Electronics One

A Brief Introduction to Electronics
for Programmers, Makers, and Students

PatternAgents 2016

Agenda

* Basic Electronics Introduction
* “It's the Law!”, Ohms, Watts, and Moore
* “On the Bus” Keseyian Signaling Methods
* UART, I2C, SPI, and other Acronyms
* Questions & Answers
* General Discussion

Source : PatternAgents.com

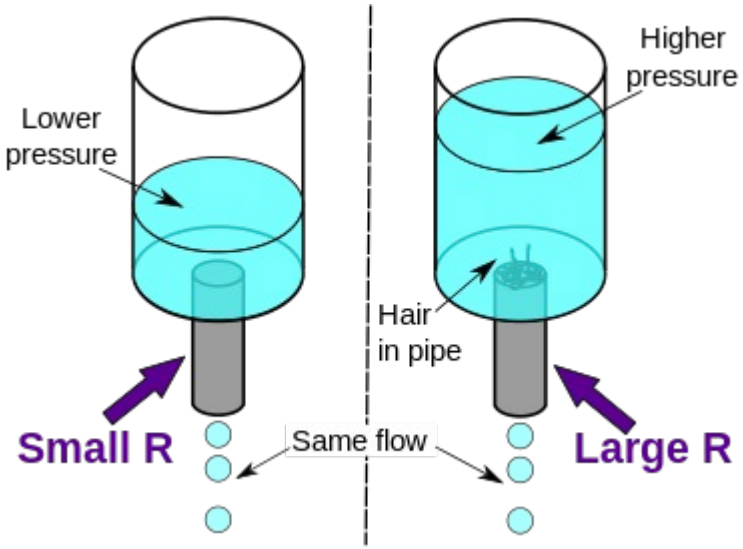
Basic Electronics Introduction

- In order to make sure everyone starts on the same page, we'll briefly cover some basic concepts in physics, mathematics, and electronics
- Please be patient if you know this, we'll quickly get into new material for most people
- For many people, electronics are literally a "black box", that they interact with daily, but don't really understand. Let's open the lid, void the warranty, and have a look inside...

Source : PatternAgents.com

Basic Electronics Concepts

* It is often easier for people to visualize the physics of electrons by comparing them to moving water in a hose/pipe as an analogy :



Source : Wikipedia

Basic Electronics Parameters

* So, the first electronics terms we will cover are the basic parameters of voltage, current, and resistance. By analogy to water they would be :

  Voltage - analogous to the water pressure
  Current - analogous to the volume of water
  Resistance - analogous to the diameter of the pipe

* See, you already have an intrinsic understanding of these physical concepts, now you just need to learn the terms and symbols to “speak” electronics properly

Source : PatternAgents.com

Representations of Electronics

* We use different representations of electronic systems for different purposes, and often to convey different types of information quickly and efficiently.

* A Schematic, or Schematic Diagram is a representation of the elements of an electronic system using abstract, graphic symbols rather than realistic pictures. A schematic usually omits all details that are not relevant to the information the schematic is intended to convey, and may add unrealistic elements that aid in comprehension or in conveying the essential “design intent”.

Source : PatternAgents.com

Schematic Subway Map

- Sometimes is it easier to think of an electronics schematic diagram as a subway map for the electrons, it describes where they can go, and the stops along the way

Source : PatternAgents.com

Basic Schematic Symbols

- We often read a schematic diagram like a Subway map, as the electrons must follow the wires, just like a train on the tracks
- The (most) basic schematic to the left, shows a Voltage (V) being applied across a Resistor (R), causing a current (I) to flow from the positive terminal through the Resistor(R) and to the negative terminal. This relationship is described by Ohm's Law

Source : PatternAgents.com

Ohm's Law

- Voltage (V) - electric potential (in Volts)
- Current (I) - electric charge (in Amperes)
- Resistance (R) - material opposition (in Ohms)

- Ohm's Law defines the relationship :

