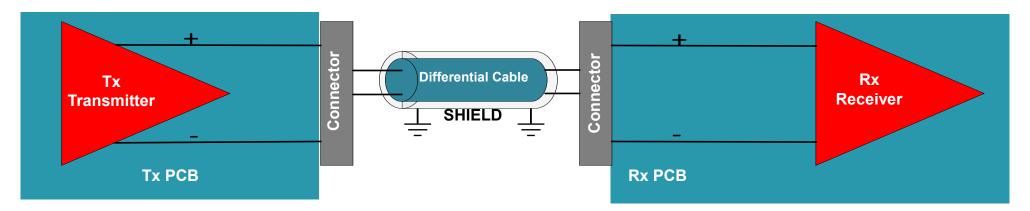
Transmission Channel Basics TI Precision Labs

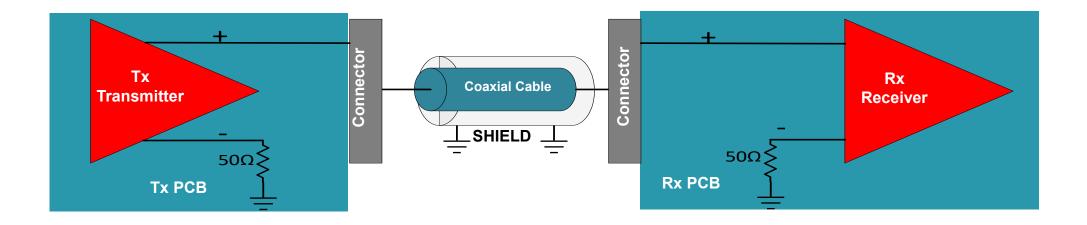
Prepared by Vijaya Ceekala Presented by Casey McCrea





