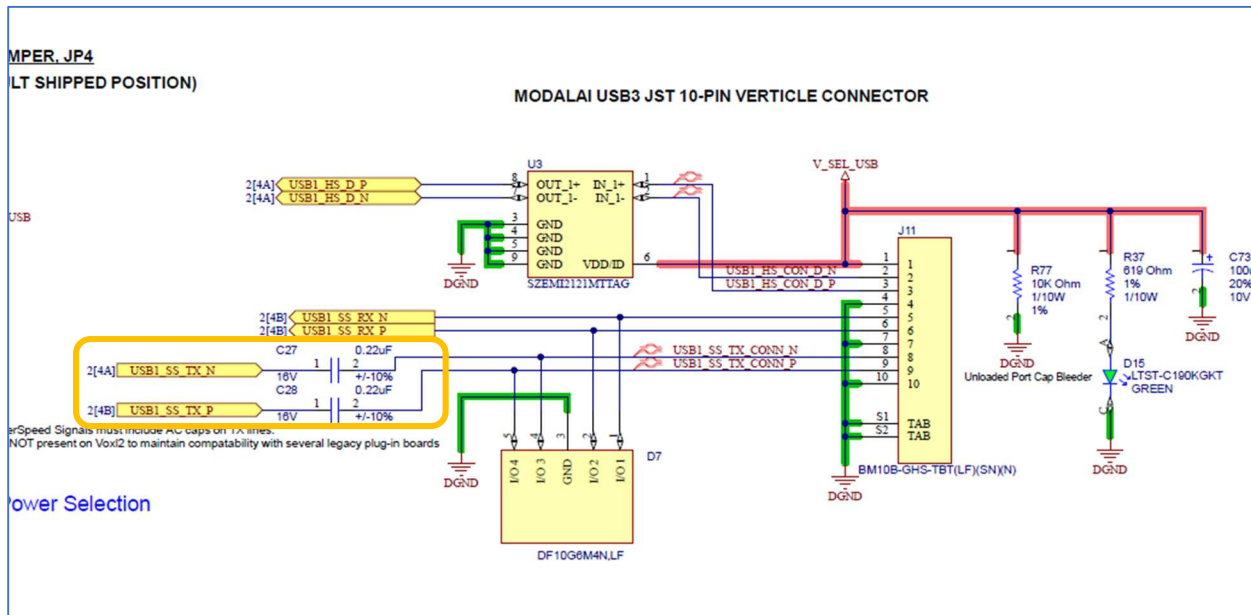# How to add AC caps to MCBL-00022-2 for Voxl 2 Mini

The goal is to add 0.22uF series caps to MCBL-00022-2 when using VOXL 2 MINI to enable USB 3 speeds (5Gbps).

We are trying to mimic the capacitor circuit on M0144 PCB for the TX lines as illustrated here from this schematic snippet:

The expectation is that COTS (Commercial Off The Shelf) devices would have the AC caps on their respective TX lines (VOXL 2 Mini's RX lines).

However, if you are making a custom circuit board that will interface with VOXL 2 Mini USB port, you can easily incorporate these caps on BOTH your TX and RX side, removing the need for any of these modifications.

Reference Links:

VOXL 2 MINI Warning on USB 3 caps: https://docs.modalai.com/voxl2-mini-connectors/#j3-usb-3-10-pin

MCBL-00022-2: https://docs.modalai.com/cable-datasheets/#mcbl-00022

M0144 Reference Design: https://docs.modalai.com/voxl2-dev-test-board/

Removing Cable Pins Guidance: https://docs.modalai.com/cable-userguides/#flightcore-v2-conversion-cables-info

Recommended Tools:

Quality ESD Tweezers

"Stripmaster" wire stripper from Ideal, covering 28AWG: https://www.grainger.com/product/IDEAL-Wire-Stripper-30-AWG-to-20-10F552

