Gizmo2 Building Instructions

The Gizmo2 board is made to look similar to the stunt versions of the Gizmo and Daughterboard used in the 2nd Ghostbusters movie. The stunt versions were not made of actual components. This kit uses real parts that are similar shape and color to the stunt parts.

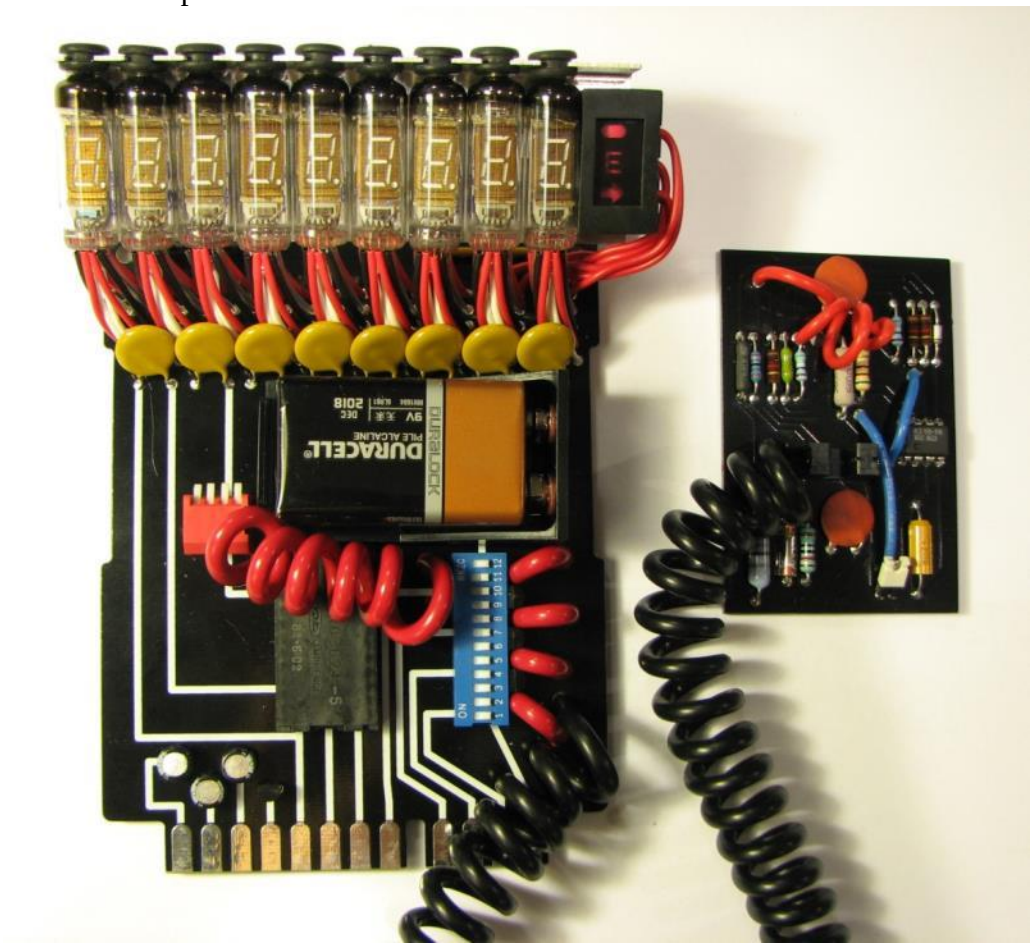
The kit contains a real circuit board with plated fingers on the card edge connector and has a black solder mask and a design in the top silk layer to make it look like the stunt version.

Reference photos:

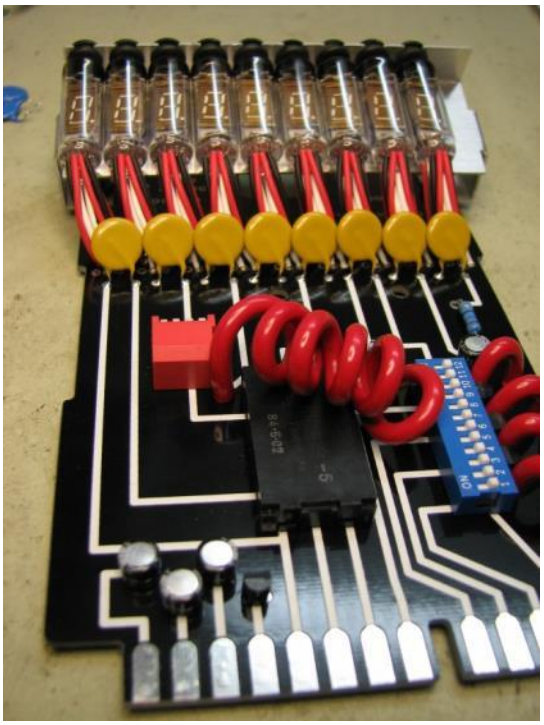




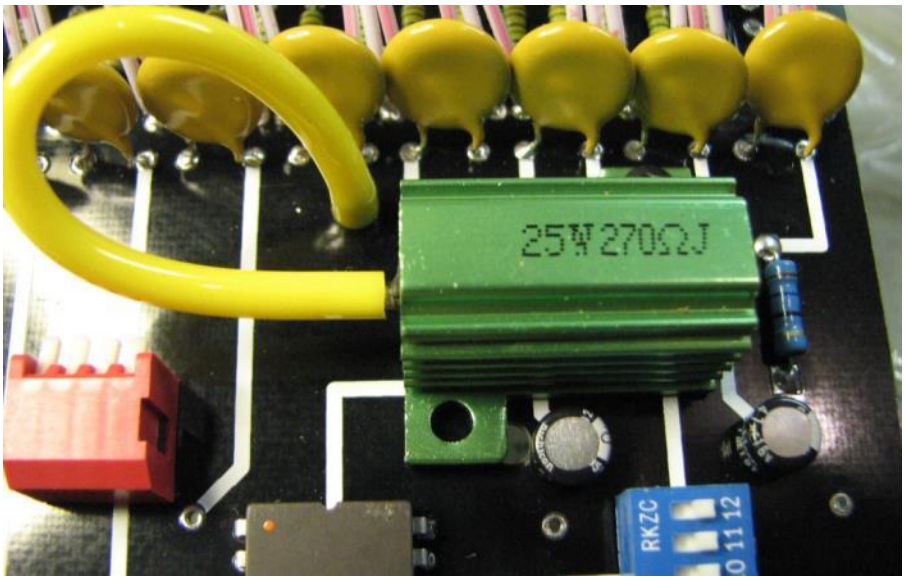
And here is a photo of a finished Gizmo2 kit:



For those that do not like the battery holder and LEDs, you could also just leave the battery holder, etc. parts off:



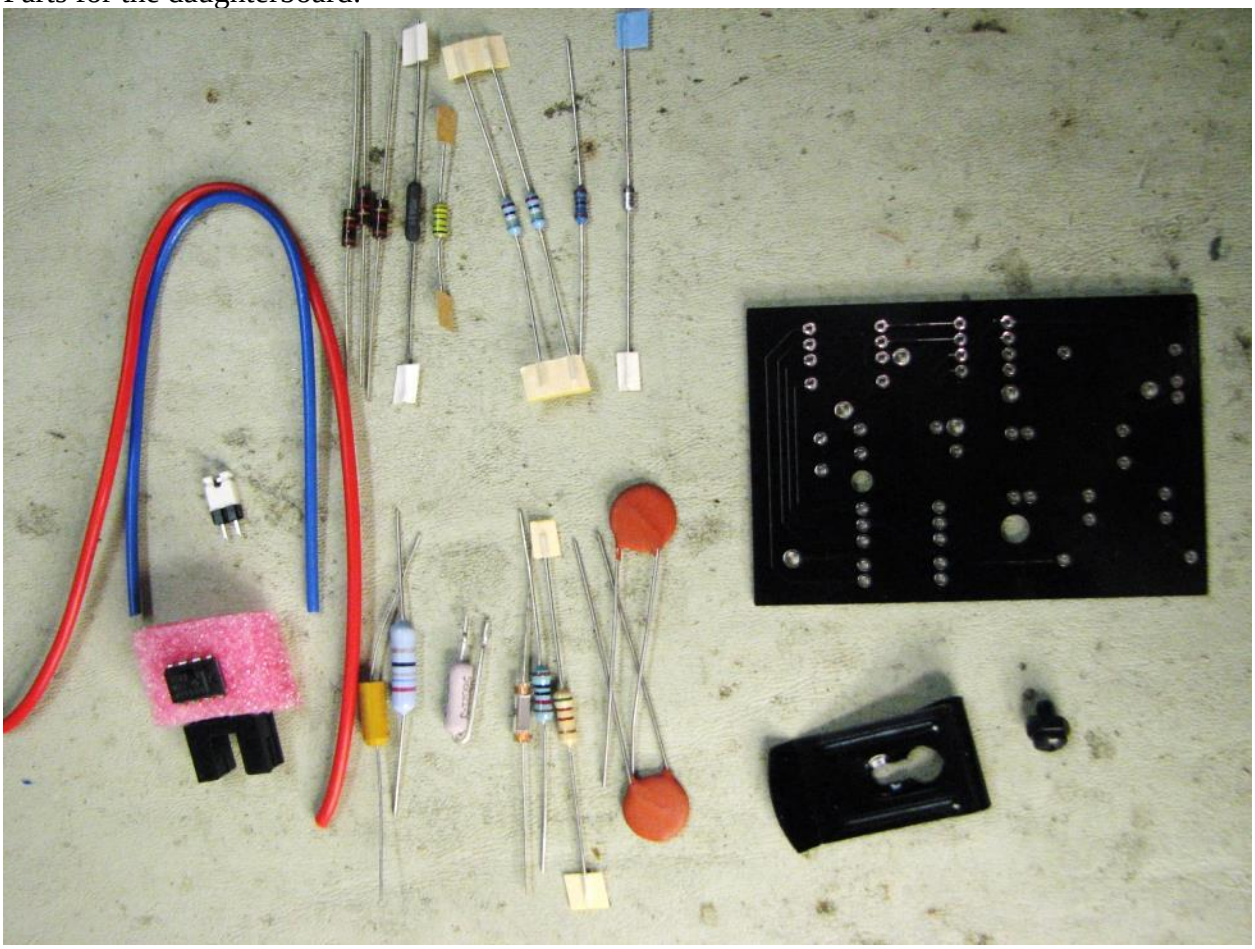
Or replace the battery holder with a power resister and some excess yellow tubing (not included in the kit) to fill that space:



“DB2” Daughter boards

There is a black version of the daughterboard circuit board and is similar to the DB2 version of the daughterboard kit that comes with the Sanyo Gizmo board replica kit.

Parts for the daughterboard:

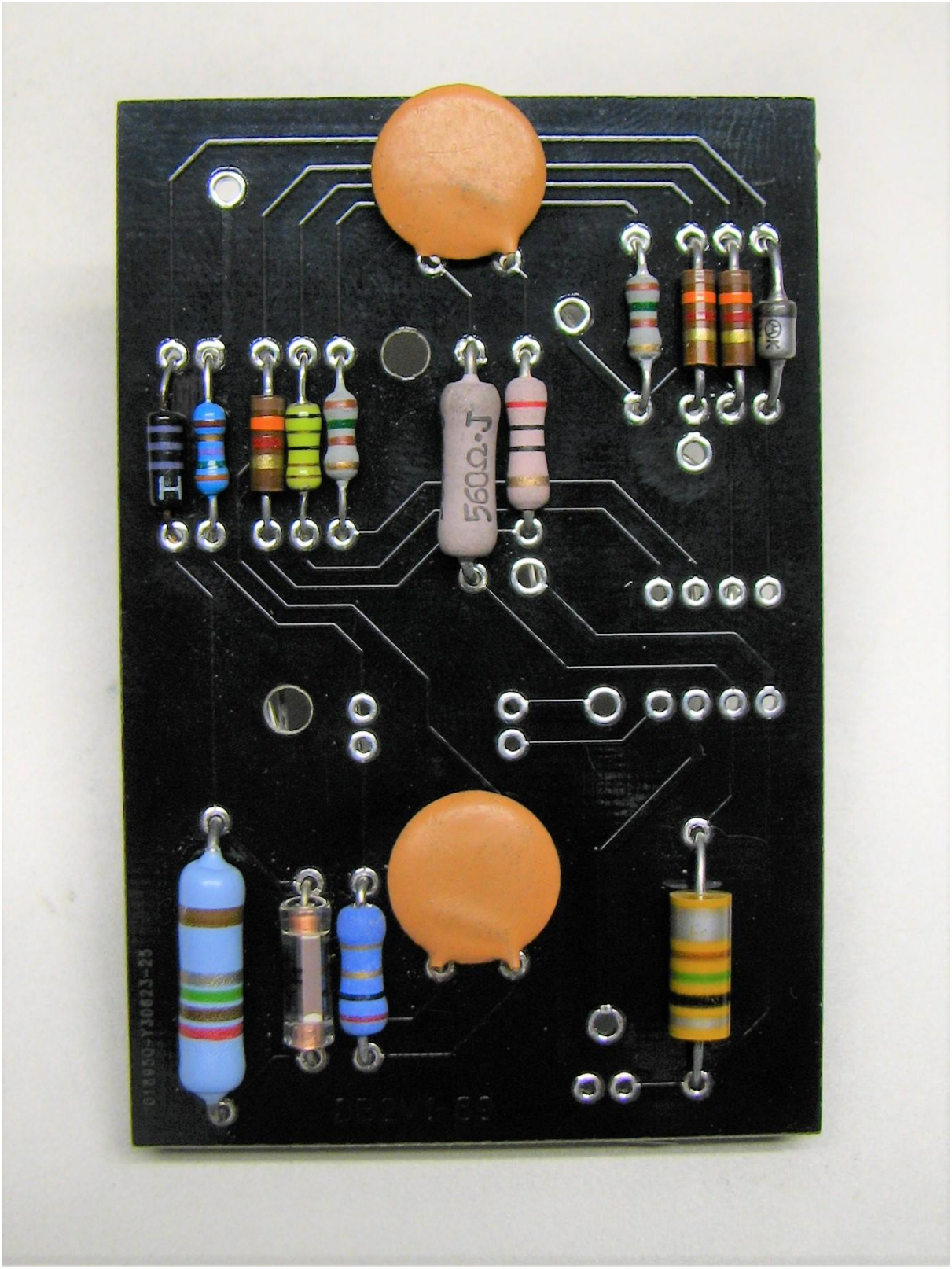


It is easiest to build up the board with the shortest parts first. This allows you to place the parts on the board and then flip the board over, resting on the parts, when you go to solder the parts on the board. The order is not necessary and with the longer leads on most parts you can bend the leads on the back side of the board to hold the parts in place.

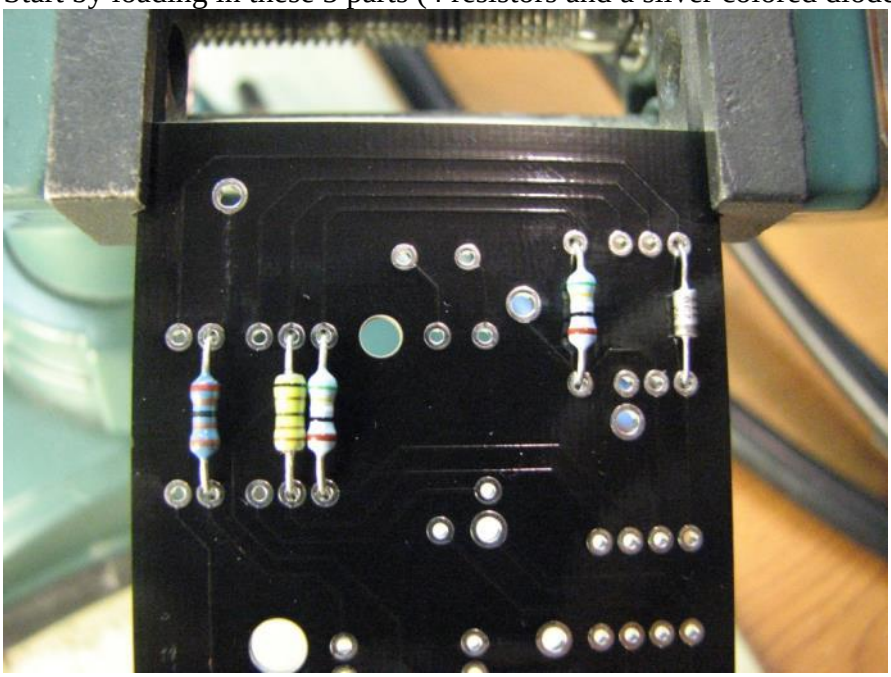
If needed, you could glue the parts in, but soldering is definitely preferred.

*** WARNING ***
Solder can contain lead and that is a poisonous substance, so be sure to keep the solder out of kids reach and wash your hands after handling the solder and before you eat or prepare food. It is best not to directly breath in the smoke when soldering, so a ventilated area is best and a light breeze from a fan can be very beneficial if you do not solder equipment designed to remove the fumes (much more expensive than the typical soldering tools most people have or purchase).
*** END OF WARNING ***
All parts are loaded on the “top” side of the board and the bottom side of the board with “DB2 DAUGHTERBOARD” printed in white is where you do your soldering.

Each run of daughter board kits will use parts I can obtain and may not be the exact parts used in the rest of these instructions. Here is a photo of the many of the parts loaded from the latest run of kits:

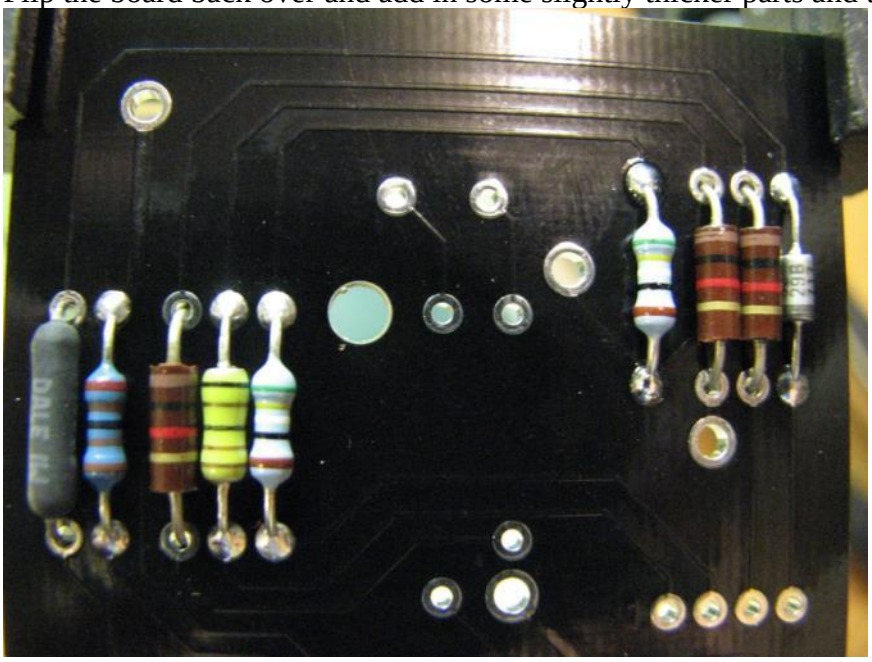


Start by loading in these 5 parts (4 resistors and a silver colored diode):

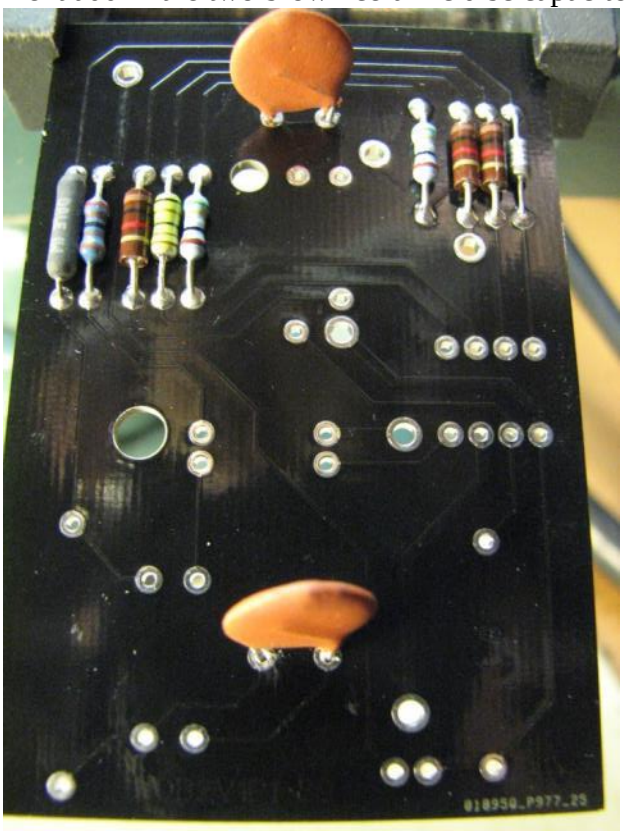


Flip the board over and solder the leads to the pads on the back side of the circuit board. For these parts, the solder is only used to make the part stay in place and look correct. No actual functioning circuitry is on the daughterboard so shorts or bad solder joints aren't much of an issue here.
After the leads are all soldered, use a set of diagonal cutters to clip the excess leads on the backside of the circuit board.

Flip the board back over and add in some slightly thicker parts and then solder those down:

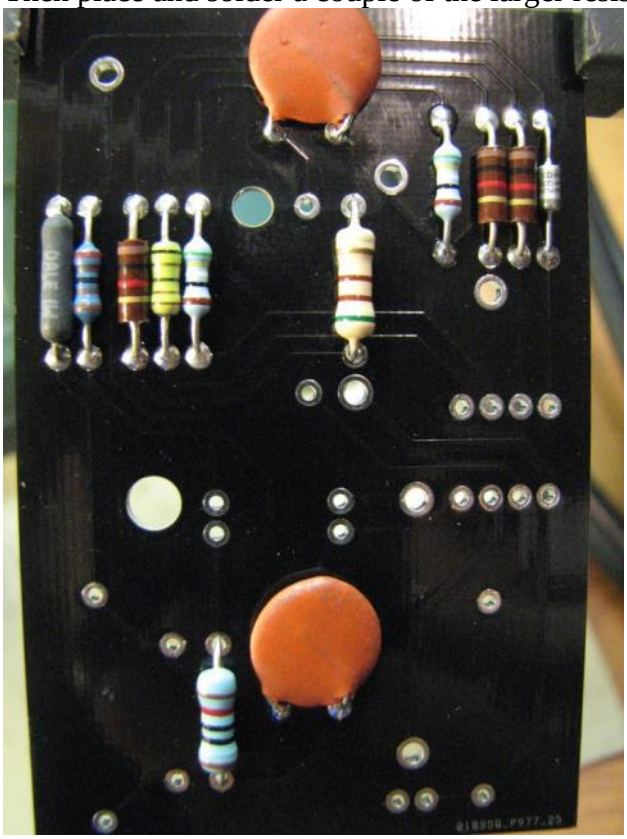


Next add in the two brown ceramic disc capacitors:

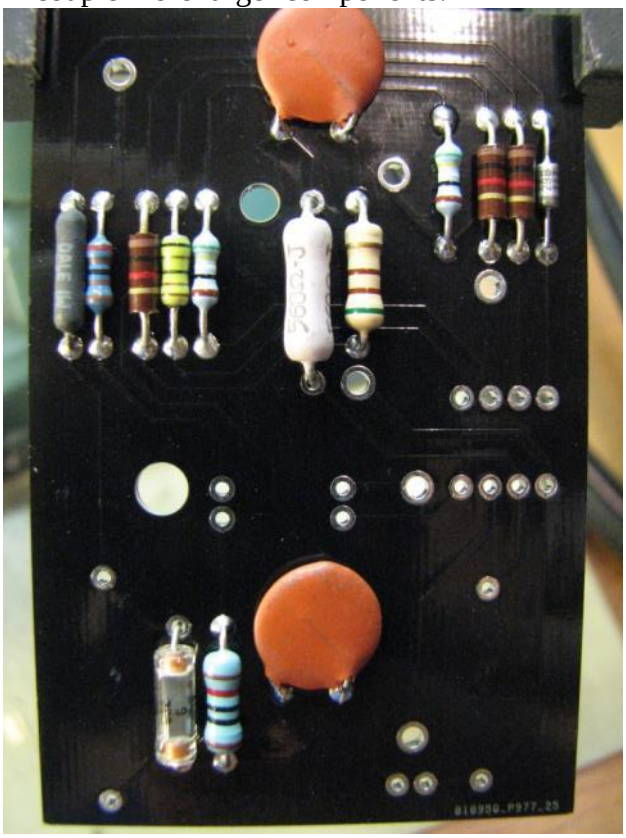


I like to solder them standing up and then bend them over, but you could bend them over first.

