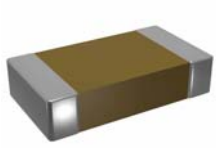
SMD CHIP VARISTORS



CHIP VARISTOR FEATURES

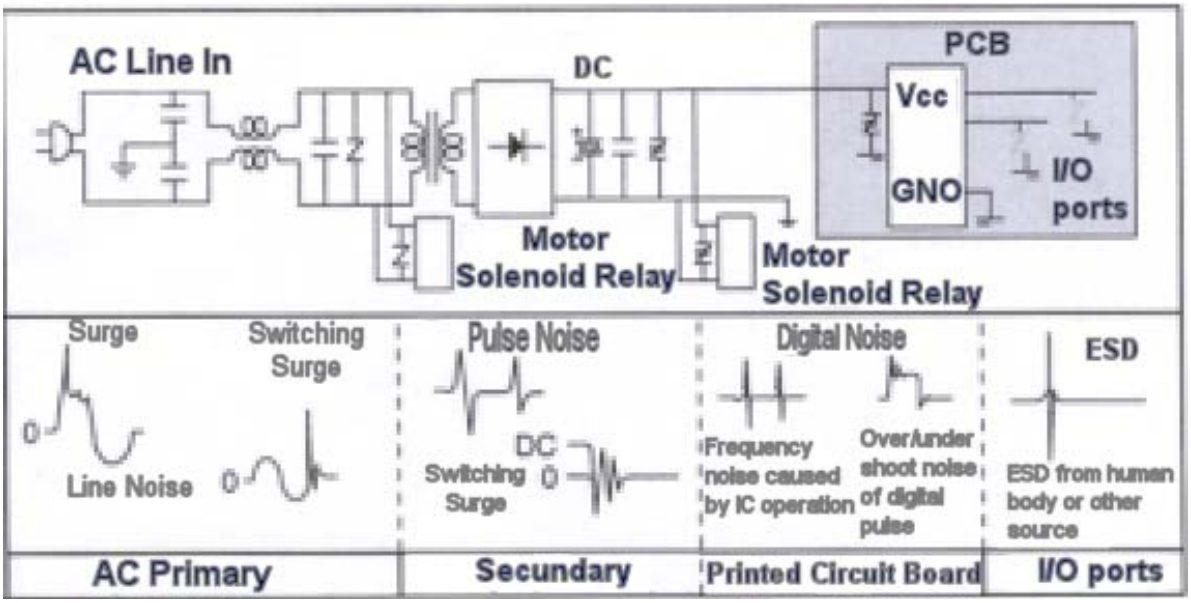
- SMD type chip varistors are highly reliable in surface mount applications.
- Wide operating voltage range.
- Large withstanding surge current and energy at small size
- Suitable for high speed signal line due to small capacitance
- Excellent solderability and superior heat resistance
- Ag base terminal electrodes with Ni + Sn-Pb electroplating
- No asymmetrical degradation as with bismuth zinc oxide varistors

CHIP VARISTOR APPLICATIONS

- Typical Applications:

  - Information and communication equipment
  - Signal line of cellular phones
  - Transient voltage protection for ICs and transistors
  - ESD and I/O protection
  - Overall telecommunication transient protection

TYPICAL APPLICATION EXAMPLES



HOW TO ORDER Chip Varistors

ICVN	05	05	X	150	P	B
①	②	③	④	⑤	⑥	⑦

① SERIES NAME

CODE	PRODUCT NAME
ICVN	Normal type chip varistor
ICVL	Low capacitance type chip varistor

② SIZE DESIGNATOR

CODE	SIZE in MM *(inches)*
05	1.0 X 0.5 *(.040 x .020)*
10	1.6 X 0.8 *(.063 x .031)*
21	2.0 X1.25 *(.079 x .050)*
31	3.2 X 1.6 *(.126 x .063)*

③ WORKING VOLTAGE

CODE	VOLTAGE (VDC)	CODE	VOLTAGE (VDC)
03	3.3	18	18.0
05	5.6	26	26.0
09	9.0	30	30.0
12	12.0	48	48.0
14	14.0	60	60.0

④ ENERGY

CODE	ENERGY (J)	CODE	ENERGY (J)
A	0.1	H	1.2
C	0.3	J	1.5
D	0.4	P	3.0
F	0.7	V	0.02
G	0.9	X	0.05

⑤ CLAMPING VOLTAGE

CODE	VOLTAGE (V)	CODE	VOLTAGE (V)
100	10.0	500	50.0
150	15.5	560	56.0
200	20.0	580	58.0
250	25.0	620	62.0
300	30.0	650	65.0
390	39.0	101	100.0
400	40.0	121	120.0

