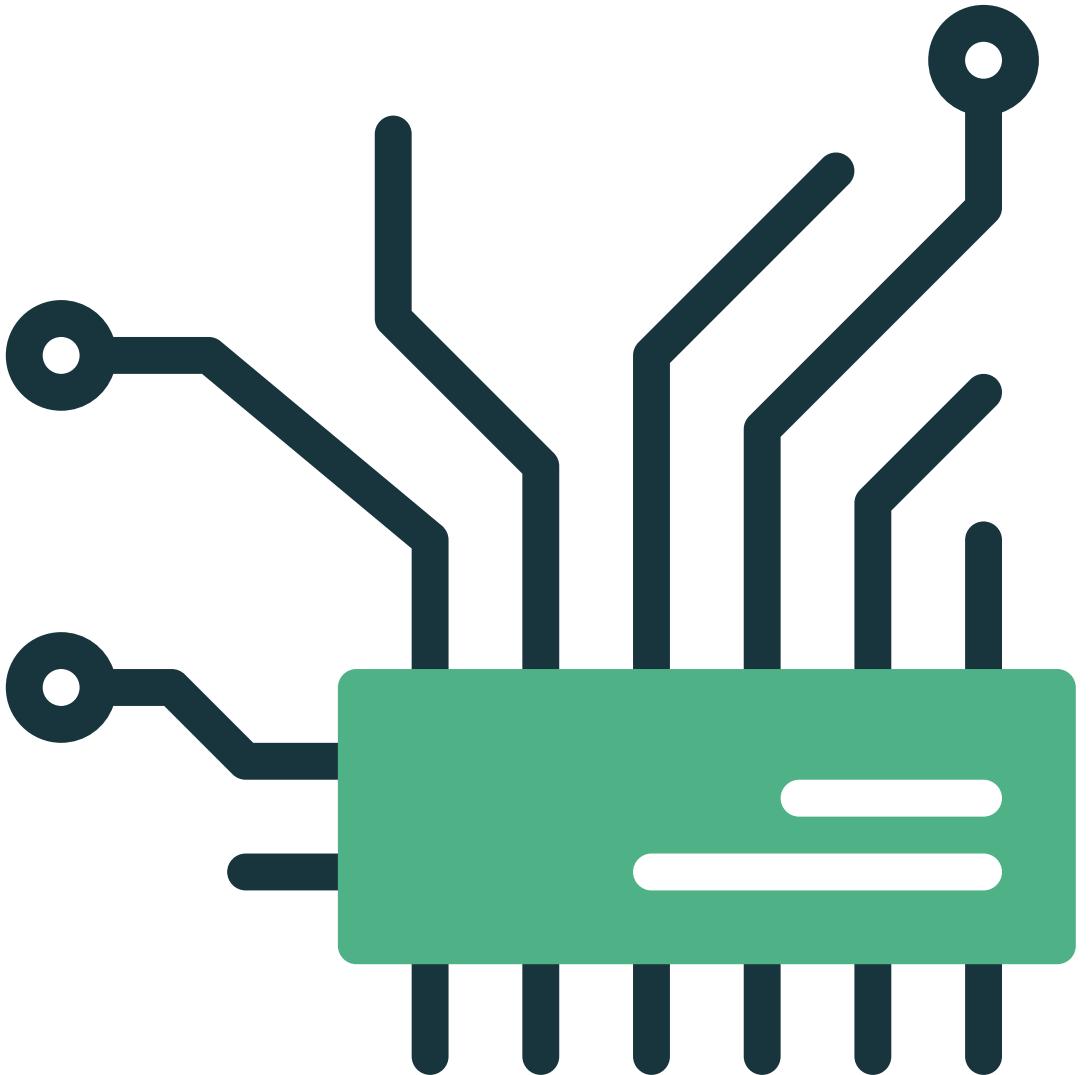


September 16, 2021

PCB Design 101

with  ALTIUM
DESIGNER

Overcoming Today's Challenge For A Better Tomorrow



Jomo
Kenyatta
University of
Agriculture and
Technology

SOCIETY OF
ENGINEERING
STUDENTS

JKUAT SES Tech Week 2021

Chrispine Tinega

Outline

01 Introduction to PCB Design

02 PCB Anatomy

03 Design & Manufacturing Process

04 Components Review

05 Models & Libraries

06 Schematic & Layout Design

07 ERC/DRC & Routing

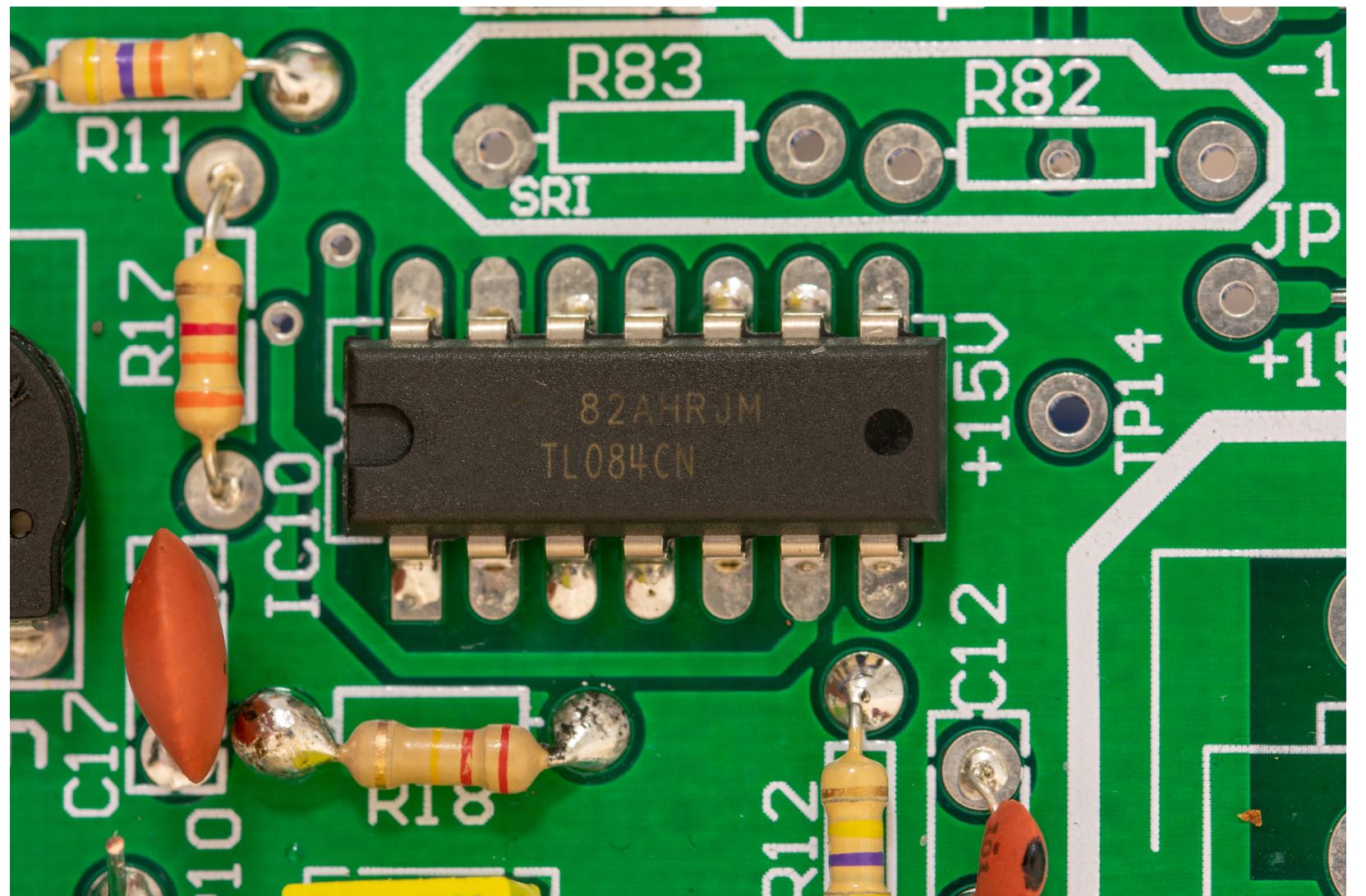
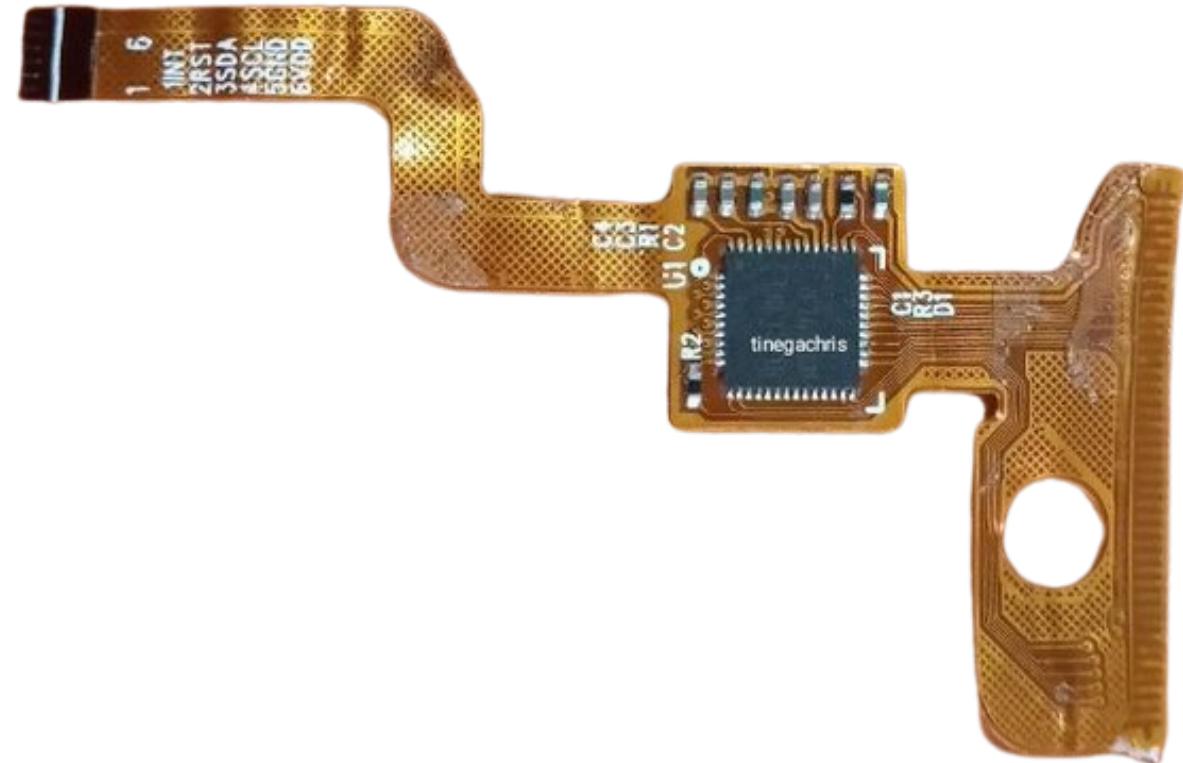
08 MFQ Output Generation



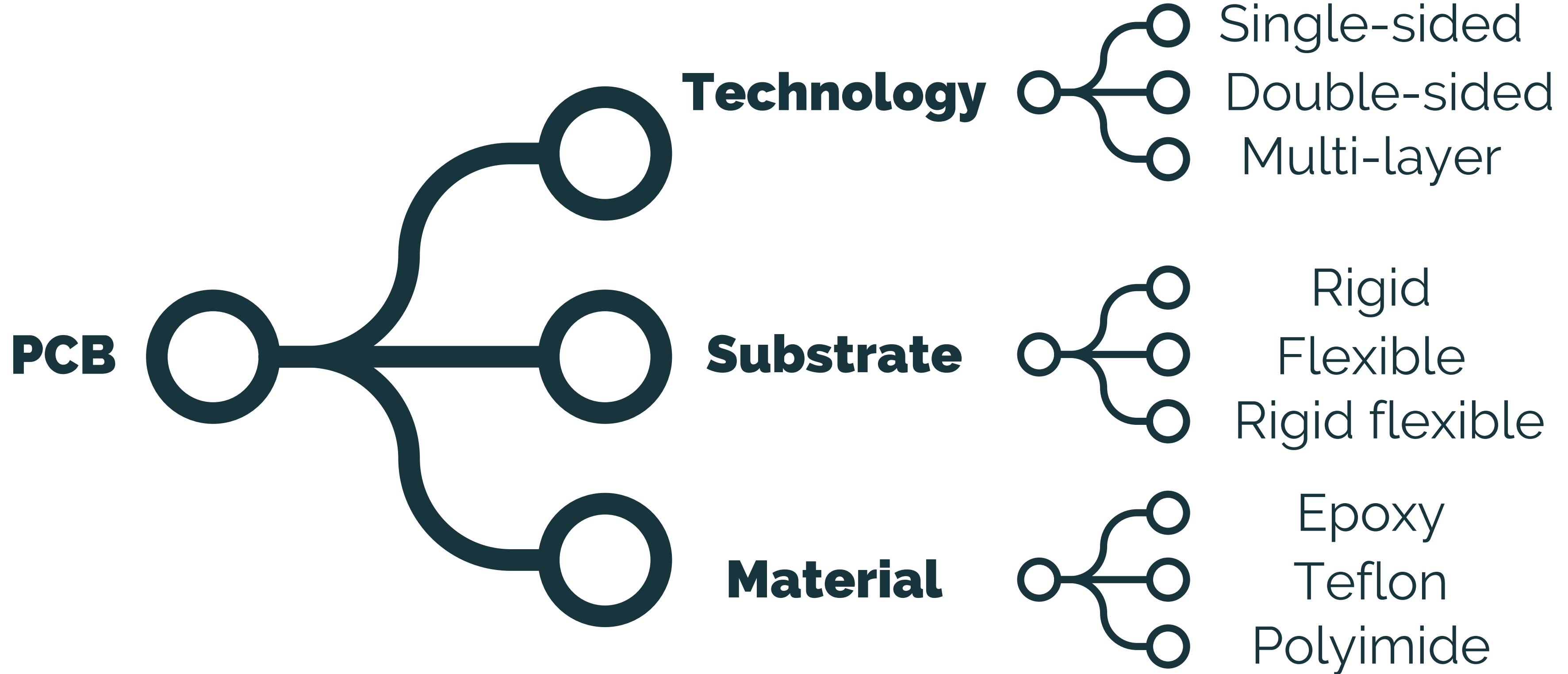
O1 Introduction

A structure that:

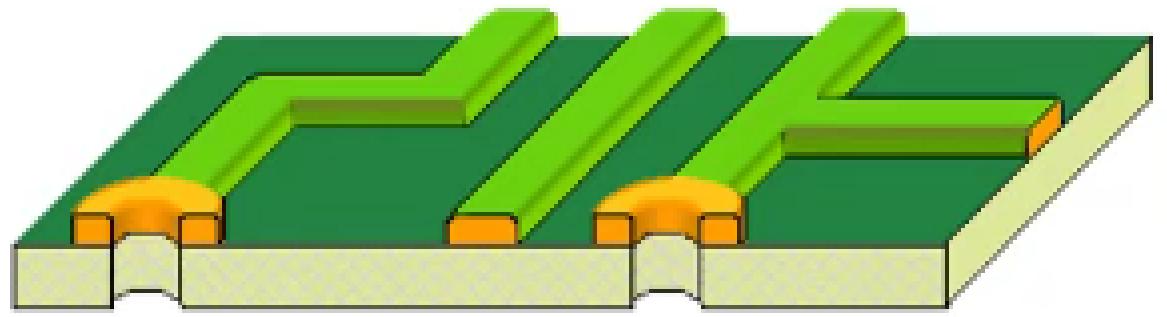
- Mechanically hold components
- Provides connectivity



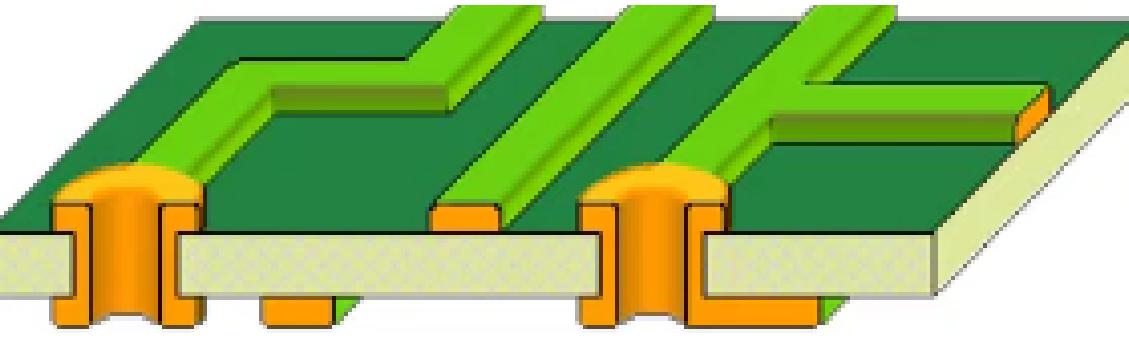
PCB Classification



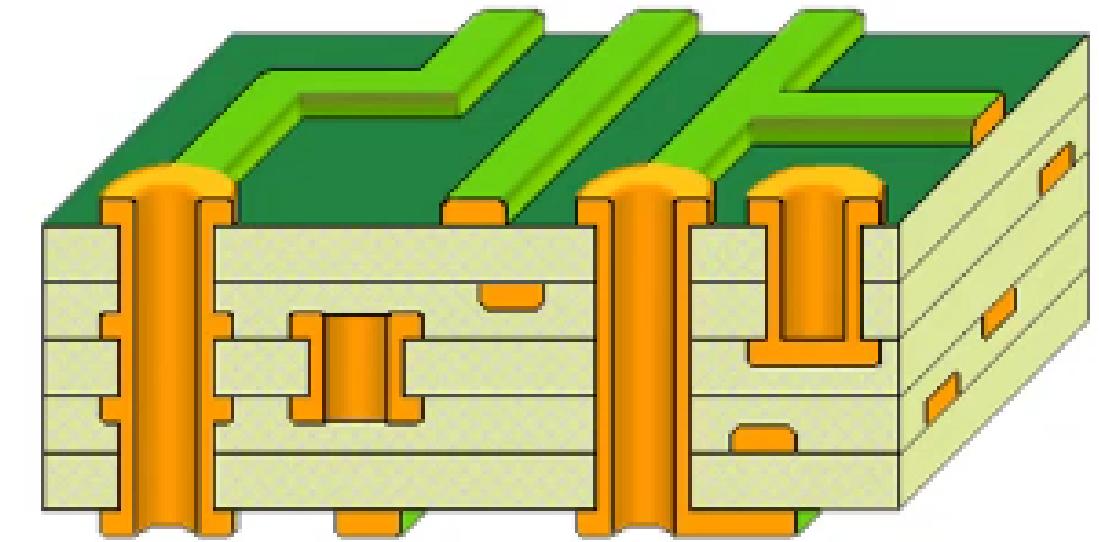
PCB Classification



Single-Layer PCB



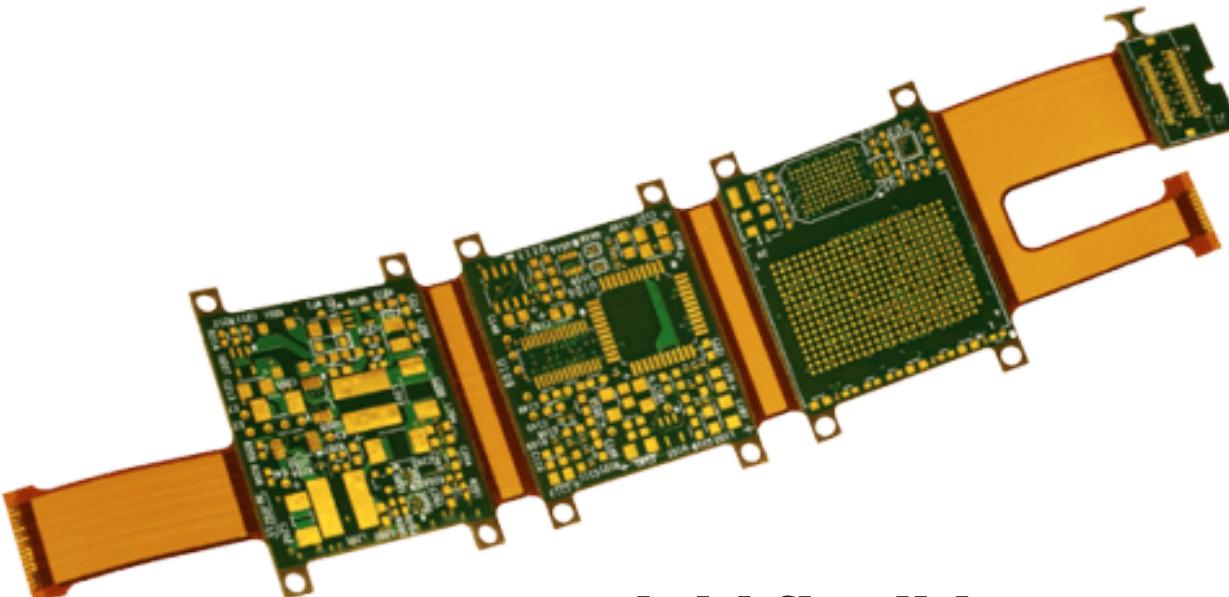
Double-Layer PCB



Multi-Layer PCB



Samsung 2GB DDR3 Ram



Rigid flexible PCB

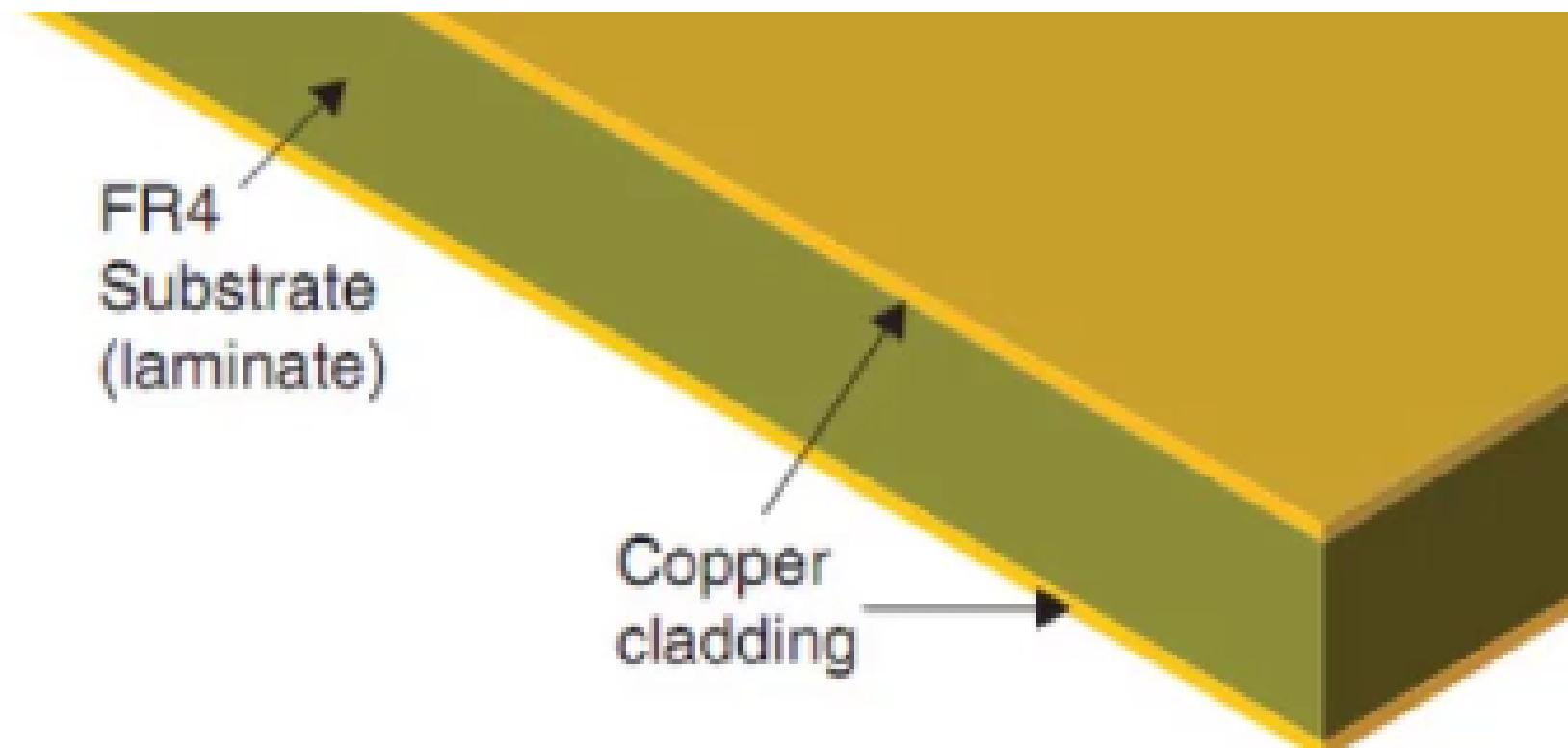


02 PCB Anatomy

- **Substrate (lamine)**

Rigid board insulating material. Mostly FR4

Provides structural support to components



- **Prepreg**

Pre-impregnated bonding sheet

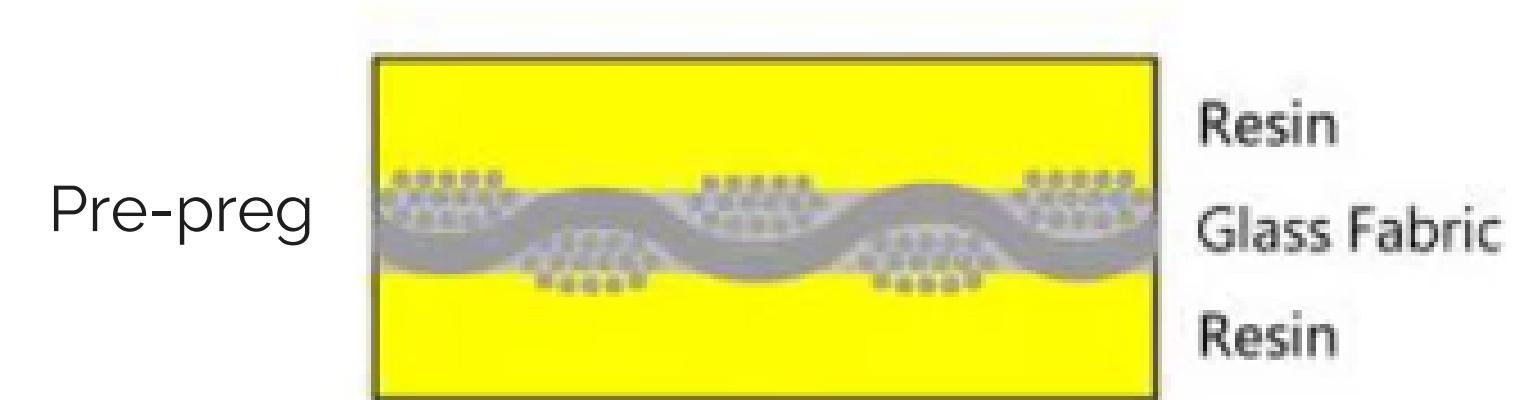
Thermosetting resin + Glass fibre



- **Copper**

Specified in ounces per square foot: 1 oz = 35 um

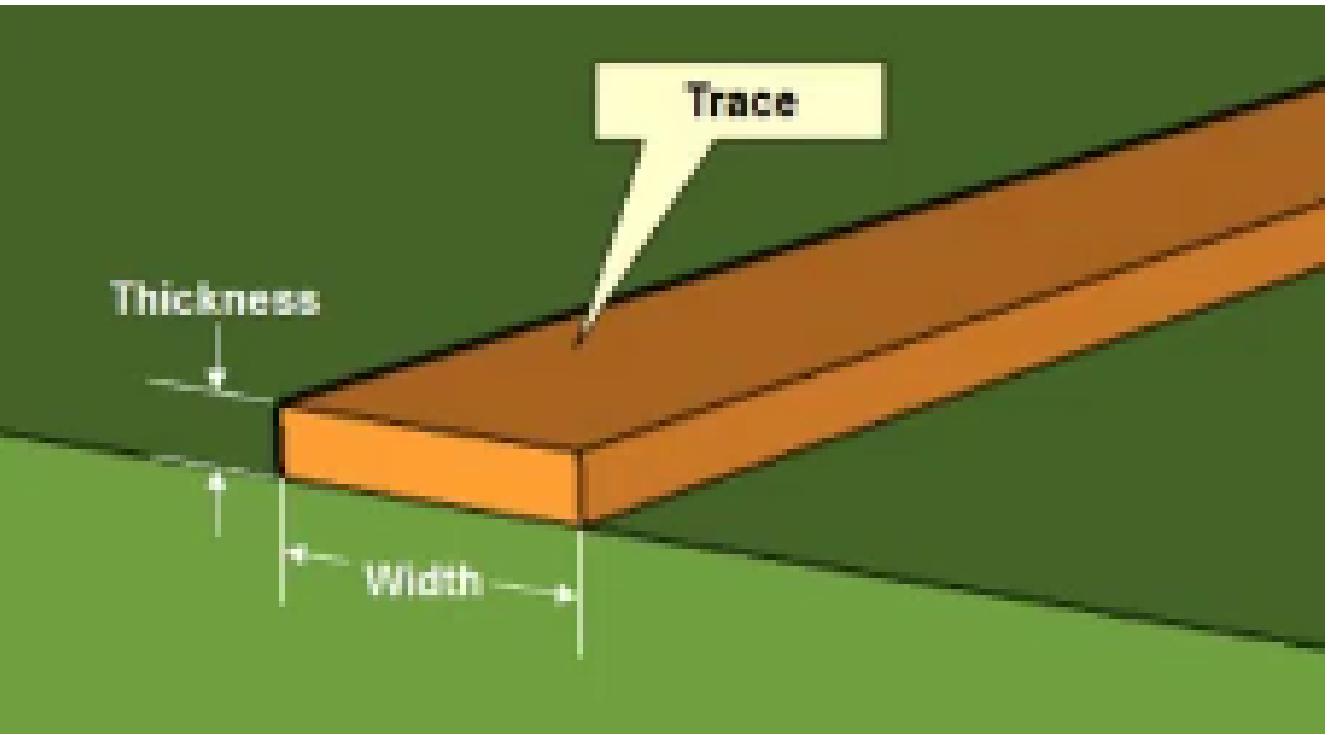
Copper clad laminate = Cu + prepreg + Cu



