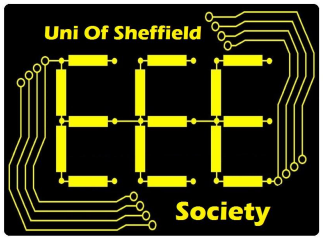
UOS EEE Society KiCAD Lectures

Schematic Capture



The University Of Sheffield.

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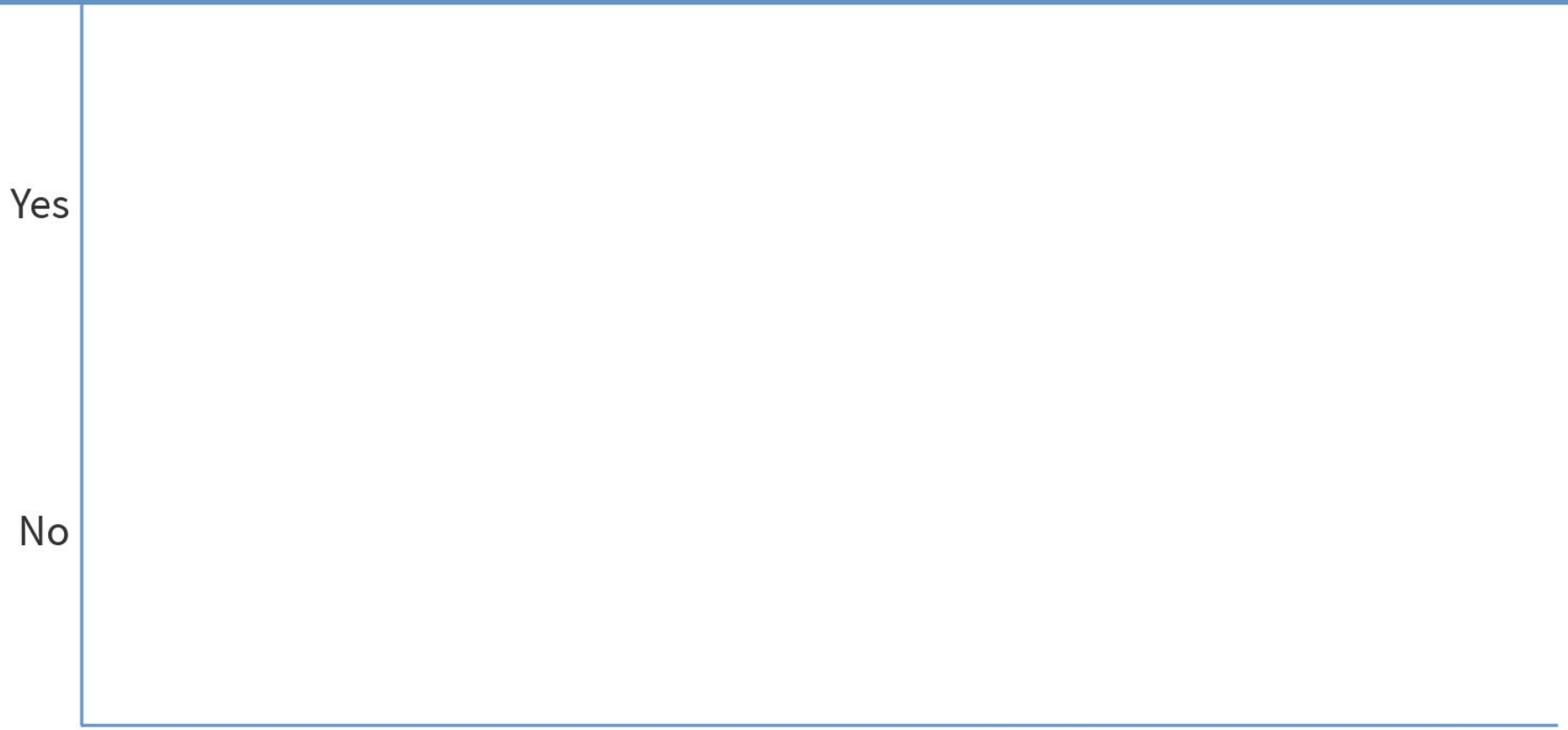
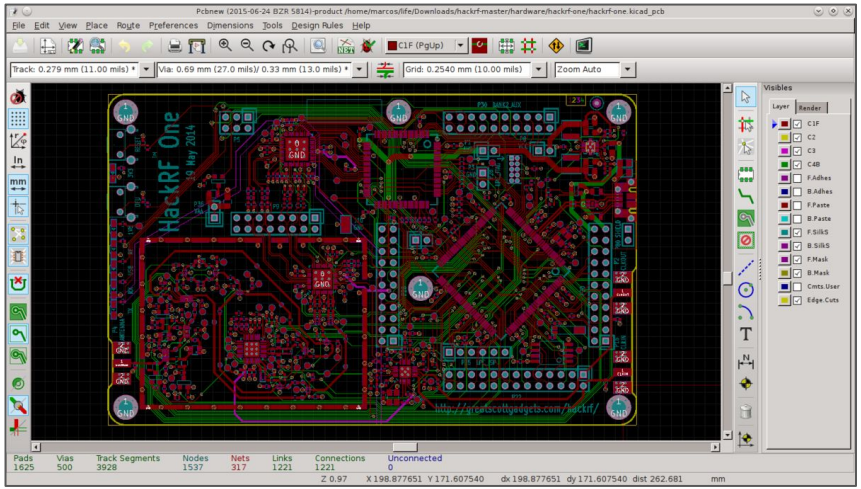
1. What is PCB Design?
2. Methods of Prototyping
3. Why would we want design a PCB?
4. What are the steps required to Design a PCB?
5. What is KiCAD?
6. Basics of Schematic Capture
7. Schematic Layout Tips
8. Why is it important to layout a schematic well?

