SJSU Robotics

Micromod-2222-C
Universal Controller

Documentation	SJSU-IB2022

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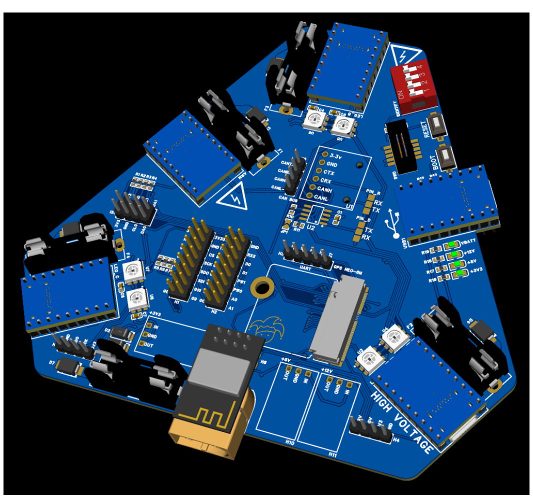
Features

USB Programming
Micromod Development Board
SWD IDC Connector
ESP-01
Mode Selector DIP Switch
CAN BUS
I2C
GPS NEO-6M
SPI RGB Status LEDs
Power Status LEDs
Fuses
TVS Diodes
3.3V, 5V, 12V Buck Converters
USB C Breakout

Application

Controller board for both drive and arm systems. Designed with LPC4078 (same as SJSUDev2) in mind as the main microcontroller. Mode selector is used to switch the board to be used for drive or arm systems.



