

Head Office

2-7-18, Machiya, Sakura-ku, Saitama-City, Saitama 338-0836, JAPAN
 TEL : +81-48-859-6010 / FAX : +81-48-852-4324 URL. <http://www.shibaura-e.co.jp/>

Sales Offices

URAWA Office

(WELK Bldg.5F) 4-3, Shintoshin, Chuo-ku, Saitama-City, Saitama 338-0081, JAPAN
 TEL : +81-48-600-6700 / FAX : +81-48-600-6800

OSAKA Office

Resona Kyoumachibori Bldg. 1-6-4, Kyoumachibori, Nishi-ku, Osaka 550-0003, JAPAN
 TEL : +81-6-6479-6000 / FAX : +81-6-6479-6010

NAGOYA Office

Shirakawa 6th Bldg. 2-18-5, Nishiki, Naka-ku, Nagoya 460-0003, JAPAN
 TEL : +81-52-203-4821 / FAX : +81-52-203-4823

International Operations

(WELK Bldg. 5F) 4-3, Shintoshin, Chuo-ku, Saitama-City, Saitama 338-0081, JAPAN
 TEL : +81-48-600-6702 / FAX : +81-48-600-6801
 Email : ovsea@shibaura-e.co.jp

Overseas Sales Offices

Shibaura Electronics Korea Co., Ltd

1017#, 917-9 Hyundai 41 Tower, Mok-Dong, Yangchen-Gu, Seoul, KOREA
 TEL : +82-2-6346-0512 / FAX : +82-2-6346-0513

Shibaura Electronics Hong Kong Co., Ltd

801 on the 8th Floor, Grand City Plaza, 1-17 Sai Lau Kok Road, Tsuen Wan, N.T.
 TEL : +852-2377-1678 / FAX : +852-2376-3361

Shibaura Electronics Europe GmbH

Bahnhofplatz 18, 82110 Germering Munich, Germany
 TEL : +49-89-84-930-922 / FAX : +49-89-84-930-960

Domestic Major Factories

Iwate Prefecture

Iwate Shibaura Electronics Co., Ltd
 Ichinohe Shibaura Electronics Co., Ltd

Aomori Prefecture

Sannohe Shibaura Electronics Co., Ltd
 Miharu Electronics Co., Ltd

Akita Prefecture

Tohoku Shibaura Electronics Co., Ltd
 Kakunodate Shibaura Electronics Co., Ltd

Fukushima Prefecture

Fukushima Shibaura Electronics Co., Ltd

Overseas Major Factories

Dongguan Shibaura Electronic Co., Ltd

Dongguan Plant Xinnongcun ind. Zone. Xinan. Changag Town. Dongguan, Guangdong, China
 TEL : +86-769-85412371 / FAX : +86-769-85412370

Thai Shibaura Denshi Co., Ltd

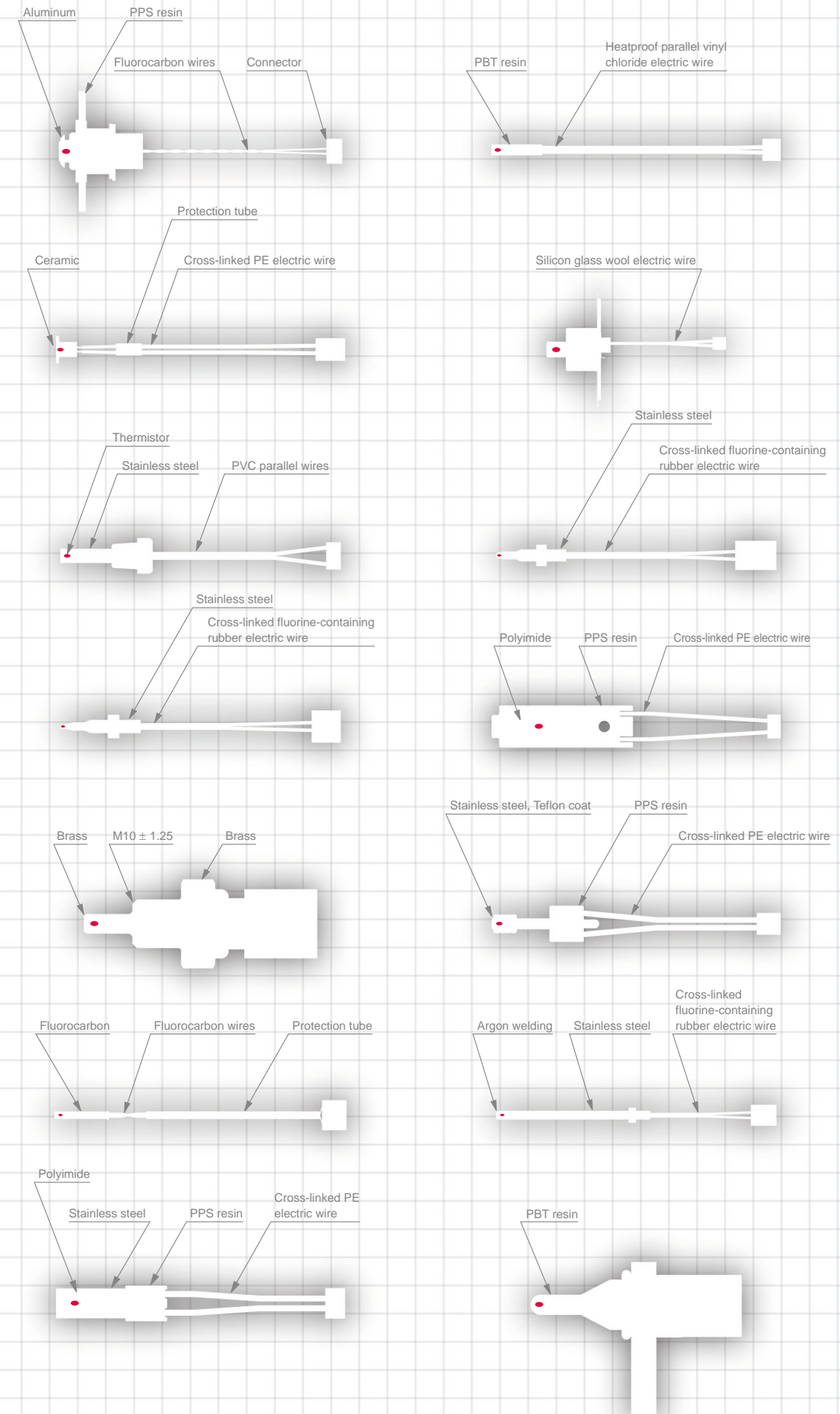
122/1 Moo 4 Tambol Bangphrakru, Amphur Nakorn Luang Ayutthaya 13260, Saha Rattana Nakorn Industrial Estate Thailand
 TEL : +66-35-716-530-6 / FAX : +66-35-716-537

Shanghai Shibaura Electronics Co., Ltd

Building C, 1411 Yecheng Rd., Jiading, Shanghai, China
 TEL : +86-21-5916-7387 / FAX : +86-21-5916-7087

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※ If you would like to learn in more details about Shibaura thermistors, please read together with our separate handbook (Shibaura Thermistor Element Explanation).

What Are Thermistors?

The king of temperature sensors with a negative temperature coefficient

Thermistors are thermally sensitive elements in a fine ceramic semiconductor.

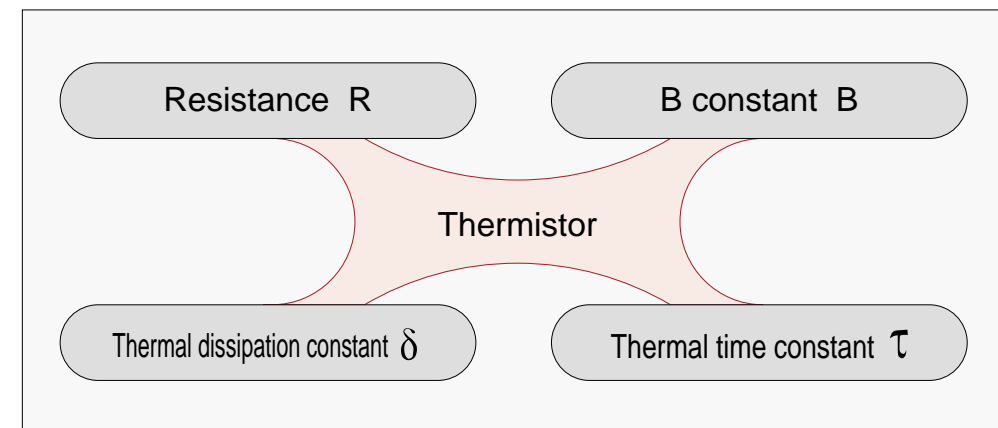
A thermistor is "a thermally sensitive resistor" that is a semiconductor whose resistance varies significantly with temperature. With ordinary materials, resistance increases slightly as temperature increases, but with NTC thermistors, that Shibaura Electronics is dedicated to, resistance decreases sharply. The following description is applicable only to NTC thermistors.

Thermistors are thermally sensitive elements of sintered fine ceramic semiconductor composed of several transition metal oxides, primarily Mn, Co and Ni. Their operating temperature range is from -50°C to +1000°C that covers the whole range necessary for ordinary temperature control. They are also small, stable and have great sensitivity. Thanks to these features, they are used in large quantities as temperature sensors and temperature compensation elements in consumer electronic appliances and industrial equipment.

Physical Characteristics of Thermistors

Four constants that determine thermistor characteristics

Basically, characteristics of a thermistors is represented by four constants: resistance R, B constant B, thermal dissipation constant δ and thermal time constant τ .



Resistance R (kΩ)

In between resistance R and absolute temperature T in thermistors, there is the following approximate relationship.

$$R_1 = R_2 \exp B \left(\frac{1}{T_1} - \frac{1}{T_2} \right) \dots\dots\dots (1)$$

R1: Resistance (Ω) at absolute temperature T1 (K)
R2: Resistance (Ω) at absolute temperature T2 (K)
B : B constant

Thermistor resistance R at any temperature T is determined from equation (1)

B constant B (K)

B is a constant that expresses a change rate in resistance between two temperatures, which is derived from the equation (1).

$$B = \frac{\ln R_1 - \ln R_2}{\frac{1}{T_1} - \frac{1}{T_2}} = \frac{2.3026(\log R_1 - \log R_2)}{\frac{1}{T_1} - \frac{1}{T_2}} \dots\dots\dots (2)$$

B: B constant (K)
R1: Resistance (Ω) at absolute temperature T1 (K)
R2: Resistance (Ω) at absolute temperature T2 (K)

In general, B constant value ranges B_{25°C/85°C} = 2,000 - 6,000K. The higher the B value is, the greater the change rate in resistance per 1°C becomes.

Thermal Dissipation Constant δ (mW/°C)

Thermal dissipation constant δ is a constant that expresses a degree of radiation from surface and lead wires of a thermistor element, when electric current is applied to heat it up.

Thermal dissipation constant δ can be determined by the equation (3) as a ratio between a power consumption applied to a thermistor and a degree of temperature increased by the power.

$$\delta = \frac{W}{T - T_a} = \frac{I^2 R}{T - T_a} \quad (3)$$

δ : Thermal dissipation constant (mW/°C)
 W : Power consumption in thermistor (mW)
 T : Temperature at heat equilibrium after rising (°C)
 T_a : External ambient temperature (°C)
 I : Electric current flowing in a thermistor at temperature T (mA)
 R : Resistance of a thermistor at temperature T (k Ω)

In order to measure temperature accurately and to control precisely, it is important to look closely at the value of δ of a thermistor and minimize electric current so that measurement error caused by heating is eliminated.

Thermal dissipation constant in this catalog shows a value when a discrete element is placed in still air. Please note that values for assembled thermal sensors will be different.

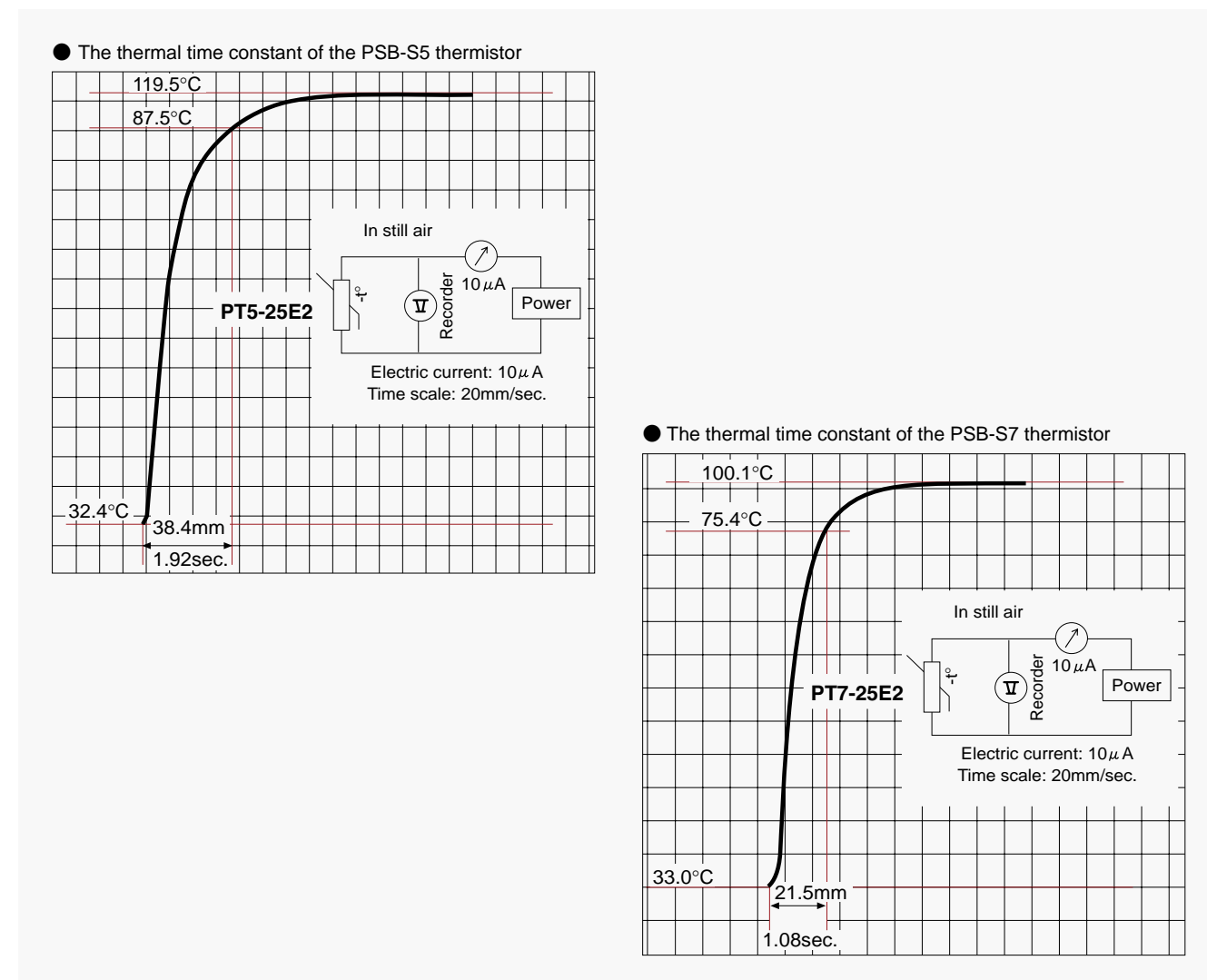
Thermal Time Constant τ (sec.)

Thermal time constant τ is a constant which indicates how fast resistance of a thermistor follows to a change in surrounding temperature or electric current injected.

The constant is expressed by a time to reach to $(1 - \frac{1}{e})$ or 63.2% of a difference between initial and final achieving temperatures of a thermistor element.

Examples of the thermal time constant measured values in our PSB measurement thermistors are shown in Figure 1.

Figure 1. Thermal Time Constant Measured Values of PSB Thermistors



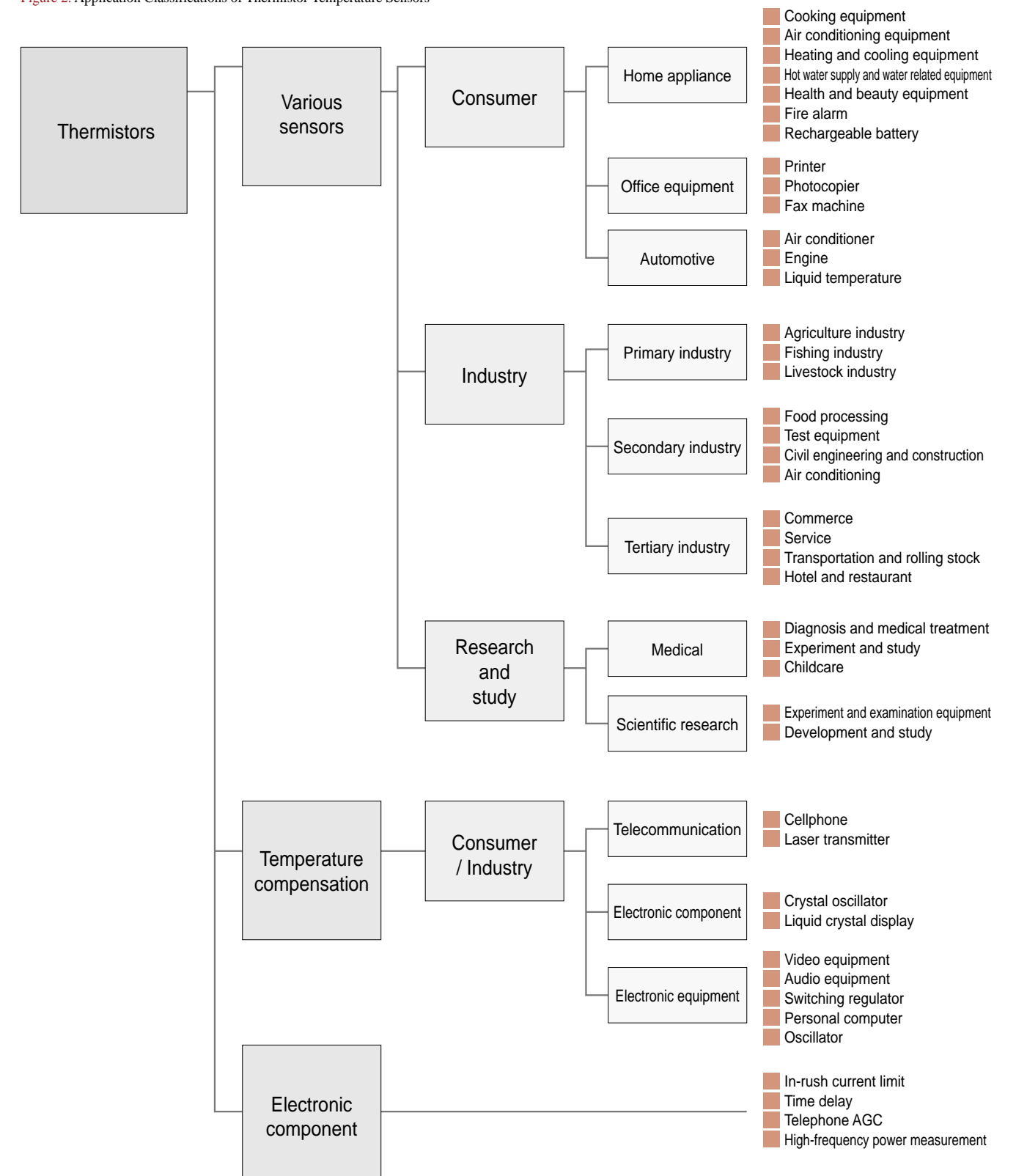
Thermistor Classifications

The applications of thermistors extend infinitely

Thermistors are primarily used as temperature sensors for temperature measurement and temperature control, as well as for temperature compensation. They are also used in humidity sensors, wind speed sensors, liquid level sensors, gas sensors, infra-red ray sensors, flow sensors and more.

The kind of fields thermistors are used in and these application classifications are shown in Figure 2.

Figure 2. Application Classifications of Thermistor Temperature Sensors



PSB Thermistors

The ultimate thermistors that have proven results with patents acquired in eight countries throughout the world

We invented our own unique PSB thermistors and have proven results with patents acquired in eight main countries around the world (Japan, the U.S., the U.K., West Germany, France, Canada, Italy and Switzerland)

Features

Many outstanding features

The five greatest features of our PSB thermistors are as follows.

- Highly stable due to delicate fine ceramics chips.
- Little variation in shape and characteristics due to automated production.
- Resistant to heat and mechanical stress, has little aging due to glass sealing.
- Micro thermistors are available with an excellent thermal response.
- Suited for stable high-volume production in high quality.

Advantages

Absolutely superior to other thermistors

PSB thermistors possess many advantages over bead thermistors, resin-coated thermistors and others, but for more details please see our separate handbook.

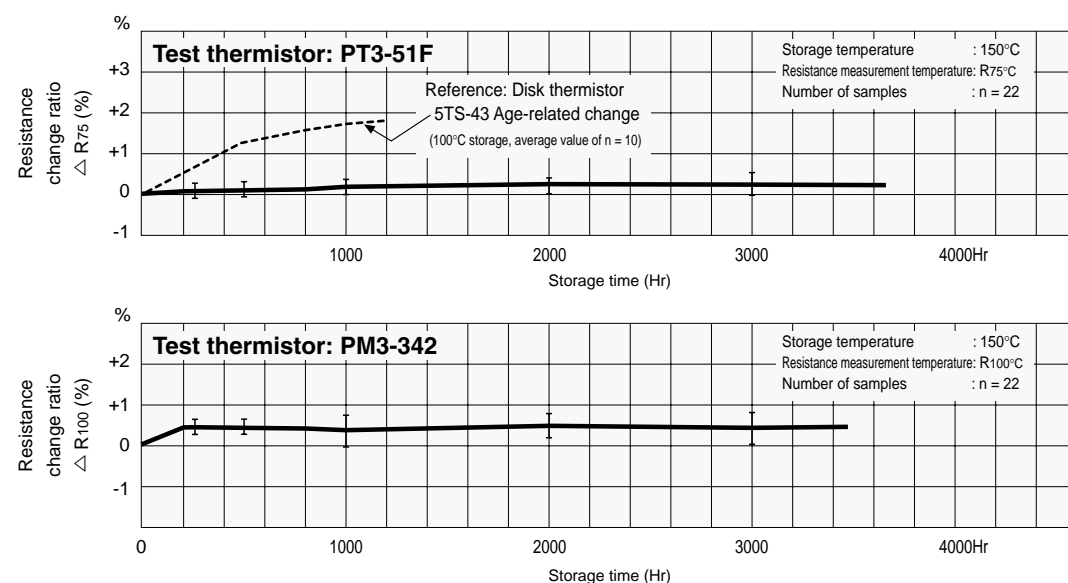
Reliability Testing

Shibaura thermistors come with the promise of a long life

Thermistors are used under all conditions that involve temperatures, so we conduct various reliability tests that verify durability in accordance with that application. We perform 20 kinds of quality validation tests. These are broadly divided into three types: electrical performance tests, mechanical performance tests and weather resistance tests.

The absolute most important quality demanded of thermistors is that they offer stability in resistance values over a long period of time. If thermistor resistance values end up varying during use, it is not possible to accurately measure the temperature, nor is it possible to control the temperature. Figure 3 shows an example of the results of the age-related resistance value changes of PSB thermistors in a case where a high temperature storage experiment took place. Alongside, the age-related changes in a disk thermistor that is not sealed with glass is shown. From Figure 3, you will see how much more stable a PSB thermistor is.

Figure 3. Age-related Changes of PSB Thermistor in a High Temperature Storage



Model Names and Product Names

PSB product names show the special characteristics of that thermistor

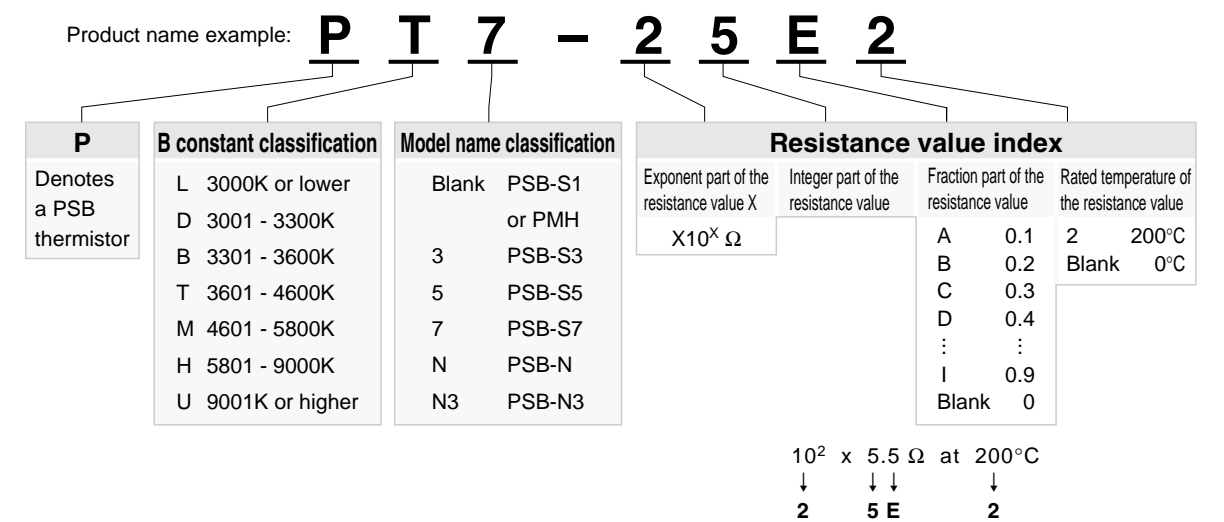
PSB thermistors have a model name classified by the shape of the thermistor and a product name that is mainly classified by the characteristics of the thermistor.

