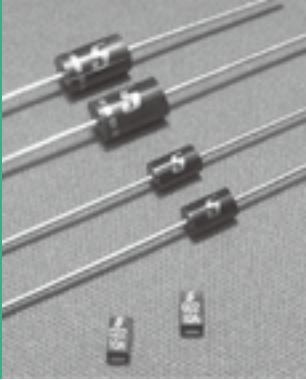


VRD voltage regulating diode (= TVS diode)

VRD

SEMITEC's voltage regulating diode (VRD) is a transient voltage suppressor device that is designed to absorb voltage surges and spikes that occur during power initiation. Our VRD features uniform avalanche breakdown across the junction, and therefore very fast response to voltage surges. Furthermore, its control voltage is almost independent from the current which makes it a highly reliable, high performance device.



Product number explanation

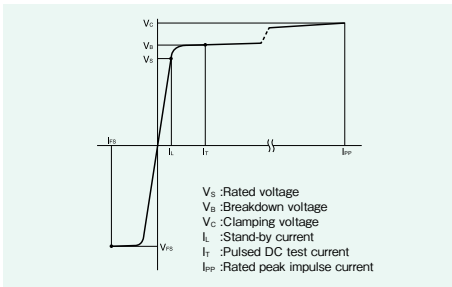
Z2 033 U -52Z	
No marking	: Untaped bulk products
52Z	: Axial taping, Z folding
52R	: Axial taping, reel
FT	: Radial taping
U	: Unipolar
No marking	: Bipolar
Z2	: Rated power = 1.0 W
Z6	: Rated power = 2.0 W
ZD	: Rated power = 0.5 W; reverse blocking type

Applications

- Protection of telecommunication lines and equipment from lightning induced surges
- ESD protection
- EMP protection
- Relays, solenoids (etc.), switching surge protection
- Surge protection of fire alarms, smoke detectors, etc.
- Protection of electric circuits from abnormal voltage conditions

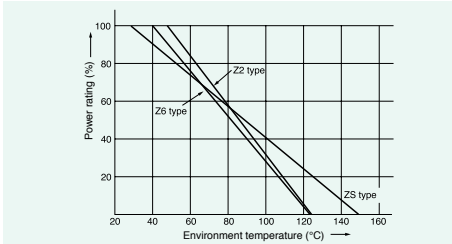
Electrical characteristics

The bipolar Z2 and Z6 types have an almost symmetrical breakdown voltage (V_{BR}). The reverse breakdown voltage of the low capacitance ZD type is 200 V or more at 10 μ A DC.



Power derating

Influence of environment temperature on power rating (%)



Taping dimensions

Axial type

Radial type

Series	Taping method		Quantity
Z2, Z2U	Axial taping	Reel	5000
		Z folding	2000
	Radial taping	Z folding	2000
Z6, Z6U	Axial taping	Z folding	1000

Dimensions

Symbol marks:
 Bipolar:
 Unipolar:
 Reverse blocking:

Cathode marks:
 Bipolar (no cathode marking):
 Unipolar:
 Reverse blocking:

Item	Z2	Z6	ZD
(A)	25	24	25
(B)	6 ± 0.3	9 ± 0.5	6 ± 0.3
(C)	Φ 0.8	Φ 1.0	Φ 0.8
(D)	3.6 ± 0.3	5.3 ± 0.5	3.6 ± 0.3

