

# Zinc Oxide Varistors

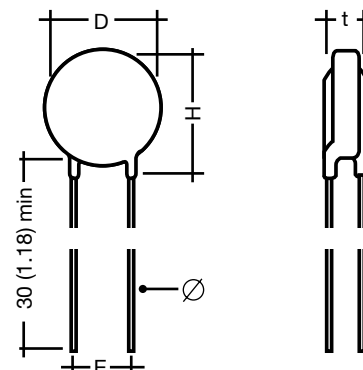


VE 07/09/13/17/24

VF 05/07/10/14/20

## FEATURES

- Radial lead varistors
- Wide operating voltage range from 14 V to 625 V ( $V_{rms}$  for VE types) or 22 V to 1000 V ( $V_{1mA}$  for VF types)
- Available in tape and reel for use with automatic insertion equipment (see pages 31 to 33 for details).



## PARTICULAR CHARACTERISTICS

| UL<br>(USA and<br>Canadian<br>Standards) | VE Series<br>P/N codification using<br><br>( $D_{max}$ , $V_{rms}$ ) | VF Series<br>P/N codification using<br><br>( $d_{ceramic}$ , $V_{1mA}$ ) | Maximum<br>operating voltage |          | Nominal voltage<br>at 1 mA dc |                    |                 |
|------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------|------------------------------|----------|-------------------------------|--------------------|-----------------|
|                                          |                                                                      |                                                                          | $V_{rms}$                    | $V_{dc}$ | $V_{1mA\ mini}$               | $V_{1mA\ nominal}$ | $V_{1mA\ maxi}$ |
| ★                                        | VE07M00140K _ _                                                      | VF05M10220K _ _                                                          | 14                           | 18       | 19.8                          | 22                 | 24.2            |
| ★                                        | VE09M00140K _ _                                                      | VF07M10220K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE13M00140K _ _                                                      | VF10M10220K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE17M00140K _ _                                                      | VF14M10220K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE07M00170K _ _                                                      | VF05M10270K _ _                                                          | 17                           | 22       | 24.0                          | 27                 | 30.0            |
| ★                                        | VE09M00170K _ _                                                      | VF07M10270K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE13M00170K _ _                                                      | VF10M10270K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE17M00170K _ _                                                      | VF14M10270K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE07M00200K _ _                                                      | VF05M10330K _ _                                                          | 20                           | 26       | 29.5                          | 33                 | 36.5            |
| ★                                        | VE09M00200K _ _                                                      | VF07M10330K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE13M00200K _ _                                                      | VF10M10330K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE17M00200K _ _                                                      | VF14M10330K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE07M00250K _ _                                                      | VF05M10390K _ _                                                          | 25                           | 31       | 35                            | 39                 | 43              |
| ★                                        | VE09M00250K _ _                                                      | VF07M10390K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE13M00250K _ _                                                      | VF10M10390K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE17M00250K _ _                                                      | VF14M10390K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE07M00300K _ _                                                      | VF05M10470K _ _                                                          | 30                           | 38       | 42                            | 47                 | 52              |
| ★                                        | VE09M00300K _ _                                                      | VF07M10470K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE13M00300K _ _                                                      | VF10M10470K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE17M00300K _ _                                                      | VF14M10470K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE07M00350K _ _                                                      | VF05M10560K _ _                                                          | 35                           | 45       | 50                            | 56                 | 62              |
| ★                                        | VE09M00350K _ _                                                      | VF07M10560K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE13M00350K _ _                                                      | VF10M10560K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE17M00350K _ _                                                      | VF14M10560K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE07M00400K _ _                                                      | VF05M10680K _ _                                                          | 40                           | 56       | 61                            | 68                 | 75              |
| ★                                        | VE09M00400K _ _                                                      | VF07M10680K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE13M00400K _ _                                                      | VF10M10680K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE17M00400K _ _                                                      | VF14M10680K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE07M00500K _ _                                                      | VF05M10820K _ _                                                          | 50                           | 65       | 73                            | 82                 | 91              |
| ★                                        | VE09M00500K _ _                                                      | VF07M10820K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE13M00500K _ _                                                      | VF10M10820K _ _                                                          |                              |          |                               |                    |                 |
| ★                                        | VE17M00500K _ _                                                      | VF14M10820K _ _                                                          |                              |          |                               |                    |                 |

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VE 07/09/13/17/24

VF 05/07/10/14/20

## DIMENSIONS millimeters (inches)

| Type   | Type   | D                |                         | H max.    | t max.    | $\phi$<br>+10%<br>-0.05 (.002) | E<br>$\pm 0.8$ (.031) |
|--------|--------|------------------|-------------------------|-----------|-----------|--------------------------------|-----------------------|
|        |        | Ceramic diameter | Maximum coated diameter |           |           |                                |                       |
| VE07   | VF05   | 5 (.196)         | 7 (.275)                | 10 (.394) | see table | 0.6 (.024)                     | 5.08 (0.20)           |
| VE09   | VF07   | 7 (.275)         | 9 (.354)                | 12 (.472) |           | 0.6 (.024)                     | 5.08 (0.20)           |
| VE13*  | VF10*  | 10 (.393)        | 13* (.512)              | 16 (.630) |           | 0.8* (.031)                    | 7.62* (0.30)          |
| VE17   | VF14   | 14 (.551)        | 17 (.669)               | 20 (.787) |           | 0.8 (.031)                     | 7.62 (0.30)           |
| VE24** | VF20** | 20 (.787)        | 24 (.945)               | 27 (1.06) |           | 0.8** (.031)                   | 7.62 (0.30)           |

\* VE13 / VF10: For models with  $V_{RMS}$  320 V  
other version/suffixes available with:  
E = 5.08 (0.20) Suffix:  
 $\phi$  = 0.6 (.024) Bulk: HB  
D = 12.5 (.492) max Tape: DA, DB, DC,  
DD, DQ, ...

\*\*VE24 / VF20: For lead diameter = 1.0 (.039),  
please consult us.

## GENERAL CHARACTERISTICS

Storage temperature: -40°C to +125°C  
Max. operating temperature: +85°C  
Response time: < 25 ns  
Voltage coefficient temp.:  $|K| < 0.09\%/^{\circ}\text{C}$   
Voltage proof: 2500 V  
Epoxy coating: Flame retardant  
UL94-VO

## MARKING

Type  
AC nominal voltage (EIA coding) for VE types  
 $V_{1mA}$  varistor voltage (EIA coding) for VF types  
Logo  
UL logo (when approved)  
Lot number (VE13/17/24 and VF10/14/20 only)