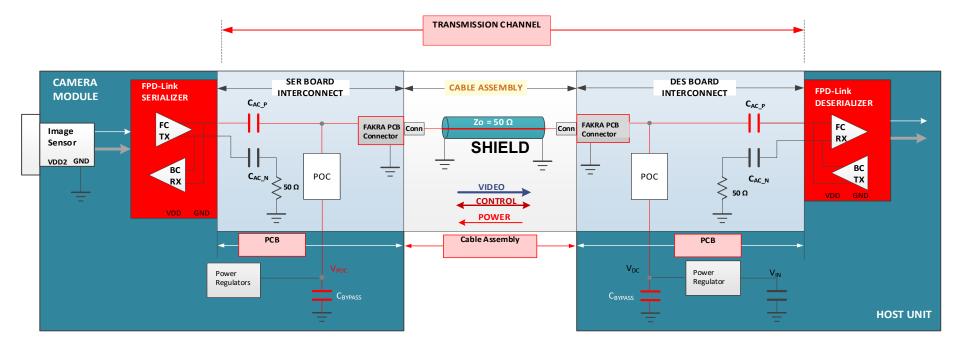
Signaling topologies

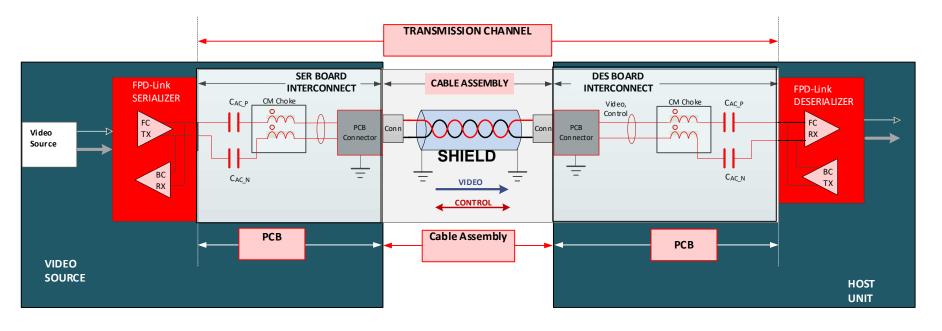






FPD-Link III signaling topologies

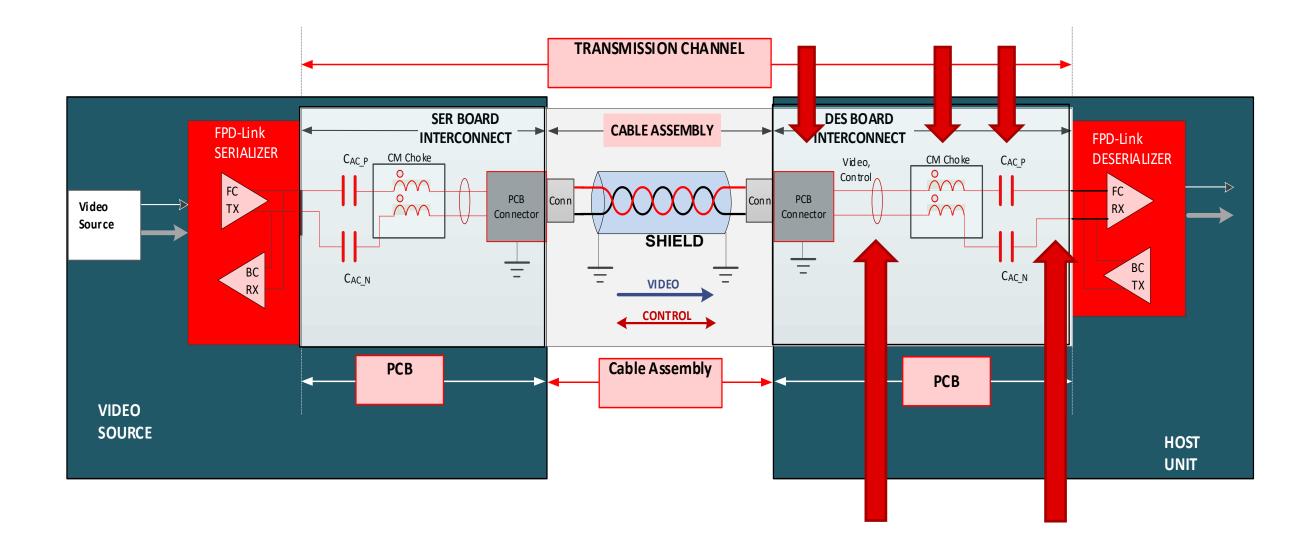






Transmission channel – differential signaling

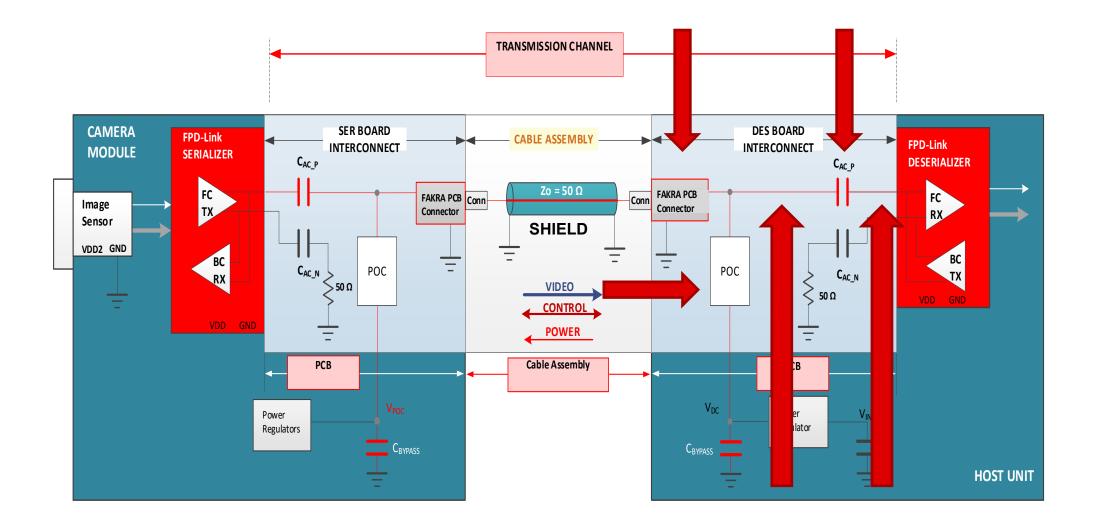
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Transmission channel – coaxial signaling



