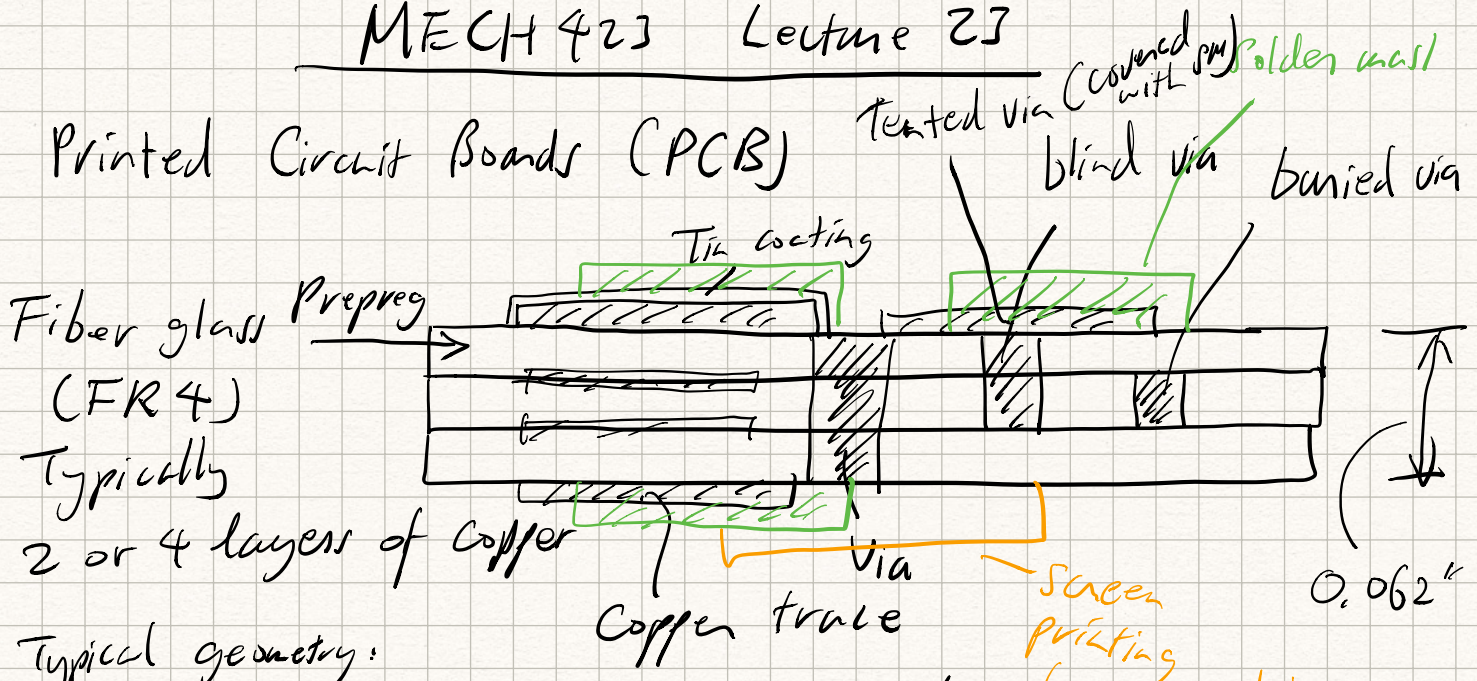
MECH 423 Lecture 23

Printed Circuit Boards (PCB)



Typical geometry:

8-10 mil min. feature

Via: ~20 mil

1oz – 4oz/ft²

Resistance (1oz) ≈ 0.5 mΩ/square

* PCBs are not for DIY
* Do not skip the soldermask
* Cost: $200–500 per run

CAD Tools

Protel (Altium Designer) — PCB Artist

Or CAD

EAGLE (free)

CAD Process

Schematic Capture

Output: Netlist (Net – electrical node)

PCB Layout

- Place Components
- Draw Copper traces
- Layout-versus-schematic (LVS)

Library

Schematic

PCB

Part (connects sch to PCB)

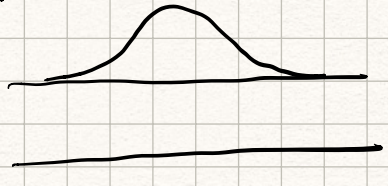
- Design Rule Check (DRC)
- Output: Gerber file:
  - Copper layers
  - Solder mask layer (inverse)
  - Screen printing
  - paste

- Signal wires
- Power wires
- Add vias
- Pour ground plane

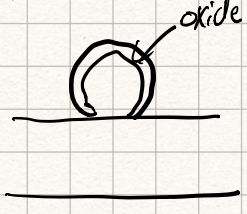
Notes on development process

* Plan for >1 iteration
* First make "mule" board
  - Not in the final form-factor
  - Easy to debug.
* Embrace zero ohm resistors

