

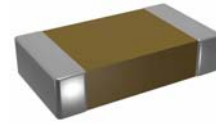
# Multilayer Chip Varistors & Leaded Disc Varistors



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DIELECTRICS 

## SMD CHIP VARISTORS



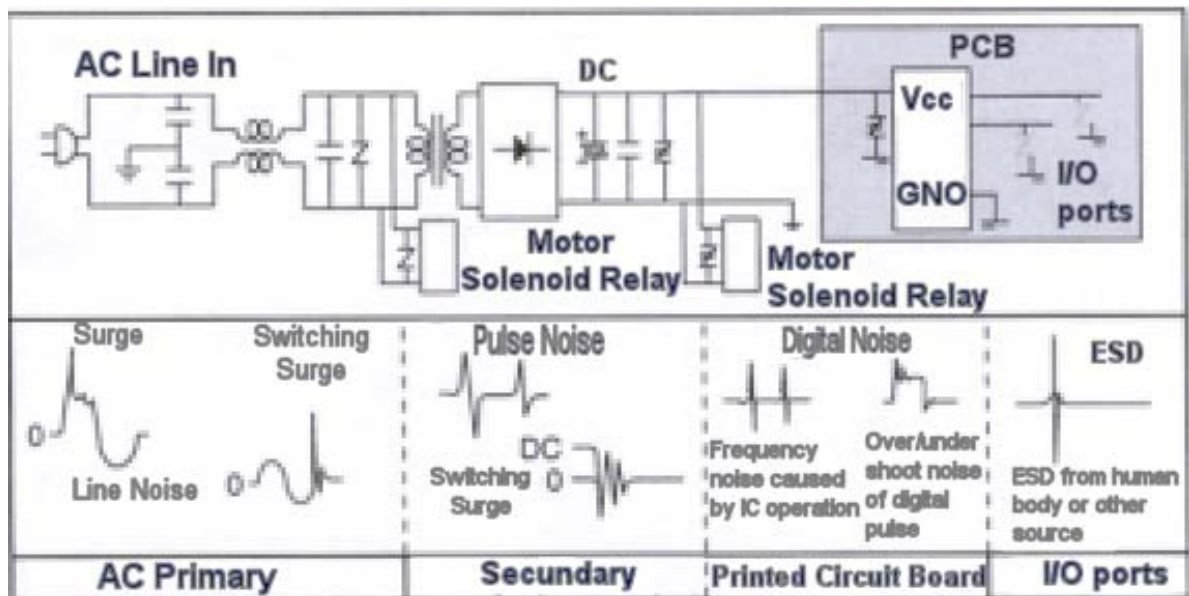
### CHIP VARISTOR FEATURES

- 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 X 1.25 (.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

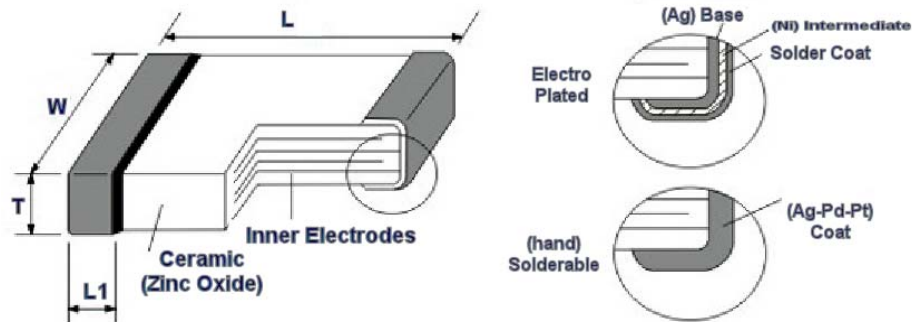
CODE	TYPE
B	Bulk Case Packaging
R	Paper Tape & Reel pack
E	Embossed Plastic Tape & Reel pack

**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  $\geq 200V$ .
- 15kV ESD pulse (air discharge) per IEC 1000-4-2.Level 4, generates <20mJ 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	<50 $\mu$ A	8/20 $\mu$ s	8/20 $\mu$ s	10/1000 $\mu$ s	0.5Vrms @ 1MHz
1005	ICVL0518V500	$\leq 18.0$	<50.0	15	0.02	40
1608	ICVL1018X500	$\leq 18.0$	50	20	0.05	75
2012	ICVL2118A500	$\leq 18.0$	50	30	0.1	100
3216	ICVL3118A500	$\leq 18.0$	50	30	0.1	200

### ■ TERMINOLOGY

- $V_{WM}$ : Maximum steady state DC operating voltage the varistor can maintain and not exceed 50 $\mu$ A 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 <sub>WM</sub>	V <sub>S</sub>	V <sub>C</sub>	I <sub>peak</sub>	E <sub>trans</sub>	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 $\pm 10\%$	Temperature: $+40 \pm 2^\circ \text{C}$ 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 $\pm 10\%$  IEC1000-4-5 standard 1.2/50 $\mu\text{s}$ - 8/20 $\mu\text{s}$ voltage-current combination pulse	Temperature: $+40 \pm 2^\circ \text{C}$ Humidity: 90—95%RH Polarity: +, - Number of pulses: one (1) Surge pulse: 8/20 $\mu\text{s}$ Applied current: maximum surge current ( <b>Is</b> )
Maximum surge energy	Varistor voltage change: within $\pm 10\%$  IEC1000-4-5 standard 10/1000 $\mu\text{s}$ current pulse	Temperature: $+40 \pm 2^\circ \text{C}$ Humidity: 90—95%RH Polarity: +, - Number of pulses: one (1) Surge pulse: 10/1000 $\mu\text{s}$ Applied current: maximum surge current ( <b>Ws</b> )
ESD life	1.No mechanical damage 2. Varistor voltage change: within $\pm 10\%$  ESD gun (IEC1000-4-2 standard) C=150pF R=330 $\Omega$	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 $\pm 10\%$  ESD gun (IEC1000-4-2 standard) C=150pF R=330 $\Omega$	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<sup>2</sup>)
- 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

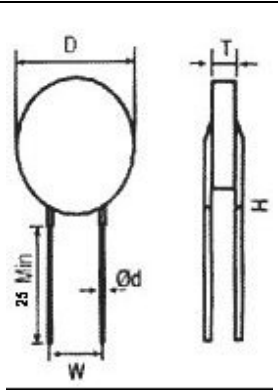
**HOW TO ORDER Zinc Oxide Leaded Varistors**

<b><u>FNR</u></b>	—	<b><u>05</u></b>	<b><u>K</u></b>	<b><u>180</u></b>	<b><u>B</u></b>
Non Linear Resistor Designation		Type & Diameter Designation	Tolerance Designation	Rated Voltage	Packaging Method
		See Table <b>A</b>	K = ± 10% M = ± 20%	First 2 digits are significant; Last digit is number of zeros	B = Bulk T = Tape & Reel

P/N Example: **FNR – 05K180T****TYPE & DIAMETER DESIGNATION**

Table A

Type Code	Varistor Type	Rated Voltage	D Max	d ± 0.1	W ± 1.0	H Max	T Max
<b>05</b>	<b>General Usage</b>	18 – 82	7.0	0.6	5.0	10.0	3.5
		100 – 470	7.5	0.6	5.0	10.0	6.0
<b>07</b>		18 – 470	9.0	0.6	5.0	12.0	6.0
<b>10</b>		18 – 330	13.5	0.8	7.5	16.5	5.4
		360 – 1100	14.0	0.8	7.5	17.0	8.5
<b>14</b>		18 – 330	17.0	0.8	7.5	20.0	5.4
		360 – 1100	17.5	0.8	7.5	20.5	8.5
		1800	25.0	0.8	15.0	30.0	12.0
<b>20</b>		18 – 330	23.0	1.0	10.0	27.0	5.5
		360 – 1100	24.0	1.0	10.0	28.0	9.0
	1800	25.0	1.0	10.0	30.0	12.0	
<b>25</b>	<b>Lightning Arrestor</b>	47 - 1100	30	1.2	15	33.0	12.0
<b>32</b>			38	1.5	18	41.0	13.0
<b>40</b>			45	1.5	20	48.0	13.0



Note:  
All dimensions in mm

**Note:** Type Codes 05, 07, 10 and 14 available on tape and in bulk; all larger sizes in bulk only.**ZINC OXIDE LEADED VARISTOR PERFORMANCE**

