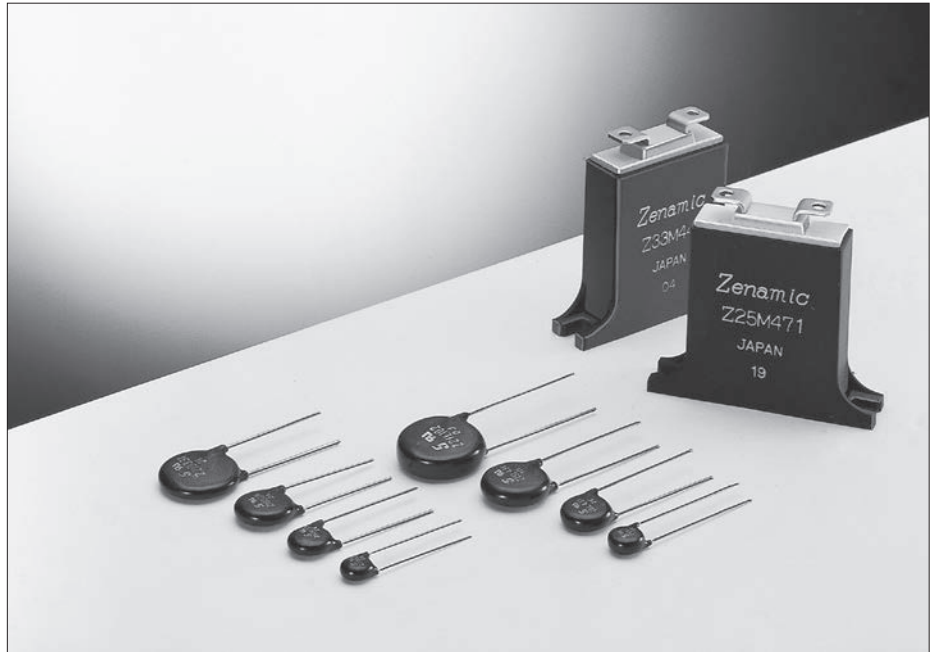




# Zenamic (Metal Oxide Varistor)

METAL OXIDE VARISTOR

## ZENAMIC



Zenamic is the registered trademark for our oxidized metal varistors. Zenamic features large surge current handling ability and transient overvoltage handling capability. Zenamic is produced by sintering a ZnO based mineral mix at temperatures of 1200 to 1400°C.

### Applications

- Semiconductor protection: Diodes, transistors, thyristors, IC etc.
- Home electronics protection: TVs, air conditioners, refrigerators, microwave ovens etc.
- Office automation device protection: PPC copy machines, fax machines, PCs etc.
- Industrial device protection: Robots, boilers, machine tooling etc.
- Inrush surge protection: Electromagnetic clutch / break devices, relay control devices, short circuit breakers etc.
- Others: Automotive electrification, vending machines, communication / broadcasting devices etc.

### V-I characteristics

ZENAMIC has the forward-reverse symmetrical characteristics as shown in figure 1. The voltage-current curves show the varistor characteristics for the range of 1 μA to 104 A, and show the resistance characteristics for the values below 1 μA and above 104 A in figure 2. The voltage across terminals when a test current (It: 1 mA) is applied to ZENAMIC is the standard varistor voltage (Vz), and the voltage across terminals when a standard surge (Ip) is applied represents the maximum suppression voltage (Vc).

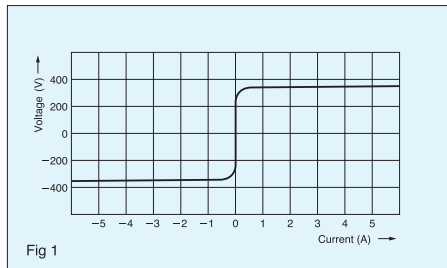


Fig 1

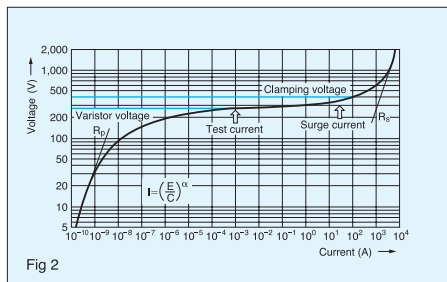


Fig 2

### Temperature characteristics

For low current values ZENAMIC features outstanding temperature characteristics. The shunt resistance Rp of the metal oxide varistor has temperature characteristics which are determined by the following equation.

