DNR VARISTORS

■ Description

DON's DNRs are ZINC OXIDE non-linear resistors whose resistance changes as a function of the applied voltage. The DNR provides a highly reliable and economic way to protect against repeated high voltage transient and surges such as those produced by induced lightning surges, switching surges and noise spike.

The DNR utilizes a ceramic element composed of Zinc Oxide and several kinds of metal oxide additives that have been sintered at relatively highly temperature. Ohmic electrodes are connected to each end of element by firing.

■ FEATURES:

* Broad products range
  Varistor Voltage : 18 V to 1.8 KV
* Fast response to the rapidly rising surge voltage (m μ Sec.)
* Excellent non-linearity voltage
* Symmetric V-1 characteristics
* Great withstanding surge current
* No follow-on current
* Long Life

SPECIFICATIONS

MODEL NO.	VARISTOR VOLTAGE (v)			MAX. CONTINUOUS VOLTAGE		MAX. CLAMPING VOLTAGE		ALLOWABLE POWER (W)	MAX. ENERGY (J) 2m Sec.	PEAK CURRENT (a) 8/20 Sec.x2	TYPICAL CAPACITANCE (Referance) @ 1 KHz (PF)
		MIN	MAX	VA Crms	VDC	Vc (V)	Ip (A)				
DNR5D180	18	16	20	11	14	40	1	0.01	0.3	50	1600
DNR5D220	22	20	24	14	18	48	1	0.01	0.4	50	1300
DNR5D270	27	24	30	17	22	60	1	0.01	0.5	50	1050
DNR5D330	33	30	36	20	26	73	1	0.01	0.6	50	900
DNR5D390	39	35	43	25	31	86	1	0.01	0.8	50	500
DNR5D470	47	42	52	30	38	104	1	0.01	1.0	50	450
DNR5D560	56	50	62	35	45	123	1	0.01	1.0	50	400
DNR5D680	68	61	75	40	56	150	1	0.01	1.2	50	350
DNR5D820	82	74	90	50	65	145	5	0.1	1.7	200	250
DNR5D101	100	90	110	60	85	175	5	0.1	2.0	200	200
DNR5D121	120	108	132	75	100	210	5	0.1	2.5	200	170
DNR5D151	150	135	165	90	125	260	5	0.1	3.0	200	140

DNR5D181	180	162	198	115	150	315	5	0.1	3.5	200	110
DNR5D201	200	180	220	130	170	355	5	0.1	4.0	200	80
DNR5D221	220	198	242	140	180	380	5	0.1	4.5	200	70
DNR5D241	240	216	264	150	200	415	5	0.1	5.0	200	70
DNR5D271	270	243	297	175	225	475	5	0.1	6.0	200	65
DNR5D331	330	297	363	210	275	580	5	0.1	6.5	200	55
DNR5D361	360	324	396	230	300	620	5	0.1	7.5	200	50
DNR5D391	390	351	429	250	320	675	5	0.1	8.0	200	50
DNR5D431	430	387	473	275	350	745	5	0.1	9.0	200	45
DNR5D471	470	423	517	300	385	810	5	0.1	10.0	200	40
DNR7D180	18	16	20	11	14	36	2.5	0.02	0.8	125	3500
DNR7D220	22	20	24	14	18	43	2.5	0.02	0.9	125	2800
DNR7D270	27	24	30	17	22	53	2.5	0.02	1.0	125	2000
DNR7D330	33	30	36	20	26	65	2.5	0.02	1.2	125	1500
DNR7D390	39	35	43	25	31	77	2.5	0.02	1.5	125	1350
DNR7D470	47	42	52	30	38	93	2.5	0.02	1.8	125	1150
DNR7D560	56	50	62	35	45	110	2.5	0.02	2.2	125	950
DNR7D680	68	61	75	40	56	135	2.5	0.02	2.5	125	700
DNR7D820	82	74	90	50	65	135	10	0.25	3.5	600	550
DNR7D101	100	90	110	60	85	165	10	0.25	4.0	600	500
DNR7D121	120	108	132	75	100	200	10	0.25	5.0	600	450
DNR7D151	150	135	165	90	125	250	10	0.25	6.0	600	350
DNR7D181	180	162	198	115	150	300	10	0.25	8.0	600	290
DNR7D201	200	180	220	130	150	340	10	0.25	10.0	600	250
DNR7D221	220	198	242	140	180	360	10	0.25	10.0	600	250
DNR7D241	240	216	264	150	200	395	10	0.25	10.0	600	200
DNR7D271	270	243	297	175	225	455	10	0.25	12.0	600	170
DNR7D331	330	297	363	210	275	550	10	0.25	14.0	600	145
DNR7D361	360	324	396	230	300	595	10	0.25	15.0	600	130
DNR7D391	390	351	429	250	320	650	10	0.25	17.0	600	130
DNR7D431	430	387	473	275	350	710	10	0.25	20.0	600	110
DNR7D471	470	423	517	300	385	775	10	0.25	20.0	600	100
DNR10D180	18	16	20	11	14	36	5	0.05	1.5	250	7500
DNR10D220	22	20	24	14	18	43	5	0.05	2.0	250	6000
DNR10D270	27	24	30	17	22	53	5	0.05	2.5	250	4000
DNR10D330	33	30	36	20	26	65	5	0.05	3.0	250	3000
DNR10D390	39	35	43	25	31	77	5	0.05	3.5	250	2600

