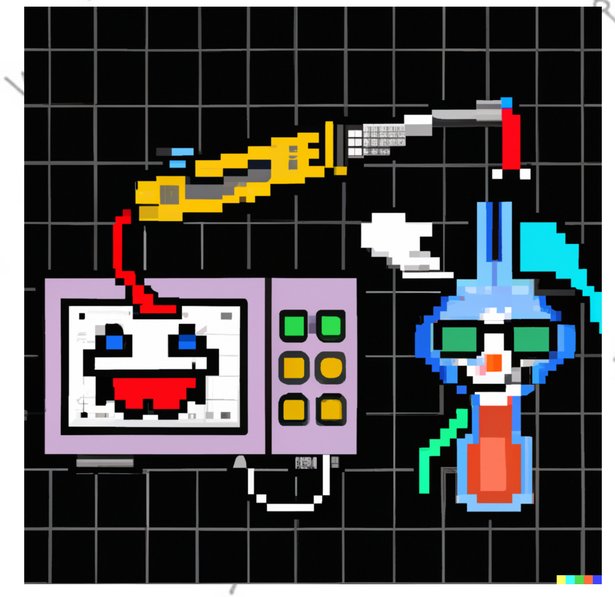
Hardware Hacking and Electronic Component Foraging

Acid Solder Club and Creative Coding Utrecht

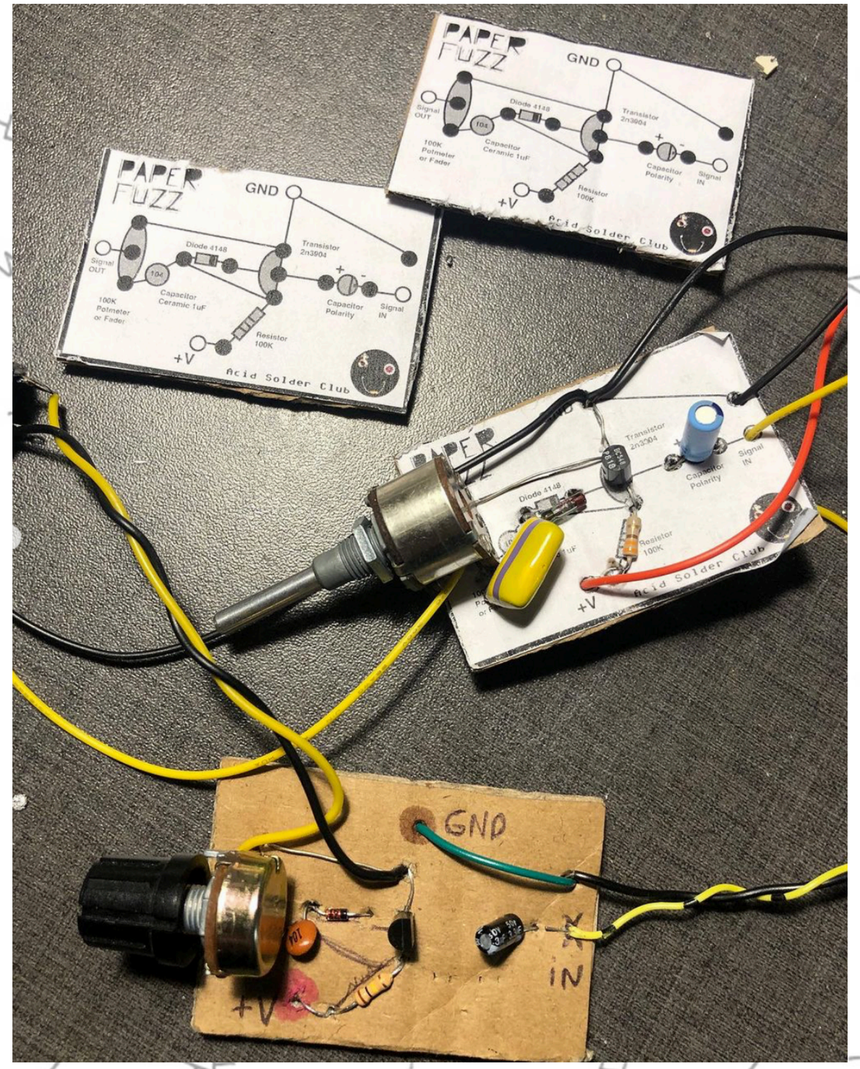


Permacomputing workshop series

Hardware Hacking and Electronic Component Foraging

Intro to Hardware Hacking
Cracking Coconuts
Electronic Components
Fuzz Circuit
Soldering and de-Soldering
Measuring Devices

Component Foraging for Super Simpel Fuzz Circuit!



Hardware Hacking?

Re-using and/or mis-use electronic apparatus beyond their initial intention in a creative way

Low-tech answers to a increasing high tech society, where we loose control over products we own.

Taking matters back in you own hands to have access to learn about electronics and sound/video.

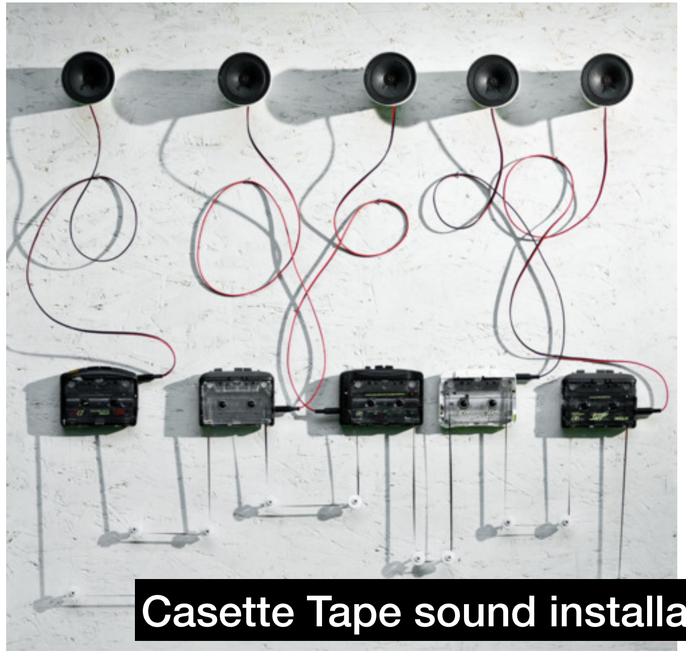
Circuit Bending
Reed Ghazala

Making Music Accessible/ find the electronic oysters

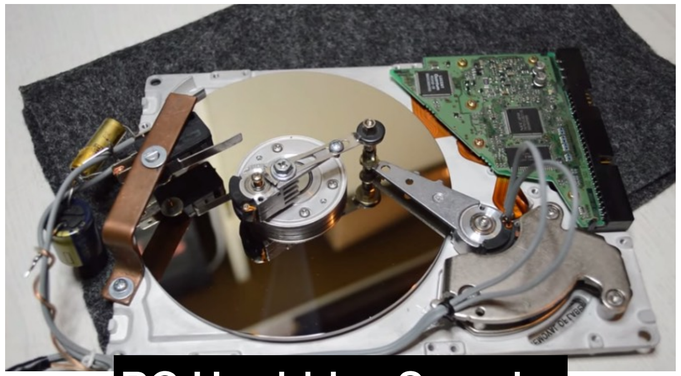
Nicolas Collins
Hardware Hacking Workshops

"How to ‘Tickle’ Electronics"

TV Oscilloscope



Casette Tape sound installation



PC Harddrive Sampler

Look Mom No Computer- Electronic Bible Hack

Familiar everyday electronics + having fun + totally taking them out of their contexts

Art, music, interaction, performance and crossovers in-between

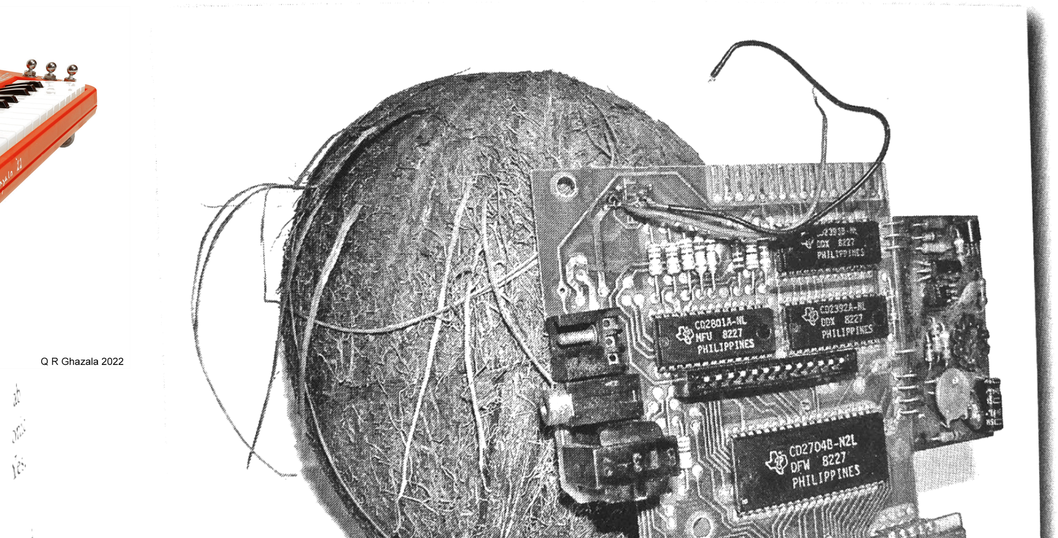
The Coconut Concept by Reed Ghazala

Anyone can step up to an open circuit and create,
without needing to know electronic theory or daunting equations.