• Traces

Width & thickness determines ampacity & Z_0 in RF designs

Practical limitations: width & spacing



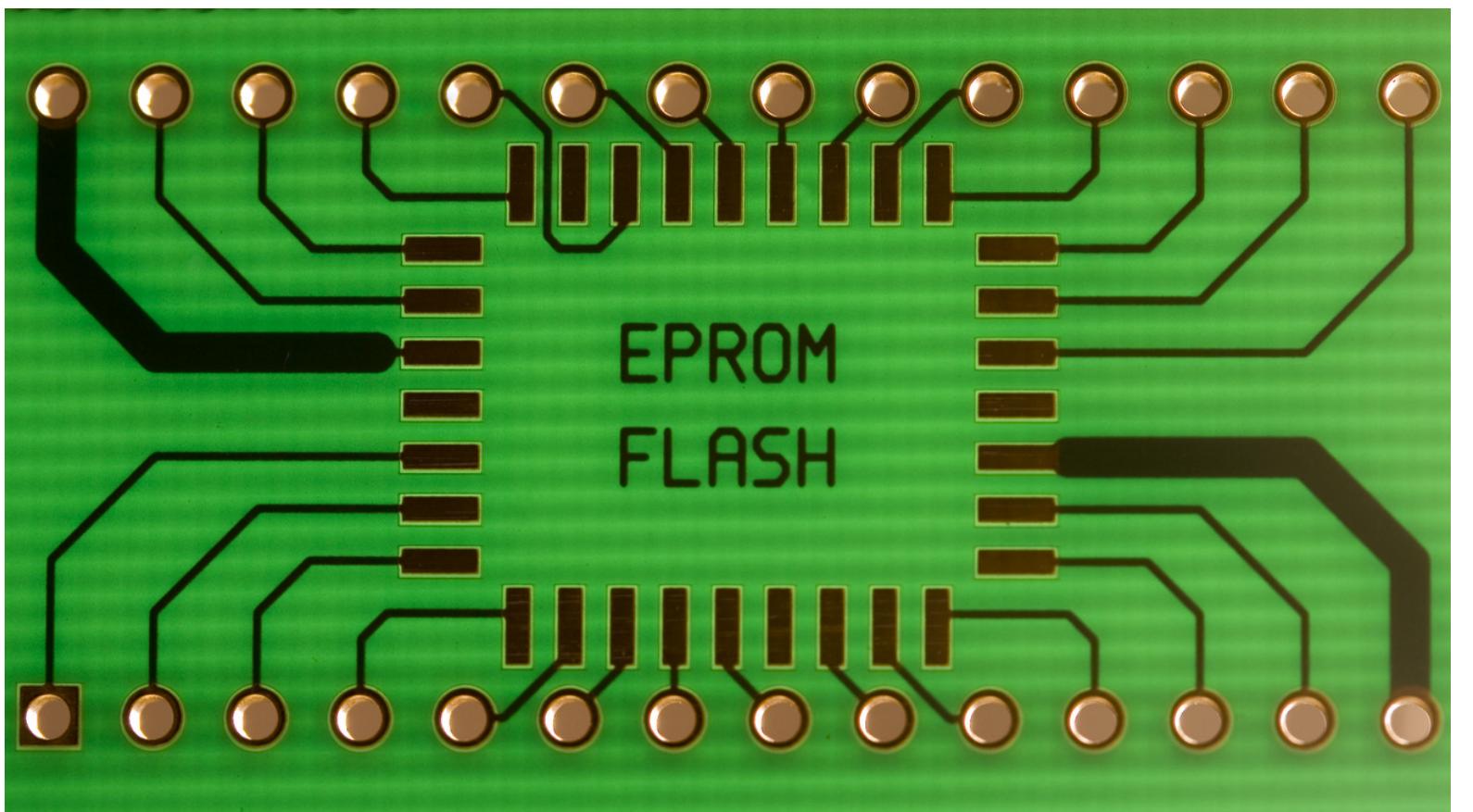
• Holes

Can be VIAs, multi-layer pads, mounting holes,
plated or non-plated

• Pads

Contact areas, solder traps, test points

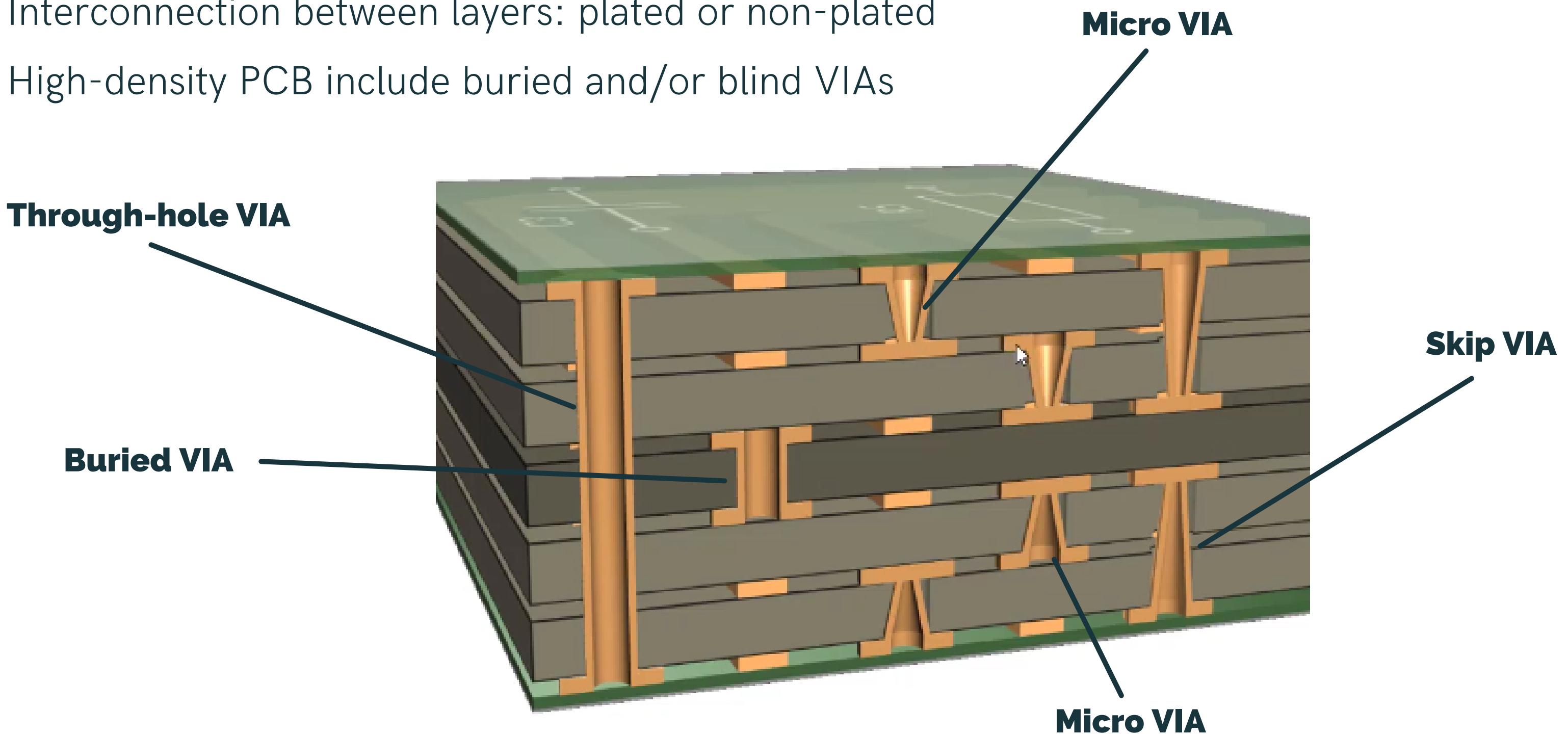
Footprints = a collection of pads



- **VIA**s

Interconnection between layers: plated or non-plated

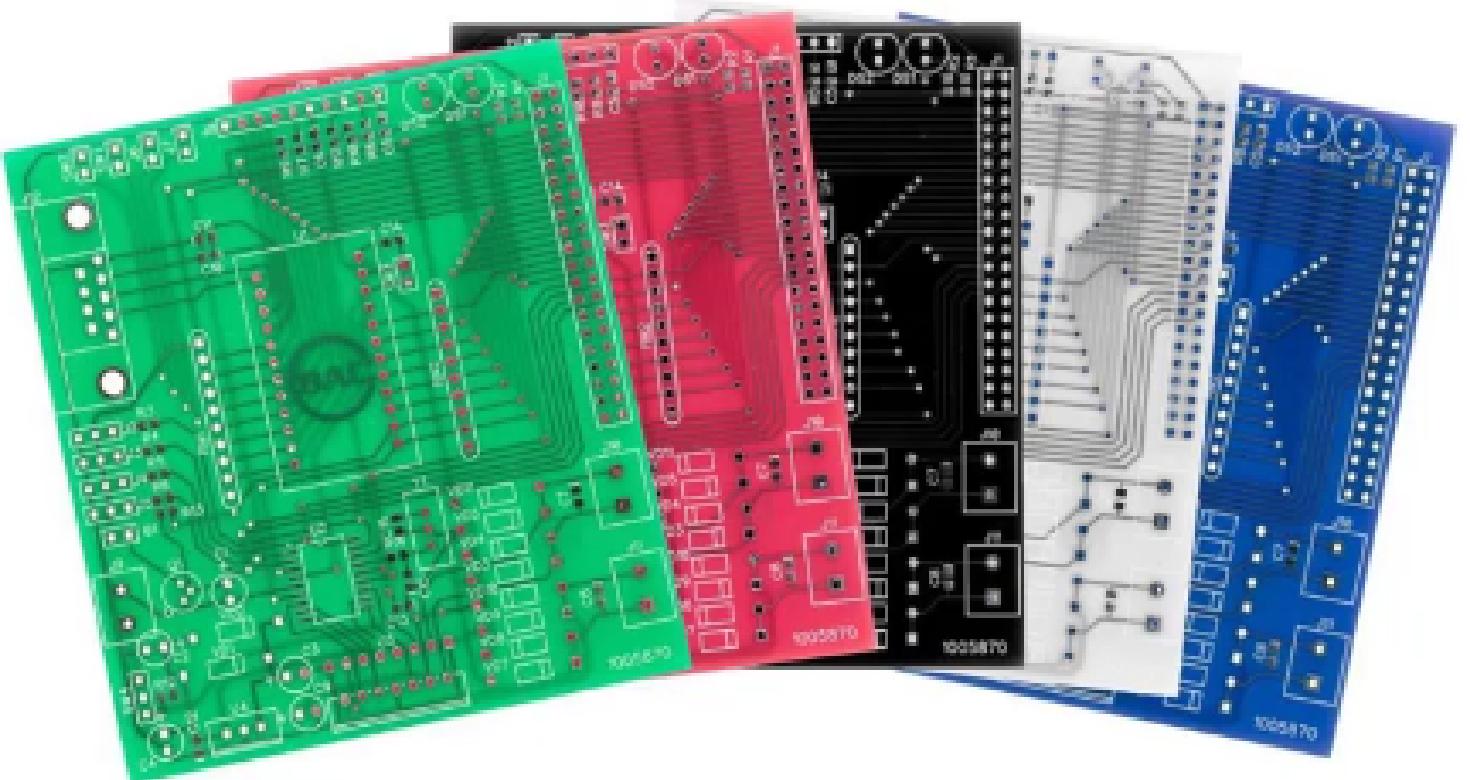
High-density PCB include buried and/or blind VIAs



