

If you would like to make a PCB for your project then this is the guide for you. We have a small etch tank and all of the equipment available at HacMan for your PCB making needs! If you would like a tutorial please ask Alex for a demonstration...

Let the instruction begin! To make a PCB you will need to obtain the following items:

- 1x piece of copper clad FR4 PCB material

It needs to be slightly larger than the total area of the design you intend to make. Single and double sided FR4 PCB material is available in the PCB equipment box which is next to the electronics bench in the 'great wall of storage'. If there is nothing of suitable size for your design you will have to buy your own PCB material.

[File:FR4 PCB.jpg](#)

- Some glossy paper for transferring the design - 120 GSM glossy paper, matt one side, smooth on the other - This is available in the stationery draw in the main part of the space next to the boxes of shame and the craft making kit. Grab an A4 sheet and prepare the laser printer. Make sure no one is printing before you press print!

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- A clothes iron or a plastic film laminator - There is an iron and a laminator in the PCB equipment box. Either can be used to transfer the toner from the glossy paper to the FR4 PCB material

[File:Clothes Iron.jpg](#)

- The etch tank! - This is available on the 'great wall of storage' at the end next to the electronics page. Carry it over to a free space in the workshop. It will need to be near an electrical socket. Please be careful and try not to spill the etch fluid. You will also need to grab the air pump.

[File:Etch Tank.jpg](#)

- Finally some latex or rubber gloves, some eye protection goggles a lab coat or work clothes and some plastic tweezers - These should all be available in the PPE box in the great wall of storage or in the PCB making equipment box.

[File:gloves.jpg](#) [File:glasses.jpg](#) [File:labcoat.jpg](#) [File:tweezers.jpg](#)

Once you have obtained all of these things the process can begin...Exciting times!

1. Load a laser printer (it has to be a laser printer) with 120 GSM glossy paper. Make sure the smooth side is the side that is presented to the toner ink. Print out the PCB layout with only the tracks, pads and dimensions present. Most people in the space use EagleCad to develop their PCBS. It doesn't matter which software you use - Be sure the printout is mirrored before you begin. Remove any excess paper after printing using scissors. These are available in the knives box next to the boxes of shame on the 'great wall of storage'

[File:printed and ready for transfer.jpg](#)

2. Once you have the printout on glossy paper its time to get hold of the blank copper clad PCB material. Cut it to size using the bandsaw or the PCB guillotine. I prefer to use the bandsaw. Clean the copper using a polishing block or pencil eraser. The copper area needs to be cleaned to remove any

excess dirt or grease. At this point I wear plastic or latex gloves to prevent finger prints. You could also use wire wool - the process is to remove any dirt, grease and oxidation from the surface of the copper.

[File:Wirewool.jpg](#)

3. Heat up the clothes iron to as hot as possible - make sure there is no water in the iron (if its a steam iron). Place the printed PCB layout toner side down onto the cleaned copper side of the PCB. If needed secure the printout in place using masking tape or box clips. I use an old piece of wood to press down on when I iron on the design. The heat causes the toner to transfer from the paper onto the PCB; About 5 minutes of ironing should see the design properly transferred. Practice makes perfect!

[File:Transferred.jpg](#)

4. Once you are happy the design has been transferred turn off the iron and place the PCB into some cold tap water. Be aware the PCB is probably quite hot so use suitable heat protective gloves or tongs! You could just leave the PCB to cool but I'm impatient! Next soak the paper off the PCB exposing just the ink and the copper. I like to use an old toothbrush to clean off the excess paper.

[File:Save paper rubbed off.jpg](#)

5. Once complete inspect your transfer. You should be able to read any text present and there should be no broken tracks. If there are broken tracks you can touch them up using an acid resistant marker pen like the permanent markers used for writing on acetate sheets. If the design didn't transfer well at all you can clean off the toner and repeat the process from step 3 onwards. Again practice makes perfect and this is why I prefer the toner transfer method. I can rectify mistakes early on.

6. Now it's time to etch the PCB using the ferric chloride. Place the PCB in the etch tank with the design facing up! Gently rock and agitate the etchant for about ten minutes. Using plastic tweezers or taking care roll the etch tank to one side so that you can see the design. See if the uncovered copper has been removed. If it hasn't continue agitating the solution until it has been completely removed.

[File:Etching.jpg](#)

7. Once all of the uncovered copper has been removed take the PCB out of the etch tank and clean the PCB in tap water. Once all of the ferric chloride has been removed, clean off the black toner using wire wool or something suitably abrasive. You should be left with something similar to the picture below. After that it's time to drill any holes required using the dremel and the correct drill bit sizes before populating your PCB with components and soldering it up. Hopefully if it was designed properly it will perform the function you require!

[File:Etched and drilled.jpg](#)

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