ITEM	REQUIREMENTS	TEST CONDITION
Humidity load resistance	1. No mechanical damage 2. Varistor voltage change: within ± 10%	Temperature / Humidity: +40 ±2° C / 90—95%RH Applied Voltage: working voltage Duration: 500 hours Measured after 24 hours at room ambient temperature
Maximum surge current	Varistor voltage change: within ± 10% per IEC1000-4-5 standard; 1.2/50 μs - 8/20 μs voltage-current combination pulse	Temperature: +40 ±2° C Humidity: 90—95%RH Number of pulses: one (1) Surge pulse: 8/20 μs Applied current: maximum surge current (Is)
Maximum surge energy	Varistor voltage change within ± 10% per IEC1000-4-5 standard: 10/1000 μs current pulse	Temperature / Humidity: +40 ±2° C / 90—95%RH Number of pulses: one (1) Surge pulse: 10/1000 μs Applied current: maximum surge current (Is)
ESD life	1. No mechanical damage 2. Varistor voltage change: within ± 10%; ESD gun (IEC1000-4-2 standard) C=150pF R=330Ω	Discharge: contact discharge Voltage: 8,000V(level 4) Number of discharges: 10,000 times in 10 sec.
ESD test	1. No mechanical damage 2. Varistor voltage change: within ± 10%; use ESD gun (IEC1000-4-2 standard) C=150pF R=330Ω	Discharge: Air discharge Voltage: 25,000V(special level) Number of discharges: 10 times in 10 sec



**Note:** All Surge Testing to be performed in both polarities.

## General Usage Zinc Oxide Leaded Varistors 18 – 100 VDC

Part No.	Varistor Voltage	Maximum Operating Voltage		Maximum Clamping Voltage (8 x 20 $\mu$ s)		Maximum Withstanding Surge Current (8 x 20 $\mu$ s)		Maximum Energy (J)		Rated Watts	Capacitance (Reference) 1KHz
	VDC (v)	AC (V)	DC (V)	VC (V)	IP (A)	2 Times (A)	1 Time (A)	2ms	10/1000 $\mu$ s	(W)	(Pf)
FNR-05K180	18	11	14	40	1	50	100	0.3	0.4	0.01	1600
FNR-07K180	18	11	14	36	2.5	125	250	0.8	0.9	0.02	3500
FNR-10K180	18	11	14	36	5	250	500	1.5	2.1	0.05	7500
FNR-14K180	18	11	14	36	10	500	1000	3.5	4.0	0.1	18000
FNR-20K180	18	11	14	36	20	1000	2000	10.0	11.0	0.2	37000
FNR-05K220	22	14	18	48	1	50	100	0.4	0.5	0.01	1300
FNR-07K220	22	14	18	43	2.5	125	250	0.9	1.1	0.02	2800
FNR-10K220	22	14	18	43	5	250	500	2.0	2.5	0.05	6000
FNR-14K220	22	14	18	43	10	500	1000	4.0	5.0	0.1	15000