http://www.anti-theory.com/bio/

Demonitron

Q R Ghazala 2022



The Coconut Concept

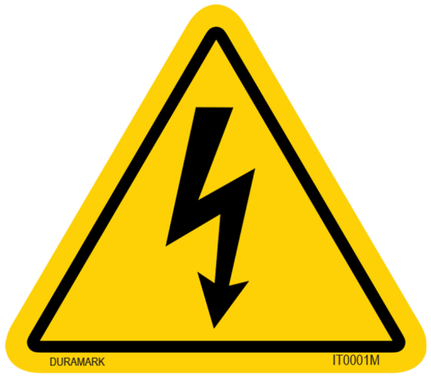
At first, this free-for-all we're having with circuitry might seem out of place. Fact is, earthlings *musicalize* things. A coconut washed up on the shore could be struck like the wood block of a percussion set. It could become the shell of a drum, the vessel of a flute, or the resonator of a fiddle. Idiophone, membranophone, aerophone, or chordophone, the simple coconut can be modified to fit all the major instrument groups of the orchestra. Add steel strings and magnetic pickup to the coconut fiddle and you've got the electronic group covered, too (Gibson guitars, give me a call).

Second-hand shops, where I find most of the circuits I bend, are like high-tide lines on a beach. They're high-tide lines for a different ocean—the ocean of western civilization. Instead of coconuts we find here everything else cast overboard by our throw-away society. Circuit-bending sees its circuits as the island native saw the coconut. In fact, in a very real sense, these things are the coconuts of our island. Adapt the coconut, adapt the circuit (see Figure 1-1).

So…How to crack that coconut?

Opening the machines

- How to open machines? What to look out for?
- Devices can NEVER be connected to the mains power both DC or AC while open!
- Dangerous components,
- Leaking coconuts (battery’s)
- Sharp parts and pcb points
- Potentially firing machines (springs, old plastic)



What is all these things?!

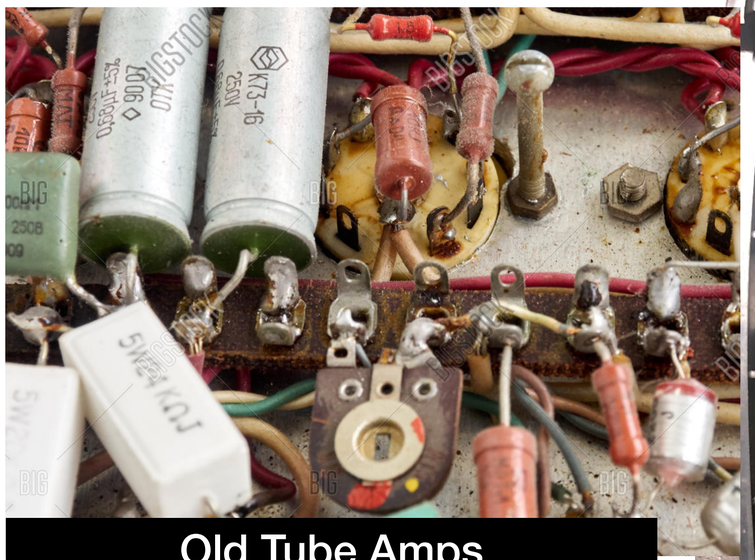
Components and their functions

PCB: Printed Circuit Board
Often green boards where components sit on.

Point-to-Point: no PCB used at all, connections from one to the other

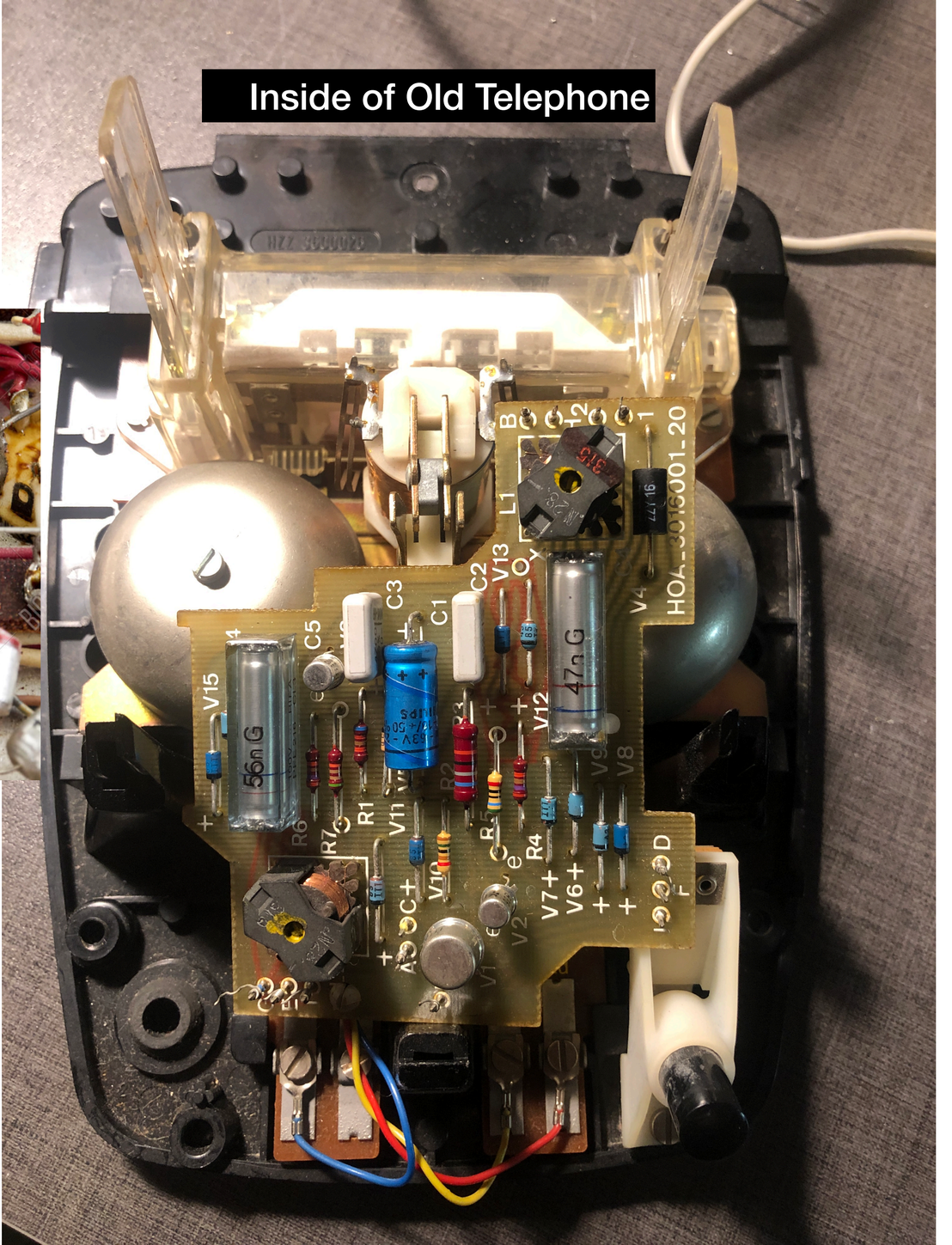
THT: Through-Hole-Technology Mounting, components go through the board and soldered on the other side.

SMD: Surface Mount Device
Very tiny electronic components placed on top of the PCB