- **Solder mask (resist)**

Polymer layer deposited on top and bottom layers

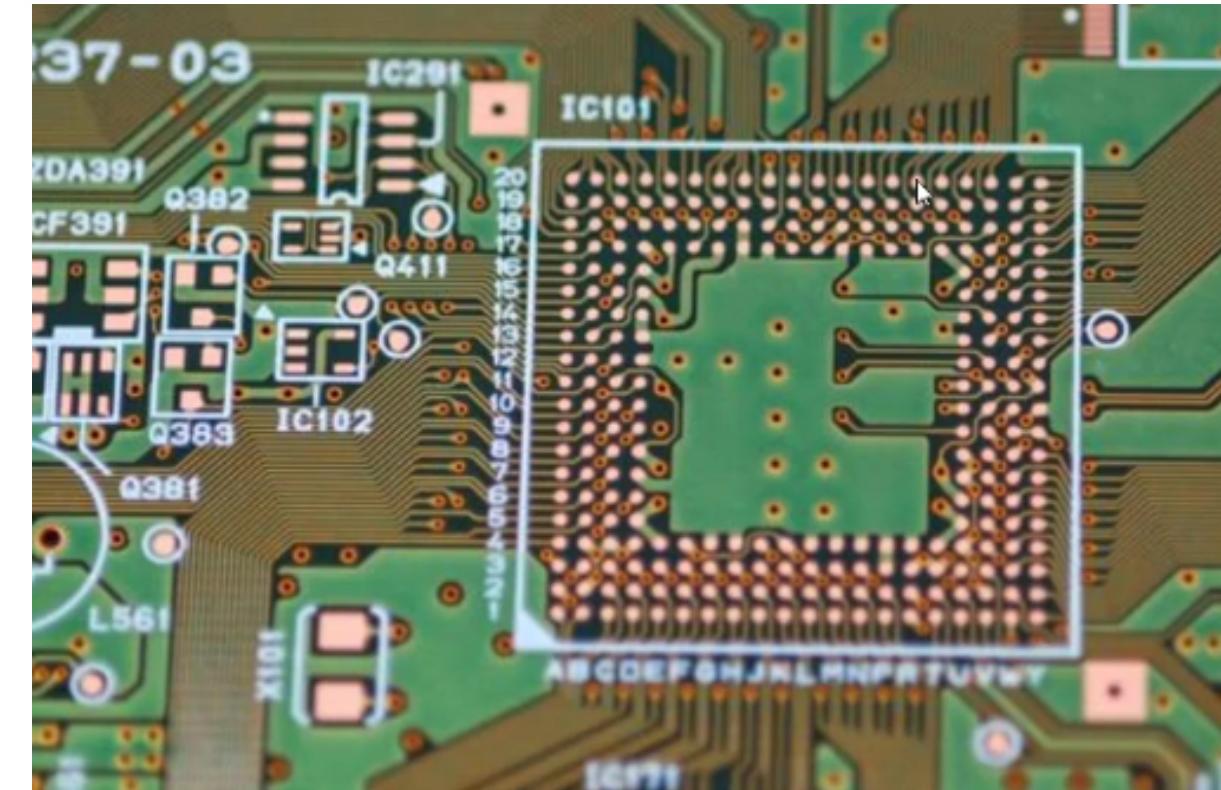
Protects against oxidation and prevents solder bridges