| Max. clamping voltage (8 x 20 $\mu\text{s}$ ) |        | Max. energy absorption (10 x 1000 $\mu\text{s}$ )<br>W (J) |     | Max. permissible peak current (8 x 20 $\mu\text{s}$ )<br>Ip (A) |          | Typical capacitance<br>$f = 1\text{kHz}$ | Mean power dissipation | Maximum thickness<br>t | V/I characteristic | Derating curves |
|-----------------------------------------------|--------|------------------------------------------------------------|-----|-----------------------------------------------------------------|----------|------------------------------------------|------------------------|------------------------|--------------------|-----------------|
| Vp (V)                                        | Ip (A) | Number of surges<br>1                                      | 10  | 1 surge                                                         | 2 surges | pF                                       | W                      | mm (inches)            | Page               | Page            |
| 43                                            | 1      | 0.4                                                        | 0.2 | 100                                                             | 50       | 1050                                     | 0.01                   | 3.6 (.142)             | 22                 | 24              |
| 43                                            | 2.5    | 0.9                                                        | 0.6 | 250                                                             | 125      | 1900                                     | 0.02                   | 3.6 (.142)             | 22                 | 25              |
| 43                                            | 5      | 2                                                          | 1.3 | 500                                                             | 250      | 4000                                     | 0.05                   | 4.3 (.169)             | 22                 | 26              |
| 43                                            | 10     | 4                                                          | 2.6 | 1000                                                            | 500      | 4000                                     | 0.10                   | 4.3 (.169)             | 23                 | 27              |
| 53                                            | 1      | 0.5                                                        | 0.3 | 100                                                             | 50       | 1050                                     | 0.01                   | 3.7 (.146)             | 22                 | 24              |
| 53                                            | 2.5    | 1.1                                                        | 0.7 | 250                                                             | 125      | 1900                                     | 0.02                   | 3.7 (.146)             | 22                 | 25              |
| 53                                            | 5      | 2.5                                                        | 1.6 | 500                                                             | 250      | 4000                                     | 0.05                   | 4.3 (.169)             | 22                 | 26              |
| 53                                            | 10     | 4.7                                                        | 3.0 | 1000                                                            | 500      | 6800                                     | 0.10                   | 4.3 (.169)             | 23                 | 27              |
| 65                                            | 1      | 0.6                                                        | 0.3 | 100                                                             | 50       | 750                                      | 0.01                   | 3.9 (.154)             | 22                 | 24              |
| 65                                            | 2.5    | 1.3                                                        | 0.9 | 250                                                             | 125      | 1500                                     | 0.02                   | 3.9 (.154)             | 22                 | 25              |
| 65                                            | 5      | 3.1                                                        | 2.0 | 500                                                             | 250      | 3100                                     | 0.05                   | 4.5 (.177)             | 22                 | 26              |
| 65                                            | 10     | 5.7                                                        | 4.0 | 1000                                                            | 500      | 5700                                     | 0.10                   | 4.5 (.177)             | 23                 | 27              |
| 77                                            | 1      | 0.7                                                        | 0.4 | 100                                                             | 50       | 660                                      | 0.01                   | 3.6 (.142)             | 22                 | 24              |
| 77                                            | 2.5    | 1.6                                                        | 1.0 | 250                                                             | 125      | 1250                                     | 0.02                   | 3.6 (.142)             | 22                 | 25              |
| 77                                            | 5      | 3.7                                                        | 3   | 500                                                             | 250      | 2800                                     | 0.05                   | 4.4 (.173)             | 22                 | 26              |
| 77                                            | 10     | 7                                                          | 5   | 1000                                                            | 500      | 4600                                     | 0.10                   | 4.4 (.173)             | 23                 | 27              |
| 93                                            | 1      | 0.9                                                        | 0.4 | 100                                                             | 50       | 580                                      | 0.01                   | 3.8 (.150)             | 22                 | 24              |
| 93                                            | 2.5    | 2.0                                                        | 1   | 250                                                             | 125      | 1050                                     | 0.02                   | 3.8 (.150)             | 22                 | 25              |
| 93                                            | 5      | 4.4                                                        | 4   | 500                                                             | 250      | 2150                                     | 0.05                   | 4.4 (.173)             | 22                 | 26              |
| 93                                            | 10     | 9.0                                                        | 7   | 1000                                                            | 500      | 3500                                     | 0.10                   | 4.4 (.173)             | 23                 | 27              |
| 110                                           | 1      | 1.1                                                        | 0.4 | 100                                                             | 50       | 460                                      | 0.01                   | 3.9 (.154)             | 22                 | 24              |
| 110                                           | 2.5    | 2.5                                                        | 1   | 250                                                             | 125      | 850                                      | 0.02                   | 3.9 (.154)             | 22                 | 25              |
| 110                                           | 5      | 5.4                                                        | 4.4 | 500                                                             | 250      | 1900                                     | 0.05                   | 4.7 (.185)             | 22                 | 26              |
| 110                                           | 10     | 10.0                                                       | 8   | 1000                                                            | 500      | 3100                                     | 0.10                   | 4.7 (.185)             | 23                 | 27              |
| 135                                           | 1      | 1.3                                                        | 0.5 | 100                                                             | 50       | 400                                      | 0.01                   | 4.1 (.161)             | 22                 | 24              |
| 135                                           | 2.5    | 3.0                                                        | 1   | 250                                                             | 125      | 720                                      | 0.02                   | 4.1 (.161)             | 22                 | 25              |
| 135                                           | 5      | 8.4                                                        | 5.9 | 500                                                             | 250      | 1700                                     | 0.05                   | 4.9 (.193)             | 22                 | 26              |
| 135                                           | 10     | 13.0                                                       | 8.5 | 1000                                                            | 500      | 2800                                     | 0.10                   | 4.9 (.193)             | 23                 | 27              |
| 135                                           | 5      | 1.8                                                        | 0.6 | 400                                                             | 200      | 300                                      | 0.1                    | 3.5 (.138)             | 22                 | 24              |
| 135                                           | 10     | 4.2                                                        | 1.6 | 1200                                                            | 600      | 530                                      | 0.2                    | 3.5 (.138)             | 22                 | 25              |
| 135                                           | 25     | 8.4                                                        | 6   | 2500                                                            | 1250     | 950                                      | 0.4                    | 4.1 (.161)             | 22                 | 26              |
| 135                                           | 50     | 15.0                                                       | 11  | 4500                                                            | 2500     | 1800                                     | 0.6                    | 4.1 (.161)             | 23                 | 27              |



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VE 07/09/13/17/24

VF 05/07/10/14/20

| UL<br>(USA and<br>Canadian<br>Standards) | VE Series<br>P/N codification using<br><br>(D <sub>max</sub> , V <sub>rms</sub> )      | VF Series<br>P/N codification using<br><br>(d <sub>ceramic</sub> , V <sub>1mA</sub> )  | Maximum<br>operating voltage |                 | Nominal voltage<br>at 1 mA dc |                          |                       |
|------------------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|------------------------------|-----------------|-------------------------------|--------------------------|-----------------------|
|                                          |                                                                                        |                                                                                        | V <sub>rms</sub>             | V <sub>DC</sub> | V <sub>1mA mini</sub>         | V <sub>1mA nominal</sub> | V <sub>1mA maxi</sub> |
| ★<br>★<br>★<br>★                         | VE07M00600K __<br>VE09M00600K __<br>VE13M00600K __<br>VE17M00600K __                   | VF05M10101K __<br>VF07M10101K __<br>VF10M10101K __<br>VF14M10101K __                   | 60                           | 80              | 90                            | 100                      | 110                   |
| ★<br>★<br>★<br>★<br>★                    | VE07M00750K __<br>VE09M00750K __<br>VE13M00750K __<br>VE17M00750K __<br>VE24M00750K __ | VF05M10121K __<br>VF07M10121K __<br>VF10M10121K __<br>VF14M10121K __<br>VF20M10121K __ | 75                           | 100             | 108                           | 120                      | 132                   |
| ★<br>★<br>★<br>★<br>★                    | VE07M00950K __<br>VE09M00950K __<br>VE13M00950K __<br>VE17M00950K __<br>VE24M00950K __ | VF05M10151K __<br>VF07M10151K __<br>VF10M10151K __<br>VF14M10151K __<br>VF20M10151K __ | 95                           | 125             | 135                           | 150                      | 165                   |
| ★<br>★<br>★<br>★<br>★                    | VE07M01150K __<br>VE09M01150K __<br>VE13M01150K __<br>VE17M01150K __<br>VE24M01150K __ | VF05M10181K __<br>VF07M10181K __<br>VF10M10181K __<br>VF14M10181K __<br>VF20M10181K __ | 115                          | 150             | 162                           | 180                      | 198                   |
| ★<br>★<br>★<br>★<br>★                    | VE07M00131K __<br>VE09M00131K __<br>VE13M00131K __<br>VE17M00131K __<br>VE24M00131K __ | VF05M12050K __<br>VF07M12050K __<br>VF10M12050K __<br>VF14M12050K __<br>VF20M12050K __ | 130                          | 170             | 184                           | 205                      | 226                   |
| ★<br>★<br>★<br>★<br>★                    | VE07M00141K __<br>VE09M00141K __<br>VE13M00141K __<br>VE17M00141K __<br>VE24M00141K __ | VF05M10221K __<br>VF07M10221K __<br>VF10M10221K __<br>VF14M10221K __<br>VF20M10221K __ | 140                          | 180             | 198                           | 220                      | 242                   |
| ★<br>★<br>★<br>★<br>★                    | VE07M00151K __<br>VE09M00151K __<br>VE13M00151K __<br>VE17M00151K __<br>VE24M00151K __ | VF05M10241K __<br>VF07M10241K __<br>VF10M10241K __<br>VF14M10241K __<br>VF20M10241K __ | 150                          | 200             | 216                           | 240                      | 264                   |
| ★<br>★<br>★<br>★<br>★                    | VE07M01750K __<br>VE09M01750K __<br>VE13M01750K __<br>VE17M01750K __<br>VE24M01750K __ | VF05M10271K __<br>VF07M10271K __<br>VF10M10271K __<br>VF14M10271K __<br>VF20M10271K __ | 175                          | 225             | 243                           | 270                      | 297                   |
| ★<br>★<br>★<br>★<br>★                    | VE07M00211K __<br>VE09M00211K __<br>VE13M00211K __<br>VE17M00211K __<br>VE24M00211K __ | VF05M10331K __<br>VF07M10331K __<br>VF10M10331K __<br>VF14M10331K __<br>VF20M10331K __ | 210                          | 275             | 297                           | 330                      | 363                   |
| ★<br>★<br>★<br>★<br>★                    | VE07M00231K __<br>VE09M00231K __<br>VE13M00231K __<br>VE17M00231K __<br>VE24M00231K __ | VF05M10361K __<br>VF07M10361K __<br>VF10M10361K __<br>VF14M10361K __<br>VF20M10361K __ | 230                          | 300             | 324                           | 360                      | 396                   |