FNR-20K220	22	14	18	43	20	1000	2000	13.0	14.0	0.2	30000
FNR-05K270	27	17	22	60	1	50	100	0.5	0.6	0.01	1050
FNR-07K270	27	17	22	53	2.5	125	250	1.0	1.4	0.02	2000
FNR-10K270	27	17	22	53	5	250	500	2.5	3.0	0.05	4000
FNR-14K270	27	17	22	53	10	500	1000	5.0	6.0	0.1	10000
FNR-20K270	27	17	22	53	20	1000	2000	15.0	18.0	0.2	20000
FNR-05K330	33	20	26	73	1	50	100	0.6	0.8	0.01	900
FNR-07K330	33	20	26	65	2.5	125	250	1.2	1.7	0.02	1500
FNR-10K330	33	20	26	65	5	250	500	3.0	4.0	0.05	3000
FNR-14K330	33	20	26	65	10	500	1000	6.0	7.5	0.1	7500
FNR-20K330	33	20	26	65	20	1000	2000	20.0	13.0	0.2	17000
FNR-05K390	39	25	31	86	1	50	100	0.8	0.9	0.01	500
FNR-07K390	39	25	31	77	2.5	125	250	1.5	2.1	0.02	1350
FNR-10K390	39	25	31	77	5	250	500	3.5	4.6	0.05	2600
FNR-14K390	39	25	31	77	10	500	1000	7.0	8.6	0.1	6500
FNR-20K390	39	25	31	77	20	1000	2000	54.0	26.0	0.2	15000
FNR-05K470	47	30	38	104	1	50	100	1.0	1.1	0.01	450
FNR-07K470	47	30	38	93	2.5	125	250	1.8	2.5	0.02	1150
FNR-10K470	47	30	38	93	5	250	500	4.5	5.5	0.05	2200
FNR-14K470	47	30	38	93	10	500	1000	8.5	10.0	0.1	5500
FNR-20K470	47	30	38	93	20	1000	2000	30.0	33.0	0.2	13000
FNR-05K560	56	35	45	123	1	50	100	1.0	1.3	0.01	400
FNR-07K560	56	35	45	110	2.5	125	250	2.2	3.1	0.02	950
FNR-10K560	56	35	45	110	5	250	500	5.5	7.0	0.05	1800
FNR-14K560	56	35	45	110	10	500	1000	10.0	11.0	0.1	4500
FNR-20K560	56	35	45	110	20	1000	2000	35.0	41.0	0.2	11000
FNR-05K680	68	40	56	150	1	50	100	1.2	1.6	0.01	350
FNR-07K680	68	40	56	135	2.5	125	250	2.5	3.6	0.02	700
FNR-10K680	68	40	56	135	5	250	500	6.5	8.2	0.05	1300
FNR-14K680	68	40	56	135	10	500	1000	12.0	14.0	0.1	3300
FNR-20K680	68	40	56	135	20	1000	2000	40.0	46.0	0.2	7000
FNR-05K820	82	50	65	145	5	200	400	1.7	2.5	0.1	250
FNR-07K820	82	50	65	135	10	600	1200	3.5	5.5	0.25	550
FNR-10K820	82	50	65	135	25	1250	2500	8.0	12.0	0.4	1800
FNR-14K820	82	50	65	135	50	2500	4500	14.0	22.0	0.6	2900
FNR-20K820	82	50	65	135	100	4000	6500	27.0	38.0	1.0	5500
FNR-05K101	100	60	85	175	5	200	400	2.0	3.0	0.1	200
FNR-07K101	100	60	85	165	10	600	1200	4.0	6.5	0.25	500
FNR-10K101	100	60	85	165	25	1250	2500	10.0	15.0	0.4	1400
FNR-14K101	100	60	85	165	50	2500	4500	18.0	28.0	0.6	2400
FNR-20K101	100	60	85	165	100	4000	6500	30.0	45.0	1.0	4800

