

Creating Printed Circuit Boards - Part I

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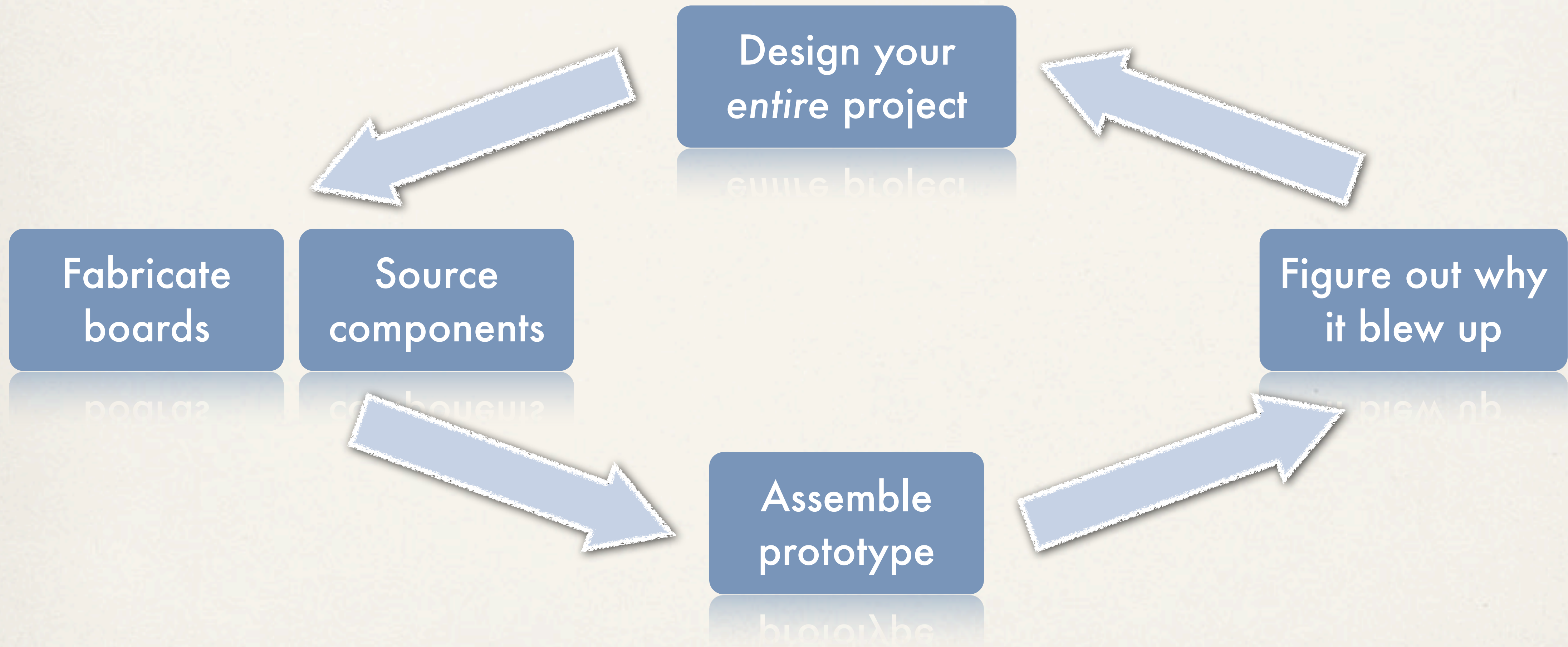
11/14/2012