Table 1. PSB Thermistor Model Names

Model name	Diameter of the glass element	Range of the operating temperature	Lead wire direction
PSB-S	PSB-S1	∅2.3 ± 0.2	Radial lead type
	PSB-S3	∅1.3 ± 0.2	
	PSB-S5	∅0.8 ± 0.1	
	PSB-S7	∅0.55 ± 0.1	
PMH	∅2.3 ± 0.2	+100 - +350°C(400°C x 100h hours is permitted)	Axial lead type
PL	PL	∅2.3 ± 0.2	
	PL2	∅1.6 ± 0.2	
	PL3	∅1.3 ± 0.2	
PSB-N	PSB-N	∅1.8 ± 0.2	-50 - +300°C
	PSB-N3	∅1.35 ± 0.2	-50 - +250°C

Unit: mm

Figure 4. Format of PSB Thermistor Product Name

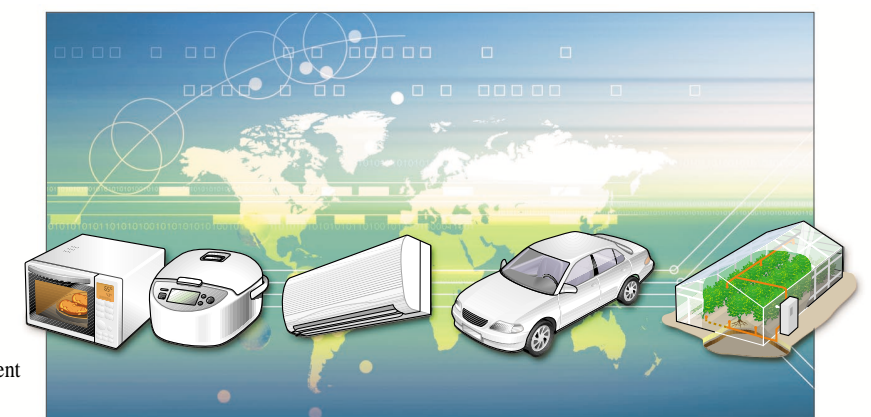


Applications

Shibaura thermistors have won a good reputation in many fields

PSB thermistors have been used in large quantities in all fields related to temperature as temperature measurement elements, or detectors for temperature control, but if they are used in the following fields in particular, they really demonstrate their power.

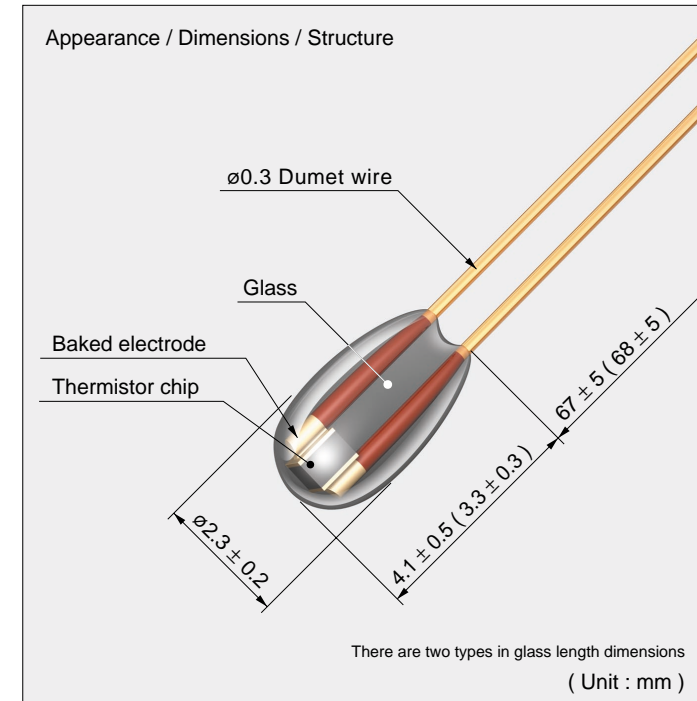
- Cooking equipment
- Air conditioning equipment
- Heating and cooling equipment
- Home appliance
- Office equipment
- Automotive parts
- Commercial and service equipment
- Health and beauty equipment
- Agricultural industrial and fishing equipment
- Medical equipment



PSB-S1 THERMISTOR

The standard product in PSB thermistors

The PSB-S1 is the standard product in PSB thermistors. The diameter of the glass part is nominal $\phi 2.35\text{mm}$ and even the largest is $\phi 2.5\text{mm}$ or under. This thermistor can be used as a temperature detection element in all fields with a temperature range of $-50^{\circ}\text{C} - +300^{\circ}\text{C}$.



Features

- This is a glass-sealed thermistor, so it has heat resistance and a high level of stability.
- Mass production of homogeneous thermistors is enabled by virtue of chip elements and integrated automatic production where processes from the chip attachment to the sealing and measurements are all mechanized.
- We invented our own unique PSB thermistors and have proven results with patents acquired in eight main countries around the world (Japan, the U.S., the U.K., West Germany, France, Canada, Italy and Switzerland)

Applications

In addition to the following equipment, please use in devices that require high reliability in temperature measurement and control.

- Air conditioning equipment
- Hot water boilers
- Cellphones
- Refrigerators
- Car air conditioners
- Industrial temperature control equipment

Rated Values

Operating temperature range : $-50^{\circ}\text{C} - +300^{\circ}\text{C}$

Thermal time constant τ : 12 sec. (10 - 17 sec.) (in still air)

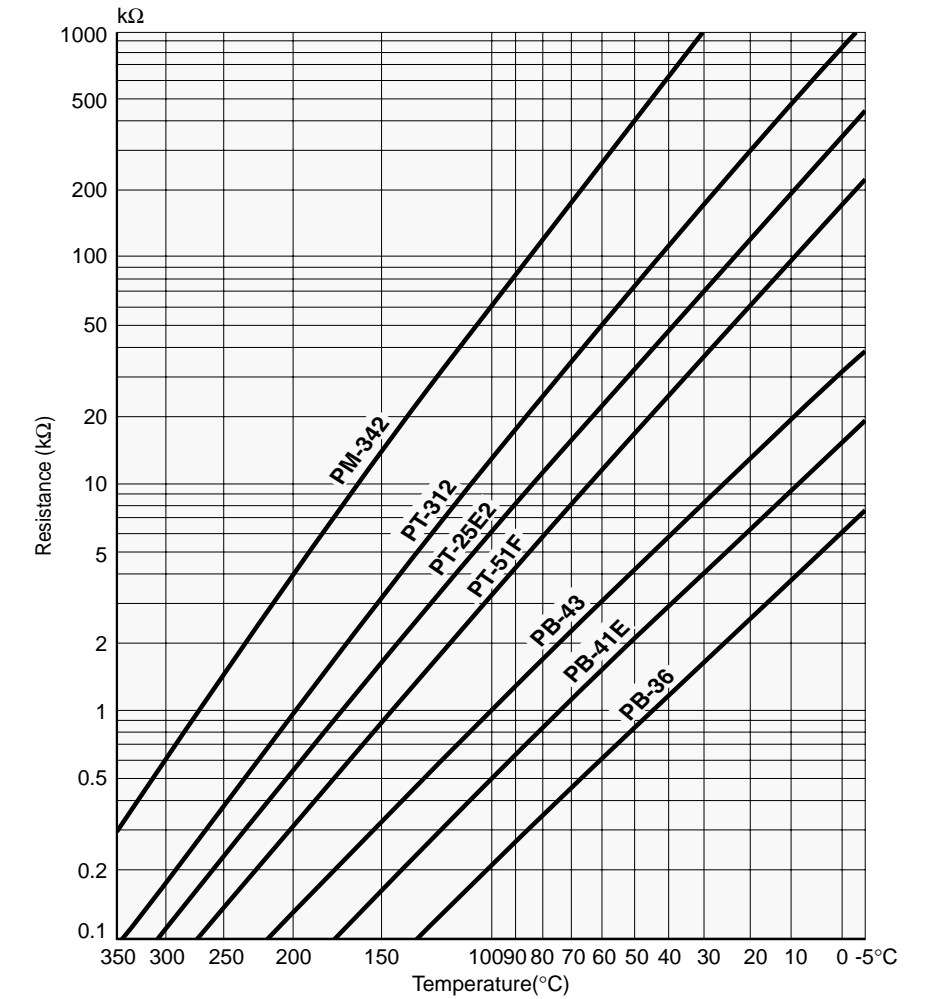
Dissipation constant δ : $1.3\text{mW}/^{\circ}\text{C}$ (1.1 - $1.6\text{mW}/^{\circ}\text{C}$) (in still air)

Insulation resistance : Min. $50\text{M}\Omega$ (500V d.c.) (between the lead wire and the glass)

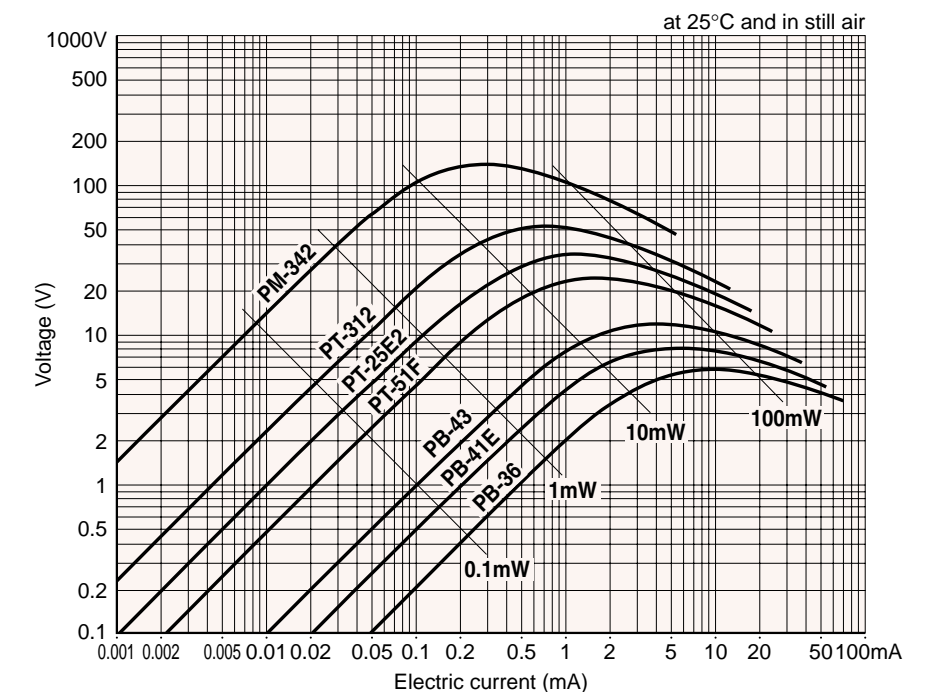
Product name	Nominal resistance value note (1)		B constant note (2)		JIS equivalent product note (3)
PB-36	6 k Ω (0°C)	2.186 k Ω (25°C)	$3420\text{K} \pm 68\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$3390\text{K} \pm 2\%$ ($0 \sim +100^{\circ}\text{C}$)	○
PB-41E	15 k Ω (0°C)	5.369 k Ω (25°C)	$3480\text{K} \pm 69\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$3450\text{K} \pm 2\%$ ($0 \sim +100^{\circ}\text{C}$)	○
PB-43	30 k Ω (0°C)	10.74 k Ω (25°C)	$3480\text{K} \pm 69\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$3450\text{K} \pm 2\%$ ($0 \sim +100^{\circ}\text{C}$)	○
PT-51F	3.3 k Ω (100°C)	49.12 k Ω (25°C)	$3992\text{K} \pm 79\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$3970\text{K} \pm 2\%$ ($0 \sim +100^{\circ}\text{C}$)	
PT-25E2	0.55 k Ω (200°C)	98.63 k Ω (25°C)	$4066\text{K} \pm 129\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$4300\text{K} \pm 3\%$ ($100 \sim 200^{\circ}\text{C}$)	○
PT-312	1 k Ω (200°C)	231.4 k Ω (25°C)	$4240\text{K} \pm 136\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$4537\text{K} \pm 3\%$ ($100 \sim 200^{\circ}\text{C}$)	
PM-342	4 k Ω (200°C)	1388 k Ω (25°C)	$4557\text{K} \pm 154\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$5133\text{K} \pm 3\%$ ($200 \sim 300^{\circ}\text{C}$)	○

Note (1): Resistance value tolerance: $\pm 1\%$, $\pm 2.5\%$, $\pm 5\%$ Note (2): There are versions of $B = \pm 1\%$ for those with $B = 3390, 3450$ and 3970K , versions of $B = \pm 1\%$ and $B = \pm 2\%$ for those with $B = 4300, 4537$ and 5133K . Note (3): JIS C 1611 'Thermistor Temperature Detector'

Resistance - Temperature Characteristics



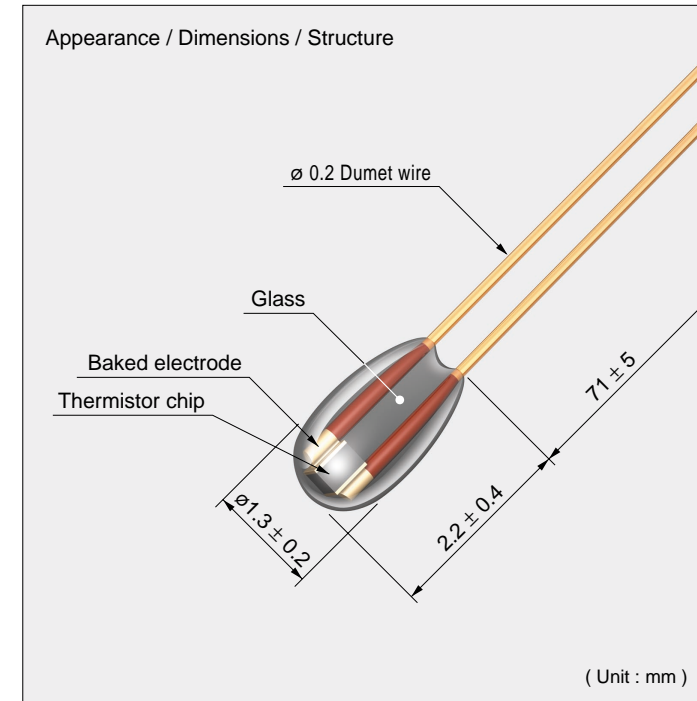
Voltage - Electric Current Characteristics



PSB-S3 THERMISTOR

For those that require a fast response speed

The PSB-S3 is a thermistor element that has been developed in response to requirements for an even faster thermal response than the PSB-S1. In a medium size of a nominal diameter of $\phi 1.32\text{mm}$, this thermistor has a fast response and is also mechanically strong.



Features

- This thermistor has a fast response and can be used in -50°C - $+300^{\circ}\text{C}$.
- This thermistor is glass-sealed so the resistance value is stable over a long period of time.
- Mass production of thermistors with uniform shapes and characteristics is enabled by virtue of chip elements and integrated automatic production.
- We invented our own unique PSB thermistors and have proven results with patents acquired in eight main countries around the world (Japan, the U.S., the U.K., West Germany, France, Canada, Italy and Switzerland)

Applications

Please use for equipment that requires a fast response, like the machines below.

- Toner fixing drum temperature control of photocopying machines
- Temperature control of thermal heads in fax machines
- Water and wind temperature control in bidet toilets
- Electronic medical thermometers, etc.

Rated Values

Operating temperature range : -50°C - $+300^{\circ}\text{C}$

Thermal time constant τ : 5 sec. (3.5 - 6.5 sec.) (in still air)

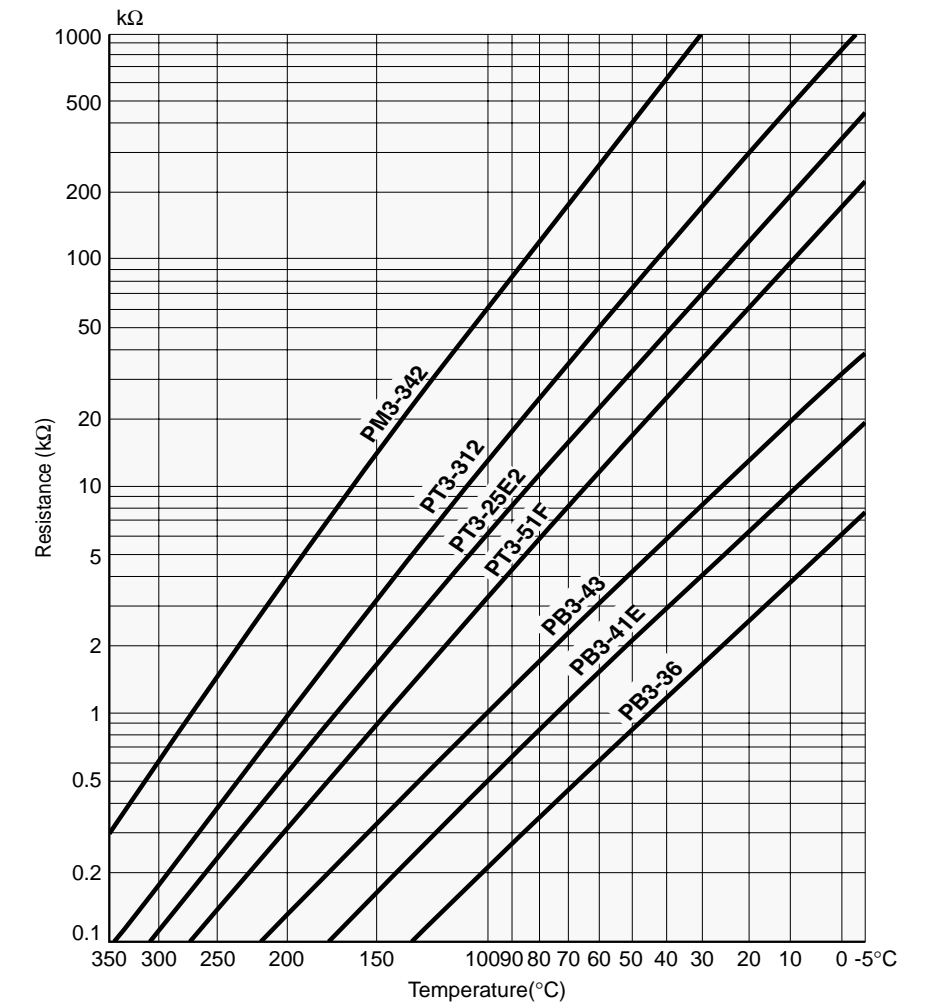
Dissipation constant δ : $0.75\text{mW}/^{\circ}\text{C}$ ($0.7 - 0.9\text{mW}/^{\circ}\text{C}$) (in still air)

Insulation resistance : Min. $10\text{M}\Omega$ (50V d.c.) (between the lead wire and the glass)

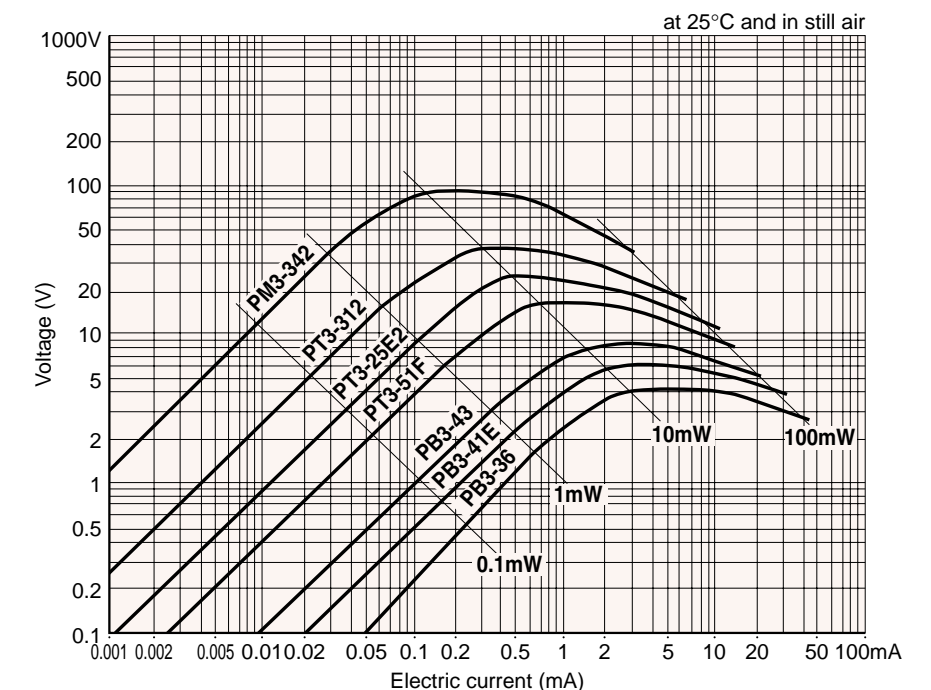
Product name	Nominal resistance value note (1)		B constant note (2)		JIS equivalent product note (3)
PB3-36	6 k Ω (0°C)	2.186 k Ω (25°C)	$3420\text{K} \pm 68\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$3390\text{K} \pm 2\%$ ($0 \sim +100^{\circ}\text{C}$)	○
PB3-41E	15 k Ω (0°C)	5.369 k Ω (25°C)	$3480\text{K} \pm 69\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$3450\text{K} \pm 2\%$ ($0 \sim +100^{\circ}\text{C}$)	○
PB3-43	30 k Ω (0°C)	10.74 k Ω (25°C)	$3480\text{K} \pm 69\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$3450\text{K} \pm 2\%$ ($0 \sim +100^{\circ}\text{C}$)	○
PT3-51F	3.3 k Ω (100°C)	49.12 k Ω (25°C)	$3992\text{K} \pm 79\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$3970\text{K} \pm 2\%$ ($0 \sim +100^{\circ}\text{C}$)	○
PT3-25E2	0.55 k Ω (200°C)	98.63 k Ω (25°C)	$4066\text{K} \pm 129\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$4300\text{K} \pm 3\%$ ($100 \sim 200^{\circ}\text{C}$)	○
PT3-312	1 k Ω (200°C)	231.4 k Ω (25°C)	$4240\text{K} \pm 136\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$4537\text{K} \pm 3\%$ ($100 \sim 200^{\circ}\text{C}$)	○
PM3-342	4 k Ω (200°C)	1388 k Ω (25°C)	$4557\text{K} \pm 154\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$5133\text{K} \pm 3\%$ ($200 \sim 300^{\circ}\text{C}$)	○

Note (1): Resistance value tolerance: $\pm 1\%$, $\pm 2.5\%$, $\pm 5\%$ Note (2): There are versions of $B = \pm 1\%$ for those with $B = 3390, 3450$ and 3970K , versions of $B = \pm 1\%$ and $B = \pm 2\%$ for those with $B = 4300, 4537$ and 5133K . Note (3): JIS C 1611 'Thermistor Temperature Detector'

Resistance - Temperature Characteristics



Voltage - Electric Current Characteristics

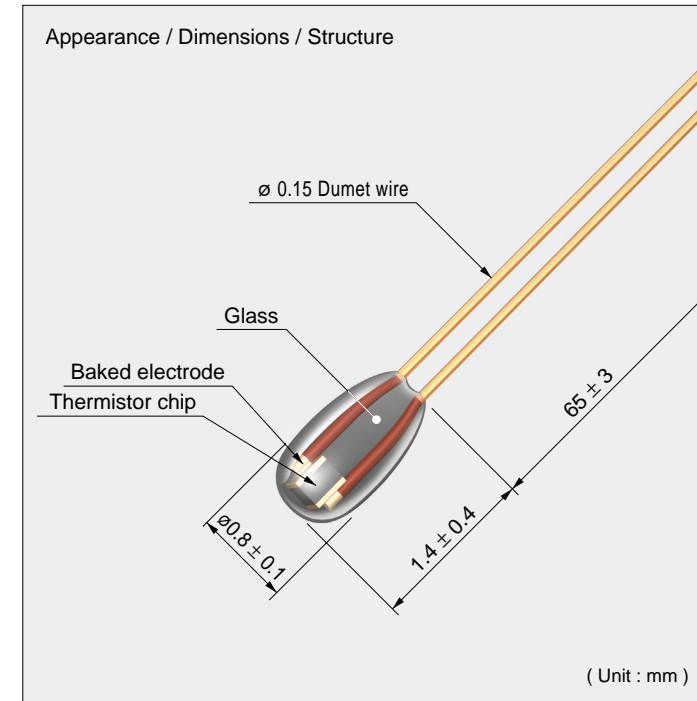


PSB-S5 THERMISTOR

For those that require a fast response speed

This is a thermistor element that has been developed in response to the requirements for a product with an even faster thermal response than the PSB-S3. This has an incredibly small size, but automatic mass production has been implemented.

The PSB-S5 has a nominal diameter of $\phi 0.8\text{mm}$, which is the size of around half a sesame seed and has a fast thermal response time of $\tau = 2$ sec. This means that the PSB-S5 is suitable for temperature control in equipment which requires a high speed response. The PSB-S5 uses a $\phi 0.15$ lead wire, so there is a certain level of mechanical strength and it can be used in places even with low level vibrations.



Features

- The thermal response of the PSB-S5 is around five times faster than that of conventional products, and although it has a small size, it is mechanically strong.

