

### BA/BB Varistor Series



The BA and BB Series transient surge suppressors are heavy-duty industrial metal-oxide varistors (MOVs) designed to provide surge protection for motor controls and power supplies used in oil-drilling, mining, transportation equipment and other heavy industrial AC line applications.

These UL-recognized varistors have similar package construction but differ in size and ratings. The BA models are rated from 130 to 880V<sub>M(AC)</sub>. The BB models from 1100 to 2800V<sub>M(AC)</sub>.

Both the BA and BB Series feature improved creep and strike capability to minimize breakdown along the package surface, a package design that provides complete electrical isolation of the disc subassembly, and rigid terminals to insure secure wire contacts.

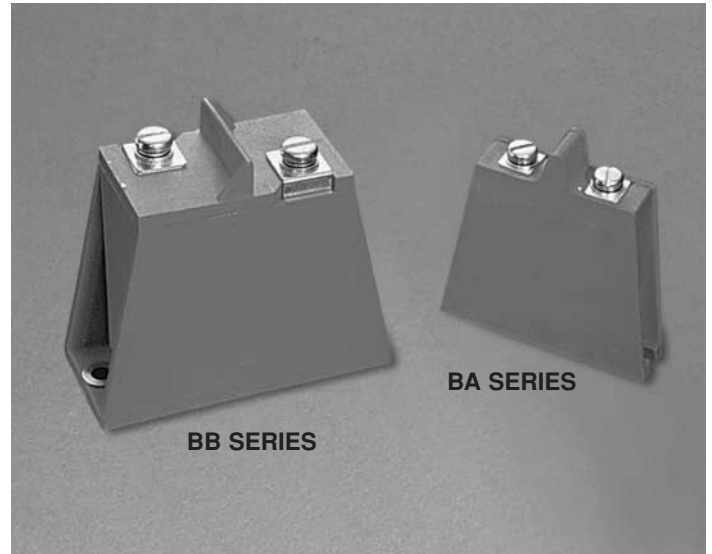
See BA/BB Series Device Ratings and Specifications table for part number and brand information.

#### Features

- High Energy Absorption Capability  $W_{TM}$   
 BA Series ..... 3200J  
 BB Series ..... 10,000J
- Wide Operating Voltage Range  $V_{M(AC)RMS}$   
 BA Series ..... 130V to 880V  
 BB Series ..... 1100V to 2800V
- Rigid Terminals for Secure Wire Contact
- Case Design Provides Complete Electrical Isolation of Disc Subassembly
- Littelfuse Largest Packaged Disc ..... .60mm Diameter
- No Derating Up to 85°C Ambient

**AGENCY APPROVALS:** Recognized under the components program of Underwriters Laboratories (BA Series only).

**AGENCY FILE NUMBERS:** UL E75961.



### BA/BB Varistor Series

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

|   | BA SERIES        | BB SERIES      | UNITS           |
|---|------------------|----------------|-----------------|
| <b>Continuous:</b>  |                  |                |                 |
| Steady State Applied Voltage:   |                  |                |                 |
| AC Voltage Range ( $V_{M(AC)RMS}$ )   | 130 to 880       | 1100 to 2800   | V               |
| DC Voltage Range ( $V_{M(DC)}$ )  | 175 to 1150      | 1400 to 3500   | V               |
| <b>Transient:</b>   |                  |                |                 |
| Peak Pulse Current ( $I_{TM}$ )   |                  |                |                 |
| For 8/20 $\mu$ s Current Wave (See Figure 2)  | 50,000 to 70,000 | 70,000         | A               |
| Single Pulse Energy Range   |                  |                |                 |
| For 2ms Current Squarewave ( $W_{TM}$ )   | 450 to 3200      | 3800 to 10,000 | J               |
| Operating Ambient Temperature Range ( $T_A$ )   | -55 to 85        | -55 to 85      | $^{\circ}$ C    |
| Storage Temperature Range ( $T_{STG}$ )   | -55 to 125       | -55 to 125     | $^{\circ}$ C    |
| Temperature Coefficient ( $\alpha_V$ ) of Clamping Voltage ( $V_C$ ) at Specified           |                  |                |                 |
| Test Current  | <0.01            | <0.01          | %/ $^{\circ}$ C |
| Hi-Pot Encapsulation (Isolation Voltage Capability)   | 5000             | 5000           | V               |
| (Dielectric must withstand indicated DC voltage for one minute per MIL-STD 202, Method 301) |                  |                |                 |
| Insulation Resistance   | 1000             | 1000           | M $\Omega$      |