Have you designed a PCB (Printed Circuit Board) before?



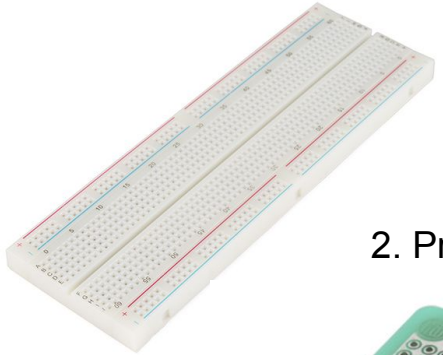
What is PCB Design?

PCB Design is the process of converting an Electronic Circuit Design into an easily manufacturable component that can be used to repeatedly produce the circuit in the real world.

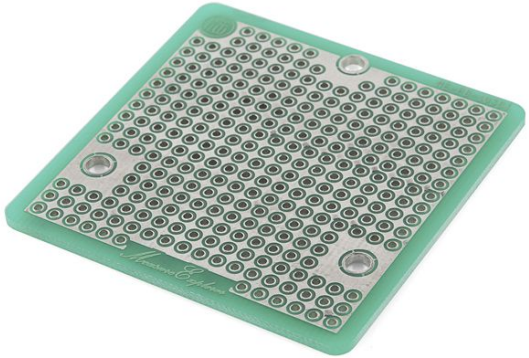


Methods of Prototyping

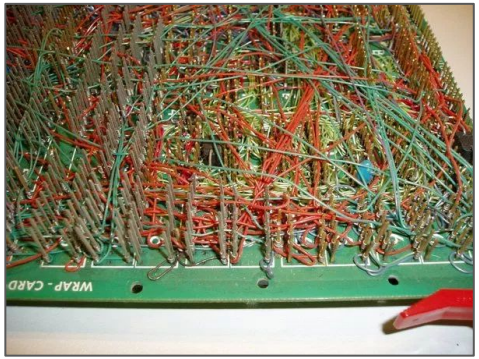
1. Breadboard



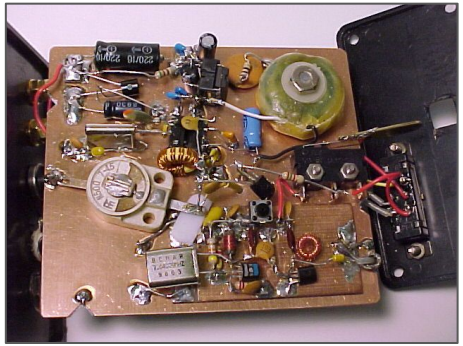
2. Protoboard



3. Wire Wrapping



4. Ugly Board

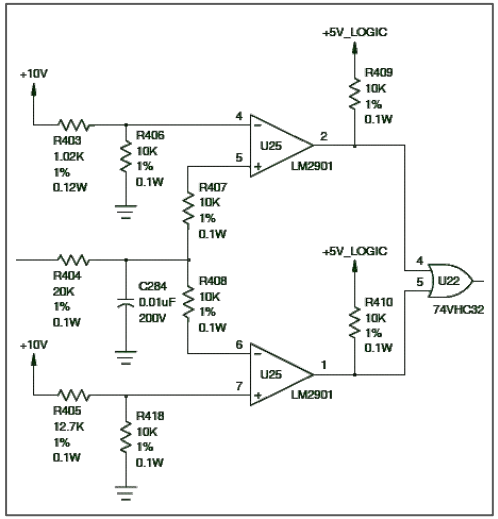


Why would we want to design a PCB?

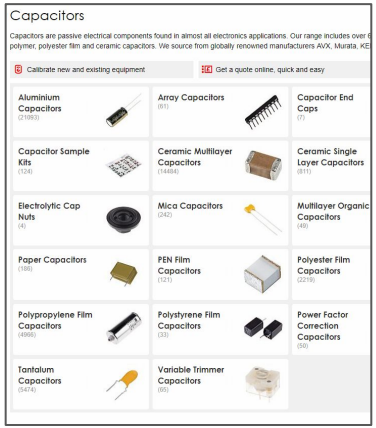
- All of the previous methods are not easily reproducible.
- Printed Circuit Boards are designs that can be reproduced by machines.
- Modern technologies for manufacture can be used ⇒ Solder Reflow, Wave Soldering, Pick and Place Machines.
- Circuit boards are much more robust ⇒ Longer Life, More Consistent Production.
