Nottinghack PCB workshop

- making your very own flashing thingy

What is a PCB?

- Printed Circuit Board
- Ubiquitous in electronic products
- Copper tracks on some form of rigid board
- Copper track join up the components in the correct way to ensure the circuit functions
- Components soldered onto the board

Health and Safety

- Chemicals being used are DANGERUOUS
- ALWAYS use gloves and goggles
- Be aware of others around you
- If you do get any on yourself
  - Wash with copious amounts of water
- Drill – wear goggles

Prototyping circuits

- Many ways to connect together components
  - Breadboard
  - Strip board
  - Tab strip
  - Wire-wrap
- Generally these methods are less permanent or for single units
- A PCB makes it more repeatable and easier to produce the circuit.

PCB board

- The board used will have three main layers:
  - Resist
  - Copper
  - Rigid substrate
- The resist is used to stop the copper being etched away where the resist is applied.
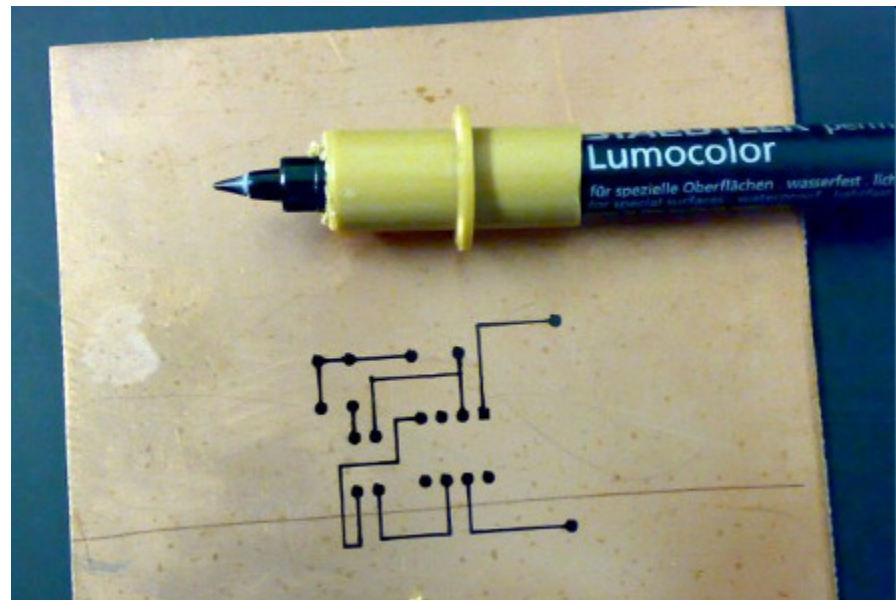- The resist layer is usually removed once etched

PCB process

1. Need to mark out the copper path (resist)

   - Lots of methods – pen, transfer, UV

2. Then remove the excess copper

   - Etching

3. Then clean and drill

Pen method

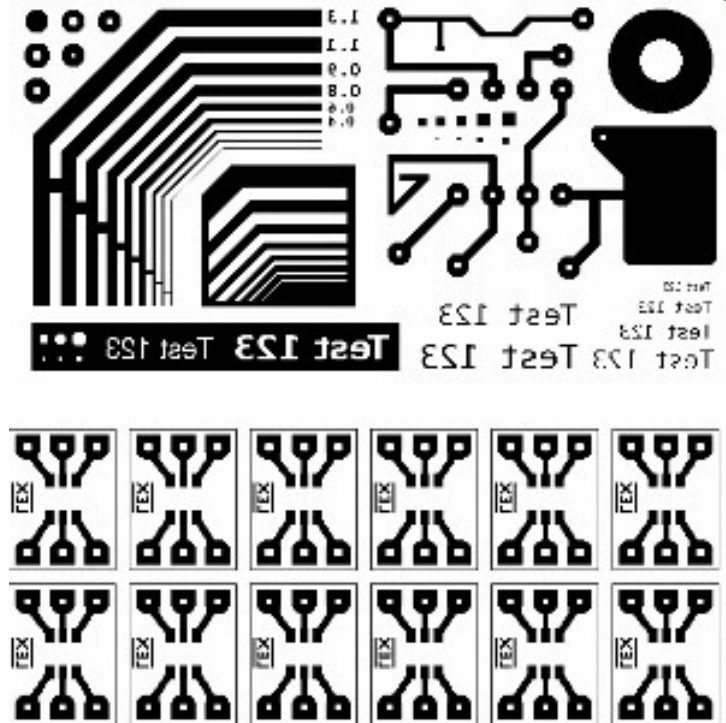- Basically just draw your design onto a copper-clad board using an etch resistant pen.

