



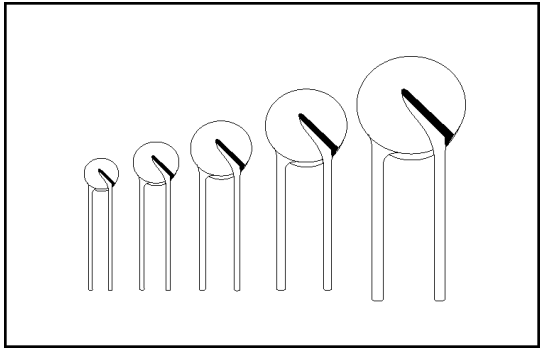
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<b>Series</b>	<b>Description</b>	<b>Page</b>
CNR	Part Numbering System	D2
	MOV Description	D2
	Selection Guide	D3-7
	Performance Characteristics	D8-10
	Line Surge Protection	D11
	Application Notes	D12-13
	Packaging	D14-15
	Tape Specifications	D16

# Metal Oxide Varistors

## RGA Varistor

Varistor's are voltage dependent, nonlinear devices which have an electrical behavior similar to back-to-back zener diodes. RGA series zinc oxide varistors are nonlinear resistors, consisting mainly of zinc oxide and several kinds of metal oxide additives. They are bilateral and symmetrical V-1 characteristics curve and unparalleled large peak current capabilities are used for absorption of transient voltage, suppression of pulse noise and circuit voltage stabilization.

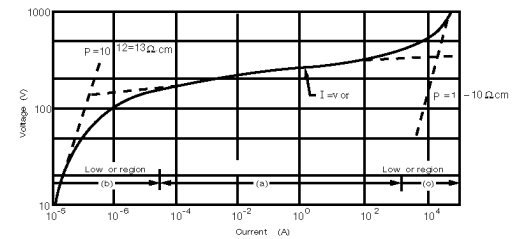


## Features

- Fast response
- Excellent voltage ratio
- High stabilization for circuit voltage
- Unparalleled absorption for transient voltage characteristics
- Bilateral and symmetrical V-1 characteristics curve

## Applications

- Surge Protection in consumer electronics
  - industrial electronics
  - telephone and telecommunication systems
  - automobile equipment
  - measuring and controller systems
  - electronic home appliances
  - gas and petroleum appliances
- Absorption of switching surge from various kinds of relays and electro-magnetic valves.
- Electrostatic discharge and spike noise suppression.
- Protection of various kinds of transistors, diodes, ICs, thyristors, triac semiconductors, etc.
- Automobile control system such as transistorized ignition system and electronic fuel injection system, etc.

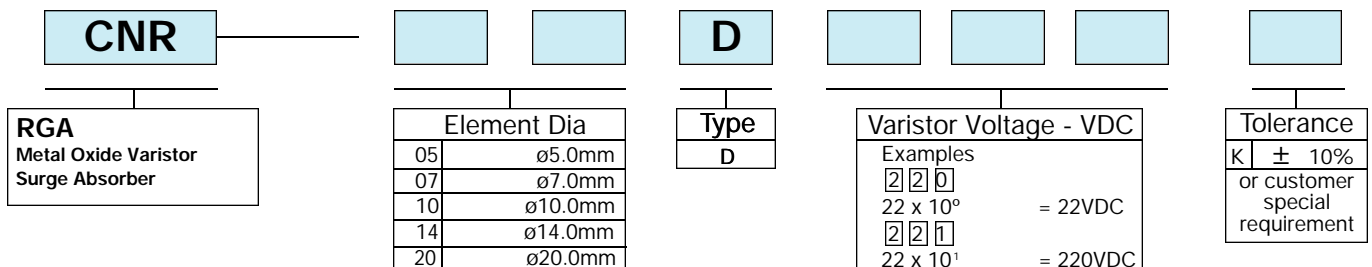


Typical Varistor V-I Curve

## Related Standards

- UL 1414, UL1449 (2nd Edition), CSA, VDE

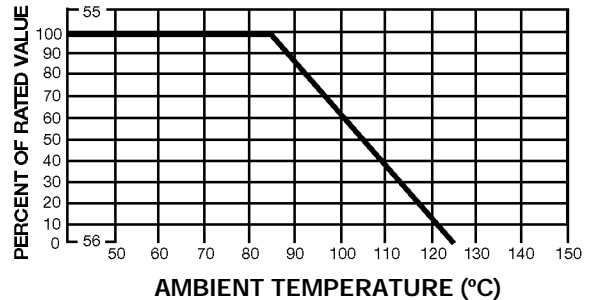
## Explanation of Part Numbers





## Specifications

- Varistor Voltage Range . . . . .82 TO 820Vdc
- Peak Current for 8/20  $\mu$ S Current Wave . . . . . 800 TO 12000A
- Energy Range For 10/1000  $\mu$ S Current Wave . . . . . 3.5 TO 460 Joul
- Storage Temperature Range . . . . . -40 TO +125°C
- Operation Ambient Temperature Range . . . . . -40 TO + 85°C
- Typical Response Time . . . . . <25ns
- Insulation Resistance . . . . . >1000M



## Device Ratings and Characteristics

Current, Energy and Power Derating Curve

Part No. Device Marking	Maximum Allowable Voltage		Varistor Voltage (@1mA)			Clamping Voltage @ Test Current (8/20 $\mu$ s)		Maximum Energy (J)	Maximum Peak Current (8/20 $\mu$ s)	Rated Power	Typical Capacitance (@1K Hz)	Standards
	ACrms(V)	DC(V)	Min.	Vb(VDC)	Max.	Vc(V)	Ip(A)	10/1000 $\mu$ s	(A)	(W)	(pF)	
CNR-05D820K	50	66	74	82	90	135	5	3.5	800	0.10	460	☆ ○
CNR-05D101K	60	85	90	10	110	175	5	4.0	800	0.10	400	☆ ○
CNR-05D121K	75	100	108	120	132	210	5	5.0	800	0.10	350	☆ ○
CNR-05D151K	95	125	135	150	165	260	5	6.5	800	0.10	300	☆ ○
CNR-05D181K	115	150	162	180	198	325	5	7.5	800	0.10	200	☆ ○
CNR-05D201K	130	175	185	200	225	330	5	8.5	800	0.10	120	☆ ★ ○
CNR-05D221K	140	180	198	220	242	360	5	9.0	800	0.10	110	☆ ★ ○
CNR-05D241K	150	200	216	240	264	395	5	10.5	800	0.10	100	☆ ★ ○
CNR-05D271K	180	230	247	270	303	475	5	11.0	800	0.10	90	☆ ★ ○
CNR-05D301K	195	250	270	300	330	505	5	12.0	800	0.10	85	☆ ★ ○
CNR-05D331K	210	275	297	330	363	540	5	13.0	800	0.10	75	☆ ★ ○
CNR-05D361K	230	300	324	360	396	620	5	16.0	800	0.10	75	☆ ★ ○
CNR-05D391K	250	320	351	390	429	675	5	17.0	800	0.10	75	☆ ★ ○
CNR-05D431K	275	350	387	430	473	745	5	20.0	800	0.10	70	☆ ★ ○
CNR-05D471K	300	385	423	470	517	775	5	21.0	800	0.10	50	☆ ★ ○
CNR-05D511K	320	410	459	510	561	880	5	21.0	800	0.10	50	☆ ★ ○
CNR-05D561K	350	460	504	560	616	940	5	22.0	800	0.10	40	☆ ★ ○
CNR-05D621K	385	505	558	620	682	1050	5	23.0	800	0.10	40	☆ ★ ○
CNR-05D681K	420	560	612	680	748	1150	5	24.0	800	0.10	40	★ ○
CNR-05D751K	460	615	675	750	825	1290	5	25.0	800	0.10	40	★ ○