Goal of soldering: Get the solder to wet on metal

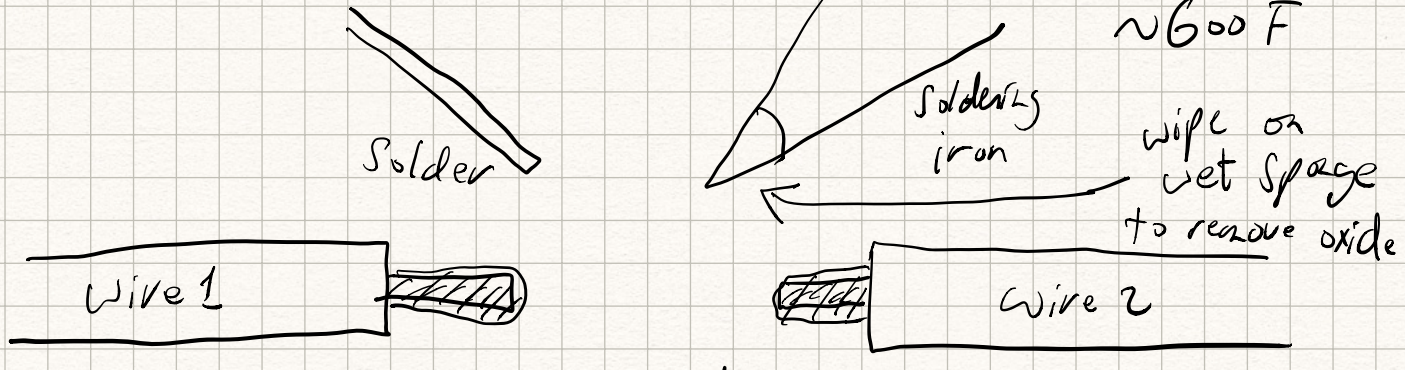


Good solder joint



Cold solder joint

Why soldering is difficult: We have only 2 arms, not 4.

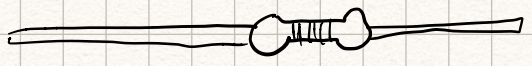


1. Tin wire 1 (melt solder on wire 1)
2. Tin wire 2
3. Take the solder away, press wire 1 & 2 together

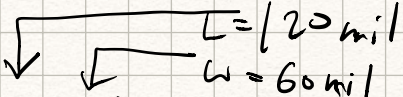
Using iron

Components

Through-hole



Surface mount (SMT)



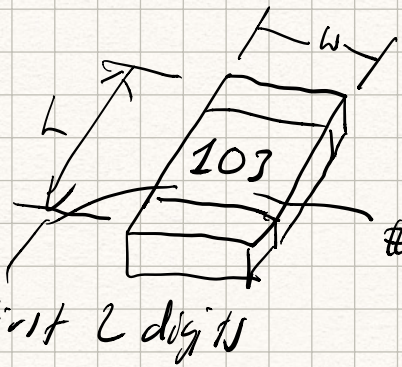
1206

0805

0603 ← Min size for hand soldering.

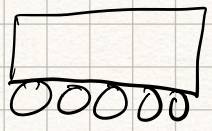
0402

0201



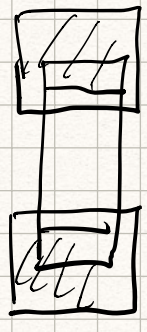
103 = 10k

- Not every component can be hand soldered.

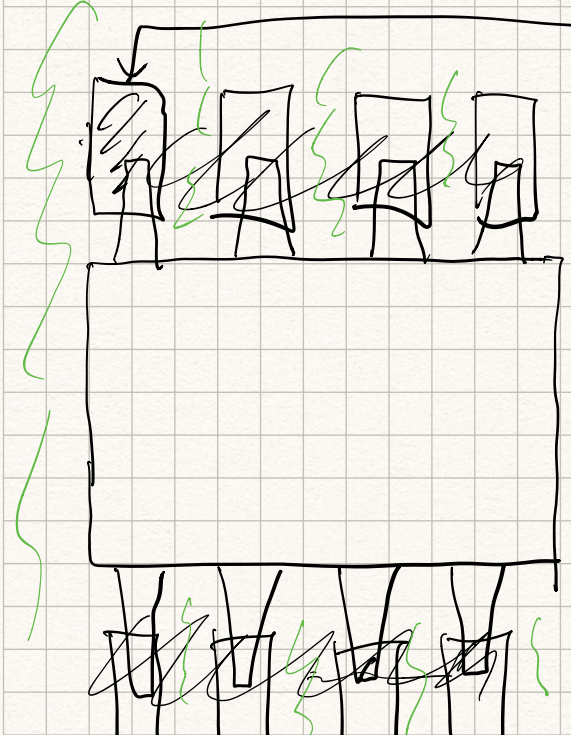


Ball grid arrays

Soldering SMT Components



1. Tin pad #1
2. Install component, heat up pad.
3. Use tweezers to align component while solder is hot
4. Add solder to pad #2.



1. Put solder on Pad #2
2. Add the part
3. Align w/ tweezers
4. Apply solder to all other pads
5. Use solder braid to remove solder bridges