PSB-S1	PSB-S5
Thermal time constant : $\tau = 12\text{sec.}$	$\tau = 2\text{sec.}$ (in still air)
- The thermistor chip is glass-sealed, so it is heat resistant and also has a high level of stability.
- There is integrated automatic production, so we deliver thermistors with uniform shapes and characteristics.
- We invented our own unique PSB thermistors and have proven results with patents acquired in eight main countries around the world (Japan, the U.S., the U.K., West Germany, France, Canada, Italy and Switzerland)

Applications

Please use in the following high speed response equipment and for fine, narrow part measurements

- Toner fixing drum temperature control of a photocopying machine
- Temperature control of a thermal head
- Hot water temperature control in instantaneous water heaters
- Light source luminance control in printers, etc.
- Hot water temperature control in bidet toilets

Rated Values

Operating temperature range : $-50^{\circ}\text{C} - +250^{\circ}\text{C}$

Thermal time constant τ : 2 sec. (1.7 - 2.9 sec.) (in still air)

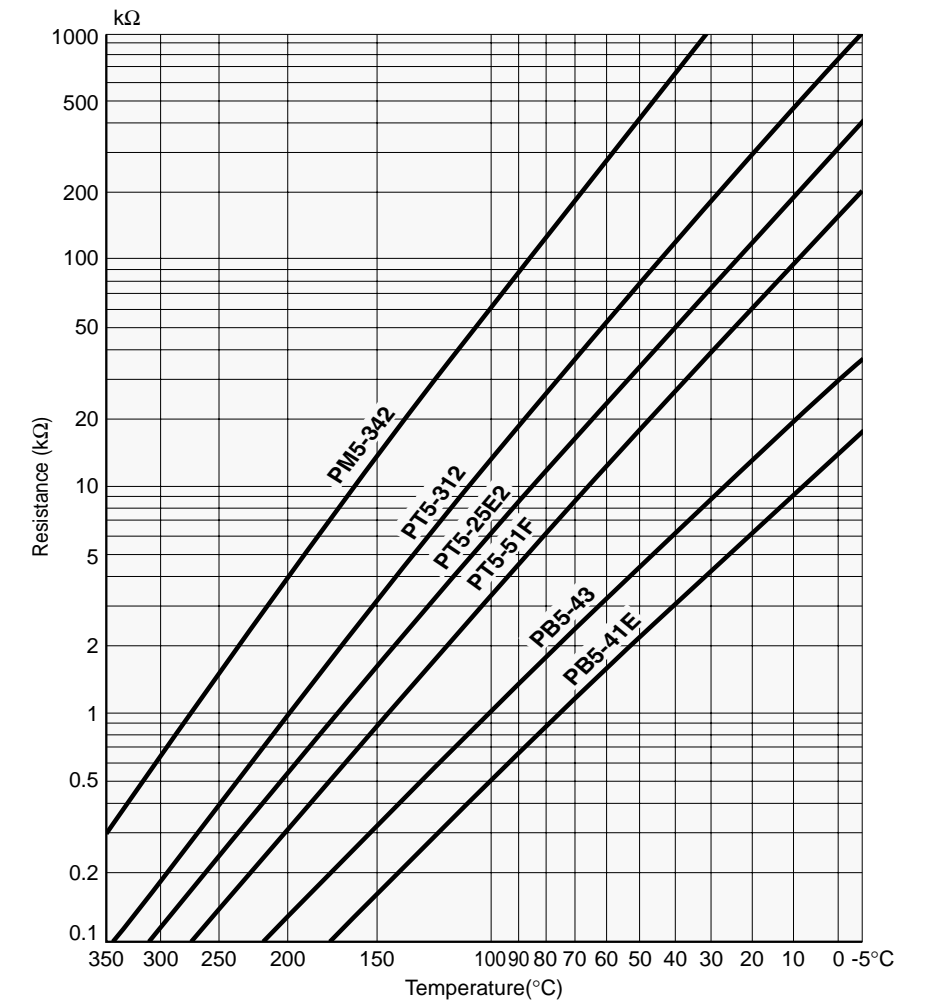
Dissipation constant δ : $0.4\text{mW}/^{\circ}\text{C}$ (0.35 - $0.55\text{mW}/^{\circ}\text{C}$) (in still air)

Insulation resistance : Min. $10\text{M}\Omega$ (50V d.c.) (between the lead wire and the glass)

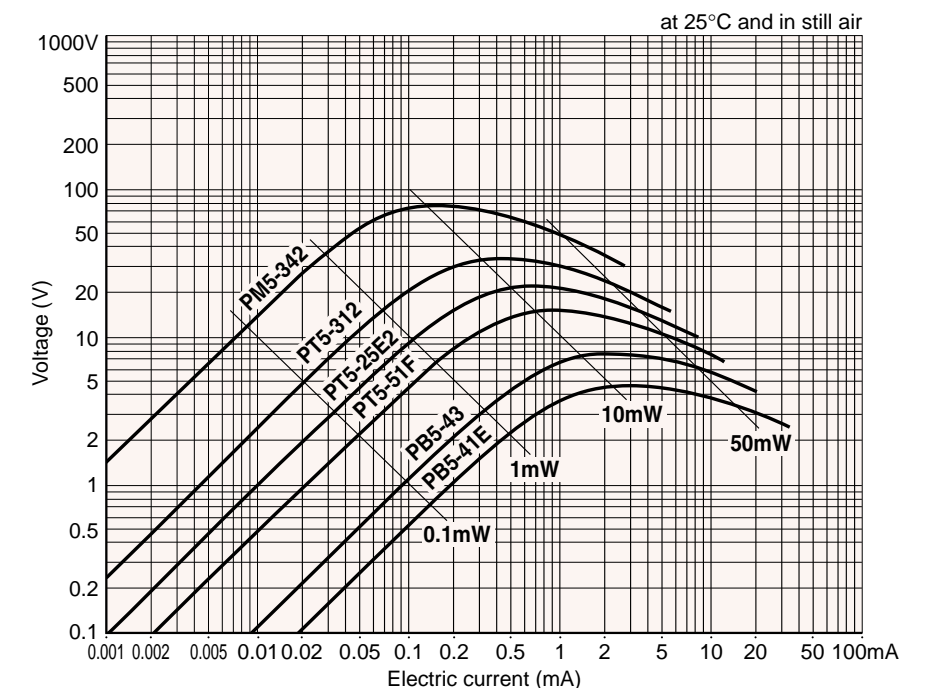
Product name	Nominal resistance value note (1)		B constant note (2)		JIS equivalent product note (3)
PB5-41E	15 $\text{k}\Omega$ (0°C)	5.369 $\text{k}\Omega$ (25°C)	$3480\text{K} \pm 68\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$3450\text{K} \pm 2\%$ ($0 \sim +100^{\circ}\text{C}$)	
PB5-43	30 $\text{k}\Omega$ (0°C)	10.74 $\text{k}\Omega$ (25°C)	$3480\text{K} \pm 69\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$3450\text{K} \pm 2\%$ ($0 \sim +100^{\circ}\text{C}$)	○
PT5-51F	3.3 $\text{k}\Omega$ (100°C)	49.12 $\text{k}\Omega$ (25°C)	$3992\text{K} \pm 79\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$3970\text{K} \pm 2\%$ ($0 \sim +100^{\circ}\text{C}$)	
PT5-25E2	0.55 $\text{k}\Omega$ (200°C)	98.63 $\text{k}\Omega$ (25°C)	$4066\text{K} \pm 129\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$4300\text{K} \pm 3\%$ ($100 \sim 200^{\circ}\text{C}$)	○
PT5-312	1 $\text{k}\Omega$ (200°C)	231.4 $\text{k}\Omega$ (25°C)	$4240\text{K} \pm 136\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$4537\text{K} \pm 3\%$ ($100 \sim 200^{\circ}\text{C}$)	
PM5-342	4 $\text{k}\Omega$ (200°C)	1388 $\text{k}\Omega$ (25°C)	$4557\text{K} \pm 154\text{K}$ ($25 \sim 85^{\circ}\text{C}$)	$5133\text{K} \pm 3\%$ ($200 \sim 300^{\circ}\text{C}$)	○

Note (1): Resistance value tolerance: $\pm 2.5\%$, $\pm 5\%$ Note (2): There are versions of $B = \pm 1\%$ for those with $B = 3450$ and 3970K , versions of $B = \pm 1\%$ and $B = \pm 2\%$ for those with $B = 4300$, 4537 and 5133K . Note (3): JIS C 1611 'Thermistor Temperature Detector'

Resistance - Temperature Characteristics



Voltage - Electric Current Characteristics

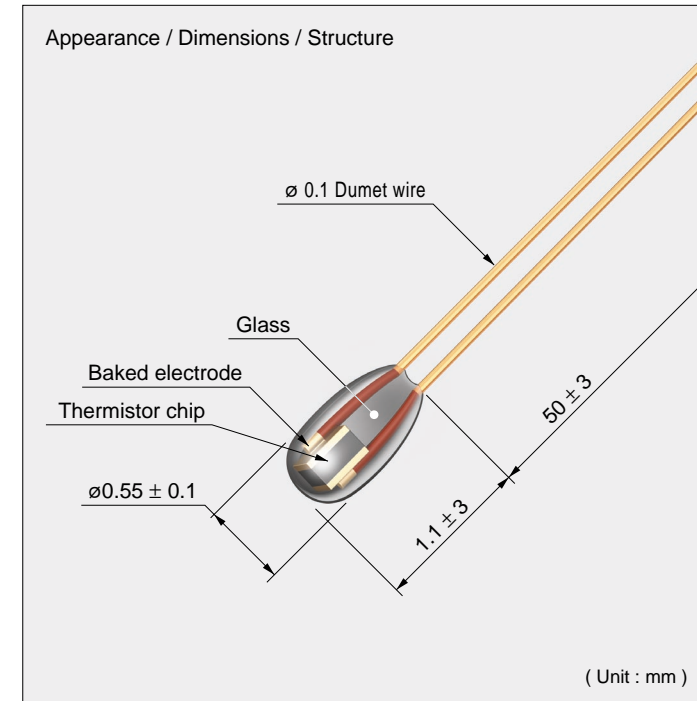


PSB-S7 THERMISTOR

This is the ultimate thermistor in high speed response and microscopic size

The PSB-S7 is a thermistor that has been developed for temperature sensors that require a microscopic shape or for equipment that requires an extremely fast thermal response, such as placing into a thin needle tip or affixing to a film.

If we look it on a photograph or a drawing, it may appear large, but the real thing is very small and can be expressed as "a thermistor attached to the end of two strands of hair."



Features

- The PSB-S7 has a small size of a nominal diameter of $\phi 0.53\text{mm}$ and comes with a response speed 12-times that of conventional products.

PSB-S1 PSB-S7
Thermal time constant : $\tau = 12\text{sec.}$ $\tau = 1\text{sec.}$ (in still air)

- The PSB-S7 is glass-sealed, so it is heat resistant and also has a high level of stability.

- We invented our own unique PSB thermistors and have proven results with patents acquired in eight main countries around the world (Japan, the U.S., the U.K., West Germany, France, Canada, Italy and Switzerland)

Applications

The PSB-S7 is suitable for the following equipment and superfine tubes that require a fast response or for temperature measurement set in narrow spaces.

- Needle sensors
- Light source luminance control in printers
- Thermal head temperature control
- For medical equipment, etc.

Rated Values

Operating temperature range : $-50^{\circ}\text{C} - +250^{\circ}\text{C}$

Thermal time constant τ : 1 sec. (0.6 - 1.5 sec.) (in still air)

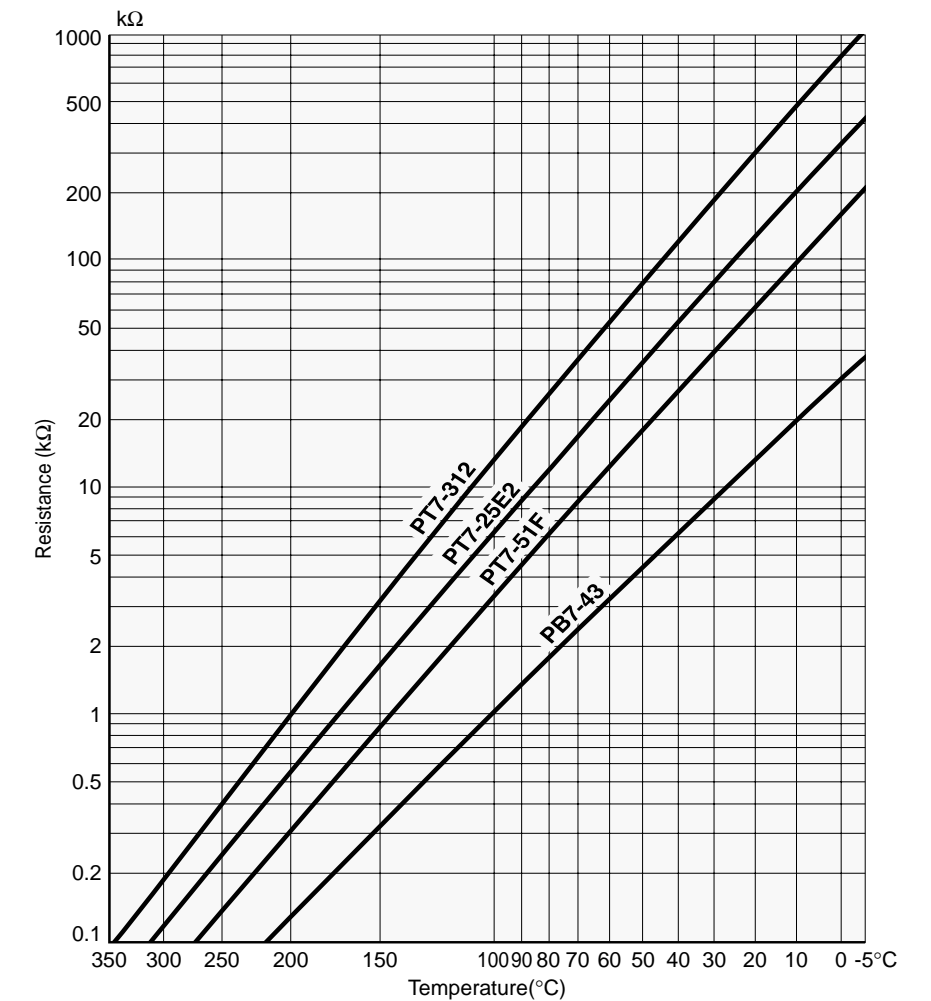
Dissipation constant δ : $0.25\text{mW}/^{\circ}\text{C}$ (0.2 - $0.3\text{mW}/^{\circ}\text{C}$) (in still air)

Insulation resistance : Min. $10\text{M}\Omega$ (50V d.c.) (between the lead wire and the glass)

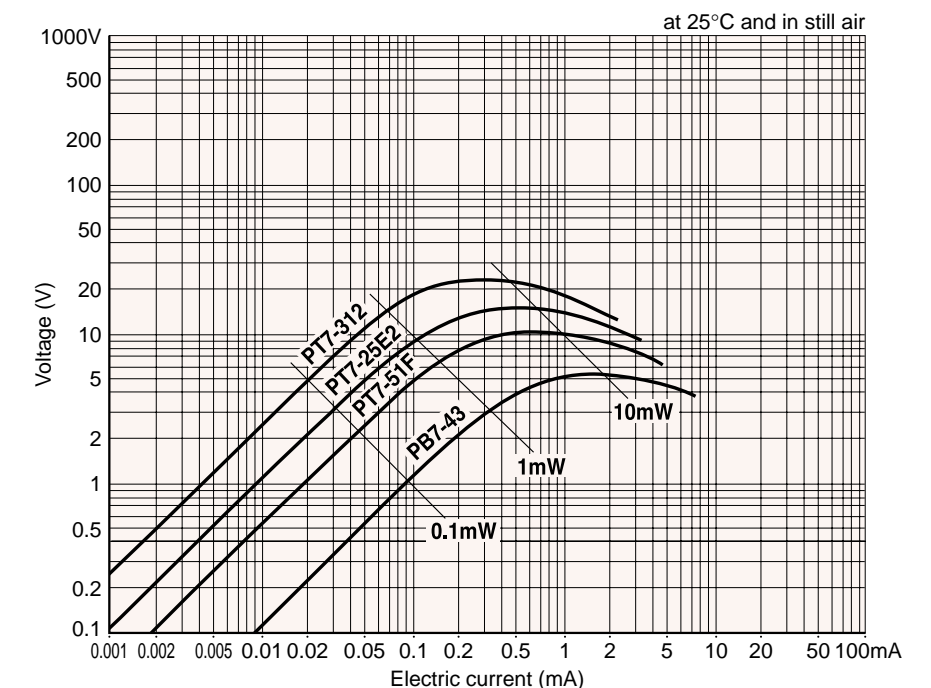
Product name	Nominal resistance value <small>note (1)</small>		B constant <small>note (2)</small>		JIS equivalent product <small>note (3)</small>
PB7-43	30 k Ω (0°C)	10.74 k Ω (25°C)	$3480\text{K} \pm 69\text{K}$ (25 ~ 85°C)	$3450\text{K} \pm 2\%$ (0 ~ $+100^{\circ}\text{C}$)	○
PT7-51F	3.3 k Ω (100°C)	49.12 k Ω (25°C)	$3992\text{K} \pm 79\text{K}$ (25 ~ 85°C)	$3970\text{K} \pm 2\%$ (0 ~ $+100^{\circ}\text{C}$)	
PT7-25E2	0.55 k Ω (200°C)	98.63 k Ω (25°C)	$4066\text{K} \pm 129\text{K}$ (25 ~ 85°C)	$4300\text{K} \pm 3\%$ (100 ~ 200°C)	○
PT7-312	1 k Ω (200°C)	231.4 k Ω (25°C)	$4240\text{K} \pm 136\text{K}$ (25 ~ 85°C)	$4537\text{K} \pm 3\%$ (100 ~ 200°C)	

Note (1): Resistance value tolerance: $\pm 2.5\%$, $\pm 5\%$ Note (2): There are versions of $B = \pm 1\%$ for those with $B = 3450$ and 3970K , versions of $B = \pm 1\%$ and $B = \pm 2\%$ for those with $B = 4300$ and 4537K . Note (3): JIS C 1611 "Thermistor Temperature Detector"

Resistance - Temperature Characteristics



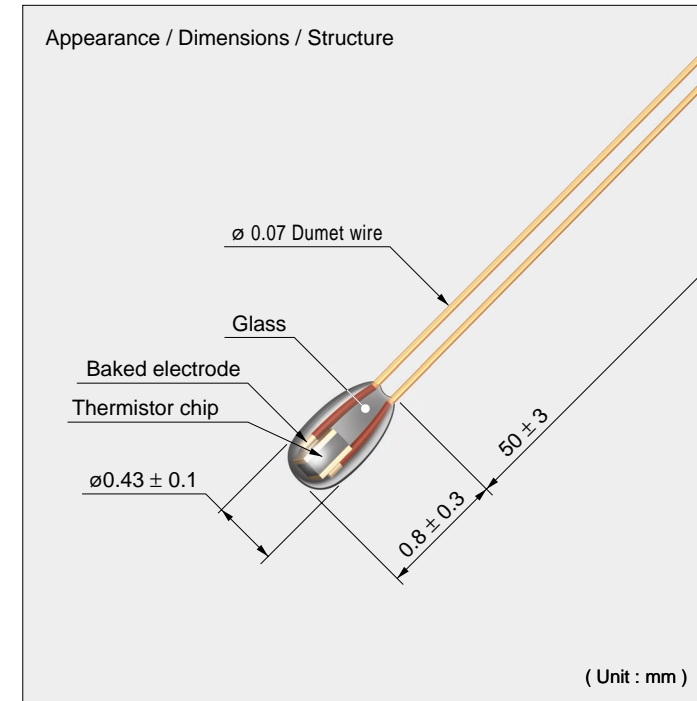
Voltage - Electric Current Characteristics



PSB-S9 THERMISTOR

For those that desire the smallest size and an ultra high speed response

The PSB-S9 is the smallest in the world among glass-sealed thermistors which can be mass produced with an external form of $\phi 0.43\text{mm}$. Compared to conventional high speed response microscopic PSB-S7, the PSB-S9 has 50% the volume and has achieved a response speed which is two times faster. The PSB-S9 was developed for sensors that require a high speed response, the smallest size and reliability. For example medical equipment where extremely small sizes are needed, as well as for applications with contactless sensors and office equipment, such as printers and photocopying machines, which demand a high speed response.



Features

- Realization of microminiaturization (50% of the volume compared to traditional products)
- A small size element with a high speed response, as well as high precision and high stability
- Excellent cost performance

Applications

The PSB-S9 is suitable for the following equipment and superfine tubes that require a high speed response or for temperature measurements set in narrow places.

- Medical catheters
- Toner fixing fast response sensors in copy machines and printers, etc.
- Application in contactless sensors
- Superfine metal protection tubes

Rated Values

Operating temperature range : $-50^{\circ}\text{C} - +250^{\circ}\text{C}$

Thermal time constant τ : 0.6 sec. (0.6 sec.) (in still air)

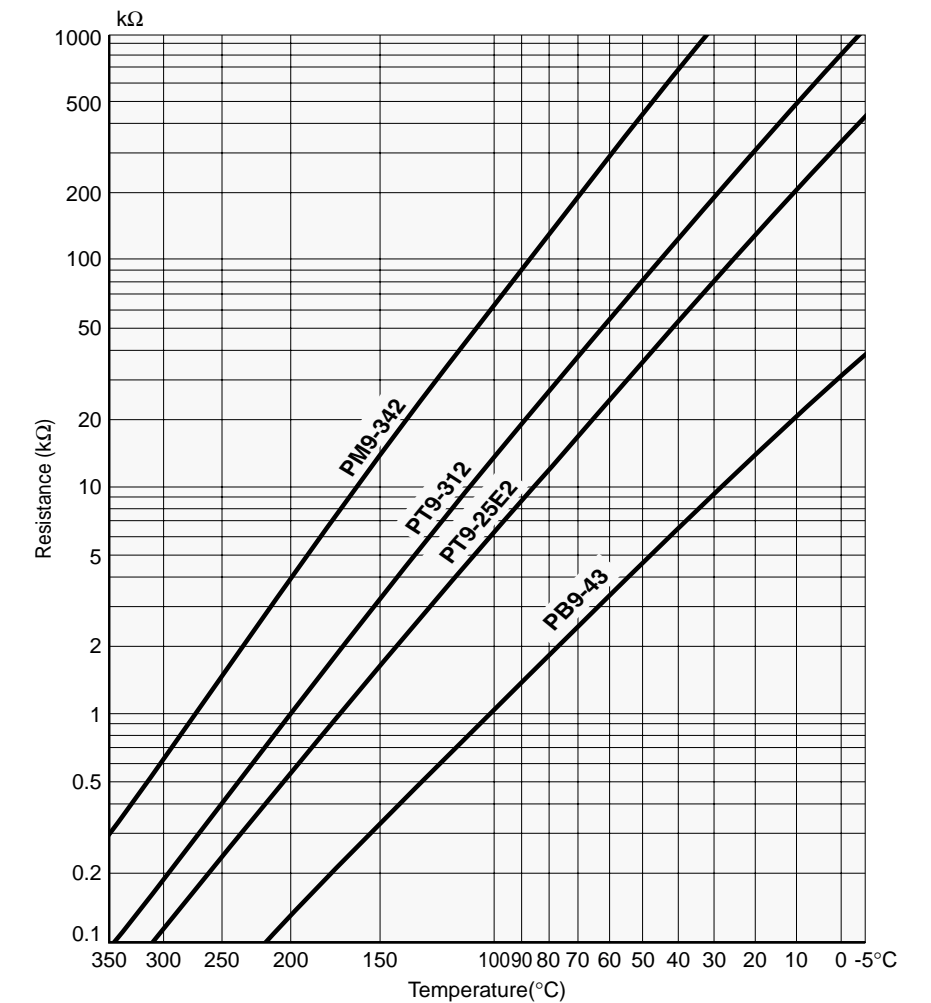
Dissipation constant δ : 0.15mW/ $^{\circ}\text{C}$ (in still air)

Insulation resistance : Min. 10M Ω (50V d.c.) (between the lead wire and the glass)

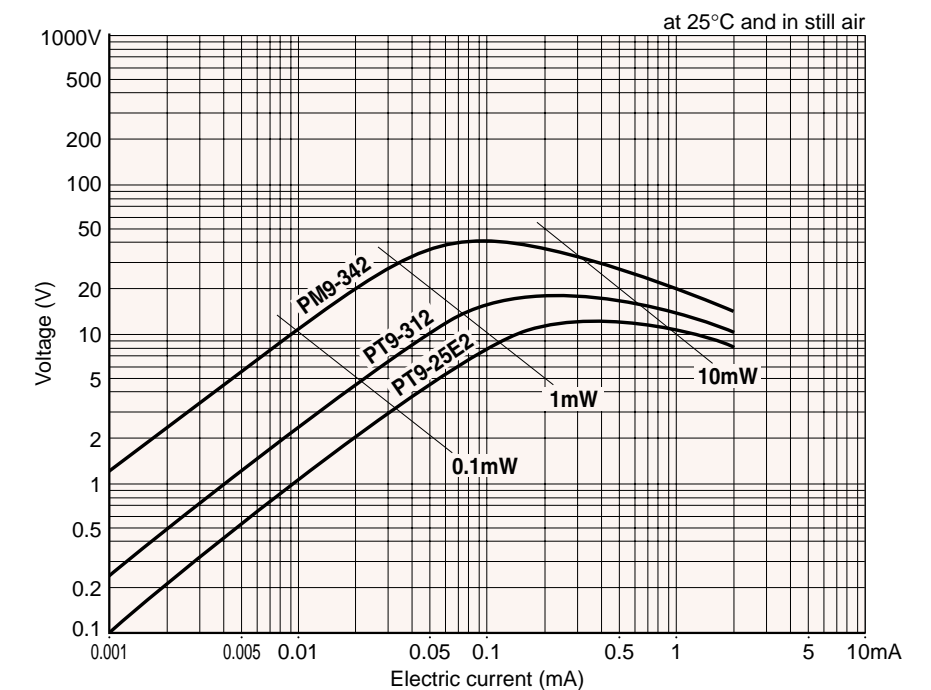
Product name	Nominal resistance value note (1)		B constant		JIS equivalent product note (2)
PB9-43	30 k Ω (0°C)	10.74 k Ω (25°C)	3480K \pm 69K (25 ~ 85°C)	3450K \pm 2% (0 ~ $+100^{\circ}\text{C}$)	○
PT9-25E2	0.55 k Ω (200°C)	98.63 k Ω (25°C)	4066K \pm 129K (25 ~ 85°C)	4300K \pm 3% (100 ~ 200°C)	○
PT9-312	1 k Ω (200°C)	231.4 k Ω (25°C)	4240K \pm 136K (25 ~ 85°C)	4537K \pm 3% (100 ~ 200°C)	
PM9-342	4 k Ω (200°C)	1388 k Ω (25°C)	4557K \pm 154K (25 ~ 85°C)	5014K \pm 3% (150 ~ 250°C)	

Note (1): Resistance value tolerance: $\pm 2.5\%$, $\pm 5\%$ Note (2): JIS C 1611 'Thermistor Temperature Detector'

Resistance - Temperature Characteristics



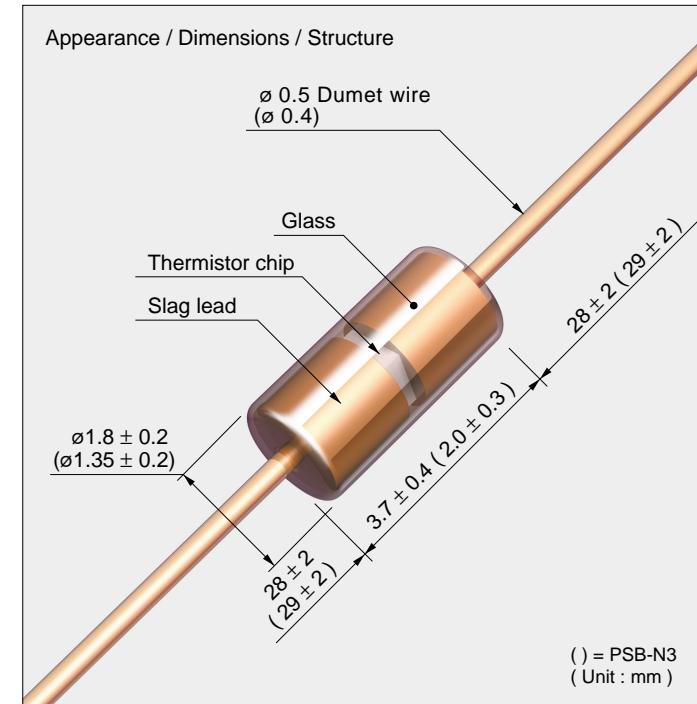
Voltage - Electric Current Characteristics



PSB-N / N3 THERMISTOR

Double heat sink diode (DHD)

These are thermistors sealed in a DHD form, using a PSB-S thermistor chip. Lead wires are coming out from both ends of the thermistor element, that is axial lead type. They are heat resistant by virtue of glass-sealing. Because of the large distance between lead wires, measurement errors by leakage are less likely to occur even with a high resistance thermistor chip, so the PSB-N/N3 can be used in many tough environments like oil smoke, dust or humidity.



