Factors that impact RF-PCB Design.

- Designing a Printed Circuit Board for Radio-Frequency (RF) applications is vastly different from designing a board for typical digital logic applications.

- Even small changes in layout geometry or component selection can make the difference between a board that achieves the desired performance vs one that underperforms or is prone to instability or oscillations.

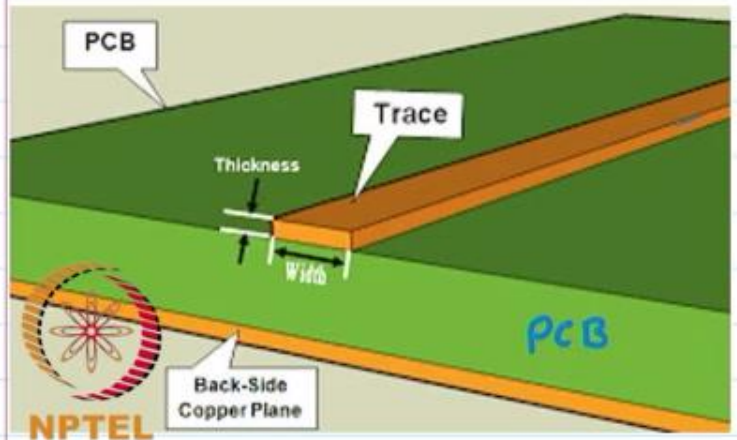
- Managing parameters like transmission line properties and impedance matching accurately across the whole RF signal chain impacts overall system performance.

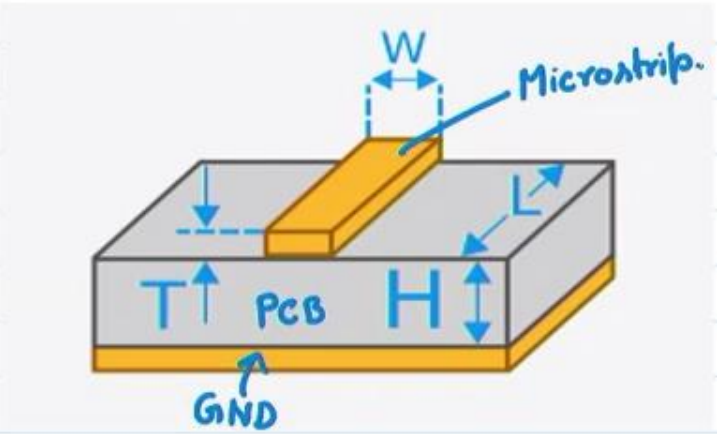
Operating Frequency :

The RF PCB layout approach varies tremendously across the frequency-spectrum.

- For lower HF or VHF bands, surface traces will suffice.

- UHF and above frequencies, microstrips or striplines are used in dielectric substrate.



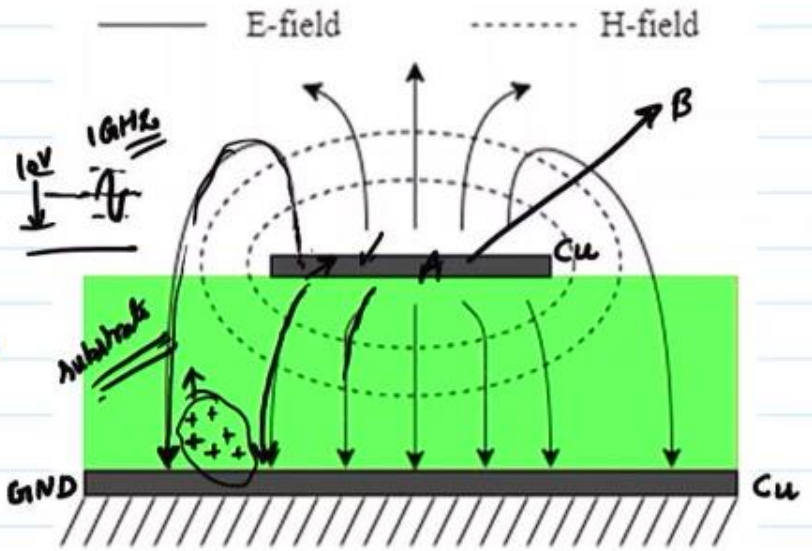


Di-electric Constant (Dk):

