Manual for etching pcb's

In this manual you will find:

How you can etch pcb's at home (or in the lab) without the use of extensive material or machinery.

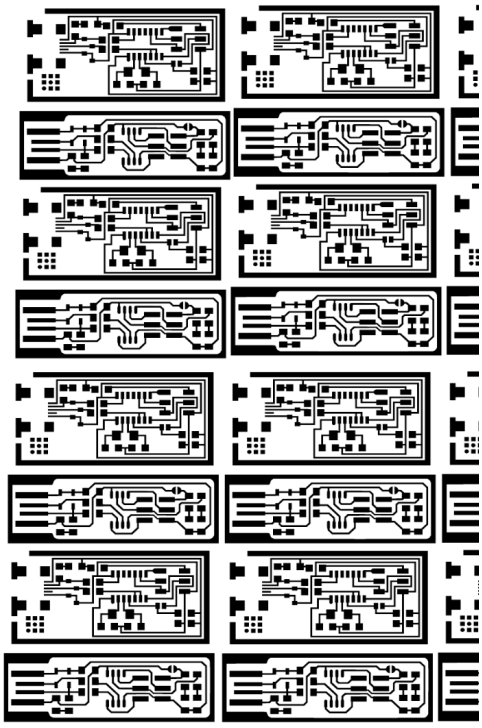
1. Collect your materials

For this proces you'll need:

- Ironer
- Glossy paper (heavy)
- Laser printer
- scotch
- copper boards
- surgical knife
- black marker (that writes on copper boards)
- Ferric Cholride (also named Iron (III) chloride or FECl3)
- 2 cups (closed and big enough for the pcb)
- water
- towel
- gloves
- baking paper/tower/special ironing t shirt towel

2. Design the board

In the next manual you could find how to draw your pcb in Eagle, as for now we use one that has been designed already. The steps are the same.



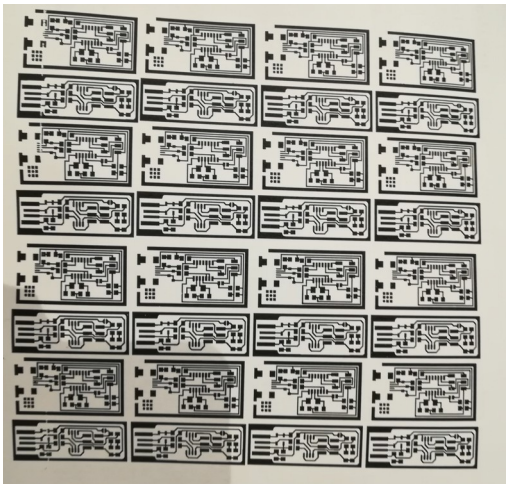
For etching, export the board from eagle with a dpi of 1000. In Inkscape I **mirror** my drawing and if needed change some of the lines (make them thicker, have more distance…). I mirror my drawings in Inkscape before printing as the image will be put on the board mirrored and it makes it easier to find your way and components back later on.

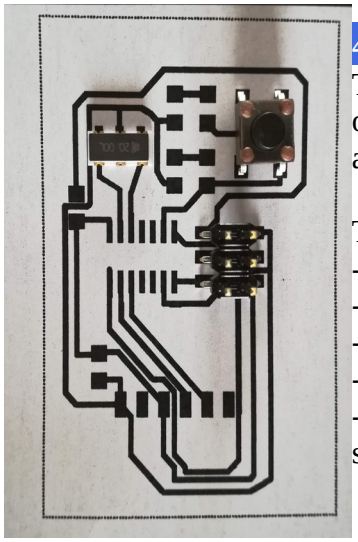
As you can see in the source files, I put more than one pcb drawing on one paper. I do this both because of quality and quantity. As you might print on advertisement paper, sometime you happen to print on a dark surface. Also, some pcb's come out better than others, depending on where the wheels of the printer are located inside the machine and how thin it can print. So I prefer to have a full page (I cant put it back in the printer anyway) and be able to manualy check the quality of the print before ironing and printing.

Created by Amy Beaulisch
March 2019

3. Print out your circuit

The next step is to print out the circuits. At first I used the advertisement paper of the ALDI. It's about A4 size, free and glossy. But not heavy enough. There were a lot of lines that often didn't come through. So I recommend you to use the heavier glossy paper. 3D printing magazine was perfect for it.





