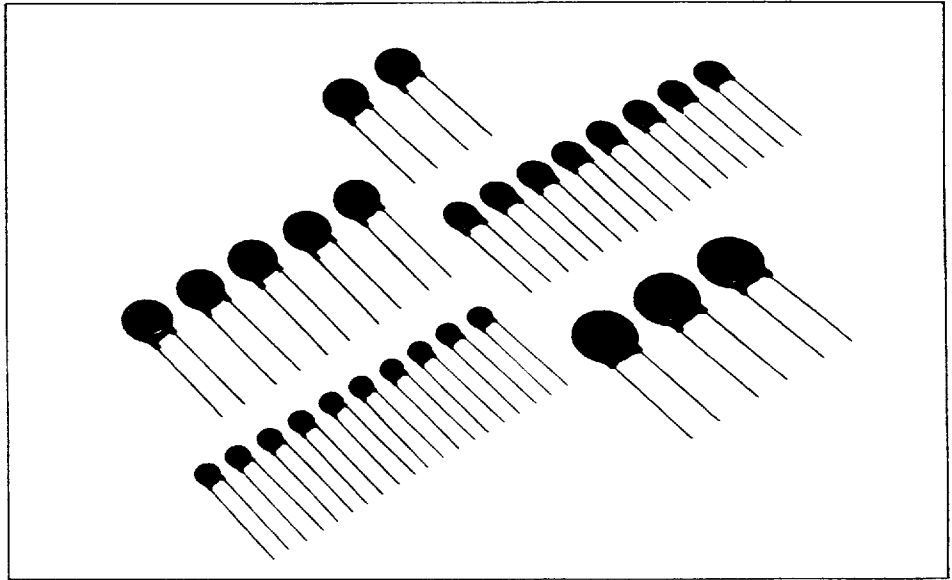


POWER PRODUCTS INTERNATIONAL LTD



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

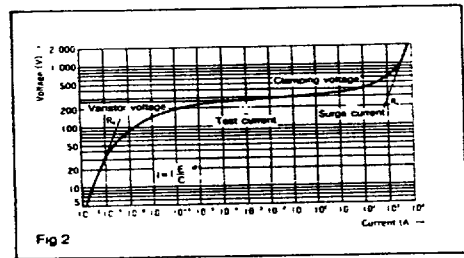
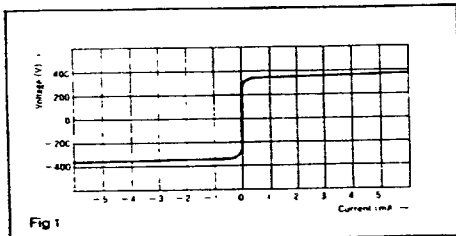
Zenamic voltage suppressors are metal oxide varistors having a non-linear current-voltage characteristic which exhibits an almost constant voltage over a wide range of current. They are ideally suited to all transient voltage protection applications and their high clamping ratios and low steady state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

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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).

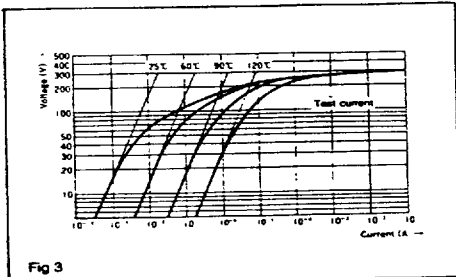


Temperature Characteristics

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.