Quality Soldering Iron with good tips

0.22uF radial caps, example part as shown:

https://www.digikey.com/en/products/detail/kemet/R82DC3220DQ60J/1930799?s=
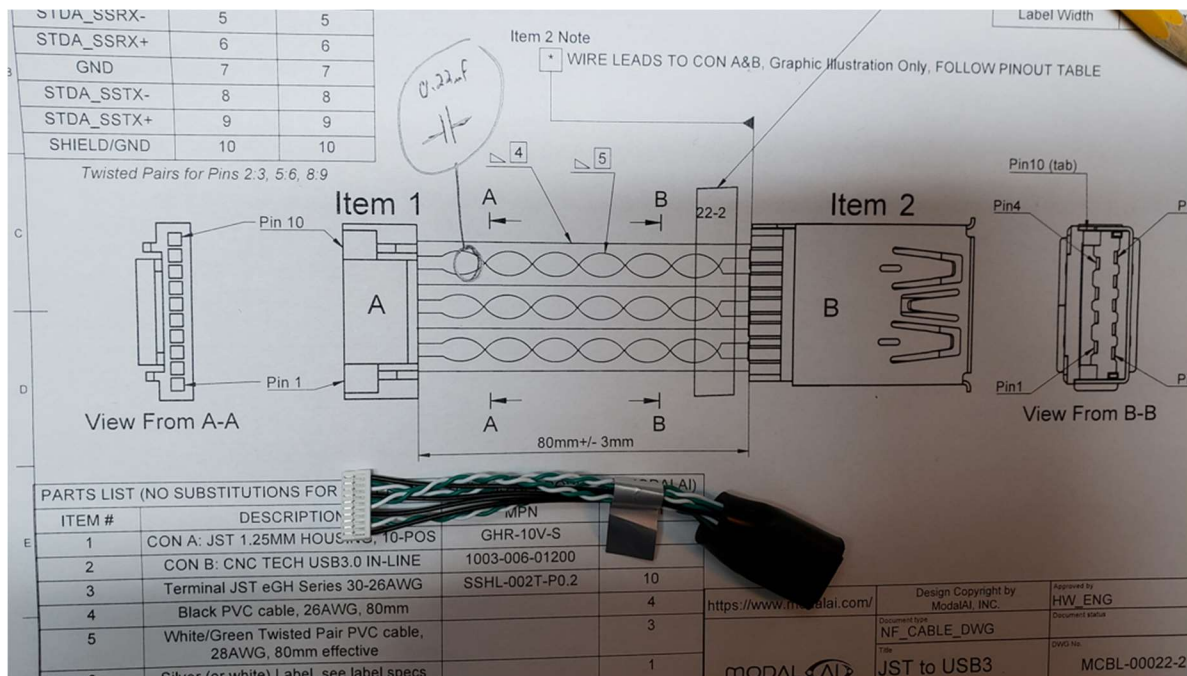
Large ID heat-shrink and heat gun

Well-lit clean workspace for soldering and working with small parts

Preparation:

1) Review the MCBL-00022-2 drawing, and note the following details:

- Pins 8 and 9 of the JST 10-pin are the USB 3 SuperSpeed TX Lines

- These are the lines we need to splice into and insert the 0.22uF cap as a series element, as annotated below:

2) Remove the JST crimp contacts from the JST 10-pin shroud carefully, not damaging the plastic shroud since we need to re-use this. Normally, we recommend saving the pin at the expense of the shroud, but in this case, care must be taken to ensure neither are damaged. Use the tweezers to help gently remove the two cables, and then untwist the wires as shown:
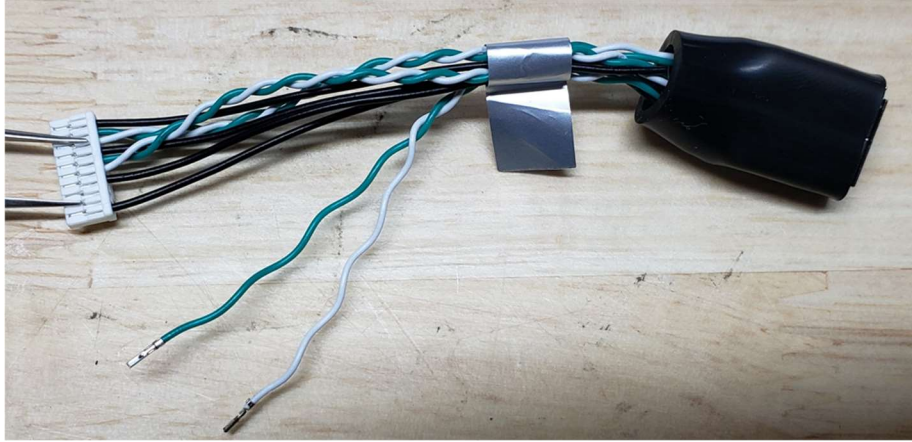
3) Use the stripmaster and very carefully open the insulation in each green and white wire about 15mm from the edge of the crimp contact. Only a 3-5mm section is needed to be exposed as shown:
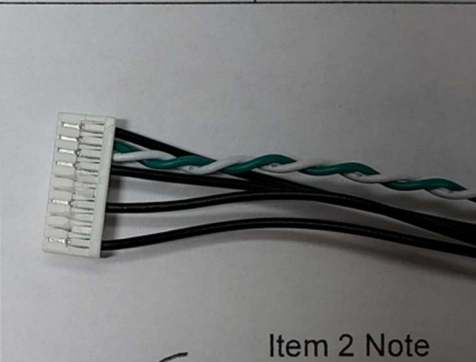

Be careful, and practice this first on some test sample wire. If you go too far with the stripmaster, you will strip off the crimp contact as shown:

and now all you can hope for is to convert this cable into a USB2 only version as shown by removing cables 5, 6, 8, &9.

| Pinout		
Signal	**CON A**	**CON B**
VBUS	1	1
D-	2	2
D+	3	3
GND	4	4
STDA_SSRX-	5	5

Item 2 Note

Adding the Caps

Note: there are other ways to install caps based on your experience. We found that this way is somewhat easy and can be done in about 5-10 minutes once you have done the first one.

1) Once you have both green and white wires spliced a little, take the 0.22uF cap and gently wind/twist one of the radial leads around the cable conductor as shown:
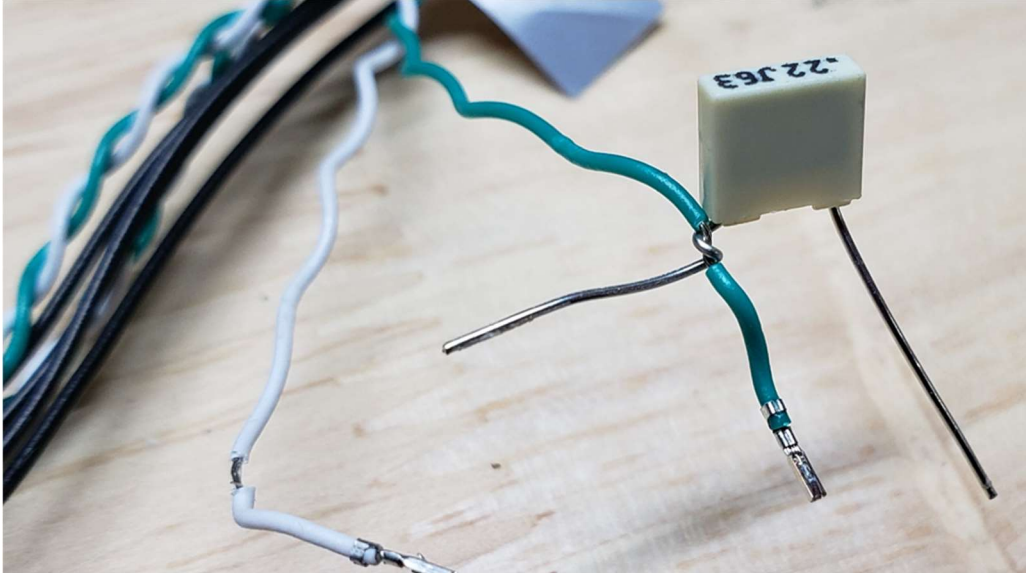
2) Now, you can solder the cable and radial lead together, and be sure to give them a gentle tug afterwards to be sure you have a good joint.

