PHYSICAL COMPUTING

WEEK 04

Inductive Load

Anything with a coil and a magnet

Inductive vs Resistive loads

1) Inductive loads use magnetic fields. Examples - Motors, solenoids, and relays. If it moves, it's probably an inductive load.

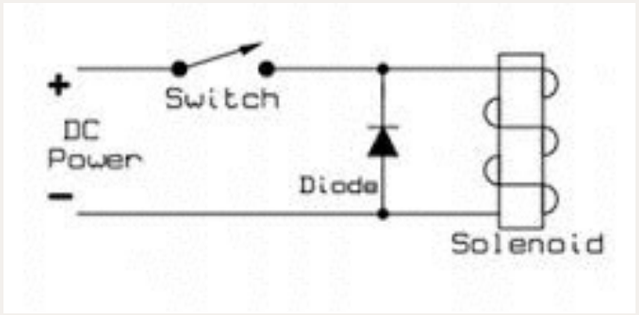
2) Inductive loads can cause blowback voltage. Circuits should be protected from this by diodes.

3) Blowback is caused by a surge of voltage created by the collapsing magnetic field in an inductor.

4) Resistive loads convert current into other forms of energy, such as heat. No risk of blowback.

Diode Protection

Anything with a coil and a magnet



- Reverse polarity protection.
- Reverse-biased diode in parallel with an inductive load. Snubs the blowback current generated by the collapsing magnetic field.

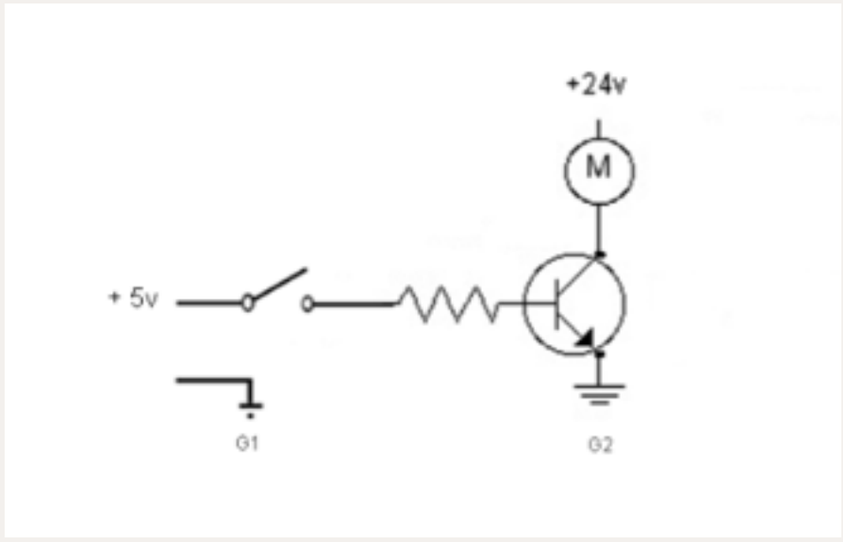
Transistor

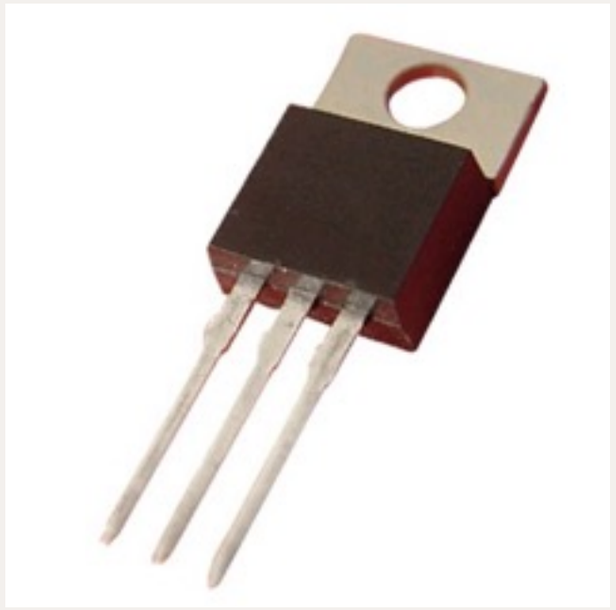
Allows a smaller current to control a larger current

Transistor as switch

1) Most sensors, processors, microcontrollers can't source enough power to make things happen in the real world.

