From Prototype to Production

A Fat bloke Presentation

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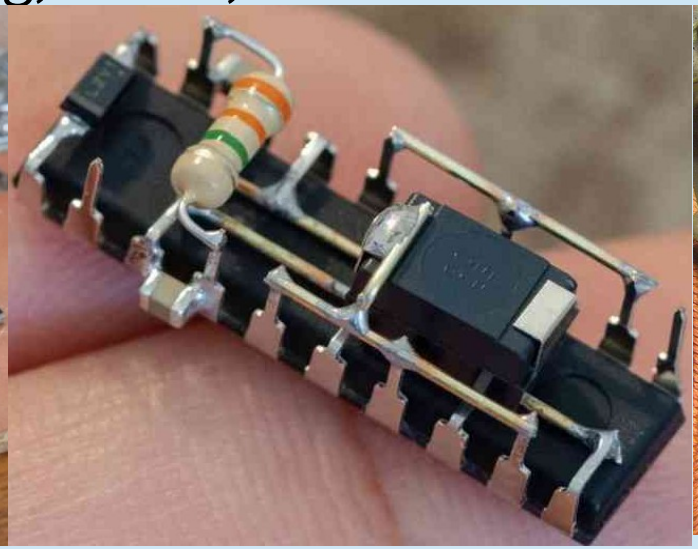
The Idea Stage…

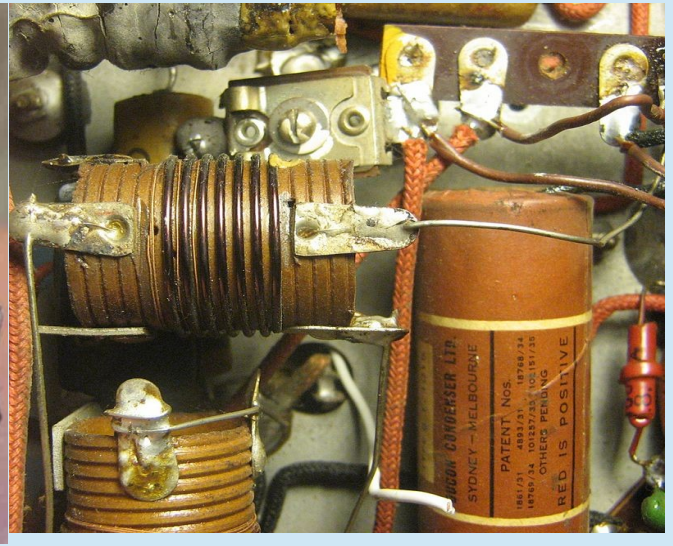
- Get your idea on paper – back of a napkin is cool.
- Consider logical flow – what do you want to achieve?
- Get creative with a block diagram – details matter.
- Think about constraints, low power, battery powered, what battery chemistry? Do you need a charging port?
- Lets make a nice schematic for our design.

Put it into practice

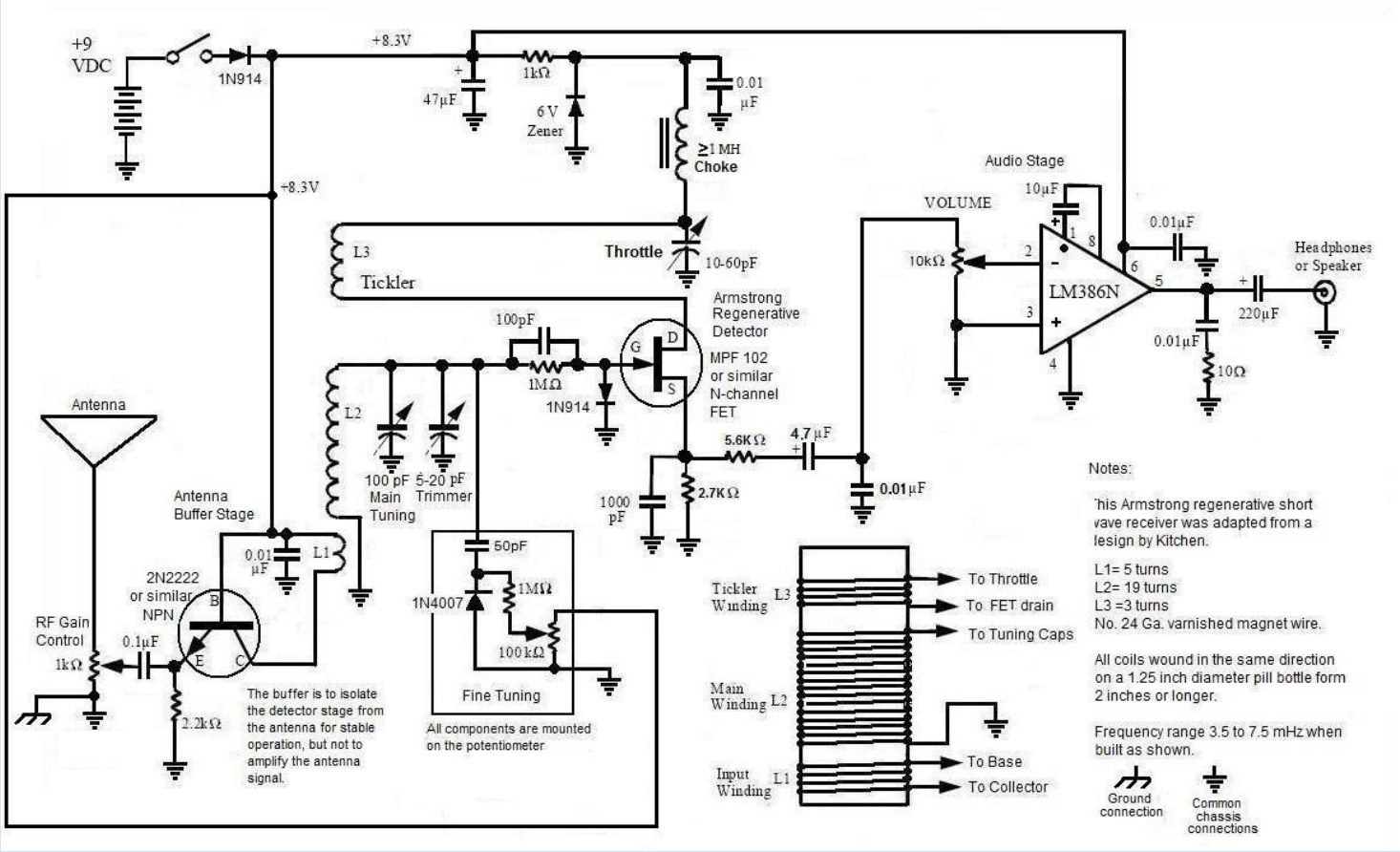
Prototype Construction Methods

- For simple projects, go ahead and prototype your design – Derek has covered this in a previous talk
- Manhattan, Dead Bug, Island, Point to Point. All valid methods.





