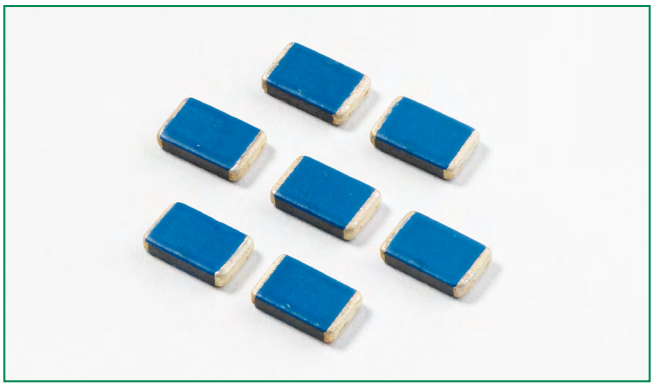
CH Varistor Series



Agency Approvals

Recognized under the components program of Underwriters Laboratories.

Agency	Agency Approval	Agency File Number
	UL1449	E320116

Description

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 8J.

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
- High surge rated up to 400A for low voltage devices

Absolute Maximum Ratings

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

Continuous		CH Series	Units
Steady State Applied Voltage:			
	AC Voltage Range ($V_{M(AC)RMS}$)	14 to 275	V
	DC Voltage Range ($V_{M(DC)}$)	18 to 369	V
Transient:			
	Peak Pulse Current (I_{TM})		
	For 8/20μs Current (See Figure 2)	100 to 400	A
	Single Pulse Energy Range		
	For 10/1000μs Current Wave (W_{TM})	1.0 to 8.0	J
Operating Ambient Temperature Range (T_A)		-55 to +125	°C
Storage Temperature Range (T_{STG})		-55 to +150	°C
Temperature Coefficient (αV) 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.

Additional Information

Datasheet | **Resources** | **Samples**

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Device Ratings and Specifications

Part Number	Maximum Ratings (125°C)				Specifications (25°C)					
	Continuous		Transient		Varistor Voltage at 1 mA DC Test Current			Max Clamping Volt V_C at Test Current (8/20μs)		Typical Capacitance
	V_{RMS}	V_{DC}	Energy (10/1000μ s)	Peak Current (8/20μs)						
	$V_{M(AC)}$	$V_{M(DC)}$	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)
V22CH8	14	18 (Note 3)	1.0 (Note2)	100	18.7	22.0	26.0	47	5	1600
V27CH8	17	22	1.0	100	23.0	27.0	31.1	57	5	1300
V33CH8	20	26	1.0	100*	29.5	33.0	36.5	68	5	750
V39CH8	25	31	1.0	100*	35.0	39.0	43.0	79	5	700
V47CH8	30	38	1.2	100*	42.0	47.0	52.0	92	5	650
V56CH8	35	45	1.4	100*	50.0	56.0	62.0	107	5	600
V68CH8	40	56	1.5	100*	61.0	68.0	75.0	127	10	500
V120CH8	75	102	2.0	250	108.0	120.0	132.0	200	10	300
V150CH8	95	127	3.0	250	135.0	150.0	165.0	250	10	250
V180CH8	115	153	4.0	250	162.0	180.0	198.0	295	10	120
V200CH8	130	175	4.0	250	184.0	200.0	228.0	340	10	110
V220CH8	140	180	5.0	250	198.0	220.0	242.0	360	10	105
V240CH8	150	200	5.0	250	212.0	240.0	268.0	395	10	100
V360CH8	230	300	6.0	250	324.0	360.0	396.0	595	10	70
V390CH8	250	330	7.0	250	354.0	390.0	429.0	650	10	60
V430CH8	275	369	8.0	250	389.0	430.0	473.0	710	10	50

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.
4. The Typical Capacitance is for reference only
5. *High Surge Option (up to 400A) available for relevant voltage ratings.

Current, Energy and Power Derating Curve

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 tempera tures as shown in this 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.