**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

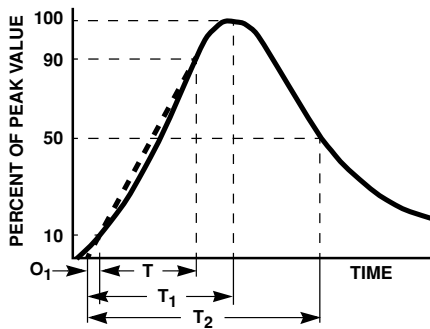
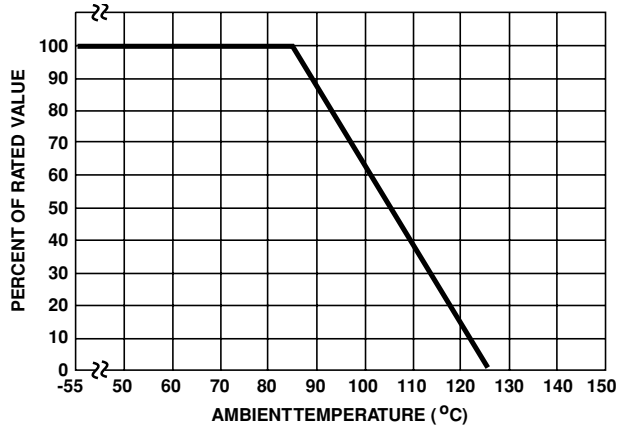
| PART NUMBER<br>AND DEVICE<br>BRANDING | MAXIMUM RATINGS (85 $^{\circ}$ C) |             |                 |                                   | SPECIFICATIONS (25 $^{\circ}$ C)              |             |      |  |                             |
|---------------------------------------|-----------------------------------|-------------|-----------------|-----------------------------------|---|-------------|------|--|-----------------------------|
|                                       | CONTINUOUS                        |             | TRANSIENT       |                                   | VARISTOR VOLTAGE<br>AT 1mA DC<br>TEST CURRENT |             |      | MAX CLAMPING<br>VOLT $V_C$ AT 200A<br>CURRENT (8/20 $\mu$ s) | TYPICAL<br>CAPACI-<br>TANCE |
|                                       | $V_{RMS}$                         | $V_{DC}$    | ENERGY<br>(2ms) | PEAK<br>CURRENT<br>(8/20 $\mu$ s) |   |             |      |  |                             |
|                                       | $V_{M(AC)}$                       | $V_{M(DC)}$ | $W_{TM}$        | $I_{TM}$                          | MIN   | $V_{N(DC)}$ | MAX  | $V_C$  | f = 1MHz                    |
| (V)                                   | (V)                               | (J)         | (A)             | (V)                               | (V)   | (V)         | (V)  | (pF)   |                             |
| V131BA60                              | 130                               | 175         | 450             | 50000                             | 184   | 200         | 228  | 340  | 20000                       |
| V151BA60                              | 150                               | 200         | 530             | 50000                             | 212   | 240         | 268  | 400  | 16000                       |
| V251BA60                              | 250                               | 330         | 880             | 50000                             | 354   | 390         | 429  | 620  | 10000                       |
| V271BA60                              | 275                               | 369         | 950             | 50000                             | 389   | 430         | 473  | 680  | 9000                        |
| V321BA60                              | 320                               | 420         | 1100            | 50000                             | 462   | 510         | 561  | 760  | 7500                        |
| V421BA60                              | 420                               | 560         | 1500            | 70000                             | 610   | 680         | 748  | 1060   | 6000                        |
| V481BA60                              | 480                               | 640         | 1600            | 70000                             | 670   | 750         | 825  | 1160   | 5500                        |
| V511BA60                              | 510                               | 675         | 1800            | 70000                             | 735   | 820         | 910  | 1300   | 5000                        |
| V571BA60                              | 575                               | 730         | 2100            | 70000                             | 805   | 910         | 1000 | 1420   | 4500                        |
| V661BA60                              | 660                               | 850         | 2300            | 70000                             | 940   | 1050        | 1160 | 1640   | 4000                        |
| V751BA60                              | 750                               | 970         | 2600            | 70000                             | 1080  | 1200        | 1320 | 1880   | 3500                        |
| V881BA60                              | 880                               | 1150        | 3200            | 70000                             | 1290  | 1500        | 1650 | 2340   | 2700                        |
| V112BB60                              | 1100                              | 1400        | 3800            | 70000                             | 1620  | 1800        | 2060 | 2940   | 2200                        |
| V142BB60                              | 1400                              | 1750        | 5000            | 70000                             | 2020  | 2200        | 2550 | 3600   | 1800                        |
| V172BB60                              | 1700                              | 2150        | 6000            | 70000                             | 2500  | 2700        | 3030 | 4300   | 1500                        |
| V202BB60                              | 2000                              | 2500        | 7500            | 70000                             | 2970  | 3300        | 3630 | 5200   | 1200                        |
| V242BB60                              | 2400                              | 3000        | 8600            | 70000                             | 3510  | 3900        | 4290 | 6200   | 1000                        |
| V282BB60                              | 2800                              | 3500        | 10000           | 70000                             | 4230  | 4700        | 5170 | 7400   | 800                         |

NOTE: Average power dissipation of transients not to exceed 2.5W. See Figures 3 and 4 for more information on power dissipation.