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VE 07/09/13/17/24

VF 05/07/10/14/20

| Max. clamping voltage (8 x 20 $\mu$ s) |        | Max. energy absorption (10 x 1000 $\mu$ s)<br>W (J) |      | Max. permissible peak current (8 x 20 $\mu$ s)<br>Ip (A) |          | Typical capacitance<br>f = 1kHz | Mean power dissipation | Maximum thickness<br>t | V/I characteristic | Derating curves |
|----------------------------------------|--------|-----------------------------------------------------|------|----------------------------------------------------------|----------|---------------------------------|------------------------|------------------------|--------------------|-----------------|
| Vp (V)                                 | Ip (A) | Number of surges<br>1                               | 10   | 1 surge                                                  | 2 surges | pF                              | W                      | mm (inches)            | Page               | Page            |
| 165                                    | 5      | 2.2                                                 | 0.7  | 400                                                      | 200      | 165                             | 0.1                    | 3.8 (.150)             | 22                 | 24              |
| 165                                    | 10     | 4.8                                                 | 1.7  | 1200                                                     | 600      | 440                             | 0.2                    | 3.8 (.150)             | 22                 | 25              |
| 165                                    | 25     | 10                                                  | 7    | 2500                                                     | 1250     | 870                             | 0.4                    | 4.5 (.177)             | 22                 | 26              |
| 165                                    | 50     | 17                                                  | 14   | 4500                                                     | 2500     | 2200                            | 0.6                    | 4.5 (.177)             | 23                 | 27              |
| 200                                    | 5      | 2.5                                                 | 0.8  | 400                                                      | 200      | 150                             | 0.1                    | 4.0 (.157)             | 22                 | 24              |
| 200                                    | 10     | 5.9                                                 | 1.8  | 1200                                                     | 600      | 400                             | 0.2                    | 4.0 (.157)             | 22                 | 25              |
| 200                                    | 25     | 12                                                  | 8    | 2500                                                     | 1250     | 700                             | 0.4                    | 4.4 (.173)             | 22                 | 26              |
| 200                                    | 50     | 20                                                  | 15   | 4500                                                     | 2500     | 1900                            | 0.6                    | 4.4 (.173)             | 23                 | 27              |
| 200                                    | 100    | 40                                                  | 30   | 6500                                                     | 4000     | 4200                            | 0.8                    | 4.8 (.189)             | 23                 | 28              |
| 250                                    | 5      | 3.4                                                 | 1    | 400                                                      | 200      | 110                             | 0.1                    | 4.4 (.173)             | 22                 | 24              |
| 250                                    | 10     | 7.6                                                 | 3    | 1200                                                     | 600      | 310                             | 0.2                    | 4.4 (.173)             | 22                 | 25              |
| 250                                    | 25     | 15                                                  | 9    | 2500                                                     | 1250     | 560                             | 0.4                    | 5.0 (.197)             | 22                 | 26              |
| 250                                    | 50     | 25                                                  | 20   | 4500                                                     | 2500     | 1200                            | 0.6                    | 5.0 (.197)             | 23                 | 27              |
| 250                                    | 100    | 50                                                  | 33   | 6500                                                     | 4000     | 3400                            | 0.8                    | 5.4 (.213)             | 23                 | 28              |
| 300                                    | 5      | 3.6                                                 | 1.3  | 400                                                      | 200      | 100                             | 0.1                    | 4.5 (.177)             | 22                 | 24              |
| 300                                    | 10     | 8.4                                                 | 3.3  | 1200                                                     | 600      | 280                             | 0.2                    | 4.5 (.177)             | 22                 | 25              |
| 300                                    | 25     | 18                                                  | 10.6 | 2500                                                     | 1250     | 500                             | 0.4                    | 5.1 (.201)             | 22                 | 26              |
| 300                                    | 50     | 30                                                  | 22   | 4500                                                     | 2500     | 1100                            | 0.6                    | 5.1 (.201)             | 23                 | 27              |
| 300                                    | 100    | 60                                                  | 40   | 6500                                                     | 4000     | 3000                            | 0.8                    | 5.5 (.217)             | 23                 | 28              |
| 340                                    | 5      | 4.2                                                 | 1.5  | 400                                                      | 200      | 90                              | 0.1                    | 4.1 (.161)             | 22                 | 24              |
| 340                                    | 10     | 9.5                                                 | 4    | 1200                                                     | 600      | 250                             | 0.2                    | 4.1 (.161)             | 22                 | 25              |
| 340                                    | 25     | 19                                                  | 11   | 2500                                                     | 1250     | 450                             | 0.4                    | 4.7 (.185)             | 22                 | 26              |
| 340                                    | 50     | 34                                                  | 25   | 4500                                                     | 2500     | 1000                            | 0.6                    | 4.7 (.185)             | 23                 | 27              |
| 340                                    | 100    | 74                                                  | 46   | 6500                                                     | 4000     | 2500                            | 0.8                    | 5.1 (.201)             | 23                 | 28              |
| 360                                    | 5      | 4.5                                                 | 1.5  | 400                                                      | 200      | 85                              | 0.1                    | 4.2 (.165)             | 22                 | 24              |
| 360                                    | 10     | 10                                                  | 4    | 1200                                                     | 600      | 235                             | 0.2                    | 4.2 (.165)             | 22                 | 25              |
| 360                                    | 25     | 22                                                  | 12.5 | 2500                                                     | 1250     | 425                             | 0.4                    | 4.8 (.189)             | 22                 | 26              |
| 360                                    | 50     | 36                                                  | 26.5 | 4500                                                     | 2500     | 930                             | 0.6                    | 4.8 (.189)             | 23                 | 27              |
| 360                                    | 100    | 78                                                  | 50   | 6500                                                     | 4000     | 2250                            | 0.8                    | 5.2 (.205)             | 23                 | 28              |
| 400                                    | 5      | 4.9                                                 | 1.8  | 400                                                      | 200      | 80                              | 0.1                    | 4.3 (.169)             | 22                 | 24              |
| 400                                    | 10     | 11                                                  | 4.1  | 1200                                                     | 600      | 220                             | 0.2                    | 4.3 (.169)             | 22                 | 25              |
| 400                                    | 25     | 24                                                  | 13   | 2500                                                     | 1250     | 400                             | 0.4                    | 4.9 (.193)             | 22                 | 26              |
| 400                                    | 50     | 40                                                  | 30   | 4500                                                     | 2500     | 850                             | 0.6                    | 4.9 (.193)             | 23                 | 27              |
| 400                                    | 100    | 85                                                  | 56   | 6500                                                     | 4000     | 2000                            | 0.8                    | 5.3 (.209)             | 23                 | 28              |
| 445                                    | 5      | 5.6                                                 | 1.9  | 400                                                      | 200      | 70                              | 0.1                    | 4.5 (.177)             | 22                 | 24              |
| 445                                    | 10     | 13                                                  | 4.5  | 1200                                                     | 600      | 190                             | 0.2                    | 4.5 (.177)             | 22                 | 25              |
| 445                                    | 25     | 28                                                  | 13.5 | 2500                                                     | 1250     | 340                             | 0.4                    | 5.1 (.201)             | 22                 | 26              |
| 445                                    | 50     | 46                                                  | 31   | 4500                                                     | 2500     | 750                             | 0.6                    | 5.1 (.201)             | 23                 | 27              |
| 445                                    | 100    | 98                                                  | 56   | 6500                                                     | 4000     | 2000                            | 0.8                    | 5.5 (.217)             | 23                 | 28              |
| 545                                    | 5      | 7.2                                                 | 2.2  | 400                                                      | 200      | 60                              | 0.1                    | 4.9 (.193)             | 22                 | 24              |
| 545                                    | 10     | 15                                                  | 5.4  | 1200                                                     | 600      | 155                             | 0.2                    | 4.9 (.193)             | 22                 | 25              |
| 545                                    | 25     | 31                                                  | 14.0 | 2500                                                     | 1250     | 275                             | 0.4                    | 5.5 (.217)             | 22                 | 26              |
| 545                                    | 50     | 54                                                  | 35   | 4500                                                     | 2500     | 600                             | 0.6                    | 5.5 (.217)             | 23                 | 27              |
| 545                                    | 100    | 115                                                 | 70   | 6500                                                     | 4000     | 1650                            | 0.8                    | 5.9 (.232)             | 23                 | 28              |
| 595                                    | 5      | 7.2                                                 | 2.4  | 400                                                      | 200      | 55                              | 0.1                    | 5.1 (.201)             | 22                 | 24              |
| 595                                    | 10     | 17                                                  | 6    | 1200                                                     | 600      | 140                             | 0.2                    | 5.1 (.201)             | 22                 | 25              |
| 595                                    | 25     | 36                                                  | 14.3 | 2500                                                     | 1250     | 250                             | 0.4                    | 5.7 (.224)             | 22                 | 26              |
| 595                                    | 50     | 60                                                  | 38   | 4500                                                     | 2500     | 550                             | 0.6                    | 5.7 (.224)             | 23                 | 27              |
| 595                                    | 100    | 130                                                 | 75   | 6500                                                     | 4000     | 1500                            | 0.8                    | 6.1 (.240)             | 23                 | 28              |