Features

- These are made by the technologies for the highly reliable PSB-S thermistors. This means they possess a high degree of stability.
- These are suitable for use in harsh environments, such as where there is high humidity and oil vapors are generated (e.g. ovens), because of the large distance between lead wires.
- These are mass produced through mechanization, so there is sufficient control over price, quality and delivery period.
- These thermistors are small and sturdy, so automatic mounting onto printed circuit boards is possible.

Applications

These thermistors are suitable for the following temperature sensors that utilize the features of axial lead.

- Microwave oven meat probes
- Temperature control in convection microwave ovens
- Temperature detection in induction cookers
- Temperature control in laser beam printer photosensitive drums, etc.

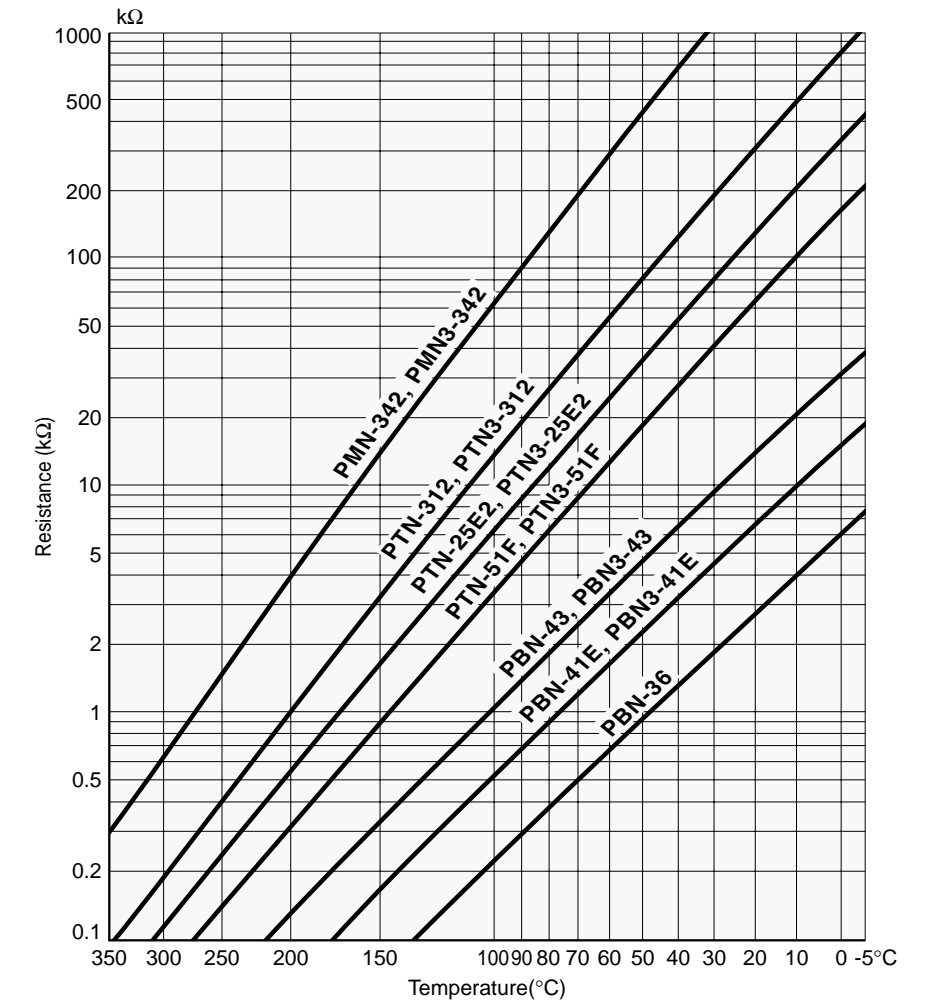
Rated Values

	PSB-N	PSB-N3
Operating temperature range	-50°C - +300°C	-50°C - +250°C
Thermal time constant τ (in still air)	12 sec. (10 - 15 sec.)	6 sec. (5 - 8 sec.)
Dissipation constant δ (in still air)	2.3mW/°C (1.9 - 3.0mW/°C)	1.3mW/°C (1.0 - 1.6mW/°C)
Insulation resistance (between the lead wire and the glass)	Min. 100M Ω (500V d.c.)	Min. 100M Ω (500V d.c.)

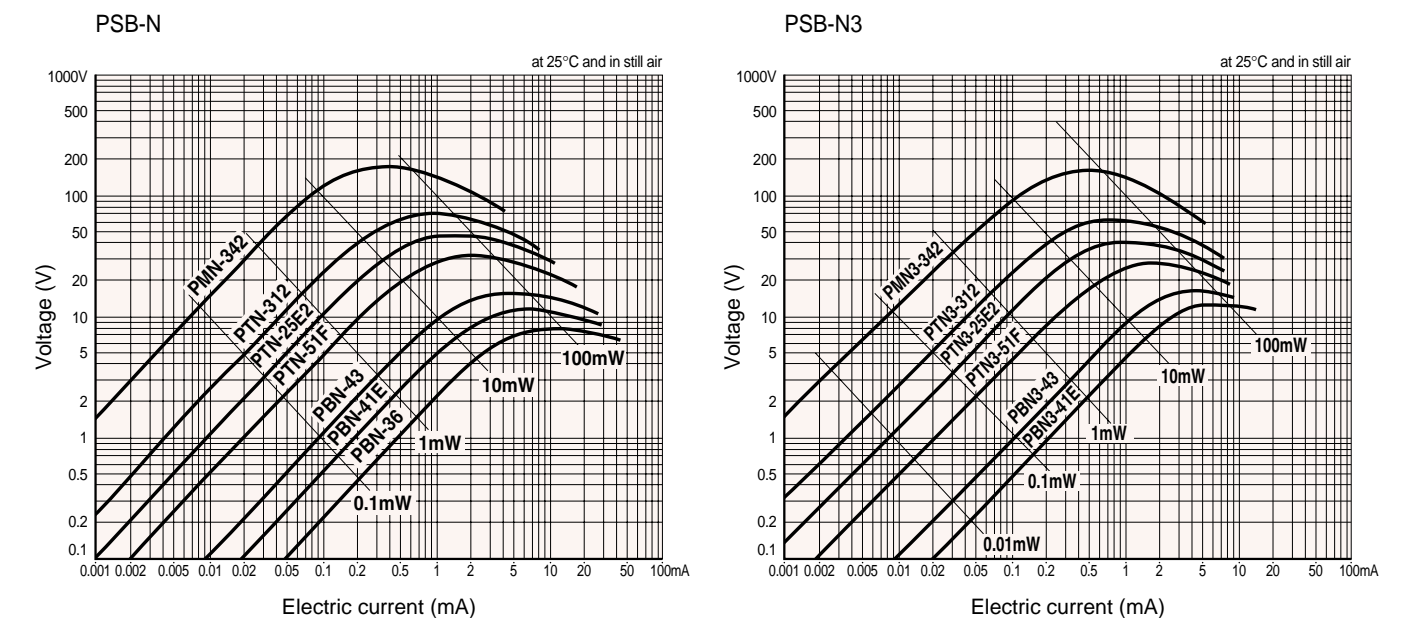
Product name	Nominal resistance value note (1)		B constant note (2)		JIS equivalent product note (3)
PBN-36	6 k Ω (0°C)	2.186 k Ω (25°C)	3420K \pm 68K (25 ~ 85°C)	3390K \pm 2% (0 ~ +100°C)	○
PBN-41E PBN3-41E	15 k Ω (0°C)	5.369 k Ω (25°C)	3480K \pm 69K (25 ~ 85°C)	3450K \pm 2% (0 ~ +100°C)	
PBN-43 PBN3-43	30 k Ω (0°C)	10.74 k Ω (25°C)	3480K \pm 69K (25 ~ 85°C)	3450K \pm 2% (0 ~ +100°C)	○
PTN-51F PTN3-51F	3.3 k Ω (100°C)	49.12 k Ω (25°C)	3992K \pm 79K (25 ~ 85°C)	3970K \pm 2% (0 ~ +100°C)	
PTN-25E2 PTN3-25E2	0.55 k Ω (200°C)	98.63 k Ω (25°C)	4066K \pm 129K (25 ~ 85°C)	4300K \pm 3% (100 ~ 200°C)	○
PTN-312 PTN3-312	1 k Ω (200°C)	231.4 k Ω (25°C)	4240K \pm 136K (25 ~ 85°C)	4537K \pm 3% (100 ~ 200°C)	
PMN-342 PMN3-342	4 k Ω (200°C)	1388 k Ω (25°C)	4557K \pm 154K (25 ~ 85°C)	5133K \pm 3% (200 ~ 300°C)	○

Note (1): Resistance value tolerance: $\pm 1\%$, $\pm 2.5\%$, $\pm 5\%$ Note (2): There are versions of B = $\pm 1\%$ for those with B = 3390, 3450 and 3970K, versions of B = $\pm 1\%$ and B = $\pm 2\%$ for those with B = 4300, 4537 and 5133K. Note (3): JIS C 1611 'Thermistor Temperature Detector'

Resistance - Temperature Characteristics



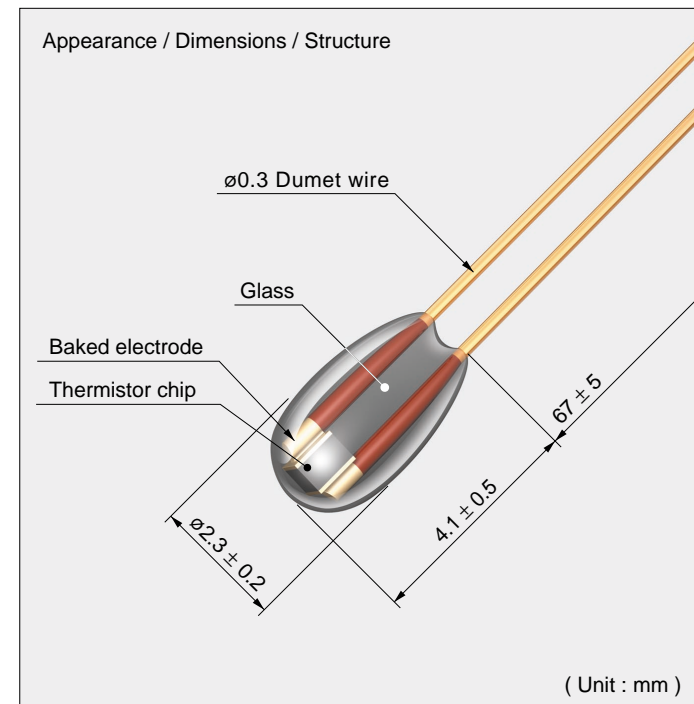
Voltage - Electric Current Characteristics



PMH THERMISTOR

Thermistors used in high temperatures

The PMH is a thermistor developed for equipment that is required to be used in high temperatures at all times. The highest operating temperature possible in continuous use is 350°C. The PMH can be used even at 400°C for less than 100 hours. Please be aware that if used for longer than this, the lead wire will be oxidized by the heat and risk of burn-out will increase. A thick (ø0.3mm) Dumet wire is used to give the thermistor heat resistance.



Features

- The PMH has heat resistance with a highest operating temperature of 350°C (400°C 100 hours is permitted)
- Mass production and stable supply of thermistors with uniform shapes and characteristics are enabled by virtue of chip elements and integrated automatic production.
- We invented our own unique PSB thermistors and have proven results with patents acquired in eight main countries around the world (Japan, the U.S., the U.K., West Germany, France, Canada, Italy and Switzerland)

Applications

Please use the PMH in the following types of equipment which are used in high temperatures so require heat resistance.

- For kerosene vaporizers in stoves
- For temperature control in convection oven and microwaves
- For temperature detection in engines, etc.

Rated Values

Operating temperature range : +100°C - +350°C (100 continuous hours at 400°C is permitted)

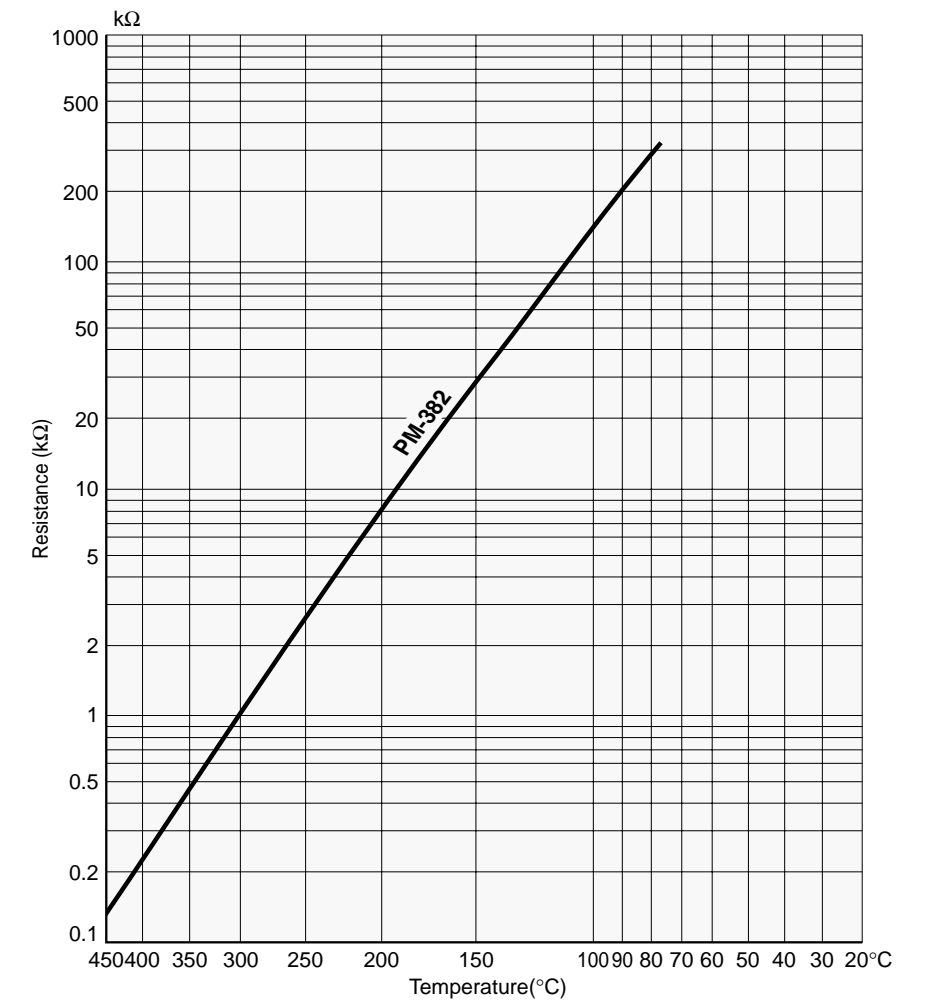
Thermal time constant τ : 12 sec. (11 - 16 sec.) (in still air)

Dissipation constant δ : 1.3mW/°C (1.1 - 1.6mW/°C) (in still air)

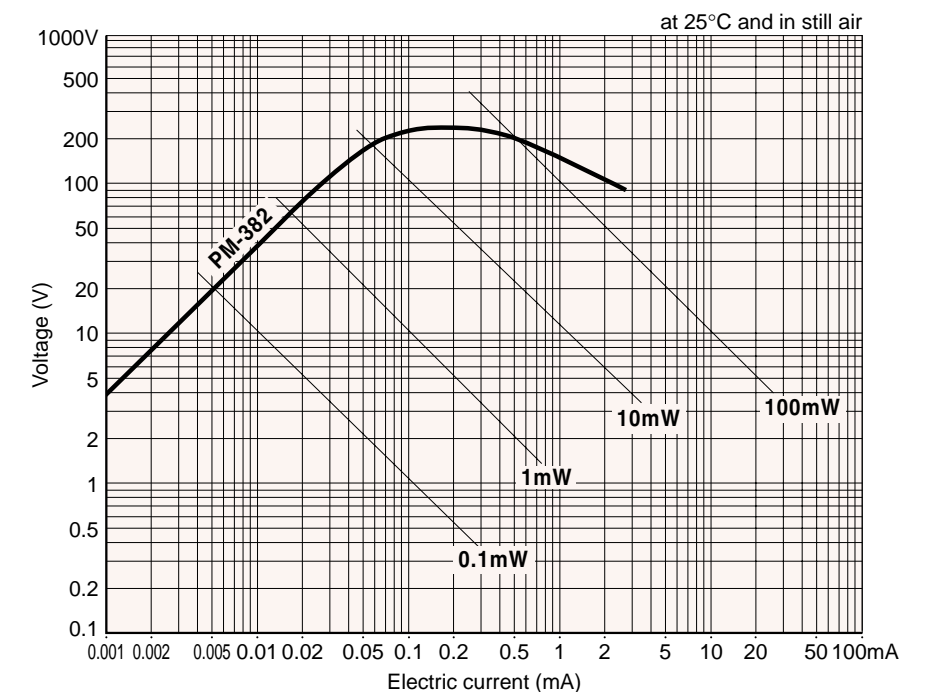
Insulation resistance : Min. 50M Ω (500V d.c.) (between the lead wire and the glass)

Product name	Nominal resistance value	B constant	Resistance tolerance value
PM-382	8 k Ω (200°C)	5300K \pm 3K (150 ~ 250°C)	\pm 2.5%, \pm 5%, \pm 10%

Resistance - Temperature Characteristics



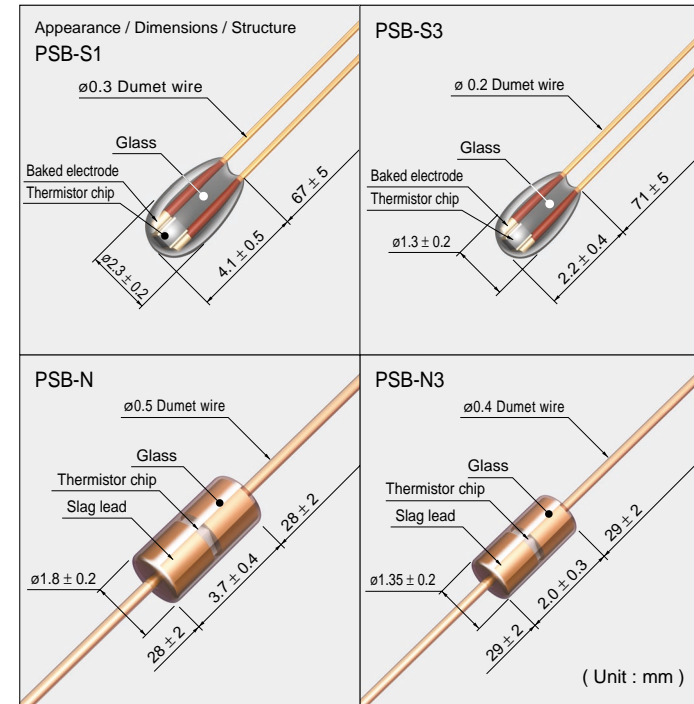
Voltage - Electric Current Characteristics



RB1 THERMISTOR

High precision of $\pm 1\%$ tolerance in both resistance value and B constant

The RB1 is a thermistor that is suitable for highly sophisticated and precise equipment. The RB1 is glass-sealed so it is highly stable and has a superior effect in maintaining the functionality of equipment.



Features

- This is glass-sealed, so it is highly stable and furthermore, it is durable in heat treatment, such as soldering of leads, resin seal processing and molding.
- The RB1 has a rich variety of shapes, so it is possible to choose the shape of the thermistor to match the application.

Applications

The RB1 is suitable for the following devices that require a highly sophisticated and precise detection.

