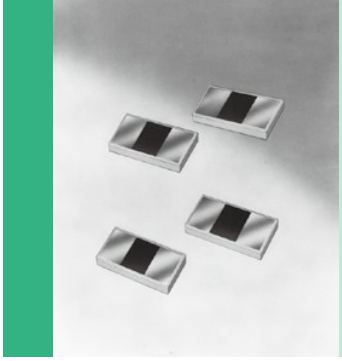


Micro thin film thermistor

FT Thermistor

FT thermistors have outclassed conventional thermistors through miniaturization, featuring quick response time, high heat resistance and excellent long term reliability.

Product number explanation

103 FT 1005 A 5P 1 — □

- T: Taping[1]
  - No marking: Untaped bulk products
- Electrode type: 1 = Pt, 2 = Au/Ni, 3 = Au
- Tolerance (R_{25}): 5P = 5%
- B value: A = 3370 K, B = 3435 K, D = 3969 K
- Size: See Fig. 1
- Micro thin film thermistor
- Rated zero-power resistance at 25 °C
- E.g.: 103 = 10 x 10^3 Ω

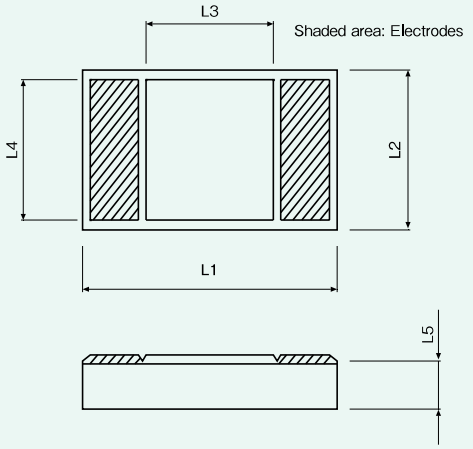
[1]: Taping is currently available only for 1005 size.

Applications

High speed electrical thermometers, wearable devices, office automation, measurement instruments, medical devices, computer and mobile devices, LCDs, security devices, laser diode modules

Dimensions

Fig. 1



Size	L1	L2	L3	L4	L5[2]
1005	1.00 ± 0.05	0.50 ± 0.05	(0.50)	(0.44)	(0.15)
0603	0.60 ± 0.05	0.30 ± 0.05	(0.15)	(0.25)	(0.15)

Unit: mm

[2]: For thinner substrates (= smaller L5 dimension) please contact SEMITEC sales staff.

Specifications

Product number	R_{25}[3]	R_{25} tolerance	B value[4]	Dissipation factor (mw / °C)	Thermal time constant (s)[5]	Rated power at 25 °C (mW)	Operating temperature range by electrode (°C)		
							1: Pt	2: Au/Ni	3: Au
103FT1005A5P	10.0 kΩ	± 5%[6]	3370 K ± 1%	approx. 0.3	approx. 1.0	1.5	- 40 to 250 (350)	- 40 to 125	- 40 to 250
103FT1005B5P	10.0 kΩ		3435 K ± 1%						
103FT1005D5P	10.0 kΩ		3969 K ± 1%						
503FT1005A5P	50.0 kΩ		3370 K ± 1%						
503FT1005B5P	50.0 kΩ		3435 K ± 1%						
364FT1005A5P	360.0 kΩ		3370 K ± 1%						
New 364FT0603A5P	360.0 kΩ		3370 K ± 1%	approx. 0.2	approx. 0.5	1.0			

[3]: Rated zero-power resistance at 25 °C [4]: B value calculated from rated zero-power resistance at 25 °C and 85 °C
[5]: Time required to reach 63.2% of temperature difference. Measured with sensor suspended in mid-air.
[6]: If your application requires other tolerance values please contact SEMITEC sales staff.

Reliability data

Item	Electrode type	Test conditions	Criteria
Solderability	2 = Au/Ni	5 s at 260 °C	More than 90% soldered
Free fall	All	Three times natural fall to a maple board from 0.75 m height.	ΔR, ΔB ± 1%
Insulation resistance	All	100 V DC	Over 100 MΩ
Dry heat (1)	1 = Pt 3 = Au	1000 hours at 250 °C	ΔR ± 5%, ΔB ± 1%
Dry heat (2)	2 = Au/Ni	1000 hours at 125 °C	ΔR ± 3%, ΔB ± 1%
Cold	All	1000 hours at - 40 °C	ΔR ± 3%, ΔB ± 1%
Temperature cycle (thermal shock)	All	100 cycles as below: 1. - 40 °C for 30 minutes 2. Room temperature for 3 minutes 3. 125 °C for 30 minutes 4. Room temperature for 3 minutes	ΔR ± 3%, ΔB ± 1%

Mounting method recommendations

Electrode type	Recommended method
1 = Pt	Conductive resin
2 = Au/Ni	Solder
3 = Au	Wire bonding

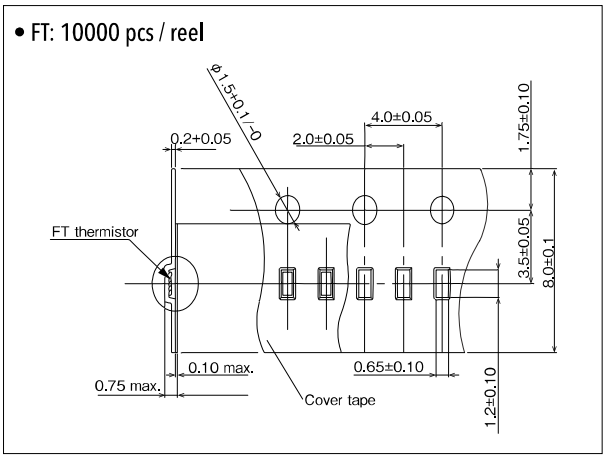
Resistance / temperature characteristics