Old Tube Amps
Point-to-Point soldering no PCB

Modern PCB with SMD components



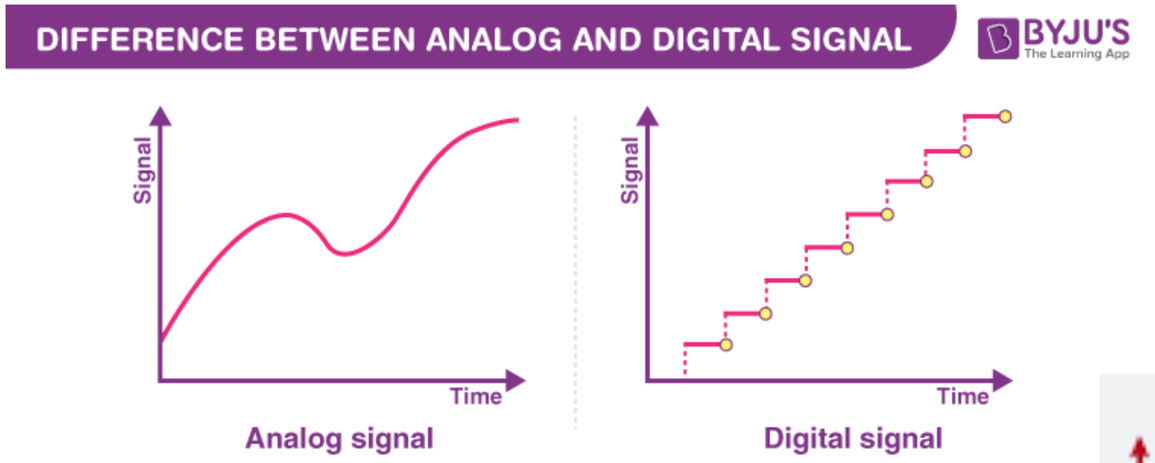
Inside of Old Telephone

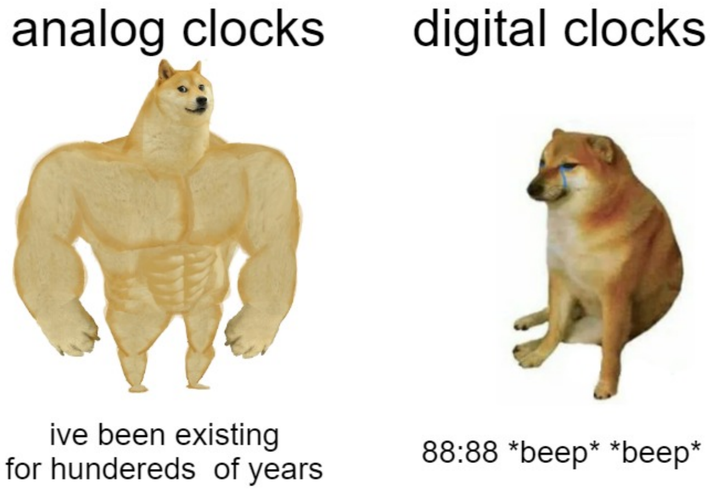
Components

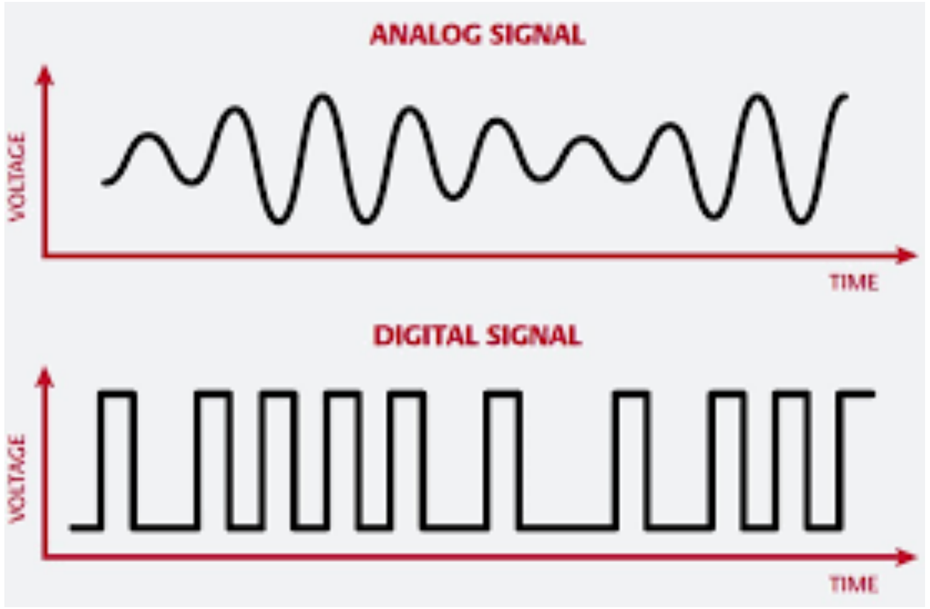
Following the Flow of Electricity

- Where does power come into the device?
- Conversion from Mains (220V) to Circuit happy volts (3V -5V - 12V etc.) PCB components ar**e mostly low voltage components.**
- ***WHY?***
- Home Devices operate on 220V. Most motor driven household appliances, blender, mixer, coffee machine, toasty machine w/heating element.
- Transporting low power volts of longer distances is more difficult.
- Analog and Digital circuits operate on low voltages. Unless we talk about tube amplifiers and specific cases = outside scope of this workshop.

Side Quest: ANALOG and DIGITAL







Electronic Components

Switches (EN) - Knoppen (NL)

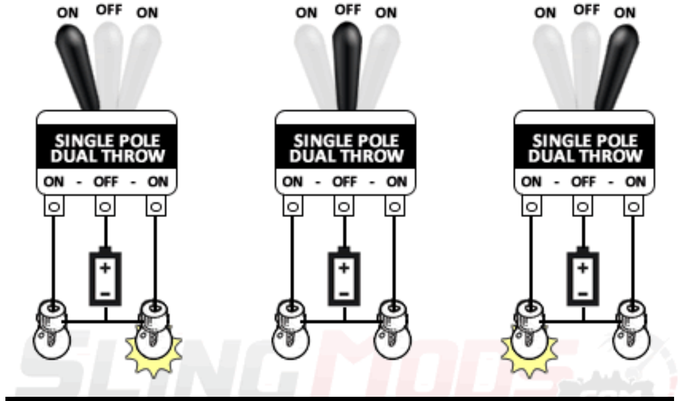
We will look at the components most useful for Hardware Hacking and Circuit Bending!

Switches turn stuff **on/off**

Switches can **make or break a connection.**

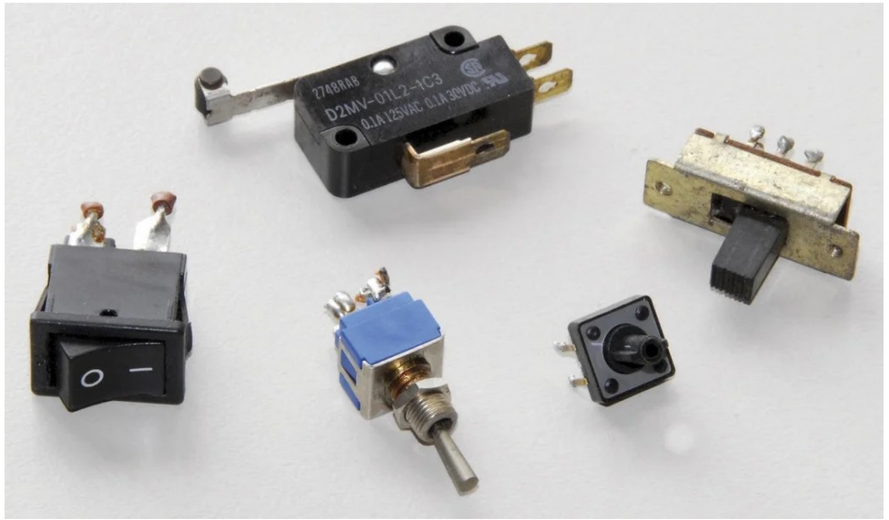
Switches allow electricity to flow or be blocked on its way to a destination.

Electronic Symbol



Left ON - Middle OFF - Right ON

On/Off Switch



Power comes into circuit

220V

Electronic Components

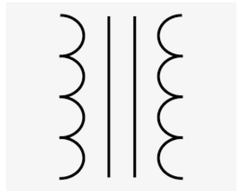
Transformer (EN)- Transformator (NL)

Convert **big power to little power** by use of copper wire wrappings generating electromagnetic fields.

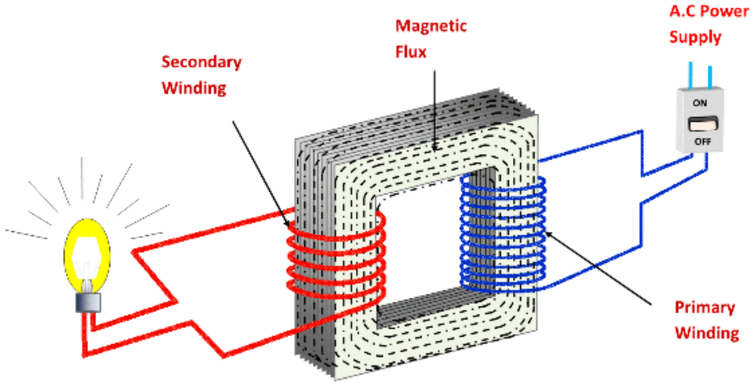
The both sides of a transformer are not connected together electronically, but via **magnetic fields.**

220V -> to -> 12V

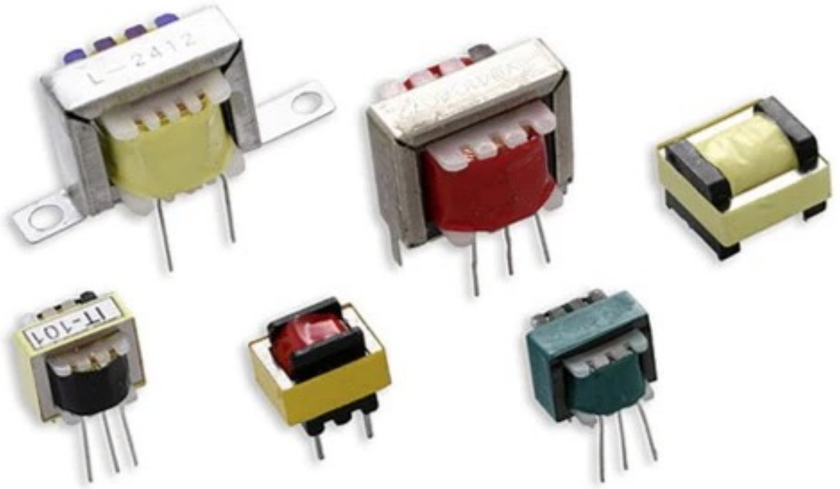
Transformers are filled with a **lot of copper** inside with many windings



