

TRANSIENT VOLTAGE SUPPRESSOR

VRD

VRD is a transient voltage suppressor used for protecting electric circuits from surge voltage and thus preventing breakdown.

VRD has superior surge suppression characteristics, such as extremely fast response time, very low clamping voltage, and high surge capacity. Unlike metal oxide varistors, VRD does not have characteristics to change with surge variations within the rated capacity. This feature comprises another superior characteristics of the VRD as a transient voltage suppressors.

Part number

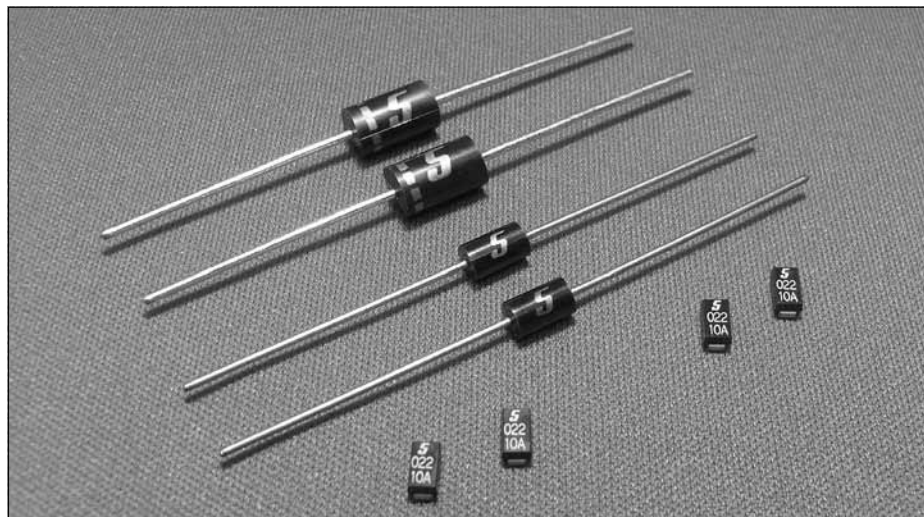
Z2 033 U - 52Z

52Z : Axial tapping winding type
52R : Axial tapping relay type
FT : Radial form tapping type
Nil : individually packed in a bag

U : Uni-Polar
Nil : Bi-Polar

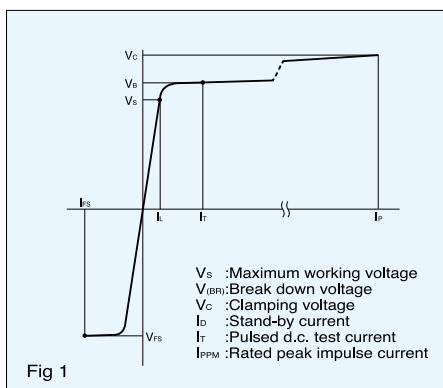
Break down voltage

Type
Z2 : Rated electricity 1.0W
Z6 : Rated electricity 2.0W
ZD : Rated electricity 0.5W
(reverse blocking type)



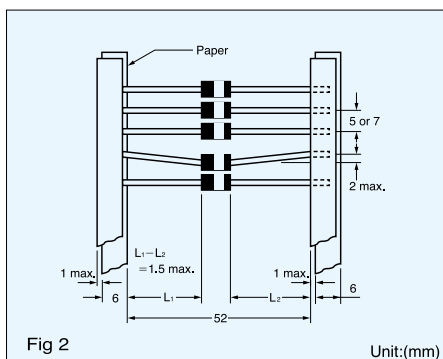
Electrical characteristics

Figure 1 shows the electrical characteristics. Bipolar type has almost symmetrical breakdown Voltage (V_B) The reverse breakdown voltage of the ZD type is 200 Volts or more at 10 μ A DC.



Taping

One of standard taping is as shown in Figure.



Taping qty

Part series	Taping method	Qty(pcs)
Z2,Z2U	Axial tapping	reel type 5,000
		winding type 2,000
	Radial tapping	winding type 2,000
		reel type 2,500
Z6,Z6U	Axial tapping	reel type 2,500
		winding type 1,000

