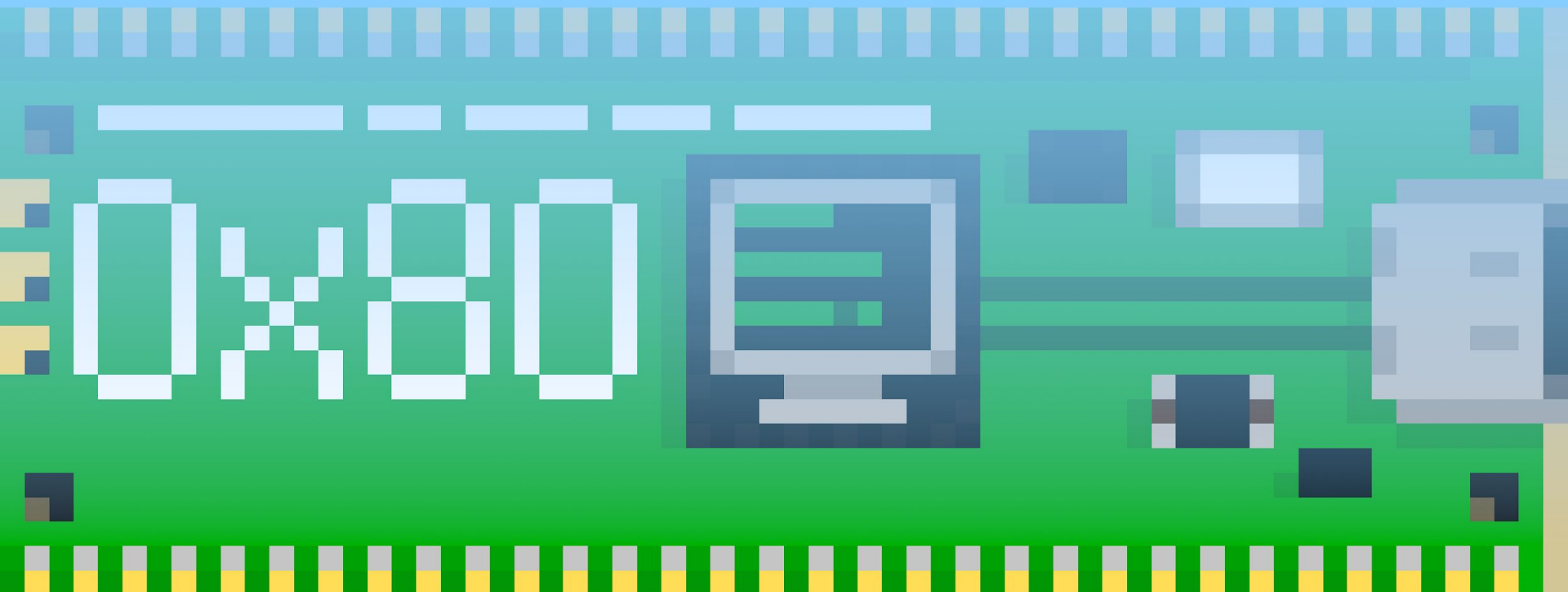


PicoPOST Build Guide



Revision 1.1

for PicoPOST v1.0 (rev7 MB, v1.0 remote)

Welcome to PicoPOST!

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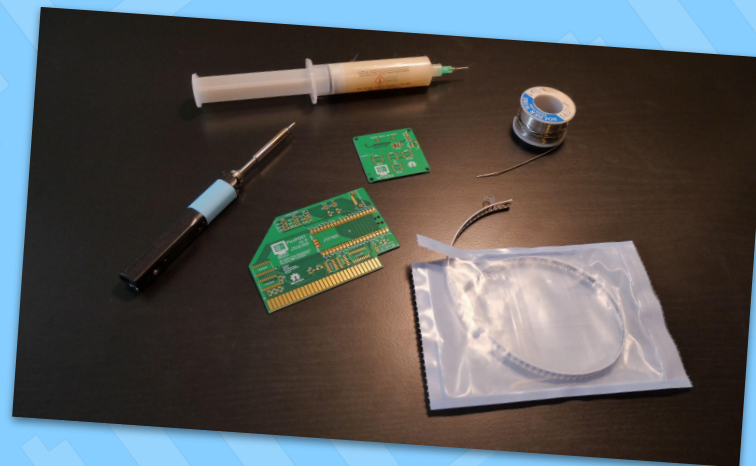
Introduction

Some surface mount assembly required.

PicoPOST is designed to be as cheap and easy to build as possible. Don't be scared by the surface-mount components, it's easier than it may look. All parts are sized to be (hopefully!) solderable even by someone who hasn't done surface mount soldering before.

This build guide is not a complete course on how to learn to solder, and assumes you have basic (through-hole) soldering skills. However, we'll still make this as easy to follow as possible. If you have ever held a soldering iron before, we're sure you'll be able to follow along! 😊

That being said, there are some tools you may need to buy to make it happen. Don't worry, it's nothing too expensive...



Preparation

Required tools:

- Tweezers
- Soldering iron
- Solder sponge (wet or brass wire)
- Solder (63/37 leaded flux-core recommended for ease of soldering)
- "No-Clean" soldering flux (syringe recommended)

Recommended tools:

- Solder braid
- Solder sucker
- Soldering stand (or other way of securely holding a PCB)

Nice to have:

- Temperature controlled soldering iron (with fine tip)
- Patience (if you're not used to doing surface mount soldering 😊)

Preparation

Down to the flux of the matter

On the previous page, you may have noticed “soldering flux” as a required tool. If you’ve never done surface-mount soldering, this may be something you’re unfamiliar with. To make a long story short, soldering flux **is the closest thing to magic you’re going to find.**

... OK, let's make the story a little longer than *that*. Soldering flux is a paste, gel, or liquid that removes the invisible oxidation that might keep your solder from sticking to the PCB and circuit components. Without it, surface mount soldering is, at best, an exercise in frustration. But with the use of enough flux, it can be a breeze.

But how much flux is “**enough flux**”? For most of the soldering you’ll be doing on the PicoPOST, **covering all the pads for each component** is probably adequate. But when in doubt, **use more.** In fact, there’s no such thing as “too much flux”! The worst thing that can happen is left over flux on the board after you’re done soldering, which is not a big deal. If it’s enough to bother you, it can easily be removed with isopropyl alcohol and a toothbrush (or paper towel).

It is recommended to use flux in a syringe with a fine tip, so you can apply it exactly where you want it. **Apply it to the PCB pads before placing each component.**

Preparation

Soldering is only sometimes a drag

The most effective way of doing SMD soldering on chips with rows of pins (for example, the 74LVC245) is **drag soldering**. Much like it sounds, this method involves **dragging the soldering iron across a row of pins**.

The general process is as follows:

1. Apply flux to solder pads
2. Place chip on solder pads
3. Apply a small amount of solder to the tip of your iron
4. Use iron to stick down one or two pins in order to keep chip in place
5. Apply moderate amount of solder to the tip of your iron
6. On the side **opposite** of stuck pin, **slowly drag soldering iron across row of pins**
7. Repeat step 6 on other side

After doing a drag solder job, inspect the pins for **bridges** (two or more pins shorted together by solder). If you find any, you should be able to remove these by dragging the soldering iron (this time with a clean tip) repeatedly across the bridged pins until they become unbridged. If this doesn't work, you may need to use soldering braid.

Preparation

Soldering is only sometimes a drag

Here's a couple video guides to get you started...



Everyone has their own way of doing drag soldering. **There is no One Right Way!** Don't be afraid to experiment – *find out what works for you!*

Bill of Materials (BOM)

To build the PicoPOST Main Board, you will need:

- 1x **Raspberry Pi Pico**
- 3x **74LVC245** (SOIC-20, 5.3mm)
- 1x **74LVC11** (SOIC-14, 3.9mm)
- 1x **74LVC02** (SOIC-14, 3.9mm)
- 4x **BAT54S** (SOT-23)
- 1x **3.3V Zener** (SOT-23)
- 2x **LED** (3.0mm through-hole)
- Many **1206 size resistors**:
 - 2x **330 Ω**
 - 5x **1000 Ω**
 - 1x **10k Ω *** ** 1% (or lower) tolerance strongly recommended*
 - 1x **12k Ω ***
 - 1x **39k Ω ***
 - 2x **47k Ω ***
 - 1x **68k Ω ***
- 5x **100nF/0.1uF capacitors** (1206)
- 1x **1nF/1000pF capacitor** (1206)
- 1x **right-angle SATA connector** (Molex 47080 recommended)
- 2x **20 pin 2.5mm pin headers** (matching female sockets optional)

Bill of Materials (BOM)

To build the PicoPOST Remote, you will need:

- 1x **OLED breakout module** (128x32 SSD1306 recommended, 128x64 compatible)
 - Do not buy a module with a bare flat flex ribbon cable!
- 1x **AMS1117-3.3** (SOT-223)
- 1x **MCP23009** (SOIC-18, 7.5mm)
- 3x **1000Ω resistors** (1206)
- 1x **100nF/0.1uF capacitor** (1206)
- 4x **push buttons** (normally open, 6mm)
- 1x **buzzer** (3V DC, 7.6mm pin pitch)
- 1x **right-angle SATA connector** (Molex 47080 recommended)
- 1x **OLED module connector** (pick the one for your OLED module):
 - 1x **1x4 2.54mm pin header** (for generic OLED breakout)
 - 1x **2x3 2.54mm pin header** (for PiOLED)
 - 1x **4-pin JST-SH** (for Qwiic or STEMMA QT)

Bill of Materials (BOM)

Other components you will need for operation:

- 1x **USB cable** (for connecting to the Pico)
 - MicroUSB if using an original Pi Pico. Some clones may use USB-C instead.
- 1x **SATA cable** (for connecting PicoPOST to remote)
 - Length is up to you, however shorter cables will be more reliable. (18 inch cables are known to be ok)
- The latest version of the **PicoPOST firmware**
 - [Available here](#) (download a .uf2 file)

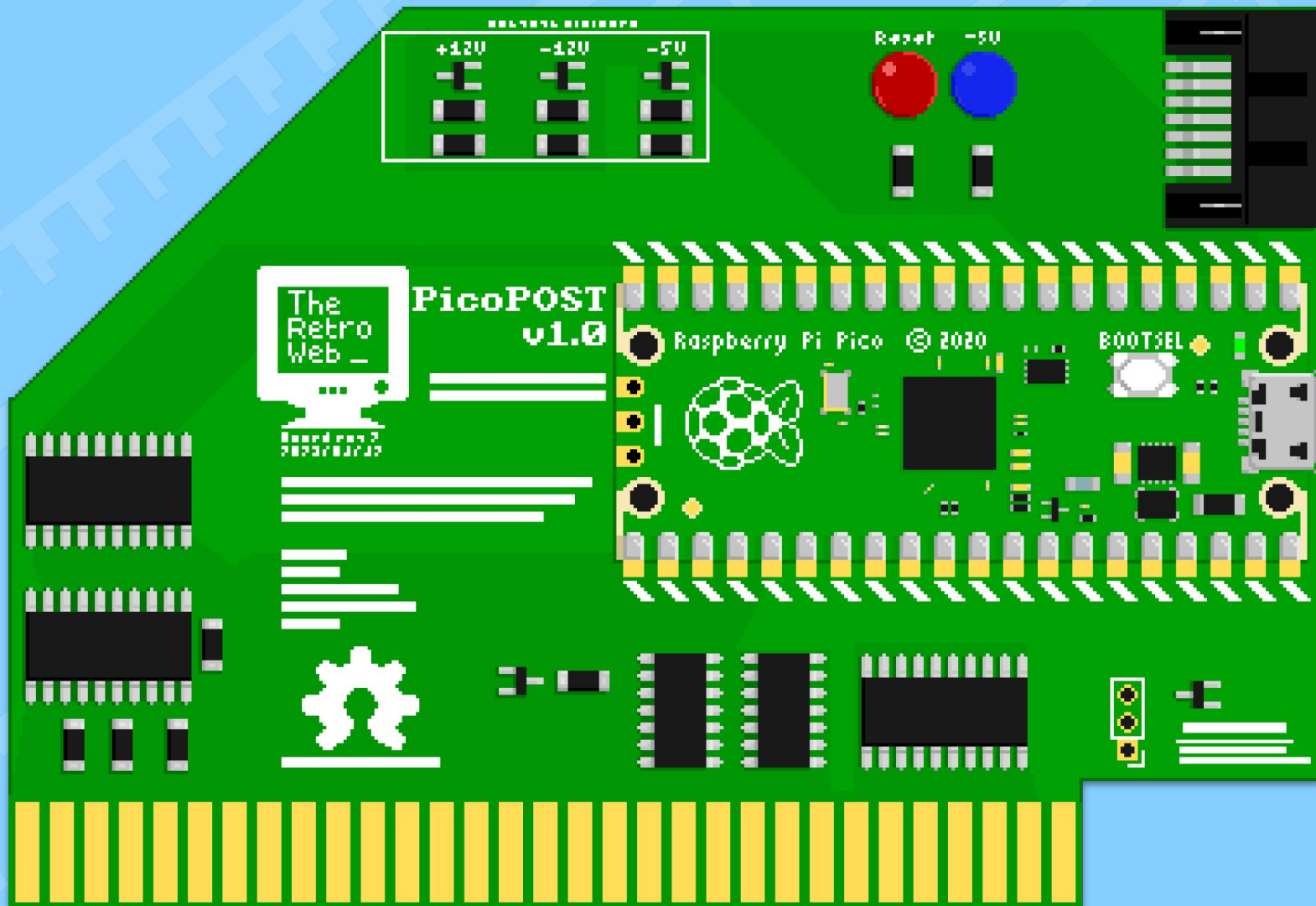
Tips and Tricks

A few things you should know...