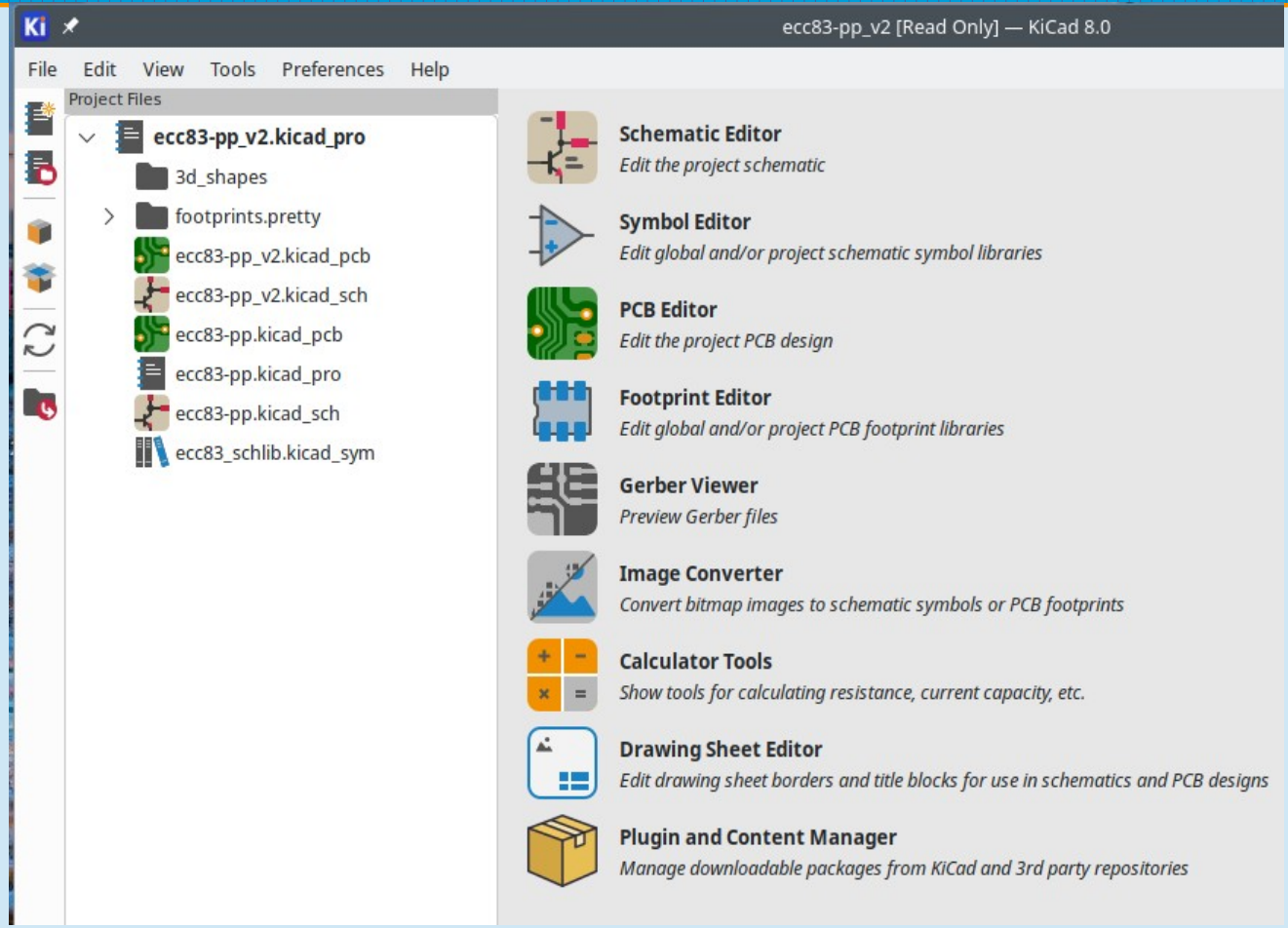
So, we have our sketch…



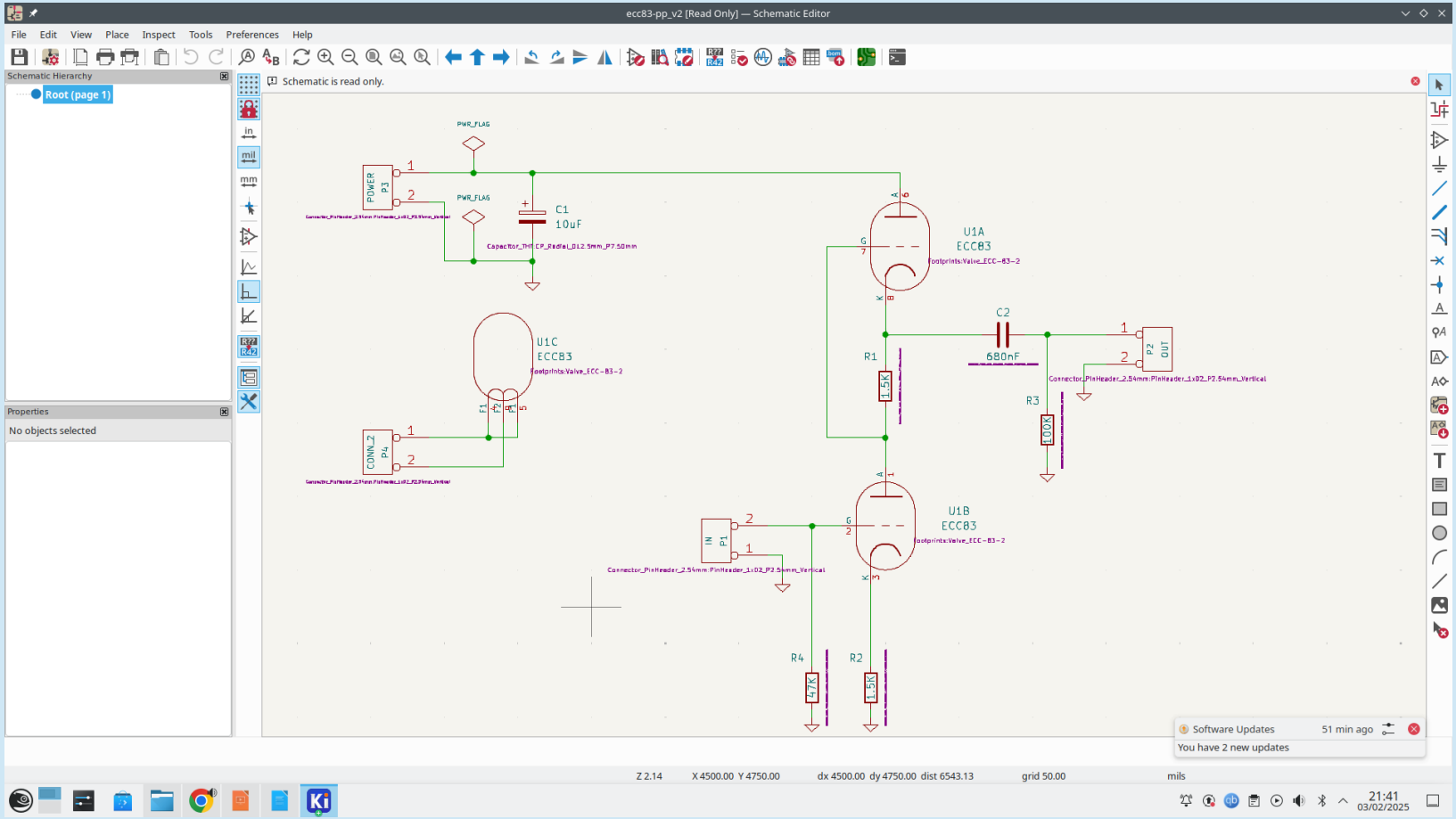
Design Software

- A Plethora of PCB design packages are available, some are free, some are very expensive.
- Free to use: KiCad (my “go to” solution), Designspark – very limited, Protel (discontinued), CadStar (limited to size of PCB and 400 pins), ExpressPCB – Free but some limitations, easy to use.
- Paid for: Eagle (was free and was my favourite), Altium (high end professional package), Proteus (£5K), OrCad (you can’t afford it), DesignSpark (free limited version)