$$I = V / R \quad (1 \text{ Ampere} = 1 \text{ Volt} / 1 \text{ Ohm})$$

Source : PatternAgents.com

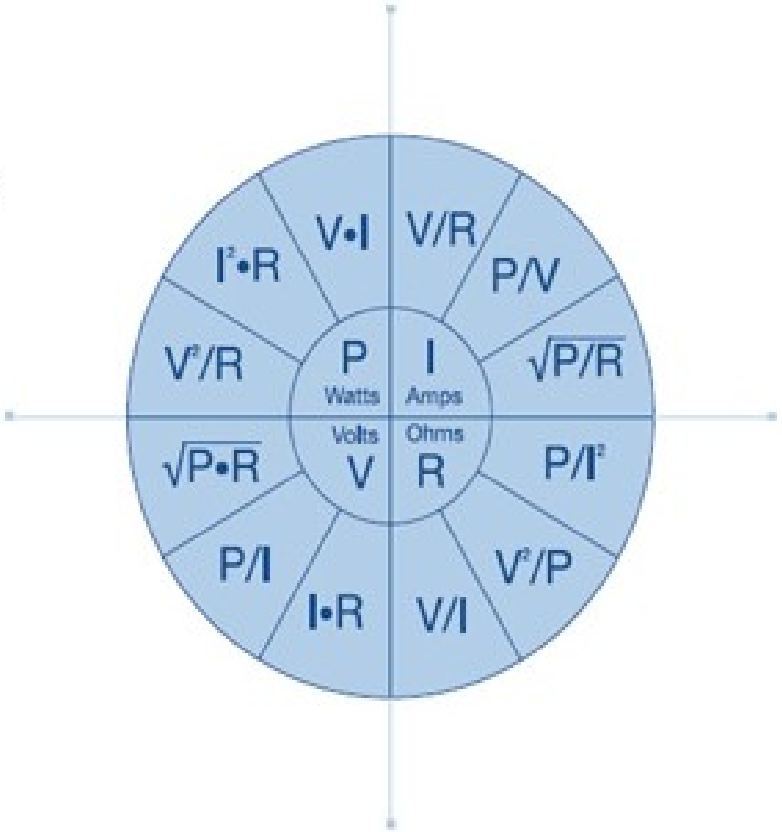
Basic Ohm's Law Equations

P = Watts

$$\text{Watts} = \frac{\text{Volts}^2}{\text{Ohms}}$$

$$\text{Watts} = \text{Amperes}^2 \times \text{Ohms}$$

$$\text{Watts} = \text{Volts} \times \text{Amperes}$$



I = Amperes

$$\text{Amperes} = \frac{\text{Volts}}{\text{Ohms}}$$

$$\text{Amperes} = \frac{\text{Watts}}{\text{Volts}}$$

$$\text{Amperes} = \sqrt{\frac{\text{Watts}}{\text{Ohms}}}$$

V = Volts

$$\text{Volts} = \sqrt{\text{Watts} \times \text{Ohms}}$$

$$\text{Volts} = \frac{\text{Watts}}{\text{Amperes}}$$

$$\text{Volts} = \text{Amperes} \times \text{Ohms}$$

R = Ohms

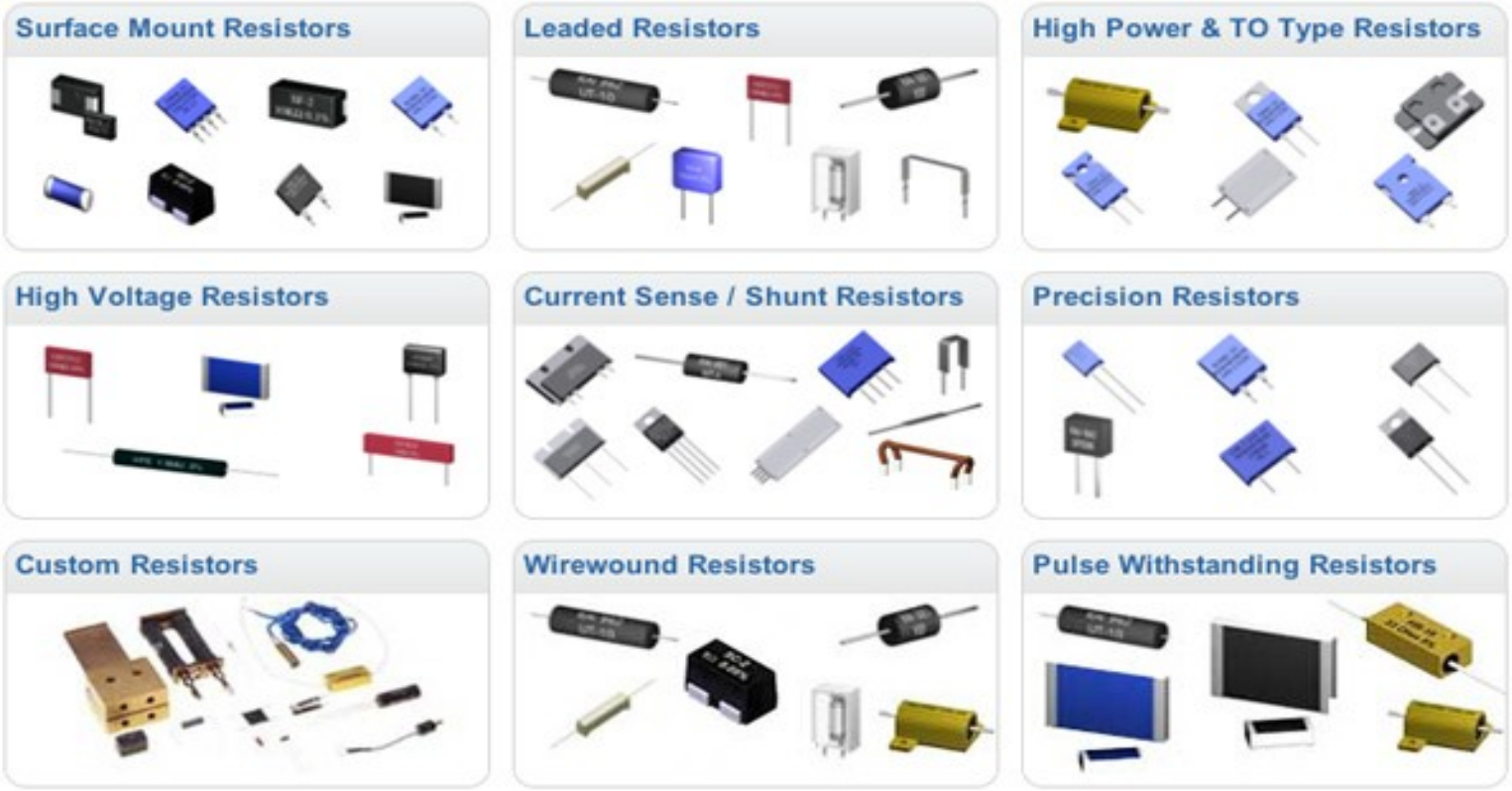
$$\text{Ohms} = \frac{\text{Volts}}{\text{Amperes}}$$

