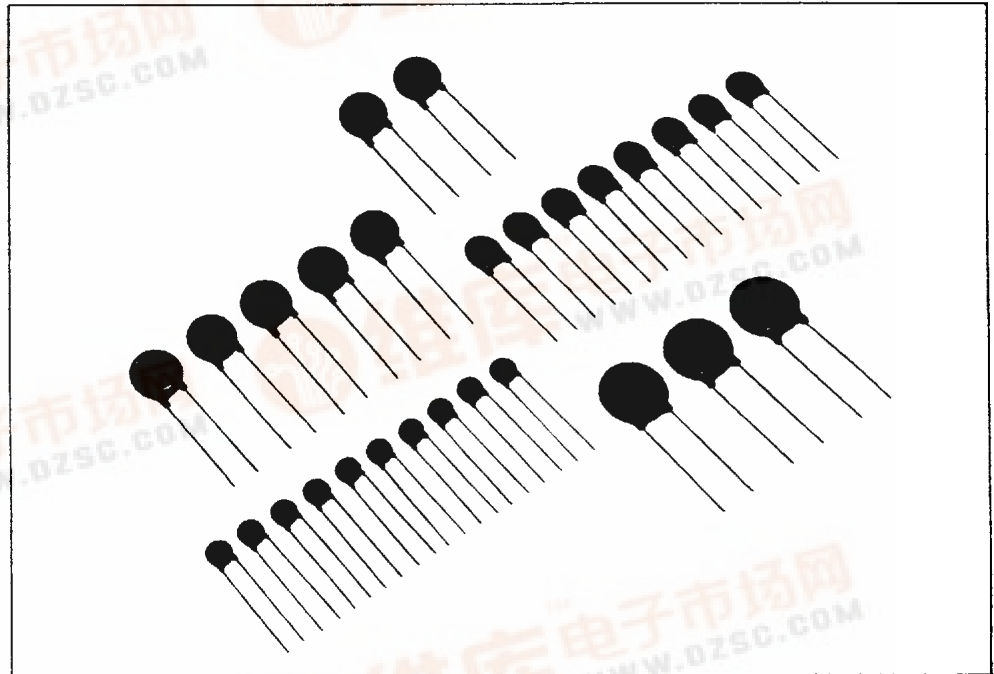




METAL OXIDE VARISTOR

ZENAMIC



ZENAMIC is the product name of a metal oxide varistor.

Features

- High energy absorption
- Excellent voltage clamping characteristics
- Symmetrical characteristics — for use on AC or DC
- Fast response
- Compact and robust construction
- Low idle power
- High surge current capability
- Specific types for PACE/paks and Solid State Relays

Applications

- For protection of all types of semiconductors
- Suppression of switching transients
- Voltage clipping, and circuit damping
- Absorption of surge voltages associated with lightning strikes
- Prolongation of contact life
- Protection in industrial switching circuits

Zenamic voltage suppressors are metal oxide varistors having a non-linear current-voltage characteristic which exhibits an almost constant voltage over a wide range of current. They are ideally suited to all transient voltage protection applications and their high clamping ratios and low steady state power consumption offer considerable circuit advantages over more traditional methods of protection.

Normally the Zenamic idles at a low current level at the nominal voltage. When a transient over-voltage occurs in the circuit, the Zenamic current increases rapidly, its voltage remaining virtually constant. The transient energy is thus absorbed by the Zenamic and the associated circuit impedances.

V-I characteristics

ZENAMIC has the forward-reverse symmetrical electrical characteristics as shown in the figure 1. The voltage-current curves show the varistor characteristics in the range $1 \mu\text{A}$ to 10^4A , and show the resistance characteristics for the range under $1 \mu\text{A}$ and over 10^4A in the figure 2.

The voltage across terminals when test current (I_t : 1 mA) is applied to ZENAMIC is a standard varistor voltage (V_z), and the voltage across terminals when a standard surge (I_p) is applied represents the maximum suppression voltage (V_c).

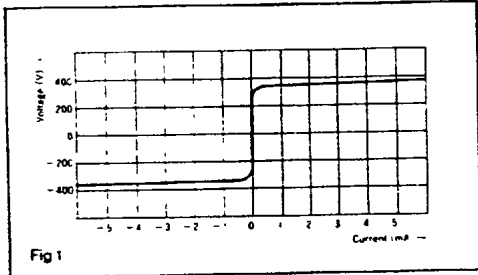


Fig 1

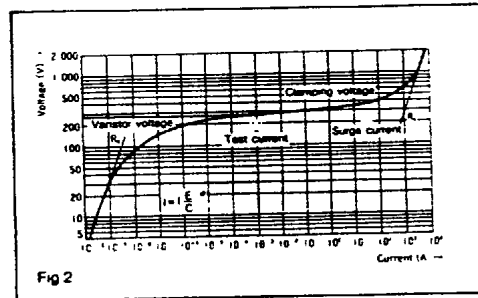


Fig 2

Temperature Characteristics

In the small current range, Zenamic features outstanding temperature characteristics. A shunt resistance R_p of metal oxide varistor has the temperature characteristics which is determined by the following equation.

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

- T: Absolute temperature
- k: Boltzmann constant
- A, E_g : constants

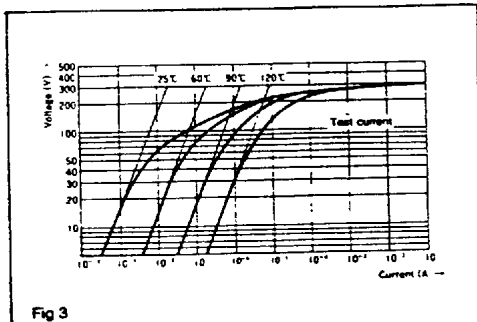


Fig 3

As shown in the figure 3, the temperature dependence characteristics are shown clearly in the low current area.

