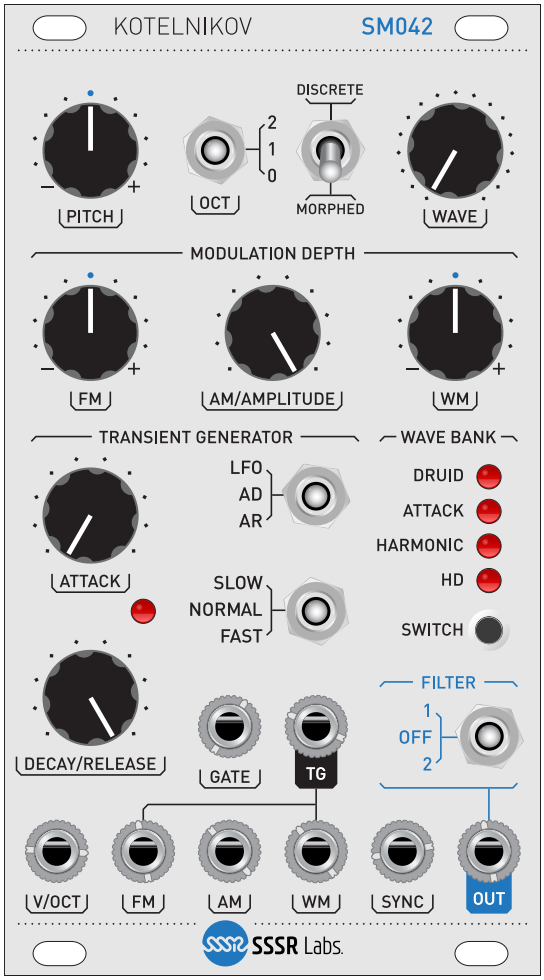
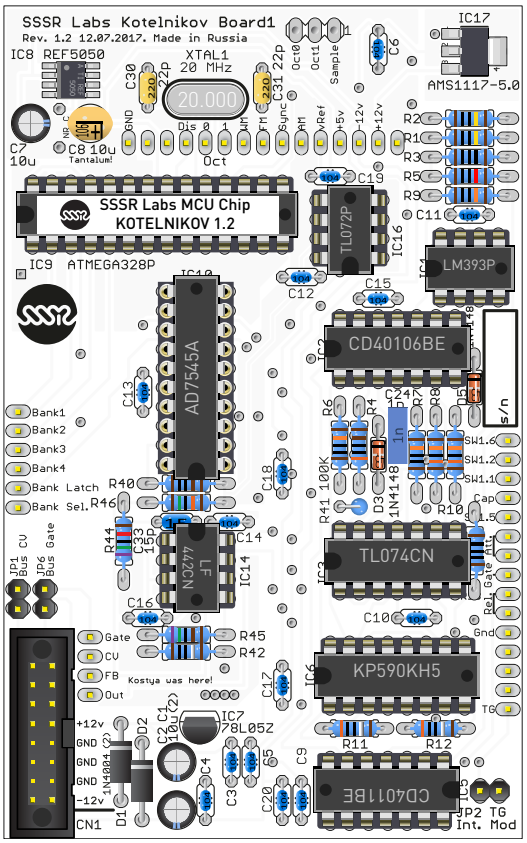
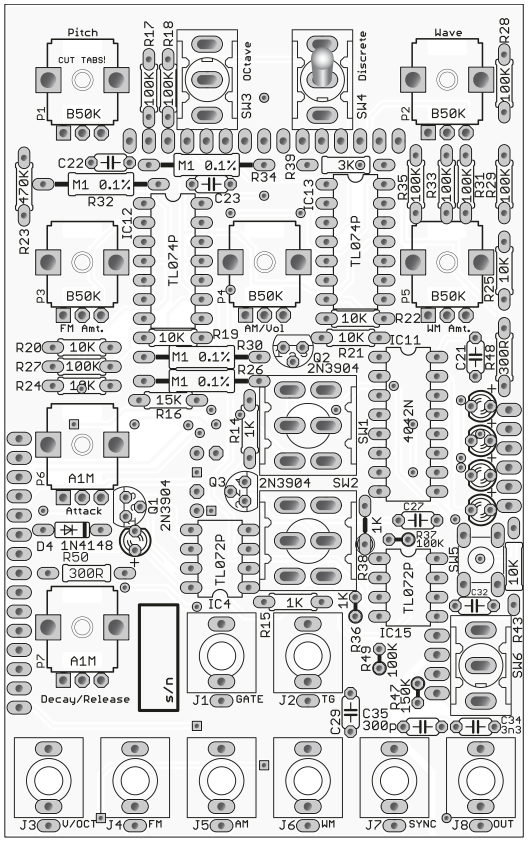
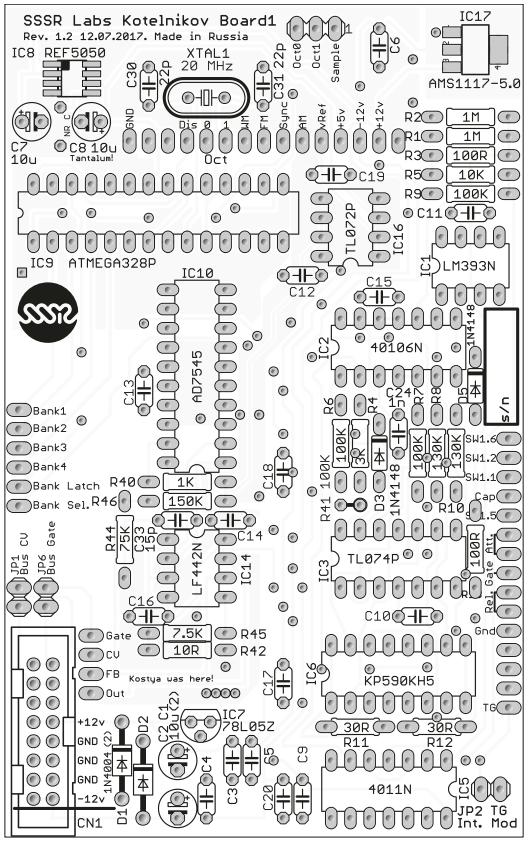
SM042, Assembly Manual

