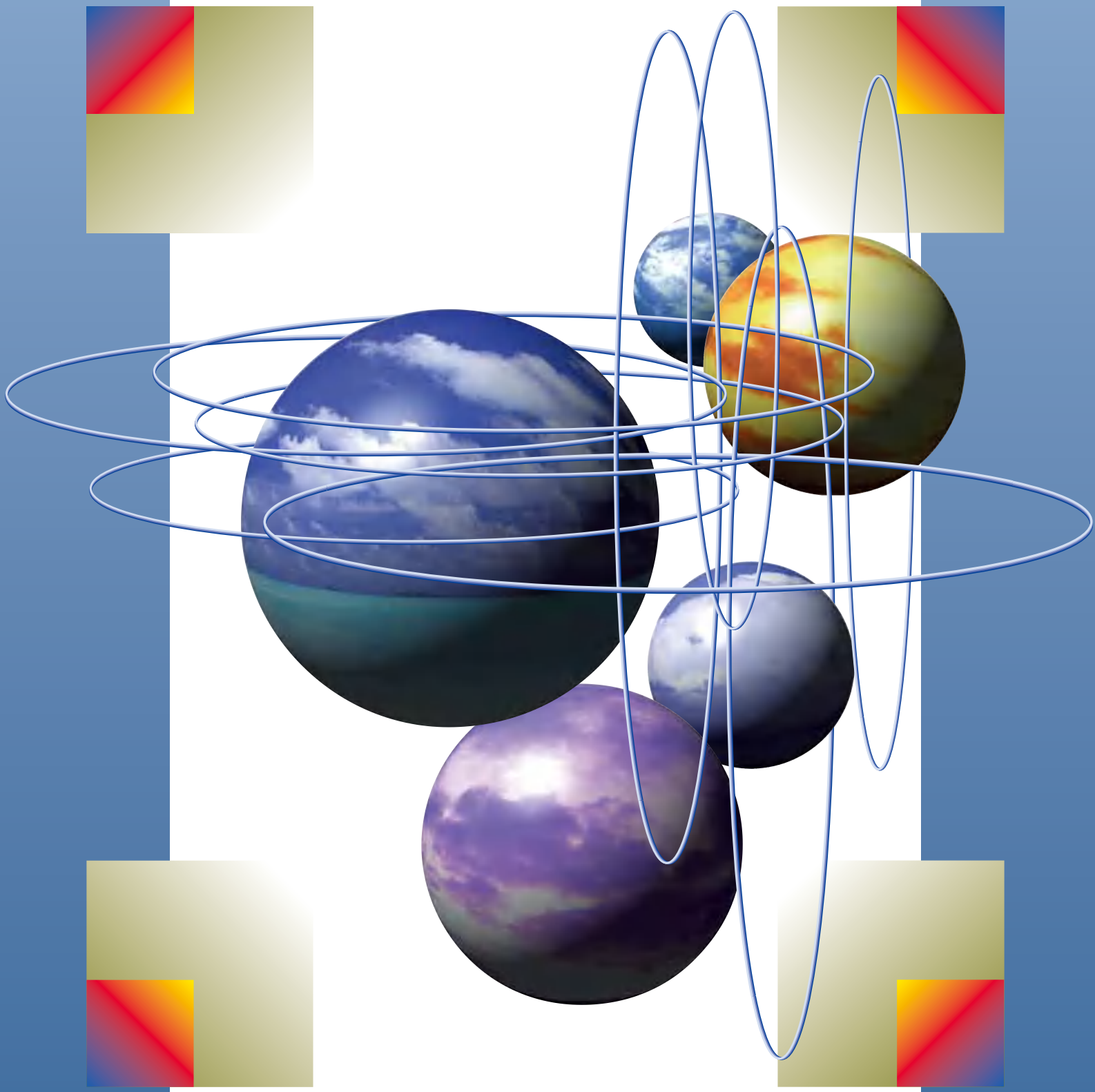
SEMITEC®

SEMITEC Corporation

PRODUCT CATALOG



CAT. No.129I

THERMISTOR 3
- SENSORS
- HIGH PRECISION SERIES
- SMD SERIES
- HIGH HEAT-RESISTANCE SERIES

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THERMISTOR

"Thermistor" is the generic name given to thermally sensitive resistors.
Negative temperature coefficient thermistor is generally called as thermistor. Thermistor is a semiconducting ceramic resistor produced by sintering the materials at high temperature and made mainly from metal oxide.
Depending on the manufacturing method and the structure, there are many shapes and characteristics for various purposes such as temperature measurement, temperature compensation and etc.
The thermistor resistance values, unless otherwise specified, are classified at a standard temperature of 25°C.
B value is calculated from the resistance values at 25°C and 85°C.

Resistance -Temperature Characteristics

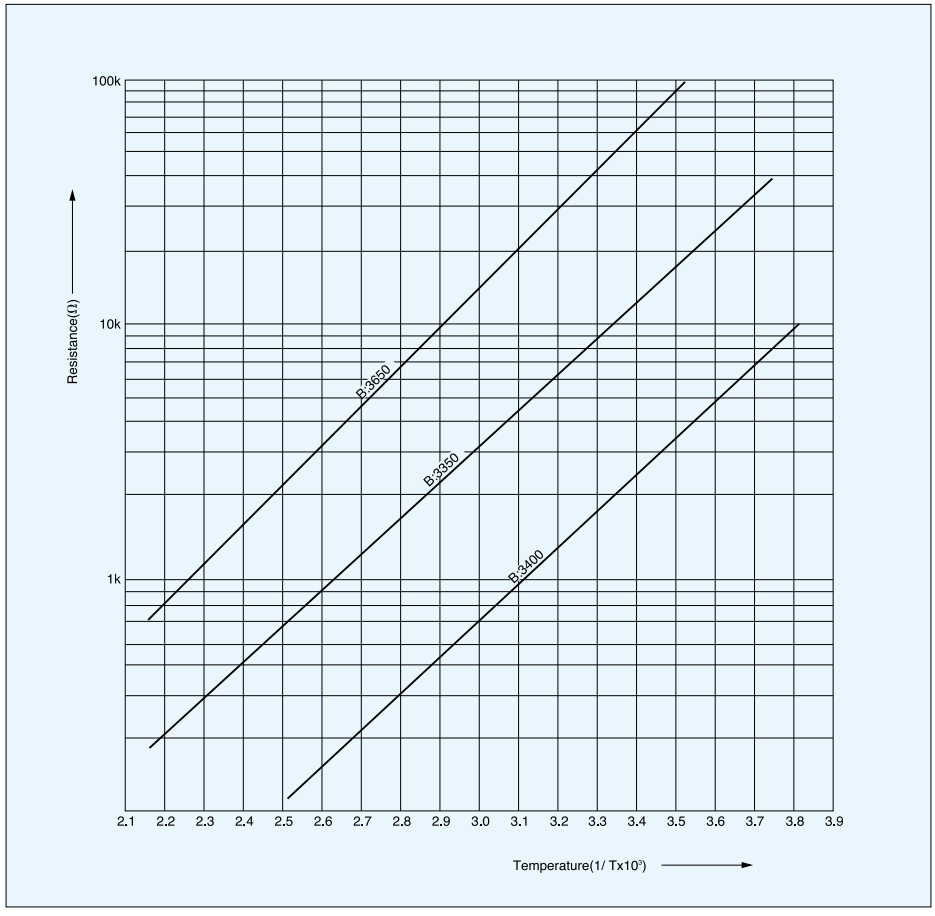
The resistance of a temperature is solely a function of its absolute temperature. Since electrical power being dissipated within a temperature might heat above its ambient temperature and thereby reduce its resistance, it is necessary to test for resistance with temperature. The resistance so measured is called RT, which means the resistance at essentially zero-power.
The mathematical expression which relates the resistance and the absolute temperature of a thermistor is as follows:

$$R_a = R_b \exp\left[B\left(\frac{1}{T_1} - \frac{1}{T_2}\right)\right]$$

Where: R_a is the resistance at absolute temperature T_1
R_b is the resistance at absolute temperature T_2
B is a constant which depends on the material of the thermistor

Unless otherwise specified,all values of B are determined from measurements made at 25°C and 85°C.
The temperature coefficient of resistance α is expressed in the following equation:

$$\alpha = -\frac{B}{T^2} \times 100\ (\%/°C)$$



Dissipation factor

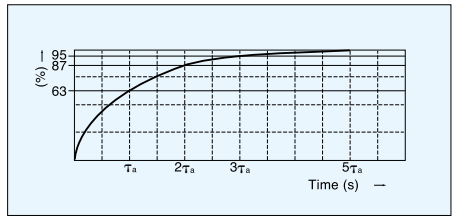
Dissipation factor (δ) is power in milliwatts required to raise thermistor temperature 1°C. Measured with thermistor suspended by its leads in a specified environment.

$$\delta = \frac{P}{\Delta t}\ (mW/°C)$$

P :Power(mW)
Δt:Raise temperature(°C)

Thermal time constant

Thermal time constant (τ_a) is the time required by a thermistor to change 63% of the difference between its initial and final temperature. Measured with thermistor suspended by its leads in specified environment.



TEMPERATURE SENSOR

The TEMPERATURE SENSOR is assembled one with various parts and thermistor devices according to the required applications. Its electric characteristics are the same as those of thermistor devices. Variable type of sensor can be utilized for detecting or controlling temperature because its operating temperature range is wide from −50 to +300°C. Standard TEMPERATURE SENSOR is available in accordance with the applications such as measurements of liquid, atmosphere and surface temperature.

External dimensions

Fig 1

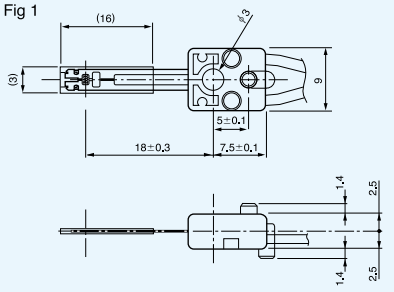


Fig 2

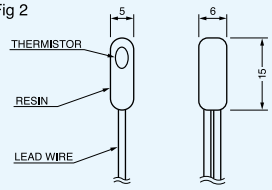


Fig 3

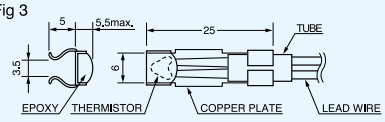


Fig 4

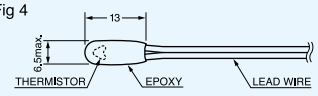


Fig 5

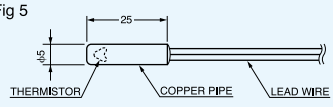


Fig 6

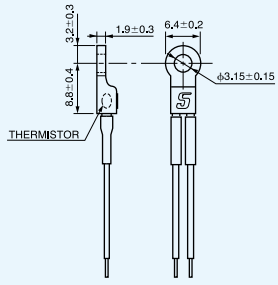


Fig 7

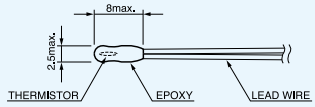


Fig 8

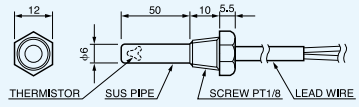


Fig 9

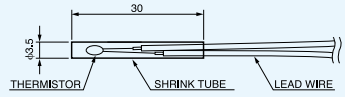


Fig 10

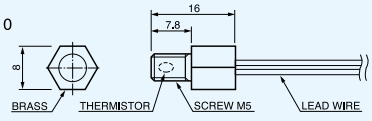


Fig 11

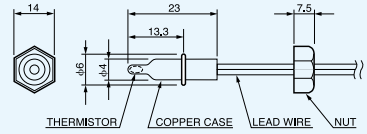


Fig 12

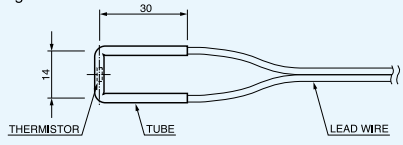


Fig 13

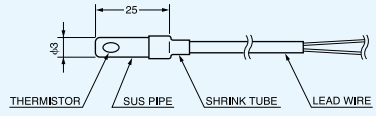


Fig 14

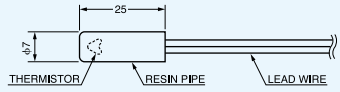
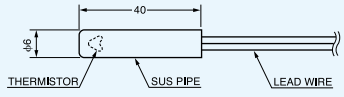


Fig 15



Unit (mm)

Specifications

Fig	Thermal Time constant(s)			Dissipation factor (mW/°C) Approx.	Category temperature range (°C)	Application	Thermistor
	Air	Water	Heater				
1	–	–	1.0	0.3	−20～+230	Surface temp. sensor for OA equipment.	FL
2	75	–	–	2.6	−50～+105	Air temp. sensor for general use.	AT
3	40	–	–	4	−30～+105	Surface temp. sensor for general use.	AT
4	70	–	–	5	−30～+110	Air temp. sensor for air conditioner.	AT(ET)
5	166	–	–	3.7	−30～+110	Air temp. sensor for air conditioner.	AT(ET)
6	80	–	–	3	−40～+110	Surface temp. sensor for general use.	AT
7	10	–	–	2	−50～+ 90	Surface temp. sensor for rechargeable battery.	AT
8	–	5	–	4.5	−30～+105	Water (Oil)temp. sensor for general use.	AT(ET, GT)
9	–	3	–	1.1	−50～+200	For general use.	BT
10	70	–	–	5	−50～+250	Inner temp. sensor for general use.	GT(BT)
11	–	1.7	–	1.0	−30～+100	Fast response water temp. sensor	ET
12	35	–	–	2.1	−50～+200	Surface temp. sensor for cooker.	CT
13	85	–	–	1.1	−30～+100	Air temp. sensor for general use.	ET
14	–	20	–	1.3	−30～+105	For general use.	AT(ET)
15	260		–	2.6	−30～+105	For general use.	AT(ET)

AP THERMISTOR

The AP Thermistor features higher accuracy and higher resistance to heat than our existing high-precision thermistor. AP Thermistor suits various types of application.

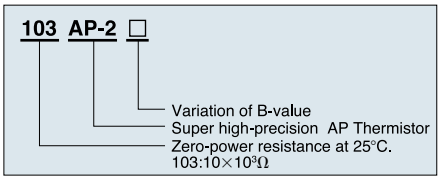
Features

· Super high-precision : Tolerance on R_{25} and $B_{25/85}$ is ±0.5%.
· Narrow deviation in wide temperature range:Accurate temperature detecting with tolerance of ±0.5°C in −60°C to 70°C.
· High resistance to heat : Category temperature range is −60°C～150°C.

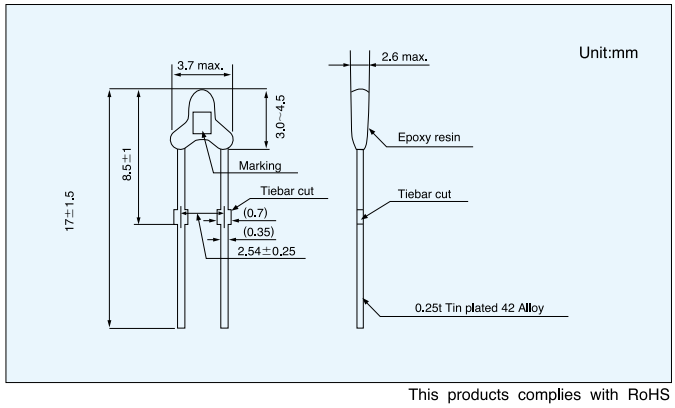
Applications

Portable devices,Battery packs,Fan motor,Automobile, Office automation equipment,Electrical household appliances, Security devices,Thermometer,Measurement equipment, Temperature detecting,etc.

Part number

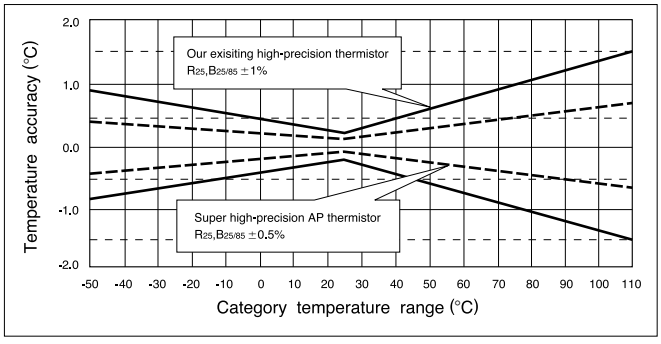


Dimensions



This products complies with RoHS

Temperature accracy



Specifications

Part No.	R_{25}*1		B value*2		Dissipation factor (mW/°C) Approx.	Thermal time constant(s)*3 Approx.	Rated maximum power dissipation(at 25°C)(mW)	Category temperature range(°C)
202AP-2	2.00kΩ	±0.5%	3976K	±0.5%	1.2	15	6	−60～+150
232AP-2	2.252kΩ		3976K					
502AP-2	5.00kΩ		3976K					
103AP-2	10.0kΩ		3435K					
103AP-2-A			3976K					
203AP-2	20.0kΩ		3976K					
503AP-2	50.0kΩ		4220K					
104AP-2	100kΩ		4261K					
204AP-2	200kΩ		4470K					

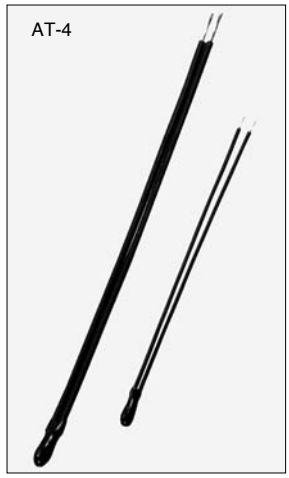
*1 R_{25} : Zero-power resistance value at 25°C.
*2 B-value : Calculated from the zero-power resistance values measured at 25°C and 85°C.
*3 Time when Thermistor temperature reaches 63.2% of the temperature difference. The value is measured in still air.

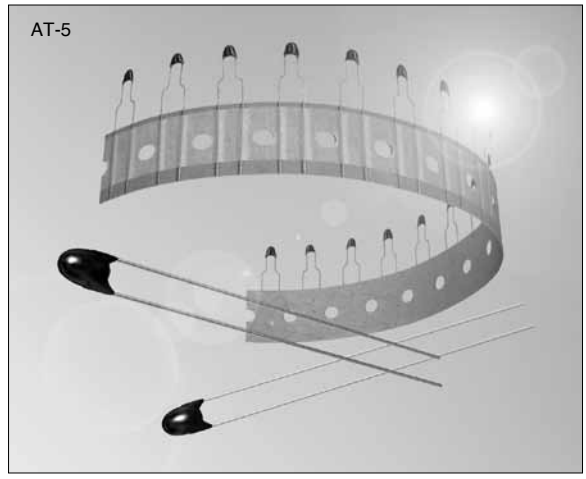
AT THERMISTOR

The AT thermistor is a high-precision thermal sensing device featuring extremely small B-value tolerance and resistance.
When used as a temperature gauge, the AT thermistor requires no adjustment between the control circuit and the sensor.

