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A Developers Introduction to Electronics

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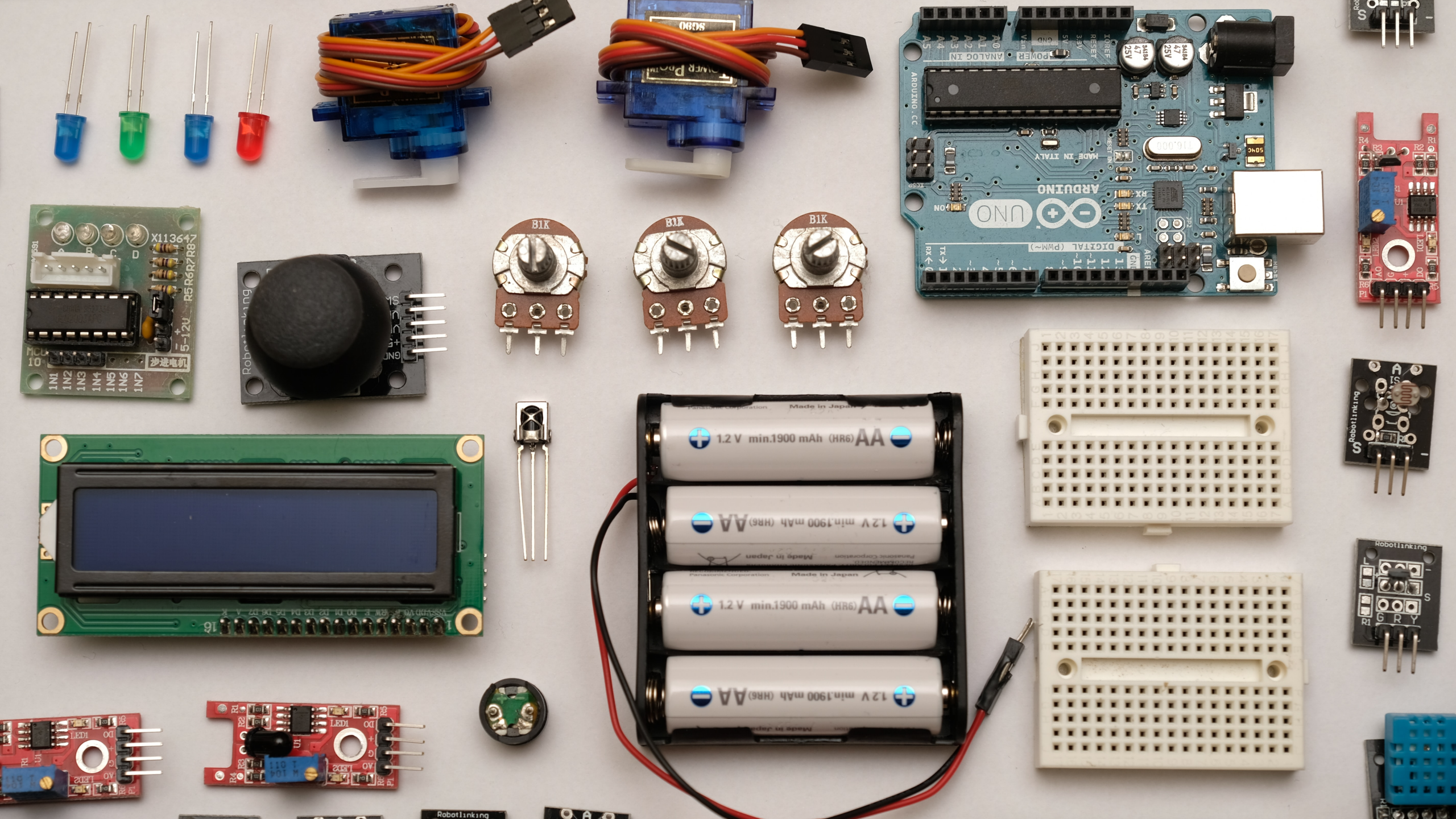
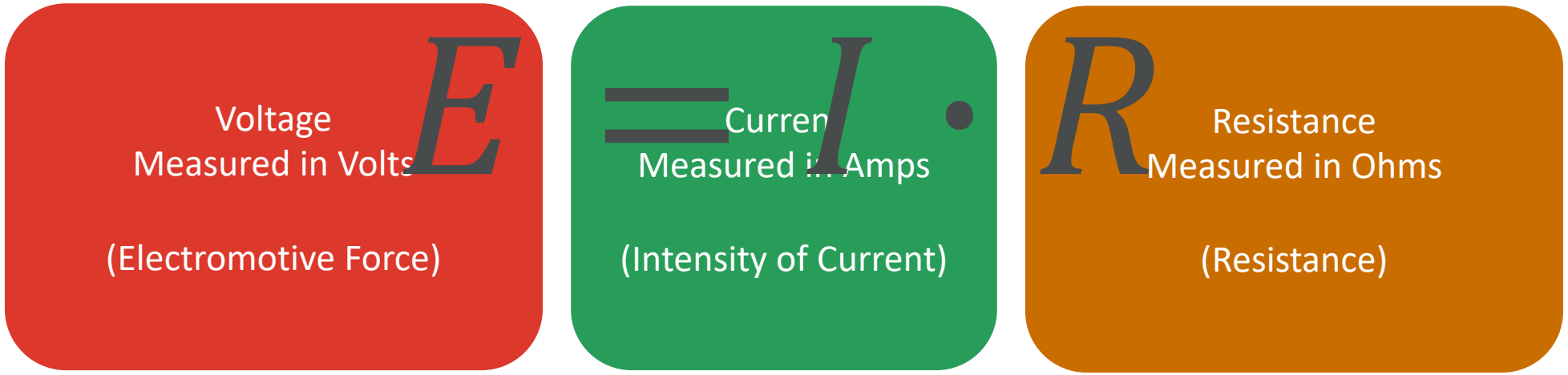
IANAEE

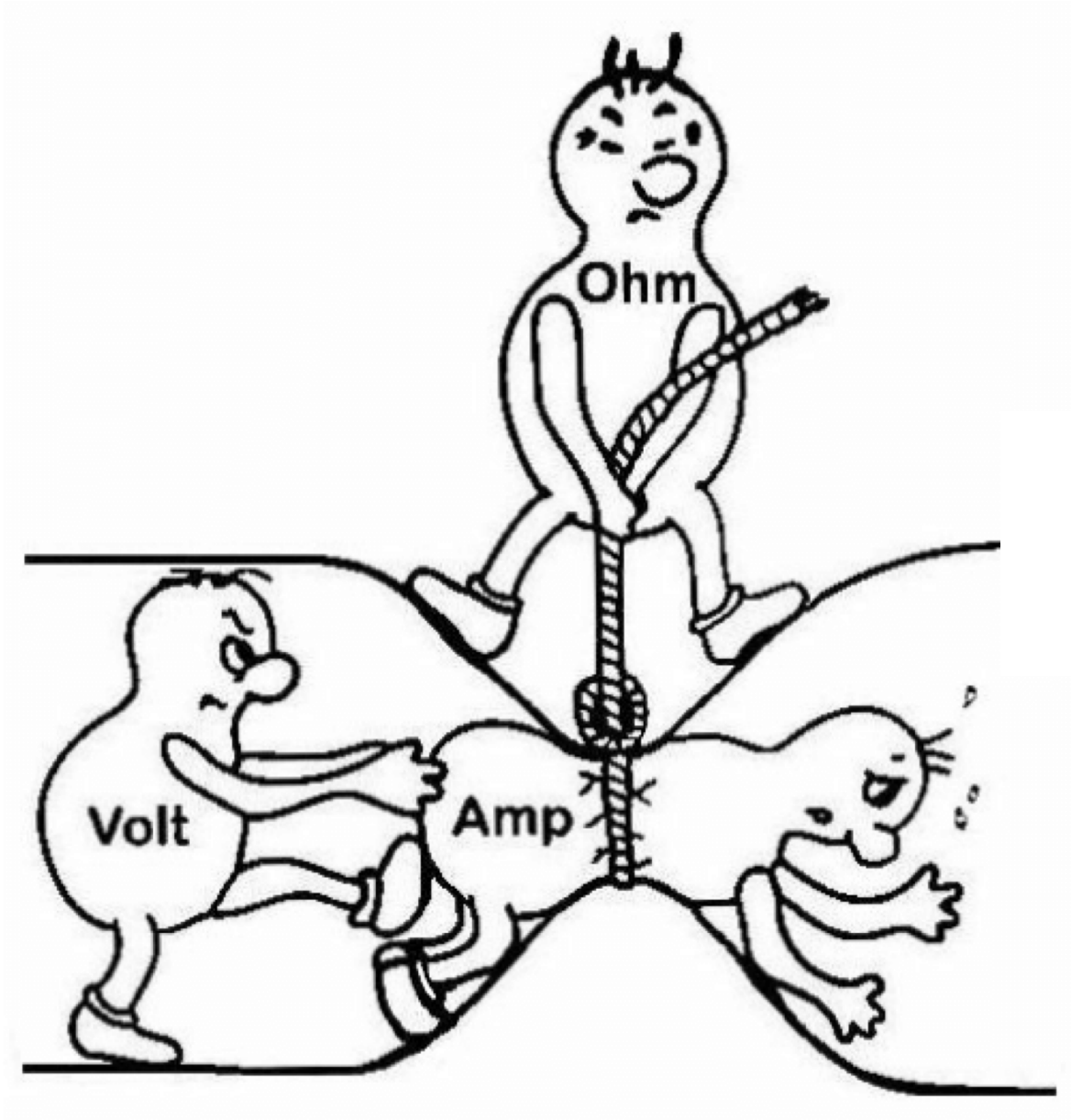

ARDUINO
UNO
Made in Japan
1.2 V min.1900 mAh (HR6) AA
Robotlinking

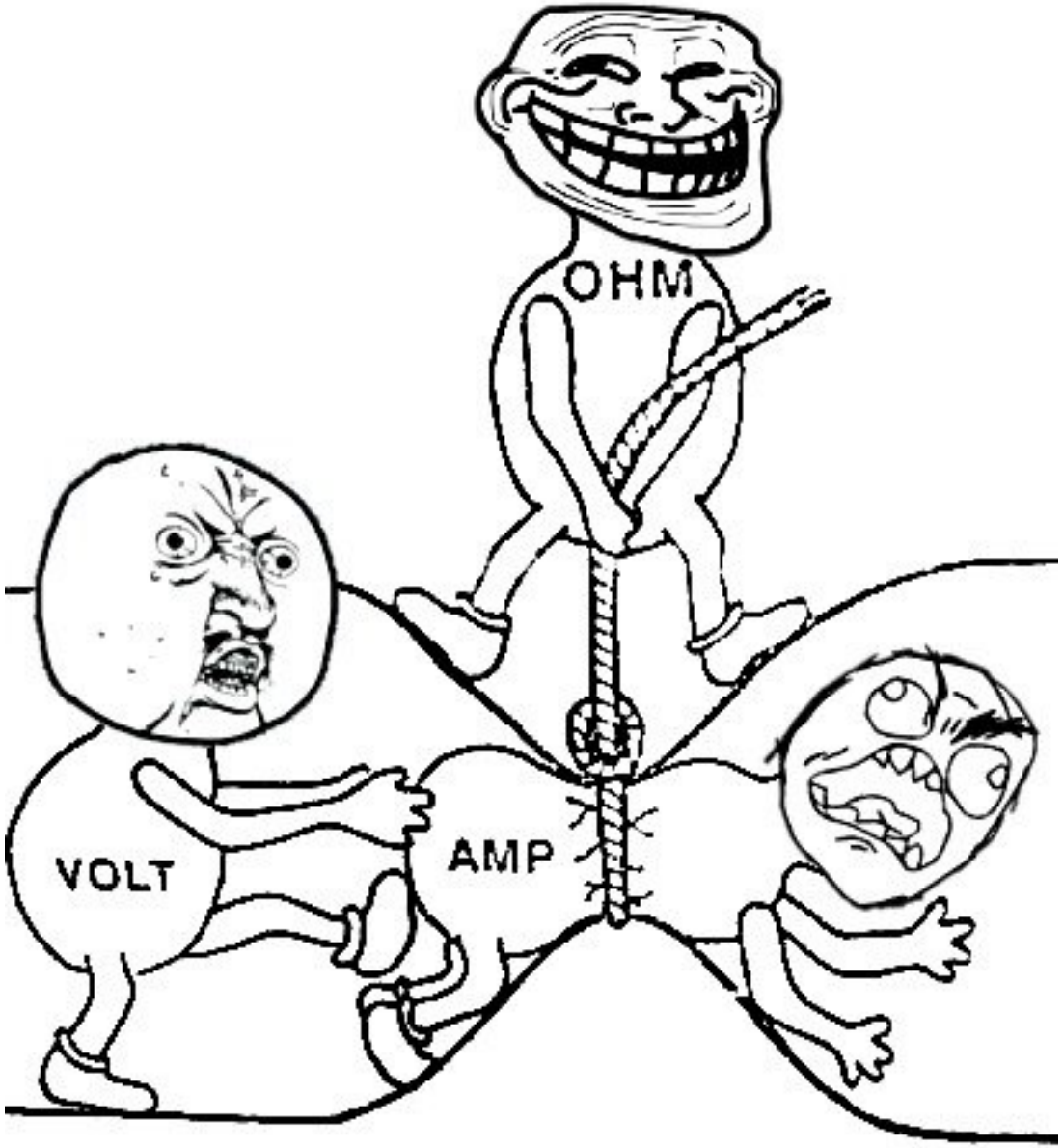
Assumptions

- You've played with an Arduino or something like it before.
- You know the difference between alternating current and direct current.
- You've had more physics than me.

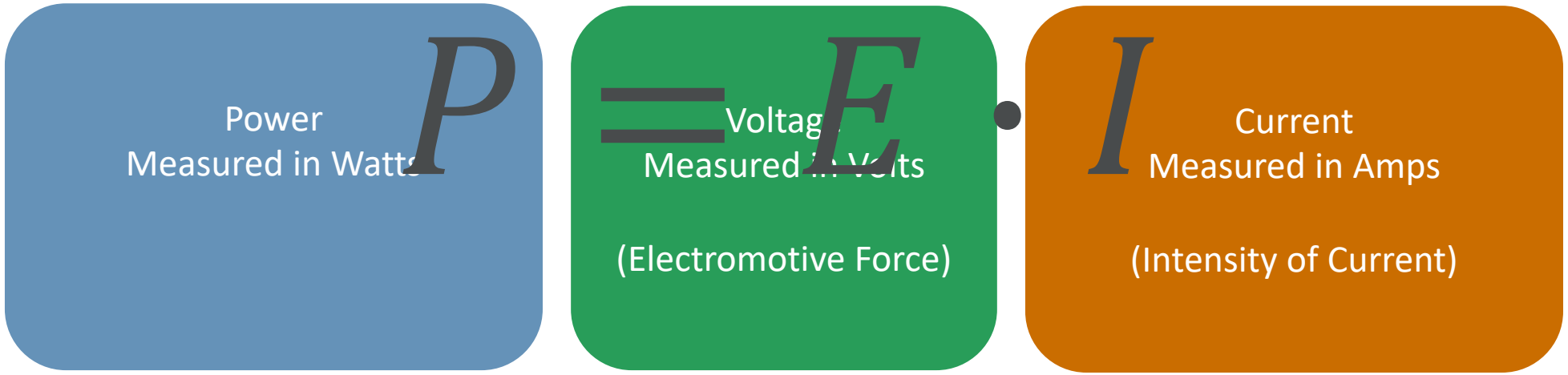
Ohm’s Law

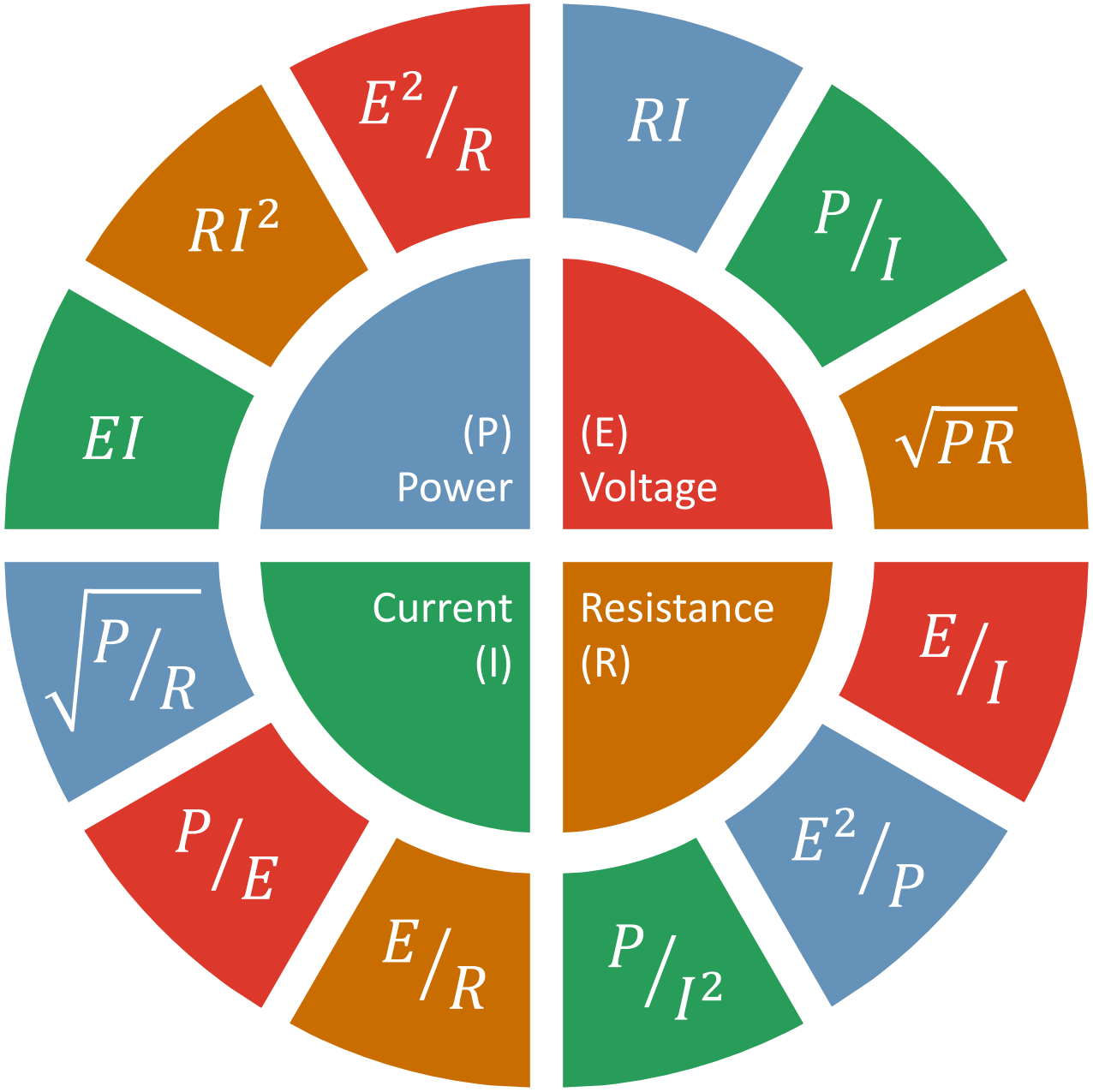




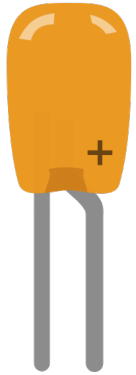


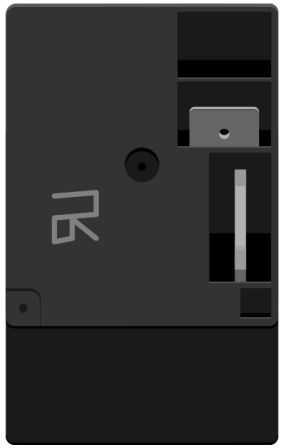
Power Law

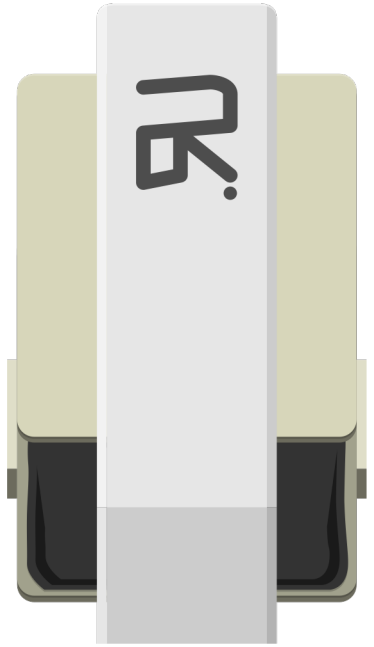




Components







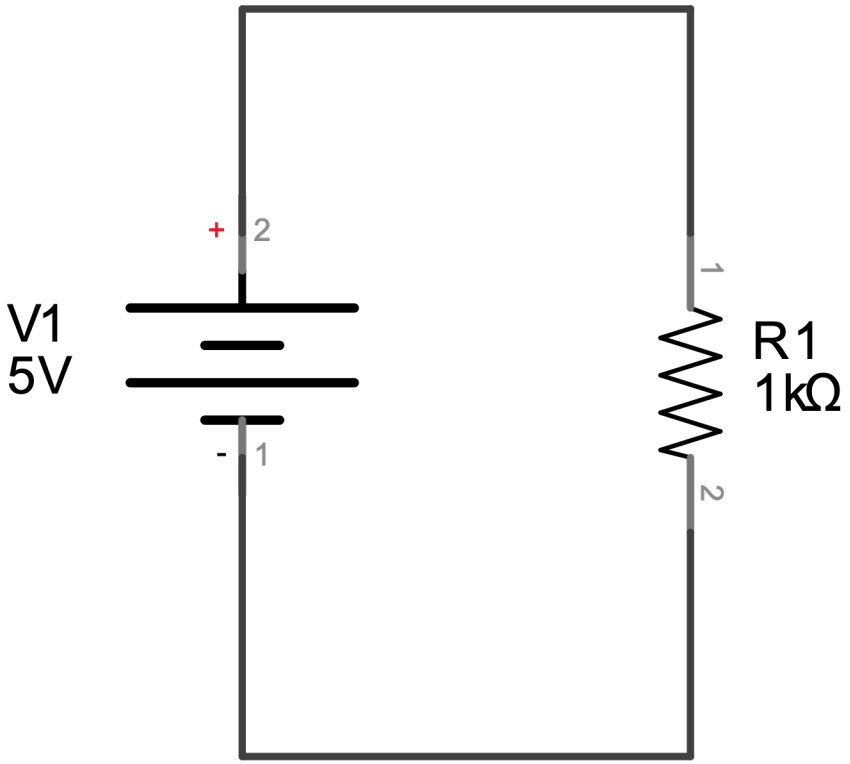
Resistors

R1
220Ω

Resistors

- Resist current flow by turning electricity into heat
- Have a value measured in Ohms (Ω)

