What is a PCB?

A Mechanical Solution to an Electrical Problem

Photo from hephestusaudio.com

Photo from www.sparkfun.com
What is a PCB?
Layers, Traces, Planes, and Vias ...
What is a PCB?

Essentially, your job is this …
The PCB Design Process
From Vision To Reality

- Place Components
- Route Traces
- Schematic Capture
- Generate Gerbers

Fab!
Iteration
PCB Design Software
A CAD Tool For Designing a Board
PCB Design Software
Symbol + Footprint + Device = Component

Symbol
Sym

Device
Dev

Footprint
Pac
PCB Design
Stuff I Need To Get Started

- A Plan
  - Block Diagram
  - Component Selection
  - Connections and Testing Considerations
  - Power and Performance Considerations

- A New Project

- Access to Libraries
PCB Design
It’s all about the planning.

Components
- Passives: 0805, 0603, etc.
- IC Packages: QFN, TQFP, etc.
- Libraries

Connections
- Mechanical Connections
- Bus Connections
- PC Connections

Power & Performance
- Power Ratings
- Battery Performance
- High-Speed / High-Sensitivity
Schematic Capture

Creating a New Schematic

- File -> New -> Schematic
- Keep a grid.
Schematic Capture

Adding Components

- Click the Add icon
- Find the component in the library
- Set values
- Don’t see the library? Try Use -> Library
Schematic Capture

Adding Global Symbols

- Click the Add icon
- Find the global symbol in the library (supply1)
- Place as if it were a component
Schematic Capture

Adding Traces (aka Wires)

• Click the Wire icon
Schematic Capture

Some General Tips

• Avoid changing the grid unless absolutely necessary.
• Use multiple “sheets”.
• Schematic drives the layout …
• Groups, Info, and Layers icons are useful.
• Pan, zoom easy to use.
• Really care about that “net”? Label it.
• Keep it clean - don’t be lazy.
• Document!
Place Components
But before you do ...

- Passives - 0805 means 0.08” by 0.05”
- Connectors - beware of physical fit
- Actives - lots of packaging alternatives
- Give thought to testability and troubleshooting

Thru-Hole (TH) | Surface Mount (SMT)
---|---
DIP | LQFP, QFP, TQFP
QFN | BGA
Place Components
Creating a new board design

- From the schematic, choose **File -> Switch to Board.**
- “Create From Schematic”
- Board window automatically opens.
Place Components

Some Common Tasks

• Right-click on top of component, select Move to reposition.

• While moving, right-click to Rotate.

• Use “Group” wisely.

• Right-click to Mirror (change to other side of board)

• Use Move to change outline
Place Components

Thinking ahead

• Take your time.
• Untangle flight lines.
• Think about planes.
• Consider testability.
• Mechanical Fit?
• Hard stuff first.
• Keep silkscreen.
• Think hard about components on 2-sides.
Some General Tips

• Are your Design Rules setup correctly?
• Run the Design Rule Check (DRC) often.
• Run the Electrical Rule Check (ERC) often.
• Save a snapshot of your placement file.
Route Traces
Adding “Waaaahrs” To Your Layout

• You want to *route*, not *wire*. 📧

• You want to *ripup*, not *delete* nets. 📧

• Are you on the top or the bottom?

• Vias are on top *and* bottom. Easy to add.

• DRC often!

• Iterate like mad.
Route Traces
Some General Tips

• Two layers? Have an x-layer and a y-layer.
• Don’t forget mounting holes, other nice things.
• Add testability features.
Generating Gerbers

Some General Tips

• Using Advanced Circuits? Have I got a script for you ...

• Generate critical layers.
Generating Gerbers
Sanity Checking The Result

- You’ll need an account with Advanced Circuits.
- Email will be sent confirming design rule checking.
- Advanced Circuits even gives you a discount.
- Squash any errors, review all warnings. Look for open vias, closed vias, etc.
Generating Gerbers
Reviewing The Result

- ViewMate - Free Gerber Viewer for Microsoft Windows
- Review planes, drill holes, and “obvious” defects. Not usually any surprises here.
- Biggest error - not exporting the proper layers.
Before you hit “the button” …

- Generate a Parts List (aka “The BOM”) using Export -> Partlist.
- Generate a Pin List (aka “The Netlist”) using Export -> Netlist.
- Sanity check both.
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Some General Tips

- Do you have all of your components? Lead time?
- Find out what file format your PCB Vendor wants.
- Advanced Circuits - GERBER_RS_274X
- Consider routing it yourself.
- Sleep on it.
The PCB Design Process
A Summary of a Lot of Information

- Schematic Capture
- Place Components
- Route Traces
- Generate Gerbers

Iteration

Fab!