FUNDAMENTALS OF ELECTRICITY AND ELECTRONICS

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Voltage **“The potential difference between two points”**

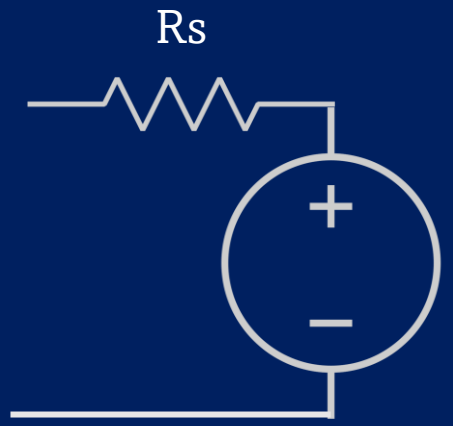
IDEAL SOURCES

Independent voltage source

Dependent voltage source

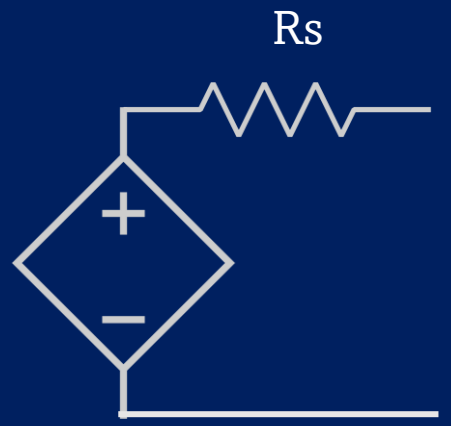
Sora

Voltage "Measured in Volts (V)"



Independent
voltage source

PRACTICAL SOURCES



Dependent
voltage source

Sora

Current

“An amount of charges flow through a cross section of conductor per amount of time”

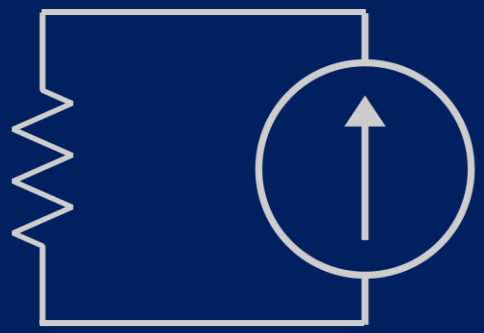
IDEAL SOURCES

Independent current source

Dependent current source

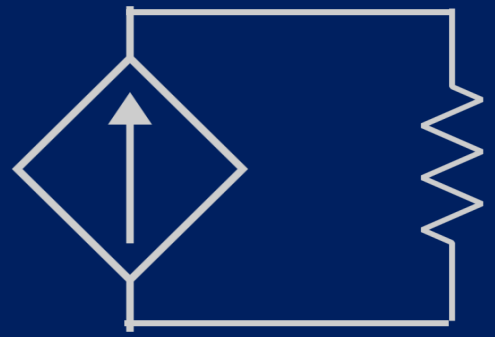
Sora

Current **“Measured in Ampere (A)”**



Independent
current source

PRACTICAL SOURCES



Dependent
current source

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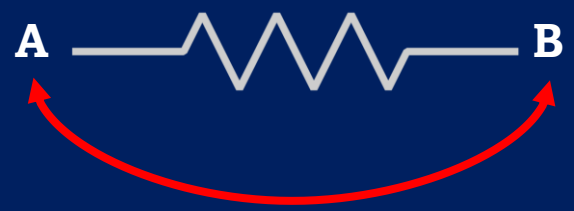
Resistance

“An ability to resists the flow of current measured in Ohm (Ω)”