- Modern Design tools allow for complex uses ⇒ High Frequency Circuit Boards, Power Electronics.

PCB Design Steps

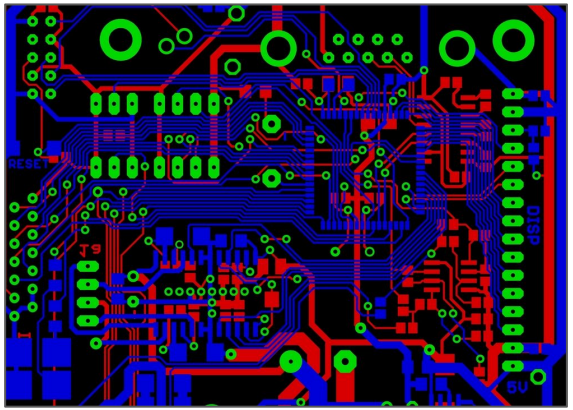
Schematic Capture



Component Selection



PCB Layout



Cost of Mistakes

What is KiCAD?

- **Open Source** PCB Design Tool.
- **Completely Free to use.**
- Still under development.
- Supported through donations and grants.
- Allows for complex tasks like Differential Routing.
- Completes the whole PCB Design Process from Schematic Capture to PCB Layout.

Basics of Schematic Capture

- Place **component symbols** on a sheet.
- Connected components to form desired circuit using **Nets** or **Buses**.
- Schematics can be made clearer using **No Connection** and **Junction** icons.
- Readability can be improved using **Labels**.
- **Global Labels** can be used to connect sections of the schematic together.
- **Hierarchical Sheets** can be used to segment a complex Schematic.

