

Low Cost Rover Assembly Directions

By: Will Gerhard and Jonathan Kayne

Welcome to the directions for assembling your very own low cost rover! These little robots pack a big punch and can do almost anything you want to program them to do!

If you are experienced in soldering, this should only take an hour to an hour and a half.

If this is your first time this should take somewhere between 2 to 3 hours to build!

Step 1:

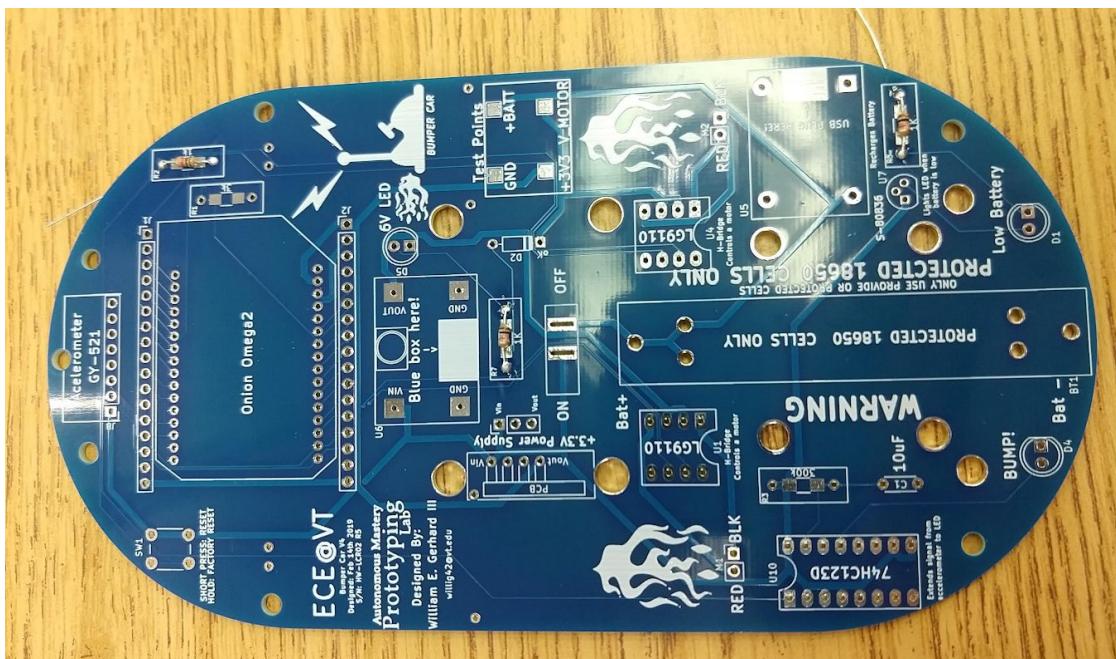
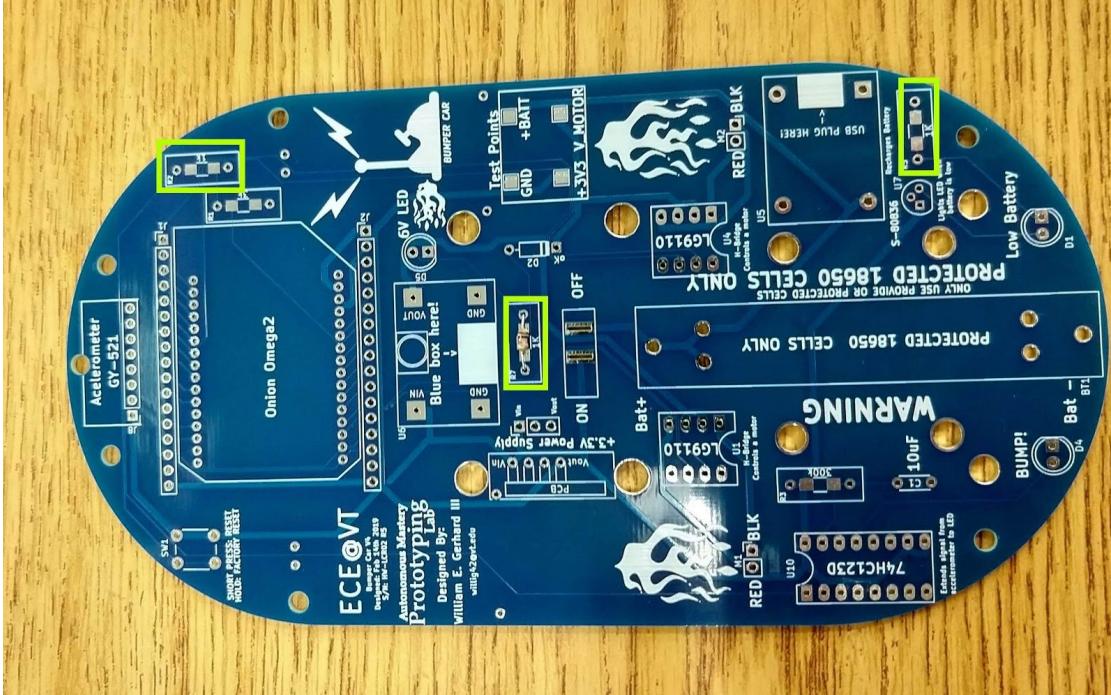
Take out your PCB board and look at it! This board is just like a computer motherboard and will both be the chassis of your robot and connect all the pieces together! Pretty cool right? If you look closely at the board, you can see numbers and letters by the footprints (the shiny pads surrounded by white boxes). The letter number combos (R1, R2, etc) are unique to each box! The value (1K, 300K, etc) tell you the value of the component that goes in that box. These makes it easy to know what goes in each box.

Very Important! Nothing goes across a white box. If you put a part in the board and it goes across a white line something is wrong!

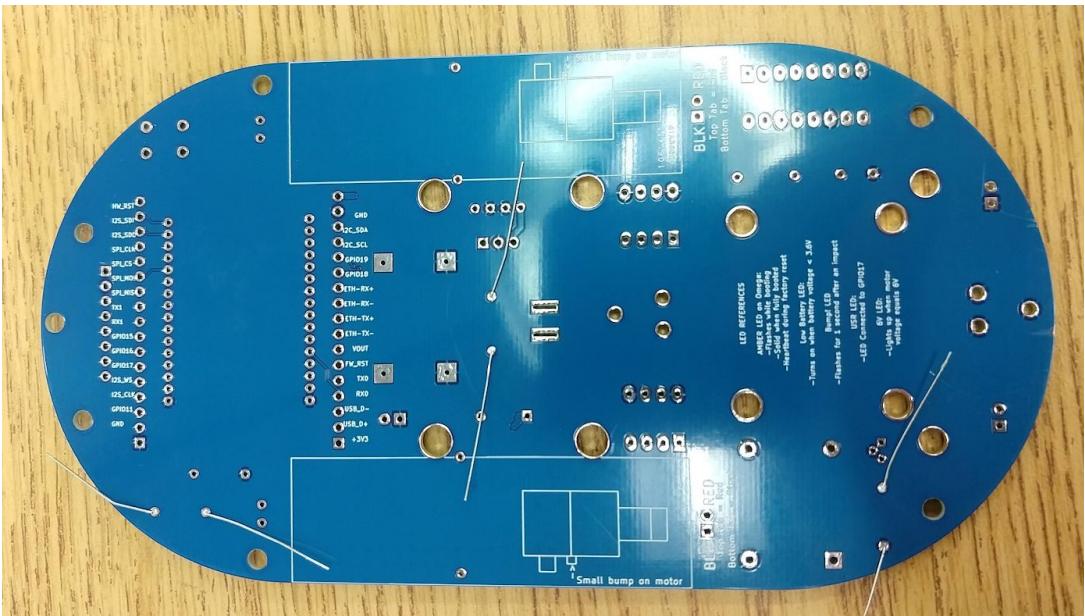


Step 2: Install 1K resistors (R2, R5, R7)

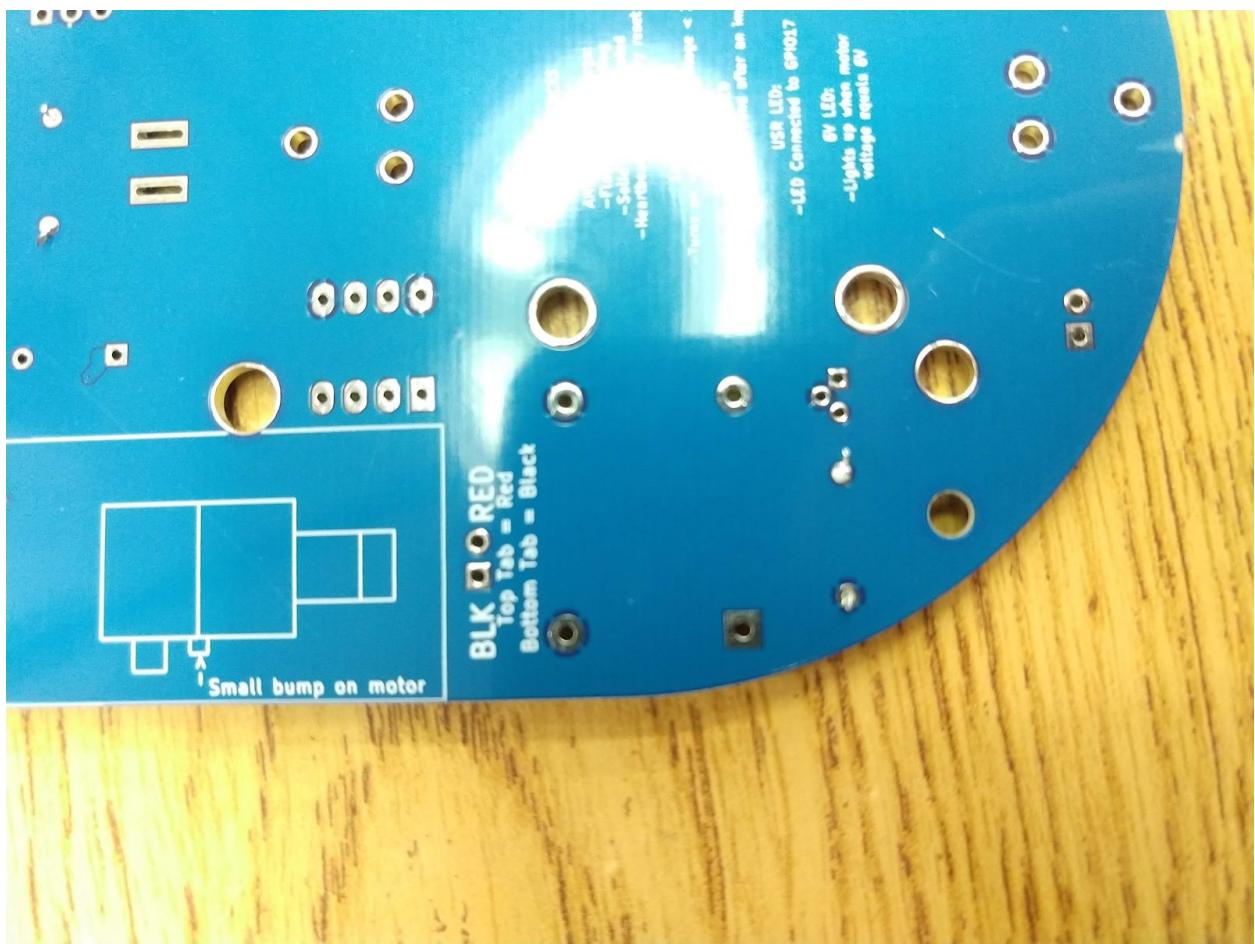
On the board there should be three boxes (R2, R5, R7) that hold 1K resistors. The first step is to insert a 1K resistor into R7 (Middle of the board) and solder it in place!



Once the resistors have been soldered, the bottom of your board should look like this:

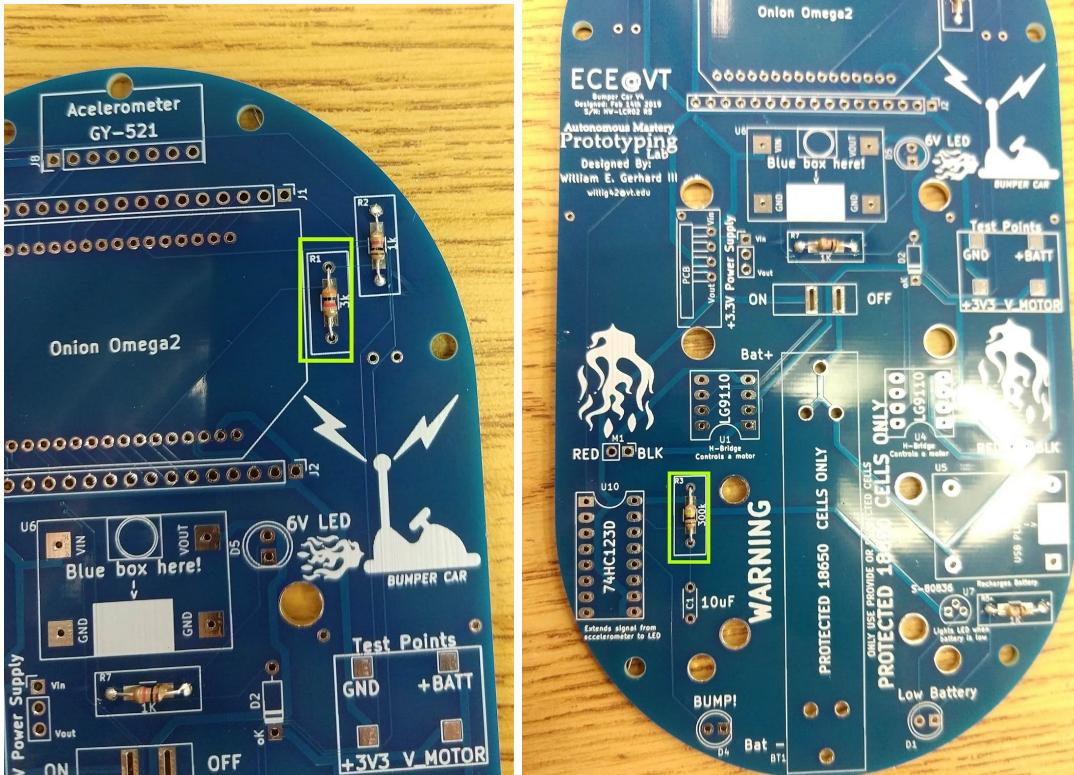


Go ahead and trim the leftover lead (little bits of metal) and **put them aside**. You will need these bits later on!