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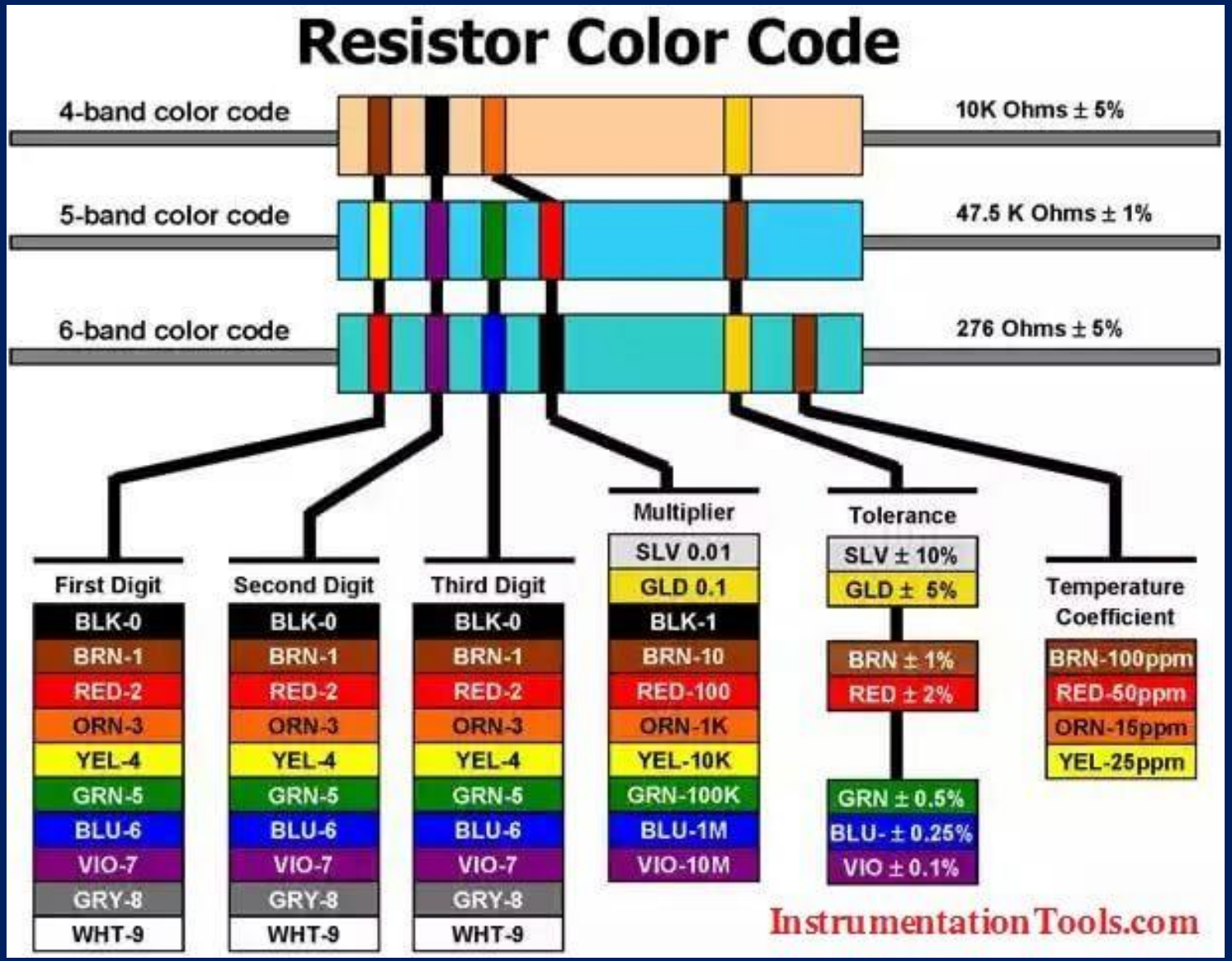
Resistor Color Code



Resistor

Linear Resistor

Fixed Resistor

- Carbon Composition Resister
- Wire-wound Resister
- Thick Film Resister
- Thin Film Resister

Variable Resistor

- Potentiometer
- Rheostat
- Trimmer

Nonlinear Resistor

- Thermistor
- Photo Resistor LDR
- Varistor Resistor
- Surface Mount (SMD)

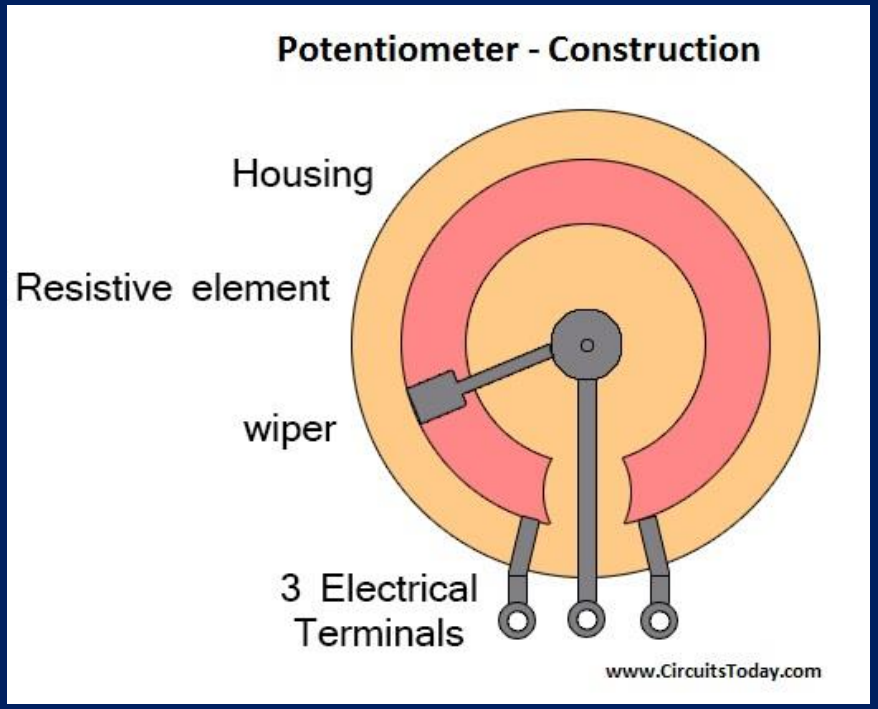
Thick Film Resister

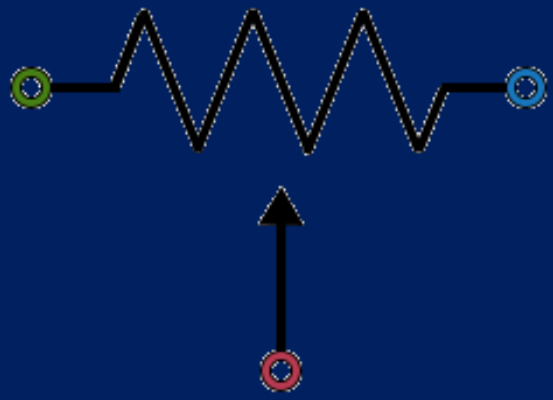
- Fusible Resister
- Cermet Film Resister
- Metal Oxide Resistor (Resistor Network)

