

Rover Assembly Directions:

Each kit should contain the following

- 1 onion omega2
- 1 button
- 1 switch
- 2 battery holders
- 1 battery
- 2 motors
- 2 wheels
- 2 screws
- 2 nuts
- 2 standoffs
- 1 accelerometer
- 1 battery charger
- 1 boost converter
- 1 3.3V power supply
- 2 L9110H motor controllers
- 1 Re-triggerable one shot (74HC123)
- 4 LEDs
- 4 10K resistors
- 4 1K resistors
- 1 3K resistor
- 1 300K resistor
- 2 10uF capacitor
- 1 100nF capacitor
- 1 diode
- 1 voltage supervisor
- 1 PCB

The estimated time to build the rover is 3 hours. All components are through hole and can be soldered from the top or the bottom of the PCB. This document will provide step by step directions with pictures to make the process as fun and easy as possible.

Lets get started!

Helpful tip: soldering resistors

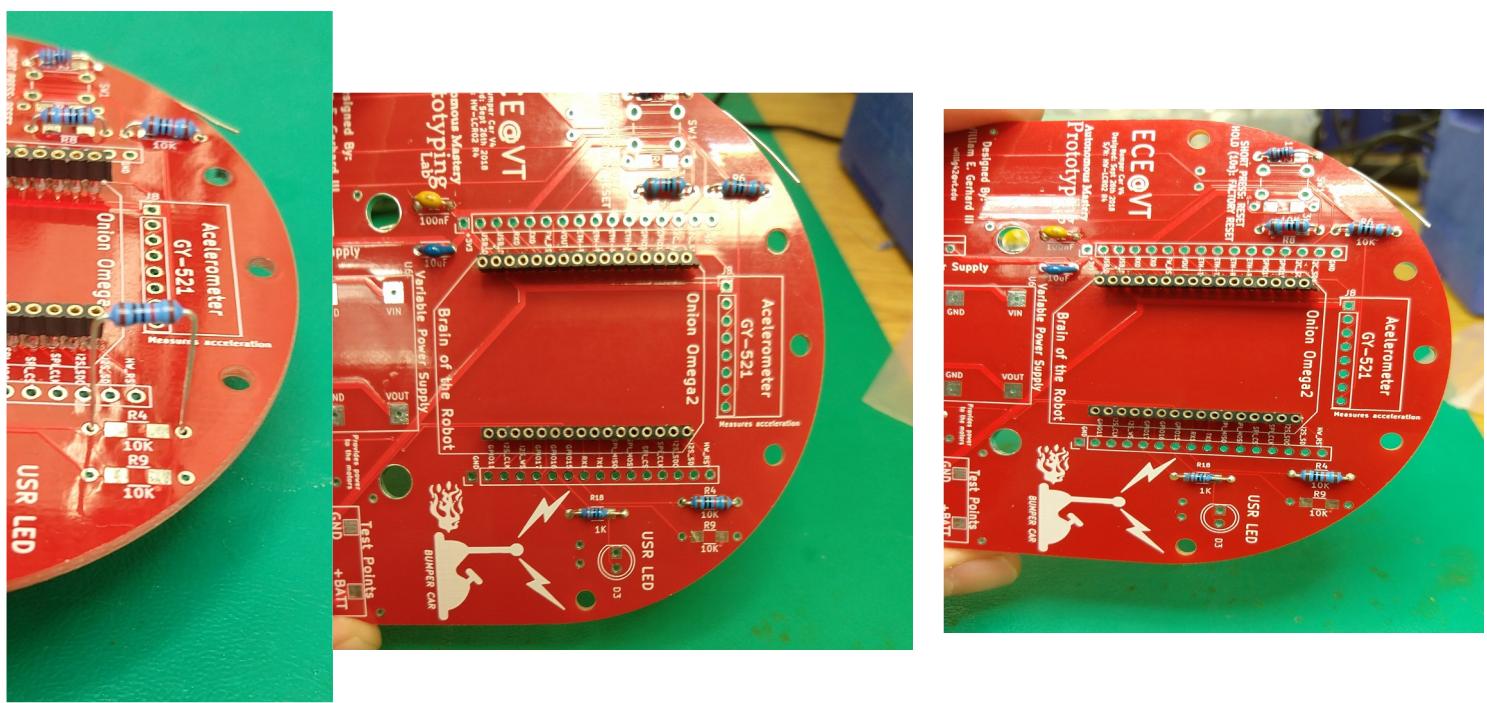
To solder the resistor shown below:



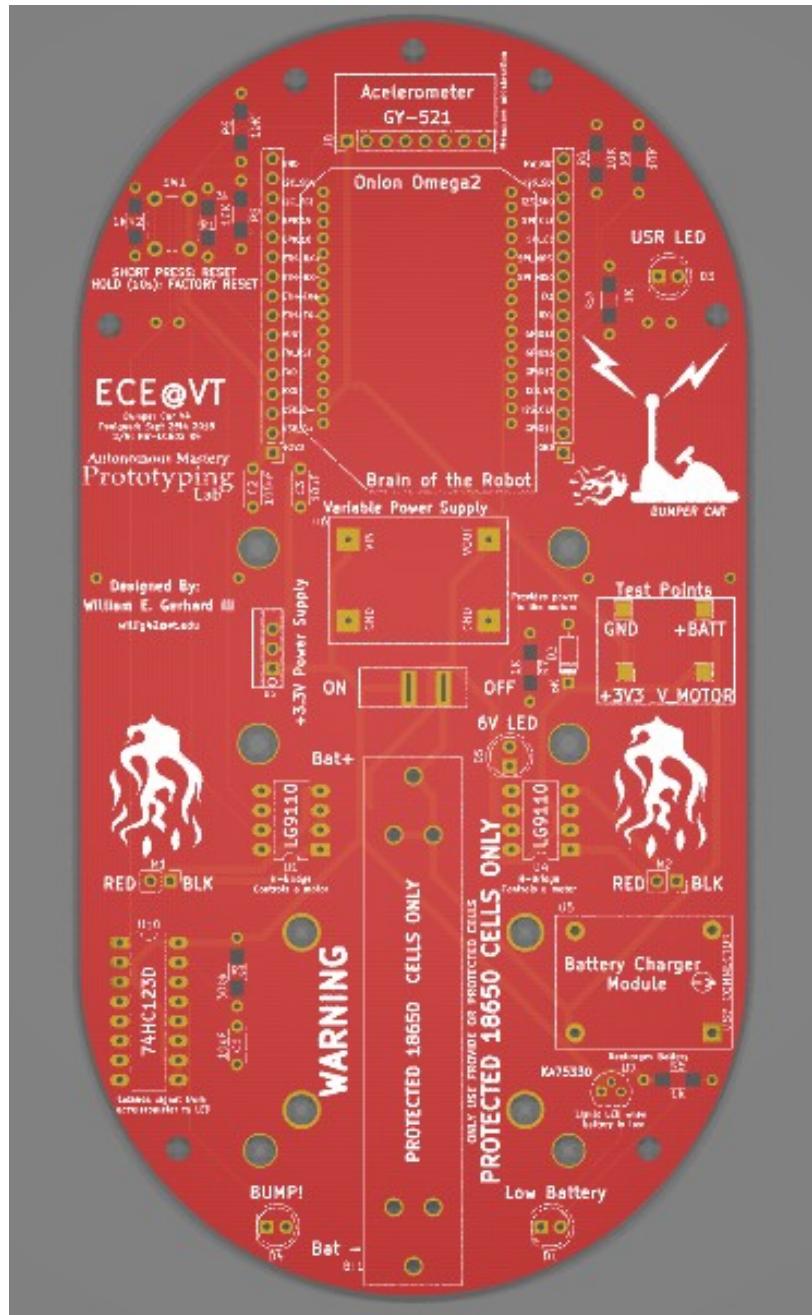
First bend the legs as close to the body as possible



Then insert into the holes on the PCB, push all the way down, and solder

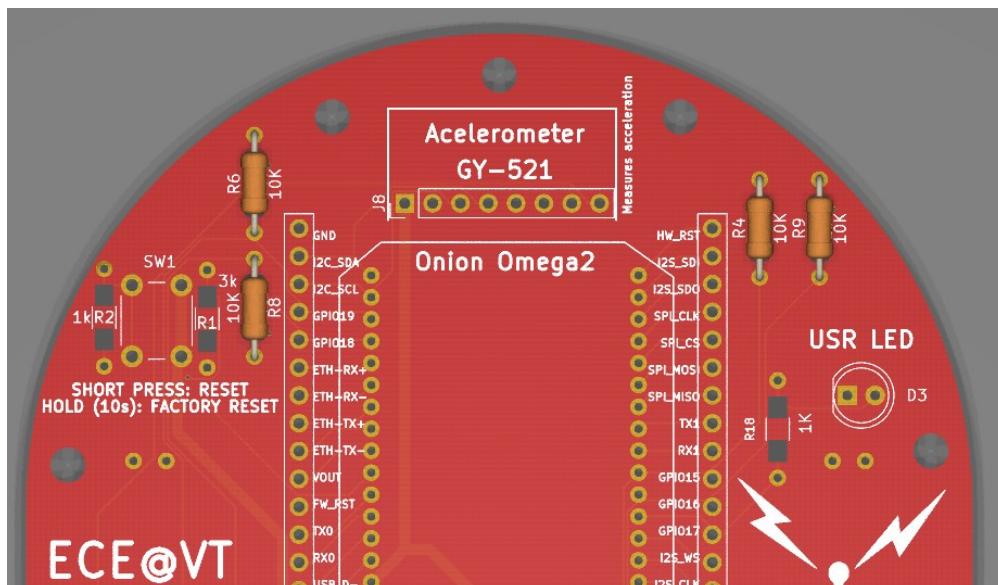
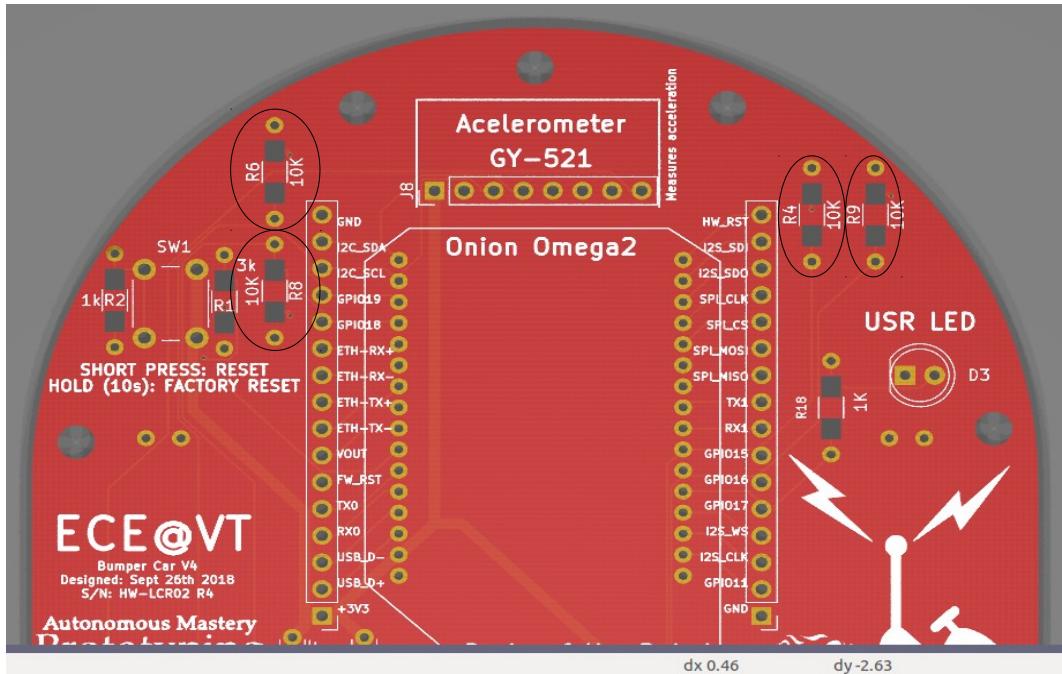


Step 1: Check you have all the parts in the kit. Make sure your PCB looks like the one below. Please note that all components are labeled on the board, so if you are unsure, check the PCB!



Step 2: Solder 10K resistors (**Direction does not matter**)

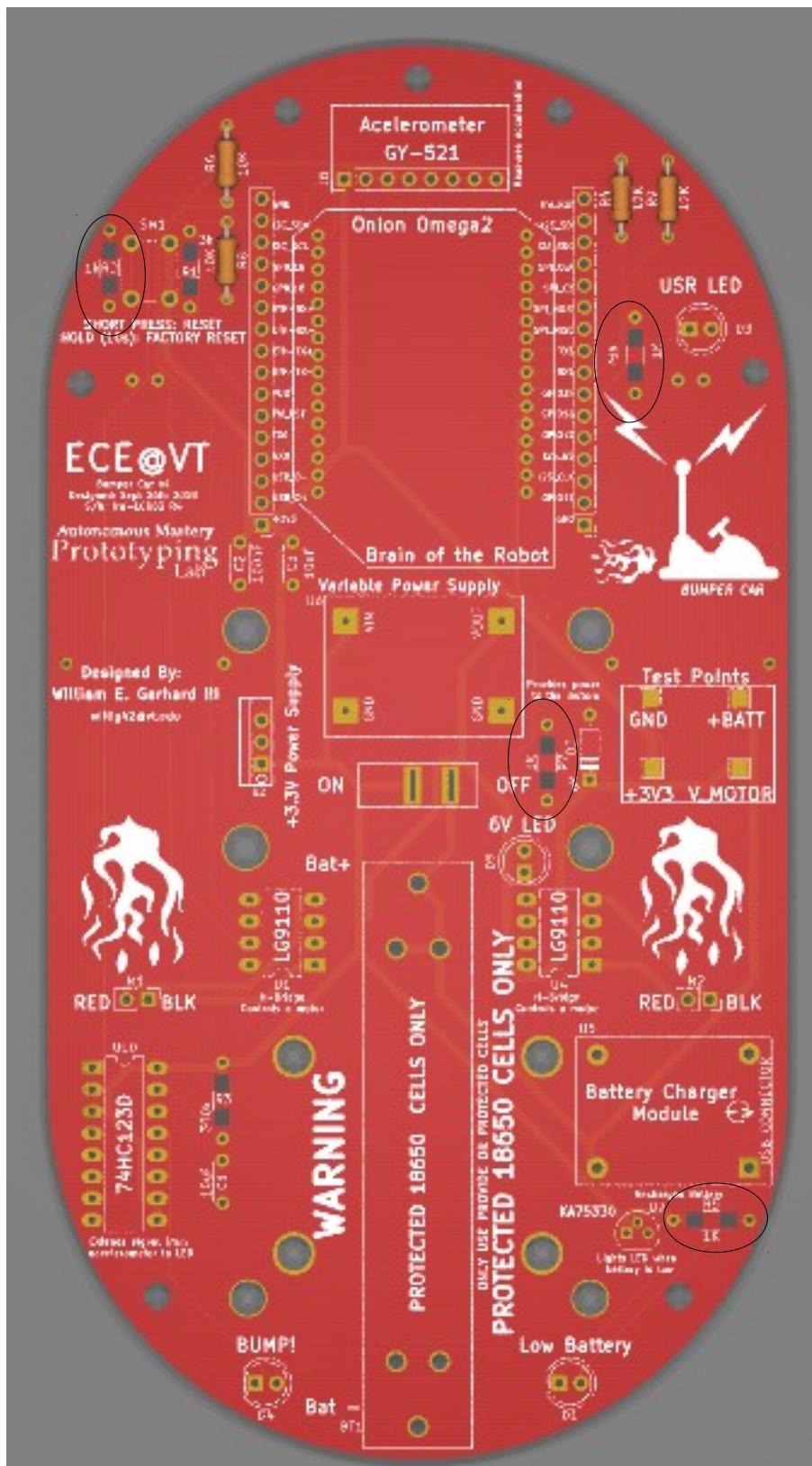
Solder the 4 10K resistors. They are located at the top of the PCB and are circled below. The purpose of these resistors is to keep the motors from moving until the robot's brain (the onion omega2) tells it to.