Circuit Board Overview

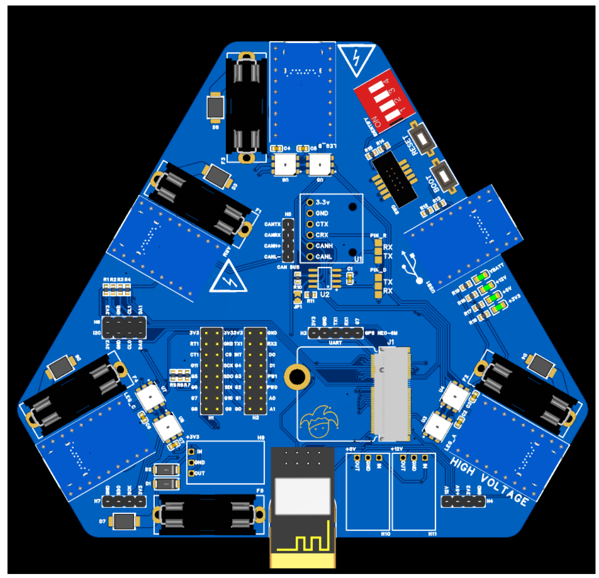


Figure 1: Top View

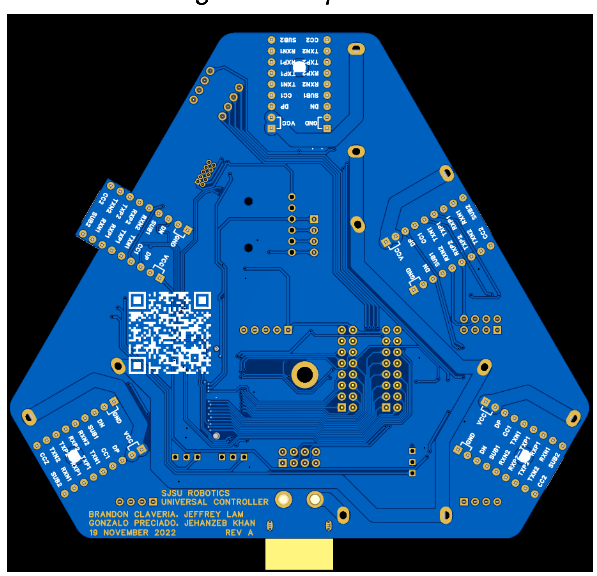


Figure 2: Bottom View

Figure 3: 3D View

Universal Controller Block Diagram

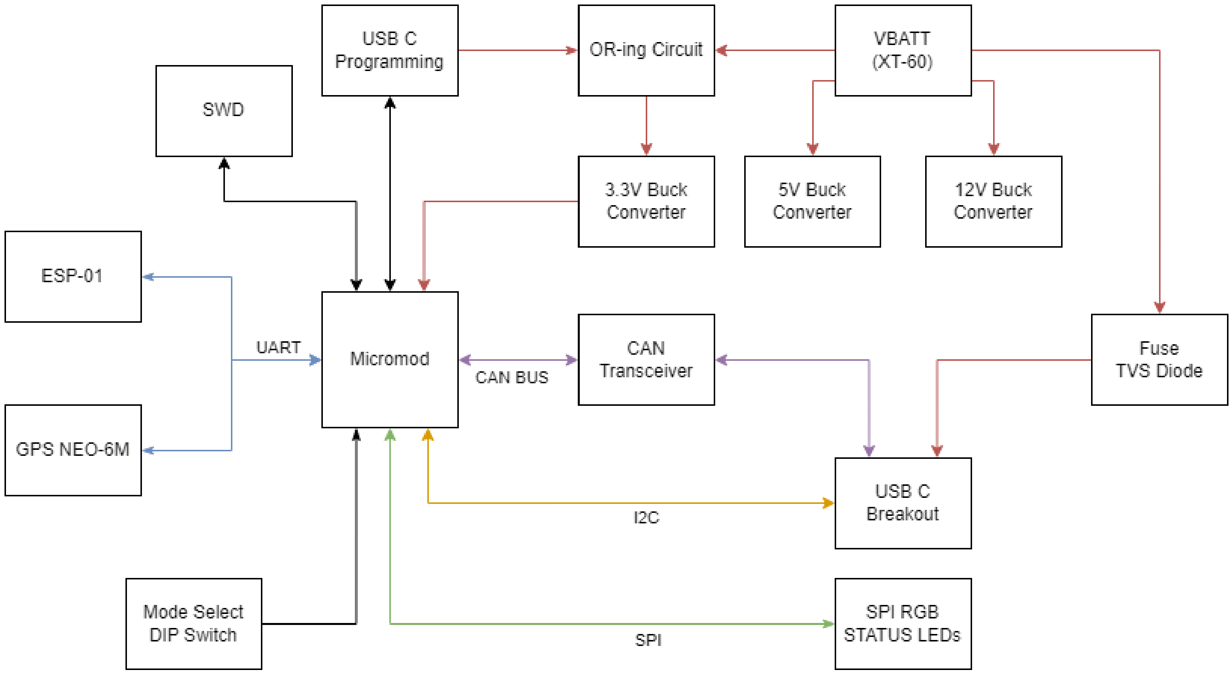


Figure 4: Universal Controller Block Diagram

Universal Controller Typical Application (Drive Systems)