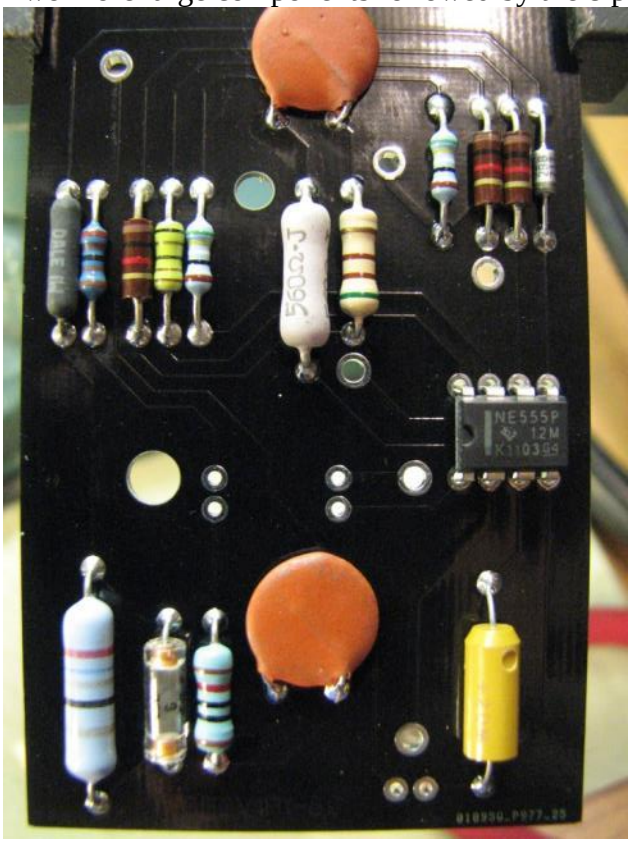
Then place and solder a couple of the larger resistors:



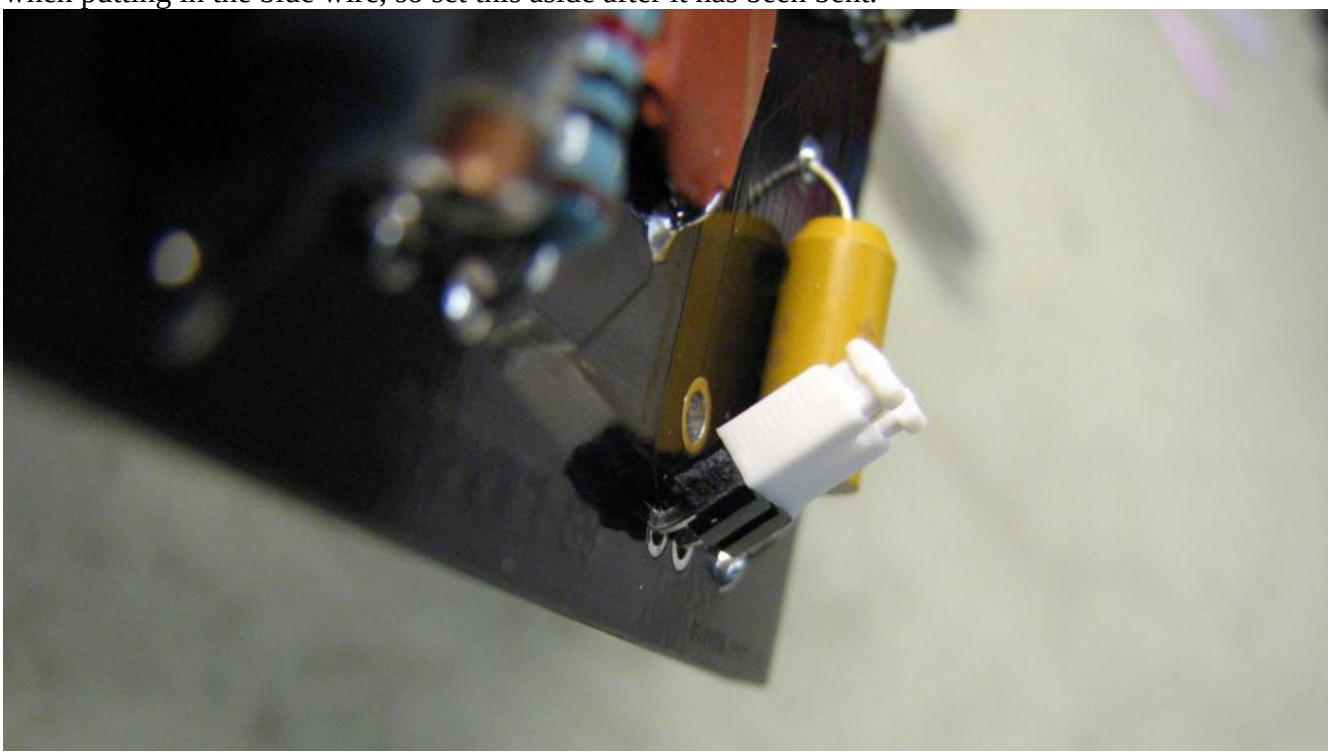
A couple more larger components:



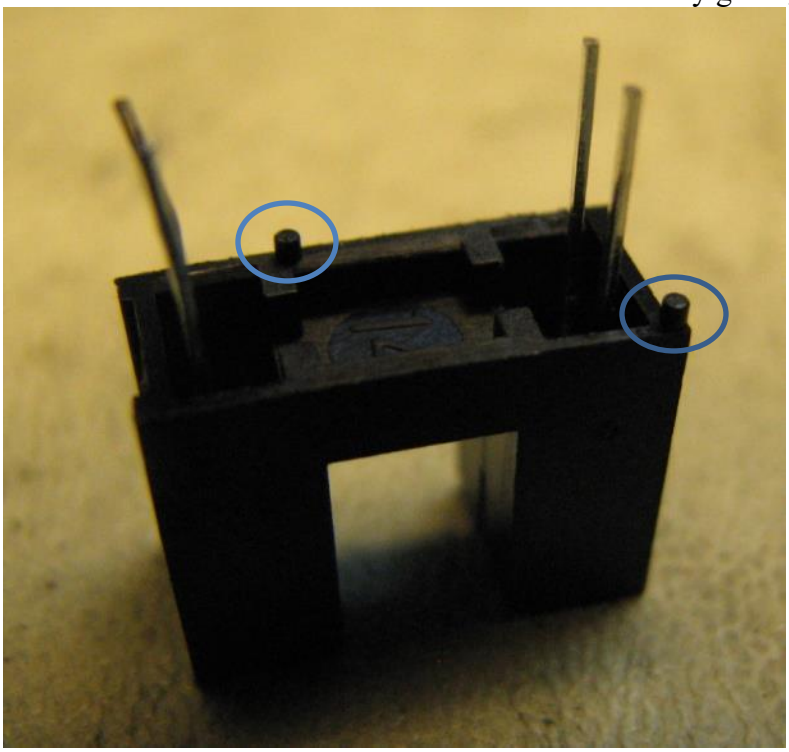
Two more large components followed by the 8 pin integrated circuit (IC):



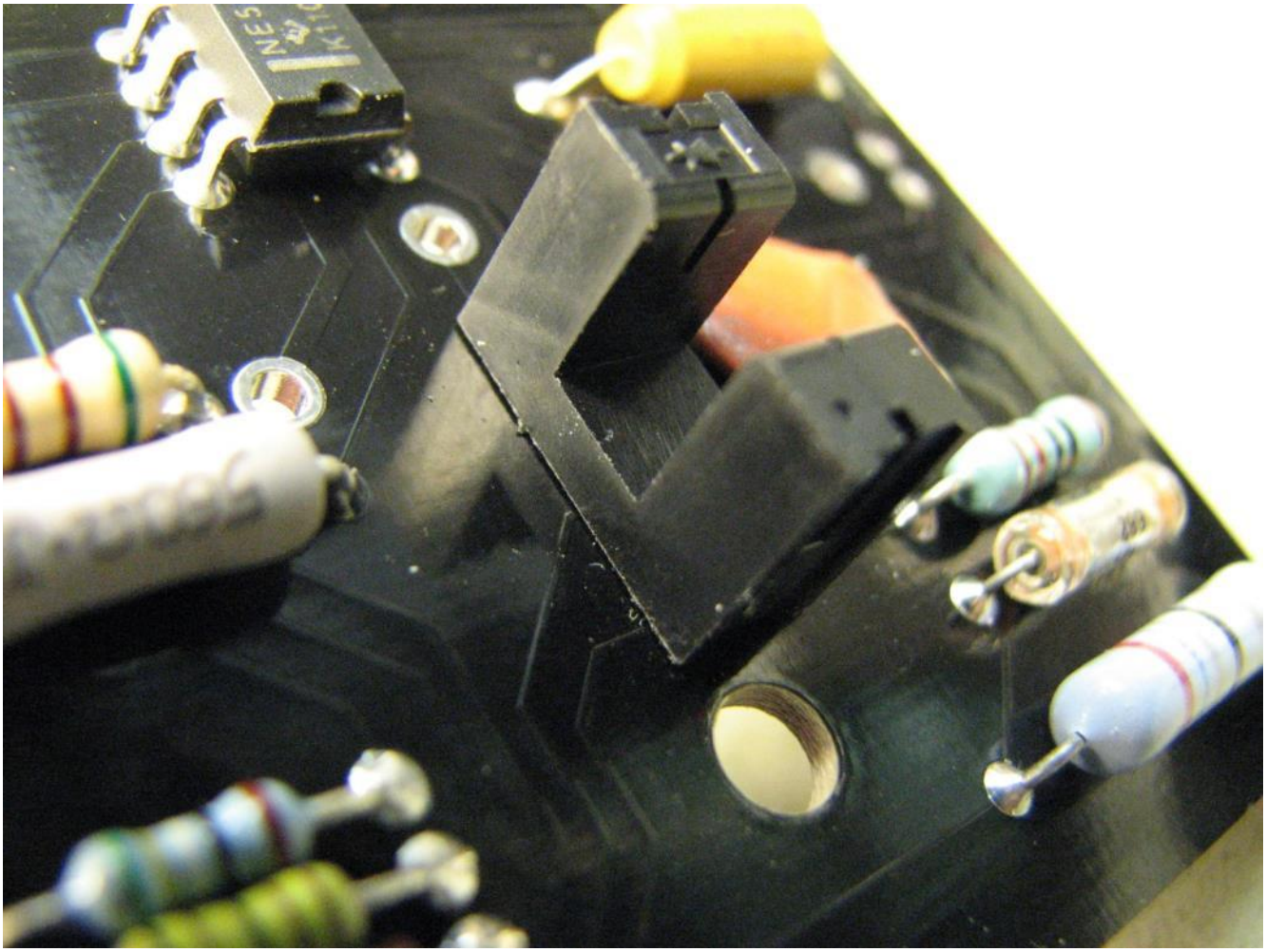
Next I bend the leads on the short 2 pin jumper with the white shorting plug by inserting the part in the holes and applying pressure with my finger. It should bend about 45 degrees and would be in the way when putting in the blue wire, so set this aside after it has been bent.



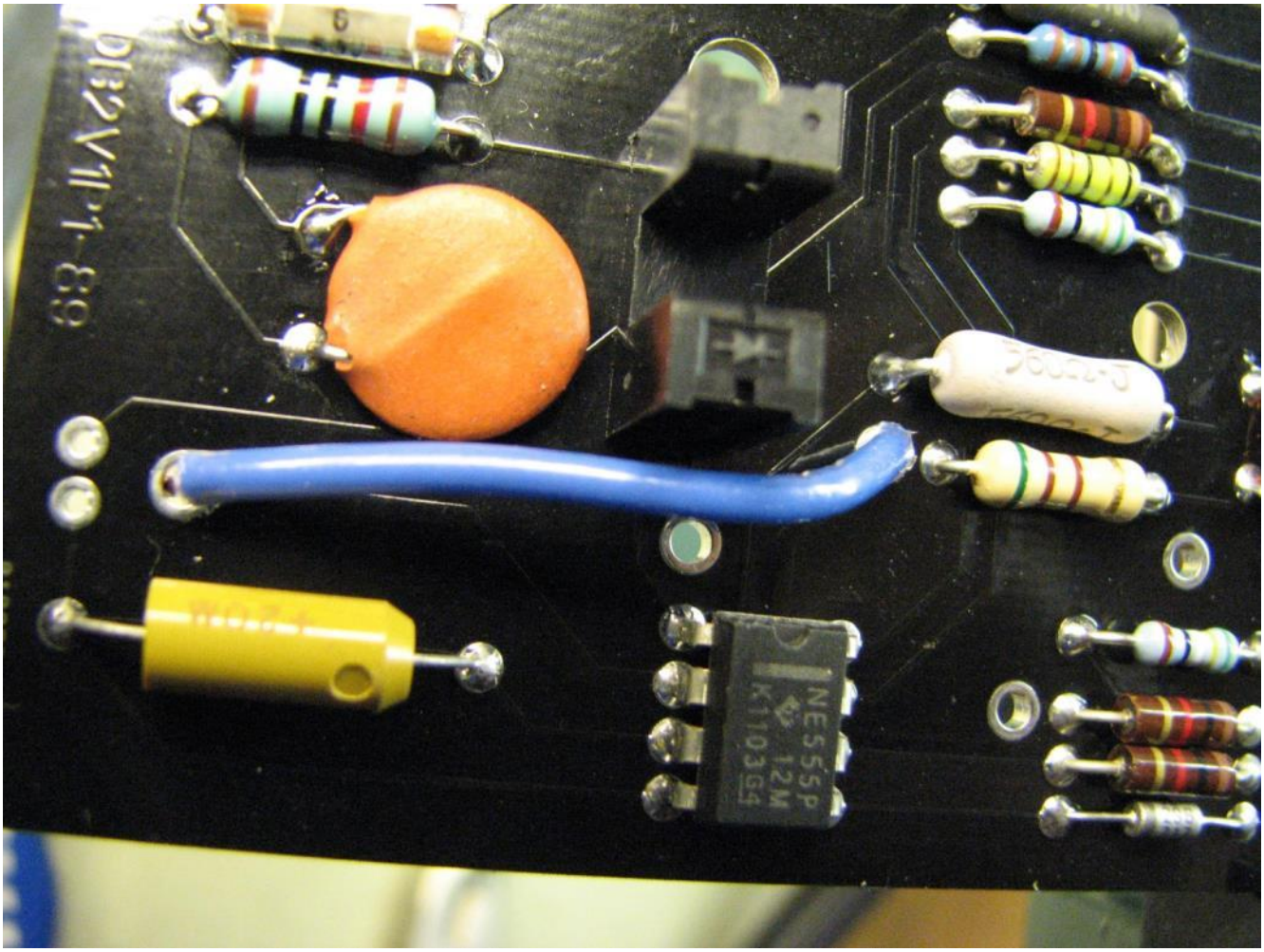
Next trim off the two small black plastic posts on the photo interruptor. They are used for alignment, but since there are no holes for them on this board they gotta go…

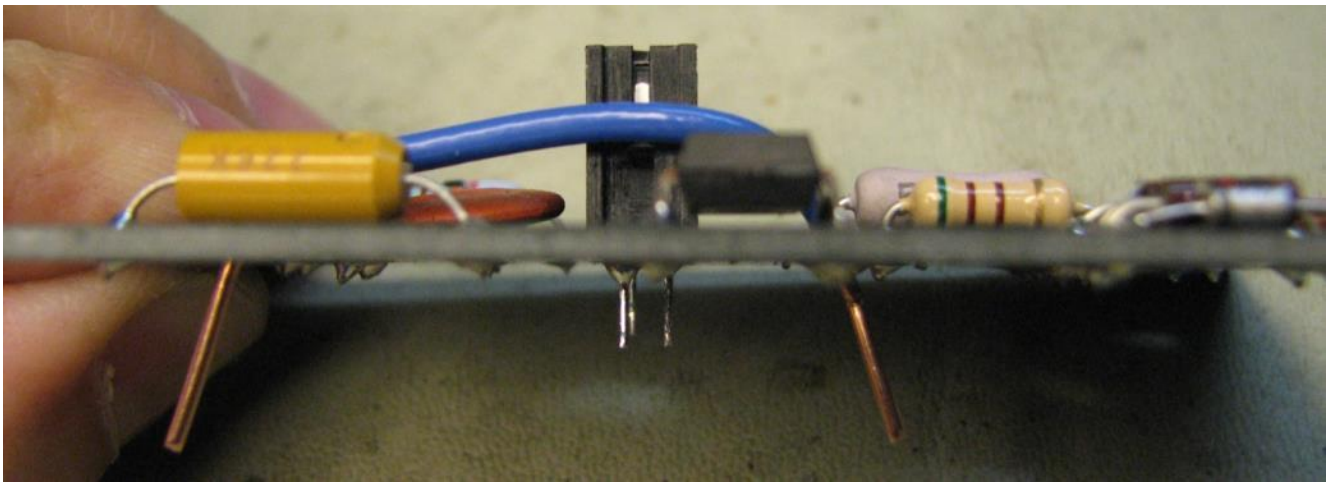


Then solder flush to the board:

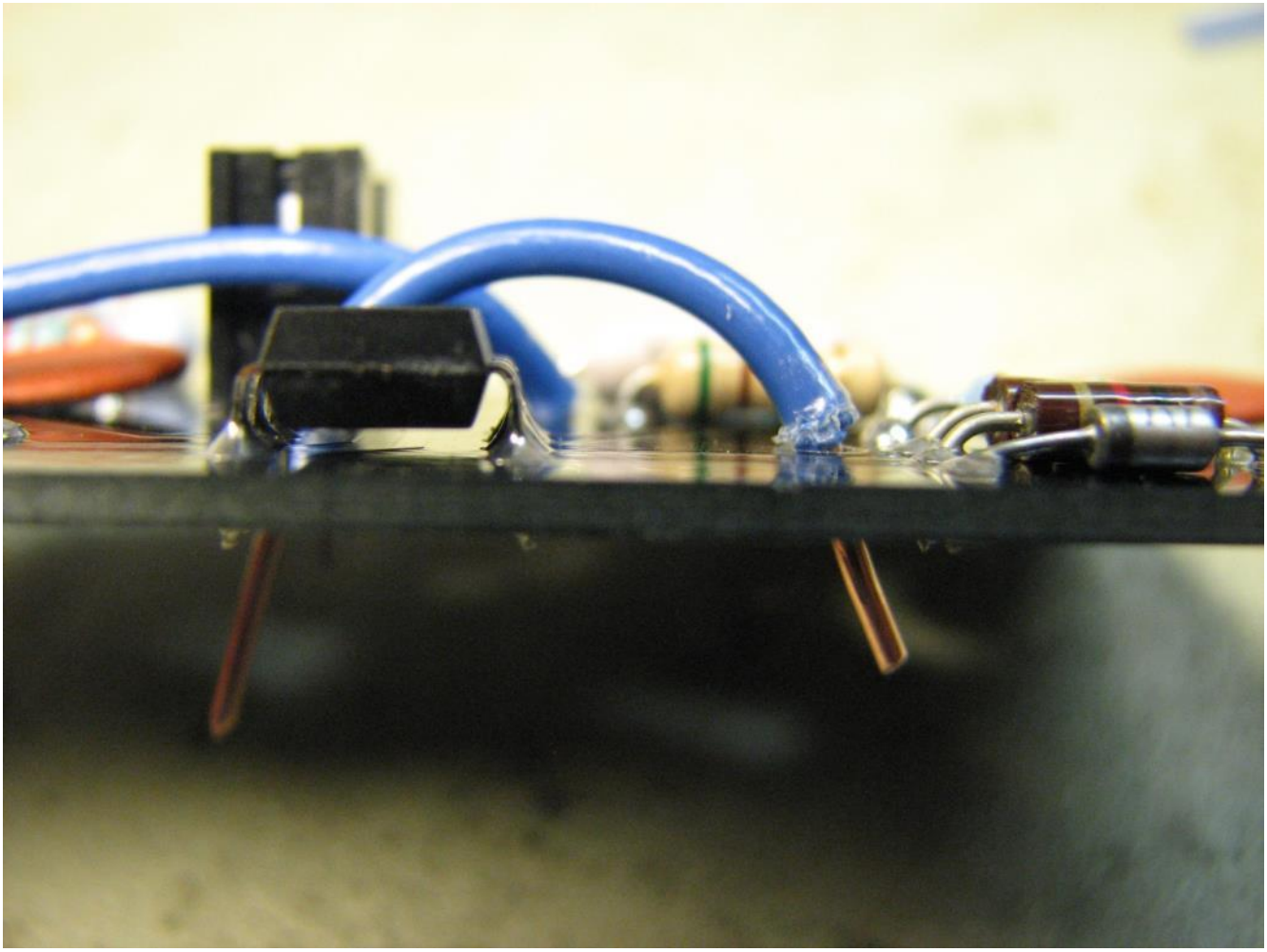


Now you get to add the blue wires. Cut them longer than needed and then keep stripping the wire back until you get the right amount of blue to get the shape you want. Having long bare wires is not an issue.



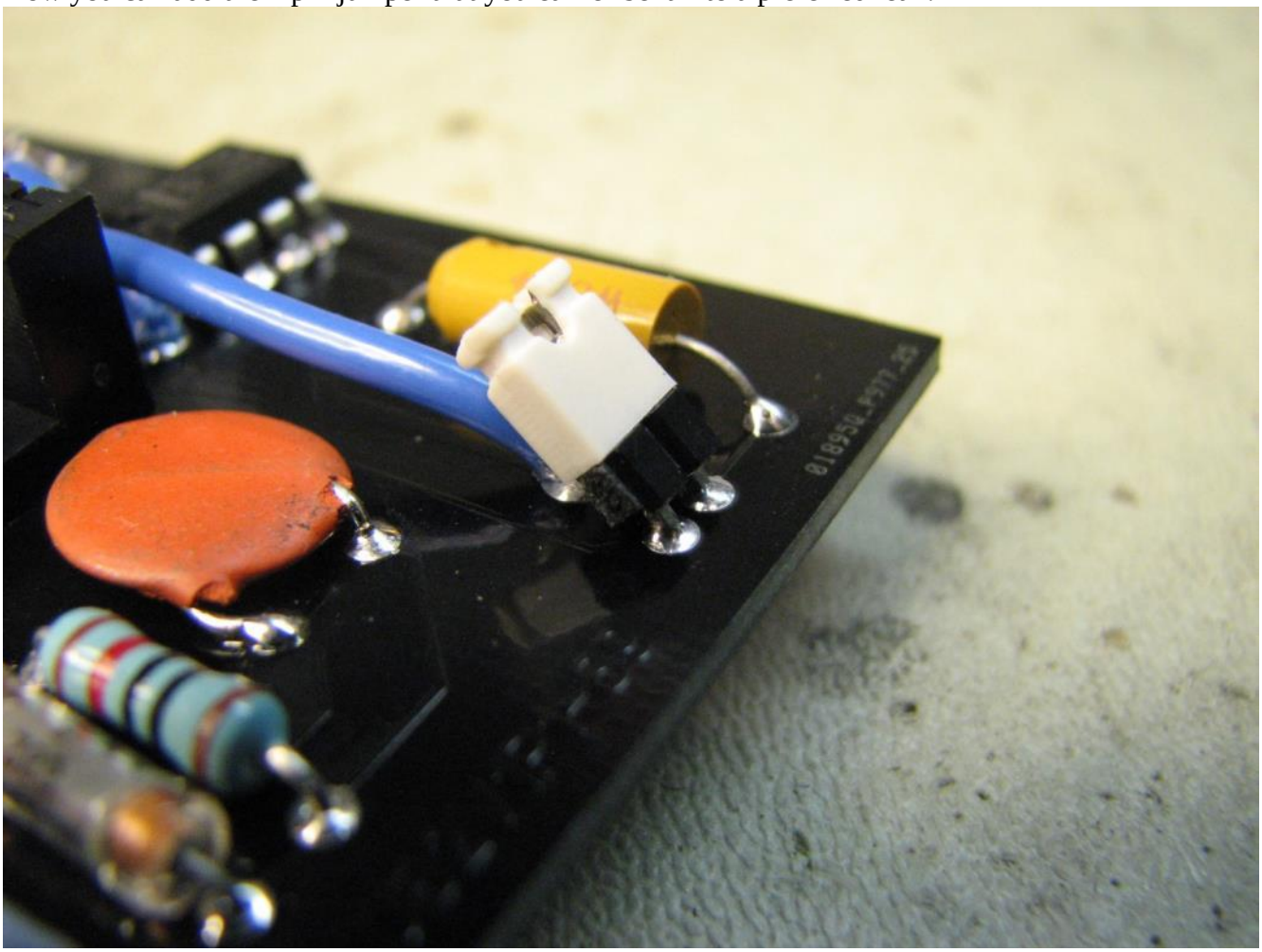


And the next blue wire:

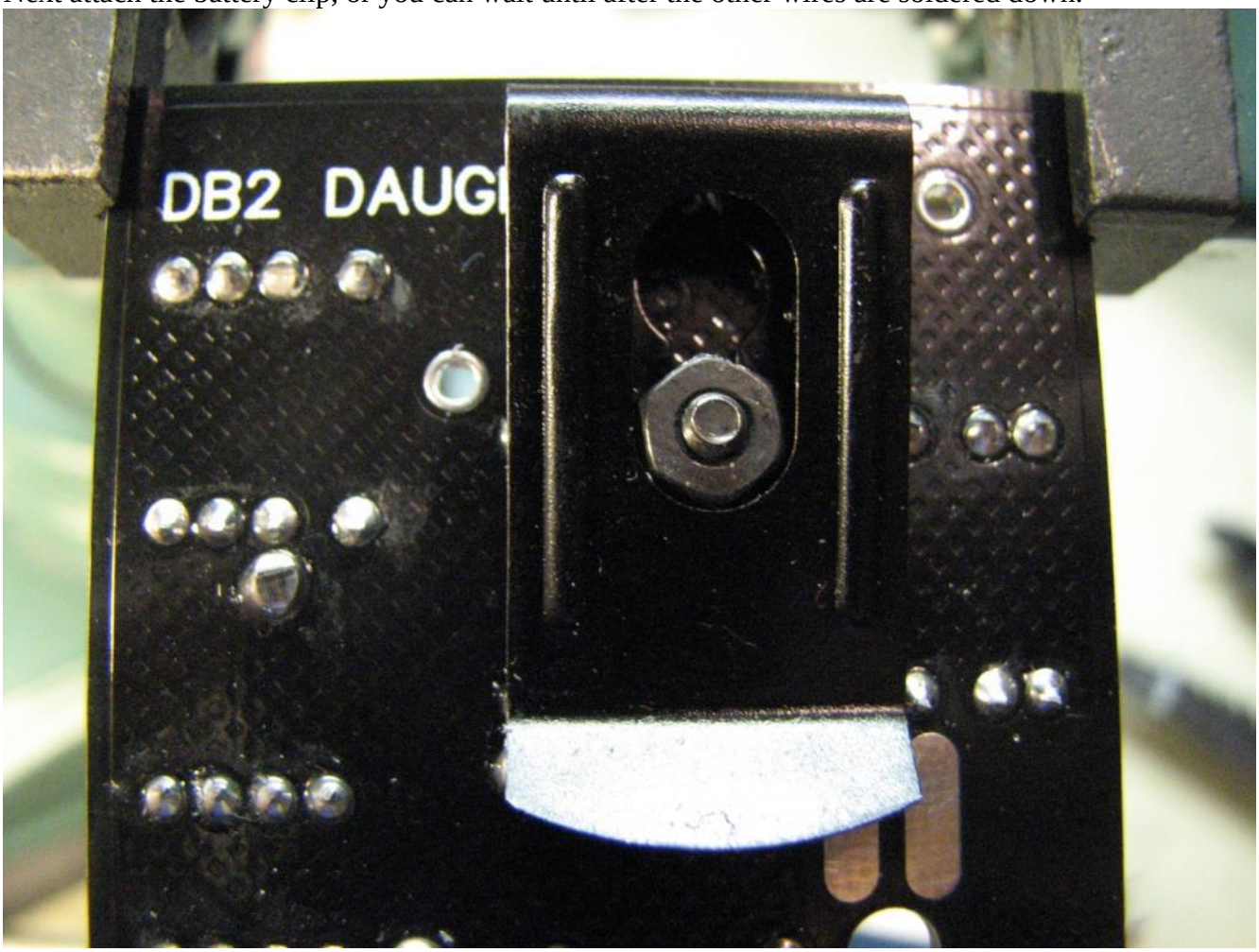


When you are happy with their looks, solder the wires to the pads on the back side of the board and then trim the excess lead length on the back side fairly close to the board.