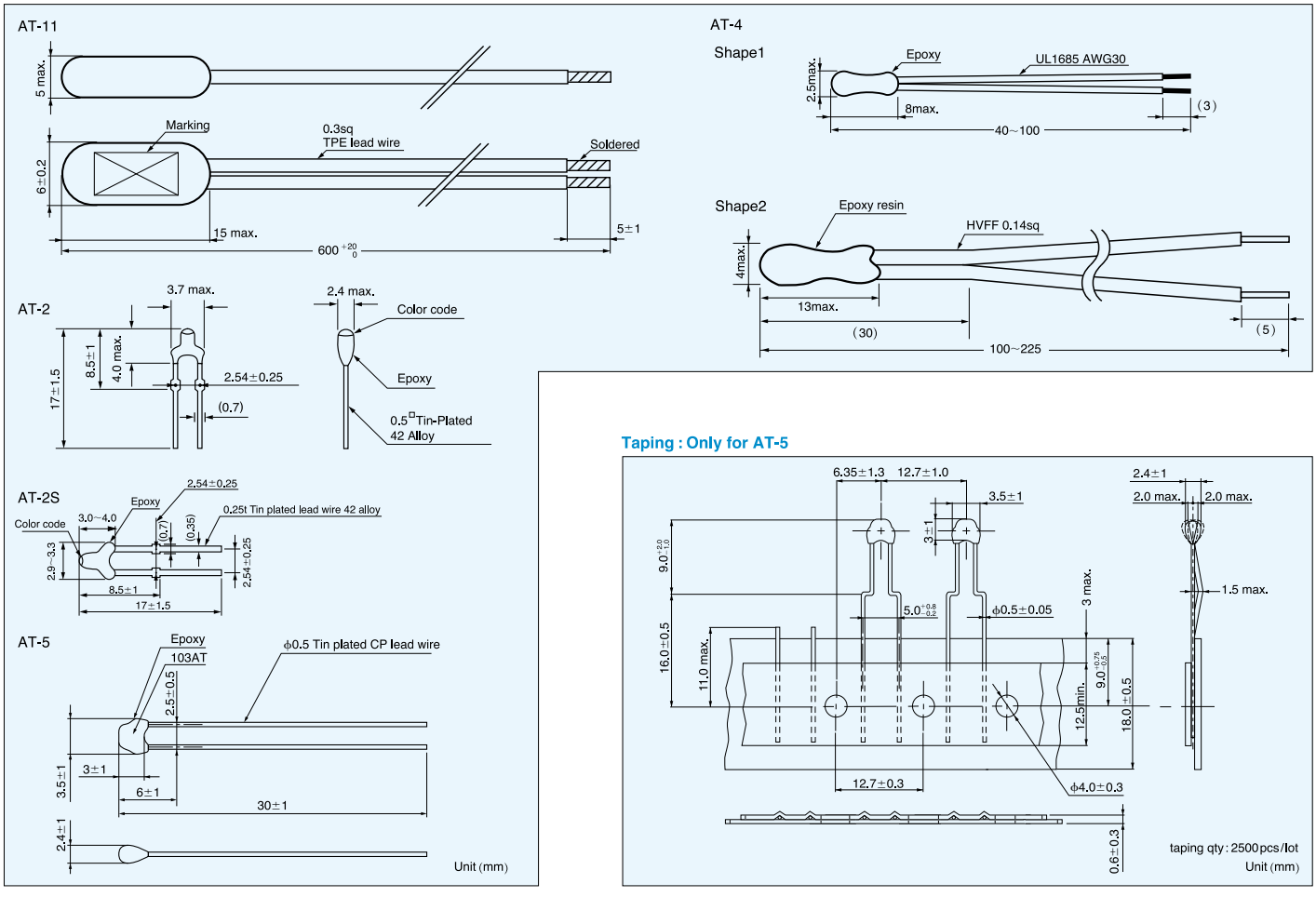
This insures temperature precision of ±0.3°C. Temperature indicators and control instruments are now available for use with the thermistor.





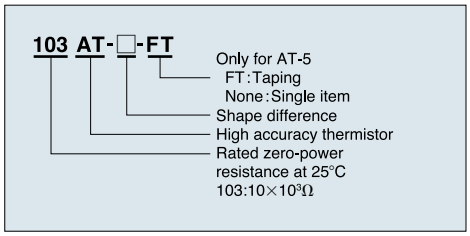


Dimensions

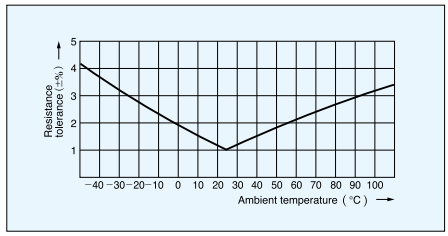


Taping : Only for AT-5

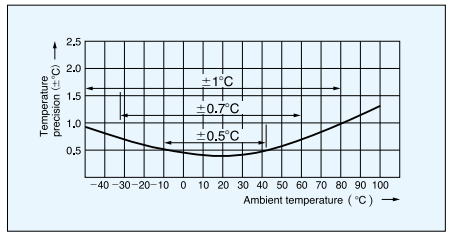
Part number



Resistance tolerance



Interchange precision



Acquisition Standard

For AT-2 type : UL1434, CSA-C22.2, No.0 Authorized.

Specifications

Part No	R_{25}*1	B value*2	Dissipation factor (mW/°C) Approx.	Thermal time constant (s)*3 Approx.	Rated maximum power dissipation (at 25°C)(mW)	Category temp. range(°C)	Color code
102AT-2	1.0kΩ±1%	3100K±1%	2	15	10	−50～+90	Black
202AT-2	2.0kΩ±1%	3182K±1%					Red
502AT-2	5.0kΩ±1%	3324K±1%				−50～+110	Yellow
103AT-2	10.0kΩ±1%	3435K±1%					White
203AT-2	20.0kΩ±1%	4013K±1%					None
104AT-2	100.0kΩ±1%	4665K±1%					
102AT-11	1.0kΩ±1%	3100K±1%	3	75	13	−50～+90	
202AT-11	2.0kΩ±1%	3182K±1%					
502AT-11	5.0kΩ±1%	3324K±1%				−50～+105	
103AT-11	10.0kΩ±1%	3435K±1%					
103AT-4 Shape1	10.0kΩ±1%	3435K±1%	2	10	10	−50～+90	
103AT-4 Shape2	10.0kΩ±1%	3435K±1%	4	35	20		
103AT-2S	10.0kΩ±1%	3435K±1%	1	15	5	−50～+110	White
103AT-5	10.0kΩ±1%	3435K±1%	2.5		12.5		None

※Other resistance is also available, please ask.

*1 R_{25} : Rated zero-power resistance value at 25°C.
*2 B value : determined by rated zero-power resistance at 25°C and 85°C.
*3 Time when thermistor temperature reaches 63.2% of the temperature difference. The value is measured in the air.

Resistance-Temperature

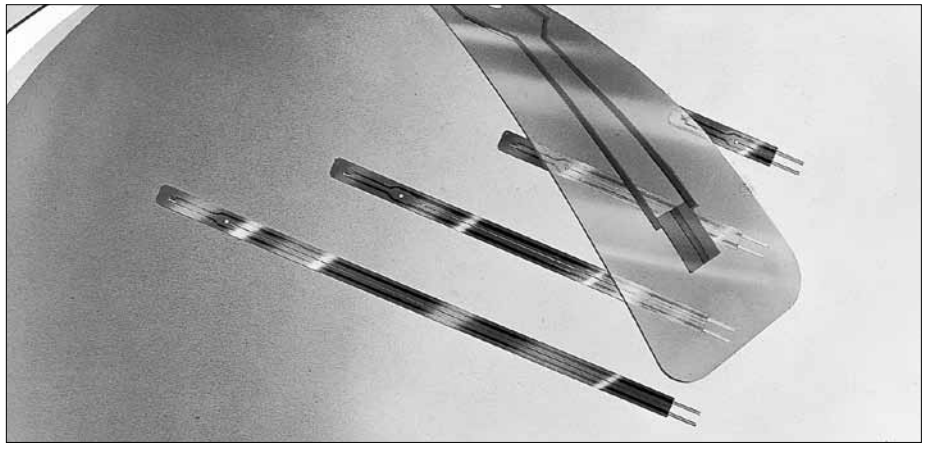
Temperature (°C)	Type							Temperature (°C)	Type						
	102AT	202AT	502AT	103AT	203AT	503AT	104AT		102AT	202AT	502AT	103AT	203AT	503AT	104AT
−50	24.46	55.66	154.6	329.5	1253	3168	11473	35	0.7229	1.424	3.508	6.940	13.06	32.48	60.94
−45	18.68	42.17	116.5	247.7	890.5	2257	7781	40	0.6189	1.211	2.961	5.827	10.65	26.43	48.10
−40	14.43	32.34	88.91	188.5	642.0	1632	5366	45	0.5316	1.033	2.509	4.911	8.716	21.59	38.13
−35	11.23	24.96	68.19	144.1	465.8	1186	3728	50	0.4587	0.8854	2.137	4.160	7.181	17.75	30.44
−30	8.834	19.48	52.87	111.3	342.5	872.8	2629	55	0.3967	0.7620	1.826	3.536	5.941	14.64	24.42
−25	6.998	15.29	41.21	86.43	253.6	646.3	1864	60	0.3446	0.6587	1.567	3.020	4.943	12.15	19.72
−20	5.594	12.11	32.44	67.77	190.0	484.3	1340	65	0.3000	0.5713	1.350	2.588	4.127	10.13	15.99
−15	4.501	9.655	25.66	53.41	143.2	364.6	969.0	70	0.2622	0.4975	1.168	2.228	3.464	8.482	13.05
−10	3.651	7.763	20.48	42.47	109.1	277.5	709.5	75	0.2285	0.4343	1.014	1.924	2.916	7.129	10.68
−5	2.979	6.277	16.43	33.90	83.75	212.3	523.3	80	0.1999	0.3807	0.8835	1.668	2.468	6.022	8.796
0	2.449	5.114	13.29	27.28	64.88	164.0	390.3	85	0.1751	0.3346	0.7722	1.451	2.096	5.105	7.271
5	2.024	4.188	10.80	22.05	50.53	127.5	292.5	90	0.1536	0.2949	0.6771	1.266	1.788	4.345	6.041
10	1.684	3.454	8.840	17.96	39.71	99.99	221.5	95			0.5961	1.108	1.530	3.712	5.037
15	1.408	2.862	7.267	14.69	31.36	78.77	168.6	100			0.5265	0.9731	1.315	3.185	4.220
20	1.184	2.387	6.013	12.09	24.96	62.56	129.5	105			0.4654	0.8572	1.134	2.741	3.546
25	1.000	2.000	5.000	10.00	20.00	50.00	100.0	110			0.4128	0.7576	0.9807	2.369	2.994
30	0.8486	1.684	4.179	8.313	16.12	40.20	77.81								

Unit(kΩ)

ULTIMATE THINNESS, JT THERMISTOR
500μm only

JT THERMISTOR

JT thermistors feature ultra thinness of 500μm and superior electrical insulation.
It is possible to use with safety in ambience that might contact with electrodes.

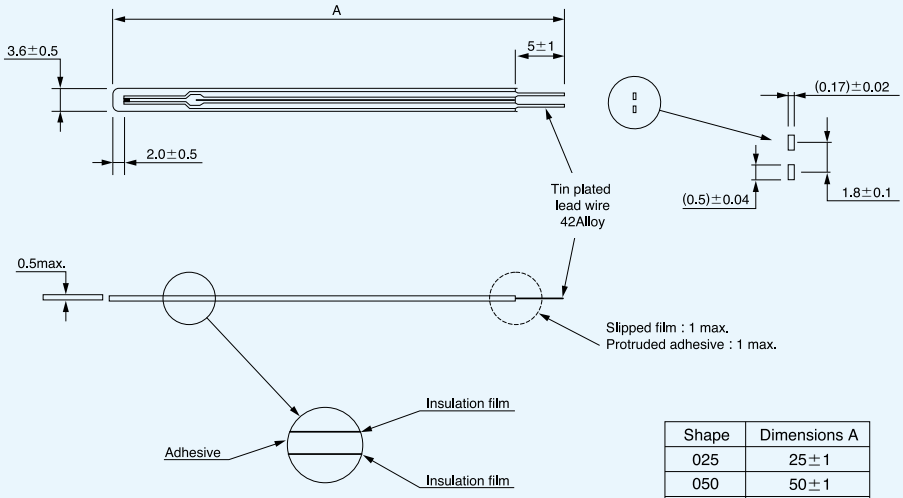


Part number

103 JT-025

- 025 : Shape
- JT : thermistor
- 103 : Rated zero-power resistance at 25°C, $10\times10^{3}\Omega$

Dimensions



Shape	Dimensions A
025	25±1
050	50±1
075	75±1
100	100±1

Unit(mm)

Resistance-Temperature

Temperature (°C)	Type	
	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
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
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

Unit(kΩ)

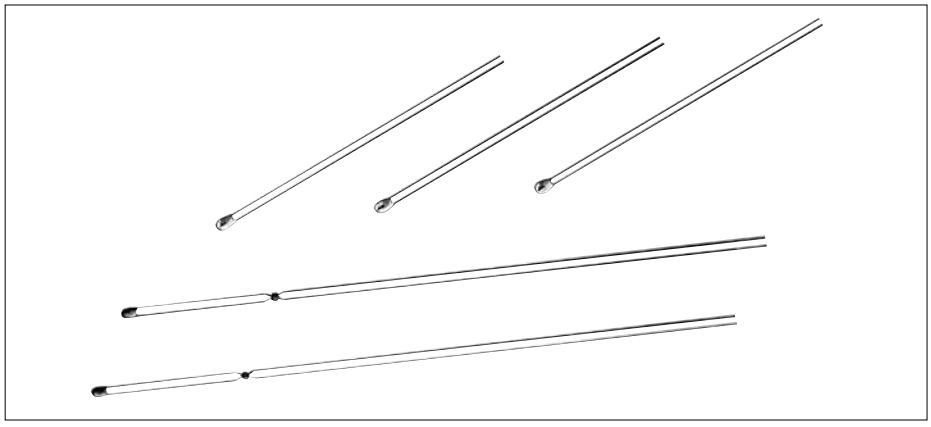
Specifications

Part No.	R_{25}*1	B value*2	Dissipation factor (mW/°C) Approx.	Thermal time constant(s)*3 Approx.	Rated maximum power dissipation(at 25°C)(mW)	Category temp. range(°C)
103JT-□□□	10kΩ±1%	3435K±1%	0.7	5	3.5	−50～+125
104JT-□□□	100kΩ±1%	4390K±1%				

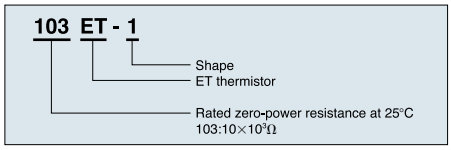
★1 R_{25} : Rated zero-power resistance value at 25°C, ±2% and 3% are also available.
★2 B value : determined by rated zero-power resistance at 25°C and 85°C.
★3 Time when thermistor temperature reaches 63.2% of the temperature difference. The value is measured in the air.

ET THERMISTOR

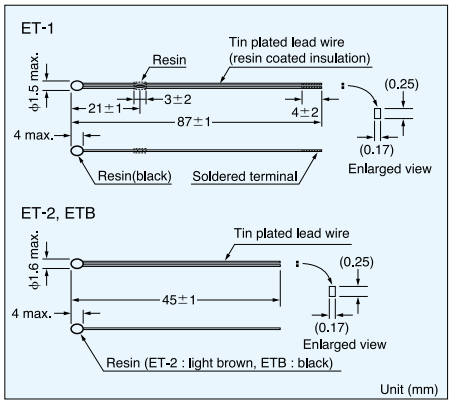
The ET thermistor is smaller version of the AT thermistor. Its fast response time and high reliability makes it particularly suitable for use in medical equipment and thermometers. Manufactured by full-automated production line, all ET thermistors have identical size and that makes it possible to assemble sensors automatically.



Part number



Dimensions



Specifications

Part No.	R_{25}*1	B value*2	Dissipation factor (mW/ °C) Approx.	Thermal time constant (s)*3 Approx.	Rated maximum power dissipation (at 25°C)(mW)	Category temp. range (°C)
402ET-1(2)	4.0kΩ±3%	3100K±1%	0.7	3.2 (3.4)	3.5	−40～ +90
103ET-1(2)	10.0kΩ±3%	3250K±1%				
303ET-1(2)	30.0kΩ±3%	3760K±1%				−40～+100
403ET-1(2)	40.0kΩ±3%	3525K±1%				
413ET-1(2)	41.0kΩ±3%	3435K±1%				
503ET-1(2)	50.0kΩ±3%	4055K±1%				
593ET-1(2)	59.0kΩ±3%	3617K±1%				
833ET-1(2)	83.0kΩ±3%	4013K±1%				
104ET-1(2)	100.0kΩ±3%	4132K±1%				−40～ +90
224ET-1(2)	226.0kΩ±3%	4021K±1%				−40～+100
234ET-1(2)	232.0kΩ±3%	4274K±1%				
103ETB(-1P)	10.0kΩ±1%,±2%	3435K±1%				−40～ +90

*1 R_{25} : Rated zero-power resistance value at 25°C.
*2 B value : determined by rated zero-power resistance at 25°C and 85°C.
*3 Time when thermistor temperature reaches 63.2% of the temperature difference. The value is measured in the air.