Note: 1.05D series Varistor voltage test current by DC 0.1mA

## Application Notes for agency Recognized Components

Related Standards

Standard No.	ULI414	ULI449 (2nd Edition)	CSA	VDE
Title	Across-The Line Components	Transient Voltage Surge Suppressors	Accessories & Parts For Electronic Product.	Varistors for use in Electronic Equipment
File No.	E165143	E150709	LR109736	21557-4790-0001
Symbols		☆	★	○

## Selection Guide

1. Determine the necessary steady-state voltage (working voltage).
2. Establish the transient energy absorbed by the varistor.
3. Calculate the peak transient current through the varistor.
4. Determine power dissipation requirement.
5. Select a model to provide the required voltage-clamping characteristics.



# Metal Oxide Varistors

## Device Ratings and Characteristics

Part No. Device Marking	Maximum Allowable Voltage		Varistor Voltage (@1mA)			Clamping Voltage @ Test Current (8/20 $\mu$ s)		Maximum Energy (J)	Maximum Peak Current (8/20 $\mu$ s)	Rated Power	Typical Capacitance (@1K Hz)	Standards
	ACrms(V)	DC(V)	Min.	Vb(VDC)	Max.	Vc(V)	Ip(A)	10/1000 $\mu$ s	(A)	(W)	(pF)	
CNR-07D820K	50	66	74	82	90	135	10	7.0	1750	0.25	790	☆ ○
CNR-07D101K	60	85	90	100	110	165	10	8.5	1750	0.25	700	☆ ○
CNR-07D121K	75	100	108	120	132	200	10	10.0	1750	0.25	590	☆ ○
CNR-07D151K	95	125	135	150	165	250	10	13.0	1750	0.25	500	☆ ○
CNR-07D181K	115	150	162	180	198	300	10	15.0	1750	0.25	420	☆ ○
CNR-07D201K	130	175	185	200	225	330	10	17.5	1750	0.25	200	☆☆○
CNR-07D221K	140	180	198	220	242	360	10	19.0	1750	0.25	190	☆☆○
CNR-07D241K	150	200	216	240	264	395	10	21.0	1750	0.25	170	☆☆○
CNR-07D271K	175	230	247	270	303	455	10	24.0	1750	0.25	150	☆☆○
CNR-07D301K	195	250	270	300	330	500	10	26.0	1750	0.25	140	☆☆○
CNR-07D331K	210	275	297	330	363	540	10	28.0	1750	0.25	130	☆☆○
CNR-07D361K	230	300	324	360	396	595	10	32.0	1750	0.25	130	☆☆○
CNR-07D391K	250	320	351	390	429	650	10	35.0	1750	0.25	130	☆☆○
CNR-07D431K	275	350	387	430	473	710	10	40.0	1750	0.25	120	☆☆○
CNR-07D471K	300	385	423	470	517	775	10	42.0	1750	0.25	100	☆☆○
CNR-07D511K	320	410	459	510	561	845	10	45.0	1750	0.25	90	☆☆○
CNR-07D561K	350	460	504	560	616	915	10	47.0	1750	0.25	80	☆☆○
CNR-07D621K	385	505	558	620	682	1025	10	47.0	1750	0.25	70	☆☆○
CNR-07D681K	420	560	612	680	748	1120	10	50.0	1750	0.25	70	☆☆○
CNR-07D751K	460	615	675	750	825	1240	10	55.0	1750	0.25	70	☆☆○
CNR-07D781K	485	640	702	780	858	1290	10	62.0	1750	0.25	70	☆☆○
CNR-07D821K	510	670	738	820	902	1355	10	62.5	1750	0.25	60	☆☆○



## Device Ratings and Characteristics

Part No. Device Marking	Maximum Allowable Voltage		Varistor Voltage (@1mA)			Clamping Voltage @ Test Current (8/20 $\mu$ s)		Maximum Energy (J)	Maximum Peak Current (8/20 $\mu$ s)	Rated Power	Typical Capacitance (@1K Hz)	Standards
	ACrms(V)	DC(V)	Min.	Vb(VDC)	Max.	Vc(V)	Ip(A)	10/1000 $\mu$ s	(A)	(W)	(pF)	
CNR-10D820K	50	66	74	82	90	135	25	14.0	3500	0.40	2000	☆ ○
CNR-10D101K	60	85	90	100	110	165	25	17.0	3500	0.40	1700	☆ ○
CNR-10D121K	75	100	108	120	132	200	25	20.0	3500	0.40	1400	☆ ○
CNR-10D151K	95	125	135	150	165	250	25	25.0	3500	0.40	1100	☆ ○
CNR-10D181K	115	150	162	180	198	300	25	30.0	3500	0.40	600	☆ ○
CNR-10D201K	130	175	185	200	225	340	25	35.0	3500	0.40	430	☆★○
CNR-10D221K	140	180	198	220	242	360	25	39.0	3500	0.40	410	☆★○
CNR-10D241K	150	200	216	240	264	395	25	42.0	3500	0.40	380	☆★○
CNR-10D271K	180	225	247	270	303	450	25	49.0	3500	0.40	350	☆★○
CNR-10D301K	195	250	270	300	330	500	25	55.0	3500	0.40	330	☆★○
CNR-10D331K	210	275	297	330	363	540	25	58.0	3500	0.40	300	☆★○
CNR-10D361K	230	300	324	360	396	595	25	65.0	3500	0.40	300	☆★○
CNR-10D391K	250	320	351	390	429	650	25	70.0	3500	0.40	300	☆★○
CNR-10D431K	275	350	387	430	473	710	25	80.0	3500	0.40	270	☆★○
CNR-10D471K	300	385	423	470	517	775	25	85.0	3500	0.40	230	☆★○
CNR-10D511K	320	420	459	510	561	840	25	92.0	3500	0.40	210	☆★○
CNR-10D561K	350	460	504	560	616	915	25	92.0	3500	0.40	200	☆★○
CNR-10D621K	385	505	558	620	682	1025	25	92.0	3500	0.40	190	☆★○
CNR-10D681K	420	560	612	680	748	1120	25	92.0	3500	0.40	170	☆★○
CNR-10D751K	460	615	675	750	825	1240	25	100.0	3500	0.40	160	☆★○
CNR-10D781K	485	640	702	780	858	1290	25	105.0	3500	0.40	150	☆★○
CNR-10D821K	510	675	738	820	902	1355	25	110.0	3500	0.40	140	☆★○