- **Surface finish**

AKA solder coat or exposed conductor plating

Sn, Ag or Au applied to pads after solder masking



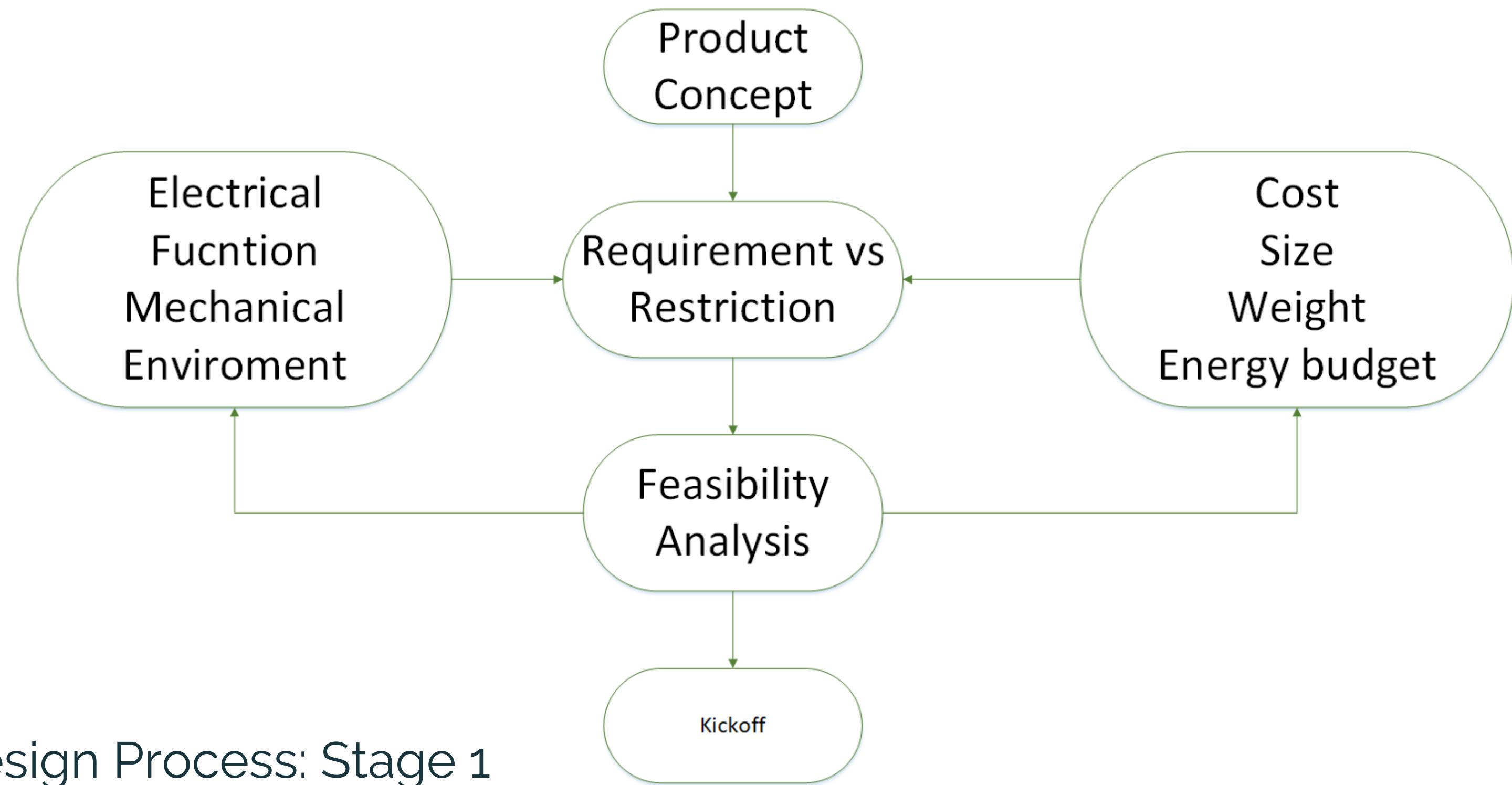
- **Legend/silkscreen/overlay**

Applied on top of solder mask

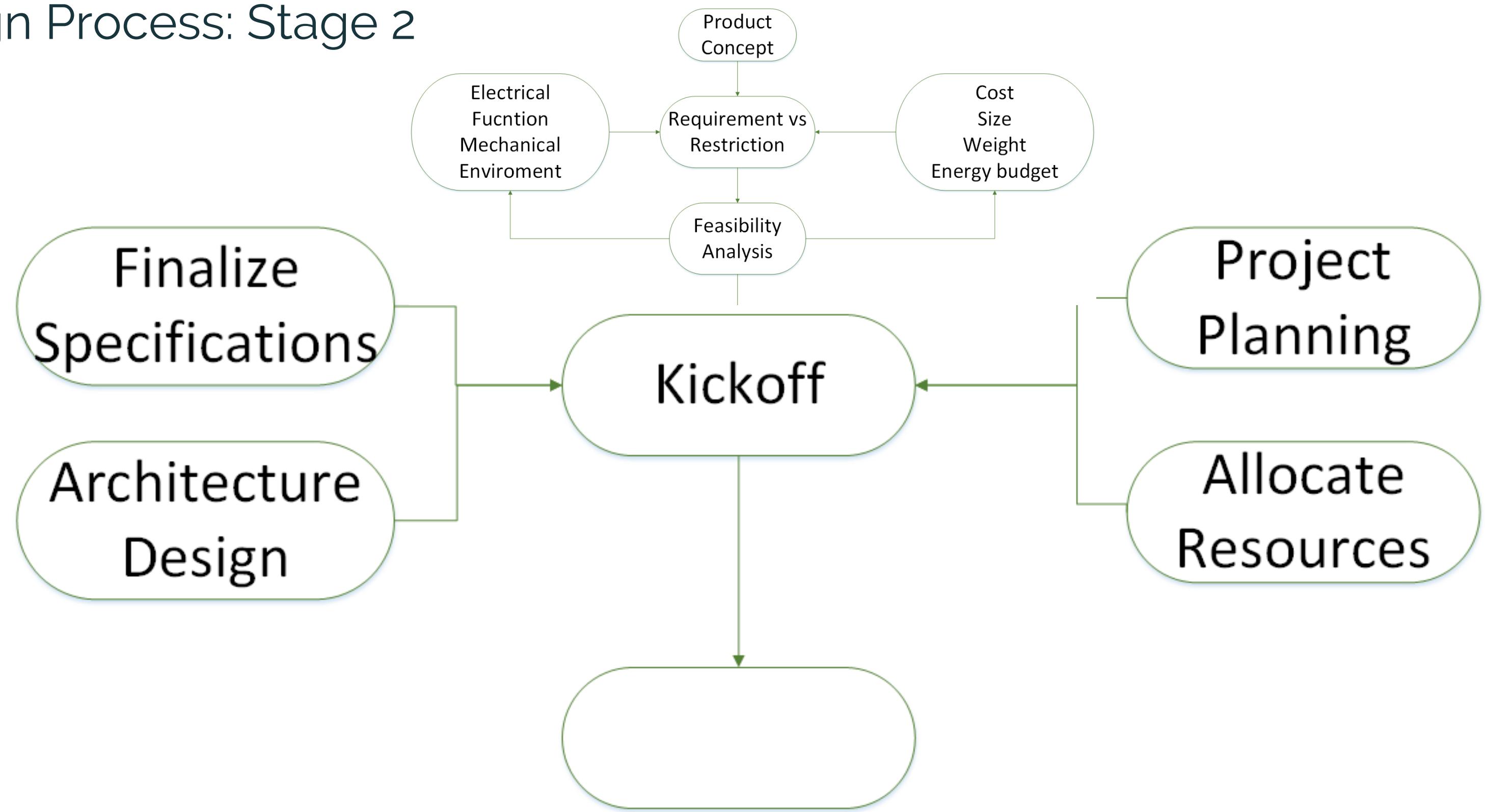
Provides information



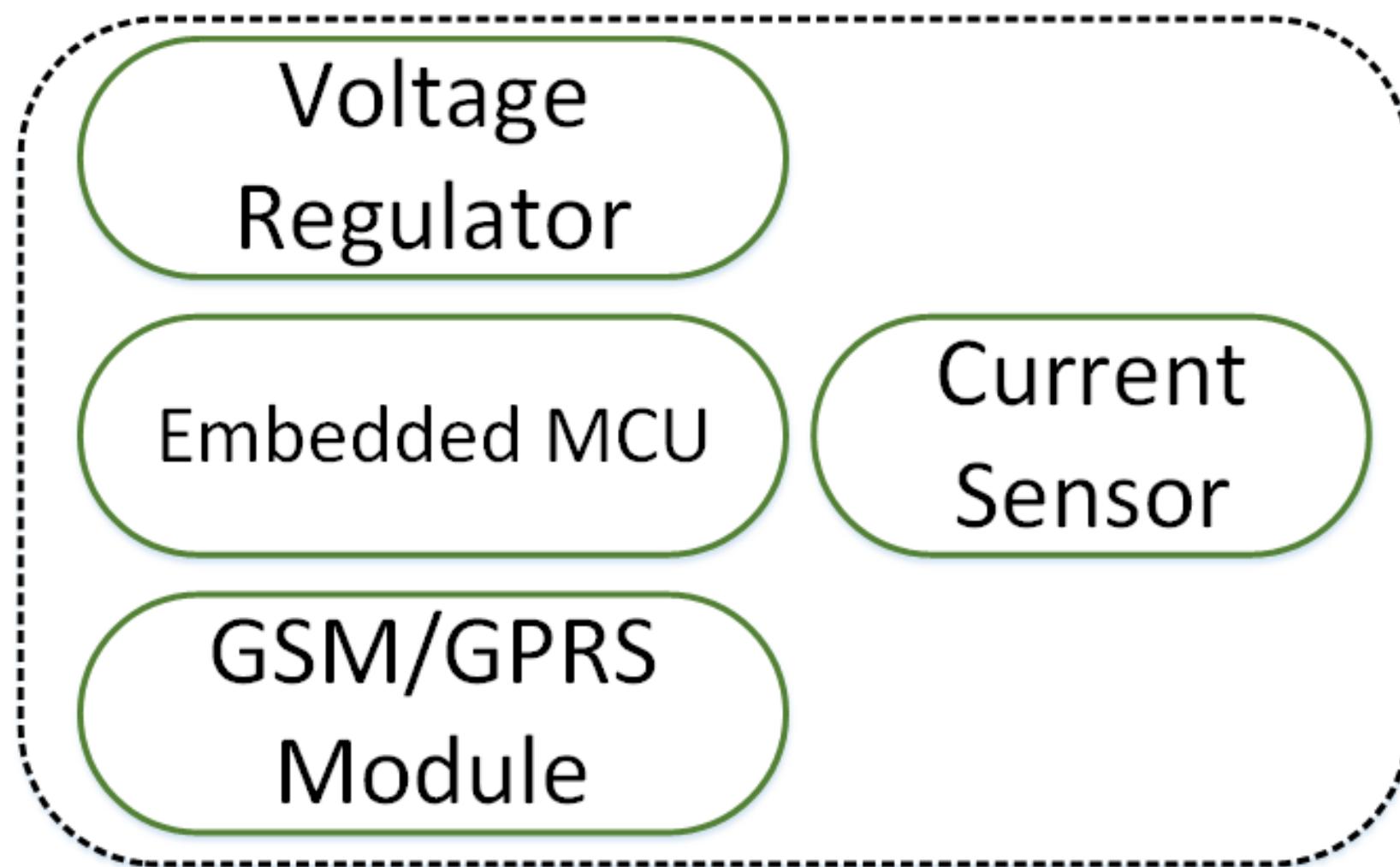
03 Design & Manufacturing Process



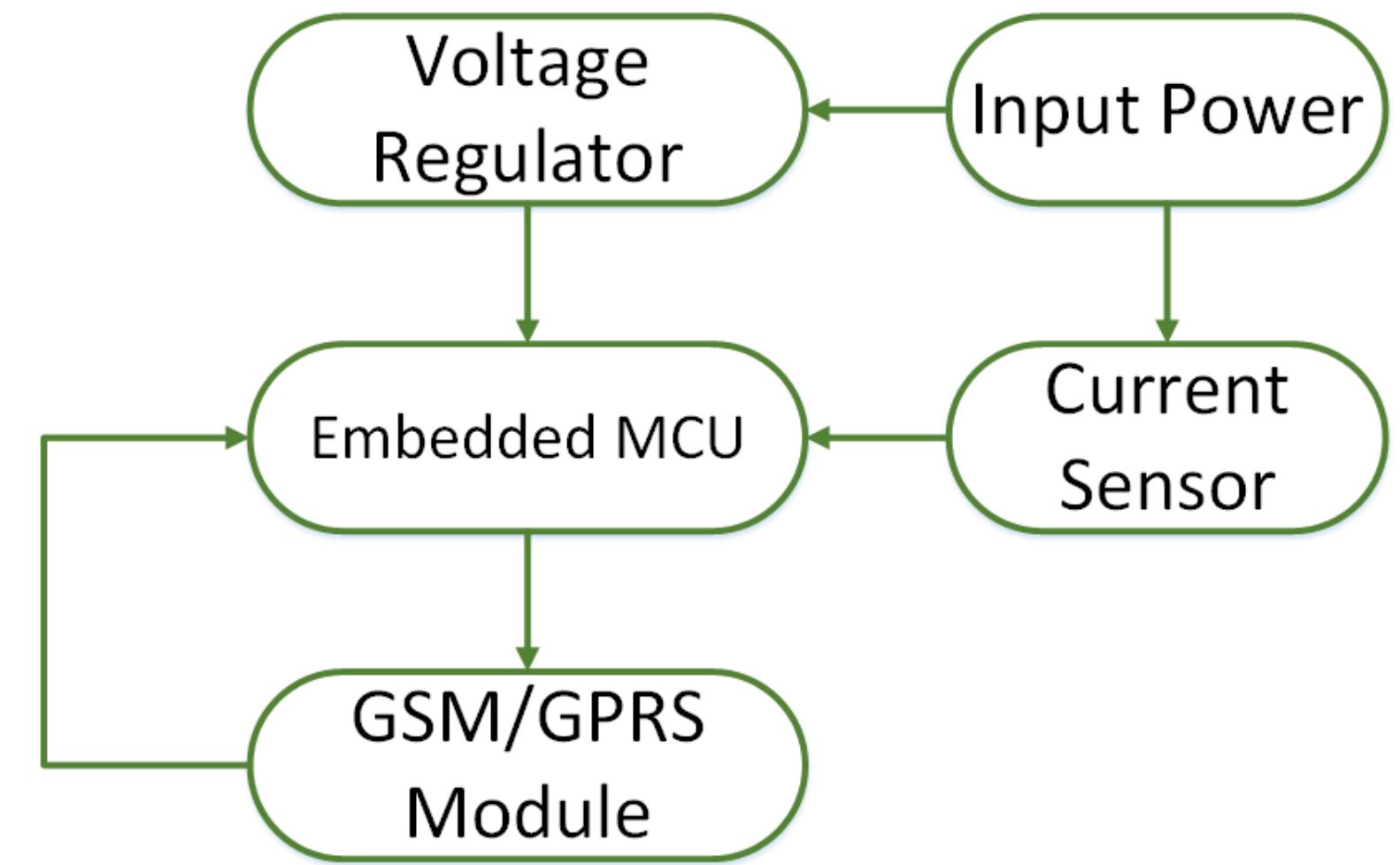
Design Process: Stage 2



Design Process: Stage 2



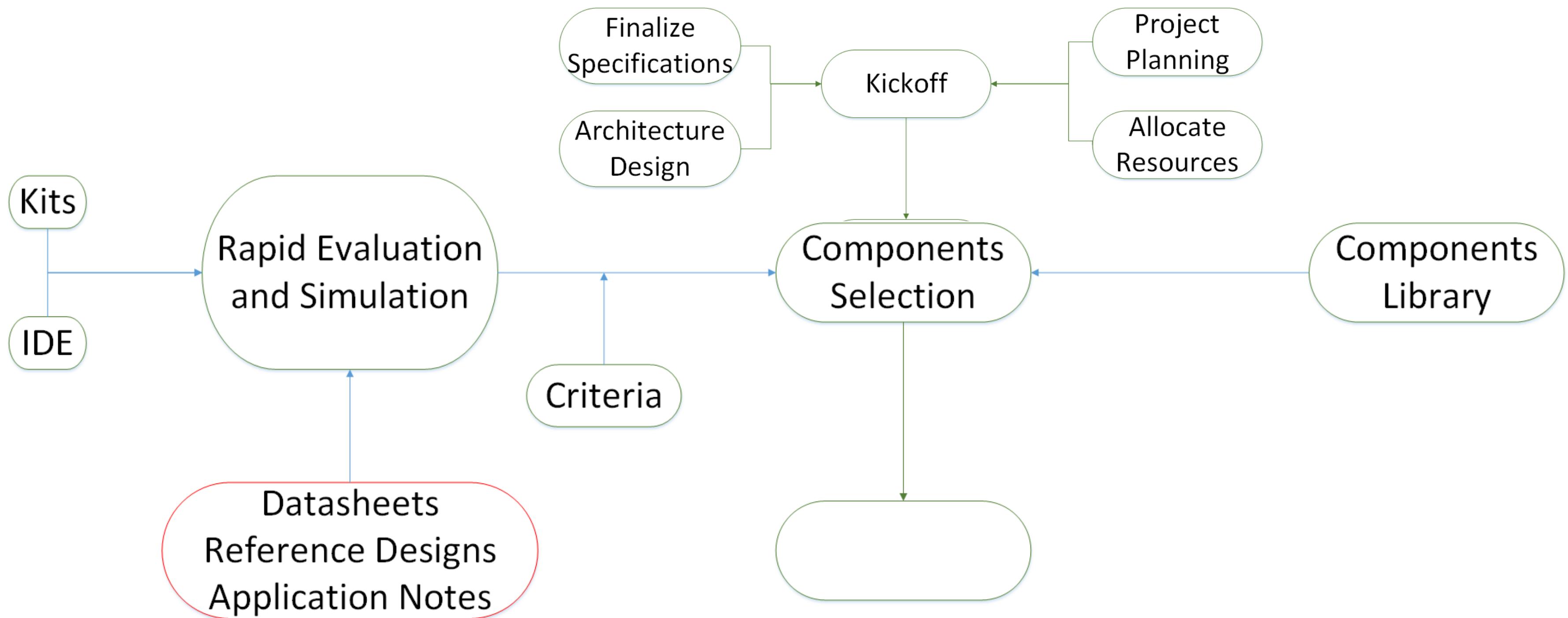
Functional Components



System Architecture



Design Process: Stage 3



04 Components Review

- **Passive Components**

R, L, C, TRANS, D? - PN

- **Active Components**

T, IC, D - (Zener, Tunnel)

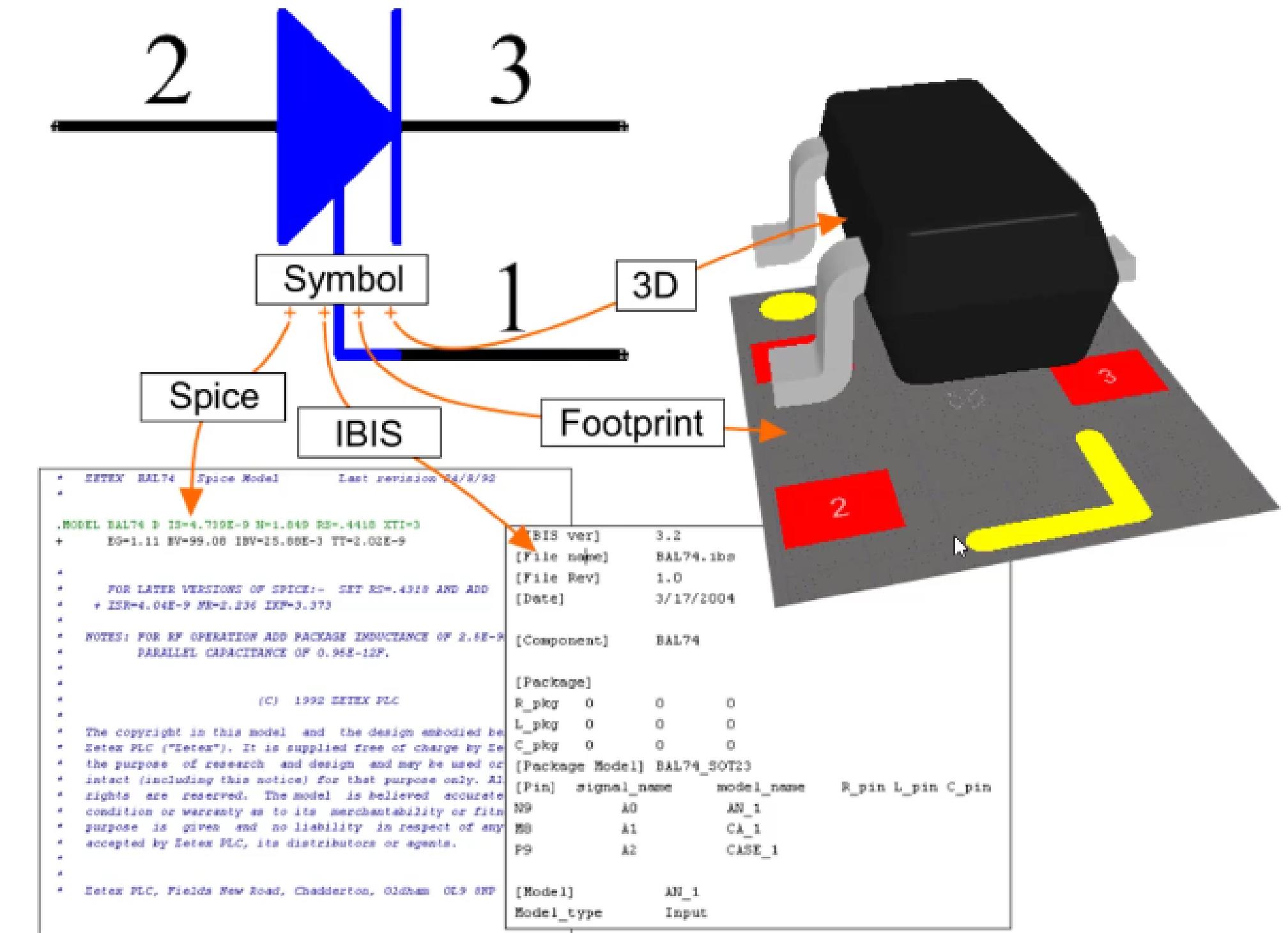
- **Electromechanical**

SW, RLY, etc



05 Models & Libraries

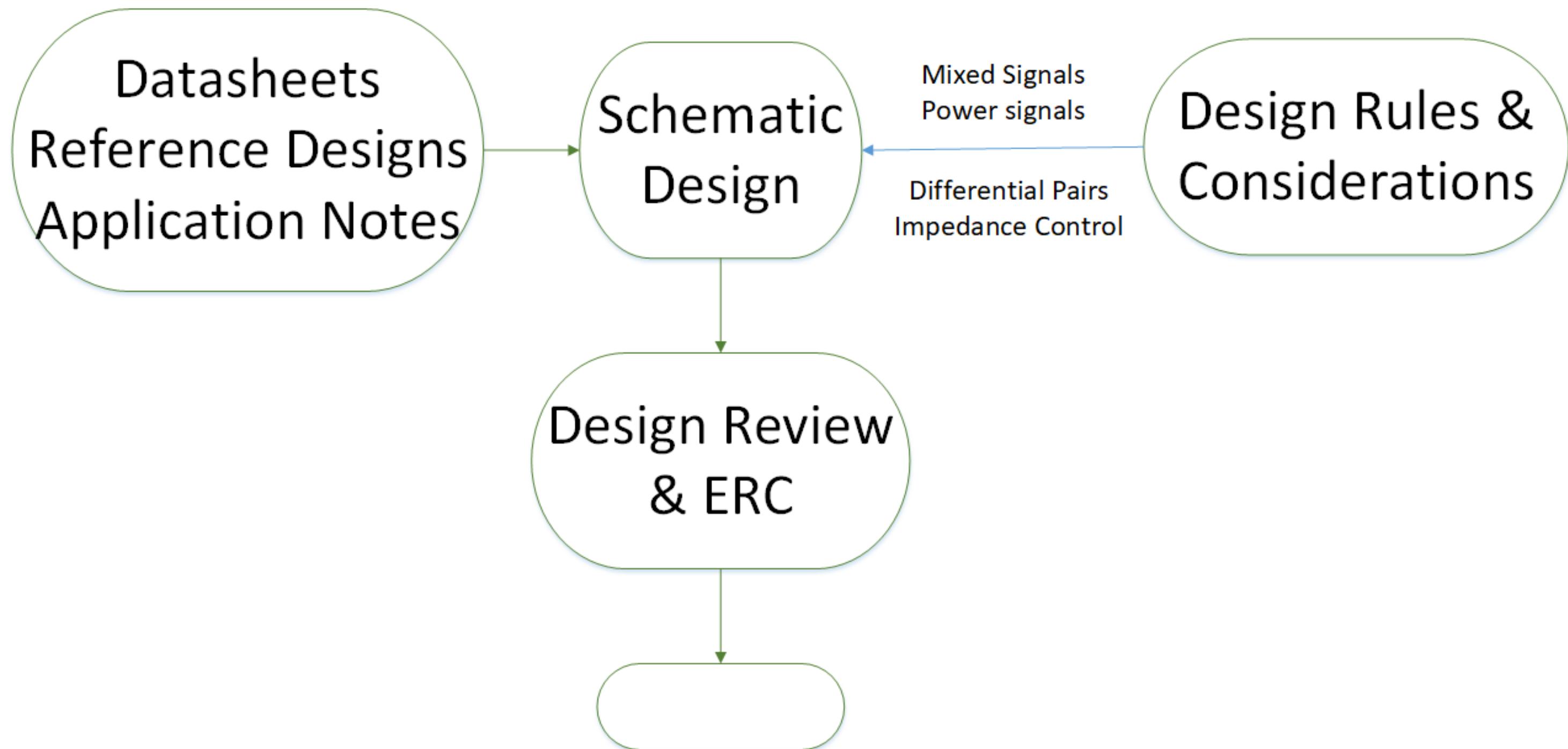
- **Schematic Symbol**
IEC Standard & US
- **PCB Footprint**
Through-hole and SMT
- **3D Model**
- **SPICE Model**
- **Signal Integrity Model**



