MAGFest 2025 Soldering Project

1

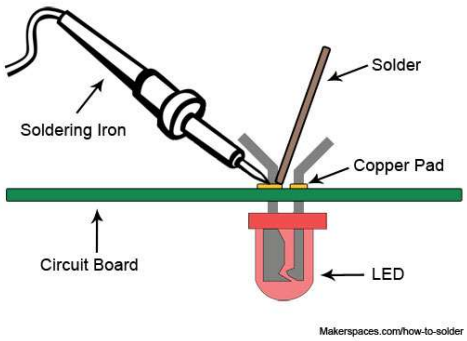
Are you following a printed version?

- Follow along with a video of me building this here. No sound, just visual
- https://bit.ly/solderMagfest
- Ask for help if you need it!

2

Soldering Terminology and Tools

- "**Soldering iron**" is a hot iron with a pen end to meld solder around electrical connections
- "**Solder**" is a metal alloy that is melted to create a bond between electrical parts
- "**Flux**" is a wax or synthetic material that is used to improve mechanical properties and bond of the solder to electrical contacts



3

Soldering Terminology and Tools

- Solder tips are cleaned when hot by rolling them over a wet **sponge**
- "**Tin the tip**" is a process to cover a newly cleaned iron tip with a small layer of solder
- It is recommended to clean and tin the tip of your iron a couple of times during this workshop

4

Soldering Terminology and Tools

Solder Sucker

Flux Paste

Wick Braid

ESD Tweezers

Helping Hand

5

Board Terminology

- "**PCB**" or a "**Printed Circuit Board**" is a multi-layer board made of fiberglass, resin, and copper (mostly)
- "**Component**" is any item attached to the board
- "**Copper Pad**" is the exposed area on a board that is ready for soldering
- "**Reference Designator**" is the shorthand note on the board for the component
- "**Thru Hole**" is a component that has holes through the board for mounting
- "**Surface Mount**" is a component that mounts on one side of the board only

6

How to Solder: summary of steps

1. *Turn on Soldering Iron and get it up to temperature*
2. *Clean soldering tip on a wet sponge*
3. *"Tin" the tip*

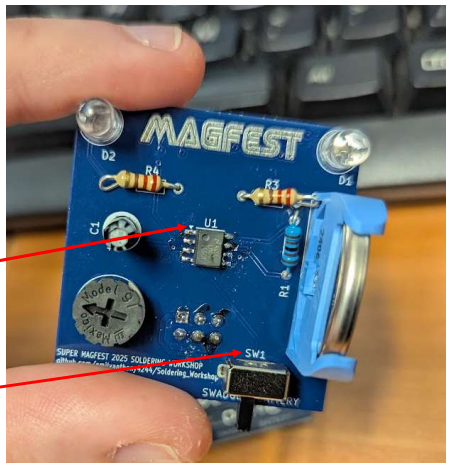
(the above steps have been done for you)

1. Place Component on board in the correct orientation
2. Heat the joint with the tip
3. Apply solder while tip is at joint
4. Remove Solder Wire
5. Remove Tip and Inspect

7

Step 1: place the component in the correct location and orientation

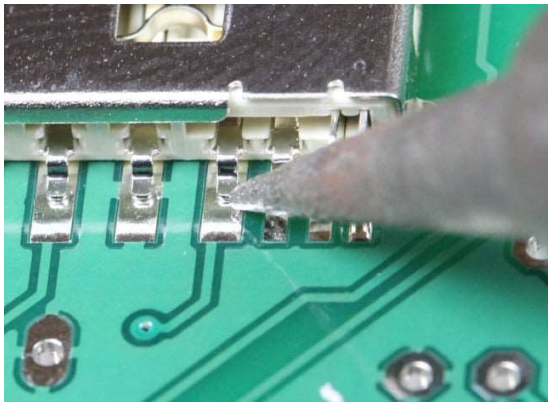
- Component orientation and positioning is critical. For each component on the board, we will tell you how to place it
- On some components, such as our **capacitors** and **resistors**, orientation doesn't matter
- Some components, like our Timer and Capacitor, have a **dot** to indicate orientation
- Every component has an alphanumeric **Reference Designator** to tell you where to put it