# Metal Oxide Varistors

## Device Ratings and Characteristics

Part No. Device Marking	Maximum Allowable Voltage		Varistor Voltage (@1mA)			Clamping Voltage @ Test Current (8/20 $\mu$ s)		Maximum Energy (J)	Maximum Peak Current (8/20 $\mu$ s)	Rated Power	Typical Capacitance (@1K Hz)	Standards
	ACrms(V)	DC(V)	Min.	Vb(VDC)	Max.	Vc(V)	Ip(A)	10/1000 $\mu$ s	(A)	(W)	(pF)	
CNR-14D820K	50	66	74	82	90	135	50	28.0	6000	0.6	3700	☆ ○
CNR-14D101K	60	85	90	100	110	165	50	35.0	6000	0.6	3200	☆ ○
CNR-14D121K	75	100	108	120	132	200	50	42.0	6000	0.6	2700	☆ ○
CNR-14D151K	95	125	135	150	165	250	50	53.0	6000	0.6	2200	☆ ○
CNR-14D181K	115	150	162	180	198	300	50	65.0	6000	0.6	900	☆ ○
CNR-14D201K	130	175	185	200	225	340	50	70.0	6000	0.6	770	☆★○
CNR-14D221K	140	180	198	220	242	360	50	78.0	6000	0.6	740	☆★○
CNR-14D241K	150	200	216	240	264	395	50	84.0	6000	0.6	700	☆★○
CNR-14D271K	180	230	247	270	303	455	50	99.0	6000	0.6	640	☆★○
CNR-14D301K	195	250	270	300	330	500	50	108.0	6000	0.6	600	☆★○
CNR-14D331K	210	275	297	330	363	545	50	115.0	6000	0.6	580	☆★○
CNR-14D361K	230	300	324	360	396	595	50	130.0	6000	0.6	540	☆★○
CNR-14D391K	250	320	351	390	429	650	50	140.0	6000	0.6	500	☆★○
CNR-14D431K	275	350	387	430	473	710	50	155.0	6000	0.6	450	☆★○
CNR-14D471K	300	385	423	470	517	775	50	175.0	6000	0.6	400	☆★○
CNR-14D511K	320	420	459	510	561	845	50	190.0	6000	0.6	350	☆★○
CNR-14D561K	350	460	504	560	616	915	50	190.0	6000	0.6	340	☆★○
CNR-14D621K	385	505	558	620	682	1025	50	190.0	6000	0.6	330	☆★○
CNR-14D681K	420	560	612	680	748	1120	50	190.0	6000	0.6	320	☆★○
CNR-14D751K	460	615	675	750	825	1240	50	210.0	6000	0.6	310	☆★○
CNR-14D781K	485	640	702	780	858	1290	50	225.0	6000	0.6	300	☆★○
CNR-14D821K	510	675	738	820	902	1350	50	235.0	6000	0.6	280	☆★○



## Device Ratings and Characteristics

Part No. Device Marking	Maximum Allowable Voltage		Varistor Voltage (@1mA)			Clamping Voltage @ Test Current (8/20 $\mu$ s)		Maximum Energy (J)	Maximum Peak Current (8/20 $\mu$ s)	Rated Power	Typical Capacitance (@1K Hz)	Standards
	ACrms(V)	DC(V)	Min.	Vb(VDC)	Max.	Vc(V)	Ip(A)	10/1000 $\mu$ s	(A)	(W)	(pF)	
CNR-20D820K	50	660	74	82	90	135	100	56	12000	1.0	7500	☆ ○
CNR-20D101K	60	85	90	100	110	165	100	70	12000	1.0	6500	☆ ○
CNR-20D121K	75	100	108	120	132	200	100	85	12000	1.0	5500	☆ ○
CNR-20D151K	95	125	135	150	165	250	100	106	12000	1.0	4500	☆ ○
CNR-20D181K	115	150	162	180	198	300	100	125	12000	1.0	2000	☆ ○
CNR-20D201K	130	175	185	200	225	340	100	140	12000	1.0	1700	☆☆○
CNR-20D221K	140	180	198	220	242	360	100	155	12000	1.0	1600	☆☆○
CNR-20D241K	150	200	216	240	264	395	100	170	12000	1.0	1500	☆☆○
CNR-20D271K	180	230	247	270	303	455	100	190	12000	1.0	1300	☆☆○
CNR-20D301K	195	250	270	300	330	500	100	215	12000	1.0	1200	☆☆○
CNR-20D331K	210	275	297	330	363	545	100	228	12000	1.0	1100	☆☆○
CNR-20D361K	230	300	324	360	396	595	100	255	12000	1.0	1100	☆☆○
CNR-20D391K	250	320	351	390	429	650	100	275	12000	1.0	1100	☆☆○
CNR-20D431K	275	350	387	430	473	710	100	303	12000	1.0	1000	☆☆○
CNR-20D471K	300	385	423	470	517	775	100	350	12000	1.0	900	☆☆○
CNR-20D511K	320	420	459	510	561	840	100	382	12000	1.0	800	☆☆○
CNR-20D561K	350	460	504	560	616	915	100	382	12000	1.0	750	☆☆○
CNR-20D621K	385	505	558	620	682	1025	100	382	12000	1.0	700	☆☆○
CNR-20D681K	420	560	612	680	748	1120	100	382	12000	1.0	650	☆☆○
CNR-20D751K	460	615	675	750	825	1240	100	420	12000	1.0	600	☆☆○
CNR-20D781K	485	640	702	780	858	1290	100	440	12000	1.0	550	☆☆○
CNR-20D821K	510	675	738	820	902	1350	100	460	12000	1.0	530	☆☆○