Hardware is hard

But it's not magic

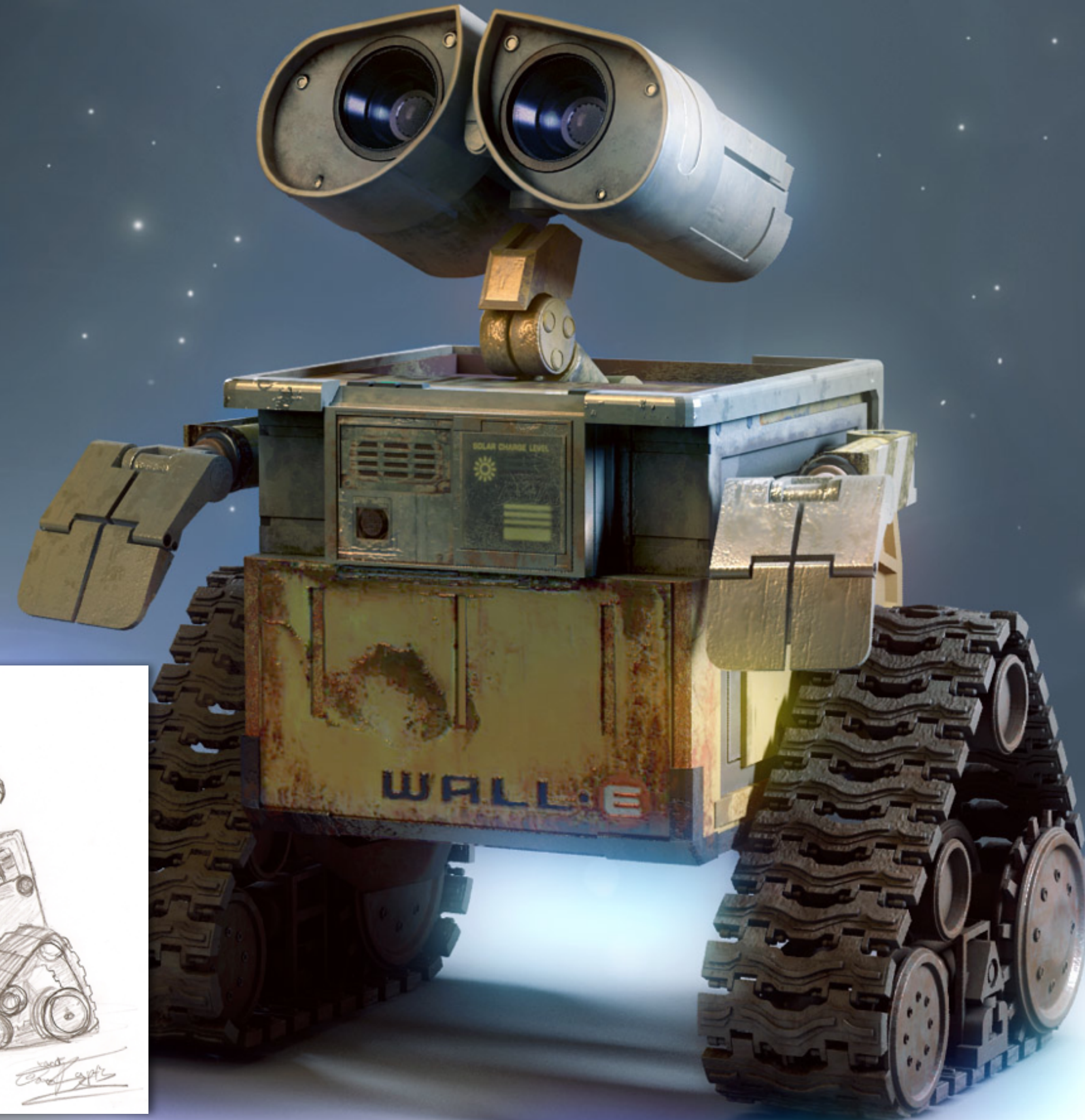


The process



The process

- ❖ Building hardware is an iterative cycle— not a continuous process
- ❖ Each iteration tests concepts and exposes problems
- ❖ *Minimum* costs of iterating a PCB
 - ❖ >1 weeks of wait
 - ❖ >10 hours of design/build/test
 - ❖ >\$100 out of pocket



