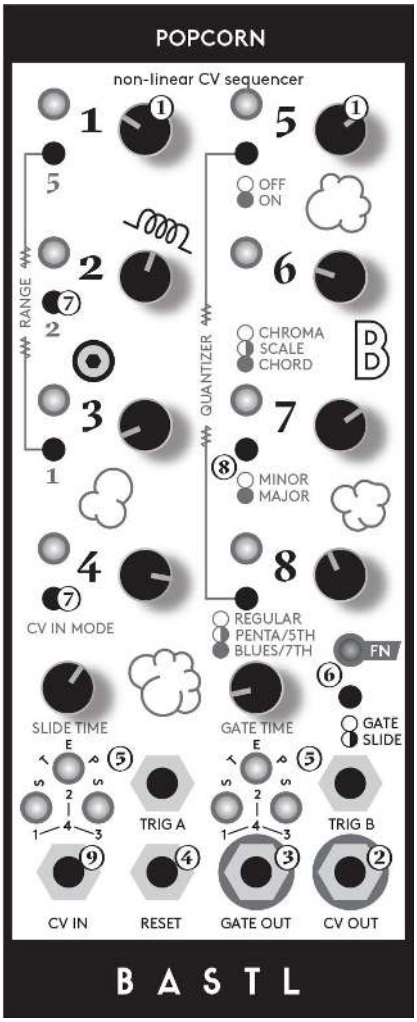
last update: 19. 7. 2018

BASTL INSTRUMENTS

POPCORN v1.1 - Assembly Guide

bastl-instruments.com



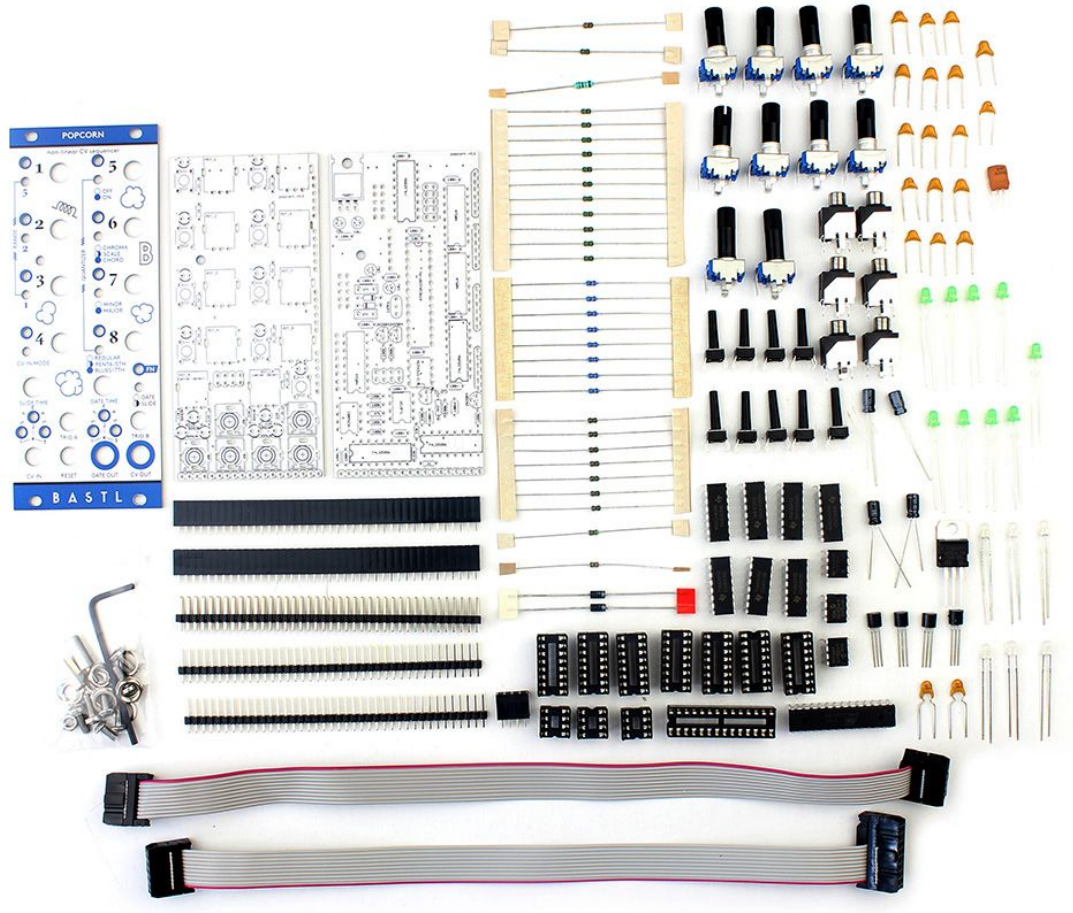
INTRODUCTION

This guide is for building Popcorn module from Bastl Instruments. It is good to have basic soldering skills and to be able to identify electronic components before starting this kit. However if you have never soldered before, check out this tutorial first[1].

The Popcorn kit consists of two boards. All the parts comes in three bags separated for Top board, Bottom board and Assembly parts. See Bill of Materials (BOM) for detailed list. We even included some of the best quality solder to help you solder everything faster and better.

[1] http://www.instructables.com/id/How-to-solder/

BILL OF MATERIALS



POPCORN v1.1		
TOP BOARD		
qty	**value**	**part**
6	220R	R-EU_0204/5
9	1k	R-EU_0204/5
9	17mm	long small button
6	PJ-301BMB	jack connector
9	green	LED 3 mm
6	bipolar R/G	LED 3 mm
8	B100K 25mm	linear potentiometer
2	B100K 25mm	linear potentiometer - central detent
1	2x4 pin	Male pinheader
1	19 pin	Male pinheader
4	6 pin	Male pinheader
BOTTOM BOARD		
1	220R	R-EU_0204/5
1	1k	R-EU_0204/5

1	10k	R-EU_0204/5
8	100k	R-EU_0204/5
1	33k	R-EU_0204/5
1	47k	R-EU_0204/5
1	330k	R-EU_0204/5
1	4M7	R-EU_0207/5
2	1N4007	DIODE-D-7.5
17	100nF	ceramic capacitor
4	10uF	electrolytic capacitor
3	2N3904	transistor
1	7805	voltage regulator
1	L79L05	voltage regulator
1	16MHz	resonator
2	100mA	fuse
1		ATMEGA328-PU-ND
4	74HC595	IC in foam
3	CD4051BE	IC in foam
1	MCP6002	IC in foam
1	MCP4921	IC in foam
1	TL072	IC in foam
3	8 pin DIL	DIL socket - in foam
7	16 pin DIL	DIL socket - in foam
1	28 pin DIL	DIL socket - in foam
2	40 pin	Female pinheader
1	2x4 pin	Double female pinheader
1	6 pin	Male pinheader
1	8 pin	Male pinheader
3	2x5 pin	Double male pinheader
ASSEMBLY		
1	M3 x 11mm	spacer nut x nut
1	M3 x 11,5mm	spacer screw x nut
3	M3 x 6mm_Imbus	screw
1	M3	nut
4	M3 x 8mm_cross	panel screw + washers
6		jack washers
6		jack nuts
1		allen key
1	bottom	PCB
1	top	PCB
1		power cable 10-10pin
1		power cable 10-16pin
1		front panel / w DIY sign

BEFORE STARTING THE KIT...

Before starting this kit, prepare the following tools:

- Soldering iron
- Multi-meter
- Flush cutters
- Smaller pliers
- n2. hex screwdriver or allen key (enclosed with kit)
- Phillips screwdriver
- Wrench No. 8
- Protective eyewear
- Isopropyl alcohol + smaller and clean brush (optional)

We suggest that you work in a clean and a well lit and ventilated environment to avoid accidents or losing any of the small components. Also briefly go through this guide and make sure that you understand all the steps before you start soldering.

When you are done with soldering, you would probably like to calibrate your Popcorn. It is pretty simple. Please check the info about firmware v1.1 and calibration guide here[2].

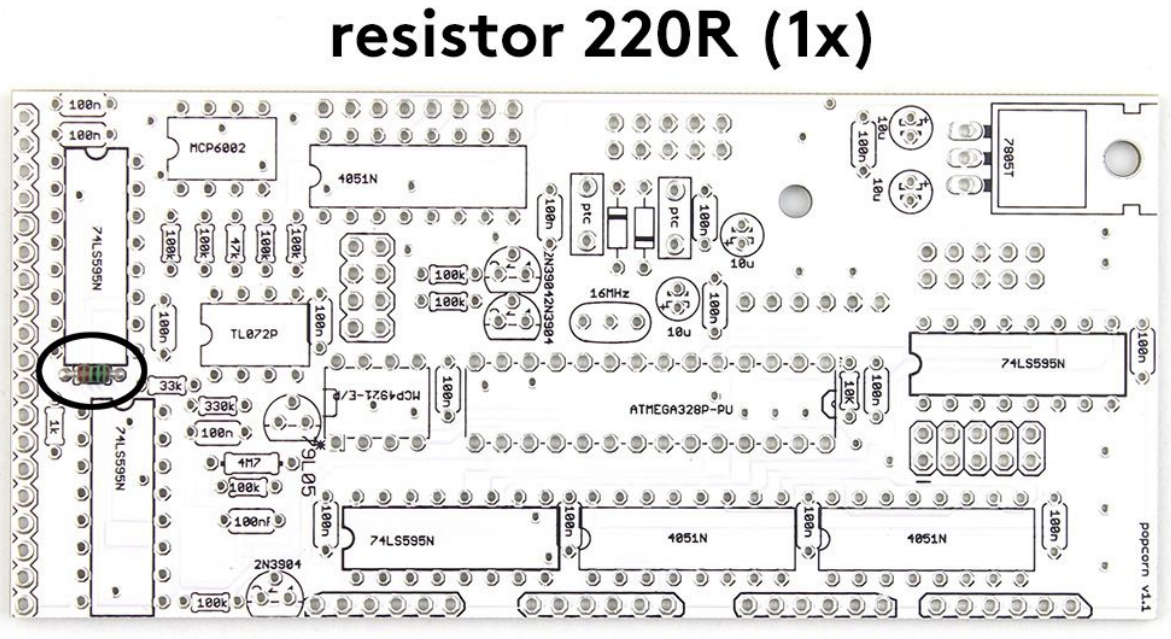
BOTTOM BOARD

RESISTORS

Start with the bottom board parts. First of all, take your time and check the **values** of all **resistors** using a multimeter[3] (or you can check the color codes if you are seasoned enough):

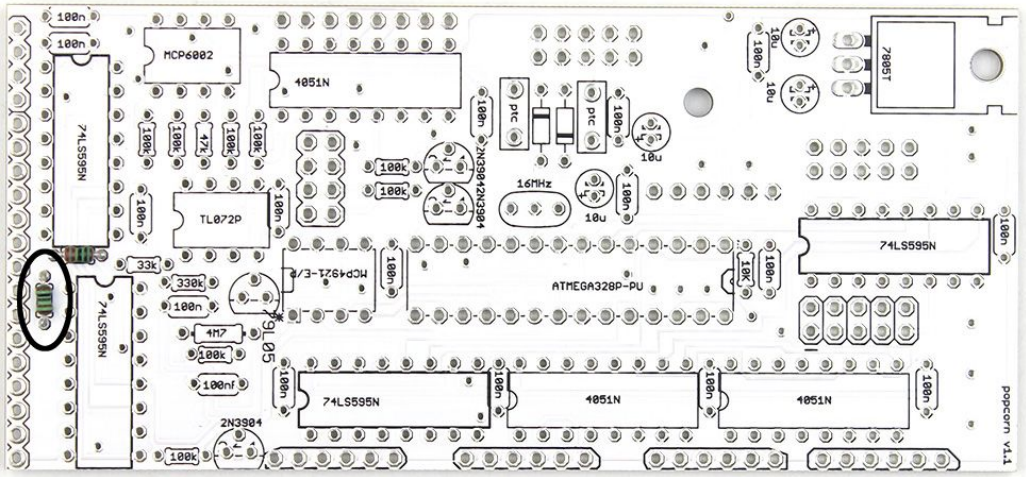
- **220R** (1x), **1k** (1x), **10k** (1x), **33k** (1x), **47k** (1x), **100k** (8x), **330k** (1x), **4M7** (1x).