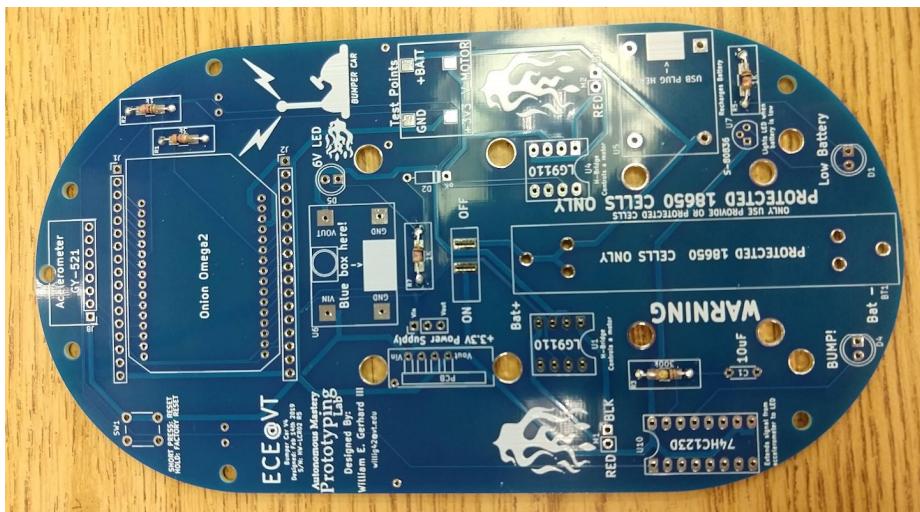


Step 3: Install 3K and 100K/300K Resistors (R1, R3)

Now that you are a master at soldering resistors, go ahead and install a 3K resistor in R1 and a 100K/300K resistor in R3.



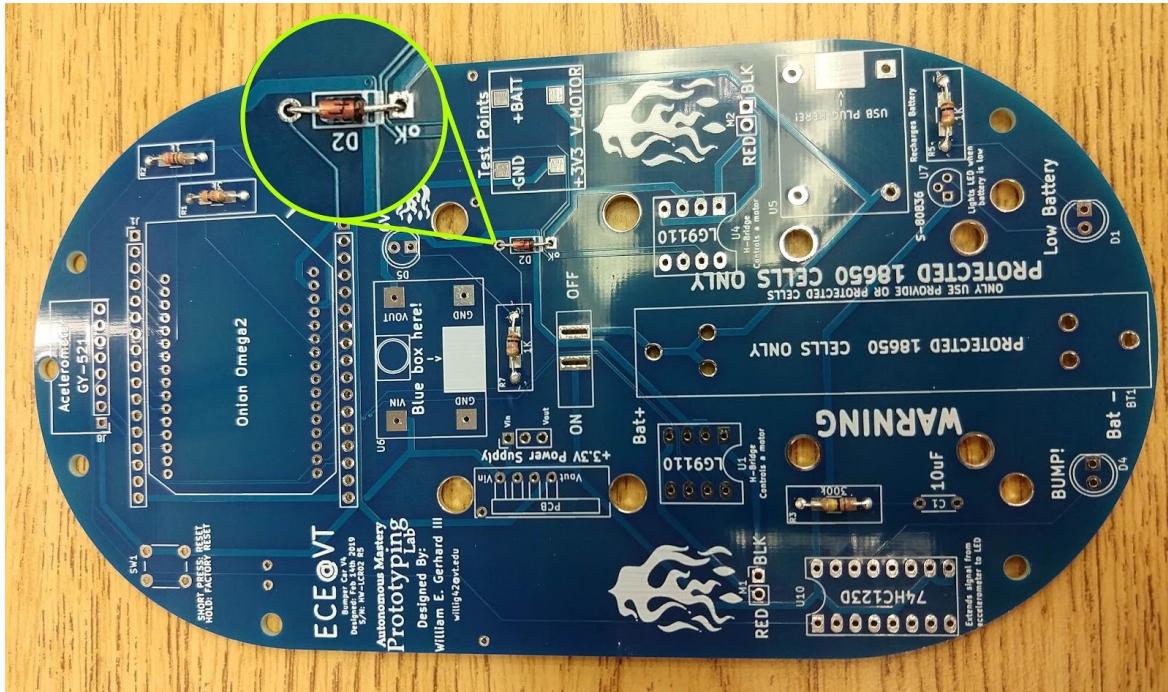
And solder them in place! Be sure to flip the board over and trim the resistors. Your board should now look like this.



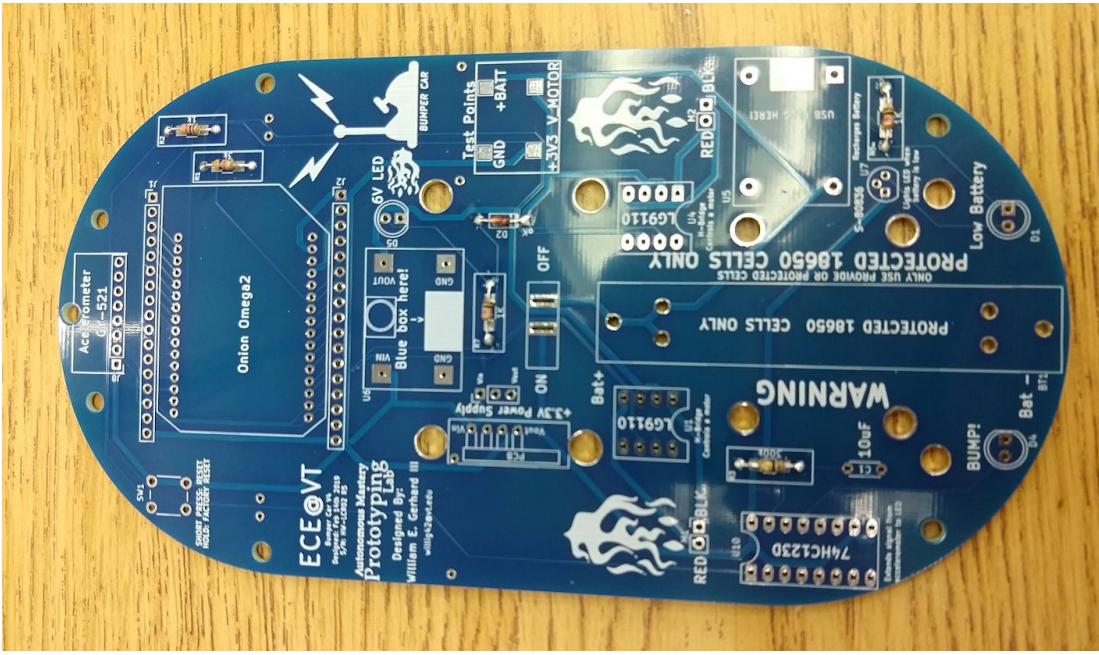
Step 4: Install Diode (D2)

DO NOT INSTALL BACKWARDS

Now install the diode. If you look close, you can see that the part has a black band. And if you look at the board, you can see the little white band. The black band needs to go on top of the white band!

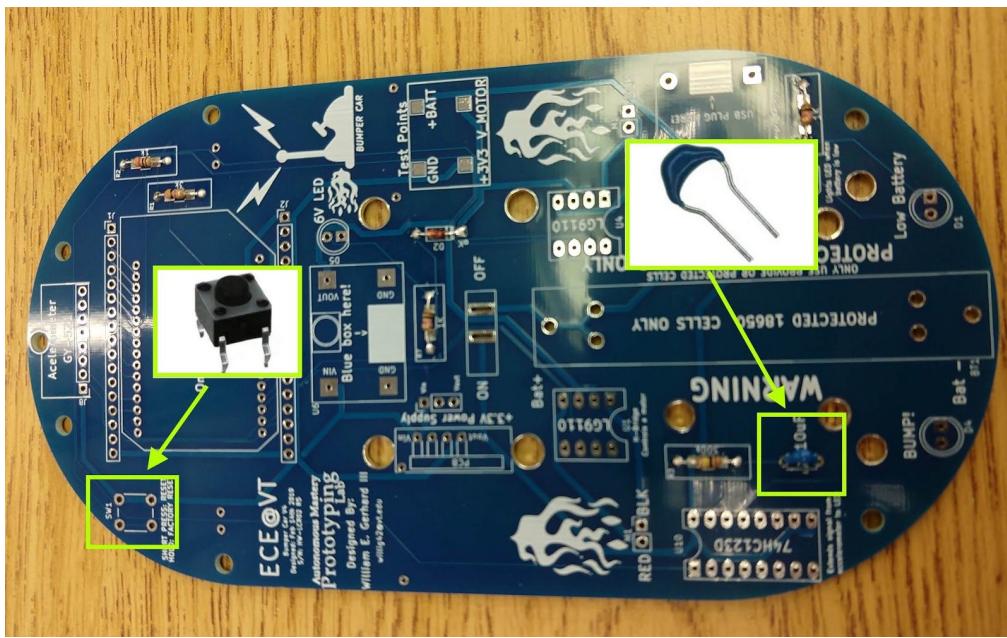


And solder it in place! Be sure to trim the leads on the bottom.

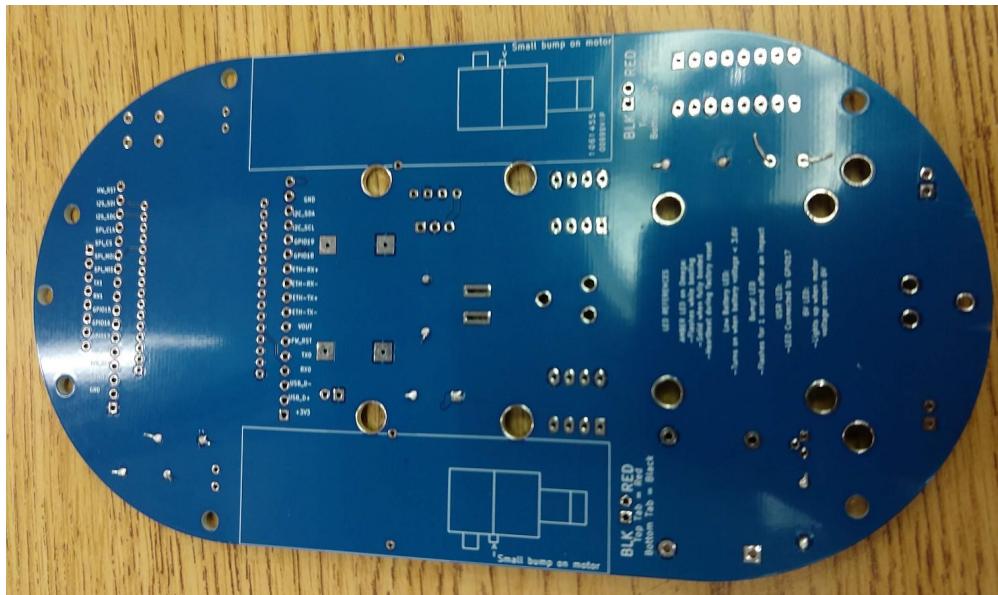


Step 5: Install 10uF Capacitor (C1) and Button (SW1)

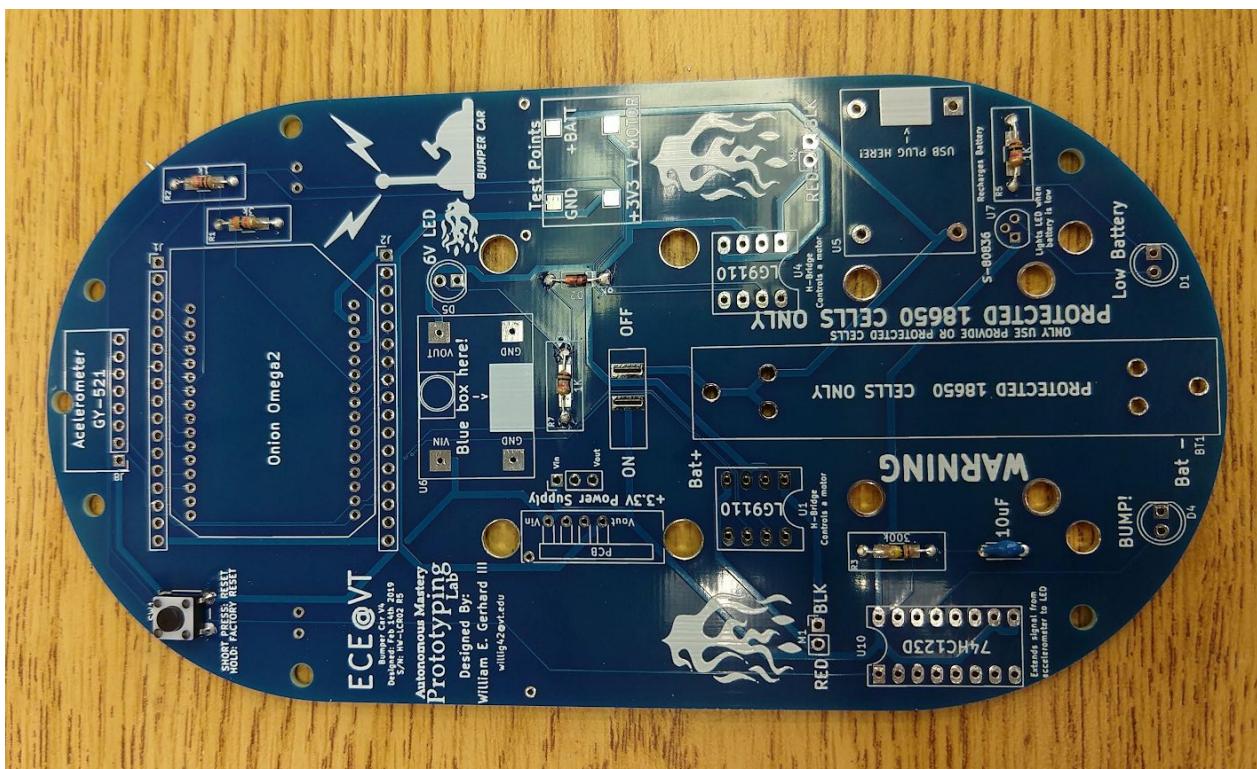
Now install the 10uF capacitor (C1) on the board. Also, add the tactile switch (SW1) as well. The switch should snap into place.



You may bend the legs out so it fits well. Then flip the board over and solder it!