Resistance-Temperature

Temperature (°C)	Type											
	402ET	103ET	303ET	403ET	413ET	503ET	593ET	833ET	104ET	224ET	234ET	103ETB
−40	57.71	170.9	810.7	833.3	772.8	1602	1318	2664	3325	7005	9046	204.7
−30	35.34	102.2	445.1	481.1	456.5	855.0	754.3	1421	1769	3784	4680	118.5
−20	22.38	63.07	253.7	287.5	277.9	474.4	445.8	788.5	977.5	2116	2515	71.02
−10	14.60	40.08	149.8	177.2	174.1	272.7	271.7	453.0	559.0	1225	1401	43.67
0	9.797	26.16	91.30	112.4	111.7	161.9	170.1	269.3	329.8	730.1	808.2	27.70
10	6.737	17.51	57.31	73.00	73.63	99.13	109.4	164.8	200.5	447.8	480.2	18.07
20	4.736	11.99	37.00	48.61	49.57	62.38	72.10	103.6	125.3	282.1	293.7	12.11
25	4.000	10.00	30.00	40.00	41.00	50.00	59.00	83.00	100.0	226.0	232.0	10.00
30	3.394	8.387	24.47	33.08	34.08	40.24	48.55	66.91	80.27	182.1	184.4	8.301
40	2.476	5.988	16.56	22.96	23.89	26.58	33.41	44.18	52.62	120.3	118.6	5.811
50	1.835	4.353	11.45	16.26	17.06	17.93	23.44	29.80	35.23	81.07	78.00	4.147
60	1.378	3.217	8.070	11.70	12.38	12.33	16.73	20.51	24.00	55.75	52.39	3.011
70	1.049	2.414	5.791	8.569	9.135	8.588	12.15	14.37	16.59	39.01	35.87	2.224
80	0.7997	1.836	4.222	6.367	6.838	6.064	8.951	10.24	11.64	27.78	24.99	1.668
90	0.6145	1.416	3.125	4.797	5.190	4.338	6.697	7.419	8.287	20.10	17.72	1.267
100			2.346	3.662	3.990	3.142	5.077	5.459		14.75	12.75	

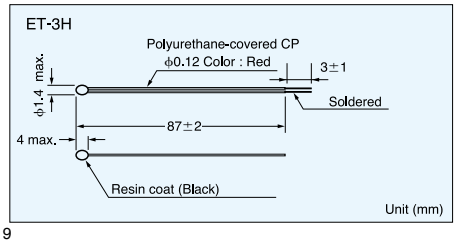
Unit (kΩ)

Specifications

Part No.	R_{37}*1	B value*2	Dissipation factor (mW/ °C) Approx.	Thermal time constant (s)*3 Approx.	Rated maximum power dissipation (at 25°C)(mW)	Category temp. range (°C)
503ET-3H87L-20073	29.615kΩ～30.263kΩ	3944K±0.5%	0.7	0.8	3.5	−40～+100

*1 R_{25} : Rated zero-power resistance value at 37°C.
*2 B value : determined by rated zero-power resistance at 30°C and 45°C.
*3 Time when thermistor temperature reaches 63.2% of the temperature difference. The value is measured in oil.

Dimensions



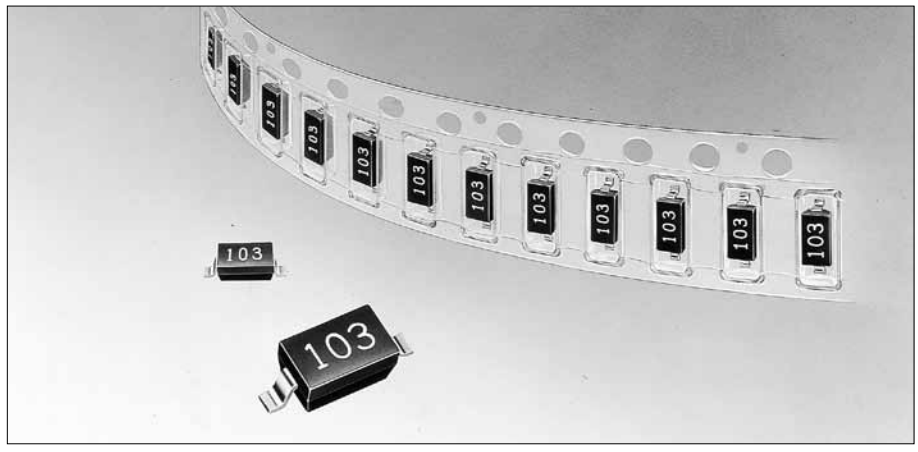
Tolerance of the group : ± 0.09% /group

Group	Resistance(kΩ)	Group	Resistance(kΩ)
C	29.615/29.641/29.667	I	29.937/29.964/29.991
D	29.668/29.695/29.721	J	29.992/30.018/30.045
E	29.722/29.749/29.775	K	30.046/30.073/30.100
F	29.776/29.802/29.828	L	30.101/30.127/30.154
G	29.829/29.856/29.883	M	30.155/30.182/30.209
H	29.884/29.910/29.936	N	30.210/30.237/30.263

Notes ; Min./Center/Max.

HT THERMISTOR

HT thermistors are entirely new type of thermistor for surface mounting (by reflow soldering) and were acquired from advanced technology.
Our HT thermistors are adapted metal electrodes packaged in a resin mold, unlike conventional chip thermistors, and can offer ±2% tolerance for a resistance value at 25°C.
HT series (SMD Thermistor) is not only compact-surface mounting type but also highly accurate and reliable.



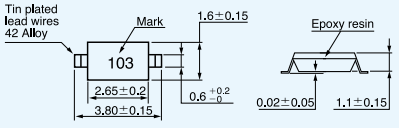
Part number

103 HT-TP

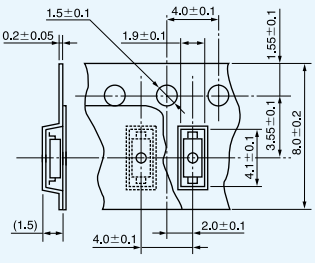
- Taping HTF only
- Shape
- Rated zero-power resistance at 25°C 103 : $10\times10^3\Omega$

HT

Dimensions

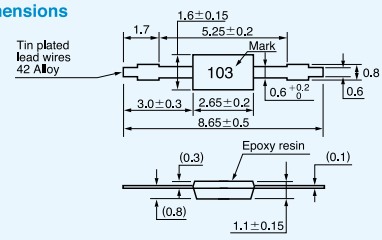


Taping

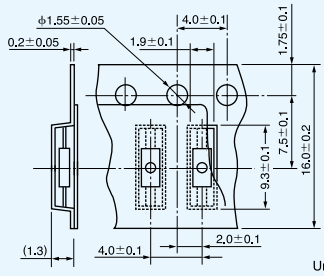


HTF

Dimensions



Taping



Unit (mm)

Minimum quantity : 3000pcs/reel

Specifications

Part No.	R_{25}*1	B value*2	Dissipation factor (mW/°C) Approx.	Thermal time constant(s)*3 Approx.	Rated maximum power dissipation (at 25°C)(mW)	Category temp. range(°C)
302HT(F)	3.0kΩ±2%	3860K±1%	1.0	8.0	5.0	−50～+125
502HT(F)	5.0kΩ±2%	3860K±1%				
103HT(F)	10.0kΩ±2%	3435K±1%				−50～+100
203HT(F)	20.0kΩ±2%	3760K±1%				−50～+125
303HT(F)	30.0kΩ±2%	3760K±1%				
503HT(F)	50.0kΩ±2%	4055K±1%				
104HT(F)	100.0kΩ±2%	4390K±1%				

*1 R_{25} : Rated zero-power resistance value at 25°C, ±1% and 3% are also available.
*2 B value : determined by rated zero-power resistance at 25°C and 85°C.
*3 Time when thermistor temperature reaches 63.2% of the temperature difference. The value is measured in the air.

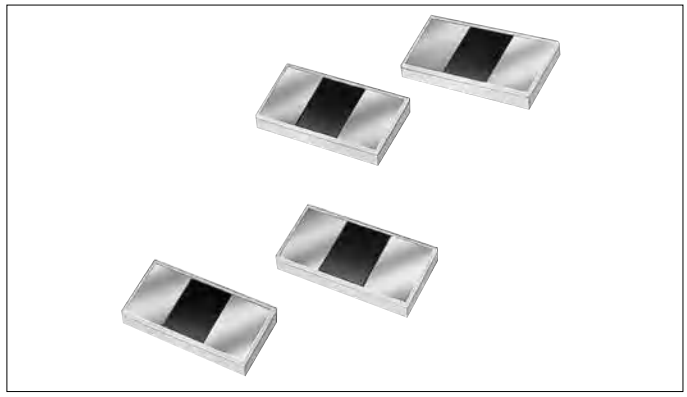
Resistance-Temperature

Temperature (°C)	Type							Temperature (°C)	Type						
	302HT	502HT	103HT	203HT	303HT	503HT	104HT		302HT	502HT	103HT	203HT	303HT	503HT	104HT
−50	182.1	303.4	367.7	1026	1539	3135	9584	40	1.623	2.705	5.811	11.04	16.56	26.58	50.03
−40	93.35	155.6	204.7	540.5	810.8	1602	4572	50	1.109	1.849	4.147	7.632	11.45	17.93	32.51
−30	49.85	83.09	118.5	296.7	445.1	855.0	2282	60	0.7744	1.291	3.011	5.380	8.070	12.33	21.61
−20	27.75	46.25	71.02	169.2	253.8	474.4	1191	70	0.5513	0.9189	2.224	3.861	5.792	8.588	14.66
−10	16.02	26.70	43.67	99.85	149.8	272.7	647.2	80	0.4000	0.6667	1.668	2.815	4.223	6.064	10.13
0	9.541	15.90	27.70	60.87	91.31	161.9	365.0	90	0.2951	0.4918	1.267	2.083	3.125	4.338	7.135
10	5.876	9.793	18.07	38.21	57.32	99.13	212.5	100	0.2210	0.3683	0.9753	1.564	2.346	3.142	5.111
20	3.728	6.214	12.11	24.66	36.99	62.38	127.7	110	0.1680	0.2800		1.190	1.785	2.302	3.720
25	3.000	5.000	10.00	20.00	30.00	50.00	100.0	120	0.1295	0.2158		0.9159	1.374	1.705	2.746
30	2.431	4.051	8.301	16.31	24.47	40.24	78.88	125	0.1142	0.1903		0.8067	1.210	1.472	2.371

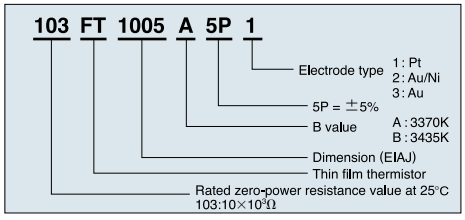
Unit (kΩ)

FT THERMISTOR

The FT thermistors, the highly reliable thermistors, are characterized by their fast response time, which was made possible by the miniaturization of the thermistor dimensions. FT thermistors are also heat-resistant type. FT thermistors are the most excellent products of today's chip thermistors manufacturing.



Part number



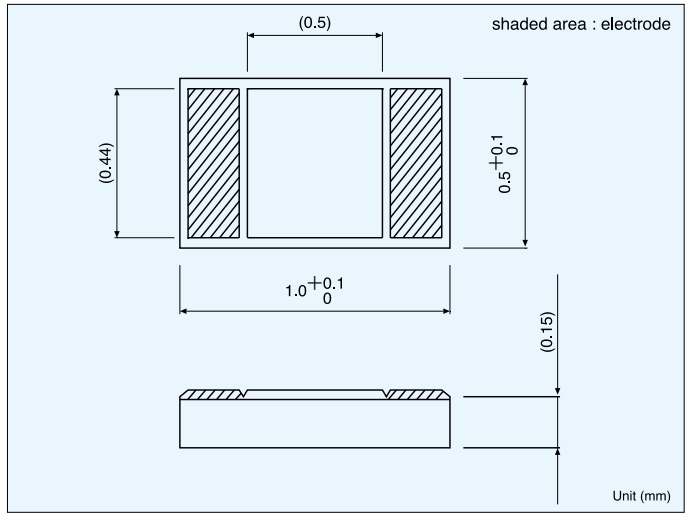
APPLICATION

OA sensor, Measuring instrument, Medical instrument, LCD, etc.

	Electrode type	Connection method	Temperature range in use (°C)
1	Pt	Conductive resins	−40～+250(+350)
2	Au/Ni	Solder	−40～+125
3	Au	Wire-bonding	−40～+250

We can also custom-make FT THERMISTOR to better suit your applications. Please consult our sales staff.

Dimensions



Specifications

Part No.	R_{25}*1	B value*2	Dissipation factor (mW/°C) Approx.	Thermal time constant(s)*3 Approx.	Rated maximum power dissipation (at 25°C)(mW)
103FT1005	10kΩ±5%	3435K±1%	0.3	1.0	1.5
		3370K±1%			
503FT1005	50kΩ±5%	3435K±1%			
		3370K±1%			
364FT1005	360kΩ±5%	3370K±1%			

*1 R_{25} : Rated zero-power resistance value at 25°C.
*2 B value : determined by rated zero-power resistance at 25°C and 85°C.
*3 Time when thermistor temperature reaches 63.2% of the temperature difference. The value is measured in the air.

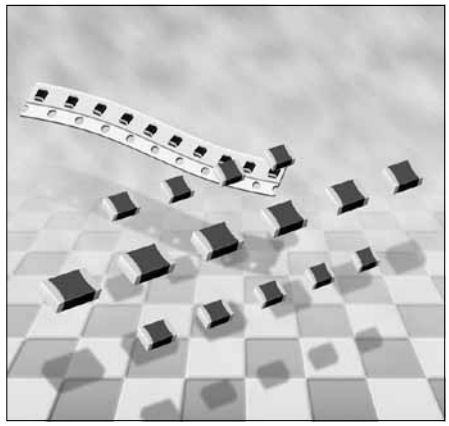
Resistance-Temperature

Temperature (°C)	P/N					Temperature (°C)	P/N				
	103FT		503FT		364FT		103FT		503FT		364FT
	B=3370K	B=3435K	B=3370K	B=3435K	B=3370K		B=3370K	B=3435K	B=3370K	B=3435K	B=3370K
−40	187.9	200.7	939.3	1002	6763	110	0.8003	0.7662	4.002	3.829	28.81
−30	110.7	117.0	553.4	584.7	3984	120	0.6345	0.6064	3.172	3.029	22.84
−20	67.26	70.34	336.3	351.9	2421	125	0.5671	0.5418	2.836	2.706	20.42
−10	42.10	43.55	210.5	217.7	1516	130					18.30
0	27.07	27.71	135.3	138.5	974.8	140					14.81
10	17.86	18.11	89.31	90.48	643.0	150					12.09
20	12.07	12.12	60.33	60.58	434.4	160					9.963
25	10.00	10.00	50.00	50.00	360.0	170					8.274
30	8.332	8.299	41.66	41.50	299.9	180					6.925
40	5.871	5.804	29.36	29.03	211.4	190					5.837
50	4.216	4.139	21.08	20.70	151.8	200					4.954
60	3.081	3.006	15.40	15.04	110.9	210					4.232
70	2.288	2.220	11.44	11.11	82.36	220					3.636
80	1.725	1.666	8.623	8.331	62.09	230					3.142
90	1.318	1.269	6.592	6.344	47.46	240					2.731
100	1.021	0.9797	5.105	4.898	36.76	250					2.385

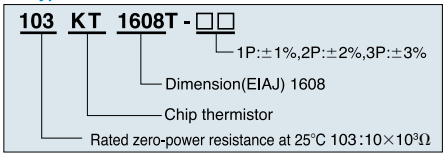
Unit (kΩ)

KT THERMISTOR

Chip thermistors are specially processed, highly reliable thermistors.
They can be face-bonded to act as thermal compensators for ICs and they are manufactured in sizes down to 1 square mm, they can also be used to detect temperature with relatively small time constants.



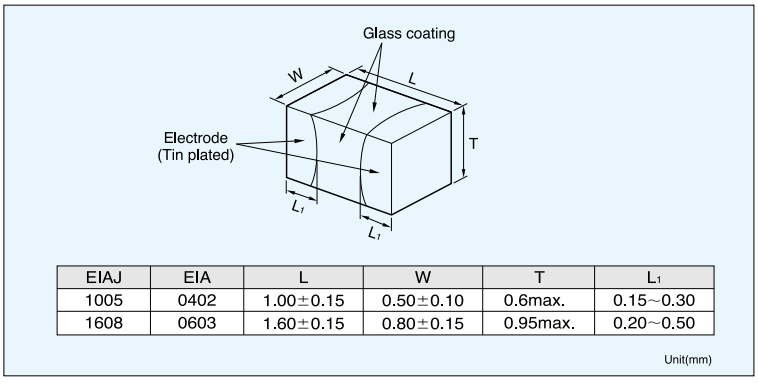
KT-type Part number



Precautions

- Do not expose the thermistors to high soldering heat for more than specified time. (260°C for not longer than 10s is recommended)

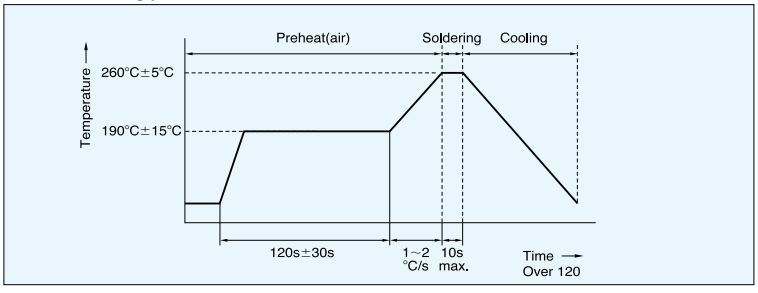
Dimensions



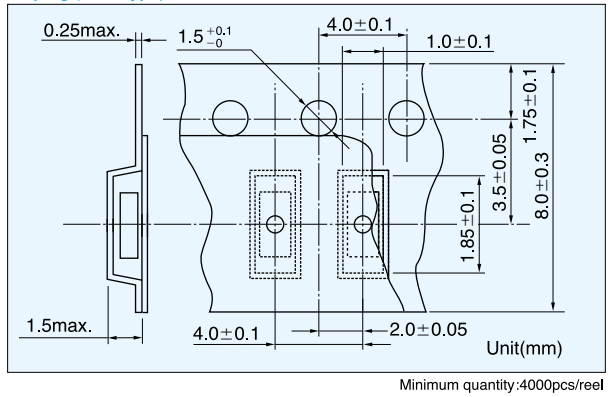
EIAJ	EIA	L	W	T	L_1
1005	0402	1.00±0.15	0.50±0.10	0.6max.	0.15~0.30
1608	0603	1.60±0.15	0.80±0.15	0.95max.	0.20~0.50

Unit(mm)

Reflow soldering profile

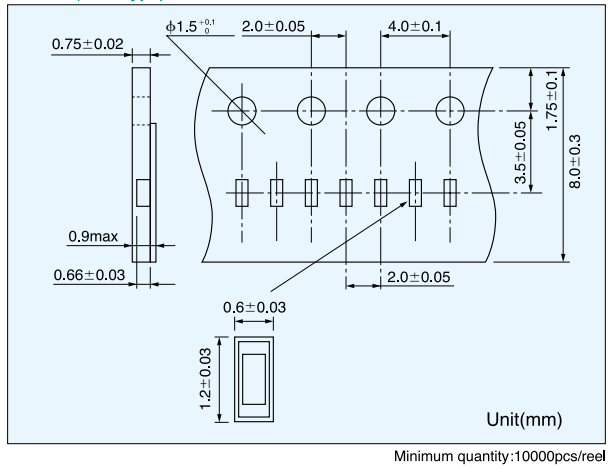


Taping (1608 type)



Minimum quantity:4000pcs/reel

(1005 type)



Minimum quantity:10000pcs/reel

Specifications

Part No.	R_{25} *1	B value*2	Dissipation factor (mW/°C) Approx.	Thermal time constant(s)*3 Approx.	Rated maximum power dissipation (at 25°C)(mW)	Category temp. range(°C)
103KT1608T	10kΩ	3435K±1%	0.9	5.0	4.5	−40~+125
503KT1608T	50kΩ	4055K±1%				
104KT1608T	100kΩ	4390K±1%				
103KT1005T	10kΩ	3435K±1%	0.7	2.2	3.5	

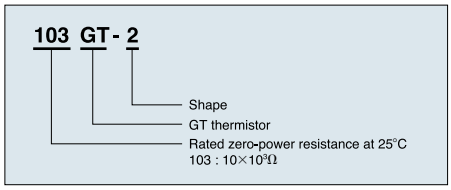
*1 R_{25} : Rated zero-power resistance value at 25°C.
*2 B value : determined by rated zero-power resistance at 25°C and 85°C.
*3 Time when thermistor temperature reaches 63.2% of the temperature difference. The value is measured in the air. Other resistance is available, please ask.