Temperature (°C)	Product number						
	103FT1005A5P	103FT1005B5P	103FT1005D5P	503FT1005A5P	503FT1005B5P	364FT1005A5P	364FT0603A5P
− 40	187.9	200.7	351.0	939.3	1,002	6,763	6,763
− 30	110.7	117.0	185.0	553.4	584.7	3,984	3,984
− 20	67.26	70.34	100.9	336.3	351.9	2,421	2,421
− 10	42.10	43.55	57.00	210.5	217.7	1,516	1,516
0	27.08	27.71	33.33	135.4	138.5	974.8	974.8
10	17.86	18.11	20.12	89.31	90.48	643.0	643.0
20	12.07	12.12	12.53	60.33	60.58	434.4	434.4
25	10.00	10.00	10.00	50.00	50.00	360.0	360.0
30	8.332	8.299	8.038	41.66	41.50	299.9	299.9
40	5.871	5.804	5.295	29.36	29.03	211.4	211.4
50	4.216	4.139	3.575	21.08	20.70	151.8	151.8
60	3.081	3.006	2.472	15.40	15.04	110.9	110.9
70	2.288	2.220	1.746	11.44	11.11	82.36	82.36
80	1.725	1.666	1.258	8.623	8.331	62.09	62.09
85	1.505	1.451	1.075	7.527	7.257	54.19	54.19
90	1.318	1.269	0.9230	6.592	6.344	47.46	47.46
100	1.021	0.9797	0.6888	5.105	4.898	36.76	36.76
110	0.8003	0.7662	0.5220	4.002	3.829	28.81	28.81
120	0.6345	0.6064	0.4012	3.172	3.029	22.84	22.84
125	0.5671	0.5418	0.3535	2.836	2.706	20.42	20.42
130	0.5084	0.4854	0.3125	2.542	2.423	18.30	18.30
140	0.4113	0.3926	0.2465	2.057	1.960	14.81	14.81
150	0.3359	0.3207	0.1969	1.680	1.601	12.09	12.09
160						9.963	9.963
170						8.274	8.274
180						6.925	6.925
190						5.837	5.837
200						4.954	4.954
210						4.232	4.232
220						3.636	3.636
230						3.142	3.142
240						2.731	2.731
250						2.385	2.385
$B_{25/85}$	3370 K	3435 K	3969 K	3370 K	3435 K	3370 K	3370 K

Unit: kΩ

Taping dimensions

• FT: 10000 pcs / reel



How to use the FT thermistor

• The FT thermistor can be used for both SMD type mounting and as a leaded thermistor (both axial and radial).
If your application requires lead wires please contact SEMITEC sales staff

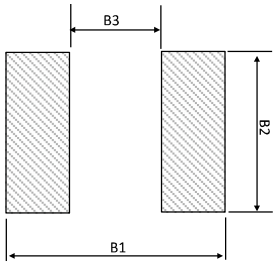
• With the FT thermistor it is possible to pair two sensors (e.g. one for temperature measurement and one for compensation) with very high accuracy. If your application may require thermistor pairing please contact SEMITEC sales staff.

Caution

• Please contact us when choosing the mounting method.

• Please contact us when considering an application with an environment temperature exceeding 350 °C.

Recommended mounting pad dimensions



Size	B1	B2	B3
1005	1.20 ± 0.03	0.60 ± 0.03	0.30 ± 0.03
0603	0.72 ± 0.03	0.36 ± 0.03	0.18 ± 0.03

Thin film thermistor

JT Thermistor

The JT series thermistor features high accuracy and a thickness of less than 500 µm. The JT thermistor also has excellent electrical insulation and can be safely used in environments where it might come in contact with electrodes.

Product number explanation

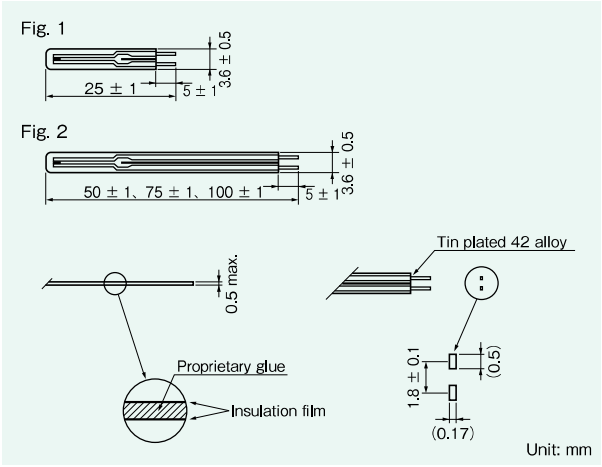
103 JT – □□□

- Shape (length) 025: 25 mm (Fig. 1)
  050: 50 mm (Fig. 2)
  075: 75 mm (Fig. 2)
  100: 100 mm (Fig. 2)
- High accuracy thin film thermistor
- Rated zero-power resistance at 25 ℃
  E.g.: 103 = 10 x 10^3 Ω

Applications

Battery packs, battery chargers, IT equipment, mobile devices, LCDs, surface temperature sensors, high sensitivity air temperature sensors

Dimensions



Specifications

Product number	R_{25}[1]	R_{25} tolerance	B value[2]	Dissipation factor (mw / ℃)	Thermal time constant (s)[3]	Rated power at 25 ℃ (mW)	Operating temperature range (℃)
103JT	10.0 kΩ	± 1%	3435 K ± 1%	approx. 0.7	approx. 5	3.5	– 50 to 125
104JT	100 kΩ		4390 K ± 1%				

[1]: Rated zero-power resistance at 25 ℃ [2]: B value calculated from rated zero-power resistance at 25 ℃ and 85 ℃
[3]: Time required to reach 63.2% of temperature difference. Measured with sensor suspended in mid-air.