Thin Film Resister

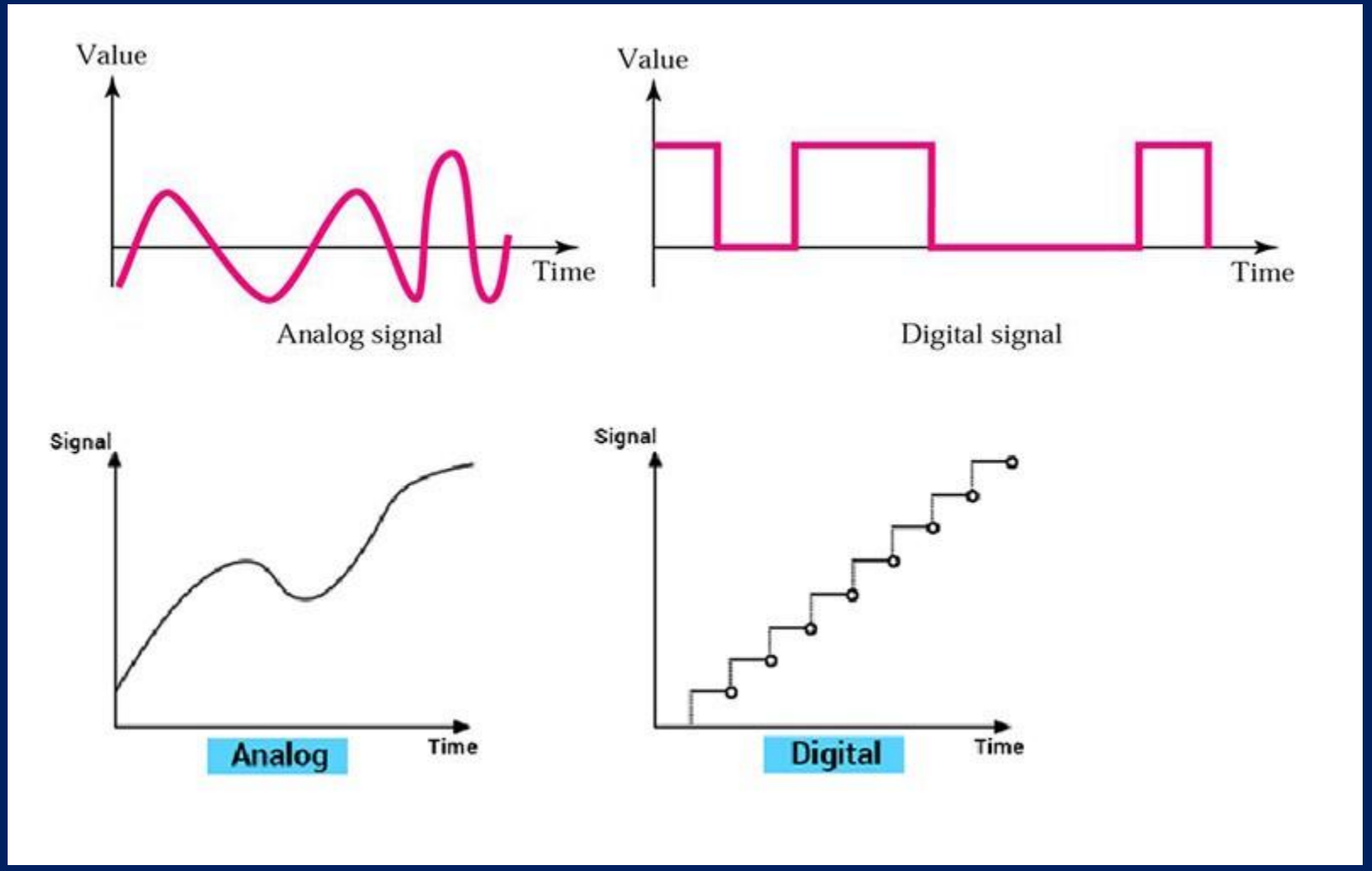
- Carbon Film Resistor
- Metal Film Resistor

Potentiometer





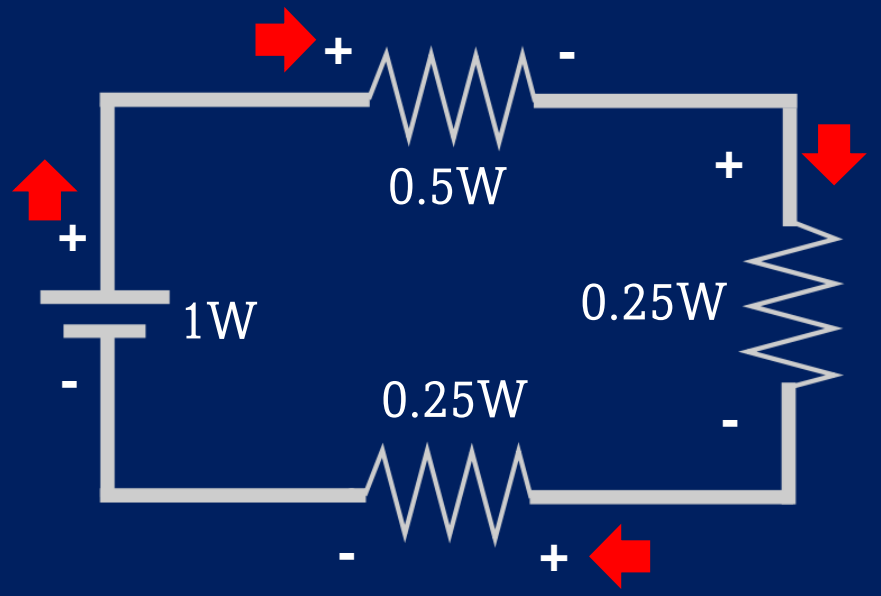
Signal fundamentals



Power **"The time rate of expending or absorbing energy measured in Watt (W)"**

Passive sign convention
(Absorb power)