Calculating Current



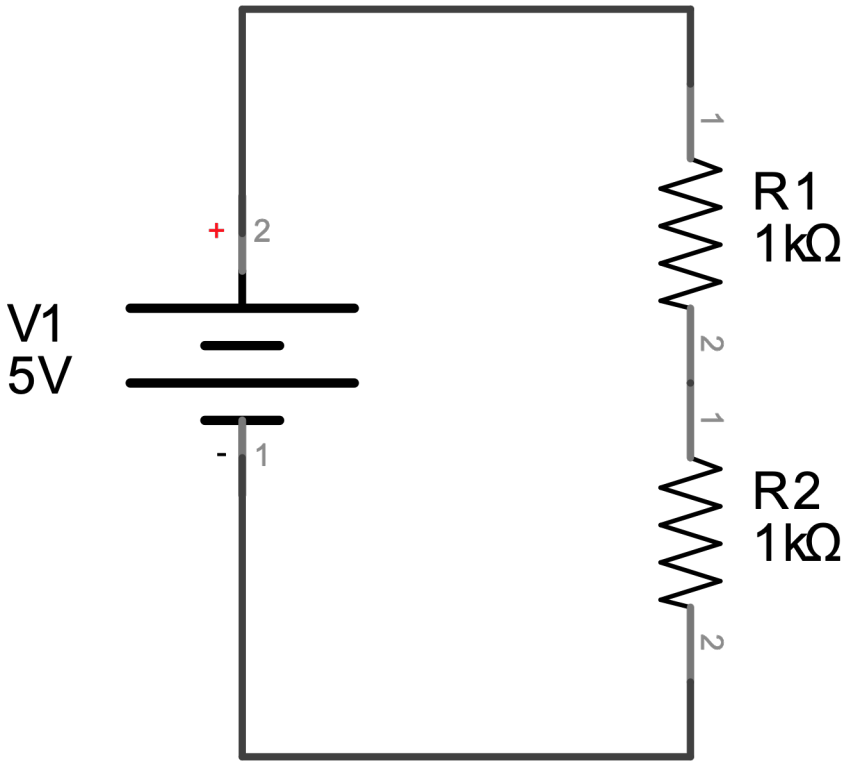
$$E = I \cdot R$$

$$5\text{v} = I \cdot 1\text{k}\Omega$$

$$I = {}^{5\text{v}}/_{1\text{k}\Omega}$$

$$I = 5\text{mA}$$

Resistors in Series

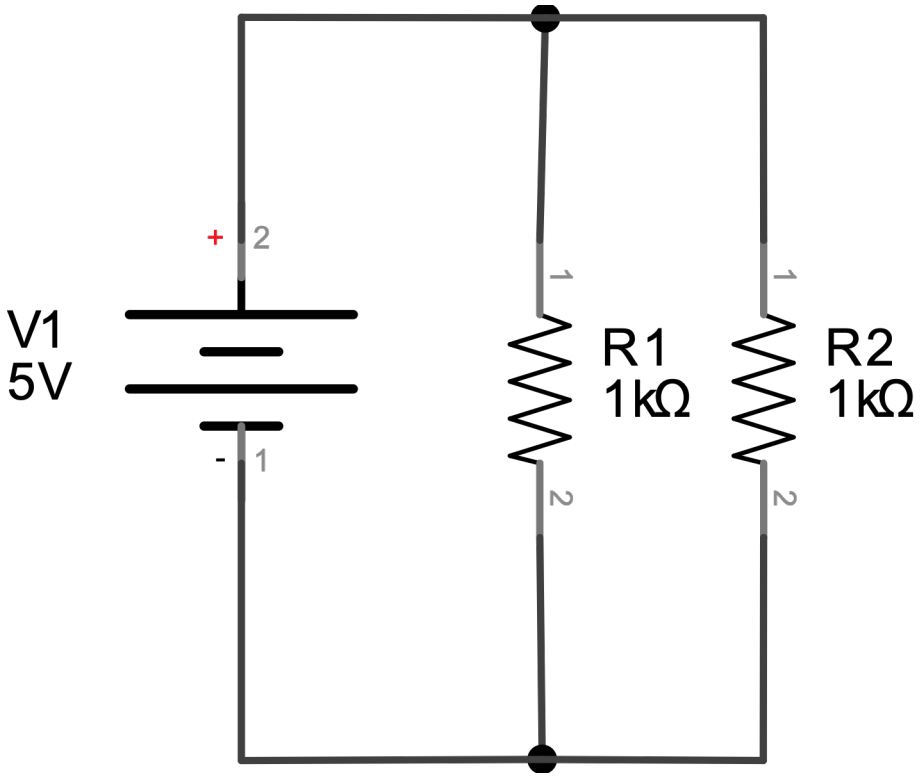


$$R = R_1 + R_2$$

$$R = 1\text{k}\Omega + 1\text{k}\Omega$$

$$R = 2\text{k}\Omega$$

Resistors in Parallel



$$1/R = 1/R_1 + 1/R_2$$

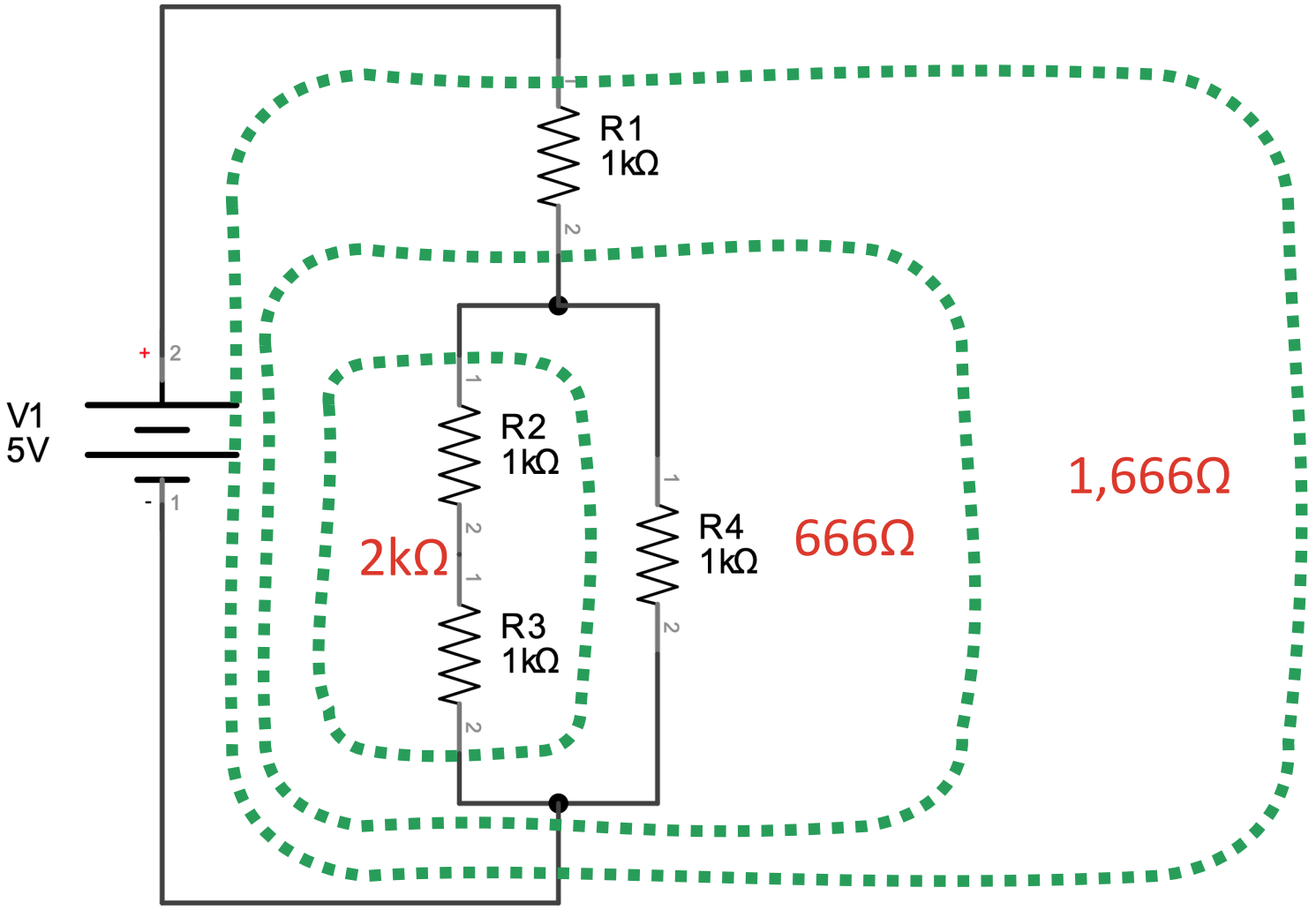
$$1/R = 1/1\text{k}\Omega + 1/1\text{k}\Omega$$

$$1/R = 2/1\text{k}\Omega$$

$$R/1 = 1\text{k}\Omega/2$$

$$R = 500\Omega$$

Resistors in Series & Parallel



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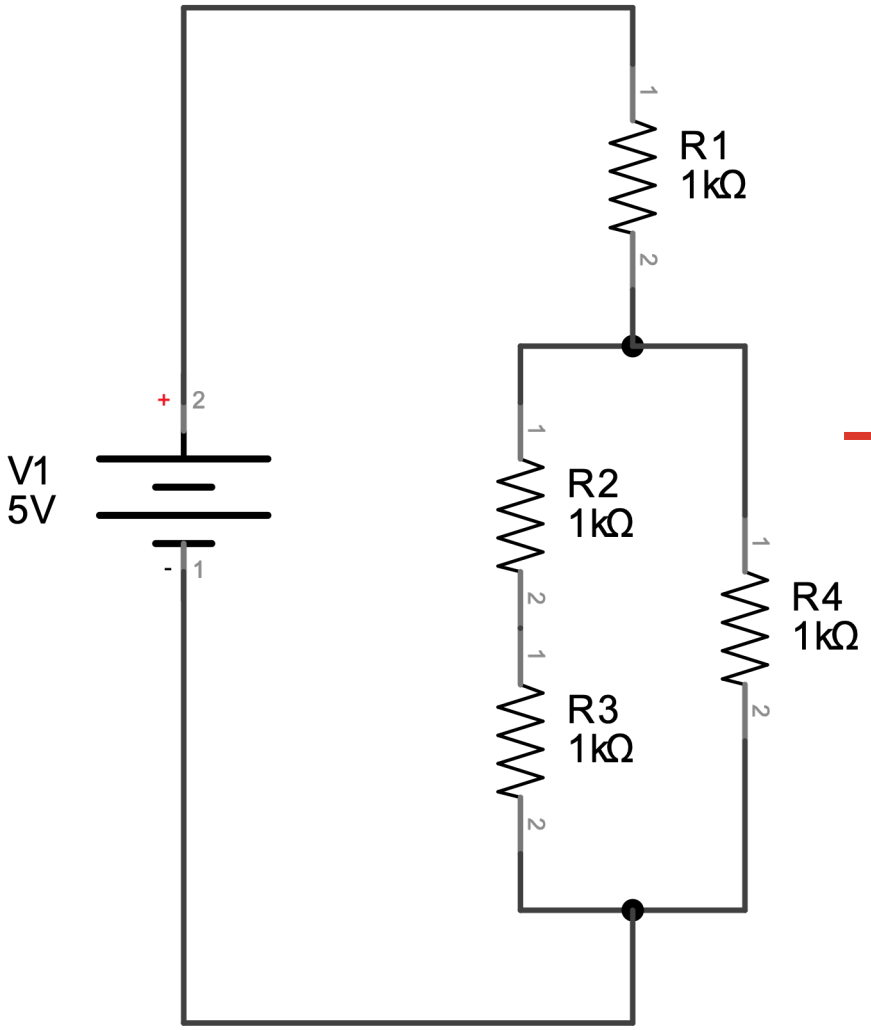
Resistors in Series & Parallel



$$R = R_1 + {}^{1}\Big/ \frac{1}{R_2 + R_3} + \frac{1}{R_4}$$

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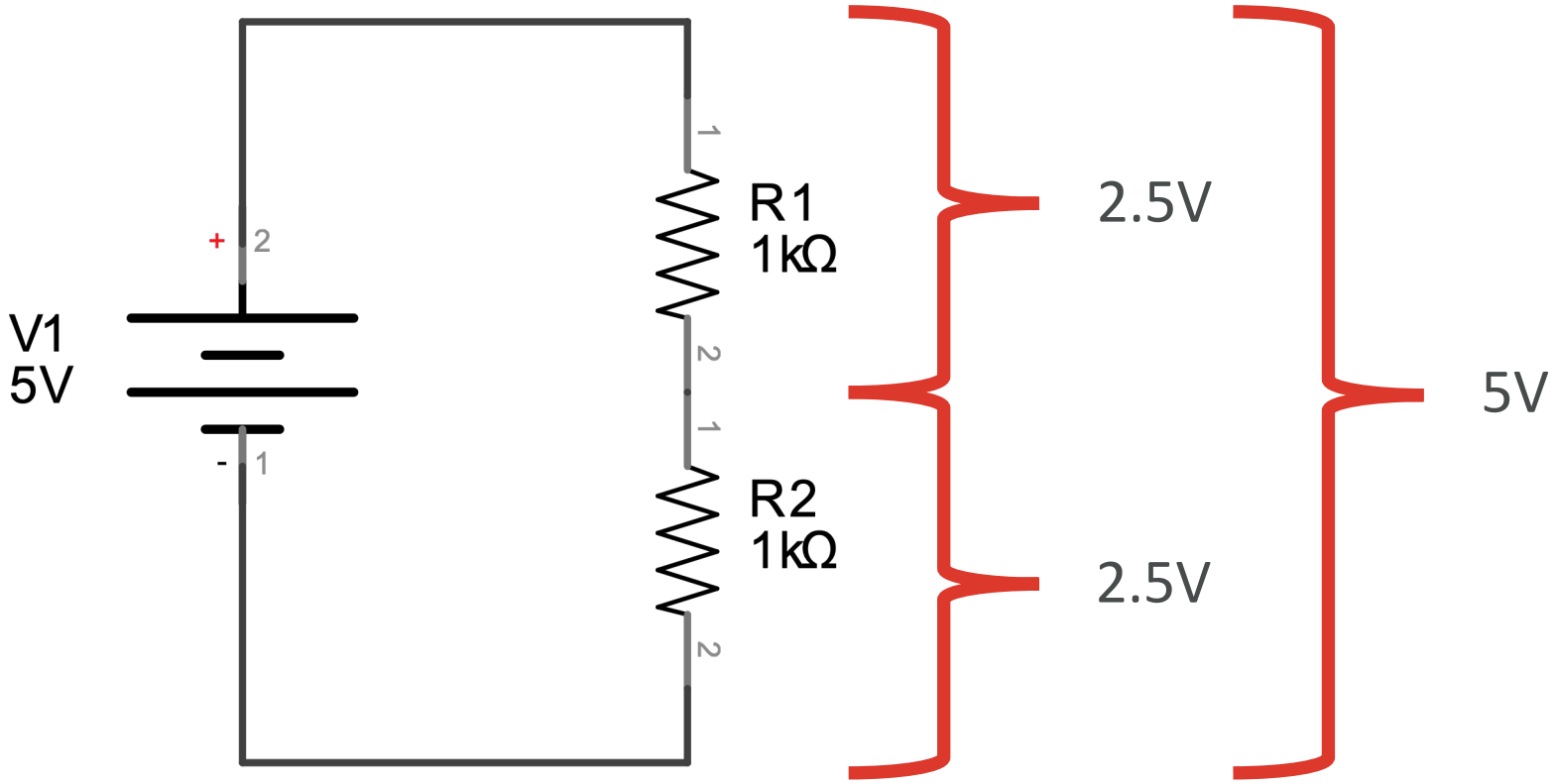
Voltage Dividers



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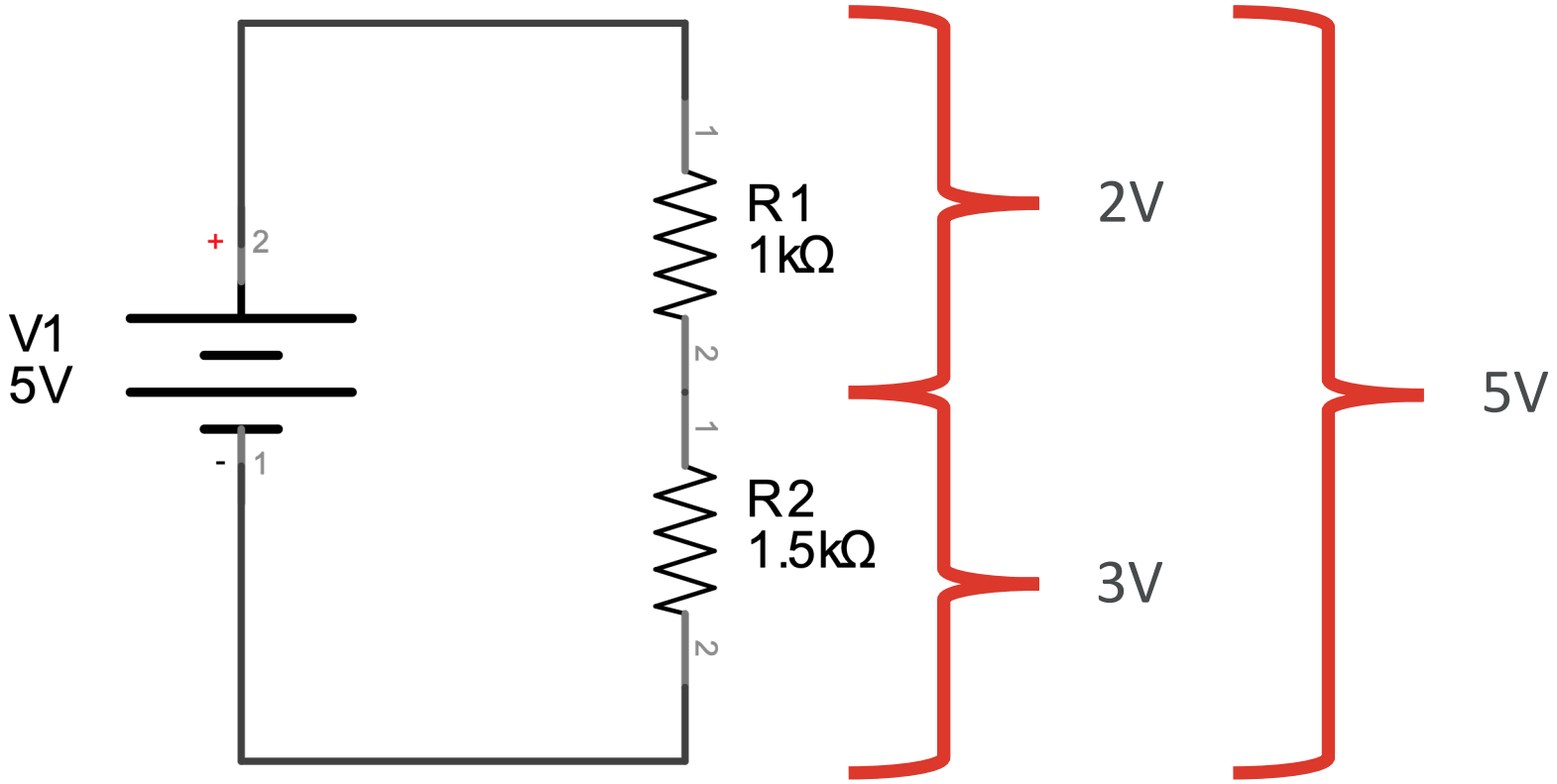
Voltage Dividers



