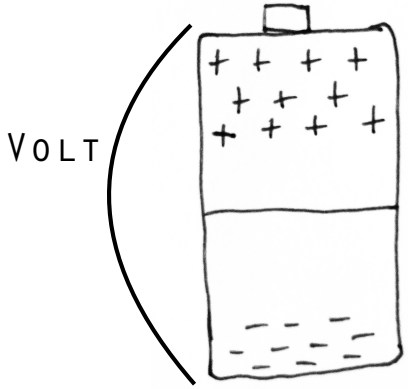
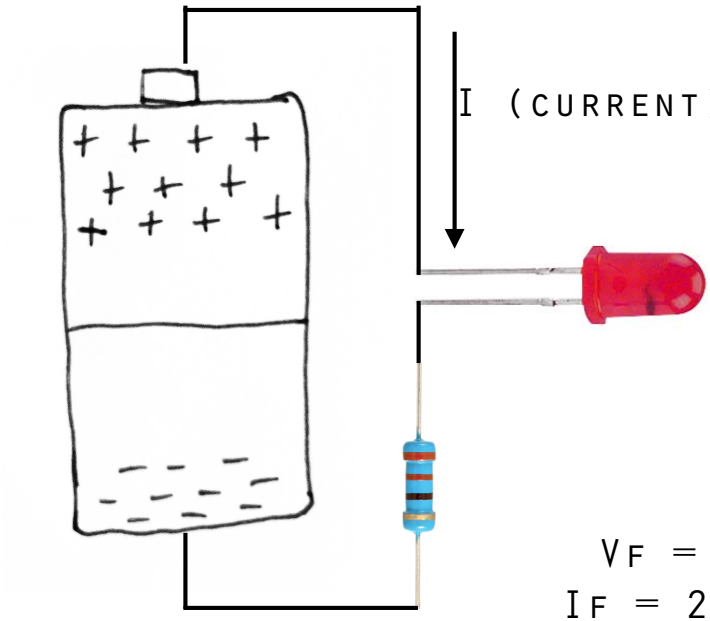
Electronics 1

Electronics for Interactive Media Design

Emma Pareschi

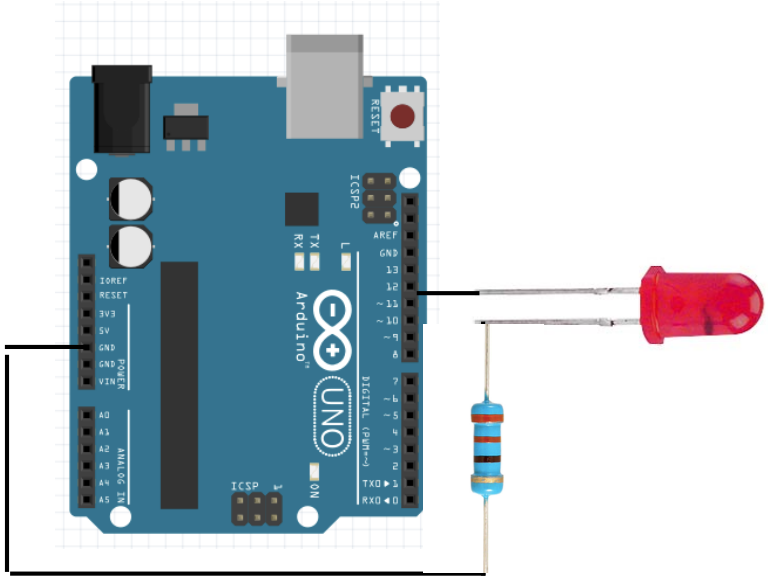
Power Consumption





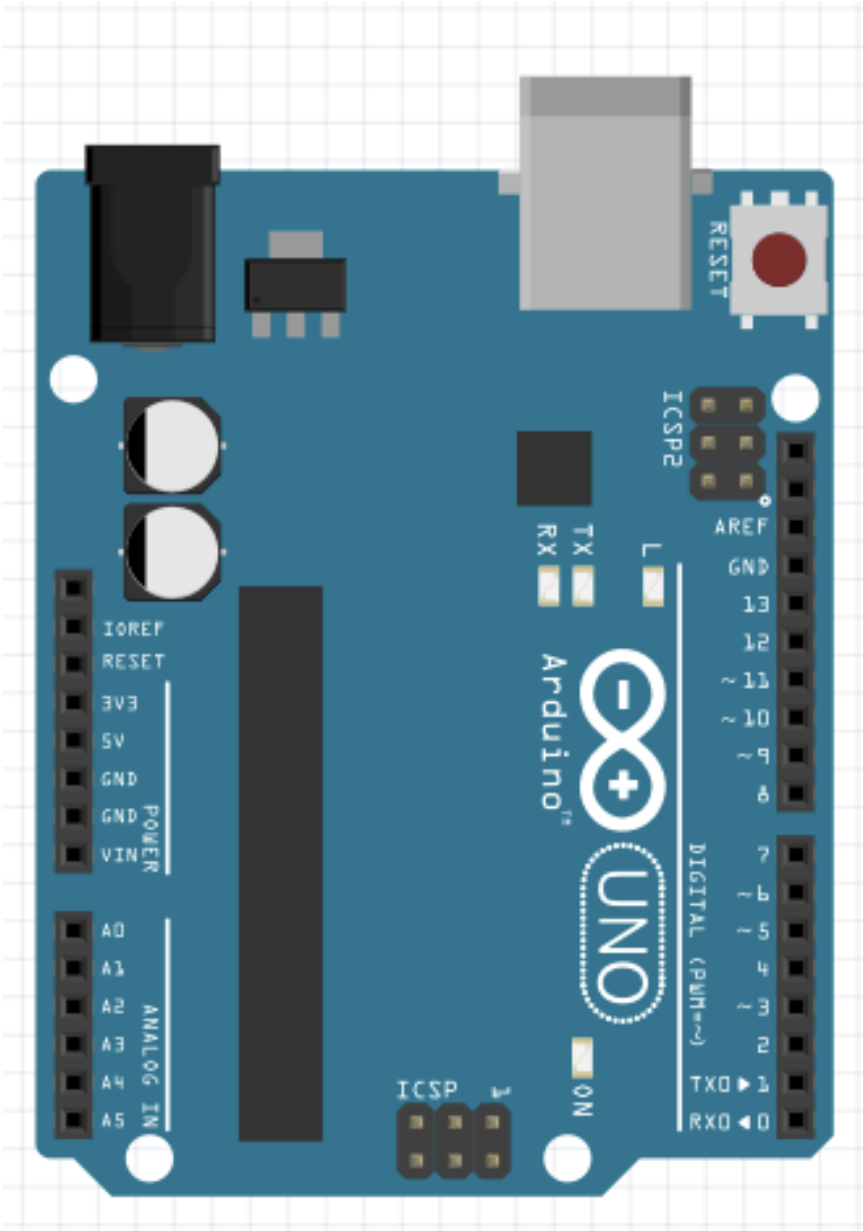
$V_F = 2V$

$I_F = 20\ mA$



Power Capability of Arduino Uno

Pin 5V:
- Powered by USB: max 500mA
- Powered by external battery or power supply: max 1A