Active sign convention
(Deliver power)



Absorb power = -(Deliver power)

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Unit transformation you should know

1. Current = Charge / Time : $I = \frac{C}{S}$

2. Power = Energy / Time : $\mathrm{P} = \frac{J}{S}$

3. Conductance = 1 / Resistance : $\mho \, or \, S = \frac{1}{R}$

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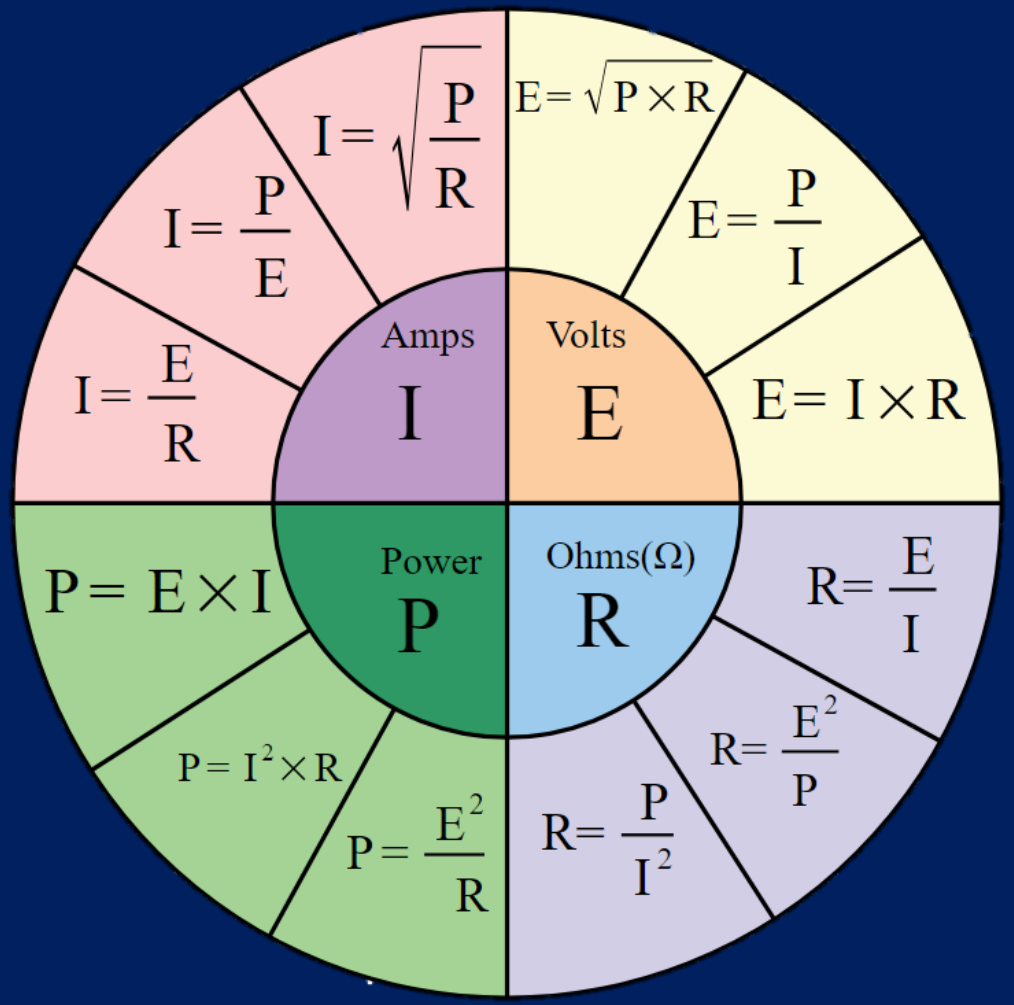
Ohm's Law



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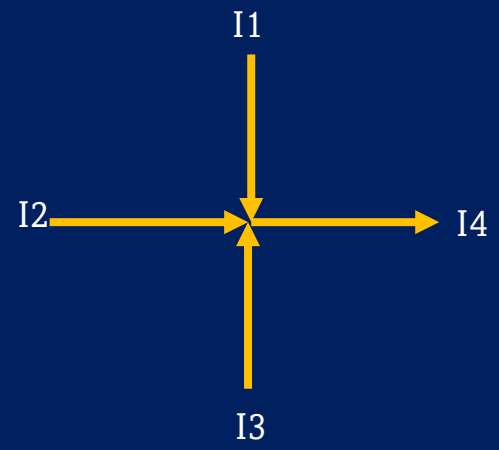
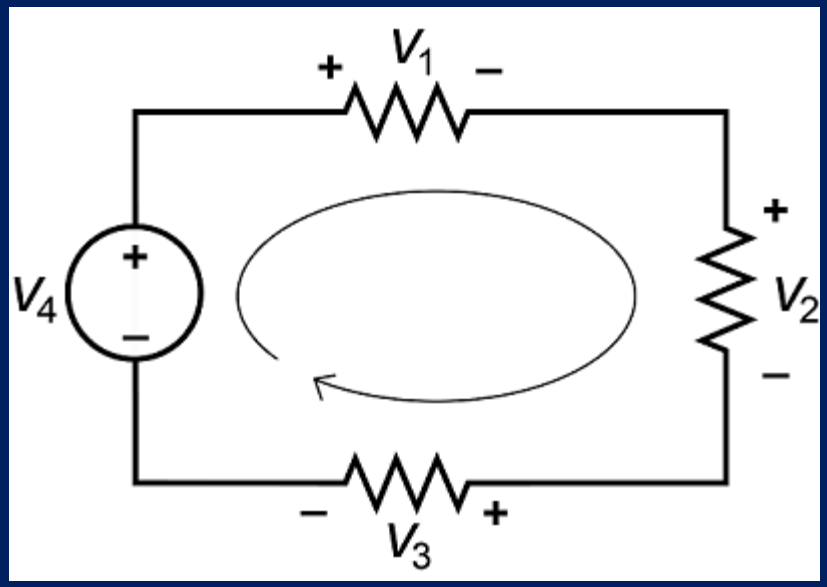
Kirchoff's Law