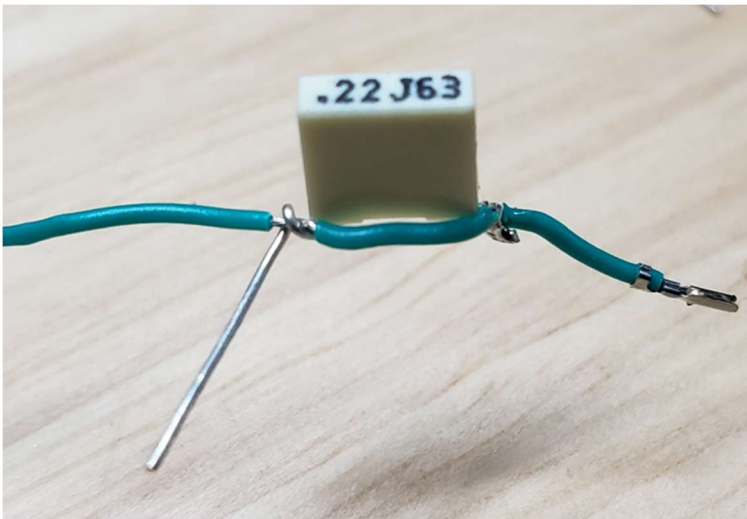3) Once you are satisfied the joint is solid, trim the remaining part of the radial lead as shown:
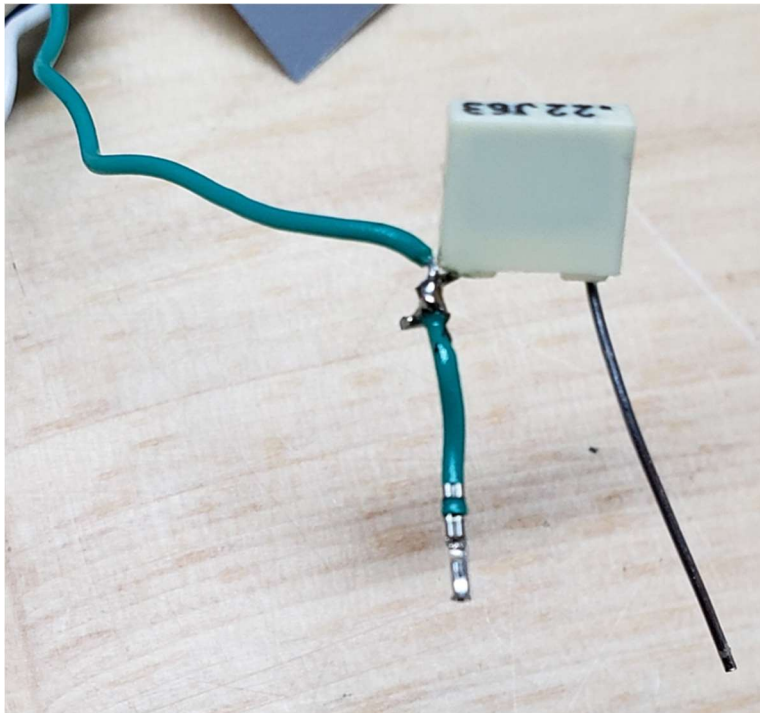
4) Now, the tricky part is to add a second insulation splice opening about 10-15mm away from the first lead further away from the crimp contact as shown:
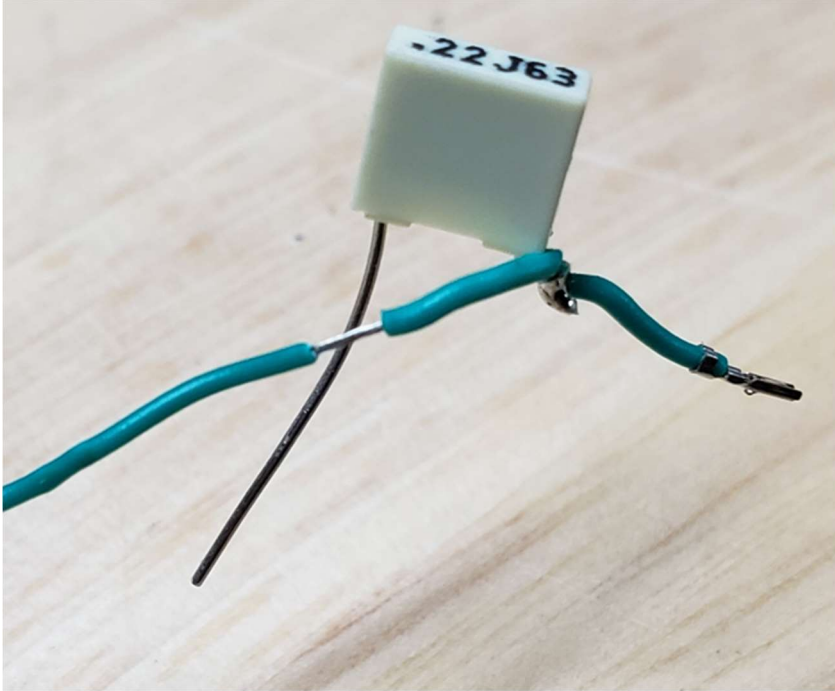
This method helps ensure the cap stays in place during soldering without the need for elaborate cable holders, but there are other ways to do this.