Then solder them on the bottom PCB and snip the leads close to the PCB (be sure to make this step on all remaining leads in the course of this guide).

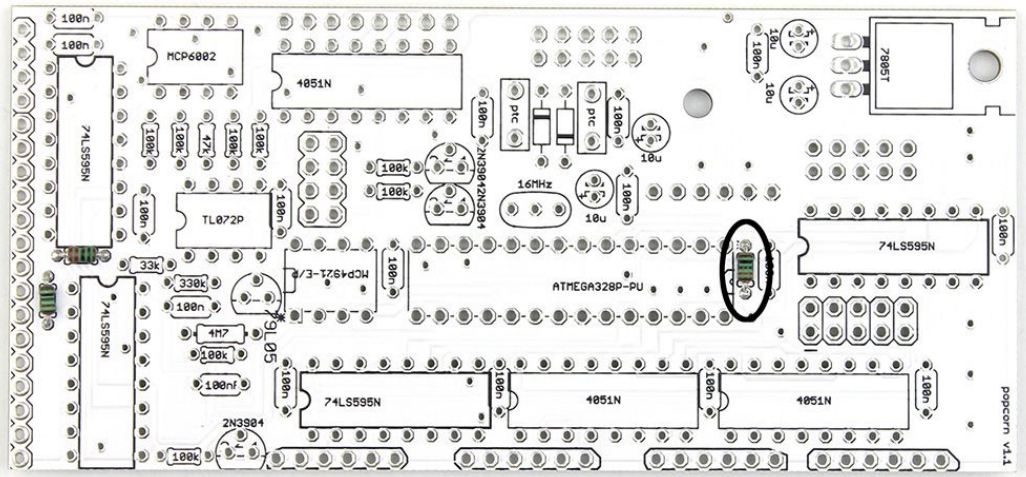


[2] http://www.bastl-instruments.com/wp-content/uploads/2018/06/popcorn-v1.1-update.pdf
[3] https://learn.sparkfun.com/tutorials/how-to-use-a-multimeter/measuring-resistance

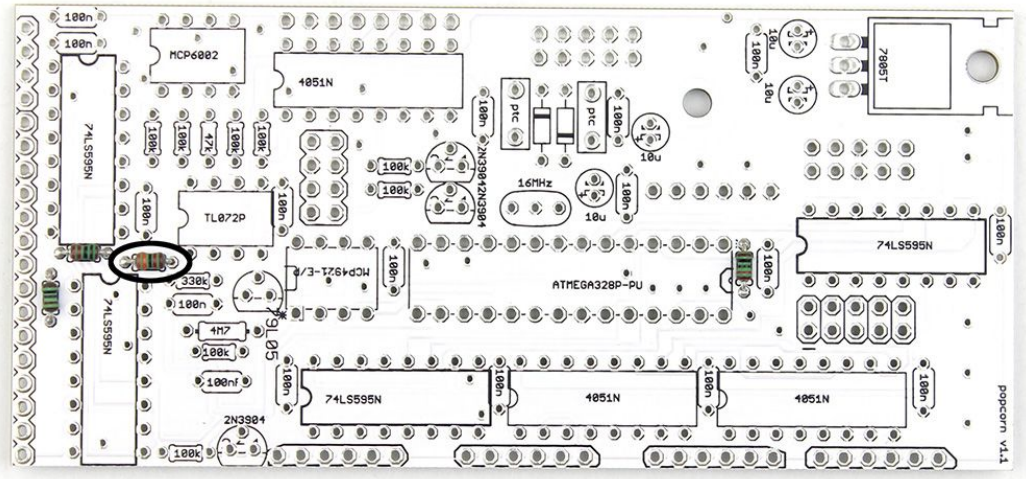
resistor 1k (1x)



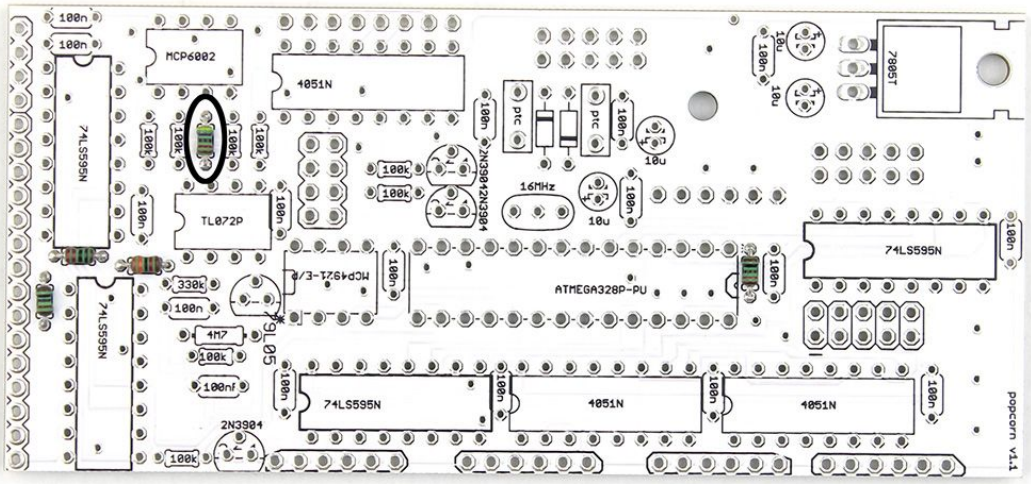
resistor 10k (1x)



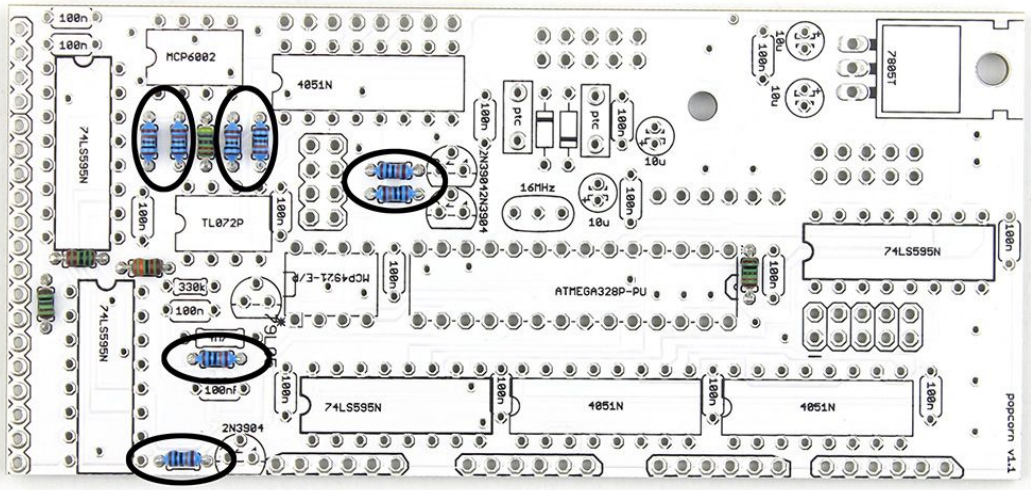
resistor 33k (1k)



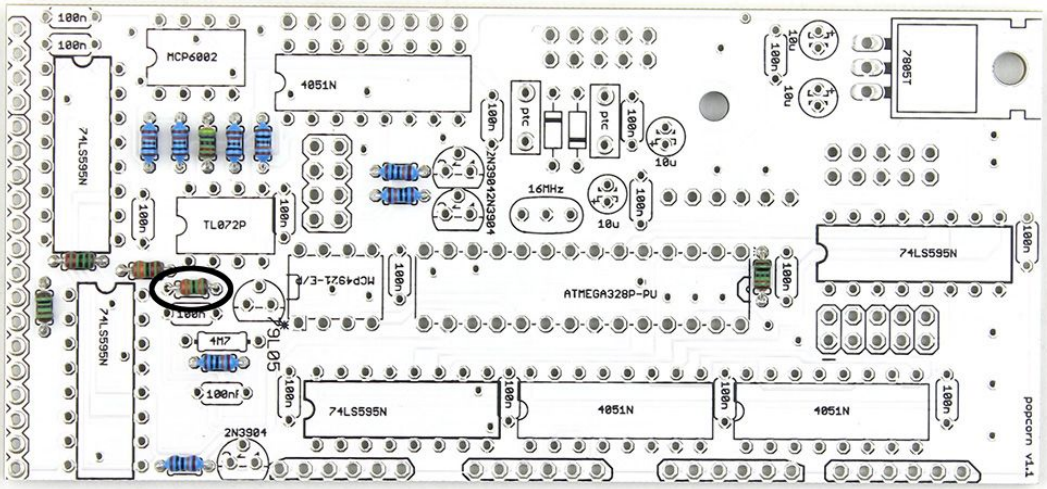
resistor 47k (1x)



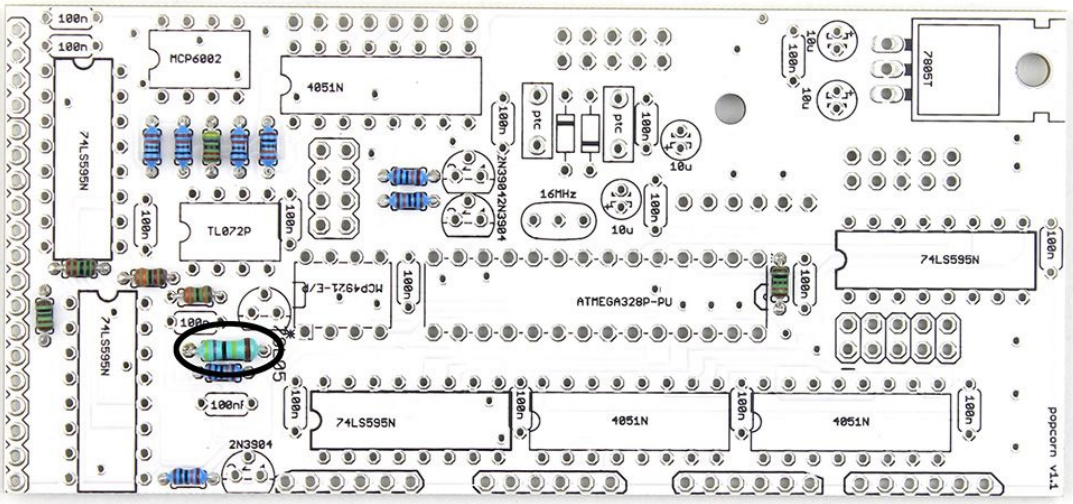
resistors 100k (8x)



resistor 330k (1x)