⑥ TERMINATION TYPE

CODE	TYPE
S	Solderable *(Ag/Pd/Pt)*
P	Electroplate (Ni Sn)

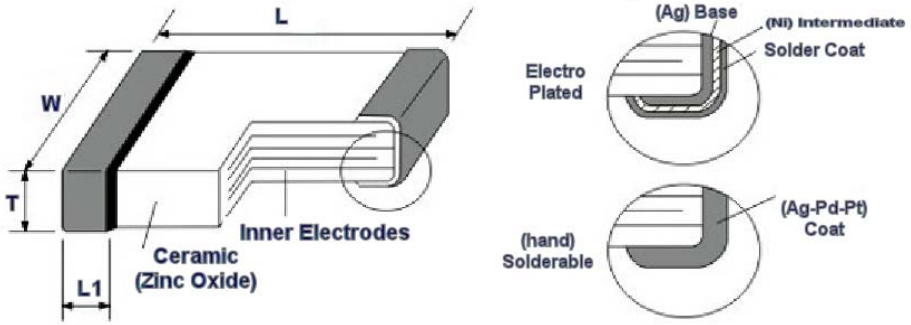
⑦ PACKAGING TYPE

CODE	TYPE
B	Bulk Case Packaging
R	Paper Tape & Reel pack
E	Embossed Plastic Tape & Reel pack

P/N Example: ICVN0518X400SE

CHIP VARISTOR CONFIGURATION AND DIMENSIONS

CODE	CHIP SIZE CODE		DIMENSIONS in mm *(inch)*			
	EIA	METRIC	L	W	T	L1
05	0402	1005	1.0± 0.05 *.040 ± .002*	0.5 ± 0.05 *.020 ± .002*	0.5 ± 0.05 *.020 ± .002*	0.2 + 0.15/-0.1 *.020 + .006 - .004*
10	0603	1608	1.6 ± 0.1 *.063 ± .004*	0.8 ±0.1 *.031 ± .004*	0.8 ±0.1 *.031 ± .004*	0.3 ± 0.2 *.012 ± .008*
21	0805	2012	2.0 ± 0.1 *.079 ± .004*	1.25± 0.1 *.050 ± .004*	1.35 MAX *.053 max*	0.5+ 0.21-0.3 *.020 + .008 - .012*
31	1206	3216	3.2 ± 0.15 *.126 ± .006*	1.6 ± 0.15 *.063 ± .006*	1.35 MAX *.057 max*	0.5+ 0.21-0.3 *.020 + .008 - .012*
Note: METRIC dimensions throughout this document govern, unless specifically indicated otherwise.						



HIGH SPEED TYPE CHIP VARISTORS

- Typical ESD failure voltage for CMOS and/or Bi Polar is ≥200V.
- 15kV ESD pulse (air discharge) per IEC 1000-4-2.Level 4, generates <2OmJ of energy.
- Low capacitance (<200pF) is required for high-speed data transmission.
- Low leakage current(I_L) is necessary for battery operated equipment.

Chip Size	JC Part Number	Working Voltage	Clamping Voltage	Peak Current	Transient Energy	Capacitance
	Symbol	V_{WM}	V_C	I_{peak}	E_{trans}	C
	Units	Volts (max)	Volts (max)	Amp (max.)	Joules (max.)	pF (typ.)
	Test Condition	<50μA	8/20 μs	8/20 μs	10/1000 μs	0.5Vrms @ 1MHz
1005	ICVL0518V500	≤18.0	<50.0	15	0.02	40
1608	ICVL1018X500	≤18.0	50	20	0.05	75
2012	ICVL2118A500	≤18.0	50	30	0.1	100
3216	ICVL3118A500	≤18.0	50	30	0.1	200

■ TERMINOLOGY

- **V_{WM}:** Maximum steady state DC operating voltage the varistor can maintain and not exceed 50μA leakage current.
- **V_B**: Voltage across the device measured at 1 mA DC current
- **V_C**: Maximum peak voltage across the varistor measured at a specified pulse and waveform
- **I_{peak}**: Maximum peak current which may be applied with the specified waveform without device failure
- **C**: Device capacitance measured @0.5Vrms and 1MHz with zero volt bias applied.