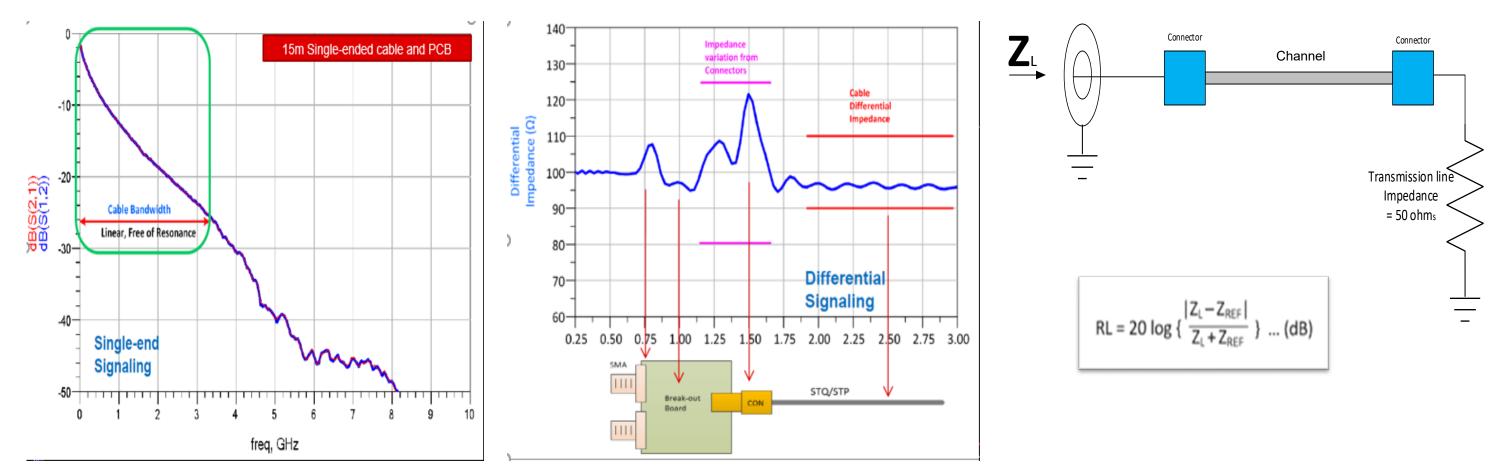


Key transmission channel parameters

Insertion loss

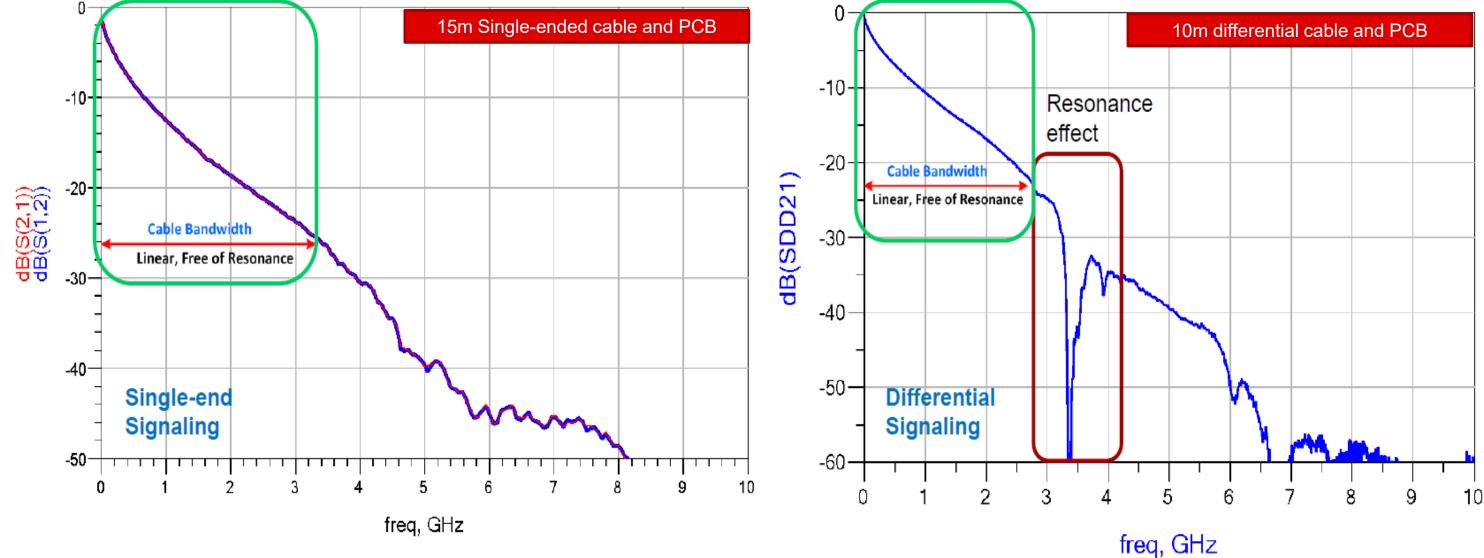
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 Return loss Impedance mismatch





Channel parameter – insertion loss



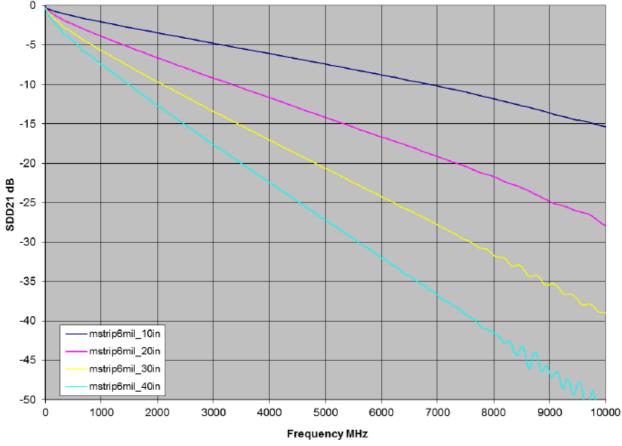
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Insertion loss from PCB traces

0 -5 -10 -15 -20 몀 SDD21 -25 -30 -35 -stripline5mil 7p5in -40 stripline5mil_18p5in stripline5mil_29p5in -45 stripline5mil_41in -50 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 Frequency MHz

Measured Stripline 5mil width



A 5-mil FR4 stripline has about 0.37 • dB/inch insertion loss at 2 GHz

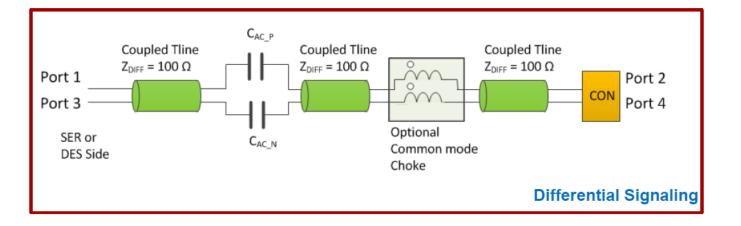
A 6-mil FR4 stripline has about 0.31 • dB/inch insertion loss at 2 GHz