$$\text{Ohms} = \frac{\text{Volts}^2}{\text{Watts}}$$

$$\text{Ohms} = \frac{\text{Watts}}{\text{Amperes}^2}$$

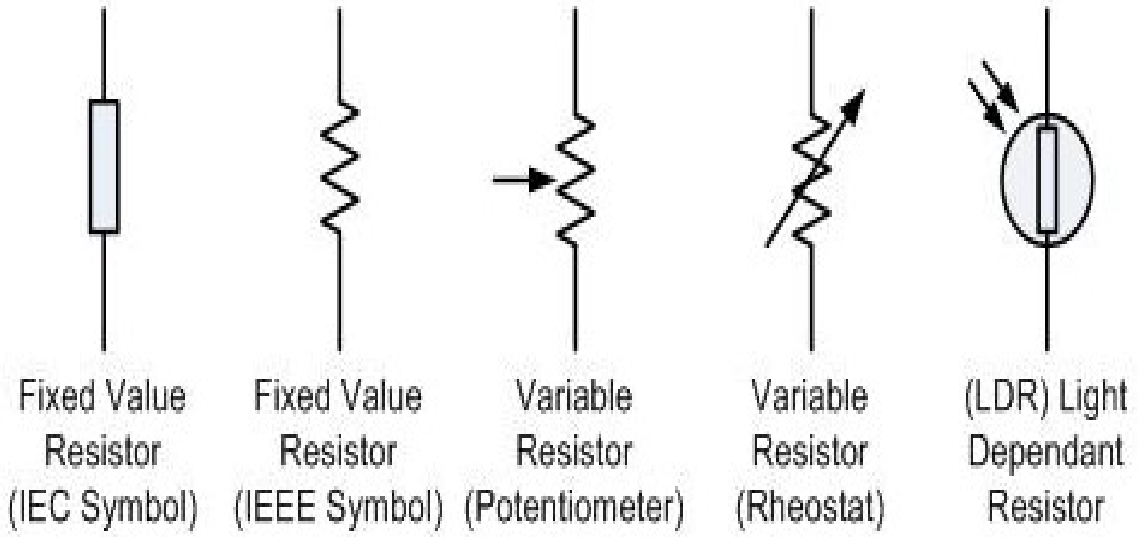
Source : PatternAgents.com

Resistor Physical Types



Source : Digikey

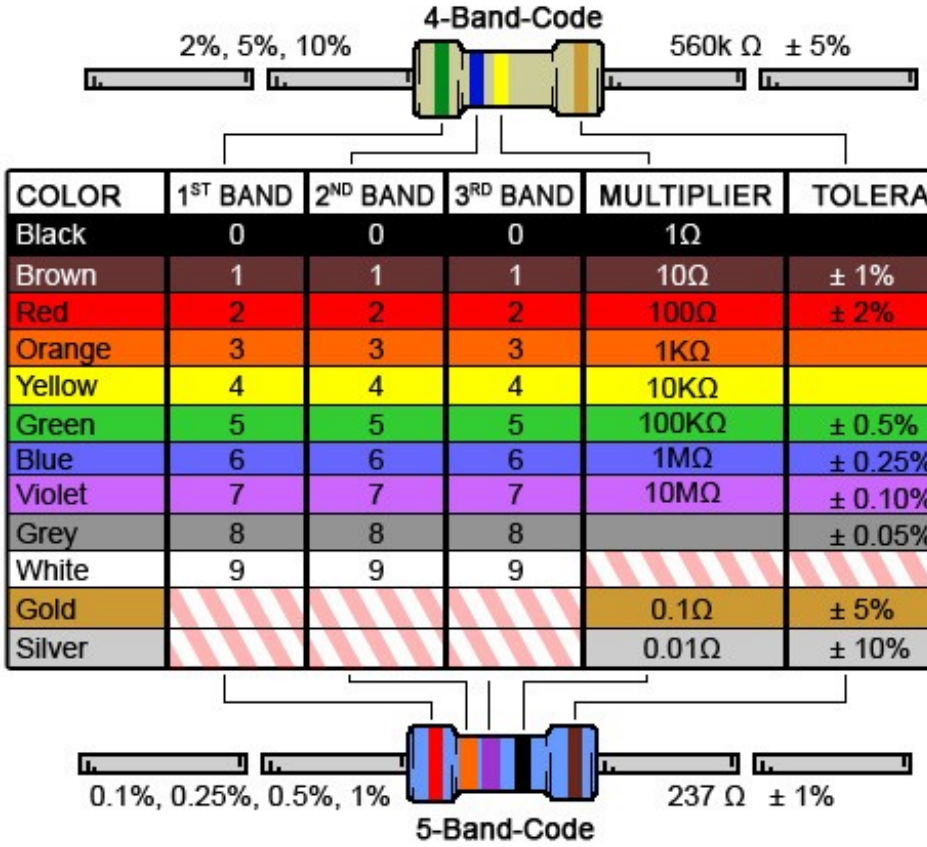
Resistor Schematic Types



We use different schematic symbols to describe different physical resistor types, but they are all members of the same resistor “class” of components

Source : PatternAgents.com

Axial Resistor Color Code



COLOR	1ST BAND	2ND BAND	3RD BAND	MULTIPLIER	TOLERANCE
Black	0	0	0	1Ω	
Brown	1	1	1	10Ω	± 1% (F)
Red	2	2	2	100Ω	± 2% (G)
Orange	3	3	3	1KΩ	
Yellow	4	4	4	10KΩ	
Green	5	5	5	100KΩ	± 0.5% (D)
Blue	6	6	6	1MΩ	± 0.25% (C)
Violet	7	7	7	10MΩ	± 0.10% (B)
Grey	8	8	8		± 0.05%
White	9	9	9		
Gold				0.1Ω	± 5% (J)
Silver				0.01Ω	± 10% (K)

