TestConX中国 China

Virtual Event

November 1 – 4, 2022 Virtual Event

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5G/mmWave

TestConX China 2022

Air over stub for 56Gbps Serdes And mmWave

Rui Chen Teradyne



Virtual - November 1-4, 2022



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Air over stub for 56Gbps Serdes and mmWave



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Introduction

- High frequency applications keep challenging the PCB manufacturing capability and simulation accuracy
- Via is a common structure on PCB and via stub loss will do effect on the high frequency signal quality for any usage
- This presentation will analyze the impact of via stub loss to the 56Gbps Serdes and mmWave signals, then introduce the high frequency SI improvement by air over stub



Air over stub for 56Gbps Serdes and mmWave



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Via stub loss: reflection and radiation

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 Reflection caused by impedance discontinuity



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Radiation

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Session 2

Presentation 2

5G/mmWave

Session 2 Presentation 2 5G/mmWave

MFG process sequence: epoxy filling vs backdrill

- For some critical signals, we will request fab vendor to fill PTH vias with non-conductive material (epoxy) and do back-drill to minimize the stub length.
- General PTH (Plated Trough-Hole) via process in PCB manufacturing



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Session 2 Presentation 2

5G/mmWave

MFG process sequence: epoxy filling vs backdrill

- The sequence of these two procedures will make a difference:
 - Back-drill first, then filling: space over stub will be filled with epoxy
 - Filling first, then back-drill: space over stub will be air



Session 2 Presentation 2

5G/mmWave

Air over stub impact on 56Gbps Serdes

• Dielectric over stub

• Air over stub



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Session 2 Presentation 2

5G/mmWave

Air over stub impact on 56Gbps Serdes

• Dielectric over stub



• Air over stub



Much bigger insertion loss @ 45~56GHz because of stub radiation.



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Air over stub impact on 56Gbps Serdes

• Dielectric over stub



• Air over stub



Eye height is 10% bigger than dielectric over stub, thanks to the lower loss @45~56GHz

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Session 2 Presentation 2

5G/mmWave

Air over stub impact on mmWave (back-drill size)

• Dielectric over stub

• Air over stub



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Session 2 Presentation 2

HFSSModel

80.00

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5G/mmWave

Air over stub impact on mmWave (back-drill size)



TDR

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-6.69 -8.64

-11.54

70.00

Session 2 Presentation 2

5G/mmWave

Air over stub impact on mmWave (back-drill size)

Return Loss





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Summary and Conclusion

• Manufacturing

- From the perspective of Signal Integrity performance, we prefer the space over stub to be filled with air, rather than dielectric
- For high frequency (>28GHz) PCB application, back-drill process preference (epoxy filling first, back-drill last) should be addressed

• Simulation

- For high frequency (>28GHz) simulation, the air over stub needs to be taken into consideration
- Bigger back-drill diameter may improve high frequency Signal Integrity for the case of air over stub



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2022

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