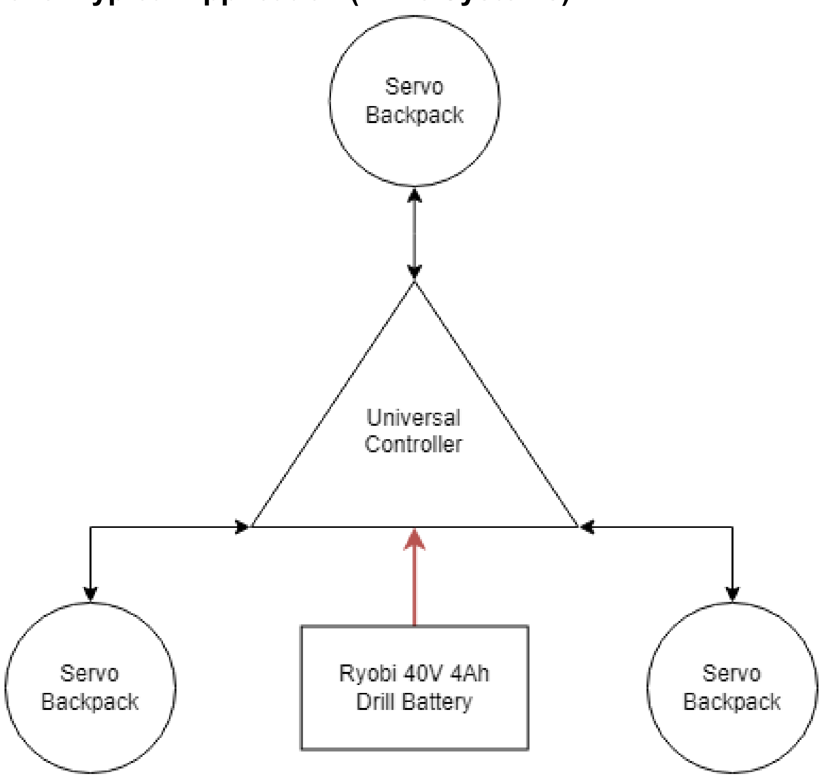


Figure 5: Universal Controller (Drive) Block Diagram

USB Programing

The USB C header that is protruded more than the rest of the USB C headers is meant for USB programming of the microcontroller on board. Only plug into the connector highlighted in figure 6.

** **WARNING : BE CAREFUL NOT TO PLUG PC INTO ANY OTHER USB C PORT** **

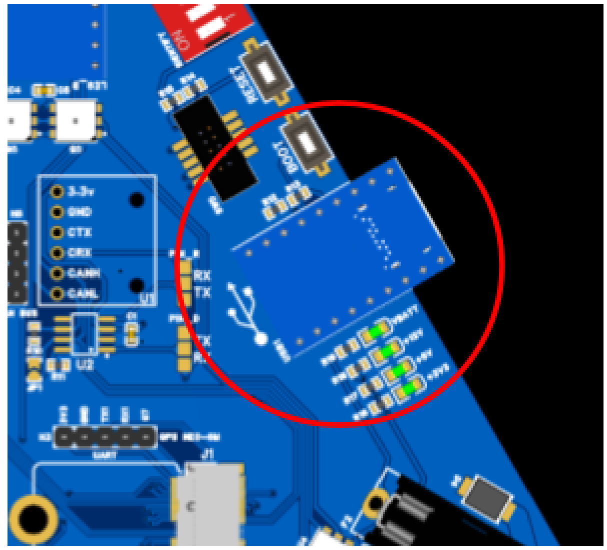


Figure 6: USB C Programming

Micromod M.2 Connector / Breakout

Standard M.2 Connector for micromod processor boards. Separate boot and reset switches located next to the USB programming connector. Connector and breakout point for extra GPIO can be found circled in figure 7. Detailed view of broken out pins found below in figure 8.

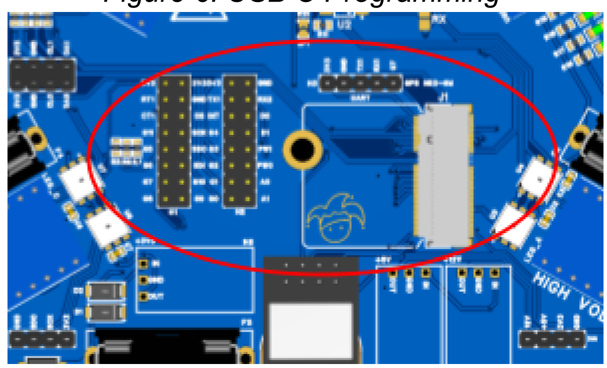


Figure 7: M.2 Connector / Breakout

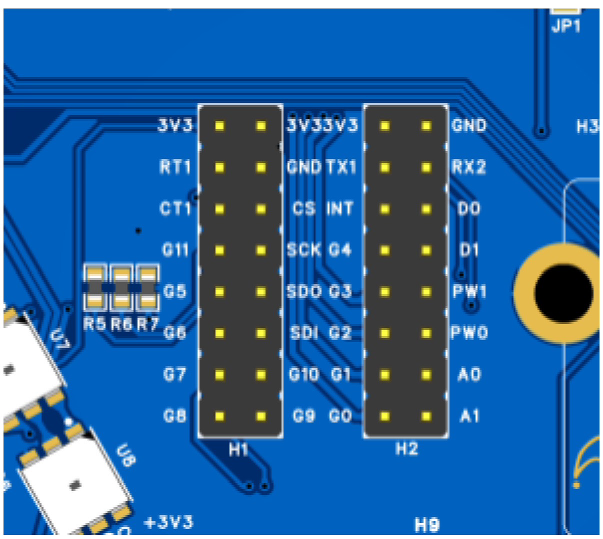


Figure 8: Micromod Breakout

SWD IDC Connector

SWD IDC connector meant for SWD programming and debugging. Uses a 2x5 1.27mm male header to interface with a SWD programming cable. Location can be found in figure 9.