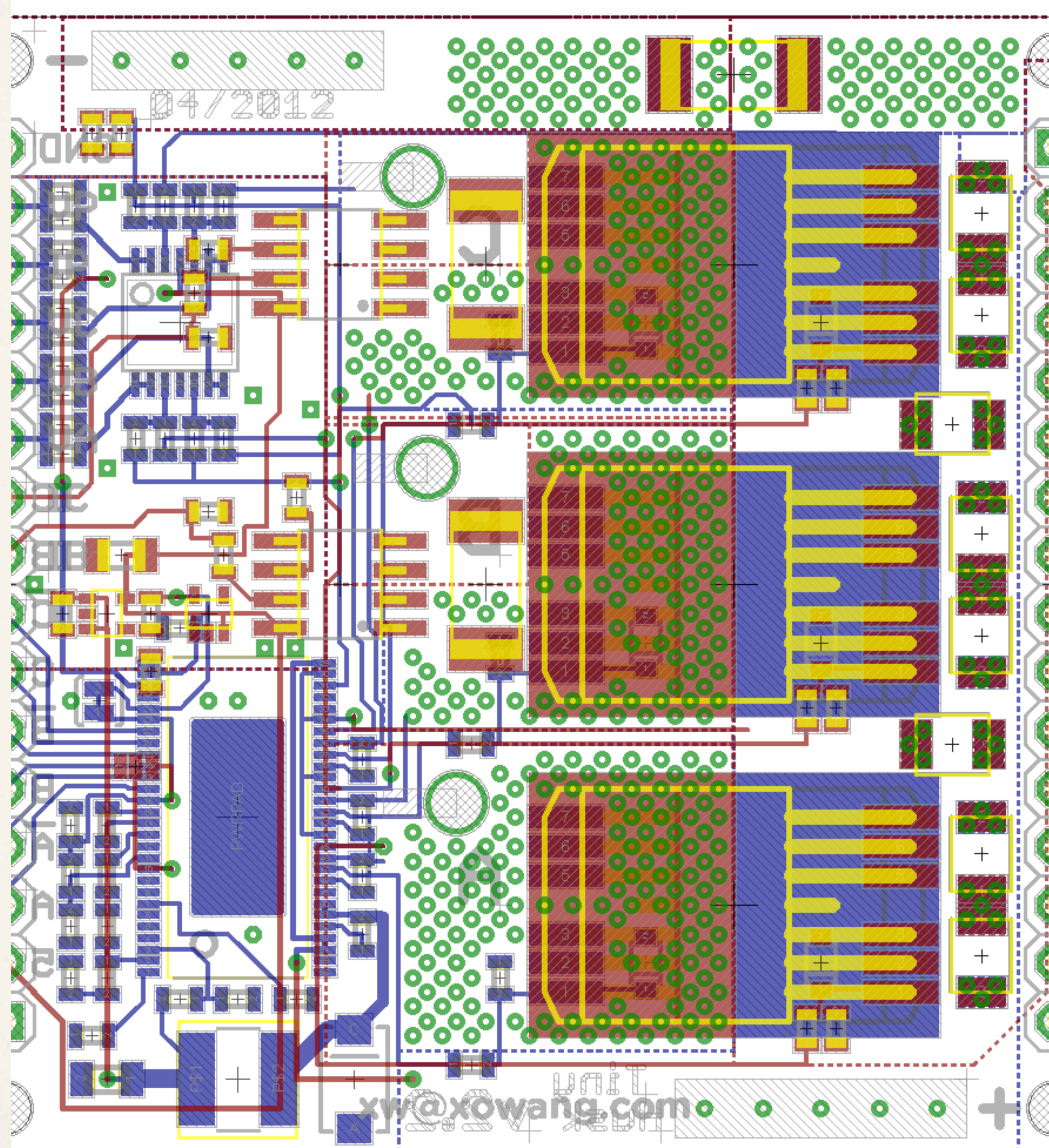
The process: parts

- ❖ Combine **parts** into **circuits**
- ❖ Get parts from **distributors** like Digi-Key, Mouser, Newark, etc.
- ❖ Every part has a **data sheet**—read it!
- ❖ For prototypes, you can connect parts on a **breadboard** or **perfboard**



