Introduction

As we bridge the gap between electrical and physical construction, components can be classified by:

1. Electrical characteristics
2. Physical package

- We have to move beyond talking about components by their names only.
- different components are treated differently depending on two types of classification:
  - electrical
  - package type (physical)

Passive vs Active

A passive device:

1. contributes no power gain (amplification) to a circuit or system
2. no control action
3. does not require any input other than a signal to perform its function

- There are three passive components (resistor, capacitor, inductor)
- Memristor coming to a research lab near you!
- These components fit the criteria here

An active device:

1. are capable of controlling voltages or current
2. can create a switching action in the circuit
3. can amplify or interpret a signal

- include diodes, transistors and integrated circuits.
- Memristor coming to a research lab near you!
- are usually semiconductor devices
- Tubes count too
- Switches, Relays... those are electromechanical

Discrete component: A component packaged with one or two functional elements

Integrated circuit: A combination of several interconnected discrete components packaged in a single case to perform multiple functions

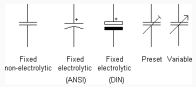
- discrete components: A single resistor, cap, inductor, diode, transistor, etc.
- Easier to repair, but larger circuits
- integrated circuit: op amp (analog), microprocessor (digital)
- harder to repair but smaller circuit
- stereo receiver example

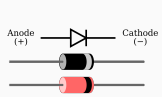
Polarized Components

Polarized components have leads marked with positive and negative polarity.

Most notable:

1. Capacitors
2. Diodes



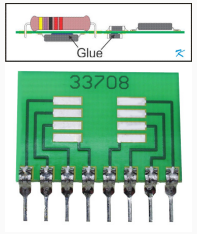


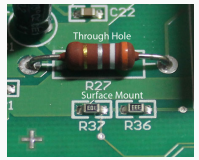
- Polarized capacitors tend to:
  1. have higher distortion
  2. smaller in size for a given value
  3. cheaper
  4. DC only, DC bias can allow AC signal
  5. relatively high values
- Unpolarized capacitors tend to:
  1. lower distortion
  2. bigger for a given value
  3. more expensive
  4. AC and DC regardless of bias
  5. All values

THT vs SMT

THT - Through-hole Technology

SMT - Surface-mount Technology



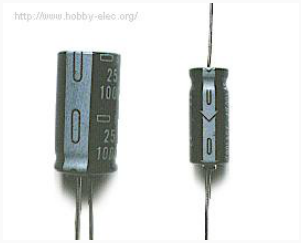


- We've talked about this one already
- to drill and plate, or to glue to the surface
- THT is a common abbreviation for Through-hole

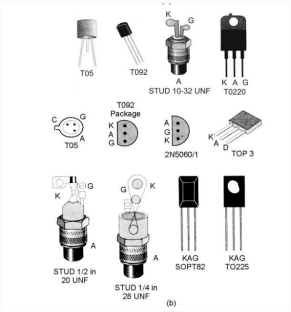
Axial vs Radial

Axis: an imaginary line about which a body rotates.

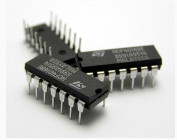
Radius: a straight line from the center to the circumference of a circle or sphere.



- Refers to where the leads attach to the component
- radial components have leads along a radius of the cylinder
- axial components have leads along an axis
- Are they discrete or integrated?
- Let's play: Which side is positive?
- Not limited to capacitors

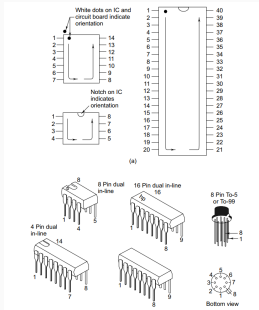


- Refers to where the leads attach to the component

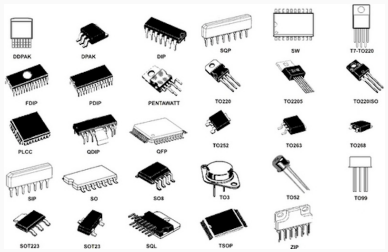


Dual Inline Package (DIP)

- Refers to where the leads attach to the component

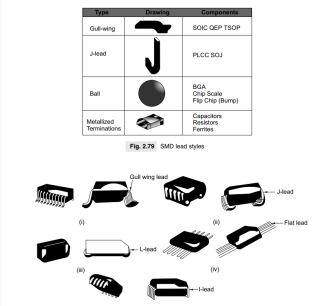


- Refers to where the leads attach to the component



- Refers to where the leads attach to the component

Common Integrated Packages



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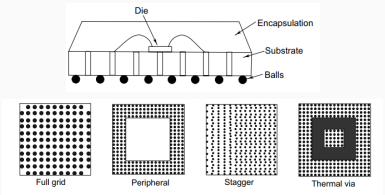

- High density
- Heat conduction to PCB
- Low-inductabce leads
- BUT, not flexible. Physical stress, thermal expansion
- soldering/assembly requires specialized equipment
- Inspection difficult