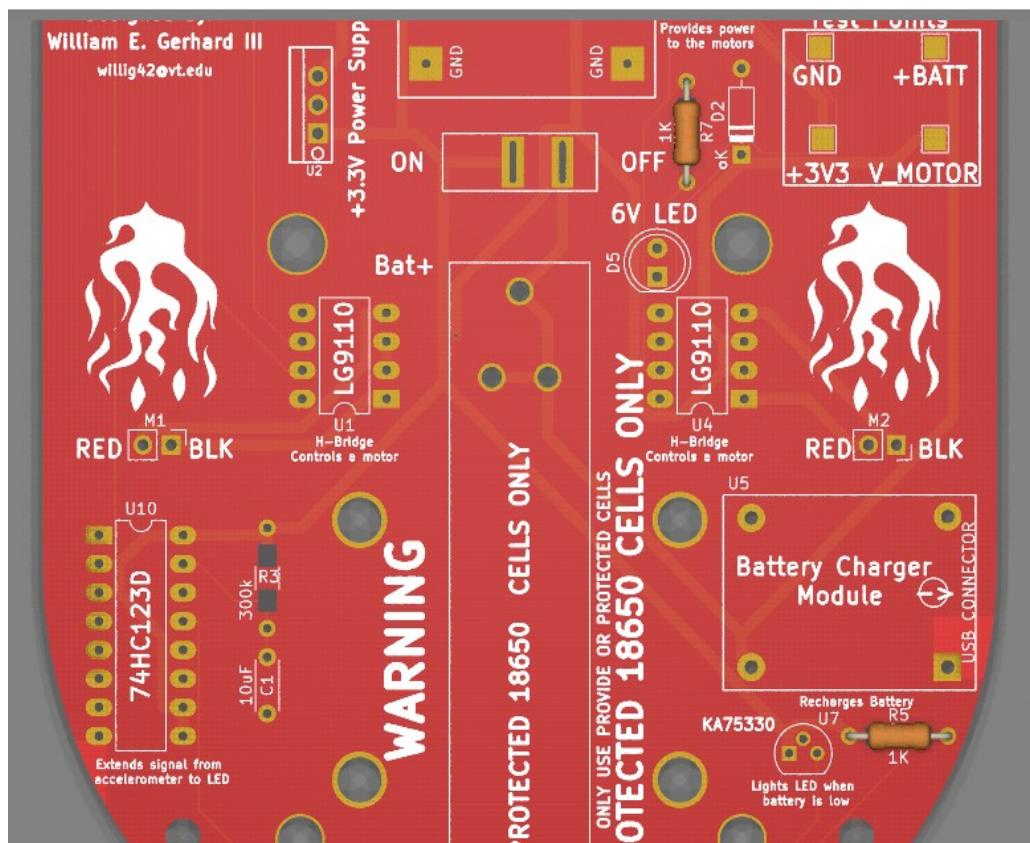
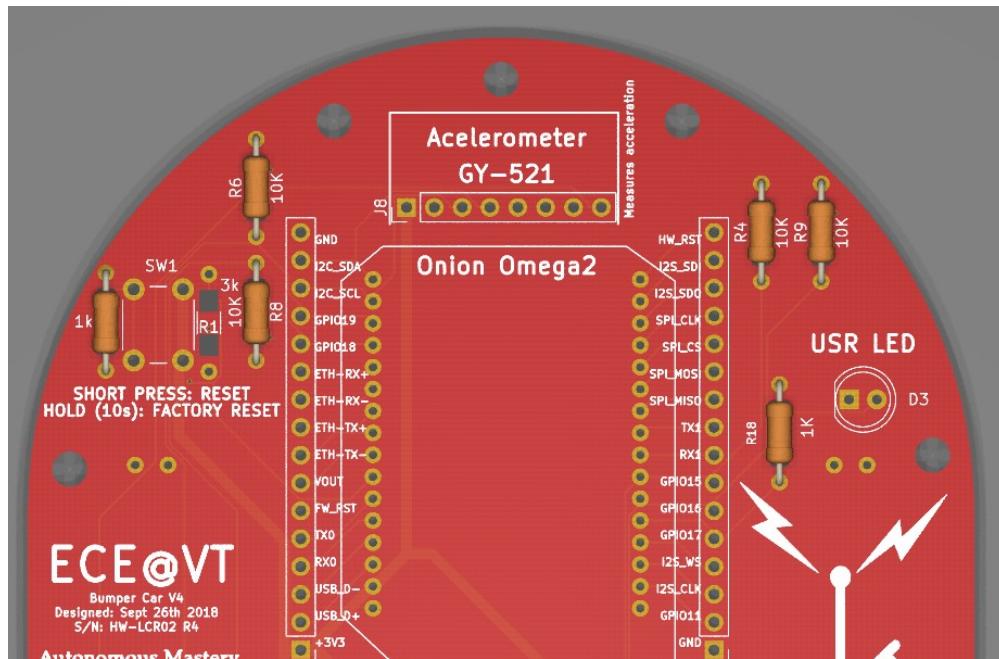
The resistors can be soldered from the top or bottom of the board, but the top is easier.

Step 3: Solder the 1K resistors (**Direction does not matter**)

There are 4 1K resistors on the board. Two are located at the top of the PCB, and two are located at the bottom. They are circled in the pictures below. The purpose of these resistors is to either limit current going to the LEDs or to form a voltage divider with the 3K resistor located near the reset button.

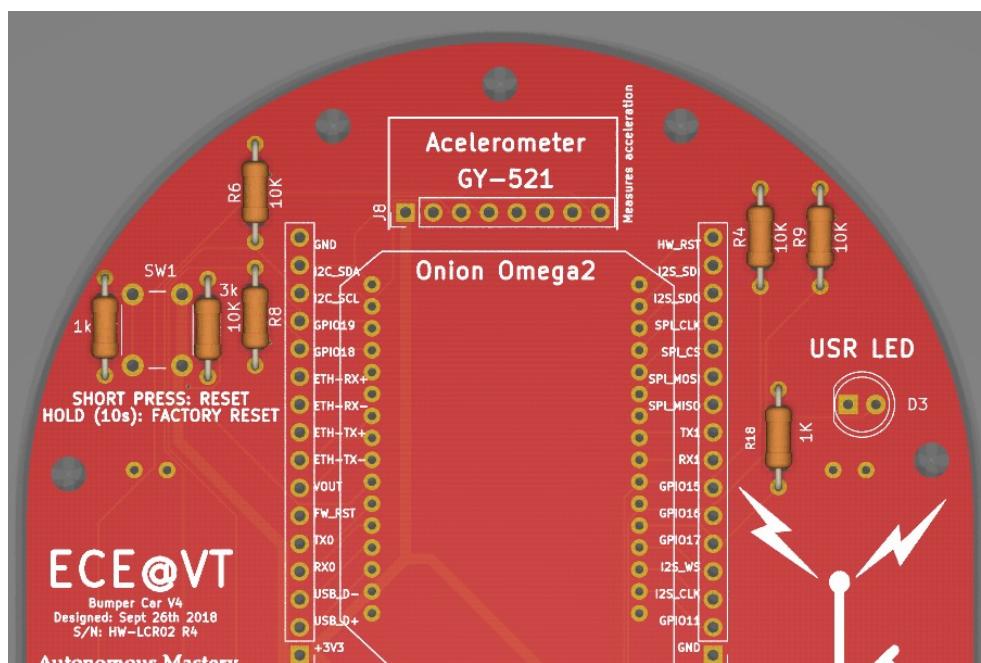
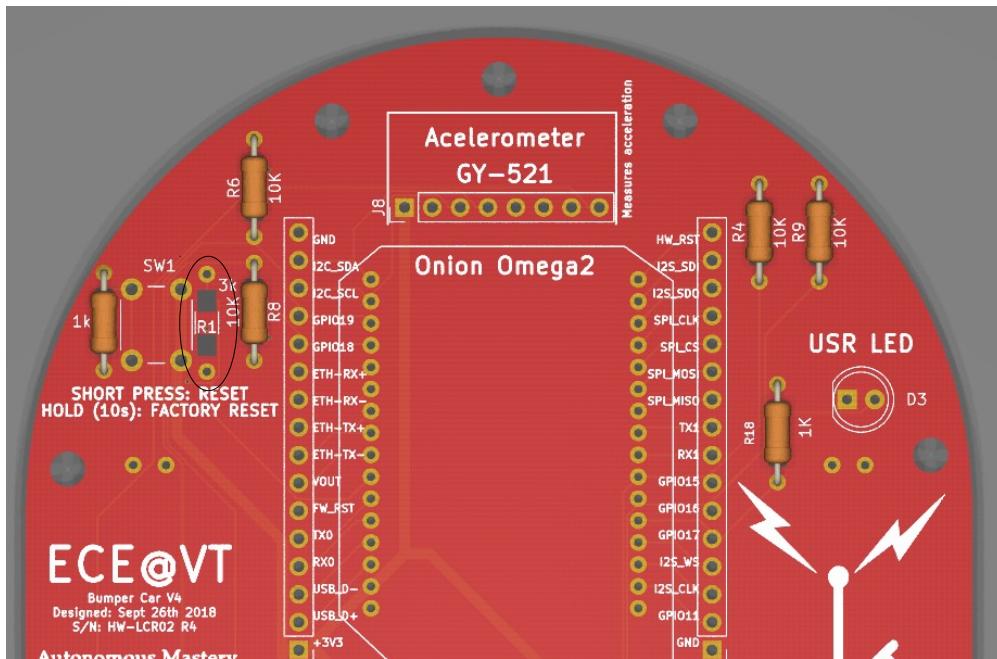


And here they are assembled (The photos are cropped to make the areas of interest bigger)



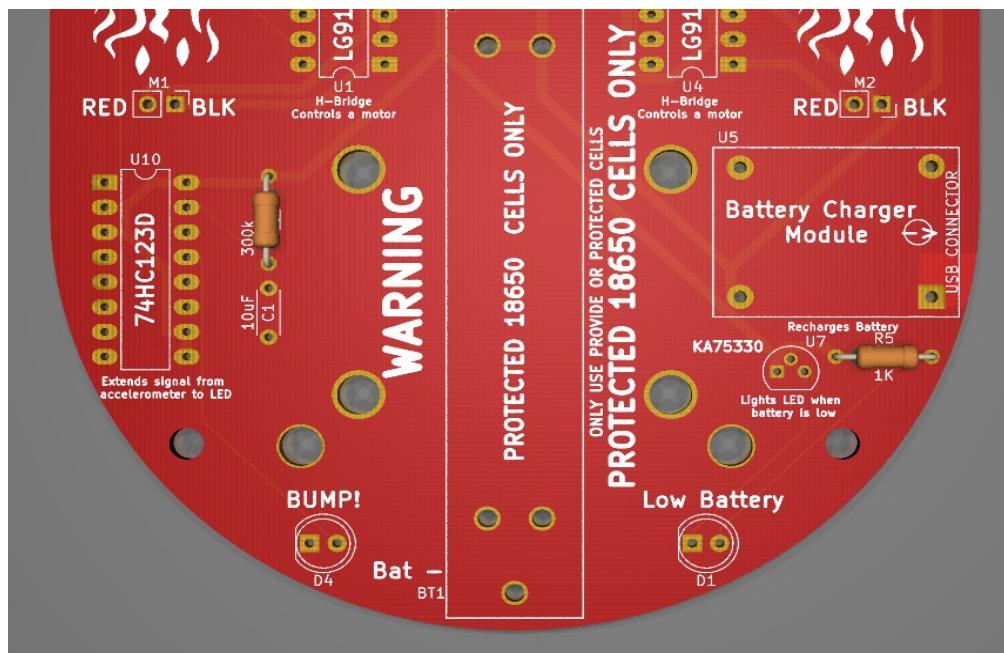
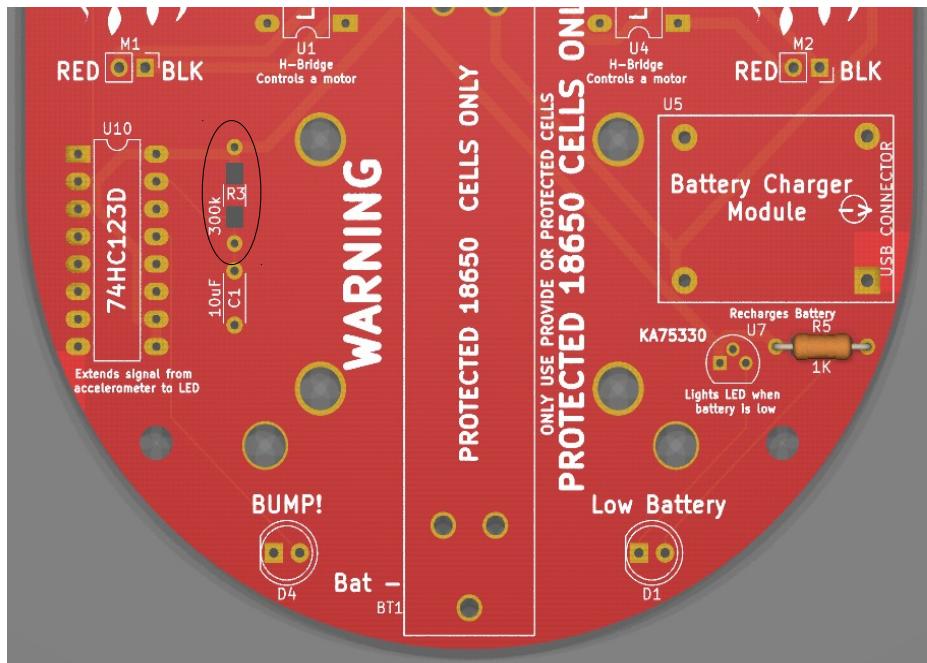
Step 4: Solder the 3K resistors (**Direction does not matter**)

The single 3K resistor is located on the front of the rover by the reset button. Its purpose is to form a voltage divider with the 1K resistor near it.



Step 5: Solder the 300K resistor (**Direction does not matter**)

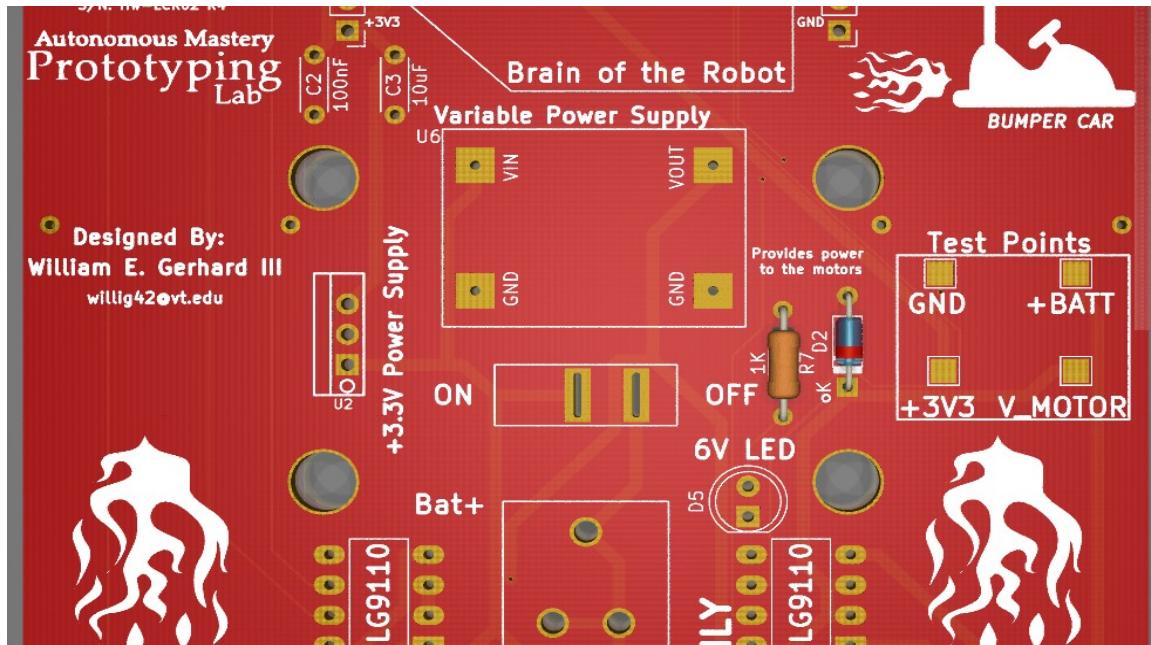
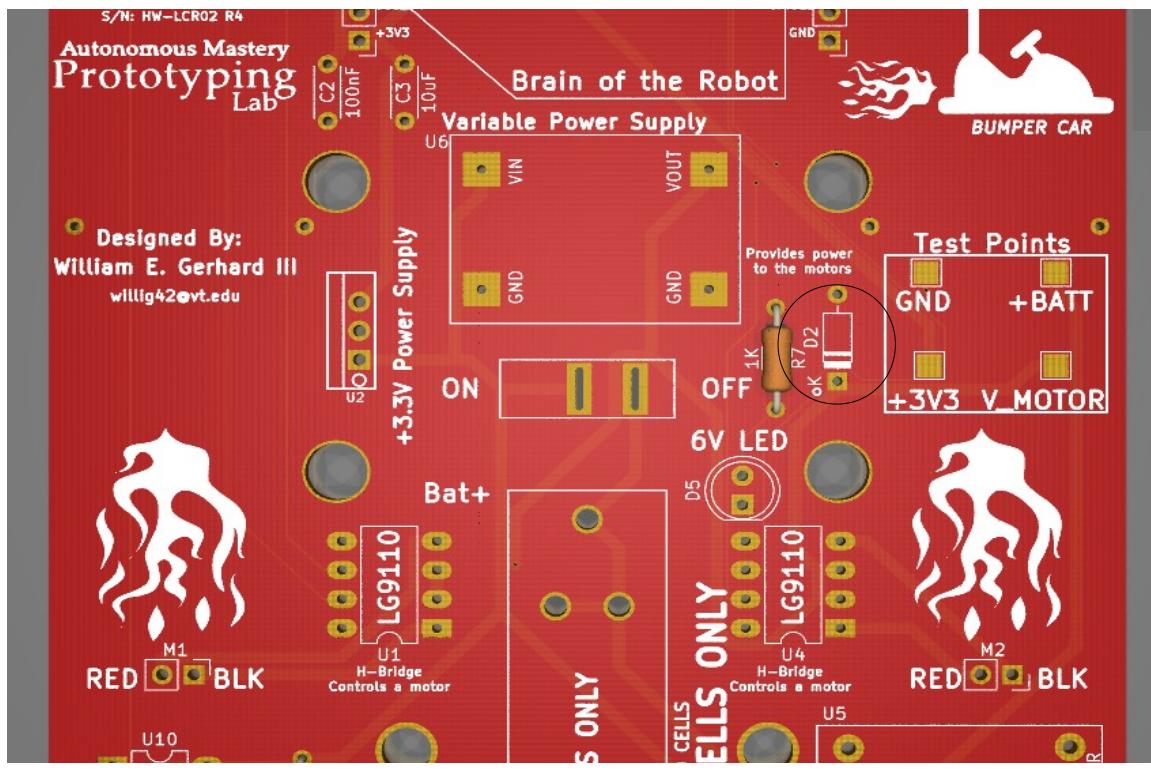
This resistor is located on the rear of the rover, and its purpose is to set how long the BUMP! LED will blink.



