Copper Etching with Laser Printed Artwork, version 1.0

By David Pickering [satdaveuk@yahoo.co.uk]

Edited by R. G. Sparber

Thought I would share my way of making cheap do-it-yourself printed circuit boards (PCBs) to you folk. Been doing it this way since the early 70s after endless experiments.

Layout

First, design your layout. I normally use Sprint because of its ease of use, you can convert your circuit diagram to bit mapped (.bmp) then use it as a transparency under lay for your track printed circuit board layout.

Once you have accomplished that you can print direct from your lay files.

Paper Selection

Second, select the paper type. In the early days I used the same as allot of you on here, old glossy magazines. The result was too hit and miss plus there was the hassle of cleaning the paper off.

The best paper found was wax[1] based. By using this type of paper, you can just peel it off the copper and the job is done. You will find all plastic ink is where you want it on the copper laminate, the paper you originally printed on will be spotless as if it had never been printed on in the first place.

The next best paper if you have no wax paper is ordinary thin old FAX paper. This is the type that was on rolls. Although thin, it is strong enough to survive passing through the printer. You will need to run it under water to get the paper off. But since it's so thin, the task only takes a few minutes.

---

[1] I have been in contact with supplier of the wax paper as I call it, and in fact it is wax based but contains other, undisclosed, chemicals. It is sold by many companies as a Heat Toner Transfer paper.
There is a company on eBay selling 10 sheet packages of A4 size for £1-28 including p/p, that's cheap.

Machinery

The laminator is a bog standard Maplin type code N38HY. I've used other types of laminators in the past and all worked fine. My printer is a Samsung ML1860. Before that used I used a photo copier.

Procedure

The whole job from start to finish including etching should take about 1 hour for a board say 95x100mm. It is essential that all materials and equipment be at hand.

1. Print your lay file to paper with the laser printer set at its best settings.
2. Print to your wax based paper.
3. Sand your pre cut copper laminate.
    a. Use a very fine wet and dry emery cloth under running warm/hot tap water
    b. Use a circular motion making sure all copper clad is spotless with a nice shinny surface
    c. At this point Its paramount you do not touch copper clad.
    d. Wipe with kitchen towel to dry.
4. Cut your lay file from the paper leaving a extra half inch perimeter all round.
5. Lay the laminate down on the paper by
    a. carefully holding it by the edges as you would a DVD or IC
    b. copper side down on top of your printed lay file.
6. Secure the paper
    a. fold tightly the half inch extra perimeter around the back end of the laminate creating lips
    b. use paper tape to secure the lips to the laminate.
7. Run the assembly through an ordinary laminator 10 times[2].
8. Place the assembly in the freezer for 30 minutes to rapidly cool it.
9. Prepare the etchant[3].

---

[2] I used to use an ordinary household iron but there are too many hit and misses. Temperatures variants from one iron to the next due to their primitive thermostats can easily damage the PCB. Using a laminator as described will give enough heat to easily melt the laser compound but not enough to delaminate the copper clad surface.

[3] If using ferric chloride granules, as I do, you can mix with water in a Pyrex dish. Heat the liquid with a heat gun directed onto the surface. The goal is to warm the liquid and not the dish.

10. Take the assembly out of the freezer and unwrap it. The paper should just fall away leaving a nice covering on the copper and nothing on the paper.
11. Rinse the copper with warm water leaving just the toner fused to the bright copper
12. Etch the board. The etching procedure should take no longer than 15 minutes. If it takes much longer, you will end up with a pitted surface due to breakdown of the toner.

Final Thoughts

You will always get 100% success providing you follow my instructions to the book. Remember,

- copper surface needs to be totally clean. Grease, which includes your finger prints, will prevent the toner from fusing to the copper.
- The temperature of transferring lay files, too much heat or not enough heat will give the same symptoms.
- The Etching procedure demands getting the right mix and keeping it warm. Glide the PCB through the solution keeping it on the move. It needs to be in and out of solution as fast as possible to avoid loose print and pitting on track surface.

Actually, the most boring and time consuming part of making a successful PCB is drilling the holes. Even though I have a pillar drill it still a pain. The task is made worse if you are getting on in the years like me. My eyes are not as good as they used to be.

Anyway hope this is of some help.

Regards,

Dave