# Zinc Oxide Varistors



VE 07/09/13/17/24

VF 05/07/10/14/20

| UL<br>(USA and<br>Canadian<br>Standards) | VE Series<br>P/N codification using<br><br>(D <sub>max</sub> , V <sub>rms</sub> )      | VF Series<br>P/N codification using<br><br>(d <sub>ceramic</sub> , V <sub>1mA</sub> )  | Maximum<br>operating voltage |                 | Nominal voltage<br>at 1 mA dc |                          |                       |
|------------------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|------------------------------|-----------------|-------------------------------|--------------------------|-----------------------|
|                                          |                                                                                        |                                                                                        | V <sub>rms</sub>             | V <sub>DC</sub> | V <sub>1mA mini</sub>         | V <sub>1mA nominal</sub> | V <sub>1mA maxi</sub> |
| ★<br>★<br>★<br>★<br>★                    | VE07M00251K __<br>VE09M00251K __<br>VE13M00251K __<br>VE17M00251K __<br>VE24M00251K __ | VF05M10391K __<br>VF07M10391K __<br>VF10M10391K __<br>VF14M10391K __<br>VF20M10391K __ | 250                          | 320             | 351                           | 390                      | 429                   |
| ★<br>★<br>★<br>★<br>★                    | VE07M02750K __<br>VE09M02750K __<br>VE13M02750K __<br>VE17M02750K __<br>VE24M02750K __ | VF05M10431K __<br>VF07M10431K __<br>VF10M10431K __<br>VF14M10431K __<br>VF20M10431K __ | 275                          | 350             | 387                           | 430                      | 473                   |
| ★<br>★<br>★<br>★<br>★                    | VE07M00301K __<br>VE09M00301K __<br>VE13M00301K __<br>VE17M00301K __<br>VE24M00301K __ | VF05M10471K __<br>VF07M10471K __<br>VF10M10471K __<br>VF14M10471K __<br>VF20M10471K __ | 300                          | 385             | 423                           | 470                      | 517                   |
| ★<br>★<br>★<br>★                         | VE09M00321K __<br>VE13M00321K __<br>VE17M00321K __<br>VE24M00321K __                   | VF07M10511K __<br>VF10M10511K __<br>VF14M10511K __<br>VF20M10511K __                   | 320                          | 420             | 459                           | 510                      | 561                   |
| ★<br>★<br>★<br>★                         | VE09M00351K __<br>VE13M00351K __<br>VE17M00351K __<br>VE24M00351K __                   | VF07M10561K __<br>VF10M10561K __<br>VF14M10561K __<br>VF20M10561K __                   | 350                          | 460             | 504                           | 560                      | 616                   |
| ★<br>★<br>★<br>★                         | VE09M03850K __<br>VE13M03850K __<br>VE17M03850K __<br>VE24M03850K __                   | VF07M10621K __<br>VF10M10621K __<br>VF14M10621K __<br>VF20M10621K __                   | 385                          | 505             | 558                           | 620                      | 682                   |
| ★<br>★<br>★<br>★                         | VE09M00421K __<br>VE13M00421K __<br>VE17M00421K __<br>VE24M00421K __                   | VF07M10681K __<br>VF10M10681K __<br>VF14M10681K __<br>VF20M10681K __                   | 420                          | 560             | 612                           | 680                      | 748                   |
| ★<br>★<br>★                              | VE13M00441K __<br>VE17M00441K __<br>VE24M00441K __                                     | VF10M17150K __<br>VF14M17150K __<br>VF20M17150K __                                     | 440                          | 585             | 643                           | 715                      | 787                   |
| ★<br>★<br>★                              | VE13M00461K __<br>VE17M00461K __<br>VE24M00461K __                                     | VF10M10751K __<br>VF14M10751K __<br>VF20M10751K __                                     | 460                          | 615             | 675                           | 750                      | 825                   |
| ★<br>★<br>★                              | VE13M00511K __<br>VE17M00511K __<br>VE24M00511K __                                     | VF10M10821K __<br>VF14M10821K __<br>VF20M10821K __                                     | 510                          | 670             | 738                           | 820                      | 902                   |
| ★<br>★<br>★                              | VE13M00551K __<br>VE17M00551K __<br>VE24M00551K __                                     | VF10M10861K __<br>VF14M10861K __<br>VF20M10861K __                                     | 550                          | 715             | 774                           | 860                      | 946                   |
| ★<br>★<br>★                              | VE13M05750K __<br>VE17M05750K __<br>VE24M05750K __                                     | VF10M10911K __<br>VF14M10911K __<br>VF20M10911K __                                     | 575                          | 730             | 819                           | 910                      | 1001                  |
| ★<br>★<br>★                              | VE13M06250K __<br>VE17M06250K __<br>VE24M06250K __                                     | VF10M10102K __<br>VF14M10102K __<br>VF20M10102K __                                     | 625                          | 825             | 900                           | 1000                     | 1100                  |