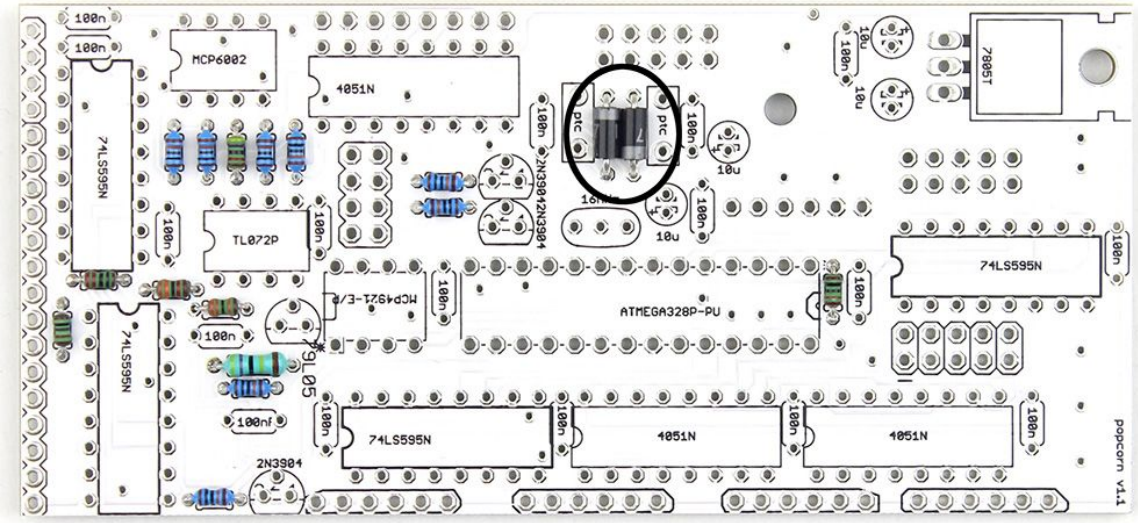
resistor 4M7 (1x)



DIODES

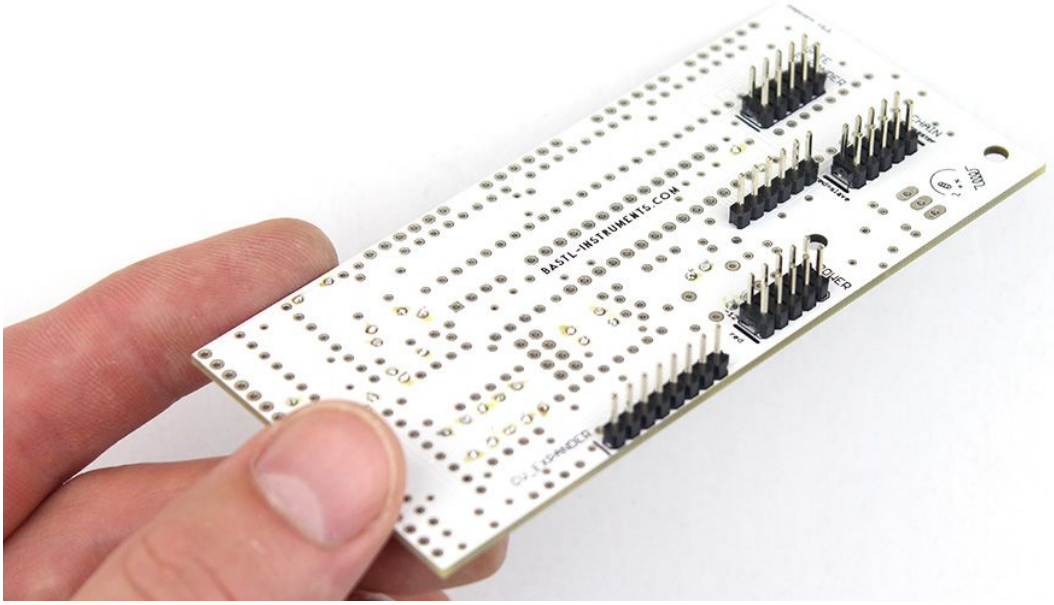
Solder also the **diodes** (**1N4007** - 2x). Be careful, **diodes are polarized**! Make sure that the marking ring on the diode body matches the marking on the circuit board**.** Check the photo below.

1N4007 DIODES (2x)
watch out for polarity!



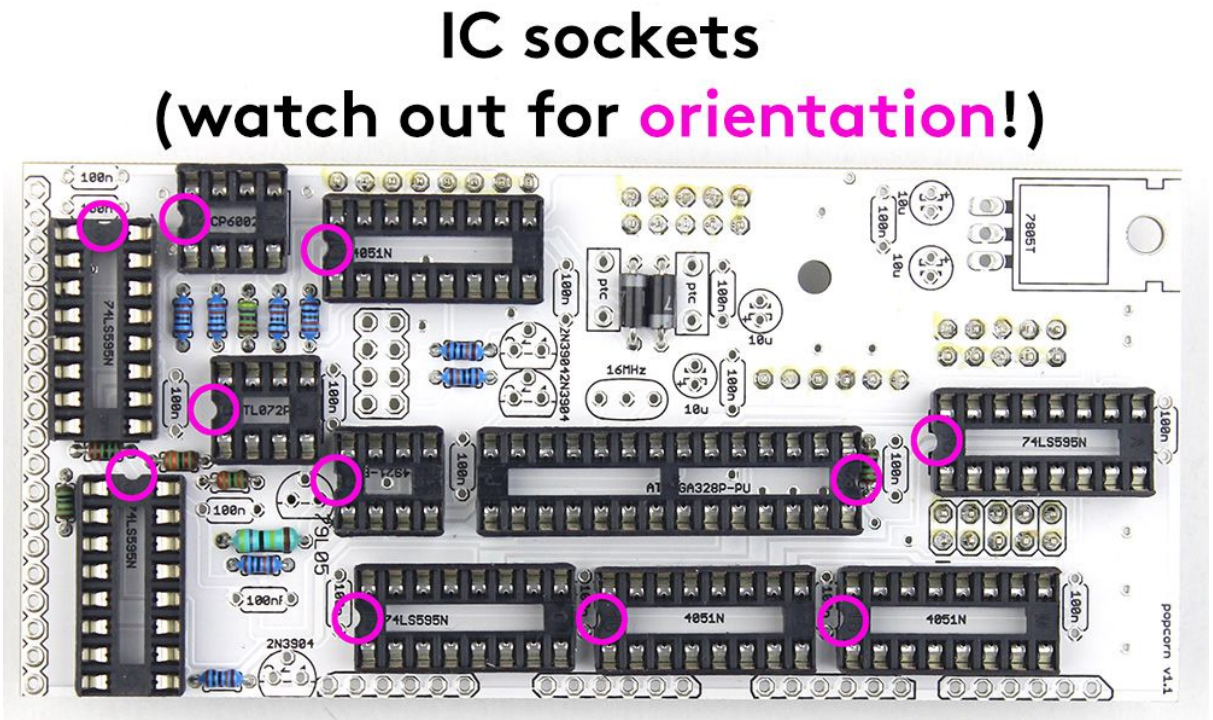
MALE HEADERS

Solder the **male pinheaders** now (1x 6 pins, 1x 8 pins and 3x double 5x pins). Be careful to solder them straight. You may first solder just one of the pin, take the board in your hand and re-heat that pin while pressing down on the header to align it (be careful, you don't want to touch the pin you are heating up). Wait for it to cool and solder the rest of the pins.



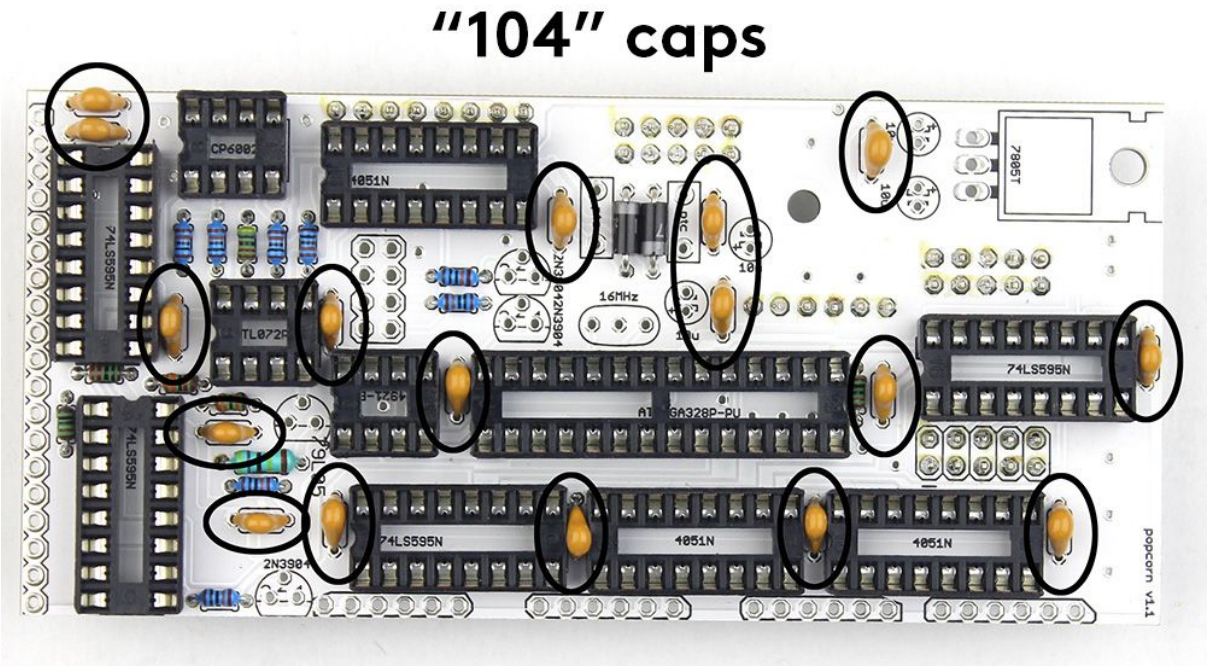
IC SOCKETS

Solder all the **IC sockets** (3x 8 pin, 7x 16 pin and 1x 28 pin). **Make sure that the notch on the socket matches the print on the board**.



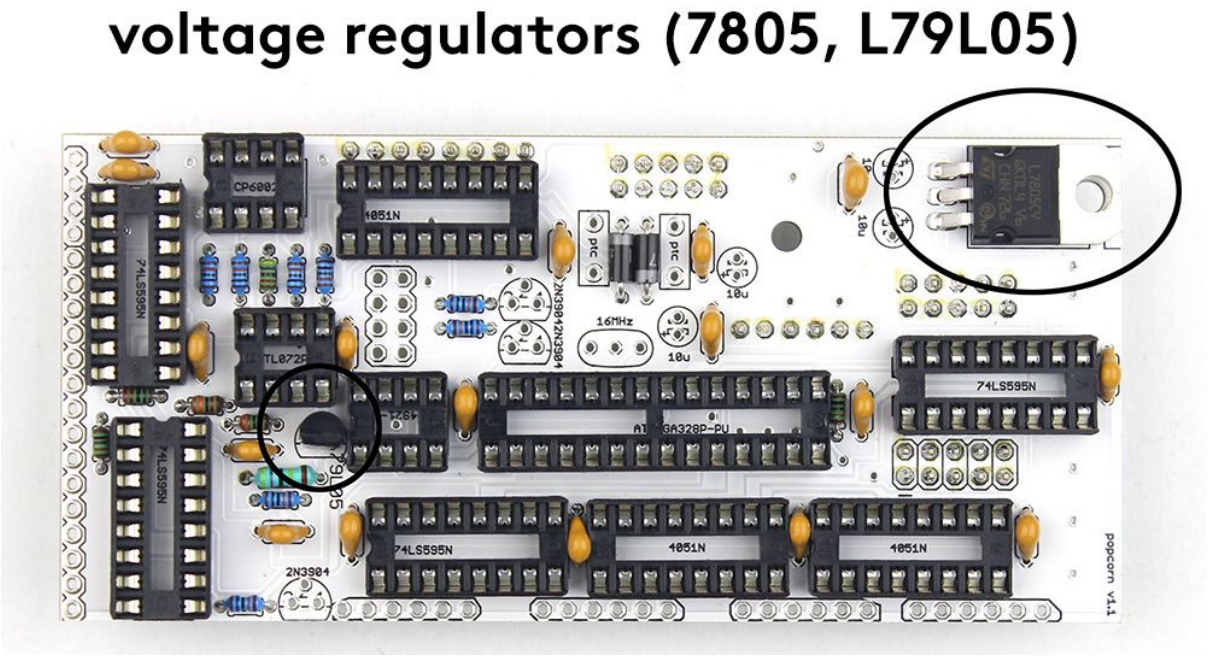
CAPACITORS

Let's do the **100nF ceramic capacitors** now. There are **seventeen** of them (marked "104" on itself).



