

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 constant 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 R_T , 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:

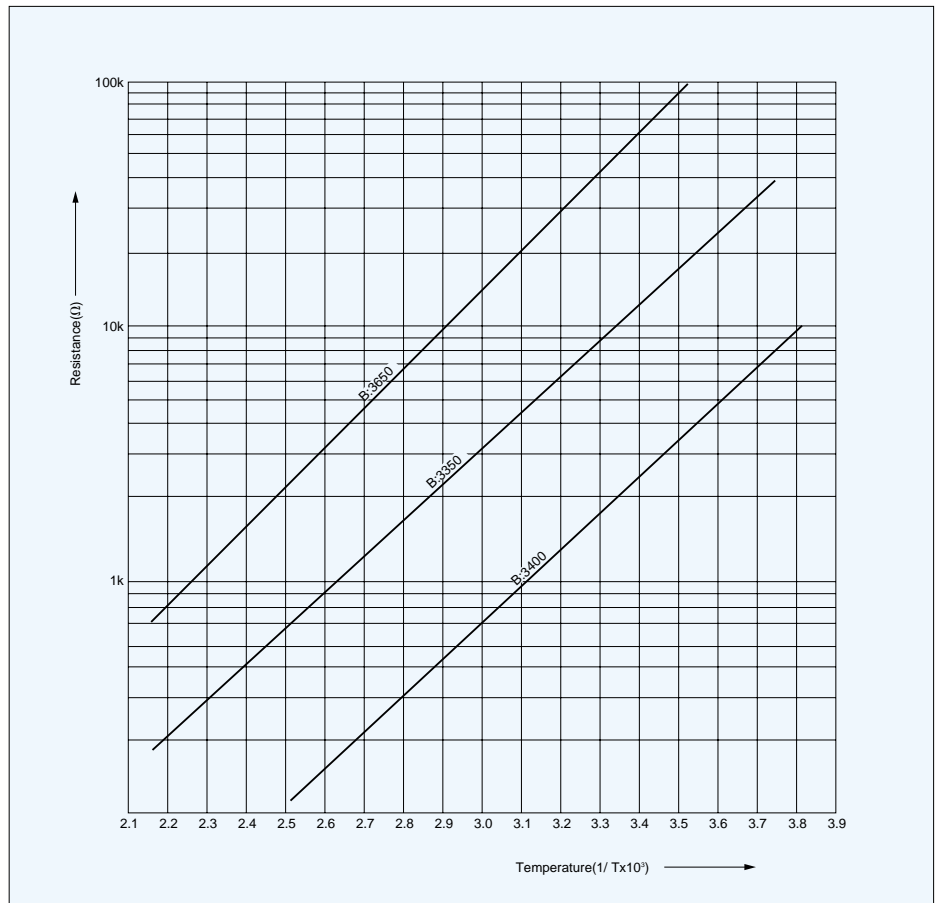
$$R_a = R_b \exp \left[B \left(\frac{1}{T_1} - \frac{1}{T_2} \right) \right]$$

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:

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



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.

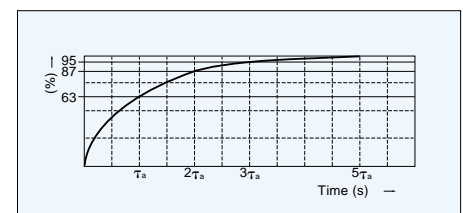
$$\delta = \frac{P}{\Delta t} (\text{mW}/^{\circ}\text{C})$$

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.



HIGH PRECISION THERMISTOR

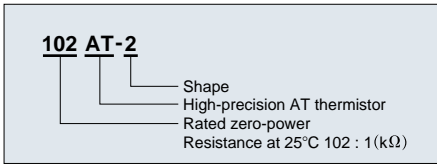
AT THERMISTOR

The AT thermistor is a high-precision thermal sensing device featuring extremely small B-value tolerance and resistance.

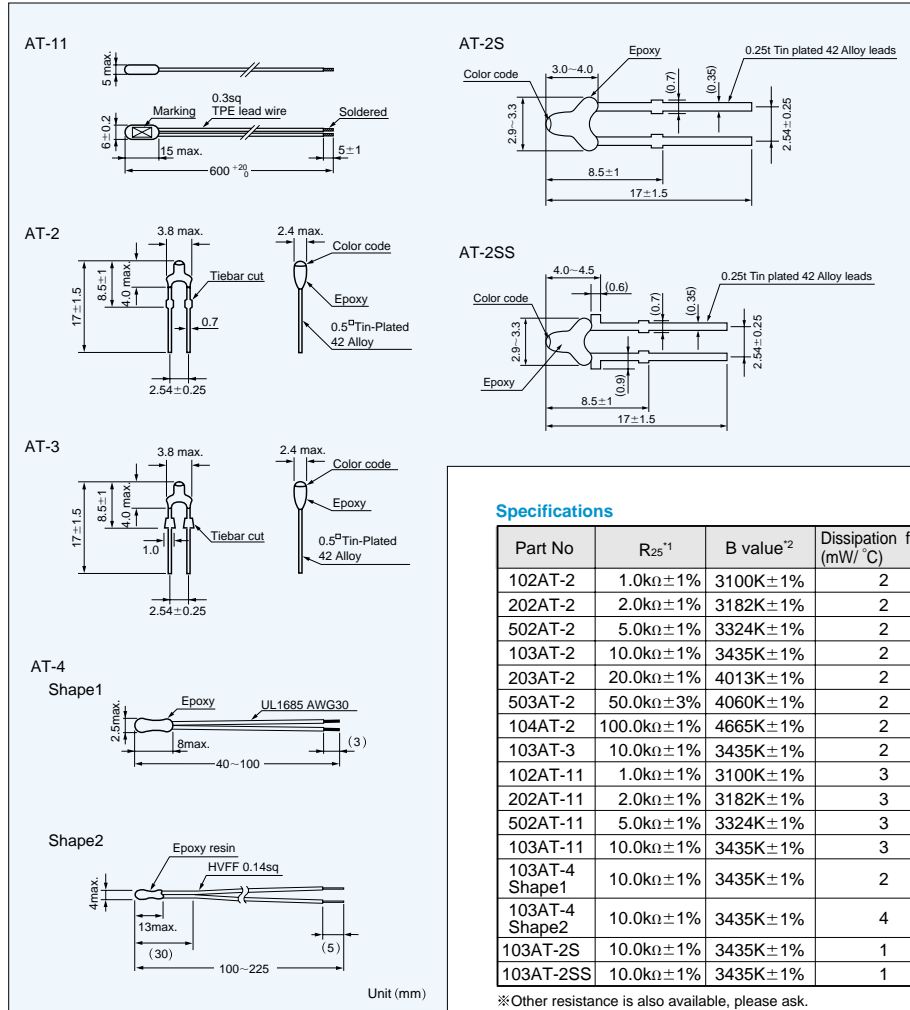
When used as a temperature gauge, the AT thermistor requires no adjustment between the control circuit and the sensor.

This insures temperature precision of $\pm 0.3^{\circ}\text{C}$. Temperature indicators and control instruments are now available for use with the thermistor.

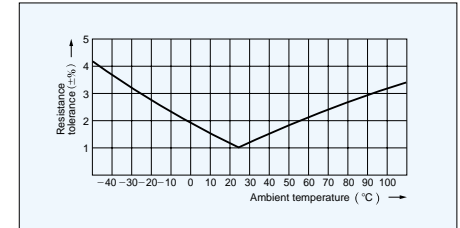
Part number



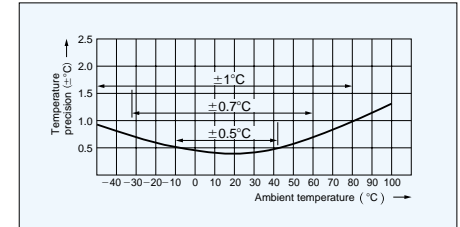
Dimensions



Resistance tolerance



Interchange precision



Specifications

Part No	R ₂₅ ¹	B value ²	Dissipation factor (mW/°C)	Thermal time constant (s) ³	Rated power at 25°C (mW)	Operating temp. range(°C)	Color code
102AT-2	1.0k Ω ±1%	3100K±1%	2	15	10	-50~90	Black
202AT-2	2.0k Ω ±1%	3182K±1%	2	15	10	-50~90	Red
502AT-2	5.0k Ω ±1%	3324K±1%	2	15	10	-50~110	Yellow
103AT-2	10.0k Ω ±1%	3435K±1%	2	15	10	-50~110	White
203AT-2	20.0k Ω ±1%	4013K±1%	2	15	10	-50~110	None
503AT-2	50.0k Ω ±3%	4060K±1%	2	15	10	-50~110	None
104AT-2	100.0k Ω ±1%	4665K±1%	2	15	10	-50~110	None
103AT-3	10.0k Ω ±1%	3435K±1%	2	15	10	-50~110	White
102AT-11	1.0k Ω ±1%	3100K±1%	3	75	15	-50~90	None
202AT-11	2.0k Ω ±1%	3182K±1%	3	75	15	-50~90	None
502AT-11	5.0k Ω ±1%	3324K±1%	3	75	15	-50~105	None
103AT-11	10.0k Ω ±1%	3435K±1%	3	75	15	-50~105	None
103AT-4 Shape1	10.0k Ω ±1%	3435K±1%	2	10	10	-30~90	None
103AT-4 Shape2	10.0k Ω ±1%	3435K±1%	4	35	20	-30~90	None
103AT-2S	10.0k Ω ±1%	3435K±1%	1	15	5	-50~110	white
103AT-2SS	10.0k Ω ±1%	3435K±1%	1	15	5	-50~110	white

*Other resistance is also available, please ask.