Step 6: Solder Diode (**Direction DOES matter**)

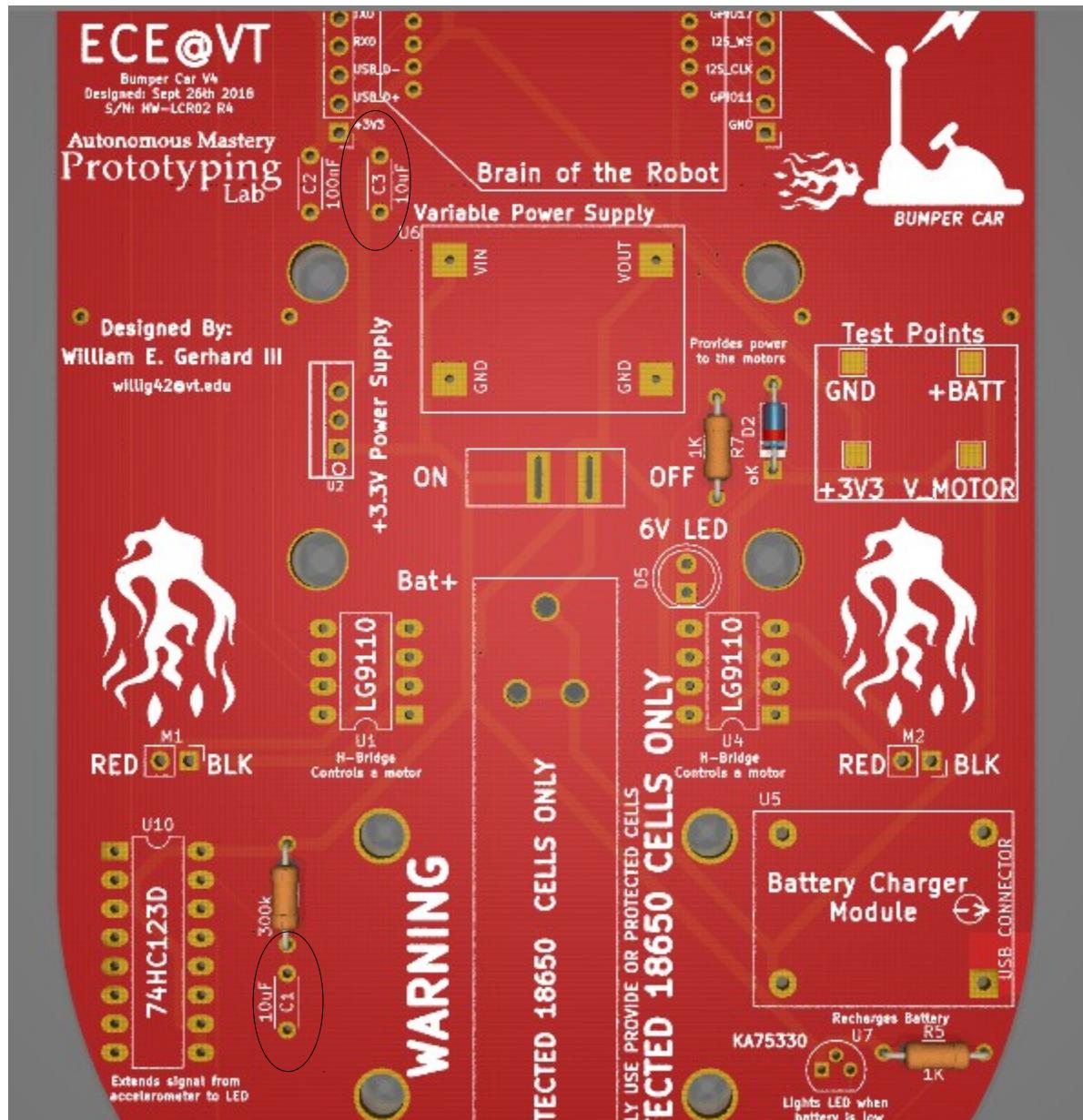
CAUTION: The must be Soldered correctly, or the ROVER WILL NOT WORK. The band on the diode and the band on the PCB must match! This is called polarity.

The diode is located on the middle of the rover and is used to make the 6V LED light up when the motor voltage is around 6V.



Step 7: Solder 10uF capacitors (**Direction does not matter**)

Solder the 2 10uF capacitors, located at the top and bottom of the board. These capacitors act as a storage tank for electrons.

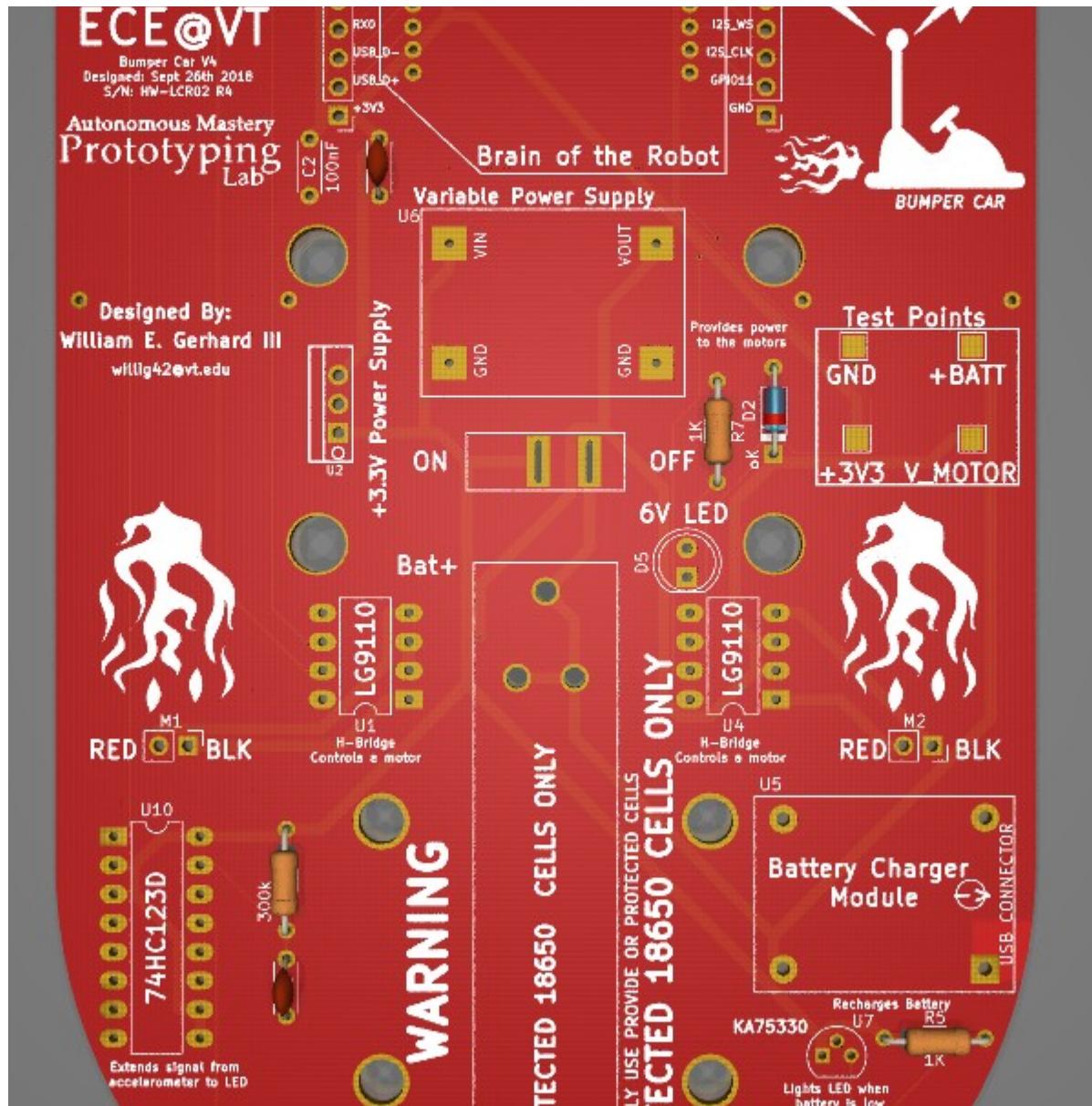


ECE@VT

Bumper Car V4
Designed: Sept 26th 2016
S/N: HW-LCR02 R4

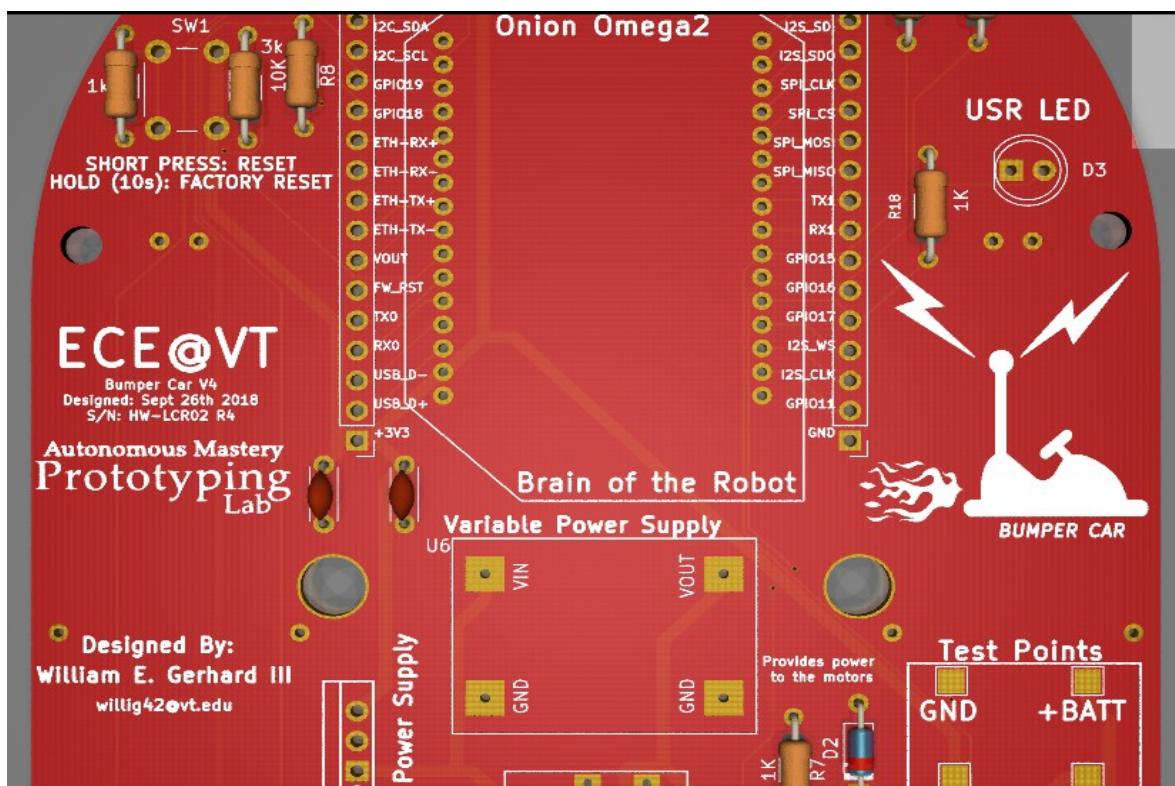
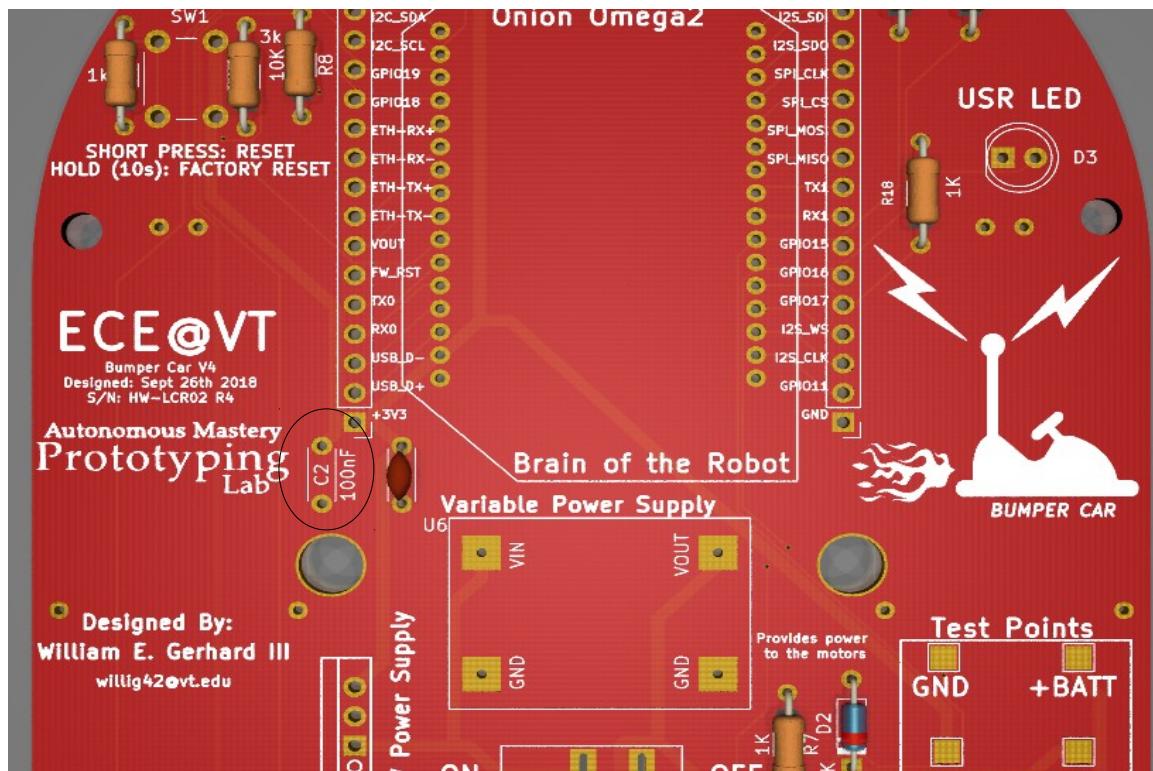
Autonomous Mastery
Prototyping Lab

Designed By:
William E. Gerhard III
willig42@vt.edu



Step 8: Solder 100nF capacitor (Direction does not matter)

Solder the 100nF or .1uF capacitor (The two values are equivalent), located at the top of the board.

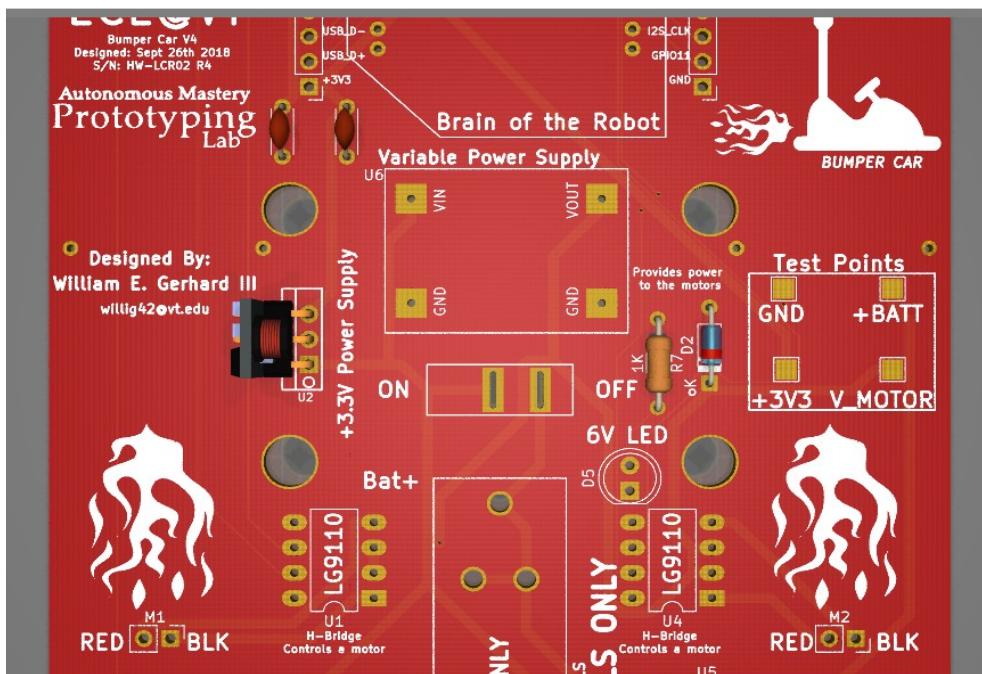
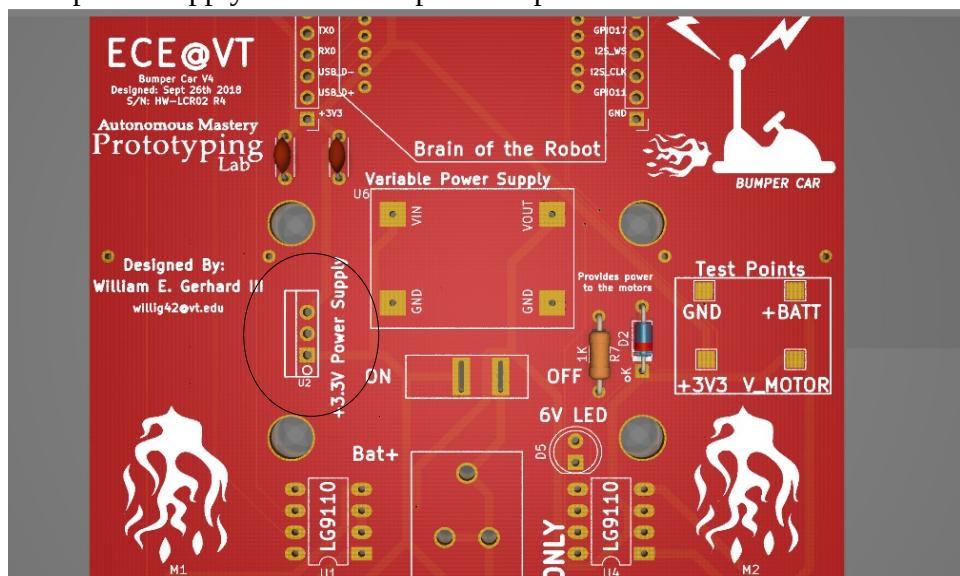


Step 9: Solder the 3.3V power supply (Direction DOES matter**)**

CAUTION: The must be Soldered correctly, or the ROVER WILL NOT WORK. Check the pictures below to ensure the power supply is placed properly. Also check that nothing is shorting between the leads. See photo below to see what a short looks like.

