

Electronic Components

Resistor

Capacitor

Inductor

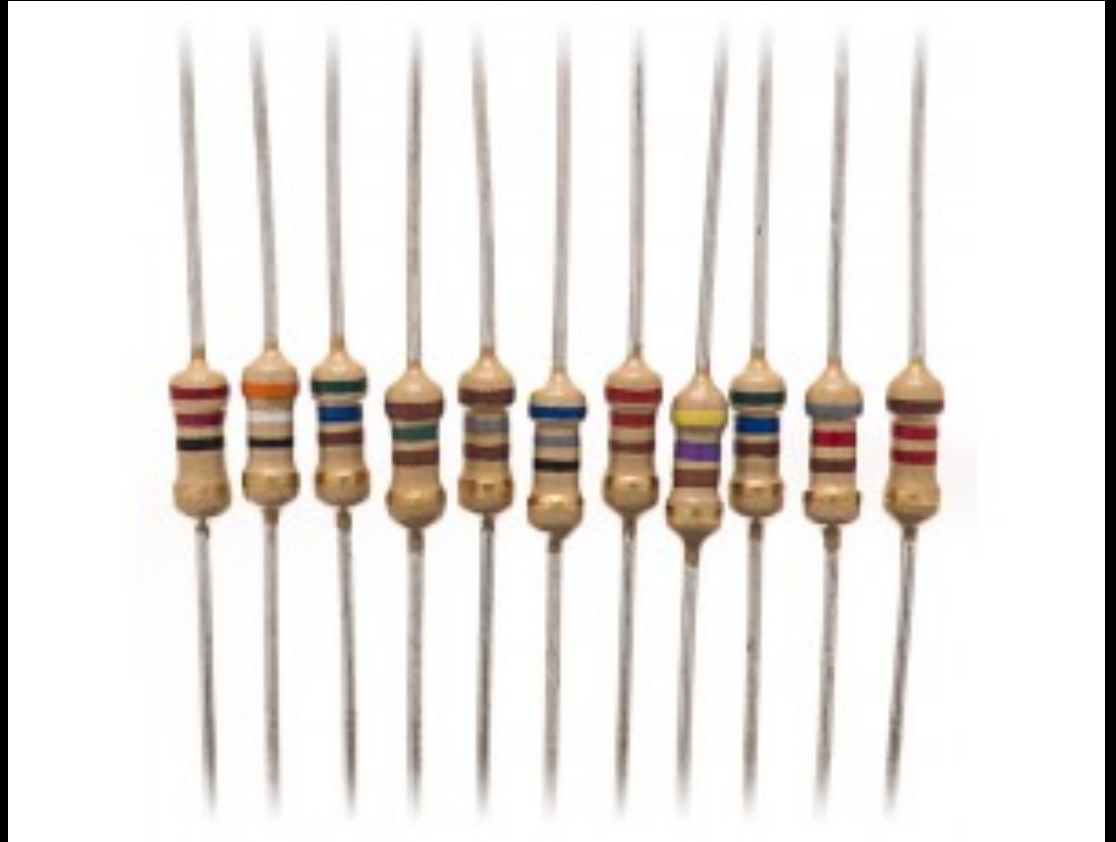
Transformer

Diode

Transistor

Integrated Circuit

Resistors

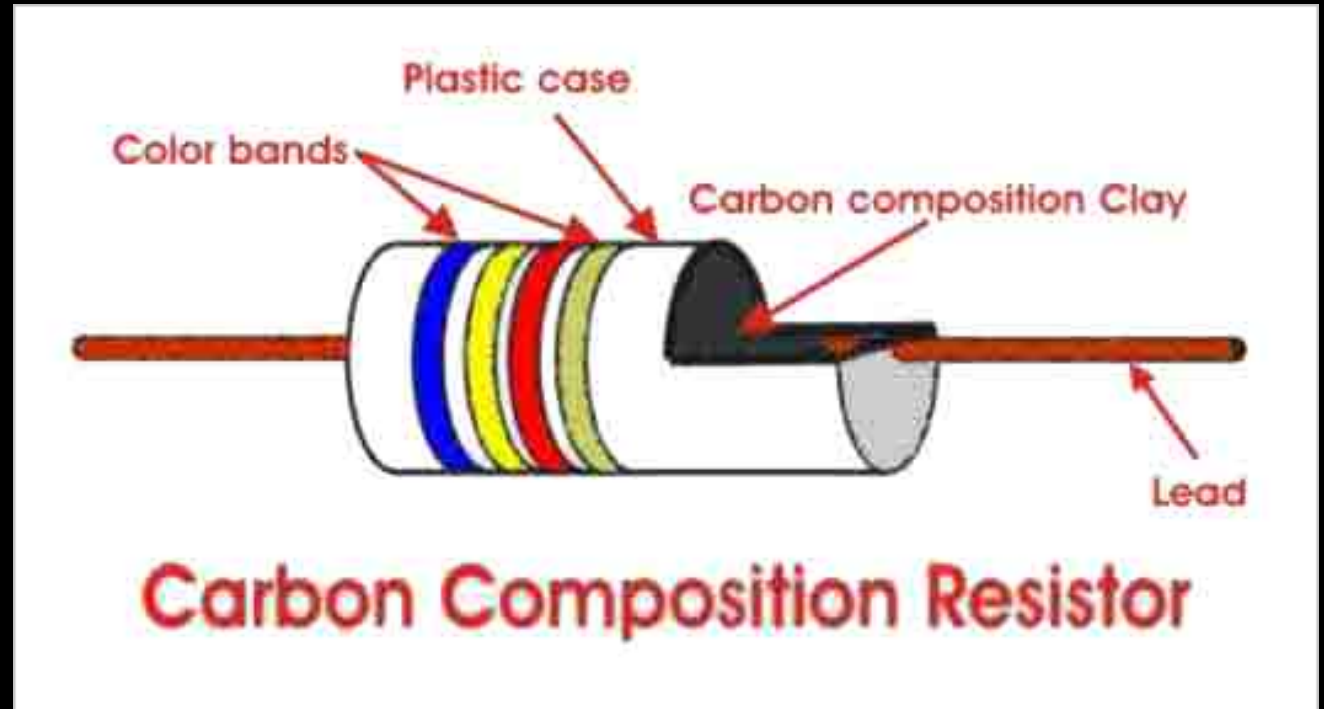


Resistors **RESIST** the flow of electrons

Measured in Ohms (Ω)

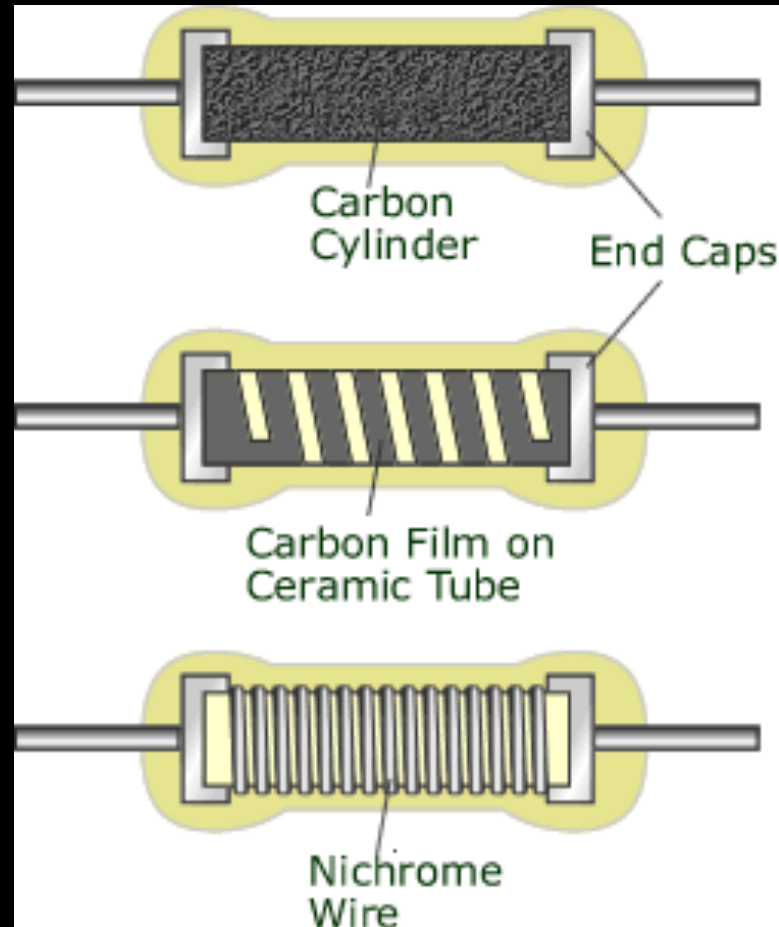
Symbol = R

Resistor composition



Carbon Composition – most common type of resistor
A slurry of insulating and conducting material is used to control conductivity/resistance

Resistor composition

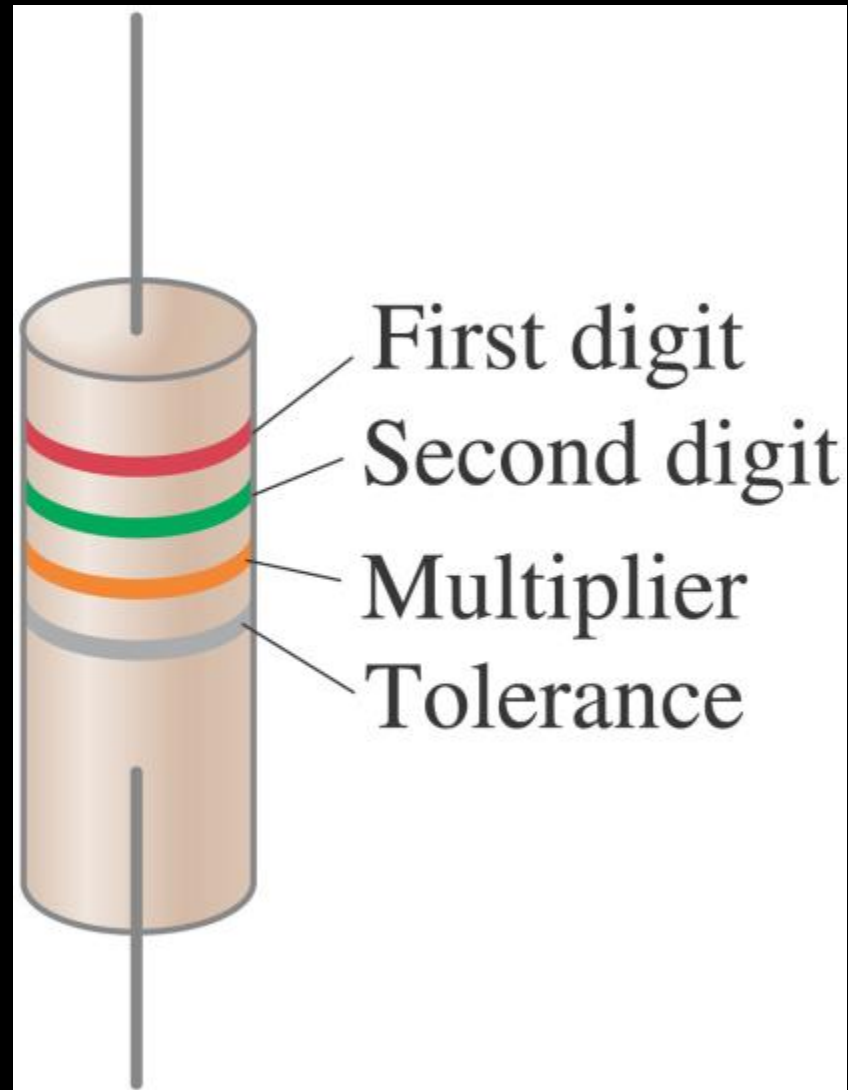


Carbon composition, Carbon film, Wire wound

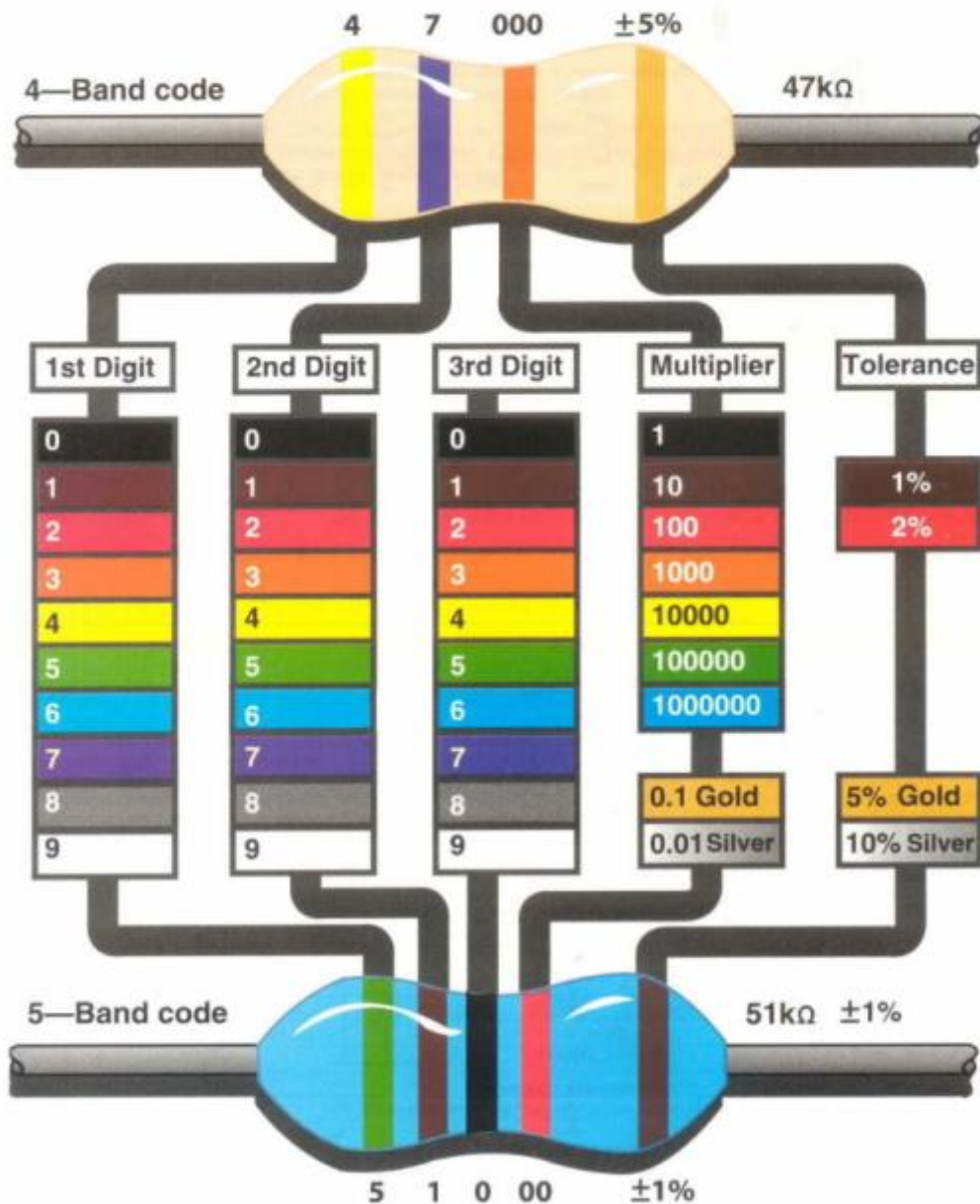
Resistor Color Code



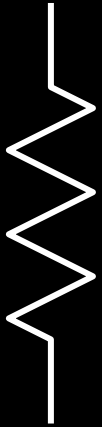
BBROYGBVGW



RESISTOR COLOUR CODE



Resistor Color Code



What is the value
of this resistor?