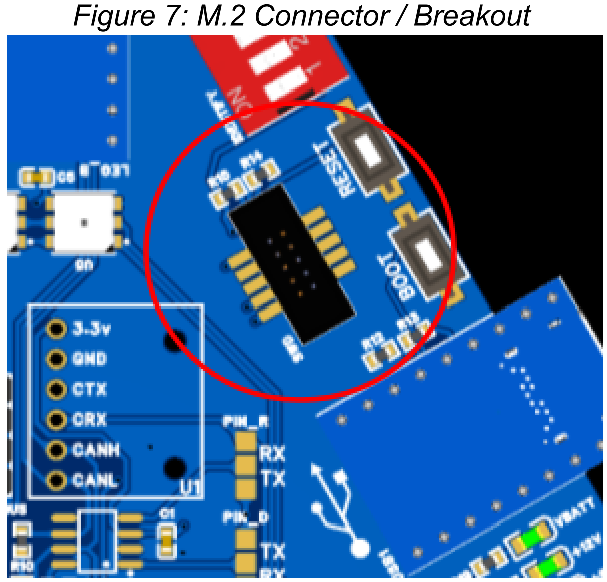


Figure 9: SWD IDC Connector

ESP-01
ESP-01 wifi module for allowing the microcontroller to interface with a wifi network. 2x4 2.54mm female header can be located in figure 10.

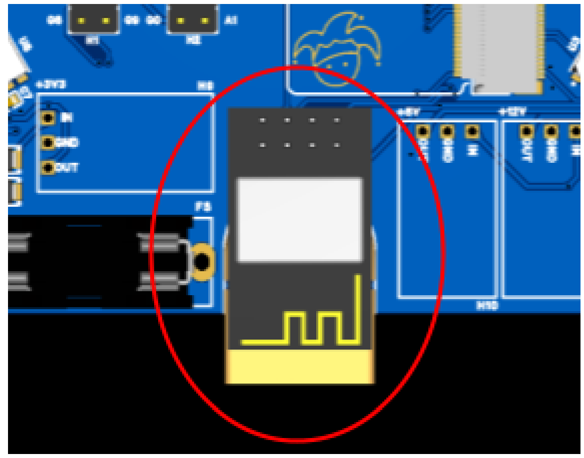


Figure 10: ESP-01 Header + Orientation

Mode Selector DIP Switch
Mode selector which utilizes GPIO pins: G0, G1, G2, G3 to determine what mode is active. When the switch open is digital low (0), closed is pulled high to 3.3V (1). This is used to set up to 16 (2^4) different modes. Location found in figure 11.

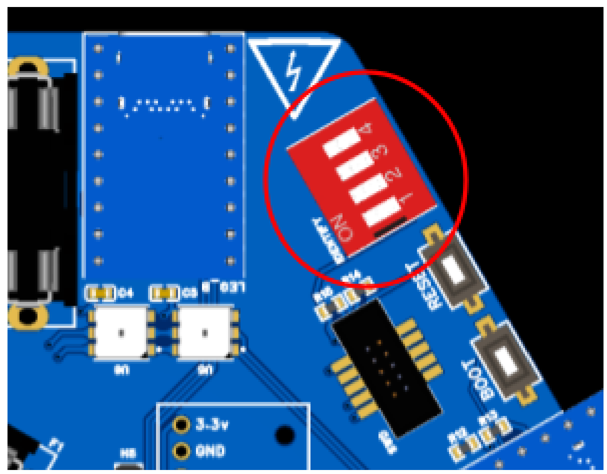


Figure 11: Mode Select DIP Switch

CAN BUS
There are two options for CAN transceivers. Either use the SN65HVD230 module or the SN65HVD230DR IC found in figure 12. There are jumper switching blocks for the IC for changing the connection of CANTX or RX to PIN D or PIN R of the IC. There is a jumper pad to enable the 120Ω terminating resistor. Close up of the jumper pads can be seen in figure 13 below.