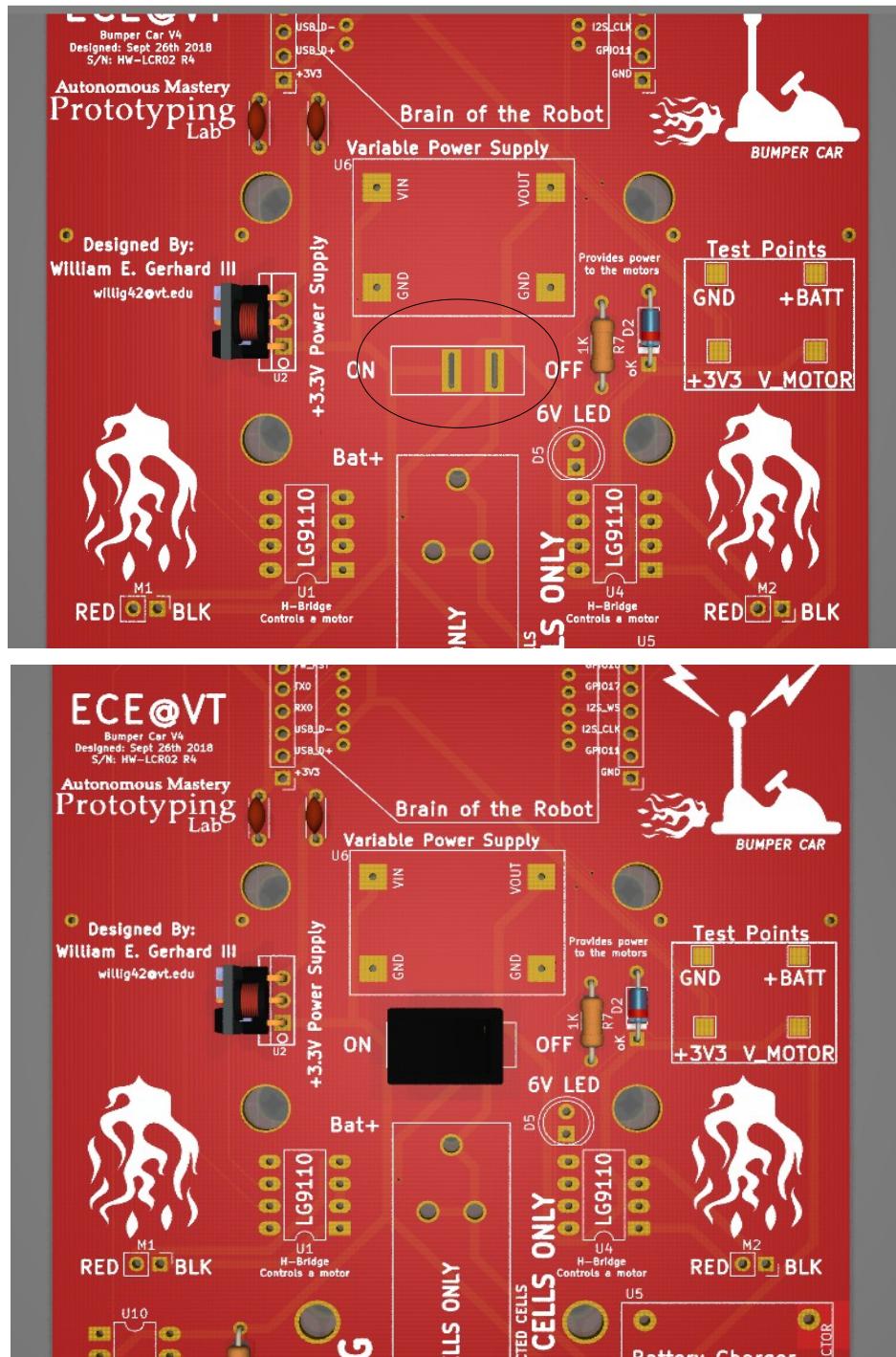


Solder the 3.3V power supply. This device provides power to the brain of the robot.



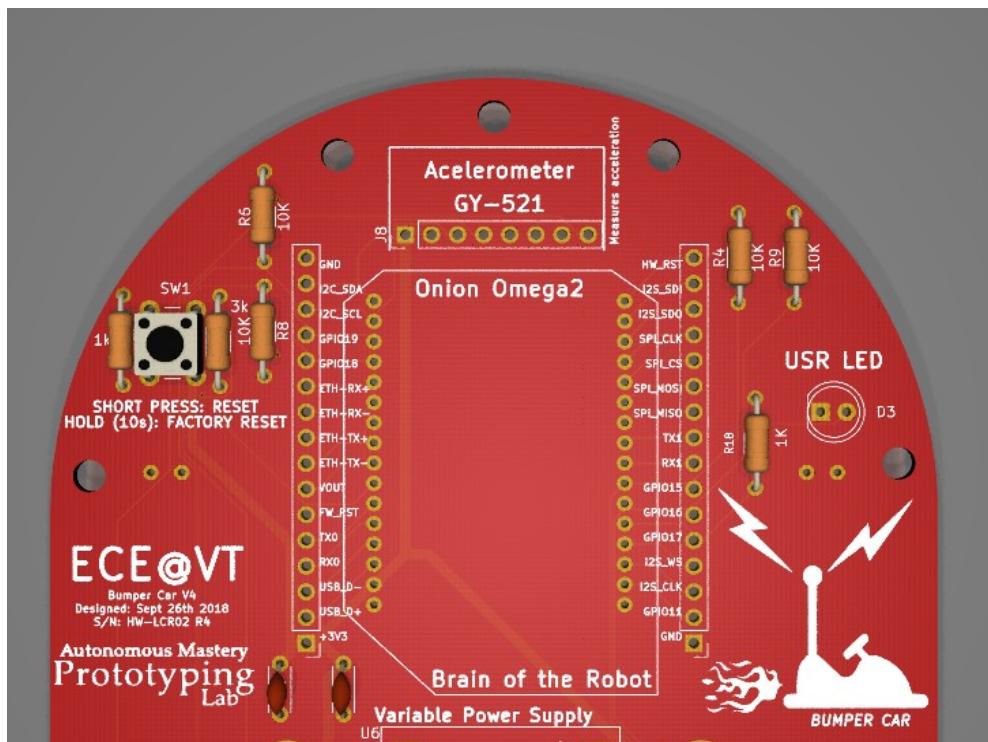
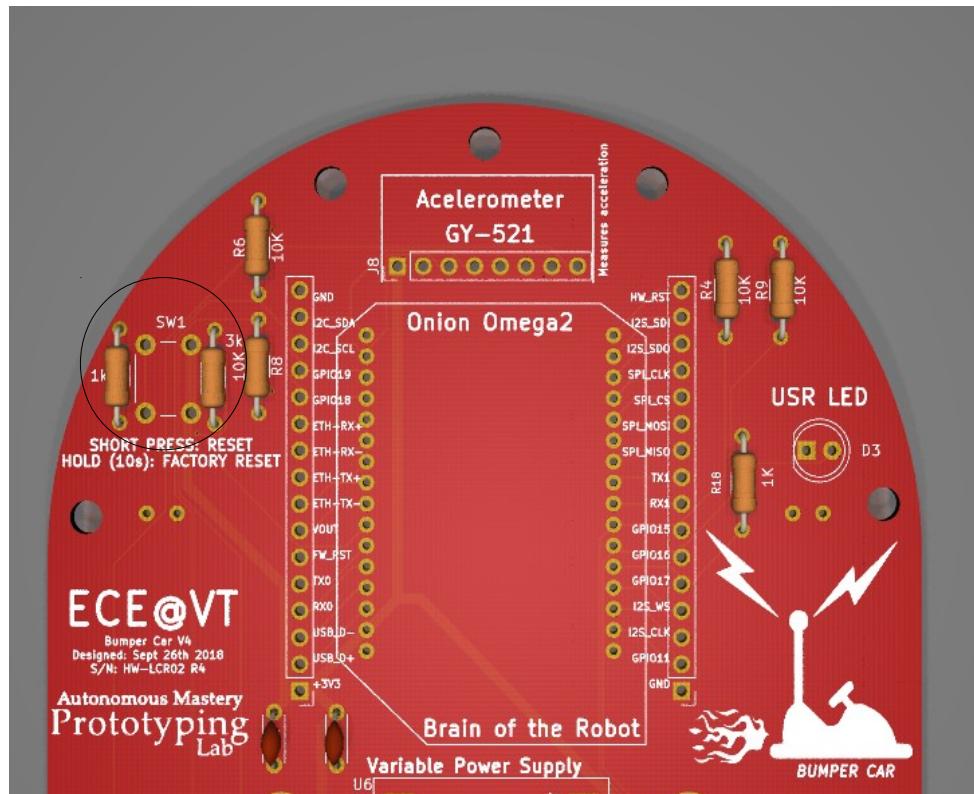
Step 10: Solder the On-Off Switch (**Direction DOES matter**)

Solder the On-Off switch in the middle of the board. It only fits in one way.



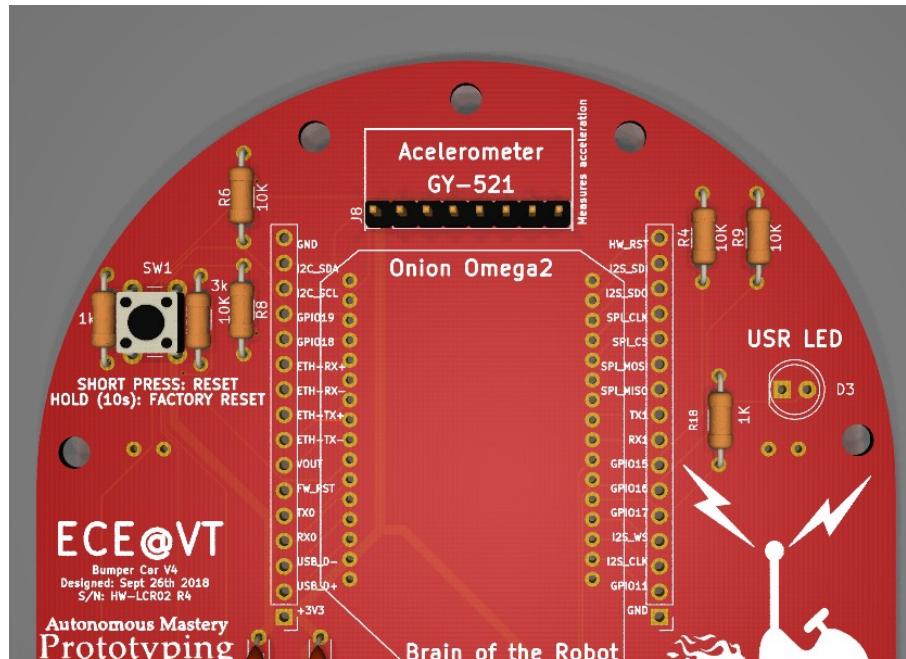
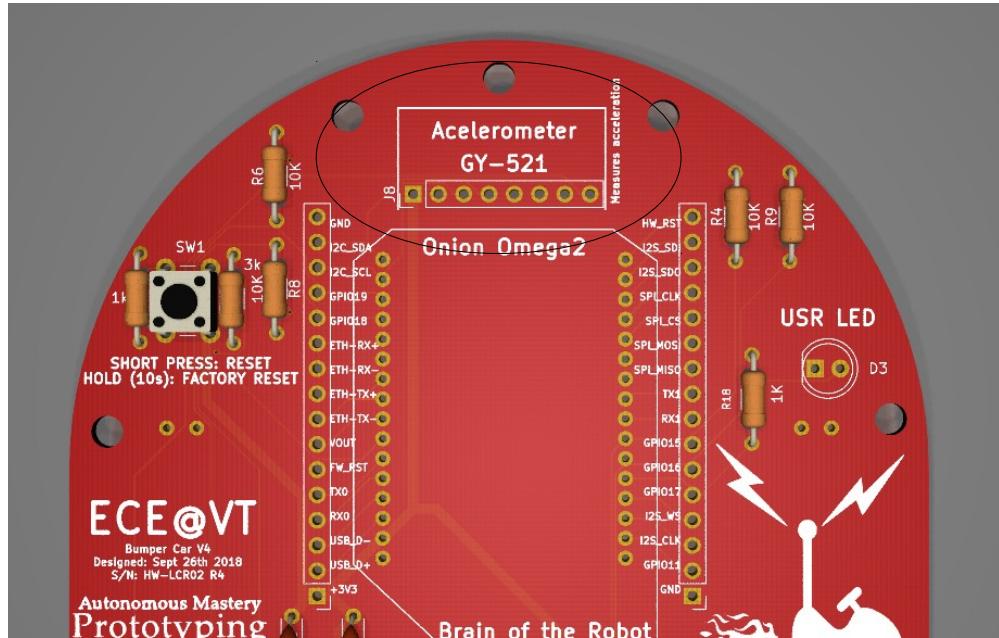
Step 11: Solder the reset button (**Direction DOES matter**)

Solder the reset button, it only fits in one way.



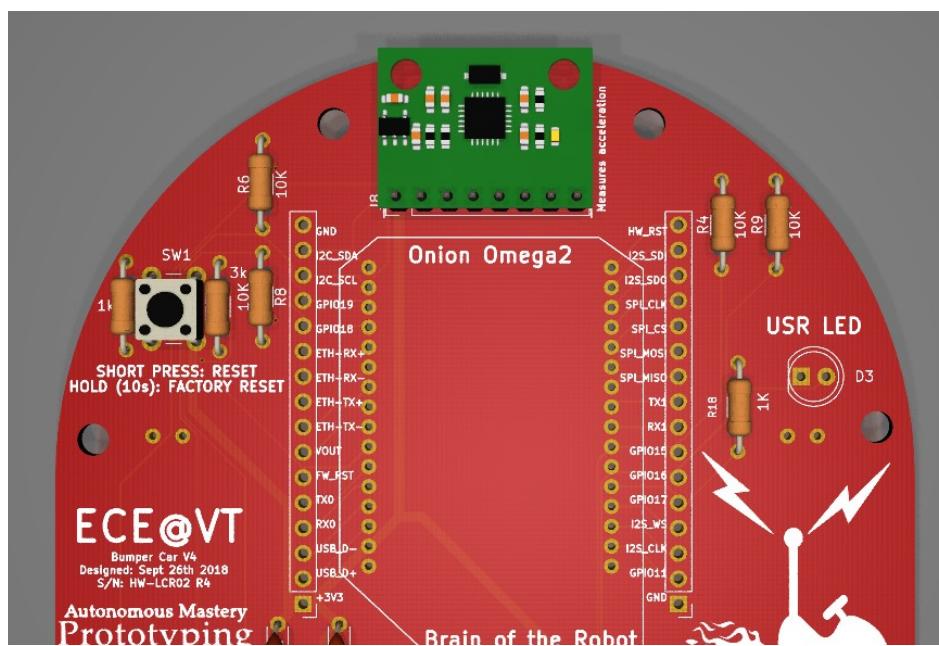
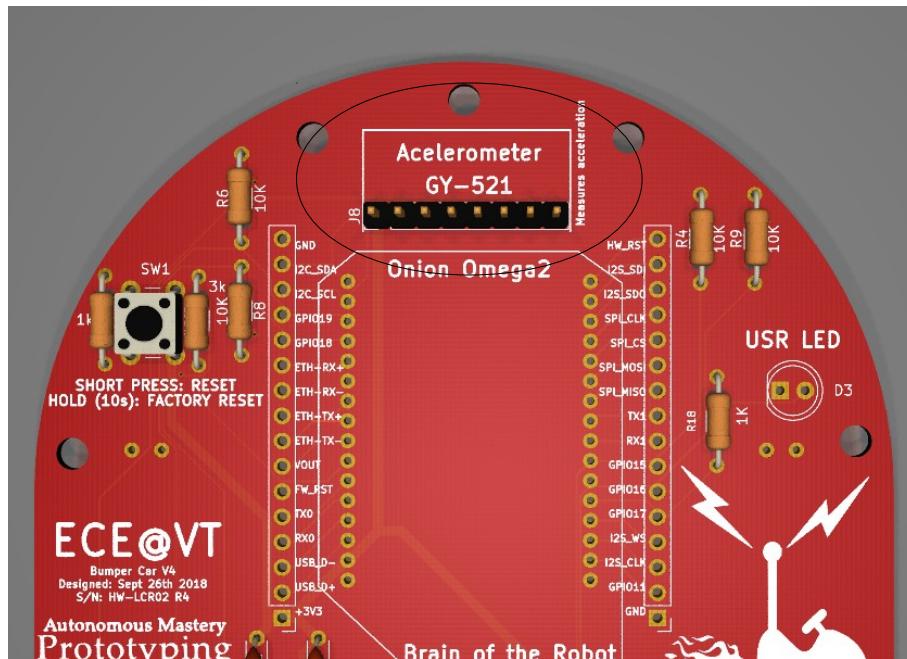
Step 12: Solder the header pins for the accelerometer (**Direction does not matter**)

Solder the header pin located in the front of the rover.