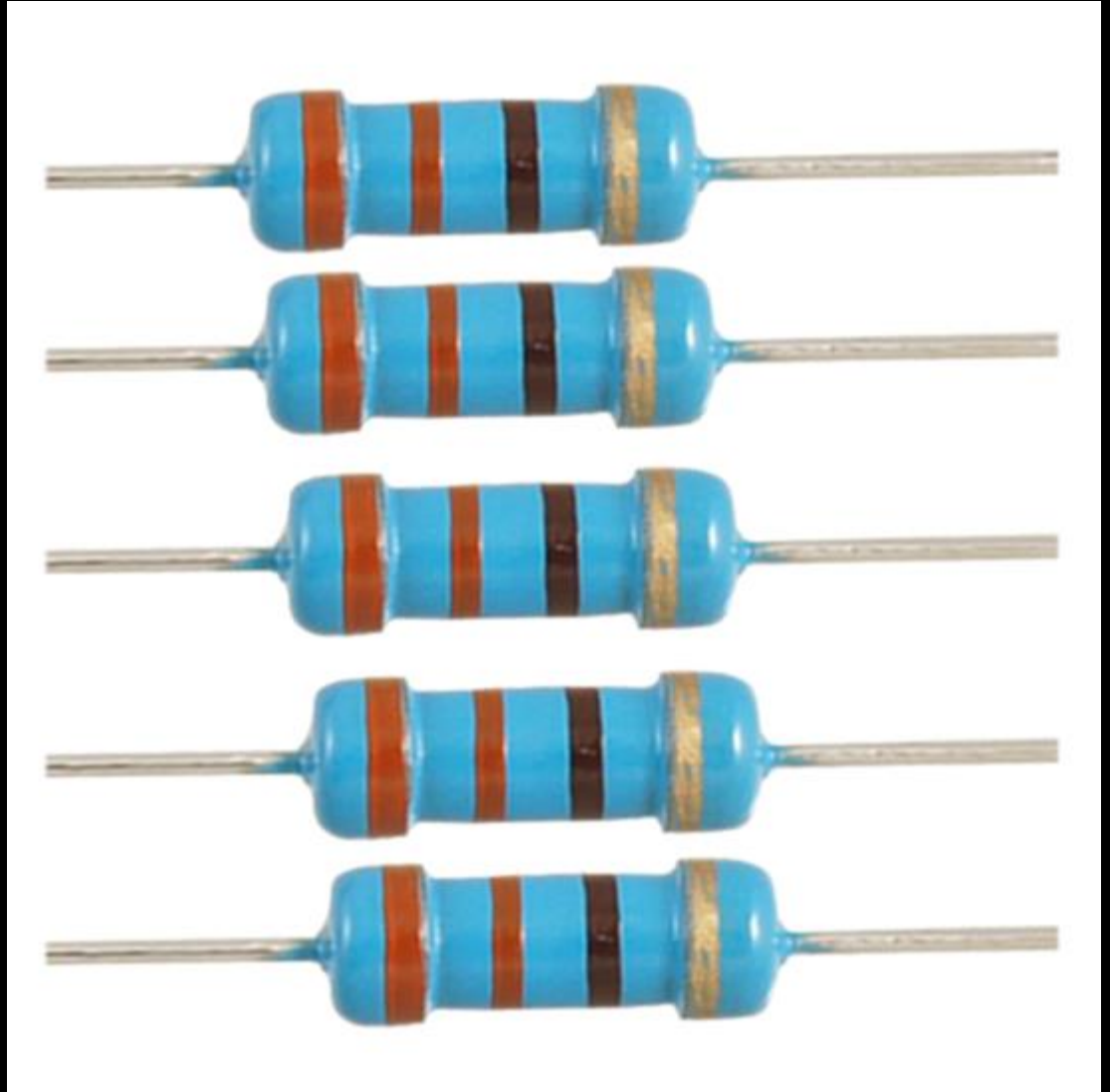


Resistor Color Code



What is the value
of these
resistors?

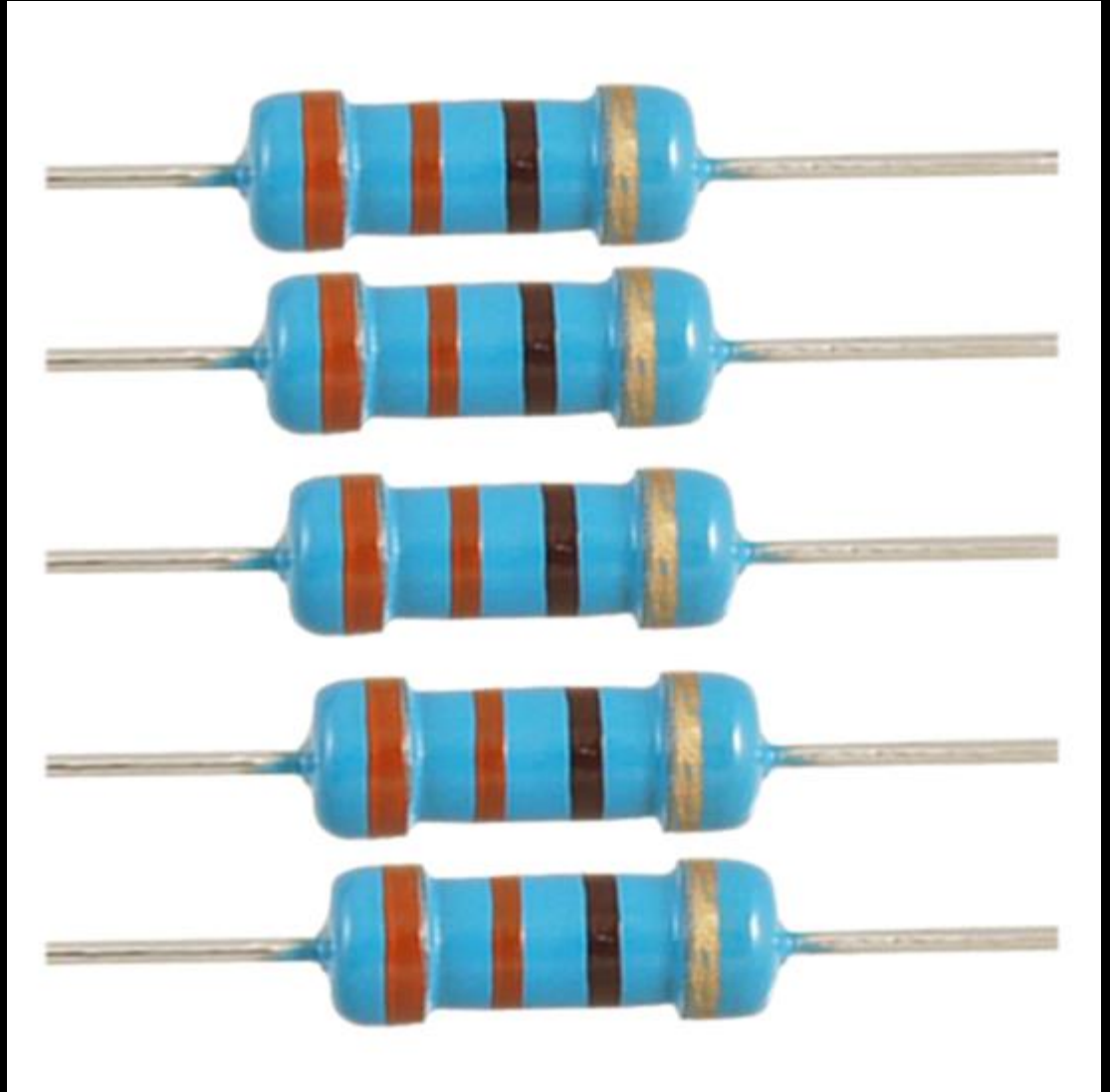
orange –orange –brown - gold



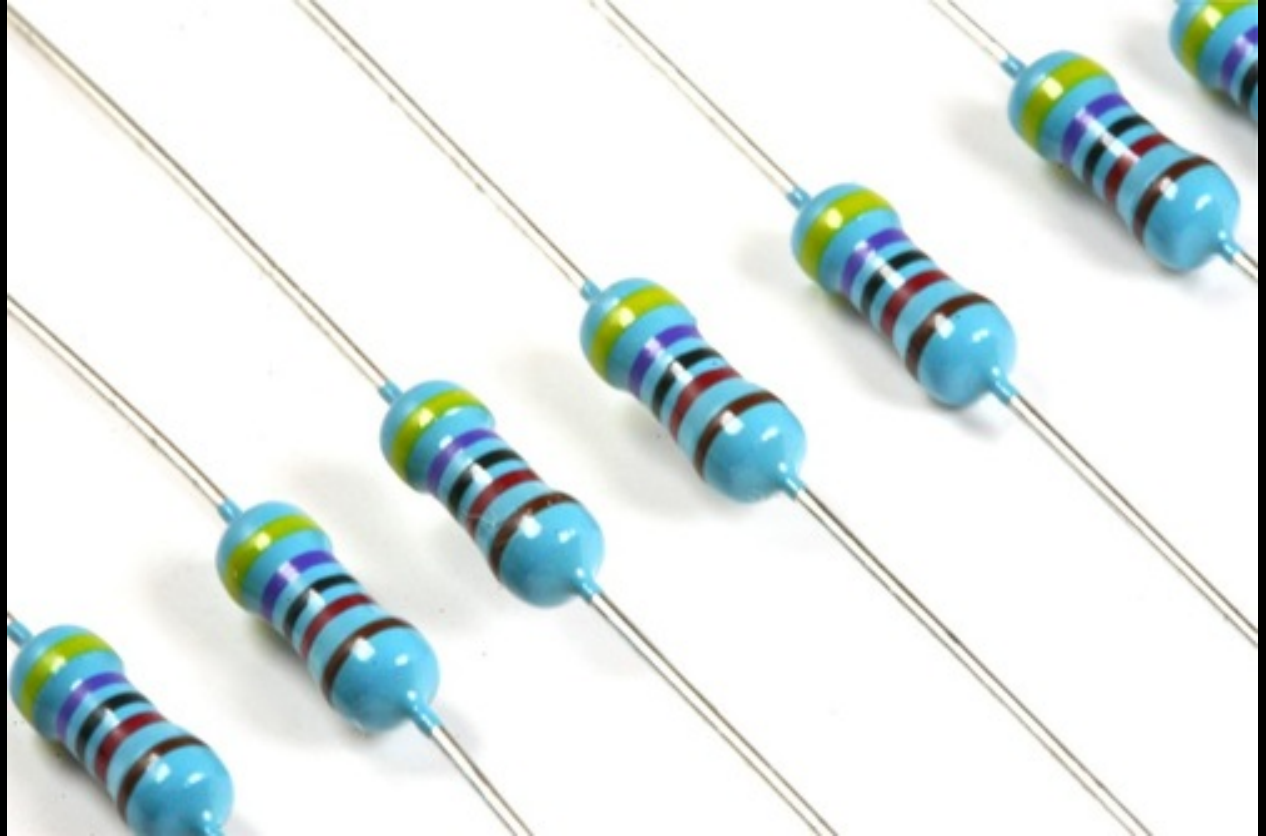
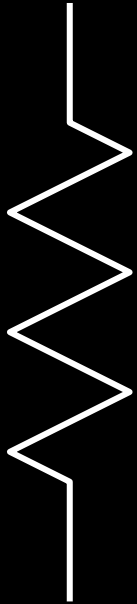
Resistor Color Code



orange – orange – brown – gold
3 – 3 – 1 – +/- 5%



Resistor Color Code



What is the value of these resistors?

Resistors – Power Ratings

Typical:

$\frac{1}{8}W$

$\frac{1}{4} W$

$\frac{1}{2} W$

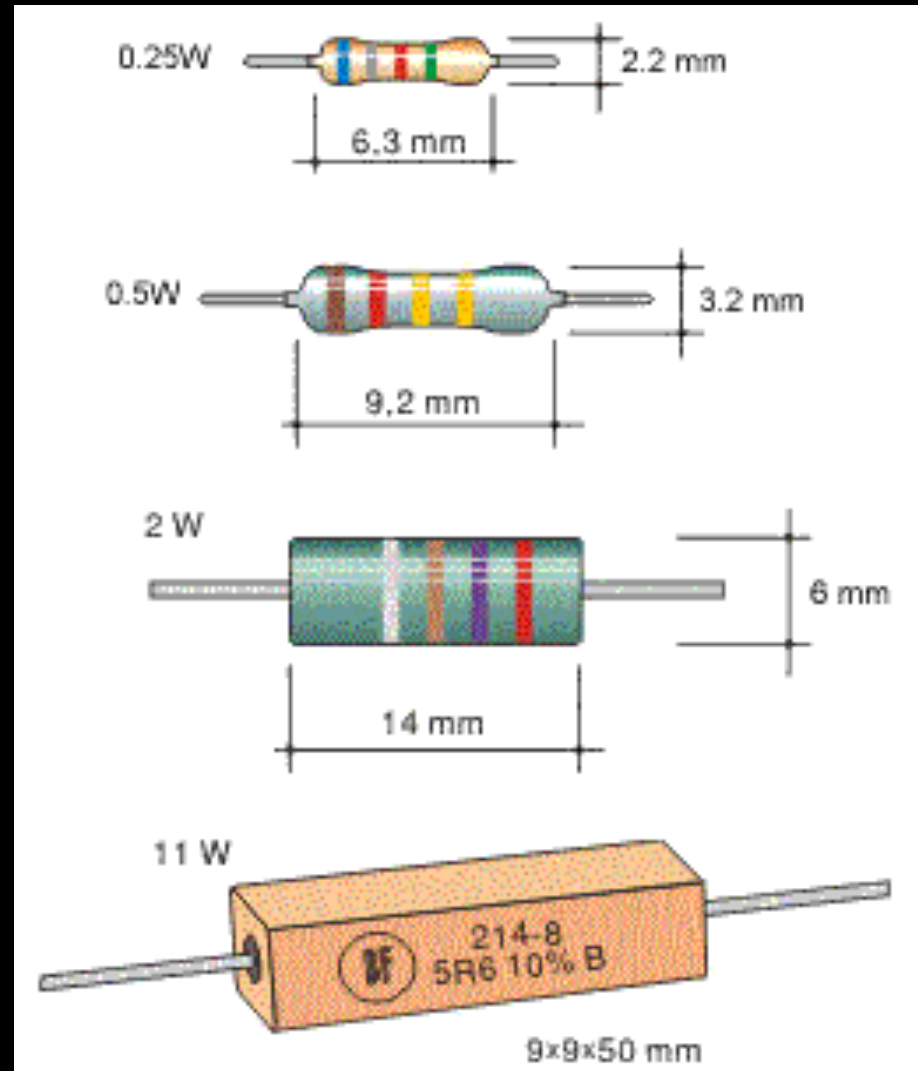
1 W

2W

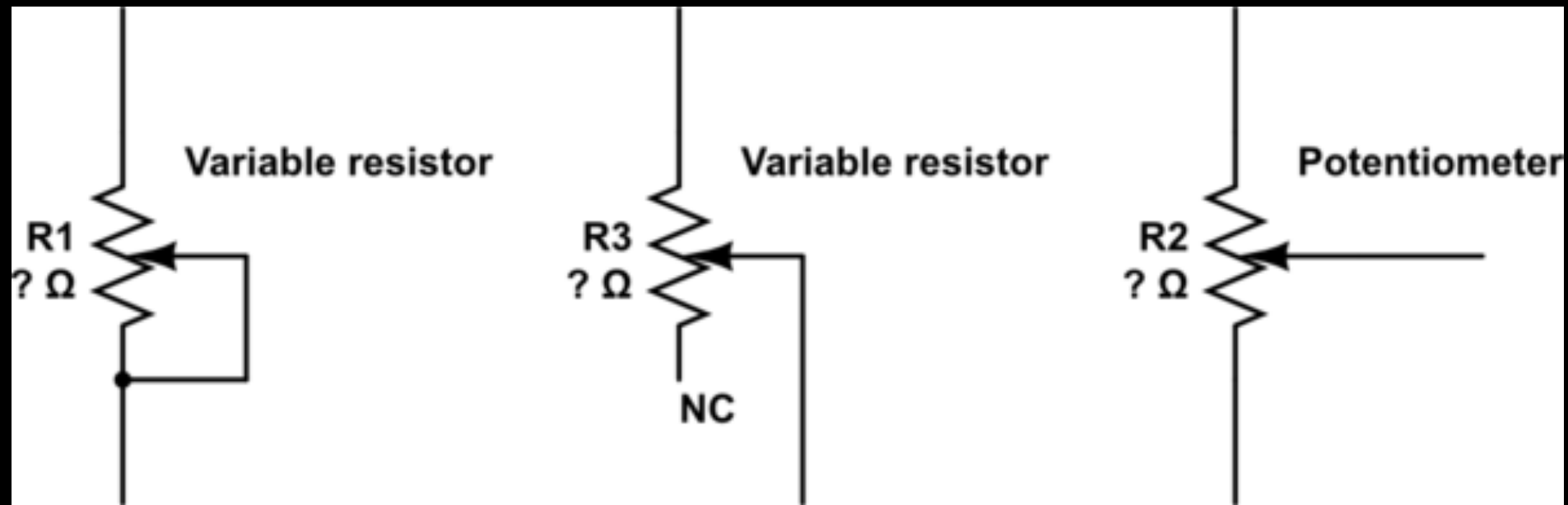
5W

10W

HUGE

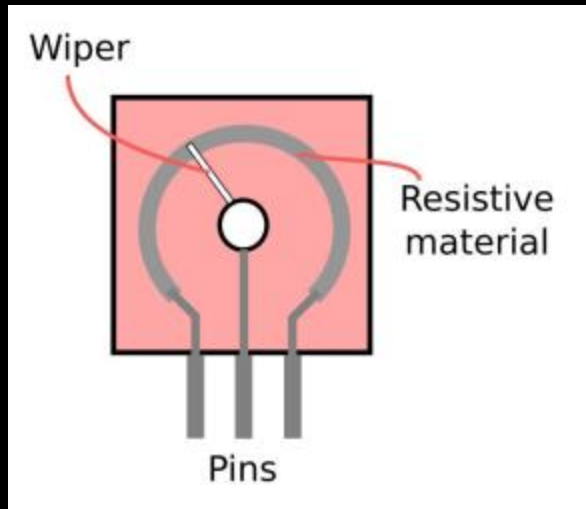


Resistors – Variable

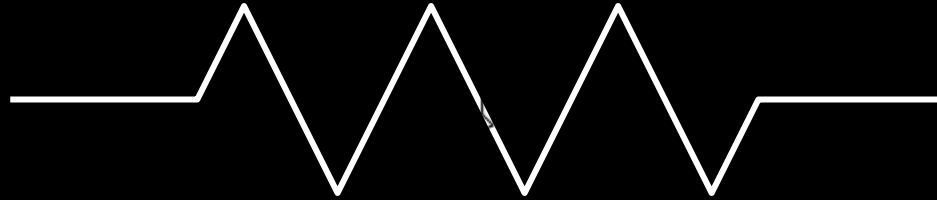


Variable Resistors - Potentiometers

Potentiometer



Resistors – Questions?