Now you can add the 2 pin jumper that you earlier bent into a preferred lean:

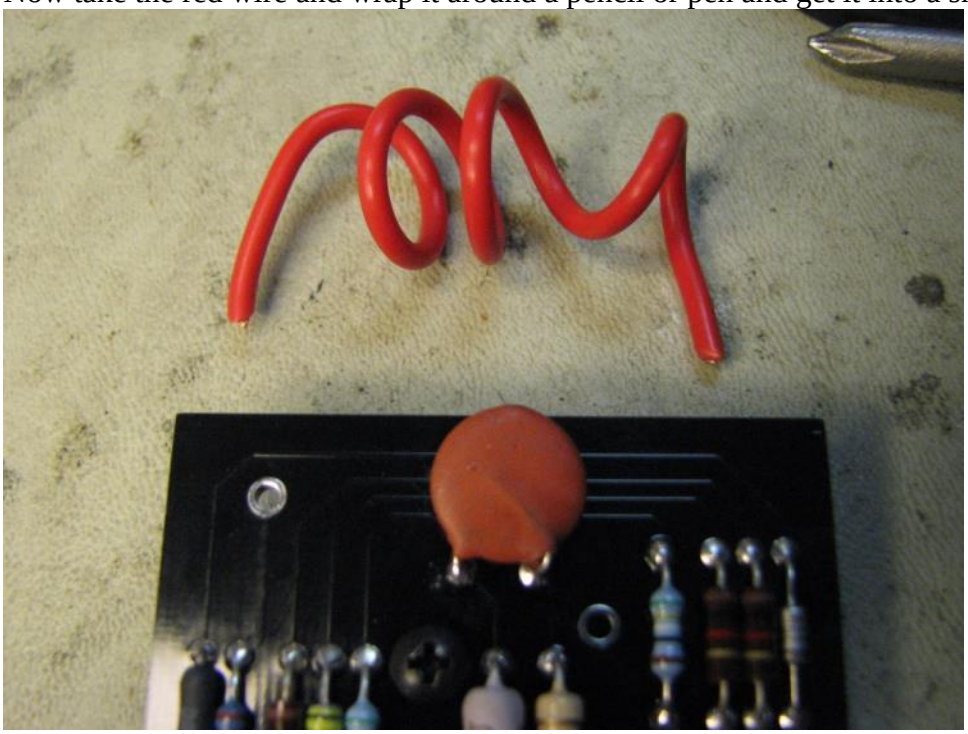


Next attach the battery clip, or you can wait until after the other wires are soldered down.



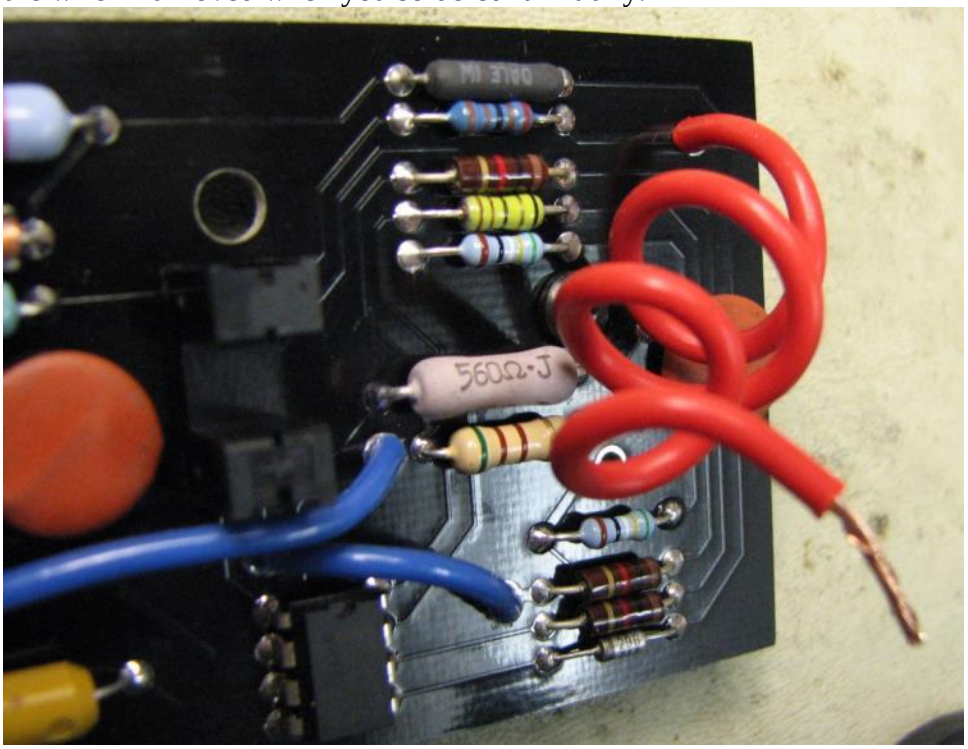
The screw is a bit longer than ideal, so if you really want you can grind down the screw so it is flush with the nut on the back side, or flip it over and have the nut and screw on the top side. I like the having the head of the screw on the top of the board since it is a bit less visible.

Now take the red wire and wrap it around a pencil or pen and get it into a shape you like:



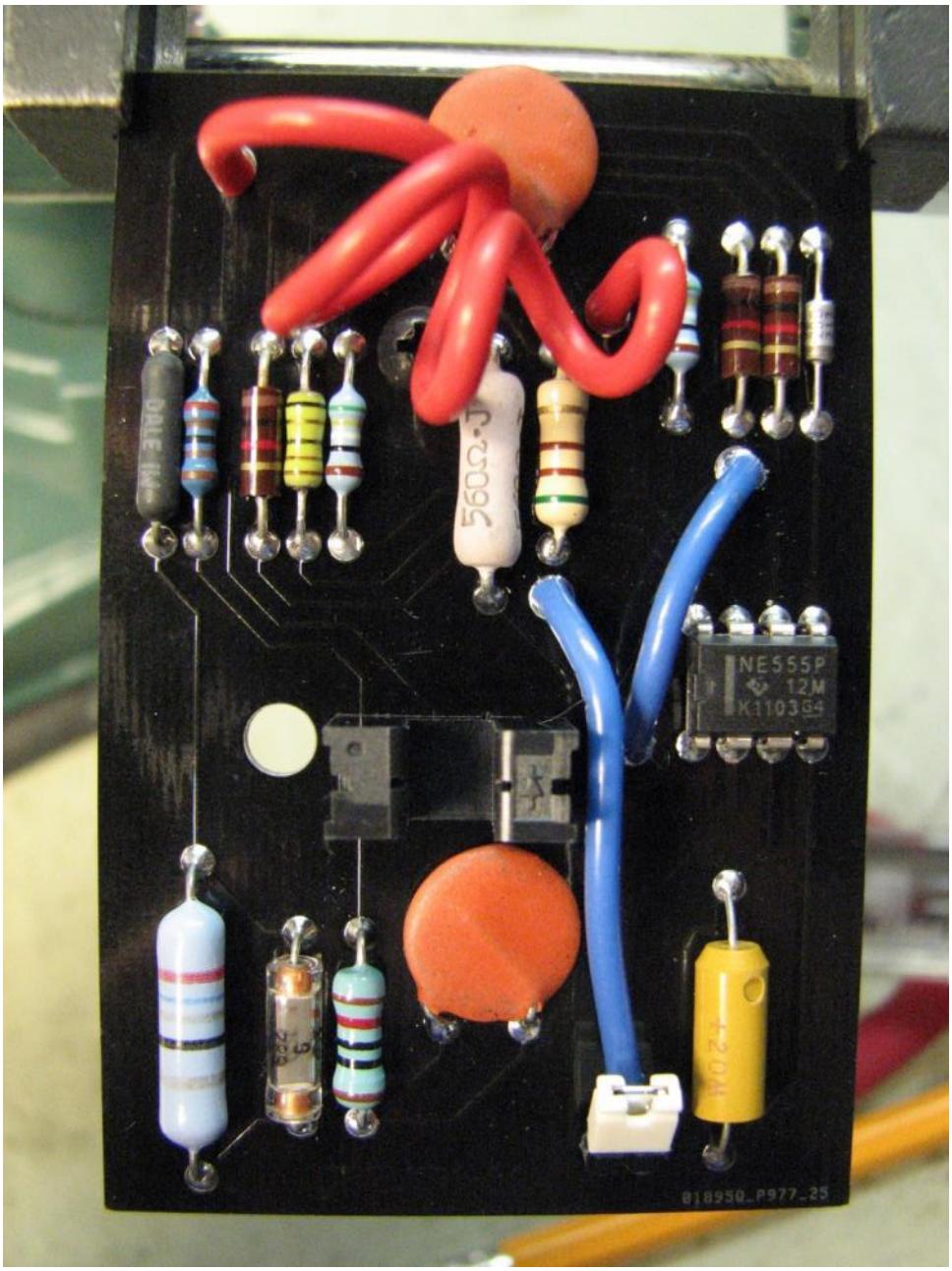
Next strip both ends and if you are having troubles with the stranded wires tries twisting the strands together a bit. If that still gives you trouble you can solder the wires a bit just to hold them together. Not too much solder since you want the wires to still be able to get in the holes on the circuit board!

Get one end in and solder it in place. You can reheat the solder joint while applying a little pressure on the wire if it moved when you soldered it initially.



Solder the other lead and then trim the excess wire on the backside of the board.

Here is a picture of the board with all of the parts and only waiting for the coiled cord that connects it to the main Gizmo board:

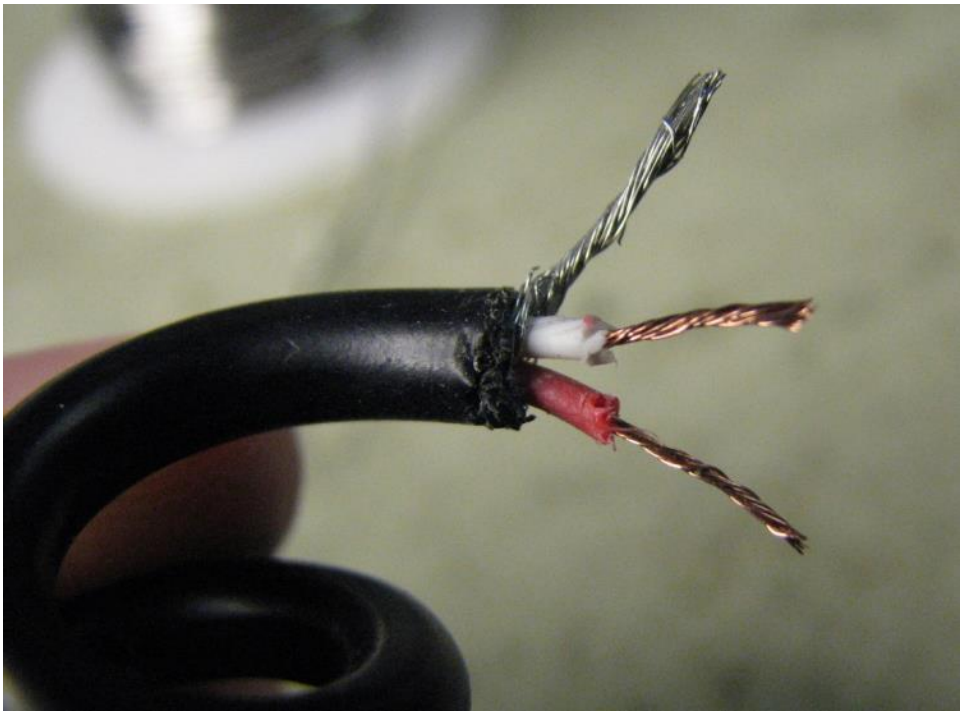


Get the coiled cable and cut off the connectors at both ends. The cable should now fit the large hole in the daughterboard:

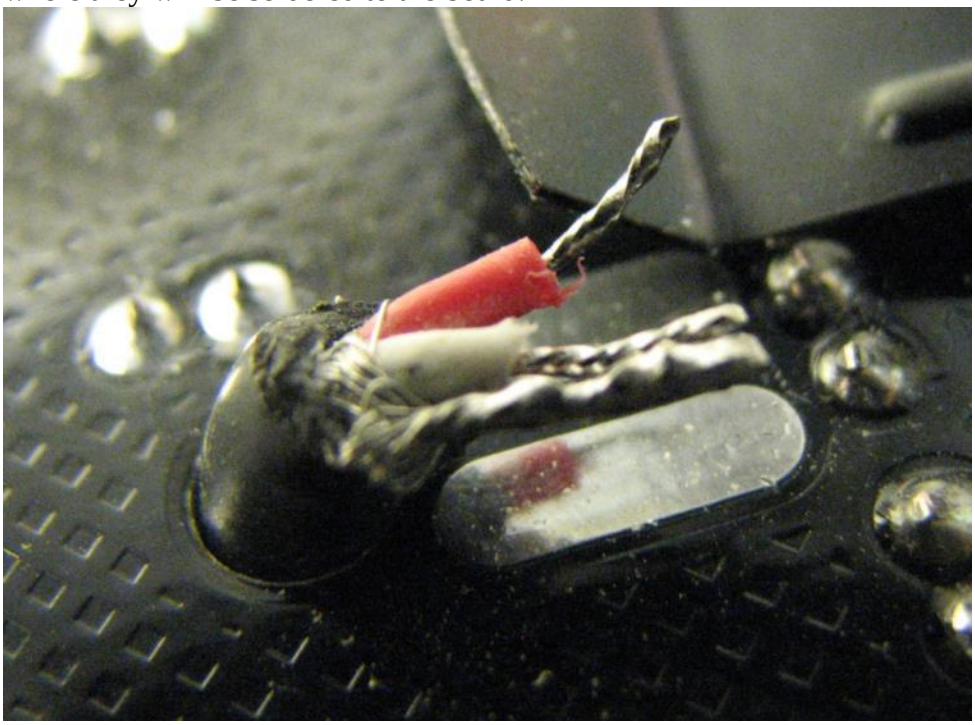


Orient the cable as you would like it to attach to the board and then strip the wires and sheathing so they can be soldered to the daughterboard for a very secure attachment. Look at the next several pictures to see how it attaches so you do not strip too much of the cable and let the wires be seen on the top side of the board.

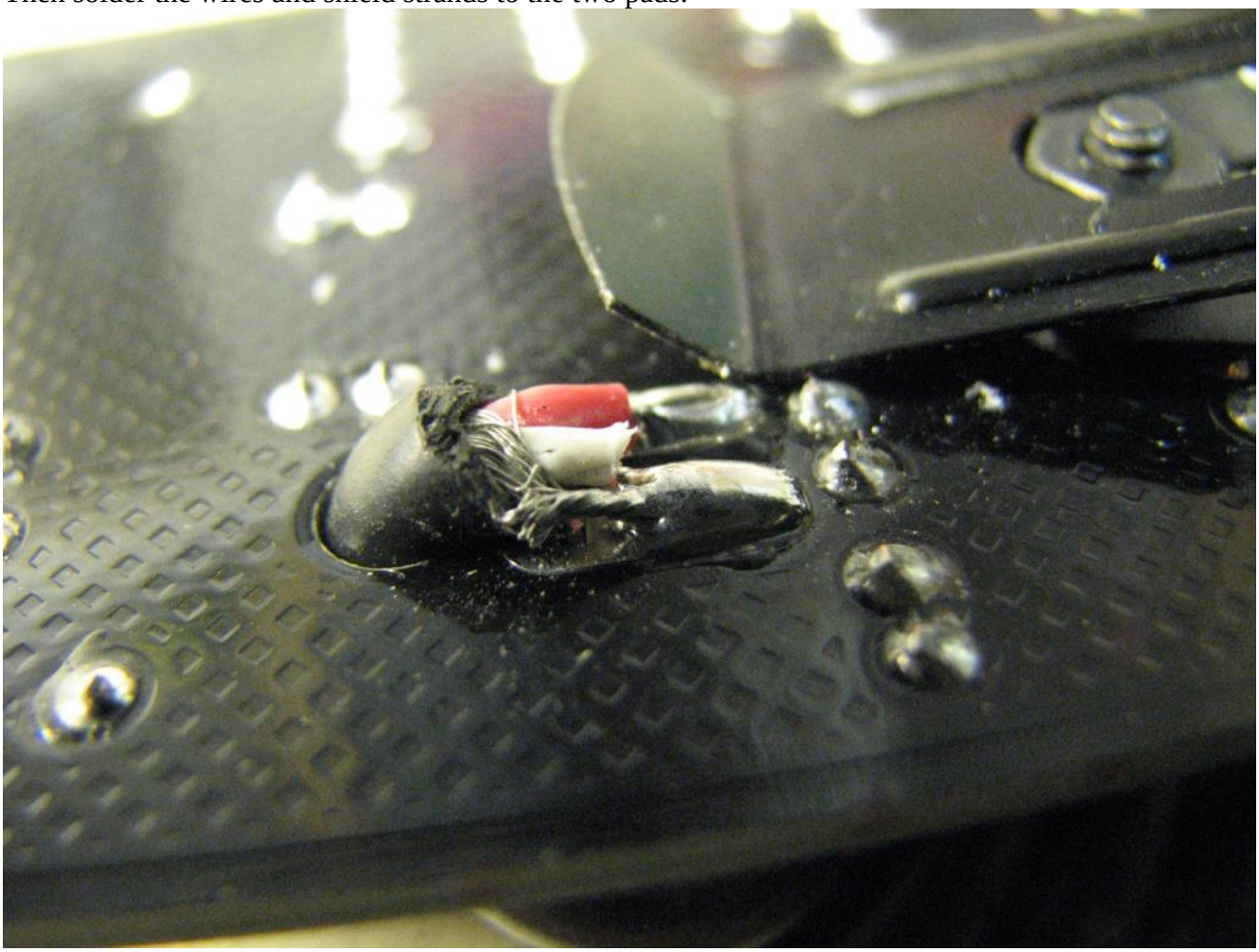
Strip the wire carefully since we also want to use the silver shielding wires as a way to secure the cable to the board:



Notice that some of the black outside insulation goes through the hole and extends into the back side. The wires are trimmed and stripped so that when they lay flat the stay on the two large tinned pads where they will be soldered to the board.

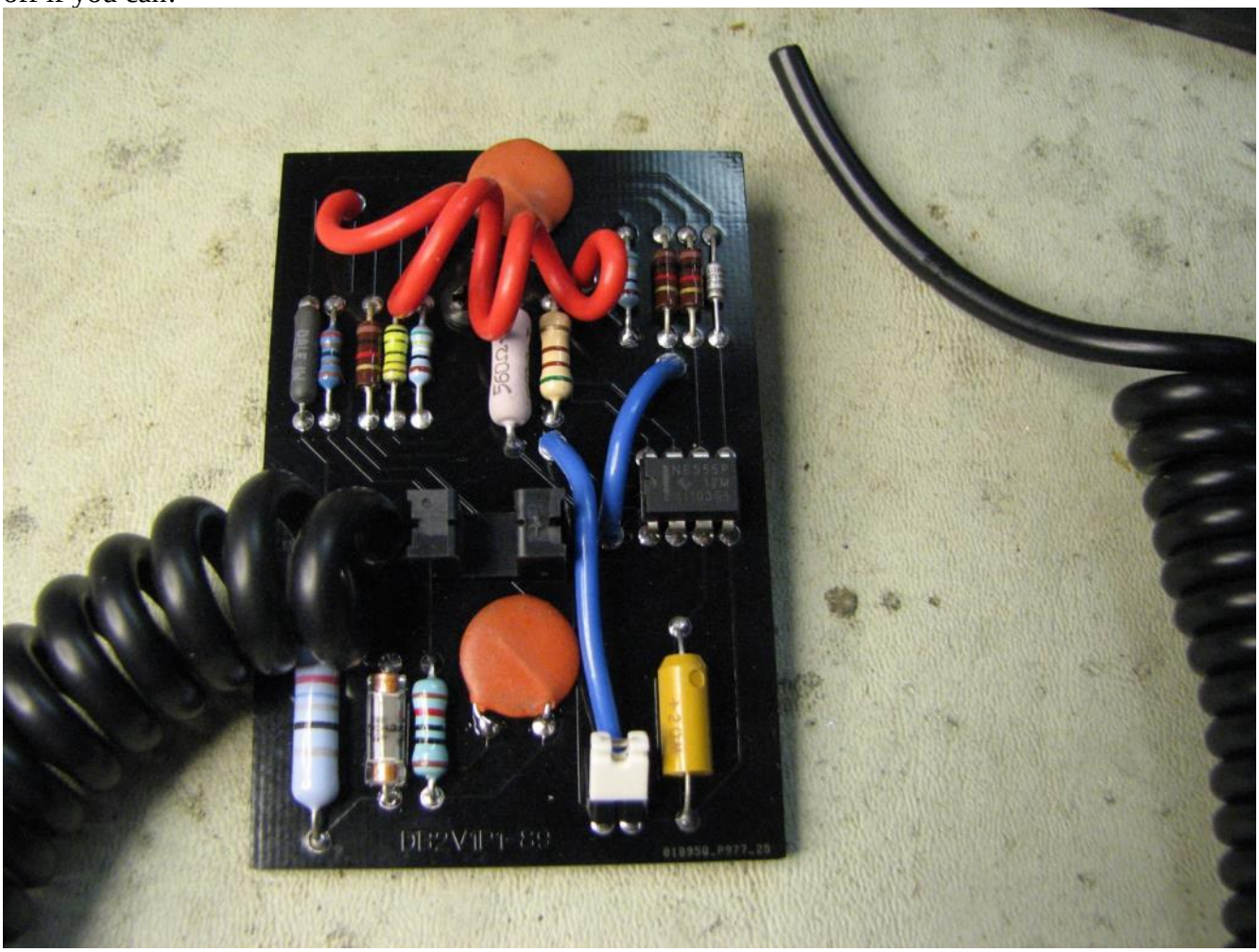


Then solder the wires and shield strands to the two pads:



You may have to rotate the belt clip a bit to solder those pads.