DNR10D470	47	42	52	30	38	93	5	0.05	4.5	250	2200
DNR10D560	56	50	62	35	45	110	5	0.05	5.5	250	1800
DNR10D680	68	61	75	40	56	135	5	0.05	6.5	250	1800
DNR10D820	82	74	90	50	65	135	25	0.4	8	1250	1800
DNR10D101	100	90	110	60	85	165	25	0.4	10	1250	1400
DNR10D121	120	108	132	75	100	200	25	0.4	12	1250	1100
DNR10D151	150	135	165	90	125	250	25	0.4	16	1250	900
DNR10D181	180	162	198	115	150	300	25	0.4	18	1250	660
DNR10D201	200	180	220	130	170	340	25	0.4	20	1250	500
DNR10D221	220	198	242	140	180	360	25	0.4	23	1250	450
DNR10D241	240	216	264	150	200	395	25	0.4	25	1250	400
DNR10D271	270	243	297	175	225	455	25	0.4	30	1250	350
DNR10D331	330	297	363	210	275	550	25	0.4	30	1250	315
DNR10D361	360	324	396	230	300	595	25	0.4	35	1250	300
DNR10D391	390	351	429	250	320	650	25	0.4	40	1250	270
DNR10D431	430	387	473	275	350	710	25	0.4	45	1250	250
DNR10D471	470	423	517	300	385	775	25	0.4	45	1250	230
DNR10D561	560	504	616	350	455	925	25	0.4	45	1250	190
DNR10D621	620	558	682	385	505	1025	25	0.4	45	1250	130
DNR10D681	680	612	748	420	560	1120	25	0.4	45	1250	130
DNR10D751	750	675	825	460	615	1240	25	0.4	50	1250	120
DNR10D781	780	702	858	485	640	1290	25	0.4	50	1250	120
DNR10D821	820	738	902	510	670	1355	25	0.4	55	1250	110
DNR10D911	910	819	1001	550	745	1500	25	0.4	60	1250	100
DNR10D102	1000	900	1100	625	825	1650	25	0.4	65	1250	90
DNR10D112	1100	990	1210	680	895	1815	25	0.4	70	1250	80
DNR14D180	18	16	20	11	14	36	10	0.1	3.5	500	18000
DNR14D220	22	20	24	14	18	43	10	0.1	4.0	500	15000
DNR14D270	27	24	30	17	22	53	10	0.1	5.0	500	10000
DNR14D330	33	30	36	20	26	65	10	0.1	6.0	500	7500
DNR14D390	39	35	43	25	31	77	10	0.1	7.0	500	6500
DNR14D470	47	42	52	30	38	93	10	0.1	8.5	500	5500
DNR14D560	56	50	62	35	45	110	10	0.1	10.0	500	4500
DNR14D680	68	61	75	40	56	135	10	0.1	12.0	500	3300
DNR14D820	82	74	90	50	65	135	50	0.6	14.0	2500	2900
DNR14D101	100	90	110	60	85	165	50	0.6	18.0	2500	2400
DNR14D121	120	108	132	75	100	200	50	0.6	22.0	2500	1900