## General Usage Zinc Oxide Leaded Varistors 120 – 360 VDC

Part No.	Varistor Voltage	Maximum Operating Voltage		Maximum Clamping Voltage (8 x 20 $\mu$ s)		Maximum Withstanding Surge Current (8 x 20 $\mu$ s)		Maximum Energy (J)		Rated Watts	Capacitance (Reference) 1KHz
	VDC (v)	AC (V)	DC (V)	VC (V)	IP (A)	2 Times (A)	1 Time (A)	2ms	10/1000 $\mu$ s	(W)	(Pf)
FNR-05K121	120	75	100	210	5	200	400	2.5	0.4	0.1	170
FNR-07K121	120	75	100	200	10	600	1200	5.0	7.8	0.25	450
FNR-10K121	120	75	100	200	25	1250	2500	12.0	18.0	0.4	1100
FNR-14K121	120	75	100	200	50	2500	4500	20.0	32.0	0.6	1900
FNR-20K121	120	75	100	200	100	4000	6500	40.0	55.0	1.0	3800
FNR-05K151	150	95	125	260	5	200	400	3.0	4.8	0.1	140
FNR-07K151	150	95	125	250	10	600	1200	6.0	9.7	0.25	350
FNR-10K151	150	95	125	250	25	1250	2500	16.0	22.0	0.4	900
FNR-14K151	150	95	125	250	50	2500	4500	25.0	40.0	0.6	1500
FNR-20K151	150	95	125	250	100	4000	6500	50.0	70.0	1.0	3000
FNR-05K181	180	115	150	315	5	200	400	3.5	5.5	0.1	110
FNR-07K181	180	115	150	300	10	600	1200	8.0	1.0	0.25	300
FNR-10K181	180	115	150	300	25	1250	2500	18.0	25.0	0.4	700
FNR-14K181	180	115	150	300	50	2500	4500	30.0	50.0	0.6	1250
FNR-20K181	180	115	150	300	100	4000	6500	60.0	85.0	1.0	2500
FNR-05K201	200	130	170	355	5	200	400	4.0	6.5	0.1	80
FNR-07K201	200	130	170	340	10	600	1200	10.0	13.0	0.25	250
FNR-10K201	200	130	170	340	25	1250	2500	20.0	30.0	0.4	500
FNR-14K201	200	130	170	340	50	2500	4500	35.0	57.0	0.6	1000
FNR-20K201	200	130	170	340	100	4000	6500	70.0	95.0	1.0	2000
FNR-05K221	220	140	180	380	5	200	400	4.5	7.0	0.1	70
FNR-07K221	220	140	180	360	10	600	1200	10.0	14.0	0.25	250
FNR-10K221	220	140	180	360	25	1250	2500	23.0	32.0	0.4	450
FNR-14K221	220	140	180	360	50	2500	4500	40.0	60.0	0.6	1000
FNR-20K221	220	140	180	360	100	4000	6500	75.0	100.0	1.0	2000
FNR-05K241	240	150	200	415	5	200	400	5.0	8.0	0.1	70
FNR-07K241	240	150	200	395	10	600	1200	10.0	15.0	0.25	200
FNR-10K241	240	150	200	395	25	1250	2500	25.0	35.0	0.4	400
FNR-14K241	240	150	200	395	50	2500	4500	40.0	63.0	0.6	900
FNR-20K241	240	150	200	395	100	4000	6500	80.0	108.0	1.0	1800
FNR-05K271	270	175	225	475	5	200	400	6.0	8.5	0.1	65
FNR-07K271	270	175	225	455	10	600	1200	12.0	18.0	0.25	170
FNR-10K271	270	175	225	455	25	1250	2500	30.0	40.0	0.4	350
FNR-14K271	270	175	225	455	50	2500	4500	50.0	70.0	0.6	750
FNR-20K271	270	175	225	455	100	4000	6500	90.0	127.0	1.0	1600
FNR-05K301	300	200	250	525	5	200	400	6.0	9.0	0.1	55
FNR-07K301	300	200	250	500	10	600	1200	13.0	20.8	0.25	150
FNR-10K301	300	200	250	500	25	1250	2500	27.0	42.0	0.4	325
FNR-14K301	300	200	250	500	50	2500	4500	55.0	75.0	0.6	650
FNR-20K301	300	200	250	500	100	4000	6500	105.0	135.0	1.0	1400
FNR-05K331	330	210	275	580	5	200	400	6.5	9.0	0.1	60
FNR-07K331	330	210	275	550	10	600	1200	14.5	22.0	0.25	150
FNR-10K331	330	210	275	550	25	1250	2500	30.0	44.0	0.4	325
FNR-14K331	330	210	275	550	50	2500	4500	60.0	80.0	0.6	650
FNR-20K331	330	210	275	550	100	4000	6500	105.0	155.0	1.0	1400
FNR-05K361	360	230	300	620	5	200	400	7.5	10.0	0.1	50
FNR-07K361	360	230	300	595	10	600	1200	15.0	25.0	0.25	130
FNR-10K361	360	230	300	595	25	1250	2500	25.0	47.0	0.4	300
FNR-14K361	360	230	300	595	50	2500	4500	65.0	93.0	0.6	550
FNR-20K361	360	230	300	595	100	4000	6500	120.0	163.0	1.0	1200