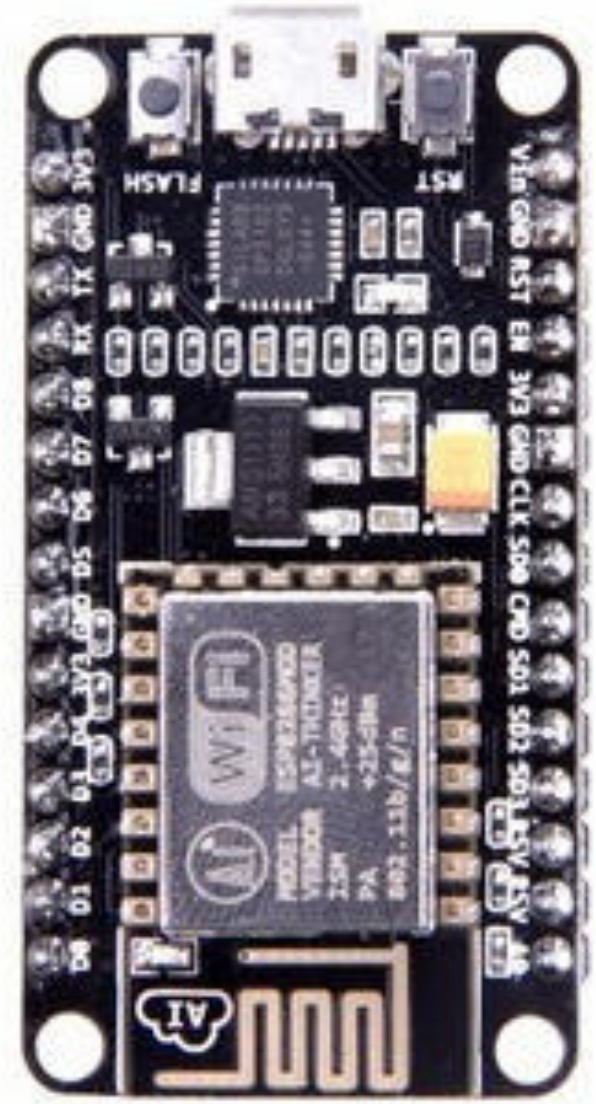


I/O pins: max 40 mA

Sum of all input/output pins combined (but NOT including the “5V” pin): 200mA

NodeMCU v2 - Power Pin

I/O pins: max 12 mA



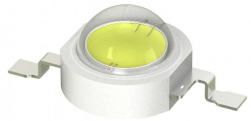
Pin Vin:
- Powered by USB: max 500mA

Pin 3V3:
- Powered by USB: max 500mA
- Powered by external battery or power supply: max 1A

Low Power / High Power

Vf: 2V
If: max 20mA

Power: Vf * If
P = 0,04W



Vf: 3.2-3.4V
If: max 350mA

Power: Vf * If
P = 1,05W

Can you drive it with Arduino Uno?
Can you drive it with NodeMCU?

Power Devices: Motors

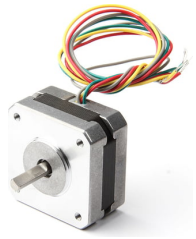
Servo Motors

9g

35Kg

DC Motors

Stepper Motors

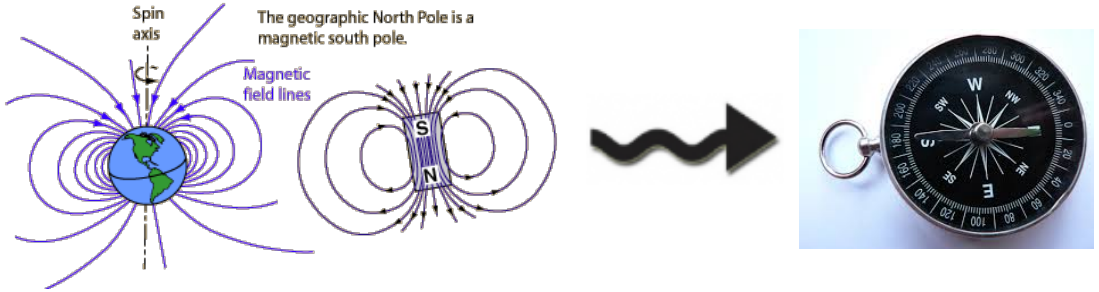


Power supply: 3V-6V
Current > 500mA

What makes Motors move?