# Metal Oxide Varistors

## Performance Characteristics (Electrical)

Characteristics	Test Methods/Description	Specifications																								
Standard Test Condition	Environmental conditions under which every measurement is done without doubt on the measured results. Unless specified, temperature, relative humidity are 5 to 35°C, 45 to 85% RH.	--																								
Varistor Voltage	The voltage between two terminals with the specified measuring current $C_{mA}$ DC applied is called $V_c$ or $V_{CmA}$ . The measurement shall be made as fast as possible to avoid heat affection.	To meet the specified value																								
Maximum Allowable Voltage	The maximum sinusoidal RMS voltage or maximum DC voltage that can be applied continuously in the specified environmental temperature range.																									
Clamping Voltage	The maximum voltage between two terminals with the specified standard impulse current (8/20 $\mu$ s) illustrated below. 																									
Rated Power	The power that can be applied in the specified ambient temperature.																									
Maximum Energy	The maximum energy within the varistor voltage change of $\pm 10\%$ when one impulse of 2 ms or 10/1000 $\mu$ s is applied.																									
Maximum Peak Current (Withstanding Surge Current)	2 times	The maximum current within the varistor voltage change of $\pm 10\%$ with the standard impulse current (8/20 $\mu$ s) applied two times with an interval of 5 minutes.																								
	1 time	The maximum current within the varistor voltage change of $\pm 10\%$ with the standard impulse current (8/20 $\mu$ s) applied one time.																								
Temperature Coefficient of Varistor Voltage	$\frac{V_c \text{ at } 85^\circ\text{C} - V_c \text{ at } 25^\circ\text{C}}{V_c \text{ at } 25^\circ\text{C}} \times \frac{1}{60} \times 100 (\%/^\circ\text{C})$	-0.05%/°C max																								
Capacitance	Capacitance shall be measured at 1K Hz $\pm 10\%$ , 1V rms max. (1MHz below 100 pF). OV bias and 20 $\pm 2^\circ$ C.	To meet the specified value																								
Dissipation Factor	Dissipation Factor shall be measured at 1K Hz $\pm 10\%$ , 1V rms max. (1MHz $\pm 10\%$ below 100 pF). OV bias and 20 $\pm 2^\circ$ C.																									
Withstanding Voltage (Body Insulation)	The specified voltage shall be applied to both terminals of the specimen connected together and metal foil closely wrapped around its body for 1 minute. Electrical breakdown shall be examined. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Classification (Nominal varistor voltage)</th> <th>Test Voltage (AC)</th> </tr> </thead> <tbody> <tr> <td><math>V_{0.1mA}, V_{1mA} \leq 330V</math></td> <td>1000V rms</td> </tr> <tr> <td><math>V_{0.1mA}, V_{1mA} &gt; 330V</math></td> <td>1500V rms</td> </tr> </tbody> </table>	Classification (Nominal varistor voltage)	Test Voltage (AC)	$V_{0.1mA}, V_{1mA} \leq 330V$	1000V rms	$V_{0.1mA}, V_{1mA} > 330V$	1500V rms	No breakdown																		
Classification (Nominal varistor voltage)	Test Voltage (AC)																									
$V_{0.1mA}, V_{1mA} \leq 330V$	1000V rms																									
$V_{0.1mA}, V_{1mA} > 330V$	1500V rms																									
Impulse Life (I)	The change of $V_c$ shall be measured after the impulse listed below is applied 10000 times continuously with the interval of ten seconds at room temperature.																									
	<table border="1" style="width: 100%;"> <tbody> <tr> <td rowspan="2">5 Series</td> <td>CNR-05D180K to CNR-05D680K</td> <td>0.5A (2 ms)</td> </tr> <tr> <td>CNR-05D820K to CNR-05D471K</td> <td>20A (8/20 us)</td> </tr> <tr> <td rowspan="2">7 Series</td> <td>CNR-07D180K to CNR-07D680K</td> <td>18A (8/20 us)</td> </tr> <tr> <td>CNR-07D820K to CNR-07D471K</td> <td>50A (8/20 us)</td> </tr> <tr> <td rowspan="2">10 Series</td> <td>CNR-10D180K to CNR-10D680K</td> <td>50A (8/20 us)</td> </tr> <tr> <td>CNR-10D820K to CNR-10D112K</td> <td>100A (8/20 us)</td> </tr> <tr> <td rowspan="2">14 Series</td> <td>CNR-14D180K to CNR-14D680K</td> <td>75A (8/20 us)</td> </tr> <tr> <td>CNR-14D820K to CNR-14D182K</td> <td>150A (8/20 us)</td> </tr> <tr> <td rowspan="2">20 Series</td> <td>CNR-20D180K to CNR-20D680K</td> <td>120A (8/20 us)</td> </tr> <tr> <td>CNR-20D820K to CNR-20D182K</td> <td>200A (8/20 us)</td> </tr> </tbody> </table>	5 Series	CNR-05D180K to CNR-05D680K	0.5A (2 ms)	CNR-05D820K to CNR-05D471K	20A (8/20 us)	7 Series	CNR-07D180K to CNR-07D680K	18A (8/20 us)	CNR-07D820K to CNR-07D471K	50A (8/20 us)	10 Series	CNR-10D180K to CNR-10D680K	50A (8/20 us)	CNR-10D820K to CNR-10D112K	100A (8/20 us)	14 Series	CNR-14D180K to CNR-14D680K	75A (8/20 us)	CNR-14D820K to CNR-14D182K	150A (8/20 us)	20 Series	CNR-20D180K to CNR-20D680K	120A (8/20 us)	CNR-20D820K to CNR-20D182K	200A (8/20 us)
5 Series	CNR-05D180K to CNR-05D680K		0.5A (2 ms)																							
	CNR-05D820K to CNR-05D471K	20A (8/20 us)																								
7 Series	CNR-07D180K to CNR-07D680K	18A (8/20 us)																								
	CNR-07D820K to CNR-07D471K	50A (8/20 us)																								
10 Series	CNR-10D180K to CNR-10D680K	50A (8/20 us)																								
	CNR-10D820K to CNR-10D112K	100A (8/20 us)																								
14 Series	CNR-14D180K to CNR-14D680K	75A (8/20 us)																								
	CNR-14D820K to CNR-14D182K	150A (8/20 us)																								
20 Series	CNR-20D180K to CNR-20D680K	120A (8/20 us)																								
	CNR-20D820K to CNR-20D182K	200A (8/20 us)																								

Note: Varistor voltage change of forward direction shall be measured in the test of uni-pole surge life and DC load life



# Metal Oxide Varistors



(Electrical)

Characteristics	Test Methods	Specifications
Impulse Life (11)	The change of $V_c$ shall be measured after the impulse listed below is applied 100000 times continuously with the interval of ten seconds at room temperature.	
	5 Series	CNR-05D180K to CNR-05D680K 0.45A (2 ms)
		CNR-05D820K to CNR-05D471K 14A (8/20 us)
	7 Series	CNR-07D180K to CNR-07D680K 12A (8/20 us)
		CNR-07D820K to CNR-07D471K 35A (8/20 us)
	10 Series	CNR-10D180K to CNR-10D680K 35A (8/20 us)
		CNR-10D820K to CNR-10D112K 70A (8/20 us)
	14 Series	CNR-14D180K to CNR-14D680K 45A (8/20 us)
		CNR-14D820K to CNR-14D182K 90A (8/20 us)
	20 Series	CNR-20D180K to CNR-20D680K 55A (8/20 us)
CNR-20D820K to CNR-20D182K 100A (8/20 us)		
		$V_{CmA}/V_{C-A} \pm 10\%$

Note: Varistor voltage change of forward direction shall be measured in the test of uni-pole surge life and DC load life.

(Mechanical)

Characteristics	Test Methods	Specifications								
Robustness of Terminations (Tensile)	<p>After gradually applying the force specified below and keeping the unit fixed for ten seconds, the terminal shall be visually examined for any damage.</p> <table border="1"> <thead> <tr> <th>Terminal diameter</th> <th>Force</th> </tr> </thead> <tbody> <tr> <td>ø 0.6 mm</td> <td>9.8 N (1.0 Kgf)</td> </tr> <tr> <td>ø 0.8 mm</td> <td>9.8 N (1.0 Kgf)</td> </tr> <tr> <td>ø 1.0 mm</td> <td>19.6 N (2.0 Kgf)</td> </tr> </tbody> </table>	Terminal diameter	Force	ø 0.6 mm	9.8 N (1.0 Kgf)	ø 0.8 mm	9.8 N (1.0 Kgf)	ø 1.0 mm	19.6 N (2.0 Kgf)	No outstanding damage
Terminal diameter	Force									
ø 0.6 mm	9.8 N (1.0 Kgf)									
ø 0.8 mm	9.8 N (1.0 Kgf)									
ø 1.0 mm	19.6 N (2.0 Kgf)									
Robustness of Terminations (Bending)	<p>The unit shall be secured with its terminal kept vertical and the force specified below be applied in the axial direction. The terminal shall gradually be bent by 90° in one direction, then 90° in the opposite direction, and again back to the original position. The damage of the terminal shall be visually examined.</p> <table border="1"> <thead> <tr> <th>Terminal diameter</th> <th>Force</th> </tr> </thead> <tbody> <tr> <td>ø 0.6 mm</td> <td>4.9 N (0.5 Kgf)</td> </tr> <tr> <td>ø 0.8 mm</td> <td>4.9 N (0.5 Kgf)</td> </tr> <tr> <td>ø 1.0 mm</td> <td>9.8 N (1.0 Kgf)</td> </tr> </tbody> </table>	Terminal diameter	Force	ø 0.6 mm	4.9 N (0.5 Kgf)	ø 0.8 mm	4.9 N (0.5 Kgf)	ø 1.0 mm	9.8 N (1.0 Kgf)	
Terminal diameter	Force									
ø 0.6 mm	4.9 N (0.5 Kgf)									
ø 0.8 mm	4.9 N (0.5 Kgf)									
ø 1.0 mm	9.8 N (1.0 Kgf)									
Vibration	<p>After repeatedly applying a single harmonic vibration (amplitude: 0.75 mm) double amplitude. 1.5mm with 1 minute vibration frequency cycles (10Hz to 55Hz to 10Hz) to each of three perpendicular directions for 2 hours. Thereafter, the unit shall be visually examined.</p>									
Solderability	<p>After dipping the terminals to a depth of approximately 3mm from the body in a soldering bath of 235±5°C for 2±0.5 seconds, the terminal shall be visually examined.</p>	Approximately 95% of the terminals shall be covered with solder uniformly.								
Resistance to Soldering Heat	<p>After each lead shall be dipped into a solder bath having a temperature 260±5°C (3 series: 250±5°C) to a point 2.0 to 2.5mm from the body of the unit, using shielding board (t=1.5mm), be held there for specified time (3 series: 3±1 s, 5 series: 5±1 s and others: 10±1 s), and then be stored at room temperature and humidity for 1 to 2 hours. The change of <math>V_c</math> and mechanical damages are examined.</p>	$V_{CmA} / V_{CMA} \leq \pm 5\%$ No outstanding damage								



# Metal Oxide Varistors

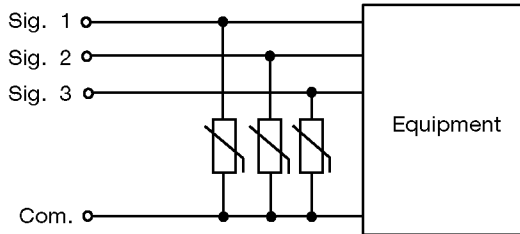
(Environmental)

Characteristics	Test Methods	Specifications														
High Temperature Storage/Dry Heat	The specimen shall be subjected to $125 \pm 2$ °C for 1000 hours in a thermostatic bath without load and then stored at room temperature and humidity for 1 to 2 hours. Thereafter, the change of Vc shall be measured.	$V_{CmA}/V_{CmA} \pm 5\%$														
Damp Heat/Humidity (Steady State)	The specimen shall be subjected to $40 \pm 2$ °C, 90 to 95% RH for 1000 hours without load and then stored at room temperature and humidity for one to two hours. Thereafter, the change of Vc shall be measured.															
Temperature Cycle	<p>The temperature cycle shown below shall be repeated five times and then stored at room temperature and humidity for one to two hours. The change of Vc and mechanical damage shall be examined.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature(°C)</th> <th>Period(minutes)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td><math>-40 \pm 3</math></td> <td><math>30 \pm 3</math></td> </tr> <tr> <td>2</td> <td>Room temperature</td> <td><math>15 \pm 3</math></td> </tr> <tr> <td>3</td> <td><math>125 \pm 2</math></td> <td><math>30 \pm 3</math></td> </tr> <tr> <td>4</td> <td>Room temperature</td> <td><math>15 \pm 3</math></td> </tr> </tbody> </table>		Step	Temperature(°C)	Period(minutes)	1	$-40 \pm 3$	$30 \pm 3$	2	Room temperature	$15 \pm 3$	3	$125 \pm 2$	$30 \pm 3$	4	Room temperature
Step	Temperature(°C)	Period(minutes)														
1	$-40 \pm 3$	$30 \pm 3$														
2	Room temperature	$15 \pm 3$														
3	$125 \pm 2$	$30 \pm 3$														
4	Room temperature	$15 \pm 3$														
High Temperature Load/Dry Heat Load	After being continuously applied at the Maximum Allowable Voltage at $85 \pm 2$ °C for 1000 hours, the specimen shall be stored at room temperature and humidity for one to two hours. Thereafter, the change of Vc shall be measured.	$V_{CmA}/V_{CmA} \pm 10\%$														
Damp Heat Load/Humidity Load	The specimen shall be subjected to $40 \pm 2$ °C, 90 to 95% RH and the Maximum Allowable Voltage for 1000 hours and then stored at room temperature and humidity for one to two hours. Thereafter, the change of Vc shall be measured.	$V_{CmA}/V_{CmA} \pm 10\%$														
Low Temperature Storage/Cold	The specimen shall be subjected to $-40 \pm 2$ °C without load for 1000 hours and then stored at room temperature for one to two hours. Thereafter, the change of Vc shall be measured.	$V_{CmA}/V_{CmA} \pm 5\%$														

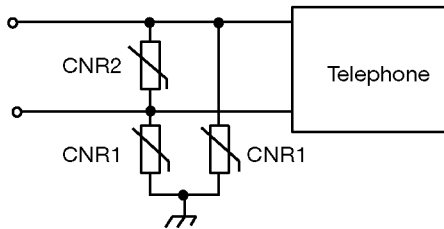


## Signal Line and Telephone Line Surge Protection

### Signal Line



### Telephone Line



Note: The RGA CNR Series has relatively high capacitance. Special attention shall be paid for it in high frequency circuits.