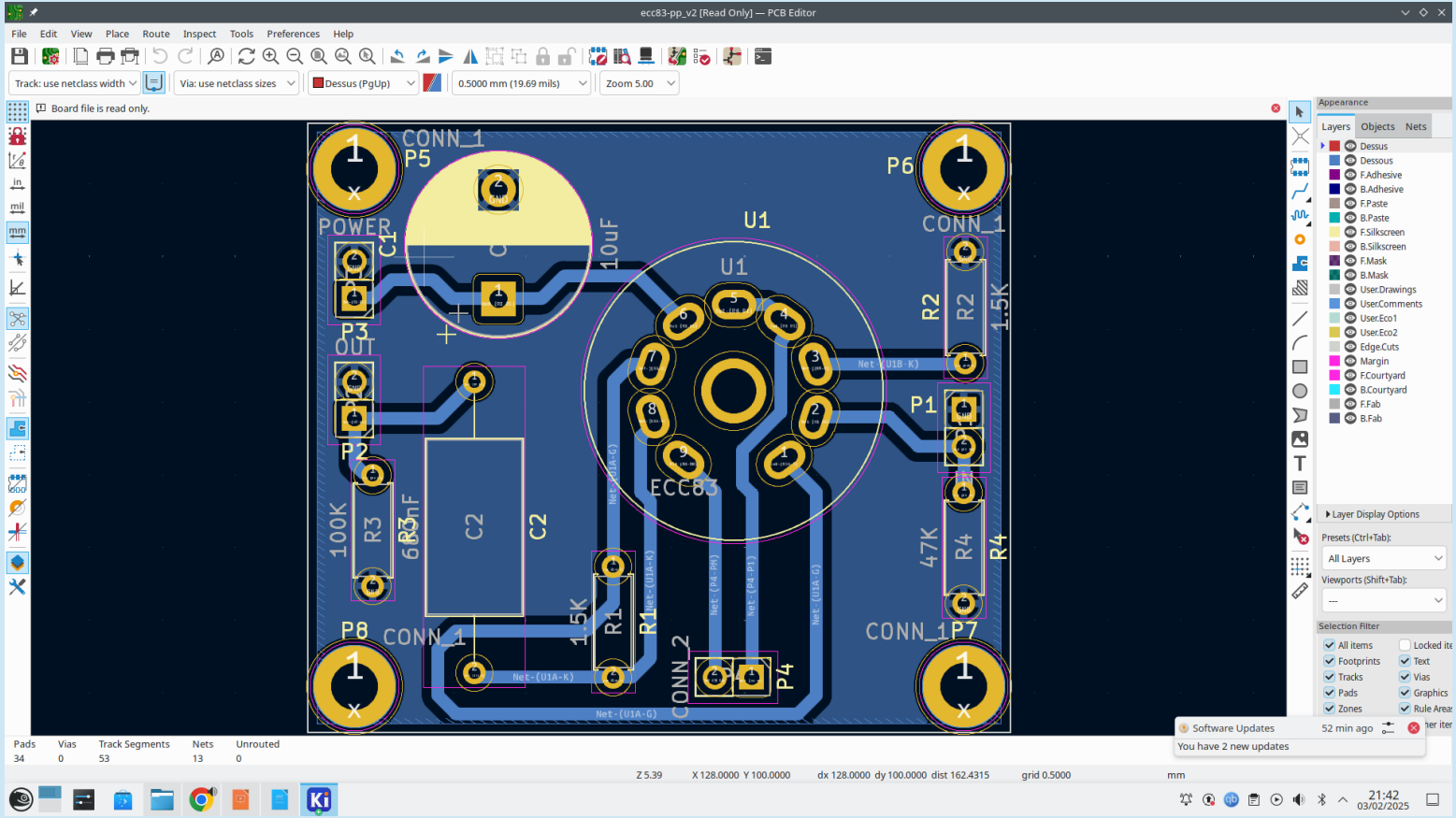
Make your Circuit



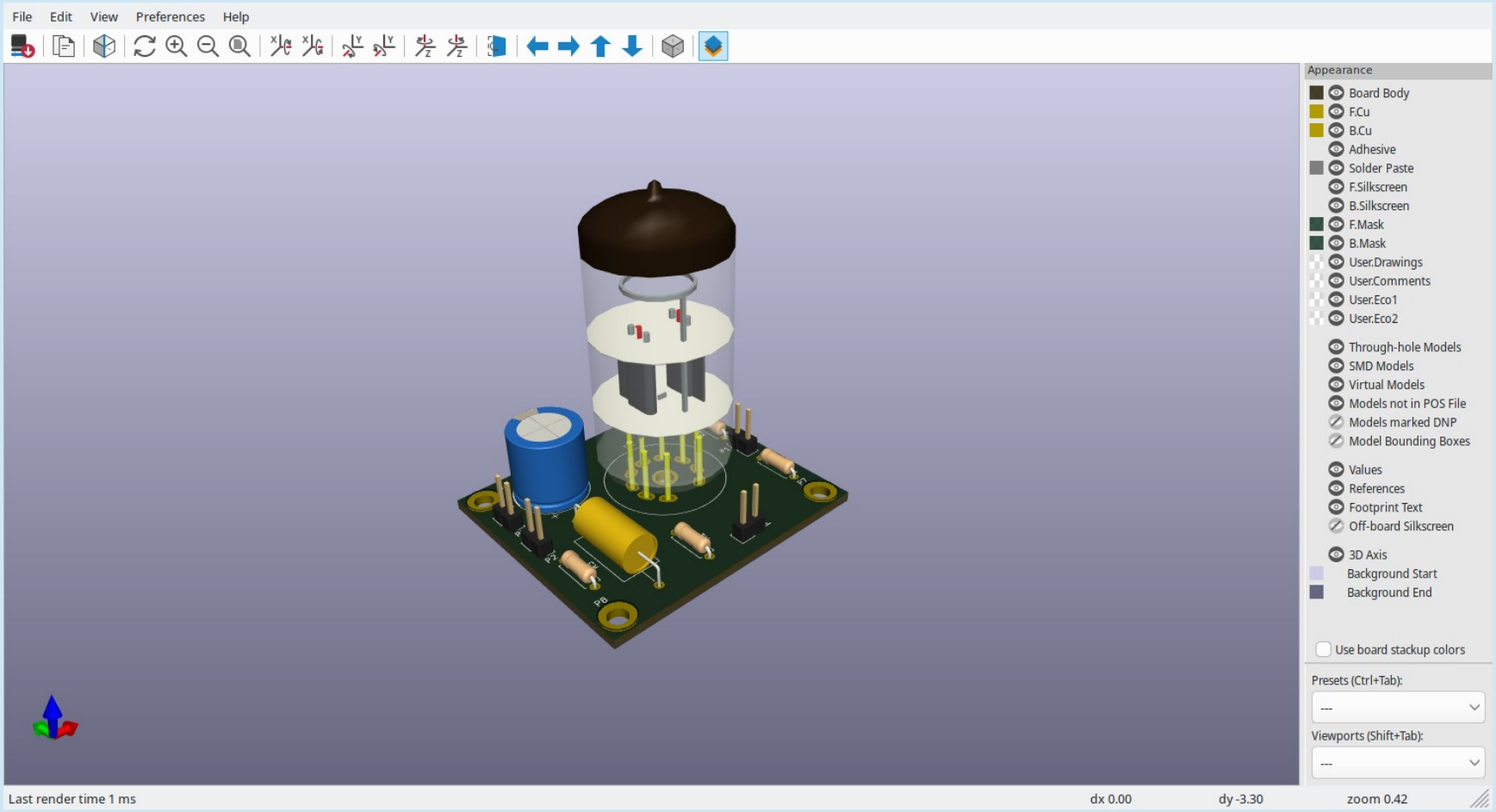
Layout the Schematic



Layout the Board



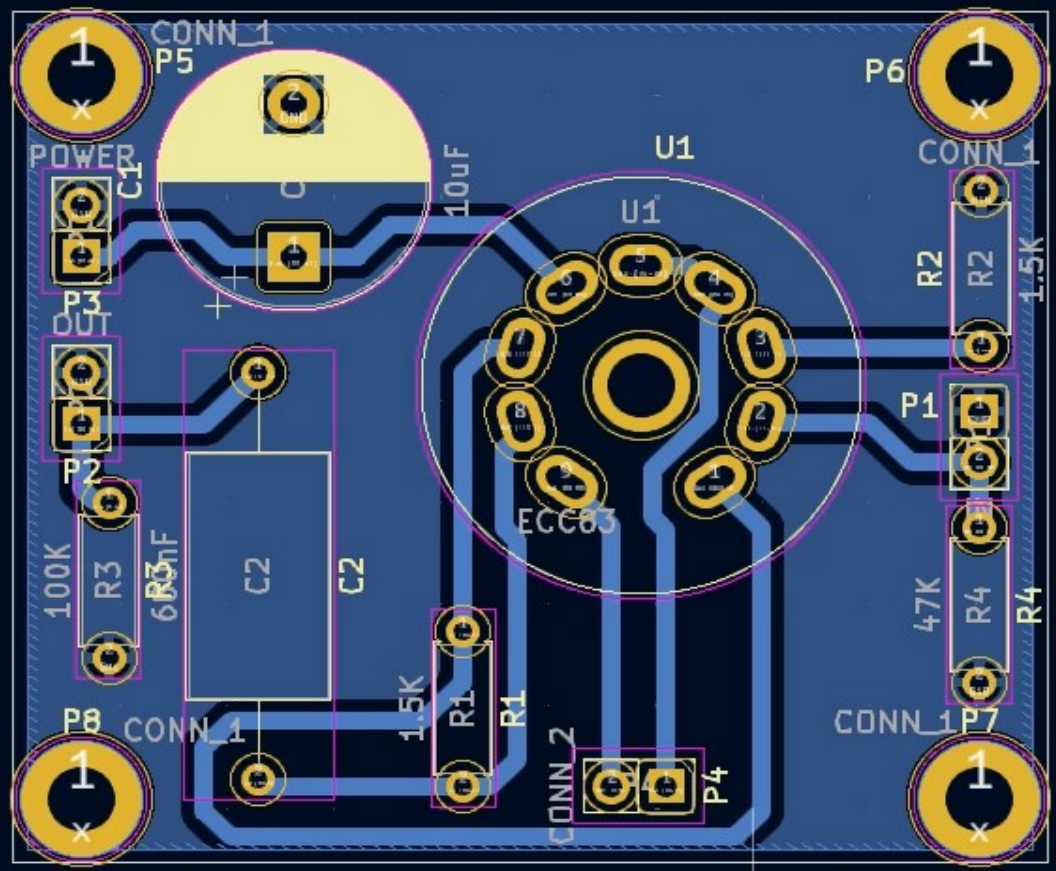
View it in 3D – Yep, 3D :)



View Place Route Inspect Tools Preferences Help

netclass width | Via: use netclass sizes | Dessus (PgUp) | 0.5000 mm (19.69 mils) | Zoom 3.50

oard file is read only.



Vias 0 | Track Segments 53 | Nets 13 | Unrouted 0

Schedule: (inactive)

Enable recording

Hotkey:

Information

Total time: 0:00:00
FPS in: 0.00
FPS out: 0.00
Size in: 1275x716
Size out: ?
File name: ?
File size: 0 B
Bit rate: 0 bit/s

Show recording a

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Can

Etching Options

- We now have our schematic and board layout done. Now what?
- Time to create a board!
- Lets look at some etching options

Do it yourself at home…

- Ferric Chloride – Environmentally unfriendly. Easy to obtain. Cheap. Can be neutralised with Baking Soda and diluted with tap water. MUST be taken to refuse site for chemical processing. Never flush or dispose of in domestic drains.