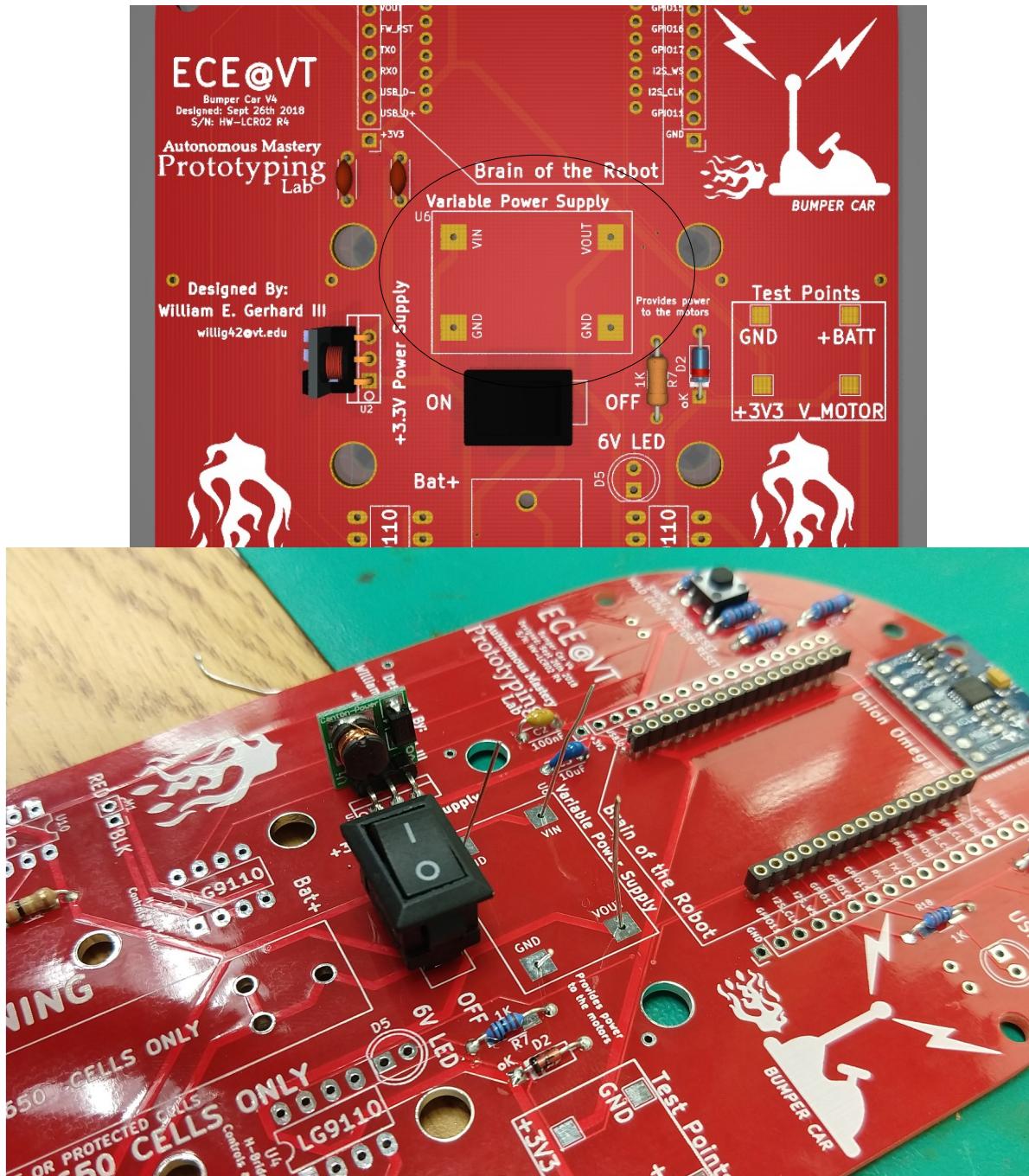
Step 13: Solder the accelerometer onto the header pins (**Direction DOES matter**)

Solder the accelerometer onto the pin located in the front of the rover.

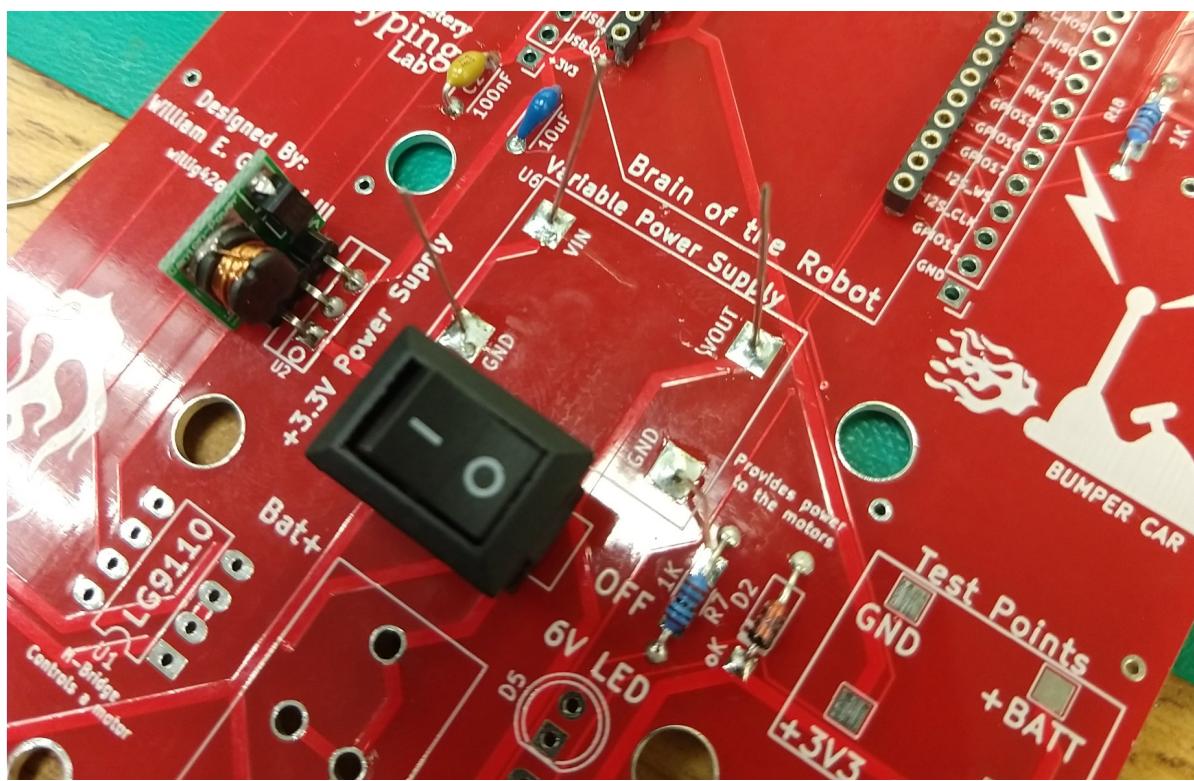


Step 13: Solder the Boost Power Supply (**Direction DOES matter**) (Issue with photo and how to do)

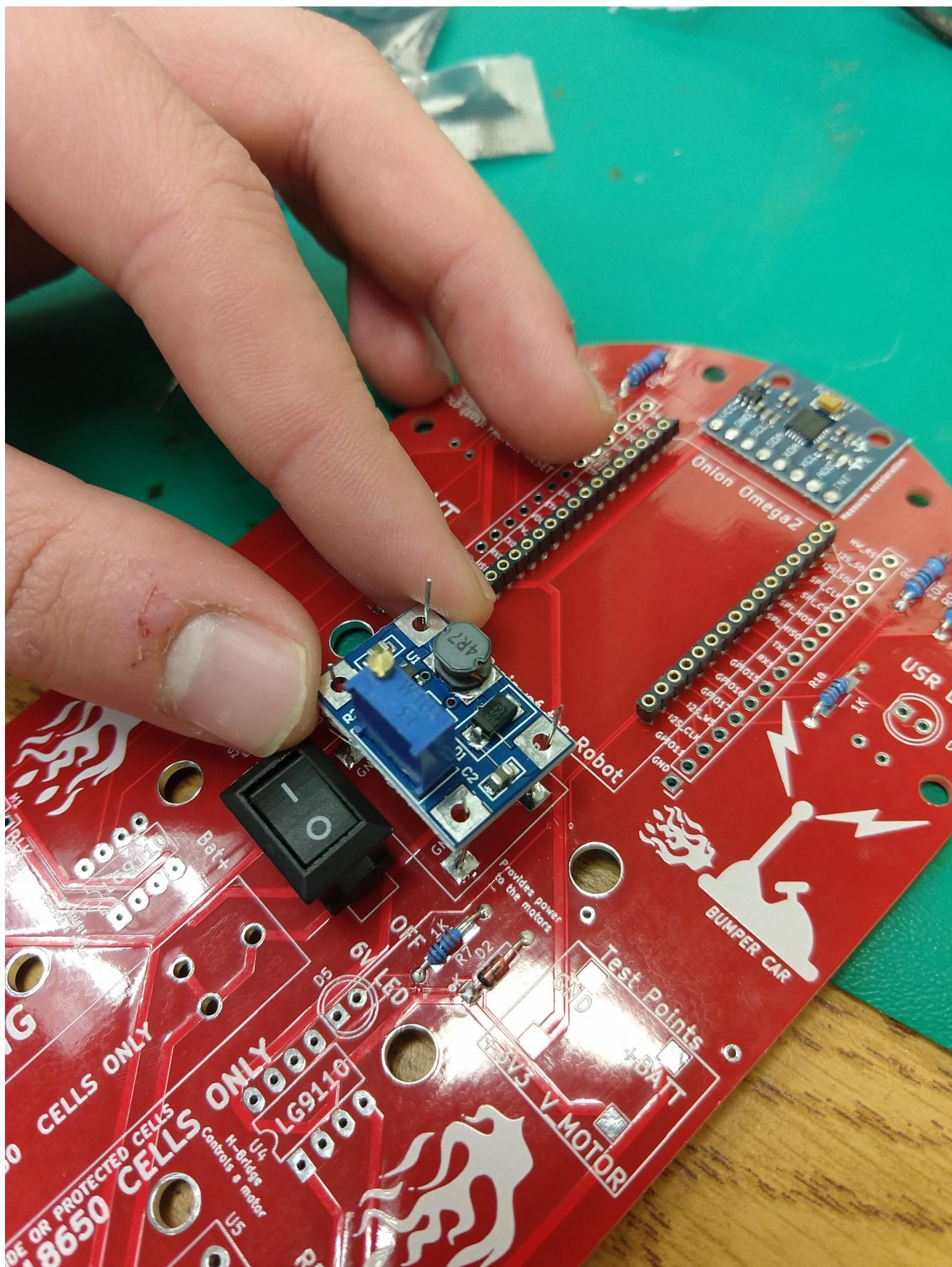
Put wire into the holes on the board



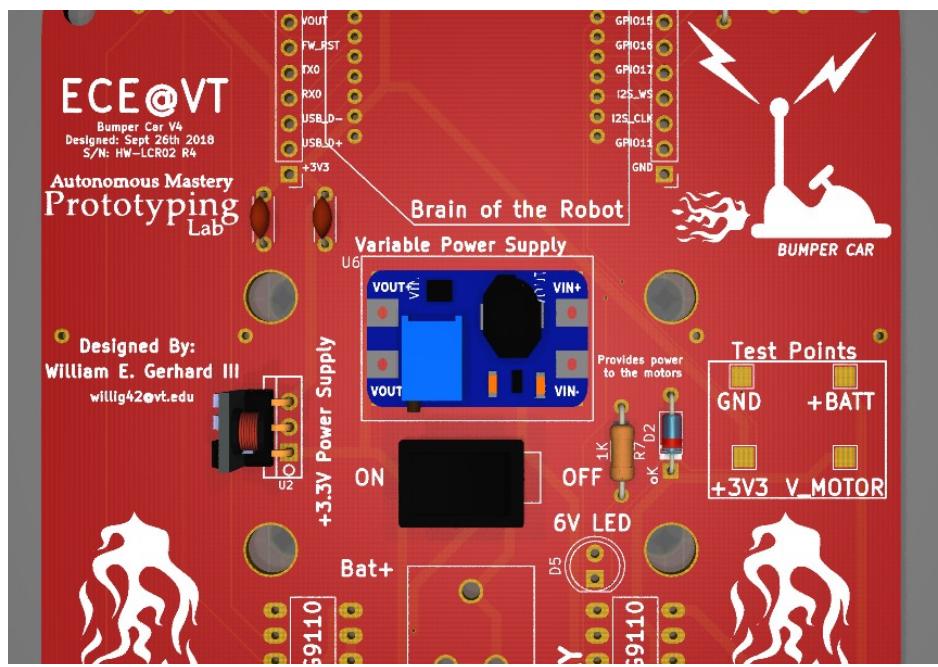
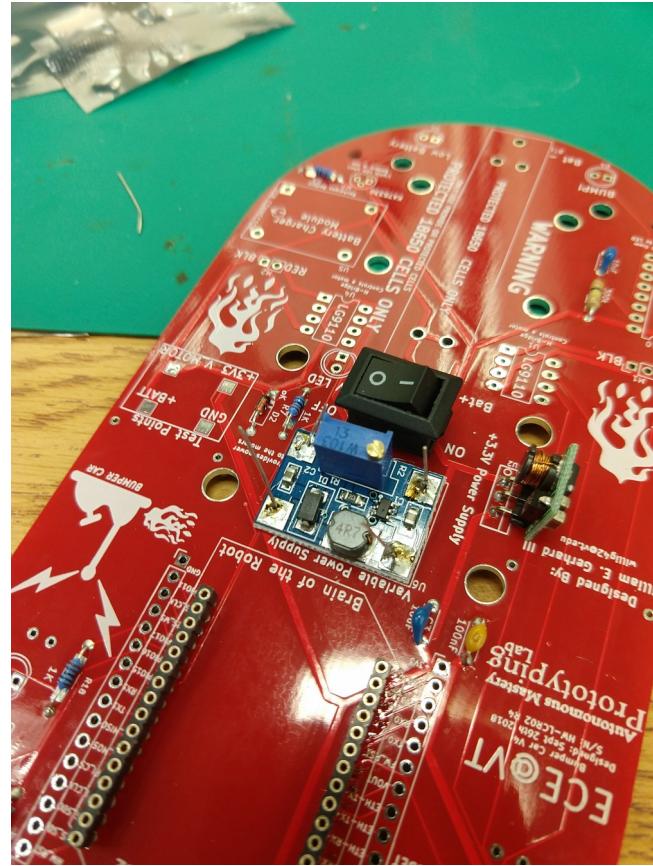
Solder the wires in the holes



