

EMP SAO v2.1 Build Instructions

2025-07-29

Tools Required

- Diagonal Cutters (Wire snips)
- Soldering Supplies
 - Soldering Iron
 - Solder
- USB-C Cable
- Computer (to flash the chip)
- Pliers (optional)

Assembly Instructions

Verify Kit Contents



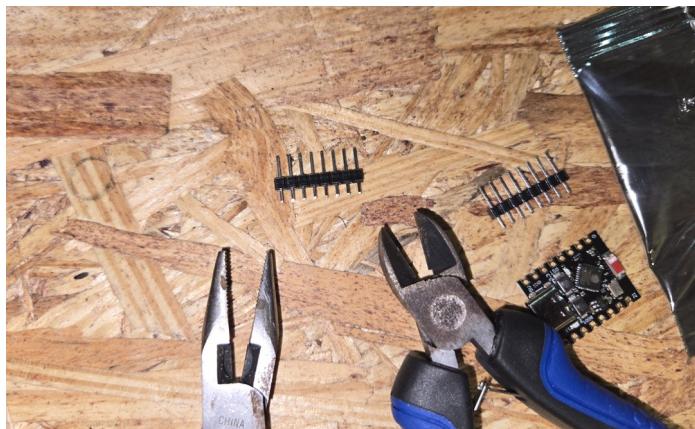
- SAO PCB
- Clear Plastic Bag
 - 1x Large LED ring
 - 1x Small LED ring
 - 2x Push Buttons
 - 1x 2x3 Pin Connector
- Metallic Bag
 - 1x ESP32-C3
 - 2x 8-pin row headers

Locate Header Pins



- Open the metallic bag
- Separate out the two sets of header pins

Separate the Pins



- Use either the snips or pliers to separate the pins
 - Cut between the pins if using snips
 - Twist them to separate if using pliers



Place the Pins in the PCB



- Place the pins upright in the PCB



- Place the longer side of the pin down
- The small plastic piece on the pin should rest on the top(front) of the pcb

Place the Rings on the Pins



- Line up the DO Pin with the Data Out
- Line Up the DI Pine with Data In
- Flip the ring over into place
- Confirm the GND and Vin pin are correct and seated

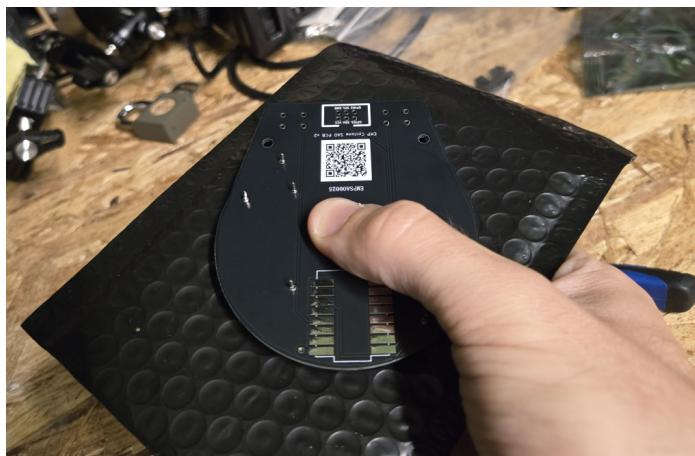


- Repeat for both rings

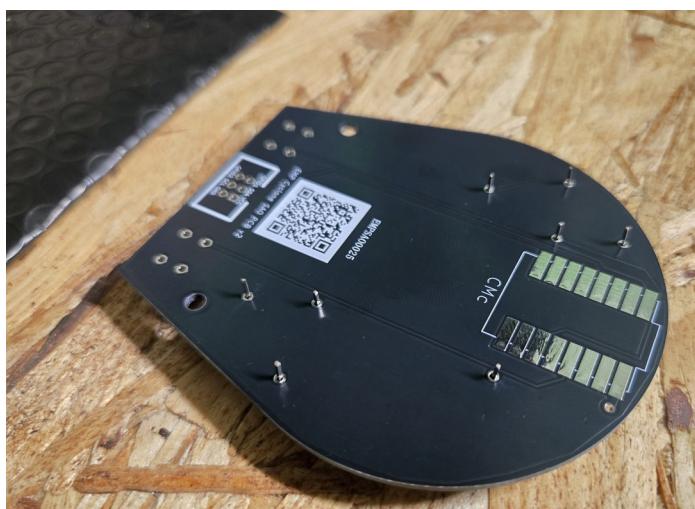
Place Assembly Face Down



- Place the envelope on top of the assembly
- Pick the assembly and envelope up together
- Make sure to keep both LED rings seated on their pins

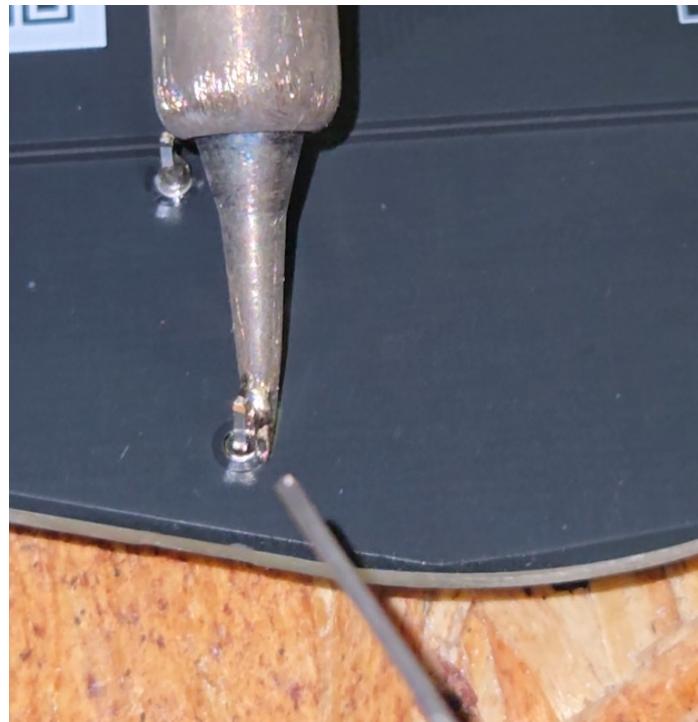


- Press gently on top and flip over
- Make sure to keep both LED rings seated on their pins

