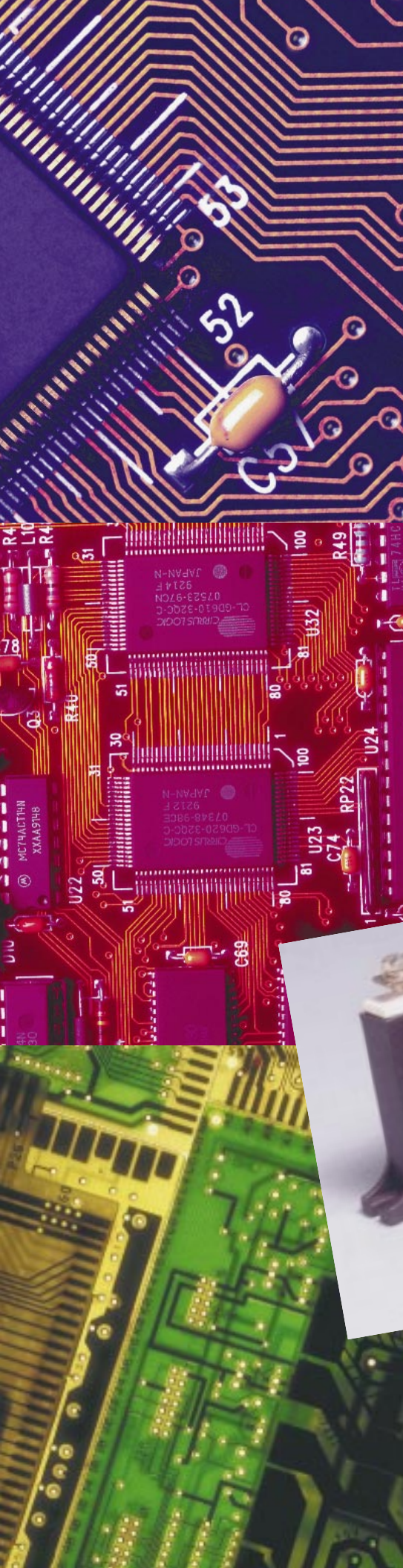




# METAL OXIDE *Varistors*



**CKE**

# MOV Transient Voltage Suppressors

## Description

CKE, Inc. features two radial leaded MOV product lines:

- Standard Series
- High Energy Series

CKE, Inc. also features three High Energy Special Package MOV products:

- PA Series
- Z33M & Z40M Series
- EH Series

Our Standard Series will continue to offer the optimum value in quality and economy. These parts are presented in Tables 1 and 2 of the catalog.

The High Energy Series offers a premium quality in a higher density package, allowing a reduction to the next lower mm size from standard MOV ratings. This can be allowed because the current and energy ratings have increases of up to 50% over the standard series MOVs. For specifications please contact CKE, Inc.

CKE, Inc. identifies its Z-MOV product line by using various characters and actual electrical specifications that are incorporated into the part number. CKE uses a "Z" prefix as its identity for all Z-MOV products and an "H" suffix to identify the High Energy Series parts. All parts 7 mm and larger with a voltage rating of 130 V and up have the RMS voltage ratings in their part number. All 5 mm parts and those with voltages lower than 130 RMS are identified by the mm size and the peak nominal clamping volts at the 1 milliamp level.

CKE, Inc. uses the latest in manufacturing technology in the production of our varistors. Both the Standard Series and High Energy Series MOV parts with a  (Underwriters Laboratories Recognized Component Mark) conform to UL1414, UL1449 and CSA class 2221 01. All of CKE's line voltage parts are [UL recognized](#) and listed on [File E90510 \(M\)](#).

## Parameter Definitions

Maximum Applied Voltage — Maximum AC RMS value of a sine wave or maximum DC value "filtered."

Varistor Voltage — Voltage between terminals when 1 mA of DC current is applied (0.1 mA for 5 mm parts).

Energy — Maximum energy of two 2 ms pulses at 1 minute interval which cause > 10% change in varistor voltage.

Maximum Clamping (V<sub>I</sub>) — Peak voltage value for peak current applied with 8 μs rise time, 20 μs decay to 50% value of the current.

## Maximum Power Dissipation Ratings

|       |           |      |           |
|-------|-----------|------|-----------|
| 5 mm  | 0.1 Watt  | Z33M | 1.5 Watt  |
| 7 mm  | 0.25 Watt | Z40M | 2.0 Watt  |
| 10 mm | 0.4 Watt  | EH4  | 1.5 Watt  |
| 14 mm | 0.6 Watt  | EH5  | 1.75 Watt |
| 20 mm | 1 Watt    | EH6  | 2.0 Watt  |

## Major Ratings and Characteristics

|                  |                                           |         |                 |
|------------------|-------------------------------------------|---------|-----------------|
| F                | Maximum pull on leads, for 1 minute       | N       | 20              |
| S <sub>V1</sub>  | Temperature coefficient of V <sub>1</sub> | %/deg C | +0.02 to -0.07  |
| T                | Operating and storage temperature range   | °C      | -40 to 125      |
| t                | Response time in typical application      | ns      | < 15            |
| R <sub>ins</sub> | Insulation resistance, element to case    | Ω       | 10 <sup>8</sup> |
| V <sub>ins</sub> | Isolation test voltage, element to case   | V       | 1500 AC         |

## Selection Procedure

MOVs are transient voltage clipping devices and cannot regulate the line voltage. Therefore, there are important steps to follow in selecting the correct MOV:

1. The open circuit or surge voltage must not exceed the maximum applied continuous voltage.
2. The energy rating of the varistor, in joules, must not be exceeded. The transient energy rating may be calculated by  $W = \frac{1}{2} LI^2$ , where "L" is the inductance of the component or the system inductance responsible for the transient. "I" would be the current flowing in the inductance during the interruption.
3. The peak current interrupted will determine the clamping voltage. Review the V<sub>I</sub> characteristics to determine if the MOV selected will clamp at the maximum peak voltage required. A larger MOV will provide a lower clamping voltage.

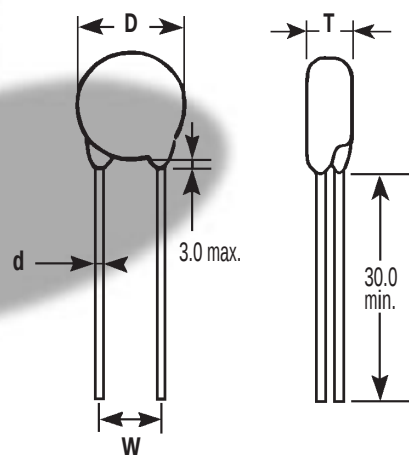
## Note:

Higher voltage MOV selection is acceptable as long as the maximum clamping voltage meets your requirements. Higher energy ratings are also acceptable provided the physical space is available. Under no circumstances is a lower voltage rating MOV to be used.