Power derating

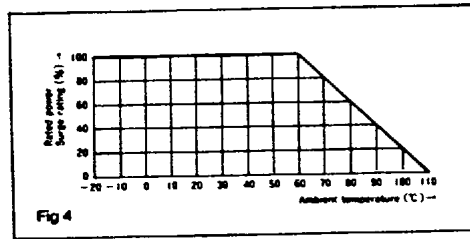


Fig 4

Surge waveform

A 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 $[t_a]$ as shown in the figure 5, and then decreases as time passes and reaches half of the peak voltage (current) at $[t_b]$. This type of the EXP waveform is shown as a $[t_a/t_b]$ voltage (current) waveform. For surge testing of ZENAMIC, the $8/20 \mu\text{sec}$ current waveform is used.

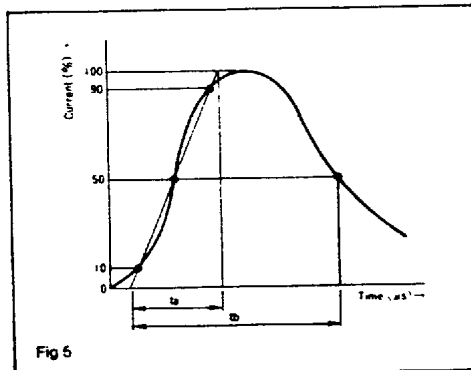
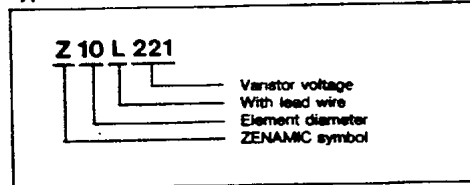


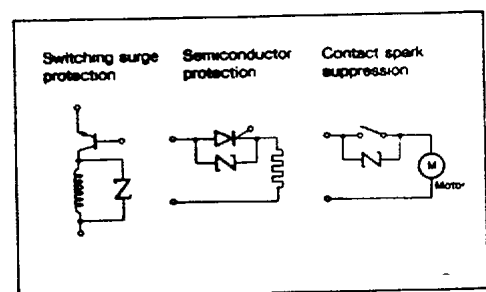
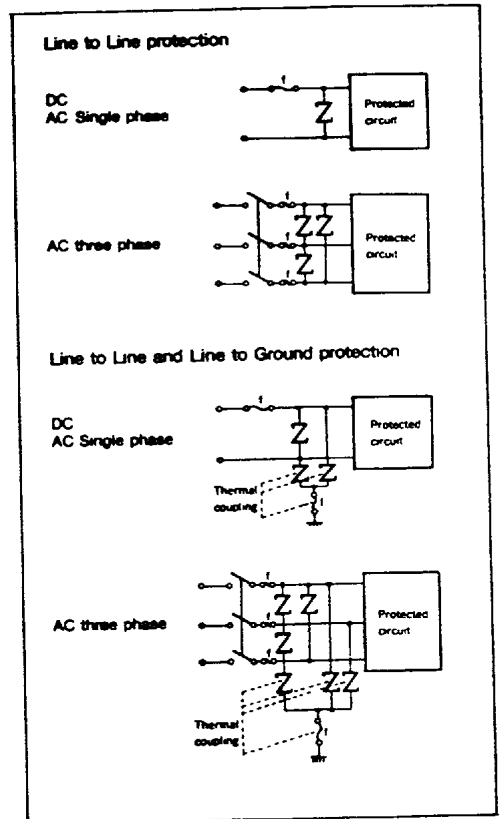
Fig 5

Type No.



Application

A few examples show. Power lines and surge absorption units with error display (SA series).

