Introduction to Circuits

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Example #1: Household Wiring



 Have you seen something like this in your home?

• What components can you identify?

• Where do the wires come from, where do they go?

• Why are there differentcolored wires?



Photo by pcutler on Flickr.

Example #2: Breadboard



Photo by Lauri Rantala on Flickr.



Example #3: Perfboard (front)



Photo by InductiveLoad on Wikimedia Commons.



Example #3: Perfboard (back)



Photo by InductiveLoad on Wikimedia Commons.



Example #4: Squishy Circuits



Photo by Tim Bieniosek.



Example #5: Sewable Circuits





Example #6: Surface-Mount (PCB)



Photo by Andrew Magill on Flickr.



What's a Voltage Source?

- Symbol: V
- Units: V (volt)
- Diagram:



A voltage source can be a battery, a power cord, a generator, a capacitor, or anything else that creates or stores power. The voltage measures how much potential energy it gives the electrons flowing out of it. One electron with one volt has a total energy of $1eV = 1.6 \times 10^{-19}$ J



What's a Resistor?

- Symbol: R
- Units: Ω (ohm)
- Diagram:

Photo by Omegatron on Wikimedia Commons.



Resistors impede the flow of current through a circuit, dissipating its power through heat, light, or other work. Many circuit elements have a resistance or can be modeled as one, along with their other functions.



How To Read a Resistor



Color	Significant figures	Multiplier	Tolerance		Temp. Coefficient (ppm/K)	
Black	0	×10 ⁰	-		250	U
Brown	1	×10 ¹	±1%	F	100	S
Red	2	×10 ²	±2%	G	50	R
Orange	3	×10 ³			15	Р
Yellow	4	×10 ⁴	(±5%)	-	25	Q
Green	5	×10 ⁵	±0.5%	D	20	z
Blue	6	×10 ⁶	±0.25%	С	10	Z
Violet	7	×10 ⁷	±0.1%	В	5	м
Gray	8	×10 ⁸	±0.05% (±10%)	А	1	к
White	9	×10 ⁹	-		2	
Gold	- 1	×10 ⁻¹	±5%	J		
Silver	-	×10 ⁻²	±10%	к	-	
None	-	-	±20%	м	-	

Photo by Omegatron on Wikimedia Commons. Resistor color chart from Wikipedia.



Special Resistors





What's a Diode?



Diodes have a nonlinear relationship between current and voltage, unlike regular resistors. They are also one-directional.

How To Use a Breadboard

Connect V+ here
Connect V- here

Build your circuit in the middle

Keep in mind which rows and columns are connected!

Don't forget to connect V+ and V- to your circuit!

Derived from an image by McSush on Wikimedia Commons.



How To Use a Breadboard



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Don't forget to connect V+ and V- to your circuit!

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Derived from an image by McSush on Wikimedia Commons.

What's a Switch?

Switches are physical interrupts in your circuit.

- Symbol: SPST, SPDT
- Units: n/a
- Diagram:





Photo by ArnoldReinhold at Wikimedia Commons.



What's a Capacitor?

- Symbol: C
- Units: F (farad)
- Diagram:



Photo by Mamun2a on Wikimedia Commons.

Capacitors are directional, like diodes. They store charge when attached to a voltage, and act as a voltage source when charged.



What Did We Learn?

- Circuits use voltage sources to push current through loads
- How batteries, resistors, LEDs, switches, and capacitors work
- Some components are directional, so polarity is important
- How to prototype a circuit on a breadboard
- Current, voltage, and resistance in series & parallel circuits
- How to troubleshoot and use a multimeter
- How to design a circuit with datasheet information
- Safe practices for people and electronics!



Coming Attractions

Cider Pressing, September 17, 6pm

Light Up Crescent Park, September 18-27

Costuming Workshops: LED Masks, EL Wire, Lilypad Basics, & More! TBD (October)

Galactic Gatsby Masquerade, November 2, 9pm

