Gizmo Building Instructions

The Gizmo board is made to look very similar to the Sanyo ICC-808D calculator board with gold fingers on the card edge connector, curved traces and the plated through holes that are in the same locations as the original board.

The actual Sanyo boards are also wanted by calculator fans, so they have become hard to find and very expensive.

The prop builders for Ghostbusters Afterlife built the Gizmos that were used in that film with earlier versions of my kits. The printed circuit board for this last run (Final^5 run?) of Gizmo kits finally has a dark circuit board with green traces so it looks even closer to the original Sanyo calculator board. Most of the components used in this kit are the same as used in the last run of Gizmo kits.

The main changes from the last run of Gizmo board kits:

1) New circuit board colors - finally a dark circuit board with green traces!!!
2) "Tear drops" added to trace ends for a closer match to the Sanyo circuit board.
3) Improved replica White ICs: raised copper area, gold trace, green dry rub transfers for part numbers and logos.
4) Replica Murata labeling on real ceramic disc capacitors.
5) Screw hole added to circuit board enabling a more secure attachment of the shaver cord.
6) Black Matte powder coated display stand.
7) Improved 3D printed black "Pillow Part".
8) New Error Box design - bolted to display stand, adhesive backed gasket for a more secure attachment to error box.

Lots of parts in the full Gizmo + Daughterboard + cord kit:

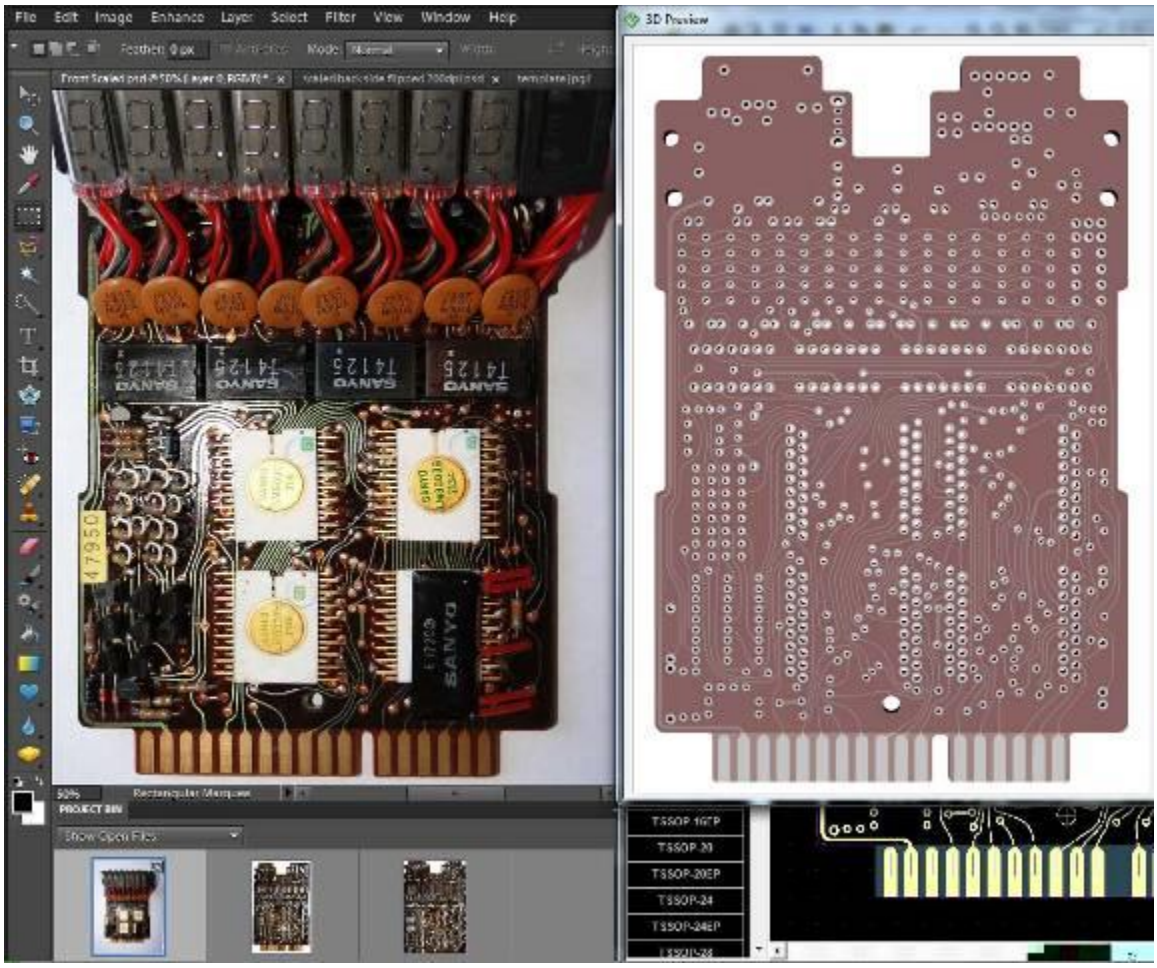


Below is a picture of the prop makers holding the finished kits from a previous “Final” run of my full Gizmo kits:



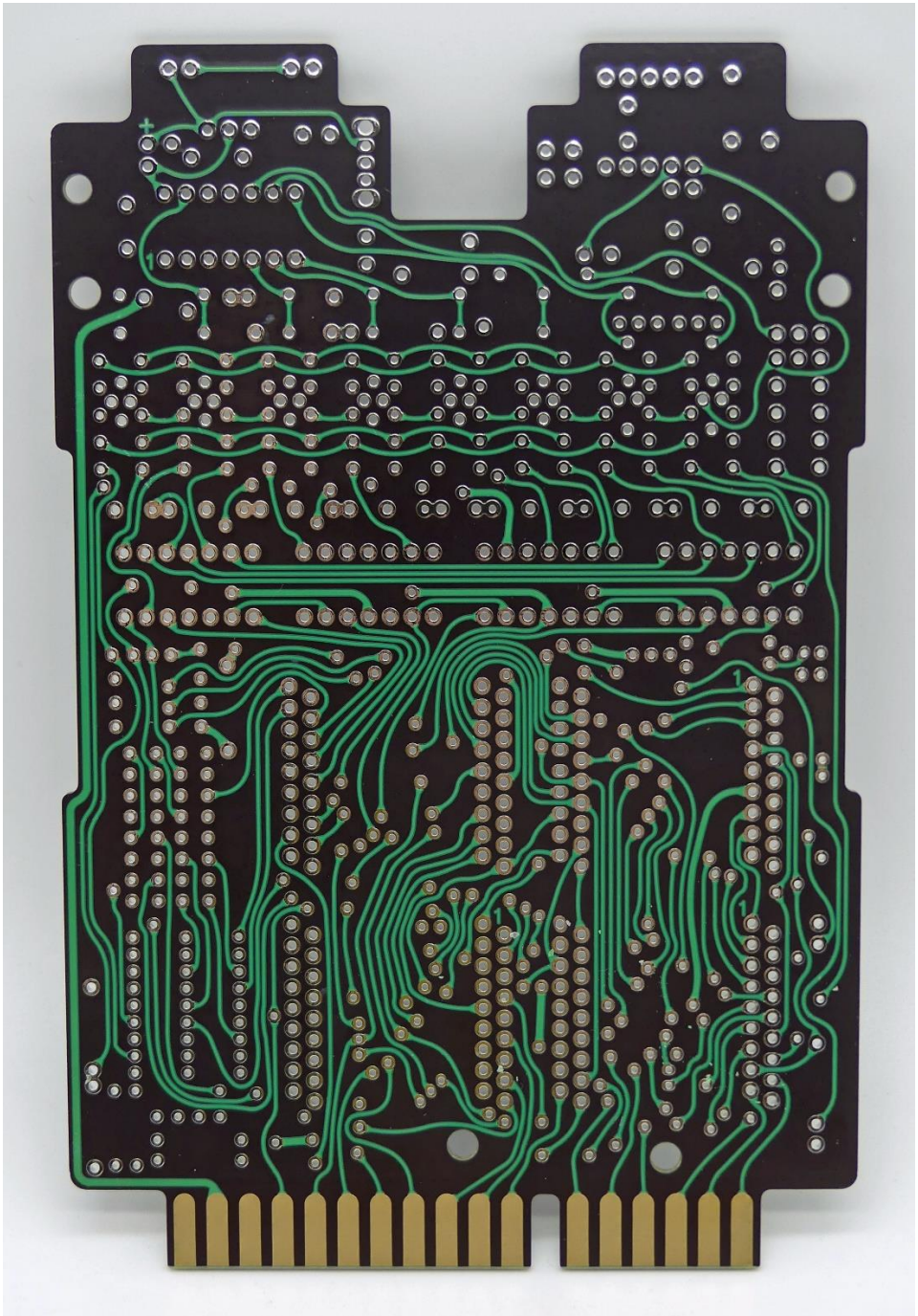
These kits are based on a real Sanyo ICC-808D board and the component values and locations as close as possible to match what was used on that Sanyo board.

The Actual Sanyo Board and a render of the Gizmo Printed Circuit Board from my CAD software:



Note: You may want to start with the “Detailed Daughterboard Instructions” at the end of this document if you are not a veteran electronics assembly person.

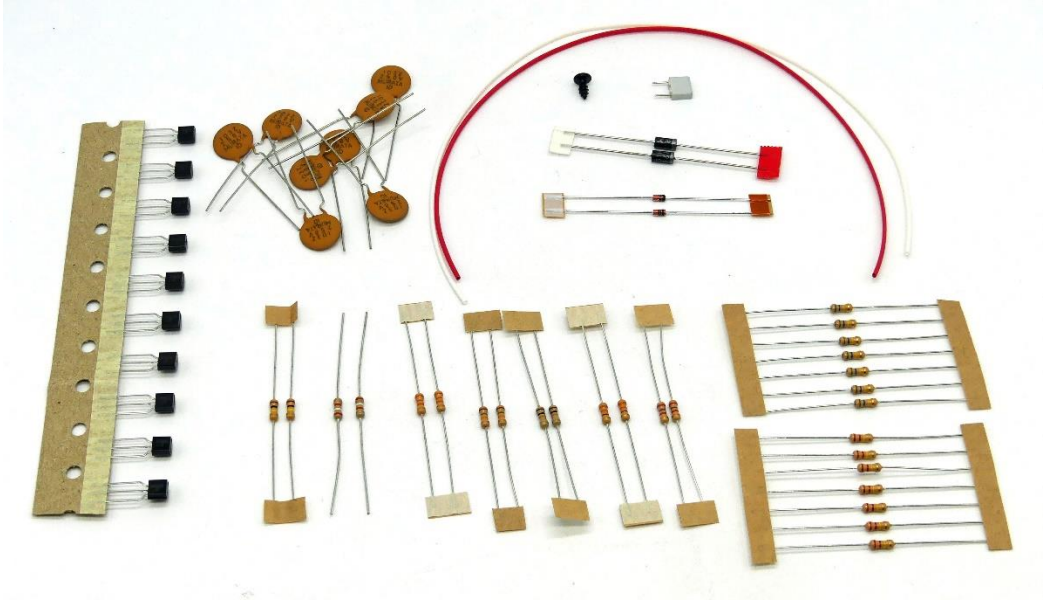
Here is a photo of the latest Gizmo kit's main printed circuit board:



This is the top side of the board where all of the components will be placed. The back side of the board has only a few traces (lines of copper that connect different holes together) and is where you will solder the part leads to the holes.

“BP” Basic Parts kit assembly

This is the basic parts kit for the real components that go on the bottom half of the board.



Transistors (Black device with 3 legs) quantity 10

Capacitors

8x Brown Ceramic Disk Capacitors, approximately 12mm in Diameter
1x White capacitor

White and Red Heat Shrink tubing

Enough to cover the leads of the 14 resistors that are standing up on the board

Screw, #4, 1/4” Philips head to secure the shaver cord to the board

Diodes

2x Black Diodes (2 leads)
2x Red/Clear Diodes (2 leads)

1/4W Resistors that lie flat on the board:

2x 2.7K (Red Violet Red Gold)
3.3K (Orange Orange Red Gold)
10K (Brown Black Orange Gold)
15K (Brown Green Orange Gold)
33K (Orange Orange Orange Gold)
39K (Orange White Orange Gold)
100K (Brown Black Yellow Gold)

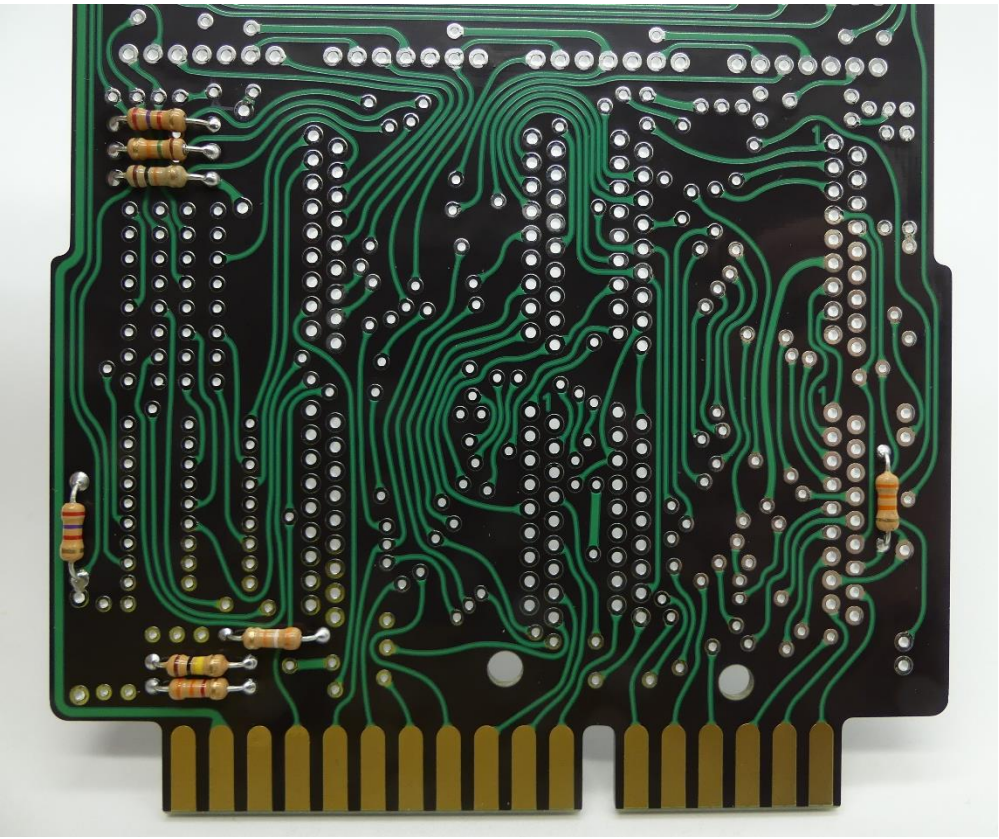
1/4W Resistors standing up on the board with white or red sleeves covering one lead:

7x 220K (Red Red Yellow Gold)
7x 560K (Green Blue Yellow Gold)

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 I didn't do this because I was too excited and just quickly built up the board without sticking to this philosophy. It also makes it more difficult when portions of the electronics should be included earlier, but hey that is in a separate bag of parts so lets build up one bag of parts at a time.

*** NOTE ***
When building up the kits for this run of boards, I put in 2 each of the 1/4W Resistors that are to lie flat on the board even though only the 2.7K resistor value needs two parts. This will leave you with an extra 6 resistors when completed. If you want, you can use 3 of these on the daughterboard to replace the green inductors. The green inductors were used in the Afterlife props, but with the new green traces on these circuit boards, you may like the look of the tan resistors instead of the green inductors that are a close color match to the color of the green traces…

Place the 8 “lying flat” resistors in the correct holes in the board:



You can match the color codes with the parts as seen in this photo or you can just randomly select a resistor if you want it to be different. The two sets of 7 resistors will be used for the stand-up section of parts. In the actual board each group of standing resistors had the same value (same colors). You can choose to do this or not – it is your board!

Resistors in real circuits can be placed in either direction. The gold band can go to the left or the right, so each real board may have them in either direction and there is no right or wrong way.

To place the resistor in the board, bend the wires up to form a “U” shape and then insert the wires into the holes as seen above. (They are shown above after I soldered them in). Be careful about finding the correct holes. The ICs do need access to the larger holes nearby, so we don’t want to mount a resistor in one of those holes.

After a resistor has its two leads placed in the holes, the resistor should be lying flat on the circuit board, and the leads should be sticking way out on the back side of the board. You can bend the leads on the back of the board at a 45-degree angle or so to help keep the part from falling out when you flip the board over to solder the leads to the circuit board pads.

You can do this one at a time or you can place all 8 resistors before you solder them.

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 being added so shorts or bad solder joints aren't much of an issue. If you end up also putting in the LED parts, those are actual electrical circuits, so the soldering is much more important.

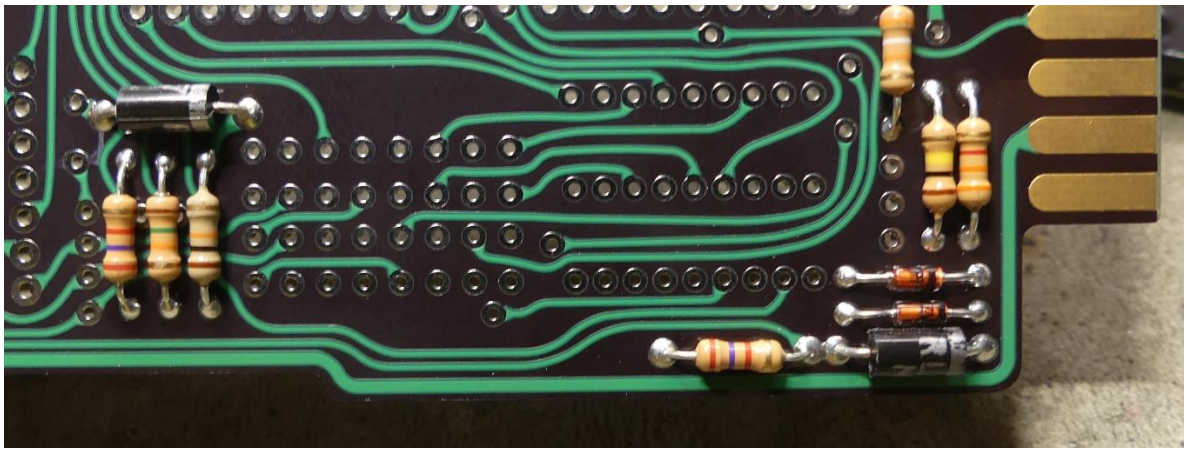
If needed, you could glue the parts in, but soldering is more accurate.

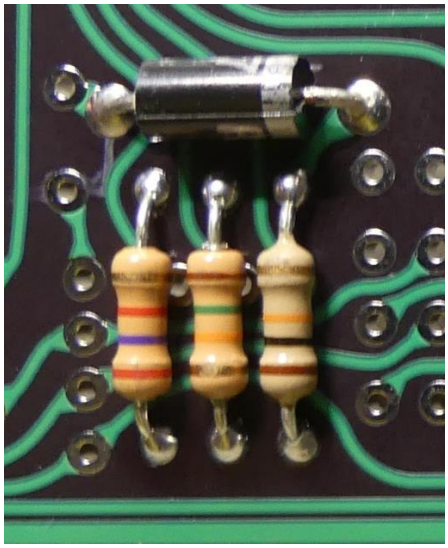
*** WARNING ***
Solder can contain lead and that is a poisonous substance, so be sure to keep the solder out of kids reach and wash your hands after handling the solder and before you eat or prepare food. It is best not to directly breath in the smoke when soldering, so a ventilated area is best and 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 ***

After the part or parts are soldered, cut off the excess part of the leads on the back side of the board. I use small diagonal cutters and cut the lead as close to the board as possible. The small stubs that are left can be fairly sharp, so be careful. Depending on how this is mounted to your belt, you may want to file them down a bit to remove any sharp edges. This is not normally done, but this won't hurt anything and since it is not a working circuit this should not cause any issues. When all done be sure and clean off any filings from the filing/sanding especially if you plan on building the operational LED circuit later on.

Add the 4 diodes, in the same way as you did the resistors. The parts should be flat on the board, and the leads should stick out the back side and be bent to hold the part in place. Flip the board over, solder the leads to the board and then trim the excess leads from the backside of the board.

Here are the two red/clear diodes and the two black diodes mounted and soldered to the board:







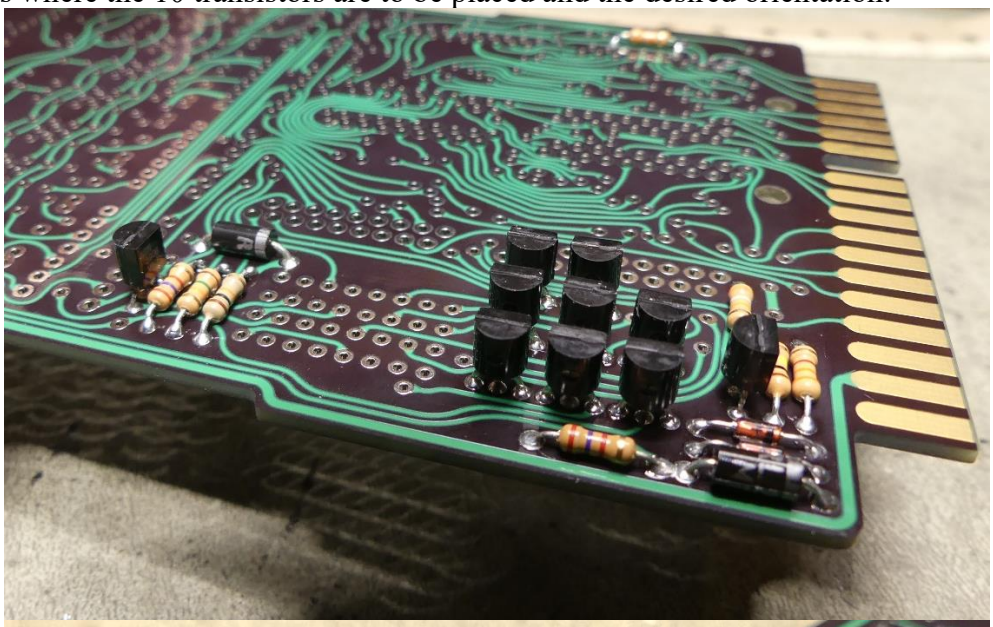
Real diodes have polarity indicators and must go in the correct direction. They have a silver or black band to indicate a particular side of the diode for you to care about. Since this is non-functional, you can put them in "backwards" here and it is fine. In the real Calculator board, they would always be placed with the same orientation, unlike the resistors that can be loaded in either orientation.

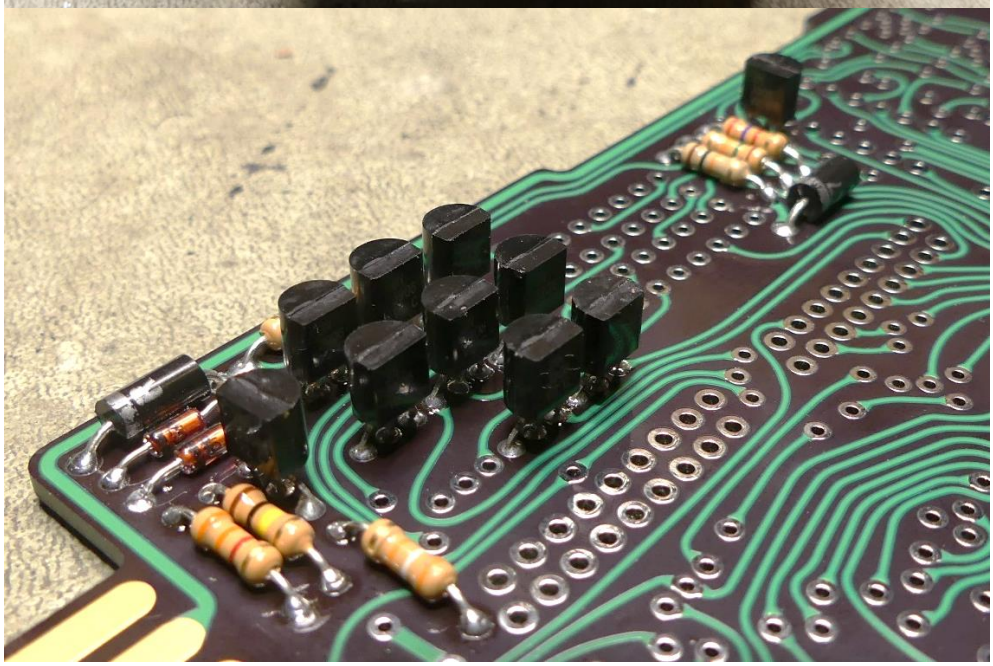
Next mount the transistors, the black devices with three wires coming out all on the same side. In the last set of kits, you had to bend the wires to make them fit, but I found some parts with pre-formed leads, so you don't have to!

Transistors also must be oriented properly in a real board so all boards should have the parts facing in a particular direction.

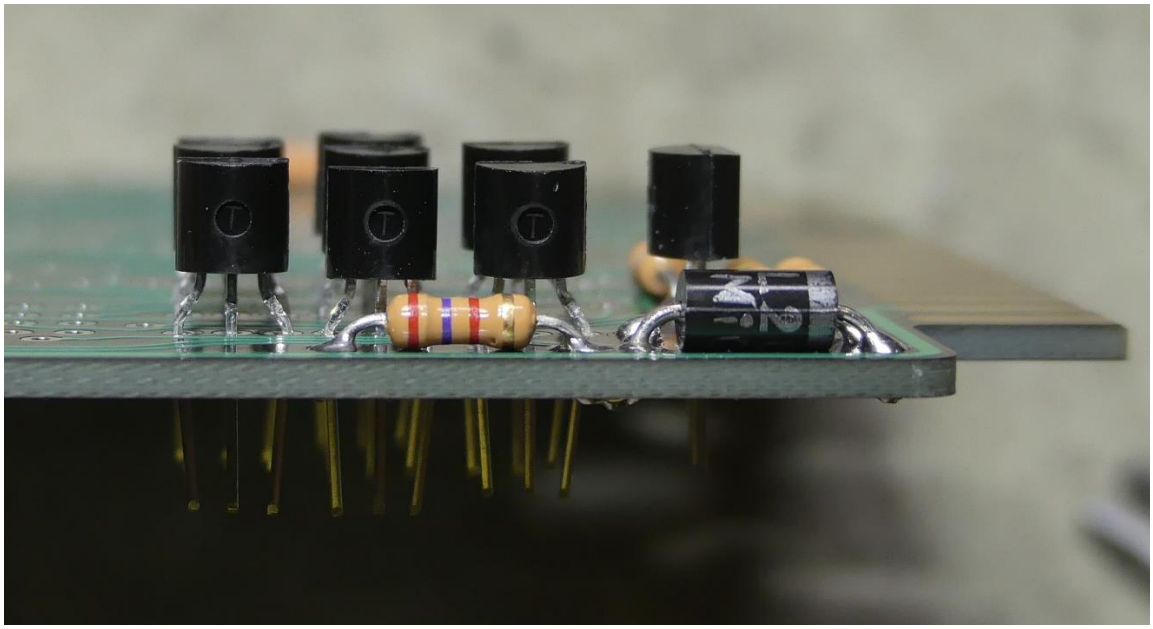
To help make the tops about level, I only solder in the center lead of each part. Then it is easier to adjust the height and make them all the same before you solder the other two leads on each part. After soldering, trim off the excess portion of the leads.

Here is where the 10 transistors are to be placed and the desired orientation:

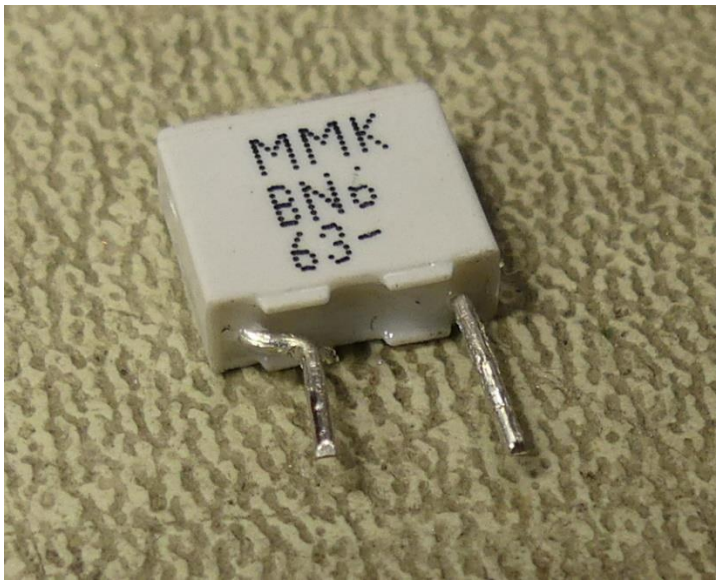


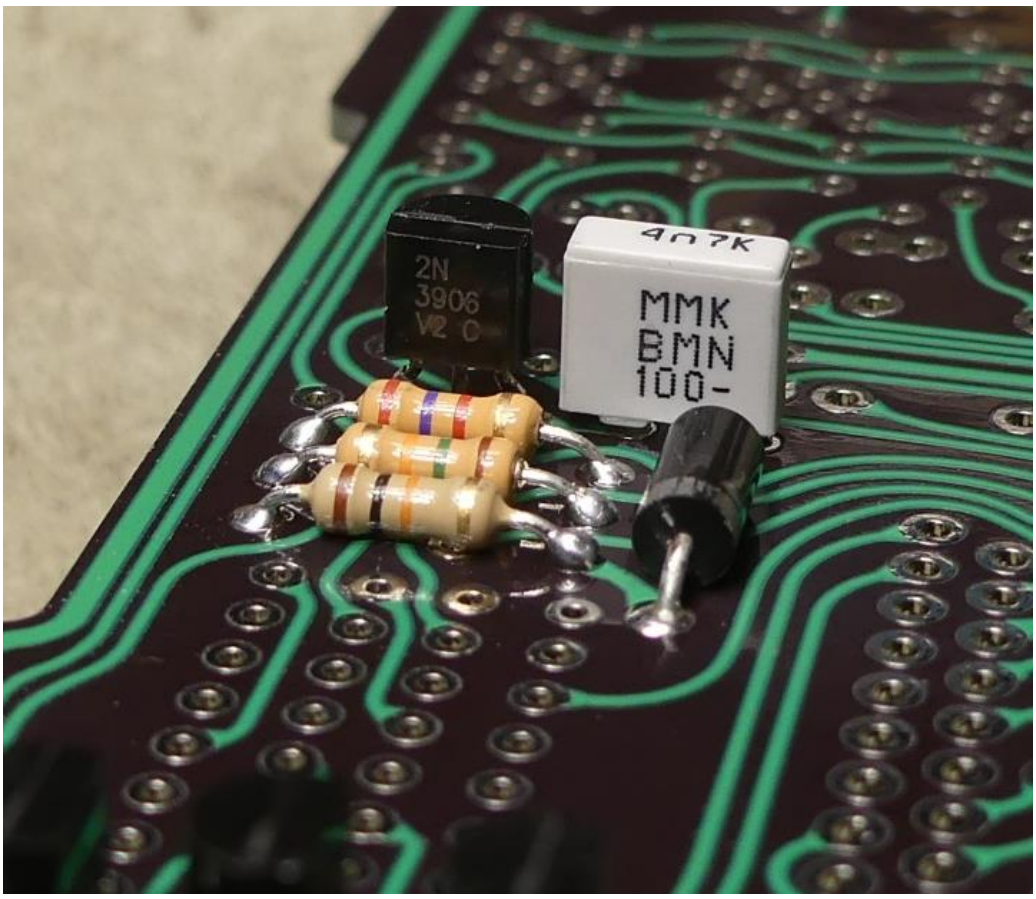


Here are the group of nine soldered transistors on the lower left-hand portion of the board.

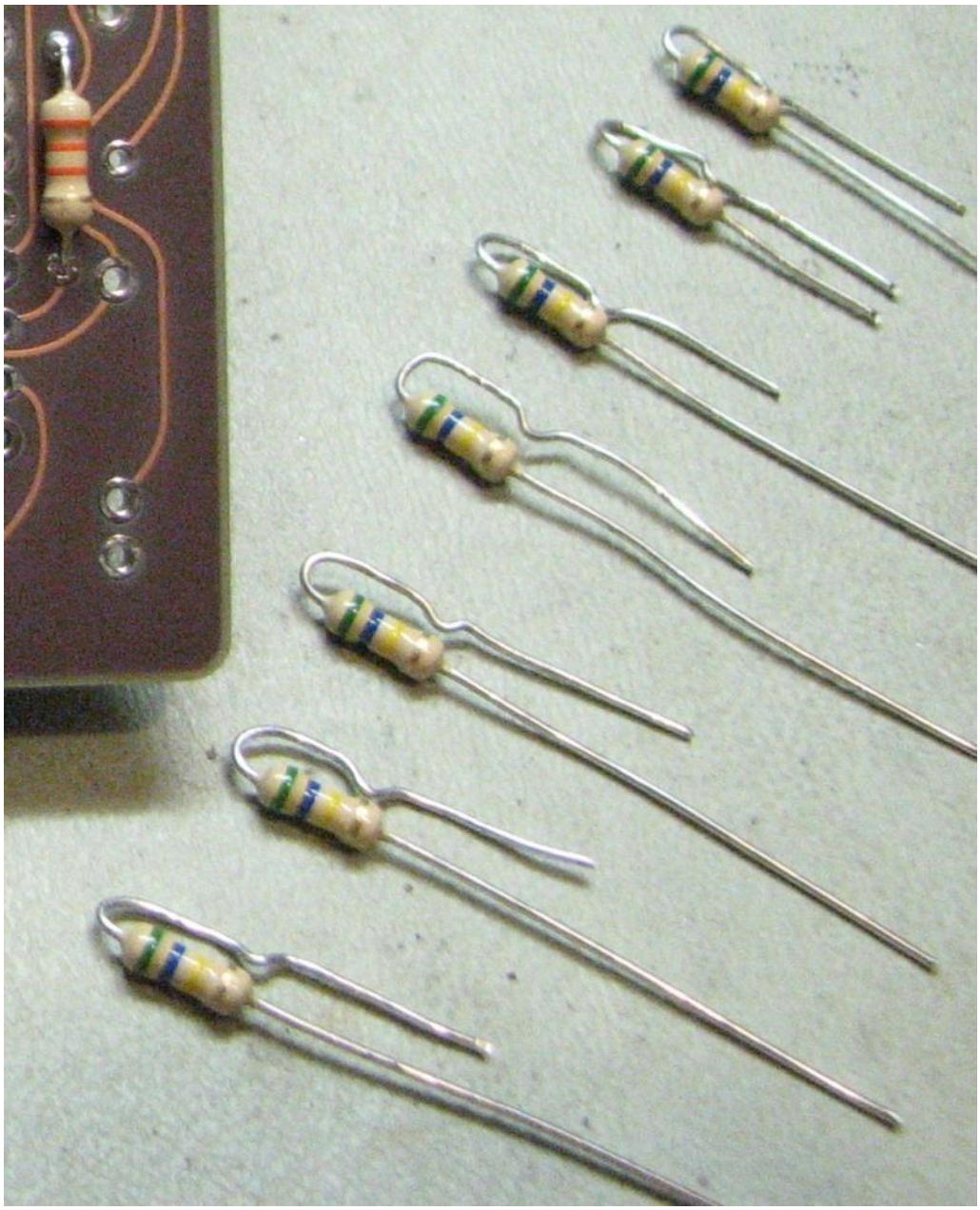


Now you can locate the white capacitor. This cap can go in either way and you can decide which side you would like to face which way. The leads are a bit wider than would be ideal for this board, so it will sit a bit above the board, and the left side wire lead needs to be bent to be able to get the part near the board. Make sure it is oriented fairly straight, flip over and solder the wires then trim off the excess portion of the leads.





In the Sanyo board, the resistors stand up and one leg is folded over and gets a kink in it and then goes into the board. You can just make the lead form a very narrow “n” or you can add the kink if you want to have the resistors look even more accurate. The parts can be oriented either way, but I like to have the Gold band on the bottom for all of the parts to make them look more uniform. I just bent the leads over by hand by making a nice arch at the top of the resistor with the lead. Then I used needle nose pliers to make a kink in the wire near the base of the resistor body.

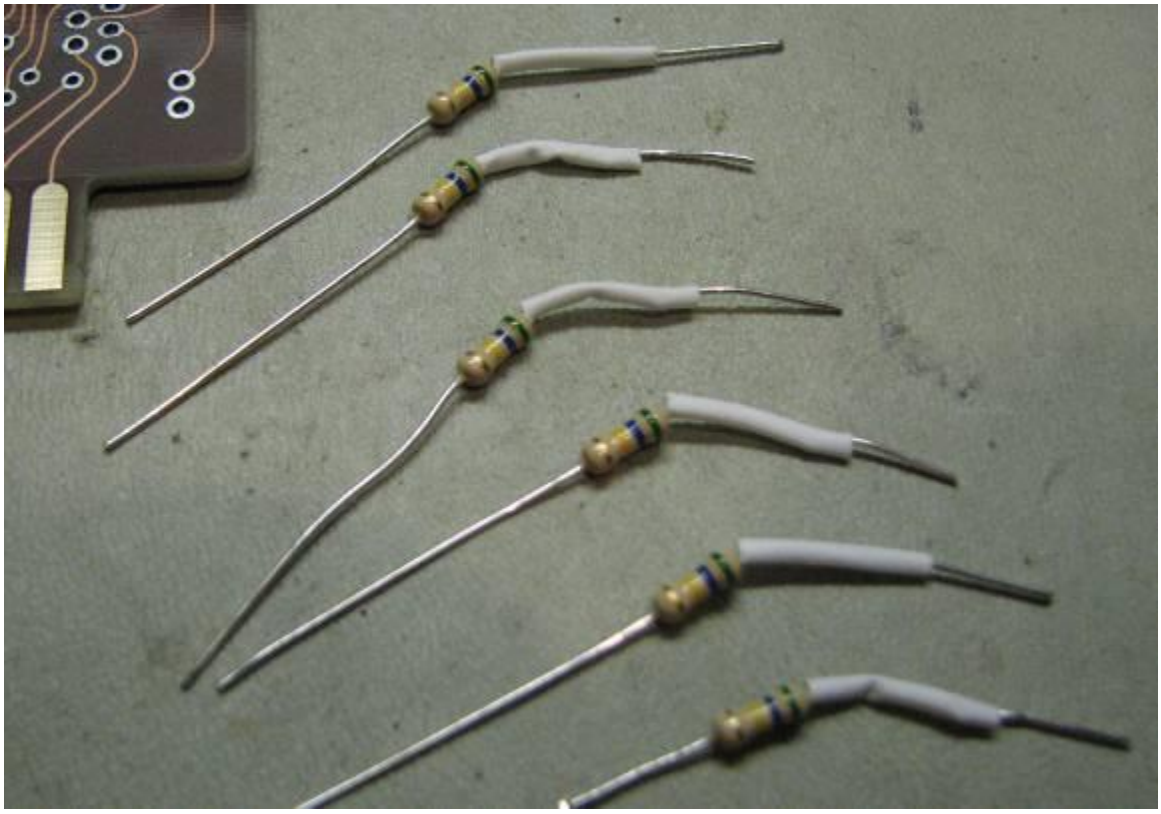


Then cut up the white or red tubing. Reference images from boards show that the 7 same value resistors have the same color tubing. Some reference boards have both sets the

same color (usually white), some have one red set and one set white, and maybe some have all red?

About a ½" of tubing for each resistor is needed but depends on how you bend your leads. The tubing should go over the leads and extend from the top of the resistor to the bottom of the body of the resistor.

Unbend the leads somewhat at the top of the resistor body and slip on the tubing:



The tubing is a bit larger than ideal and if you use a heat gun (designed to shrink heat shrink tubing – hotter than a hair dryer) it will shrink down to a very snug fit and look even better. I found that the top bend would not be covered as well if you shrink the wire in this bent position, so I measured and cut a piece of tubing and bent the lead out to make the bend much less sharp, used the heat gun and then waited a few minutes for the heated tubing to cool before I bent the lead back to the tight angle shown above.

Then shrink the tubing with the heat shrink gun, let them cool and then bend back:

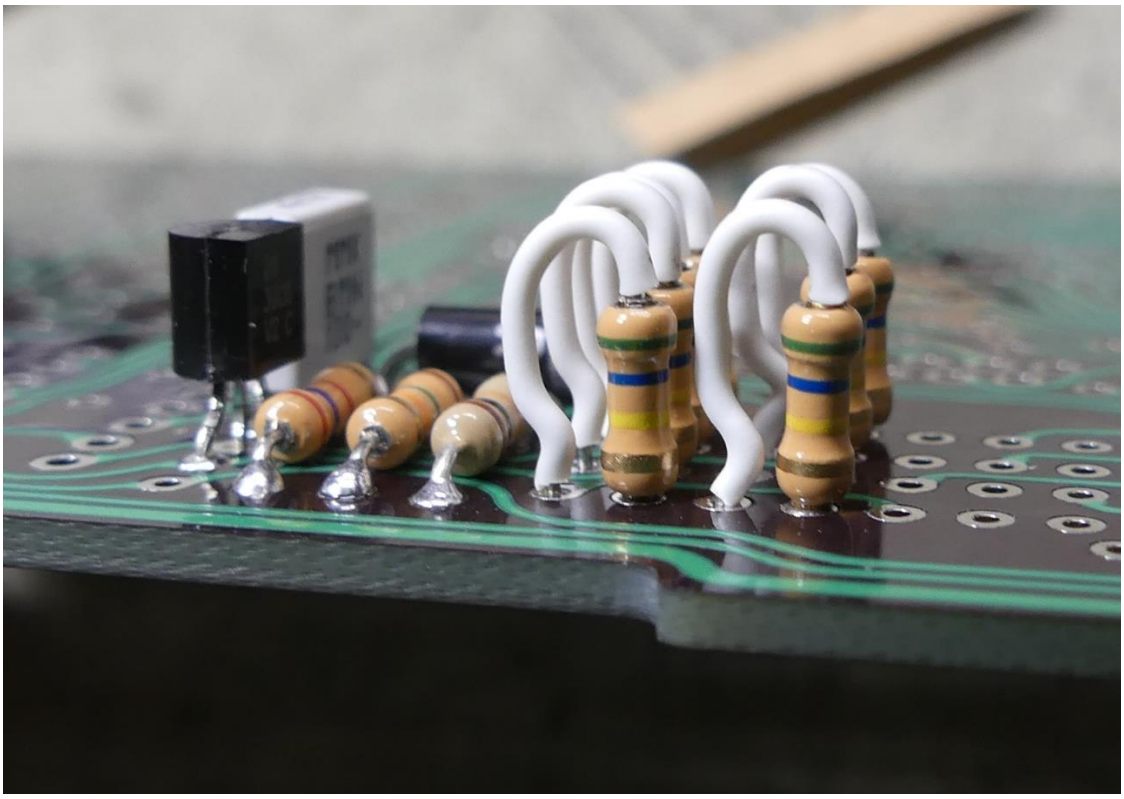


There should be seven resistors in each set that have the same color tubing.

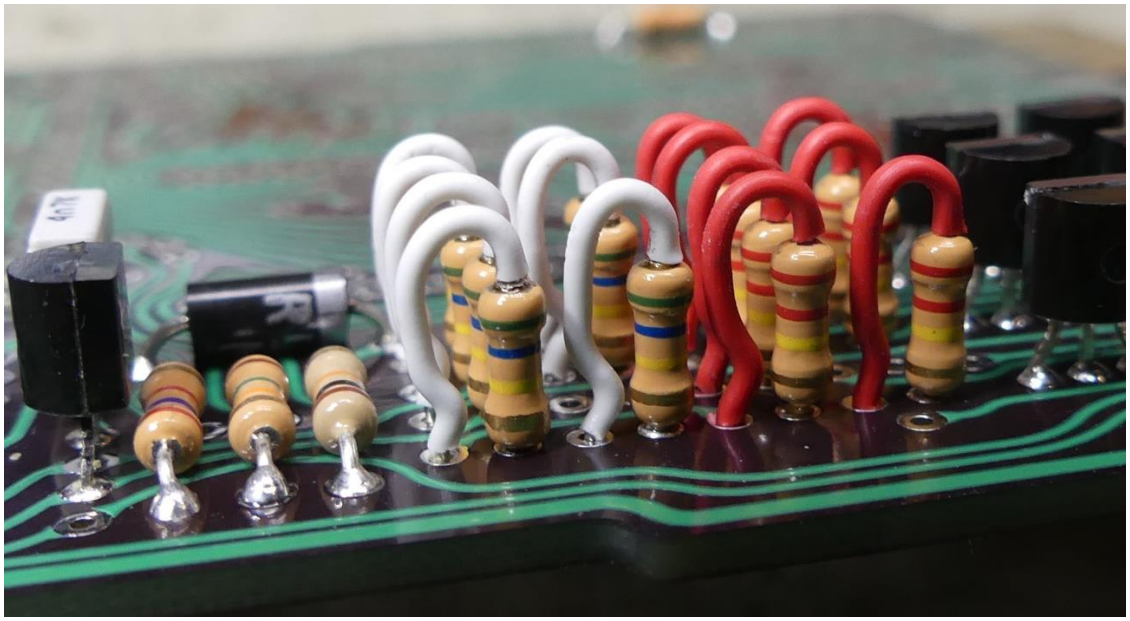
You can test place each resistor and use a standard wire stripper to cut off the excess tubing if it holds the resistor up off the board. You want the part to stand fairly straight up, and one side of the resistor should be very close to the board. See the reference photos on the next page.

Like before, place the leads through the board, you can bend the leads on the backside to hold them in place and then flip the board over, solder and then trim off the excess lead. I did use a trick to get them better aligned: Just solder the longest lead (the lead that does not have any tubing on it). Then you can position the part and adjust the tubing covered lead a bit before it gets soldered. Use your fingers or wider blade flat tweezers if you are adjusting the tubing covered lead. Pliers (and even your fingernails) can leave noticeable marks in the tubing if they are aggressively handled.

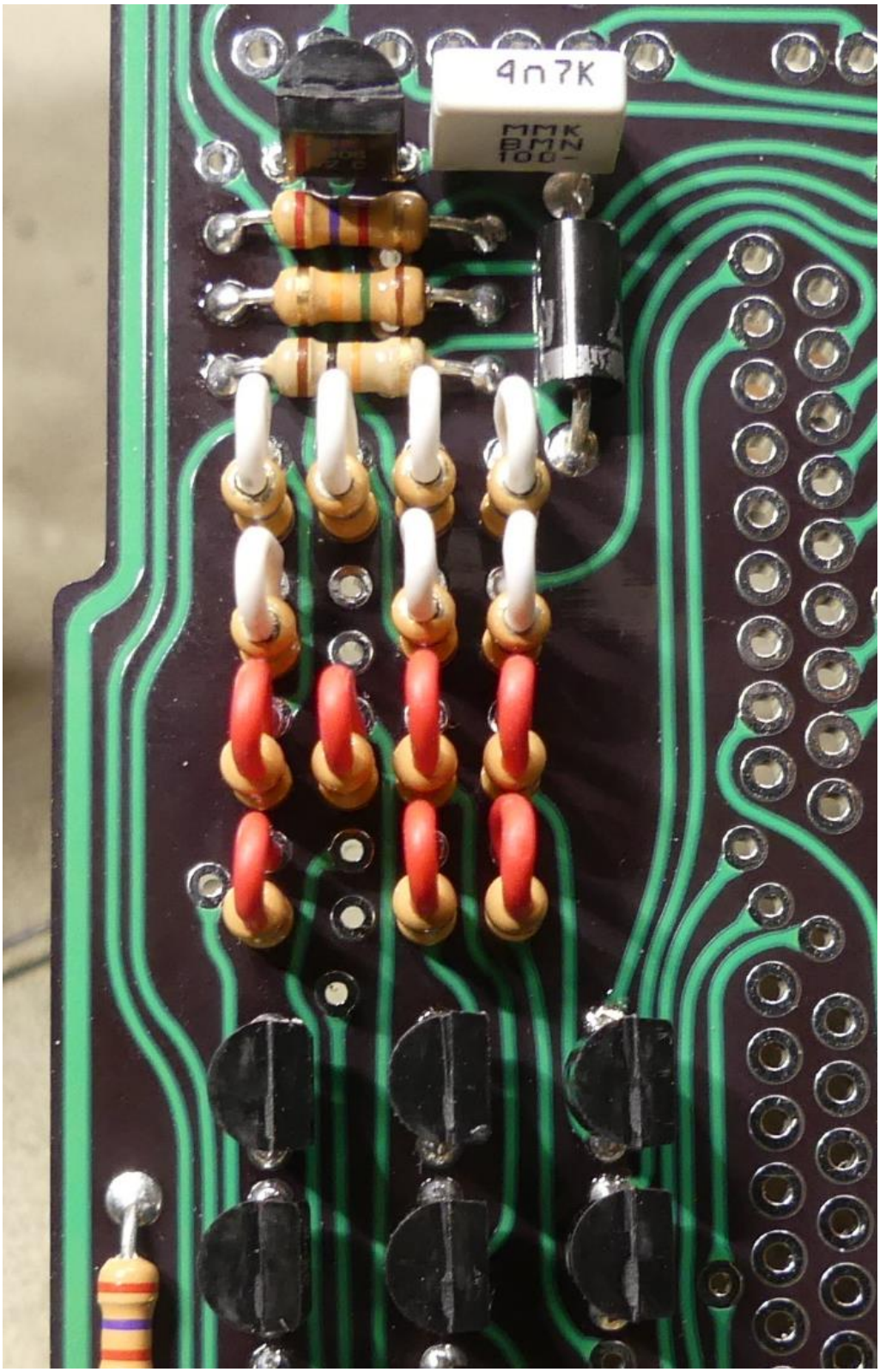
Now mount them all facing the same way with 4 across in one row and one missing in the second row.