Reliability data

Item	Test conditions	Criteria
Resistance to soldering heat	5 s at 260 ℃	ΔR, ΔB ± 1%
Solderability	2 s at 245 ℃ Flux material: Rosin 25%, ethyl alcohol 75%	More than 90% soldered
Tensile strength (lead wire)	10 s at 1 N (horizontal pull)	ΔR, ΔB ± 1% and visual inspection
Termination bending	2.5 N, one time, 90°	
Free fall	Three times natural fall to a maple board from 0.75 m height.	
Voltage proof	100 V AC for one minute	Less than 1 mA
Insulation resistance	100 V DC	Over 100 MΩ
Dry heat	1000 hours at 125 ℃	ΔR, ΔB ± 1%
Damp heat (under electrical load)	1000 hours at 40 ℃ and 90% humidity Electrical load: 1 mA DC	
Temperature cycle (thermal shock)	100 cycles as below: 1. - 25 ℃ for 30 minutes 2. Room temperature for 3 minutes 3. 125 ℃ for 30 minutes 4. Room temperature for 3 minutes	

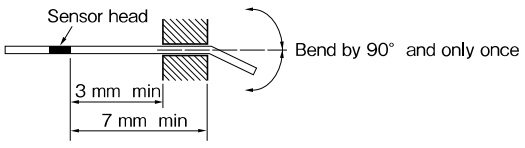
Caution

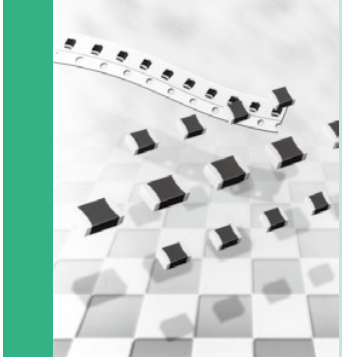
- If you plan pressing or pushing the thermistor against an object or inserting it into a tight space please contact SEMITEC sales staff.
- When soldering make sure to avoid contact of the hot part (over 150 ℃) and the sensor, because this may melt the sensor film.
- When bending the sensor make sure to not apply force on the sensor head (minimum distance from sensor: 3 mm) when fixing it. Additionally, make sure to bend the lead wire with a minimum distance of 7 mm from the sensor head.

Resistance / temperature characteristics

Temperature (℃)	Product number	
	103JT	104JT
– 50	367.7	9584
– 40	204.7	4572
– 30	118.5	2282
– 20	71.02	1191
– 10	43.67	647.2
0	27.70	365.0
10	18.07	212.5
20	12.11	127.7
25	10.00	100.0
30	8.301	78.88
40	5.811	50.03
50	4.147	32.51
60	3.011	21.61
70	2.224	14.66
80	1.668	10.13
85	1.451	8.483
90	1.267	7.135
100	0.9753	5.111
110	0.7597	3.720
120	0.5981	2.746
125	0.5331	2.371
$B_{25/85}$	3435 K	4390 K

Unit: kΩ





High accuracy, SMD chip type thermistor

KT Thermistor

The KT series SMD thermistor features high accuracy with tight resistance and B-value tolerances of ± 1%, high performance, high reliability and complies with EIAJ standards (dimensions: 1005, 1608).

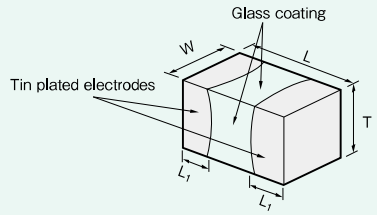
Product number explanation

103 KT 1608T – □□

- R_{25} tolerance: 1P: ± 1%; 2P: ± 2%; 3P: ± 3%
- Size according to EIAJ standard: See Fig. 1
- High accuracy SMD chip thermistor
- Rated zero-power resistance at 25 ℃
  E.g.: 103 = 10 x 10^3 Ω

Dimensions

Fig. 1



Size (Metric / EIAJ)	Size (Imperial)	L (mm)	W (mm)	T (mm)	L_1 (mm)
1005	0402	1.00 ± 0.15	0.50 ± 0.10	0.6 max.	0.15 to 0.30
1608	0603	1.60 ± 0.15	0.80 ± 0.15	0.95 max	0.20 to 0.50

Unit: mm

Applications

Office automation equipment, communication equipment, IT equipment, mobile devices, battery packs, battery chargers, LCDs, hybrid ICs, AV equipment

Specifications

Product number	R_{25}[1]	R_{25} tolerance	B value[2]	Dissipation factor (mw / ℃)	Thermal time constant (s)[3]	Rated power at 25 ℃ (mW)	Operating temperature range (℃)
103KT1608T	10 kΩ	± 1% ± 2% ± 3%	3435 K ± 1%	approx. 0.9	approx. 5	4.5	– 40 to 125
503KT1608T	50 kΩ		4055 K ± 1%				
104KT1608T	100 kΩ		4390 K ± 1%				
103KT1005T	10 kΩ		3435 K ± 1%	approx. 0.7	approx. 2.2	3.5	

[1]: Rated zero-power resistance at 25 ℃ [2]: B value calculated from rated zero-power resistance at 25 ℃ and 85 ℃
[3]: Time required to reach 63.2% of temperature difference. Measured with sensor suspended in mid-air.

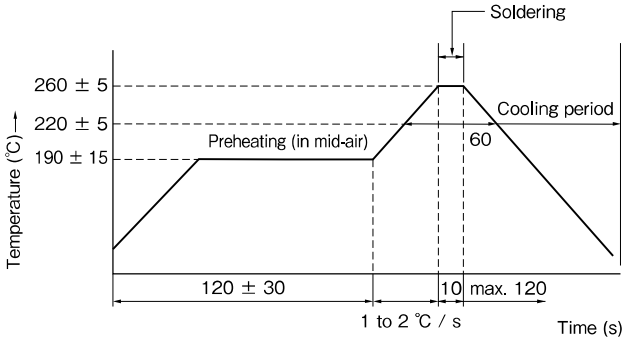
Reliability data

Item	Test conditions	Criteria
Resistance to soldering heat	10 s at 260 ℃ (wave soldering)	ΔR, ΔB ± 3%
Solderability	5 s at 235 ℃ Flux material: Rosin 25%, ethyl alcohol 75%	More than 75% soldered
Electrode connection strength vs. circuit board (horizontal)	After mounting the thermistor body is pushed horizontally with a jig with a force of 5 N for 10 s.	ΔR, ΔB ± 3% and visual inspection
Electrode connection strength vs. circuit board (vertical)	After mounting the circuit board is bent from the back side to a maximum of 2 mm for 5 s.	
Strength of NTC body	A force of 10 N is applied vertically with a jig for 10 s.	
Dry heat	1000 hours at 125 ℃	ΔR, ΔB ± 3%
Damp heat	1000 hours at 40 ℃ and 90% humidity	
Temperature cycle (thermal shock)	50 cycles as below: 1. - 25 ℃ for 30 minutes 2. Room temperature for 15 minutes 3. 100 ℃ for 30 minutes 4. Room temperature for 15 minutes	