HIGH HEAT-RESISTANCE AND HIGH SENSITIVE THERMISTOR

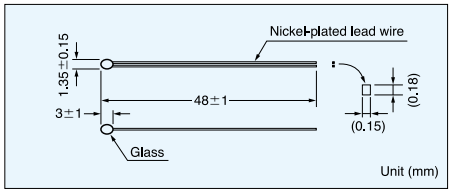
GT THERMISTOR

GT thermistor is combined both superior feature of BT thermistor and ET thermistor as fast response time, high reliability, wide category temperature range, high moisture proof, high accuracy and reasonable price.
GT thermistor is made up of a high quality thermistor element and the lead wire is connected to the thermistor element by alloyed technology, and glass coating for the thermistor element.

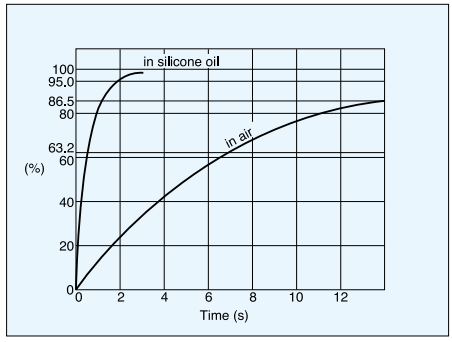
Part number

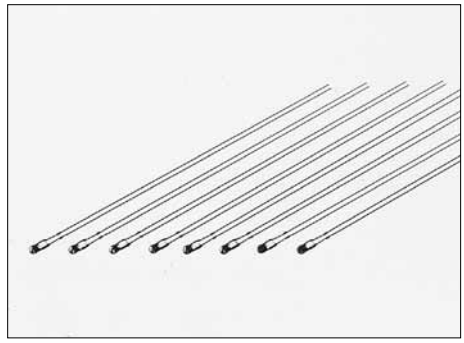


Dimensions



Time constant





Specifications

Part No.	R_{25}*1	B value*2	Dissipation factor (mW/°C) Approx.	Thermal time constant(s)*3 Approx.	Rated maximum power dissipation (at 25°C)(mW)	Category temp. range(°C)
102GT-2	1.0kΩ±3%	3305K±2%	0.6	7	3.0	−50～+200
202GT-2	2.0kΩ±3%	3838K±2%				−50～+300
502GT-2	5.0kΩ±3%	3964K±2%				
103GT-2	10.0kΩ±3%	4126K±2%				
203GT-2	20.0kΩ±3%	4282K±2%				
503GT-2	50.0kΩ±3%	4288K±2%				
104GT-2	100.0kΩ±3%	4267K±2%				
104GTA-2	100.0kΩ±3%	4390K±2%				
204GT-2	200.0kΩ±3%	4338K±2%				
504GT-2	500.0kΩ±3%	4526K±2%				
105GT-2	1000.0kΩ±3%	4608K±2%				

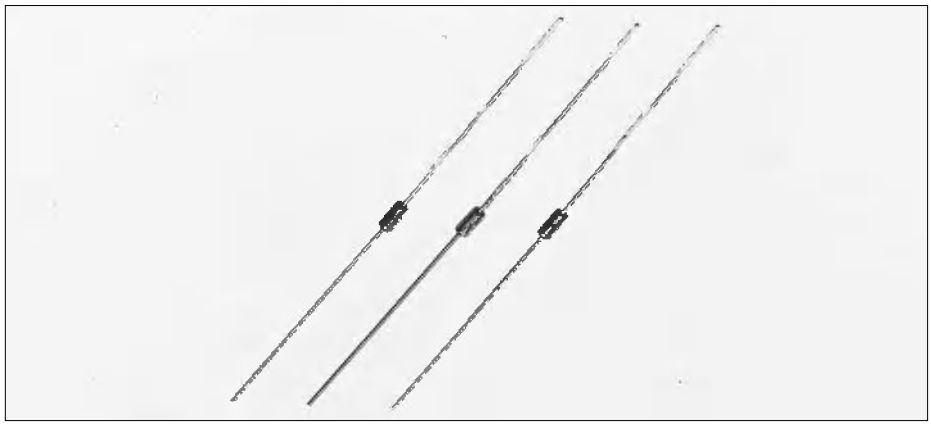
Specifications

Part No.	Rated zero-power resistance			temperature (°C)	B value*2	Dissipation factor (mW/°C) Approx.	Thermal time constant(s)*3 Approx.	Rated Electricity mW at 25°C	Category temp. range(°C)
	temperature*1 (°C)	resistance	tolerance						
252GT-2-20185	0	6kΩ	±5%	0/100	3390K±2%	0.6	7	3.0	−50～+300
252GT-2-20197	25	2.5kΩ	±2.5%						
262GT-2-20198	0	8kΩ	±1%	25/50	3745K±2%				
542GT-2-20184	75	0.7331kΩ	±3%	0/100	3450K±2%				
542GT-2-20186	0	15kΩ	±3%						
852GT-2-20156	50	3.485kΩ	±3%						
103GT-2-20196	25	10kΩ	±1%	25/85	3435K±1%				
103GTA-2-20199	25	10kΩ	±5%	25/125	3980K±2%				
303GT-2-20205	25	30kΩ	±3%	0/100	3970K±2%				
333GT-2-20204	125	1.509kΩ	±3%	0/100	3570K±2%				
493GT-2-20157	5	127kΩ	±2%	0/100	3970K±2%				
493GT-2-20159	75	7.214kΩ	±3%						
493GT-2-20188	40	26.06kΩ	±2%						
104GT-2-20201	25	100kΩ	±3%	100/200	4300K±3%				
234GT-2-20194	25	231.44kΩ	±3%	100/200	4537K±1%				
234GT-2-20195	150	3.161kΩ	±3%		4537K±2%				
145GT-2-20203	200	4kΩ	±5%	200/300	5133K±3%				

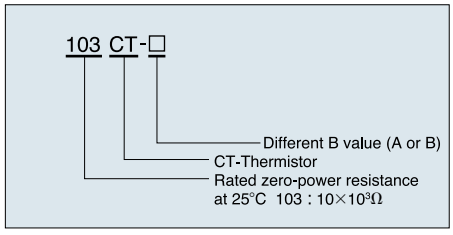
*1 Rated zero-power resistance at each temperature.
*2 B value : determined by rated zero-power resistance at each temperature.
*3 Time when thermistor reaches 63.2% of the temperature difference. The value is measured in the air.

CT THERMISTOR

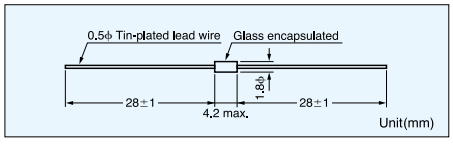
The CT thermistor is a thermal sensor in a DO35 package. Similar to the BT thermistor, it is highly reliable and offers a wide operating range of −50°C to (150°C) 250°C. It is primarily used in home electric appliances and features a competitive price for full-automated manufacturing system.



Part number

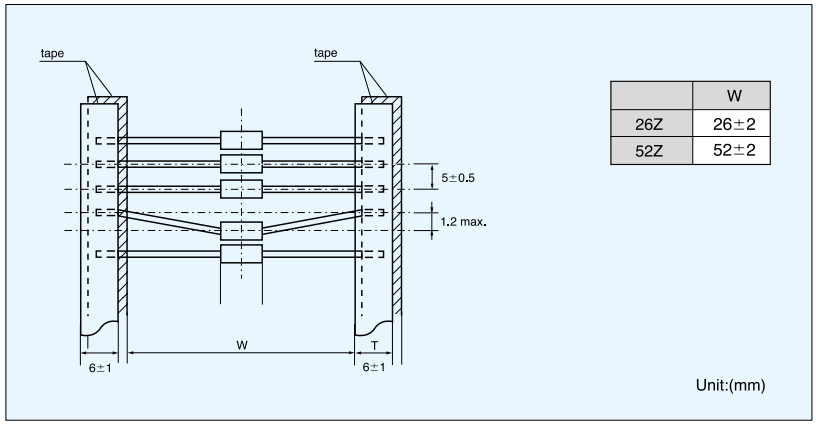


Dimensions



To allow automatic insertion, this product can be taped.

Taping Specification



	W
26Z	26±2
52Z	52±2

Specifications

Part No.	Rated zero-power resistance			temperature (°C)	B value*2	Dissipation factor (mW/°C) Approx.	Thermal time constant(s)*3 Approx.	Rated Electricity mW at 25°C	Category temp. range(°C)	Lead wire	Packing Method
	temperature*1 (°C)	resistance	tolerance								
252CT-4	25	2.50kΩ	±5%	25/85	3670K±2%	2.1	10~20	10.5	−50~+250	Nickel plate	Individually packed
512CT-4		5.10kΩ			3200K±2%				−50~+200		
562CT-4		5.60kΩ			3200K±2%						
912CT-4		9.10kΩ			3270K±2%				−50~+250		
103CT-4		10.0kΩ			3270K±2%						
113CT-4		11.0kΩ			3270K±2%						
203CT-4		20.0kΩ			3410K±2%						
473CT-4		47.0kΩ			3610K±2%						
513CT-4		51.0kΩ			3610K±2%						
563CT-4		56.0kΩ			3610K±2%						
104CT-4		100kΩ			3450K±2%						
204CT-4		200kΩ			3500K±2%						
252CT-20218	0	7.881kΩ	±3%	25/50	3745K±2%				−40~+150	Tin plate	52mm taping
103CT-11005	25	10.0kΩ	±2%	25/50	3680K±2%				−30~+150		26mm taping
103CT-21048	25	10.0kΩ	±3%	25/85	4100K±2%				−40~+150		Individual
103CT-01006	25	10.0kΩ	±5%	25/85	3900K±2%				−30~+150		26mm taping
103CT-20217	0	30.0kΩ	±3%	25/50	3434K±2%				−40~+150		52mm taping
503CT-91027	50	19.727kΩ	±2.5%	25/85	3992K±2%						26mm taping
104CT-90113	25	100.0kΩ	±5%	25/85	4070K±2%						52mm taping
503CT-90083	85	5.911kΩ	±3%	25/85	3800K±2%				−40~+250	Nickel plate	Individual

*1 Rated zero power resistance at each temperature.
*2 B value : determined by rated zero-power resistance at each temperature.
*3 Time when thermistor reaches 63.2% of the temperature difference. The value is measured in the air.

THERMOPILE

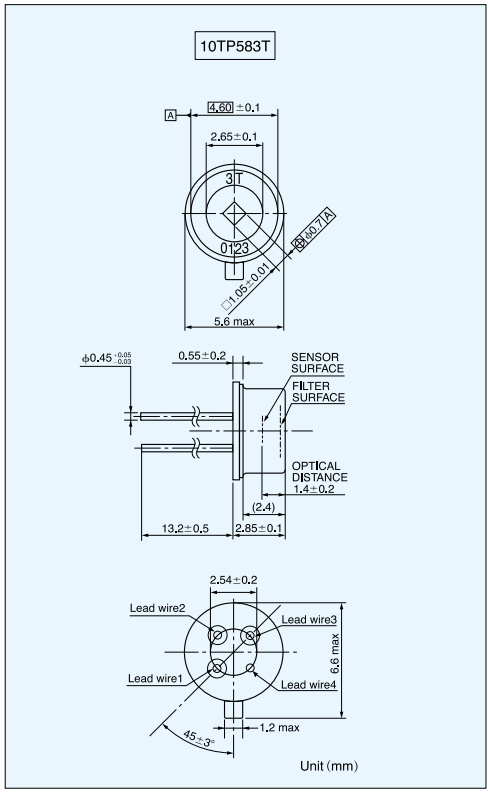
Thermopile type Infrared sensor
utilizing own silicon micromachining
technology.
Applications: Tympanic thermometer
Microwave oven
Non contact temperature measurement



Part number

Part No.	type	Thermistor
10TP583T	TO18	Built-in

Dimensions



Ratings

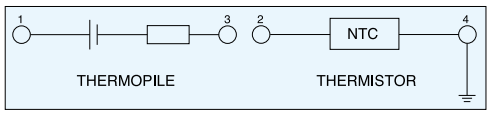
Parameters	Value	Unit	Conditions
	10TP583T		
Sensitive area	1.05×1.05	mm^2	Size of Absorbing Film
*1 Responsivity	15±30%	V/ W	
*1 Output Voltage	200±30%	μV	
*2 Output Voltage	1.00±30%	mV	
*1 Temperature Coefficient of Responsivity	0.02±0.02	% / °C	Reference
Thermopile Resistance	65±30%	kΩ	
Temperature Coefficient of Thermopile Resistance	±0.1	% / °C	
Johnson Noise Voltage	33	nV/ $\sqrt{Hz}$	Johnson Noise r.m.s.,298K 1Hz Typical
*1 S/N Ratio	75.7	dB	Output Voltage/Johnson Noise, Typical
*1 Noise Equivalent Power	2.2	nW/ $Hz^{1/2}$	Typical
*1 Specific Detectivity	4.7×10^{7}	cm·$Hz^{1/2}$/ w	Typical
Time Constant	15	ms	Typical
Operating Temperature range	−20~+100	°C	
Strage Temperature range	−40~+100	°C	
Filter Range	Cut on 5	μm	Standard
Field of View	±50	deg.	Incident Angle to Achieve 50% Responsivity
Insulation Resistance	≧500	MΩ	Application of DC25V
Sealing	≦1×10^{-9}	Pa·m^3/ s	
*3 Thermistor Resistance Value	100±3%	kΩ	Rated Zero-power Resistance Value at 25°C
*3 Thermistor B-Value	3435±0.7%	K	
*3 Thermistor Rated Power	0.5	mW	at 25°C

*1 Test Condition
Blackbody Temperature : 500K
Sensor-Blackbody Distance : 100mm
Sensor Temperature : 298K
Aperture size : ϕ12.7mm

*2 Test Condition
Blackbody Temperature : 310K
Sensor Temperature : 298K

*3 Built-in Type

Conections



NC SENSOR

NC SENSOR is the remote temperature sensor consisting of two precision thermistors.





1.Features

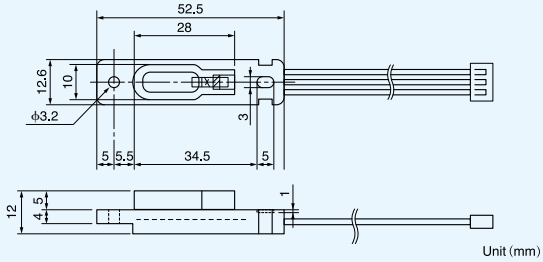
· Larger output in comparison with other IR sensors.
· Operating temperature of up 150°C.
· Minimum negative influence caused by a dew and/or dust.

2.Applications

· Temperature measurement of the LBP and PPC heat-roller.
· Any other measurement requiring the remote-sensing.

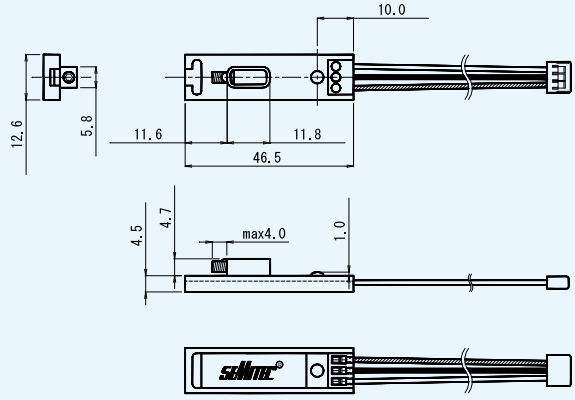
3. Dimensions

F16-type



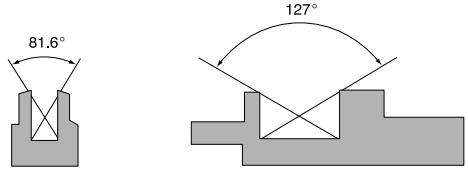
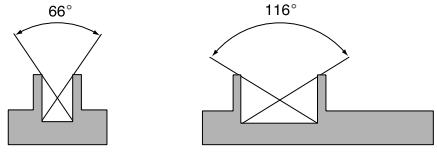
Unit (mm)

F10-type



Unit (mm)

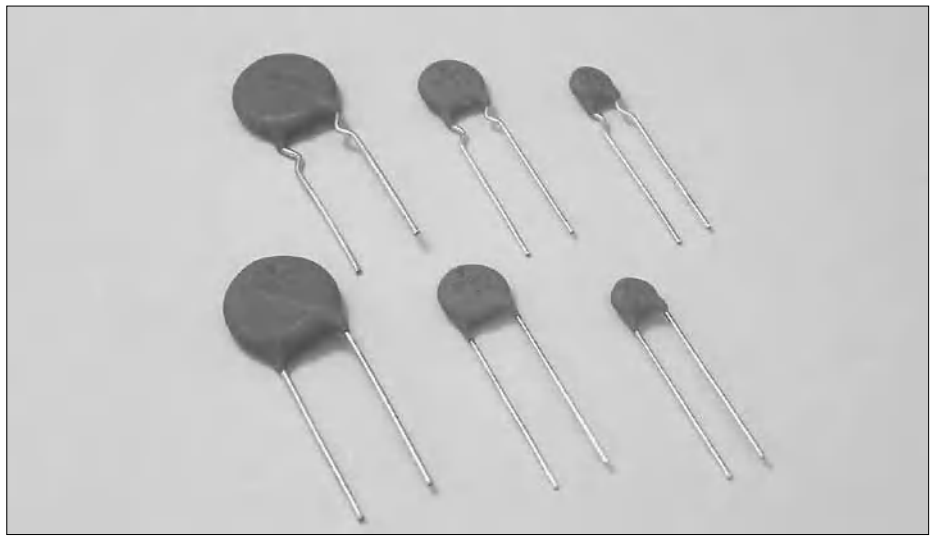
4.Specifications

Parameters	F16-type		F10-type	
	Performance	Conditions	Performance	Conditions
Accuracy Temperature	180°C±3°C	Blackbody Temperature : 180°C Thermal Emissivity : 0.96 Compensation Temperature : 100°C Roller Size : ϕ40mm Test Distance : 5mm Resistor Connected : 33.0kΩ Power Line Voltage : DC 5.000V	180°C±3°C	Blackbody Temperature : 180°C Thermal Emissivity : 0.96 Compensation Temperature : 100°C Roller Size : ϕ40mm Test Distance : 5mm Resistor Connected : 33.0kΩ Power Line Voltage : DC 5.000V
Field of View Field of View 1 Field of View 2	 Field of View 1 Field of View 2		 Field of View 1 Field of View 2	
Operating Temperature Range	−10°C~+150°C			
Temperature Detection Range	−10°C~+260°C			

The NC SENSOR is a custom-made product. Please consult our sales staff.