5) Twist the other radial lead around the cable conductor as last time:

6) Repeat the soldering step, and again, once you are sure the joint is solid, trim back the rest of the radial lead, and then cut away the center cable "bridge" between the two radial leads as shown:
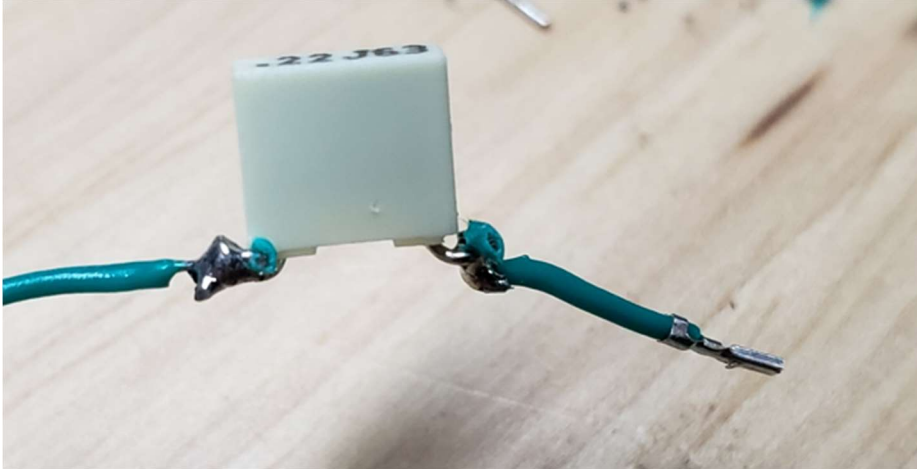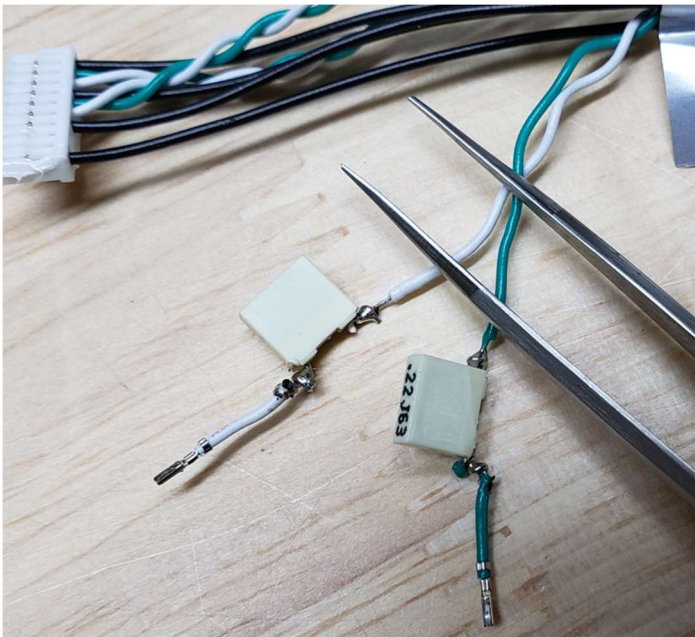
Repeat for White Wire