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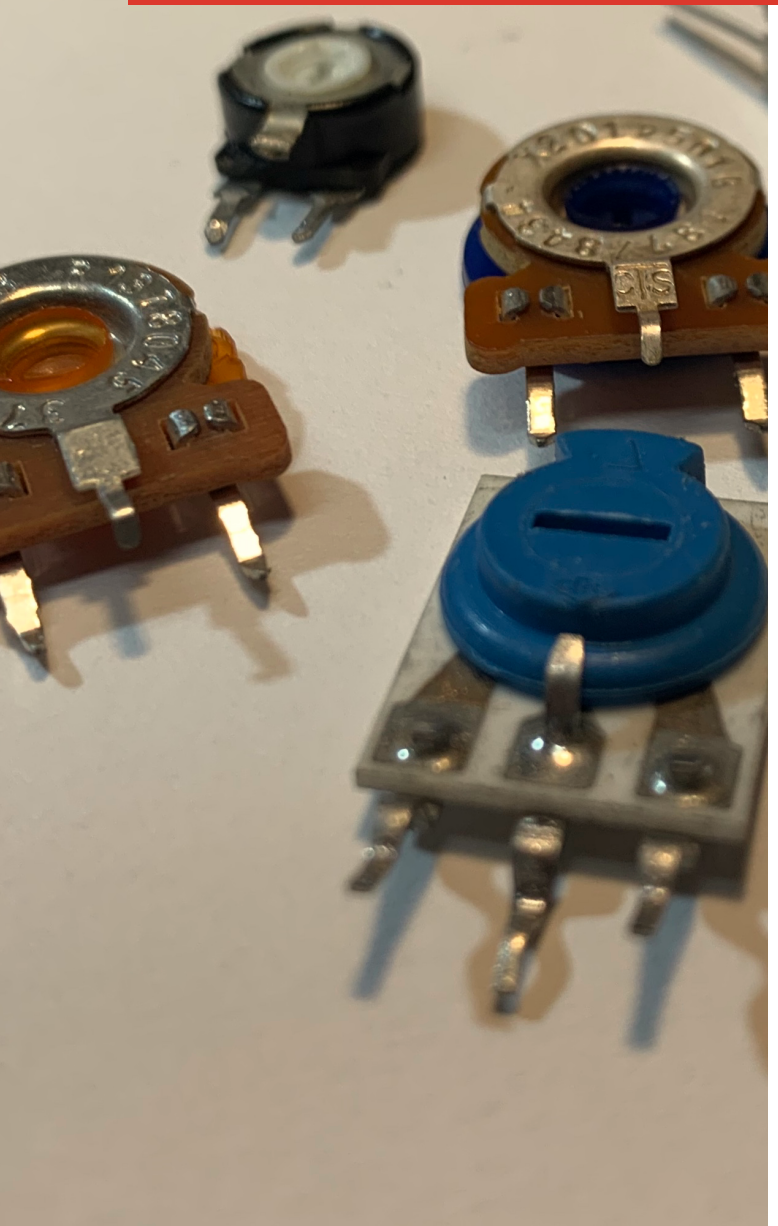
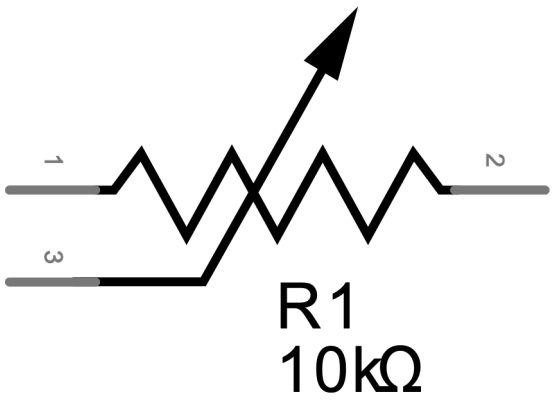
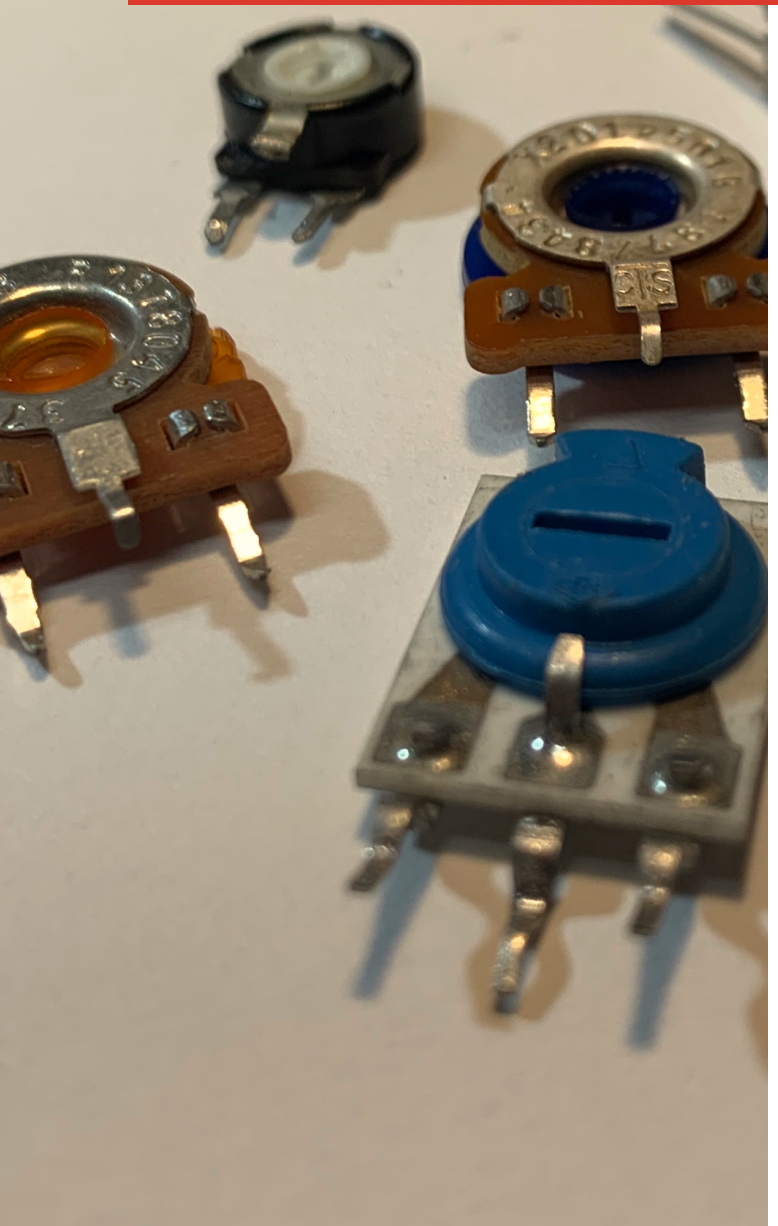
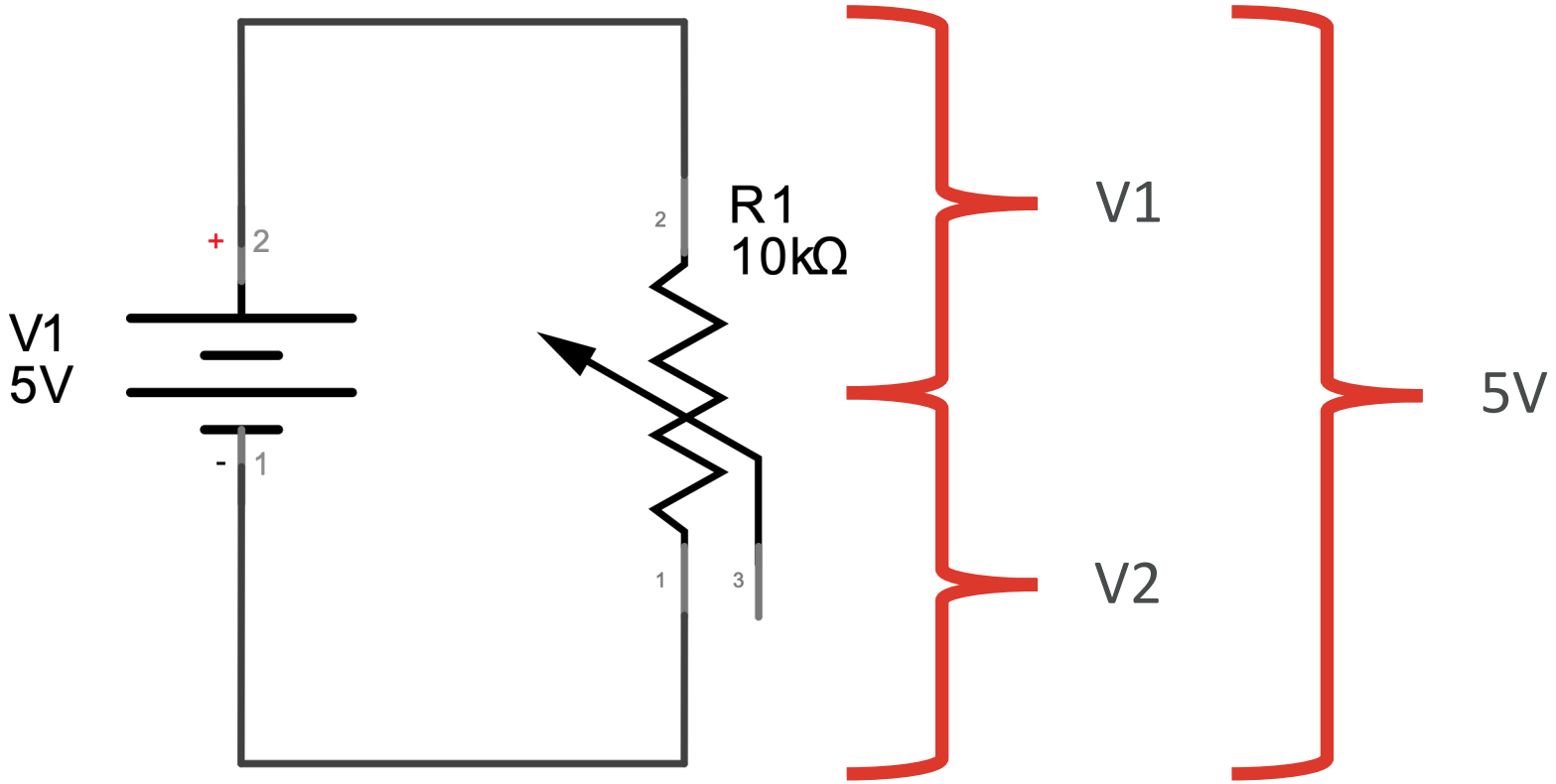
Potentiometers





Potentiometers as Voltage Dividers





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Demo

Redis

Stores state reported from and to be sent to the Arduino.

Repolla

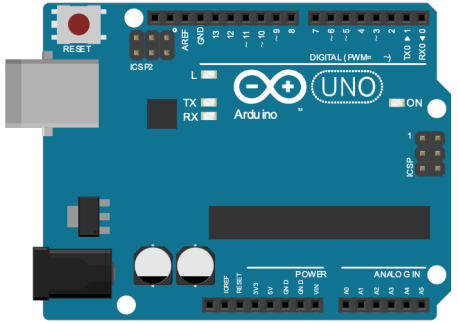
```
board.on('ready',
  () => {
    redis.set(
      'foo',
      'bar')
  })
```

Node app that polls Redis for state changes to be given to Johnny Five and vice versa.

Johnny Five

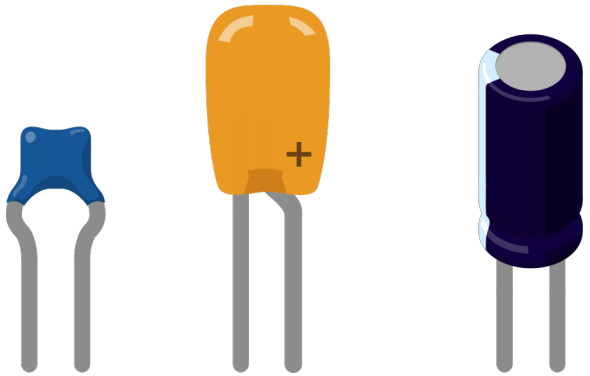
Open source node module that allows easy manipulation of an Arduino.

Arduino



Arduino loaded with Firmata and setup for digital input and output, PWM output, and analog input.

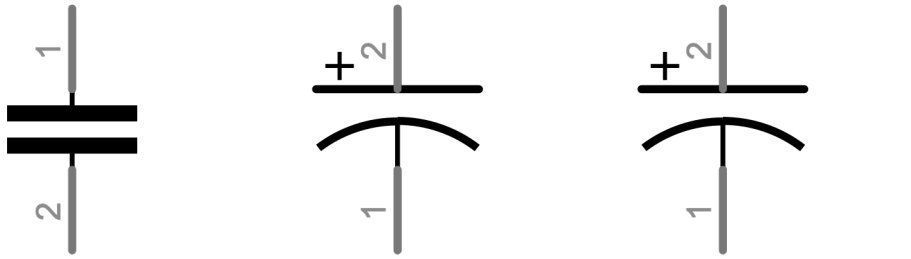
Capacitors



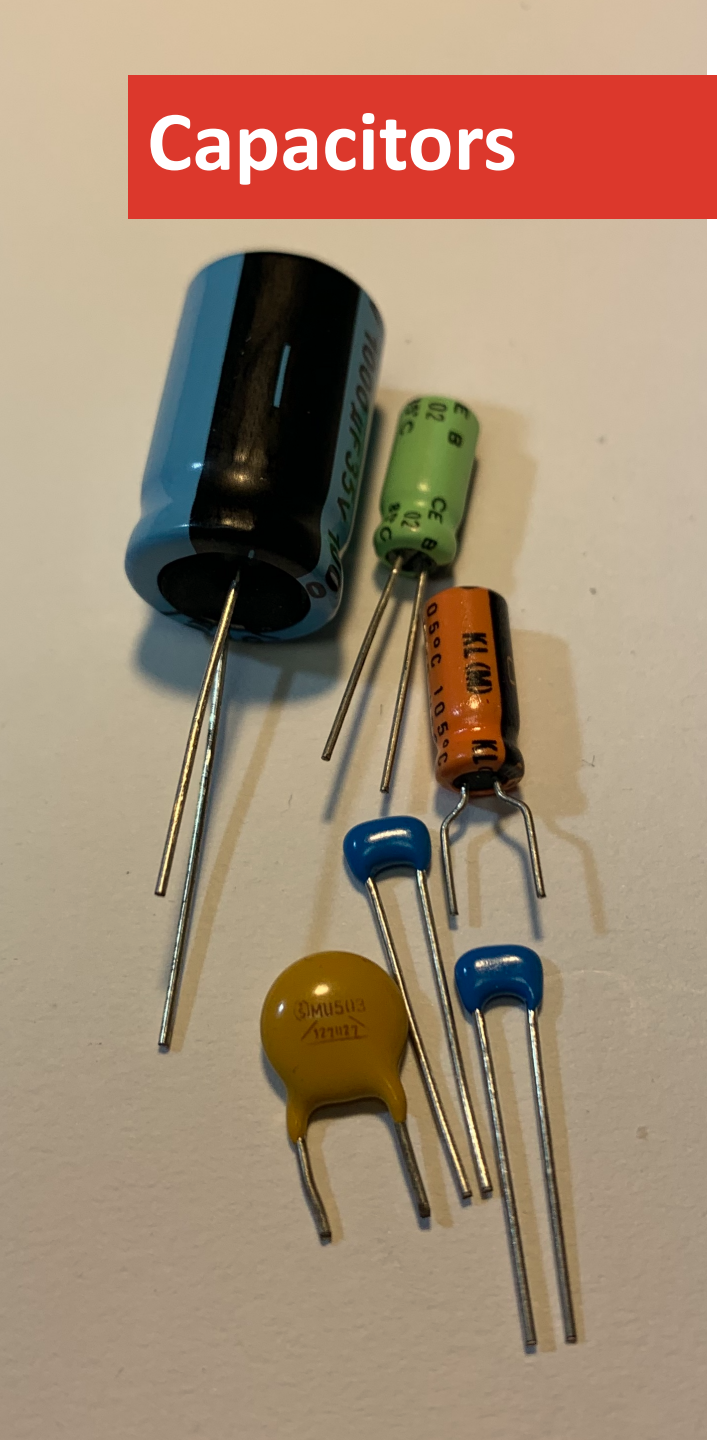
C1
100nF

C2
1µF

C3
1µF

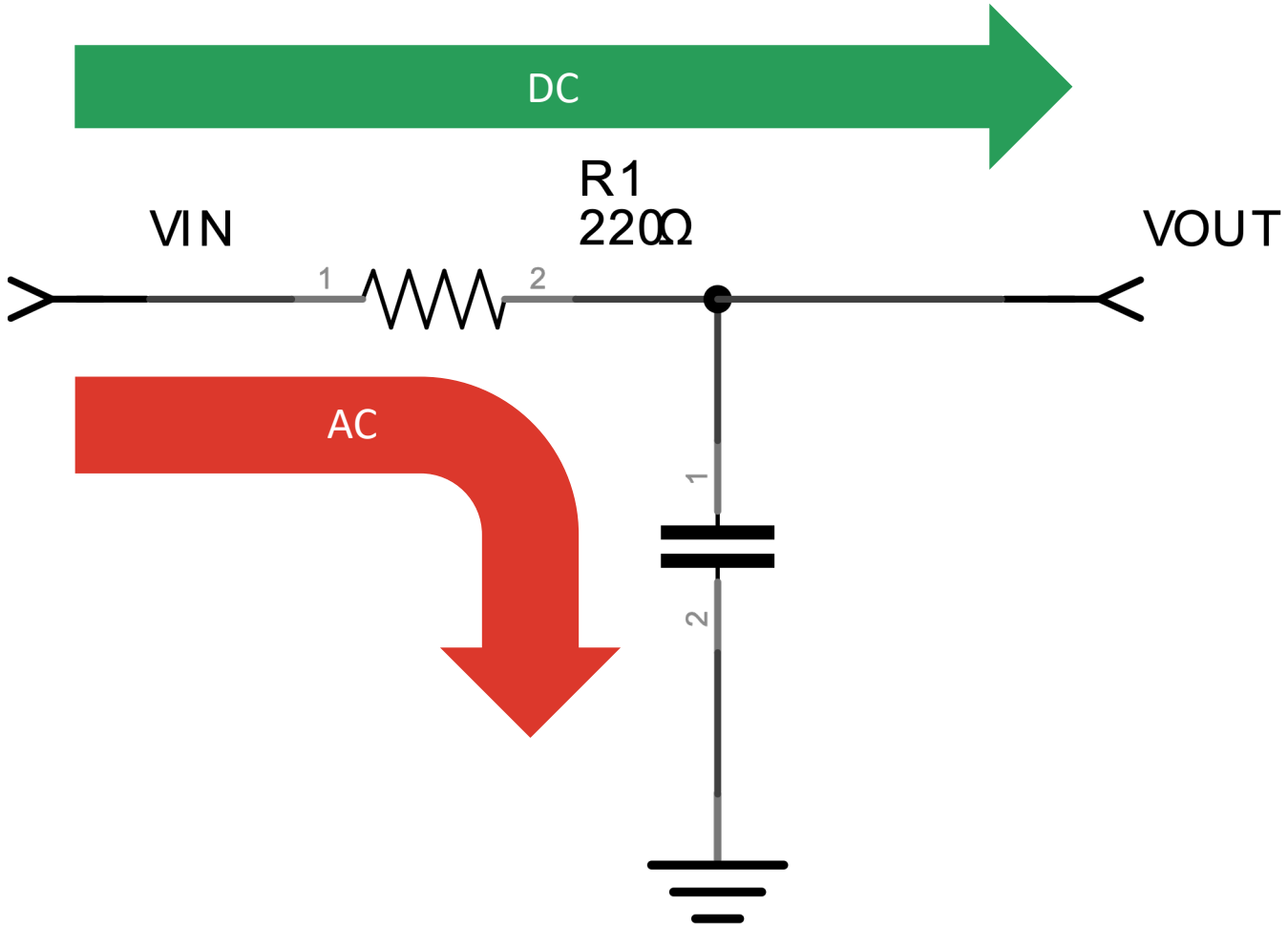


Capacitors



- Hold a charge
- Block direct current
- Pass alternating current
- Have a capacity measured in Farads (F)
- Sometimes have polarity