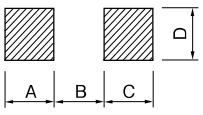
Caution

- Before and after soldering always make sure the circuit board is not bent or warped.
- The size of the soldering pad should be the same for both the left and the right side.

Recommended temperature profile for wave soldering



Recommended soldering pad size



Size (EIAJ)	A	B	C	D
1005	0.6	0.5	0.6	0.6
1608	1.0	1.0	1.0	1.2

Unit: mm

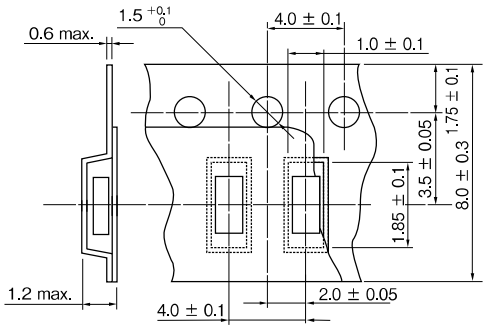
Resistance / temperature characteristics

Temperature (℃)	Product number			
	103KT1608T	503KT1608T	104KT1608T	103KT1005T
− 40	221.9	1920	5218	223.9
− 30	125.1	981.8	2530	126.1
− 20	73.38	525.2	1285	73.87
− 10	44.72	293.3	682.0	44.91
0	28.16	169.7	376.8	28.22
10	18.25	101.7	216.1	18.27
20	12.14	62.90	128.3	12.15
25	10.00	50.00	100.0	10.00
30	8.283	40.05	78.55	8.282
40	5.781	26.20	49.56	5.778
50	4.120	17.56	32.13	4.119
60	2.996	12.04	21.36	2.992
70	2.214	8.431	14.53	2.212
80	1.665	6.021	10.10	1.664
85	1.451	5.122	8.487	1.451
90	1.271	4.376	7.164	1.271
100	0.9832	3.237	5.176	0.9840
110	0.7707	2.433	3.803	0.7710
120	0.6114	1.855	2.839	0.6115
125	0.5469	1.627	2.466	0.5470
$B_{25/85}$	3435 K	4055 K	4390 K	3435 K

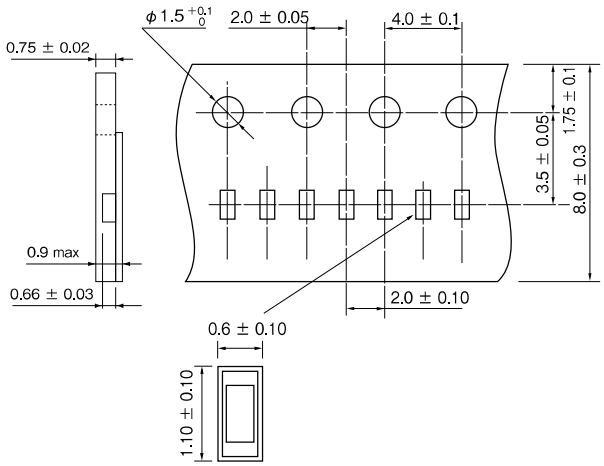
Unit: kΩ

Taping dimensions

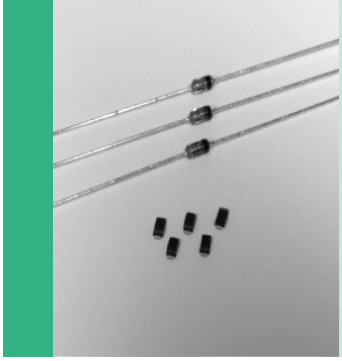
●1608: 4.000 pcs / reel



●1005: 10.000 pcs / reel



Unit: kΩ



Current regulating diode

CRD

Current regulating diodes (CRD hereunder) are diodes that maintain a constant current flow despite voltage fluctuations. CRDs supply constant current over a wide range of voltage from less than 1V to 100V. Constant current is supplied regardless of fluctuations in voltage applied, load resistance changes and ripple voltage. Creating a constant current circuit generally involves multiple components, but with SEMITEC CRDs only one part is required to accomplish the same function.

Product number explanation

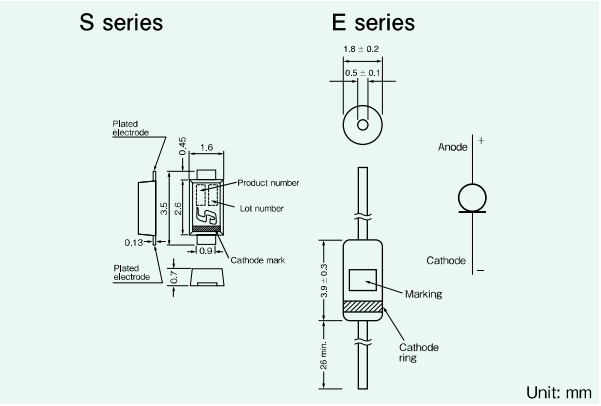
□ 102 □

Packing method
No marking: Untaped bulk products
26Z: 26 mm width; axial taping; Z folding
26R: 26 mm width; axial taping; reel
52Z: 52 mm width; axial taping; Z folding
T: S series only; SMD reel taping