Electronic Symbol



12V lamp



Transformer

Electronic Components

Diodes (EN) - Diodes (NL)

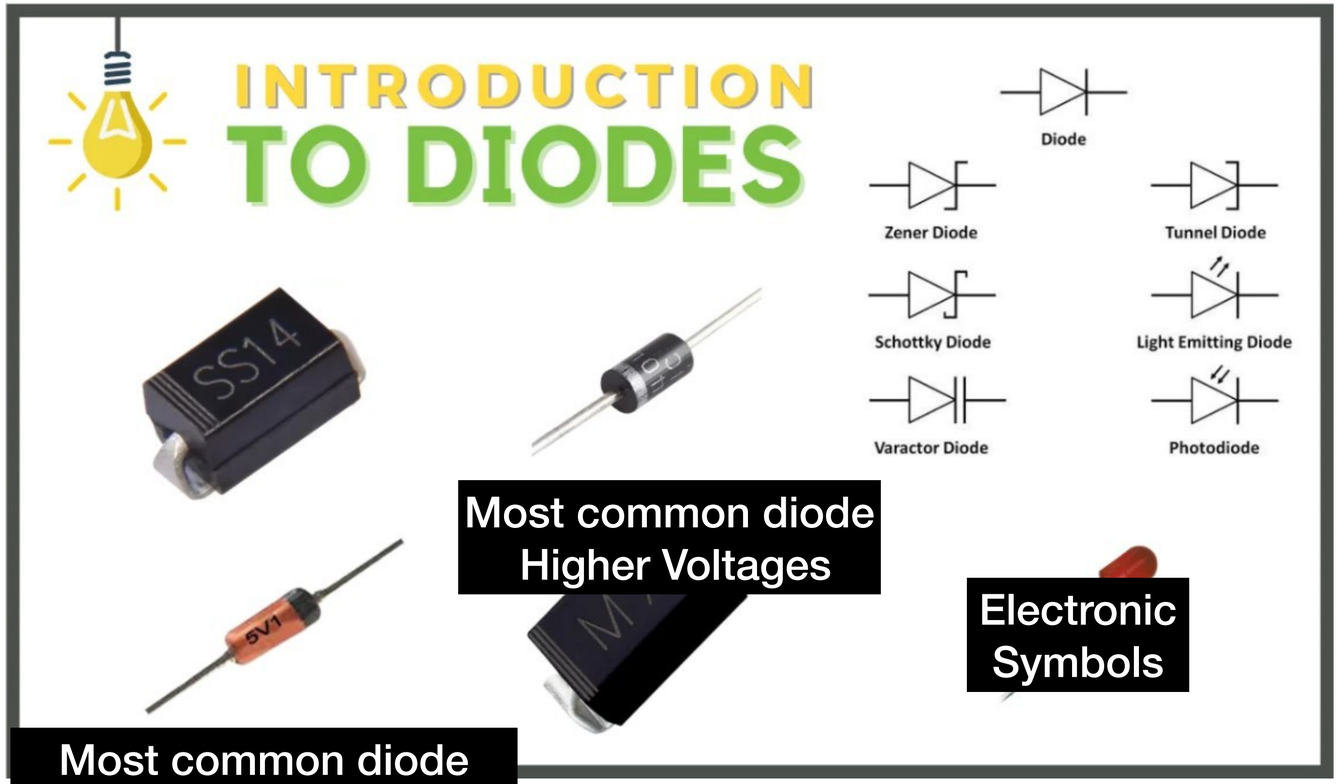
The **“you shall not pass!”** component!

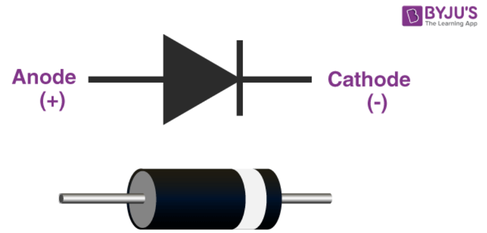
Only passes electricity through in one direction

Recognisable old ones with glass outsides.

Other indicator = STRIPE!
Direction of signal flow the Diode will allow to flow in.

Diodes

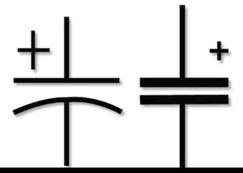




Electronic Components

Capacitors (EN) - Condensators (NL)

Capacitors **stores** voltage and when full, release it. When the capacitor reaches it maximum charge -> it will discharge -> before recharging again.



Electronic Symbol

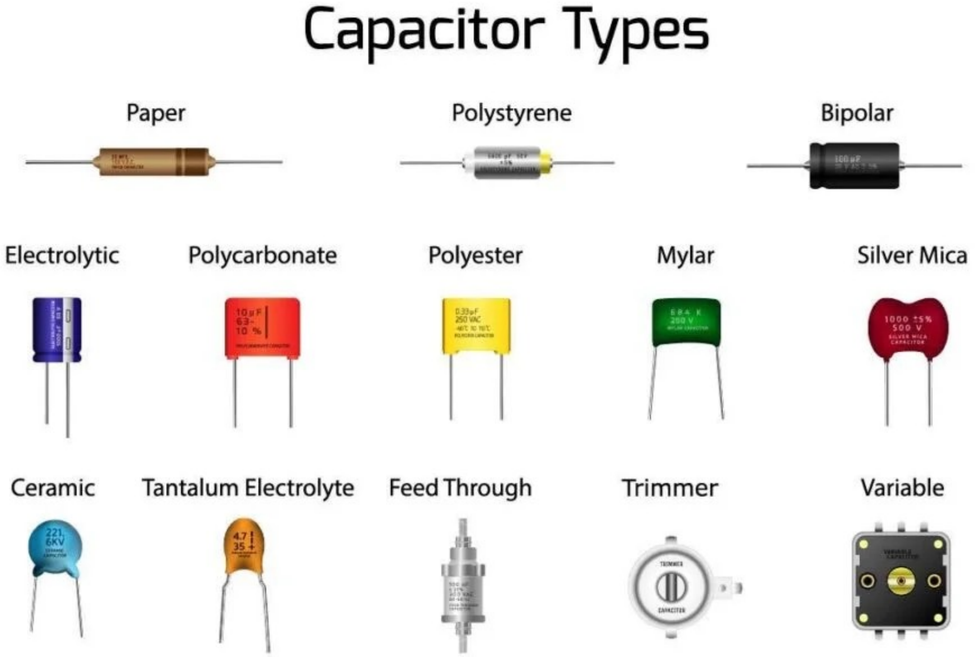
Input capacitors aka the **BIG ONES can KILL!**
They can store voltage for a long time, even after the power is turned off!

Capacitors are used often n **oscillator circuits**, filter circuits, noise spike reduction, but also to smooth out signals

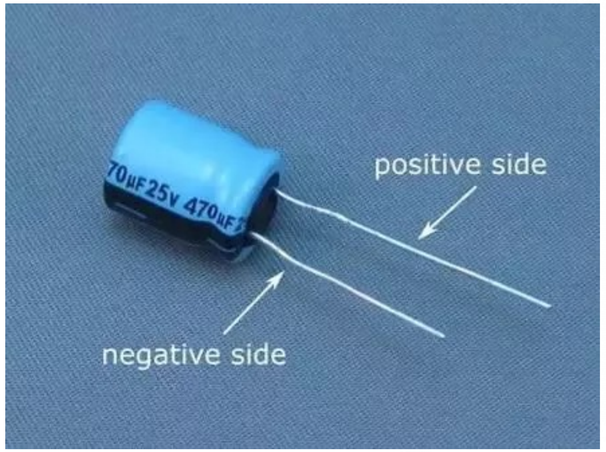
Value measured in **Farad.**
Microfarad> Nanofarad-> Picofarad
1 uF -> 1000 nF -> 1,000,000 pF

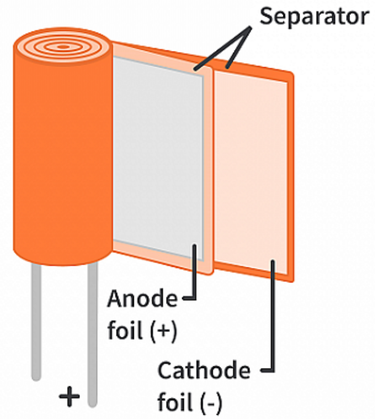
Polarised + and -

Unpolarized



Different Applications have different capacitors





Electronic Components

Resistors (EN) - Weerstanden (NL)

Resisting the flow of electricity.