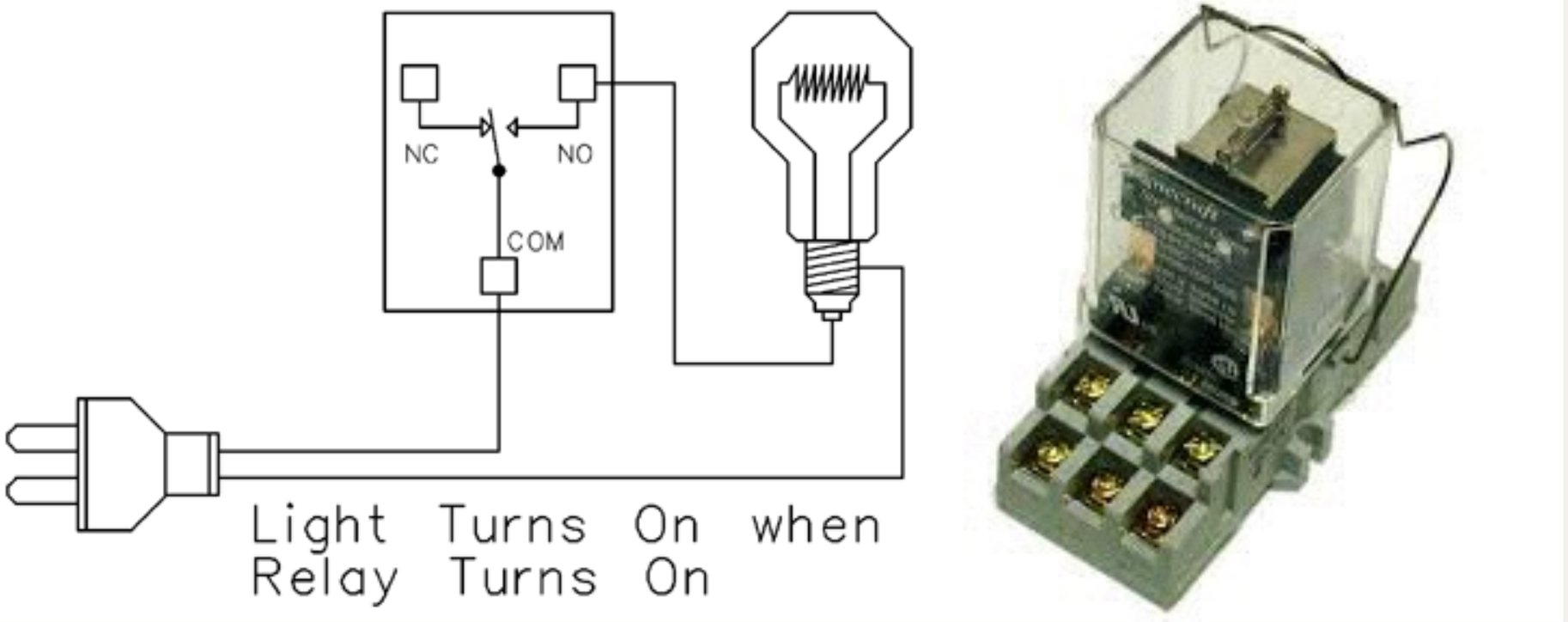
2) Transistors allow a large amount of current to be controlled by a small change in voltage. 3) Grounds between control circuit and transistor must be common.

