

# Surface Mount Varistors

## Transient Voltage Surge Suppressor

RoHS



## CH Varistor Series

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CH series transient surge suppressors are small, metal-oxide varistors (MOVs) manufactured in leadless chip form. They are intended for use in a variety of applications from low voltage DC to off-line board-level protection. These devices, which have significantly lower profiles than traditional radial-lead varistors, permit designers to reduce the size and weight and increase the reliability of their equipment designs.

CH series varistors are available in a voltage range from 14V to 275V  $V_{M(AC)RMS}$ , and energy ratings up to 23J.

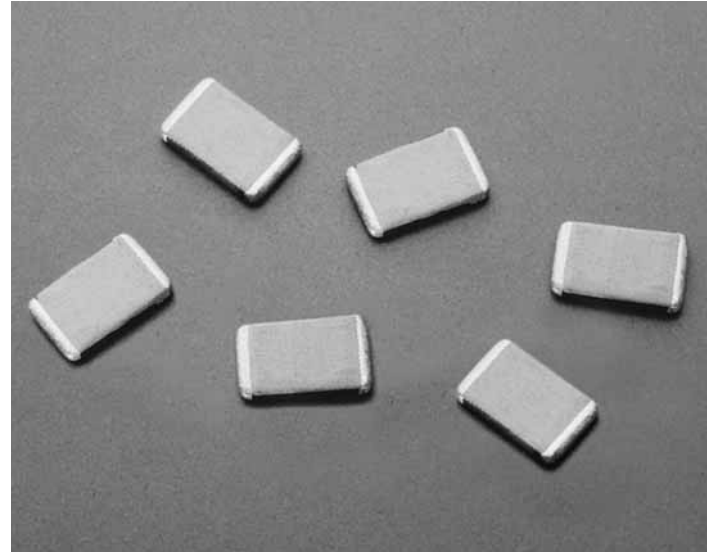
See the Littelfuse Multilayer Suppressor Series also.

### Features

- Lead-Free
- Leadless, Surface Mount Chip in 5 x 8mm Size
- Voltage Ratings  $V_{M(AC)RMS}$  . . . . . 14V to 275V
- Supplied in Tape and Reel or Bulk Pack
- No Derating up to 125°C Ambient

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

**AGENCY FILE NUMBERS:** UL E75961, E135010.



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SURFACE MOUNT  
VARISTORS

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

Continuous:

Steady State Applied Voltage:

AC Voltage Range ( $V_{M(AC)RMS}$ ) ..... 14 to 275

DC Voltage Range ( $V_{M(DC)}$ ) ..... 18 to 369

Transient: ..... V

Peak Pulse Current ( $I_{TM}$ )