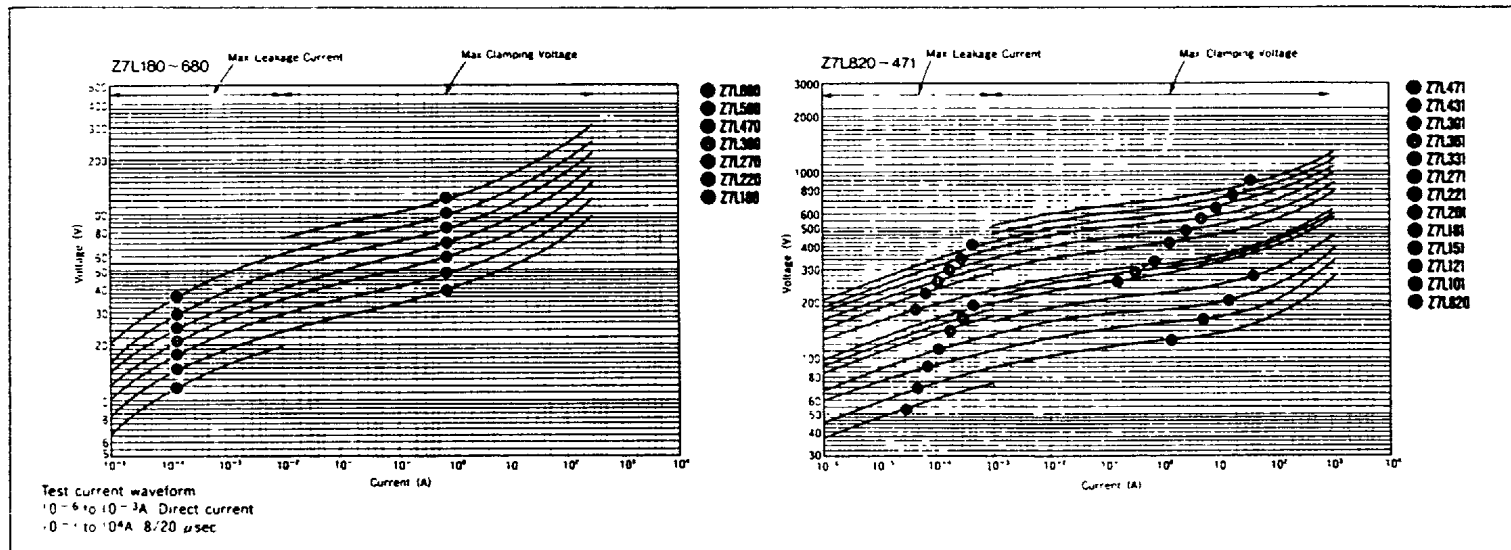


Z7L Series

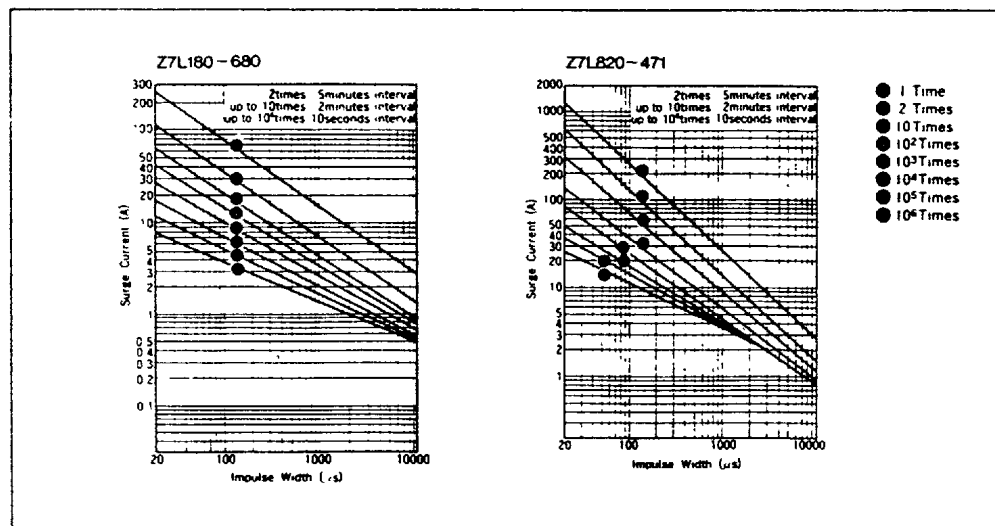
Specifications

Type No.	Varistor voltage V_{VMA} (V)		Maximum allowable voltage		Maximum clamping voltage	Rated wattage	Energy (2ms)	Withstanding Surge current (8/20 μ s)		Typical capacitance (@ 1kHz)
			AC	DC				1 Time	2 Times	
	Min	Max	V_{VMA}	V	V	W	J			pF
Z7L180	18 (16~20)		11	14	36 at 2.5A	0.02	0.8	250A	125A	3,500
Z7L220	22 (20~24)		14	18	43		0.9			2,800
Z7L270	27 (24~30)		17	22	53		1.0			2,000
Z7L330	33 (30~36)		20	26	65		1.2			1,500
Z7L390	39 (35~43)		25	31	77		1.5			1,350
Z7L470	47 (42~52)		30	38	93		1.8			1,150
Z7L580	58 (50~62)		35	45	110		2.2			950
Z7L680	68 (61~75)		40	55	135		2.5			700
Z7L820	82 (74~90)		50	65	135 at 10A	3.5	1200A	600A	550	
Z7L101	100 (90~110)		60	85	165	4.0			500	
Z7L121	120 (108~132)		75	100	200	5.0			450	
Z7L151	150 (135~165)		95	125	250	6.0			350	
Z7L181	180 (162~198)		110	145	300	10.0			300	
*Z7L201	200 (185~225)		130	170	340	10.0			250	
*Z7L221	220 (198~242)		140	180	380	10.0			250	
*Z7L271	270 (247~303)		175	225	455	12.0			170	
*Z7L331	330 (297~363)		210	275	550	15.0			150	
*Z7L361	360 (324~396)		230	300	595	15.0			130	
*Z7L381	390 (351~429)		250	320	650	17.0			130	
*Z7L431	430 (387~473)		275	350	710	20.0			110	
*Z7L471	470 (423~517)		300	385	775	20.0			100	

V-I characteristics



Surge Life Time Ratings (Relation between impulse width and surge repetition time)