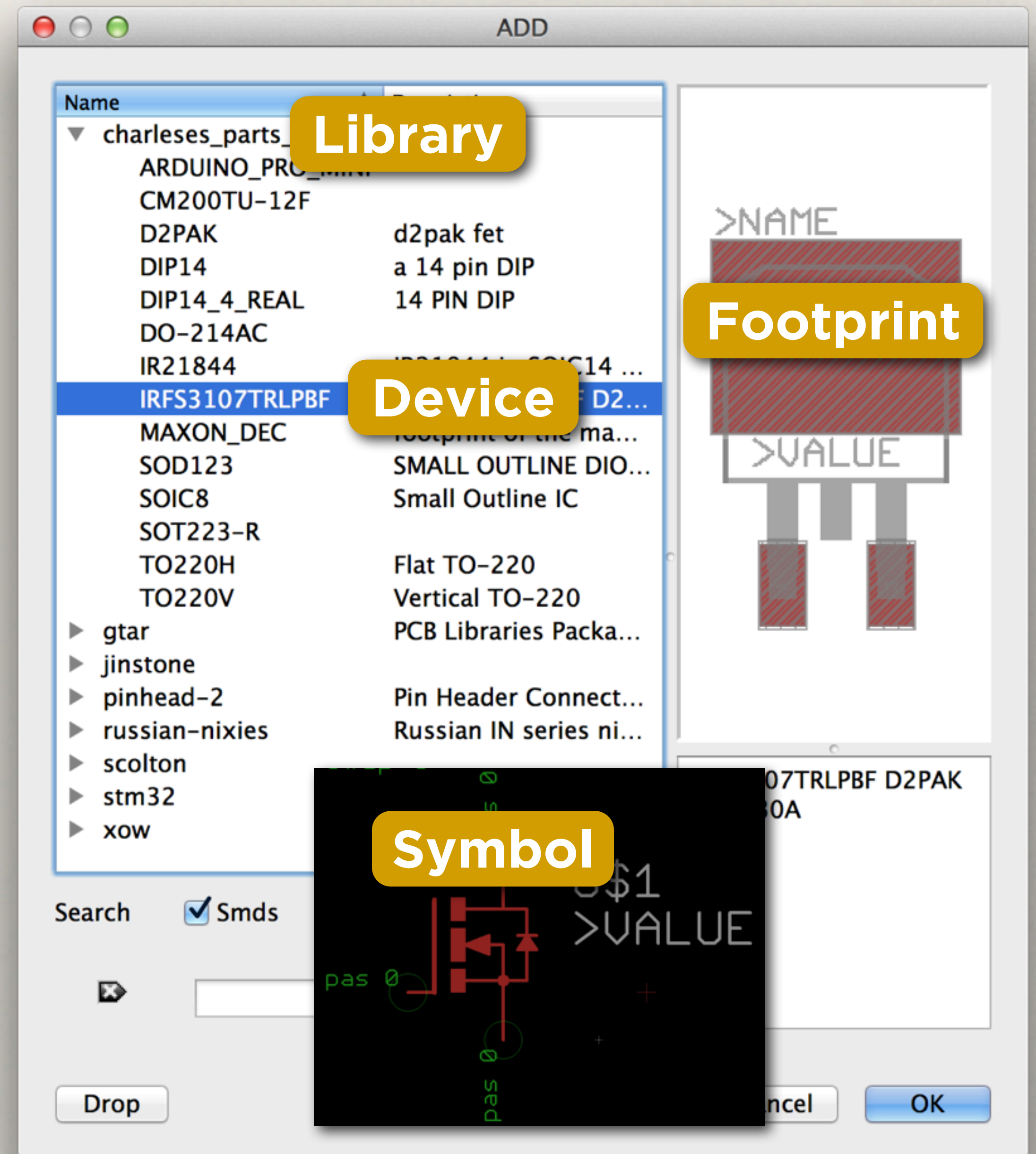
The process: design

- ❖ Circuit boards used to be made by drawing **traces** by hand and **taping out** photoresist mask
- ❖ Now we use ancient **computer-aided design (CAD)** programs
- ❖ EAGLE, Cadence, Altium, Mentor
- ❖ Not so old: Fritzing, Circuits.io, Upverter