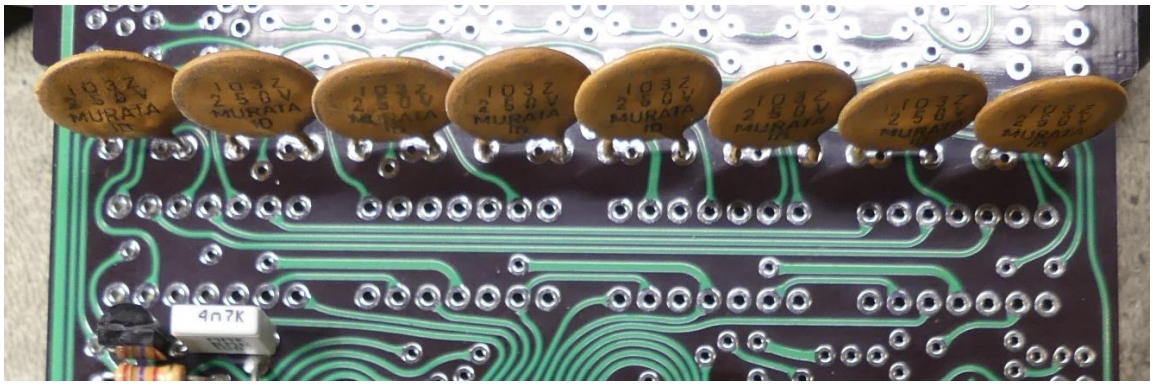
Do the same with the other group of seven resistors. You can use either color of tubing for each set.

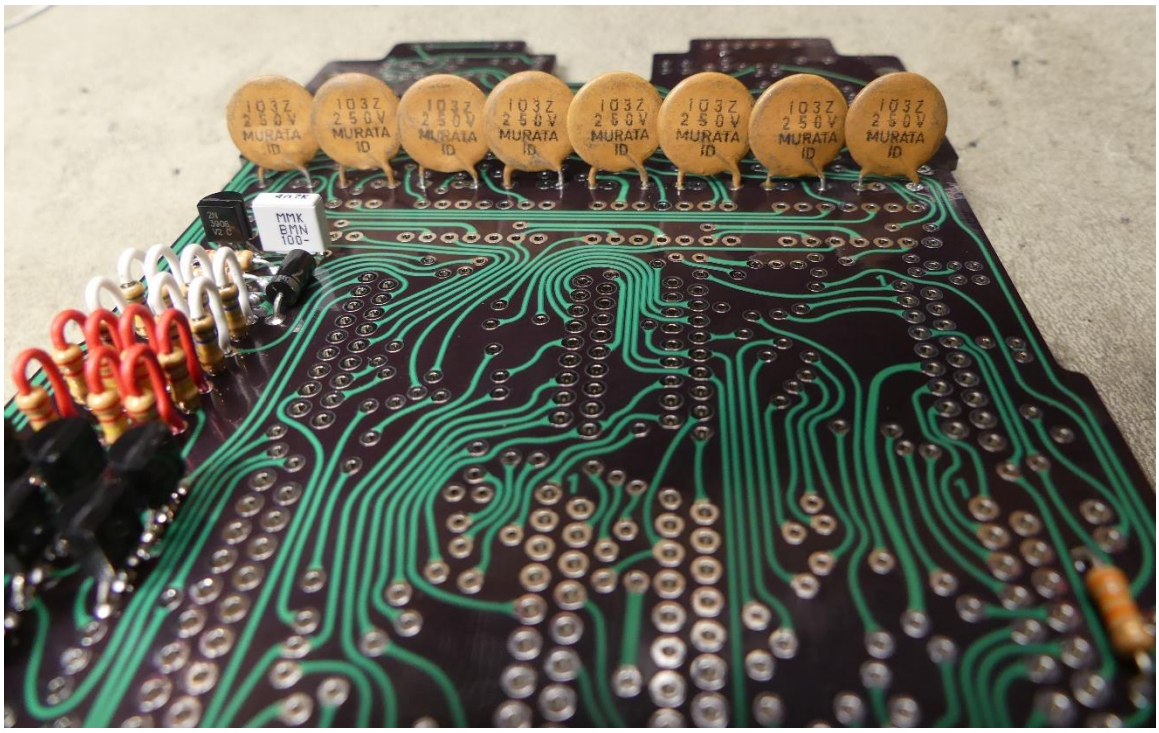


Just a different view after all 14 resistors are soldered in place:



Now you can place the 8 larger brown ceramic disk capacitors across the board. Bend leads on the back side to hold them in place, flip the board over and solder then in. You may want to solder just one lead, make sure the part is positioned well, and then solder the other lead.





Now all of your basic parts should be mounted, and there are a few parts that were not used:

- Six 1/4W resistors – because I cannot follow my own directions
- One #4 1/4" black screw. You will need this later, so keep in a safe place (back in the bag?) for use at the very end when the shaver cord is to be attached to this circuit board.

“IC” Integrated Circuit parts kit assembly

More parts for the bottom portion of the circuit board. Most of these parts are replicas of real parts in the Sanyo calculators.

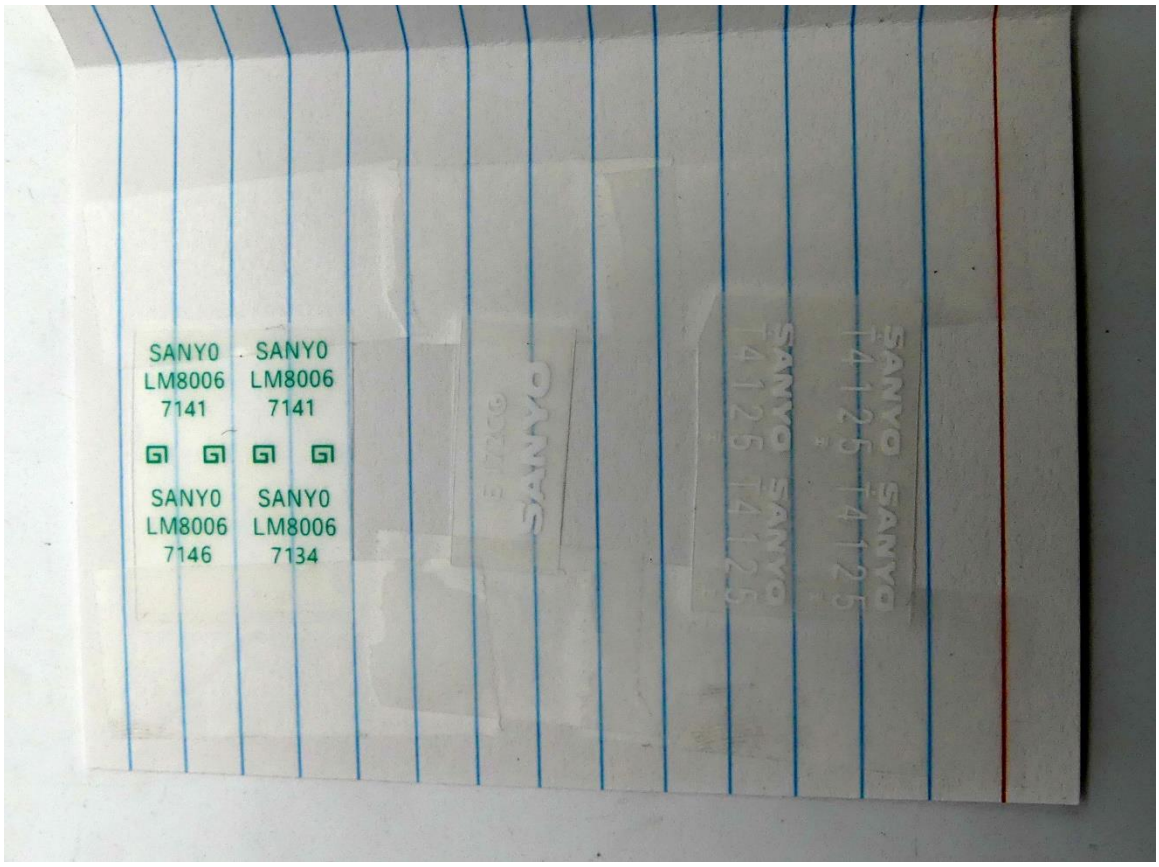


4x 40-pin Gold Right Angle Connectors

4x Thick Black Acrylic rectangles, with paper protective covers on both sides
4x Thin White Acrylic rectangles, with paper protective covers on both sides

24” #22 AWG solid core red insulated copper wire. Used for the “pillow part” and the “Error Box” connections to the circuit board.
4x copper discs that go on the white acrylic parts
1mm wide adhesive backed gold strip. For use on the white acrylic part.

1x Error box (to be used later)
1x Foam gasket for error box (to be used later)
1x Black Pillow part



Also needed: Folded notecard that contains the dry-rub transfers that was packaged inside the bubble-wrapped main circuit board.

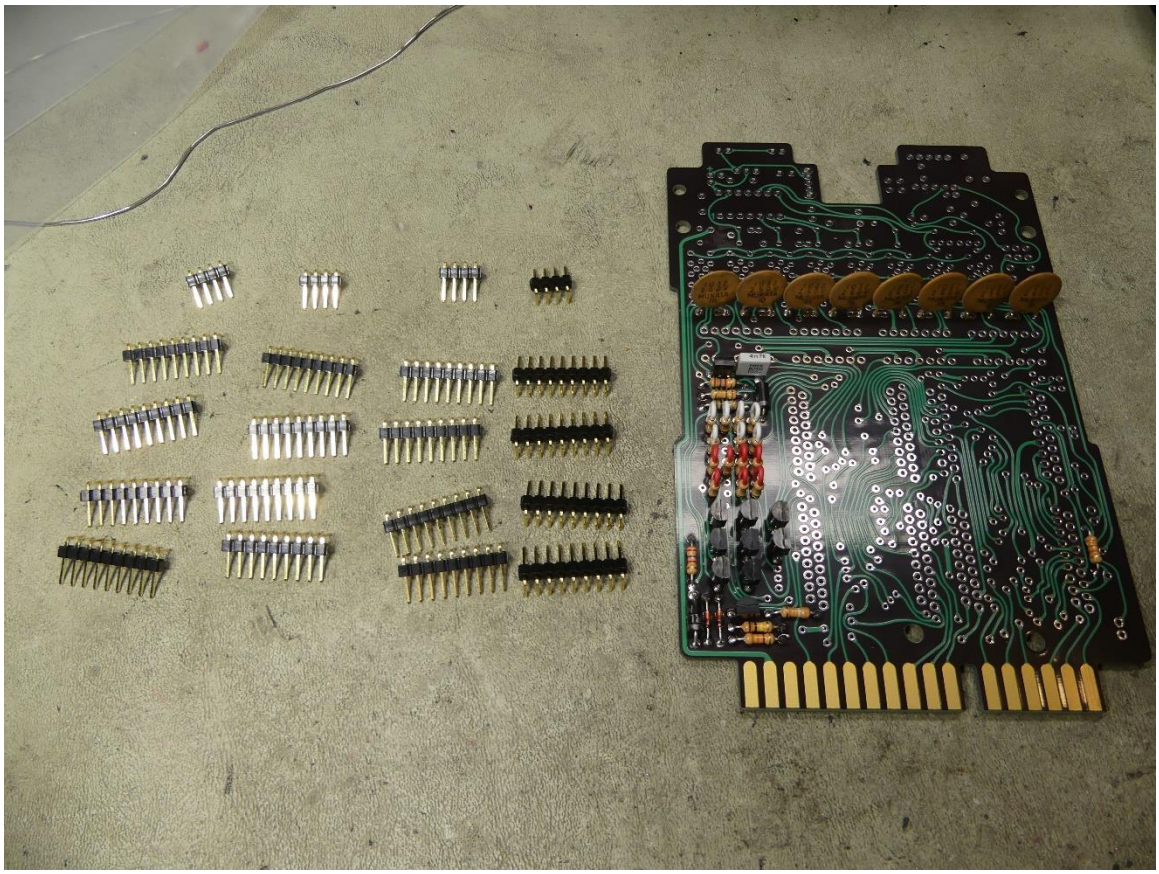
4x Green Sanyo labels for the white acrylic parts
4x Green Logos (small rectangular spirals) for the white acrylic parts
1x White Sanyo label for the “Pillow Shape” part
4x White Sanyo labels for the black acrylic parts

There are 4 40 pin angled gold connectors included in this kit. Each connector has enough pins (and a few spares) for the 36 pins that are needed for each of the four white “Integrated Circuits” that sit on the bottom half of the board.

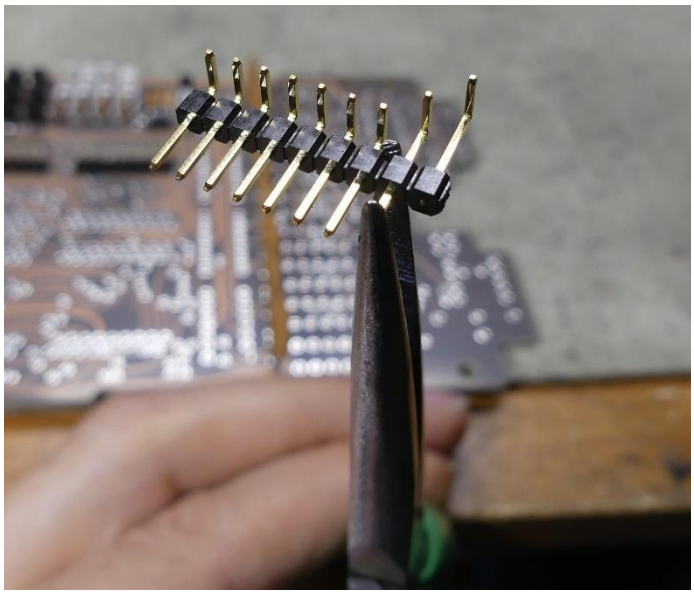
The procedure described for each of the four ICs will be identical.

The angled gold portion of the connector will end up being the visible part of the lead for the IC. The problem is that the black plastic portion of the connector is too close to the bend and would not look right. We want to keep the black portion of the part around for a while since it can hold the pins in place and at a great angle while we are soldering the pins in place. If you had to solder each bent pin in place individually it would be very difficult to make them look uniform.

First break each 40-pin part into four separate 9-pin sections and you will be left with a 4-pin section that we are not going to use.

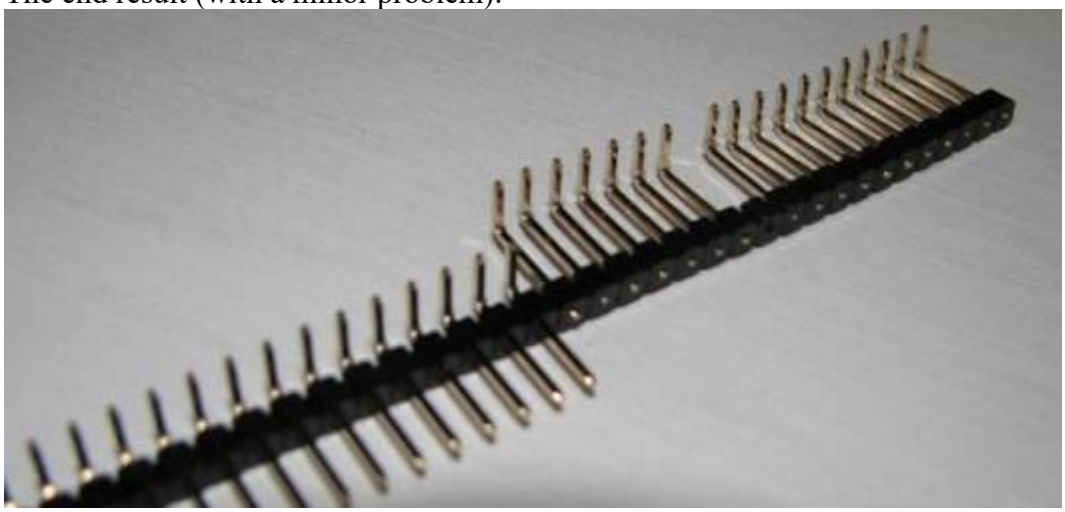


I used to heat them up a bit to aid in moving the pins, but needle nose pliers also worked pretty well just squeezing the pins down into the holder 1 or 2 at a time.



*** NOTE ***
Practice on the 4-pin pieces first since they are not needed for the Gizmo!

The end result (with a minor problem):



Notice that one of the pins fell out in the middle of the section I was heating up. You can just put the pin back in, but they can be loose enough that you must be careful when handling the parts after you pressed the pins up to the edge of the black portion like in the upper right-hand portion in the photo above.

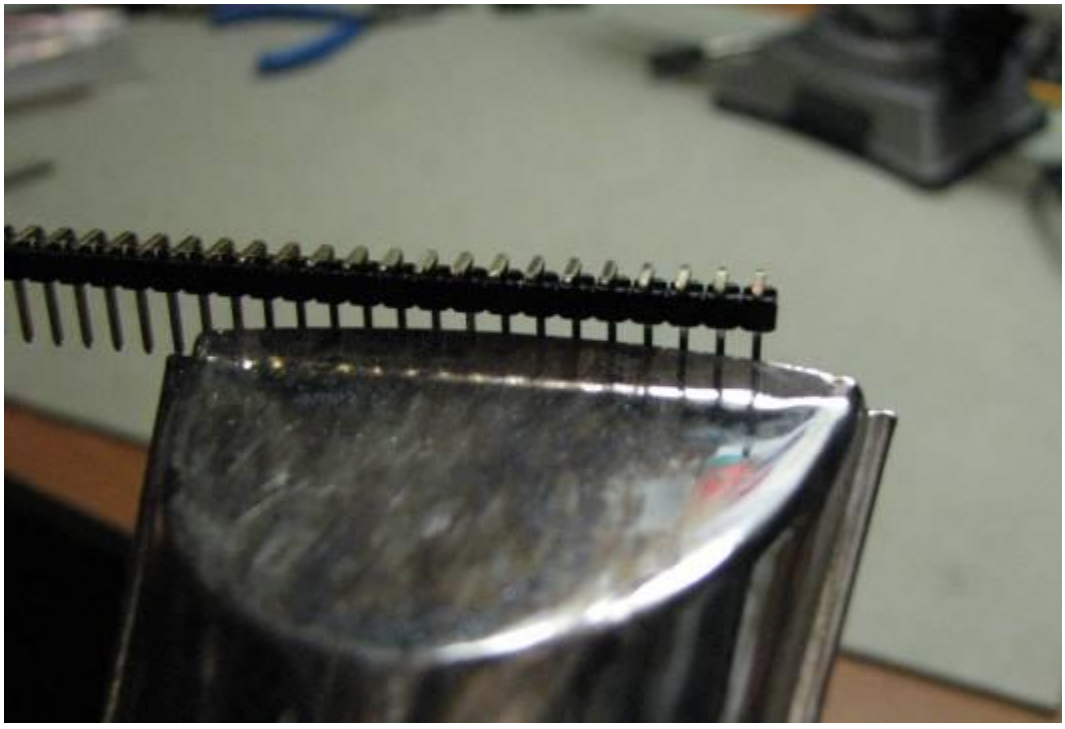
I also tried cutting the 40 pin parts into the 9 pin sections first and just applying pressure like shown above and the black plastic was able to be moved down to the end without any heating of the part.

Here is the heat method:

Heat up a bit more than half of the pins since you are holding on to some of the others and you don't want to burn your fingers. I heated them with my heat gun for about 8 seconds. The pins should be hot enough to loosen the connection between the pins and the black plastic. On a hard surface that will probably get marked up a bit, put the heated pins against the surface (only the half that were heated) and use something like very narrow pliers or heavy duty tweezers and push down on the top of the black portion and slide it down to the hard surface.

All of the pins may not move at the same time; you may have to work from side to side pressing on the black portion and having it slide just a little. Once you get all of them started, the black portion will slide down much more easily.

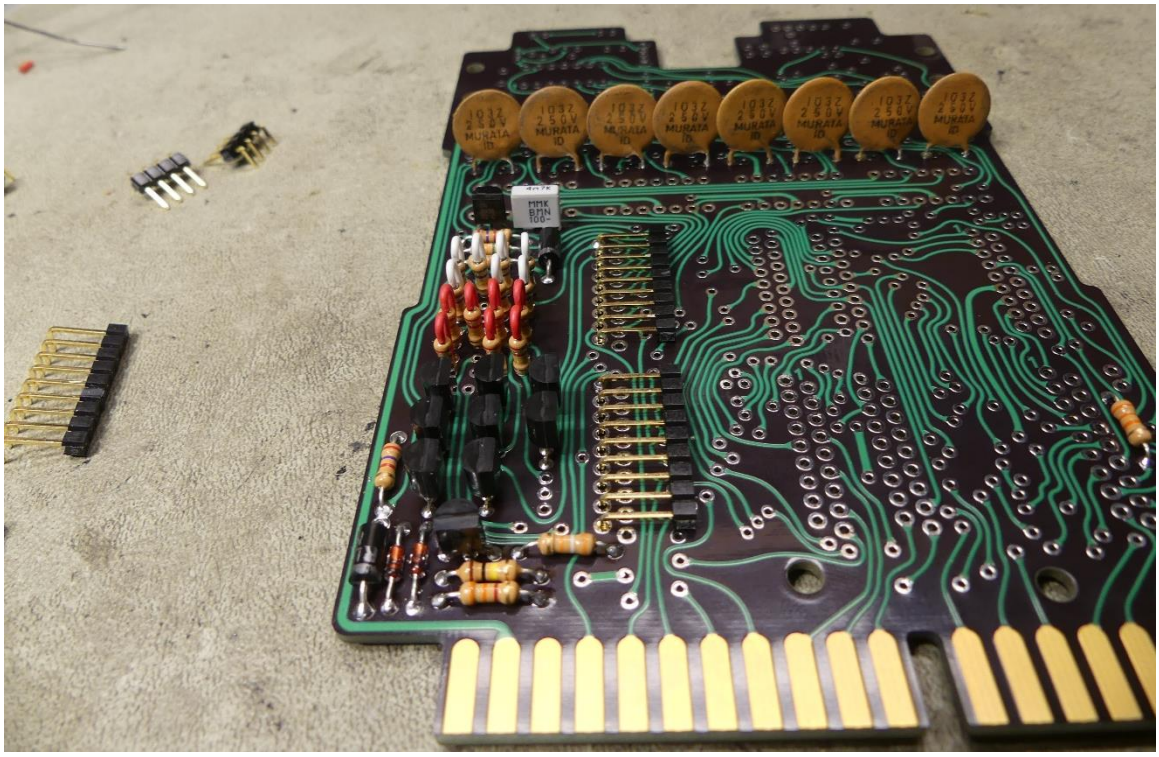
Here are photos of one of the first pieces I was playing around with. Heating up the leads directly (and not the black plastic very directly):



Pressing down on the black plastic while the leads are still hot (against a hard surface):



Now you get to place them on the board and solder them down. A single IC has 4 sets of interleaved pins. The holes on the board are the in two sets of 9 holes that are staggered. Work from the outside in (it works better! I had a problem working from the inside out and had to trim the leads on the top of the board after they were soldered in just to be able to slide the black part off).

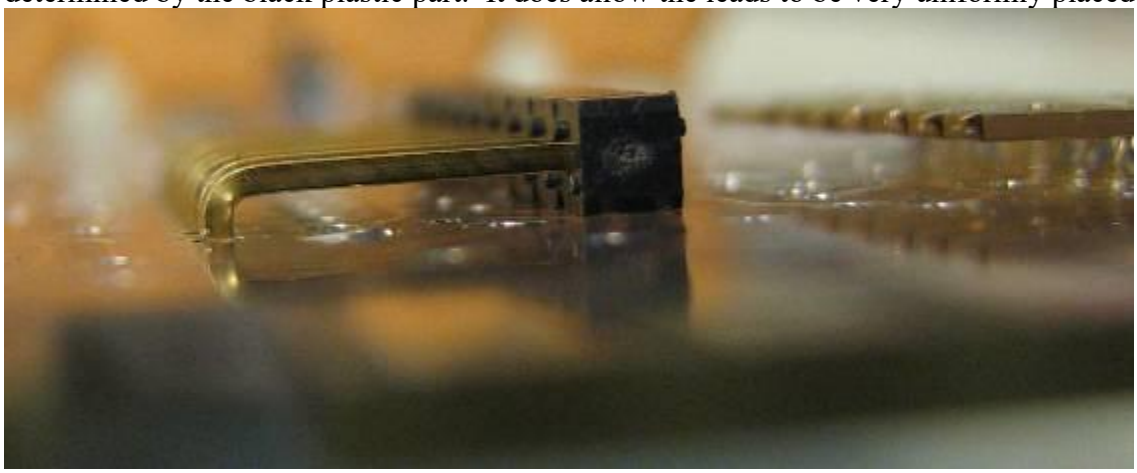




The parts on the left have the 9 pins set in the outside set of 9 holes. Holding the black portion and keeping the pins flat, flip the board over and only solder the outside pins. Notice that only the top and bottom pins are soldered. Start with soldering just one pin and adjust until the pins are level and horizontally straight. If the black portion is slanted (some leads at one end are sticking in or out differently than the other end) the pins start to become slanted, and you don't want that.

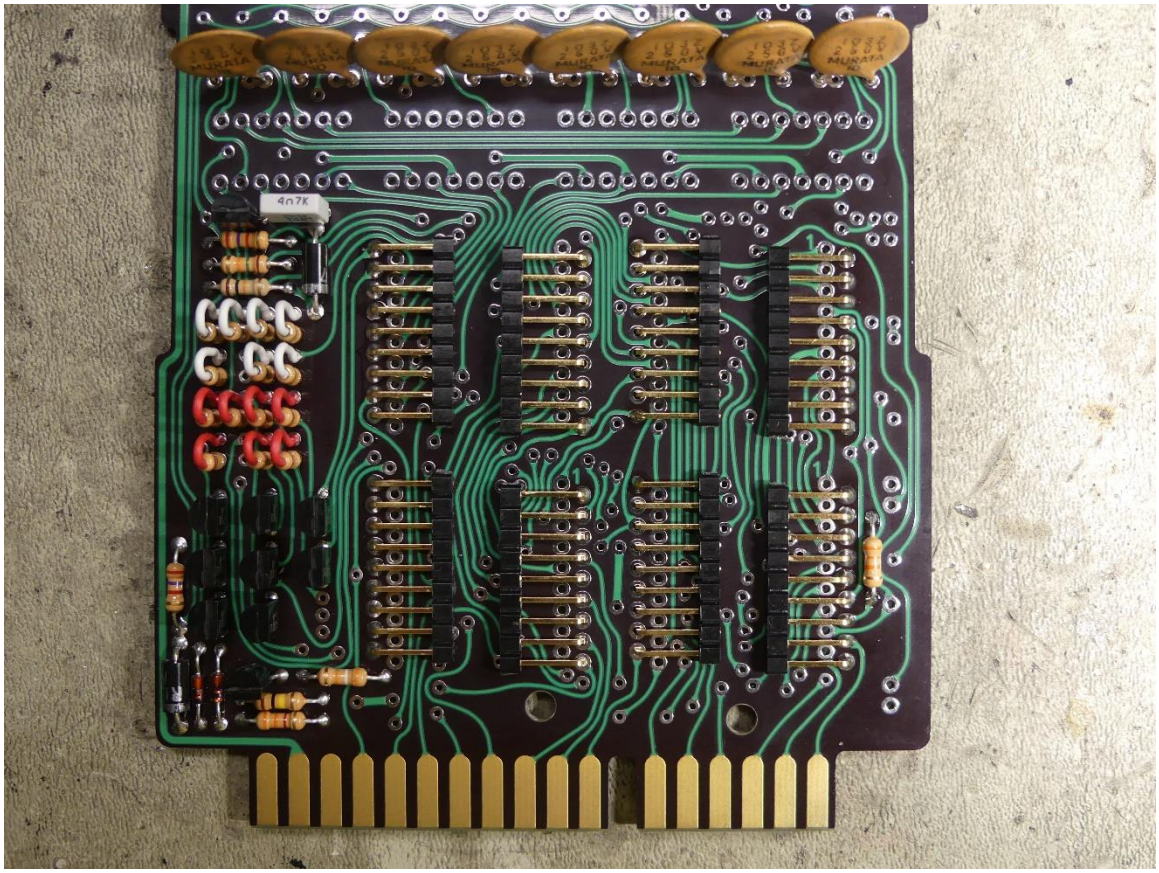
All soldering is done on the backside of the circuit board. You should hold the part in place with your finger when soldering the one pin down. Hold the part at the opposite end of the part so you do not burn your finger that is doing the holding.

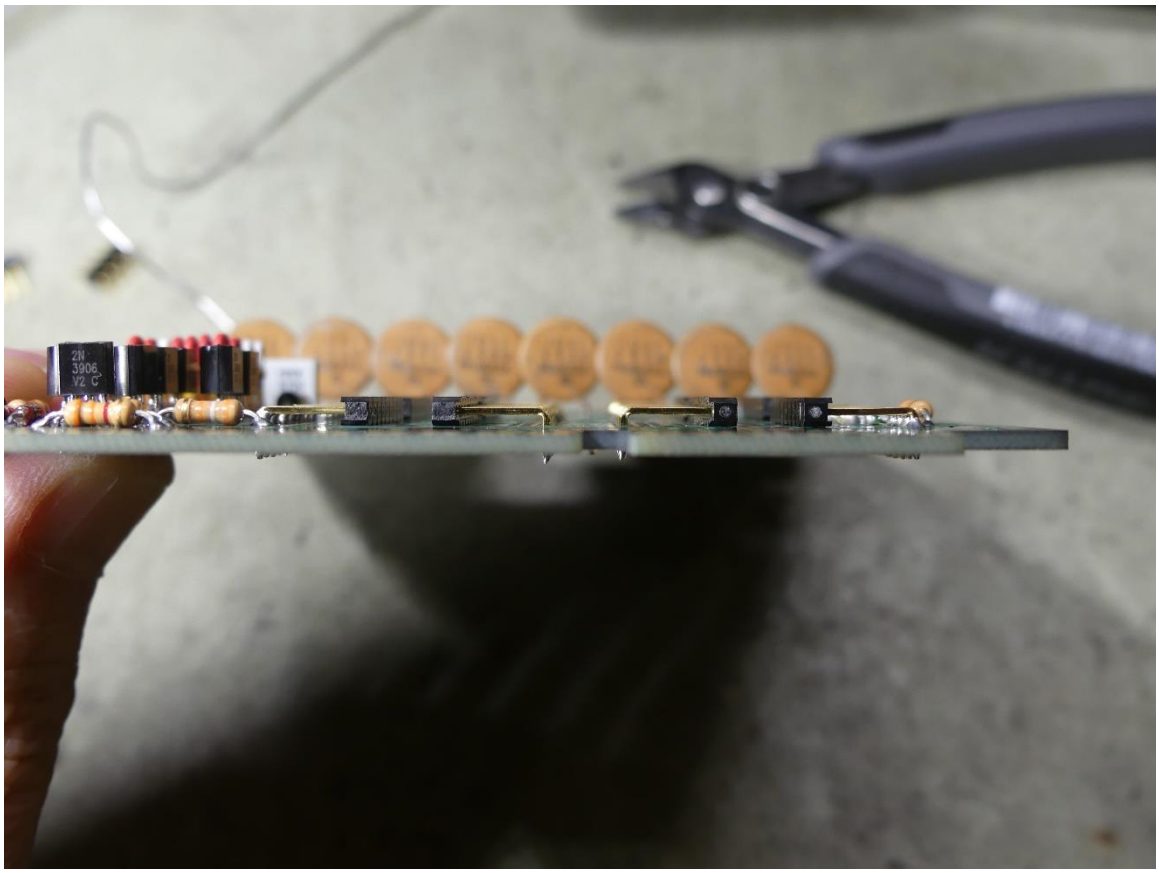
Here is a low angle shot to show that the leads are parallel to the board, and the height is determined by the black plastic part. It does allow the leads to be very uniformly placed:



When one side looks good, solder down the pin at the opposite side of the 9 pins and make sure it also looks good. When you are satisfied with the placement, you should now be able to solder down the middle 7 pins.

Now do the outside column with another set of 9 pins:

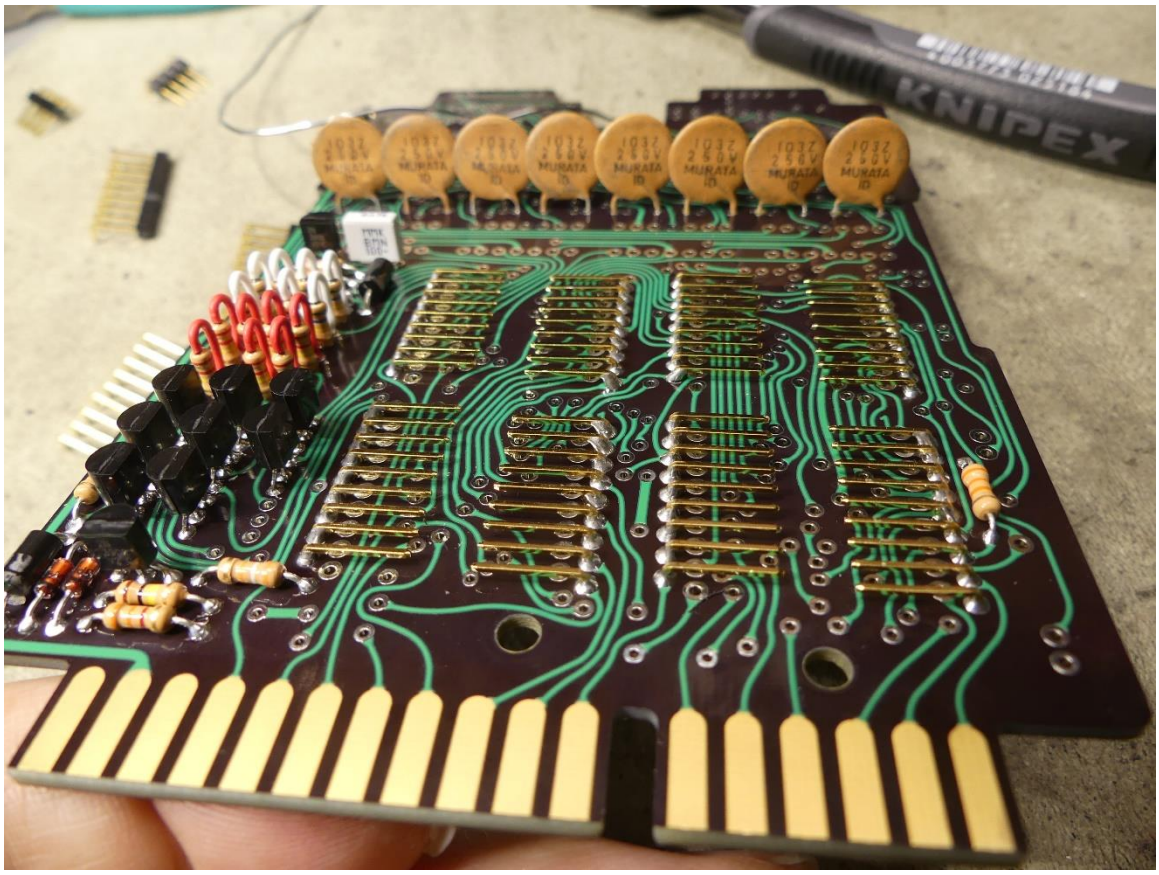




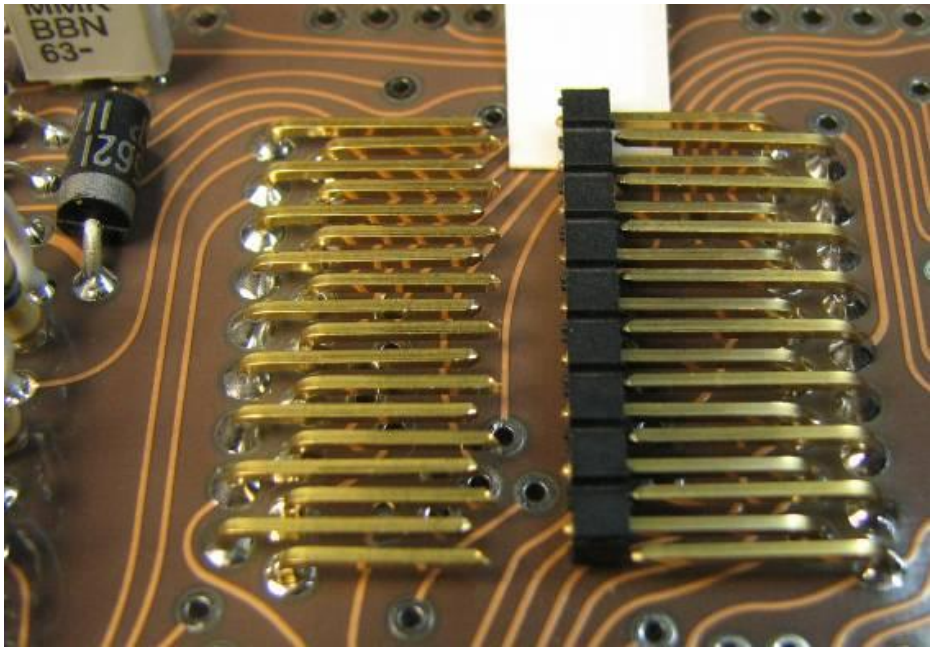
The next step is to slide off the black portion and once you do that you do not want to solder any of the pins again. The black portion is what held the pins in place so without it the pins can move around considerably, and it will be a pain to get them back in place. So now slide off the black pieces so there is room to place the pins for the inner columns of pins.

Once, I forgot to solder the middle pins and when I pulled off the black part the 7 middle pins just fell out. After a mild panic, I just individually put the pins back in the middle positions of the connector and then slid the black connector w/7 pins back onto the 2 soldered down pins. It takes a bit of work, and the outer pins do get bent upwards a little, but it can be done. Got the whole thing back into position and then I soldered down the 7 middle pins.

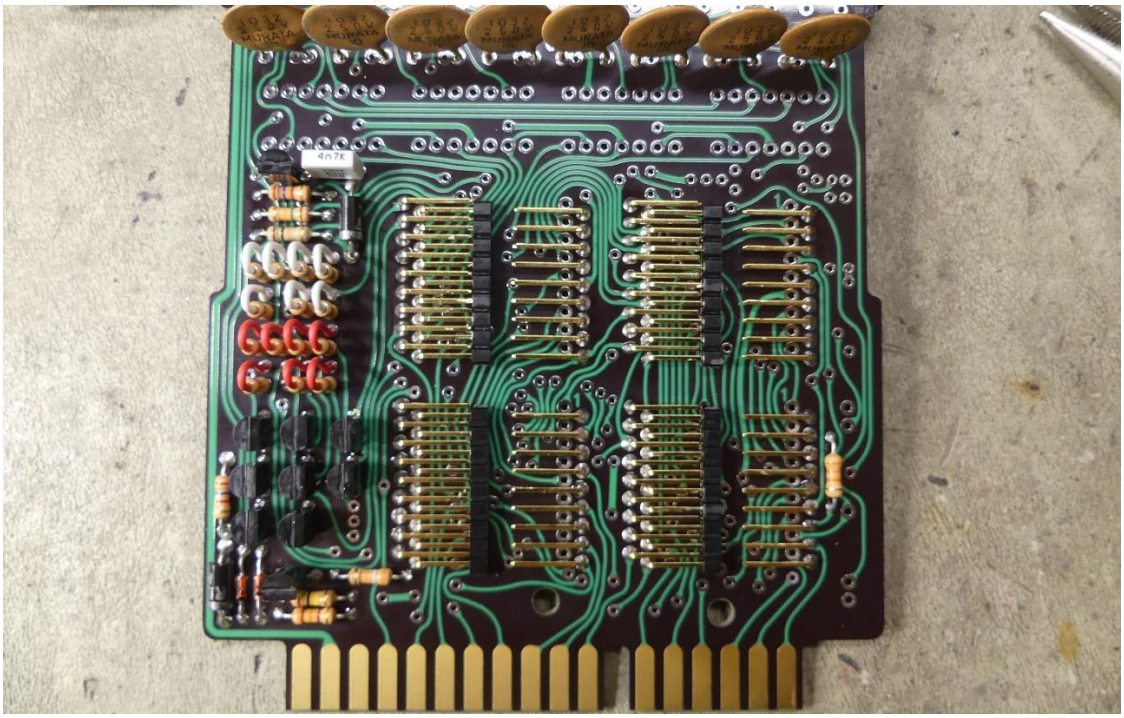
The outer pins should all be soldered and with the black portion removed it should look like this:



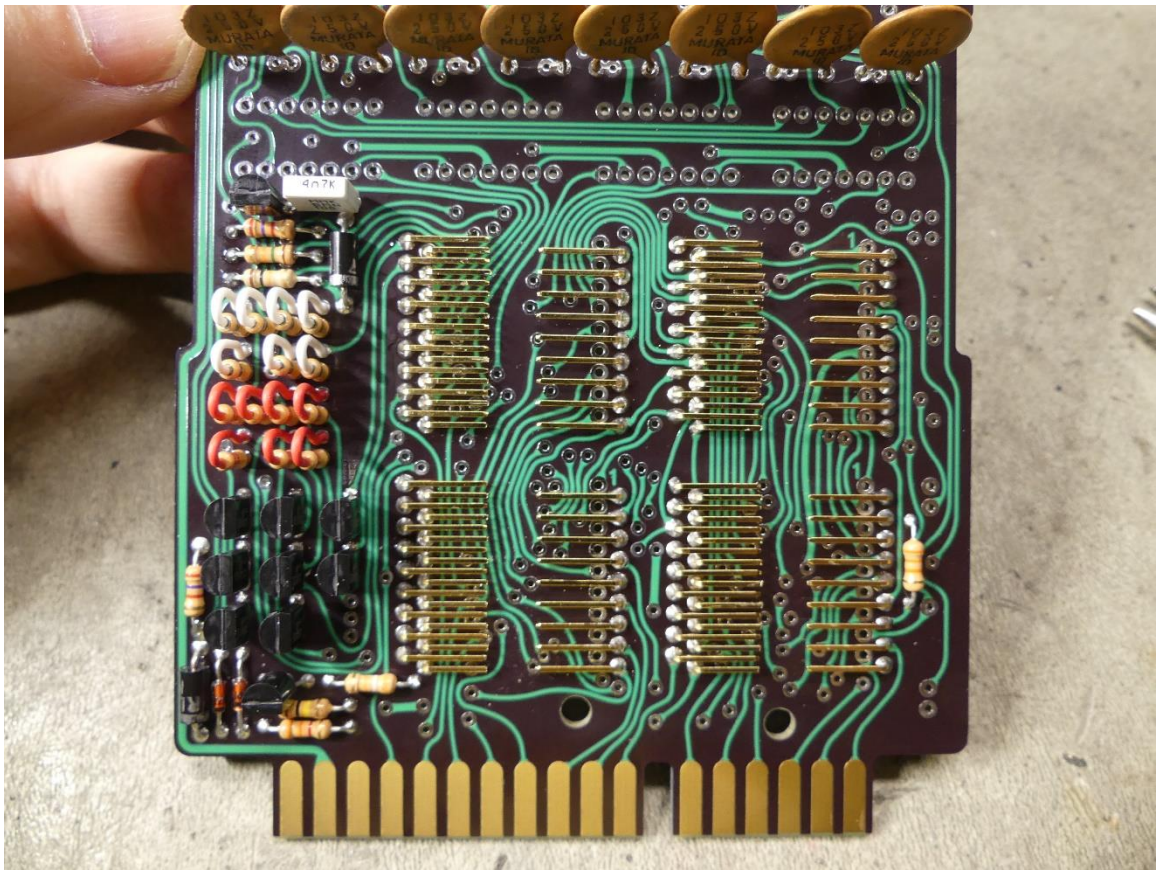
The inner columns should be done one at a time. They also need to be level with the outer pins. Here I am showing the last of the 4 sets being placed and I used a piece of paper to shim the connector to get it level with the outside set of pins I can no longer adjust with the soldering iron. When they looked level with the others, I soldered down just the outside pins and verified the placement. When it looked good, I soldered all of the middle pins and then removed the shim and the black portion.

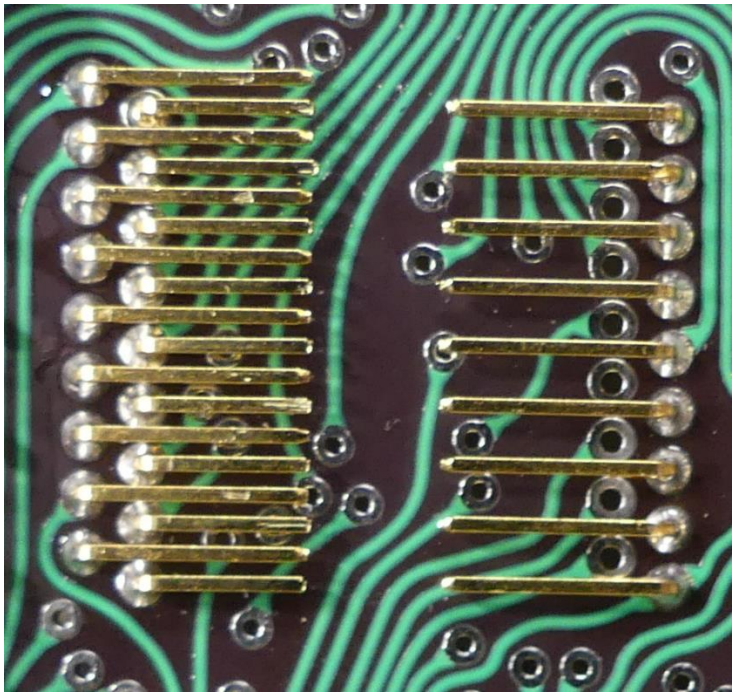


Here is a build where I did the inside rows on the left first:

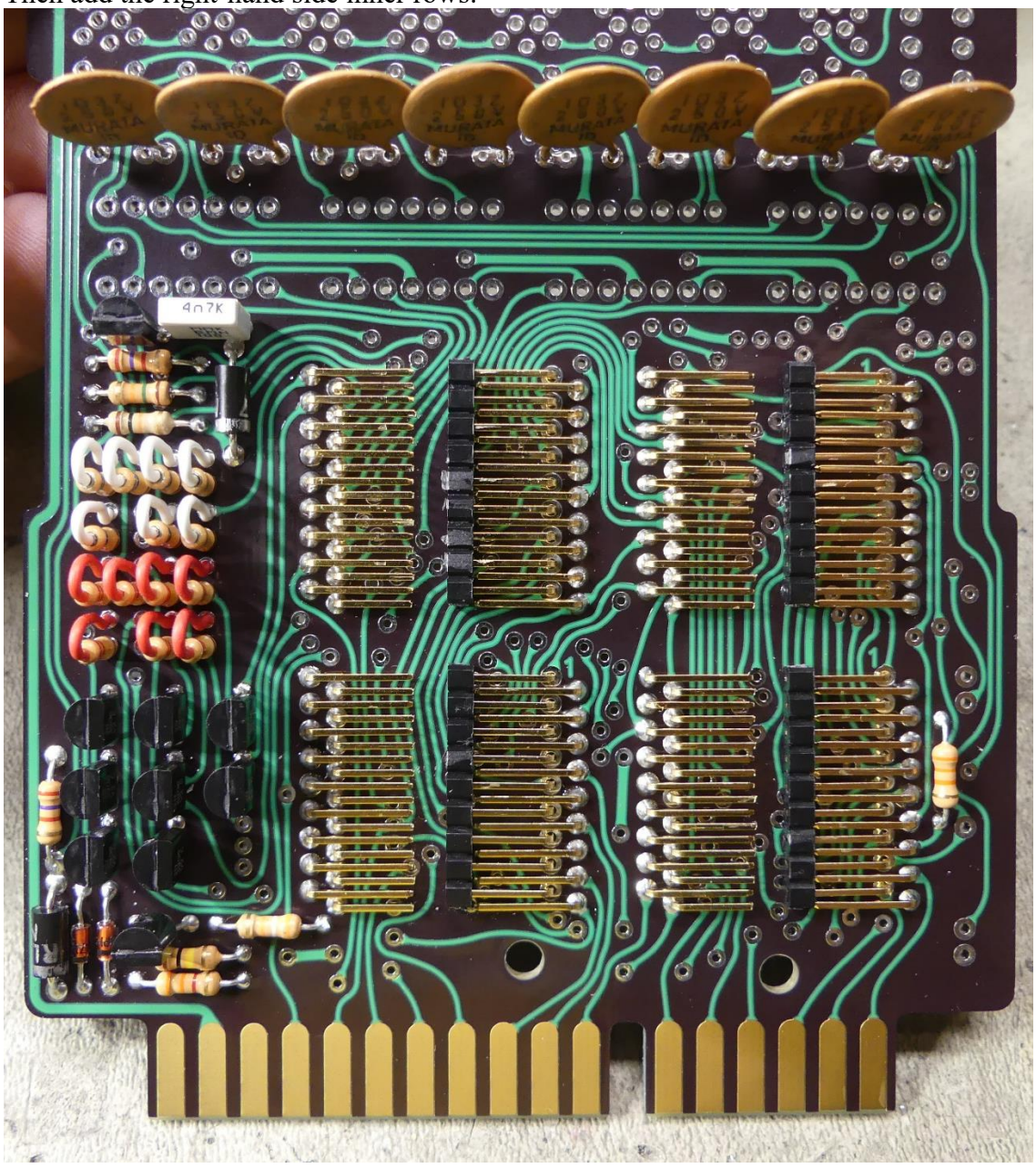


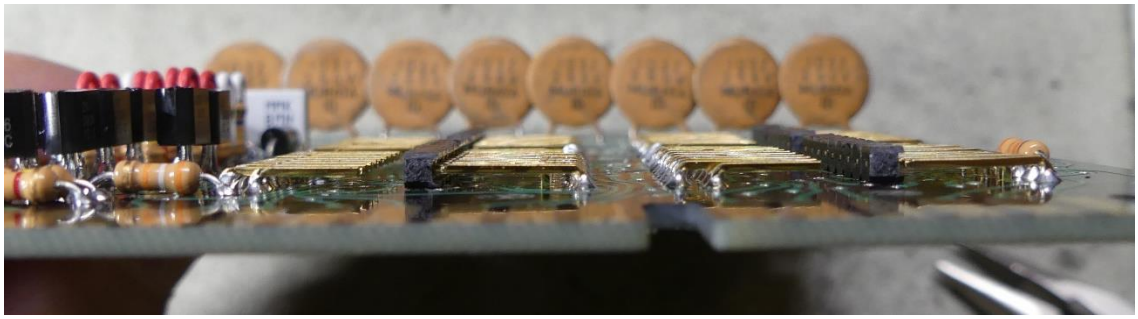
Then remove those black spacers and trim the leads on the inside row that was just completed. This is needed to get the black spacer off of the last (right hand side) inner rows:



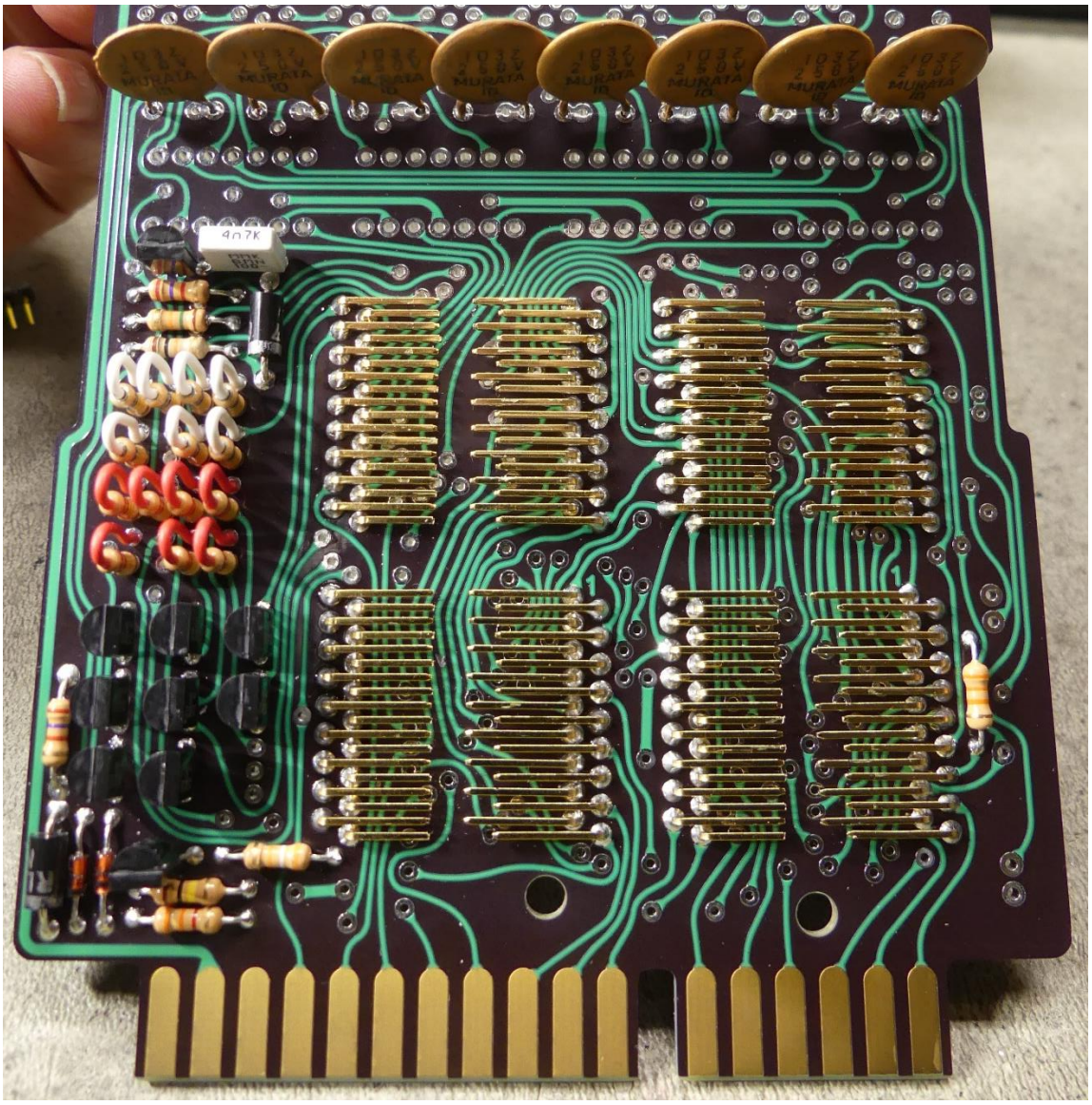


Then add the right-hand side inner rows:





With all of the pins soldered and all of the black portions removed, here is what the board looks like:



Now for the Black ICs...