POWER THERMISTOR

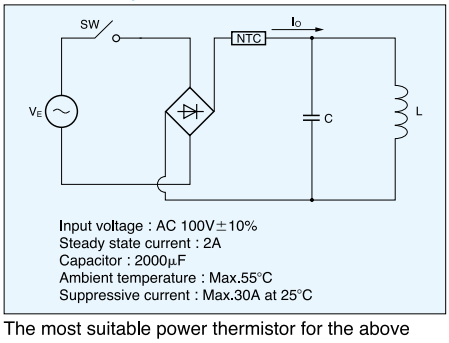
The POWER THERMISTOR is a device for suppressing inrush current to an electric circuit. Circuits including electric bulbs or capacitors induce a inrush current more than 100 times the normal current when the circuit switch is turned on. The POWER THERMISTOR in the circuits protects electric equipments from being damaged by limiting the inrush current.



Application

The power thermistor will suppress inrush current which is caused by a capacitor, filament for a bulb, inverter for fluorescent lamp, a heater and etc., also will control fan motor speed of cooler for electric circuit.
It is developed to use for power supply of TV, VCR instead of cement resistor.

How to use the power thermistor



Input voltage : AC 100V±10%
Steady state current : 2A
Capacitor : 2000μF
Ambient temperature : Max.55°C
Suppressive current : Max.30A at 25°C

The most suitable power thermistor for the above circuit is required to fulfill the following terms and conditions.

1. The permissible current at ambient temperature of 55°C should be over 2A.
2. The thermistor resistance for suppressive current which becomes below 30A should be over 4.2 ohm from the under-mentioned formula.

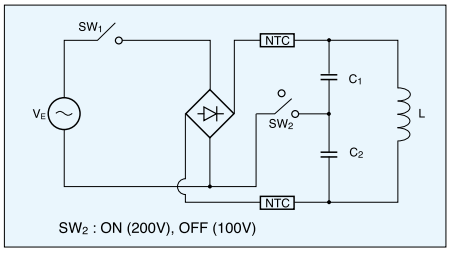
$$\frac{\sqrt{2}\,V_E \times 1.1}{R_C + R_{25}} \leqq 30$$

R_C : Internal resistance value in the circuit is 1 ohm (100V/100A)
R_{25} : Rated zero-power resistance at 25°C

3. Max. capacitance shall be over 2000μF at AC 100V.

Accordingly, suitable thermistors are 6D2-22, 5D2-18 and 8D2-18, and if we consider in the points of small time constant which means a small size and large effect for suppressive current which means large rated zero-power resistance, 8D2-18 is the most suitable one.

Use the following circuit in the power supply for 100V and 200V.



SW_2 : ON (200V), OFF (100V)

Thermal time constant

If ambient temperature of a thermistor is changed from T_1 to T_2 suddenly, temperature of the thermistor changes slowly.
The time constant means the time when temperature of the thermistor reaches 63% of the temperature difference.

Residual resistance

If current is flowed through a thermistor, any heat will be generated in the thermistor by which its resistance will be decreased, however, a decrease of a resistance will be stabilized at a saturation resistance value which is determined by impressed electric power and a dissipation constant. The residual resistance value means maximum saturation resistance value when the maximum permissible current is flowed through the thermistor.

Temperature coefficient α

The temperature coefficient of a thermistor is expressed by the following equation ;

$$\alpha = -\frac{B}{T_2} \times 100\ (\%/^\circ C)$$

Dissipation factor

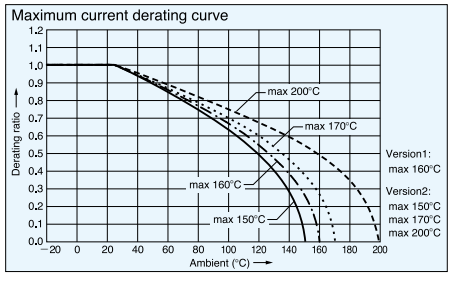
If small voltage is applied to a thermistor, small current will flow which produce enough heat in the thermistor. Dissipation factor is electric power which make 1°C raise by heat in a thermistor.

$$\delta = \frac{P}{\Delta t}\ (mW/^\circ C)$$

P is applied electric power.
Δt is rised temperature of the thermistor.

Maximum permissible current

If the maximum permissible current flows to a thermistor at 25°C, temperature of the thermistor rises to 200°C, (160°C). When ambient temperature is above 25°C, the maximum permissible current shall be over reduced as the maximum permissible current reduction curve.



Reliability tests

Version1

Dry heat test

Test sample is exposed in air at 160°C for 1,000 hours. ΔR25/R25 ±15%

Damp heat test

Test sample is exposed in atmosphere of 95%RH at 40°C for 1,000 hours. ΔR25/R25 ±15%

Load test

Test sample is applied the maximum rating current in air at 25°C for 1,000 hours. ΔR25/R25 ±15%

Change of temperature

Test sample is given 10 times of the following temperature cycle,
→ −40°C for 30 minutes → room temperature for 5 minutes →
→ 160°C for 30 minutes → room temperature for 5 minutes.
ΔR25/R25 ±15%

Version2

Dry heat test

Test sample is exposed in air at 150°C～200°C for 1,000 hours. ΔR25/R25 ±20%

Damp heat test

Test sample is exposed in atmosphere of 95%RH at 40°C for 1,000 hours. ΔR25/R25 ±15%

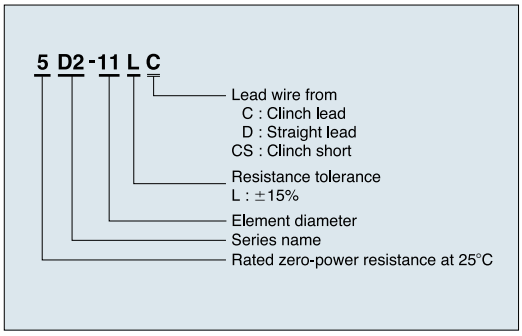
Load test

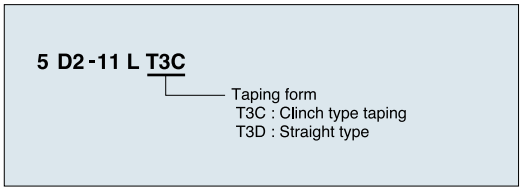
Test sample is applied the maximum rating current in air at 25°C for 1,000 hours. ΔR25/R25 ±20%

Change of temperature

Test sample is given 10 times of the following temperature cycle,
→ −40°C for 30 minutes → room temperature for 5 minutes →
→ 160°C for 30 minutes → room temperature for 5 minutes.
ΔR25/R25 ±15%

Part number





Applications

- Switching power supply
- Adapter
- LC, Plasma TV, DVD player
- AV, home electricity, Air-con
- OA, printer, PC

etc.

Acquisition Standard

UL1434 File No. E92669

Specifications : D2 Series Version 1

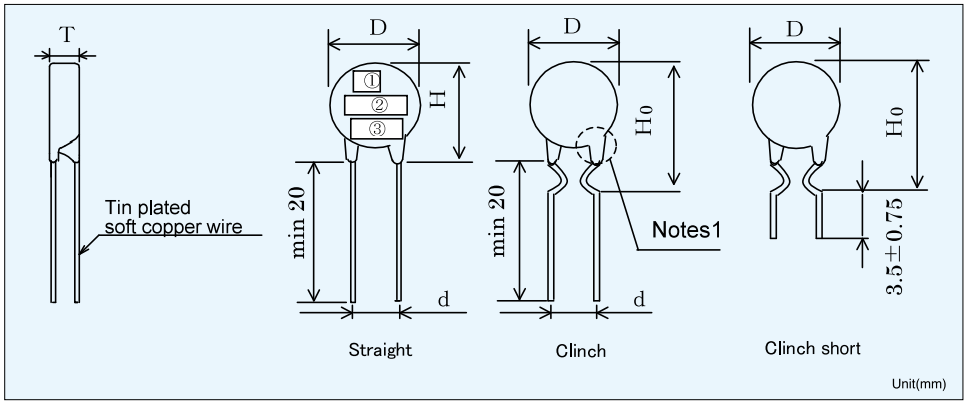
Part No.	Rated zero-power resistance (±15%)	Dissipation factor	Thermal time constant	Maximum current at 25°C	Residual resistance	Maximum permissible capacitance		Category temperature range
	[Ω]	[mW/°C]	[S]	[A]	[Ω]	AC.100V	AC.220V	(°C)
5D2-07 □ □	5.0	(30)	(35)	3.0	0.36	400	80	−40~+160
8D2-07 □ □	8.0		(41)	2.0	0.58	560	110	
10D2-07 □ □	10.0		(45)		0.72	680	140	
12D2-07 □ □	12.0		(41)	1.7	0.78	380	80	
16D2-07 □ □	16.0		(45)	2.0	1.04	800	160	
22D2-07 □ □	22.0		(50)	1.0	1.43	960	190	
2D2-10 □ □	2.0	(32)	(50)	5.0	0.15	1640	330	
3D2-10 □ □	3.0		(53)	4.0	0.22	1720	350	
5D2-10 □ □	5.0		(53)		0.33	1440	290	
8D2-10 □ □	8.0		(70)	3.0	0.52	1560	320	
10D2-10 □ □	10.0		(75)		0.65	1640	330	
12D2-10 □ □	12.0		(53)	1.8	0.71	830	170	
16D2-10 □ □	16.0		(70)	1.6	0.94			
2D2-14 □ □	2.0	(36)	(90)	5.0	0.15	4200	860	
3D2-14 □ □	3.0		(80)		0.20	3080	630	
4D2-14 □ □	4.0		(95)		0.26	3400	700	
5D2-14 □ □	5.0		(110)	4.0	0.33	3600	740	
8D2-14 □ □	8.0		(80)	2.5	0.47	1390	280	
10D2-14 □ □	10.0		(95)	2.2	0.59	1790	370	
12D2-14 □ □	12.0		(105)	2.0	0.71	2190	450	
16D2-14 □ □	16.0		(115)	1.8	0.94	2790	570	

*The rated values in "Dissipation factor" and "Thermal time constant" are for reference.

Specifications : D2 Series Version 2

Part No.	Rated zero-power resistance (±15%)	Dissipation factor	Thermal time constant	Maximum current at 25°C	Residual resistance	Maximum permissible capacitance		Category temperature range	Rated B-value (±5%)
	[Ω]	[mW/°C]	[S]	[A]	[Ω]	AC.100V	AC.220V	(°C)	[K]
5D2-05 □ □	5.0	(15)	(20)	2.0	0.48	860	170	−50～+150	2650
10D2-05 □ □	10.0	(7)		1.0	0.91				2700
20D2-05 □ □	20.0	(1)		0.3	1.66				2800
5D2-08 □ □	5.0	(22)	(35)	3.0	0.35	1260	260	−50～+170	2700
10D2-08 □ □	10.0	(17)		2.0	0.63				2800
15D2-08 □ □	15.0	(26)			0.94	2880	590		2800
20D2-08 □ □	20.0	(8)		1.0	1.13				2900
2D2-11 □ □	2.0	(26)	(40)	5.0	0.15	2700	550	−50～+170	2650
3D2-11 □ □	3.0	(24)		4.0	0.22	4830	990		2650
4D2-11 □ □	4.0	(31)			0.28	2880	590		2700
5D2-11 □ □	5.0	(39)			0.35	2700	550		2700
8D2-11 □ □	8.0	(31)		3.0	0.50				2800
10D2-11 □ □	10.0	(42)		3.1	0.63	2880	590		2800
12D2-11 □ □	12.0	(21)		2.0	0.75	4030	830		2800
15D2-11 □ □	15.0	(34)		2.5	0.80	2880	590		2950
16D2-11 □ □	16.0	(37)			0.86				2950
20D2-11 □ □	20.0	(28)		2.0	1.02				3000
1D2-13 □ □	1.0	(12)	(55)	6.0	0.06	860	170	−50～+200	2650
2D2-13 □ □	2.0	(21)			0.10				2700
4D2-13 □ □	4.0	(24)		5.0	0.18				2800
4.7D2-13 □ □	4.7	(26)			0.18	2700	550		2900
5D2-13 □ □	5.0	(27)			0.19				2900
8D2-13 □ □	8.0	(25)		4.0	0.27	2880	590		3000
10D2-13 □ □	10.0	(29)			0.32				3050
12D2-13 □ □	12.0	(37)			0.41	4830	990		3000
15D2-13 □ □	15.0	(25)		3.0	0.48				3050
16D2-13 □ □	16.0	(26)			0.51				3050
1D2-15 □ □	1.0	(22)	(70)	8.0	0.06	6910	1420	−50～+200	2650
1.5D2-15 □ □	1.5	(29)			0.08				2650
2D2-15 □ □	2.0	(37)			0.10				2700
3D2-15 □ □	3.0	(36)		7.0	0.13	4030	830		2800
4D2-15 □ □	4.0	(48)			0.18				2800
4.7D2-15 □ □	4.7	(37)		6.0	0.18				2900
5D2-15 □ □	5.0	(39)			0.19				2900
8D2-15 □ □	8.0	(39)		5.0	0.27				3000
10D2-15 □ □	10.0	(49)			0.34	5760	1190		3000
12D2-15 □ □	12.0	(54)			0.39				3050
15D2-15 □ □	15.0	(41)		4.0	0.45				3100
16D2-15 □ □	16.0	(44)			0.48				3100
4D2-18 □ □	4.0	(59)	(90)	8.0	0.16	6910	1420	−50～+200	2900
5D2-18 □ □	5.0	(66)			0.18				2950
8D2-18 □ □	8.0	(53)		6.0	0.26				3050
10D2-18 □ □	10.0	(62)			0.30				3100
47D2-18 □ □	47.0	(21)		2.0	0.94				3450
3D2-22 □ □	3.0	(48)	(130)	8.0	0.13	12600	2610	−50～+200	2800
4D2-22 □ □	4.0	(59)			0.16				2900
6D2-22 □ □	6.0	(43)		6.0	0.21				3000

Dimentions



①: Trade mark **5** ②: Part.No. (Notes 2) ③: Lot.No.

Notes1 : In case of adding strength to lead wire from the side, it may occur crack and fragment at a part of pants legs.