## Products/Services Available From CKE

1. Complete line of Radial Lead Metal Oxide Varistors (Z-MOVs) and high energy packages
2. Zener Surge Suppressors (Trans Zaps)
3. Selenium Surge Suppressors (Klip-Sels, Voltraps)
4. Selenium Rectifier Assemblies
5. Custom Silicon Rectifier Assemblies
6. Custom Surge Suppressors
7. Engineering and technical assistance

## Dimensions



**TABLE 1 STANDARD ENERGY SERIES LOW VOLTAGE MOVs**

| CKE<br>Part Number | Marking<br>On Part | Max Applied<br>Contin. Volt |     | Varistor Voltage<br>@ 1 ma DC | Energy<br>2ms | Max. Clamping<br>Voltage 8/20 $\mu$ s |      | Peak<br>Current | Typical<br>Capacitance | Dimensions |            |      |     |
|--------------------|--------------------|-----------------------------|-----|-------------------------------|---------------|---------------------------------------|------|-----------------|------------------------|------------|------------|------|-----|
|                    |                    | AC                          | DC  | DC Volts                      | Joules        | Volts                                 | Amps | Amps            | pF                     | D-Max      | $\pm 1$ mm |      | d   |
| Z5L180             | 180                | 11                          | 14  | 18(16-20)                     | 0.3           | 40                                    | 1    | 100             | 1600                   | 7.5        | 3.5        | 5.0  | 0.6 |
| Z5L220             | 220                | 14                          | 18  | 22(20-24)                     | 0.4           | 48                                    | 1    | 100             | 1300                   | 7.5        | 3.5        | 5.0  | 0.6 |
| Z5L270             | 270                | 17                          | 22  | 27(24-30)                     | 0.5           | 60                                    | 1    | 100             | 1050                   | 7.5        | 3.5        | 5.0  | 0.6 |
| Z5L330             | 330                | 20                          | 26  | 33(30-36)                     | 0.6           | 73                                    | 1    | 100             | 900                    | 7.5        | 3.5        | 5.0  | 0.6 |
| Z5L390             | 390                | 25                          | 31  | 39(35-43)                     | 0.8           | 86                                    | 1    | 100             | 500                    | 7.5        | 3.5        | 5.0  | 0.6 |
| Z5L470             | 470                | 30                          | 38  | 47(42-52)                     | 1.0           | 104                                   | 1    | 100             | 450                    | 7.5        | 3.5        | 5.0  | 0.6 |
| Z5L560             | 560                | 35                          | 45  | 56(50-62)                     | 1.0           | 123                                   | 1    | 100             | 400                    | 7.5        | 3.5        | 5.0  | 0.6 |
| Z5L680             | 680                | 40                          | 56  | 68(61-75)                     | 1.2           | 150                                   | 1    | 100             | 350                    | 7.5        | 3.5        | 5.0  | 0.6 |
| Z5L820             | 820                | 50                          | 65  | 82(74-90)                     | 1.7           | 145                                   | 5    | 400             | 250                    | 7.5        | 3.5        | 5.0  | 0.6 |
| Z5L101             | 101                | 60                          | 85  | 100(90-110)                   | 2.0           | 175                                   | 5    | 400             | 200                    | 7.0        | 3.7        | 5.0  | 0.6 |
| Z5L121             | 121                | 75                          | 100 | 120(108-132)                  | 2.5           | 210                                   | 5    | 400             | 170                    | 7.0        | 3.8        | 5.0  | 0.6 |
| Z5L151             | 151                | 95                          | 125 | 150(135-165)                  | 3.0           | 260                                   | 5    | 400             | 140                    | 7.0        | 4.0        | 5.0  | 0.6 |
| ⚡ Z5L181           | 181                | 115                         | 153 | 180(162-198)                  | 3.5           | 300                                   | 5    | 400             | 100                    | 7.0        | 4.1        | 5.0  | 0.6 |
| ⚡ Z5L201           | 201                | 130                         | 170 | 200(185-225)                  | 4.0           | 355                                   | 5    | 400             | 80                     | 7.0        | 4.2        | 5.0  | 0.6 |
| ⚡ Z5L221           | 221                | 140                         | 180 | 220(198-242)                  | 4.5           | 380                                   | 5    | 400             | 70                     | 7.0        | 4.3        | 5.0  | 0.6 |
| ⚡ Z5L241           | 241                | 150                         | 200 | 240(216-264)                  | 5.0           | 415                                   | 5    | 400             | 70                     | 7.0        | 4.4        | 5.0  | 0.6 |
| ⚡ Z5L271           | 271                | 175                         | 225 | 270(243-297)                  | 6.0           | 475                                   | 5    | 400             | 60                     | 7.0        | 4.6        | 5.0  | 0.6 |
| ⚡ Z5L331           | 331                | 210                         | 275 | 330(297-363)                  | 6.5           | 580                                   | 5    | 400             | 55                     | 7.0        | 4.9        | 5.0  | 0.6 |
| ⚡ Z5L361           | 361                | 230                         | 300 | 360(324-396)                  | 7.5           | 620                                   | 5    | 400             | 50                     | 7.0        | 5.1        | 5.0  | 0.6 |
| ⚡ Z5L391           | 391                | 250                         | 320 | 390(351-429)                  | 8.0           | 675                                   | 5    | 400             | 50                     | 7.0        | 5.4        | 5.0  | 0.6 |
| ⚡ Z5L431           | 431                | 275                         | 350 | 430(387-473)                  | 9.0           | 745                                   | 5    | 400             | 45                     | 7.0        | 5.7        | 5.0  | 0.6 |
| ⚡ Z5L471           | 471                | 300                         | 385 | 470(423-517)                  | 10.0          | 810                                   | 5    | 400             | 40                     | 7.0        | 6.0        | 5.0  | 0.6 |
| Z7L180             | 7L180              | 11                          | 14  | 18(16-20)                     | 0.8           | 36                                    | 2.5  | 250             | 3500                   | 9.0        | 3.5        | 5.0  | 0.6 |
| Z7L220             | 7L220              | 14                          | 18  | 22(20-24)                     | 0.9           | 43                                    | 2.5  | 250             | 2800                   | 9.0        | 3.6        | 5.0  | 0.6 |
| Z7L270             | 7L270              | 17                          | 22  | 27(24-30)                     | 1.0           | 53                                    | 2.5  | 250             | 2000                   | 9.0        | 3.7        | 5.0  | 0.6 |
| Z7L330             | 7L330              | 20                          | 26  | 33(30-36)                     | 1.2           | 65                                    | 2.5  | 250             | 1500                   | 9.0        | 3.9        | 5.0  | 0.6 |
| Z7L390             | 7L390              | 25                          | 31  | 39(35-43)                     | 1.5           | 77                                    | 2.5  | 250             | 1350                   | 9.0        | 3.8        | 5.0  | 0.6 |
| Z7L470             | 7L470              | 30                          | 38  | 47(42-52)                     | 1.8           | 90                                    | 2.5  | 250             | 1150                   | 9.0        | 3.9        | 5.0  | 0.6 |
| Z7L560             | 7L560              | 35                          | 45  | 56(50-62)                     | 2.3           | 105                                   | 2.5  | 250             | 950                    | 9.0        | 4.0        | 5.0  | 0.6 |
| Z7L680             | 7L680              | 40                          | 56  | 68(61-75)                     | 3.0           | 125                                   | 2.5  | 250             | 700                    | 9.0        | 4.2        | 5.0  | 0.6 |
| Z7L820             | 7L820              | 50                          | 65  | 82(74-90)                     | 4.0           | 135                                   | 10.0 | 1200            | 550                    | 9.0        | 3.6        | 5.0  | 0.6 |
| ⚡ Z7L101           | 7L101              | 60                          | 85  | 100(90-110)                   | 5.0           | 165                                   | 10.0 | 1200            | 500                    | 9.0        | 3.7        | 5.0  | 0.6 |
| ⚡ Z7L121           | 7L121              | 75                          | 100 | 120(108-132)                  | 6.0           | 200                                   | 10.0 | 1200            | 450                    | 9.0        | 3.8        | 5.0  | 0.6 |
| Z7L151             | 7L151              | 95                          | 125 | 150(135-165)                  | 8.0           | 250                                   | 10.0 | 1200            | 350                    | 9.0        | 4.0        | 5.0  | 0.6 |
| ⚡ Z7L181           | 7L181              | 115                         | 153 | 180(162-198)                  | 10.0          | 300                                   | 10.0 | 1200            | 220                    | 9.0        | 4.1        | 5.0  | 0.6 |