# Zinc Oxide Varistors



VE 07/09/13/17/24

VF 05/07/10/14/20

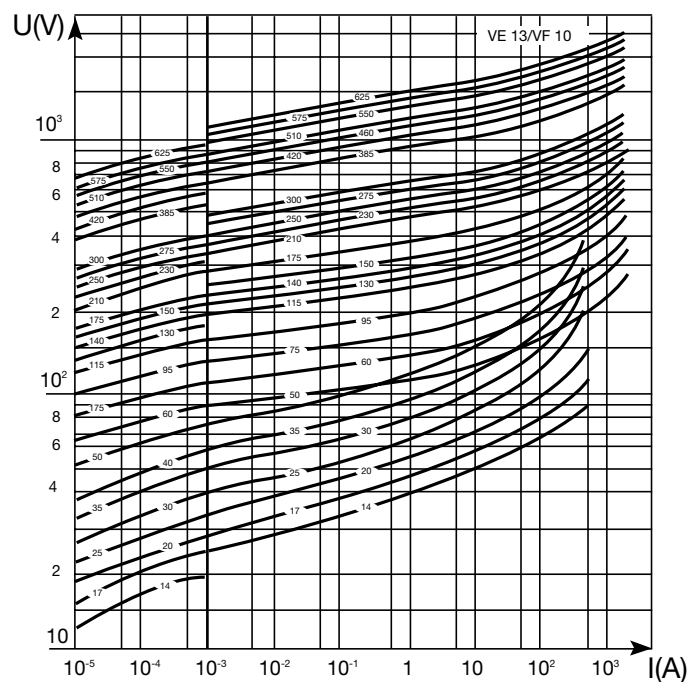
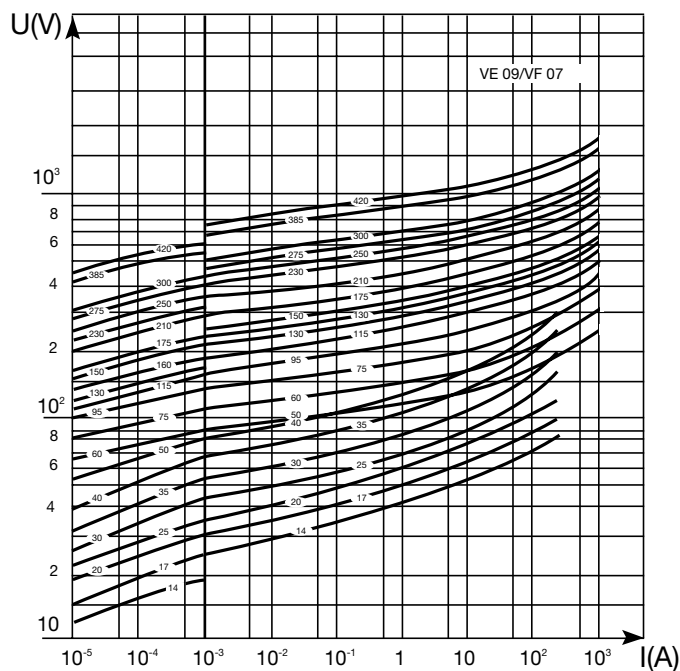
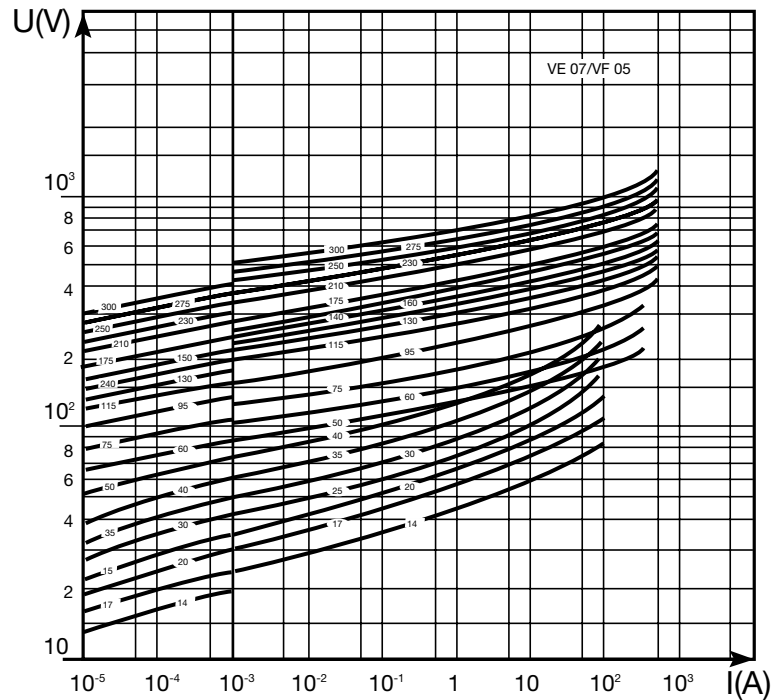
| Max. clamping voltage (8 x 20 $\mu$ s) |        | Max. energy absorption (10 x 1000 $\mu$ s)<br>W (J) |     | Max. permissible peak current (8 x 20 $\mu$ s)<br>Ip (A) |          | Typical capacitance<br>f = 1kHz | Mean power dissipation | Maximum thickness<br>t | V/I characteristic | Derating curves |
|----------------------------------------|--------|-----------------------------------------------------|-----|----------------------------------------------------------|----------|---------------------------------|------------------------|------------------------|--------------------|-----------------|
| Vp (V)                                 | Ip (A) | Number of surges                                    |     | Ip (A)                                                   |          | pF                              | W                      | mm (inches)            | Page               | Page            |
|                                        |        | 1                                                   | 10  | 1 surge                                                  | 2 surges |                                 |                        |                        |                    |                 |
| 645                                    | 5      | 8.2                                                 | 2.8 | 400                                                      | 200      | 50                              | 0.1                    | 5.4 (.213)             | 22                 | 24              |
| 645                                    | 10     | 19                                                  | 7.3 | 1200                                                     | 600      | 130                             | 0.2                    | 5.4 (.213)             | 22                 | 25              |
| 645                                    | 25     | 38                                                  | 19  | 2500                                                     | 1250     | 230                             | 0.4                    | 5.9 (.232)             | 22                 | 26              |
| 645                                    | 50     | 65                                                  | 39  | 4500                                                     | 2500     | 500                             | 0.6                    | 5.9 (.232)             | 23                 | 27              |
| 645                                    | 100    | 140                                                 | 100 | 6500                                                     | 4000     | 1300                            | 0.8                    | 6.3 (.248)             | 23                 | 28              |
| 710                                    | 5      | 8.6                                                 | 3   | 400                                                      | 200      | 45                              | 0.1                    | 5.7 (.224)             | 22                 | 24              |
| 710                                    | 10     | 21                                                  | 7.4 | 1200                                                     | 600      | 120                             | 0.2                    | 5.7 (.224)             | 22                 | 25              |
| 710                                    | 25     | 43                                                  | 20  | 2500                                                     | 1250     | 210                             | 0.4                    | 6.3 (.248)             | 22                 | 26              |
| 710                                    | 50     | 71                                                  | 40  | 4500                                                     | 2500     | 450                             | 0.6                    | 6.3 (.248)             | 23                 | 27              |
| 710                                    | 100    | 151                                                 | 105 | 6500                                                     | 4000     | 1200                            | 0.8                    | 6.7 (.264)             | 23                 | 28              |
| 775                                    | 5      | 9                                                   | 3.3 | 400                                                      | 200      | 40                              | 0.1                    | 6.0 (.236)             | 22                 | 24              |
| 775                                    | 10     | 25                                                  | 7.5 | 1200                                                     | 600      | 100                             | 0.2                    | 6.0 (.236)             | 22                 | 25              |
| 775                                    | 25     | 45                                                  | 20  | 2500                                                     | 1250     | 180                             | 0.4                    | 6.6 (.260)             | 22                 | 26              |
| 775                                    | 50     | 80                                                  | 42  | 4500                                                     | 2500     | 400                             | 0.6                    | 6.6 (.260)             | 23                 | 27              |
| 775                                    | 100    | 150                                                 | 107 | 6500                                                     | 4000     | 1000                            | 0.8                    | 7.0 (.276)             | 23                 | 28              |
| 840                                    | 10     | 25                                                  | 7.5 | 1200                                                     | 600      | 100                             | 0.2                    | 6.4 (.252)             | 22                 | 25              |
| 840                                    | 25     | 45                                                  | 20  | 2500                                                     | 1250     | 170                             | 0.4                    | 7.0 (.276)             | 22                 | 26              |
| 840                                    | 50     | 82                                                  | 42  | 4500                                                     | 2500     | 380                             | 0.6                    | 7.0 (.276)             | 23                 | 27              |
| 840                                    | 100    | 150                                                 | 107 | 6500                                                     | 4000     | 950                             | 0.8                    | 7.5 (.276)             | 23                 | 28              |
| 910                                    | 10     | 25                                                  | 7.5 | 1200                                                     | 600      | 95                              | 0.2                    | 6.6 (.260)             | 22                 | 25              |
| 910                                    | 25     | 45                                                  | 20  | 2500                                                     | 1250     | 160                             | 0.4                    | 7.3 (.287)             | 22                 | 26              |
| 910                                    | 50     | 85                                                  | 42  | 4500                                                     | 2500     | 365                             | 0.6                    | 7.3 (.287)             | 23                 | 27              |
| 910                                    | 100    | 155                                                 | 107 | 6500                                                     | 4000     | 900                             | 0.8                    | 7.8 (.307)             | 23                 | 28              |
| 1025                                   | 10     | 25                                                  | 7.5 | 1200                                                     | 600      | 95                              | 0.2                    | 7.0 (.276)             | 22                 | 25              |
| 1025                                   | 25     | 45                                                  | 20  | 2500                                                     | 1250     | 150                             | 0.4                    | 7.7 (.303)             | 22                 | 26              |
| 1025                                   | 50     | 88                                                  | 42  | 4500                                                     | 2500     | 350                             | 0.6                    | 7.7 (.303)             | 23                 | 27              |
| 1025                                   | 100    | 155                                                 | 107 | 6500                                                     | 4000     | 850                             | 0.8                    | 8.1 (.319)             | 23                 | 28              |
| 1120                                   | 10     | 25                                                  | 7.5 | 1200                                                     | 600      | 80                              | 0.2                    | 7.4 (.291)             | 22                 | 25              |
| 1120                                   | 25     | 45                                                  | 20  | 2500                                                     | 1250     | 120                             | 0.4                    | 8.2 (.323)             | 22                 | 26              |
| 1120                                   | 50     | 90                                                  | 42  | 4500                                                     | 2500     | 300                             | 0.6                    | 8.2 (.323)             | 23                 | 27              |
| 1120                                   | 100    | 160                                                 | 107 | 6500                                                     | 4000     | 700                             | 0.8                    | 8.6 (.339)             | 23                 | 28              |
| 1180                                   | 25     | 45                                                  | 20  | 2500                                                     | 1250     | 115                             | 0.4                    | 8.4 (.331)             | 22                 | 26              |
| 1180                                   | 50     | 95                                                  | 44  | 4500                                                     | 2500     | 275                             | 0.6                    | 8.4 (.331)             | 23                 | 27              |
| 1180                                   | 100    | 165                                                 | 115 | 6500                                                     | 4000     | 650                             | 0.8                    | 8.8 (.346)             | 23                 | 28              |
| 1240                                   | 25     | 45                                                  | 20  | 2500                                                     | 1250     | 110                             | 0.4                    | 8.5 (.335)             | 22                 | 26              |
| 1240                                   | 50     | 100                                                 | 47  | 4500                                                     | 2500     | 250                             | 0.6                    | 8.5 (.335)             | 23                 | 27              |
| 1240                                   | 100    | 175                                                 | 120 | 6500                                                     | 4000     | 600                             | 0.8                    | 9.0 (.354)             | 23                 | 28              |
| 1350                                   | 25     | 55                                                  | 22  | 2500                                                     | 1250     | 100                             | 0.4                    | 9.0 (.354)             | 22                 | 26              |
| 1350                                   | 50     | 110                                                 | 57  | 4500                                                     | 2500     | 220                             | 0.6                    | 9.0 (.354)             | 23                 | 27              |
| 1350                                   | 100    | 190                                                 | 150 | 6500                                                     | 4000     | 550                             | 0.8                    | 9.4 (.370)             | 23                 | 28              |
| 1420                                   | 25     | 57                                                  | 24  | 2500                                                     | 1250     | 90                              | 0.4                    | 9.3 (.366)             | 22                 | 26              |
| 1420                                   | 50     | 113                                                 | 57  | 4500                                                     | 2500     | 200                             | 0.6                    | 9.3 (.366)             | 23                 | 27              |
| 1420                                   | 100    | 200                                                 | 150 | 6500                                                     | 4000     | 500                             | 0.8                    | 9.7 (.382)             | 23                 | 28              |
| 1500                                   | 25     | 60                                                  | 25  | 2500                                                     | 1250     | 80                              | 0.4                    | 9.7 (.382)             | 22                 | 26              |
| 1500                                   | 50     | 120                                                 | 60  | 4500                                                     | 2500     | 180                             | 0.6                    | 9.7 (.382)             | 23                 | 27              |
| 1500                                   | 100    | 210                                                 | 160 | 6500                                                     | 4000     | 450                             | 0.8                    | 10.1 (.398)            | 23                 | 28              |
| 1650                                   | 25     | 68                                                  | 25  | 2500                                                     | 1250     | 74                              | 0.4                    | 10.5 (.413)            | 22                 | 26              |
| 1650                                   | 50     | 130                                                 | 60  | 4500                                                     | 2500     | 165                             | 0.6                    | 10.5 (.413)            | 23                 | 27              |
| 1650                                   | 100    | 230                                                 | 160 | 6500                                                     | 4000     | 410                             | 0.8                    | 11.0 (.433)            | 23                 | 28              |



### VOLTAGE-CURRENT CHARACTERISTICS

V/I characteristics give:

- for  $I$  below 1 mA the maximum leakage current under  $V_{dc}$
- for  $I$  above 1 mA the maximum clamping voltage