8

Step 2: Heat the Joint with the Tip

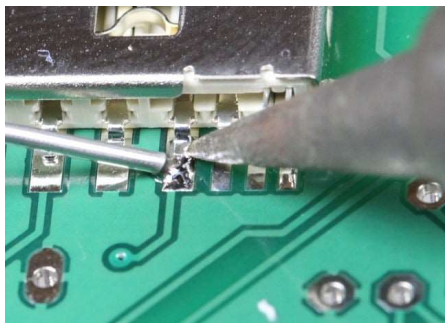
- Place the hot iron on the pad to preheat it
- Make sure the iron is touching the pad on the PCB and not the component. This is to make sure there is enough heat in the solder pad and to avoid damaging the component



9

Step 3: Apply solder to the joint

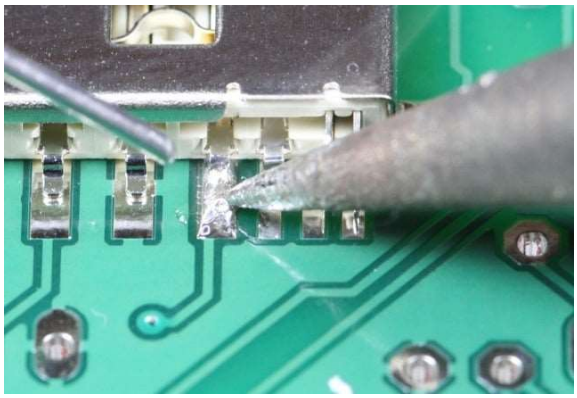
- Solder looks like wire, and melts quickly. Place the tip of the solder on the pad and press gently
- Too much solder can lead to bridging of adjacent pads
- Too little solder may not provide sufficient connection



10

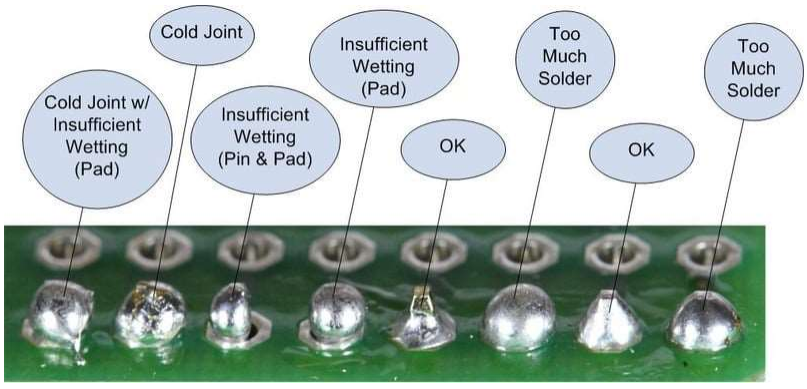
Step 4: Remove the solder wire

- Do not remove the iron first
- If you remove the iron first, you risk cooling the solder wire to the pad and ripping it when you pull it away



11

Step 5: Remove the tip and inspect

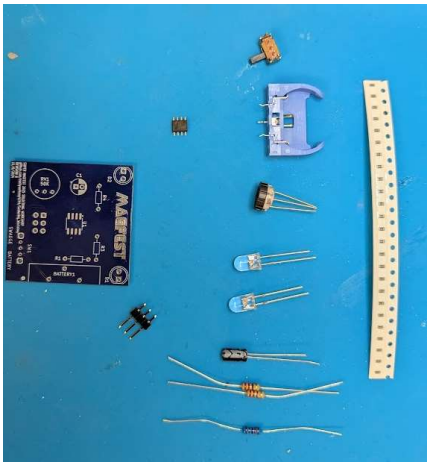


12

Okay… so what are we building?

- This is a custom designed PCB for this lab that can connect to your Swadge
- It has 2 LEDS and a 555 timer to flash the LEDs, with a knob to adjust the flashing speed
- We will assemble the PCB in steps together, going from least to most difficult components

Note: This can work without a swadge



13

Two Options

- Build with a battery

- Get:
- 1 bagged kit
- **1 blue battery holder**
- **1 battery**
- 2 leds, any color

- Build to connect a swadge

- Get:
- 1 bagged kit
- **1 2x3 pin header**
- 2 leds, any color

Or get both! Your choice.

14

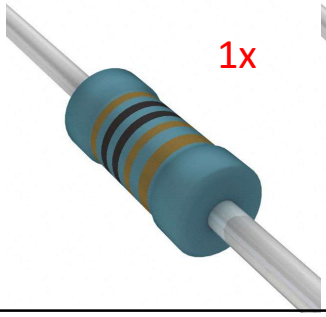
Safety Brief

- Soldering irons are hot. Do not touch your skin or others with them, or place them on a work table. They may only be in your hands or in the holder.
- The Solder we are using has Lead in it. Lead is hazardous to your health when ingested. Wash your hands after soldering and DO NOT EAT while participating in this workshop. You may wear nitrile gloves.
- It is recommended to wear protective eyewear.
- It is recommended to wear a mask.
- Note the location of a fire extinguisher nearby, AED, and emergency exits.

