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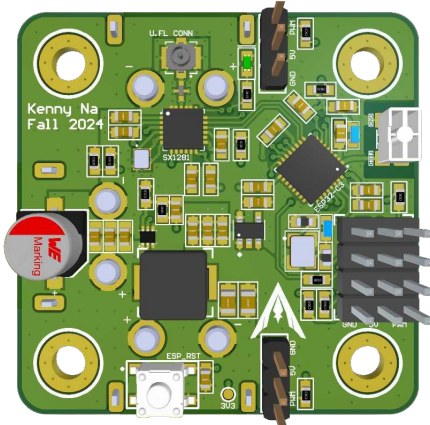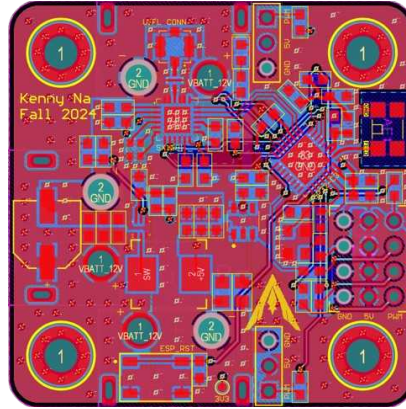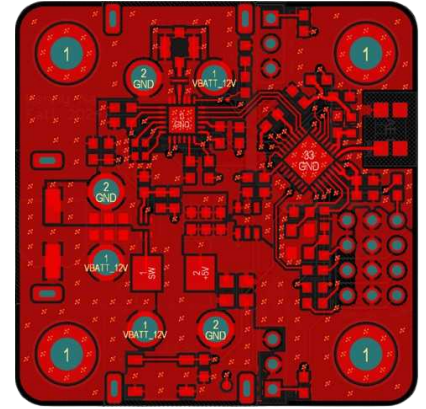Systems Design Engineering Student at the University of Waterloo
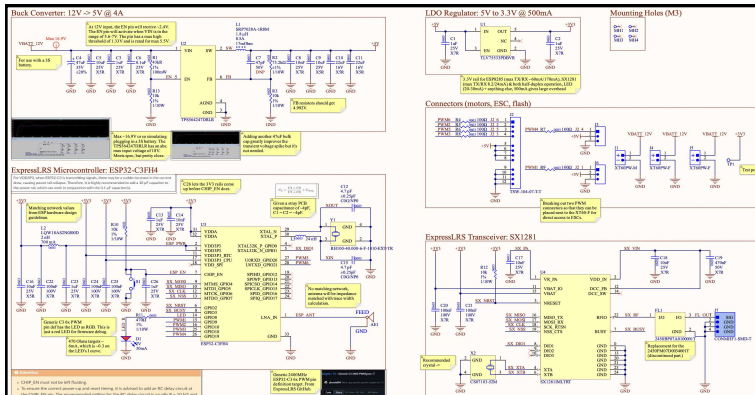
12-5V @ 4A Buck Converter with ExpressLRS Module

Top 3D View

2D View (L1/L3/L4)

Top Layer (SIG/PWR)

Description

- Integrates a 12V to 5V at 4A buck converter with a 5V to 3.3V LDO, ESP32-C3, and SX1281 RF transceiver, supporting two 12V propellers and six 5V PWM servo outputs on a COTS board size of 30.5x30.5mm.
- Features a pi-network matching circuit and impedance-matched routing for the ESP32-C3's power and antenna nets.
- Addresses possible transient voltage spikes from the source impedance of a 3S battery and XT60 connector, as well as resonant frequencies in high-Q capacitors (MLCCs), using LTspice simulations.
- Built to be deployed for a fleet of foam fixed-wing UAVs for flight training at the Waterloo Aerial Robotics Group.
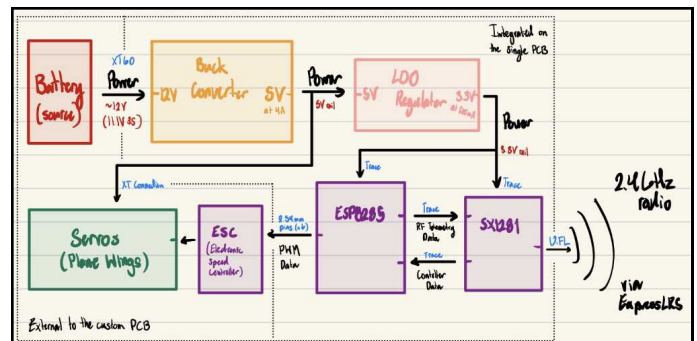

Schematic

Details

- Splits power to two XT60s, capable of up to 30A per motor (transient max)
- Matches existing ExpressLRS target for straightforward firmware flashing
- Originally implemented with an ESP8285, redesigned with ESP32-C3 for stronger PWM signalling, 6+ available GPIO pins for PWM, and better ExpressLRS compatibility

Relevant Skills

- Schematic and layout with Altium Designer
- PDN analysis with Power Analyzer by Keysight
- Frequency domain and time domain-based input filter simulation with LTspice, SimSurfing by Murata
- Impedance-controlled layout/routing for RF signals

System Diagram