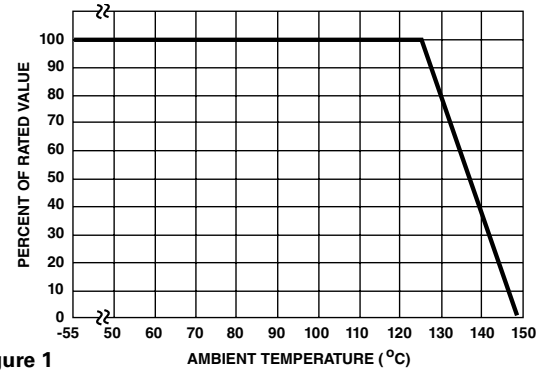

Figure 1

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Peak Pulse Current Test Waveform

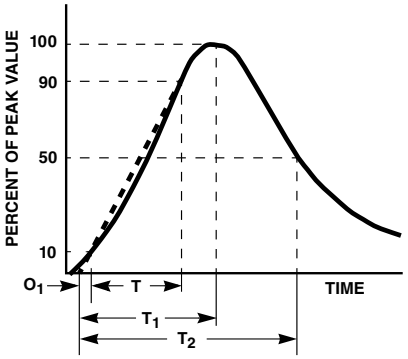

Figure 2

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 μs Current Waveform:
8μs = T_1 = Rise Time
20μs = T_2 = Decay Time

Clamping Voltage for V22CH8 – V68CH8

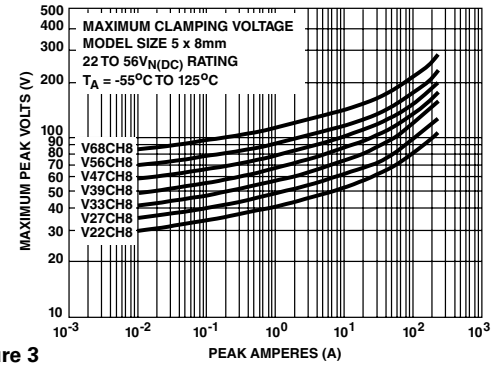

Figure 3

Clamping Voltage for V120CH8 – V430CH8

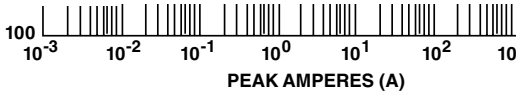

FIGURE 4. CLAMPING VOLTAGE FOR V120CH8 - V43

Figure 4

Pulse Rating Curves

Surge Current Rating Curves for V22CH8 - V56CH8

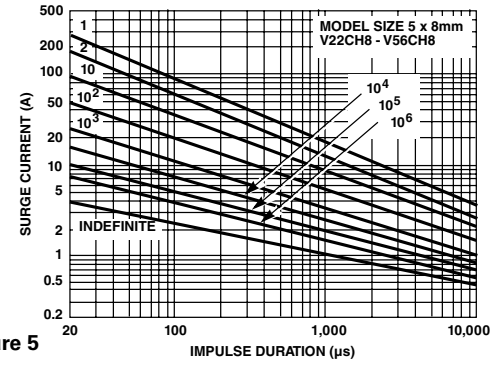

Figure 5

Surge Current Rating Curves for V120CH8 - V430CH8

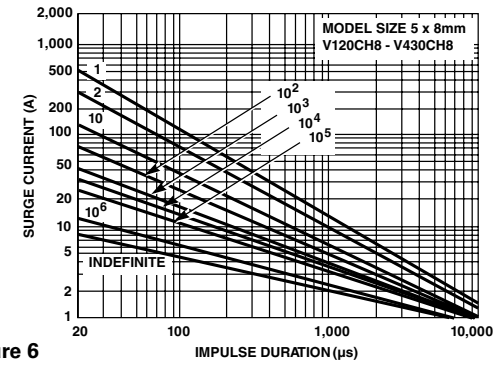

Figure 6

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.

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Lead (Pb) Soldering Recommendations

The principal techniques used for the soldering of components in surface mount technology are IR Re-flow and Wave soldering. Typical profiles are shown on the right.

