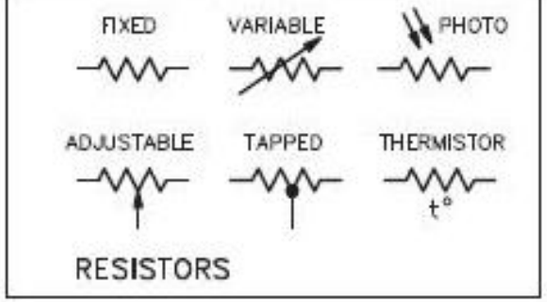
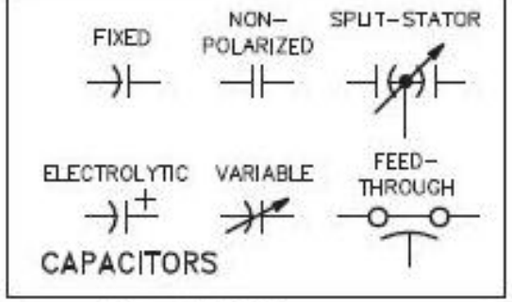
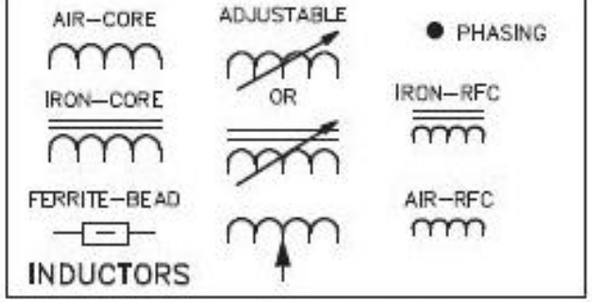
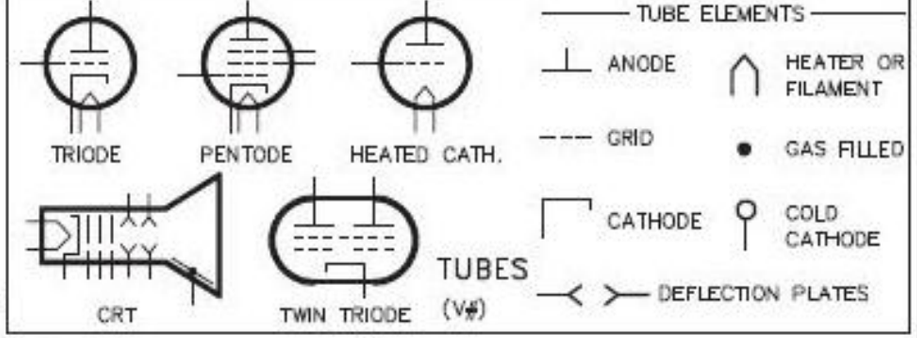
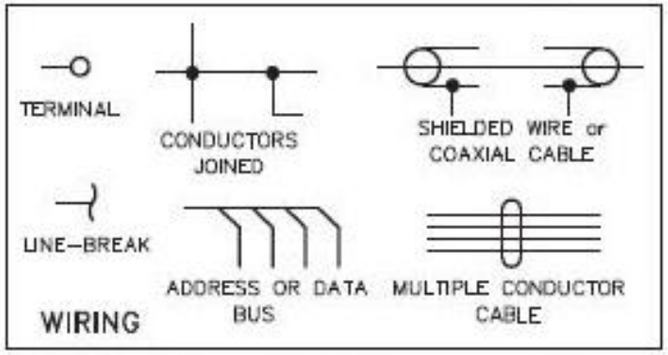
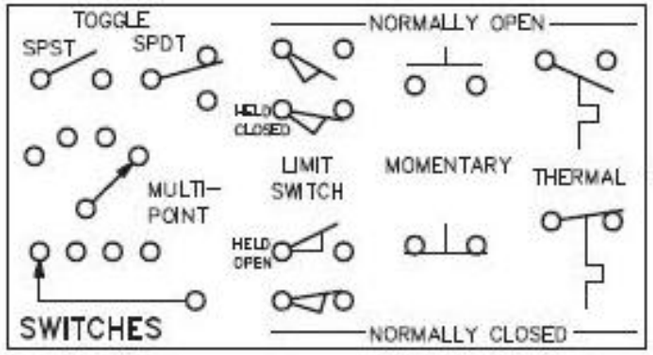