Capacitor as Low Pass Filter



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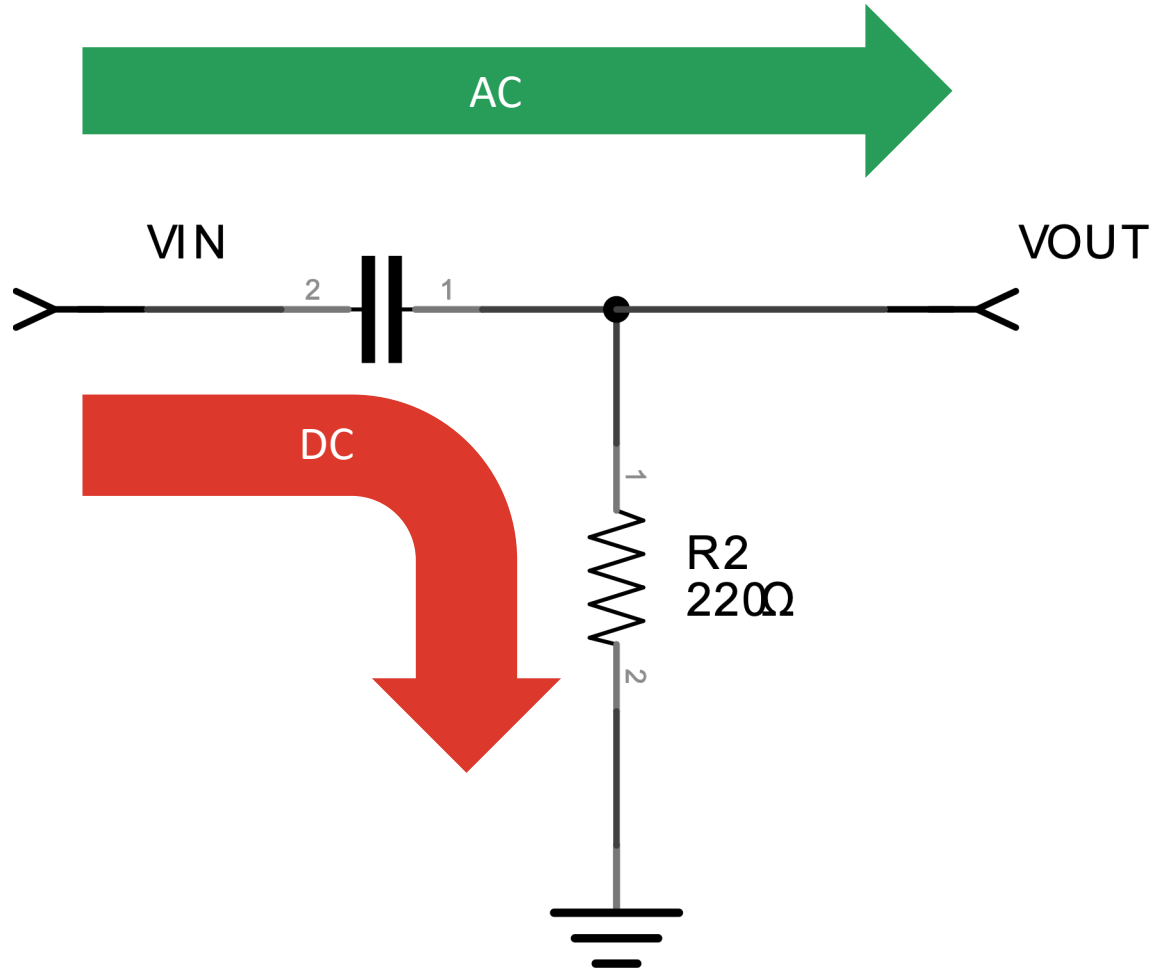
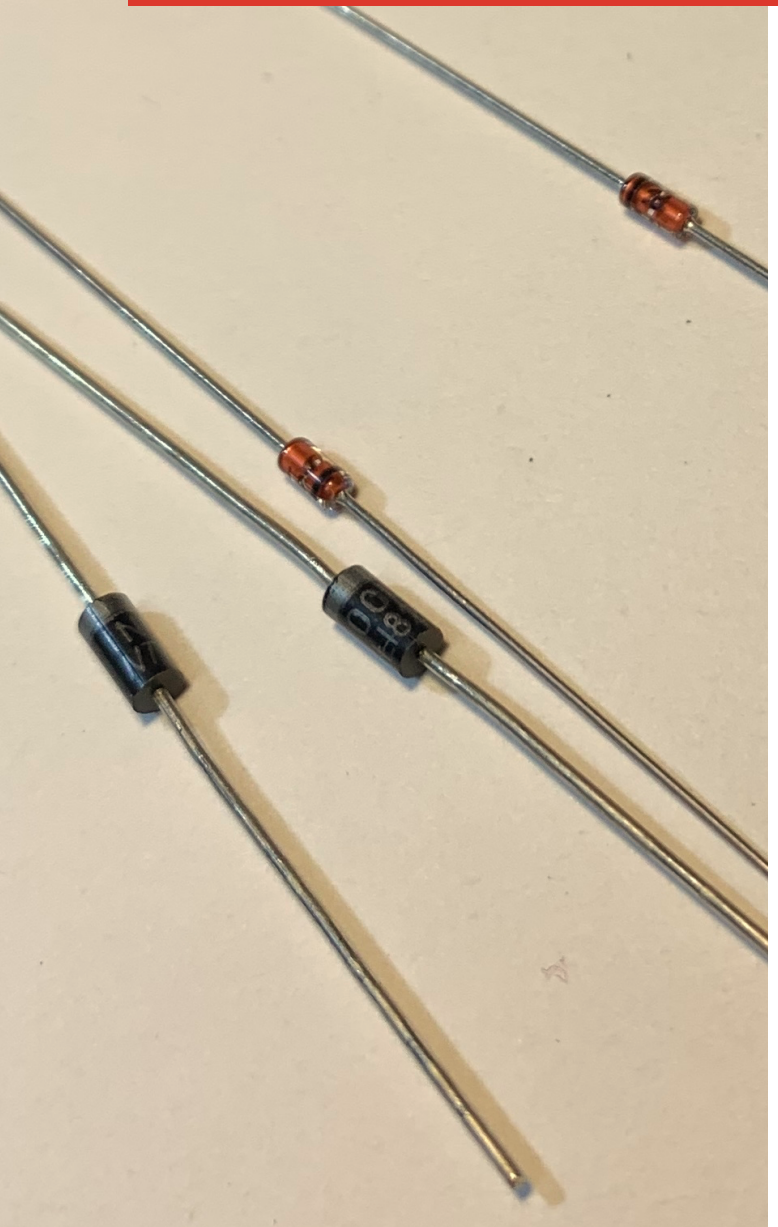
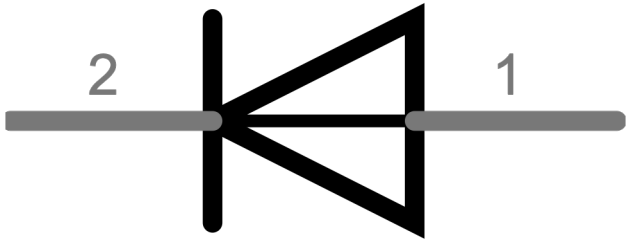
Capacitor as High Pass Filters