- The chip labels (silkscreen) on the boards are in the same orientation as the markings on the chips should be. **Make sure to orient the chip correctly before soldering!**
- A fun trick to get small components (such as resistors and capacitors) aligned to their pads is to place the component loosely in place, and then melt solder to one pad. With the right technique, the component should “snap” into place!
 - If you’re still having trouble, an alternate way is to add solder to one bare pad, use tweezers to hold on to the component, and then place it down while re-melting the solder.
- When soldering surface mount components, it’s best to do the most complex parts first, while you have the least obstructions to getting the right angle to solder.
 - You don’t have to worry about figuring that out here – we already have accounted for that in the following steps!
- **Remember to use flux! There’s no such thing as too much!**
 - This means **electronics** flux! **DO NOT** use plumbing flux, especially the acid kind! It will corrode and destroy the PCB and components over time.

Build the Main Board

Let's get to it...



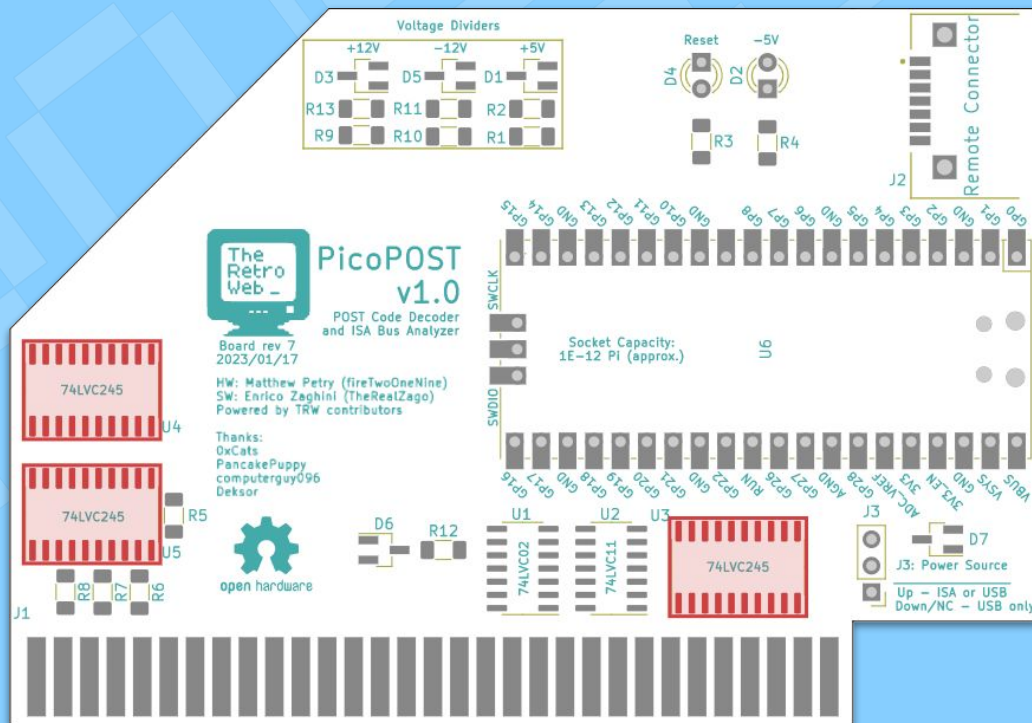
Build the Main Board

Front Side

Step 1: 74LVC245

The '245s are the easiest to handle SMD part, and therefore the easiest to get started on.

Don't forget to use flux and drag soldering!



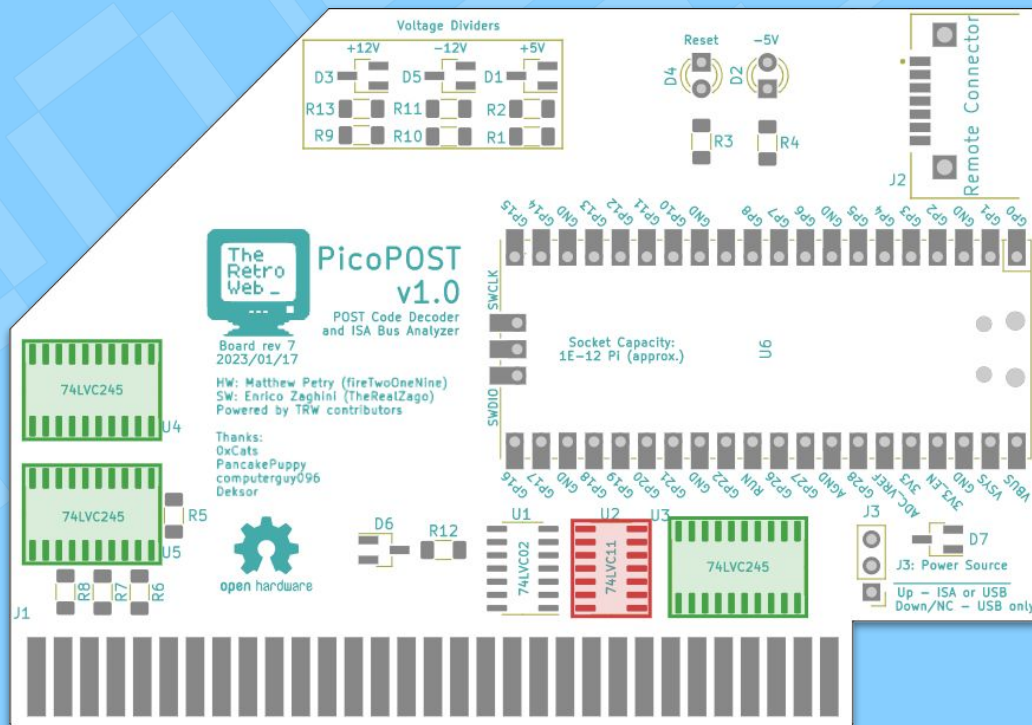
Build the Main Board

Front Side

Step 2: 74LVC11

The '11 is a smaller package than the '245s you just soldered, but the same principles apply.

Don't forget to use flux and drag soldering!



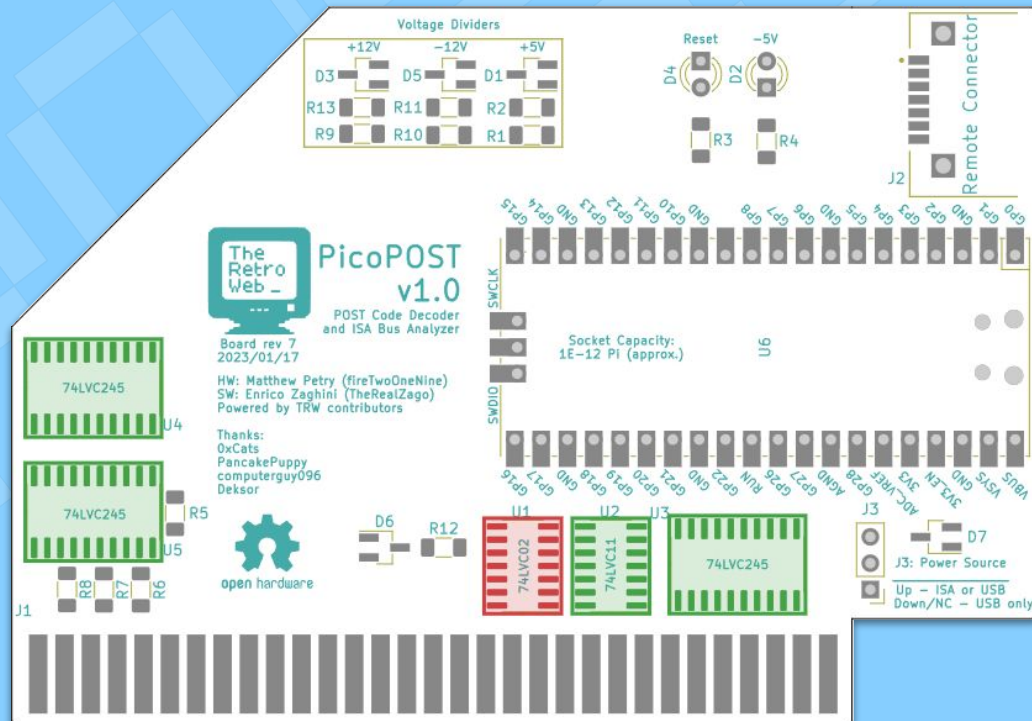
Build the Main Board

Front Side

Step 3: 74LVC02

The '02 is the same size as the '11. You're a pro at this now, right?

Don't forget to use flux and drag soldering!



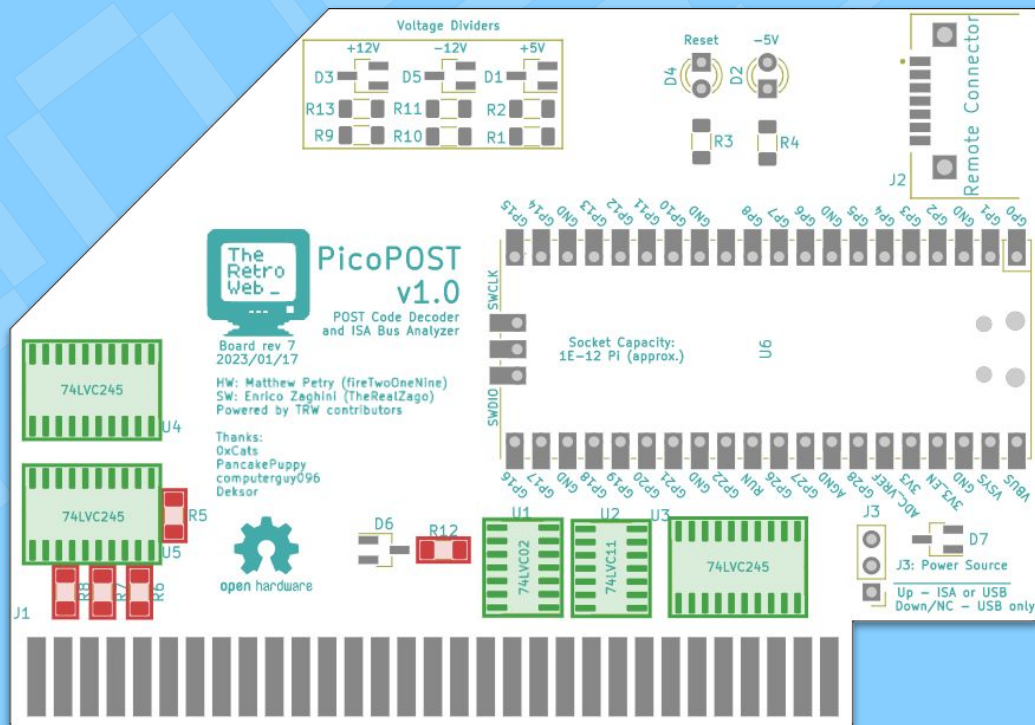
Build the Main Board

Front Side

Step 4: 1000 ohm resistors

Here's the first set of tiny SMD components to solder. Luckily, they're "1206" size, meaning they're not *that* tiny... Use tweezers to place them, and you'll be fine!

Don't forget to use flux! (last time we'll remind you...)

