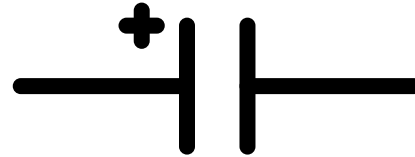


Electronic Components, Basic Circuits

An Introduction to Circuits

- ◎ Basic Electronic Components
 - > Capacitors
 - > Resistors
 - > Diodes
 - > Switches
 - > Power supplies

Capacitors



- ◎ What are They?
 - > Parallel conductive plates separated by an insulator
- ◎ Uses in Circuits
 - > Store and disperse charge (denouncing circuits)
- ◎ Types of Capacitors
 - > Fixed-capacitance
 - > Variable capacitance
- ◎ Connections
 - > Dedicated + and – terminals (2 leads)

Resistors



- ◎ What are They?
 - > High-resistive metal alloy surrounded by a carbon casing
- ◎ Uses in Circuits
 - > Limit voltage and current
- ◎ Types of Resistors
 - > Fixed-resistance
 - > Rheostat
 - > Potentiometer
- ◎ Connections
 - > 2 terminals (voltage independent), 3 terminals (+, –, and signal)

Resistors (cont.)

Reading Resistor Color Codes

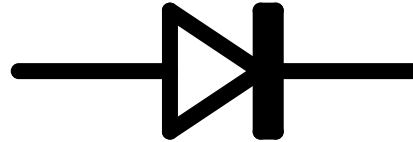
- > 4 and 5 color band resistors
- > Resistance measured in ohms (Ω)
- > Last band measures tolerance (%)

COLOR	1st BAND	2nd BAND	3rd BAND	MULTIPLIER	TOLERANCE
Black	0	0	0	1 Ω	
Brown	1	1	1	10 Ω	\pm 1% (F)
Red	2	2	2	100 Ω	\pm 2% (G)
Orange	3	3	3	1K Ω	
Yellow	4	4	4	10K Ω	
Green	5	5	5	100K Ω	\pm 0.5% (D)
Blue	6	6	6	1M Ω	\pm 0.25% (C)
Violet	7	7	7	10M Ω	\pm 0.10% (B)
Grey	8	8	8		\pm 0.05%
White	9	9	9		
Gold				0.1	\pm 5% (J)
Silver				0.01	\pm 10% (K)

Electronix Express / RSR
<http://www.elexp.com>

1-800-972-2225
 In NJ 732-381-8020

Diodes



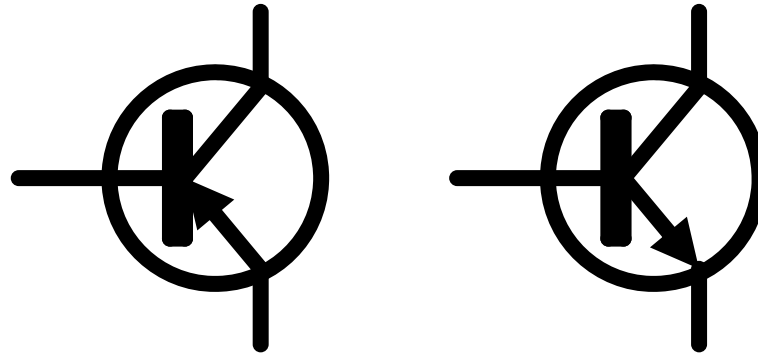
- ◎ What are They?
 - > Insulated p-type and n-type silicon plates
- ◎ Uses in Circuits
 - > Allow the flow of current only in one direction
- ◎ Types of Diodes
 - > LEDs (Light Emitting Diodes)
 - > Zener/Schottky diodes (voltage regulation)
- ◎ Connections
 - > Dedicated + and – terminals (2 or 3 leads)

Switches



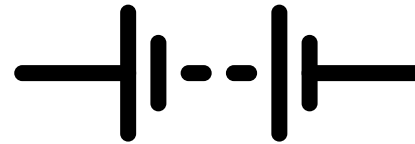
- ◎ What are They?
 - > Breakable connections within a circuit
- ◎ Uses in Circuits
 - > Opens or closes a circuit, switches connections
- ◎ Types of Switches
 - > ON/OFF
 - > ON/OFF/ON
- ◎ Connections
 - > Varies (usually 2 or 3 terminals, no dedicated leads)

Transistors



- ◎ What are They?
 - > Solid-state silicon switch
- ◎ Uses in Circuits
 - > Switches or amplifies electronic signals
- ◎ Types of Transistors
 - > PNP
 - > NPN
- ◎ Connections
 - > Dedicated terminals for base, collector, and emitter pins (BCE)

Power Supplies



- ◎ What are They?
 - > Power cells or batteries
- ◎ Uses in Circuits
 - > Create voltage to drive circuits
- ◎ Types of Power Supplies
 - > Single power cell
 - > Battery
- ◎ Connections
 - > Dedicated terminals for + and – leads

An Introduction to Circuits

- ◎ Network Capacitors and Resistors
 - > Capacitors in series and parallel configuration
 - > Resistors in series and parallel configuration