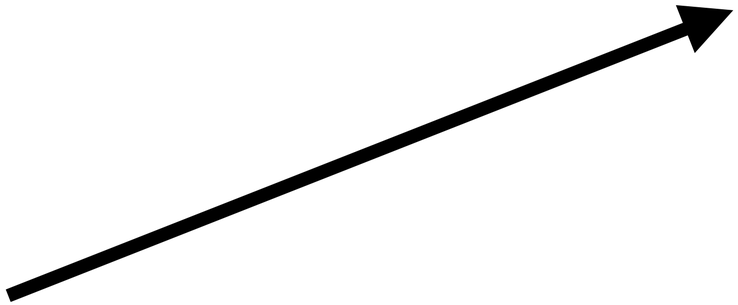
Used for lowering the flow of electricity in audio circuits to **“cool down”** audio outputs.

Prevent LED’s from burning out.

Lvl of resistance is measured in **OHMS** Ω
100 ohm -> 1 Kohm -> 1 Mega Ohm

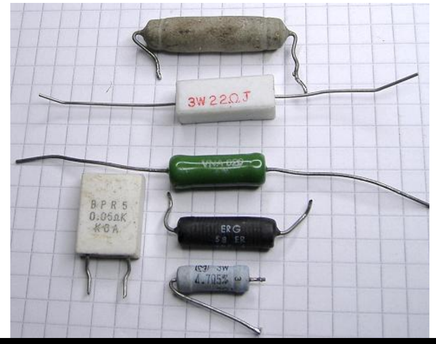
Very common, cheap to buy.

Inside combination of powdered carbon

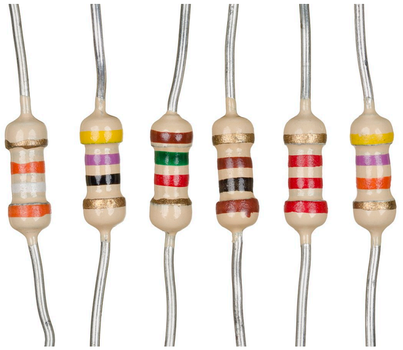


Resistor

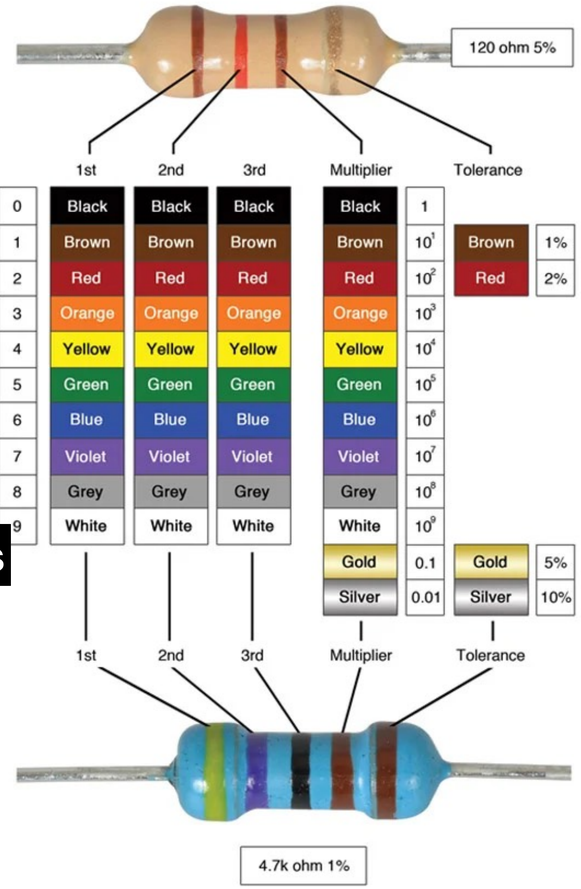
Electronic Symbol



Old resistors without colours



Colour bands indicate lvl of resistance

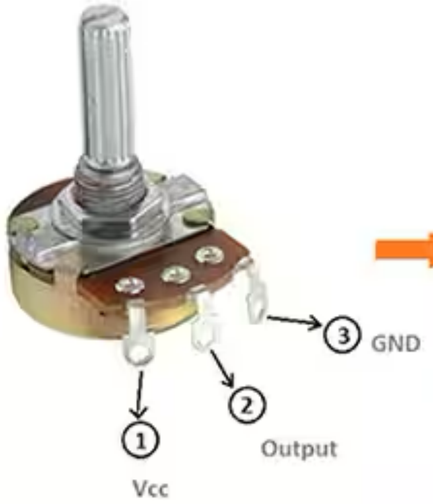


Electronic Components

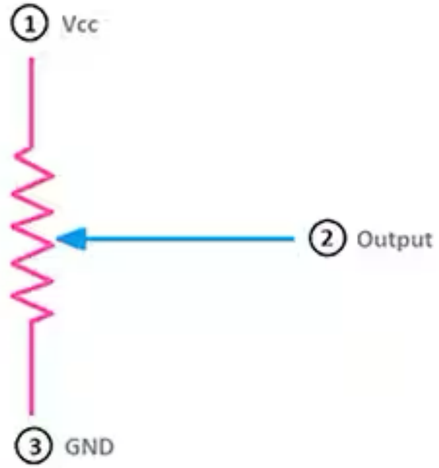
Variable Resistors

Not one resistance value, but a fluctuating/ **changing value of resistance based on certain conditions.**

Common used in audio devices for volume control

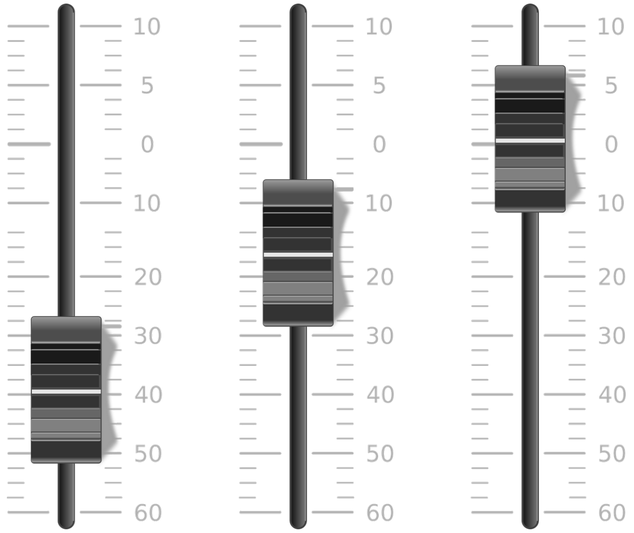


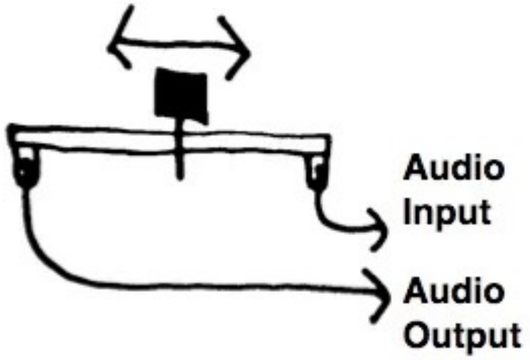
Potentiometer



Schematic

Fader





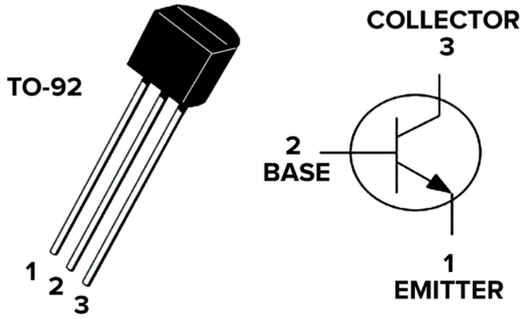
Fader Controller

Thermistor - Temperature resistor

Light dependent resistor

Electronic Components

Transistor (EN) - Transistor (NL)

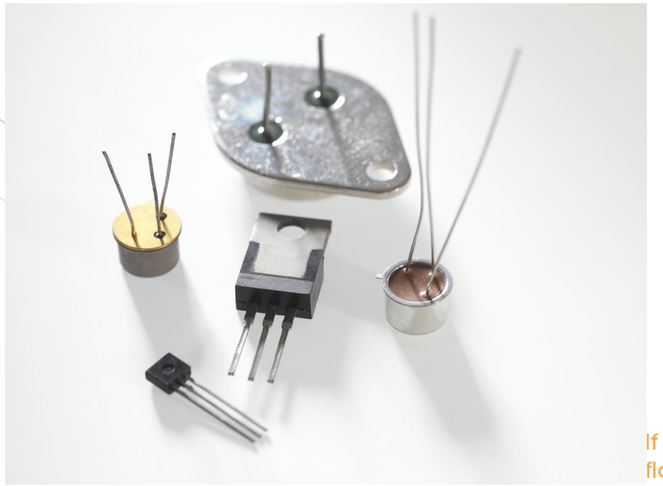


Transistor can act as **switch or gate** for electronic signals. Opening and closing an electronic gate **many times per second.**

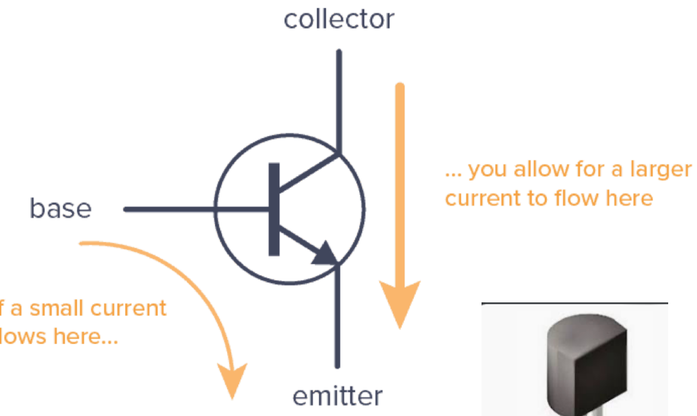
Transistors are used to **amplify signals.** Fuzz and Distortion circuits.