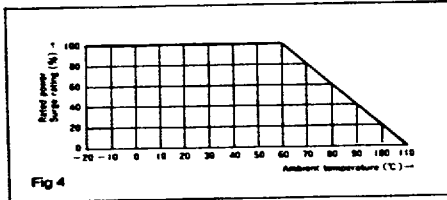
$$R_p = A e^{E_g/2kT} \quad (2)$$

T Absolute temperature
k Boltzmann constant
A, E_g constants



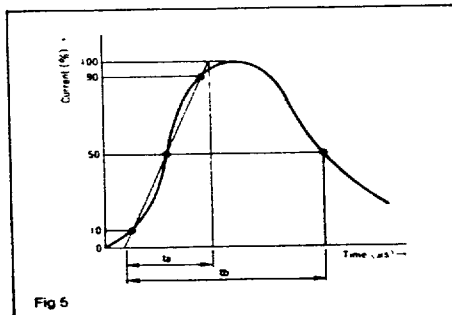
As shown in the figure 3, the temperature dependence characteristics are shown clearly in the low current area

Power derating

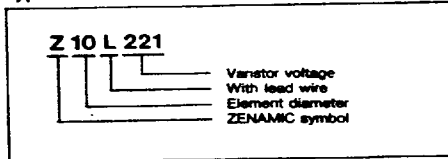


Surge waveform

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.

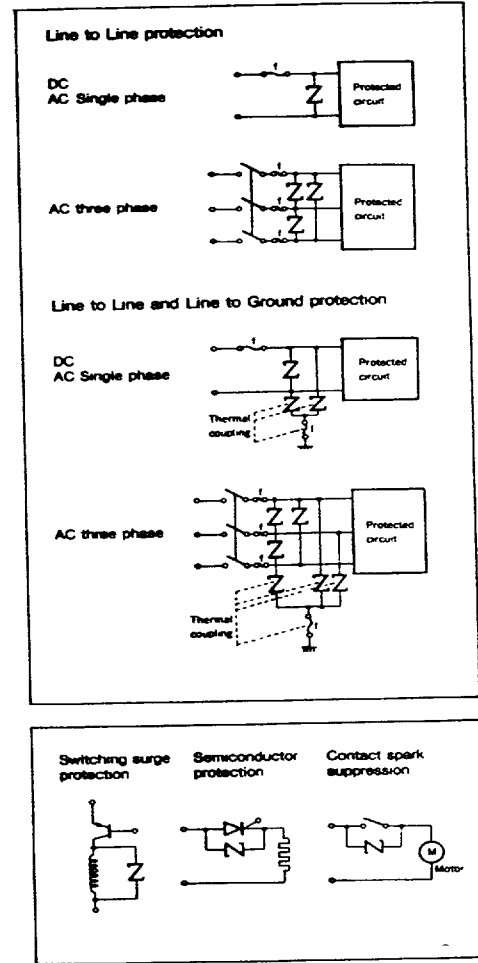


Type No.



Application

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



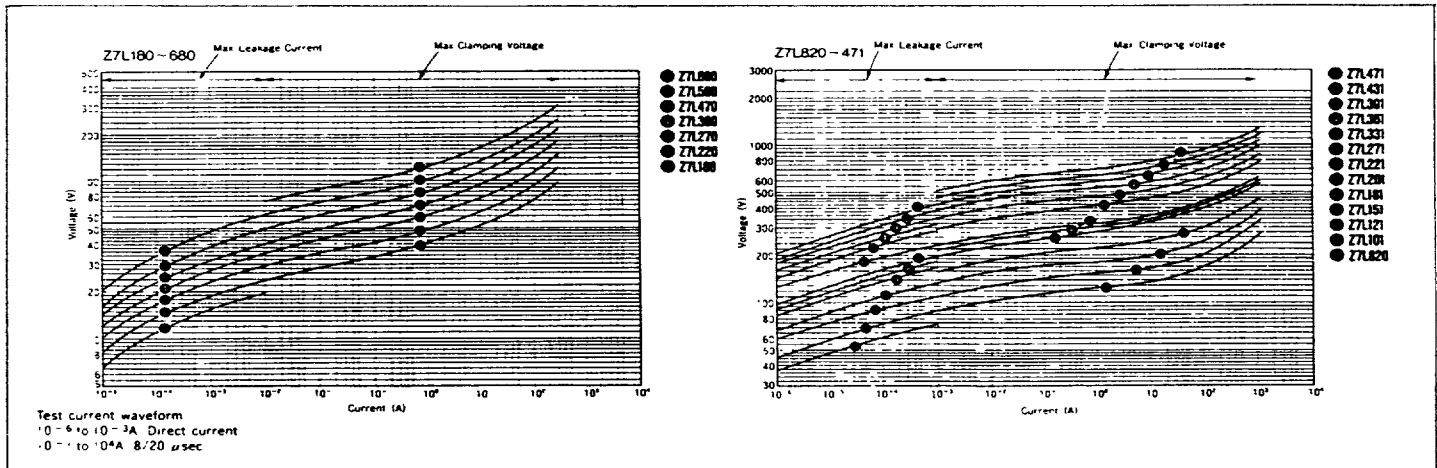
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Z7L Series