- For charging control of battery packs and battery chargers, as well as for temperature compensation of crystal oscillators in mobile communication devices
- For office equipment, cooking devices, home appliances such as water heaters, driving force in automobiles, as well as temperature measurement and control in industrial measuring equipment

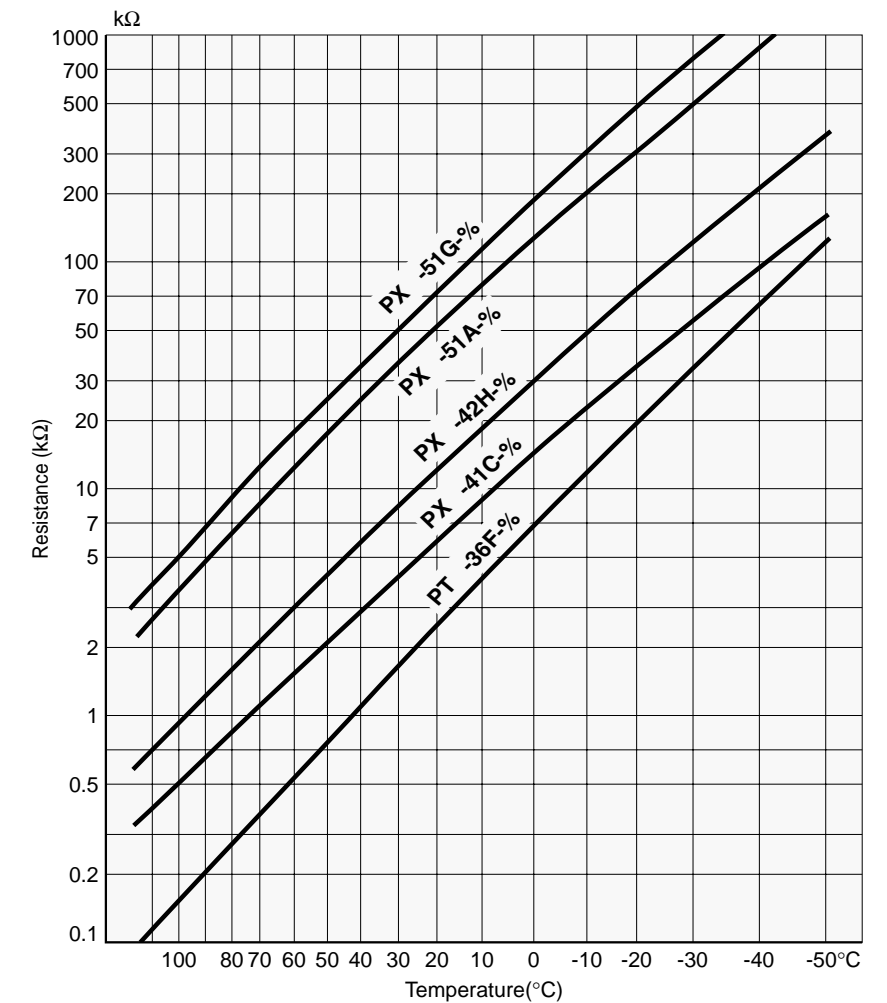
Rated Values

S1	S3	N	N3
Operating temperature range : $-50^{\circ}\text{C} - +120^{\circ}\text{C}$	$-50^{\circ}\text{C} - +120^{\circ}\text{C}$	$-50^{\circ}\text{C} - +120^{\circ}\text{C}$	$-50^{\circ}\text{C} - +120^{\circ}\text{C}$
Thermal time constant τ (in still air): Approx. 12 sec. (10 - 17 sec.)	Approx. 5 sec. (3.5 - 6.5 sec.)	Approx. 12 sec. (10 - 15 sec.)	Approx. 6 sec. (5 - 8 sec.)
Dissipation constant δ (in still air): Approx. $1.3\text{mW}/^{\circ}\text{C}$ (1.1 - 1.6 $\text{mW}/^{\circ}\text{C}$)	Approx. $0.75\text{mW}/^{\circ}\text{C}$ (0.7 - 0.9 $\text{mW}/^{\circ}\text{C}$)	Approx. $2.3\text{mW}/^{\circ}\text{C}$ (1.9 - 3.0 $\text{mW}/^{\circ}\text{C}$)	Approx. $1.3\text{mW}/^{\circ}\text{C}$ (1.0 - 1.6 $\text{mW}/^{\circ}\text{C}$)
Insulation resistance: Min. $50\text{M}\Omega$ (500V d.c. megger)	Min. $10\text{M}\Omega$ (50V d.c. megger)	Min. $100\text{M}\Omega$ (500V d.c. megger)	Min. $100\text{M}\Omega$ (500V d.c. megger)

Product name	Nominal resistance value note (1)	B constant
PT-36F-% PT3-36F-% PTN-36F-% PTN3-36F-%	$2.10 \pm 1\% \text{k}\Omega(25^{\circ}\text{C})$	$3850\text{k} \pm 1\%(25 \sim 85^{\circ}\text{C})$
PX-41C-% PX3-41C-% PXN-41C-% PXN3-41C-%	$5 \pm 1\% \text{k}\Omega(25^{\circ}\text{C})$	$3300\text{k} \pm 1\%(25 \sim 85^{\circ}\text{C})$
PX-42H-% PX3-42H-% PXN-42H-% PXN3-42H-%	$10 \pm 1\% \text{k}\Omega(25^{\circ}\text{C})$	$3435\text{k} \pm 1\%(25 \sim 85^{\circ}\text{C})$
PX-51A-% PX3-51A-% PXN-51A-% PXN3-51A-%	$40 \pm 1\% \text{k}\Omega(25^{\circ}\text{C})$	$3535\text{k} \pm 1\%(25 \sim 85^{\circ}\text{C})$
PX-51G-% PX3-51G-% PXN-51G-% PXN3-51G-%	$58.5 \pm 1\% \text{k}\Omega(25^{\circ}\text{C})$	$3630\text{k} \pm 1\%(25 \sim 85^{\circ}\text{C})$

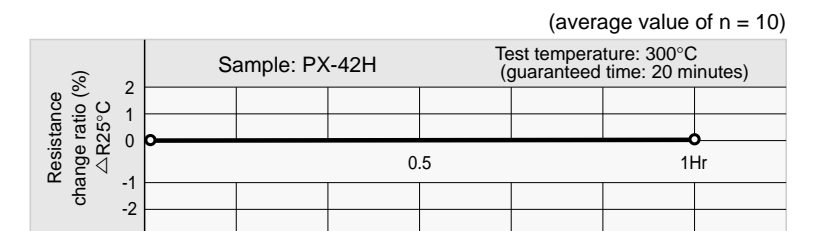
Note (1): Variations with other resistance values are available.

Resistance - Temperature Characteristics

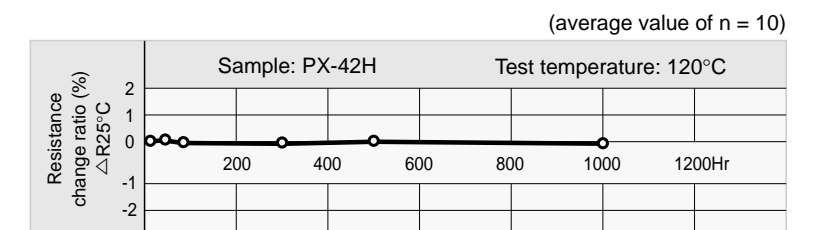


Reliability Data

- Heat resistance test (Soldering and resin sealing in high temperatures is possible.)

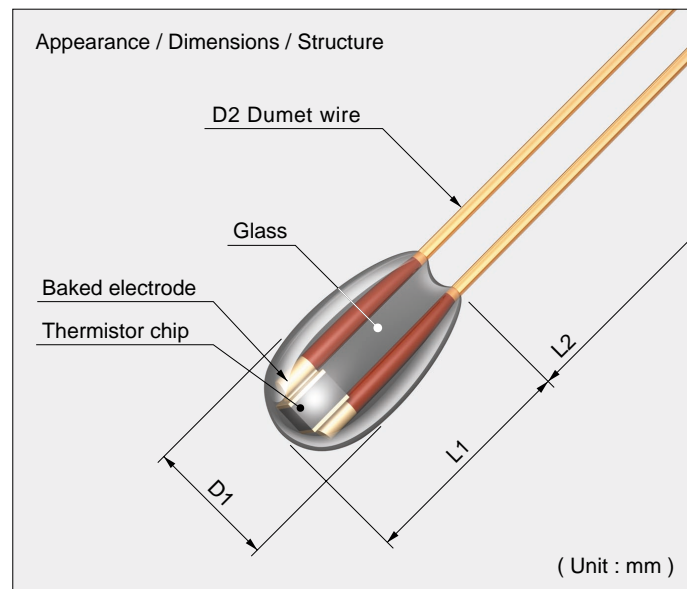


- Heat resistance test (The highest operating temperature is 120°C)



PL Series SHIBAURA WIDE TEMPERATURE RANGE THERMISTOR

Thermistors that can give high precision measurements in a wide range of temperatures



Type	Size	D1	D2	L1	L2
PL		∅2.3 ± 0.2	∅0.3	4.1 ± 0.5	67 ± 5
PL2		∅1.6 ± 0.2	∅0.25	2.7 ± 0.4	65 ± 5
PL3		∅1.3 ± 0.2	∅0.2	2.2 ± 0.4	71 ± 5

Features

- These thermistors can be used in a wide temperature range, because the resistance value is high and the B constant is a low 2240K, which was not available in traditional thermistors.
- The PL Series are glass-sealed thermistors, so the operating temperature range is wide like traditional PSB-S models at -50°C - +300°C. This gives about 1.5 times wider temperature control range where its change of resistance value is kept within 10 times, that makes design easy.
Comparison with our products:
PSB: 200°C = 1kΩ, 108°C = 10kΩ
PL : 200°C = 1kΩ, 48°C = 10kΩ (Extended control range)
- PL Series thermistors are available in three types of sizes for applications, so processing into various sensor shapes is possible.

Applications

In addition to the following equipment, please use in devices that require high reliability in temperature measurements and control.

- Home appliances, including microwaves, rice cookers and induction heating cooking appliances
- White goods, like refrigerators and air conditioners which switch temperature control ranges
- Industrial equipment using platinum or thermocouples

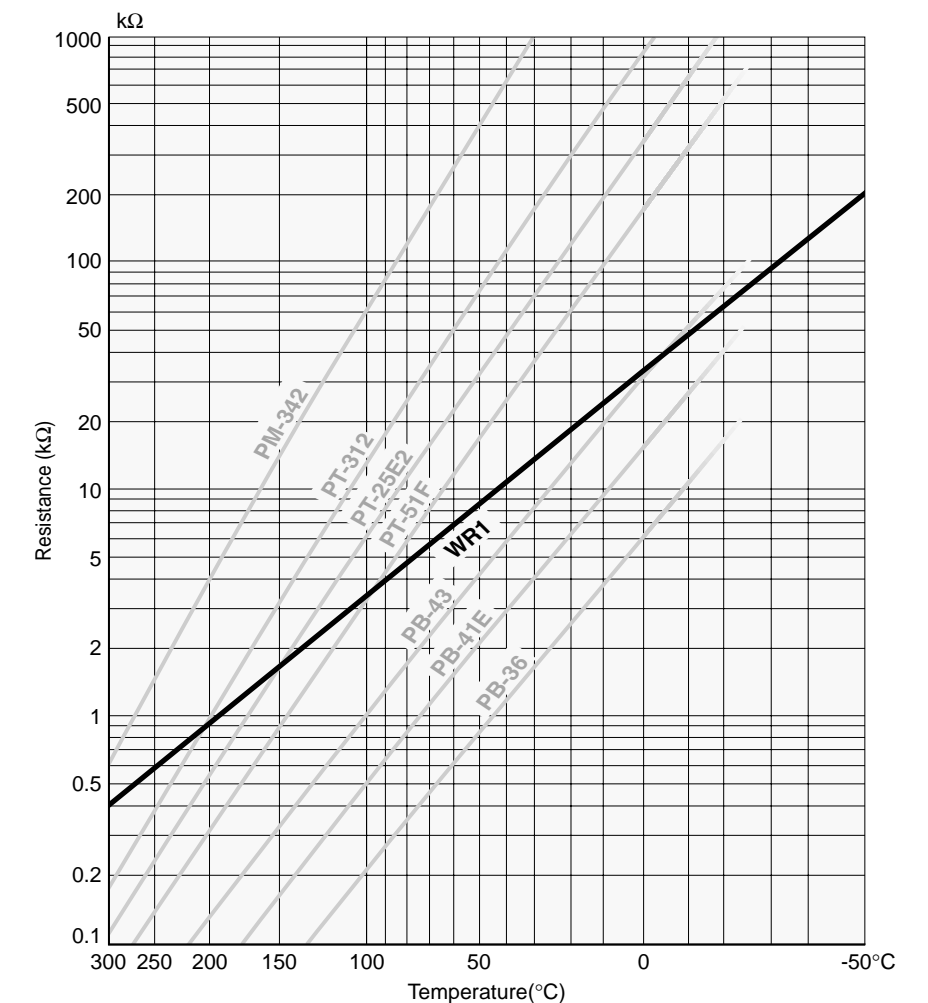
Rated Values

	PL	PL2	PL3
Operating temperature range	: -50°C - +300°C	-50°C - +300°C	-50°C - +300°C
Thermal time constant τ (in still air):	12 sec. (10 - 17 sec.)	8 sec. (6.5 - 10 sec.)	5 sec. (3.5 - 6.5 sec.)
Dissipation constant δ (in still air):	1.3mW/°C (1.1 - 1.6 mW/°C)	0.9mW/°C (0.8 - 1.1 mW/°C)	0.75mW/°C (0.7 - 1.0 mW/°C)
Insulation resistance (between the lead wire and the glass):	Min. 50MΩ (500V d.c.)	Min. 10MΩ (50V d.c.)	Min. 10MΩ (50V d.c.)

Product name	Nominal resistance value note (1)	B constant note (2)
PT -312	1 kΩ (200°C) 17.13 kΩ (25°C)	2240K ± 2% (25 ~ 85°C)

Note (1): Resistance value tolerance: ± 1%, ± 2.5%, ± 5% Note (2): There are versions of B = ± 1% for those with B = 3390, 3450 and 3970K, versions of B = ± 1% and B = ± 2% for those with B = 4300, 4537 and 5133K.

Resistance - Temperature Characteristics

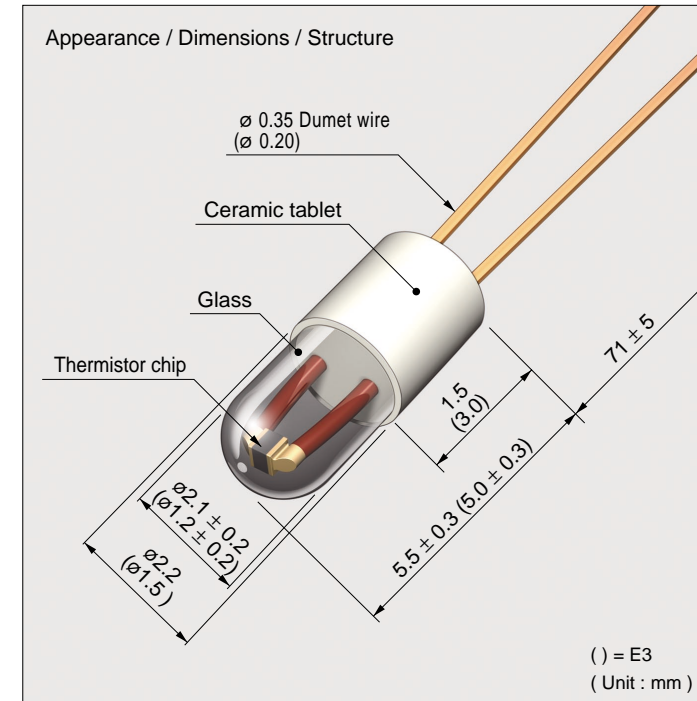


Temperature(°C)	Standard Value (kΩ)
-50	205.0
-40	134.8
-20	64.12
0	33.88
20	19.46
25	17.13
40	11.96
60	7.772
80	5.288
100	3.741
120	2.735
140	2.057
160	1.585
180	1.247
200	1.000
220	0.8150
240	0.6739
260	0.5644
280	0.4782
300	0.4094

NS II THERMISTOR

A thermistor for temperature measurements in wet environment

The NSII is a thermistor that mechanically reinforces, with a ceramic tablet, the outlet of the lead wire in a glass-sealed thermistor and so has remarkably elevated the electrical insulation and mechanical strength. In particular, it is suitable for use in places with much humidity.



Features

- The creepage distance between the lead wires has been made long in the ceramic tablet, so there is excellent moisture-resistance.
- The strength of the outlet of the lead wire has been increased, so the glass seal does not break or crack due to forming and resin injections during sensor processing

Applications

The NSII is suitable for temperature detection in the following equipment that is used in places with a high humidity.

- For temperature control in oil and gas boilers
- Temperature sensors that require moisture-resistance and mechanical strength for water heaters, dish dryers, clothes dryers, bidets, automobile coolants and engine oils

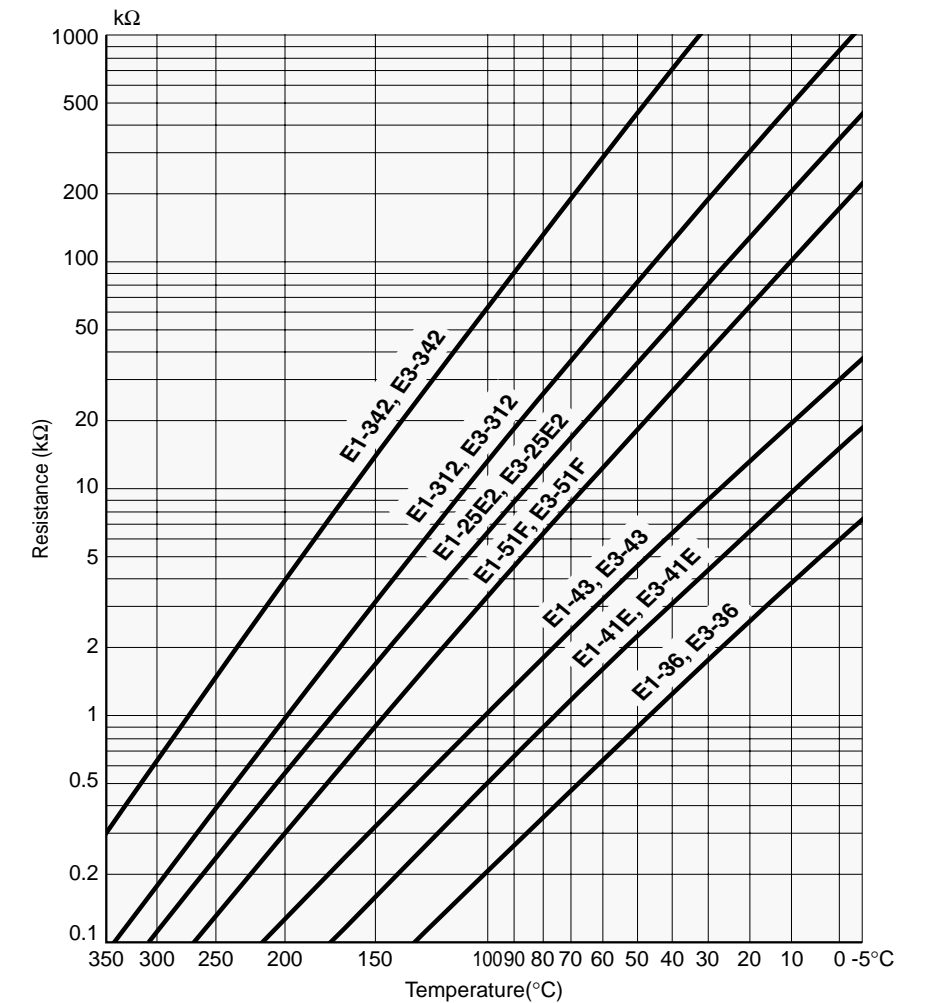
Rated Values

	E1	E3
Highest operating temperature :	300°C	300°C
Thermal time constant τ :	Approx. 18 sec	Approx. 10 sec
Dissipation constant δ :	Approx. 1.5mW/°C	Approx. 1.2mW/°C
Insulation resistance :	Min. 100M Ω (500V d.c.)	Min. 10M Ω (50V d.c.)

Product name	Nominal resistance value <small>note (1)</small>	B constant
E1-36 E3-36	6 k Ω (0°C)	3420K \pm 68K (25 ~ 85°C) 3390K \pm 2% (0 ~ 100°C)
E1-41E E3-41E	15 k Ω (0°C)	3480K \pm 69K (25 ~ 85°C) 3450K \pm 2% (0 ~ 100°C)
E1-43 E3-43	30 k Ω (0°C)	3480K \pm 69K (25 ~ 85°C) 3450K \pm 2% (0 ~ 100°C)
E1-51F E3-51F	3.3 k Ω (100°C)	3992K \pm 79K (25 ~ 85°C) 3970K \pm 2% (0 ~ 100°C)
E1-25E2 E3-25E2	0.55 k Ω (200°C)	4066K \pm 129K (25 ~ 85°C) 4300K \pm 3% (100 ~ 200°C)
E1-312 E3-312	1 k Ω (200°C)	4240K \pm 136K (25 ~ 85°C) 4537K \pm 3% (100 ~ 200°C)
E1-342 E3-342	4 k Ω (200°C)	4557K \pm 154K (25 ~ 85°C) 5133K \pm 3% (200 ~ 300°C)

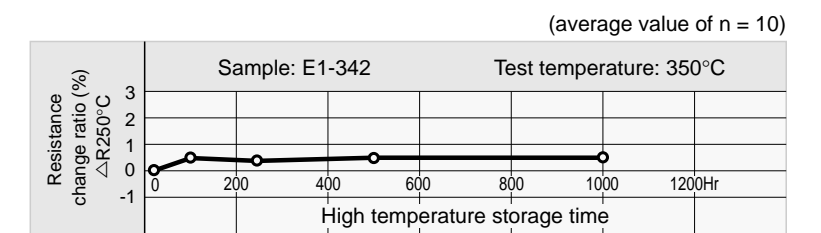
Note (1): Resistance value tolerance: \pm 2.5%, \pm 5%, \pm 10%

Resistance - Temperature Characteristics

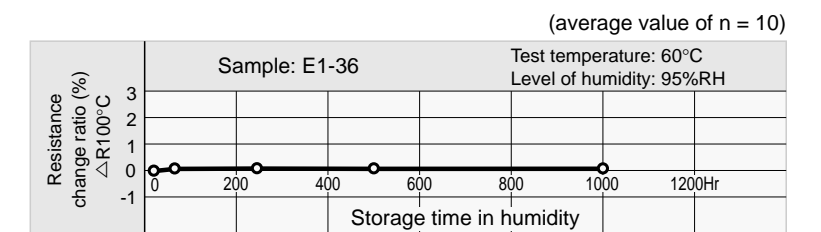


Reliability Data

● Heat resistance test



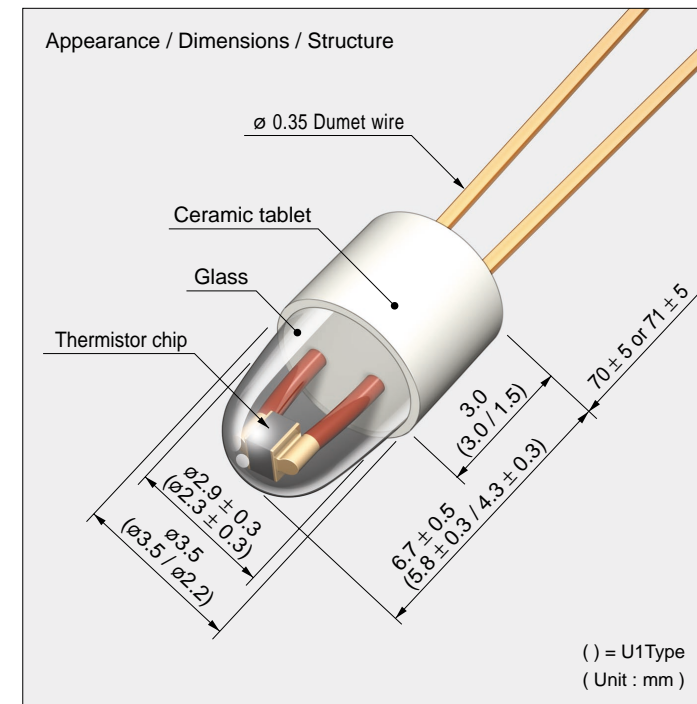
● Damp heat test



NS III THERMISTOR

Heat resistance of 500°C achieved

The NSIII is a thermistor that has been given a significantly wider operating temperature range due to a heat resistant thermistor chip that is sealed in heat resistant glass and by being combined with a ceramic tablet.



Features

- The NSIII is suitable for use under harsh conditions at high temperatures due to the adoption of a heat resistant thermistor chip and glass.
- There is superior moisture-resistance and mechanical strength in the thermistor lead wire outlet from the combination of the thermistor glass and ceramic tablet.

Applications

The NSIII is suitable for the following equipment that detects high temperatures

- Temperature sensors used in high temperature and harsh environmental conditions, such as for kerosene vaporizers in warm air heaters, automotive exhaust, convection microwave ovens, as well as gas ranges.

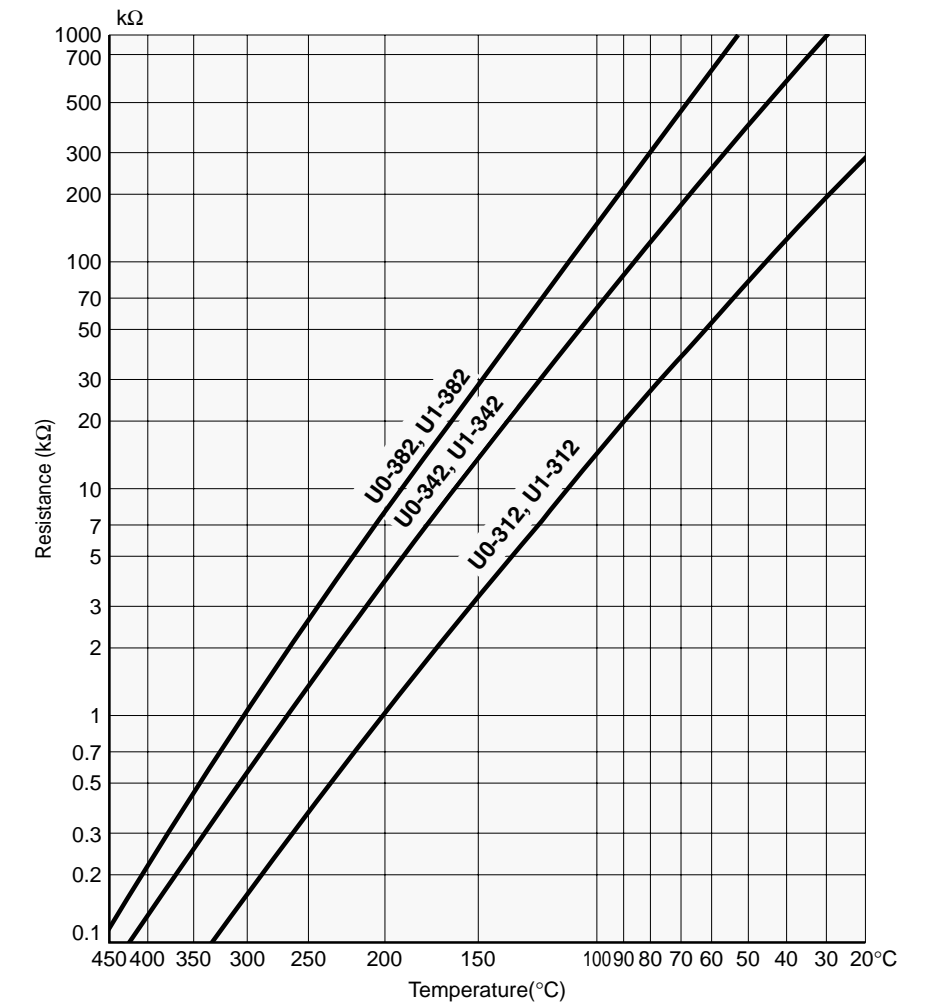
Rated Values

U0		U1	
Highest operating temperature : 500°C		500°C	
Thermal time constant τ : Approx. 20 sec		Approx. 18 sec	
Dissipation constant δ : Approx. 2.0mW/°C		Approx. 1.5mW/°C	
Insulation resistance : Min. 100M Ω (500V d.c.)		Min. 100M Ω (500V d.c.)	