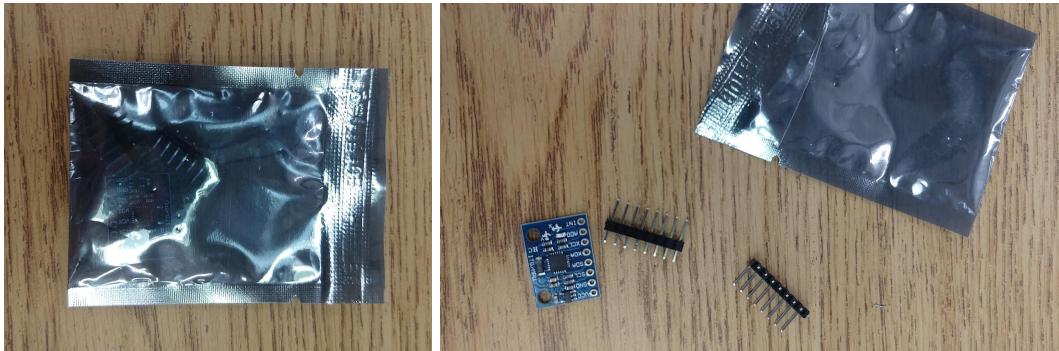


And your board should look like this.

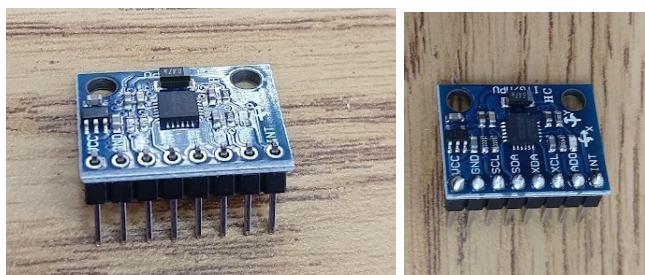


Step 6: Build Accelerometer

Go ahead and pull out the accelerometer out, it is in a baggie like this.

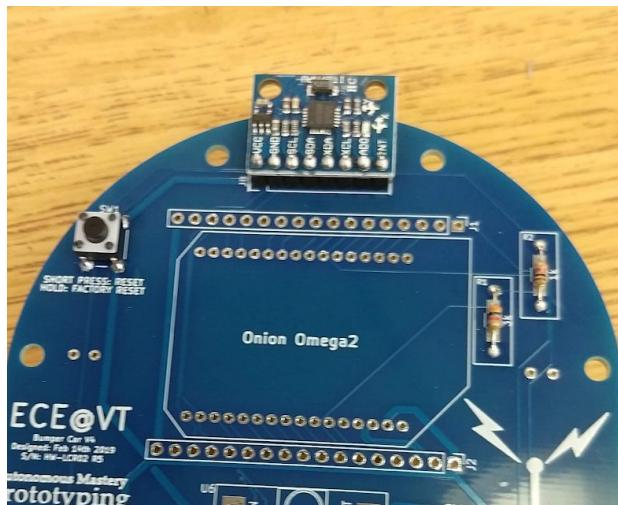


So go ahead and install the long straight pin like this. Then, solder it!

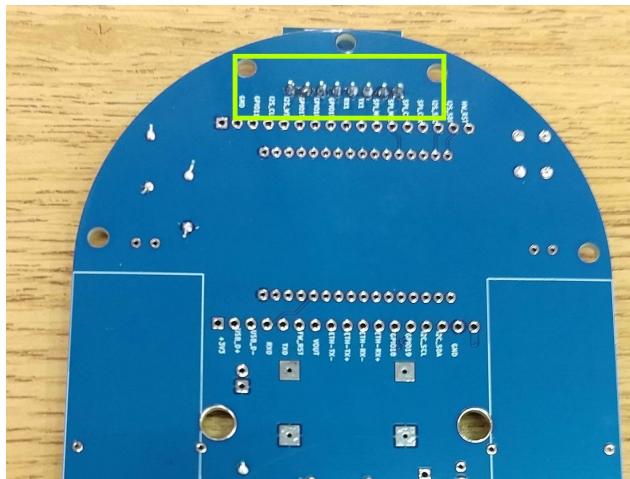
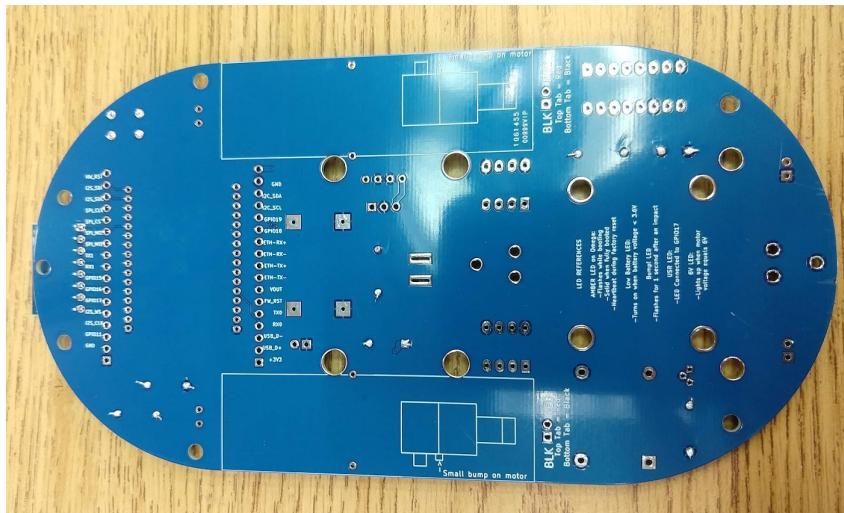


Step 7: Install Accelerometer on rover

Now install the accelerometer you just built on the rover!



Flip the board and solder it.

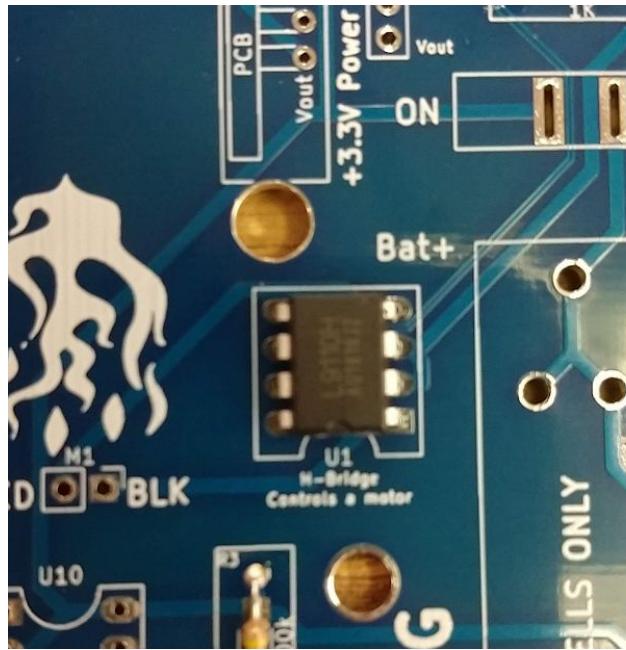


Step 8: Install Motor Controllers (U1, U4)

Now it is time to install the motor controllers! If you look at the chip and the board, you can see there is a notch on the chip and a dip in the white box

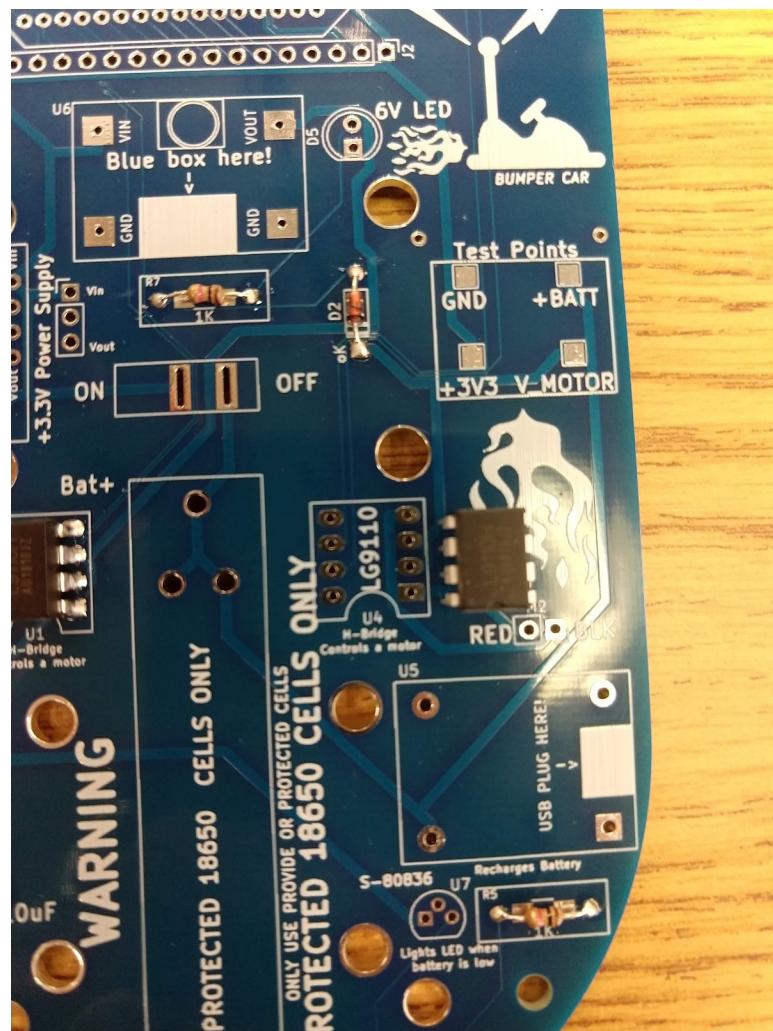


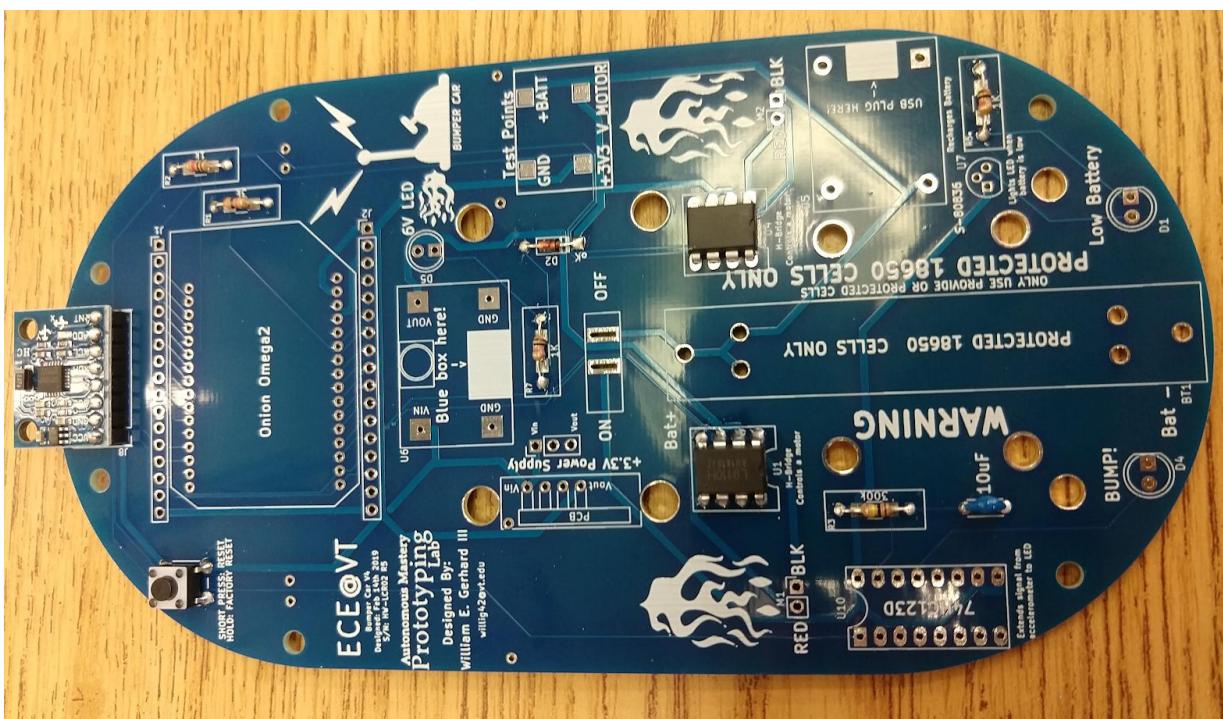
Make sure they line up!



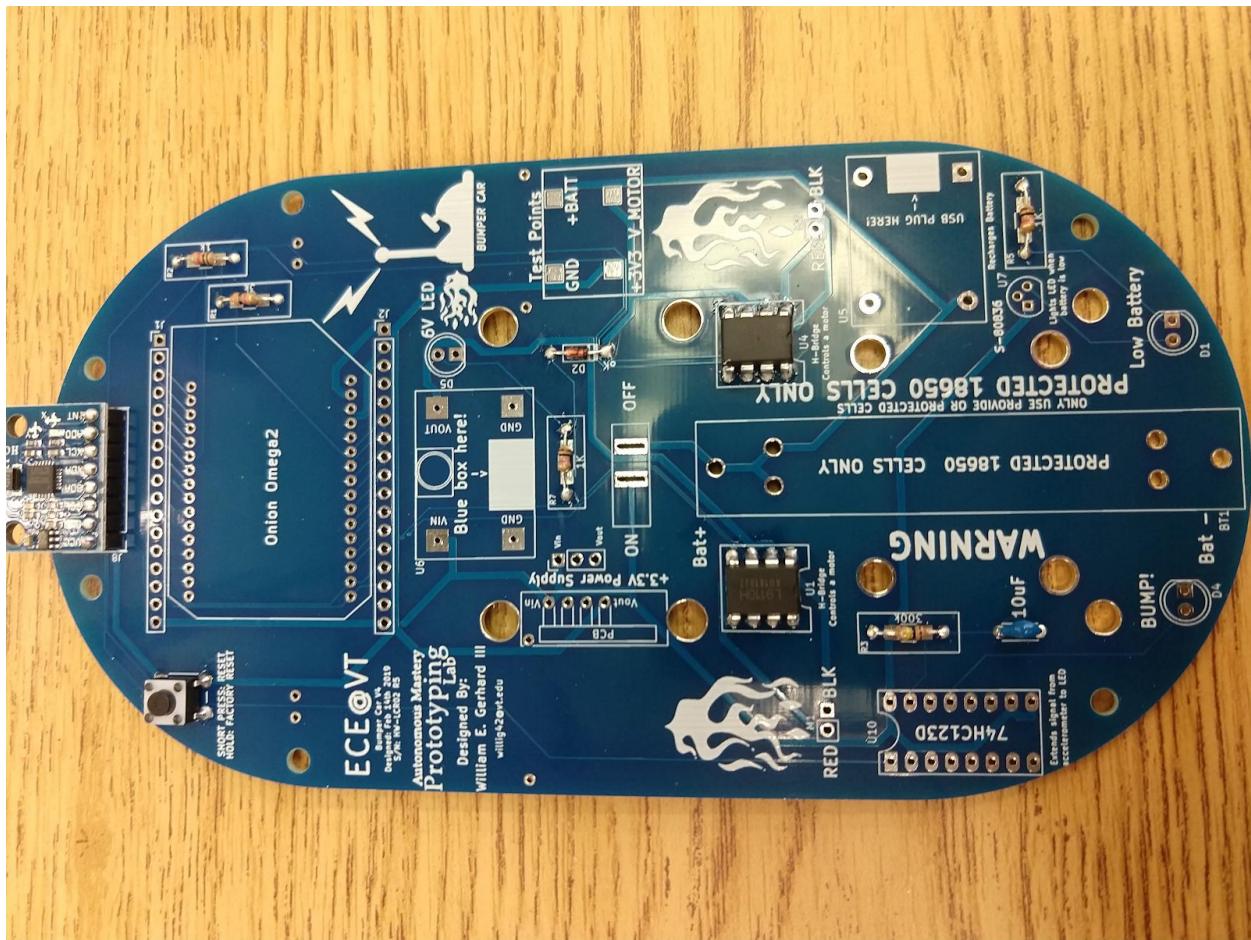
The go ahead and flip the board over and solder it.