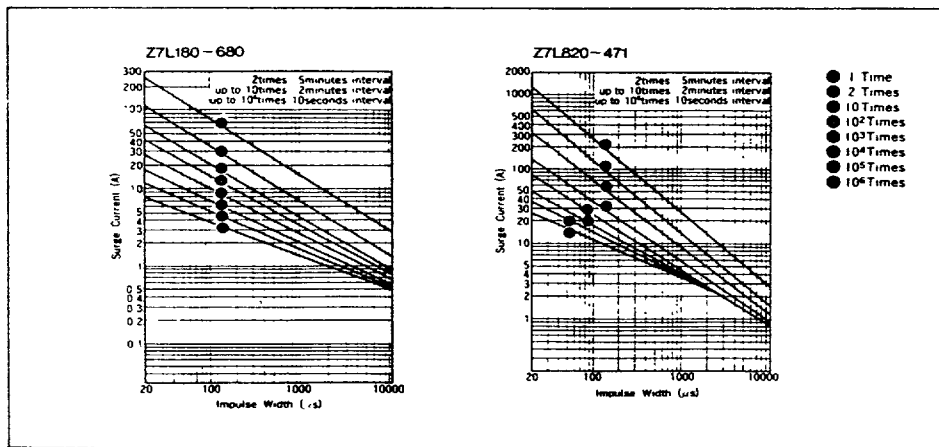
Specifications

Type No.	Varistor voltage V_{VMA} (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 Vrms	DC V				1 Time	2 Times	
Z7L180	18 (16~20)	20	11	14	36 at 2.5A		0.8		3,500	
Z7L220	22 (20~24)	24	14	18	43		0.9		2,800	
Z7L270	27 (24~30)	30	17	22	53		1.0		2,000	
Z7L330	33 (30~36)	36	20	26	65		1.2		1,500	
Z7L390	39 (35~43)	43	25	31	77		1.5		1,350	
Z7L470	47 (42~52)	52	30	36	93	0.02	1.8	250A	1,150	
Z7L580	56 (50~62)	62	35	45	110		2.2		850	
Z7L680	68 (61~75)	75	40	56	135		2.5		700	
Z7LB20	82 (74~90)	90	50	65	135 at 10A		3.5		550	
Z7L101	100 (90~110)	110	60	85	165		4.0		500	
Z7L121	120 (108~132)	132	75	100	200		5.0		450	
Z7L151	150 (135~165)	165	95	125	250		6.0		350	
Z7L181	180 (162~198)	198	110	145	300		10.0		300	
● Z7L201	200 (180~225)	225	130	170	340		10.0		250	
● Z7L221	220 (198~242)	242	140	180	380	0.25	10.0	1200A	250	
● Z7L271	270 (247~303)	303	175	225	455		12.0		170	
● Z7L331	330 (297~363)	363	210	275	550		15.0		150	
● Z7L361	360 (324~396)	396	230	300	595		15.0		130	
● Z7L391	390 (351~429)	429	250	320	650		17.0		130	
● Z7L431	430 (387~473)	473	275	350	710		20.0		110	
● Z7L471	470 (423~517)	517	300	365	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

