

## Varistor Products

### Base Mount

## PA Varistor Series



The PA Series of transient surge suppressors are metal-oxide varistors (MOVs) featuring a rigid base mount package construction, and are useful in applications which are subject to vibration.

These UL and CSA recognized varistors are available in a wide range of operating voltages, from 130V to 660V  $V_{M(AC)RMS}$ . The base-mount package has a quick-connect tab terminal that provides a fast, secure lead attach. The mounting base forms the second electrical connection, usually chassis ground. Meeting rigid NEMA standards, PA series varistors have a creep and strike distance capability that minimizes breakdown along the package surface.

See PA Series Device Ratings and Specifications table for part number and brand information.



### Features

- Wide Operating Voltage Range  
 $V_{M(AC)RMS}$  ..... 130V to 660V
- Creep and Strike Distance Capability Meets Rigid NEMA Standards
- Base Mount Construction Forms One Electrical Connection
- Quick Connect Tab Terminal
- No Derating Up to 85°C Ambient

**AGENCY APPROVALS:** Recognized under the components program of Underwriters Laboratories. Certified by CSA.

**AGENCY FILE NUMBERS:** UL E75961, CSA LR91788.

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**Absolute Maximum Ratings** For ratings of individual members of a series, see Device Ratings and Specifications chart

|  | PA SERIES  | UNITS |
|--|------------|-------|
| Continuous:  |            |       |
| Steady State Applied Voltage:  |            |       |
| AC Voltage Range ( $V_{M(AC)RMS}$ )  | 130 to 660 | V     |
| DC Voltage Range ( $V_{M(DC)}$ )   | 175 to 850 | V     |
| Transient:   |            |       |
| Peak Pulse Current ( $I_{TM}$ )  |            |       |
| For 8/20 $\mu$ s Current Wave (See Figure 2)   | 6500       | A     |
| Single Pulse Energy Range  |            |       |
| For 10/1000 $\mu$ s Current Wave ( $W_{TM}$ )  | 70 to 250  | J     |
| Operating Ambient Temperature Range ( $T_A$ )  | -55 to 85  | °C    |
| Storage Temperature Range ( $T_{STG}$ )  | -55 to 125 | °C    |
| Temperature Coefficient ( $\alpha_V$ ) of Clamping Voltage ( $V_C$ ) at Specified Test Current | <0.01      | %/°C  |

*CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.*

### Device Ratings and Specifications

| PART NUMBER<br>AND DEVICE<br>BRANDING | MAXIMUM RATINGS (85°C) |             |                             |                                   | SPECIFICATIONS (25°C)                         |           |      |  |       |                             |
|---------------------------------------|------------------------|-------------|-----------------------------|-----------------------------------|---|-----------|------|--|-------|-----------------------------|
|                                       | CONTINUOUS             |             | TRANSIENT                   |                                   | VARISTOR VOLTAGE<br>AT 1mA DC<br>TEST CURRENT |           |      | MAX CLAMPING<br>VOLT $V_C$ AT TEST<br>CURRENT (8/20 $\mu$ s) |       | TYPICAL<br>CAPACI-<br>TANCE |
|                                       | $V_{RMS}$              | $V_{DC}$    | ENERGY<br>(10/1000 $\mu$ s) | PEAK<br>CURRENT<br>(8/20 $\mu$ s) |   |           |      |  |       |                             |
|                                       | $V_{M(AC)}$            | $V_{M(DC)}$ | $W_{TM}$                    | $I_{TM}$                          | MIN   | $V_N(DC)$ | MAX  | $V_C$  | $I_p$ | f = 1MHz                    |
| (V)                                   | (V)                    | (J)         | (A)                         | (V)                               | (V)   | (V)       | (V)  | (A)  | (pF)  |                             |
| V130PA20A                             | 130                    | 175         | 70                          | 6500                              | 184   | 200       | 243  | 360  | 100   | 1900                        |
| V130PA20C                             | 130                    | 175         | 70                          | 6500                              | 184   | 200       | 220  | 325  | 100   | 1900                        |
| V150PA20A                             | 150                    | 200         | 80                          | 6500                              | 212   | 240       | 284  | 420  | 100   | 1600                        |
| V150PA20C                             | 150                    | 200         | 80                          | 6500                              | 212   | 240       | 243  | 360  | 100   | 1600                        |
| V250PA40A                             | 250                    | 330         | 130                         | 6500                              | 354   | 390       | 453  | 675  | 100   | 1000                        |
| V250PA40C                             | 250                    | 330         | 130                         | 6500                              | 354   | 390       | 413  | 620  | 100   | 1000                        |
| V275PA40A                             | 275                    | 369         | 140                         | 6500                              | 389   | 430       | 494  | 740  | 100   | 900                         |
| V275PA40C                             | 275                    | 369         | 140                         | 6500                              | 389   | 430       | 453  | 680  | 100   | 900                         |
| V320PA40A                             | 320                    | 420         | 160                         | 6500                              | 462   | 510       | 565  | 850  | 100   | 750                         |
| V320PA40C                             | 320                    | 420         | 160                         | 6500                              | 462   | 510       | 540  | 800  | 100   | 750                         |
| V350PA40A                             | 350                    | 460         | 165                         | 6500                              | 500   | 559       | 618  | 910  | 100   | 700                         |
| V350PA40C                             | 350                    | 460         | 165                         | 6500                              | 500   | 535       | 570  | 840  | 100   | 700                         |
| V420PA40A                             | 420                    | 560         | 170                         | 6500                              | 610   | 680       | 790  | 1160   | 100   | 600                         |
| V420PA40C                             | 420                    | 560         | 170                         | 6500                              | 610   | 680       | 690  | 1050   | 100   | 600                         |
| V480PA80A                             | 480                    | 640         | 180                         | 6500                              | 670   | 750       | 860  | 1280   | 100   | 550                         |
| V480PA80C                             | 480                    | 640         | 180                         | 6500                              | 670   | 750       | 790  | 1160   | 100   | 550                         |
| V510PA80A                             | 510                    | 675         | 190                         | 6500                              | 735   | 820       | 963  | 1410   | 100   | 500                         |
| V510PA80C                             | 510                    | 675         | 190                         | 6500                              | 735   | 820       | 860  | 1280   | 100   | 500                         |
| V575PA80A                             | 575                    | 730         | 220                         | 6500                              | 805   | 910       | 1050 | 1560   | 100   | 450                         |
| V575PA80C                             | 575                    | 730         | 220                         | 6500                              | 805   | 910       | 960  | 1410   | 100   | 450                         |
| V660PA100A                            | 660                    | 850         | 250                         | 6500                              | 940   | 1050      | 1210 | 1820   | 100   | 400                         |

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#### Power Dissipation Ratings

Should transients occur in rapid succession, the average power dissipation required is simply the energy (watt-seconds) per pulse times the number of pulses per second. The power so developed must be within the specifications shown on the Device Ratings and Specifications table for the specific device. Furthermore, the operating values need to be derated at high temperatures as shown in Figure 1. Because varistors can only dissipate a relatively small amount of average power they are, therefore, not suitable for repetitive applications that involve substantial amounts of average power dissipation.