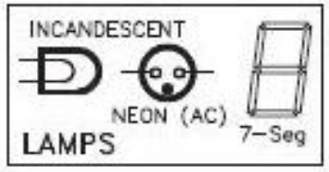


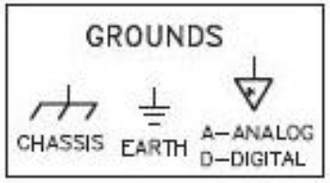


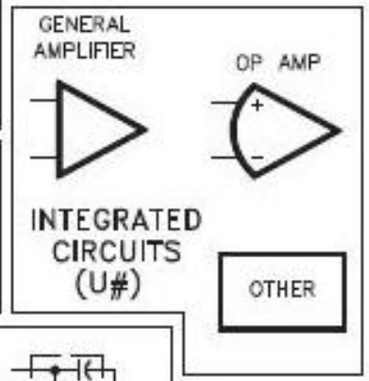


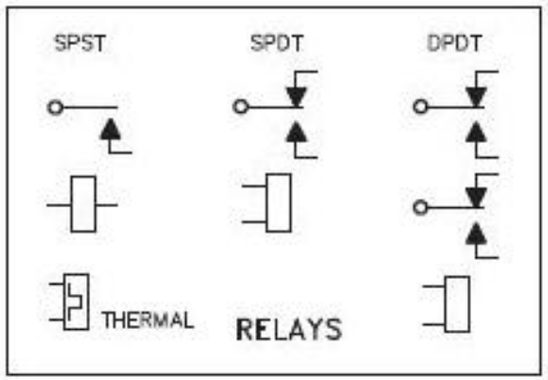


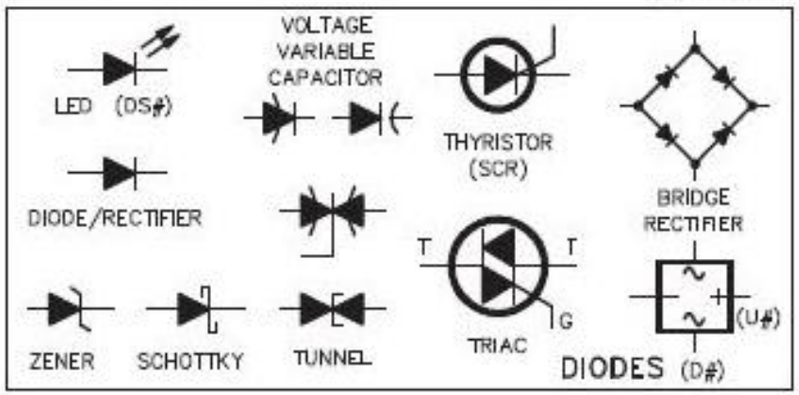


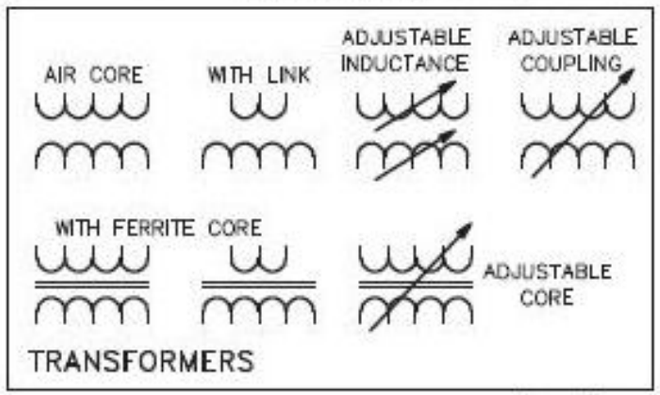


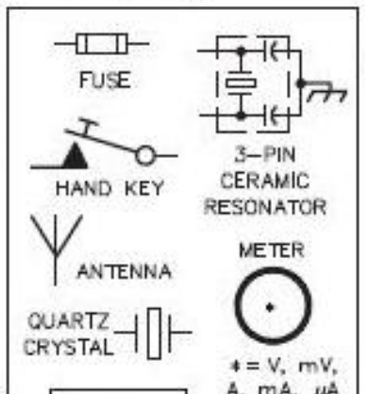


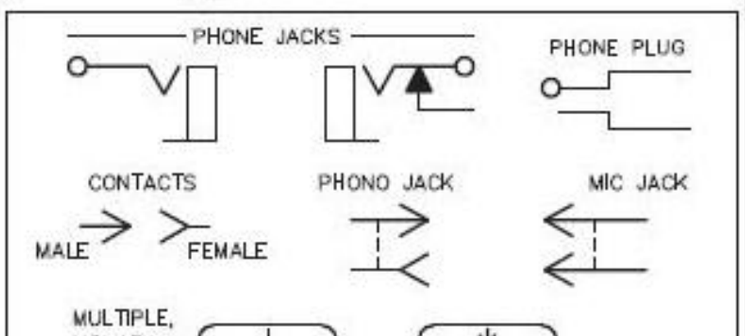


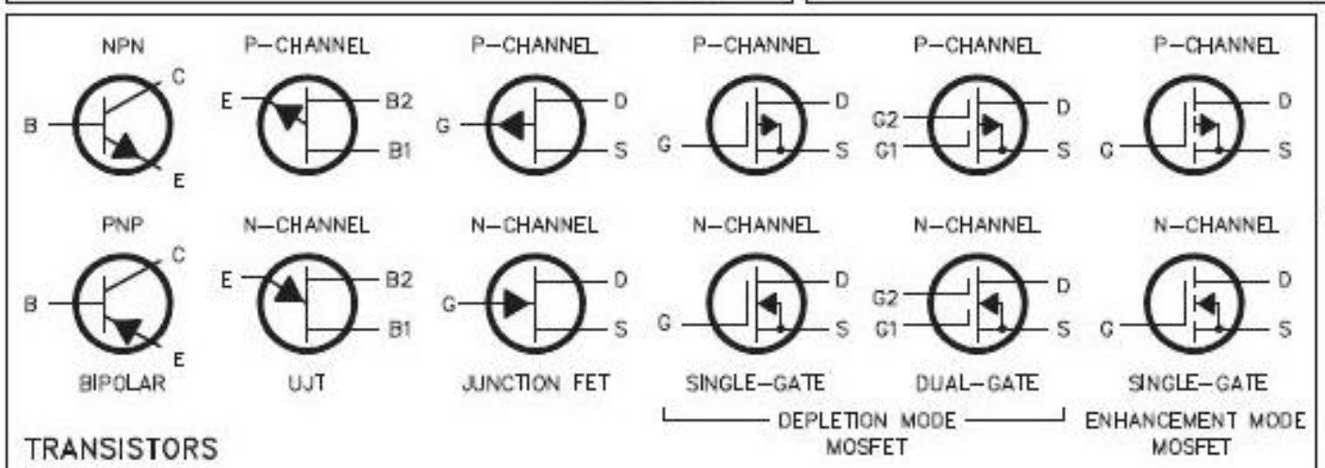


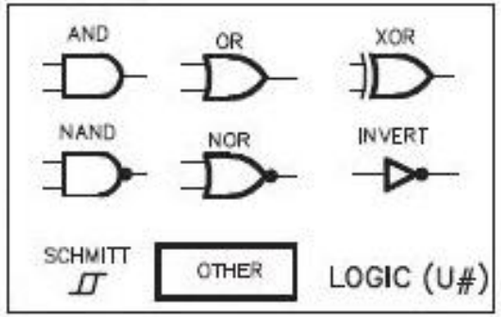






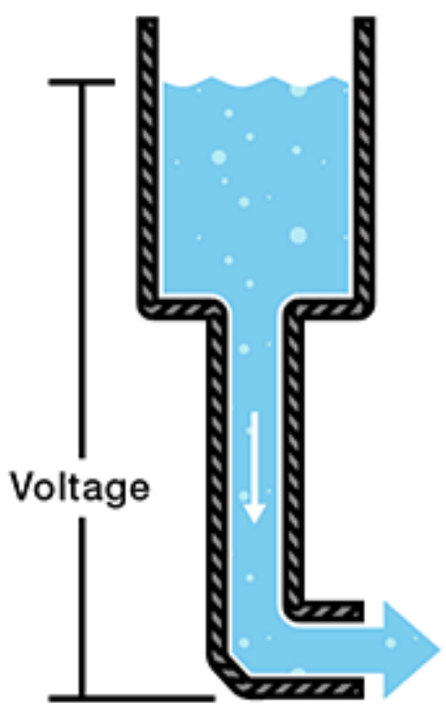


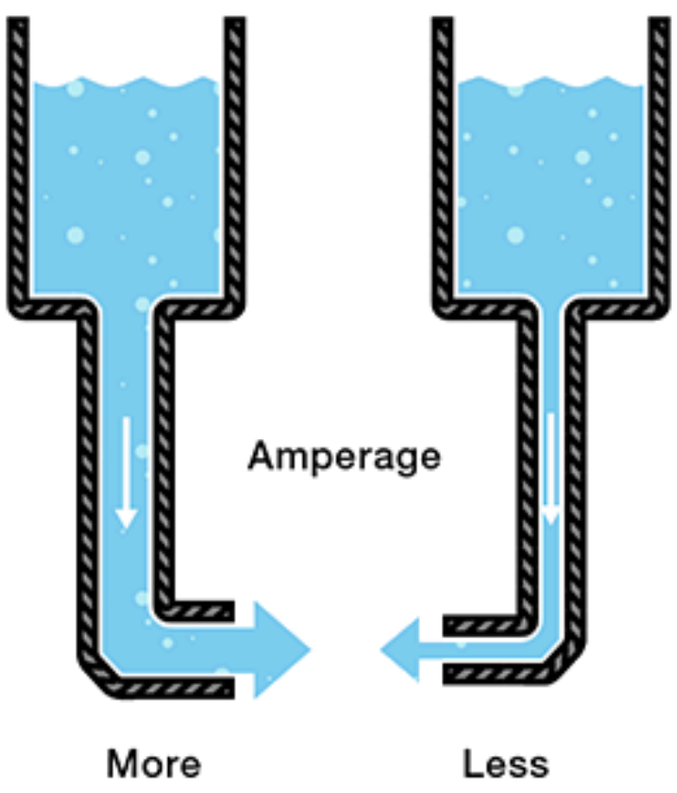


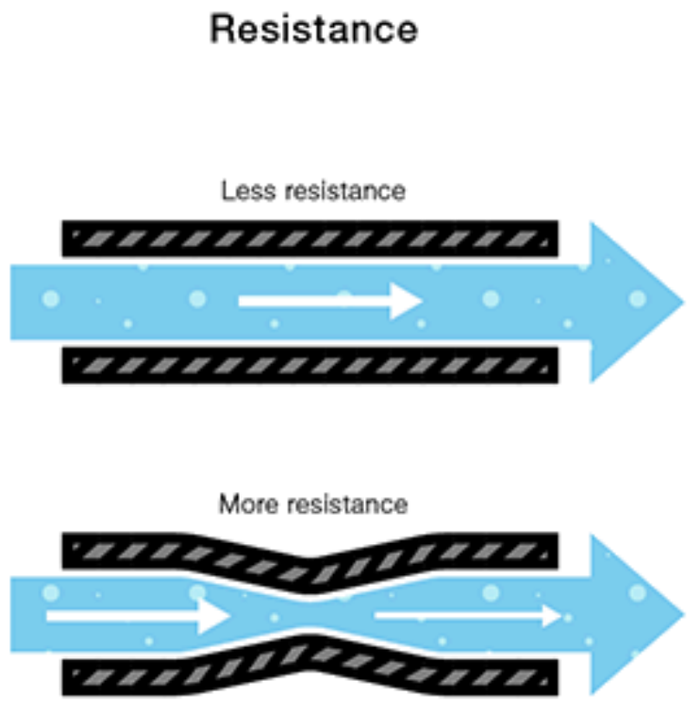


Sensing & Acting

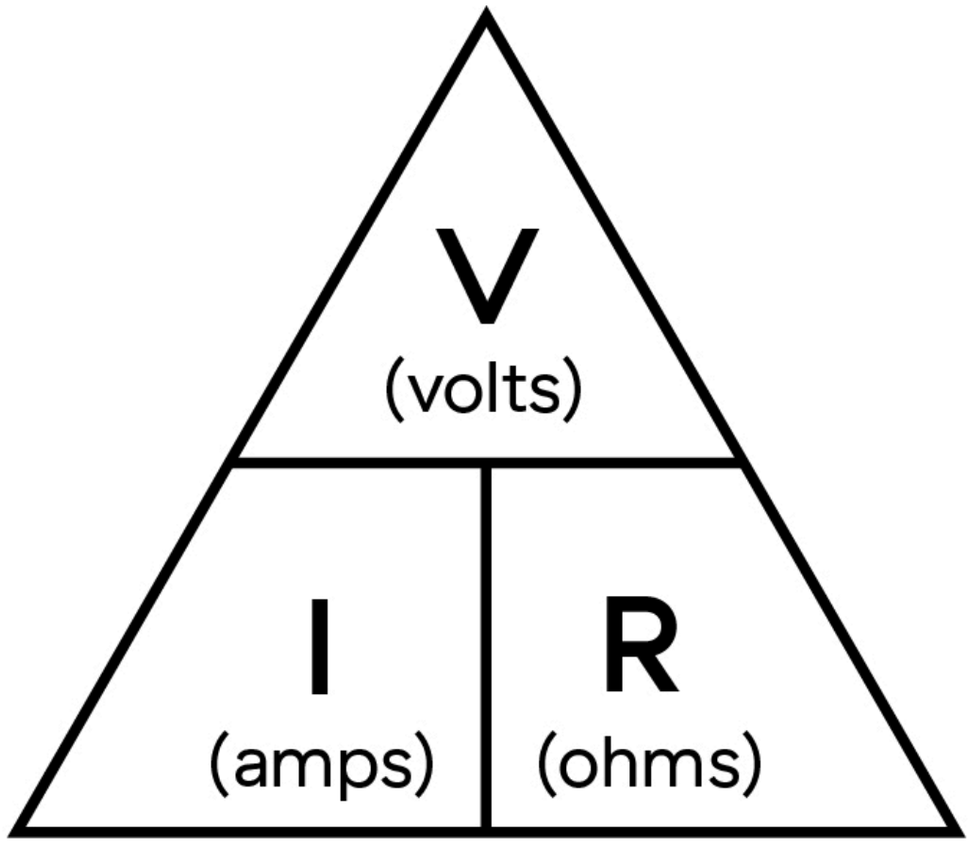
Recap







Measures of Electricity



$$V = I \times R$$

$$I = \frac{V}{R}$$

$$R = \frac{V}{I}$$

Ohms LAW

Bluetooth headphones
0.03 W

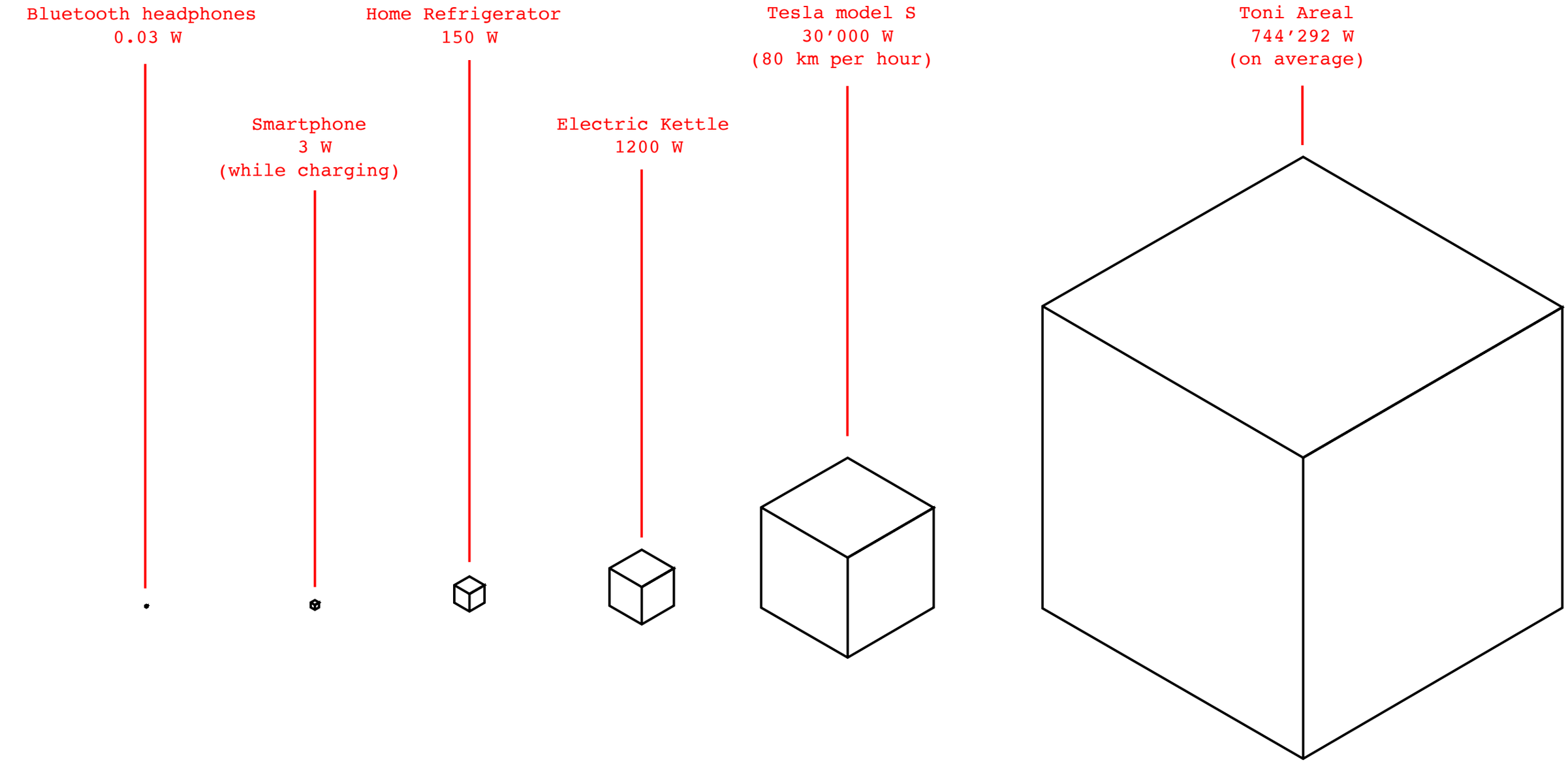
Smartphone
3 W
(while charging)