Caution: Refer to the power line protection.

### Selection Example

#### Surge Protection of Signal Line

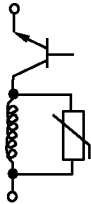
Signal Line	Part Number
DC 48V	CNR-□□D820K
DC 100V	CNR-□□D201K

#### Surge Protection of Telephone Line

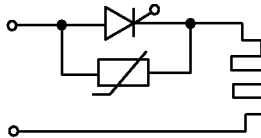
CNR	Part Number
CNR1	CNR-□□D331K CNR-□□D361K
CNR2	CNR-□□D151K

## Switching surge protection, semiconductor protection and contact spark suppression

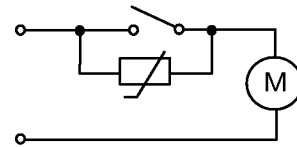
### Switching Surge Protection



### Semiconductor Protection



### Contact Spark Suppression



### Selection Examples

Voltage	Part Number
DC 12V	CNR-□□D220K
DC 24V	CNR-□□D390K
DC 100V	CNR-□□D151K
AC 120V	CNR-□□D221K CNR-□□D241K CNR-□□D271K

Note:

1. The Maximum Allowable Voltage to be higher than maximum operation voltage at all time.
2. Energy handling capability of CNR Series shall be selected by studying switching surge energy from the inductive load.

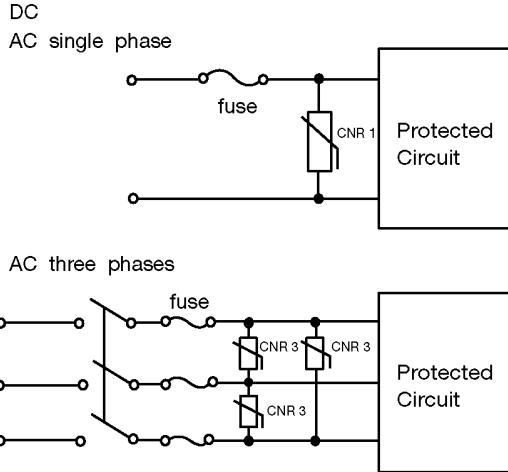
Caution:

1. Refer to the mentioned caution described in power line protection.
2. The relation between surge current repetition and CNR ratings is drawn in the CNR's impulse life characteristics.
3. Capacitor connection in parallel CNR is recommended for a contact spark suppression.

## Application Notes

### 1. Line Protection

Line to Line Protection Connections



### Selection of Ratings and Varistor Voltage

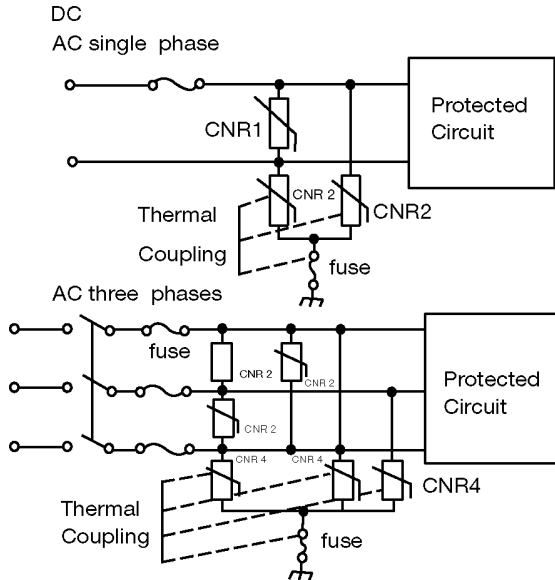
#### Line to Line

Symbol	Line Voltage	Part Number	
CNR 1	DC 12V	CNR-□□D220K	
	DC 24V	CNR-□□D390K	
	AC 120V	AC 120V	CNR-□□D201K, CNR-□□D221K CNR-□□D241K*, CNR-□□D271K*
			AC 127V
	AC 200V	AC 200V	CNR-□□D391K, CNR-□□D431K CNR-□□D471K
			AC 240V
	AC 240V	AC 240V	CNR-□□D431K, CNR-□□D471K*
CNR 3	AC 240V	CNR-□□D511K	
		AC 265V	CNR-□□D511K
		AC 380V	CNR-□□D821K
		AC 415V	CNR-□□D911K
		AC 460V	CNR-□□D112K
AC 480V	AC 480V	CNR-□□D112K	

### Notes

1. Maximum operating voltage shall be lower than Maximum allowable voltage of CNR Series at any time.
2. CNR Series with \* are recommended for single phase, 3 wire applications to withstand a temporary overvoltage caused by unbalanced load.

Line to Line and Line ground Protection Connections



### Selection of Ratings and Varistor Voltage

#### Line to Ground

Symbol	Line Voltage	Part Number
CNR 2	AC 100V to AC 220V	CNR-□□D431K, CNR-□□D471K or CNR-□□D751K** or higher Varistor Voltage
	AC 240V	or CNR-□□D182K***
CNR 4	AC 240V	CNR-□□D431K
		CNR-□□D471K
		or CNR-□□D751K**
		or higher Varistor Voltage or CNR-□□D182K***

### Notes

1. When the 500 V insulation resistance test of the circuits employing MOVs is conducted, MOV shall be removed after getting approval from the customer, or MOV \*\* with the Maximum Allowable Voltage exceeding to test voltage shall be used.
2. When the 1000 V withstanding voltage test is conducted, MOV shall be removed after getting approval from the customer according to the relevant regulations, or MOV \*\*\* with the Maximum allowable exceeding to the test Voltage shall be used.
3. To avoid MOV failure caused by the ground fault, MOV with higher Varistor Voltage listed in the table shall be used for the AC 120 V line to ground application.



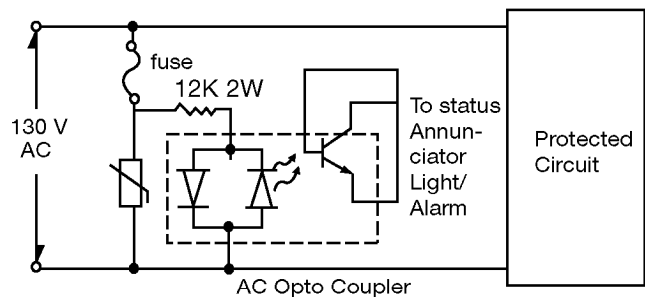
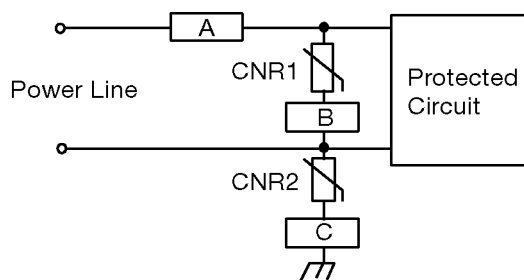
## Application Examples

Protected Circuit	Location	Part Number
Home Appliances	Indoor	CNR-05D□□□K
		CNR-07D□□□K
		CNR-10D□□□K
	Outdoor	CNR-10D□□□K
		CNR-14D□□□K
		CNR-20D□□□K
Consumer Industrial	Indoor, Outdoor	CNR-14D□□□K CNR-20D□□□K

Protected Circuit	Location	Part Number
Communications	Indoor	CNR-05D□□□K
		CNR-07D□□□K
		CNR-10D□□□K
Measurements Controls	Outdoor	CNR-10D□□□K
		CNR-14D□□□K
		CNR-20D□□□K

### Caution:

1. A surge excess of the specific Maximum Peak Current may cause short circuit or mechanical damage. The following measures are recommended.



