Reference Die/Device Model and Parameters for 802.3dj COM Baseline

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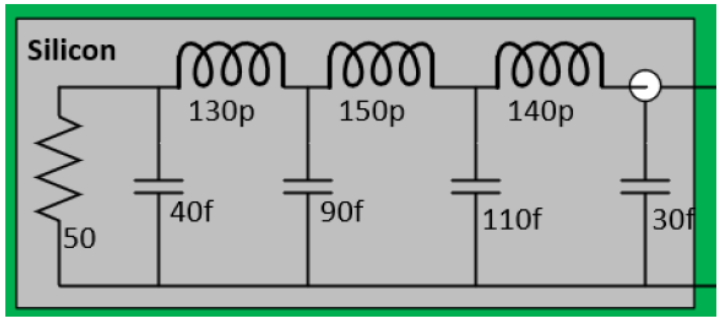
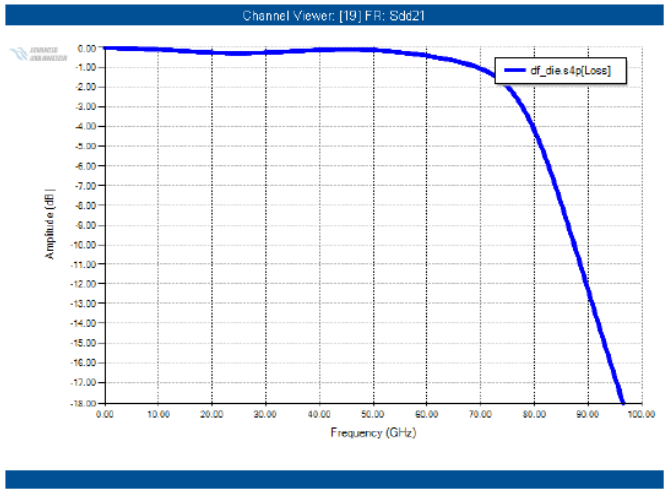
Background, Motivation, and Objective

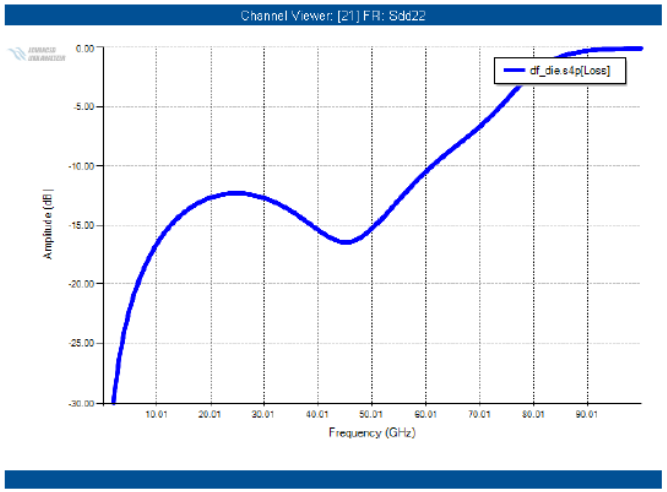
- COM is the specification method for channel compliances for 802.3 and other related standards (e.g., OIF/CEI, FC, JESD204, etc.).
- Reference die/device model and parameters are critical elements of COM.
- 200G/L reference die/device model and parameters had been extracted from the Intel test chips [1], [2], and presented at 802.3df [3] in Mar, 2022.
- COM die/device model had been extended to scalable LC ladder, with three stage LC ladder, and related LC parameters from [3] for 200G/L since COM3.7 [4].
- All the channel and system analysis of 200G/L using COM3.7, 3.9, and 4.0+ are based on the die/device model and parameters defined in [3], [4].
- 200G/L reference die/device model and been accepted in July, 2023 meeting
- It is time to formally consider adopting the parameters defined in [3], [4], [5] after > 1.5 yr validation, evaluation, and analysis, to enable 802.3dj, and related OIF/CEI, FC, JESD204 specification developments.