Home Refrigerator
150 W

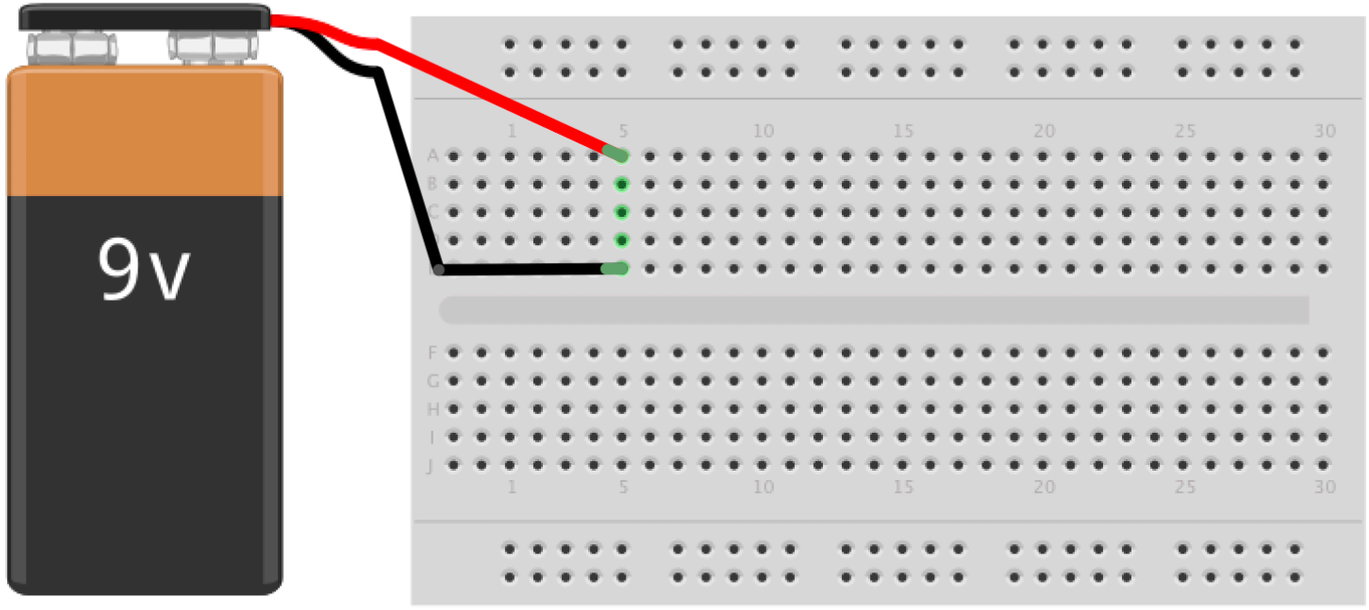
Electric Kettle
1200 W

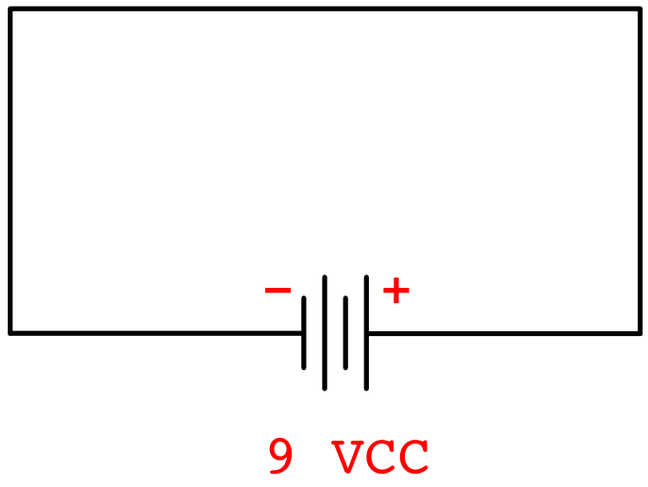
Tesla model S
30’000 W
(80 km per hour)

Toni Areal
744’292 W
(on average)

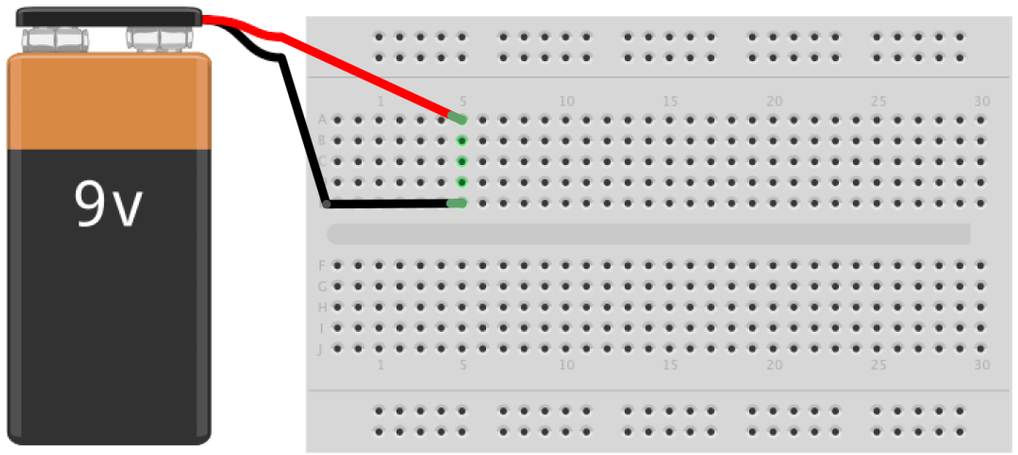


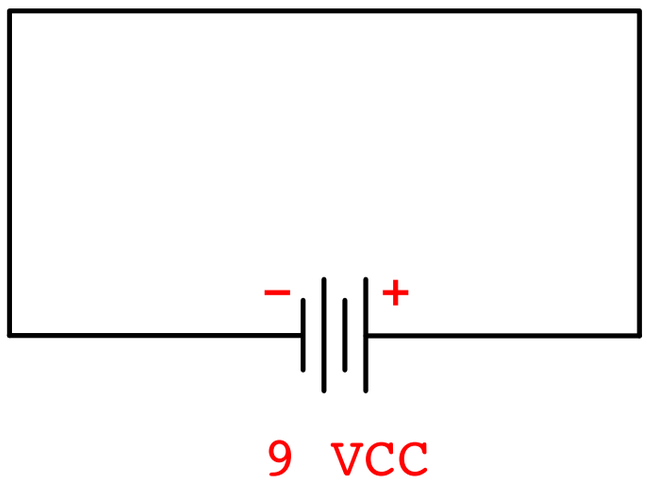
Energy (watts)

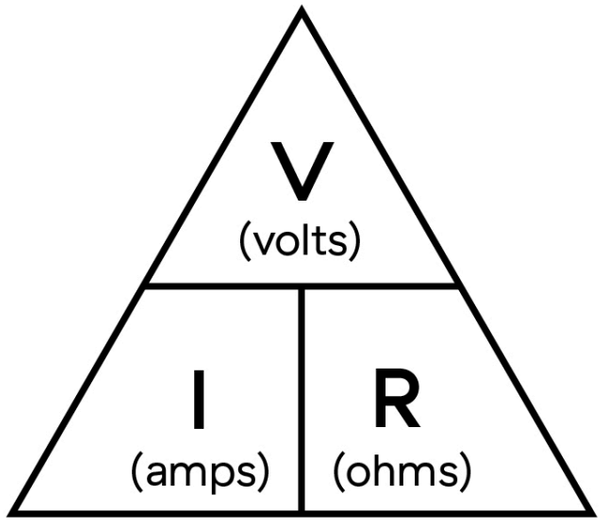




Short Circuits and Joule heating





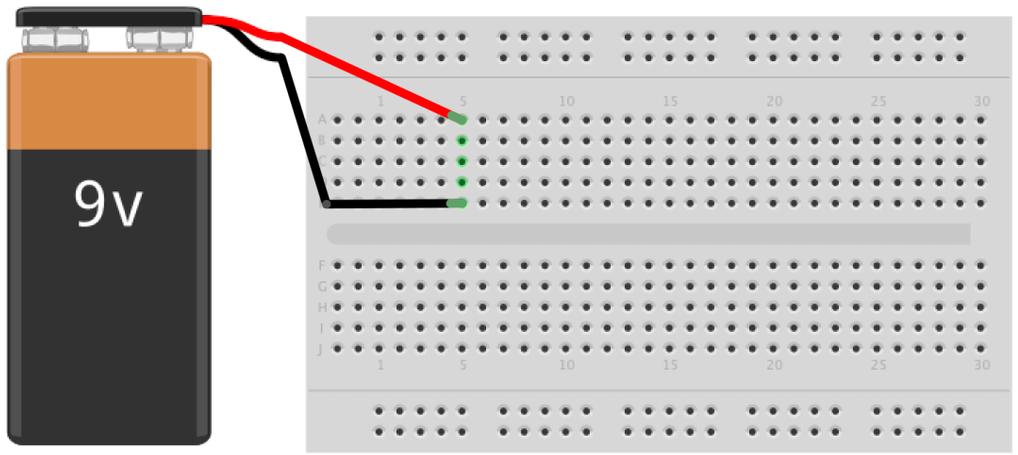


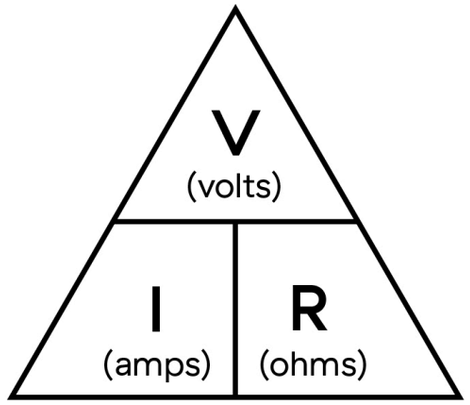
$$V = I \times R$$

$$I = \frac{V}{R}$$

$$R = \frac{V}{I}$$

Short Circuits and Joule heating

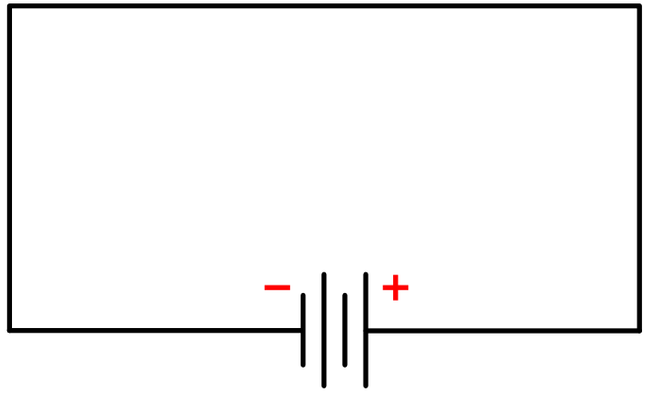




$$V = I \times R$$

$$I = \frac{V}{R}$$

$$R = \frac{V}{I}$$



$$\frac{9\text{ v}}{0.0000001\text{ ohm}} = 90\,000\,000\text{ amps}$$

or

81 000 0000 watts!