Pinch-off current
E.g.: 301: 30 x 10^1 µA = 0.3 mA
102: 10 x 10^2 µA = 1.0 mA
452: 45 x 10^2 µA = 4.5 mA

E: Leaded type
S: SMD type

Dimensions



Unit: mm

Applications

- Constant current source for LED brightness stabilization
- LED street lights, LED fluorescent lamps, LED light bulbs, LED downlights
- Constant voltage circuit for supplying constant current to Zener diodes
- Constant current source for proximity sensors and other sensors
- Battery charge / discharge circuits
- Electrolytic capacitor aging equipment
- Constant current test equipment for various semiconductor devices
- Telecommunications line interface
- Earth leakage circuit breakers
- Current source for piezoelectric actuators
- Stabilized power supply circuits

Specifications

General

	E series	S series
Rated power	300 mW	500 mW
Rated voltage (pulse wave)	100 V (E-101 to E-562) 50 V (E-822 to E183)	100 V (S-101 to S-562) 50 V (S-822 to S-223)
Allowable reverse current	50 mA	
Junction temperature	150 °C	
Operating temperature range	− 30 to 150 °C	− 40 to 150 °C

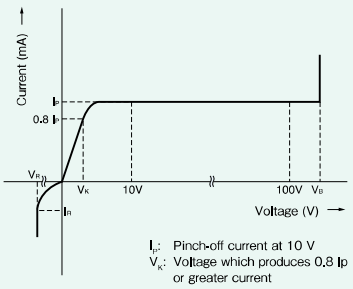
Recommended maximum voltage

Product number	Voltage	Product number	Voltage
E-101 to E-562	100	S-101 to S-562	100
E-822	30	S-822T to S-223T	50
E-103			
E-123			
E-153	25		
E-183			

Product number		Pinch-off current (10 V)[1]		Limiting current[1]		Limiting current ratio $I_{100V}/Ip*I_{30V}/Ip$	Temperature coefficient (% / °C)[2]
SMD	Leaded	Ip (mA) typical	Min - max	V_K (V)	I_K (mA)		
S-101T	E-101	0.10	0.05 – 0.21	0.5	0.8 Ipmin.	1.1 max	+ 2.10 to + 0.10
S-301T	E-301	0.30	0.20 – 0.4	0.8			+ 0.40 to − 0.20
S-501T	E-501	0.50	0.40 – 0.6	1.1			+ 0.15 to − 0.25
S-701T	E-701	0.70	0.60 – 0.9	1.4			0.00 to − 0.32
S-102T	E-102	1.00	0.88 – 1.3	1.7			− 0.10 to − 0.37
S-152T	E-152	1.50	1.28 – 1.7	2.0			− 0.13 to − 0.40
S-202T	E-202	2.00	1.68 – 2.3	2.3			− 0.15 to − 0.42
S-272T	E-272	2.70	2.28 – 3.1	2.7			− 0.18 to − 0.45
S-352T	E-352	3.50	3.00 – 4.1	3.2			− 0.20 to − 0.47
S-452T	E-452	4.50	3.90 – 5.1	3.7			− 0.22 to − 0.50
S-562T	E-562	5.60	5.00 – 6.5	4.5			− 0.25 to − 0.53
S-822T	E-822	8.20	6.56 – 9.8	3.1		1.0 max (I_{30}/Ip)	− 0.25 to − 0.45
S-103T	E-103	10.0	8.00 – 12.4	3.5			− 0.25 to − 0.45
S-123T	E-123	12.0	9.60 – 14.4	3.8			− 0.25 to − 0.45
S-153T	E-153	15.0	12.0 – 18.0	4.3			− 0.25 to − 0.45
S-183T	E-183	18.0	16.0 – 20.0	4.6			− 0.25 to − 0.45
New S-223T		22.5	20.0 – 25.0	5.3			− 0.25 to − 0.45

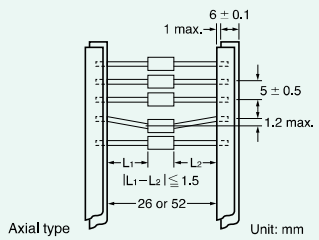
[1]: Pinch-off current and limiting current are measured by pulse wave at 25 °C environment temperature
[2]: Temperature coefficient is calculated from measurements at 25 and 50 °C.

Voltage - current characteristics



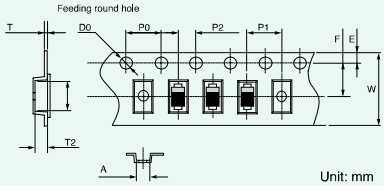
I_p: Pinch-off current at 10 V
V_K: Voltage which produces 0.8 Ip or greater current
V_B: Breakdown voltage
I_R: Permitted reverse current

Taping options
SEMITEC offers both axial and SMD taping.



Axial type

Unit: mm



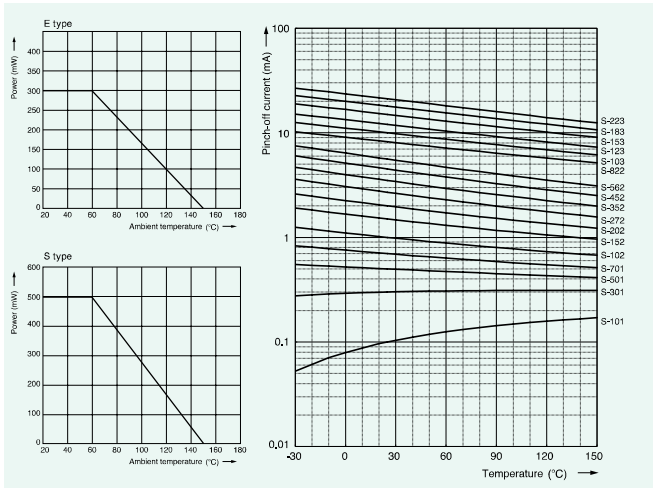
Unit: mm

A	B	W	F	E	P0	P1	P2	D0	T	T2
1.8	3.74	8.0	3.50	1.75	4.0	4.0	2.00	φ1.5	0.2	0.9
± 0.1	± 0.10	± 0.1	± 0.05	± 0.10	± 0.1	± 0.1	± 0.05	+0.1/-1	± 0.05	± 0.1

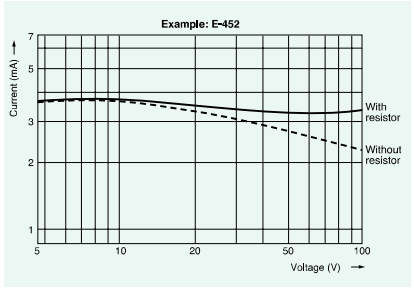
SMD element is set with the cathode side on the side with holes.