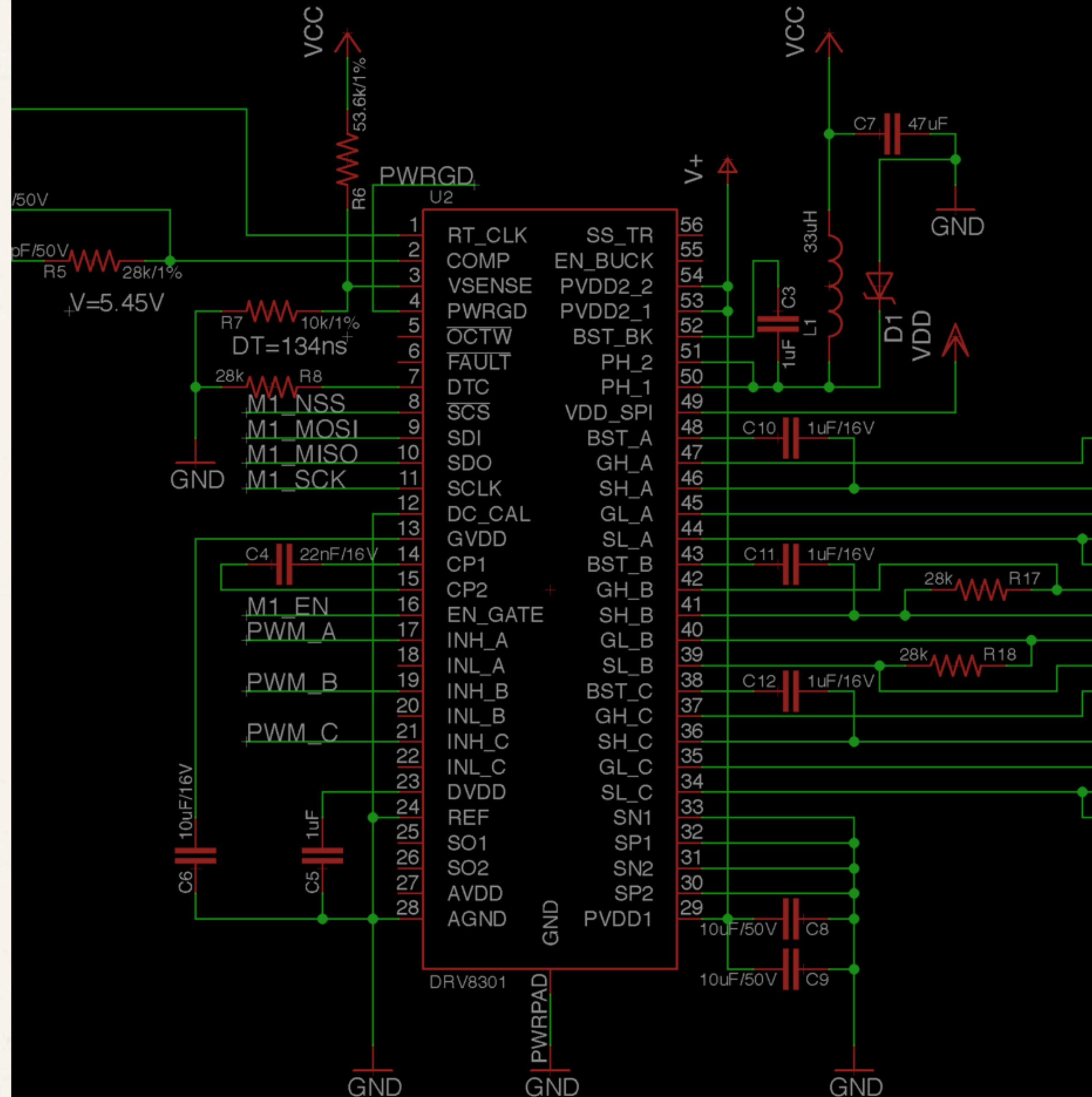
CAD: definitions

- ❖ A **part/device** in CAD is a **footprint/package** together with a **symbol**
 - ❖ Symbol is for your **schematic**
 - ❖ Footprint/package is for your **board**
- ❖ Your **library** is a collection of devices