Recap of 200G/L Die/Device Model and Parameters Extracted from Test Chips[1],[2],[3],[6]

A Proposed Reference Die Model for 802.3df

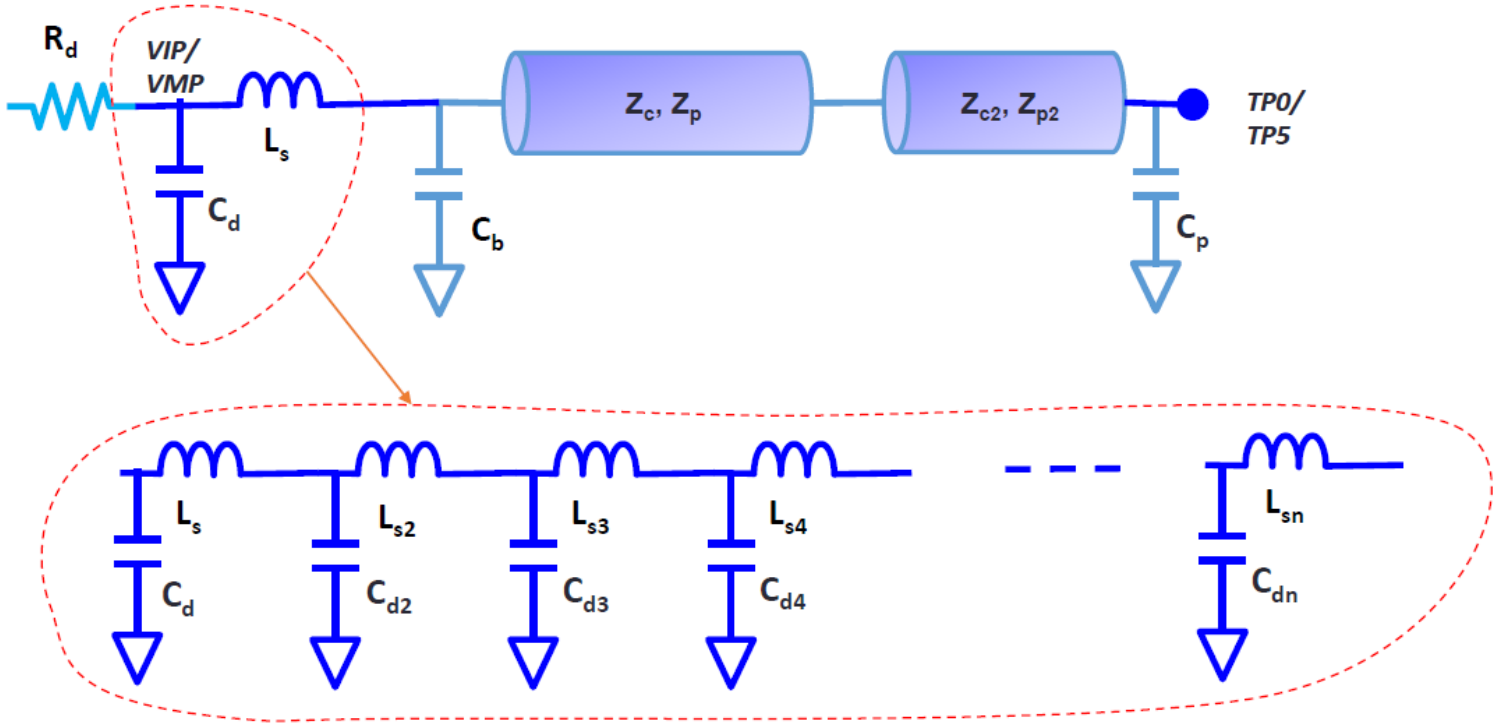






Recap of 200G/L Die/Device Model for Annex 93A/COM [4]

Replace Cd and Ls with a Ladder



C_d	[Cd Cd2 Cd3 Cd4 … Cdn ; Cd Cd2 Cd3 Cd4 … Cdn]	nF	[TX ; RX]
L_s	[Ls Ls2 Ls3 Ls4 … Lsn; Ls Ls2 Ls3 Ls4 … Lsn]	nH	[TX ; RX]