For 8/20 $\mu$ s Current Wave (See Figure 2) ..... 250 to 500

Single Pulse Energy Range

For 10/1000 $\mu$ s Current Wave ( $W_{TM}$ ) ..... 1.0 to 23

Operating Ambient Temperature Range ( $T_A$ ) ..... -55 to 125

Storage Temperature Range ( $T_{STG}$ ) ..... -55 to 150

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<br>NUMBER | MAXIMUM RATINGS (125°C) |                |                             |                                   | SPECIFICATIONS (25°C)                      |           |       |                                                              |       |                                             |
|----------------|-------------------------|----------------|-----------------------------|-----------------------------------|--------------------------------------------|-----------|-------|--------------------------------------------------------------|-------|---------------------------------------------|
|                | CONTINUOUS              |                | TRANSIENT                   |                                   | VARISTOR VOLTAGE AT 1mA<br>DC TEST CURRENT |           |       | MAX CLAMPING<br>VOLT $V_C$ AT TEST<br>CURRENT (8/20 $\mu$ s) |       | TYPICAL<br>CAPACI-<br>TANCE<br><br>f = 1MHz |
|                | $V_{RMS}$               | $V_{DC}$       | 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   | $V_C$                                                        | $I_P$ |                                             |
|                | (V)                     | (V)            | (J)                         | (A)                               | (V)                                        | (V)       | (V)   | (V)                                                          | (A)   | (pF)                                        |
| V22CH8         | 14                      | 18<br>(Note 3) | 10.0<br>(Note 2)            | 250                               | 18.7                                       | 22.0      | 26.0  | 47                                                           | 5     | 1600                                        |
| V27CH8         | 17                      | 22             | 1.0                         | 250                               | 23.0                                       | 27.0      | 31.1  | 57                                                           | 5     | 1300                                        |
| V33CH8         | 20                      | 26             | 1.2                         | 250                               | 29.5                                       | 33.0      | 36.5  | 68                                                           | 5     | 1100                                        |
| V39CH8         | 25                      | 31             | 1.5                         | 250                               | 35.0                                       | 39.0      | 43.0  | 79                                                           | 5     | 900                                         |
| V47CH8         | 30                      | 38             | 1.8                         | 250                               | 42.0                                       | 47.0      | 52.0  | 92                                                           | 5     | 800                                         |
| V56CH8         | 35                      | 45             | 2.3                         | 250                               | 50.0                                       | 56.0      | 62.0  | 107                                                          | 5     | 700                                         |
| V68CH8         | 40                      | 56             | 3.0                         | 250                               | 61.0                                       | 68.0      | 75.0  | 127                                                          | 10    | 600                                         |
| V120CH8        | 75                      | 102            | 6.0                         | 500                               | 108.0                                      | 120.0     | 132.0 | 200                                                          | 10    | 300                                         |
| † V150CH8      | 95                      | 127            | 8.0                         | 500                               | 135.0                                      | 150.0     | 165.0 | 250                                                          | 10    | 250                                         |
| † V180CH8      | 115                     | 153            | 10.0                        | 500                               | 162.0                                      | 180.0     | 198.0 | 295                                                          | 10    | 200                                         |
| † V200CH8      | 130                     | 175            | 11.0                        | 500                               | 184.0                                      | 200.0     | 228.0 | 340                                                          | 10    | 180                                         |
| † V220CH8      | 140                     | 180            | 12.0                        | 500                               | 198.0                                      | 220.0     | 242.0 | 360                                                          | 10    | 160                                         |
| † V240CH8      | 150                     | 200            | 13.0                        | 500                               | 212.0                                      | 240.0     | 268.0 | 395                                                          | 10    | 150                                         |
| † V360CH8      | 230                     | 300            | 20.0                        | 500                               | 324.0                                      | 360.0     | 396.0 | 595                                                          | 10    | 100                                         |
| † V390CH8      | 250                     | 330            | 21.0                        | 500                               | 354.0                                      | 390.0     | 429.0 | 650                                                          | 10    | 90                                          |
| † V430CH8      | 275                     | 369            | 23.0                        | 500                               | 389.0                                      | 430.0     | 473.0 | 710                                                          | 10    | 80                                          |

NOTES:

1. Power dissipation of transients not to exceed 0.25W.
2. Energy rating for impulse duration of 30ms minimum to one half of peak current value.
3. Also rated to withstand 24V for 5 minutes.

†V150 - V430 CH Varistors are recognized under UL file #E75961 as a recognized component.

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#### Power Dissipation Ratings

Continuous power dissipation capability is not an applicable design requirement for a suppressor, unless transients occur in rapid succession. Under this condition, 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.