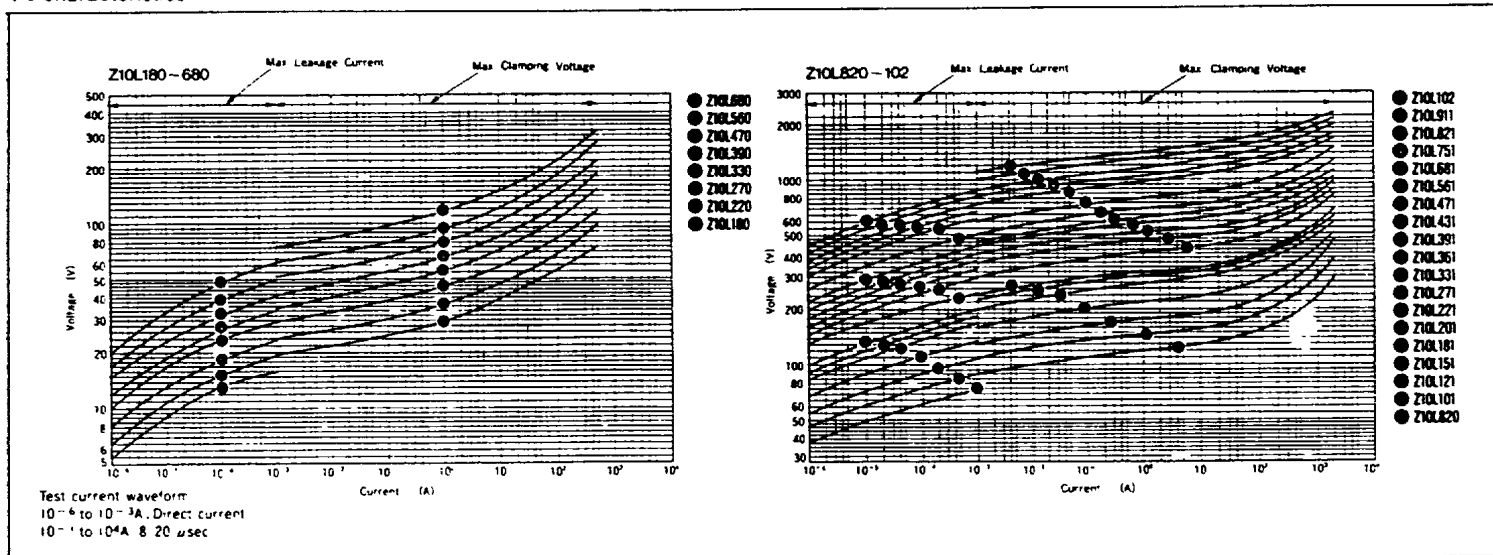
- 1 Operating temperature range -40 to 85 °C
- 2 Storage temperature range -40 to 125 °C
- 3 * UL approved model

Z10L Series

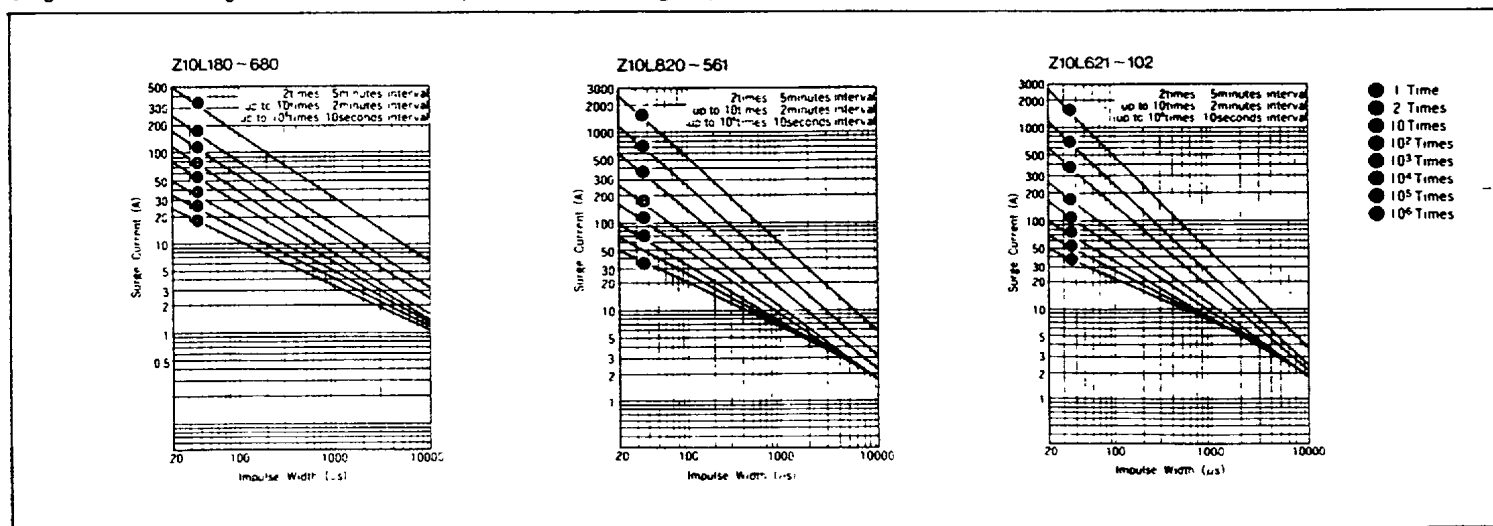
Specifications

Type No.	Varistor voltage V_{1mA} (V)		Maximum allowable voltage		Maximum clamping voltage V	Rated wattage W	Energy (2ms) J	Withstanding surge current (8/20 μ s)		Typical capacitance (@ 1kHz) pF
			AC	DC				1 Time	2 Times	
	Min	Max	V_{rms}	V						
Z10L180	18 (16~20)	11	14	36 at 5A	0.05	1.5	500A	250A	7,500	
Z10L220	22 (20~24)	14	18	43						
Z10L270	27 (24~30)	17	22	53						
Z10L330	33 (30~36)	20	28	65						
Z10L390	39 (35~43)	25	31	77						
Z10L470	47 (42~52)	30	38	93						
Z10L560	56 (50~62)	35	45	110						
Z10L680	68 (61~75)	40	56	135						
Z10L820	82 (74~90)	50	65	135 at 25A	0.4	8	2500A	1250A	1,800	
Z10L101	100 (90~110)	60	85	165						
Z10L121	120 (108~132)	75	100	200						
Z10L151	150 (135~165)	95	125	250						
Z10L181	180 (162~198)	110	145	300						
* Z10L201	200 (185~225)	130	170	340						
* Z10L221	220 (198~242)	140	180	360						
* Z10L271	270 (247~303)	175	225	455						
* Z10L331	330 (297~363)	210	275	560						
* Z10L361	360 (324~396)	230	300	595						
* Z10L391	390 (351~429)	250	320	650						
* Z10L431	430 (387~473)	275	350	710						
* Z10L471	470 (423~517)	300	385	775						
* Z10L561	560 (504~616)	350	460	925						
* Z10L681	680 (612~748)	420	560	1,120						
* Z10L751	750 (675~825)	480	615	1,240						
* Z10L821	820 (738~902)	510	670	1,355						
* Z10L911	910 (819~1,001)	550	745	1,500						
* Z10L102	1,000 (900~1,100)	625	825	1,650						