DNR14D151	150	135	165	95	125	250	50	0.6	25.0	2500	1500
DNR14D181	180	162	198	115	150	300	50	0.6	30	2500	1300
DNR14D201	200	180	220	130	170	340	50	0.6	35.0	2500	1000
DNR14D221	220	198	242	140	180	360	50	0.6	40	2500	1000
DNR14D241	240	216	264	150	200	395	50	0.6	40	2500	900
DNR14D271	270	243	297	175	225	455	50	0.6	50	2500	750
DNR14D331	330	297	363	210	275	550	50	0.6	60	2500	650
DNR1D361	360	324	396	230	300	595	50	0.6	65	2500	550
DNR14D391	390	351	429	250	320	650	50	0.6	70	2500	500
DNR14D431	430	387	473	275	350	710	50	0.6	75	2500	450
DNR14D471	470	423	517	300	385	775	50	0.6	80	2500	400
DNR14D561	560	504	616	350	455	925	50	0.6	80	2500	350
DNR1D621	620	558	682	385	505	1025	50	0.6	85	2500	250
DNR14D681	680	612	748	420	560	1120	50	0.6	90	2500	250
DNR14D751	750	675	825	460	615	1240	50	0.6	100	2500	230
DNR14D781	780	702	858	485	640	1290	50	0.6	105	2500	230
DNR14D821	820	738	902	510	670	1355	50	0.6	110	2500	200
DNR14D911	910	819	1001	550	745	1500	50	0.6	120	2500	180
DNR14D102	1000	900	1100	625	825	1650	50	0.6	130	2500	150
DNR14D112	1100	990	1210	680	895	1815	50	0.6	140	2500	150
DNR14D182	1800	1620	1980	1000	1465	2970	50	0.6	240	2500	100
DNR20D180	18	16	20	11	14	36	20	0.2	10	1000	37000
DNR20D220	22	20	24	14	18	43	20	0.2	13	1000	30000
DNR20D270	27	24	30	17	22	53	20	0.2	15	1000	22000
DNR20D330	33	30	36	20	26	65	20	0.2	20	1000	17000
DNR20D390	39	35	43	25	31	77	20	0.2	24	1000	15000
DNR20D470	47	42	52	30	38	93	20	0.2	30	1000	13000
DNR20D560	56	50	62	35	45	110	20	0.2	35	1000	11000
DNR20D680	68	61	72	40	56	135	20	0.2	40	1000	7000
DNR20D820	82	74	90	50	65	135	100	1.0	27	4000	5500
DNR20D101	100	90	110	60	85	165	100	1.0	30	4000	4800
DNR20D121	120	108	132	75	100	200	100	1.0	40	4000	3800
DNR20D151	150	135	165	95	125	250	100	1.0	50	4000	3000
DNR20D181	180	162	198	115	150	300	100	1.0	60	4000	2400
DNR20D201	200	180	220	130	170	340	100	1.0	70	4000	2000
DNR20D221	220	190	242	140	180	360	100	1.0	75	4000	2000
DNR20D241	240	216	264	150	200	395	100	1.0	80	4000	1800

