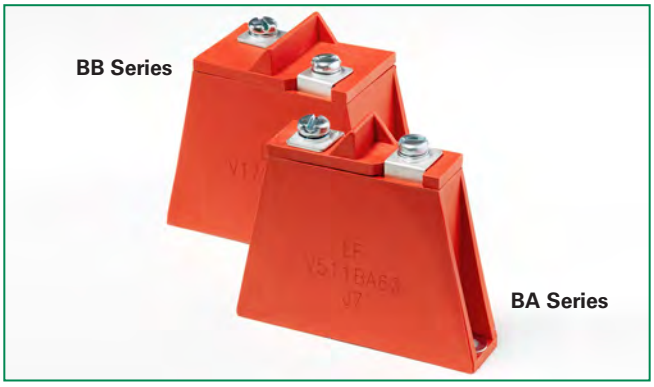
# RoHS BA/BB Varistor Series




## Agency Approvals

| Agency | Agency File Number |
|---|---|
| | E320116 - for BA Series only. |

## Description

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 880$V_{M(AC)}$. The BB models from 1100 to 2800$V_{M(AC)}$.

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 ensure 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
- RoHS compliant

## Absolute Maximum Ratings

• For ratings of individual members of a series, see Device Ratings and Specifications chart

| Continuous | BA Series | BB Series | Units |
|---|---|---|---|
| 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 |
| Transients: | | | |
| Peak Pulse Current ($I_{TM}$) | | | |
| For 8/20μs 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 10000 | J |
| Operating Ambient Temperature Range ($T_A$) | -55 to +85 | -55 to +85 | °C |
| Storage Temperature Range ($T_{STG}$) | -55 to +125 | -55 to +125 | °C |
| Temperature Coefficient ($a^V$) of Clamping Voltage ($V_C$) at Specified Test Current | <0.01 | <0.01 | %/°C |
| Hi-Pot Encapsulation (COATING Isolation Voltage Capability) (Dielectric must withstand indicated DC voltage for one minute per MIL–STD–202, Method 301) | 5000 | 5000 | V |
| COATING Insulation Resistance | 1000 | 1000 | MΩ |

*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.*

BA/BB Series

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## BA/BB Series Ratings & Specifications

| Part Number | Maximum Rating (85°C) | | | | Specifications (25°C) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Continuous | | Transient | | Varistor Voltage at 1mA DC Test Current | | | Maximum Clamping Volt $V_C$ at 200A Current (8/20$\mu$s) | Typical Capacitance $f$ = 1MHz |
| | $V_{RMS}$ | $V_{DC}$ | Energy (2ms) | Peak Current 8 x 20$\mu$s | Min | $V_{N(DC)}$ | Max | $V_C$ | C |
| | $V_{M(AC)}$ | $V_{M(DC)}$ | $W_{TM}$ | $I_{TM}$ | | | | | |
| | (V) | (V) | (J) | (A) | (V) | (V) | (V) | (V) | (pF) |
| **BA Series** | | | | | | | | | |
| 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 |
| **BB Series** | | | | | | | | | |
| 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

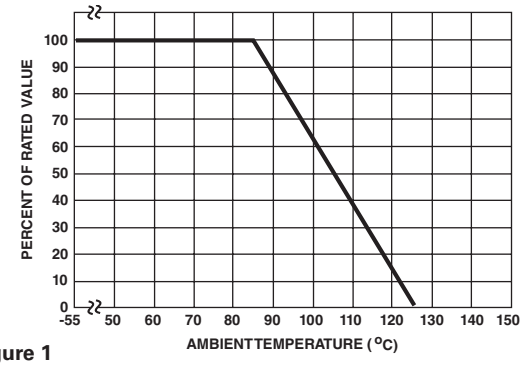


**Figure 1**

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 the above diagram. 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.