Product name	Nominal resistance value note (1)	B constant
U0-312 U1-312	1 k Ω (200°C)	4537k \pm 3% (100 ~ 200°C)
U0-342 U1-342	4 k Ω (200°C)	5133k \pm 3% (200 ~ 300°C)
U0-382 U1-382	8 k Ω (200°C)	5300k \pm 3% (150 ~ 250°C)

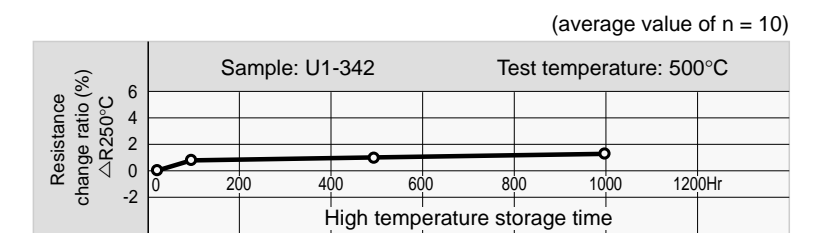
Note (1): Resistance value tolerance: \pm 2.5%, \pm 5%, \pm 10%

Resistance - Temperature Characteristics

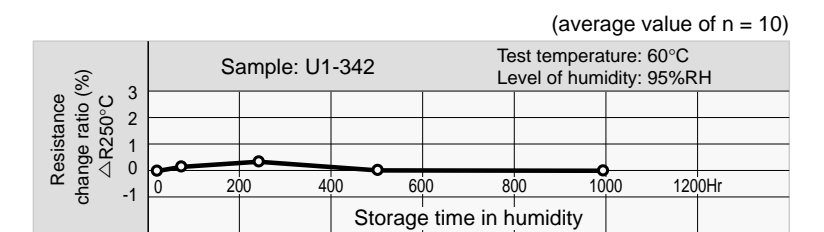


Reliability Data

- Heat resistance test



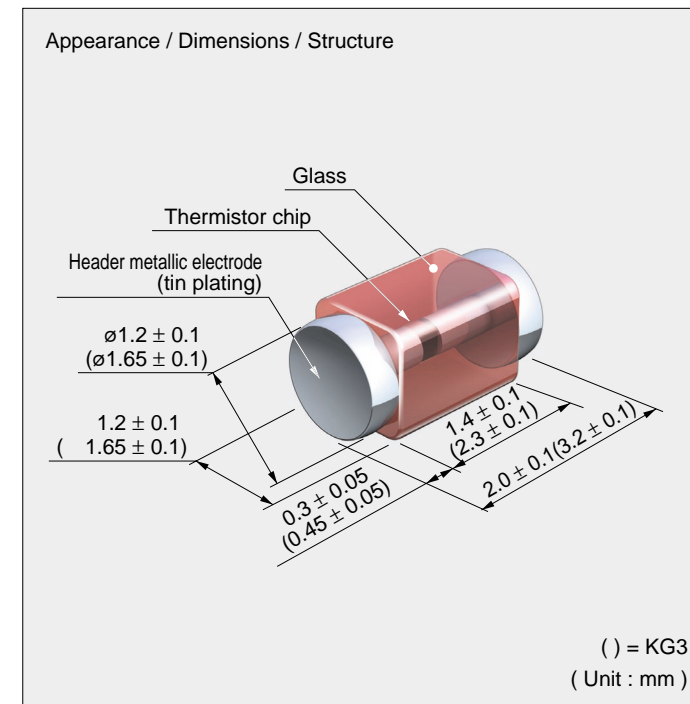
- Damp heat test



KG2 , KG3 THERMISTOR

Highly reliable SMT device

The KG is a chip thermistor that has been developed in response to the requirements for a thermistor with high reliability. A square glass and header metallic electrodes are used, so the KG offers reduced deterioration with age, as well as superior soldering and mounting.



Features

- There are two types of KG to choose from, the KG3 (3216) and KG2 (2012), depending on your intended use.
- The electrode is not film, but instead a metallic body with solder plated, so there is no solder leaching or electrode peeling.
- Square glass is used, so there is no misalignment during insertion or mounting defect, such as omission.

Applications

KG thermistors are suitable for the following temperature measurements with SMT.

- Temperature compensation in electronic components, such as crystal oscillators, hybrid integrated circuits and transistors
- Temperature compensation for surface-mounted general electronic circuit components
- Temperature control in printers and thermal heads, etc.
- Over-charging prevention in mobile communication batteries
- Over-charging prevention in audiovisual equipment batteries
- Brightness adjustment voltage control for liquid crystal displays
- Temperature sensors in general measurement and control devices, as well as precision equipment

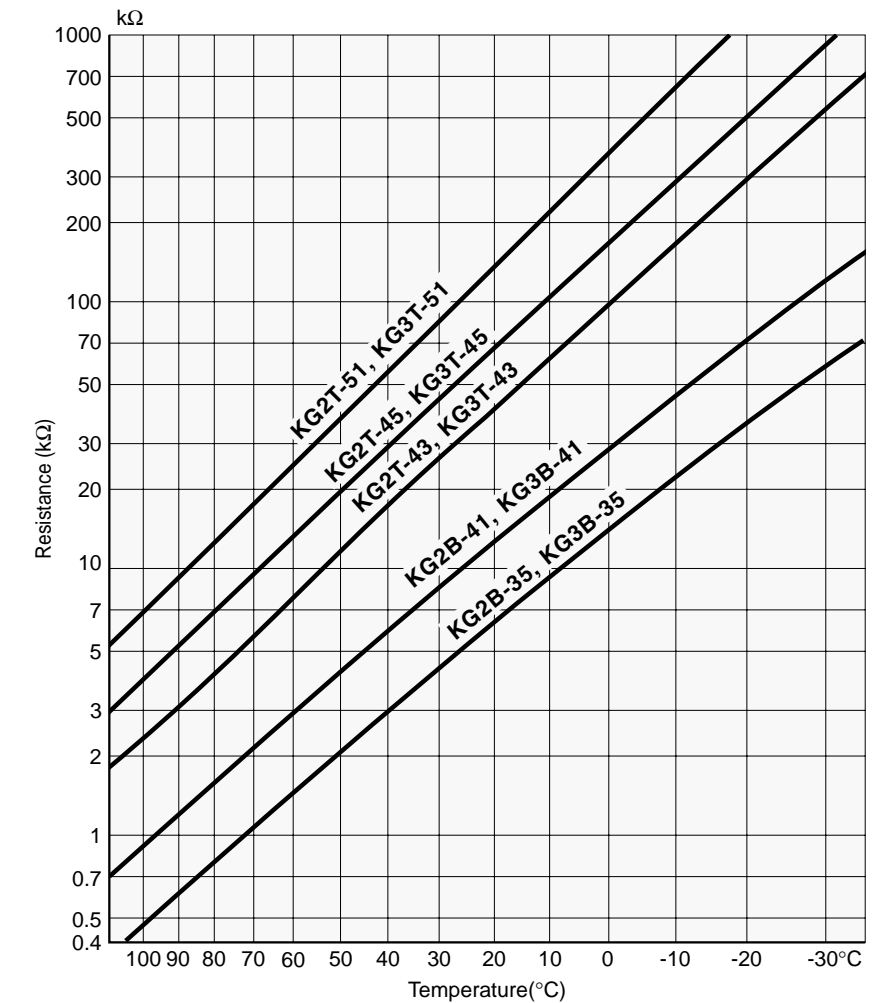
Rated Values

KG3		KG2	
Operating temperature range : -50°C - +200°C		-50°C - +200°C	
Thermal time constant τ : Approx. 10 sec		Approx. 5 sec	
Dissipation constant δ : Approx. 1.4mW/°C		Approx. 1.3mW/°C	
Soldering heat resistance: 3 sec. at 350°C		3 sec. at 350°C	

Product name		Nominal resistance value note (1)		B constant
KG3B-35	KG2B-35	13.72 k Ω (0°C)	5 k Ω (25°C)	3375K \pm 2% (25 ~ 50°C)
KG3B-41	KG2B-41	28.08 k Ω (0°C)	10 k Ω (25°C)	3450K \pm 2% (25 ~ 50°C)
KG3T-43	KG2T-43	98.90 k Ω (0°C)	30 k Ω (25°C)	3950K \pm 2% (25 ~ 50°C)
KG3T-45	KG2T-45	164.8 k Ω (0°C)	50 k Ω (25°C)	3950K \pm 2% (25 ~ 50°C)
KG3T-51	KG2T-51	332.3 k Ω (0°C)	100 k Ω (25°C)	4000K \pm 2% (25 ~ 50°C)

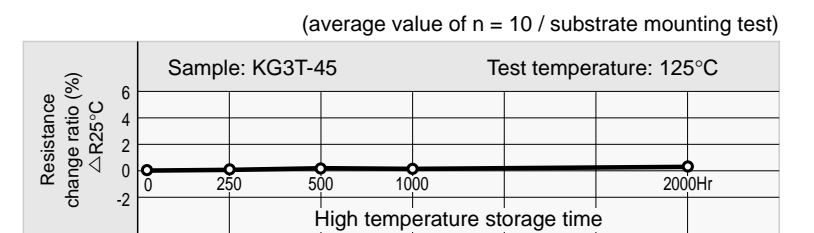
Note (1): Resistance value tolerance: \pm 3%, \pm 5%

Resistance - Temperature Characteristics

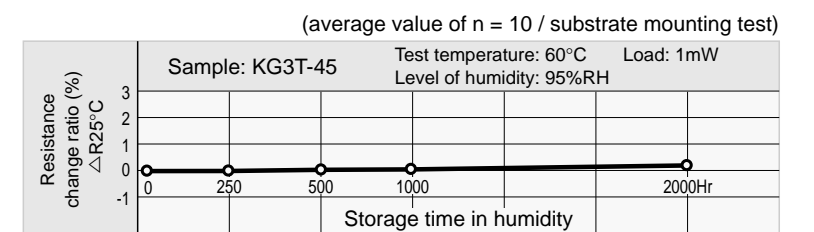


Reliability Data

● Heat resistance test



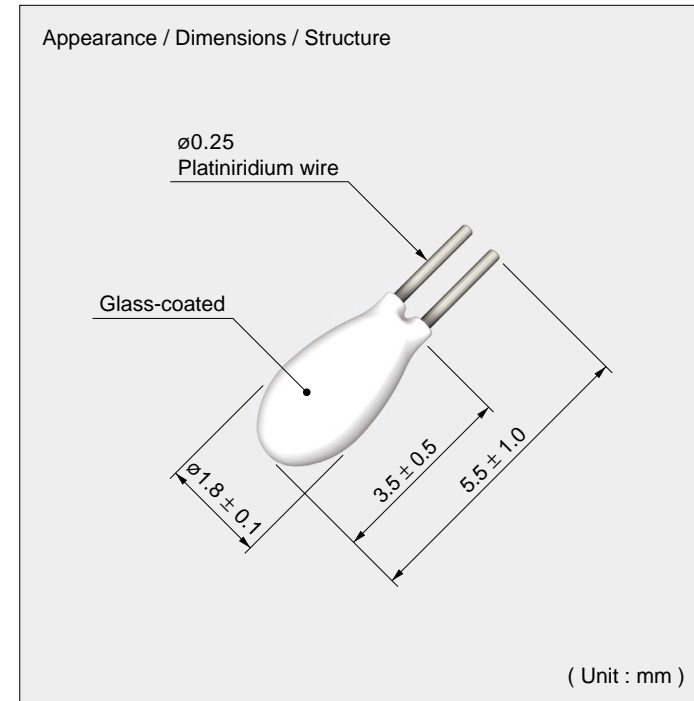
● Humidity load test



UH1 Shibaura High Temperature Thermistor

Heat resistance of 1000°C achieved

Finally the long awaited high temperature thermistor that can be mass produced has been completed!



Features

- The UH1 is the thermistor with a small temperature change ratio, which can be used in a wide temperature range; from -50°C to high temperatures of 1000°C.
- The ceramic type special glass possesses a strength more than two times that of traditional glass-coated products (compared to our company's products).
- The UH1 has excellent durability against reducible gases, such as hydrogen gas.

Applications

- Applications that directly detect high temperatures in regions to be heated
- Burner temperature control in gas ranges and water heaters
- For industrial equipment using platinum temperature detectors and thermocouples
- Other abnormal heating detection in combustion equipment

Rated Values

Operating temperature range : -50°C - +1000°C

Thermal time constant τ : 12 sec. (10 - 14 sec.) (in still air)

Dissipation constant δ : 1.1mW/°C (0.9 - 1.3mW/°C) (in still air)

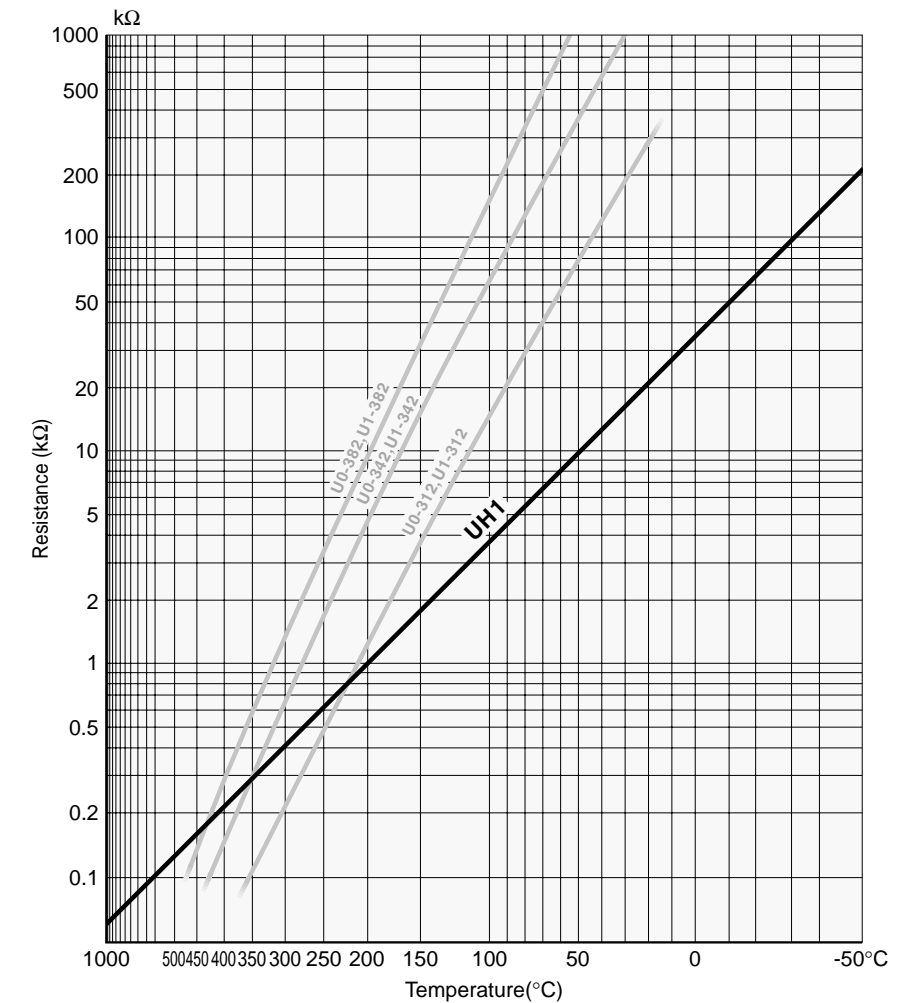
Insulation resistance : Min. 50M Ω (500V d.c.) (between the lead wire and the glass)

Product name	Nominal resistance value	B constant
UH1	1 k Ω (200°C)	2250K \pm 1% (25 ~ 50°C)

Resistance - Temperature Characteristics

Temperature(°C)	Resistance (k Ω)
-50	200.8
0	34.49
50	9.747
100	3.769
150	1.801
200	1.000
250	0.6155
300	0.4109
350	0.2915
400	0.2167
450	0.1670
500	0.1326
550	0.1077
600	0.08923
650	0.07512
700	0.06410
750	0.05534
800	0.04824
850	0.04241
900	0.03757
950	0.03350
1000	0.03004

R200=1k Ω \pm 2% B25/50=2250K \pm 1%



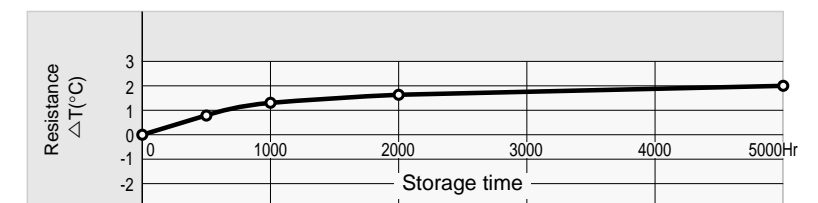
Durability test

■ 1000°C: Stored for 1000 hours (within \pm 2°C)

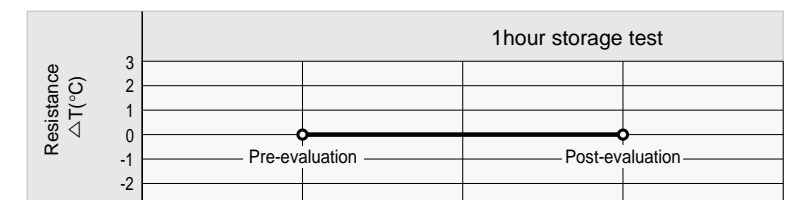
■ 900°C: 1 hour in an atmosphere of 5% hydrogen (within \pm 1°C)

■ 1000°C \leftrightarrow room temperature: 1000 cycles (within \pm 2°C)

● 1000°C continuous storage test



● 900°C (in an atmosphere of 5% hydrogen)



Terms of Use

How to Order

When ordering or making an inquiry about measurement thermistors, please specify the following eight items after reading the individual standards of each PSB thermistor in this catalog.

1. Intended use

Temperature measurement, temperature record, temperature control, temperature compensation, other

2. Environmental conditions of use

In air, in water, in ocean water, in humidity, in acid/alkaline atmospheres, other

3. Reliability test items

Temperature cycle, thermal shock, moisture-proof, water-proof, vibration-proof, heat resistance, cold resistance, etc. and their test conditions

4. Operating temperature range

°C - °C

5. Model or product name and dimensions

6. Resistance value

K Ω \pm % at °C

7. B constant (Please consult with the individual standards tables in this catalog and then specify from these.)

B = K \pm %

8. Thermal time constant

sec. - sec., in atmosphere

Precautions in Use

When using thermistors, please take the following precautions.

- As far as possible, do not subject thermistors to heat shocks with a large temperature difference.
- It is recommended to limit a conduction current less than 1/100 of the dissipation constant δ .
- There should be a circuit design that prevents excessive electric current to flow in the thermistor.
- Measurements should commence after 5 τ (sec.) or more elapses.
- In systems that require high precision measurement and control, it is desirable to have a glass-coated thermistor.
- It is appropriate that the insertion depth to the target of the temperature measurement be 25 times or more of the diameter of metallic protection tube and 15 times or more for non-metallic protection tube.
- Moisture-proofing and insulation treatment should be completely applied between the lead wires of the thermistor element.

SHIBAURA THERMISTOR SHIBAURA THERMISTOR SENSORS

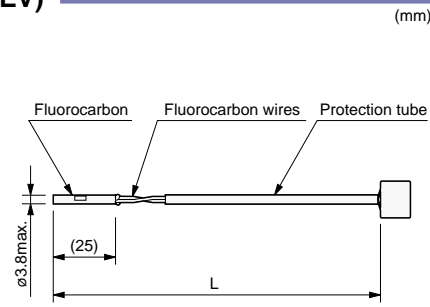
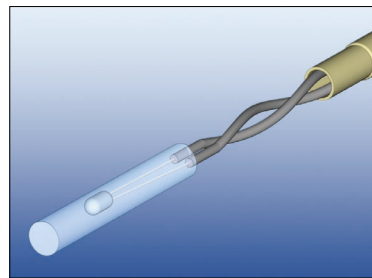
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Automobiles

for Automotive (EV,HEV)

A1 for Electric Motors (EV, HEV)



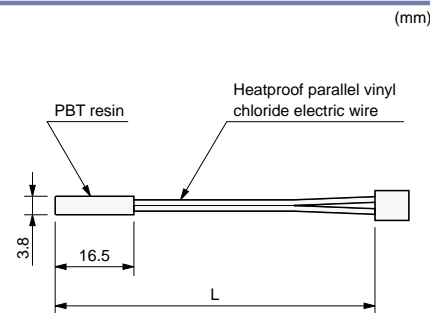
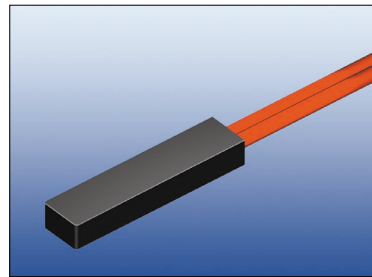
Features
High & low temperature proof, oil proof and solvent proof because of fluoro resin sealing.

Applications
Electric motors for EV, HEV and their inverter temperature measurement etc.

Operating temperature range
-40°C to 200°C(250°C for a short time)

Thermal time constant
Approx. 4 sec. (in liquid)

A2 for Batteries



Features
Standard plastic casing solution for low temperature range.

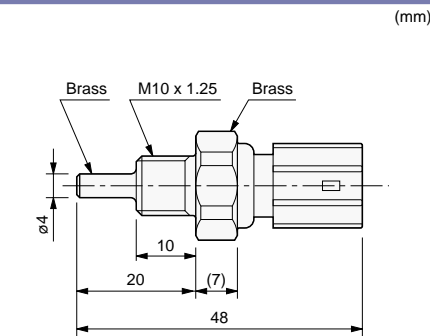
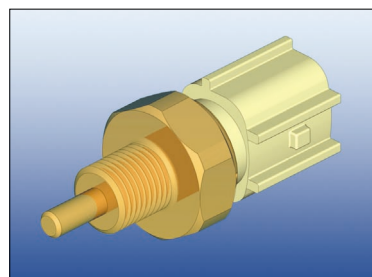
Applications
Battery temperature measurement for EV and HEV.

Operating temperature range
-40°C to 80°C

Thermal time constant
Approx. 4 sec. (in liquid)

for Automotive (Engine)

A3 for Water Temperature



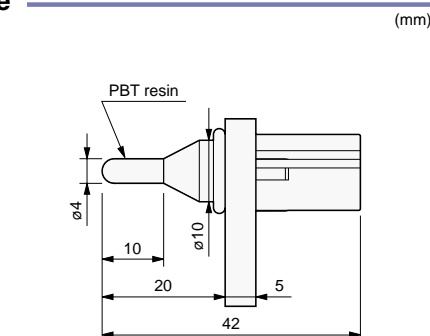
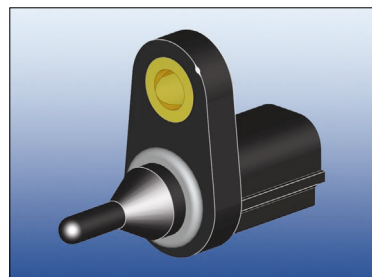
Features
Direct coupler type with durable NSII thermistor element. Available for each car maker standards.

Applications
Water and Oil temperature detection for automotive and motorcycles etc.

Operating temperature range
-40°C to 150°C (200°C type available)

Thermal time constant
Approx. 2 sec. (in liquid)

A4 for Intake Air Temperature



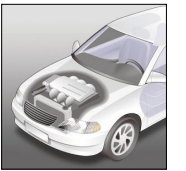
Features
Direct coupler type with one-piece plastic casing. Good for Engine control.

Applications
Intake air temperature detection for automotive and motorcycles etc.

Operating temperature range
-40°C to 150°C (200°C type available)

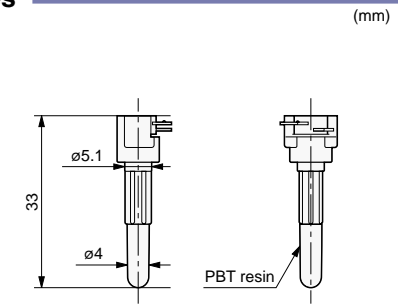
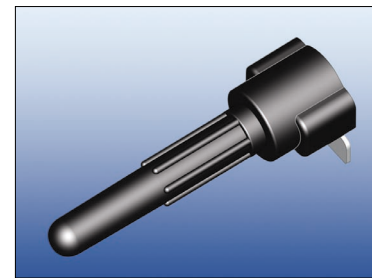
Thermal time constant
Approx. 8 sec. (in liquid)

※ Above-described shapes are just for example, customized designs are available.



for Automotive (Engines)

A5 for Intake Air for Motorcycles



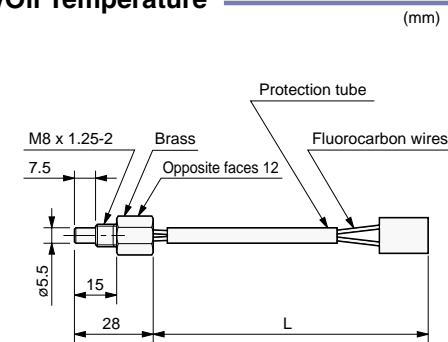
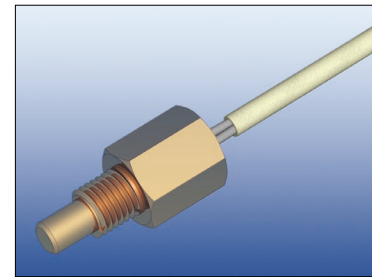
Features
Small and light weight. Good to combine with other components.

Applications
Intake air temperature detection for motorcycles etc.

Operating temperature range
-40°C to 120°C

Thermal time constant
Approx. 6 sec. (in liquid)

A6 for Engine Temperature/Oil Temperature



Features
Good for narrow fixation area and medium temperature range.