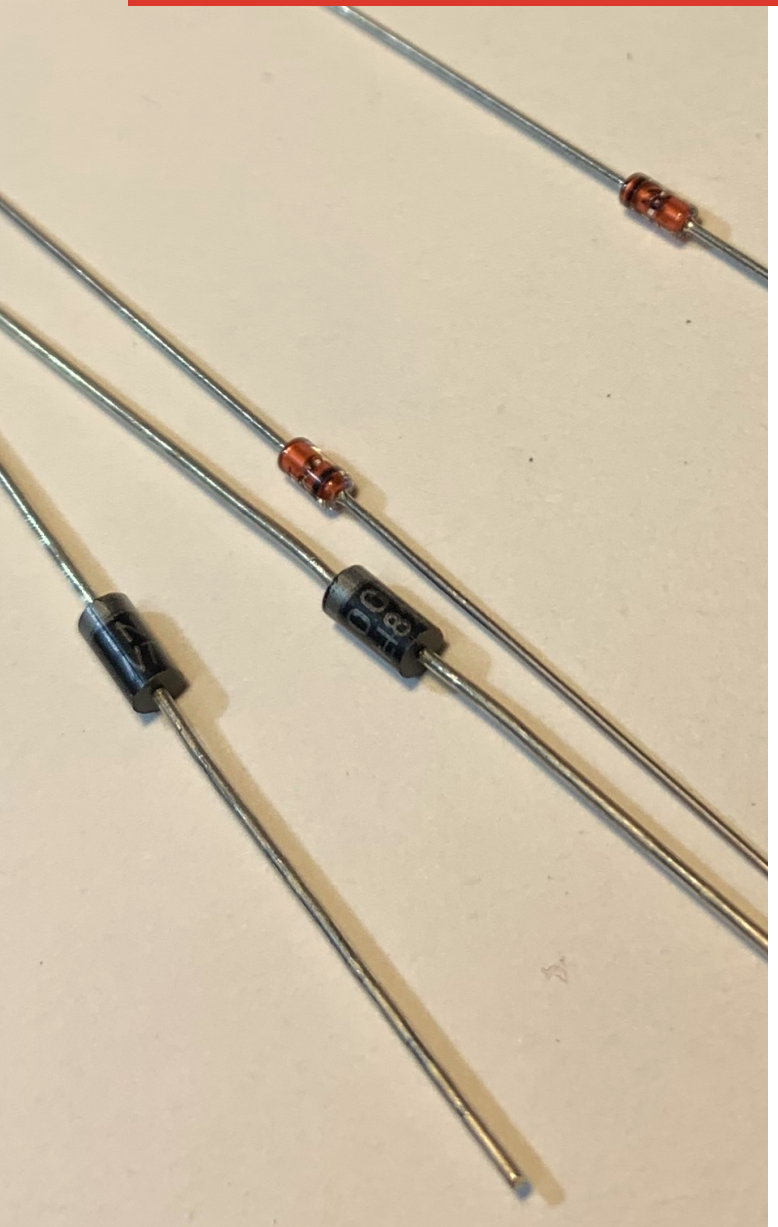


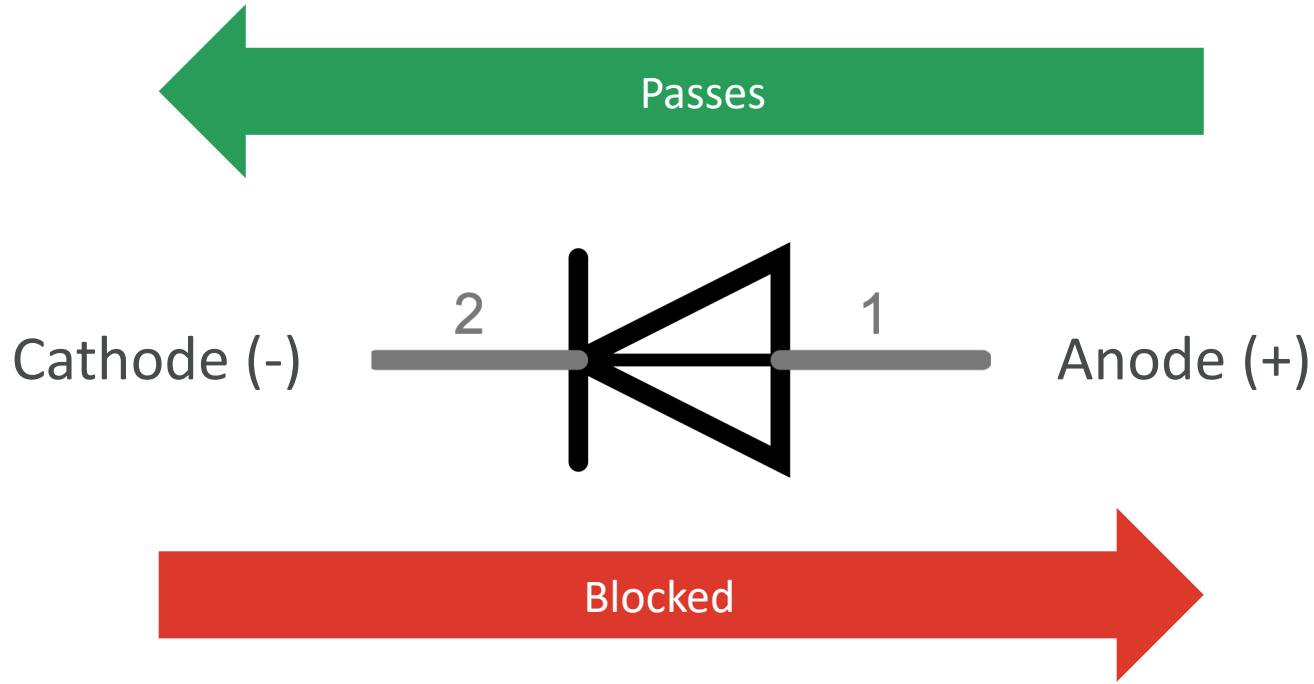
Diodes



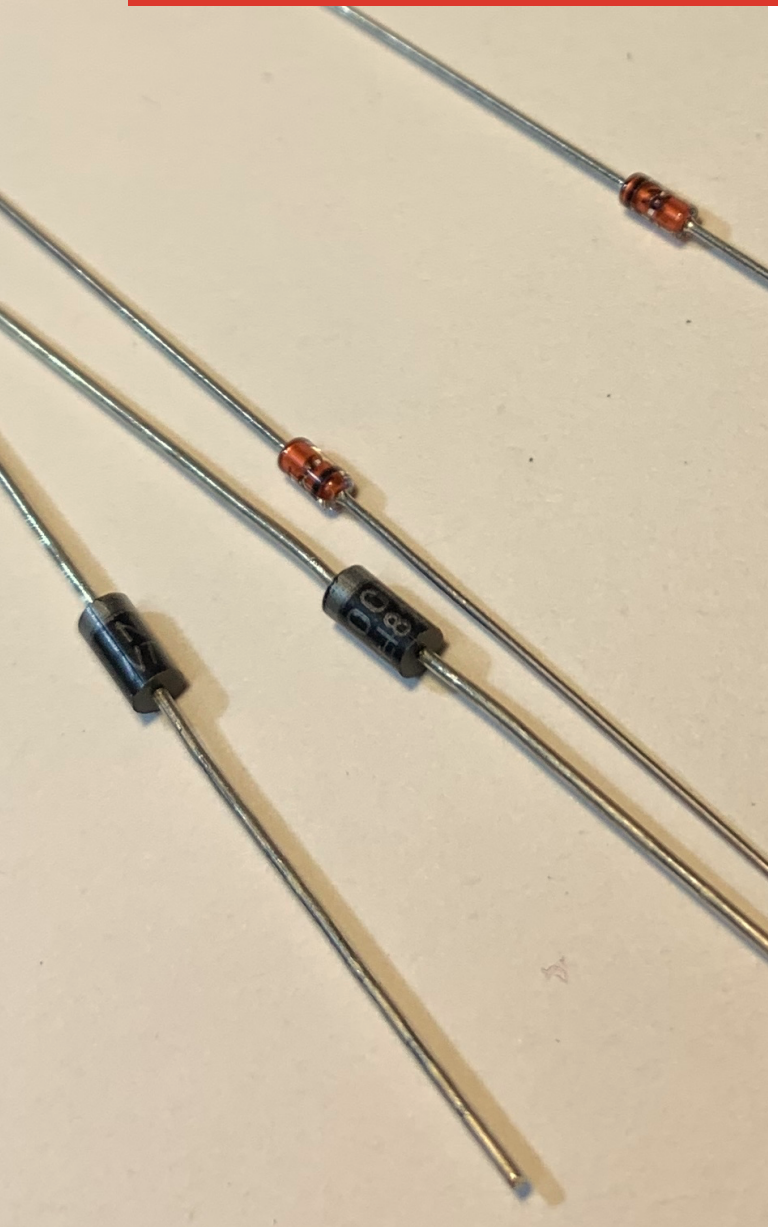


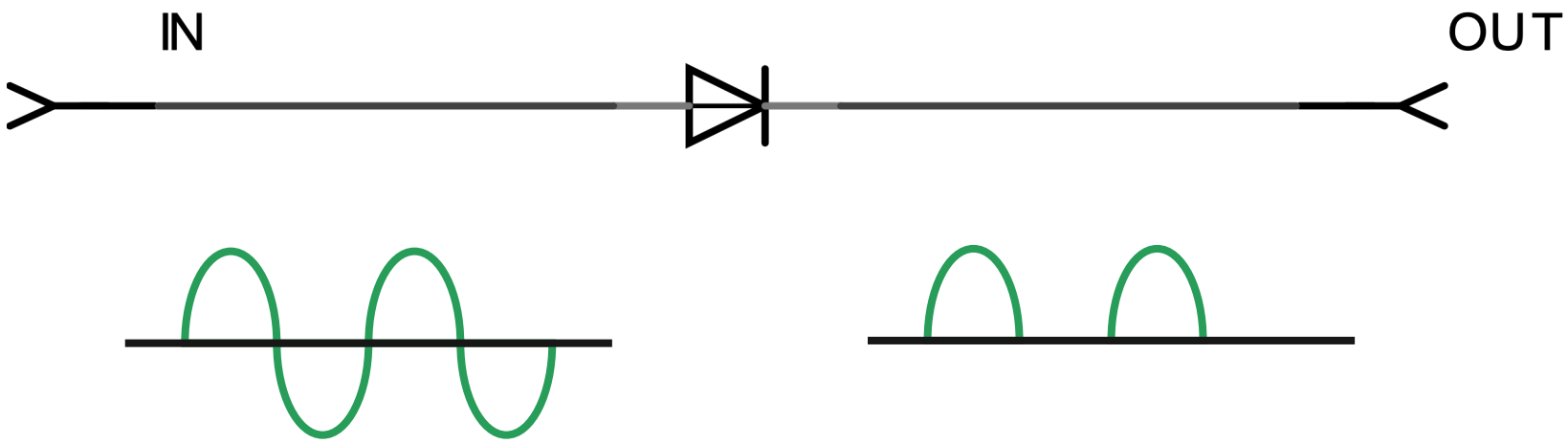
Diodes Act as Check Valves



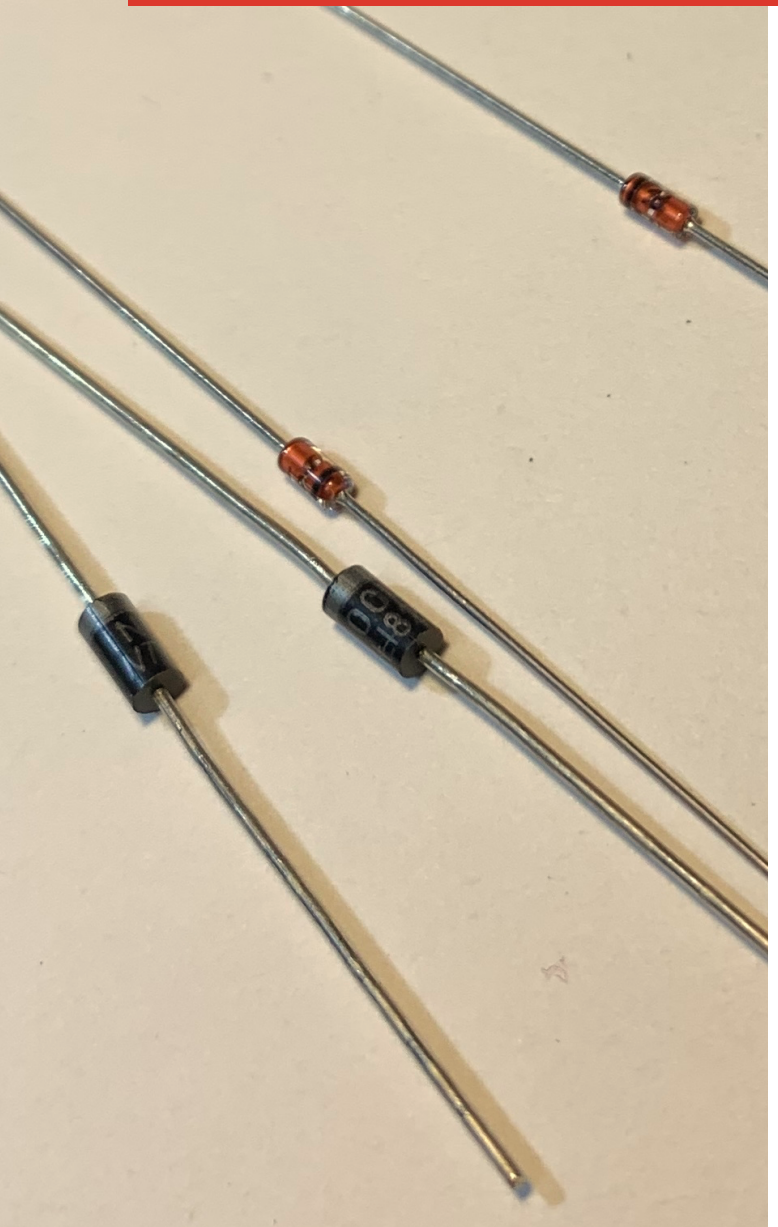


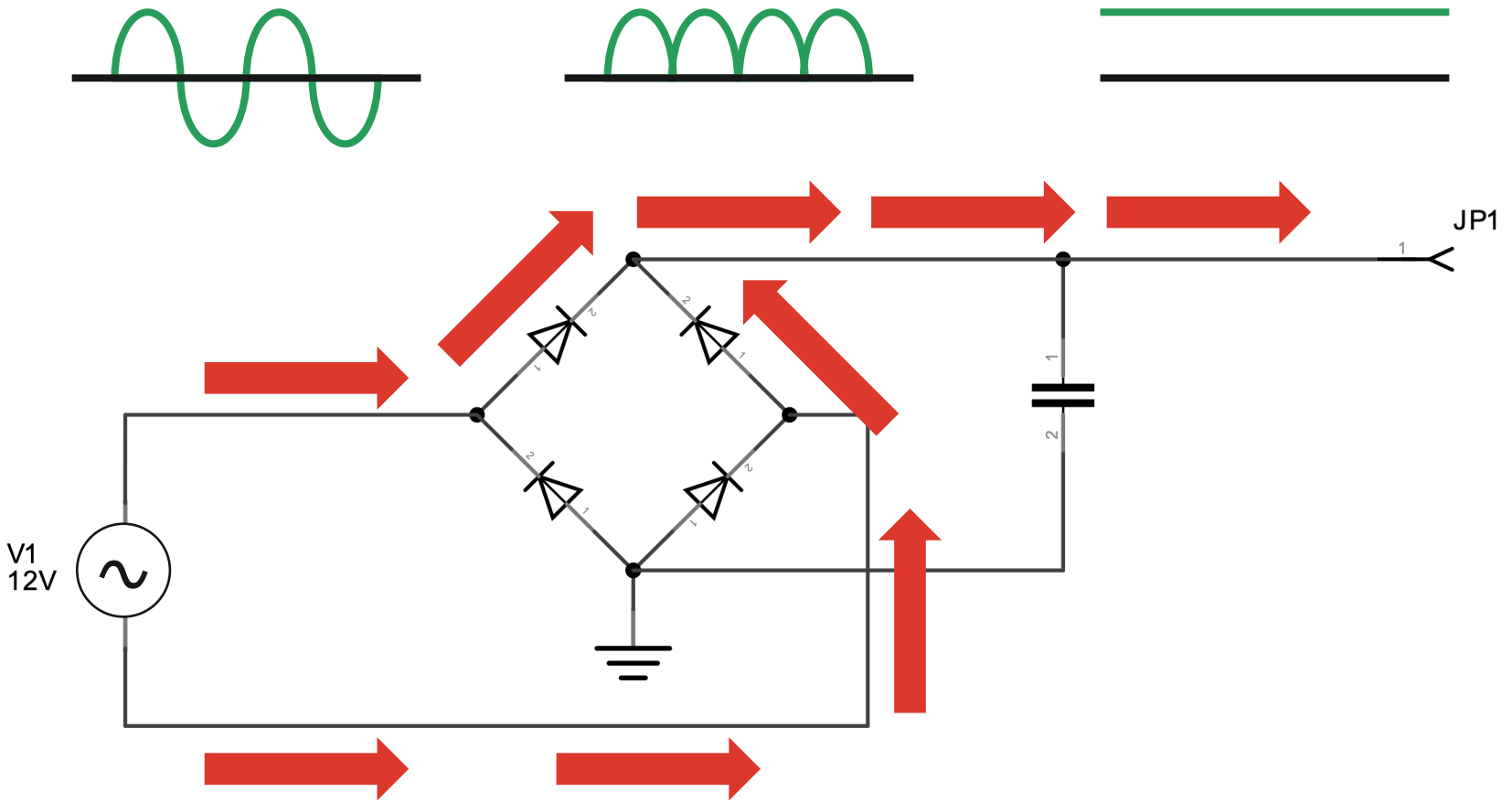
Diodes Turn AC into DC



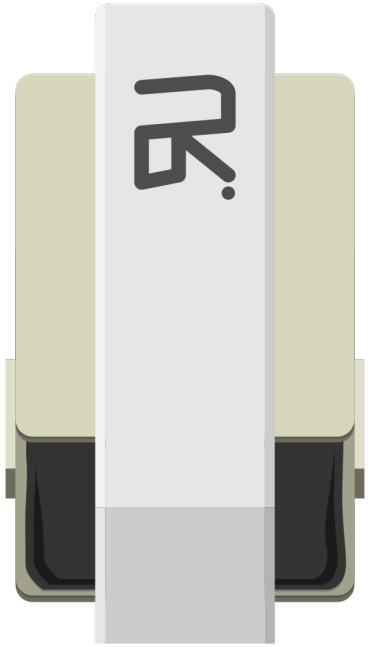


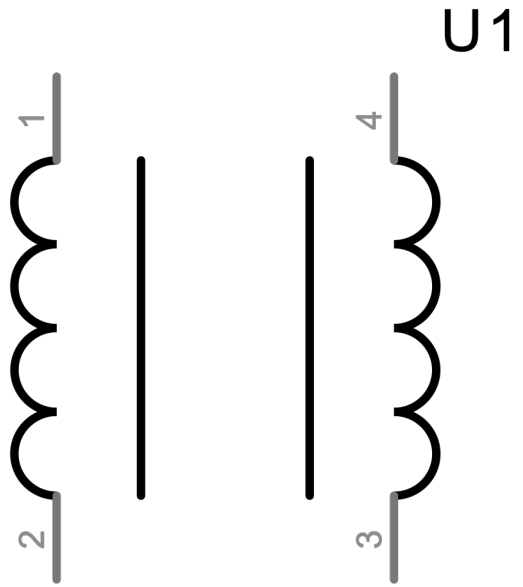
Rectifier





Transformers





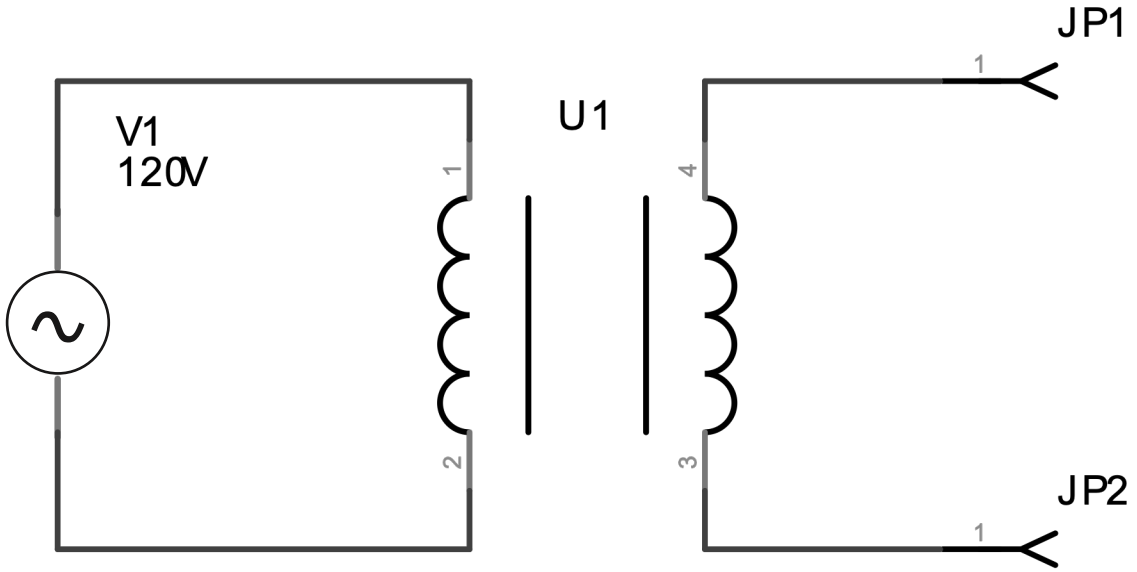
Transformers

- Change voltage for a corresponding and opposite change in current
- Only works with alternating current