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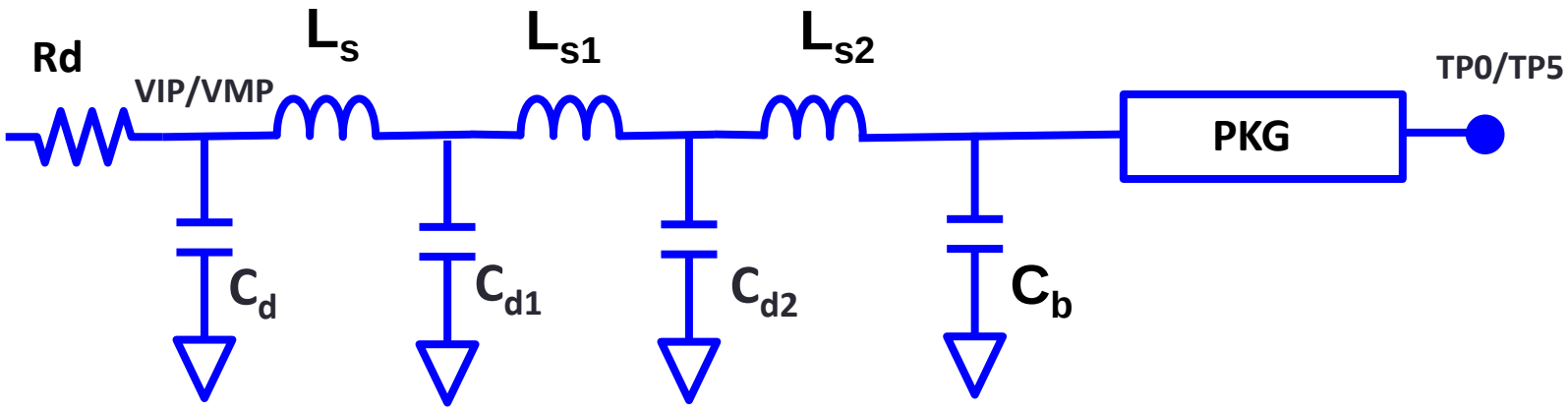
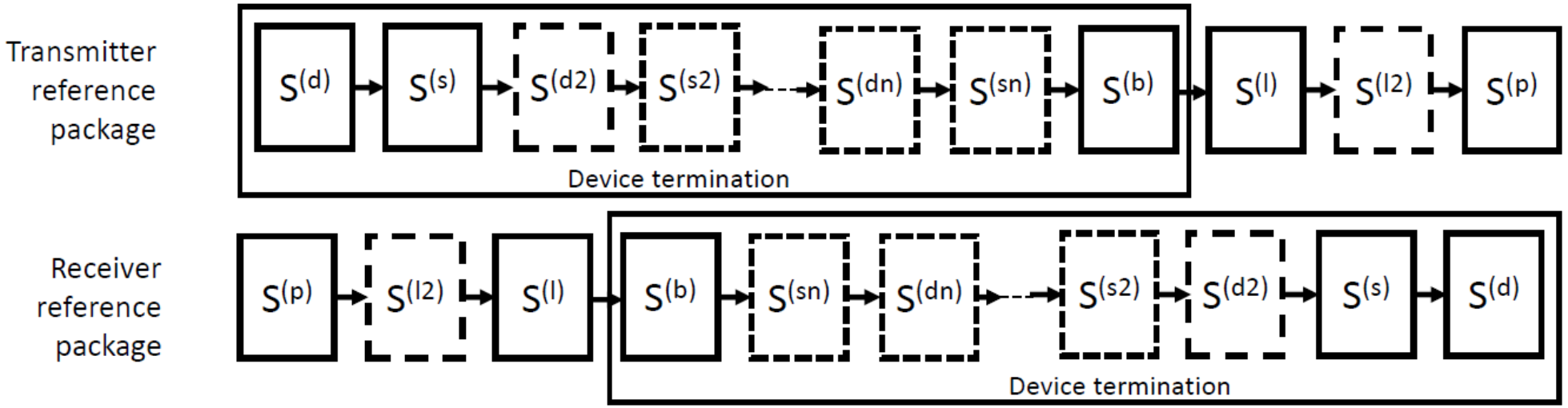
5

Recap of Adopted 200G/L Reference Die/Device Model for Annex 93A/COM [5]



C_d	[Cd Cd1 Cd2; Cd Cd1 Cd2]	nF	[TX ; RX]
L_s	[Ls Ls1 Ls2; Ls Ls1 Ls2]	nH	[TX ; RX]
C_b	[Cb;Cb]	nF	[TX ; RX]

Recap of Adopted Updated Figure 93A-2 for Annex 93A/COM [5]