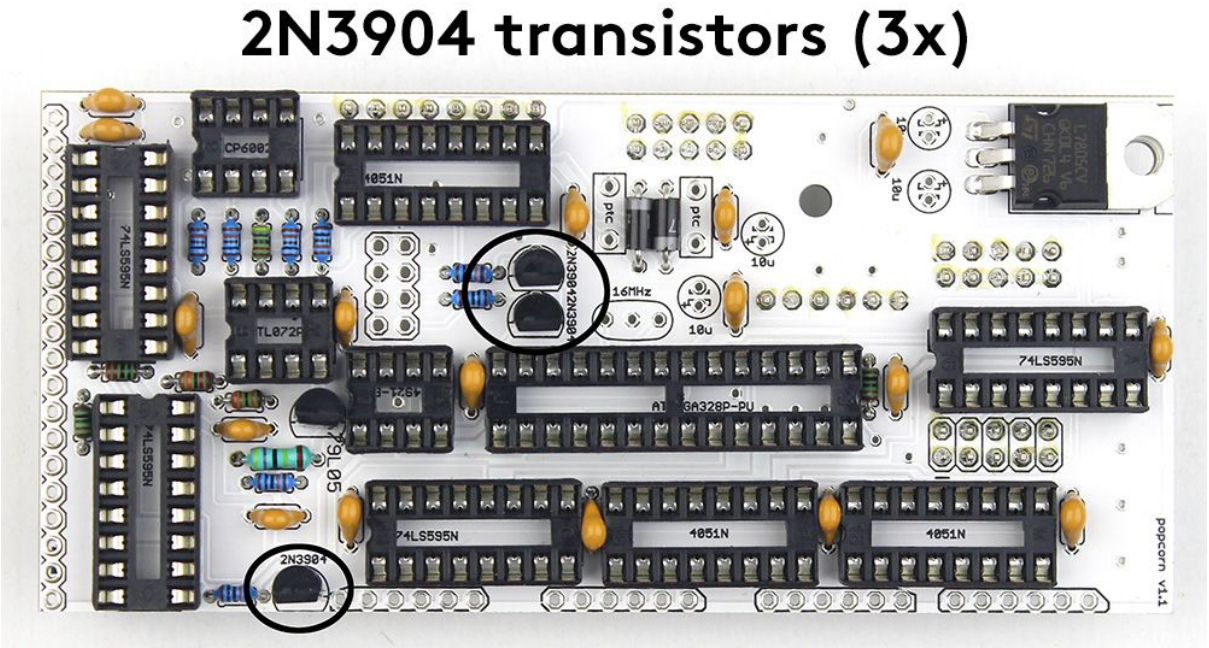
VOLTAGE REGULATOR

Proceed to the **7805 voltage regulator.** Bend its legs close to the body first. Insert it then to the spot and make it lay on the PCB.
There is also another **voltage regulator** (**L95L05**). Add it to the right spot and be aware of the **orientation**. It has to match the outline on the PCB.



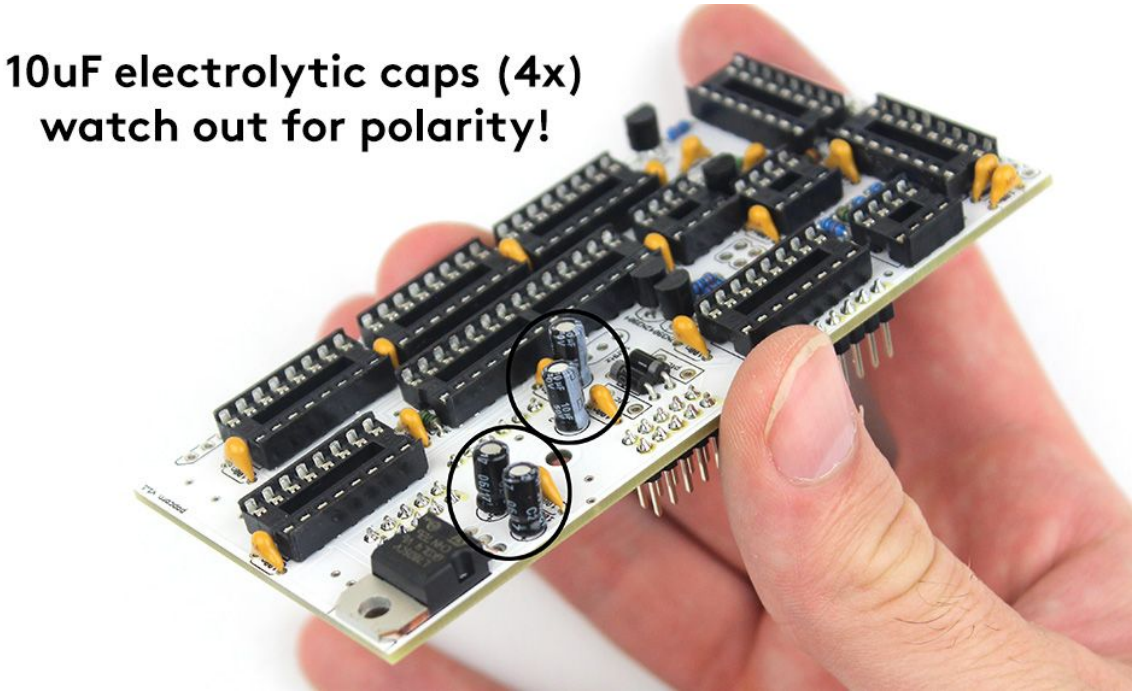
TRANSISTORS

Add **three transistors** (**2N3904**). Just be aware of the right **orientation** again!



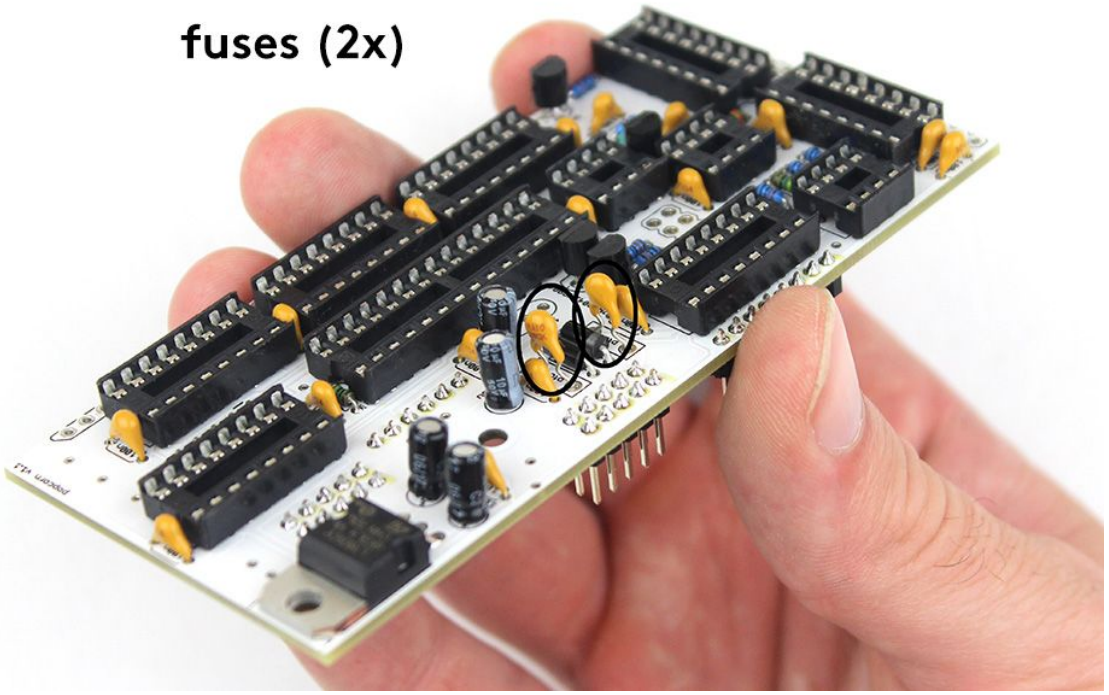
ELECTROLYTIC CAPACITORS

Let's do the **electrolytic caps** (4x **10µF**). These ones are **polarized!** There is a plus (+) sign on the PCB that has to match the longer lead of the electrolytic capacitor (actually the minus (–) side is also marked on the body of the capacitor with a white strip).



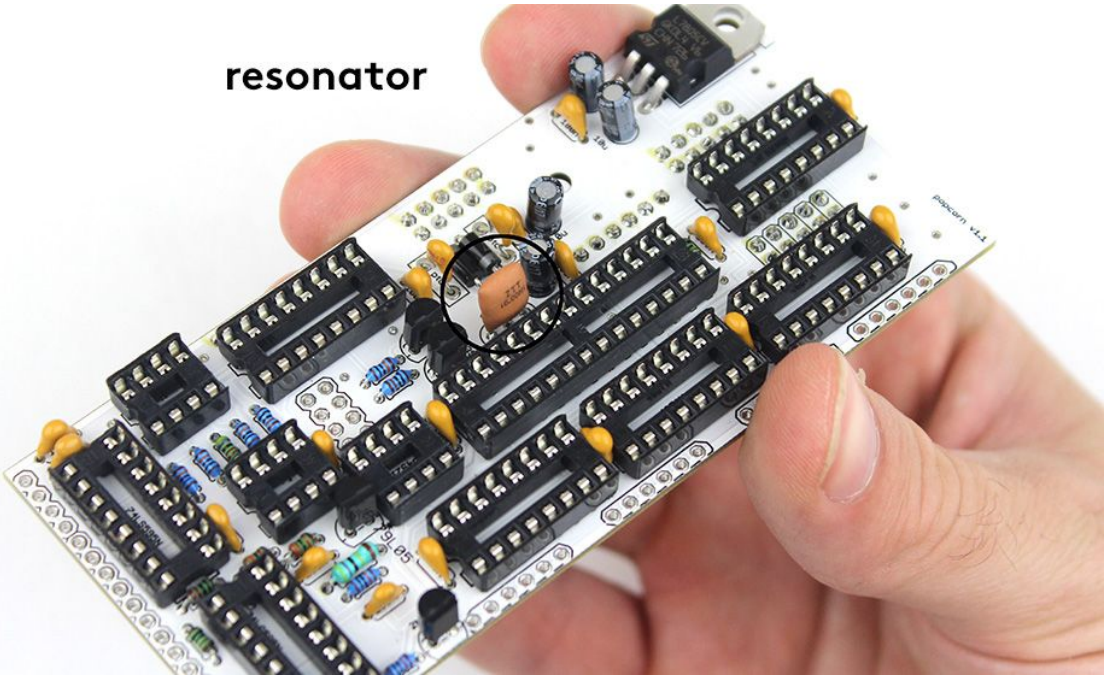
FUSES

Solder the **two fuses** right on the rectangular spot signed “PTC”. These parts look quite similar to capacitors so don’t let it confuse you.