| Z10L180            | 10L180             | 11                          | 14  | 18(16-20)                     | 1.5           | 36                                    | 5    | 500             | 7500                   | 13.5       | 3.6        | 7.5  | 0.8 |
| Z10L220            | 10L220             | 14                          | 18  | 22(20-24)                     | 2.0           | 43                                    | 5    | 500             | 6000                   | 13.5       | 3.7        | 7.5  | 0.8 |
| Z10L270            | 10L270             | 17                          | 22  | 27(24-30)                     | 2.5           | 53                                    | 5    | 500             | 4000                   | 13.5       | 3.8        | 7.5  | 0.8 |
| Z10L330            | 10L330             | 20                          | 26  | 33(30-36)                     | 3.0           | 65                                    | 5    | 500             | 3000                   | 13.5       | 4.0        | 7.5  | 0.8 |
| Z10L390            | 10L390             | 25                          | 31  | 39(35-43)                     | 3.5           | 77                                    | 5    | 500             | 2600                   | 13.5       | 4.1        | 7.5  | 0.8 |
| Z10L470            | 10L470             | 30                          | 38  | 47(42-52)                     | 4.5           | 90                                    | 5    | 500             | 2200                   | 13.5       | 4.0        | 7.5  | 0.8 |
| Z10L560            | 10L560             | 35                          | 45  | 56(50-62)                     | 5.5           | 105                                   | 5    | 500             | 1800                   | 13.5       | 4.1        | 7.5  | 0.8 |
| Z10L680            | 10L680             | 40                          | 56  | 68(61-75)                     | 6.5           | 125                                   | 5    | 500             | 1300                   | 13.5       | 4.3        | 7.5  | 0.8 |
| Z10L820            | 10L820             | 50                          | 65  | 82(74-90)                     | 8.0           | 135                                   | 25   | 2500            | 1800                   | 13.5       | 4.0        | 7.5  | 0.8 |
| Z10L101            | 10L101             | 60                          | 85  | 100(90-110)                   | 10.0          | 165                                   | 25   | 2500            | 1400                   | 13.5       | 4.1        | 7.5  | 0.8 |
| Z10L121            | 10L121             | 75                          | 100 | 120(108-132)                  | 12.0          | 200                                   | 25   | 2500            | 1100                   | 13.5       | 4.2        | 7.5  | 0.8 |
| ⚡ Z10L151          | 10L151             | 95                          | 125 | 150(135-165)                  | 16.0          | 250                                   | 25   | 2500            | 900                    | 13.5       | 4.5        | 7.5  | 0.8 |
| Z10L181            | 10L181             | 115                         | 153 | 180(162-198)                  | 18.0          | 300                                   | 25   | 2500            | 550                    | 13.5       | 4.5        | 7.5  | 0.8 |
| Z15L180            | Z15L180            | 11                          | 14  | 18(16-20)                     | 3.5           | 36                                    | 10   | 1000            | 18000                  | 17.0       | 3.6        | 7.5  | 0.8 |
| Z15L220            | Z15L220            | 14                          | 18  | 22(20-24)                     | 4.0           | 43                                    | 10   | 1000            | 15000                  | 17.0       | 3.7        | 7.5  | 0.8 |
| Z15L270            | Z15L270            | 17                          | 22  | 27(24-30)                     | 5.0           | 53                                    | 10   | 1000            | 10000                  | 17.0       | 3.8        | 7.5  | 0.8 |
| Z15L330            | Z15L330            | 20                          | 26  | 33(30-36)                     | 6.0           | 65                                    | 10   | 1000            | 7500                   | 17.0       | 4.0        | 7.5  | 0.8 |
| Z15L390            | Z15L390            | 25                          | 31  | 39(35-43)                     | 7.2           | 77                                    | 10   | 1000            | 6500                   | 17.0       | 4.1        | 7.5  | 0.8 |
| Z15L470            | Z15L470            | 30                          | 38  | 47(42-52)                     | 8.8           | 90                                    | 10   | 1000            | 5500                   | 17.0       | 4.0        | 7.5  | 0.8 |
| Z15L560            | Z15L560            | 35                          | 45  | 56(50-62)                     | 10.0          | 105                                   | 10   | 1000            | 4500                   | 17.0       | 4.1        | 7.5  | 0.8 |
| Z15L680            | Z15L680            | 40                          | 56  | 68(61-75)                     | 13.0          | 125                                   | 10   | 1000            | 3300                   | 17.0       | 4.3        | 7.5  | 0.8 |
| Z15L820            | Z15L820            | 50                          | 65  | 82(74-90)                     | 14.5          | 135                                   | 50   | 4500            | 2900                   | 17.0       | 4.0        | 7.5  | 0.8 |
| Z15L101            | Z15L101            | 60                          | 85  | 100(90-110)                   | 20.0          | 165                                   | 50   | 4500            | 2400                   | 17.0       | 4.1        | 7.5  | 0.8 |
| Z15L121            | Z15L121            | 75                          | 100 | 120(108-132)                  | 22.0          | 200                                   | 50   | 4500            | 1900                   | 17.0       | 4.2        | 7.5  | 0.8 |
| Z15L151            | Z15L151            | 95                          | 125 | 150(135-165)                  | 30.0          | 250                                   | 50   | 4500            | 1500                   | 17.0       | 4.5        | 7.5  | 0.8 |
| ⚡ Z15L181          | Z15L181            | 115                         | 153 | 180(162-198)                  | 35.0          | 300                                   | 50   | 4500            | 1200                   | 17.0       | 4.5        | 7.5  | 0.8 |
| Z21L180            | Z21L180            | 11                          | 14  | 18(16-20)                     | 10.0          | 36                                    | 20   | 2000            | 18000                  | 23.0       | 4.1        | 10.0 | 1.0 |
| Z21L220            | Z21L220            | 14                          | 18  | 22(20-24)                     | 13.0          | 43                                    | 20   | 2000            | 15000                  | 23.0       | 4.2        | 10.0 | 1.0 |
| Z21L270            | Z21L270            | 17                          | 22  | 27(24-30)                     | 15.0          | 53                                    | 20   | 2000            | 10000                  | 23.0       | 4.3        | 10.0 | 1.0 |
| Z21L330            | Z21L330            | 20                          | 26  | 33(30-36)                     | 20.0          | 65                                    | 20   | 2000            | 7500                   | 23.0       | 4.5        | 10.0 | 1.0 |
| Z21L390            | Z21L390            | 25                          | 31  | 39(35-43)                     | 24.0          | 77                                    | 20   | 2000            | 6500                   | 23.0       | 4.5        | 10.0 | 1.0 |
| Z21L470            | Z21L470            | 30                          | 38  | 47(42-52)                     | 30.0          | 90                                    | 20   | 2000            | 5500                   | 23.0       | 4.6        | 10.0 | 1.0 |
| Z21L560            | Z21L560            | 35                          | 45  | 56(50-62)                     | 35.0          | 105                                   | 20   | 2000            | 4500                   | 23.0       | 4.7        | 10.0 | 1.0 |
| Z21L680            | Z21L680            | 40                          | 56  | 68(61-75)                     | 40.0          | 125                                   | 20   | 2000            | 3300                   | 23.0       | 4.8        | 10.0 | 1.0 |
| Z21L820            | Z21L820            | 50                          | 65  | 82(74-90)                     | 27.0          | 135                                   | 100  | 6500            | 2900                   | 23.0       | 4.5        | 10.0 | 1.0 |
| Z21L101            | Z21L101            | 60                          | 85  | 100(90-110)                   | 30.0          | 165                                   | 100  | 6500            | 2400                   | 23.0       | 4.6        | 10.0 | 1.0 |
| Z21L121            | Z21L121            | 75                          | 100 | 120(108-132)                  | 40.0          | 200                                   | 100  | 6500            | 1190                   | 23.0       | 4.7        | 10.0 | 1.0 |
| Z21L151            | Z21L151            | 95                          | 125 | 150(135-165)                  | 50.0          | 250                                   | 100  | 6500            | 1500                   | 23.0       | 4.9        | 10.0 | 1.0 |
| ⚡ Z21L181          | Z21L181            | 115                         | 153 | 180(162-198)                  | 60.0          | 300                                   | 100  | 6500            | 1200                   | 23.0       | 4.9        | 10.0 | 1.0 |