Electronic Components

Resistor

Capacitor

Inductor

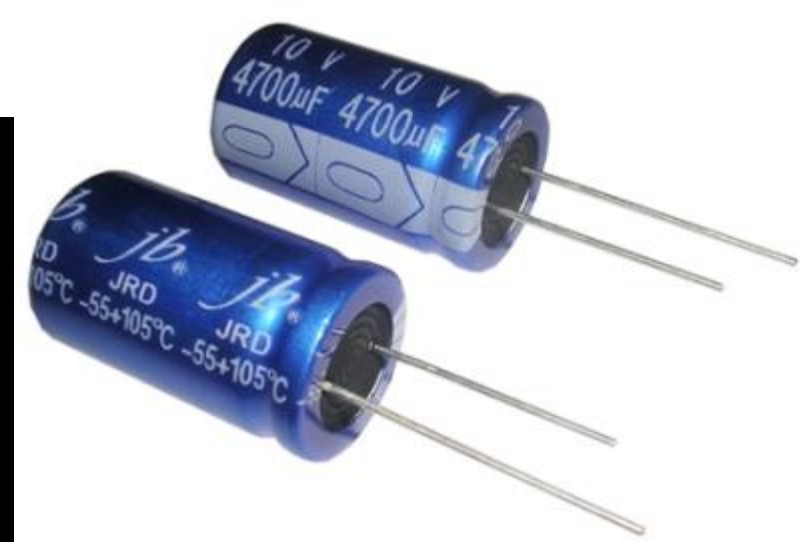
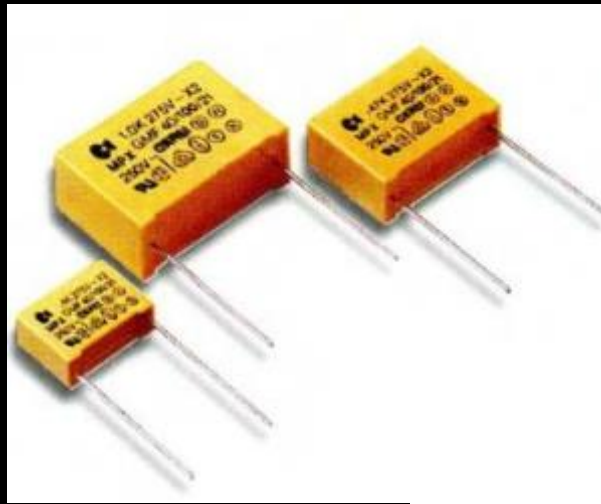
Transformer

Diode

Transistor

Integrated Circuit

Capacitors



Capacitors:

store energy (just a tiny bit)

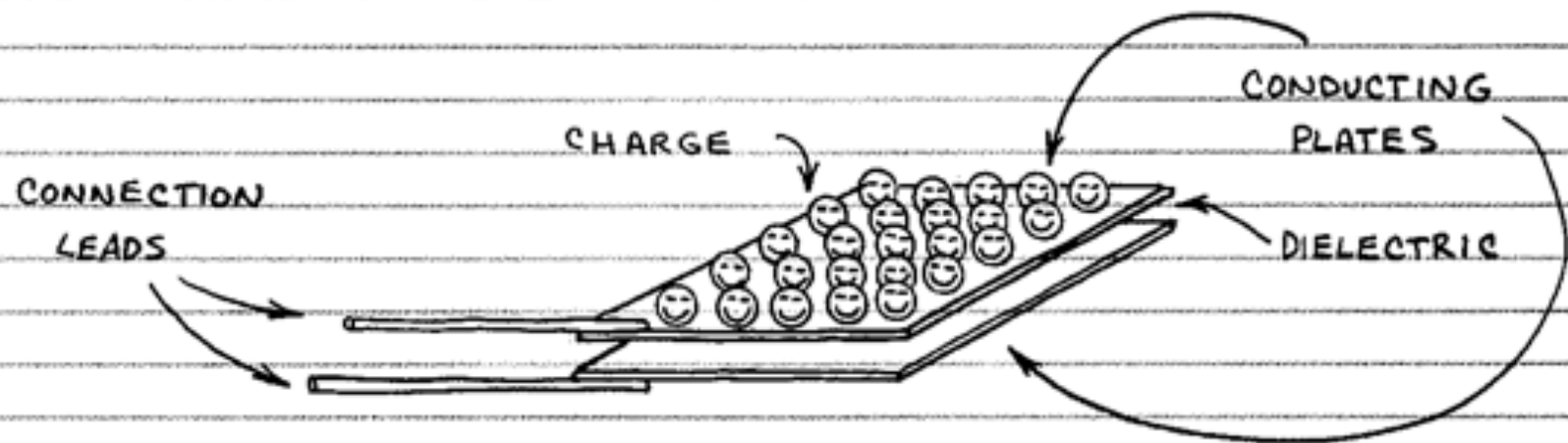
Block DC - low frequency audio signal

Pass AC – high frequency audio signal

Smooth ripple in power supplies

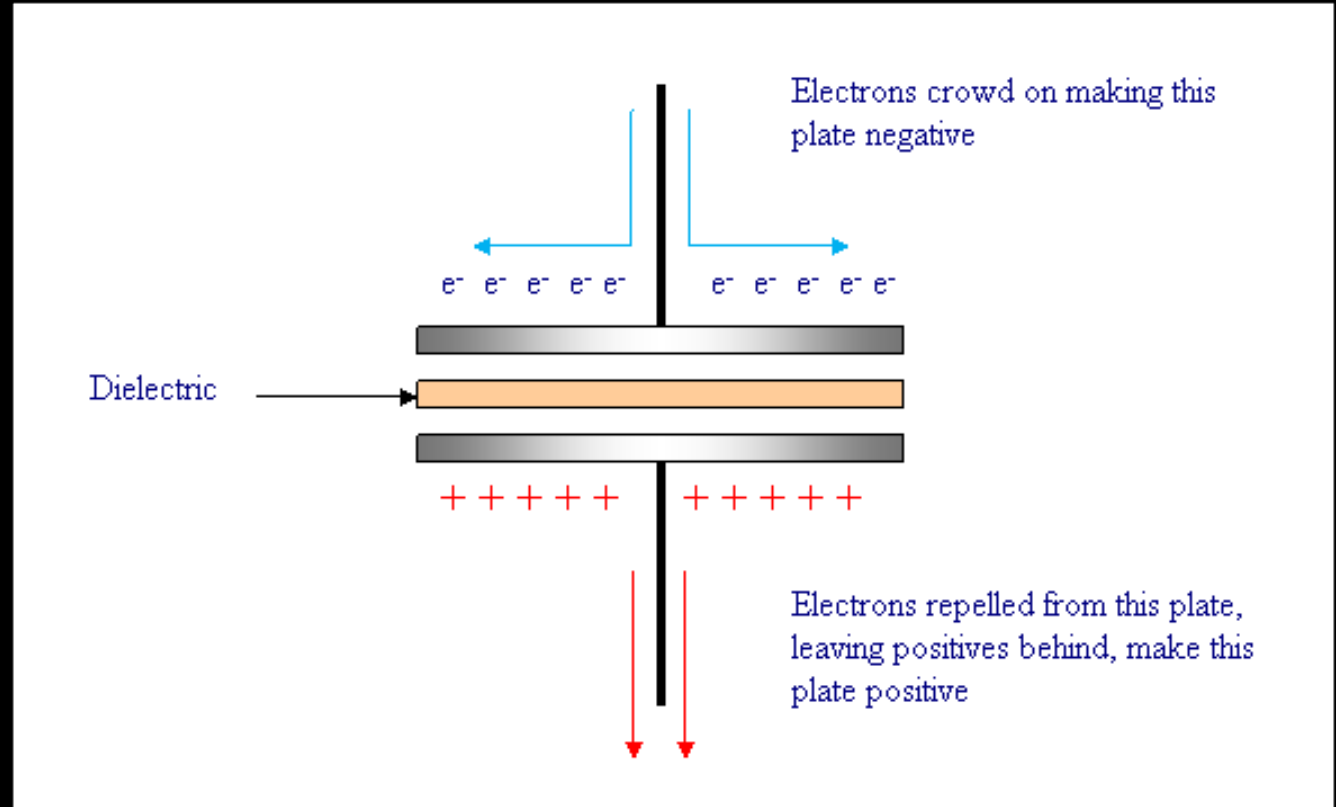
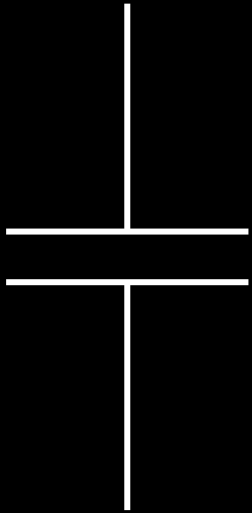
CAPACITORS

THERE ARE MANY KINDS OF CAPACITORS, BUT THEY ALL DO THE SAME THING: STORE ELECTRONS. THE SIMPLEST CAPACITOR IS TWO CONDUCTORS SEPARATED BY AN INSULATING MATERIAL CALLED THE DIELECTRIC. LIKE THIS:



THE DIELECTRIC CAN BE PAPER, PLASTIC FILM, MICA, GLASS, CERAMIC, AIR OR A VACUUM. THE PLATES CAN BE ALUMINUM DISCS, ALUMINUM FOIL OR A THIN FILM OF METAL APPLIED TO OPPOSITE SIDES OF A SOLID DIELECTRIC. THE CONDUCTOR - DIELECTRIC - CONDUCTOR SANDWICH CAN BE ROLLED INTO A CYLINDER OR LEFT FLAT. MORE ABOUT TYPES OF CAPACITORS LATER.

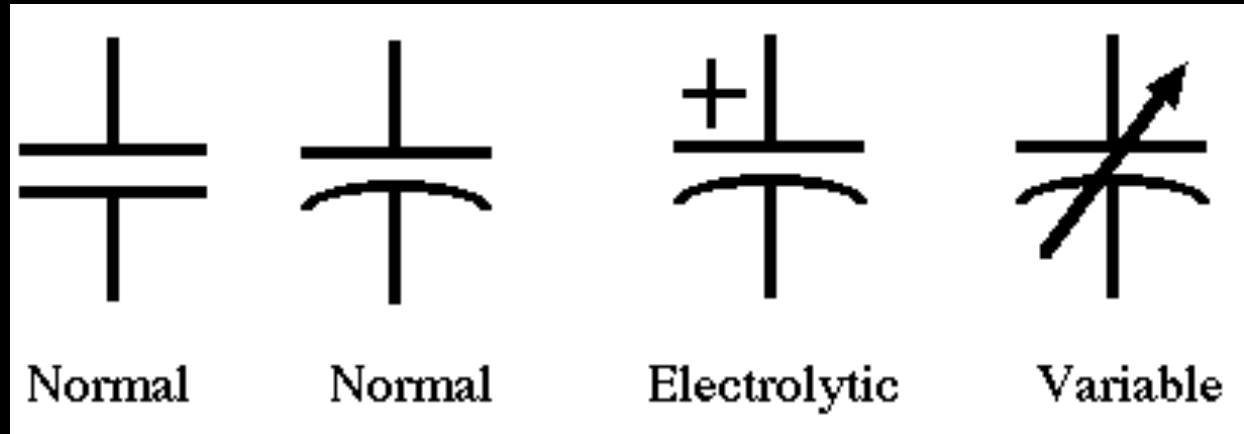
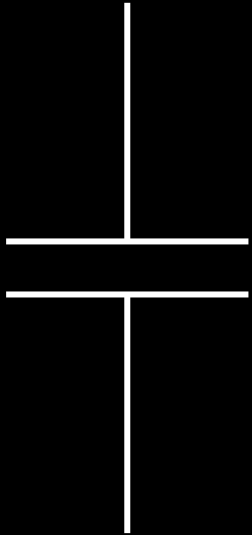
Capacitors



Conductive plates separated by an insulator (dielectric)

Dielectric : air, mica, plastic film, oxide, mica, or any insulator

Capacitors

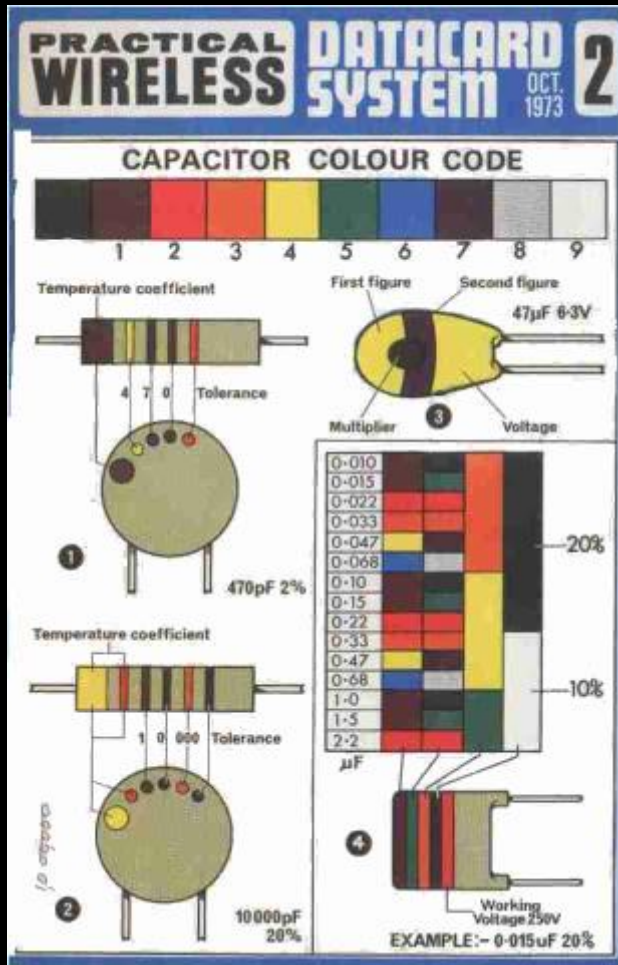


Capacitance is measured in Farads

Symbol = C

Some capacitors are polarized and some are not

Capacitor Codes



Electrolytic Capacitors



Value shown in micro-farads [µF]

