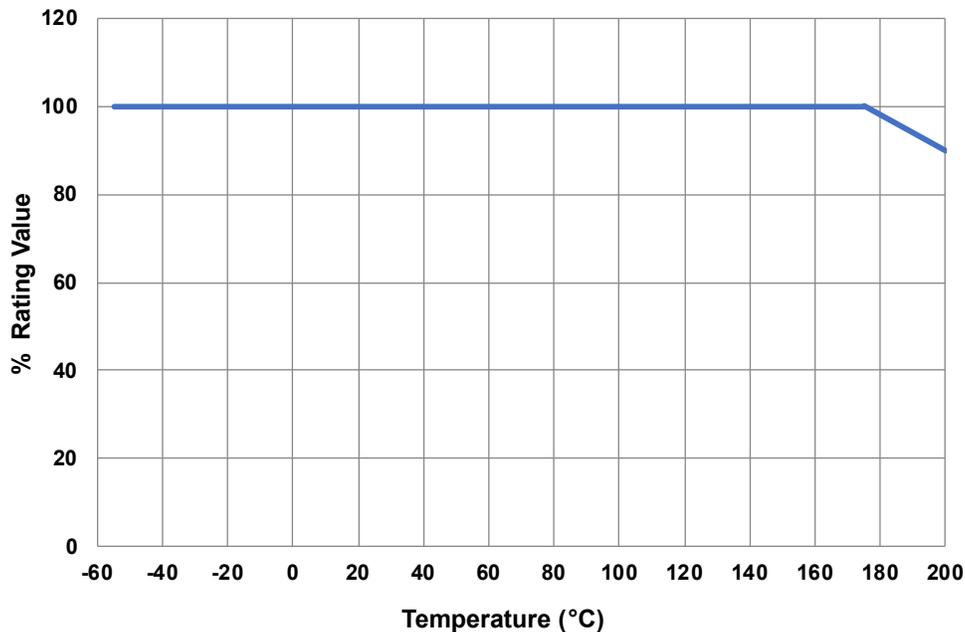


# High Temp. Automotive VT Series

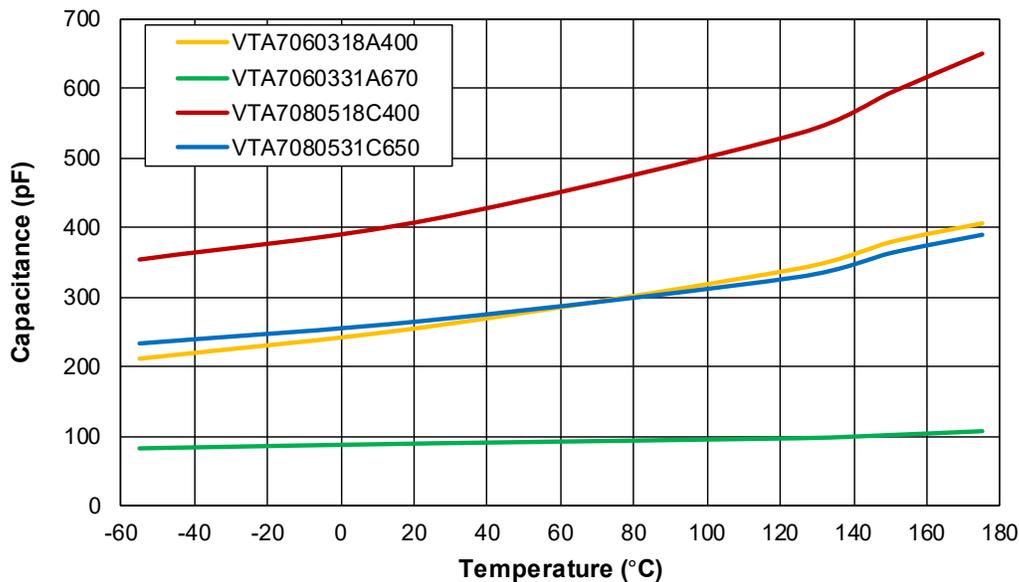
## +150°C and 175°C Rated Varistors



### VTA7 (+175°C): POWER DERATING CURVE (CURRENT, ENERGY, POWER)



### VTA7 (+175°C): CAPACITANCE VS TEMPERATURE



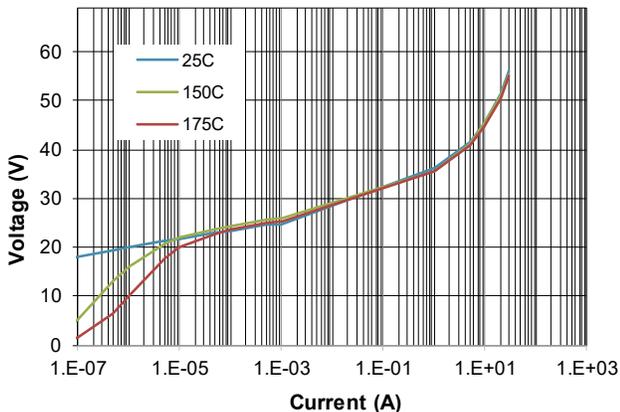
# High Temp. Automotive VT Series

## +150°C and 175°C Rated Varistors

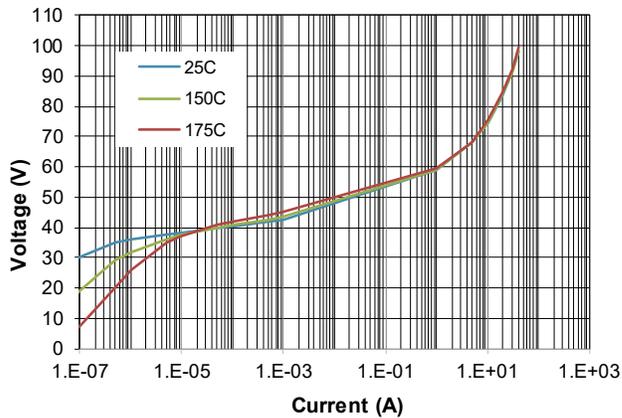