**TABLE 2 STANDARD ENERGY SERIES LINE VOLTAGE MOVs**

| CKE<br>Part Number                                                                            | Marking<br>On Part | Max Applied<br>Contin. Volt |      | Varistor Voltage<br>@ 1 ma DC | Energy<br>2ms | Max. Clamping<br>Voltage 8/20 $\mu$ s |      | Peak<br>Current | Typical<br>Capacitance | Dimensions |            |      |     |
|-----------------------------------------------------------------------------------------------|--------------------|-----------------------------|------|-------------------------------|---------------|---------------------------------------|------|-----------------|------------------------|------------|------------|------|-----|
|                                                                                               |                    | AC                          | DC   | DC Volts                      | Joules        | Volts                                 | Amps | Amps            | pF                     | D-Max      | $\pm 1$ mm |      | d   |
|                                                                                               |                    |                             |      |                               |               |                                       |      |                 |                        |            | T          | W    |     |
|  Z130LA2     | 1302               | 130                         | 170  | 200(185-225)                  | 11            | 340                                   | 10   | 1200            | 250                    | 9.0        | 4.2        | 5.0  | 0.6 |
|  Z130LA5     | 1305               | 130                         | 170  | 200(185-225)                  | 20            | 340                                   | 25   | 2500            | 500                    | 13.5       | 4.6        | 7.5  | 0.8 |
|  Z130LA10A   | Z130LA10A          | 130                         | 170  | 200(185-225)                  | 38            | 340                                   | 50   | 4500            | 1000                   | 17.0       | 4.6        | 7.5  | 0.8 |
|  Z130LA20A   | Z130LA20A          | 130                         | 170  | 200(185-225)                  | 70            | 340                                   | 100  | 6500            | 2000                   | 23.0       | 5.0        | 10.0 | 1.0 |
|  Z140LA2     | 1402               | 140                         | 180  | 220(198-242)                  | 12            | 360                                   | 10   | 1200            | 250                    | 9.0        | 4.3        | 5.0  | 0.6 |
|  Z140LA5     | 1405               | 140                         | 180  | 220(198-242)                  | 23            | 360                                   | 25   | 2500            | 450                    | 13.5       | 4.7        | 7.5  | 0.8 |
|  Z140LA10A   | Z140LA10A          | 140                         | 180  | 220(198-242)                  | 42            | 360                                   | 50   | 4500            | 1000                   | 17.0       | 4.7        | 7.5  | 0.8 |
|  Z140LA20A   | Z140LA20A          | 140                         | 180  | 220(198-242)                  | 75            | 360                                   | 100  | 6500            | 2000                   | 23.0       | 5.2        | 10.0 | 1.0 |
|  Z150LA2     | 1502               | 150                         | 200  | 240(216-264)                  | 13            | 395                                   | 10   | 1200            | 200                    | 9.0        | 4.4        | 5.0  | 0.6 |
|  Z150LA5     | 1505               | 150                         | 200  | 240(216-264)                  | 25            | 395                                   | 25   | 2500            | 400                    | 13.5       | 4.8        | 7.5  | 0.8 |
|  Z150LA10A   | Z150LA10A          | 150                         | 200  | 240(216-264)                  | 45            | 395                                   | 50   | 4500            | 900                    | 17.0       | 4.8        | 7.5  | 0.8 |
|  Z150LA20A   | Z150LA20A          | 150                         | 200  | 240(216-264)                  | 80            | 395                                   | 100  | 6500            | 1800                   | 23.0       | 5.3        | 10.0 | 1.0 |
|  Z175LA2     | 1752               | 175                         | 225  | 270(247-303)                  | 15            | 455                                   | 10   | 1200            | 170                    | 9.0        | 4.6        | 5.0  | 0.6 |
|  Z175LA5     | 1755               | 175                         | 225  | 270(247-303)                  | 30            | 455                                   | 25   | 2500            | 350                    | 13.5       | 5.0        | 7.5  | 0.8 |
|  Z175LA10A   | Z175LA10A          | 175                         | 225  | 270(247-303)                  | 55            | 455                                   | 50   | 4500            | 750                    | 17.0       | 5.1        | 7.5  | 0.8 |
|  Z175LA20A   | Z175LA20A          | 175                         | 225  | 270(247-303)                  | 90            | 455                                   | 100  | 6500            | 1600                   | 23.0       | 5.4        | 10.0 | 1.0 |
| Z210LA4                                                                                       | 2104               | 210                         | 275  | 330(297-363)                  | 15            | 550                                   | 10   | 1200            | 140                    | 9.0        | 4.8        | 5.0  | 0.6 |
| Z210LA10                                                                                      | 210L               | 210                         | 275  | 330(297-363)                  | 32            | 550                                   | 25   | 2500            | 300                    | 13.5       | 5.2        | 7.5  | 0.8 |
| Z210LA20A                                                                                     | Z210LA20A          | 210                         | 275  | 330(297-363)                  | 60            | 550                                   | 50   | 4500            | 650                    | 17.0       | 5.3        | 7.5  | 0.8 |
| Z210LA40A                                                                                     | Z210LA20A          | 210                         | 275  | 330(297-363)                  | 105           | 550                                   | 100  | 6500            | 1400                   | 23.0       | 5.5        | 10.0 | 1.0 |
|  Z230LA4     | 2304               | 230                         | 300  | 360(324-396)                  | 15            | 595                                   | 10   | 1200            | 130                    | 9.0        | 5.2        | 5.0  | 0.6 |
|  Z230LA10    | 230L               | 230                         | 300  | 360(324-396)                  | 35            | 595                                   | 25   | 2500            | 300                    | 14.0       | 5.7        | 7.5  | 0.8 |
|  Z230LA20A   | Z230LA20A          | 230                         | 300  | 360(324-396)                  | 65            | 595                                   | 50   | 4500            | 550                    | 17.5       | 5.7        | 7.5  | 0.8 |
|  Z230LA40A   | Z230LA40A          | 230                         | 300  | 360(324-396)                  | 120           | 595                                   | 100  | 6500            | 1200                   | 24.0       | 6.1        | 10.0 | 1.0 |
|  Z250LA4     | 2504               | 250                         | 330  | 390(351-429)                  | 21            | 650                                   | 10   | 1200            | 130                    | 9.0        | 5.4        | 5.0  | 0.6 |
|  Z250LA10    | 250L               | 250                         | 330  | 390(351-429)                  | 40            | 650                                   | 25   | 2500            | 270                    | 14.0       | 5.8        | 7.5  | 0.8 |
|  Z250LA20A   | Z250LA20A          | 250                         | 330  | 390(351-429)                  | 72            | 650                                   | 50   | 4500            | 500                    | 17.5       | 5.8        | 7.5  | 0.8 |
|  Z250LA40A   | Z250LA40A          | 250                         | 330  | 390(351-429)                  | 130           | 650                                   | 100  | 6500            | 1000                   | 24.0       | 6.4        | 10.0 | 1.0 |
|  Z275LA4     | 2754               | 275                         | 350  | 430(387-473)                  | 23            | 710                                   | 10   | 1200            | 110                    | 9.0        | 5.7        | 5.0  | 0.6 |
|  Z275LA10    | 275L               | 275                         | 350  | 430(387-473)                  | 45            | 710                                   | 25   | 2500            | 250                    | 14.0       | 6.2        | 7.5  | 0.8 |
|  Z275LA20A | Z275LA20A          | 275                         | 350  | 430(387-473)                  | 75            | 710                                   | 50   | 4500            | 450                    | 17.5       | 6.2        | 7.5  | 0.8 |
|  Z275LA40A | Z275LA40A          | 275                         | 350  | 430(387-473)                  | 140           | 710                                   | 100  | 6500            | 900                    | 24.0       | 6.7        | 10.0 | 1.0 |
|  Z300LA4   | 3004               | 300                         | 385  | 470(423-517)                  | 25            | 775                                   | 10   | 1200            | 100                    | 9.0        | 6.0        | 5.0  | 0.6 |
|  Z300LA10  | 300L               | 300                         | 385  | 470(423-517)                  | 45            | 775                                   | 25   | 2500            | 230                    | 14.0       | 6.2        | 7.5  | 0.8 |
|  Z300LA20A | Z300LA20A          | 300                         | 385  | 470(423-517)                  | 80            | 775                                   | 50   | 4500            | 440                    | 17.5       | 6.2        | 7.5  | 0.8 |