Ferric Chloride (FeCl3)

‹ Back to results

Click to open expanded view

500ml Ferric Chloride So

Brand: Birsppy

4.6 ★★★★½ 17 ratings

Amazon's Choice for "ferric chloride"

£8.97

Brand	Birsppy
Material feature	Natural
Colour	NTurquoise
Sunlight exposure	Full Sun

Report an issue with this product

MR.SIGA Microfil

4.3 ★★★★½

-20% £11.99 £1

Sponsored

Ferric Chloride (FeCl3)

5L-FERRIC, Ferric Chloride Etching Chemical for Etching in Liqu

RS Stock No.: **201-7945** | Mfr. Part No.: **5L-FERRIC** | Brand: Fortex

Subtotal (
£18.3
(exc. VAT)

Units

Select or t

56 In sto
available

* Delivery d
delivery add

FRE

Checl

View all Etching Chemicals

Alternatives to Ferric Chloride

- Sodium Peroxydisulfate – Cheap, just as nasty too!
- 60% vinegar and 40% hydrogen peroxide :) Dilute and neutralise with tap water – drain friendly (just) Don’t forget to add ionised salt.

Before we etch. . ..

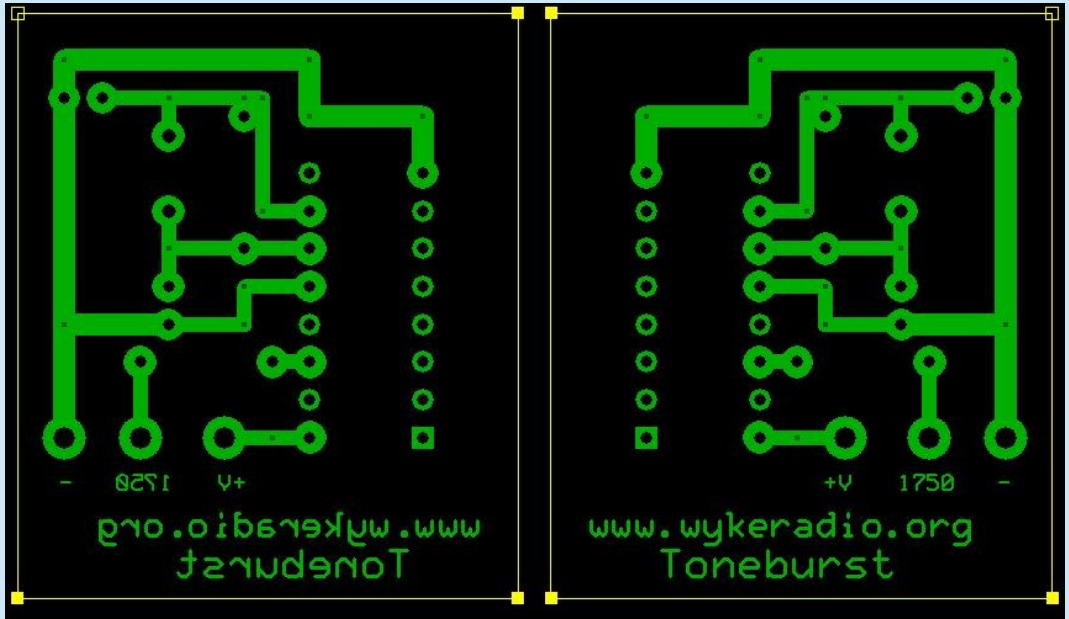
- We need to prepare the board.
- Wash your new copper clad board with luke warm water then rinse off and wash in IPA. Remove oxide layer with a light rubbing alcohol or very light application of a “Brillo” pad.
- Light circular motion is best.
- The board is ready so we have yet another choice.

More choices…. Oh Joy :(

- There are various methods of transferring the wanted image from your cad software to your new board.
- Toner Transfer method (cheap and easy for 1 or 2 boards), Lower quality, some practice is required. Results vary.
- UV chemical treatment using chemical resist liquid or pre sensitised board. Excellent quality using transparency sheets. Requires a UV light box with timer.

Toner Transfer Method

- Only works with a Laser Printer.
- When you print your board layout, use all black in your printer settings. The blacker the better. Don’t forget to flip / mirror when you print it out.



Transfer the Toner!

- Place the print out on a clean board. Grab the wife's iron and apply heat to the print out. Nice and hot for 5 minutes.
- Dump the board with paper attached into a bowl of hot water, the same hot water you are going to be in when the wife finds out about the iron.
- Leave to soak and gently rub off the paper. Be gentle. The paper will dissolve leaving a board ready to etch.

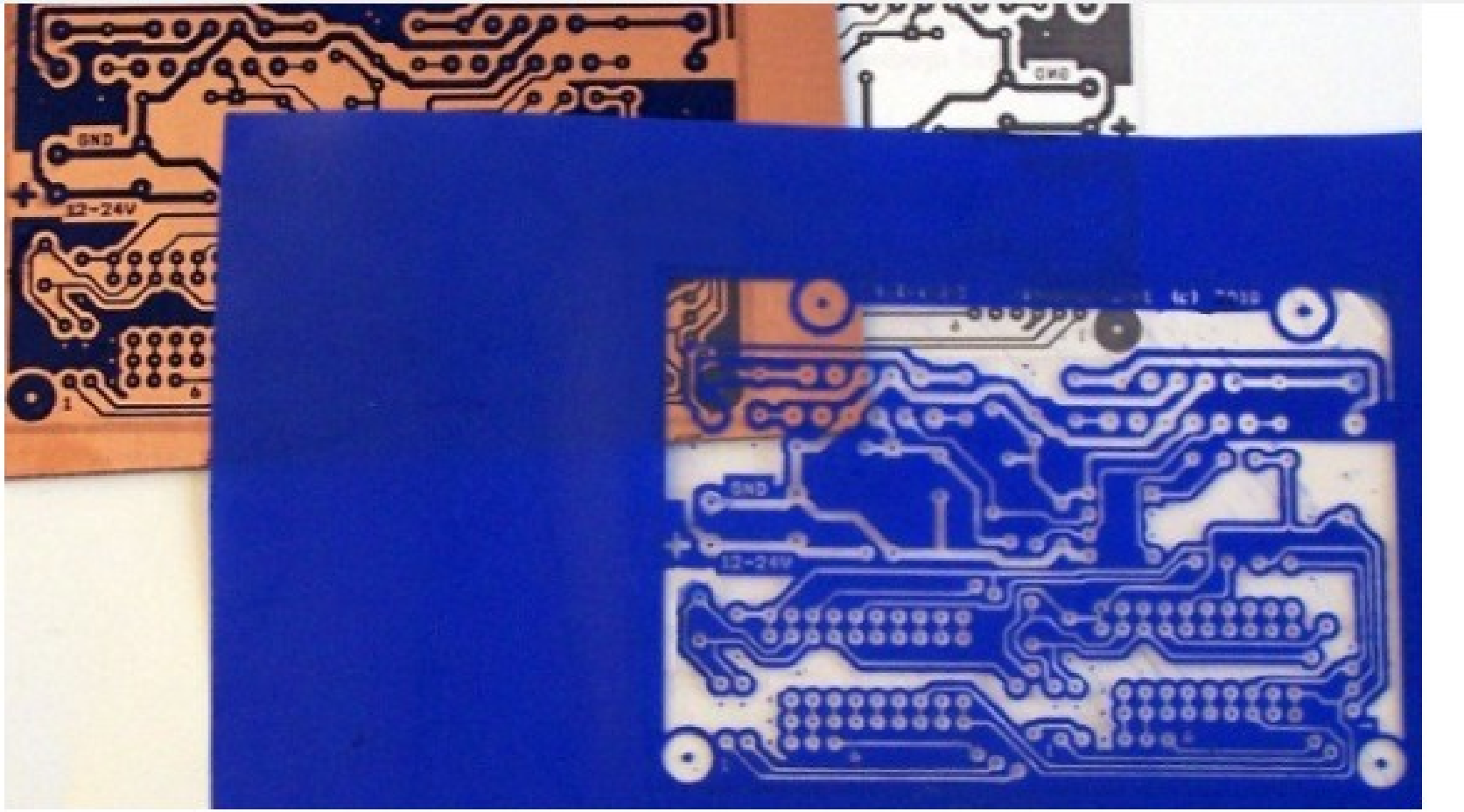
UV Method.

- Print your board design onto transparency acetate. Print a couple of them to ensure maximum blackness when stacked.
- Remove the protective coating from the board and place thew stacked sheets onto the board. Ensure correct orientation. (Been there and done that). Tape the sheets and board along one edge to secure the alignment.
- Place on a UV light box and develop the pattern.