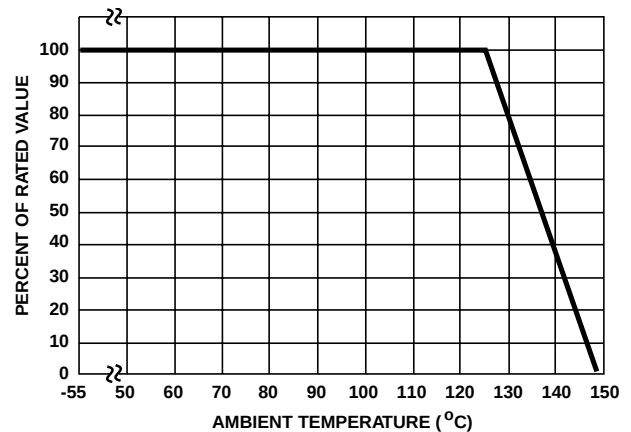


FIGURE 1. CURRENT, ENERGY AND POWER DERATING CURVE

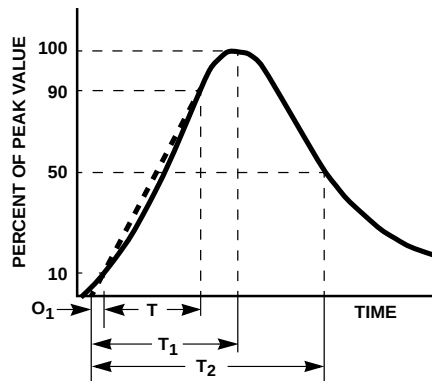


FIGURE 2. PEAK PULSE CURRENT TEST WAVEFORM

$O_1$  = 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

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#### Transient V-I Characteristics Curves