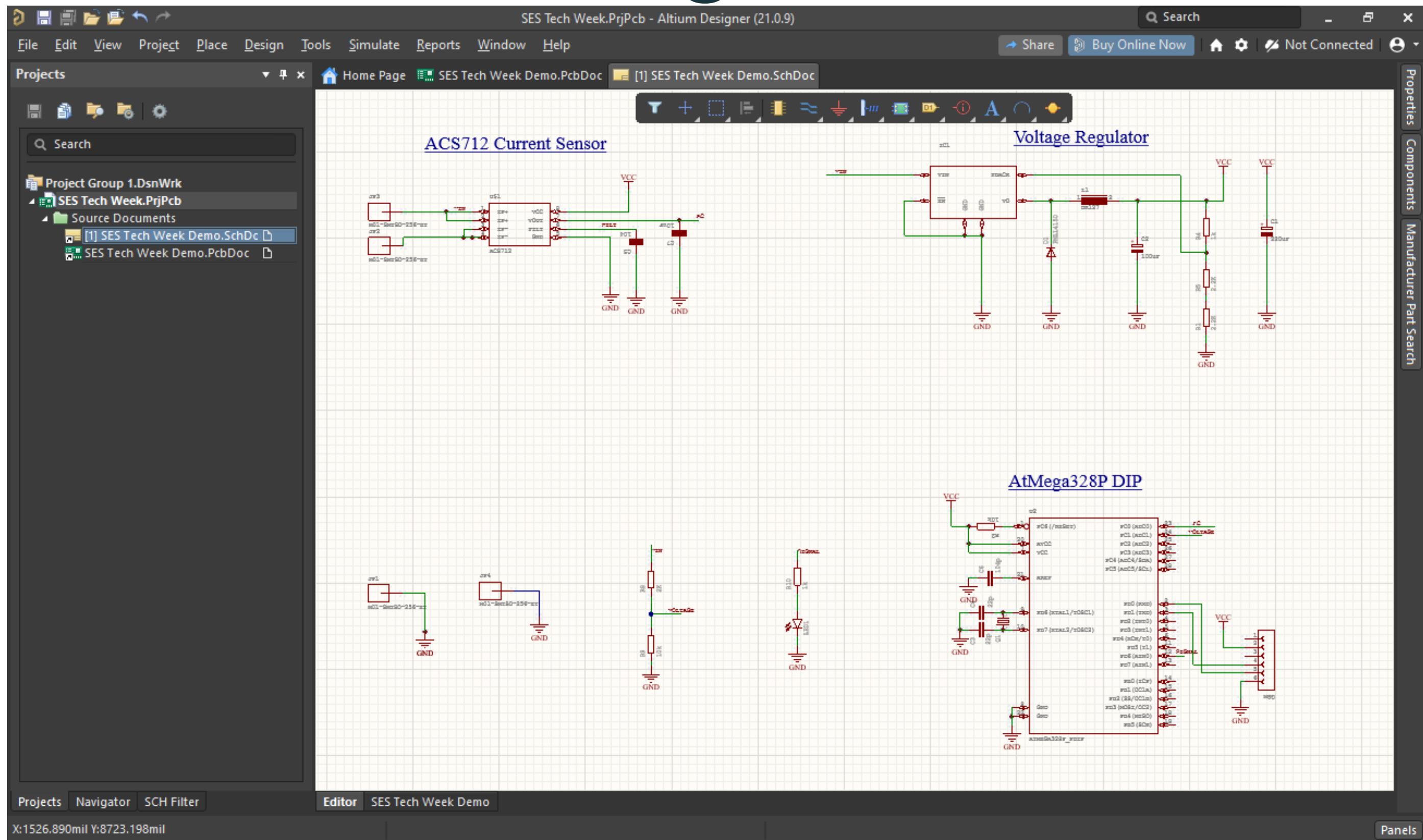
REF: [https://www.altium.com/documentation/19.1/display/ADES/\(\(Understanding+Models,+Components+and+Libraries\)\)_AD](https://www.altium.com/documentation/19.1/display/ADES/((Understanding+Models,+Components+and+Libraries))_AD)