V-I characteristics



Surge Life Time Ratings (Relation between impulse width and surge repetition time)



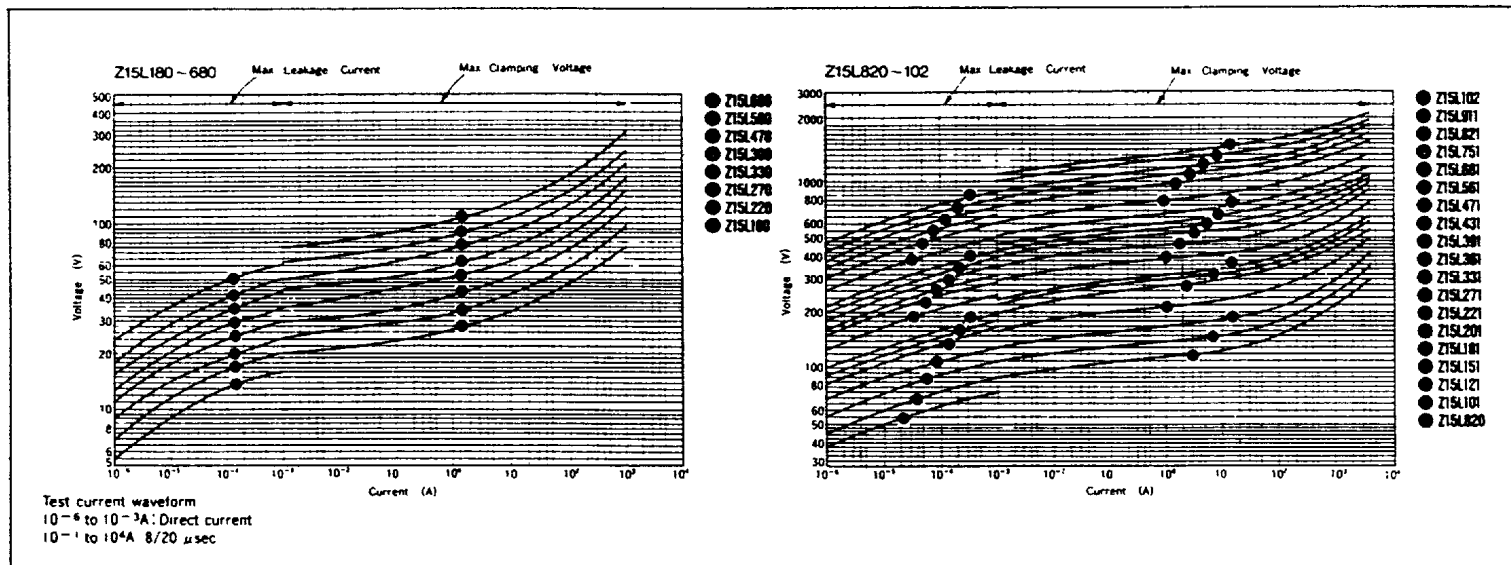
1. Operating temperature range -40 to 85°C
2. Storage temperature range -40 to 125°C
3. * : UL approved model

