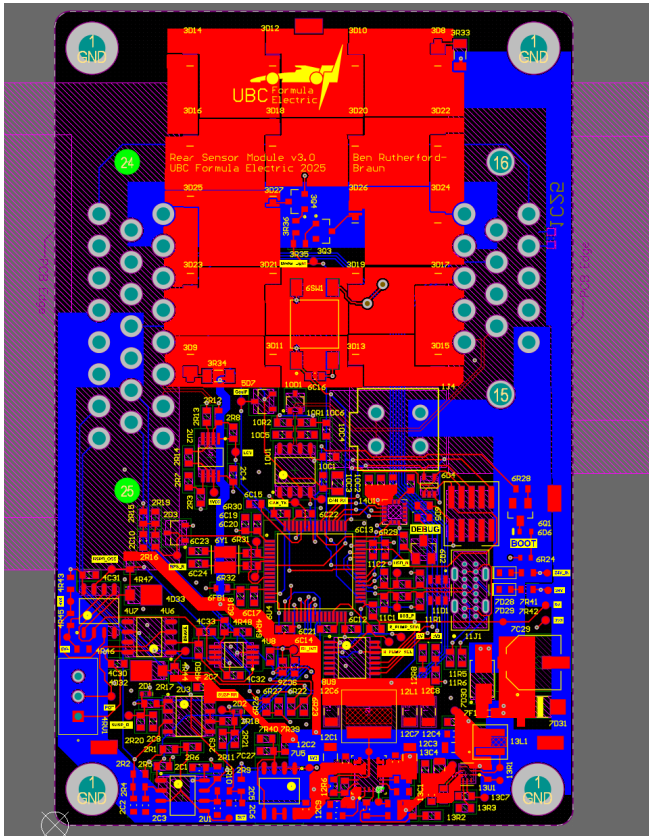
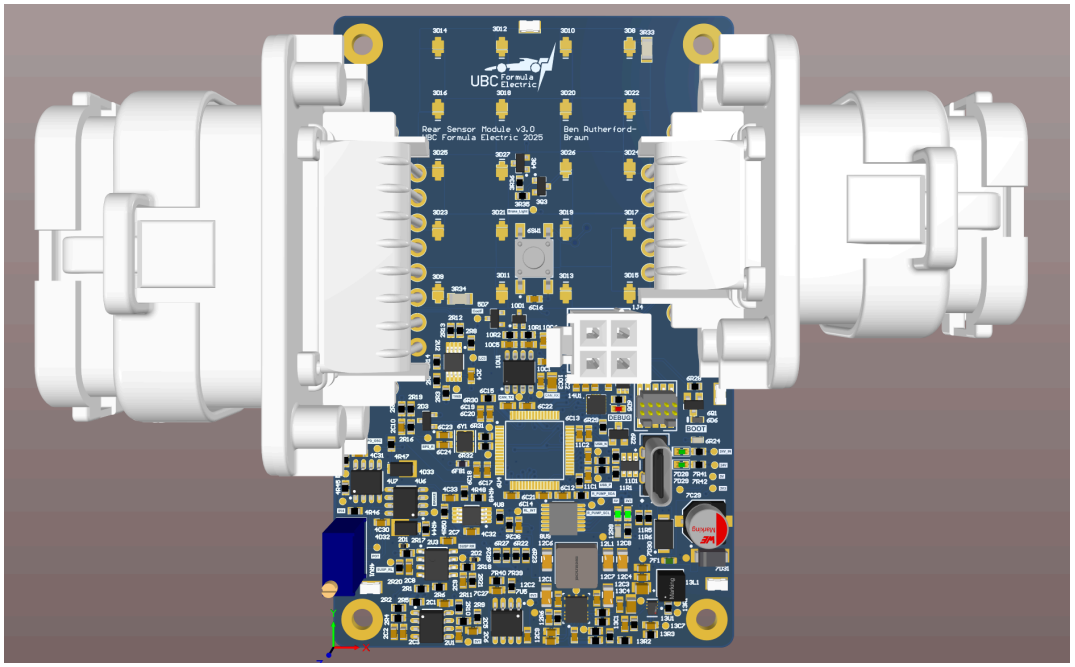
