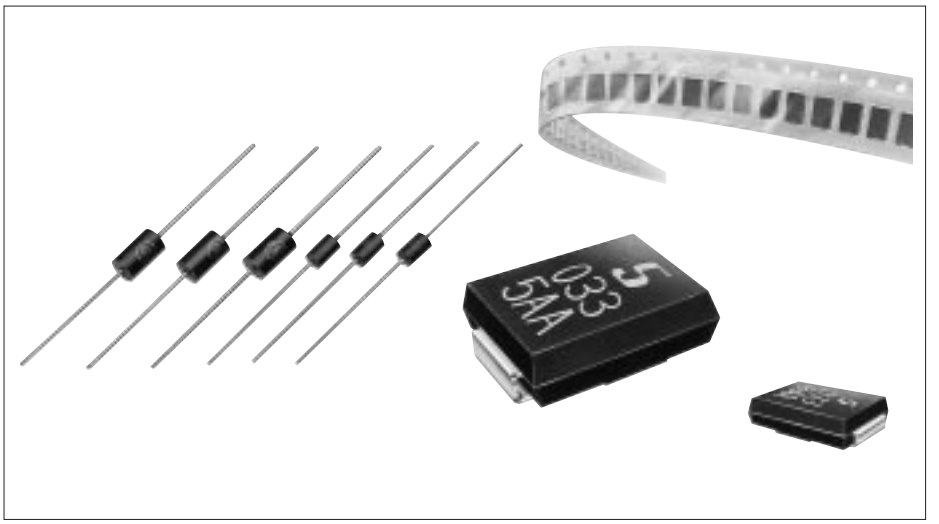
TRANSIENT VOLTAGE SUPPRESSOR

VRD

VRD is a transient voltage suppressor used for protecting electronic 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.



Electrical characteristics

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

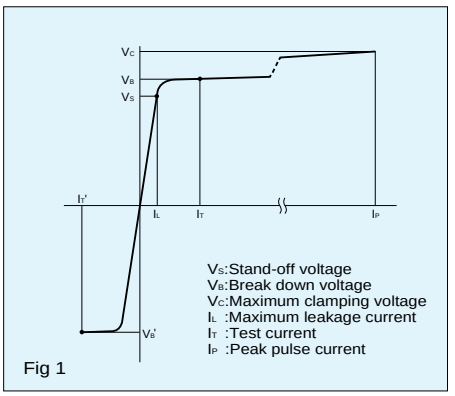


Fig 1

Taping

One of standard taping is as shown in Figure.

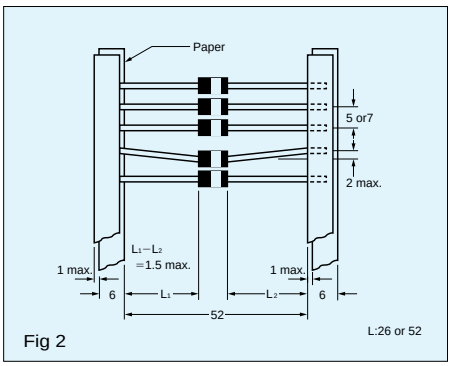


Fig 2

Surge capability

Allowable surge capability (Pm) is determined by the following equation:

Pm=Ip×Vc
Ip:Peak current
Vc:Maximum clamping voltage

The allowable surge capability (peak pulse power) of VRD is shown in following Figure 3 and the surge capability derating characteristics are shown in Figure 6.

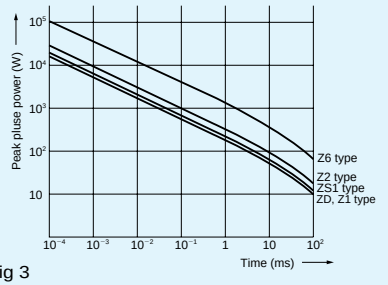


Fig 3

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 ta/tb depending on the time width, however 10/1000 waveform is used as the standard test waveform.