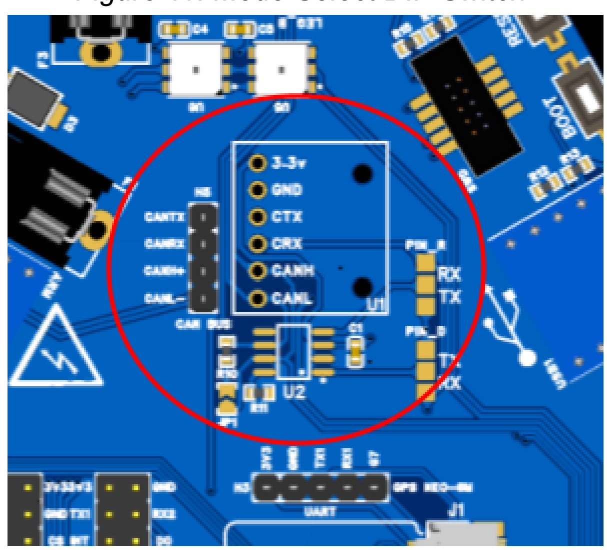


Figure 12: CAN Transceivers

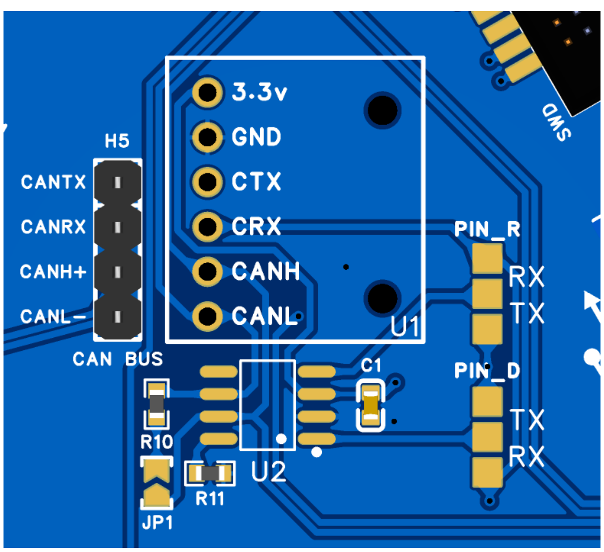


Figure 13: Detail View CAN Jumper Pads

I2C

The two I2C channels are broken out and also transferred over to the ARM Breakout connector. I2C interrupt can be found in the micromod breakout in figure 8. There are pull up resistors (2.2KΩ) on both SDA and SCL pins. I2C header for debugging or testing can be seen in figure 13.

GPS NEO-6M

UART breakout pins for the GPS NEO-6M can be found in figure 14. PPS pin is connected to GPIO G7.

SPI RGB Status LEDs

SPI RGB LEDs are located near each of the drive connectors. Uses SK9822 RGB LEDs and has the output extended for use of an external SK9822 RGB strip.

Power Status LEDs

LEDs located near the programming side of the board are used to indicate what power is currently connected to the board. See Figure 16 for location.