Repeat the same exact steps from the green wire, but this time for the white wire as shown:

And do your final clean-ups and trimming:

Heatshrinking and Insertion

1) The next step, BEFORE inserting the crimp pins back into the JST 10-pin shroud, each cap must be individually heat-shrinked to prevent any shorting or strain on the junctions or leads.

The specific heat shrink you use is up to you, but make sure it is big enough to cover the caps, and it is cut long enough to extend past the terminals that were soldered.

Here is an example of a heat shrink kit, and we used the largest one with 10mm ID cut in half as shown for this application:
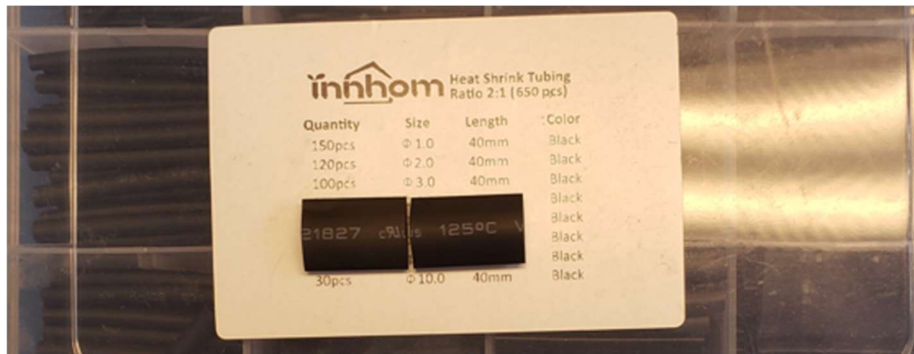
Here is an example of each cap heat-shrinked:
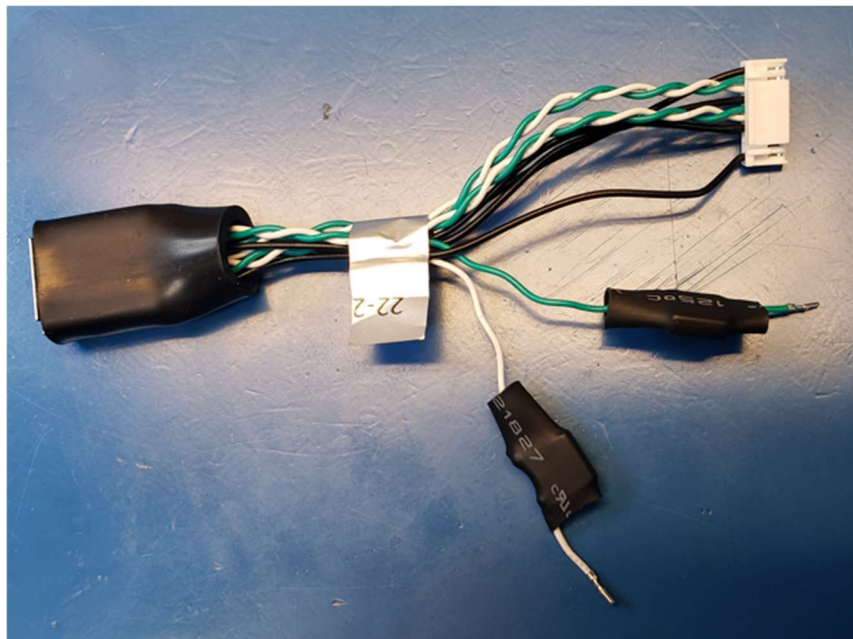
2) Then, using tweezers, insert the **white wire into the JST shroud at position 9** and the **green wire into the shroud at position 8** to recreate the original pinout from the drawing. An unmodified cable will help as a quick guide to make sure you have the wires back in their correct locations.