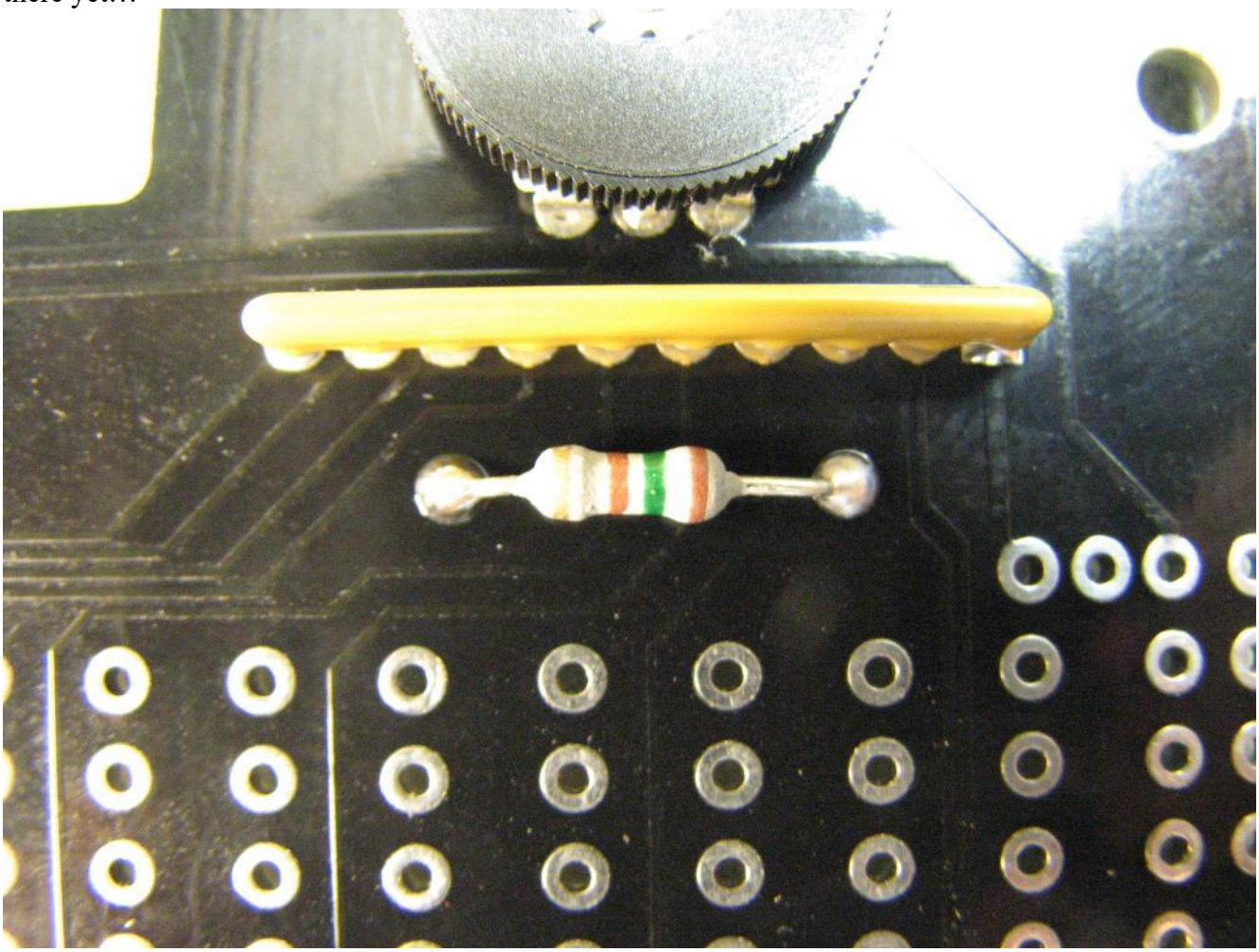
Your finished daughterboard just waiting for the main Gizmo board to be completed before the coiled wire is attached to that board. Take a deep breath and be impressed with your great work and show it off if you can!



Gizmo2 Electrical Part 1…

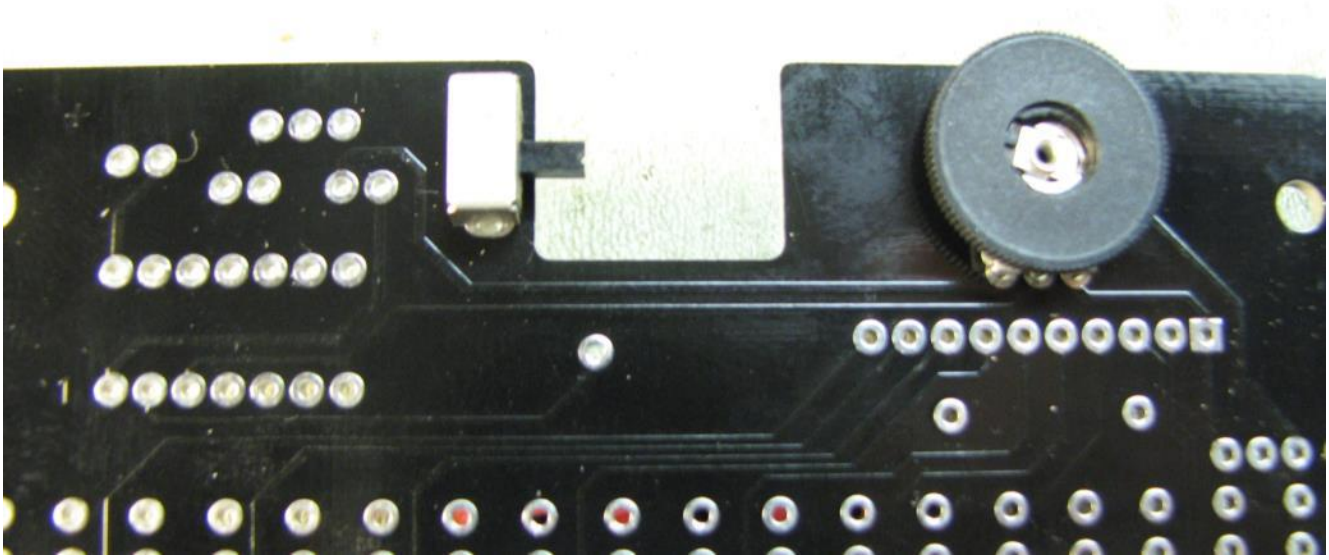
Like with the daughterboard, let's start with short components and get those soldered down on the board. These parts are real parts and need to make good electrical contacts so now you should care about your solder joints!

In some of these photos you will see that I missed the first part – the lone resistor which should have been the first component to go onto the board shown here with two components that should not be there yet…



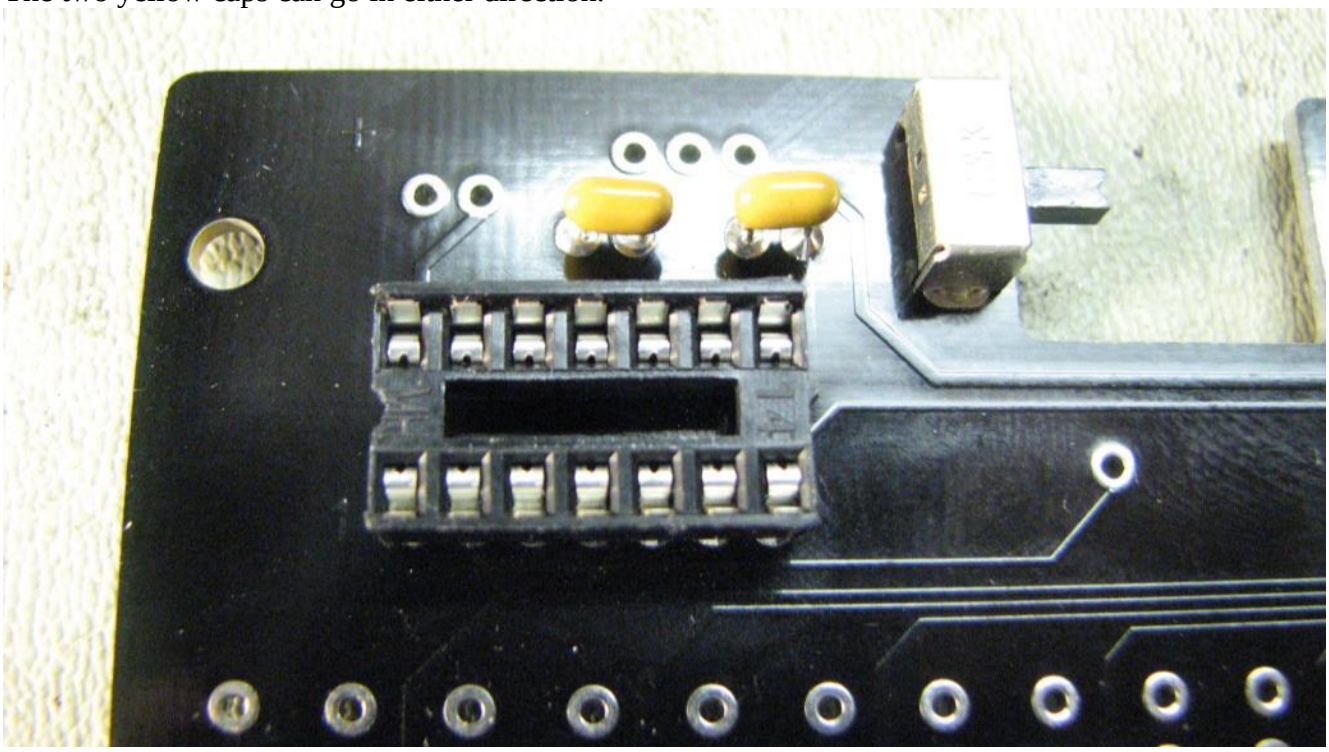
The correct resistor is critical so make sure it has the same color coding as shown above (Brown Green Brown Gold – this is a 150 ohm 5% resistor). The resistor can go in either way, so just center the part and make it look good, just because. Flip the board over, solder the part down and then trim the excess leads close to the back side of the board.

Next we put on the slide switch and the thumbwheel potentiometer:



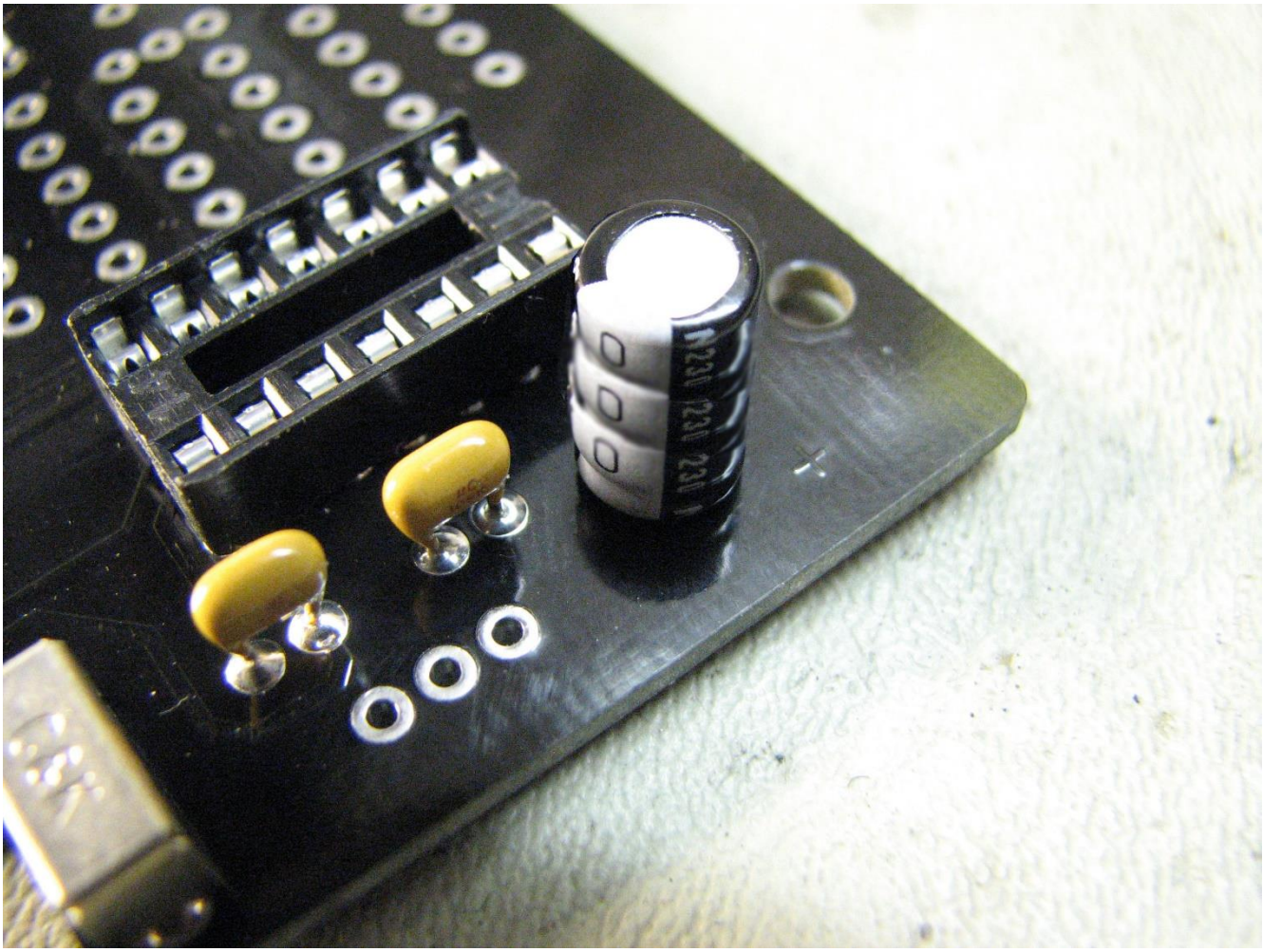
Solder them both down and no leads to trim for those components.

Next place the socket and two yellow capacitors in place. The socket should be oriented the correct way with the notch between the two rows of pins on the left to indicate that pin one goes to the left. The two yellow caps can go in either direction.



Flip the board over, solder the parts and trim the leads on the two capacitors.

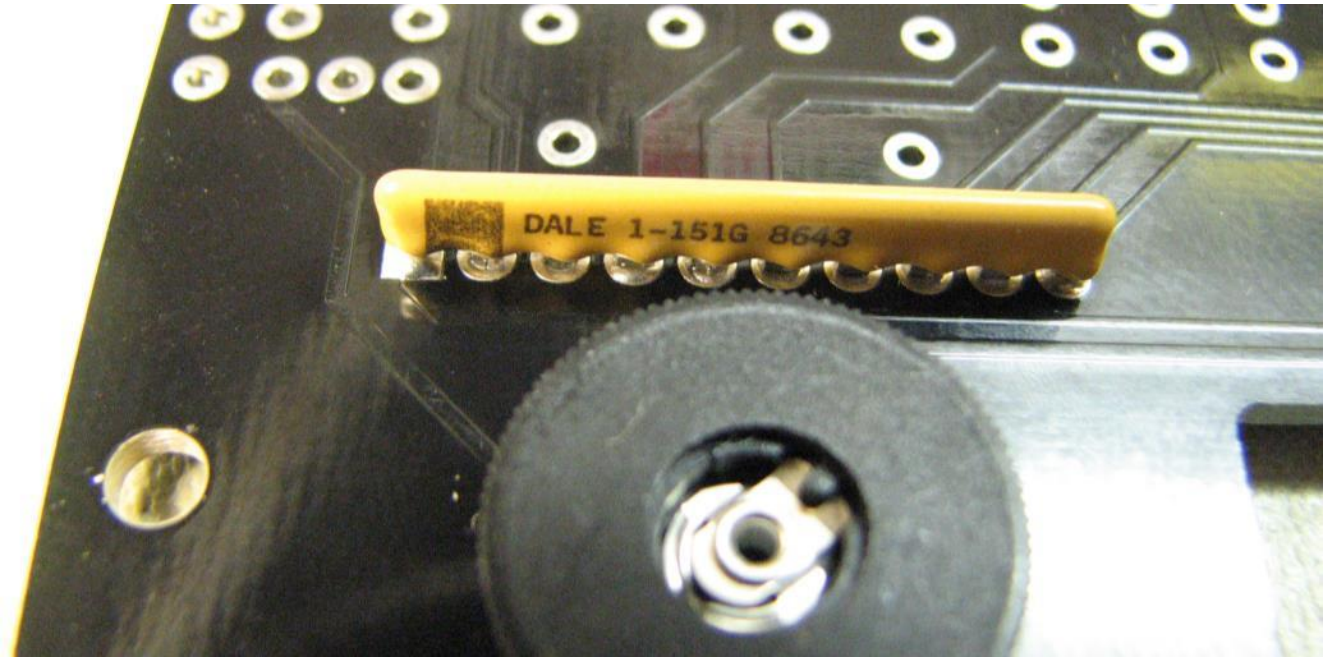
Next use the one tall Black capacitor that was in the pink foam next to the large regulator part. Orientation is critical on this part. Make sure the white stripe on the side of the capacitor is facing the yellow capacitors. The white stripe is used to indicate the negative ("-") side of the capacitor and the other side is positive ("+"). The positive side is marked on the bottom side of the board.



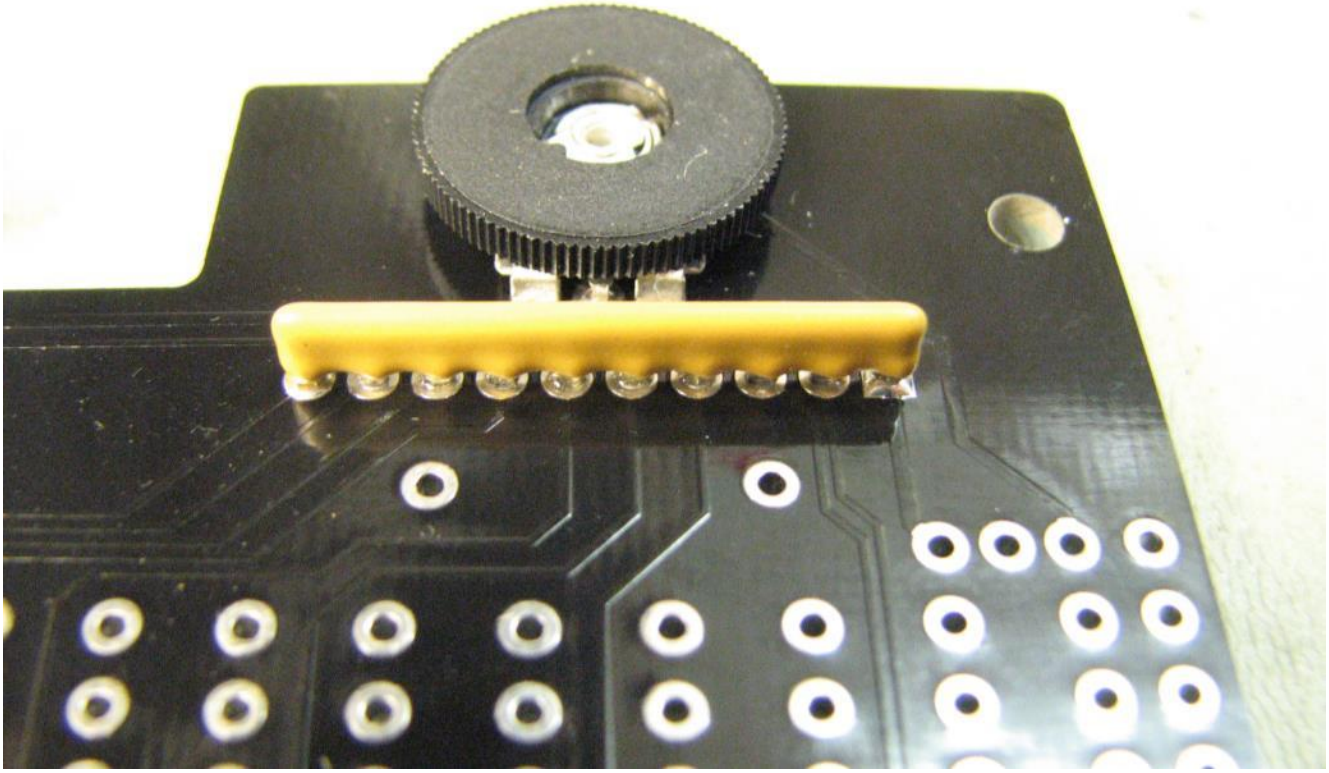
Insert the newfound cap in the correct orientation, solder it down and then trim the long leads.

Yes it is a bad photoshop and the cap does not look quite like this, since I used a shorter cap when I took these pictures, and wanted you to see that it is a taller cap.

Next you will put in the resistor array. This 10 pin device is located next to the thumbwheel potentiometer and it cares about which way it is place on the board. The pin “1” end is marked with a black strip and needs to go towards the outside edge of the board. Pin 1 is marked on the board with a square solder pad and the other 9 pads are all round.



Viewed from the other side:

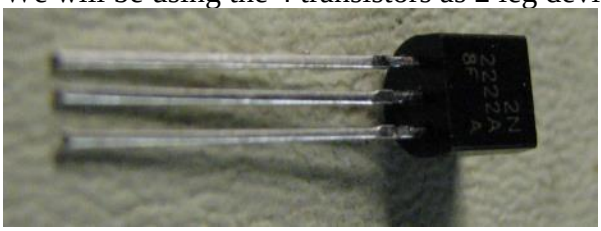


Place the 10 pin resistor in the correct orientation and solder to the board.

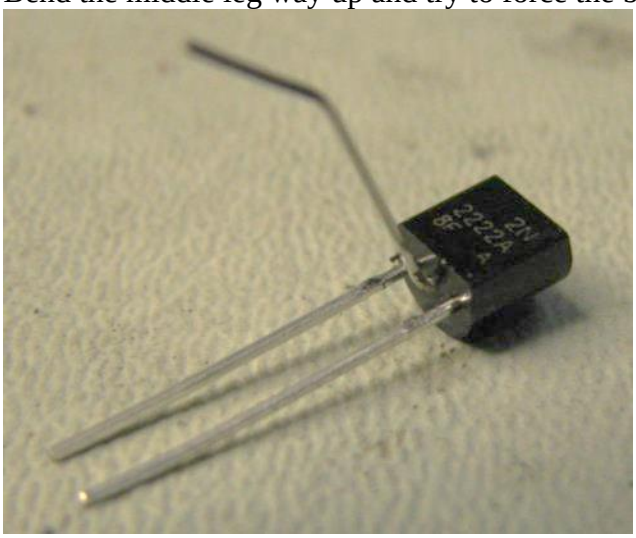
Gizmo2 Basic Parts Part 1

Because I like working with short parts first, we need to switch gears a bit and build up some basic parts that have nothing to do with the LED or electronics.

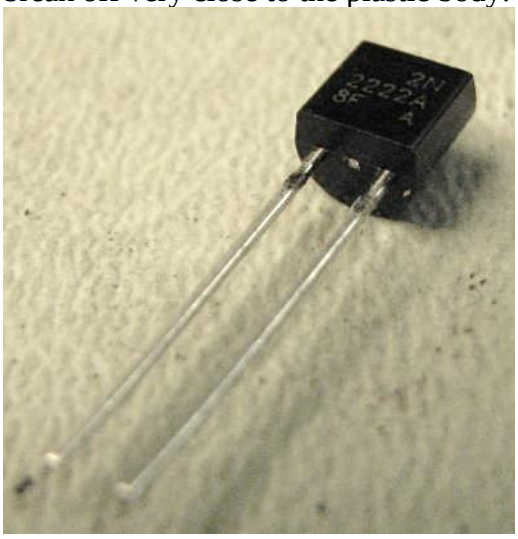
We will be using the 4 transistors as 2 leg devices even though they initially come with three legs:



Bend the middle leg way up and try to force the bend as close to the plastic body as possible:

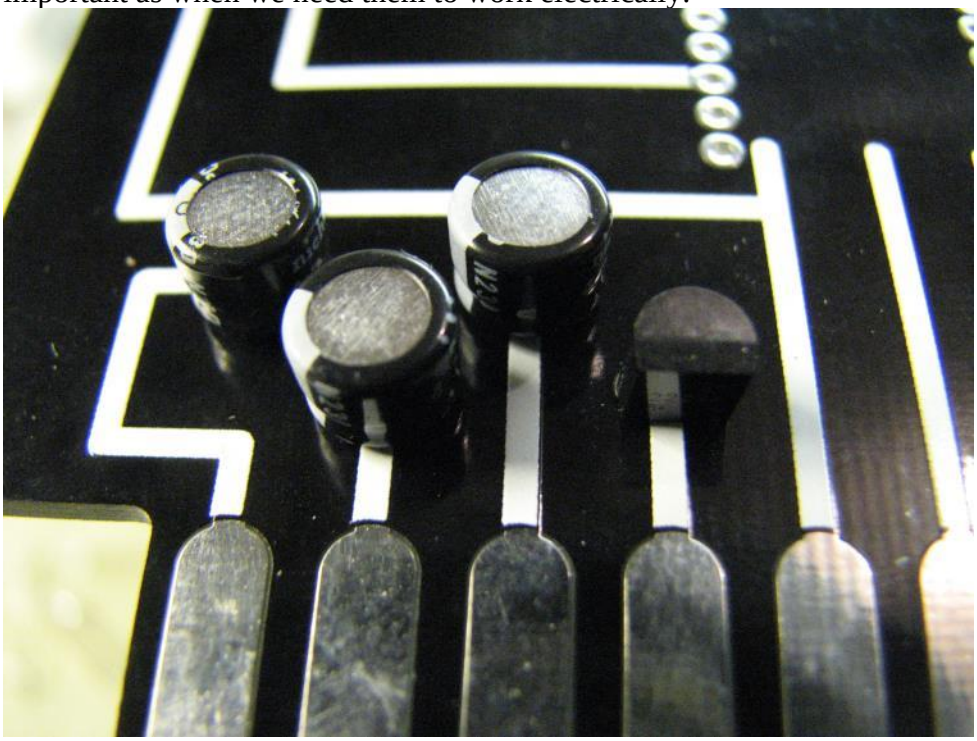


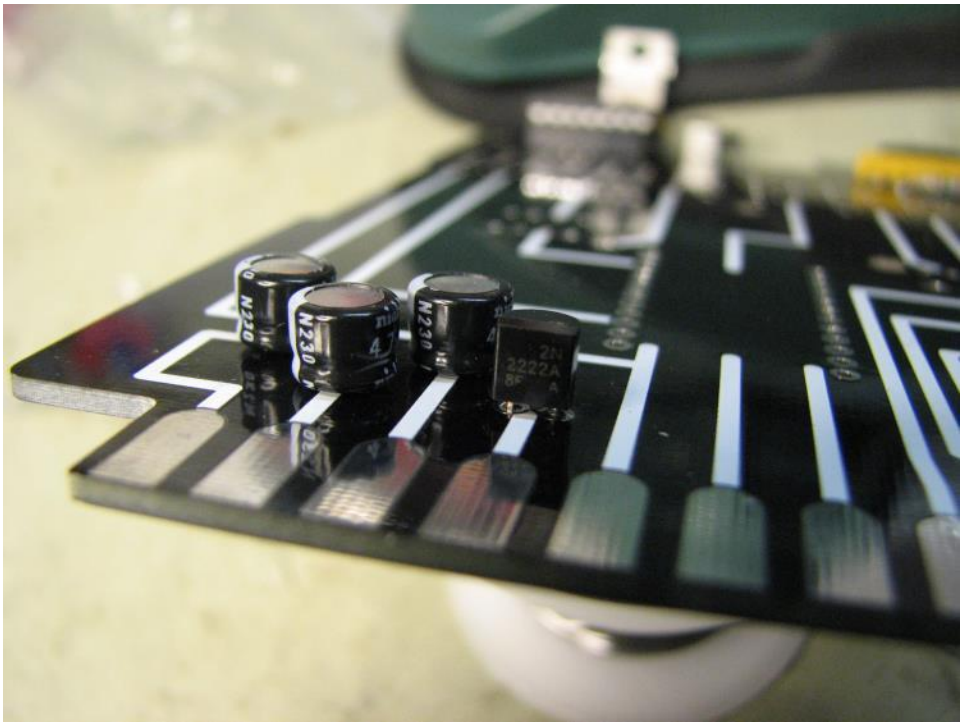
Bend that middle leg the other way and then back again. It doesn't take much to get that metal leg to break off very close to the plastic body:



Do this to all four transistors. The legs that are removed are not needed for this project.