$$\textbf{KCL} : I_{in} = I_{out}$$

$$\textbf{KCL} : I_1 + I_2 + I_3 = I_4$$

The sum of the current entering any point is equal to the sum of the current leaving the same point



$$\textbf{KVL} : \sum V = 0$$

$$\textbf{KVL} : V_1 + V_2 + V_3 = V_4$$

The sum of the voltage in any close loop is equal to zero

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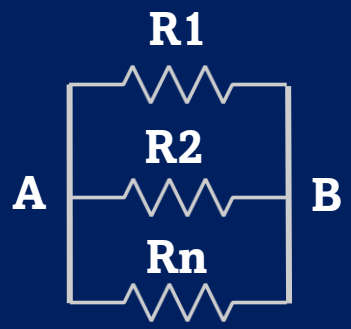
Total Resistance

Series connection

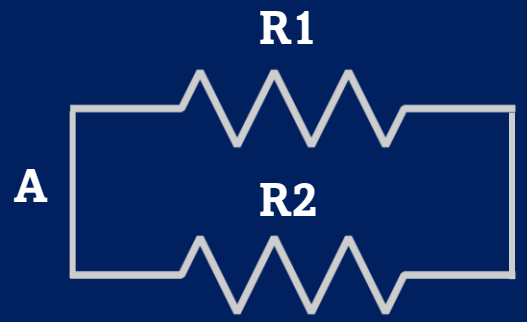
$$R_t = R_1 + R_2 + \cdots + R_n$$

Parallel connection



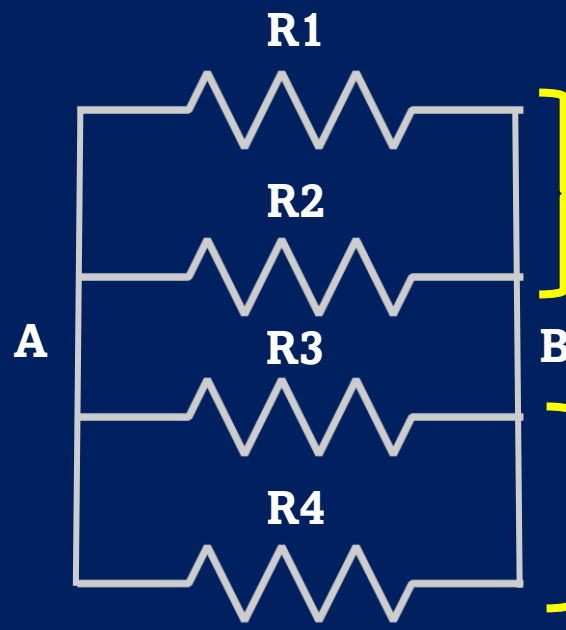
$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}$$

2 Resistor connected in parallel



$$R_t = \frac{R_1 \times R_2}{R_1 + R_2}$$

What if...



$$R_a = \frac{R_1 \times R_2}{R_1 + R_2}$$

$$R_b = \frac{R_3 \times R_4}{R_3 + R_4}$$

$$R_t = \frac{R_a \times R_b}{R_a + R_b}$$

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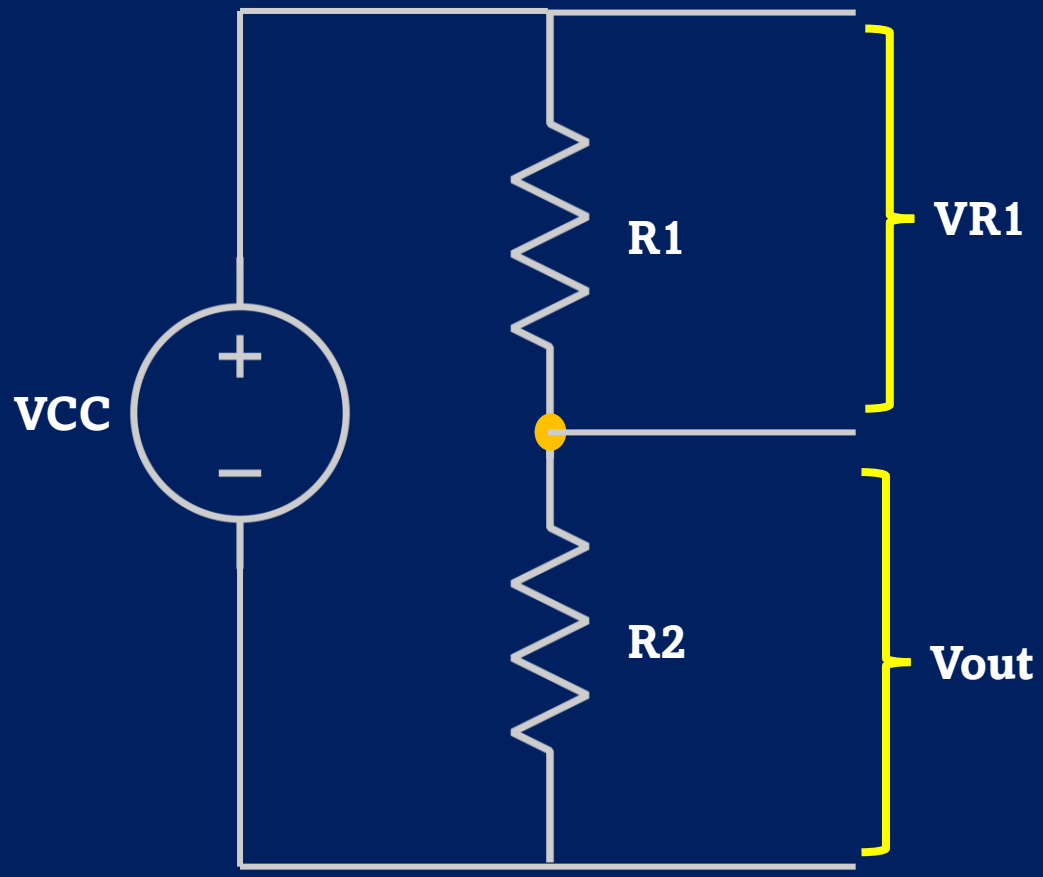
Voltage divider