Transforming Power

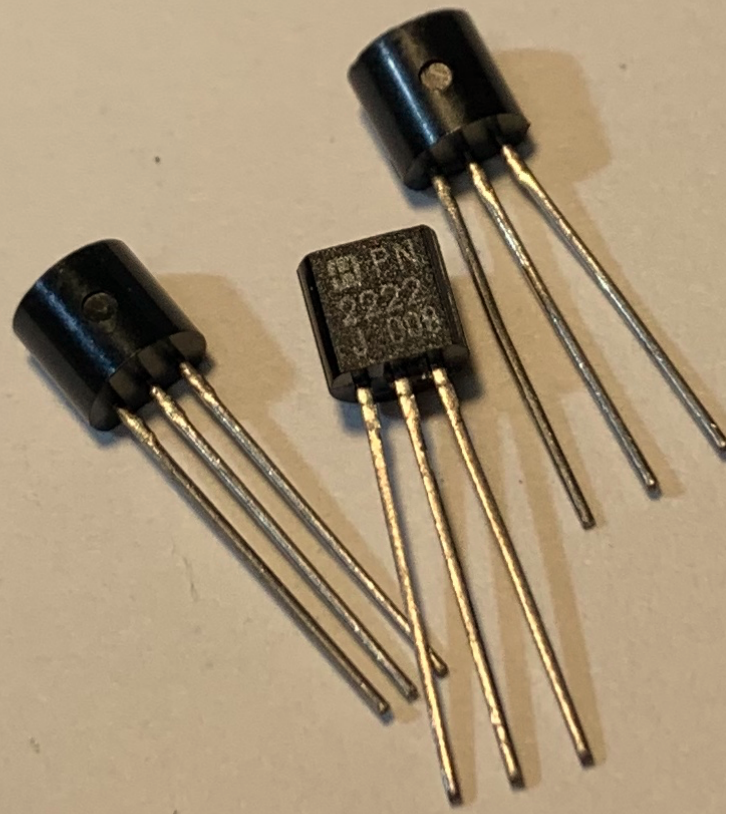
$$120V \cdot 100mA = 12W$$

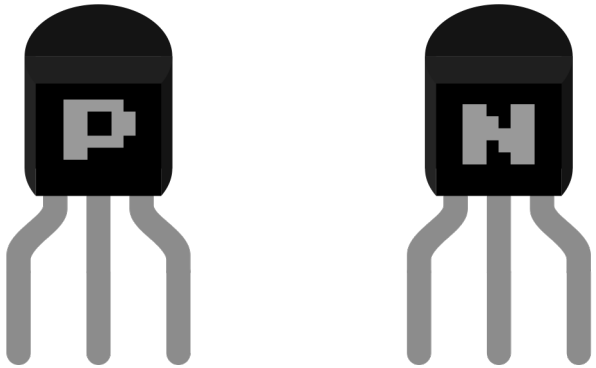
$$12W = 1A \cdot 12V$$

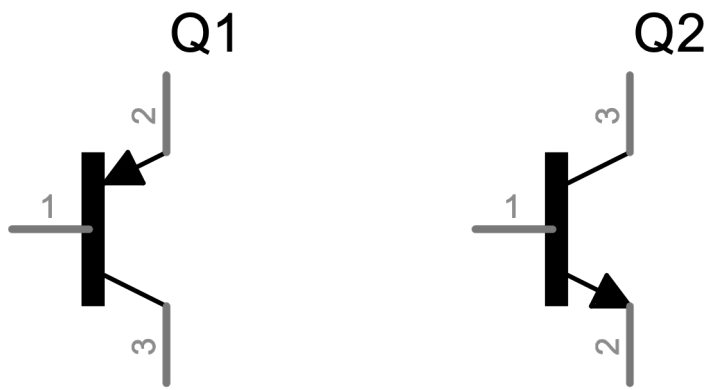


10:1 Ratio

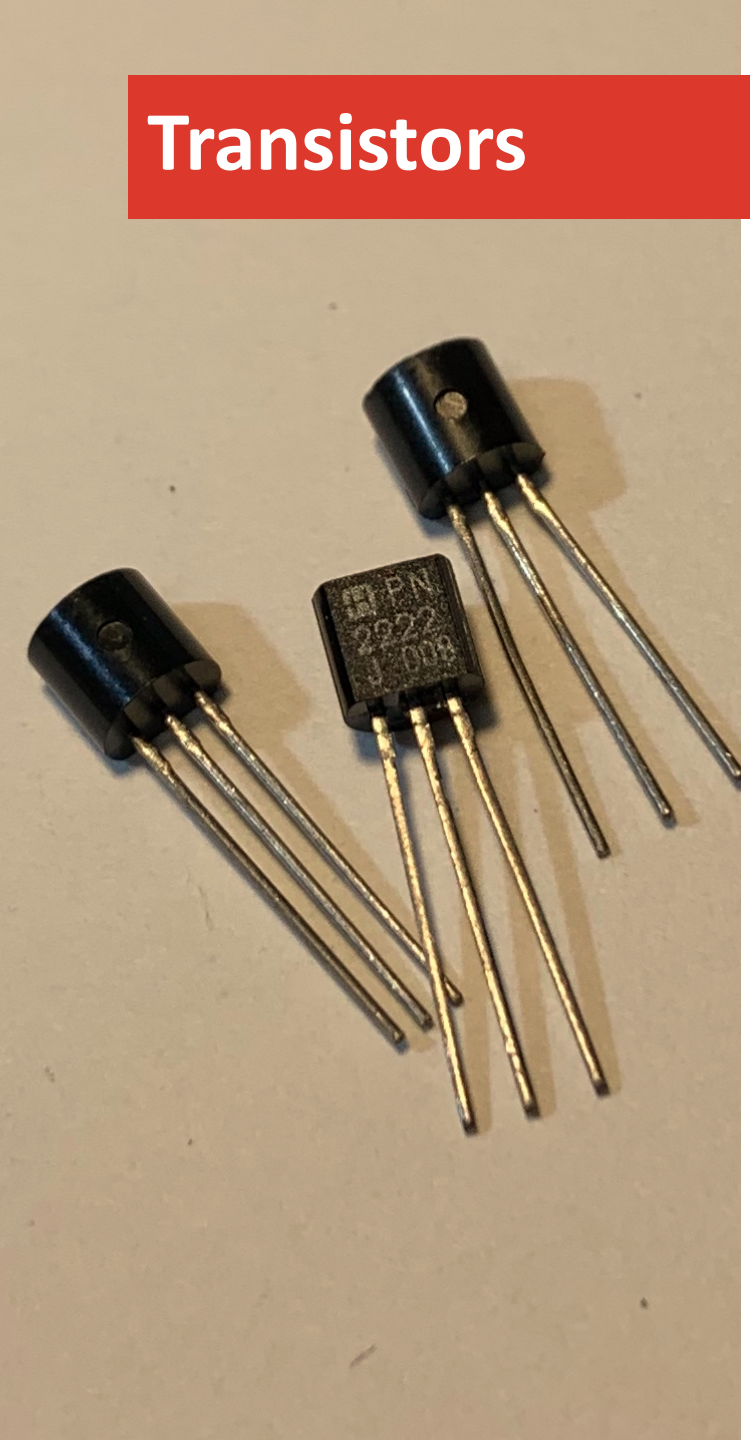
Transistors





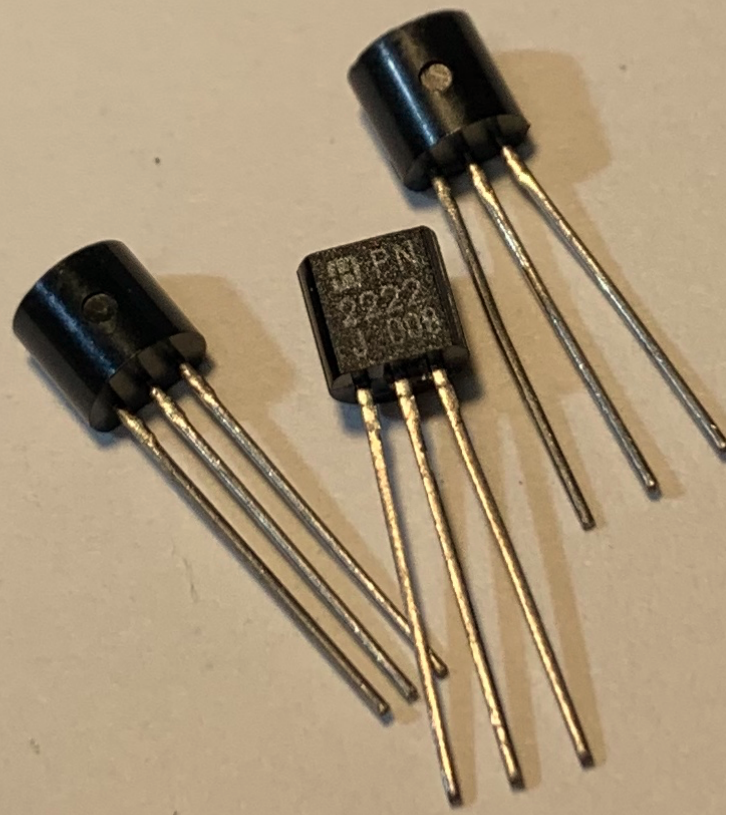


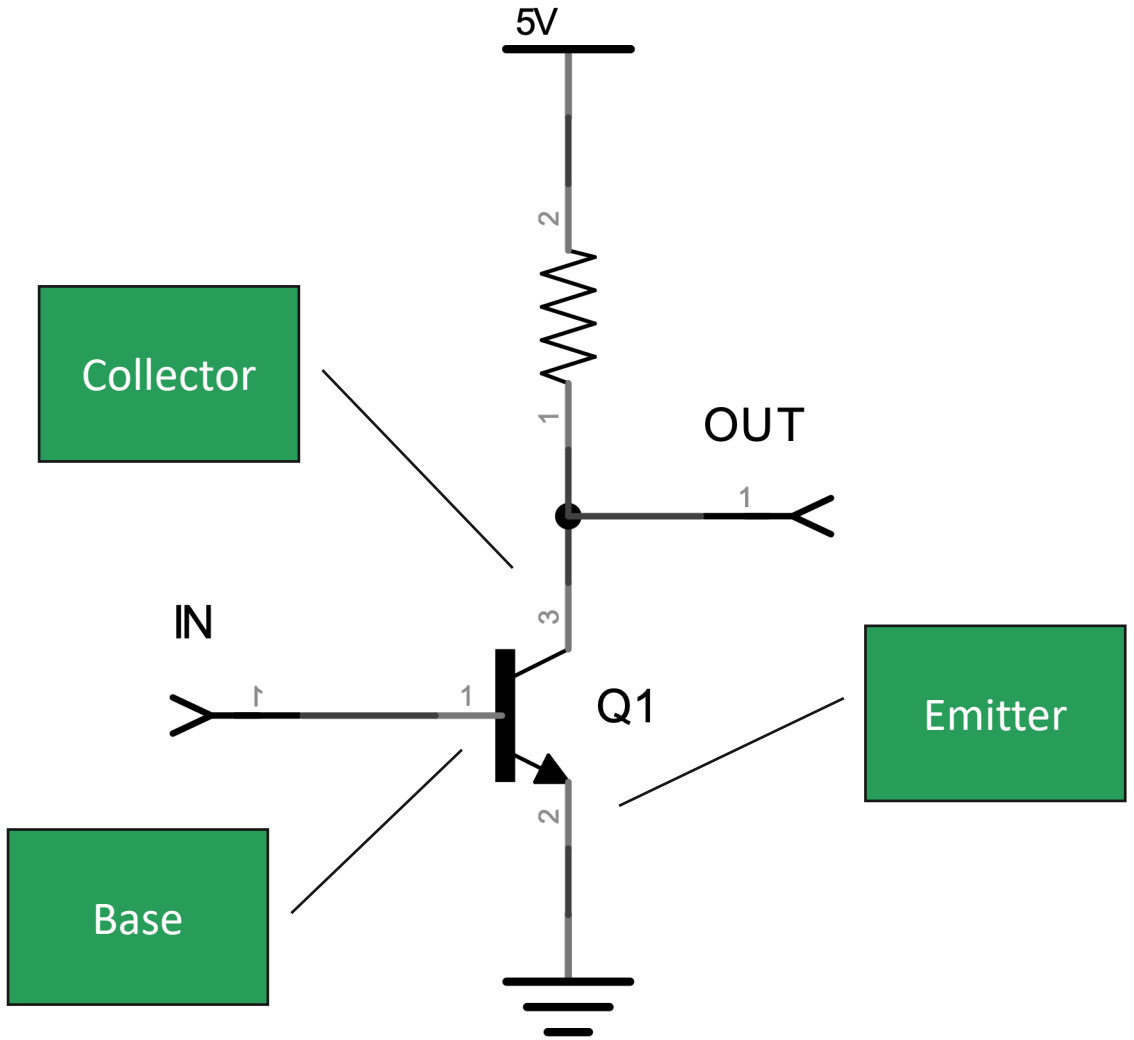
Transistors



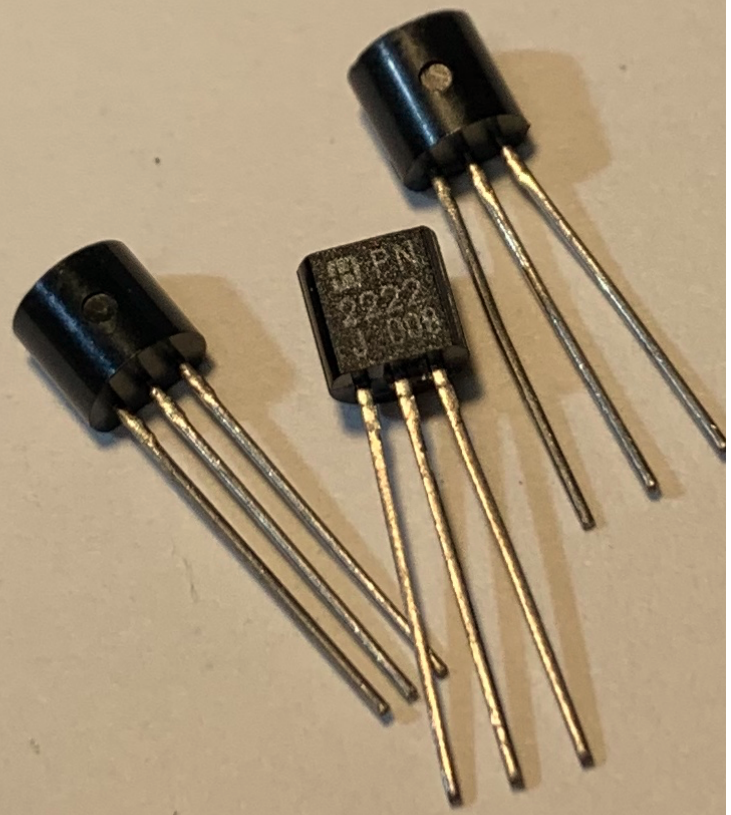
- Varies current flow based on an input
- Used as an electronic switch
- Used to amplify signals

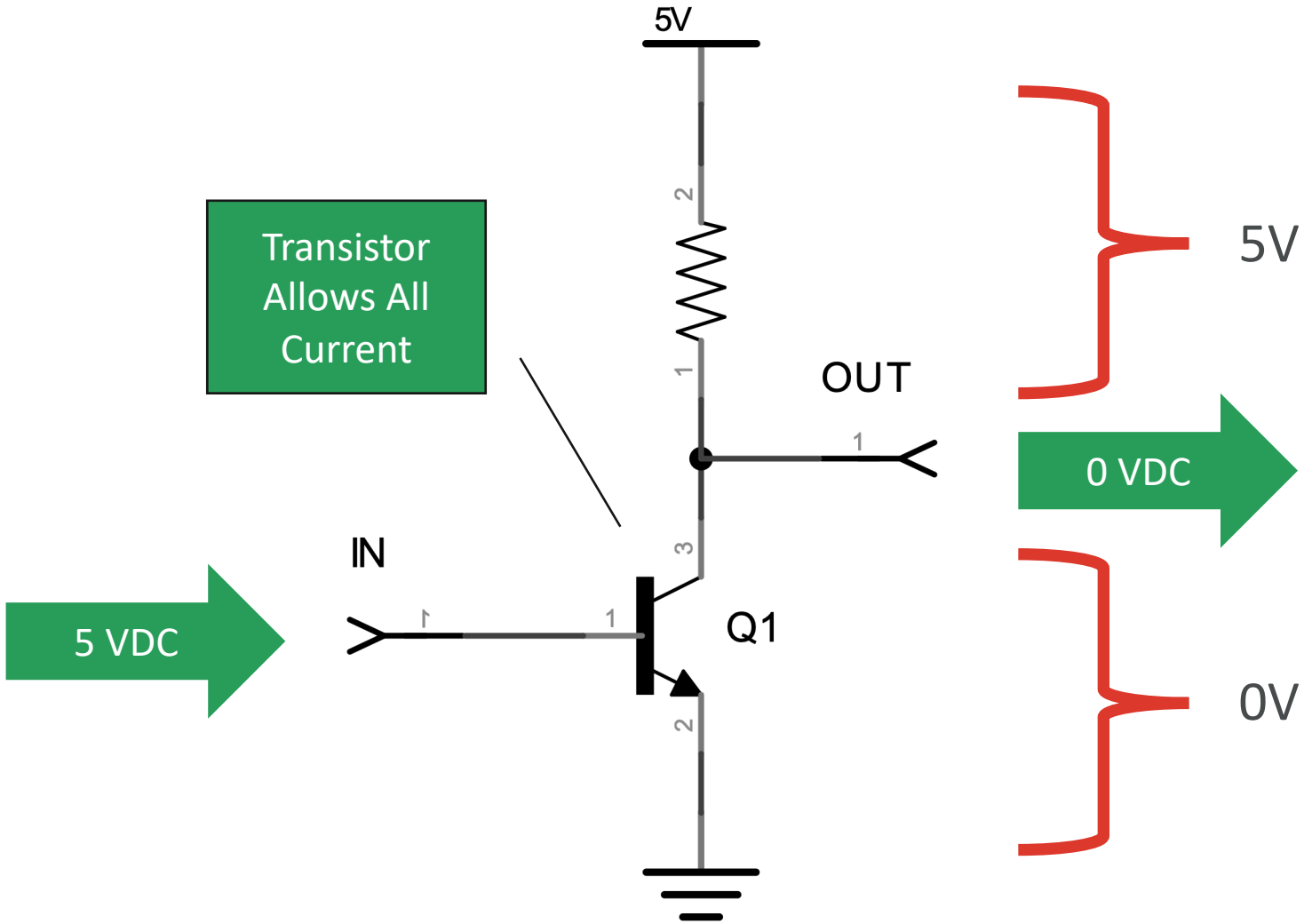
Parts of a Transistor





Transistor as Inverter





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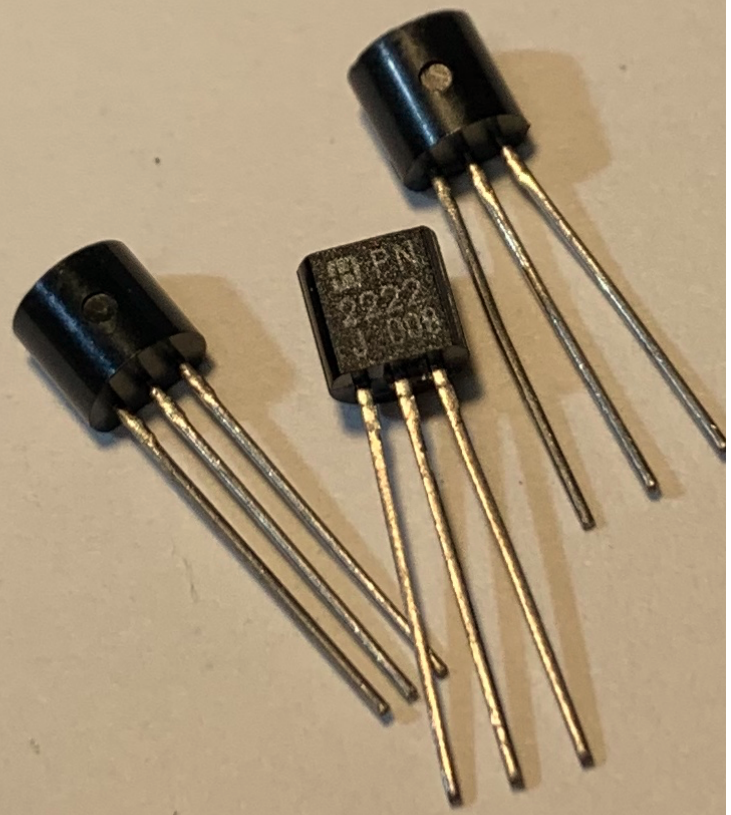