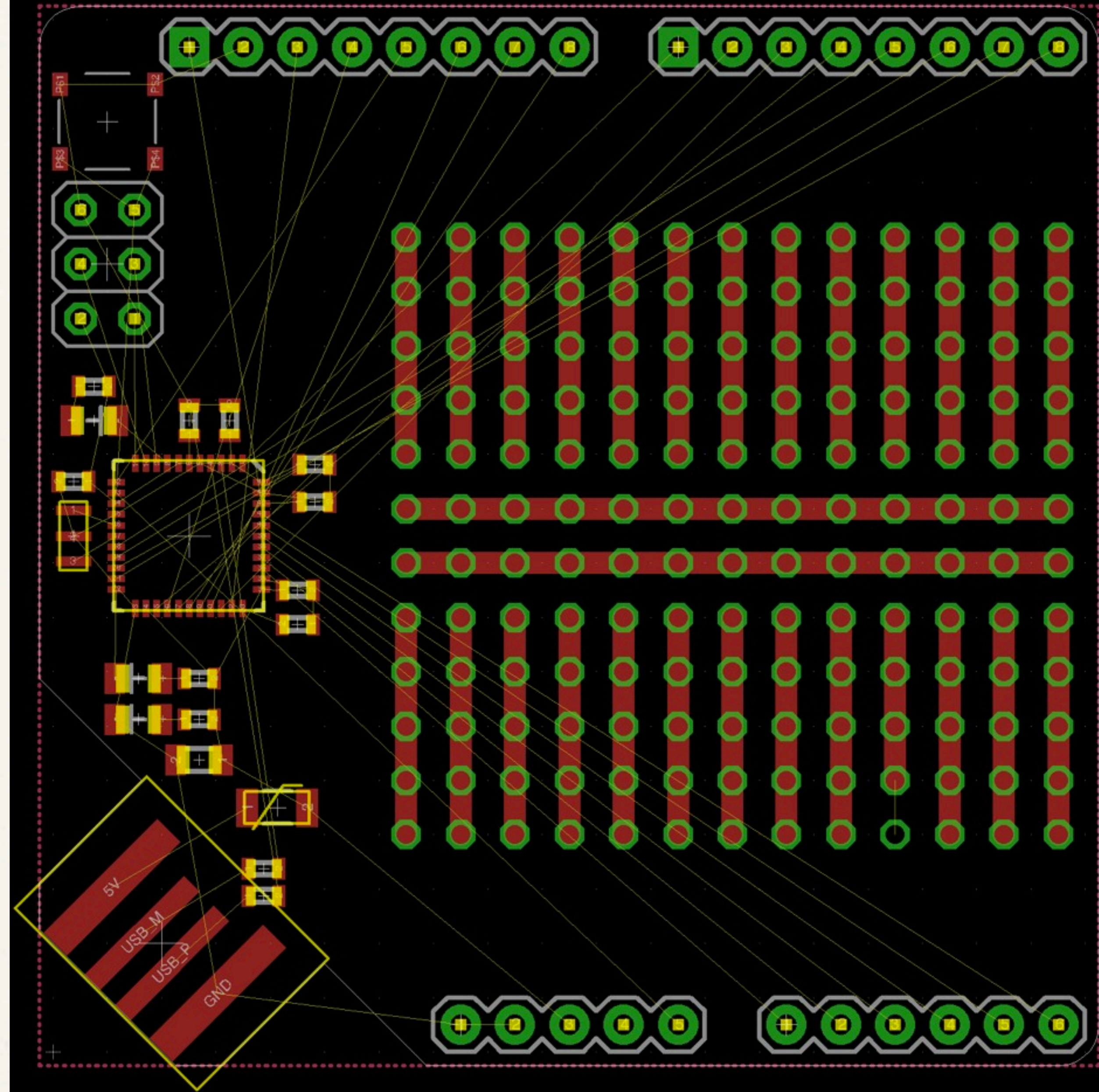
CAD: schematic

- ❖ Your electrical design is your **schematic**
- ❖ Drawing a schematic in CAD is **schematic capture**
- ❖ You draw **nets** to connect **pins** of symbols together
 - ❖ Be neat and document your work because you'll come back to this!