Only allows current to flow **under certain conditions.**

Special type transistors can be very rare to find.



Electronic Symbol



Transistor

Very small in SMD size

onsemi NPN Darlington…
€701.80
RS Netherlands
Free shipping
By smec

Electronic Components

Integrated Circuits/ IC chips

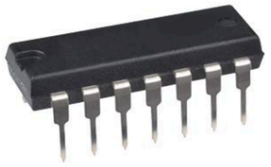
IC Chips also known as **“Chippies”** are blocks of electronic components squished together to form a new component, the IC chip.

Inside a IC chip there is a **whole new circuit of tiny components, microscopic size.**

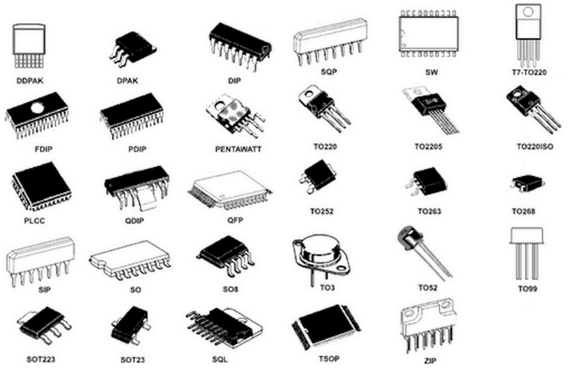
IC chips **can be rare,** can also be very common.

Very **sensitive to static electricity,** Handle with care. Easy to fry with soldering iron.

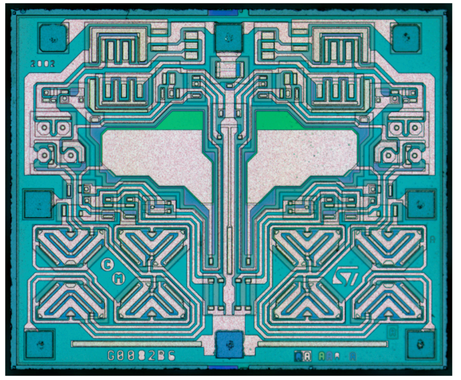
Not every chip does the same thing, **different chips have different functions.**



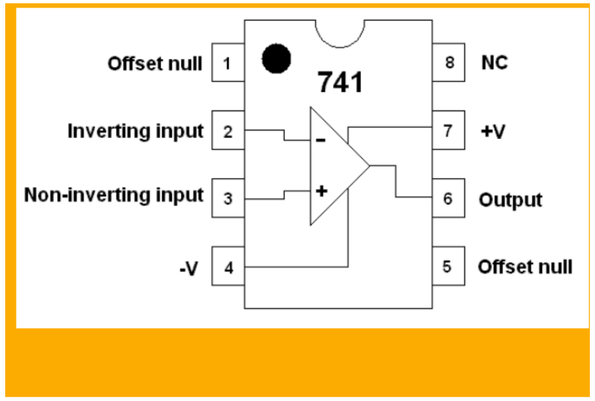
Chippies!



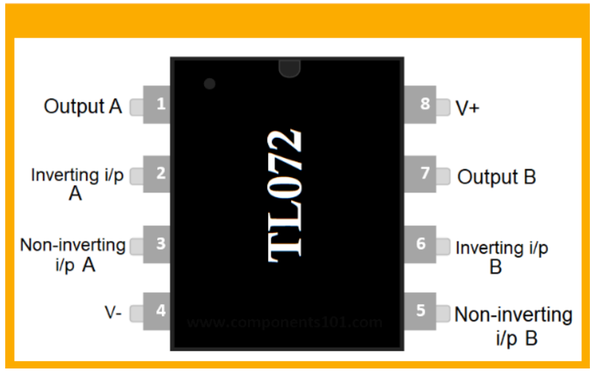
Very different layouts

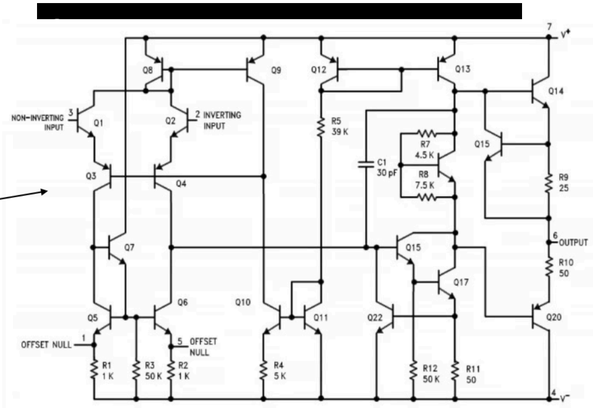


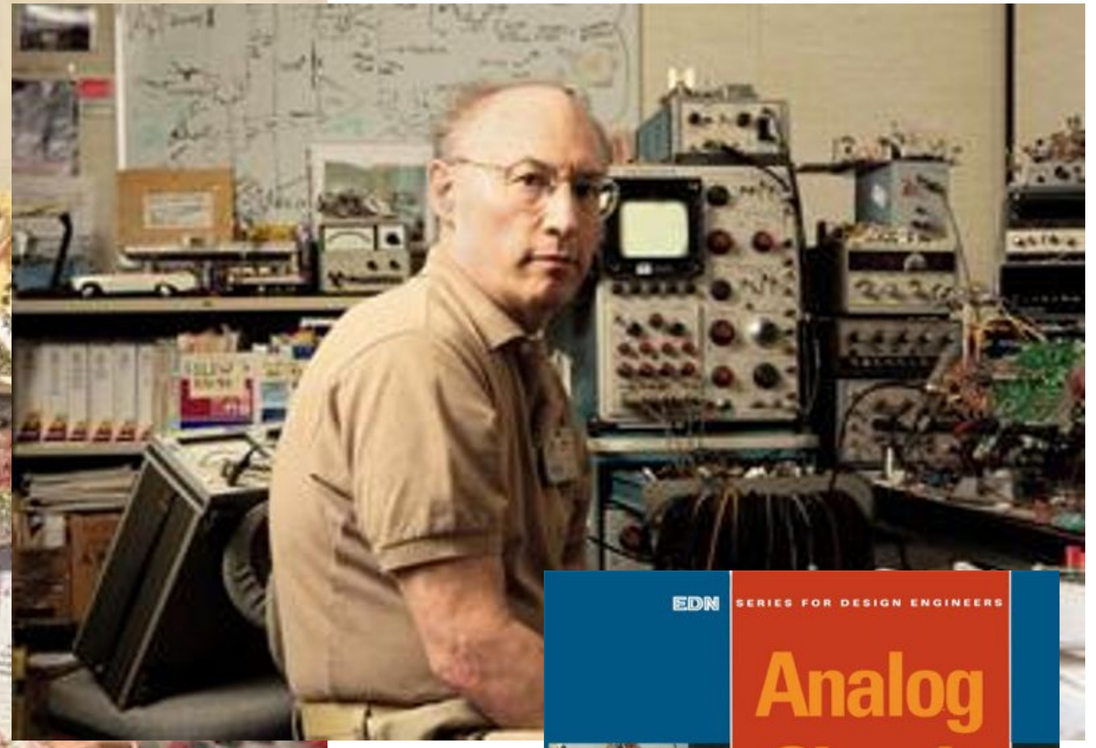
Pin Layout

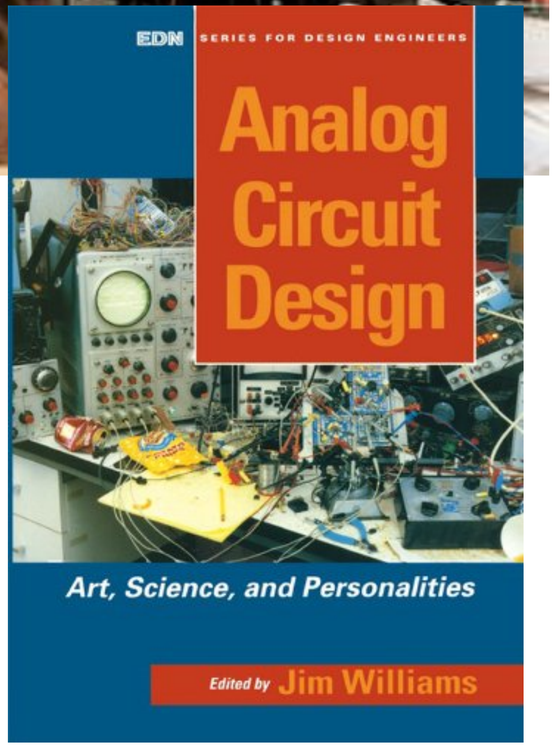


Pinouts of Op amp 741

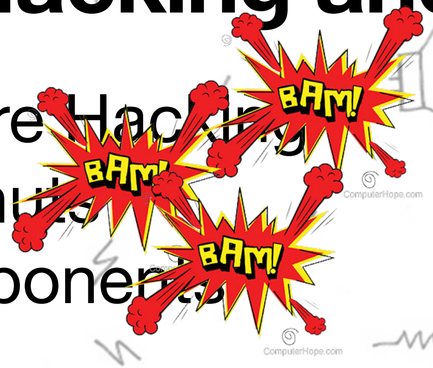







EDN
SERIES FOR DESIGN ENGINEERS
Analog Circuit Design
Art, Science, and Personalities
Edited by Jim Williams

