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Title: **Package & IC Model Impacts**

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Abstract: This contribution provides simulation results comparing impacts of package and IC models.

Outline

Simulations performed across a mix of package/ic model configurations

- no package, no ic model (ideal 50 ohm terminations only)
- ind_like package, no ic model
- cap_like package, no ic model
- no package, ic model
- ind_like package, ic model
- cap_like package, ic model

Simulations performed across a subset of ad-hoc channels

- Tyco Case5, Case6
- Peters B3, B12

Simulation setup same as that for results provided in abler_01_0105

Simulation Conditions

Simulation model summary

Launch amplitude set to minimum	800 mVpp
Transmitter DJ set to maximum	0.15 UIpp
Transmitter RJ set to maximum	0.0107 UIrms (0.15UIpp @ 10^{-12} BER)
Tx/Rx termination set to nominal (ideal)	5050/5050 ohms
Receiver DJ	0.10 UIpp
Receiver RJ set to maximum	0.0107 UIrms (0.15UIpp @ 10^{-12} BER)
Data rate	10.3 Gbps
Receiver offset	0 ppm
Data pattern	PRBS15
Random noise	1.46mV rms
AC coupling:	4.7nf

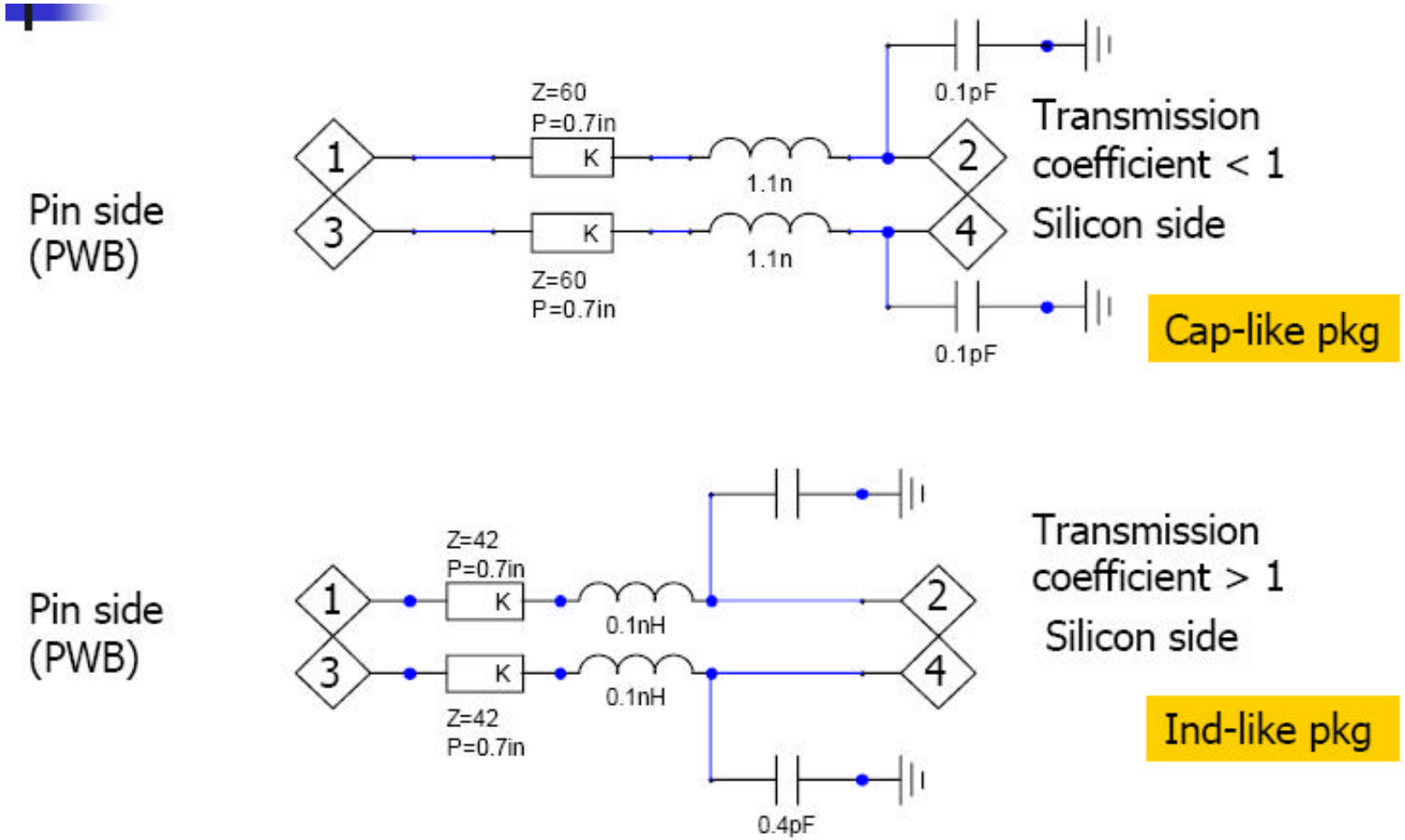
Simulate across package types

- Spec_RL_ind_like
- Spec_RL_cap_like
- Comparison to IBM organic package

Simulate FFE3/DFE5 NRZ configuration

- Includes all crosstalk channels
- Results provided for BER E-12

Package Models (from Mellitz WC Pkg Models)



Note: A simple IC model would likely be a shunt C to ground

- Already captured in package model

Simulation Results

	Tyco Channels				Peters Channels			
	Case 5		Case 6		B3		B12	
FFE3/DFE5 (E-12)	timing margin (ps_{p-p})	voltage margin (mV_{p-p_diff})	timing margin (ps_{p-p})	voltage margin (mV_{p-p_diff})	timing margin (ps_{p-p})	voltage margin (mV_{p-p_diff})	timing margin (ps_{p-p})	voltage margin (mV_{p-p_diff})
no package, no ic	26.7	55.7	15.6	21.8	9.4	16.9	14.4	25.6
no package, IBM ic	22.7	37.9	10.5	12.7	12.0	23.3	10.2	18.9
cap_like pkg, no addl ic	28.4	47.5	7.0	11.5	0	0	14.1	18.8
cap_like pkg, IBM ic	17.2	30.5	9.9	15.9	0	0.3	4.1	5.6
ind_like pkg, no addl ic	19.4	37.0	5.0	6.3	10.6	23.3	2.5	2.8
ind_like pkg, IBM ic	21.2	36.2	6.1	7.9	5.8	9.2	9.5	15.8
IBM pkg, IBM ic	26.8	44.4	3.7	0.2	3.4	6.0	0	0.2

Observations

- Simulation without package model provides overly optimistic results
  - Doesn't account for device return loss
- Simulation with ind or cap packages in comparison to IBM pkg/ic provides mixed results
  - Dependent on particular channel
  - Impedence matching varies depending on model

Recommendations

Common IC model approach:

- Would likely be modeled as shunt C to gnd
  - Would simply add to existing cap on package models
- Package models already defined for -10dB return loss at 5GHz
  - Should not need to be updated

Package model selection:

- Results can vary significantly depending on package model and channel
  - One will always provide better matching than the other

Require simulations to be done with a common package

- Agree on at least one package to be common across all simulations
  - ind or cap
- Simulation with 2'nd package is optional