Shunt Characterization Technique of Decoupling Transmission Line for Millimeter-Wave CMOS Amplifier Design

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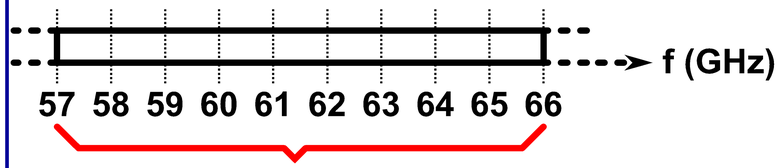
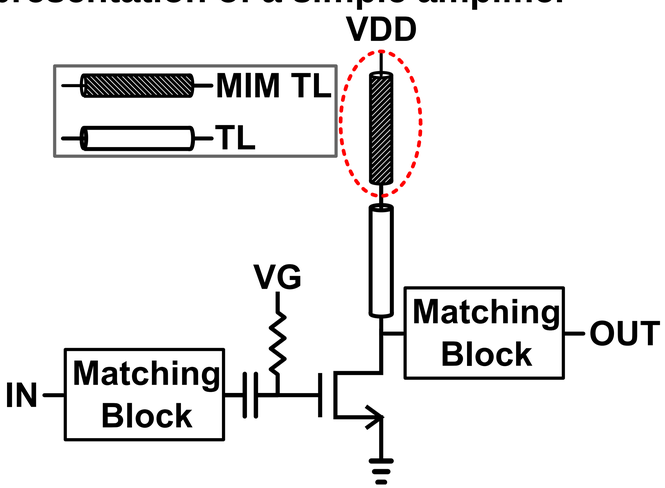
1. Motivation



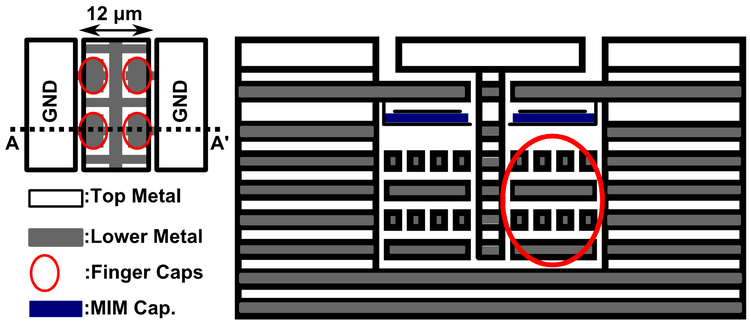
- 60-GHz wireless communication with 9 GHz unlicensed bandwidth
  - Wide bandwidth: 2.16 GHz x 4 channels
  - Ultra high data rate:
    64QAM → 10.56Gbps/ch
    64QAM → 42.24Gbps (4-ch bonding)
- Secure communication

- Representation of a simple amplifier



- Decoupling of DC and RF:
  - Metal-Insulator-Metal TL
  - Lumped components lacks accuracy
  - More reliable in millimeter-wave

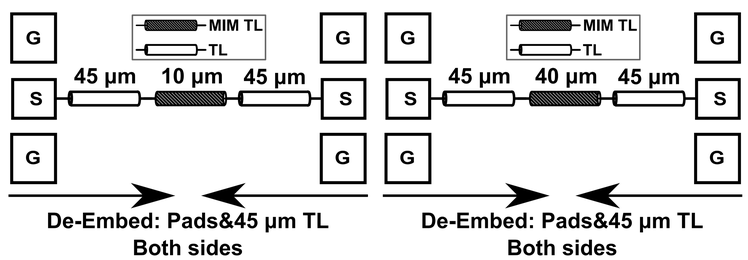
2. MIM Transmission Line



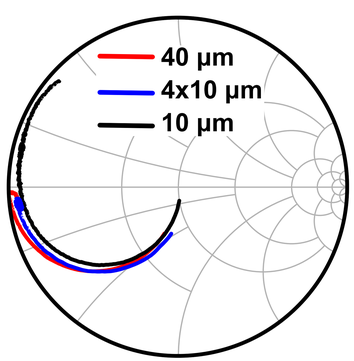
- Desired MIM TL characteristics:
  - Low characteristic impedance (1~3 Ω)
  - High RF loss

Issues:

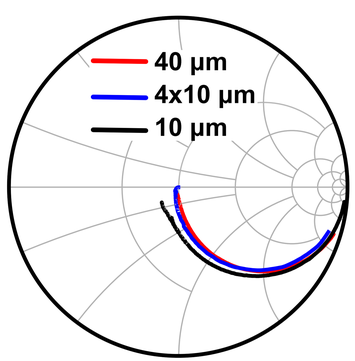
- Direct measurement accuracy



Return Loss

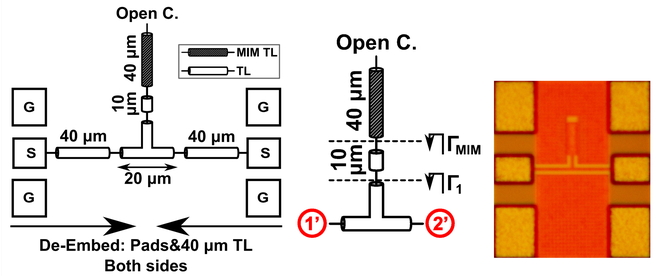


Insertion Loss

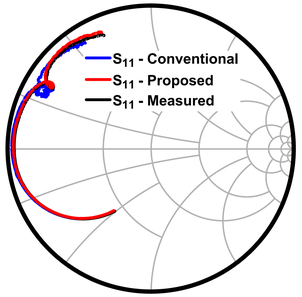


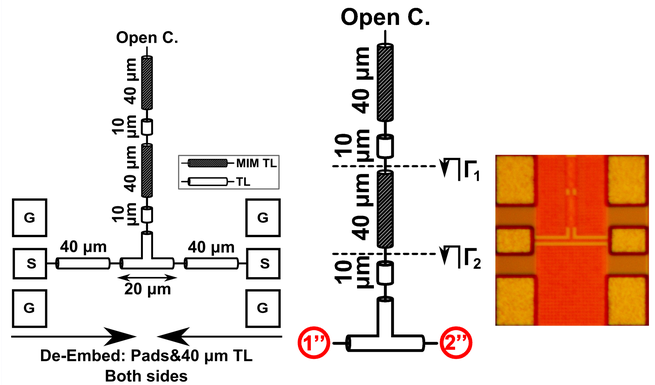
3. Shunt Characterization

- Two characterization structures

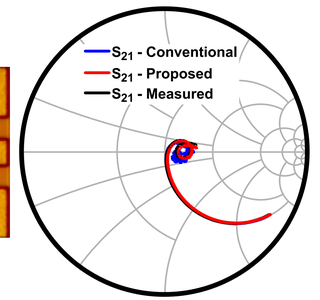


Return Loss





Insertion Loss



4. Conclusion

- Metal-insulator-metal decoupling transmission line with very low characteristic impedance
- Inaccuracy in direct measurements
- A shunt characterization method is proposed for increased accuracy
- S-parameters of Metal-insulator-metal transmission line calculated from reflections
- Shunt characterization results show good agreement up to 110 GHz
- Better agreement than conventional approach