I decided to apply the dry rub on labels before mounting the parts to the board. The Black parts have one side glossy and the other has a matte finish. I chose to have the matte finish on the top side, but whichever you like best use that. I cut the rub on transfers into the individual labels.

Apply with the SANYO label right side up and the small notch in the black acrylic to the left-hand side.



Then use a piece of cellophane tape to hold it in place while it gets burnished:



Try to only rub on the white lettering directly and not just across the entire surface. There is adhesive over the entire surface of the transfer, so you do get extra goop on the part if you just rub across the entire surface. Notice the notch on the left and the lettering is right side up. This extra residue is much harder to see on the matte surface.

Peel up the tape and carrier from one side and make sure all the lettering is transferred. By keeping the other side still taped down if something doesn't transfer this will help keep it all aligned.

When removed, you can use the other portion of the rub-on (the backing that was keeping it from stickling to something else) to place over the finished part and rub down the whole thing again to make sure it is well attached to the black part.

Tips for rubdown application from the dry rub manufacturer:

- Remove the backing sheet and place the rubdown in the appropriate place.
- It is important not to move the sheet once you start burnishing the letters.
- When burnishing, be sure not to miss any part of the letterforms, especially the thinnest parts. Also, try to burnish only the letters to avoid transferring excess adhesive from the back of the sheet. You will see a slight change in color as the rubdown releases.
- When complete, slowly remove the sheet, starting with one corner and taking care that the entire rubdown is releasing. You may need to reburnish any part that was missed.
- Once complete, place the backing sheet over the rubdown and reburnish lightly.
- Excess adhesive can be cleaned with a solvent, such as Bestine®, a rubber cement thinner. Carefully wipe the rubdown area with a soft, cotton pad with the solution.

I haven't tried any solvent and since this is on acrylic, you should test any solvent on the bottom side of the part to make sure it does not do something whacky to the surface you want to clean.

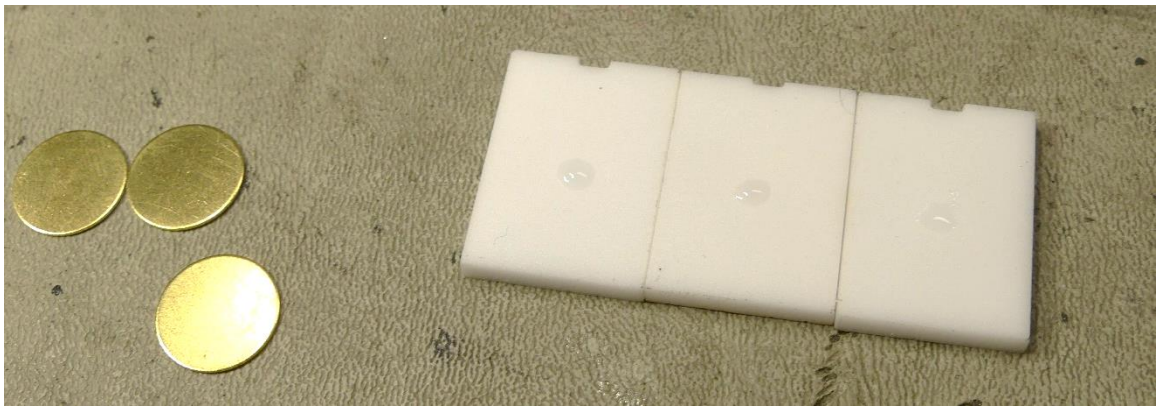


Now for the white ICs…

Grab the white (thinner) laser cut piece of acrylic and peel off the protective paper coating on both sides. One side is glossy and the other has a matte finish. I chose to have the matte finish on the top side, but whichever you like best use that. I also ended up spraying a matte protective finish on the parts so it will end up being matte finish anyway.

Clean the copper discs with rubbing alcohol to make sure they are clean and free of oils for better adhesion of the superglue and the dry-rub transfers.

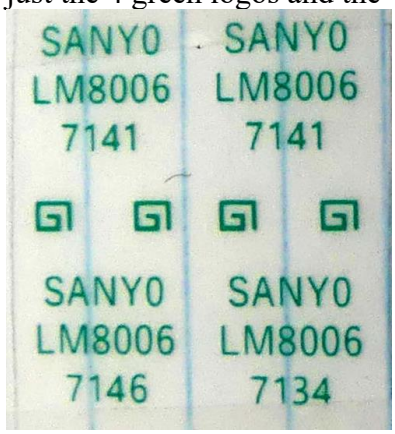
I put a dab of Loctite Ultra Gel Control Super Glue in the middle of the white pieces (on the matte side). For this build I am only putting 3 of the copper discs on the white pieces and am leaving the 4th without the copper disc.



I then put the copper discs on and roughly centered the sticker on the part. Then press down. With only a small dab of blue, there was no squeeze-out, but have a toothpick and paper towel handy (to wipe off anything the toothpick can scrape up) in case you see any superglue coming out from under the disc.

Next, get tape and the Green dry rub transfers. We are going to add the correct markings to the white pieces before we attach them to the board.

I cut the piece out of the folded card first – it was easier for me to do that than to peel off the tape that is holding the dry rub piece to the paper. Now you have one dry rub with just the 4 green logos and the 4 labels for the white acrylic parts.



Attach the tape to just the section of label you are going to use and cut that section out of the larger label set. With the tape still attached, you can lightly place it on the part and use the tape to hold it in the correct place. Too much pressure and the transfer may start, so be gentle!

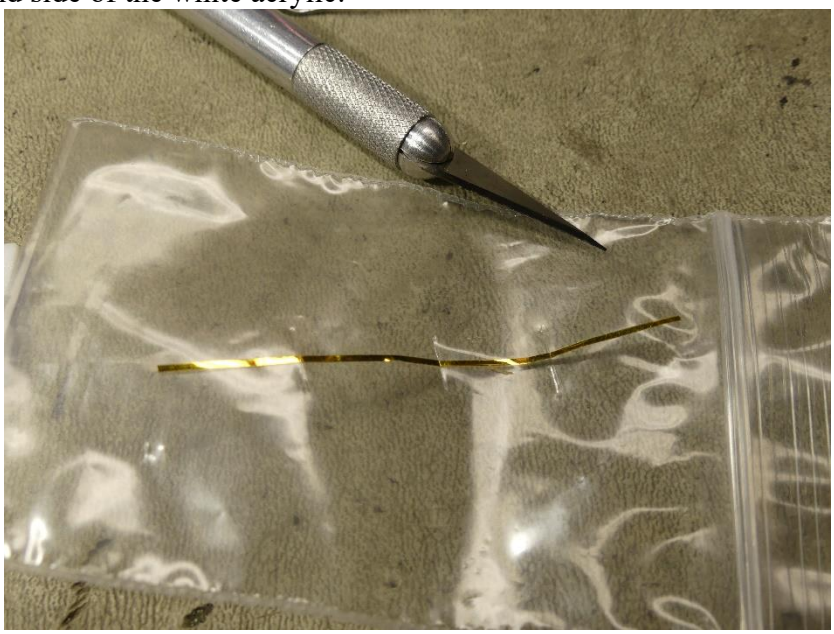


In the actual parts, the labeling was sometimes at a small random angle, but I chose to make them all straight and nearly identical.

I used a toothpick and rubbed across the green lettering first horizontally then vertically. A blunt end works best, so nothing with a sharp point, or use a file to blunt the end of your toothpick.

After the Sanyo labels were attached, I did the same for the tiny green logo (square spiral?). Placing that in the lower right-hand corner of each white acrylic.

Next, I use the thin gold adhesive backed strip to add a line from the brass disk over to the right-hand side of the white acrylic.



Using an Exacto knife (or razor blade), cut the strip into 4 equal sections.

Then align on the top from the brass disc over to the edge of the white part. Once in place, wrap the rest of the gold strip around the acrylic and make sure it adheres to the underside of the whit acrylic part.



The dry rub looks great, but can be scratched off fairly easily. Especially on the copper discs, so I decided to coat both the black and the white parts with a matte clear coating for extra protections. I used Rustoleum Matte Clear Enamel rattle can spray for this (and also later for the dry rub on the black "pillow" part).

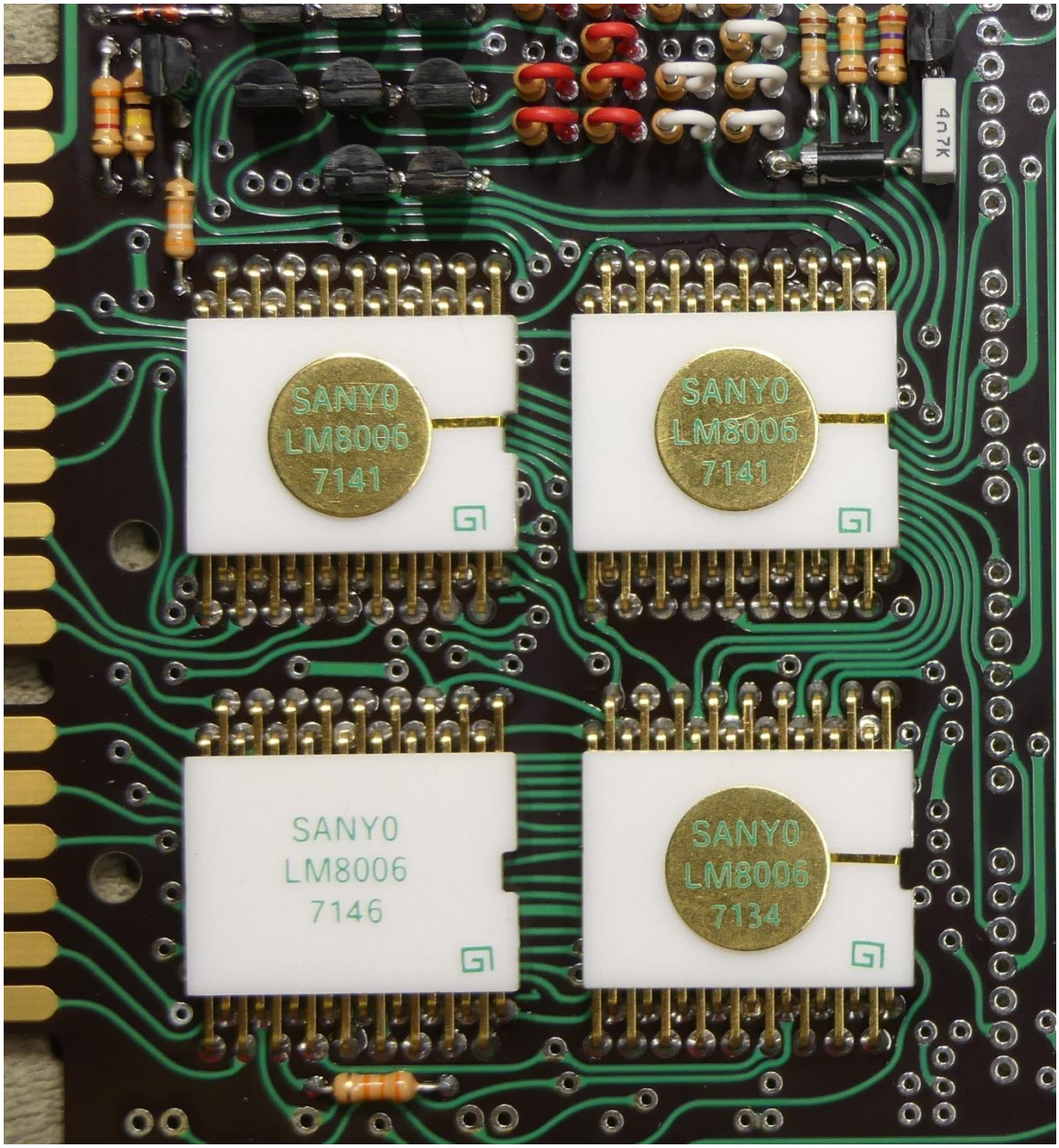


After the coating dried, here are the parts:



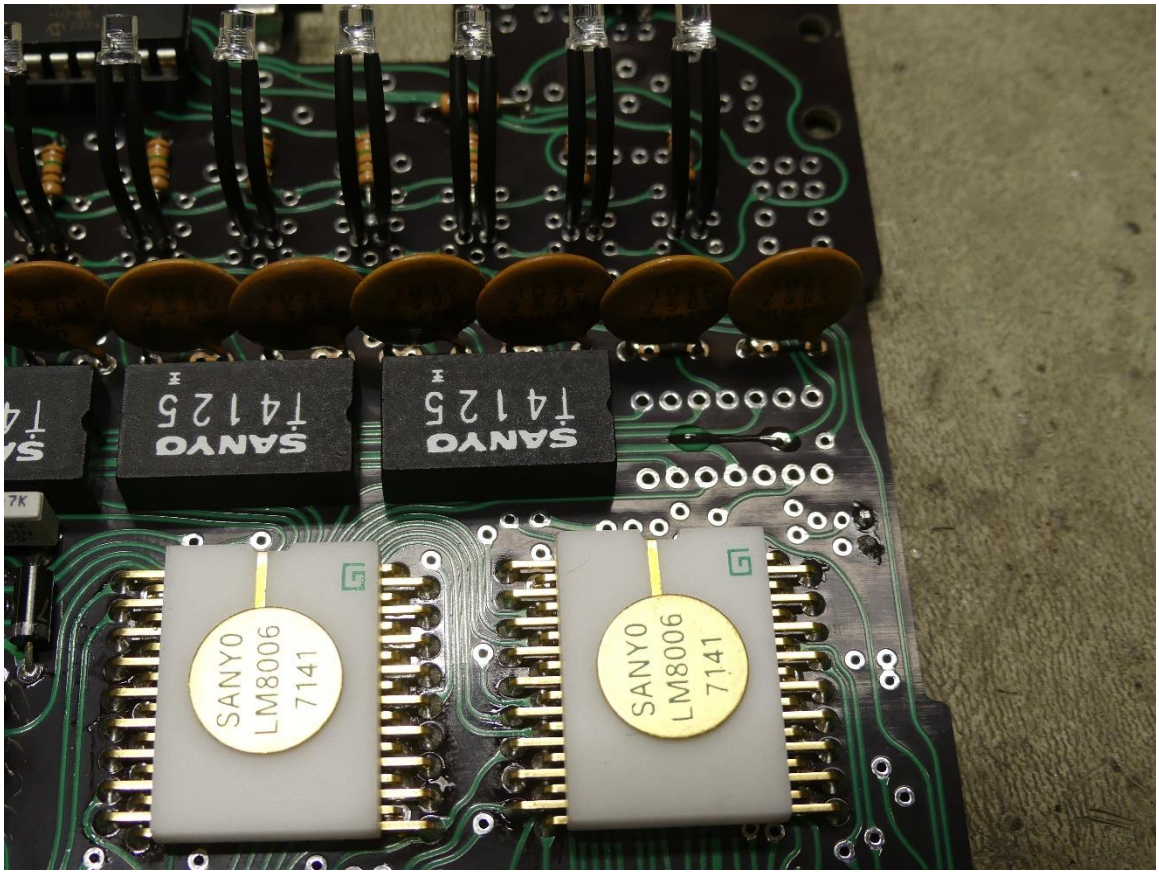
Now ready to mount, the parts need to be attached to the leads on this board. I used Loctite Ultra Gel Control Super Glue. A few drops on the inside tops of the inner portions of pins from all four columns. I did not put glue on the outside pins and only on the inside portion of the pins so no glue would reach the edge of the acrylic part and show. Then I carefully positioned and centered the part on the pins and waited a few minutes for the glue to dry. I did this one at a time, since I tended to bump into the other pieces, I wanted to make sure they were firmly attached before moving on to the next one.

Others have suggested roughening up the underside of the plastic parts for better glue adhesion. Also consider using an epoxy instead of superglue.



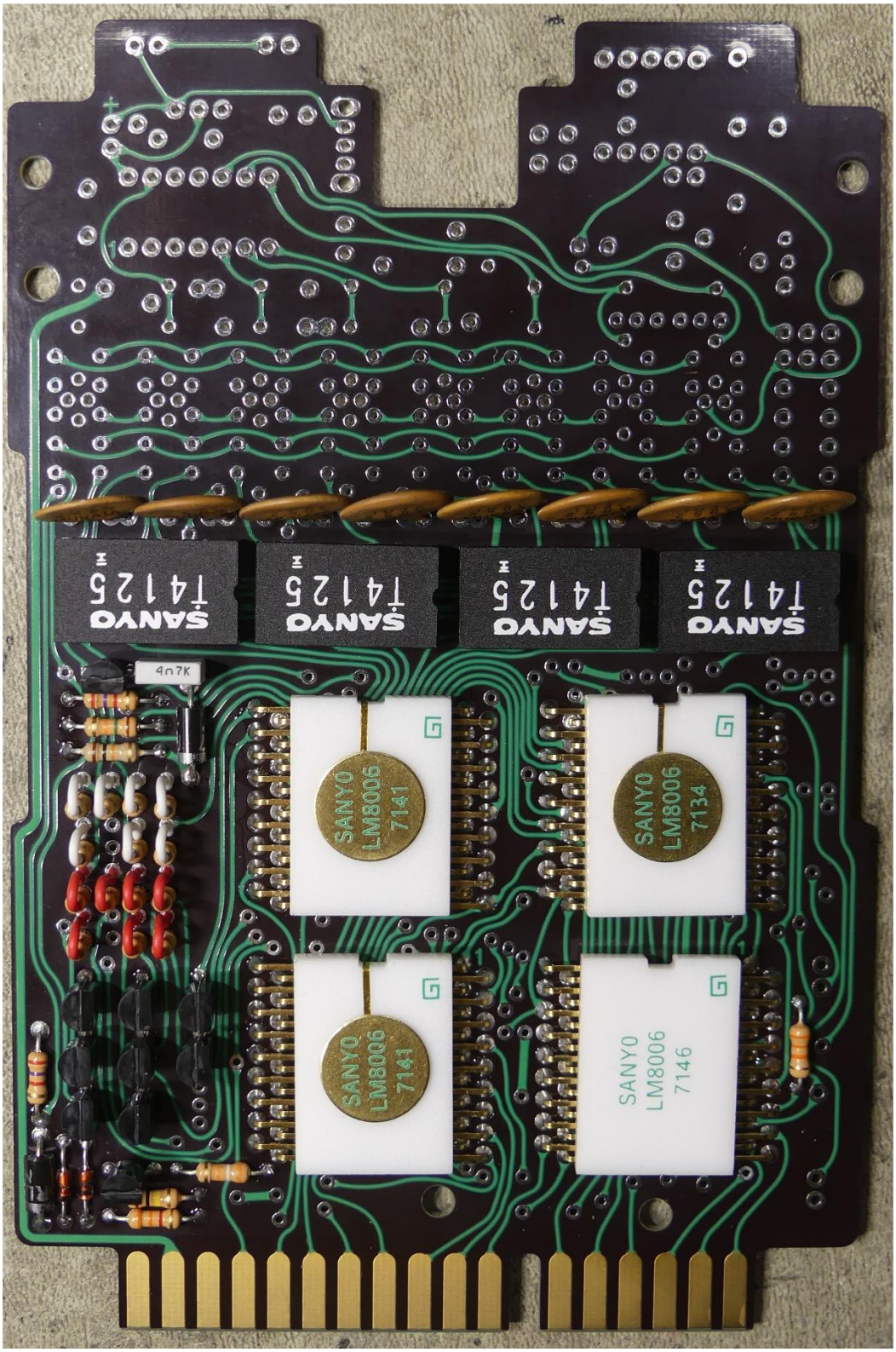
You can glue the part directly to the board, either the gel super glue or a dab of J-B Weld KwikWeld epoxy. I used the gel super glue for this build.

Start with the two middle parts and make sure they are spaced and aligned well, then let them dry (a few minutes). Then you can move to the outer parts without worrying about disturbing the position of the inner parts.



Using the KwikWeld allows a much more forgiving alignment process since the parts do not move around too freely but are easy to adjust – at least for a few minutes! The super glue sets much faster, but I have done this a lot so used super glue…

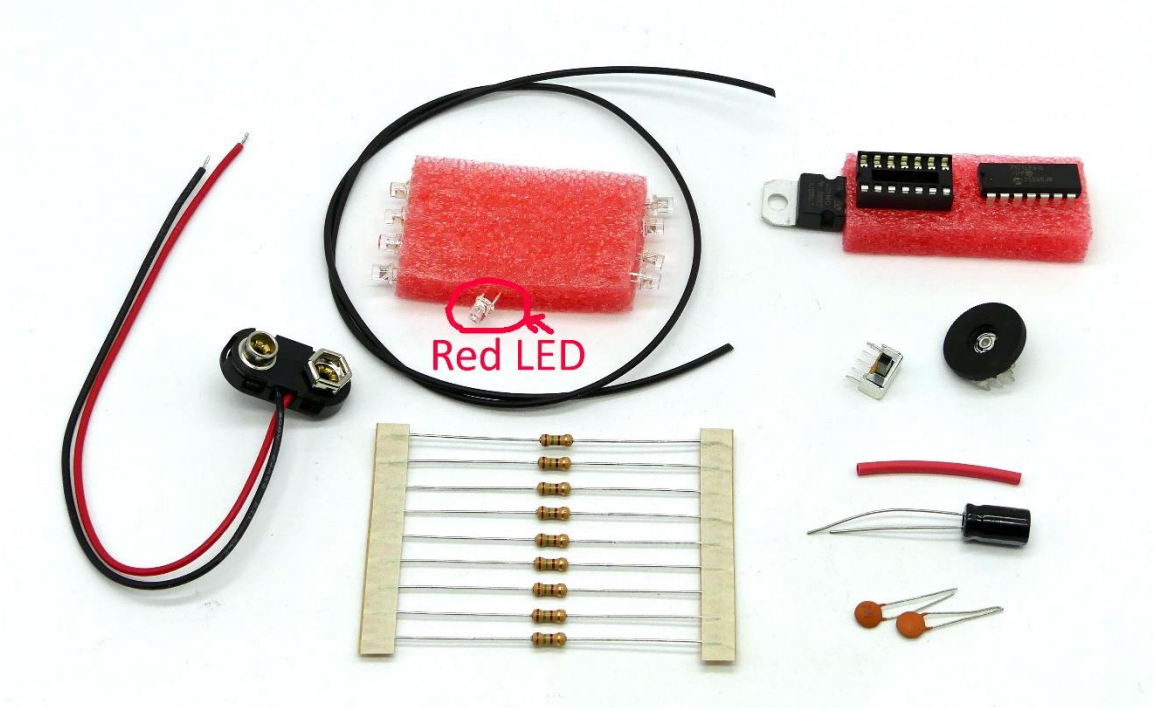
All of the black parts are mounted with the indent to the right side of the board and the lettering upside down with the board gold edge fingers pointing down. See the reference photos below.



Others have suggested roughening up the underside of the plastic parts for better glue adhesion.

“Display” circuitry parts kit assembly

This set of parts enables illuminating the display on the Gizmo.



One 9V battery connector

16” Black 3/64” heat shrink tubing for use in covering the Ambler LED’s legs

LEDs – Parts look identical, so be sure and leave the red LED in the foam until needed!
- 8x Amber 3mm flat top LEDs, 4 each on two sides of the pink foam
- 1x Red 3mm flat top LED, lonely single LED on one side of the pink foam

Pink foam of components
- 1x 7805 5V regulator (large black part with 3 legs
- 1x 14 pin DIP socket
- 1x PIC microcontroller, in 1980’s style DIP package
- 1x Slide switch (power on / off of the electronics)
- 1x Thumbwheel potentiometer to adjust the sequence of the lights

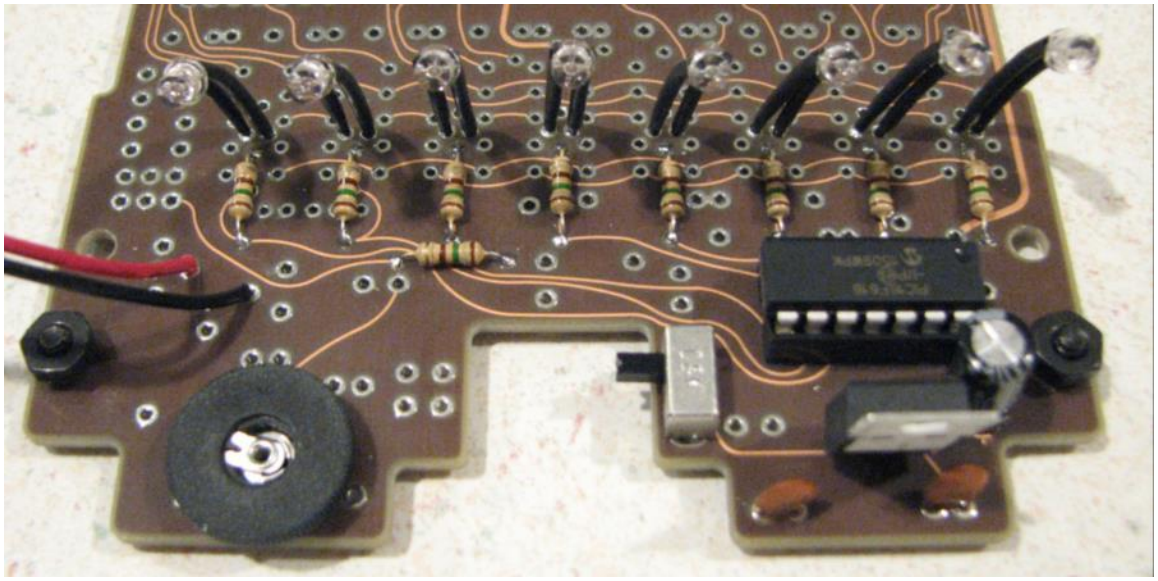
1” of larger red heat shrink tubing for the red LED
1x Black cylindrical electrolytic capacitor
2x Smal ceramic disc capacitors

9x 150 ohm ¼ W resistors (Brown Green Brown). One for each LED.

The Display driver circuitry is mostly installed near the top of the board. The Battery connector is soldered to the board in one of two different places (you choose which one you want) either the area below the thumbwheel pot or the middle of the right-hand side of the board.

The kit does contain some small loose parts (like the switch) so be careful when opening the parts bag. Seven of the parts should be placed in a small pink piece of static with an additional 8 LEDs that will be included in the LED driver.

There are seven components and 9 resistors that need to be soldered to the top side of the circuit board and are shown installed in this photo.



All 9 resistors have the same color code of Brown-Green-Brown-Gold, so resistor choice is very easy. The LEDs only work if put in the correct direction (longer lead to hole with "+" mark on the bottom of the board.

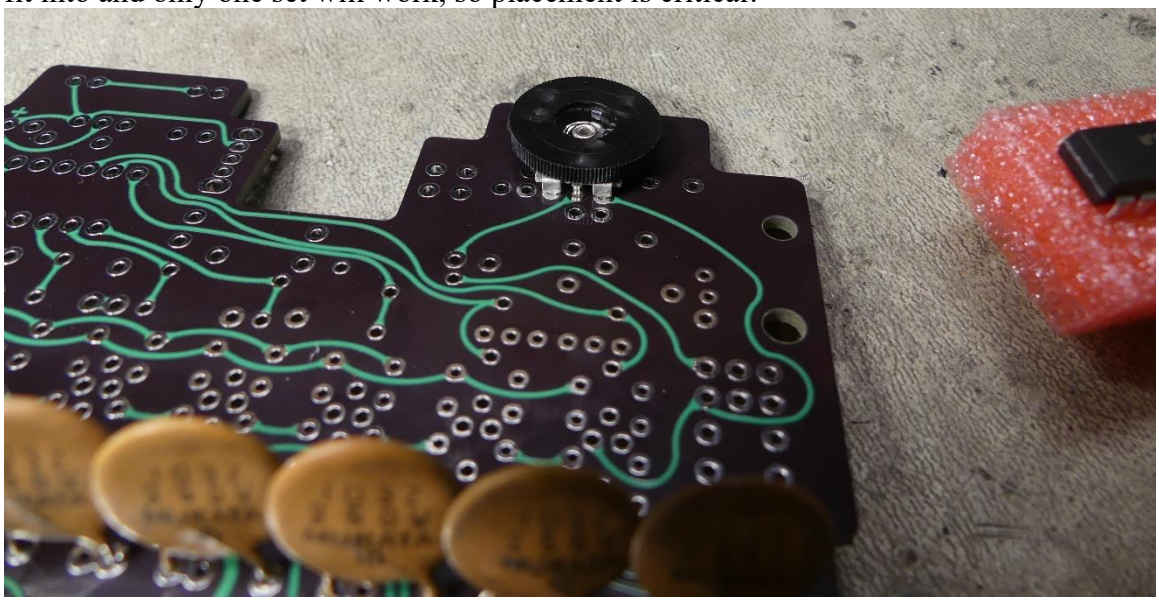
On the back side of the board there are white silk-screened indicators that will help you make sure the parts are in the correct location. Normally the silk screen is on the top side to help you build, but the Sanyo board we are emulating did not have any silk screen on the top side and so this makes the board look more like the original even though it does make building a bit harder.

The board is typically built with the shortest components first, but you may already have the "BP" parts installed and they will hold the board up off the surface when you flip the board over to solder. This is fine, just be aware that the components can fall out or shift positions when flipping the board over to solder in the components.

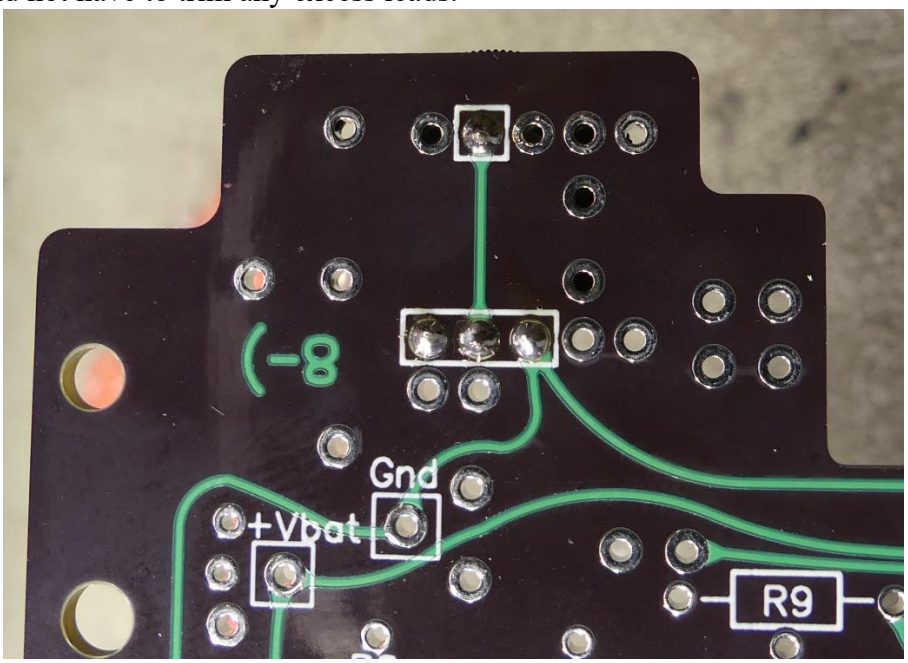
The soldering done for this kit of parts is important and since all of the parts are functional and shorts or "cold" solder joints (nonfunctioning solder joints) can cause the circuit to malfunction or not work at all.

Let’s get started!

Looking at the front side of the board, at the upper right edge, we want to place the potentiometer – it has a large black disk on top that you use to adjust the speed of several different available patterns. The potentiometer has 4 leads that will go through the circuit board: 3 on the bottom and one at the top. There are several holes available that this will fit into and only one set will work, so placement is critical!

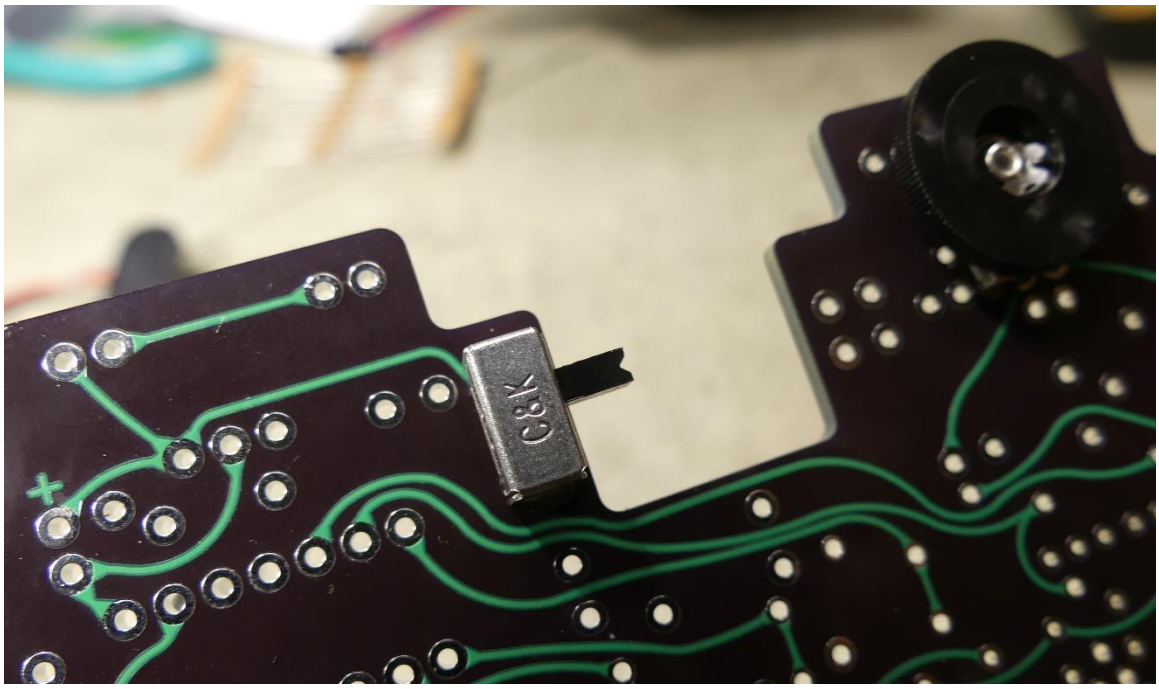


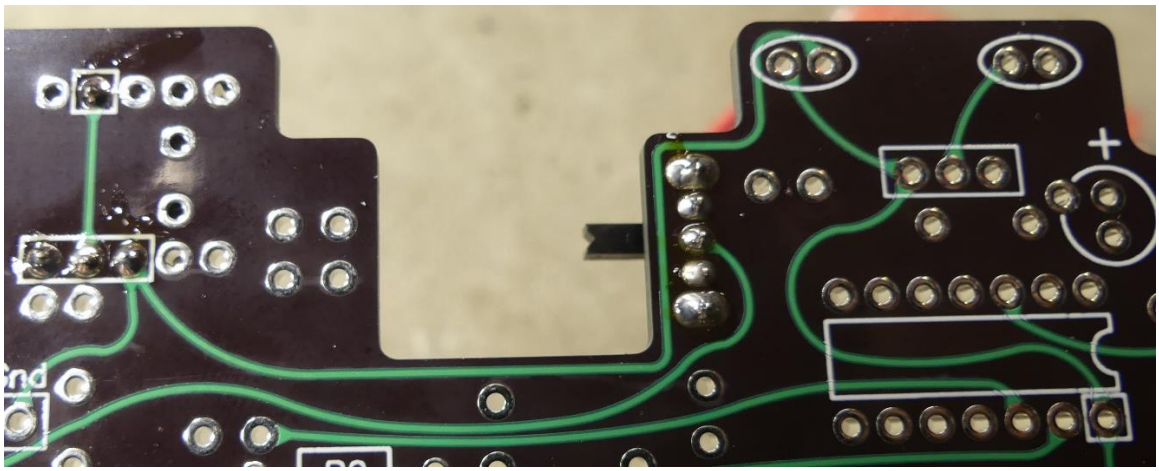
The back side of the board has white rectangles drawn to indicate which holes the potentiometer should be placed in, and you need to solder all four leads (pins) in those holes. You can solder one and then make sure the potentiometer is sitting flat on the board. The leads should only stick through the bottom of the board a short distance and you should not have to trim any excess leads.



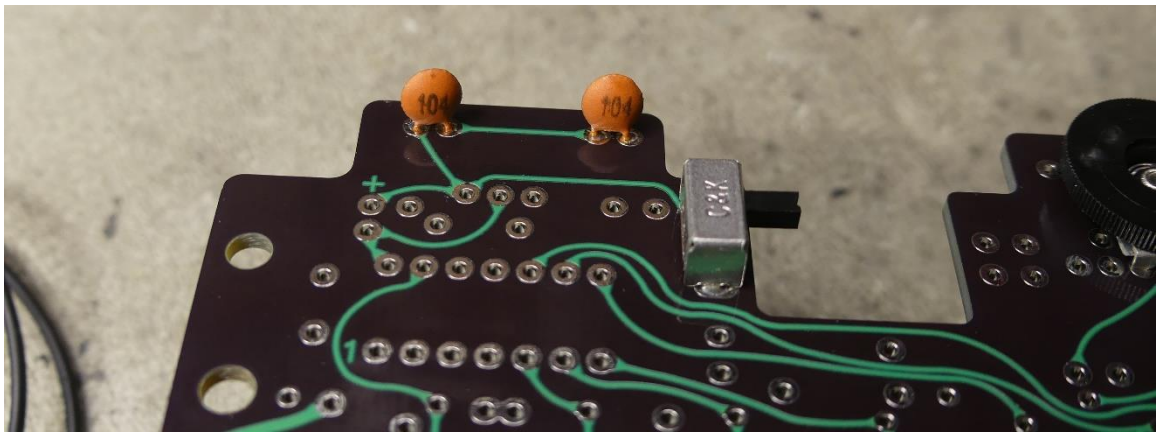
Next place the small slide switch (the main power on/off switch) on the board and solder it on the backside. You can see this metal rectangle in the center of the picture below. The black slide portion of the switch should be facing to the right (like in the photo), or it will be very difficult for you to operate when the Gizmo is finished.

The switch will fall out of the holes when flipping the board over to solder if there is nothing to hold it in place, so use some electrical tape or just your finger when you flip the board over and make sure the switch is resting on a hard surface when you go to solder the leads. You may wish to solder just a single lead then flip the board over and make sure the part is sitting flat against the board and re-solder the lead while holding/adjusting the part position.

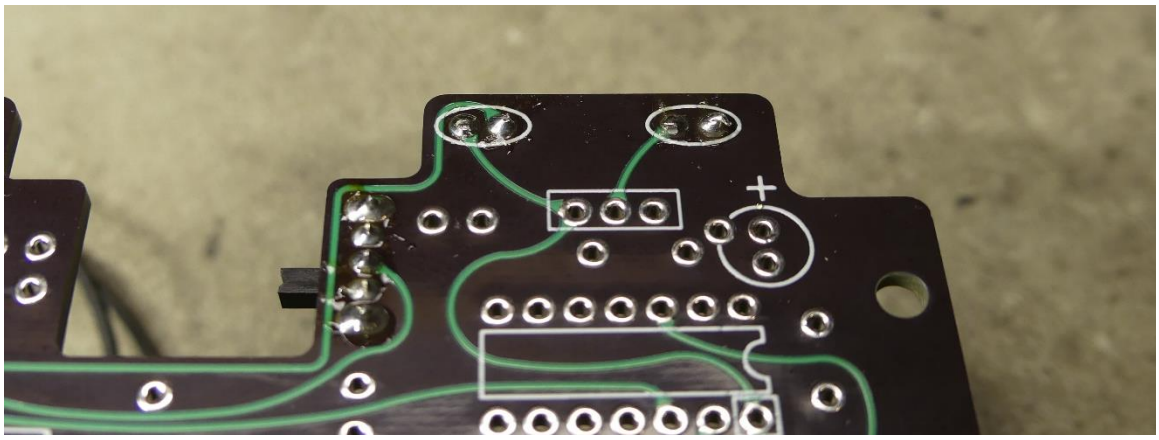




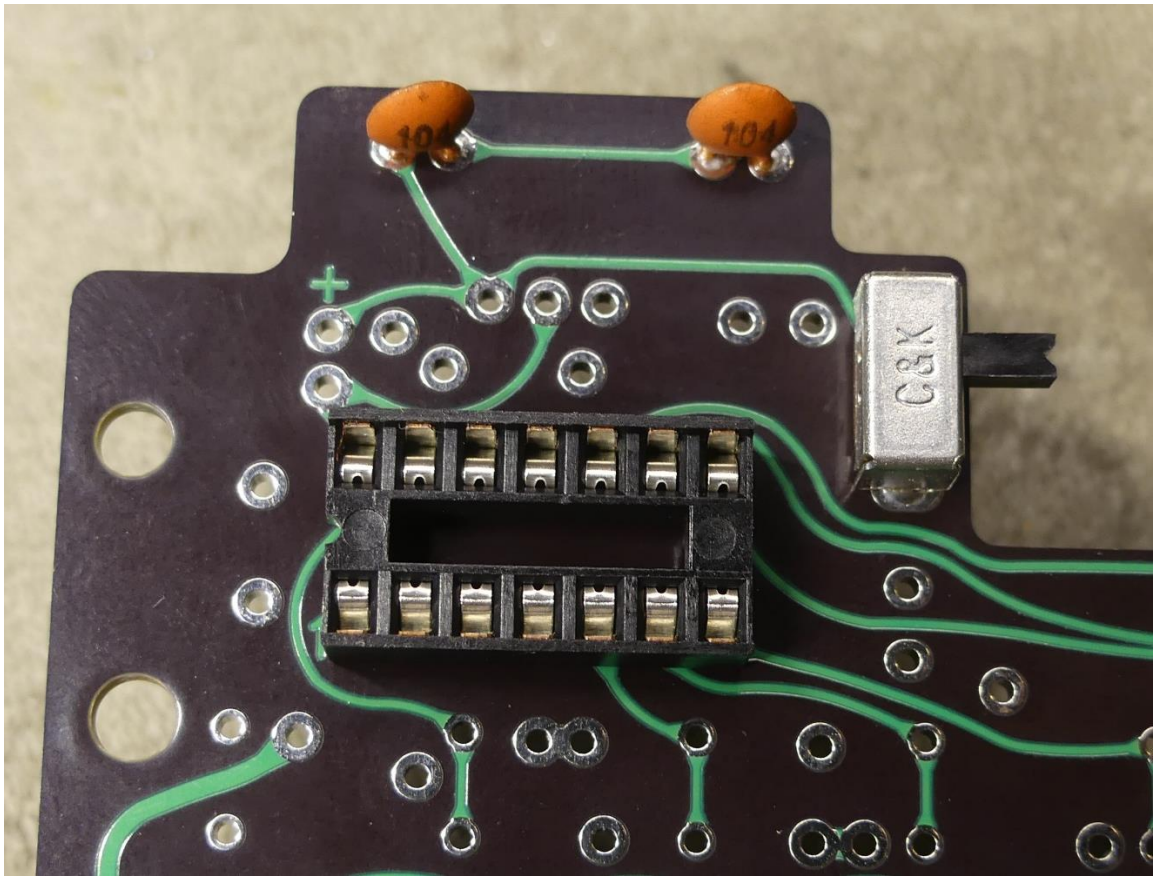
Next let's put in the two small brown ceramic disc capacitors. Looking at the front side of the board, they are placed at the upper left edge of the circuit board and are at the top of the photo above. They can go in either way so just choose which side you want the writing to face. Place the parts in the holes and then spread the wires apart on the bottom side of the board so they are held in place.



The bottom of the board has two ellipses to indicate the position of the caps. The leads are fairly long, so after soldering you will want to trim off the excess leads very close to the board. Small diagonal cutters work very well for this.