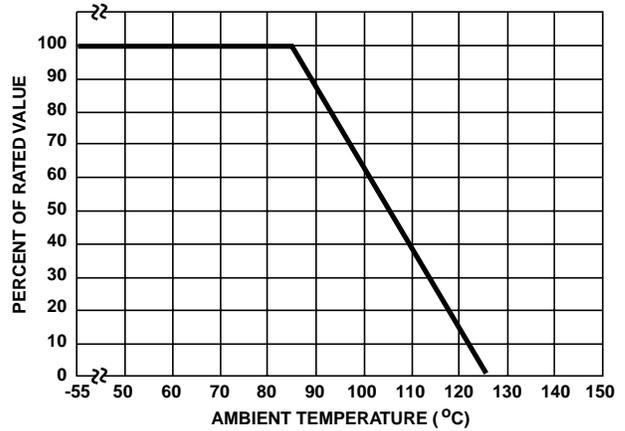


FIGURE 1. CURRENT, ENERGY AND POWER DERATING CURVE

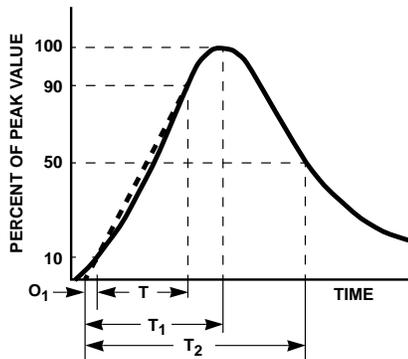


FIGURE 2. PEAK PULSE CURRENT TEST WAVEFORM

$O_1$  = Virtual Origin of Wave  
 $T$  = Time From 10% to 90% of Peak  
 $T_1$  = Virtual Front time =  $1.25 \cdot t$   
 $T_2$  = Virtual Time to Half Value (Impulse Duration)  
 Example: For an 8/20 $\mu$ s Current Waveform:  
 $8\mu$ s =  $T_1$  = Virtual Front Time  
 $20\mu$ s =  $T_2$  = Virtual Time to Half Value