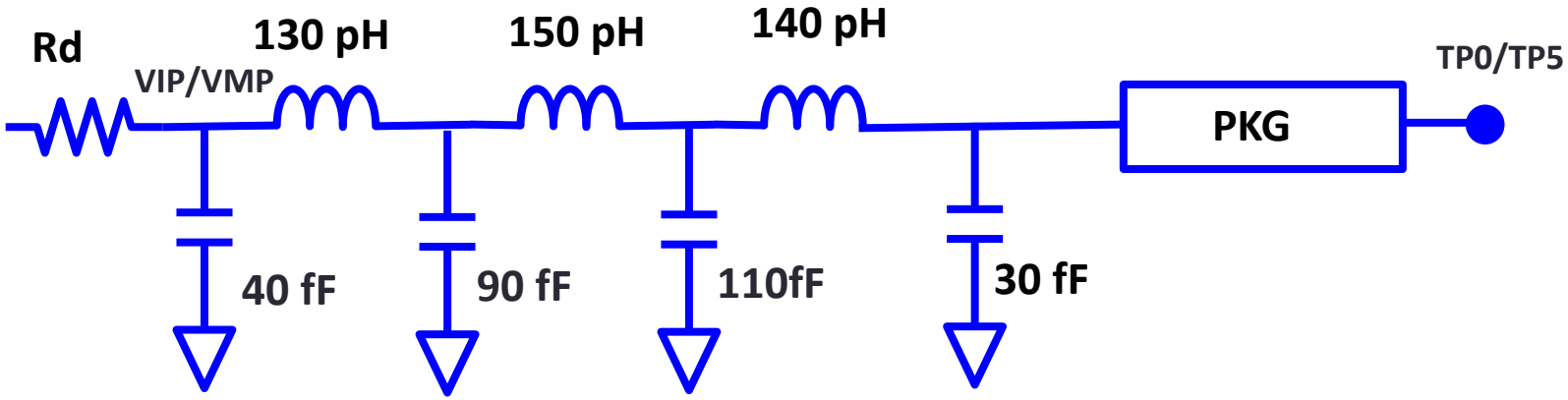


$S^{(d)}$ = device capacitance S-parameter
$S^{(s)}$ = device series inductance S-parameter
$S^{(d2)}$ = device capacitance 2 S-parameter
$S^{(s2)}$ = device series inductance 2 S-parameter
$S^{(dn)}$ = n^{th} device capacitance S-parameter
$S^{(sn)}$ = n^{th} device series inductance S-parameter
$S^{(b)}$ = bump capacitance S-parameter
$S^{(l)}$ = package transmission line S-parameter
$S^{(l2)}$ = package transmission line 2 S-parameter
$S^{(p)}$ = package capacitance S-parameter

Note: PMD calls out which blocks are included in the package model

Updated Figure 93A-2-Reference package Models

Proposed 200G/L Reference Die/Device Model Parameters for COM [5]



C_d	[0.4e-4 0.9e-4 1.1e-4 ; 0.4e-4 0.9e-4 1.1e-4]	nF	[TX RX]
L_s	[.13 .15 .14; .13 .15 .14]	nH	[TX RX]
C_b	[.3e-4 .3e-4]	nF	[TX RX]

References

[1] J. Kim et al, “A 224Gb/s DAC-Based PAM-4 Transmitter with 8-Tap FFE in 10nm CMOS”, ISSCC, 2021.

[2] A. Khairi “A 1.4 pJ/b 224 Gb/s- PAM4 SERDES Receiver with 31 dB Loss Compensation “, ISSCC, 2022.

[3] M. Li et al, “Reference Die and Package Models for 802.3df Host”, https://www.ieee802.org/3/df/public/22_03/mli_3df_02a_220316.pdf, 802.3df, 2022.

[4] R. Mellitz et al, “Annex 93A Package/Die Load Proposal and COM 3.70 with Exploratory Features including Package/Die Load Ladder”, https://www.ieee802.org/3/df/public/22_03/mellitz_3df_01b_220316.pdf, 802.3df, 2022.

[5] M. Li, R. Mellitz et al, “Reference Die/Device Model and Parameters for 802.3dj COM Baseline”, https://www.ieee802.org/3/dj/public/23_07/lim_3dj_01_2307.pdf, 802.3dj, 2023.

[6] M. Cusmai et al., “A 224Gb/s sub-pJ/b PAM-4 and PAM-6 DAC-Based Transmitter in 3nm FinFET”, ISSCC, 2024.

Thank You!