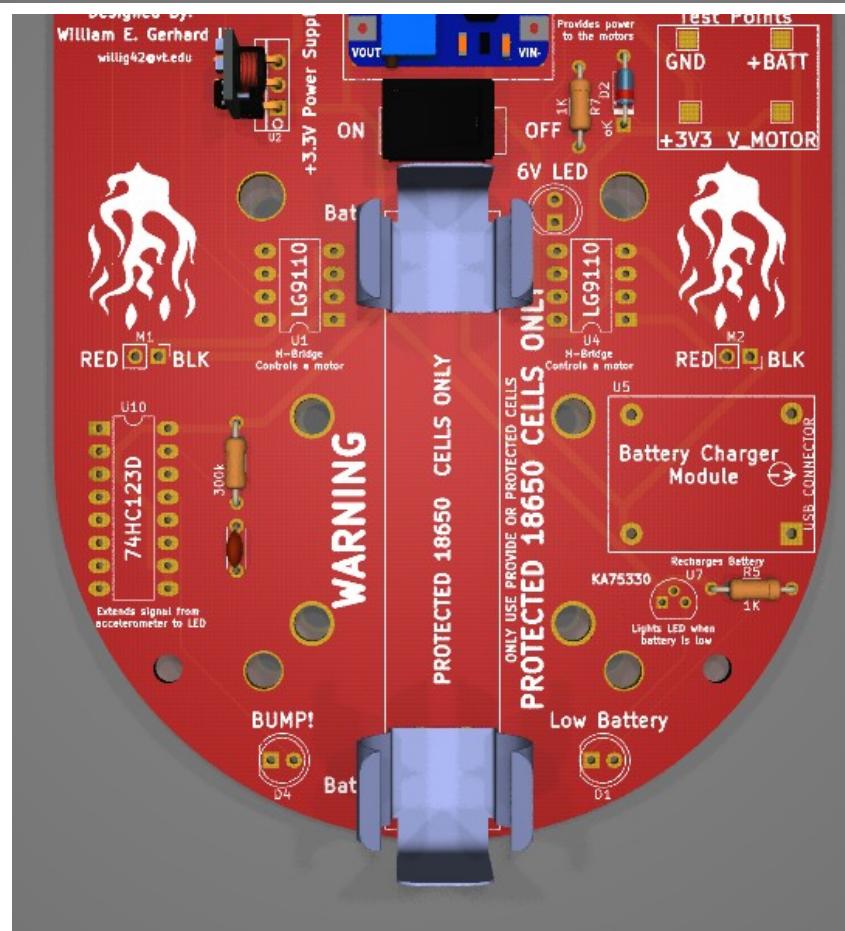
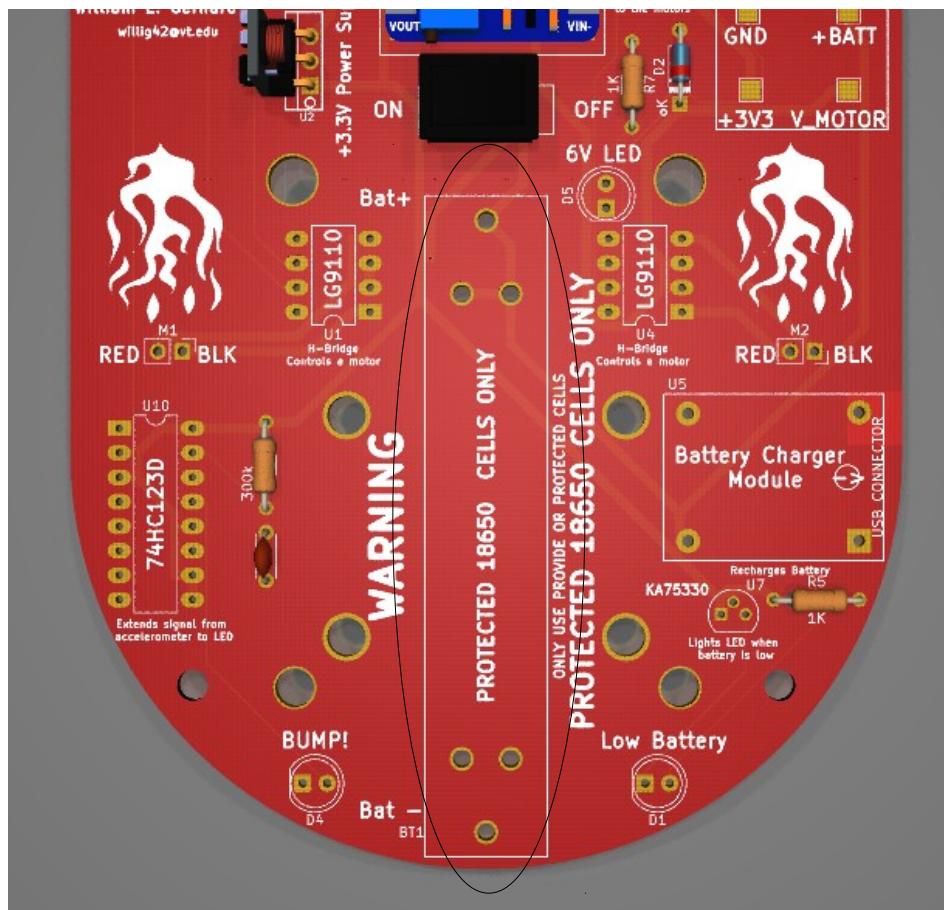
Put the component on the wires so that each wire goes through one hole on the part. The blue box goes on the same side as the switch.



Push the part down as far as you can and solder it.



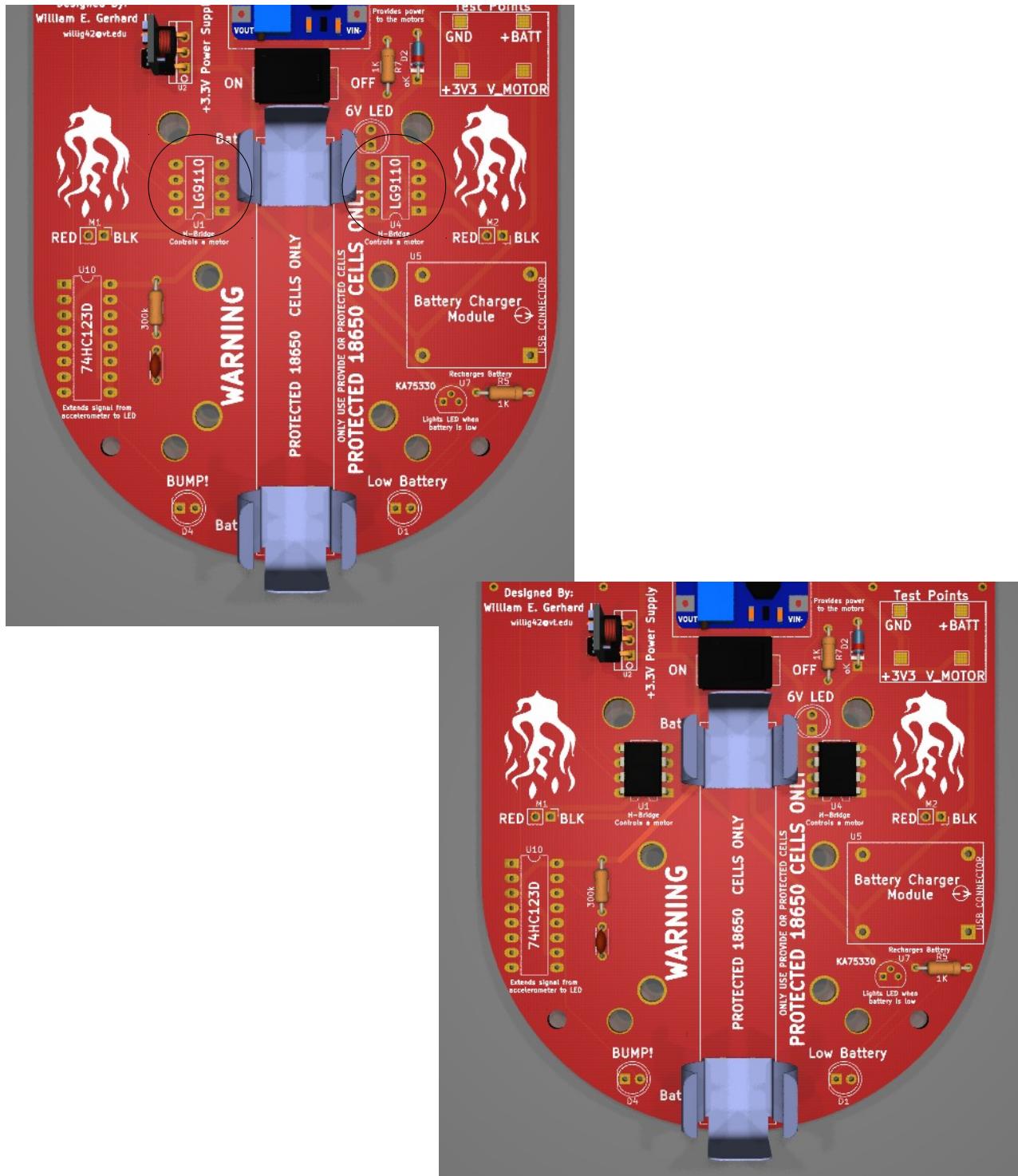
Step 14: Solder the battery holders



Step 15: Solder the L9110Hs (**Direction DOES matter**)

CAUTION: These must be soldered correctly, or the ROVER WILL NOT WORK. The notch on the chip and the notch on the silkscreen must match!

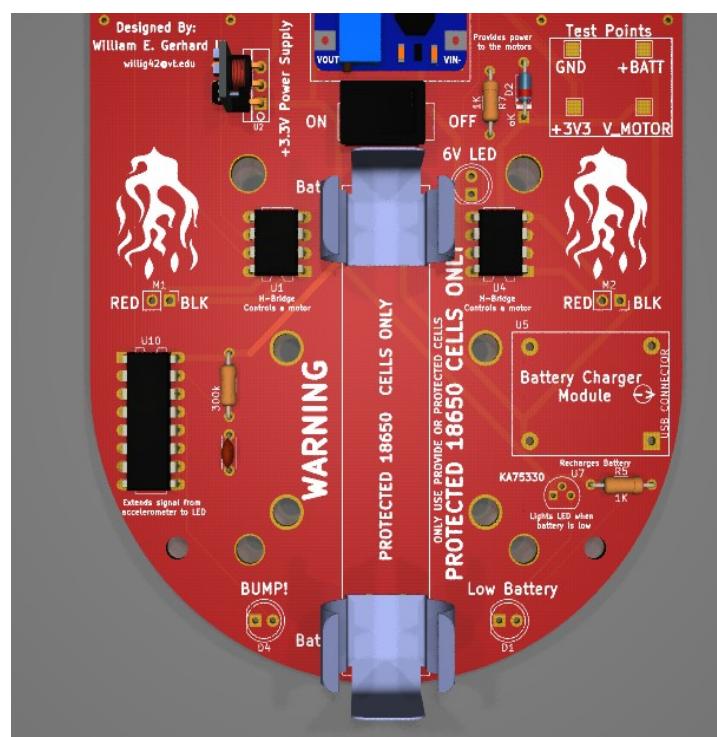
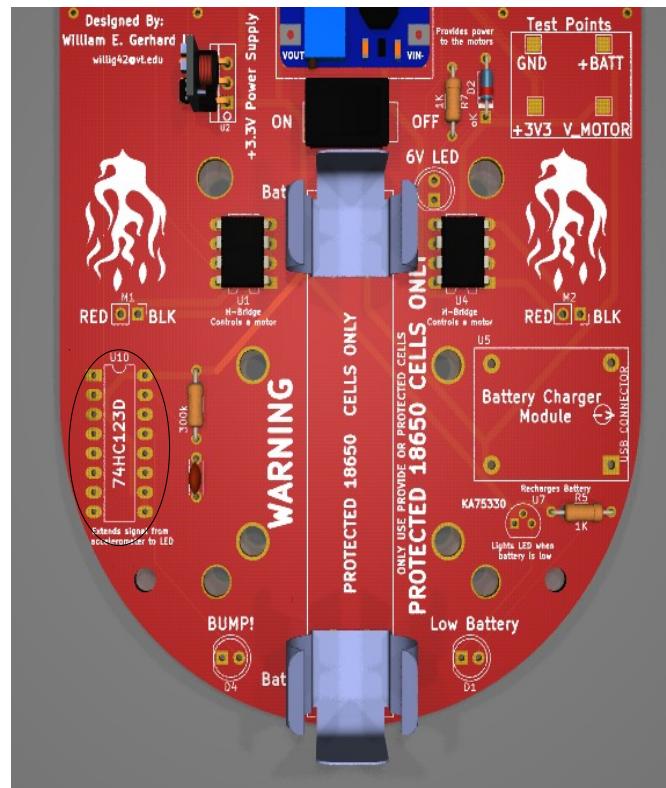
Solder the 2 L9110H chips. These devices control the motors.



Step 16: Solder the 74HC123 (**Direction DOES matter**)

CAUTION: The must be Soldered correctly, or the ROVER WILL NOT WORK. The notch on the chip and the notch on the silkscreen must match!

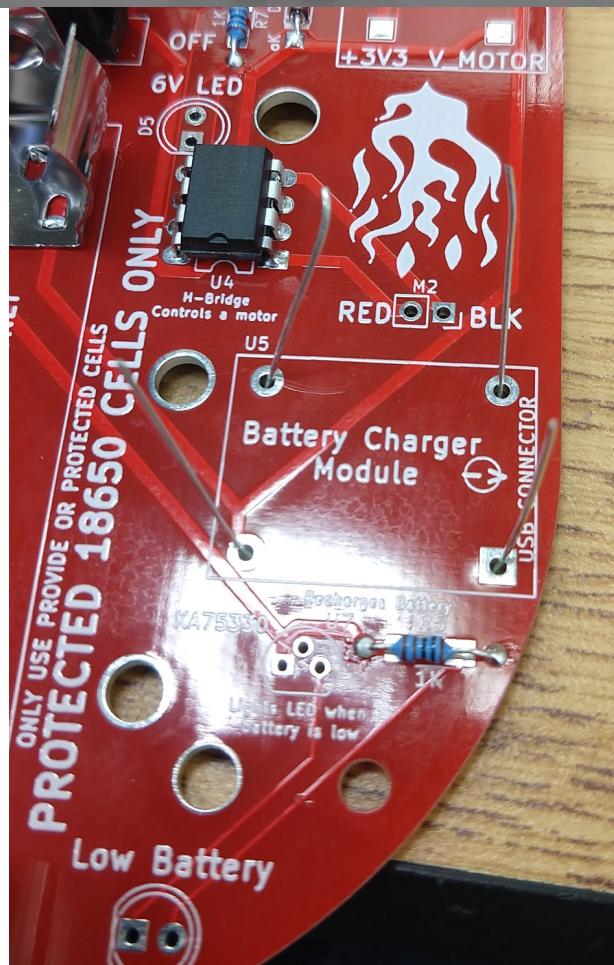
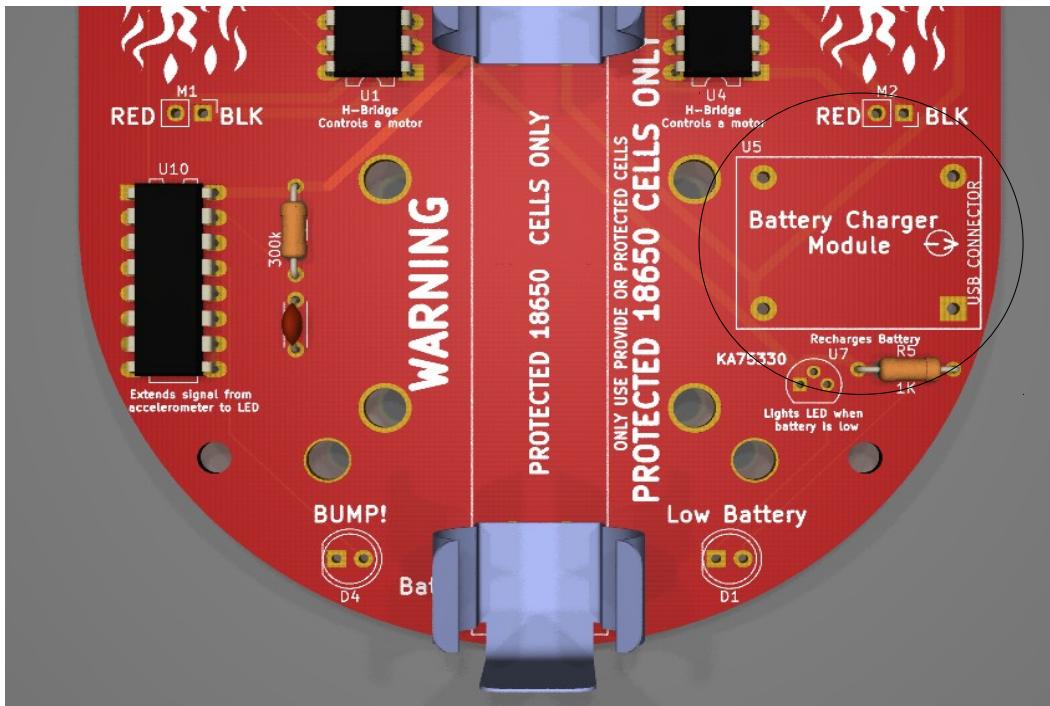
Solder the 74HC123 onto the board