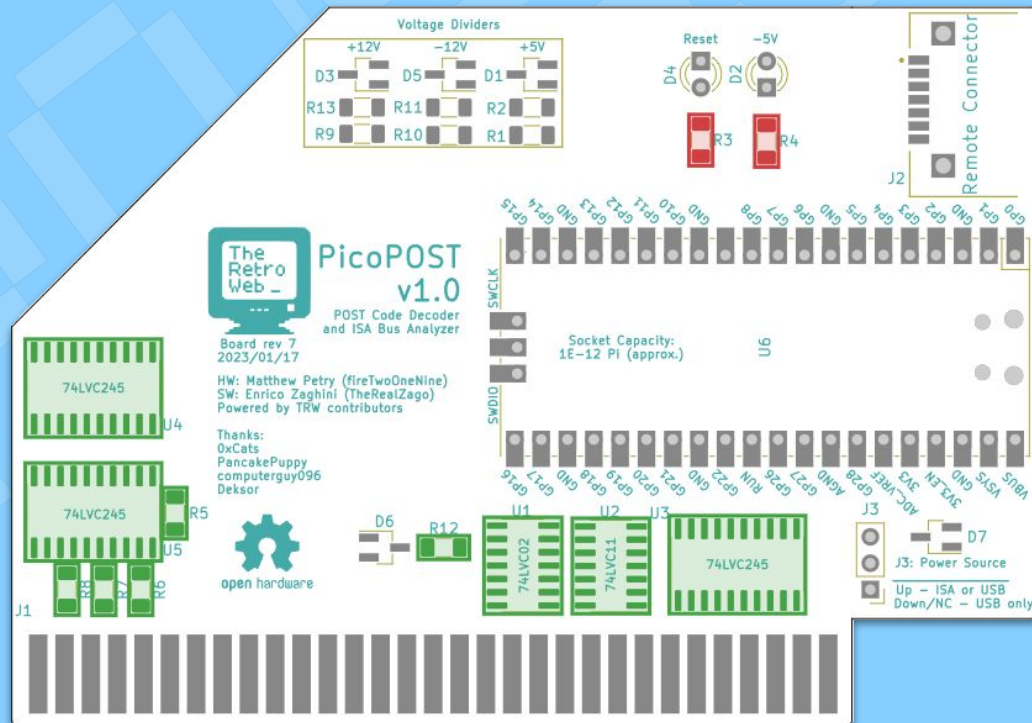


Build the Main Board

Front Side

Step 5: 330 ohm resistors

“1206” sized resistors, round two!

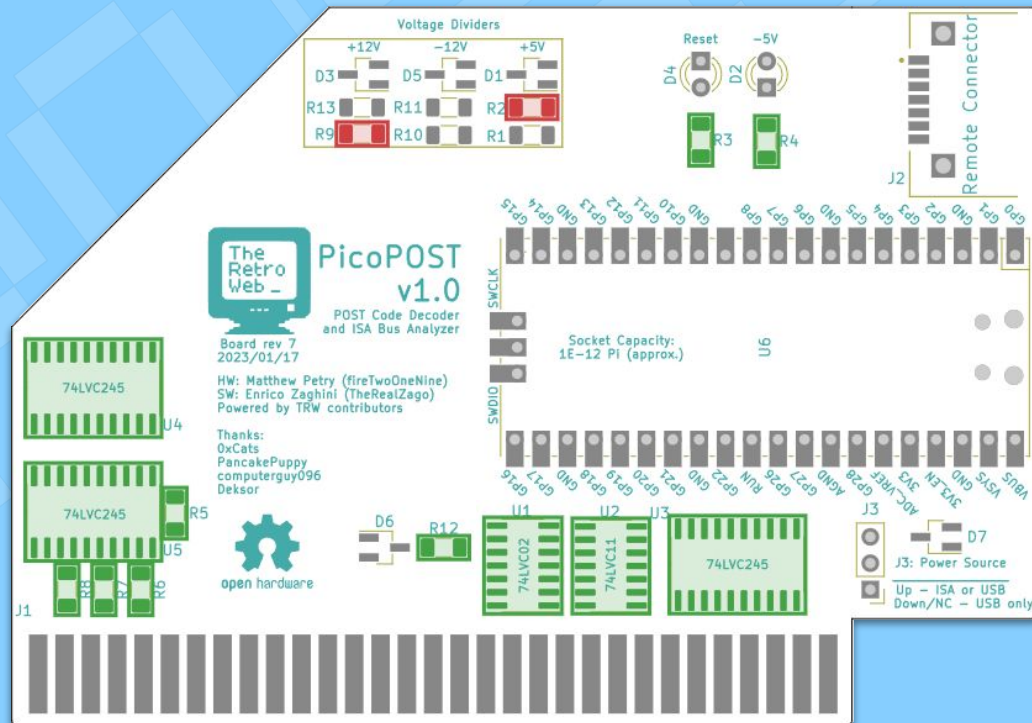


Build the Main Board

Front Side

Step 6: 47k ohm resistors

“1206” sized resistors, round three! Getting the hang of it yet?

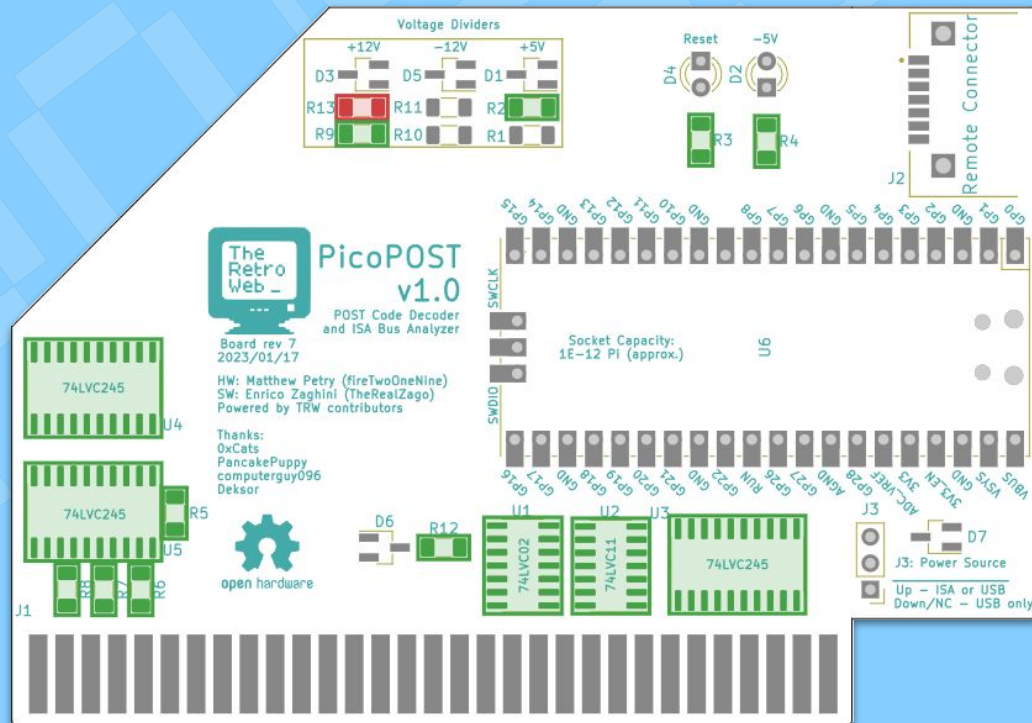


Build the Main Board

Front Side

Step 7: 12k ohm resistor

“1206” sized resistors, round four! Or should I just say *resistor*? It’s just one this time...

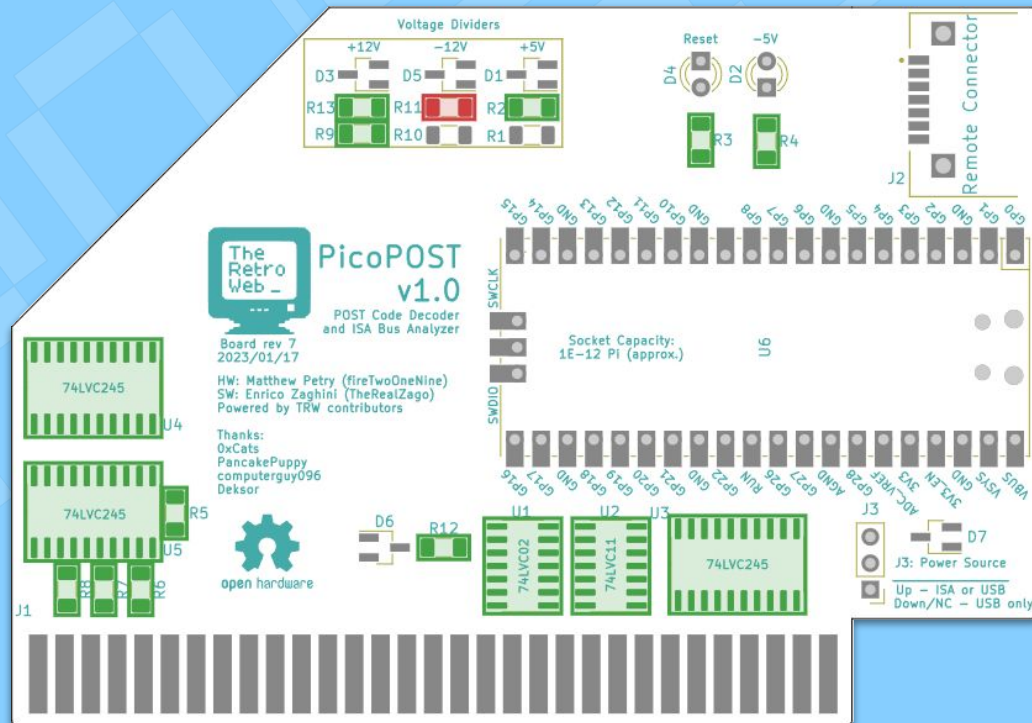


Build the Main Board

Front Side

Step 8: 10k ohm resistor

“1206” sized resistor(s), round five! It’s just one again.

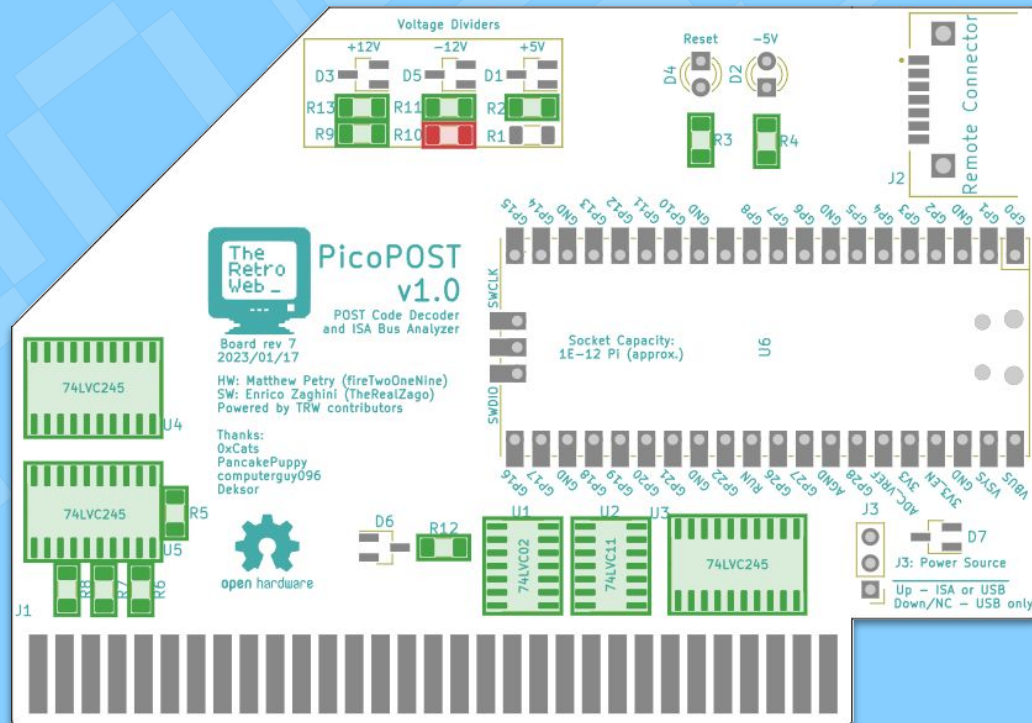


Build the Main Board

Front Side

Step 9: 68k ohm resistor

“1206” sized resistor(s), round six! Still just one... Sorry, voltage dividers need specific values!