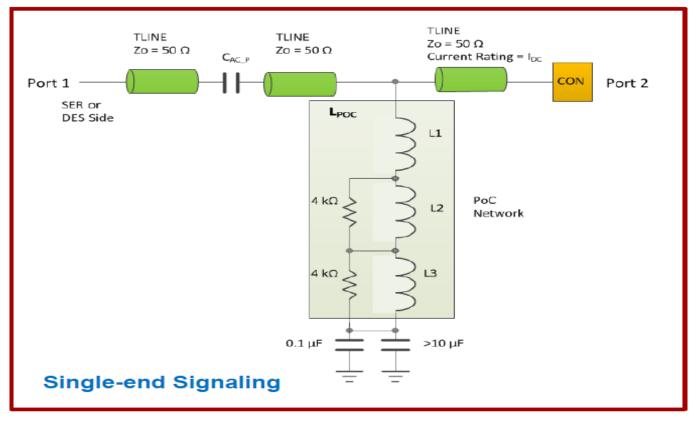
FR4 Microstrip 6mil-width

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SER-board and DES-board elements





transmission loss due to SER-board + transmission loss due to cable

+ transmission loss due to DES-board total channel transmission loss

 Transmission loss of SER-board and DESboard are usually small compared with that of the cable



Estimating channel budget

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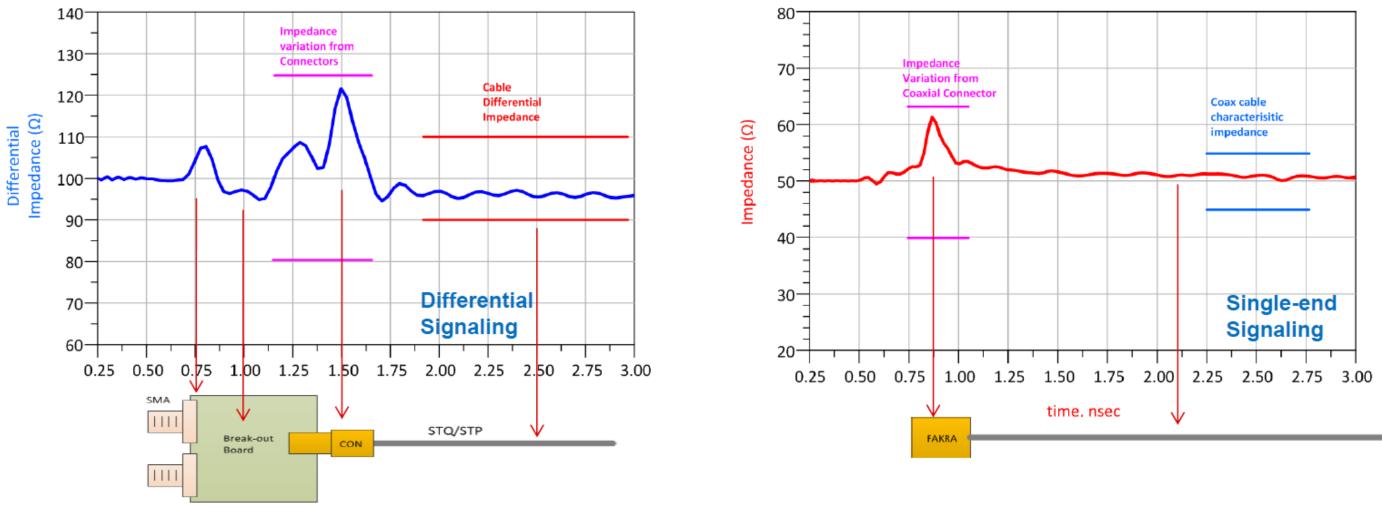
Compare the Total Transmission Channel loss with the Channel Requirement Specifications of FPD-Link III SER-DES chipset.