Z15L Series

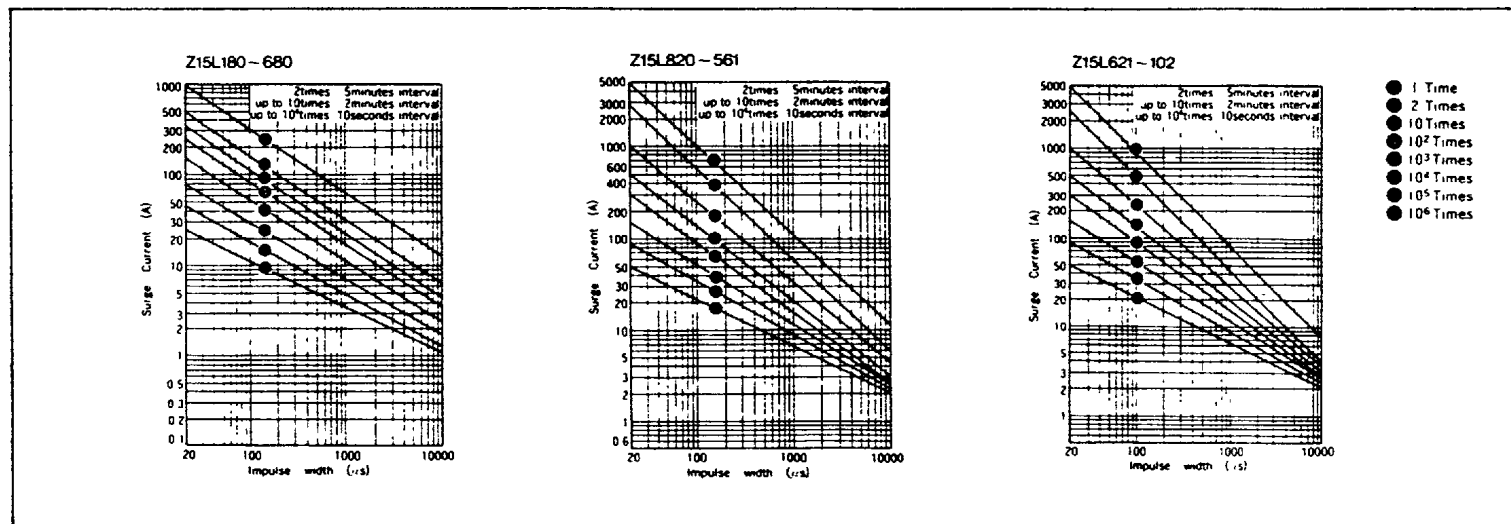
Specifications

Type No.	Varistor voltage V_{1mA} (V)		Maximum allowable voltage		Maximum clamping voltage V	Rated wattage W	Energy (2ms) J	Withstanding Surge current (8/20 μ s)		Typical capacitance (@ 1kHz) pF
	Min	Max	AC	DC				1 Time	2 Times	
			V_{rms}	V						
Z15L180	18 (16~20)	11	14	36 at 10A	0.1	3.5	1000A	500A	18,000	
Z15L220	22 (20~24)	14	18	43						
Z15L270	27 (24~30)	17	22	53						
Z15L330	33 (30~36)	20	26	65						
Z15L360	36 (35~43)	25	31	77						
Z15L470	47 (42~52)	30	38	93						
Z15L560	56 (50~62)	36	45	110						
Z15L680	68 (61~75)	40	56	135						
Z15L820	82 (74~90)	50	65	135 at 50A	0.6	14	4500A	2500A	2,900	
Z15L101	100 (90~110)	60	85	165						
Z15L121	120 (108~132)	75	100	200						
Z15L151	150 (135~165)	95	125	250						
Z15L181	180 (162~198)	110	145	300						
Z15L201	200 (185~225)	130	170	340						
Z15L221	220 (198~242)	140	180	360						
Z15L271	270 (247~303)	175	225	455						
Z15L331	330 (297~363)	210	275	550						
Z15L361	360 (324~396)	250	300	595						
Z15L391	390 (351~429)	280	350	650						
Z15L431	430 (387~473)	275	350	710						
Z15L471	470 (423~517)	300	385	775						
Z15L561	560 (504~616)	350	460	925						
Z15L681	680 (612~748)	420	560	1,120						
Z15L751	750 (675~825)	480	615	1,240						
Z15L821	820 (738~902)	510	670	1,355						
Z15L911	910 (819~1,001)	550	745	1,500						
Z15L102	1,000 (900~1,100)	625	825	1,650						

V-I characteristics



Surge Life Time Ratings (Relation between impulse width and surge repetition time)



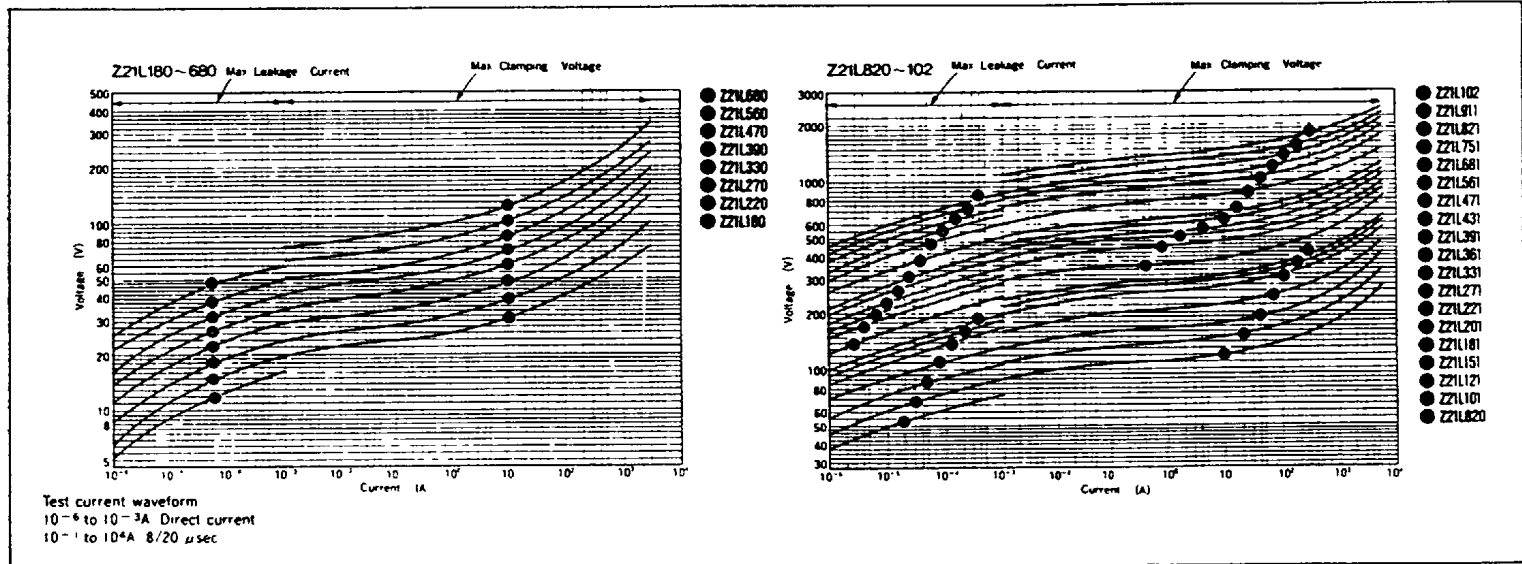
1. Operating temperature range: -40 to 85 $^{\circ}$ C
2. Storage temperature range: -40 to 125 $^{\circ}$ C
3. *: UL approved model