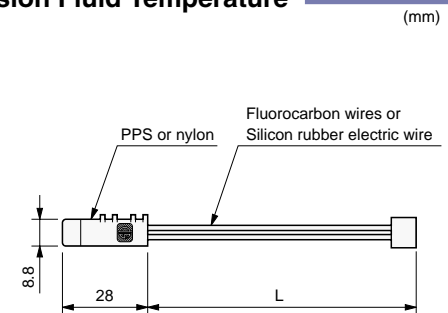
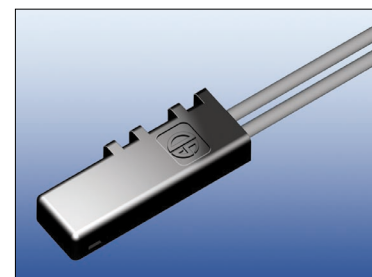
Applications
Water, oil and engine temperature for motorcycles or multi-purpose engines etc.

Operating temperature range
-40°C to 150°C (200°C for a short time)

Thermal time constant
Approx. 2 sec. (in liquid)

for Automotive (Drive Trains / Exhaust)

A7 for Automatic Transmission Fluid Temperature



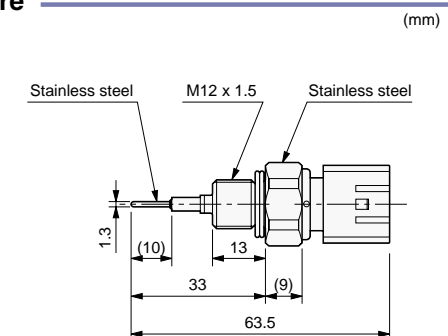
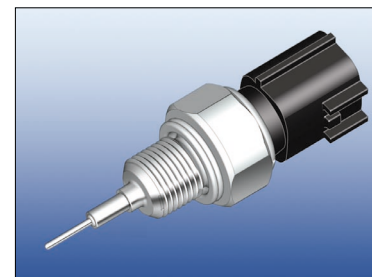
Features
Standard solution of insulating oil temperature measurement.

Applications
ATF temperature detection for automotive etc.

Operating temperature range
-40°C to 165°C

Thermal time constant
Approx. 20 sec. (in liquid)

A8 for EGR Gas Temperature



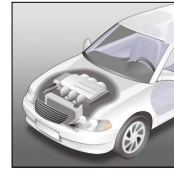
Features
Quick response as thermocouples. Good for medium temperature range.

Applications
Water, Intake air and EGR gas temperature detection for automotive etc.

Operating temperature range
-40°C to 180°C (250°C for short term)

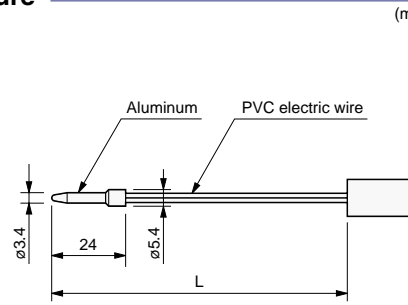
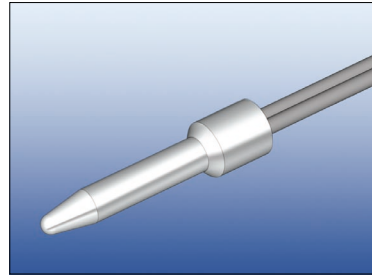
Thermal time constant
Less than 1 sec. (in liquid)

※ Above-described shapes are just for example, customized designs are available.



for Automotive (Car Air Conditioner)

A9 for Evaporator Temperature



(mm)

Features

Standard Aluminum protection cap solution.

Applications

Evaporator temperature detection for automotive etc.

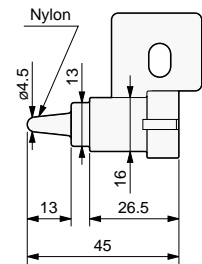
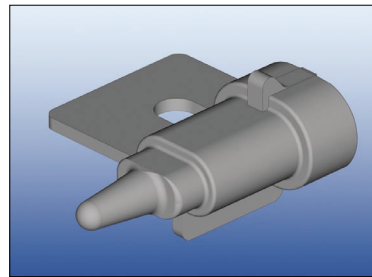
Operating temperature range

-40°C to 80°C

Thermal time constant

Approx. 3 sec. (in liquid)

A10 for Outside Air Temperature



(mm)

Features

Direct coupler type with one-piece resin casing.

Applications

Outside temperature detection for automotive etc.

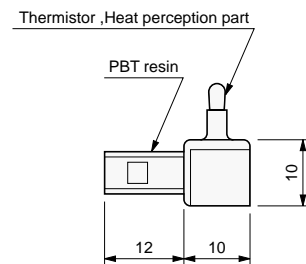
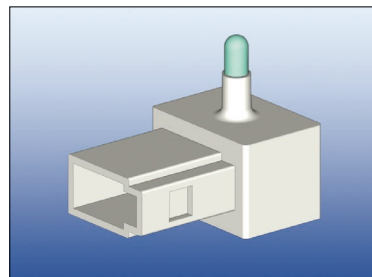
Operating temperature range

-40°C to 120°C

Thermal time constant

Approx. 10 sec. (in liquid)

A11 for Room Temperature



(mm)

Features

Direct coupler type with exposed element head.

Applications

Room temperature detection for automotive etc.

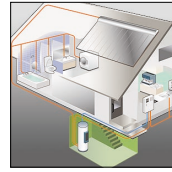
Operating temperature range

-40°C to 130°C

Thermal time constant

Less than 1 sec. (in liquid)

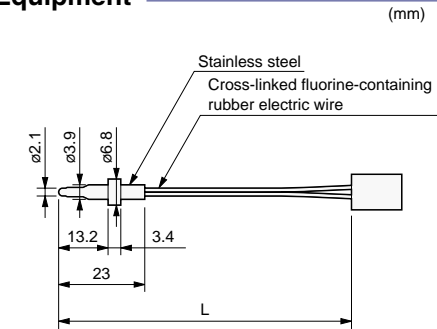
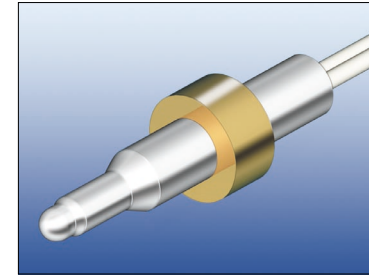
※ Above-described shapes are just for example, customized designs are available.



Water Related Equipment

for Water Related Equipment

B1 Standard Type for Water Equipment



(mm)

Features

Durable solution using NS type element. Smaller element is also applicable for faster response.

Applications

Instant water heater, heat pumps, coffee machines, toilet seat heating, floor heating and cogeneration systems etc.

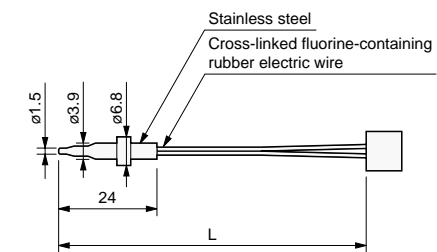
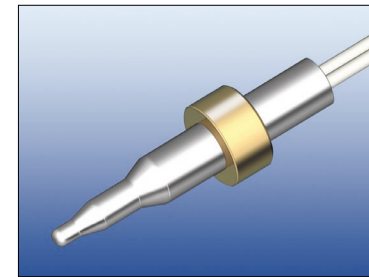
Operating temperature range

-20°C to 120°C

Thermal time constant

Less than. 2 sec. (in water, 90% response time)

B2 Quick Response Type for Water Equipment



(mm)

Features

Quicker response by using PSB-S5 element. Also applicable for a level detector.

Applications

Toilet seat heating. Water heater, floor heating and cogeneration systems etc.

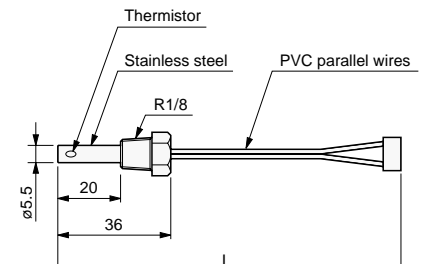
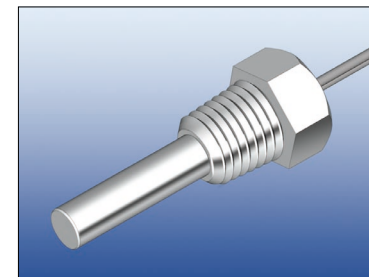
Operating temperature range

-20°C to 120°C

Thermal time constant

Less than 0.5 sec. (in water)

B3 for Boiler Temperature



(mm)

Features

Screw type water proof sensor.

Applications

Machine tools, medical devices, coffee machines and solar systems etc.

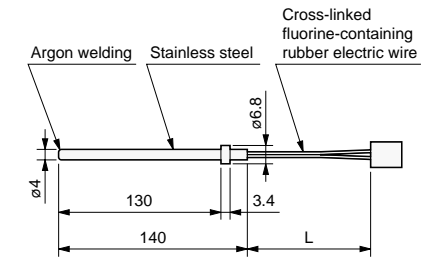
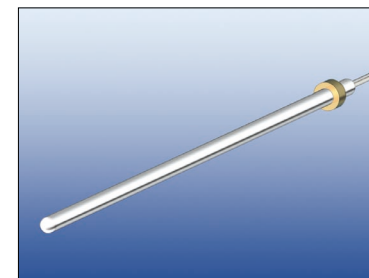
Operating temperature range

-20°C to 100°C

Thermal time constant

Approx. 5 sec. (in liquid)

B4 for Cogeneration Systems



(mm)

Features

Durable solution for water temperature detection using NS type element. Equipped with a fixing flange.

Applications

Cogeneration system equipment and water storage tanks for solar systems etc.

Operating temperature range

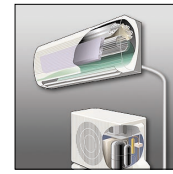
-20°C to 120°C

Thermal time constant

Less than 5 sec. (in water)

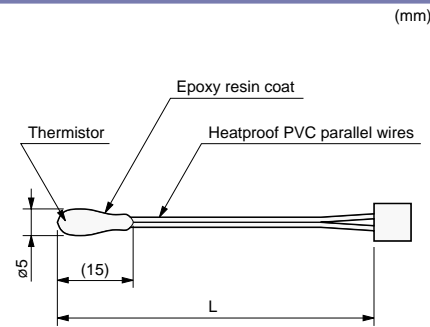
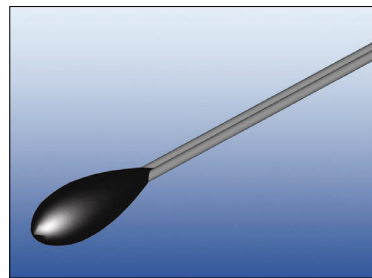
※ Above-described shapes are just for example, customized designs are available.

Air-Conditioning Equipment



for air-Conditioning Equipment

C1 for Room Temperature



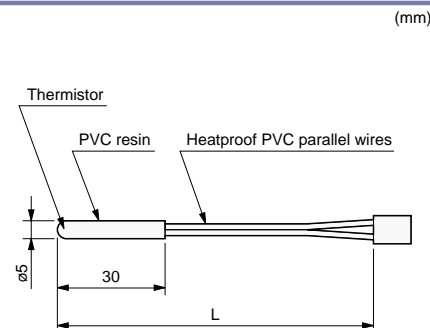
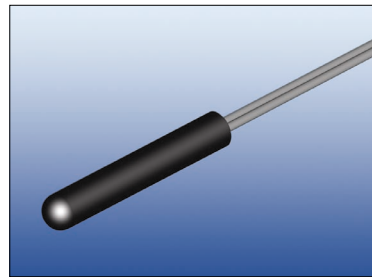
Features
As both Chip and PSB type element are applicable, available for various temperature ranges. Epoxy coating around the element.

Applications
Ambient temperature measurement etc.

Operating temperature range
-25°C to 80°C

Thermal time constant
Less than 5 sec. (in liquid)

C2 for Room Temperature



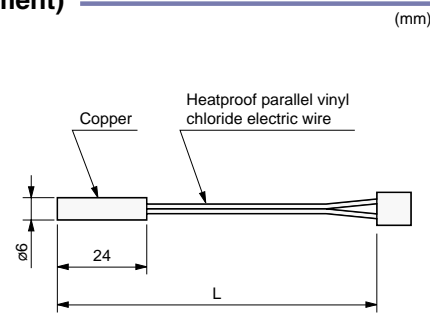
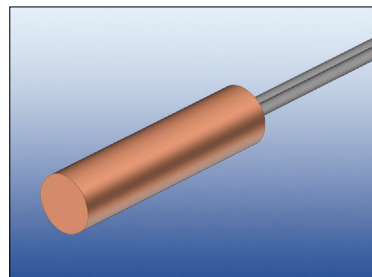
Features
Highly drip-proof because PVC resin and PVC wires are integrated. Easy fixation with its flexibility.

Applications
Ambient temperature measurement etc.

Operating temperature range
-30°C to 100°C

Thermal time constant
Less than 15 sec. (in liquid)

C3 for Pipes (Chip Type Element)



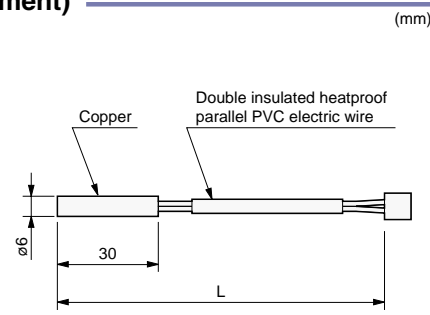
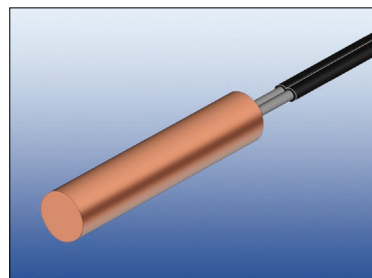
Features
Both Chip and PSB type element are applicable. Epoxy coated element with protection cap. Good workability and durability. Double insulated lead wire for better weather resistance is also available.

Applications
Pipe surface temperature etc.

Operating temperature range
-30°C to 100°C

Thermal time constant
Less than 10 sec. (in liquid)

C4 for Pipes(Glass Type Element)



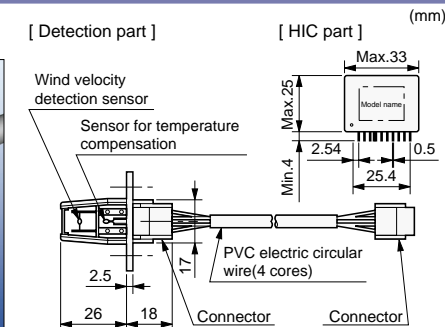
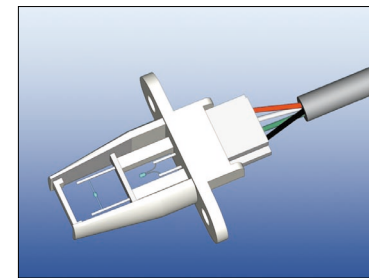
※ Above-described shapes are just for example, customized designs are available.

Air Conditioning Equipment, Fire Prevention and Security Equipment



Air Conditioning Equipment

C5 for Air Flow Sensor



Features
Consists of direct heated type PSB-A wind speed detection element and HIC circuit, it can easily detect wind speed. Alarm signals corresponding wind speed setting also can be supplied to the output.

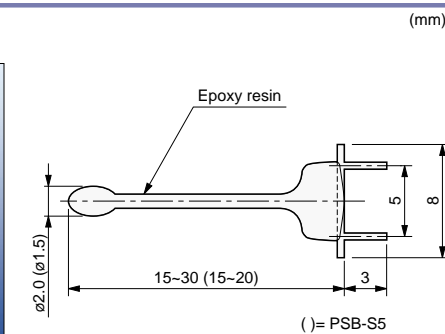
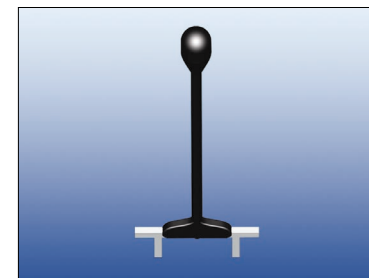
Applications
Filter clogging detection in clean bench etc.

Operating wind speed range
0 to 20m/s (Normal pressure, normal air)

Thermal time constant
Approx. 1 sec. (Normal pressure, normal air)

for Fire Prevention and Security Equipment

D1 for Fire Alarm



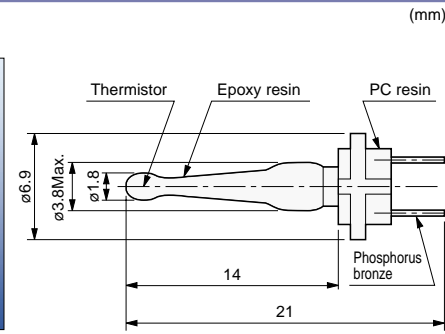
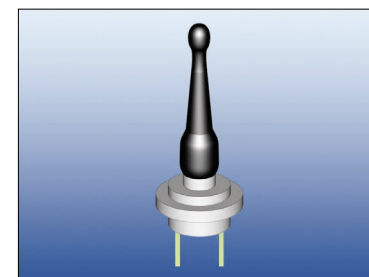
Features
Epoxy dipping insulation. Directly mount on PCB. PSB-S3 and S5 are applicable.

Applications
Fire alarm and PCB surrounding temperature detection etc.

Operating temperature range
-30°C to 100°C

Thermal time constant
PSB-S3 : 9~21 sec. (in air)
PSB-S5 : 2~15 sec. (in air)

D2 for Fire Alarm



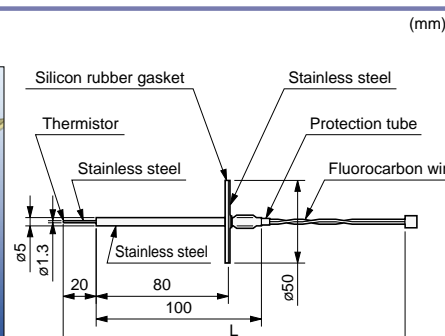
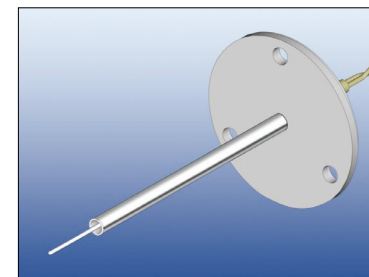
Features
Epoxy dipping insulation. Commonly used for ceiling type fire alarm.

Applications
Fire alarm and PCB surrounding temperature detection etc.

Operating temperature range
-40°C to 120°C

Thermal time constant
14~24 sec. (in air)

D3 Duct Fire Prevention



Features
Quick response and durable sensor for fire prevention using PSB-S5 element.

Applications
Extinguish equipment for professional kitchen etc.

Operating temperature range
-40°C to 200°C

Thermal time constant
Less than 3 sec. (in air)

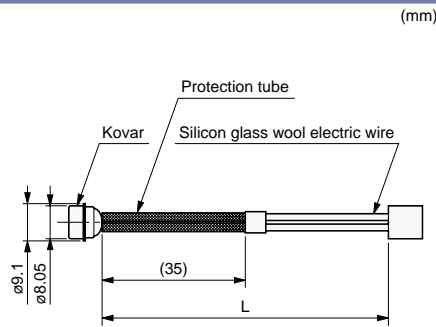
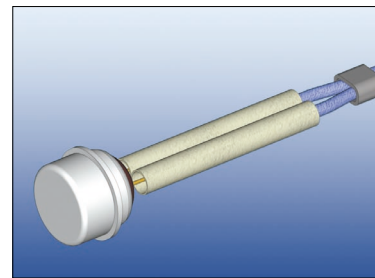
※ Above-described shapes are just for example, customized designs are available.

Food Processing Machines and Cooking Appliances



for Food Processing Machines and Cooking Appliances

E1 Hermetic Type



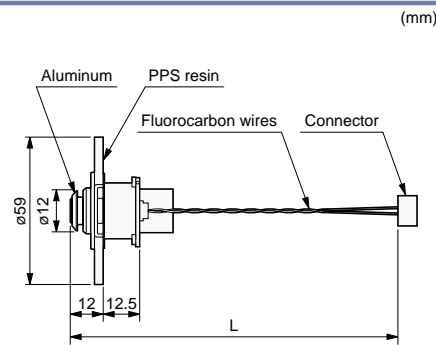
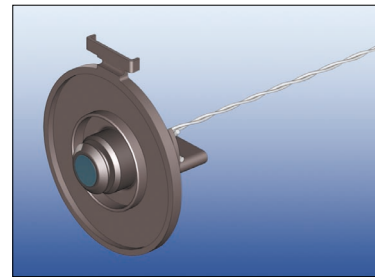
Features
Hermetic type standard surface temperature sensor.

Applications
Electric hot-water pot, Dish washer, Hot plate and IH grill-pan etc.

Operating temperature range
-20°C to 180°C

Thermal time constant
Approx. 4 sec. (on hot plate)

E2 for IH Cooking



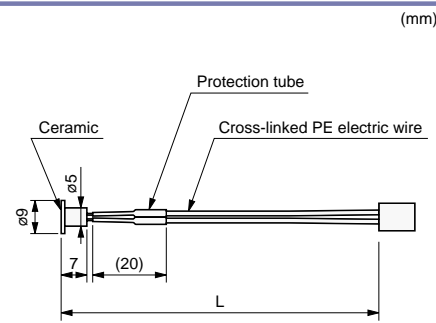
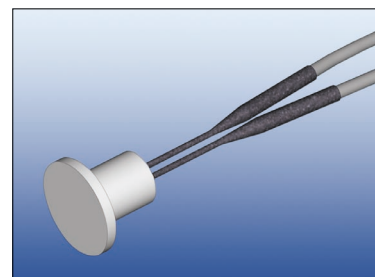
Features
Using durable NSII element, and well contacted onto measuring objects with spring inside.

Applications
IH cooker etc.

Operating temperature range
-20°C to 250°C

Thermal time constant
Approx. 8 sec. (on hot plate)

E3 Mushroom Shape



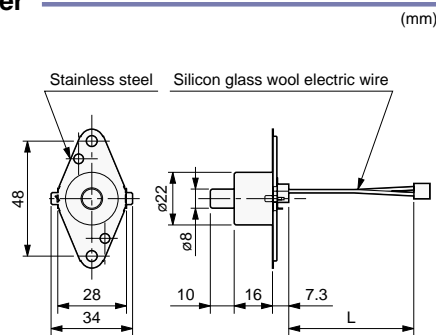
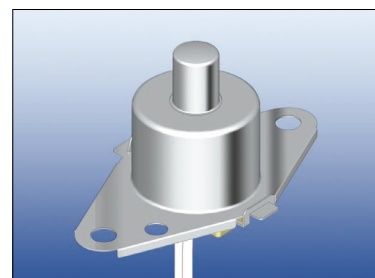
Features
Using Ceramic protection cap for high insulation level and easy installation with its shape. Aluminum cap with faster response is also available.

Applications
Surface temperature detection, IH cookers, Electric hot-water pot and IH rice cookers etc.

Operating temperature range
-20°C to 300°C

Thermal time constant
Approx. 7 sec. (on hot plate)

E4 for Electronic Rice Cooker



Features
Surface temperature sensor with movable sensing part. Able to detect if the inner pan is set or not. NTC element and reed switch are integrated. [PAT.3605600]

Applications
Rice cookers etc.

Operating temperature range
-20°C to 180°C

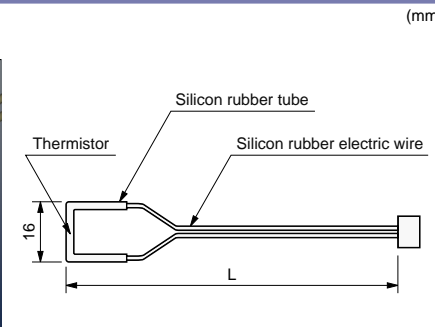
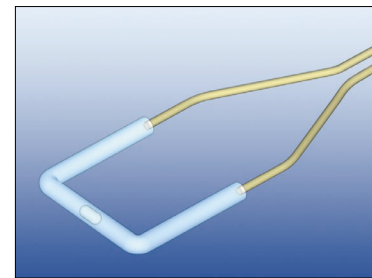
Thermal time constant
Less than 5 sec. (on hot plate)

※ Above-described shapes are just for example, customized designs are available.

for Food Processing Machines and Cooking Appliances



E5 for Rice Cooker



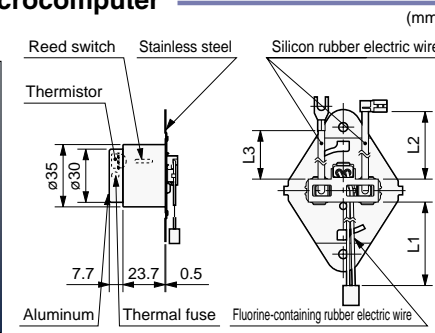
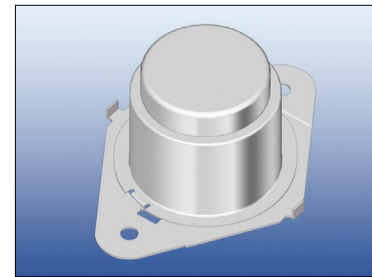
Features
PSB-N is simply connected to silicon rubber lead wire and protected by silicon rubber tube.

Applications
Lid temperature of rice cooker and ambient temp etc.