Parameters	Description	Insertion Loss at 1.5 GH
Common mode choke	DLW21SZ900HQ2.s4p	0.4 dB
FR4 board trace 2-inch, 6-mil width	0.26 dB/inch 6-mil 100-Ω coupled microstrip	0.52 dB
Channel-SER		0.92 dB
Channel-DES	Assume same as Channel-SER	0.92 dB
Channel-Cable	10m STQ w/HSD connector on both ends, measured	14 dB
Total Channel	Channel-SER + Channel-Cable + Channel-DES	15.84 dB

Hz (3 Gbps)



Channel parameter – characteristic impedance



Differential signaling: $100 \Omega \pm \text{tolerance}$

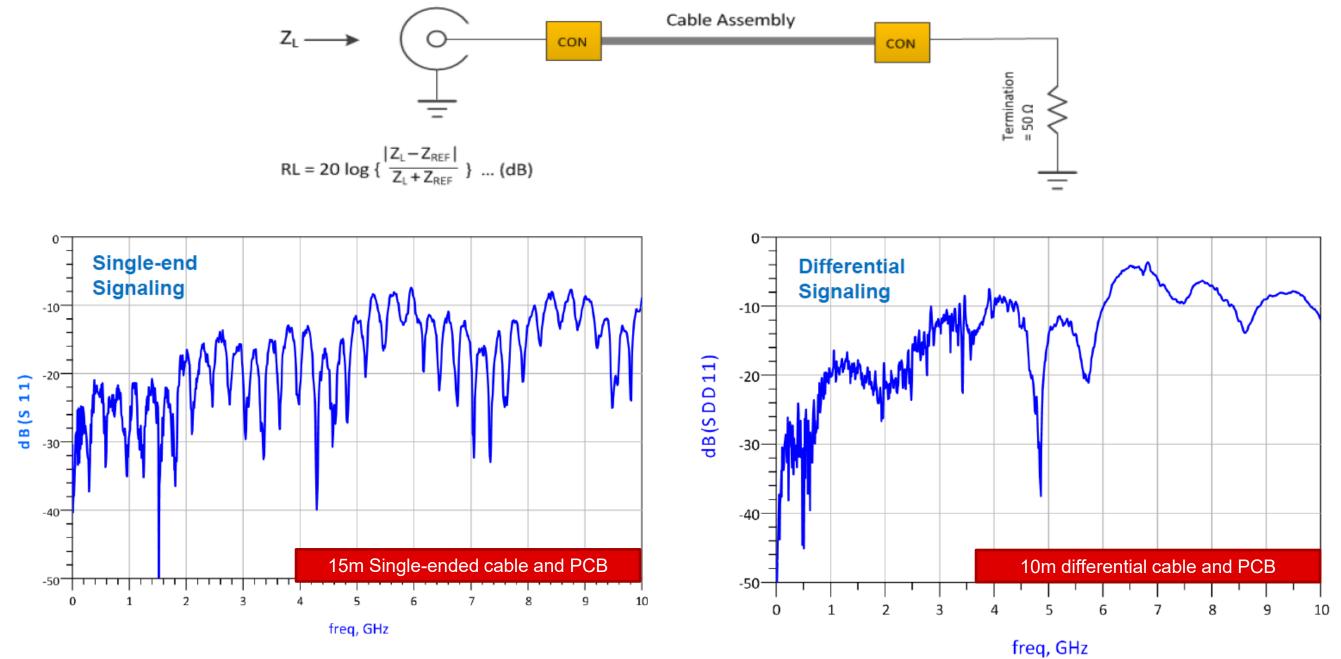
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Single-end signaling: 50 Ω ± tolerance •





Channel parameter – return loss





Summary of FPD-Link transmission channel basics

- FPD-Link signaling topologies
 - Differential

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- Single-ended
- Transmission channel parameters
 - Insertion loss
 - Characteristic Impedance
 - Return Loss





Quiz

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- How can you compensate for the insertion loss effect of a transmission channel
 - a) Low-pass filter with gain
 - High-pass filter with gain $\sqrt{}$ b)
 - Insertion loss due to transmission channel cannot be compensated C)
- What return-loss measurements shown below corresponds with the ideal performance criteria?
 - a) Return loss of 0 dB
 - b) Return loss of negative 10dB
 - Return loss of negative infinity $\sqrt{}$ C)



TEXAS INSTRUMENTS

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