|  Z300LA40A | Z300LA40A          | 300                         | 385  | 470(423-517)                  | 150           | 775                                   | 100  | 6500            | 900                    | 24.0       | 6.7        | 10.0 | 1.0 |
| Z350LA10                                                                                      | 350L               | 350                         | 455  | 560(504-616)                  | 45            | 925                                   | 25   | 2500            | 180                    | 14.0       | 6.1        | 7.5  | 0.8 |
| Z350LA20A                                                                                     | Z350LA20A          | 350                         | 455  | 560(504-616)                  | 80            | 925                                   | 50   | 4500            | 350                    | 17.5       | 6.3        | 7.5  | 0.8 |
| Z350LA40A                                                                                     | Z350LA40A          | 350                         | 455  | 560(504-616)                  | 150           | 925                                   | 100  | 6500            | 700                    | 24.0       | 6.8        | 10.0 | 1.0 |
| Z385LA10                                                                                      | 385L               | 385                         | 505  | 620(558-682)                  | 45            | 1025                                  | 25   | 2500            | 130                    | 14.0       | 6.2        | 7.5  | 0.8 |
| Z385LA20A                                                                                     | Z385LA20A          | 385                         | 505  | 620(558-682)                  | 85            | 1025                                  | 50   | 4500            | 250                    | 17.5       | 6.5        | 7.5  | 0.8 |
| Z385LA40A                                                                                     | Z385LA40A          | 385                         | 505  | 620(558-682)                  | 150           | 1025                                  | 100  | 6500            | 500                    | 24.0       | 6.9        | 10.0 | 1.0 |
|  Z420LA10  | 420L               | 420                         | 560  | 680(612-748)                  | 45            | 1120                                  | 25   | 2500            | 130                    | 14.0       | 6.5        | 7.5  | 0.8 |
| Z420LA20A                                                                                     | Z420LA20A          | 420                         | 560  | 680(612-748)                  | 90            | 1120                                  | 50   | 4500            | 250                    | 17.5       | 6.5        | 7.5  | 0.8 |
| Z420LA40A                                                                                     | Z420LA40A          | 420                         | 560  | 680(612-748)                  | 160           | 1120                                  | 100  | 6500            | 460                    | 24.0       | 6.9        | 10.0 | 1.0 |
| Z460LA10                                                                                      | 460L               | 460                         | 615  | 750(675-825)                  | 50            | 1240                                  | 25   | 2500            | 120                    | 14.0       | 6.8        | 7.5  | 0.8 |
|  Z460LA20A | Z460LA20A          | 460                         | 615  | 750(675-825)                  | 100           | 1240                                  | 50   | 4500            | 230                    | 17.5       | 6.8        | 7.5  | 0.8 |
| Z460LA40A                                                                                     | Z460LA40A          | 460                         | 615  | 750(675-825)                  | 175           | 1240                                  | 100  | 6500            | 420                    | 24.0       | 7.3        | 10.0 | 1.0 |
|  Z480LA20  | 480L               | 480                         | 640  | 780(702-858)                  | 50            | 1290                                  | 25   | 2500            | 120                    | 14.0       | 6.9        | 7.5  | 0.8 |
|  Z480LA40A | Z480LA40A          | 480                         | 640  | 780(702-858)                  | 105           | 1290                                  | 50   | 4500            | 230                    | 17.5       | 6.9        | 7.5  | 0.8 |
| Z480LA80A                                                                                     | Z480LA80A          | 480                         | 640  | 780(702-858)                  | 180           | 1290                                  | 100  | 6500            | 420                    | 24.0       | 7.4        | 10.0 | 1.0 |
|  Z510LA20  | 510L               | 510                         | 670  | 820(738-902)                  | 55            | 1355                                  | 25   | 2500            | 105                    | 14.0       | 7.1        | 7.5  | 0.8 |
|  Z510LA40A | Z510LA40A          | 510                         | 670  | 820(738-902)                  | 110           | 1355                                  | 50   | 4500            | 200                    | 17.5       | 7.1        | 7.5  | 0.8 |
|  Z510LA80A | Z510LA80A          | 510                         | 670  | 820(738-902)                  | 190           | 1355                                  | 100  | 6500            | 400                    | 24.0       | 7.6        | 10.0 | 1.0 |
| Z550LA20                                                                                      | 550L               | 550                         | 700  | 910(819-1000)                 | 60            | 1500                                  | 25   | 2500            | 95                     | 14.0       | 7.6        | 7.5  | 0.8 |
| Z550LA40A                                                                                     | Z550LA40A          | 550                         | 700  | 910(819-1000)                 | 120           | 1500                                  | 50   | 4500            | 180                    | 17.5       | 7.6        | 7.5  | 0.8 |
| Z550LA80A                                                                                     | Z550LA80A          | 550                         | 700  | 910(819-1000)                 | 220           | 1500                                  | 100  | 6500            | 350                    | 24.0       | 8.1        | 10.0 | 1.0 |
| Z575LA20                                                                                      | 575L               | 575                         | 745  | 920(819-1000)                 | 60            | 1500                                  | 25   | 2500            | 95                     | 14.0       | 7.6        | 7.5  | 0.8 |
| Z575LA40A                                                                                     | Z575LA40A          | 575                         | 745  | 920(819-1000)                 | 120           | 1500                                  | 50   | 4500            | 180                    | 17.5       | 7.6        | 7.5  | 0.8 |
| Z575LA80A                                                                                     | Z575LA80A          | 575                         | 745  | 920(819-1000)                 | 220           | 1500                                  | 100  | 6500            | 350                    | 24.0       | 8.1        | 10.0 | 1.0 |
| Z600LA20                                                                                      | 625L               | 625                         | 825  | 1000(900-1100)                | 65            | 1650                                  | 25   | 2500            | 80                     | 14.0       | 8.0        | 7.5  | 0.8 |
| Z600LA50A                                                                                     | Z600LA50A          | 625                         | 825  | 1000(900-1100)                | 130           | 1650                                  | 50   | 4500            | 150                    | 17.5       | 8.0        | 7.5  | 0.8 |
| Z600LA100A                                                                                    | Z600LA100A         | 625                         | 825  | 1000(900-1100)                | 230           | 1650                                  | 100  | 6500            | 320                    | 24.0       | 8.5        | 10.0 | 1.0 |
| Z660LA20A                                                                                     | 660L               | 680                         | 895  | 1100(990-1210)                | 70            | 1815                                  | 25   | 2500            | 80                     | 14.0       | 8.5        | 7.5  | 0.8 |
| Z660LA50A                                                                                     | Z660LA50A          | 680                         | 895  | 1100(990-1210)                | 140           | 1815                                  | 50   | 4500            | 150                    | 17.5       | 8.5        | 7.5  | 0.8 |
| Z660LA100A                                                                                    | Z660LA100A         | 680                         | 895  | 1100(990-1210)                | 250           | 1815                                  | 100  | 6500            | 300                    | 24.0       | 9.0        | 10.0 | 1.0 |
| Z1000LA80A                                                                                    | Z1000LA80A         | 1000                        | 1465 | 1800(1620-1980)               | 240           | 2970                                  | 50   | 4500            | 100                    | 17.5       | 12.0       | 15.0 | 0.8 |
| Z1000LA160A                                                                                   | Z1000LA160A        | 1000                        | 1465 | 1800(1620-1980)               | 400           | 2970                                  | 100  | 6500            | 200                    | 25.0       | 12.0       | 15.0 | 1.0 |