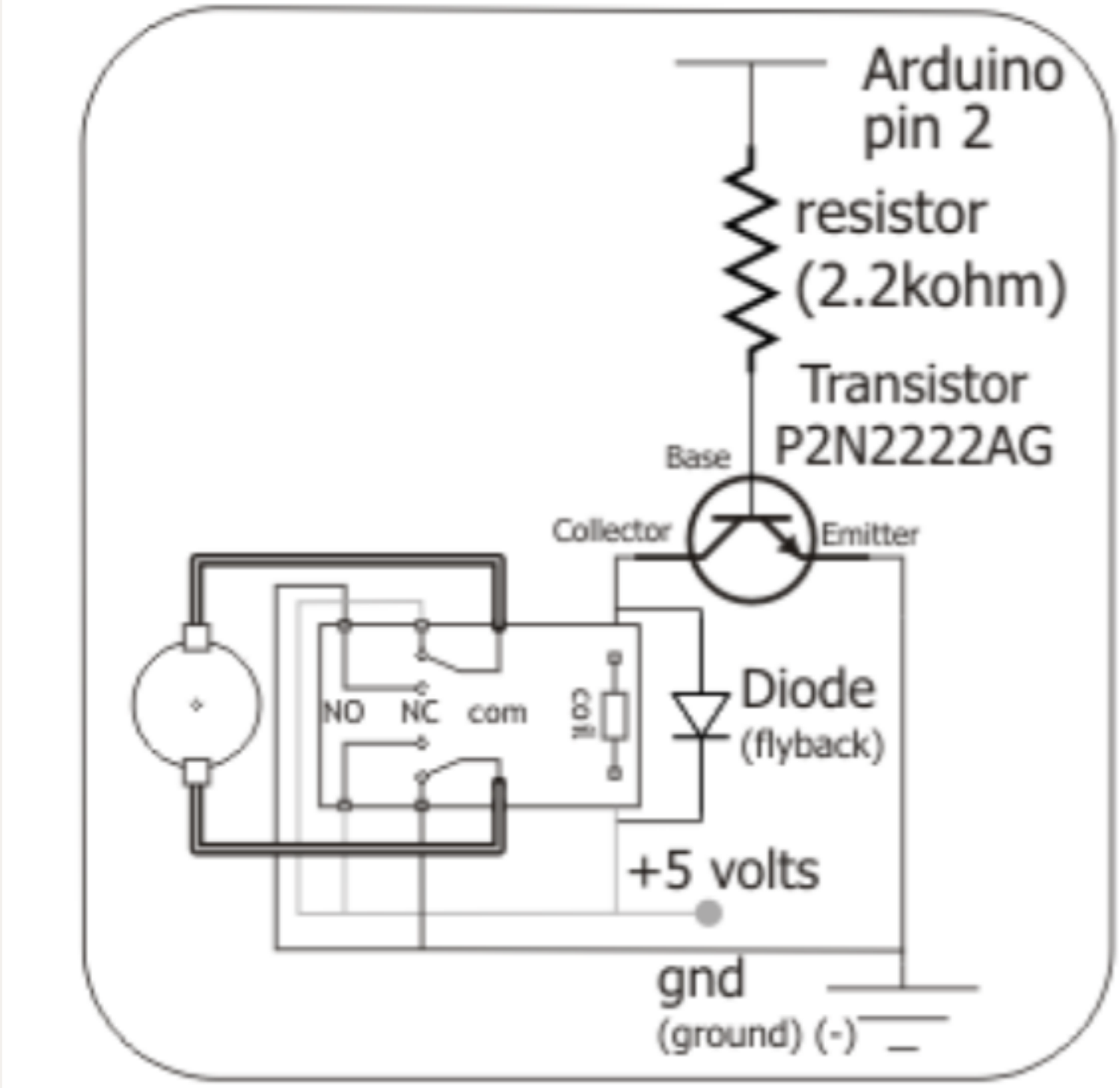




Relay

An electronically controlled magnetic switch



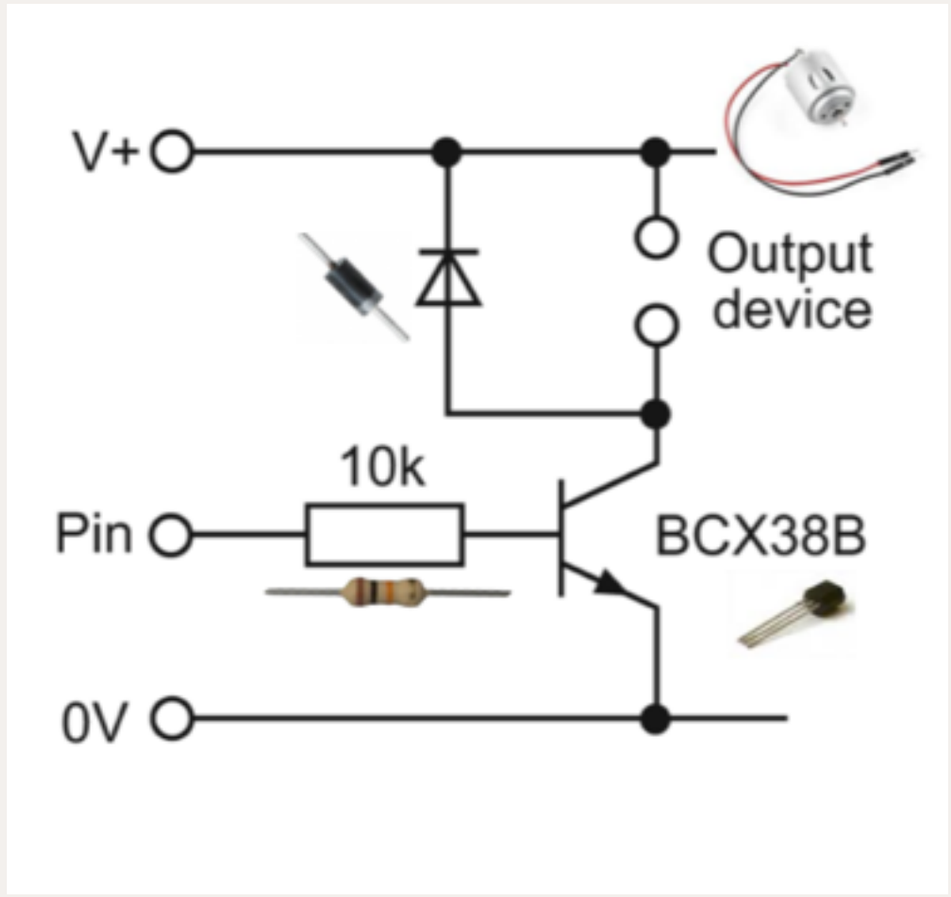

Arduino
pin 2
resistor
(2.2kohm)
Transistor
P2N2222AG
Base
Collector
Emitter
NO
NC
com
Diode
(flyback)
+5 volts
gnd
(ground) (-)

Low current load

Use this type of circuit for low current loads only

BCX38B darlington or other NPN transistor

(uyp to 60V, 800mA, power: 1 WaB)