- 1). Location of the over current protector (circuit breaker or current fuse) shall be in the power line to the circuit (Location A) or in series with CNR (Location B),

Part Number	CNR-05D□□□K	CNR-07D□□□K	CNR-10D□□□K	CNR-14D□□□K	CNR-20D□□□K
Fuse Rating	1 to 2 A	2 to 3 A	3 to 5 A	3 to 10 A	5 to 15 A

- 2). It is recommended that a fuse listed in the table shall be put in location A or B.
- 3). In case the CNR Series is used in line to ground, the ground fault circuit interrupter shall be applied to locate A or thermally coupled fuse shall be applied in location C.
- 4). Fuse mounted Type K or Type P are available for CNR 1 and CNR 2 applications.
- 5). The CNR Series shall not be used near flammable materials.

2. When the CNR Series is molded at end user, molding resin materials shall be carefully selected
3. The CNR Series shall not be used near heat generating device's and free from direct sunlight. CNR shall be used within the specified Operating Temperature Range.
4. The CNR Series shall be free from dust, metal powder, dew and sea wind. A protective box is recommended to prevent the unit from the aforementioned.

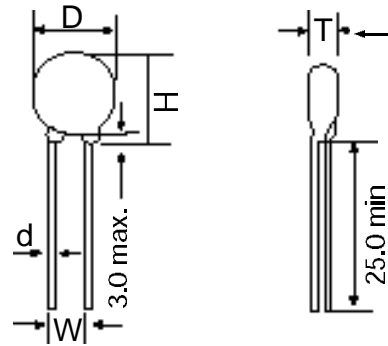
# Metal Oxide Varistors

## Dimension of Component For Standard Product

Dimension Table

Unit: mm

Symbol	5D	7D	10D	14D	20D
D max.	7.5	9.0	14.0	17.5	25.0
H max.	10.0	12.0	17.0	20.5	28.0
W ( $\pm 1.0$ )	5.0	5.0	7.5	7.5	10.0
d ( $\pm 0.02$ )	0.6	0.6	0.8	0.8	1.0



T max. Table

Part No.	5D	7D	10D	14D	20D
180K	3.3	3.5	3.9	4.0	4.3
220K	3.6	3.8	4.2	4.3	4.6
270K	3.8	4.0	4.4	4.5	4.8
330K	3.3	3.5	3.9	4	4.3
390K	3.5	3.7	4.1	4.2	4.5
470K	3.7	3.9	4.3	4.4	4.7
560K	4.0	4.2	4.6	4.7	5.0
680K	4.3	4.5	4.9	5	5.3
820K	3.3	3.5	3.9	4	4.3
101K	3.6	3.8	4.2	4.3	4.6
121K	3.8	4.0	4.4	4.5	4.8
151K	4.1	4.3	4.7	4.8	5.1
181K	3.2	3.4	3.8	3.9	4.2
201K	3.3	3.5	3.9	4.0	4.3
221K	3.4	3.6	4.0	4.1	4.4
241K	3.5	3.7	4.1	4.2	4.5
271K	3.7	3.9	4.2	4.3	4.6

Unit: mm

Part No.	5D	7D	10D	14D	20D
301K	3.9	4.1	4.3	4.4	4.7
331K	4.0	4.2	4.5	4.6	4.9
361K	4.1	4.3	4.7	4.8	5.1
391K	4.2	4.4	4.8	4.9	5.2
431K	4.4	4.6	5.0	5.1	5.4
471K	4.6	4.8	5.2	5.3	5.6
511K	4.8	5.0	5.3	5.4	5.7
561K	5.0	5.2	5.5	5.6	5.9
621K	5.3	5.5	5.7	5.8	6.1
681K	5.4	5.6	5.8	5.9	6.2
751K	5.6	5.8	6.0	6.1	6.4
781K	5.8	6.0	6.3	6.4	6.7
821K	-	6.3	6.5	6.6	6.9
911K	-	-	6.6	6.7	7.0
102K	-	-	7.0	7.1	7.4
112K	-	-	7.4	7.5	7.9
182K	-	-	-	11.5	11.9

## Packaging Specifications

Part No.	Min. Q'ty(pcs)/Bags	Q'ty(pcs)/Inner Box	Q'ty(pcs)/Carton
CNR-05D 180K to CNR-05D391K	1000	10000	20000
CNR-05D431K to CNR-05D621K	1000	10000	20000
CNR-07D180K to CNR-07D391K	1000	10000	20000
CNR-07D431K to CNR-07D621K	1000	8000	16000
CNR-07D681K to CNR-07D821K	1000	5000	10000
CNR-10D180K to CNR-10D391K	500	5000	10000
CNR-10D431K to CNR-10D102K	500	4000	8000
CNR-14D180K to CNR-14D391K	500	3000	6000
CNR-14D431K to CNR-14D621K	500	2500	5000
CNR-14D681K to CNR-14D102K	500	2000	4000
CNR-20D180K to CNR-20D391K	250	1500	3000
CNR-20D431K to CNR-20D621K	250	1250	2500
CNR-20D681K to CNR-20D102K	250	1000	2000



## Packing Specifications

Dimensions are in mm	Flat Box				Reel				
	Symbol	5D	7D	10D	Symbol	5D	7D	10D	14D
	A	55 max.			W	Approx. 45			55
	B	330 max.			D	360 max.			
C	340 max.			A	Approx. $\phi 30$				
				B	Approx. $\phi 90$				

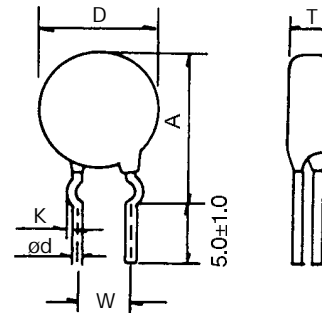
## Order Information of Flat Box

Standard Products	Tape Box Straight Lead	Tape Box Crimped Lead	Max. Q'ty	Q'ty/Inner Box	Q'ty/Carton
CNR-05DXXXK	CNR-05DXXXK-BTS	CNR-05DXXXK-BTK	2000/1500	4000/3000	20000/15000
CNR-07DXXXK	CNR-07DXXXK-BTS	CNR-07DXXXK-BTK	2000/1500	4000/3000	20000/15000
CNR-10DXXXK	CNR-10DXXXK-BTS	CNR-10DXXXK-BTK	1500/1000	3000/2000	15000/10000

### Note:

- "2000/1500" Packing in CNR-XXD180K to CNR-XXD271K are 2000 pcs, CNR-XXD301K to CNR-XXD471K with 1500 pcs.