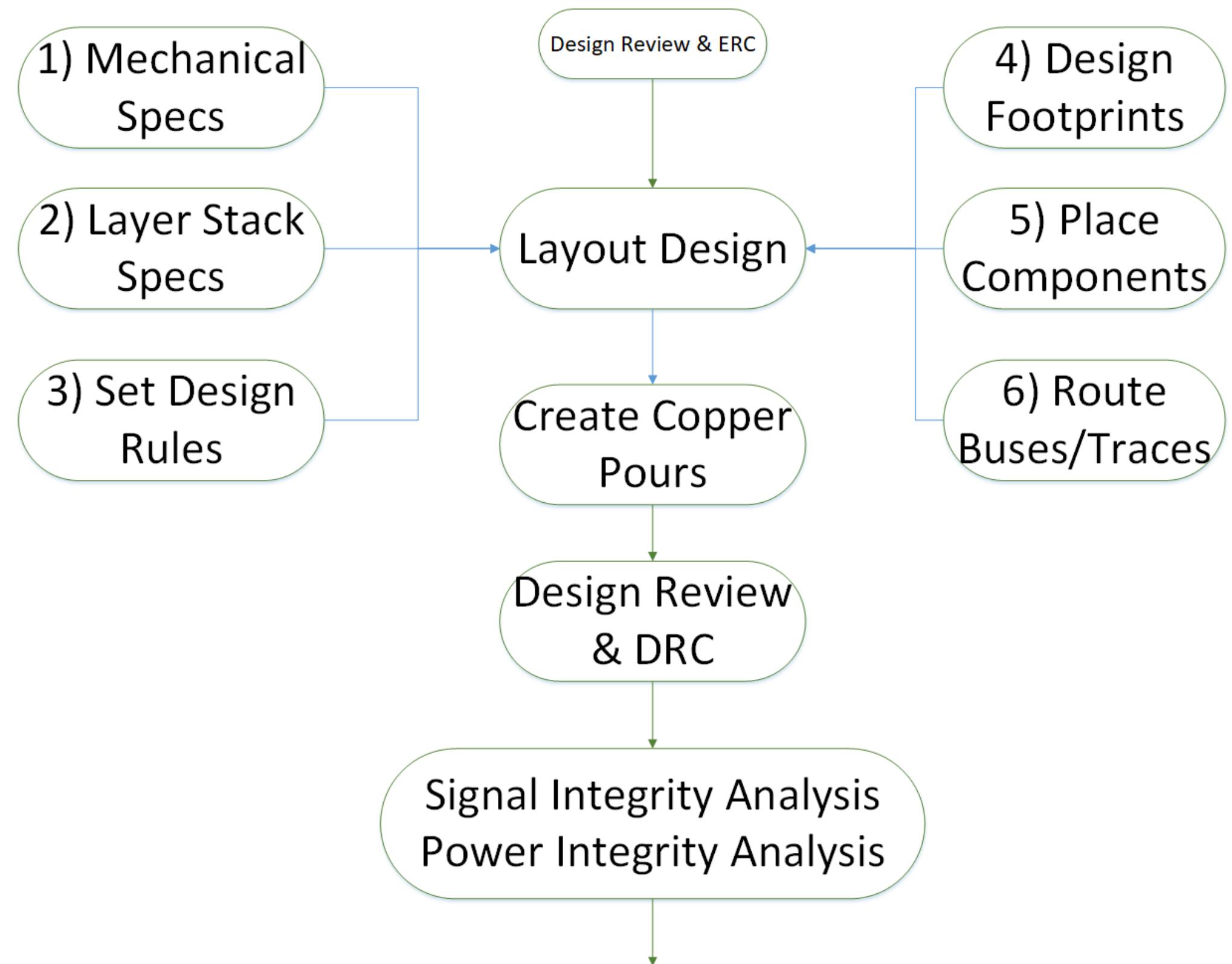
Design Process: Stage 4



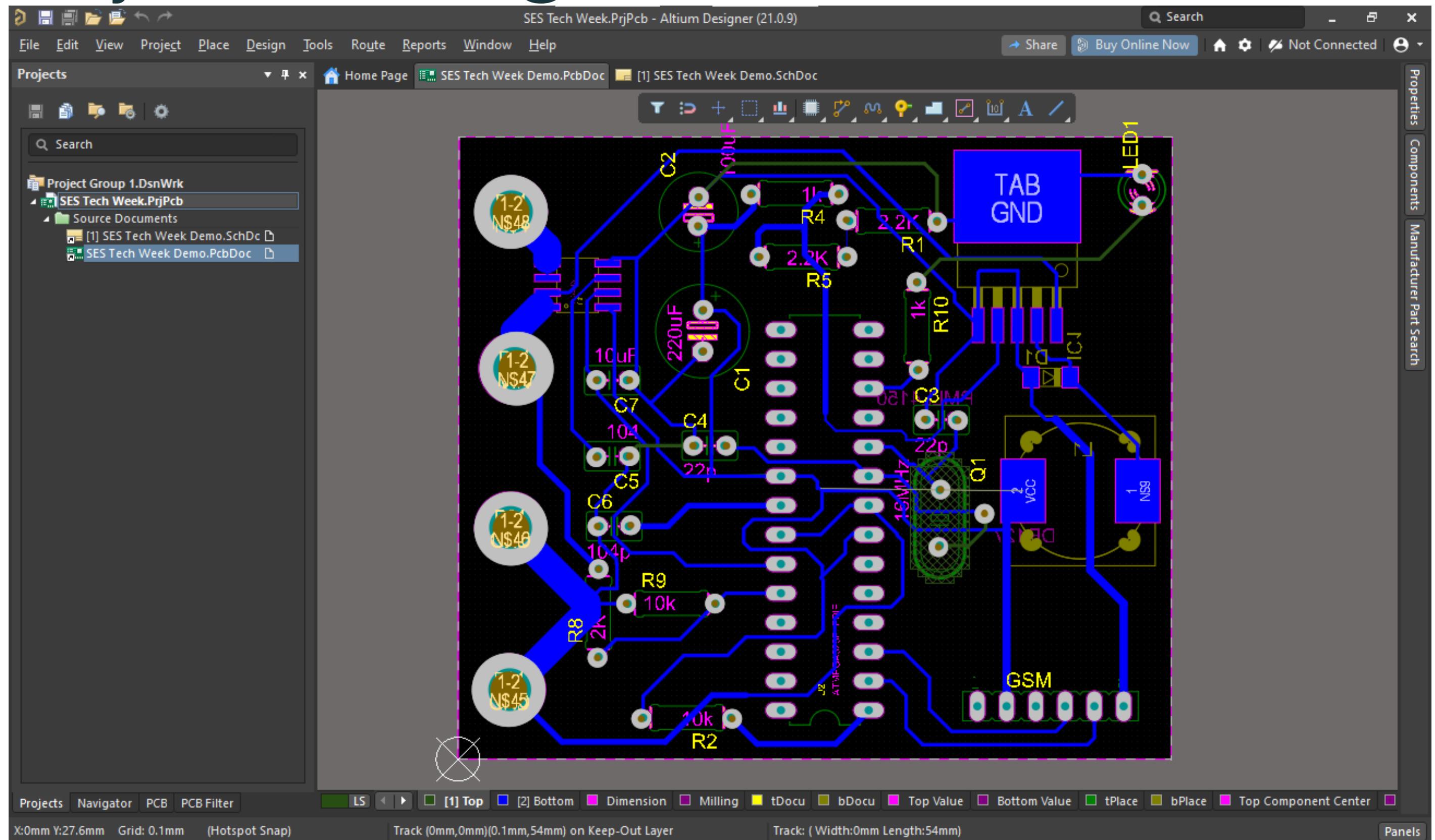
06 Schematic Design



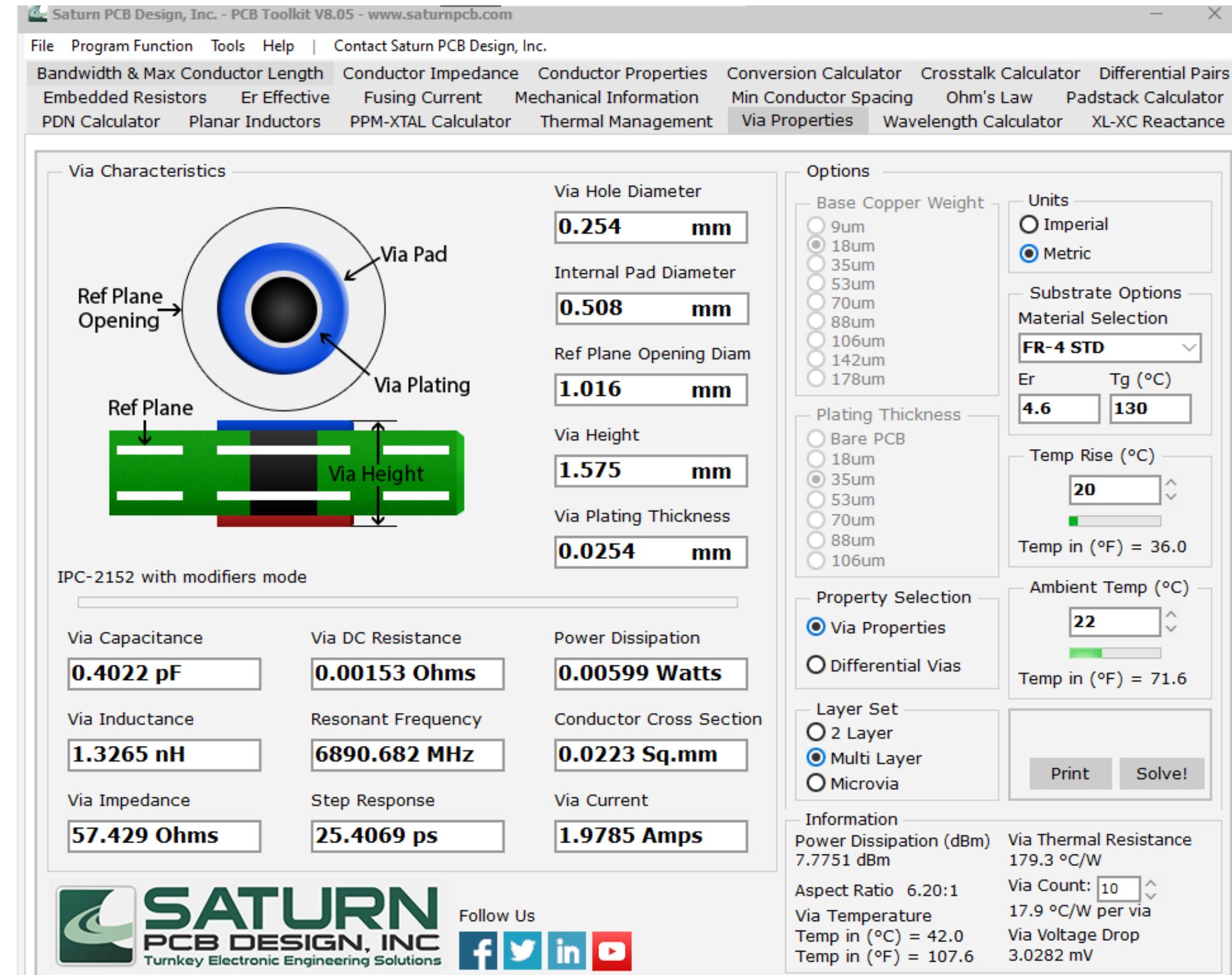
Design Process: Stage 5



07 Layout Design

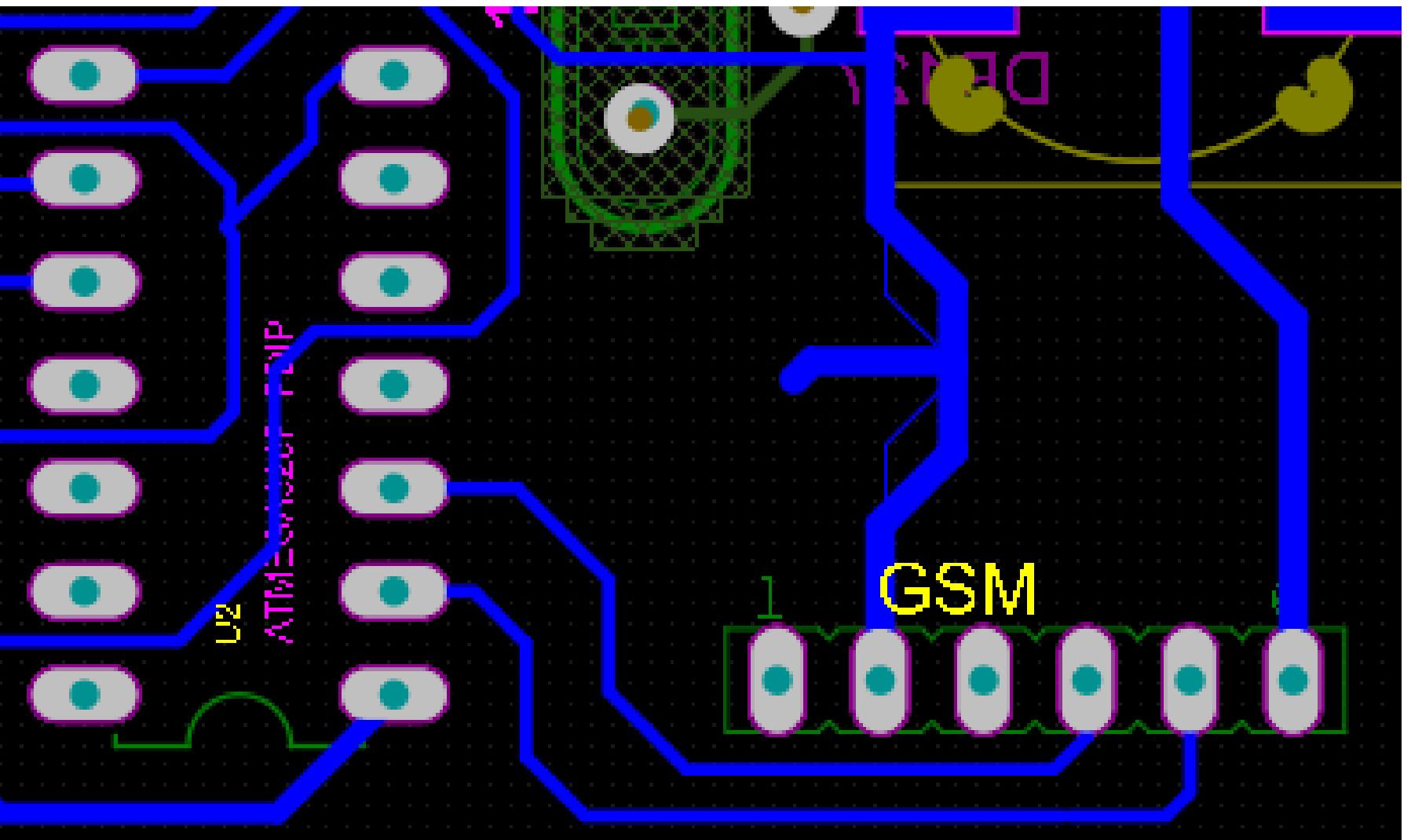


07 ERC/DRC

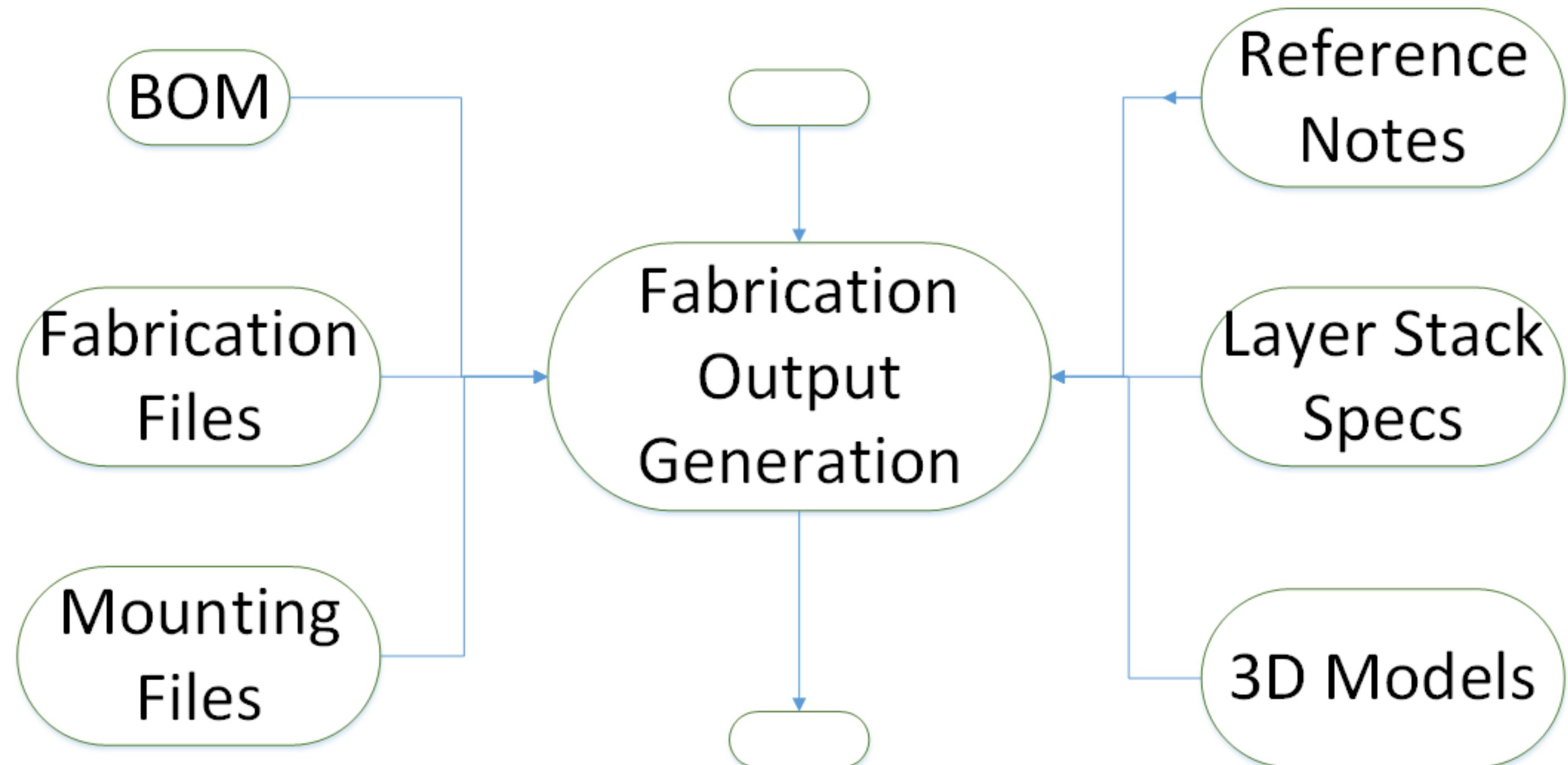


07 Routing

- Auto-Routing
- Active Routing
- Interactive Routing

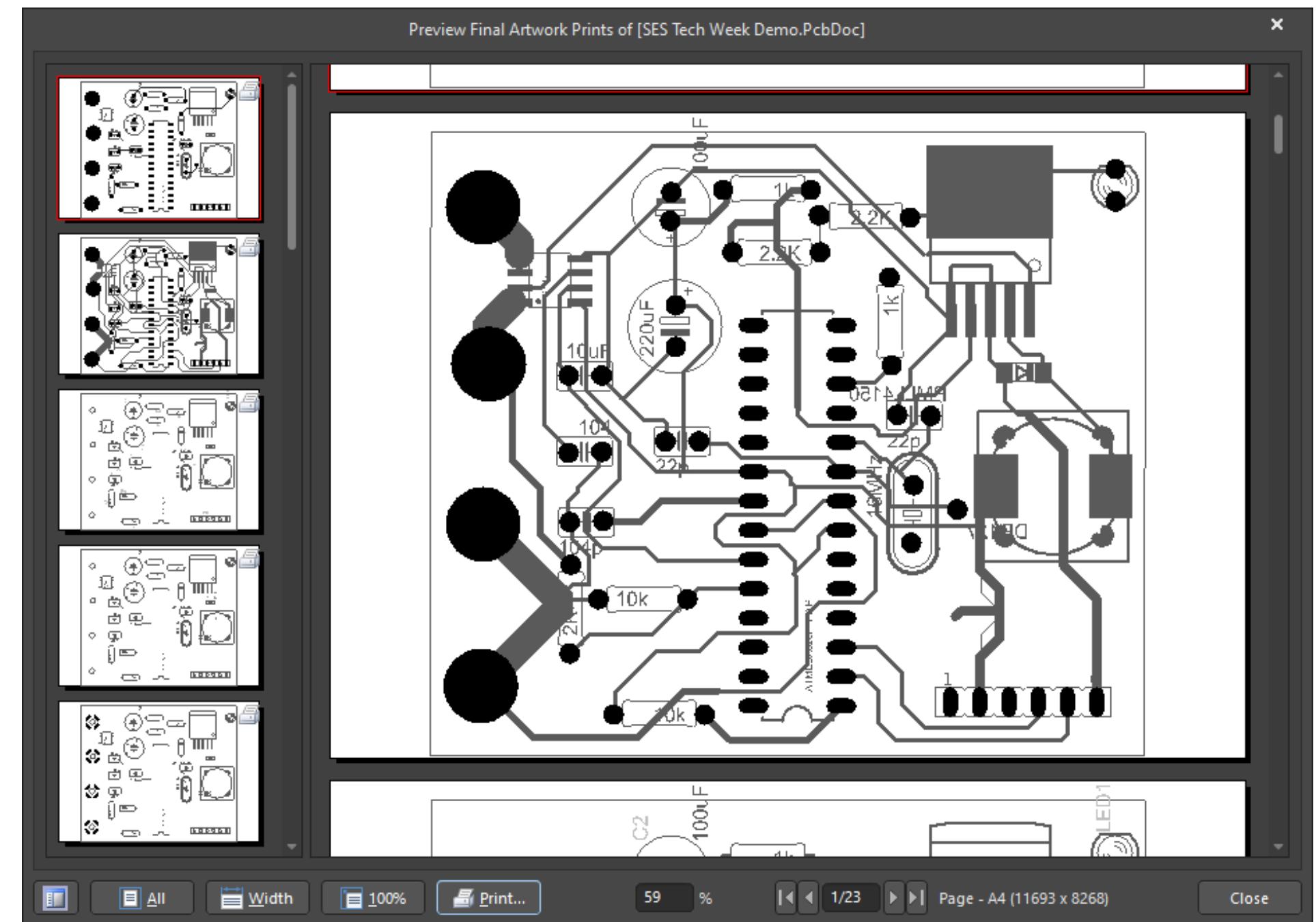


Design Process: Stage 6

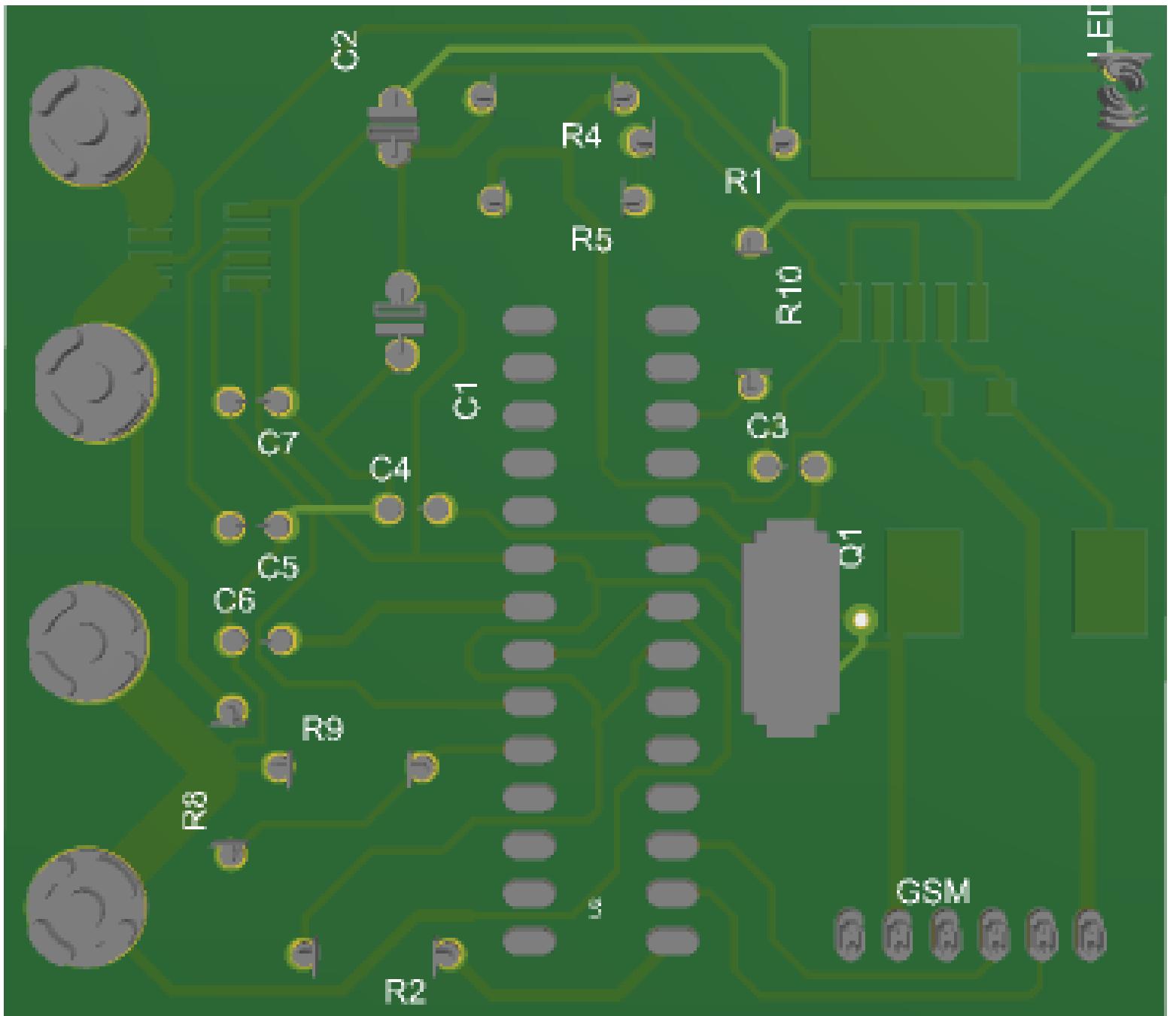


08 MFQ Output Generation

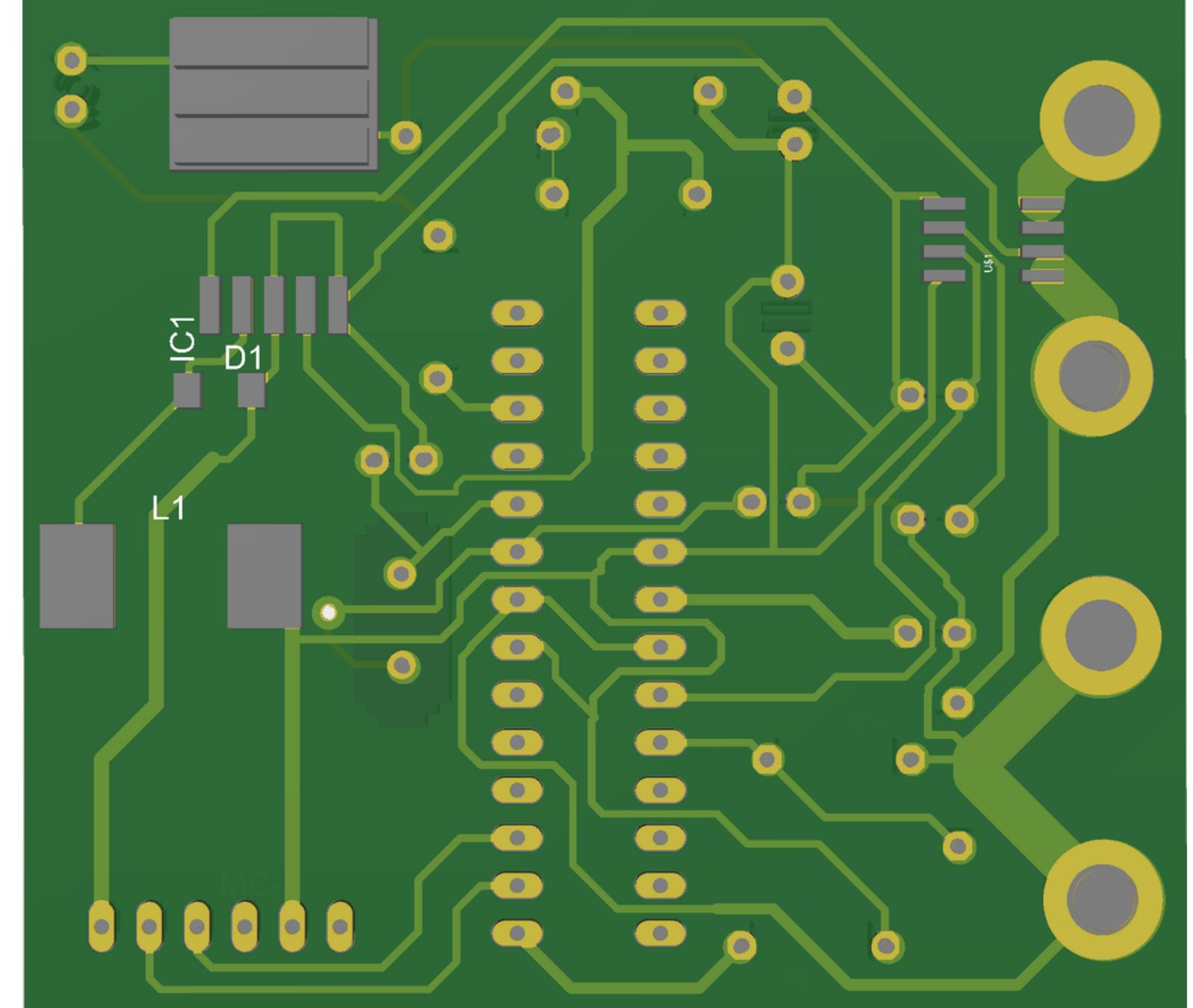
- Fabrication files
- Mounting files
- BOM
- Reference Notes
- Layer Stack specs