### VTA7 (+175°C): V-I CHARACTERISTICS

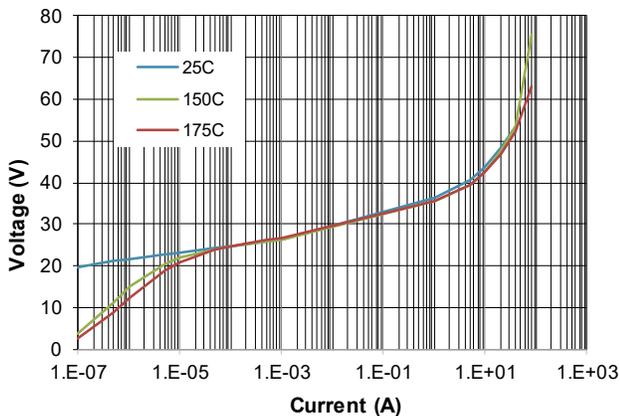
VTA7060318A400



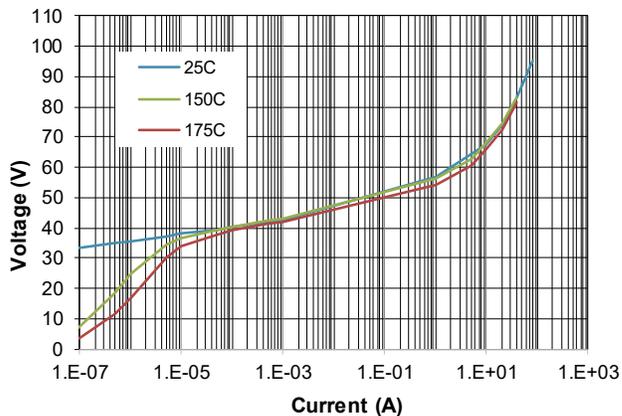
VTA7060331A650



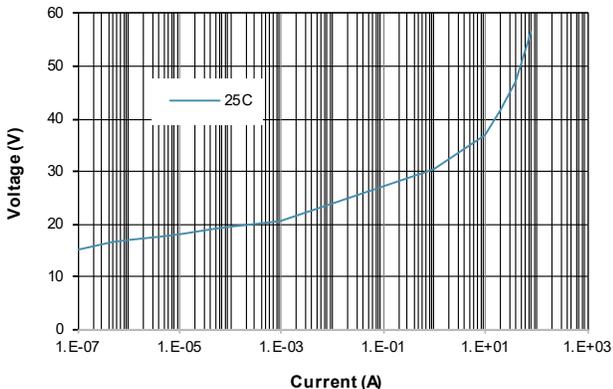
VTA7080518C400



VTA7080531C650



VTA7060314A300



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## VTA7 (+175°C): FORWARD TRANSMISSION CHARACTERISTICS (S21)