Notes2 : In case of D2-05, Marking is Resistance and D2. (example) 5D2-05…「5D2」

Dimensions Version 1

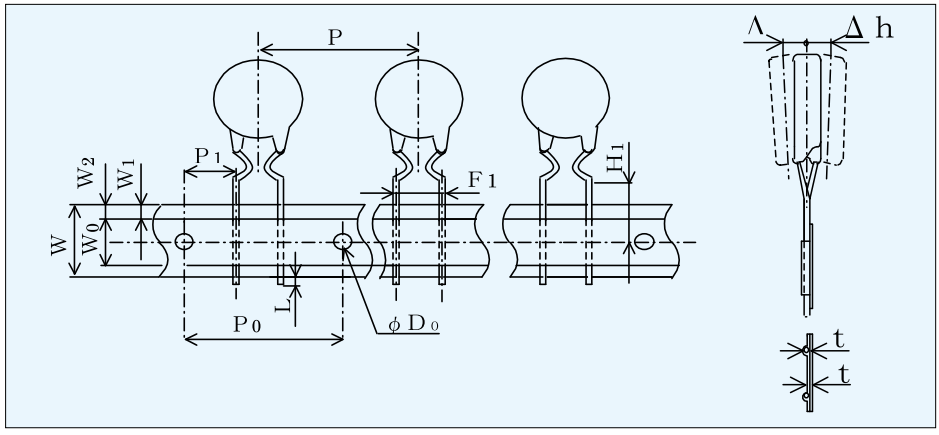
Part No.	Dimensions [mm]					
	D	H	T	d	H0	lead wire
□D2-07 □ □	max. 11.0	max. 13.0	max. 9.0	5.0±1.0	max. 16.0	(ϕ0.8)
□D2-10 □ □	max. 13.0	max. 17.0			max. 19.5	
□D2-14 □ □	max. 17.0	max. 21.0		7.5±1.0	max. 22.5	

Dimensions Version 2

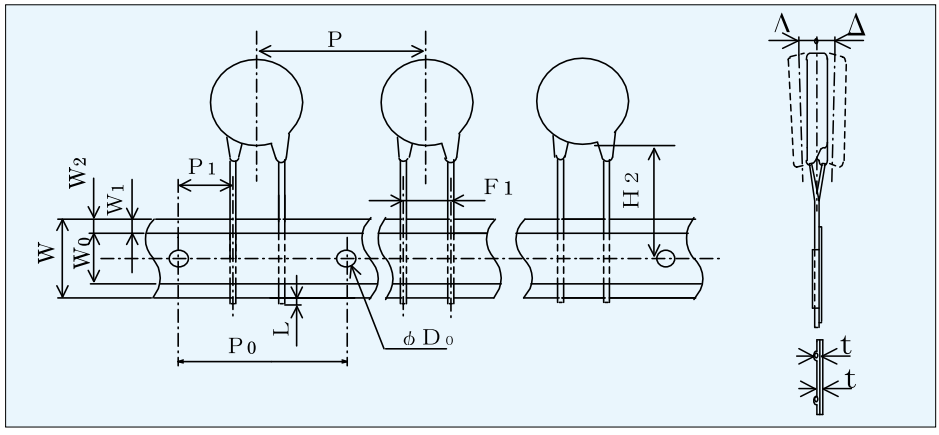
Part No.	Dimensions [mm]					
	D	H	T	d	H0	lead wire
□D2-05 □ □	max 8.5	max 11.5	max. 7.0	5.0±1.0	max 15.5	(ϕ0.8)
□D2-08 □ □	max 10.0	max 13.0			max 17.0	
□D2-11 □ □	max 11.5	max 15.0	max. 8.0	7.5±1.0	max 18.5	
□D2-13 □ □	max 14.5	max 18.0			max 21.5	
□D2-15 □ □	max 16.5	max 20.0		10.0±1.0	max 23.0	(ϕ1.0)
□D2-18 □ □	max 19.5	max 23.0			max 26.0	
□D2-22 □ □	max 23.0	max 26.5	max. 8.5		max 29.5	

Taping

Clinch type taping : T3C



Straight type taping : T3D



Taping qty

version 1

D2-07 D2-10	1,000pcs/box
D2-14	(Part 500pcs/box)

version 2

D2-05 D2-08 D2-11	1,000pcs/box
D2-13	(Part 500pcs/box)

Dimensions (Version 1)

Unit(mm)

	P	P0	P1	W	W0	W1	W2	H1
D2-07	15.0±1.0	15.0±3.0	5.0±0.7	17.5～19.0	min5.0	9.0±0.5	max3.0	16.0±0.5
D2-10	15.0±1.0							
D2-14	30.0±1.0		3.75±0.7					
	H2	L	F1	ϕD0	t	t1	Δh	
D2-07	19.0～21.5	max1.0	5.0±0.5	4.0±0.2	0.6±0.3	max1.5	0±2.0	
D2-10								
D2-14			7.5±0.5					

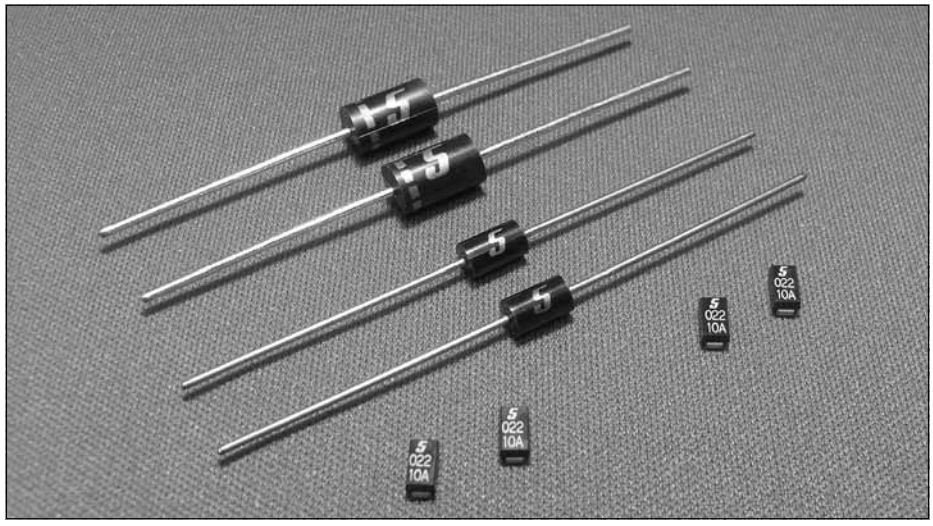
Dimensions (Version 2)

	P	P0	P1	W	W0	W1	W2	H1
D2-05	15.0±1.0	15.0±3.0	5.0±0.7	17.5～19.0	min5.0	9.0±0.5	max3.0	16.0±0.5
D2-08	15.0±1.0							
D2-11	15.0±1.0		3.75±0.7					
D2-13	30.0±1.0							
	H2	L	F1	ϕD0	t	t1	Δh	
D2-05	19.0～21.5	max1.0	5.0±0.5	4.0±0.2	0.6±0.3	max1.5	0±2.0	
D2-08								
D2-11			7.5±0.5					
D2-13								

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 taping winding type
- 52R : Axial taping relay type
- FT : Radial form taping 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 10μA DC.

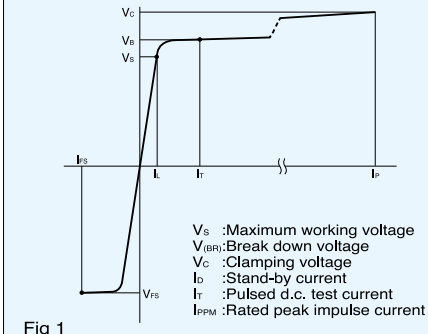


Fig 1

Taping

One of standard taping is as shown in Figure.

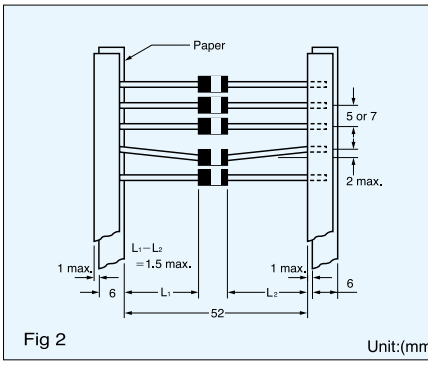


Fig 2 Unit:(mm)

Taping qty

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

Vc: 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.

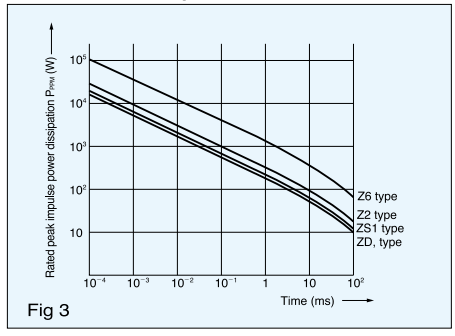


Fig 3

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.

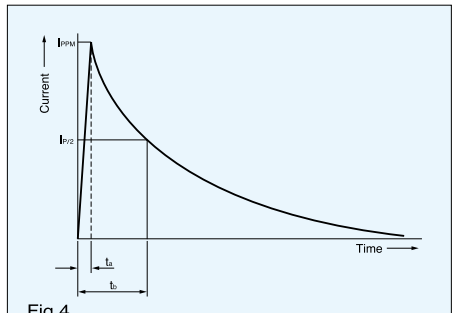


Fig 4

Surge suppression characteristics

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

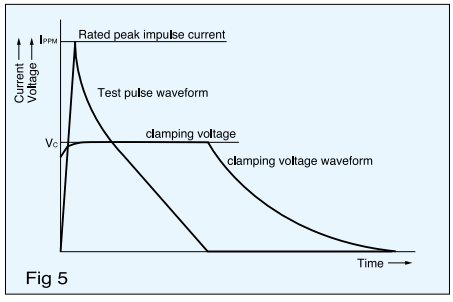


Fig 5

Power derating

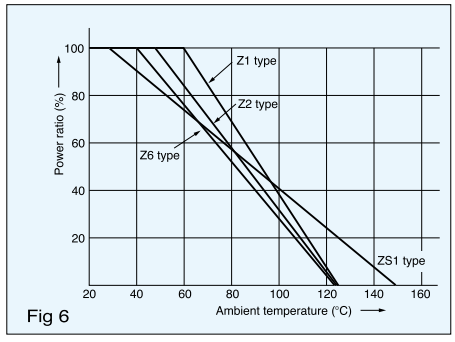


Fig 6

Z2 type VRD has bipolar or unipolar electrical characteristics.

Maximum ratings

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

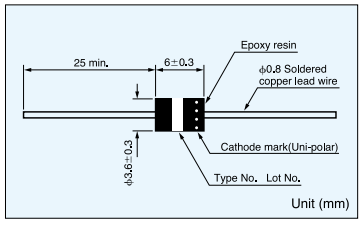
Rated average power dissipation:1W

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_D 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
						10/1000μs		8/20μs			
Bi-polar type	Uni-polar type					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		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			10.8-13.2						0.074	1580
Z2015	–	12.1		13.5-16.5		22.0	22.7	28.4	213	0.075	640
–	Z2015U			13.5-16.5						0.079	1280
Z2018	–	14.5		16.2-19.8		26.5	18.8	34.0	178	0.079	520
–	Z2018U			16.2-19.8						0.083	1040
Z2022	–	17.8		19.8-24.2		31.9	15.7	41.2	147	0.082	420
–	Z2022U			19.8-24.2						0.086	840
Z2027	–	21.8		24.3-29.7		39.1	12.8	50.5	120	0.085	340
–	Z2027U			24.3-29.7						0.089	680
Z2033	–	26.8		29.7-36.3		47.7	10.5	61.7	98.2	0.087	280
–	Z2033U			29.7-36.3						0.092	560
Z2039	–	31.6		35.1-42.9		56.4	8.86	73.0	83.0	0.090	240
–	Z2039U			35.1-42.9						0.095	480
Z2047	–	38.1	5	42.3-51.7	1	67.8	7.37	88.0	68.9	0.092	200
–	Z2047U			42.3-51.7						0.097	400
Z2056	–	45.4		50.4-61.6		80.5	6.21	105.0	57.7	0.094	160
–	Z2056U			50.4-61.6						0.099	320
Z2068	–	55.1		61.2-74.8		98.0	5.10	127.0	47.7	0.096	130
–	Z2068U			61.2-74.8						0.100	260
Z2082	–	66.4		73.8-90.2		118.0	4.24	153.0	39.6	0.099	110
–	Z2082U			73.8-90.2						0.102	220
Z2100	–	81.0		90.0-110		144.0	3.47	187.0	32.4	0.101	90
–	Z2100U			90.0-110						0.104	180
Z2120	–	97.2		108-132		173.0	2.89	222.0	27.3	0.103	75
–	Z2120U			108-132						0.106	150
Z2150	–	121.0		135-165		215.0	2.32	277.0	21.9	0.105	60
–	Z2150U			135-165						0.107	120
Z2180	–	146.0		162-198		258.0	1.94	333.0	18.2	0.106	49
–	Z2180U			162-198						0.108	98

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

Part No.		Stand-off voltage V_S V	Stand-by current I_D 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			
Bi-polar type	Uni-polar type					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		5	10.8-13.2						0.074	8800
Z6015	–	12.1		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.

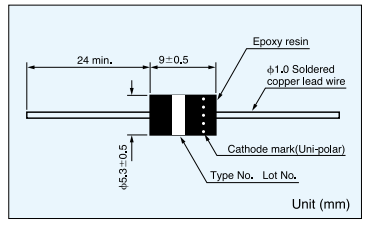
Maximum ratings
Rated peak impulse power dissipation
:1.5kW(10/1000μs)
18.0kW (8/20μs)
Rated average power dissipation:2W
Operating and storage temperature
:−40°C to 125°C
Symbol mark

Bi-polar



Uni-polar



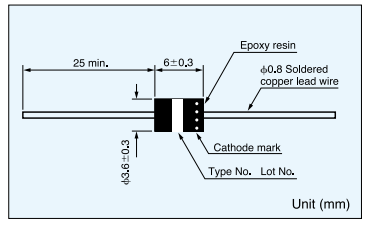


VRD part No.	Stand-off voltage V_S V	Stand-by current I_D μA	Breakdown voltage $V_{(BR)}$ V	Pulsed d.c. test current I_T mA	Clamping Voltage & Rated peak impulse current				Max. temp. coef. %/°C	Capacitance (TYP) pF
					10/1000μs		8/20μs			
					V_C V	I_{PPM} A	V_C V	I_{PPM} A		
ZD015	11.4	10	12.8-17.2	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(10/1000μs)
3.00 kW (8/20μs)
Rated average power dissipation:500 mW
Operating and storage temperature
:−40°C to 125°C
Symbol mark





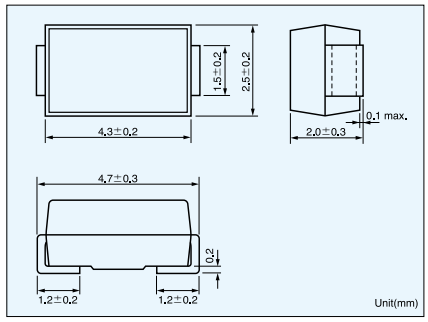
SMD VRD

Part number

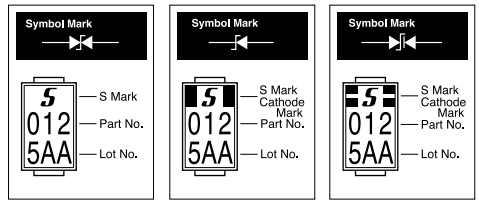
ZS 1 033 D-T

- Taping
- Nil : Bi-Polar
- U : Uni-Polar
- D : High-Reverse voltage type
- Break down voltage
- Steady state power
- SMD type

Dimensions

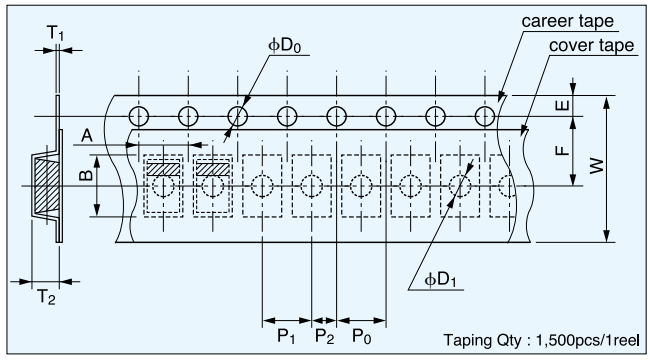


Marking



	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}					C
	It=1mA	D.C.	V_S	10/1000μs		8/20μs		25°C~50°C	
	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	$V_C$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
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

CURRENT REGULATIVE DIODE

CRD

CRD is a diode which supplies constant current to an electric circuit, even when power supply voltage fluctuations or load impedance fluctuations occur.
CRD is used for current stabilization and current limiting.

Part number

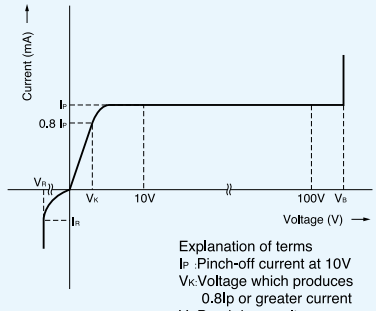
□ 102 □

Packing condition
None : E Series, Individually packed in a bag
26Z : E Series, 26mm wide axial taping winding type
26R : E Series, 26mm wide axial taping role type
52Z : E Series, 52mm wide axial taping winding type
52R : E Series, 52mm wide axial taping role type
RE : E Series, Radial taping winding type
T : S Series, Taping role

Pinch off current
e.g.) : 301⇒30×10¹μA=0.3mA
102⇒10×10²μA=1.0mA
452⇒45×10²μA=4.5mA

E : Lead wire type
S : SMD type

Basic characteristics



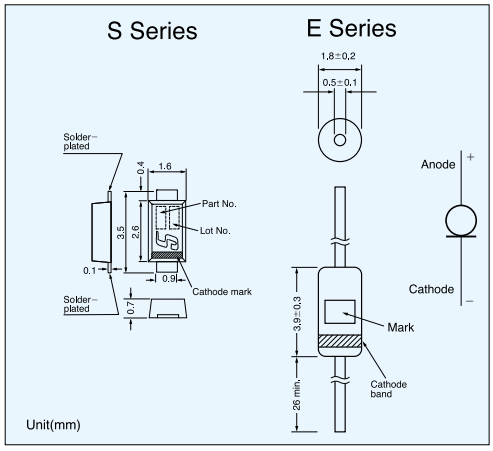
Explanation of terms
I_P :Pinch-off current at 10V
V_K:Voltage which produces 0.8Ip or greater current
V_B:Breakdown voltage
I_R :Permitted reverse current

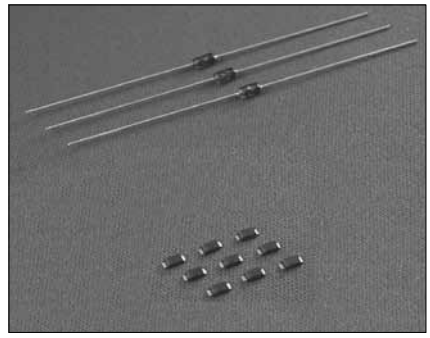
Ratings

	E series	S series
Rating power	300mW	500mW
Rated voltage (Pulse wave)	100V(E-101~E-562)	100V(S-101T~S-562T)
	50V(E-822~E-183)	50V(S-822T~S-183T)
Reverse current	50mA	
Junction temp	150°C	
Operating temp	−30°C~150°C	−40°C~150°C

Maximum rating voltage

Part No.	Voltage	Part No.	Voltage
E101~E-562	100V	S-101T~S-562T	100V
E-822	30	S-822T	50
E-103		S-103T	
E-123		S-123T	
E-153	25	S-153T	
E-183		S-183T	40





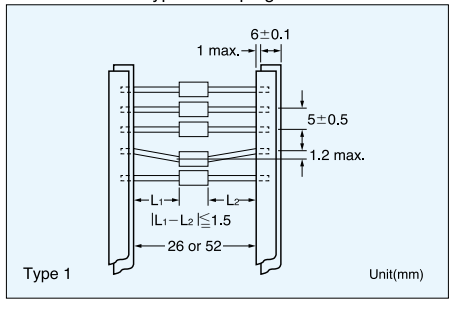
Specifications

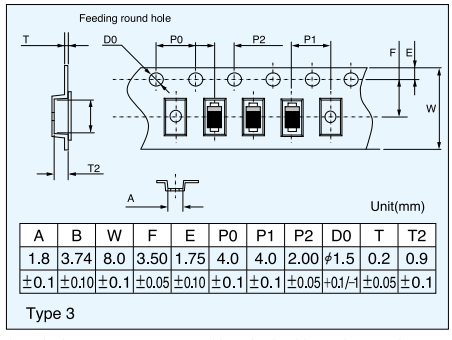
Part No.		Pinch-off current*1			Limiting current*2		Limiting current ratio $I_{100V}/Ip^*I_{30V}/Ip$	Temperature*3 Coefficient (%/°C)
SMD	With Lead	Test Voltage	Ip(mA) Typical	min~max	V_K(V)	I_K(mA)		
S-101T	E-101	10V	0.10	0.05~0.21	0.5	0.8 Ipmin	1.1max	+2.10~+0.10
S-301T	E-301		0.30	0.20~0.42	0.8			+0.40~−0.20
S-501T	E-501		0.50	0.40~0.63	1.1			+0.15~−0.25
S-701T	E-701		0.70	0.60~0.92	1.4			0.00~−0.32
S-102T	E-102		1.00	0.88~1.32	1.7			−0.10~−0.37
S-152T	E-152		1.50	1.28~1.72	2.0			−0.13~−0.40
S-202T	E-202		2.00	1.68~2.32	2.3			−0.15~−0.42
S-272T	E-272		2.70	2.28~3.10	2.7			−0.18~−0.45
S-352T	E-352		3.50	3.00~4.10	3.2			−0.20~−0.47
S-452T	E-452		4.50	3.90~5.10	3.7			−0.22~−0.50
S-562T	E-562		5.60	5.00~6.50	4.5			−0.25 ~−0.53
S-822T	E-822		8.20	6.56~9.84	3.1		*1.0max	−0.25 ~−0.45
S-103T	E-103		10.0	8.00~12.0	3.5			−0.25 ~−0.45
S-123T	E-123		12.0	9.60~14.4	3.8			−0.25 ~−0.45
S-153T	E-153		15.0	12.0~18.0	4.3			−0.25 ~−0.45
S-183T	E-183		18.0	16.0~20.0	4.6			−0.25 ~−0.45

*1,*2 Pinch-off current limiting current are measured by impulse wave at 25°C
*3 Temperature coefficient is measured between 25°C and 50°C.
*I_{30}/Ip

Taping

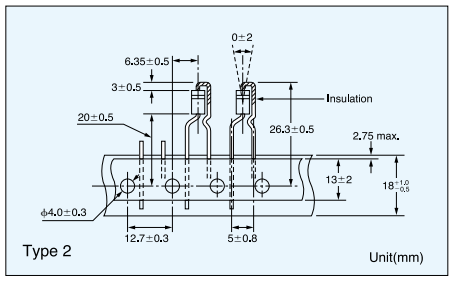
There are three Types for taping.