CHIP VARISTOR STANDARD SPECIFICATIONS BY SIZE

Chip Size	JC Part Number	Working Voltage	Varistor Voltage	Clamping Voltage	Peak Current	Transient Energy	Capacitance
	Symbol	V_{WM}	V_S	V_C	I_{peak}	E_{trans}	C
	Units	Volts (max)	Volts	Volts (max)	Amp (max.)	Joules (max.)	pF (typ)
	Test Condition	<50μA	1 mA DC	8/20 μs	8/20 μs	10/1000 μs	0.5Vrms @ 1MHz
1005	ICVN0505X150	5.6	7.6 -9.3	15.5	20	0.05	360
	ICVN0509X200	9.0	11.0-14.0	20.0	20	0.05	230
	ICVN0514X300	14.0	16.5-20.3	30.0	20	0.05	120
	ICVN0518X400	18.0	22.9-28.0	40.0	20	0.05	90
1608	ICVN1003A100	3.3	4.1 -6.0	10	30	0.1	1230
	ICVN1005A150	5.6	7.6 - 9.3	15.5	30	0.1	825
	ICVN1 009A200	9.0	11.0-15.0	20	30	0.1	550
	ICVN1014A300	14.0	16.5-20.3	30	30	0.1	424
	ICVN1018A400	18.0	22.9-28.0	40	30	0.1	225
	ICVN1026A580	26.0	31.0-38.0	58	30	0.1	160
	ICVN1030A650	30.0	37.0-46.0	65	30	0.1	150
2012	ICVN2103A100	3.3	4.1 -6.0	10	40	0.1	930
	ICVN2105A150	5.6	7.6-9.3	15.5	40	0.1	860
	ICVN2109A200	9	11.0-14.0	20	40	0.1	585
	ICVN2112A250	12	14.0-18.3	25	40	0.1	400
	ICVN2114A300	14	16.5-20.3	30	40	0.1	280
	ICVN2118A400	18	22.9-28.0	40	30	0.1	275
	ICVN2126A580	26	31.0-38.0	58	30	0.1	110
	ICVN2130A650	30	37.0-46.0	65	30	0.1	80
3216	ICVN3103A100	3.3	4.1-6.0	10	40	0.1	1500
	ICVN3105A150	5.6	7.6 -9.3	15.5	40	0.1	870
	ICVN3114A300	14	16.5-20.3	30	40	0.1	500
	ICVN3118A400	18	22.9-28.0	40	30	0.1	270
	ICVN3126D580	26	30.5-37.3	58	120	0.4	450
	ICVN31300650	30	37.0-45.0	65	120	0.4	400
	ICVN3148D101	48	56.0-68.0	100	100	0.4	185

CHIP VARISTOR PACKAGING SPECIFICATION

- All SMD type chip varistors are Tape and Reel packaged in according with the latest revision of EIA 481B

Packaging Tape Material	0402 Chip Size	0603 Chip Size	0805 and 1206 Chip Sizes	
			Thickness ≤0.85mm	Thickness ≥ 1.0mm
Paper	10,000 pcs/reel	4,000 pcs/reel	4,000 pcs/reel	N/A
Embossed Plastic	N/A	N/A	Optional on request	2,000 pcs/reel

All Tape and Reeled product is supplied on 178 ± 2 mm diameter reels with 13 ± 0.5 mm arbor holes.

- Packaging in Bulk Case is optional as follows:

Size	0402 Chip Size	0603 Chip Size	0805 and 1206 Chip Sizes	
			Thickness ≤0.85mm	Thickness ≥ 1.0mm
Quantity/case	80,000 pcs	15,000 pcs	10,000 pcs	5,000 pcs

Bulk case material is ABS plastic

CHIP VARISTOR PERFORMANCE

ITEM	REQUIREMENTS				TEST CONDITION
	1005	1608	2012	3216	
Operating Temperature Range	-55° C to + 125 ° C				--
Storage Temperature & humidity range	40° C max, 70% RH max.				At packing
Resistance to solder heat	1. No damage such as cracks in the chip element. 2. Greater than 75% of the terminal shall be covered with fresh solder				Preheat temperature: 100 to 150° C Preheat time: 1 minute Solder temperature: 260 ± 10° C Immersion time: 10 ± 0.5 sec.
Solderability	More than 90% of the terminal shall be covered with fresh solder				Preheat temperature: 100 to 150° C Preheat time: 1 minute Solder temperature: 230 ± 10° C Immersion time: 3 ± 1 sec.
Reflow soldering	1. More than 50% of the terminal shall be covered with fresh solder. 2. Varistor voltage change not to exceed ± 10%.				Preheat temperature: 150° C Preheat time: 1 minute Solder temperature: 230 ° C Soldering time: 10 sec.max
Tensile Strength (terminal strength)	Per JIS-C-6429				Appendix 1 Note: Force of 1.8kg for 60 seconds.
Board Flex (Bending Strength)	1. The body shall not be damaged by the forces shown in the table				Appendix 2 Note: 2mm (Min.)
Min Flex by Size	-	2.0	3.0	4.0	
Drop	1. No mechanical damage				Drop 10 times on a concrete floor from a height of three ft (91cm)
Vibration	1. No mechanical damage				Frequency: 10~55—10Hz Amplitude: 1.52mm Direction and time: X,Y,X directions for 2 hours
Temperature cycle	1. No mechanical damage 2. Varistor voltage change: within ± 10%				Step 1. –40 ±3° C for 30± 3min. Step 2. +85 ±3° C for 30± 3min. Number **of cycles:** 100
Heat load resistance	1. No mechanical damage 2. Varistor voltage change: within ± 10%				Temperature : +85 ±2° C Applied Voltage: working voltage Duration: 1,000 hours Measured after 24 hours at room ambient temperature
Low temperature resistance	1. No mechanical damage 2. Varistor voltage change: within ± 10%				Temperature: -40 ±5° C Duration: 1,000 hours Measured after 24 hours at room ambient temperature
Humidity resistance	1. No mechanical damage 2. Varistor voltage change: within ± 10%				Temperature: +40 ±2° C Humidity: 90—95%RH Duration: 500 hours Measured after 24 hours at room ambient temperature

CHIP VARISTOR PERFORMANCE (Continued)

ITEM	REQUIREMENTS All Sizes	TEST CONDITION
Humidity load resistance	1. No mechanical damage 2. Varistor voltage change: within ± 10%	Temperature: +40 ±2° C Humidity: 90—95%RH Applied Voltage: working voltage Duration: 500 hours Measured after 24 hours at room ambient temperature
Maximum surge current	1.Varistor voltage change: within ± 10% IECI000-4-5 standard 1.2/50 μs - 8/20 μs voltage-current combination pulse	Temperature: +40 ±2° C Humidity: 90—95%RH Polarity: +, - Number of pulses one (1) Surge pulse: 8/20 μs Applied current: maximum surge current (**Is**)
Maximum surge energy	Varistor voltage change: within ± 10% IECI000-4-5 standard 10/1000 μs current pulse	Temperature: +40 ±2° C Humidity: 90—95%RH Polarity: +, - Number of pulses one (1) Surge pulse: 10/1000 μs Applied current: maximum surge current (**Ws**)
ESD life	1.No mechanical damage 2. Varistor voltage change: within ± 10% ESD gun (IEC1000-4-2 standard) C=l50pF R=330Ω	Discharge: contact discharge Voltage: 8,000V(level 4) Polarity: +, - Number of discharges: 10,000 times in 10 sec.
ESD test	1.No mechanical damage 2. Varistor voltage change: within ± 10% ESD gun (IEC1000-4-2 standard) C=l50pF R=330Ω	Discharge: Air discharge Voltage: 25,000V(special level) Polarity: +, - Number of discharges: 10 times in 10 sec

ZINC OXIDE LEADED VARISTORS

FEATURES

- Voltage range from 18V up to 1800V
- Fast response time
- Symmetrical V-I (Volt-Amp) characteristics
- High surge current (2000A/cm^2)
- No follow on current

APPLICATIONS

- **General Type:**
  - Semiconductor surge protection (IC, diodes,triacs, thyristors)
  - Military and Industrial telecom
  - Powerline noise suppression
  - Measurement and control instrumentation
- **Lightning Arrester Type:**
  - Semiconductor protection (IC, diodes,triacs, thyristors)
  - Telecom base station and distribution boards
  - Measurement and control instrumentation