Negative terminal shown by stripe or arrow



ROBOT X MILL

Disc / Ceramic Capacitors



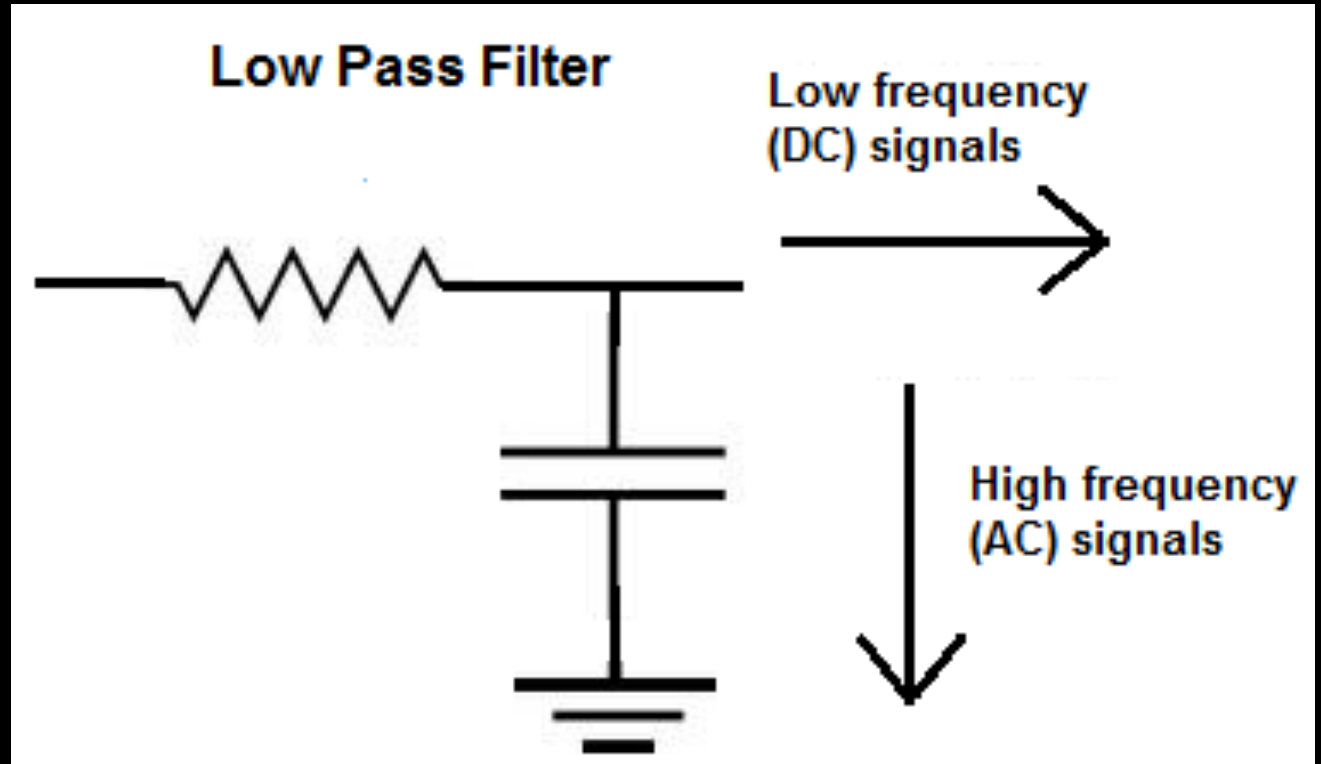
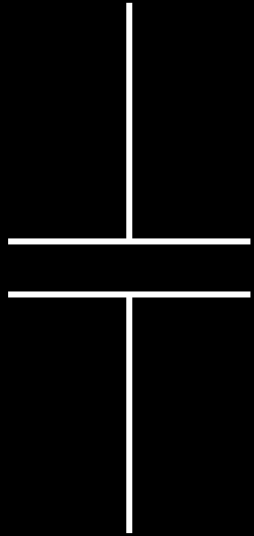
Value shown in pico-farads [pF]
(1 pF = 0.000001 µF)

Non-polar (no + / - terminals)

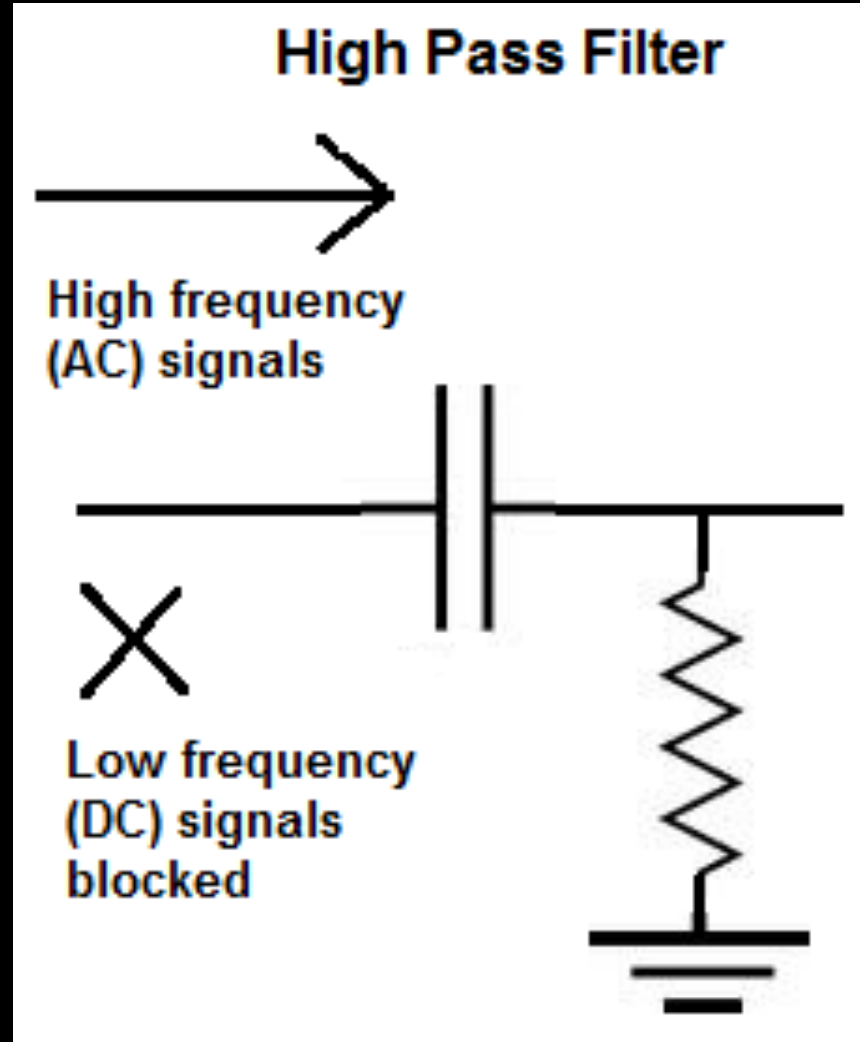
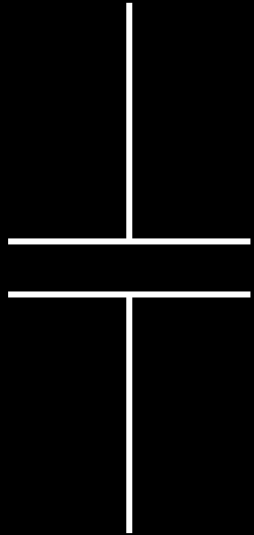
3rd digit is multiplier
ex: 154 = 150000 pF

0 = x1	4 = x10000
1 = x10	5 = x100000
2 = x100	8 = x .01
3 = x1000	9 = x .1

Capacitor - RC Low Pass filter

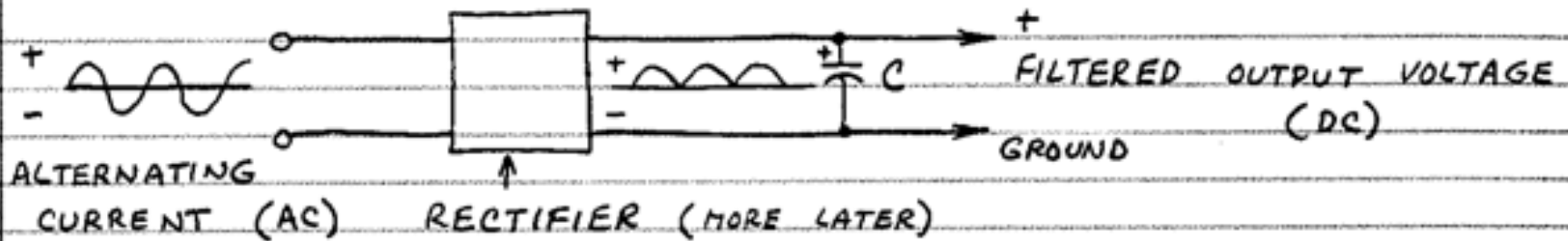


Capacitor - RC High Pass filter



Capacitor – Power Supply Filtering

□ POWER SUPPLY FILTER — A CAPACITOR WILL SMOOTH (FILTER) THE PULSATING VOLTAGE FROM A POWER SUPPLY INTO A STEADY DIRECT CURRENT (DC).



Capacitors – Questions?

Capacitor – Reactive Component #1

REACTANCE: X

Opposition that **capacitance** or inductance offers to alternating current. This opposition changes with frequency.

IMPEDANCE: Z

A frequency dependent resistance that is the combined opposition to AC by DC resistance and **capacitive** and inductive reactance.

Inductor – Reactive Component #2

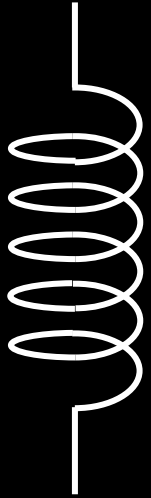
REACTANCE: X

Opposition that capacitance or **inductance** offers to alternating current. This opposition changes with frequency.

IMPEDANCE: Z

A frequency dependent resistance that is the combined opposition to AC by DC resistance and capacitive and **inductive** reactance.

Inductor – AKA Coil, Choke

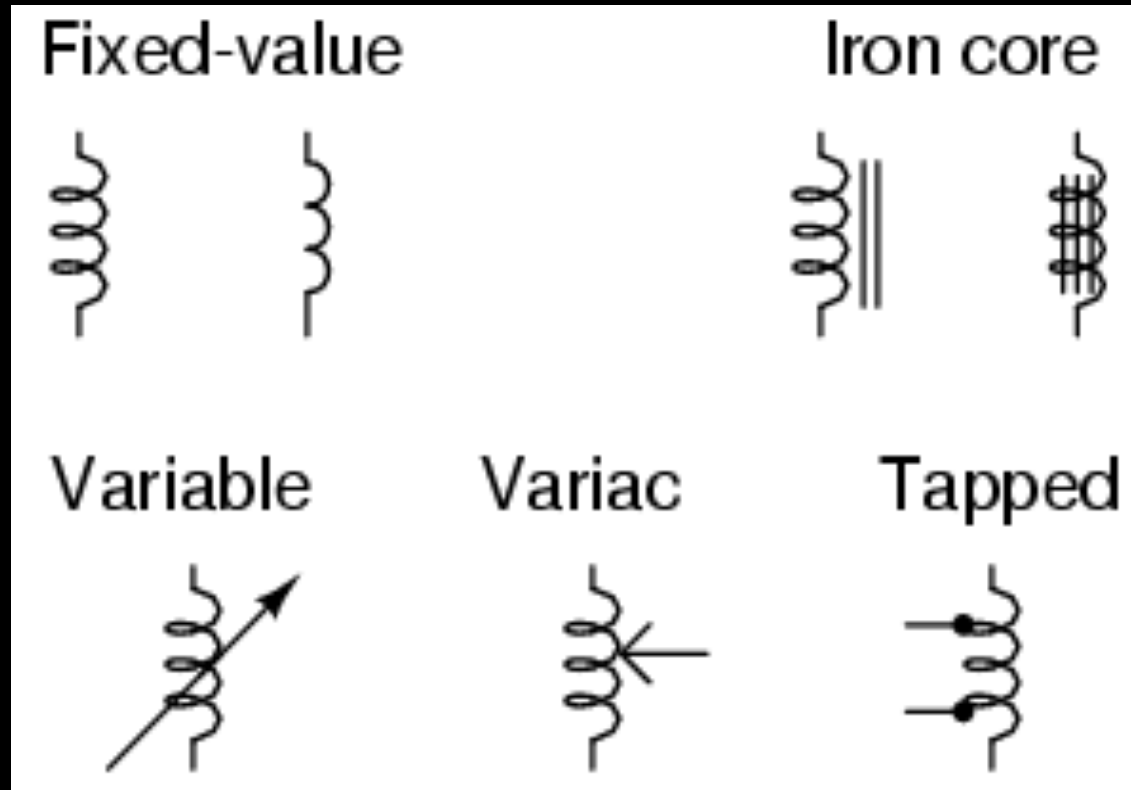
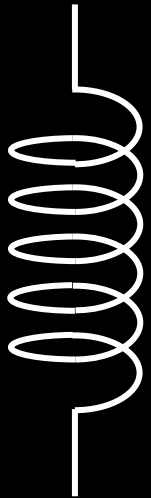


Inductors resist change/ are slow to react to current changes

Measured in Henries

Symbol = L

Inductor

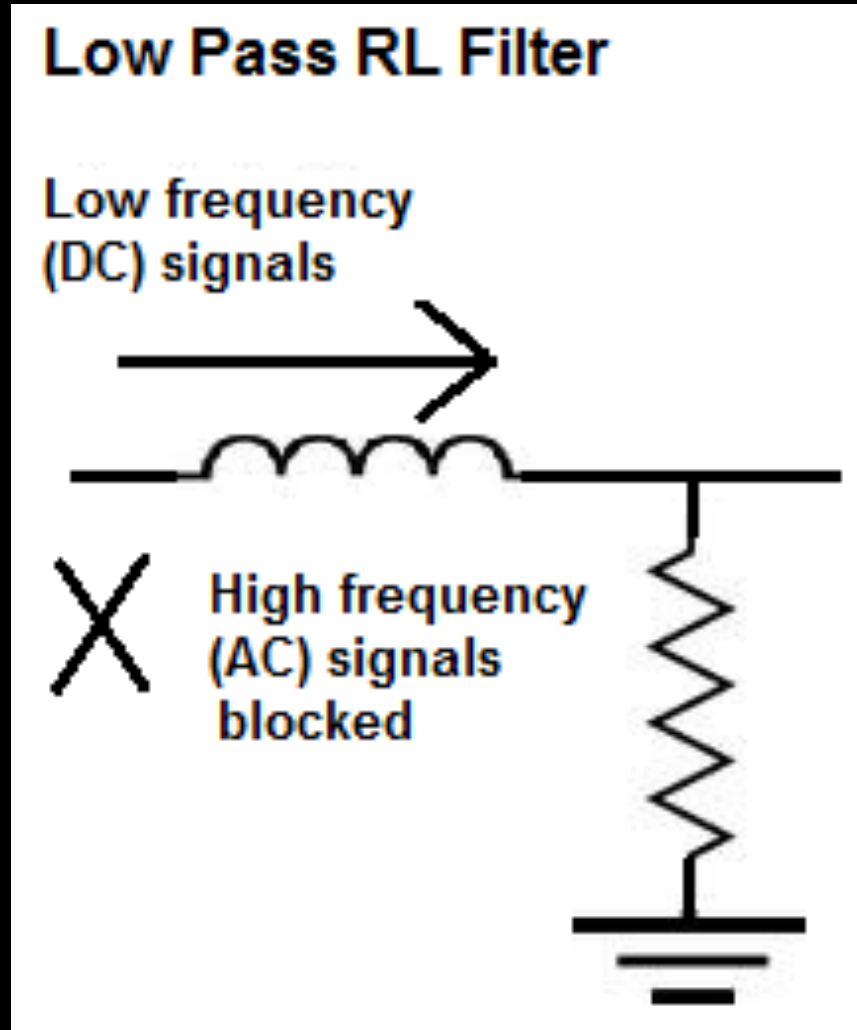
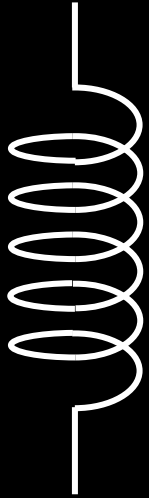


