

Mech 25 Final Project

USB C Tester

Patrick Leiser

Overview

Because USB Type C is such a comprehensive standard, it has a lot of optional features, which is great, but can be confusing, especially since most cables don't clearly label which of these features they actually support. Similarly, the USB C power-delivery protocol is very flexible, but not all features are universally supported. Given these challenges, I decided to make a USB C tester, that would allow me to definitively identify exactly what features a given USB C cable and USB C power supply would support.

Parts

I knew I needed lots of I/O pins in order to test every pin on a USB C cable, and would also need the ability to speak the USB Power Delivery protocol in order to fully test power supplies.

I settled on a Raspberry Pi Pico microcontroller for the overall form factor, and found the perfect option for my project, PicoPD, a Raspberry Pi Pico compatible microcontroller, with added support for USB PD up to 20 volts and 5 amps, perfect for testing all but the most powerful and newest variants of USB PD devices.

Because I needed so many signals to test, the 26 GPIO of the Pi Pico alone wouldn't be enough, so I used several 74HC595 shift registers for additional output signals, both for driving the testing pins, and for controlling all the status LEDs. Even with these shift registers, I ended up using every single pin on the Pi Pico, most of which were dedicated to the inputs on every USB pin to test.

Cost

A set of 10 circuit boards including most of the required components costs around \$100. The PicoPD board, required for a full-featured implementation, costs \$20 each, but it can be substituted with an ordinary Raspberry Pi Pico which only costs \$4 each. In total, for all 3 revisions of the circuit board, the total cost was around \$350.

See the presentation slides for more details of the overall process, and some of the challenges encountered. The slides, code, and design files are both available on the GitHub repo, at github.com/Patronics/USBC-Tester