Demonstration

Schematic Layout Tips

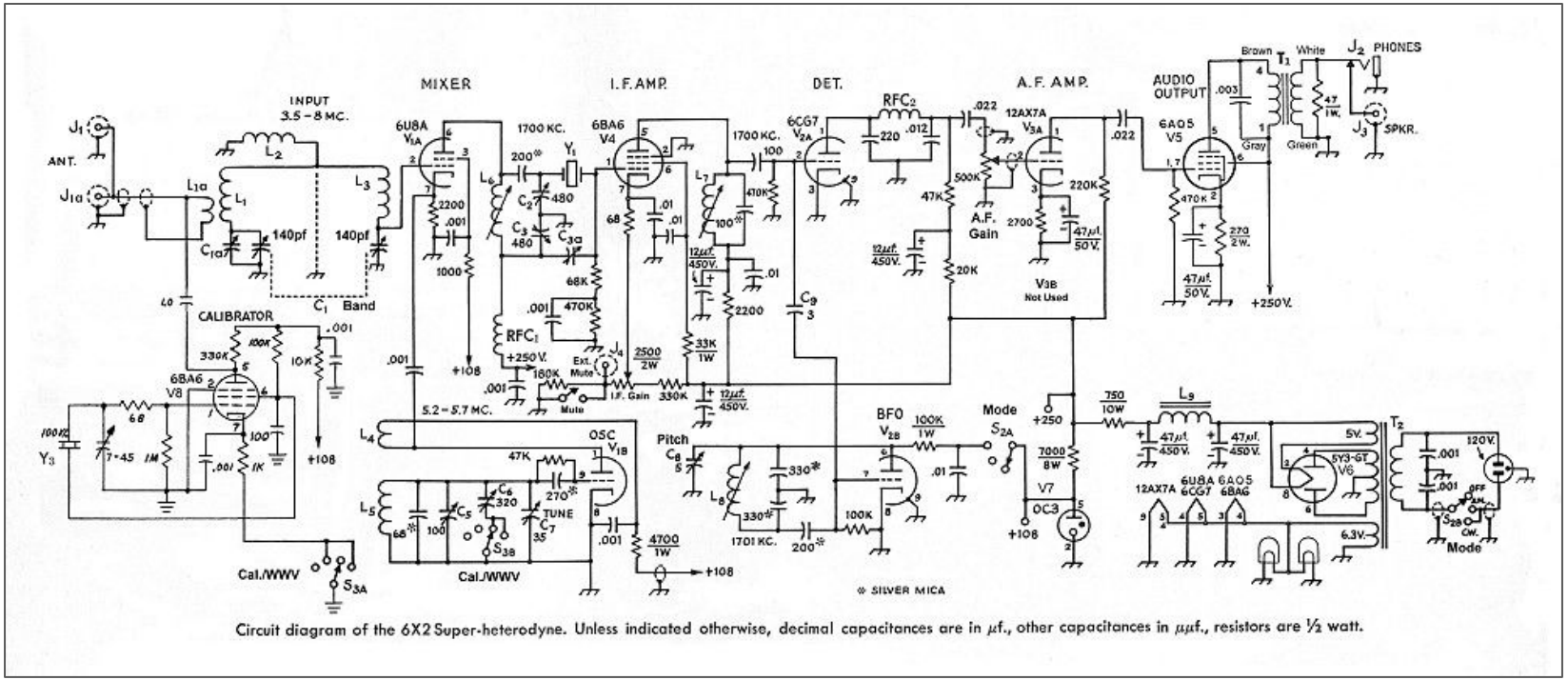
- **Text** and **Lines** can be used to show **Schematic Building Blocks**.
- **Hierarchical Sheets** can be used to implement a systems design structure (Top Down Design/Bottom Up Implementation).
- **Global Labels** are useful for connecting parts of the Schematic that are physically far apart.
- Don’t be afraid to use lots of space for a simple part of the circuit.

Clarity over Efficiency!

Why is it important to Layout a Schematic well?