Z21L Series

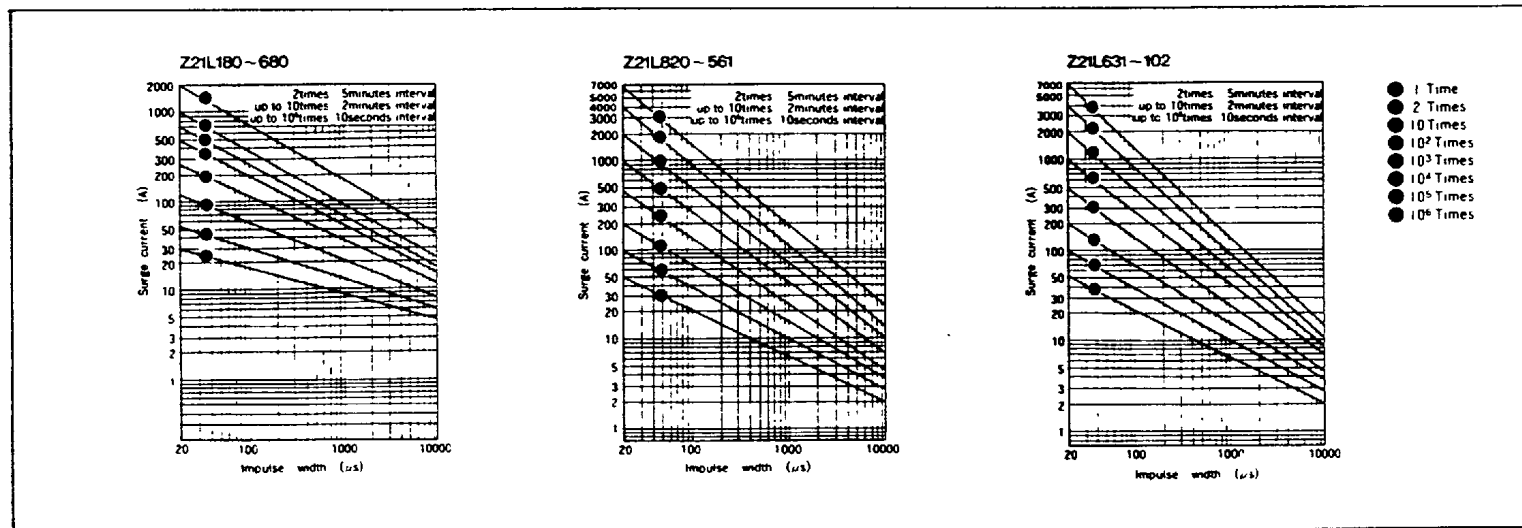
Specifications

Type No.	Varistor voltage V_{VMA} (V)		Maximum allowable voltage		Maximum clamping voltage V	Rated wattage W	Energy (Jms) J	Withstanding Surge current (@20 μ s)		Typical capacitance (@ 1kHz) pF
			AC	DC				1 Time	2 Time	
	Min	Max	Vrms	V						
Z21L180	18	16 ~ 20	11	14	36 at 20A	0.2	10	2000A	1000A	37,000
Z21L220	22	20 ~ 24	14	18	43		13			
Z21L270	27	24 ~ 30	17	22	53		15			
Z21L330	33	30 ~ 36	20	26	65		20			
Z21L390	39	35 ~ 43	25	31	77		24			
Z21L470	47	42 ~ 52	30	38	93		30			
Z21L560	56	50 ~ 62	35	45	110		35			
Z21L680	68	61 ~ 75	40	55	135		40			
Z21L820	82	74 ~ 90	50	65	135 at 100A	1.0	27	6500A	4000A	5,500
Z21L101	100	90 ~ 110	60	85	165		30			
Z21L121	120	108 ~ 132	75	100	200		40			
Z21L151	150	135 ~ 165	95	125	250		50			
Z21L181	180	162 ~ 198	110	145	300		65			
Z21L201	200	185 ~ 225	130	170	340		70			
Z21L221	220	198 ~ 242	140	180	360		75			
Z21L271	270	247 ~ 303	175	225	455		90			
Z21L331	330	297 ~ 363	210	275	550		110			
Z21L361	360	324 ~ 396	230	300	595		120			
Z21L391	390	351 ~ 429	250	320	650		130			
Z21L431	430	387 ~ 473	275	350	710		140			
Z21L471	470	423 ~ 517	300	385	775		150			
Z21L561	560	504 ~ 616	350	460	925		150			
Z21L681	680	612 ~ 748	420	560	1,120		160			
Z21L751	750	675 ~ 825	460	615	1,240		175			
Z21L821	820	738 ~ 902	510	670	1,355		190			
Z21L911	910	819 ~ 1,001	550	745	1,500		215			
Z21L102	1,000	900 ~ 1,100	625	825	1,650	230				

V-I characteristics



Surge Life Time Ratings (Relation between impulse width and surge repetition time)