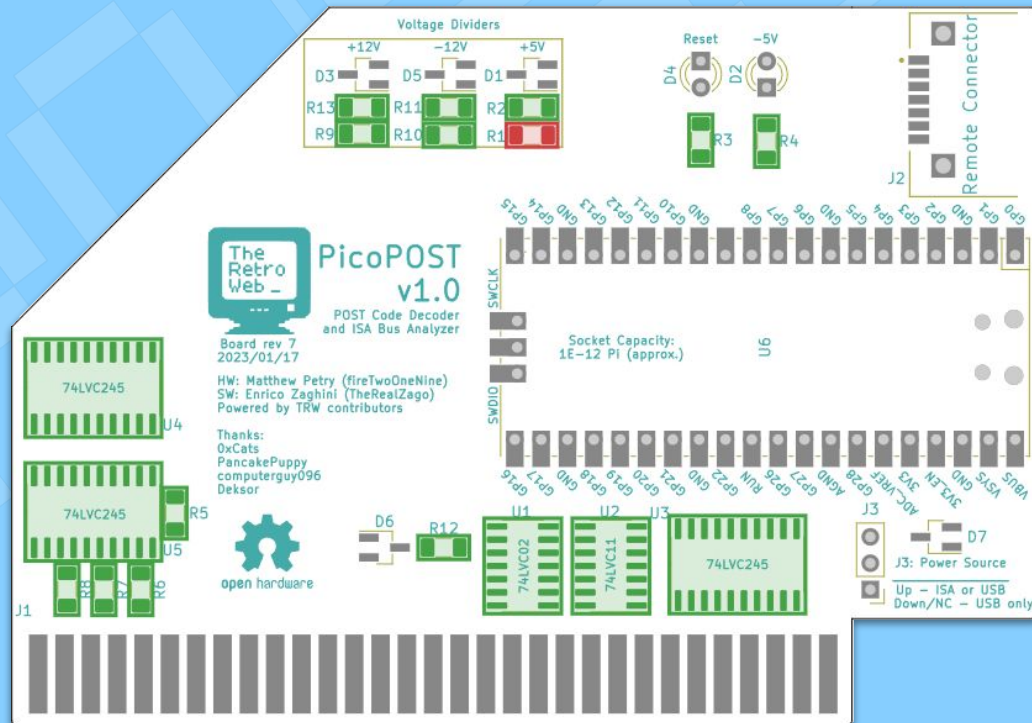


Build the Main Board

Front Side

Step 10: 39k ohm resistor

“1206” sized resistor(s), round seven! It’s the last resistor on the main board! 😊

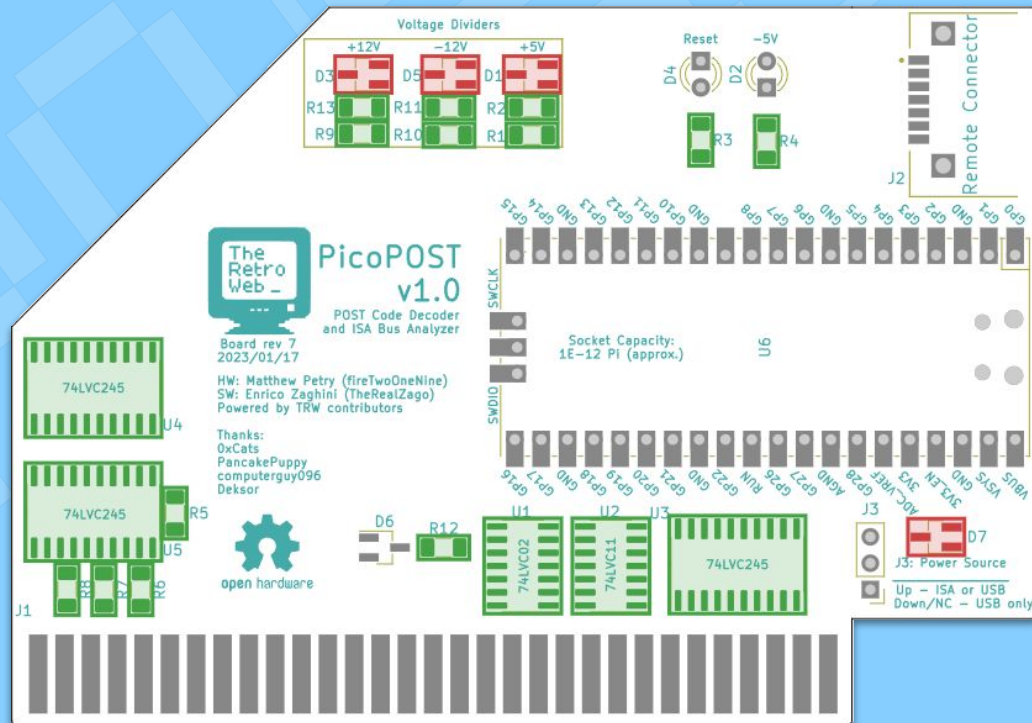


Build the Main Board

Front Side

Step 11: BAT54 barrier diode

Finally something new! Unfortunately, it's the most difficult part to handle – tweezers are not optional here! (*Tip: Solder the one pin on its own side first.*)

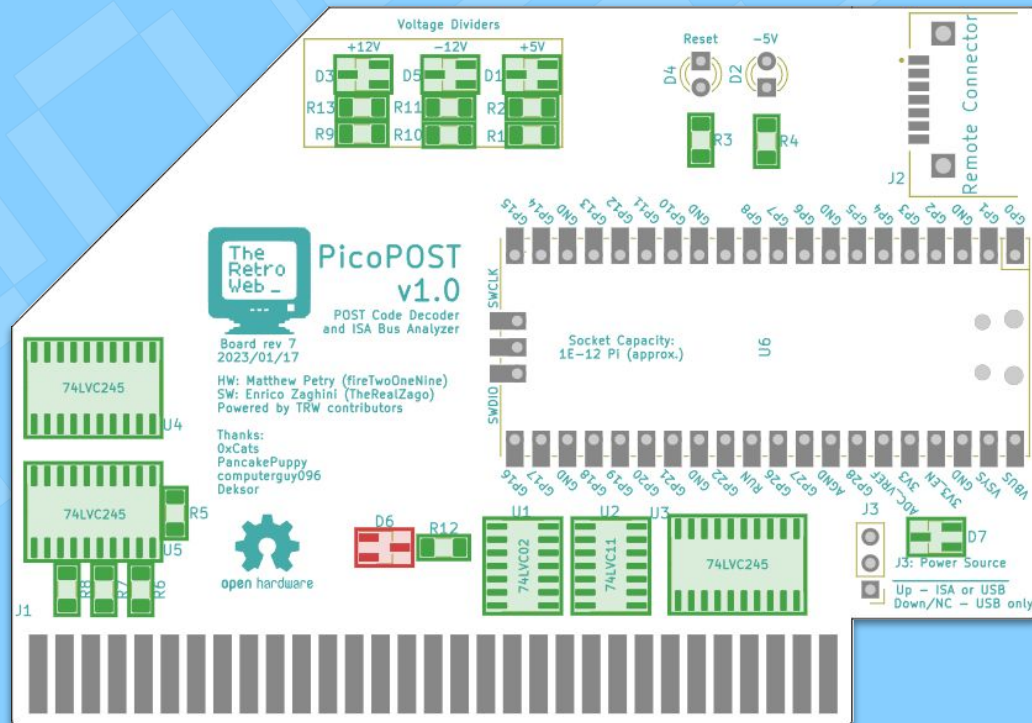


Build the Main Board

Front Side

Step 12: 3.3v zener diode

This part may look identical to the BAT54s to the naked eye, but don't get it confused – they perform different tasks!

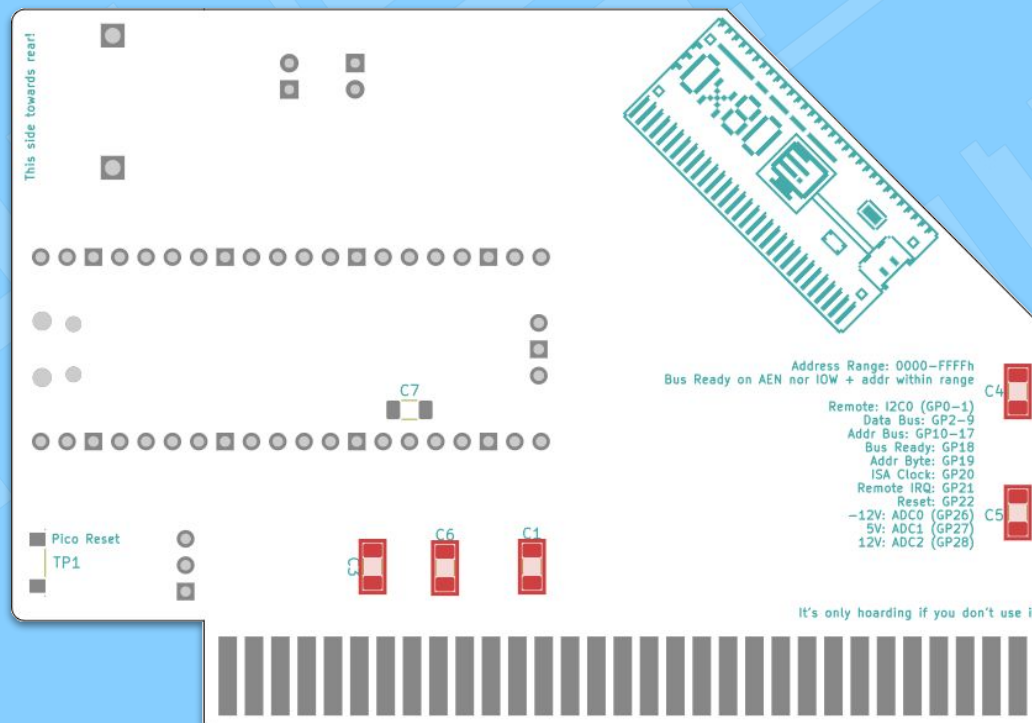


Build the Main Board

Back Side

Step 13: 100nF capacitors

Time to flip that board around! You've got more 1206 components to handle – but they're not resistors this time!

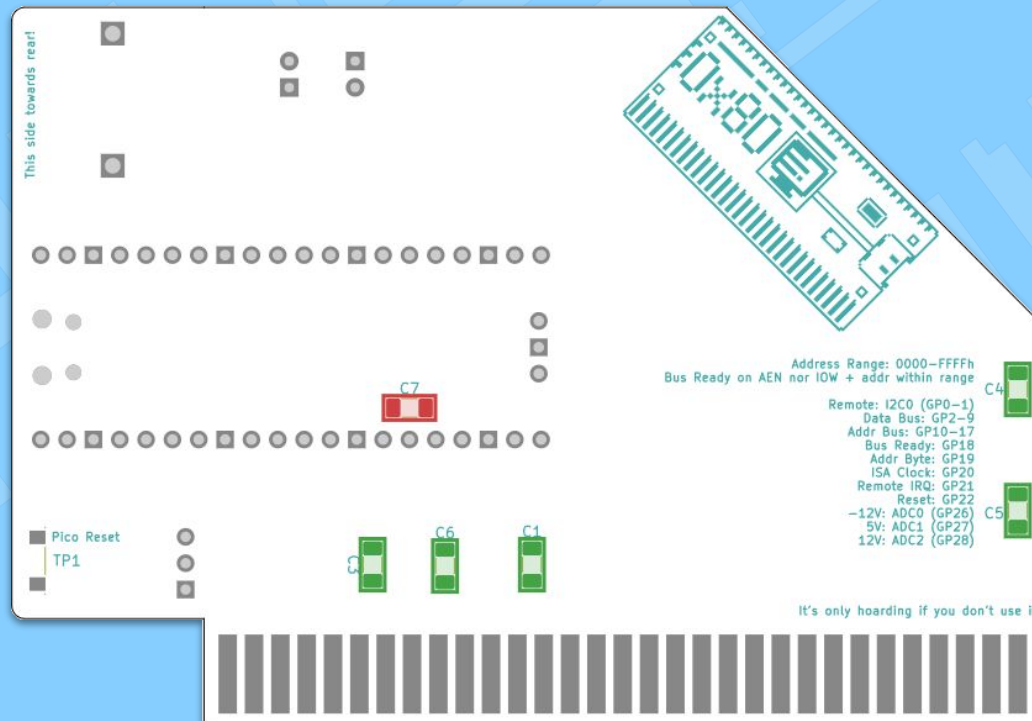


Build the Main Board

Back Side

Step 14: 1nF capacitor

Last 1206 component of the main board – and the last solely surface mount component on it too! 🧑🏻‍🔧