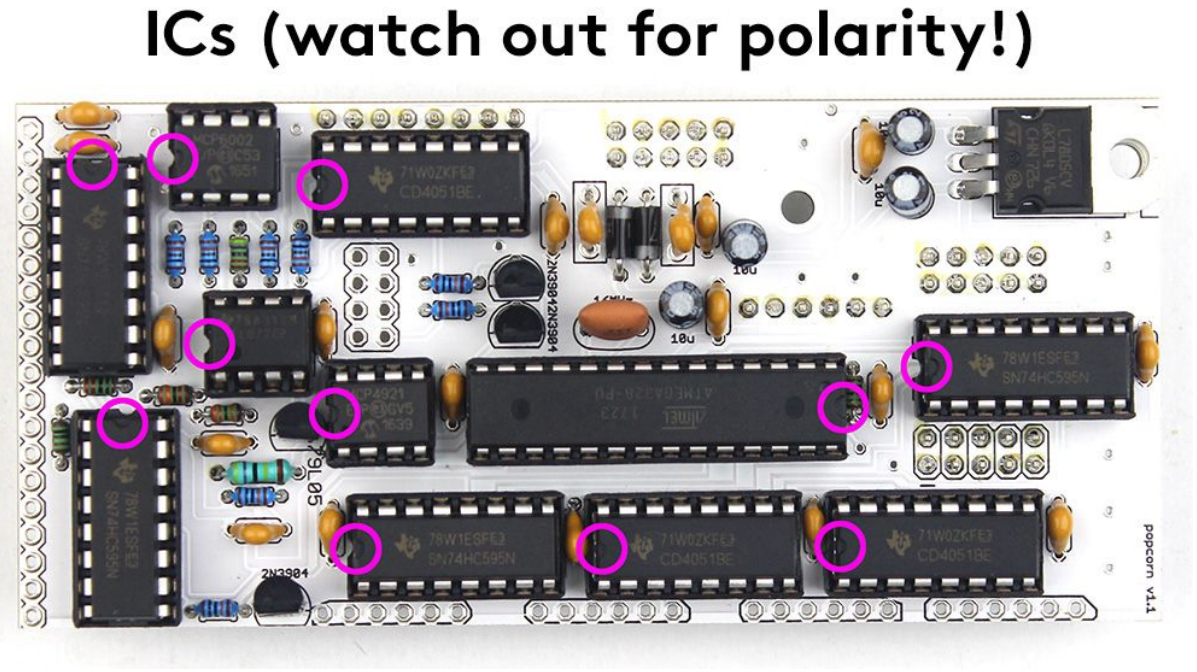
RESONATOR

Insert also the **resonator** (the orange component with 3 leads). This part is not polarized so you can insert it in any direction.



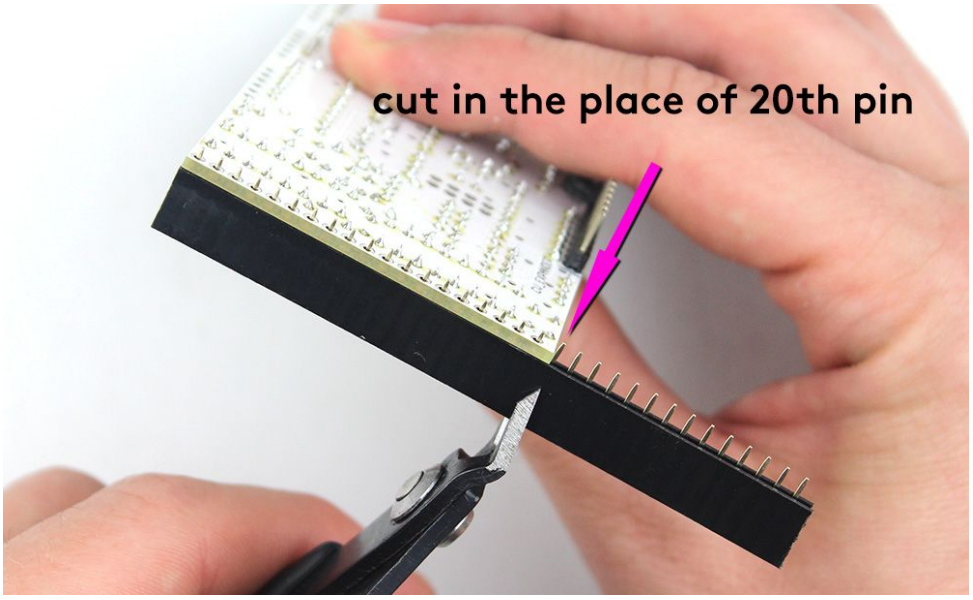
INSERTING ICs

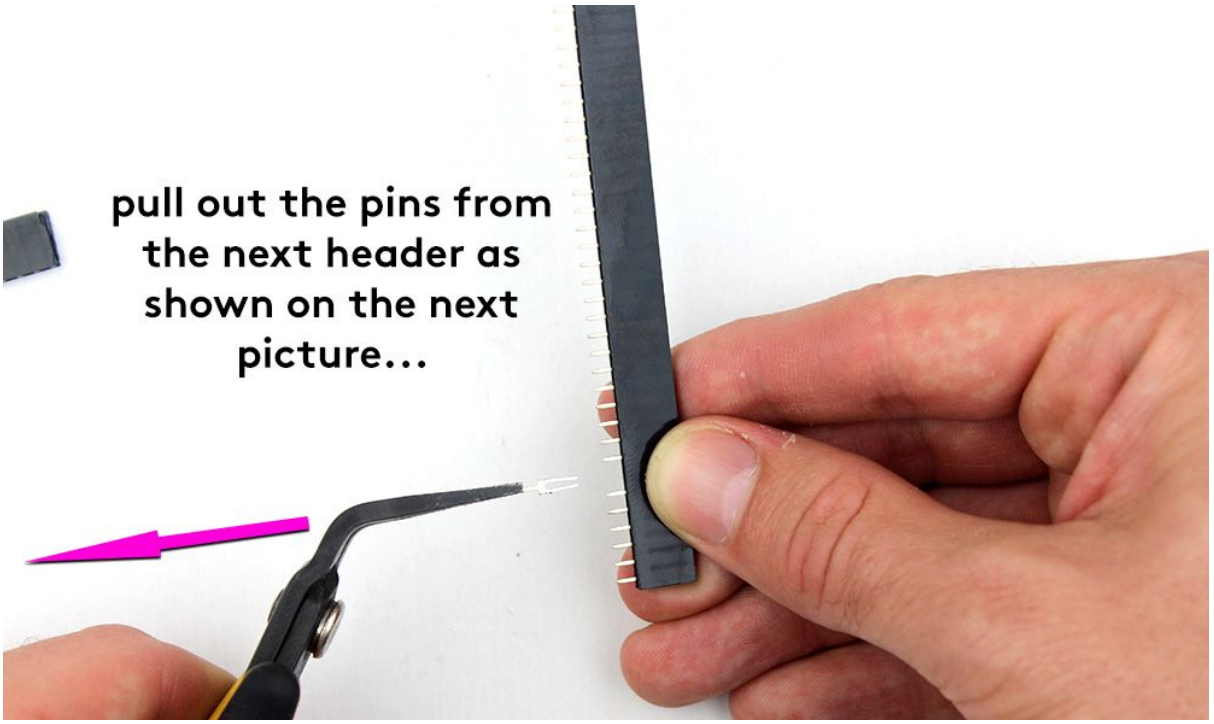
Next don't forget to place **ICs** into the sockets (1x **TL072**, 1x **MCP4921**, 1x **MCP6002**, 3x **CD4051BE**, 4x **74HC595**, 1x **Atmega**). **There is a notch on each IC that should match with the notch on the socket (for TL072 is relevant the dot on it).** Installing ICs can be also a little tricky. You should bend the IC leads in slightly with your fingers. Then press all the leads into the sockets in one shot.

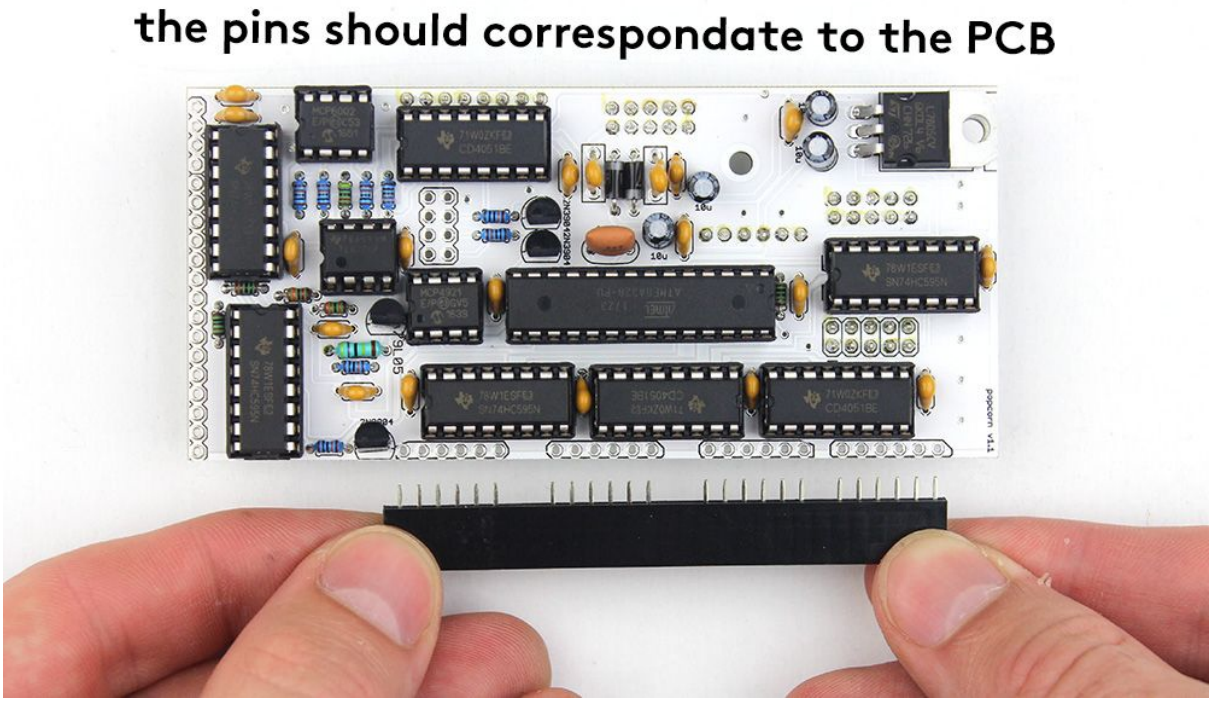


PREPARING FEMALE HEADERS

As you can see **two female pinheaders left**. You can prepare them now. Use your flush cutters to get the lengths of **19 and 29 pins.** You will always lose one pin when cutting the female headers, so be sure to cut it always after the last required pin - see the picture to check where to cut to get 19 pin. Then you have to adjust the 29 pin one by pulling out some pins. See the photos again. Hold on with these parts then. You will use them in later steps