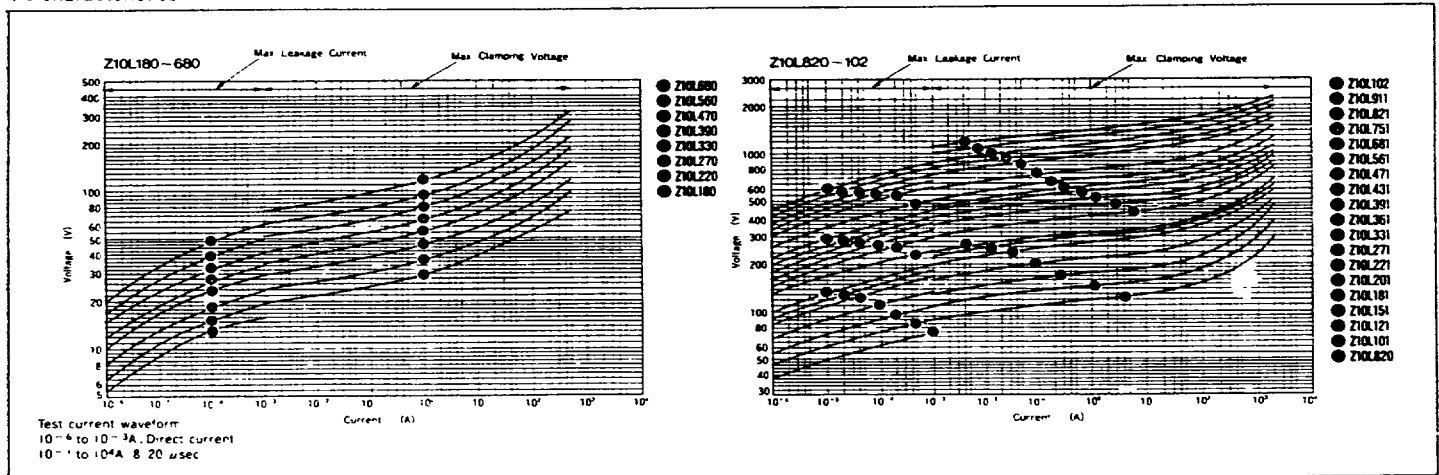
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Z10L Series