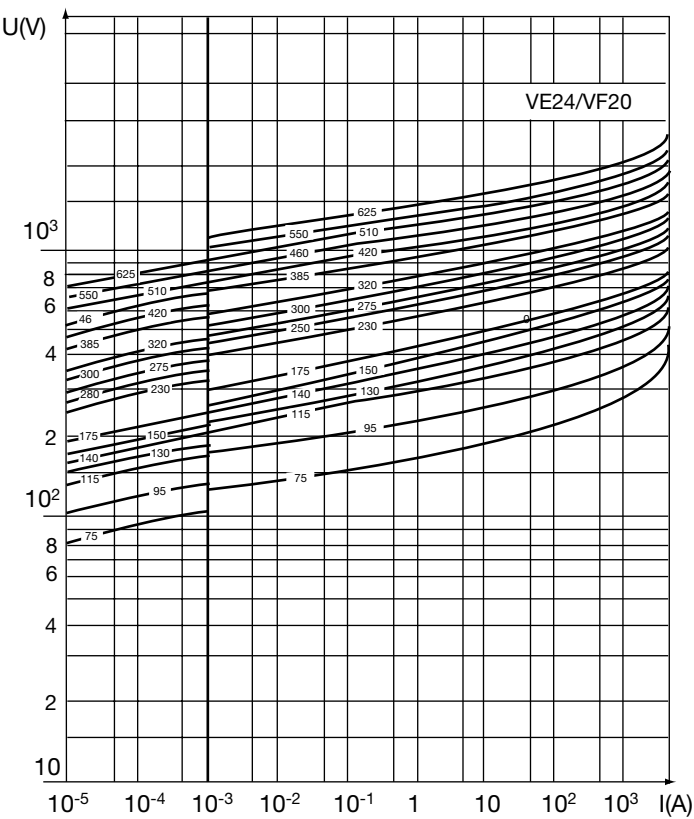
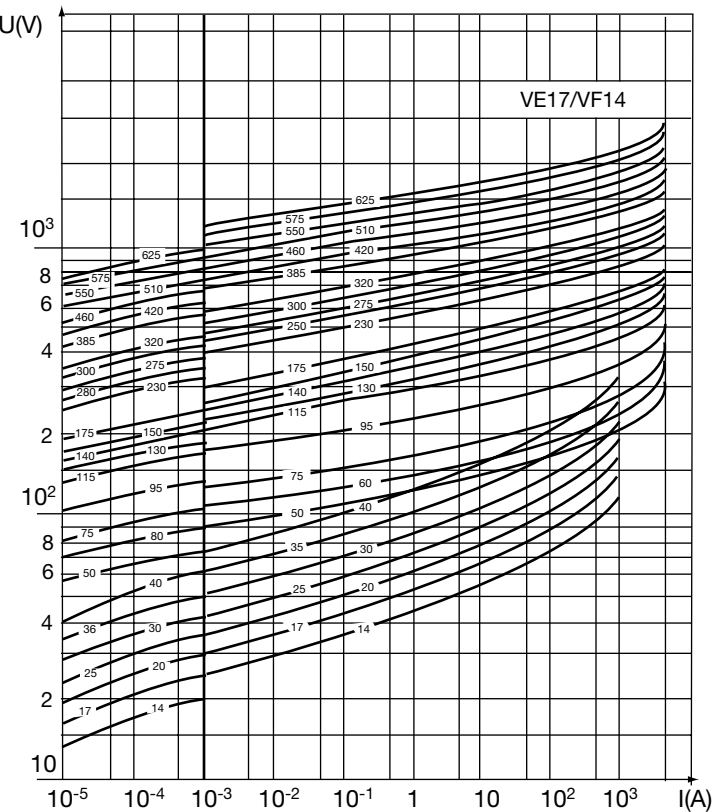


# Zinc Oxide Varistors

## Electrical Characteristics VE / VF Types



### VOLTAGE-CURRENT CHARACTERISTICS

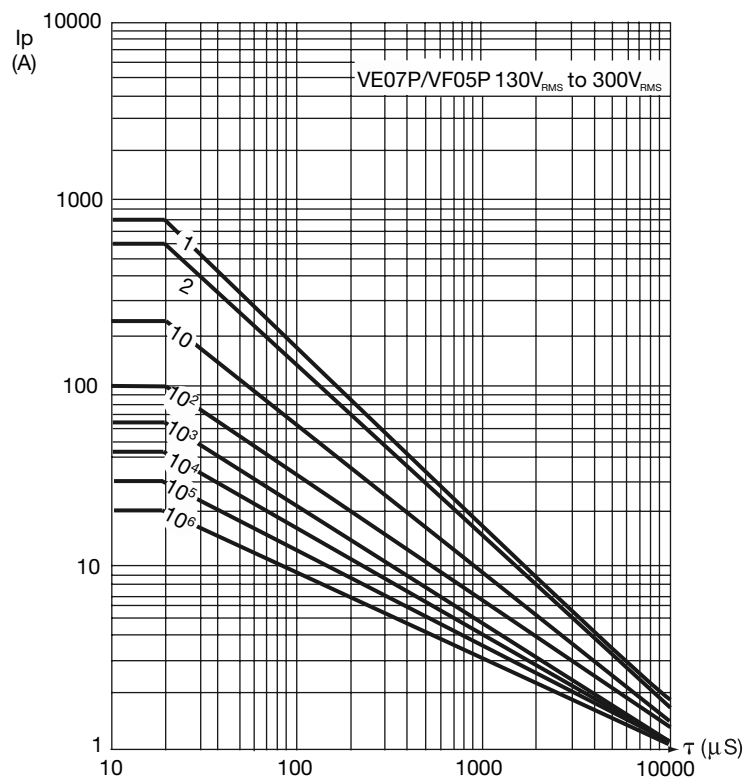
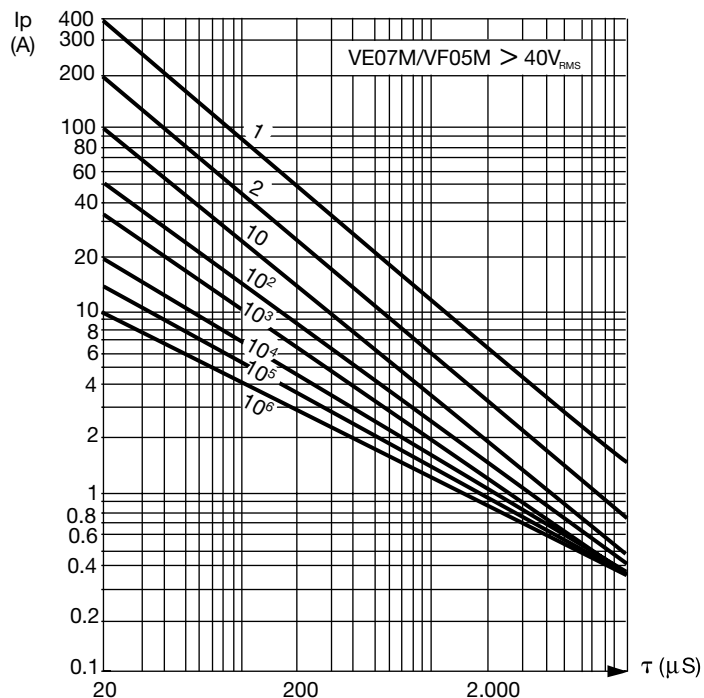
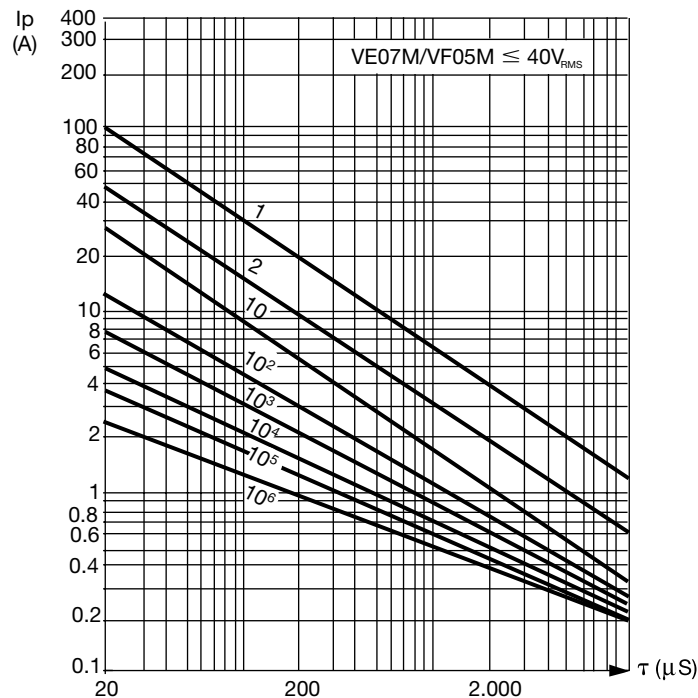