## Peak Pulse Current Test Waveform

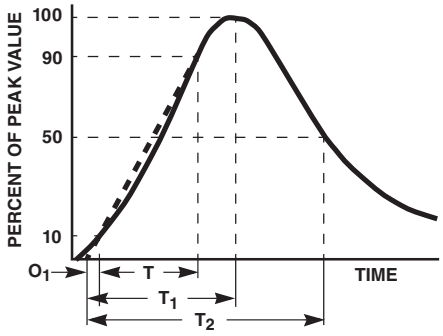


**Figure 2**

$0_1$ = Virtual Origin of Wave
T = Time from 10% to 90% of Peak
$T_1$ = Rise Time = 1.25 x T
$T_2$ = Decay Time

**Example** - For an 8/20 $\mu$s Current Waveform:
8$\mu$s = $T_1$ = Rise Time
20$\mu$s = $T_2$ = Decay Time

## Stand by Power Dissipation vs Applied $V_{Rms}$ at Varied Temperatures

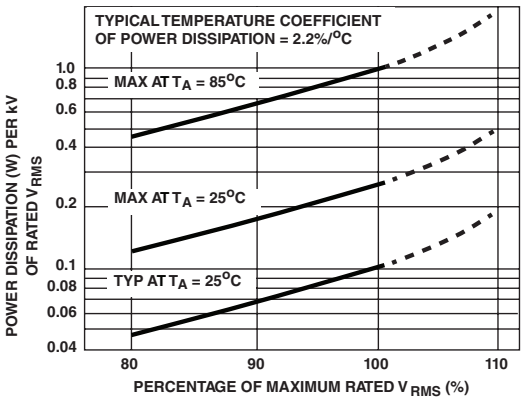


**Figure 3**

## Typical Stability of Standby Power Dissipation at Rated $V_{RMS}$ vs Time

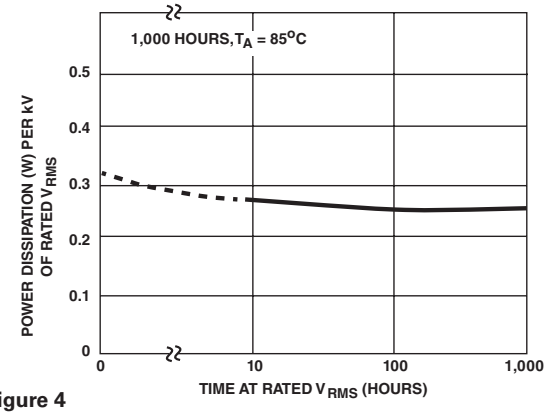


**Figure 4**



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## Maximum Clamping Voltage BA Series