**TABLE 3 HIGH ENERGY SERIES TRANSIENT VOLTAGE SUPPRESSORS Z33M & Z40M SERIES**

| Type    | Voltage Ratings     |              |                          |       | Energy | Maximum Operating Conditions |       |                                     | Typical Capacitance |
|---------|---------------------|--------------|--------------------------|-------|--------|------------------------------|-------|-------------------------------------|---------------------|
|         | VAC<br>Volts<br>RMS | VDC<br>Volts | Varistor<br>Peak Voltage |       |        | Max. Clamping<br>Voltage     |       | Peak<br>Current<br>(8x20μs)<br>Amps |                     |
|         |                     |              | Min.                     | Max.  |        |                              |       |                                     |                     |
|         |                     |              | Volts                    | Volts |        | Joules                       | Volts | Amp.                                |                     |
| Z33M201 | 130                 | 170          | 180                      | 220   | 210    | 340                          | 200   | 25000                               | 6600                |
| Z33M241 | 150                 | 200          | 216                      | 264   | 240    | 395                          | 200   | 25000                               | 6000                |
| Z33M271 | 175                 | 225          | 243                      | 297   | 255    | 455                          | 200   | 25000                               | 5010                |
| Z33M361 | 230                 | 300          | 324                      | 396   | 325    | 595                          | 200   | 25000                               | 4200                |
| Z33M391 | 250                 | 320          | 351                      | 429   | 350    | 650                          | 200   | 25000                               | 3600                |
| Z33M431 | 275                 | 350          | 387                      | 473   | 400    | 710                          | 200   | 25000                               | 3300                |
| Z33M471 | 300                 | 385          | 423                      | 517   | 405    | 775                          | 200   | 25000                               | 3100                |
| Z33M511 | 320                 | 415          | 459                      | 561   | 415    | 845                          | 200   | 25000                               | 3000                |
| Z33M621 | 385                 | 505          | 558                      | 682   | 425    | 1025                         | 200   | 25000                               | 2640                |
| Z33M681 | 420                 | 560          | 612                      | 748   | 450    | 1120                         | 200   | 25000                               | 2520                |
| Z33M751 | 460                 | 615          | 675                      | 825   | 500    | 1240                         | 200   | 25000                               | 2300                |
| Z33M781 | 485                 | 640          | 702                      | 858   | 520    | 1290                         | 200   | 25000                               | 2300                |
| Z33M821 | 510                 | 670          | 738                      | 902   | 545    | 1355                         | 200   | 25000                               | 2160                |
| Z33M911 | 550                 | 745          | 819                      | 1001  | 600    | 1500                         | 200   | 25000                               | 2100                |
| Z33M102 | 625                 | 825          | 900                      | 1100  | 655    | 1650                         | 200   | 25000                               | 2040                |
| Z33M112 | 680                 | 895          | 990                      | 1210  | 725    | 1815                         | 200   | 25000                               | 1850                |
| Z40M201 | 130                 | 170          | 180                      | 220   | 310    | 340                          | 300   | 40000                               | 13200               |
| Z40M241 | 150                 | 200          | 216                      | 264   | 360    | 395                          | 300   | 40000                               | 12000               |
| Z40M271 | 175                 | 225          | 243                      | 297   | 380    | 455                          | 300   | 40000                               | 10020               |
| Z40M361 | 230                 | 300          | 324                      | 396   | 460    | 595                          | 300   | 40000                               | 8400                |
| Z40M391 | 250                 | 320          | 351                      | 429   | 490    | 650                          | 300   | 40000                               | 7200                |
| Z40M431 | 275                 | 350          | 387                      | 473   | 550    | 710                          | 300   | 40000                               | 6600                |
| Z40M471 | 300                 | 385          | 423                      | 517   | 590    | 775                          | 300   | 40000                               | 6200                |
| Z40M511 | 320                 | 420          | 459                      | 561   | 640    | 845                          | 300   | 40000                               | 6000                |
| Z40M621 | 385                 | 505          | 558                      | 682   | 775    | 1025                         | 300   | 40000                               | 5280                |