# Zinc Oxide Varistors



## Electrical Characteristics VE / VF Types

### MAXIMUM SURGE CURRENT ( $I_p$ ) DERATING CURVES WITH PULSE WIDTH ( $\tau$ ) AND FREQUENCY

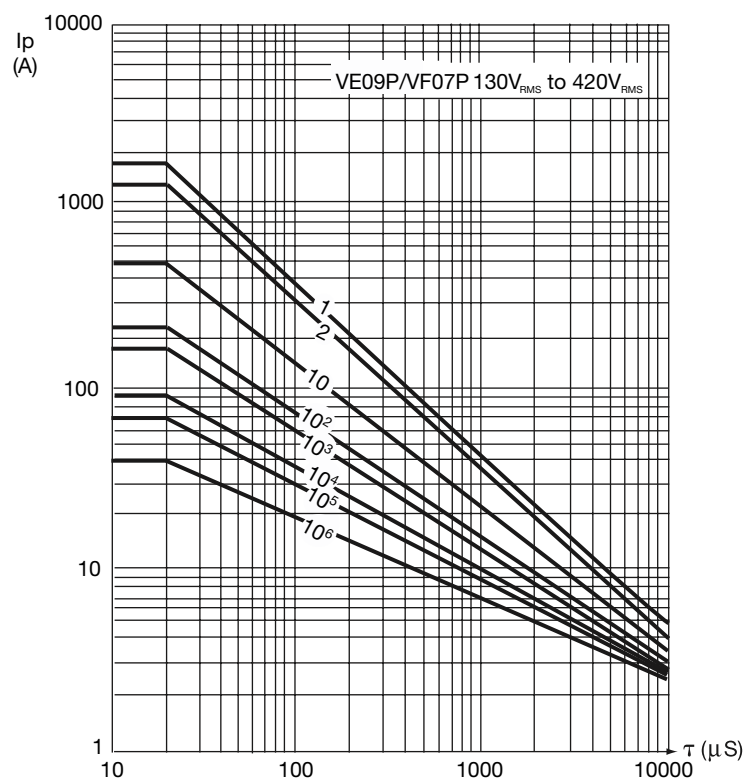
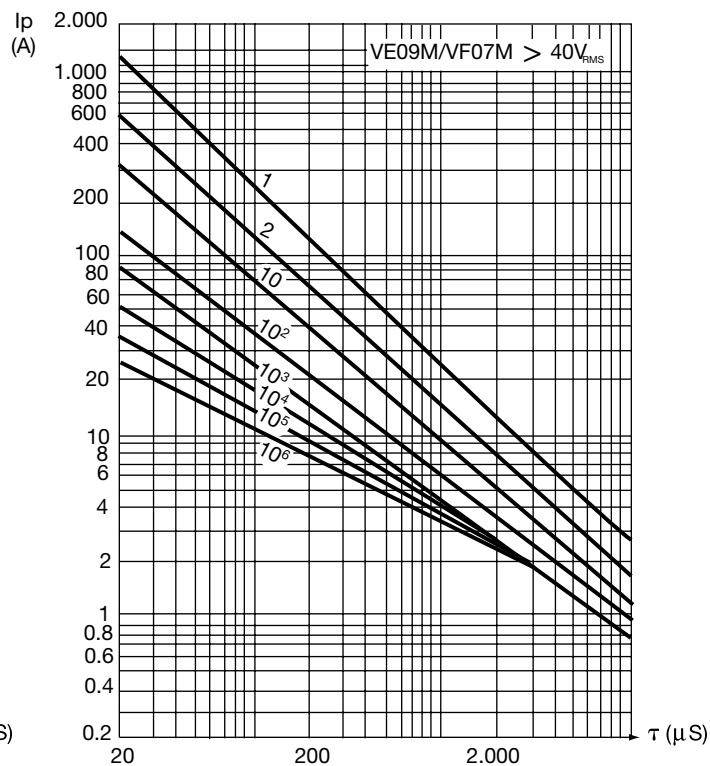
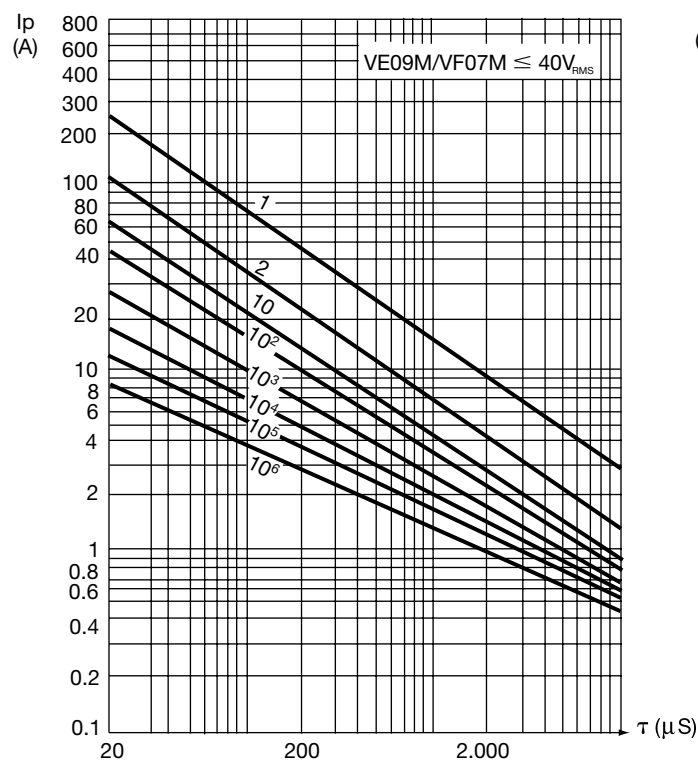


# Zinc Oxide Varistors



## Electrical Characteristics VE / VF Types

### MAXIMUM SURGE CURRENT ( $I_p$ ) DERATING CURVES WITH PULSE WIDTH ( $\tau$ ) AND FREQUENCY

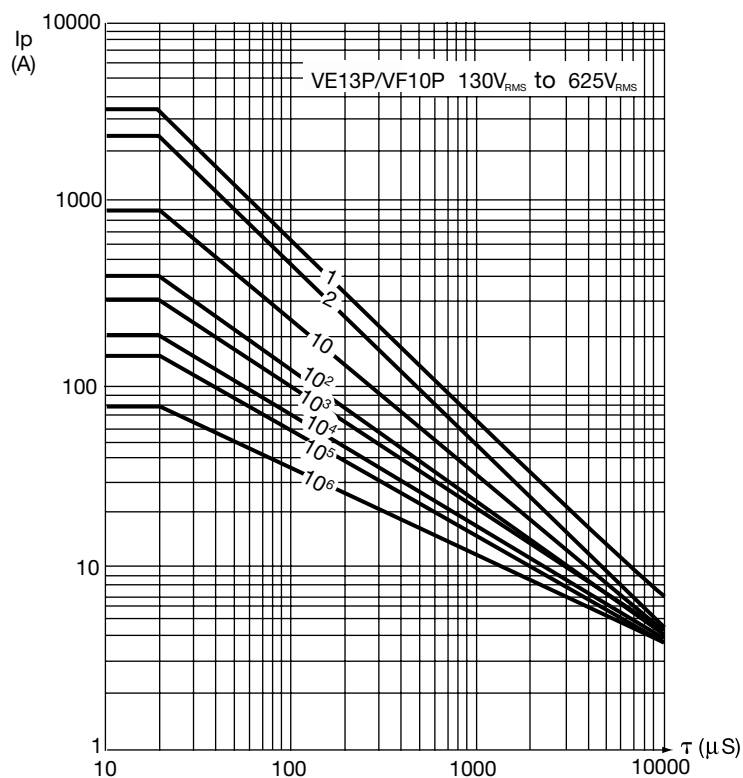
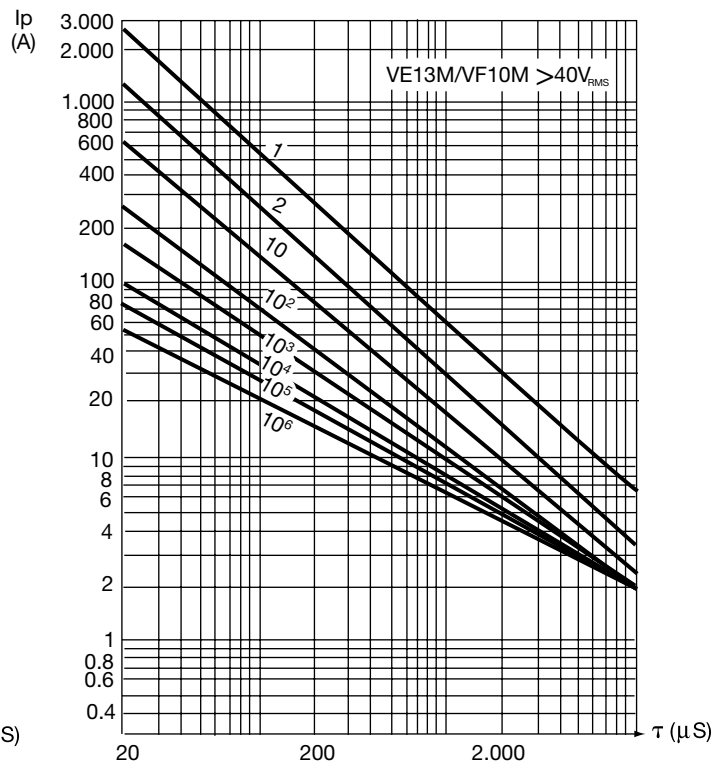
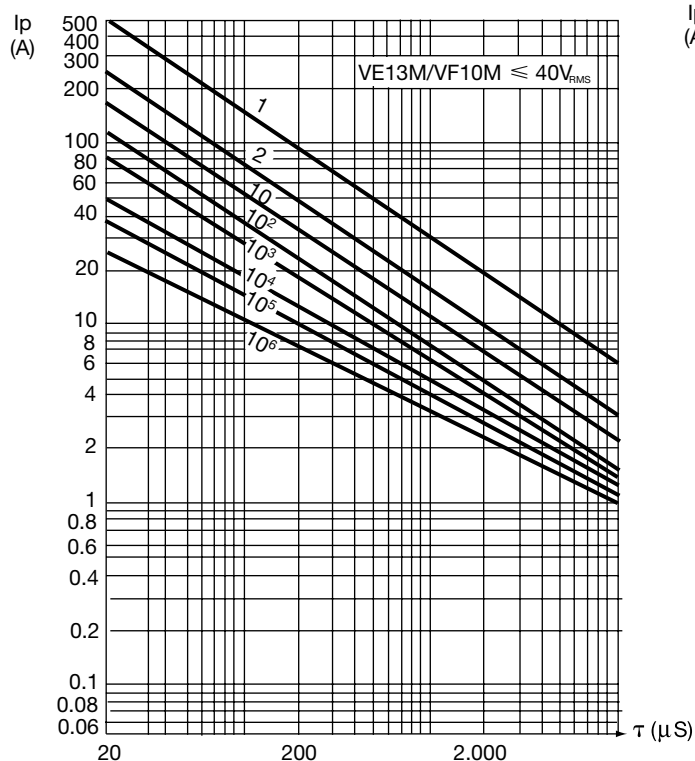