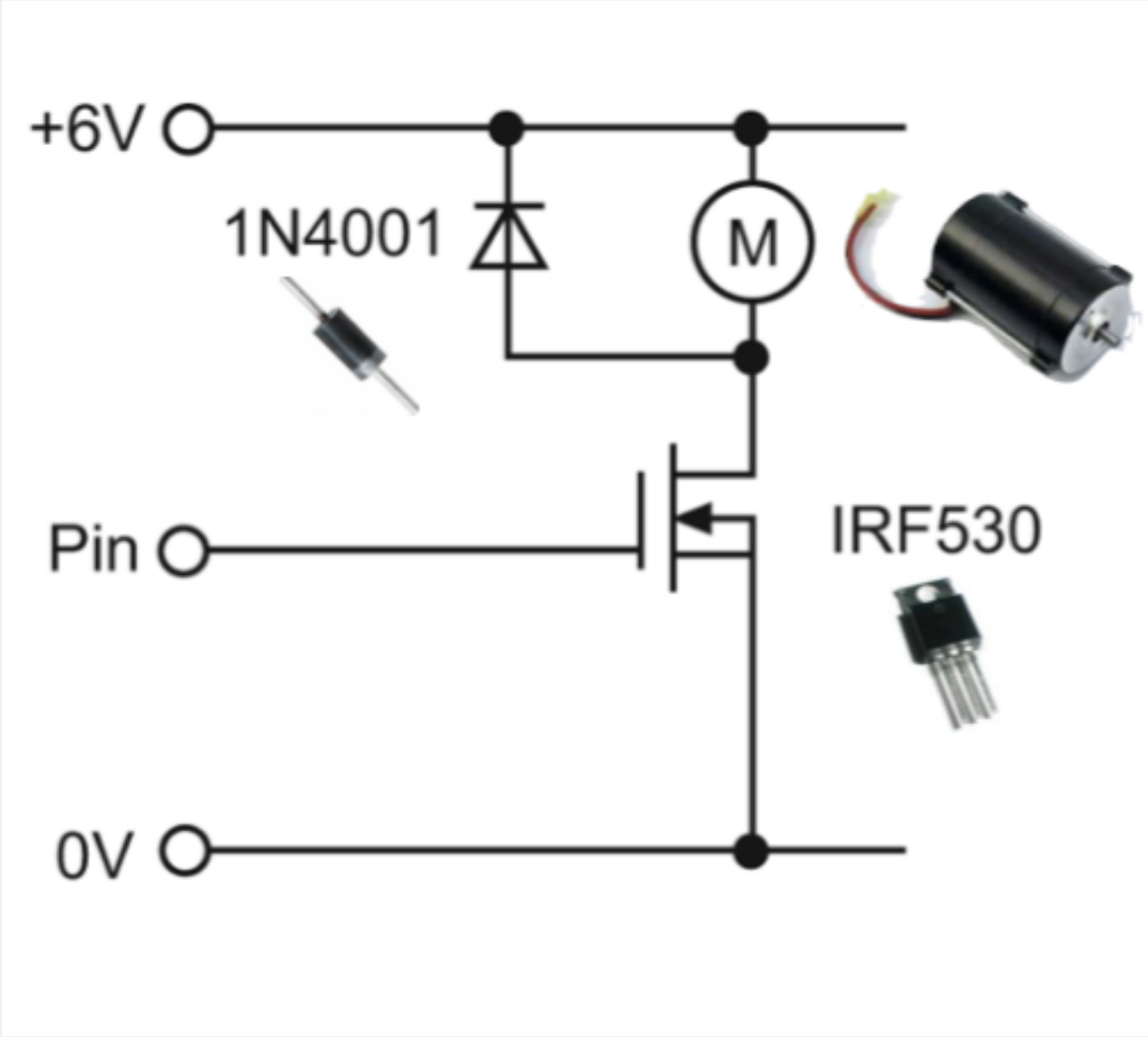


High current load

Use this type of circuit for high current loads only

Use a heat sink for high currents (see how warm the tab gets, during use)

IRF530 power MOSFET(up to 14A 100V!)