Inductors

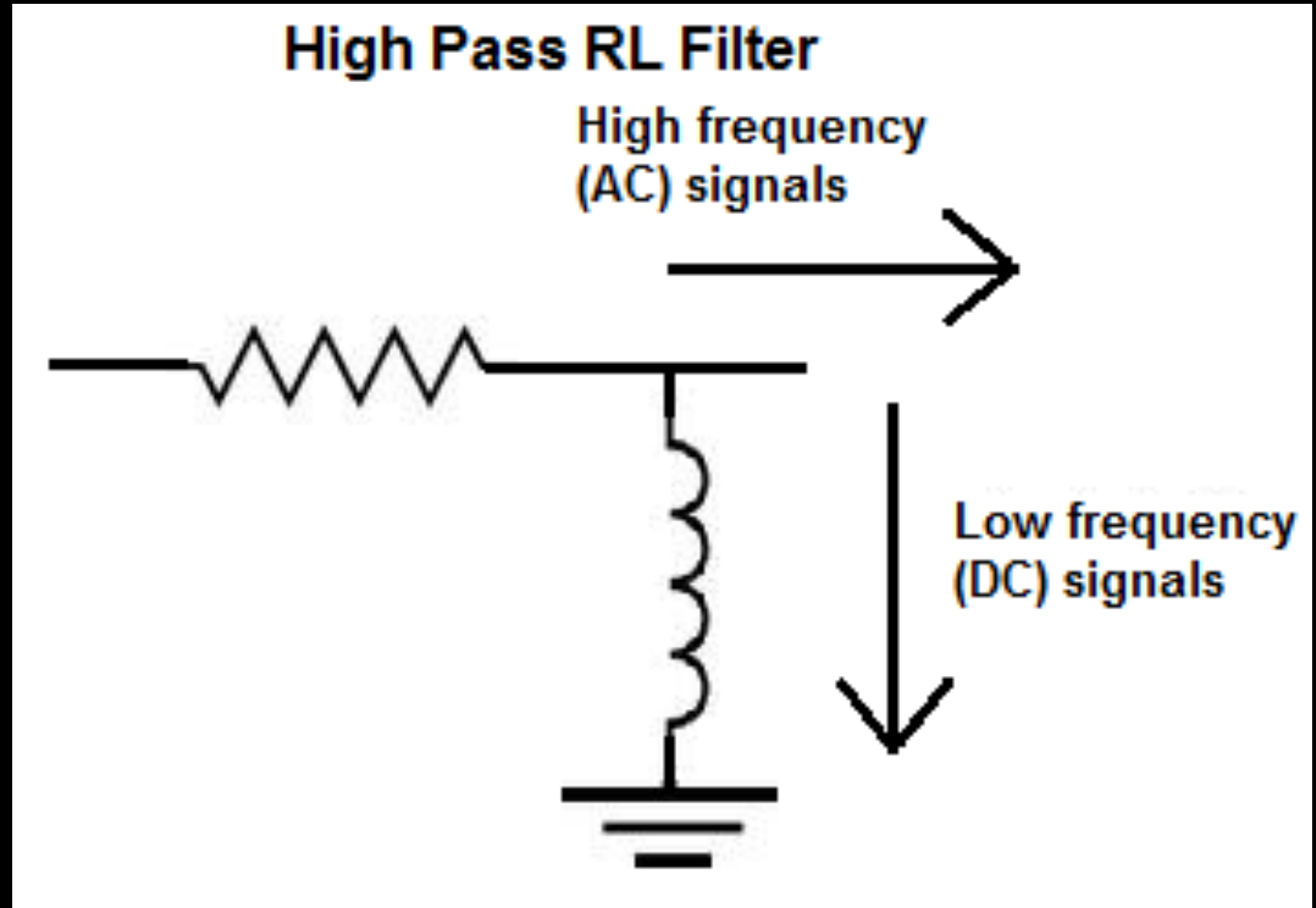
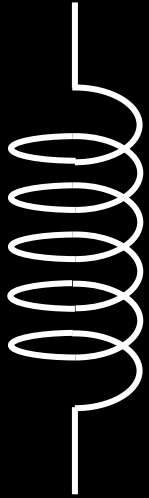
Pass DC - low frequency audio signal

Block AC – high frequency audio signal

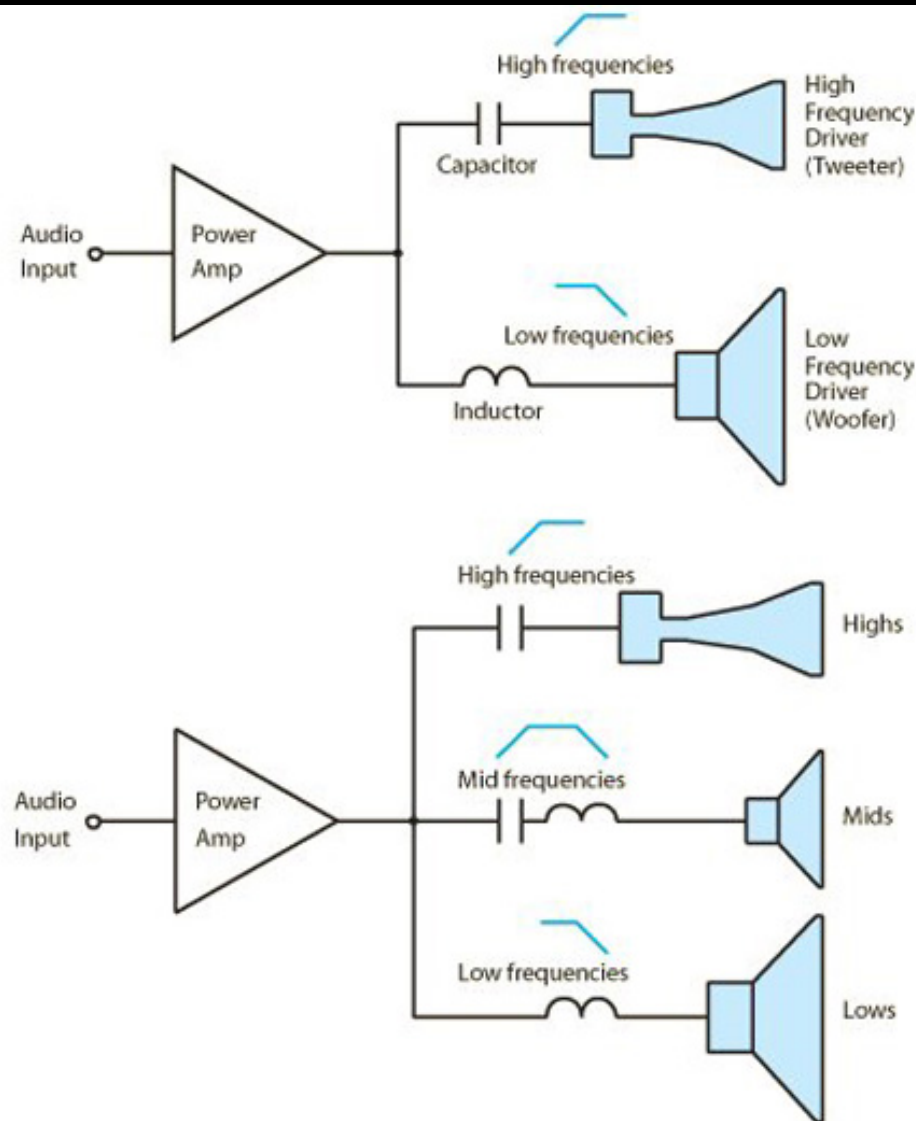
Inductor – Low Pass filter



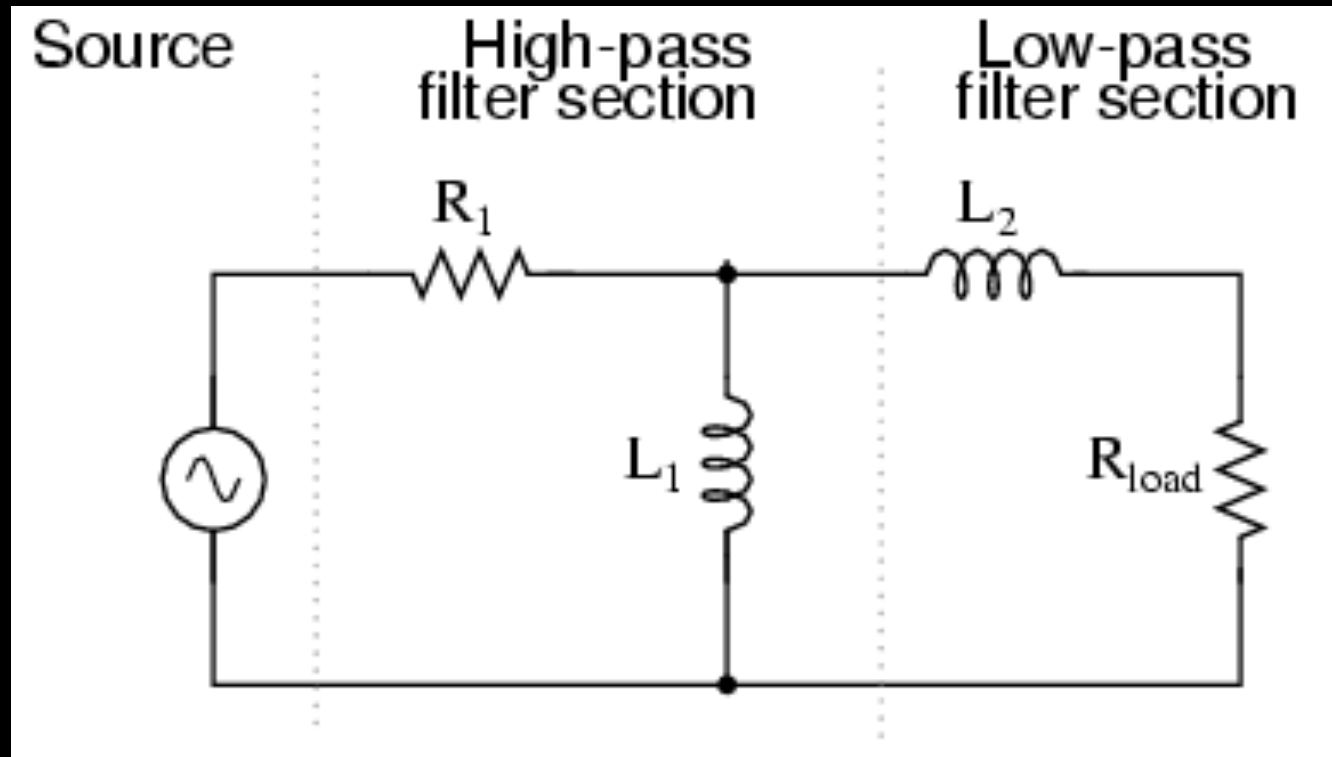
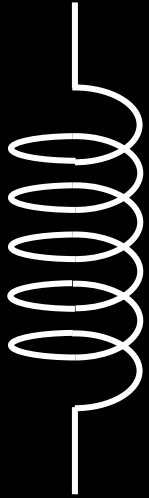
Inductor – High Pass filter



Inductors & Capacitors - Passive Crossover



Inductors – Questions?



Electronic Components

 Resistor

 Capacitor

 Inductor

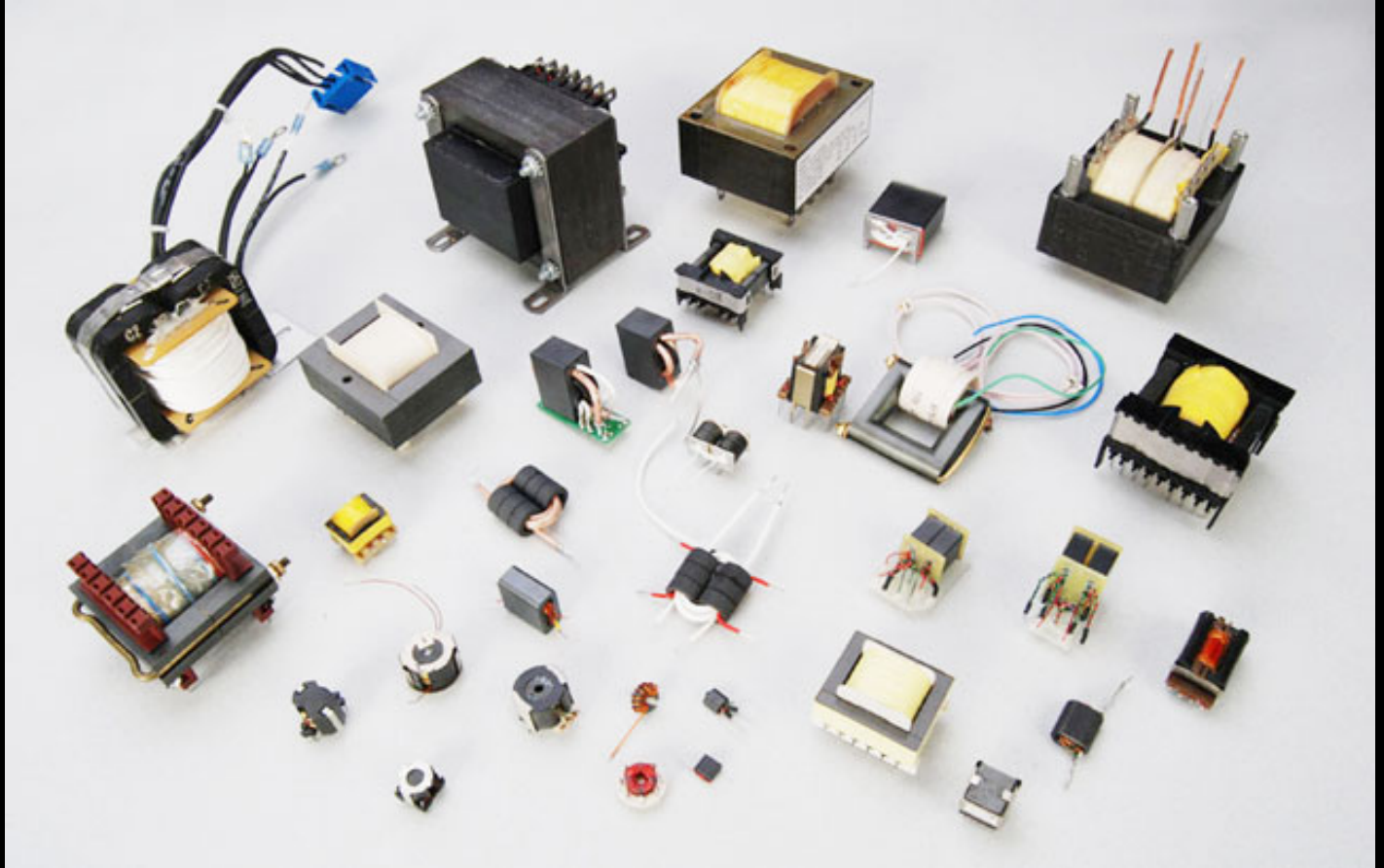
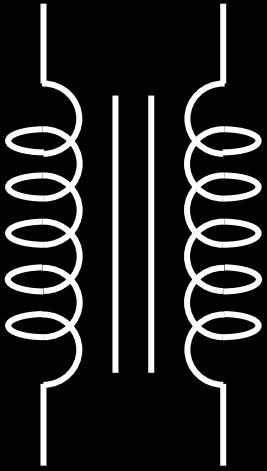
 Transformer

Diode

Transistor

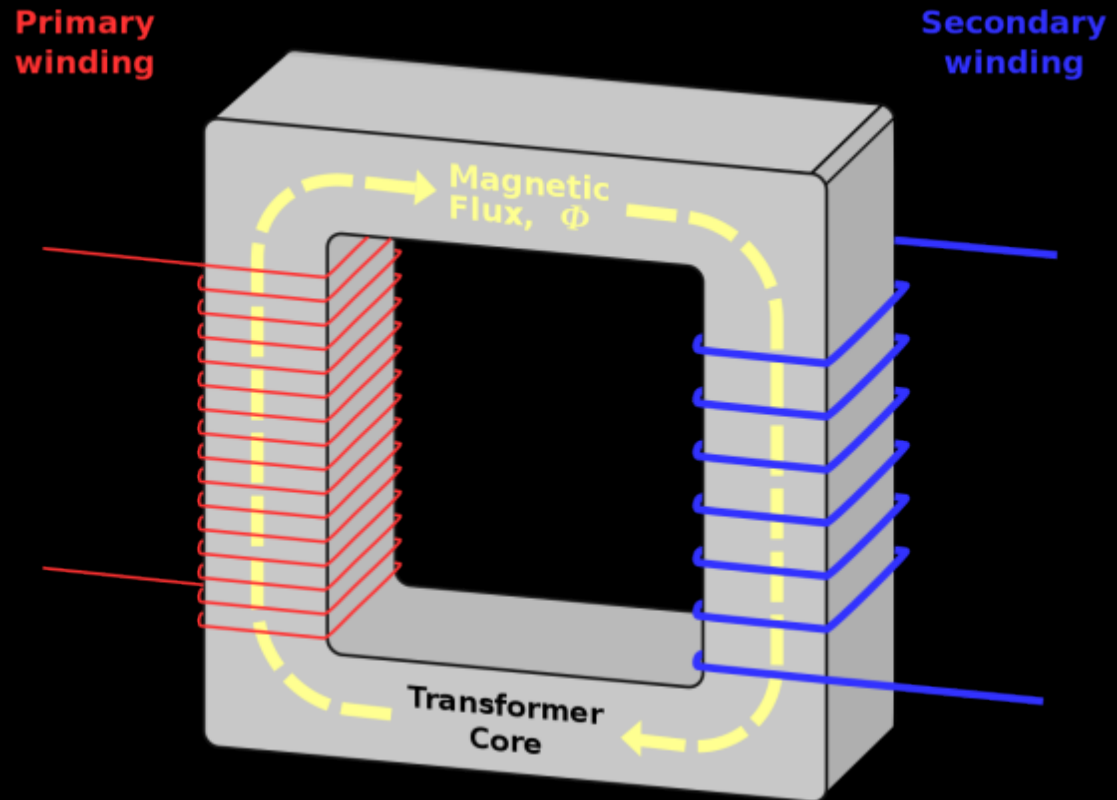
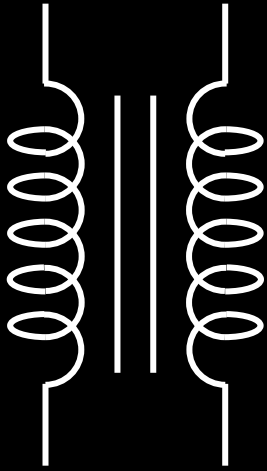
Integrated Circuit

Transformers



Transformers **TRANSFORM** Alternating Current (AC)
A transformer will not pass DC!