Unit: mm

Specifications

Z2 / Z2U series

Product number		Stand-off voltage	Stand-by current	Breakdown voltage	Pulsed test current	Clamping voltage / rated peak impulse current		Temperature coefficient	Capacitance		
Bipolar type	Unipolar type	V_S DC V	$I_{S, max}$ V_S μ A	V_{BR} V $I_T = 1$ mA	DC mA	V_C V	I_{RP} A	25 to 50 °C %/ °C	C pF		
-	Z2008U	6.63	500	7.38 - 9.02	10	12.5	40	16.3	372	0.063	2400
-	Z2010U	8.10	20	9.00 - 11.0	-	15	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	-	-	-	-	17.3	28.9	22.7	267	0.074	1580
-	Z2015	-	12.1	13.5 - 16.5	-	22.0	22.7	28.4	213	0.075	640
-	Z2015U	-	-	-	-	22.0	22.7	28.4	213	0.079	1280
-	Z2018	-	14.5	16.2 - 19.8	-	26.5	18.8	34.0	178	0.079	520
-	Z2018U	-	-	-	-	26.5	18.8	34.0	178	0.083	1040
-	Z2022	-	17.8	19.8 - 24.2	-	31.9	15.7	41.2	147	0.082	420
-	Z2022U	-	-	-	-	31.9	15.7	41.2	147	0.086	840
-	Z2027	-	21.8	24.3 - 29.7	-	39.1	12.8	50.5	120	0.085	340
-	Z2027U	-	-	-	-	39.1	12.8	50.5	120	0.089	680
-	Z2033	-	26.8	29.7 - 36.3	-	47.7	10.5	61.7	98.2	0.087	280
-	Z2033U	-	-	-	-	47.7	10.5	61.7	98.2	0.092	560
-	Z2039	-	31.6	35.1 - 42.9	-	56.4	8.86	73.0	83.0	0.090	240
-	Z2039U	-	-	-	-	56.4	8.86	73.0	83.0	0.095	480
-	Z2047	-	38.1	42.3 - 51.7	1	67.8	7.37	88.0	68.9	0.092	200
-	Z2047U	-	-	-	-	67.8	7.37	88.0	68.9	0.097	400
-	Z2056	-	45.4	50.4 - 61.6	-	80.5	6.21	105	57.7	0.094	160
-	Z2056U	-	-	-	-	80.5	6.21	105	57.7	0.096	320
-	Z2068	-	55.1	61.2 - 74.8	-	98.0	5.10	127	47.7	0.096	130
-	Z2068U	-	-	-	-	98.0	5.10	127	47.7	0.10	260
-	Z2082	-	66.4	73.8 - 90.2	-	118	4.24	153	39.6	0.099	110
-	Z2082U	-	-	-	-	118	4.24	153	39.6	0.102	220
-	Z2100	-	81	90.0 - 110	-	144	3.47	187	32.4	0.101	90
-	Z2100U	-	-	-	-	144	3.47	187	32.4	0.104	180
-	Z2120	-	97.2	108 - 132	-	173	2.89	222	27.3	0.103	75
-	Z2120U	-	-	-	-	173	2.89	222	27.3	0.106	150
-	Z2150	-	121	135 - 165	-	215	2.32	277	21.9	0.105	60
-	Z2150U	-	-	-	-	215	2.32	277	21.9	0.107	120
-	Z2180	-	146	162 - 198	-	258	1.94	333	18.2	0.106	48
-	Z2180U	-	-	-	-	258	1.94	333	18.2	0.108	98

*Rated peak impulse power dissipation: 500 W (10 / 1000 μ s), 6.0 kW (8 / 20 μ s)

*Rated average power dissipation: 1 W

*Operating / storage temperature: - 40 to 125 °C

Z6 / Z6U series

Product number		Stand-off voltage	Stand-by current	Breakdown voltage	Pulsed test current	Clamping voltage / rated peak impulse current		Temperature coefficient	Capacitance		
Bipolar type	Unipolar type	V_S DC V	$I_{S, max}$ V_S μ A	V_{BR} V $I_T = 1$ mA	DC mA	V_C V	I_{RP} A	25 to 50 °C %/ °C	C pF		
-	Z6012	9.72	10	10.8 - 13.2	1	17.3	86.7	22.7	802	0.066	4400
-	Z6012U	-	-	-	-	17.3	86.7	22.7	802	0.075	8800
-	Z6015	12.1	-	13.5 - 16.5	-	22	68.2	28.4	641	0.075	3300
-	Z6015U	-	-	-	-	22	68.2	28.4	641	0.079	6600
-	Z6018	14.5	-	16.2 - 19.8	-	26.5	56.6	34.0	535	0.079	2700
-	Z6018U	-	-	-	-	26.5	56.6	34.0	535	0.083	5400
-	Z6022	17.8	-	19.8 - 24.2	-	31.9	47.0	41.2	442	0.082	2400
-	Z6022U	-	-	-	-	31.9	47.0	41.2	442	0.086	4400
-	Z6027	21.8	-	24.3 - 29.7	-	39.1	38.4	50.5	360	0.085	1700
-	Z6027U	-	-	-	-	39.1	38.4	50.5	360	0.089	3300
-	Z6033	26.8	-	29.7 - 36.3	-	47.7	31.4	61.7	295	0.087	1400
-	Z6033U	-	-	-	-	47.7	31.4	61.7	295	0.092	2800
-	Z6039	31.6	-	35.1 - 42.9	1	56.4	26.6	73.0	249	0.090	1200
-	Z6039U	-	-	-	-	56.4	26.6	73.0	249	0.095	2400
-	Z6047	38.1	5	42.3 - 51.7	-	67.8	22.1	88.0	207	0.092	1000
-	Z6047U	-	-	-	-	67.8	22.1	88.0	207	0.097	2000
-	Z6056	45.4	-	50.4 - 61.6	-	80.5	18.6	105	173	0.094	850
-	Z6056U	-	-	-	-	80.5	18.6	105	173	0.099	1700
-	Z6068	55.1	-	61.2 - 74.8	-	98.0	15.3	127	143	0.096	720
-	Z6068U	-	-	-	-	98.0	15.3	127	143	0.100	1440
-	Z6082	66.4	-	73.8 - 90.2	-	118	12.7	153	119	0.099	610
-	Z6082U	-	-	-	-	118	12.7	153	119	0.099	610
-	Z6100	81.0	-	90.0 - 110	-	144	10.4	187	97.3	0.101	520
-	Z6100U	-	-	-	-	144	10.4	187	97.3	0.104	1040
-	Z6120	97.2	-	108 - 132	-	173	8.67	222	82.0	0.103	440
-	Z6120U	-	-	-	-	173	8.67	222	82.0	0.106	880
-	Z6150	121	-	135 - 165	-	215	6.98	277	65.7	0.107	720
-	Z6150U	-	-	-	-	215	6.98	277	65.7	0.107	720