Surge capability

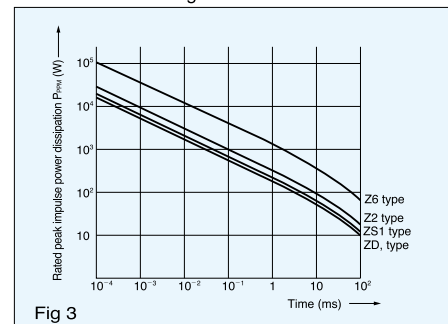
Allowable surge capability (P_{PPM}) is determined by the following equation:

$$P_{PPM} = I_{PPM} \times V_C$$

I_{PPM} : Rated peak impulse current

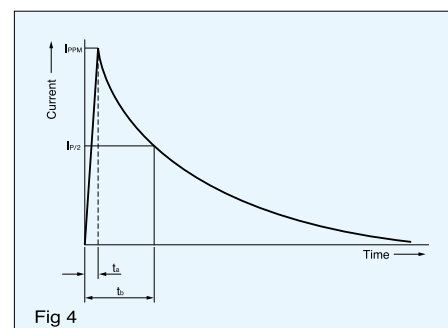
V_C : clamping voltage

The allowable surge capability (Rated peak impulse power dissipation P_{PPM}) of VRD is shown in following Figure 3 and the surge capability derating characteristics are shown in Figure 6.



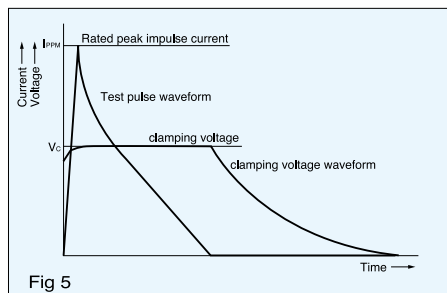
Surge waveform

There are many types of surge waveform depending on the source of the surge. For the VRD surge suppression characteristics test, the EXP waveform shown below is used. The EXP waveform is shown as t_a/t_b depending on the time width, however 10/1000 waveform is used as the standard test waveform.

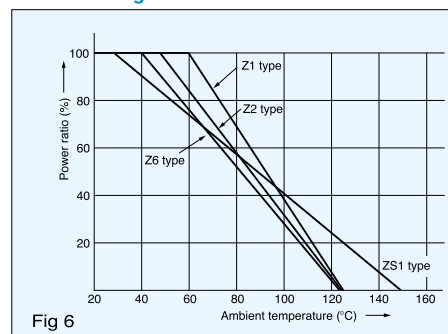


Surge suppression characteristics

When EXP waveform is applied, the surge suppression waveform shown in the figure 5 can be observed.



Power derating



Z2 type VRD has bipolar or unipolar electrical characteristics.

Maximum ratings

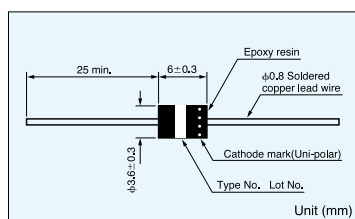
Rated peak impulse power dissipation
:500 W (10/1000 μ s)
6.00 kW (8/20 μ s)

Rated average power dissipation:1W
Operating and storage temperature
: -40°C to 125°C

Symbol mark

Bi-polar

Uni-polar



Part No.		Stand-off voltage V _S V	Stand-by current I _O μA	Breakdown voltage V _(BR) V	Pulsed d.c. test current I _T mA	Clamping Voltage & Rated peak impulse current				Temperature coefficient (TYP)	Capacitance (TYP) pF
Bi-polar type	Uni-polar type					10/1000μs		8/20μs			
						V _C V	I _{PPM} A	V _C V	I _{PPM} A		
—	Z2008U	6.63	500	7.38-9.02	10	12.5	40.0	16.3	372	0.063	2400
—	Z2010U	8.10	20	9.00-11.0	1	15.0	33.4	19.5	311	0.071	1900
Z2012	—	9.72	10.8-13.2	17.3		28.9	22.7	267	0.066	790	
—	Z2012U			—		—	—	—	0.074	1580	
Z2015	—	12.1	13.5-16.5	22.0		22.7	28.4	213	0.075	640	
—	Z2015U			—		—	—	—	0.079	1280	
Z2018	—	14.5	16.2-19.8	26.5		18.8	34.0	178	0.079	520	
—	Z2018U			—		—	—	—	0.083	1040	
Z2022	—	17.8	19.8-24.2	31.9		15.7	41.2	147	0.082	420	
—	Z2022U			—		—	—	—	0.086	840	
Z2027	—	21.8	24.3-29.7	39.1		12.8	50.5	120	0.085	340	
—	Z2027U			—	—	—	—	0.089	680		
Z2033	—	26.8	29.7-36.3	47.7	10.5	61.7	98.2	0.087	280		
—	Z2033U							0.092	560		
Z2039	—	31.6	35.1-42.9	56.4	8.86	73.0	83.0	0.090	240		
—	Z2039U							0.095	480		
Z2047	—	38.1	42.3-51.7	67.8	7.37	88.0	68.9	0.092	200		
—	Z2047U							0.097	400		
Z2056	—	45.4	50.4-61.6	80.5	6.21	105.0	57.7	0.094	160		
—	Z2056U							0.099	320		
Z2068	—	55.1	61.2-74.8	98.0	5.10	127.0	47.7	0.096	130		
—	Z2068U							0.100	260		
Z2082	—	66.4	73.8-90.2	118.0	4.24	153.0	39.6	0.099	110		
—	Z2082U							0.102	220		
Z2100	—	81.0	90.0-110	144.0	3.47	187.0	32.4	0.101	90		
—	Z2100U							0.104	180		
Z2120	—	97.2	108-132	173.0	2.89	222.0	27.3	0.103	75		
—	Z2120U							0.106	150		
Z2150	—	121.0	135-165	215.0	2.32	277.0	21.9	0.105	60		
—	Z2150U							0.107	120		
Z2180	—	146.0	162-198	258.0	1.94	333.0	18.2	0.106	49		
—	Z2180U							0.108	98		