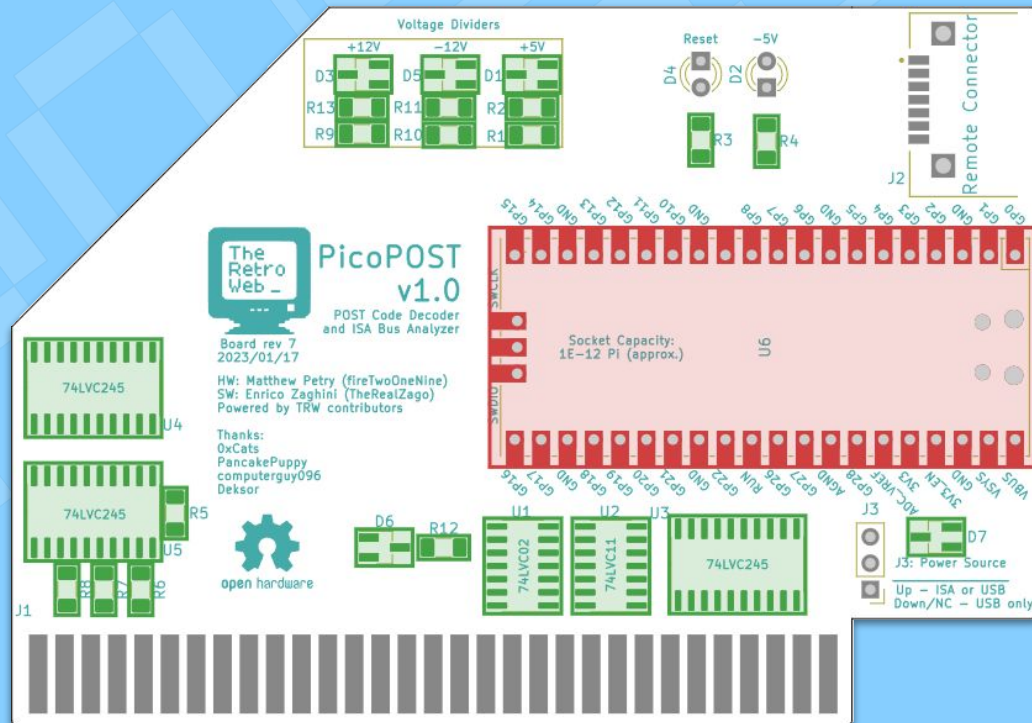
Build the Main Board

Through-Hole

Step 15: Pico (Header)

Now you're doing through-hole! You can either solder your two 20 pin female pin headers here, or you could directly solder the Pico's male headers – if you're brave!

Alternate Option:
If you're both brave *and* adverse to through-hole soldering, the pads are provided to directly surface mount solder the Pico to the board.



Tips:

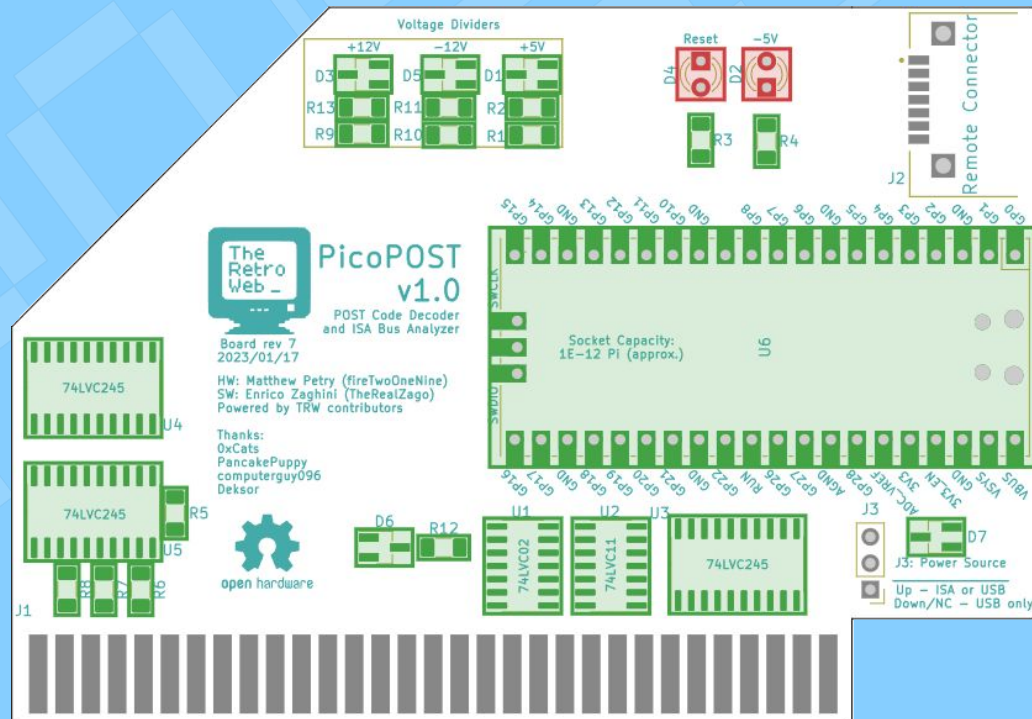
1. No need to solder anything to the three pins (SWD) on the short end. They're not used here.
2. To install the headers straight, socket them onto the Pico's pins first, then insert them!
3. If you have a 40 pin header, you can cut it in half and leave the empty pin at VBUS.

Build the Main Board

Through-Hole

Step 16: LEDs

Finally something easy – install some nice and pretty blinkenlights!



Tips:

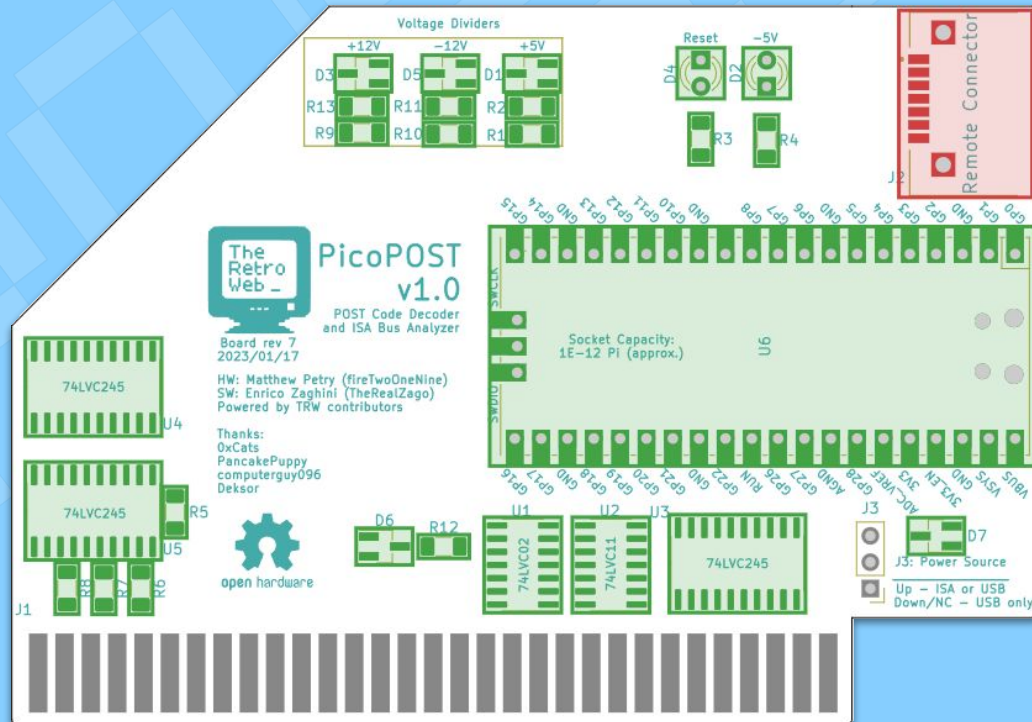
1. The flat side (cathode) of the LEDs goes towards the square pads.
2. Bend the leads behind the board to keep them on while you solder.
3. Don't forget to snip the excess leads once soldered.

Build the Main Board

Finishing Up

Step 17: Remote Connector

Yes, we feel clever for using a SATA connector here. Is it a little anachronistic on an ISA board? Maybe...



Tips:

1. Unfortunately, we may have left the most difficult for last. The surface mount pins here love to wick solder up and create bridges. **Keep solder braid and/or a solder sucker handy.**
2. Soldering the through-hole pins is technically optional, but strongly recommended.

Build the Main Board

Complete!

Your main board is ready for use – it just needs a Pico installed, if it doesn't already have one!

You can jump to the [Build the Remote](#) section if you're ready.

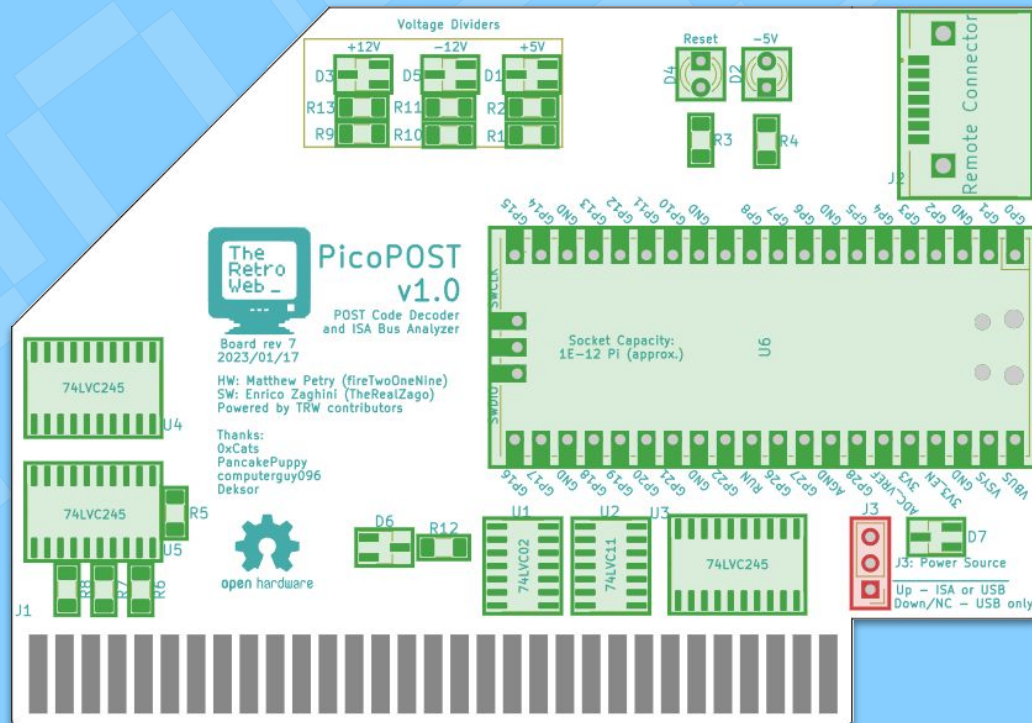
... but there's a few optional features on the main board you can install first!

Build the Main Board

Optional Goodies

Step A1: Power Source Jumper

By default, your PicoPOST is only powered by a USB cable connected to the Pico. However, if you bridge the top two pins of the J3 header, it can also be powered from the ISA bus!



Tips:

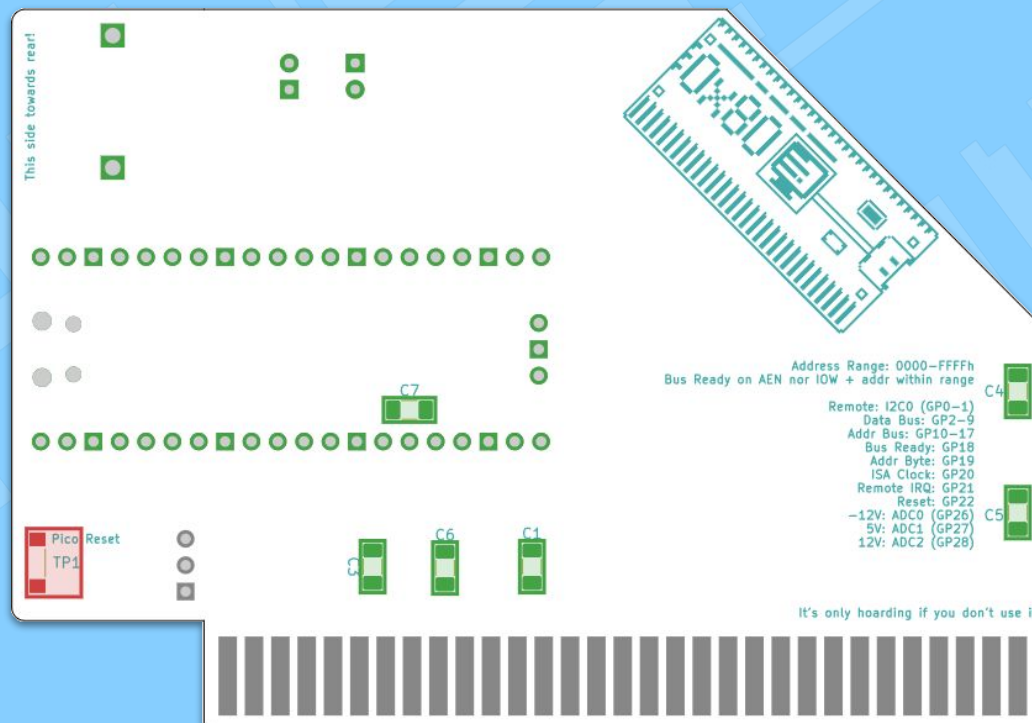
1. The intended method is to solder on a small male header to these pins and use a jumper.
2. If you're lazy, you could also solder a bridge between the top two pins. But be aware that a misbehaving power supply could damage your PicoPOST!