**V131BA60 - V881BA60**

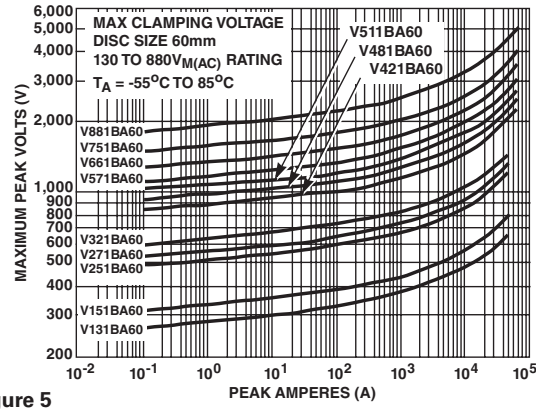


**Figure 5**

## Maximum Clamping Voltage BB Series

**V112BB60 - V282BB60**

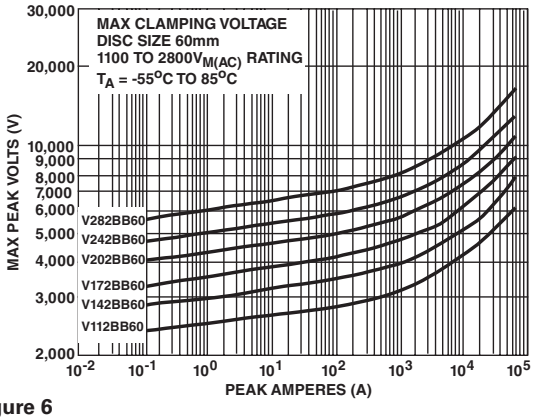


**Figure 6**

## Repetitive Surge Capability BA Series

**V131BA60 - V321BA60**

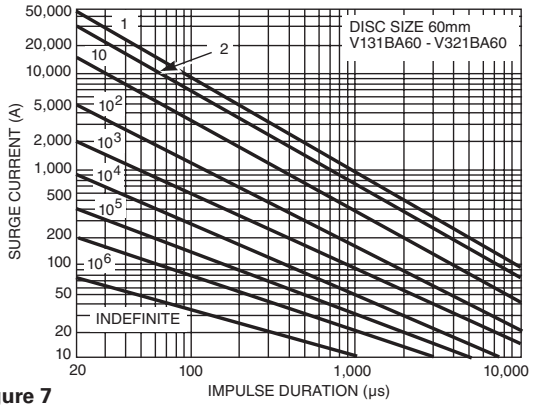


**Figure 7**

## Repetitive Surge Capability BB Series

**V421BA60 - V282BB60**

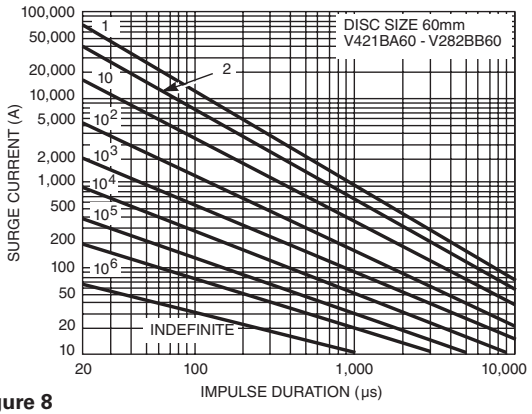


**Figure 8**

NOTE: If pulse ratings are exceeded, a shift of $V_N$(DC) (at specified current) of more than +/-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.

## Physical Specifications

| | |
|---|---|
| **Lead Material** | BA / BB – Copper with Tin Plating |
| **Insulating Material** | Cured, flame retardant epoxy polymer meets UL94V–0 requirements. |
| **Device Labeling** | Marked with LF, Part Number and Date code |

## Environmental Specifications

| | |
|---|---|
| **Operating/Storage Temperature** | -55°C to +85°C/ -55°C to +125°C |
| **Humidity Aging** | +85°C, 85% RH, 1000 hours +/- 5% typical resistance change |
| **Thermal Shock** | +85°C to -40°C 10 times +/- 5% typical resistance change |
| **Solvent Resistance** | MIL–STD–202, Method 215F |
| **Moisture Sensitivity** | Level 1, J–STD–020C |


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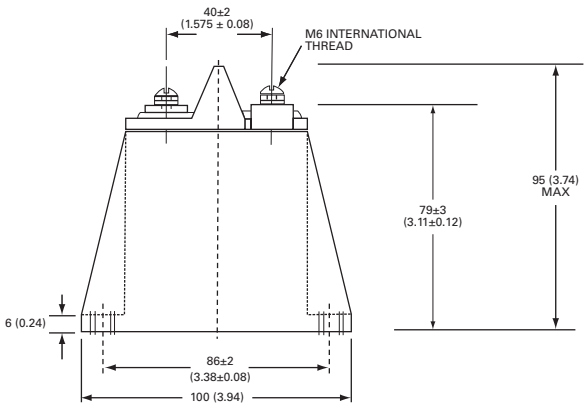
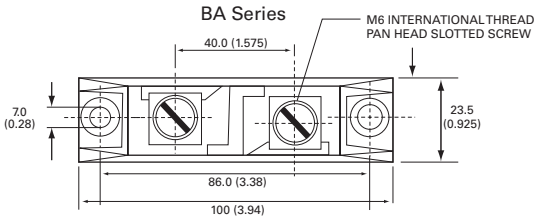
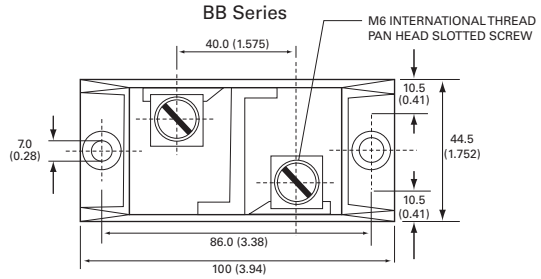
## Dimensions




Notes:
Typical weight: BA Series:250g and BB Series: 600g
Dimensions are in mm; inches in parentheses for reference only.

## Part Numbering System

**V XX X BA 60**

**VARISTOR**

**$V_{M(AC)}$**
First Two Significant Digits*

**$V_{M(AC)}$**
Decade Multiplier*
(1 or 2)

**DISC SIZE (60mm)**

**SERIES DESIGNATOR**
BA or BB

*Refer to Rating & Specifications table
Examples:
13**0** $V_{M(AC)}$ = 13**1**
28**00** $V_{M(AC)}$ = 28**2**

BA/BB Series

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