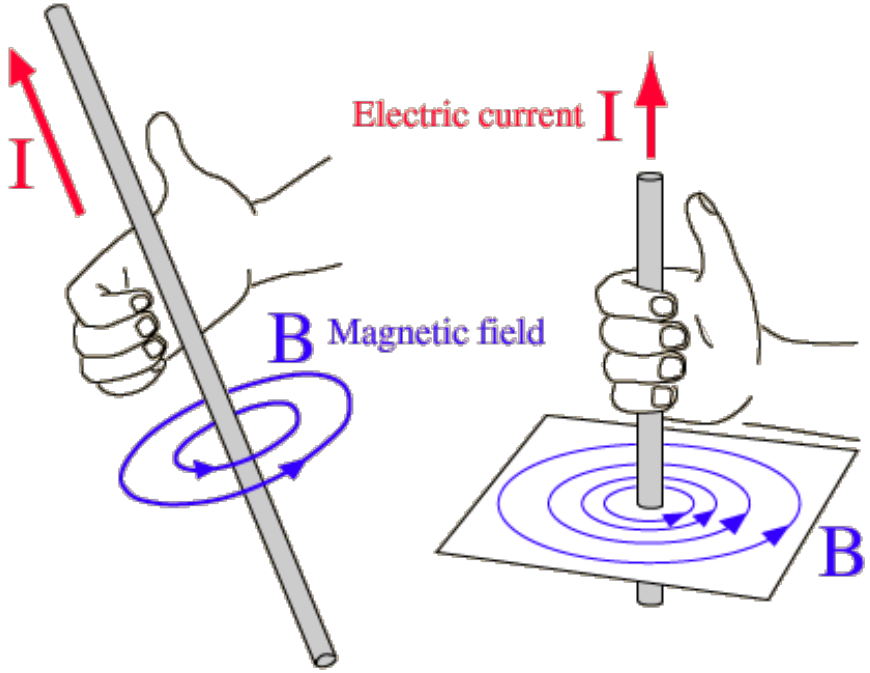
Magnetic Field

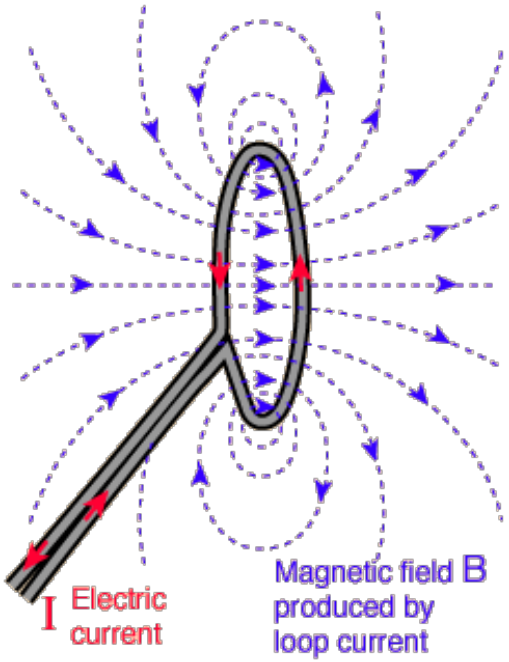
Motion



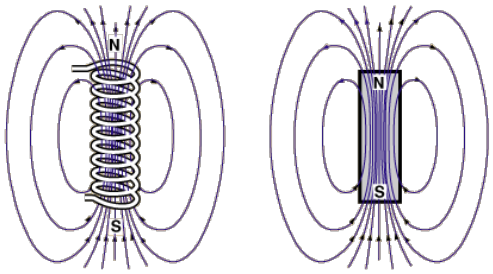
Electromagnetism

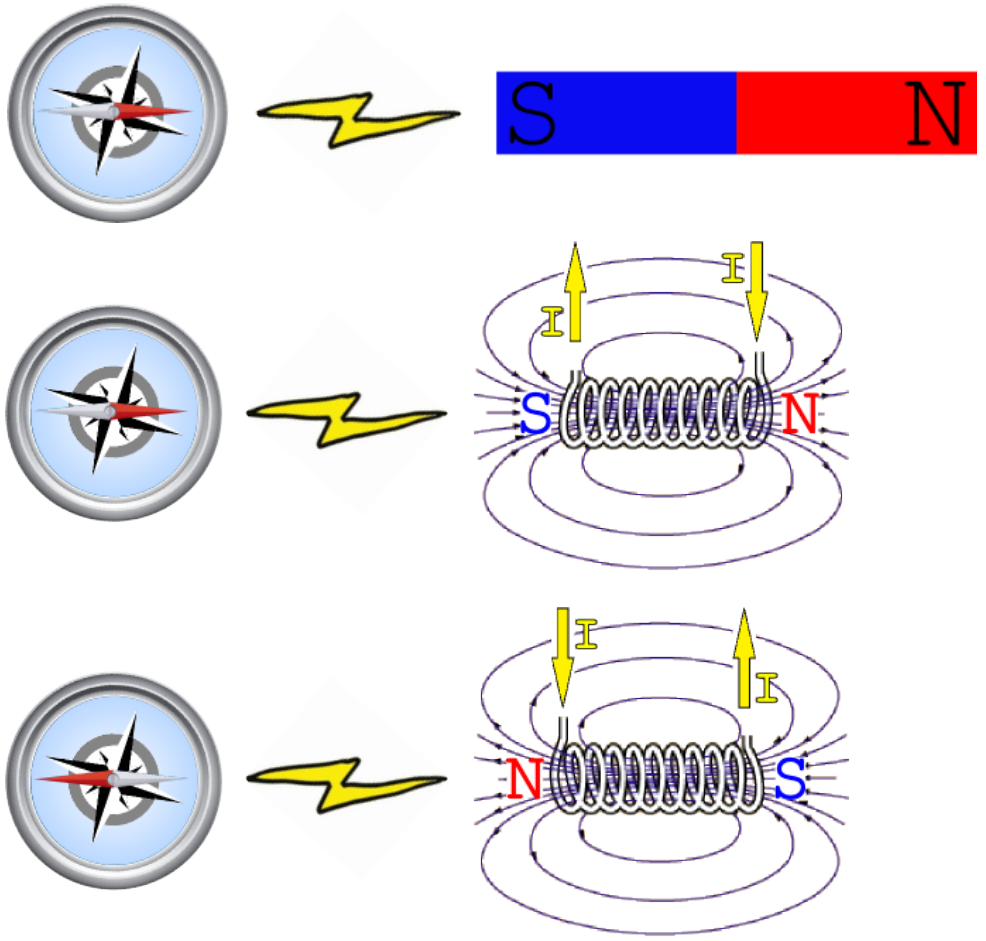
To create a magnet or magnetic field: current through a wire.





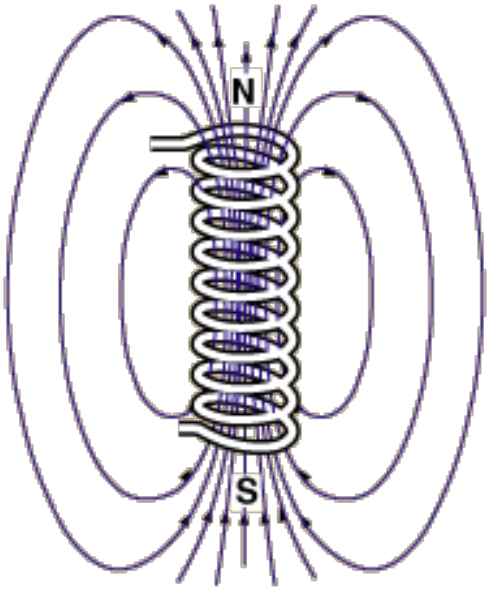
Electromagnet

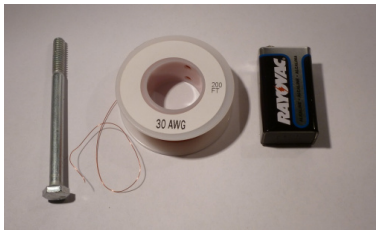


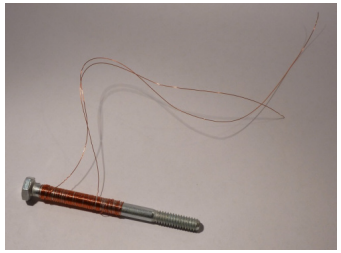


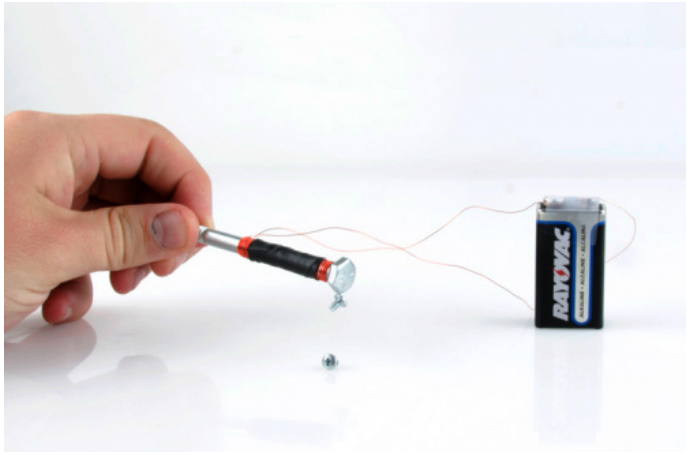
A Solenoid with current = Magnet!!!!