#### Transient V-I Characteristics Curves

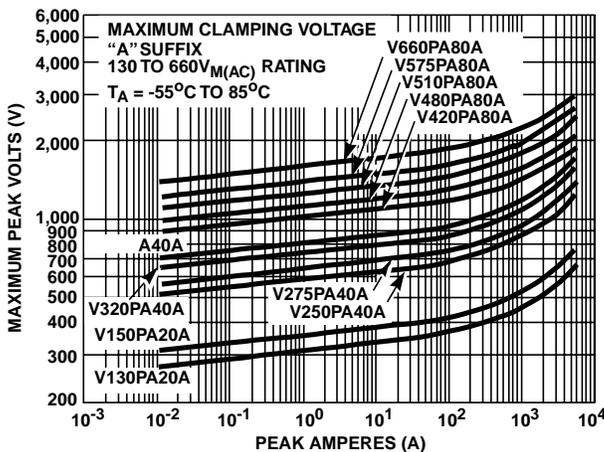


FIGURE 3. CLAMPING VOLTAGE FOR V130PA20A - V660PA100A

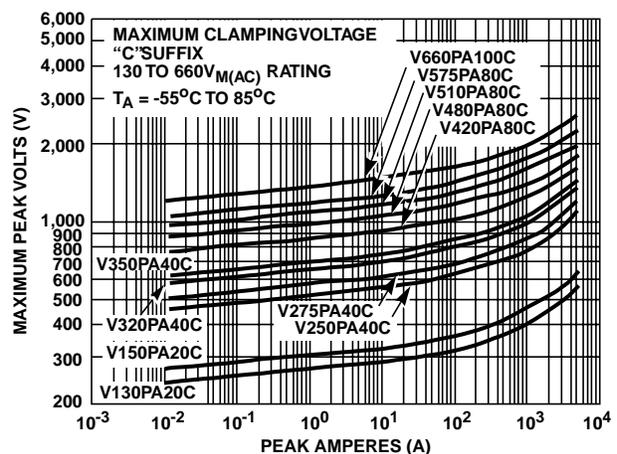


FIGURE 4. CLAMPING VOLTAGE FOR V130PA20C - V660PA100C

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#### Pulse Rating Curves

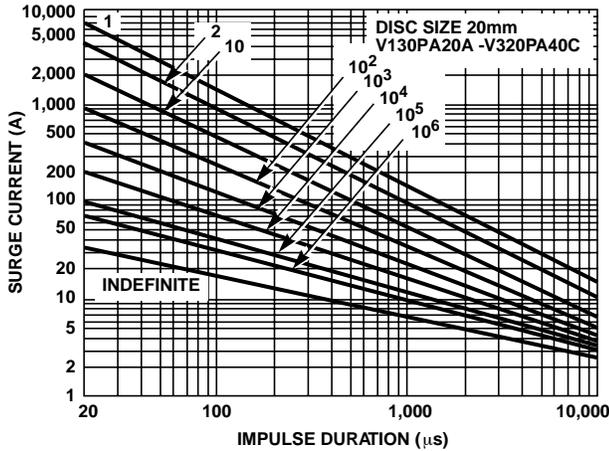


FIGURE 5. SURGE CURRENT RATING CURVES FOR V130PA20A - V320PA40C

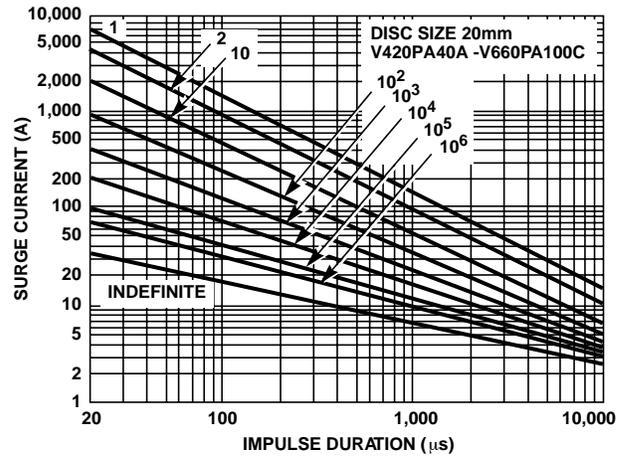
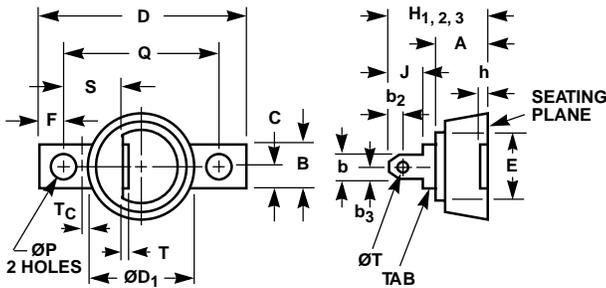


FIGURE 6. SURGE CURRENT RATING CURVES FOR V420PA40A - V660PA100C

NOTE: If pulse ratings are exceeded, a shift of  $V_N(DC)$  (at specified current) of more than  $\pm 10\%$  could result. This type of shift, which normally results in a decrease of  $V_N(DC)$ , may result in the device not meeting the original published specifications, but it does not prevent the device from continuing to function, and to provide transient protection

#### Mechanical Dimensions



NOTES:

1. Tab is designed to fit 1/4" quick-connect terminal.
2. Case temperature is measured at  $T_C$  on top surface of base plate.
3.  $H_1$  (130-150V<sub>RMS</sub> devices).  
 $H_2$  (250-320V<sub>RMS</sub> devices).  
 $H_3$  (420-660V<sub>RMS</sub> devices).
4. Electrical connection: top terminal and base plate.
5. Typical weight: 30g.