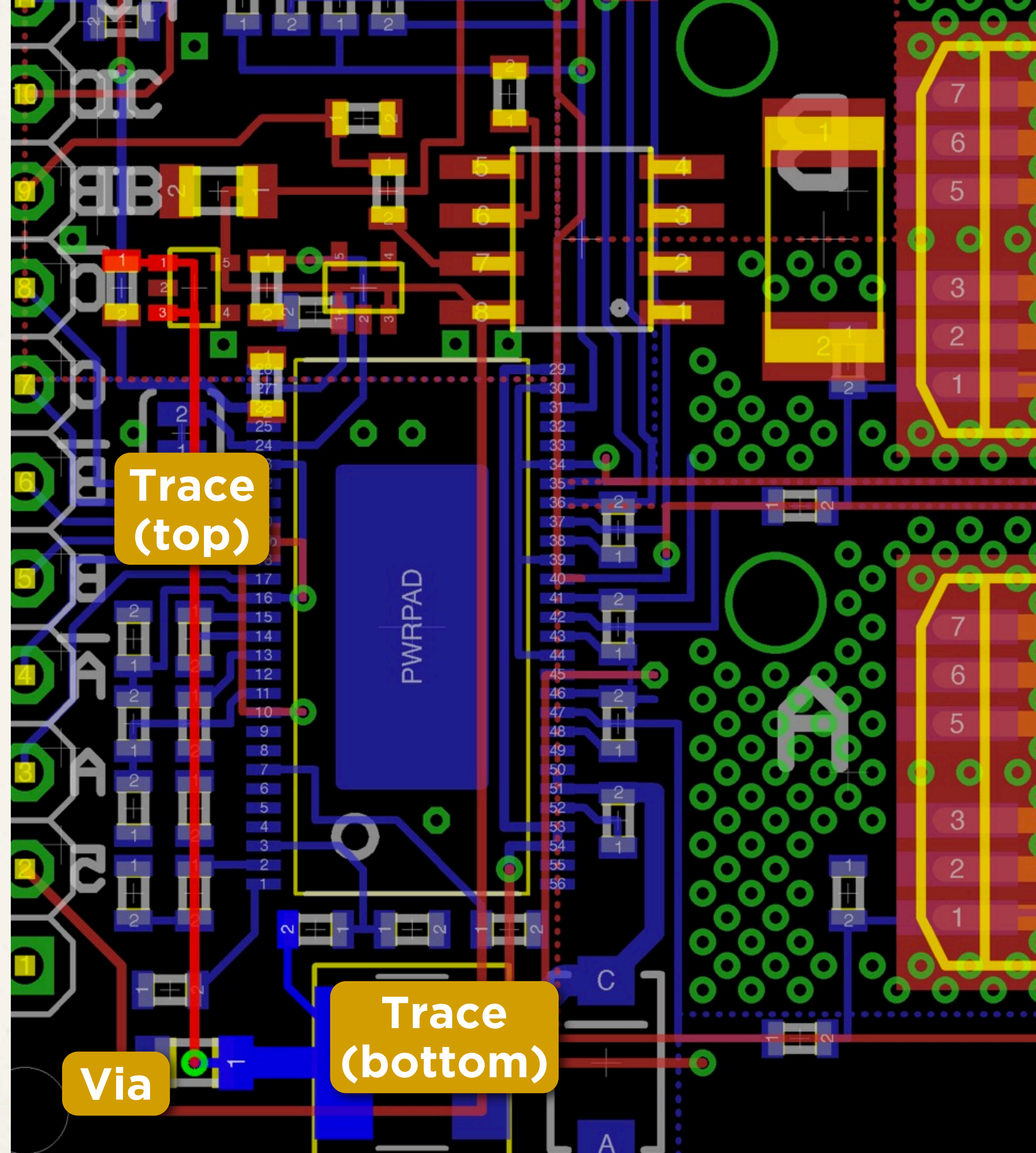
CAD: board

- ❖ The CAD program extracts a **netlist** of nets to create a **board layout**
- ❖ You then **lay out** the components
- ❖ Note: the components are placed, but not connected yet!



CAD: board

- * You **route** the physical copper according to your schematic design
- * You draw **traces** of copper between **pads** and/or **through-holes**
- * Through-holes are usually **plated** on the inside wall of the **drill**
- * **Vias** are plated holes that switch **sides** on the board (they're conductive!)



To explore more

- ❖ Sparkfun tutorials & catalog
- ❖ Google for answers
- ❖ Ask us questions
- ❖ Give it a shot!



Quick points

- ❖ Credit to Amanda Wozniak for her talk
“Hardware Will Cut You”
- ❖ Thanks to Greg Shikhman & Sterling Peet
- ❖ Arduino is a toy
- ❖ Hardware hacking ≠ hardware design
- ❖ Good luck; have fun!