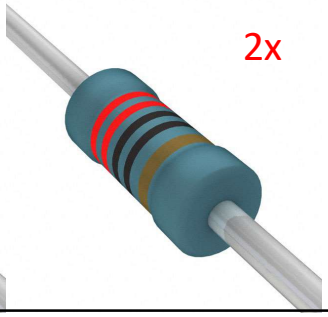
15

Step 1: The resistors

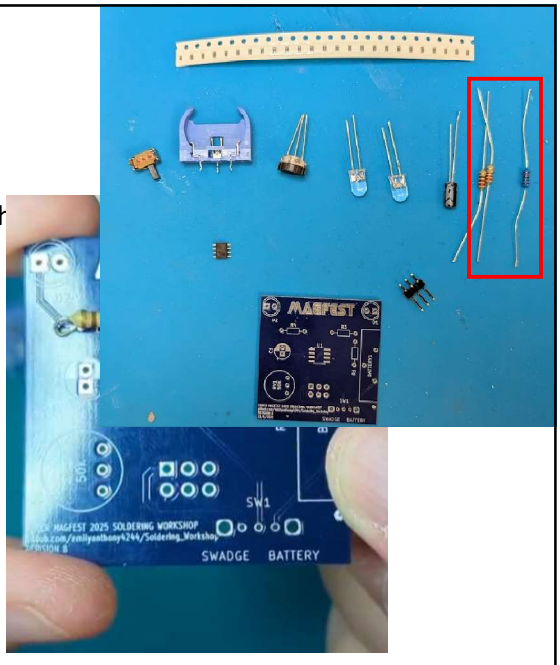
- There are 3 resistors in your bag
- There are two different types. 2 of one, 1 of the oth
  Examine the bands of colors for the difference
- Install the single one in R1
- Install the other two in R3 and R4
- Trim the leads with cutters when you are done



1x



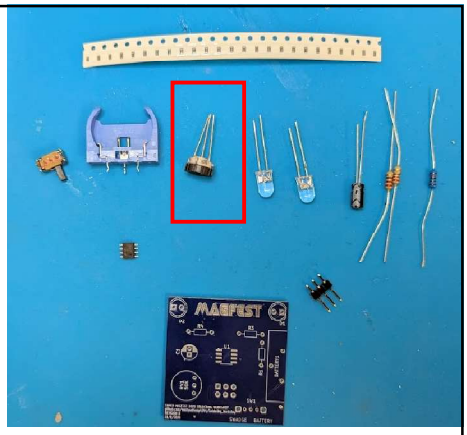
2x



16

Step 2: knob

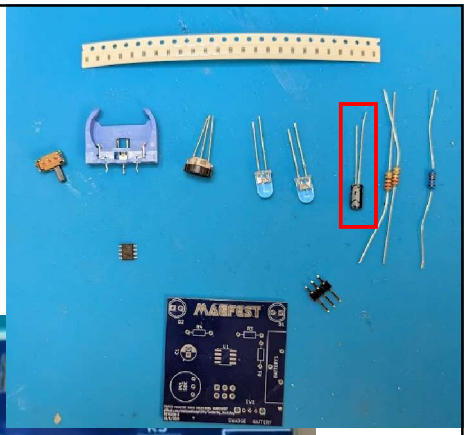
- Pretty self explanatory. Make it land in the circle drawn for it at RV1
- Trim the leads when you are done

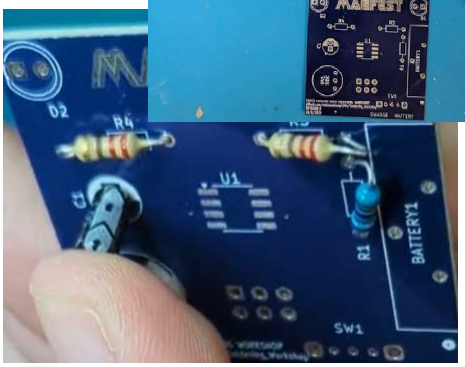


17

Step 3: The capacitor

- The capacitor is **Polarized**
- This means the way it gets installed matters!
- Look for the white marking on the body and align it with the white marking on the PCB
- Again, trim the leads when you are done!