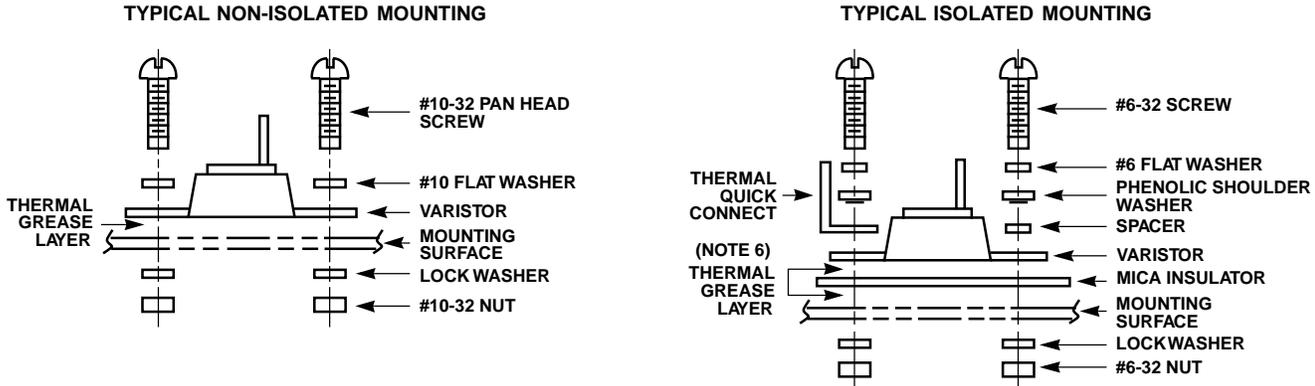
| SYMBOL         | MILLIMETERS |      |      | INCHES |       |       | NOTES |
|----------------|-------------|------|------|--------|-------|-------|-------|
|                | MIN         | NOM  | MAX  | MIN    | NOM   | MAX   |       |
| A              | -           | -    | 14.3 | -      | -     | 0.570 | -     |
| b              | -           | -    | 6.6  | -      | -     | 0.260 | 1     |
| b2             | 3.94        | 4.06 | 4.18 | 0.155  | 0.160 | 0.165 | -     |
| b3             | 3.05        | 3.17 | 3.29 | 0.120  | 0.125 | 0.130 | -     |
| B              | -           | -    | 12.9 | -      | -     | 0.510 | -     |
| C              | -           | -    | 6.6  | -      | -     | 0.260 | -     |
| D              | -           | -    | 66.3 | -      | -     | 2.610 | -     |
| ØD1            | -           | -    | 33.5 | -      | -     | 1.320 | -     |
| E              | -           | 11.2 | -    | -      | 0.440 | -     | -     |
| F              | 7.50        | 7.62 | 7.75 | 0.295  | 0.300 | 0.305 | -     |
| h              | -           | 0.8  | 1.0  | -      | 0.030 | 0.040 | -     |
| H <sub>1</sub> | -           | -    | 25.6 | -      | -     | 1.010 | 3     |
| H <sub>2</sub> | -           | -    | 28.3 | -      | -     | 1.120 | 3     |
| H <sub>3</sub> | -           | -    | 32.8 | -      | -     | 1.290 | 3     |
| J              | -           | -    | 8.1  | -      | -     | 0.320 | -     |
| ØP             | 5.6         | -    | 6.0  | 0.220  | -     | 0.240 | -     |
| Q              | 50.6        | 50.8 | 51.0 | 1.990  | 2.000 | 2.010 | -     |
| S              | 18.4        | 19.2 | 20.0 | 0.72   | 0.75  | 0.78  | -     |
| T              | -           | -    | 1.0  | -      | -     | 0.040 | -     |
| ØT             | 2.8         | -    | -    | 0.110  | -     | -     | -     |
| T <sub>C</sub> | -           | 3.2  | -    | -      | 0.126 | -     | 2     |

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#### Suggested Hardware and Mounting Arrangements



NOTE:

6. GE G623, Dow Corning, DC3, 4, 340, or 640 Thermal Grease recommended for best heat transfer.

**1,000V Isolation Kit containing the following parts can be ordered by part #A7811055 (Qty).**

- |  |                              |                       |                                   |
|--|------------------------------|-----------------------|-----------------------------------|
| (1) MICA insulation 1"/3.1"/0.005" thick | (2) Phenolic shoulder washer | (2) #6-32/3 / 4 screw | (2) #6 internal tooth lock washer |
| (1) 1/4 " quick-connect terminal         | (1) Spacer                   | (2) #6-32 nut         | (2) #6 flat washer                |

#### Ordering Information