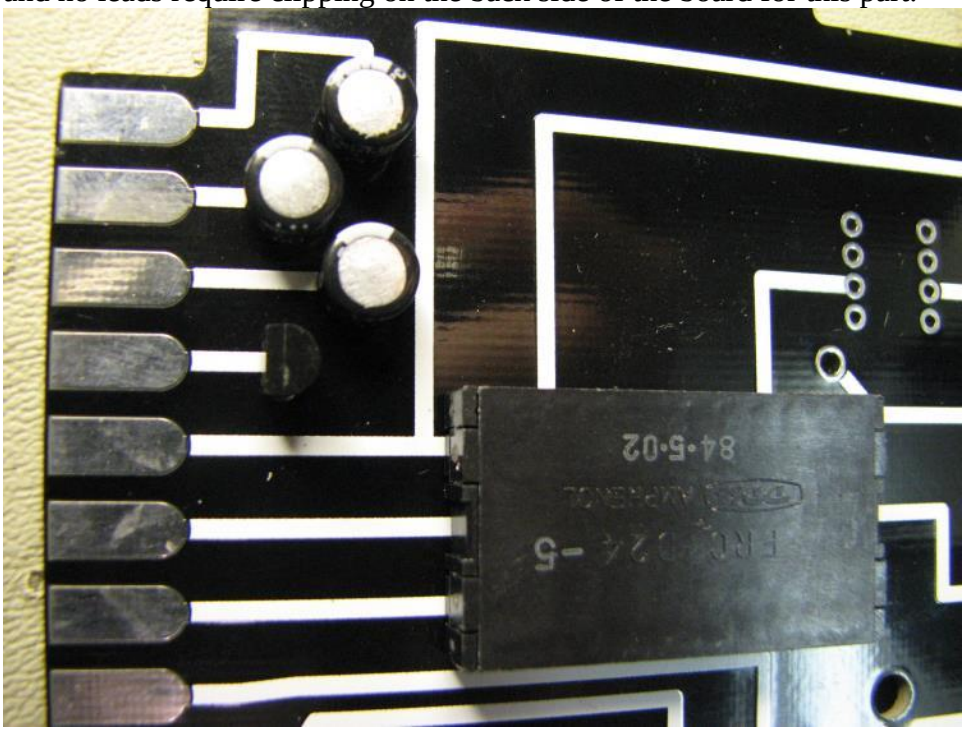
Now locate 3 of the short black capacitors and one of the “fixed” transistors and mount them in the lower left hand corner of the board. Since these are for looks only, the orientations are not as important as when we need them to work electrically.



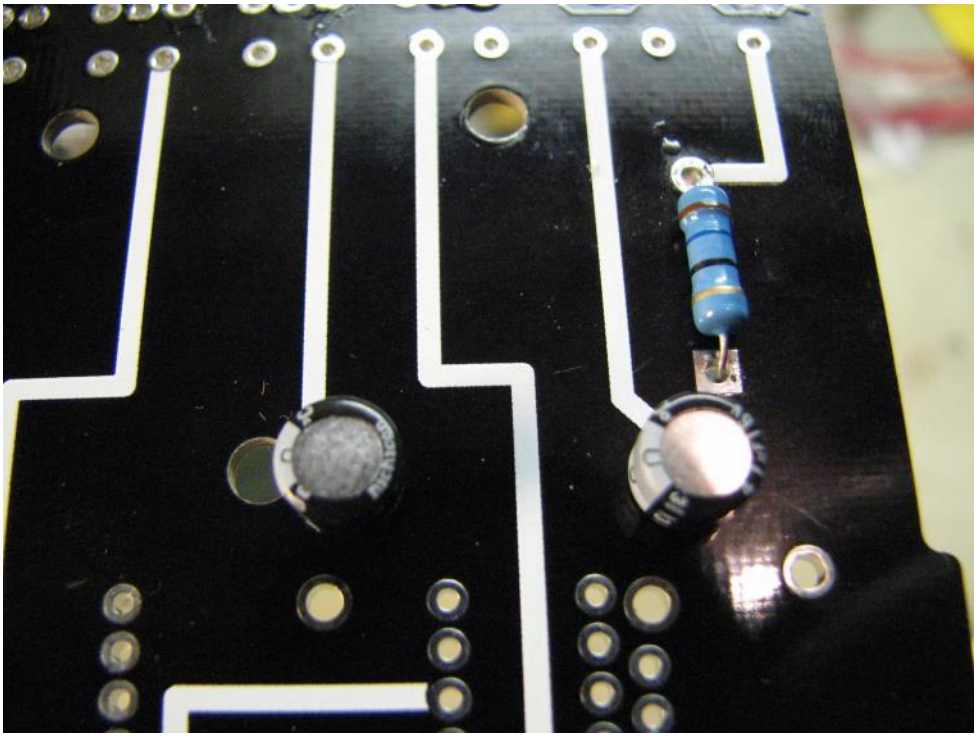


Flip the board over, solder the leads and then clip the excess leads off close to the backside of the board.

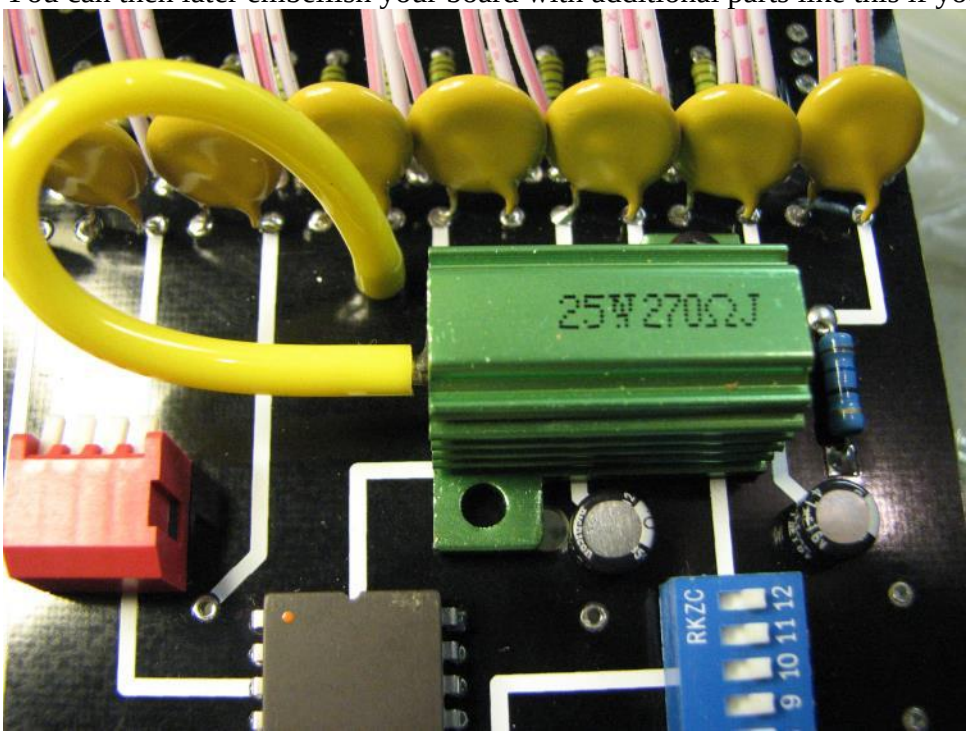
Next load the black rectangular cable connector and place it in the center of the board, solder the leads and no leads require clipping on the back side of the board for this part.



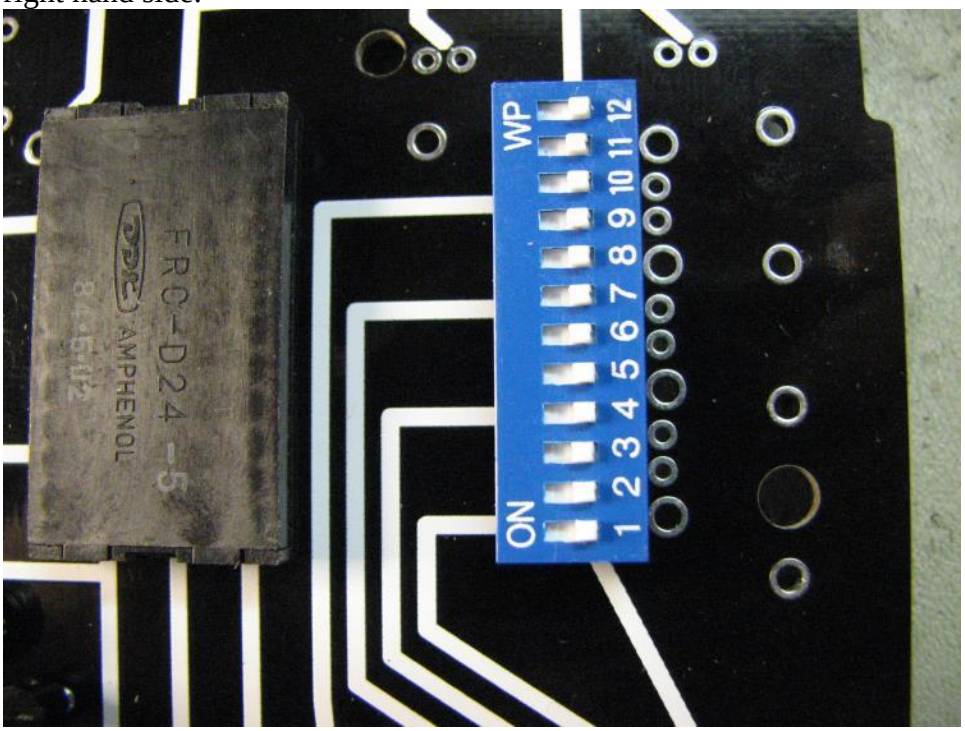
**** Only install these three parts if you are not going to use the battery holder ****



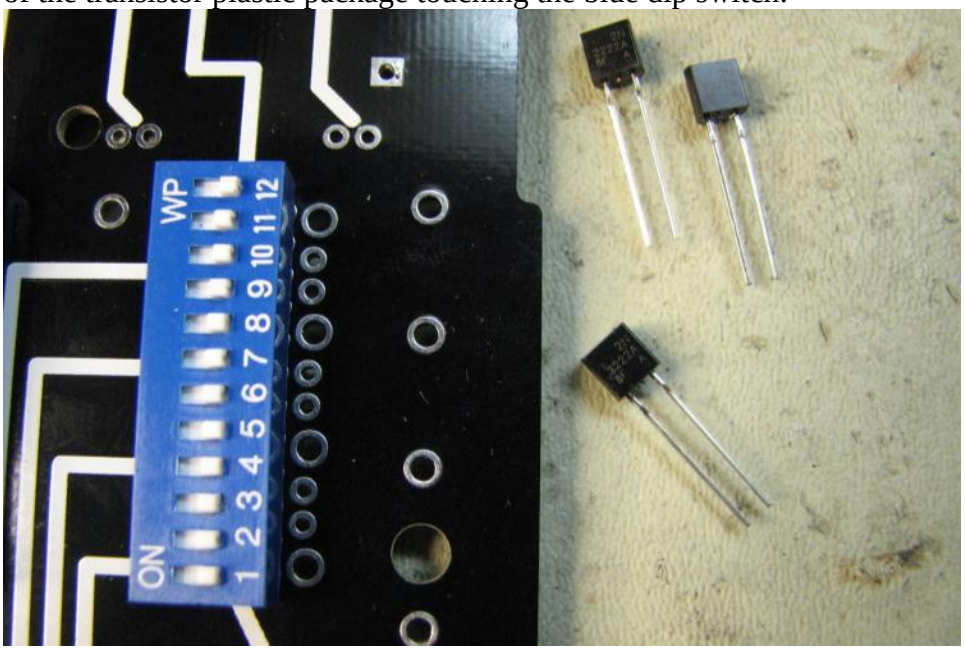
You can then later embellish your board with additional parts like this if you choose:



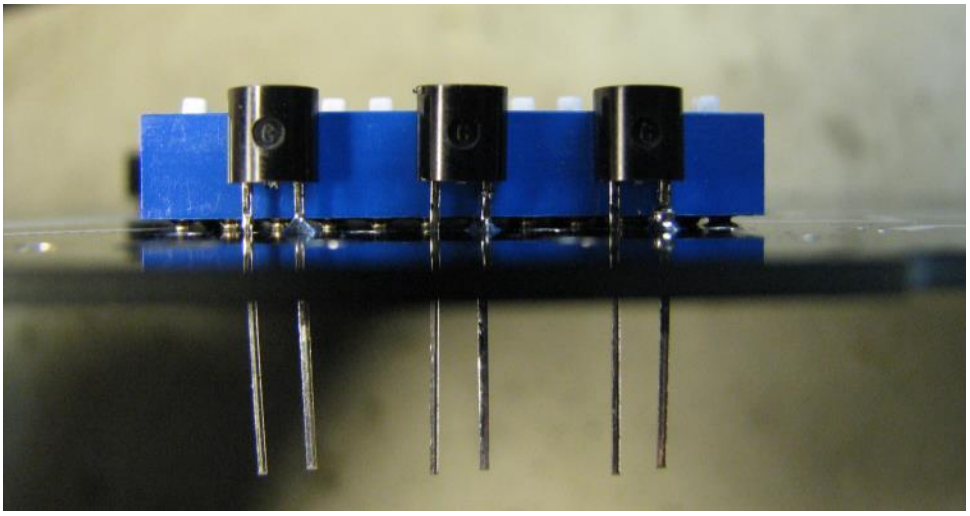
Load the blue dip switch and solder in this part. You may care which way this part is loaded. I like having more white lettering on the right hand side. For most accuracy, have the switches all set to the right hand side:



Next take the three “fixed” transistors and place them up against the blue dip switch with the flat side of the transistor plastic package touching the blue dip switch:

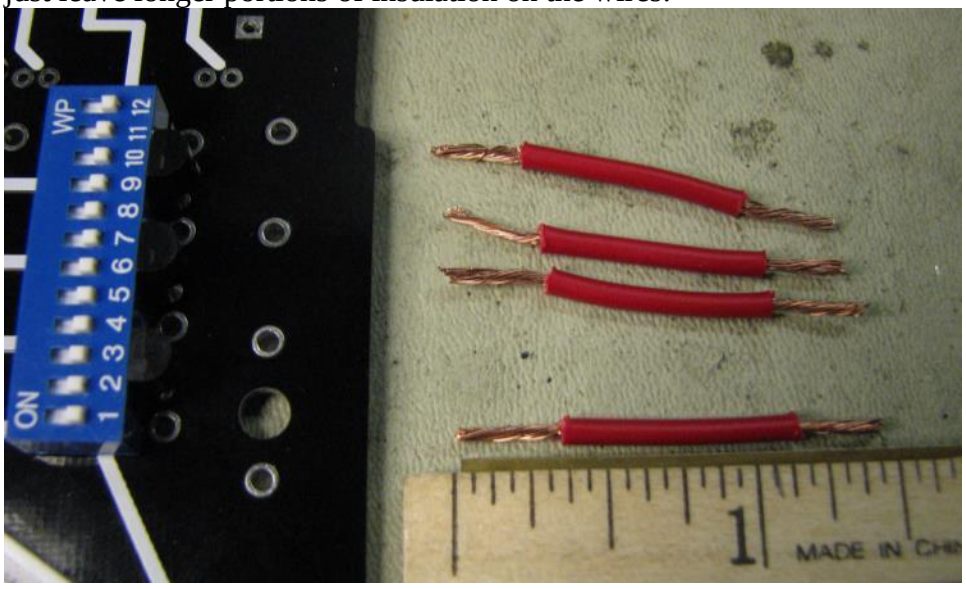


The transistors go in the smaller holes and the 4 larger holes will be used by some red wire which will be added next.



Flip the board over and solder just one leg of each transistor. This makes it easier to adjust the height and position of each transistor by reheating the one soldered lead on the back of the board and moving the transistor into place. After you are satisfied with the placement, solder the second lead of each transistor and then trim the excess lead length on the back side of the board.

Next cut the red wire into four equal sized pieces of wire, each about 1 1/2" long and then strip them on each side. Leaving a bit over 3/4" of insulated wire worked well. If you want larger arches of wire just leave longer portions of insulation on the wires:

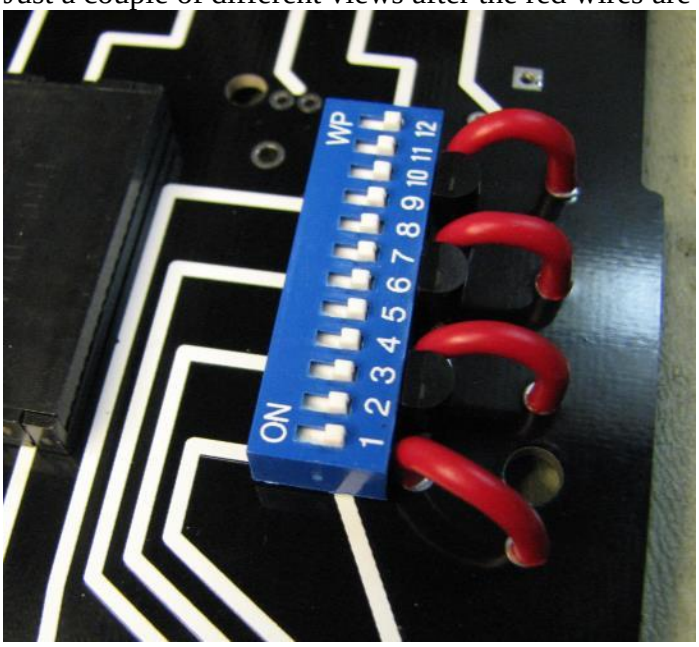


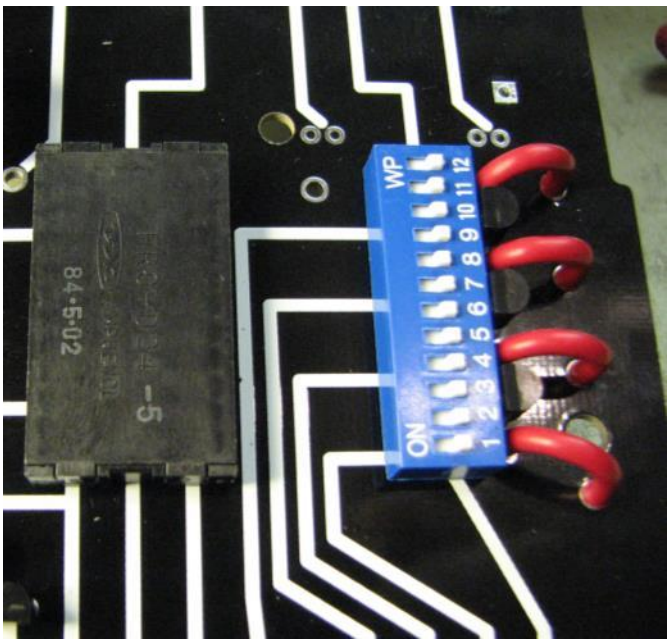
If needed twist the stranded wires to get them through the holes. You can also lightly solder the ends to keep the wires together if needed.

Bend the wires into shape and also test fit all of them. I start by only soldering one end of each wire and making sure it is pushed in so that there is little or no exposed wire on the top of the board. Then after any adjustments, solder the other end of the wire:

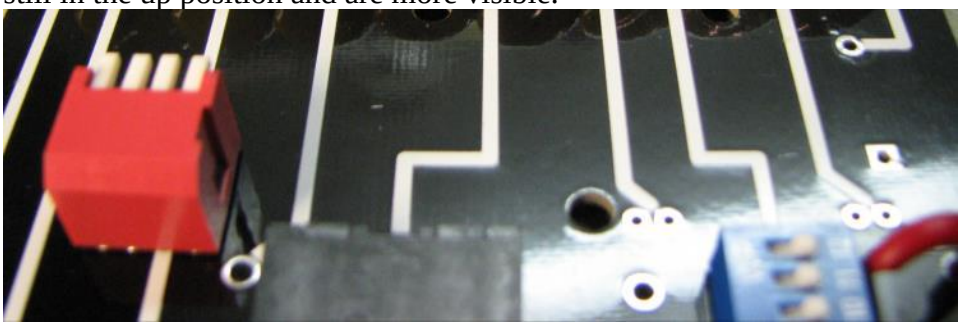


Then trim off the excess wire on the backside of the board.
Just a couple of different views after the red wires are soldered:

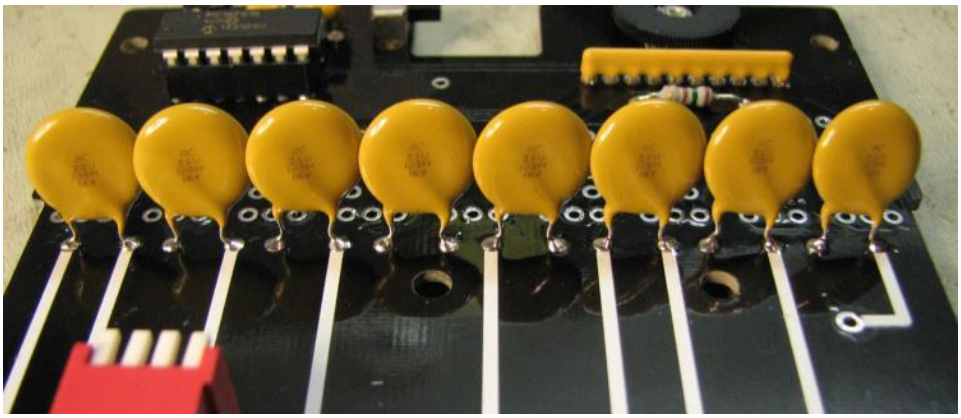




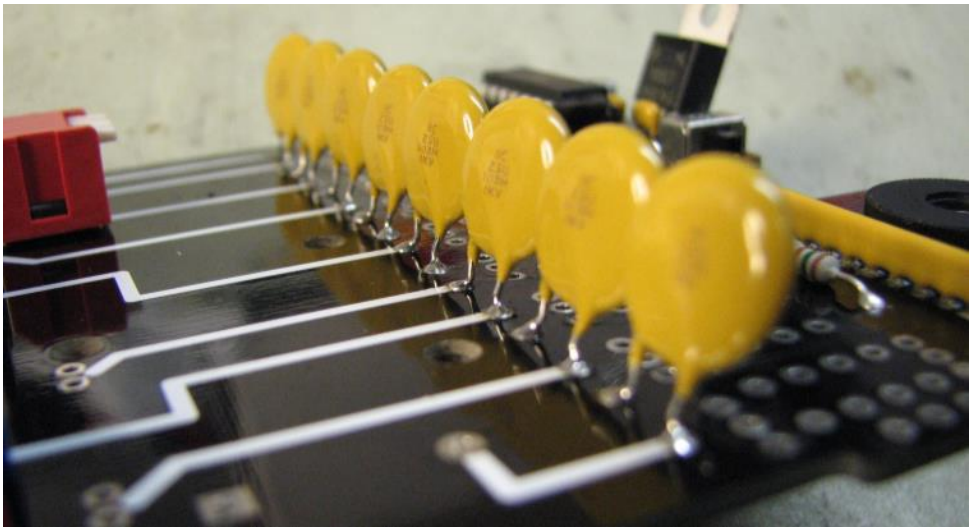
Next mount and solder the small red piano style dip switch. Face the white switches away from the bottom of the board and all switches down so they are harder to see. In the photos, the switches are still in the up position and are more visible.