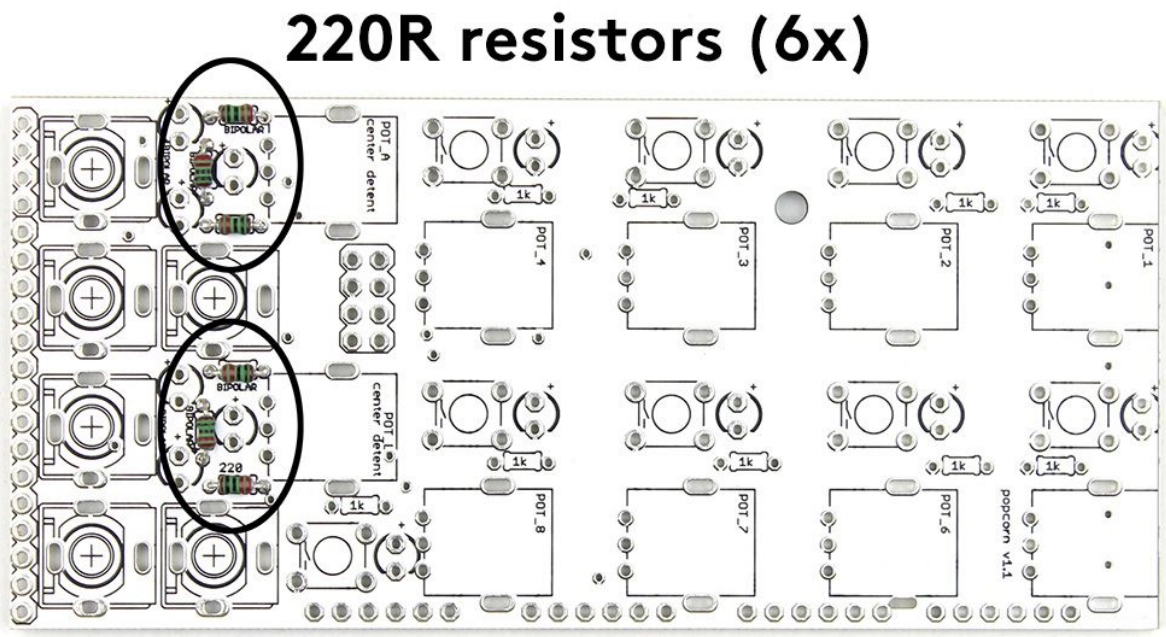
For now you are finally done with the bottom board. Make the last check that all parts are on the right place and everything is properly soldered.

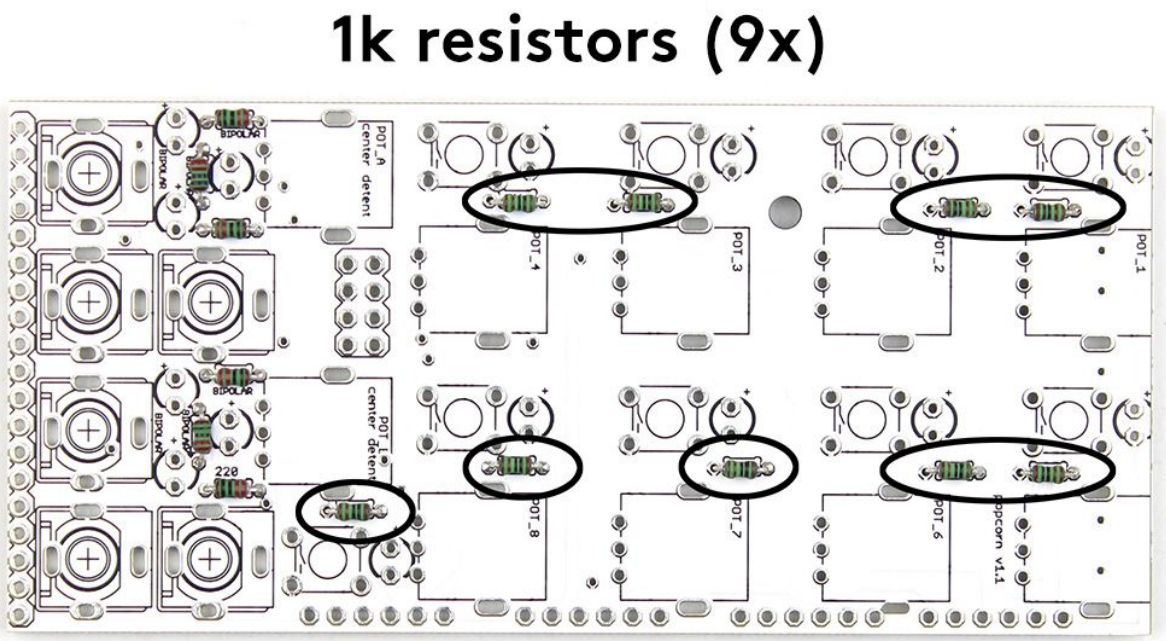
TOP BOARD

RESISTORS

Let's move to the top PCB now. Again, start with the **resistors**:

- **220R** (6x), **1k** (9x)