  ✓Very simple

  ✖Not suitable for complex designs

Transfer method

- Use press-on transfers as the resist.

- ✓ Simple
- ✓ Will work with standard components
- ✖ Expensive
- ✖ Non-repeatable

Press n peel

- Use a special transfer paper, then iron on the pattern to the board.

✓ Print out design
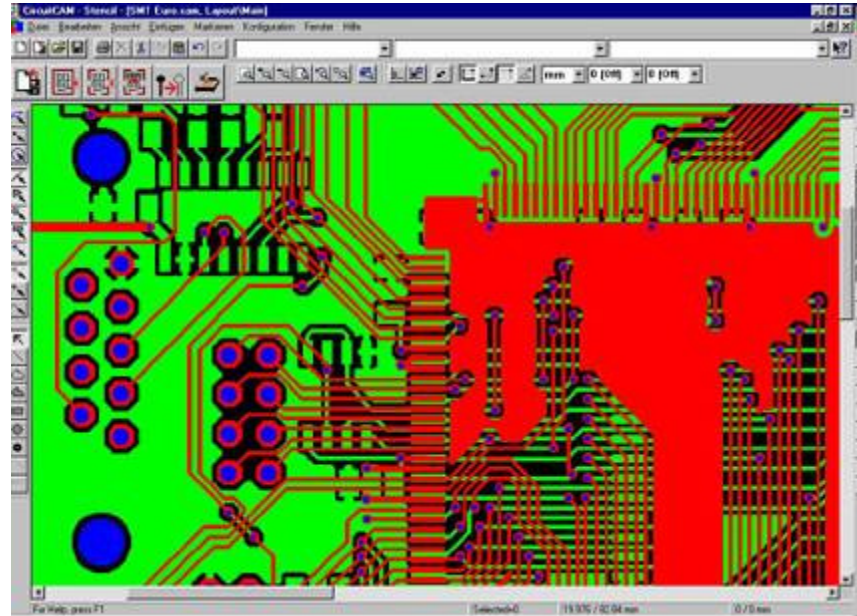✓ Complex designs
✗ Expensive
✗ Non-repeatable

UV resist

- The resist is made from a UV sensitive material.
- A transparency is made with the circuit board image.
- The board is exposed to UV.
- The UV exposed material can then be washed away with UV resist developer.

✓ Accurate
✓ Repeatable
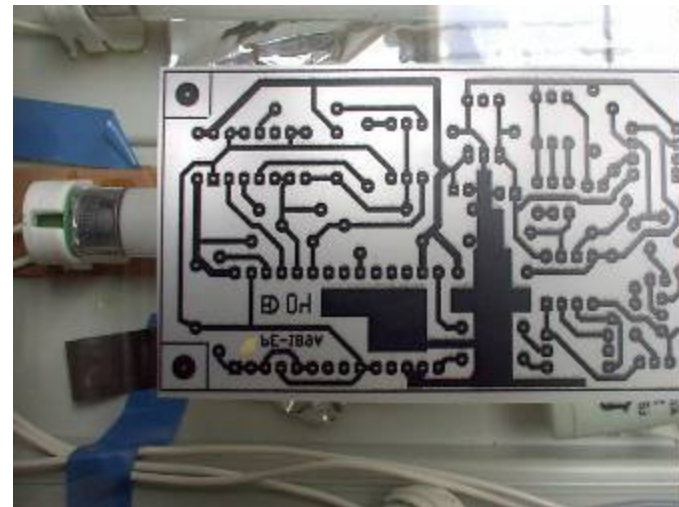
Circuit design programs

- Lots available
  - Eagle
  - KiCAD
  - Proteus
  - Many many more….

- I used KiCAD for this design
- ✓ open source, free, unlimited

Circuit design

- First create the circuit schematic (a circuit diagram).

- Then create a 'netlist' which lists all the component pins and how they connect to each other.

- Include data on the

component packages.

- This is used to create

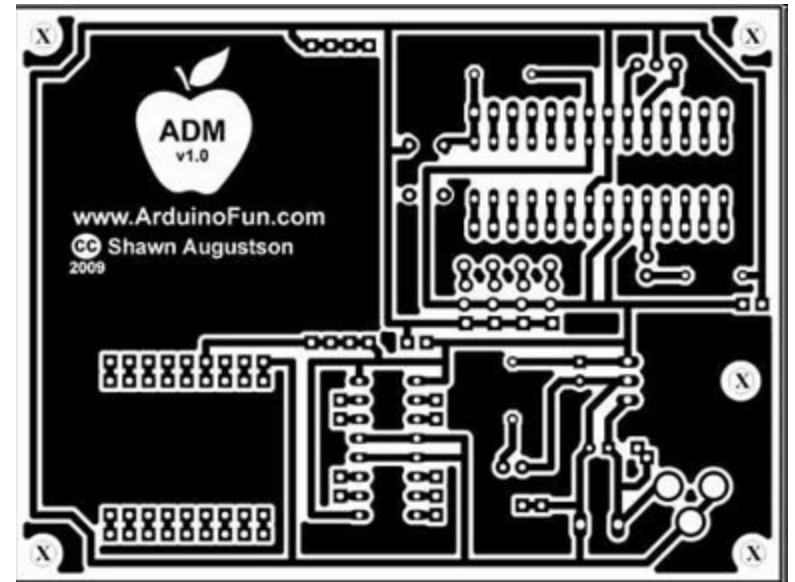the circuit board design
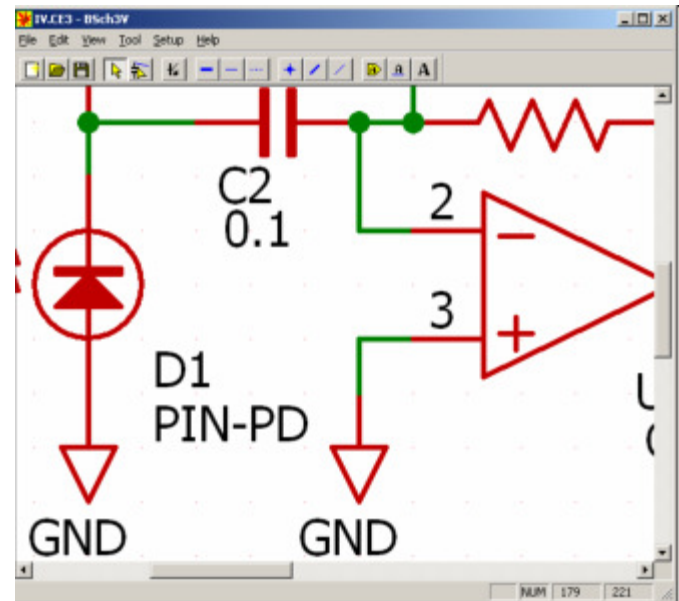
Printed circuit design

- Very different to schematic design
- From the netlist you have all the components connected together
- Place components
- Add tracks between
the components

(show KiCAD here)
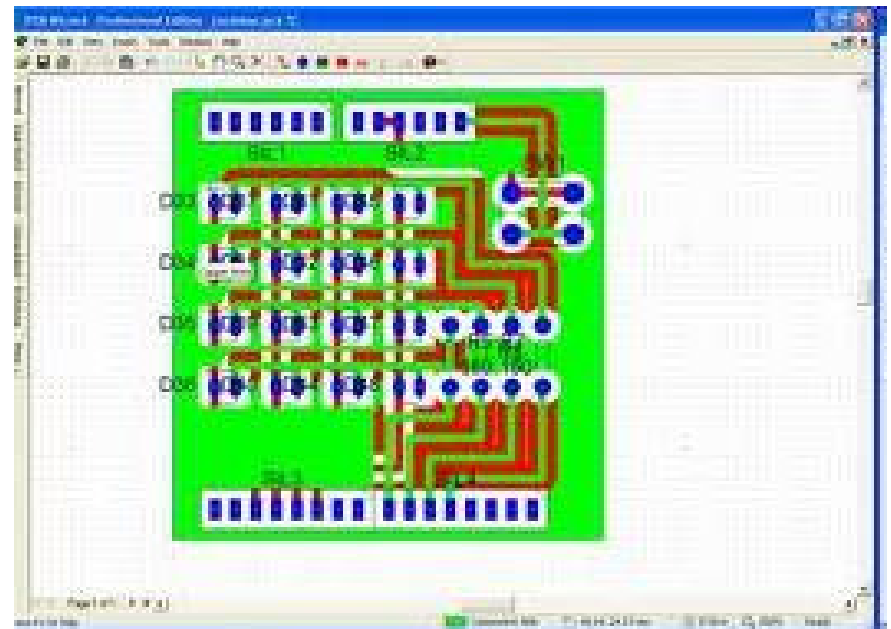
Produce artwork

- Printed onto transparency
- Must be very dark print
  - Laser printer best
- Can use:
  - OHP transparencies
  - Tracing paper

I use heavy tracing paper – cheap and good

Exposing the board

- Use a UV exposure box.
- Easy to make your own.
  - http://www.electronics-lab.com/articles/uv_box_fluo/index.html
- Needs around 3-4mins exposure.

- Ensure transparency
is correctly orientated
(Print on some words)

Develop UV resist

- Use UV resist developer.
- The parts exposed to UV will be removed.
- Typically takes 1-2mins
- Wash board after

Etch board

- Use Ferric Chloride
- Follow mixing instructions on packet
- This chemical EATS METAL so use ONLY plastic tools and implements.
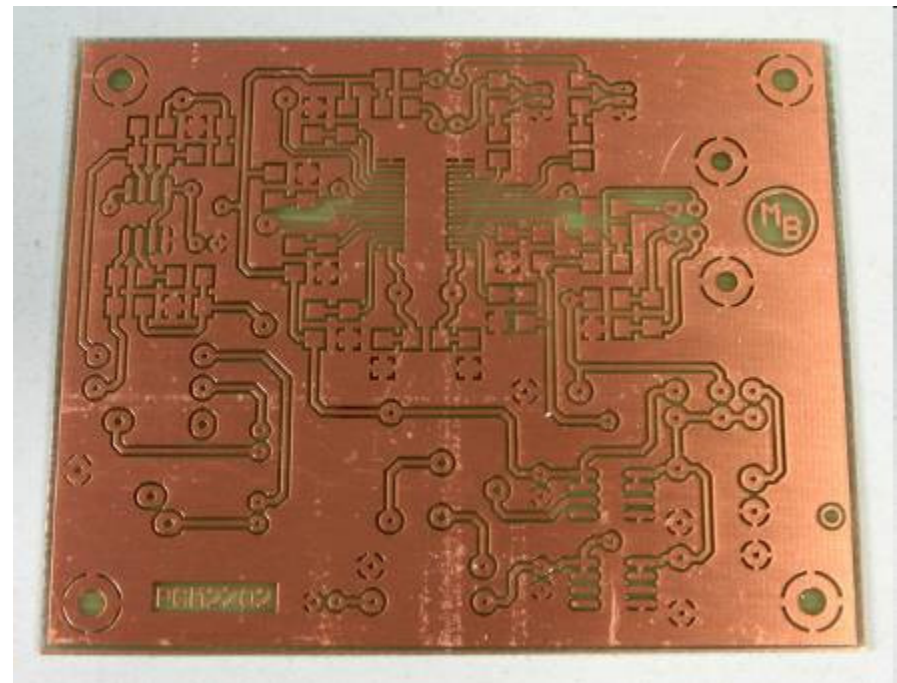- DO NOT put down your sink!

Etch board

- Place board into a bath of etchant.
- Should be warmed and agitated
- Usually use a heated bubble tank.
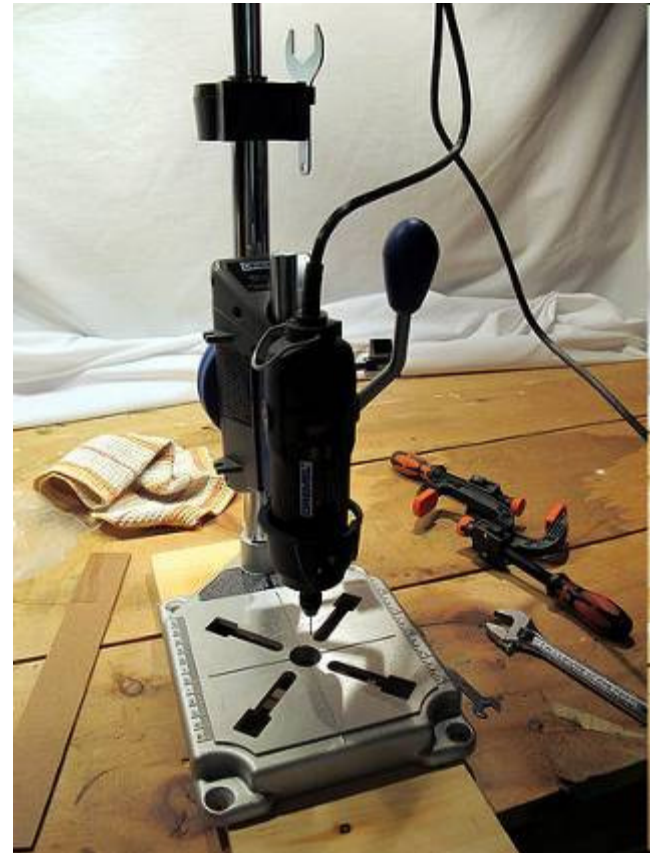- Takes around 10-20mins

Clean board

- Wash board thoroughly in clean water.
- Can remove etch resist using acetone (nail varnish remover)

Drill board

- Might not be needed
  - eg. surface mount
- Use correct size drill for components
  - Typically 0.8, 1.0, 1.2mm
- Use a drill stand
- Be VERY careful – easy to break a drill bit

Other aspects

- Silk screen for components
- Silk screen for copper protect
- Double layer
- Through hole connections
- Tinning

Other methods

- Sponge method
  - http://www.instructables.com/id/Sponge-Ferric-Chloride-Method-Etch-Circuit-Bo/

- Iron on transfer method
  - Eg press n peel
  - http://www.semis.demon.co.uk/PCB/PCB.html

Resources

- Websites that might be useful:

  - http://www.electricstuff.co.uk/pcbs.html
    - Useful tips on producing PCBs
  - http://www.megauk.com/producing_a_pcb.php
    - UK company supplying all equipment related to PCB manufacture
  - http://www.elektorpcbservice.com/
    - Elektor PCB service (if you don't want to make your own)

Health and Safety

- Again!
  - Chemicals being used are DANGERUOUS
  - Use gloves and goggles
  - Be aware of others around you
  - If you do get any on yourself
    - Wash with copious amounts of water
  - Drill – wear goggles