Now you need to mount the 8 large yellow ceramic disc capacitors. Choose which way you would like to have them face: all with the black markings visible, all without or a pattern of some showing and some not. Here is when they have their markings all facing the bottom of the board and the markings will be more visible:



And another view:

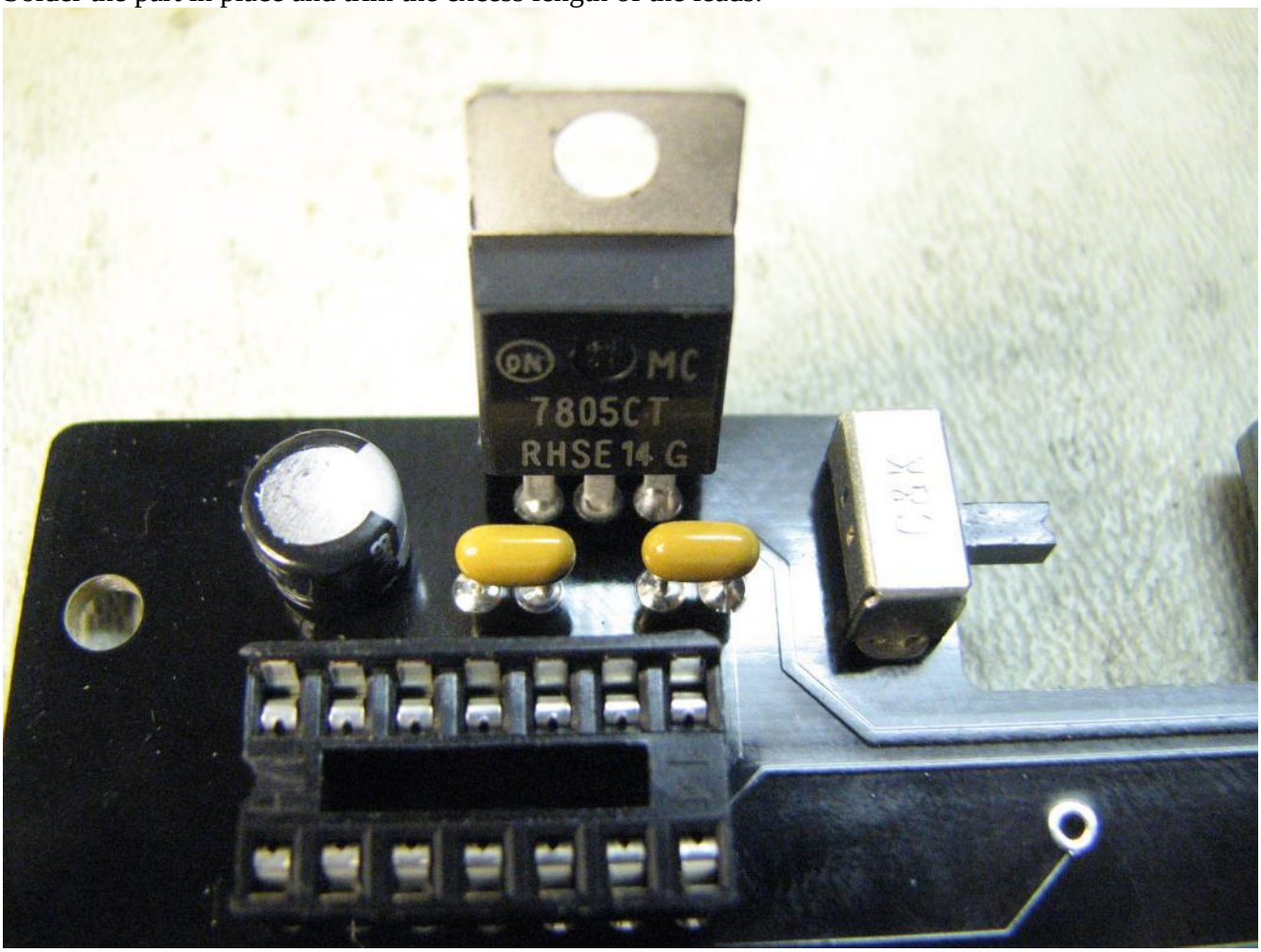


I like to place all 8 caps in the holes and then solder just one leg of each cap and then go through and adjust each cap and possibly reheat that single solder joint to allow moving the cap up or down. When they all look aligned solder the other lead of each of the caps and then trim the excess lead length from the bottom of the board.

Gizmo2 Electrical Part 2…

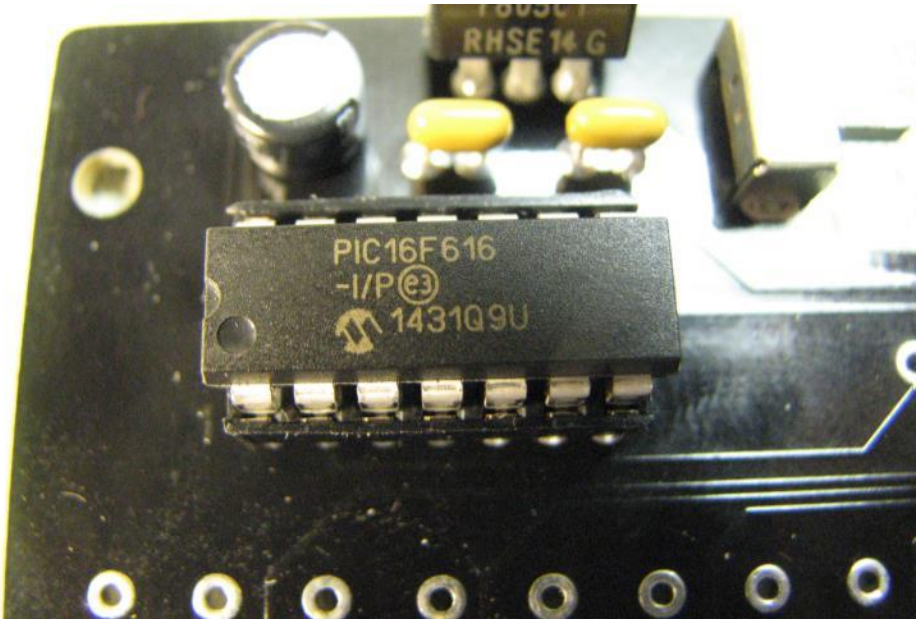
Mount the voltage regulator (7805, 3 leg device) up at the top of the board. The orientation is critical and the part must have the markings facing the shorter two yellow capacitors that were already installed in the board. The regulator will be leaning back some to allow more clearance for the display tube shelf that will be installed later.

Solder the part in place and trim the excess length of the leads.

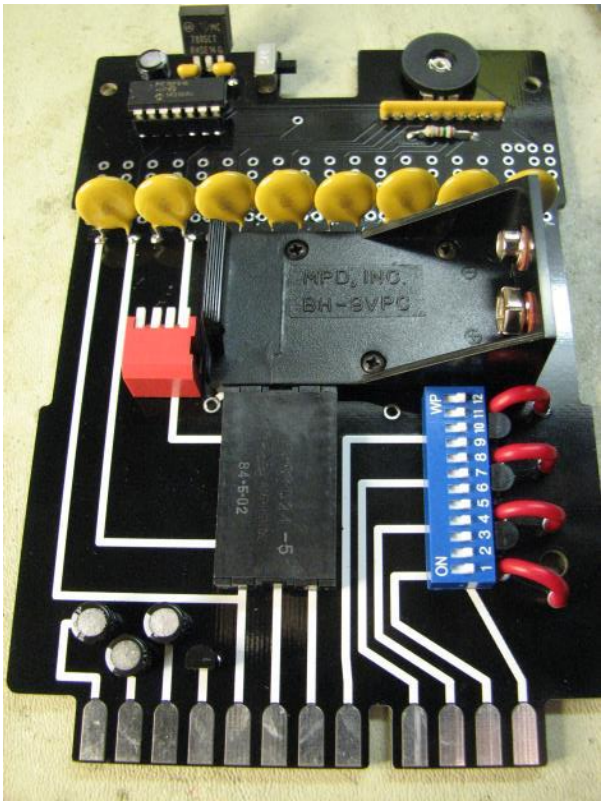


Now install the PIC microcontroller in the 14 pin socket that is next to the voltage regulator.

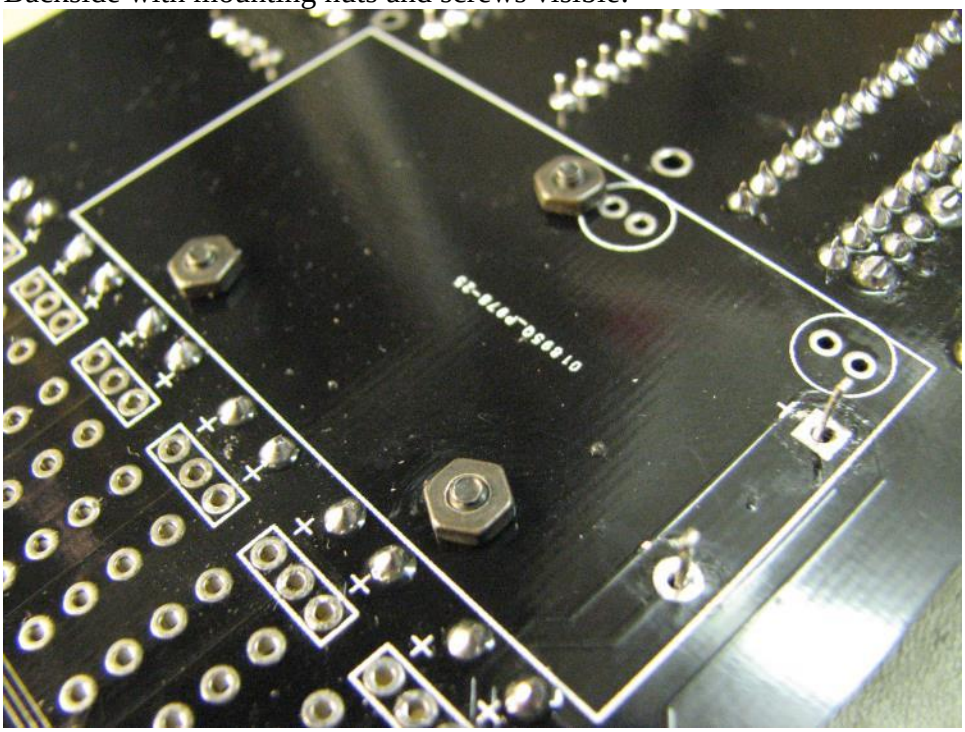
Orientation is critical and pin 1 is to the left. So the indent on one end of the PIC should be on the same side as the indent in the side of the socket:



Next mount the battery holder in the board and hold it in place with the included 3 sets of screws and nuts:



Backside with mounting nuts and screws visible:

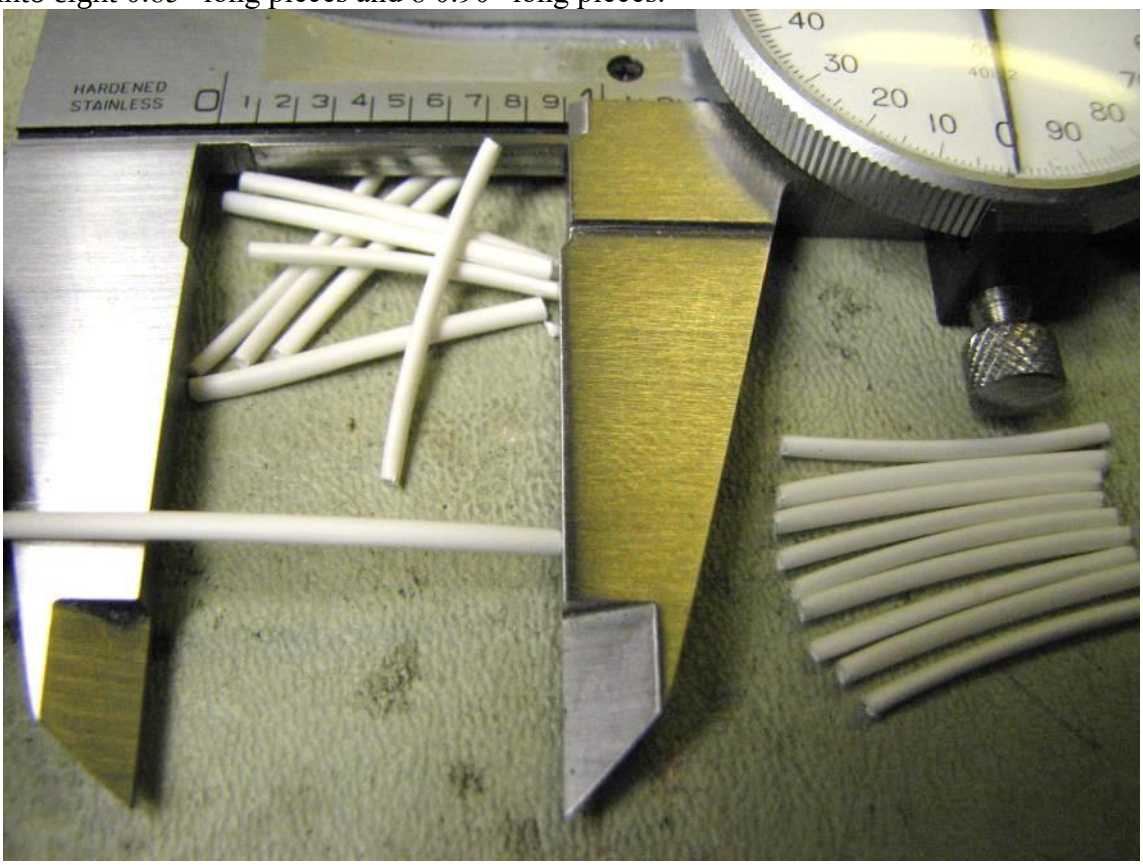


Solder the two battery holder pins and then trim off the excess lead length on the bottom side of the board.

Next the 8 amber LEDs need to be mounted to the board. The 8 are in the pink foam on each side of where the electrical parts were. The one LED up next to the regulator is the red LED for the error box. The LEDs appear identical, so be careful not to mix them up.

If you mix them up, or want to check them prior to soldering them to the Gizmo board you need to get a 350 to 500 ohm resistor and connect the LED and resistor in series across a 9V battery terminals. The LED's longer lead goes to the positive terminal on the battery and the shorter lead goes to the resistor and the other lead of the resistor goes to the battery negative terminal. This should let you light up an LED and see what color it is.

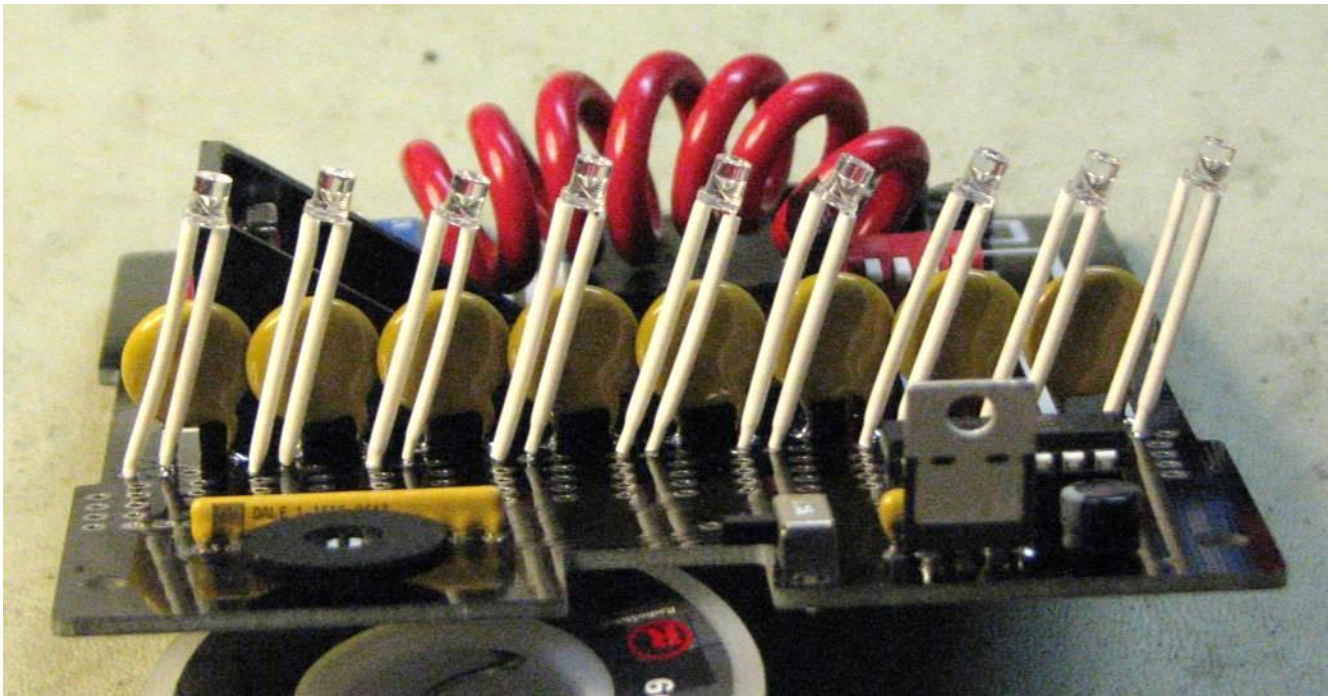
Back to the 8 amber LEDs… They need white insulation tubing placed over the leads to help line them up and also protect them from shorting to some other wire. You will need to cut up the white tubing into eight 0.85” long pieces and 8 0.90” long pieces.



The long pieces go on the long leads and the short pieces go on the short leads.

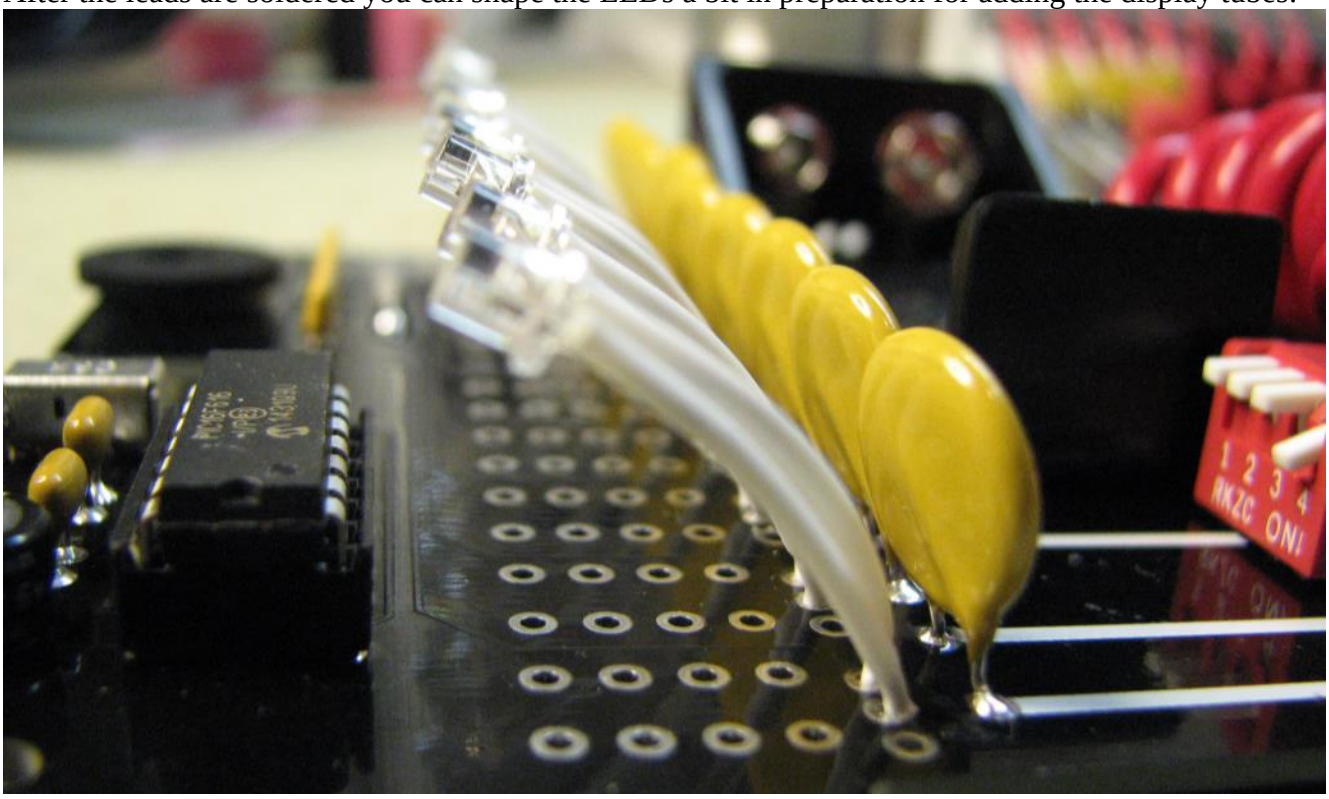


The long leads need to go into holes that are marked with a “+” on the bottom side of the board and the short leads need to go into unmarked holes between the two holes that have “+” signs:

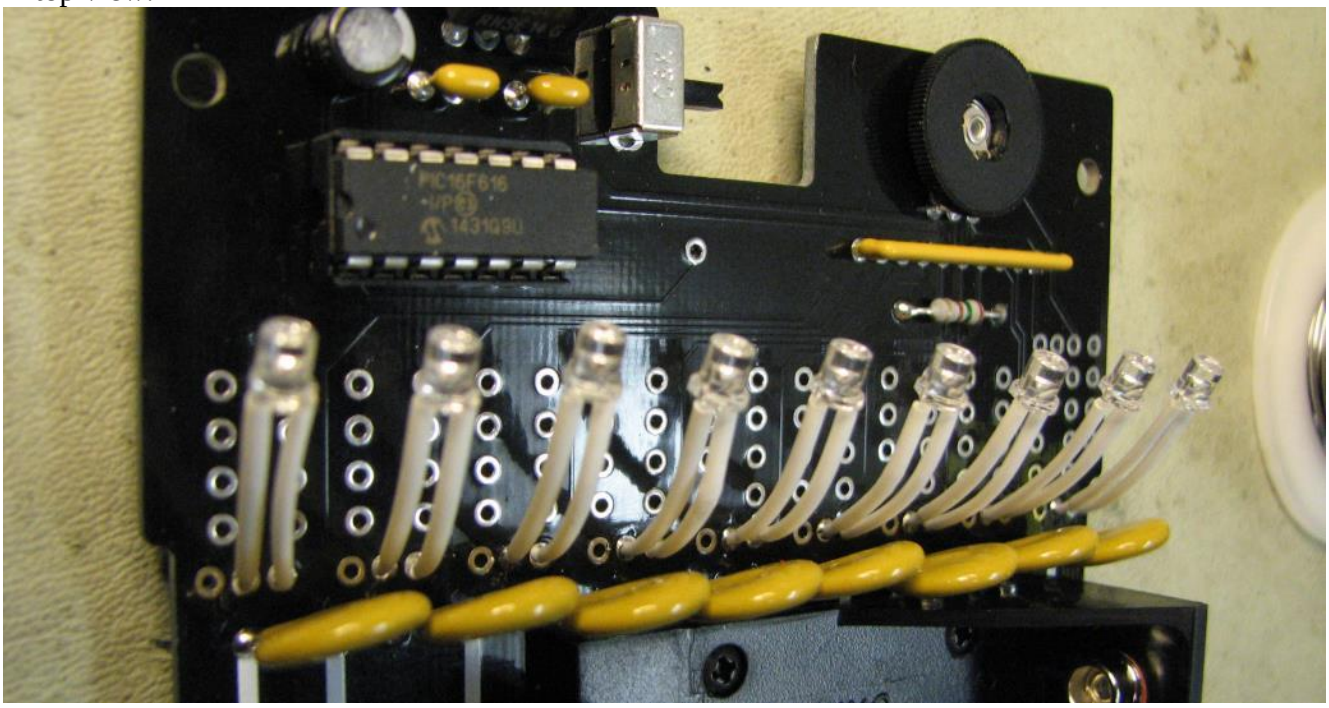


The LEDs will lean to one side and not much of the leads should show. Solder one lead of each LED and adjust the position. When satisfied solder the other lead of each LED. If you heat up the lead too much the white heat shrink tube will shrink. You can see that at the bottom of most of the LEDs in the picture above. If you get the lead really hot it could shrink the tubing up much higher and it will be more visible. You can always use a heat gun to shrink the tubing but still try to do that minimally since heating up the clear portion of the LEDs can cause them to fail.

After the leads are soldered you can shape the LEDs a bit in preparation for adding the display tubes:

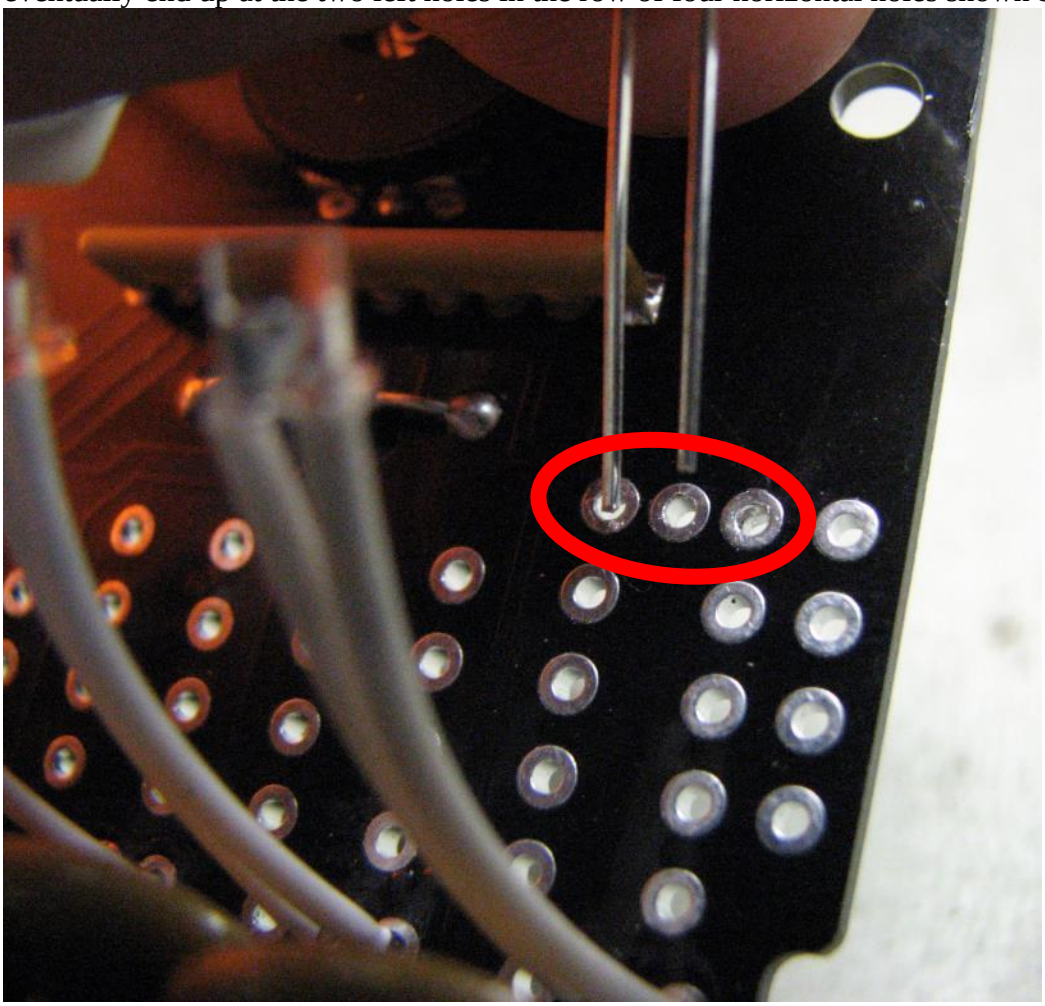


A top view:



You can now test the amber LEDs by putting a 9V battery in the holder and turning on the power switch. All nine amber LEDs should operate.