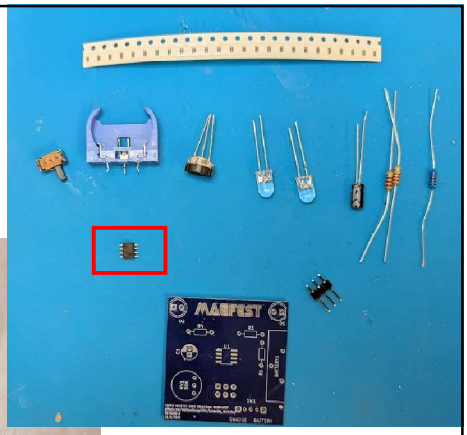


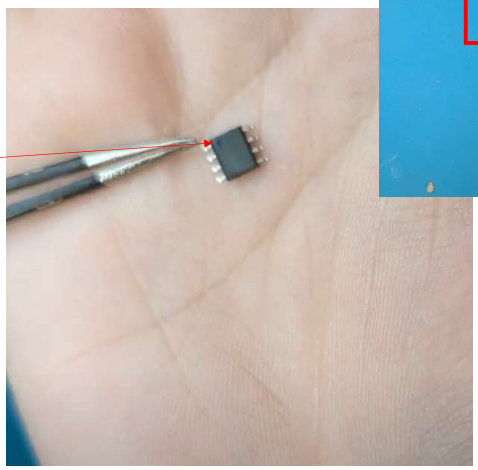


18

Step 4: The surface mount timer

- The timer has a small mark noting its orientation
- Look at the piece and inspect it
- See the dot?

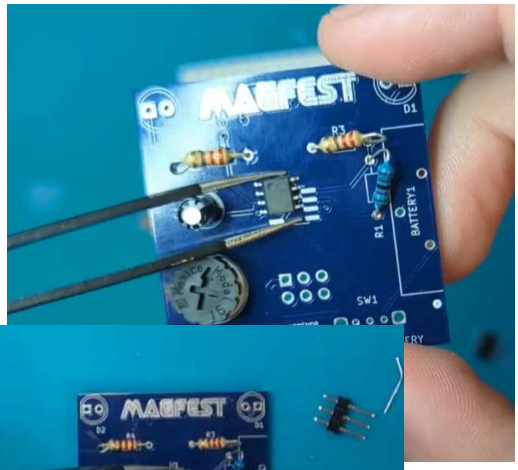




19

Step 4: Timer continued

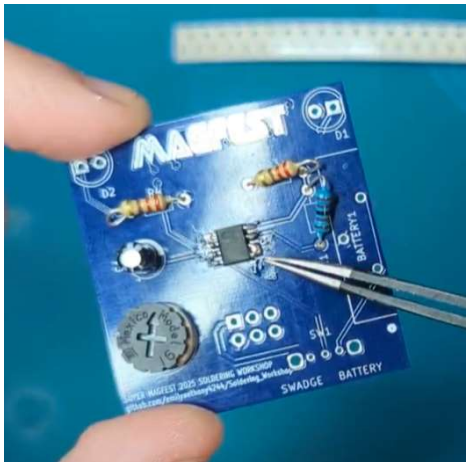
- Make sure you place the timer in the correct orientation! See the image on the right
- Use tweezers or flux to help hold it in place – ask for tools if you need them
- Solder one of the corners first, and then another
- Make sure you solder each connection



20

Oh no, I bridged two pins!

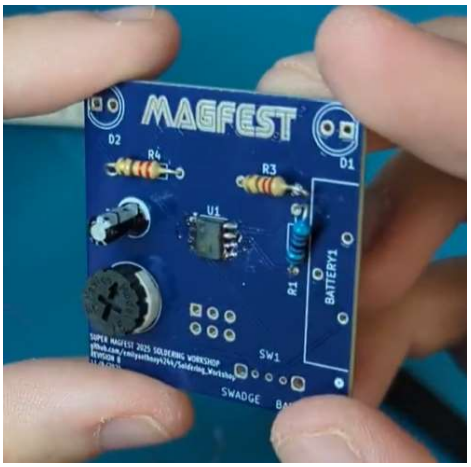
- This is okay
- Ask for the solder sucker
- Plunge the sucker down
- Heat the joint with the iron, do not remove
- Place the sucker and press the button to suck the liquid solder up