Electromagnet



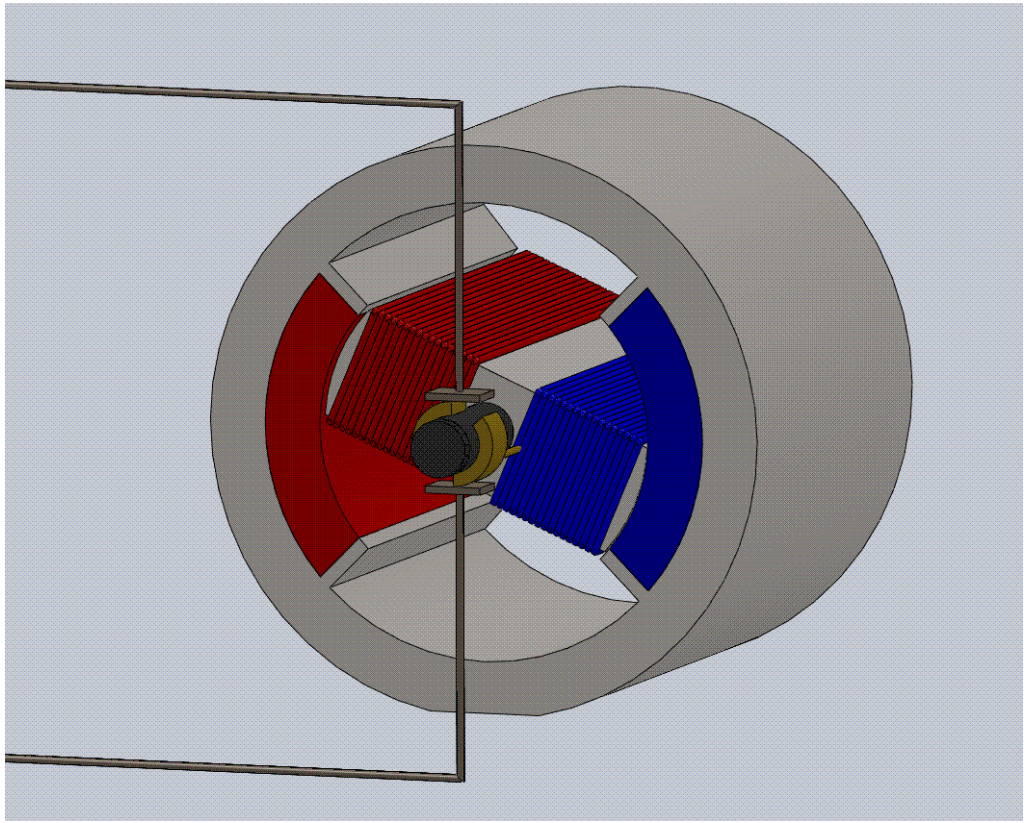


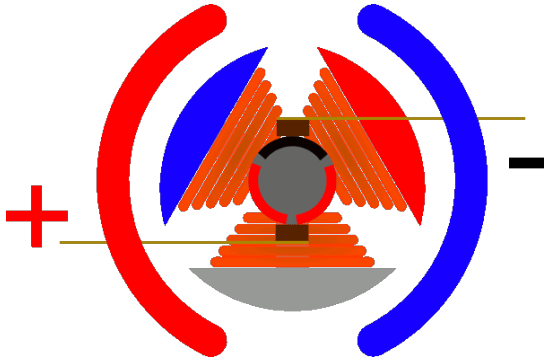




DC Brushed Motor

Current per solenoids: 70mA





https://nationalmaglab.org/education/magnet-academy/watch-play/interactive/dc-motor

High Power drivers devices: TRANSISTORS

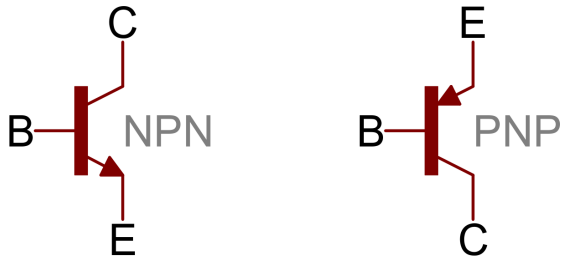
The transistors are active devices and the basic blocks of any electronics circuit.