DNR20D271	270	243	297	175	225	455	100	1.0	90	4000	1600
DNR20D331	330	297	363	210	275	550	100	1.0	105	4000	1350
DNR20D361	360	324	396	230	300	595	100	1.0	120	4000	1200
DNR20D391	390	351	429	250	320	650	100	1.0	130	4000	1000
DNR20D431	430	387	473	275	350	710	100	1.0	140	4000	900
DNR20D471	470	423	517	300	385	775	100	1.0	150	4000	900
DNR20D561	560	504	616	350	455	925	100	1.0	150	4000	660
DNR20D621	620	558	682	385	505	1025	100	1.0	150	4000	500
DNR20D681	680	612	748	420	560	1120	100	1.0	160	4000	460
DNR20D751	750	675	825	460	615	1240	100	1.0	175	4000	420
DNR20D781	780	702	858	485	640	1290	100	1.0	180	4000	420
DNR20D821	820	738	902	510	670	1355	100	1.0	190	4000	400
DNR20D911	910	819	1001	550	745	1500	100	1.0	215	4000	350
DNR20D102	1000	900	1100	625	825	1650	100	1.0	230	4000	320
DNR20D112	1100	990	1210	680	895	1815	100	1.0	250	4000	300
DNR20D182	1800	1620	1980	1000	1465	2970	100	1.0	400	4000	200

temperature : -40℃-+85℃

Storage temperature : -40℃-+125℃

VARISTOR VOLTAGES are measured at 0.1 mA for 5D Series, and at 1 mA for 7D, 10D, 14D and 20D Series.

“Non-Standard Specifications ” are available.

■ APPLICATIONS :

- ✳ Transistor, Diode, IC, Thyristor and Triac semiconductor.
- ✳ Surge protection in consumer electronics.
- ✳ Surge protection in industrial electronics.
- ✳ Surge protection in communication, measuring and controller electronics.
- ✳ Surge protection in electronic home appliances, gas and petroleum appliances.
- ✳ Electrostatic discharges and noise spike suppression.
- ✳ Relay and electromagnetic valve surge absorption.

CHARACTERISTICS

DNR has the forward-reverse symmetrical electrical characteristics shown in the Fig 1.

The curve is plotted for a wider range of current than that normally given in data sheet to show three regions in Fig 2.

*Pre –breakdown region

*Normal operating region

*Upturn region

Fig 1

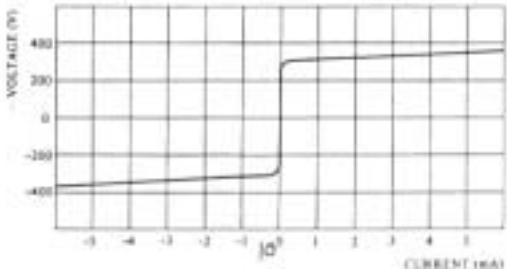
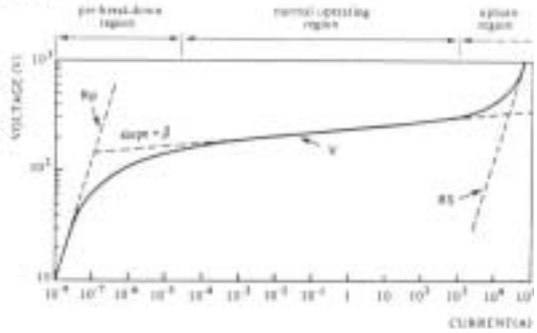