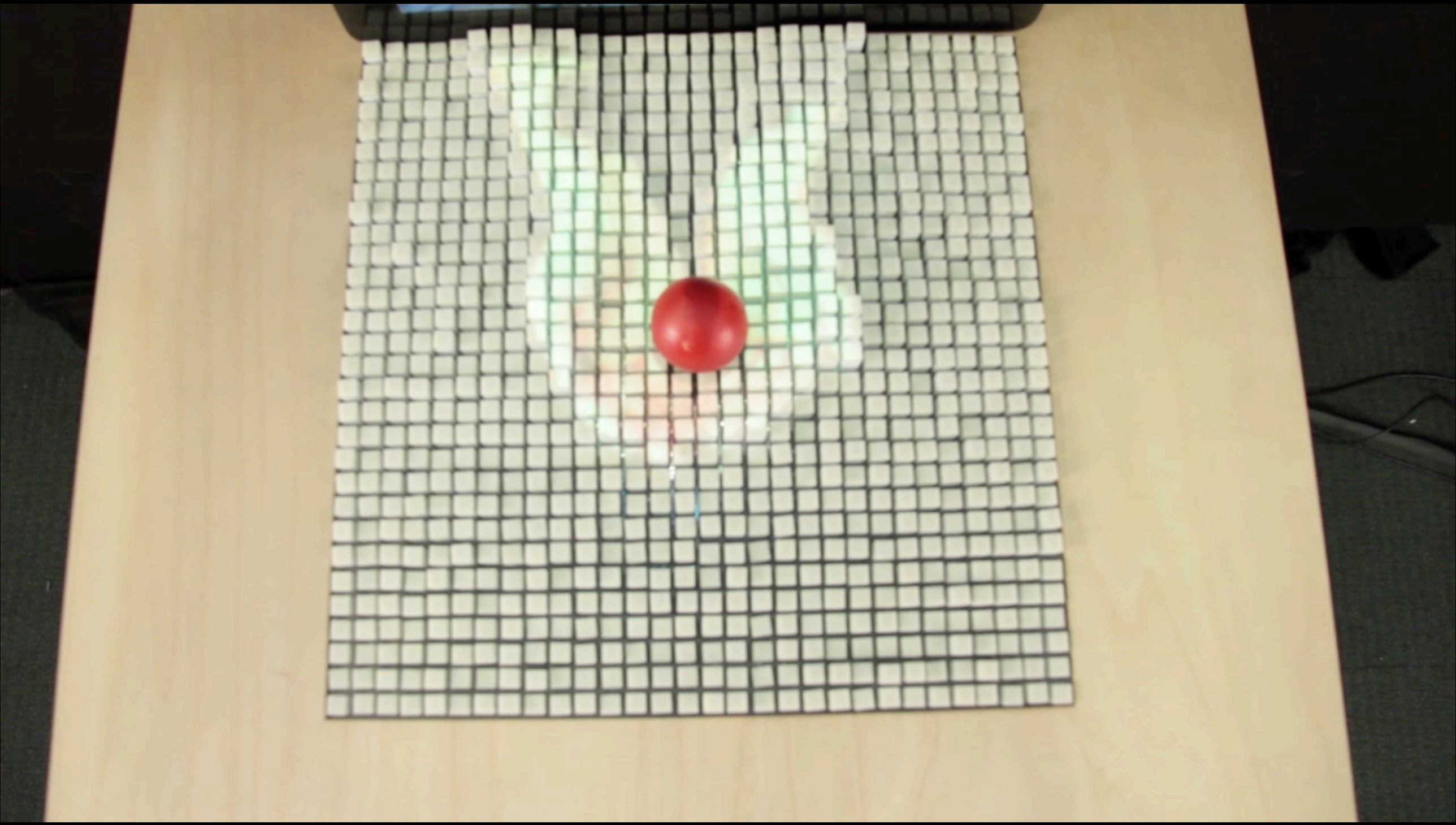
Short Circuits and Joule heating

Physical Computing

Physical computing means building interactive physical systems by the use of software and hardware that can sense and respond to the analog world.

https://en.wikipedia.org/wiki/Physical_computing

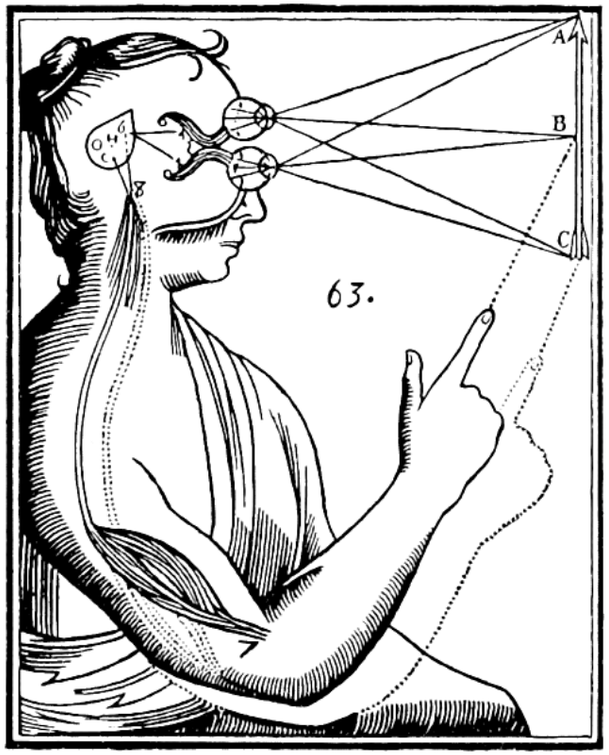
inFORM - Tangible Media Group MIT



Birdly - flight simulator

Embodiment

René Descartes, (1596-1650)



Mind–body dualism

Image: J. van Dijk (2013)

Embodiment

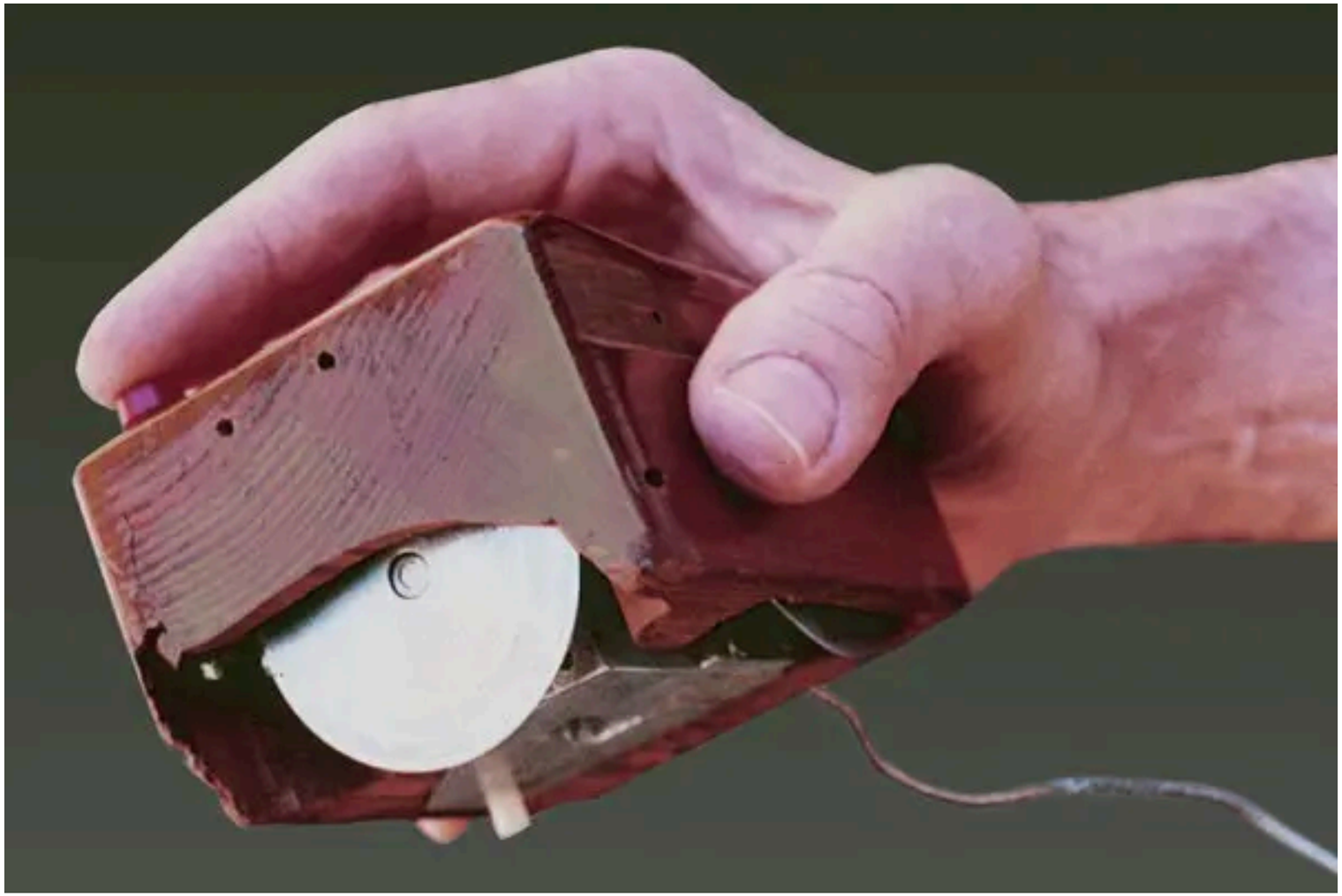
Theory of Embodied Cognition

…brain, body and the environment, and in particular relations between them, are all considered to be part of the cognitive system - part of the mechanism that makes cognition happen

Jelle van Dijk

https://youtu.be/wIiDomlEjJw?t=58

Human Computer Interactions



Augmenting Human Intelligence at ARC (1963)

Xerox PARCtab 1994

"Good Technology is invisible"

