

# TB550A

## Assembly Guide

V1.0



## TB550A Assembly Guide

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Hello and thank you for purchasing the TB550A! The TB550A is a faithful reproduction of API's classic 550A equalizer using modern, commonly available components. It has been designed for easy assembly by the amateur DIY enthusiast. The circuit is exactly that which was published with the original product nearly 40 years ago with a few small exceptions such as the hard bypass functionality.

Is it exactly the same as the vintage unit? No, that wouldn't be quite right given the modern components at least. It is also not the same as the modern production unit but I think it is fair to say that it captures the essence of that vintage EQ very well and from a functional point of view, it produces almost identical sweeps.

In order to be successful with this build, you will need one main thing – PATIENCE. There is nothing terribly complicated going on, but there are a LOT of parts and it is very easy to put something in the wrong place. If you have to find your mistake after the fact, it will be a painful process. Work slowly and carefully and you will be rewarded at the end with a great EQ!

If you have questions, please visit the support thread on the GroupDIY forum:

<http://www.groupdiy.com/index.php?topic=47100.0>

Above all, have fun!

- Brian Horvitz

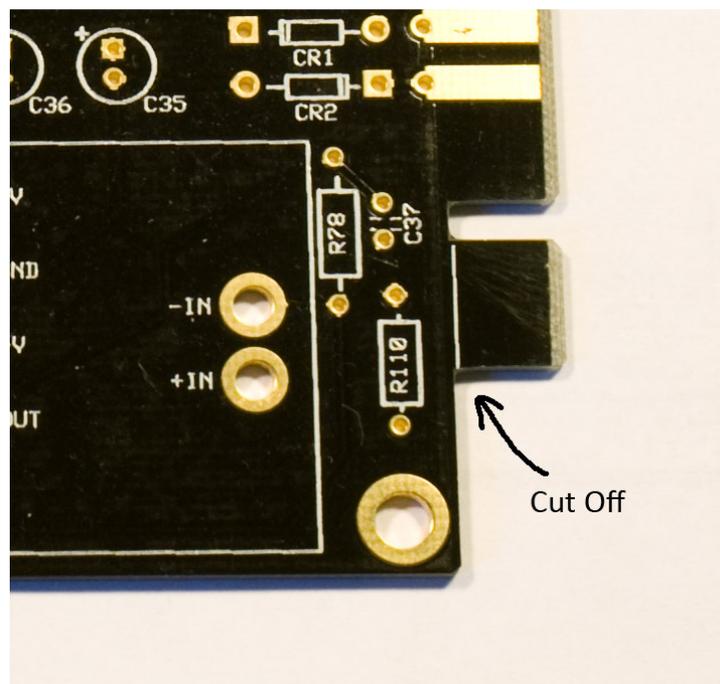
# TB550A Assembly Guide

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## Board Prep

To get started, we need to potentially make one small modification to the PCB depending upon your application. If you intend to use the TB550A in a GDIY 51X rack, then you're all set! If it will be installed in any VPR compatible rack (lunchbox, etc.) then you'll need to remove the small indexing tab at the bottom of the card edge connector at the back of the board. You can see there's a small line that shows where it needs to be cut.

To remove the tab, you'll need a hacksaw or something like a rotary tool with a cutoff wheel. **\*\*BE CAREFUL\*\*** If you are using a power tool to do this, it will put a very fine powder of fiberglass and other nasty stuff in the air. Even if using a hand saw please make sure to wear a mask and work in a **WELL** ventilated area. If needed, you can use a small file or sandpaper to make the edge nice. As always, wear eye protection and take all necessary precaution.



# TB550A Assembly Guide

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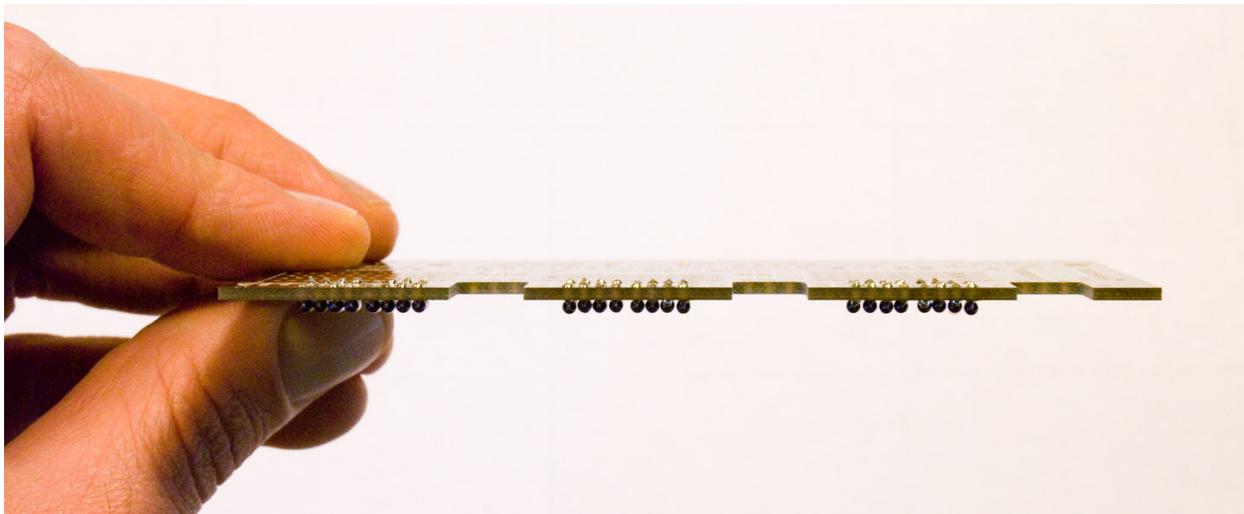
## Small Resistors

Now we can really begin with the assembly. Step one is to install the small blue Vishay-Dale resistors. These resistors go on the **bottom** of the board. They go under because the Grayhill switches will be installed directly on top.

First, get them sorted out. There are four different values and six of each. If you use a magnifying glass (or just have much better eyes than me) you can read the values on the resistors. Better though is to test them on your multimeter to be sure.

Keeping in mind that those switches will be above, you need to make sure that the resistors are cut off as flush as possible to the top of the board. In order to accomplish this, solder from the bottom and don't let too much solder flow through. If you use too much, it will make a solder blob on the top which will interfere with the switch. It is critical that this be done well or those resistors will short to the switch (and eventually the chassis) and bad stuff will happen. We'll double-check this later when the switches are installed.

Reference the BOM to see which goes where. We're looking at R3-6,9-12,28-31,34-37,54-57,60-63. It is handy to have the picture of the board in front of you so you don't have to keep turning it over to look at the markings.



## Resistors

At this point we'll install all the remaining resistors. First, the tedious bit – sorting. At the end of this manual you'll find a sorting sheet which will help you arrange the mountain of resistors which need to be installed. You will need to test each and

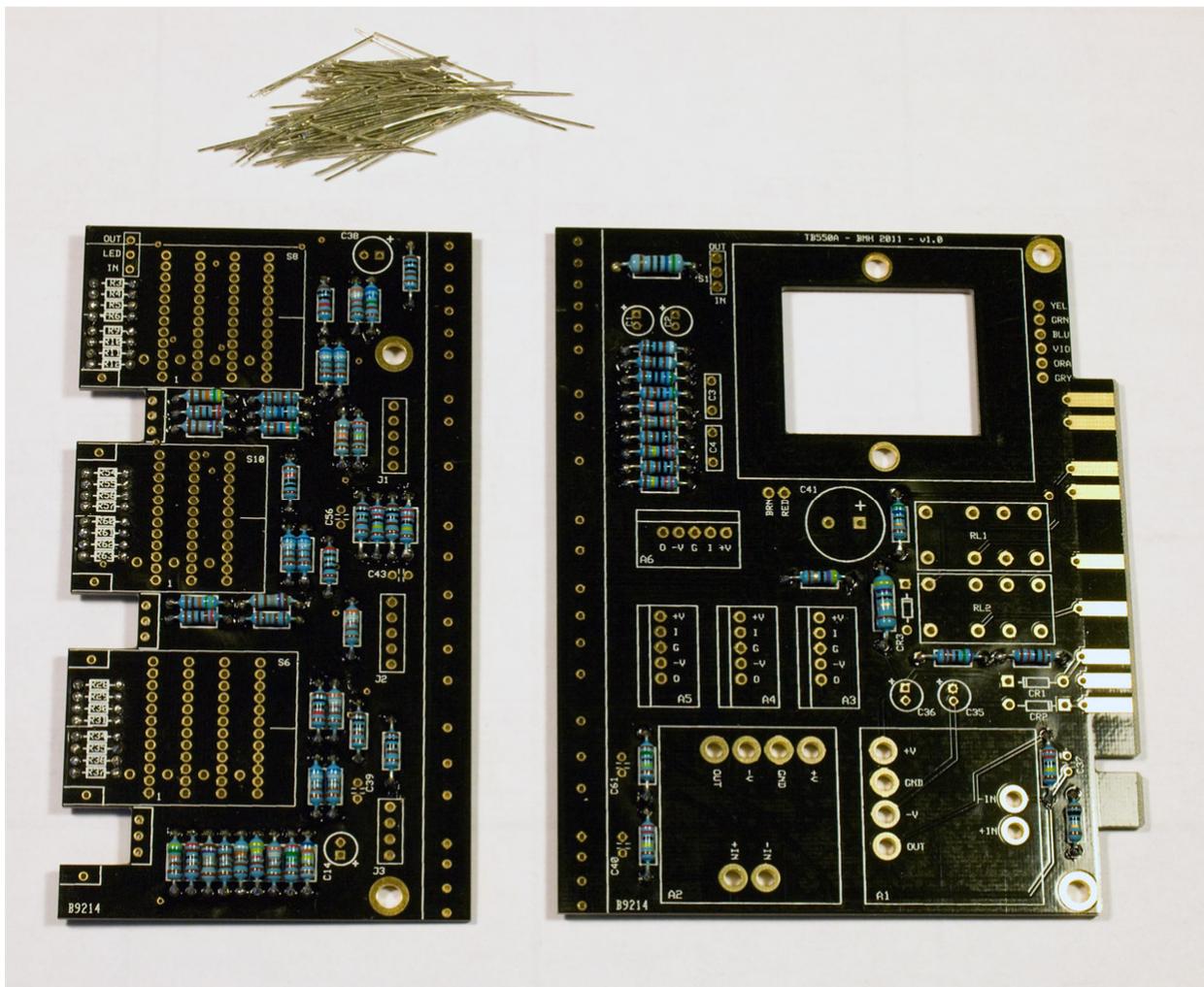
## TB550A Assembly Guide

every one on your meter. The expected quantity of each is indicated on the sheet, so give a quick count and make sure they're all there. Also note that there are two 1/2 watt resistors in there. They are bigger than the rest so they should be easy to identify. Just don't mix up the 47R 1/4W with the 47R 1/2W.

There is nothing particularly special about installing all the resistors. Just work carefully and check them off on the BOM as you get them done. Pay very close attention to the component numbering and locations on the board!! Sometimes they don't quite go in order. It is VERY easy to put something in the wrong place and VERY hard to figure out what you did wrong later. If it says 1,2,3,5,4 make sure they go that way. A little patience with this step will go a long way.

**Note:** As you're working through this, make yourself a pile of all the cut off legs. You will need them later.

Finished? Go grab a coffee and take a break. That was a lot of work!

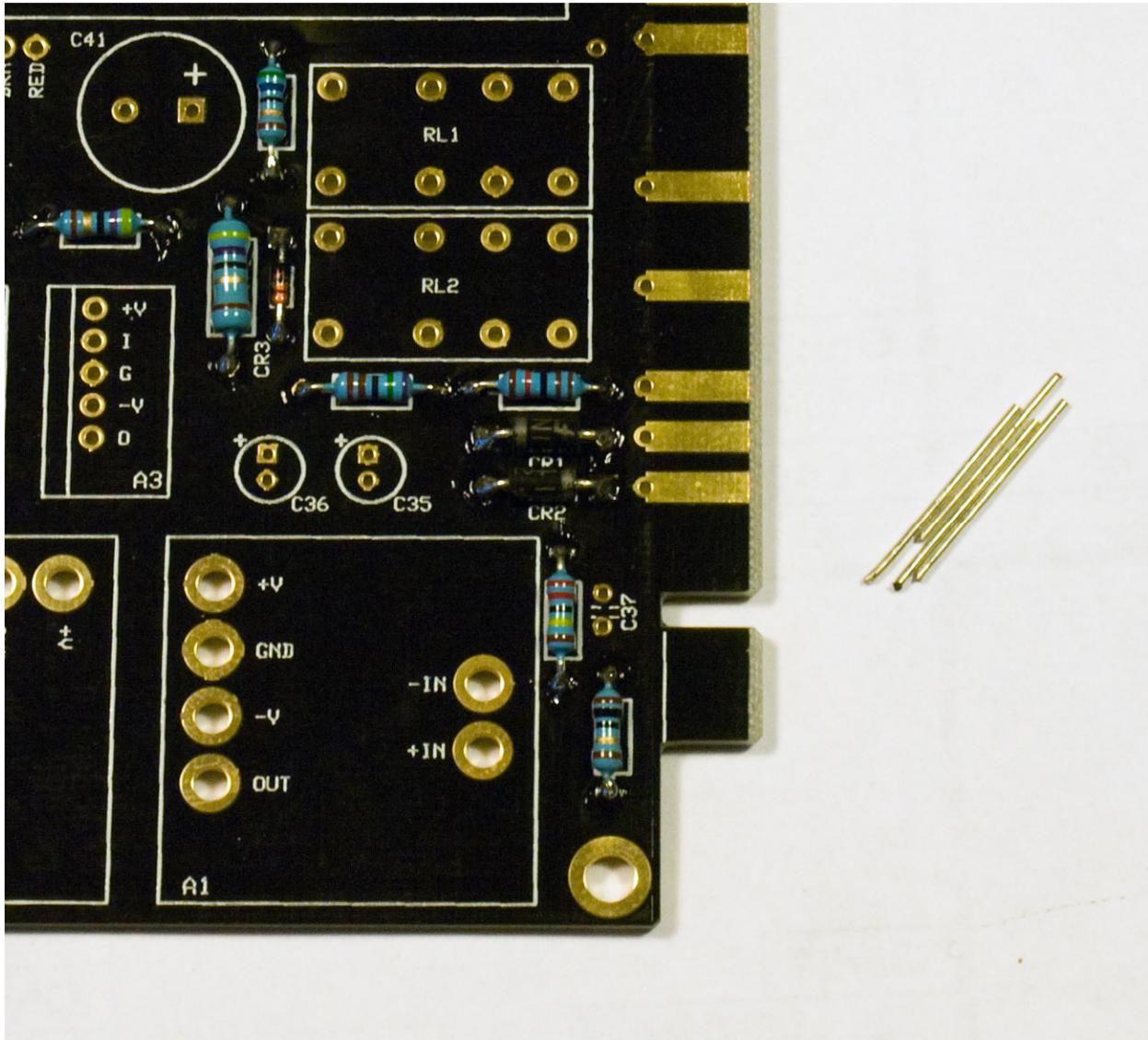


# TB550A Assembly Guide

## Diodes

A quick and easy step. Install the three diodes. The 4004 are the larger ones, 4148 the smaller. The only note is to pay attention to the orientation. The stripe on the diode lines up with the stripe on the board.

As with the resistors, save the legs from the 4004s but keep them in a separate pile.