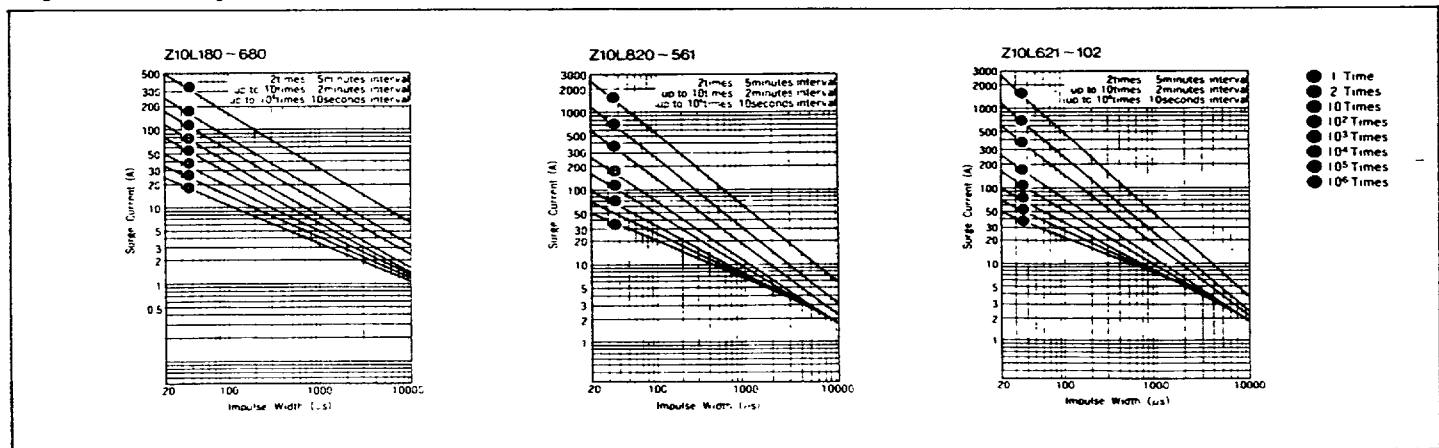
Specifications

Type No.	Varistor voltage V_{rms} (V)		Maximum allowable voltage		Maximum clamping voltage V	Rated voltage W	Energy (2ms) J	Withstanding surge current (8/20 μ s)		Typical capacitance (@ 1kHz) pF
	Min	Max	AC V_{rms}	DC V				1 Time	2 Times	
Z10L180	18 (16~20)		11	14	36 at 5A	0.05	1.5	500A	250A	7,500
Z10L220	22 (20~24)		14	18	43		2.0			6,000
Z10L270	27 (24~30)		17	22	53		2.5			4,000
Z10L330	33 (30~36)		20	26	65		3.0			3,000
Z10L390	38 (35~43)		25	31	77		3.5			2,800
Z10L470	47 (42~52)		30	38	93		4.5			2,200
Z10L560	56 (50~62)		35	45	110	5.5	1,800			
Z10L680	68 (61~75)		40	56	135	6.5	1,300			
Z10L820	82 (74~90)		60	65	135 at 25A	8	2500A	1250A	1,800	
Z10L101	100 (90~110)		60	65	165	10			1,400	
Z10L121	120 (108~132)		75	100	200	12			1,100	
Z10L151	150 (135~165)		95	125	250	16			900	
Z10L181	180 (162~198)		110	145	300	18			700	
Z10L201	200 (185~225)		130	170	340	20			500	
Z10L221	220 (198~242)		140	180	360	23			450	
Z10L271	270 (247~303)		175	225	455	30			350	
Z10L331	330 (297~363)		210	275	550	35			300	
Z10L361	360 (324~396)		230	300	565	40			270	
Z10L391	390 (351~429)		250	320	580	45			250	
Z10L431	430 (387~473)		275	350	600	45			230	
Z10L471	470 (423~517)		300	385	710	45			150	
Z10L561	560 (504~616)		350	460	925	45			130	
Z10L681	680 (612~748)		420	560	1,120	50	120			
Z10L751	750 (675~825)		460	615	1,240	55	110			
Z10L821	820 (738~902)		510	670	1,355	60	100			
Z10L911	910 (819~1,001)		550	745	1,500	65	90			
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)