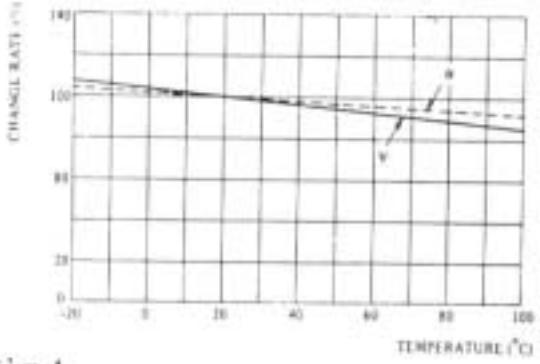
Fig 2



2-2 Voltage temperature coefficient

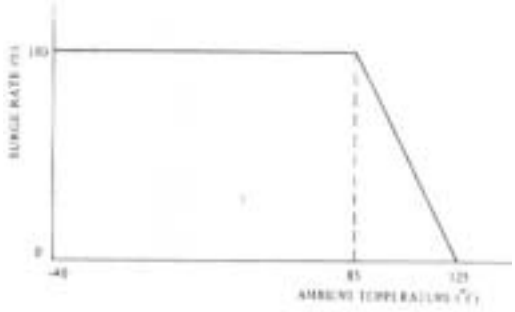
The voltage temperature coefficient (TC) is generally calculated by measuring VIcm A at 20 C and V2cmA at 70 C.

Fig 3



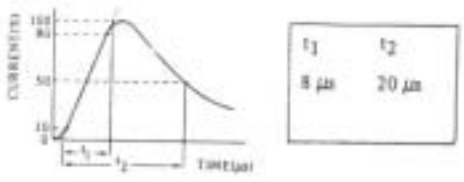
2-3 Power derating

Fig 4



2-4 Surge test wave form according to IEC60 – 2, section 6.

Fig 5

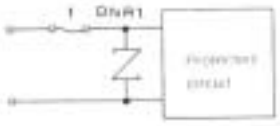
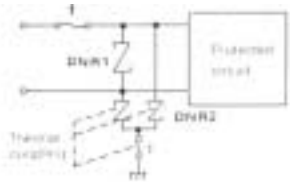
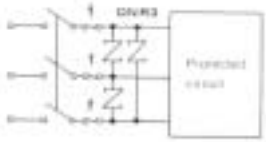
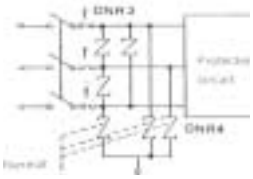


□ Precaution for Handing

1. Line protection

Application examples

Connections

Line to Line protection	Line to Line to Ground protection
DC AC Single phase 	DC AC Single phase 
Ac three phase 	AC three phase 

Selection of ratings

Varistor voltage

Line to Line

DNR	Line voltahe	Part number	
	AC 110V	DNR-□□D	201K 221K 241K 271K*
DNR 1	AC 220V	DNR-□□D	391K 431K 471K
	DC 12V	DNR-□□D	220K
	DC 24V	DNR-□□D	390K
DNR 3	AC 220V	DNR-□□D	391K 431K 471K*

Notes:

1) Maximum operating voltage should be lower than maximum allowable voltage of DNR at all times.

2) DNRs with ＊are recommended for AC 110 and 220 applications to withstand a temporary over voltage caused by LC resonation in capacitive load.

Line to Ground

DNR	Line voltage	Part number
DNR 2	AC 110/220V	DNR-□□D 431K 471K or DNR- D 751K** or higher varistor voltage or DNR- D 182K**
DNR 4	AC 220V	DNR-□□D 431K 471K or DNR- D 751K** or higher varistor voltage or DNR- D 182K**

Notes:

1) when the 500V insulation resistance test of the circuits employing NDR is conducted, DNR should be removed after getting approval from the custom, or DNR** with the maximum allowable voltage exceeding to test voltage should be used.

2) When the 1000V withstanding voltage test is conducted, DNR should be removed after getting approval from the customer according to the relevant regulations, or DNR***with the maximum allowable voltage exceeding to the test voltage should be used.