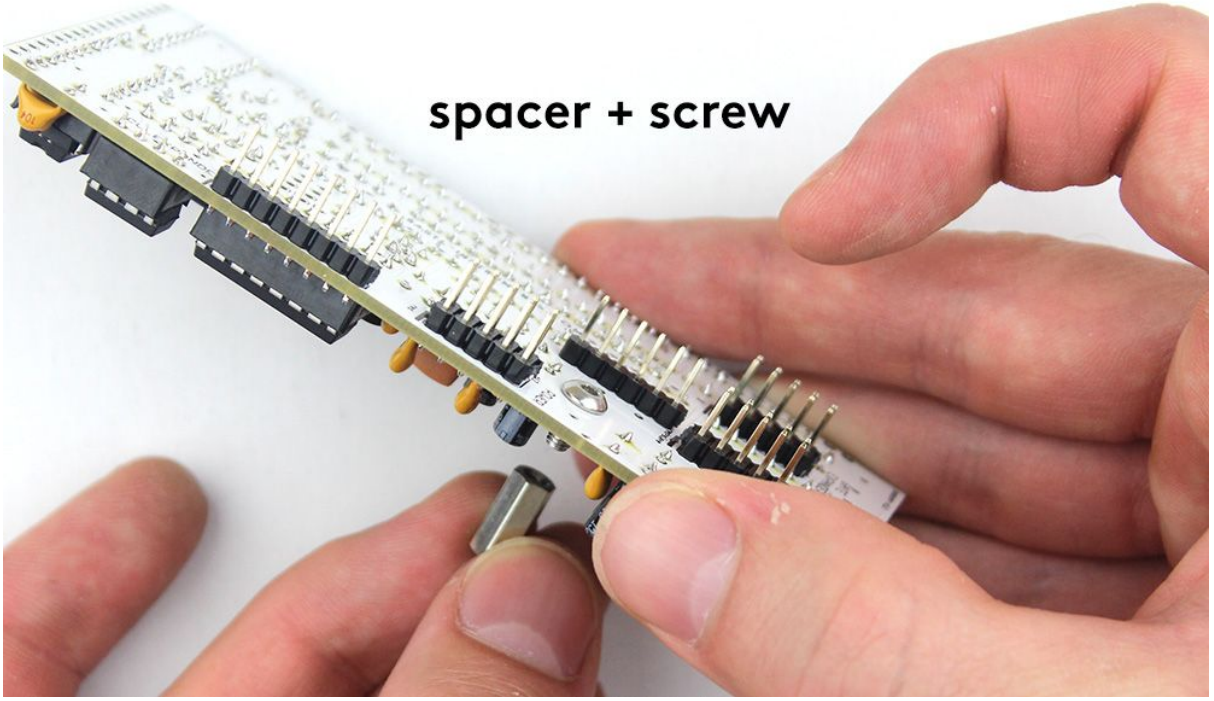


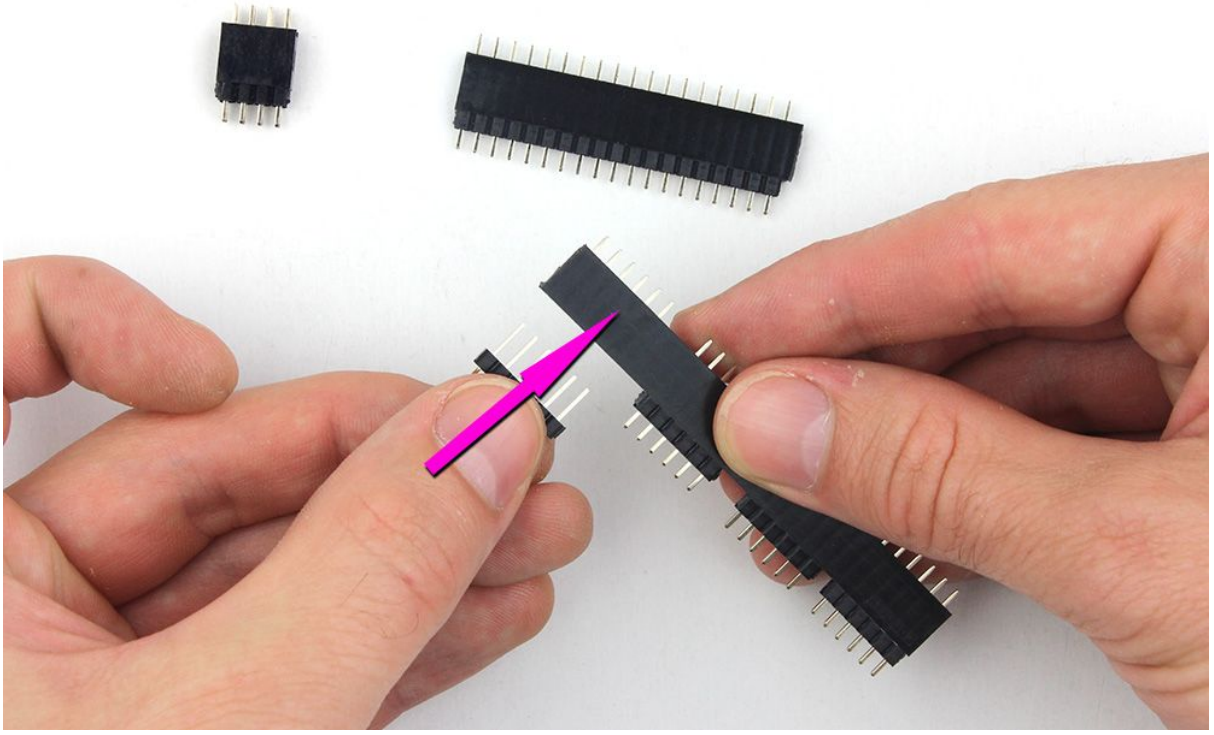


PINHEADERS

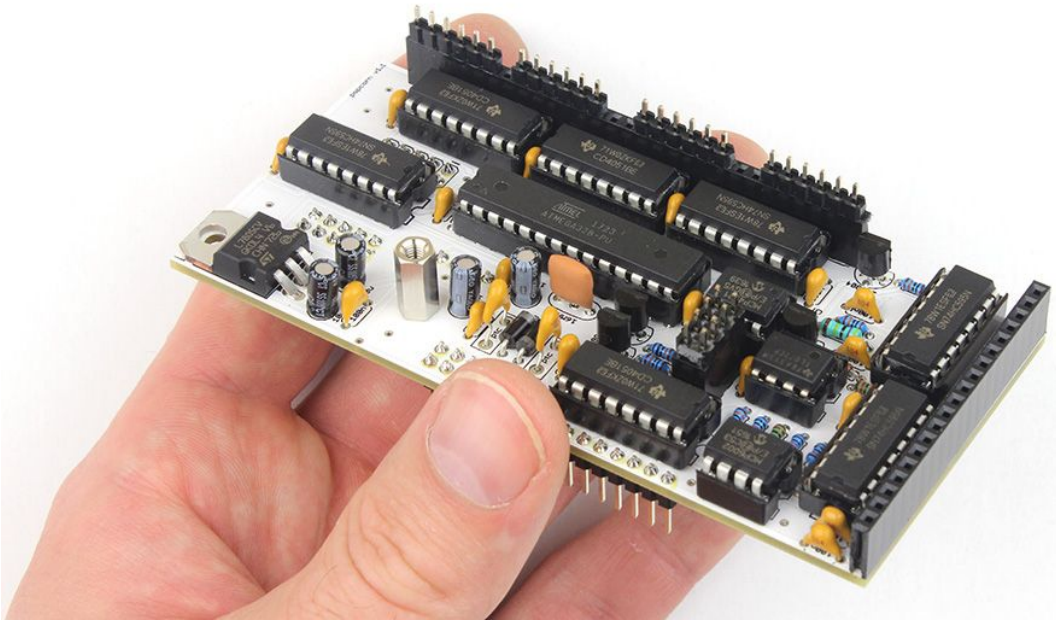
Now it's time to connect the boards with pinheaders.

1) Mount the spacer with the screw to the bottom board first.
2) Insert male headers into the female ones.
3) Put the headers on the bottom board facing the female ones down.
4) Place the top board on and secure it with the other spacer. Check the position and do the soldering of headers finally.

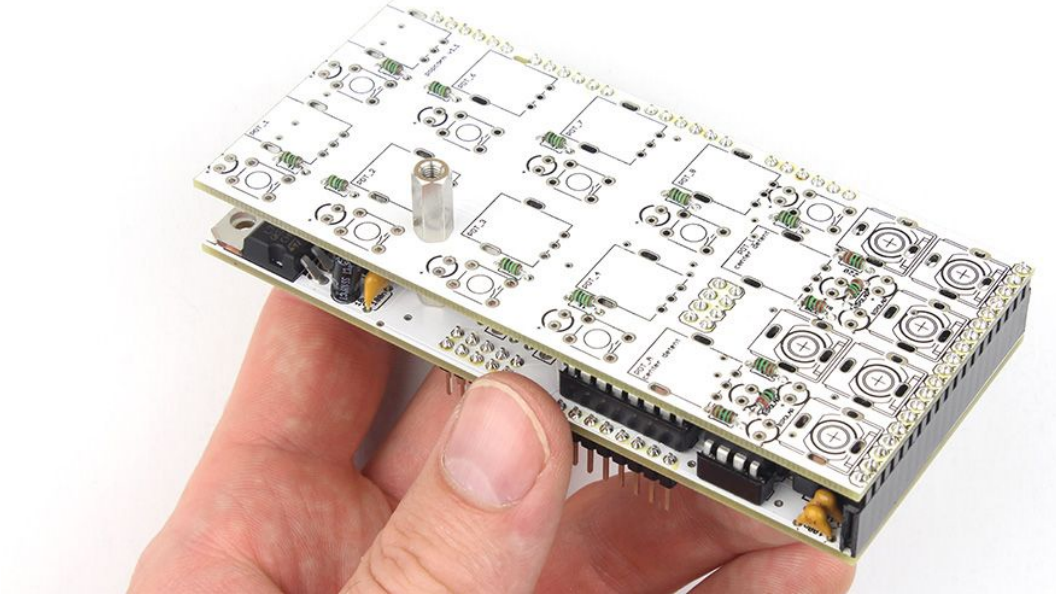




place the headers facing female ones down



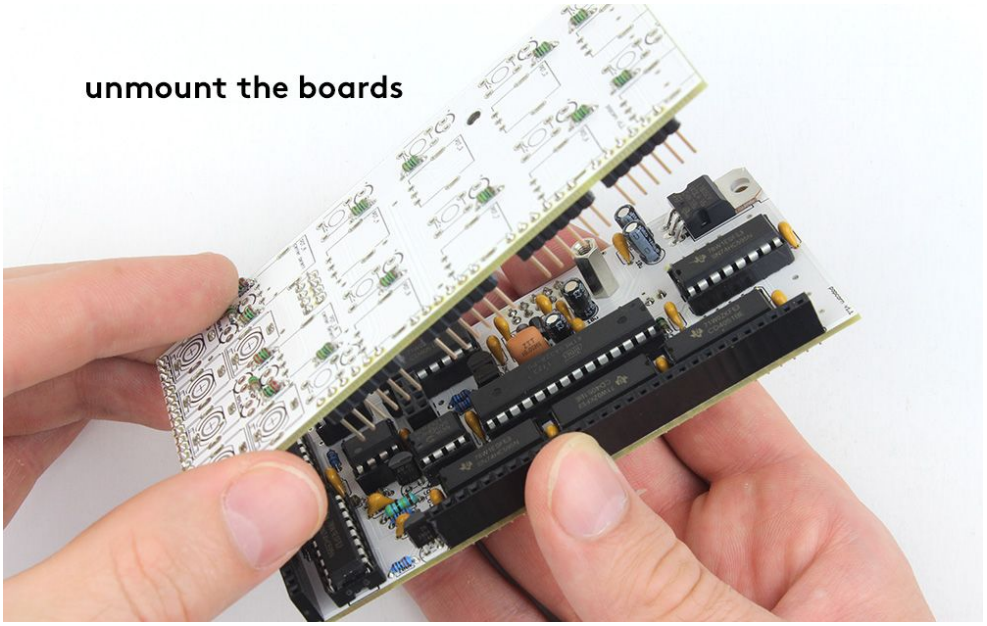
secure the top board and do the soldering

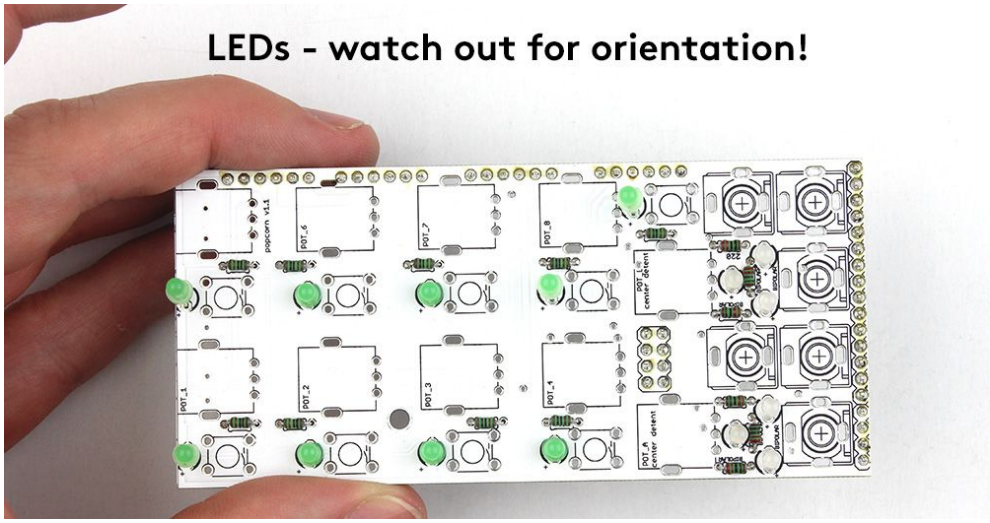


JACKS, POTENTIOMETERS, BUTTONS & LEDS

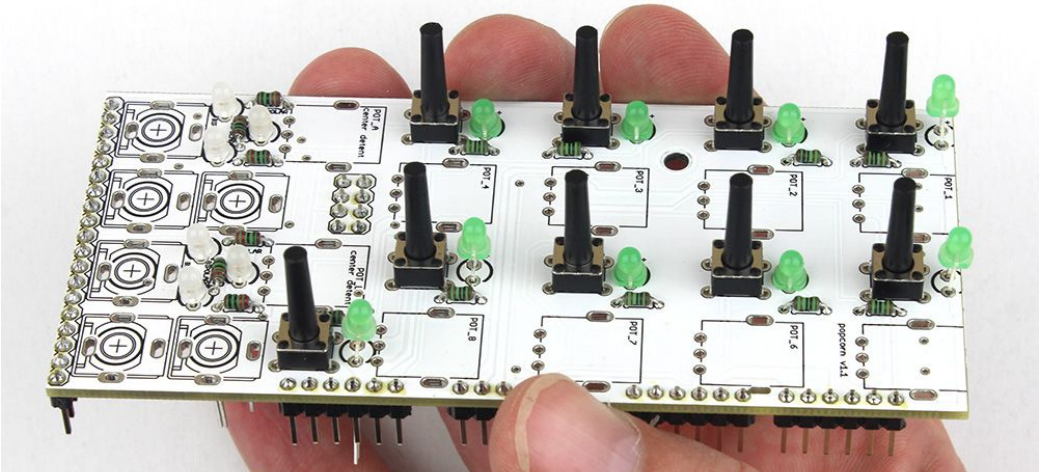
You are almost done. Let's do the rest of the components by just putting them in first (**no soldering yet! It starts at point 8!**):

1) Unmount the top board.
2) Insert green **LEDs (9x)** - **watch out for orientation**! (the longer lead has to go into the plus (+) hole signed on PCB). Insert also the transparent ones **(6x) - watch out for orientation again**!
3) Insert **buttons (9x)** - be sure they're at the right angle and right on the board.
4) Try the **center detent potentiometers (2x)** and place them at their spot - be sure they're placed in the right angle and they're right on the board. Then do also the rest of **potentiometers (8x)**.
5) Insert **jack connectors** (6x).
6) Mount the spacer to the **front panel**.
7) Place the **front panel** on and mount the jacks (you don't have to mount them all as you have to unmount them in the next step).
8) Mount the spacer with the other one. Check the position of all the parts if they are flat on the board and at the right angle, push the LEDs to the panel and do the soldering (SOLDERING TIP: you can start by soldering just one of the leg at each component so you can make adjustments easier by reheating)