The voltage is depends on it's own resistance

$$V_{R1} = Vcc \times \left(\frac{R_1}{R_1 + R_2} \right)$$

$$V_{out} = Vcc \times \left(\frac{R_2}{R_1 + R_2} \right)$$

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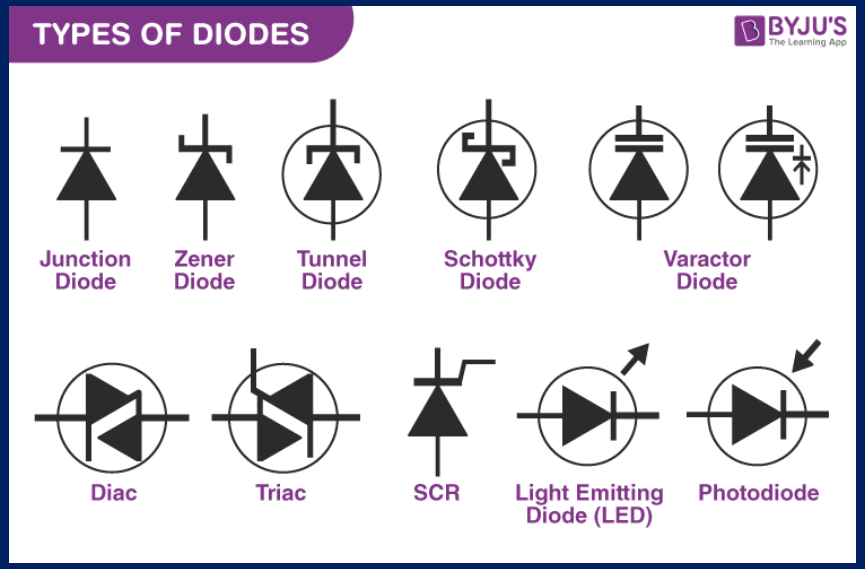
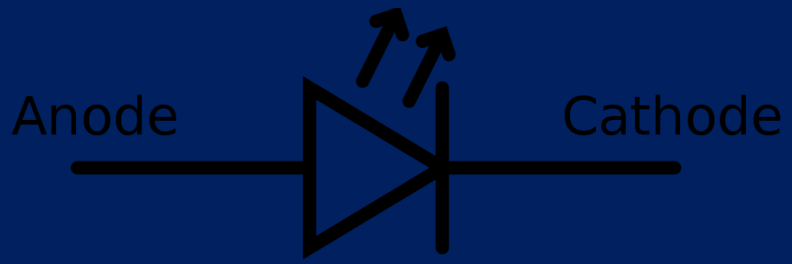
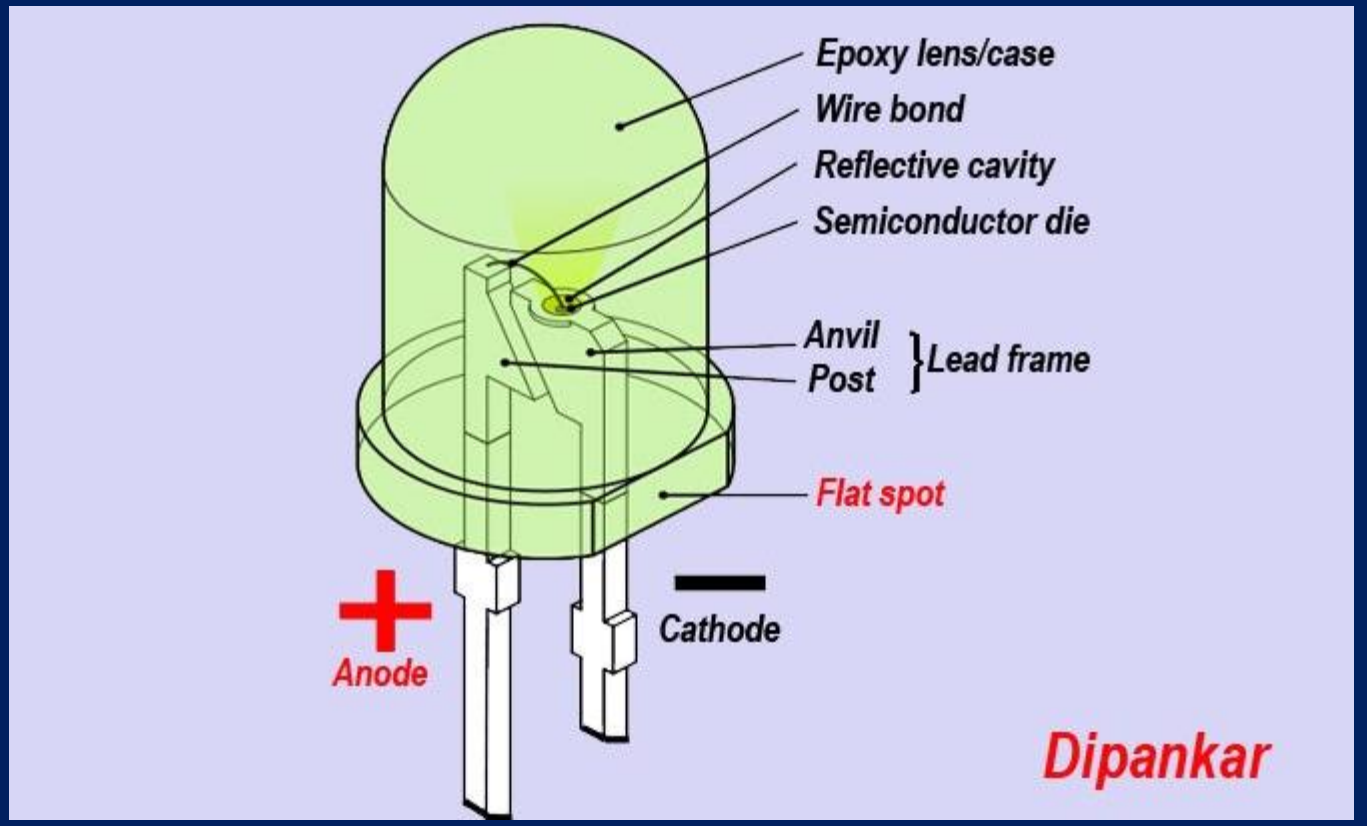
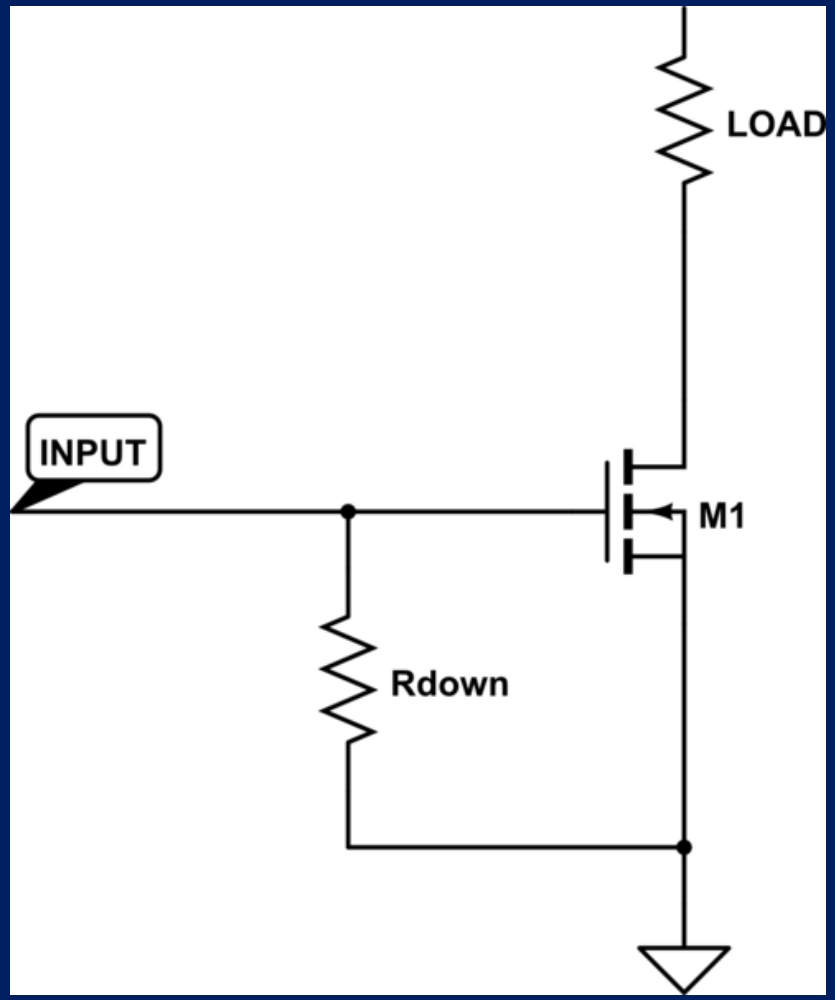
The Light Emitting Diode