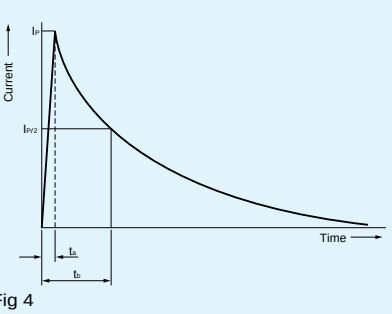


Fig 4

Surge suppression characteristics

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

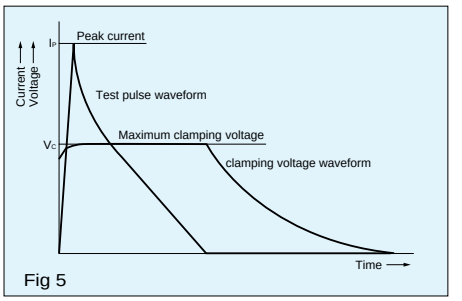


Fig 5

Power derating

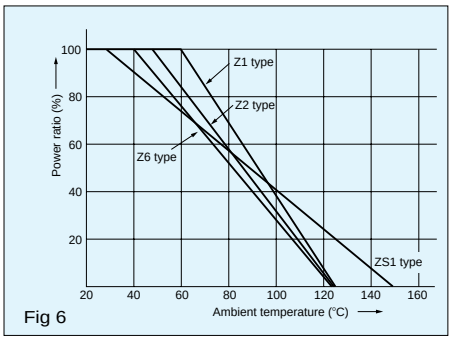
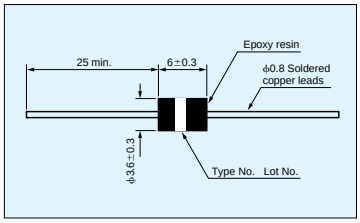


Fig 6

Z1 type VRD has bipolar electrical characteristics.

Maximum ratings
Peak pulse power:250 W(10/1000μs)
3.00 kW(8/20μs)
Steady state power dissipation:500 mW
Operating and storage temperature
:−40°C to 125°C
Symbol mark

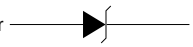


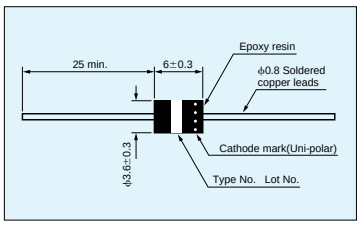
Bi-polar type	Stand-off voltage V_S V	Maximum leakage current I_L	Breakdown voltage V_B	Test current I_T mA	Maximum clamping voltage & Maximum peak pulse current				Max. temp. coef. %/°C	Capacitance (TYP) pF
					10/1000μs		8/20μs			
					V_C V	I_p A	V_C V	I_p A		
Z1015	12.1	5	13.5-16.5	1	22.0	11.3	28.4	106.	0.075	450
Z1018	14.5	5	16.2-19.8	1	26.5	9.43	34.0	89.1	0.079	360
Z1022	17.8	5	19.8-24.2	1	31.9	7.83	41.2	73.5	0.082	290
Z1027	21.8	5	24.3-29.7	1	39.1	6.39	50.5	60.0	0.085	240
Z1033	26.8	5	29.7-36.3	1	47.7	5.24	61.7	49.1	0.087	200
Z1039	31.6	5	35.1-42.9	1	56.4	4.43	73.0	41.5	0.090	170
Z1047	38.1	5	42.3-51.7	1	67.8	3.69	88.0	34.4	0.092	140
Z1056	45.4	5	50.4-61.6	1	80.5	3.10	105.0	28.8	0.094	110
Z1068	55.1	5	61.2-74.8	1	98.0	2.55	127.0	23.8	0.096	90
Z1082	66.4	5	73.8-90.2	1	118.0	2.14	153.0	19.8	0.099	80
Z1100	81.0	5	90.0-110	1	144.0	1.73	187.0	16.2	0.101	65
Z1120	97.0	5	108-132	1	173.0	1.44	222.0	13.6	0.103	53
Z1150	121.0	5	135-165	1	215.0	1.16	277.0	10.9	0.105	42

Z2 type VRD has bipolar or unipolar electrical characteristics.

Maximum ratings
Peak pulse power:500 W (10/1000μs)
6.00 kW (8/20μs)
Steady state power dissipation:1W
Operating and storage temperature
:−40°C to 125°C
Symbol mark