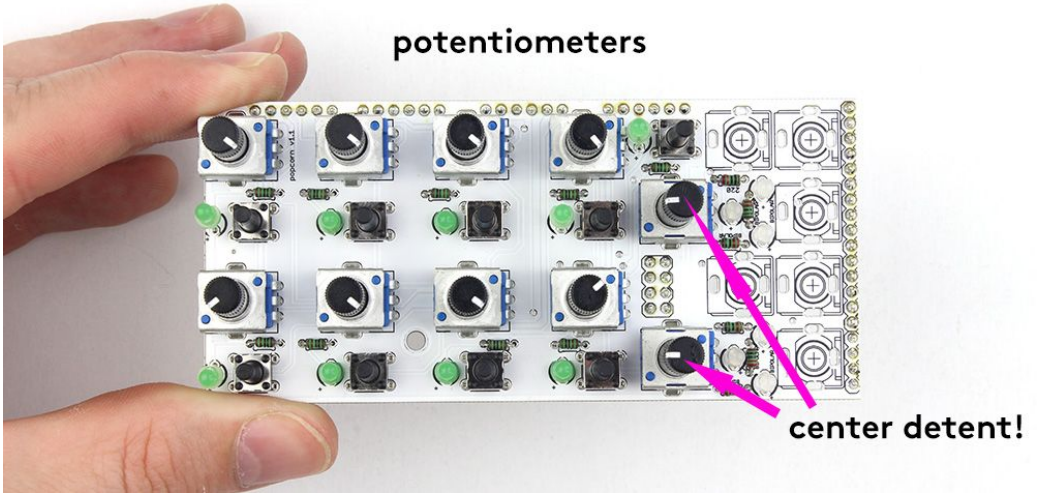




insert the buttons

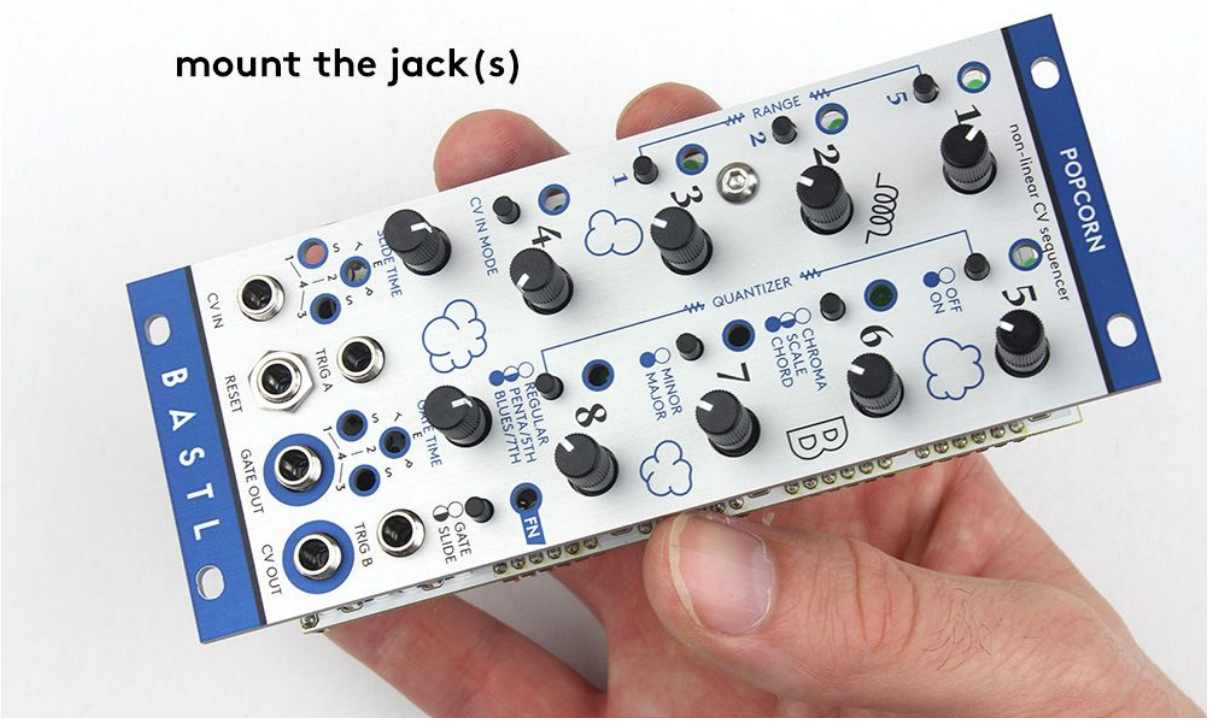


potentiometers

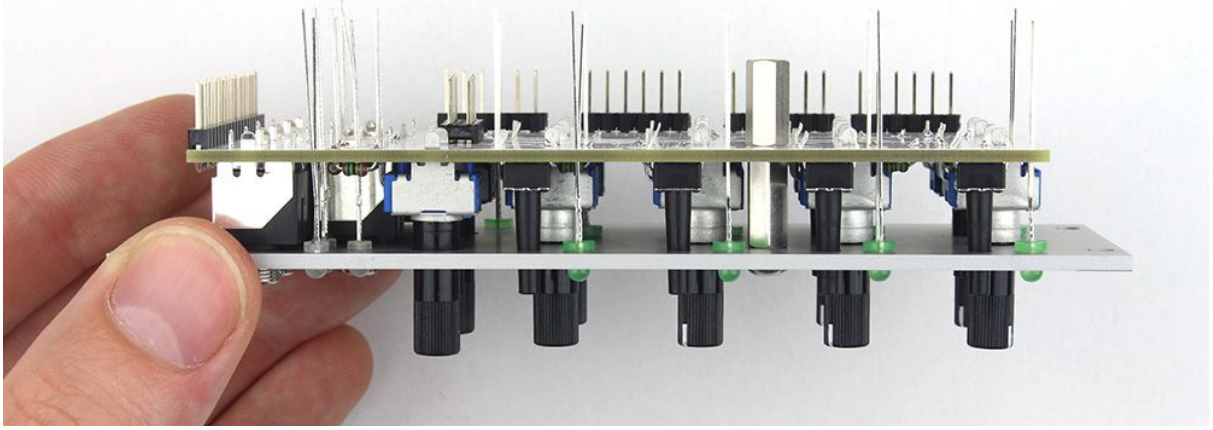


mount the spacer

mount the jack(s)

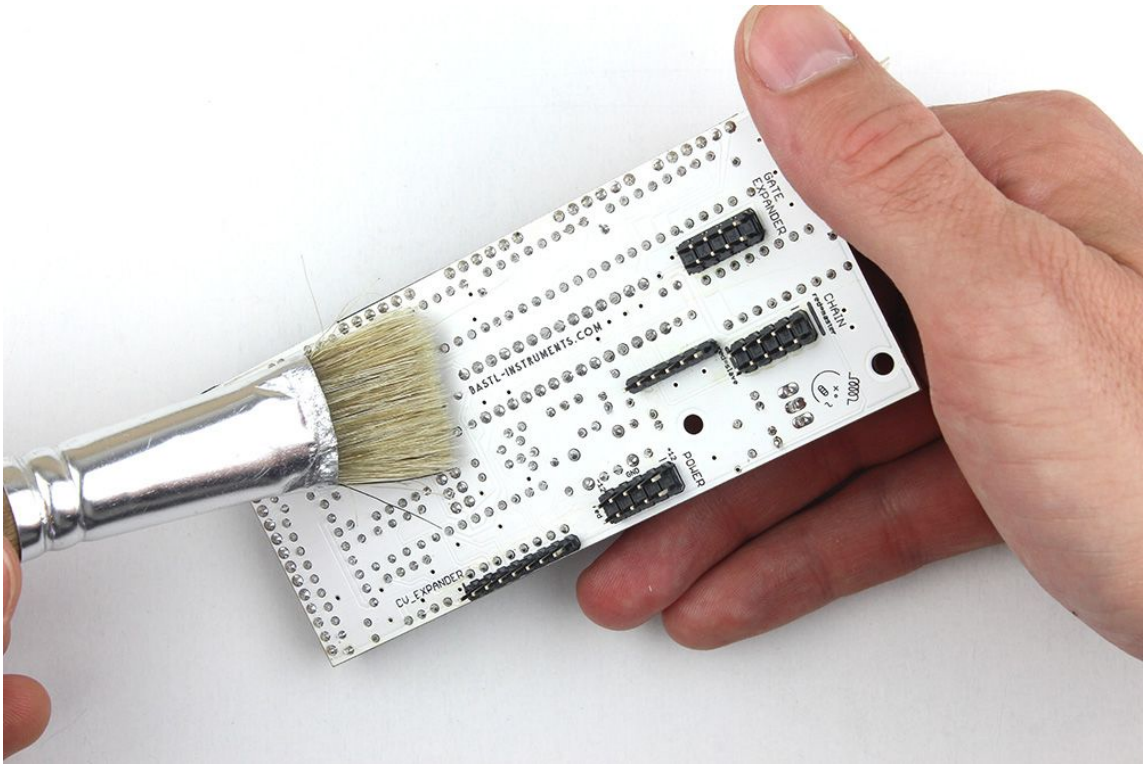


mount the other spacer,
check the position of all parts and do the soldering



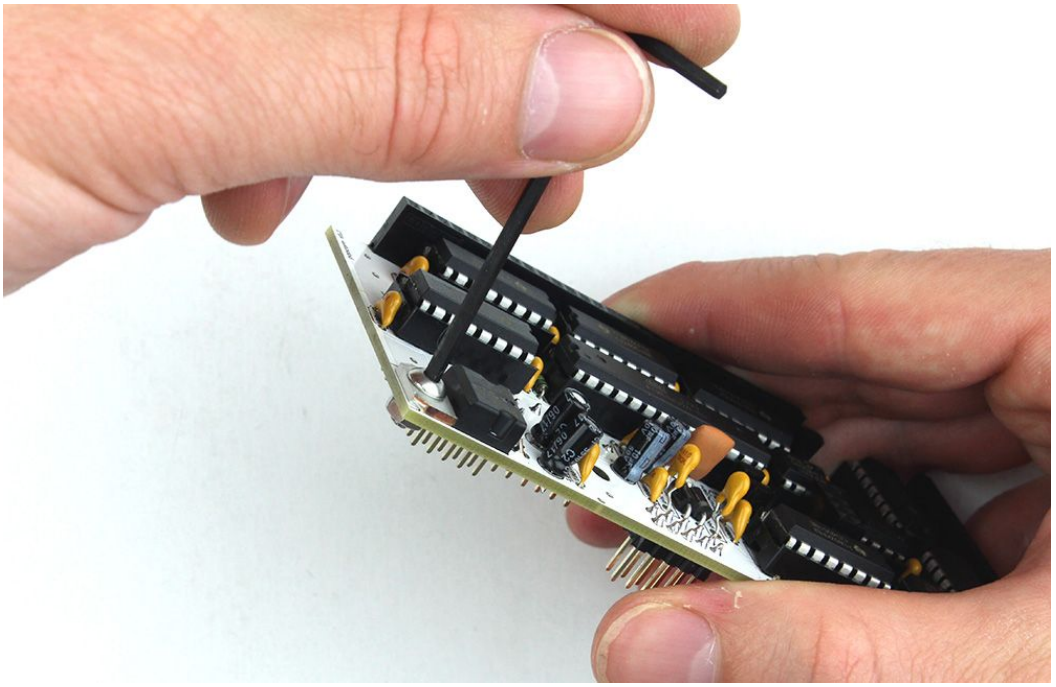
CLEANING (OPTIONAL)

After the soldering is done you might want to **clean** your PCB. You can use e.g. isopropyl alcohol. Put some of the liquid all over the PCB using the brush (be aware to not let it flow into the pots), let it act for a while and sweep it off. Then just let it dry. You can repeat these steps until you are satisfied with the result.



SCREW + NUT

You can also mount the screw and nut to the voltage regulator now.



FINAL ASSEMBLY

Congratulations! You have made it through, your Popcorn is ready to work! If you want to calibrate it first, follow the guide here. Before you connect anything, make sure that your system is disconnected from power. Also double check the polarity of the ribbon cable, the red cable should match the -12V rail both on the module and on the bus board!

TROUBLESHOOTING

If you have any issues with the module, please check the F.A.Q. at our website first. You can also reach us here: diy@bastl-instruments.com.