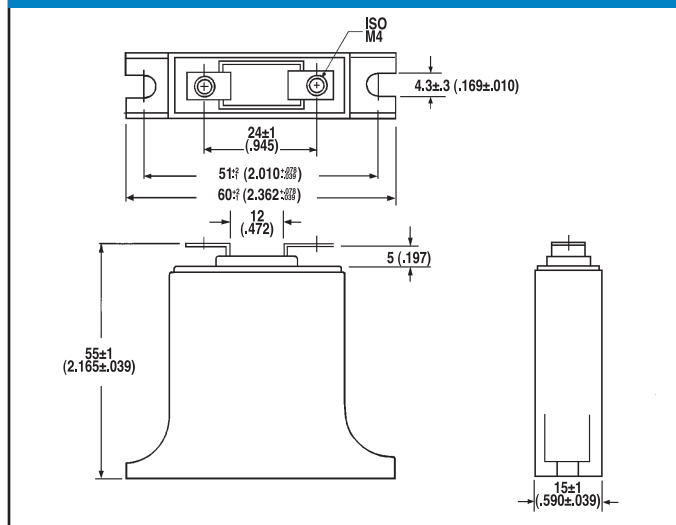
**TABLE 4 HIGH ENERGY SERIES TRANSIENT VOLTAGE SUPPRESSORS PA SERIES**

| Type                       | Voltage Ratings     |              |                          |              | Energy | Maximum Operating Conditions |                                     |       | Typical Capacitance |
|----------------------------|---------------------|--------------|--------------------------|--------------|--------|------------------------------|-------------------------------------|-------|---------------------|
|                            | VAC<br>Volts<br>RMS | VDC<br>Volts | Varistor<br>Peak Voltage |              |        | Max. Clamping<br>Voltage     | Peak<br>Current<br>(8x20μs)<br>Amps |       |                     |
|                            |                     |              | Min.                     | Max.         |        |                              |                                     |       |                     |
|                            |                     |              | Volts                    | Volts        |        |                              |                                     | Volts |                     |
| Z130PA20A<br>Z130PA20C     | 130                 | 175          | 184<br>184               | 243<br>220   | 100    | 360<br>325                   | 100<br>100                          | 6500  | 2400                |
| Z150PA20A<br>Z150PA20C     | 150                 | 200          | 212<br>212               | 284<br>243   | 100    | 420<br>360                   | 100<br>100                          | 6500  | 2000                |
| Z200PA20A                  | 200                 | 260          | 297                      | 363          | 110    | 550                          | 100                                 | 6500  | 1800                |
| Z250PA40A<br>Z250PA40C     | 250                 | 330          | 354<br>354               | 453<br>413   | 130    | 675<br>620                   | 100<br>100                          | 6500  | 1400                |
| Z275PA40A<br>Z275PA40C     | 275                 | 369          | 389<br>389               | 494<br>453   | 140    | 740<br>680                   | 100<br>100                          | 6500  | 1200                |
| Z320PA40A<br>Z320PA40C     | 320                 | 420          | 462<br>462               | 565<br>539   | 160    | 850<br>800                   | 100<br>100                          | 6500  | 1100                |
| Z420PA40A<br>Z420PA40C     | 420                 | 560          | 610<br>610               | 790<br>690   | 160    | 1160<br>1050                 | 100<br>100                          | 6500  | 1000                |
| Z480PA80A<br>Z480PA80C     | 480                 | 640          | 670<br>670               | 860<br>790   | 180    | 1280<br>1160                 | 100<br>100                          | 6500  | 1000                |
| Z510PA80A<br>Z510PA80C     | 510                 | 675          | 735<br>735               | 963<br>860   | 190    | 1410<br>1280                 | 100<br>100                          | 6500  | 1000                |
| Z550PA80A<br>Z550PA80C     | 550                 | 700          | 775<br>775               | 1000<br>960  | 200    | 1500<br>1400                 | 100<br>100                          | 6500  | 900                 |
| Z575PA80A<br>Z575PA80C     | 575                 | 730          | 805<br>805               | 1050<br>960  | 220    | 1560<br>1410                 | 100<br>100                          | 6500  | 900                 |
| Z625PA80A                  | 625                 | 825          | 900                      | 1100         | 230    | 1650                         | 100                                 | 6500  | 800                 |
| Z660PA100A<br>Z660PA100C   | 660                 | 850          | 940<br>940               | 1210<br>1100 | 250    | 1820<br>1650                 | 100<br>100                          | 6500  | 800                 |
| Z1000PA100A<br>Z1000PA100C | 1000                | 1350         | 1460<br>1460             | 1880<br>1720 | 380    | 2800<br>2580                 | 100<br>100                          | 6500  | 600                 |

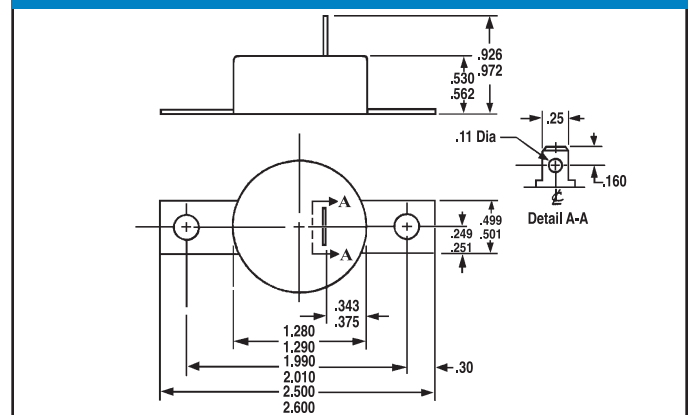
**TABLE 5 HIGH ENERGY SERIES TRANSIENT VOLTAGE SUPPRESSORS EH SERIES**

| Part<br>Number | Continuous     |               |             | Transient Characteristics   |                                           |       |       |                                     |                | Typical<br>Capacitance |
|----------------|----------------|---------------|-------------|-----------------------------|-------------------------------------------|-------|-------|-------------------------------------|----------------|------------------------|
|                | RMS<br>Voltage | DC<br>Voltage | (10/1000μs) | Peak<br>Current<br>(8/20μs) | Varistors<br>@ 1 mA DC<br>Test<br>Current |       |       | Clamping<br>Voltage<br><br>(8/20μs) |                |                        |
|                |                |               |             |                             | Min.                                      | Nom.  | Max.  | V <sub>c</sub>                      | I <sub>p</sub> |                        |
|                |                |               |             |                             |                                           |       |       |                                     |                |                        |
| Volts          | Volts          | Joules        | Amperes     | Volts                       | Volts                                     | Volts | Volts | Volts                               | Amps           | Picofarads             |
| Z130EH4        | 130            | 175           | 200         | 25000                       | 184                                       | 200   | 228   | 330                                 | 200            | 6800                   |
| Z130EH5        | 130            | 175           | 270         | 32000                       | 184                                       | 200   | 228   | 325                                 | 200            | 8500                   |
| Z130EH6        | 130            | 175           | 370         | 40000                       | 184                                       | 200   | 228   | 320                                 | 200            | 10200                  |
| Z150EH4        | 150            | 200           | 220         | 25000                       | 212                                       | 240   | 268   | 385                                 | 200            | 6800                   |
| Z150EH5        | 150            | 200           | 300         | 32000                       | 212                                       | 240   | 268   | 380                                 | 200            | 8500                   |
| Z150EH6        | 150            | 200           | 400         | 40000                       | 212                                       | 240   | 268   | 375                                 | 200            | 10200                  |
| Z250EH4        | 250            | 330           | 330         | 25000                       | 354                                       | 390   | 429   | 635                                 | 200            | 4000                   |
| Z250EH5        | 250            | 330           | 370         | 32000                       | 354                                       | 390   | 429   | 630                                 | 200            | 5000                   |
| Z250EH6        | 250            | 330           | 650         | 40000                       | 354                                       | 390   | 429   | 620                                 | 200            | 6000                   |
| Z275EH4        | 275            | 369           | 360         | 25000                       | 389                                       | 430   | 473   | 690                                 | 200            | 3800                   |
| Z275EH5        | 275            | 369           | 400         | 32000                       | 389                                       | 430   | 473   | 685                                 | 200            | 4750                   |
| Z275EH6        | 275            | 369           | 700         | 40000                       | 389                                       | 430   | 473   | 685                                 | 200            | 5700                   |
| Z320EH4        | 320            | 420           | 390         | 25000                       | 462                                       | 510   | 539   | 830                                 | 200            | 3600                   |
| Z320EH5        | 320            | 420           | 460         | 32000                       | 462                                       | 510   | 539   | 820                                 | 200            | 4500                   |
| Z320EH6        | 320            | 420           | 750         | 40000                       | 462                                       | 510   | 539   | 810                                 | 200            | 5400                   |
| Z420EH4        | 420            | 560           | 400         | 25000                       | 610                                       | 680   | 748   | 1050                                | 200            | 2040                   |
| Z420EH5        | 420            | 560           | 600         | 32000                       | 610                                       | 680   | 748   | 1025                                | 200            | 2720                   |
| Z420EH6        | 420            | 560           | 850         | 40000                       | 610                                       | 680   | 748   | 1000                                | 200            | 3780                   |
| Z480EH4        | 480            | 640           | 450         | 25000                       | 670                                       | 750   | 824   | 1160                                | 200            | 2320                   |
| Z480EH5        | 480            | 640           | 650         | 32000                       | 670                                       | 750   | 824   | 1140                                | 200            | 2900                   |
| Z480EH6        | 480            | 640           | 900         | 40000                       | 670                                       | 750   | 824   | 1120                                | 200            | 3480                   |
| Z510EH4        | 510            | 675           | 500         | 25000                       | 735                                       | 820   | 910   | 1280                                | 200            | 2320                   |
| Z510EH5        | 510            | 675           | 700         | 32000                       | 735                                       | 820   | 910   | 1270                                | 200            | 2900                   |
| Z510EH6        | 510            | 675           | 950         | 40000                       | 735                                       | 820   | 910   | 1250                                | 200            | 3480                   |
| Z575EH4        | 575            | 730           | 550         | 25000                       | 805                                       | 910   | 1005  | 1500                                | 200            | 2320                   |
| Z575EH5        | 575            | 730           | 770         | 32000                       | 805                                       | 910   | 1005  | 1490                                | 200            | 2900                   |
| Z575EH6        | 575            | 730           | 1050        | 40000                       | 805                                       | 910   | 1005  | 1480                                | 200            | 3480                   |
| Z600EH4        | 600            | 810           | 575         | 25000                       | 900                                       | 1000  | 1100  | 1650                                | 200            | 1320                   |
| Z600EH5        | 600            | 810           | 810         | 32000                       | 900                                       | 1000  | 1100  | 1640                                | 200            | 1640                   |
| Z600EH6        | 600            | 810           | 1100        | 40000                       | 900                                       | 1000  | 1100  | 1620                                | 200            | 1980                   |
| Z660EH4        | 660            | 850           | 600         | 25000                       | 940                                       | 1050  | 1160  | 1780                                | 200            | 1320                   |
| Z660EH5        | 660            | 850           | 900         | 32000                       | 940                                       | 1050  | 1160  | 1760                                | 200            | 1640                   |
| Z660EH6        | 660            | 850           | 1250        | 40000                       | 940                                       | 1050  | 1160  | 1740                                | 200            | 1980                   |