If you need assistance inserting the pins back into the shroud correctly, use a microscope or a magnifying glass to ensure the barb is rotated correctly on the crimp pin so that it will grab the plastic shroud retaining pin that you had to lift to remove the pin during the prep stages. There are numerous video tutorials on YouTube showing how to remove pins and insert them for JST shrouds.

3) After the contacts are inserted, be sure to test them by gently pulling back, and the contact should stay engaged in the shroud housing.

Testing:

Now that you have a modified cable with series caps, you want to test your VOXL 2 Mini with a known USB 3 device, such as a WLAN dongle or Solid State Drive that has the blue inserts (for USB 3 indication).

1) First, we take a normal VOXL 2 Mini and an unmodified MCBL-00022-2 and show that a USB3 device does not show up in the console:
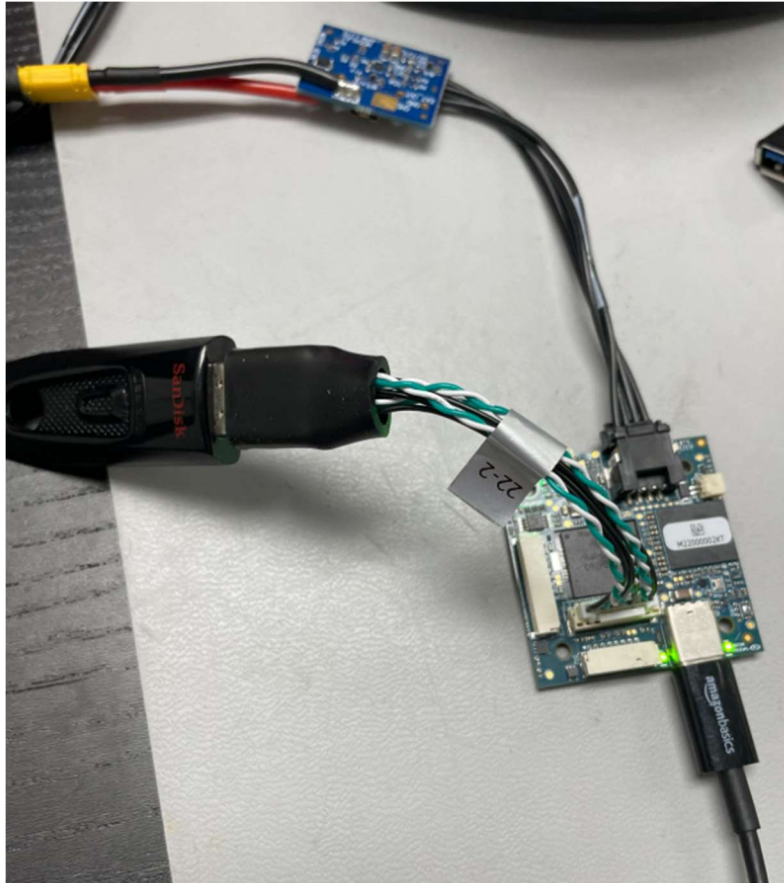
```
voxl2-mini:/$ lsusb -t
/:  Bus 02.Port 1: Dev 1, Class=root_hub, Driver=xhci-hcd/1p, 10000M
/:  Bus 01.Port 1: Dev 1, Class=root_hub, Driver=xhci-hcd/1p, 480M
voxl2-mini:/$ 
```