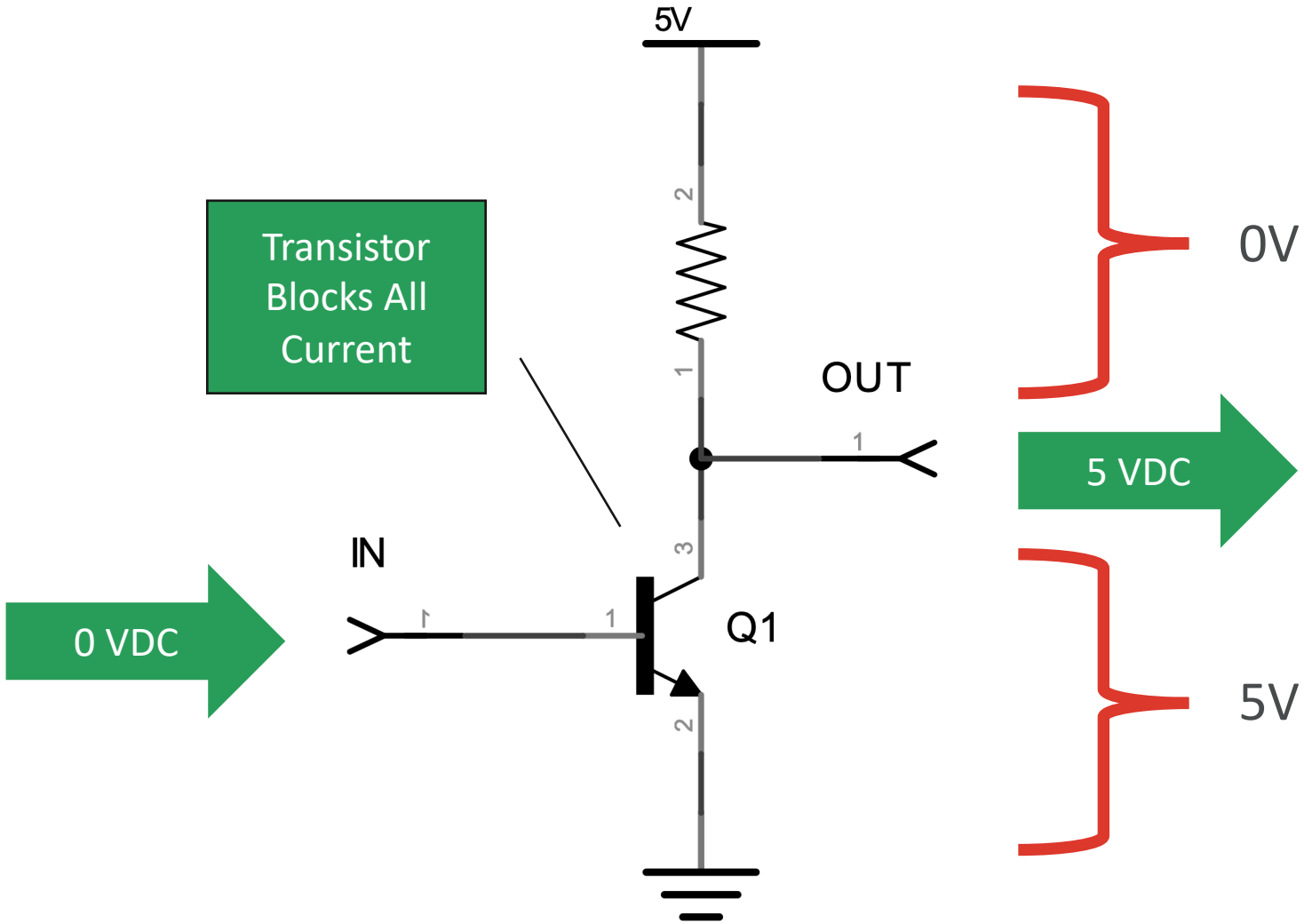

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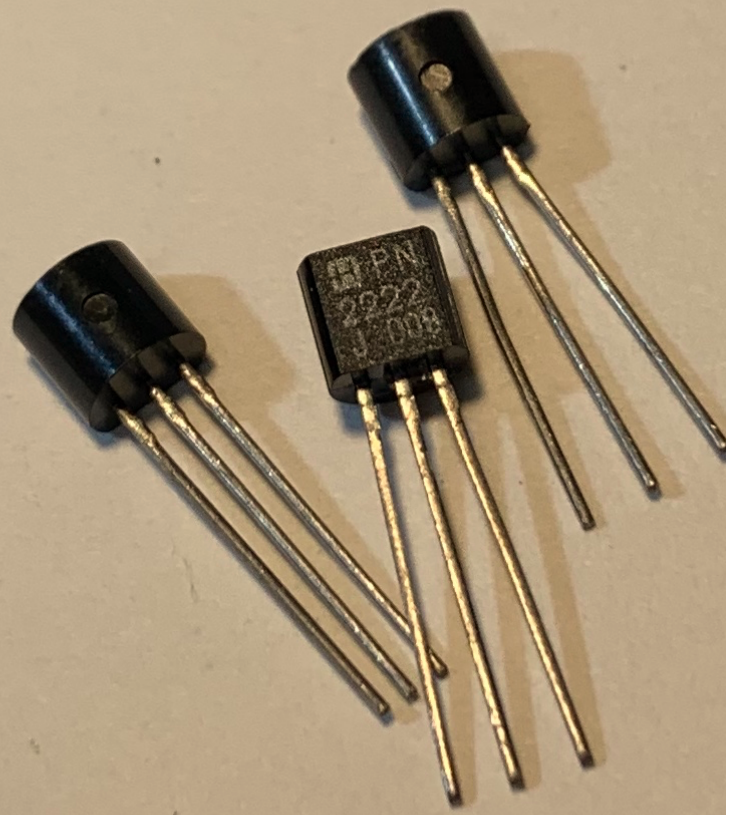
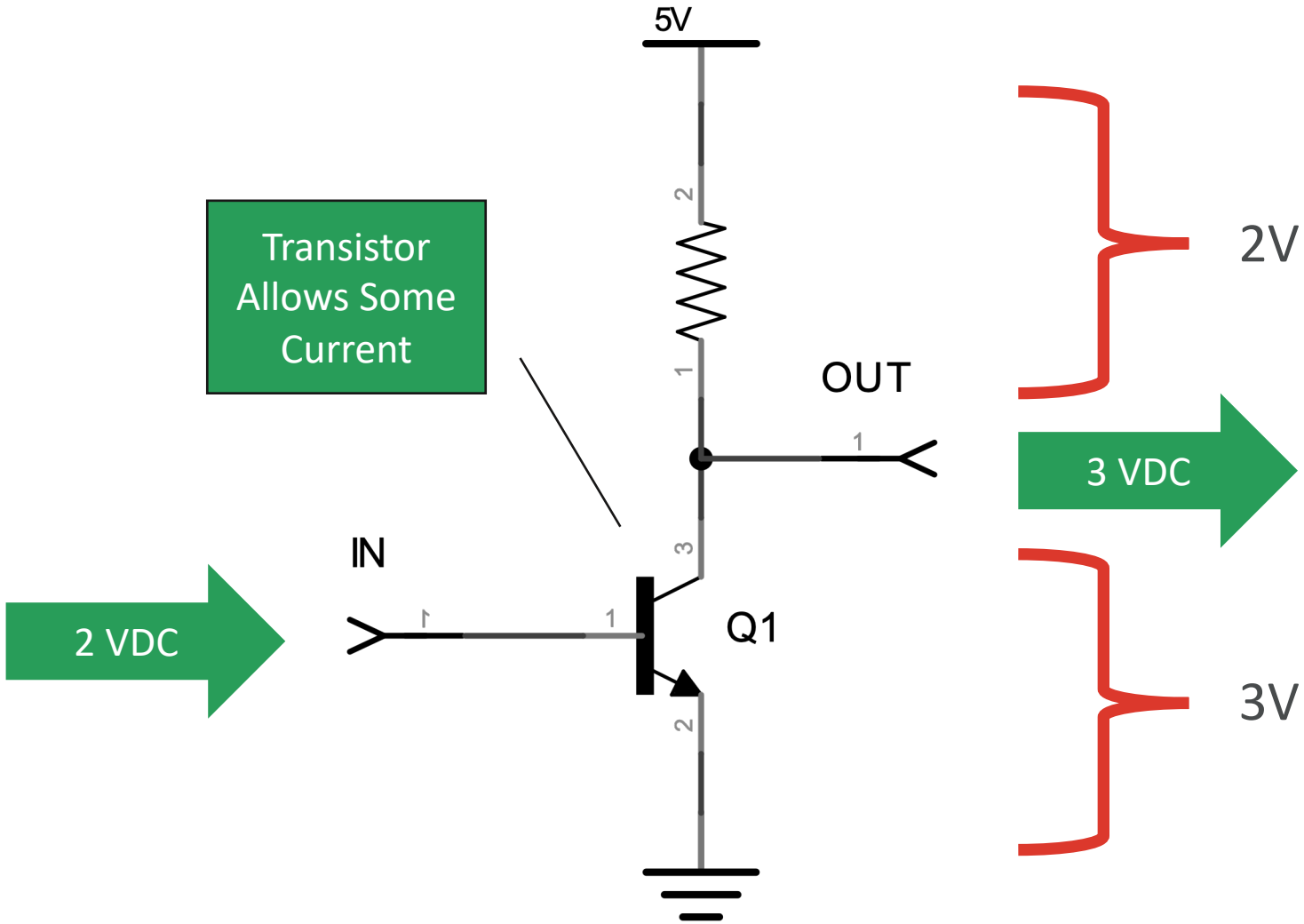
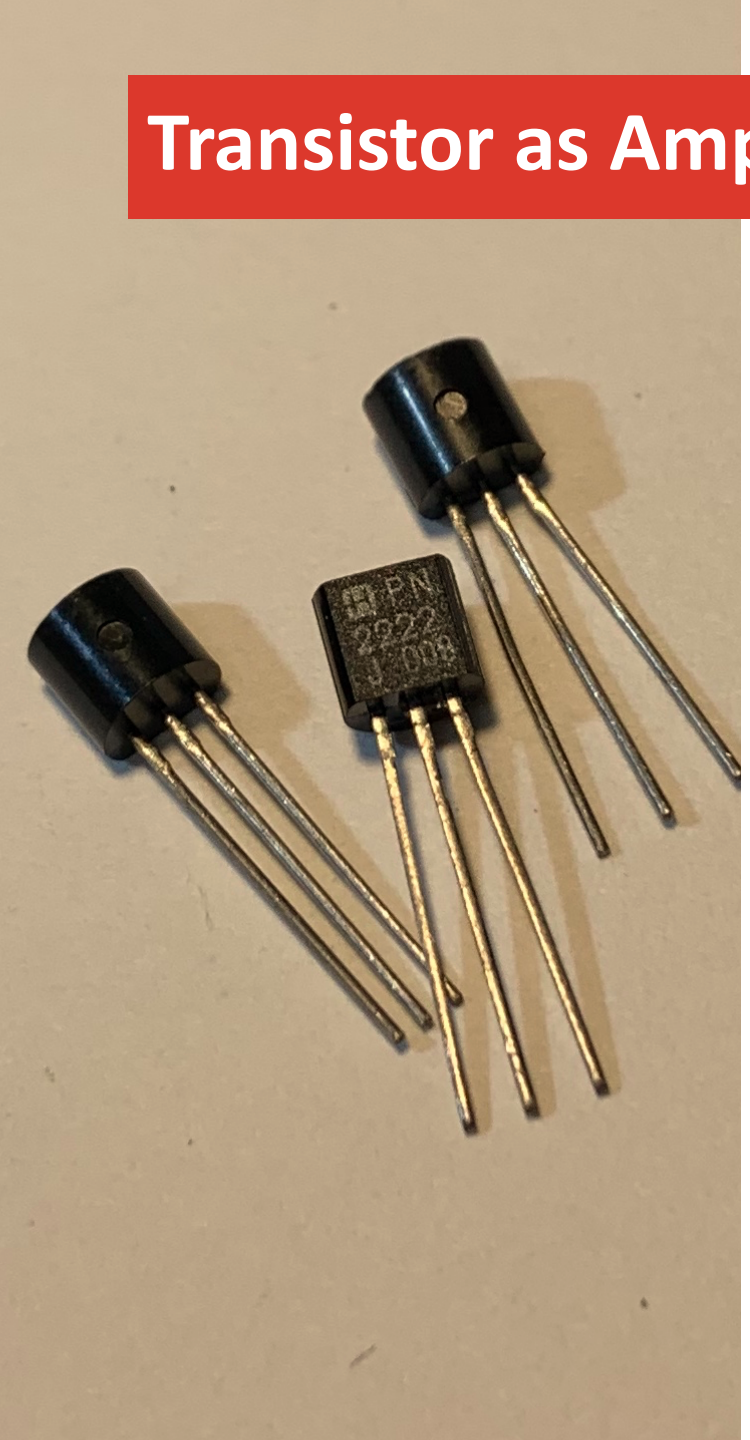
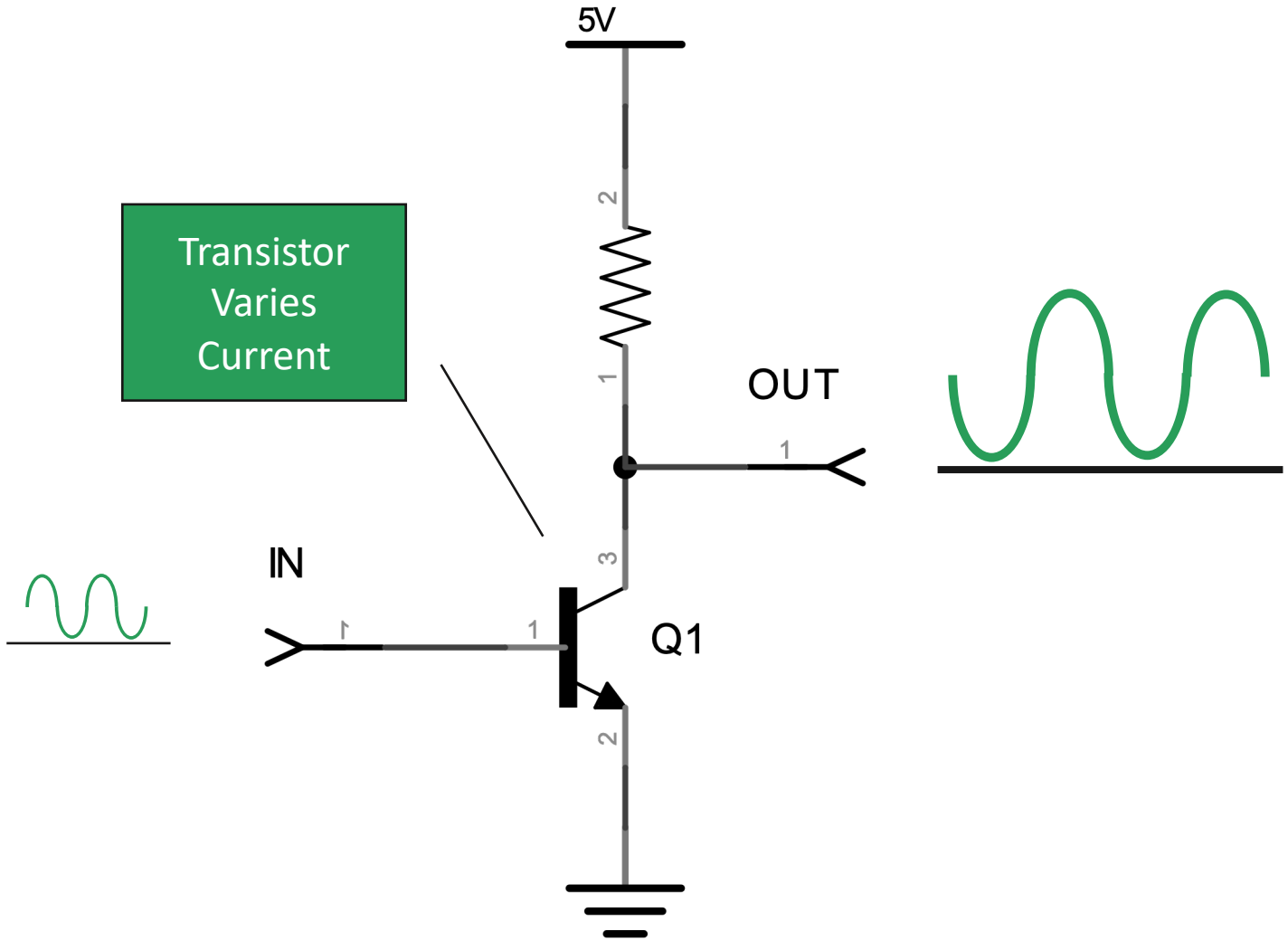
More Transistor Stuff





Transistor as Amplifier





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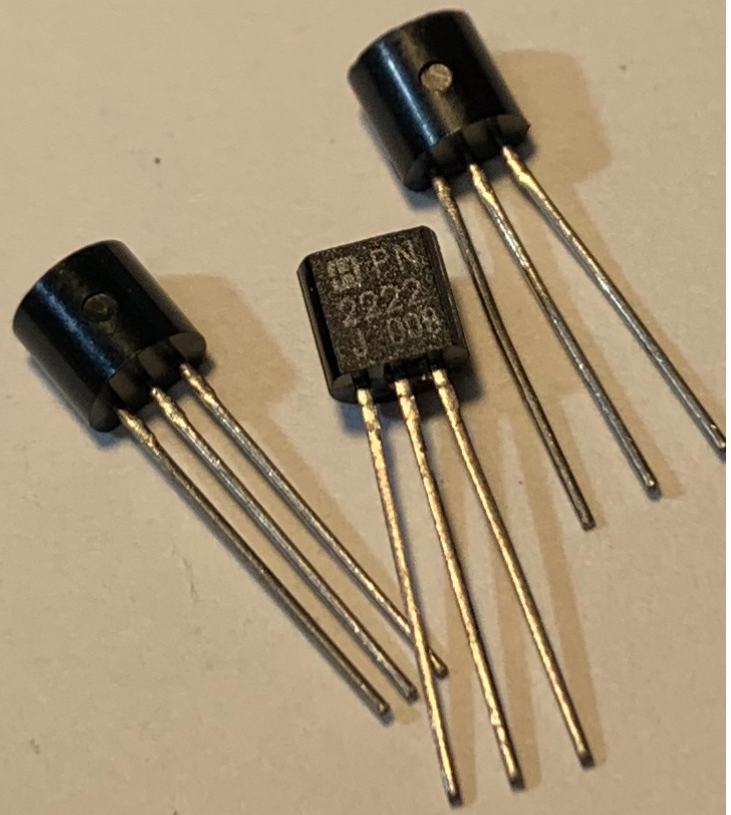
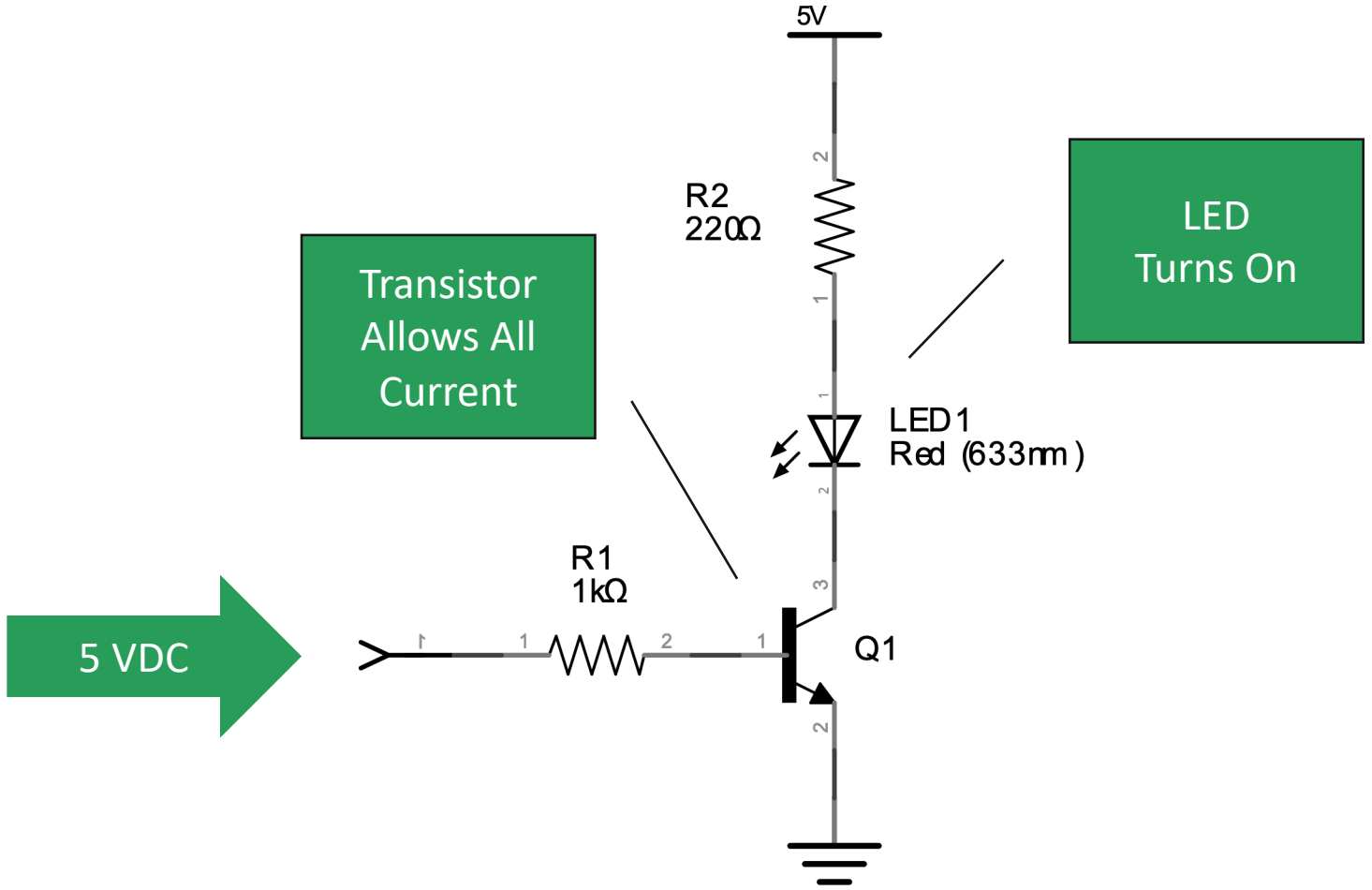
Transistor Controlling an LED





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Demo

Redis

Stores state reported from and to be sent to the Arduino.

Repolla

```
board.on('ready',
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    redis.set(
      'foo',
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  })
```
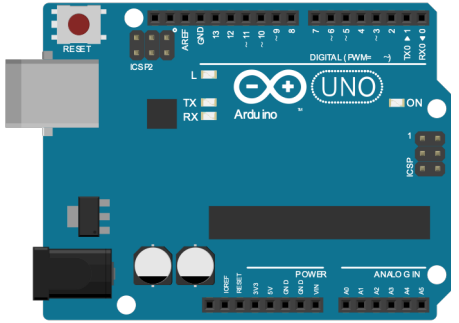

Node app that polls Redis for state changes to be given to Johnny Five and vice versa.

Johnny Five

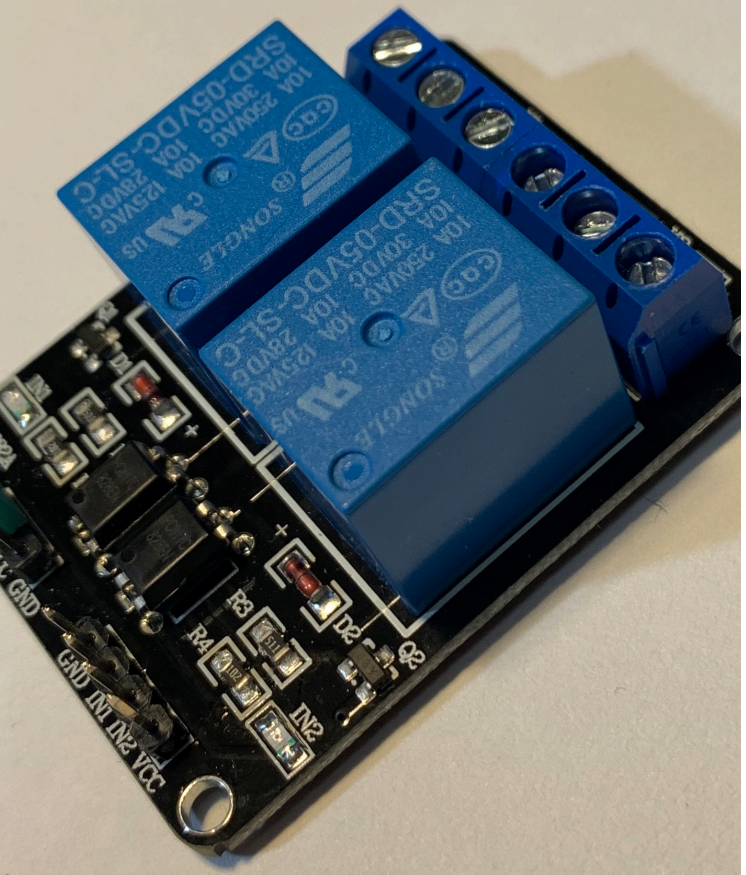
Open source node module that allows easy manipulation of an Arduino.

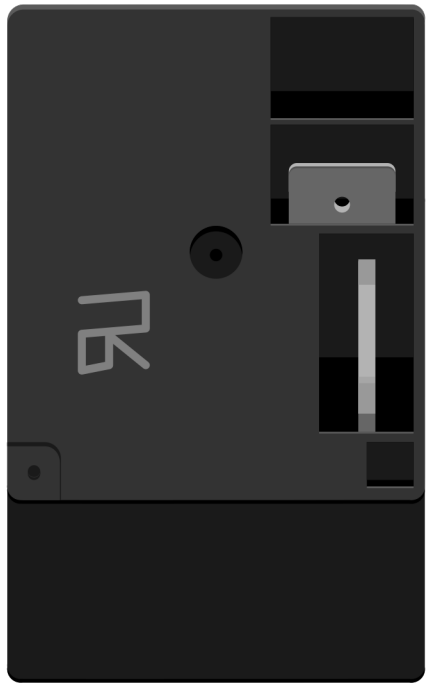
Arduino



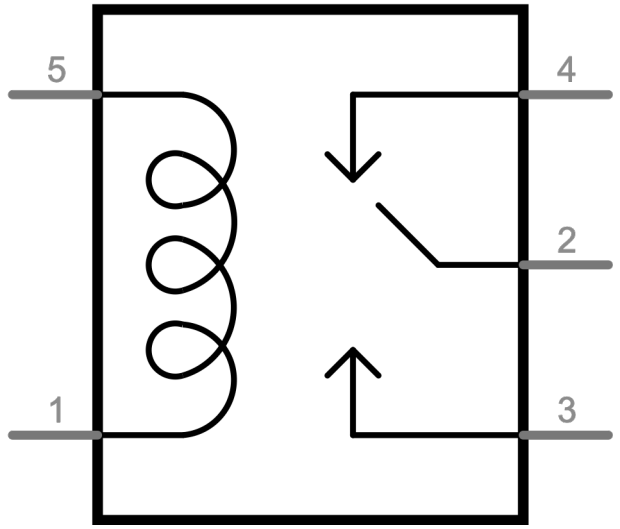
Arduino loaded with Firmata and setup for digital input and output, PWM output, and analog input.