3) To avoid DNR failure caused by the ground fault, DNR with higher varistor voltage listed in the table should be used for the AC 110V line to ground application

Application examples

Selection for ratings

WITHSTANDING SURGE CURRENT

Application examples

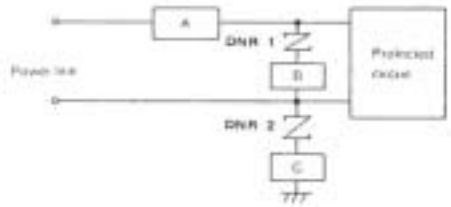
Protected circuit	Location	Part number
Home application	Indoor	05 DNR-07D□□□K 14
	Outdoor	07 DNR-10D□□□K 14
Communications Measurements Controls	Indoor	DNR-10D□□□K
	Outdoor	10 DNR-14D□□□K 20
Consumer Industrial	Indoor Outdoor	14 DNR- D□□□K 20

Notes for selection

1) The special using conditions of the individual protected circuit should be taken into account to DNR selection in addition to the general selection procedure.
2) Lightning arrester box are available for heavy duty operations.

Precaution for handling

1. A surge excess of the specified withstanding surge current may cause short circuits or mechanical breakdown. The following counter measures re recommended.

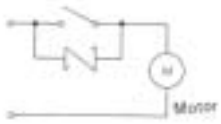


   1) Location of the over current protector (circuit breaker and current fuse) should be in the power line to the circuit (Location A) or in series with DNR (Location B).

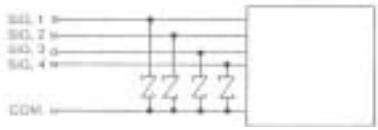
Part number	DNR+05D□□□K	DNR+07D□□□K	DNR+10D□□□K	DNR-14D□□□K	DNR-20D□□□K
Fuse rating	1 to 2A	2 to 3A	3 to 5A	3 to 10A	5 to 10A

   2) It is recommended that a fuse listed in the table be put in location A or B.
   3) In case that DNR is used in line to ground, the ground fault circuit interrupter should be applied in location A or thermally coupled fuse should be applied in location B.
   4) DNR should not be used near the flamable materials.
2. When DNR is molded at end-user, molding resin materials should be carefully selected, otherwise DNR's long term stability could degradate.
3. DNR should not be used near heat generating devise and free from direct sunlight. DNR should be used within the specified operating temperature range.
4. DNR should be free from dust, metal power, dew and sea wind. A protective box is recommended to prevent the unit from those.

2. Switching surge protection, semiconductor protection and contact spark suppression.

General application	Circuit	Switching surge protection	Semiconductor protection	Contact spark suppression
				
	Selection examnle	General selection examples		Notes for selection
	Varistor voltage	Voltage	Varistor voltage	1) The maximum allowable voltage of DNR should be higher than maximum operating voltage at all times. 2) Energy handling capability (energy or wattage rating) of DNR should be selected by studying switching surge energy from the inductive load.
		DC 12V	DNR-☐☐D220K	
		DC 24V	DNR-☐☐D390K	
		DC 100V	DNR-☐☐D151K	
		AC 110V	201K 221K DNR-☐☐D241K 271K	
Precaution for handing		1) Refer to the mentioned precautions described in power line protection. 2) Capacitor connection in parallel with DNR is recommended for a contact spark suppression.		

3. Signal line protection

General application	Circuit	Signal line protection		
				
	Selection example	General selection examples		Notes for selection
	Varistor voltage	Signal voltage	Varistor voltage	1) DNR has relatively high capacitance listed in the table. Special attention should be paid for it in high frequency circuits. 2) When high voltage such as the ringer voltage in telephone signal line is overlaid on signal voltage, varistor voltage of DNR should be selected based upon above higher voltage. 3) When DNR's insertion loss in high frequency circuits is vary critical, DNR with * is recommended.
		DC 12V Max.	DNR-☐☐D180K or DNR-☐☐D220K or DNR-☐☐D820K or higher varistor voltage	
		DC 24V	DNR-☐☐D390K or DNR-☐☐D820K or higher varistor voltage	
Precaution for handling		Refer to the mentioned precautions described in power line protection.		

ORDERING SYSTEM

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