PCB Version 1.2



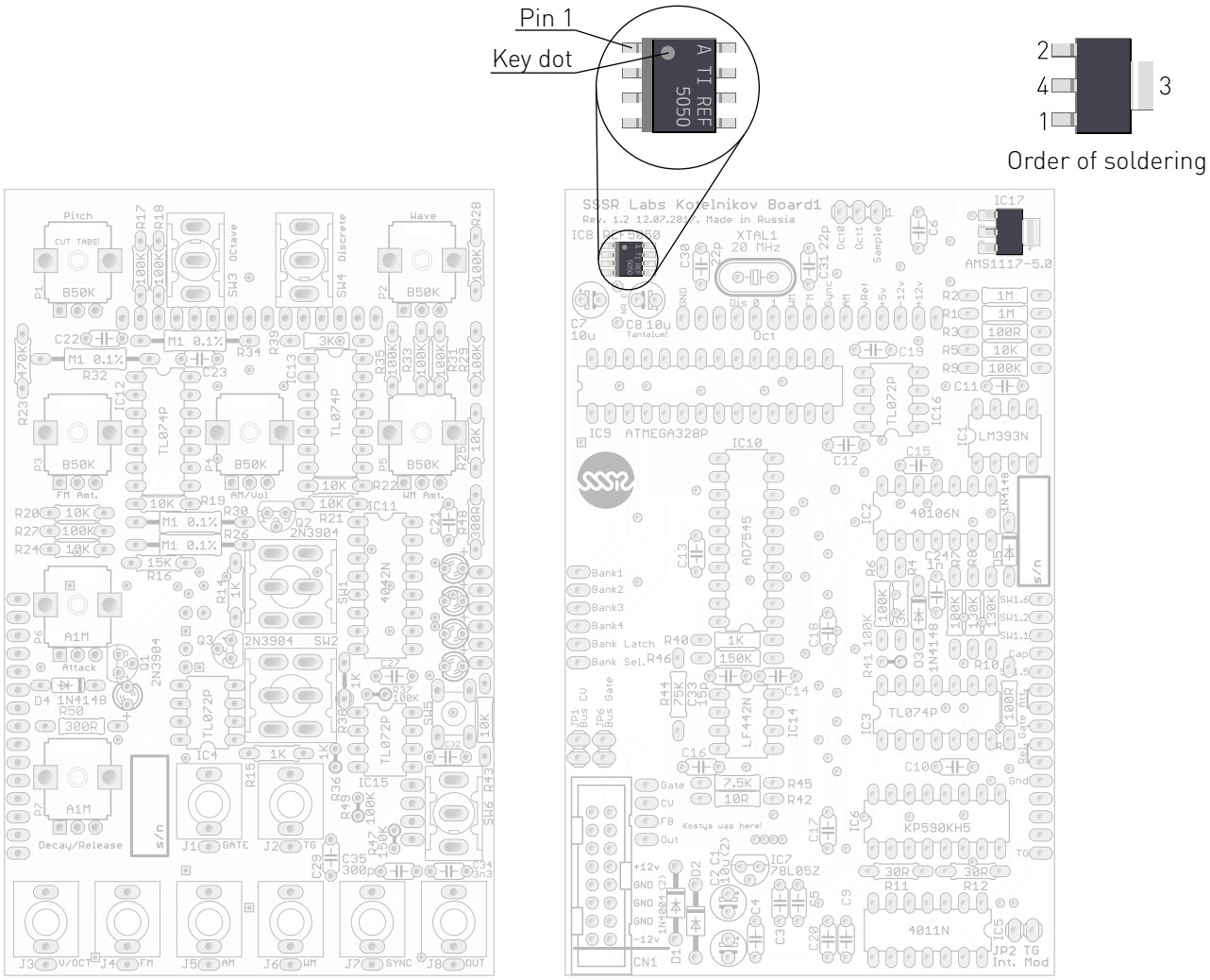






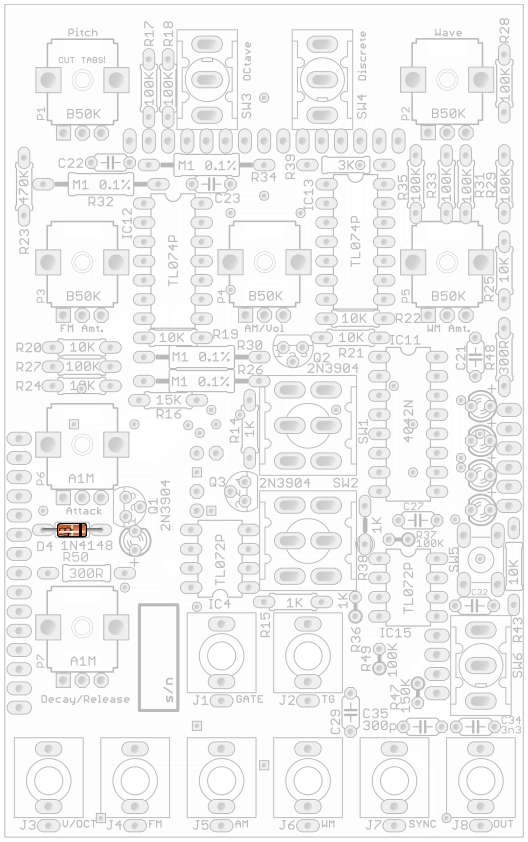
Step 1: PCB Top Side

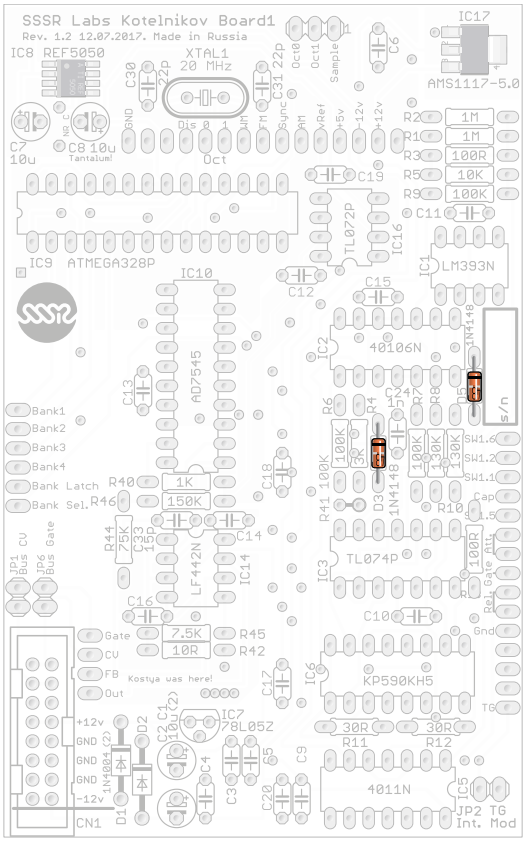
The SM042 DIY Kit contains two boards:
Circuit board 1. (Rear) This board consists of the main powering, VCO and TG circuitry.
Circuit board 2. (Front) This board contains interface circuitry and the linear scaling circuitry for CV and reference voltage.
Most of the components have to be placed on the top side of both boards, but pin-header connectors and couple of aluminium capacitors are have to be soldered to the bottom side
The order of assembly briefly can be described like that: Install SMD components, small diodes, horizontally placed resistors, IC sockets, small capacitors, the rest of non-mechanical components, then LED, pin-headers and bottom-side capacitors, then install all chips, power and jumper connectors, the tactile switch, then toggle switches, potentiometers and jack sockets. The following manual will guide you through the assembling process in details.



Step 2: SMD Components

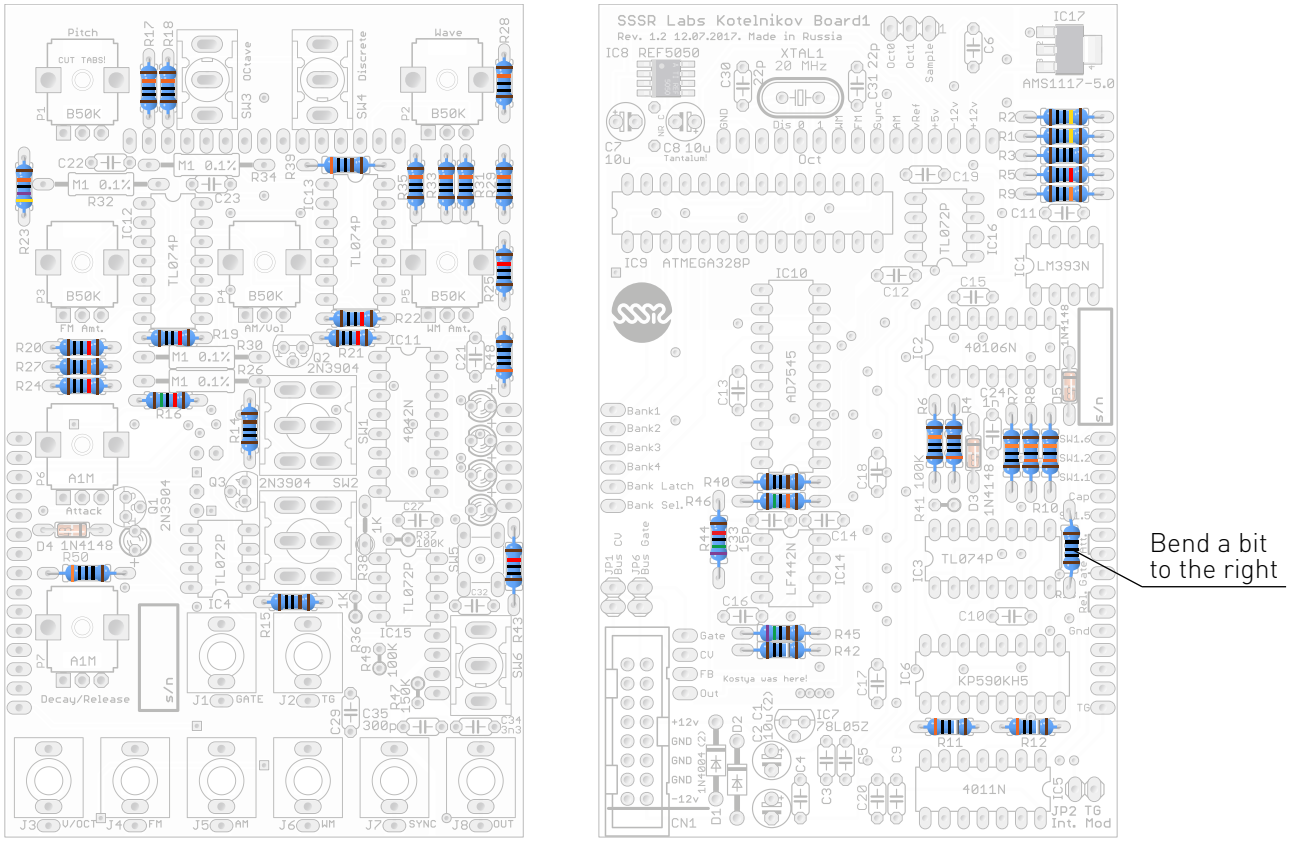
The AMS1117-5.0 and REF5050 are the only two SMD components in our DIY kit. Place the AMS1117 chip accurately aligned to its footprint, then solder pins according to the order given in the picture above. The pin 4 (heatsink) will require long heating up. Don't worry about the overheating, this component is designed to be heated seriously! Install the REF5050 chip oriented as shown on the picture above. Solder one of the pins in a corner, align the chip well, solder the opposite corner, then the remaining pins.





Step 3: Small Signal Diodes

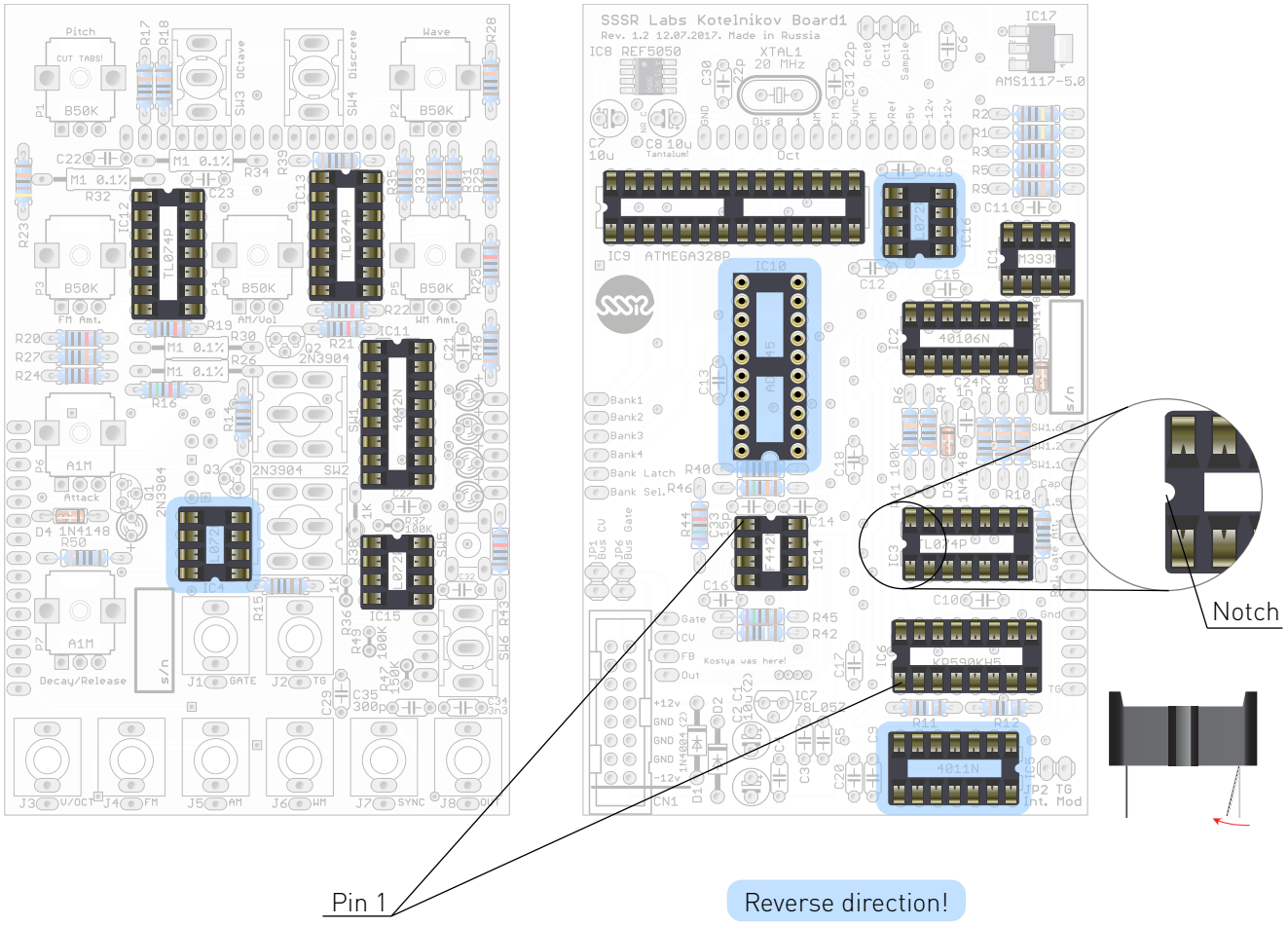
Find the thinnest components: a silicon small-signal diodes. Notice the polarity. The black stripes indicating the cathodes must correspond with stripes on the PCB. Solder all diodes to the top side of the PCB, then proceed to step 4.



Step 4: Resistors

Install the resistors. You can use the above picture as the reference to verify values before soldering.

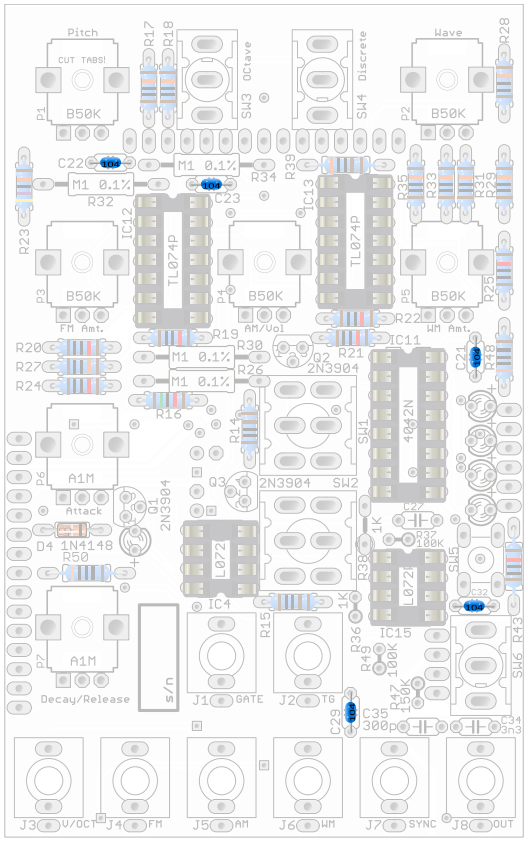
Flip the PCB over, trim the pins and reflow and solder everything to the bottom side. This technique is the best method to accurately and firmly solder axial components, so it's recommended to use it with all components allowing you access to the top side.

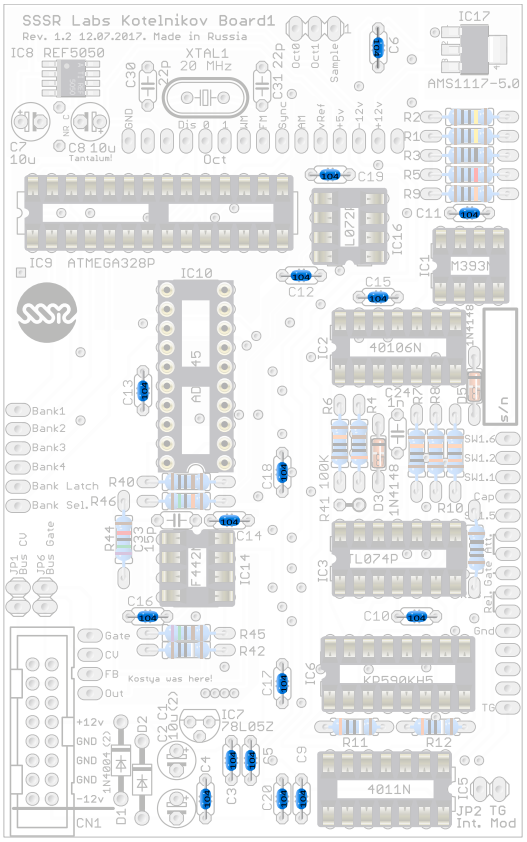


Step 5: IC Sockets

Insert all DIP IC sockets. Please pay double attention to the correct orientation. The default orientation for chips in the module is the notch turned to the top, or to the left, but there are chips with other directions, marked by blue areas in the picture.

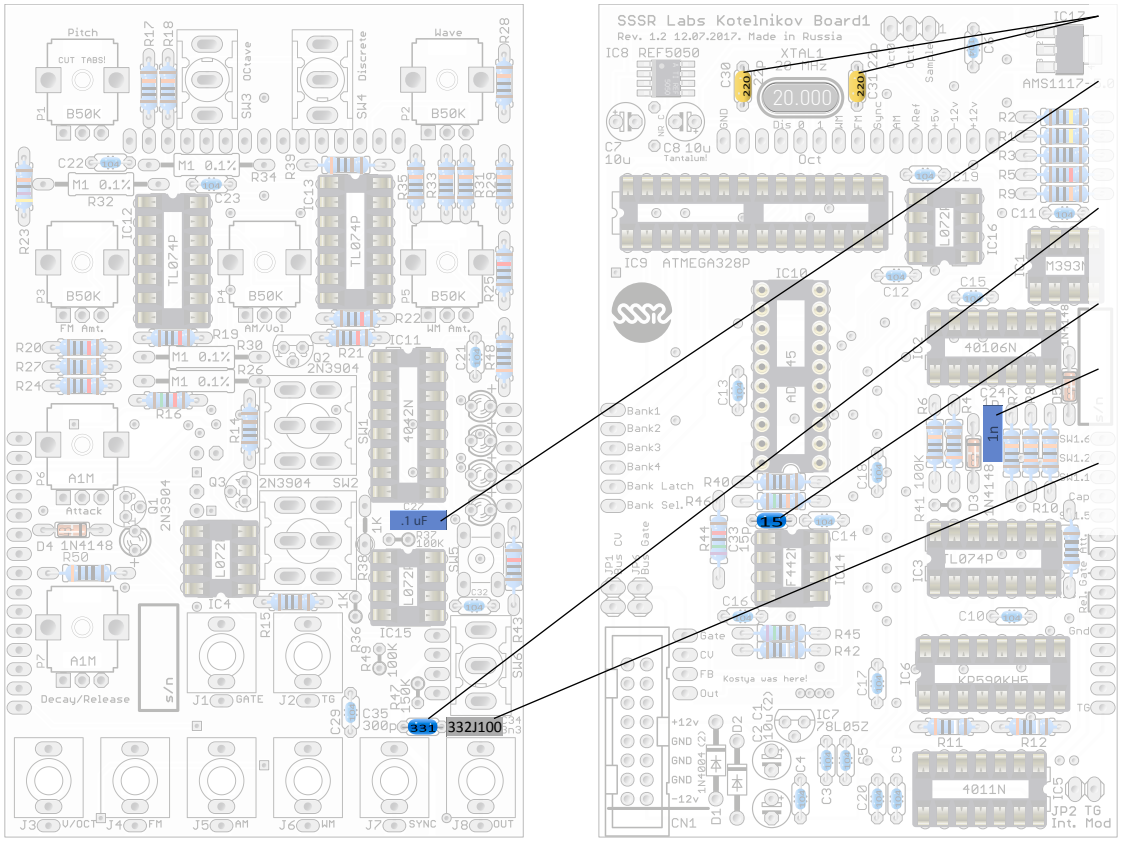
These sockets are very slippy, so it's practical to gently bend their pins towards each other to help them fixate in the holes while you're flipping the board over and soldering them. It's recommended to solder just two pins in the opposite corners of each socket and then reflow them while pushing the socket closer to the surface of the PCB. Then solder the remaining pins.





Step 6: Bypass Capacitors

Install and solder the 100 nF bypass capacitors, labelled as “104”. There are total of 21 of them. In some early kits, the MuRata ceramic capacitors was replaced with Epcos polyester film capacitors.



Identifying capacitors:

22 or 220: **220 pF**

.1µJ100
or µ10J100
or 104: **100 nF**

331: **330 pF**
(repl. for 300 pF)

15 or 150: **15 pF**

1nJ100
or 102: **1 nF**

332J100
or 332: **3.3 nF**

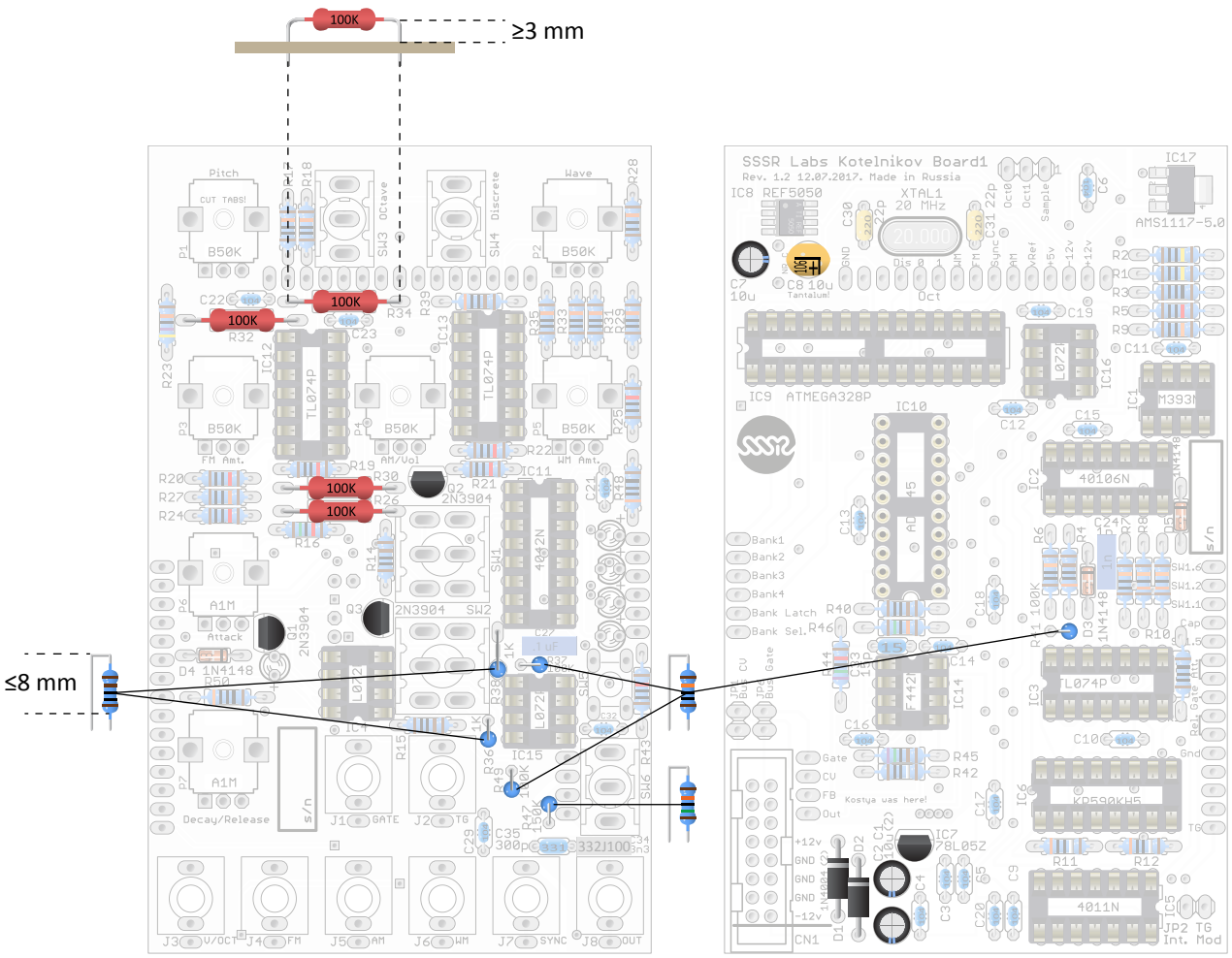
Step 7: Other Small Capacitors And Quartz Crystal

Install other small capacitors. You can identify them by labels listed on the picture.

Also, it's good to know that there are two types of notation for a capacitor value.

Style 1: 3-digit. The first two digits should be read as they are, and then you need to add as much zeroes as are indicated by the third digit, and interpret this as the value in pF. 150 means 15 pF, 334 means 330000 pF (= 330 nF). Very simple.

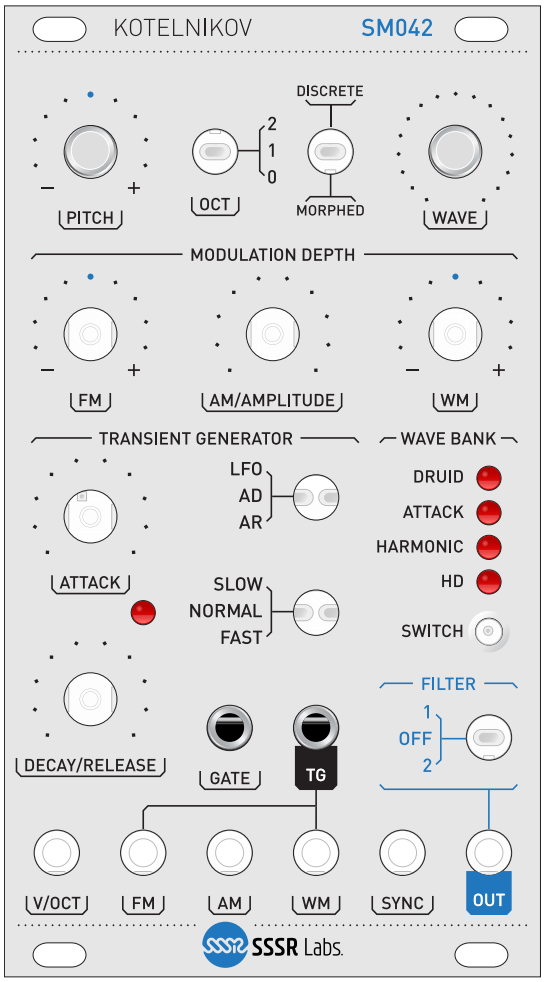
Style 2: The value usually consists of 2 or 3 digits and a letter p, n or u (µ) indicating the unit of the value. This letter actually stands in place of the decimal point, so 33n means 33 nF, 3n3 means 3.3 nF, and n33 means 0.33 nF (= 330 pF). The following "J100" on film capacitors indicates the tolerance class, and the voltage rating.

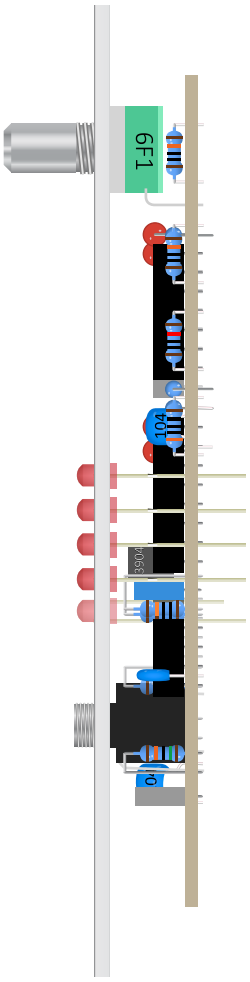


Step 8: Remaining Top-Side Components

Install precision 100K resistors into their places. They must be elevated above the board as shown on the picture. This method of installation is required by the resistors' design and it helps to keep values within tolerance. Then install rectifier diodes and aluminium capacitors. All of those are all polarized components! As with the small-signal diodes, cathodes of the rectifier diodes are marked with stripes on diodes and footprints. All holes for the positive pins of electrolytic capacitors are marked with the "+" sign. All positive pins on capacitors are longer than negative pins

Finally, install the vertically oriented resistors. The allowed height of the resistors must be non greater than 8 mm to ensure that leads do not touch the surface of the panel.

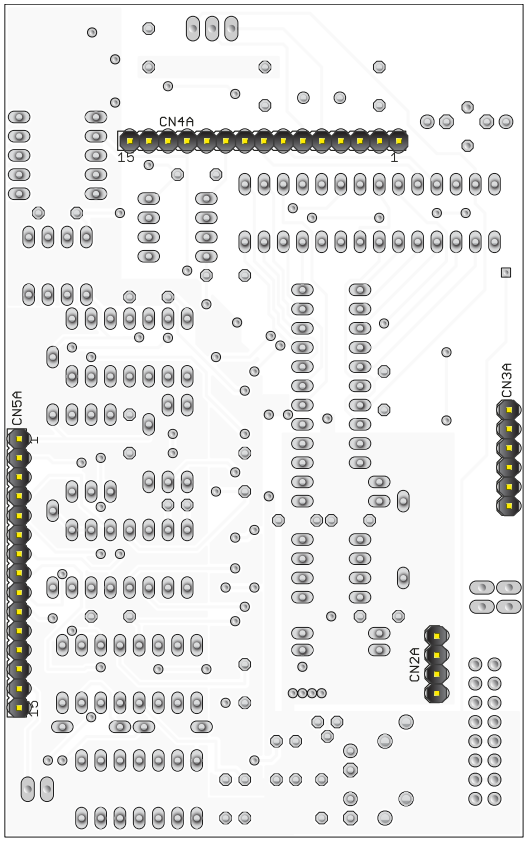


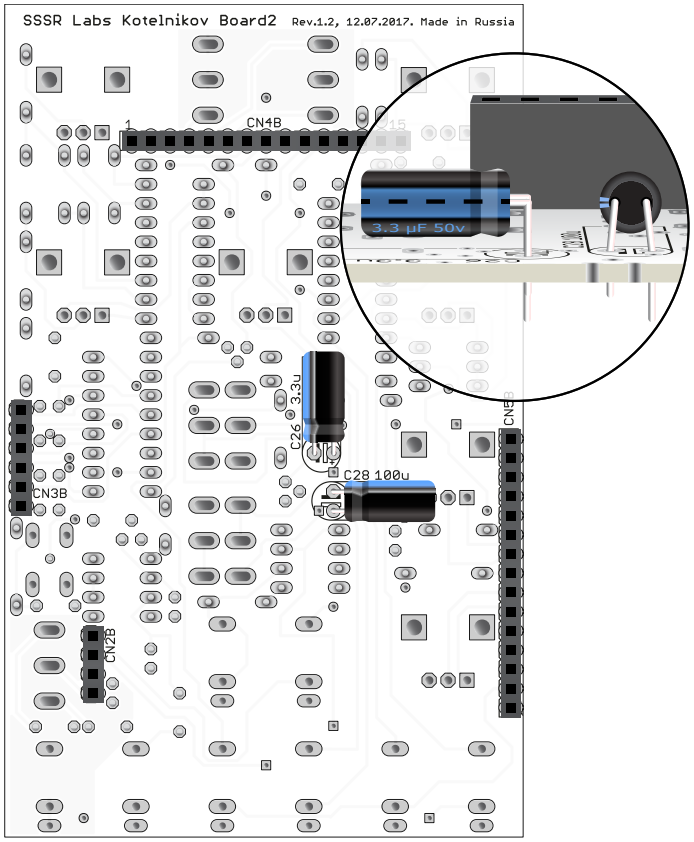


Step 9: LED

Take two potentiometers or toggle switches, and two jack sockets. Install them into places for P1, P2 (SW3, SW4), J1 and J2 but do not solder them. Then insert five LEDs keeping the correct polarity. Anodes are indicated by the “+” sign on the board and the longer pins. Remove the film from the front panel if there's any, and install the panel onto the board through the switches and jack sockets. Holding the panel, turn the module upside down and let all diodes slip into their holes. Then solder them one by one keeping the correct clamping of the panel and LEDs' height.

Now, take off the panel and proceed to the next step.

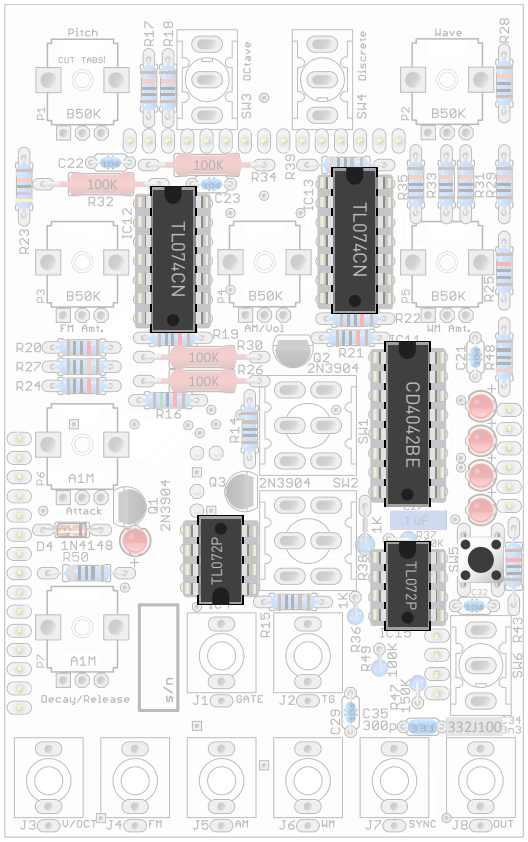


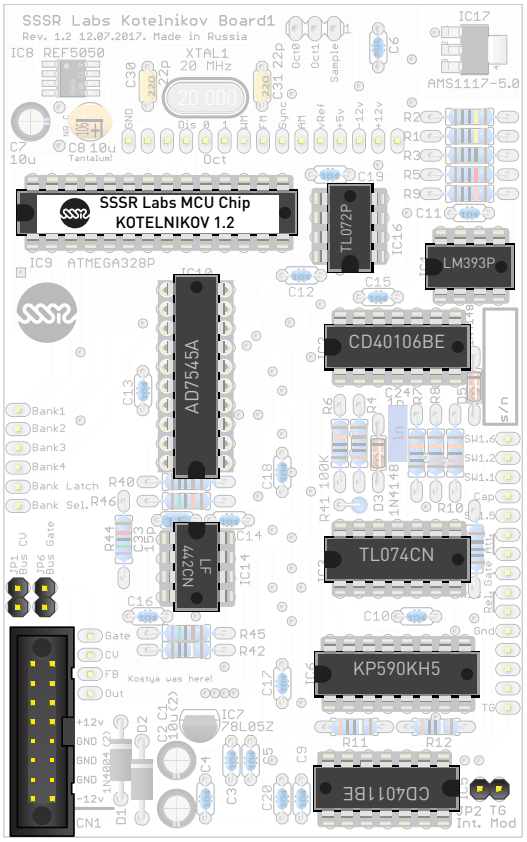


Step 10: Bottom Side Components

You will find 4 complementary pairs of pin-headers tied together: 2 × 15-pin, 1 × 4-pin and 1 × 6-pin. The female part must be installed on Board 2, and the male part — on Board 1. Install connectors on the bottom side of Board 1, then construct a sandwich out of both boards as shown on the picture. Solder all headers ensuring that all construction is clamped tight and secure.

Insert electrolytic capacitors into the bottom side of Board 2. Bend them as shown on the picture, and solder. The holes for the positive pins are indicated with white stripes and the negative are black. The positive pins are longer than the negative.





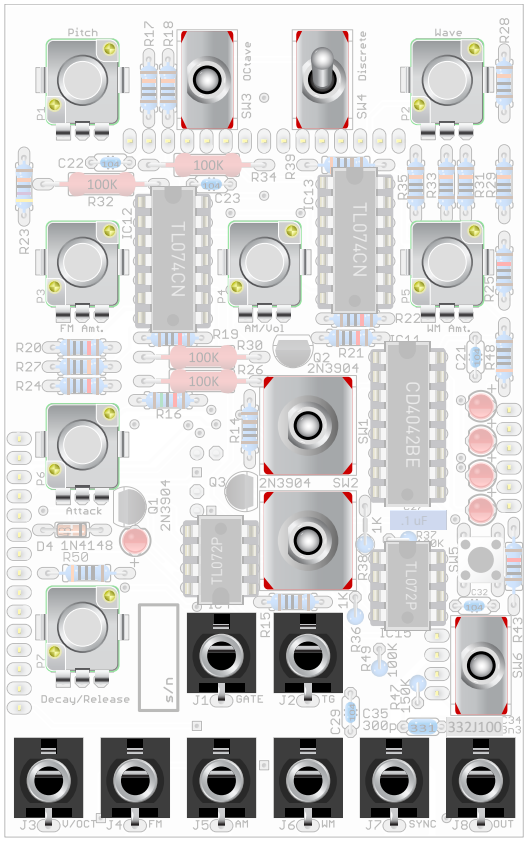
Step 11: Headers, Tactile Switch, IC

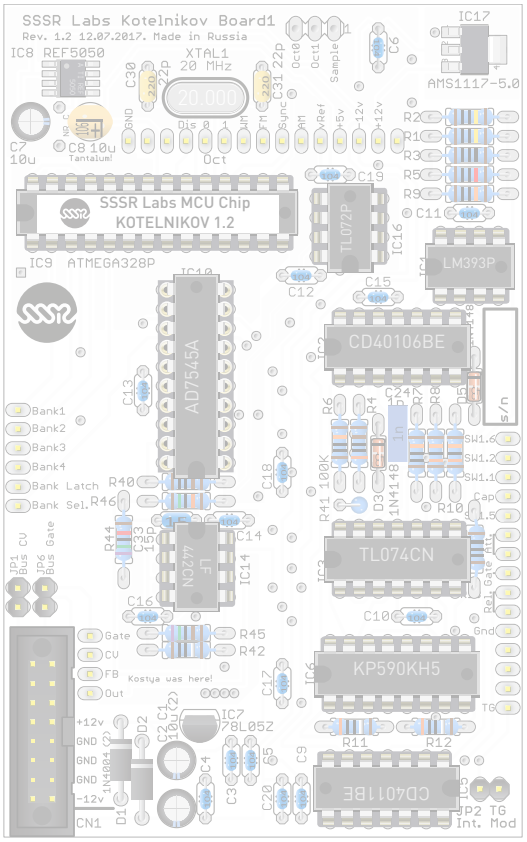
Install three 2-pin headers and wear the jumpers on. Then solder all headers.

Install the power pin-header. Notice the orientation! It's recommended to solder two pins in the opposite corners, then solder the remaining pins. The six pins from 3 to 8 are connected with the ground plane and require extra heating. It is also recommended to plug the power cable to prevent pins from bending if the plastic case has started to melt due to extensive heating.

Insert all integrated circuits into their sockets. Refer to the picture for correct placement and orientation. Install and solder the tactile switch.

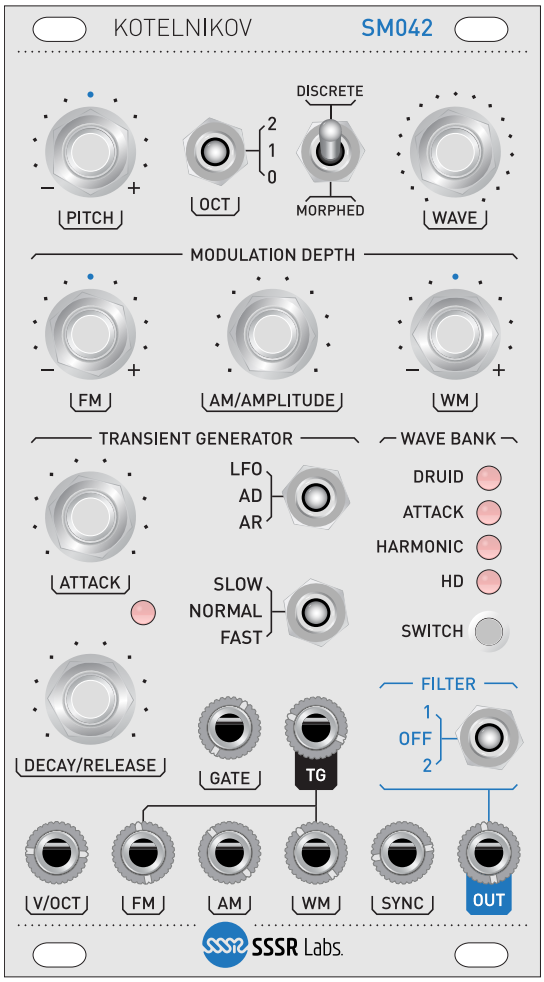
It's highly recommended to clean the top sides of the boards now, before installing the control hardware and the front panel.

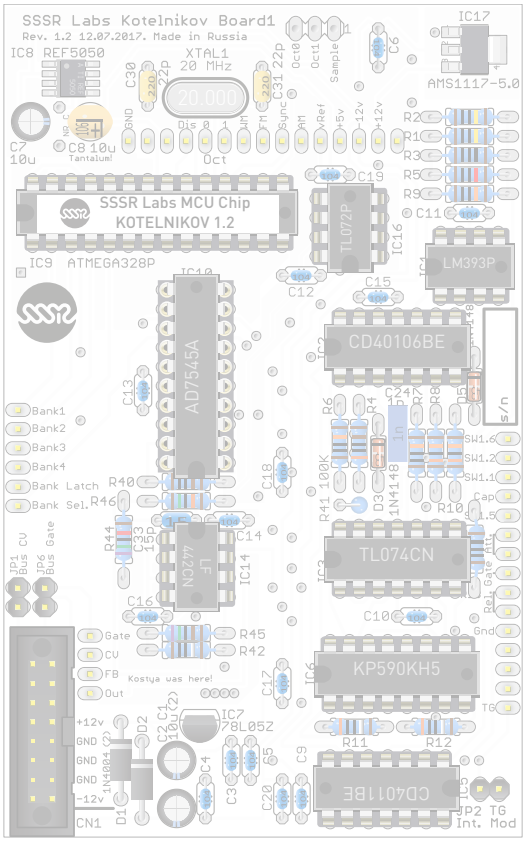




Step 12: Potentiometers, Switches, Jack Sockets

Install all potentiometers, toggle switches and jack sockets without washers and nuts. Also, if there are fixing tabs on the potentiometers, you need to break them off with pliers. The two 1M potentiometers must be installed in the TG area.

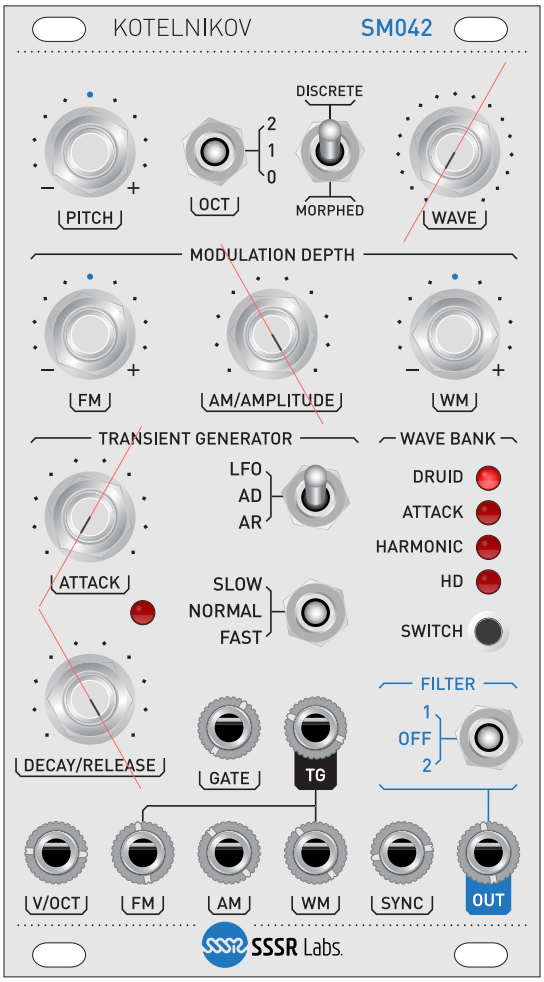




Step 13: Front Panel

Put on the panel back to its place. Since you do not longer need access to the top side of the Board 2, you can put on and tighten all washers and nuts. Solder everything.

It is advisable to clean the Board 2 a second time, from the bottom side, but you must do it carefully, avoiding moistening of the hardware. Any liquid inside the potentiometers, switches or jacks can cause serious performance degradation.

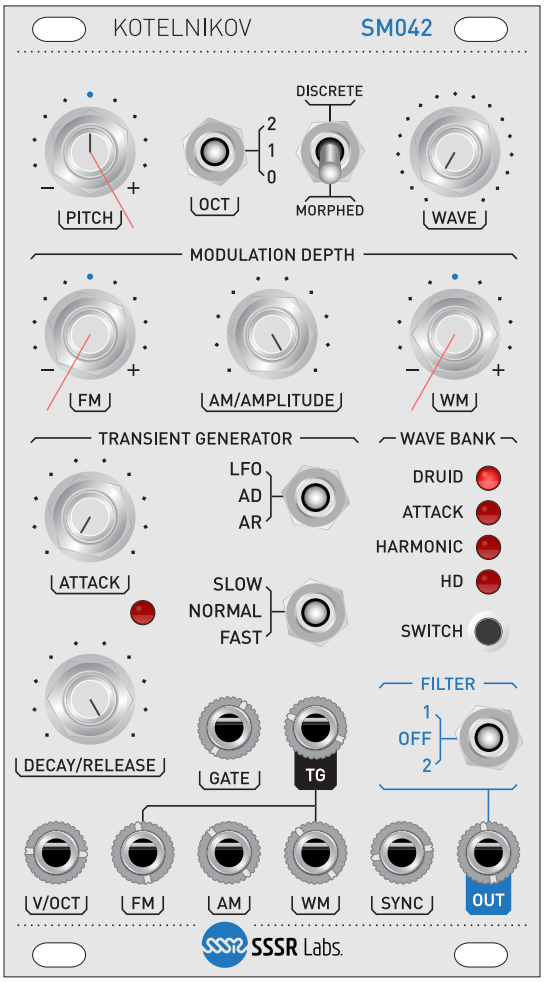


Step 14: First Power-On

The KOTELNIKOV module does not need any adjustment, but you can improve your experience of using attenuverters if you're using round shafted potentiometers with corresponding knobs.

Look over the module one more time and check everything you can.

Set the module to the settings pictured above. Connect the power, turn on your system and make sure that DRUID indicator is on and TG LED is blinking. If it doesn't happen for more than two seconds after powering-on, turn it off immediately and check for build errors again.
If module is working as intended, you can proceed to knobs centering.

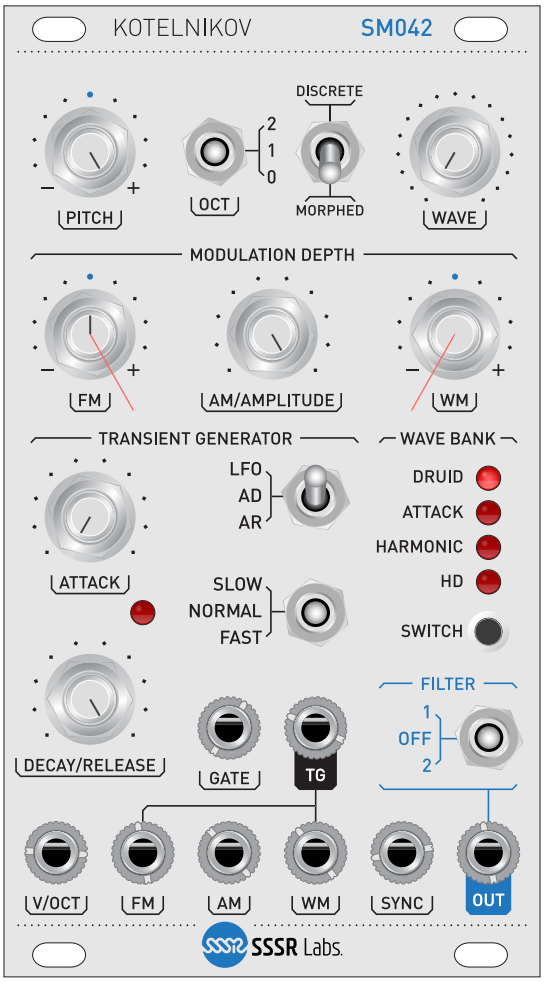


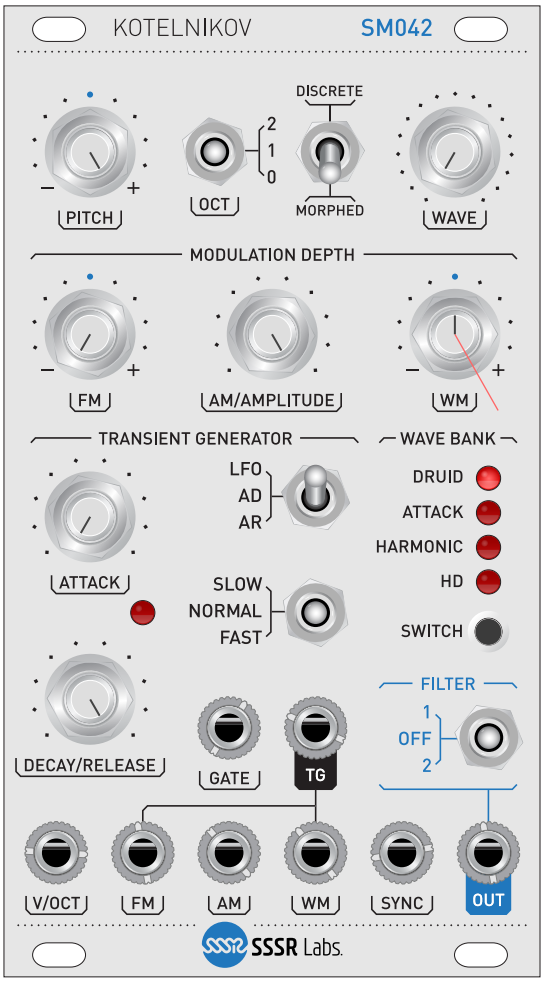
Step 15: Centering the Pitch Potentiometer

Prepare a thin permanent marker or a soft pencil. You are going to determine the exact mid-points for all three polarized potentiometers.

For your convinience, you could also outline the pointer lines on the Wave, AM, Attack and Decay shafts.

Set the module to the settings pictured above. Monitor the output frequency with an oscilloscope, frequency meter, tuner or your ears and turn the Pitch shaft counter-clockwise until the frequency stops changing. This will be the mid-point for the Pitch knob. Now draw a straight line on the shaft's edge, pointing exactly to the top. Later, this line will help you to put on the respective knob correctly.

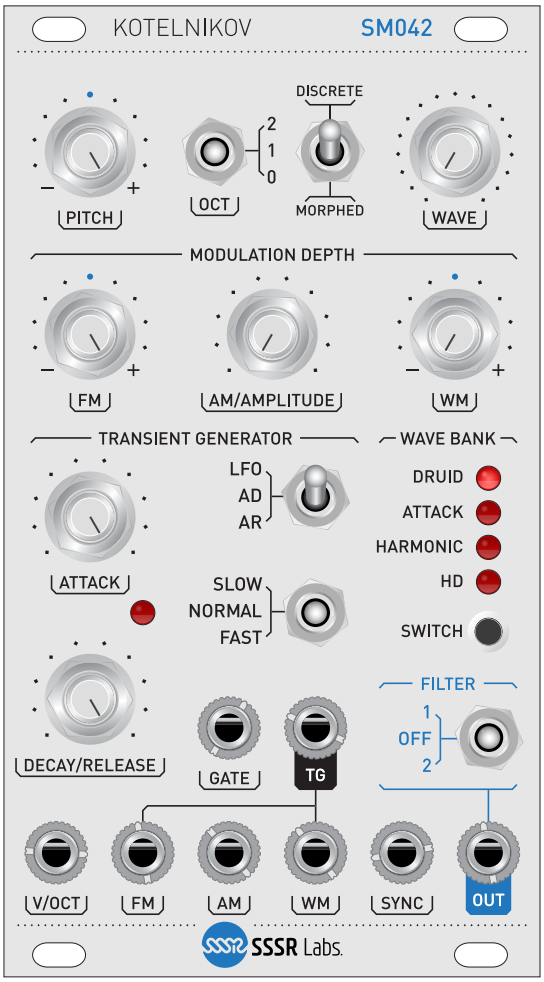


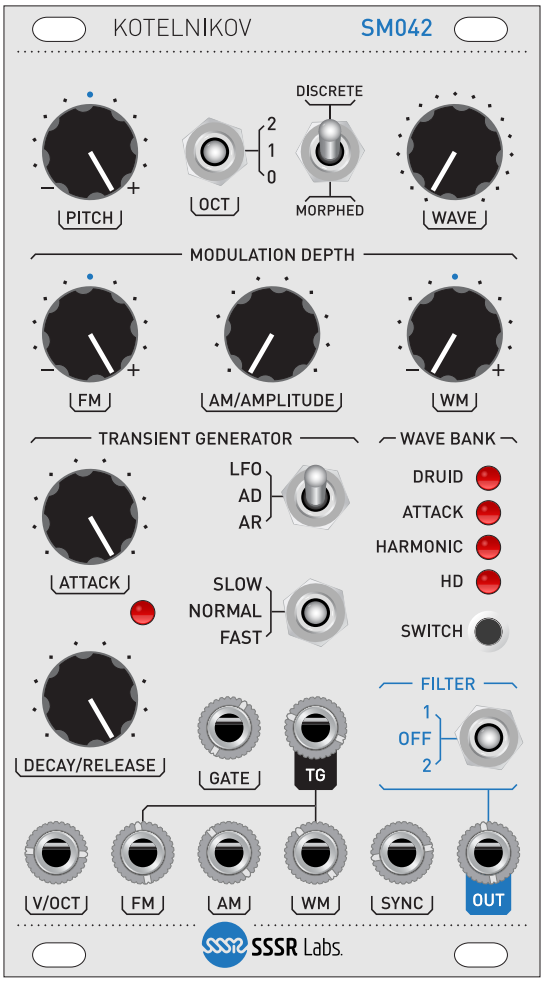


Step 16: Centering the FM and WM Potentiometers

Set the module to the settings shown on the left picture.
Module will sound like a kind of siren. Find the position of the FM shaft where frequency modulation is negligible or disappears completely. This is the mid-point for the FM control. Outline the pointer line on this shaft.

Repeat this procedure with the WM shaft. The initial position is shown on the right picture. The mid-point can be found using the similar procedure as for the FM shaft.





Step 17: Finishing the Build

Install the knobs. Some kits contain the D-Shaft sets of potentiometers and knobs. Others contain the round shaft sets. If you have the round shaft set, you need to perform the following procedure. Turn all potentiometers to the position shown on the left picture, then install each knob, one at a time, keeping it in the correct position. You may also put the edge of a business card or other object of similar thickness under the knob to make a little gap between the nut and the knob to prevent them from scraping each other.

Once you have installed all knobs you are done building the module! Thank you for purchasing an SSSR Labs product and we wish you to have a lot of fun with your new module!