Bi-polar 

Uni-polar 



Bi-polar type	Uni-polar type	Stand-off voltage V_S V	Maximum leakage current I_L μA	Breakdown voltage V_B V	Test current I_T mA	Maximum clamping voltage & Maximum peak pulse current				Max. temp. coef. %/°C	Capacitance (TYP) pF
						10/1000μs		8/20μs			
						V_C V	I_p A	V_C V	I_p A		
Z2008	–	6.63	500	7.38-9.02	10	12.5	40.0	16.3	372	0.045	1200
–	Z2008U	6.63	500	7.38-9.02	10	12.5	40.0	16.3	372	0.063	2400
Z2010	–	8.10	100	9.00-11.0	1	15.0	33.4	19.5	311	0.055	950
–	Z2010U	8.10	20	9.00-11.0	1	15.0	33.4	19.5	311	0.071	1900
Z2012	–	9.72	5	10.8-13.2	1	17.3	28.9	22.7	267	0.066	790
–	Z2012U	9.72	5	10.8-13.2	1	17.3	28.9	22.7	267	0.074	1580
Z2015	–	12.1	5	13.5-16.5	1	22.0	22.7	28.4	213	0.075	640
–	Z2015U	12.1	5	13.5-16.5	1	22.0	22.7	28.4	213	0.079	1280
Z2018	–	14.5	5	16.2-19.8	1	26.5	18.8	34.0	178	0.079	520
–	Z2018U	14.5	5	16.2-19.8	1	26.5	18.8	34.0	178	0.083	1040
Z2022	–	17.8	5	19.8-24.2	1	31.9	15.7	41.2	147	0.082	420
–	Z2022U	17.8	5	19.8-24.2	1	31.9	15.7	41.2	147	0.086	840
Z2027	–	21.8	5	24.3-29.7	1	39.1	12.8	50.5	120	0.085	340
–	Z2027U	21.8	5	24.3-29.7	1	39.1	12.8	50.5	120	0.089	680
Z2033	–	26.8	5	29.7-36.3	1	47.7	10.5	61.7	98.2	0.087	280
–	Z2033U	26.8	5	29.7-36.3	1	47.7	10.5	61.7	98.2	0.092	560
Z2039	–	31.6	5	35.1-42.9	1	56.4	8.86	73.0	83.0	0.090	240
–	Z2039U	31.6	5	35.1-42.9	1	56.4	8.86	73.0	83.0	0.095	480
Z2047	–	38.1	5	42.3-51.7	1	67.8	7.37	88.0	68.9	0.092	200
–	Z2047U	38.1	5	42.3-51.7	1	67.8	7.37	88.0	68.9	0.097	400
Z2056	–	45.4	5	50.4-61.6	1	80.5	6.21	105.0	57.7	0.094	160
–	Z2056U	45.4	5	50.4-61.6	1	80.5	6.21	105.0	57.7	0.099	320
Z2068	–	55.1	5	61.2-74.8	1	98.0	5.10	127.0	47.7	0.096	130
–	Z2068U	55.1	5	61.2-74.8	1	98.0	5.10	127.0	47.7	0.100	260
Z2082	–	66.4	5	73.8-90.2	1	118.0	4.24	153.0	39.6	0.099	110
–	Z2082U	66.4	5	73.8-90.2	1	118.0	4.24	153.0	39.6	0.102	220
Z2100	–	81.0	5	90.0-110	1	144.0	3.47	187.0	32.4	0.101	90
–	Z2100U	81.0	5	90.0-110	1	144.0	3.47	187.0	32.4	0.104	180
−Z2120	–	97.2	5	108-132	1	173.0	2.89	222.0	27.3	0.103	75
–	Z2120U	97.2	5	108-132	1	173.0	2.89	222.0	27.3	0.106	150
Z2150	–	121.0	5	135-165	1	215.0	2.32	277.0	21.9	0.105	60
–	Z2150U	121.0	5	135-165	1	215.0	2.32	277.0	21.9	0.107	120
Z2180	–	146.0	5	162-198	1	258.0	1.94	333.0	18.2	0.106	49
–	Z2180U	146.0	5	162-198	1	258.0	1.94	333.0	18.2	0.108	98