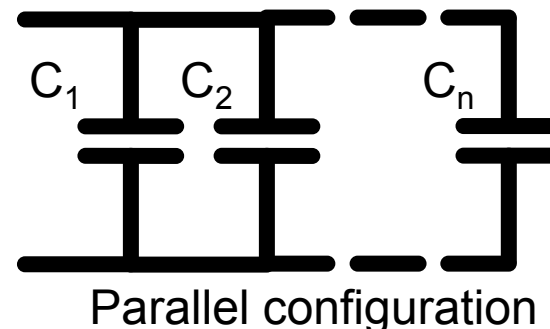
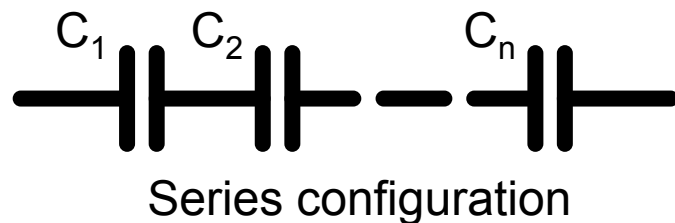
Capacitors in Series and Parallel

Series Configuration

- > Current remains constant; voltage does not
- > Net capacitance: $1/C_1 + 1/C_2 + \dots + 1/C_n = 1/C_c$

Parallel Configuration

- > Voltage remains constant; current does not
- > Net capacitance: $C_1 + C_2 + \dots + C_n = C_c$



Resistors in Series and Parallel

Series Configuration

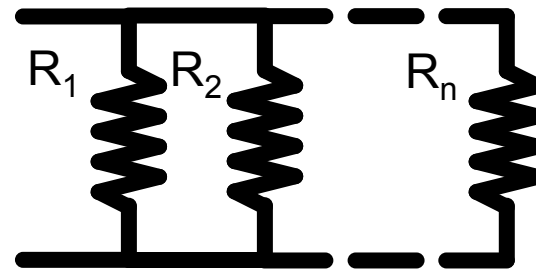
- > Current remains constant; voltage does not
- > Net resistance: $R_1 + R_2 + \dots + R_n = R_r$

Parallel Configuration

- > Voltage remains constant; current does not
- > Net resistance: $1/R_1 + 1/R_2 + \dots + 1/R_n = 1/R_r$



Series configuration



Parallel configuration

An Introduction to Circuits

- ◎ Laws of Circuits
 - > Ohm's Law
 - > Watt's Law
 - > Kirchhoff's Law

Ohm's Law

Description

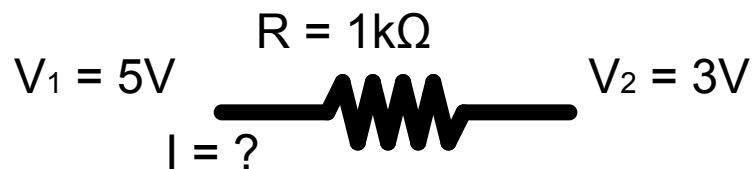
- > Relates the difference in potential (voltage) of a circuit as a function of the current and the resistance of the circuit

Formula

- > $V = I \cdot R$

Example

- > $(V_1 - V_2) = I \cdot R$
- > $(5V - 3V) = I \cdot (1000\Omega)$
- > $I = 2V/1000\Omega = 0.002A$



Watt's Law

⊙ Description

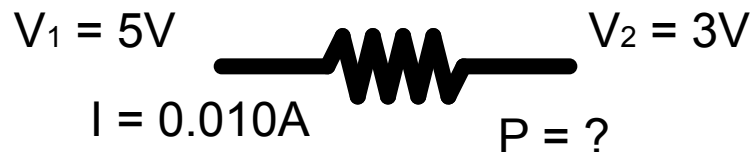
- > Relates the power of a circuit as a function of the voltage and current of the circuit

⊙ Formula

- > $P = V \cdot I = I^2 R$

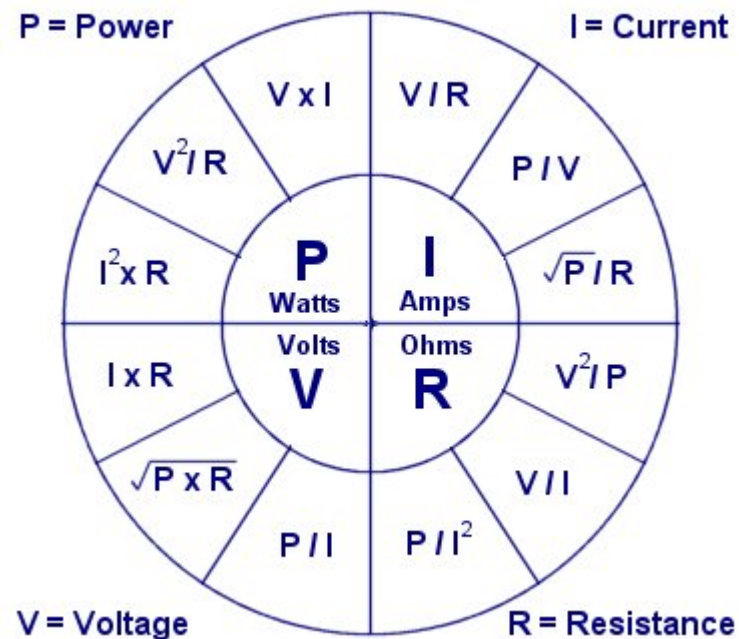
⊙ Example

- > $P = (V_1 - V_2) \cdot I$
- > $P = (5V - 3V) \cdot (0.010A)$
- > $P = 0.02W$



Watt's Law (cont.)