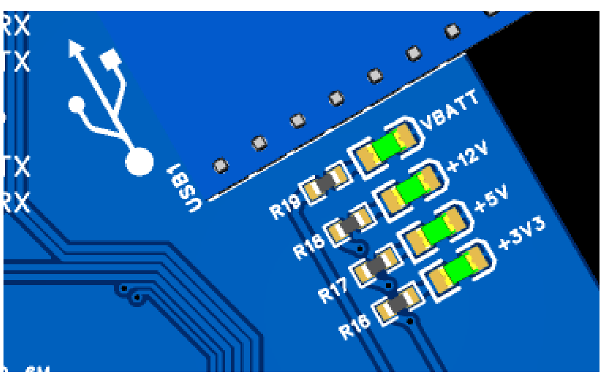


Figure 16: Power Status LEDs

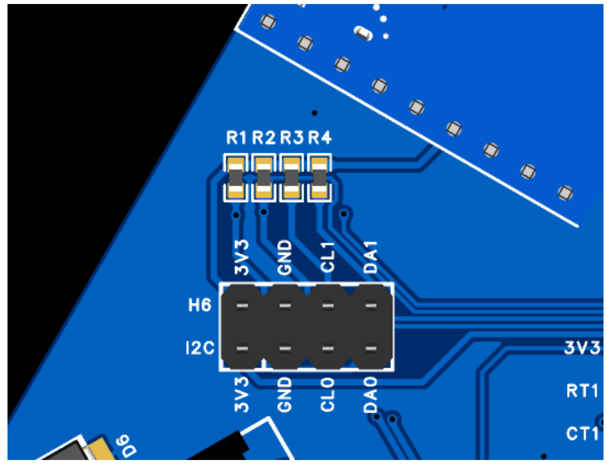


Figure 13: Detail View I2C Header

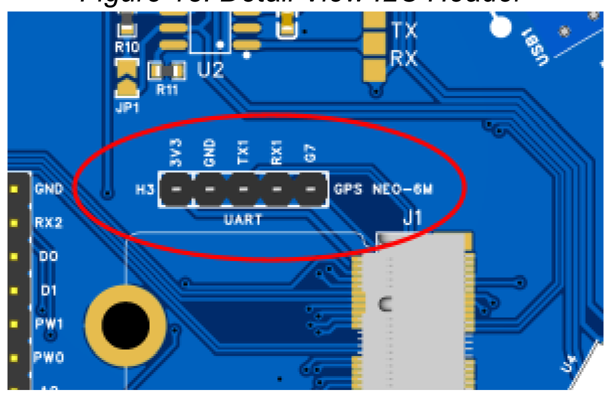


Figure 14: GPS NEO-6M Breakout

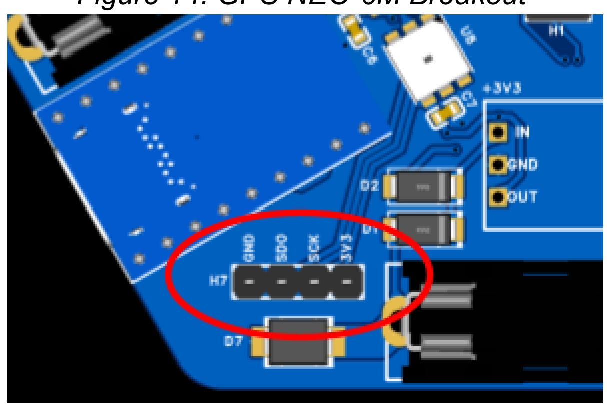


Figure 15: SPI RGB Status LEDs Extension

Fuses / TVS Diodes

Input into the power connector, and output going out of USB for arm and drive, will have currents ~ 4A. For now, 6A glass fuses are placed as circuit protection. TVS diodes are also placed near the input and output sources to protect against back-emf. The specific TVS diode is SMBJ45CA 45V.

3.3V Buck Converter / ORing Circuit

A 3.3V buck converter is used to power the micromod processor. An OR-ing circuit utilizing MSK340A schottky diodes allows for simultaneous power from USB programming and VBATT. Figure 17 shows the location of the 3.3V buck converter and OR-ing circuit.
[Buck Converter]

5V / 12V Buck Converter

5V and 12V outputs can be found in figure 18.
[Buck Converter]