$$R_P = A e^{E_g / 2kT} \quad (2)$$

T: Absolute temperature  
k: Boltzmann constant  
A, Eg: constants

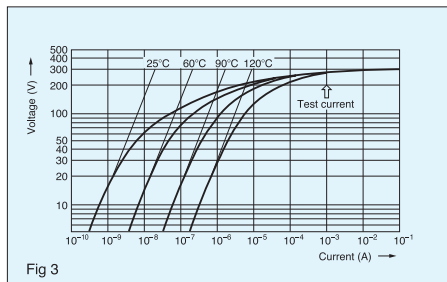


Fig 3

Temperature dependence characteristics for low current values.

### The surge waveform

The surge waveform varies according to the sources. An EXP waveform is used for surge testing of ZENAMIC, while a AC half-wave is used for the energy absorption test. The EXP waveform reaches its peak voltage (current) at [ta] as shown in figure 5, and then decreases as time passes and reaches half of the peak voltage (current) at [tb]. This type of the EXP waveform is shown as a [ta/tb] voltage (current) waveform. For surge testing of ZENAMIC, a 8/20μ. sec current waveform is used.

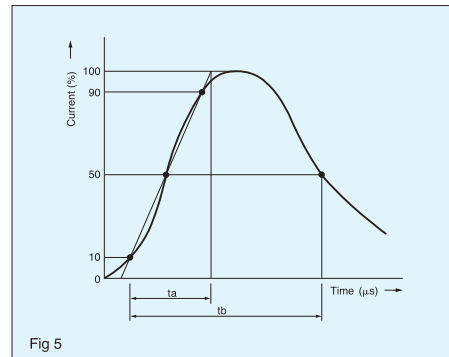
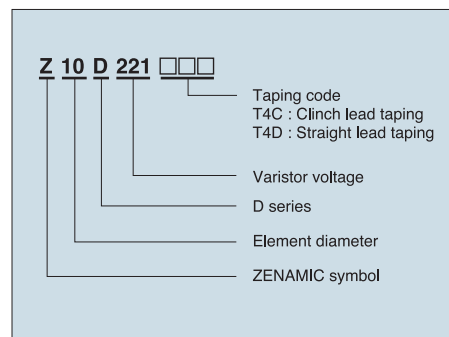


Fig 5

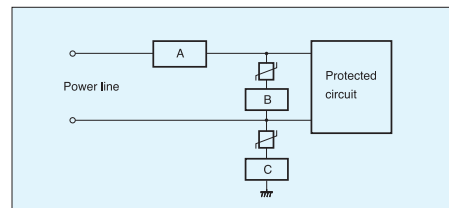
### Part Number



### Application notes (general)

A surge in excess of the specified maximum peak current may cause a short circuit or mechanical damage. The following measures are recommended.

- If ZENAMIC is used in line to ground, the ground fault circuit interrupter should be applied in location A or, alternatively, a thermally coupled fuse should be applied in location C.
- ZENAMIC should not be used near heat generating devices and not be subjected to direct sunlight.
- ZENAMIC should not be used near flammable materials.



- 1) The location of the over current protector (circuit breaker or current fuse) should be in the power line to the circuit (location A) or in series with ZENAMIC (location B).
- 2) It is recommended that a fuse similar to the ones listed in the table below be put in location A or B.

- 3) If ZENAMIC is used in line to ground, the ground fault circuit interrupter should be applied in location A or, alternatively, a thermally coupled fuse should be applied in location C.

Part Number	Z7D□□□	Z10D□□□
Rating of fuse	5A max.	7A max.

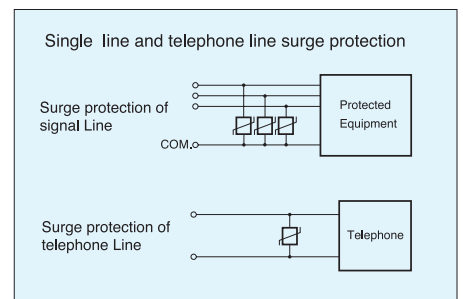
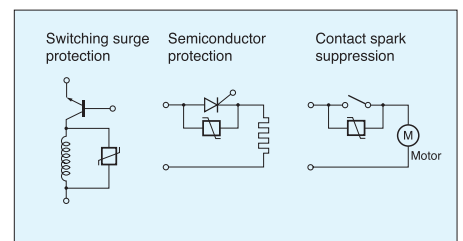
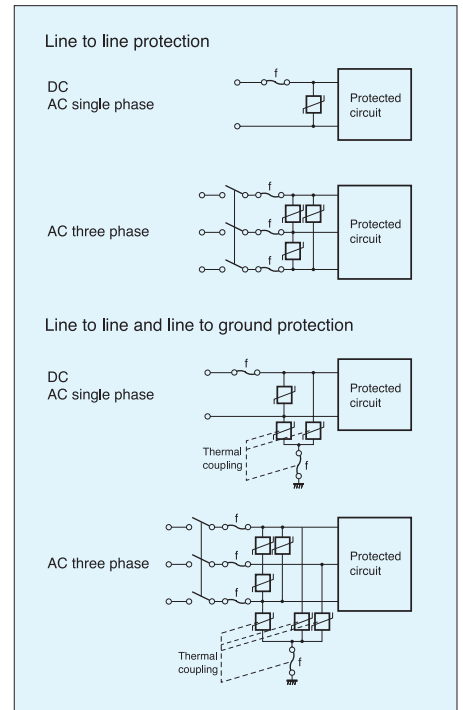
  

Part Number	Z15D□□□	Z21D□□□
Rating of fuse	10A max.	15A max.

Please also consult the related safety standards.

### Example circuits

Example circuits with power lines and surge absorption unit locations.



## Z7D Series

### Specifications

Part No.	Varistor voltage	Maximum allowable voltage		Clamping voltage (max.)	Rated power	Maximum energy		Maximum peak current (8/20 $\mu$ s) 2 times	Capacitance (TYP) 1kHz
		V <sub>1mA</sub> (V)	AC <sub>rms</sub> (V)			DC(V)	V(V)		
Z7D180	18(16-20)	11	14	36 at 2.5A	0.02	1.1	0.9	250	3800
Z7D220	22(20-24)	14	18	43		1.3	1.1		3600
Z7D270	27(24-30)	17	22	53		1.6	1.3		3400
Z7D330	33(30-36)	20	26	65		2.0	1.6		2900
Z7D390	39(35-43)	25	31	77		2.4	1.9		1600
Z7D470	47(42-52)	30	38	93		2.8	2.3		1550
Z7D560	56(50-62)	35	45	110		3.4	2.7		1500
Z7D680	68(61-75)	40	56	135		4.1	3.3		1200
Z7D820 <sup>1</sup>	82(74-90)	50	65	135 at 10A		7	5		810
Z7D101 <sup>1</sup>	100(90-110)	60	85	165		8.5	6		700
Z7D121 <sup>1</sup>	120(108-132)	75	100	200	10	7	590		
Z7D151 <sup>1</sup>	150(135-165)	95	125	250	13	9	500		
Z7D201 <sup>1</sup>	200(185-225)	130	170	340	17.5	12.5	200		
Z7D221 <sup>1</sup>	220(198-242)	140	180	360	19	13.5	190		
Z7D241 <sup>1</sup>	240(216-264)	150	200	395	21	15	170		
Z7D271 <sup>1</sup>	270(247-303)	175	225	455	24	17	150		
Z7D331 <sup>1</sup>	330(297-363)	210	270	545	28	20	130		
Z7D361 <sup>1</sup>	360(324-396)	230	300	595	32	23	130		
Z7D391 <sup>1</sup>	390(351-429)	250	320	650	35	25	130		
Z7D431 <sup>1</sup>	430(387-473)	275	350	710	40	27.5	120		
Z7D471 <sup>1</sup>	470(423-517)	300	385	775	42	30	100 <sup>2</sup>		
Z7D511 <sup>1</sup>	510(459-561)	320	410	845	45	32	90 <sup>2</sup>		