4. Manually check the circuits and cut them out

The next step is to manually check the circuit for parts that are missing or lines that are touching and cut them out. You can use the main square around the drawing as a reference or make it smaller.

Tips:
- Take a circuit that has good connections (no parts missing)
- Don't take a circuit that has a lot of (black) text on it
- Make sure you have enough light
- Take your time!
- Add the components on the paper to see if the actually fit. This will save you a lot of time and materials.

5. Put the circuit on the board

Make sure that you cut the board to the right size before doing all of this.

The next step is t get the circuit on the board. You've cut out the circuit, so now place it upside down on the board. That way you don't see the traces that you want to copy. Take a little piece of scotch and place it over the paper and the board, on the sides.

This will fixate the paper on the board so that it won't move when ironing.

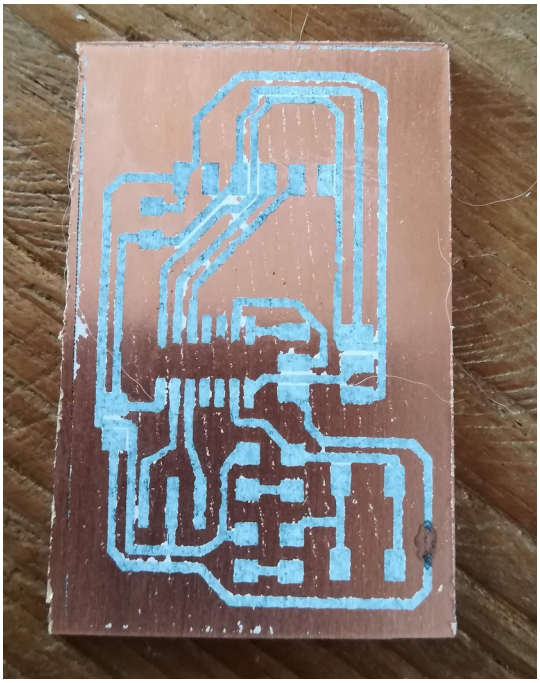
Created by Amy Beaulisch
March 2019

6. Iron the board

Next you have to iron the board. I always put the ironer on maximum. Use the baking paper(or similar) to put it between the board and the ironer to prototect the ironer. At home I use a old ironer that is not used for clothes anymore. In the lab we have ironers that we use for plastic workshops so they are okay with different materials.

How long do you need to iron it? Not that long, just a minute or so. Just don't look at your social network feed while doing it as you lose pressure. You need to push with the ironer to make the ink stick to the board.

7. Wash the board



Once you're ready with ironing, you can wash the paper of. Let the plate sink into the water for a few minutes so that the water has time to soften the paper. Once the corners get loose you can start peeling off. But don't go to fast as you might take off the ink layers of the traces. Don't force the paper to come loose.

note: be careful as the board is quite hot now!

8. Look for faults on the board

Nothing is perfect from the start, so take the board and check for bad connections. I use the surgical knife to scratch out black traces. And use the black pen to draw new ones or add parts of black where the laser ink didn't stay put.

9. Start etching!

The next step is to start etching. Put on your gloves and put some of the ferric chloride in to the little jars that you prepared. In the other jar you put water (you'll need this later). Gently put the board into the jar.

You have several options now: or you close the lid and start walking around with it, making sure that the ferric chloride keeps moving.

Or you use a vibrating plate that makes the ferric chloride move. Or you put in a magnet that reacts to another magnet and keeps the ferric cloride moving.

Created by Amy Beaulisch
March 2019

As you notice, it’s all about keeping the ferric chloride moving. You can put the copper plate into it and not move, but you’ll have to wait a very long time before it’s etched. So keep it moving. You could also stir it if you want.

A small plate should take around 20 min of etching (if it moves) and in outside (winterish) temperatures. You can add oxiginated water to speed up the proces, or heath it up a bit in the microwave, but as I prefer to keep everything away from things that come into contact with food: walking and waiting it is.

10. Clean the board

The last step is to take out the board out of your ferric chloride (keep this as you can re-use it) and put it in the jar with water. In essence, the jar of water is not enough to clean up the board, but good enough to bring it inside or move it to a place with more running water.

Once you know you’ve cleaned the board well enough, you can dry it and start soldering. For cleaning the board you can use acetone (to take out the ink) and soap (for the grease from your fingers)

Created by Amy Beaulisch
March 2019