# Zinc Oxide Varistors



## Electrical Characteristics VE / VF Types

### MAXIMUM SURGE CURRENT ( $I_p$ ) DERATING CURVES WITH PULSE WIDTH ( $\tau$ ) AND FREQUENCY

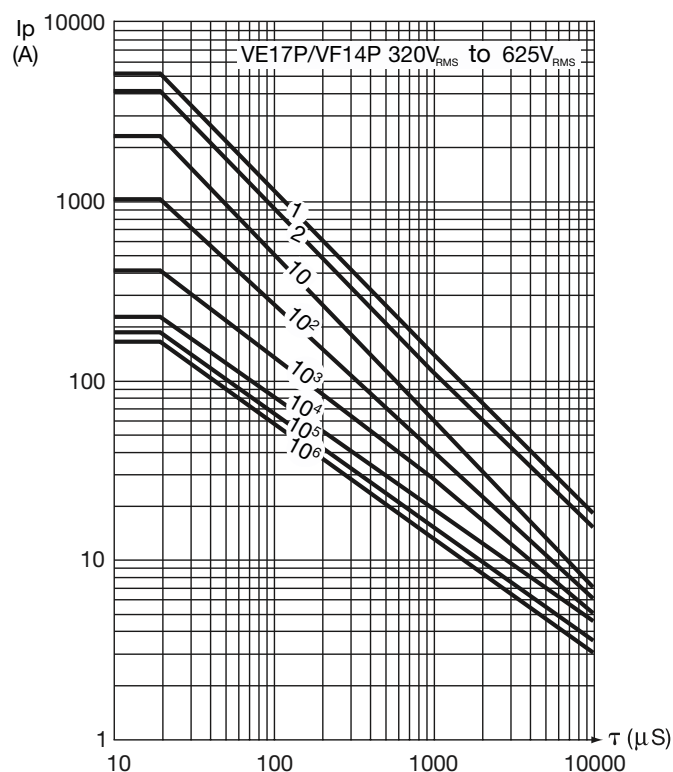
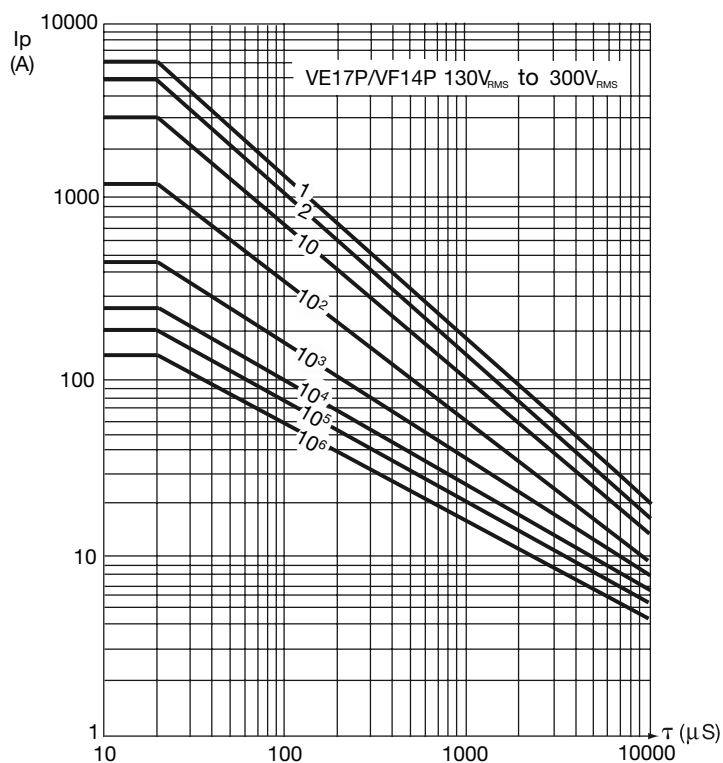
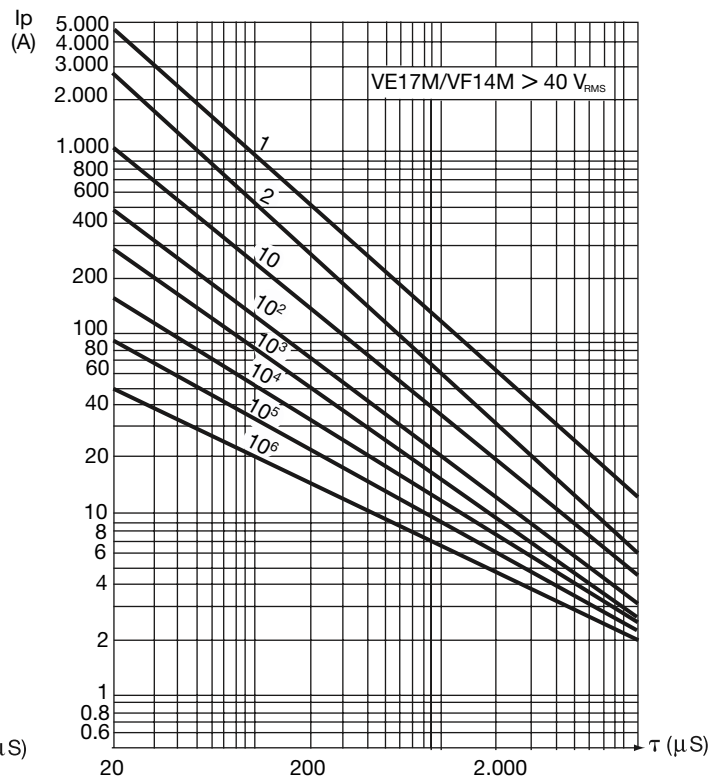
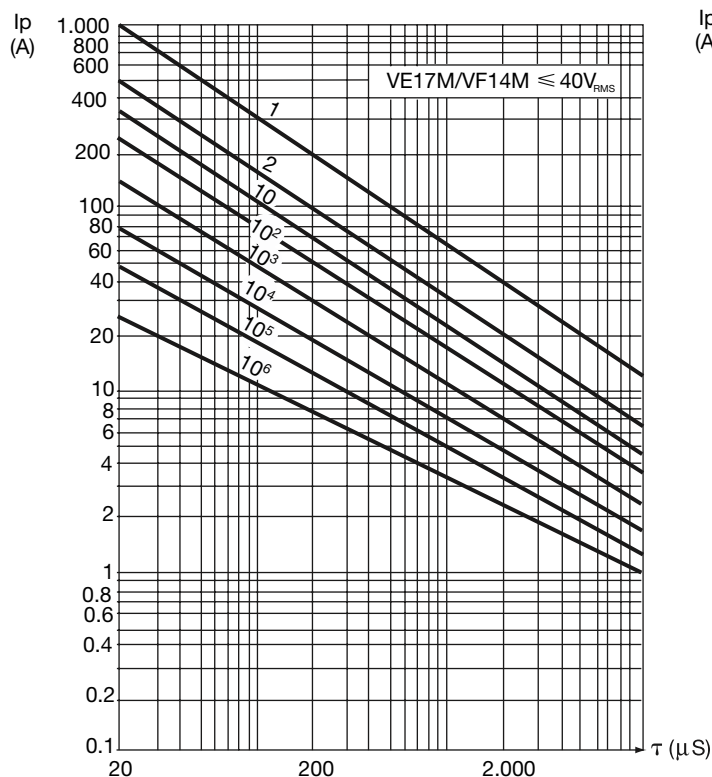


# Zinc Oxide Varistors



## Electrical Characteristics VE / VF Types

### MAXIMUM SURGE CURRENT ( $I_p$ ) DERATING CURVES WITH PULSE WIDTH ( $\tau$ ) AND FREQUENCY



# Zinc Oxide Varistors



## Electrical Characteristics VE / VF Types

### MAXIMUM SURGE CURRENT ( $I_p$ ) DERATING CURVES WITH PULSE WIDTH ( $\tau$ ) AND FREQUENCY