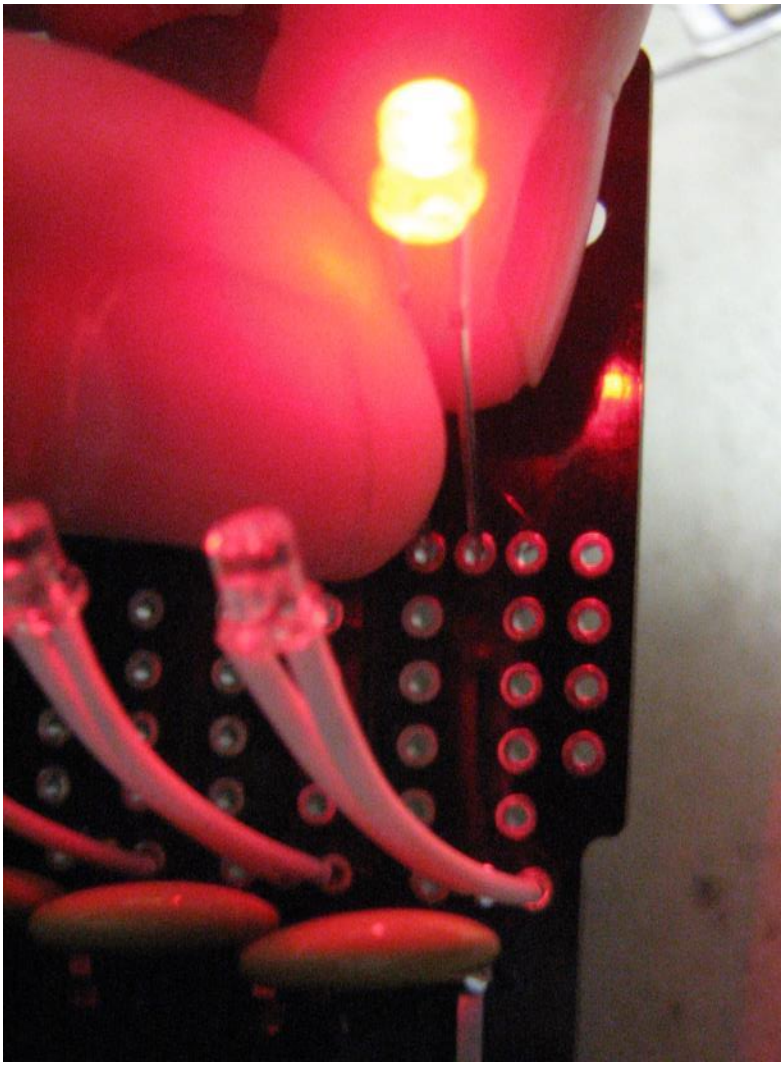
Testing the error box LED before soldering is recommended. The wire leads for the LED need to eventually end up at the two left holes in the row of four horizontal holes shown below:



The left most through hole pad is connected to the regulated +5V and needs to connect to the longest LED lead (anode, or positive). The 2nd through hole pad from the left is driven by the PIC microcontroller and is current limited to about 20mA for driving the shorter LED lead (cathode, or negative). The third through hole pad is connected to ground so if you want to power your own LED and resistor or something else, you can connect to these three through hole pads.

The pads are labeled on the back side of the board as “+5”, “LED” and “GND”.

For testing, there is no need to solder the LED to these pads, just have your battery installed and turn on the electronics with the power switch and set it to a nice steady rate of updating for the amber LEDs (I like the left to right scan since the Red LED is on longer) and hold the red LED in place. Apply enough pressure to make sure both leads make contact with the inside of the through hole pads.

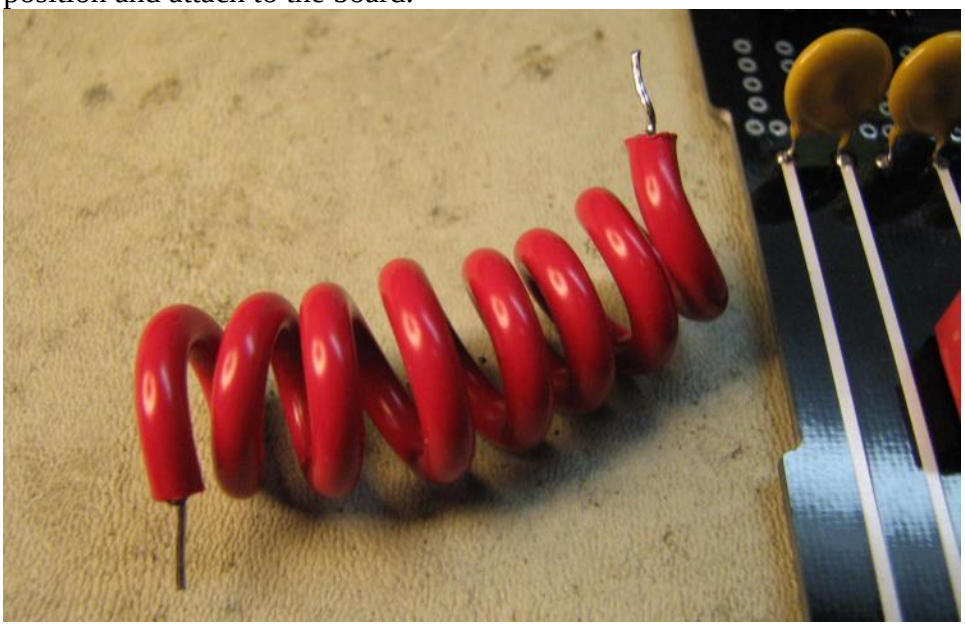


Gizmo2 Basic Parts Part 2…

The main coil can be constructed with the thicker red wire. This wire is not very compliant so needs to be encouraged into the desired shape. Wrap the wire around a pencil and hold one end in a vise and the other with your hand. If you let go the wire will unwrap and not retain the shape. If you heat the wire with a heat shrink gun while being held in the shape it will now stay in the new shape. Be sure to evenly heat the wire all the way around the pencil. Do not get too close to your fingers or you can get burned!

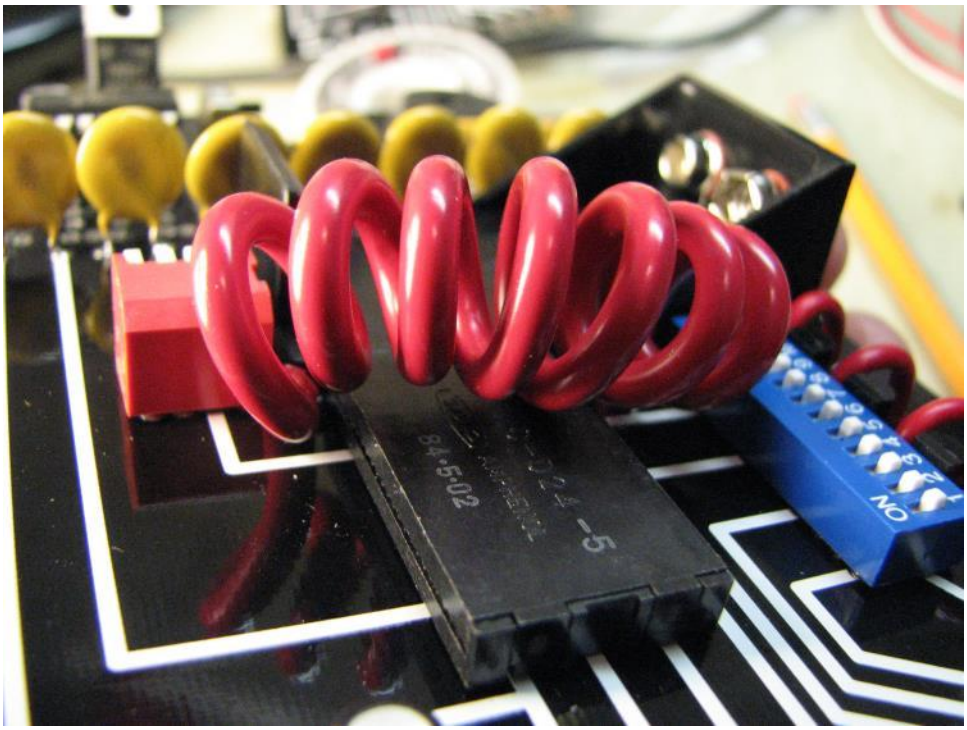


After the heat treatment, cut to the desired length (number of windings) leaving a bit extra at each end so you can strip the wire. The wire will now hold in the desired shape and make it much easier to position and attach to the board.

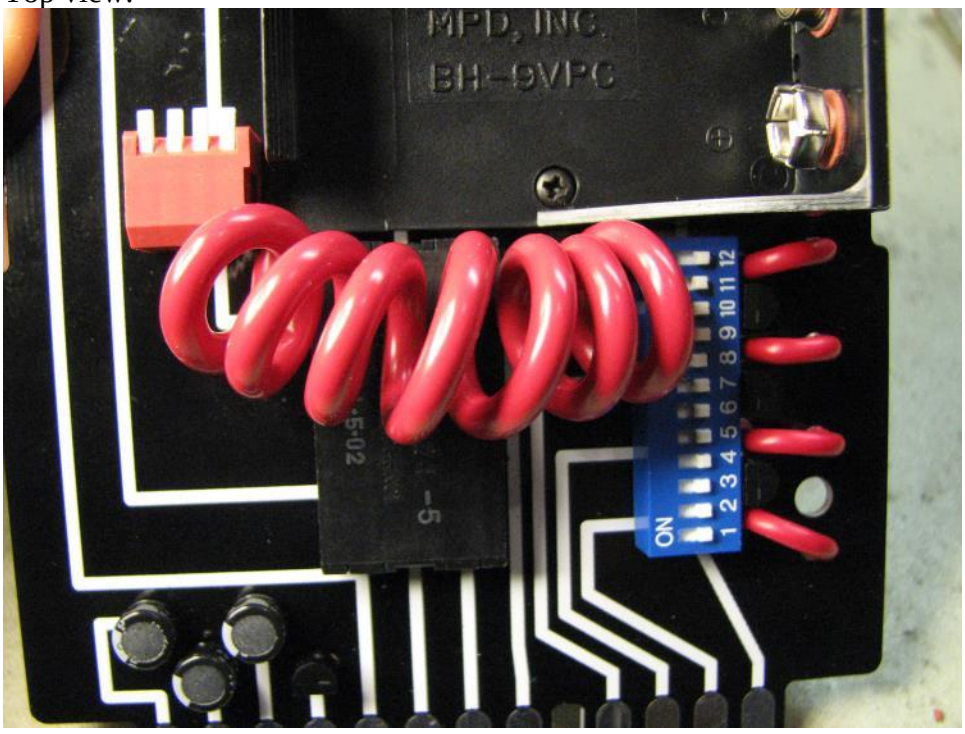


Solder one side and verify the positioning before soldering the other side. Then trim off the excess wire on the back side of the board.

Side view:



Top view:



Gizmo2 Display tubes…

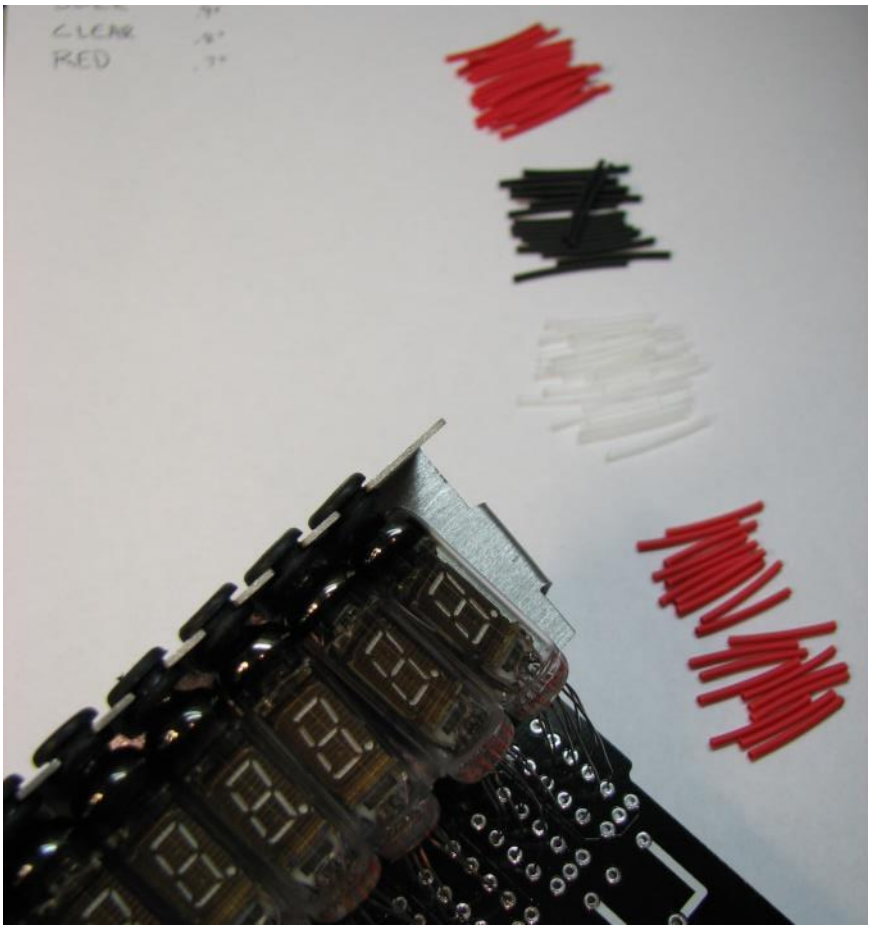
You may wish to prep and paint the aluminum display tube shelf with legs or just leave it with the aluminum showing as was done in these instructions. But before we can use the shelf we need to prepare and solder to the board the 9 display tubes.

Prepare the display tubes for insertion by removing the short lead (it poked me on more than one occasion and deserves to be cut off first thing). There are 8 solder through pads per display tube, but these display tubes still have more than 8 leads. If you wish to leave on all of the leads and just stuff several leads into one hole that is fine. I chose to remove the back side 3 long leads so only 8 visible leads would remain on each tube.

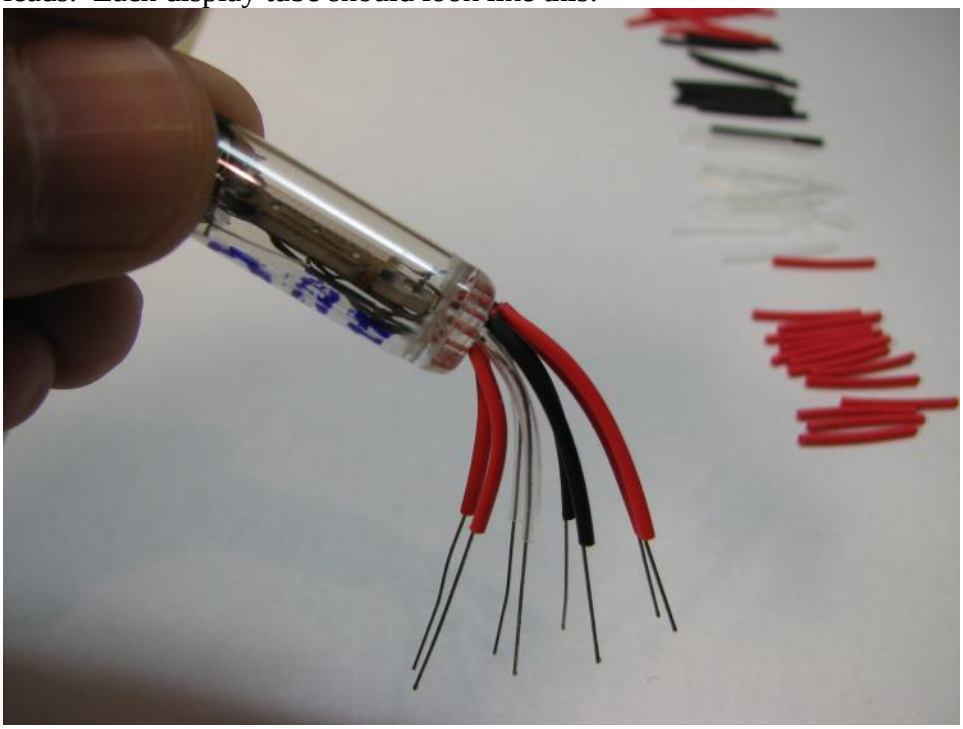
Next form the leads into two groups, 4 on each side with the display digit facing you. Then curve the leads so they will sit in the 8 solder through pads. You can mount the shelf and have all 9 display tubes setting in the shelf and legs through the appropriate holes before going on to cutting the heat shrink tubing that will go over each display tube lead.

Cut up a bunch of heat shrink tubing to be slipped over the display tube leads.

- 18 Red 1.0” long pieces (two per display tube on the front two leads)
- 18 Black 0.9” long pieces (two per display tube on the next two leads, one on each side)
- 18 Clear 0.8” long pieces (two per display tube on the next two leads, one on each side)
- 18 Red 0.7” long pieces (two per display tube on the next two leads, one on each side)

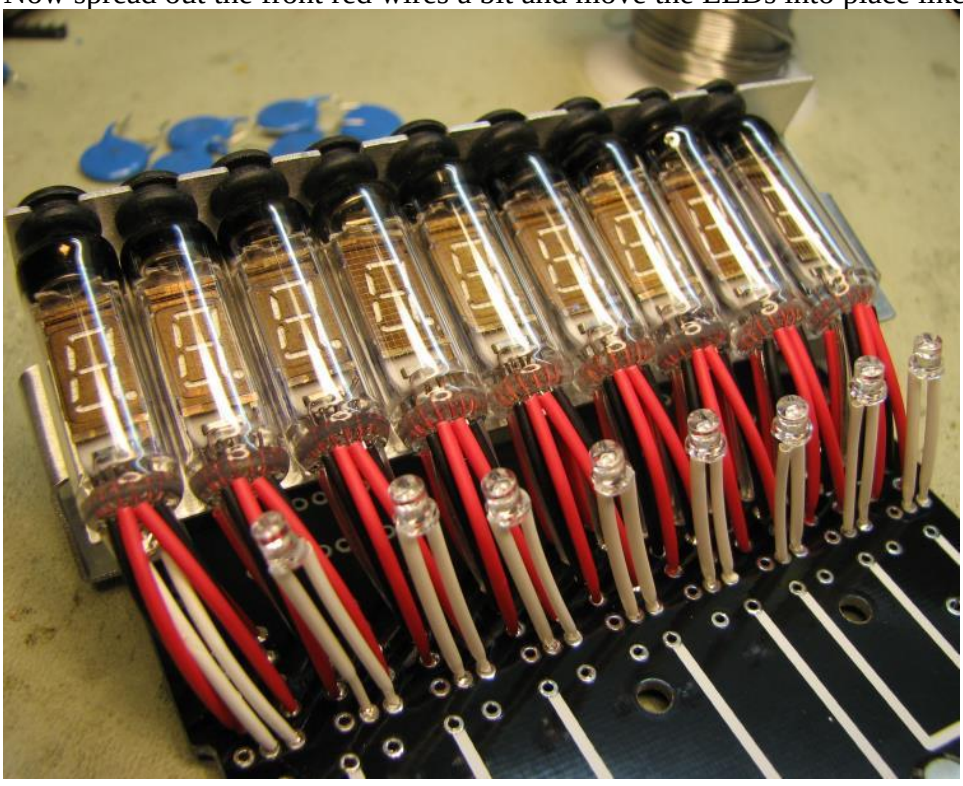


Now remove the display tubes from the board and slip on the 8 heat shrink tubes onto each of the 8 leads. Each display tube should look like this:

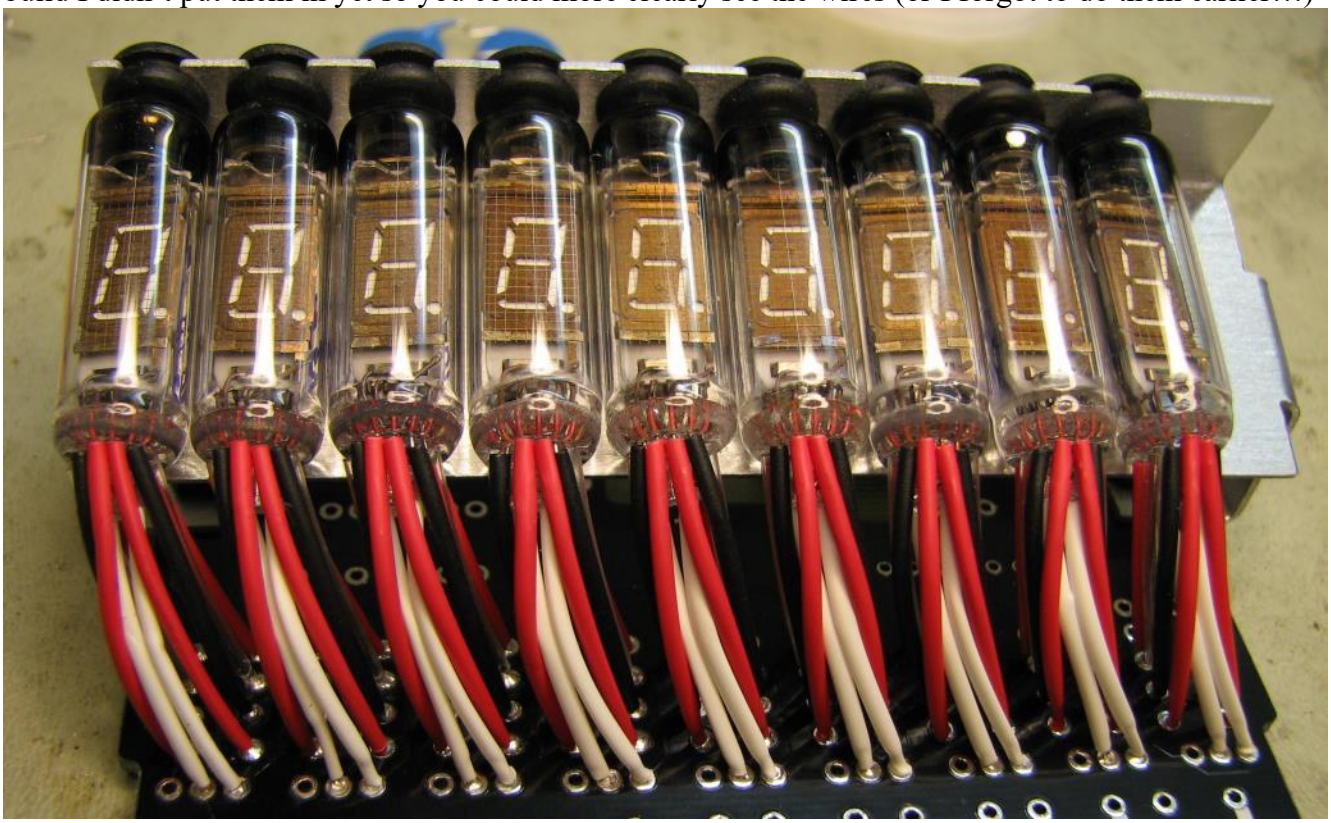


Then mount and solder the display tube leads to the board 1 at a time. Make sure you do not skip any rows of holes since there are just enough for the 9 display tubes. Also leave the horizontal row of 4 through hole pads and the 3 additional pads on the far right hand side of the board for the error box!