Operating temperature range: -40 to 85°C

Storage temperature range: -40 to 125°C

<sup>1</sup> UL 1449 approved model

<sup>2</sup> Measured at 1MHz

## Z10D Series

### Specifications

Part No.	Varistor voltage	Maximum allowable voltage		Clamping voltage (max.)	Rated power	Maximum energy		Maximum peak current (8/20 $\mu$ s) 2 times	Capacitance (TYP) 1kHz
		V <sub>1mA</sub> (V)	AC <sub>rms</sub> (V)			DC(V)	V(V)		
Z10D180	18(16-20)	11	14	36 at 5A	0.05	2.6	2.2	500	16000
Z10D220	22(20-24)	14	18	43		3.2	2.6		11000
Z10D270	27(24-30)	17	22	53		3.9	3.2		8000
Z10D330	33(30-36)	20	26	65		4.8	4.0		6300
Z10D390	39(35-43)	25	31	77		5.6	4.7		5200
Z10D470	47(42-52)	30	38	93		6.8	5.6		4600
Z10D560	56(50-62)	35	45	110		8.1	6.7		3750
Z10D680	68(61-75)	40	56	135		9.8	8.2		2800
Z10D820 <sup>1</sup>	82(74-90)	50	65	135 at 25A		14	10		2000
Z10D101 <sup>1</sup>	100(90-110)	60	85	165		17	12		1700
Z10D121 <sup>1</sup>	120(108-132)	75	100	200	20	14.5	1400		
Z10D151 <sup>1</sup>	150(135-165)	95	125	250	25	18	1100		
Z10D201 <sup>1</sup>	200(185-225)	130	170	340	35	25	430		
Z10D221 <sup>1</sup>	220(198-242)	140	180	360	39	27.5	410		
Z10D241 <sup>1</sup>	240(216-264)	150	200	395	42	30	380		
Z10D271 <sup>1</sup>	270(247-303)	175	225	455	49	35	350		
Z10D331 <sup>1</sup>	330(297-363)	210	270	545	58	42	300		
Z10D361 <sup>1</sup>	360(324-396)	230	300	595	65	45	300		
Z10D391 <sup>1</sup>	390(351-429)	250	320	650	70	50	300		
Z10D431 <sup>1</sup>	430(387-473)	275	350	710	80	55	270		
Z10D471 <sup>1</sup>	470(423-517)	300	385	775	85	60	230		
Z10D511 <sup>1</sup>	510(459-561)	320	410	845	92	67	210		
Z10D561 <sup>1</sup>	560(504-616)	350	450	930	92	67	200		
Z10D681 <sup>1</sup>	680(612-748)	420	560	1120	92	67	170		
Z10D751 <sup>1</sup>	750(675-825)	460	615	1240	100	70	160		
Z10D821 <sup>1</sup>	820(738-902)	510	670	1355	110	80	140		
Z10D911 <sup>1</sup>	910(819-1001)	550	745	1500	130	90	120		
Z10D102 <sup>1</sup>	1000(900-1100)	625	825	1650	140	100	110		