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

Bi-polar type	Uni-polar type	Stand-off voltage V_S V	Maximum leakage current I_L μA	Breakdown voltage V_B V	Test current I_T mA	Maximum clamping voltage & Maximum peak pulse current				Max. temp. coef. %/°C	Capacitance (TYP) pF
						10/1000μs		8/20μs			
						V_C V	I_p A	V_C V	I_p A		
–	Z6008U	6.63	500	7.38-9.02	10	12.5	120	16.3	1120	0.063	14600
Z6010	–	8.10	200	9.00-11.0	1	15.0	100	19.5	933	0.055	5600
–	Z6010U	8.10	50	9.00-11.0	1	15.0	100	19.5	933	0.071	11200
Z6012	–	9.72	10	10.8-13.2	1	17.3	86.7	22.7	802	0.066	4400
–	Z6012U	9.72	5	10.8-13.2	1	17.3	86.7	22.7	802	0.074	8800
Z6015	–	12.1	5	13.5-16.5	1	22.0	68.2	28.4	641	0.075	3300
–	Z6015U	12.1	5	13.5-16.5	1	22.0	68.2	28.4	641	0.079	6600
Z6018	–	14.5	5	16.2-19.8	1	26.5	56.6	34.0	535	0.079	2700
–	Z6018U	14.5	5	16.2-19.8	1	26.5	56.6	34.0	535	0.083	5400
Z6022	–	17.8	5	19.8-24.2	1	31.9	47.0	41.2	442	0.082	2400
–	Z6022U	17.8	5	19.8-24.2	1	31.9	47.0	41.2	442	0.086	4400
Z6027	–	21.8	5	24.3-29.7	1	39.1	38.5	50.5	360	0.085	1700
–	Z6027U	21.8	5	24.3-29.7	1	39.1	38.4	50.5	360	0.089	3300
Z6033	–	26.8	5	29.7-36.3	1	47.7	31.4	61.7	295	0.087	1400
–	Z6033U	26.8	5	29.7-36.3	1	47.7	31.4	61.7	295	0.092	2800
Z6039	–	31.6	5	35.1-42.9	1	56.4	26.6	73.0	249	0.090	1200
–	Z6039U	31.6	5	35.1-42.9	1	56.4	26.6	73.0	249	0.095	2400
Z6047	–	38.1	5	42.3-51.7	1	67.8	22.1	88.0	207	0.092	1000
–	Z6047U	38.1	5	42.3-51.7	1	67.8	22.1	88.0	207	0.097	2000
Z6056	–	45.4	5	50.4-61.6	1	80.5	18.6	105.0	173	0.094	850
–	Z6056U	45.4	5	50.4-61.6	1	80.5	18.6	105.0	173	0.099	1700
Z6068	–	55.1	5	61.2-74.8	1	98.0	15.3	127.0	143	0.096	720
–	Z6068U	55.1	5	61.2-74.8	1	98.0	15.3	127.0	143	0.100	1440
Z6082	–	66.4	5	73.8-90.2	1	118.0	12.7	153.0	119	0.099	610
–	Z6082U	66.4	5	73.8-90.2	1	118.0	12.7	153.0	119	0.102	1220
Z6100	–	81.0	5	90.0-110	1	144.0	10.4	187.0	97.3	0.101	520
–	Z6100U	81.0	5	90.0-110	1	144.0	10.4	187.0	97.3	0.104	1040
Z6120	–	97.2	5	108-132	1	173.0	8.67	222.0	82.0	0.103	440
–	Z6120U	97.2	5	108-132	1	173.0	8.67	222.0	82.0	0.106	880
–	Z6150U	121.0	5	135-165	1	215.0	6.98	277.0	65.7	0.107	720

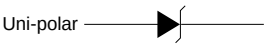
NOTE : Nonsuffix : Bi-polar, suffix "U" : Uni-polar.

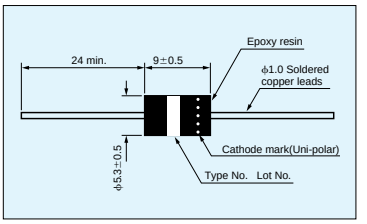
Z6 type VRD has bipolar or unipolar electrical characteristics.

Maximum ratings
Peak pulse power:1.5kW(10/1000μs)
18.0kW(8/20μs)
Steady state power dissipation:2W
Operating and storage temperature
:−40°C to 125°C
Symbol mark

Bi-polar

Uni-polar





VRD type No.	Stand-off voltage V_S V	Maximum leakage current I_L	Breakdown voltage V_B	Test current I_T mA	Maximum clamping voltage & Maximum peak pulse current				Max. temp. coef. %/°C	Capacitance (TYP) pF
					10/1000μs		8/20μs			
					V_C V	I_p A	V_C V	I_p 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	10	15.3-20.7	1	28.0	8.93	36.0	83.3	0.079	31.0
ZD022	16.8	5	18.7-25.3	1	33.2	7.53	43.0	69.7	0.082	29.0
ZD027	20.6	5	23.0-31.0	1	40.0	6.25	52.0	57.7	0.085	28.2
ZD033	25.2	5	28.1-37.9	1	48.6	5.14	63.0	47.6	0.087	27.2
ZD039	29.8	5	33.2-44.8	1	57.4	4.35	74.0	40.5	0.090	26.3
ZD047	35.9	5	40.0-54.0	1	68.5	3.65	89.0	33.7	0.092	25.0
ZD056	42.8	5	47.6-64.4	1	81.0	3.08	106.0	28.6	0.094	24.1
ZD068	52.0	5	57.8-78.2	1	98.0	2.55	127.0	23.8	0.096	22.0

Low capacitance type

Maximum ratings
Reverse voltage:200 VDC
Peak pulse power:250 W(10/1000μs)
3.00 kW(8/20μs)
Steady state power dissipation:500 mW
Operating and storage temperature
:−40°C to 125°C
Symbol mark