Minimum taping quantities
Axial type Reel: 5000 pcs
Box: 2500 pcs
SMD type 3000 pcs

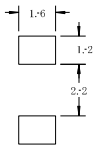
Influence of environment temperature on power and pinch-off current rating



Current - voltage characteristics with and without resistor (example)

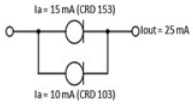


Recommended mounting pad dimensions (S series only)



CRD for higher currents

CRDs can be used in row to amplify permissable current.



CRD for higher voltages

Using CRDs in row with Zener diodes allows the use of stable currents at higher voltage values.

How to compensate current reduction due to heat up of the CRD

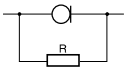
For currents of 1 mA or more resistors can be used together with CRDs to compensate for current decreases and fluctuations. The following values are typical for compensation resistors.

Rated power: 500 mW

Product number	S-102	S-152	S-202	S-272	S-352	S-452	S-562	S-822	S-103	S-123	S-153	S-183	S-223
Recommended resistance value	1.1 MΩ	430 kΩ	300 kΩ	200 kΩ	130 kΩ	91 kΩ	62 kΩ	27 kΩ	18 kΩ	15 kΩ	12 kΩ	9 kΩ	5.6 kΩ

Rated power: 300 mW

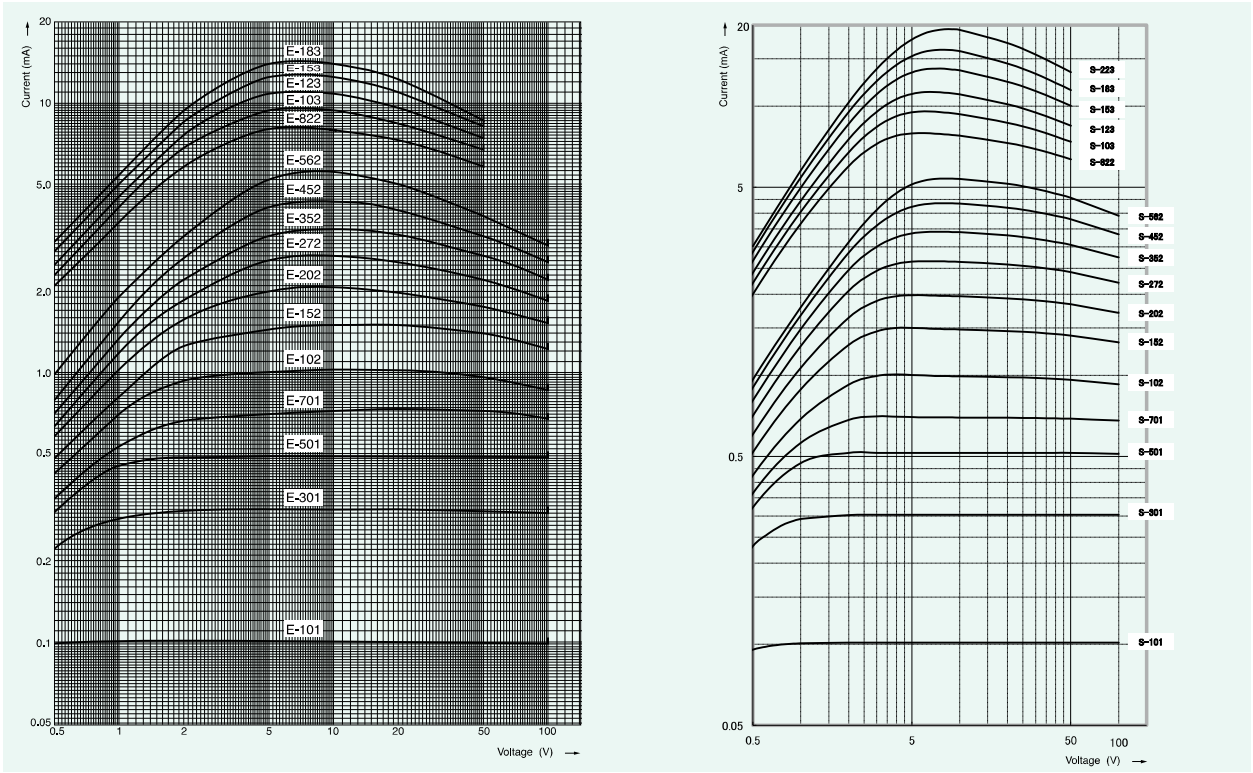
Product number	E-102	E-152	E-202	E-272	E-352	E-452	E-562	E-822	E-103	E-123	E-153	E-183
Recommended resistance value	1 MΩ	390 kΩ	240 kΩ	120 kΩ	82 kΩ	56 kΩ	39 kΩ	20 kΩ	15 kΩ	11 kΩ	9.1 kΩ	7.5 kΩ

