NTC Thermistor

GLOSSARY

■ Thermistor

A thermistor is a thermally sensitive semiconductor resistor whose primary function is to exhibit an important change in electrical resistance with a change in body temperature.

■ Negative temperature coefficient thermistor (NTC)

An NTC thermistor is one in which the resistance decreases with increasing temperature.

■ Zero-power resistance (R_T)

The zero-power resistance is the value of a resistance when measured at a specified temperature, under conditions such that the change in resistance due to the internal generation of heat is negligible with respect to the total error of measurement.

■ Rated zero-power resistance

The rated zero-power resistance is the nominal value at the standard temperature of 25℃ unless otherwise specified.

■ B-value

An index of the thermal sensitivity expressed by the formula :

$$B = \frac{T_1 \cdot T_2}{T_2 - T_1} \cdot \mathrm{Log}_e \frac{R_1}{R_2}$$

Or

$$B = 2.303 \frac{T_1 \cdot T_2}{T_2 - T_1} \cdot \mathrm{Log}_{10} \frac{R_1}{R_2}$$

Where
B: constant in Kelvins (K)
R_1: resistance in ohms (Ω) at temperature T_1
R_2: resistance in ohms (Ω) at temperature T_2
T_1=298.15k (+25℃), T_2=358.15k (+85℃)

The value given above for T_1 and T_2 are the preferred values. When the detail specification prescribes that the B-value shall be measured at other temperatures, the specified value (in Kelvins) shall be used for T_1 and T_2 in the calculation in place of the preferred values.

■ Zero-power temperature coefficient of resistance (α_T)

The ratio at a specified temperature (T) of the rate of change of zero-power resistance with temperature to the zero-power resistance of the thermistor, expressed by the formula:

$$\alpha_T = \frac{1}{R_T} \cdot \frac{dR_T}{dT} = -\frac{B}{T^2}$$

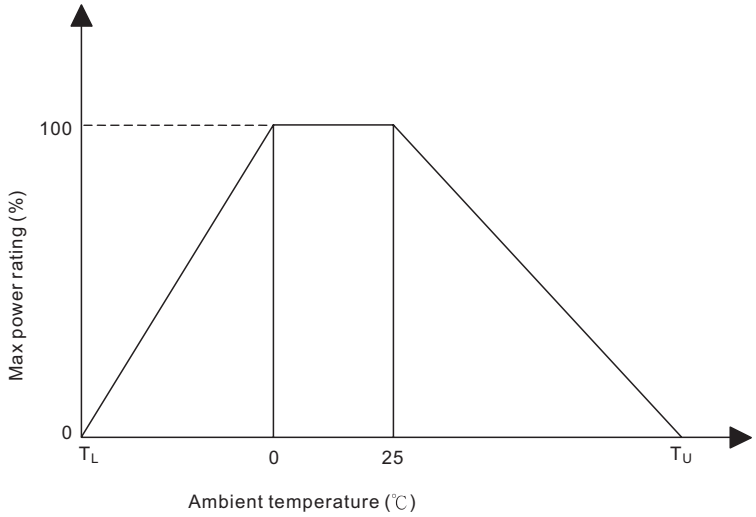
Where
B: index of the thermal sensitivity in Kelvins
T: temperature in Kelvins

■ Operating temperature range

The operating temperature range is the range of ambient temperature for which the thermistor has been designed to operate continuously at zero-power. The limits are the upper and lower operating temperature.

■ Maximum power rating (Pmax)

The maximum power rating is the maximum dissipation which can be applied to the thermistor for an extended period of time, at an ambient temperature of 25℃ or at such temperature as may be specified in the detail specification. Thinking's maximum power derating curve is given as below. At a certain ambient temperature, the power-rating shall be derated linearly to zero.

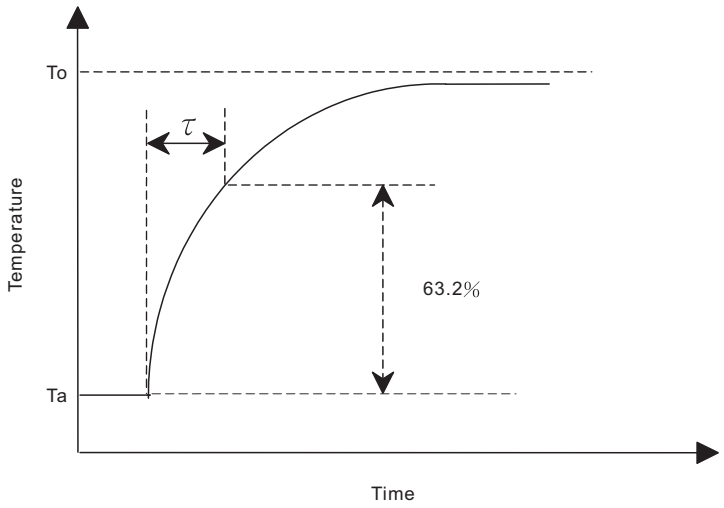


■ Dissipation constant (δ)

The dissipation constant is the quotient (in W/K), at a specified ambient temperature in a specified medium of a change in power dissipation in a thermistor to the resultant body temperature change.

■ Thermal time constant (τ)

The time (in s) required for the temperature of a thermistor to change by 63.2% of the difference between its initial and final temperatures when subjected to a step function change in temperature under zero-power conditions.



- **Table 1: Heating time constant and temperature change ratio.**

Code	Rate of change (%) for T_0-T_a
τ	63.2
2 τ	86.5
3 τ	95.0
4 τ	98.2
5 τ	99.4
6 τ	99.8
7 τ	99.9

■ Resistance/temperature characteristic

The relationship between the zero-power resistance of a thermistor and its body temperature. The resistance law follow approximately the formula:

$$R = R_1 e^{B(\frac{1}{T} - \frac{1}{T_1})}$$

Where R and R1 are the value of the zero-power resistance of the thermistor at temperature T and T1 respectively, expressed in Kelvins, and B is the thermal sensitivity index.

■ Voltage/current characteristic

The relationship in still air at 25℃ or at such a temperature as may be prescribed in the detail specification between the dc or ac rms voltage across the thermistor and the applied steady-state current.