Hardware Hacking and Electronic Component Foraging



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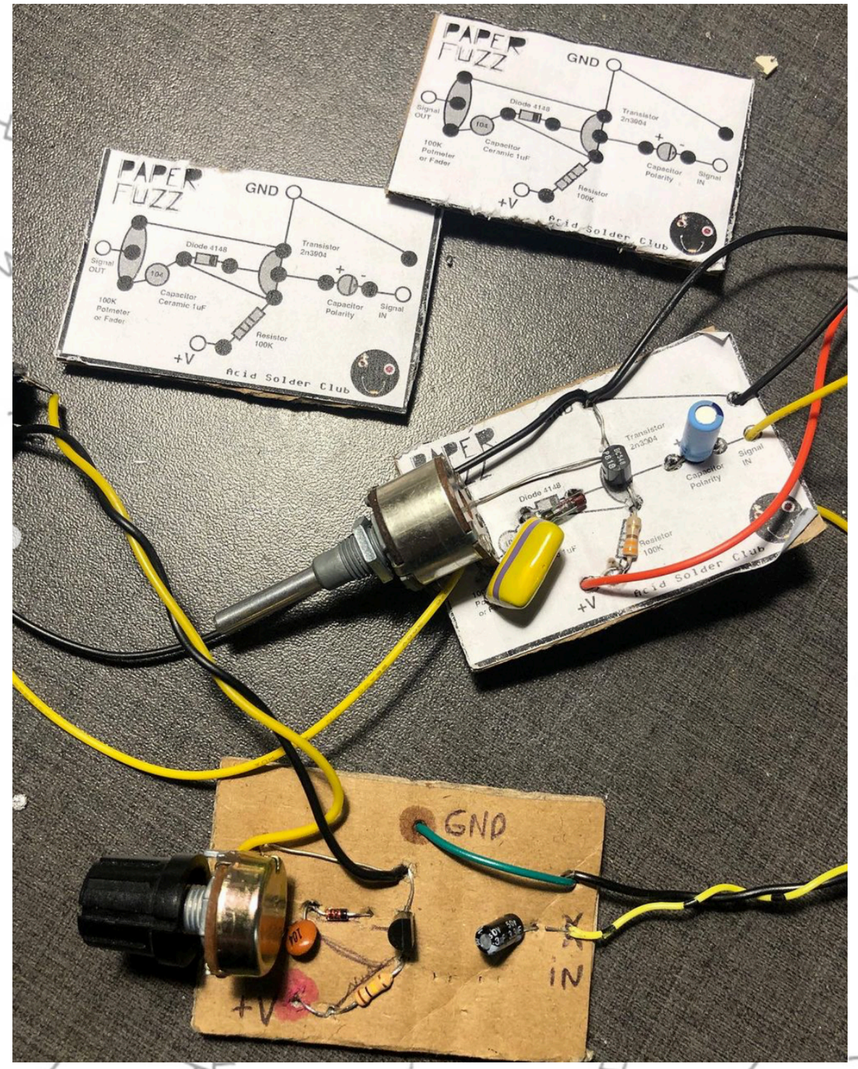
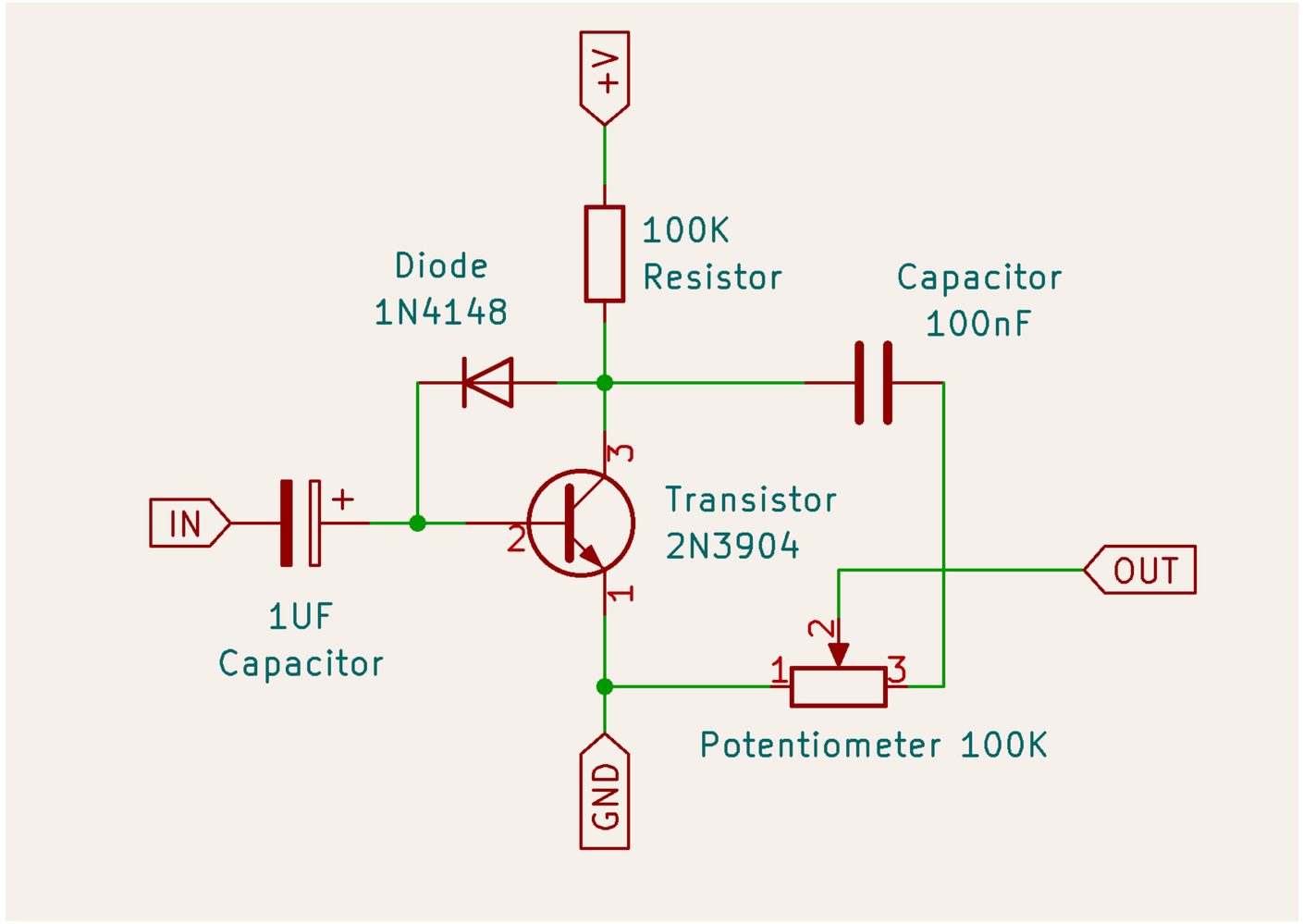
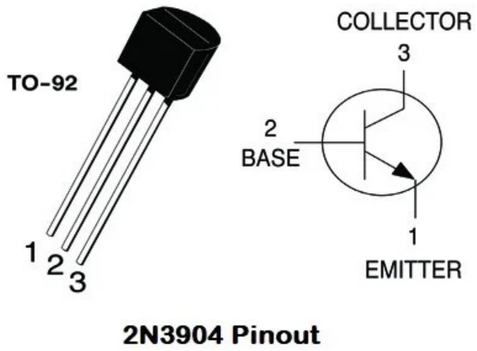
Soldering and de-Soldering
Measuring Devices

Component Foraging for Super Simpel Fuzz Circuit!