¹ R₂₅: Rated zero-power resistance value at 25°C.

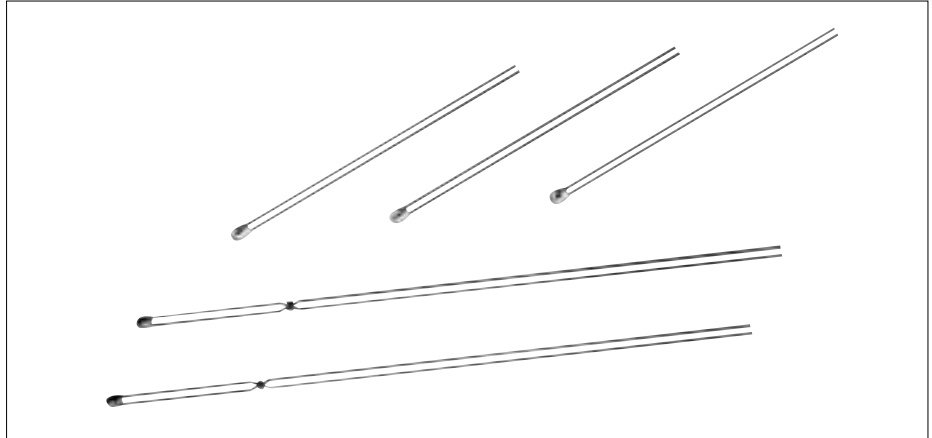
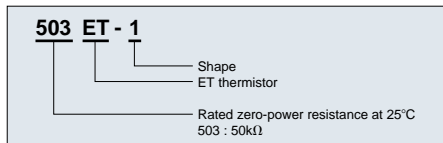
² B value: determined by rated zero-power resistance at 25°C and 85°C.

³ Time when thermistor temperature reaches 63.2% of the temperature difference. The value is measured in the air.

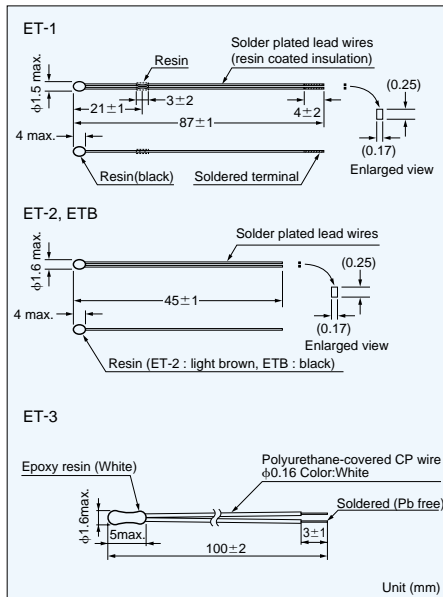
ET THERMISTOR

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)	Thermal time constant (s)*3	Rated power at 25°C(mW)	Operating temp. range (°C)
402ET-1(2)	4.0kΩ±3%	3100K±1%	0.7	6	3.5	-40~ 90
103ET-1(2)	10.0kΩ±3%	3250K±1%	0.7	6	3.5	-40~ 90
303ET-1(2)	30.0kΩ±3%	3760K±1%	0.7	6	3.5	-40~100
403ET-1(2)	40.0kΩ±3%	3525K±1%	0.7	6	3.5	-40~100
413ET-1(2)	41.0kΩ±3%	3435K±1%	0.7	6	3.5	-40~100
503ET-1(2)	50.0kΩ±3%	4055K±1%	0.7	6	3.5	-40~100
593ET-1(2)	59.0kΩ±3%	3617K±1%	0.7	6	3.5	-40~100
833ET-1(2)	83.0kΩ±3%	4013K±1%	0.7	6	3.5	-40~100
104ET-1(2)	100.0kΩ±3%	4132K±1%	0.7	6	3.5	-40~ 90
224ET-1(2)	226.0kΩ±3%	4021K±1%	0.7	6	3.5	-40~100
234ET-1(2)	232.0kΩ±3%	4274K±1%	0.7	6	3.5	-40~100
103ETB	10.0kΩ±2%	3435K±1%	0.7	6	3.5	-40~ 90
503ET-3	50.0kΩ±2%	4086K±1%	0.7	6	3.5	-40~100

*1 R₂₅: 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
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 for clinical thermo-meter

Temperature (°C)	Type			
	503ET	833ET	224ET	234ET
R ₃₀	40.22	67.04	182.4	184.5
R ₃₇	30.00	50.00	136.0	135.0
R ₄₅	21.75	36.25	98.56	95.87
B _{30/45} (K)	3953	3953	3958	4209

Unit (kΩ)