- The dielectric layer material heavily influences the impedance and velocity of RF signal in traces.
- Materials with stable Dk allow controlled impedance traces to be created.
- Common substrate for RF use are FR4 (Dk ≈ 4.5), Rogers (Dk ≈ 3), and ceramic filled PTFE composites.

Loss Tangent :

- Dielectric materials have inherent losses indicated by the loss tangent (Df).
- Choose a material with low Df to minimize insertion loss in transmission lines.
- Glass microfiber substrates offer exceptional Df and well suited for wireless applications.

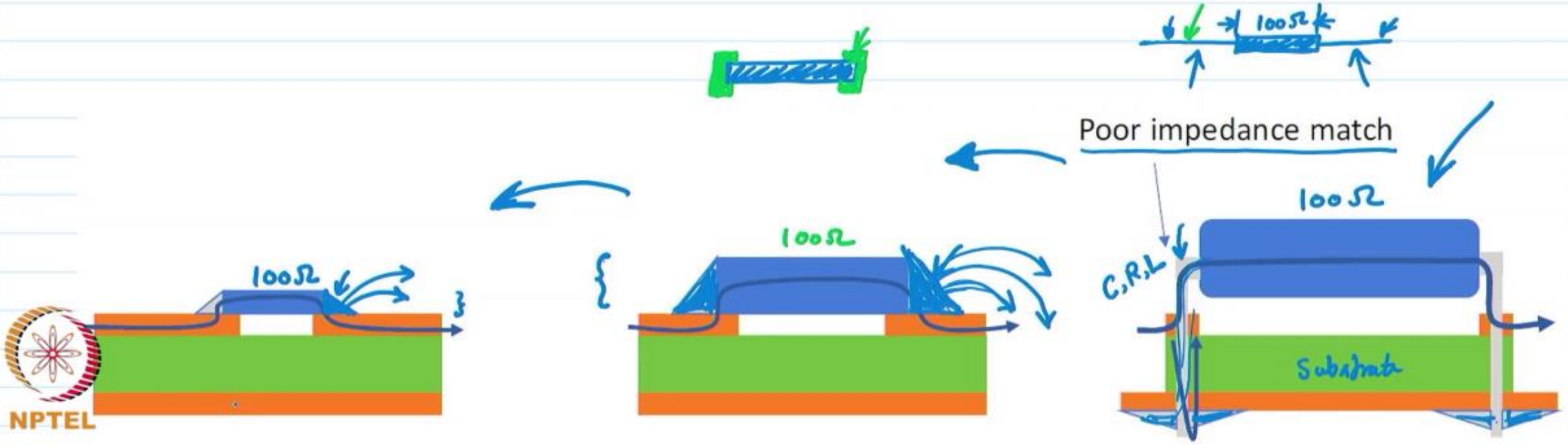


Impedance Matching :

As RF signal encounter discontinuities from traces to Pads, vias and components, abrupt impedance mismatch causes problematic signal reflections.

Component Selection :