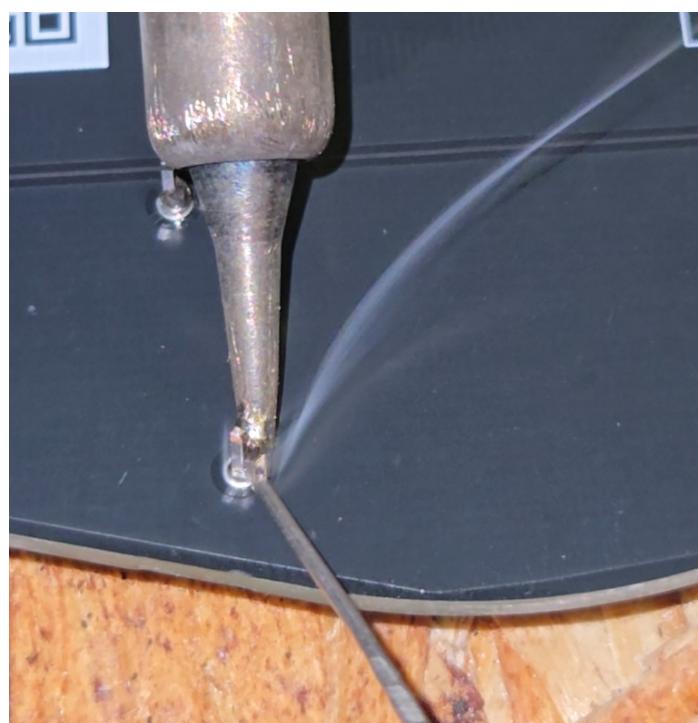


- Place down on a surface suitable for soldering
- Pull the envelope out from underneath the assembly

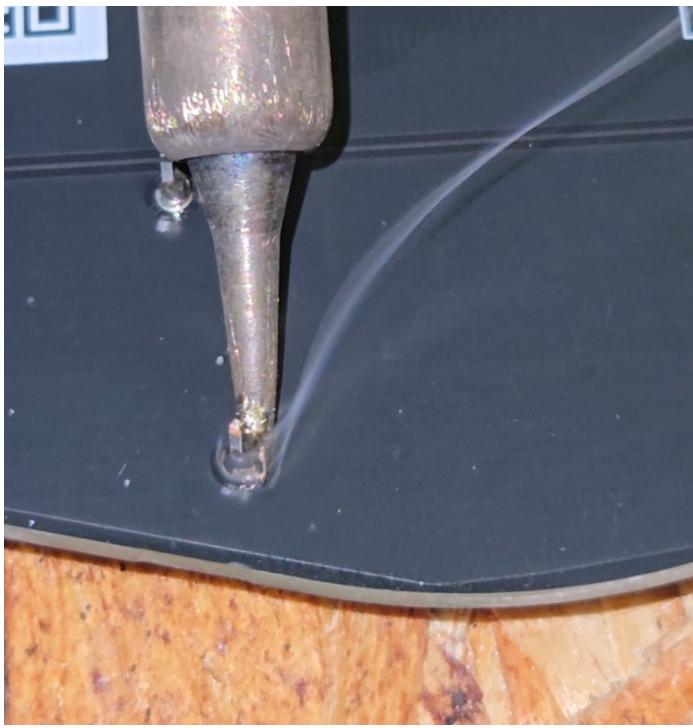
Solder the Pins



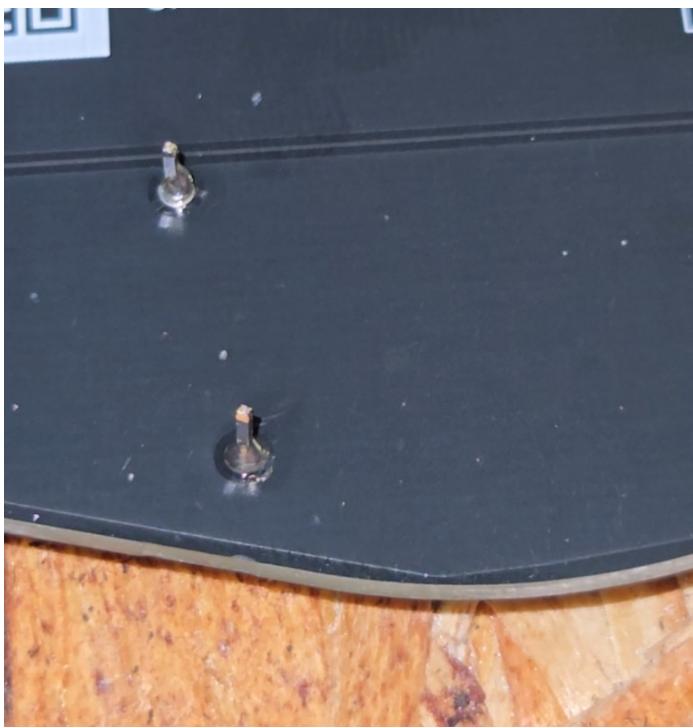
- Clean the tip of your iron
- Apply a small amount of fresh solder to the tip of the iron to “tin” it
- Place your soldering iron tip diagonally across the pin and pad
- Allow a few seconds for the heat to spread