NOTE: Nonsuffix:bi-polar, suffix"U" : uni-polar.

Part No.		Stand-off voltage V _s V	Stand-by current I _b μA	Breakdown voltage V _(BR) V	Pulsed d.c. test current I _T mA	Clamping Voltage & Rated peak impulse current				Max. temp. coef. %/°C	Capacitance (TYP) pF	
Bi-polar type	Uni-polar type					10/1000μs		8/20μs				
						V _C V	I _{PPM} A	V _C V	I _{PPM} A			
Z6012	—	9.72	10	10.8-13.2	1	17.3	86.7	22.7	802	0.066	4400	
—	Z6012U			10.8-13.2		—	—	—	—	0.074	8800	
Z6015	—	12.1	5	13.5-16.5		22.0	68.2	28.4	641	0.075	3300	
—	Z6015U			13.5-16.5		—	—	—	—	0.079	6600	
Z6018	—	14.5		16.2-19.8		26.5	56.6	34.0	535	0.079	2700	
—	Z6018U			16.2-19.8		—	—	—	—	0.083	5400	
Z6022	—	17.8		19.8-24.2		31.9	47.0	41.2	442	0.082	2400	
—	Z6022U			19.8-24.2		—	—	—	—	0.086	4400	
Z6027	—	21.8		24.3-29.7		39.1	38.4	50.5	360	0.085	1700	
—	Z6027U			24.3-29.7		—	—	—	—	0.089	3300	
Z6033	—	26.8		29.7-36.3		47.7	31.4	61.7	295	0.087	1400	
—	Z6033U			29.7-36.3		—	—	—	—	0.092	2800	
Z6039	—	31.6		35.1-42.9		56.4	26.6	73.0	249	0.090	1200	
—	Z6039U			35.1-42.9		—	—	—	—	0.095	2400	
Z6047	—	38.1		42.3-51.7		67.8	22.1	88.0	207	0.092	1000	
—	Z6047U			42.3-51.7		—	—	—	—	0.097	2000	
Z6056	—	45.4		50.4-61.6		80.5	18.6	105.0	173	0.094	850	
—	Z6056U			50.4-61.6		—	—	—	—	0.099	1700	
Z6068	—	55.1		61.2-74.8		98.0	15.3	127.0	143	0.096	720	
—	Z6068U			61.2-74.8		—	—	—	—	0.100	1440	
Z6082	—	66.4		73.8-90.2		118.0	12.7	153.0	119	0.099	610	
—	Z6082U			73.8-90.2		—	—	—	—	0.102	1220	
Z6100	—	81.0		90.0-110		144.0	10.4	187.0	97.3	0.101	520	
—	Z6100U			90.0-110		—	—	—	—	0.104	1040	
Z6120	—	97.2		108-132		173.0	8.67	222.0	82.0	0.103	440	
—	Z6120U			108-132		—	—	—	—	0.106	880	
—	Z6150U	121.0		—		135-165	215.0	6.98	277.0	65.7	0.107	720

NOTE : Nonsuffix : Bi-polar, suffix "U" : Uni-polar.

Z6 type VRD has bipolar or unipolar electrical characteristics.