Mark Weisser

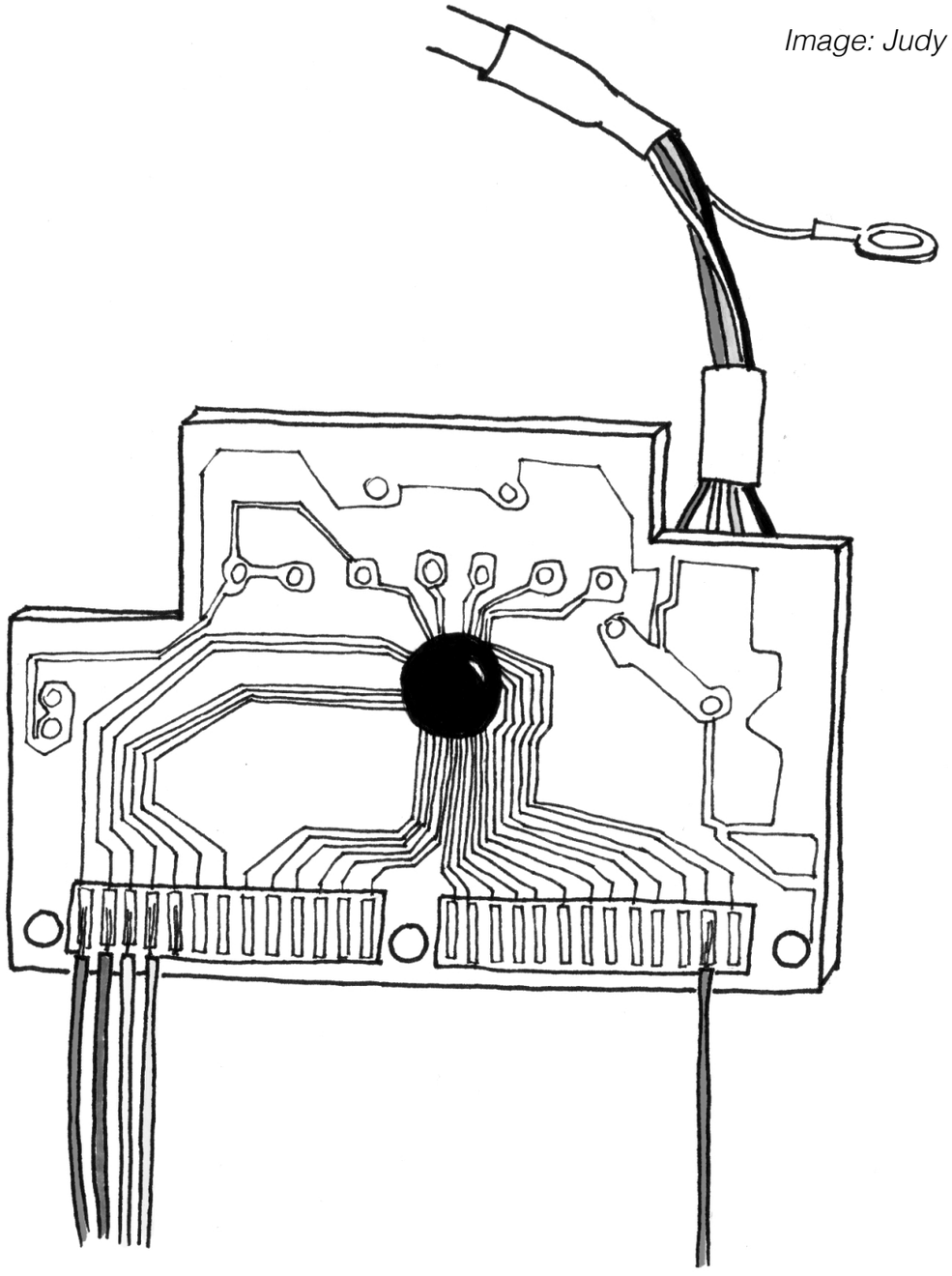
Ubiquitous computing and IOT (1988)

Tangible User Interfaces (1997)

“Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms”

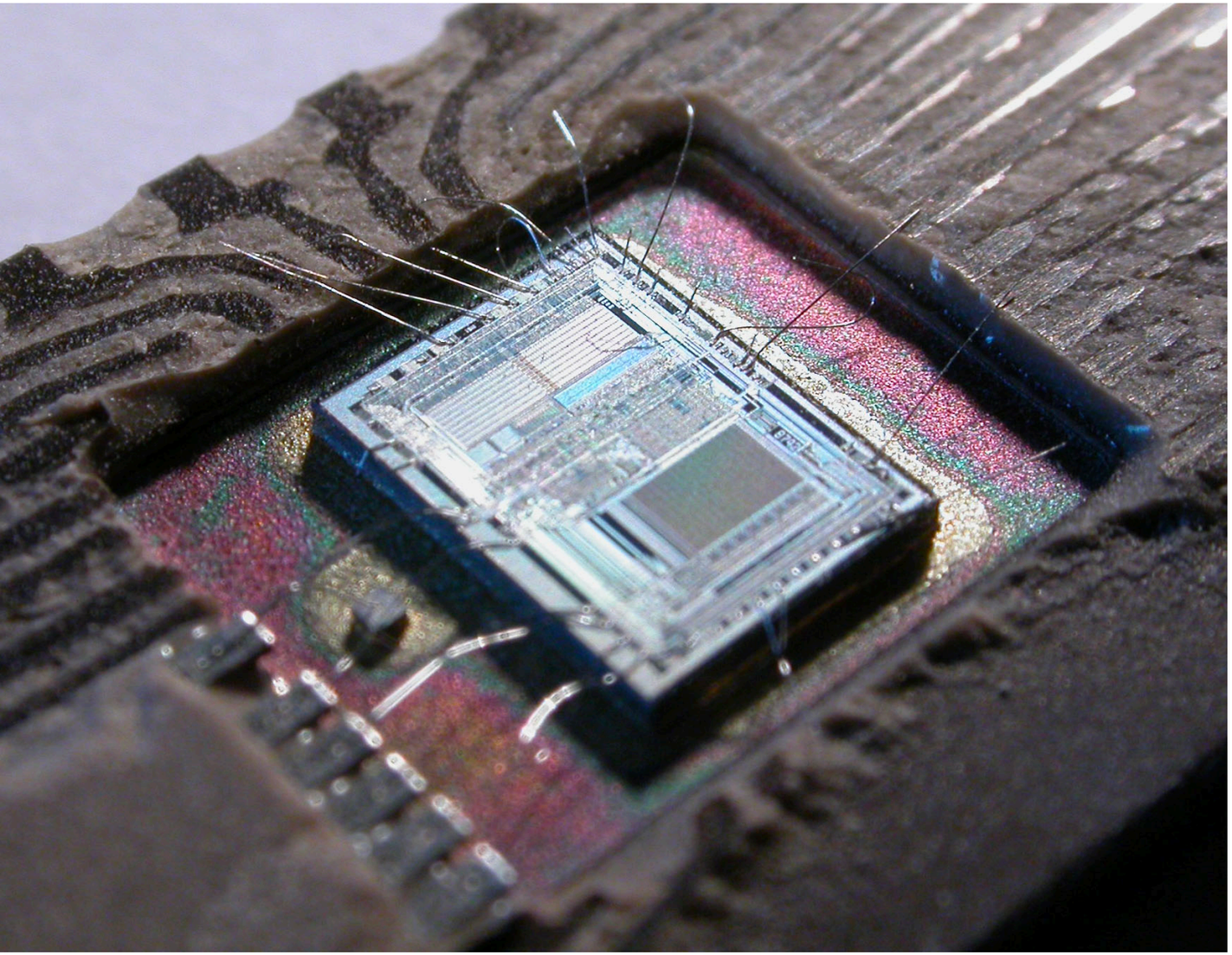
Major Developments in Physical Computing

Image: Judy Aime' Castro

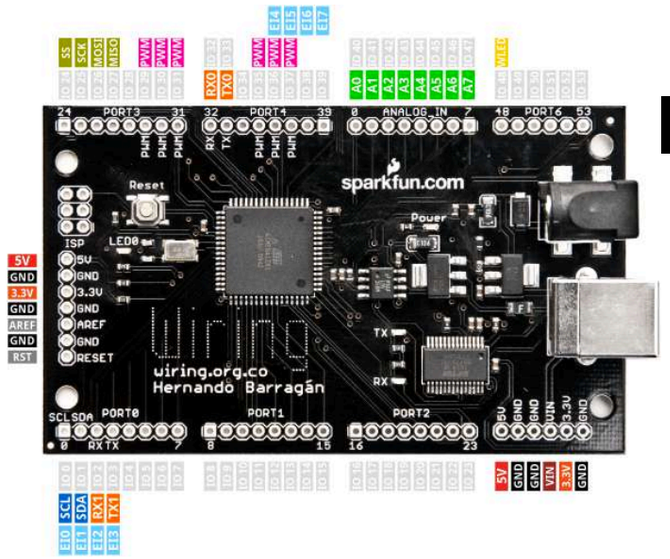


DIY movement:

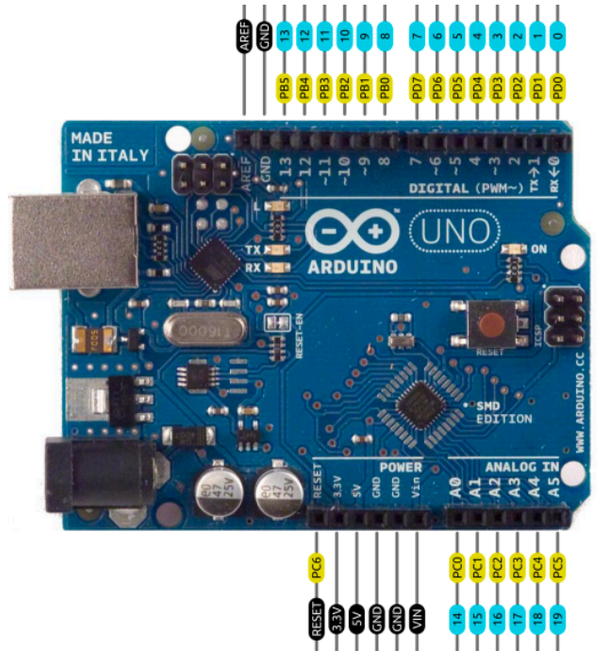
Keyboard Hacking (1990's)