Relays

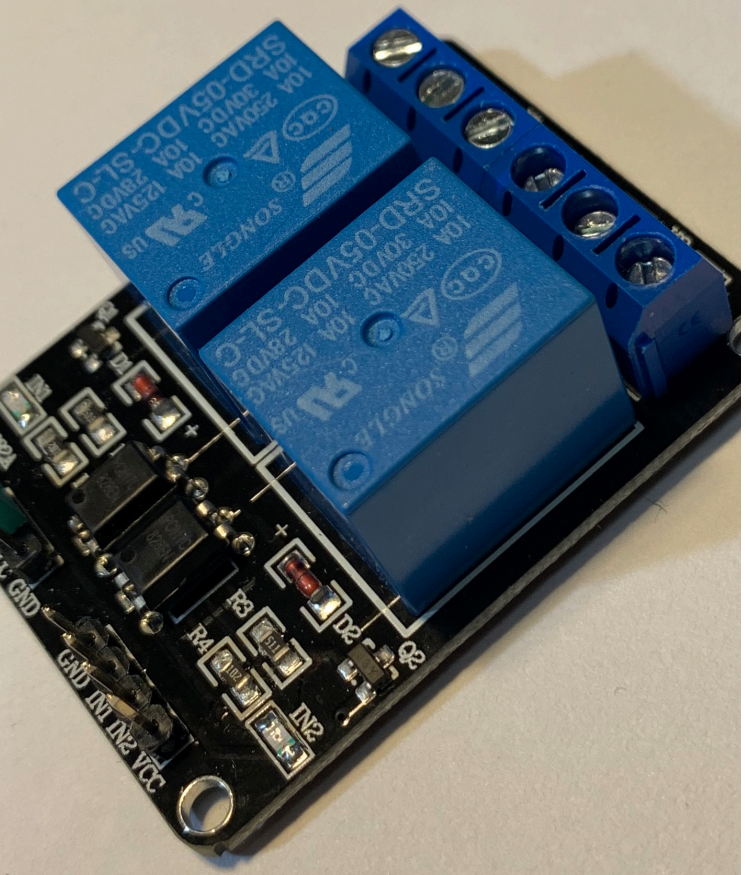




U4

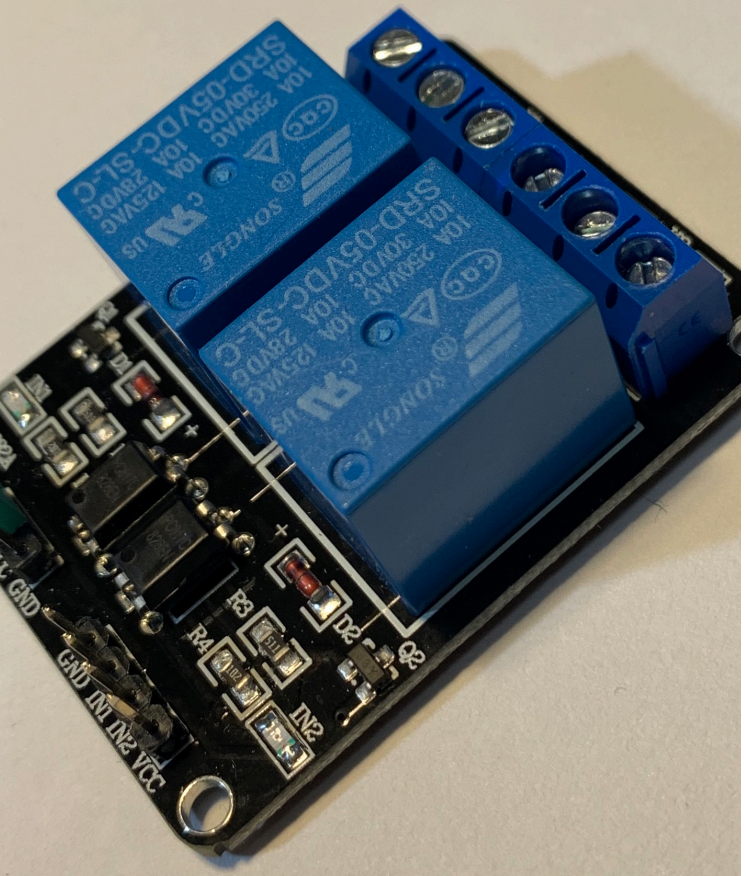


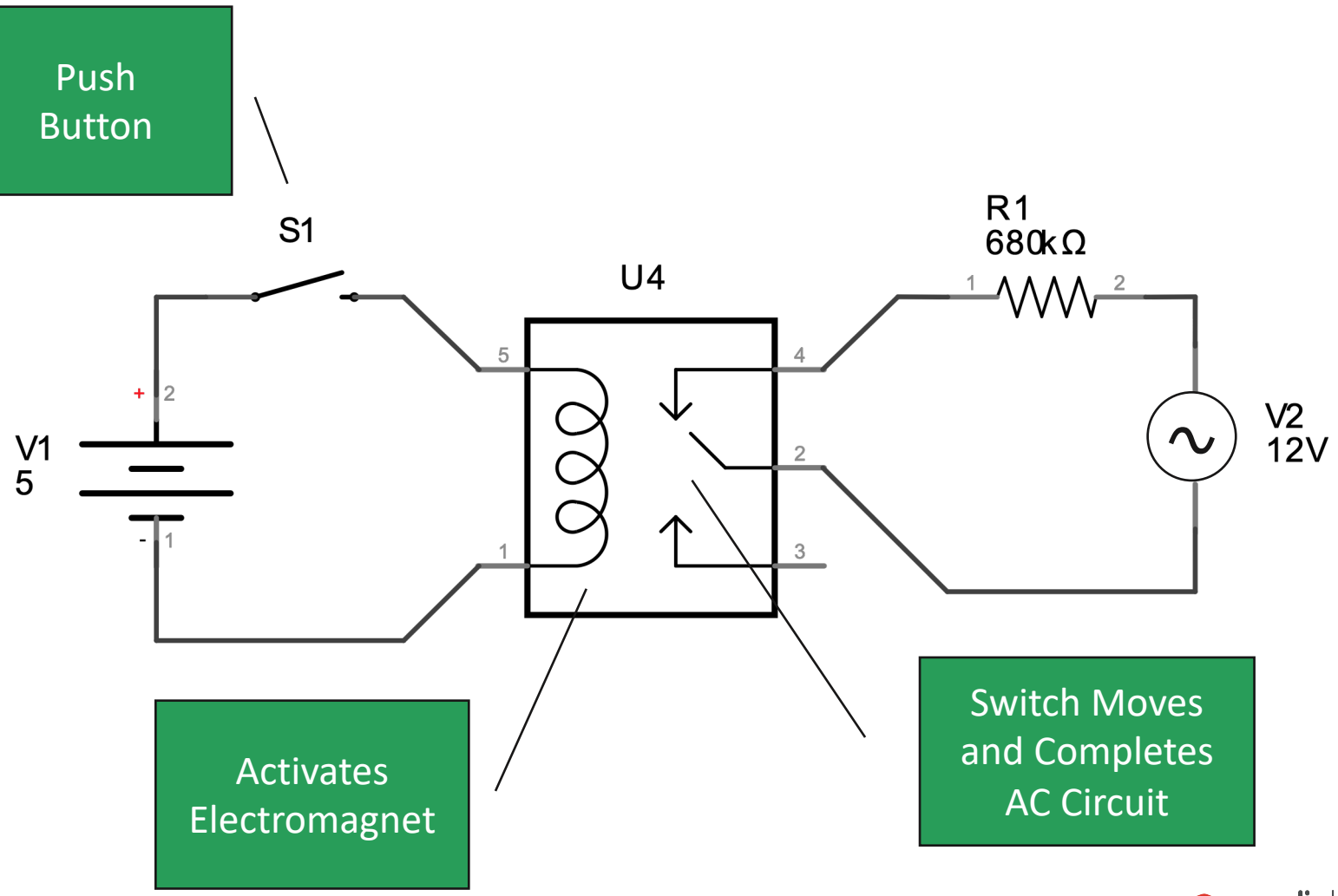
Relays



- Provides electromagnetic control of a mechanical switch
- Used to control AC circuits from DC circuits
- Used to control high voltages from low ones

Using a Relay to Control an AC Circuit





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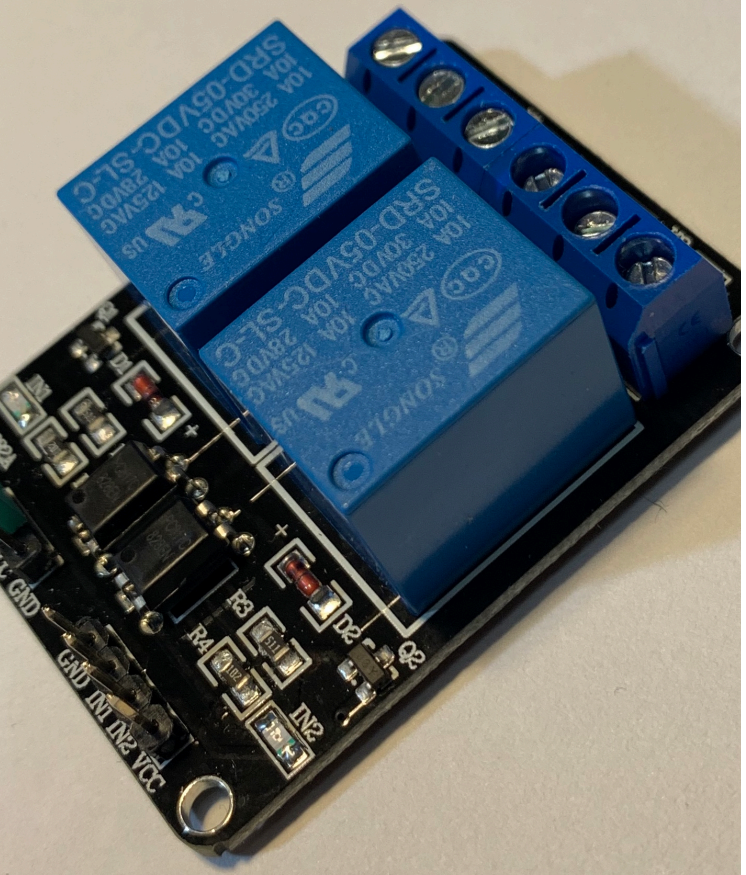
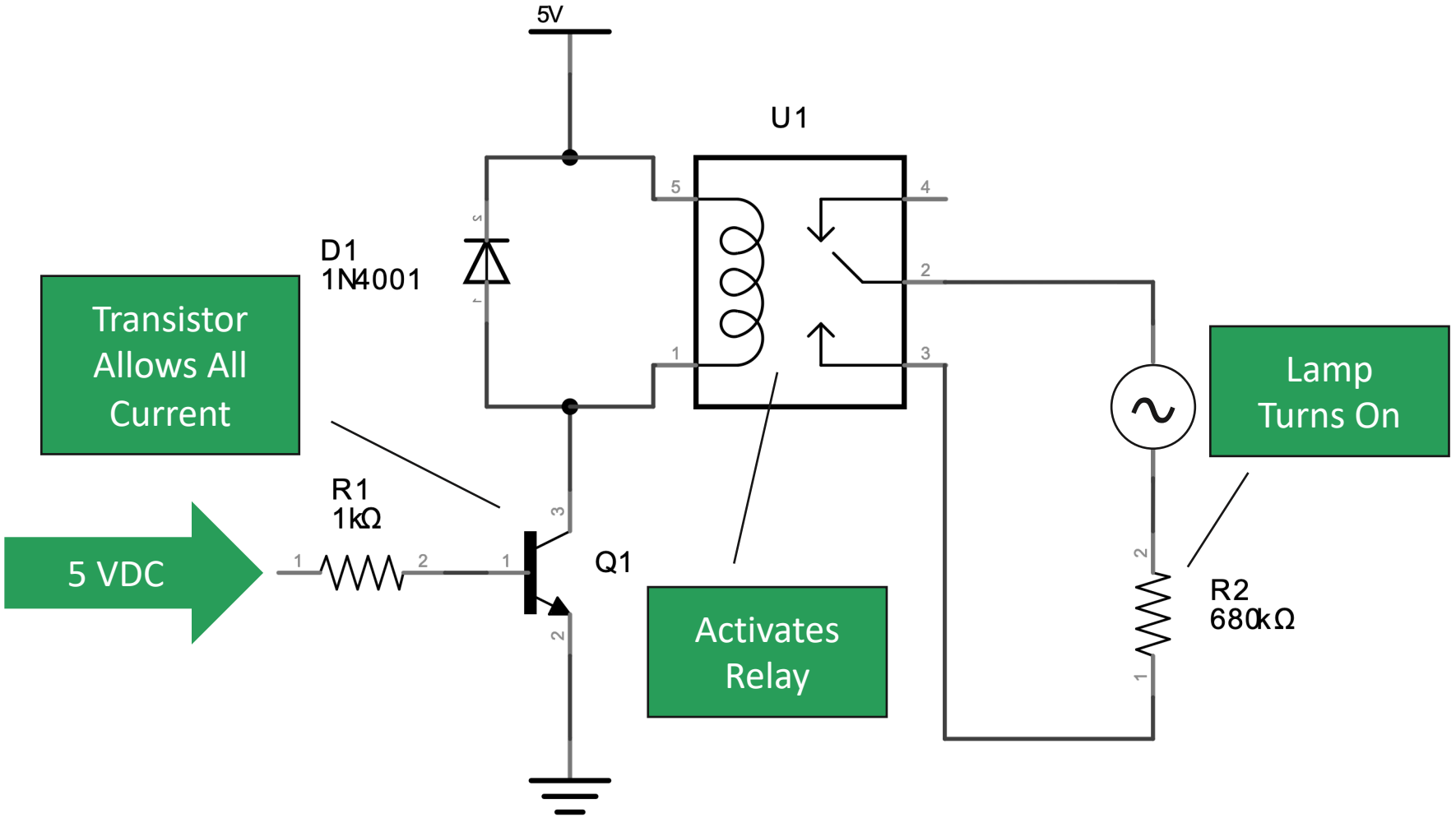
Controlling AC from a Digital Signal





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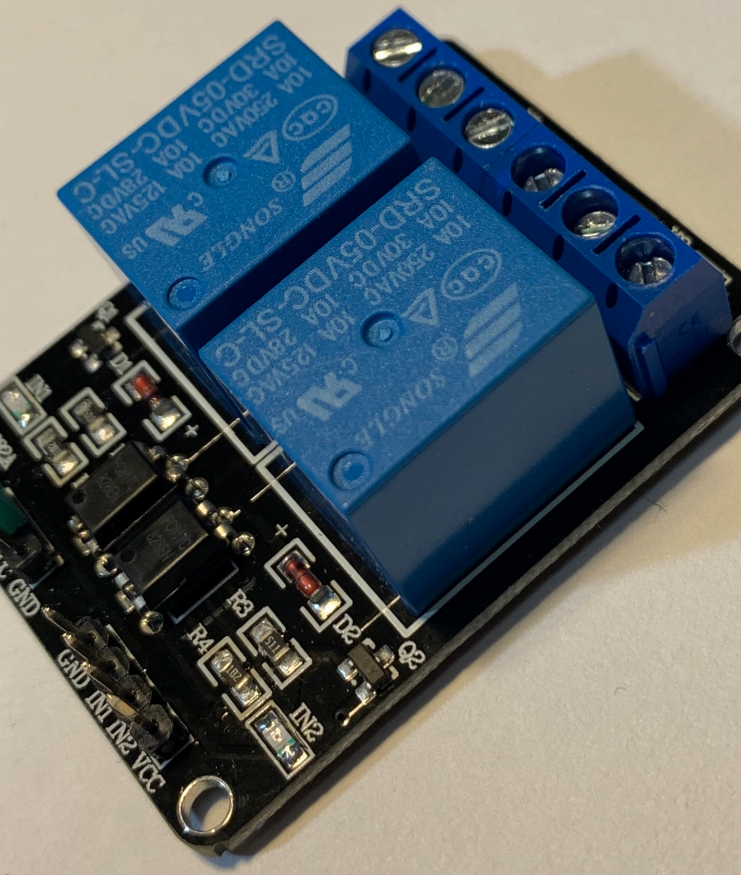
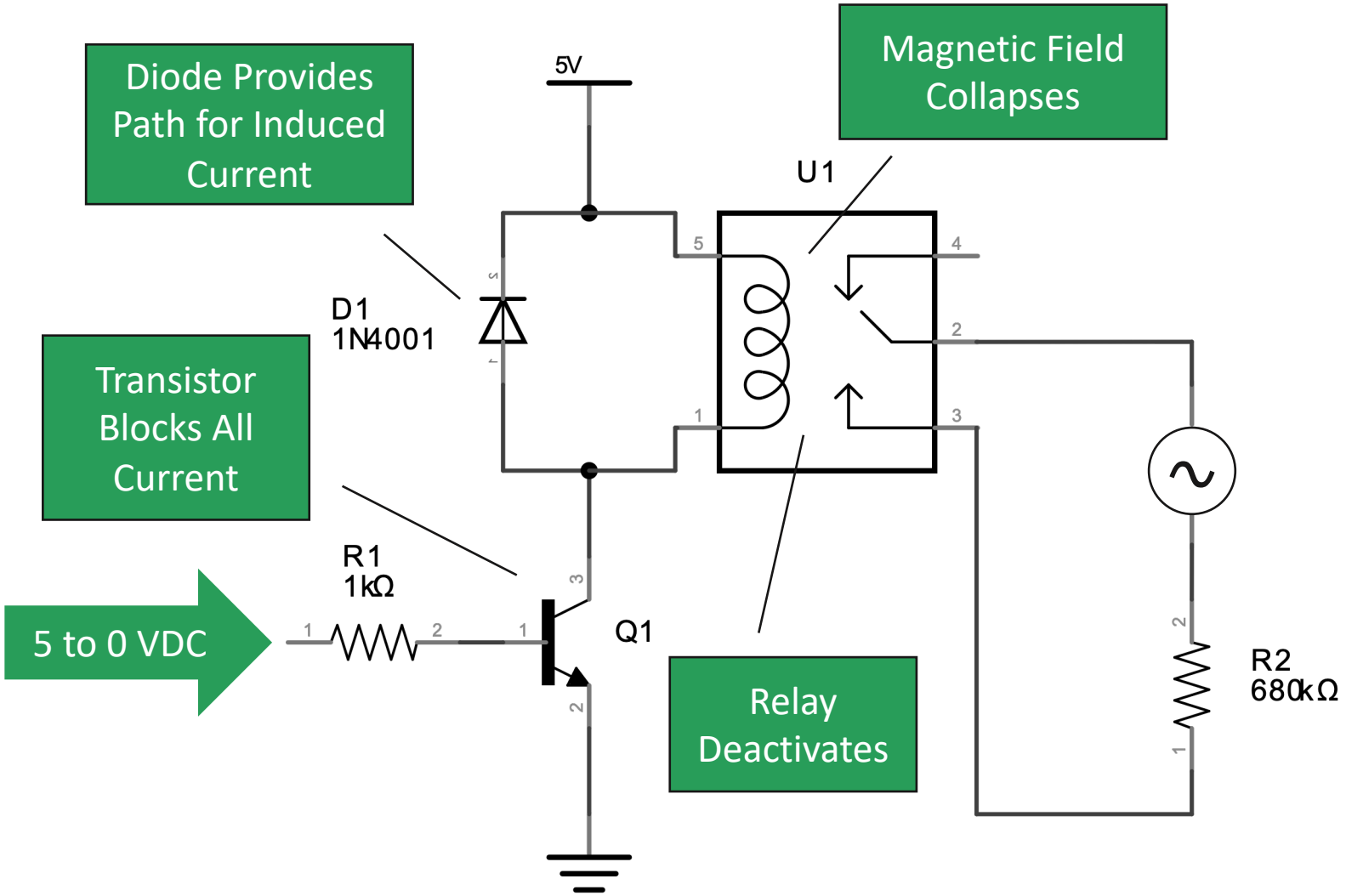
Controlling AC from a Digital Signal





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Demo

Redis

Stores state reported from and to be sent to the Arduino.

Repolla

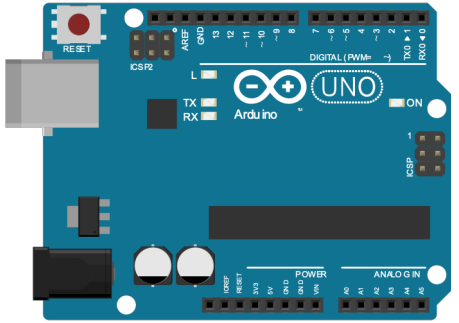
```
board.on('ready',
  () => {
    redis.set(
      'foo',
      'bar')
  })
```

Node app that polls Redis for state changes to be given to Johnny Five and vice versa.

Johnny Five

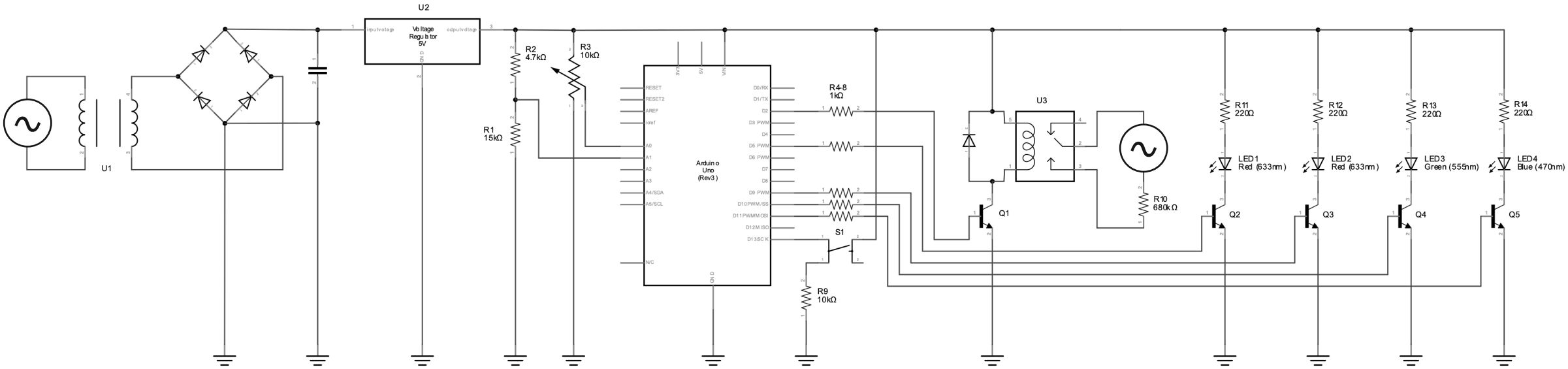
Open source node module that allows easy manipulation of an Arduino.

Arduino



Arduino loaded with Firmata and setup for digital input and output, PWM output, and analog input.

Schematic



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Thanks!

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