21

Inspect the pins after before moving on

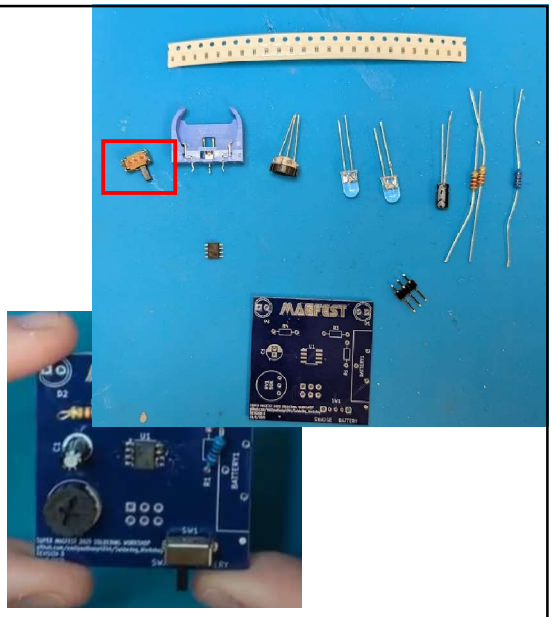
- Looks good!



22

Step 5: Power switch

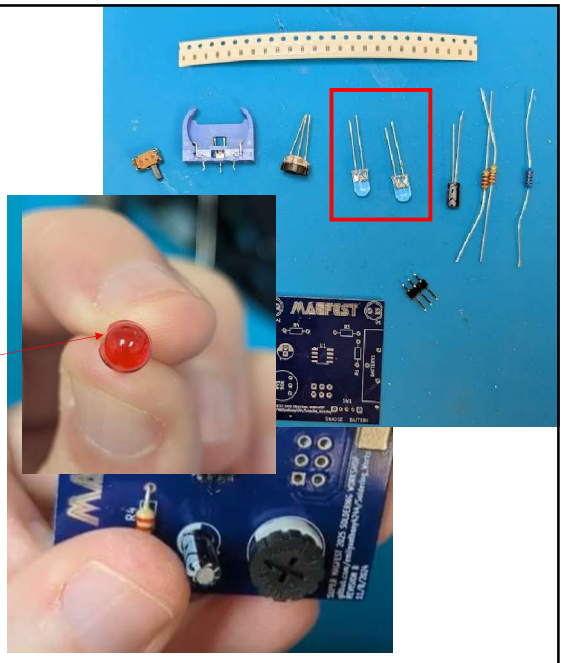
- Back to thru-hole (yay, you lived!)
- Place on the front side of the board, and then flip it over and rest it on your mat to solder the back
- Connect one of the small MIDDLE pins first, and then the ends



23

Step 6: LEDs

- Pick your two favorite colors
- The LEDs have a polarity just like the capacitors
- Inspect the board; you'll see a flat side of the circle for the LEDs D1 and D2
- Inspect the LED, you'll see the same flat
- Note that the flats are facing opposite sides
- Align the flats and solder
- Trim your leads after!



24

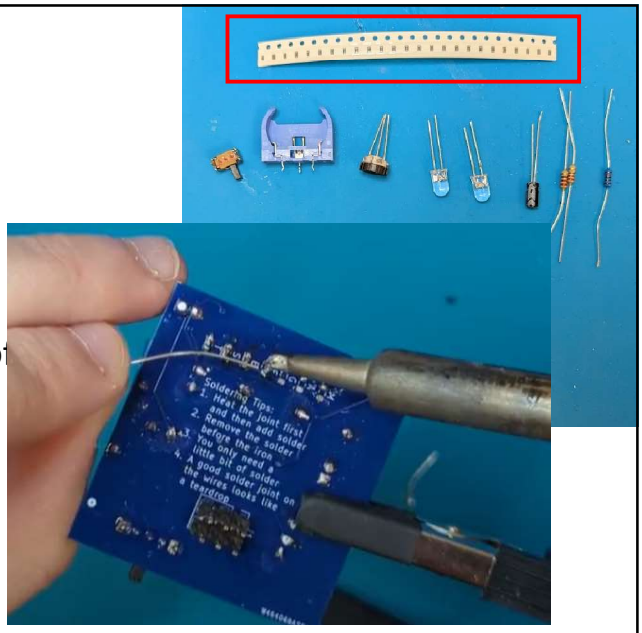
Oh no, I put my LED in the wrong way!