- Apply a small amount of solder to the intersection of the iron, pad, and pin



- Hold the iron in place for a few seconds to make sure the heat spreads enough to allow the solder toe “flow”



- Remove the iron
- Let the joint cool for 15-30 seconds
- Inspect for:
 - Cold solder joints
 - Poor flowing into the pad via (hole)
 - Too little or too much solder
- Repeat for all eight pins

Flip Back Over



- Flip the assembly back over
- Make sure the LED rings are still in place

Solder the Ring in Place



- Start with the inner ring
 - Remove the outer ring to make space if you prefer
- Clean the tip of your iron
- Apply a small amount of fresh solder to the tip of the iron to “tin” it
- Place your soldering iron tip diagonally across the pin and pad
- Allow a few seconds for the heat to spread



- Apply a small amount of solder to the intersection of the iron, pad, and pin



- Hold the iron in place for a few seconds to make sure the heat spreads enough to allow the solder toe “flow”



- Remove the iron
- Let the joint cool for 15-30 seconds
- Inspect for:
 - Cold solder joints
 - Poor flowing into the pad via (hole)
 - Too little or too much solder
- Repeat for all eight pins

Locate the Buttons



- Find the 2x push buttons
- Make sure the legs are not crushed or bent
- Note the pins do have an odd shape from the factory
 - This helps them grab a pcb better

Place the Pins on the PCB Face



- Place the button on the face of the PCB

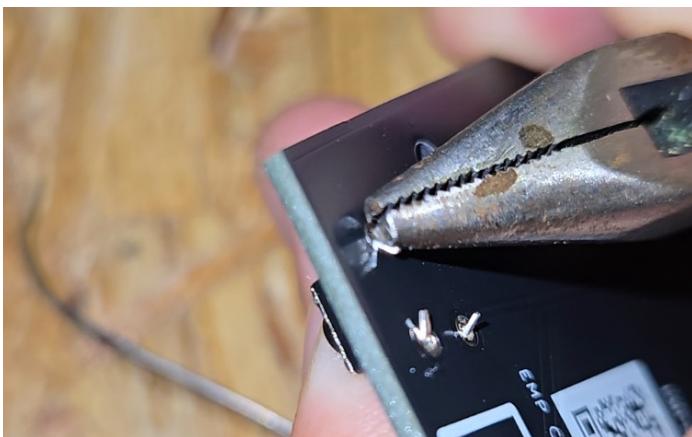


- Pass the legs through the vias (holes)

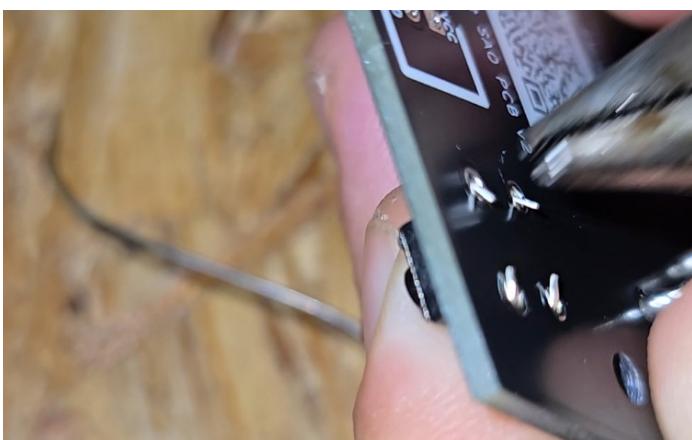
Bend the Pins to Hold the Button(s)