Now do the same thing to the other side.



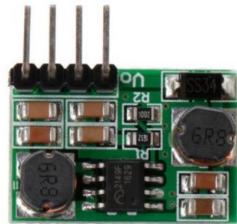


Your board should look like this!

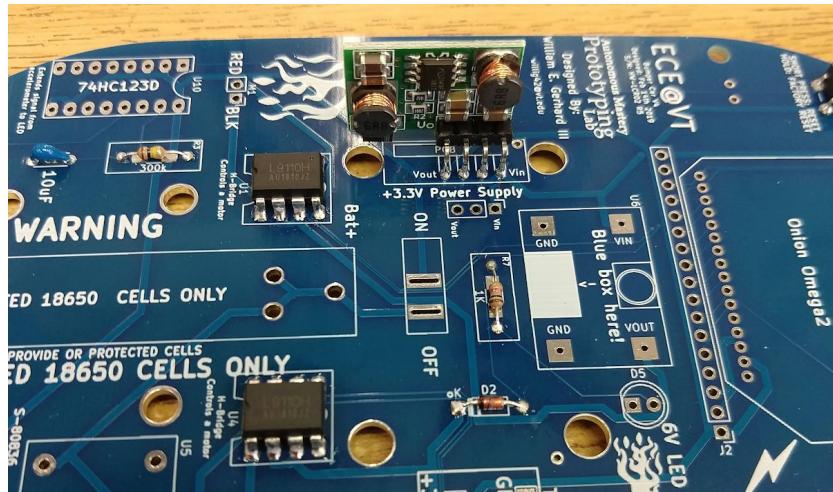


Step 9: Install 3.3V Power Supply

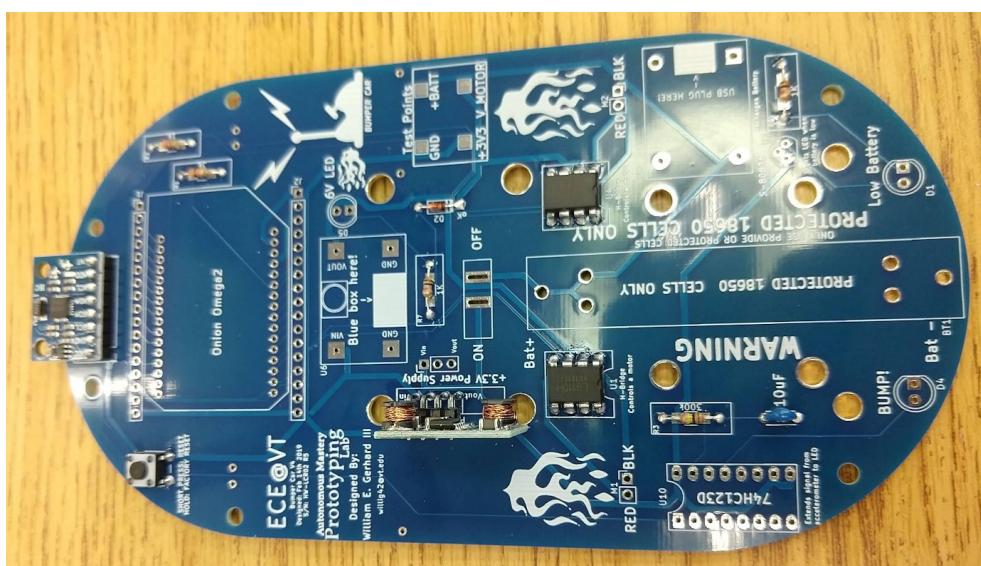
Look for a board that looks like this:



Insert it into the board as shown below and solder it. Note that if you are using version 5.1, it will have a different orientation on the board.

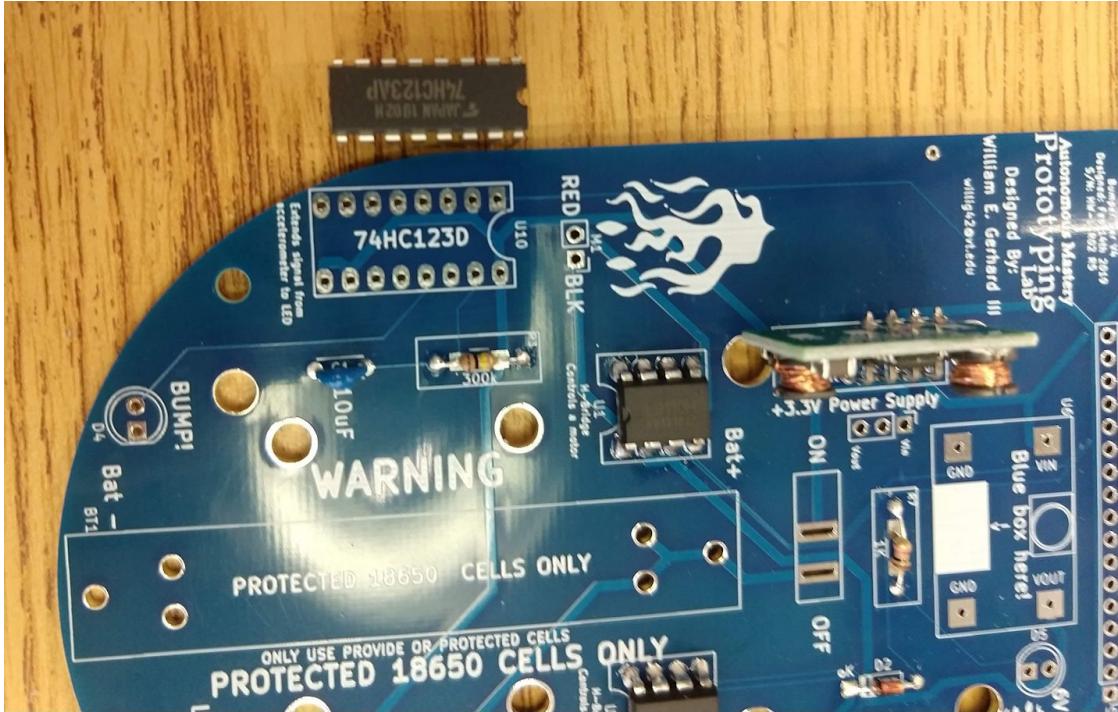


Your board should look like this:

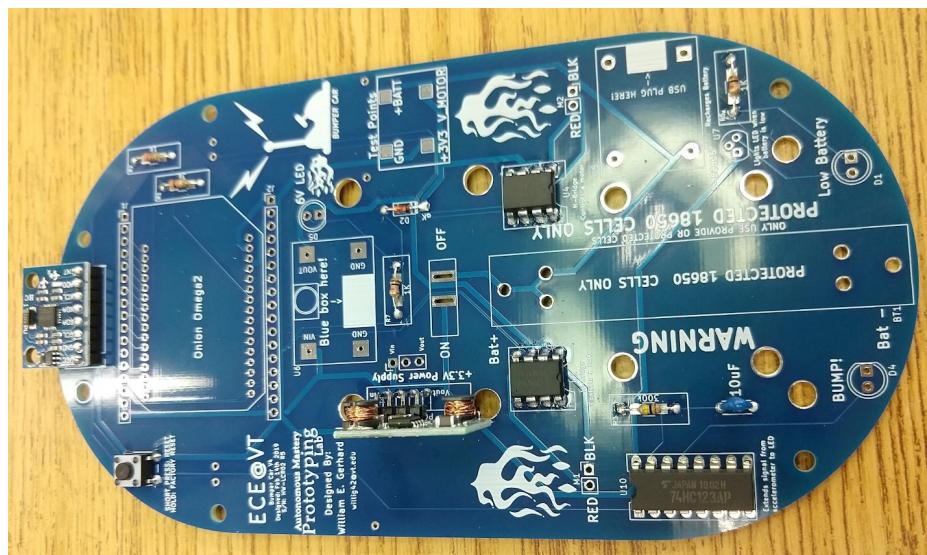


Step 10: Install the 74HC123D IC Chip

Look for a chip that looks similar to the motor drivers. Just like the motor drivers, line up the notch with the board,



Insert the chip and solder it in place!



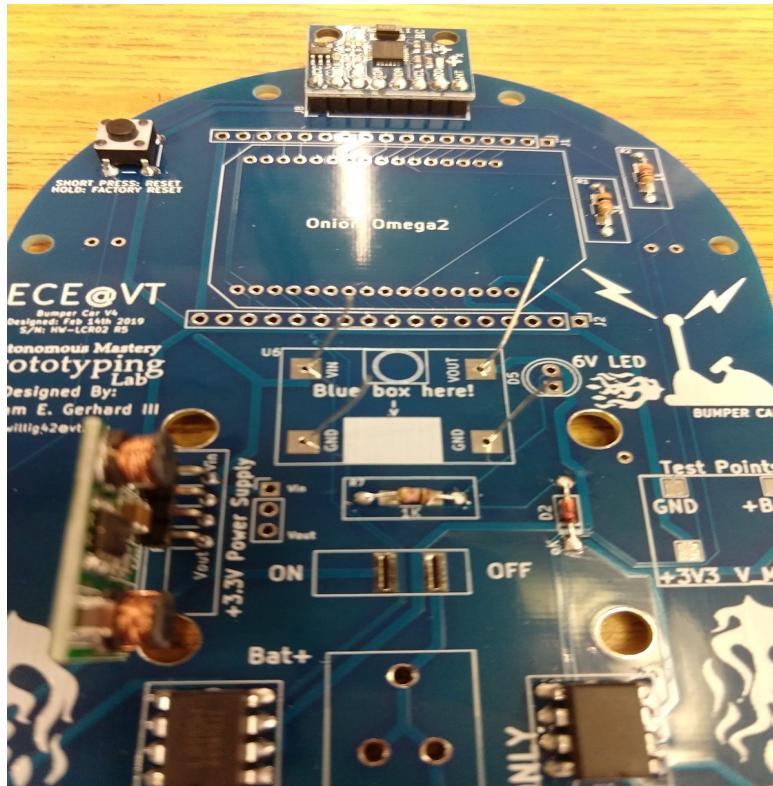
Step 11: Install the Boost Converter Module

Look for a bag with a module that looks like this:

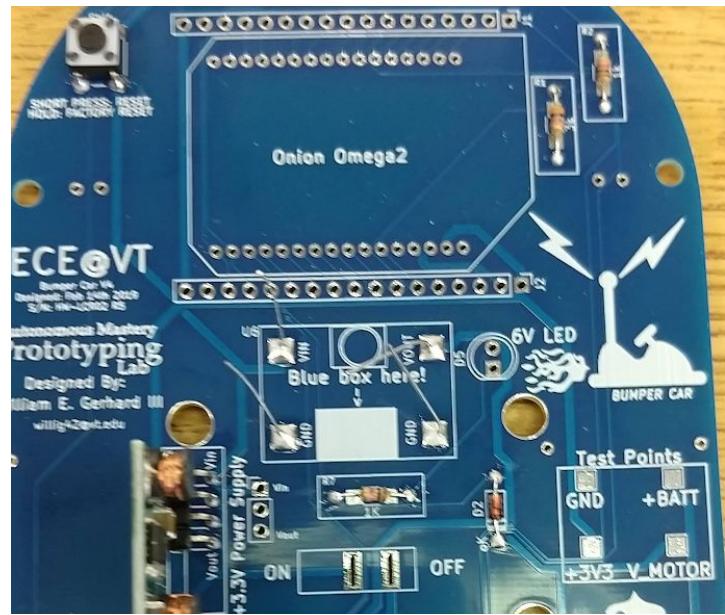


Go ahead and put it aside for the moment.