Symbol		Series	05D	07D	10D	14D
		A max.	Varistor Voltage V1mA(V)	18 to 270	13.0	15.0
		360 to 470	13.0	15.0	20.5	23.5
D max.			7.5	9.0	14.0	17.5
K			1.2±0.4	1.2±0.4	1.4±0.4	1.4±0.4
W			5.0±1.0	5.0±1.0	7.5±1.0	7.5±1.0
$\phi d$			0.6	0.6	0.8	0.8



T max. see standard product specification table.

## Order Information of Crimp Leads

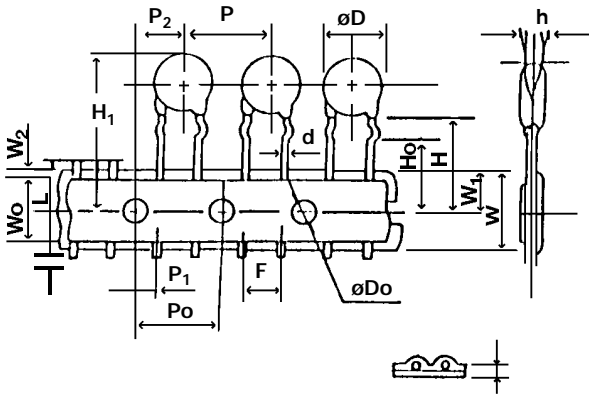
Standard Products	Cut Off Straight Lead	Cut Off Crimped Lead	Max. Q'ty	Q'ty/Box	Q'ty/Carton
CNR-05DXXXK	CNR-05DXXXK-TTS	CNR-05DXXXK-TTK	1000	25000	50000
CNR-07DXXXK	CNR-07DXXXK-TTS	CNR-07DXXXK-TTK	1000	20000	40000
CNR-10DXXXK	CNR-10DXXXK-TTS	CNR-10DXXXK-TTK	1000	20000	40000
CNR-14DXXXK	CNR-14DXXXK-TTS	CNR-14DXXXK-TTK	1000	10000	20000

### Note:

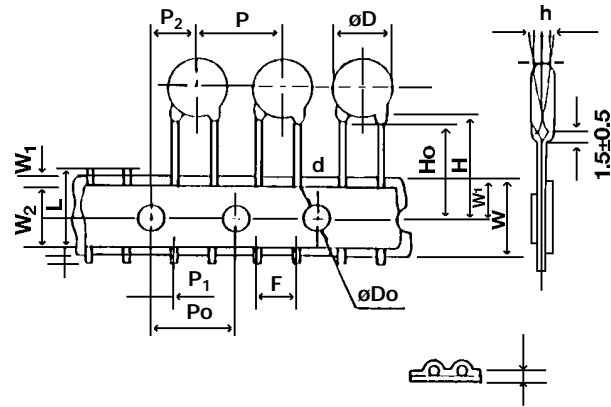
- Packing unit in pcs.

## Tape and Reel Specifications

### 1. Crimped Leads



### 2. Straight Leads



Symbol	Parameter	Series			
		05D	07D	10D	14D
P	Pitch of Component	12.7 ± 1.0	12.7 ± 1.0	12.7 ± 1.0	25.4 ± 1.0
Po	Feed Hole Pitch	12.7 ± 0.2	12.7 ± 0.2	12.7 ± 0.2	12.7 ± 0.2
P <sub>1</sub>	Feed Hole Center to Lead	3.85 ± 0.7	3.85 ± 0.7	2.6 ± 0.7	2.6 ± 0.7
P <sub>2</sub>	Hole Center to Component Center	6.35 ± 0.7	6.35 ± 0.7	6.35 ± 0.7	6.35 ± 0.7
F	Lead to Lead Distance	5.0 ± 0.8	5.0 ± 0.8	7.50 ± 0.8	7.50 ± 0.8
h	Component Alignment	2.0 Max	2.0 Max	2.0 Max	2.0 Max
W	Tape Width	18.0 + 1.0	18.0 + 1.0	18.0 + 1.0	18.0 + 1.0
		18.0 - 0.5	18.0 - 0.5	18.0 - 0.5	18.0 - 0.5
W <sub>0</sub>	Hold Down Tape Width	16.0 ± 0.3	16.0 ± 0.3	16.0 ± 0.3	16.0 ± 0.3
W <sub>1</sub>	Hole Position	9.0 + 0.75	9.0 + 0.75	9.0 + 0.75	9.0 + 0.75
		9.0 - 0.50	9.0 - 0.50	9.0 - 0.50	9.0 - 0.50
W <sub>2</sub>	Hold Down Tape Position	0.5 Max	0.5 Max	0.5 Max	0.5 Max
H	Height from Tape Center to Component	18.0 + 2.0	18.0 + 2.0	18.0 + 2.0	18.0 + 2.0
		18.0 - 0.0	18.0 - 0.0	18.0 - 0.0	18.0 - 0.0
Ho	Seating Plane Height	16.0 ± 0.5	16.0 ± 0.5	16.0 ± 0.5	16.0 ± 0.5
H <sub>1</sub>	Component Height	29.0 Max	32.0 Max	36.0 Max	40.0 Max
Do	Feed Hole Diameter	4.0 ± 0.2	4.0 ± 0.2	4.0 ± 0.2	4.0 ± 0.2
t	Total Tape Thickness	0.7 ± 0.2	0.7 ± 0.2	0.7 ± 0.2	0.7 ± 0.2
L	Length of Clipped Lead	11.0 Max	11.0 Max	11.0 Max	11.0 Max

Note: Dimensions are in mm.

## Order Information of Tape Reel

Standard Products	Tape Reel Straight Lead	Tape Reel Crimped Lead	Min. Q'ty	Q'ty/Inner Box	Q'ty/Carton
CNR-05DXXXK	CNR-05DXXXK-TRS	CNR-05DXXXK-TRK	2000/1500	4000/3000	20000/15000
CNR-07DXXXK	CNR-07DXXXK-TRS	CNR-07DXXXK-TRK	2000/1500	4000/3000	20000/15000
CNR-10DXXXK	CNR-10DXXXK-TRS	CNR-10DXXXK-TRK	1500/1000	3000/2000	15000/10000
CNR-14DXXXK	CNR-14DXXXK-TRS	CNR-14DXXXK-TRK	1000/800	2000/1600	8000/6400

### Note:

1. "2000/1500" Packing in CNR-XXD180K to CNR-XXD271K are 2000 pcs, CNR-XXD301K to CNR-XXD471K with 1500 pcs.