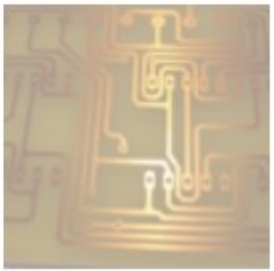
UV Box


Over 50 Years Experience
Free UK Delivery on orders over £100

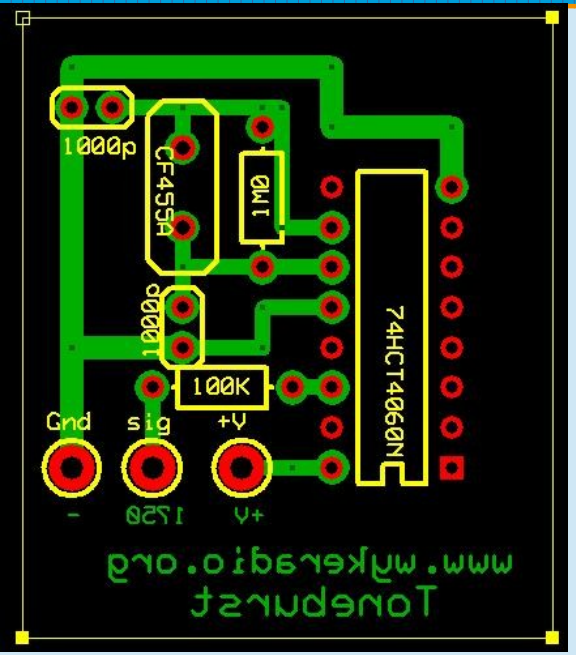
Press and Peel

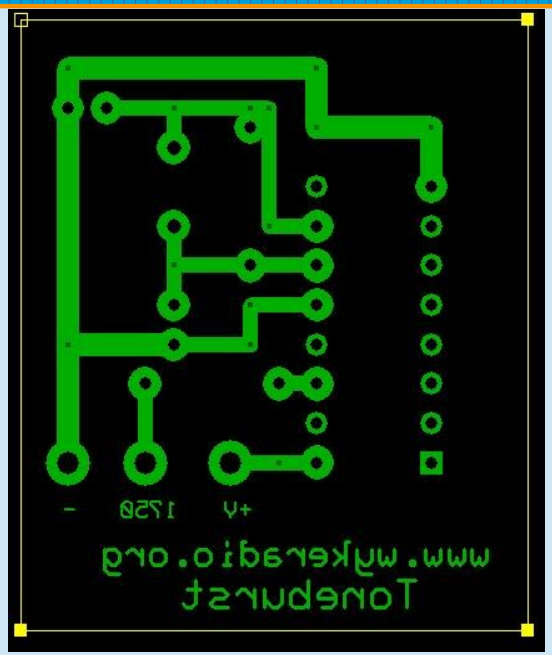


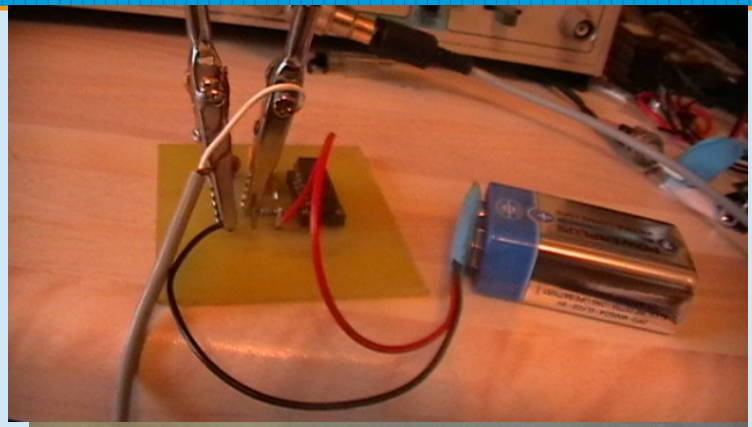
Pre Sensitised Board

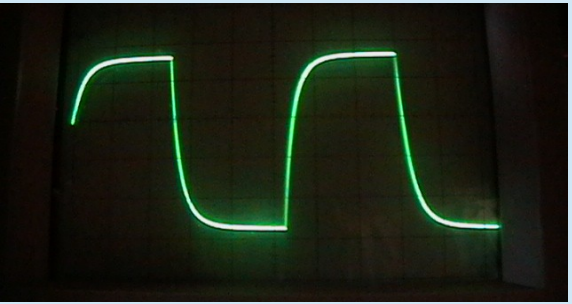


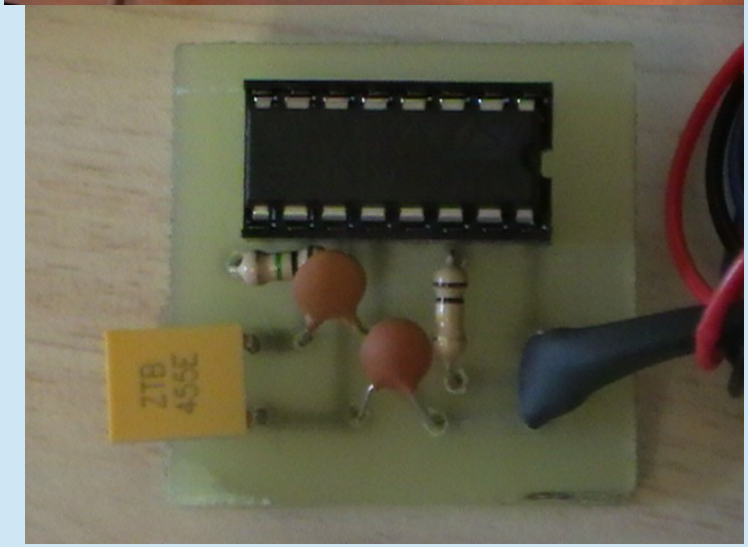
Finished board











Solder and Flux. . .

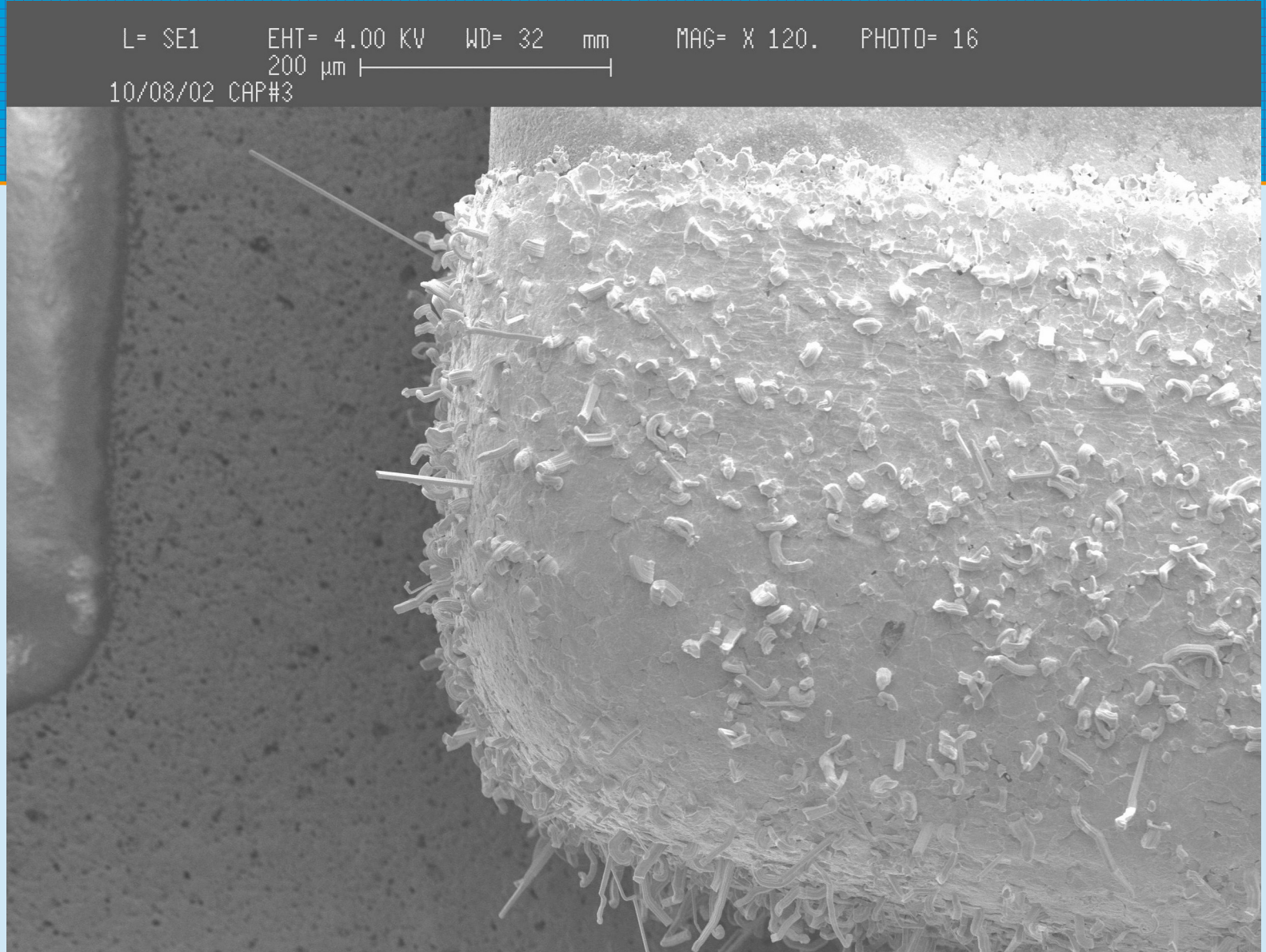
- For the hobbyist, nothing beats 60/40. This is a ratio between elements that make up the alloy. Different alloy blends have different melting points and different “plastic” ranges.
- 63/37 is also called “Eutectic” and exhibits a very unique characteristic.
- Other “exotic” alloy blends are on the market for more specialised applications.