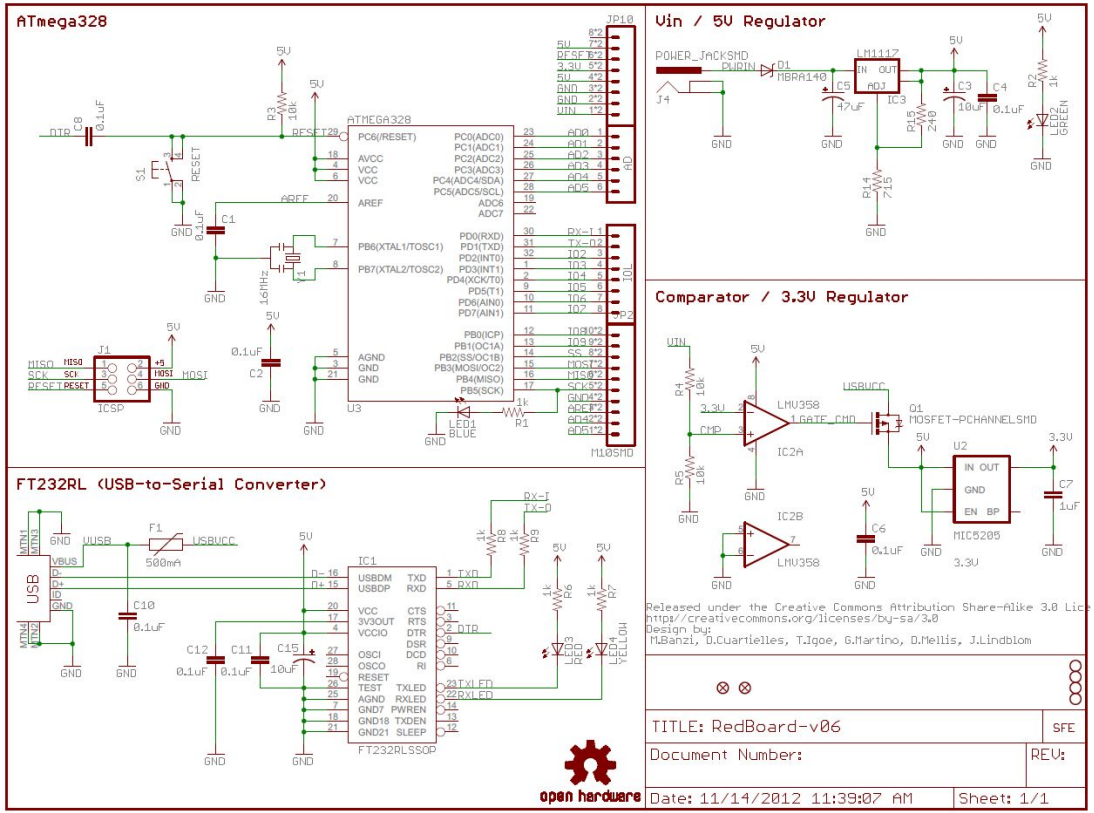
- When designing complex circuits you need to be able to come back to something and still understand it (**possibly after a few years**).
- Other engineers need to be able to read your designs!
- Troubleshooting is easier with a readable schematic.
- Designs are easier to modify in the future if they are readable.

Why is it important to Layout a Schematic well?