—> Amplifier

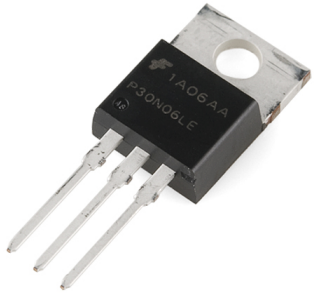
—> switch controlled by a voltage

Bipolar

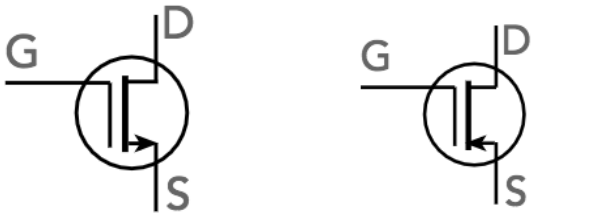
Two types



Mosfet

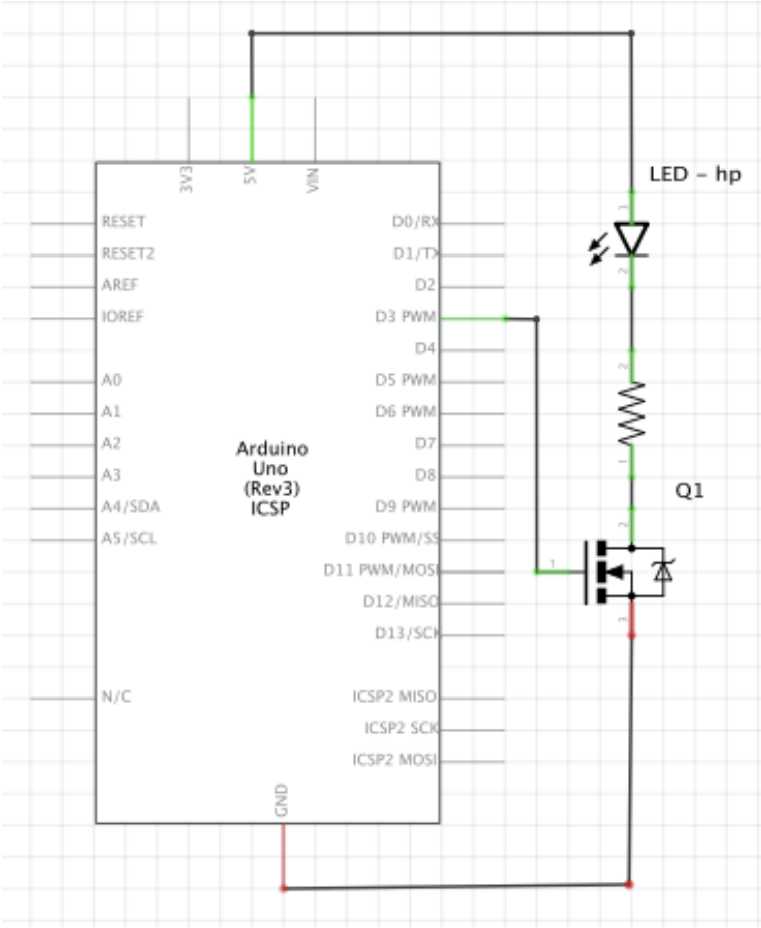


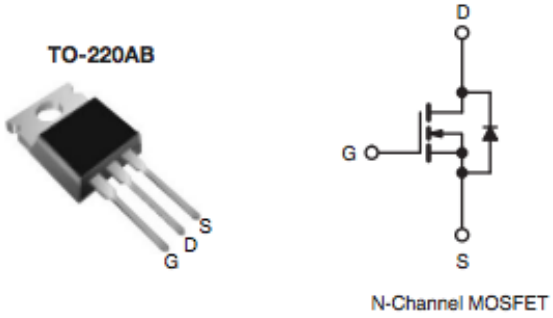
Two types



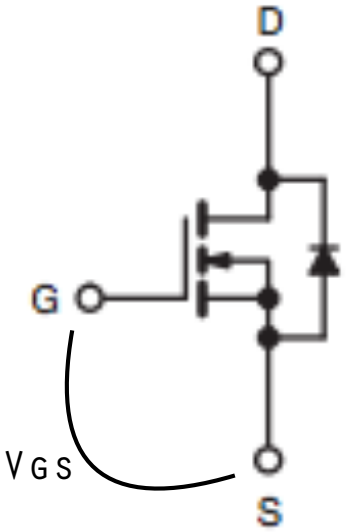
N-channel P-channel

MOSFET N-CHANNEL

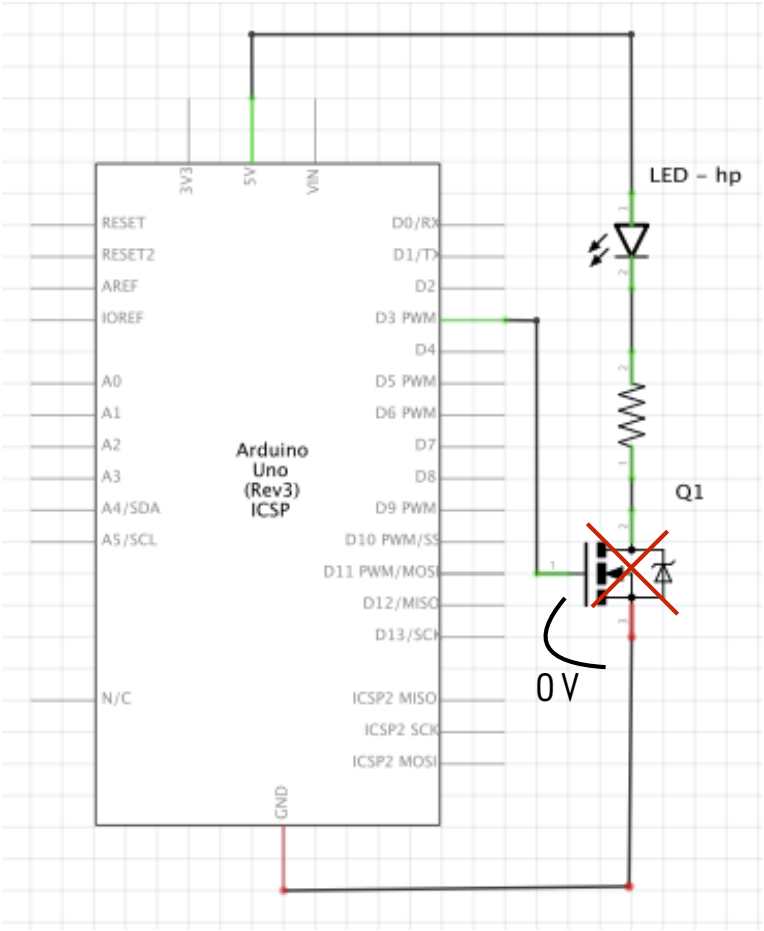


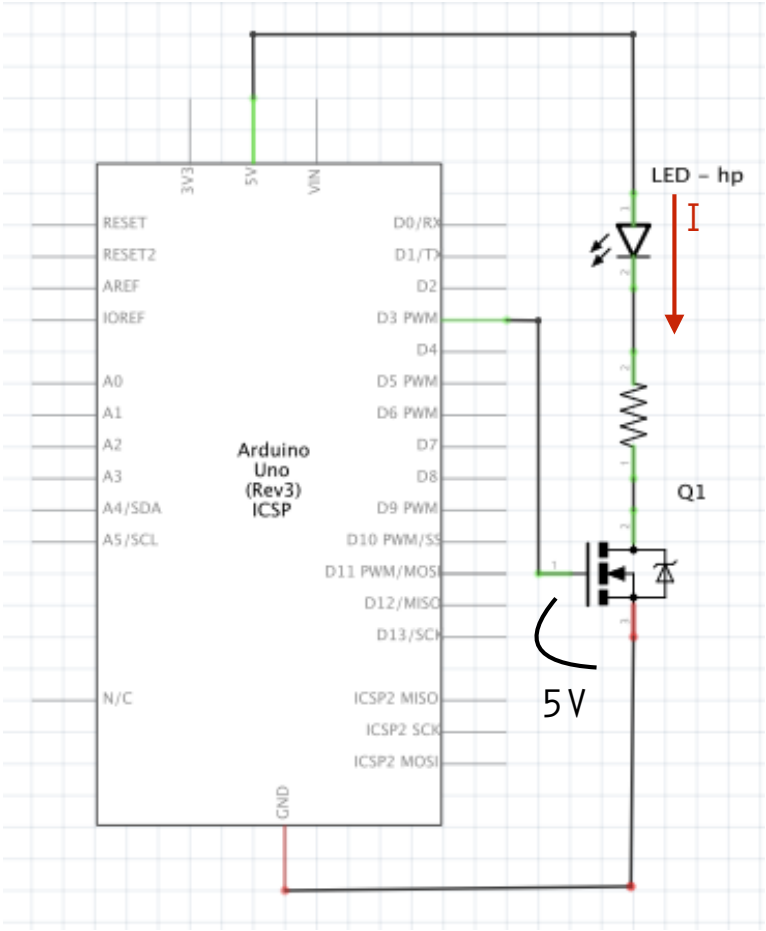


THREE TERMINALS:
SOURCE
GATE
DRAIN



MOSFET N-CHANNEL