- Trim the leads down as low as possible, and use the solder sucker
- Heat the joint with the iron, do not remove
- Use sucker
- Pull away
- Get a new LED

25

Bonus content: Surface Mount Resistors on the back

- **Do this before the battery**
- If you want a challenge, pick 6 surface mount resistors out (the same or different resistance) out of the booklet at a high impedance (30kOhm or above)
- Place solder on one pad of each resistor spot labeled M A G F E S T

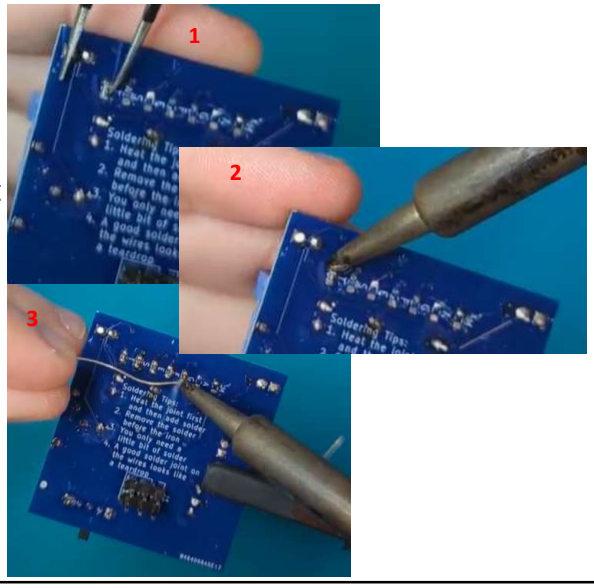


26

Bonus content: Surface Mount Resistors on the back

1. Place the resistor on the pad
   - You can use flux paste to hold it still
   - Recommend tweezers
2. Remelt the solder of the pad you just put solder on with the resistor attached
3. Solder the other side

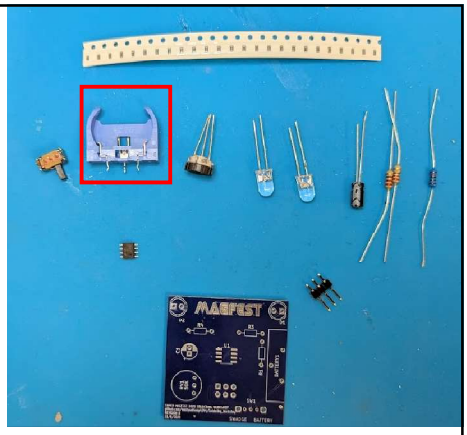
This is hard, don't sweat it if you can't get it. You can do any number of them. It won't impact the circuit in the end



27

Step 7: Battery Mount

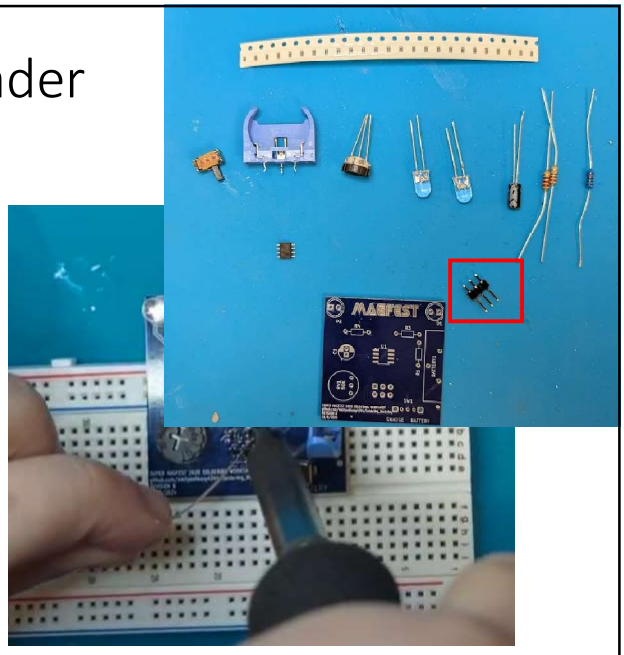
- The battery mount must be clipped in with the open side facing out!



28

Step 8: Swadge SAO header Mount

- Place the header on the BACK of the board, not the front!!
- Solder on the front
- Use a breadboard to hold it if you are having trouble (but you should be ok)



29

Congrats!

- Turn the power on to inspect your work
- The leds should flash back and forth
- Turn the knob to change the rate at which they flash

30