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

*Rated average power dissipation: 2 W

*Operating / storage temperature: - 40 to 125 °C

ZD series (low capacitance, reverse blocking type)

Product number		Stand-off voltage	Stand-by current	Breakdown voltage	Pulsed test current	Clamping voltage / rated peak impulse current		Temperature coefficient	Capacitance		
Bipolar type	Unipolar type	V_S DC V	$I_{S, max}$ V_S μ A	V_{BR} V $I_T = 1$ mA	DC mA	V_C V	I_{RP} A	25 to 50 °C %/ °C	C pF		
-	ZD015	11.4	10	12.8 - 17.2	1	24.0	10.4	31.0	86.7	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	-	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	5	28.1 - 37.9	1	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

*Reverse voltage: 200 V DC

*Rated peak impulse power dissipation: 250 W (10 / 1000 μ s), 3.0 kW (8 / 20 μ s)

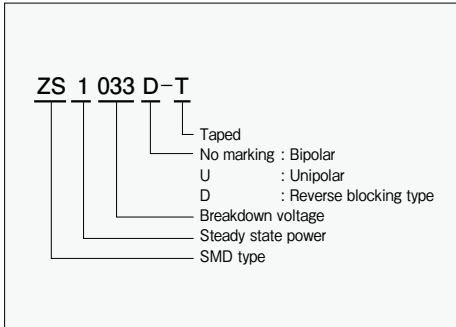
*Rated average power dissipation: 500 mW

*Operating / storage temperature: - 40 to 125 °C

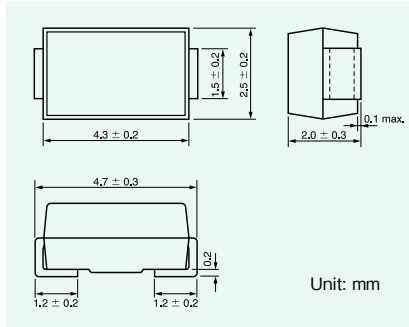
■ VRD voltage regulating diode (= TVS diode)