## General Usage Zinc Oxide Leaded Varistors 390 – 1800 VDC

Part No.	Varistor Voltage	Maximum Operating Voltage		Maximum Clamping Voltage (8 x 20 $\mu$ s)		Maximum Withstanding Surge Current (8 x 20 $\mu$ s)		Maximum Energy (J)		Rated Watts	Capacitance (Reference) 1KHz
	VDC (v)	AC (V)	DC (V)	VC (V)	IP (A)	2 Times (A)	1 Time (A)	2ms	10/1000 $\mu$ s	(W)	(Pf)
FNR-05K391	390	250	320	675	5	200	400	8	12	0.1	50
FNR-07K391	390	250	320	650	10	600	1200	17	25	0.25	130
FNR-10K391	390	250	320	650	25	1250	2500	40	60	0.4	270
FNR-14K391	390	250	320	650	50	2500	4500	70	100	0.6	500
FNR-20K391	390	250	320	650	100	4000	6500	130	180	1.0	1000
FNR-05K431	430	275	350	745	5	200	400	9	13	0.1	45
FNR-07K431	430	275	350	710	10	600	1200	20	28	0.25	110
FNR-10K431	430	275	350	710	25	1250	2500	45	65	0.4	250
FNR-14K431	430	275	350	710	50	2500	4500	75	115	0.6	450
FNR-20K431	430	275	350	710	100	4000	6500	140	190	1.0	900
FNR-05K471	470	300	385	810	5	200	400	10	15	0.1	40
FNR-07K471	470	300	385	775	10	600	1200	20	30	0.25	100
FNR-10K471	470	300	385	775	25	1250	2500	45	70	0.4	230
FNR-14K471	470	300	385	775	50	2500	4500	80	125	0.6	440
FNR-20K471	470	300	385	775	100	4000	6500	150	220	1.0	900
FNR-10K511	510	318	415	840	25	1250	2500	45	70	0.4	200
FNR-14K511	510	318	415	840	50	2500	4500	80	125	0.6	380
FNR-20K511	510	318	415	840	100	4000	6500	150	220	1.0	800
FNR-10K561	560	350	455	925	25	1250	2500	45	70	0.4	180
FNR-14K561	560	350	455	925	50	2500	4500	80	125	0.6	345
FNR-20K561	560	350	455	925	100	4000	6500	150	220	1.0	700
FNR-10K621	620	380	505	1025	25	1250	2500	45	70	0.4	130
FNR-14K621	620	380	505	1025	50	2500	4500	85	125	0.6	250
FNR-20K621	620	380	505	1025	100	4000	6500	150	220	1.0	500
FNR-10K681	680	420	560	1120	25	1250	2500	45	70	0.4	130
FNR-14K681	680	420	560	1120	50	2500	4500	90	130	0.6	250
FNR-20K681	680	420	560	1120	100	4000	6500	160	230	1.0	460
FNR-10K751	750	460	615	1240	25	1250	2500	50	75	0.4	120
FNR-14K751	750	460	615	1240	50	2500	4500	100	143	0.6	230
FNR-20K751	750	460	615	1240	100	4000	6500	175	255	1.0	420
FNR-10K781	780	485	640	1290	25	1250	2500	50	80	0.4	120
FNR-14K781	780	485	640	1290	50	2500	4500	105	148	0.6	230
FNR-20K781	780	485	640	1290	100	4000	6500	180	265	1.0	420
FNR-10K821	820	510	670	1355	25	1250	2500	55	85	0.4	110
FNR-14K821	820	510	670	1355	50	2500	4500	110	157	0.6	200
FNR-20K821	820	510	670	1355	100	4000	6500	190	282	1.0	400
FNR-10K911	910	550	745	1500	25	1250	2500	60	93	0.4	100
FNR-14K911	910	550	745	1500	50	2500	4500	120	175	0.6	180
FNR-20K911	910	550	745	1500	100	4000	6500	215	310	1.0	350
FNR-10K102	1000	625	825	1650	25	1250	2500	65	102	0.4	90
FNR-14K102	1000	625	825	1650	50	2500	4500	130	190	0.6	150
FNR-20K102	1000	625	825	1650	100	4000	6500	230	342	1.0	320
FNR-10K112	1100	680	895	1815	25	1250	2500	70	115	0.4	80
FNR-14K112	1100	680	895	1815	50	2500	4500	140	213	0.6	150
FNR-20K112	1100	680	895	1815	100	4000	6500	250	383	1.0	300
FNR-14K182	1800	1000	1465	2970	50	2500	4500	240	337	0.6	100
FNR-20K182	1800	1000	1465	2970	100	4000	6500	400	625	1.0	200