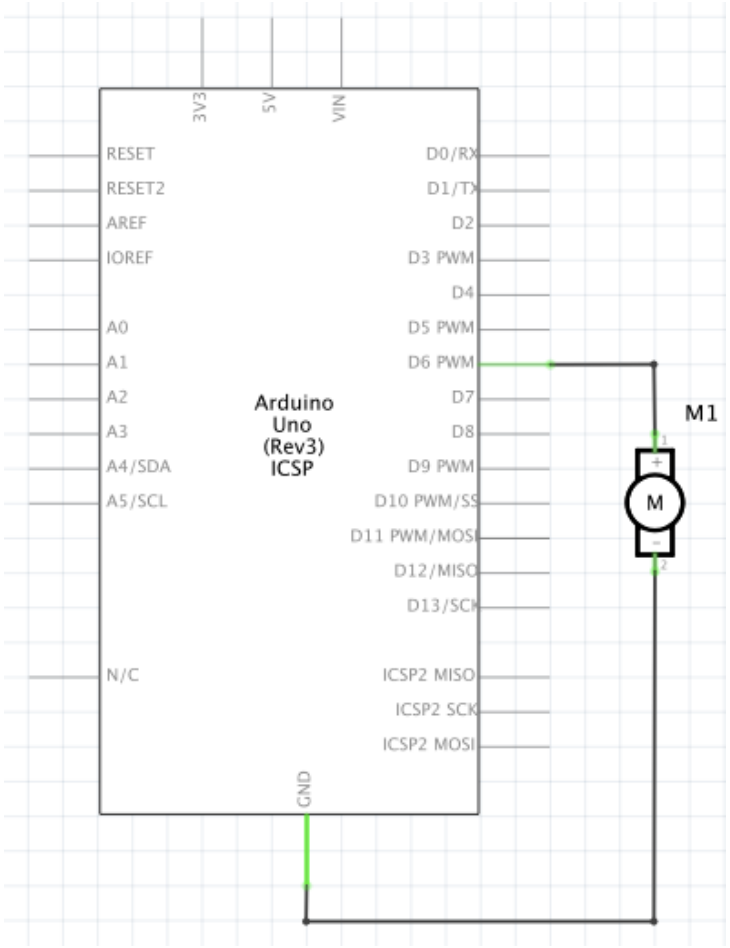


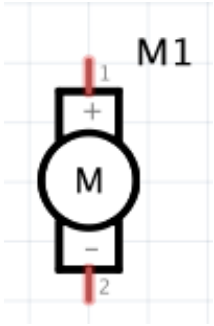


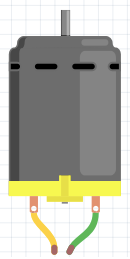
IF VGS = 0V
=> OPEN LOOP, NO CURRENT

IF VGS > 2V
=> CLOSE LOOP, CURRENT

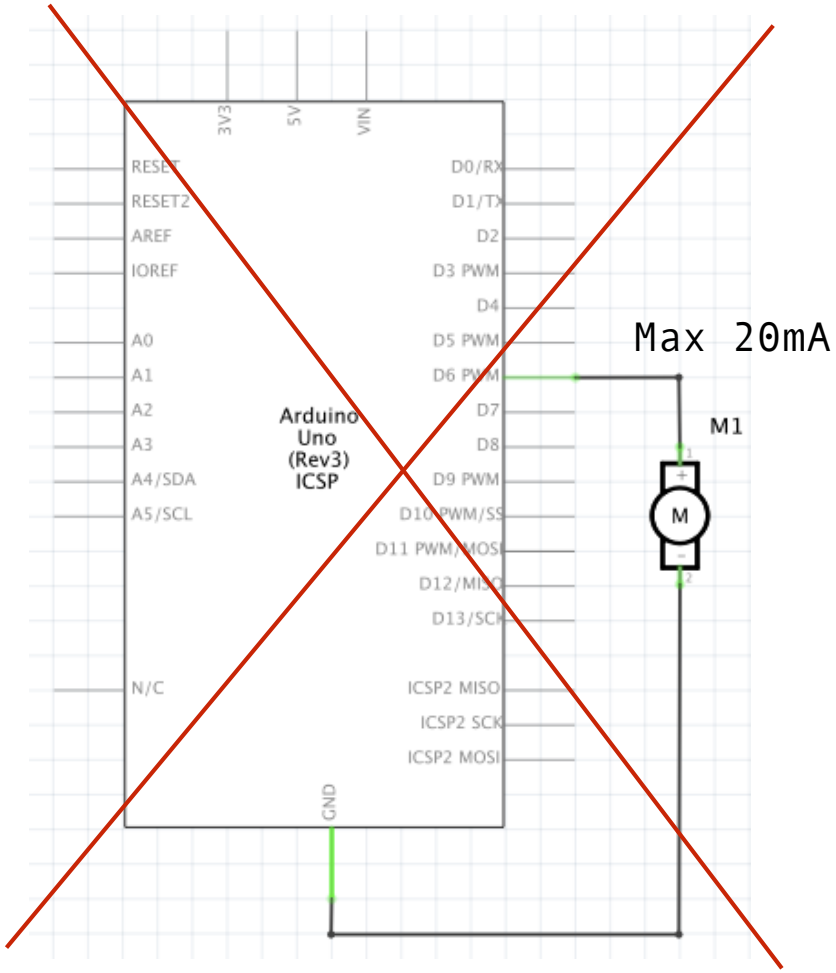
DC Motor (brushed) - Schematic - WRONG

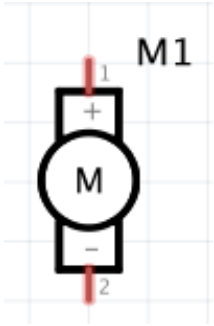


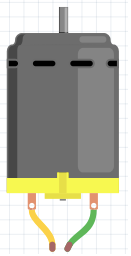




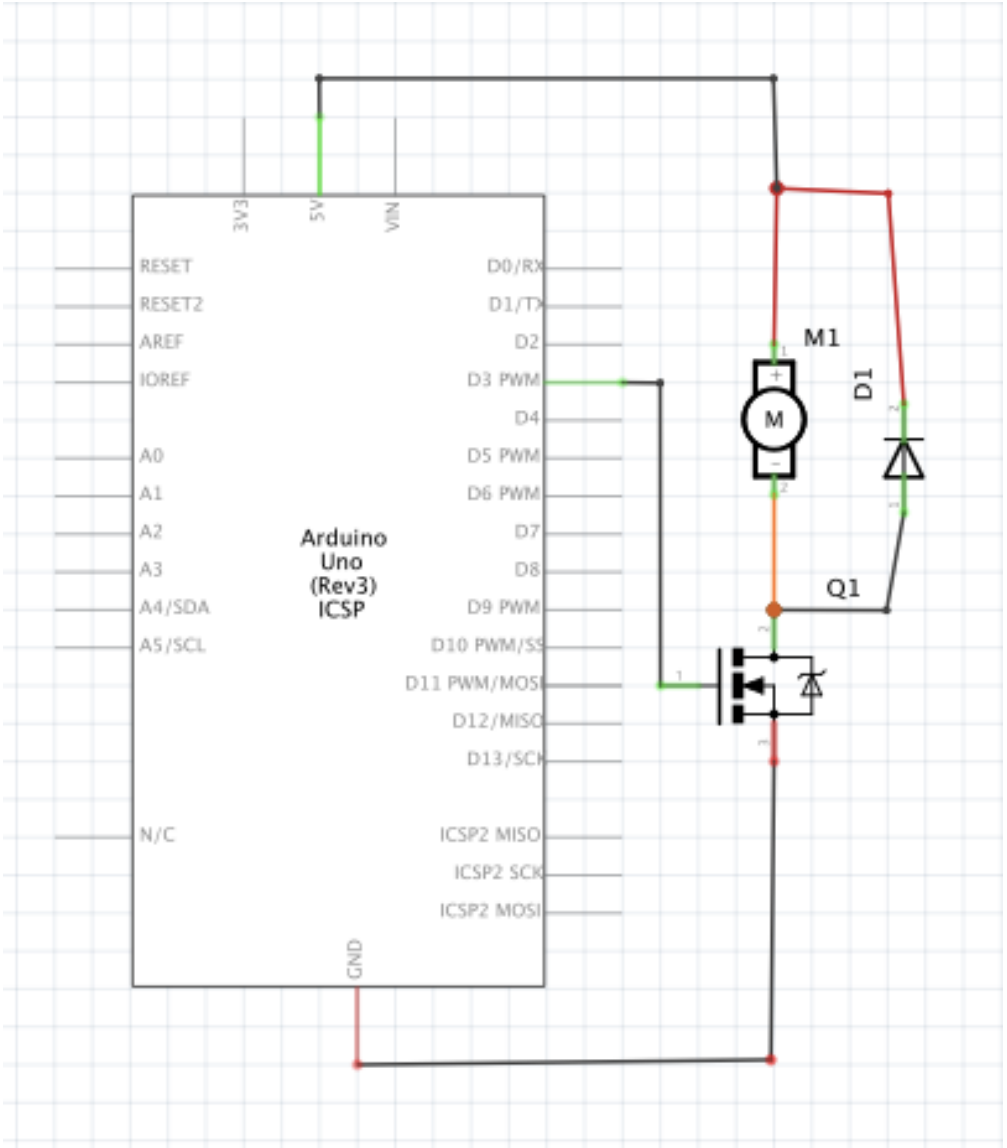
DC Motor (brushed) - Schematic - WRONG







DC Motor (brushed) - Schematic

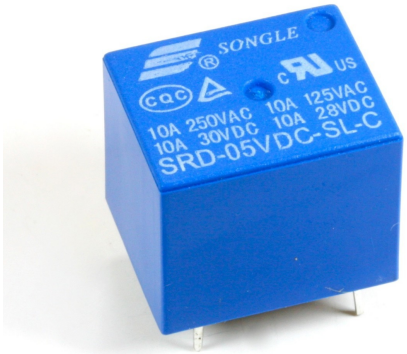


Diode

Relay - 220V

A relay is an electromagnetic switch operated by a relatively small electric current that can turn on or off a much larger electric current. The heart of a relay is an electromagnet (a coil of wire that becomes a temporary magnet when electricity flows through it). You can think of a relay as a kind of electric lever: switch it on with a tiny current and it switches on ("leverages") another appliance using a much bigger current.