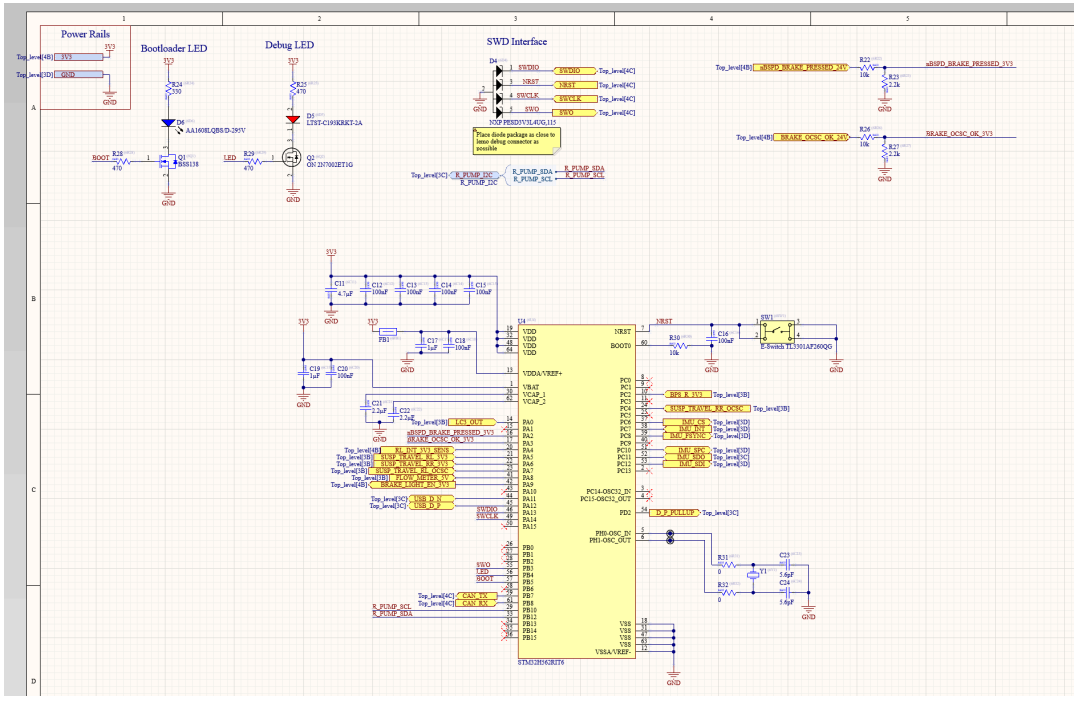
Rear Sensor Module PCB