SMD type VRD

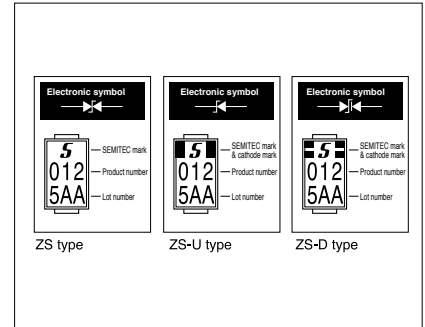
Product number



Dimensions



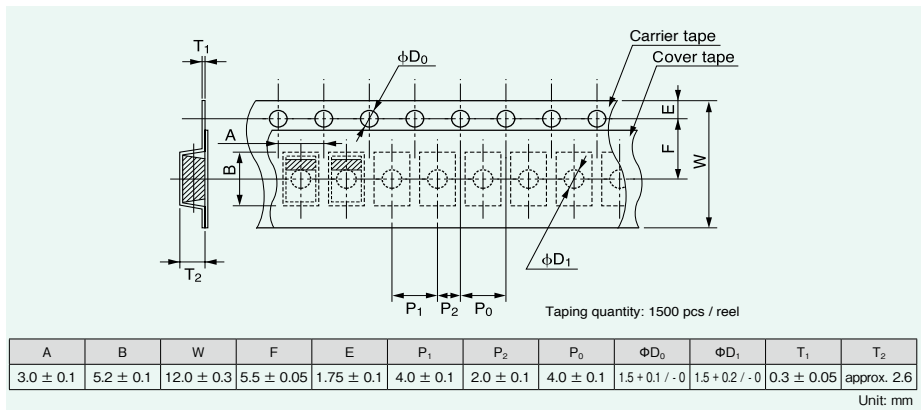
Product marking



General specifications for all types

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

Taping dimensions



Specifications

ZS type

Product number	Stand-off voltage		Stand-by current I_s max VS μ A	Breakdown voltage V_{BR} $I_T = 1$ mA V	Clamping voltage / rated peak impulse current V_C max / I_{PP}				Temperature coefficient 25 to 50 °C % / °C	Capacitance C pF
	DC	V			10 / 1000 μ s		8 / 20 μ s			
	V	V	V	V	A	V	A			
ZS1012	12 (10.8 to 13.2)	9.72	5	10	17.3	17.3	22.4	89.3	0.066	551
ZS1015	15 (13.5 to 16.5)	12.1		22.0	13.6	28.5	70.2	0.075	465	
ZS1018	18 (16.2 to 19.8)	14.5		26.5	11.3	34.4	58.1	0.079	376	
ZS1022	22 (19.8 to 24.2)	17.8		31.9	9.40	41.4	48.3	0.082	299	
ZS1027	27 (24.3 to 29.7)	21.8		39.1	7.67	50.7	39.4	0.085	248	
ZS1033	33 (29.7 to 36.3)	26.8		47.7	6.29	61.8	32.4	0.087	198	
ZS1039	39 (35.1 to 42.9)	31.6		56.4	5.32	73.1	27.4	0.090	164	
ZS1047	47 (42.3 to 51.7)	38.1		67.8	4.42	88.0	22.7	0.092	137	

Ta = 25 °C

ZS-U type

Product number	Stand-off voltage		Stand-by current I_s max VS μ A	Breakdown voltage V_{BR} $I_T = 1$ mA V	Clamping voltage / rated peak impulse current V_C max / I_{PP}				Temperature coefficient 25 to 50 °C % / °C	Capacitance C pF
	DC	V			10 / 1000 μ s		8 / 20 μ s			
	V	V	V	V	A	V	A			
ZS1012U	12 (10.8 to 13.2)	9.72	5	10	17.3	17.3	22.4	89.3	0.066	1,102
ZS1015U	15 (13.5 to 16.5)	12.1		22.0	13.6	28.5	70.2	0.075	929	
ZS1018U	18 (16.2 to 19.8)	14.5		26.5	11.3	34.4	58.1	0.079	751	
ZS1022U	22 (19.8 to 24.2)	17.8		31.9	9.40	41.4	48.3	0.082	598	
ZS1027U	27 (24.3 to 29.7)	21.8		39.1	7.67	50.7	39.4	0.085	497	
ZS1033U	33 (29.7 to 36.3)	26.8		47.7	6.29	61.8	32.4	0.087	395	
ZS1039U	39 (35.1 to 42.9)	31.6		56.4	5.32	73.1	27.4	0.090	328	
ZS1047U	47 (42.3 to 51.7)	38.1		67.8	4.42	88.0	22.7	0.092	274	

Ta = 25 °C

ZS-D type

Product number	Stand-off voltage		Stand-by current I_s max VS μ A	Breakdown voltage V_{BR} $I_T = 1$ mA V	Clamping voltage / rated peak impulse current V_C max / I_{PP}				Temperature coefficient 25 to 50 °C % / °C	Capacitance C pF
	DC	V			10 / 1000 μ s		8 / 20 μ s			
	V	V	V	V	A	V	A			
ZS1012D	12 (10.8 to 13.2)	9.72	5	10	17.3	17.3	22.4	89.3	0.066	30.2
ZS1015D	15 (13.5 to 16.5)	12.1		22.0	13.6	28.5	70.2	0.075	29.1	
ZS1018D	18 (16.2 to 19.8)	14.5		26.5	11.3	34.4	58.1	0.079	28.2	
ZS1022D	22 (19.8 to 24.2)	17.8		31.9	9.40	41.4	48.3	0.082	27.3	
ZS1027D	27 (24.3 to 29.7)	21.8		39.1	7.67	50.7	39.4	0.085	26.4	
ZS1033D	33 (29.7 to 36.3)	26.8		47.7	6.29	61.8	32.4	0.087	25.5	
ZS1039D	39 (35.1 to 42.9)	31.6		56.4	5.32	73.1	27.4	0.090	24.8	
ZS1047D	47 (42.3 to 51.7)	38.1		67.8	4.42	88.0	22.7	0.092	24.0	

Ta = 25 °C

• Reverse voltage: 200 V DC