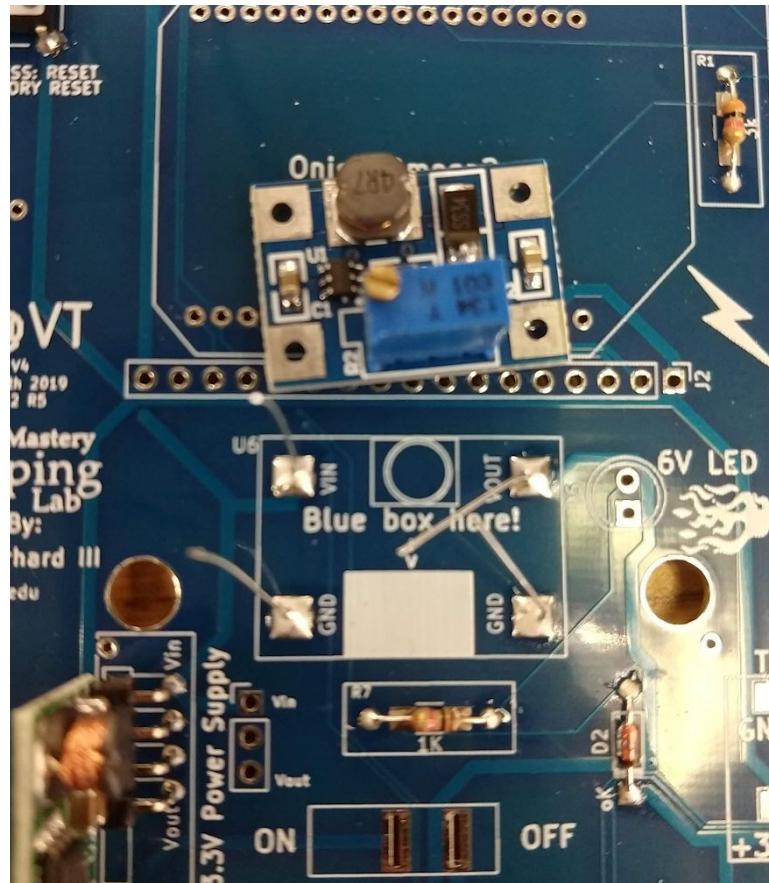
Remember those leads we saved earlier? Here is where they come in! Grab 4 leads and place them in the holes like so:



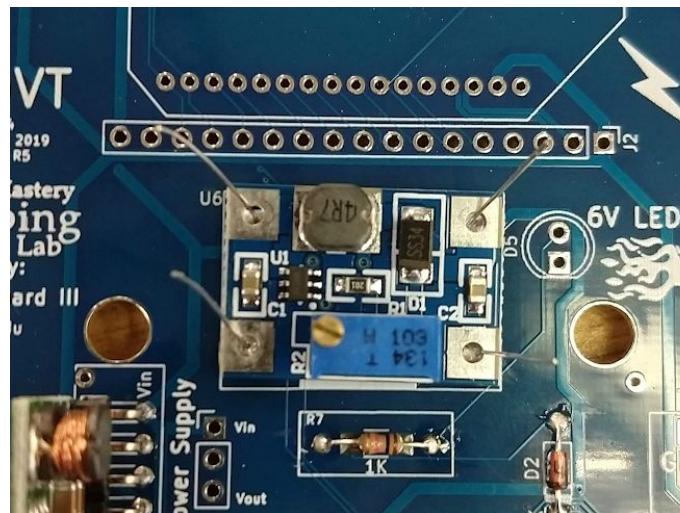
Now, solder them in place:



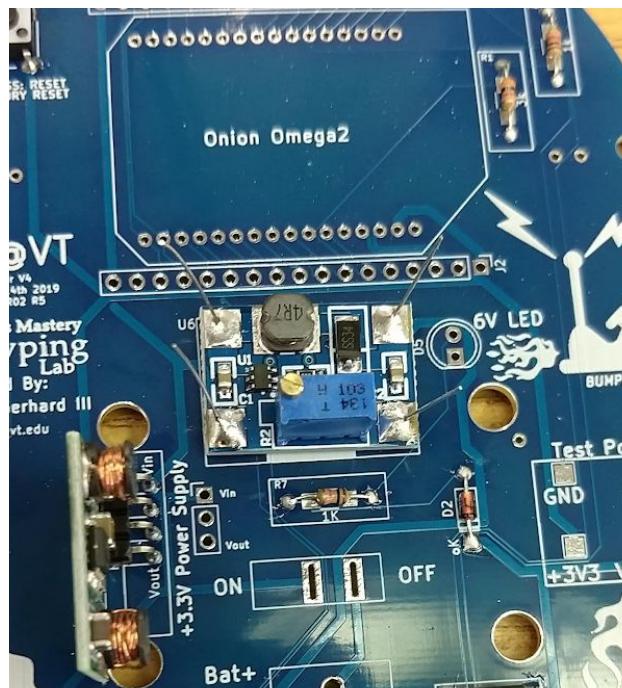
Now, take the module and orient it so that the blue box with the screw is at the bottom:



Slide the module through the leads. You may have to bend them to get it to fit!



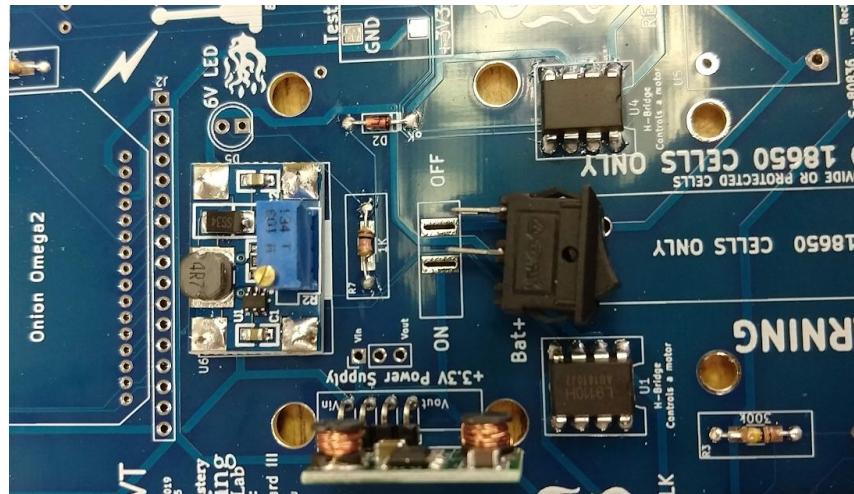
Solder the module to the leads.



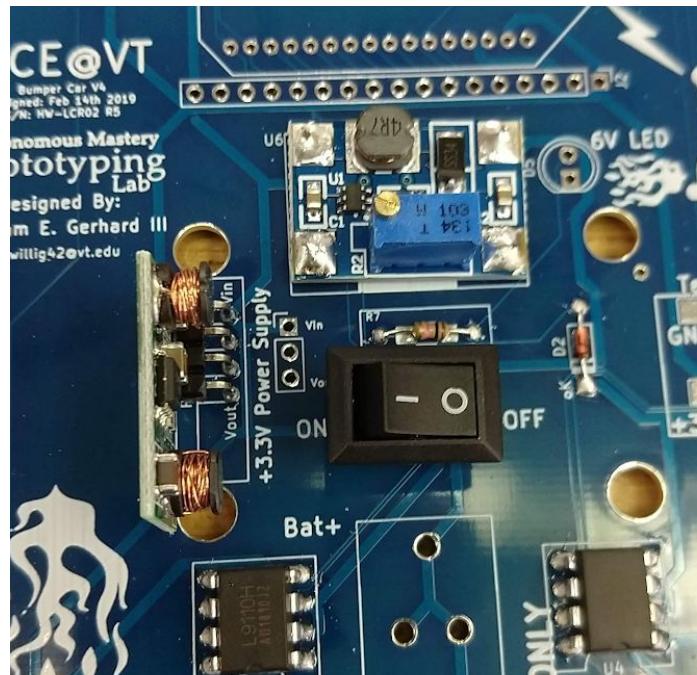
Go ahead and trim the leads on both sides.

Step 12: Install the Power Switch

Look for a black switch on your bag. It should have a 0 and a 1 on it. Orient it like so on the board:

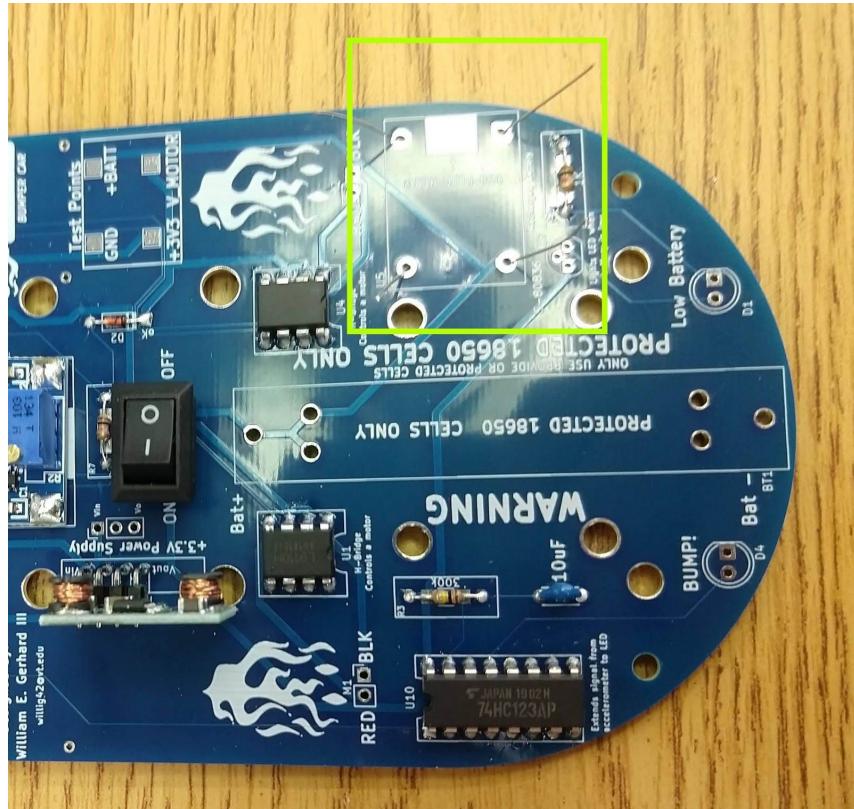


Slide the switch in place and solder it. If the orientation is correct, the 0 should be on the side that says "OFF" and the 1 on the side that says "ON".



Step 13: Install the Battery Charger Module

Just like with the Boost module, grab 4 clipped leads and drop them onto the board like so:



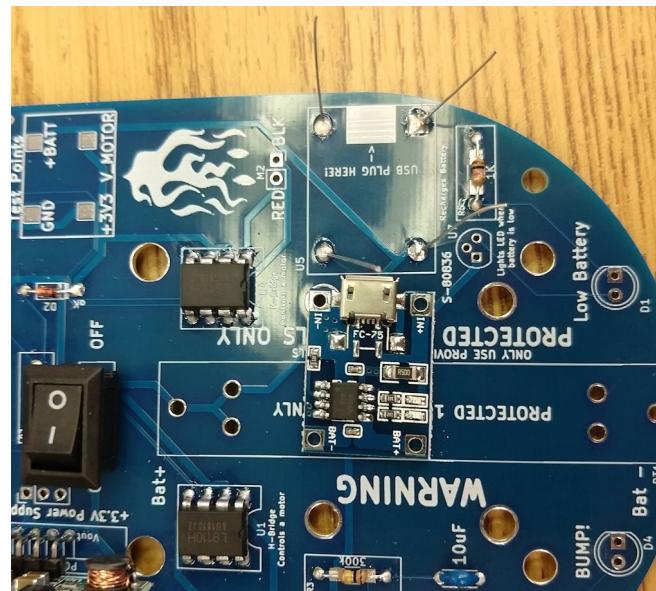
Solder them in place:



Find a module that looks like this:



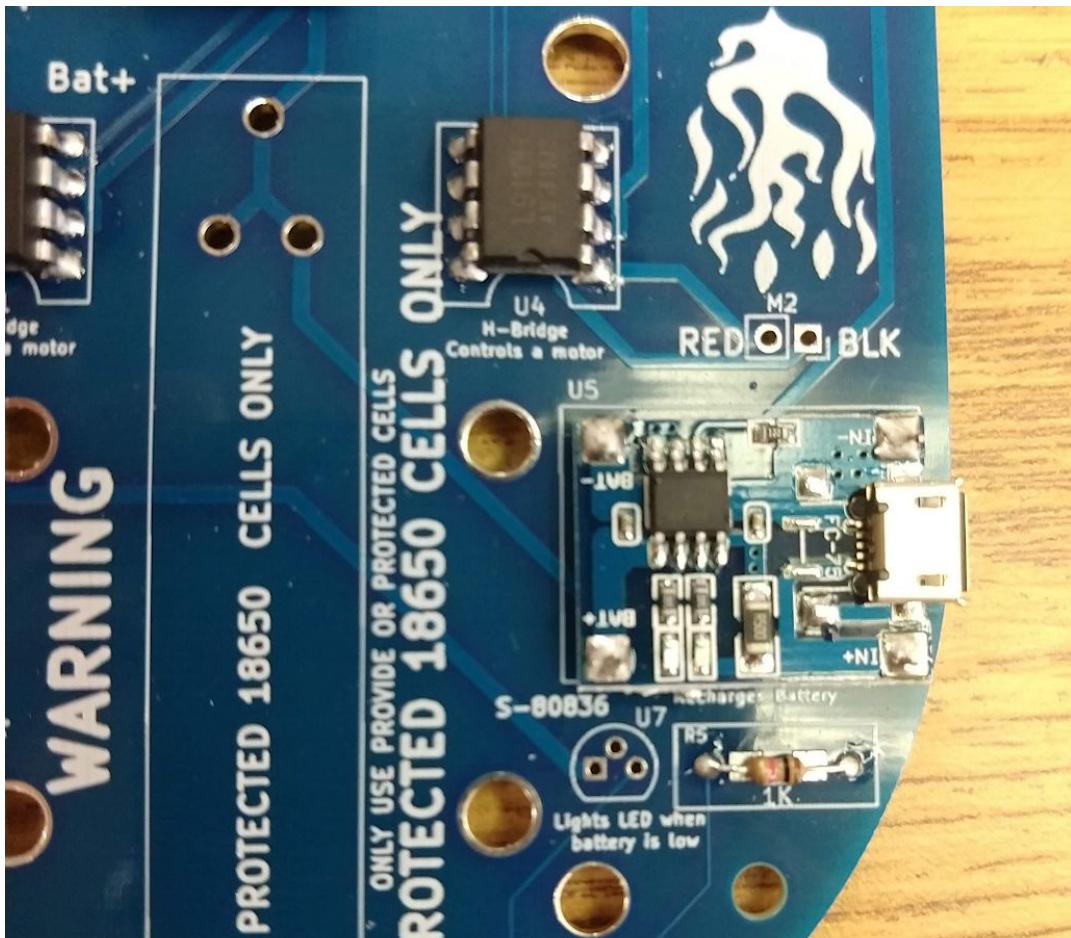
Orient it so that the micro-USB connector points outward:



Slide the module over the leads,

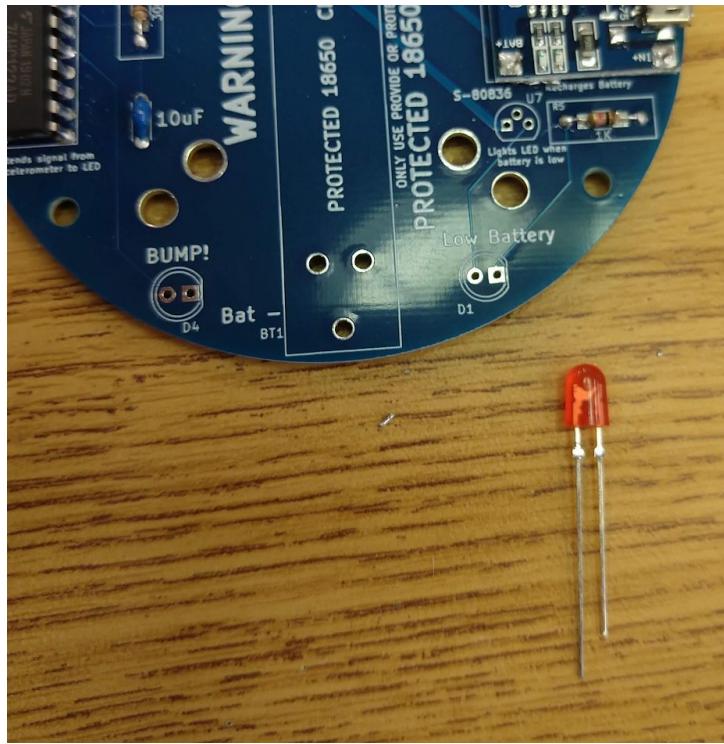


And solder it in place. Also, trim the leads on both sides.