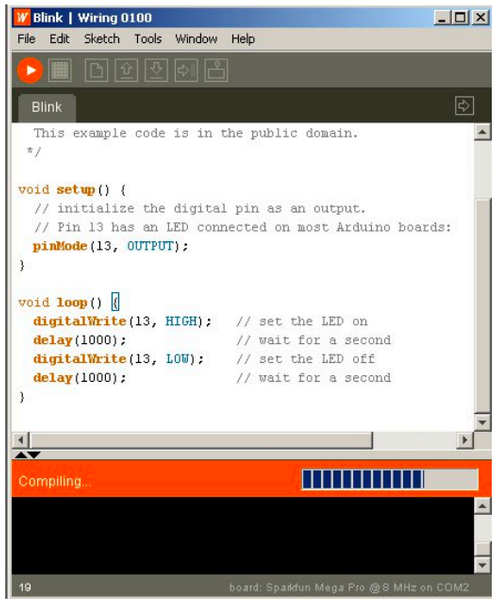
Microcontrollers



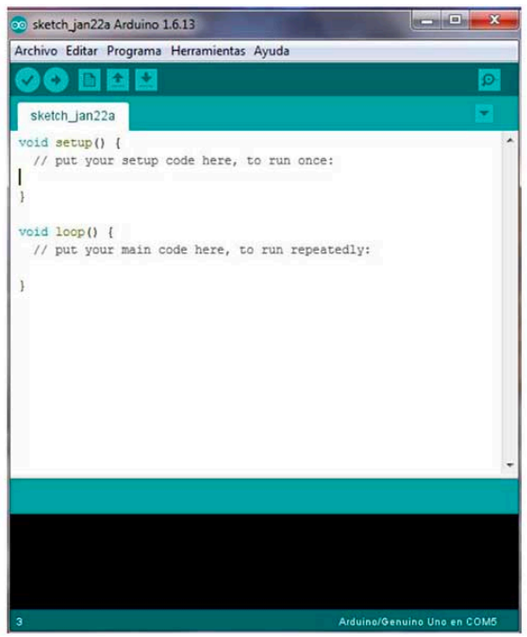
Wiring Device



Arduino Device



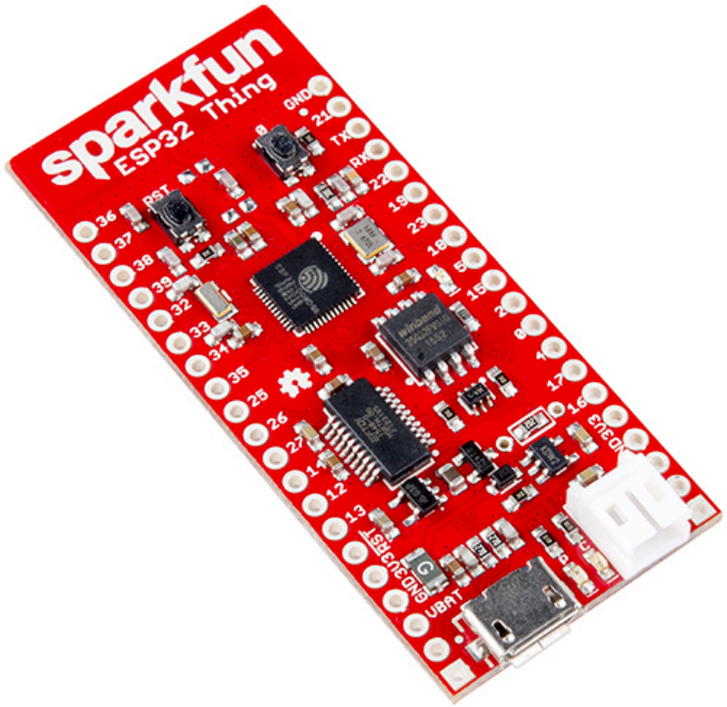
Wiring IDE



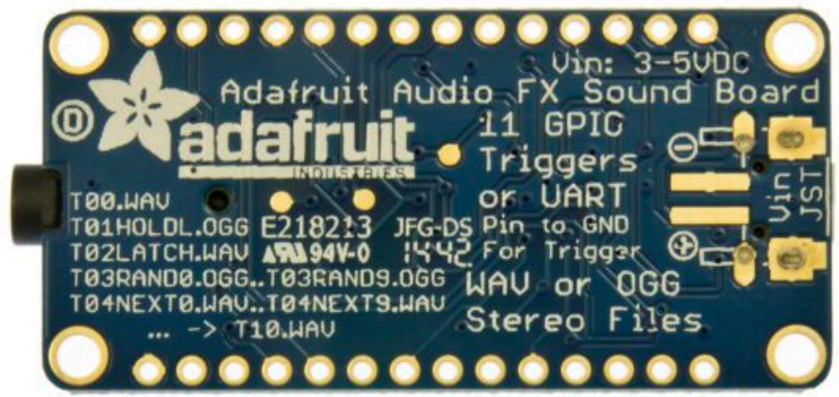
Arduino IDE

Wiring platform by Hernando Barragán (2003)

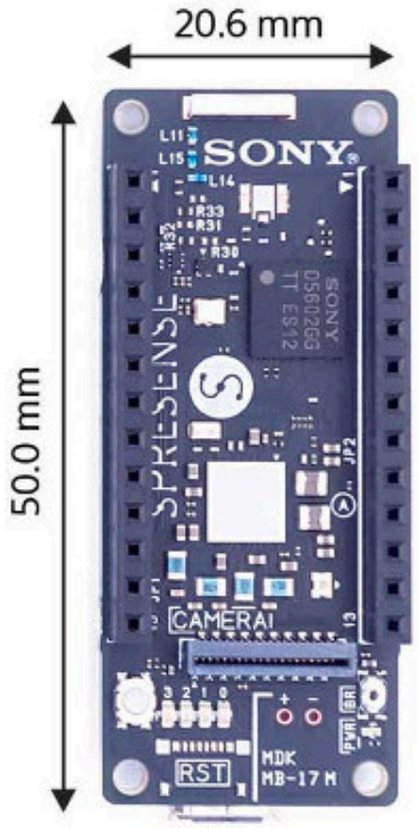
The Arduino platform (2005)

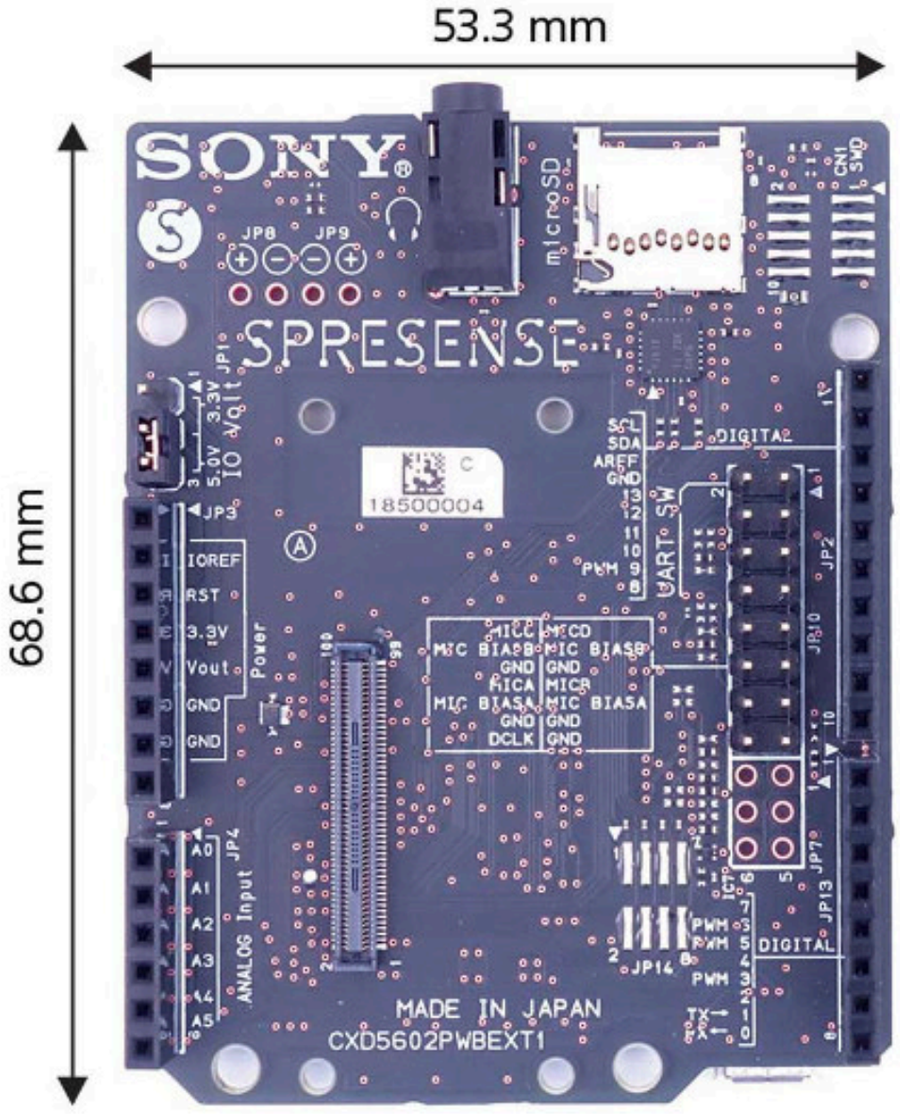


SparkFun (2003)



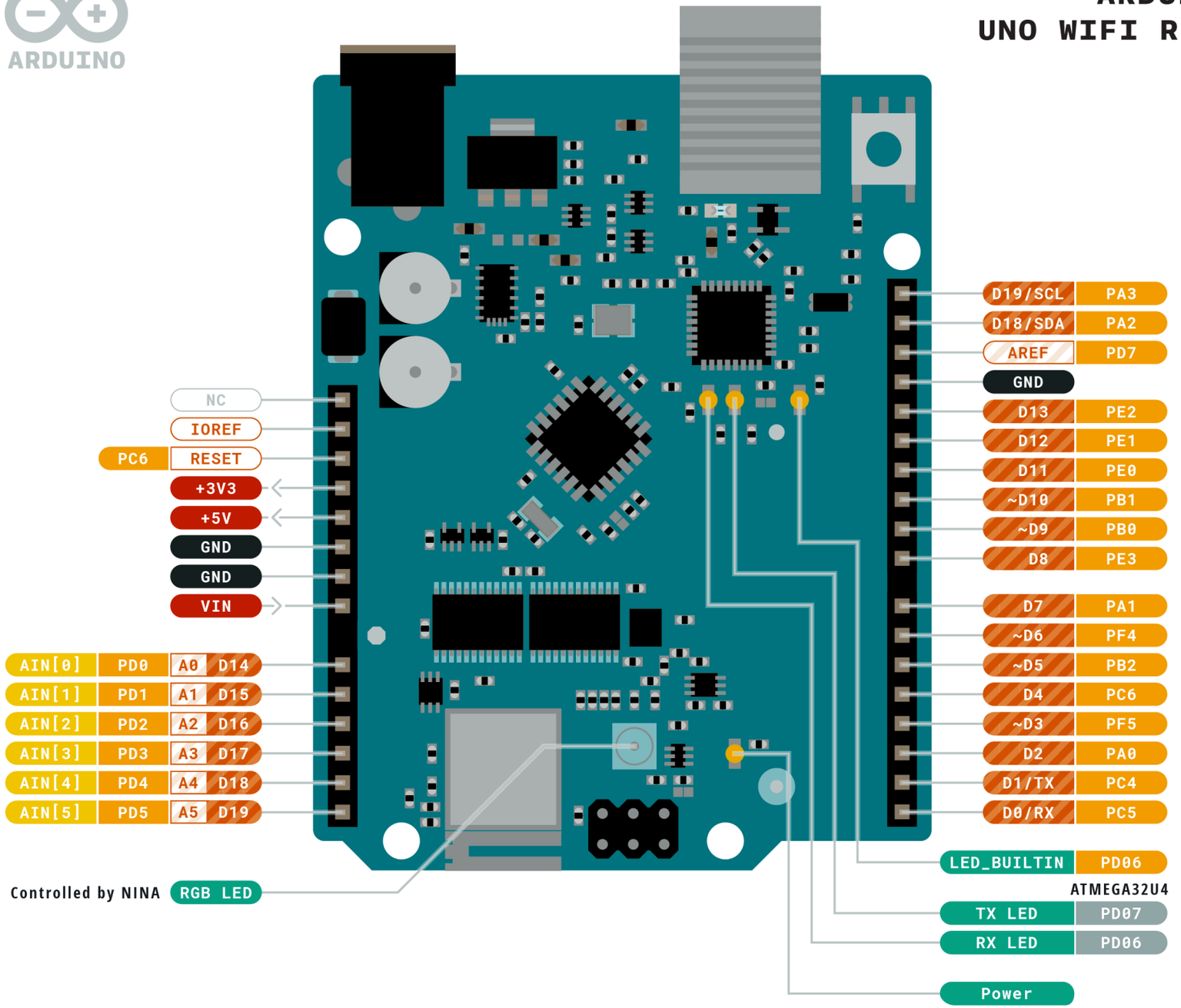
Adafruit (2005)


20.6 mm
50.0 mm
SONY
CAMERAI
RST
MDK
MB-17M


53.3 mm
68.6 mm
SONY
SPRESENSE
MADE IN JAPAN
CXD5602PWBEXT1

And so on….