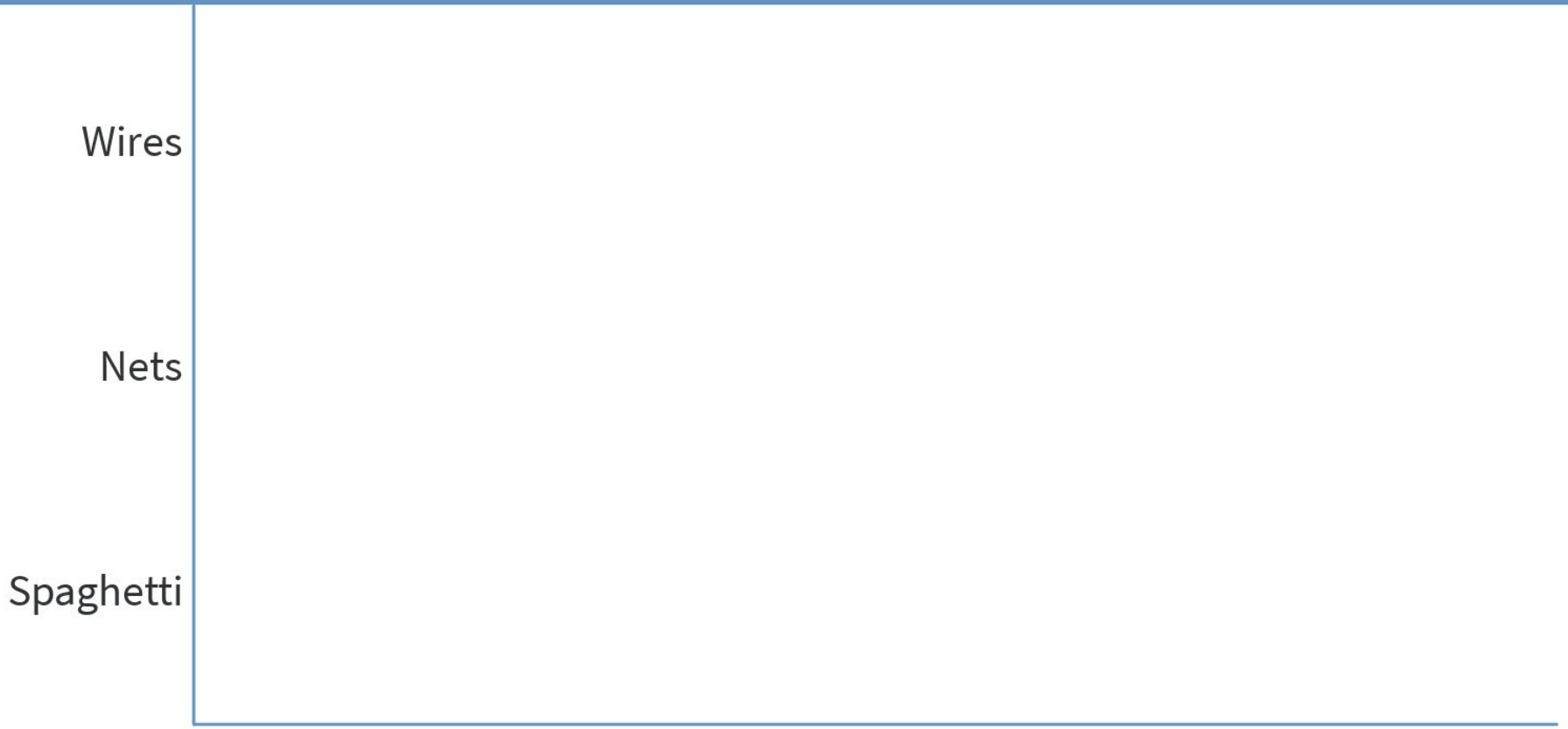
Circuit diagram of the 6X2 Super-heterodyne. Unless indicated otherwise, decimal capacitances are in μf., other capacitances in μμf., resistors are ½ watt.

Why is it important to Layout a Schematic well?



Quiz Time!

What are components connected with on a Schematic?



What is a Bus used for?

Private Transport

Connection of Multiple Nets used for the same purpose

To make your schematic look more cluttered

What are Global Labels used for?

Connection of different points in a Schematic without a Net

Connection of different points in a Schematic with a Net

Giving a component a name throughout the Schematic

Hierarchical sheets are used to:

Keep all parts of the design in one space

Show that one design is superior to another

Break complex designs down into smaller parts

Why is it important to layout Schematics well?

So that future engineers get very confused by your designs

So that it is easy for people to copy your designs

So that anyone can understand your designs

So that future engineers can understand your designs

A schematic should be:

Clear, Easy to Read and broken down into bite size chunks

Efficient with Space, Complicated and difficult to Read

Before you go!

- Next week we are running a lecture on Data Analysis with Python!
- Diamond Building, Lecture Theatre 2, 5 - 6pm.
- This is a great skill for writing reports and analyzing experimental data.

Thanks for listening!

Next time we will be:

1. Looking at how to select components.
2. Inputting components into a KiCAD Schematic.
3. Footprint Selection.
4. Footprint Generation.

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