As part of my role on UBC Formula Electric I designed the Rear Sensor Module PCB for this year's car in Altium, which controls and manages the pump, suspension, and brake sensors on the car. Through this I learned:

- **Circuit theory** involving the uses of Buck Converters, Buffers, Comparators, and transistors
- **Altium PCB Design**, in particular how to manage both high current power lines along with sensitive differential pairings (USB, CAN)
- **Electrical schematic design**, including mixed-signal organization, component selection, and power/signal integrity considerations.
- **Different Communication protocols** (I2C, SPI, CAN) and how they interact with the car's sensors and the board's MCU



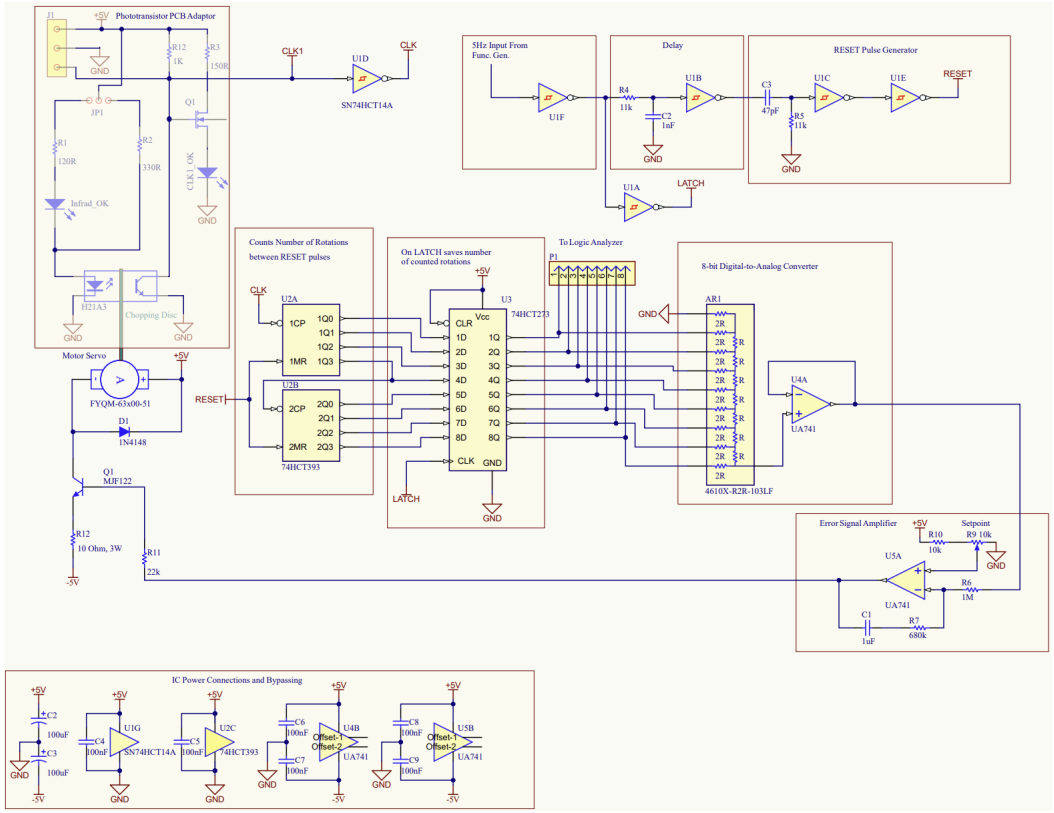


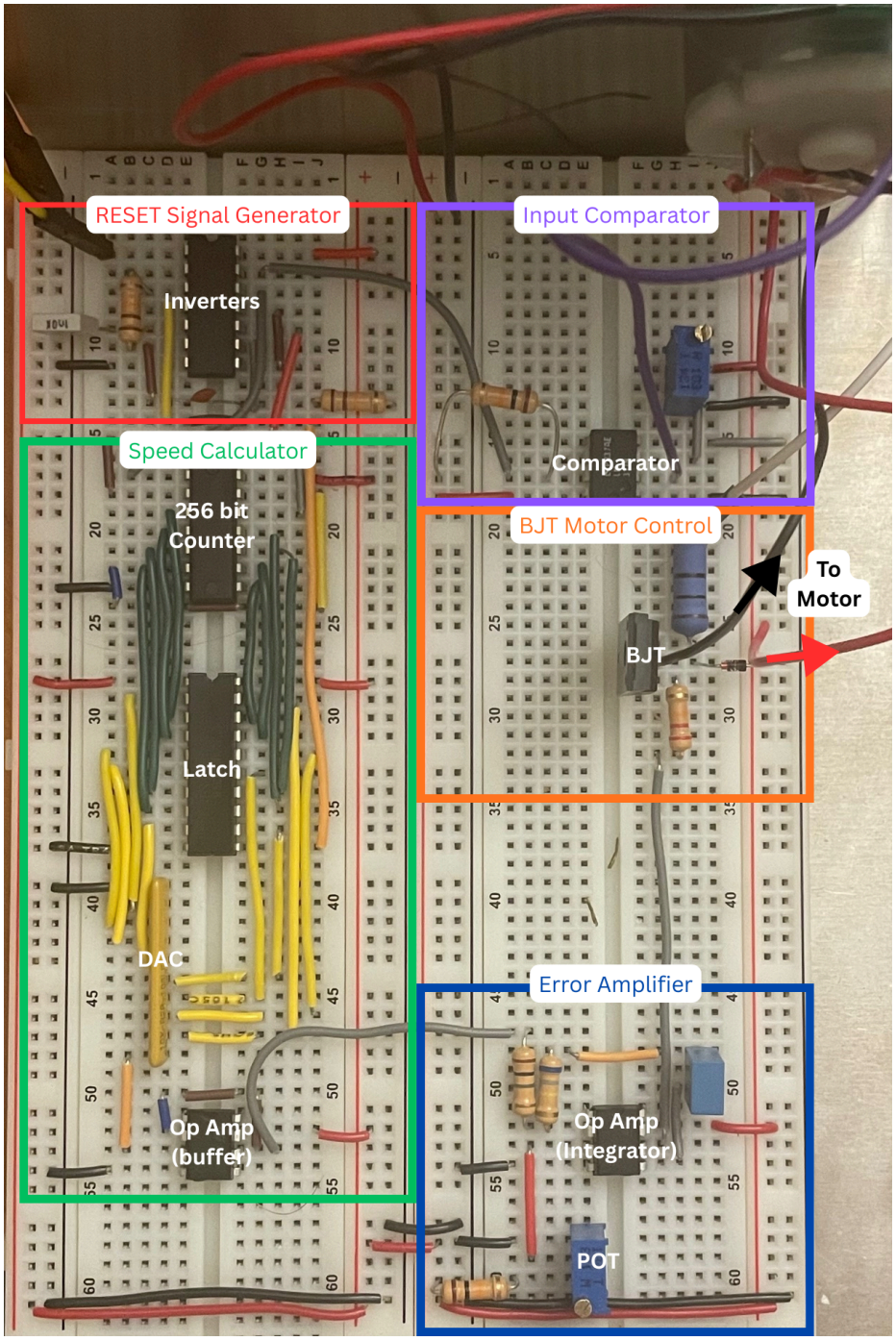


Motor RPM Control Circuit

I built a closed-loop motor control system that senses motor RPM using a phototransistor–LED pair, converts the signal into an analog voltage, and uses the error signal amplifier to regulate the current flow to the motor until it matches the voltage of the potentiometer. Through this project I learned:

- **Analog circuit design**, including differential amplifiers, error signal amplifiers, comparators, and transistor-based motor drivers.
- **Signal conditioning techniques** involving a comparator and Schmidt trigger inverter to convert the sinusoidal sensor input into a square wave response.
- **Practical electronics skills**, such as breadboarding, troubleshooting with an oscilloscope, and using digital buses for counting





Dashboard Enclosure

For Formula Electric, one of my roles was to design the dashboard Enclosure for the 2025 car in SolidWorks. The dashboard houses the electronic driver interface and requires a fully waterproof enclosure while accommodating numerous openings for buttons, switches, and LEDs. Through this I learned:

- **Solidworks mechanical design** that involves working within larger assemblies and integrates electronics into mechanical CAD
- **Precision manufacturing techniques**, including water-jetting aluminum plates, laser-cutting gasket materials, and 3D-printing custom components.
- **Waterproofing design** techniques involving custom rubber gaskets and plexiglass sheets to seal the button, switch, and LED openings
- **Cross-disciplinary integration,** balancing competing requirements from electrical, software, and mechanical teams to optimize the des