## Lightning Arrestor Zinc Oxide Leaded Varistors 47 - 680 VDC

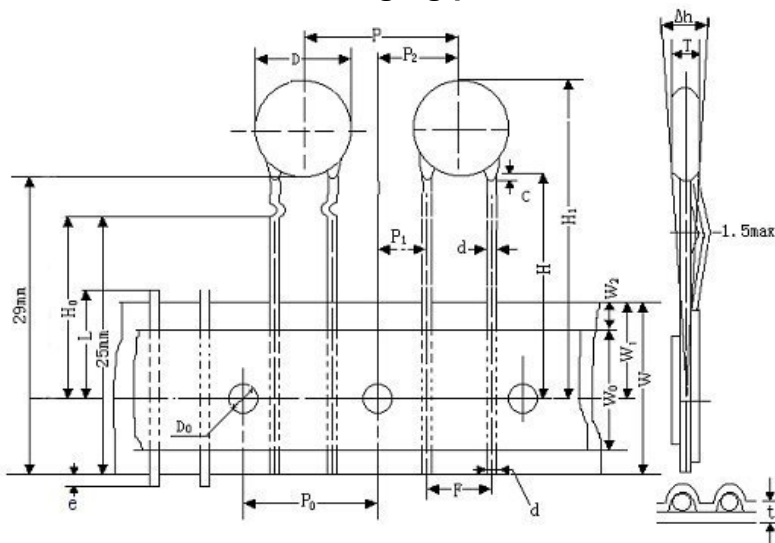
Part No.	Varistor Voltage	Maximum Operating Voltage		Maximum Clamping Voltage (8 x 20 $\mu$ s)		Maximum Withstanding Surge Current (8 x 20 $\mu$ s)	Maximum Energy (J)	Rated Watts	Capacitance (Reference) 1KHz
	VDC (v)	AC (V)	DC (V)	VC (V)	IP (A)	2 Times (A)	2ms	(W)	(Pf)
FNR-25K470	47	30	38	89	40	1250	15	1.0	10000
FNR-32K470	47	30	38	89	40	2500	25	1.2	11000
FNR-40K470	47	30	38	89	40	5000	40	1.4	15000
FNR-25K560	56	35	45	106	40	1250	18	1.0	8000
FNR-32K560	56	35	45	106	40	2500	30	1.2	10000
FNR-40K560	56	35	45	106	40	5000	45	1.4	14000
FNR-25K680	68	40	56	129	40	1250	21	1.0	7000
FNR-32K680	68	40	56	129	40	2500	32	1.2	9000
FNR-40K680	68	40	56	129	40	5000	50	1.4	13000
FNR-25K820	82	50	65	156	200	5000	23	1.0	6000
FNR-32K820	82	50	65	156	200	10000	35	1.2	8000
FNR-40K820	82	50	65	156	200	20000	60	1.4	12000
FNR-25K101	100	60	85	190	200	5000	25	1.0	5000
FNR-32K101	100	60	85	190	200	10000	38	1.2	7000
FNR-40K101	100	60	85	190	200	20000	75	1.4	11500
FNR-25K121	120	75	100	216	200	5000	28	1.0	4000
FNR-32K121	120	75	100	216	200	10000	42	1.2	6000
FNR-40K121	120	75	100	216	200	20000	90	1.4	11000
FNR-25K151	150	95	125	270	200	5000	30	1.0	3000
FNR-32K151	150	95	125	270	200	10000	50	1.2	5000
FNR-40K151	150	95	125	270	200	20000	120	1.4	10500
FNR-25K201	200	130	270	360	200	5000	35	1.0	2400
FNR-32K201	200	130	270	360	200	10000	70	1.2	4700
FNR-40K201	200	130	270	360	200	20000	160	1.4	10000
FNR-25K221	220	140	180	385	200	5000	40	1.0	2200
FNR-32K221	220	140	180	385	200	10000	90	1.2	4300
FNR-40K221	220	140	180	385	200	20000	180	1.4	9500
FNR-25K241	240	150	200	420	200	5000	60	1.0	2000
FNR-32K241	240	150	200	420	200	10000	120	1.2	4000
FNR-40K241	240	150	200	420	200	20000	220	1.4	9000
FNR-25K271	270	175	225	473	200	5000	90	1.0	1700
FNR-32K271	270	175	225	473	200	10000	150	1.2	3500
FNR-40K271	270	175	225	473	200	20000	260	1.4	750
FNR-25K361	360	230	300	612	200	5000	120	1.0	1400
FNR-32K361	360	230	300	612	200	10000	180	1.2	3000
FNR-40K361	360	230	300	612	200	20000	300	1.4	6000
FNR-25K391	390	250	320	663	200	5000	150	1.0	1200
FNR-32K391	390	250	320	663	200	10000	220	1.2	2500
FNR-40K391	390	250	320	663	200	20000	340	1.4	5000
FNR-25K431	430	275	350	731	200	5000	180	1.0	1100
FNR-32K431	430	275	350	731	200	10000	260	1.2	2250
FNR-40K431	430	275	350	731	200	20000	380	1.4	4500
FNR-25K471	470	300	380	799	200	5000	220	1.0	1000
FNR-32K471	470	300	380	799	200	10000	300	1.2	1900
FNR-40K471	470	300	380	799	200	20000	420	1.4	3600
FNR-25K621	620	385	505	1054	200	5000	260	1.0	1500
FNR-32K621	620	385	505	1054	200	10000	340	1.2	3200
FNR-40K621	620	385	505	1054	200	20000	450	1.4	3300
FNR-25K681	680	420	560	1160	200	5000	300	1.0	1200
FNR-32K681	680	420	560	1160	200	10000	380	1.2	3000
FNR-40K681	680	420	560	1160	200	20000	500	1.4	3000