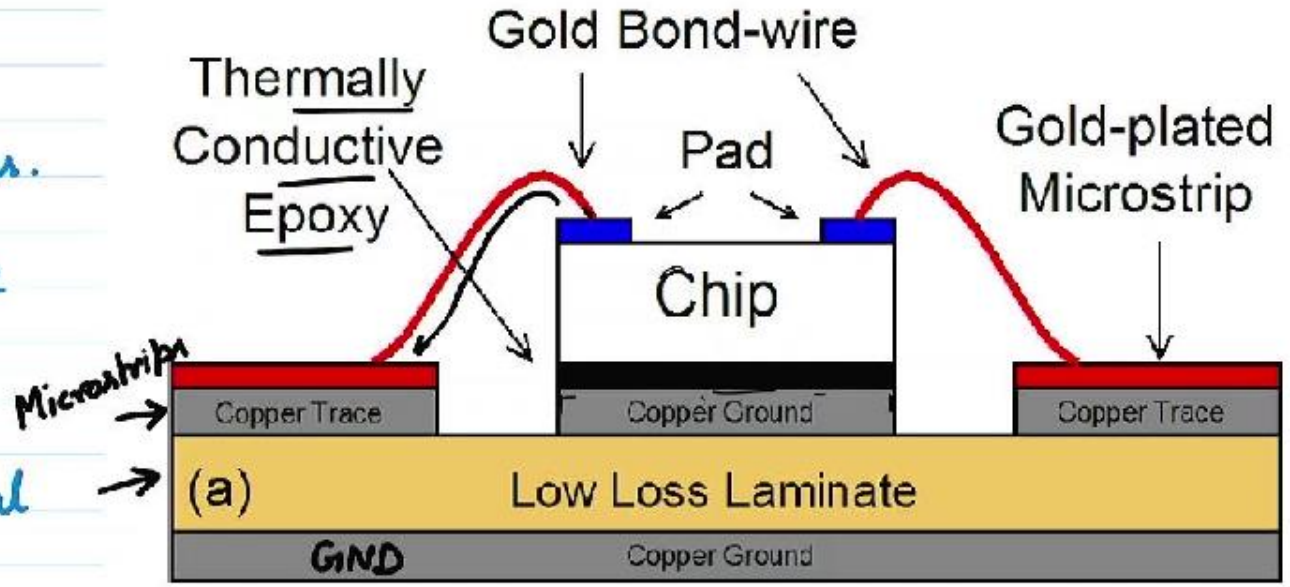
All components have parasitics. but they are especially pronounce at high frequency.



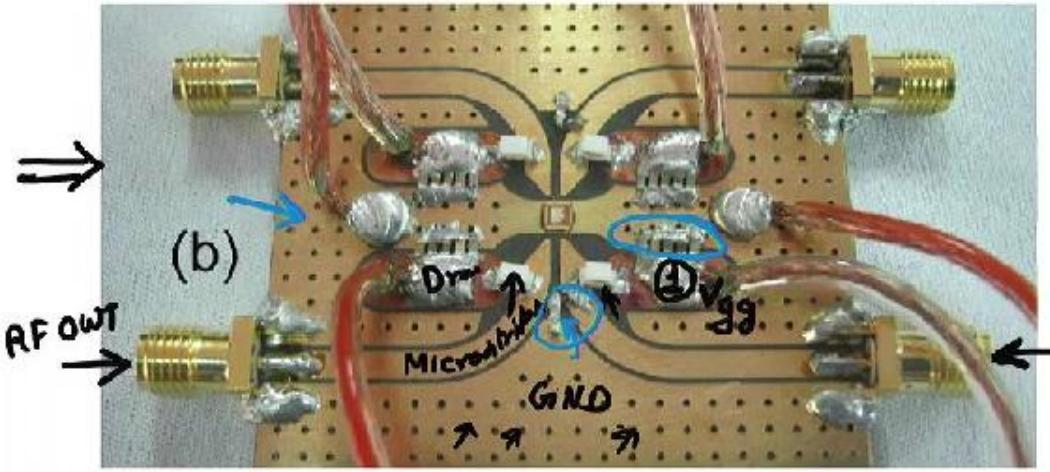
RF PCB :

Key considerations :

- Gold bondwires are used for connections.
- Each bondwire has ~1nH inductance for ~1cm long length.
- Thermal conductive epoxy for thermal management.
- Rogers Duroid substrate for low RF loss.
- Decoupling capacitors.
- Stability RC network.
- All smd components to reduce parasitics.



RF PCB Photo



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