Super Simpel Fuzz Circuit

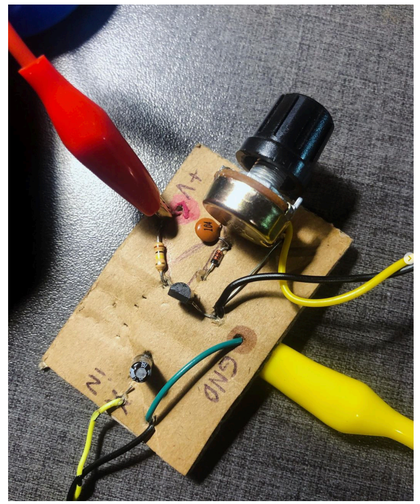




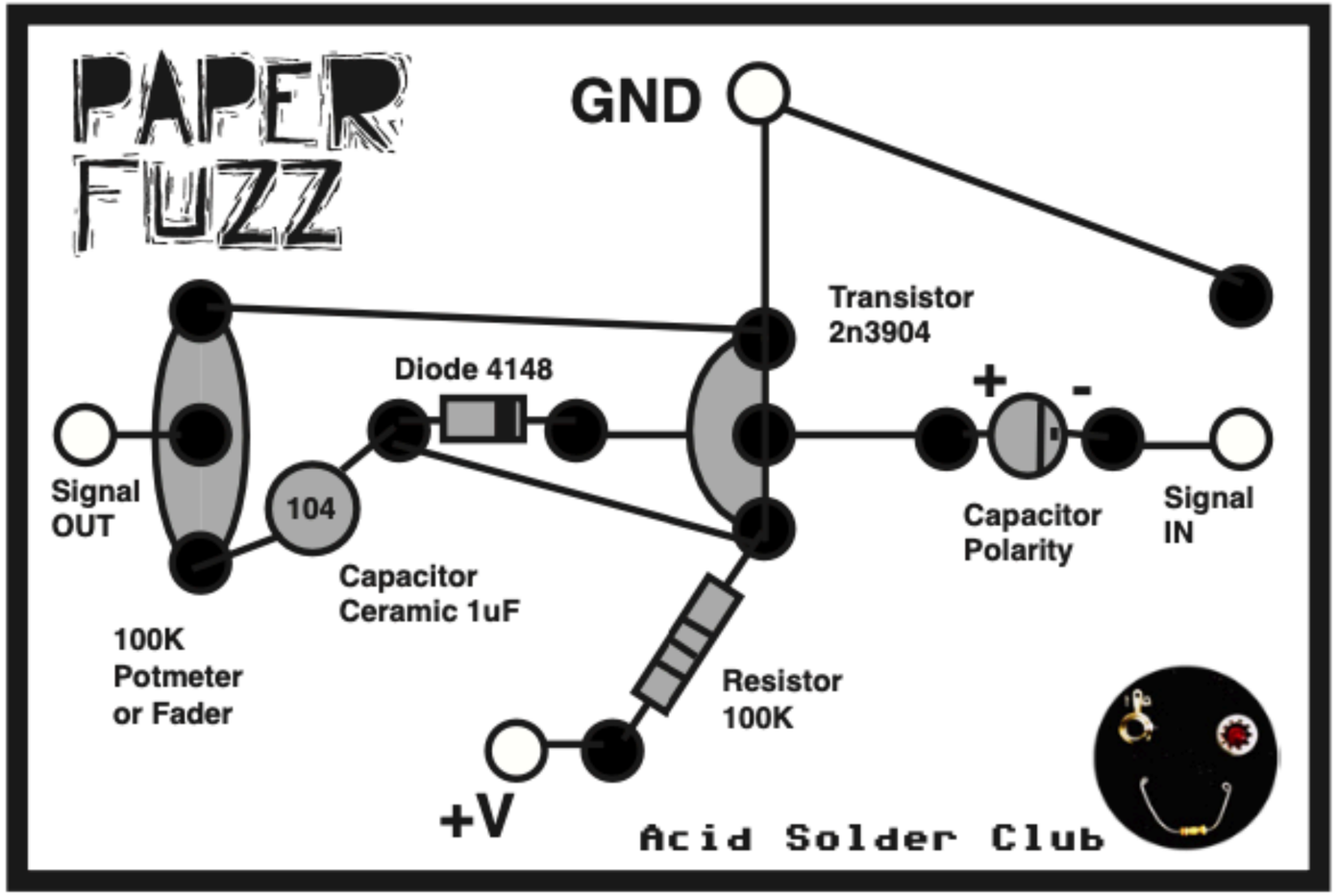
2N3904 Pinout

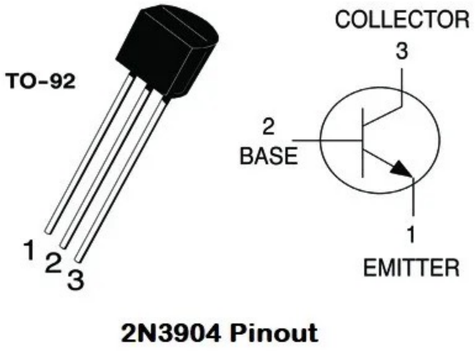
Bill of Materials (BOM)

1 uF Electrolytic Capacitor
100nF Ceramic Capacitor
100K Resistor
100K Potentiometer
2n3904 Transistor
1N4148 Diode



Super Simpel Fuzz Circuit



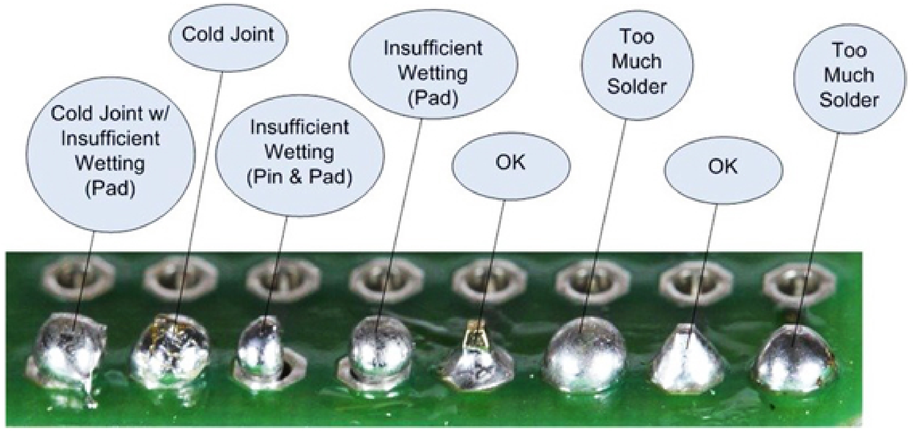


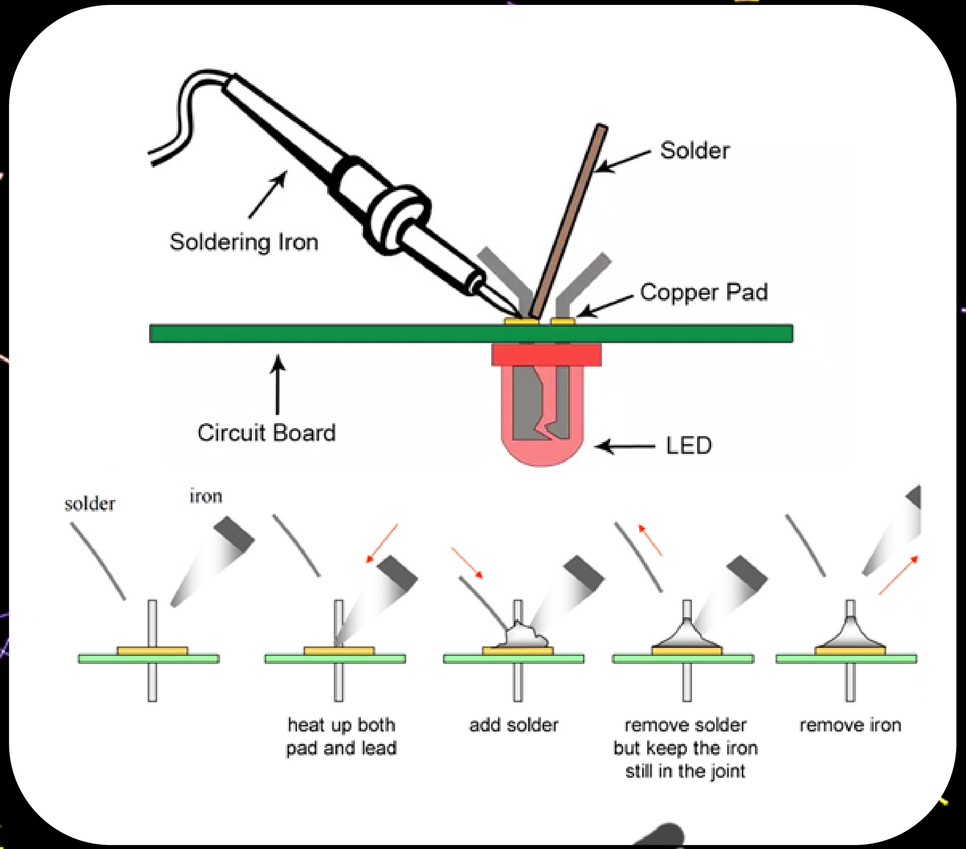
2N3904 Pinout

Bill of Materials (BOM)

1 uF Electrolytic Capacitor
100nF Ceramic Capacitor
100K Resistor
100K Potentiometer
2n3904 Transistor
1N4148 Diode

SOLDERING GUIDELINES:





MAKE SURE THE TIP IS ALWAYS CLEAN:)

Measuring Things!

Using the multimeter