## Lightning Arrestor Zinc Oxide Leaded Varistors 750 - 1800 VDC

Part No.	Varistor Voltage	Maximum Operating Voltage		Maximum Clamping Voltage (8 x 20 $\mu$ s)		Maximum Withstanding Surge Current (8 x 20 $\mu$ s)	Maximum Energy (J)	Rated Watts	Capacitance (Reference) 1KHz
	VDC (v)	AC (V)	DC (V)	VC (V)	IP (A)	2 Times (A)	2ms	(W)	(Pf)
FNR-25K751	750	460	615	1275	200	5000	350	1.0	1100
FNR-32K751	750	460	615	1275	200	10000	430	1.2	2700
FNR-40K751	750	460	615	1275	200	20000	550	1.4	2500
FNR-25K781	780	485	640	1326	200	5000	370	1.0	1050
FNR-32K781	780	485	640	1326	200	10000	480	1.2	2600
FNR-40K781	780	485	640	1326	200	20000	600	1.4	2450
FNR-25K821	820	510	670	1400	200	5000	400	1.0	1000
FNR-32K821	820	510	670	1400	200	10000	530	1.2	2400
FNR-40K821	820	510	670	1400	200	20000	640	1.4	2400
FNR-25K911	910	550	745	1550	200	5000	420	1.0	900
FNR-32K911	910	550	745	1550	200	10000	580	1.2	2200
FNR-40K911	910	550	745	1550	200	20000	700	1.4	2200
FNR-25K102	1000	625	825	1700	200	5000	450	1.0	800
FNR-32K102	1000	625	825	1700	200	10000	630	1.2	1900
FNR-40K102	1000	625	825	1700	200	20000	800	1.4	2000
FNR-25K112	1100	680	895	1870	200	5000	500	1.0	700
FNR-32K112	1100	680	895	1870	200	10000	700	1.2	1700
FNR-40K112	1100	680	895	1870	200	20000	850	1.4	1800
FNR-32K182	1800	1000	1465	3060	200	10000	750	1.2	1600
FNR-40K182	1800	1000	1465	3060	200	20000	1000	1.4	1600

### Packaging

#### AMMO Packaging per EIA 468



Quantity per Ammo Box		
Type Code	18 – 270 VDC	300 – 470 VDC
05	2500	2000
07	2000	1500
10	2000	1500
14	1500	1000

**Note:**  
Type Codes 05, 07, 10 and 14 available on tape per the above table.

Symbol	Item		Dimension (in mm)			
	Type Code in Part Number		05	07	10	14
D	Body diameter		7.5 max	9.0 max	13.5 max	16.5 max
T	Body thickness		Table A		Table A	
d	Lead-wire diameter		0.6 ± 0.1		0.8 ± 0.1	
P	Pitch between capacitors		12.7 ± 1.0		25.4 ± 1.0	
P <sub>0</sub>	Feed hole pitch		12.7 ± 0.3		12.7 ± 0.3	
P <sub>1</sub>	Feed hole center to lead center *		3.85 ± 0.7		7.5 ± 0.8	
P <sub>2</sub>	Feed hole center to capacitor center		6.35 ± 1.3		12.7 ± 1.3	
F	Lead spacing		5.0 +0.8/-0.8		7.5 +0.8/-0.8	
Δh	Capacitor alignment F-R		0 ± 2.0		0 ± 2.0	
W	Tape width		18.0 +1.0/-0.5		18.0 +1.0/-0.5	
W <sub>0</sub>	Hold-down tape width		12 min		12 min	
W <sub>1</sub>	Hole position		9.0 ± 0.5		9.0 ± 0.5	
W <sub>2</sub>	Hold-down tape position		3.0 max		3.0 max	
H	Height to seating plane (See Note)	For straight Lead type	20.0 +1.5/-1.0		20.0 +1.5/-1.0	
H <sub>0</sub>		For Kinked Lead type	16.0 ± 0.5 <b>Outside Kink</b>		16.0 ± 0.5 <b>Inside Kink</b>	
H <sub>1</sub>	Capacitor height		32.25 max		40 max	
e	Lead-wire protrusion		1.0 max		1.0 max	
D <sub>0</sub>	Feed hole diameter		4.0 ± 0.2		4.0 ± 0.2	
t	Total tape thickness		0.7 ± 0.2		0.9 ± 0.2	
L	Length of snapped off leads		11.0 max		11.0 max	
C	Coating rundown on leads		2.0 max		2.5	

**Note:** OUTSIDE Kink and straight leads available on 05 and 07 Type Codes; INSIDE Kink and straight leads on 10 and 14 Type Codes; STRAIGHT LEADS only on all other Type Codes.