CH series devices have silver-platinum terminals (Ag/Pt), and the recommended solder is 62/36/2 (Sn/Pb/Ag), 60/40 (Sn/Pb) or 63/37 (Sn/Pb). Littelfuse also recommends an RMA solder flux.

Wave soldering is the most strenuous of the processes. To avoid the possibility of generating stresses due to thermal shock, a preheat stage in the soldering process is recommended, and the peak temperature of the solder process should be rigidly controlled.

When using a reflow process, care should be taken to ensure that the CH chip is not subjected to a thermal gradient steeper than 4 degrees per second; the ideal gradient being 2 degrees per second. During the soldering process, preheating to within 100 degrees of the solder's peak temperature is essential to minimize thermal shock.

Once the soldering process has been completed, it is still necessary to ensure that any further thermal shocks are avoided. One possible cause of thermal shock is hot printed circuit boards being removed from the solder process and subjected to cleaning solvents at room temperature. The boards must be allowed to cool gradually to less than 50°C before cleaning.

Reflow Solder Profile

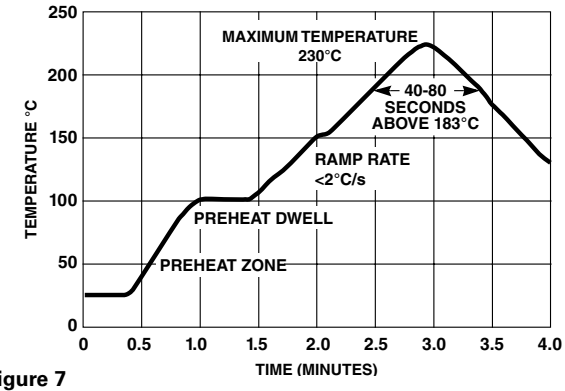

Figure 7

Wave Solder Profile

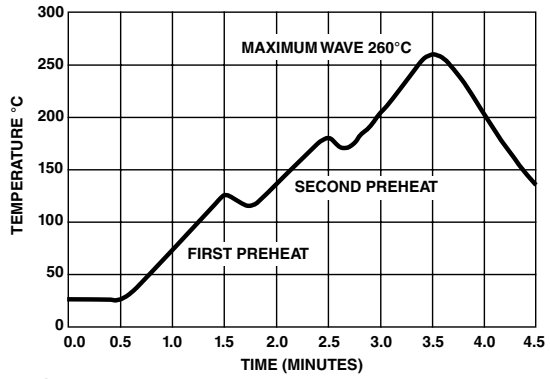

Figure 8

Lead–free (Pb-free) Soldering Recommendations

CH series devices have silver-platinum terminals (Ag/Pt), and the recommended Lead-free solder is 96.5/3.0/0.5 (SnAgCu) with an RMA flux, though there is a wide selection of pastes and fluxes available that should be compatible.

The reflow profile must be constrained by the maximums in the Lead–free Reflow Profile. For Lead–free Wave soldering, the Wave Solder Profile still applies.

Note: the Lead–free paste, flux and profile were used for evaluation purposes by Littelfuse, based upon industry standards and practices. There are multiple choices of all three available, it is advised that the customer explores the optimum combination for their process as processes vary considerably from site to site.

Lead–free Re-flow Solder Profile

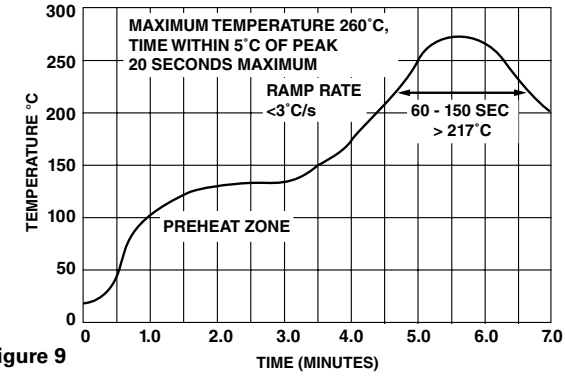

Figure 9

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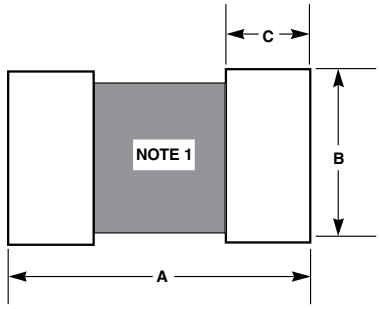
Part Numbering System