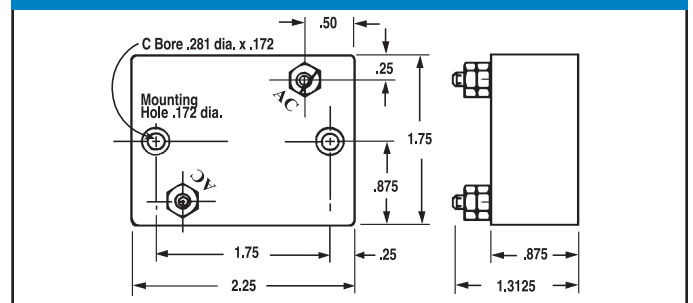
### Z33M & Z40M SERIES



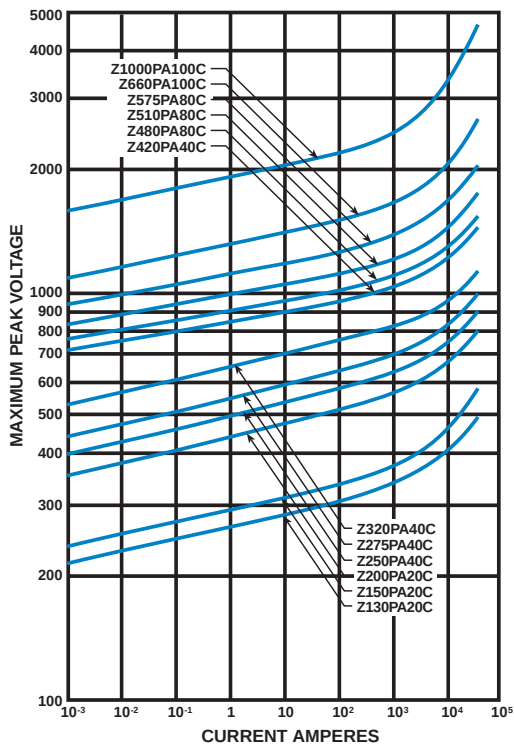
### PA SERIES



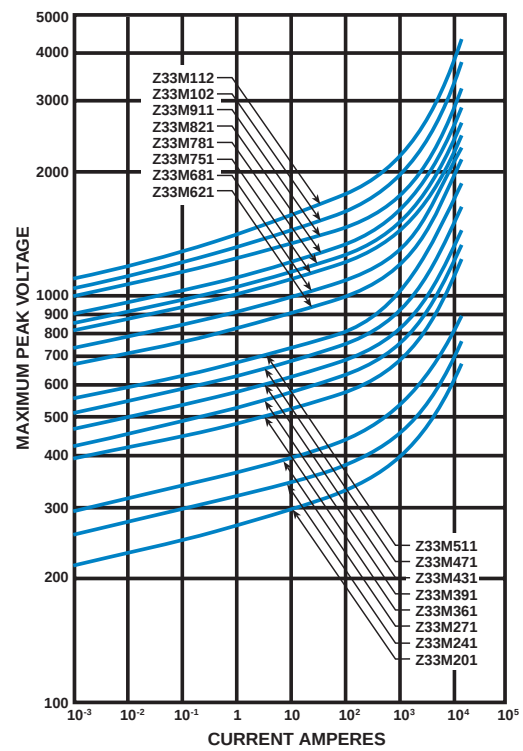
### EH SERIES



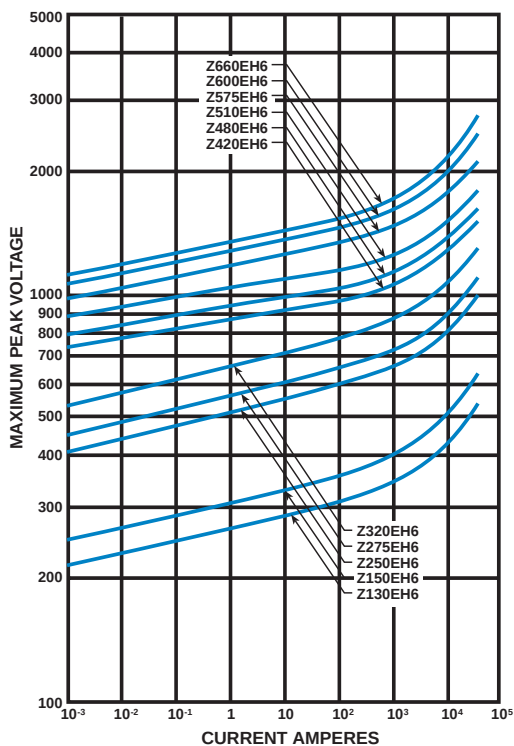
PA Series Voltage VS Current Characteristics



Z33M Series Voltage VS Current Characteristics



EH Series Voltage VS Current Characteristics



Z40M Series Voltage VS Current Characteristics