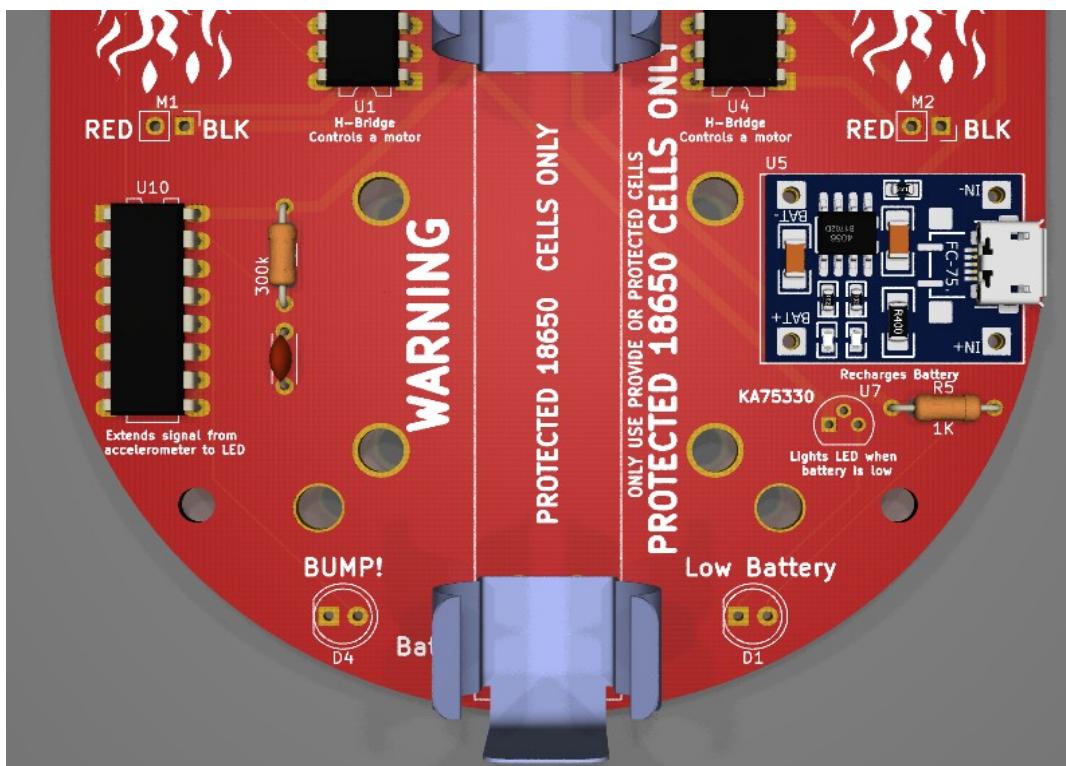
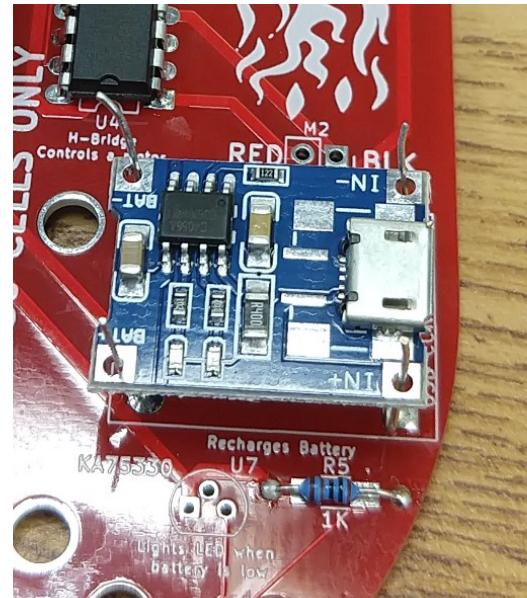
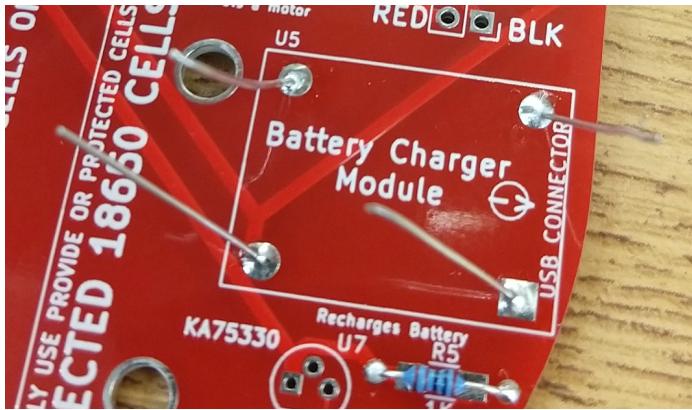


Step 17: Solder the Battery Charger Module (**Direction DOES matter**)

CAUTION: The must be Soldered correctly, or the ROVER WILL NOT WORK. The usb connector must be pointed out from the board!

Solder the battery charger module to the board. It charges the onboard battery. First solder wires into the holes, then solder the module onto those wires the same way as you did with the boost converter

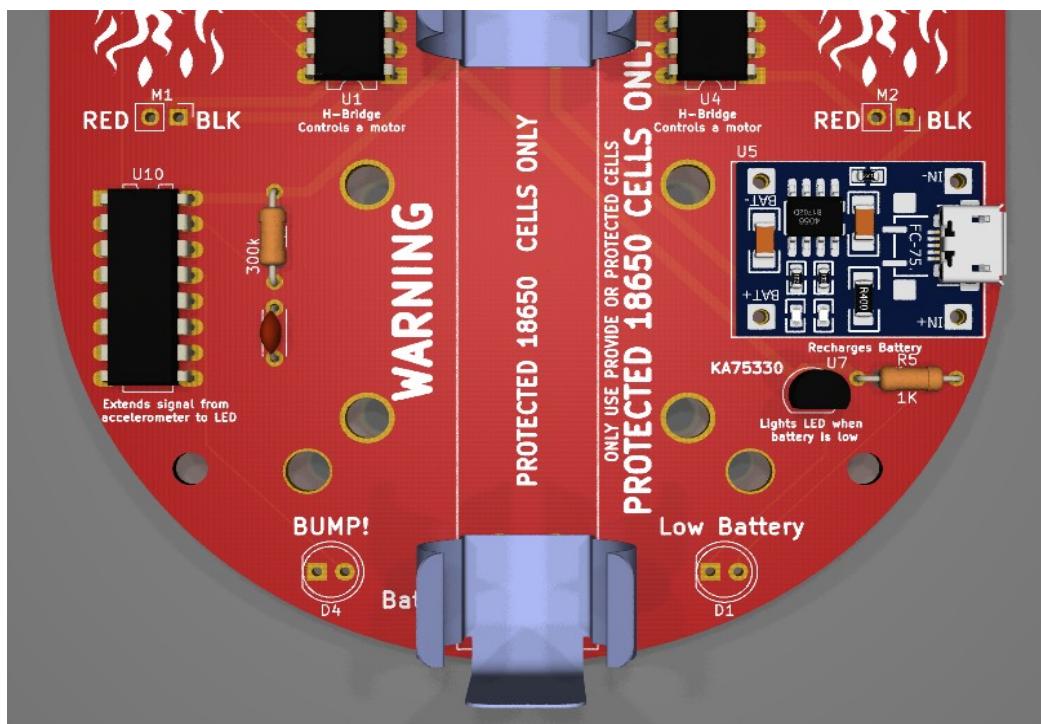
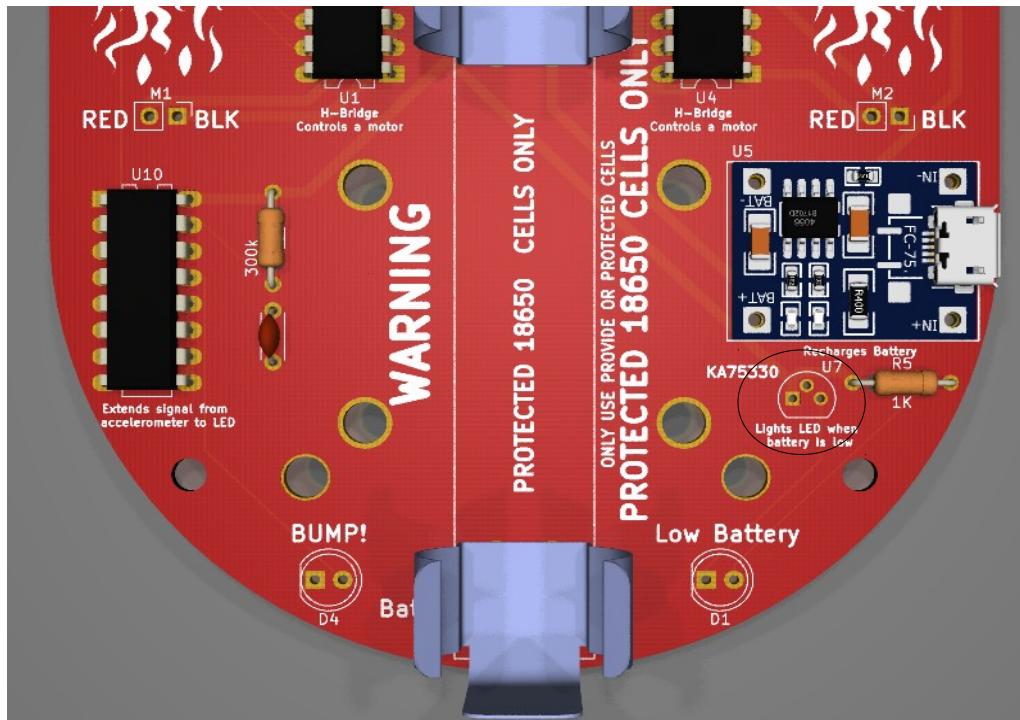




Step 18: Solder voltage supervisor IC (**Direction DOES matter**)

CAUTION: The must be Soldered correctly, or the ROVER WILL NOT WORK. IC is shaped like the letter D, and the footprint on the board also has the outline of the letter D. Make sure the IC and the silkscreen match!

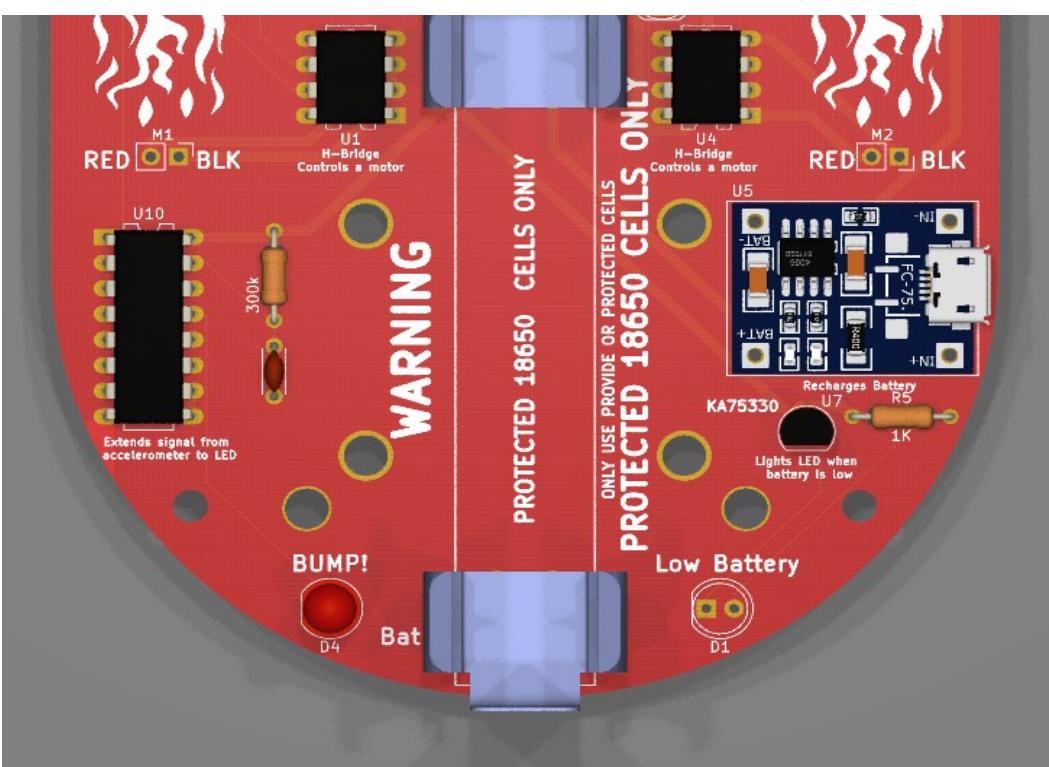
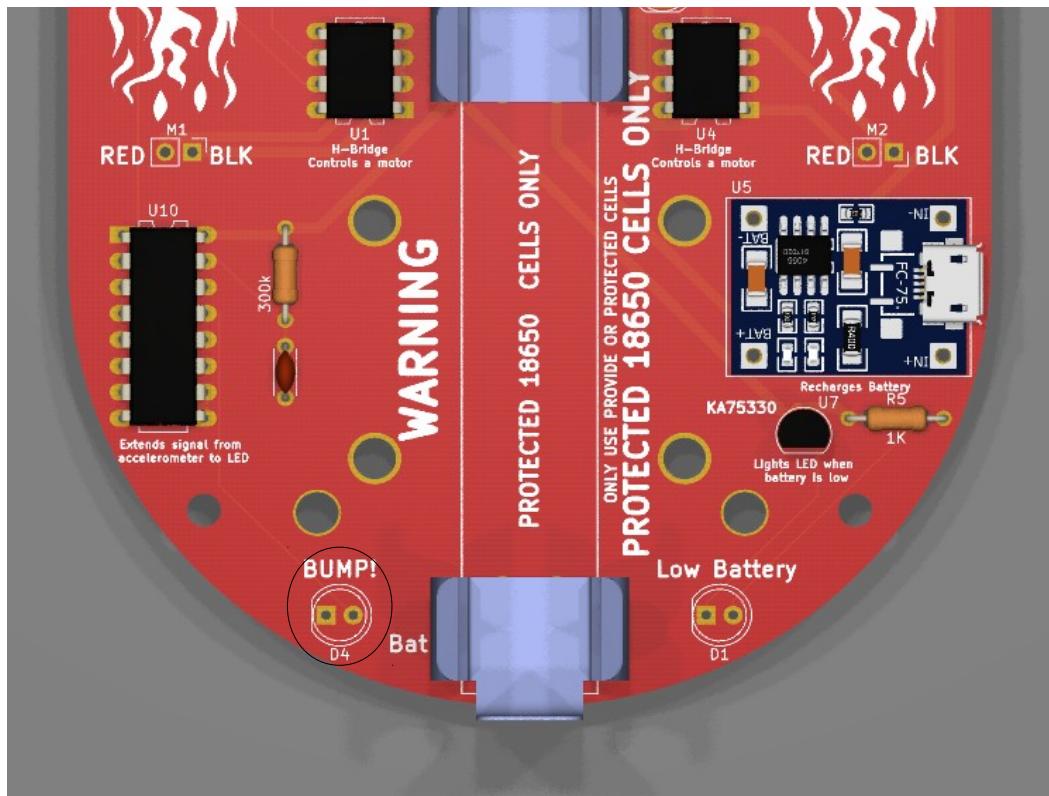
Solder the voltage supervisor IC onto the board.



Step 18: Solder BUMP! Led (**Direction DOES matter**) (**Update Photos**)

CAUTION: The must be Soldered correctly, or the LED WILL NOT WORK. The shorter leg needs to go by the flat side of the circle around the holes.

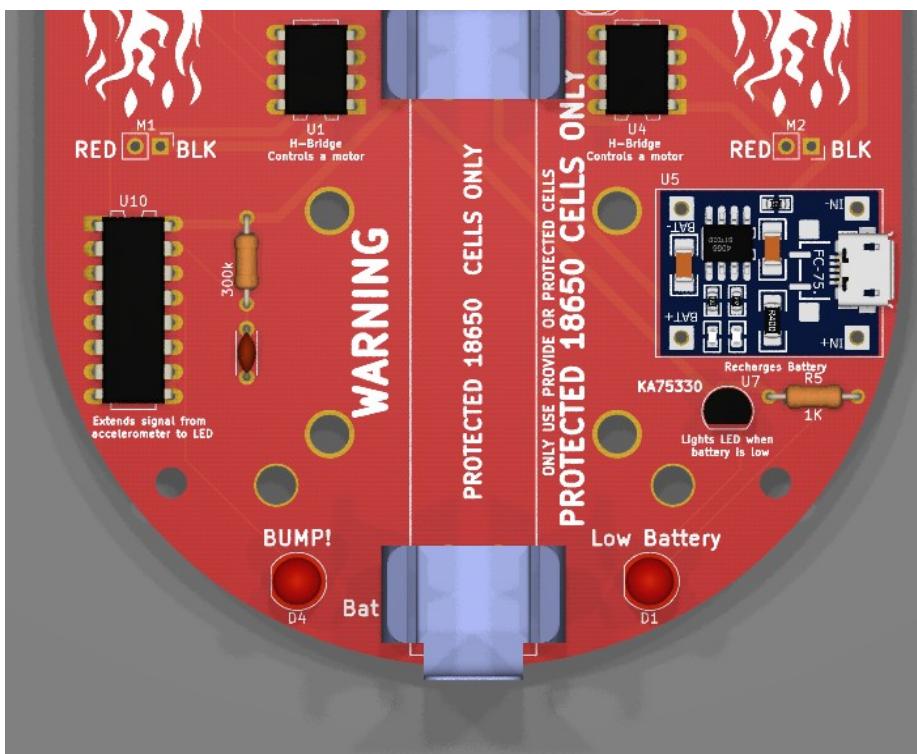
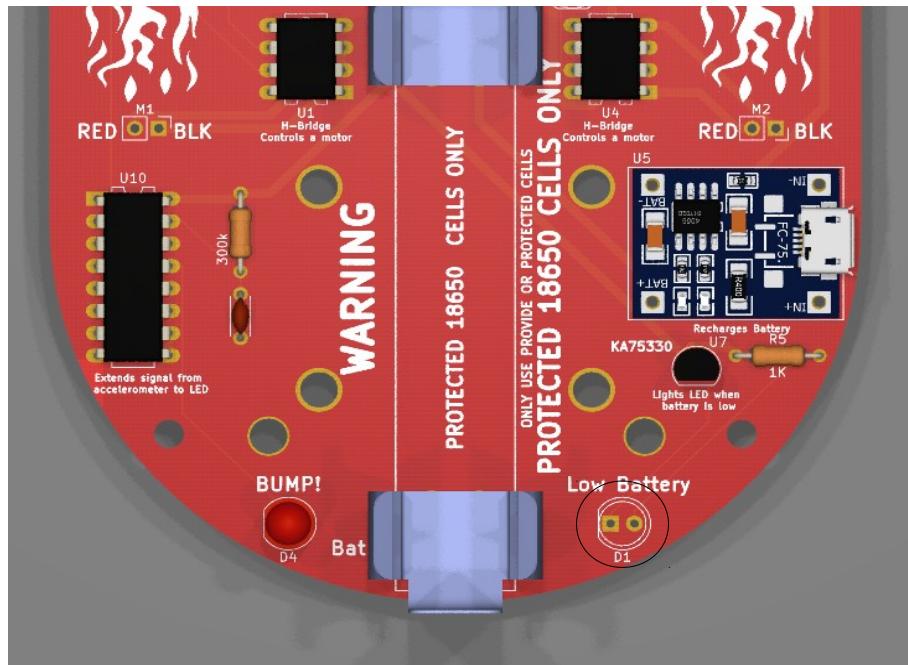
Solder the CLEAR LED into the BUMP! LED footprint



Step 18: Solder Low Battery Led (**Direction DOES matter**) (**Update Photos**)

CAUTION: The must be Soldered correctly, or the LED WILL NOT WORK. The shorter leg needs to go by the flat side of the circle around the holes.