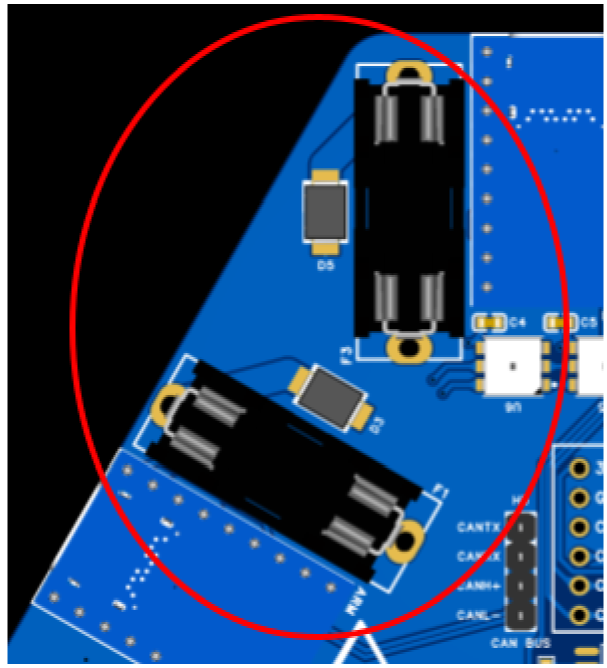


Figure 16: Fuses / TVS Diodes

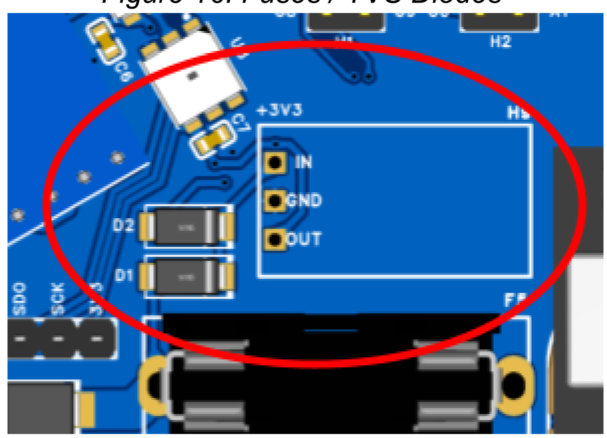


Figure 17: 3.3V Buck Converter / ORing Circuit

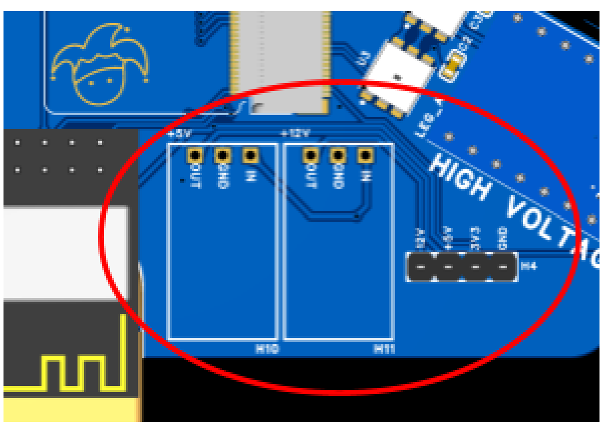


Figure 18: 5V / 12V Buck Converters and Power Debug Header

USB C Breakout

TXP pins are shorted together.

TXN pins are shorted together.

SUB pins are shorted together.

RXP pins are shorted together.

RXN pins are shorted together.

USB-C is broken out with the intention of using a USB 3.X C to C cable to make connections to different parts of the rover.

TX and RX pins are not connected for drive

VBUS	D+	D-	TXP	TXN
VBATT	CANH	CANL	I2C_SDA	I2C_SCL

GND	RXP	RXN	SUB DRIVE	SUB ARM
GND	I2C_SDA1	I2C_SCL1	HOME_X	3V3

Table 1: USB C Breakout Connections

**** USB C CABLE CROSSES TX > RX and RX > TX (KEEP IN MIND FOR UPSTREAM CONNECTIONS) ****

**** USE ONLY 240W USB 3.X C TO C CABLES FOR CONNECTIONS OTHERWISE RISK OF BURNING CABLE ****

USB C 3.X Breakout Board seen below in figure 19.