- 3D Model



PCB 3D Images Export



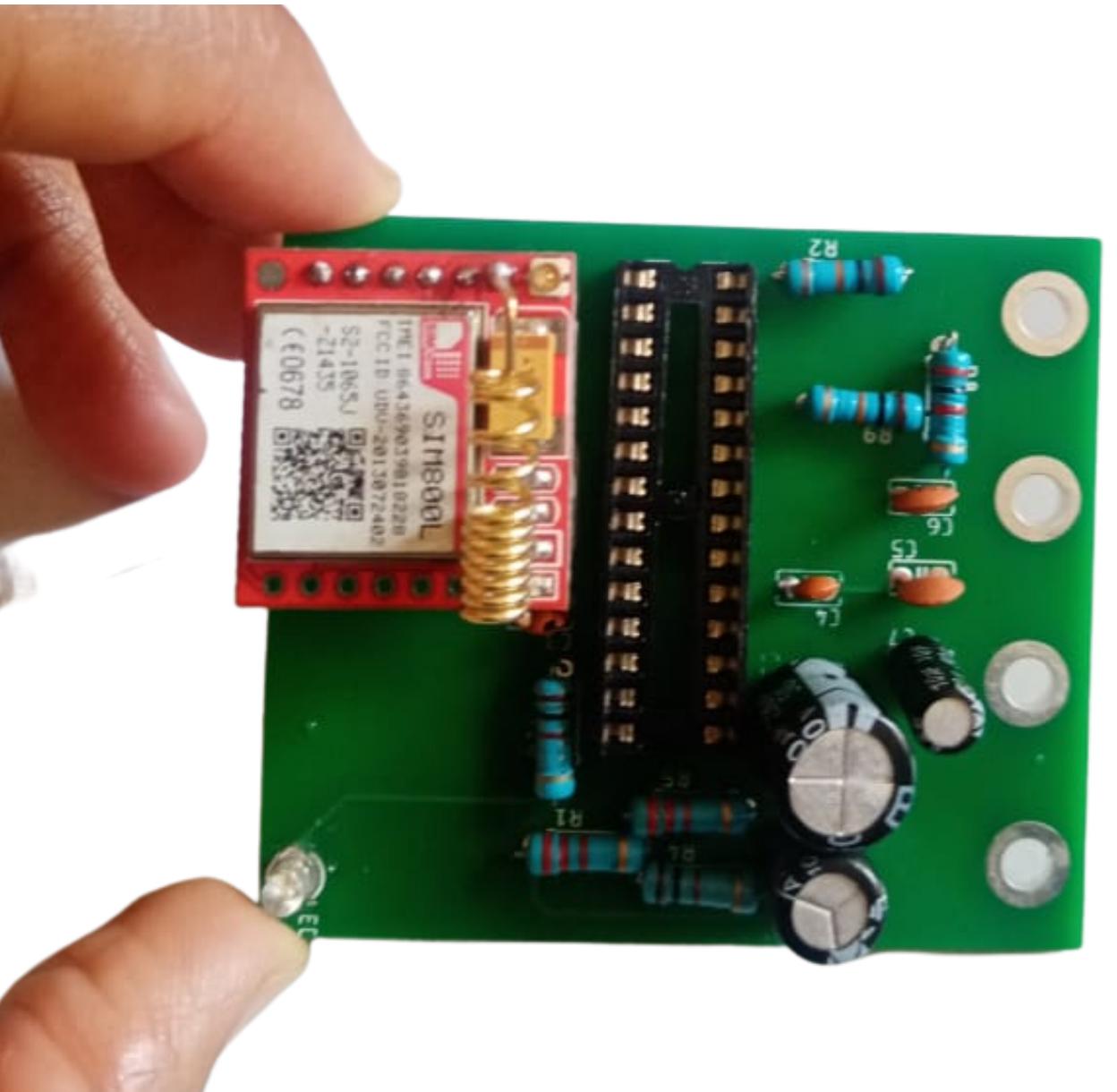
TOP View



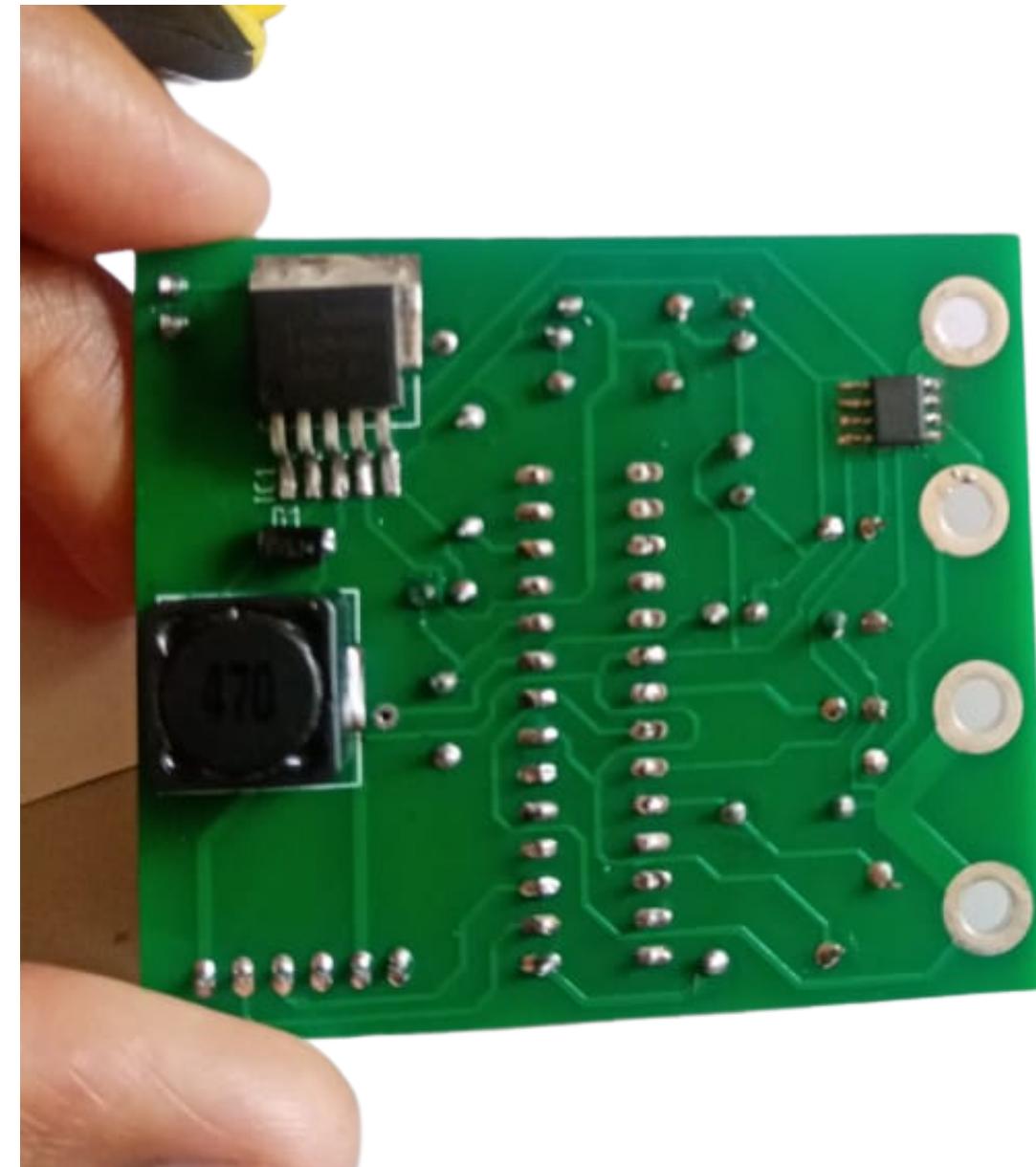
BOTTOM View



PCBA



TOP View



BOTTOM View



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Resources & References



The [Saturn PCB Toolkit](#)



PCB Design [YouTube Playlist](#)



PCB Libraries [Downloads](#)



[Predictable Designs](#)



[Altium Documentation](#)





Thank you!

You can't see the forest through the trees. To be a successful designer, you need to see both the trees and the forest!

Chrispine Tinega



tinegachris



tinegachris



tinegachris



tinega_chris