

# Voltage, Current and Resistance

{ ELTN 130  
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Three concepts are critical in understanding applied electronics:

Voltage  
Current  
Resistance

# Basic Definitions: Voltage

An electromotive force or potential difference expressed in volts.

1. Units are Volts (V)
2. Electromotive force is abbreviated **EMF**.
3. In electronics it is considered the “cause” of electric effects.
4. Base formula: 1 Volt = 1 Joule / Coulomb\* (energy to move charge)
4. Similar to “potential energy” it can store energy to be used at a later time.
5. Voltage is the difference in electrical potential between two points – therefore it is always measured between two points

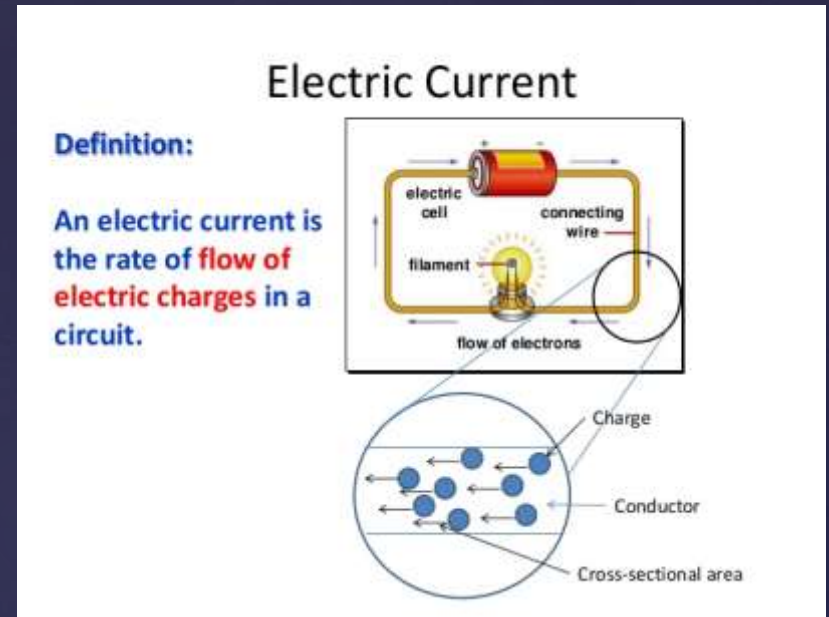


\* 1 Coulomb = a LARGE quantity of electrons:  $6.24 \times 10^{18}$

# Basic Definitions: Current

The rate of flow of electric charge, having a magnitude equal to the quantity of charge passing a fixed point in a fixed period of time.

1. Units are Amps (A). Symbol is "I"
2. In electronics it is considered the "result" of an electrical "pressure."
3. Base formula:  
 $1 \text{ Amp} = 1 \text{ Coulomb} / \text{Second}$
4. In order for current to flow, there must be a complete path or "circuit" for it to move through.
5. Since current is a flow it is measured "through" a point in a circuit.



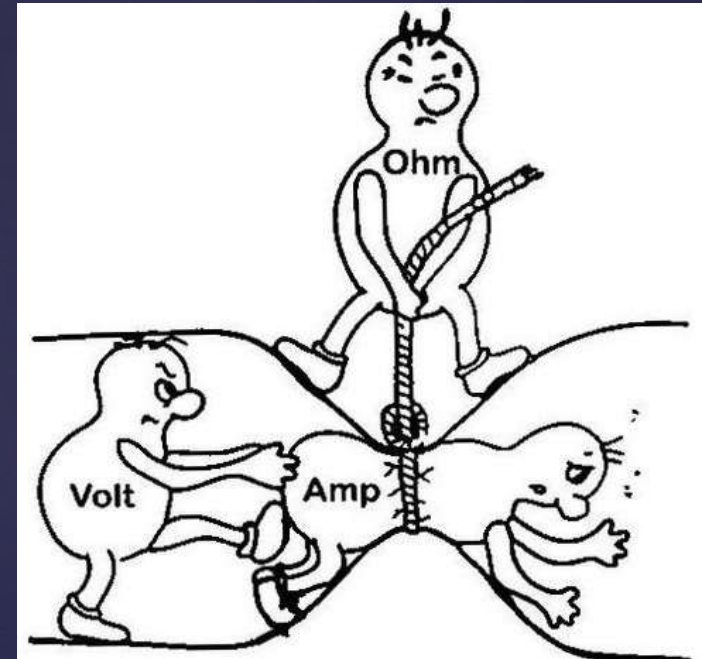
# Basic Definitions: Resistance

**Resistance** is an **electrical** quantity that measures how the device or material reduces the electric current flow through it.

1. **Resistance** is measured in units of ohms ( $\Omega$ ).
2. In electronics it is considered the “opposition” of electric effects.
3. Base formula:  $R = V / I$

# How are the three concepts related???

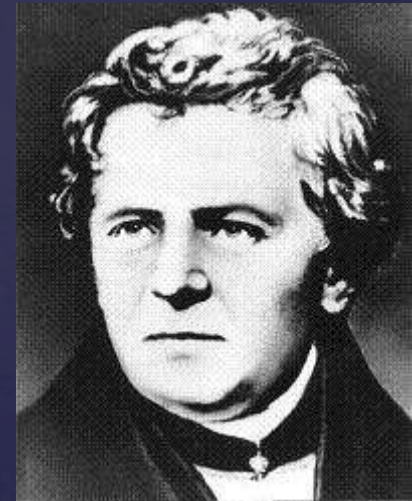
Current is the **flow** of electron charge pushed by a Voltage source through a conductor\*, but is **limited in speed** by the Resistance of the circuit.



\* Usually a wire, or copper trace on a circuit board

A scientist named George Ohm discovered this relationship; it later became known as *Ohm's Law*. This law can be quantified with a formula:

- Voltage = Current x Resistance
- Or,  $V = I \times R$
- Where does the "I" come from?



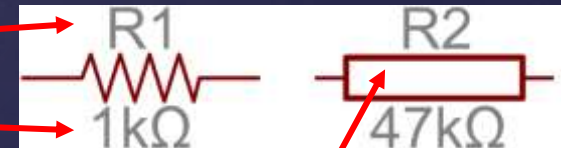
George Ohm,  
circa early 1800's

Voltage      Current      Resistance

Units: (of measurement)	Volts (V)	Amps (A)	Ohms ( $\Omega$ )
Designator: (used in schematics)	V	I	R

What's the difference between *designators* and *units*?

Resistor #1 in a circuit is *called* R1  
The *value* of R1 is 1000 $\Omega$



Resistor schematic symbols

Resistor #2 in a circuit is *called* R2  
The *value* of R2 is 47,000 $\Omega$



# References

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