Build the Main Board

Optional Goodies

Step A2: Pico reset

Two small pads are present on the back of the mainboard, which will reset the Pico (*not the PC!*) when shorted. If you desire, a spare pushbutton (same size used on the PicoPOST Remote) can be soldered here.

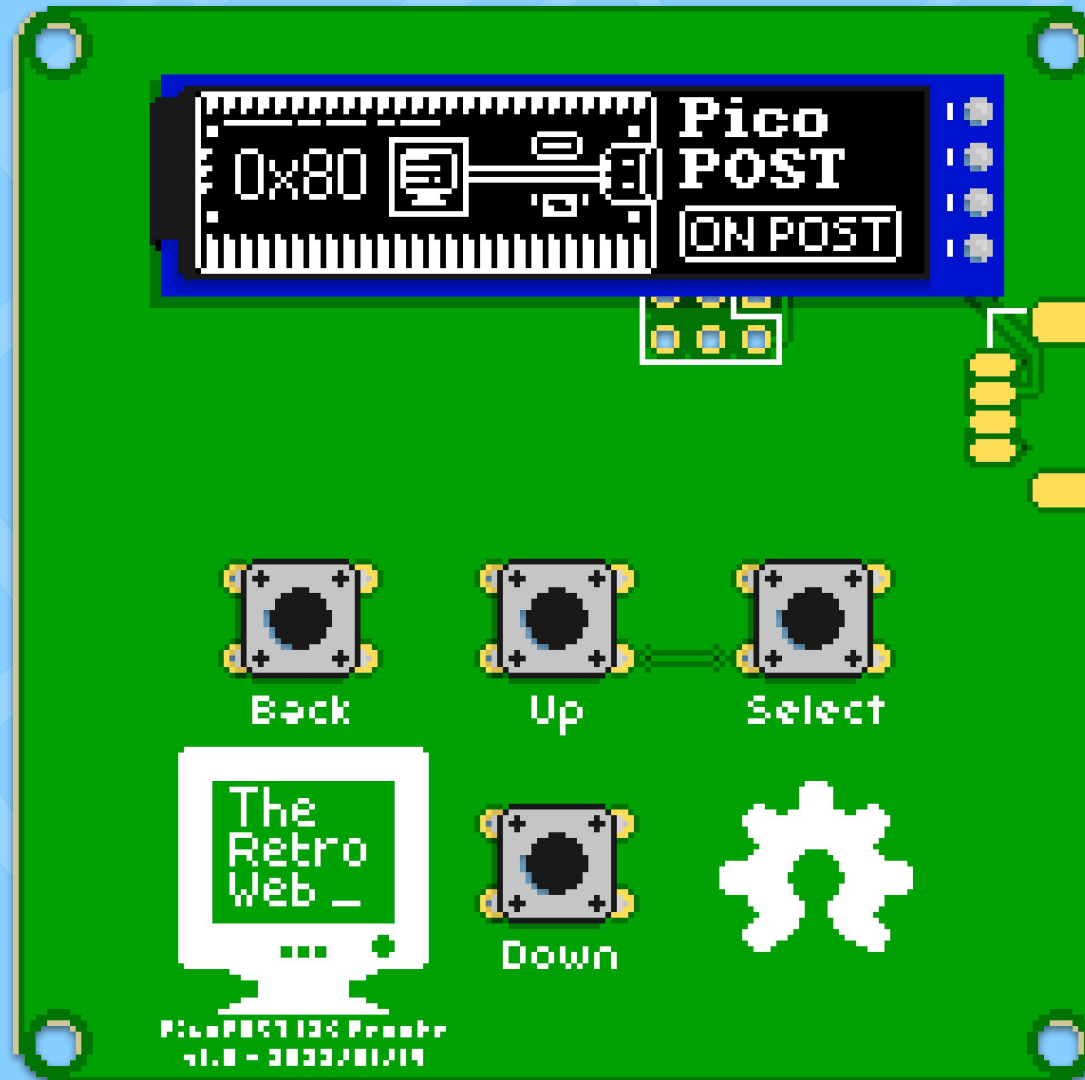


Tips:

1. If you aren't developing firmware for the PicoPOST, you likely do not need this. But it's your hardware, **do as you wish!**

Build the Remote

Ready for Round Two?



Build the Remote

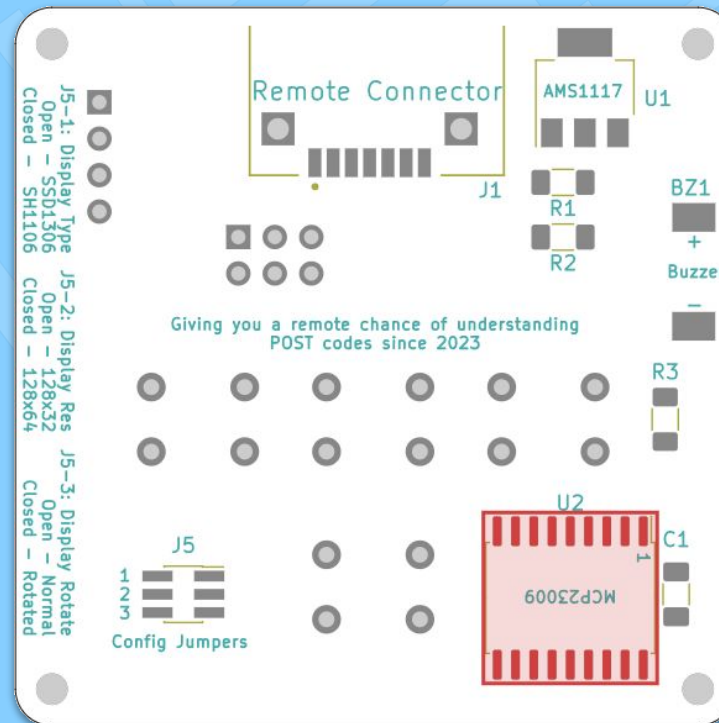
Back Side

Step 1: MCP23009

We're starting on the back side this time! Here's the one and only chip you'll need drag soldering on for the remote. **Be careful – be sure to mount it upside down!**

(upside down)

Don't forget to use flux and drag soldering!

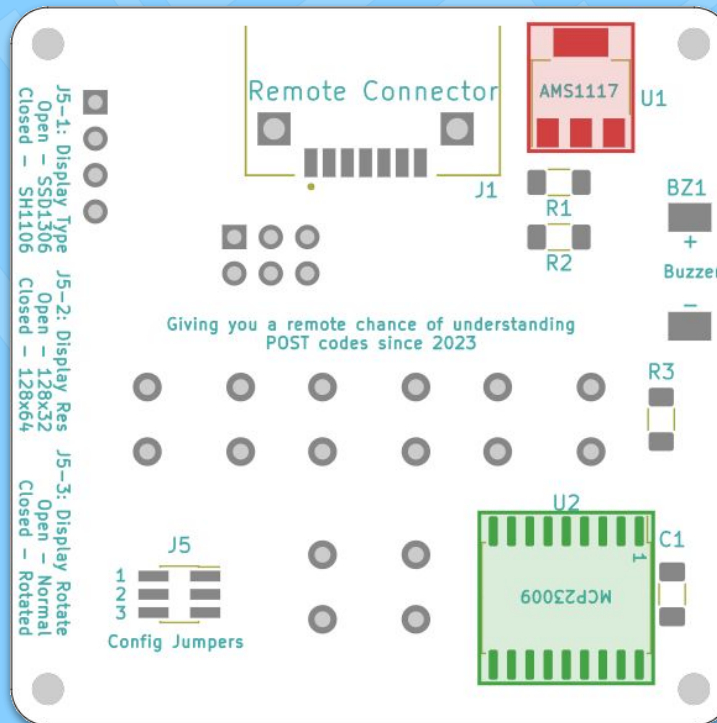


Build the Remote

Back Side

Step 2: AMS1117

Compared to most of the other SMD soldering you've done, this should be a breeze – those pins are big!

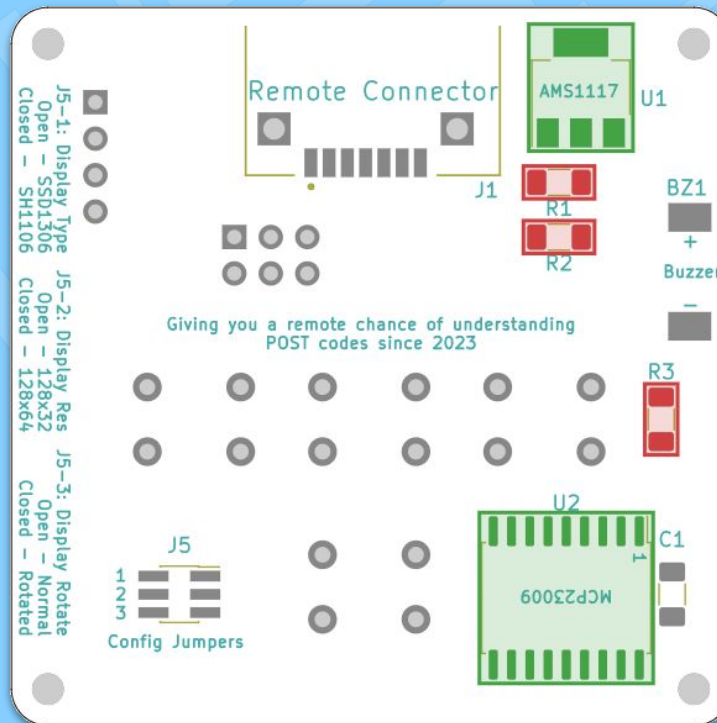


Build the Remote

Back Side

Step 3: 1000 ohm resistors

Now we're back to 1206 sized components.

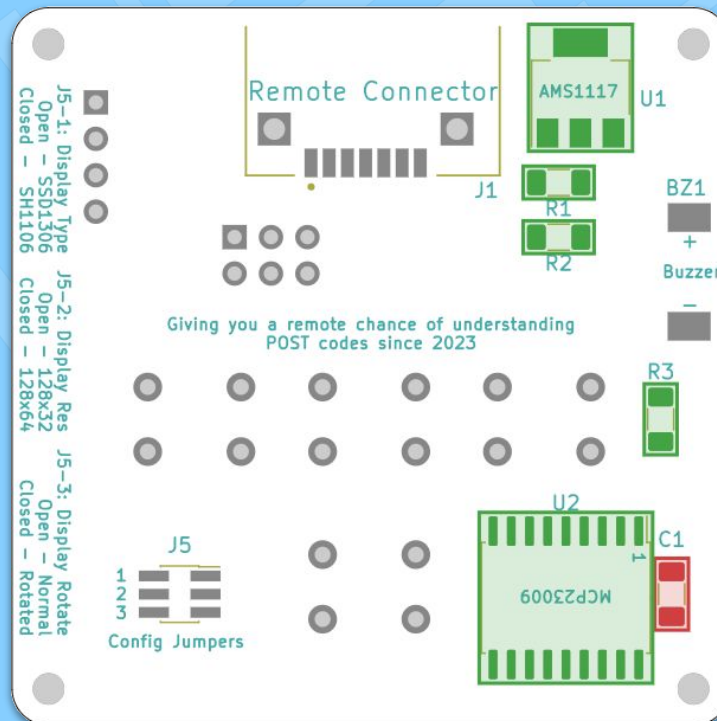


Build the Remote

Back Side

Step 4: 1n capacitor

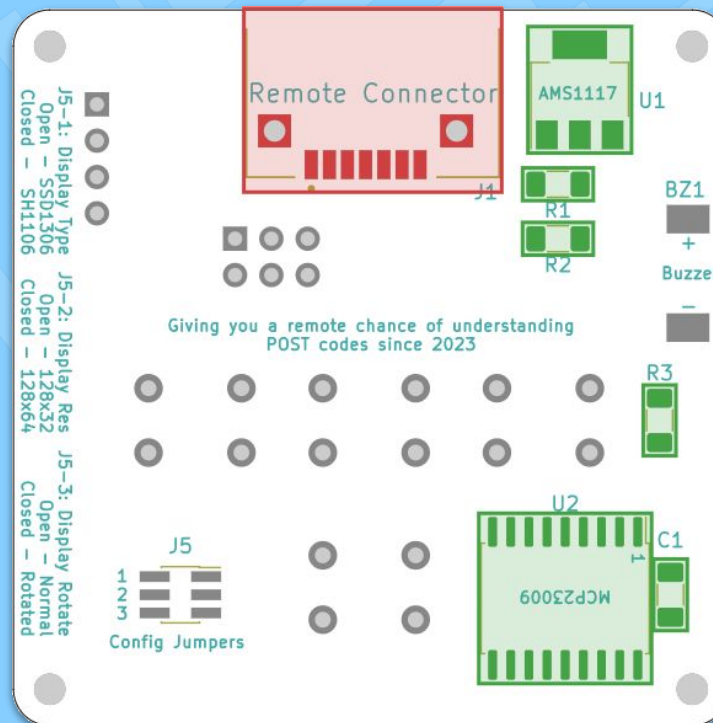
One more 1206 component, then you can probably put the tweezers away!



