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CPE-301

Activity 5

1) Resistance Temperature Detector (RTD)

Description: An RTD (Resistance Temperature Detector) is a sensor that measures temperature by comparing the resistance of the RTD element (usually platinum) to temperature. As the temperature rises, so does the element's electrical resistance, allowing for more accurate temperature measurements. RTDs are classified into two types: wire-wound, which uses platinum wire to wrap around a ceramic/glass core for high accuracy, and thin-film, which uses a platinum layer on ceramic for durability and low price.

Operation: Electrical current runs through the RTD, and its resistance changes with temperature, resulting in a temperature measurement.

Applications: Include automobiles, medical devices, food processing, aircraft, and industrial electronics.

Picture:

2) Thermo-diode

Description: Thermo-diodes are semiconductor diodes that use the temperature dependency of the forward voltage drop across a p-n junction.

Operation: The forward voltage drop across a p-n junction diode reduces with increasing temperature. This connection is almost linear and may be used to measure temperature changes. The voltage loss normally changes by around 1.5 mV per degree Celsius.

Applications:

- Consumer electronics (CPU and GPU temperature monitoring)
- Automotive temperature sensors
- Portable devices
- Disposable temperature probes in medical applications

Picture:

3) Thermo-transistor

Description: Thermo-transistors are transistors whose base-emitter voltage varies according to temperature. These are frequently integrated into circuits to provide on-chip temperature monitoring.

Operation: The base-emitter junction voltage of thermo-transistors, like diodes, varies with temperature. As temperature rises, the base-emitter voltage falls, which may be monitored to calculate temperature. Thermo-transistors are highly sensitive and frequently put directly into integrated circuits (ICs).

Applications:

- CPU and GPU temperature regulation
- Thermal management in integrated circuits
- Industrial sensors
- Wireless sensor networks
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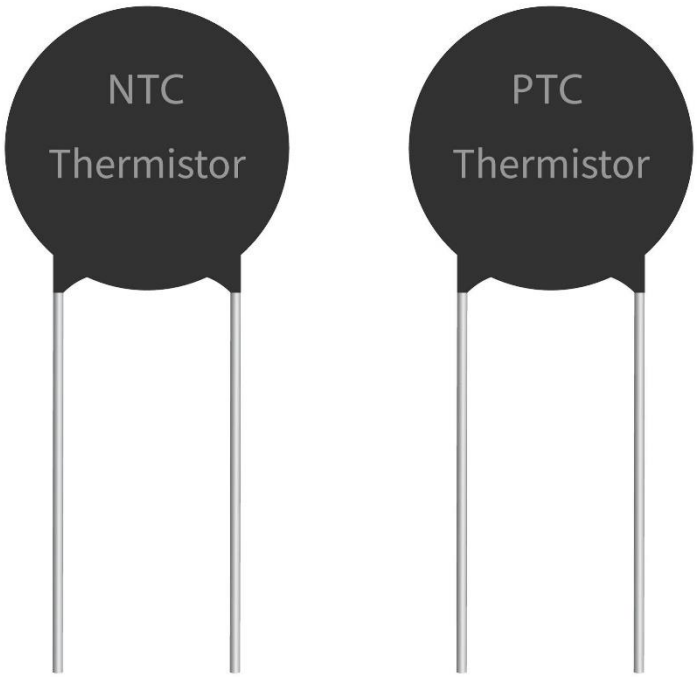
Picture:



4) **Photo transistor**

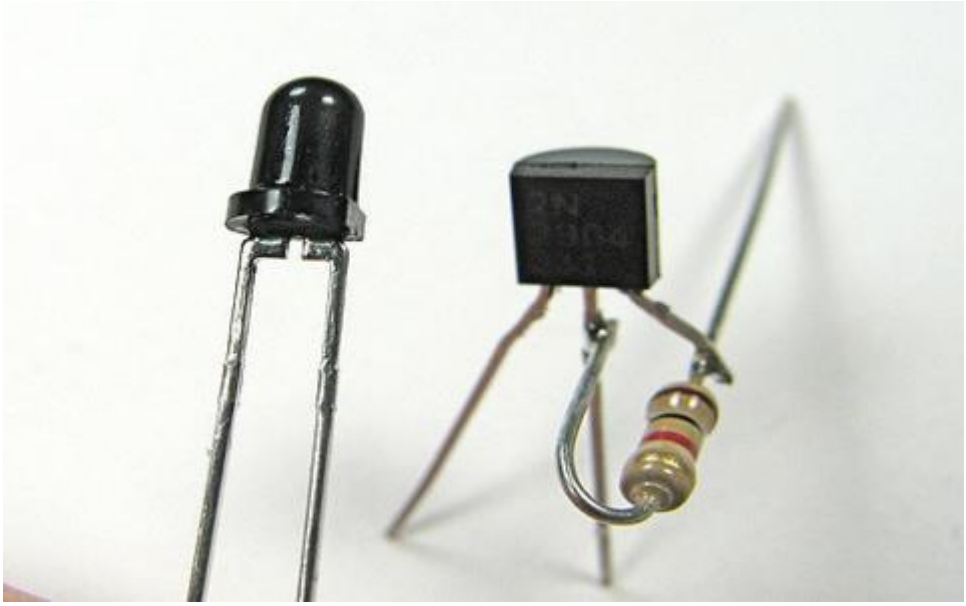
Description: A phototransistor is a semiconductor device that detects light and turns it into electricity. It functions similarly to a typical transistor, but is controlled by light rather than electric current. Phototransistors are primarily composed of silicon and come in P-N-P or N-P-N types.

Operation: When light photons impact the base, electron-hole pairs form, causing photocurrent to flow between the collector and emitter. The current changes with light intensity, allowing phototransistors to amplify signals in response to light levels. They have two modes of operation: active (linear response to light intensity) and switching (light-dependent on/off).

Applications:

- Punch-card Readers
- Security Systems
- Speed and Direction Encoders
- IR Detectors for Photoelectric Controls
- Computer Logic Circuitry
- Relays
- Lighting Control (e.g., highways)
- Level Indication
- Counting Systems

Picture:



5) **Charge Coupled Device (CCD)**

Description: Charge-coupled devices (CCDs) are semiconductor devices that catch and transform light into electrical signals. They are made up of an array of photosensitive components, also known as pixels, on a silicon surface. Each pixel functions as a photodiode, absorbing photons and producing electrical charges proportionate to the light intensity.

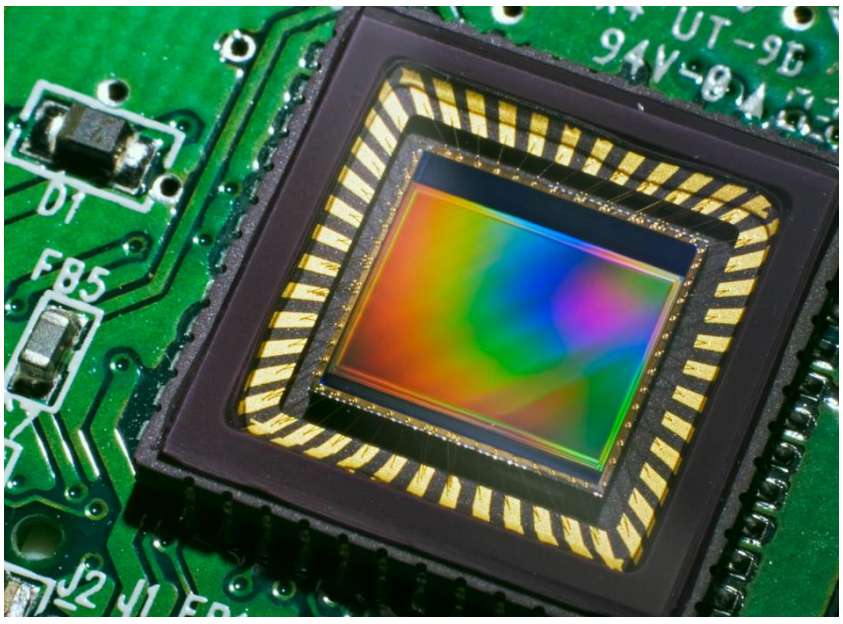
Operations:

- Photon Capture: When photons hit the CCD, electron-hole pairs form in the photosensitive area of each pixel. This method turns light into a little electrical charge.
- Charge Transfer: Charges are produced and stored in potential wells created between pixels, which may be transferred along the array by applying voltage. This transfer procedure transfers the charge row by row through the device.
- Image Creation: The charge in each pixel gets converted to a voltage signal, which is eventually digitized by the electronics. The output is a high-quality digital picture.

Applications:

- Life sciences
- Optical microscopy
- Astronomy

Picture:



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