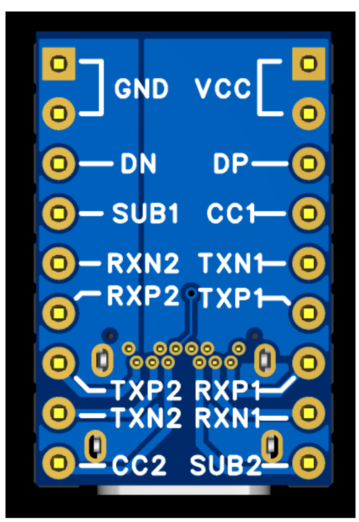


Figure 19: USB-C Breakout

Designed Ratings

Parameter	Rating
USB C Breakout Current	5A
Buck Converter Current	1A

Table 2: Designed Ratings

Physical Dimensions / Mechanical Mounting Points

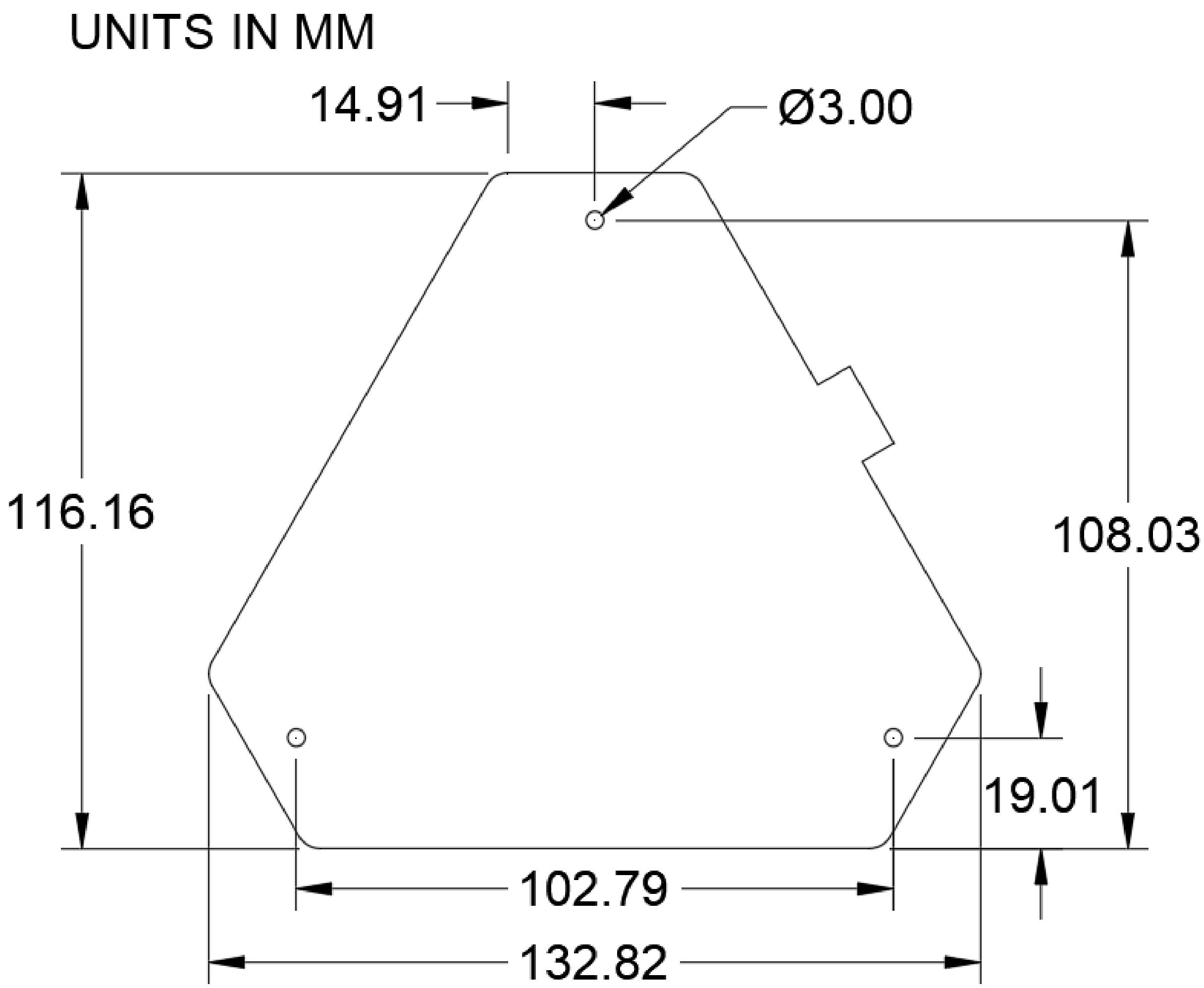


Figure 20: Max Length / Width

For more accurate model see included .STEP file

Known Issues / Findings

Work in progress