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

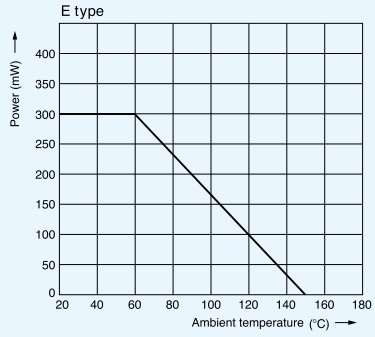
*In principal elements are set with cathode side on the round hole side.

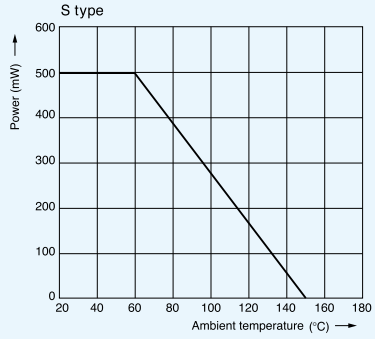


Minimum taping quantity for

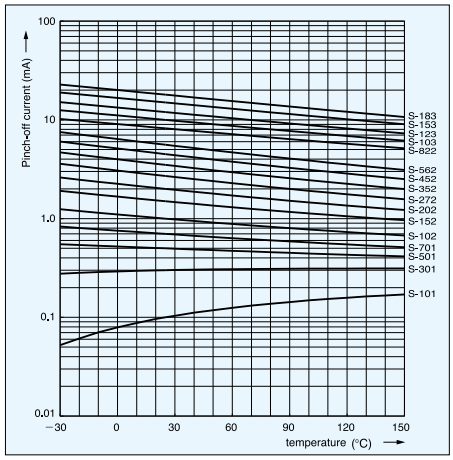
Type 1 Roll·····5000pcs
Box·····2500pcs
Type 2 4000pcs
Type 3 3000pcs

Power derating





Pinch-off current Temperature

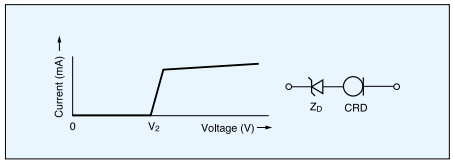


CRD in parallel

The use of CRD in parallel increases their current handling capabilities.

Increasing the voltage range using a zener diode

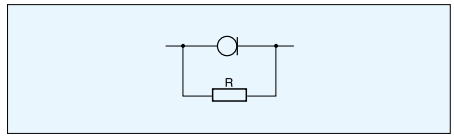
Connecting zener diodes in series with the line ensures that the current is constant in high-voltage area.



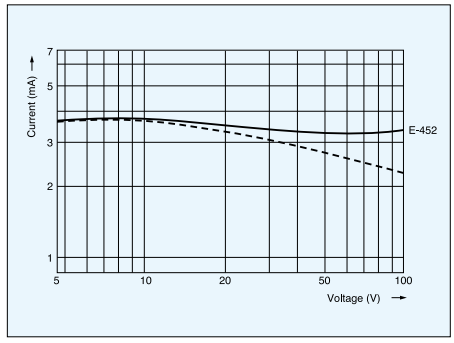
The compensation of current reduction due to self heating

Placing resistors in parallel with CRD can correct any current decrease when the applied voltage increases. The following values are typical for correction resistors.

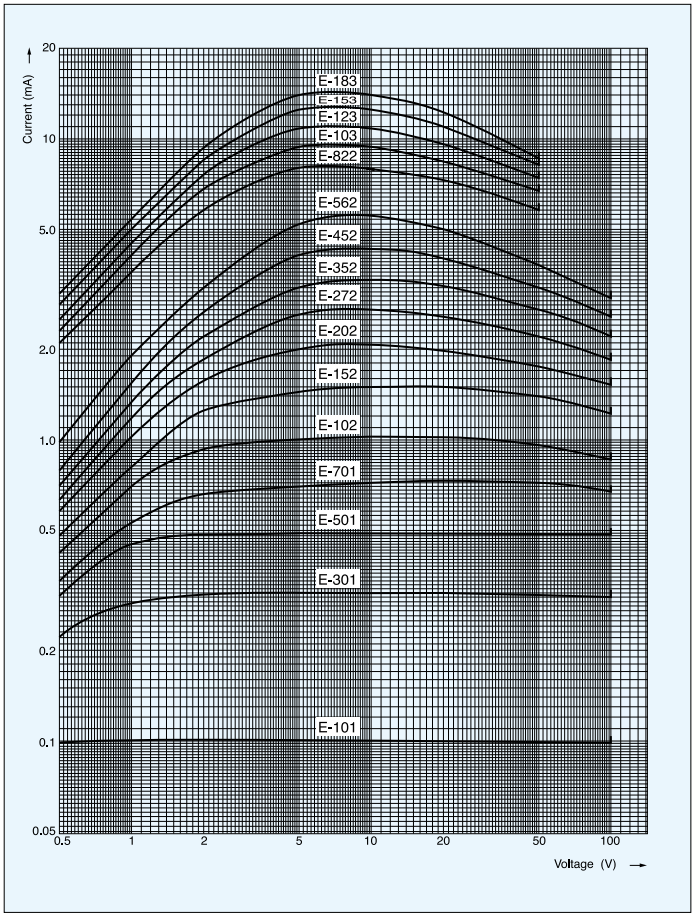
E-102	1MΩ	E-352	82kΩ
E-152	390kΩ	E-452	56kΩ
E-202	240kΩ	E-562	39kΩ
E-272	120kΩ		

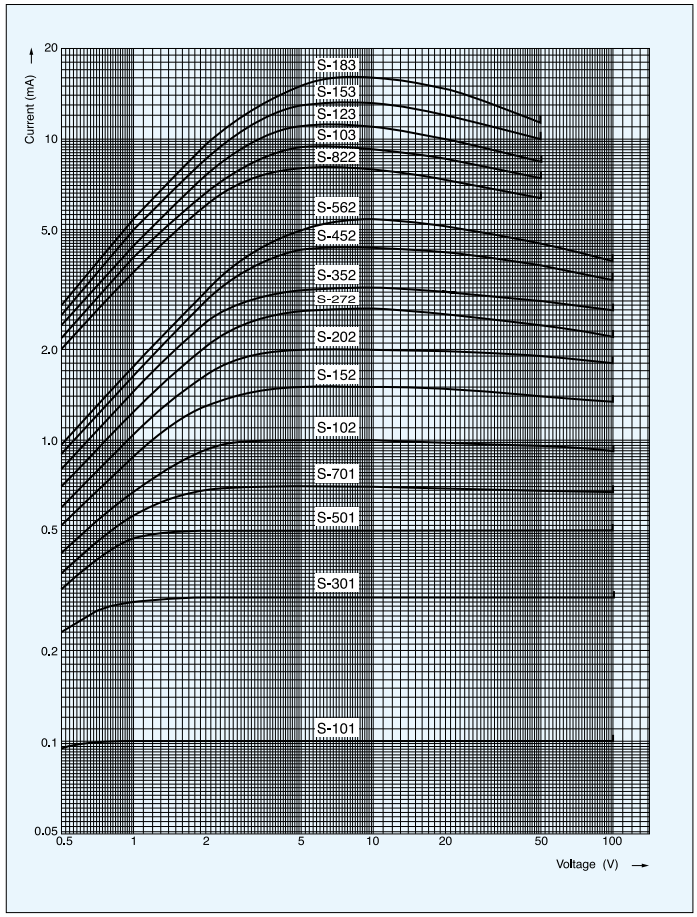


Compensative resistor is not necessary if the current value is less than 1 mA.



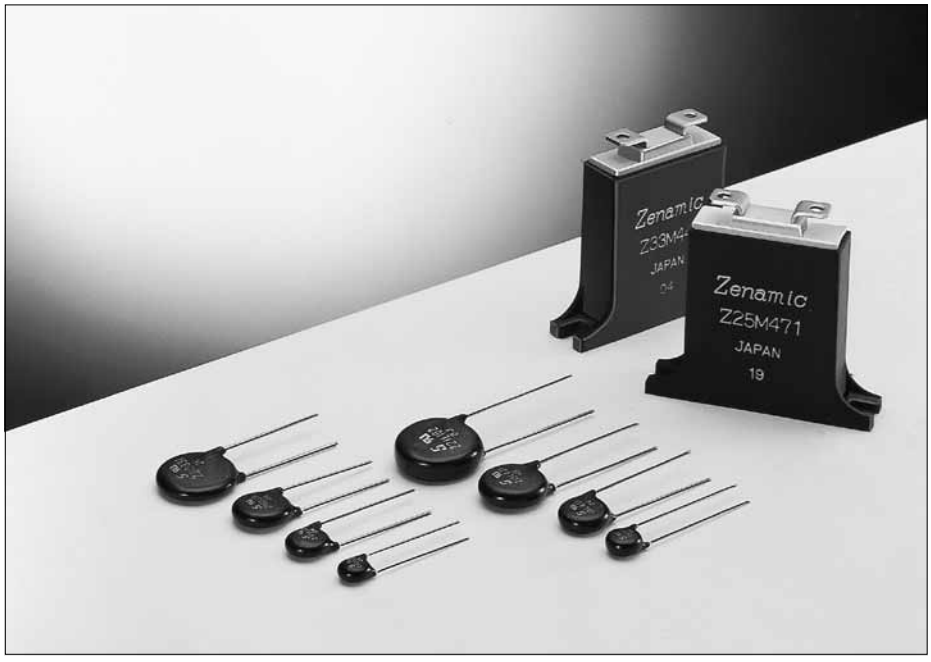
Dynamic characteristics (saturation characteristics)





METAL OXIDE VARISTOR

ZENAMIC



ZENAMIC is the product name of a metal oxide varistor.
ZENAMIC Transient/Surge Absorber, Series D is newly released through our continued research in ceramic material composition of ZnO varistor and manufacturing process, featuring large surge current handling capability and energy handling capability for absorbing transient overvoltage in compact size.

Features

- Improved in "Surge Current Handling Capability (at 8/20μs, 2 times)" by about 2 times over the current.
- Very large "Energy Handling Capability" absorbing transient overvoltages in compact sizes.
- Lower Clamping Voltage for better surge protection.
- Fast response to high speed transient/surge voltage.
- Wide products range for transient/surge protection on AC 100V to AC 480V nominal system with the maximum peak current ratings of 600A to 7000A (at 8/20 μs, 2 times).

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 1μA to 10^4A, and show the resistance characteristics for the range under 1 μA and over 10^4A in the figure 2.
The voltage across terminals when test current(It: 1 mA)is applied to ZENAMIC is the standard varistor voltage(Vz), and the voltage across terminals when a standard surge(Ip) is applied represents the maximum suppression voltage(Vc).

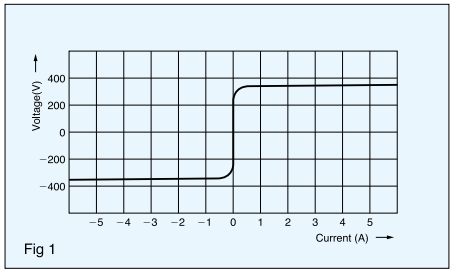


Fig 1

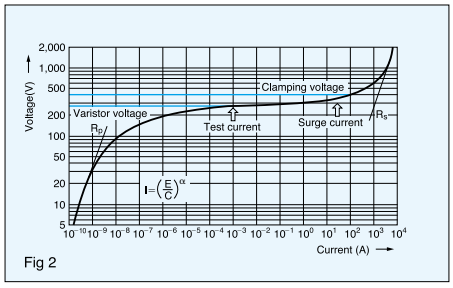


Fig 2

Temperature characteristics

In the small current range, ZENAMIC features outstanding temperature characteristics. A shunt resistance Rp of metal oxide varistor has the temperature characteristics which is determined by the following equation.

$$Rp = Ae^{Eg/2kT} \quad (2)$$

T:Absolute temperature
k:Boltzmann constant
A, Eg:constants

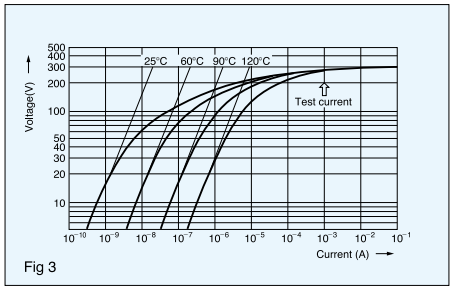


Fig 3

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

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 [ta] as shown in the figure 5, and then decreases as time passes and reaches half of the peak voltage (current) at [tb]. This type of the EXP waveform is shown as a [ta/tb] voltage (current) waveform. For surge testing of ZENAMIC, the 8/20μ sec current waveform is used.

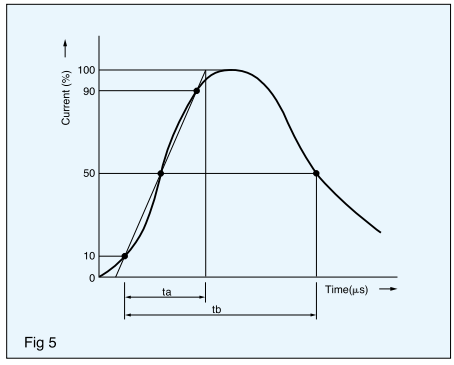
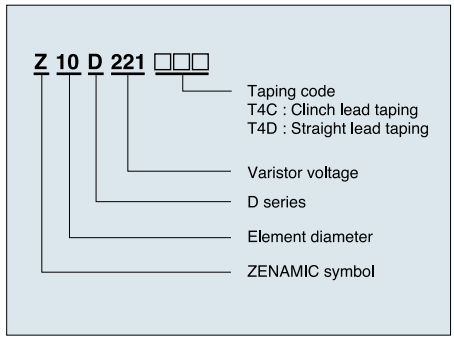


Fig 5

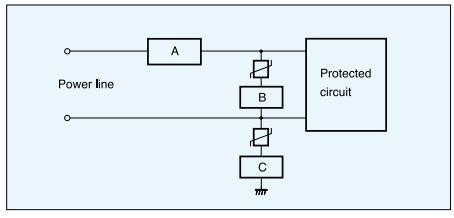
Part Number.



Application notes(General)

1.A surge excess of the specified Maximum Peak Current may cause short circuit or mechanical damage. The following measures are recommended.

- In case that ZENAMIC is used in line to ground, the ground fault circuit interrupter shall be applied in location A or thermally coupled fuse shall be applied in location C.
- ZENAMIC shall not be used near heat generating device and free from direct sunlight.
- ZENAMIC shall not be used near the flammable materials.



1) Location of the over current protector(circuit breaker or current fuse)shall be in the power line to the circuit(Location A)or in series with ZENAMIC (Location B).
2) It recommended that a fuse listed in the table be put in location A or B.
3) In case that ZENAMIC is used in line to ground, the ground fault circuit interrupter should be applied in location A or thermally coupled fuse should be applied in location C.

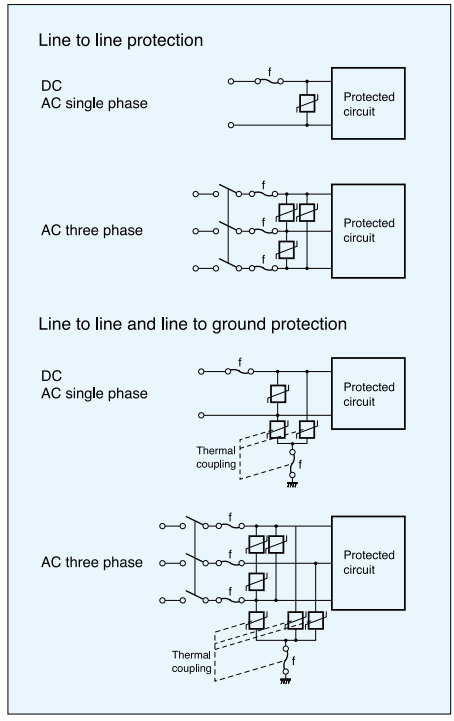
Part Number	Z7D□□□	Z10D□□□
Rating of fuse	5A max.	7A max.

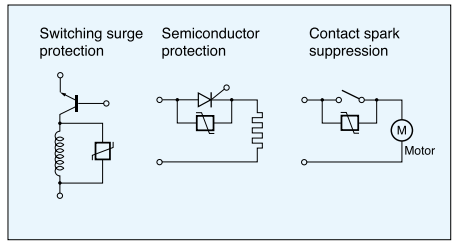
Part Number	Z15D□□□	Z21D□□□
Rating of fuse	10A max.	15A max.

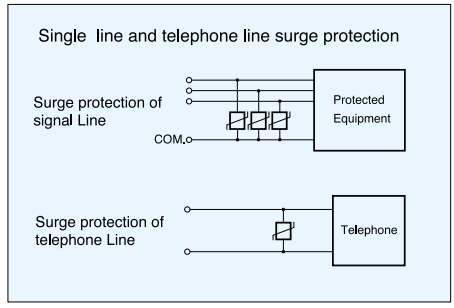
Refer to the related Safety Standards.

Applications

Power lines and surge absorption units with error display (SA series).







Z7D Series

Specifications

Part No.	Varistor Voltage	Maximum Allowable Voltage		Clamping Voltage (max.)	Rated Power	Maximum Energy		Maximum Peak Current (8/20μs)	Capacitance (TYP) 1kHz
						(10/1000μs)	(2ms)	2 times	
	V_{1mA}(V)	AC_{rms} (V)	DC(V)	V(V)	(W)	(J)	(J)	(A)	(pF)
Z7D180	18(16-20)	11	14	36 at 2.5A	0.02	1.1	0.9	250	3800
Z7D220	22(20-24)	14	18	43		1.3	1.1		3600
Z7D270	27(24-30)	17	22	53		1.6	1.3		3400
Z7D330	33(30-36)	20	26	65		2.0	1.6		2900
Z7D390	39(35-43)	25	31	77		2.4	1.9		1600
Z7D470	47(42-52)	30	38	93		2.8	2.3		1550
Z7D560	56(50-62)	35	45	110		3.4	2.7		1500
Z7D680	68(61-75)	40	56	135		4.1	3.3		1200
*1 Z7D820	82(74-90)	50	65	135 at 10A	0.25	7	5	1250	810
*1 Z7D101	100(90-110)	60	85	165		8.5	6		700
*1 Z7D121	120(108-132)	75	100	200		10	7		590
*1 Z7D151	150(135-165)	95	125	250		13	9		500
*1 Z7D201	200(185-225)	130	170	340		17.5	12.5		200
*1 Z7D221	220(198-242)	140	180	360		19	13.5		190
*1 Z7D241	240(216-264)	150	200	395		21	15		170
*1 Z7D271	270(247-303)	175	225	455		24	17		150
*1 Z7D331	330(297-363)	210	270	545		28	20		130
*1 Z7D361	360(324-396)	230	300	595		32	23		130
*1 Z7D391	390(351-429)	250	320	650		35	25		130
*1 Z7D431	430(387-473)	275	350	710		40	27.5		120
*1 Z7D471	470(423-517)	300	385	775		42	30		100 *2
*1 Z7D511	510(459-561)	320	410	845		45	32		90 *2

1. Operating temperature range:−40 to 85°C
2. Storage temperature range:−40 to 125°C
*1 UL 1449 approved model
*2 Measured at 1MHz

Z10D Series

Specifications

Part No.	Varistor Voltage	Maximum Allowable Voltage		Clamping Voltage (max.)	Rated Power	Maximum Energy		Maximum Peak Current (8/20μs)	Capacitance (TYP) 1kHz
						(10/1000μs)	(2ms)	2 times	
	V_{1mA}(V)	AC_{rms}(V)	DC(V)	V(V)	(W)	(J)	(J)	(A)	(pF)
Z10D180	18(16-20)	11	14	36 at 5A	0.05	2.6	2.2	500	16000
Z10D220	22(20-24)	14	18	43		3.2	2.6		11000
Z10D270	27(24-30)	17	22	53		3.9	3.2		8000
Z10D330	33(30-36)	20	26	65		4.8	4.0		6300
Z10D390	39(35-43)	25	31	77		5.6	4.7		5200
Z10D470	47(42-52)	30	38	93		6.8	5.6		4600
Z10D560	56(50-62)	35	45	110		8.1	6.7		3750
Z10D680	68(61-75)	40	56	135		9.8	8.2		2800
* Z10D820	82(74-90)	50	65	135 at 25A	0.4	14	10	2500	2000
* Z10D101	100(90-110)	60	85	165		17	12		1700
* Z10D121	120(108-132)	75	100	200		20	14.5		1400
* Z10D151	150(135-165)	95	125	250		25	18		1100
* Z10D201	200(185-225)	130	170	340		35	25		430
* Z10D221	220(198-242)	140	180	360		39	27.5		410
* Z10D241	240(216-264)	150	200	395		42	30		380
* Z10D271	270(247-303)	175	225	455		49	35		350
* Z10D331	330(297-363)	210	270	545		58	42		300
* Z10D361	360(324-396)	230	300	595		65	45		300
* Z10D391	390(351-429)	250	320	650		70	50		300
* Z10D431	430(387-473)	275	350	710		80	55		270
* Z10D471	470(423-517)	300	385	775		85	60		230
* Z10D511	510(459-561)	320	410	845		92	67		210
* Z10D561	560(504-616)	350	450	930		92	67		200
* Z10D681	680(612-748)	420	560	1120		92	67		170
* Z10D751	750(675-825)	460	615	1240		100	70		160
* Z10D821	820(738-902)	510	670	1355		110	80		140
* Z10D911	910(819-1001)	550	745	1500		130	90		120
* Z10D102	1000(900-1100)	625	825	1650		140	100		110

1. Operating temperature range:−40 to 85°C
2. Storage temperature range:−40 to 125°C

* UL 1449 approved model

Z15D Series

Specifications

Part No.	Varistor Voltage	Maximum Allowable Voltage		Clamping Voltage (max.)	Rated Power	Maximum Energy		Maximum Peak Current (8/20μs)	Capacitance (TYP) 1kHz
						(10/1000μs)	(2ms)	2 times	
	V_{1mA}(V)	AC_{rms}(V)	DC(V)	V(V)	(W)	(J)	(J)	(A)	(pF)
Z15D180	18(16-20)	11	14	36 at 10A	0.1	5.2	4.3	1000	25000
Z15D220	22(20-24)	14	18	43		6.3	5.3		20000
Z15D270	27(24-30)	17	22	53		7.8	6.5		16000
Z15D330	33(30-36)	20	26	65		9.5	7.9		12200
Z15D390	39(35-43)	25	31	77		11	9.4		7000
Z15D470	47(42-52)	30	38	93		14	11		6750
Z15D560	56(50-62)	35	45	110		16	13		6500
Z15D680	68(61-75)	40	56	135		20	16		5500
* Z15D820	82(74-90)	50	65	135 at 50A	0.6	28	20	4500	3700
* Z15D101	100(90-110)	60	85	165		35	25		3200
* Z15D121	120(108-132)	75	100	200		42	30		2700
* Z15D151	150(135-165)	95	125	250		53	37.5		2200
* Z15D201	200(185-225)	130	170	340		70	50		770
* Z15D221	220(198-242)	140	180	360		78	55		740
* Z15D241	240(216-264)	150	200	395		84	60		700
* Z15D271	270(247-303)	175	225	455		99	70		640
* Z15D331	330(297-363)	210	270	545		115	80		580
* Z15D361	360(324-396)	230	300	595		130	90		540
* Z15D391	390(351-429)	250	320	650		140	100		500
* Z15D431	430(387-473)	275	350	710		155	110		450
* Z15D471	470(423-517)	300	385	775		175	125		400
* Z15D511	510(459-561)	320	410	845		190	136		350
* Z15D561	560(504-616)	350	450	930		190	136		340
* Z15D681	680(612-748)	420	560	1120		190	136		320
* Z15D751	750(675-825)	460	615	1240		210	150		310
* Z15D821	820(738-902)	510	670	1355		235	165		280
* Z15D911	910(819-1001)	550	745	1500		255	180		250
* Z15D102	1000(900-1100)	625	825	1650		280	200		230

1. Operating temperature range:−40 to 85°C
2. Storage temperature range:−40 to 125°C

* UL 1449 approved model

Z21D Series

Specifications

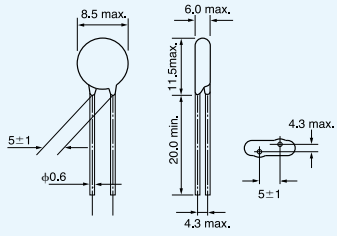
Part No.	Varistor Voltage	Maximum Allowable Voltage		Clamping Voltage (max.)	Rated Power	Maximum Energy		Maximum Peak Current (8/20μs)	Capacitance (TYP) 1kHz
						(10/1000μs)	(2ms)	2 times	
	V_{1mA}(V)	AC_{rms}(V)	DC(V)	V(V)	(W)	(J)	(J)	(A)	(pF)
Z21D180	18(16-20)	11	14	36 at 20A	0.2	13	12	2000	40000
Z21D220	22(20-24)	14	18	43		16	14		30000
Z21D270	27(24-30)	17	22	53		19	17		24500
Z21D330	33(30-36)	20	26	65		24	21		20000
Z21D390	39(35-43)	25	31	77		28	25		13800
Z21D470	47(42-52)	30	38	93		34	30		13500
Z21D560	56(50-62)	35	45	110		41	36		12200
Z21D680	68(61-75)	40	56	135		49	44		11500
* Z21D820	82(74-90)	50	65	135 at 100A	1.0	56	40	6500	7500
* Z21D101	100(90-110)	60	85	165		70	50		6500
* Z21D121	120(108-132)	75	100	200		85	60		5500
* Z21D151	150(135-165)	95	125	250		106	75		4500
* Z21D201	200(185-225)	130	170	340		140	100		1700
* Z21D221	220(198-242)	140	180	360		155	110		1600
* Z21D241	240(216-264)	150	200	395		168	120		1500
* Z21D271	270(247-303)	175	225	455		190	135		1300
* Z21D331	330(297-363)	210	270	545		228	160		1100
* Z21D361	360(324-396)	230	300	595		255	180		1100
* Z21D391	390(351-429)	250	320	650		275	195		1100
* Z21D431	430(387-473)	275	350	710		303	215		1000
* Z21D471	470(423-517)	300	385	775		350	250		900
* Z21D511	510(459-561)	320	410	845		382	273		800
* Z21D561	560(504-616)	350	450	930		382	273		750
* Z21D681	680(612-748)	420	560	1120		382	273		650
* Z21D751	750(675-825)	460	615	1240		420	300		600
* Z21D821	820(738-902)	510	670	1355		460	325		530
* Z21D911	910(819-1001)	550	745	1500		510	360		500
* Z21D102	1000(900-1100)	625	825	1650		565	400		450

1. Operating temperature range:−40 to 85°C
2. Storage temperature range:−40 to 125°C

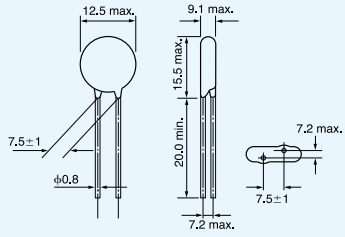
* UL 1449 approved model

Dimensions

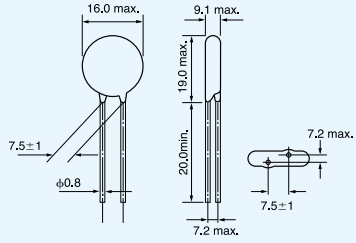
Z7D



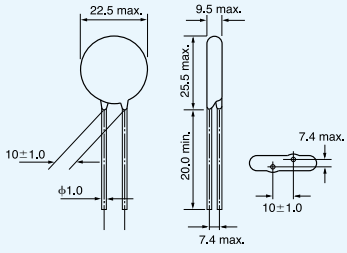
Z10D



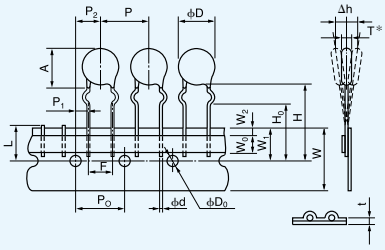
Z15D



Z21D



Crimped Leads and Taped
Z7D□□□ T4C

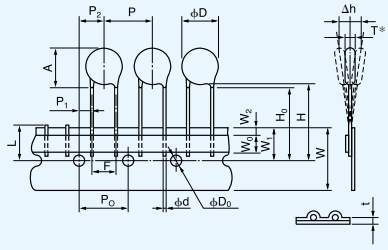


*Dimension"T":Conforms to each individual specification
*Packing quantily:1000pcs/BOX

Symbol	Type Ⅰ
P	12.7±1.0
P_0	12.7±0.3
P_1	3.85±0.70
P_2	6.35±1.30
ϕd	$0.60^{+0.06}_{-0.05}$
F	5.0±0.5
Δh	0±2
W	$18.0^{+1.0}_{-0.5}$
ϕD	Z7D:8.5max

Symbol	Type Ⅰ
W_0	5.0min
W_1	9.0±0.5
W_2	3max
H	Approx. 22
H_0	17.0±0.5
ϕD_0	ϕ4.0±0.2
t	0.6±0.3
L	11max

Straight Leads and Taped
Z7D □□□ T4D



*Dimension"T":Conforms to each individual specification
*Packing quantily:1000pcs/BOX

P	12.7±1.0
P_0	12.7±0.3
P_1	3.85±0.70
P_2	6.35±1.30
ϕd	$0.60^{+0.06}_{-0.05}$
F	5.0±0.5
Δh	0±2
W	$18.0^{+1.0}_{-0.5}$

W_0	5.0min
W_1	9.0±0.5
W_2	3max
H	Approx. 20
H_0	17.0±0.5
ϕD_0	ϕ4.0±0.2
t	0.6±0.3
L	11max
ϕD	Z7D:8.5max

Unit(mm)

Z25M, Z33M Series

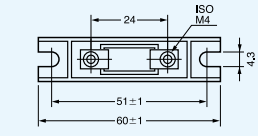
Specifications

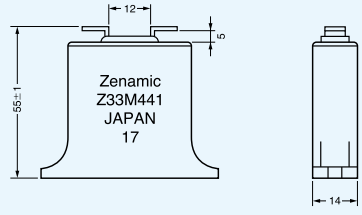
Part No.	Varistor voltage V_{1mA}(V)		Maximum allowable voltage		Clamping voltage	Rated power	Maximum energy (2ms)	Withstanding surge current (8/20μs)	Capacitance (TYP) (1kHz)
			AC	DC					
	Min	Max	V_{rms}	V	V	W	J	2 Times (A)	pF
Z25M221S	220(187	~253)	120	165	380 at 150A	1.0	125	10000	3300
Z25M271S	270(229.5	~310.5)	150	210	465		155		2200
Z25M331S	330(280.5	~379.5)	175	245	570		185		1900
Z25M391S	390(331.5	~448.5)	210	295	675		215		1700
Z25M441S	440(374	~506)	240	335	760		225		1500
Z25M471S	470(399.5	~540.5)	250	350	810		235		1500
Z25M561S	560(476	~644)	300	420	970		260		1400
Z25M681S	680(578	~782)	365	510	1175		280		1250
Z25M821S	820(697	~943)	440	615	1415		330		800
Z25M102S	1000(850	~1,150)	520	730	1725		375		500
Z33M221S	220(187	~253)	120	165	380 at 200A	1.2	200	20000	5500
Z33M271S	270(229.5	~310.5)	150	210	465		255		4200
Z33M331S	330(280.5	~379.5)	175	245	570		310		3700
Z33M391S	390(331.5	~448.5)	210	295	675		360		3200
Z33M441S	440(374	~506)	240	335	760		370		2800
Z33M471S	470(399.5	~540.5)	250	350	810		385		2600
Z33M561S	560(476	~644)	300	420	970		425		2200
Z33M681S	680(578	~782)	365	510	1175		460		1800
Z33M821S	820(697	~943)	440	615	1415		580		1500
Z33M102S	1000(850	~1150)	520	730	1725		620		1000

1. Operating temperature range: −40 to 85°C
2. Storage temperature range: −40 to 125°C

Dimensions

Z25M, Z33M type





Unit(mm)

WARRANTY

The manufacturer hereby warrants, that it will replace this product or any part thereof which shall prove to be defective in workmanship or material, subject to the following limitations:

(1) This is only for the benefit of the original purchaser and to no other person, company or individual.

(2) This warranty does not apply to defects caused by improper installation.

(3) This warranty is limited to the replacement of the defective product, or part thereof, and does not include any labor costs for installation or removal of the product.

(4) The manufacturer shall not be liable for indirect, consequential or special damages and is limited solely to replacement of the product.

If the product or any part thereof shall prove to be defective in workmanship or material, the original purchaser shall ship the product to the manufacturer in the original packing carton, together with a copy of the original sales receipt for the product, and, if in the opinion of the manufacturer, the product proves to be defective in workmanship or material, the sole obligation of the manufacturer shall be the replacement of the defective product or part thereof. Shipping charges to the manufacturer is the obligation of the original purchaser.

This limited warranty is in lieu of and replaces all of the warranties previously given by the manufacturer, both express and implied, including any warranties of merchantability or fitness for a particular purpose. There are no warranties which extend beyond the face hereof.

No lawsuit may be commenced against the manufacturer unless the original consumer purchaser has complied with all of the terms and conditions of this warranty and the manufacturer has refused to comply therewith.

(04.9.3K)

ISO9001 Certified

SEMITEC®

SEMITEC Corporation

HEAD OFFICE:7-7, Kinshi 1-Chome, Sumida-ku, Tokyo, 130-8512 Japan
TEL:81-3-3621-2704 FAX:81-3-3623-6100
E-mail : overseas@mail.semitec.co.jp

SEMITEC GROUP

USA :SEMITEC USA CORP.	TEL:1-310-540-2330	FAX:1-310-540-2331
	E-mail:sales@semitec-usa.com	
HONG KONG:SEMITEC(H.K.)CO.,LTD.	TEL:852-2369-6773	FAX:852-2739-2396
	E-mail:semihk@netvigator.com	
SEMITEC TRADING (SHENZHEN)CO.,LTD.	TEL: 86-755-83480961 / 83480965	FAX:86-755-83480964
	E-mail: semi-trading@963.net	
TAIWAN :SEMITEC TAIWAN CORP.	TEL:886-2-2593-6622	FAX:886-2-2593-0089
	E-mail:sales@semitec.com.tw	
UK :ATC SEMITEC LTD.	TEL:44-1606-871680	FAX:44-1606-872938
	E-mail:sales@atcsemitec.co.uk	
KOREA :SEMITEC KOREA CO., LTD.	TEL:82-2-3281-1155	FAX:82-2-3281-3338
	E-mail:semitec@semiteckorea.com	
CHINA :SEMITEC INTERNATIONAL (SHANGHAI) CO., LTD. SHANGHAI OFFICE	TEL:86-21-5308-6000	FAX:86-21-5830-5008
	E-mail:sales@semitec-shanghai.com	

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