

StuPD Prototype System Design Overview



USB
Type-C
Connector



USB PD 2.0
Negotiator
(STUSB4500)



Buck-Boost
Converter
(LM2577S)
with Adjustable
voltage knob



Output 4mm
'Banana Jack'

Here is the scenario...

Do you have a USB-C compatible Portable Power Bank laying around?

Do you have a project that requires 3.3V but don't want to splice a USB Cable for the purpose?

Or maybe, you have a project that requires 12V but don't own a Boost Converter so cannot step-up your USB 5V.

StuPD (Student Power Delivery) is here to solve all these problems!

StuPD is currently in its prototype stage and requires funding. However, a beta test prototype is out there for you to try, give feedback and help improve the next iteration.

So, imagine you're late for your assignment because you had to work on another assignment before finishing another assignment... You go to the electronics lab and find out everyone else is in the same situation as you, occupying all the available power supplies!

Bummer.

StuPD is here to save you! If you have a USB-C PD compliant Portable Power Bank, you can make your own Adjustable Power Supply!

Get yourself a USB-C Cable, plug one end into the Power Bank and the other into StuPD — and there you have it! Your own Power Supply.

Adjust the output voltage or pre-set it and you are good to go.

You can now work whenever you want, wherever you want, with StuPD!

How it works:

Right now, StuPD uses USB-PD on the type C's CC lines to 'request' voltages through the STUSB4500 chip. The output, a LM2577S Buck-Boost adjustable regulator, controls the voltage level as the user desires.

This is merely the prototype. Additional features will be added to the first release of StuPD stated below.

Specifications:

		Min	Max	Unit	Notes
Input Voltage	(V_{in})	5.0	20.0	V	The STUSB4500 is programmed to default to 5V if source isn't USB-PD compliant. Otherwise it requests 12V or 20V.
Input Voltage	(V_{inBB})	V_{in}	40.0	V	Limited by STUSB4500 output voltage. Thus, maximum voltage will be 20V input to the Buck-Boost.
Output Current	(I_o)	0	1.0	A	Limited by STUSB4500 output FET current. Although the Buck-Boost can reach higher current, the prototype is rated conservatively.

Disclaimer:

StuPD prototype is only for proof of concept, thus the lack of finer details. Please note that StuPD prototype is currently in its beta testing phase so some of the stated parameters might differ. 18W USB-PD Power Banks will not produce more than 18W. Inefficiencies caused by battery to USB voltage switching losses and higher USB-PD voltages can affect the overall lifetime of the battery, depending on configurations.

Future Goals and Objectives:

StuPD projects the following future goals:

- Accept QC 2.x or later as input. Allowing USB-A to USB-C cables to work without requiring CC pins.
- Higher output current.
- Intelligent input-output voltage efficiency computation. StuPD will decide what input power it will require to produce the requested output as efficiently as possible.
- Using Bluetooth, one can use the Android app or PC application to graph/control and monitor voltages/currents.
- Otherwise, USB-Micro output VCOM/UART serial which will power just the logic side of StuPD, and the output will be powered by the USB-C input.
- Physical knob controls for current and voltage.
- Ability to measure current input and warn user if battery is low. If one decides to input the charge capacity of the battery and other parameters, StuPD will estimate power life and warn you if the battery is low.
- Indicator LEDs, so we know it's working...
- Physical power-off switch.
- Output Over Voltage Protection (OVP).
- Output Over Current Protection (OCP).

Final Notes:

StuPD is not a complete replacement for a better functioning desktop power supply. It is only there to provide convenience for moderately low power projects. If you are to require extensive data collection and analysis, please use a proper benchtop power supply.

StuPD intends to be a portable power supply for hobbyists, engineers and tinkerers who wish to experiment with low power projects. In later editions, StuPD intends to have a higher current output functionality and be able to do other listed goals stated above.

Prototype Images:

