**Circuit Board Design Reference Sheet**

**Anatomy of a circuit board**

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| C:\Users\Ducky\Desktop\quackers\EE4\pcb anatomy.png | **Silkscreen**: for "artwork" - text and drawings  **Soldermask**: resists solder  **Copper**: conductive layer, etched to design, contains traces and pads  **Substrate**: insulating layer, usually FR-4 fiberglass  **Plated Holes**: electrically connects top and bottom copper layers |

**Design rules**

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| --- | --- | --- |
| **Rule** | **Description** | **Common values** |
| **Minimum trace width** | The minimum width of any copper shape | 6 mil, 8 mil |
| **Minimum trace spacing** | The minimum spacing between two non-connected copper shapes | 6 mil, 8 mil |
| **Minimum drill size** | The minimum size of any via or hole | 13 mil, 20 mil |
| **Maximum drill size** | The maximum size of any via or hole | big |
| **Annular ring** | The minimum copper ring width around any plated via or hole | same as trace width |

\* 1 mil = 1/1000 in = 0.0254 mm

**Reference designator meanings**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Letter** | **Meaning** | **Letter** | **Meaning** | **Letter** | **Meaning** |
| **C** | Capacitors | **L** | Inductors | **TP** | Test points |
| **D** | Discrete diodes, including LEDs | **Q** | Transistors | **U** | Integrated circuits and misc. |
| **F** | Fuses | **R** | Resistors | **X** | Crystals |
| **J** | Connectors | **S / SW** | Switches |  |  |

**Board design workflow**

1. Idea: You need to know what you want to do first.
2. Circuit: Figure out how to implement your idea using electronic parts.
3. Schematic capture: Enter your circuit schematic into the design suite.
4. Board layout: Convert your schematic into a circuit board layout, then place and route the components.
5. Verification: Ensure that your circuit will work as intended and is within design constraints.
6. Fabrication: Generate the design files, and send them off for manufacture.

**Essential fabrication data**

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| --- | --- |
| **Extension** | **Function** |
| **.gbr** | Generic Gerber file |
| **.gtl** | Top copper layer |
| **.gbl** | Bottom copper layer |
| **.gto** | Top silkscreen layer |
| **.gbo** | Bottom silkscreen layer |
| **.gts** | Top soldermask layer |
| **.gbs** | Bottom soldermask layer |
| **.drl, .txt** | NC Drill file |
| **.oln, .outline** | Board outline |