Operating temperature range: -40 to 85°C

Storage temperature range: -40 to 125°C

<sup>1</sup> UL 1449 approved model

# Z15D Series

## Specifications

Part No.	Varistor voltage	Maximum allowable voltage		Clamping voltage (max.)	Rated power	Maximum energy		Maximum peak current (8/20 $\mu$ s) 2 times	Capacitance (TYP) 1kHz
		V <sub>1mA</sub> (V)	AC <sub>rms</sub> (V)			DC(V)	V(V)		
Z15D180	18(16-20)	11	14	36 at 10A	0.1	5.2	4.3	1000	25000
Z15D220	22(20-24)	14	18	43		6.3	5.3		20000
Z15D270	27(24-30)	17	22	53		7.8	6.5		16000
Z15D330	33(30-36)	20	26	65		9.5	7.9		12200
Z15D390	39(35-43)	25	31	77		11	9.4		7000
Z15D470	47(42-52)	30	38	93		14	11		6750
Z15D560	56(50-62)	35	45	110		16	13		6500
Z15D680	68(61-75)	40	56	135		20	16		5500
Z15D820 <sup>1</sup>	82(74-90)	50	65	135 at 50A		28	20		3700
Z15D101 <sup>1</sup>	100(90-110)	60	85	165		35	25		3200
Z15D121 <sup>1</sup>	120(108-132)	75	100	200	42	30	2700		
Z15D151 <sup>1</sup>	150(135-165)	95	125	250	53	37.5	2200		
Z15D201 <sup>1</sup>	200(185-225)	130	170	340	70	50	770		
Z15D221 <sup>1</sup>	220(198-242)	140	180	360	78	55	740		
Z15D241 <sup>1</sup>	240(216-264)	150	200	395	84	60	700		
Z15D271 <sup>1</sup>	270(247-303)	175	225	455	99	70	640		
Z15D331 <sup>1</sup>	330(297-363)	210	270	545	115	80	580		
Z15D361 <sup>1</sup>	360(324-396)	230	300	595	130	90	540		
Z15D391 <sup>1</sup>	390(351-429)	250	320	650	140	100	500		
Z15D431 <sup>1</sup>	430(387-473)	275	350	710	155	110	450		
Z15D471 <sup>1</sup>	470(423-517)	300	385	775	175	125	400		
Z15D511 <sup>1</sup>	510(459-561)	320	410	845	190	136	350		
Z15D561 <sup>1</sup>	560(504-616)	350	450	930	190	136	340		
Z15D681 <sup>1</sup>	680(612-748)	420	560	1120	190	136	320		
Z15D751 <sup>1</sup>	750(675-825)	460	615	1240	210	150	310		
Z15D821 <sup>1</sup>	820(738-902)	510	670	1355	235	165	280		
Z15D911 <sup>1</sup>	910(819-1001)	550	745	1500	255	180	250		
Z15D102 <sup>1</sup>	1000(900-1100)	625	825	1650	280	200	230		

Operating temperature range: -40 to 85°C <sup>1</sup> UL 1449 approved model  
Storage temperature range: -40 to 125°C

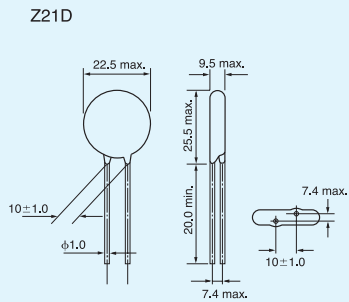
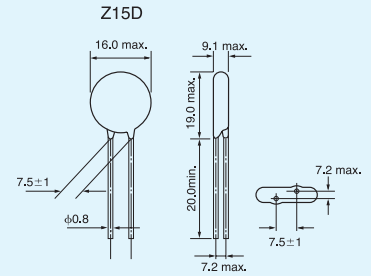
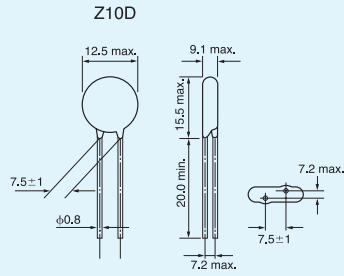
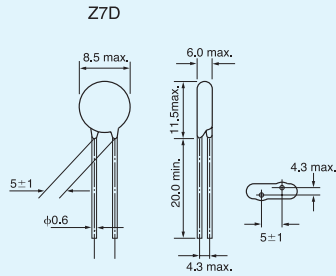
# Z21D Series