Melting Points

60/40	**60%Tin 40%Lead**	**180°C to 190°C (General purpose)**
63/37 (Eutectic)	**63%Tin 37%Lead**	**183°C Low plastic range**
58/42	**58% Bismuth 42%Tin**	**138°C Avoids Tin Whiskers**
80/20	**80%Gold 20%Tin**	**Varies (Aerospace / Mil)**
S.A.C	**Tin Silver Copper**	**217°C to 240°C Reflow / Wave Soldering**
Lead Free (Typical)	**99.3%Tin 0.6%Copper 0.5%Nickel**	**217°C to 230°C**

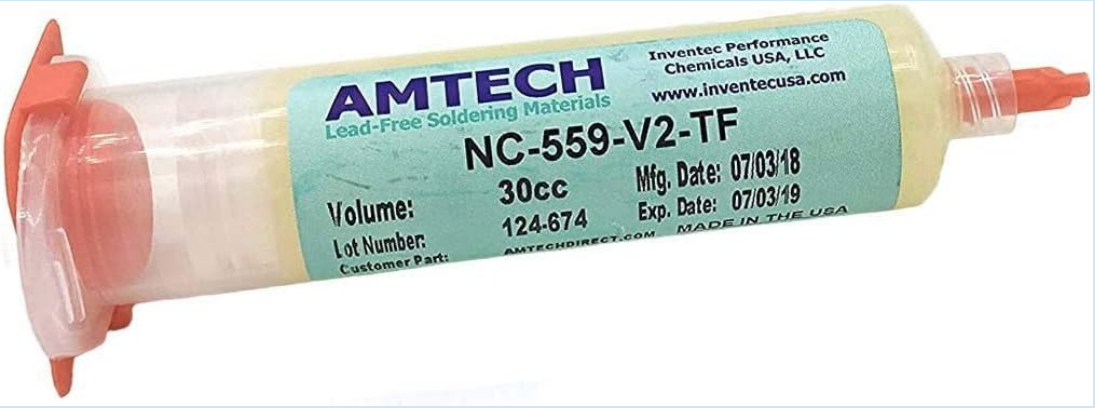
Tin Whiskers

- The hobbyist doesn’t have to worry too much about Tin Whiskers
- Tin Atoms migrate over time and can cause shorts.
- Lead (Pb) was added to Tin solder to help combat Tin Whiskers
- Tin has a higher tensile and shear strength.


L= SE1 EHT= 4.00 KV WD= 32 mm MAG= X 120. PHOTO= 16
200 µm
10/08/02 CAP#3

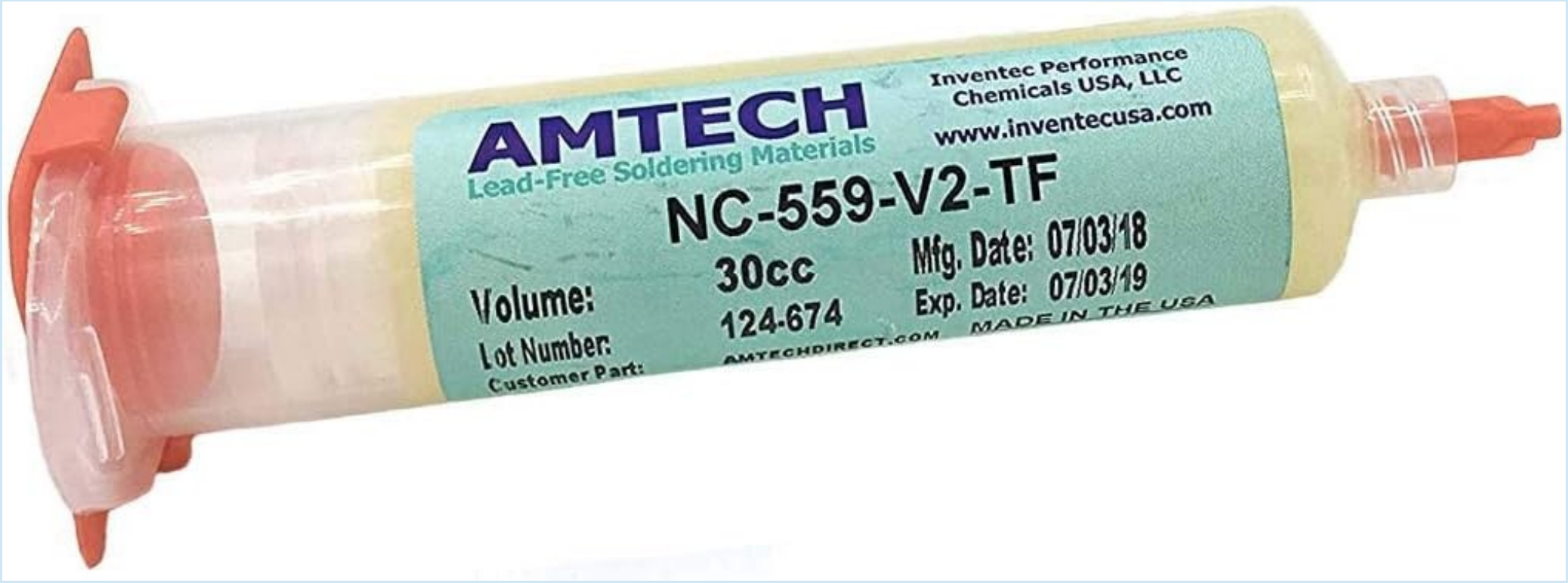
Solder Flux (Nearly there guys)

- Solder flux normally contains Rosin. Flux can be in many forms.
- Rosin core solder is most common.
- Gel and Liquid fluxes come in different flavours.
- Ever wonder what that code is on flux?



Flux cored Solder.

Flux Codes


AMTECH
Lead-Free Soldering Materials
Inventec Performance Chemicals USA, LLC
www.inventecusa.com
NC-559-V2-TF
Volume: 30cc
Lot Number: 124-674
Customer Part:
Mfg. Date: 07/03/18
Exp. Date: 07/03/19
AMTECHDIRECT.COM
MADE IN THE USA

Flux Type

- RO – Rosin
- OR – Organic
- IN – InOrganic
- RE – Resin or Synthetic Resin

Activity Level

- L – Low Activity. Less than 0.5% Halide
- M – Medium Activity. 0 to 2% Halide
- H – High Activity. More than 2% Halide

Halide Content

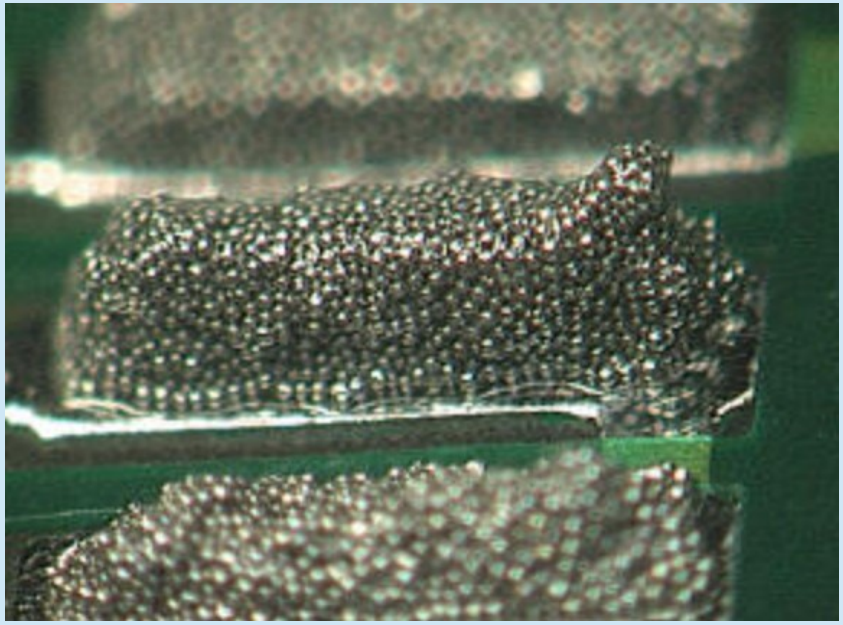
- 0 – No Halides
- 1- Some Halides

Examples

- **ROL0: Rosin flux with low activity and no halides**
- **RMA: Rosin mildly activated, typically no halides**
- **RA: Rosin activated, high activity, contains halides**
- **OA: Organic acid, high activity, highly corrosive**
- **SA: Synthetically activated, high activity, easily soluble in organic solvents**
- **WS: Water-soluble, highly corrosive residues**
- **SRA: Superactivated rosin, very high activity**
- **IA: Inorganic acid, highest activities, highly corrosive**