ARDUINO
UNO WIFI REV2

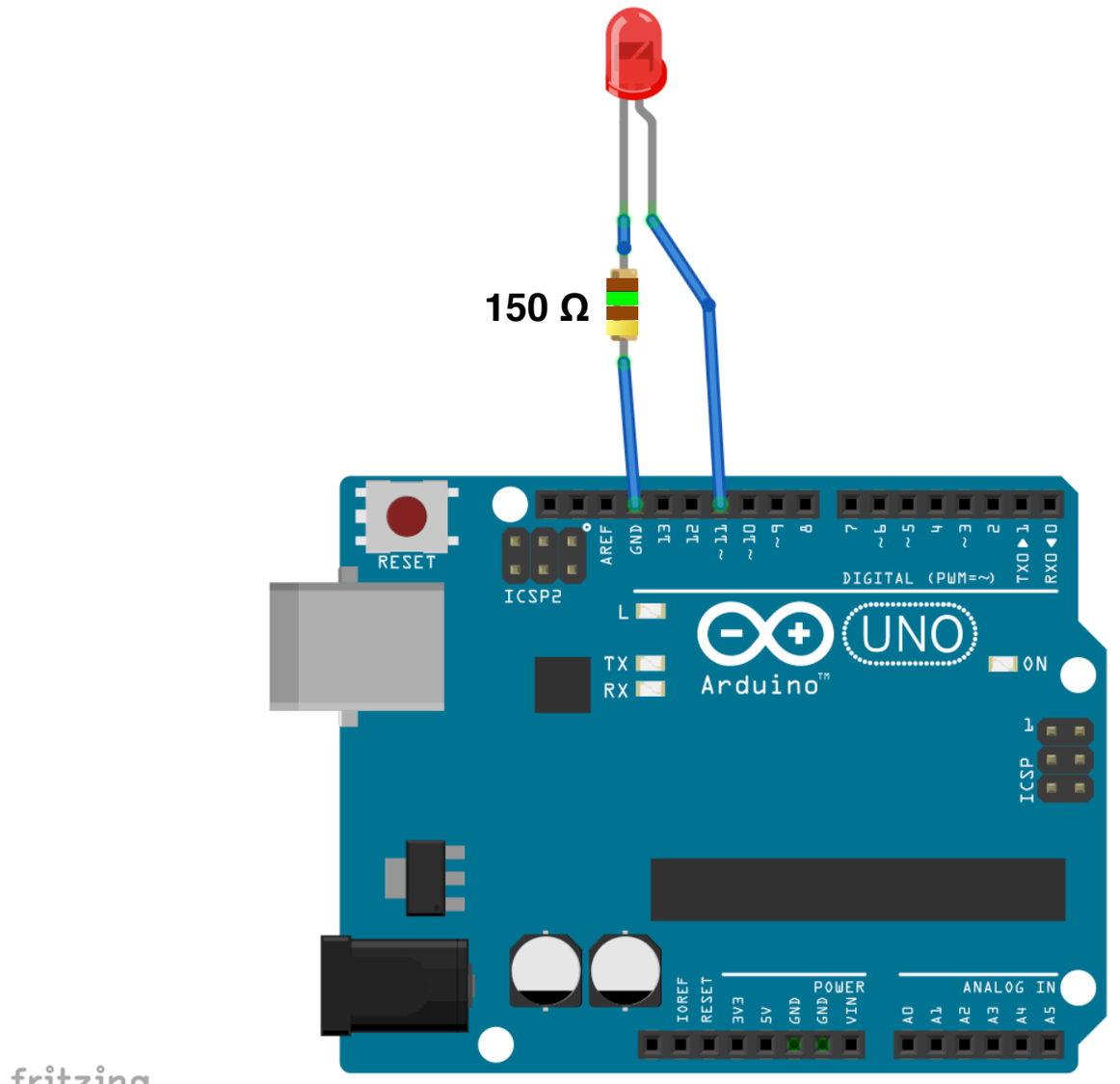


Getting Started with Arduino

Ground
Power
LED
Internal Pin
SWD Pin
Other Pin
Digital Pin
Analog Pin
Default
Microcontroller's Port

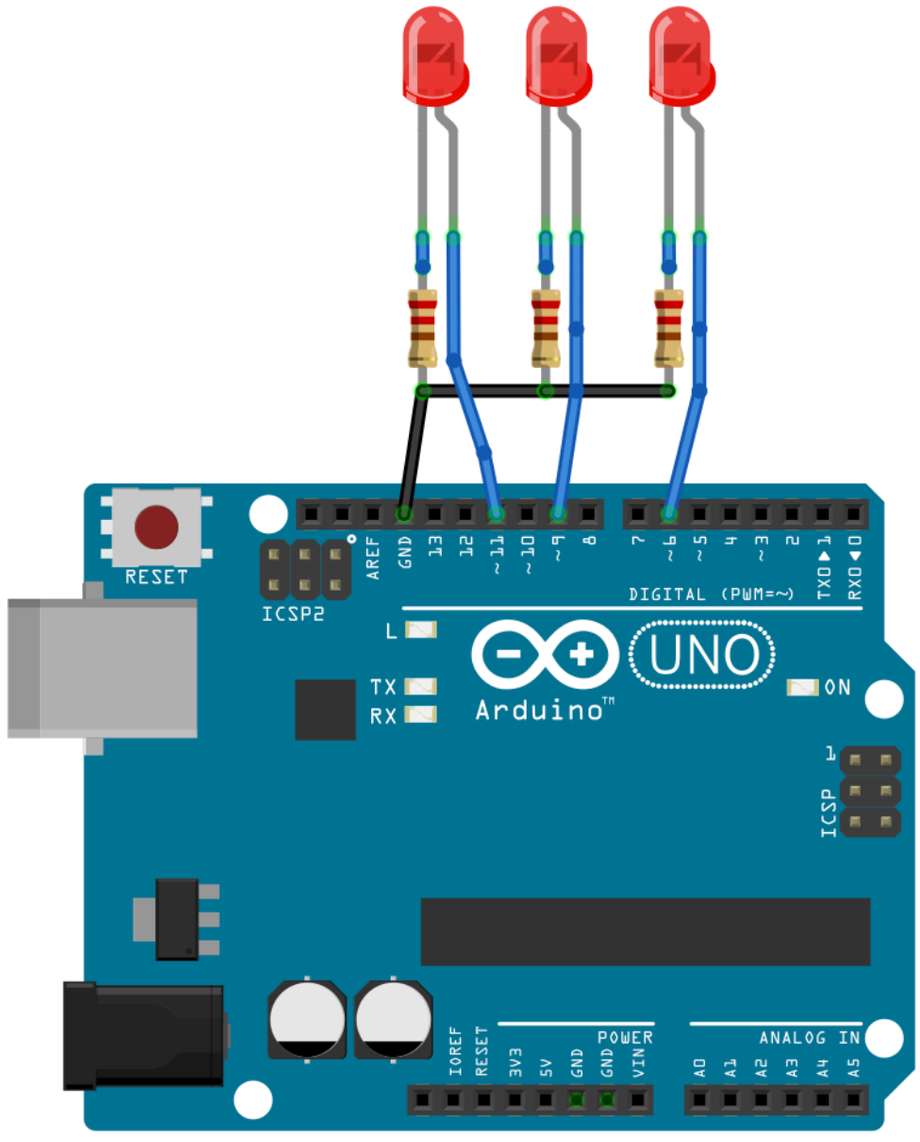
ARDUINO.CC

This work is licensed under the Creative Commons Attribution-ShareAlike 4.0 International License. To view a copy of this license, visit http://creativecommons.org/licenses/by-sa/4.0/ or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.



Exercise 2.1: Arduino Blinky

Connect an LED and Resistor to your Arduino to GND and Pin 11 using your breadboard. Code it to blink using the examples

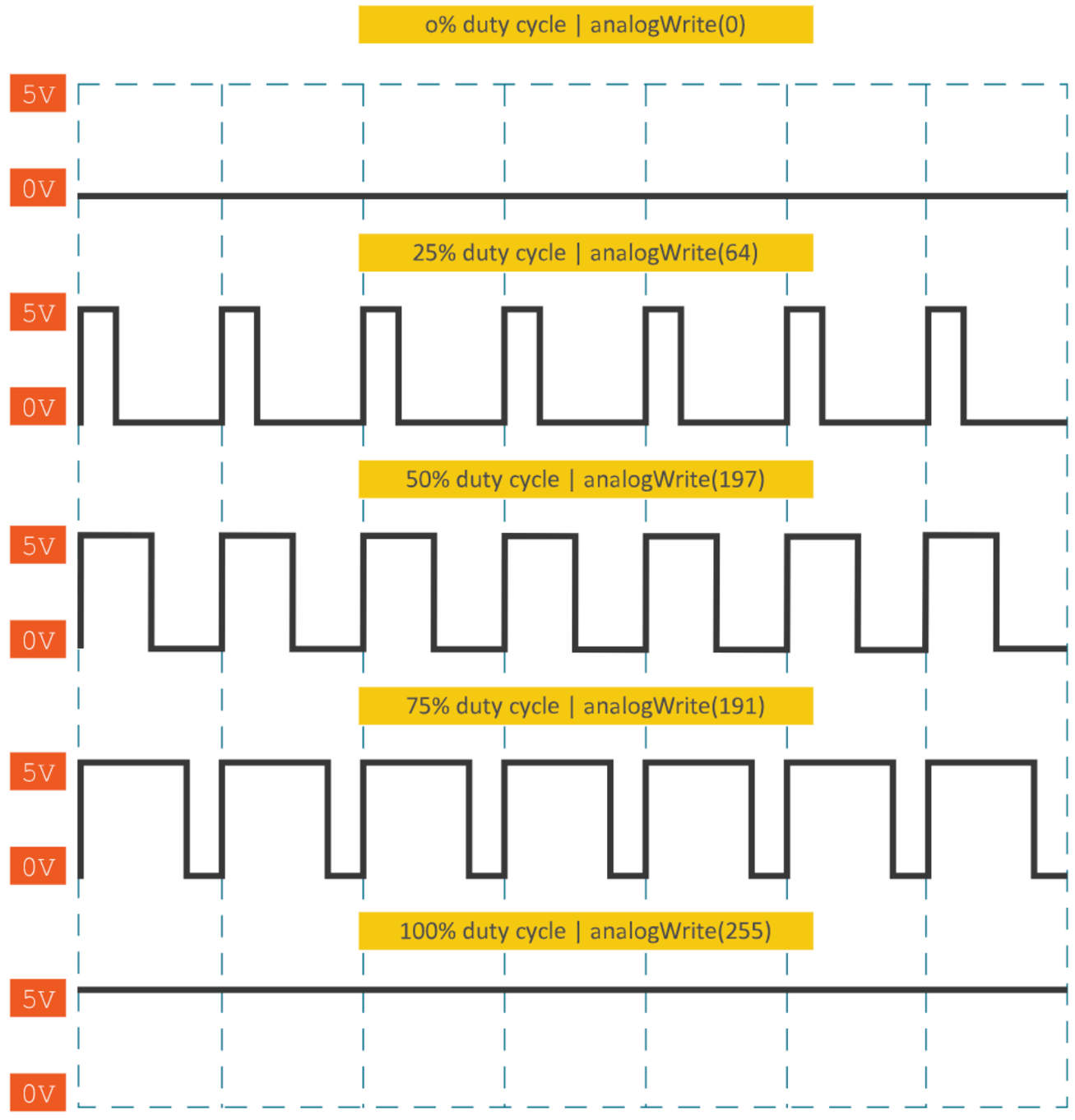


Exercise 2.2: More Blinkys

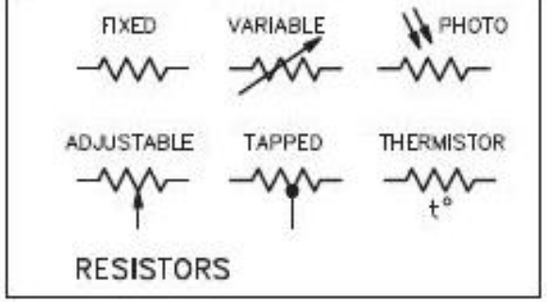
Connect two more LED and Resistors to your Arduino. Code it to blink a sequence on all LED.