- Place the nose of your pliers or cutters against the outer side of the leg



- Bend it over and downward against the PCB



- Repeat for all pins on both buttons

Place the Board Face Down

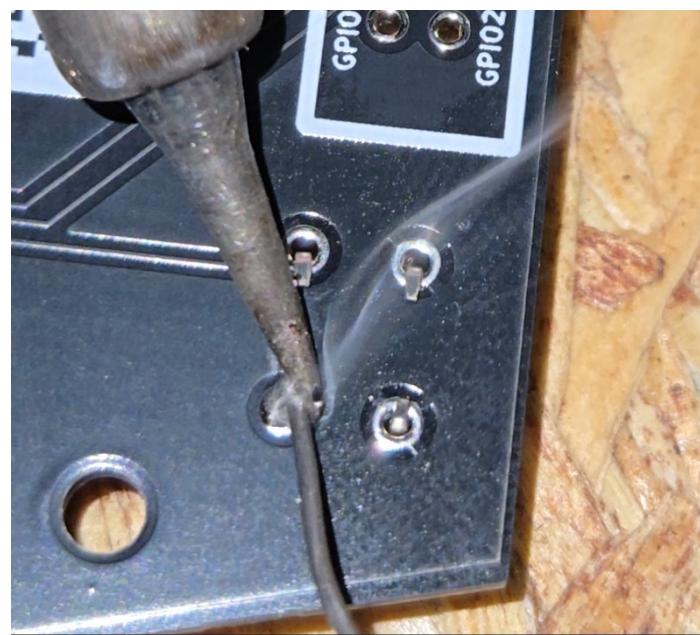


- Place face down on a surface suitable for soldering

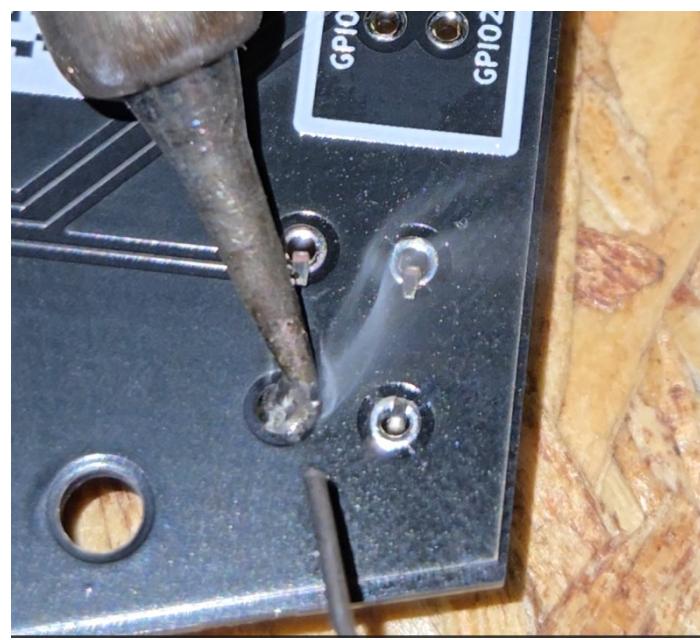
Solder on the Button Legs



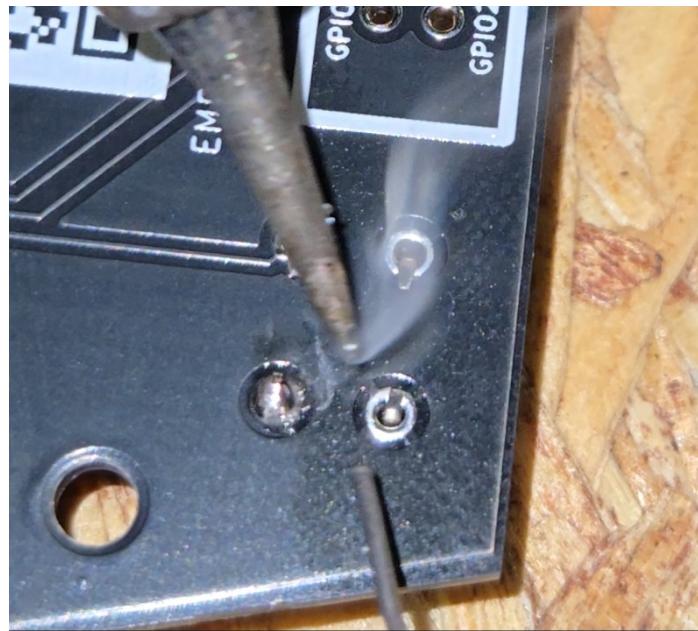
- Clean the tip of your iron
- Apply a small amount of fresh solder to the tip of the iron to "tin" it
- Place your soldering iron tip diagonally across the pin and pad
- Allow a few seconds for the heat to spread



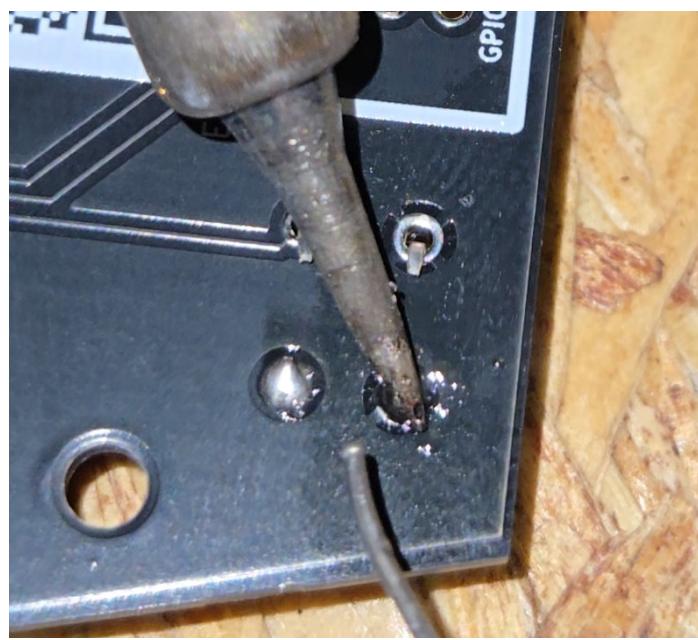
- Apply a small amount of solder to the intersection of the iron, pad, and leg



- Hold the iron in place for a few seconds to make sure the heat spreads enough to allow the solder toe "flow"