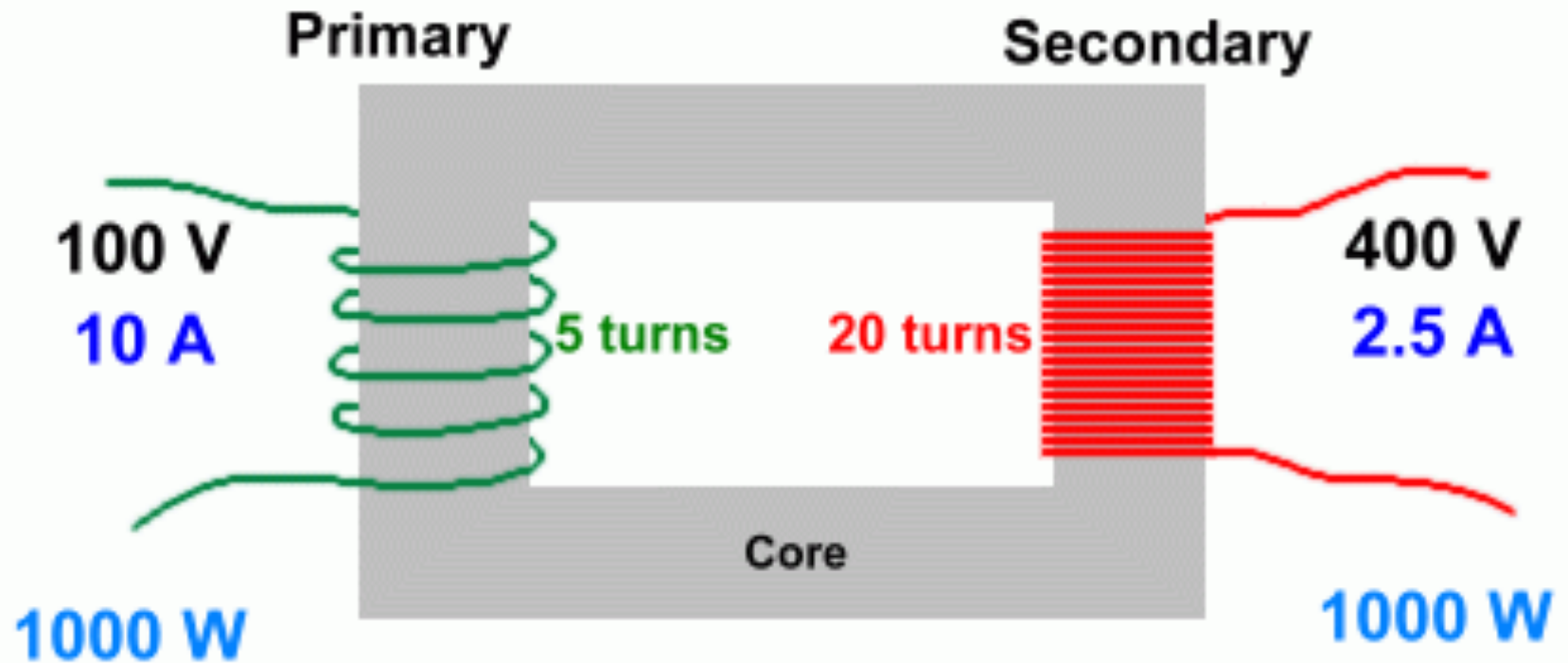
Transformers



The ratio of primary to secondary windings determines the transformation: Step-Up, Step-Down, or Unity (Isolation)

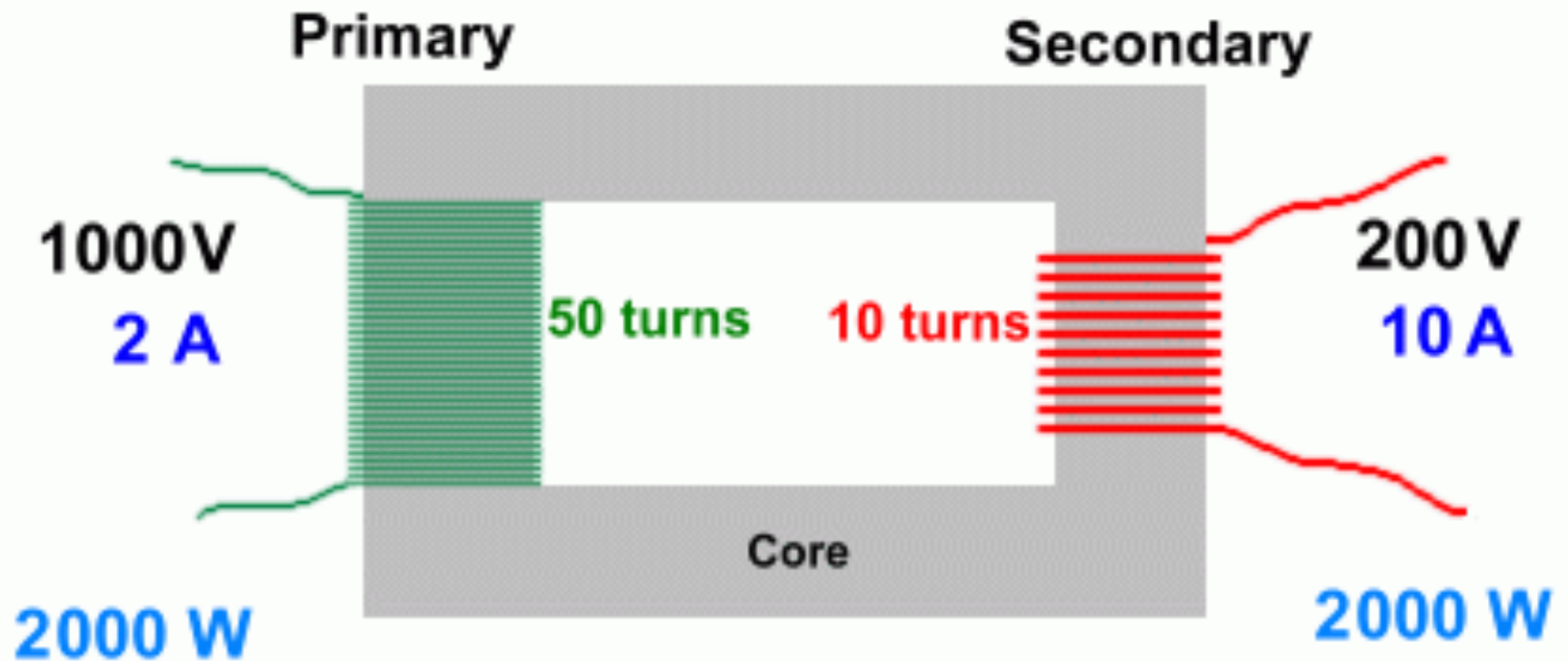
Transformers

Step Up Transformer

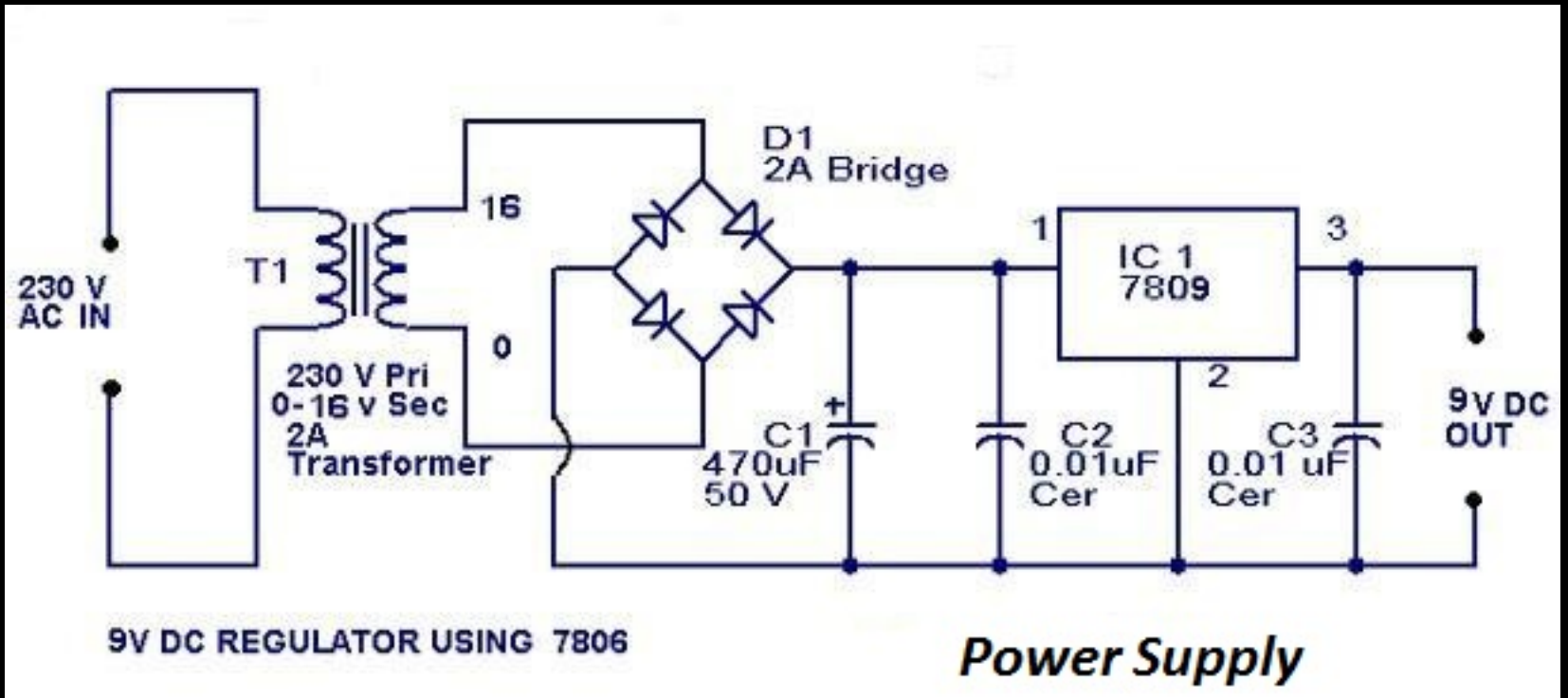


Transformers

Step Down Transformer

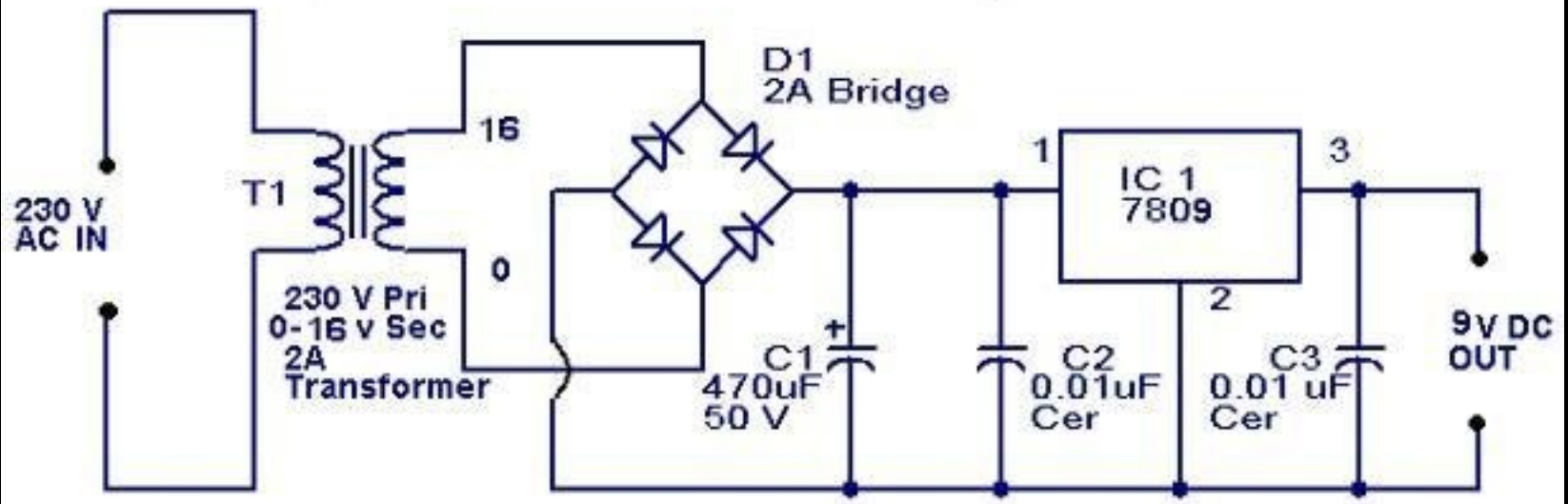


Transformers



Transformers are essential for modern-day power use: long distance transmission and conversion of AC to DC

Transformers – Questions?



9V DC REGULATOR USING 7806

Power Supply

Electronic Components

 Resistor

 Capacitor

 Inductor

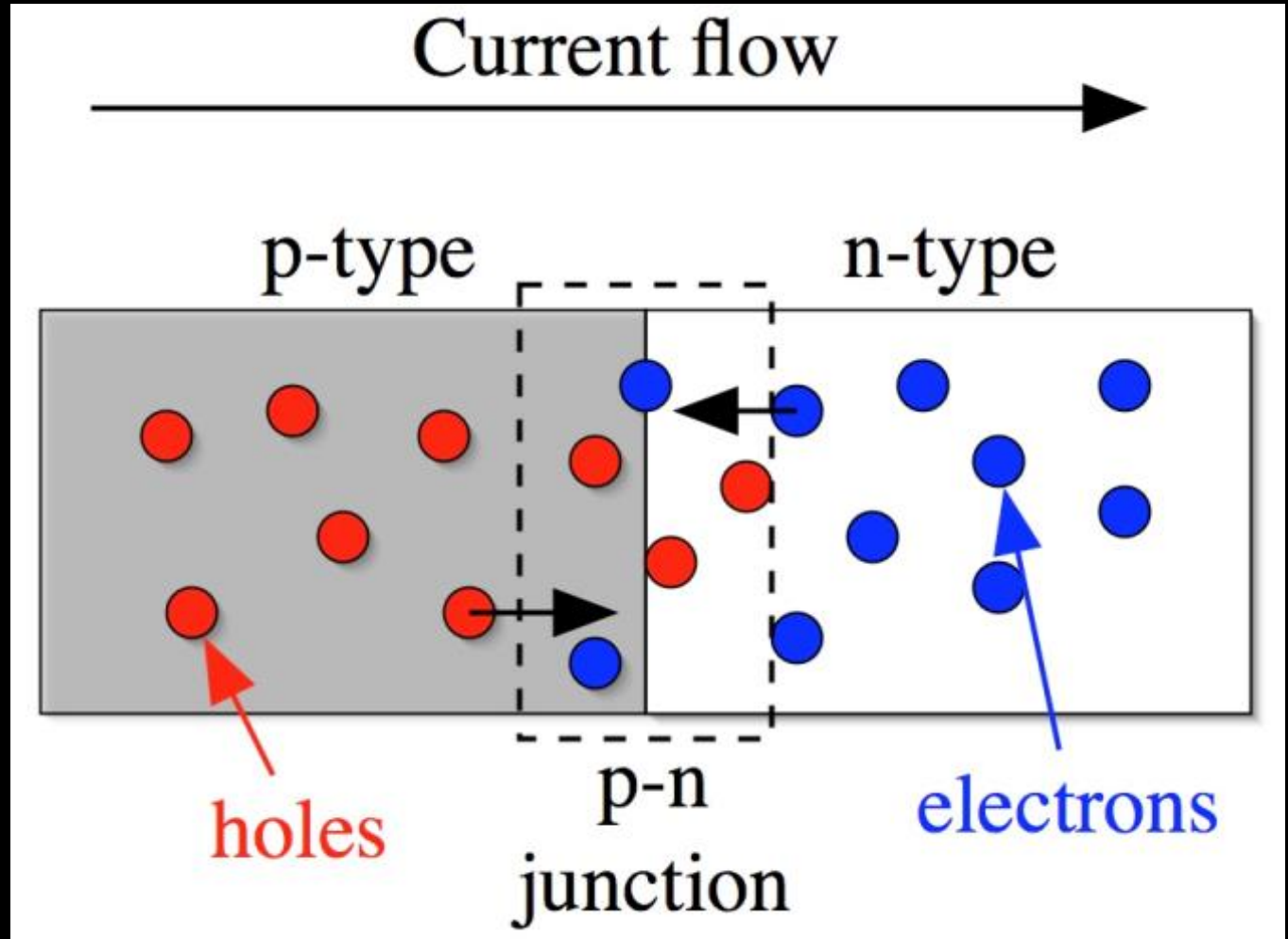
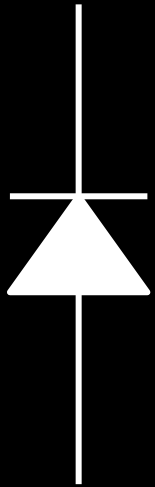
 Transformer