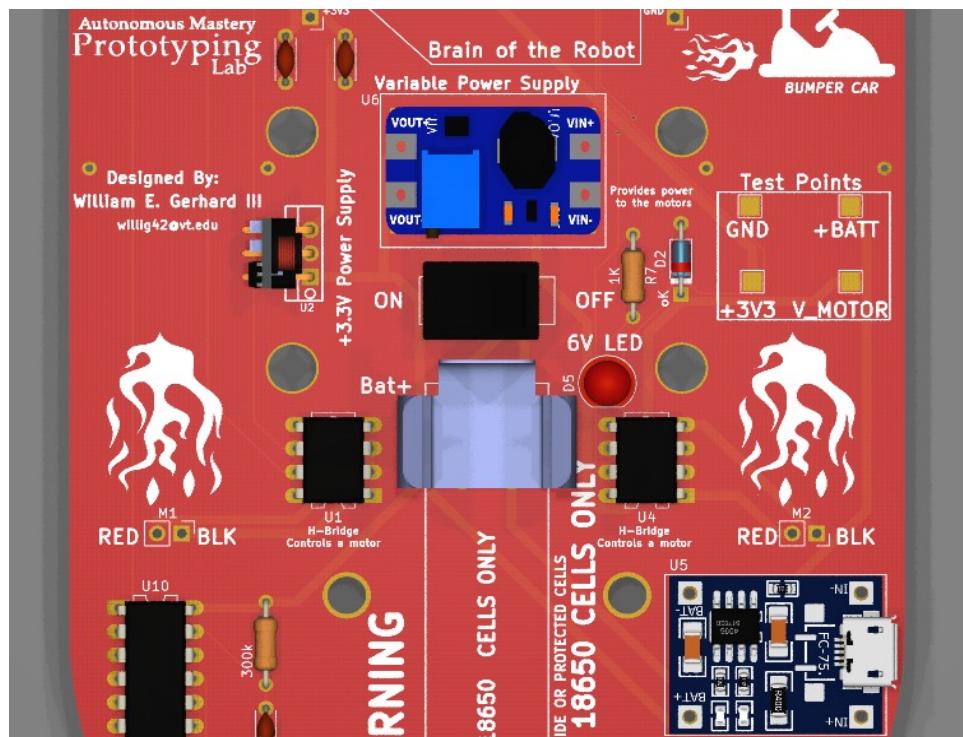
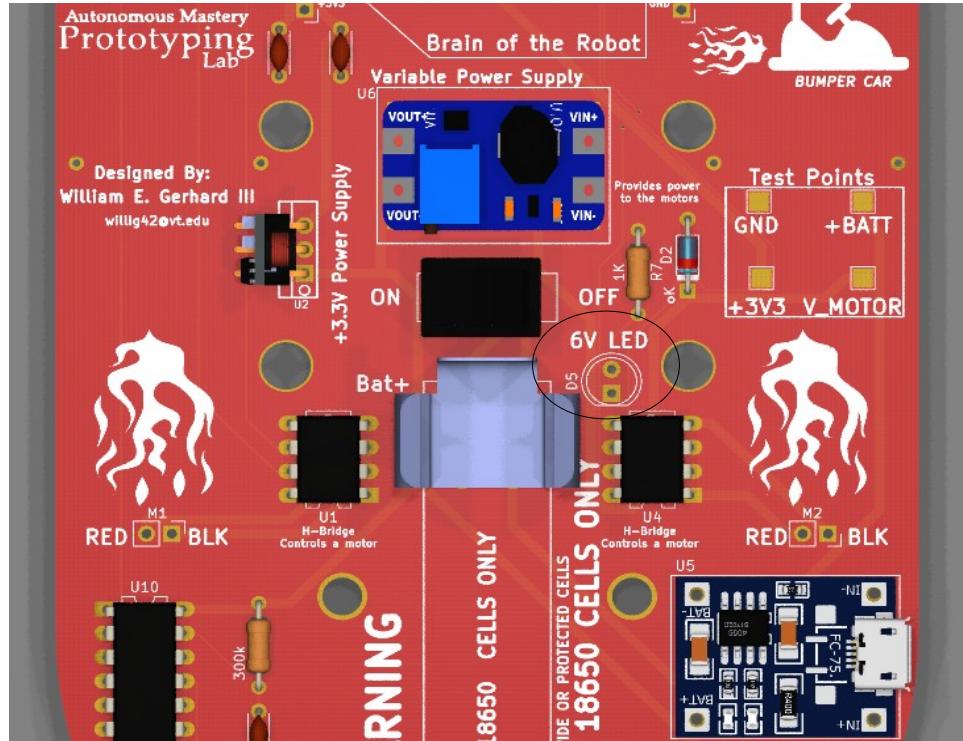
Solder the RED LED into the Low Battery LED footprint



Step 18: Solder 6V Led (Direction DOES matter) (Update Photos)

CAUTION: The must be Soldered correctly, or the LED WILL NOT WORK. The shorter leg needs to go by the flat side of the circle around the holes.

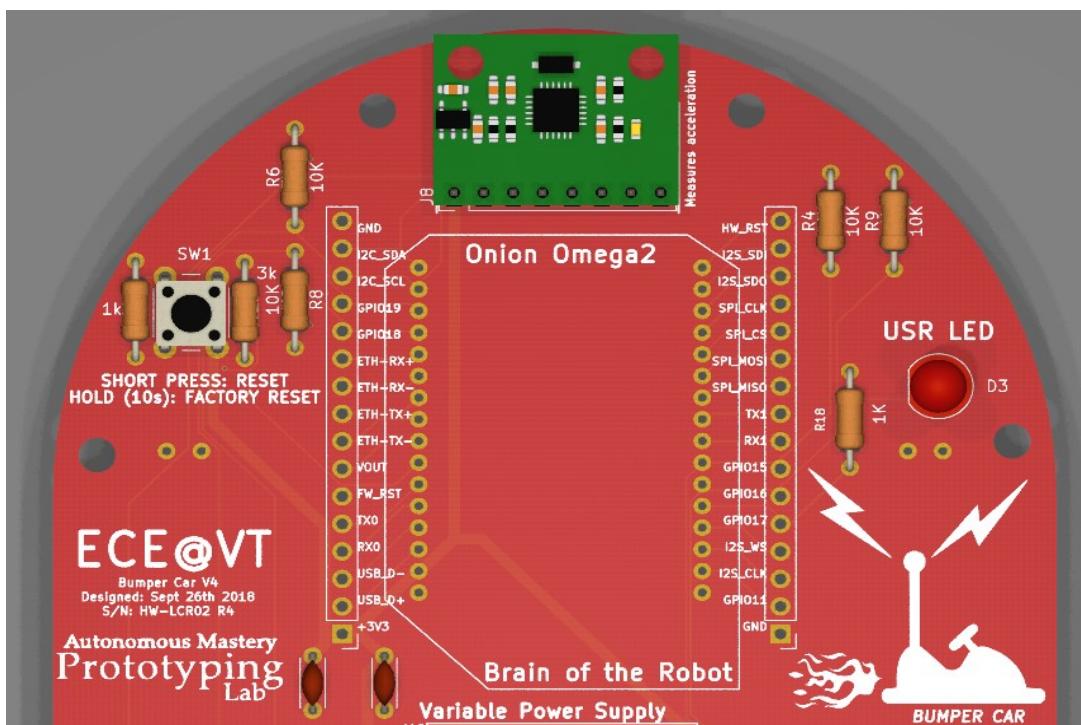
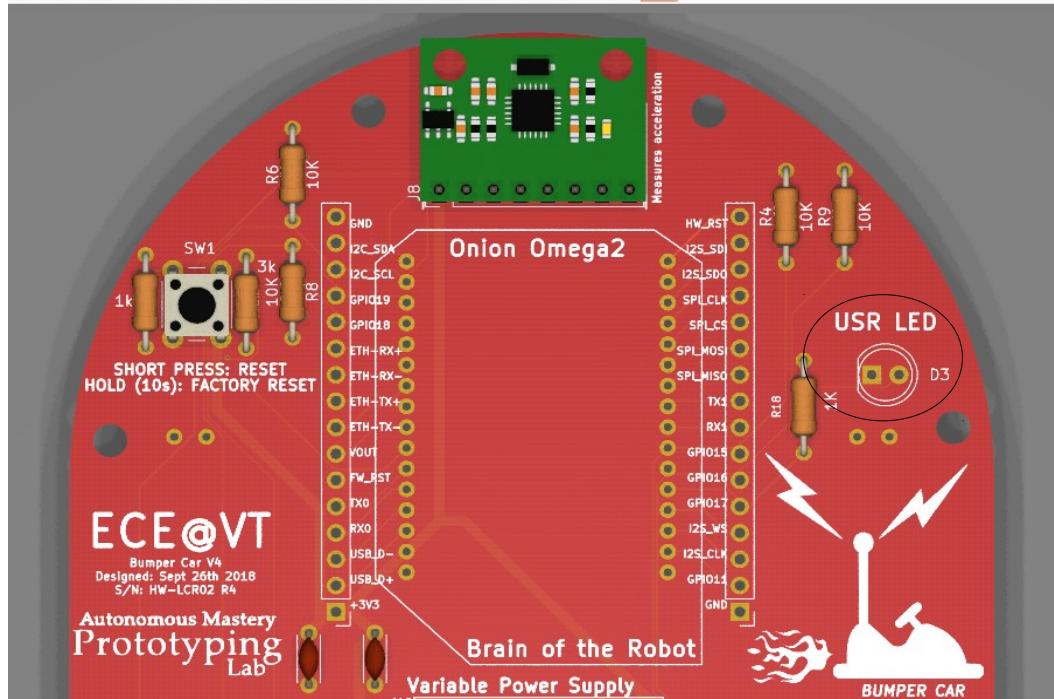
Solder the RED LED into the 6V LED footprint



Step 19: Solder USR Led (Direction DOES matter) (Update Photos)

CAUTION: The must be Soldered correctly, or the LED WILL NOT WORK. The shorter leg needs to go by the flat side of the circle around the holes.

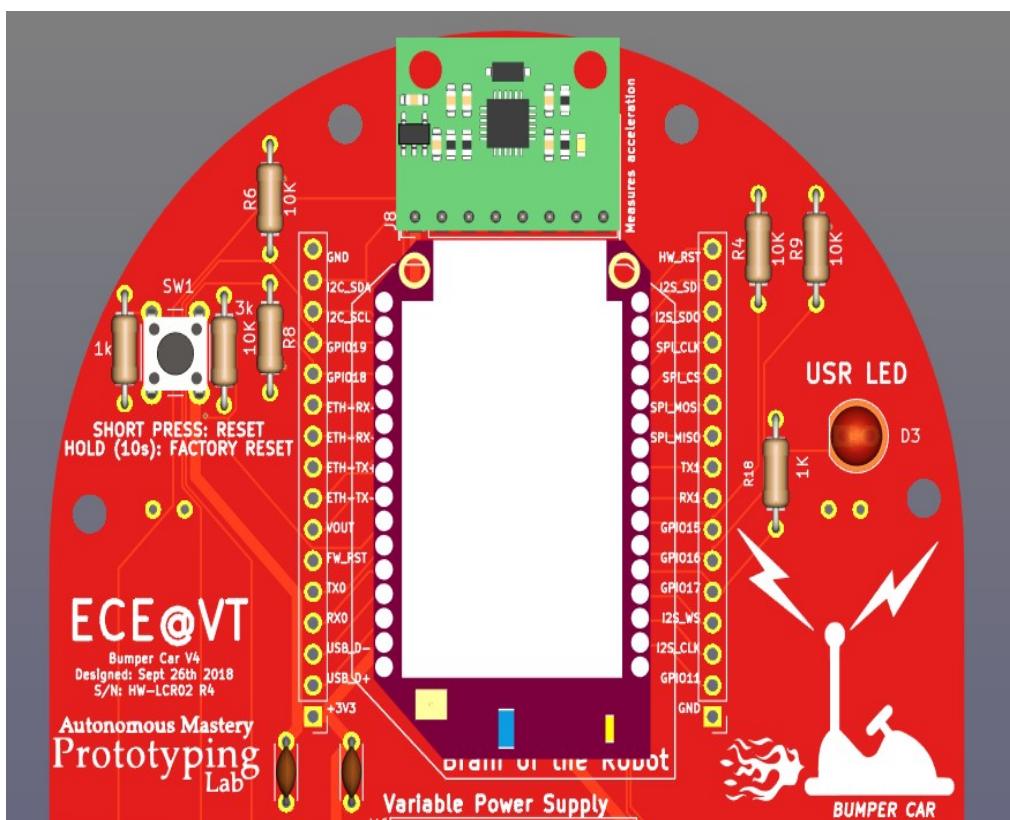
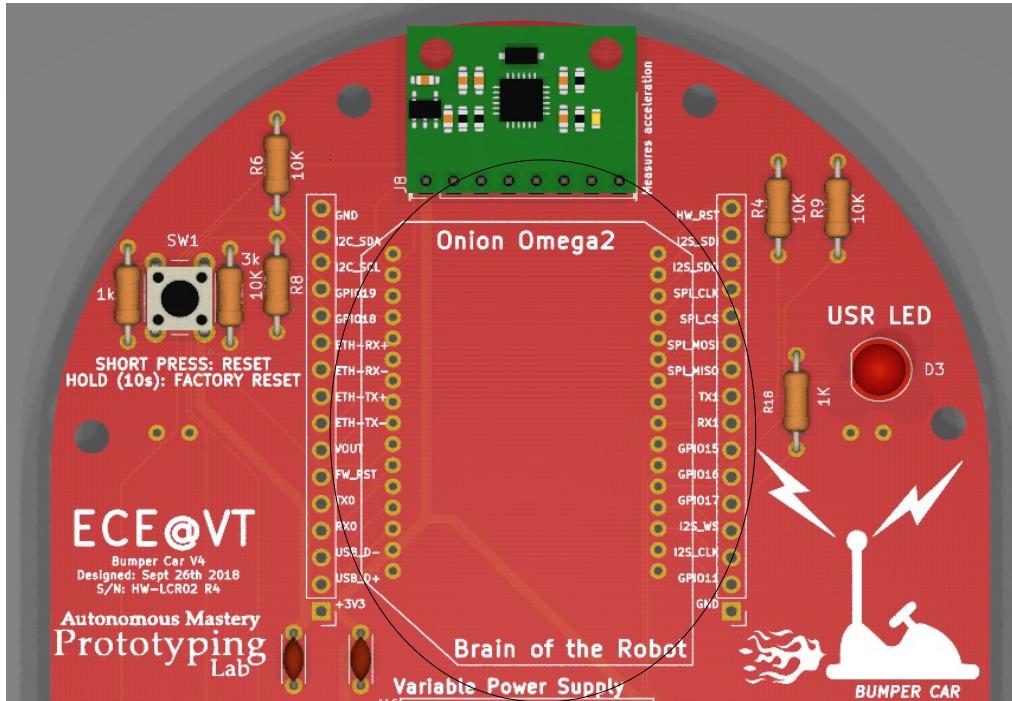
Solder the Yellow or Green LED into the USR LED footprint



Step 19: Solder Onion Omega2 (Direction DOES matter) (Update Photos)

CAUTION: The must be soldered correctly, or the ROVER WILL NOT WORK. The outline of the Omega2 is on the board and must match the part!

Solder the onion omega2 onto the board, Be careful not to short the pins together!



Step 20: Solder wires onto the motors

Each motor has two tabs, solder wire to each of the tabs. Do this to both motors following the directions on the bottom of the PCB (Add Photo)

Step 21: solder motor wires into holes on the PCB labeled Red and BLK.

Step 22: Using Zipties and the holes on the board, attach the motors to the board (Add Photo)

Step 23: Go to soldering trainer or GTA to attach battery to battery holder.

Step 24: To make the robot go fast, rotate the small brass screw on the blue box on the boost convert counter clockwise until the Red 6V LED turns on.

Congrats! Your rover is now finished and ready to be programmed!