

MAKE YOUR OWN FINE PCBs

Using an overhead projector (OHP) marker pen from Luxor instead of enamel paints or nail polish will allow you to draw straight PCB traces with separation as small as 0.5 mm

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For those who like to have their circuits made on perfect PCBs rather than veroboards, here is a method of making excellent PCB prototypes at home. Though there is no change in the basic idea, the trick lies in the choice of the drawing material. Many people use quick-dry enamel paints or nail polish to draw PCBs. They can instead use a cheap overhead projector (OHP) marker pen from Luxor, which is very convenient to draw straight PCB traces thinner than 1 mm! Separation between traces can be as small as 0.5 mm depending upon the steadiness of your hand. This method is suitable for medium-sized, single-sided through-hole boards.

The procedure

Draw the PCB design using any PCB design software. One such software is ExpressPCB, which is available for no cost on the Internet and was included in the EFY-CD of May 2000. It can be used to design small and moderate PCBs. Another good software is Eagle Layout Editor, which can be downloaded from 'www.cadsoft.de' as freeware. Eagle is more advanced than ExpressPCB, as it includes a schematic editor, board editor,

and bigger component libraries.

If you don't have a PC, draw the design using a scale and a sharp pencil. You may need to rub off the drawing several times to correctly place the components. Take a high-contrast photocopy of the final drawing.

Print the PCB drawing in actual size. In the case of ExpressPCB printing is done from the component side, so the actual solder side drawing will be a mirror image of the printout. Eagle has options for printing the PCB as mirror image or up-side-down and is more convenient.

If you are using ExpressPCB, mark holes on the PCB (with a sharp pencil) from the reverse side of the printout by facing it towards some light source. Cut the print along the borders of the actual drawing. Cut a copper-clad board to the actual PCB size. Place the drawing on the board with printed side facing the copper cladding. Fix it with a transparent plastic tape or some easily removable adhesive.

Drill holes at the marked positions over the print from the copper side. For drilling, you may use a hand drill or an electric drill, if available. We've used an old 12V Epson motor fitted with a drilling bit.

After all the holes are drilled, remove the paper from the board. Smoothen the rough edges of the PCB and the holes with a fine file used to sharpen saws, which is easily available from the hardware stores. Clean the clad board with some dishwasher soap (such as Vim) and a soft scrubber until the copper starts shining.

For drawing the PCB traces on the board, use a Luxor OHP marker pen and a small scale. This pen is easily available at stationary shops for around Rs 20. It can draw traces less than 1 mm wide. Take a rough paper and touch the tip of the pen on the paper before starting to draw. This ensures a good drawing. You will

have to draw each line two times or more to have a thick layer of ink on the copper.

The pen ink dries very quickly, so put on the cap of the pen immediately whenever you stop drawing. Don't press the pen against the PCB. The tip of the pen should just touch the PCB while drawing. For large copper pad areas, draw the boundary with the help of the scale and fill the inside carefully.

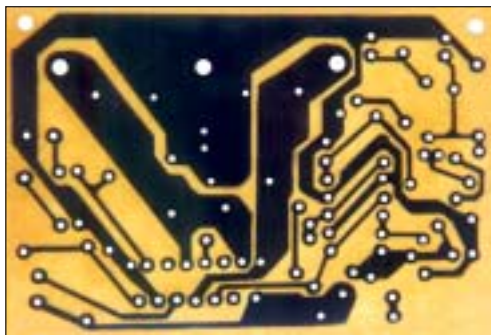
After drawing all the traces, minimise bare PCB areas by drawing large ground planes, covering as much copper as possible. This will improve the noise immunity of your circuit and ensure less time for etching in ferric chloride solution. After the drawing is complete, inspect the PCB under bright light for areas with thin ink layer. Larger pad areas need more care. Leave the PCB for 10 to 15 minutes so that the ink may dry well.

Take the required amount of ferric chloride solution on a plastic tray or enameled metal tray. Be very careful while handling ferric chloride as it is highly corrosive. It reacts with cement floors and even stainless steel. Add some warm water (heated to 60-70°C) to the solution. Dip the PCB in this solution with copper side facing upwards.

Leave the PCB in the tray and occasionally stir the solution by lifting one end of the tray slightly and then the other end. Don't touch the PCB. The actual etching time will depend on how frequently you stir the solution. For faster etching, initially stir the solution continuously for about 10 minutes.

Monitor the progress and take the PCB out of the solution as soon as the bare copper is completely removed. Don't leave the board in the solution for too long, as ferric chloride starts corroding the copper below the ink layer and the quality of the PCB degrades considerably. This is very important for high-current carrying wide PCB traces.

Wash the board with some dishwasher soap and a scrubber until the copper layer is exposed. The marker ink on copper gets very easily removed by the soap. Wipe the board to get a shining new PCB. □



Completely etched 6.5x4.5cm PCB drawn with OHP marker ink