V 220 CH 8 X

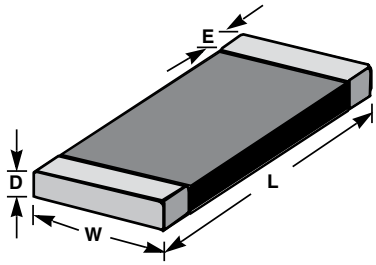
- V — LITTELFUSE VARISTOR
- 220 — NOMINAL VARISTOR VOLTAGE
- CH — SERIES DESIGNATOR
- 8 — RELATIVE SIZE INDICATOR
- X — PACKAGING OPTIONS
  - No Letter: Standard 13 Inch Reel
  - T: 7 Inch Reel
  - S: Bulk Pack

Dimensions

PAD LAYOUT DIMENSIONS



CHIP LAYOUT DIMENSIONS



Symbol	Inches		Millimeters	
	Min	Max	Min	Max
A	0.402		10.210	
B	0.216		5.500	
C	0.087		2.210	
D	-	0.080	-	2.00
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

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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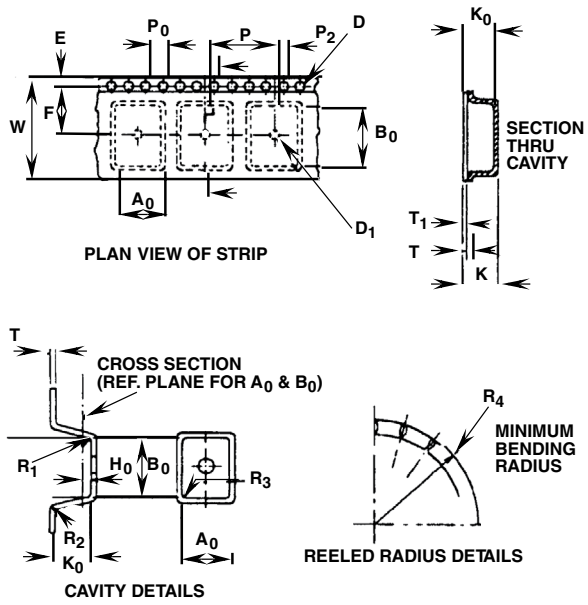
Tape and Reel Specifications



Symbol	Parameter	Size (mm)
B_0	Cavity Length	8.8 -/+ 0.1
A_0	Cavity Width	5.5 -/+ 0.1
K_0	Cavity Depth	2.0 Min.
H_0	Ref. Plane for A0 and B0	+ 0.10 0.3 - 0.05
R_1, R_2, R_3	Tape Cavity Radii	0.5 Max.
T	Carrier Tape Thickness	1.0 Max.
T_1	Cover Tape Thickness	0.1 Max.
E	Sprocket Hole from Edge	1.75 -/+ 0.1
P_0	Sprocket Hole Pitch	4.0 -/+ 0.1
D	Sprocket Hole Diameter	+ 0.1 1.5 - 0.0
P_2	Hole Centre to Component Centre	2.0 -/+ 0.15
R_4	Min. Bending Radius	30.5 Min.
D_1	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

Notes :
- Conforms to EIA-481-1, Revision A
- Can be supplied to IEC P ublication 286-3

Standard Packaging*

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

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

*NOTE: It is recommended that parts be kept in the sealed bag provided and that parts be used as soon as possible when removed from bags.

Special Packaging

Option 1 7-inch reels containing 1000 pieces are available. To order 7-inch 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.

Ordering Notes:

X3313: HIGH SURGE RATING OPTION --

Low voltage (V22~V68) standard parts high surge rating to 100A, to order high surge rated up to 400A with suffix X3313. Example:

Standard Model	Order As
V33CH8	V33CH8X3313

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