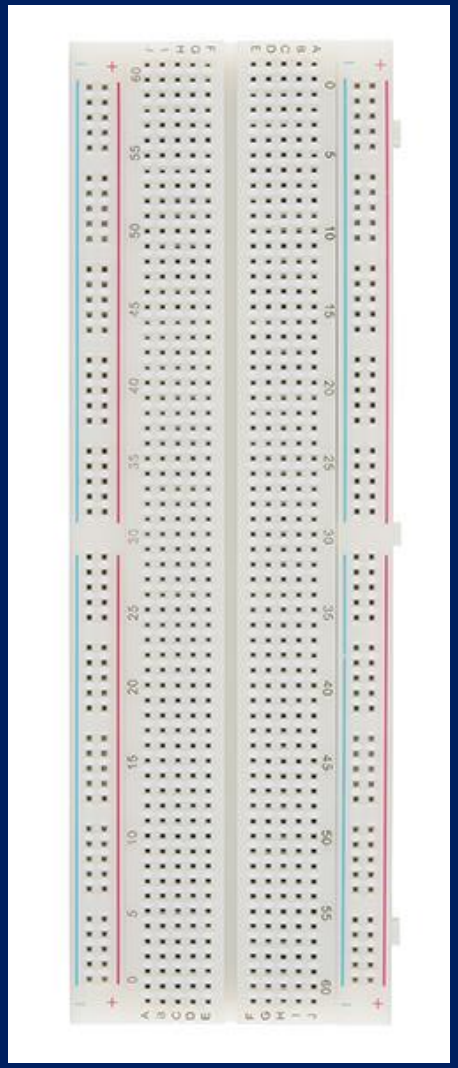


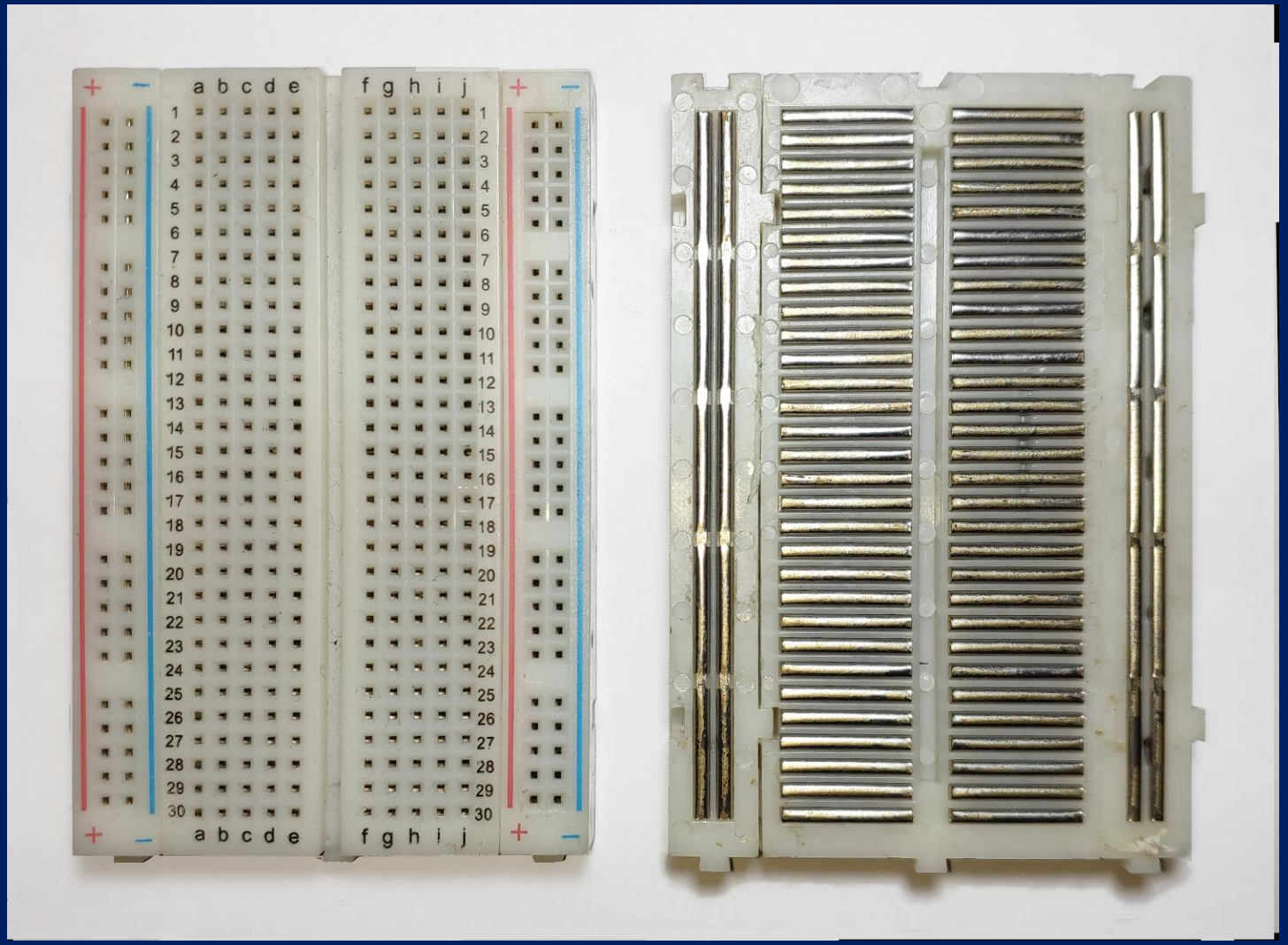


The pulldown resistor



Bread board




a b c d e
f g h i j
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30