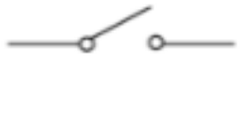
P = I(to the)2 R

Symbols for Components

Wires crossing – no contact

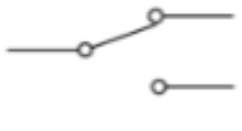
Junction (wires joined)

Junction

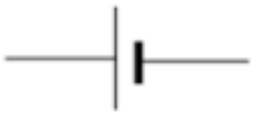


Switch (normally open)

Switch (normally closed)

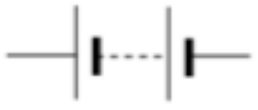


Two- way switch



Single cell

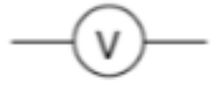
Battery of three cells



Power supply (DC)

Power supply (AC)

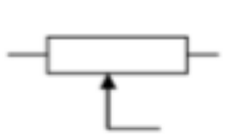
Ammeter



Voltmeter

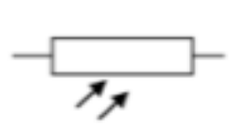
Resistor

Variable resistor



Variable resistor or potentiometer

Thermistor

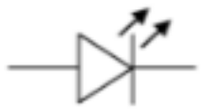


Light dependent resistor (LDR)

Fuse

Earth

Diode



Light-emitting diode (LED)

(Signal) lamp

Filament lamp

Loudspeaker

Electric bell

Buzzer

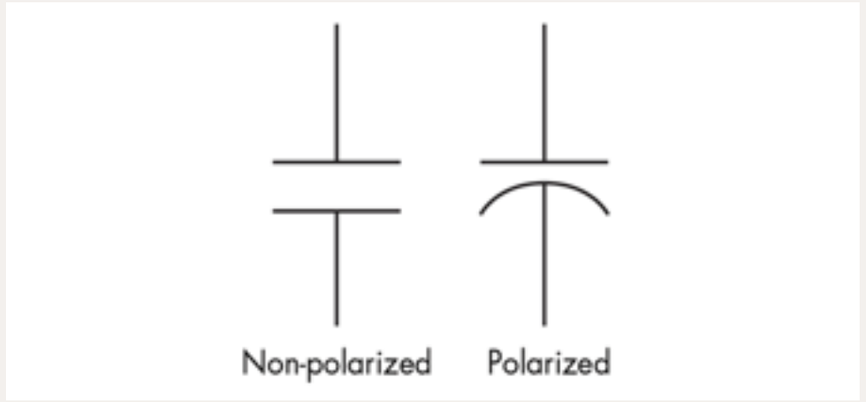
Microphone

Motor

Generator

Transformer

Capacitor



Stores electrical current for a duration

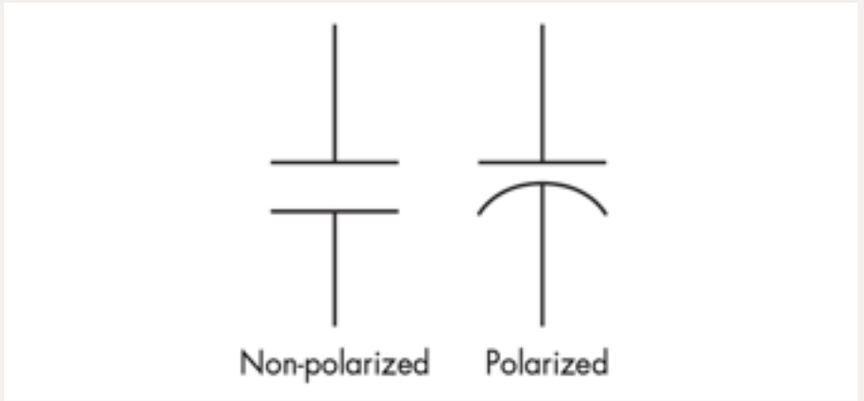
Measured in Farads.

Typical capacitance values range from about 1 pF

(10−12 F) to about 1 mF (10−3 F).