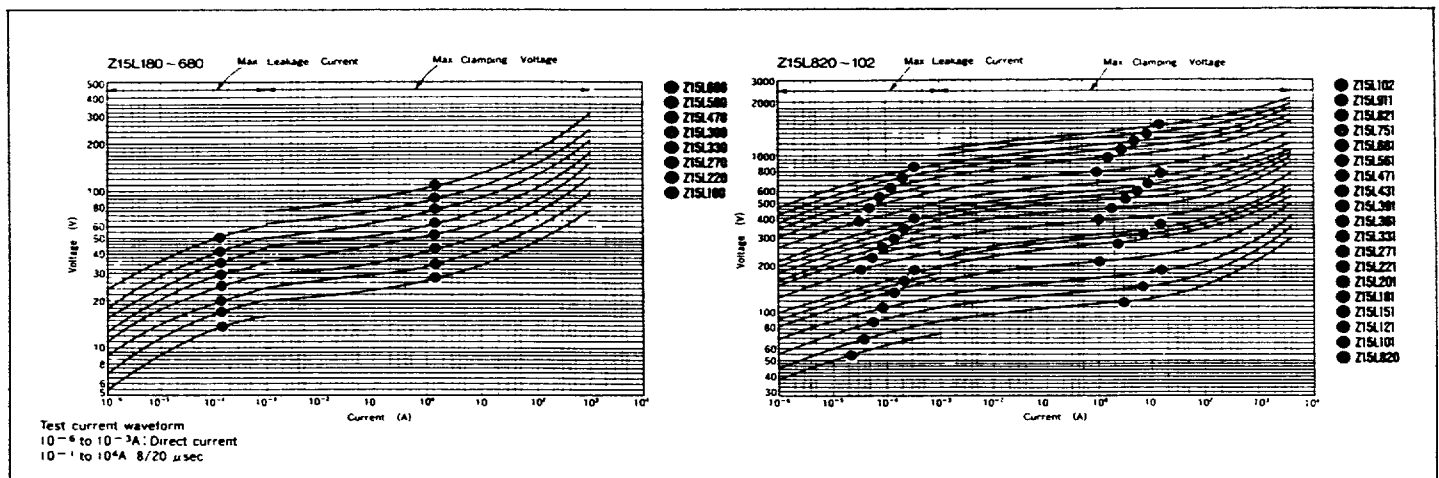


1. Operating temperature range -40 to 85°C
2. Storage temperature range -40 to 125°C
3. * : UL approved model

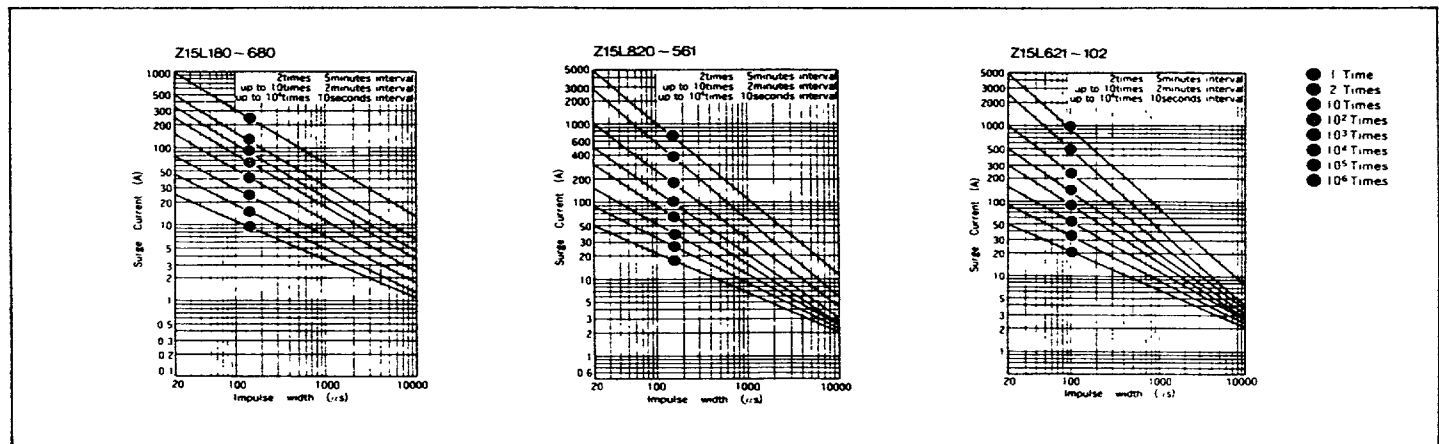
Z15L Series Specifications

Type No.	Varistor voltage V_{VMA} (V)		Maximum allowable voltage		Maximum clamping voltage V	Rated wattage W	Energy (2ms) J	Withstanding Surge current (5/20 μ s)		Typical capacitance (@ 1kHz) pF
	Min	Max	AC Vrms	DC V				1 Time	2 Times	
Z15L180	18	16~20	11	14	38 at 10A	0.1	3.5	1000A	500A	18,000
Z15L220	22	20~24	14	18	43		4.0			15,000
Z15L270	27	24~30	17	22	53		5.0			10,000
Z15L330	33	30~38	20	26	65		6.0			7,500
Z15L390	39	35~43	25	31	77		7.0			6,500
Z15L470	47	42~52	30	38	93		8.5			5,500
Z15L560	56	50~62	35	45	110	10.0	4,500			
Z15L660	66	61~75	40	56	135	12.0	3,300			
Z15L820	82	74~90	50	65	135 at 50A	0.6	14	4500A	2500A	2,900
Z15L101	100	90~110	60	85	165		18			2,400
Z15L121	120	108~132	75	100	200		20			1,900
Z15L151	150	135~165	95	125	250		25			1,500
Z15L181	180	162~198	110	145	300		30			1,200
* Z15L201	200	185~225	130	170	340		35			1,000
* Z15L221	220	198~242	140	180	380		40			1,000
* Z15L271	270	247~303	175	225	455		50			750
* Z15L331	330	297~363	210	275	550		60			650
* Z15L361	360	324~396	230	300	595		65			550
* Z15L391	390	351~429	250	320	650		70			500
* Z15L431	430	387~473	275	350	710		75			450
* Z15L471	470	423~517	300	385	775		80			400
* Z15L561	560	504~616	350	460	925		80			300
* Z15L661	660	612~748	420	560	1,120	80	250			
* Z15L751	750	675~825	490	615	1,240	100	230			
* Z15L821	820	738~902	510	670	1,355	110	200			
* Z15L911	910	819~1,001	550	745	1,500	120	180			
* Z15L102	1,000	900~1,100	625	825	1,650	130	150			