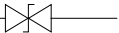
Maximum ratings

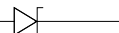
Rated peak impulse power dissipation
:1.5kW(10/1000 μ s)
18.0kW(8/20 μ s)

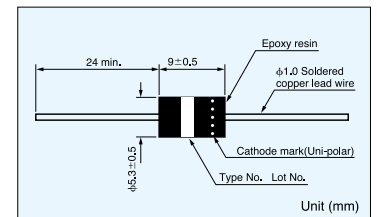
Rated average power dissipation:2W

Operating and storage temperature
:−40°C to 125°C

Symbol mark

Bi-polar 

Uni-polar 



VRD part No.	Stand-off voltage V _S V	Stand-by current I _B μA	Breakdown voltage V _(BR) V	Pulsed d.c. test current I _T mA	Clamping Voltage & Rated peak impulse current				Max. temp. coef. %/°C	Capacitance (TYP) pF
					10/1000μs		8/20μs			
					V _C V	I _{PPM} A	V _C V	I _{PPM} A		
ZD015	11.4	10	12.8-17.2	1	24.0	10.4	31.0	96.7	0.075	31.5
ZD018	13.7		15.3-20.7		28.0	8.93	36.0	83.3	0.079	31.0
ZD022	16.8	5	18.7-25.3		33.2	7.53	43.0	69.7	0.082	29.0
ZD027	20.6		23.0-31.0		40.0	6.25	52.0	57.7	0.085	28.2
ZD033	25.2		28.1-37.9		48.6	5.14	63.0	47.6	0.087	27.2
ZD039	29.8		33.2-44.8		57.4	4.35	74.0	40.5	0.090	26.3
ZD047	35.9		40.0-54.0		68.5	3.65	89.0	33.7	0.092	25.0
ZD056	42.8		47.6-64.4		81.0	3.08	106.0	28.6	0.094	24.1
ZD068	52.0		57.8-78.2		98.0	2.55	127.0	23.8	0.096	22.0

Low capacitance type

Maximum ratings

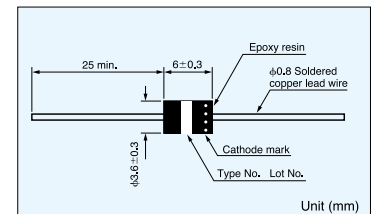
Reverse voltage:200 VDC

Rated peak impulse power dissipation
:250 W(10/1000 μ s)
3.00 kW(8/20 μ s)

Rated average power dissipation:500 mW
Operating and storage temperature
:−40°C to 125°C

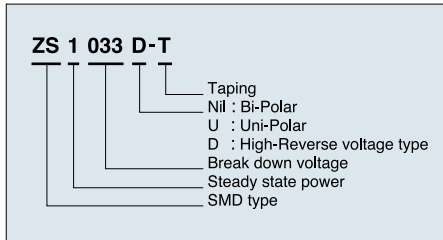
Symbol mark



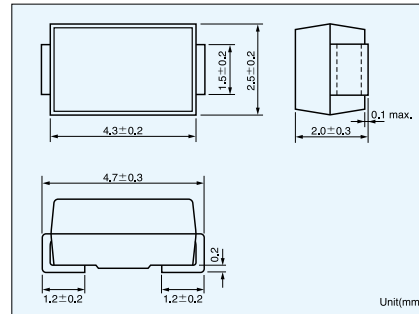


SMD VRD

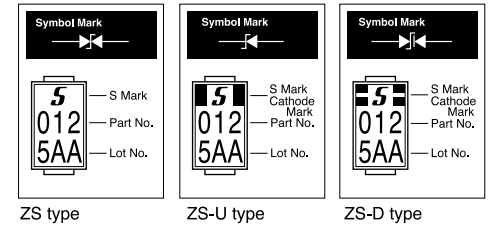
Part number



Dimensions

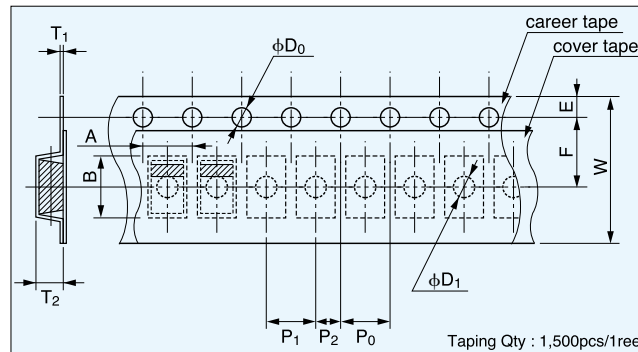


Marking



	Rating
Rated average power dissipation	1.0W
Rated peak impulse power dissipation	300W(10/1000μs)
	1200W(1.2/50μs)
	2000W(8/20μs)
Storage temp. range	-40°C~150°C