1. Operating temperature range: -40 to 85 °C
2. Storage temperature range: -40 to 125 °C
- 3 * : UL approved model

Z25M, Z33M Series

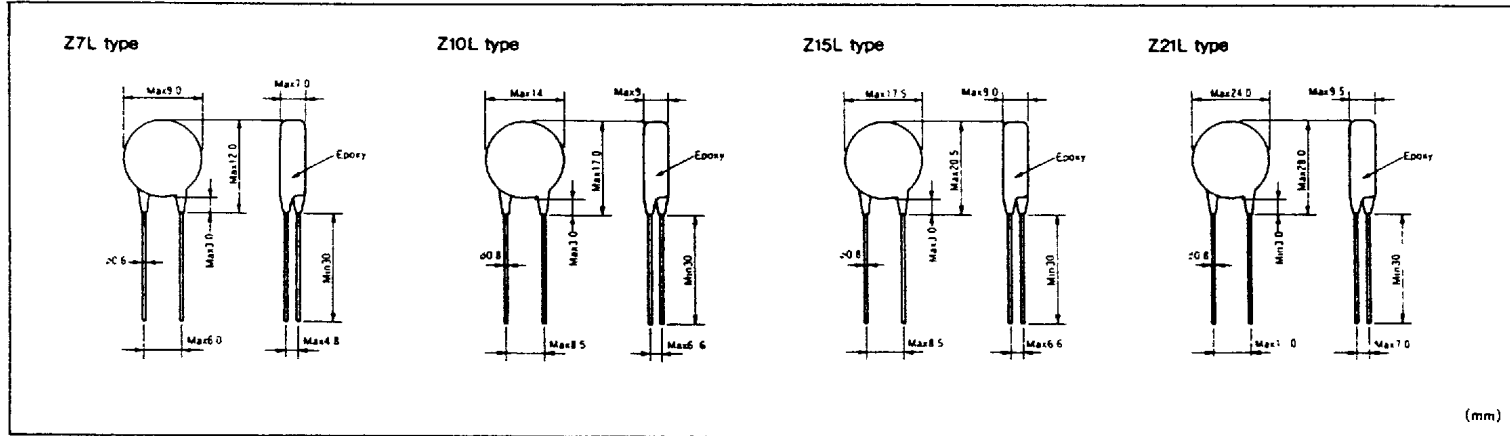
25

Specifications

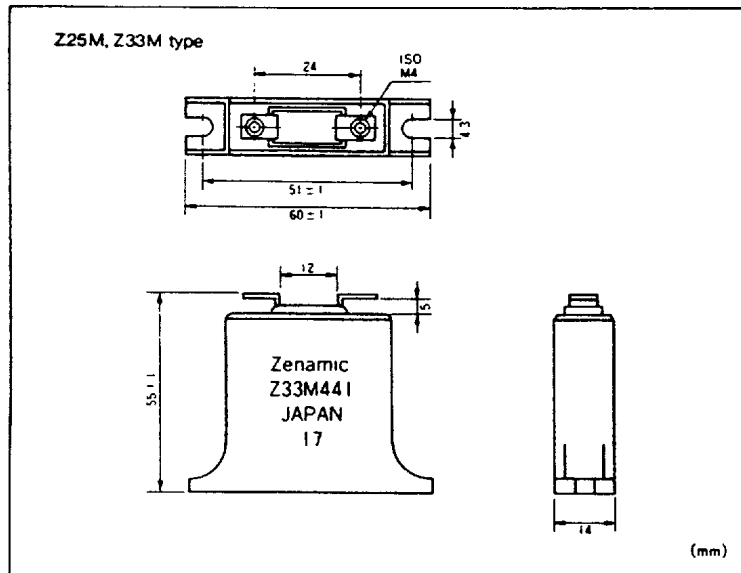
Type No.	Variator voltage V_{rms} (V)		Maximum allowable voltage		Maximum clamping voltage V	Rated wattage W	Energy (J) J	Withstanding Surge current (8/20 μ s)		Typical capacitance (@ 1kHz) μ F			
	Min	Max	AC V_{rms}	DC V				1 Time	2 Times				
Z25M221S	220 (187 ~ 253)	120	165	380 at 100A	125	10	15000A	10000A	3,300				
Z25M271S	270 (229.5 ~ 310.5)	150	210	465	156								
Z25M331S	330 (280.5 ~ 379.5)	175	245	570	186								
Z25M391S	390 (331.5 ~ 448.5)	210	295	675	215								
Z25M441S	440 (374 ~ 506)	240	335	780	225								
Z25M471S	470 (399.5 ~ 540.5)	250	350	810	235								
Z25M4581S	580 (476 ~ 644)	300	420	970	280								
Z25M681S	680 (578 ~ 782)	365	510	1,175	280								
Z25M821S	820 (697 ~ 943)	440	615	1,415	330								
Z25M102S	1000 (850 ~ 1,150)	520	730	1,725	375								
Z33M221S	220 (187 ~ 253)	120	165	380 at 100A	200					1.2	25000A	20000A	6,500
Z33M271S	270 (229.5 ~ 310.5)	150	210	465	256								
Z33M331S	330 (280.5 ~ 379.5)	175	245	570	310								
Z33M391S	390 (331.5 ~ 448.5)	210	295	675	360								
Z33M441S	440 (374 ~ 506)	240	335	780	370								
Z33M471S	470 (399.5 ~ 540.5)	250	350	810	385								
Z33M4581S	580 (476 ~ 644)	300	420	970	425								
Z33M681S	680 (578 ~ 782)	365	510	1,175	460								
Z33M821S	820 (697 ~ 943)	440	615	1,415	580								
Z33M102S	1000 (850 ~ 1,150)	520	730	1,725	620								

- 1. Operating temperature range: -40 to 85 °C
- 2. Storage temperature range: -40 to 125 °C

Dimensions



Dimensions



Taping