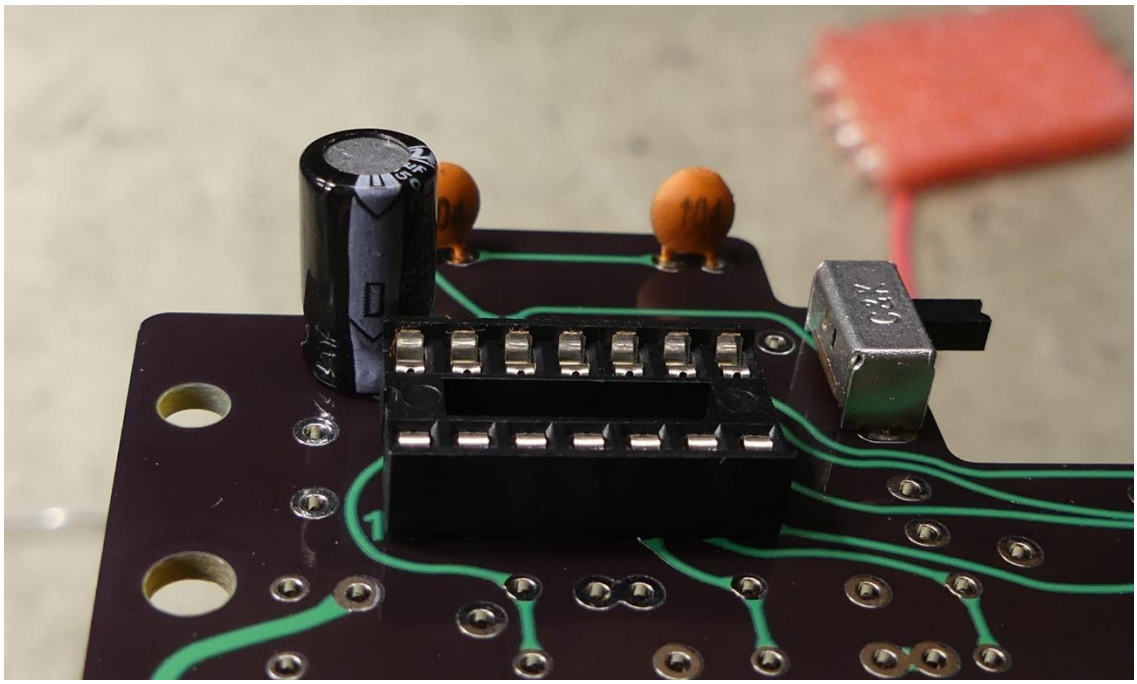
Next, we want to solder in the 14-pin black socket that will hold the microcontroller that controls the LEDs. The socket does have a notch that we want to be near pin 1 (the lower left corner of the socket) so this notch needs to go to the left as shown here:



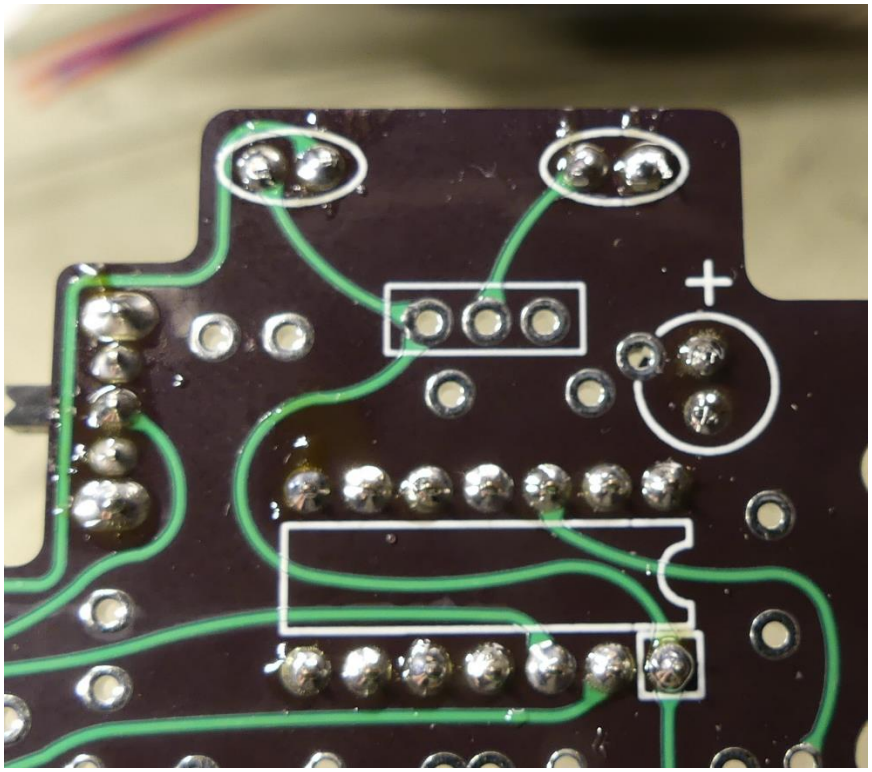
The socket will be similar to the switch in that it will want to fall out when you flip the board over. Use electrical tape or your finger to hold the part while you flip the board over and then have it rest on something flat and hard to make the soldering easier. You may want to solder just two opposite corner pins and then check to make sure the socket is flat against the board. After any needed adjustments (using the soldering iron and holding the board and the part – this takes some practice!) solder the other 12 pins on the bottom side of the board. The leads are not long enough to require any trimming.

Next, we want to attach the electrolytic capacitor – the larger black cylinder with two leads coming out of one end of the cylinder. This part also needs to go in the correct way, so only one way is correct, and you need to be careful. The capacitor has the "-" lead marked on the cylinder with a wide light gray stripe with "-" indicated a couple of times. The "+" lead is on the other side and usually denoted by having a longer lead coming out of the part. The "+" lead needs to go into the top hole that has the "+" sign in copper on the top side of the board.

In this photo you can see the “-“ markings on the cylinder and the “-“ lead is closest to the 14-pin socket.

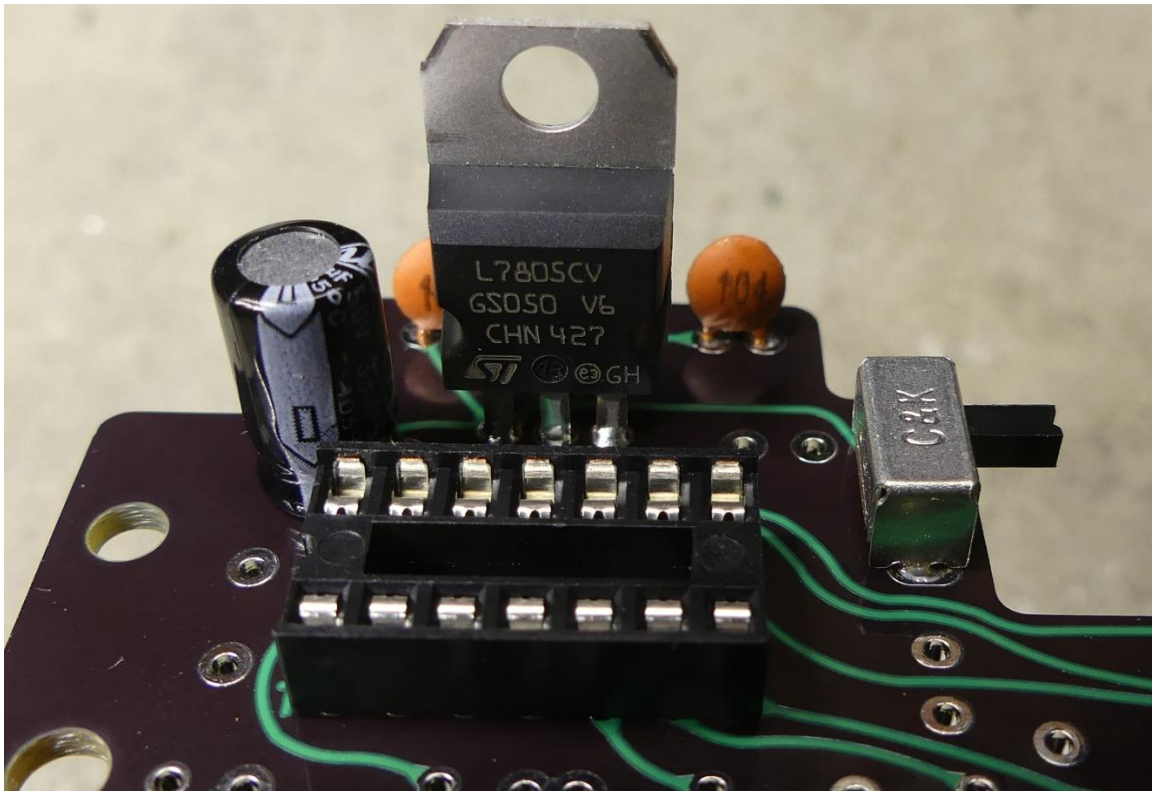


On the bottom side of the board this capacitor’s holes are indicated by a white circle and the “+” lead (usually longer) is also indicated in white. Solder and trim the excess leads.



Next the large Voltage regulator part will need to be attached. This is a part that is very similar to the one used in the Sanyo board and it is placed in the same holes that were used in the Sanyo board. This adds authenticity to the board even though we are using it for a different purpose.

The part must be oriented the correct way, or the board will not work. The large metal heat sink portion of the part must be facing the top of the board and the black portion with the part identification will be facing the 14-pin black socket, as shown below:



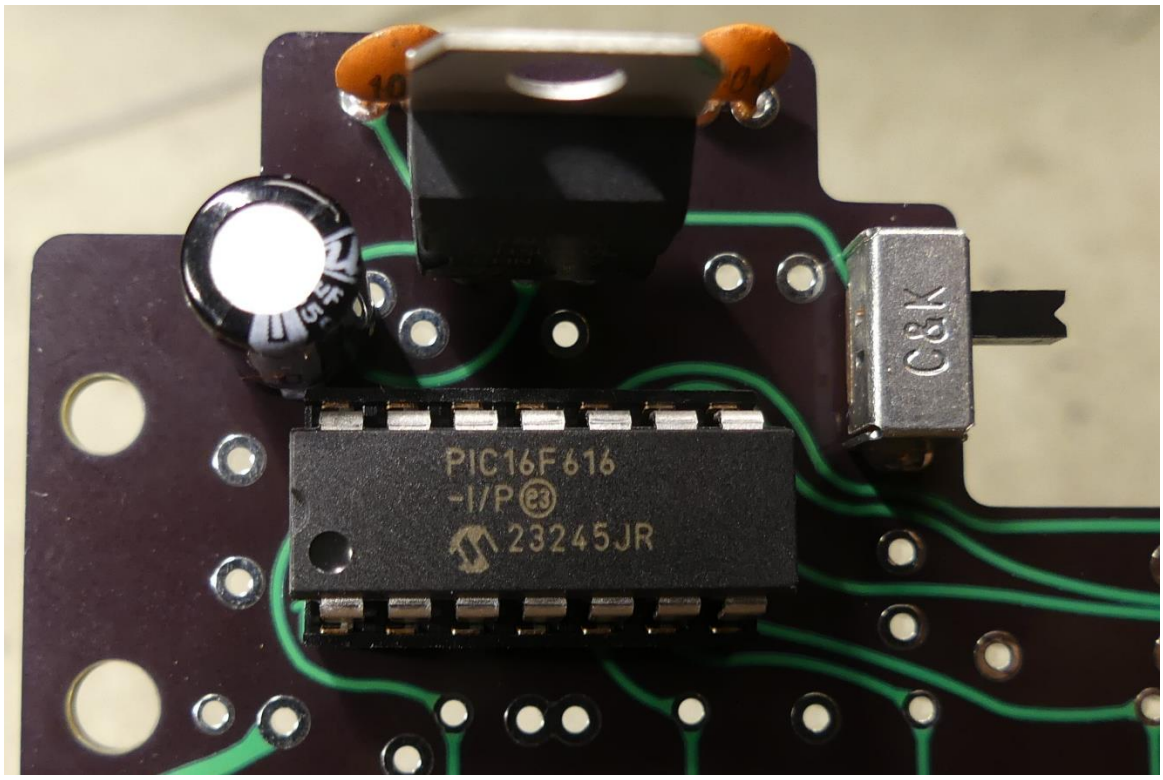
Flip the board over, solder the three pins and trim the excess leads near the bottom surface of the board.

The bottom of the board should now look like this since all parts are now soldered in:



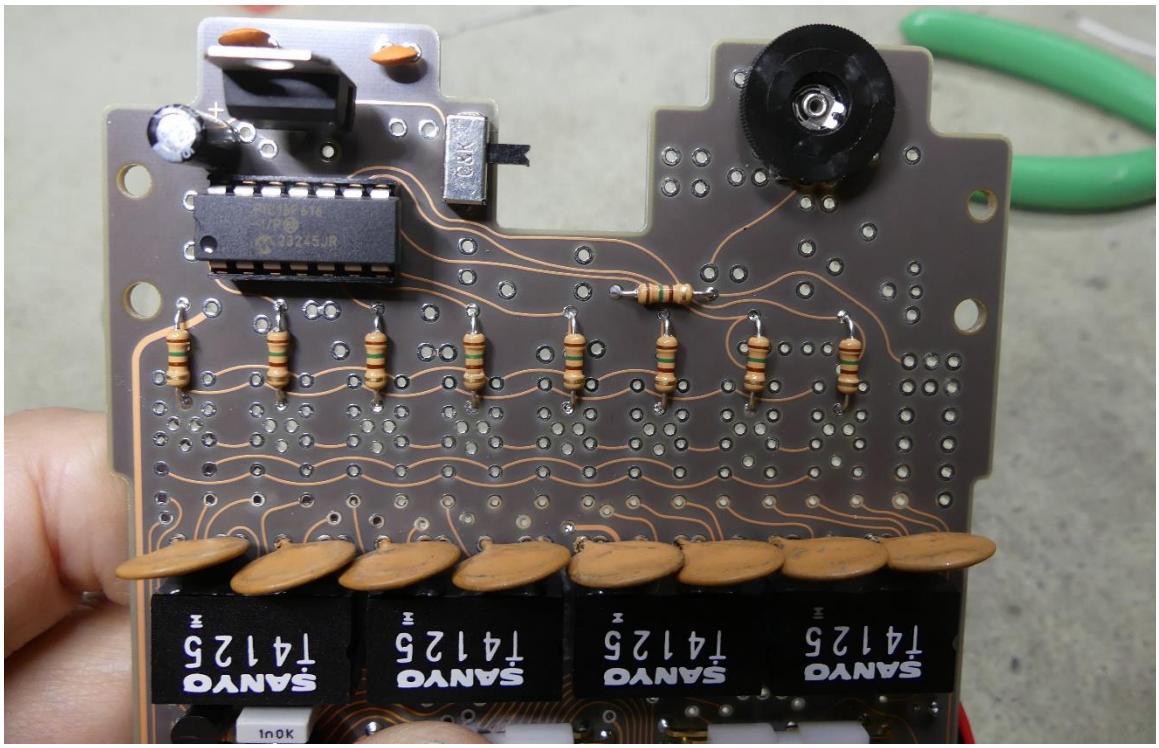
The PIC controller needs to be placed in the soldered in socket. Orientation is critical and all leads must go into the socket (sometimes you can miss or a lead gets bent under and it is difficult to see – you may need to remove the part and look to make sure the leads are all still straight – use a small flat blade screwdriver to carefully pry each side of the part out of the socket).

One side of the PIC controller will have an indicator for pin 1. That needs to go on the left side so that it is near the same indicator on the 14-pin socket and also the "1" in copper on the top of the circuit board:

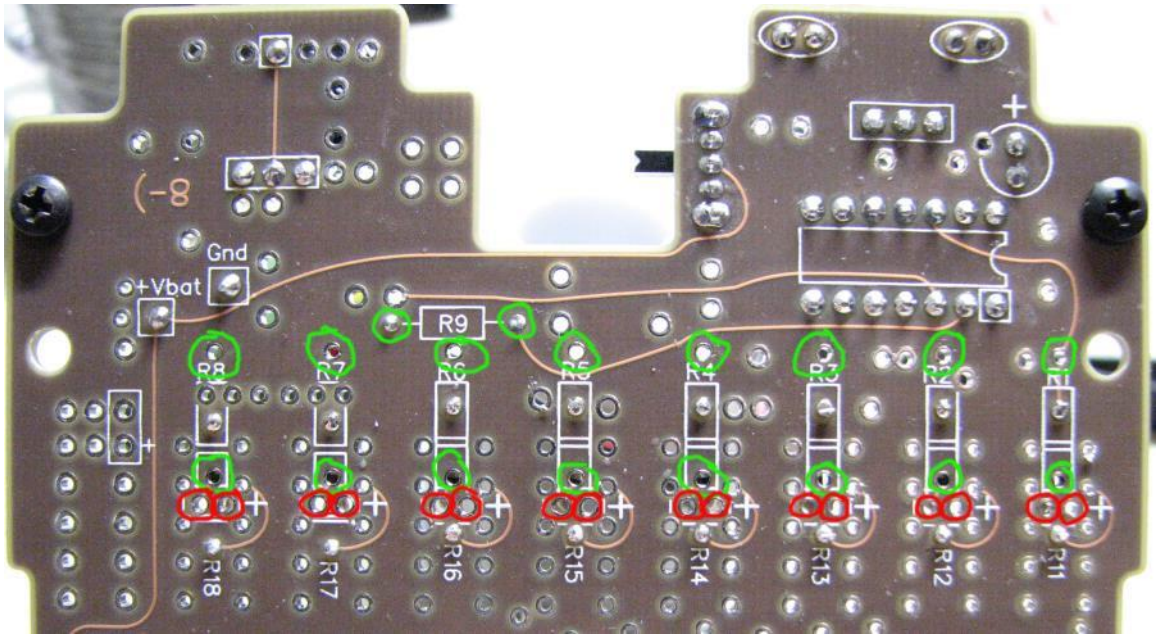


Next, we need to install the 9 resistors, one for each thing we want to illuminate.

Front side:



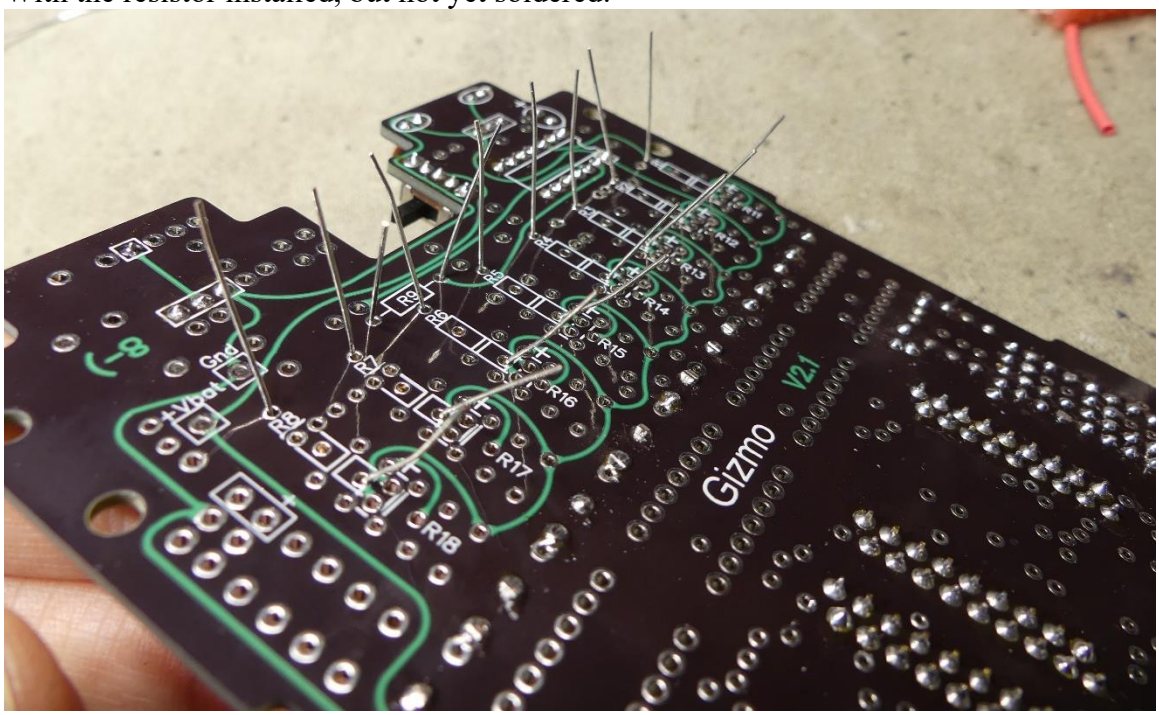
Back side:



The resistors go into the holes that are circled in GREEN, and the amber LEDs will go into the holes circled in RED. Note that the LED orientation does matter and the holes on the right side of each pair of holes are marked with a "+" sign to indicate you should put the positive (longer) lead of the LED in the hole on the right.
Resistors work in either direction, so orientation is not critical.

This kit uses the same resistor that is 150 ohms (Brown-Green-Brown-Gold) for each of the 9 LED connections, labeled R1-R9.

With the resistor installed, but not yet soldered:



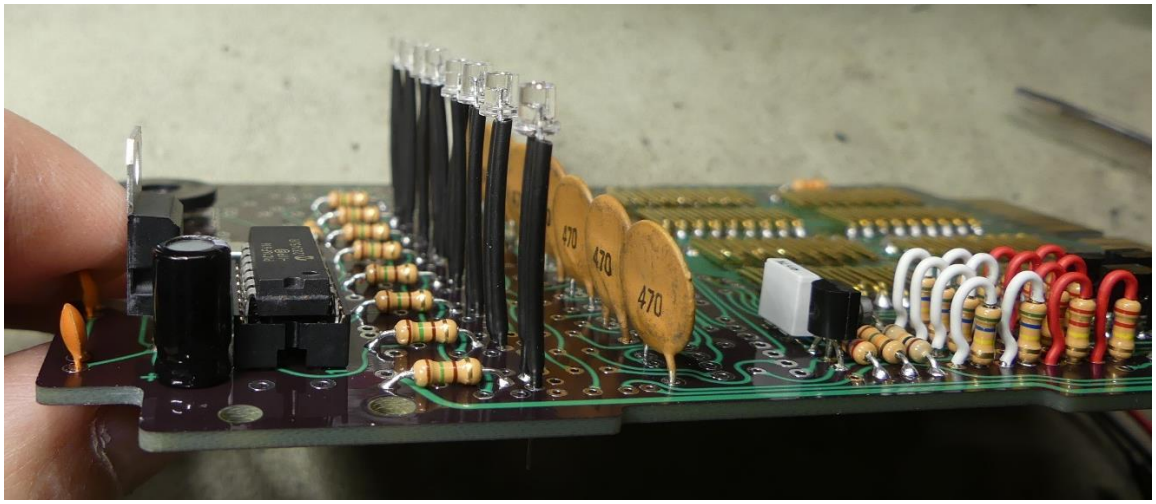
Display LEDs:
The 8 amber LEDs need to be mounted to the board. The 8 are in the pink foam, 4 on each side. The one LED at an angle all alone on one side is the red LED for the error box.

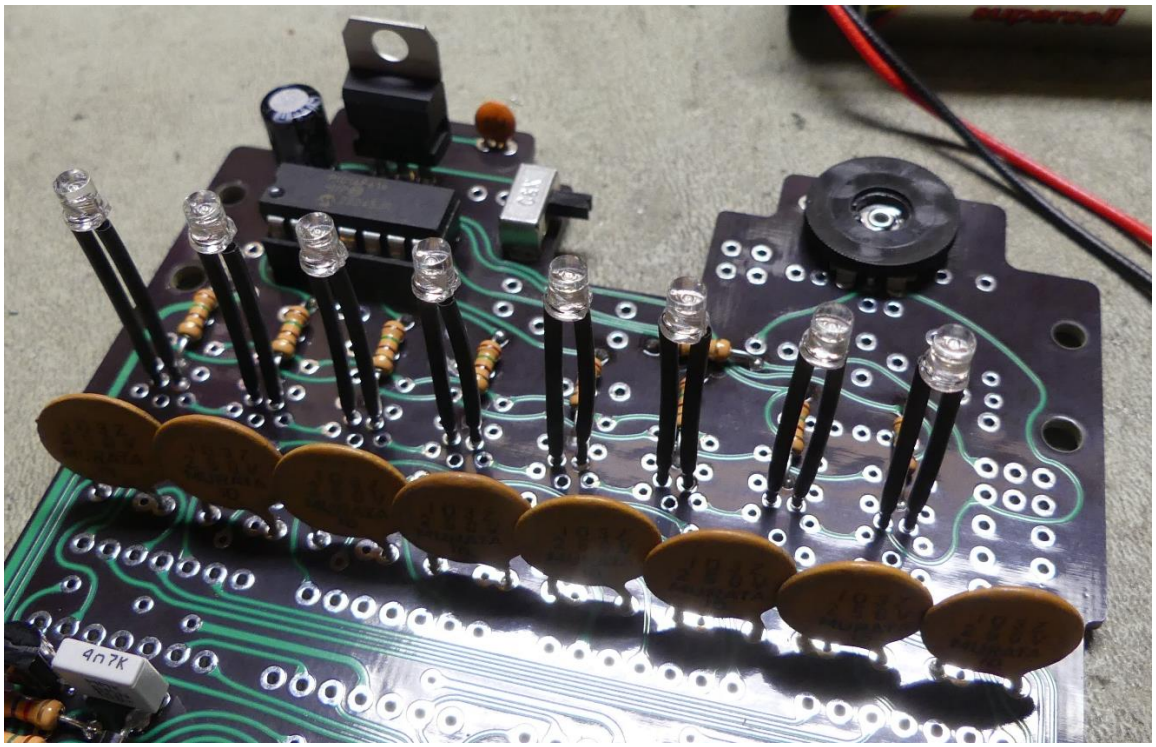
The LEDs appear identical, so be careful not to mix them up!

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.

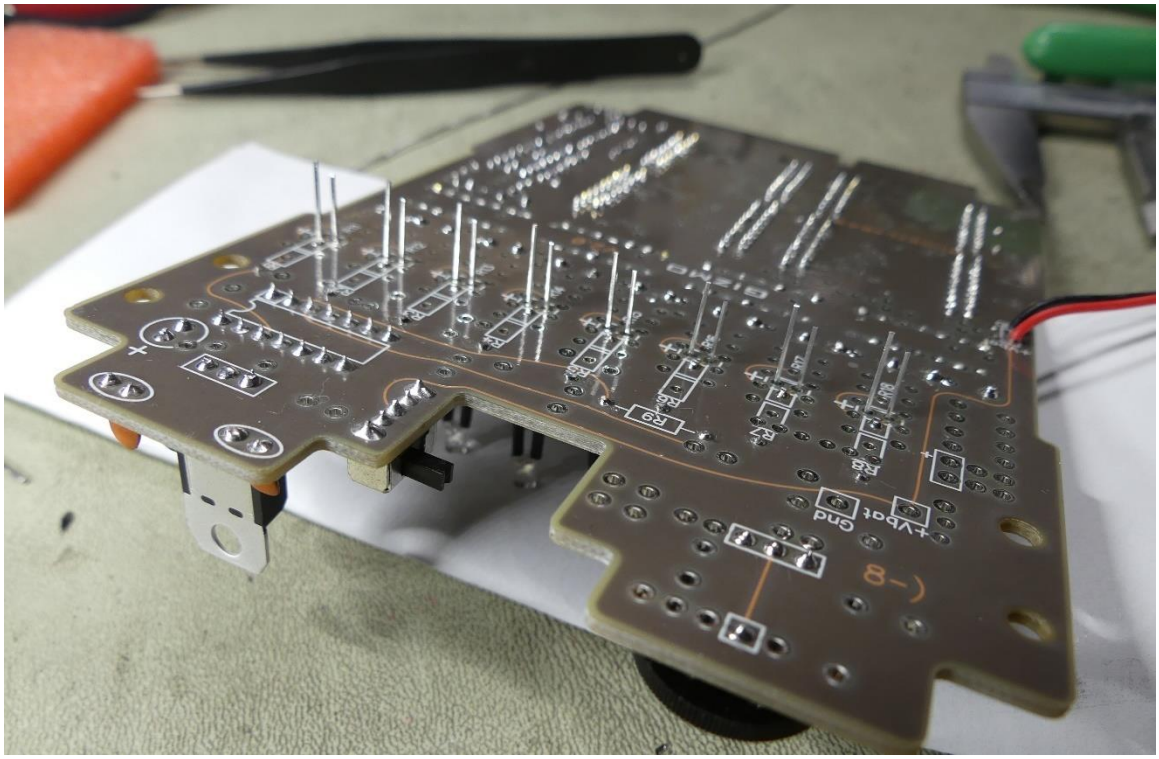
Back to the 8 amber LEDs… They need black insulation tubing placed over the leads to help line them up and also protect them from shorting to some other wire. You will need to cut up the black tubing into sixteen 0.82” long pieces.

Place the black tubing over each lead of the amber LEDs. Do not cut the leads of the LEDs since we need to make sure we can identify the longer of the two leads and put that in the hole next to the “+” symbol. With the LEDs installed they should look like this:

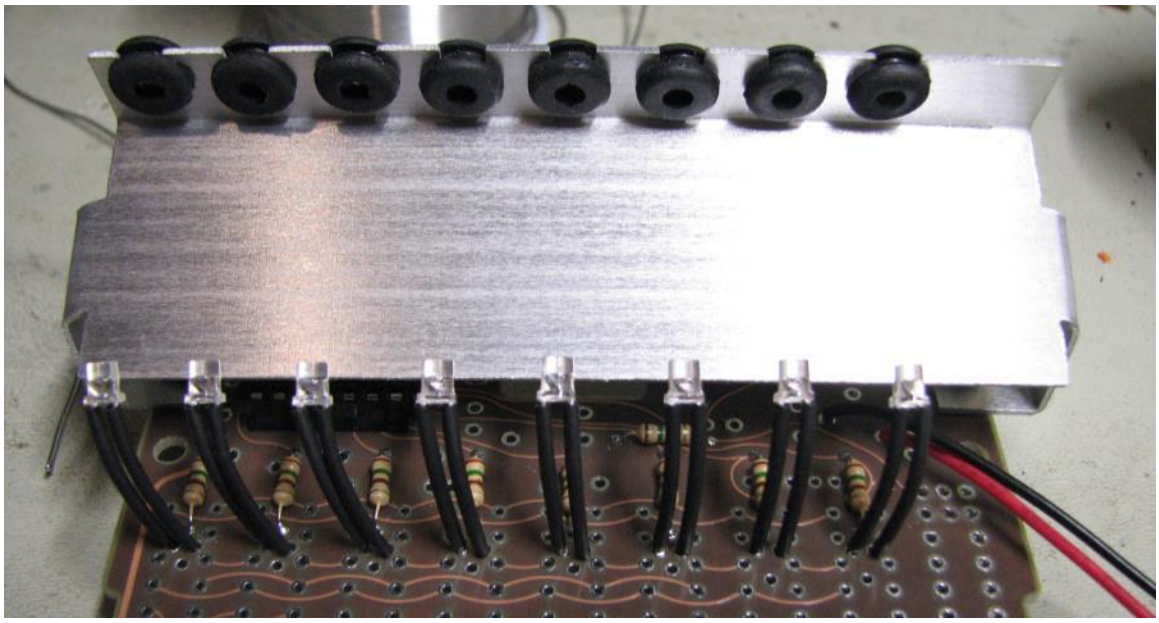


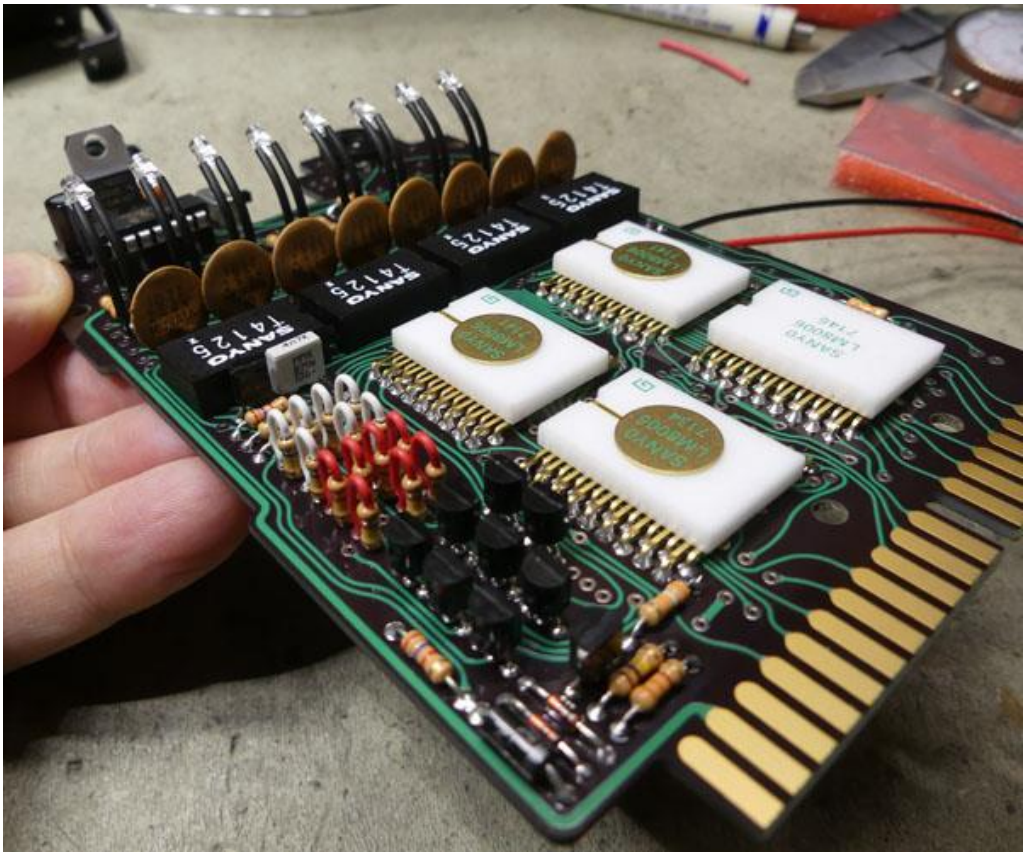


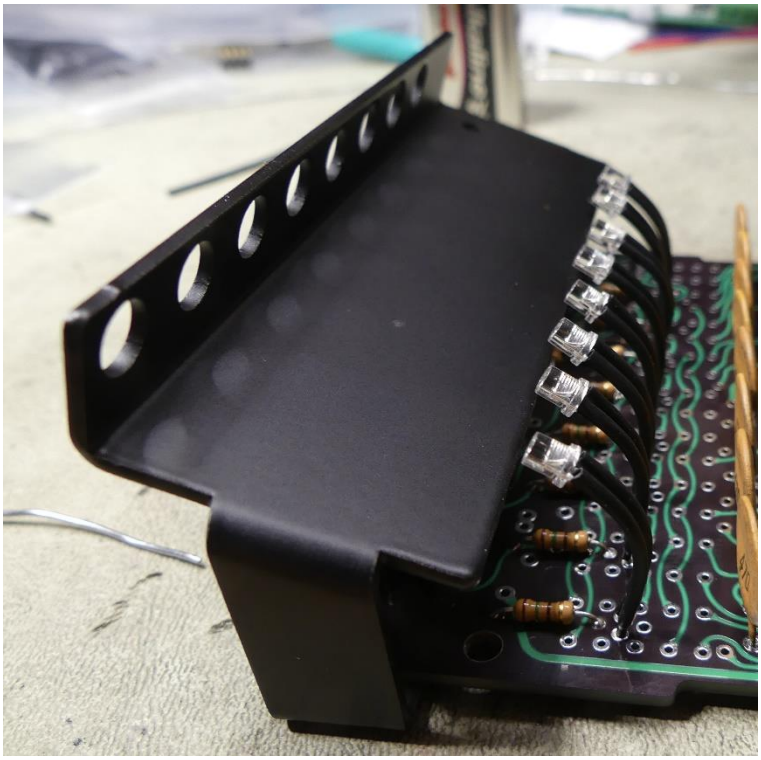
Longer leads in the pads maked with “+”:



You may want to temporarily mount the display tube stand and bend the LEDs into positions that will be approximately where they will end up when the display tubes are mounted:




SANYO
SANYO
SANYO
SANYO



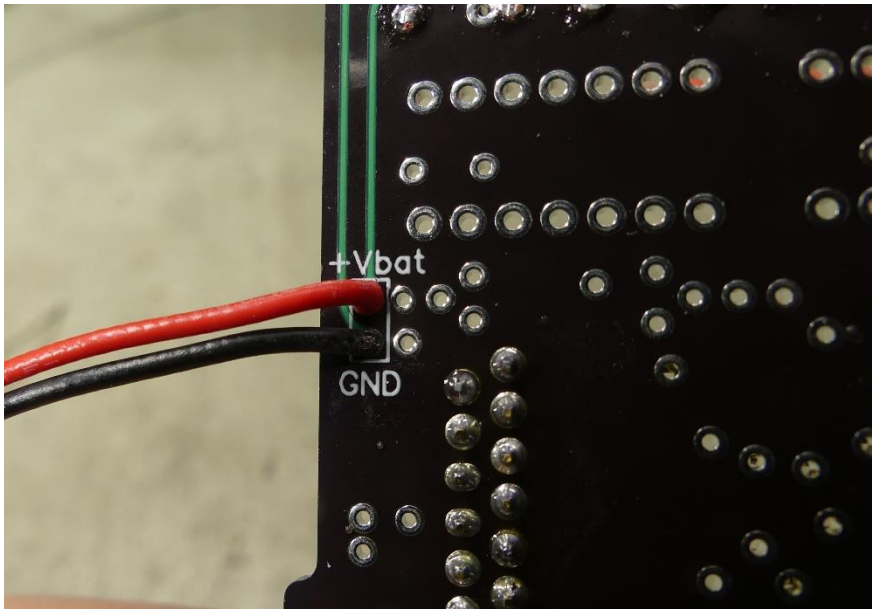
The 9V battery connector can go in next.

The wires can attach to two different locations on the board, and they can be soldered in from the top or the bottom of the board. One location is below the thumbwheel pot and the other is on the side of the board near the middle. Since this board may be shown off, you may want to attach the wires to the bottom of the board and soldered to the top side. This makes the board look as authentic as possible.

The Black wire from the battery connector must go to a hole with a rectangle around it on the back side of the board and labeled with “Gnd” or “GND”. The Red wire from the battery connector must go to a hole with a rectangle around it on the back side of the board and labeled with “+Vbat”

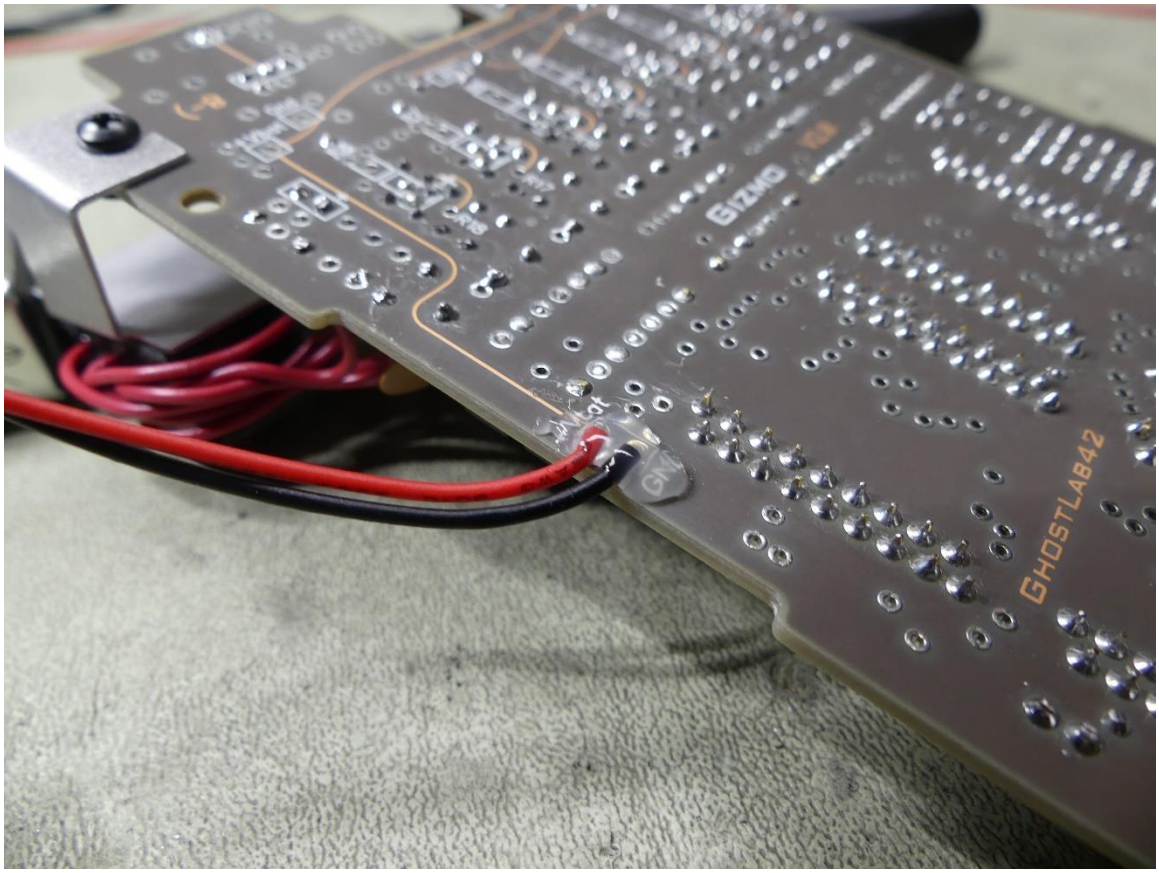
There is no strain relief for the 9V battery connector wires, so take care not to bend/yank on them or they may break, and you will have to strip the wire and re-solder them. This should be fine since the wires are plenty long and once the board is mounted in some holster, the wires will probably not move around much. If needed, you can glue the wires down on the back side and the bending should take place farther from the solder joint and that will last much longer.

Here is showing the battery connector mounted on the back side of the board (soldered on the other side) on the side location:



The 9V battery holder clip can be mounted to the Leather holster inside the strap that goes across the front of the board. You could mount it to the board, but after all this work do you really want to attach the battery to the top of this beautiful work of art?!?

I also ended up moving the wires around quite a bit during the build and wanted to make them less likely to break, so added a small bit of hot glue to the back side of the board to hold the soldered connection in place:

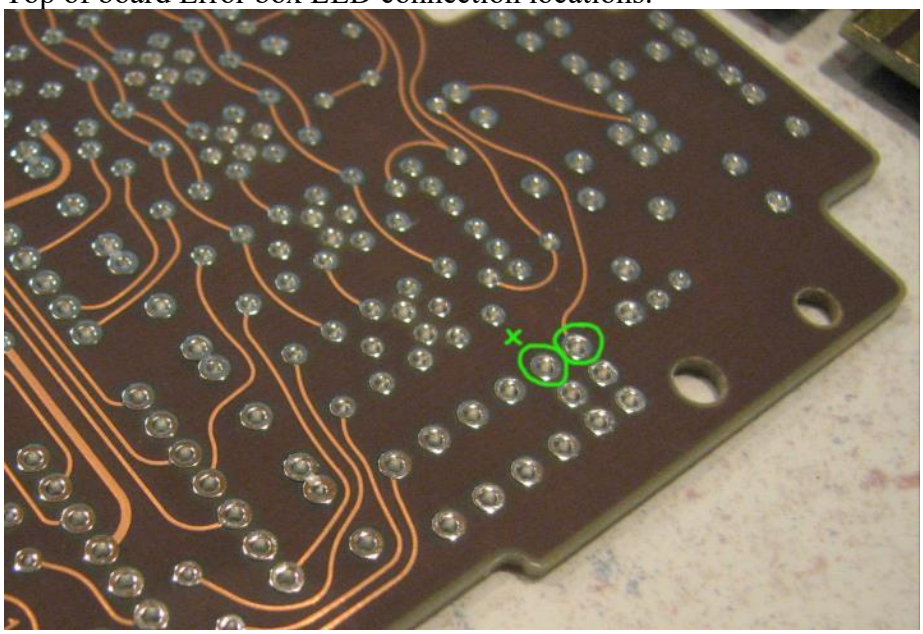


Not too much since we do not want a large thick blob of glue here since we do want the board to sit as flat as possible in the holster.

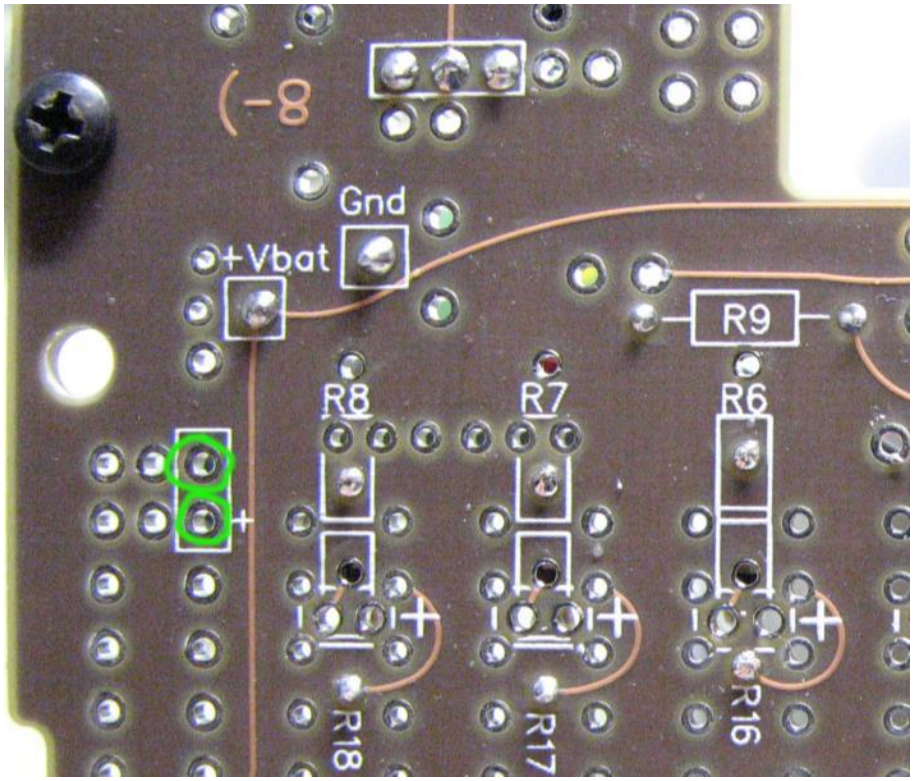
Testing the Error Box LED:

The LED can be set in the proper holes, and it will illuminate (may take several seconds, depending on the thumbwheel pot setting.

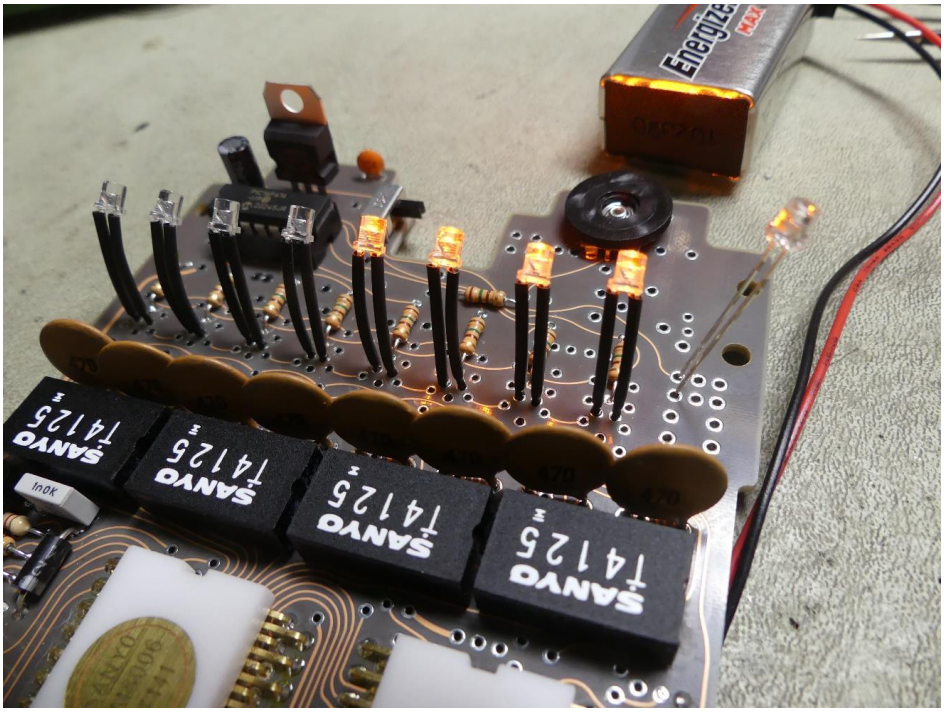
Top of board Error box LED connection locations:

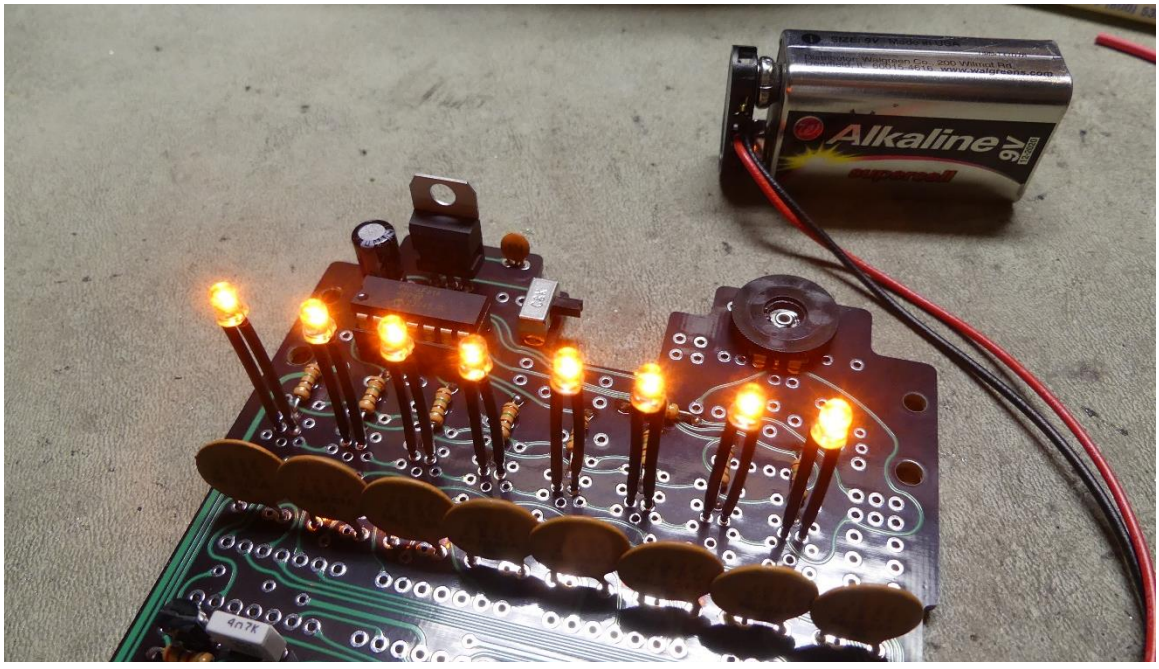


Bottom of board Error box LED connection locations:



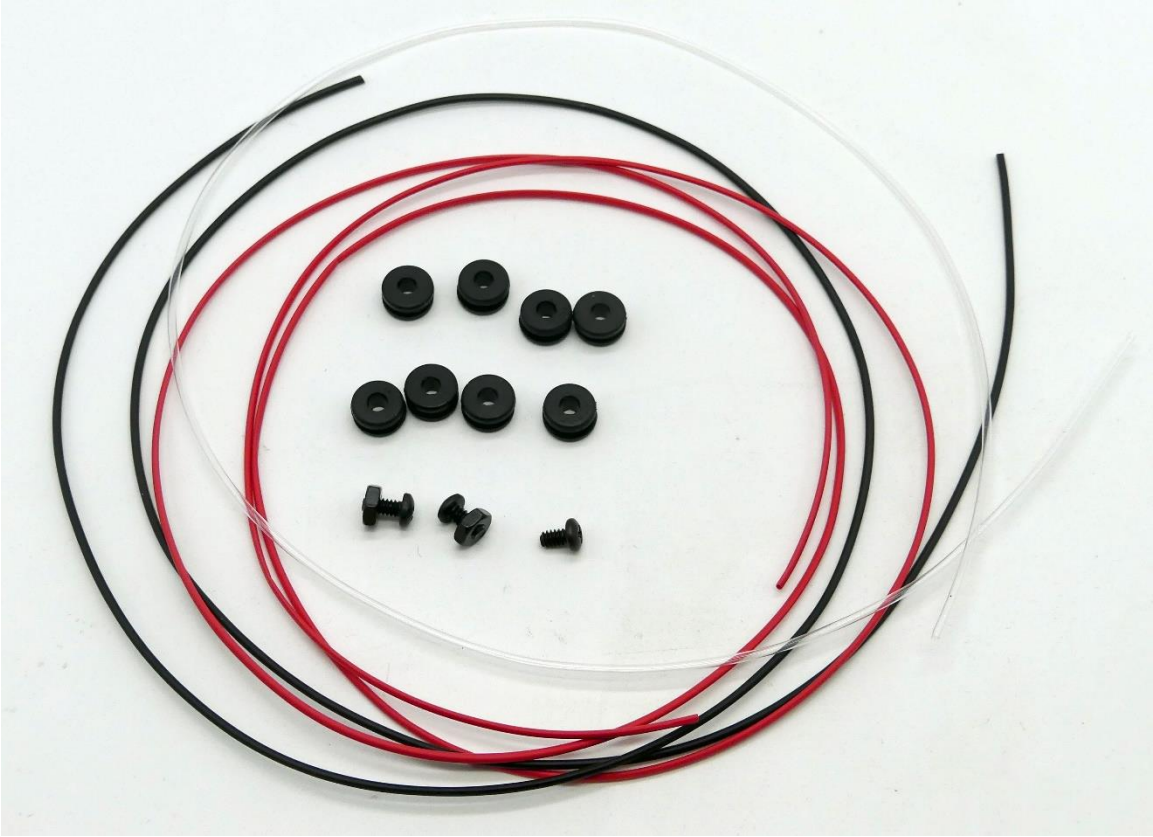
Testing all of the LEDs:





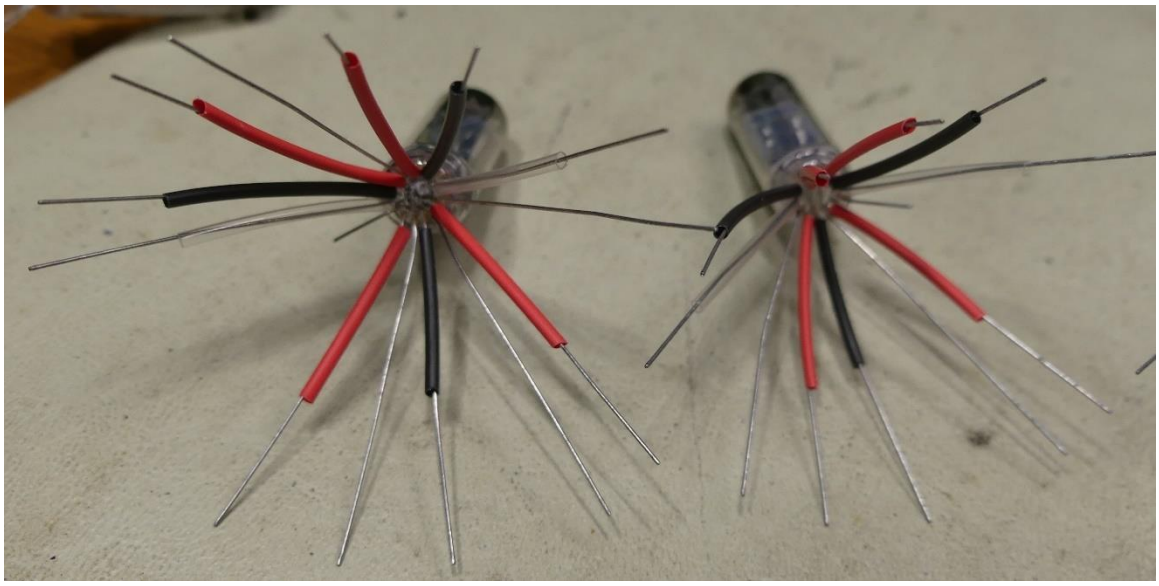
(Did this while waiting for the clear matte spray paint to dry on the black and white acrylic parts!)

Display Tube parts kit assembly



You should have 8 display tubes. There is also enough Clear, Red and Black tubing in a separate zip lock baggie to cover the leads in the way shown below.

There are several extra wires leads out of each tube that we want to remove so we have the same number of leads as were used with the other display tubes in the previous version of the kits. Here are two different tubes, the one on the left needs 5 leads removed and the one on the right needs 3 leads removed. Both have the face of the display pointing upward.



You can see the short lead sticking out on the right and a long lead opposite it sticking out on the left. These extra leads will need to be removed. You can either snip these two leads off with cutters or just work them back and forth a few times and they will break off. I waited until I had the tubing on them just to make sure the correct wires were being removed!

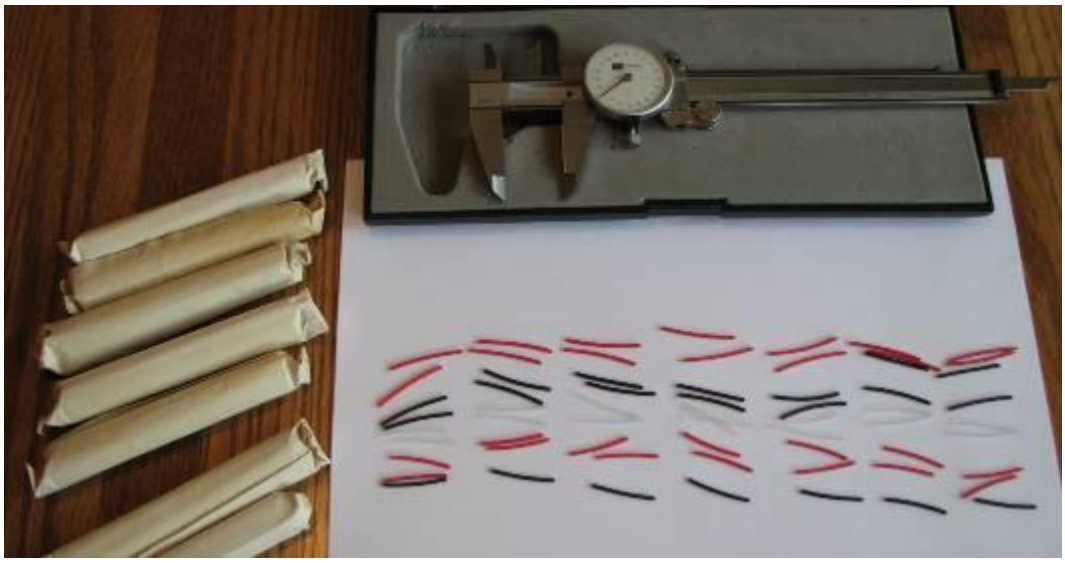
The display tubes will be sitting at an angle, so the front tubing is longer than the back tubing. This also appears to be what was done in the Sanyo board based on some measurements of the wire in the photos.

I started by cutting one tubing the desired length then used it to measure and cut the other tubing that will be the same size. By using the one tubing as a reference it was easier to get them all about the same length.

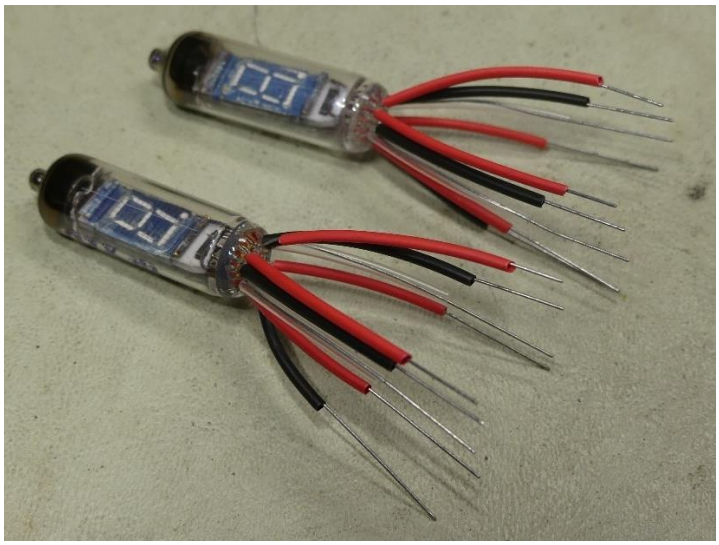
You will need:

Tubing Color	Length	Quantity
RED	1.17”	16
BLACK	1.09”	16
CLEAR	0.99”	16
RED	0.92”	16
BLACK	0.82”	8

I used my calipers to get the first one as close as possible to the desired length. This will make an ideal length and fairly straight wires.

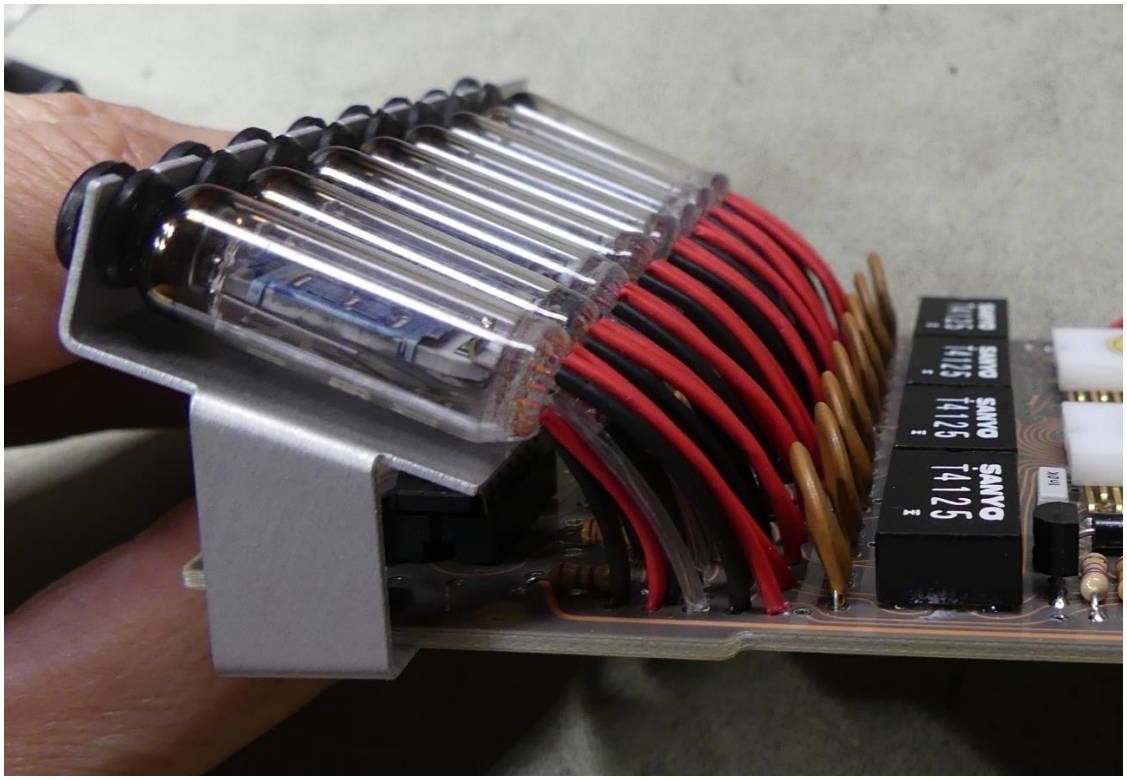


Next straighten and slightly fan-out all of the leads of the display tubes and put the longest tubing on the front side (look at the face of the display tube to make sure you know where the front is located) and work your way back. Be aware that the display tubes in this kit have a few extra leads that we do want removed as described above. After leads dressed a bit:

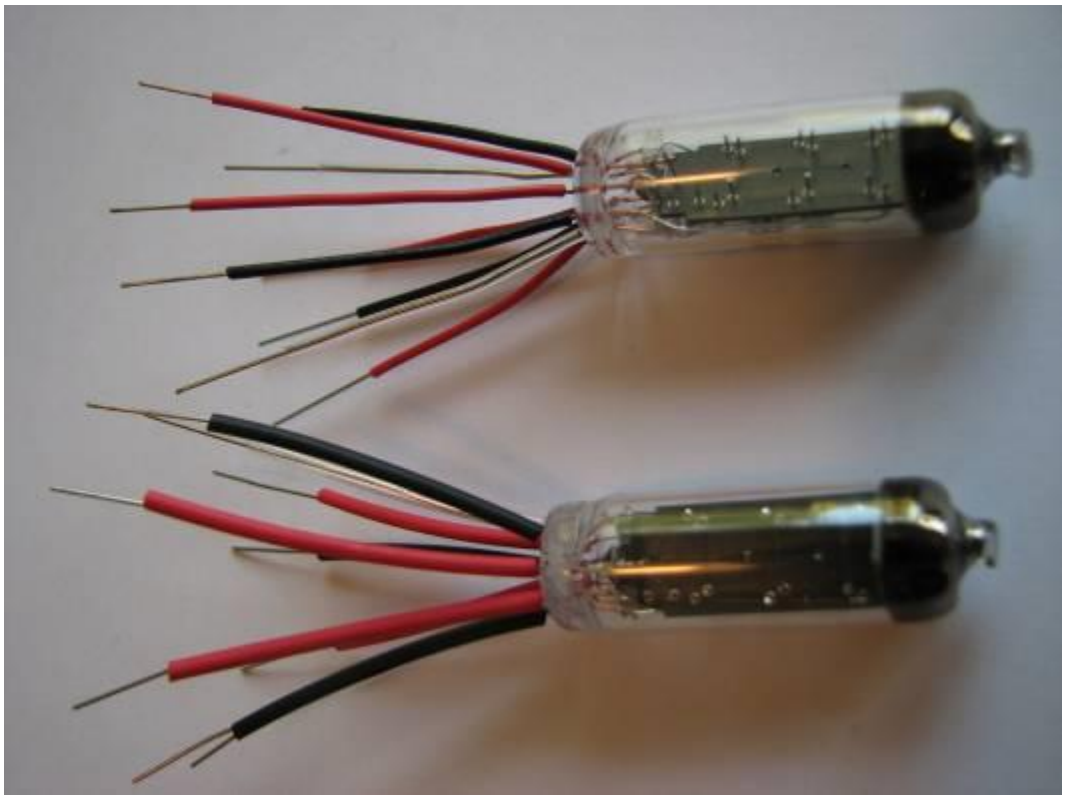


The tubing should be loose and if you turn the display tubes over all of the tubing will fall off and you will have “fun” finding them, picking them up and putting them back on.

Here is a close-up of the installed parts to make sure you have the colored tubing on the correct leads.



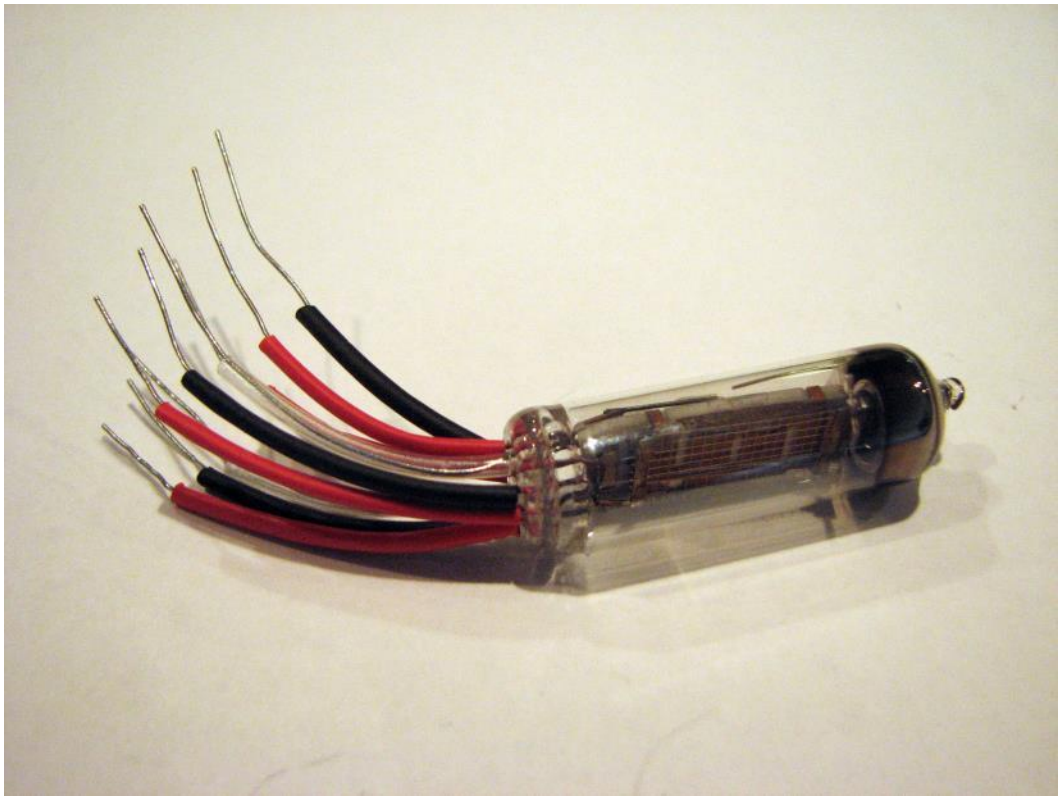
You now have a choice – leave them as-is and just deal with the loose nature while mounting or using your heat shrink gun and shrinking the tubing onto the leads. This will allow them to be just tight enough not to fall off, though you can slide them off if desired. The top display tube in the photo below is after the heat gun has been used.

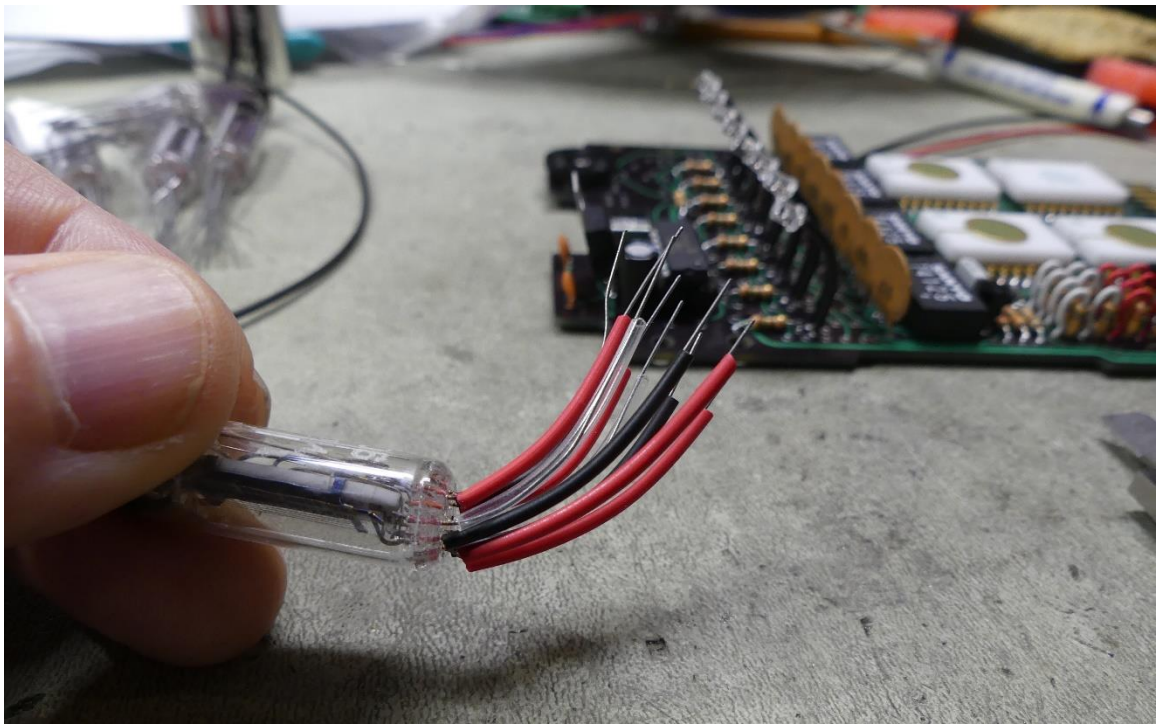


I like them left alone - "un-heat shrinked" / unshrunk ? Because they hide the LED that will be pointing at the base of the display tube.

You can do this one at a time or just get the tubing on all of the display tubes and then get to mounting them on the board.

The next step is getting the leads in about the right shape before you get to mount these on the board. This will make it easier to mount and probably save you time overall. The holes in the PCB are two sets of vertical columns. Bend and line up the leads in two columns 4 leads on the right half of the display tube and 5 Leads (they get the extra Black lead in the back) on the left side. They are also bent in an arch so that the tubing ends are roughly all in a line:

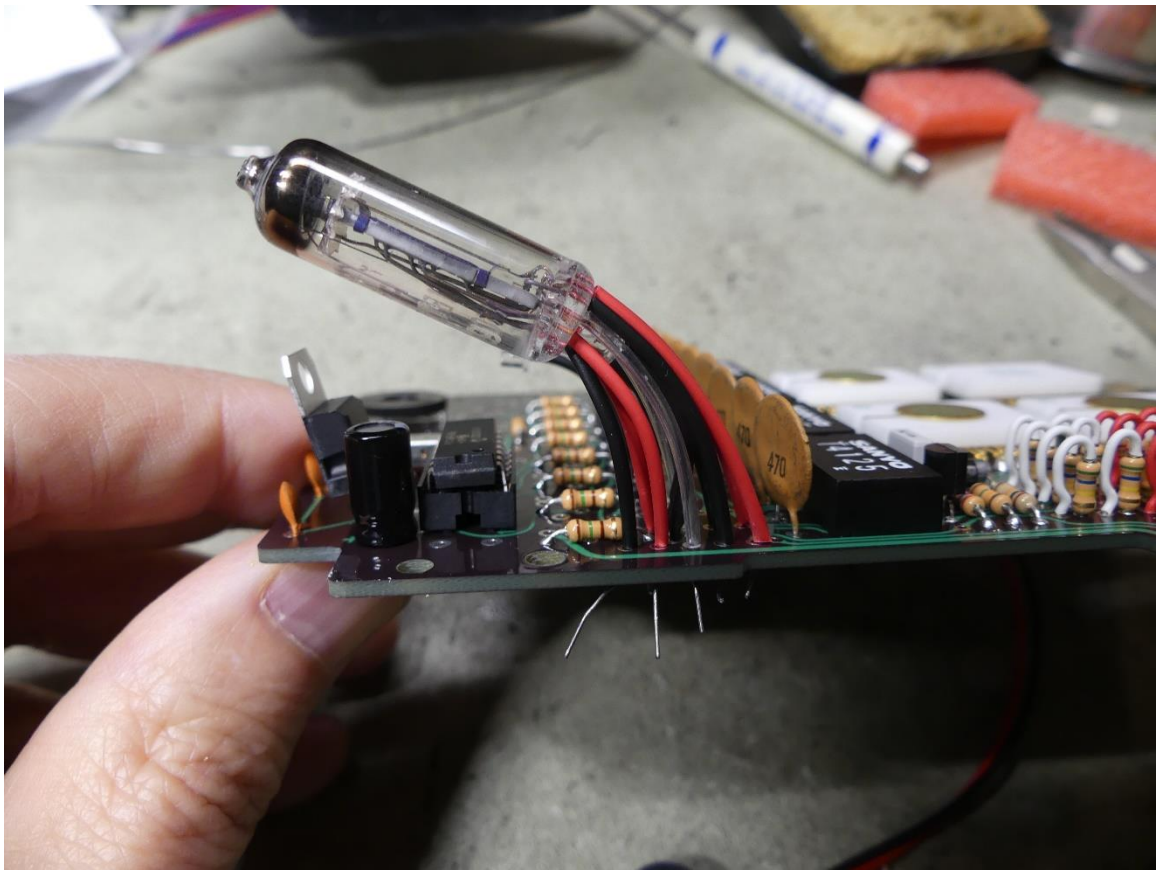


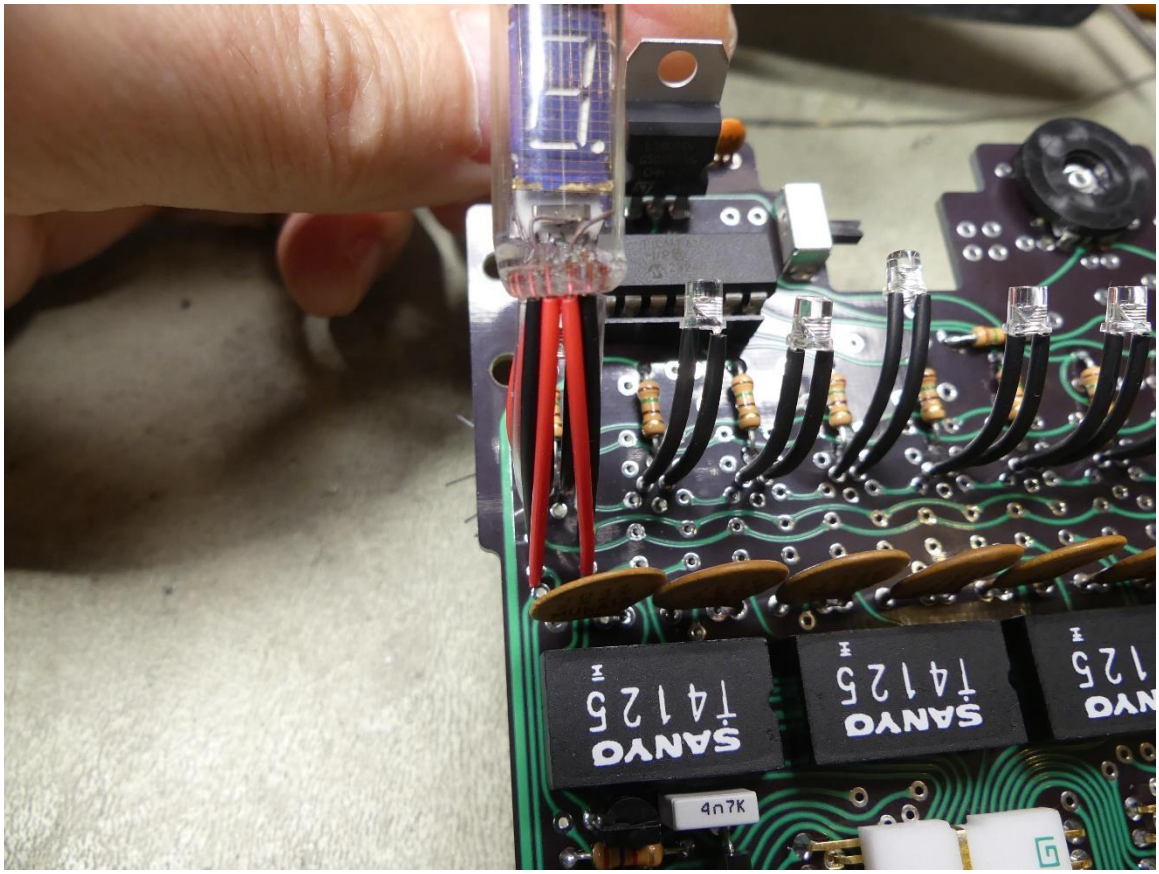


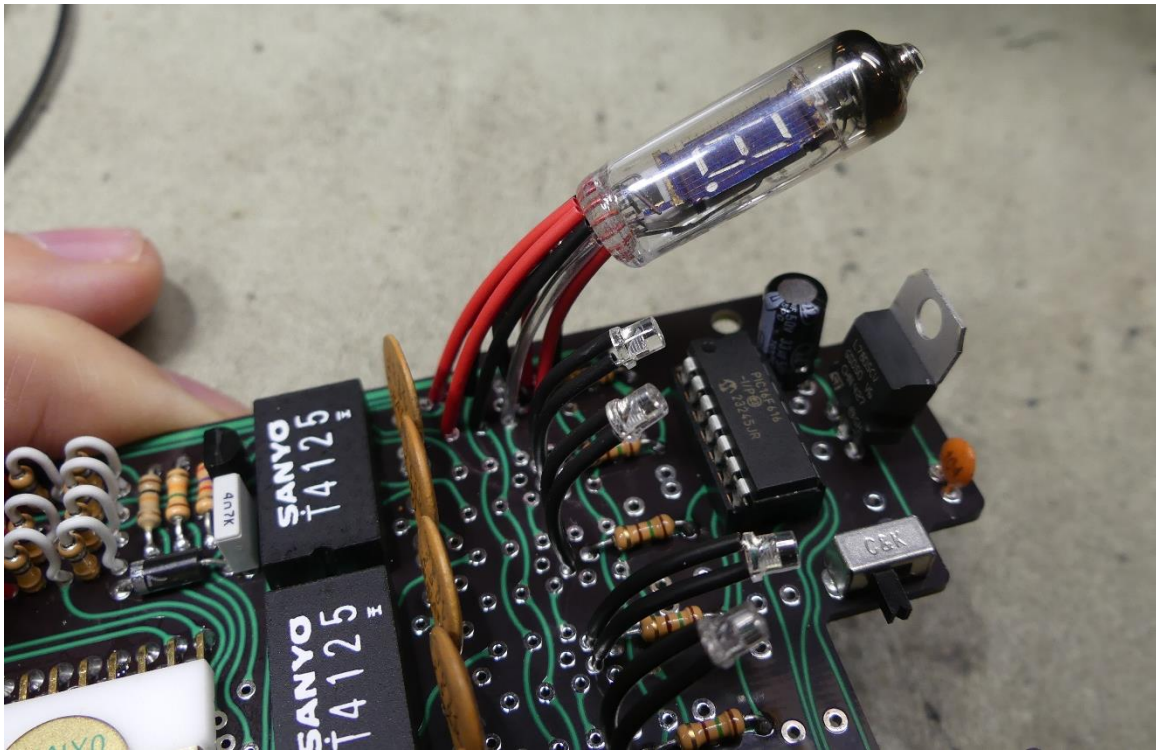
Test fit one and you may want to apply what you learn by putting this one on the board to the others, so the leads are bent for easiest installation into the board holes.

You may want the display tube stand mounted on the board. This helps with aligning up the display tube but can also get in the way. I ended up doing this without the display stand so there was more room to get the leads placed in the holes.

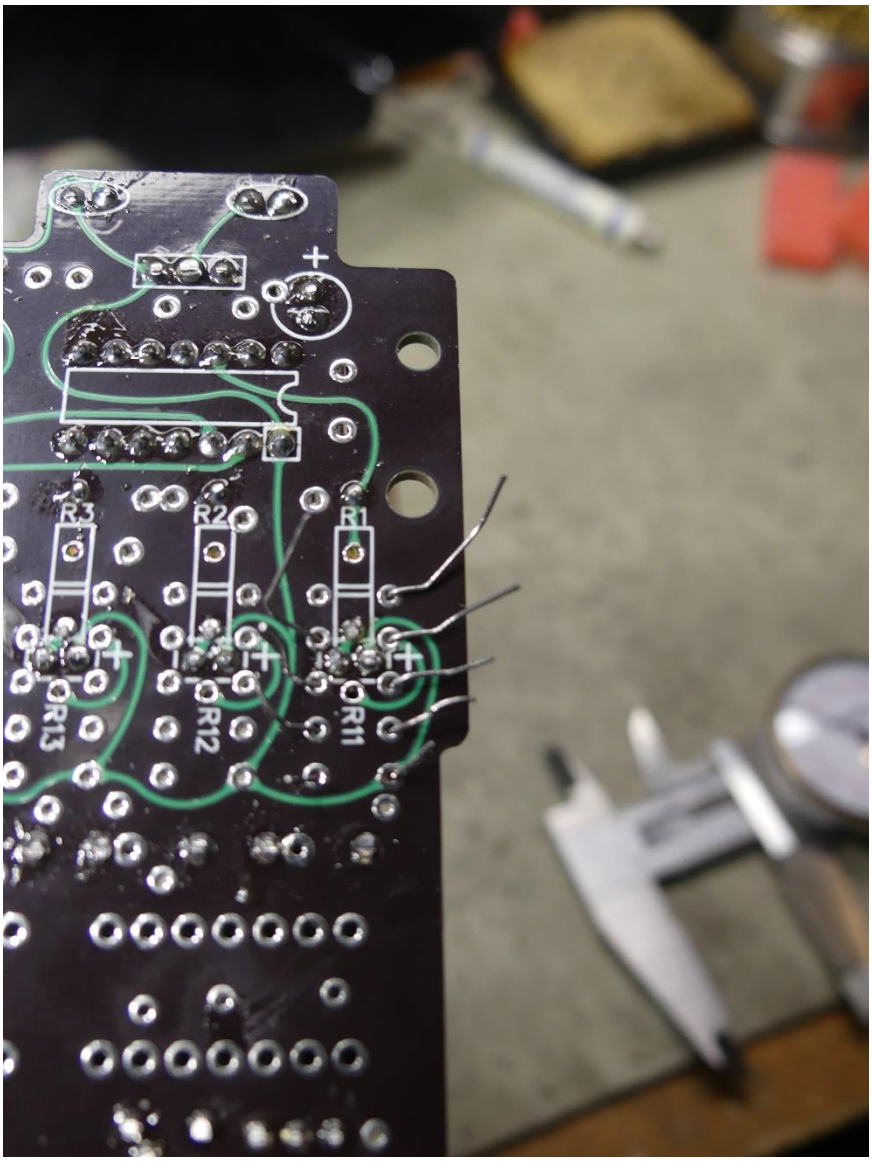
I installed starting from the left side – not sure where it is best to start but this at least makes the photos easy and worked fine. I was able to get a few wires from one side into the holes and then used tweezers to get the wires into the hole. If your tubing is loose, take care to make sure the wire is in all the way and there isn't a gap between the tubing and the display tube and the tubing and the printed circuit board. I bent a couple of wires on the bottom of the board to hold the part in pace. I then pressed on the display tube to help make sure the wire tubing covered the wire leads on both ends and soldered the first and last wire to hold the part securely. I then made sure the other wires were in place and tugged on them and bent them slightly on the bottom of the board to hold them in place before soldering.




SANYO
T4125
4n7K


SANYO
T4125
4n7K

To hold the display tube in place, the leads are splayed out as shown below:

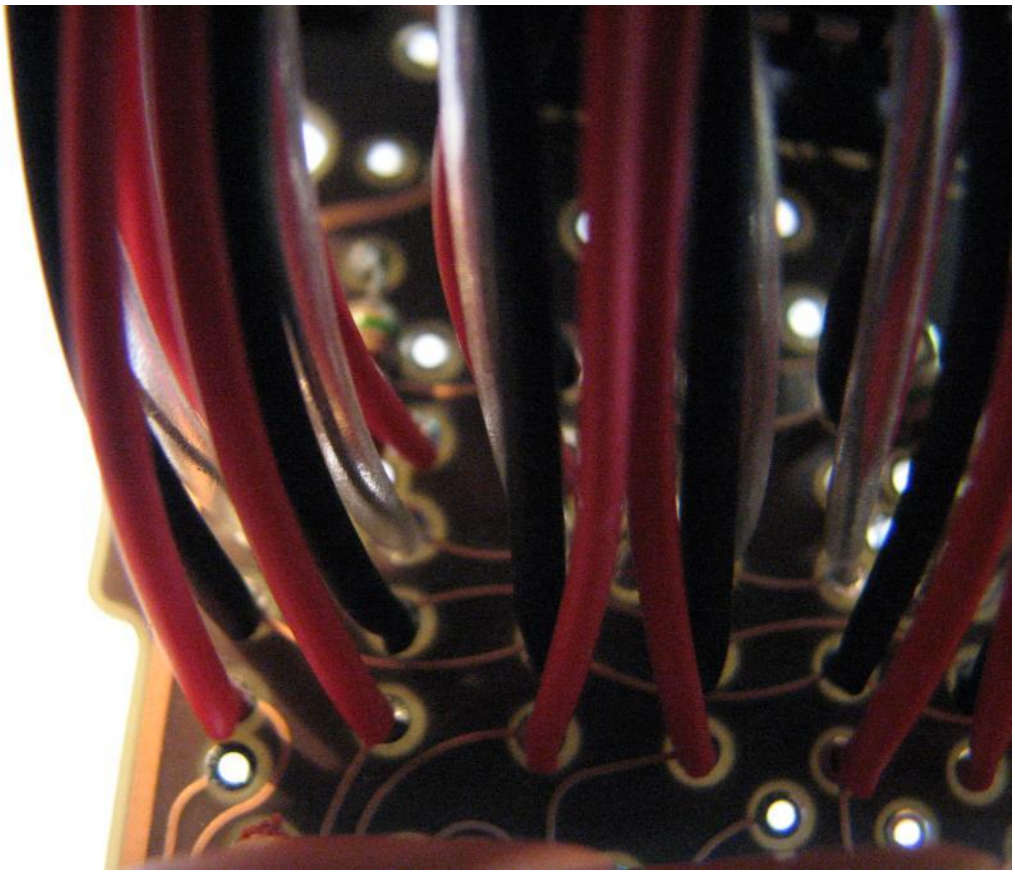


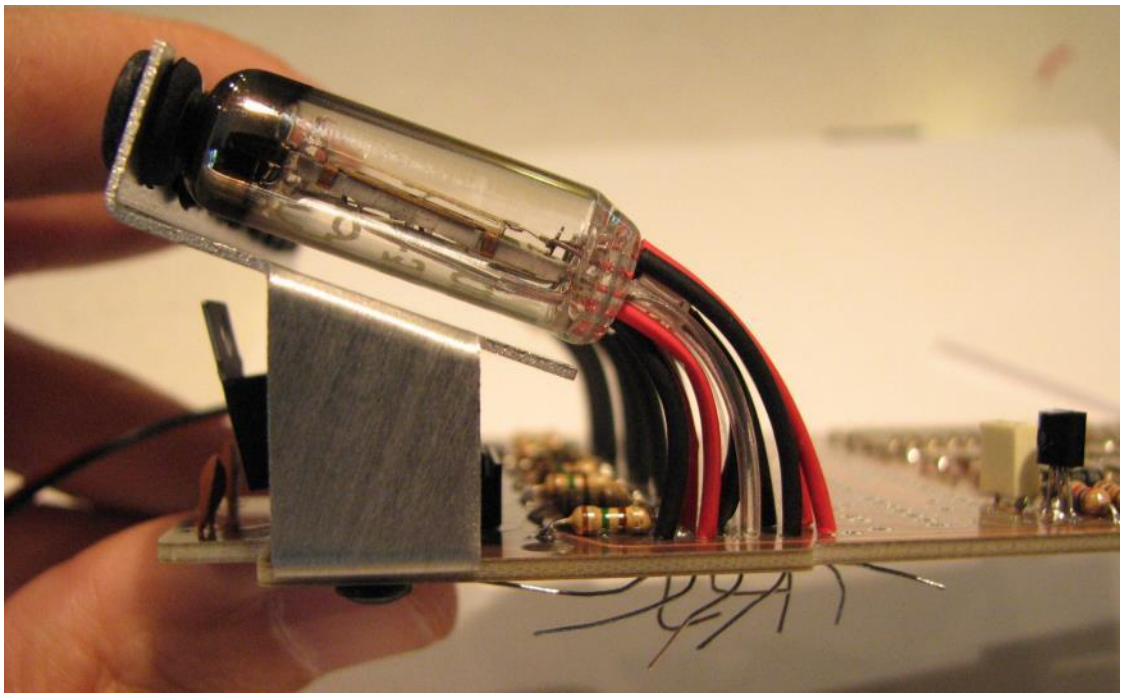
Reminds me of the Alien face hugger legs…

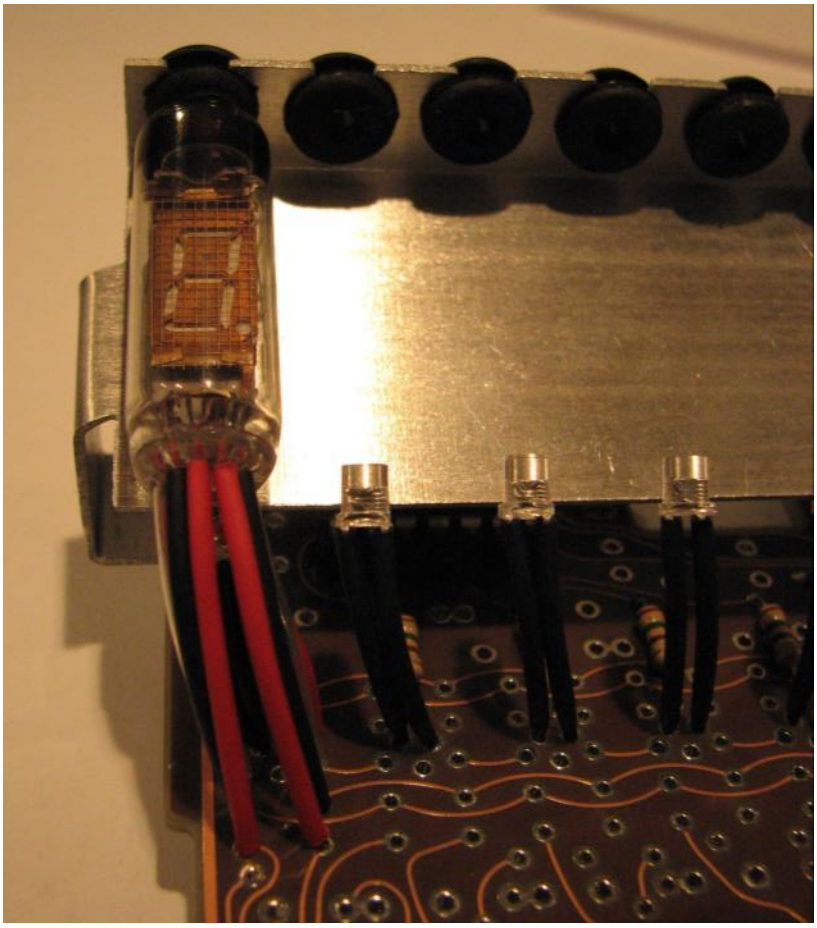
From the top view here is the color coding into the two columns of holes:

Back BLACK	X
RED	**RED**
CLEAR	**CLEAR**
BLACK	**BLACK**
Front RED	**Front RED**

Be sure to start with the holes on the farthest left of the board just above the large brown ceramic disc capacitors. There are 5 holes in each column all with the same spacing. Each display tube will use two columns.

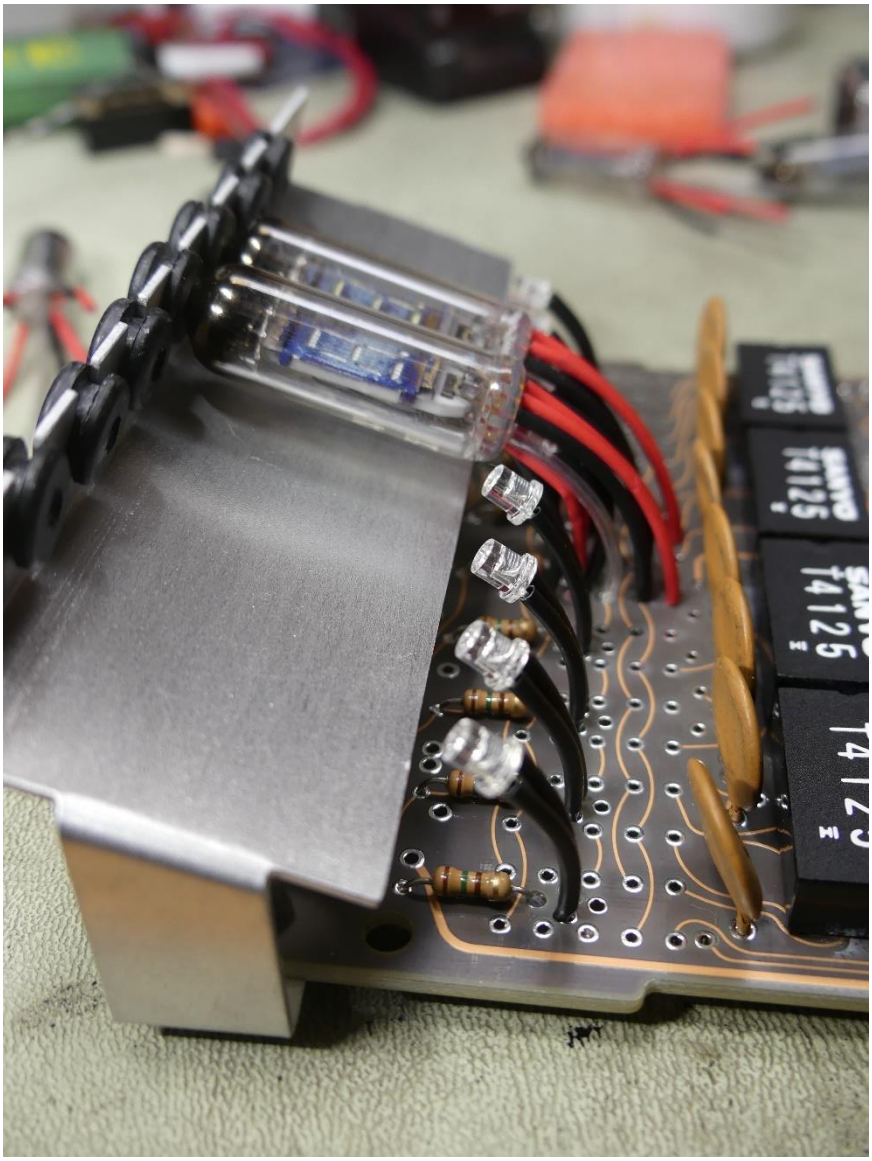






After positioned and you check to make sure all of the wires are pulled tight enough that the wires are covered by the tubing, you can flip the board over and solder and then trim off the extra wire.

You can work from one side to the other, or it may be easier to start in the middle and work out from both sides… I tried both ways and not sure either is really easier.

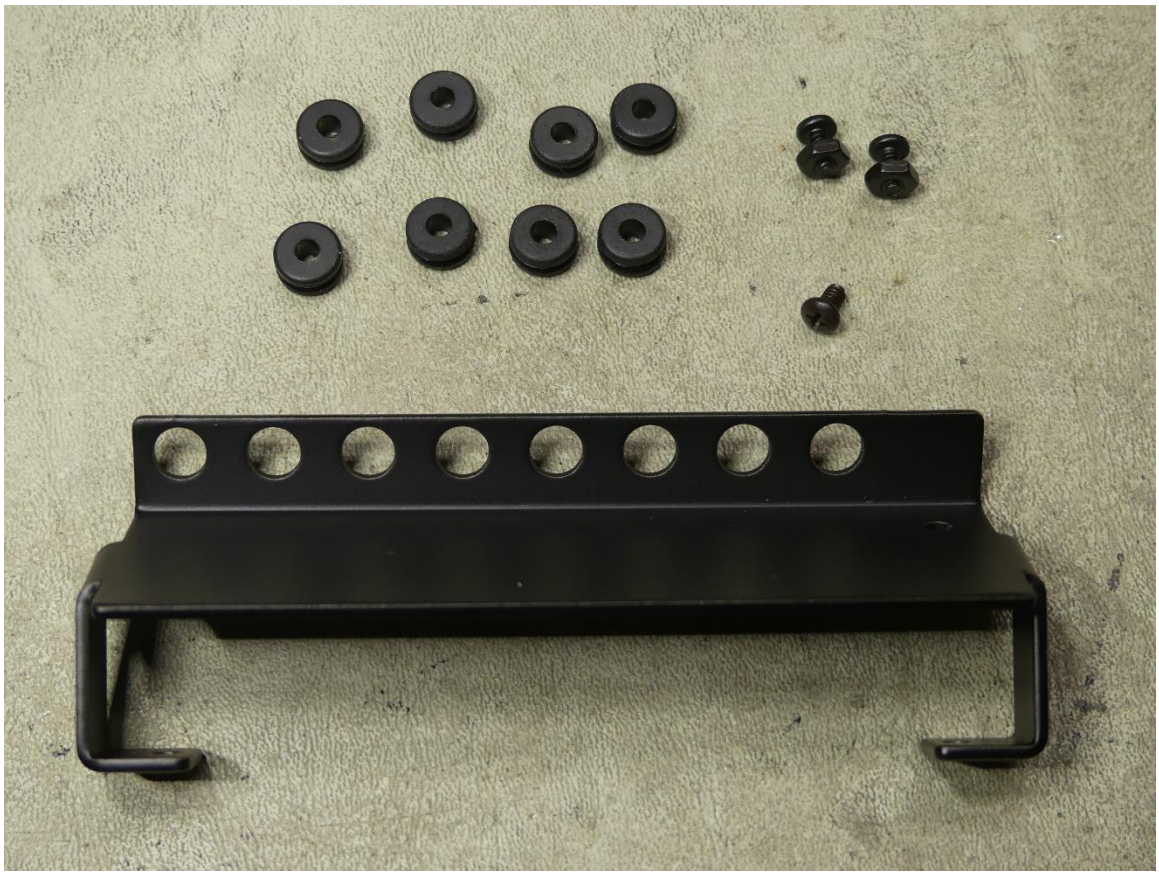


Just repeat the installation for the next 7, using the next available columns of holes (do not skip any columns of holes!), and you are now done with the display tubes. Adjust the LEDs so they are shining into the center of the display tube base for each display tube.

With the display tubes in place (and LEDs), you can check the illumination (again!) by connecting the 9V battery, turning on the power switch and adjusting the thumbwheel pot.

“SGL” Display Tube Shelf with Grommets and Legs

This metal bracket sits between the display tubes and the printed circuit board.



8x rubber grommets
2x screw and nut to attach to the stand to the circuit board
1x screw to attach the error box to the stand – very secure!

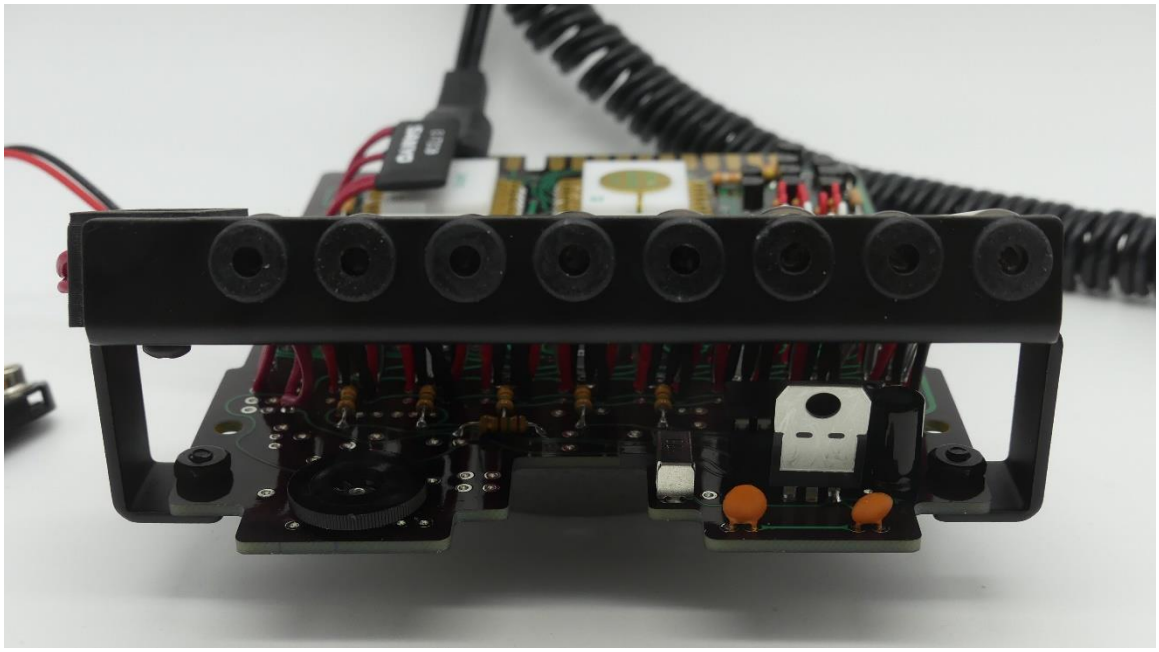
1x Matte Black Powder coated display stand

The grommets are a bit stubborn to install but will be very secure. I find squeezing them into an oval and starting with just one side in first and then pressing the rest into the hole worked well. Then rotate the gromet in the hole to make sure both sides are set properly (not still folded or caught in the hole.)





The shelf with legs is designed to locate under the holes in the circuit board:



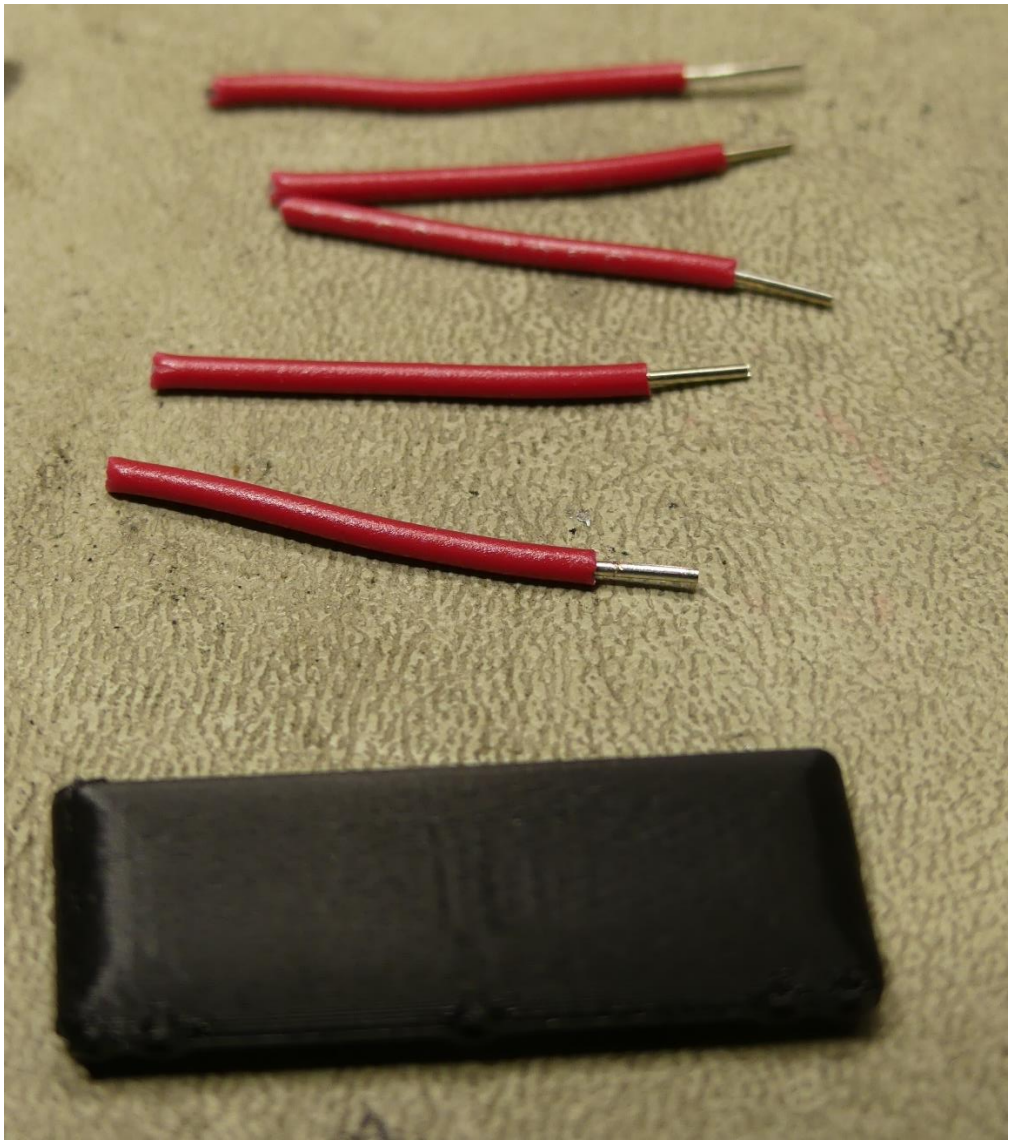
You attach this to the circuit board with the included small screws.

”Pillow Shaped Part”

I originally glued two 0.1" thick pieces of styrene together (1 1/8” x 0.5”) and sanded it down around the edges for the shape, used solid wire, heated with the soldering iron and melted each of the 5 wires into the end of the glued styrene pieces. The placement of the wires was based on the holes that will be used in the circuit board.

Now a 3D printed part that is black is included and has been designed and tested to make sure the holes will accept a 22AWG solid core wire. The wire will be snug, but I also added a small amount of super glue to ensure the wire will be held firmly.

First cut 5 pieces 7/8” pieces out of the 24” Red wire.
Strip 3/16" of the wire insulation off of one end of each of these pieces so they can be inserted into the black “pillow part”.

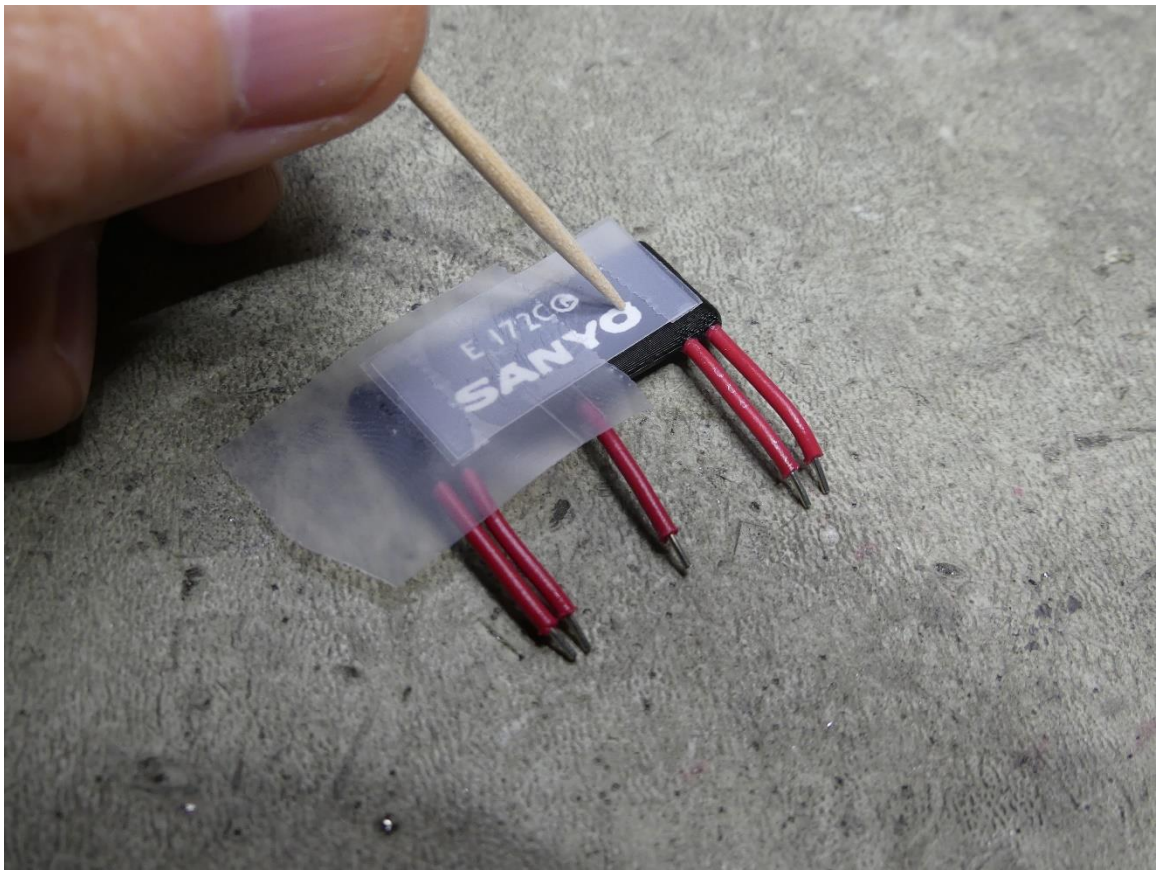


Test fit the bare wires in the 5 holes on one side of the pillow part. Once you are sure they will go all of the way in (no bare wire should be showing), add a small amount of super glue to the hole. I put a few drops on a piece of paper and then used a toothpick with a sharp end to get a small amount of glue on the end of the toothpick. I then touched this on the hole I was going to insert the wire into and then pushed the wire in.

You can also just get a bit of glue on the bare wire and then push the wire into the hole. Both worked, and not too much cleanup for either method. I did have a separate toothpick and a paper towel to wipe off the toothpick to use as a cleanup tool for and squeeze-out.



You could use some black plasti-dip, but the new prints are quire reasonable without doing that. For this build I cut out the Sanyo label, added tape to the top side (not the transfer side!) and used the tape to hold the dry-rub in place. I then used a toothpick to rub on the white transfer areas to attach the dry-rub to the pillow part.

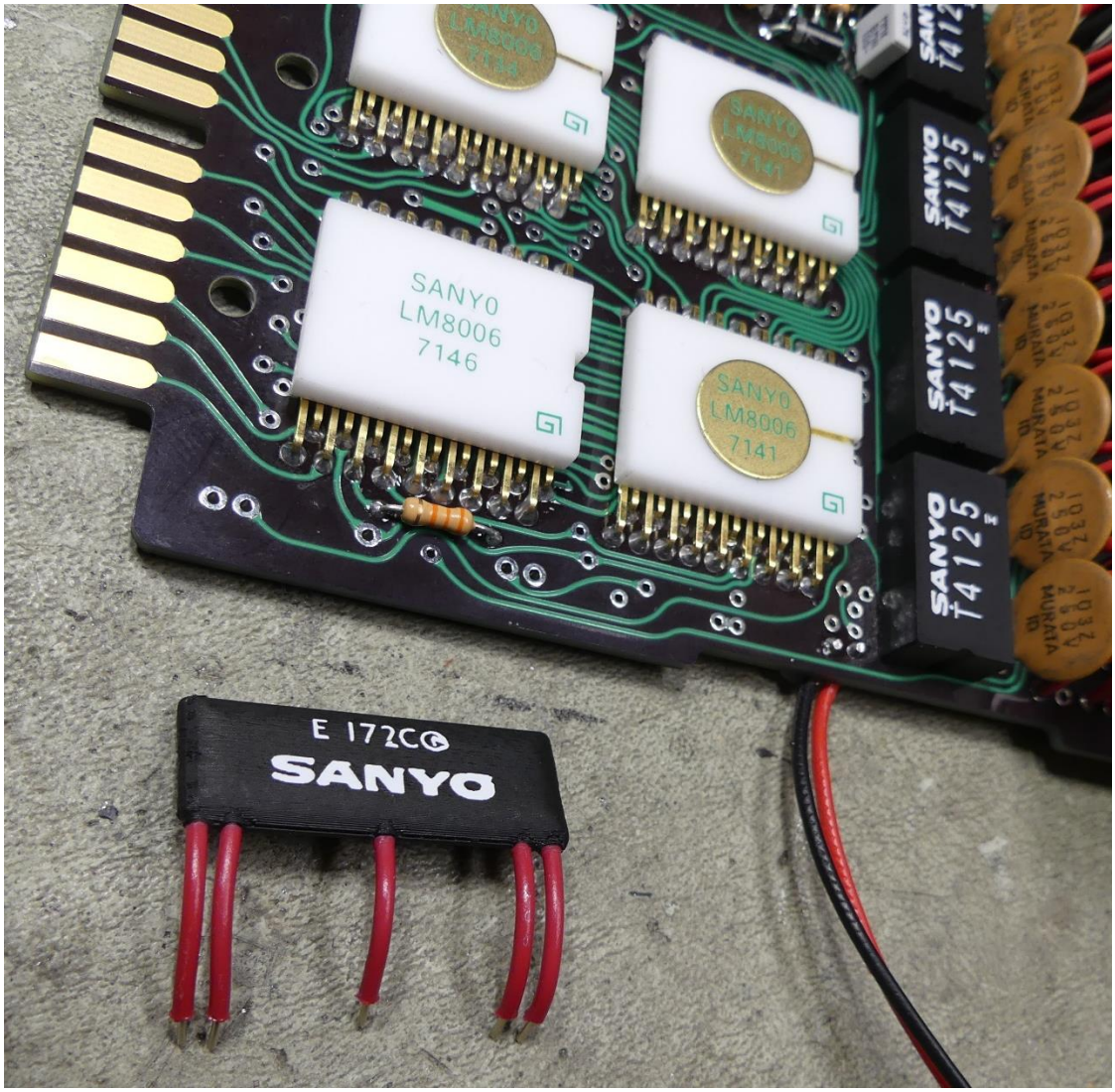


After I made sure the transfer was sufficiently rubbed, the part looked great. Since I had applied a clear matte spray to the other dry-rub parts I also applied it to this part. I did let it dry for 24 hours, so had to wait to mount the pillow part.

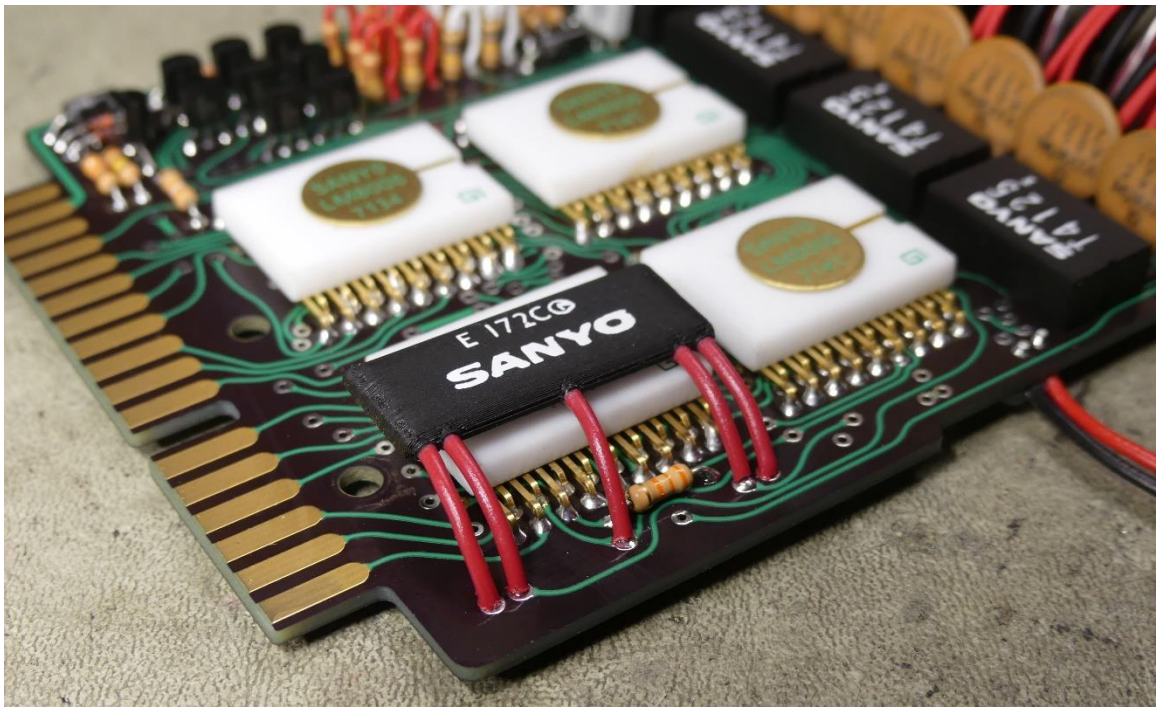
Before coating the part, I placed a piece of tape over the red wires – I did not want to paint those since they were going to be bent after the part was attached to the circuit board.

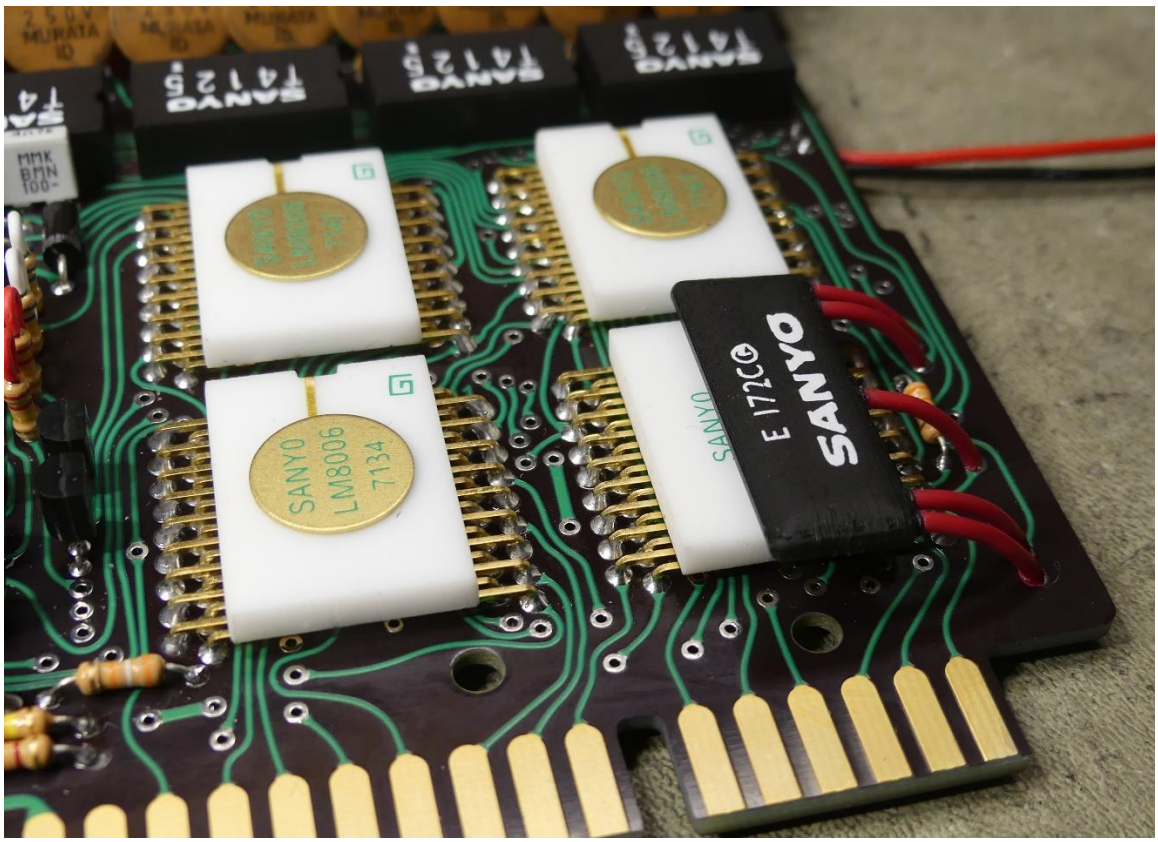


After the part had dried, the other ends of the wire were stripped about 3/16" and I test fit the part and slightly bend (rounded?) the leads. For the first test the red insulation was a bit too long, so I just stripped a bit more off of the wires and test fitted again.



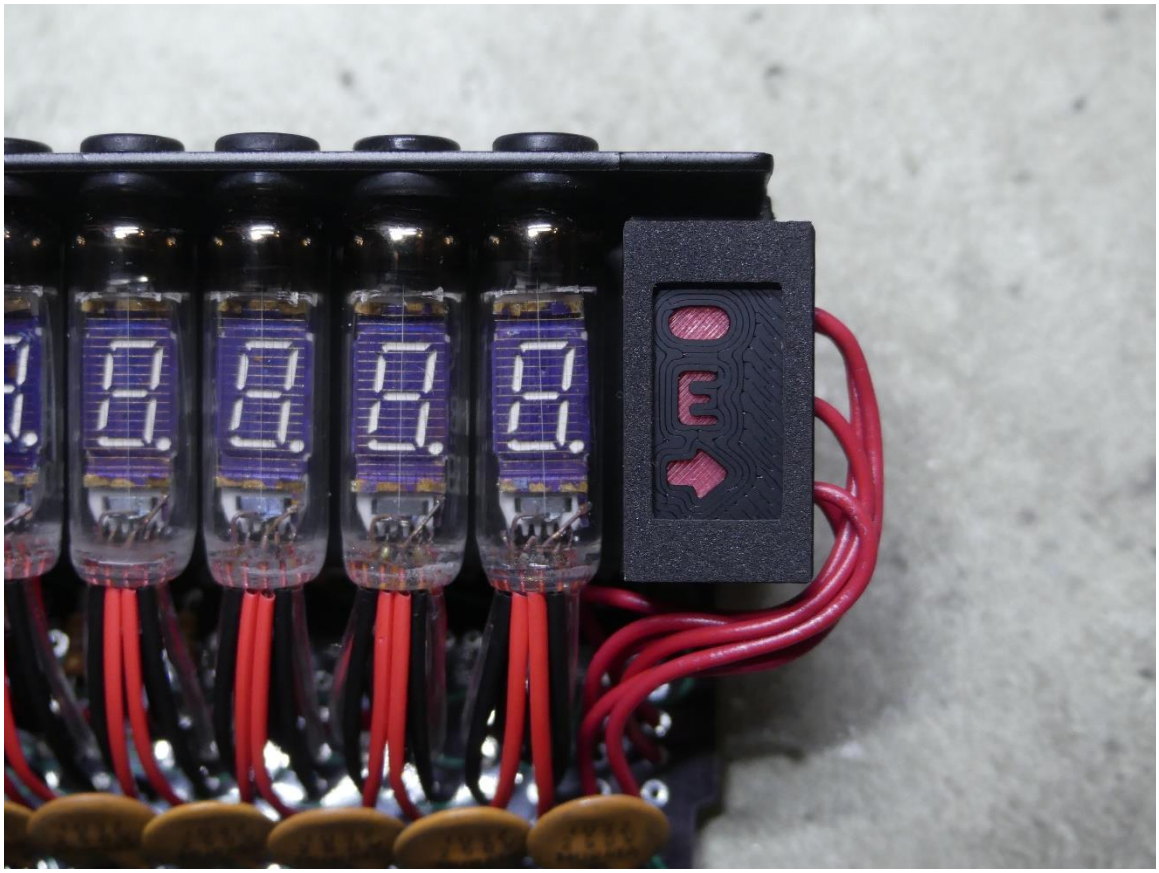
Then placed the part, soldered the 5 leads on the back side of the board and then cut off the back side leads close to the circuit board.





”ER” Error Box

The Error Box is a small box that sets on the shelf to the right of the display tubes. In the actual calculator 3 neon lights are used to light up the three separate symbols: a bar on top, the letter “E” in the middle and a right arrow on the bottom.



1x Error Box
1x Error box adhesive backed gasket
1x black screw to attach the error box to the display stand
20” of red insulated 22 AWG solid core wire
1x Red 3mm flat top LED
1” piece of large diameter (5/64” ID) Red heat shrink tubing

This error box is held on to the shelf with the small, included screw. The screw is placed on the bottom side of the display stand and can be accessed even if the display stand is mounted to the circuit board.

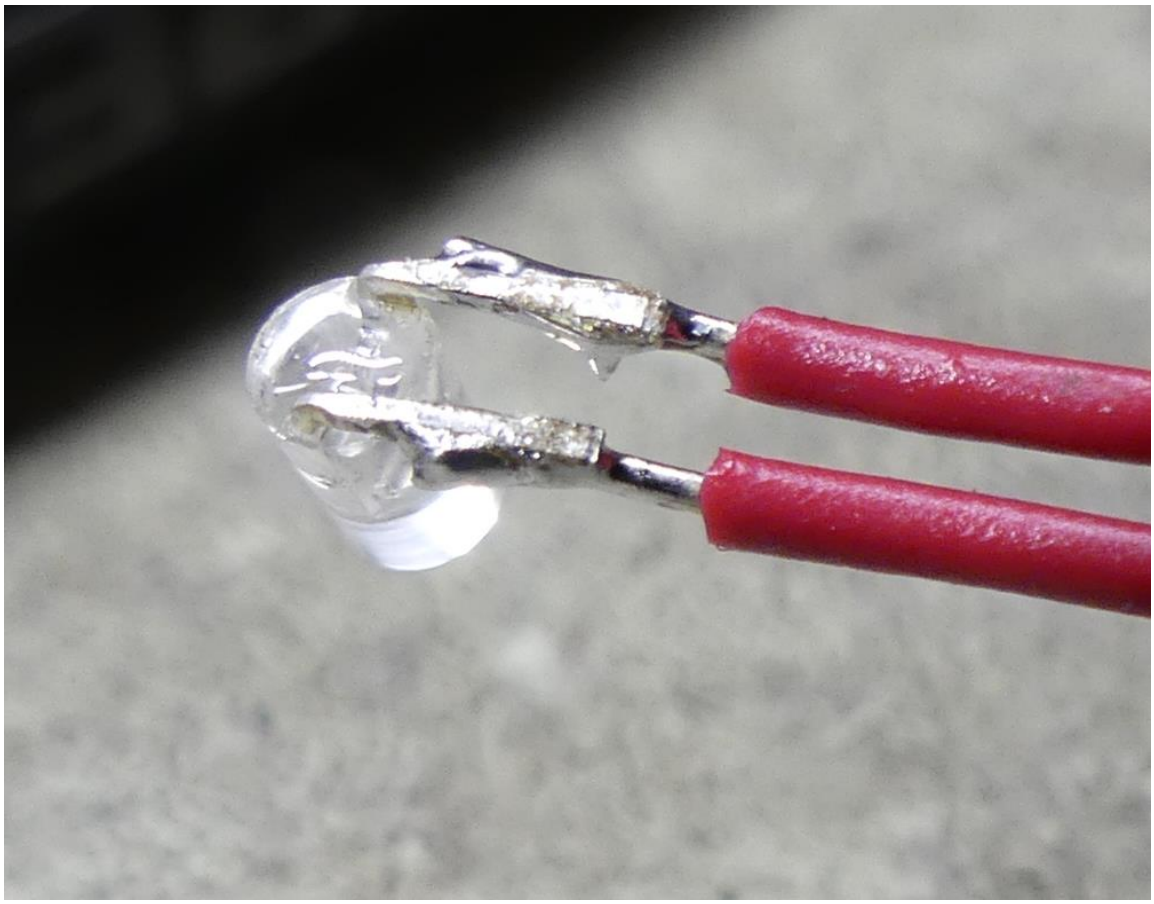
The Red LED needs to be attached to the red wires and installed inside the error box.

Cut the remainder of the included 24” red wire (now a bit less than 20” long) into 4 pieces:

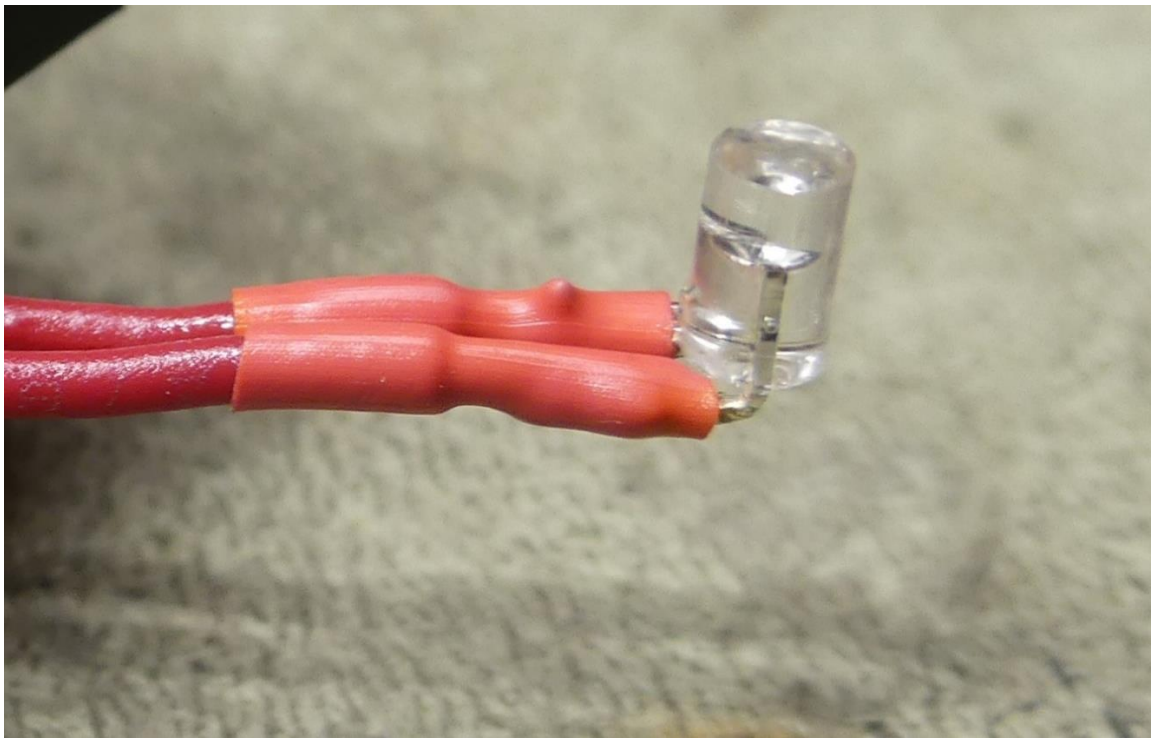
- 2x 6” long pieces for the non-functional connections (for looks!)
- 2x 3.5” long pieces for the LED connections

Time to form the leads on the Red LED. Bend the leads over to a 90-degree angle very close to the LED plastic body.
Next trim the leads to a 1/4". No need to keep track of polarity since we will figure that out later.
Take the two 3.5” long pieces of red wire and strip about 1/4" of the insulation off of each end.

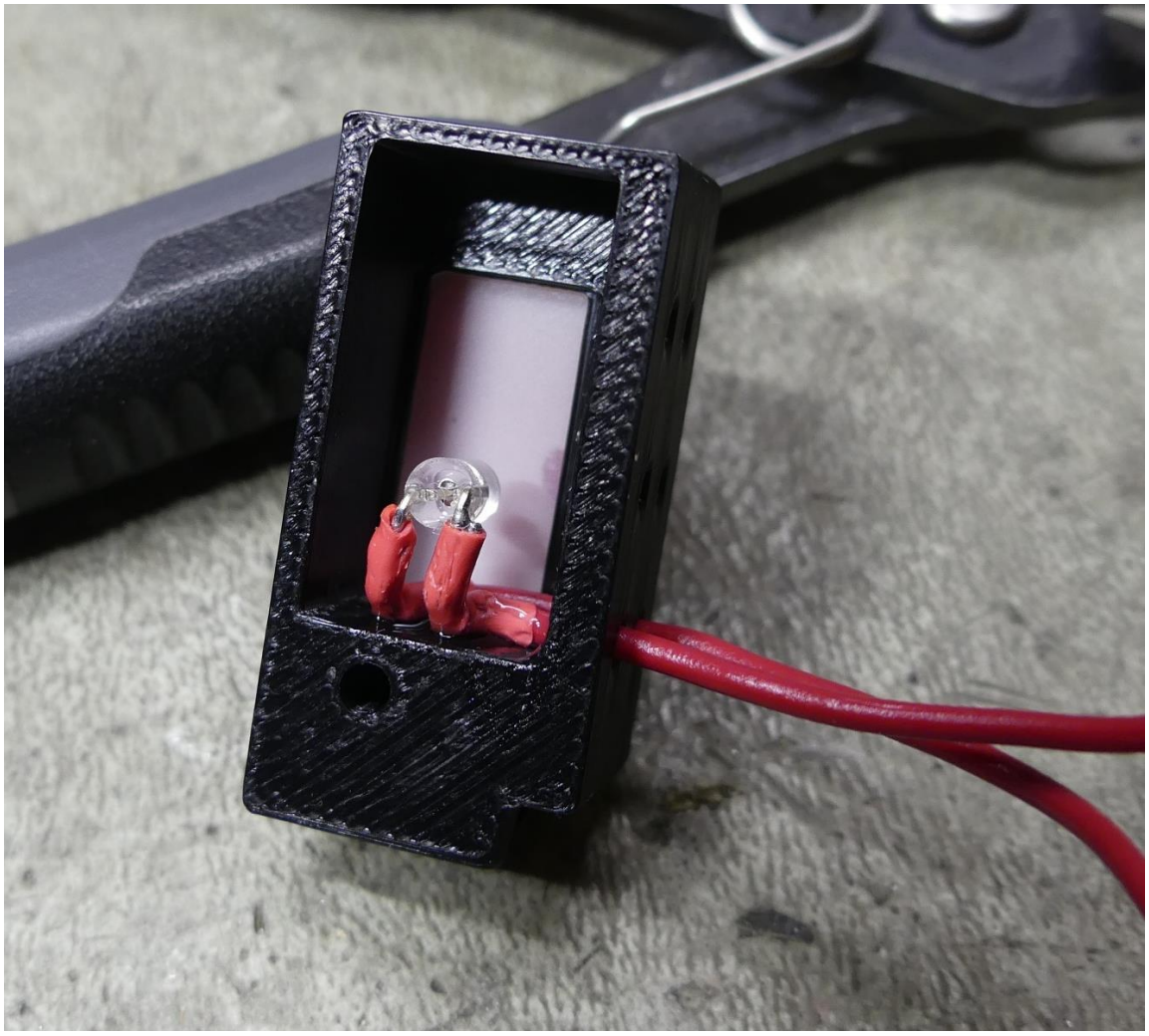
Solder the two wires onto the RED LED’s bent leads:



Next, cut the 1” piece of red heat shrink tubing in half and slip each over one of the wires and slide it up and over to the LED leads that are soldered. The use a heat gun to shrink the tubing. Try not to get the LED too hot as that can damage the LED. You don’t have to heat and shrink the tubing, but it does help it hold in place.



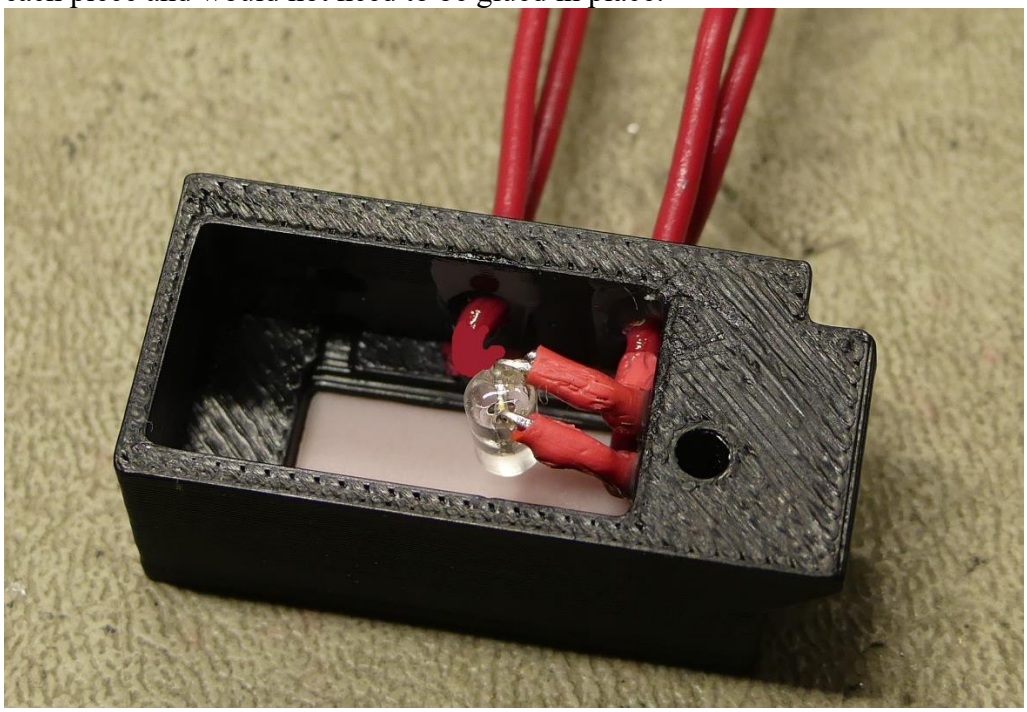
Now slide the two red wire ends through the end two holes near the mounting tab of the error box from the inside of the box. You also get to bend the wires so that the LED ends up pointing straight up at the “E” in the center of the display. It ends up looking like this:

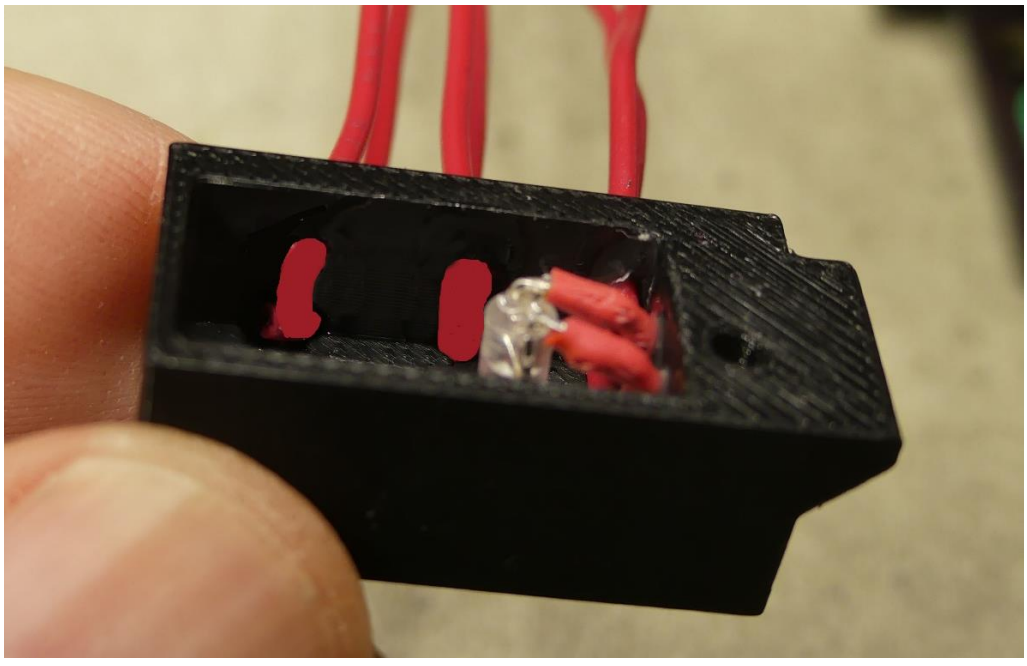


You will need the 4 other red wires coming from the error box, so we will add these next.

I ended up cutting the 6” pieces in half and then bent the ends of the four wires so they can have a bit more contact inside the box and be held more securely. I then glued them in place.

I think it would have worked out better to leave that as two 6” wires and then just bent it in half and then threaded it out the to closest holes so that it extended out about 3” for each piece and would not need to be glued in place.



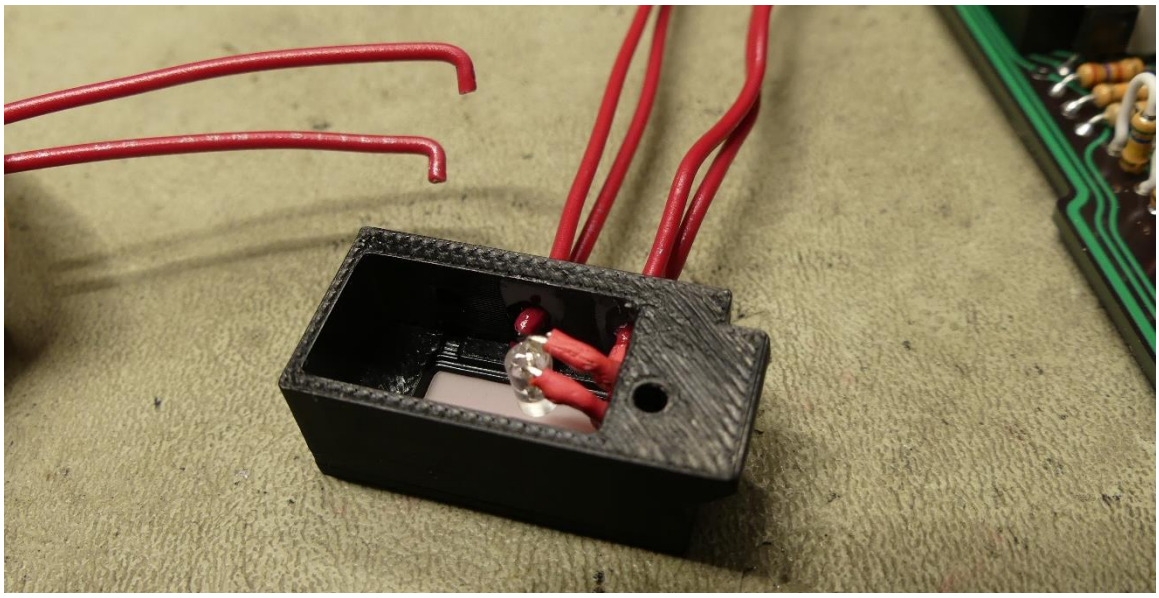


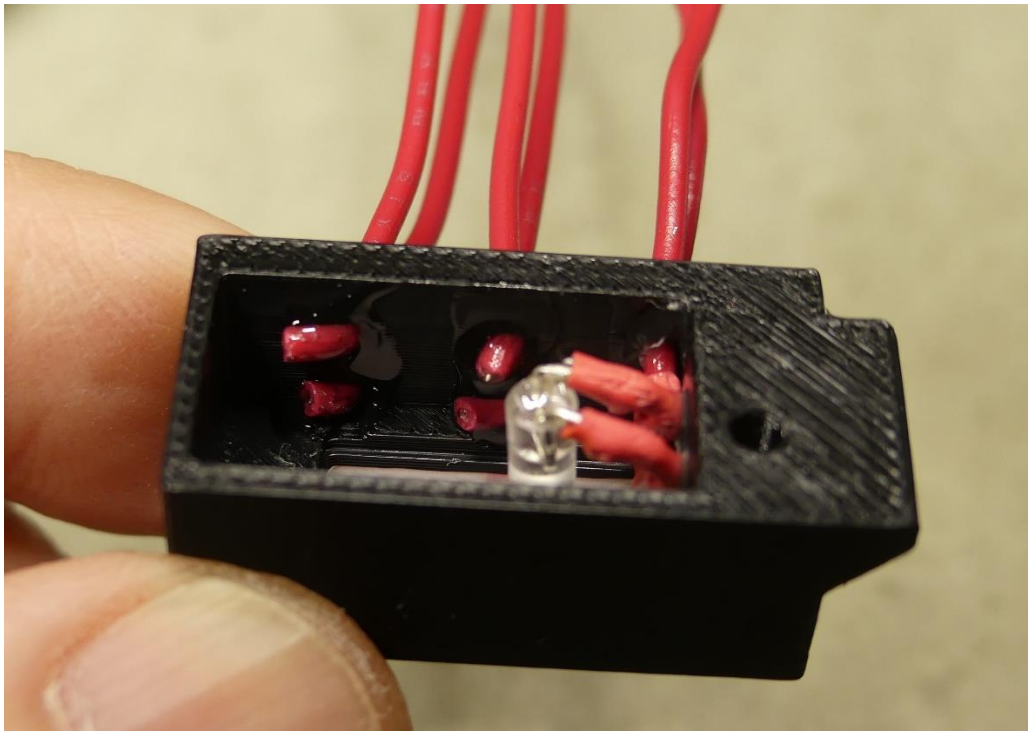
Probably not the preferred way:

But I did the cut and glue way (because I didn't think of the just loop-it through the holes way:

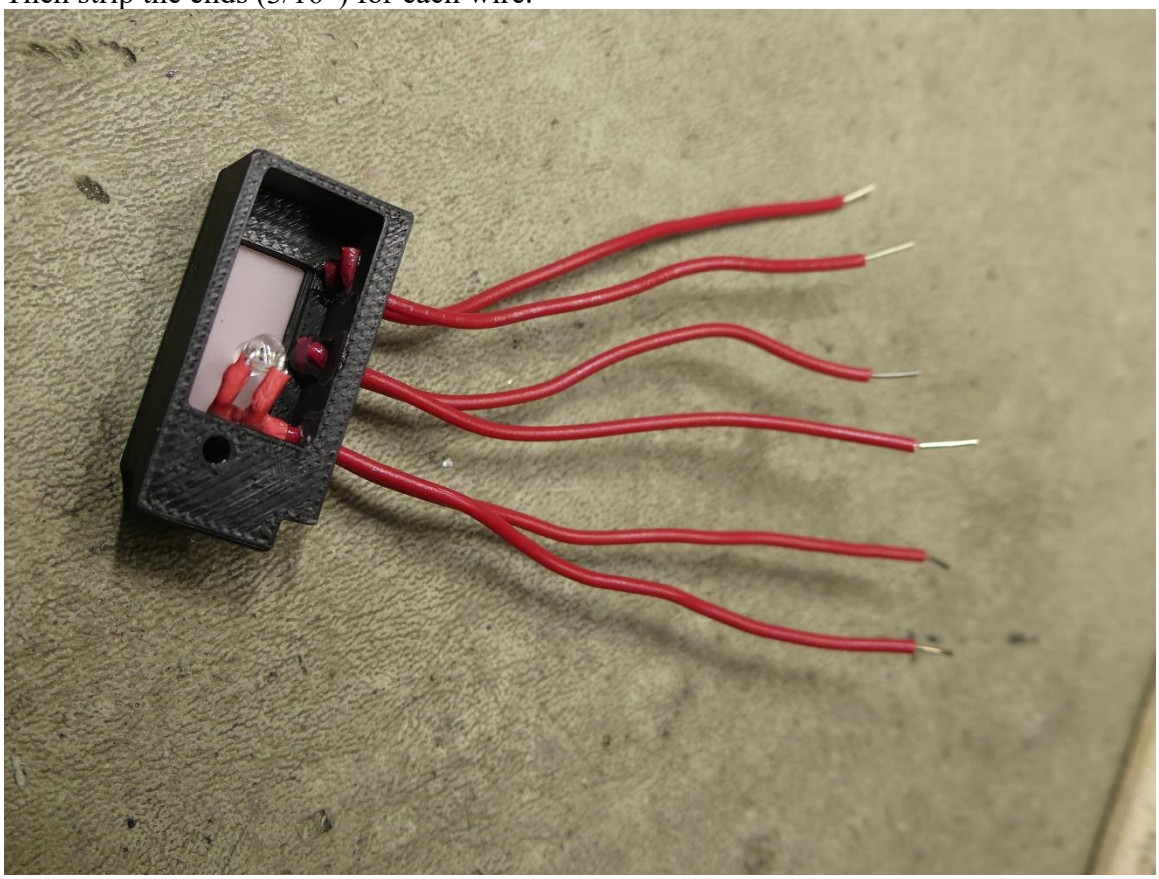
Cut the 2 6" wires in half and bend the very ends for extra grip.

Test fit, then add a bit of superglue to the hole you are going to place the wire in and then place the wire in.

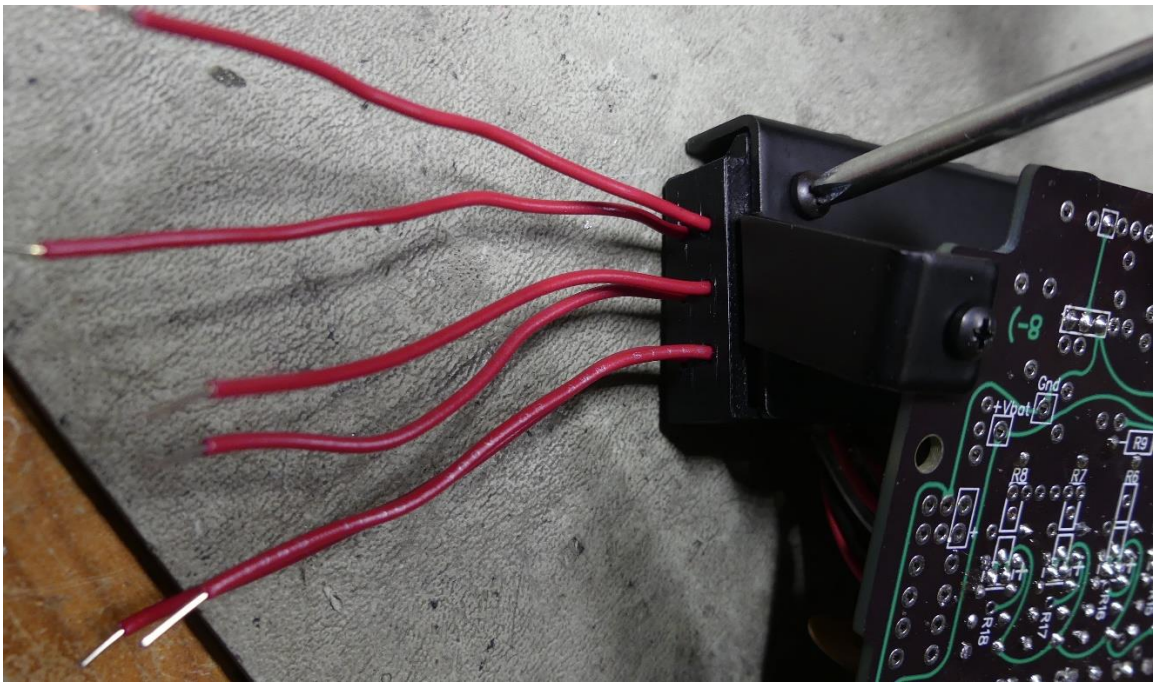


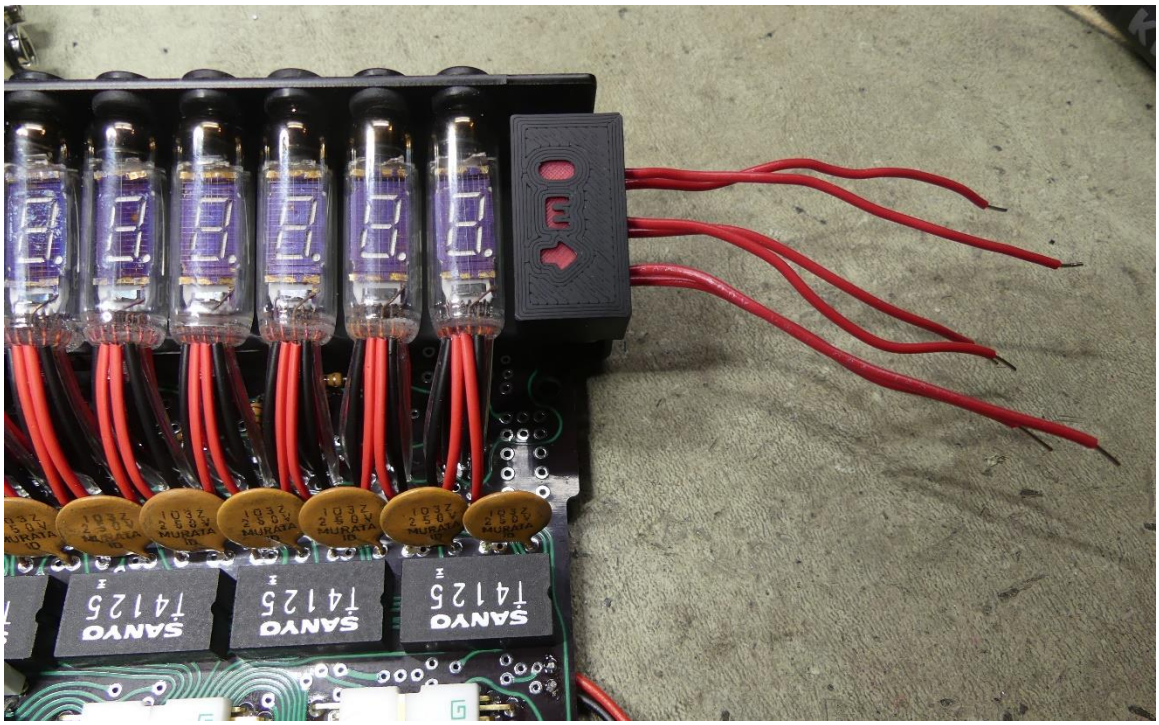


Then strip the ends (3/16”) for each wire.

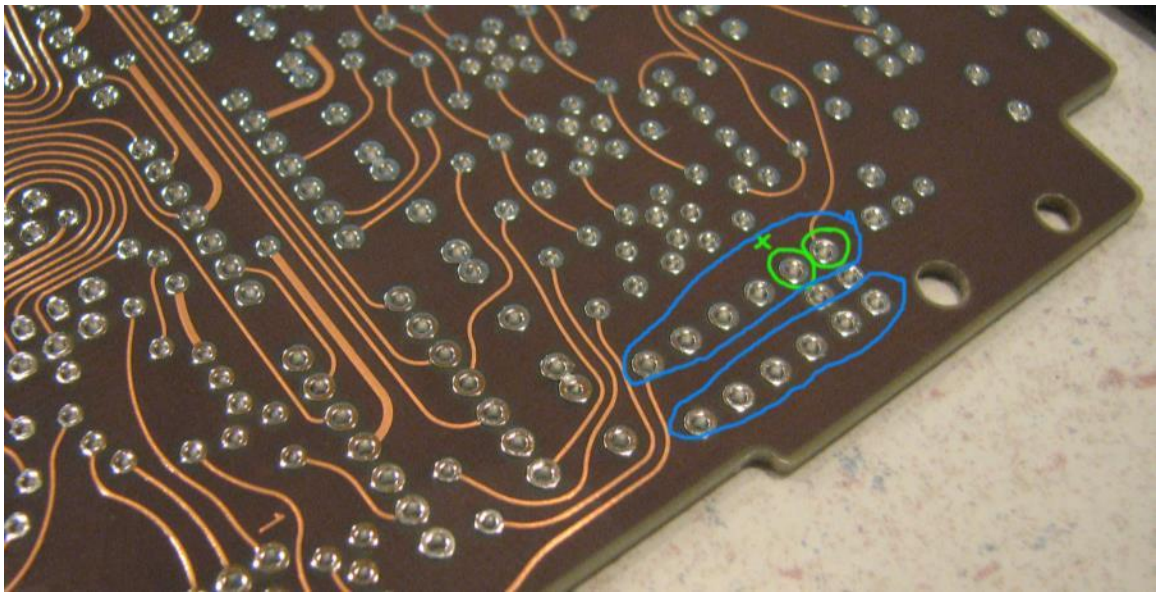


Next attach the error box to the Display stand (and the display stand to the board, if not there already) with the single screw from the bottom die of the display stand through the stand into the error box.



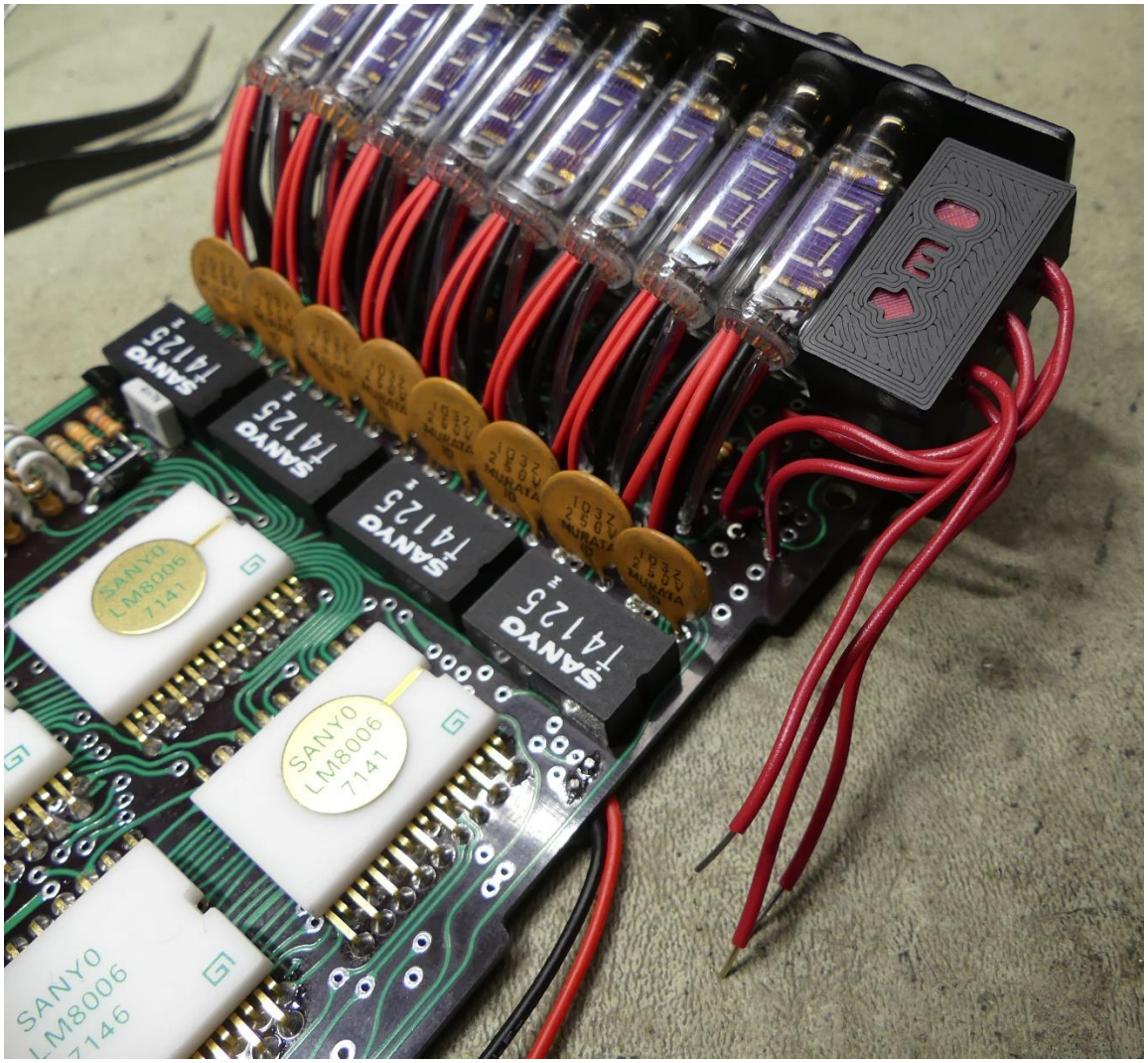


The wires can go into the holes that form two rows of holes (circled in Blue):
A B C D E F
G H I J K L



Use whatever holes you want to if there is no Error Box LED. If you are using the Error box LED, Hole E is the positive ("+") connection and F is the negative connection for the LED. Those LED connections are circled in GREEN in the above image.

We do need to make sure the LED wires go to the correct holes, so attach the battery, turn on the electronics and look for which connection makes the Error box LED occasionally flash.

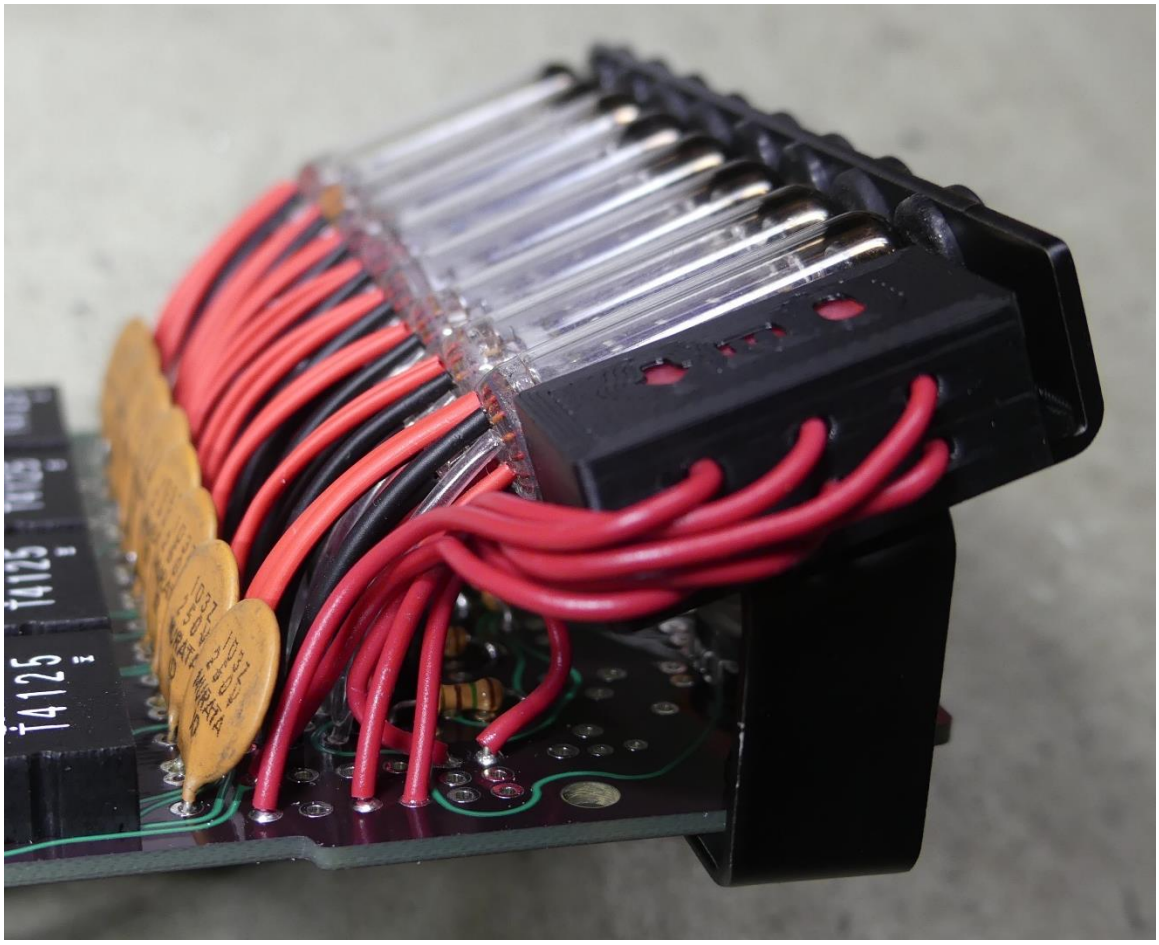


You can just dress the two wires from the LED (closest to the Round rectangle above the “E” on the error box), and try placing the bare copper ends into the two holes for the LED and if nothing happens, then swap the two wires (wires go to different circuit board LED holes).

Once you have the LED working, make sure the wires are about the correct length, or you may need to shorten them if you think it would look better. If you change the length, make sure and test the operation again before turning off the board and soldering those two wires in place.

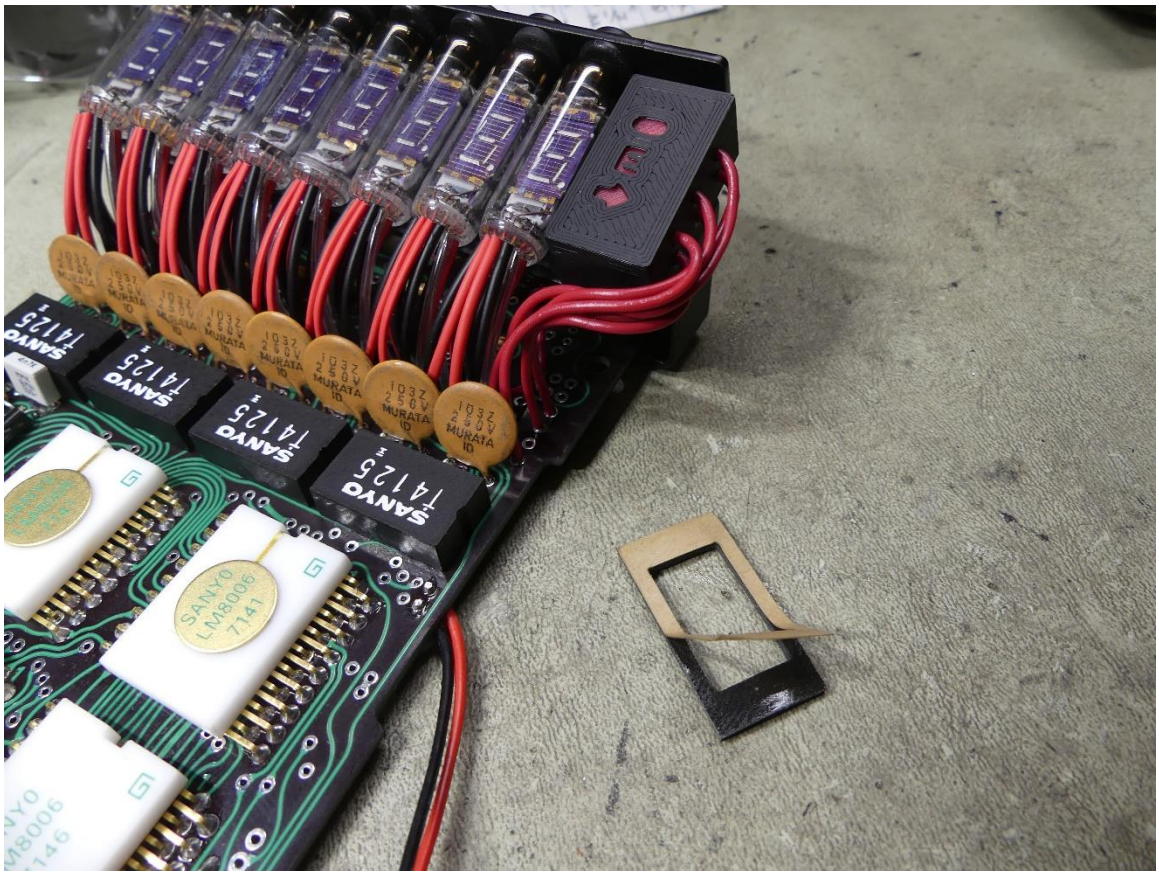
After soldering the two LED wires, turn the board back on and make sure the LED is working before you go to placing/dressing the other 4 wires.

Here is the way I placed the wires from the error box to the circuit board:




T4125
T41
MURATA
250V
103Z
MURATA
250V
103Z
MURATA
250V
103Z

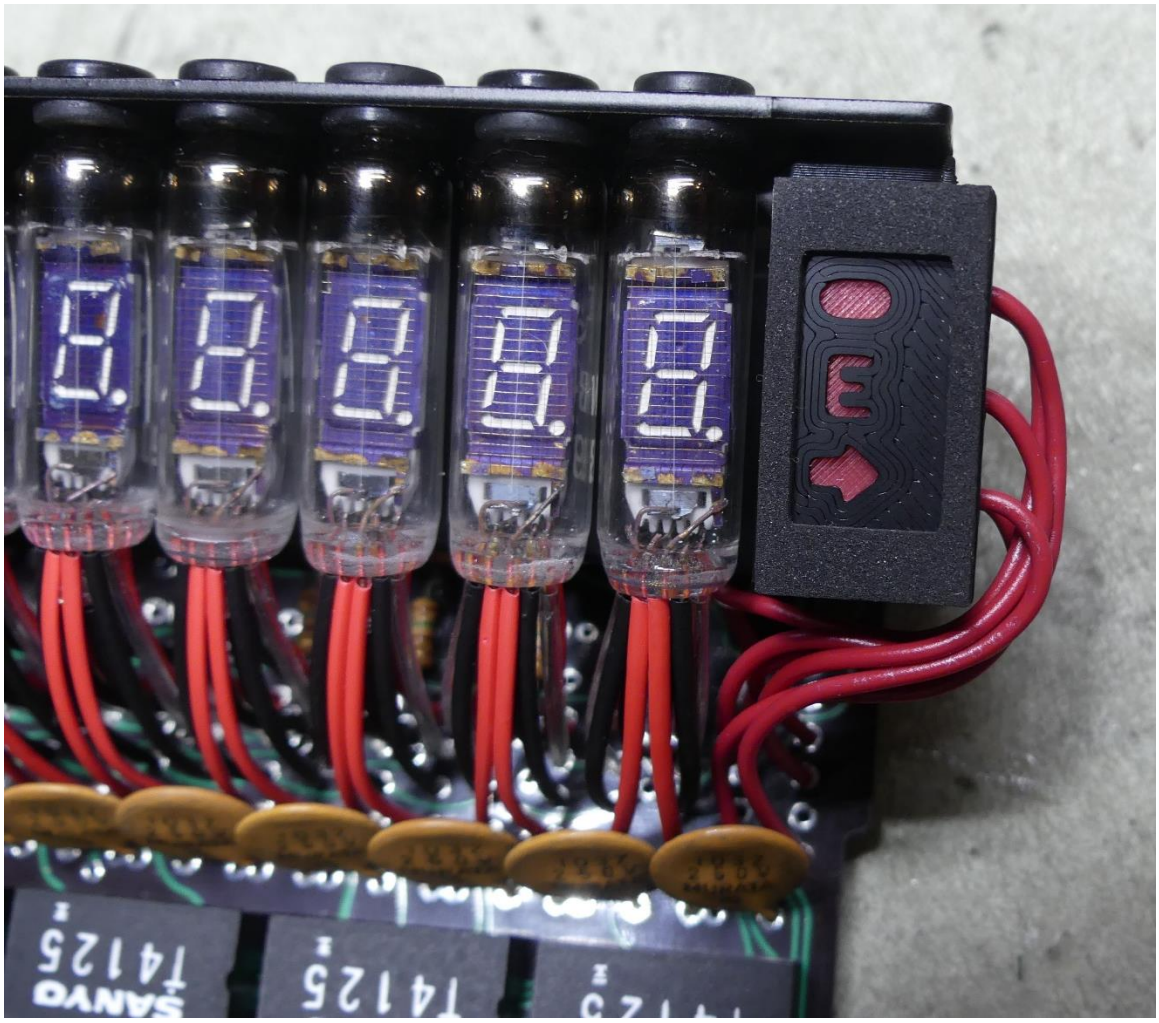
Now to apply the gasket to the error box.
First, peel up the adhesive backing from the foam gasket:



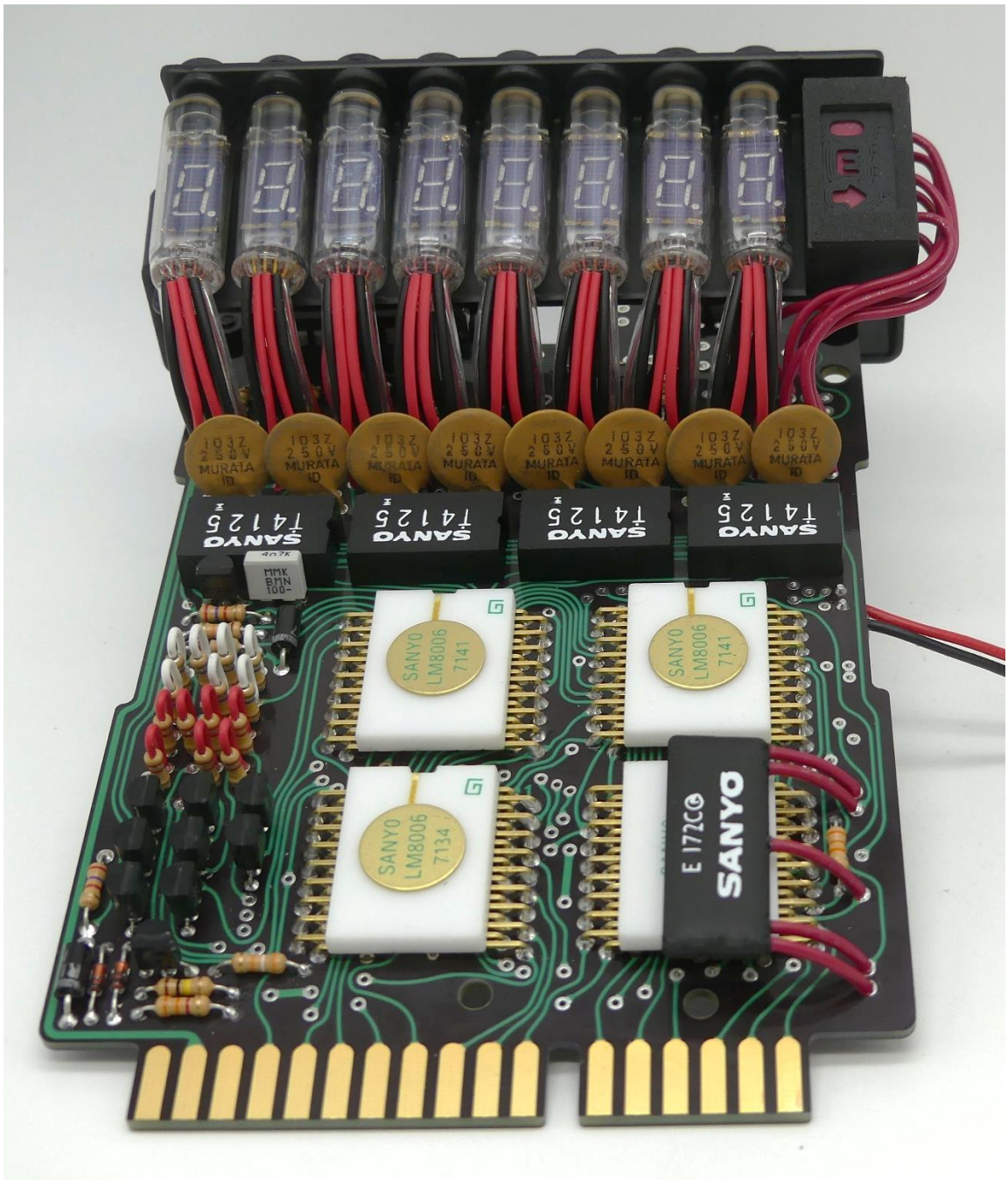
Carefully align and gently place it on the error box face. If not pressed on too aggressively, you can peel off and try again. The Foam is somewhat stretchy, so do not deform it too much when pulling it.

Once in place press firmly on all of the foam to make sure the adhesive is in great contact with the error box.

Here is what it looks like after attaching:

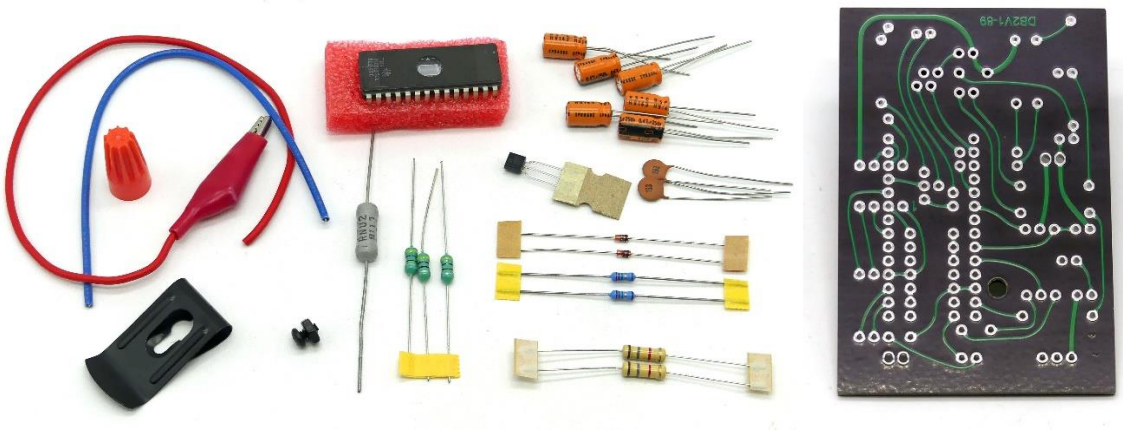


Almost finished – you just have to attach the shaver cord, but that is left to be done until the daughterboard is finished.



Detailed Daughter Board Instructions

The Daughterboard can be built up in many different ways, but here is a detailed write-up for the version that was used in the Afterlife props.



1x Red Alligator clip and attached wire
1x Blue Wire
1x Belt Clip
1x Short screw and nut to attach the belt clip to the circuit board.

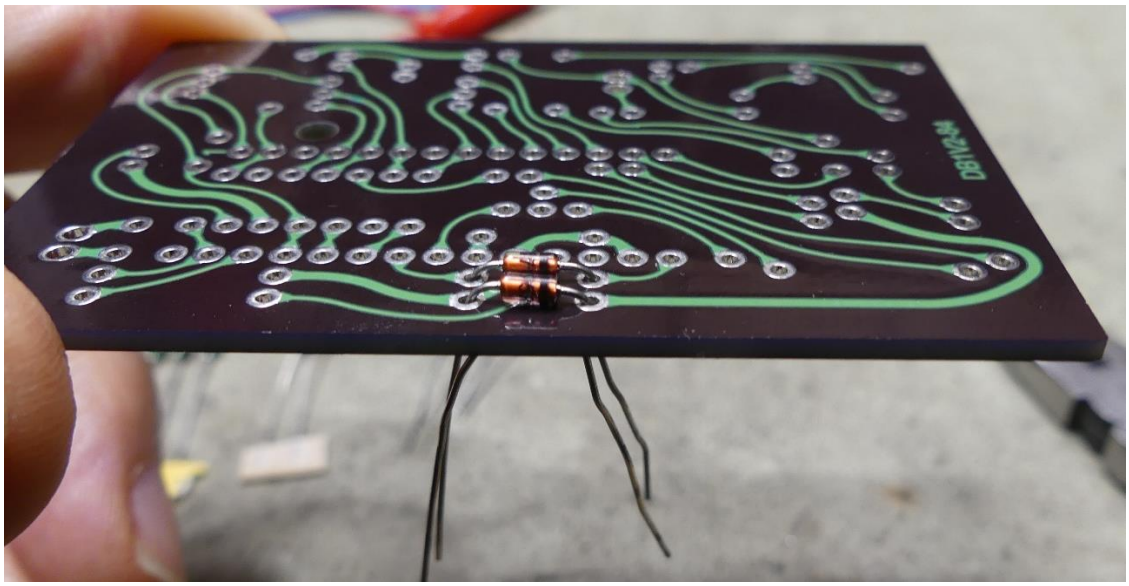
1x Large 28-pin Integrated Circuit (EPROM)
1x Large grey wire wound power resistor
3x Green inductors
6x Orange cylindrical electrolytic capacitors
1x Black transistor (3 leads)
2x small tan colored ceramic disc capacitors
2x small glass diodes
2x 1/4W blue resistors
2x larger tan colored resistors

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

*** 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 ***

It is best 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. This order is not necessary, and I don't always remember, and it still works out OK, though it may be a bit more difficult.

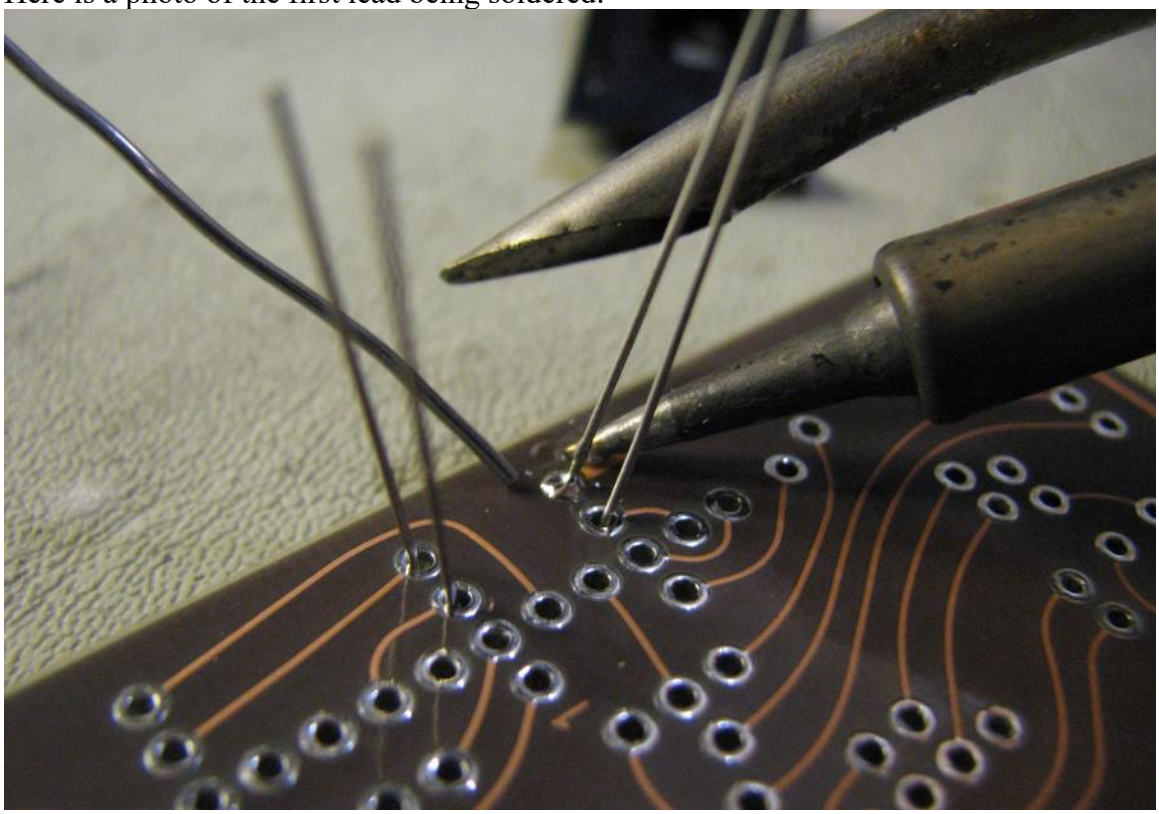
The shortest parts are the two diodes, so let's start with those. Bend the leads, insert the leads in the holes and press the diodes flat against the board:



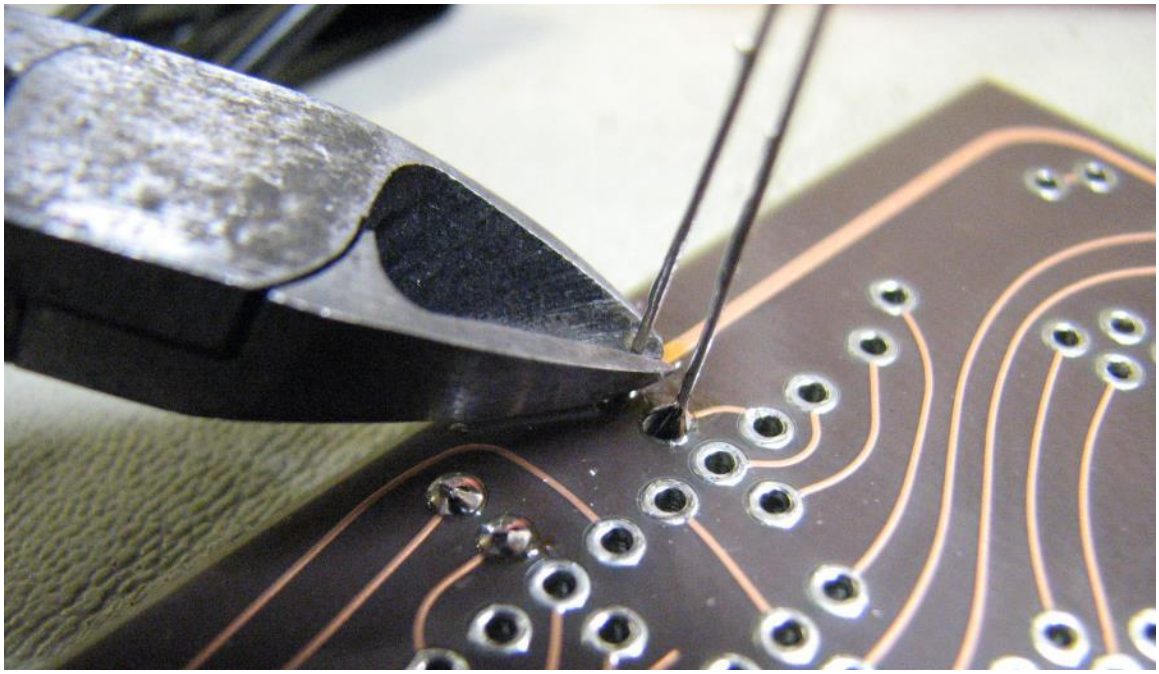
Now flip the board over (you can bend the leads a bit to hold the diodes in place or hold on to the leads or parts as you flip the board over, so they do not fall out), and make sure the parts are still flat against the board.

Now solder at least one wire from each component to the board. By only soldering one wire, you can flip the board over and make sure the part is positioned properly. It is much easier to adjust the part position with only a single wire soldered to the board!

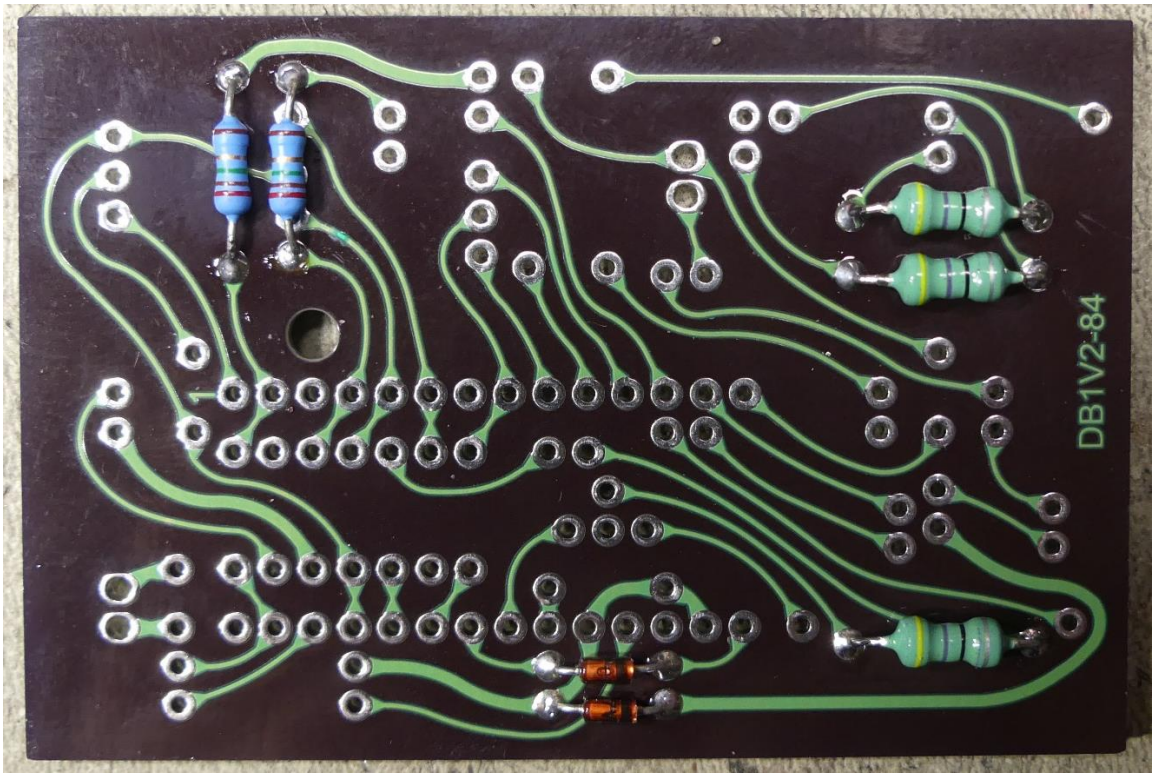
Here is a photo of the first lead being soldered:



After the part is verified to be in the correct position and all the leads are soldered, use some diagonal cutters to trim the leads on the solder side of the board very close to the board:

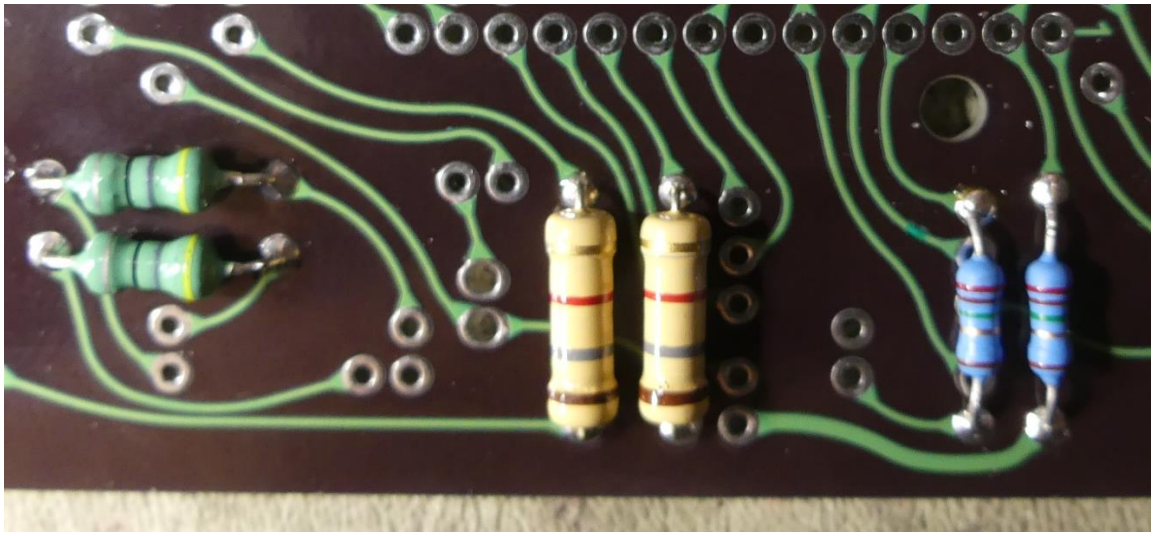


Next, mount the 2 smaller blue resistors and the 3 green inductors (or use three of the leftover resistors from the basic parts kit) at the same time since they are about the same size:

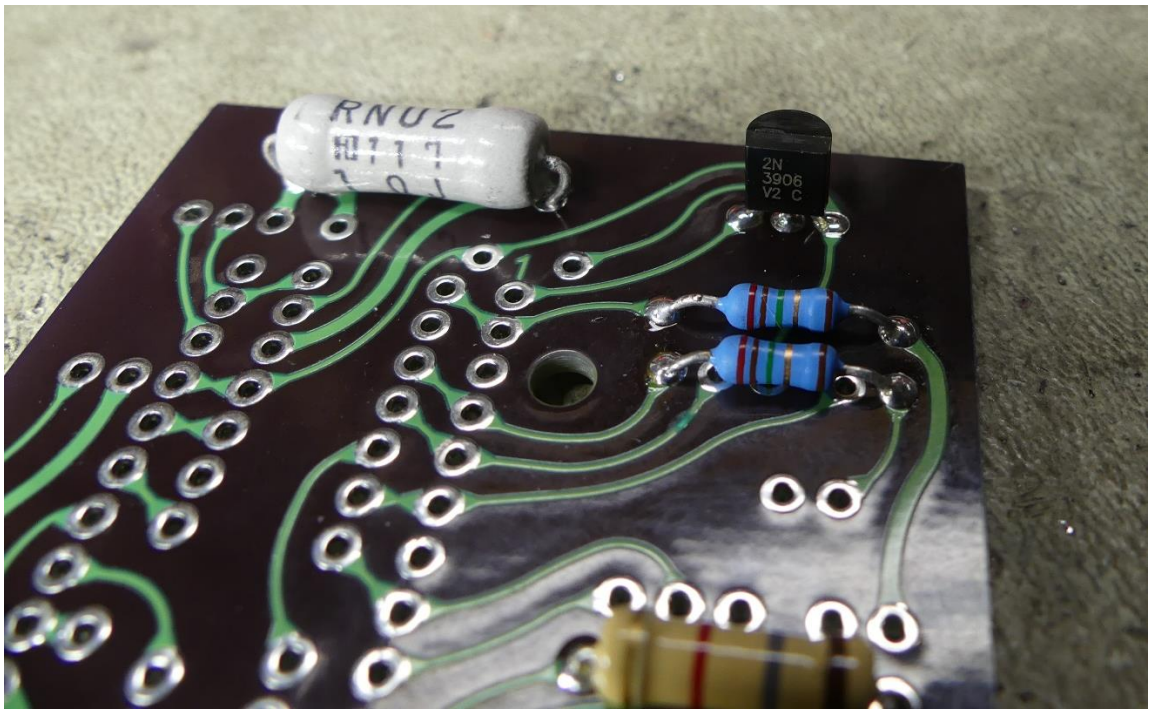


Flip the board over, solder and then trim off those long leads.

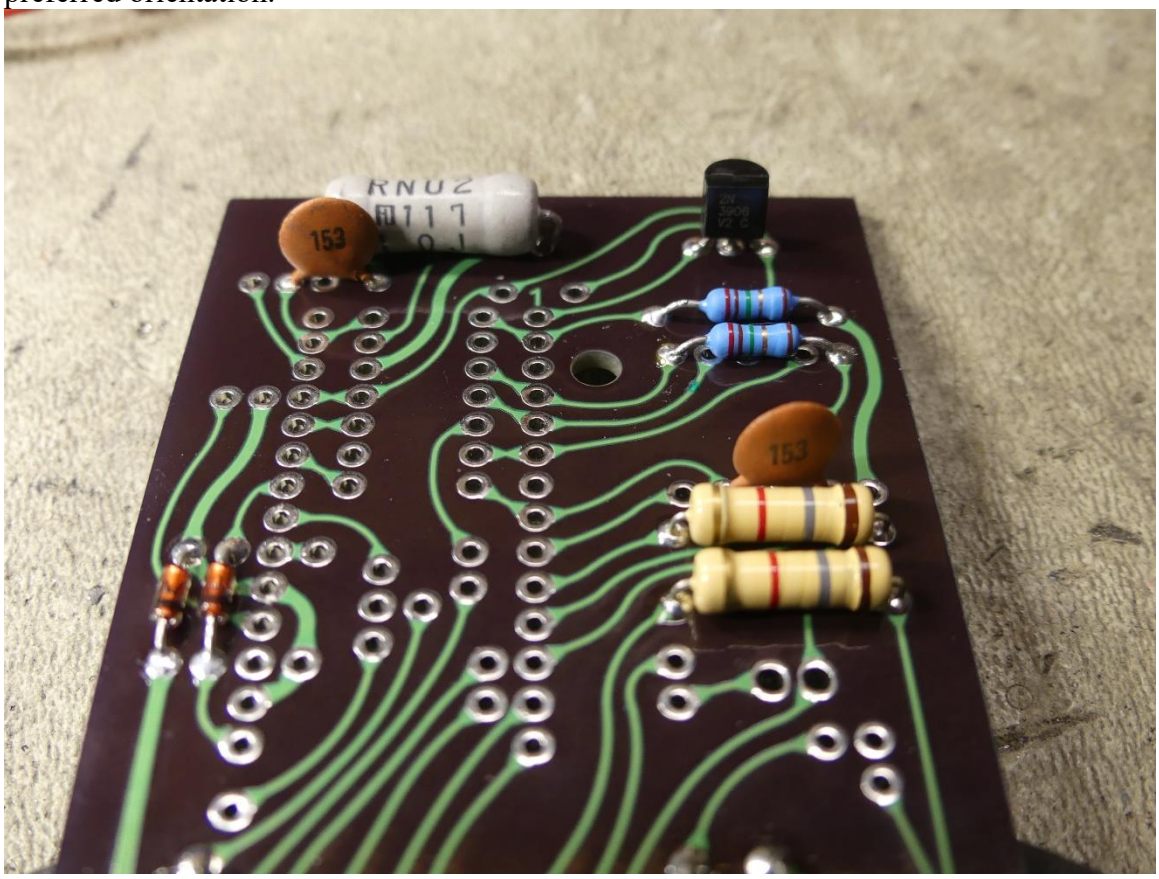
Add the two slightly larger resistors, solder and trim off the excess leads. The parts can be oriented either way, but I like to make the pairs both have the color code in the same direction.

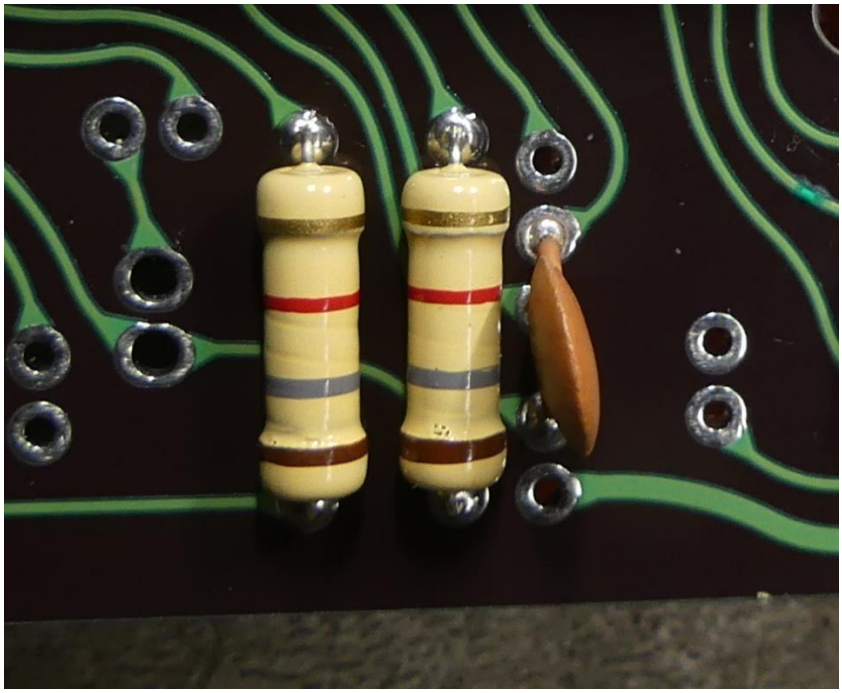


Then the large resistor. This one is a bit wider than the hole spacing, so you have to bend the leads quite a bit and add some shape to them to get the part centered and close to the board. This is the same part that was used in the Afterlife kit, so we are keeping the same part for this build! The part does not require a specific orientation.