- Relationship of Voltage, Current, and Resistance



Kirchhoff's Law

⊙ Descriptions

- > Indicates that the sum of the potential differences through the circuit must be zero (Voltage Law)
- > Indicates that the sum of the currents from a wire branch must be equal to the input current (Current Law)

⊙ Formulas

- > $\sum V = 0$
- > $I_s = I_1 + I_2 + \dots + I_n$

Kirchhoff's Law (cont.)

Examples

> $I = V/R$

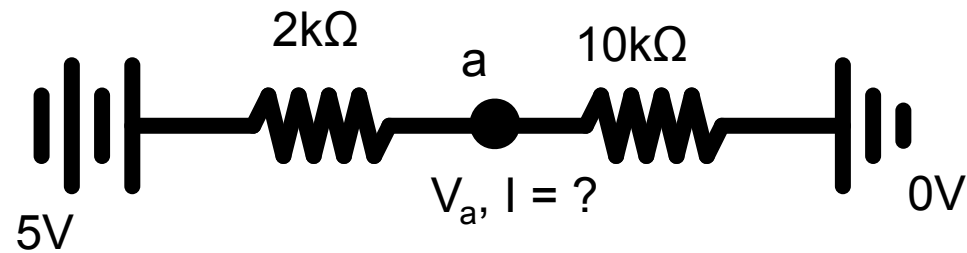
> $R_r = R_1 + R_2$

> $R_r = 12\text{k}\Omega$

> $I = (5\text{V} - 0\text{V})/12\text{k}\Omega = 4.167 \cdot 10^{-4}\text{A}$

> $V_a = 5\text{V} - I \cdot R_1$

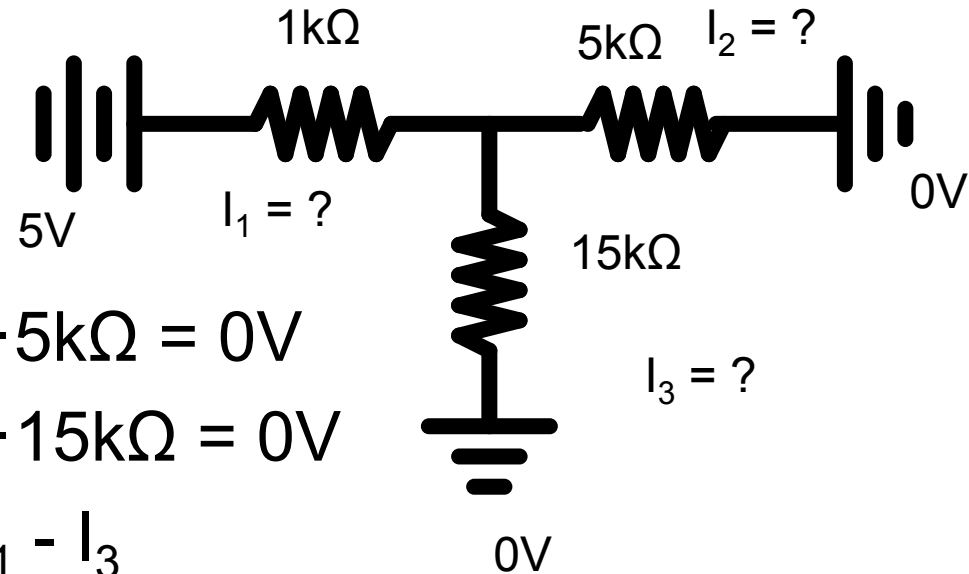
> $V_a = 5\text{V} - (4.167 \cdot 10^{-4}\text{A}) \cdot 2\text{k}\Omega = 4.167\text{V}$



Kirchhoff's Law (cont.)

Examples

- > $\sum V = 0$
- > $5V - I_1 \cdot 1k\Omega - I_2 \cdot 5k\Omega = 0V$
- > $5V - I_1 \cdot 1k\Omega - I_3 \cdot 15k\Omega = 0V$
- > $I_1 = I_2 + I_3, I_2 = I_1 - I_3$
- > 3 linear equations, 3 variables
- > $I_1 = 1.053 \text{ mA}$
- > $I_2 = 0.789 \text{ mA}$
- > $I_3 = 0.264 \text{ mA}$



Additional Resources

- ◎ Wikipedia

- > <http://www.wikipedia.org/>

- ◎ Circuit Info

- > <http://www.kpsec.freeuk.com/index.htm>