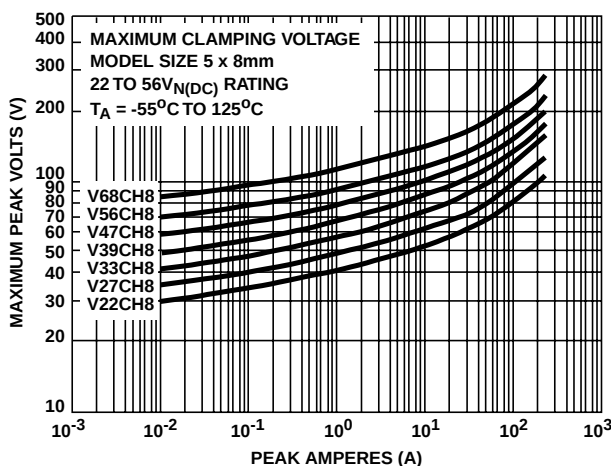


FIGURE 3. CLAMPING VOLTAGE FOR V22CH8 - V68CH8

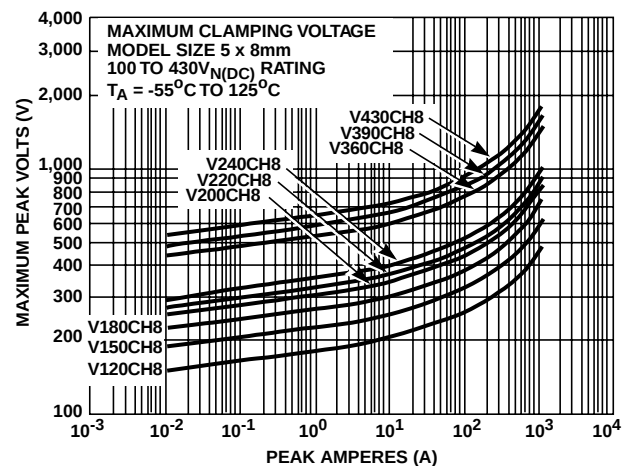


FIGURE 4. CLAMPING VOLTAGE FOR V120CH8 - V430CH8

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#### Pulse Rating Curves

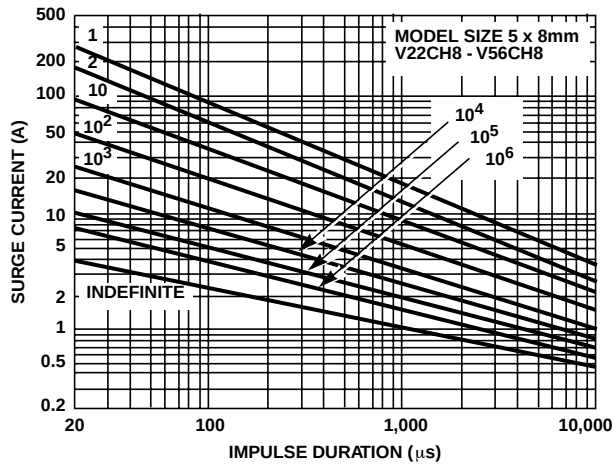


FIGURE 5. SURGE CURRENT RATING CURVES FOR V22CH8 - V56CH8

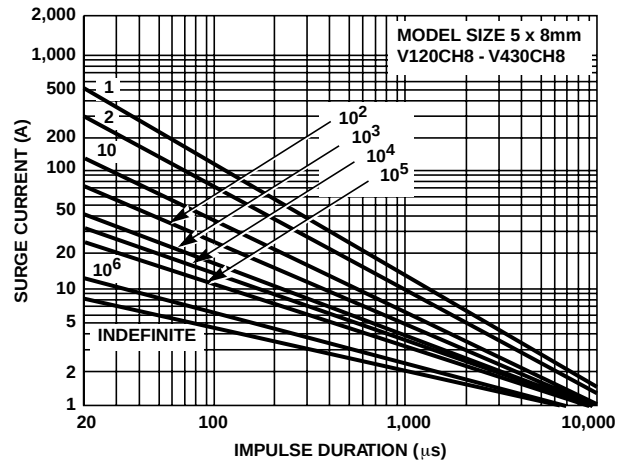
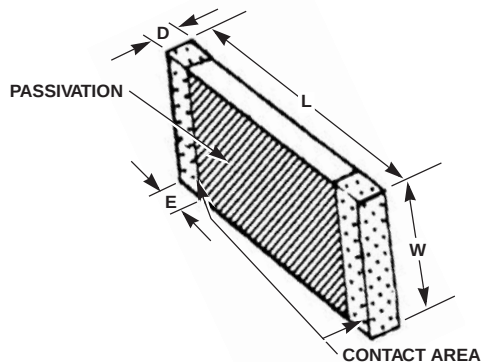


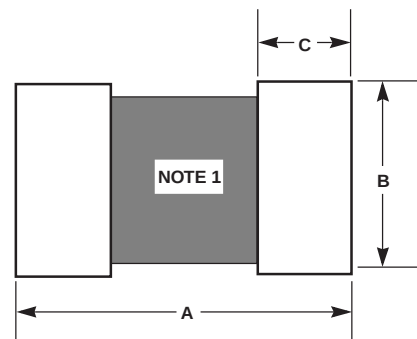
FIGURE 6. SURGE CURRENT RATING CURVES FOR V120CH8 - V430CH8

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.

#### Mechanical Dimensions



#### Recommended Pad Outline



| SYMBOL | INCHES |       | MILLIMETERS |      |
|--------|--------|-------|-------------|------|
|        | MIN    | MAX   | MIN         | MAX  |
| D      | -      | 0.080 | -           | 2.03 |
| E      | 0.016  | 0.050 | 0.41        | 1.27 |
| L      | 0.311  | 0.335 | 7.90        | 8.51 |
| W      | 0.185  | 0.207 | 4.70        | 5.26 |

| SYMBOL | INCHES | MILLIMETERS |
|--------|--------|-------------|
| A      | 0.402  | 10.21       |
| B      | 0.216  | 5.50        |
| C      | 0.087  | 2.21        |

NOTE: Avoid metal runs in this area. Soldering recommendations: Material - 62/36/2 Sn/Pb/Ag or equivalent. Temperature - 230°C Max., 5s. Max. Flux - R.M.A.