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

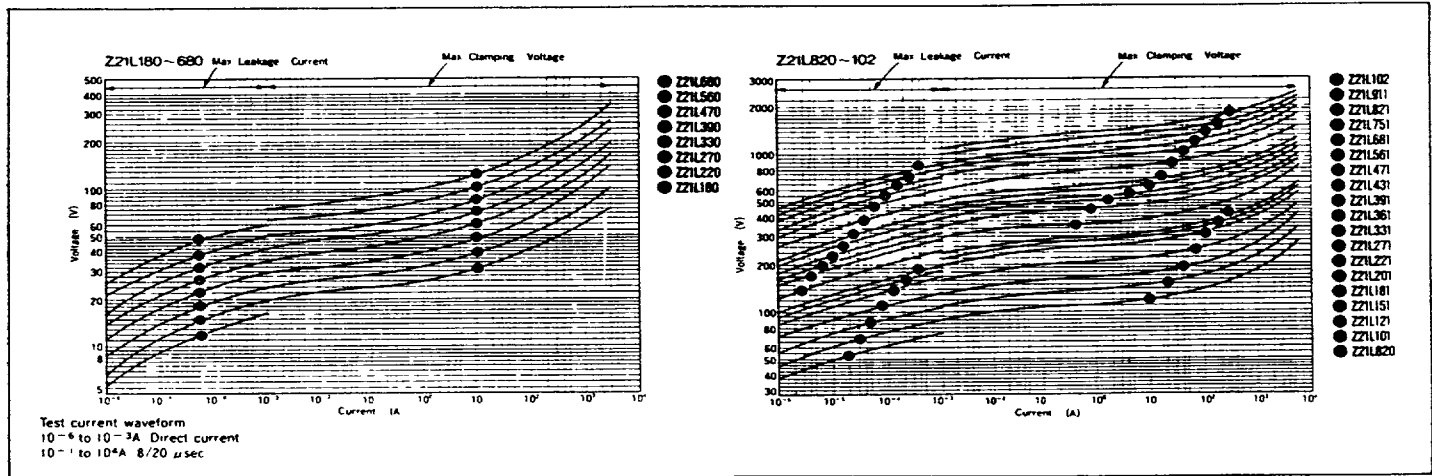
T-11-25

Z21L Series

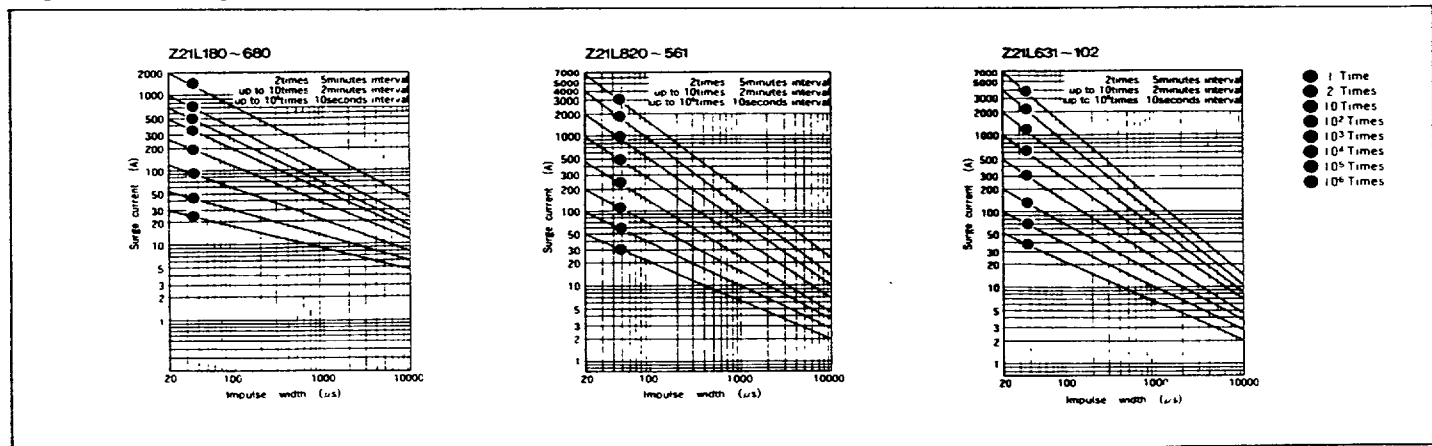
Specifications

Type No.	Varistor voltage V_{VMA} (V)		Maximum allowable voltage		Maximum clamping voltage V	Rated wattage W	Energy (J) J	Withstanding Surge Current (8/20 μ s)		Typical capacitance (#1kHz) pF
	Min	Max	AC Vrms	DC V				1 Time	2 Time	
Z21L180	18 (16~20)	20	11	14	36 at 20A	0.2	10	2000A	1000A	37,000
Z21L220	22 (20~24)	24	14	18	43		13			30,000
Z21L270	27 (24~30)	30	17	22	53		15			22,000
Z21L330	33 (30~36)	36	20	26	65		20			17,000
Z21L390	39 (35~43)	43	25	31	77		24			15,000
Z21L470	47 (42~52)	52	30	38	93		30			13,000
Z21L560	56 (50~62)	62	36	45	110	35	11,000			
Z21L680	68 (61~75)	75	40	56	135	40	7,000			
Z21L820	82 (74~90)	90	50	65	135 at 100A	1.0	27	6500A	4000A	5,500
Z21L101	100 (90~110)	110	60	85	165		30			4,800
Z21L121	120 (109~132)	132	75	100	200		40			3,800
Z21L151	150 (136~165)	165	95	125	250		50			3,000
Z21L181	180 (162~198)	198	110	145	300		65			2,500
Z21L201	200 (185~225)	225	130	170	340		70			2,000
Z21L221	220 (198~242)	242	140	180	360		75			2,000
Z21L271	270 (247~303)	303	175	225	455		90			1,800
Z21L331	330 (297~363)	363	210	275	550		110			1,400
Z21L361	360 (324~396)	396	230	300	595		120			1,200
Z21L391	390 (351~429)	429	250	320	650		130			1,000
Z21L431	430 (387~473)	473	275	350	710		140			900
Z21L471	470 (423~517)	517	300	385	775		150			900
Z21L561	560 (504~616)	616	350	460	925		160			800
Z21L681	680 (612~748)	748	420	560	1,120	180	600			
Z21L751	750 (675~825)	825	460	615	1,240	175	420			
Z21L821	820 (738~902)	902	510	670	1,355	190	400			
Z21L911	910 (819~1,001)	1,001	550	745	1,500	215	350			
Z21L102	1,000 (900~1,100)	1,100	625	825	1,650	230	320			

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