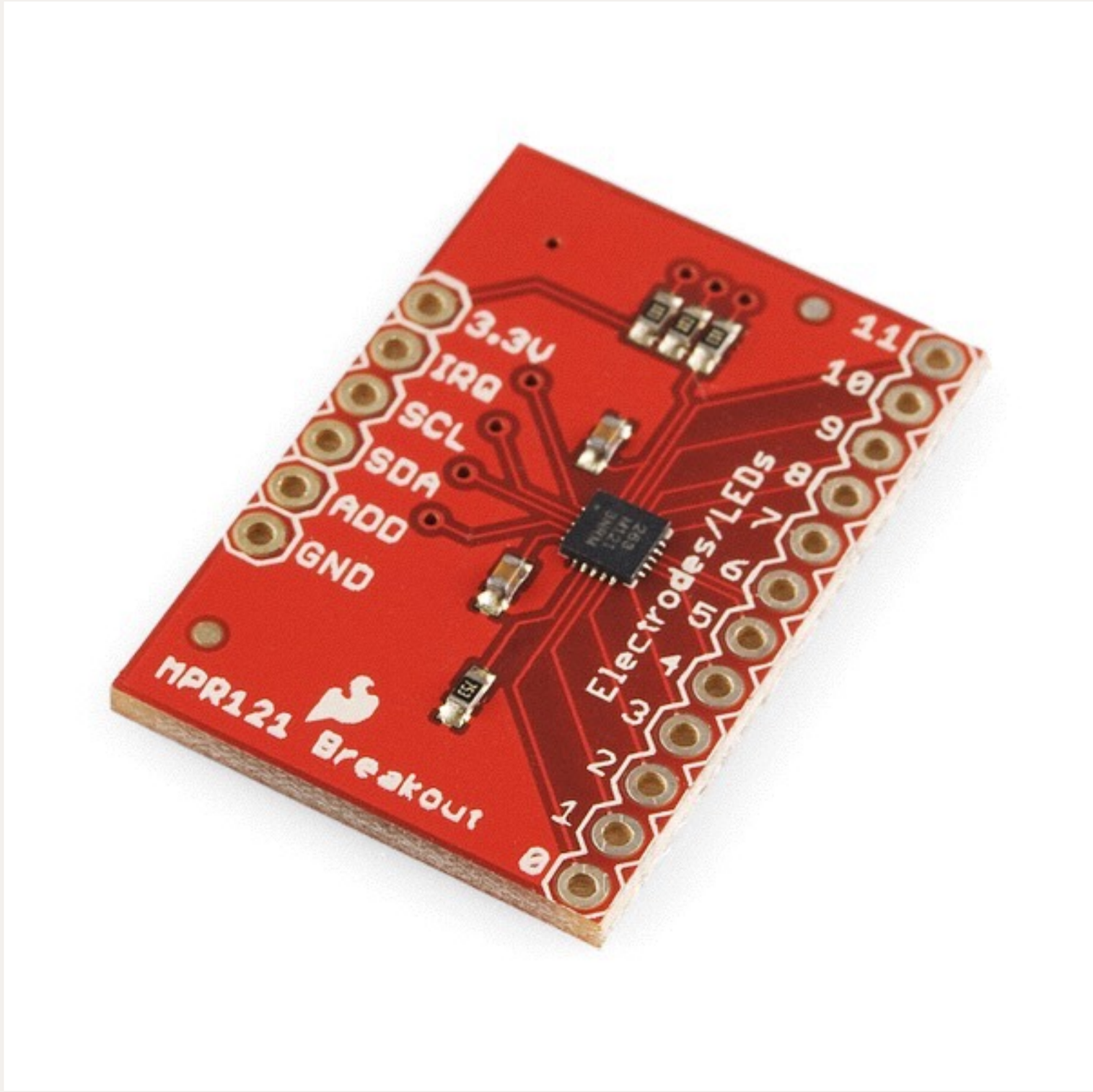
Capacitor

Has two sides - two “plates” and when enough charge builds up a current flows between them.



Can serve to regulate uneven current flow

This is you, the carpet and your childhood friends.

You can measure this with your arduino. For more info see here:
https://www.youtube.com/watch?v=ZYH9dGl4gUE

MPR121 breakout