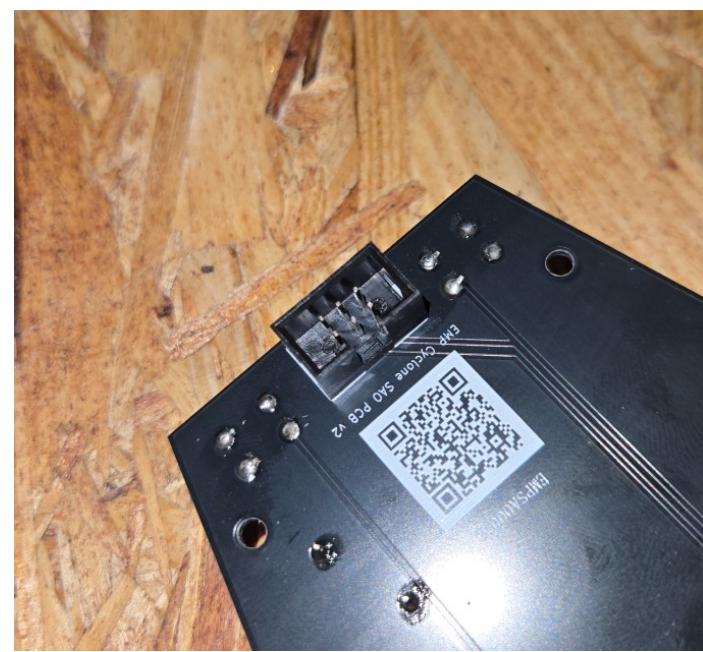


- Allow to cool



- Repeat for all legs

Place the SAO Connector on the Board

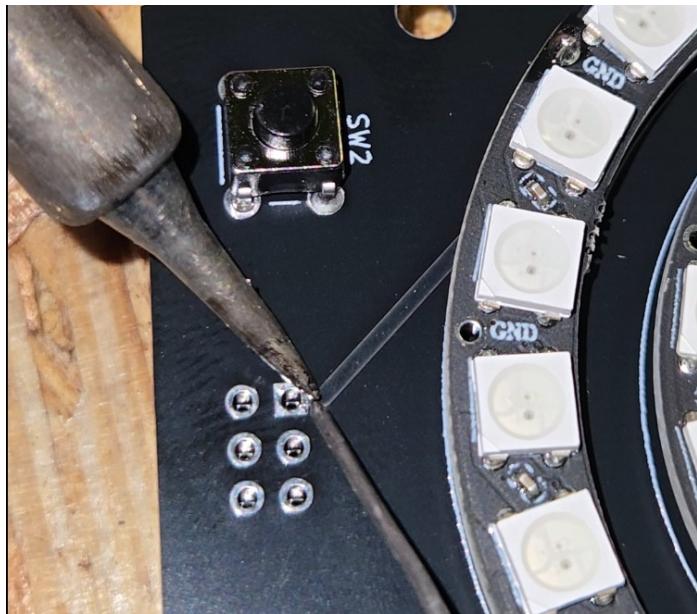


- Use the white outline to show how to place on the PCB

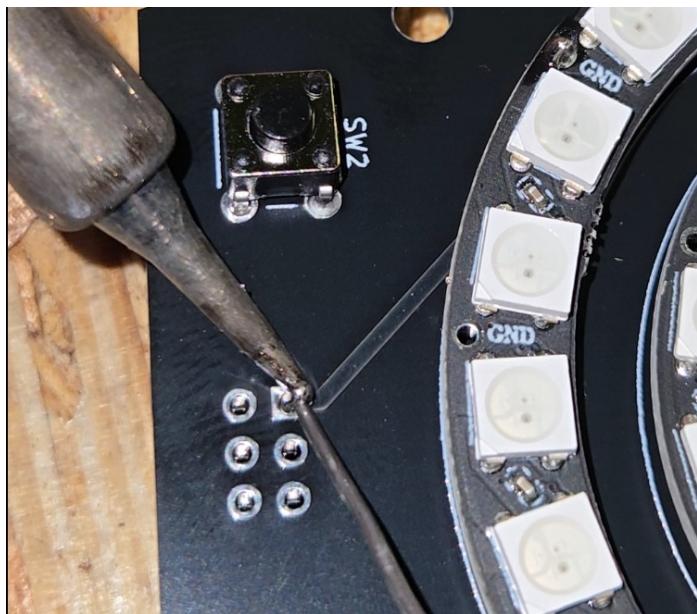


- Flip the board over and place down on a surface suitable for soldering
- Make sure all the pins are coming up through the vias (holes)

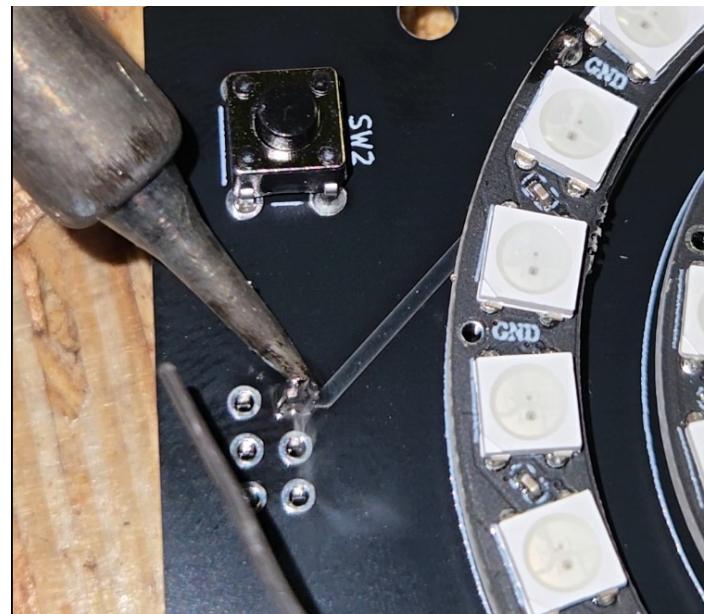
Solder on The SAO Connector



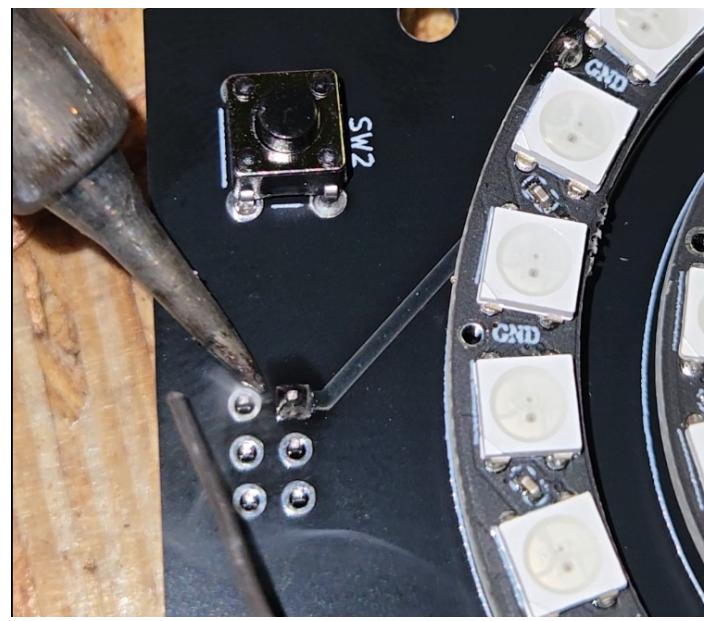
- Clean the tip of your iron
- Apply a small amount of fresh solder to the tip of the iron to "tin" it
- Place your soldering iron tip diagonally across the pin and pad
- Allow a few seconds for the heat to spread



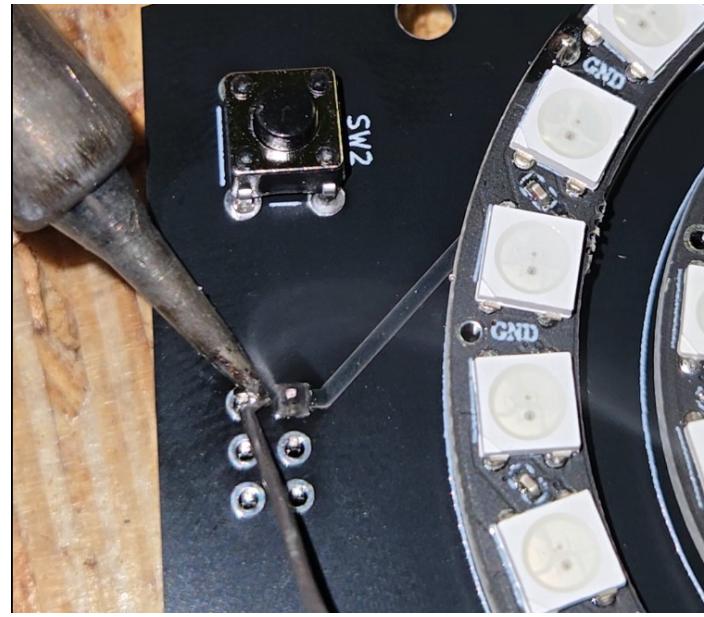
- Apply a small amount of solder to the intersection of the iron, pad, and leg



- Hold the iron in place for a few seconds to make sure the heat spreads enough to allow the solder toe "flow"

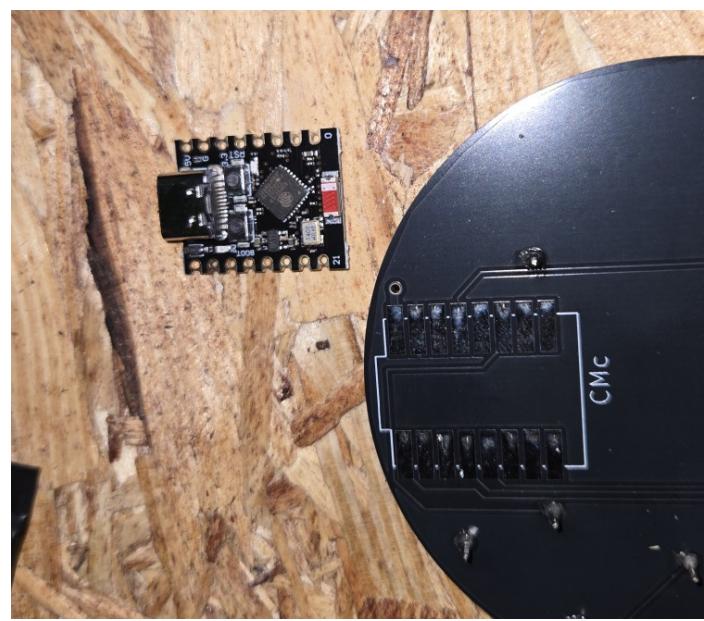


- Allow to cool

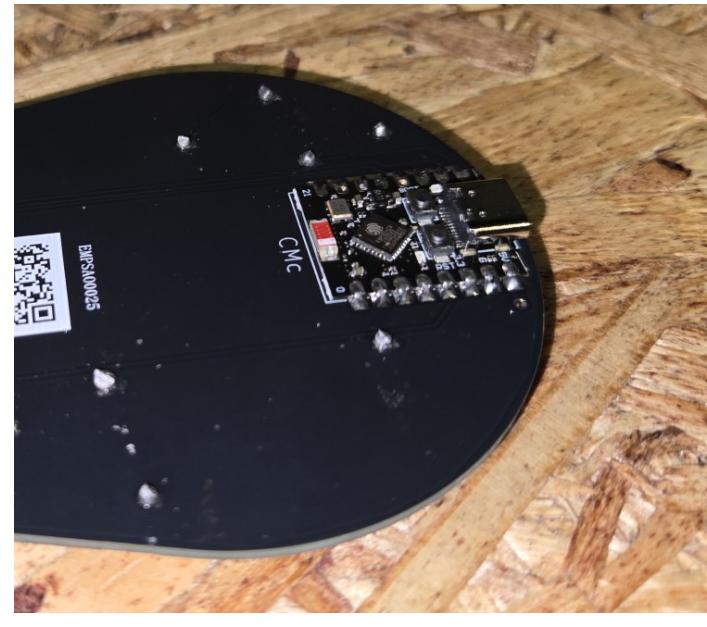


- Repeat for all pins

Place the ESP Chip on the Back

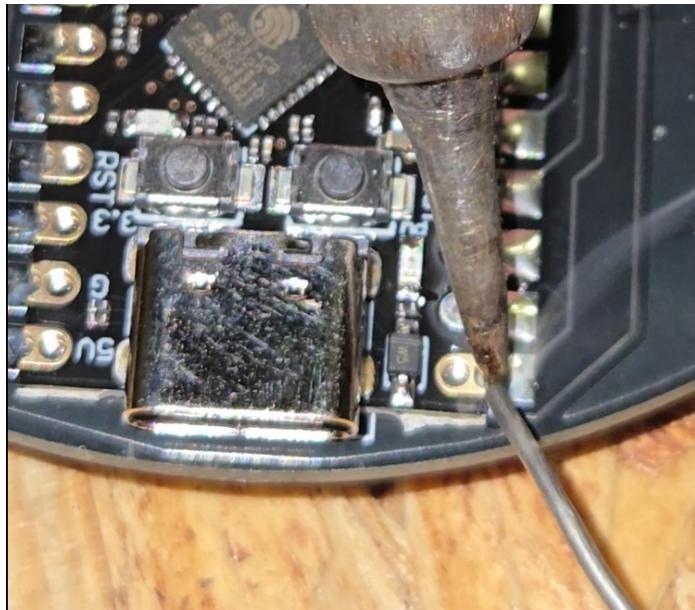


- Find the ESP chp

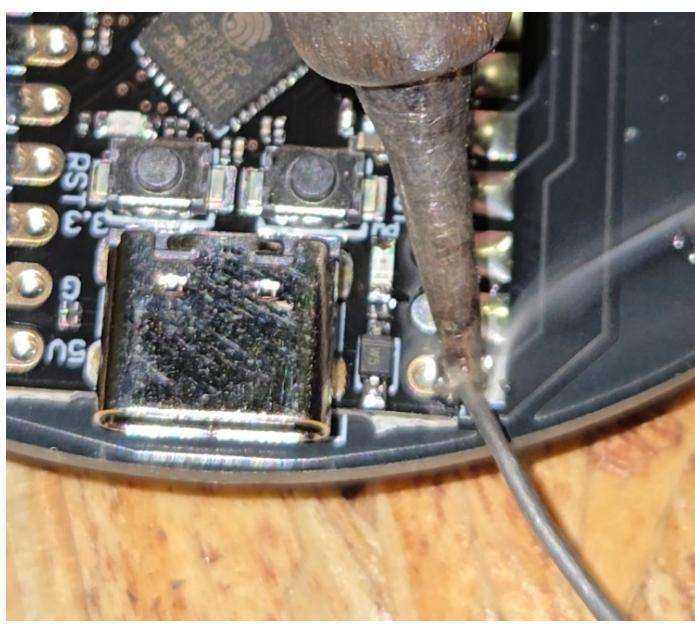


- Place on the board and align with the white line and solder pads
- The USB-C port will face up/out

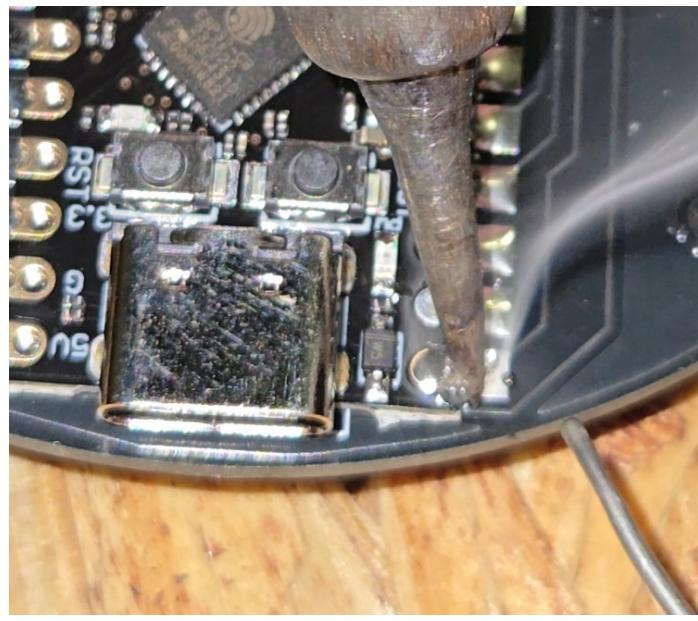
Solder on the ESP Chip



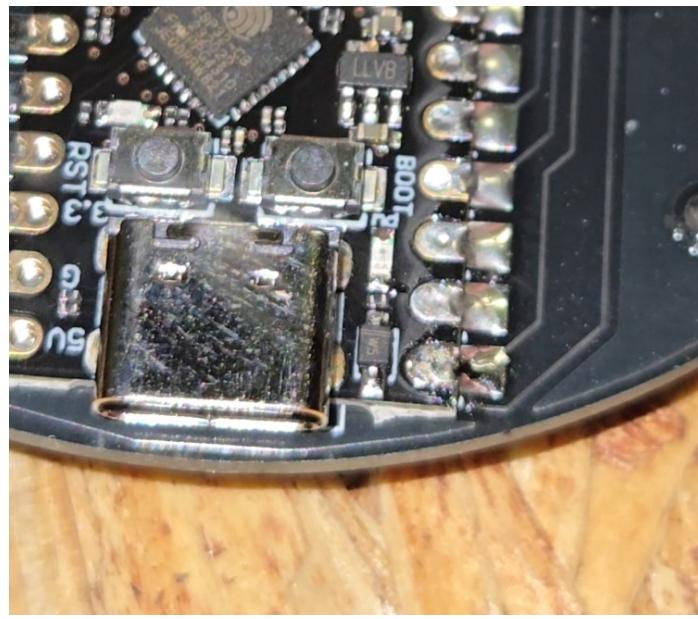
- Clean the tip of your iron
- Apply a small amount of fresh solder to the tip of the iron to "tin" it
- Place your soldering iron tip diagonally across the pin and pad
- Allow a few seconds for the heat to spread
- You may hold or tape the ESP chip in place from the far edge while soldering the first pad
- Once the first pad is soldered the board will hold in place



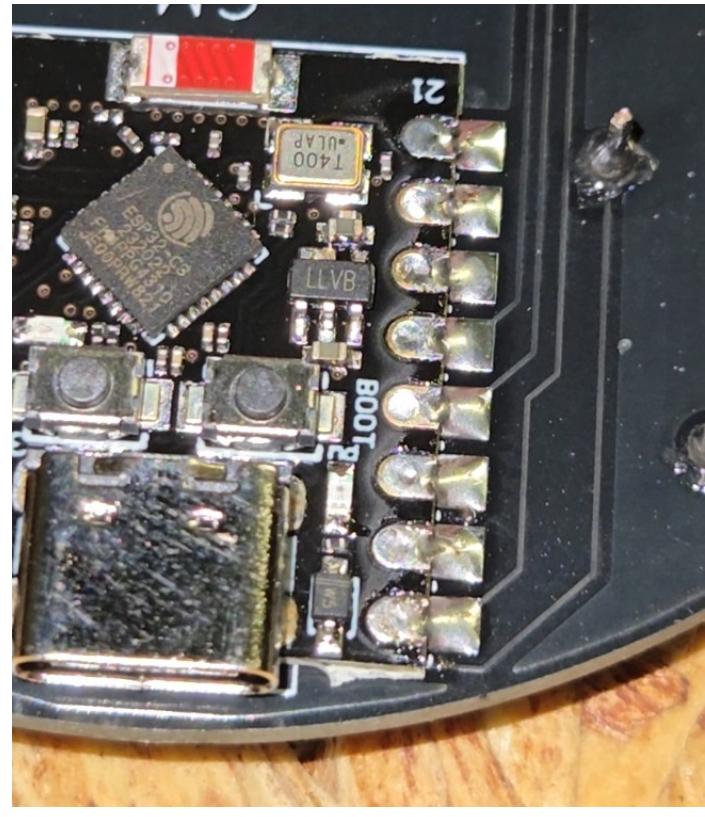
- Apply a small amount of solder to the intersection of the iron, pad, and leg



- Hold the iron in place for a few seconds to make sure the heat spreads enough to allow the solder toe “flow”



- Allow to cool



- Repeat for all pins on both rows

Flashing Instructions

Download the Latest Release

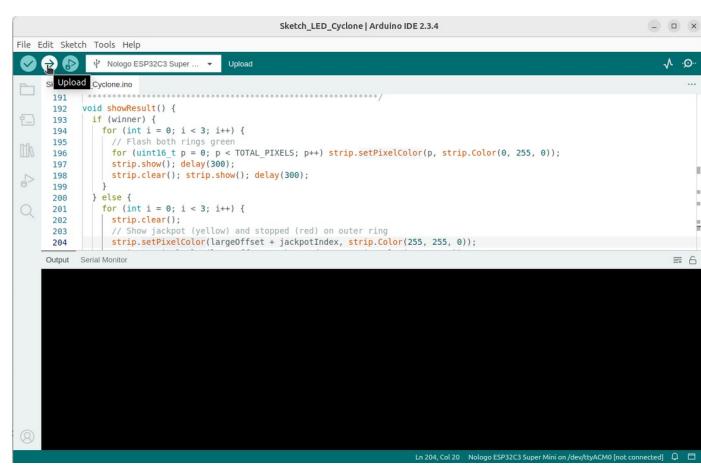
A screenshot of a GitHub repository page for 'EMP SAO v2.1. Ge...'. The page shows several commits and a 'Releases' section. The 'Releases' section contains one entry for 'EMP SAOv2.1' (Latest), which was released last week. Below the releases is a 'Packages' section indicating 'No packages published'.

- Open the link to the code in your browser
- <https://github.com/ExMachinaParlor/EMP-SAO-Cyclone-Badge>
- Click on the releases

A screenshot of the GitHub release page for 'EMP SAOv2.1'. It shows the release notes for Version 2.1, which state: 'Version 2.1 of the EMP SAO badge.' Below this is a 'Assets' section containing four files: 'Gerber.zip', 'Sketch_LED_Cyclone.ino', 'Source code (zip)', and 'Source code (tar.gz)'. Each asset has its file size and a timestamp of 'last week'.

- Download the ".ino" firmware file

Flash the Badge



The screenshot shows the Arduino IDE interface with the sketch `Sketch_LED_Cyclone.ino` open. The code is a C++ program for an ESP32C3 Supermini board. It includes functions for handling a winner, showing results, and clearing the LED strip. The serial monitor window is visible at the bottom, showing the connection status: "Ln 204, Col 20 Nologo ESP32C3 Super Mini on /dev/lsykCM0 [not connected]".

```
Sketch_LED_Cyclone | Arduino IDE 2.3.4
File Edit Sketch Tools Help
S Upload Cydone.ino
191
192 void showResult() {
193     if (winner) {
194         for (int i = 0; i < 3; i++) {
195             // Flash both rings green
196             for (int p = 0; p < TOTAL_PIXELS; p++) strip.setPixelColor(p, strip.Color(0, 255, 0));
197             strip.show(); delay(200);
198         }
199     } else {
200         for (int i = 0; i < 3; i++) {
201             strip.clear();
202             // Show jackpot (yellow) and stopped (red) on outer ring
203             strip.setPixelColor(largeOffset + jackpotIndex, strip.Color(255, 255, 0));
204         }
    }
}
Output: Serial Monitor
Ln 204, Col 20 Nologo ESP32C3 Super Mini on /dev/lsykCM0 [not connected]
```

- Install the Arduino IDE
- Open the firmware file using the Arduino IDE
- Connect the board to our PC using a USB cable
- Set board type to "nologo ESP32C3 Supermini"
- Click upload

Test

Test the Badge



- Make sure all the LEDs are lighting up
- Make sure both buttons work
- If available, connect to a badge to test the SAO port

Enjoy Your EMP SAO