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RoHS Pb CH Varistor Series

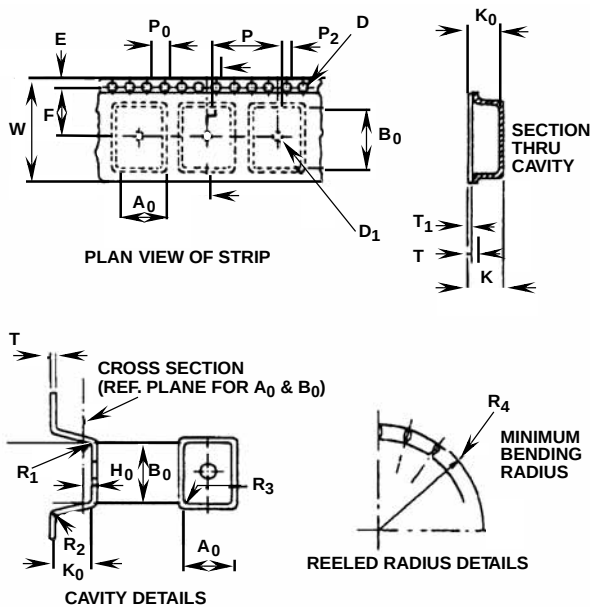
Standard Packaging

CH Series varistors are always shipped in tape and reel. The standard 13in reel utilized contains 4000 pieces.

Note also that the CH Series receives no branding on the chip itself.

Tape and Reel Specifications

- Conforms to EIA-481, Revision A
- Can be Supplied to IEG Publication 286-3



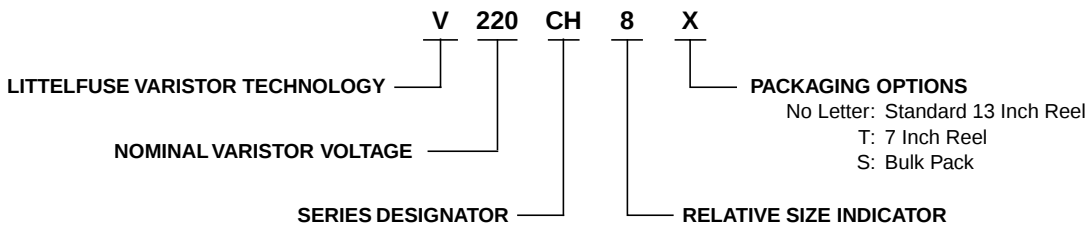
Special Packaging

**Option 1** - 7-inch reels containing 1000 pieces are available. To order 7in reels add a T suffix to the part number; e.g., V47CH8T.

**Option 2** - For small quantities (less than 100 pieces) the units are shipped bulk pack. To order, add a S suffix to the part number; e.g., V47CH8S.

| SYMBOL                                           | PARAMETER                                        | SIZE (mm)             |
|--------------------------------------------------|--------------------------------------------------|-----------------------|
| B <sub>0</sub>                                   | Cavity Length                                    | 8.5 ± 0.1             |
| A <sub>0</sub>                                   | Cavity Width                                     | 5.5 ± 0.1             |
| K <sub>0</sub>                                   | Cavity Depth                                     | 2.0 Min.              |
| H <sub>0</sub>                                   | Ref. Plane for A <sub>0</sub> and B <sub>0</sub> | +0.10<br>0.3<br>-0.05 |
| R <sub>1</sub> , R <sub>2</sub> , R <sub>3</sub> | Tape Cavity Radii                                | 0.5 Max.              |
| T                                                | Carrier Tape Thickness                           | 1.0 Max.              |
| T <sub>1</sub>                                   | Cover Tape Thickness                             | 0.1 Max.              |
| E                                                | Sprocket Hole from Edge                          | 1.75 ± 0.1            |
| P <sub>0</sub>                                   | Sprocket Hole Pitch                              | 4.0 ± 0.1             |
| D                                                | Sprocket Hole Diameter                           | +0.1 1.5<br>-0.0      |
| P <sub>2</sub>                                   | Hole Centre to Component Centre                  | 2.0 ± 0.15            |
| R <sub>4</sub>                                   | Min. Bending Radius                              | 40.0 Min.             |
| D <sub>1</sub>                                   | Ejection Hole Diameter                           | 1.5 Min.              |
| K                                                | Overall Thickness                                | 3.0 Min.              |
| P                                                | Pitch Of Component                               | 8.0 ± 0.1             |
| F                                                | Sprocket Hole to Ejection Hole                   | 7.5 ± 0.1             |
| W                                                | Carrier Tape Width                               | 16.0 ± 0.3            |

Ordering Information



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