Diode 

Transistor

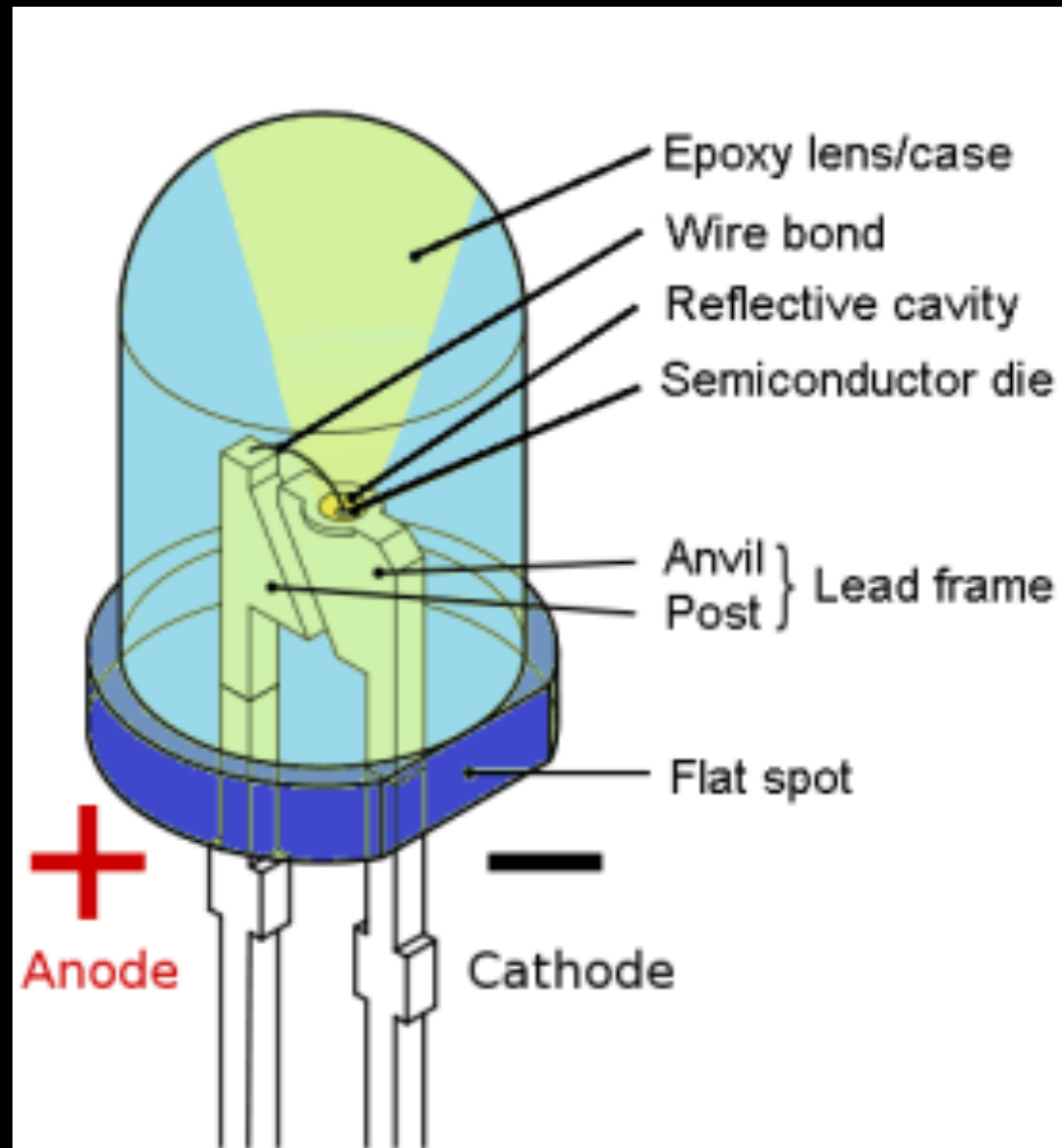
Integrated Circuit

Diode



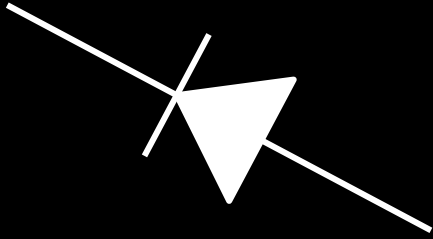
Diodes act as a “one-way valve” for electron flow