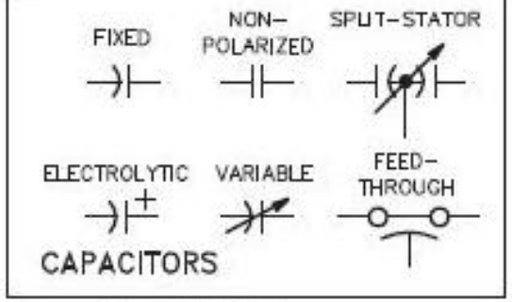
PWM pins on the Arduino Uno Wifi:

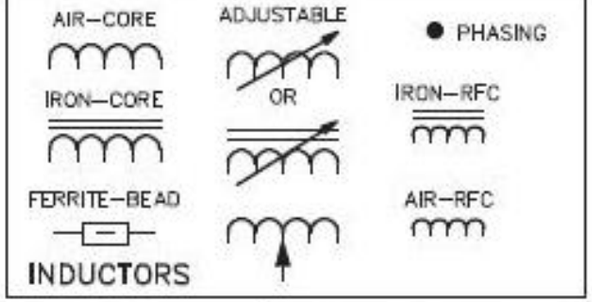
10, 9, 6, 5, 3

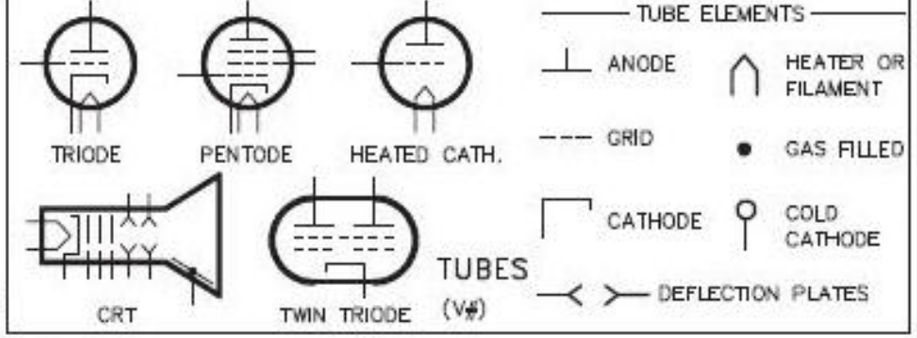


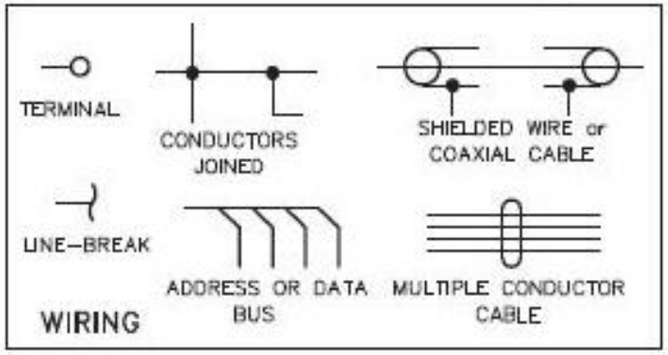
Pulse Width Modulation

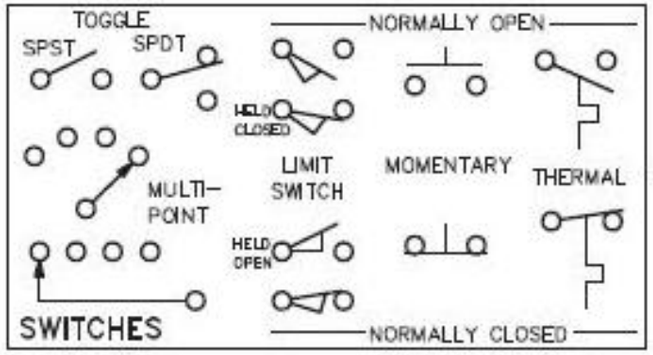


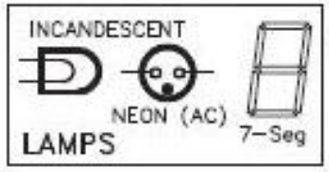


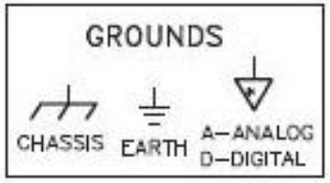


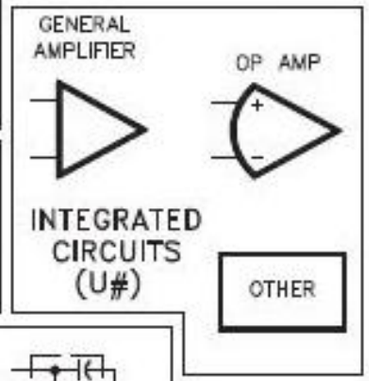


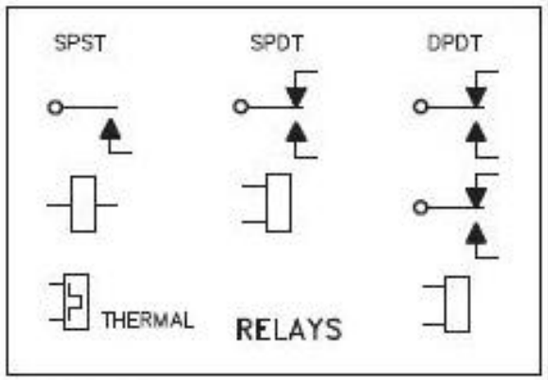


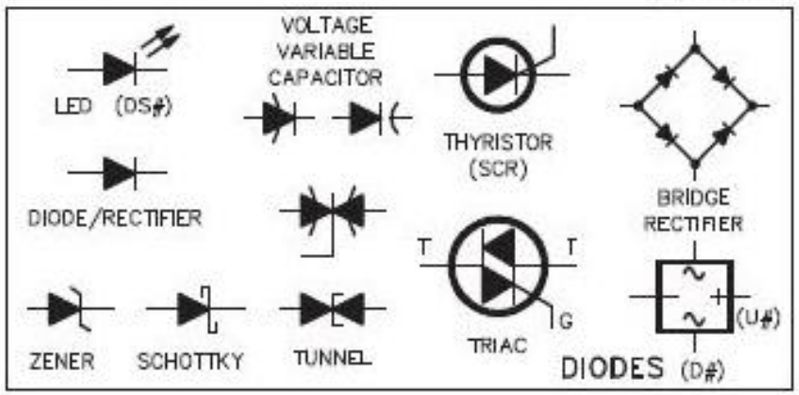


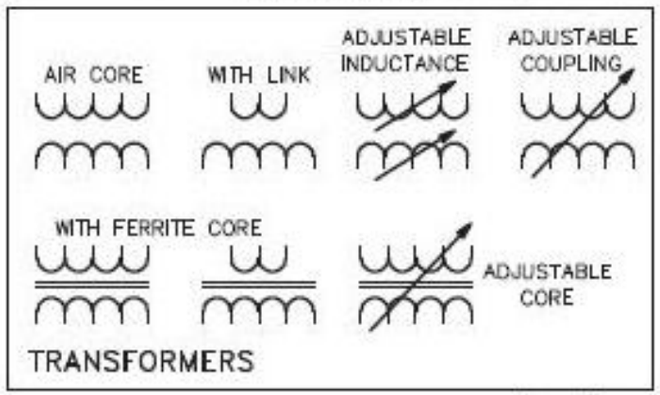


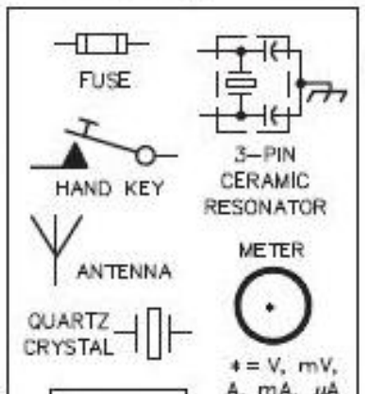


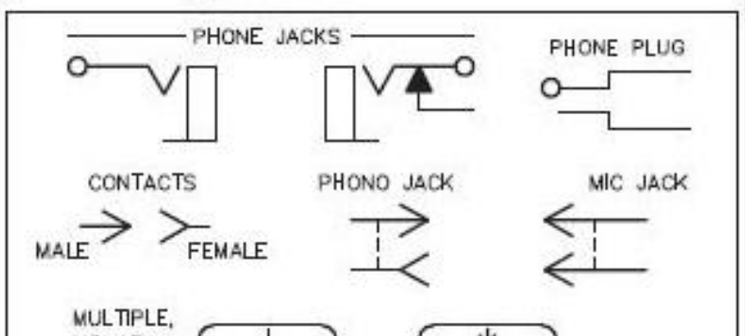


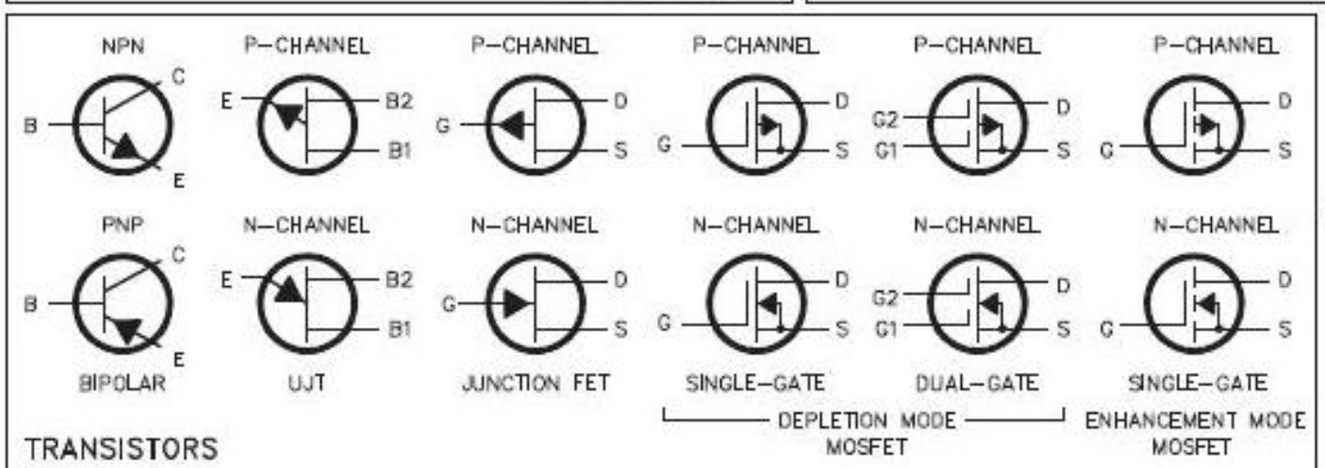


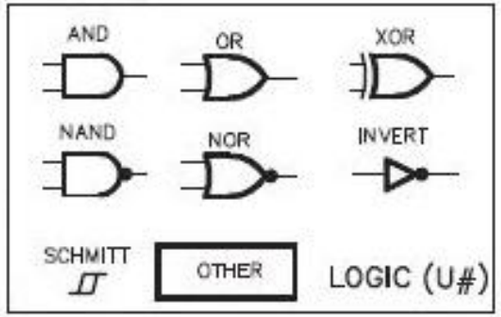












Sensing & Acting