Build the Remote Back Side

Step 5: Remote Connector

Yep, we need to add the ~~SATA~~ **Remote** connector here too. Sorry about that.



Tips:

1. The surface mount pins here love to wick solder up and create bridges. **Keep solder braid and/or a solder sucker handy.**
2. Soldering the through-hole pins is technically optional, but strongly recommended.

Build the Remote

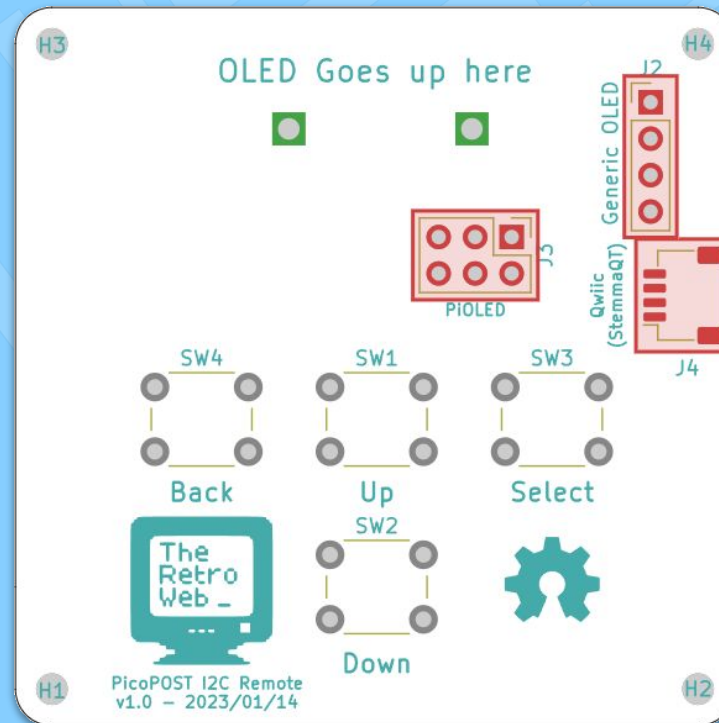
Front Side

Step 6: OLED connector

Alright, decision time. You need to determine which connector you need for your OLED of choice. Or do all three, if you're indecisive...

Options:

1. If you bought a generic four-pin gumstick-type display, solder the 1x4 **female** header.
2. If you bought a PiOLED, solder the 2x3 **male** header.
3. If you bought a Qwiic/STEMMA QT display, solder the JST SH connector.



Tips:

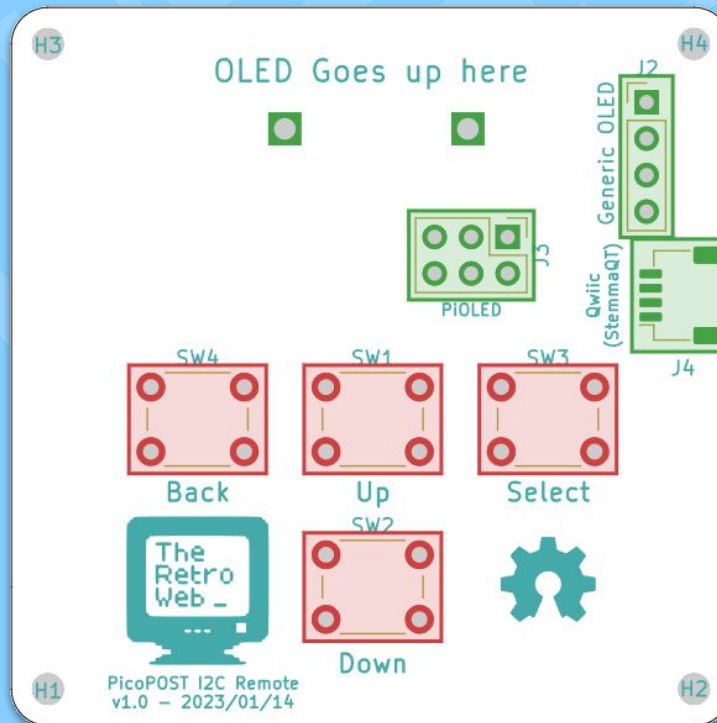
1. The remote was designed with 128x32 displays in mind. It is compatible with 128x64, but jumper leads may be required.
2. The JST SH connector is **not recommended** unless you're well experienced in SMD soldering!

Build the Remote

Front Side

Step 7: Buttons

Time to... **button** this project up! 😎



Build the Remote

Complete!

Your PicoPOST Remote is ready!

You can jump to the **Finishing Steps** section if you're ready.

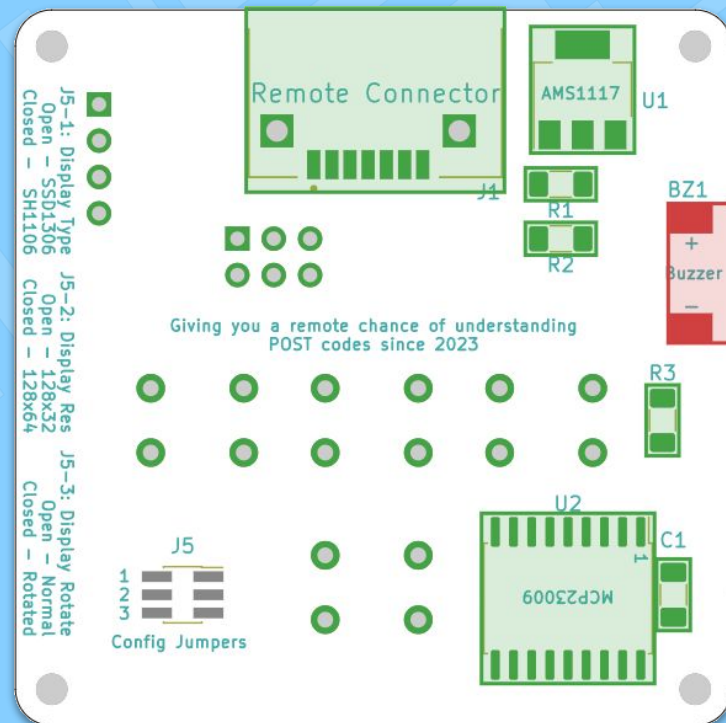
... but there's one more feature on the remote you can install first!

Build the Remote

Optional Goodies

Step A1: Buzzer

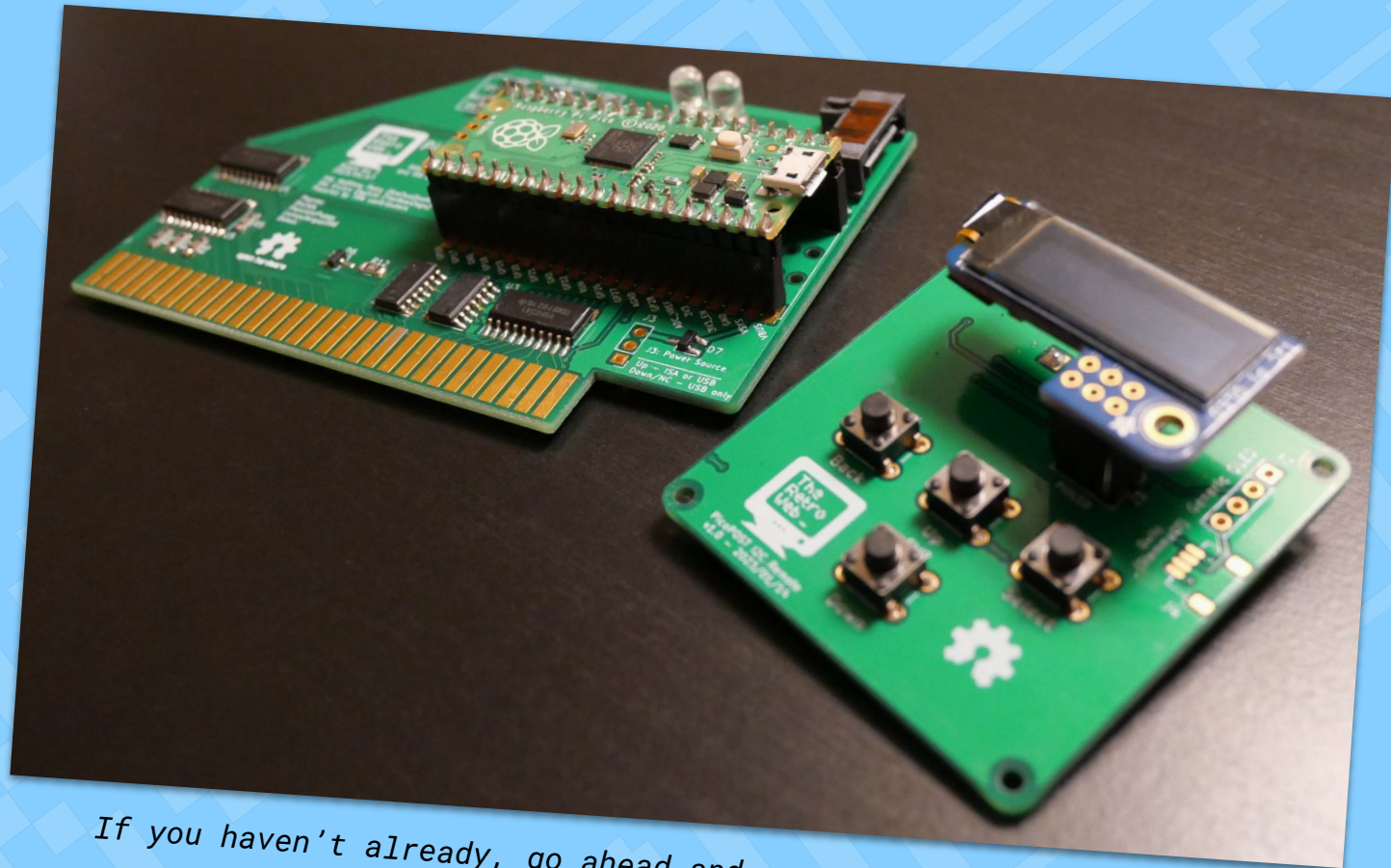
If you desire, you can attach a buzzer to the provided pads. It will be used for audible alerts, such as a system voltage that is out of spec!



Note:
The buzzer **must** be the 3 volt DC type (self-sounding).
Buzzers that require AC **will not work!**

Finishing Steps

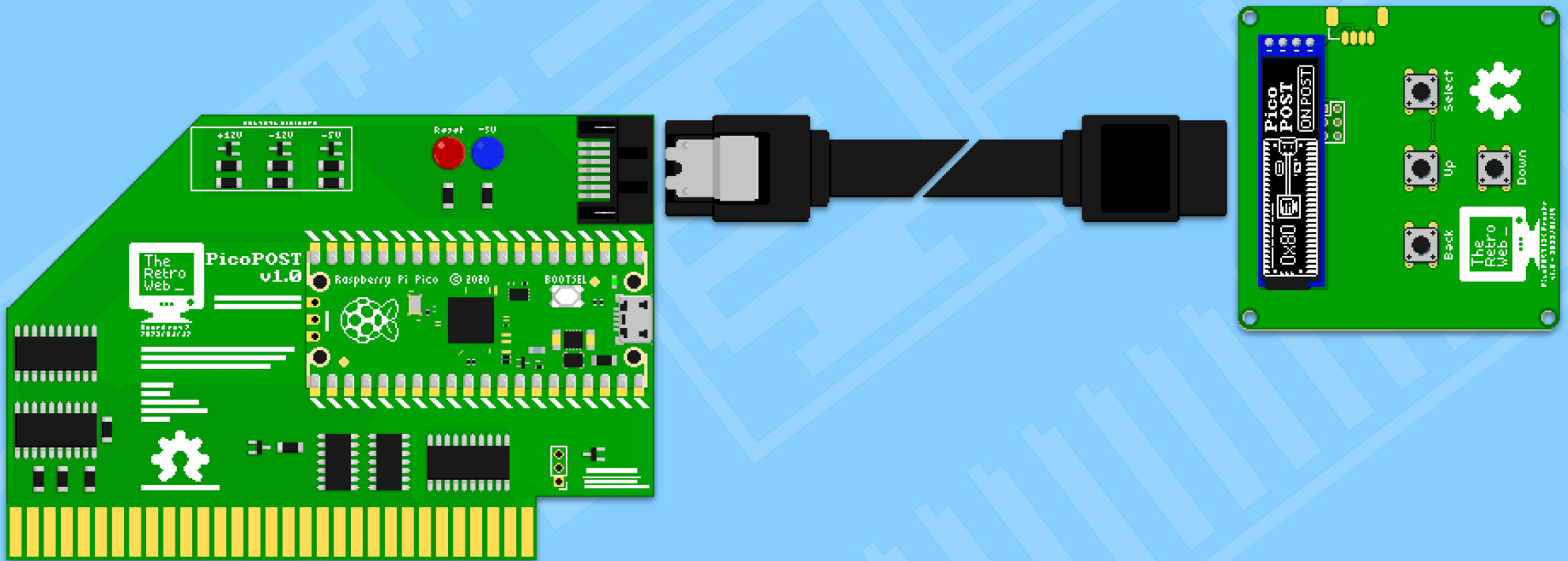
We're almost ready to go!