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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 Characteristics 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.



$O_1$  = 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

FIGURE 2. PEAK PULSE CURRENT TEST WAVEFORM

#### Typical Performance Curves

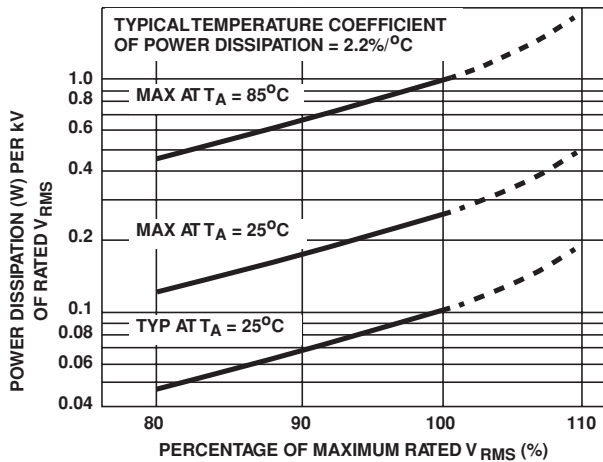


FIGURE 3. STANDBY POWER DISSIPATION vs APPLIED  $V_{RMS}$  AT VARIED TEMPERATURES

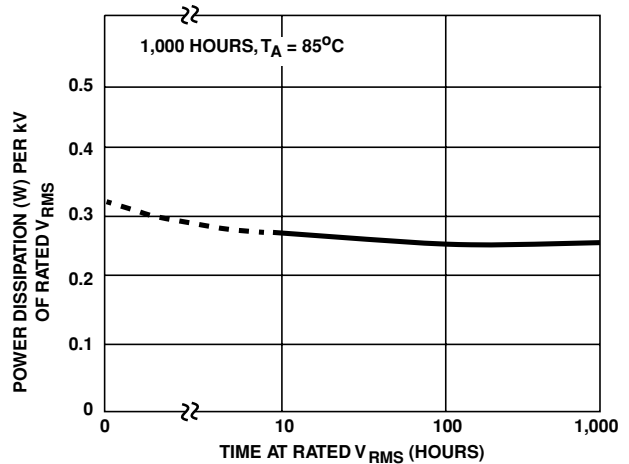


FIGURE 4. TYPICAL STABILITY OF STANDBY POWER DISSIPATION AT RATED  $V_{RMS}$  vs TIME

## BA/BB Varistor Series

### Transient V-I Characteristics Curves

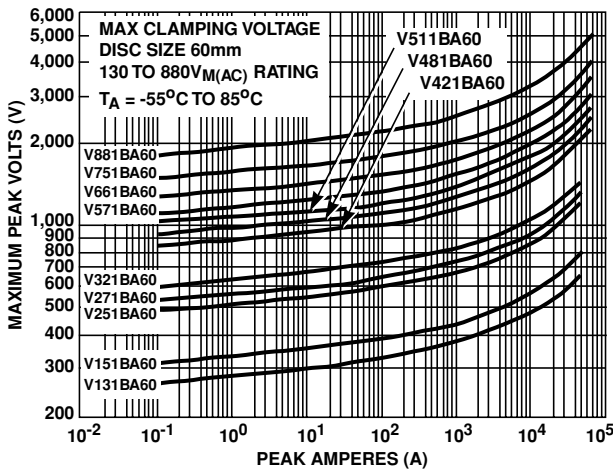


FIGURE 5. CLAMPING VOLTAGE FOR V131BA60 - V881BA60

