Comparison of Chip to Chip COM Transmitter with Tx specifications.

Mike Dudek Cavium
Tao Hu Cavium
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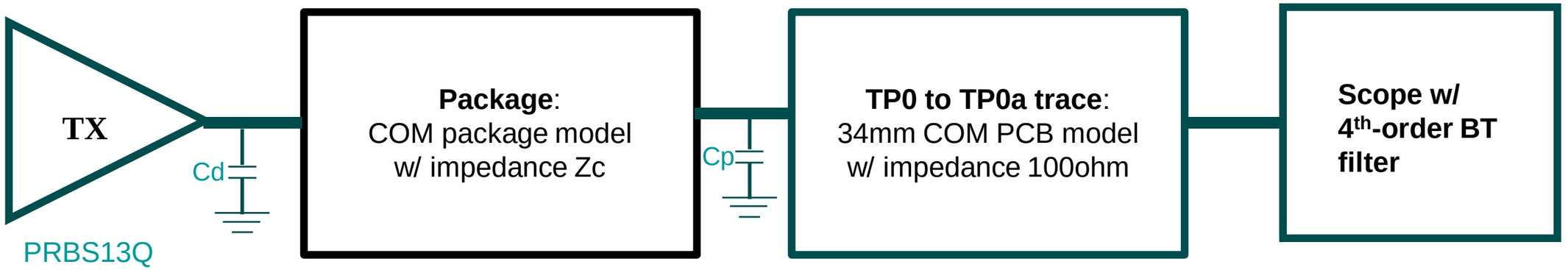
Introduction

- In order to close the Chip to Chip budget it is important that the Tx used in COM is no better than the worst case Tx allowed by the Tx specifications.
- This presentation takes the Tx used in COM and simulates the performance that would be measured at Test point TP0a.
- The simulations and analysis were performed in a mixture of ADS and Matlab.
- The effect of changing the values of Rd (die impedance) and Zc (package trace impedance) was investigated to investigate how manufacturing tolerances would change the results.
- The Value of Av was adjusted so that Vf (the steady state voltage) was the same for all the combinations of Rd and Zc.

Transmitter simulation block diagram



Transmitter including package and PCB trace measured w/ 4th-order BT filter

53.125G PAM4 Transmitter Characteristics @ TP0a w/o TX Equalization: measured w/ 4th order 33GHz BT Filter

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	Simulated PRBS13Q @ TP0a						
Parameters	53.125G Gaussian TX Filter Risetime 13ps; 30mm package; Cd 0.18pF; Cp 0.11pF					Units	SPEC (Table 120D-1)
Rd	55	50	45	50	55	ohm	
Zc_pkg	90	100	110	95	80	ohm	
Av	0.438	0.416	0.395	0.416	0.441	V	
Sigma-e	0.042	0.033	0.039	0.041	0.034	mV	
Vf (steady-state voltage)	0.400	0.400	0.400	0.400	0.400	V	0.4V=< Vf <=0.6V
Pmax (Linear fit pulse peak)	0.303	0.303	0.301	0.303	0.302	V	
Differential Peak to Peak Voltage	0.801	0.801	0.800	0.800	0.802	V	<=1.2V
Pmax/Vf	0.758	0.757	0.753	0.759	0.755	N/A	>=0.736
SNR_{isi}	36.07	39.89	42.76	38.68	33.42	dB	<=38dB
SNDR (@ Sigman = 0)	77.11	79.17	77.67	77.5	79.04	dB	>=31dB
Sigma-n (for SNDR 31dB@TP0a)	8.534	8.538	8.493	8.551	8.517	mV	
TXSNR@die (to create above sigma-n)	31.00	31.00	31.00	31.00	31.00	dB	

Conclusions.

- The package and die impedances only have a small affect on the Pmax/Vf ratio and the existing spec is too relaxed. It should be increased to 0.76
- With the current values for Rc and Zc the value of Av is too high. Av and Afe values in COM should be reduced to 0.44
- The Sigma-e (with Np=200) is negligible for all the combinations. The SNDR specification is controlling noise, crosstalk and non-linearities. Having SNDR=TxSNR=31dB is fine provided the Tx specification for SNR_{ISI} is no lower than the value calculated from the parameters used in COM. (36dB with the present COM parameters). However requiring SNDR to be a higher value than the TxSNR used in COM would allow a smaller value of SNR_{ISI}.

Backup.

Tp0 to Tp0a Insertion loss.