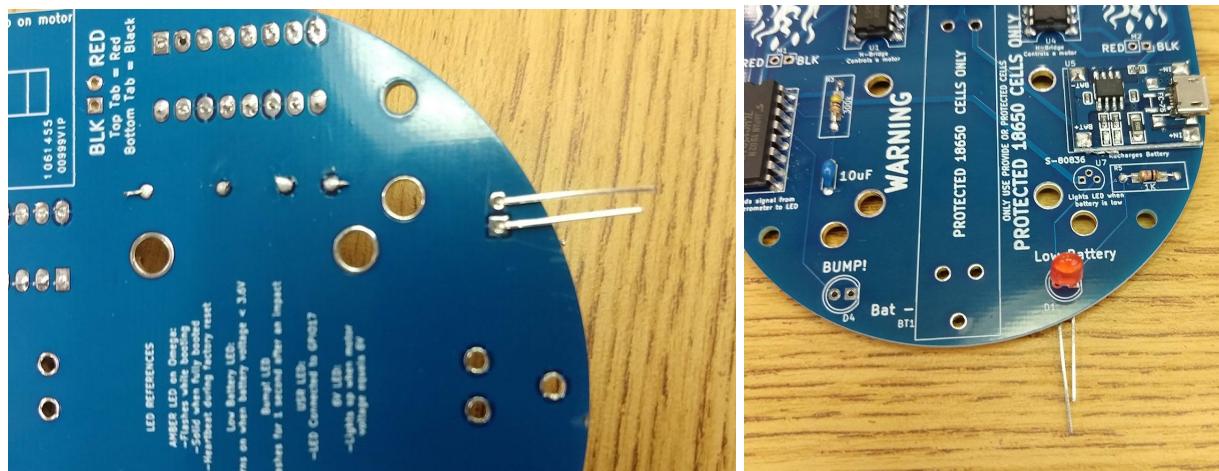


Step 14: Install the Red LEDs

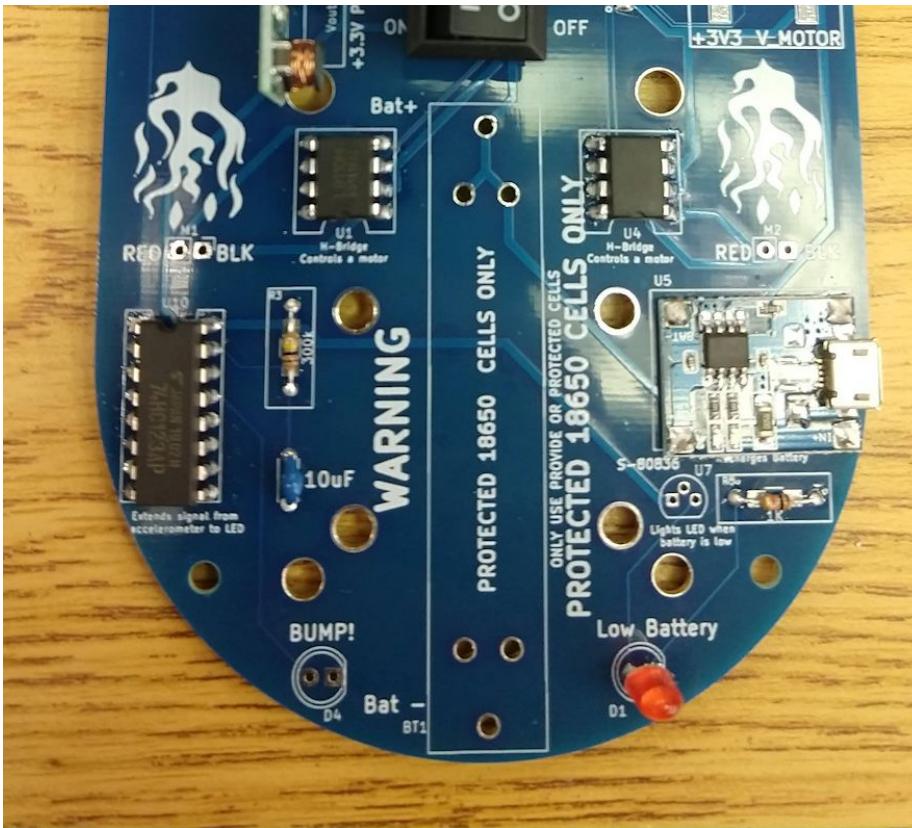
Look in your bag for two red LEDs. Note the two lead lengths. LEDs are polarized, so the shorter lead is the negative. It should go in the hole with the square shaped pad.



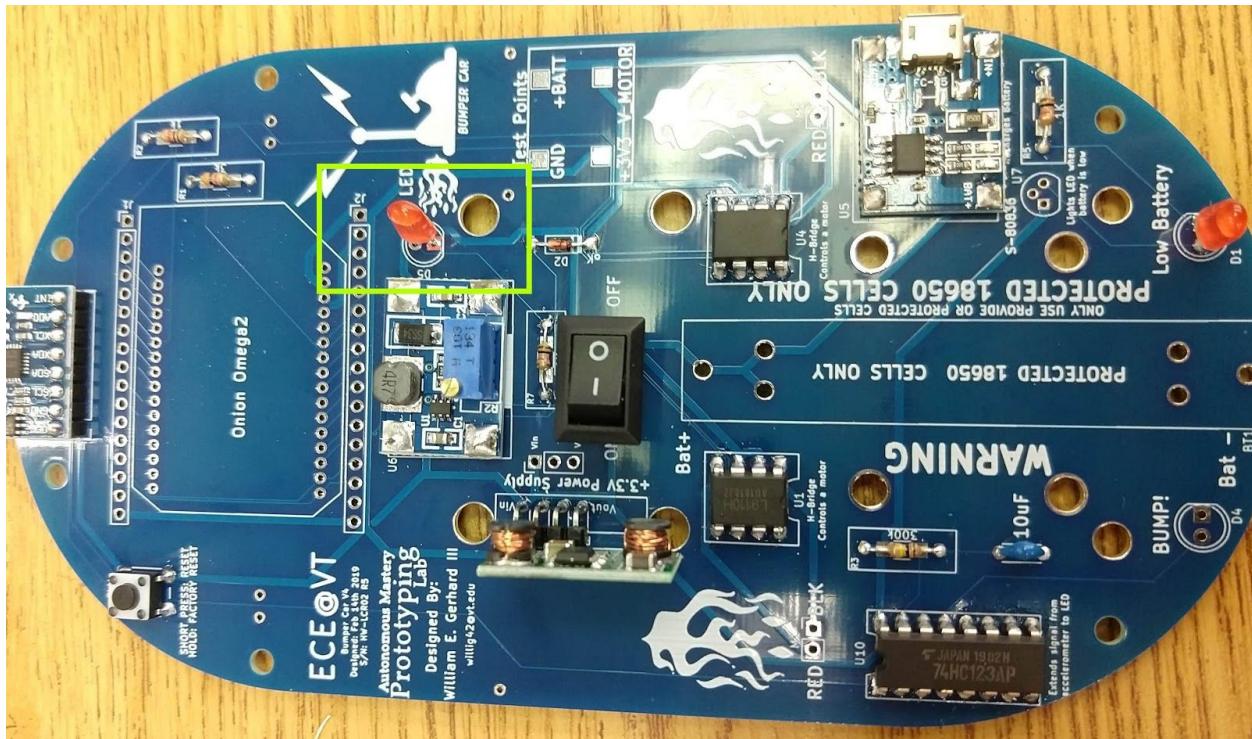
Bend the leads over:



And solder them in place. Clip the excess leads too.



Repeat this for the 6V LED:



Step 15: Install the RGB LED

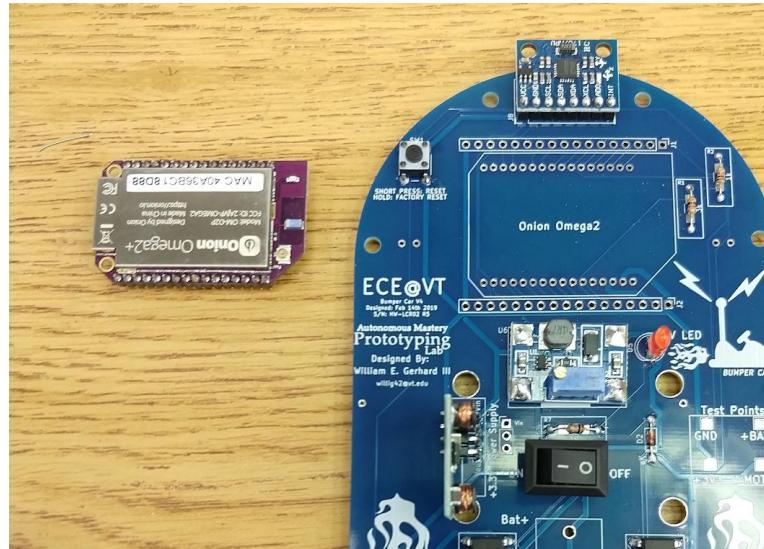
Look for an LED that is clear. It goes where the “BUMP!” spot is located.



Solder and trim the leads like before.

Step 16: Install the Onion Omega

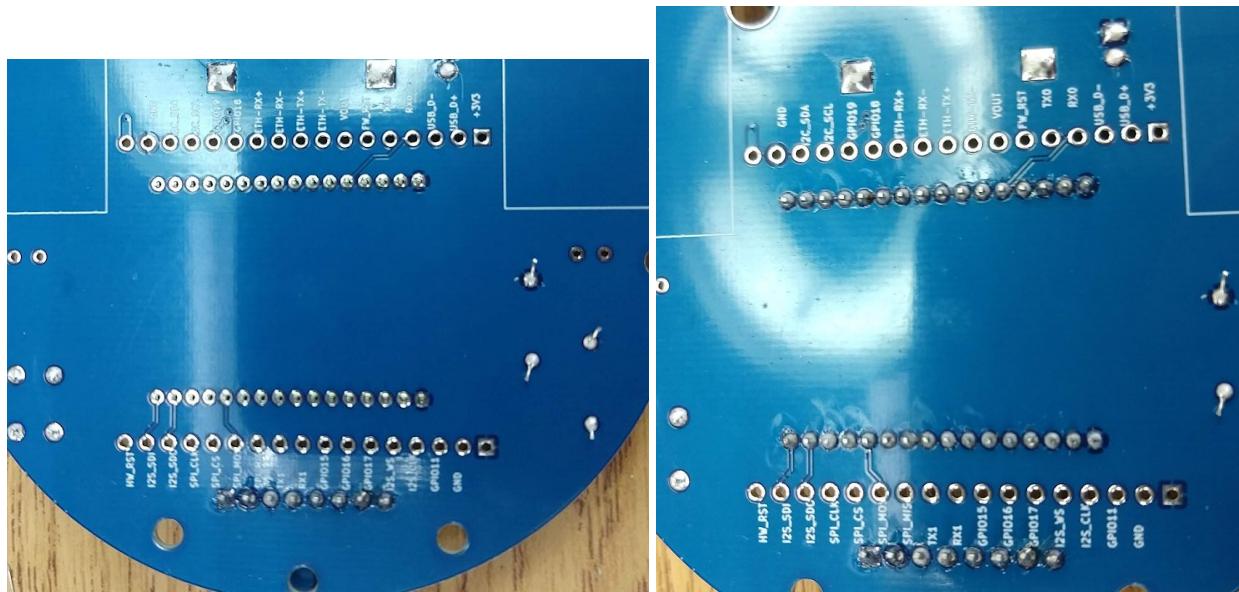
Find a box in your kit. It should say “Omega”. Open it up and remove the board. Orient it so that the diagonal is on the bottom right and corner on the top right as pictured below:



Put the omega in place.



Flip the board over and solder the pins in place. Be careful not to add too much solder, as you can easily create a solder-bridge if you aren't careful!

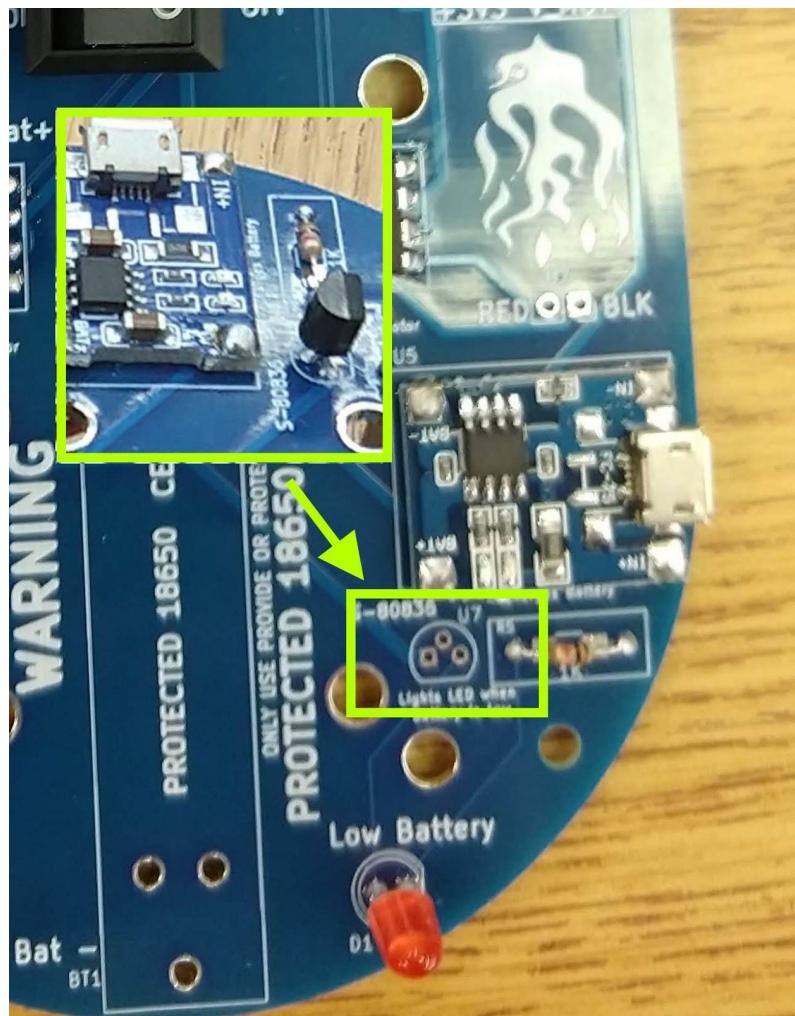


Step 17: Install the Transistor

Look for a component that looks like this:

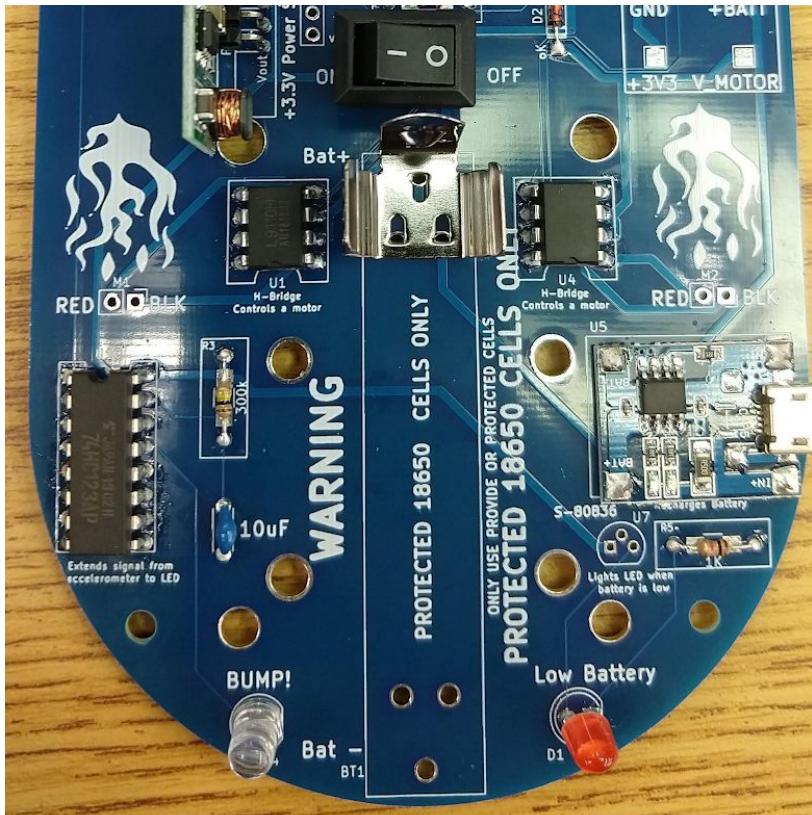


One side of it is flat. Align it with the flat of the board and solder it in:

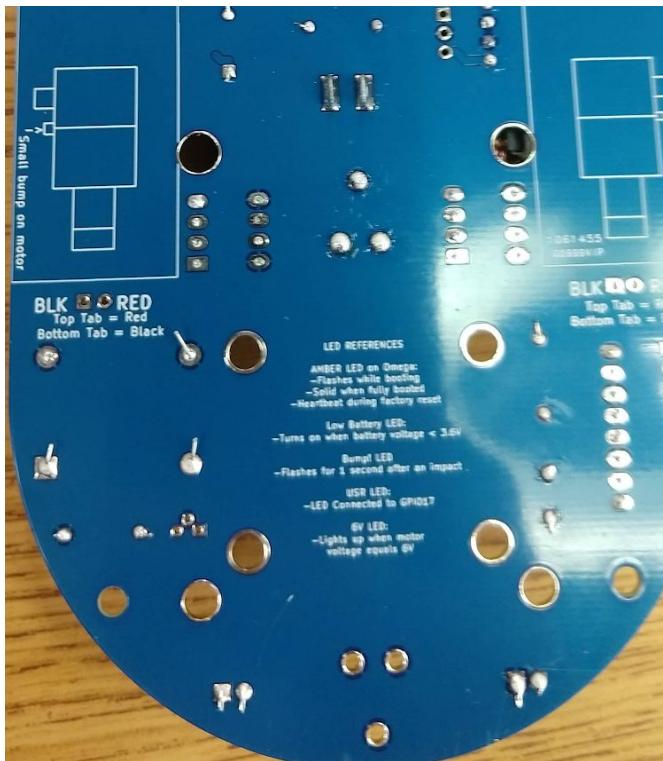


Step 18: Install the Battery Clips

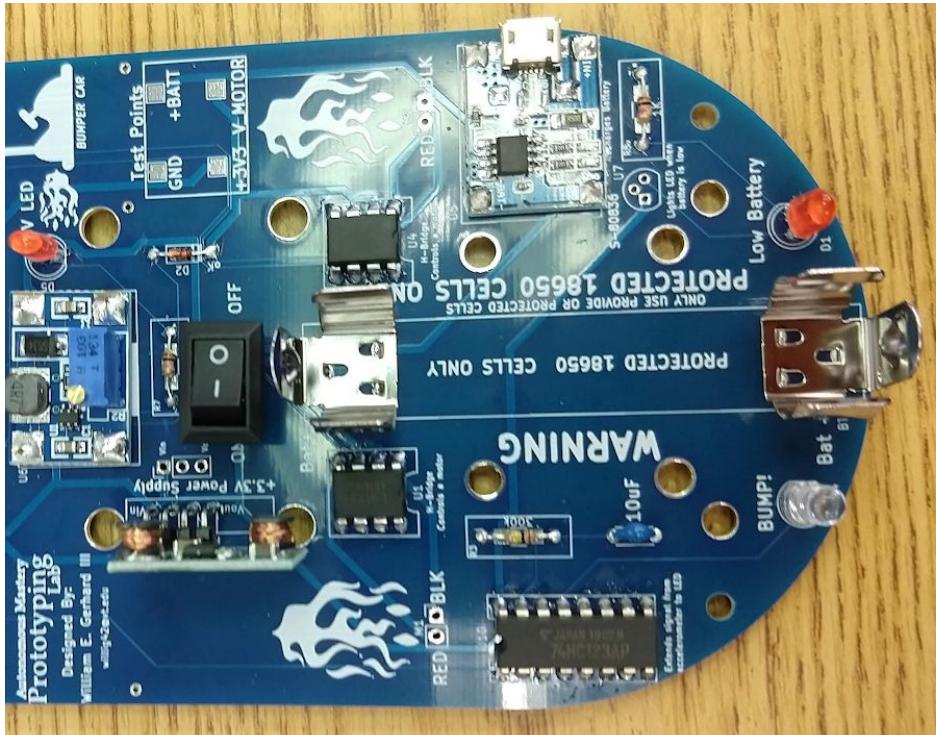
Look for two metal battery clips. Drop them in place like so:



Flip the board over and solder them in place. It might take a bit longer for the solder to flow due to the large component heating up. Be patient!



Repeat for the other clip:

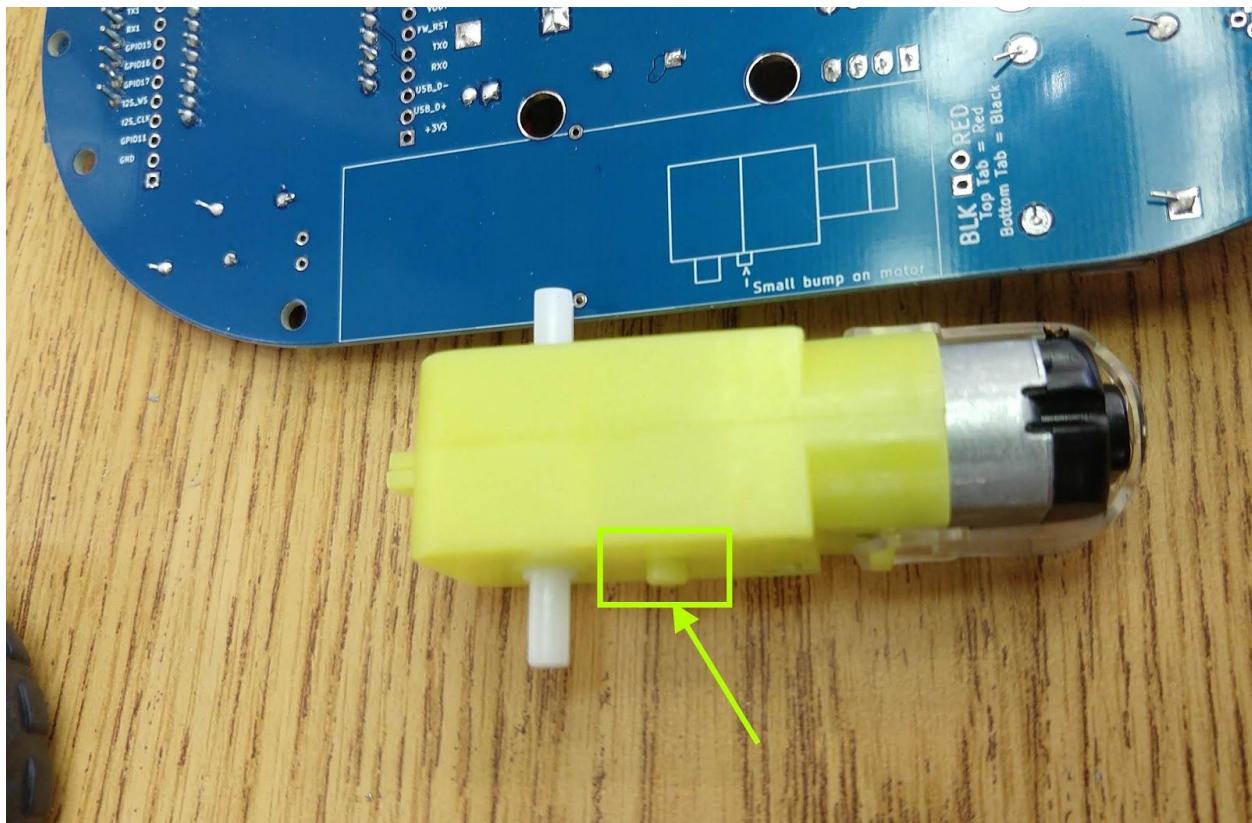


Step 19: Preparing the Motors

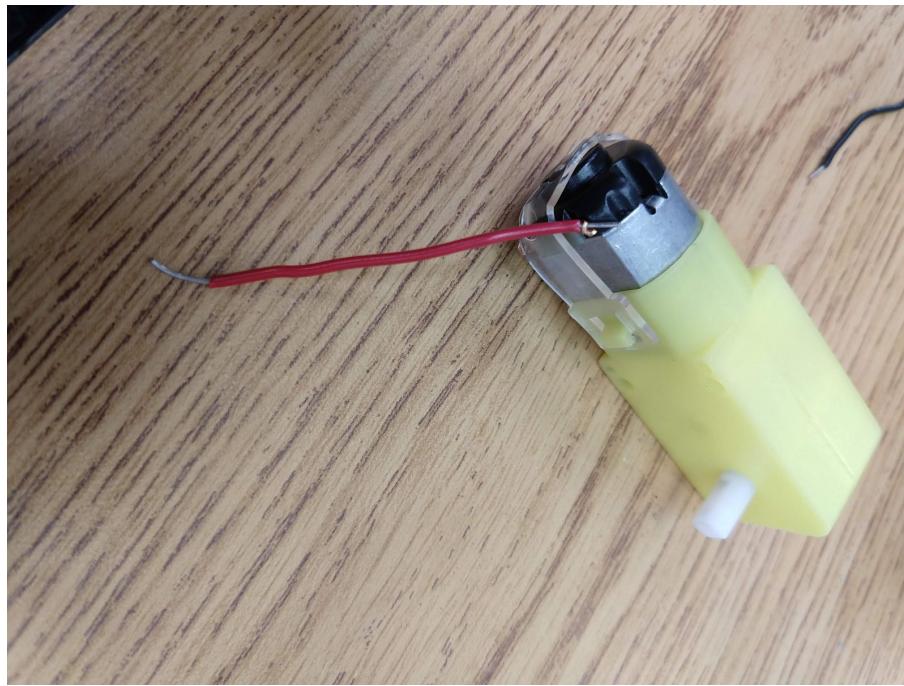
In your kit, there should be two motors and two wheels:

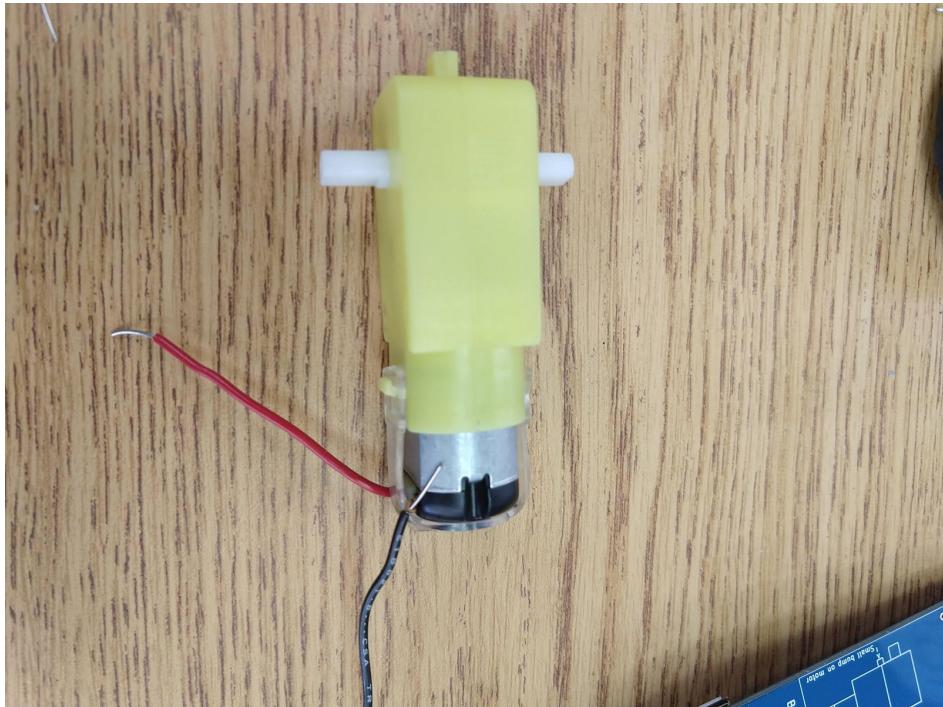


Take one of the motors and align it with the board so that the small bump points outward:

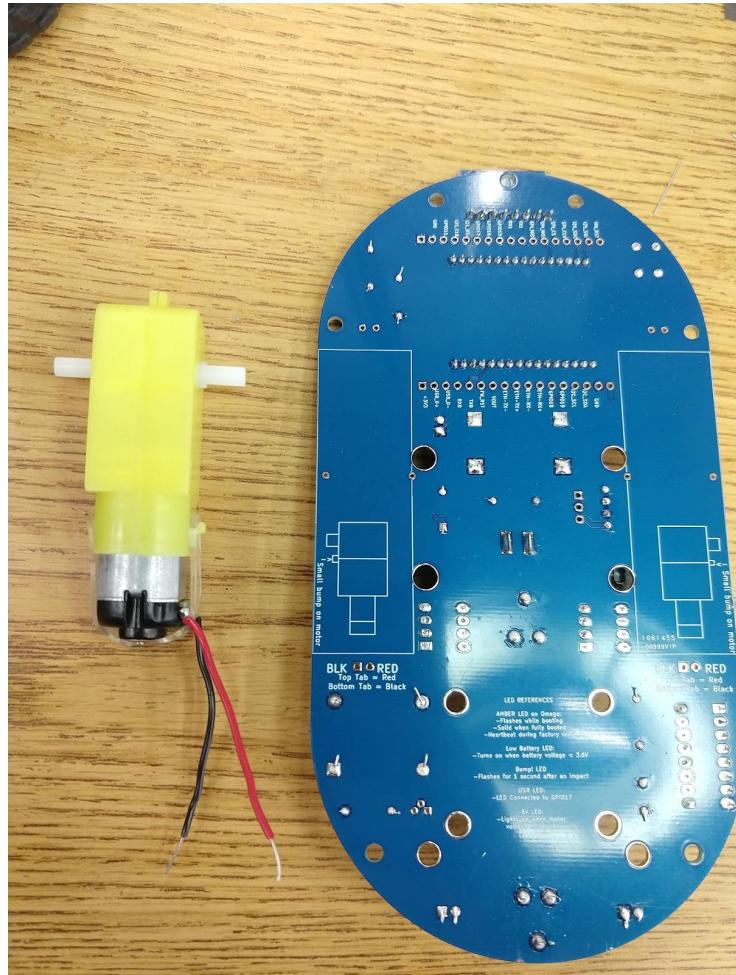


Now, take a black and red wire. Strip the insulation off the ends. Stick the red wire through the top tab, and the black through the bottom:



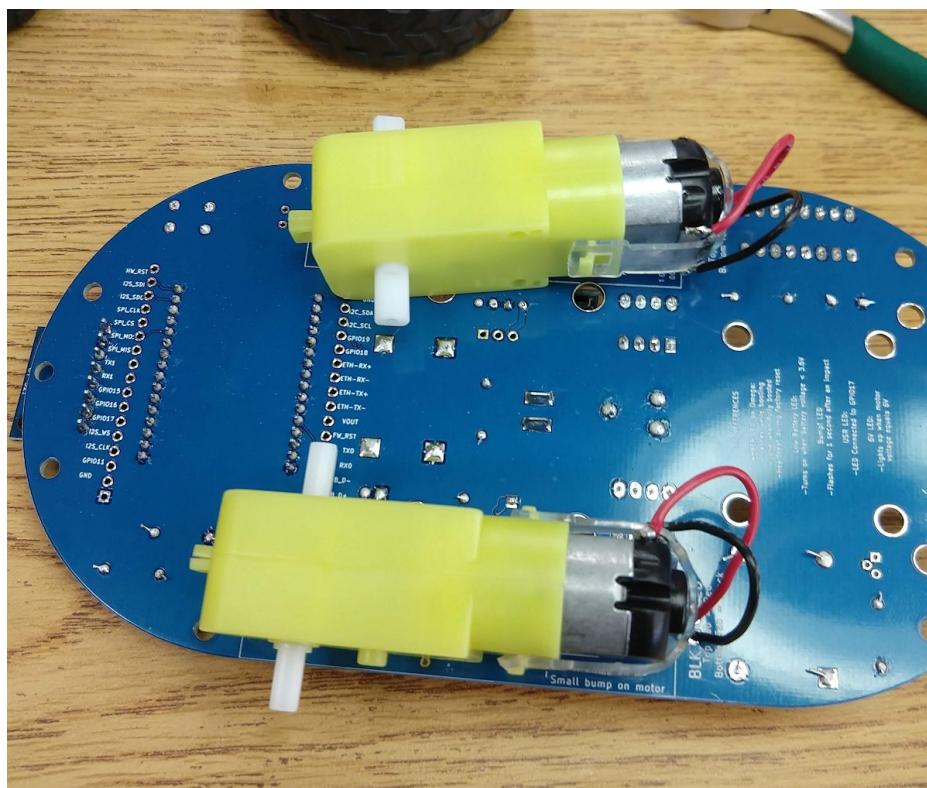
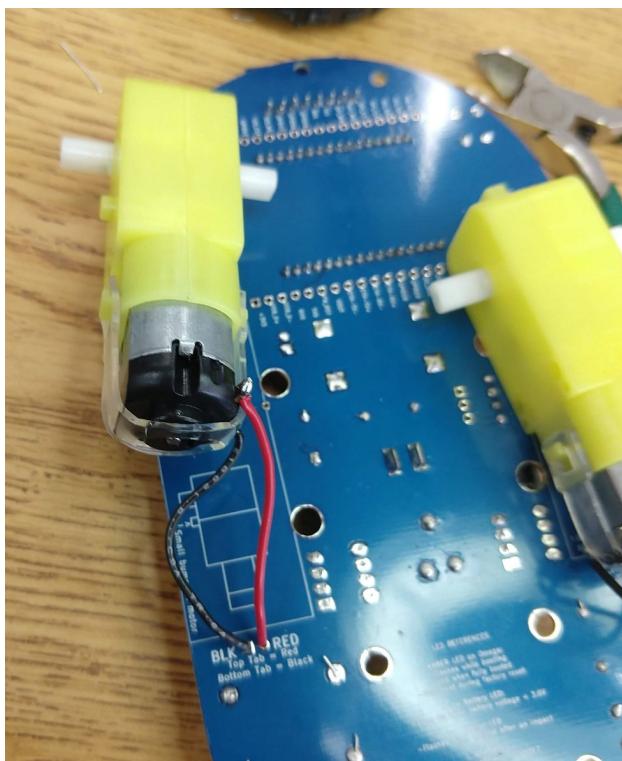


Solder the wires to the tabs and trim the excess wire. It should look like so:



Repeat this for the other motor. If you look at them side by side, they will appear to be mirrored.

Insert the correct colored wires in the holes as shown below and solder them in place. Do the same for both motors.

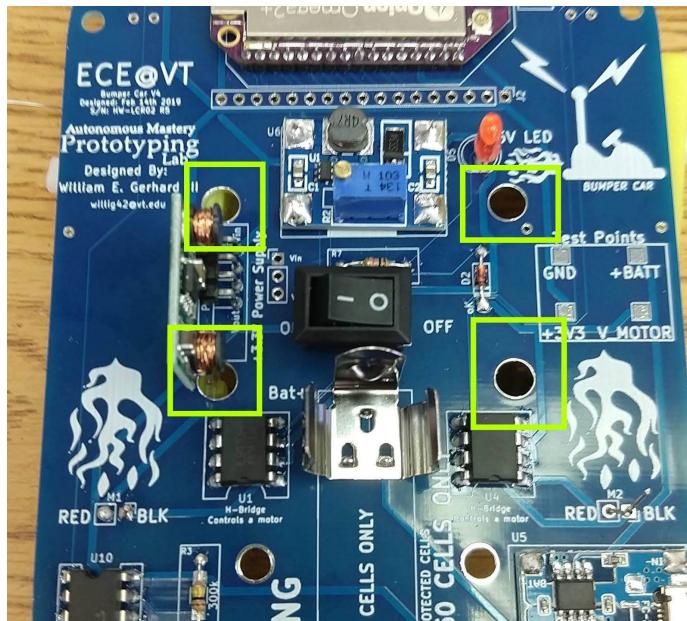


Step 20: Mount the Motors

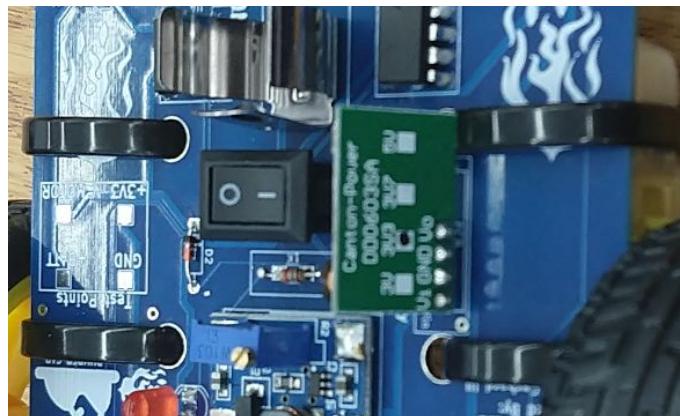
Find the four zip-ties in your kit. They look like this:



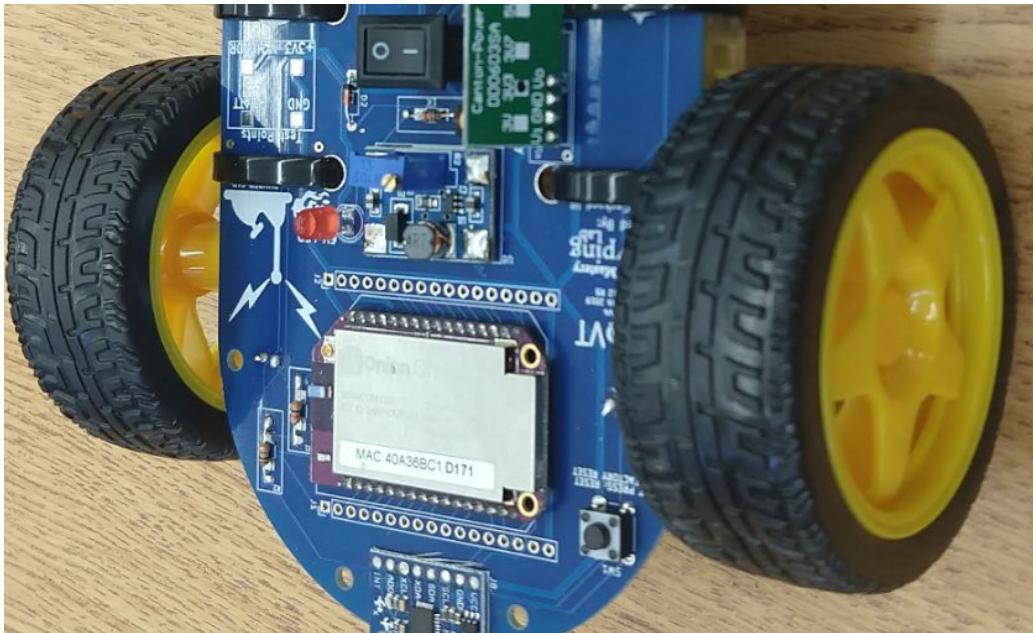
Take them and use them to mount the motors to the board through the holes shown below. The "head" of the zip-tie should be underneath.



You can tighten them using a pair of pliers if needed. Cut off the tail once tight.



After that, go ahead and install the two wheels by pushing them into the motors.

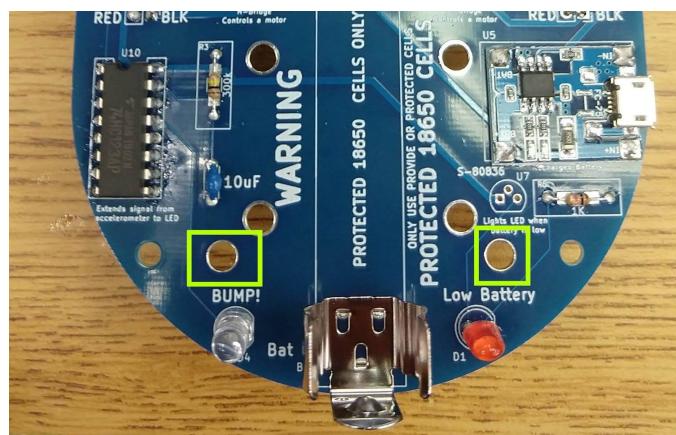


Step 21: Install the Rear Wheel

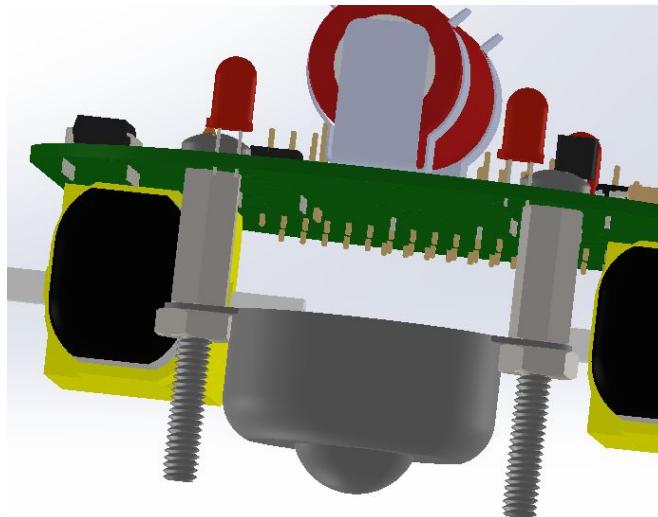
In your kit, there are two screws, nuts, and standoffs as well as a metal wheel:



Take the two screws and screw them into these two holes:



Lock them in place with the standoffs, then slide on the rear wheel, followed by the two nuts.



Step 22: Install the Battery

First, make sure that the switch is in the off position. Next, take the battery and find the side that is the positive.



Next, slide it into the battery holder so that the positive faces inwards (with the "Battery +" on the board)



With that, you have completed the assembly of your low-cost rover! Head over to the YouTube video <https://tinyurl.com/amplab-rover-video> to see how to configure the Onion Omega and get the WiFi working on the rover.

Congratulations!