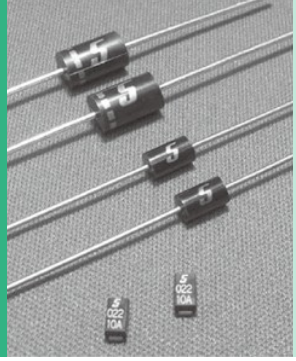


Reliability data

Item	Test conditions	Criteria
Resistance to soldering heat	10 s at 260 °C (wave soldering)	Δ Ip ± 5%
Solderability	3 s at 245 °C Flux material: Rosin 25%, propanol 75%	More than 90% soldered
Dry heat	1000 hours at 150 °C	Δ Ip ± 5%
Damp heat (CRD S)	1000 hours at 85 °C and 85% humidity	
Damp heat (CRD E)	1000 hours at 70 °C and 90% humidity	
Temperature cycle / thermal shock (CRD S)	10 cycles as below: 1. - 55 °C for 15 minutes 2. Room temperature for 15 minutes 3. 150 °C for 15 minutes 4. Room temperature for 15 minutes	
Temperature cycle / thermal shock (CRD E)	5 cycles as below: 1. - 25 °C for 30 minutes 2. Room temperature for 15 minutes 3. 150 °C for 30 minutes 4. Room temperature for 15 minutes	

Dynamic characteristics (voltage - current)





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

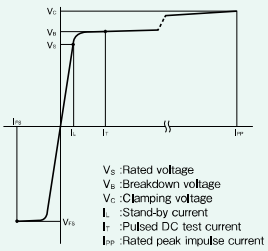
- No marking : Untaped bulk products
- 52Z : Axial taping, Z folding
- 52R : Axial taping, reel
- FT : Radial taping
- U : Unipolar
- No marking : Bipolar
- Z2 : Rated power = 1.0 W
- Z6 : Rated power = 2.0 W
- ZD : Rated power = 0.5 W; reverse blocking type

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

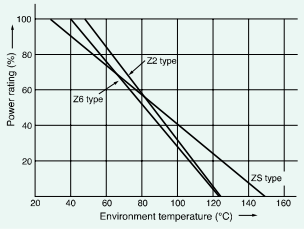
The bipolar Z2 and Z6 types have an almost symmetrical breakdown voltage (V_{BR}). The reverese breakdown voltage of the low capacitance ZD type is 200 V or more at 10 µA DC.



V_S :Rated voltage
V_B :Breakdown voltage
V_C :Clamping voltage
I_L :Stand-by current
I_F :Pulsed DC test current
I_{PP} :Rated peak impulse current

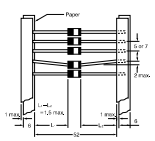
Power derating

Influence of environment temperature on power rating (%)

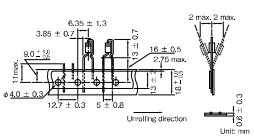


Taping dimensions

Axial type

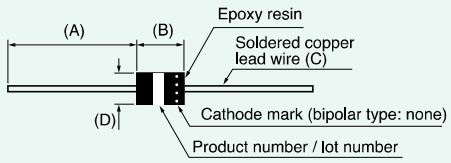


Radial type



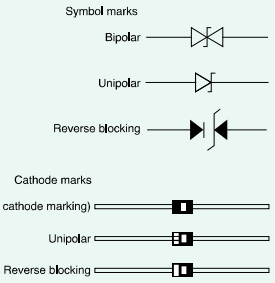
Series	Taping method		Quantity
Z2, Z2U	Axial taping	Reel	5000
		Z folding	2000
	Radial taping	Z folding	2000
Z6, Z6U	Axial taping	Z folding	1000

Dimensions



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
		V_S	$I_{L\,max}$	V_{BR}	I_F	V_C	I_{PP}	V_C	I_{PP}		C
Bipolar type	Unipolar type	DC	V_S	I_F = 1 mA	DC	10 / 1000 µs		8 / 20 µs		25 to 50 °C	
		V	µA	V	mA	V	A	V	A	% / °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									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
-	Z2022									0,086	840
Z2027	-	21.8		24.3 - 29.7		39.1	12.8	50.5	120	0,085	340
-	Z2027									0,089	680
Z2033	-	26.8		29.7 - 36.3		47.7	10.5	61.7	98.2	0,087	280
-	Z2033									0,092	560
Z2039	-	31.6		35.1 - 42.9		56.4	8.86	73.0	83.0	0,090	240
-	Z2039									0,095	480
Z2047	-	38.1	5	42.3 - 51.7	1	67.8	7.37	88.0	68.9	0,092	200
-	Z2047									0,097	400
Z2056	-	45.4		50.4 - 61.6		80.5	6.21	105	57.7	0,094	160
-	Z2056									0,099	320
Z2068	-	55.1		61.2 - 74.8		98.0	5.10	127	47.7	0,096	130
-	Z2068									0,10	260
Z2082	-	66.4		73.8 - 90.2		118	4.24	153	39.6	0,099	110
-	Z2082									0,102	220
Z2100	-	81		90.0 - 110		144	3.47	187	32.4	0,101	90
-	Z2100									0,104	180
Z2120	-	97.2		108 - 132		173	2.89	222	27.3	0,103	75
-	Z2120									0,106	150
Z2150	-	121		135 - 165		215	2.32	277	21.9	0,105	60
-	Z2150									0,107	120
Z2180	-	146		162 - 198		258	1.94	333	18.2	0,106	49
-	Z2180									0,108	98

