SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution

Coimbatore-35

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

IIYEAR/ III SEMESTER

19ECT201 Electrical Engineering and Instrumentation

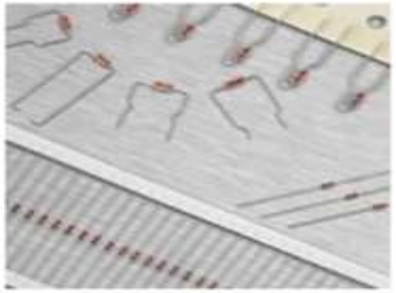
TOPIC – THERMISTOR

THERMISTOR

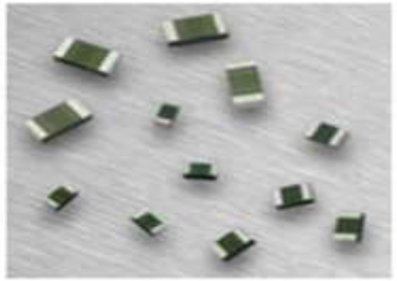
Thermistors: THERMal resISTORS

- Thermistor is a combination of the words thermal and resistor.
- Thermistor was invented by Samuel Ruben in 1930
- A thermistor is a type of resistor used to measure temperature changes, relying on the change in its resistance with changing temperature.
  - Typically have a negative temperature coefficient (NTC),
  - Resistance decreases with increasing temperature
- Thermistor can measures across the range of **40~150 ±0.35 °C**

Leads, coated



Glass encased



Surface mount

Relationship b/w resistance & temperature

- Assume a simple linear relationship between resistance and temperature for the following discussion:

$$\Delta R = k \Delta T$$

Where

- ΔR = change in resistance
- ΔT = change in temperature
- **k** = first-order temperature coefficient of resistance

Thermistors

❖ Thermistors have **high sensitivity** which can be up to 10 percent change per degree Celsius, making them the most sensitive temperature elements available, but with very nonlinear characteristics.

❖ The typical **response times** is 0.5 to 5 s with an **operating range** from - 50 to typically 300°C. Devices are available with the temperature range extended to 500°C.

❖ Thermistors are low cost and manufactured in a wide range of shapes, sizes, and values.

❖ When in use care has to be taken to minimize the effects of internal heating.

Thermistors Classification

- Thermistors can be classified into two types depending on the sign of k.
- **If k is positive**, the resistance increases with increasing temperature, and device is called a positive temperature coefficient (**PTC**) thermistor, some time also known as **Resistance Temperature Detector (RTD)**
  - **If Platinum and nickel are used as metal in RTD.**
- **If k is negative**, the resistance decreases with increasing temperature, and the device is called a negative temperature coefficient (**NTC**) **thermistor**.
- **Resistors that are not thermistors are designed to have the smallest possible k, so that their resistance remains almost constant over a wide temperature range.**

Application of PTC Thermistors

- They are used as resettable fuses.
- They are used in time delay circuits.
- PTC Thermistors are used in motor starting circuits.
- They are also used in Degaussing circuitry.

Application of NTC Thermistors

- General industrial applications
  - Industrial process controls
  - Plastic laminating equipment
  - Fiber processing & manufacturing
  - Hot mold equipment (thermoplastics)
  - Solar energy equipment
- Automotive & Transportation Application
  - Emission controls
  - Engine temperatures
  - Aircraft Temperatures.

Medical Applications
- Fever Thermometers
- Fluid temperature
- Dialysis Equipment

Consumer/Household Applications
- Burglar alarm
- Refrigeration & air conditioning
- Fire detection
- Oven temperature control

Thermistors

Advantages

- High sensitivity to small temperature changes
- Temperature measurements become more stable with use
- Copper or nickel extension wires can be used

Disadvantages

- Limited temperature range
- Fragile
- Some initial accuracy "drift"
- Decalibration if used beyond the sensor's temperature ratings
- Lack of standards for replacement