2) Then, we change out the MCBL-00022-2 for the MCBL-00022-AC and show the device does indeed now enumerate as USB3 as noted by the 5,000Mbps query:
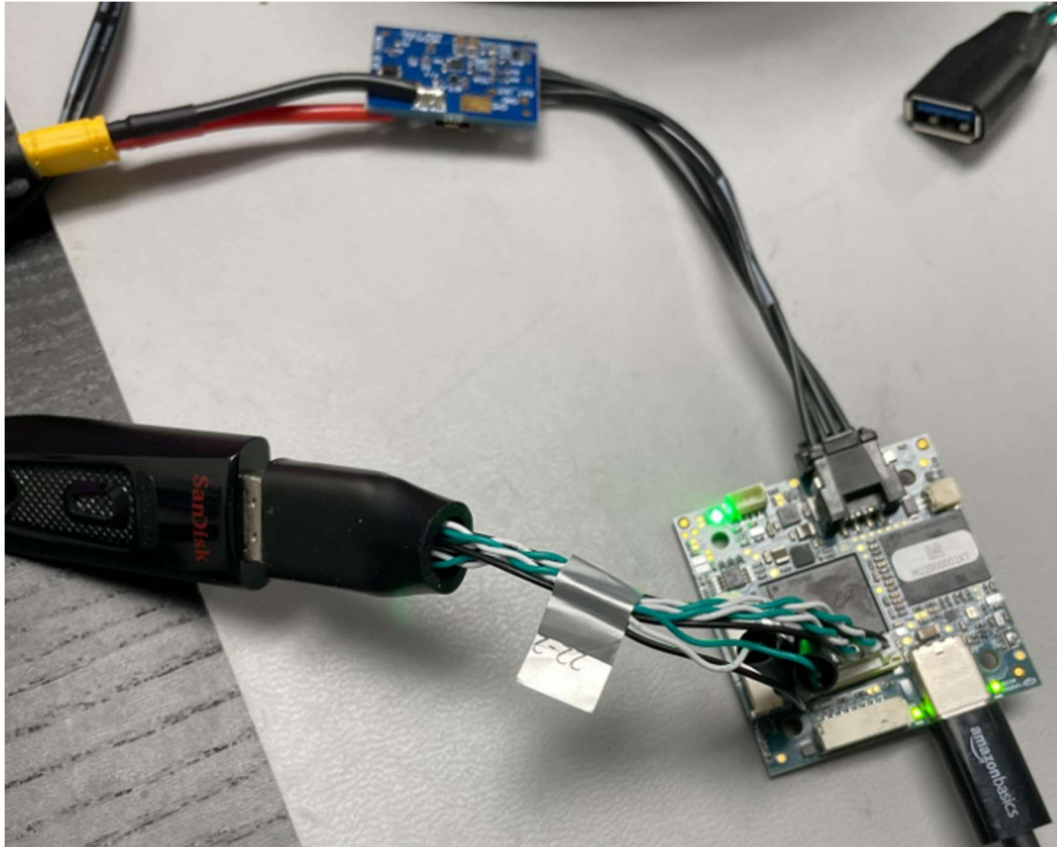
```
voxl2-mini:/$ lsusb -t
/:  Bus 02.Port 1: Dev 1, Class=root_hub, Driver=xhci-hcd/1p, 10000M
    |__ Port 1: Dev 3, If 0, Class=Mass Storage, Driver=usb-storage, 5000M
/:  Bus 01.Port 1: Dev 1, Class=root_hub, Driver=xhci-hcd/1p, 480M
voxl2-mini:/$ 
```