·Rated peak impulse power dissipation: 500 W (10 / 1000 µs), 6.0 kW (8 / 20 µs)
·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
		V_S	$I_{L\,max}$	V_{BR}	I_F	V_C	I_{PP}	V_C	I_{PP}		C
Bipolar type	Unipolar type	DC	V_S	I_F = 1 mA	DC	10 / 1000 µs		8 / 20 µs		25 to 50 °C	
		V	µA	V	mA	V	A	V	A	% / °C	pF
Z6012	-	9.72	10	10.8 - 13.2		17.3	86.7	22.7	802	0,066	4400
-	Z6012U									0,074	8800
Z6015	-	12.1		13.5 - 16.5		22	68.2	28.4	641	0,075	3300
-	Z6015U									0,079	6600
Z6018	-	14.5		16.2 - 19.8		26.5	56.6	34.0	535	0,079	2700
-	Z6018U									0,083	5400
Z6022	-	17.8		19.8 - 24.2		31.9	47.0	41.2	442	0,082	2400
-	Z6022U									0,086	4400
Z6027	-	21.8		24.3 - 29.7		39.1	38.4	50.5	360	0,085	1700
-	Z6027U									0,089	3300
Z6033	-	26.8		29.7 - 36.3		47.7	31.4	61.7	295	0,087	1400
-	Z6033U									0,092	2800
Z6039	-	31.6	5	35.1 - 42.9	1	56.4	26.6	73.0	249	0,090	1200
-	Z6039U									0,095	2400
Z6047	-	38.1		42.3 - 51.7		67.8	22.1	88.0	207	0,092	1000
-	Z6047U									0,097	2000
Z6056	-	45.4		50.4 - 61.6		80.5	18.6	105	173	0,094	850
-	Z6056U									0,099	1700
Z6068	-	55.1		61.2 - 74.8		98.0	15.3	127	143	0,096	720
-	Z6068U									0,100	1440
Z6082	-	66.4		73.8 - 90.2		118	12.7	153	119	0,099	610
-	Z6082U									0,102	1220
Z6100	-	81.0		90.0 - 110		144	10.4	187	97.3	0,101	520
-	Z6100U									0,104	1040
Z6120	-	97.2		108 - 132		173	8.67	222	82.0	0,103	440
-	Z6120U									0,106	880
-	Z6150U	121		135 - 165		215	6.98	277	65.7	0,107	720

·Rated peak impulse power dissipation: 1.5 kW (10 / 1000 µs), 18.0 kW (8 / 20 µs)
·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
	V_S	$I_{L\,max}$	VBR	I_F	V_C	I_{PP}	V_C	I_{PP}		C
	DC	V_S	I_F = 1 mA	DC	10 / 1000 µs		8 / 20 µs		25 to 50 °C	
	V	µA	V	mA	V	A	V	A	% / °C	pF
ZD015	11.4	10	12.8 - 17.2		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		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	1	48.6	5.14	63.0	47.6	0,087	27.2
ZD039	29.8	5	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 µs), 3.0 kW (8 / 20 µs)
·Rated average power dissipation: 500 mW
·Operating / storage temperature: - 40 to 125 °C

VRD voltage regulating diode (= TVS diode)

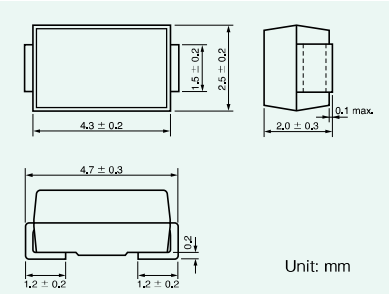
SMD type VRD

Product number

ZS 1 033 D-T

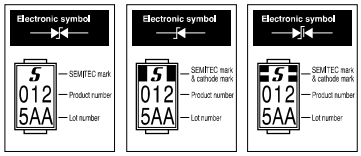
- Taped
- No marking : Bipolar
  U : Unipolar
  D : Reverse blocking type
- Breakdown voltage
- Steady state power
- SMD type

Dimensions



Unit: mm

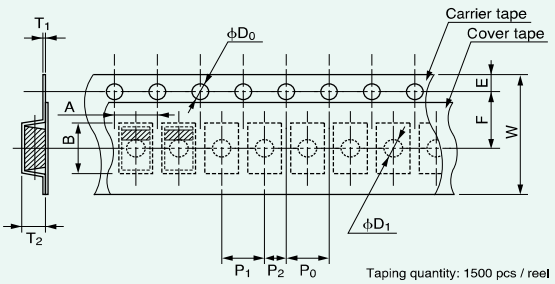
Product marking



General specifications for all types

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

Taping dimensions



Taping quantity: 1500 pcs / reel

A	B	W	F	E	P_1	P_2	P_0	ΦD_0	ΦD_1	T_1	T_2
3.0 ± 0.1	5.2 ± 0.1	12.0 ± 0.3	5.5 ± 0.05	1.75 ± 0.1	4.0 ± 0.1	2.0 ± 0.1	4.0 ± 0.1	1.5 + 0.1 / - 0	1.5 + 0.2 / - 0	0.3 ± 0.05	approx. 2.6

Unit: mm

Specifications

ZS type

Product number	Stand-off voltage	Stand-by current	Breakdown voltage	Clamping voltage / rated peak impulse current				Temperature coefficient	Capacitance
	V_S	I_L max	V_{BR}	V_C max / I_{PP}					C
	DC	VS	I_T= 1 mA	10 / 1000 μs		8 / 20 μs		25 to 50 ℃	
	V	μA	V	V	A	V	A	% / ℃	pF
ZS1012	12 (10.8 to 13.2)	9.72	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	5	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 ℃

ZS-U type

Product number	Stand-off voltage	Stand-by current	Breakdown voltage	Clamping voltage / rated peak impulse current				Temperature coefficient	Capacitance
	V_S	I_L max	V_{BR}	V_C max / I_{PP}					C
	DC	VS	I_T= 1 mA	10 / 1000 μs		8 / 20 μs		25 to 50 ℃	
	V	μA	V	V	A	V	A	% / ℃	pF
ZS1012U	12 (10.8 to 13.2)	9.72	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	5	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 ℃

ZS-D type

Product number	Stand-off voltage	Stand-by current	Breakdown voltage	Clamping voltage / rated peak impulse current				Temperature coefficient	Capacitance
	V_S	I_L max	V_{BR}	V_C max / I_{PP}					C
	DC	VS	I_T= 1 mA	10 / 1000 μs		8 / 20 μs		25 to 50 ℃	
	V	μA	V	V	A	V	A	% / ℃	pF
ZS1012D	12 (10.8 to 13.2)	9.72	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	2 7(24,3 to 29,7)	21,8	5	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

• Reverse voltage: 200 V DC

Ta = 25 ℃