Source : Digikey

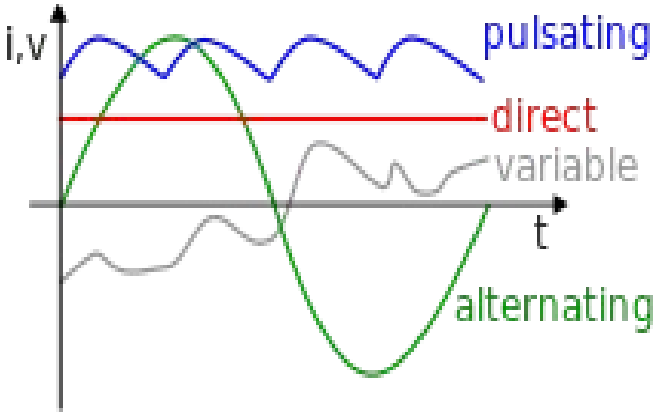
AC-DC

- We already talked a little about “Current”, or the amount of electrons flowing in a circuit, which is measured in Amperes (or Amps for short)
- We break down current into two major classes, Alternating Current and Direct Current (AC~DC)

Alternating & Direct Current

- Direct Current, or D.C. as the name would suggest moves in only one direction in a wire, from positive to negative

- Alternating Current, or A.C. changes the direction of current flow in a wire from positive to negative, and then from negative to positive, as some frequency



Source : PatternAgents.com

Summary

Thank You !

Questions?

Sources and References :

* Wikipedia : en.wikipedia.org/wiki/
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Notes :