Diode



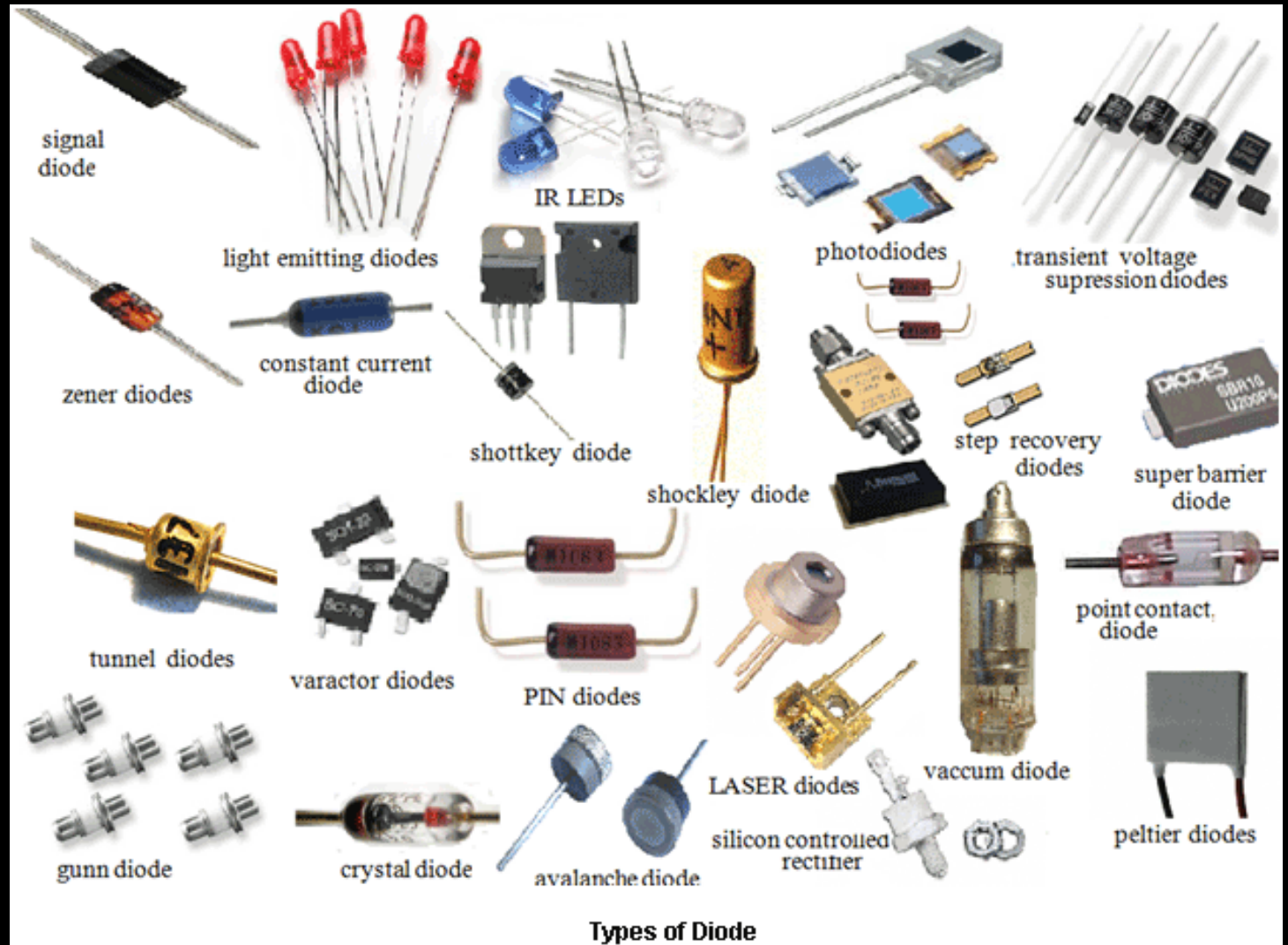
LED = Light-Emitting Diode

Diode



Common types – signal and power diodes

Diode



Electronic Components

 Resistor

 Capacitor

 Inductor

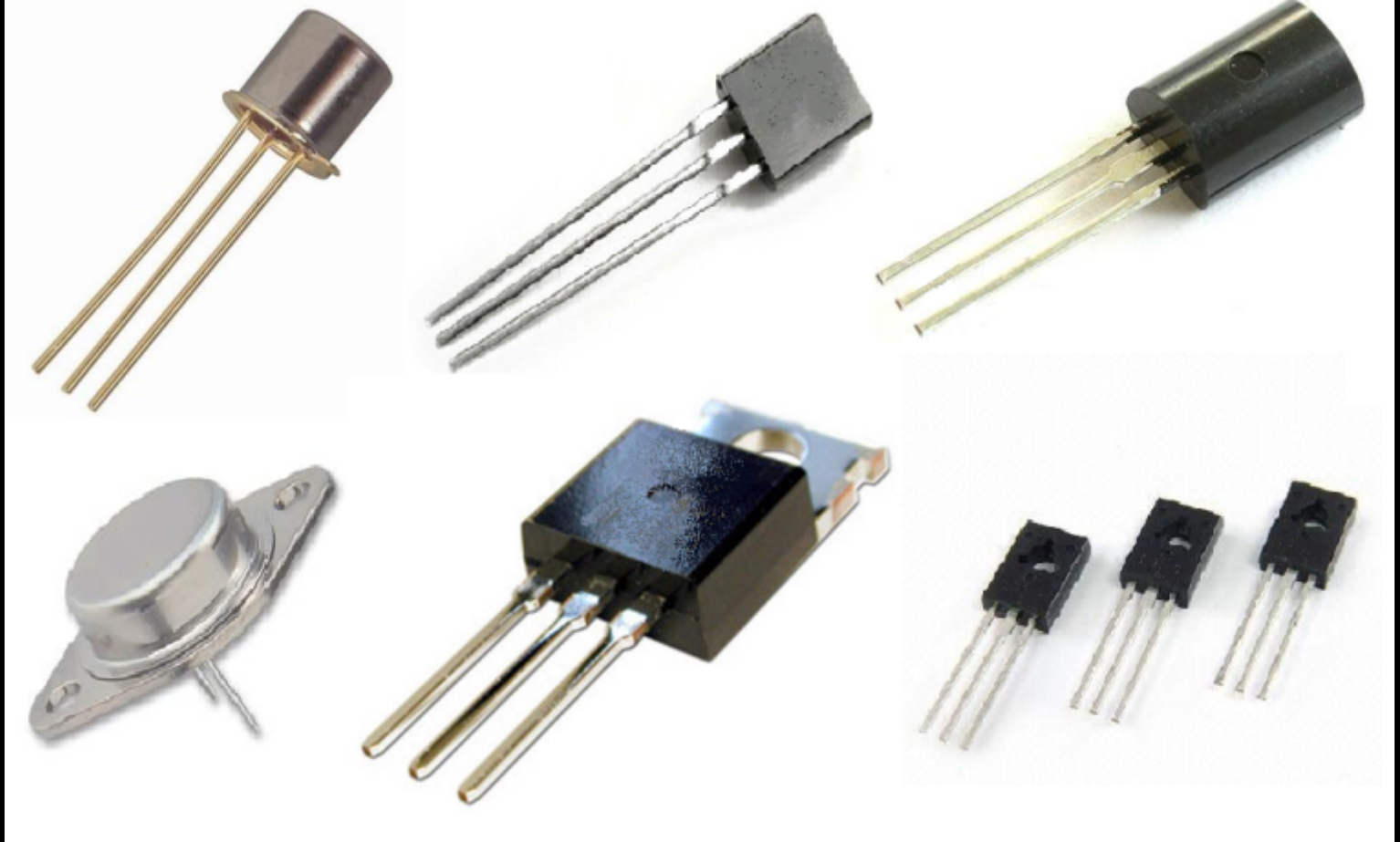
 Transformer

Diode 

 Transistor

Integrated Circuit

Transistors

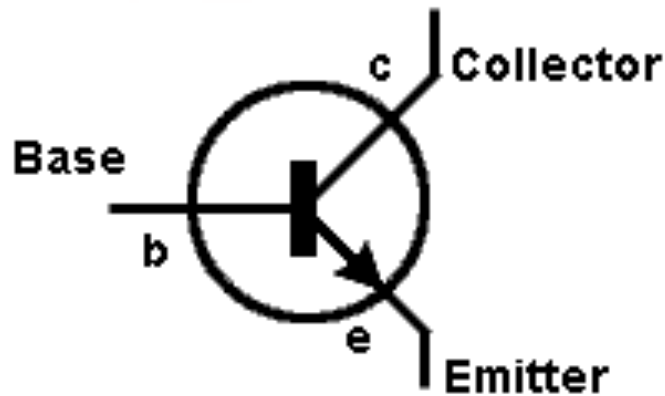


Transistors amplify voltage or current

Transistors – Bipolar Junction Transistors

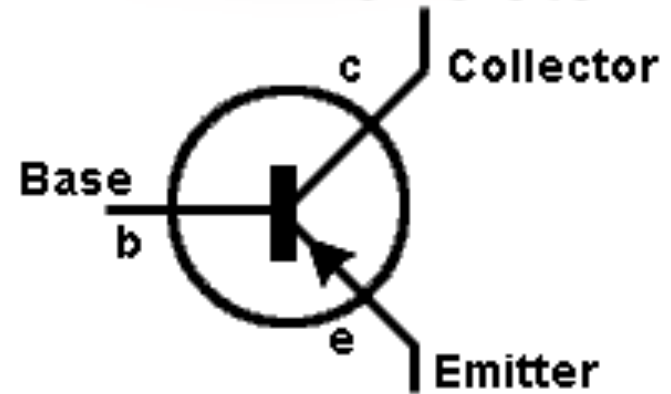


NPN Transistor



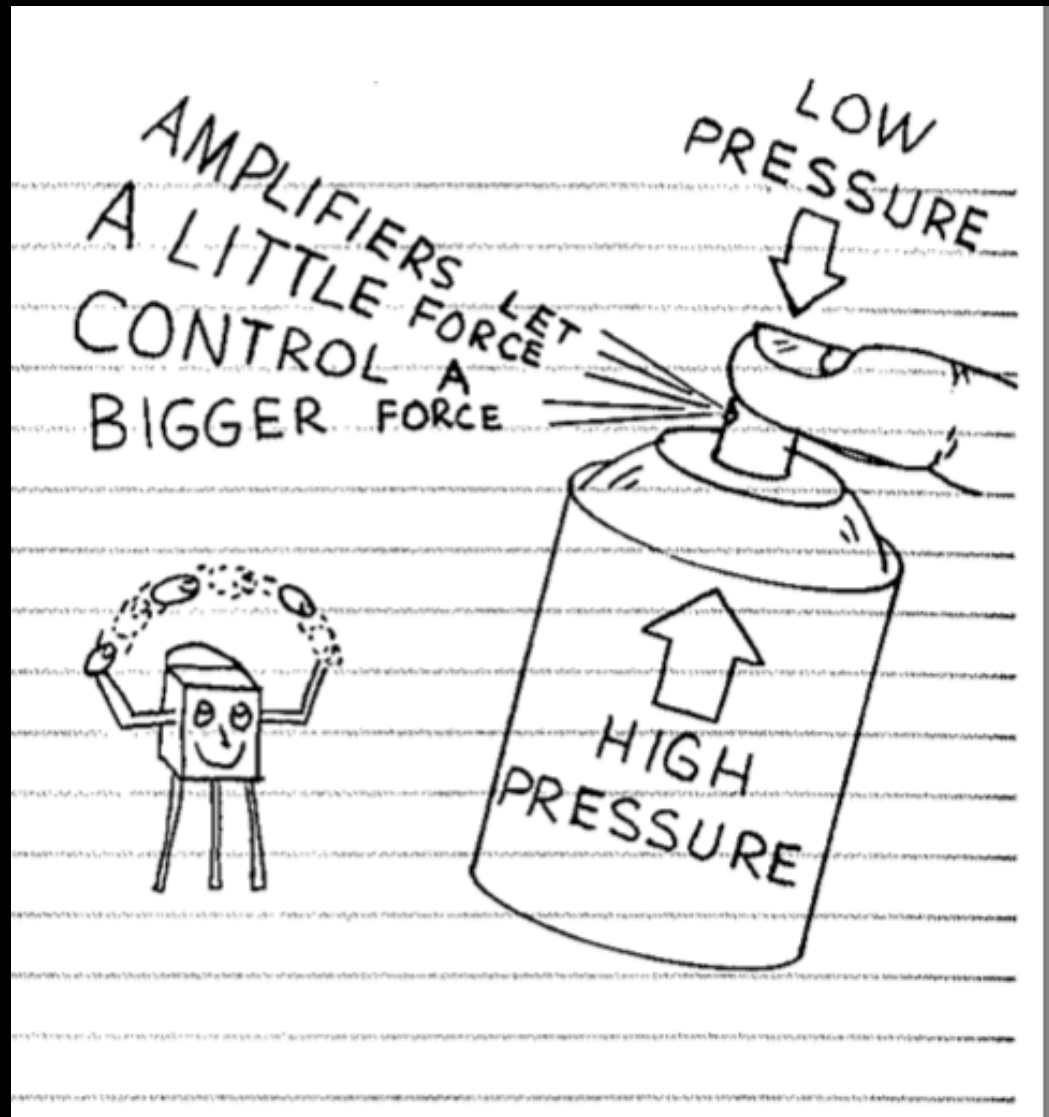
N **N**ever
P **P**oints
N **i****N**

PNP Transistor



P **P**oints
N **i****N**
P **P**ermanently

Transistors

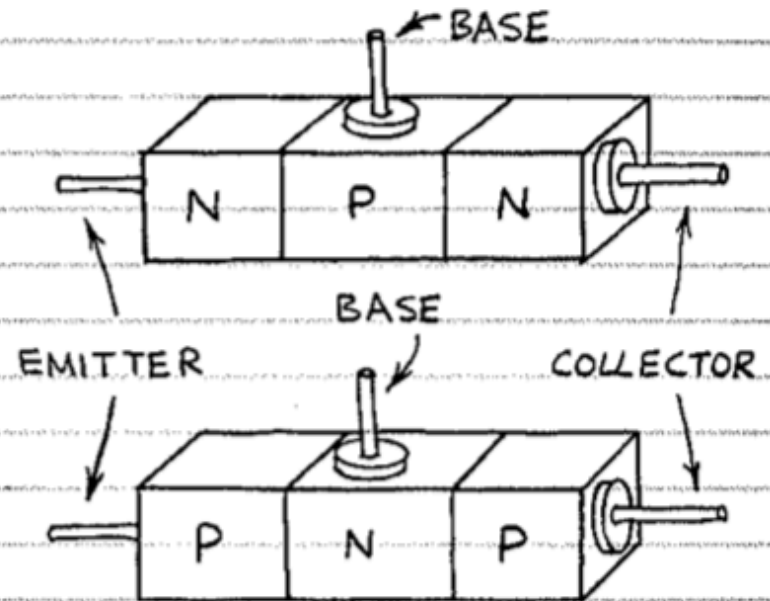


Transistor amplification analogy ala Mimms

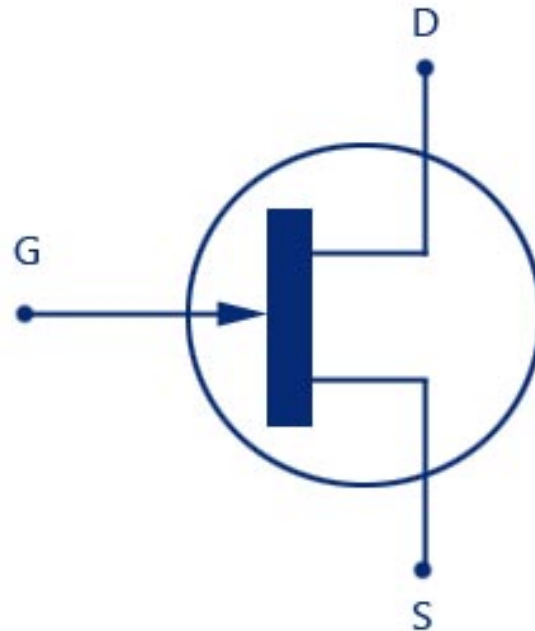
Transistors

BIPOLAR TRANSISTORS

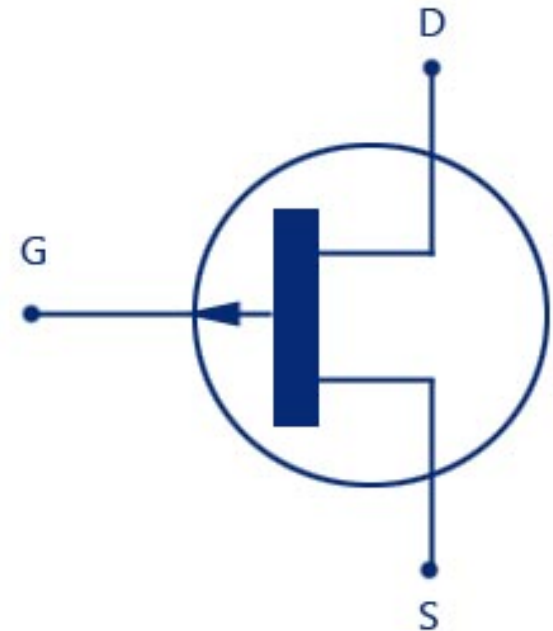
ADD A SECOND JUNCTION TO A PN JUNCTION DIODE AND YOU GET A 3-LAYER SILICON SANDWICH. THE SANDWICH CAN BE EITHER NPN OR PNP. EITHER WAY, THE MIDDLE LAYER ACTS LIKE A FAUCET OR GATE THAT CONTROLS THE CURRENT MOVING THROUGH THE THREE LAYERS.



Transistors – Field Effect Transistors



N Channel JEFT



P Channel JEFT

JFET-N-Channel and P-channel Schematic Symbol

Transistors – Questions??



Electronic Components

 Resistor

 Capacitor

 Inductor

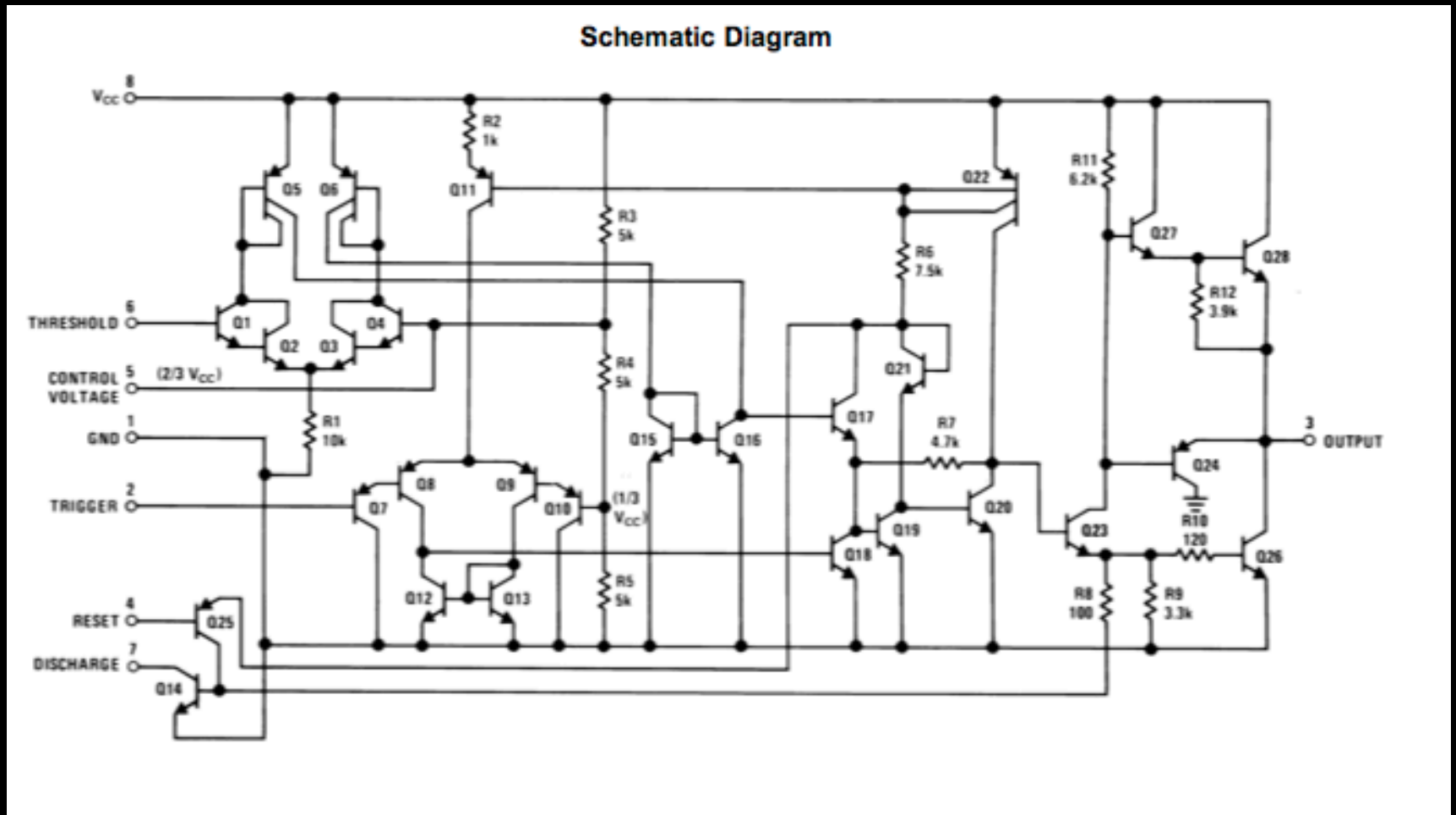
 Transformer

Diode 

 Transistor

Integrated Circuit

Integrated Circuits

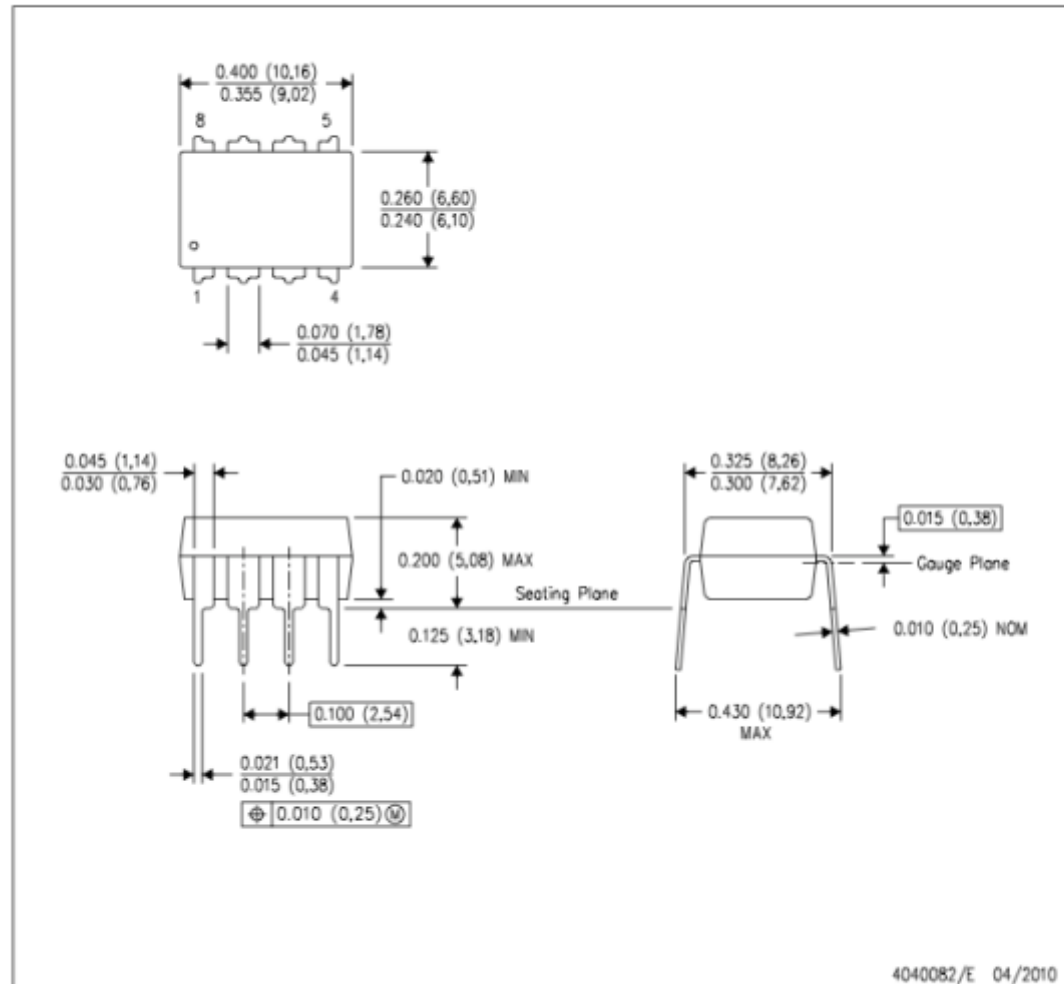


Many resistors, diodes, and transistors all in one tiny package!

Integrated Circuits

P (R-PDIP-T8)

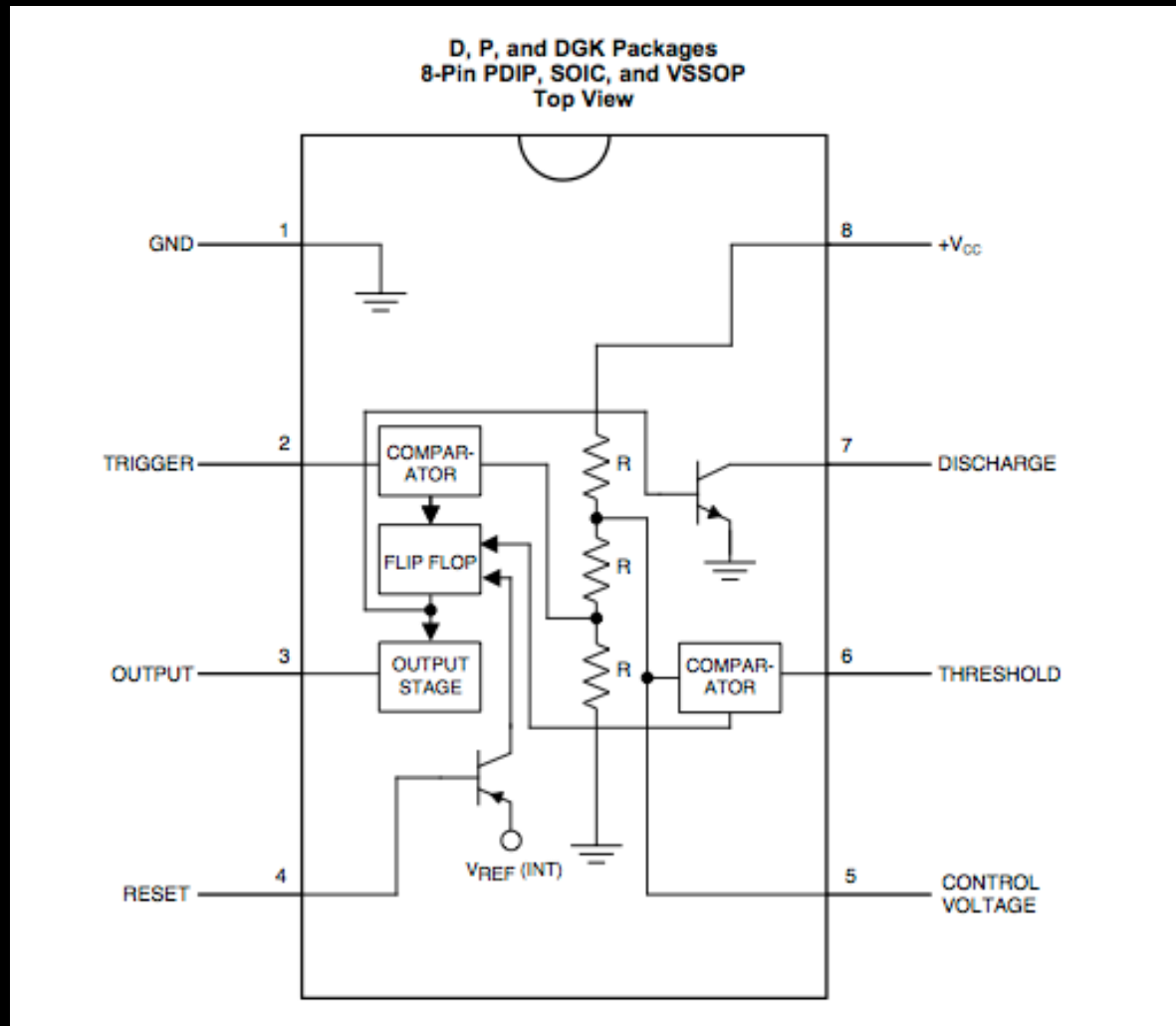
PLASTIC DUAL-IN-LINE PACKAGE



4040082/E 04/2010

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Falls within JEDEC MS-001 variation BA.

Integrated Circuits



Questions?