Operating temperature range
-20°C to 180°C

Thermal time constant
Less than 60 sec. (in air)

E6 for Rice Cooker with Microcomputer



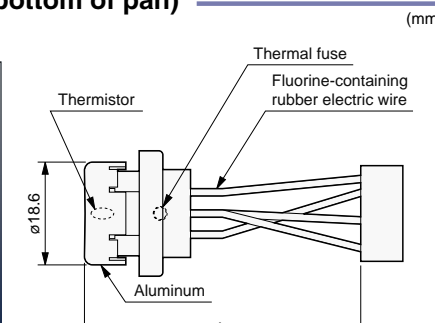
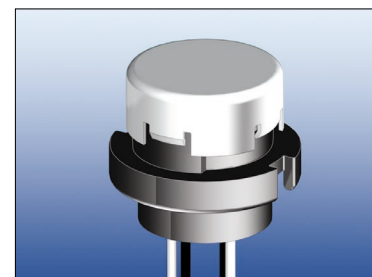
Features
Surface temperature sensor with movable sensing part. Able to detect if the inner pan is set or not. Compact shape, easy fixation and thermal fuse is also built in.

Applications
Rice cooker, Soup cooker and Chocolate warmer etc.

Operating temperature range
-10°C to 180°C

Thermal time constant
Approx. 25 sec. (on hot plate)

E7 for IH Rice Cooker (for bottom of pan)



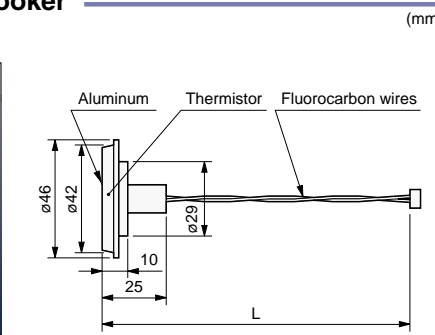
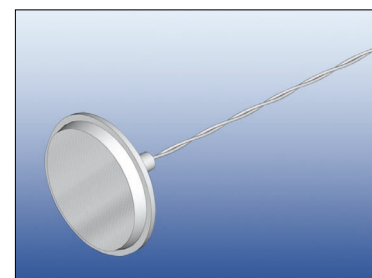
Features
Temperature sensor with thermal fuse built in, designed mainly for induction heaters.

Applications
IH cooker and Rice cooker etc.

Operating temperature range
-10°C to 200°C

Thermal time constant
Less than 8 sec. (on hot plate)

E8 for Professional Rice Cooker



Features
Durable surface temperature sensor, specially designed for professional cooking.

Applications
Professional Rice cooker etc.

Operating temperature range
-20°C to 250°C

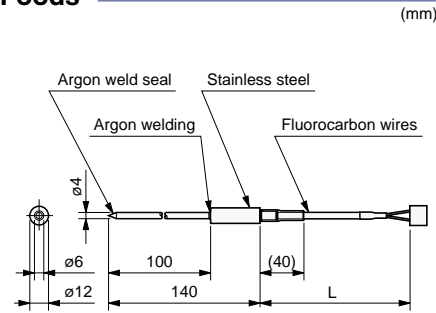
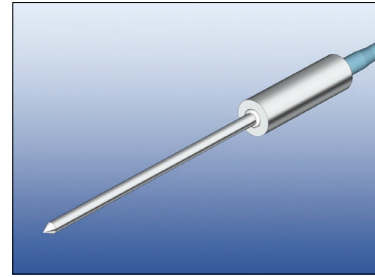
Thermal time constant
Approx 6 sec. (in liquid)

※ Above-described shapes are just for example, customized designs are available.



for Food Processing Machines and Cooking Appliances

E9 for Core Temperature of Foods



Features

Sting into the foods to measure the inside temperature. High temperature and water proof. Both low and high temperature models are available.

Applications

Blast chiller, Steam convection oven and Food processing machines etc.

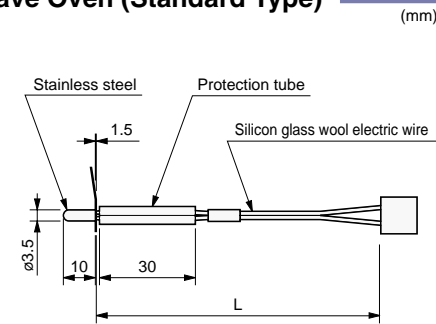
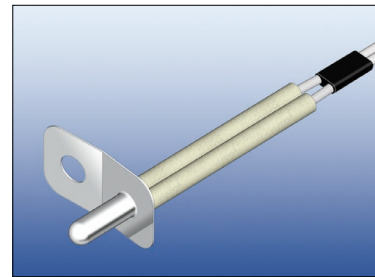
Operating temperature range

-40°C to 80°C (Low temperature model)
-20°C to 150°C (High temperature model)

Thermal time constant

Approx. 6 sec. (in liquid)

E10 for Convection Microwave Oven (Standard Type)



Features

One-piece protection cap. NS type element can be applied. Standard chamber temperature sensor.

Applications

Chamber temperature for Microwave oven, Gas cooker, IH cooker, Liquid crystal projector, Dehumidifier, and Cleaners etc.

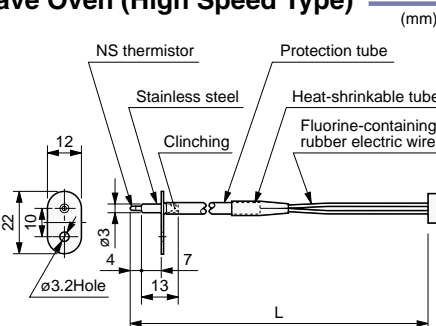
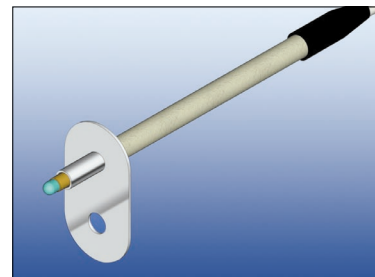
Operating temperature range

-20°C to 300°C

Thermal time constant

Less than 80 sec. (in air)

E11 for Convection Microwave Oven (High Speed Type)



Features

Quick response detection with exposed NS type element. Also applicable for wind flow detector.

Applications

Vapor detection for Microwave oven, Exhaust temperature for hot water supply and Chamber temperature of Liquid crystal projectors etc.

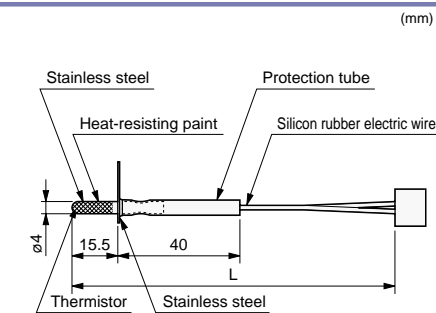
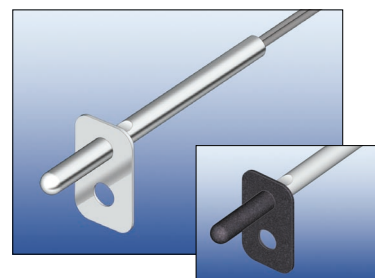
Operating temperature range

-20°C to 260°C

Thermal time constant

Approx. 60 sec. (with wind flow)

E12 for Toaster Oven



Features

NS type element as well as PSB is applicable. Additional heat collective coating and various length of cap size available.

Applications

Toaster oven, Food waste disposer and Dish washer etc.

Operating temperature range

-20°C to 300°C

Thermal time constant

Approx. 90 sec. (in air)

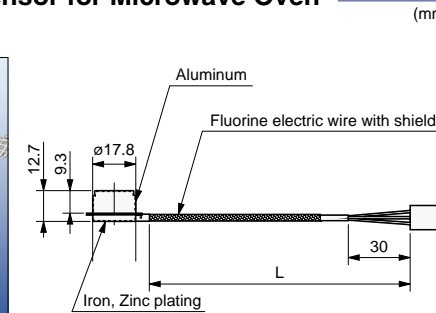
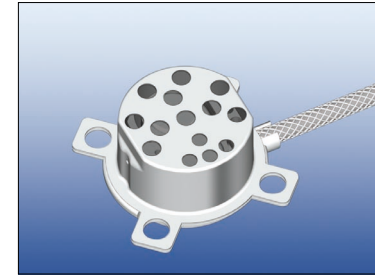
※ Above-described shapes are just for example, customized designs are available.

Food Processing Machines and Cooking Appliances, White Goods



for Food Processing Machines and Cooking Appliances

E13 Absolute Humidity Sensor for Microwave Oven



Features

Absolute humidity sensor for intelligent cooking of microwave oven. [PAT.3057920]

Applications

Microwave oven and Tumble dryer etc.

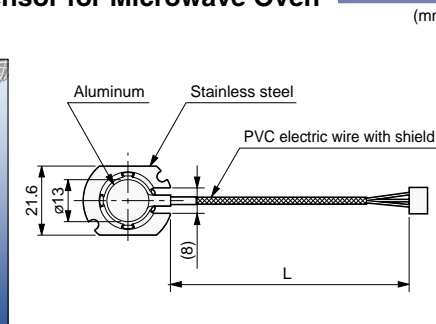
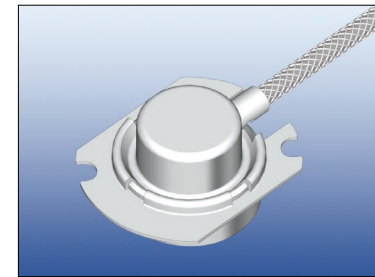
Operating temperature range

0°C to 200°C

Thermal time constant

Approx. 16 sec. (90% response)

E14 Absolute Humidity Sensor for Microwave Oven



Features

To measure the humidity difference between inside and outside of chamber. For control of single-function microwave oven [PAT.3057920]

Applications

Microwave oven

Operating temperature range

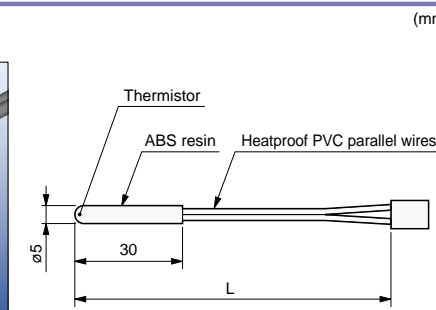
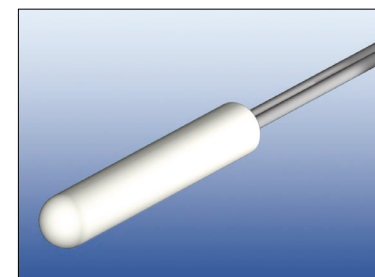
0°C to 100°C

Thermal time constant

Approx. 50 sec. (90% response)

for White Goods

F1 for Refrigerator



Features

Low temperature air measurement with ABS resin protection cap.

Applications

Chamber air temperature etc.

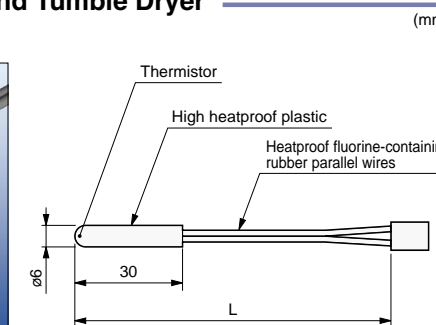
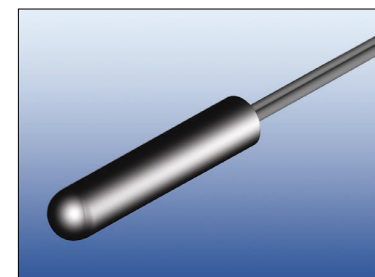
Operating temperature range

-30°C to 100°C

Thermal time constant

Less than 15sec. (in liquid)

F2 for Washing Machine and Tumble Dryer



Features

High temperature air measurement with high temperature proof plastic protection cap.

Applications

Outlet air of Tumble dryer etc.

Operating temperature range

-30°C to 180°C

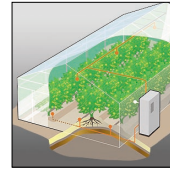
Thermal time constant

Less than 11sec. (in liquid)

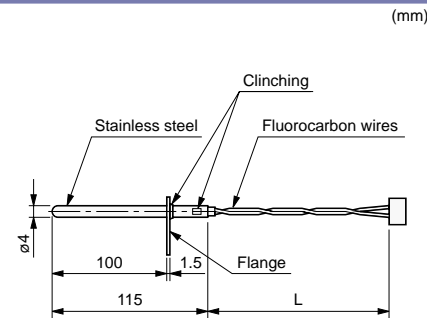
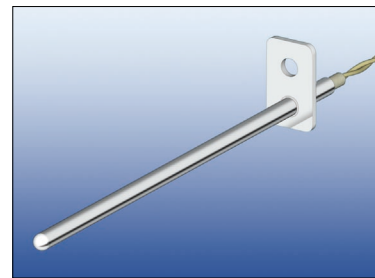
※ Above-described shapes are just for example, customized designs are available.

Industrial Equipment

for Industrial Equipment



G1 With Fixing Flange



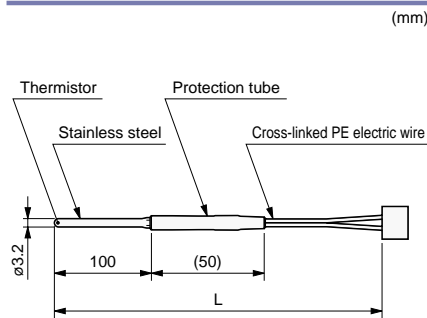
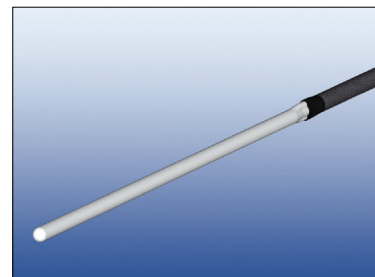
Features
Designed for easy installation on the applications. Good level of water proof and durability.

Applications
Constant temperature liquid bath and Constant temperature air chambers etc.

Operating temperature range
0°C to 200°C

Thermal time constant
Less than 20sec. (in liquid)

G2 for Household Fuel Cell

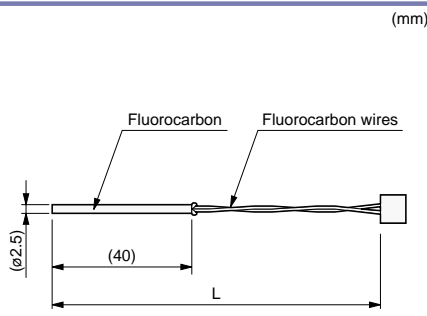
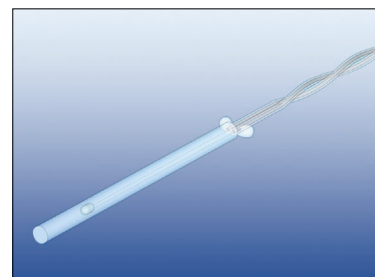


Features
Thin shape with NS type element. Commonly used for Reformer.

Applications
Liquid temperature measurement etc.

Operating temperature range
0°C to 250°C

G3 for Level Detection



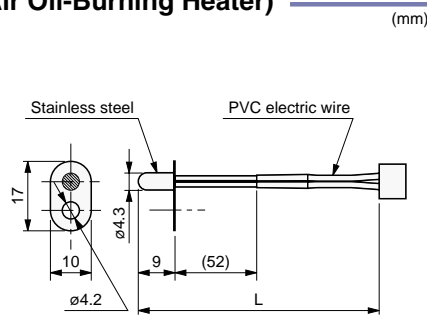
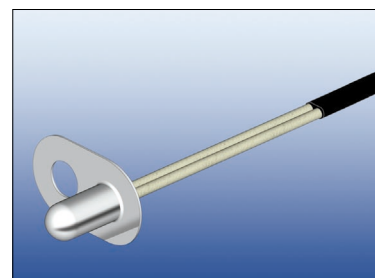
Features
Integrated sensor with Fluorocarbon resin and fluorocarbon-covered lead wire. Chemical proof. Used for surface level detection of Photo developing fluid.

Applications
Surface level detection etc.

Operating temperature range
-40°C to 105°C

Thermal time constant
Less than 3.5sec. (in liquid)

G4 for Fan Heater (Forced Air Oil-Burning Heater)



Features
High level of durability and quick response time with simple configuration and durable NS type element.

Applications
Carburetor of Fan heater etc.

Operating temperature range
-20°C to 350°C

Thermal time constant
Less than 7sec. (in liquid)

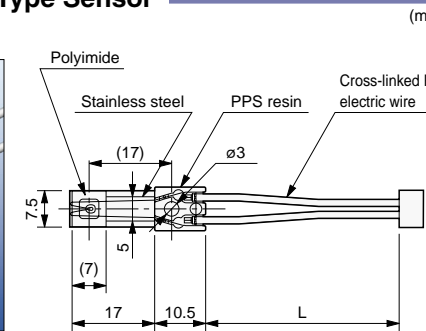
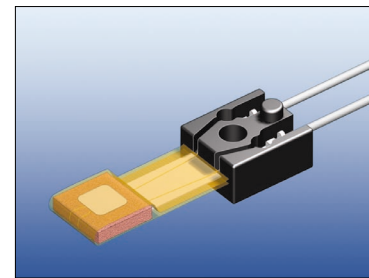
※ Above-described shapes are just for example, customized designs are available.

Office Automation Equipment

for Office Automation Equipment



H1 "Sheet with a Sponge" Type Sensor



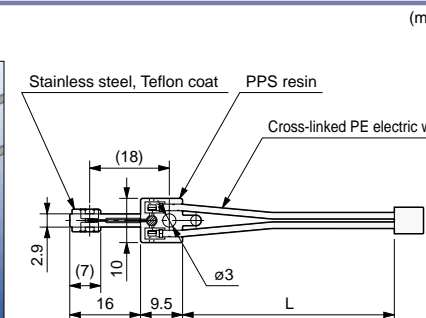
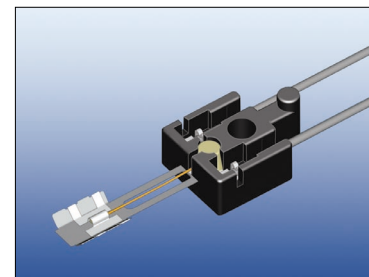
Features
Standard solution for Heat/Press rollers. Minimal position misalignment on rollers by sponge effect.

Applications
Copying machine, Printers and Multi function machines etc.

Operating temperature range
-20°C to 200°C (at sensing point)

Thermal time constant
Less than 3.5sec. (on hot plate)

H2 "Board" Type Sensor



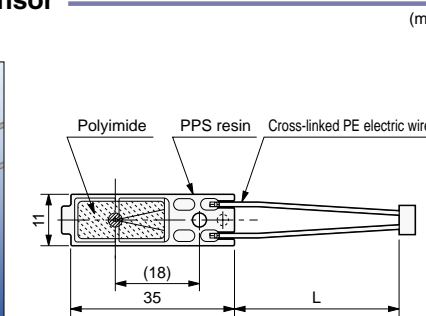
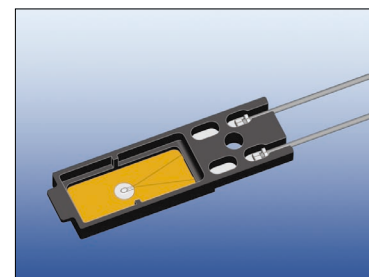
Features
High temperature resistant solution for Heat/Press rollers. Low contacting pressure reduces damage on rollers.

Applications
Copying machine, Printers, Multi function machines and Laminating machine etc.

Operating temperature range
-20°C to 250°C (at sensing point)

Thermal time constant
Less than 2sec. (on hot plate)

H3 "Non-Contact" Type Sensor



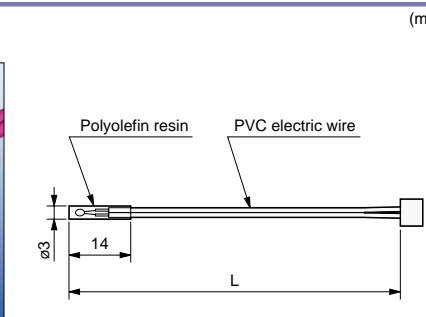
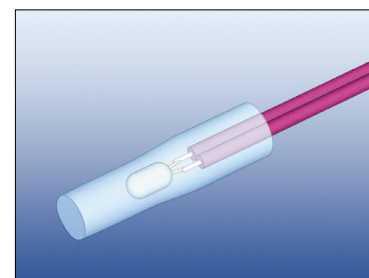
Features
Non-contact sensing solution for Heat/Press rollers. As it is not attached onto the roller, good for color printers and copiers.

Applications
Copying machine, Printers, Multi function machines etc.

Operating temperature range
0°C to 200°C (at sensing point)

Thermal time constant
Less than 4sec. (1mm from hot plate)

H4 for Projector



Features
Air temperature sensor with simplified water proof treatment.

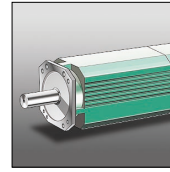
Applications
Air temperature measurement etc.

Operating temperature range
0°C to 60°C

Thermal time constant
Less than 30 sec. (in air)

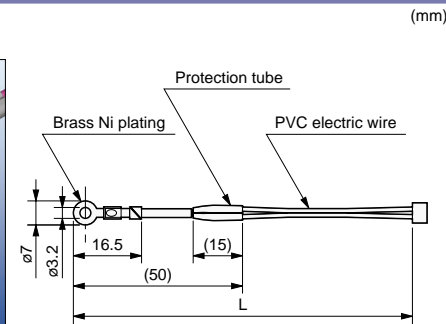
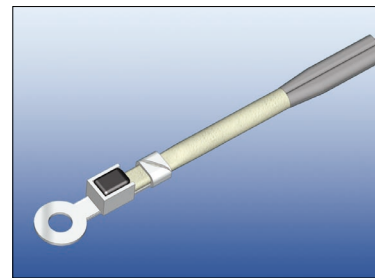
※ Above-described shapes are just for example, customized designs are available.

Lug (Ring) Terminal



Lug (Ring) Terminal

J1 Standard Type



(mm)

Features

Standard Lug terminal sensor with PSB type element. Designed for easy installation.

Applications

Magnetron, Data projector, Plotter, Inverter (multi-purpose & Automotive) and Heat pumps etc.

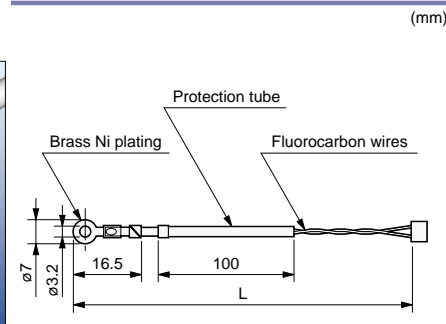
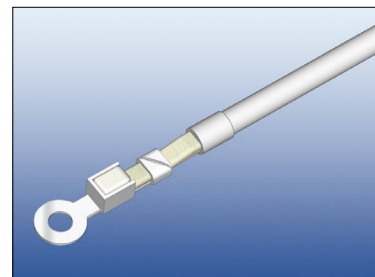
Operating temperature range

0°C to 150°C (sensing part)

Thermal time constant

Approx. 6 sec. (on hot plate)

J2 High Temperature Type



(mm)

Features

Applicable for high temperature heaters with NS type element and heat proof sealing agent.

Applications

Heat blade cutter, Packing machine and Industrial Ironing machine etc.

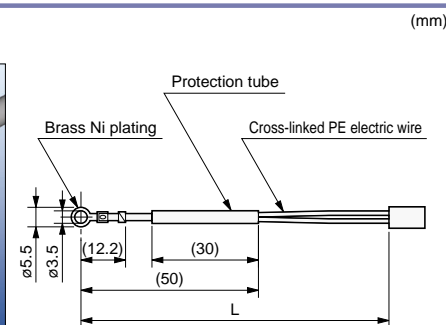
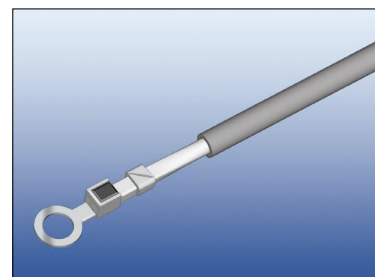
Operating temperature range

-5°C to 300°C (sensing part)

Thermal time constant

Approx. 6 sec. (on hot plate)

J3 Compact Type



(mm)

Features

PSB-S3 small element applied. Good for Fixing to narrow area.

Applications

Projector, Motor, Thermal head and Printers etc.

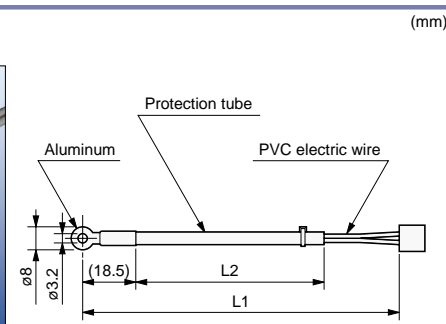
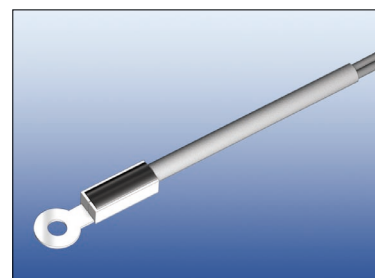
Operating temperature range

-5°C to 125°C

Thermal time constant

Approx. 3 sec. (on hot plate)

J4 for Heat Sink



(mm)

Features

Good for products with high volume production.

Applications

Heat sink for Inverters of Air conditioners etc.

Operating temperature range

0°C to 100°C

Thermal time constant

Less than 15 sec. (on hot plate)

※ Above-described shapes are just for example, customized designs are available.

BRAND



SD stands for Shibaura Denshi ("electronics" in Japanese).

It also means our activities.

- ① (production of) Sensing Device
- ② Successive Development
- ③ Speedy Delivery

ISO 9001 Approved

ISO 14001 Approved