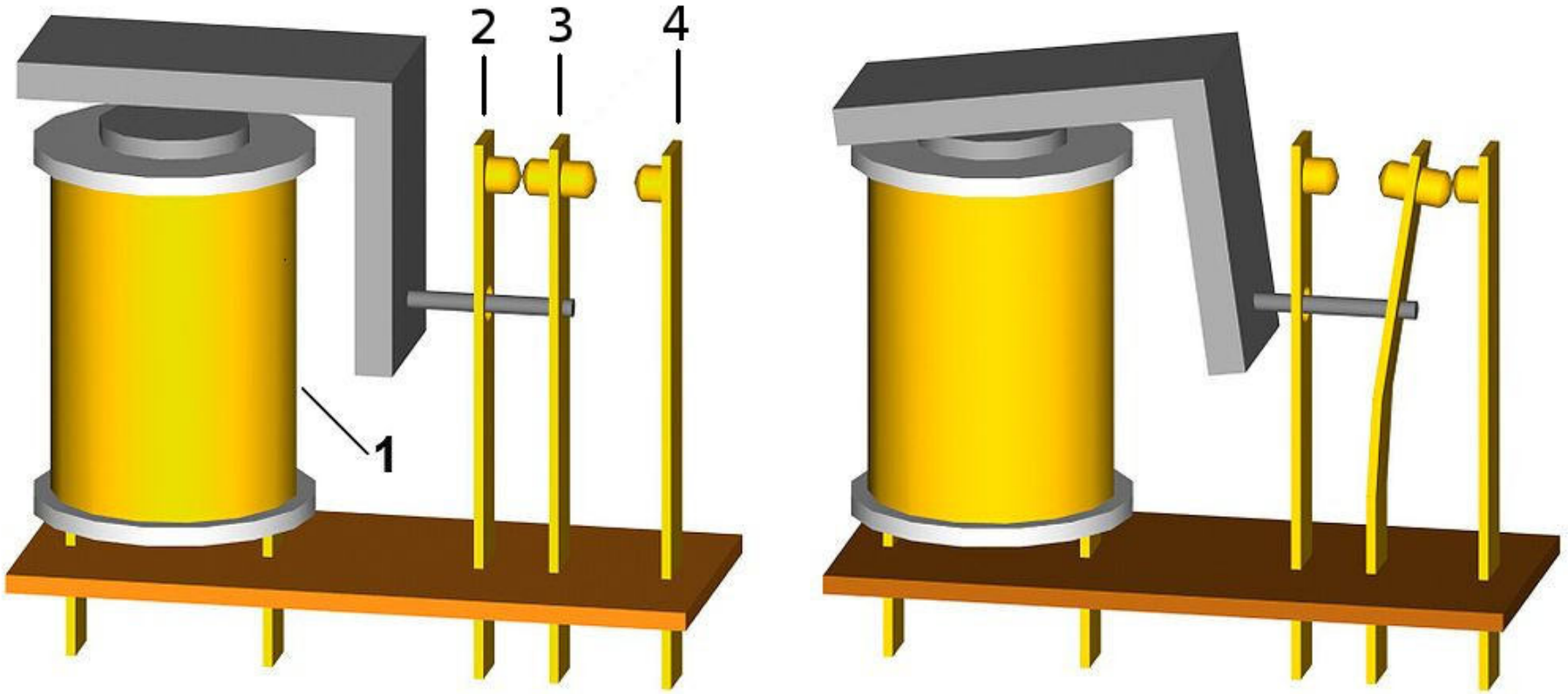
Mini SPDT Relay
12V 10A 250V



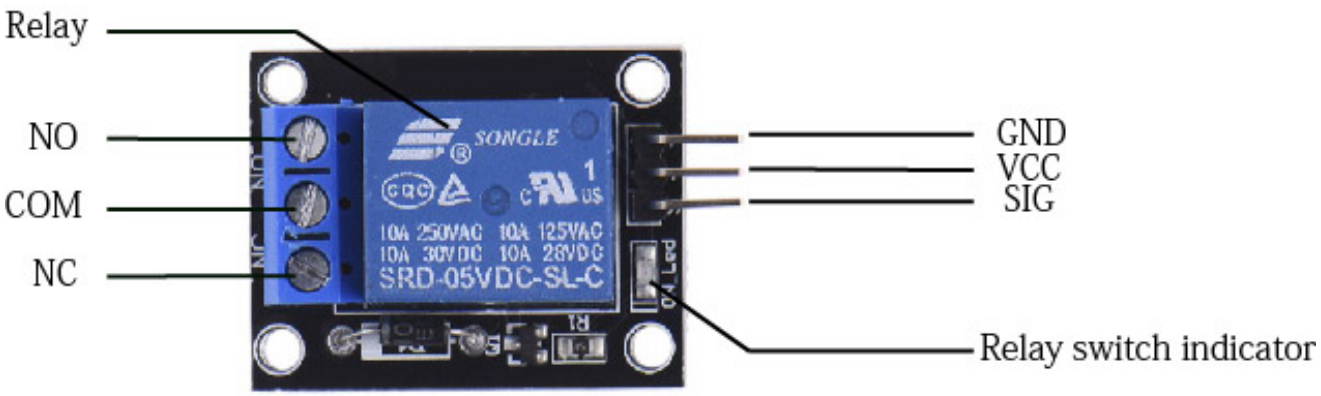
Mini SPDT Relay
5V 10A 250V

Mini SPDT Relay
24V 10A 250V

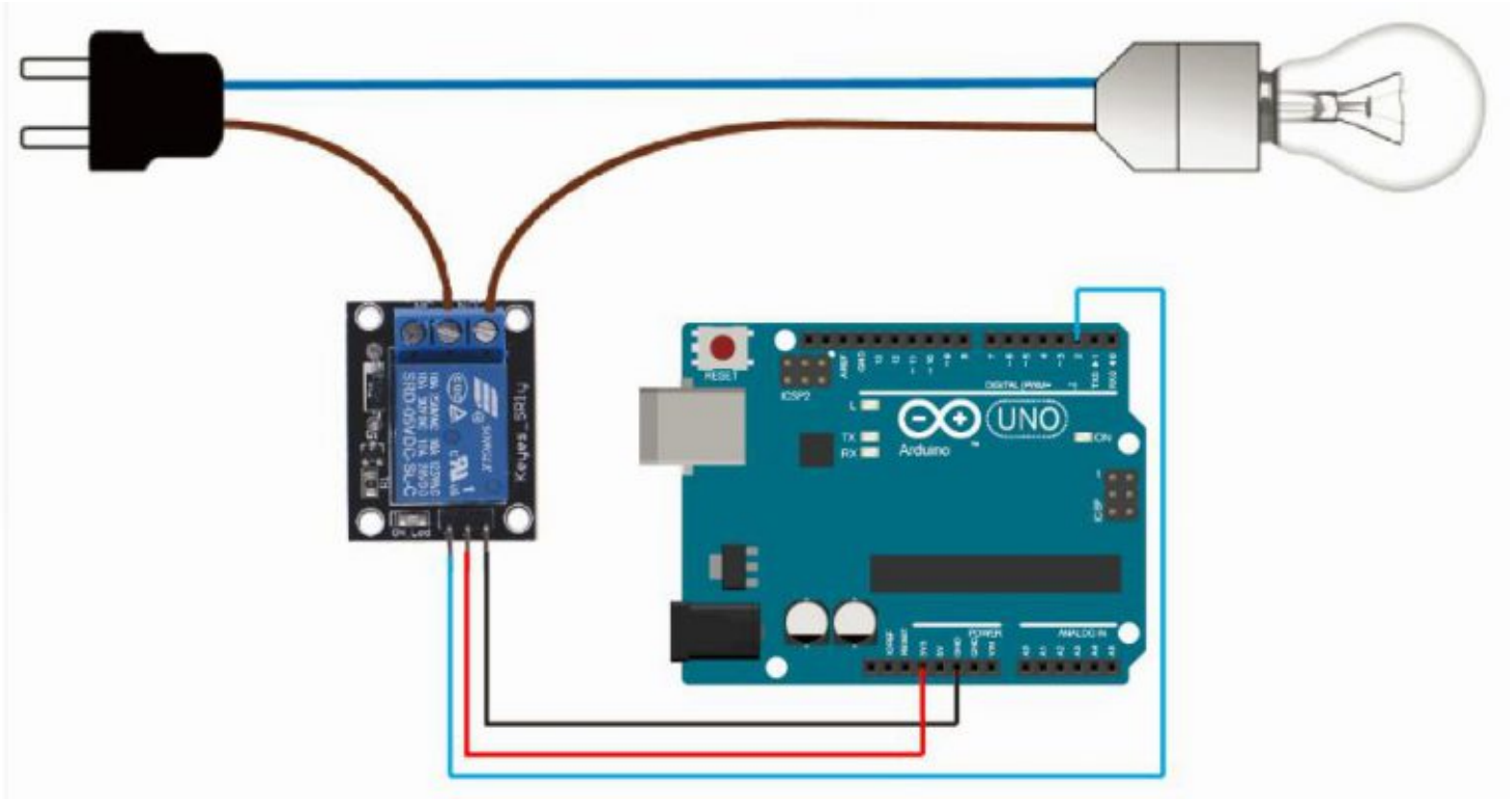
Relay - inside



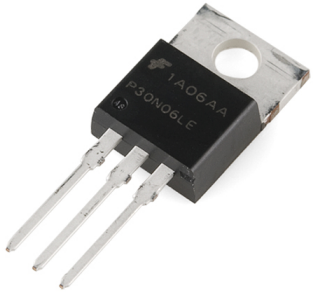
Relay - breakout board



Relay



Mosfet vs Relay



Analog and Digital

Only DC Power (400V)

Digital

DC (24V) and AC (220V)

Assignment

Use NodeMCU to control a high power led and a motor.
Preparation: solder the wires to the DC Motor

Ex 1:
Control the High Power led with the MOSFET N-channel. Fade the light of the led using “analogWrite” command and “for” loop. Use the same circuit and code to control the motor.

Ex 2:
Control the dc motor using the relay. Using digital write command. Use the same circuit and code to control the High Power Led.

Extra:
Use one of the circuit of the previous exercise and send to your thing speak account the information of when the output device is on/off.

Document ex1, ex2 (and extra):
Document the process in your blog:
—> schematic of the circuit
—> code (readable)
—> video