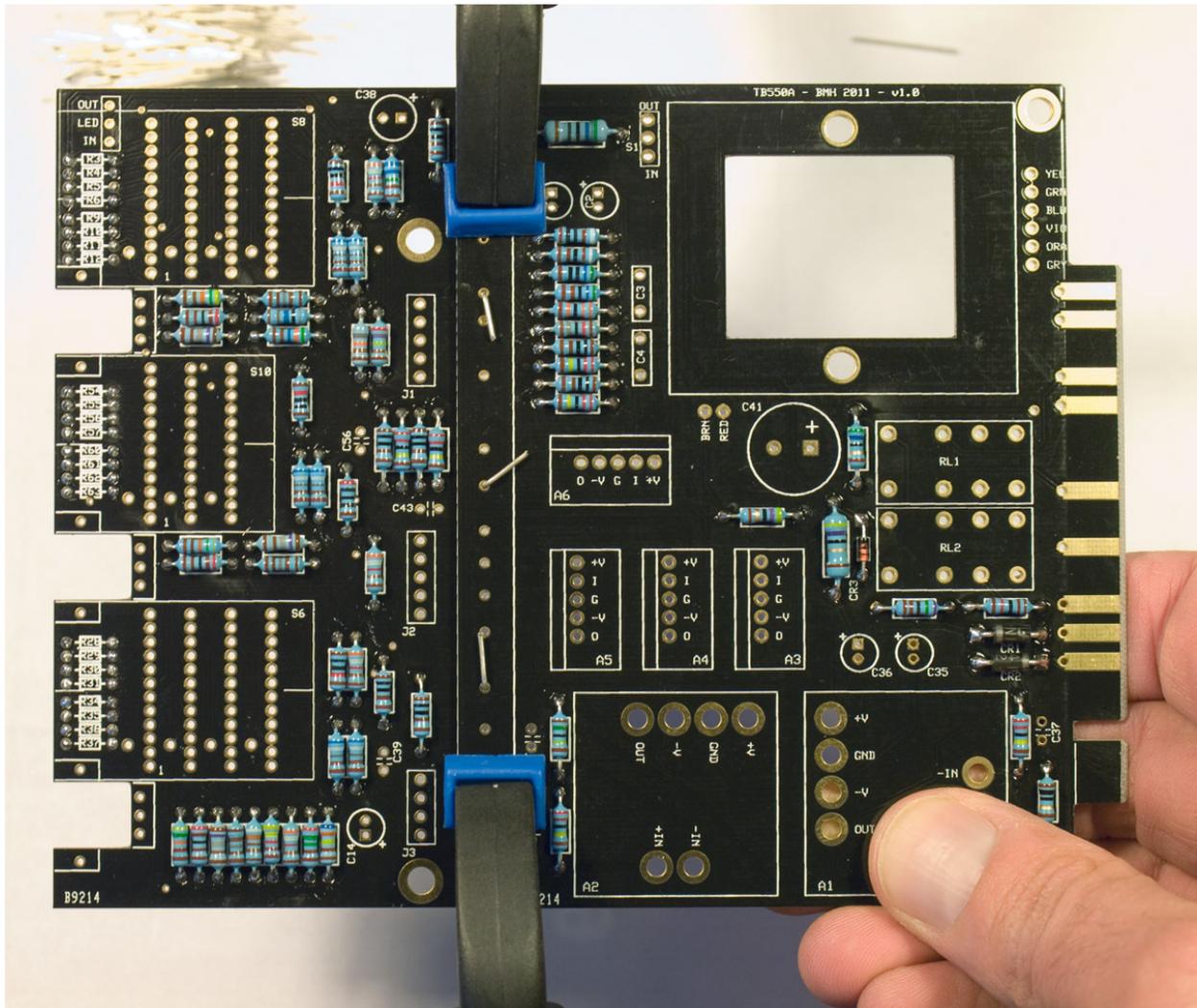
# TB550A Assembly Guide

## Join Boards

We are going to join the two main boards together at this point. It is critical to get them aligned properly and absolutely flush together. This is fortunately not hard to do.

Lay the boards out so that the rear board with the card edge connector is on **TOP** of the front board where the switches go. Roughly line up the holes and insert two or three of the cut off 4004 legs from the previous step. You won't be soldering these in, but bend them over on top and bottom so that they don't fall out.

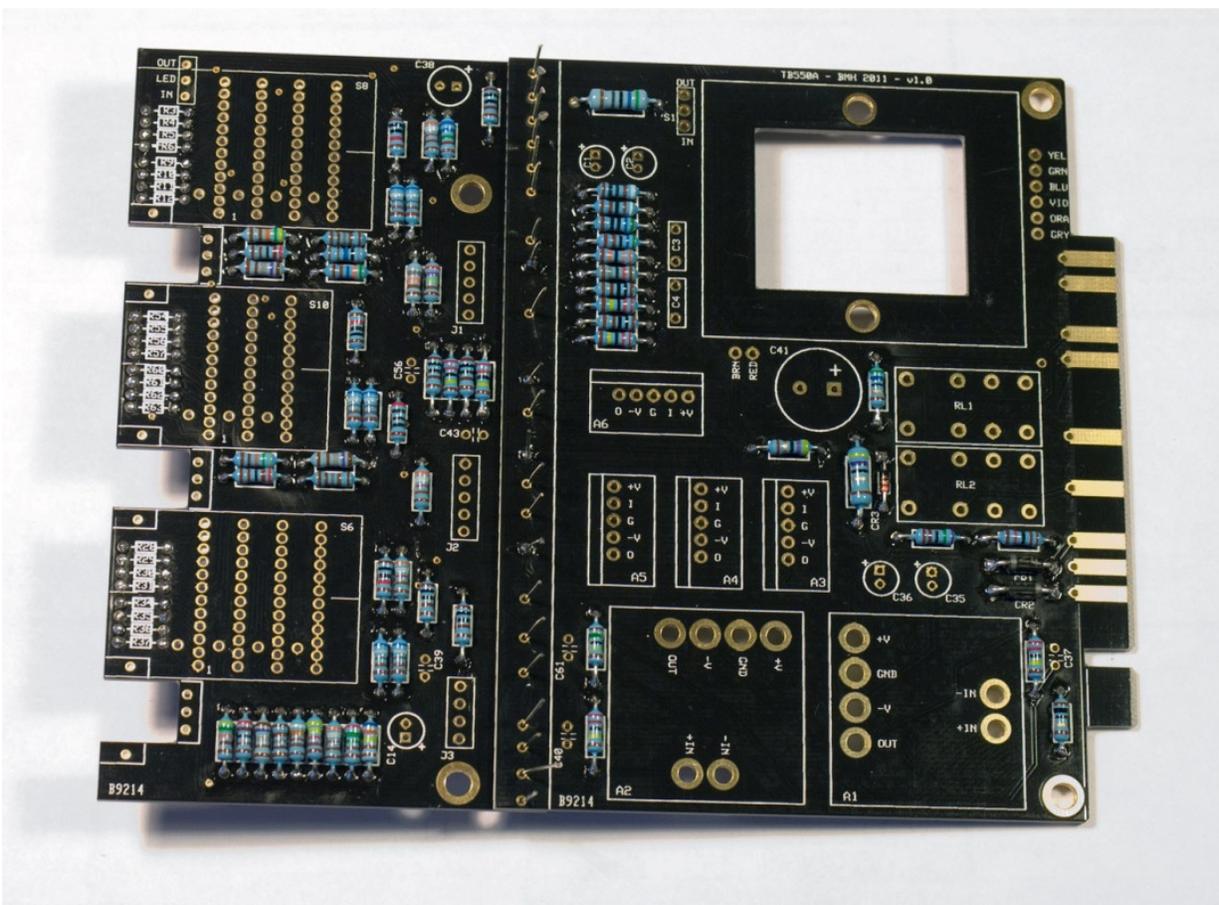
Once the holes are aligned, clamp the boards together. I use some small plastic spring-loaded clamps that I got at Home Depot for very short money. It should look something like this:



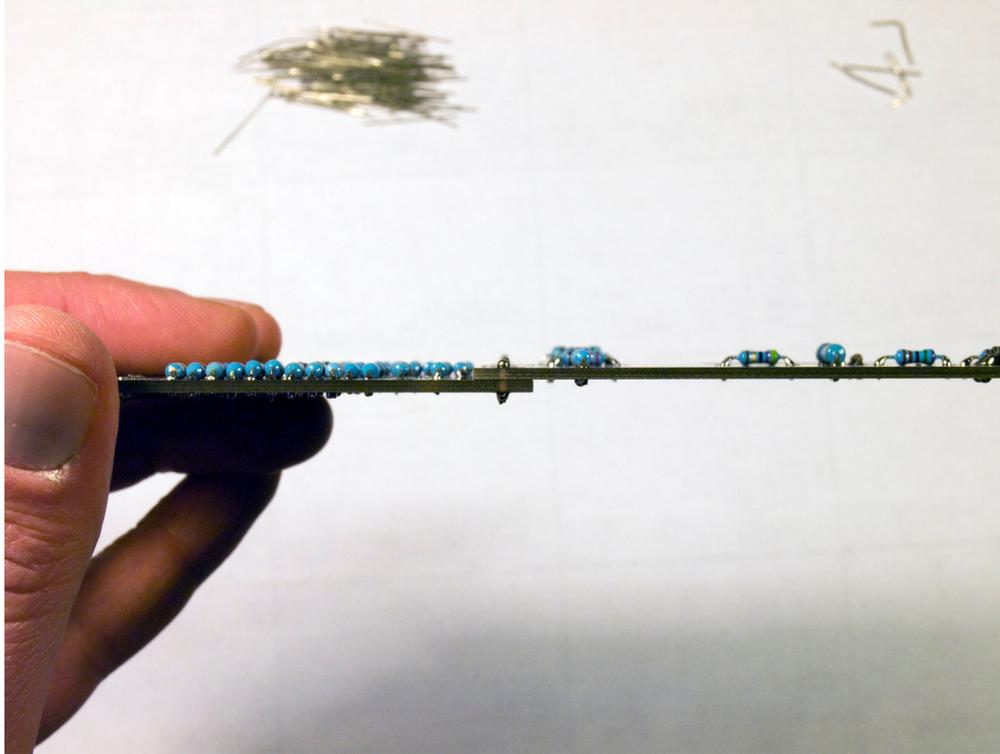
## TB550A Assembly Guide

Now install 4 or so of the resistor legs in the other holes. Space them out a little bit. If everything is lined up, they should drop in easily. Solder them in place. Be generous with the solder and it should flow all the way through both boards to the bottom. Once that is done, you should be able to remove the clamps and the diode legs. We aren't soldering in those diode legs because they are too tight and you don't get good flow through from the solder. Keep them aside as you will need them again later.

Typically, I don't cut off the resistor legs yet because they prop the boards up nicely while I work my way through the rest of the holes. So go ahead and do the rest now. Ensure that you are getting good flow all the way through.



When you are finished, cut off all the legs and clean up. Apply a little touch-up solder to any that look like they didn't flow all the way through. Don't get rid of your pile of resistor legs yet though, you'll need them for the next step.



### **Toggle Switches**

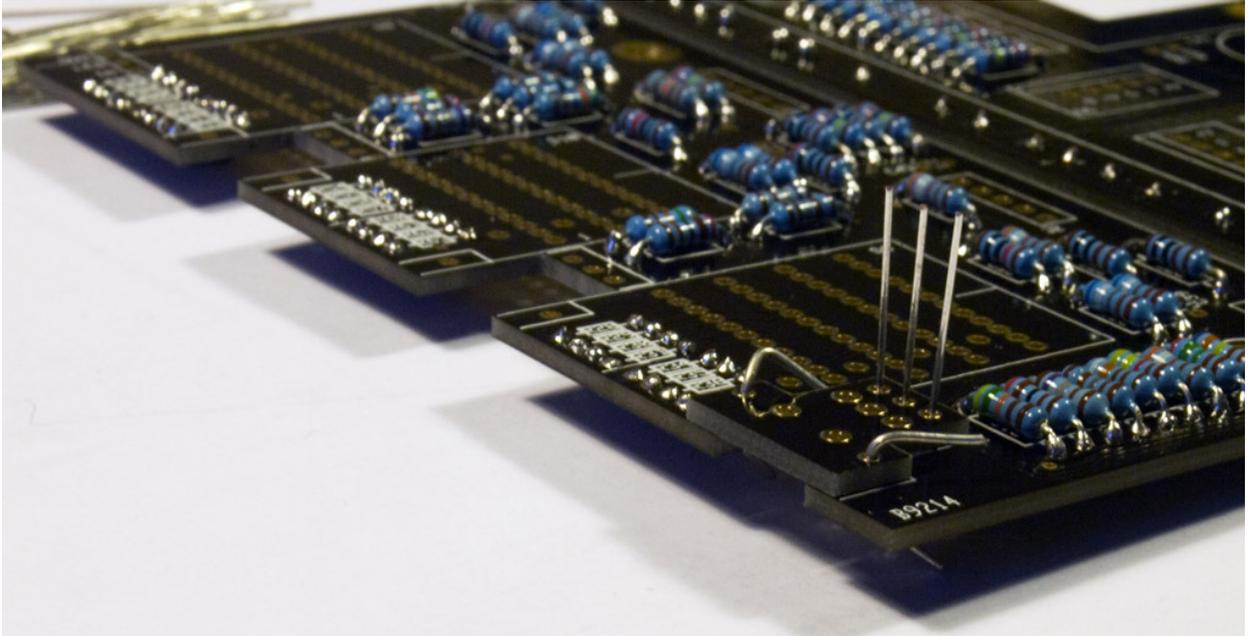
More so than connecting the main boards, doing the toggle switches correctly is probably the most critical alignment step in the whole assembly process. If this isn't done well, you'll have an impossible time trying to get everything to fit together in the final assembly. Please read through this whole section and get an idea of how it goes together before getting started.

We'll start with the three small T shaped PCBs. These are attached in the same fashion as joining the main PCBs together. They go on TOP of the board. They are the same up or down so there it doesn't matter which side is up.

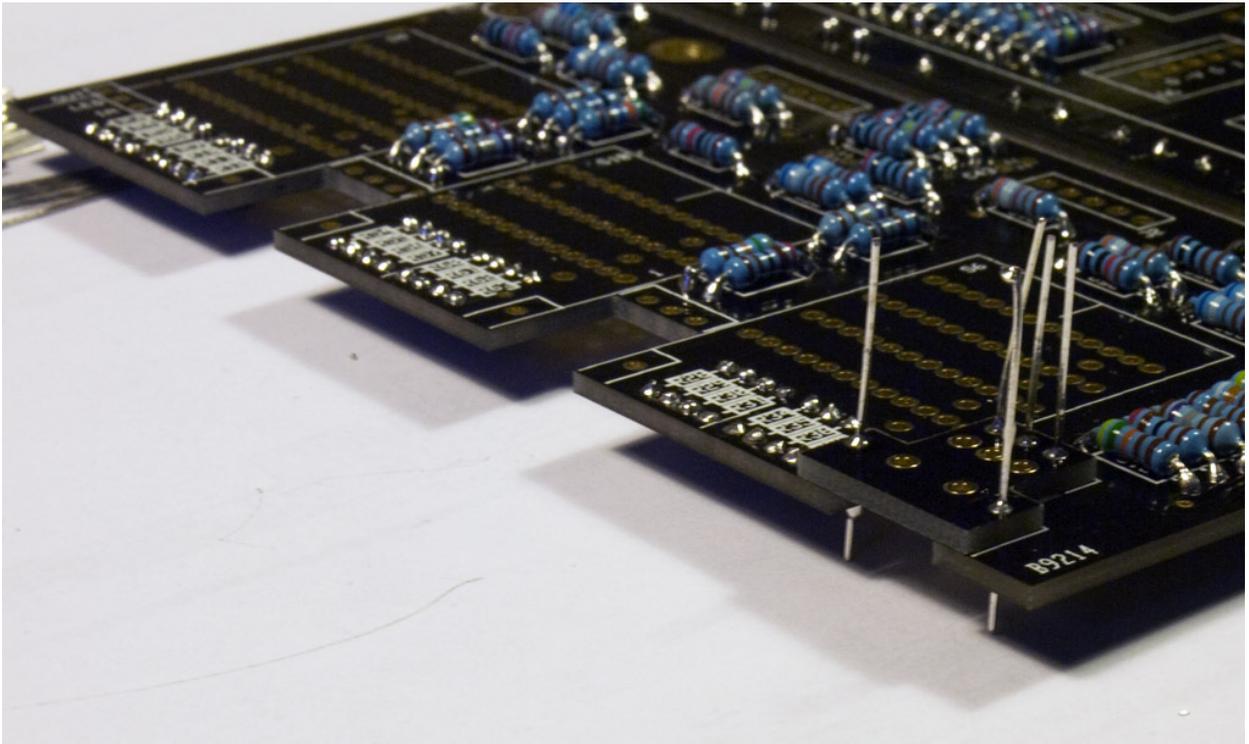
Use two of the diode legs to get the proper alignment but as before, don't solder them in. Put resistor legs in the other three holes. Either clamp the boards in place or just let gravity do its thing and it'll sit down flush. Most important here is that they T boards don't protrude past the front of the main board.

## TB550A Assembly Guide

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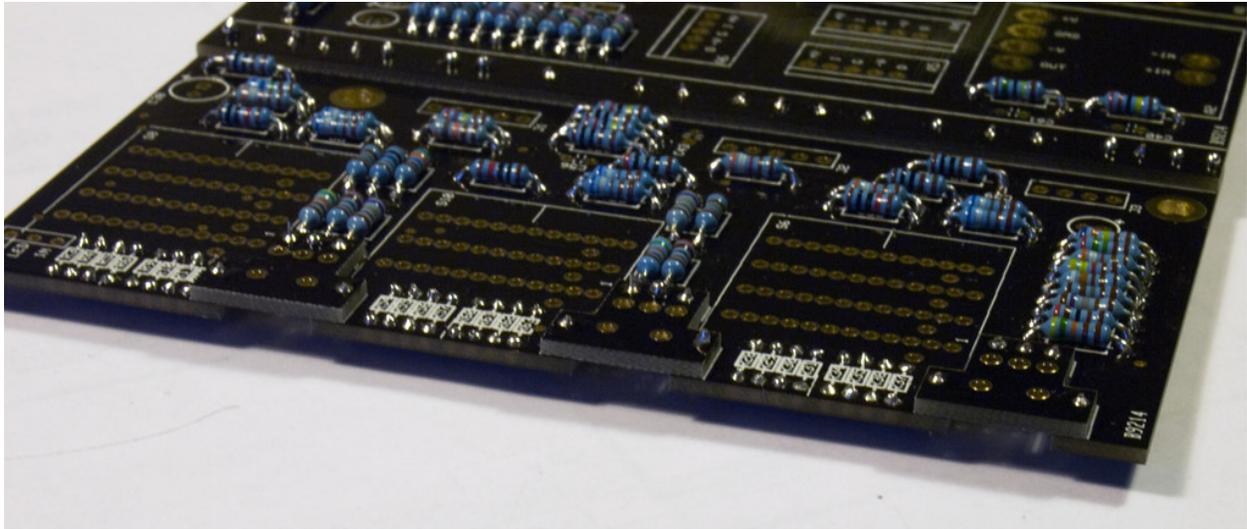


Solder in the three resistor legs, remove the diode legs, and then add two more resistor legs to finish it up. Repeat the process for all three.

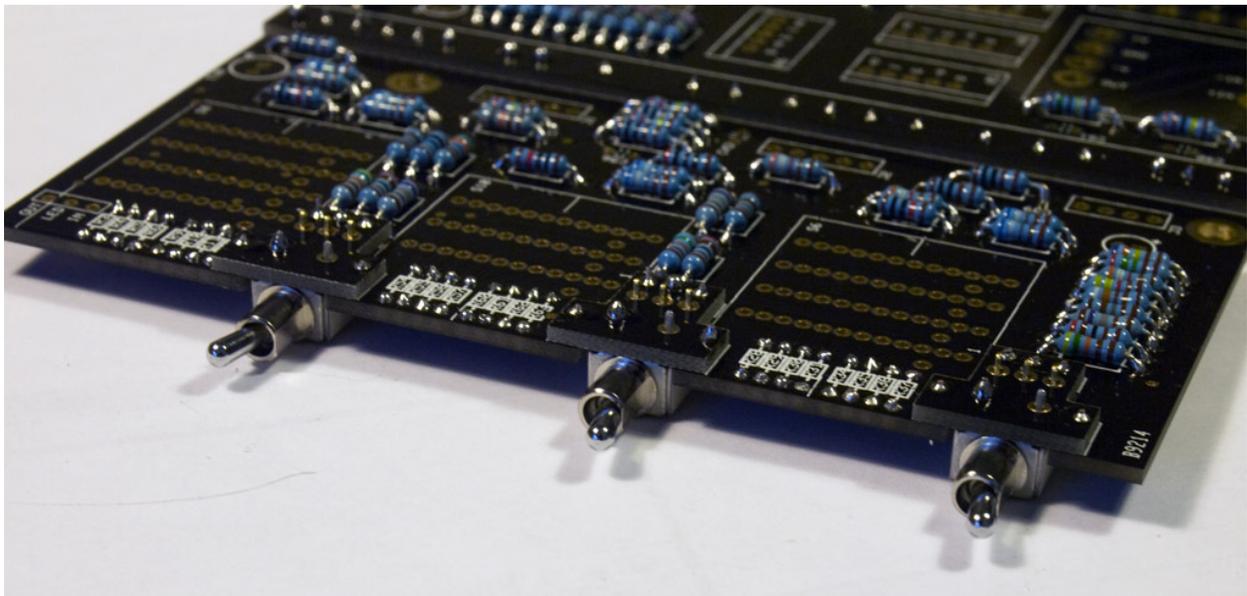


## TB550A Assembly Guide

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Next you'll be attaching the toggle switches to the T boards. They go on from the bottom and you want to get them flush up against the board. For now though, only solder **ONE** pin just to hold them in place.



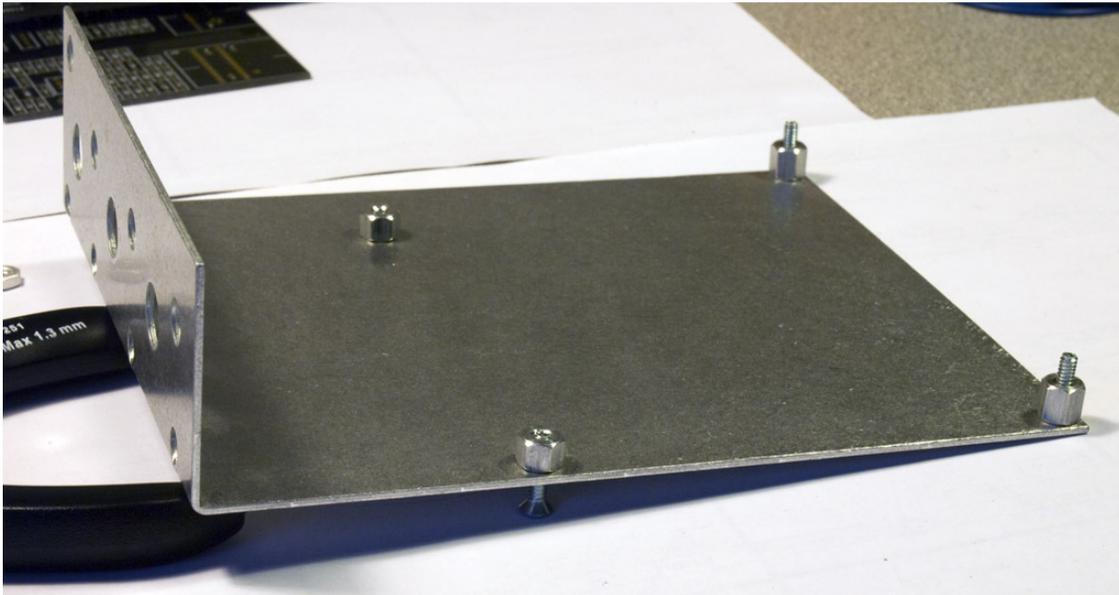
In order to align everything, you'll also need one of the Grayhill switches partially installed. Take the 3-deck switch and solder it to the board using only two pins in opposite corners. You want to make it dead flush to the PCB but don't solder the remaining pins yet in case it needs to come out later.

Put the PCB aside for the moment and we'll prepare the L-bracket. Start with connecting the standoffs. Use the four 1/2" 4-40 screws and put the two 1/4" standoffs in the rear holes and the two 3/16" standoffs in the front holes. For the front standoffs,

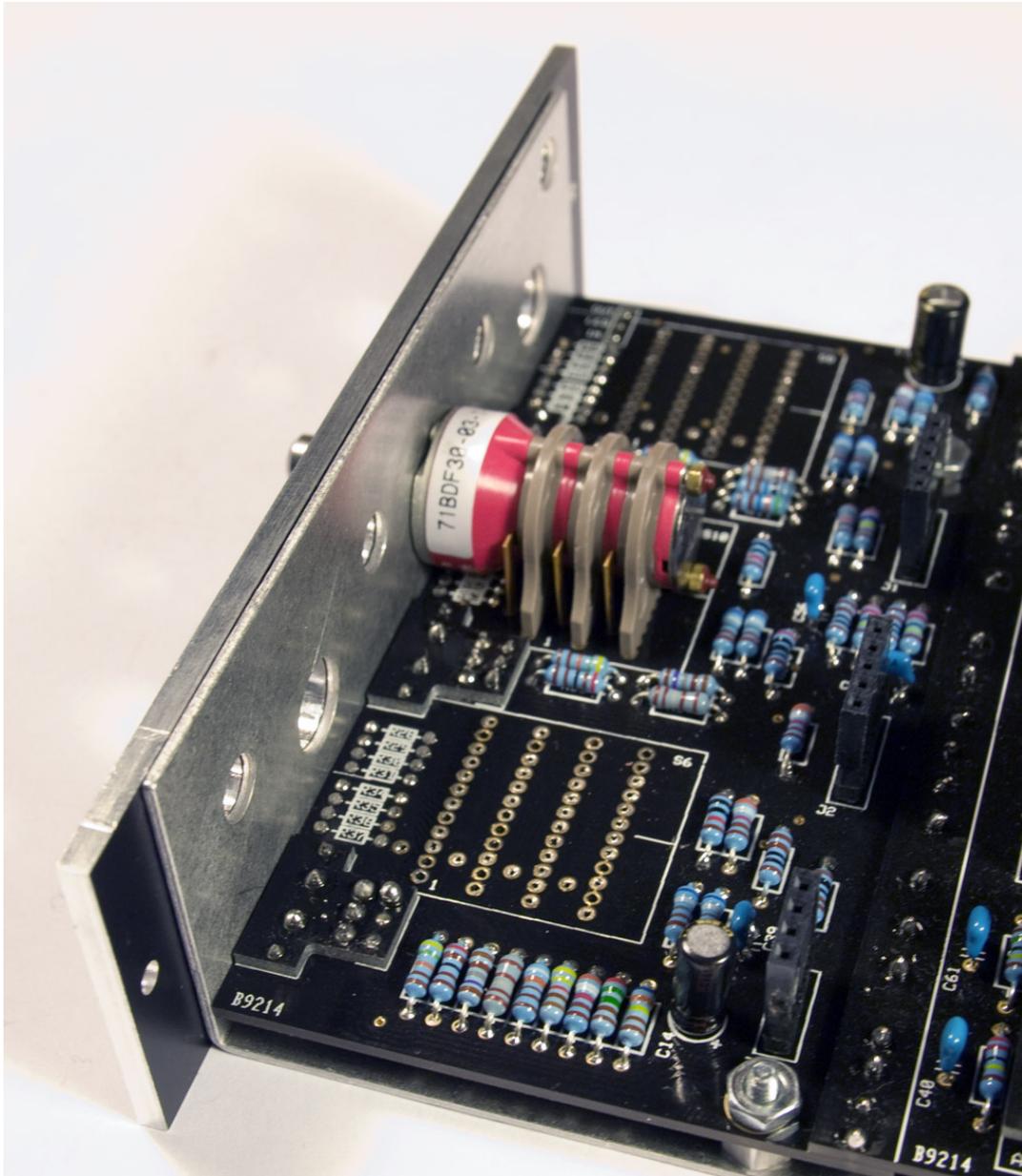
## TB550A Assembly Guide

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don't put the screws all the way through yet. You'll need to do that after the board is installed so that you can get a proper angle on it.



Install the PCB in the bracket now and put the front panel on. The toggles should slide easily into the holes in the front panel. Place the nut (without the lock washer) on the Grayhill switch to hold the front panel on. Screw in the screws in the small standoffs and place a 4-40 nut on each screw. Don't use the lock washers for now since this will all be coming apart. Make sure that the board is sitting absolutely flush up against the L-brackets and tighten all the nuts to hold it in place.



You can now go ahead and solder all the remaining pins on the toggles. Once that is done, take the whole thing apart and put aside the front panel and L-bracket for a while.

### **Ceramic Caps**

There are six of the blue Murata ceramics to be installed. Please refer to the BOM for placement and to figure out which marking refers to which value.

# TB550A Assembly Guide

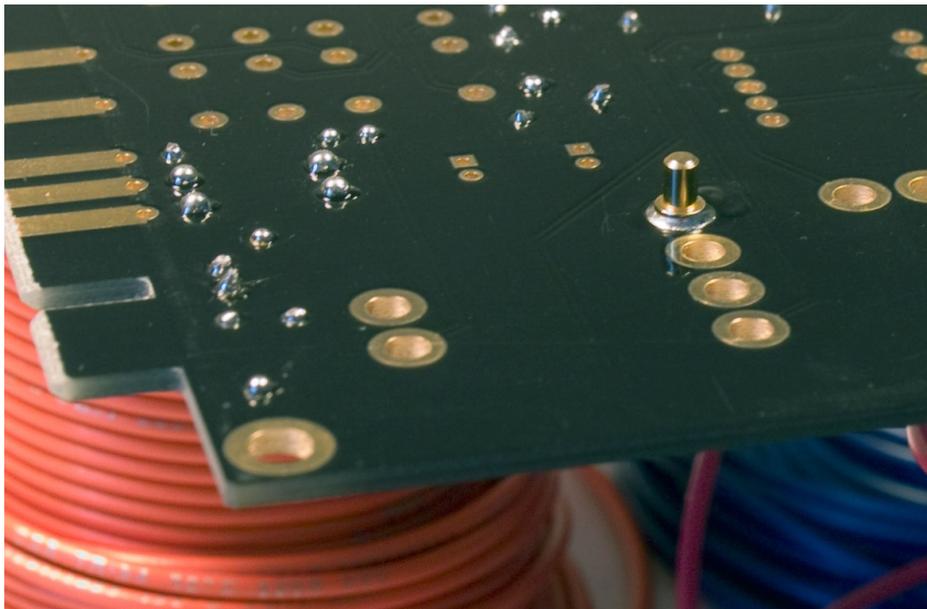
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## Mill-Max Sockets

Installing the Mill-Max sockets is a bit of an art, but easy to get the hang of. Flip the main board over since the sockets install from the bottom. You'll want to prop the board up on something and hold it in place so it doesn't move around too much.

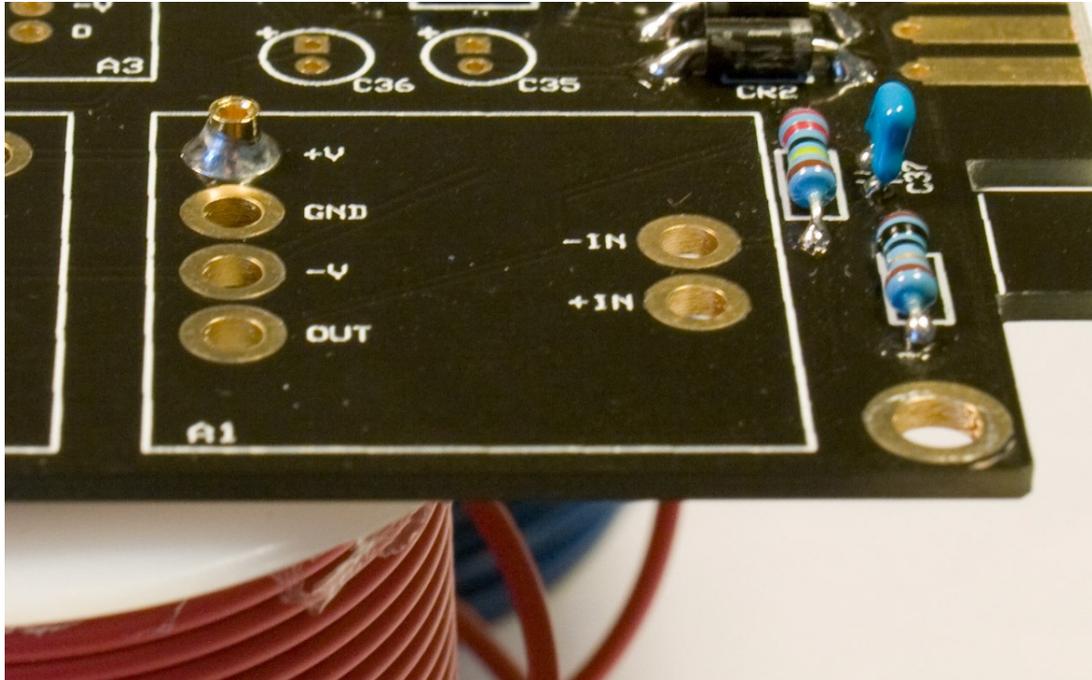
Insert one of the sockets. You'll notice they sit pretty nice and snug. Place the tip of your iron right where the socket meets the pad and feed in a generous bit of solder. By keeping the heat on and moving the iron around the pad, you will get the solder to flow all the way around the pad and through the hole a bit.

Don't worry if the socket moves around a little while you're doing this. When you have all the solder where you want it, just remove the iron and gravity should pull the socket down onto the pad before the solder sets. If you pull the iron off and the socket looks a little crooked, just quickly use the tip of the iron to push the socket down so it seats nicely. If need be, heat the solder again and manipulate the socket in place with the iron. Work your way through all 12 sockets. When finished, give a quick look from the side to make sure that they are all sitting level.



## TB550A Assembly Guide

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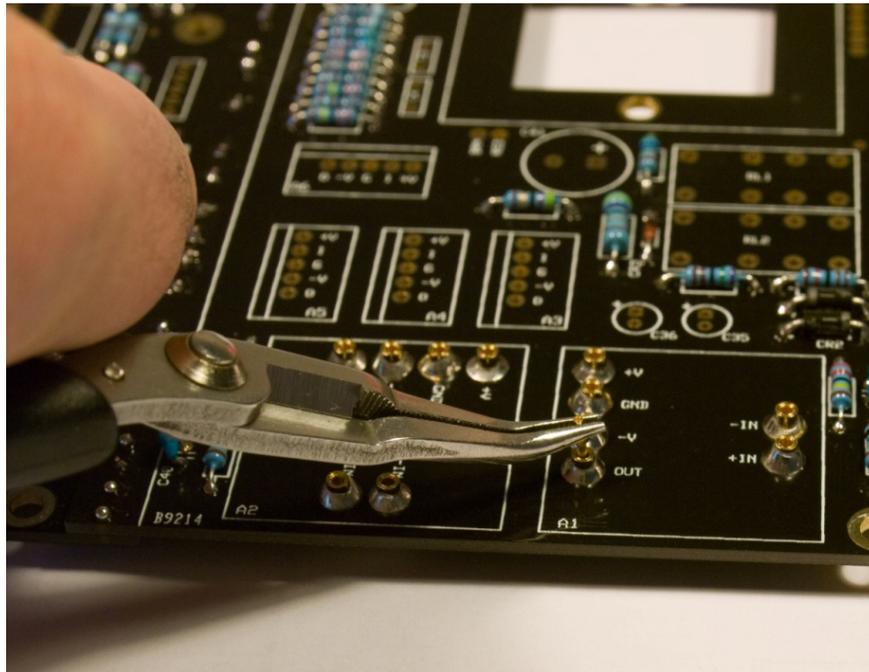
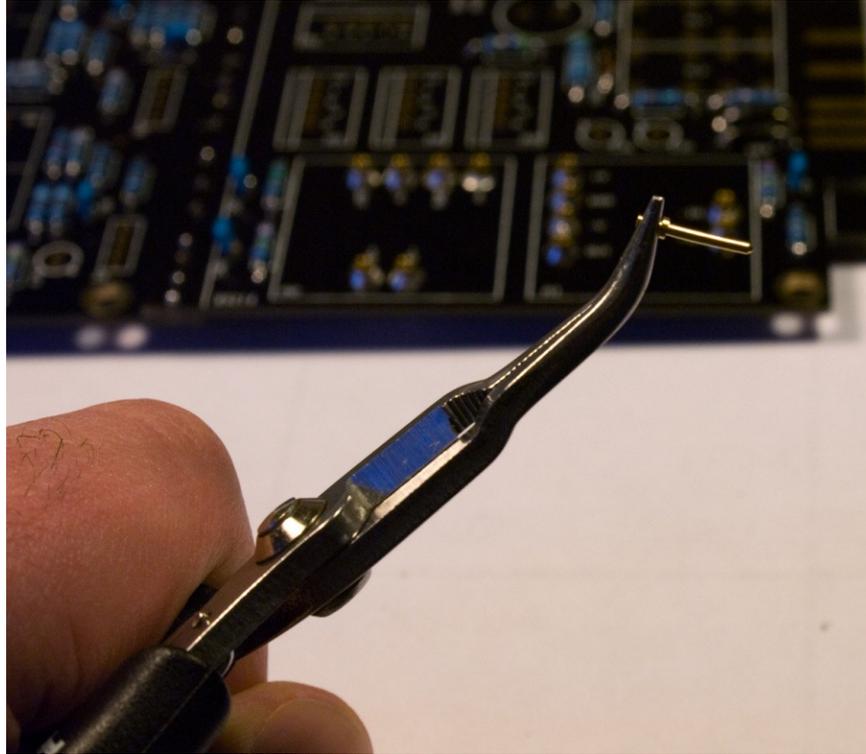


When finished, there is one additional step that needs to be done to make the sockets ready to accept a DOA. These sockets are designed to accept anywhere from a .032" to .046" size pin. Your DOA most likely has an .040" (1mm) pin. As such, the sockets are very tight when they are brand new. You'll want to break them in a bit prior to installing your expensive DOA so that you don't wind up pressing down too hard and breaking something.

Ideally, I like to use an actual pin that will be going on a DOA. If you are assembling your own and haven't done so yet, maybe you have one. You can grab the end in your small pliers and insert the pin in the socket. Just once in and out will do it. No need to spin it or anything further. If you get too crazy here, you can make the socket loose and unreliable!

## TB550A Assembly Guide

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If you don't have such a pin, a small paperclip will do the job too. Compare it to the pins on your DOA and make sure it is no bigger. Again, just once in and out will be fine.

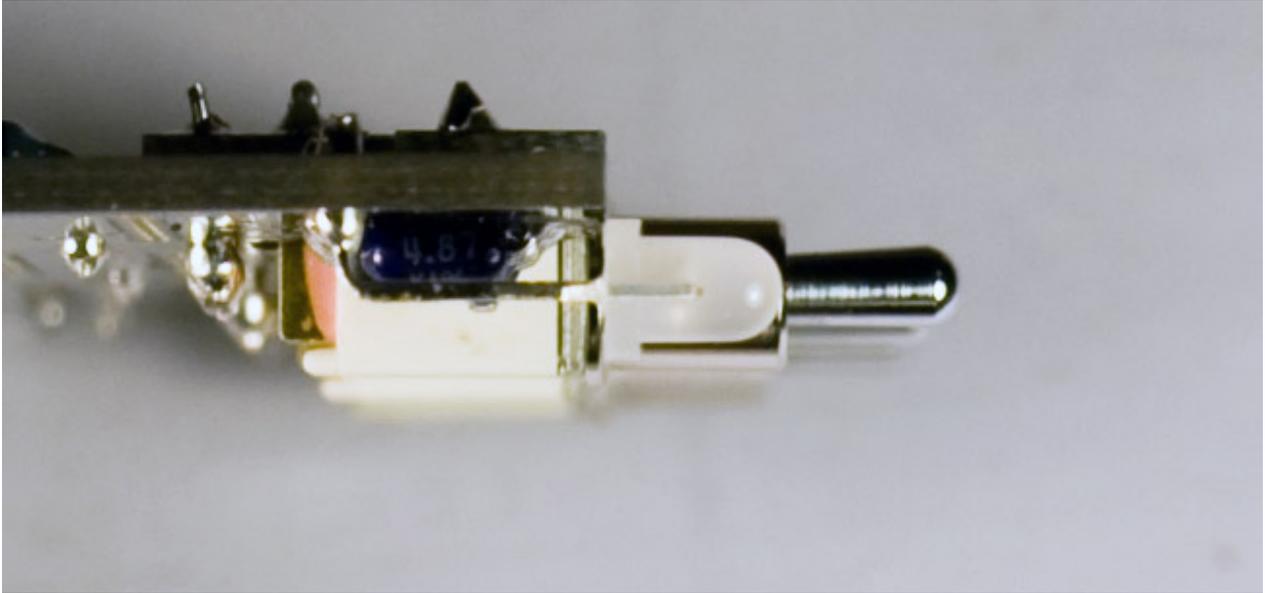


## TB550A Assembly Guide

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### LED

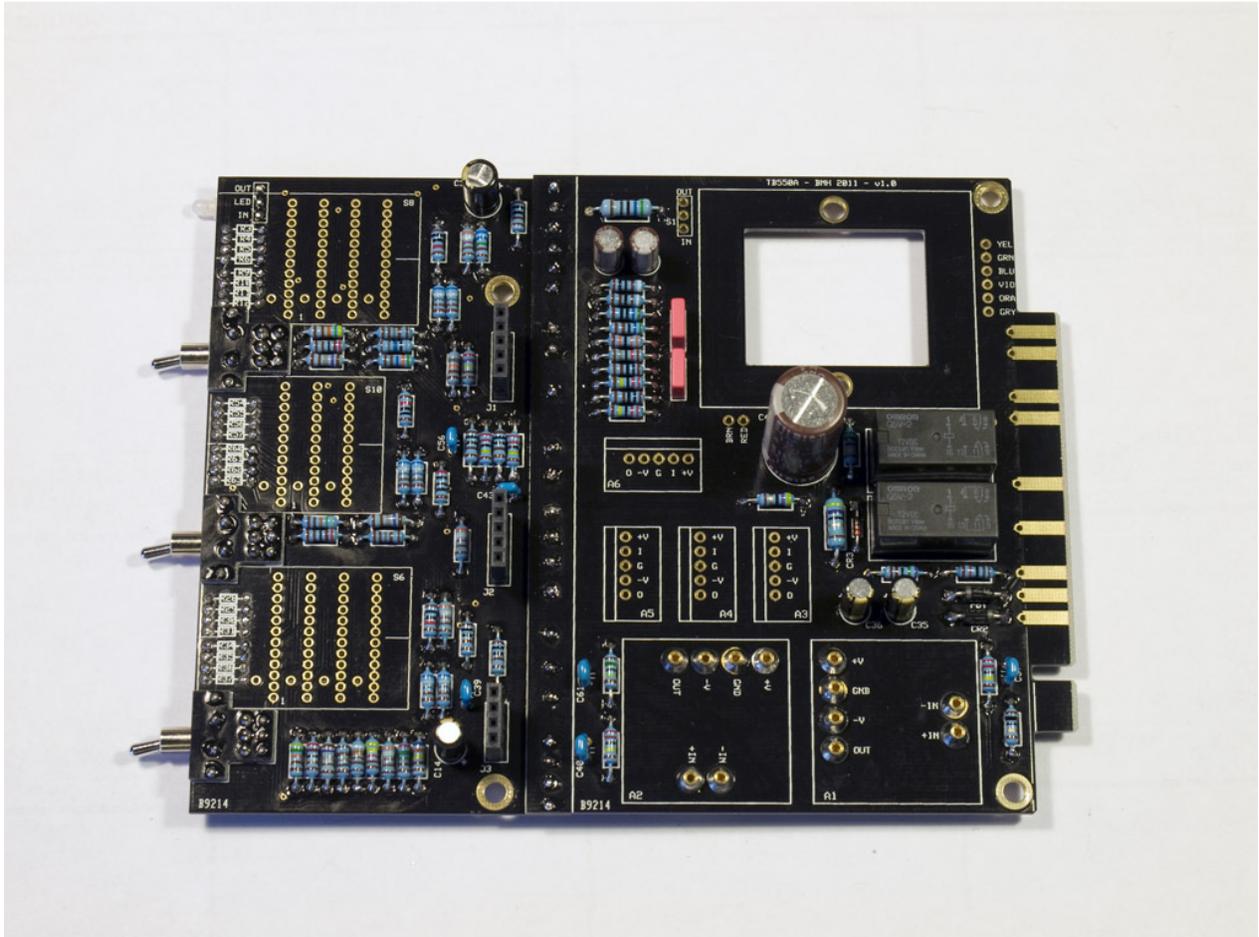
In order to have the LED be green for EQ in and red for EQ out, make sure that the shortest leg goes into the hole marked "in". What you're going for here is to have the back of the collar lined up with the front of the board and the top of the collar lined up with the bottom of the board. Further, the legs should be parallel to the board itself. That's a little hard to visualize, but the photo says it all. Don't worry if it's not exactly perfect, there's a little play here.



# TB550A Assembly Guide

## Samtec Sockets

Install the three Samtec sockets, J1-J3, which will connect the main PCB to the filter board. It is not critical to get these 100% perfect, but get as close as you can. Install each socket by soldering just one pin. Then by heating up the solder, you can maneuver the socket so that it sits flush to the board and is as close to perpendicular as possible.

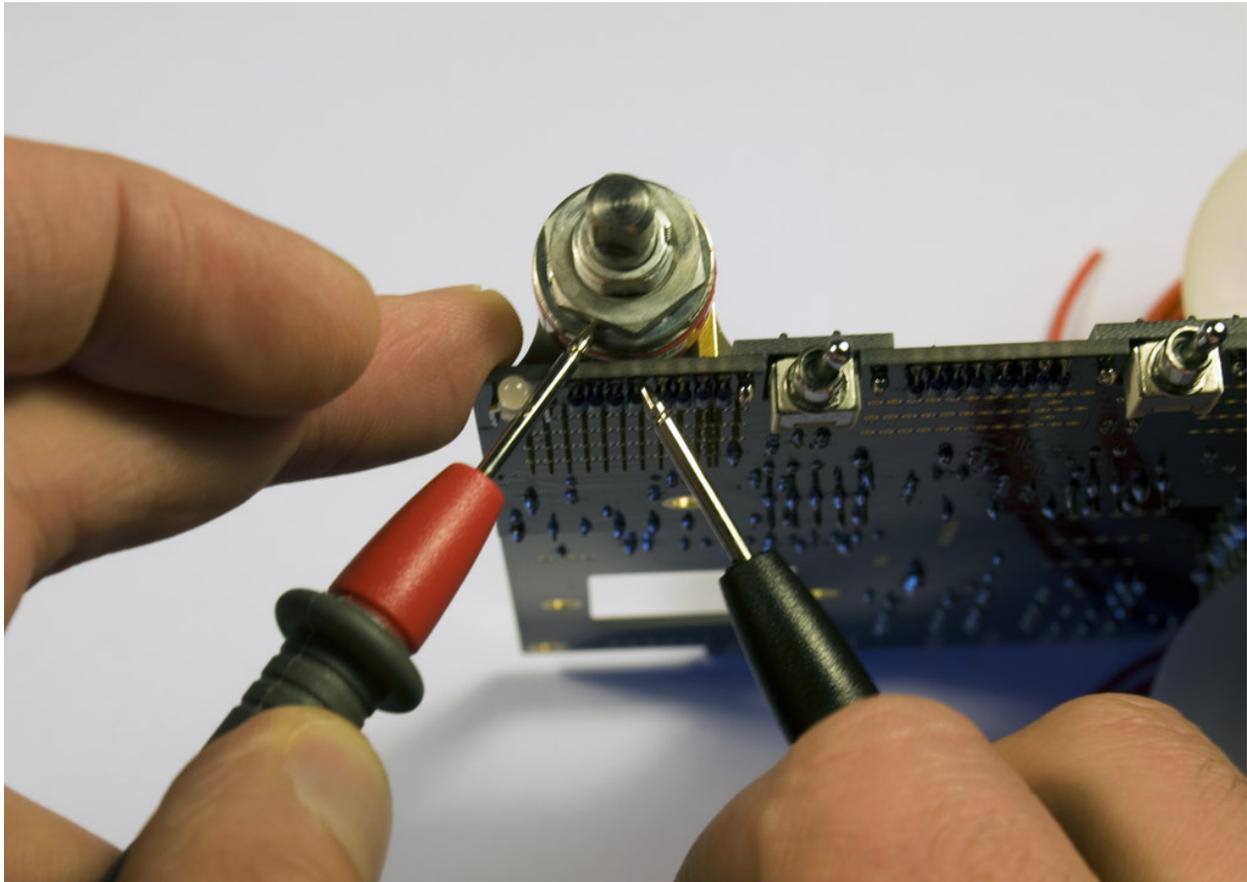


# TB550A Assembly Guide

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## Grayhill Switches

We'll start with the three deck middle switch that we partially installed while doing the toggle switches. If you'll remember, we were concerned about the small resistors underneath shorting to the switches when installed. You should check this now. Use your meter to check for continuity from the front legs of the two center-most resistors to the face of the switch. They should not be shorted! If so, you will be basically connecting that resistor to the chassis and causing very bad (potentially damaging) things to happen. If all is well, go ahead and solder the remaining pins on the switch. Double check your work to ensure that you didn't bridge any of the pins.



Repeat this process for the other two switches, remembering to tack down two pins and get the switch completely flush to the PCB before checking the resistors and then soldering the remaining pins.

This is an excellent time for another cup of coffee!

# TB550A Assembly Guide

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## Filter Board

The filter board is not terribly complicated to put together but very easy to screw up! To begin, use the sorting sheet at the end of this document to get organized on the WIMA caps. If you've received some blue caps, don't worry. Those are identical to the red ones, just older stock.

Some notes on component values. The BOM states everything in microfarads -  $\mu\text{F}$ . The capacitors are marked the same down to  $.01\mu\text{F}$ . The smaller caps are marked in picofarads. To convert,  $.001\mu\text{F}$  as indicated on the BOM is the same as 1000pF marked on the capacitor.  $.0033\mu\text{F}$  is 3300pF, etc. The Xicon polystyrene caps are all less than 1000pF and marked in picofarads. For those, you'll see for instance 680 marked on the capacitor which is equal to  $.00068$  on the BOM.

Everything on the filter board will be installed on the silkscreen side. The whole thing will be install upside down so you have a nice clean look facing out.

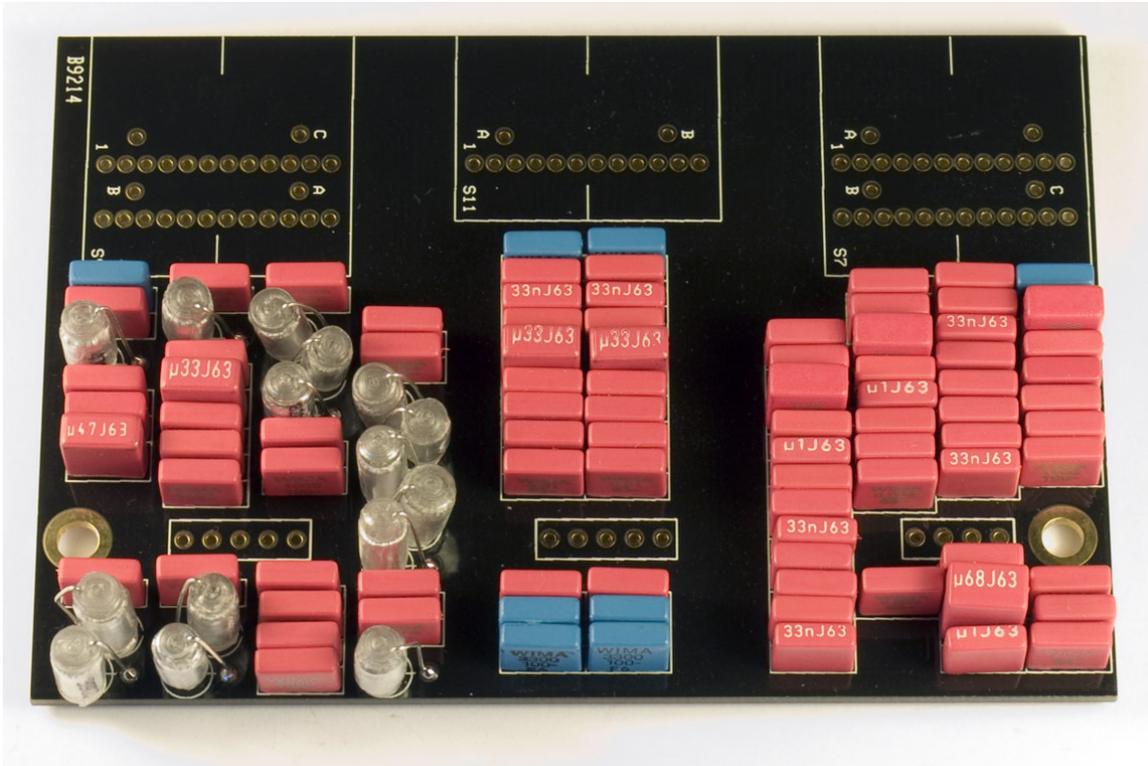
Start working through all the WIMA caps. I like to install all the shortest ones first. This is most of them. It just makes it all easier to work on.

Be **VERY** careful with making sure that everything goes in the right place! As with the resistors, the component numbering isn't always sequential so it's easy to make a mistake. When something gets installed in the wrong place, you're going to have a very hard time finding it later.

When installing the caps, make sure to clip the leads as close as possible to the board. There is very little space from where the bottom of the board will be to the right-hand edge of the card. If left too long, the leads could end up touching the card in the next slot. More on this later.

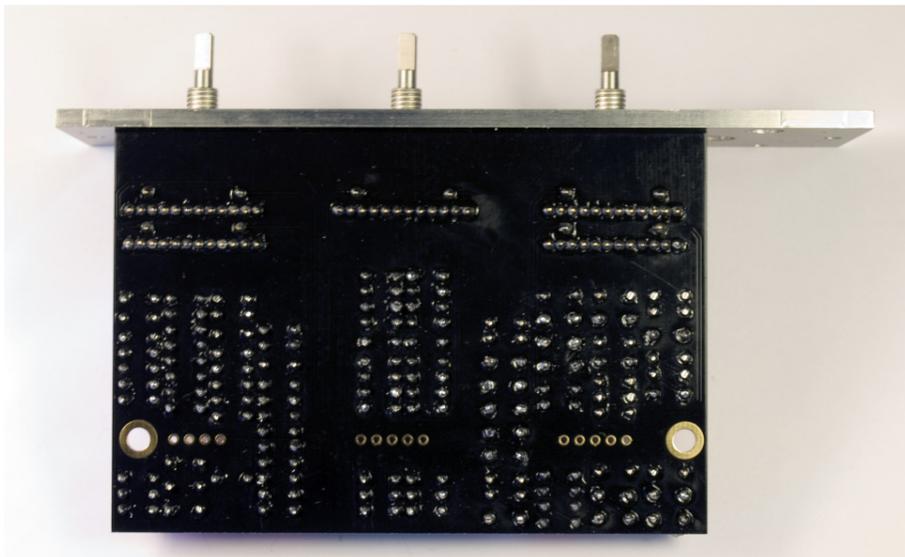
## Polystyrene Capacitors

These axial capacitors are installed upright. Simply bend one leg over and have at it.



## Grayhill Switches

Installing the switches on the filter board goes just like the main board. I start with both outside 2-deck switches. Tack the corners, get them flush, solder the remaining pins. Since the middle switch can rock forwards and back even if it's flush to the PCB, I use the front panel as an aligning guide to get it just right.

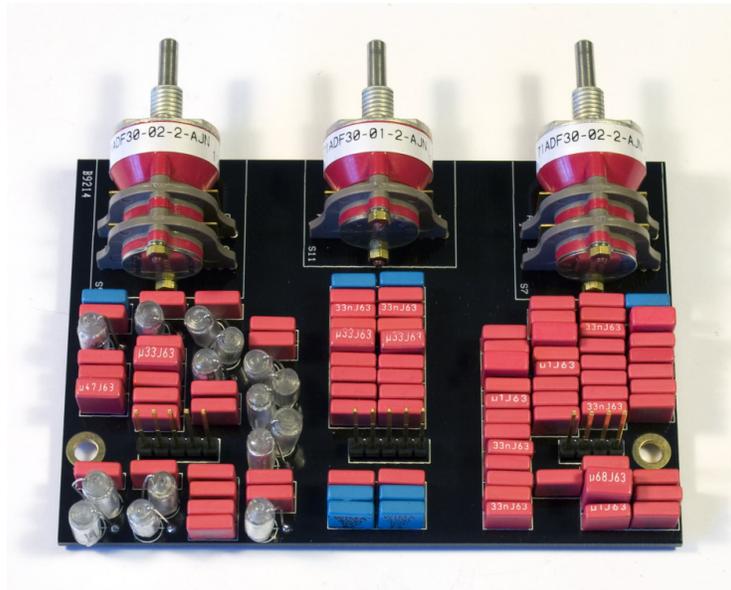


# TB550A Assembly Guide

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## Samtec Headers

Install the Samtec headers just like the sockets. Solder one pin and then manipulate the header so it is flush with the board and as close to vertical as you can get it. Solder the remaining pins.



**\*\*Coffee Break\*\***

# TB550A Assembly Guide

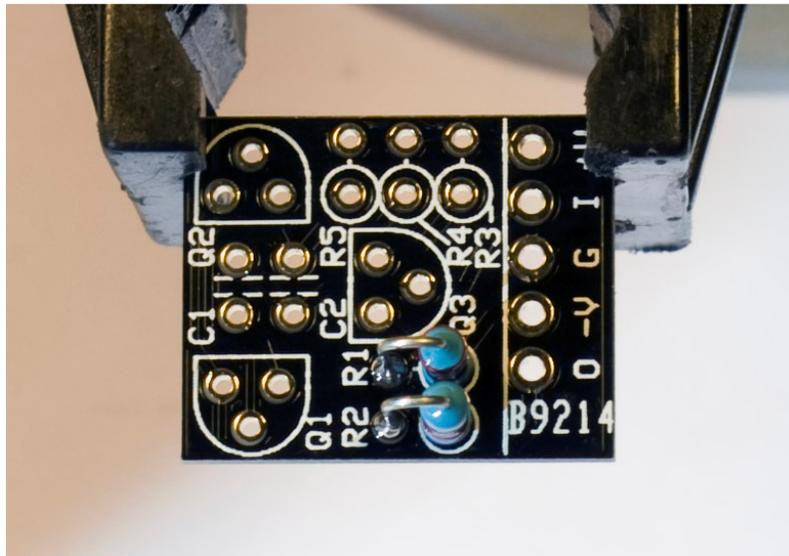
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## Discrete Voltage Followers

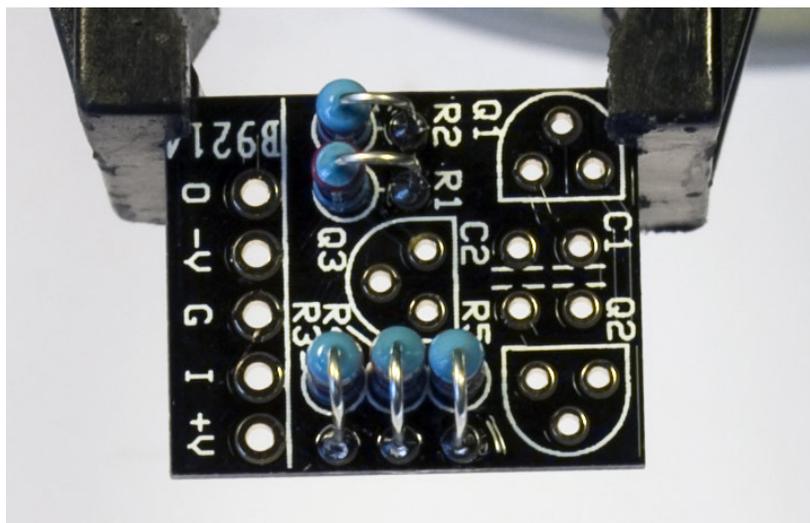
Building the four discrete voltage follower boards is a fairly simple task but the work is very tight, so be careful with your soldering. I'll simply walk through the recommended stuffing order. It helps to have a small Panavise or something similar to hold the boards while you're working on them.

Do the resistors first. They are installed upright, so you'll have to bend over one leg. I like to wrap it around the end of my small pliers to make a nice round bend.

R1 and R2:



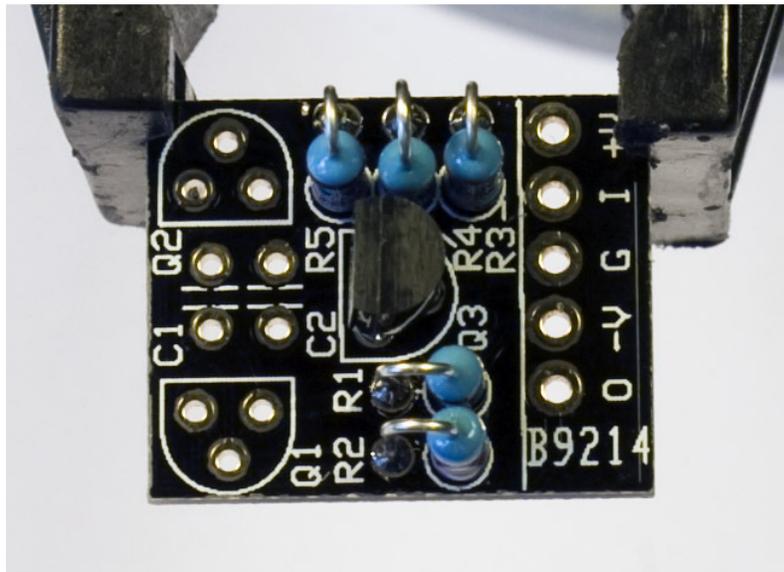
R3, R4, and R5:



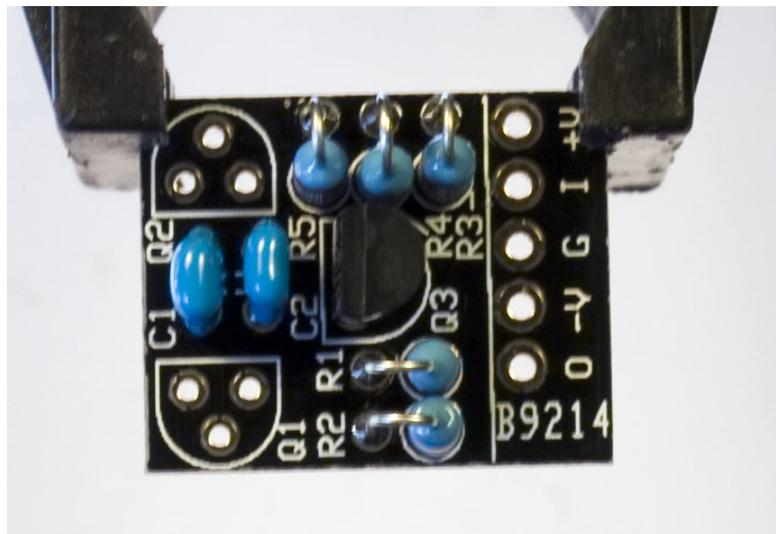
## TB550A Assembly Guide

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Q3. Note that Q1-3 look the same, but Q3 is actually different! It is the one that says 5087 on it. The other two say 5088.



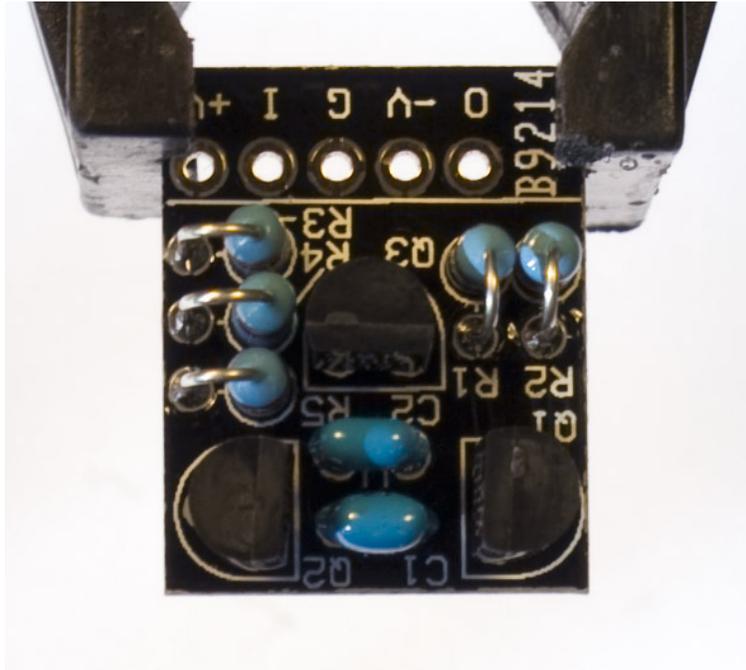
C1 and C2. **\*\*NOTE\*\*** C2 is only installed on **ONE** of the DVF boards!! That board will be installed in the A5 location. The remaining three only have C1.



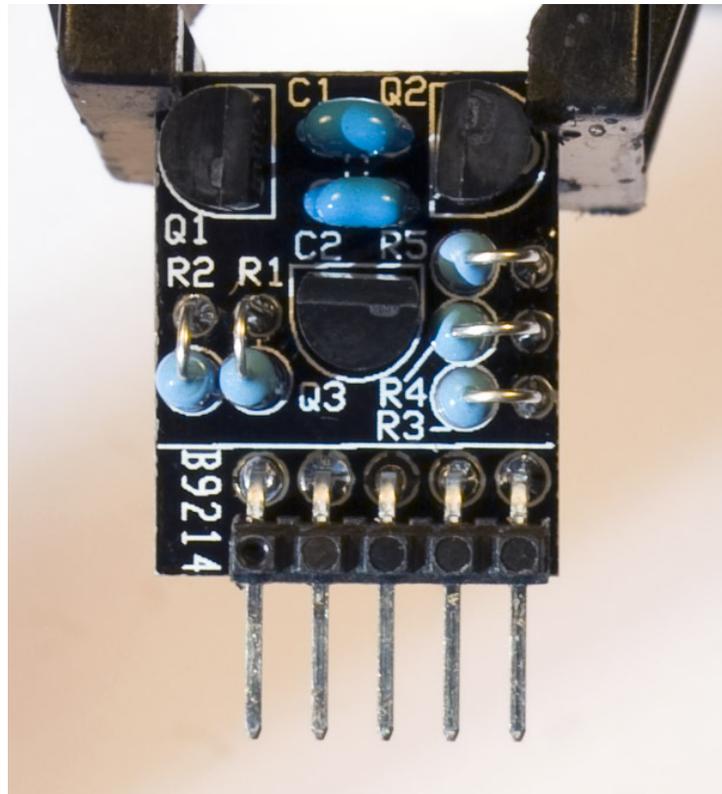
# TB550A Assembly Guide

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Q1 and Q2:



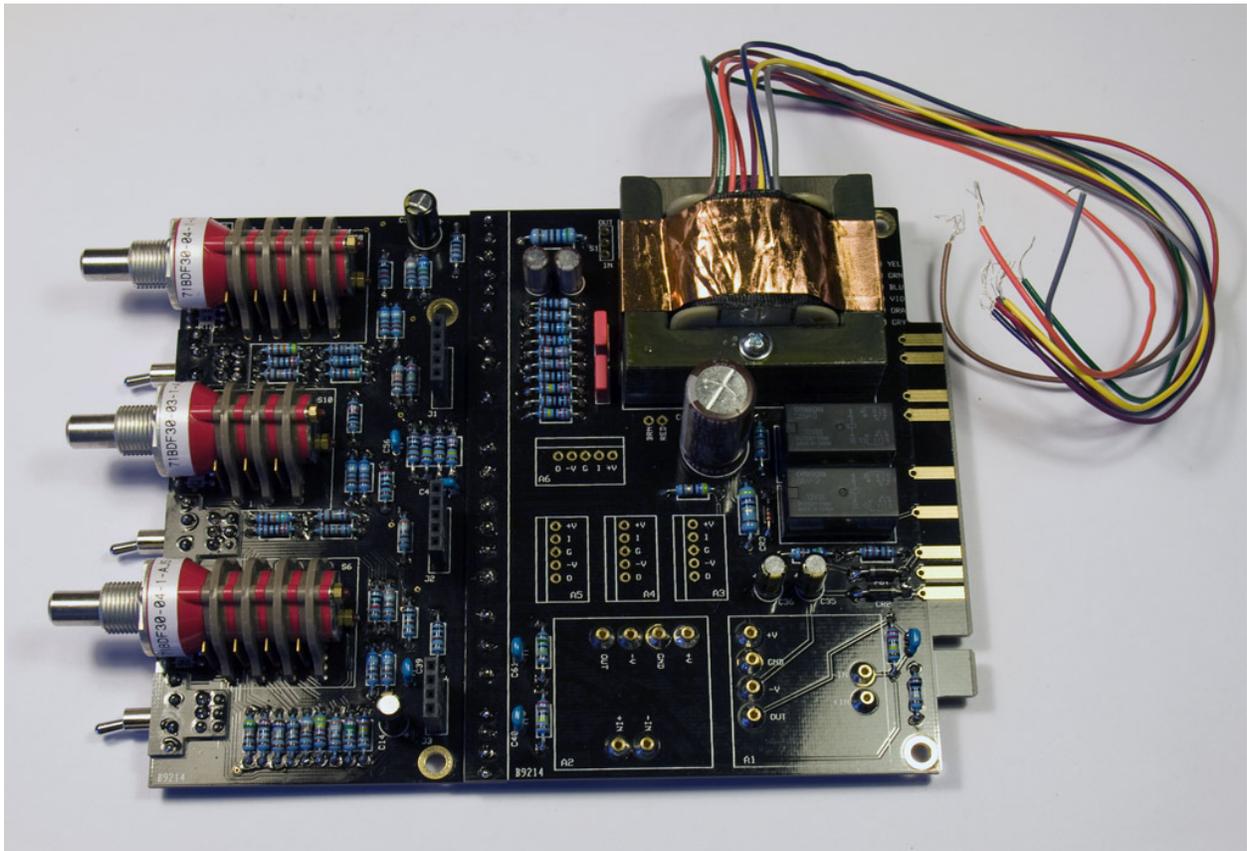
Right angle connector:



# TB550A Assembly Guide

## Transformer Install

Mount your 2503 transformer to the board. Use the 7/8" screws supplied with the kit. Put a washer on the screws and put them in the top of the transformer, then place the transformer into the board. Underneath, place a lock washer and then the nut. There will be a little play, so line the transformer up nicely so it's parallel with the top edge of the board and tighten it down. Optional – if you would like (or need) to sit the transformer up from the board a little bit for clearance, there are two extra washers in the kit that you can use between the transformer and the PCB.



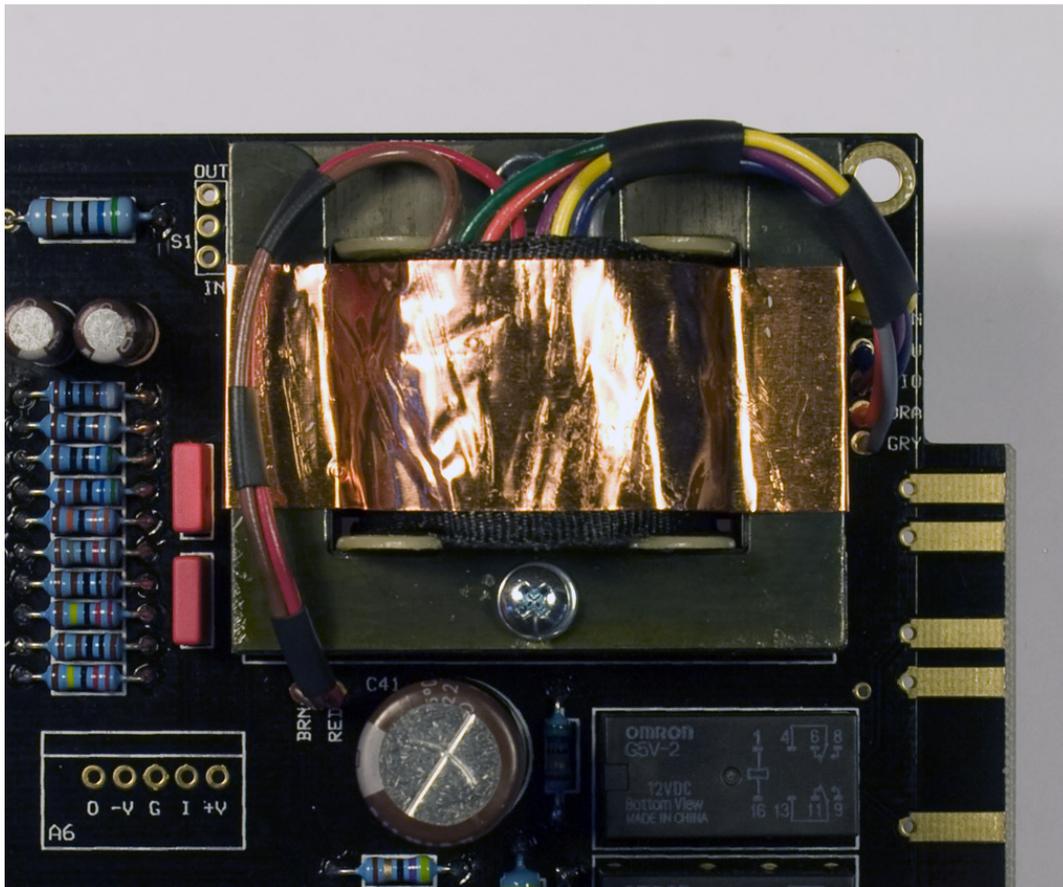
The leads all go in their respectively marked holes on the board. Decide how you will route the leads, measure them out, and cut to length leaving them just a little long. Strip the ends of the wires. Make sure to tin your leads appropriately before attaching them by running just a bit of solder into the exposed wire.

I like to use a bit of shrink tube to keep everything organized and protected. 1/16" will work nicely for the red and brown wires going to the bottom and 1/8" for the remainder of the wires going to the back. Install the shrink tube now and then solder each wire into its correct spot as marked on the board.

## TB550A Assembly Guide

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Note – we'll need some wire later to hook up the bypass switch. If you don't have any, the longer cut off leads will do nicely so you may want to save them.



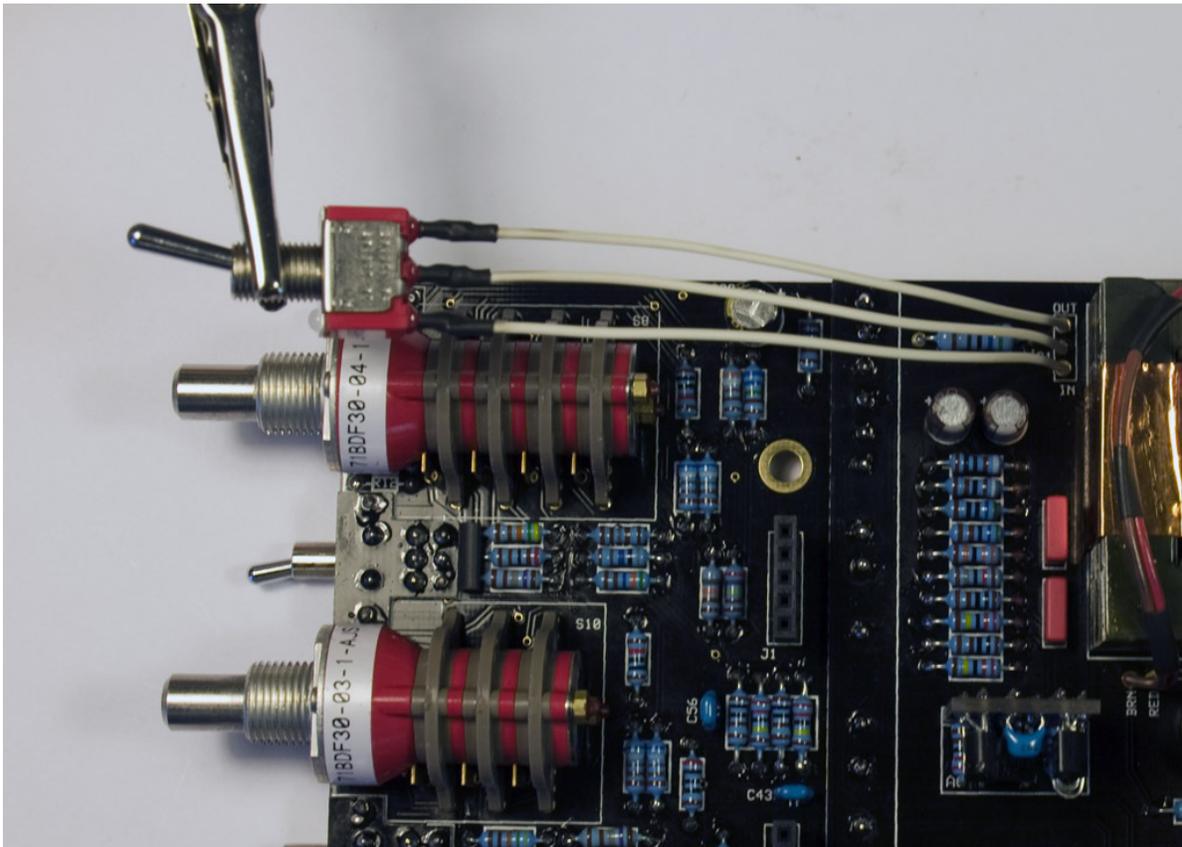


# TB550A Assembly Guide

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## Bypass Switch

The bypass switch is wired straight through. That is, the hole nearest the top of the board goes to the lead on the switch nearest the top, the middle to the middle, etc. I use 24 gauge wire on this, but 22 or 26 (like the leads from the transformer) would also be fine. Cut three lengths of wire 3-5/8" long, strip the ends, and be sure to tin the leads just like the transformer. It's not necessary, but some shrink tube on the switch end is nice. There's some slack there so that the wires can be bundled up and tied off to the standoff between the boards later.



# TB550A Assembly Guide

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## Grayhill Stop Pins

The picture below shows both boards in their final installed positions, so keep in mind that the filter board is upside down. All of the Grayhill switches ship in the "1" position, and that's where you want to leave them for this operation. That's also good to keep in mind for later when you install the knobs. Place the pins in the indicated holes and then put a sticker over the top to keep them in. When you do this, make sure to work over some sort of light colored surface so that when you drop one of these pins you can find it again! Notice that I said when, not if. The little things are wily and like to run away so be careful. If you do happen to lose one (or several), a cut off bit of resistor leg 4mm in length will work too.

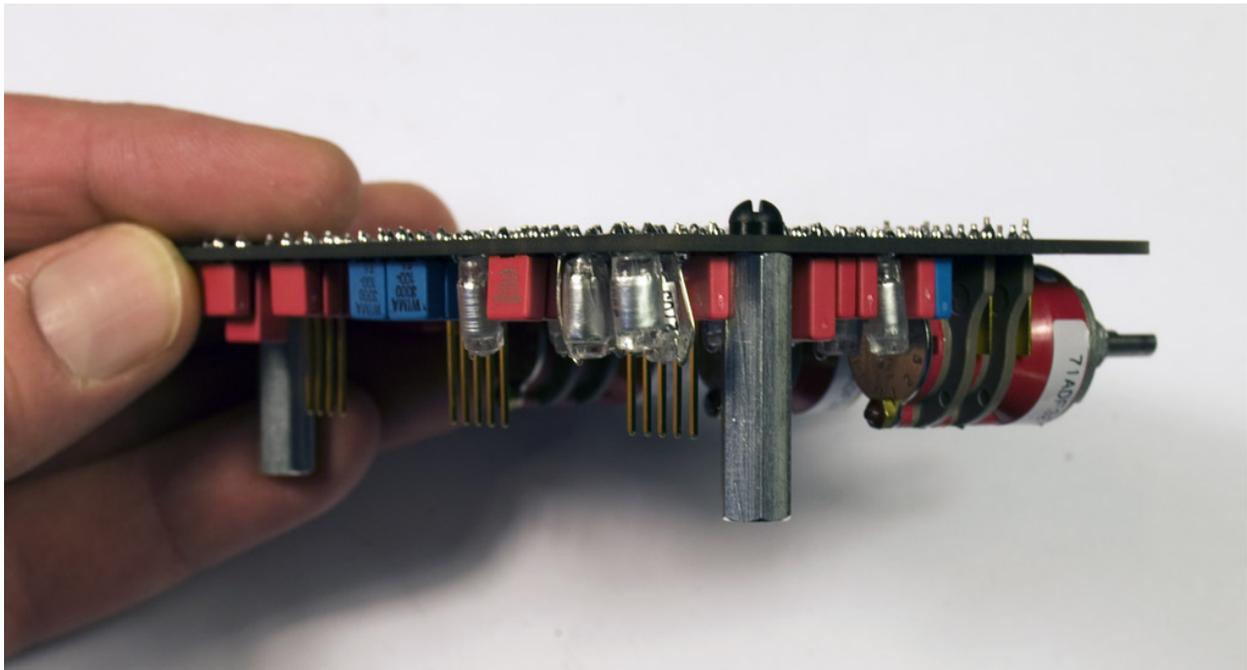


# TB550A Assembly Guide

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## Final Assembly

Time to put it all together!! Start by attaching the 1" standoffs to the filter board. You'll use the nylon screws and washers for this. The idea here is that the head of the nylon screw is the tallest part of the board and will give us protection from any module in the next slot to the right intruding on our space and potentially grounding out the components in that section. The washer gets the screw to just the right height. Be sure not to go too hard on these screws because it's easy to strip the threads. There is a little bit of play in these, so don't make them tight yet.

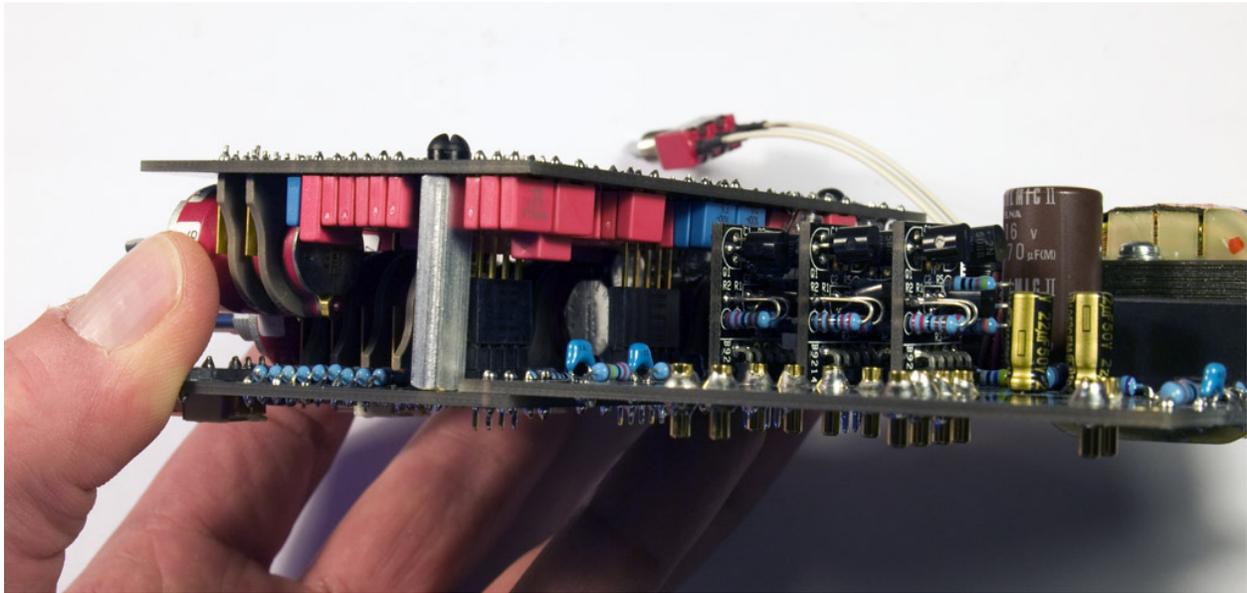


Install the standoffs in the L-bracket if they aren't still there from before. Again, the 1/4" standoffs go in the back, the 3/16" standoffs in the front. On the front standoffs, put the screw in just far enough so that it holds the standoff in place but doesn't protrude through the top.

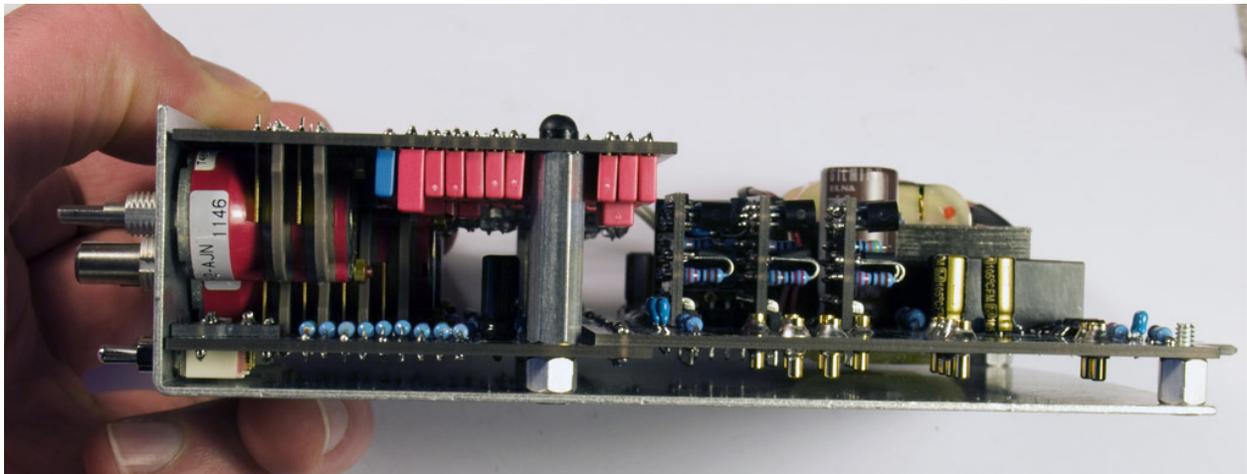
## TB550A Assembly Guide

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Attach the filter board to the main board. Make sure that all three Samtec headers get into their sockets.



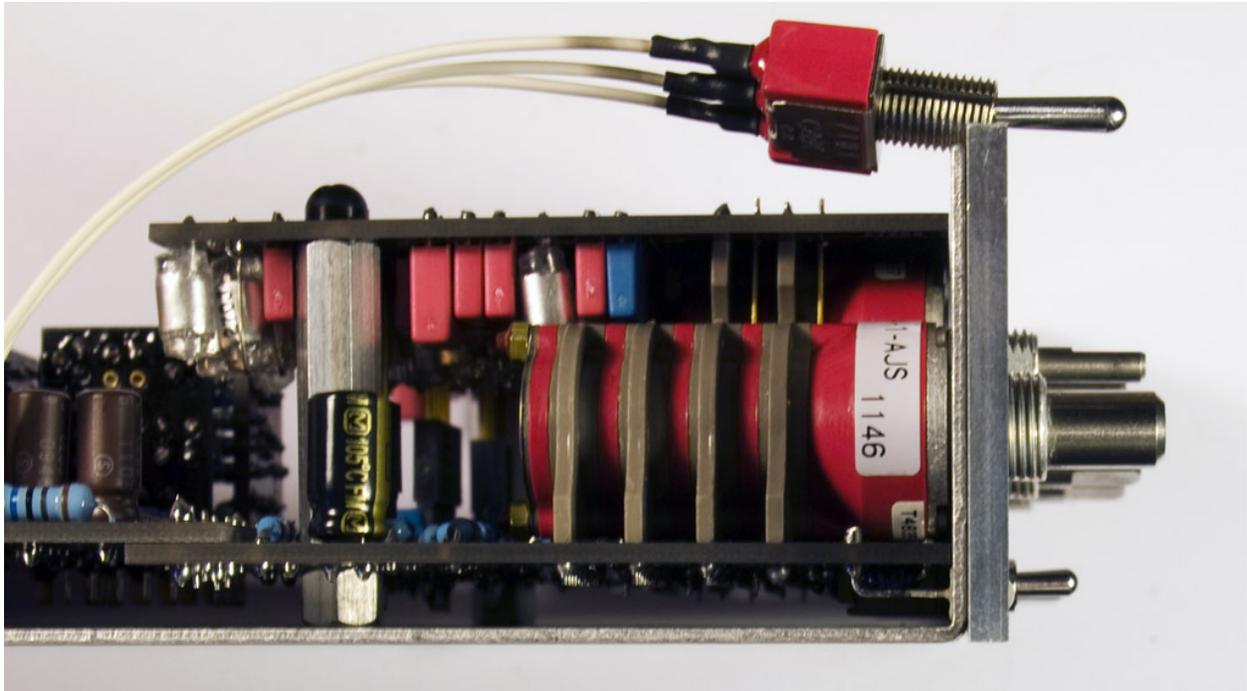
Slide the whole assembly into the L-bracket. At this point, you can screw in the screws in the 3/16" standoffs. They should grab the 1" standoffs above and hold the whole thing together. Don't make them tight just yet.



## TB550A Assembly Guide

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Put the front panel on. Tolerances are tight so it might take a bit of wrangling but if you followed all the alignment steps above, you should be able to get it to sit nicely. You may have to move the LED slightly to get it in the right place. Make sure that the LED leads don't touch the L-bracket.



Put the nuts on the six switches. You won't be using the lock washers that came with them, so you can put those aside. On the smaller shaft switches on the filter board, be careful that you use the nuts that came with them and not the nuts for the bypass switch! They look the same but the thread is different. You can tell them apart easily because the nuts for the bypass switch are shiny and the nuts for the Grayhills are a dull finish. On the boost/cut switches, you can put aside both the lock washers and the nuts that came with them. You will find an additional three black nuts in the kit to use here. Those black nuts make a much nicer finish look since they protrude from under the knobs just slightly.

Tighten down all six of the switch nuts using pliers or sockets. I like to put a bit of masking tape on the end of the pliers so that the front panel doesn't get scratched up.

## TB550A Assembly Guide

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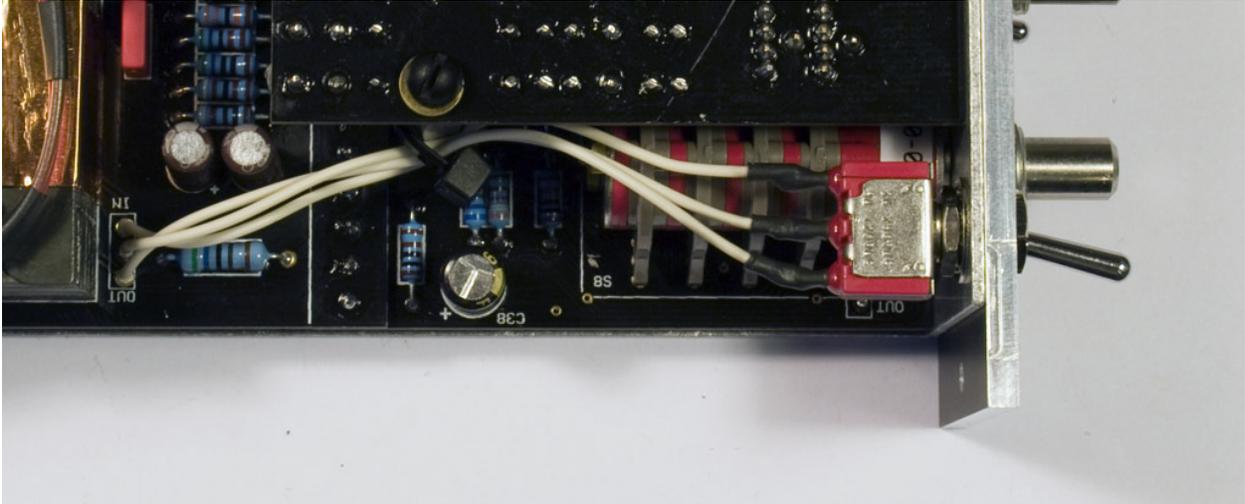


You should now tighten all the screws in the standoffs. Also, put a lock washer and nut on the rear screws and make them tight.

Install the bypass switch by first placing a nut (remember, these are the shiny 1/4-32 nuts) and lock washer on the shaft. These go on the inside of the L-bracket. Put the switch through the front panel and screw on the other nut. By adjusting the inside nut, you should be able to make the switch sit nice and flush with the front panel. I use a small tie-wrap here to tie off the slack in the wires to the standoff.

## TB550A Assembly Guide

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### **Knobs**

To install the knobs, remember that the Grayhill switches ship in the "1" position. That is, each of the gain switches are pointed at -12 and the frequency selects are pointed at their lowest setting. Simply slide the switches on and tighten the set screws. You will need a .05" Allen (hex) wrench for the blue knobs and 1/16" for the clear knobs.

### **Done!!**

That's it! Install your DOAs, fire it up, and have fun! If you followed all of the instructions carefully, you should be well caffeinated at this point and ready to stay up all night recording. Enjoy!

# TB550A Assembly Guide

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## Bill of Materials

Desg.	Desc.	Notes
R1	11K	
R2	7.5K	
R3	4.87K	Small
R4	4.53K	Small
R5	3.32K	Small
R6	3.48K	Small
R7	6.98K	
R8	6.98K	
R9	3.48K	Small
R10	3.32K	Small
R11	4.53K	Small
R12	4.87K	Small
R13	910R	
R14	9.1K	
R15	330K	
R16	560R	
R17	5.6K	
R18	4.53K	
R19	2.1K	
R20	1.78K	
R21	1.18K	
R22	3.92K	
R23	9.31K	
R24	4.42K	
R25	3.92K	
R26	2.55K	
R27	6.34K	
R28	4.87K	Small
R29	4.53K	Small
R30	3.32K	Small
R31	3.48K	Small
R32	6.98K	
R33	6.98K	
R34	3.48K	Small
R35	3.32K	Small
R36	4.53K	Small
R37	4.87K	Small
R38	4.53K	
R39	2.1K	
R40	1.78K	
R41	1.18K	
R42	3.92K	
R43	8.06K	
R44	5.36K	
R45	3.83K	
R46	2.74K	
R47	6.65K	
R48	10K	
R49	2.2M	
R50	10K	

# TB550A Assembly Guide

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R51	2.2M	
R52	10K	
R53	1K	
R54	4.87K	Small
R55	4.53K	Small
R56	3.32K	Small
R57	3.48K	Small
R58	6.98K	
R59	6.98K	
R60	3.48K	Small
R61	3.32K	Small
R62	4.53K	Small
R63	4.87K	Small
R64	4.53K	
R65	2.1K	
R66	1.78K	
R67	1.18K	
R68	3.92K	
R71	1K	
R72	1K	
R73	1K	
R75	1K	
R76	56R	
R77	1K	
R78	2.2M	
R79	2.2M	
R80	1.5M	
R81	2.2M	
R82	2.2M	
R99	1K	
R100	560R 1/2W	LED
R101	47R	
R106	200R	
R107	18K	
R110	10R	
R111	47R 1/2W	Relay
C1	4.7u 63v	Elec
C2	.47u 63v	Elec
C3	.01u	Film
C4	.001u	Film
C14	22u 50v	Elec
C35	22u 50v	Elec
C36	22u 50v	Elec
C37	68p	Ceram 68J
C38	120u 16v	Elec
C39	47p	Ceram 47J
C40	120p	Ceram 121J
C41	470u 16v	Elec
C43	47p	Ceram 47J
C56	47p	Ceram 47J
C61	10p	Ceram 10J

# TB550A Assembly Guide

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CR1	1N4004
CR2	1N4004
CR3	1N4148
DS1	3mm Com. Anode
RL1	G5V DPDT 12V
RI2	G5V DPDT 12V

## Filter Board

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C100	.01u
C101	.015u
C102	.033u
C103	.01u
C104	.015u
C105	.033u
C106	.01u
C107	.022u
C108	.022u
C109	.01u
C110	.022u
C111	.022u
C112	.001u
C113	.033u
C114	.047u
C115	.001u
C116	.033u
C117	.047u
C118	.015u
C119	.1u
C120	.15u
C121	.015u
C122	.1u
C123	.15u
C124	.047u
C125	.047u
C126	.22u
C127	.047u
C128	.047u
C129	.22u
C130	.01u
C131	.01u
C132	.0047u
C133	.01u
C134	.01u
C135	.0015u
C136	.047u
C137	.22u
C138	.0047u
C139	.1u
C140	.68u
C141	.0033u

# TB550A Assembly Guide

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C200	.0033u
C201	.0033u
C202	.0022u
C203	.0033u
C204	.0022u
C205	.0033u
C206	.0022u
C207	.0022u
C208	.01u
C209	.0022u
C210	.0022u
C211	.01u
C212	.015u
C213	.33u
C214	.0068u
C215	.015u
C216	.33u
C217	.0068u
C218	.0033u
C219	.0068u
C220	.033u
C221	.0033u
C222	.0068u
C223	.033u
C300	.0015u
C301	.01u
C302	.015u
C303	.00082u
C304	.0015u
C305	.001u
C306	.00039u
C307	.00047u
C308	.001u
C309	.00068u
C310	.00068u
C311	.0022u
C312	.0047u
C313	.015u
C314	.33u
C315	.001u
C316	.00033u
C317	.001u
C318	.00027u
C319	.00039u
C320	.001u
C321	.0047u
C322	.0047u
C323	.47u
C324	.0033u
C325	.022u
C326	.00047u
C327	.0022u

# TB550A Assembly Guide

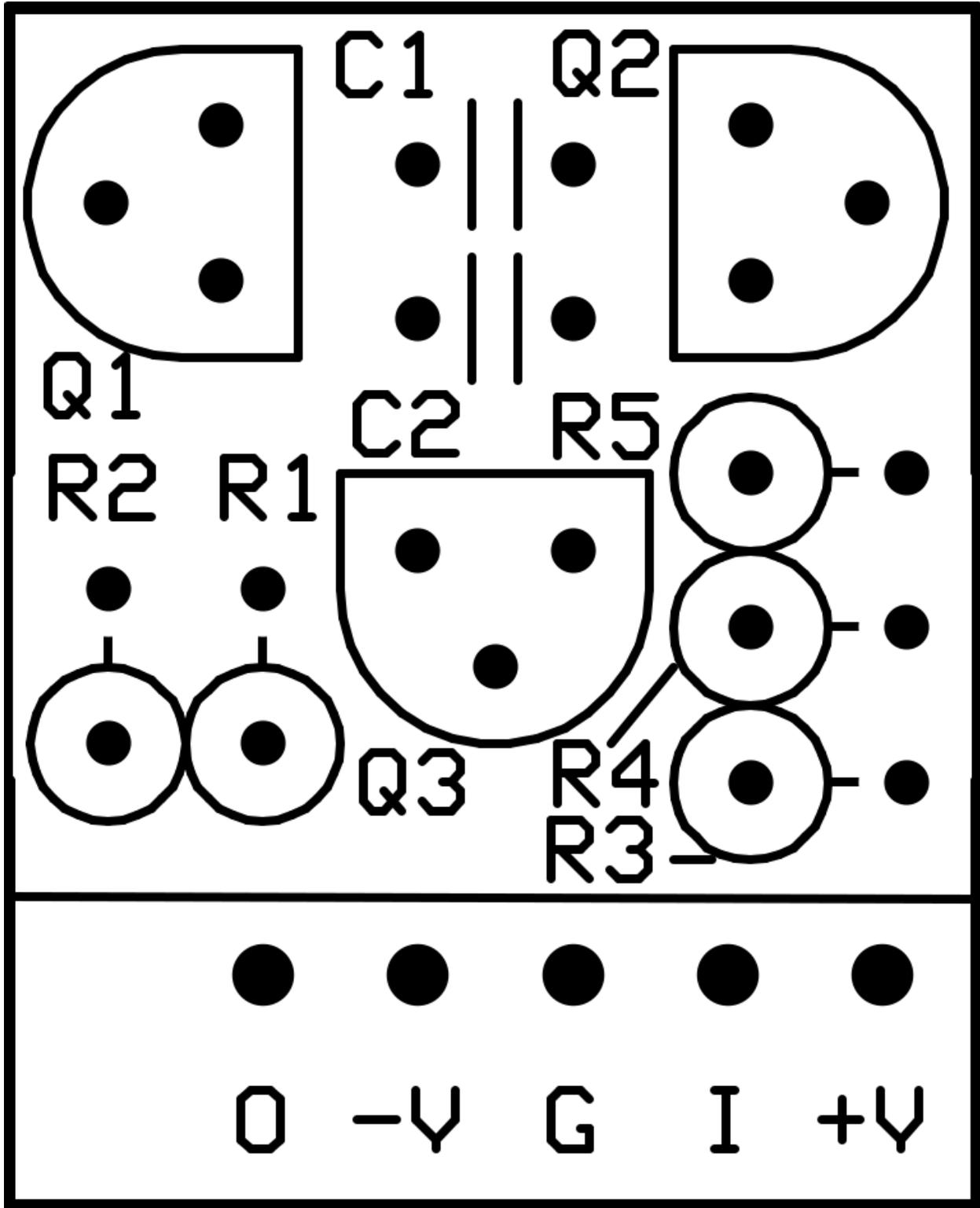
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C328	.00047u
C329	.0022u
C330	.00033u
C331	.00082u
C332	.0022u
C333	.00027u
C334	.00033u
C335	.0047u
C336	.0068u
C337	.068u
C338	.00047u

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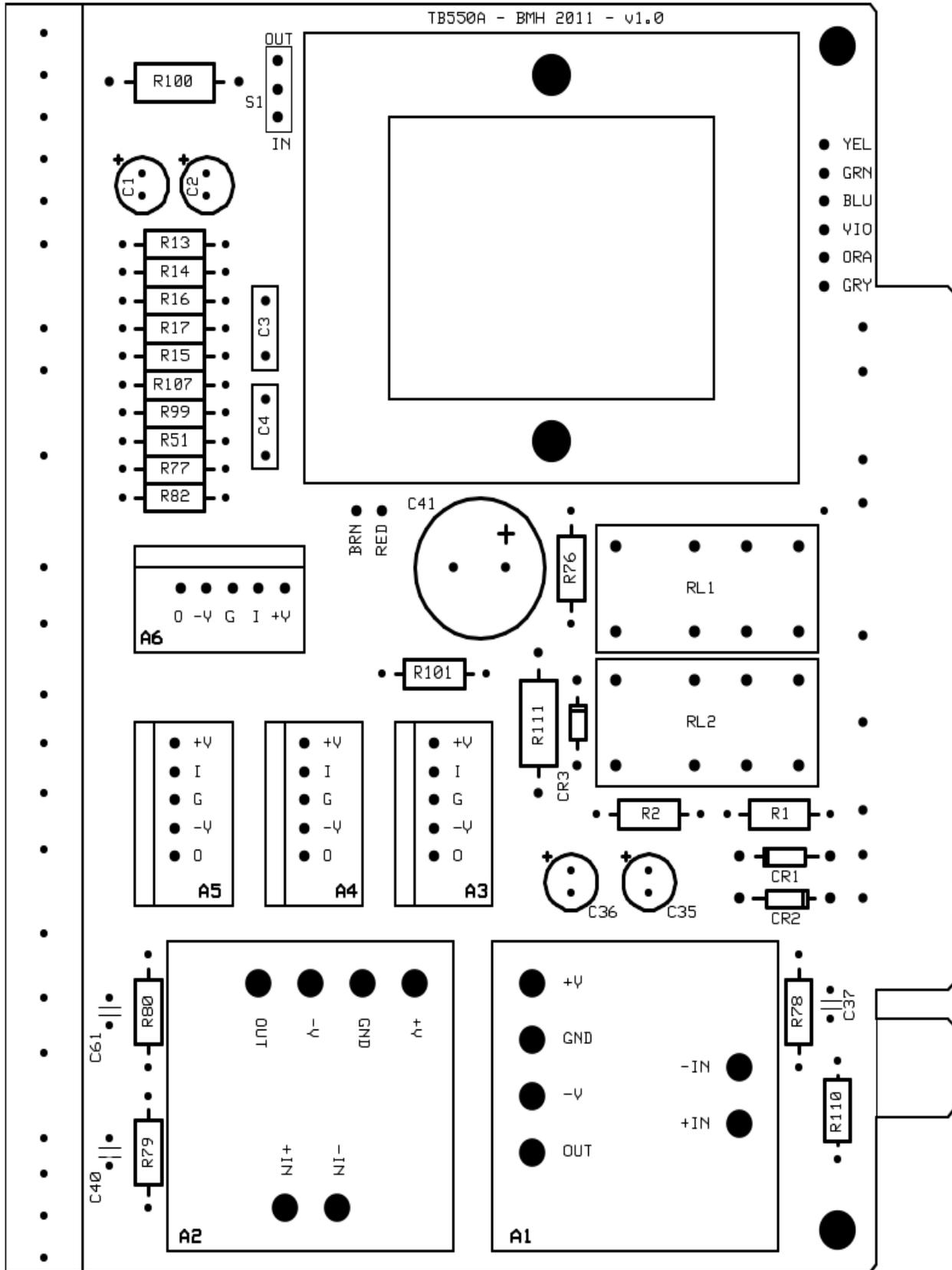
**DVF**

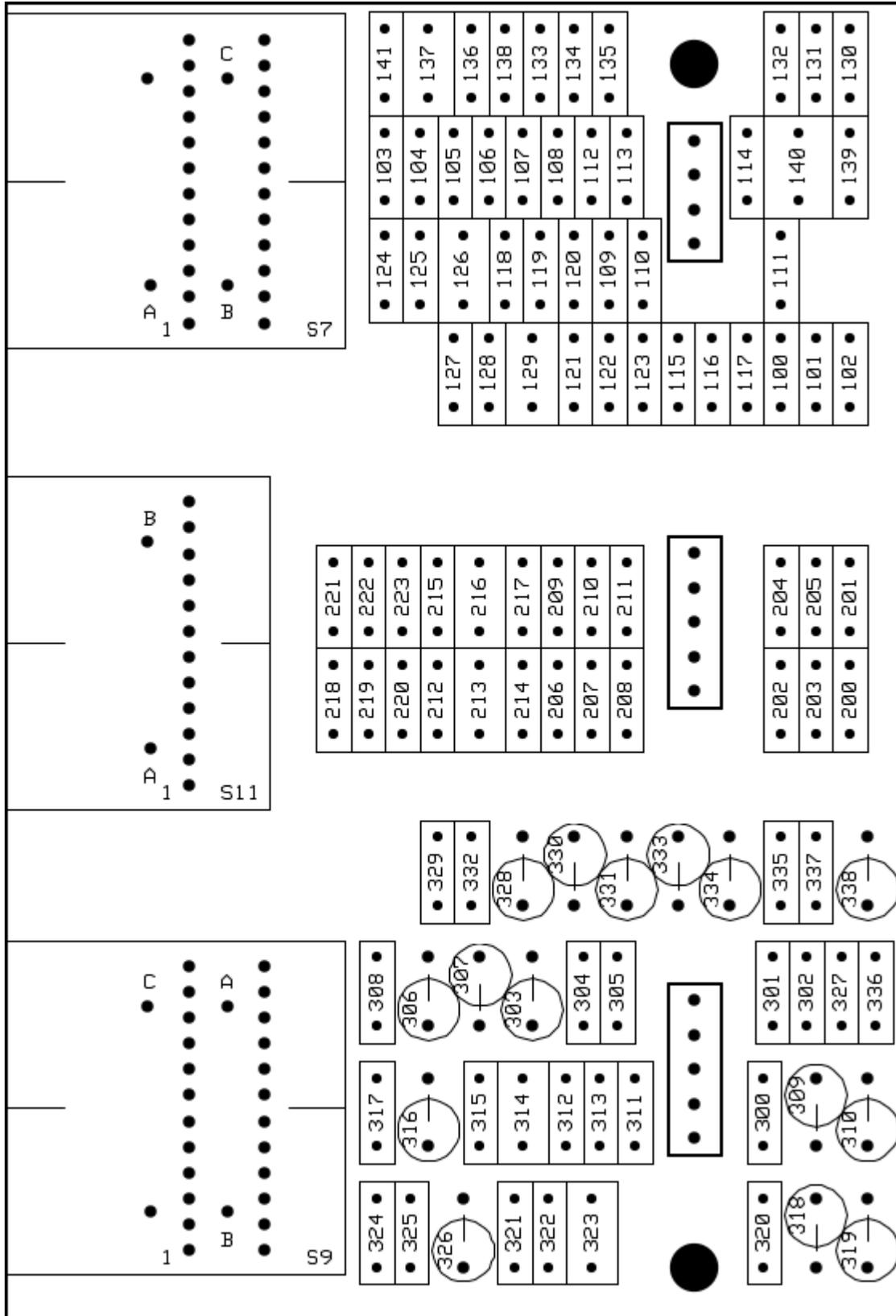
R1	200R	
R2	2.2K	
R3	39K	
R4	36K	
R5	430R	
Q1	2N5088	
Q2	2N5088	
Q3	2N5087	
C1	39p	39J
C2	22p	22J ** Only on A5





# TB550A Assembly Guide





## Resistors

10R – Qty 1	47R – Qty 1	56R – Qty 1
200R – Qty 5 ** Qty 4 on DVF **	430R – Qty 4 ** On DVF **	560R – Qty 1
910R – Qty 1	1K – Qty 7	1.18K – Qty 3
1.78K – Qty 3	2.1K – Qty 3	2.2K – Qty 4 ** On DVF **

## Resistors

2.55K – Qty 1	2.74K – Qty 1	3.83K – Qty 1
3.92K – Qty 4	4.42K – Qty 1	4.53K – Qty 3
5.36K – Qty 1	5.6K – Qty 1	6.34K – Qty 1
6.65K – Qty 1	6.98K – Qty 6	7.5K – Qty 1

## Resistors

8.06K – Qty 1	9.1K – Qty 1	9.31K – Qty 1
10K – Qty 3	11K – Qty 1	18K – Qty 1
36K – Qty 4 ** On DVF **	39K – Qty 4 ** On DVF **	330K – Qty 1
1.5M – Qty 1	2.2M – Qty 6	

## WIMA Caps

0.001uF – Qty 8 ** Qty 1 on Main PCB **	0.0015uF – Qty 3	0.0022uF – Qty 10
0.0033uF – Qty 8	0.0047uF – Qty 6	0.0068uF – Qty 5
0.01uF – Qty 12 ** Qty 1 on Main PCB **	0.015uF – Qty 8	0.022uF – Qty 5
0.033uF – Qty 6	0.047uF – Qty 7	0.068uF – Qty 1

**WIMA Caps**

0.1uF – Qty 3	0.15uF – Qty 2	0.22uF – Qty 3
0.33uF – Qty 3	0.47uF – Qty 1	0.68uF – Qty 1

### Polystyrene Caps

270pF (0.00027uF) – Qty 2	330pF (0.00033uF) – Qty 3	390pF (0.00039uF) – Qty 2
470pF (0.00047uF) – Qty 4	680pF (0.00068uF) – Qty 2	820pF (0.00082uF) – Qty 2