Taping



A	B	W	F	E	P1
3.0 ±0.1	5.2 ±0.1	12.0 ±0.3	5.5 ±0.05	1.75 ±0.1	4.0 ±0.1
P2	P0	φD0	φD1	T1	T2
2.0 ±0.1	4.0 ±0.1	1.5 +0.1 -0	1.5 +0.2 -0	0.3 ±0.05	(2.6)

Unit (mm)

Specifications

ZS type

Part No.	Breakdown voltage	Stand-off voltage	Stand-by current	Maximum clamping voltage & Maximum peak pulse current				Temperature coefficient (TYP)	Capacitance (TYP)
	V _(BR)	V _S	I _L max	V _C max/I _{PPM}				25°C~50°C	C
	It=1mA	D.C.	V _S	10/1000μs		8/20μs			
	V	V	μA	V	A	V	A	%/°C	pF
ZS1012	12(10.8~13.2)	9.72	10	17.3	17.3	22.4	89.3	0.066	551
ZS1015	15(13.5~16.5)	12.1	5	22.0	13.6	28.5	70.2	0.075	465
ZS1018	18(16.2~19.8)	14.5		26.5	11.3	34.4	58.1	0.079	376
ZS1022	22(19.8~24.2)	17.8		31.9	9.40	41.4	48.3	0.082	299
ZS1027	27(24.3~29.7)	21.8		39.1	7.67	50.7	39.4	0.085	248
ZS1033	33(29.7~36.3)	26.8		47.7	6.29	61.8	32.4	0.087	198
ZS1039	39(35.1~42.9)	31.6		56.4	5.32	73.1	27.4	0.090	164
ZS1047	47(42.3~51.7)	38.1		67.8	4.42	88.0	22.7	0.092	137

ZS-U type

Part No.	Breakdown voltage	Stand-off voltage	Stand-by current	Maximum clamping voltage & Maximum peak pulse current				Temperature coefficient (TYP)	Capacitance (TYP)
	V _(BR)	V _S	I _L max	V _C max/I _{PPM}					C
	It=1mA	D.C.	V _S	10/1000μs		8/20μs		25°C~50°C	
	V	V	μA	V	A	V	A	%/°C	pF
ZS1012U	12(10.8~13.2)	9.72	10	17.3	17.3	22.4	89.3	0.066	1,102
ZS1015U	15(13.5~16.5)	12.1	5	22.0	13.6	28.5	70.2	0.075	929
ZS1018U	18(16.2~19.8)	14.5		26.5	11.3	34.4	58.1	0.079	751
ZS1022U	22(19.8~24.2)	17.8		31.9	9.40	41.4	48.3	0.082	598
ZS1027U	27(24.3~29.7)	21.8		39.1	7.67	50.7	39.4	0.085	497
ZS1033U	33(29.7~36.3)	26.8		47.7	6.29	61.8	32.4	0.087	395
ZS1039U	39(35.1~42.9)	31.6		56.4	5.32	73.1	27.4	0.090	328
ZS1047U	47(42.3~51.7)	38.1		67.8	4.42	88.0	22.7	0.092	274

ZS-D type

Part No.	Breakdown voltage	Stand-off voltage	Stand-by current	Maximum clamping voltage & Maximum peak pulse current				Temperature coefficient (TYP)	Capacitance (TYP)
	V _(BR)	V _S	I _L max	V _{Cmax} /I _{PPM}					C
	It=1mA	D.C.	V _S	10/1000μs		8/20μs		25°C~50°C	
	V	V	μA	V	A	V	A	%/°C	pF
ZS1012D	12(10.8~13.2)	9.72	10	17.3	17.3	22.4	89.3	0.066	30.2
ZS1015D	15(13.5~16.5)	12.1	5	22.0	13.6	28.5	70.2	0.075	29.1
ZS1018D	18(16.2~19.8)	14.5		26.5	11.3	34.4	58.1	0.079	28.2
ZS1022D	22(19.8~24.2)	17.8		31.9	9.40	41.4	48.3	0.082	27.3
ZS1027D	27(24.3~29.7)	21.8		39.1	7.67	50.7	39.4	0.085	26.4
ZS1033D	33(29.7~36.3)	26.8		47.7	6.29	61.8	32.4	0.087	25.5
ZS1039D	39(35.1~42.9)	31.6		56.4	5.32	73.1	27.4	0.090	24.8
ZS1047D	47(42.3~51.7)	38.1		67.8	4.42	88.0	22.7	0.092	24.0

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