Now spread out the front red wires a bit and move the LEDs into place like shown on the far left:



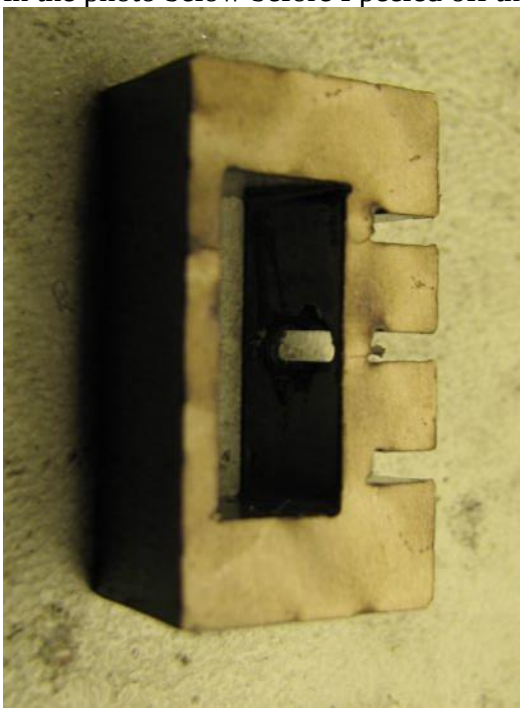
Here is the finished set of display tubes. Yes the large Yellow caps are not show here because on this build I didn't put them in yet so you could more clearly see the wires (or I forgot to do them earlier…)



The color of the front faces of your display tubes may also be different than shown in the photo above. I do hand sort all of the display tubes to get you a set of nine that have very similar color.

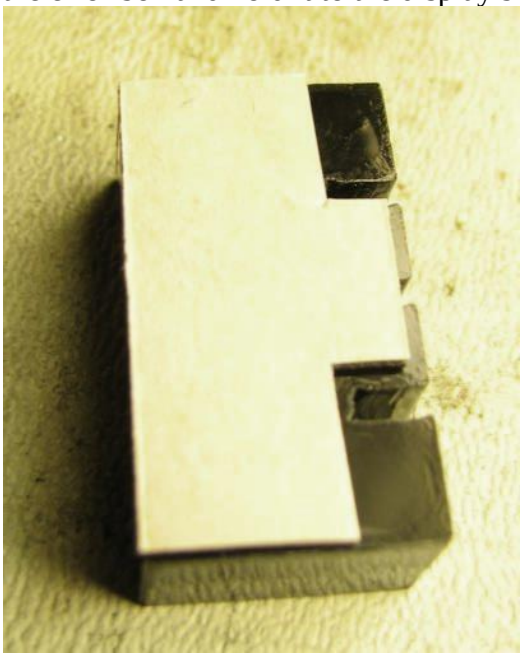
Gizmo2 Error Box

To get the Red LED to light up the error box, we need to get wires all the way inside the box. You could do it some other way, but I like adding a hole in the center of the right hand side that can be seen in the photo below before I peeled off the protective paper:

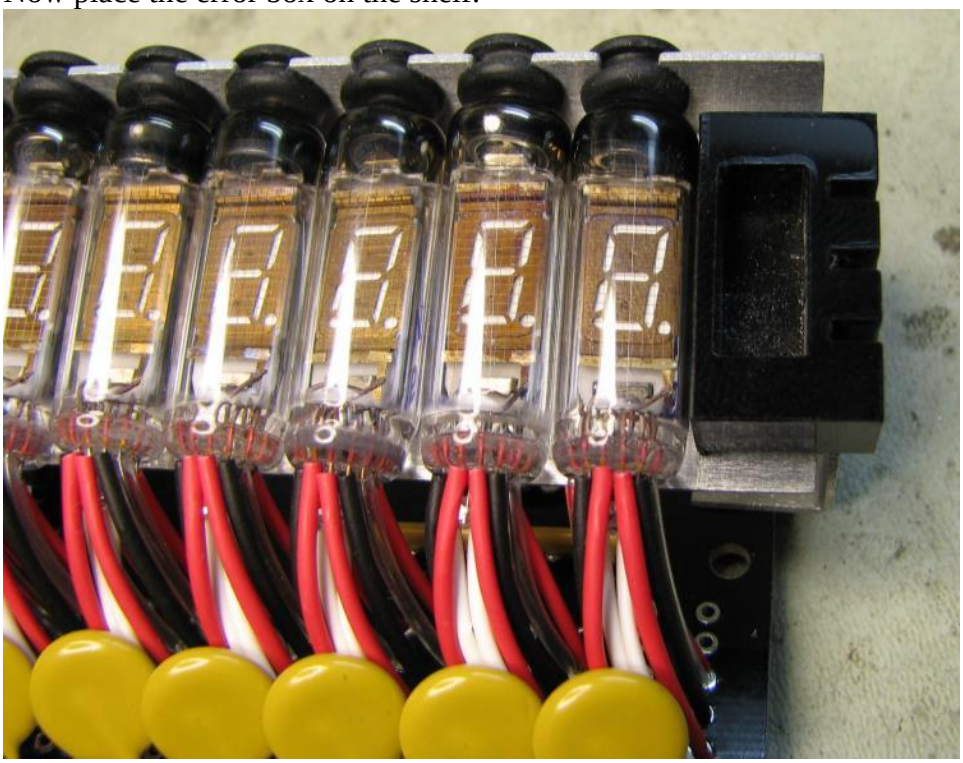


I used a Dremel with a very small grinding head, but a tiny drill bit would also work.

Next use some double faced black foam tape and cut out a shape that can be attached to the bottom of the error box and hold it to the display shelf. You could use glue, but this worked out real well.

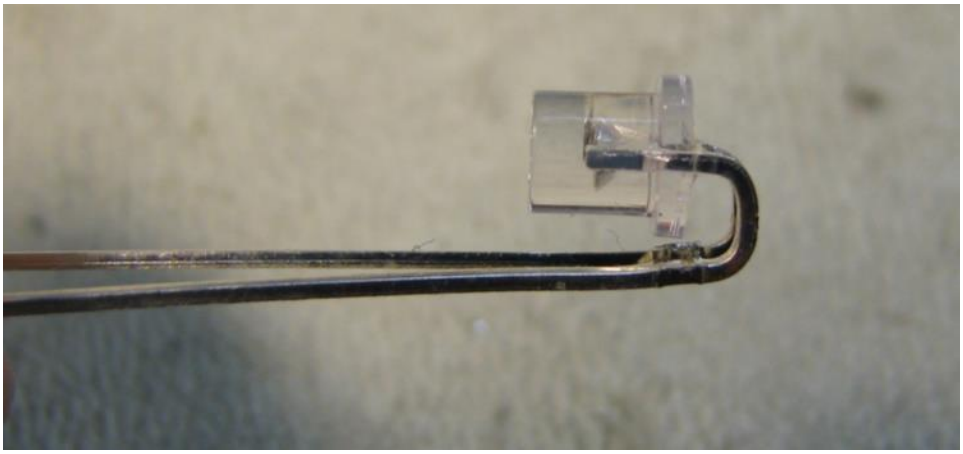


Now place the error box on the shelf:



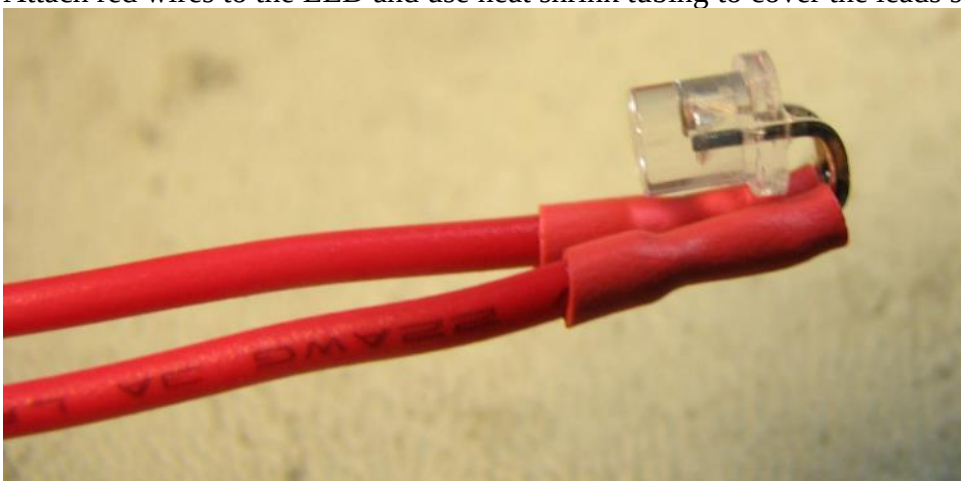
Time to form the leads on the Red LED. I tried to keep track of the long lead so I could get it to the correct hole on the gizmo board but eventually forgot so just ended up testing it and by holding the wires both ways in the board before soldering the wires to the gizmo board.

First bend the leads around like this:

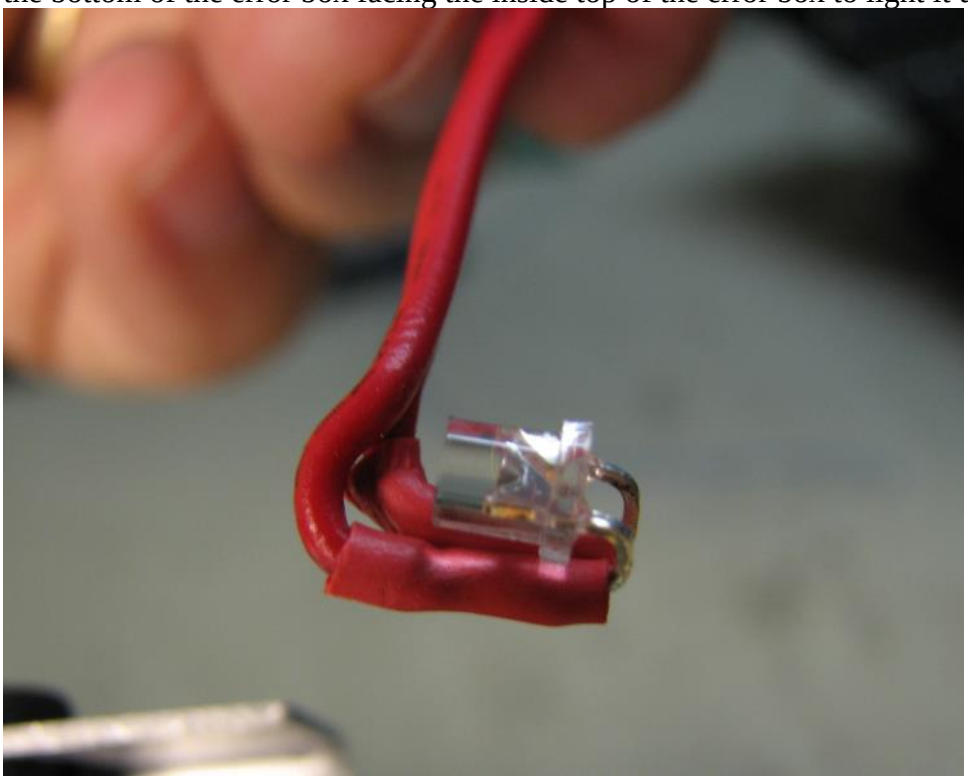


You will need 6 red wires coming from the error box, two from the LED and two more pairs just for show. The extra 4 wires will go to the four solder through pads on the far right side of the board next to the last leads from the far right display tube.

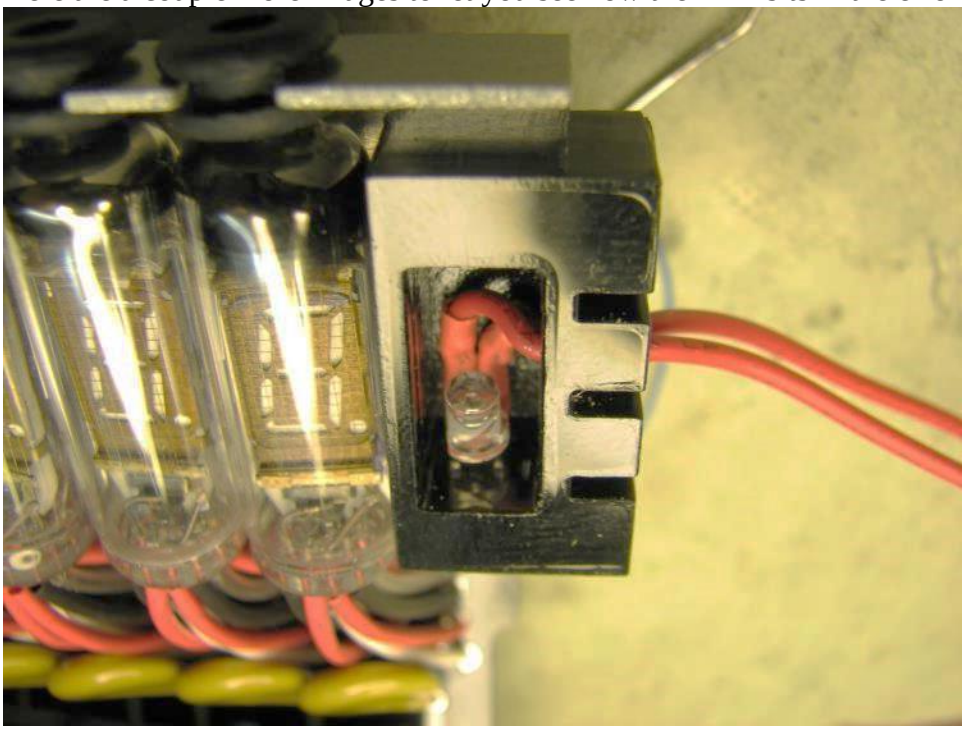
Attach red wires to the LED and use heat shrink tubing to cover the leads so they do not short together.

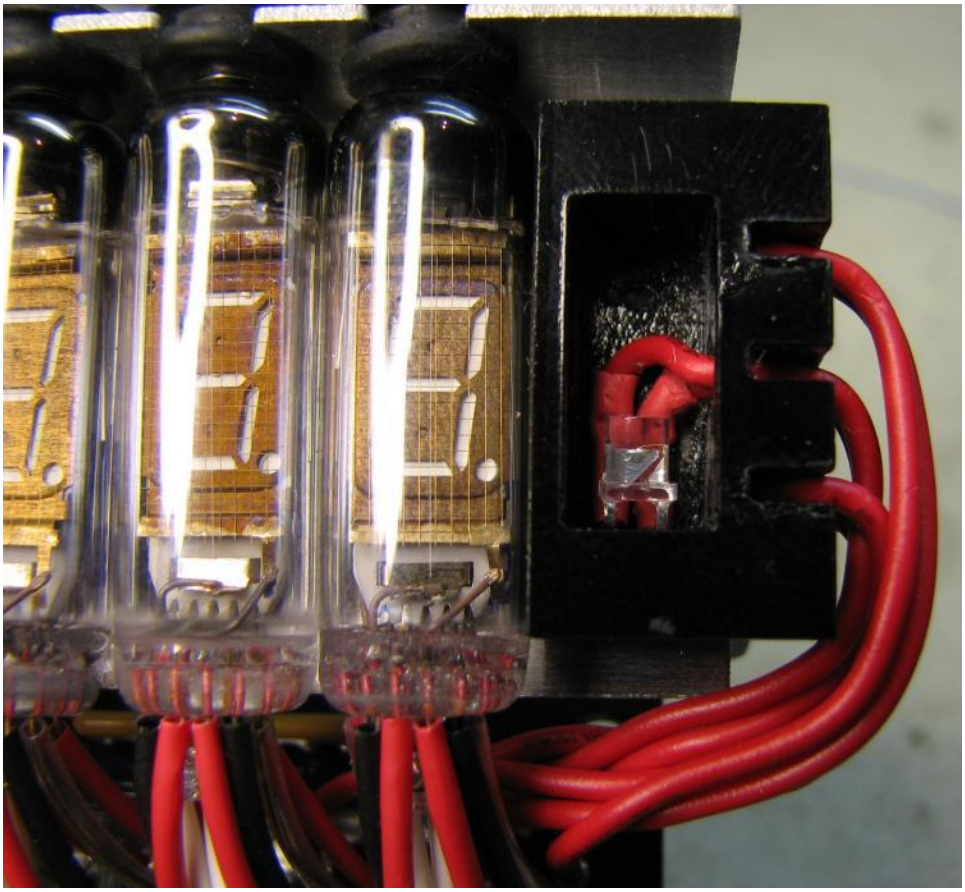


Now bend the wires in some way so that they will come out of the error box, but position the LED at the bottom of the error box facing the inside top of the error box to light it up.



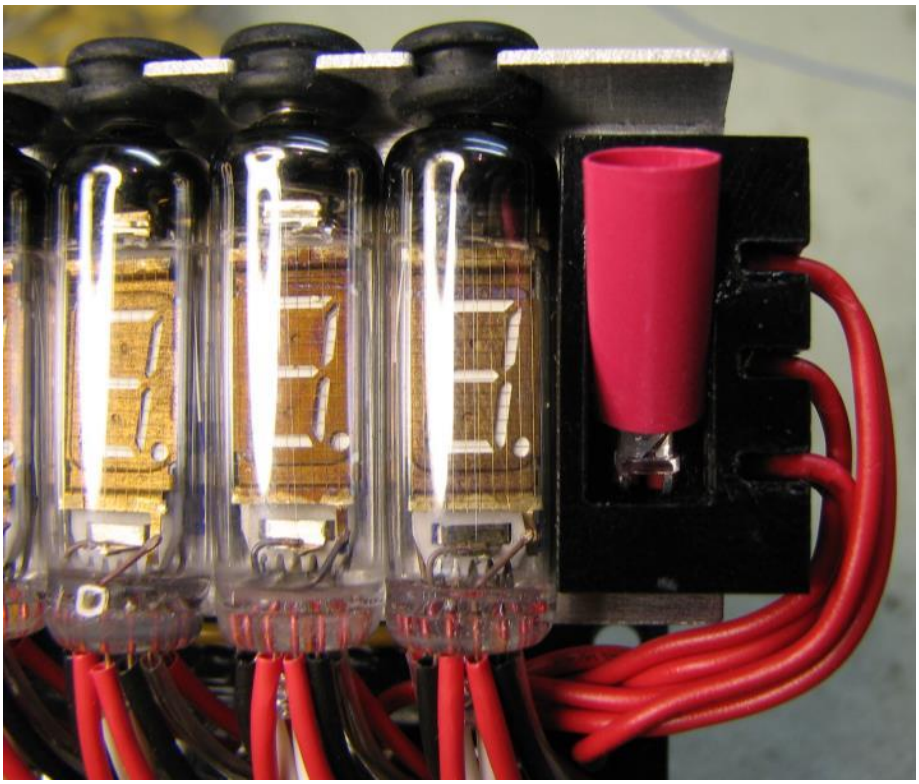
Here are a couple more images to let you see how the LED sits in the error box:



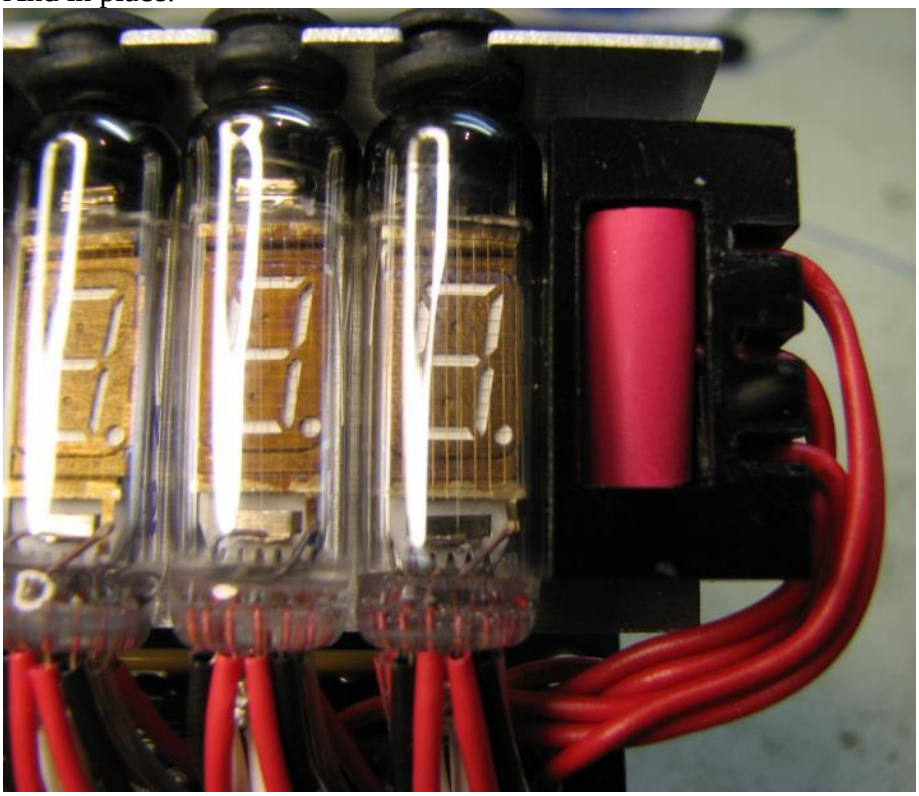


Now cur the large heat shrink tubing to just the right length to fill the inside of the error box and slip it over the LED. Do NOT heat this up or it will shrink and we really want it to stay the size it is!

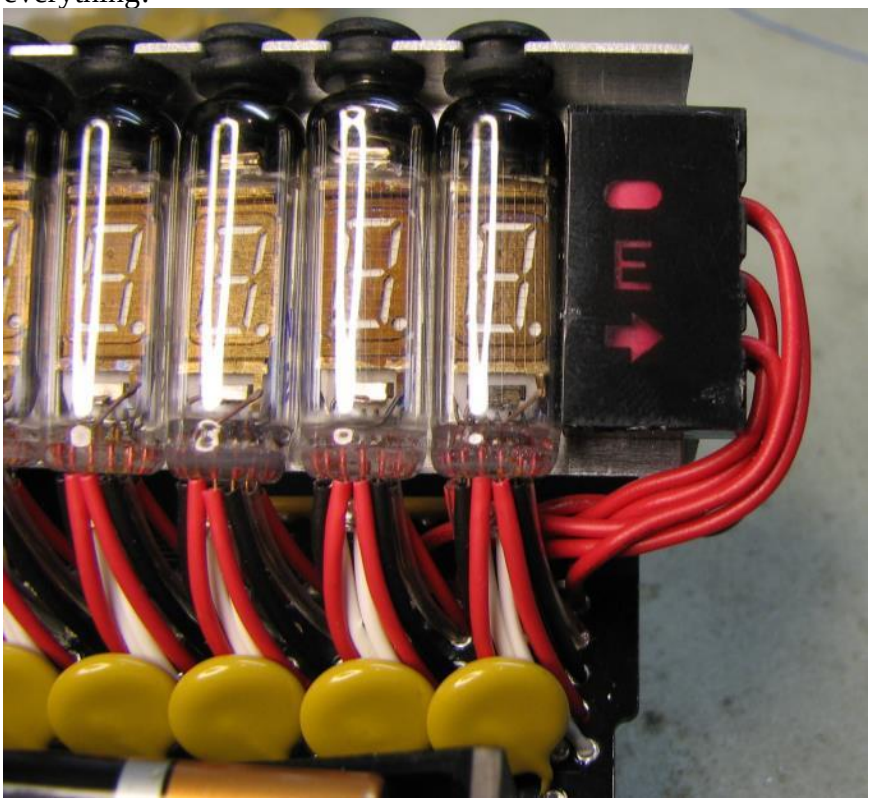
About to slide it over the LED:



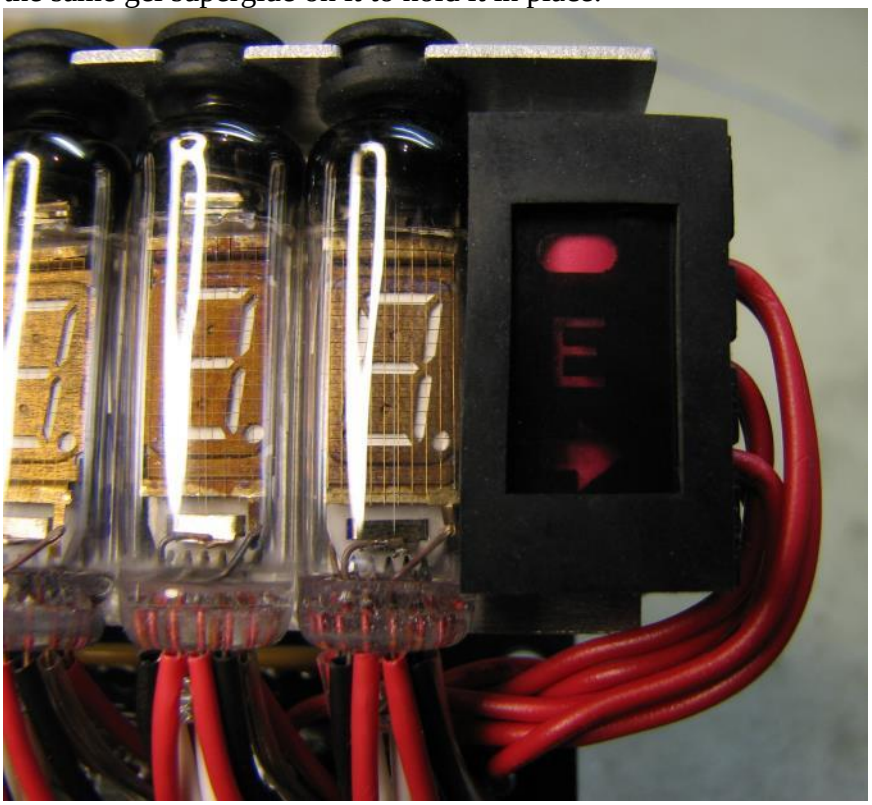
And in place:



Apply glue to top the edge of the error box and place the printed piece on the error box. I used gel type superglue sparingly and it worked very well. Regular superglue tends to wick out more and can get on everything!



Next rough up the back side of the silicon rubber gasket so it has a better chance of sticking and use the same gel superglue on it to hold it in place:



The actual positions of the error box wires in the above photos into holes on the gizmo circuit board will not match yours since these pictures were taken of the prototype board I was using. On your gizmo board the 4 additional red wires are soldered into the four outside holes:

