"Thomas Henry Super Controller Module"

Eurorack Version

Build and Test Manual Doc. Rev. A

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SCM Overall Description:

This module & SMT PCB was designed and manufactured with kind permission of "FONITRONIK" and Thomas Henry. It is the Supercontroller Circuit published in Polyphony Issue Sept./Oct. 1981 and his book "Build a better music Synthesizer" 1987. This version of the module is a Eurorack format with some extra functionality added such as an extra delay mode and external sample & hold clock. To quote Thomas Henry: "If the VCO, VCF, and VCA form the heart of a synthesizer, then this module is surely the brain! It gives you most standard controller options (LFO, noise source, and sample and hold), but also includes some extras. The heart of the Super Controller Module (SCM) is the SN76477. This chip is known as a complex sound generator and was originally designed to provide sound effects for pinball machines and other computer type games." Another use of the SN76477 chip is in the famous video game from 1978 called Space Invaders. The chips role in the Space Invaders game was to meerly produce the flying saucer sound thus it was hardwired for this single sound on the games sound board. Other sound generating circuits on the sound board filled the roles of all the other sounds for the game. Seems a waste and Thomas Henry certainly recognized all the chips possibilities many years ago. A great companion to the Thomas Henry SCM is the **SN Voice Module** shown below of which is **also a Eurorack version available at Synthcube.**

Eurorack Thomas Henry SN Voice

Functional description:

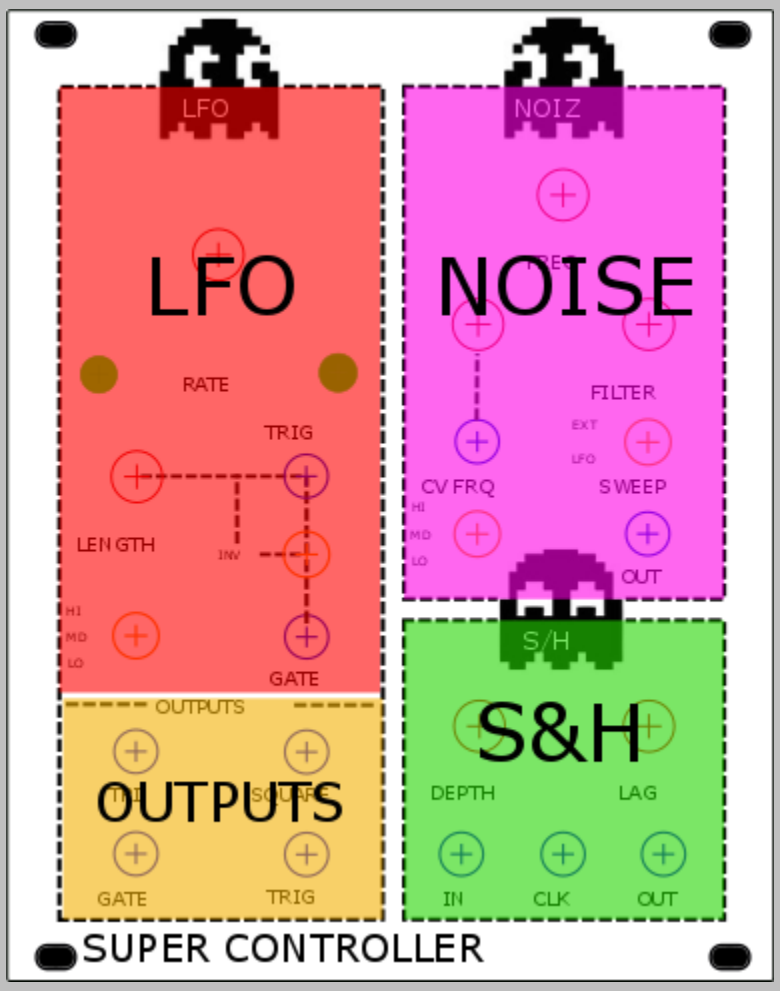


Figure 1 SCM functional sections

The picture above in figure 1 shows the front panel of Euro module. Each section is color coded for easy identification for this discussion.

The **LFO** section located in top left: You can choose three modes of operation with the three position switch which are two delay modes and a gated mode. In the INV delay mode, switch in the middle position, the LFO turns off when triggered and after a certain amount of time, depending on the LENGTH knob setting, will turn back on . In the TRIG delay mode , switch in the left position, the LFO will be off and then and turn on immediately when triggered, stay active for a delay time depending on the LENGTH setting, will turn back off. It should be noted that turning the LENGTH knob CW increases delay and CCW decreases the delay time. In GATE mode, switch in the right position, the LFO is always "on" until you plug a

cable into the GATE jack. From now on the LFO is only "on" when a gate signal is present. The status LED on the right indicates the LFO on-off-status. There is a selector for the LFO range of which there are three (LO, MID, HI), and a RATE control with a sub-hertz to approximately 350 Hz. The LED on the left flashes at the rate the LFO.

There are four **OUTPUTS** in the lower left: TRIANGLE, SQUARE, GATE, and TRIGGER that are all derived from the LFO. The 0V to approx 10V GATE output is derived from the square wave output. The TRIGGER is derived from the triangle and delivers a positive 1ms pulse. *Don't forget:* The outputs are gateable by the DELAY and GATE modes in the LFO section. The SQUARE and TRIANGLE are both bi-polar signals and can be used as audio sources also.

The S/H section: The **S/H** in the bottom right, the CLK input is internally normalled to the LFO trigger. With a clock jacked into CLK, a slow rising clock as low as 1.2 V peak can clock the S&H this it works equally as well with fast rising pulses or slow sine waves and ramps. The image below in figure 2 illustraites the action of a sine wave clock on trace one with a peak amplitude of 1.16 volts. Trace two is the input and trace three is the resultant sampled waveform. In this example, the lag is set to minimum and the depth is set to maximum amplitude.

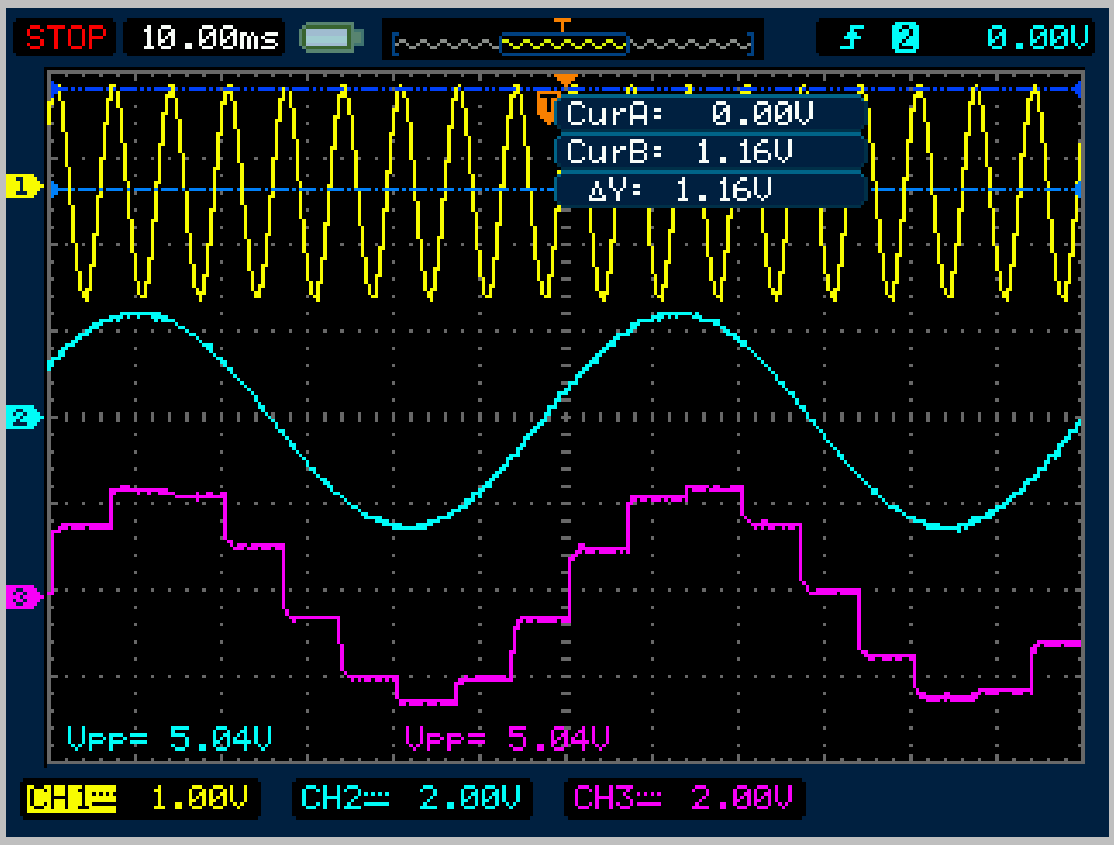


Figure 2 External Sample Clock Example

The S&H provides a portamento (lag) and depth control. The input “IN” is normalled to the SCM’s NOISE source with the ability to accept a bi-polar input source.

The **NOISE** section to the top right: the frequency range of the noise source is selectable by a switch (LO, MID, HI). Thomas Henry: ”Something should be said about why you might want to change the clock rate. The best answer is, try it, you’ll like it! The sound is an incredible swooshing noise not unlike phasing or flanging. The noise takes on a new tonality and sweeping the clock changes the spectra in a dramatic and eerie manner.” Furthermore there is a filter control (known from the SN voice) and a attenuated CV in for the sweep, which base frequency is set by the FREQ control. you can select external (EXT) modulation (switch left) or internal (LFO) sweep modulation (switch right)

Building the SCM:

If you are building this board its likley you have constructed boards using SMT devices but for folks that are just beginning their journey, here is a useful video to check out:

SparkFun Hot Air Rework tutorial with David Stillman Time: 4:36 :

Photo 1 David Stillman

https://youtu.be/9D0oTGeheBA

There are thouands of video tutorials about SMD soldering on Youtube that you can watch. Some better than others so watch several. Remember, you're not limited to using a hot air rework station. It is just my preference. Because of the size of the components chosen for the the SCM PC board, you can also get away with using a soldering iron with a fine tip and steady hand to solder all the components. This was an important design goal of this PCB.

The hot air rework station that I personally use is the YiHUA Model 898D shown in photo 2 and find its quality and price are excellent and perfect for all hobby soldering jobs. The model 898D goes by several other names so just plug in a search for the 898D hot air rework. Amazon has the best deals. The link is shown below. The price range at the time of writing manual ranges from about $50.00 to $65.00 USD which is quite an excellent deal.

https://www.amazon.com/s/ref=nb_sb_noss?url=search-alias%3Daps&field-keywords=898D+hot+air+rework

Photo 2 Hot Air Rework Station

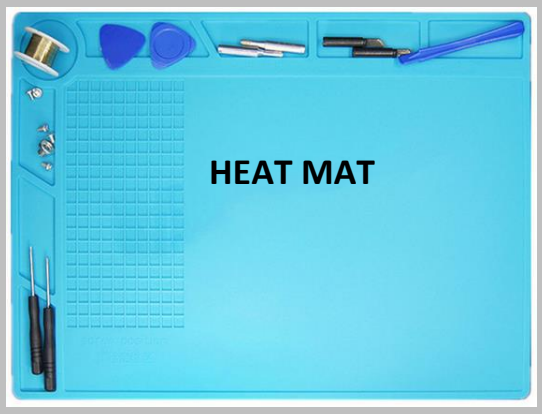
Other essential items you will need are shown below in photo 3 and 4. I use solder paste that is leaded and find it easier to work with. I use acid brushes instead of a toothbrush. I also use lead/tin solder paste & solder. I like to use a manual paste dispenser like the one in photo 3.

Photo 3 Manual Solder Paste Dispenser

Photo 4 Suggested Tools for Soldering

To prepare the board, clean with alcohol or flux remover then use an air duster to dry and blow any remaining debre off the board.

I also find these tools essential, magnifier with light and heat mat:



Locate and identify that you have all you components. Use the check boxes as you go.

RESISTORS:

QTY	REFERENCE	VALUE	CHECK
17	R1,R7,R9,R11,R13-R14,R23,R30-R31 ,R33,R40,R44-R45,R50,R53-R54,R61	100K	_____
2	R2,R20	1.0M	_____
4	R3-R4,R22,R24	3K	_____
4	R5,R21,R32,R49	1.00K	_____
3	R6,R26,R42	2.2M	_____
8	R8,R12,R25,R41,R38,R43,R56-R57	10K	_____
3	R10,R15,R27	2.20K	_____
2	R16	390K	_____
1	R51 (SEE NOTE 1)	249K	_____
1	R17	15.0K	_____
1	R18	68K	_____
1	R19	5.6M	_____
2	R28,R39	220	_____
1	R29	10	_____
4	R34,R58-R59,R62	33K	_____
1	R35	4.7K	_____
3	R36,R46-R47	47K	_____
1	R37	39K	_____
1	R48	200K	_____
1	R52	22K	_____
1	R55	220K	_____
1	R60	56K	_____

NOTE 1 : IF POWERING THE MODULE FROM J13 MOTM (+15, -15 VDC) then R51 is 390K, same part type as R16.

CAPACITORS:

QTY	REFERENCE	VALUE	CHECK
7	C1-C3,C6-C7,C18,C30	10000pF	_____
3	C4-C5,C8	10u	_____
2	C9,C28	220n	_____
2	C10,C29	0.047u	_____
8	C11-C14,C20-C21,C23,C25	0.1u	_____
2	C15,C22	10000pF	_____
1	C16	100u	_____
2	C17,C24	1000pF	_____
1	C19	4.7u	_____
1	C26	2.2u	_____
1	C27	10u	_____

INTEGRATED CIRCUITS:

QTY	REFERENCE	VALUE	CHECK
1	U1	4001	_____
1	U2	LM1117S-5,0	_____
3	U3-U5	TL074	_____
1	U6 (U7 is an alternate package size)	Complex Sound Generator	_____
1	U8	NE555	_____

TRANSISTORS:

QTY	REFERENCE	VALUE	CHECK
2	Q1,Q8	2N5486CS	_____
6	Q2-Q7	2N3904	_____

DIODES (Si Switching):

QTY	REFERENCE	VALUE	CHECK
5	D1-D2,D5-D7	1N4148	_____

DIODES (LED):

QTY	REFERENCE	VALUE	CHECK
2	D3-D4	DIODE-LED	_____

MISC. :

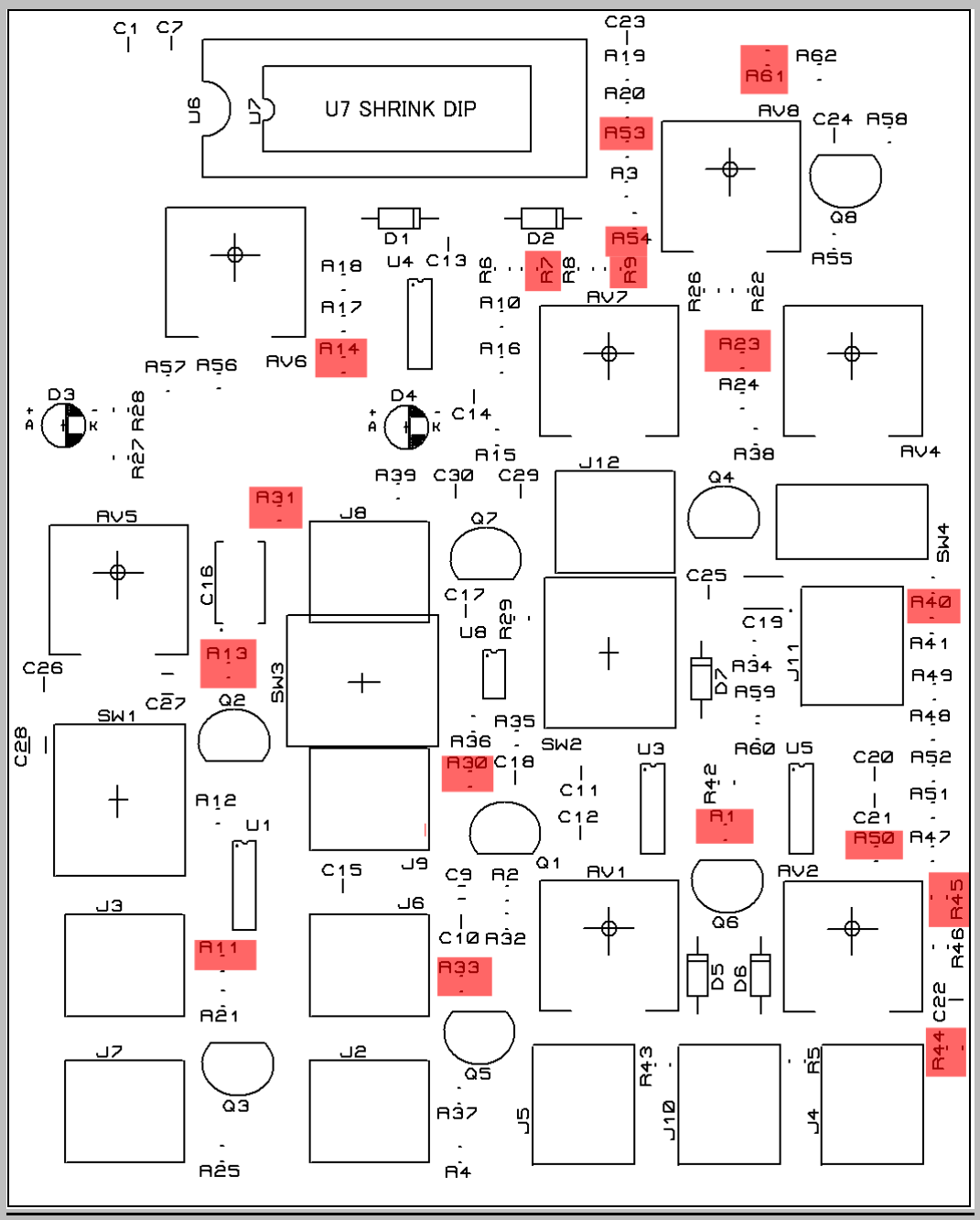
QTY	REFERENCE	VALUE	CHECK
1	J1	CONN-DIL10	_____
11	J2-J12	Mono JACK	_____
1	J13	SIL-156-04	_____
3	RV1,RV7-RV8	100K	_____
3	RV2,RV4,RV6	1M	_____
2	RV3,RV9	100K	_____
1	RV5	500K	_____
3	SW1-SW3	SWITCH ON-ON-ON	_____
1	SW4	SWITCH SPDT	_____

TOTAL PARTS – 141

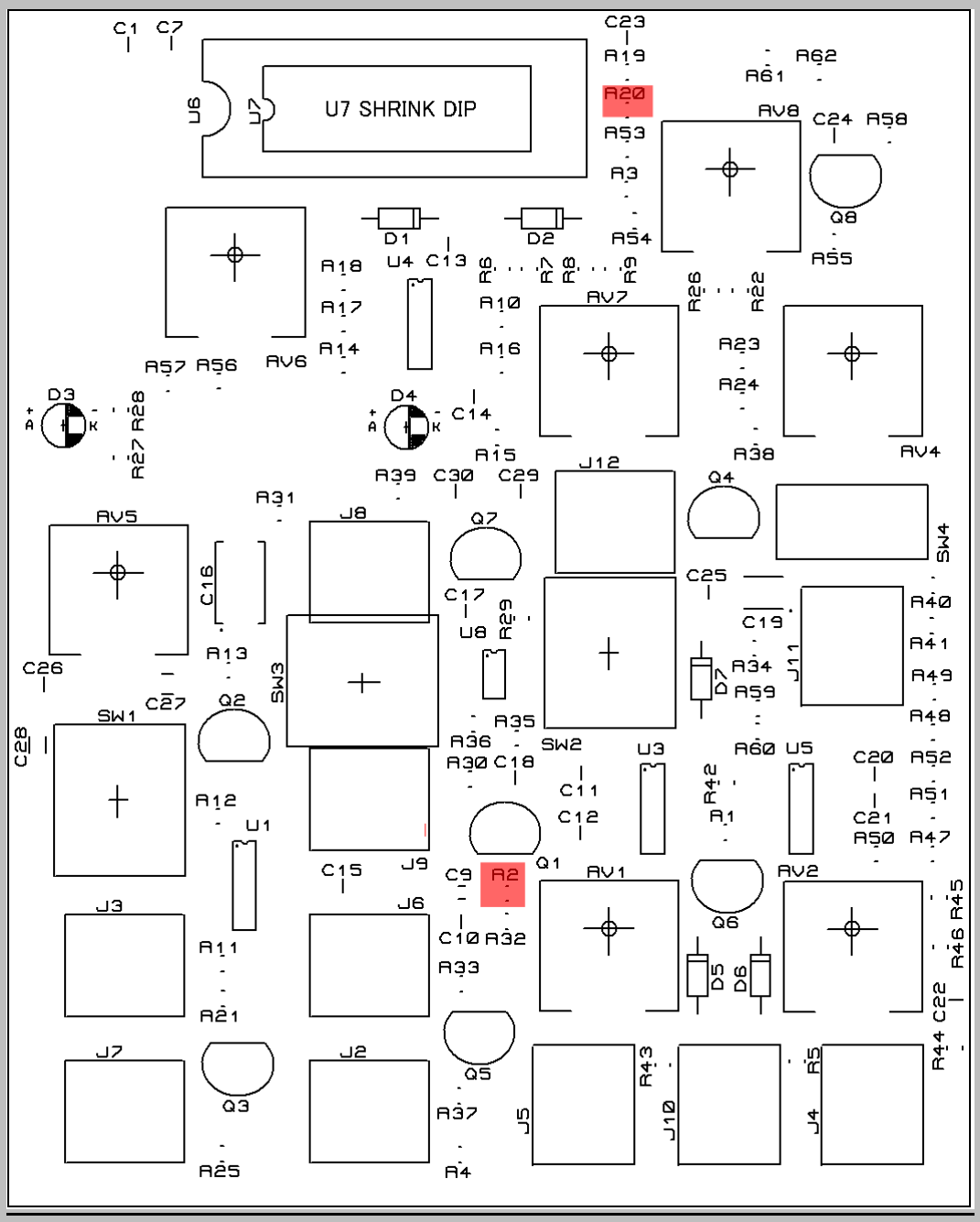
RESISTOR PLACEMENT:

Start construction by installing all resistors first by applying your solder paste, placing the resistor, and using your hot air gun to solder in place. I usually set the temperature to 340C. You need very little paste in order to solder these components but the proper amount will come with practice so inspect each component that you solder until you get a good feel. Remember not to dwell too long when soldering. Apply heat just long enough to make sure the solder flows.

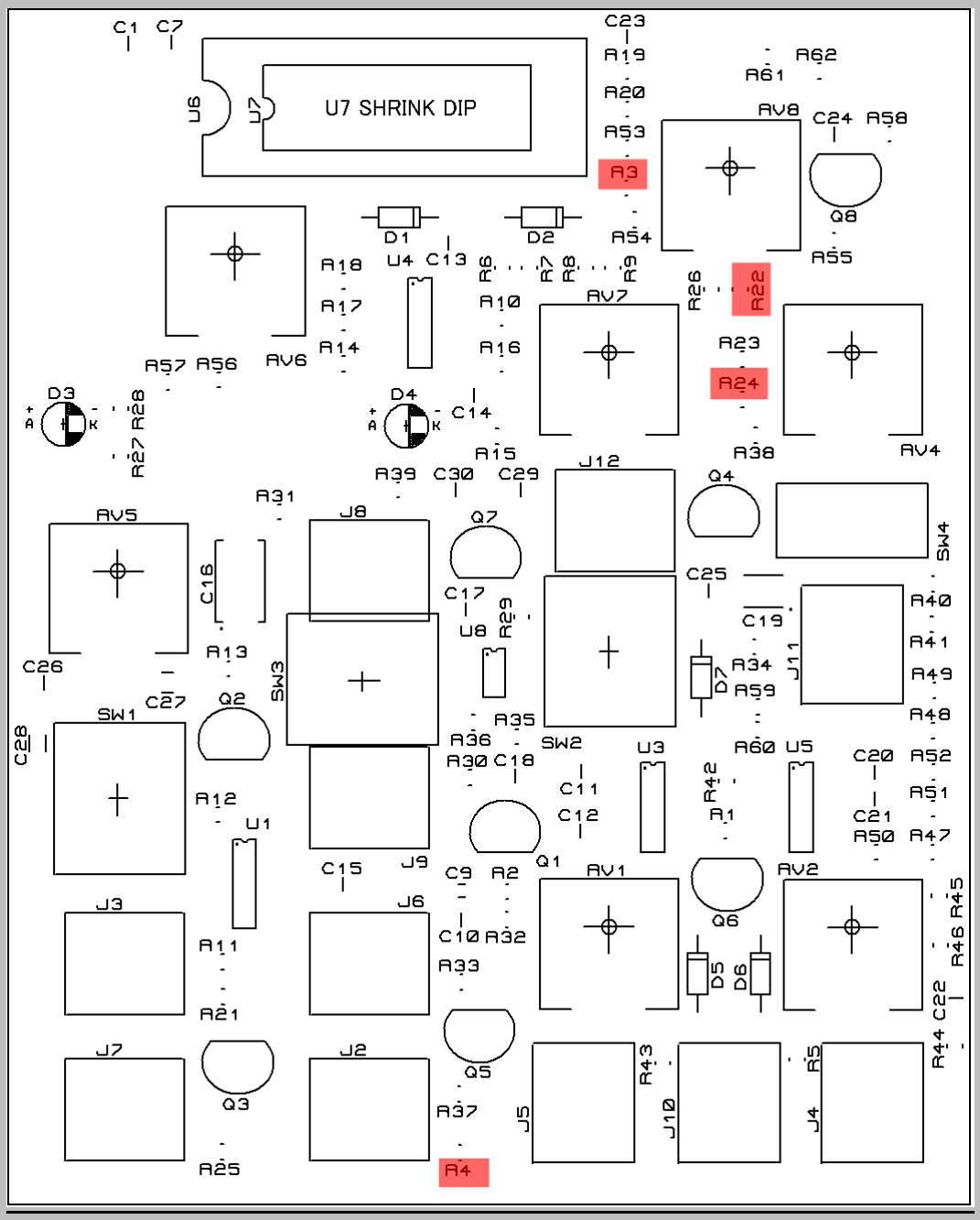
I find that a big time suck in hand building printed circuit boards is locating the components on complex boards, thus the use of component placement templates that highlight the components along with a check list will speed up the build process and reduce the chances of any errors. I would consider this PCB simple to moderately complex.



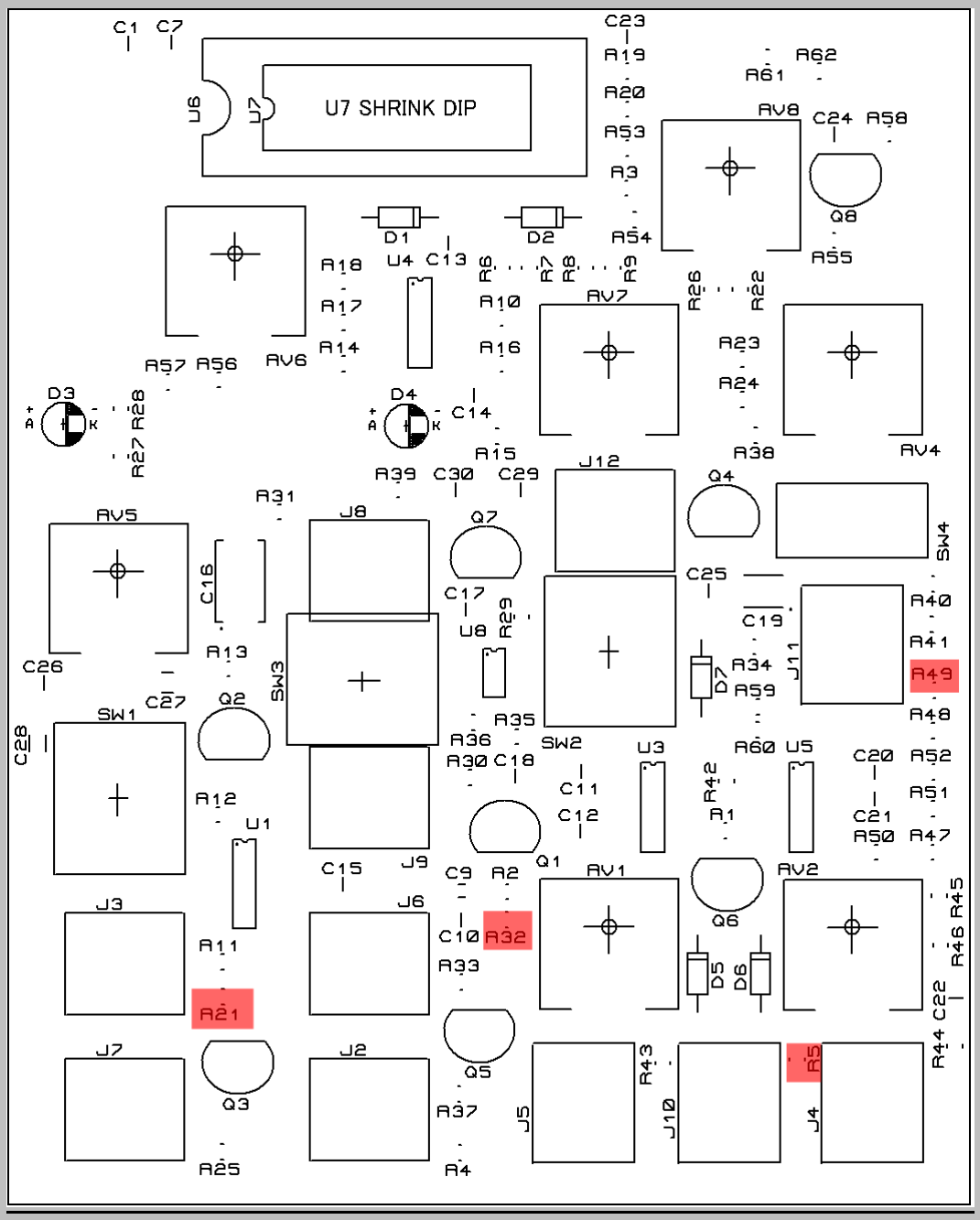
R1,R7,R9,R11,R13-R14,R23,R30-R31 ,R33,R40,R44-R45,R50,R53-R54,R61	**100K**	**_____**
Componet Count 17		**Check**



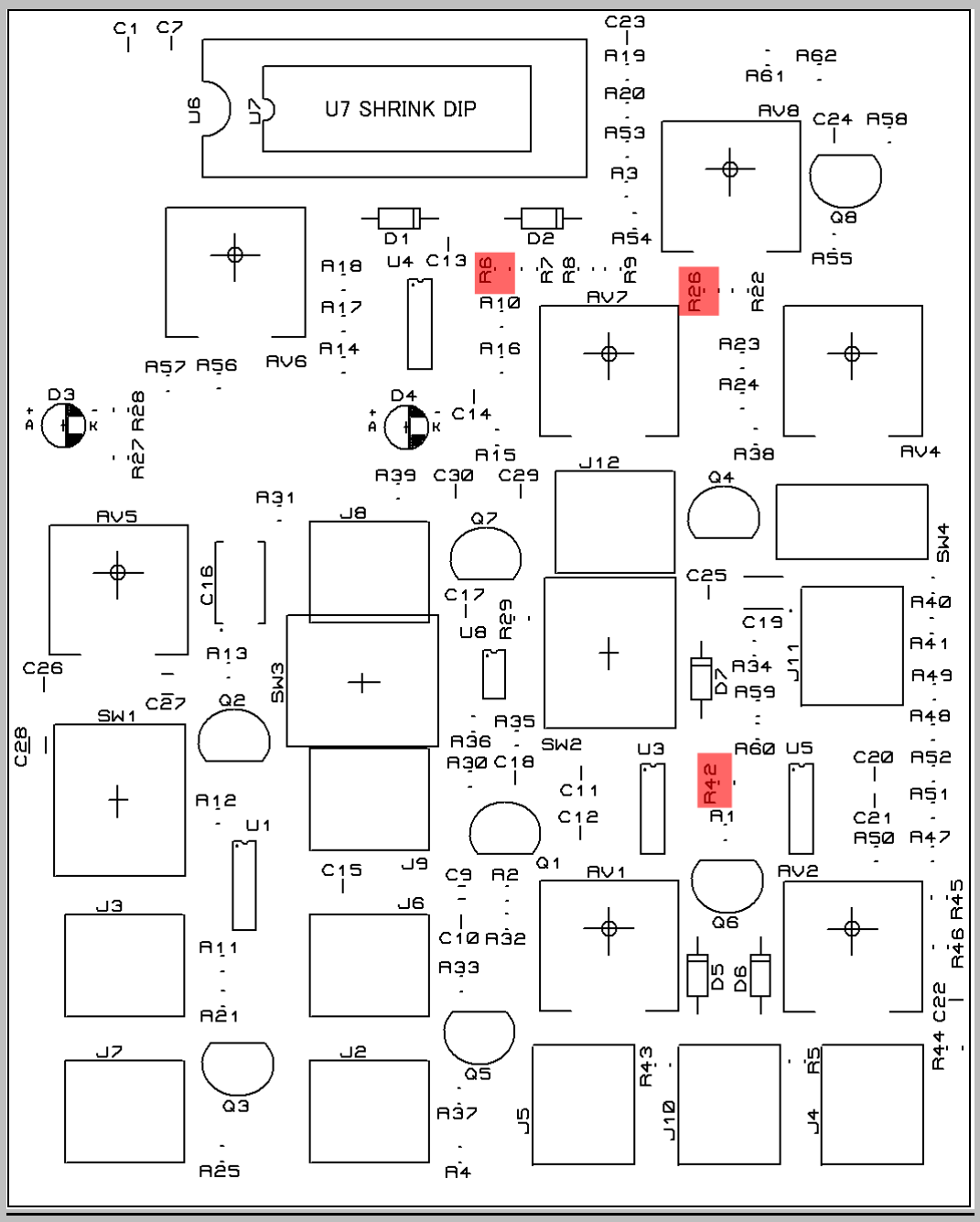
R2,R20	**1.0M**	**_____**
Component Count 2		**Check**



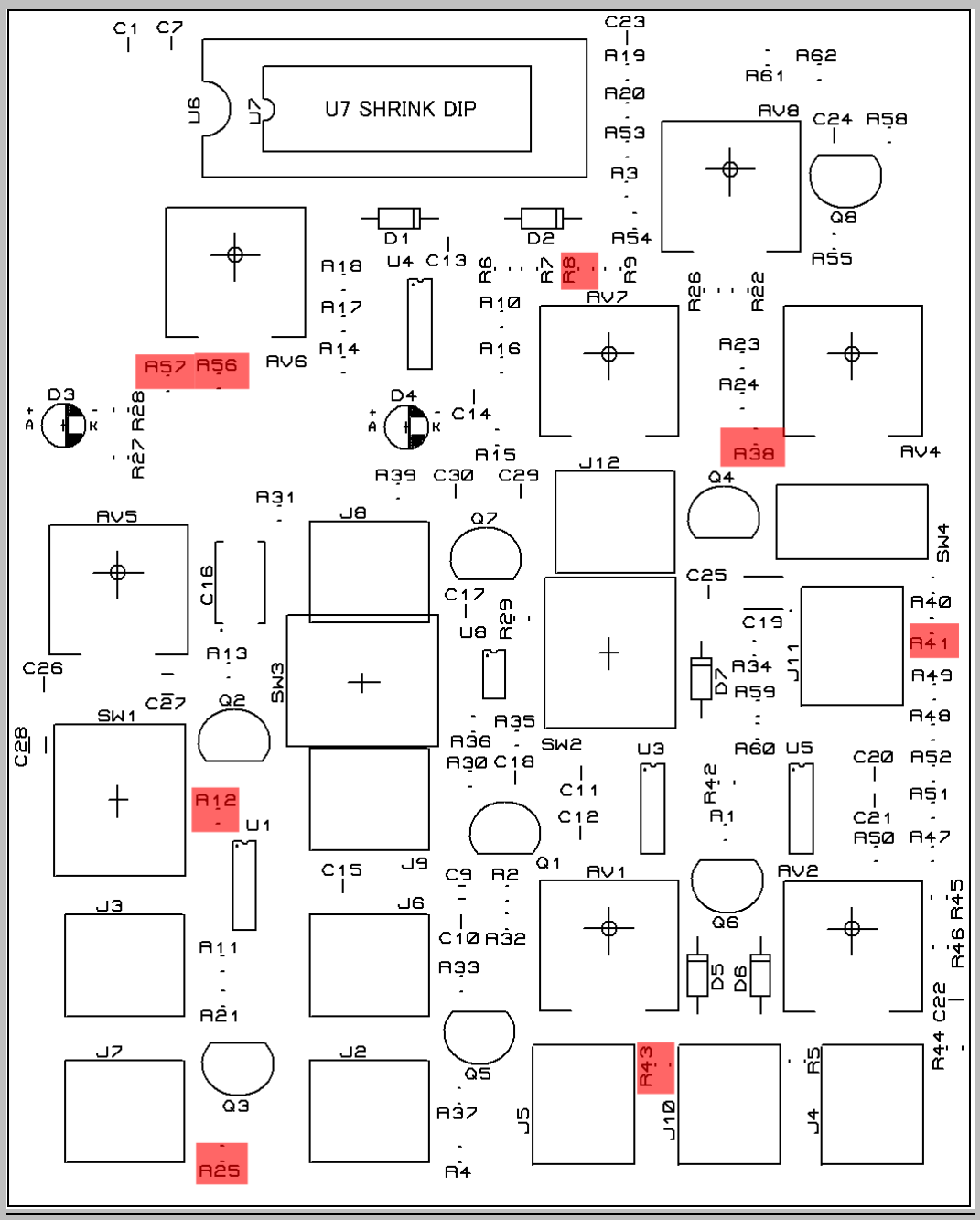
R3-R4,R22,R24	**3K**	**_____**
Component Count 4		**Check**



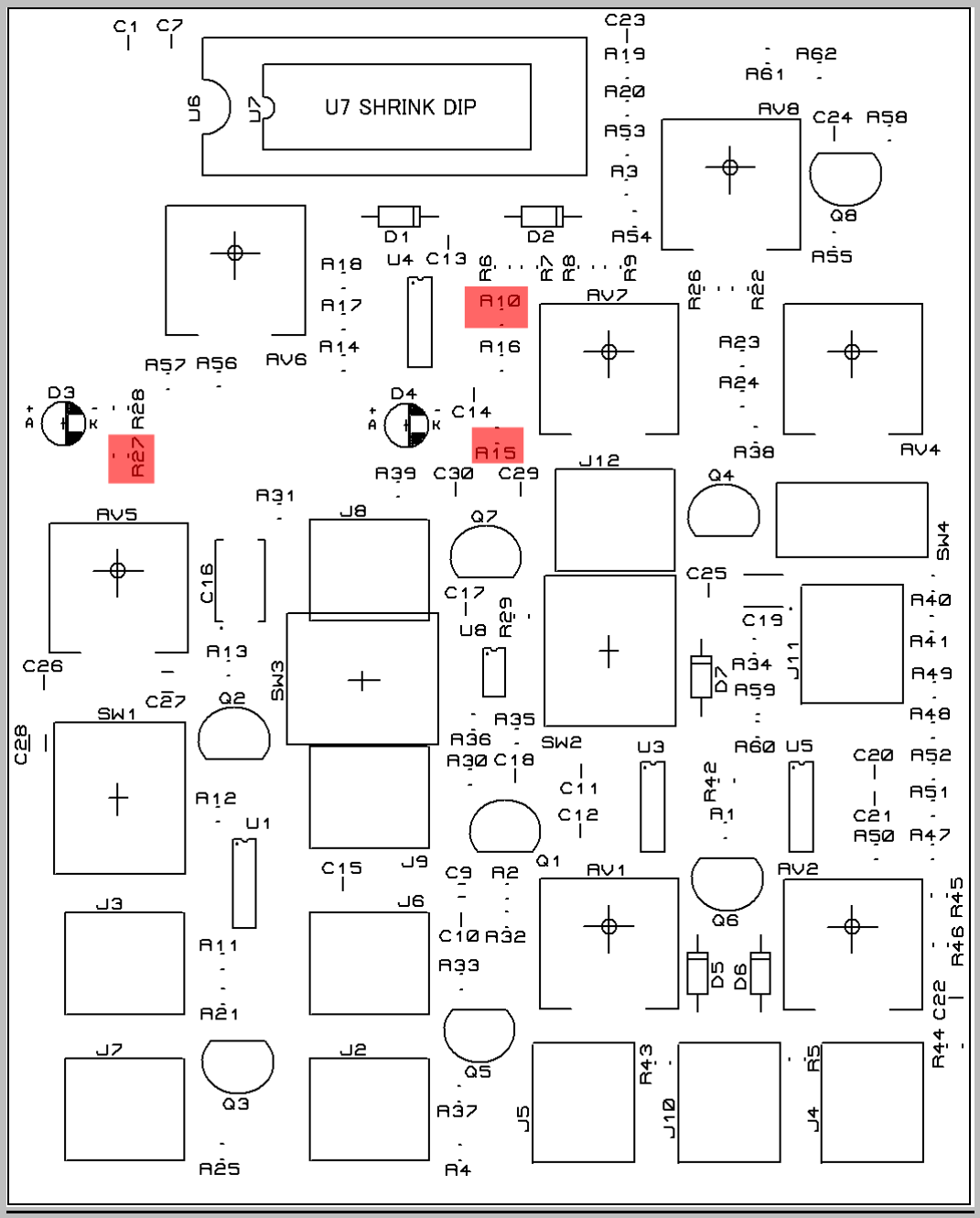
R5,R21,R32,R49	**1.00K**	**_____**
Component Count 4		**Check**



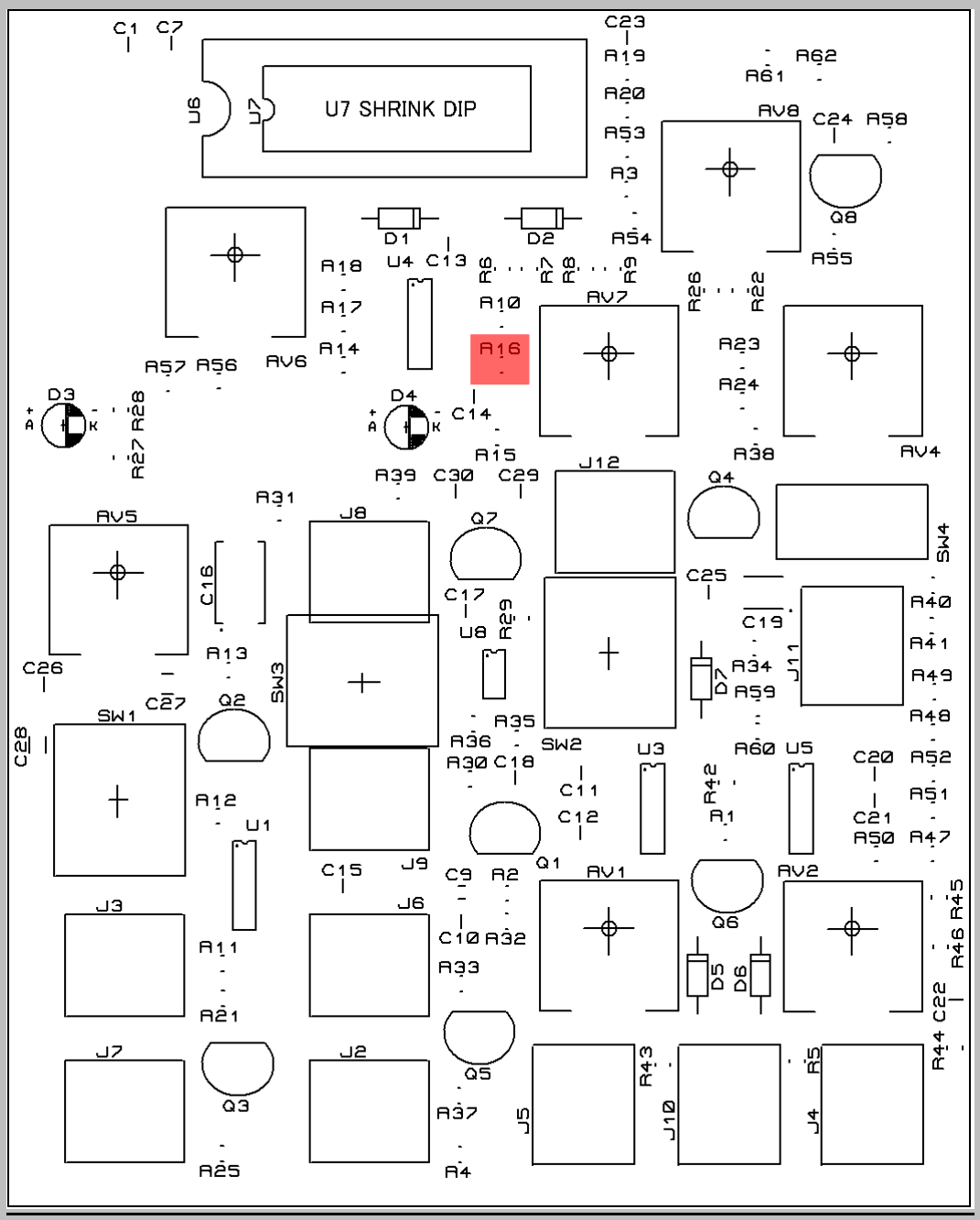
R6,R26,R42	**2.2M**	**_____**
Component Count 3		**Check**



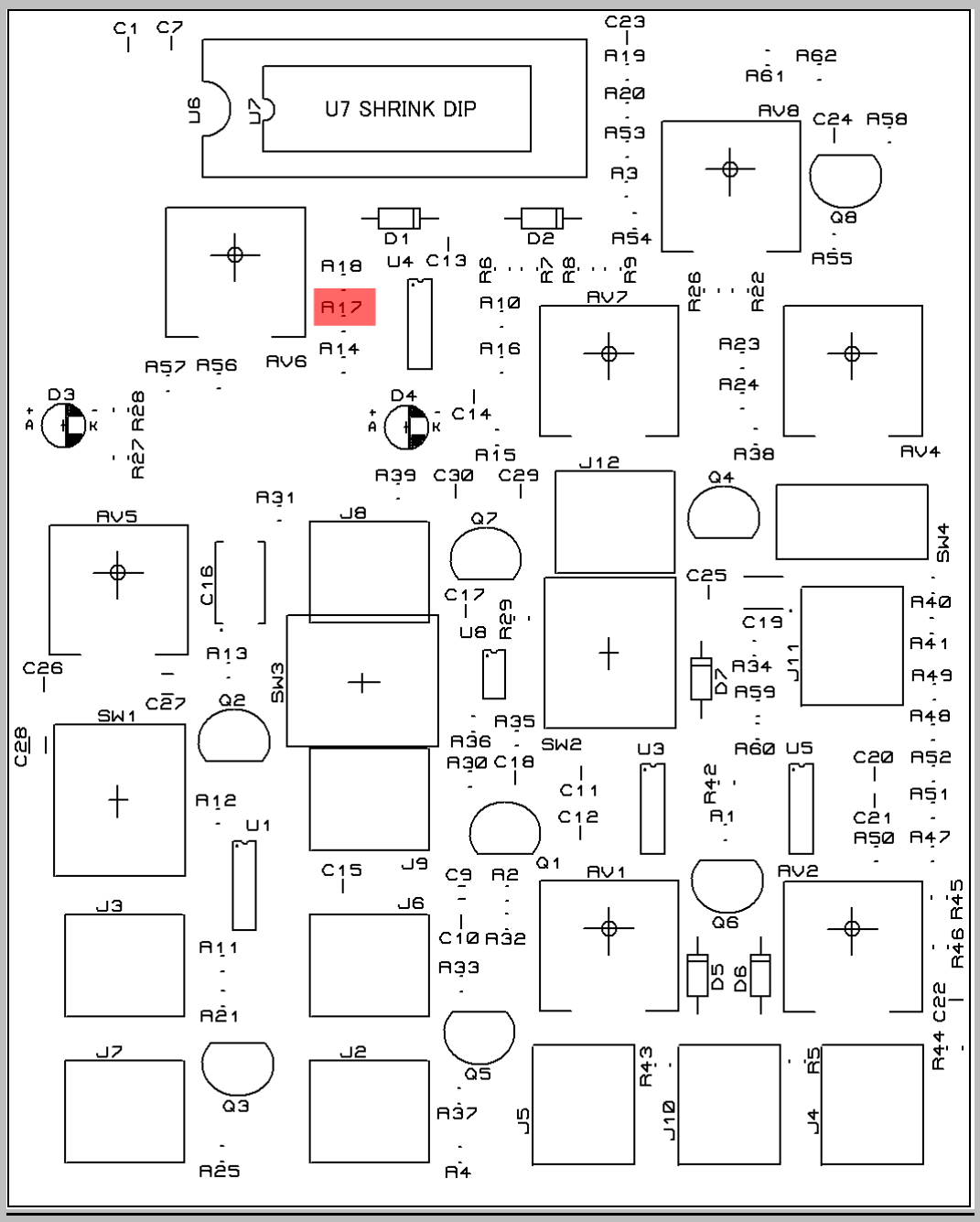
R8,R12,R25,R41,R38,R43,R56-R57	**10K**	**_____**
Component Count 8		**Check**



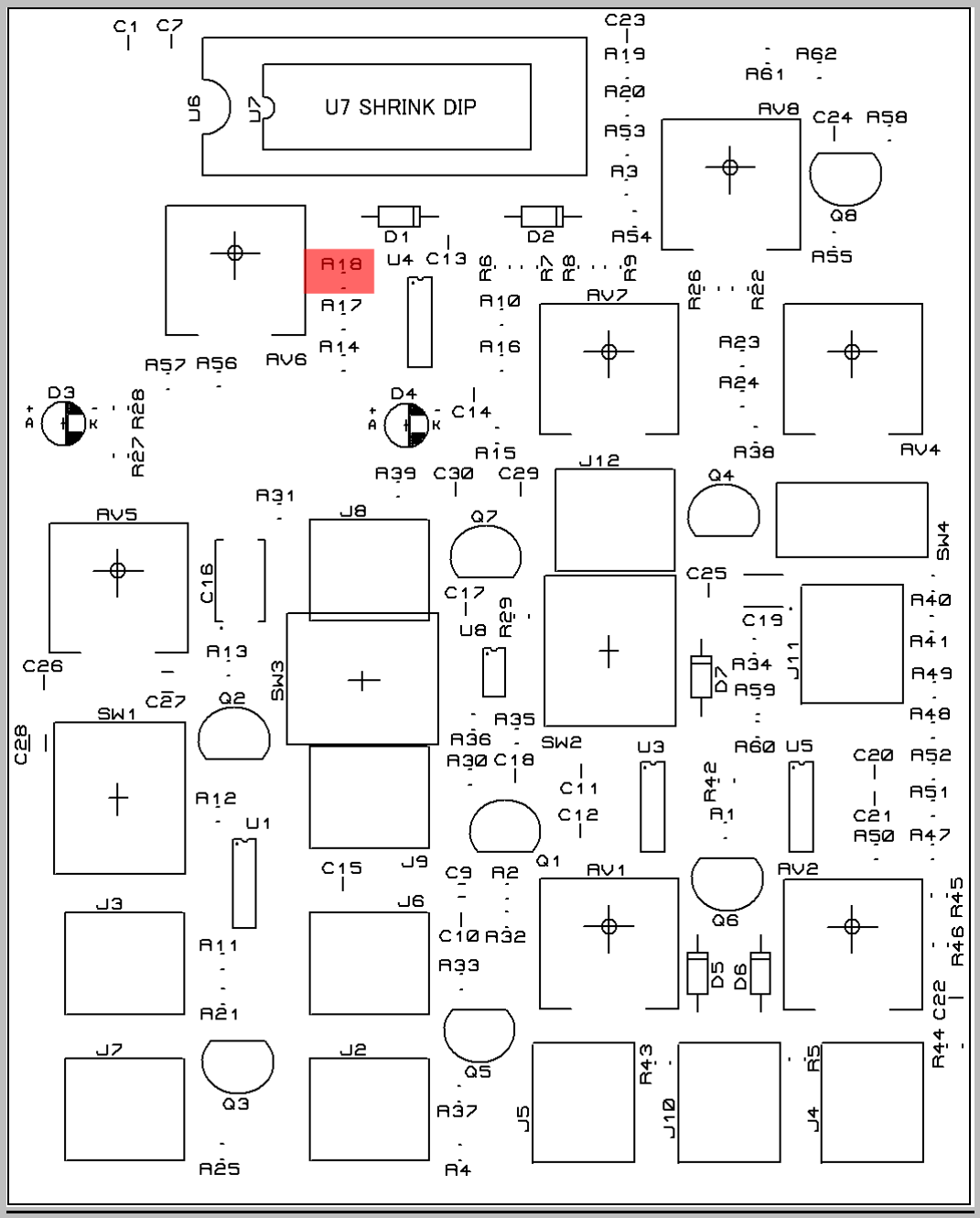
R10,R15,R27	**2.20K**	**_____**
Component Count 3		**Check**



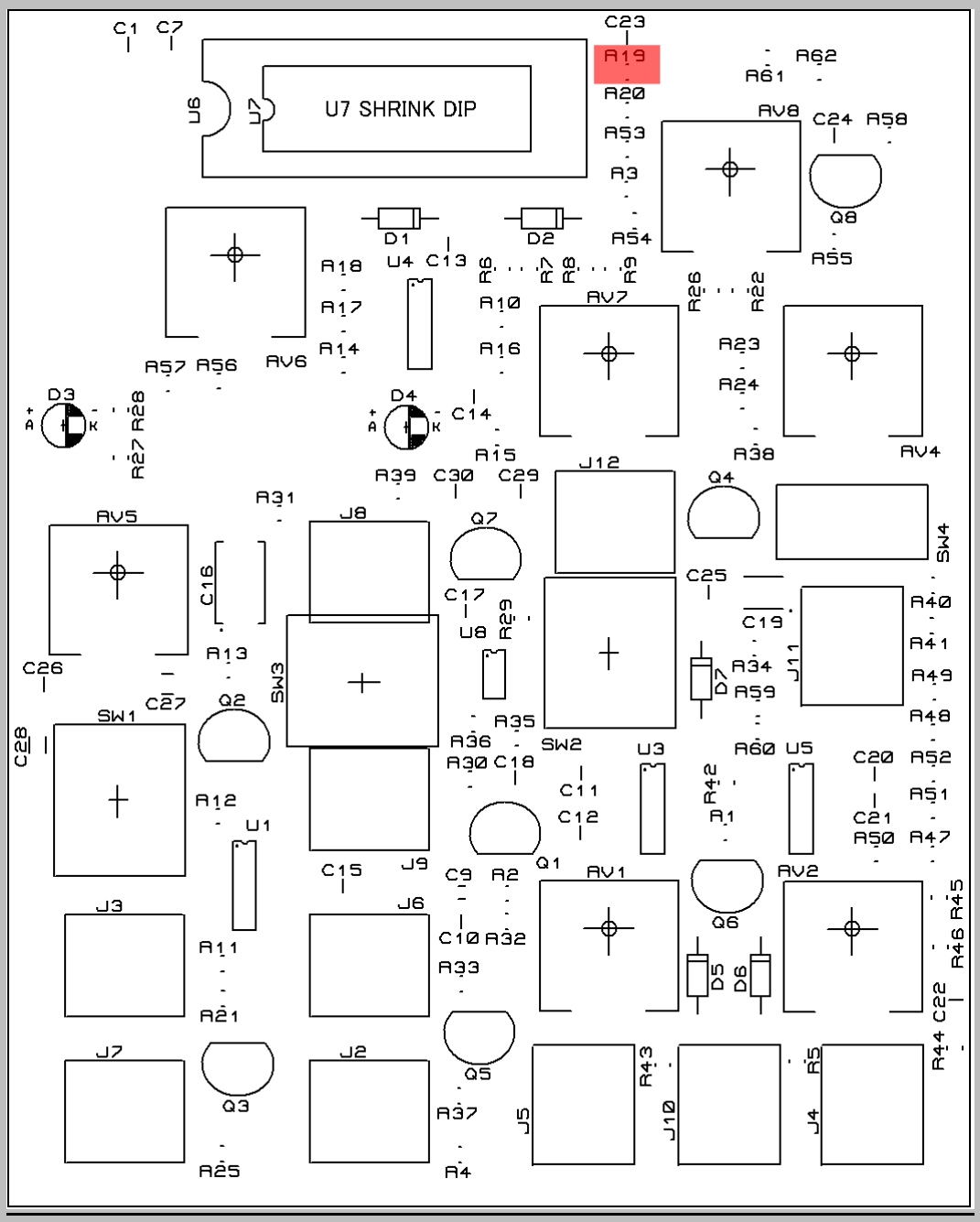
R16	**390K**	**_____**


U7 SHRINK DIP
C1
C7
U6
U7
C23
R19
R20
R53
R3
R54
R61
R62
AV8
C24
R58
Q8
R55
D1
D2
U4
C13
R18
R17
R14
R6
R7
R8
R9
R10
R16
AV7
R26
R22
R23
R24
R38
AV4
AV6
R57
R56
D3
D4
C14
R15
R27
R28
R39
C30
C29
J12
Q4
SW4
AV5
J8
Q7
C17
C16
R31
U8
R29
C25
C19
R40
R41
R49
R48
J11
D7
R34
R59
C26
R13
SW3
C27
Q2
SW1
C28
R35
R36
R30
C18
SW2
C11
C12
U3
R60
U5
R42
R1
C20
R52
R51
C21
R50
R47
R12
U1
C15
J9
C9
R2
Q1
AV1
AV2
Q6
J3
J6
C10
R32
R33
R11
R21
D5
D6
R46
R45
R44
C22
J7
J2
Q5
Q3
R37
R4
R25
J5
R43
J10
J4
R5

R17	**15.0K**	**_____**



R18	**68K**	**_____**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C1 C7
C23
R19
R20
R53
R3
R54
R61 R62
AV8
C24 R58
Q8
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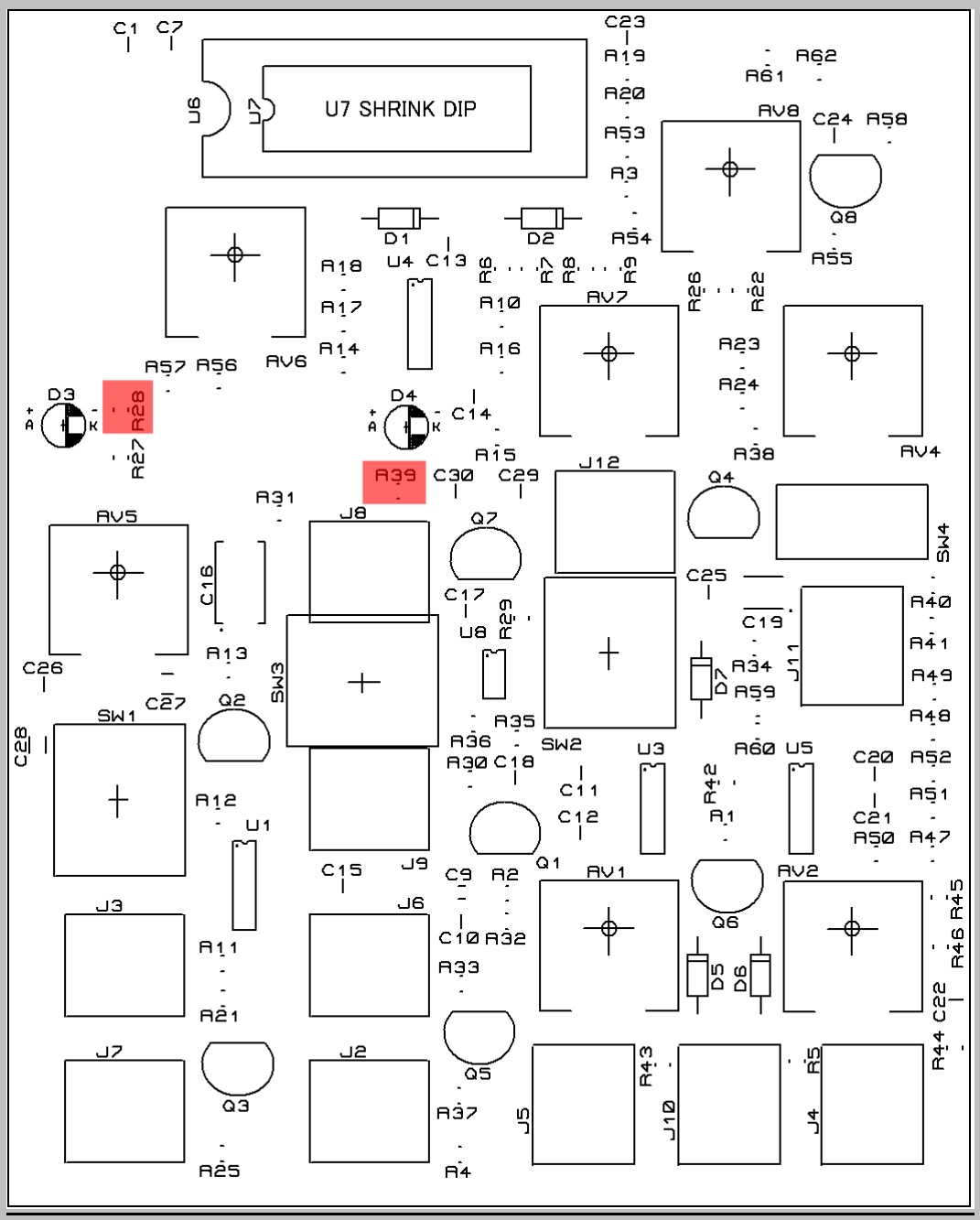
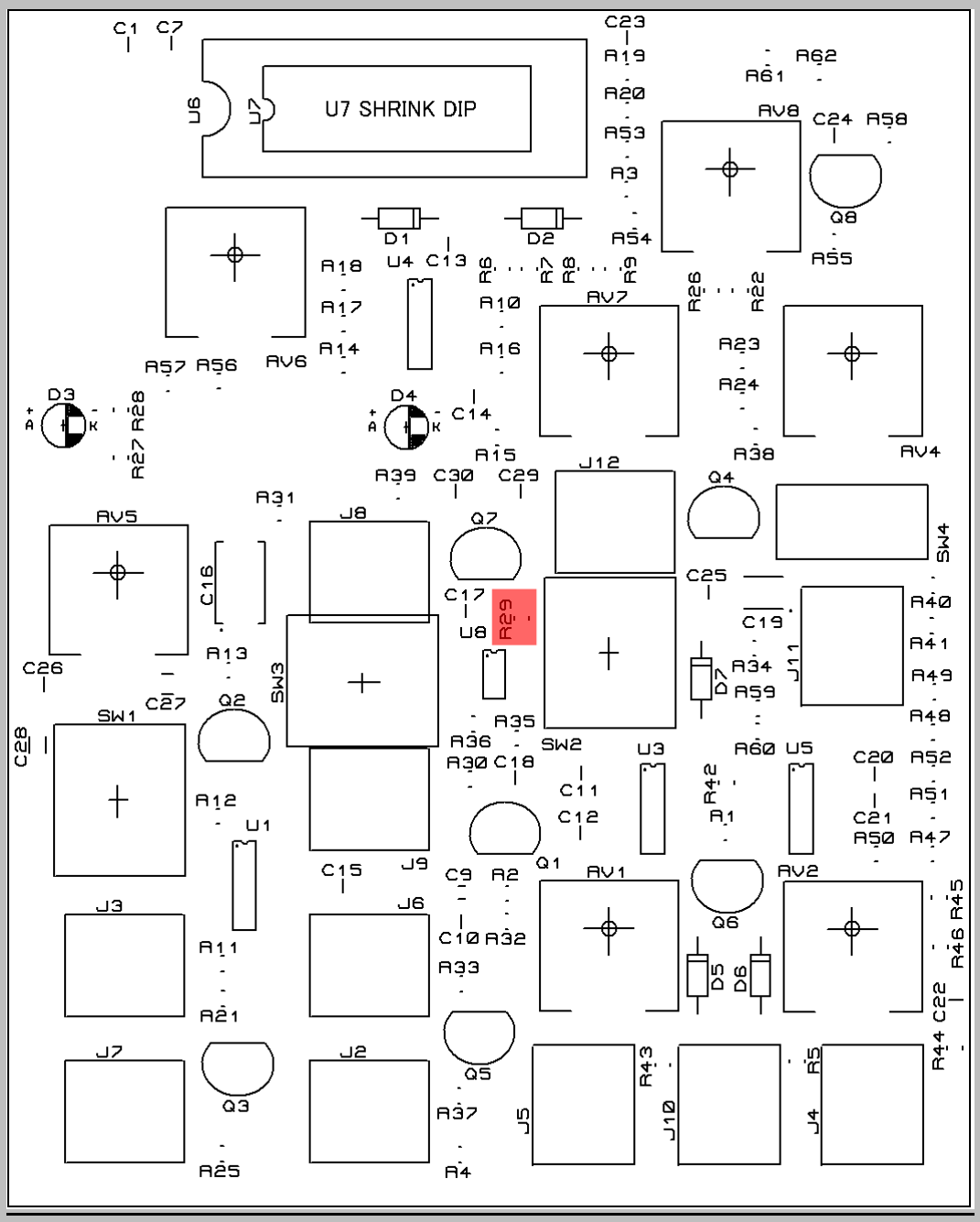
D1
D2
U4 C13
R18
R17
R14
R6 R7 R8 R9
R10
R16
AV7
R26 R22
R23
R24
R38
AV4
R57 R56
AV6
D3
D4
C14
R15
R27 R28
R39 C30 C29
J12
Q4
SW4
AV5
J8
Q7
C17
C16
R31
U8 R29
C25
C19
R40
R41
R49
R48
J11
D7
R34
R59
C26
R13
SW3
C27
Q2
SW1
C28
R35
R36
R30 C18
SW2
U3
C11
C12
R60 U5
R42
R1
C20 R52
C21
R50 R51 R47
U1
R12
Q1
C15 J9
C9 R2
AV1
AV2
Q6
J3
J6
C10 R32
R33
R11
R21
D5
D6
R46 R45
R44 C22
J7
J2
Q5
Q3
R37
R4
J5
R43
J10
R5
J4

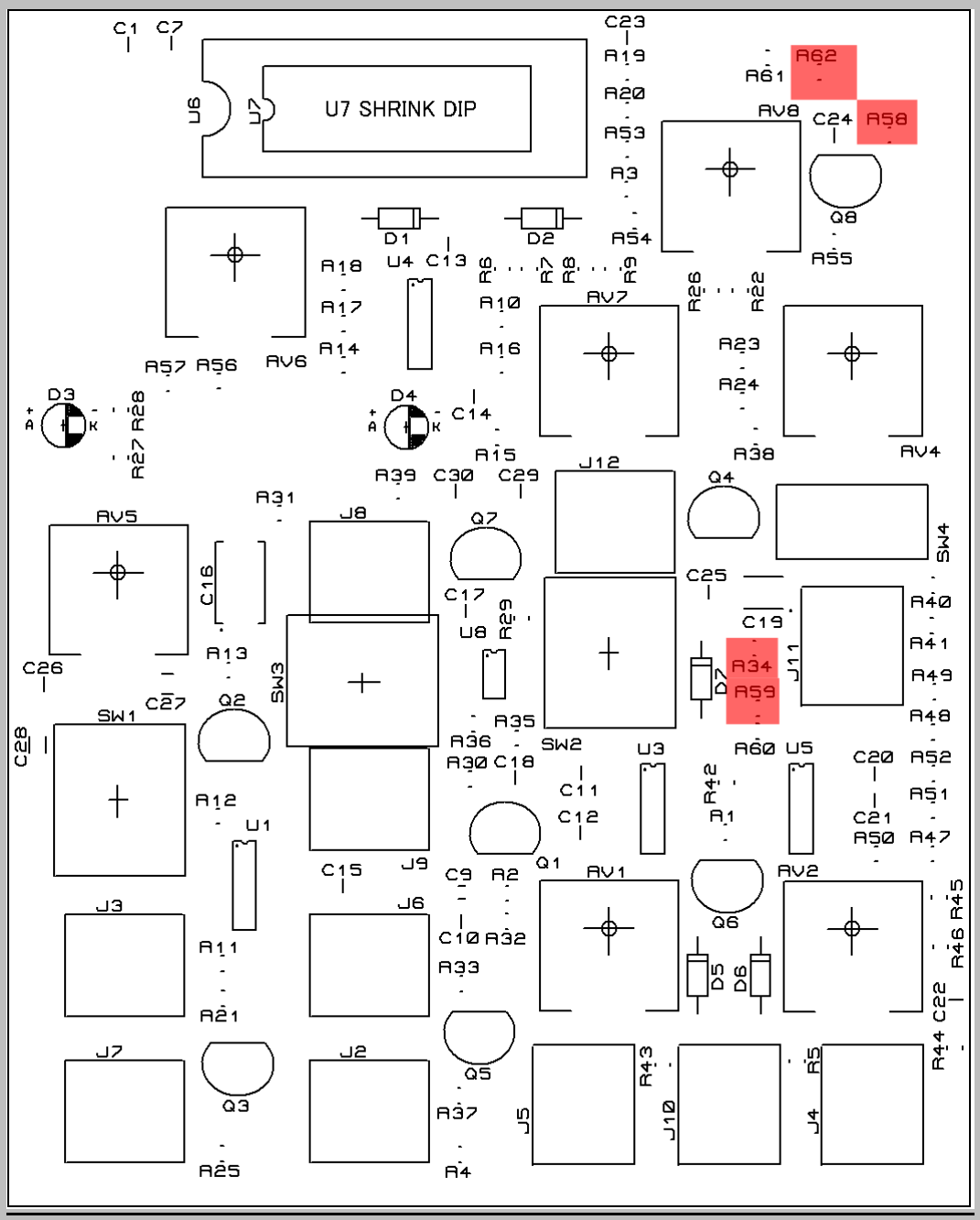
R19	**5.6M**	**_____**



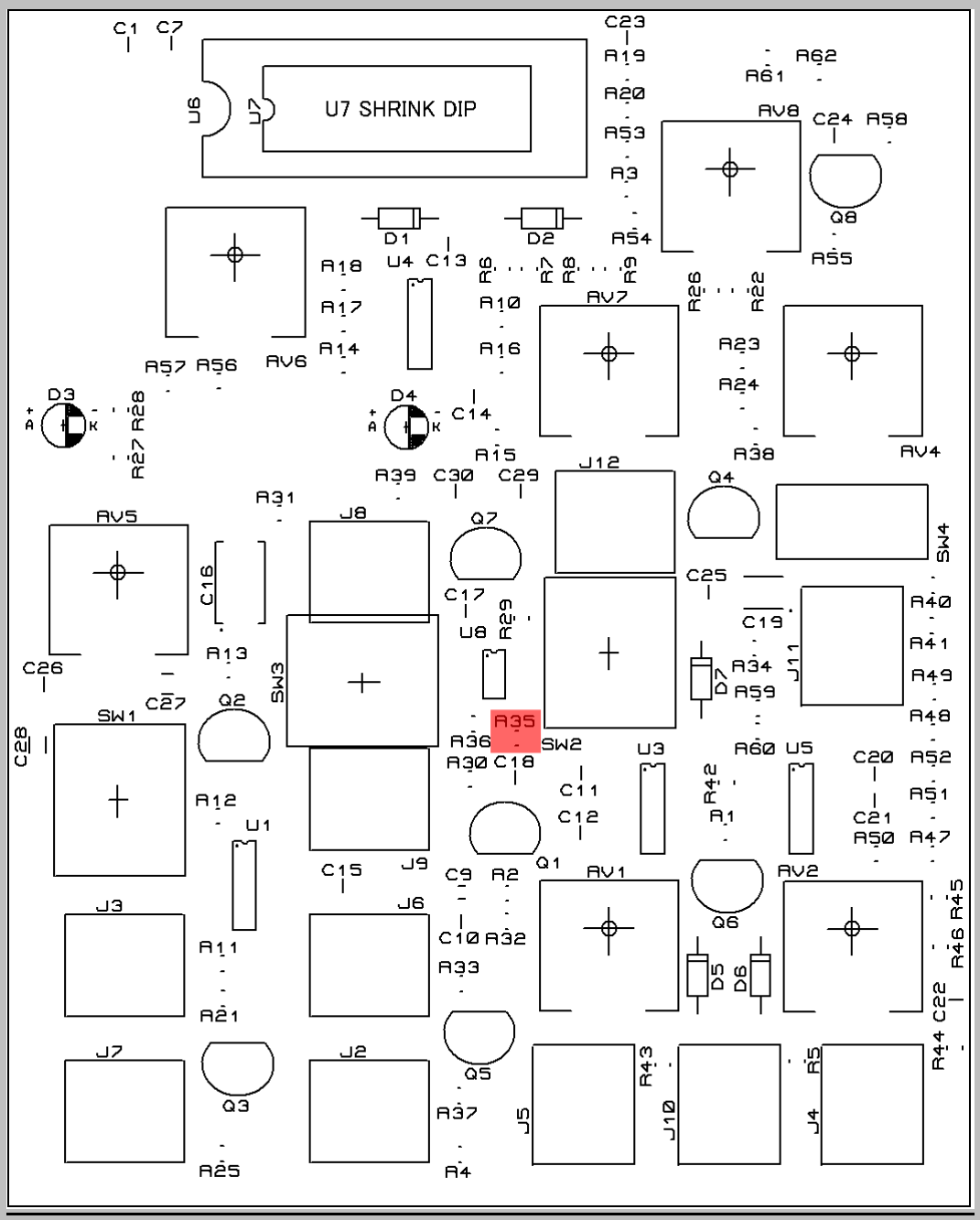
R28,R39	**220**	**_____**
Component Count 2		**Check**



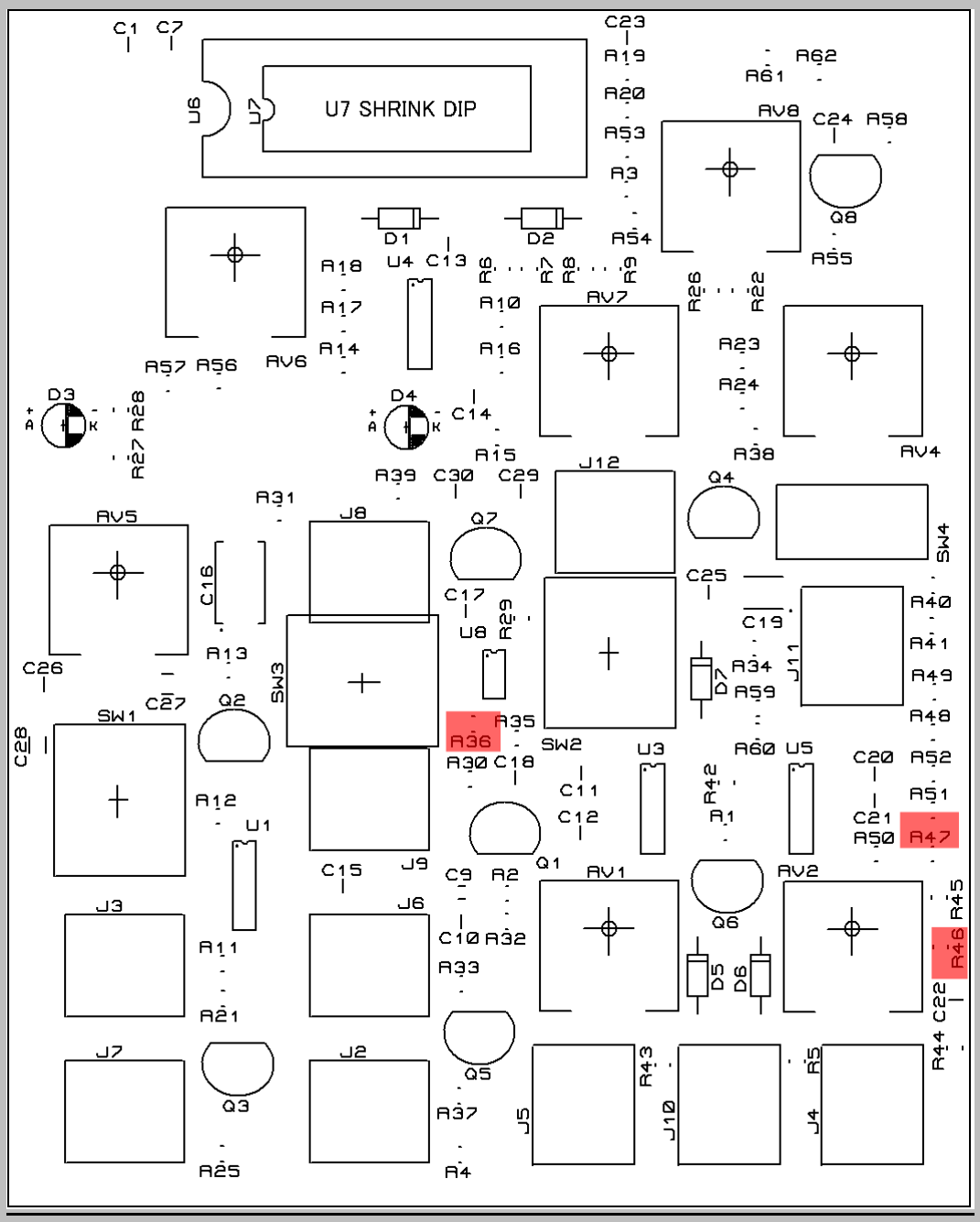
R29	**10**	**_____**



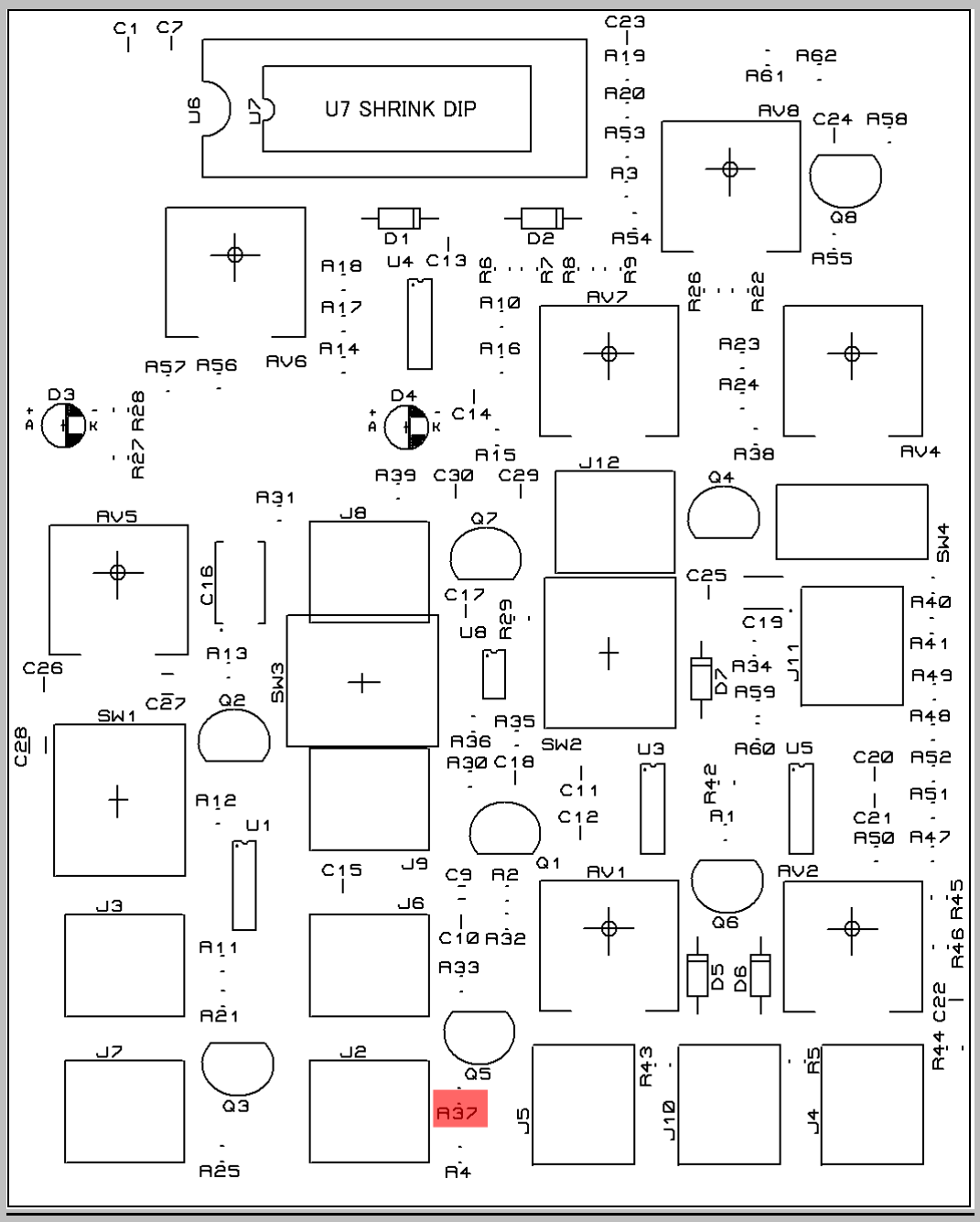
R34,R58-R59,R62	**33K**	**_____**
Component Count 4		**Check**



R35	**4.7K**	**_____**



R36,R46-R47	**47K**	**_____**
Component Count 3		**Check**


U7 SHRINK DIP
C1 C7
U6
U7
C23
R19
R20
R53
R3
R54
R61
R62
AV8
C24
R58
Q8
R55
D1
D2
U4
C13
R18
R17
R14
R6
R7
R8
R9
R10
R16
AV7
R26
R22
R23
R24
R38
AV4
R57
R56
AV6
D3
D4
C14
R15
R27
R28
R39
C30
C29
J12
Q4
SW4
AV5
J8
Q7
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C16
R31
U8
R29
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R48
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SW2
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C12
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R1
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R21
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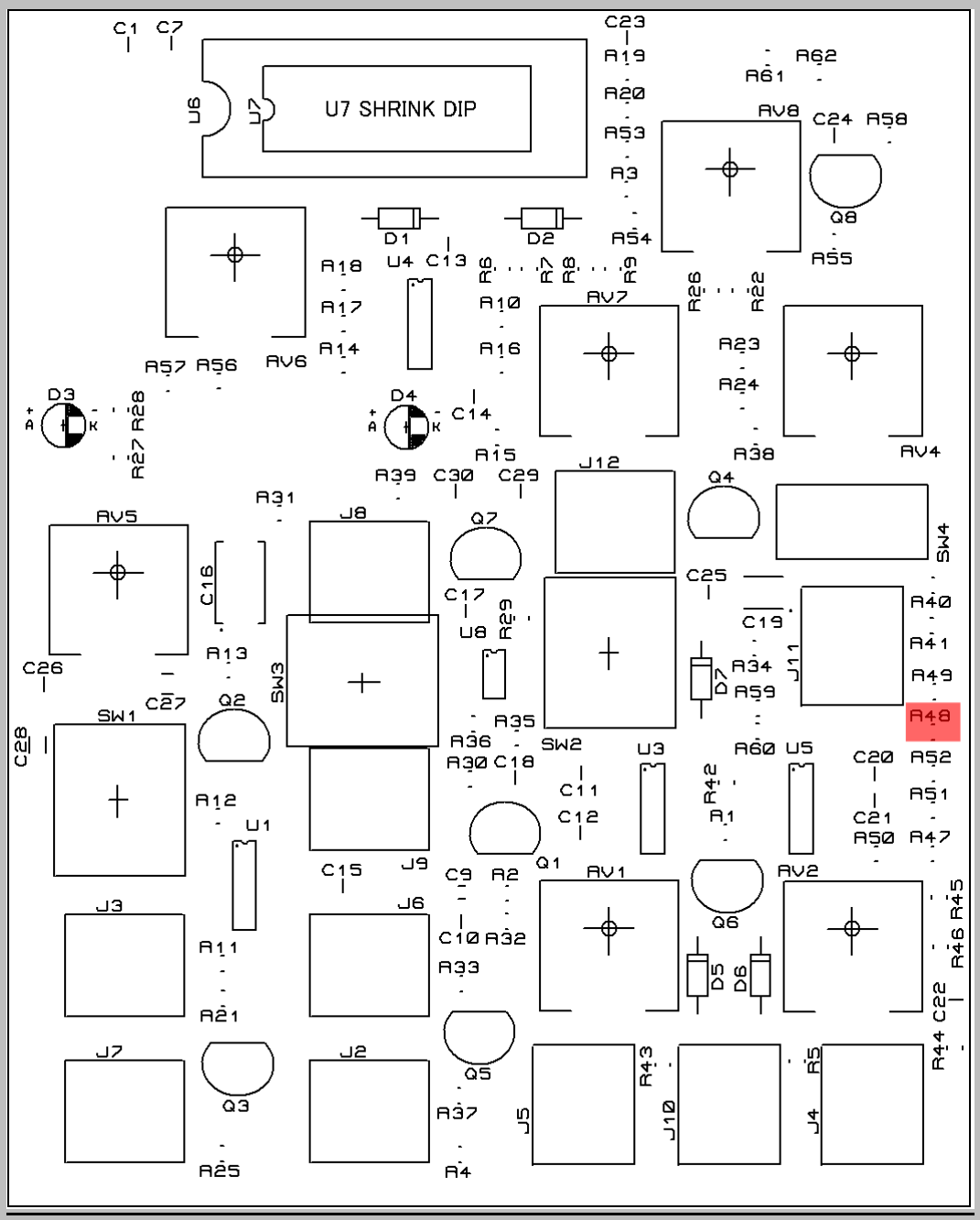
D6
R46
R45
R44
C22
J7
J2
Q5
Q3
R37
R43
J5
J10
R5
J4
R25
R4

R37	**39K**	**_____**


U7 SHRINK DIP
C1
C7
U6
U7
C23
R19
R20
R53
R3
R54
R61
R62
AV8
C24
R58
Q8
R55
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R30
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R50
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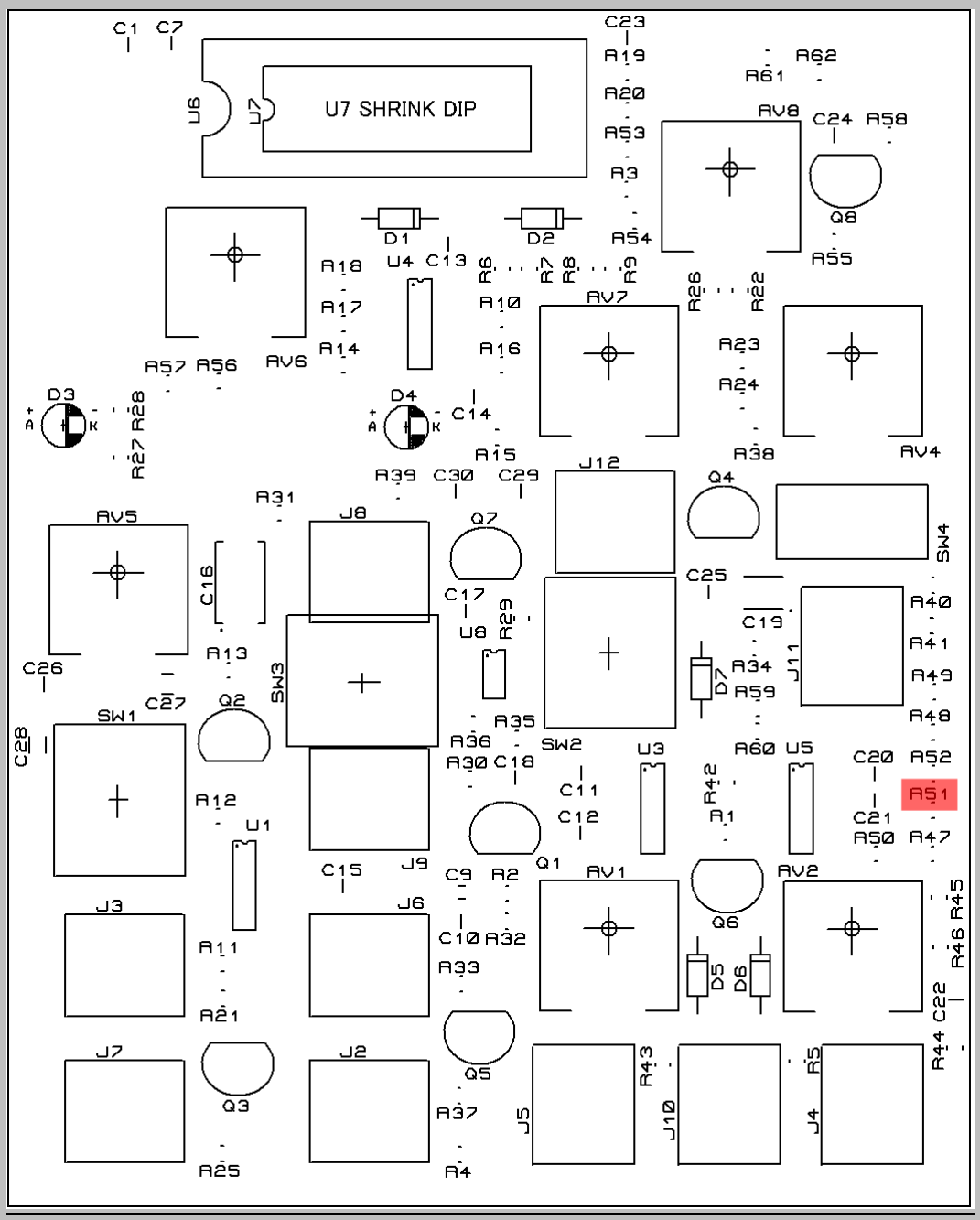
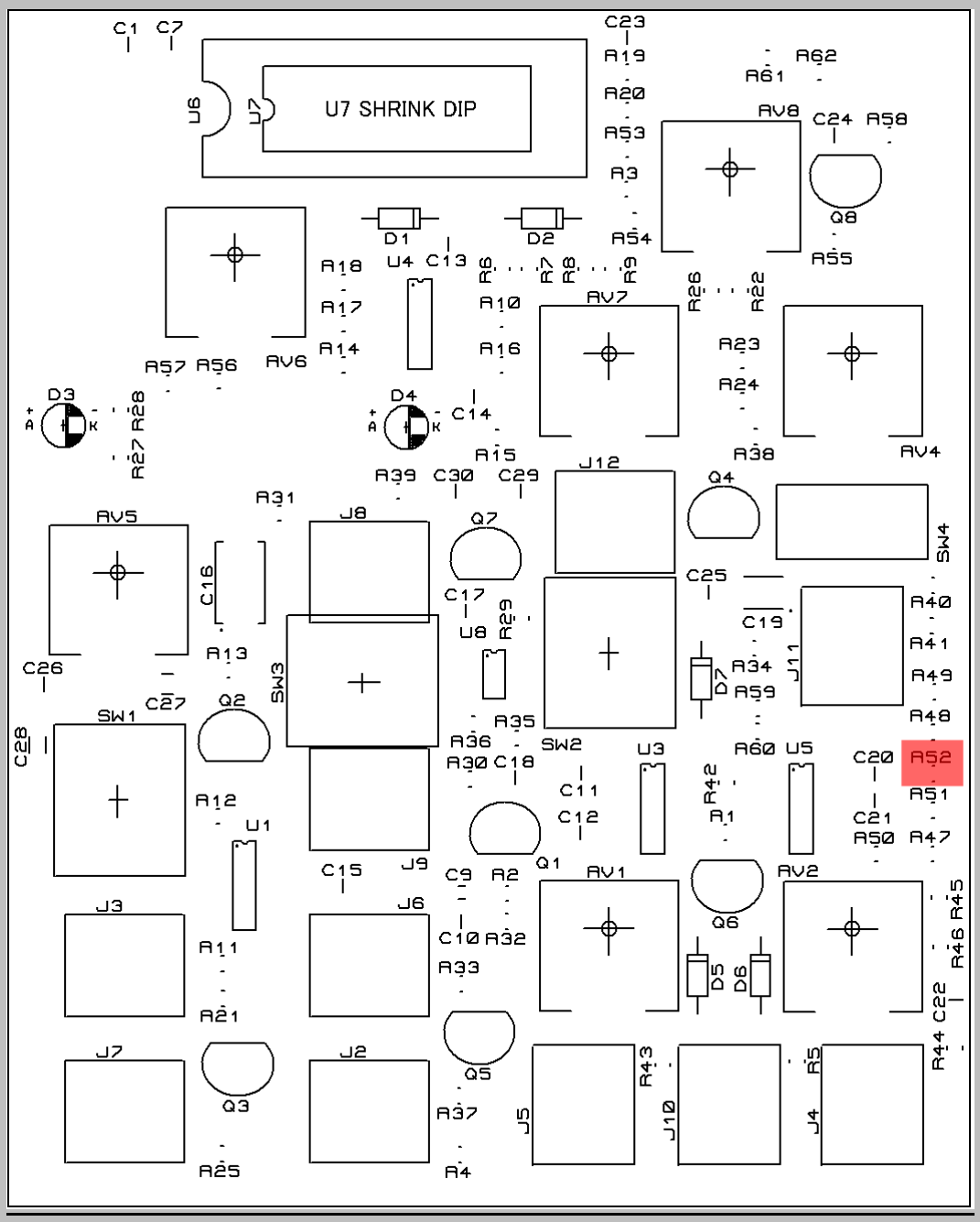
U1
C15
J9
C9
R2
Q1
AV1
AV2
Q6
J3
J6
C10
R32
R33
R11
R21
D5
D6
R46
R45
R44
C22
J7
J2
Q5
Q3
R37
R4
R25
J5
R43
J10
J4
R5

R48	200K	_____

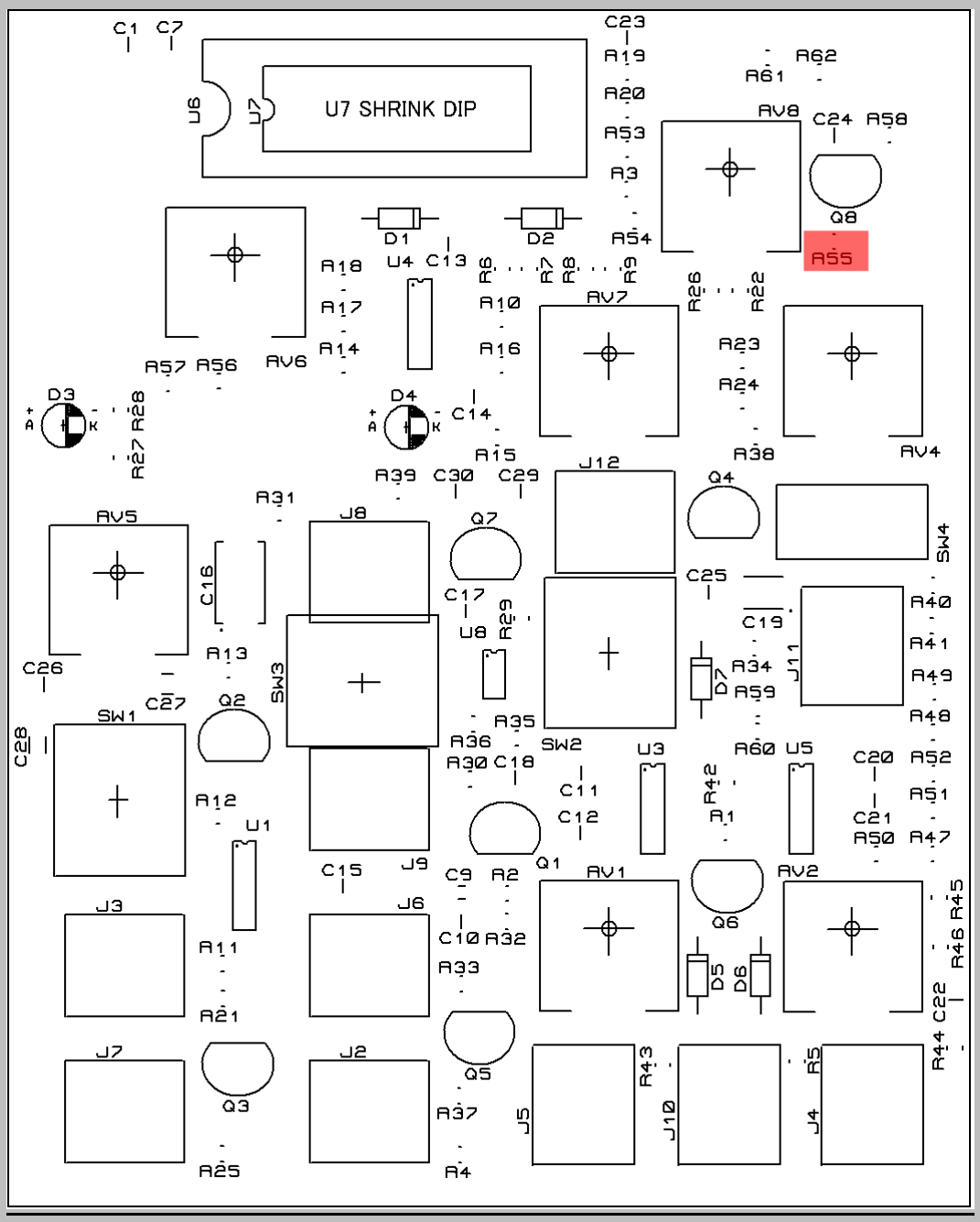


R51 (SEE NOTE 1)	**249K**	**_____**

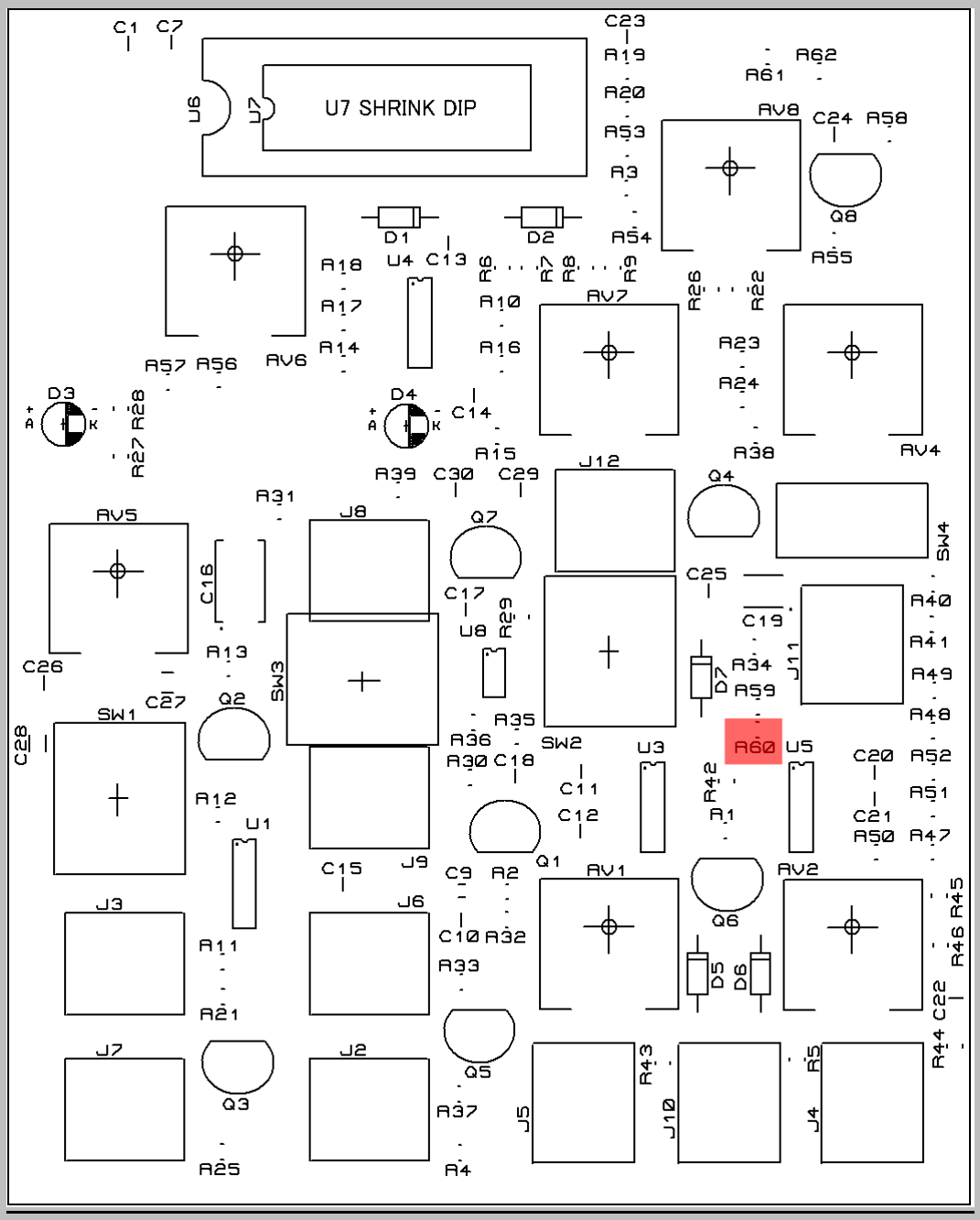
NOTE 1 : IF POWERING THE MODULE FROM J13 MOTM (+15, -15 VDC) then R51 is 390K


U7 SHRINK DIP
C1 C7
U6
U7
C23
R19
R20
R53
R3
R54
R61
R62
AV8
C24
R58
Q8
R55
D1
D2
U4
C13
R18
R17
R14
R6
R7
R8
R9
R10
R16
AV7
R26
R22
R23
R24
R38
AV4
R57
R56
AV6
D3
D4
C14
R15
R27
R28
R39
C30
C29
J12
Q4
SW4
AV5
J8
Q7
C17
C16
R31
U8
R29
C25
C19
R40
R41
R49
R48
J11
C26
R13
SW3
D7
R34
R59
C27
Q2
SW1
C28
R35
R36
R30
C18
SW2
C11
C12
U3
R42
R1
R60
U5
C20
R52
R51
C21
R50
R47
R12
U1
Q1
C15
J9
C9
R2
AV1
AV2
Q6
J3
J6
C10
R32
R33
R11
R21
D5
D6
R46
R45
R44
C22
J7
J2
Q5
Q3
R37
R4
R25
J5
R43
J10
J4
R5

R52	**22K**	**_____**

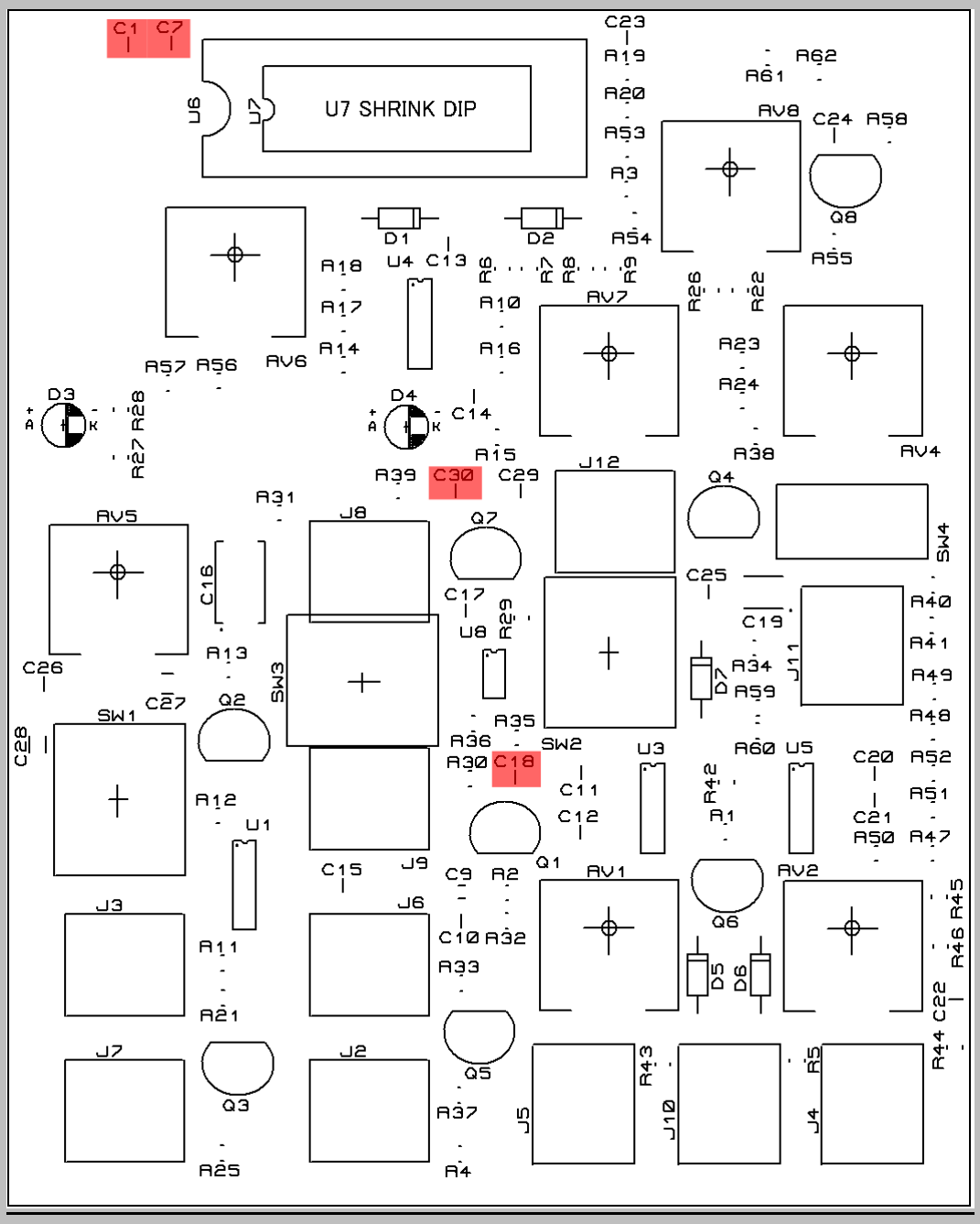

U7 SHRINK DIP
C1
C7
U6
U7
C23
R19
R20
R53
R3
R54
R61
R62
AV8
C24
R58
Q8
R55
D1
D2
U4
C13
R18
R17
R14
R6
R7
R8
R9
R10
R16
AV7
R26
R22
R23
R24
R38
AV4
R57
R56
AV6
D3
D4
C14
R15
R27
R28
R39
C30
C29
J12
Q4
SW4
AV5
J8
Q7
C17
C16
R31
U8
R29
C25
C19
R40
R41
R49
R48
J11
D7
R34
R59
C26
R13
SW3
C27
Q2
SW1
C28
R35
R36
R30
C18
SW2
C11
C12
U3
R42
R1
R60
U5
C20
R52
R51
C21
R50
R47
R12
U1
C15
J9
C9
R2
Q1
AV1
AV2
Q6
J3
J6
C10
R32
R33
R11
R21
D5
D6
R46
R45
C22
R44
J7
J2
Q5
Q3
R37
R4
J5
R43
J10
R5
J4
R25

R55	**220K**	**_____**

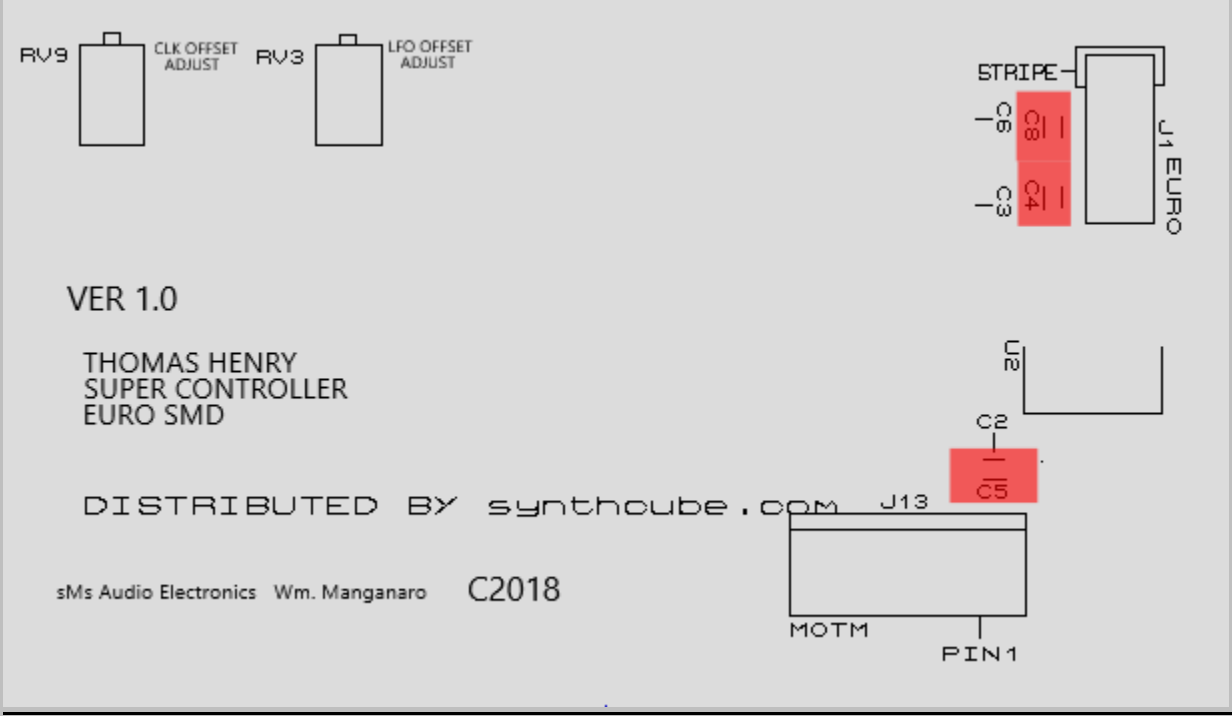


R60	**56K**	_____

Capacitor Installation :

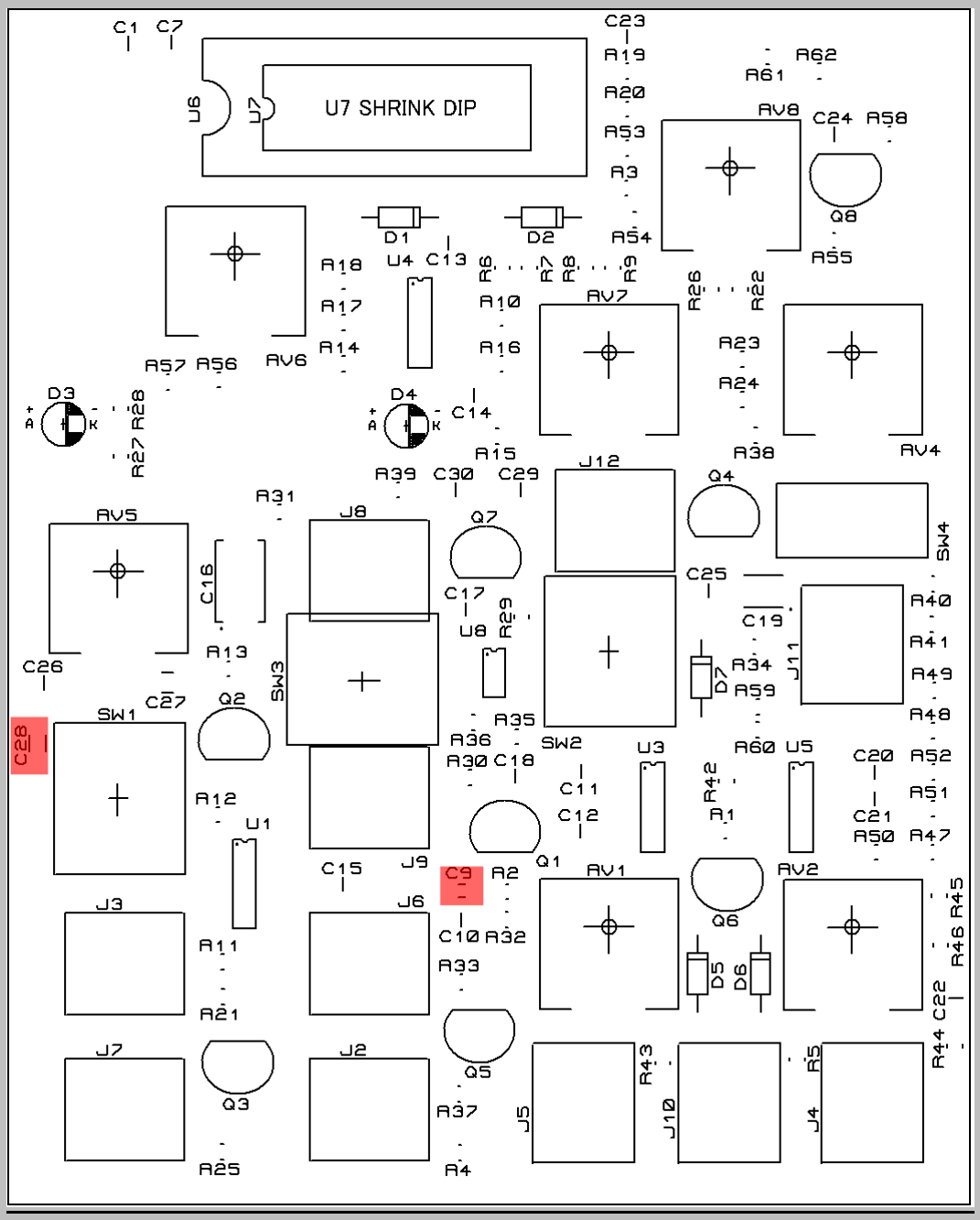


C1,C7,C18,C30	**10000pF**	**_____**
Component Count 4		**Check**

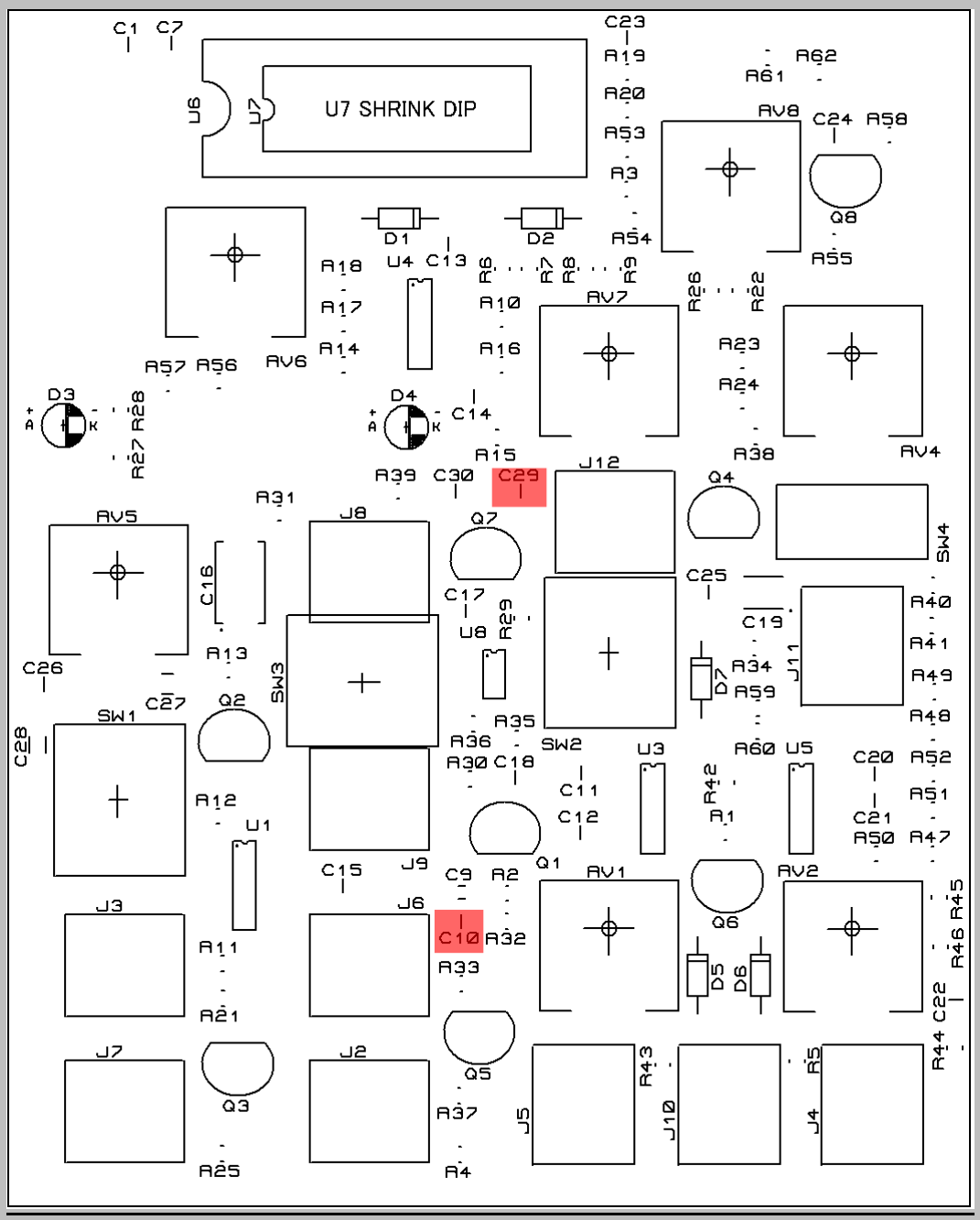


NOTE: These capacitors are on solder side of board

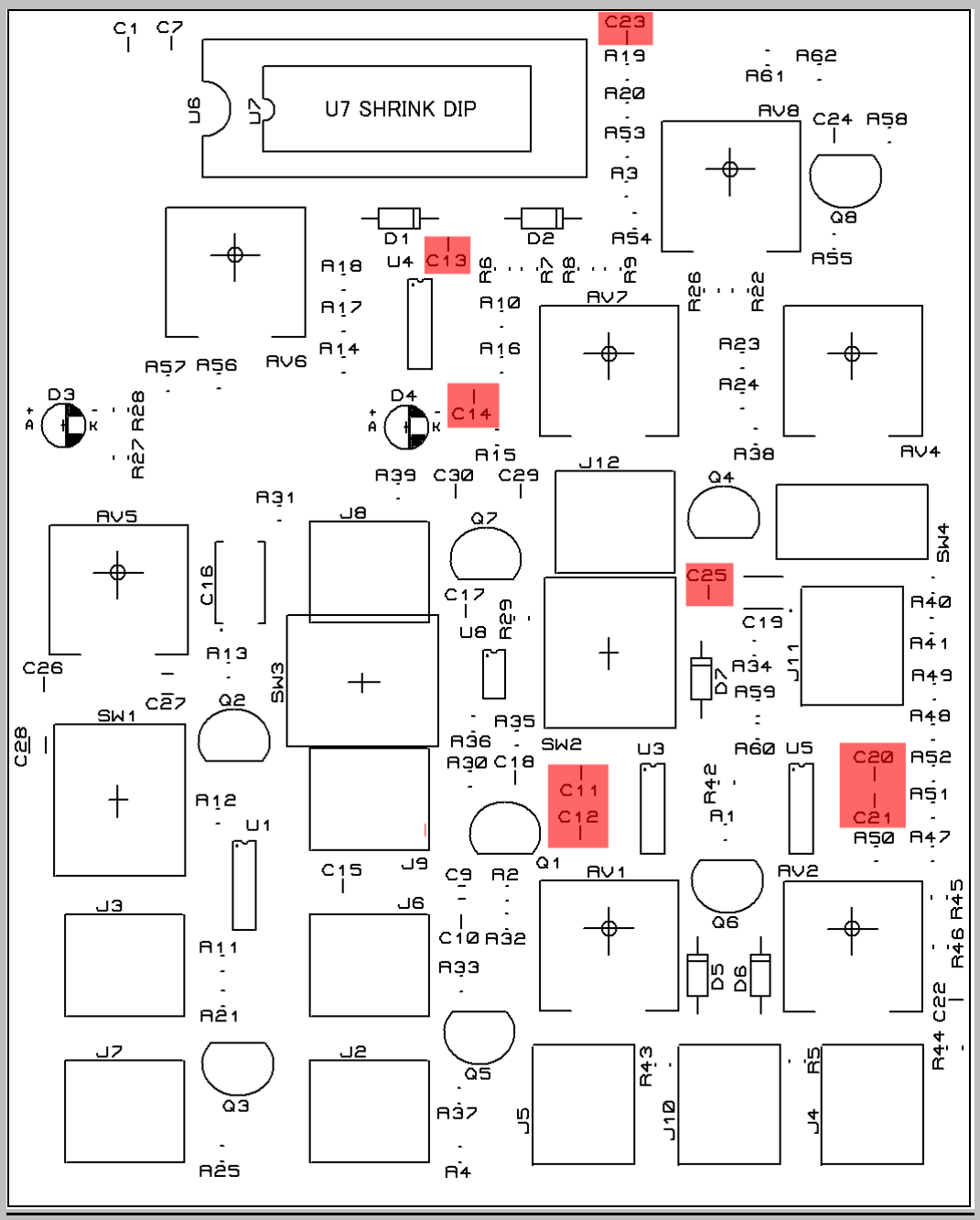
C4-C5,C8	**10uF**	**_____**
Component Count 3		**Check**



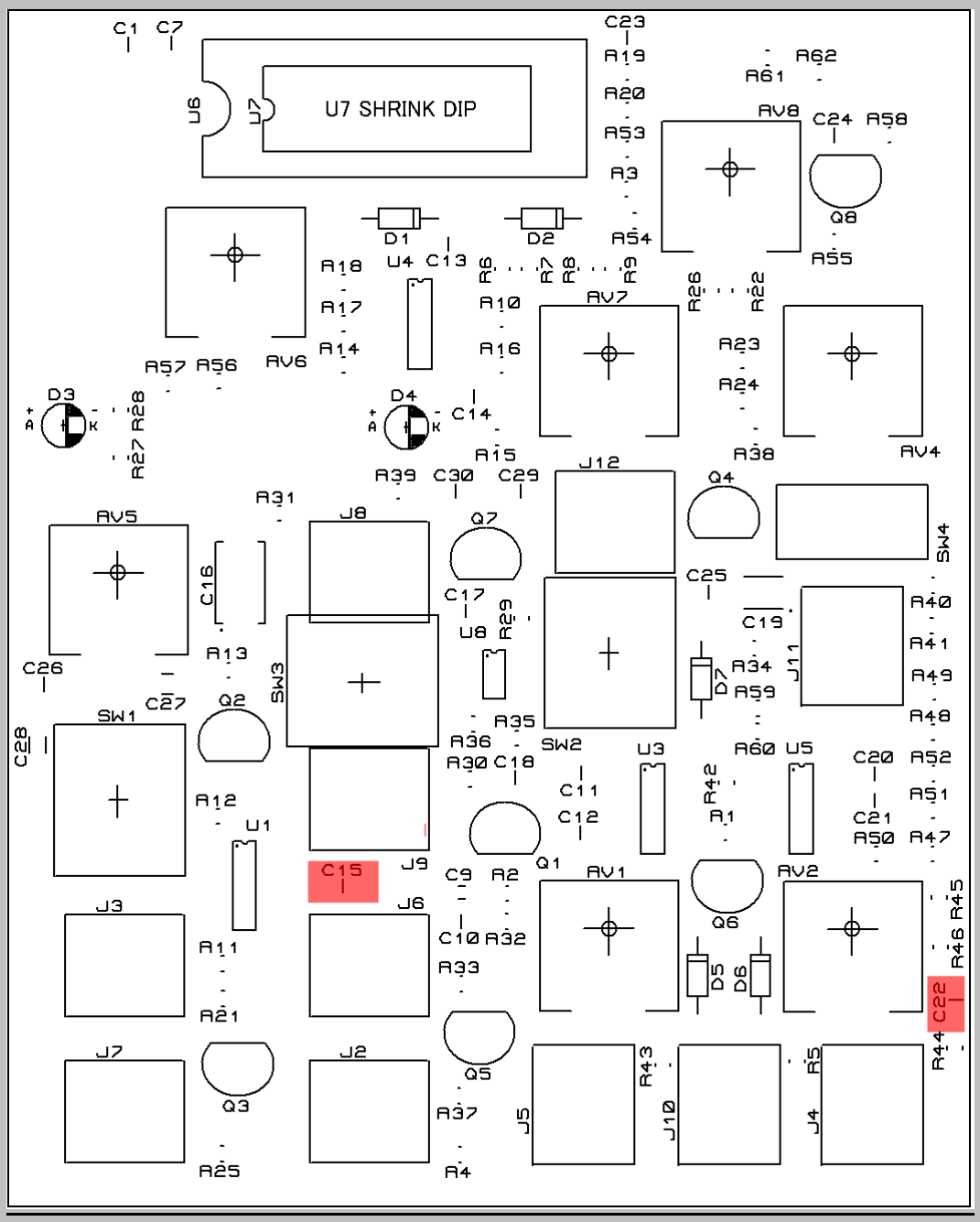
C9,C28	**220nF**	**_____**
Component Count 2		**Check**



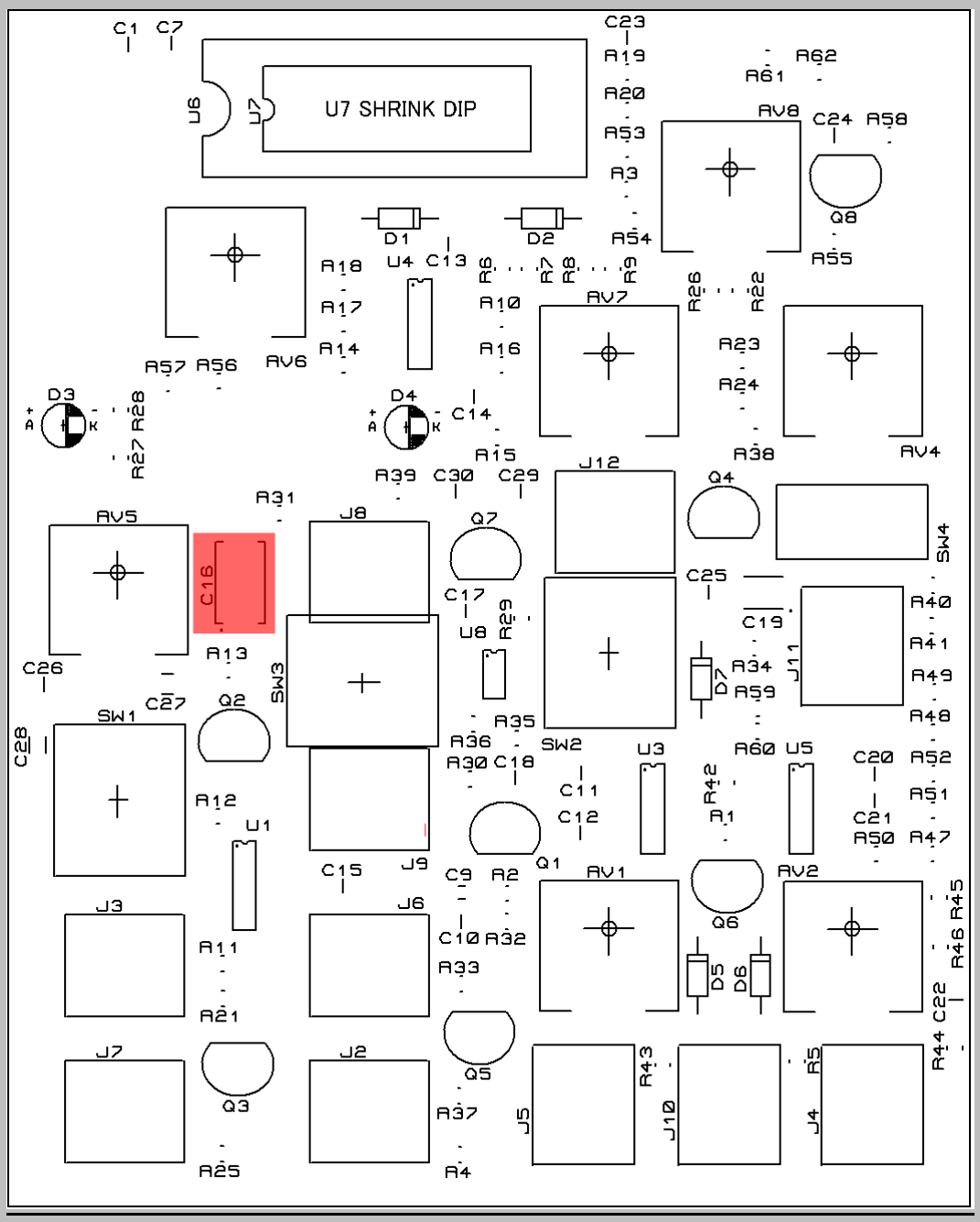
C10,C29	**0.047uF**	**_____**
Component Count 2		**Check**



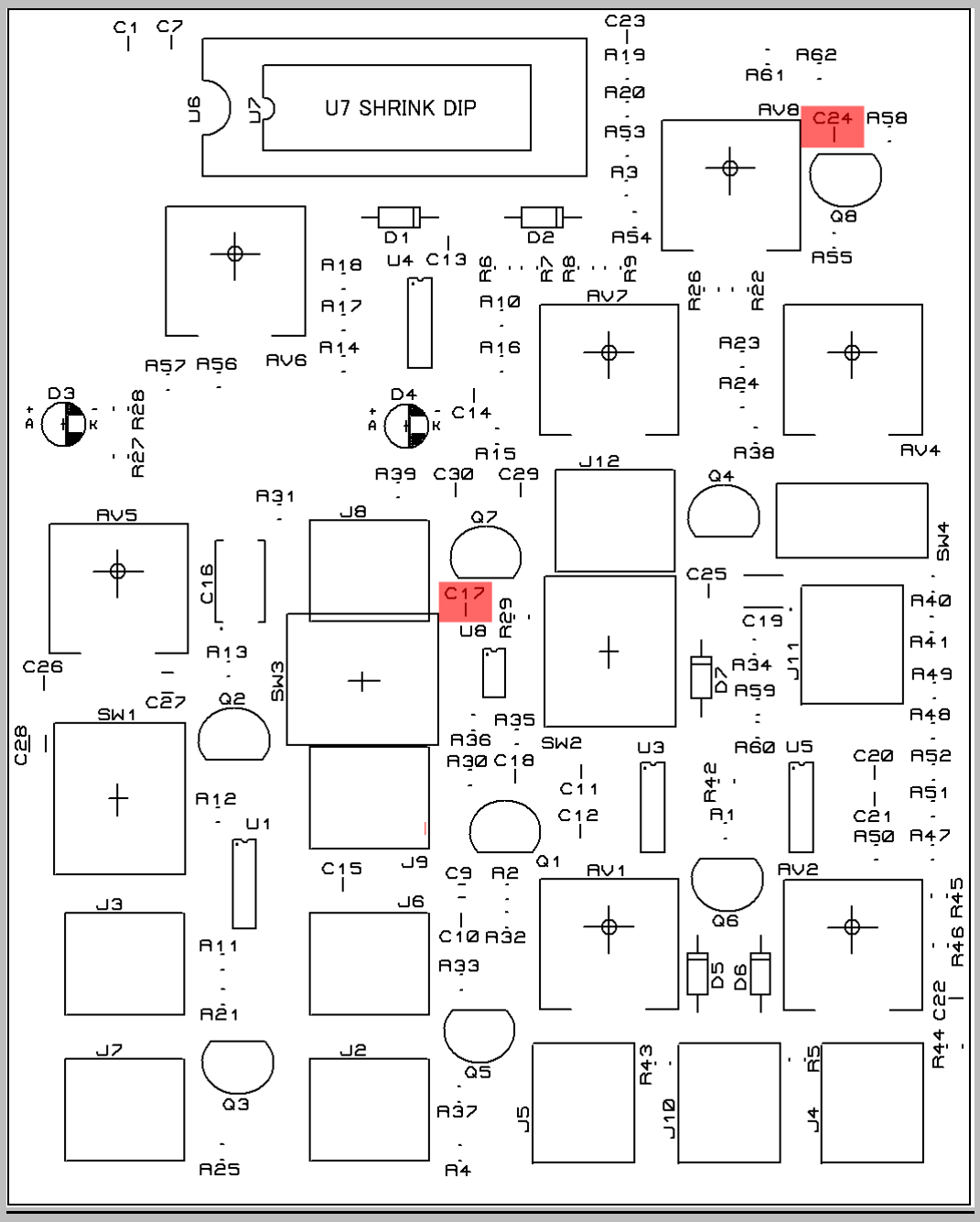
C11-C14,C20-C21,C23,C25	**0.1uF**	**_____**
Component Count 8		**Check**



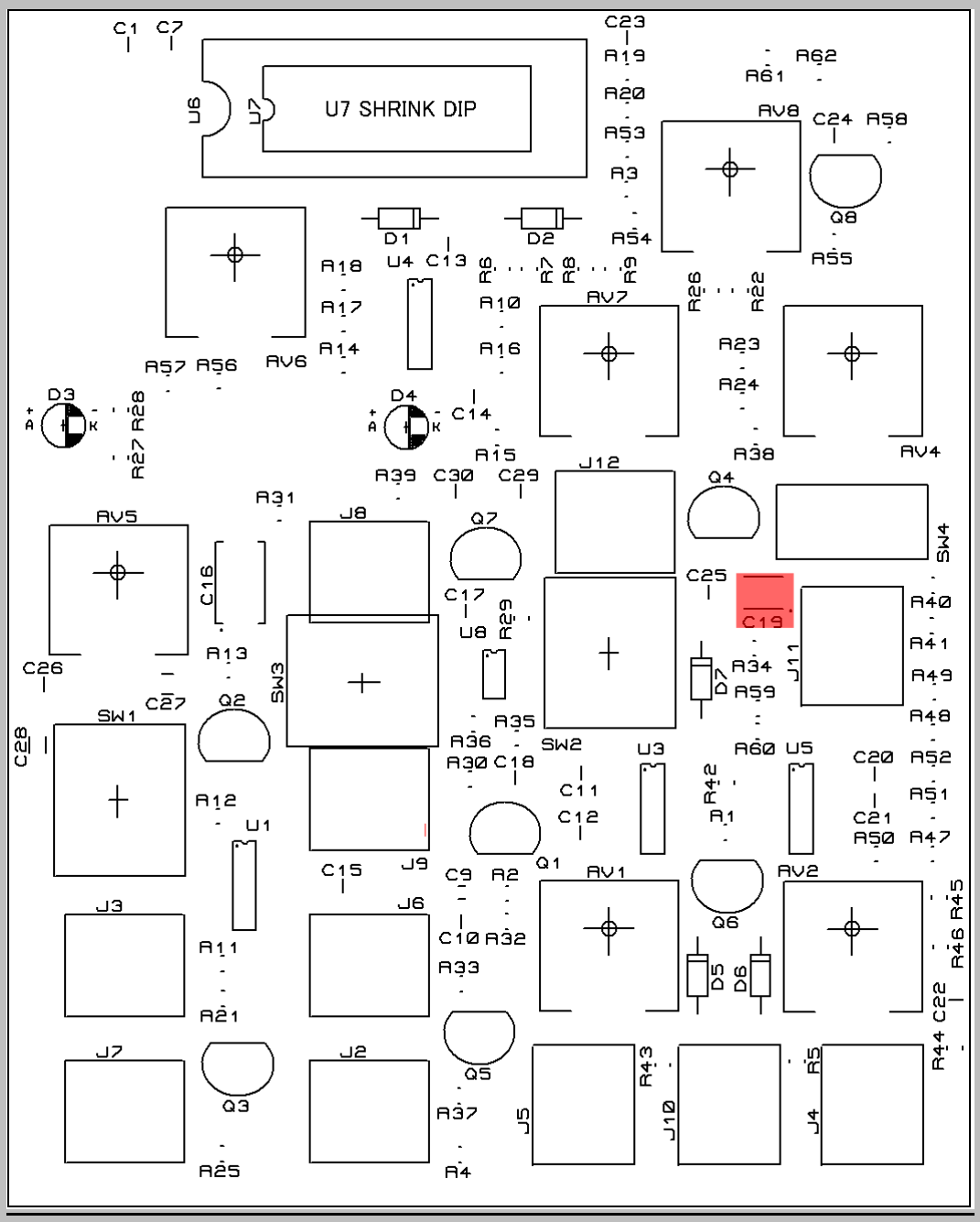
C15,C22	**10000pF**	**_____**
Component Count 2		**Check**



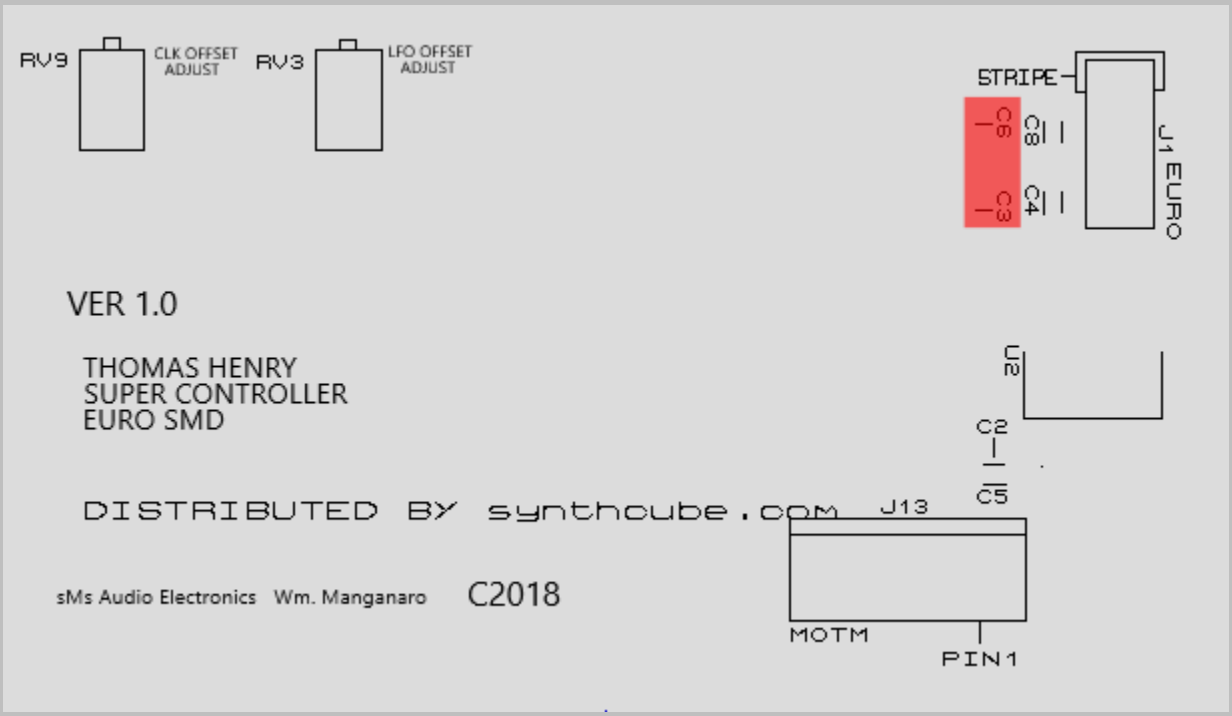
C16	**100uF**	**_____**
		Check



C17,C24	**1000pF**	**_____**
Component Count 2		**Check**

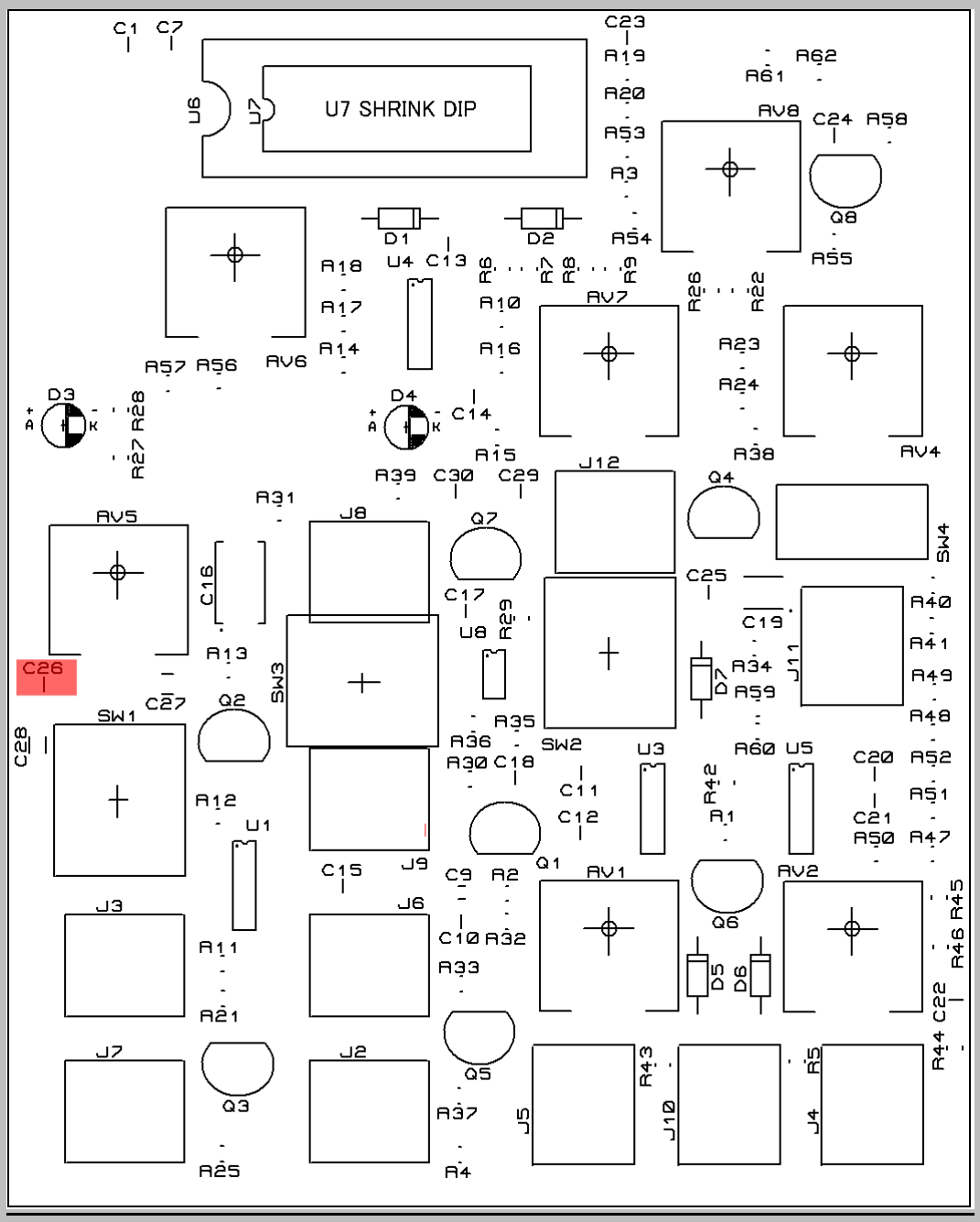


C19	4.7u	_____
		Check

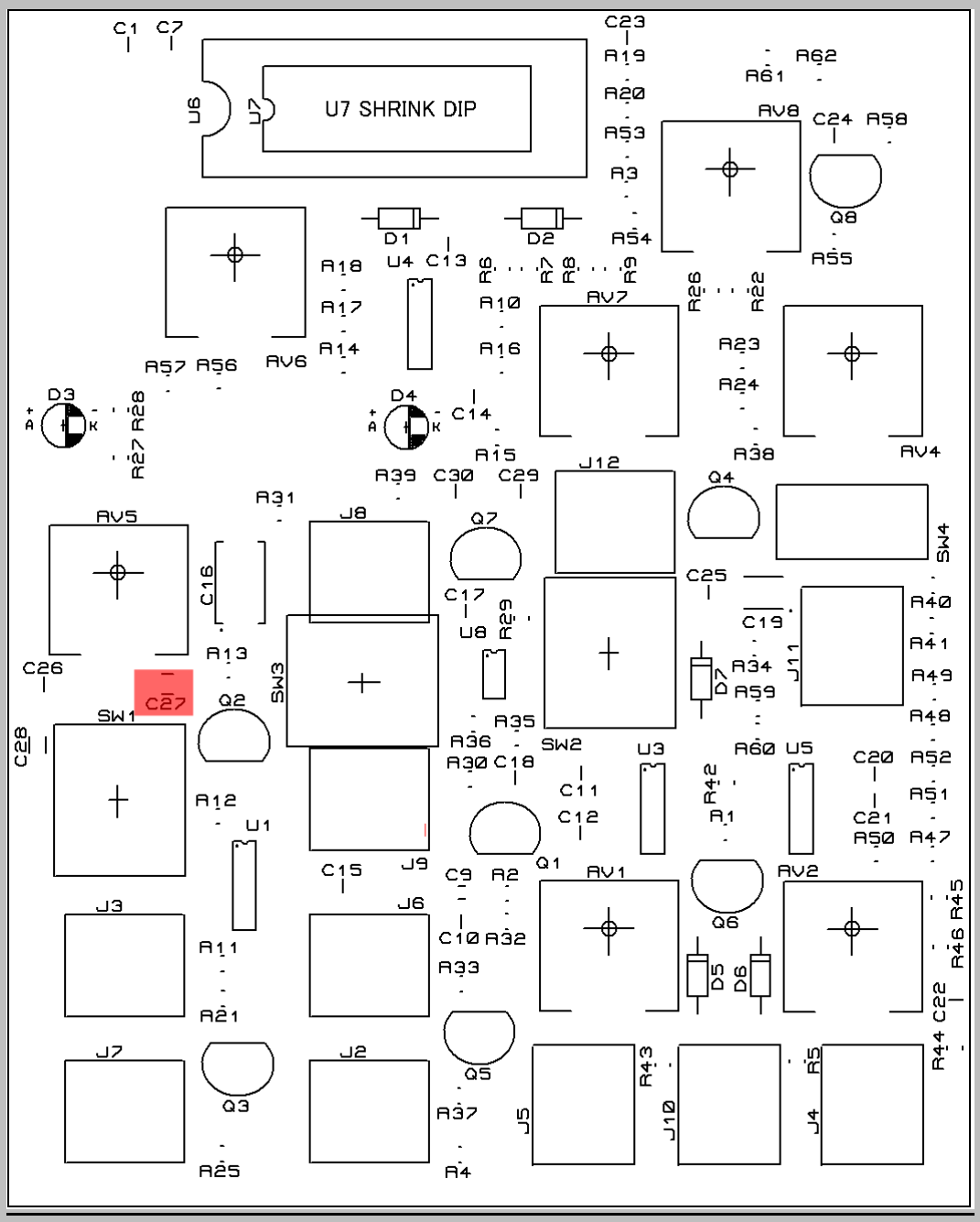


NOTE: These capacitors are on solder side of board

C3, C6	**10000pF**	_____
Component Count 2		**Check**



C26	**2.2u**	**_____**
		Check

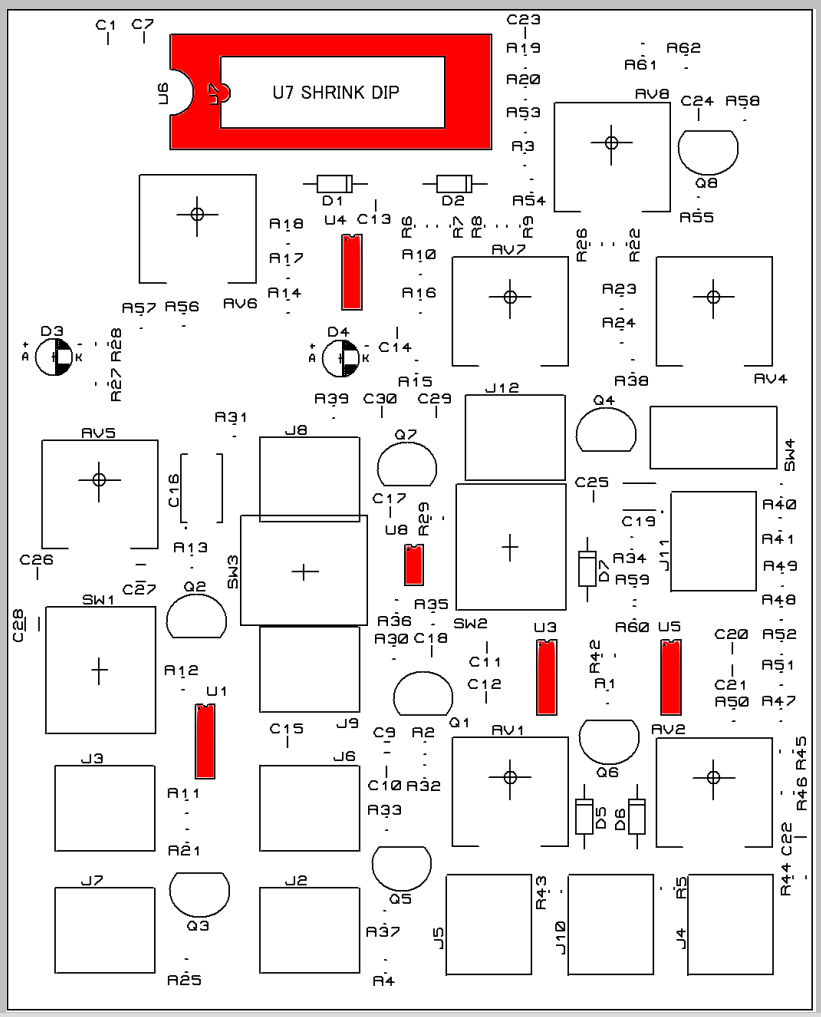


C27	10u	_____
		Check

Now entering the semiconductor zone

Thus the obligatory ESD mention

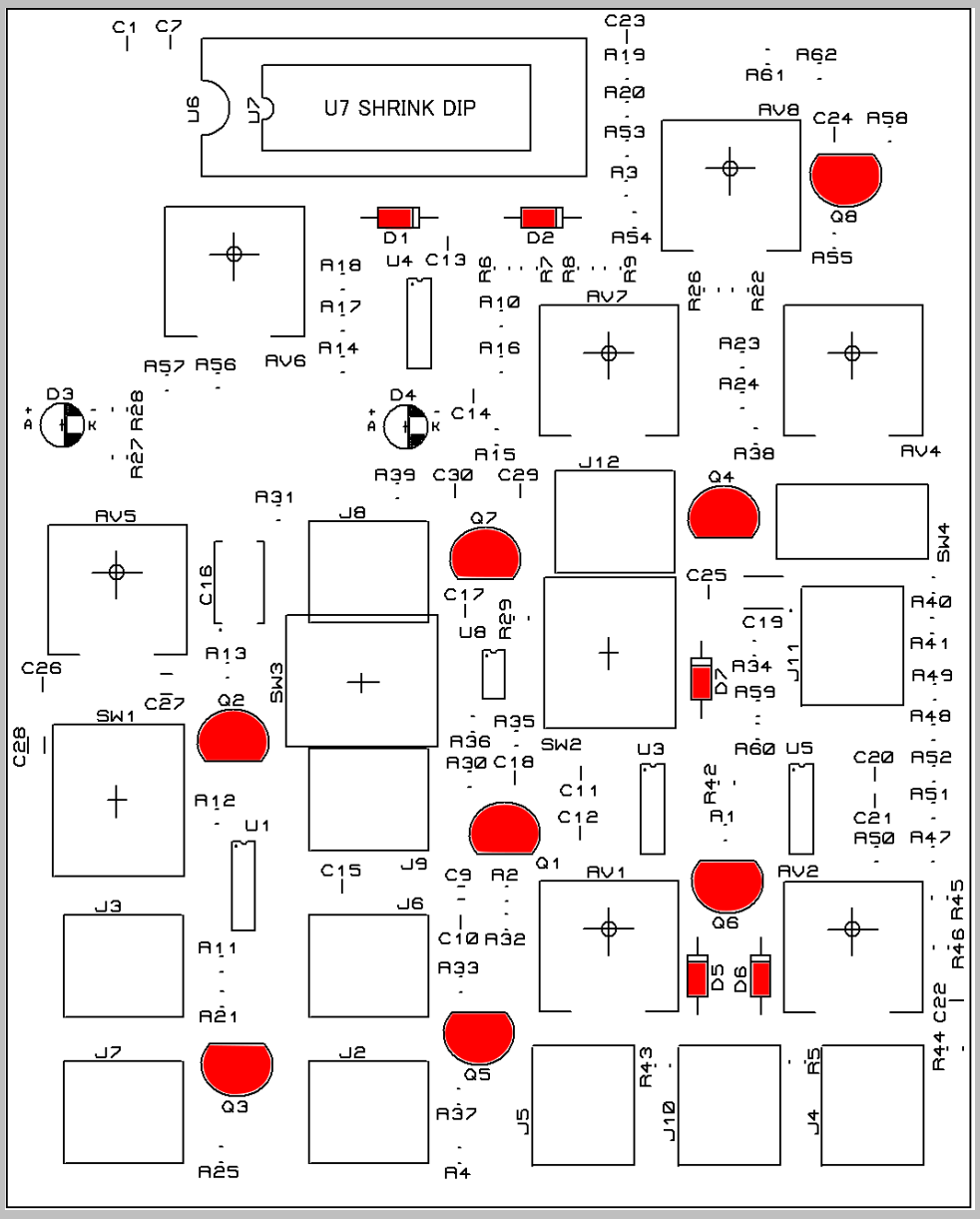
Integrated Circuits Installation:



U1	**4001**	**_____**
U2 (Located on Back of Board)	**LM1117S-5,0**	**_____**
U3-U5 (QTY 3)	**TL074**	**_____**
*** U6 (U7 is an alternate narrow DIP package size) (QTY 1)**	**SN76477 CSG**	**_____**
U8	**NE555**	**_____**
		Check

***You may use a socket for U6 or U7.**

Transistor and Switching Diode Installation:



Q1,Q8 (2)	2N5486CS	_____
Q2-Q7 (6)	2N3904	_____
D1-D2, D5-D7 (5)	1N4148	_____

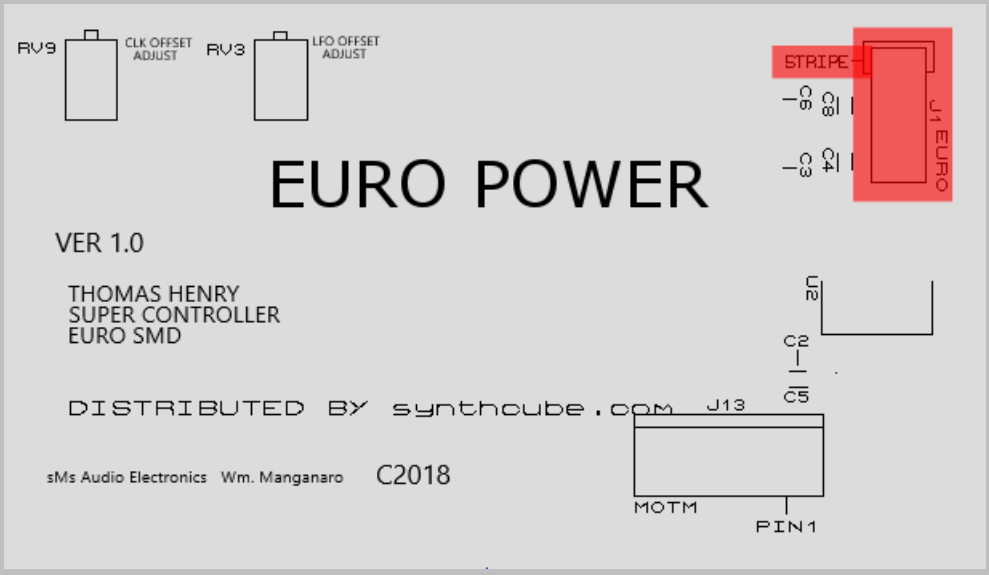
NOTE: Q1 and Q8 are JFET devices so pay attention to their placement. Observe transistor orientation by noting the flat side of the device. Pay attention to diode placement and note the band placement.

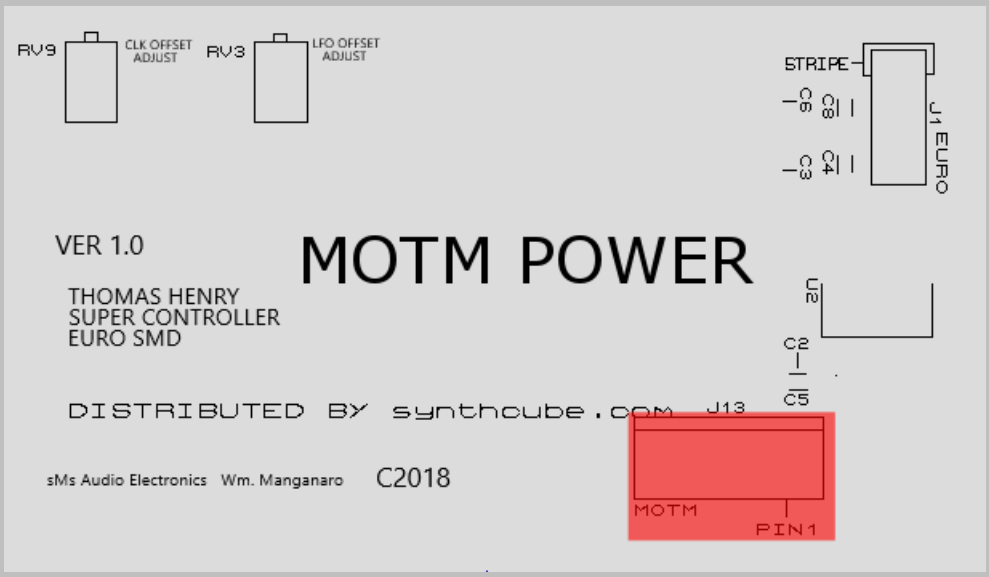
J1 & J13 POWER:

Flip the board around to the bottom and install J1 and J13 power headers ,

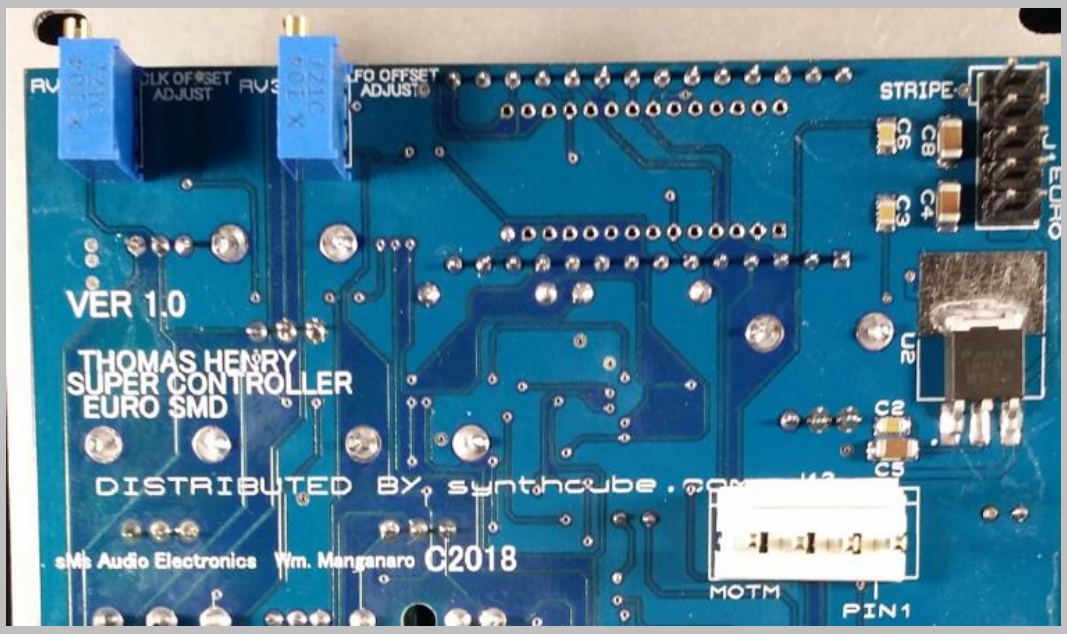
and RV9 and RV3 potentiometers.

Check _____





The back of your PCB should now look like this at this point in the build:



Check _____

STOP HERE

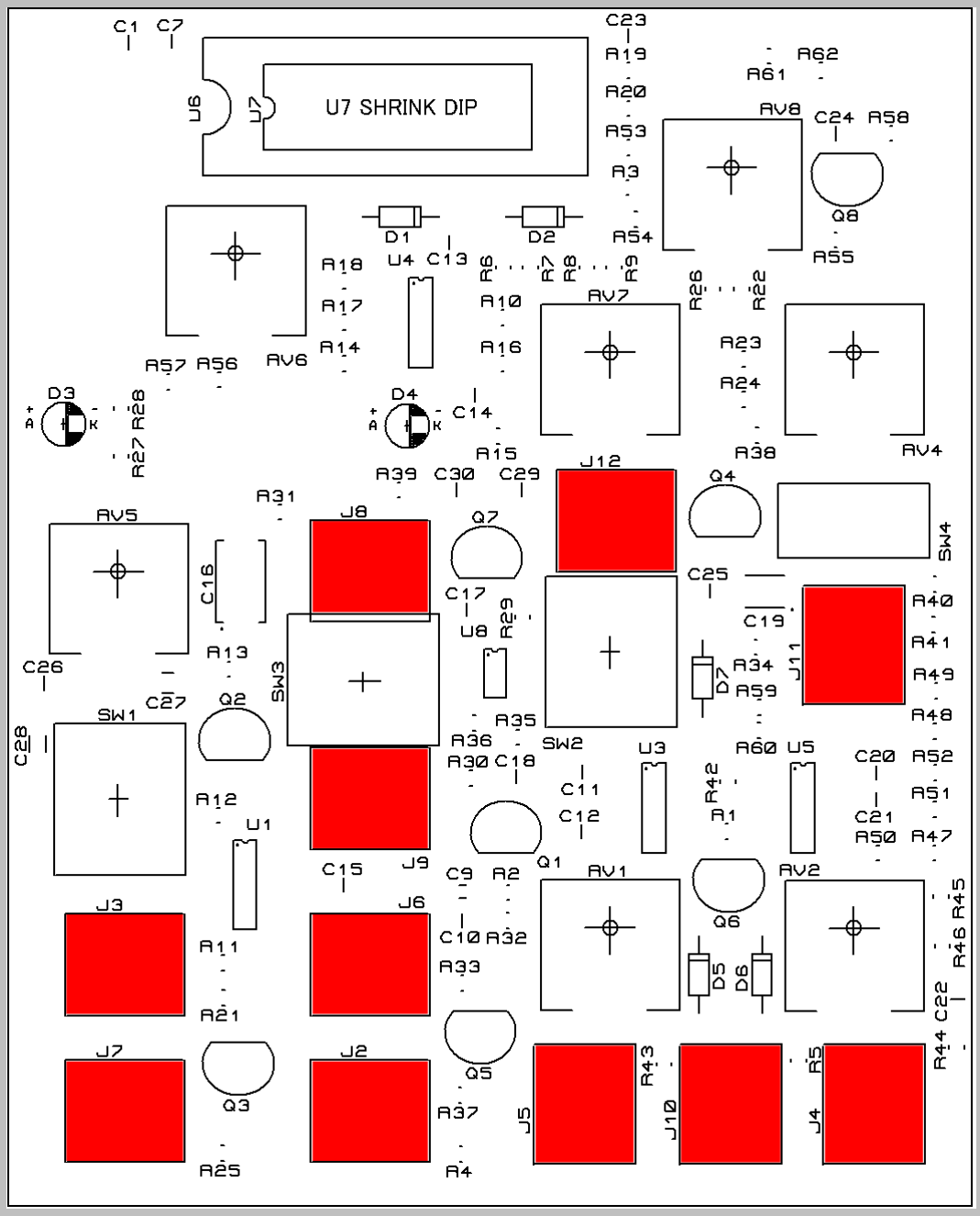
Its probably a good time to stop and inspect your work to make sure that all components thus far are placed, soldered, and are in the proper orientation where applicable. Check all your solder joints for quality and for any bridging that may have occurred. When you are satisfied with your work, its time to move forward

Jack Installation:

Insert all the jacks and before soldering, place the front panel onto the jacks and secure some of the jacks with a nut so that the front panel lays flush against the jacks. This will insure proper alignment with the panel. Now solder all the jacks

and then remove the panel for the next components. Check all your solder joints and be sure that every jack has been soldered.

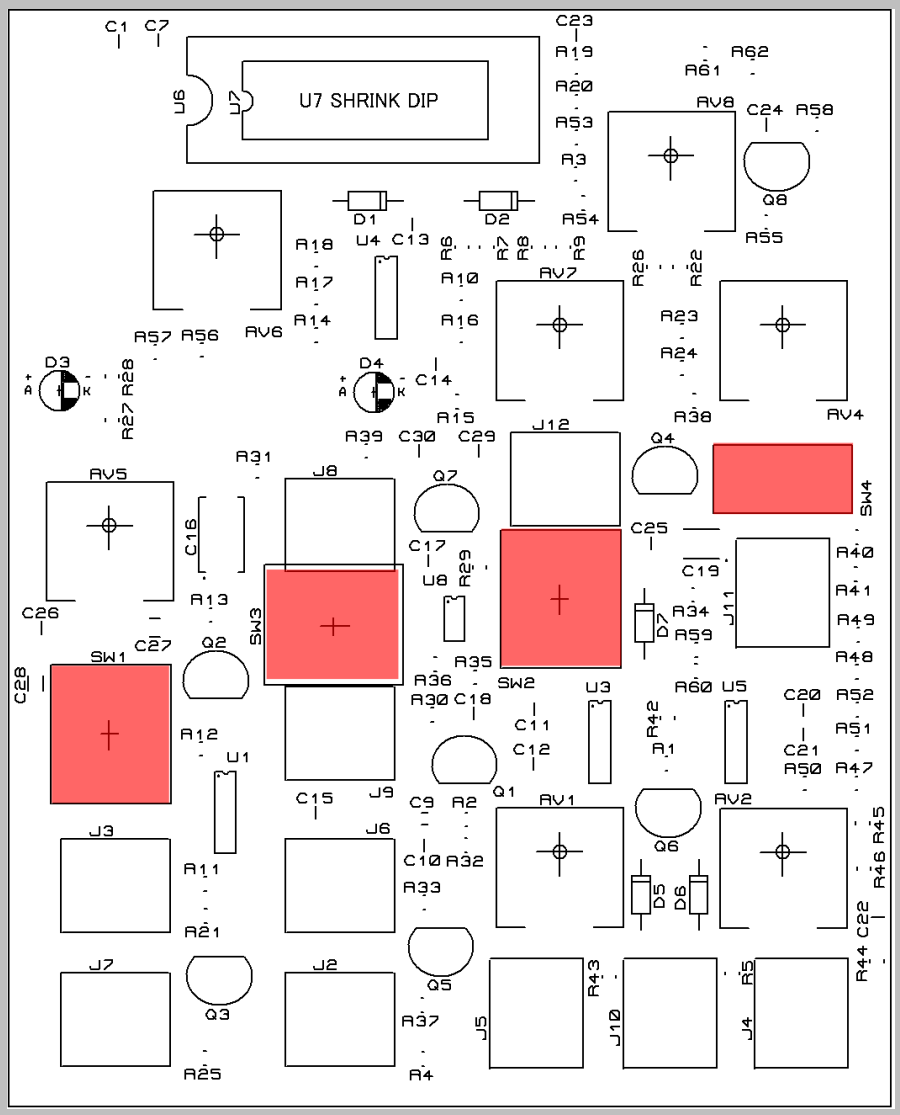
Jack Installation:



J2-J12 (11)	Mono JACK	_____

Switch Installation:

Insert all the switches and before soldering, place the front panel onto the switches and secure the switches with a nut so that the front panel lays flush against the switches. This will insure proper alignment with the panel. Now solder all the switches and then remove the panel for the next components. Check all your solder joints and be sure that every switch has been soldered.

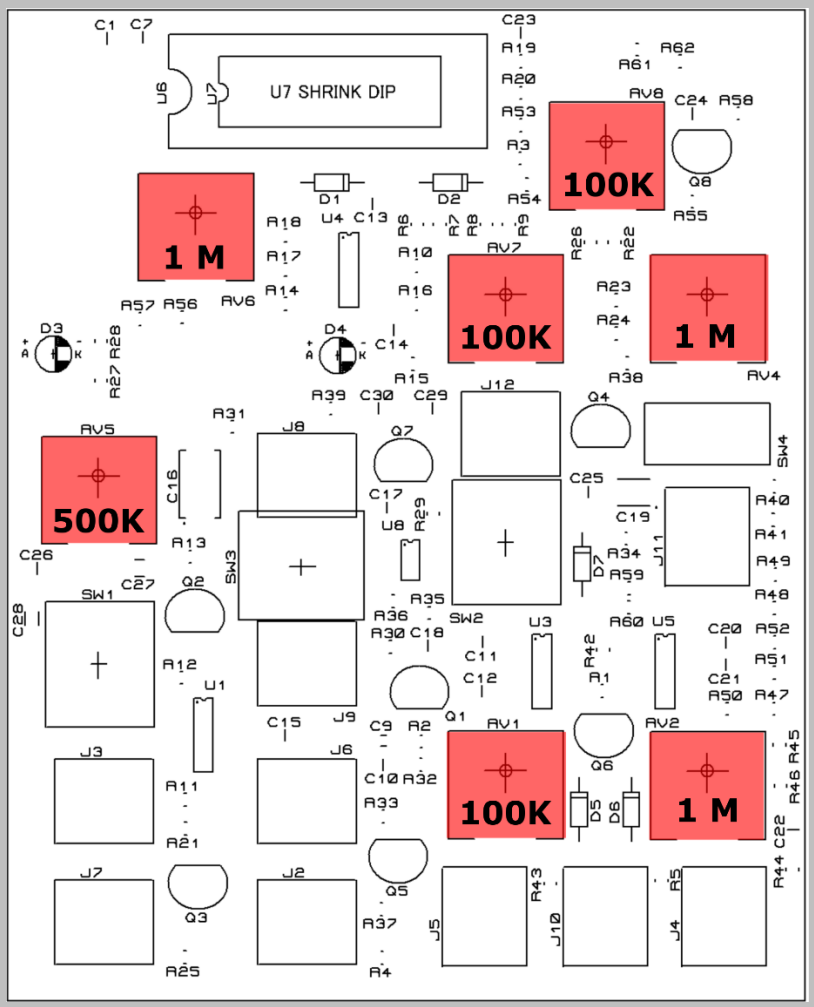


SW1-SW3 (3)	SWITCH ON-ON-ON	_____
SW4	SWITCH SPDT	_____

Potentiometer Installation:

Insert all the potentiometers while observing their values shown in template before soldering, place the front panel onto them and secure some of the them with a nut so that the front panel lays flush against the potentiometers. This will insure proper alignment with the panel. Now solder all the potentiometers and then remove the panel once again. Check all your solder joints and be sure that every potentiometer has been soldered.

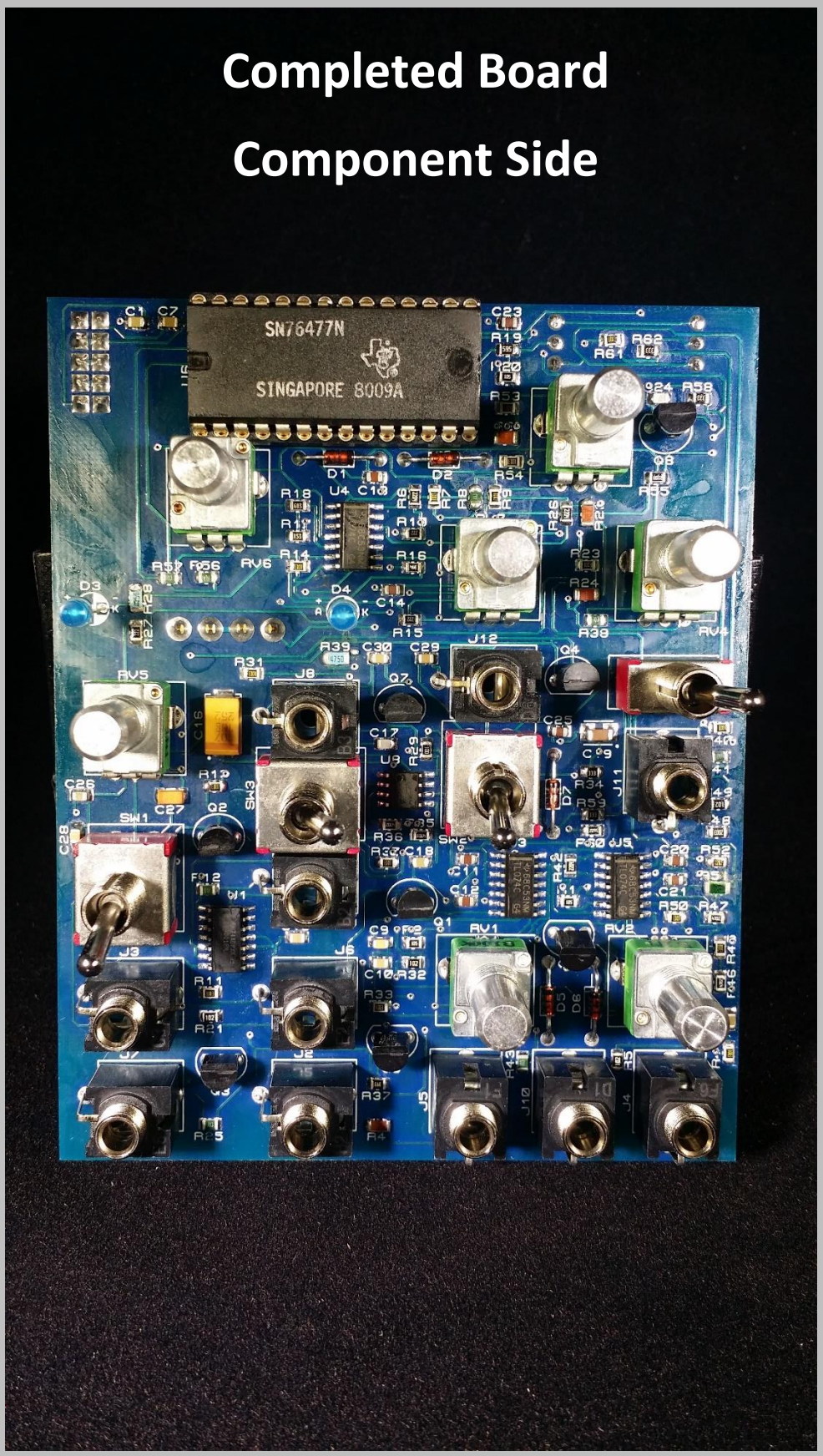
NOTE: Some potentiometers have anti-rotation tabs on them. If so, they need to be snipped off with a flush cutter so that the potentiometer lays flush with the front panel surface. If there is a small nub left, you can file it off.



RV1,RV7-RV8 (3)	100K	_____
RV2,RV4,RV6 (3)	1M	_____
RV5	500K	_____

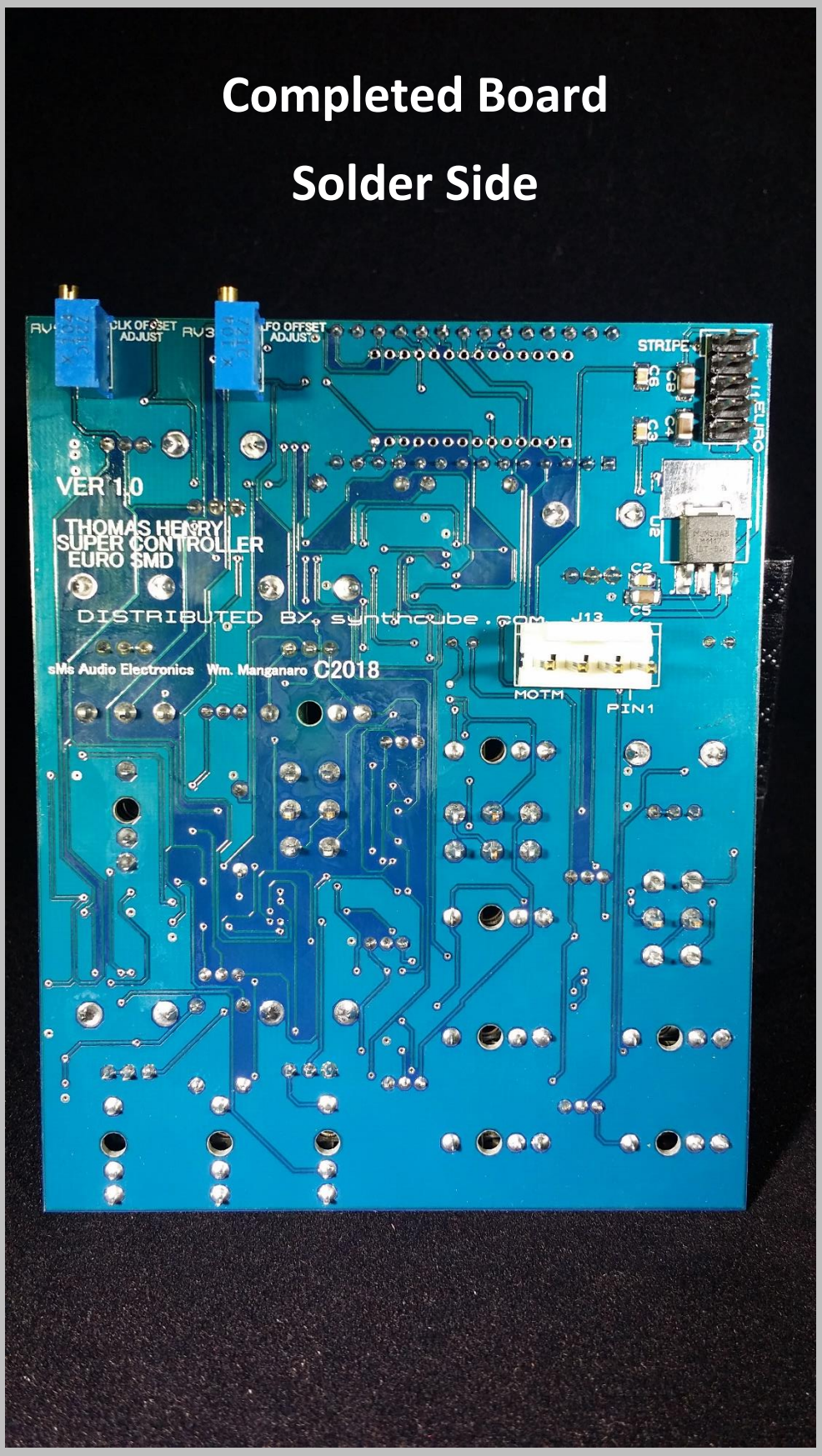
Completed Board

Component Side



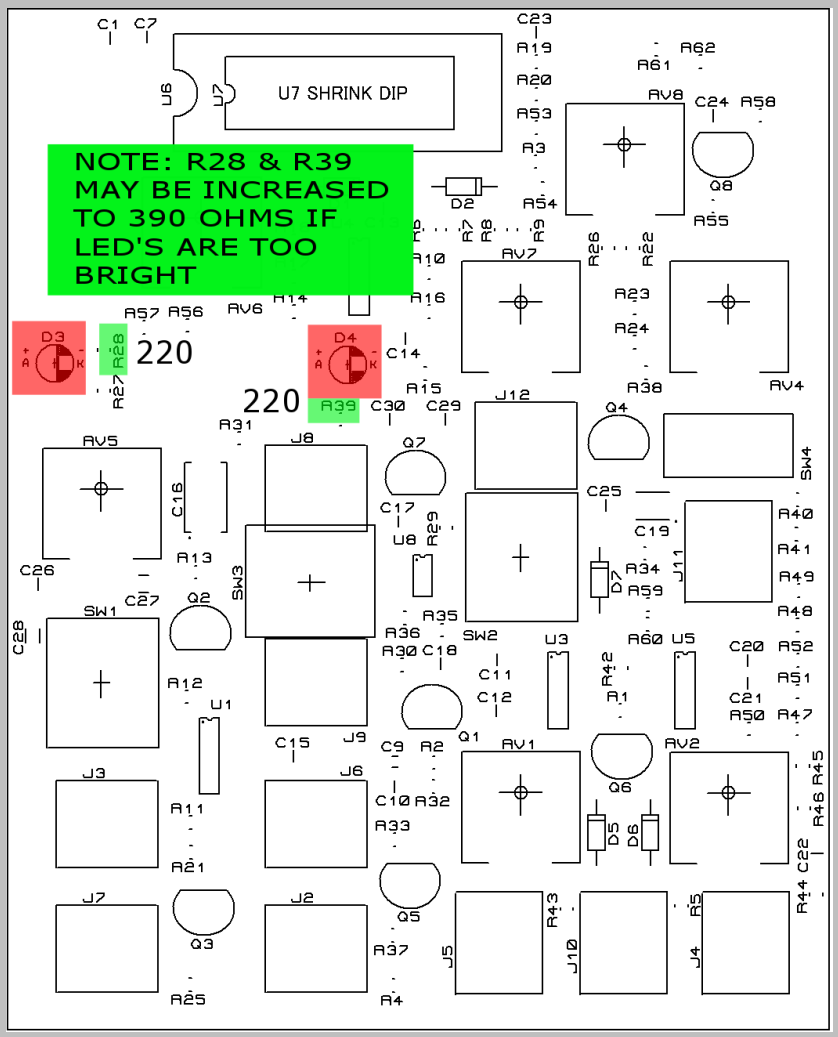
Completed Board

Solder Side



LED Installation:

Insert the LED's with the longer lead placed in the "A(+)" locations. Push the LED's slightly down into the board and then place the front panel back over the board and make sure all controls, switches, and jacks are flush with the panel. Place all the nuts to hold the panel in place. When tightening be careful not to scratch the panel. You may want to make sure the module works and leave the tightening for the very last step in this procedure. Now push the LED's into the panel holes. Once they are secure in the holes, solder them in place making sure the LED's did not slip down. Cut the excess diode leads on solder side of the board with flush cutter.



D3-D4 (2) DIODE-LED _____

The knobs that you choose are a personal choice but for this project, the knobs used are the **Davies 1900h** clones with the 6.4 mm round shaft from Synthcube and Thonk. Just be gentle with the set screw when installing onto the potentiometer shaft as the knob body will crack if too much torque is used.

Specifications:

Davies 1900 clone knob, abs plastic, 6.4mm solid shaft

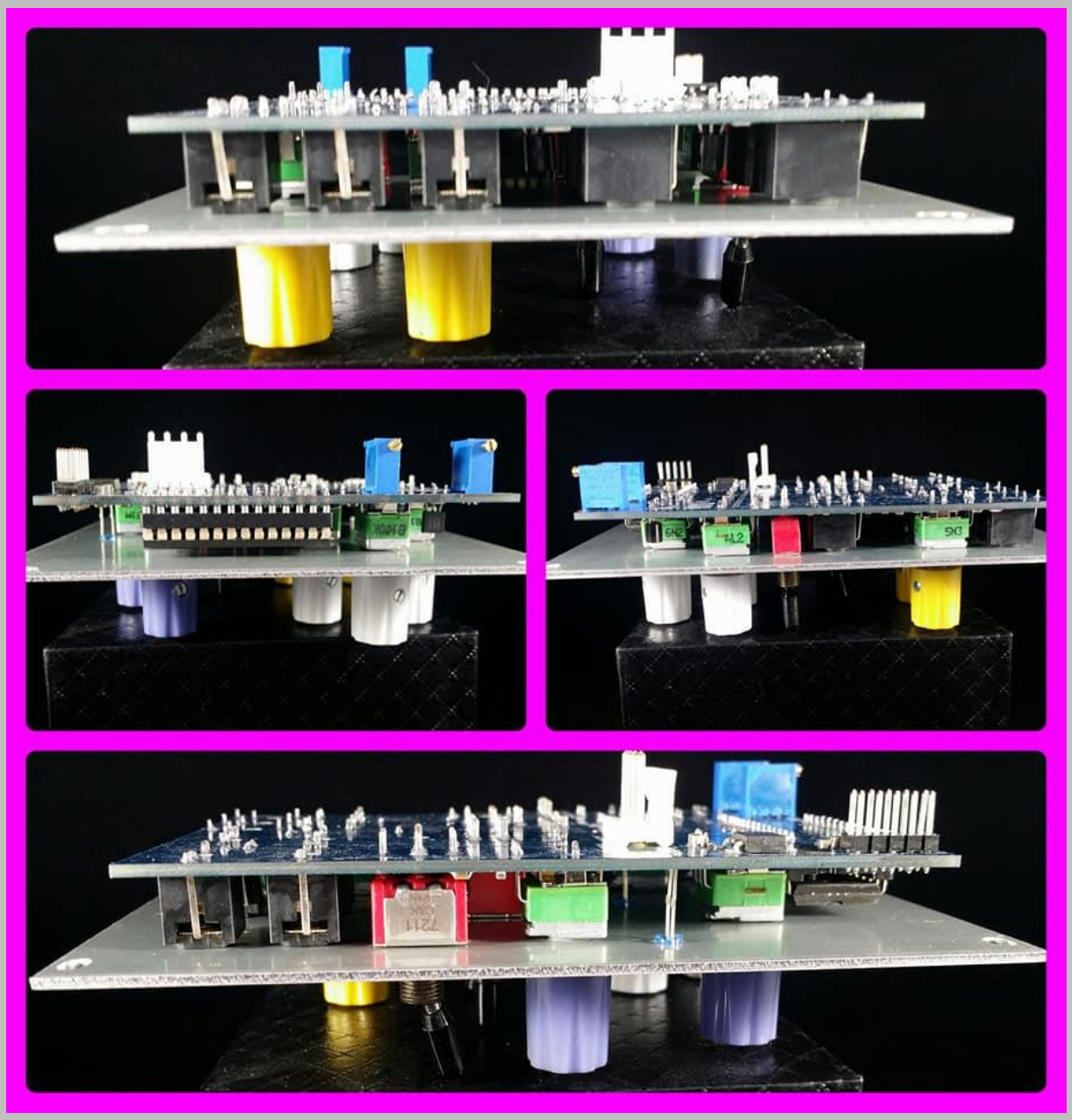
Classic and popular Davies 1900 clone abs plastic knob, used on many Eurorack and other synth modules

6.4mm (1/4") shaft size, solid round shaft

Brass collar insert and set screw

Congratulations !!! You have completed the build portion of the Super Controller EURO module.

LEFT, RIGHT, TOP, AND BOTTOM VIEWS OF THE FINISHED ASSEMBLY



These four views show how the PC board shall look when mating to the front panel.

Front and rear views of the SCM:

AM I ALIVE !!

IMPORTANT: Make sure your power source in your case is OFF, connect one end of the ribbon cable to the module making sure to place the ribbon cable red stripe at the location labeled "STRIPE" on J1. Connect the other end of the cable to the case power connector making sure alignment is correct and is in the correct orientation. Most case power connectors look like the one below so no mistakes can be made.

Setting up the SCM before use:

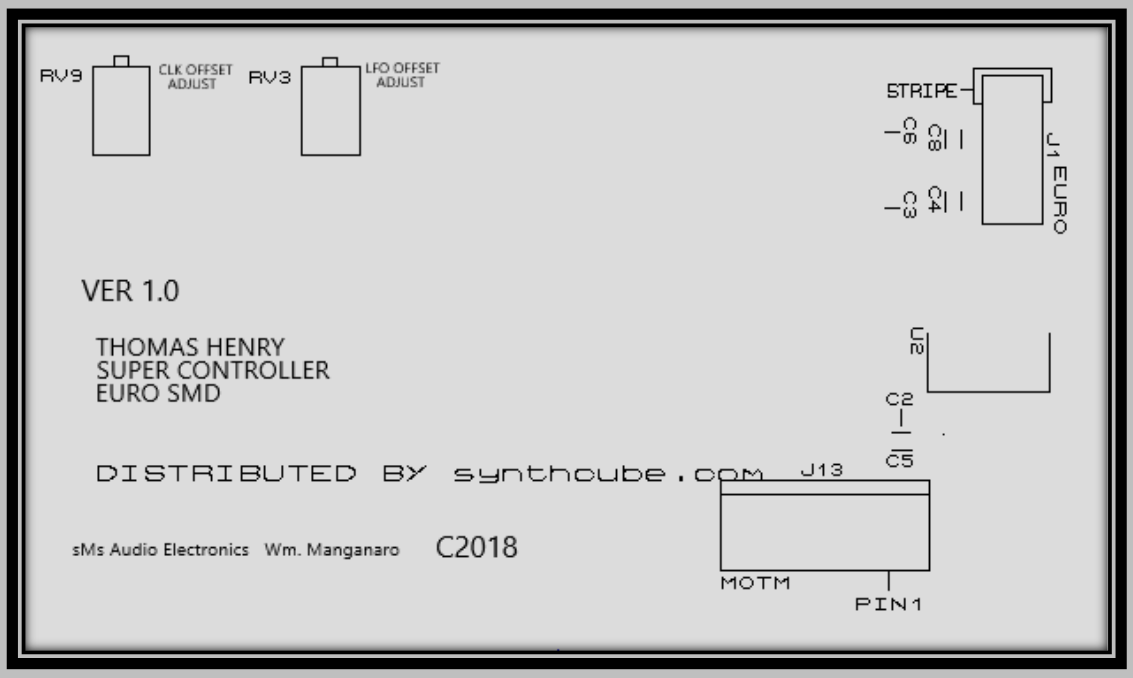


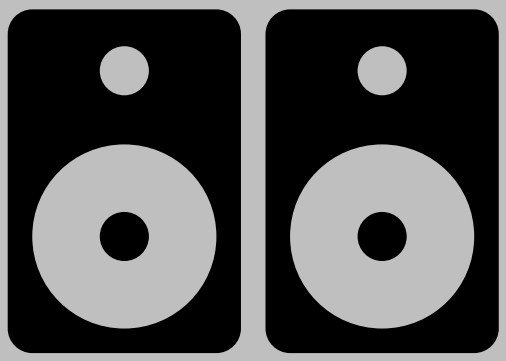
Figure 3 SCM PCB adjustment potentiometers RV9 / RV3

As a first test, In the LFO section, place the RATE knob at 12 o'clock position and the mode switch to the right which is the GATE mode. Place the rate range switch to Hi. Turn the case power on. The right LED should be on solidly and the left LED should be blinking. If it is, the LFO is operating and the sound chip is alive. Placing the switch to the middle should also produce the same result. With the switch set to the left, both LED's shall be OFF.

The potentiometers used for this setup procedure are located on the rear of the PCB. This is shown above in figure 3. First you need to adjust the RV3 potentiometer (LFO OFFSET ADJUST), which is the dc offset trim for the triangle wave output. The fastest way to set this is to monitor the triangle wave on an oscilloscope and set the potentiometer RV3 so that the triangle wave is symmetrically oriented about the ground reference. If you don't have a scope, monitor the triangle wave with a voltmeter in DC measurement mode. Then set the RV3 potentiometer so that you get an voltmeter indication as close to zero volts as possible. If you are not fussy about zeroed-out triangle waves, simply set the trimmer in mid-position and leave it. You will need to determine the mid point of the potentiometer to do this. This should give you good enough results for all applications. To adjust the noise clock offset adjust potentiometer RV9 (CLK

OFFSET ADJUST), monitor the noise with an amplifier. Turn RV8 (FREQ) and RV7 (CV FRQ) front panel controls completely CCW, then adjust potentiometer RV9 around a few times to get familiar with it's effect. At one extreme you won't hear anything through the monitor amp; at the other extreme you will hear a very shrill white noise sound. Starting from a no-noise position, adjust RV9 until the noise just starts. This is the optimum position. By setting RV9 in such a way, you will be able to utilize the RV8 (FREQ) control to it's fullest range.

Set the LFO controls back to the way they were set in the first section and then check to see that all OUTPUTS are present on a scope of in your music setup. Work all the controls and inputs in the NOIZE and S&H sections to verify proper operation in accordence to the functional description.



Your DCM module is now ready to use !!

Schematic diagrams are provided at the end of this document to aid in troubleshooting in case things do not work. If they don't work, don't be dissapointed. It's a good chance to troubleshoot and learn! If you get stuck, the folks in the build thread that is established (link will be provided on Synthcube web site) will be eager to help. Myself included.

BILL OF MATERIALS:

References	Value	Digikey Stock Code	Manufacturers Part Number	Description
CAPACITORS				
C1-C3,C6-C7,C18,C30	10000pF	478-10687-2-ND	08055C103KAT4A (AVX)	CAP CER 10000PF 50V X7R 0805
C4-C5,C8	10u	399-5152-1-ND	T491A106M020AT (KEMET)	CAP TANT 10UF 20V 20% 1206
C9,C28	220n	478-1399-1-ND	08053C224KAT2A (AVX)	CAP CER 0.22UF 25V X7R 0805
C10,C29	0.047u	709-1012-1-ND	500X15W473MV4E (Johanson)	CAP CER 0.047UF 50V X7R 0805
C11-C14,C20-C21,C23,C25	0.1u	478-1423-1-ND	08053G104ZAT2A (AVX)	CAP CER 0.1UF 25V Y5V 0805
C15,C22	10000pF	399-1158-1-ND	C0805C103K5RACTU (KEMET)	CAP CER 10000PF 50V X7R 0805
C16	100u	399-3770-1-ND	T491D107K016AT (KEMET)	CAP TANT 100UF 16V 10% 2917
C17,C24	1000pF	478-1290-1-ND	08051A102JAT2A (AVX)	CAP CER 1000PF 100V C0G/NP0 0805
C19	4.7u	495-2272-2-ND	T491B475K025ZT (KEMET)	CAP TANT 4.7UF 25V 10% 1411
C26	2.2u	478-1413-2-ND	0805ZD225KAT2A (AVX)	CAP CER 2.2UF 10V X5R 0805
C27	10u	587-1339-1-ND	EMK316BJ106KL-T (TAIYO YUDEN)	CAP CER 10UF 16V X5R 1206
RESISTORS				
R1,R7,R9,R11,R13-R14,R23,R30-R31 ,R33,R40,R44-R45,R50,R53-R54,R61	100K	311-100KCTR-ND	9C08052A1003FKHFT (YAGEO)	RES SMD 100K OHM 1% 1/8W 0805
R2,R20	1.0M	311-1.00MCRCT-ND	RC0805FR-071ML (YAGEO)	RES SMD 1M OHM 1% 1/8W 0805

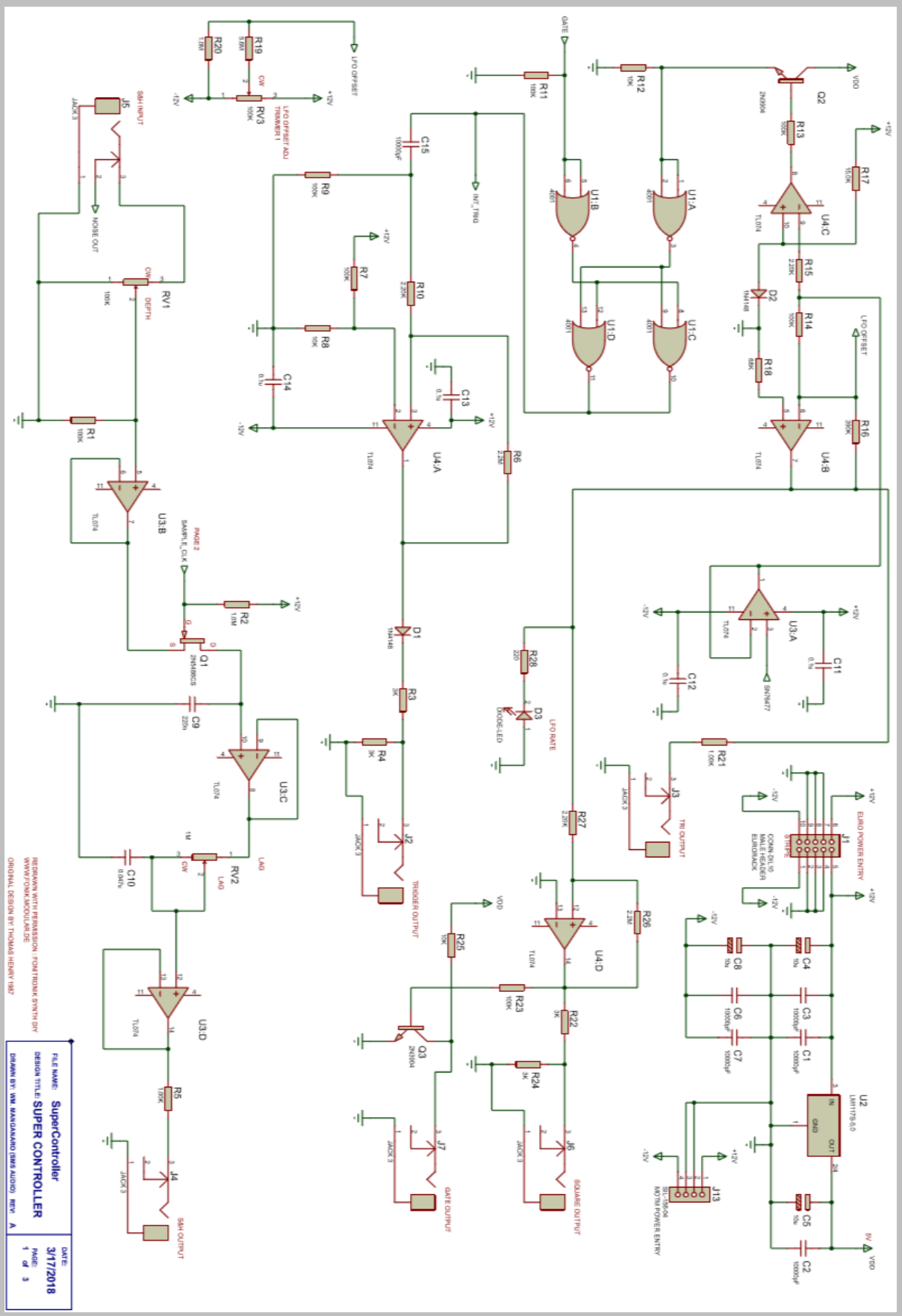
R3-R4,R22,R24	3K	311-3.0KACT-ND	9C08052A3001JLHFT (YAGEO)	RES SMD 3K OHM 5% 1/8W 0805
R5,R21,R32,R49	1.00K	311-1.00KCRCT-ND	RC0805FR-071KL (YAGEO)	RES SMD 1K OHM 1% 1/8W 0805
R6,R26,R42	2.2M	311-2.20MCRCT-ND	RC0805FR-072M2L (YAGEO)	RES SMD 2.2M OHM 1% 1/8W 0805
R8,R12,R25,R41,R38,R43,R56-R57	10K	311-10KARDKR-ND	RC0805JR-0710KL (YAGEO)	RES SMD 10K OHM 5% 1/8W 0805
R10,R15,R27	2.20K	311-2.20KCRDKR-ND	RC0805FR-072K2L (YAGEO)	RES SMD 2.2K OHM 1% 1/8W 0805
R16	390K	311-390KCRCT-ND	RC0805FR-07390KL (YAGEO)	RES SMD 390K OHM 1% 1/8W 0805
R51 (SEE NOTE 1)	249K	311-249KCRCT-ND	RC0805FR-07249KL (YEAGO)	RES SMD 249K OHM 1% 1/8W 0805
R17	15.0K	311-15.0KCRDKR-ND	RC0805FR-0715KL (YAGEO)	RES SMD 15K OHM 1% 1/8W 0805
R18	68K	311-68.0KCRCT-ND	RC0805FR-0768KL (YAGEO)	RES SMD 68K OHM 1% 1/8W 0805
R19	5.6M	311-5.6MARCT-ND	RC0805JR-075M6L (YEAGO)	RES SMD 5.6M OHM 5% 1/8W 0805
R28,R39	220	311-220CRCT-ND	RC0805FR-07220RL (YEAGO)	RES SMD 220 OHM 1% 1/8W 0805
R29	10	311-10.0CRCT-ND	RC0805FR-0710RL (YEAGO)	RES SMD 10 OHM 1% 1/8W 0805
R34,R58-R59,R62	33K	311-33.0KCRCT-ND	RC0805FR-0733KL (YEAGO)	RES SMD 33K OHM 1% 1/8W 0805
R35	4.7K	311-4.70KCRCT-ND	RC0805FR-074K7L (YEAGO)	RES SMD 4.7K OHM 1% 1/8W

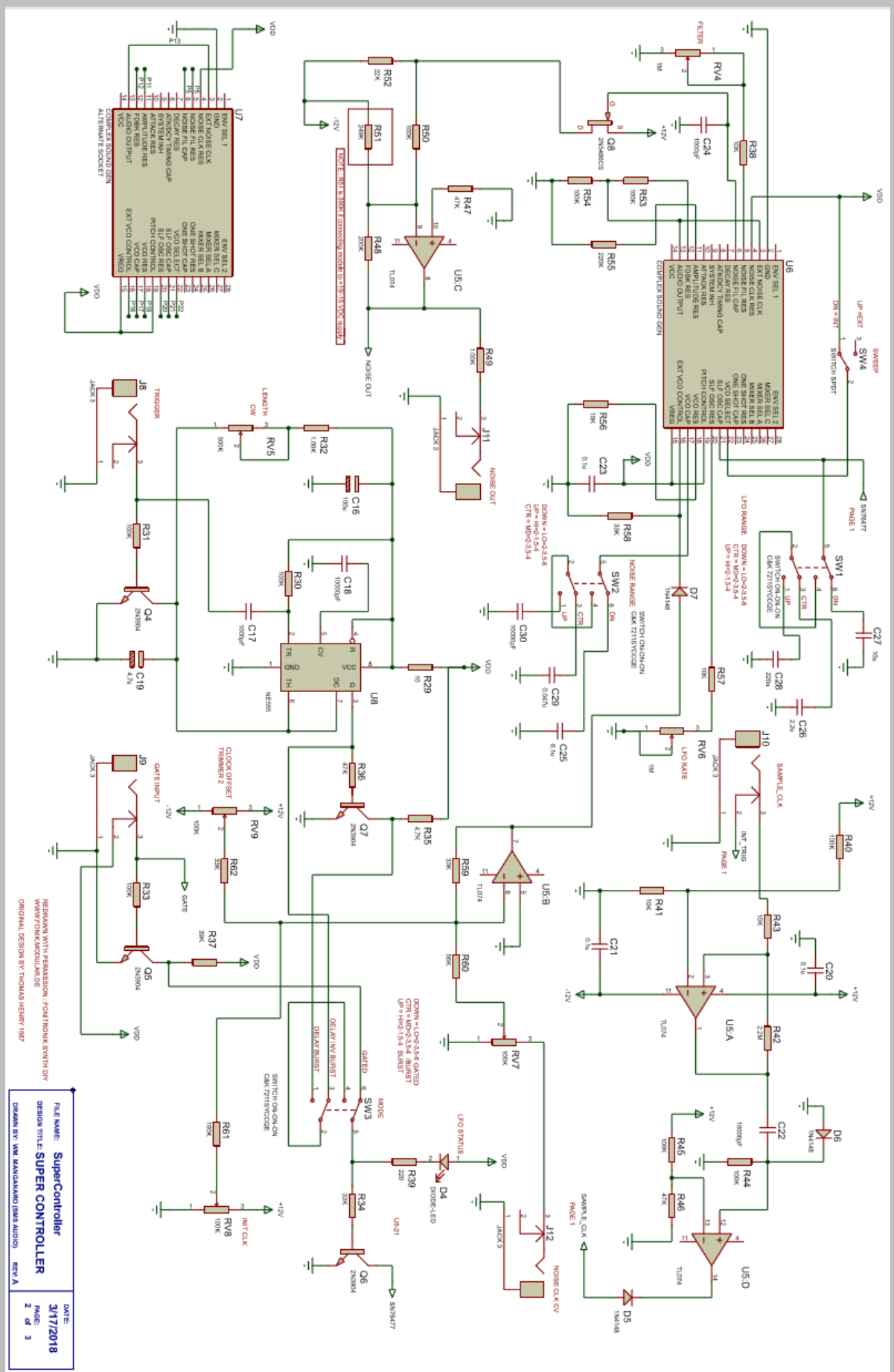
				0805
R36,R46-R47	47K	311-47.0KCRCT-ND	RC0805FR-0747KL (YEAGO)	RES SMD 47K OHM 1% 1/8W 0805
R37	39K	311-39KARCT-ND	RC0805JR-0739KL (YEAGO)	RES SMD 39K OHM 5% 1/8W 0805
R48	200K	311-200KCRCT-ND	RC0805FR-07200KL (YEAGO)	RES SMD 200K OHM 1% 1/8W 0805
R52	22K	311-22KARCT-ND	RC0805JR-0722KL (YEAGO)	RES SMD 22K OHM 5% 1/8W 0805
R55	220K	311-220KARCT-ND	RC0805JR-07220KL (YEAGO)	RES SMD 220K OHM 5% 1/8W 0805
R60	56K	311-56KARCT-ND	RC0805JR-0756KL (YEAGO)	RES SMD 56K OHM 5% 1/8W 0805
SEMICONDUCTORS				
U1	4001	296-24346-1-ND	CD4001BM96 (TI)	IC GATE NOR 4CH 2-INP 14-SOIC
U2	LM1117S-5,0	LM1117SX-5.0/NOPBCT-ND	LM1117SX-5.0/NOPB	IC REG LIN 5V 800MA DDPAK/TO263
U3-U5	TL074	296-1283-1-ND	TL074CDR (TI)	IC OPAMP JFET 3MHZ 14SOIC
U6 (U7 is an alternate package size)	Complex Sound Generator	MULT INTERNET SOURCES as NOS (SEE NOTE 3)	SN76477 (Texas Instruments TI)	Complex Sound Generator
U8	NE555	NE555S-13DICT-ND	NE555S-13 (Diodes INC.)	IC OSC SINGLE TIMER 500KHZ 8SO
Q1,Q8	2N5486CS	2N5486CS-ND	2N5486 (Central Semiconductor)	JFET N-CH 25V 30MA TO92
Q2-Q7	2N3904	2N3904TARCT-ND	2N3904TAR (ON Semiconductor)	TRANS NPN 40V 0.2A TO-

				92
D1-D2,D5-D7	1N4148	1N4148FS-ND	1N4148 (ON Semiconductor)	DIODE GEN PURP 100V 200MA DO35
D3-D4	DIODE-LED	VAOL-3MSBY2-ND	VAOL-3MSBY2 (VCC)	LED BLUE DIFF 3MM ROUND T/H
JACKS				
J1	CONN-DIL10	609-3243-ND	67997-410HLF (Amphenol)	CONN HEADER 10POS .100 STR TIN
J2-J12	Mono JACK	Synthcube PJ301M-12 (SEE NOTE 2)	JCKWQPPJ301M12HXMASTER	3.5mm mono jack PJ301M-12
J13	SIL-156-04	A1972-ND	640445-4 (TE Connectivity AMP)	CONN HEADER VERT 4POS .156 TIN
POTENTIOMETERS				
RV1,RV7-RV8	100K	Thonk	(SEE NOTE 4)	Alpha 9mm Pots – Vertical
RV2,RV4,RV6	1M	Thonk	(SEE NOTE 4)	Alpha 9mm Pots – Vertical
RV3,RV9	100K	490-2895-ND	PV36X104C01B00 (Bournes)	TRIMMER 100K OHM 0.5W TH
RV5	500K	Thonk	(SEE NOTE 4)	Alpha 9mm Pots – Vertical
SWITCHES				
SW1-SW3	SWITCH ON-ON-ON	CKN1493-ND	7211SYCQE (C&K)	SWITCH TOGGLE SP3T 5A 120V
SW4	SWITCH SPDT	CKN1004-ND	7101SYCQE (C&K)	SWITCH TOGGLE SPDT 5A 120V

Total Parts Count	**141**					
NOTE 1		**IF POWERING THE MODULE FROM J13 MOTM (+15, -15 VDC) then R51 is**	**390K**	**Digikey 311-390KCRCT-ND**	**RC0805FR-07390KL (YAGEO)**	**RES SMD 390K**
NOTE 2		**Web Address : http://synthcube.com/cart/3-5mm-mono-jack-pj301m-12-hex-nut**		**Additional source : THONK UK: https://www.thonk.co.uk/shop/3-5mm-jacks/**		
NOTE 3		**Source : http://www.arcadechips.com/index.php**		**Additional sources are eBay which have been reliable sources**		
NOTE 4		**Source : https://www.thonk.co.uk/shop/alpha-9mm-pots/**				

SCHEMATIC DIAGRAM:


SUPER CONTROLLER
SuperController
3/17/2018
REDRAWN WITH PERMISSION - FONTRONIK SYNTH DIY
WWW.FONIK.MODULAR.DE
ORIGINAL DESIGN BY: THOMAS HENRY 1987
DRAWN BY: WM. MANGANARO (SMS AUDIO) REV: A
SAH INPUT
MORSE OUT
DEPTH
LFO OFFSET
LFO OFFSET ADJ TRIMMER 1
INT_TRIG
GATE
PHASE 2
SAMPLE_CLK
LAG
LFO RATE
DIODE-LED
TRI OUTPUT
TRIGGER OUTPUT
GATE OUTPUT
SQUARE OUTPUT
S&H OUTPUT
EURO POWER ENTRY
MOTM POWER ENTRY
VDD
8V


SuperController
SUPER CONTROLLER
3/17/2018
REDRAWN WITH PERMISSION - FONTRONIK SYNTH DIY
WWW.FONIK.MODULAR.DE
ORIGINAL DESIGN BY: THOMAS HENRY 1987
U6
U7
U8
U5:A
U5:B
U5:C
U5:D
SW1
SW2
SW3
SW4
RV4
RV5
RV6
RV7
RV8
RV9
J8
J9
J10
J11
J12
Q4
Q5
Q6
Q7
Q8
D4
D5
D6
D7
SWEEP
FILTER
LFO RANGE
NOISE RANGE
LFO RATE
LFO STATUS
MODE
TRIGGER
GATE INPUT
SAMPLE_CLK
NOISE OUT
NOISE CLK CV
INT_TRIG
INT CLK
GATE
SN76477
TL074
2N3904
DIODE-LED
1N4148