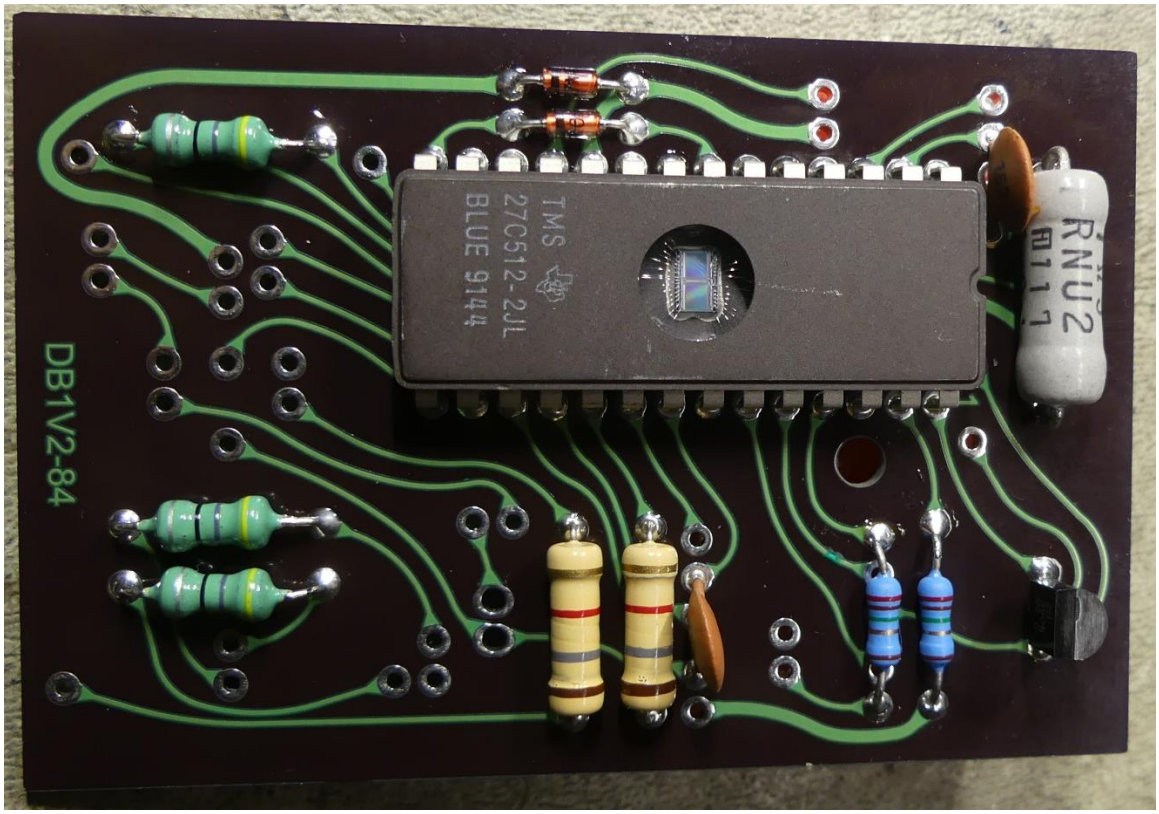
Next are the two ceramic disc capacitors and the black transistor. The capacitors can go in either way, but I like having the markings show the same way. The transistor has a preferred orientation.



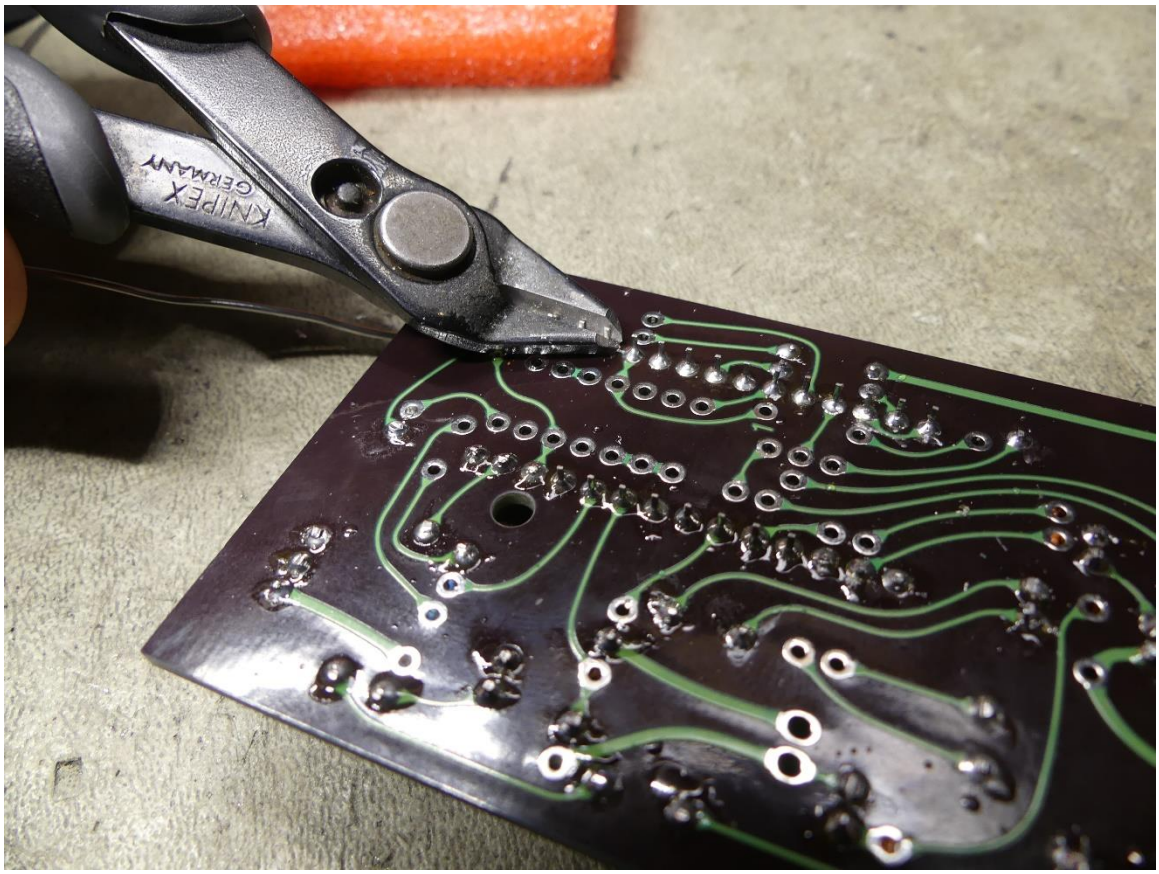


The large Integrated Circuit (EPROM) is next. It is a bit shorter than the caps, so when you flip the board over it helps you to have something under the part to hold it against the board. I used the pink foam from this bag of parts. Orientation is critical for this part if it is actually functional.

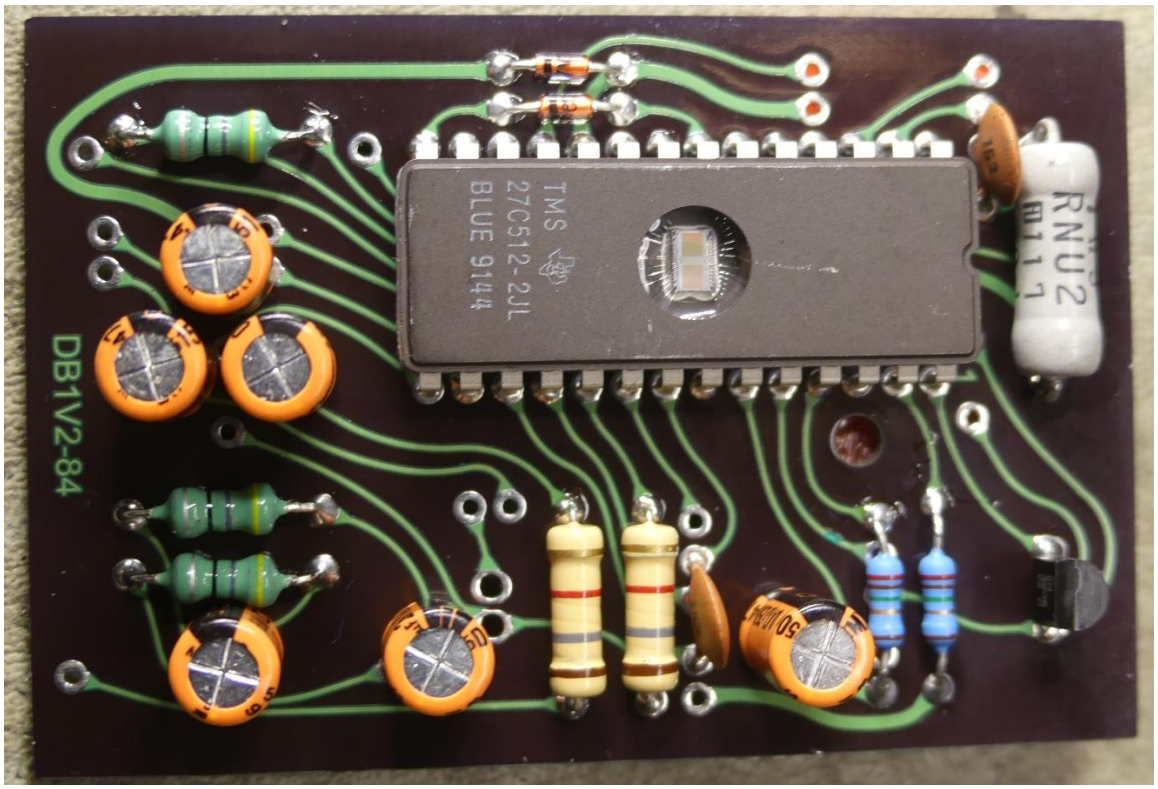
Only solder two pins on opposite corners and then flip the board over and make sure the part is sitting against the board. If you solder a lot of pins before you check for this, it will be very difficult repositioning the part. If the part is not quite on the board you can hold the board up, put the soldering iron on the pin you want to adjust and press on the part at the same time. When the solder melts, you should be able to press the part into the board.

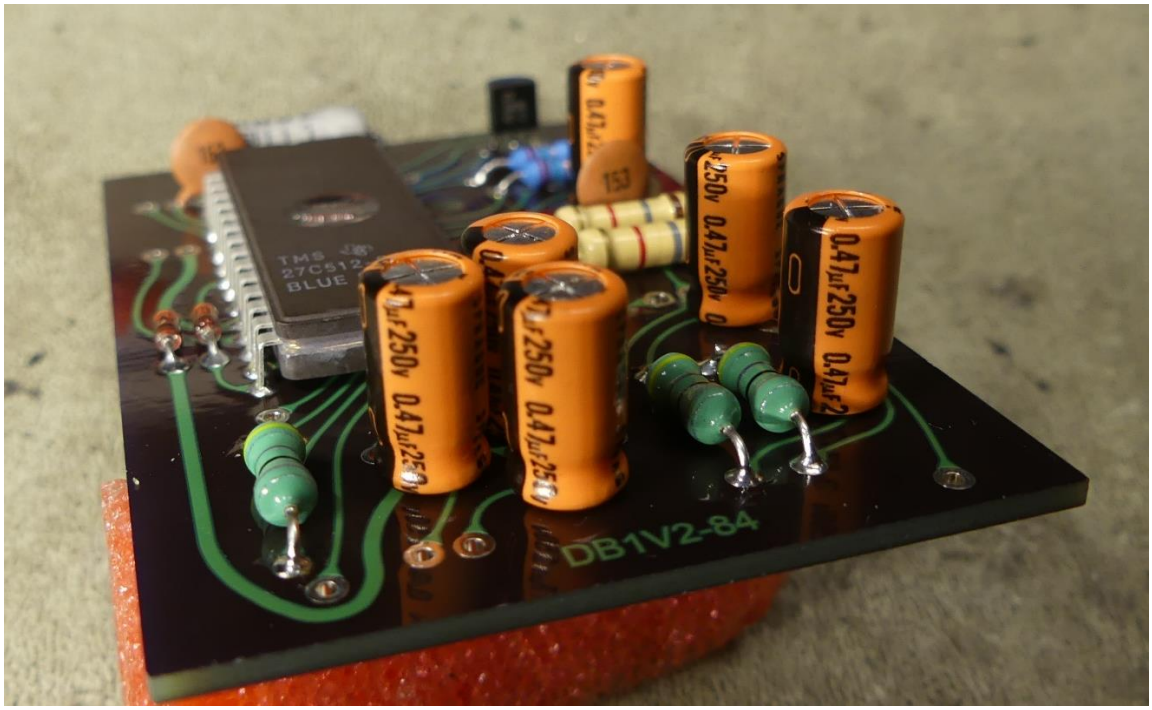


The black belt clip needs to lie flat against the circuit board, so the leads of the large integrated circuit (EPROM) needs to have the leads trimmed close to the board surface:

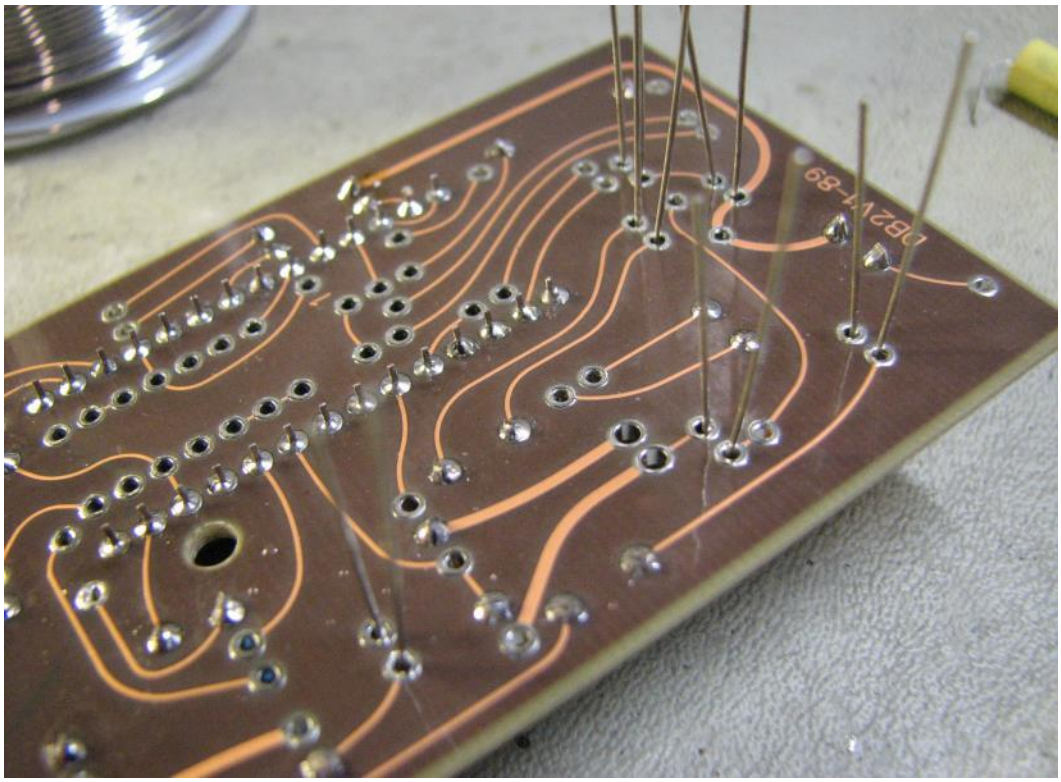


Next put in the 6 orange capacitors. These capacitors do have a preferred orientation so look for the black stripe and make sure they are all facing the correct direction:



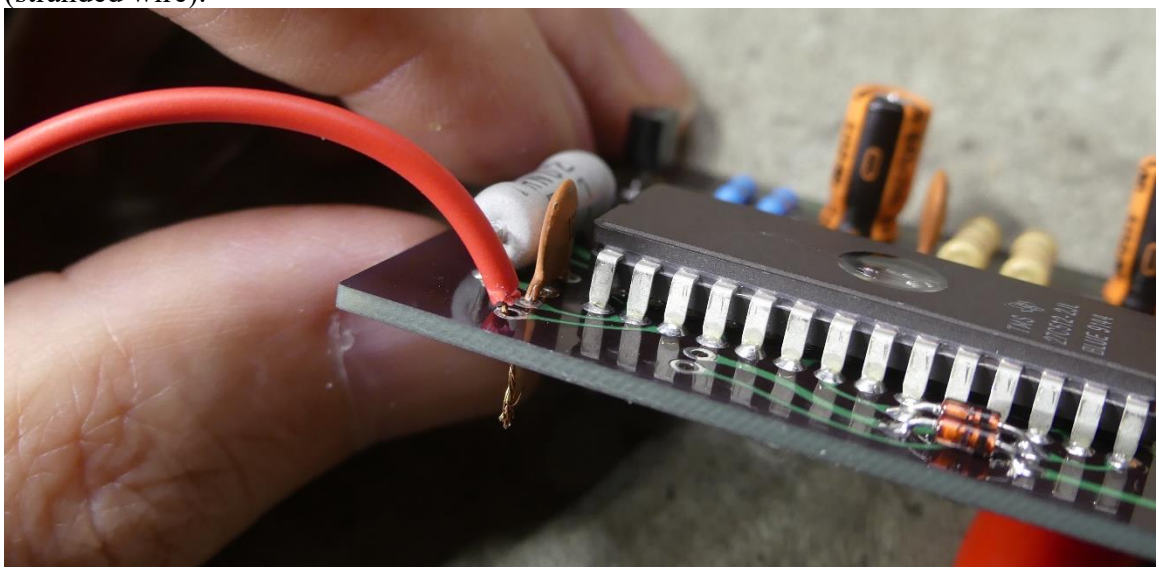


Flip the board over and solder one lead from each of the orange capacitors. Then flip the board over and make sure they are flush with the board and also standing straight up.

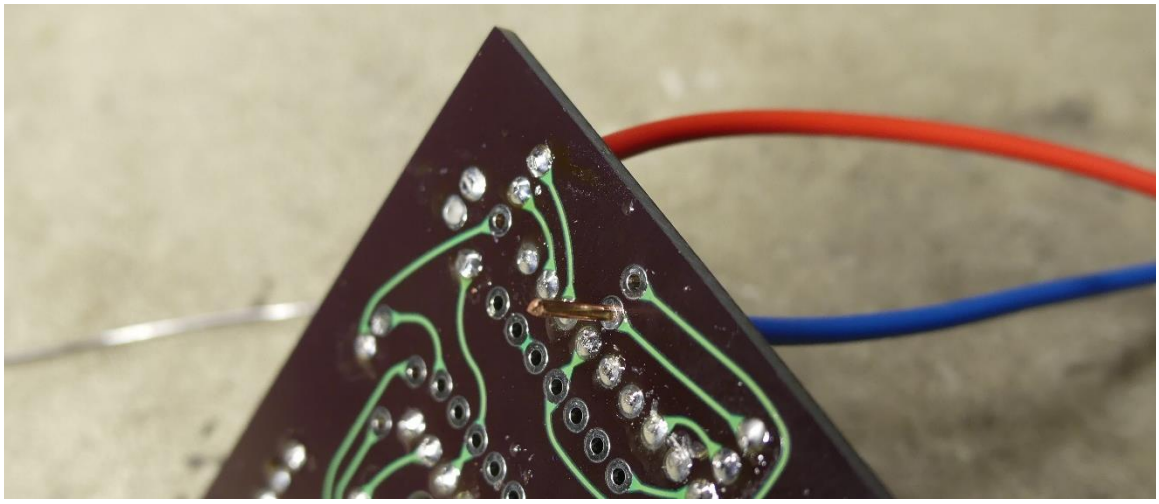


I forgot to get a picture of this with the new board, so just imagine this as a dark board with green traces…

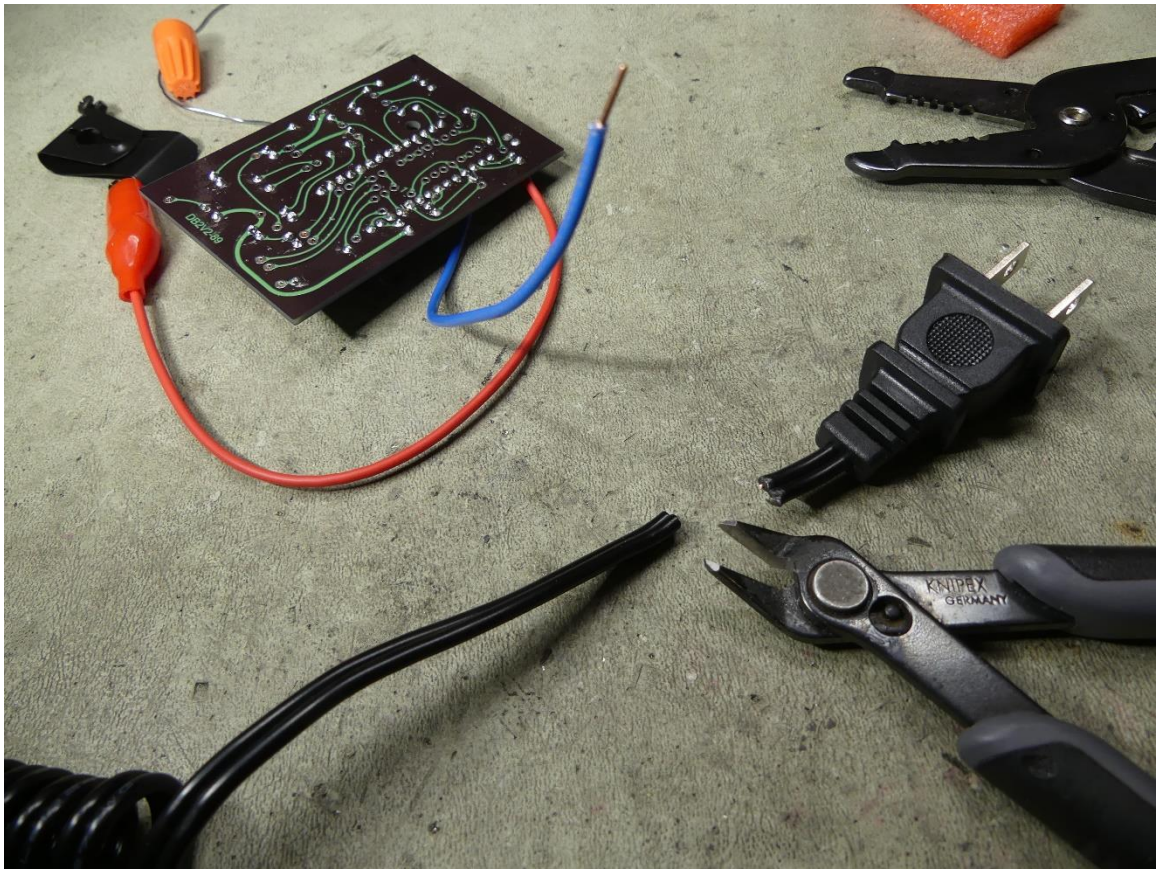
Next strip the end of the red wire with the alligator clip on it and solder it into the board (stranded wire):



And the same for the Blue solid core wire:

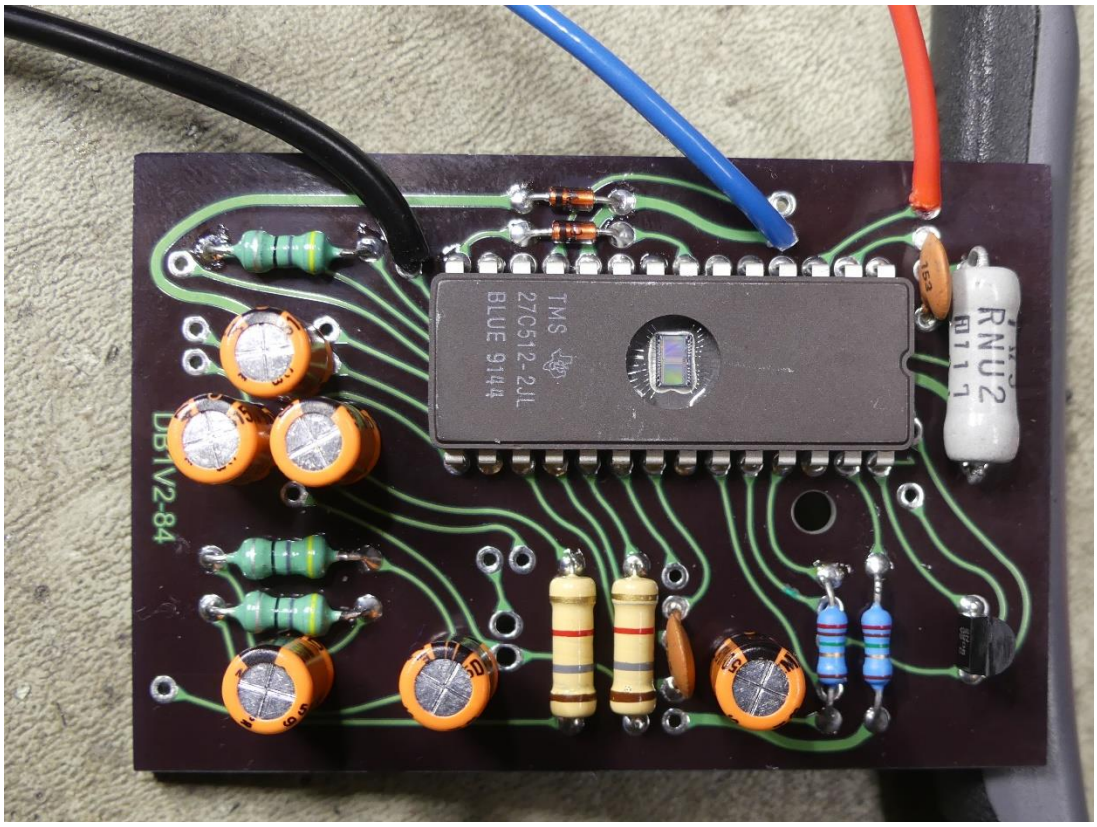


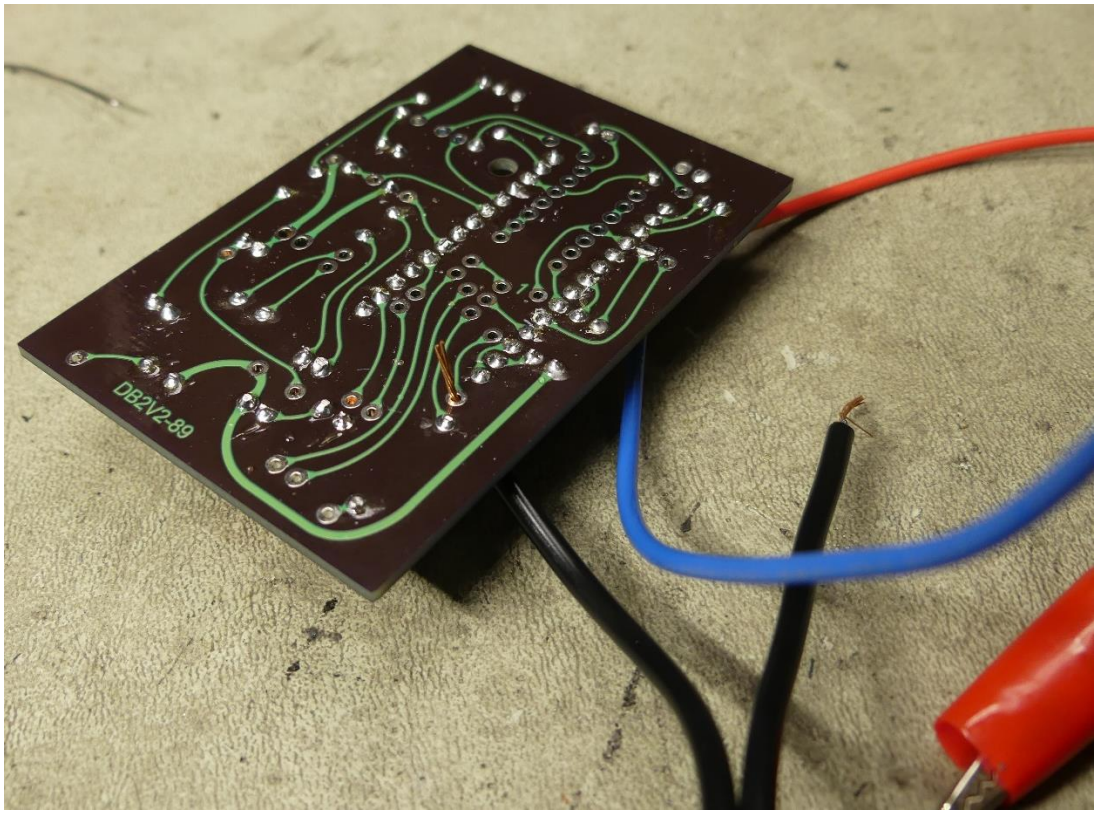
Get the shaver cord, cut the US Plug end off to a desired length and strip the wires:



The shaver cord has VERY fine wires, so take great care when stripping the wire. You may want to practice stripping the wire before you decide on the overall length of the straight section, so you have some wire to practice on.

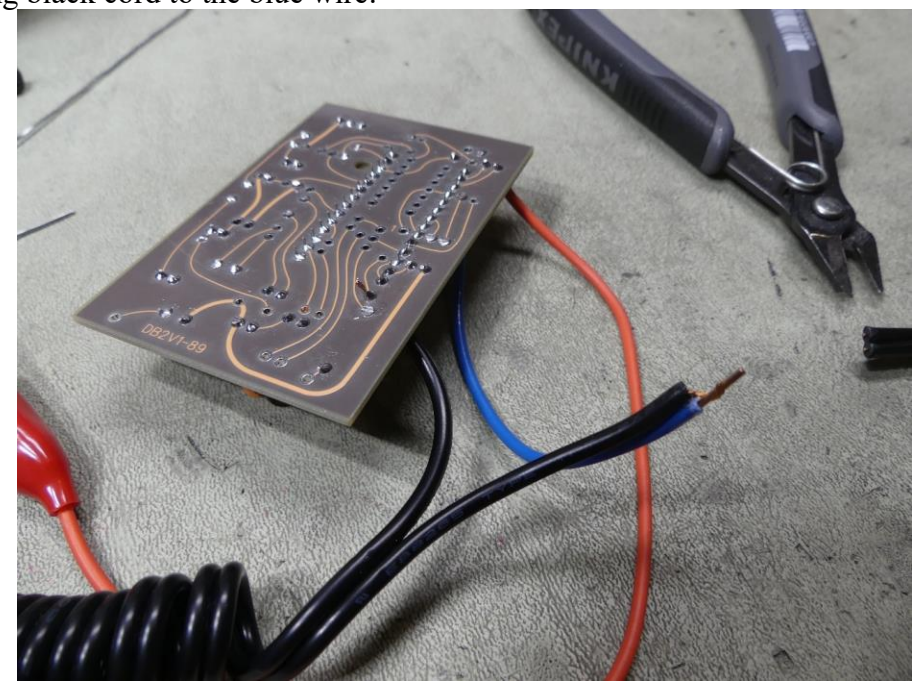
Solder one end of the shaver cord’s wire to the board.



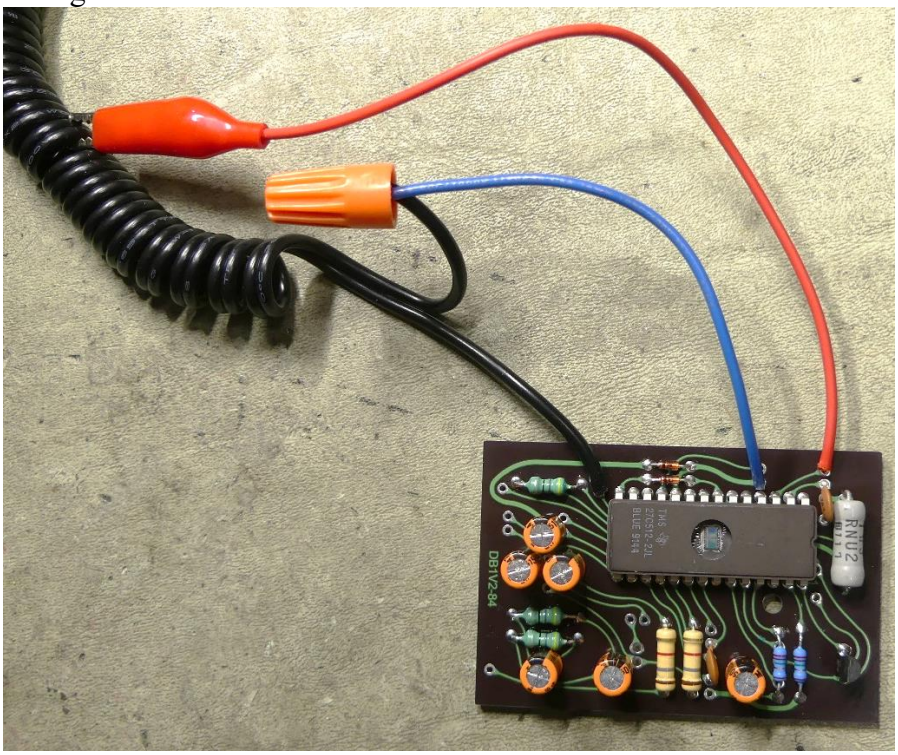


The Orange wire nut that is normally used to hold wires together will not work very well with the shaver cord's tiny wires, so it is best to solder this other black wire to the blue wire.

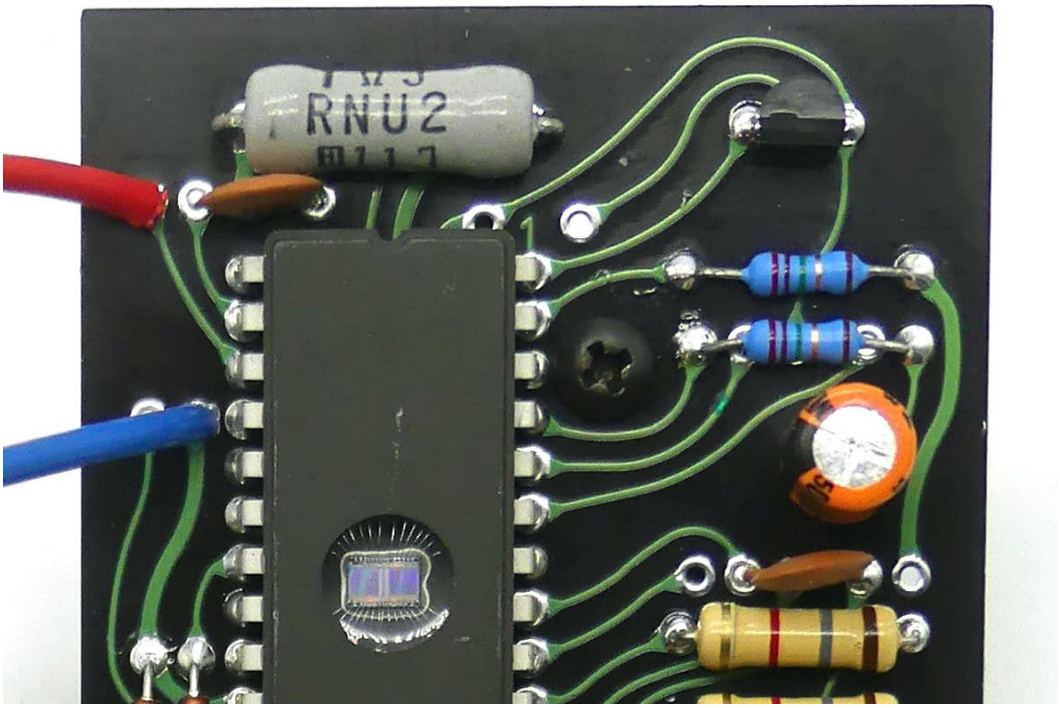
Trim the blue lead to the desired length and then strip about a ½" of the wire. Solder the remaining black cord to the blue wire:



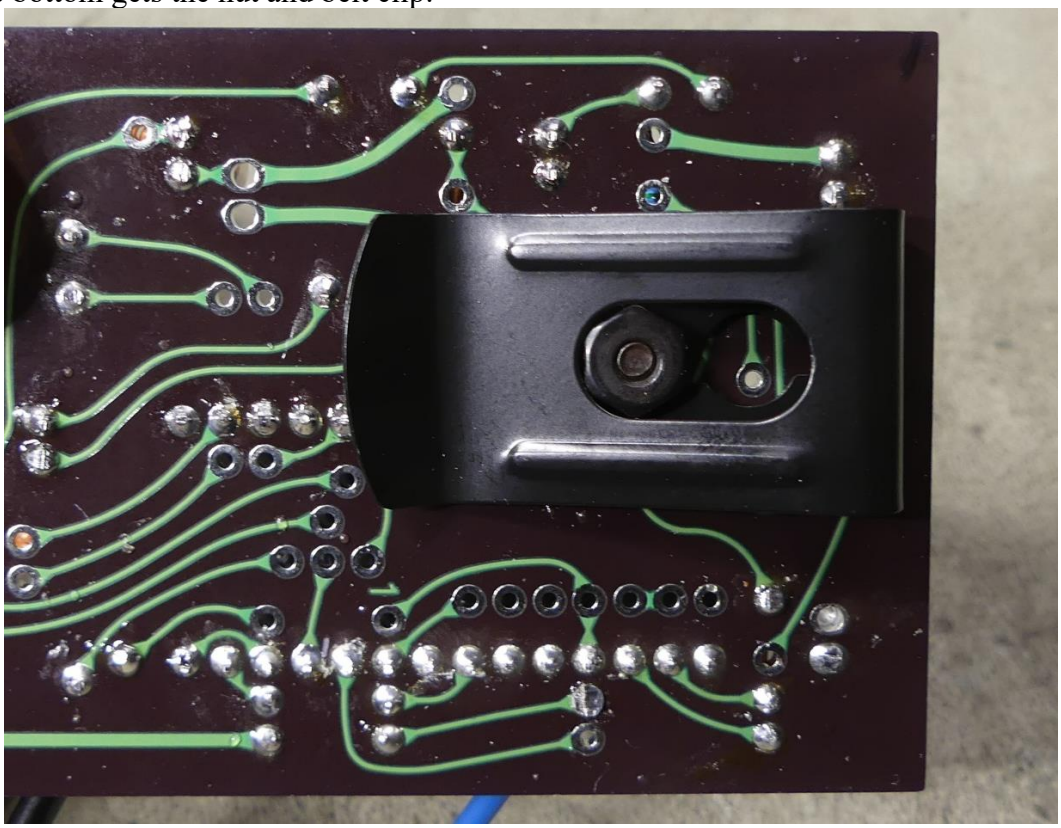
Attach the orange wire nut to the Blue wire.



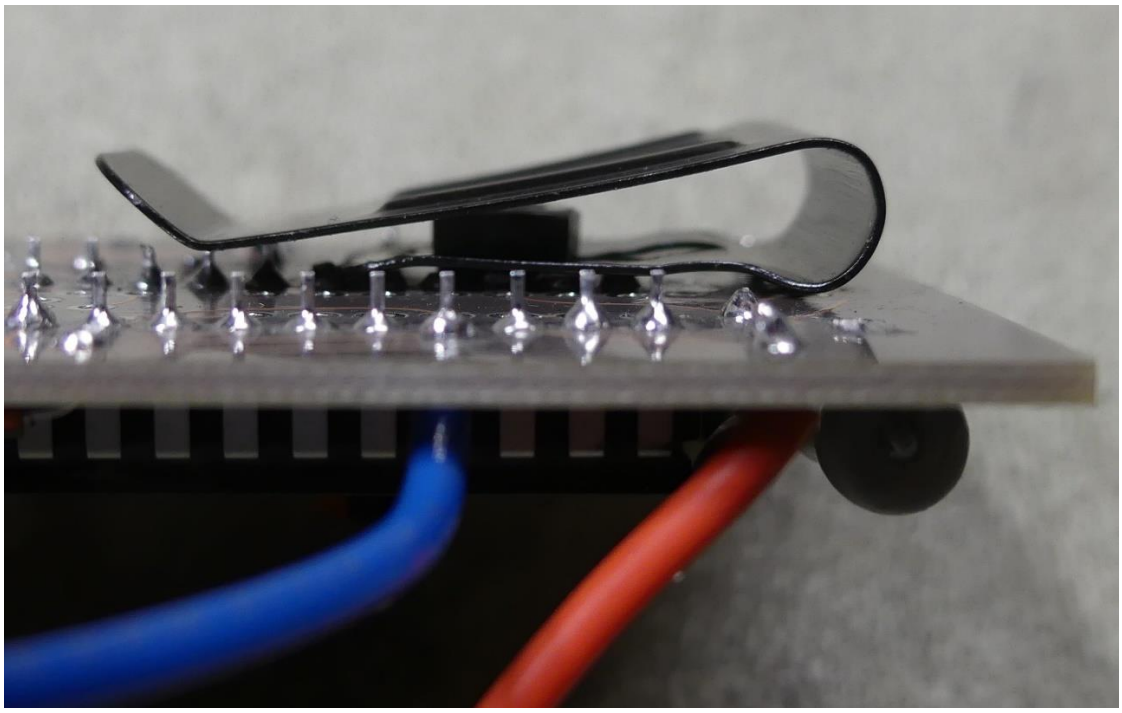
Next add the belt clip. The black Philips head screw goes on the top next to the large IC and the Blue resistors:



The bottom gets the nut and belt clip:



I did use diagonal cutters to clip off the seven or so leads of the large IC to make the attachment of the nut on the screw easier:



This allowed the back side of the clip to rest closer to the circuit board instead of on top of the taller IC leads.

Last step – Attaching the Shaver Cord

The last step is to connect the other end of the coiled black cord to the Gizmo board. I held the end of the cord in place and marked through the center of the hole from the backside of the circuit board with a pencil onto the shaver cord end.



The mark was about the center of the logo for me but may vary a bit based on how the white acrylic part was placed on the gold leads on the main Gizmo board.

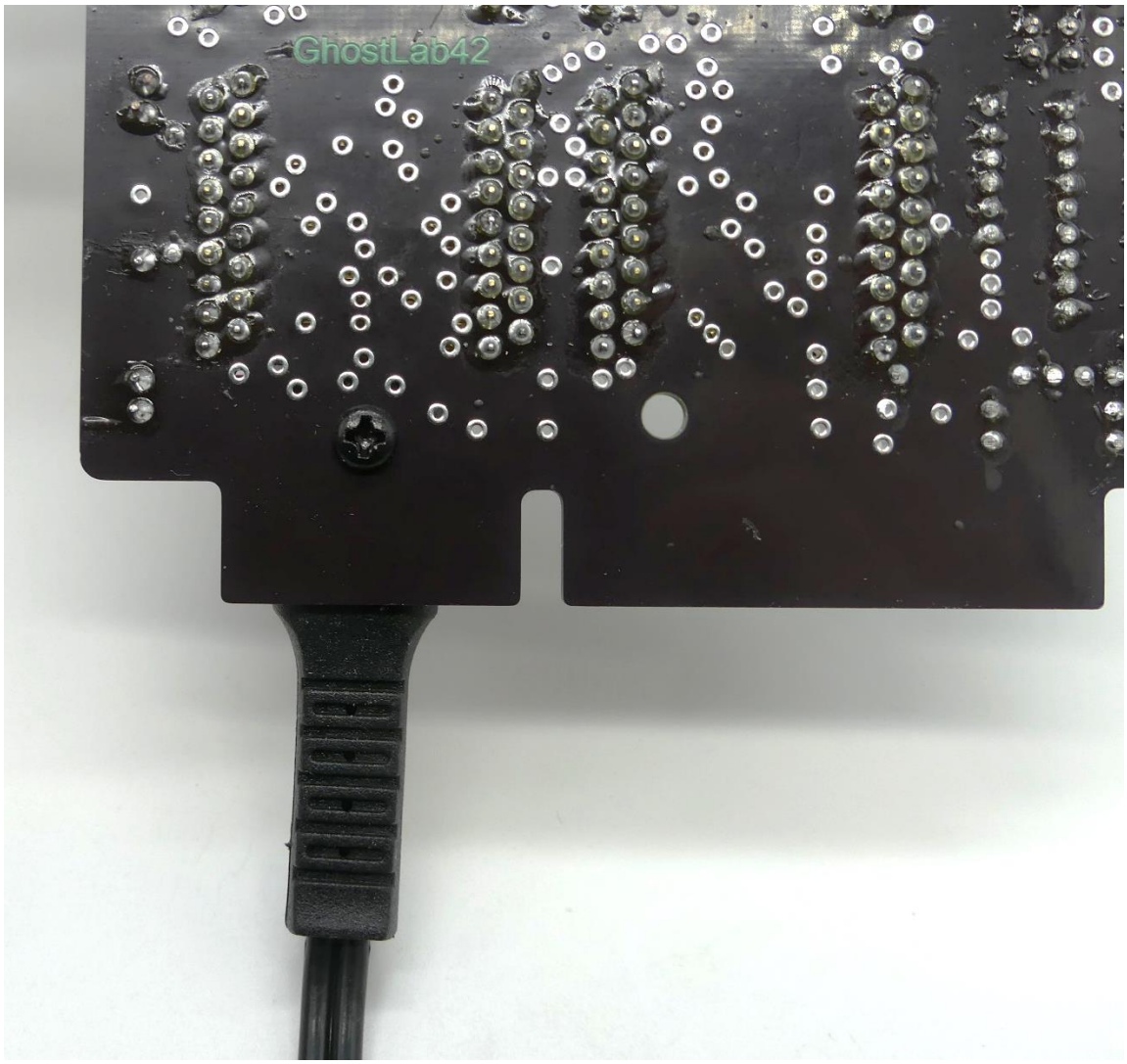
Using a 1/16” drill I drilled a hole where this was marked. Take great care not to drill all of the way through the cable since you do not want a hole to show up on the other side of this connector!

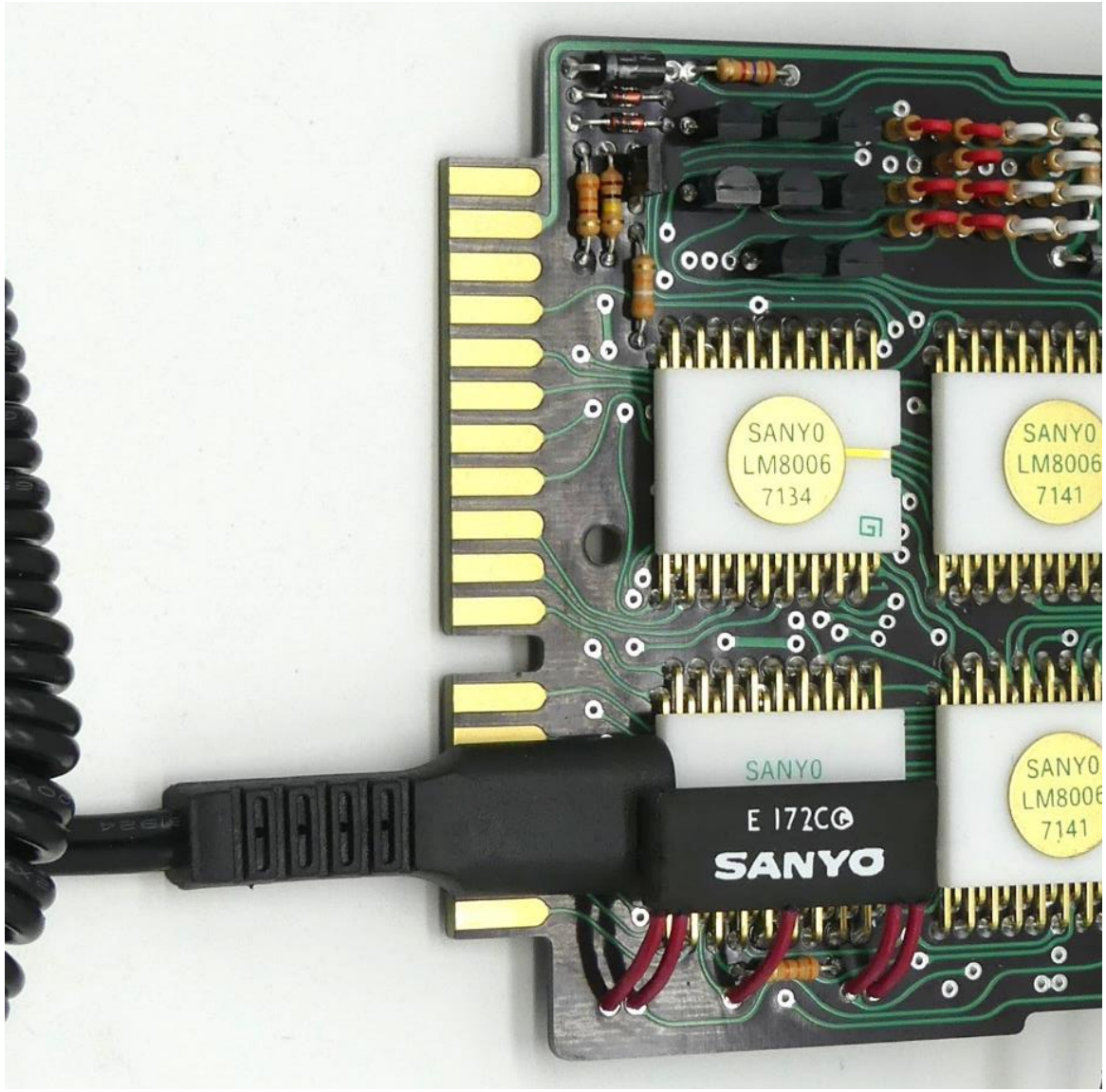
Now go get the #4 1/4" screw from the bag that held the Basic Parts kit. It is finally time to use it!

With a small Philips head screwdriver drive the screw partway in to make sure it would be easy to get started when actually mounting this end of the cable to the main gizmo board.



Remove the screw, then mount the cable onto the board by holding it in place and driving the screw into the connector from the bottom side of the board.




SANYO
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Now you can sit back and enjoy the amazing creation you just completed!