## Specifications

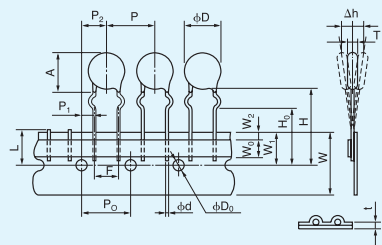
Part No.	Varistor voltage	Maximum allowable voltage		Clamping voltage (max.)	Rated power	Maximum energy		Maximum peak current (8/20 $\mu$ s) 2 times	Capacitance (TYP) 1kHz
		V <sub>1mA</sub> (V)	AC <sub>rms</sub> (V)			DC(V)	V(V)		
Z21D180	18(16-20)	11	14	36 at 20A	0.2	13	12	2000	40000
Z21D220	22(20-24)	14	18	43		16	14		30000
Z21D270	27(24-30)	17	22	53		19	17		24500
Z21D330	33(30-36)	20	26	65		24	21		20000
Z21D390	39(35-43)	25	31	77		28	25		13800
Z21D470	47(42-52)	30	38	93		34	30		13500
Z21D560	56(50-62)	35	45	110		41	36		12200
Z21D680	68(61-75)	40	56	135		49	44		11500
Z21D820 <sup>1</sup>	82(74-90)	50	65	135 at 100A		56	40		7500
Z21D101 <sup>1</sup>	100(90-110)	60	85	165		70	50		6500
Z21D121 <sup>1</sup>	120(108-132)	75	100	200	85	60	5500		
Z21D151 <sup>1</sup>	150(135-165)	95	125	250	106	75	4500		
Z21D201 <sup>1</sup>	200(185-225)	130	170	340	140	100	1700		
Z21D221 <sup>1</sup>	220(198-242)	140	180	360	155	110	1600		
Z21D241 <sup>1</sup>	240(216-264)	150	200	395	168	120	1500		
Z21D271 <sup>1</sup>	270(247-303)	175	225	455	190	135	1300		
Z21D331 <sup>1</sup>	330(297-363)	210	270	545	228	160	1100		
Z21D361 <sup>1</sup>	360(324-396)	230	300	595	255	180	1100		
Z21D391 <sup>1</sup>	390(351-429)	250	320	650	275	195	1100		
Z21D431 <sup>1</sup>	430(387-473)	275	350	710	303	215	1000		
Z21D471 <sup>1</sup>	470(423-517)	300	385	775	350	250	900		
Z21D511 <sup>1</sup>	510(459-561)	320	410	845	382	273	800		
Z21D561 <sup>1</sup>	560(504-616)	350	450	930	382	273	750		
Z21D681 <sup>1</sup>	680(612-748)	420	560	1120	382	273	650		
Z21D751 <sup>1</sup>	750(675-825)	460	615	1240	420	300	600		
Z21D821 <sup>1</sup>	820(738-902)	510	670	1355	460	325	530		
Z21D911 <sup>1</sup>	910(819-1001)	550	745	1500	510	360	500		
Z21D102 <sup>1</sup>	1000(900-1100)	625	825	1650	565	400	450		

Operating temperature range: -40 to 85°C <sup>1</sup> UL 1449 approved model  
Storage temperature range: -40 to 125°C

Dimensions



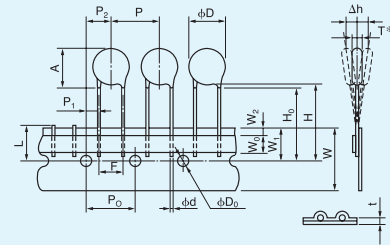
Crimped leads + taping  
Z7D□□□ T4C



'Dimension "T" changes for each individual part specification.  
Packing quantity: 1000 pcs/box

Symbol	Type I	Symbol	Type I
P	12.7±1.0	W <sub>0</sub>	5.0min
P <sub>0</sub>	12.7±0.3	W <sub>1</sub>	9.0±0.5
P <sub>1</sub>	3.85±0.70	W <sub>2</sub>	3max
P <sub>2</sub>	6.35±1.30	H	Approx. 22
φd	0.60 <sup>+0.06</sup> <sub>-0.05</sub>	H <sub>0</sub>	17.0±0.5
F	5.0±0.5	φD <sub>0</sub>	φ4.0±0.2
Δh	0±2	t	0.6±0.3
W	18.0 <sup>+1.0</sup> <sub>-0.5</sub>	L	11max
φD	Z7D: 8.5max		

Straight leads + taping  
Z7D□□□ T4D




'Dimension "T" changes for each individual part specification.  
Packing quantity: 1000 pcs/box

P	12.7±1.0	W <sub>0</sub>	5.0min
P <sub>0</sub>	12.7±0.3	W <sub>1</sub>	9.0±0.5
P <sub>1</sub>	3.85±0.70	W <sub>2</sub>	3max
P <sub>2</sub>	6.35±1.30	H	Approx. 20
φd	0.60 <sup>+0.06</sup> <sub>-0.05</sub>	H <sub>0</sub>	17.0±0.5
F	5.0±0.5	φD <sub>0</sub>	φ4.0±0.2
Δh	0±2	t	0.6±0.3
W	18.0 <sup>+1.0</sup> <sub>-0.5</sub>	L	11max
		φD	Z7D: 8.5max

Unit (mm)

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