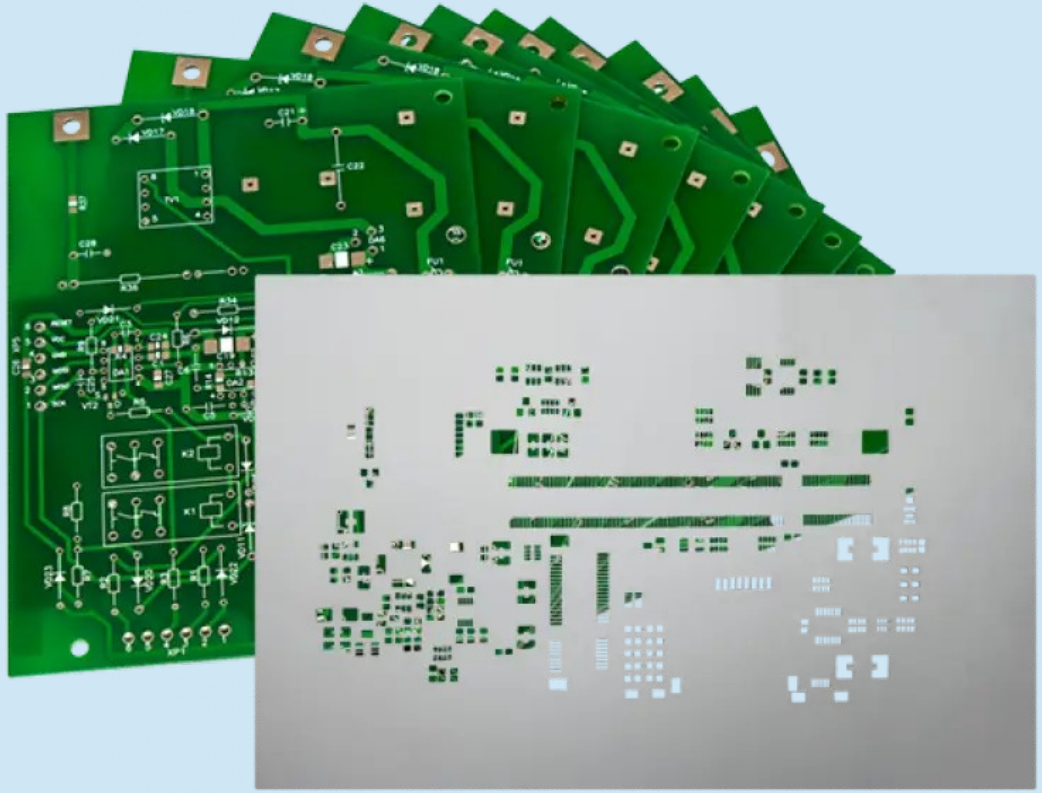
Solder Paste

- Solder paste is a blend of flux that suspends a quantity of solder balls and is used in surface mount soldering.
- A HUGE range of blends are available.

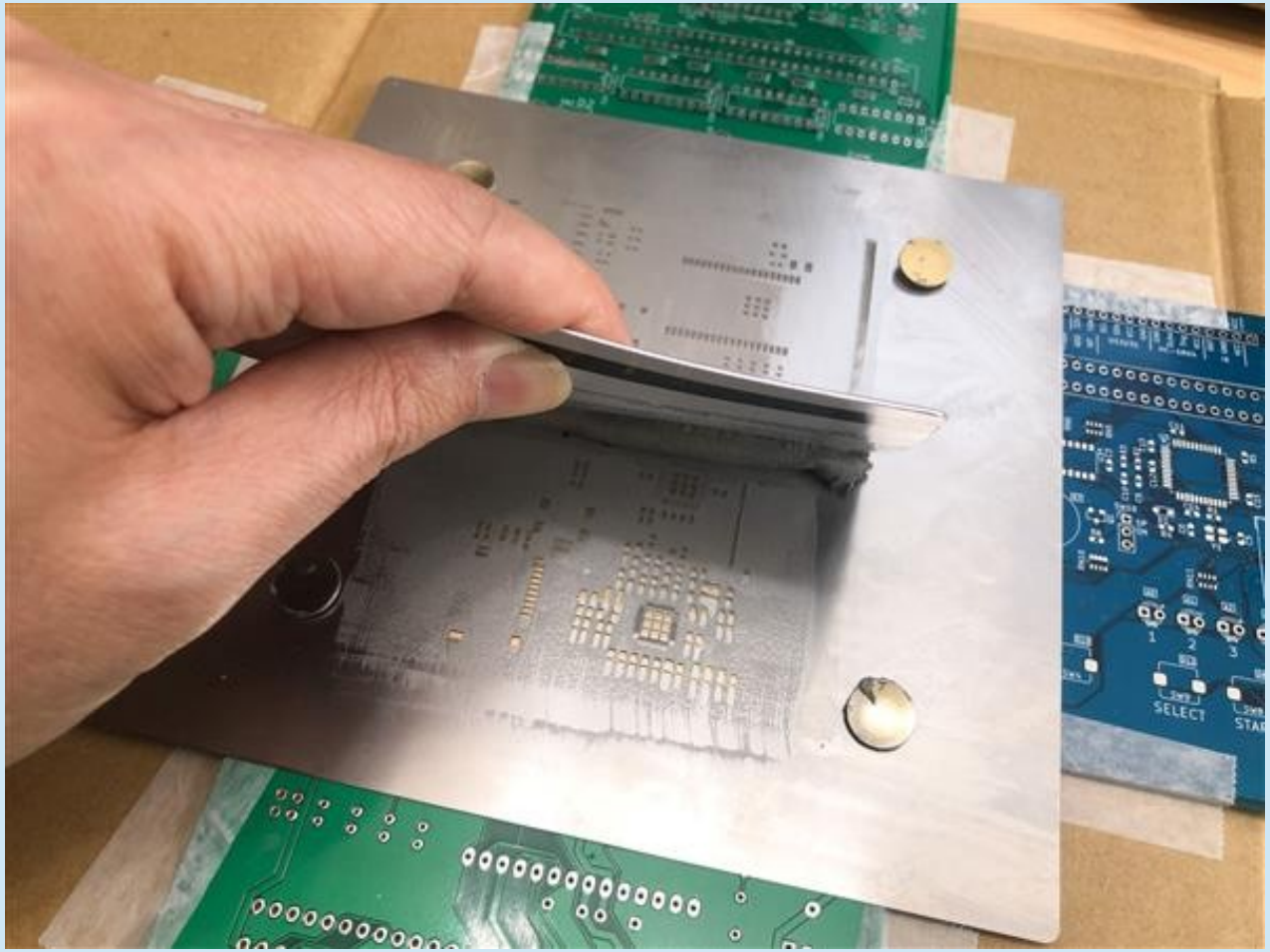


Applications

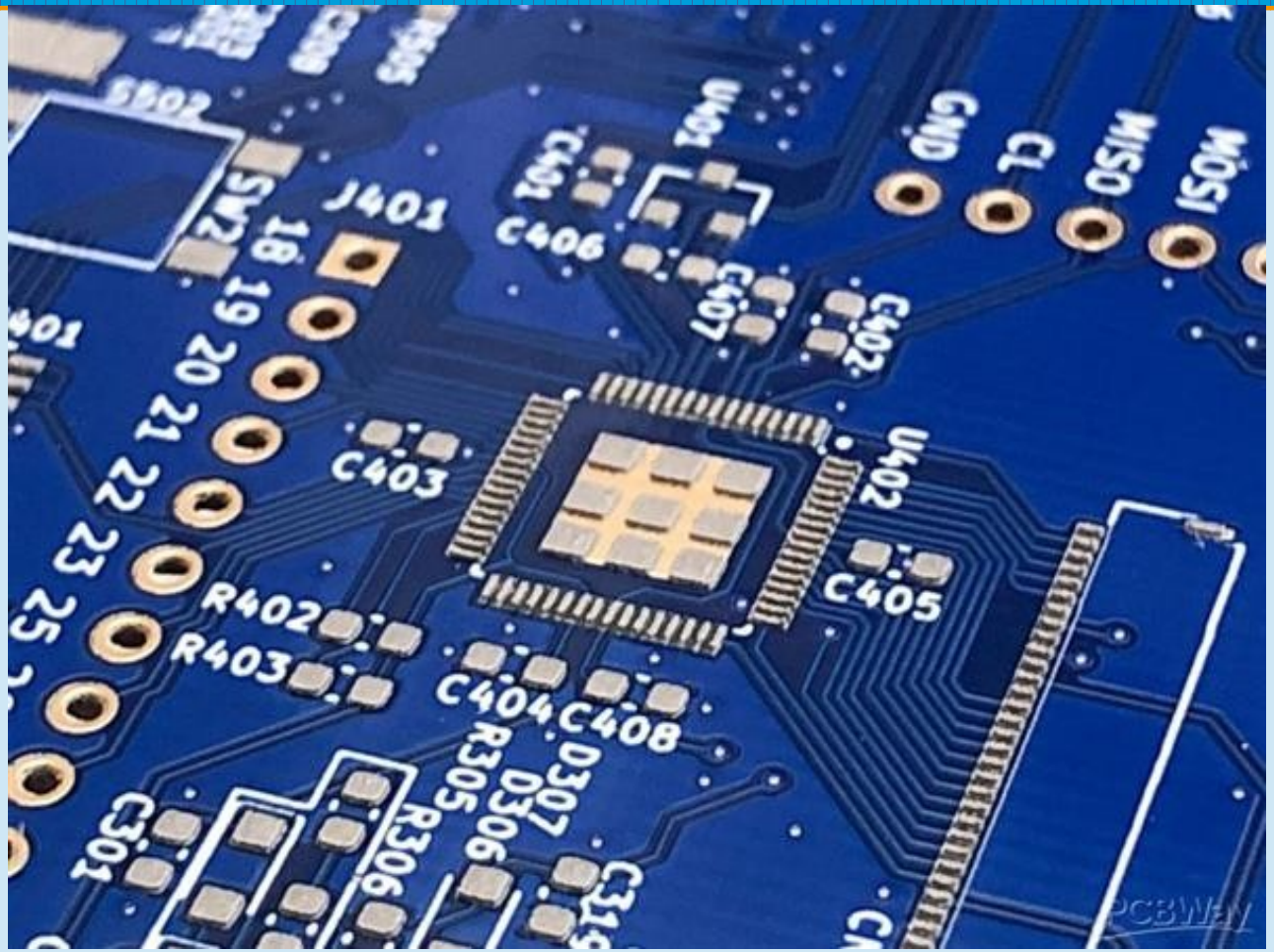
- Solder paste is normally applied to a board using stainless steel stencils.



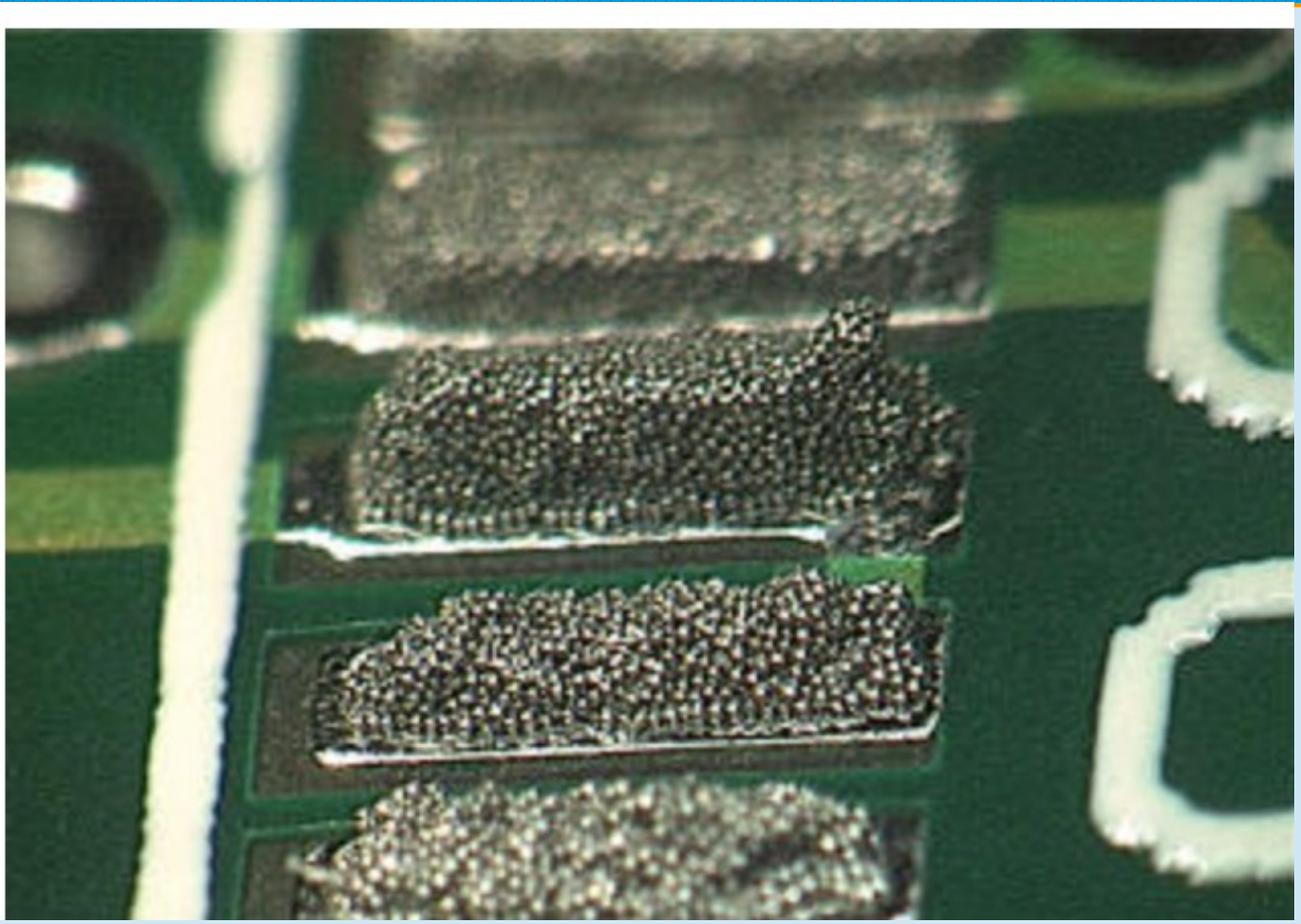
Apply the paste!

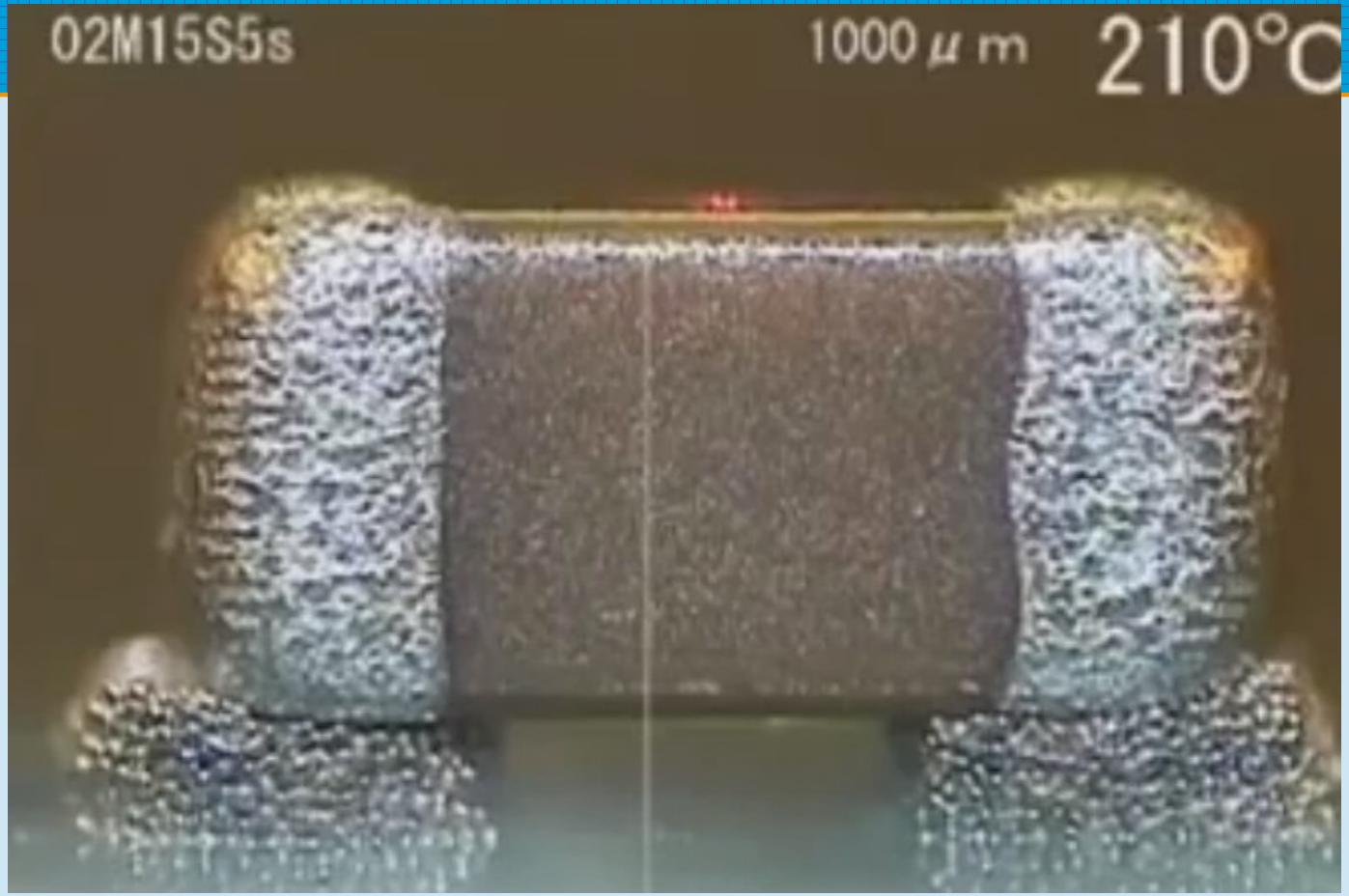


End result


J401
C406
C407
C402
C403
U402
C405
R402
R403
C404
C408
R305
Q307
Q306
C301
R306
GND
CL
MISO
MOSI
PCBWAY

End Result




02M15S5s
1000 μ m
210°C

Demo Time

- Power up Kicad and show the guys