If you haven't already, go ahead and connect your Pico and OLED...

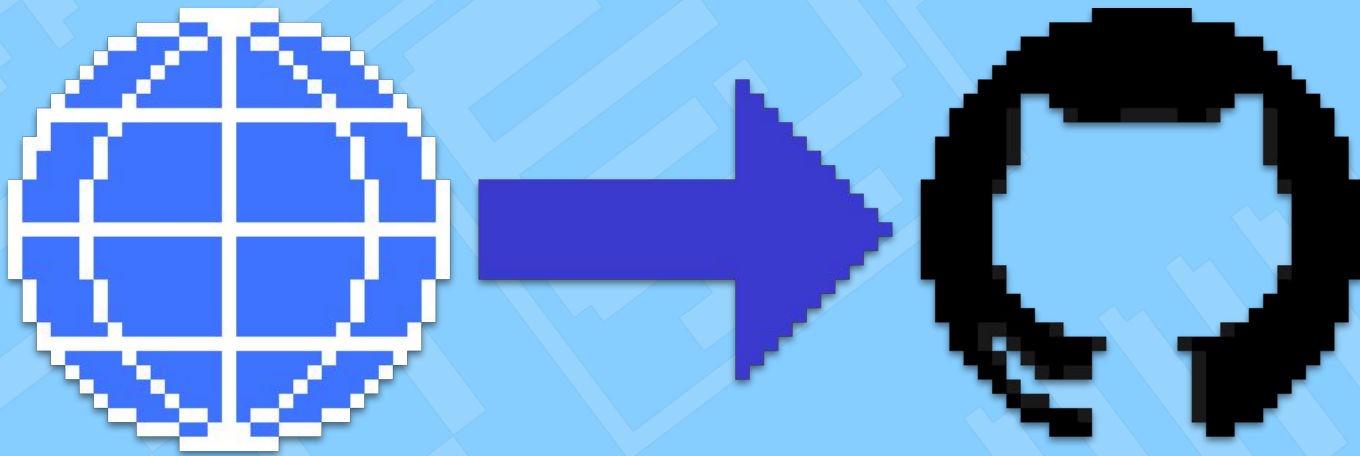
Finishing Steps

Connect the SATA cable



Finishing Steps

Downloading the firmware



<https://github.com/TheRetroWeb/PicoPOST/releases>

Finishing Steps

Downloading the firmware



Assets



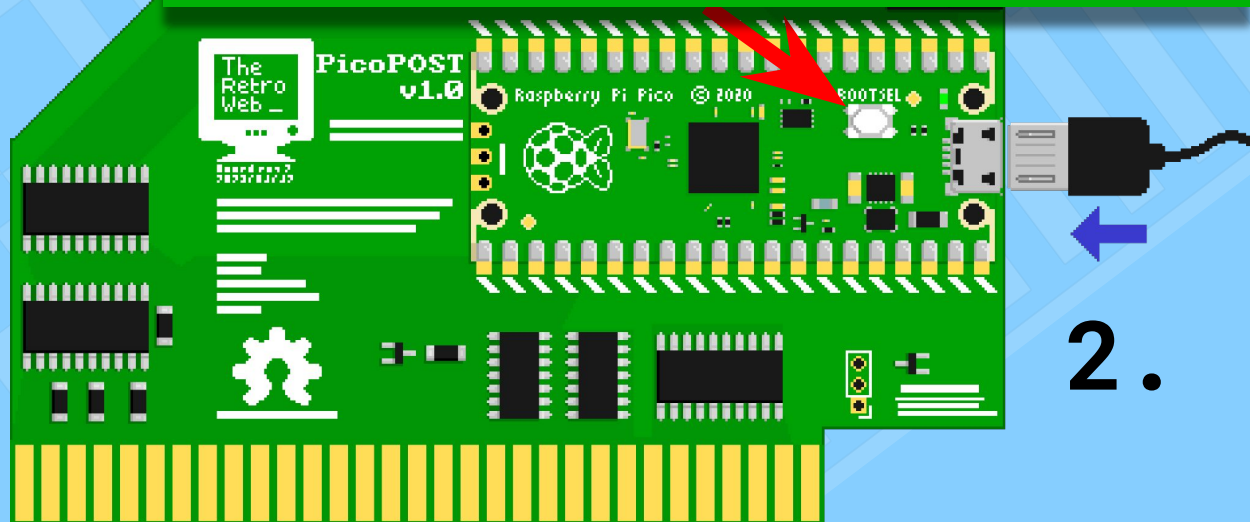
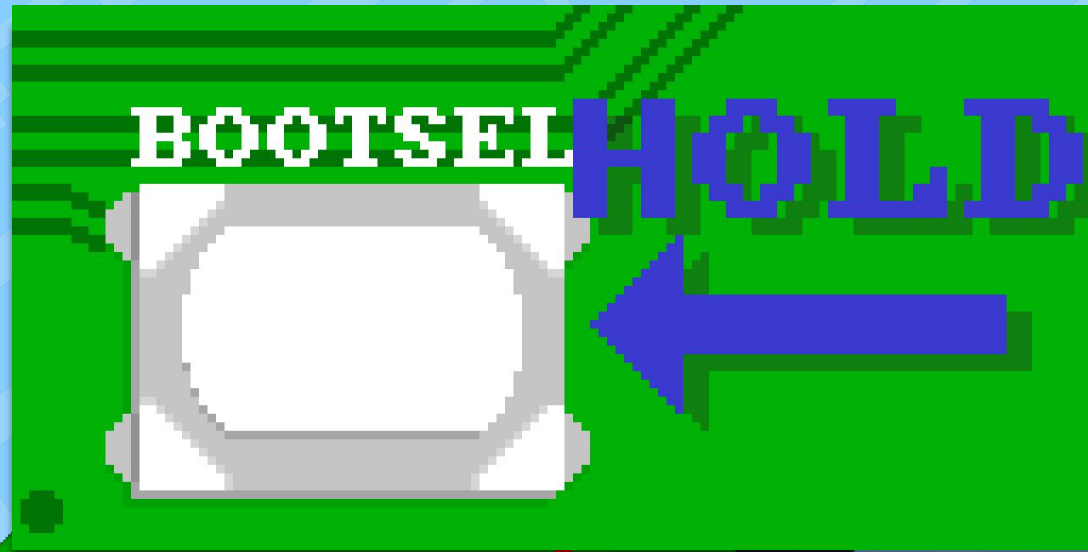
PicoPOST.uf2

Download the .uf2 file for the latest version of the PicoPOST firmware

Finishing Steps

Put the Pico into Flash Mode

1.



2.

Finishing Steps

Load the .uf2 file into the Pico



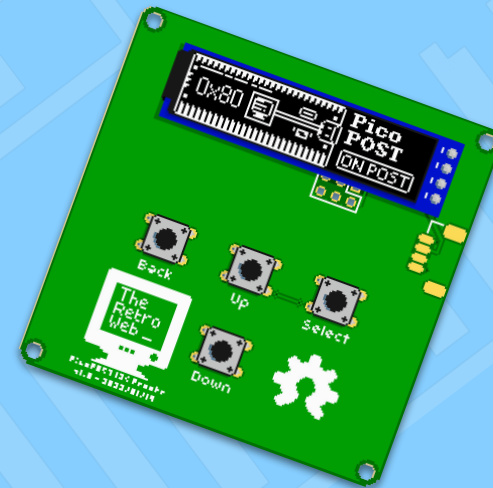
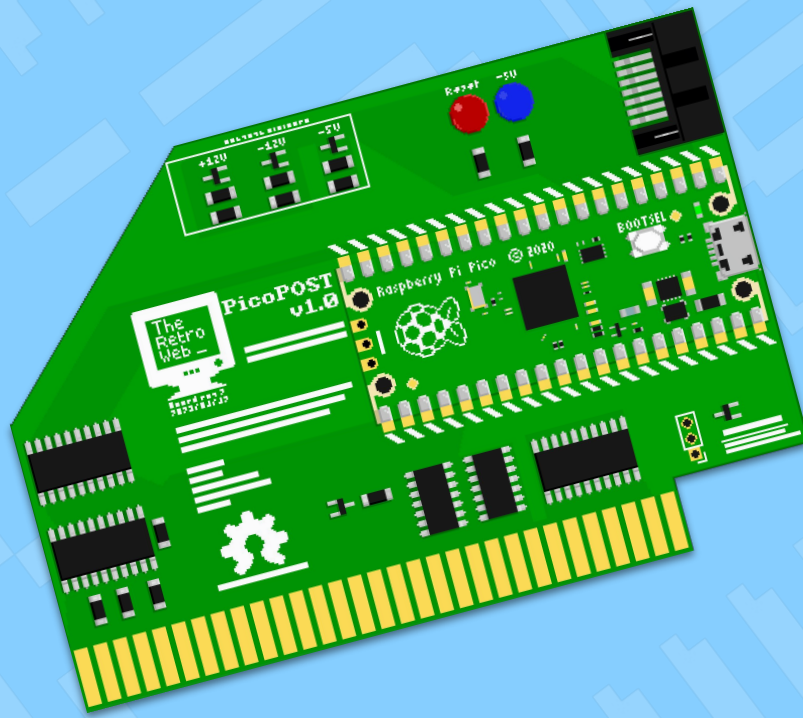
Move the .uf2 file to the Pico just like if it were a flash drive

Finishing Steps

Complete!

Congratulations!

Your PicoPOST is now ready for use!



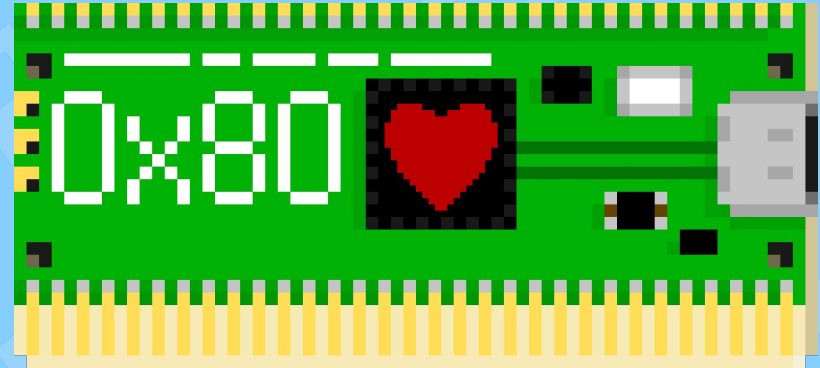
Credits and Thanks

It's a team effort

PicoPOST was developed by:

Matthew Petry (fireTwoOneNine) – *Hardware Design*

Enrico Zaghini (TheRealZago) – *Firmware*



The rest of The Retro Web team:

computerguy096

Deksor

evasive

Rigo

Fo-91

Wolt1x

and many more contributors

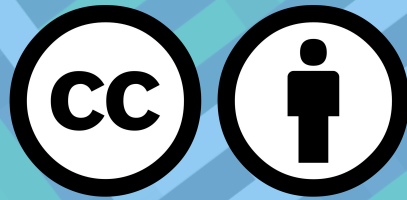


Other thanks:

Raspberry Pi Foundation

The "Retro Pico Hardware" Discord Server

Everyone who provided feedback along the way ❤️



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