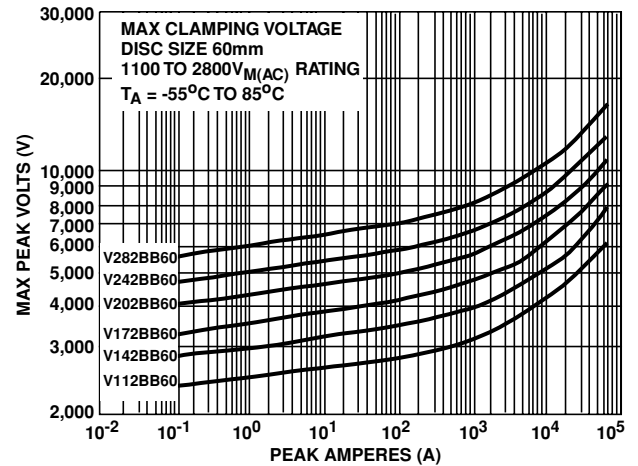


FIGURE 6. CLAMPING VOLTAGE FOR V112BB60 - V282BB60

### Pulse Rating Curves

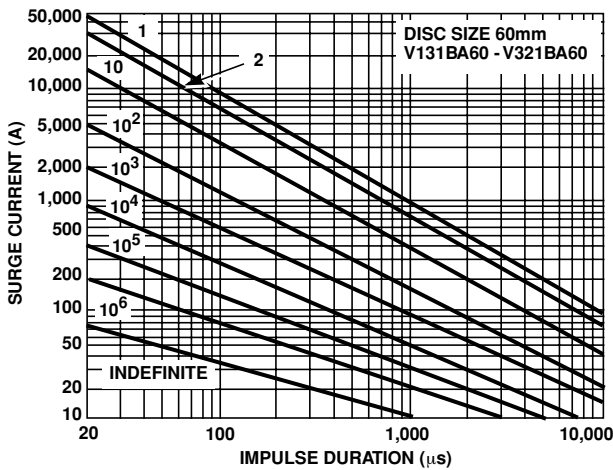


FIGURE 7. SURGE CURRENT RATING CURVES FOR V131BA60 - V321BA60

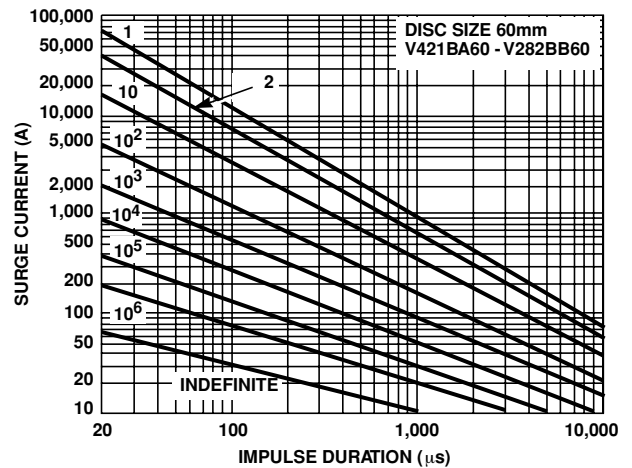


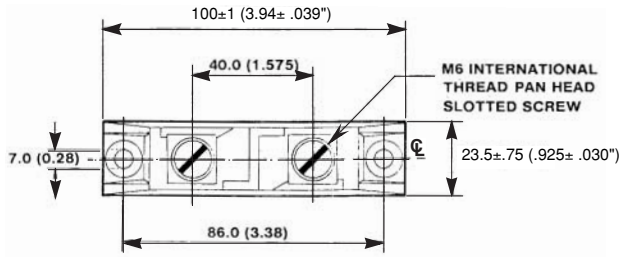
FIGURE 8. SURGE CURRENT RATING CURVES FOR V421BA60 - V282BB60

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 ample protection.

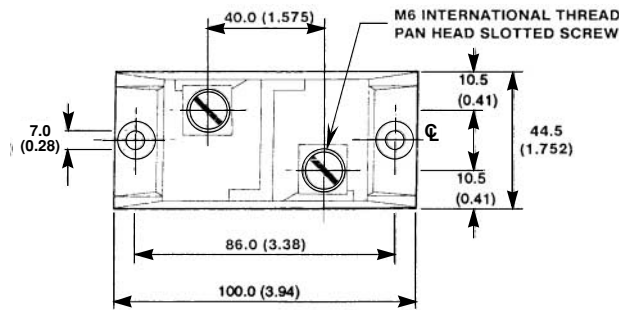
### BA/BB Varistor Series

#### Mechanical Dimensions

**BA SERIES**



**BB SERIES**

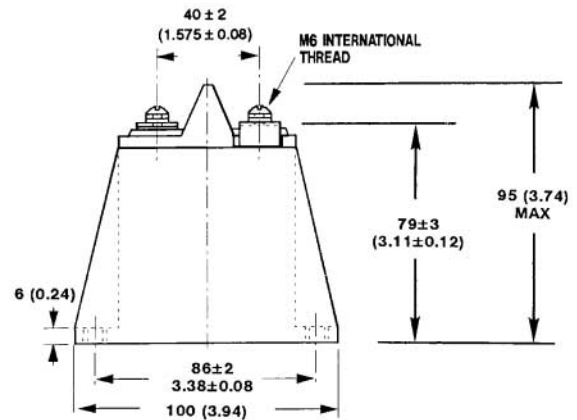


**NOTES:**

1. Typical weight:

- BA.....250g
- BB.....600g

Dimensions are in mm; inches in parentheses for reference only.



#### Ordering Information

