

# Baseline proposal for 100, 200 and 400 Gb/s Backplane

Clint Walker, Alphawave IP

# Contributors

Upen Kareti, Cisco

Adam Healey, Broadcom

Phil Sun, Credo

Mau-lin Wu, Mediatek

Mike Li, Intel

Matt Brown

Beth Kochuparambil, Cisco

Kent Lusted, Intel

Howard Heck, Intel

# Supporters

- Howard Heck, Intel
- Rich Mellitz, SamTec
- Upen Kareti, Cisco
- Clint Walker, Alphawave IP
- Adam Healey, Broadcom
- Phil Sun, Credo

# Method

- Leverage 802.3cd specification with modifications for updated COM reference package, reference receiver and SerDes parameters.
  - Clause 137
  - Annex 93A

# Contents

- Reference receiver # taps, # banks, span
- Termination model
- Rx noise figure ( $\eta_0$ )
- Transmitter Equalization c(-3) (pre-cursor 3)

# COM Reference Rx DFE # taps, #float, span

- DFE COM parameters go into COM Table (refer to Table 137-6 for an example)

Parameter	Symbol	Value	Units
.....			
Decision feedback equalizer (DFE) length	Nb	12	UI
Normalized DFE coefficient magnitude limit n = 1 n = 2 to Nb		0.85 0.2	—
Number of DFE floating tap groups	N_bg	3	
Number of DFE floating taps per group	N_bf	3	
UI span for floating taps	N_f	40	UI
Max DFE value for floating taps	Bmaxg	0.2	

# Package COM parameters

- Package COM parameters go into COM Table (refer to 137-6 for an example)

Parameter	Symbol	Value	Units
.....			
Device package model			
Single-ended device capacitance	Cd	1.2e-4	nF
Single-device series inductance	Ls	0.12	nH
Single-ended capacitance at the device-to-package interface	Cb	0.30e-4	nF
Transmission line length, Test 1	Zp	12	mm
Transmission line length, Tx Test 2	Zp	31	mm
Transmission line length, Rx Test 2	Zp	29	mm
Transmission line 2 length	Z <sub>p2</sub>	1.8	mm
Single-ended package capacitance to package-to-board interface	Cp	0.87x10-4	nF
Package transmission line nominal characteristic impedance	Zc	87.5	Ω
Package transmission line 2 nominal characteristic impedance	Z <sub>c2</sub>	92.5	Ω
Single-ended termination resistance	Rd	50	Ω

# Reference package changes

From Adam Healey presentation.

[http://www.ieee802.org/3/ck/public/adhoc/jun12\\_19/healey\\_3ck\\_adhoc\\_01\\_061219.pdf](http://www.ieee802.org/3/ck/public/adhoc/jun12_19/healey_3ck_adhoc_01_061219.pdf)

## Changes to Annex 93A to implement this proposal (1 of 3)

Table 93A-1—COM parameters

Parameters	Reference	Symbol	Units
...			
Device package model	93A.1.2		
Single-ended device capacitance		$C_d$	nF
<a href="#">Single-ended device series inductance<sup>a</sup></a>		$L_c$	nH
<a href="#">Single-ended capacitance at the device-to-package interface<sup>a</sup></a>		$C_b$	nF
Transmission line length		$z_p$	mm
Single-ended package capacitance at package-to-board interface		$C_p$	nF
Transmission line characteristic impedance <sup>a</sup>		$Z_c$	$\Omega$
...			

<sup>a</sup> Some clauses that invoke this method do not provide a value for [L<sub>c</sub>, C<sub>b</sub> or Z<sub>c</sub>](#). See 93A.1.2.

### 93A.1.2.2 Two-port network for a shunt capacitance

The scattering parameters for the device capacitance  $C_d$  are denoted as  $S^{(d)}(C_d)$ , [the scattering parameters for the device capacitance  \$C\_b\$  are denoted as  \$S^{\(b\)}\(C\_b\)\$](#) , and the scattering parameters for the device capacitance  $C_p$  are denoted as  $S^{(p)}(C_p)$ . [When a value for  \$C\_b\$  is not provided by the clause that invokes this method,  \$C\_b\$  is set to 0.](#)



# Reference package change

From Adam Healey presentation.

[http://www.ieee802.org/3/ck/public/adhoc/jun12\\_19/healey\\_3ck\\_adhoc\\_01\\_061219.pdf](http://www.ieee802.org/3/ck/public/adhoc/jun12_19/healey_3ck_adhoc_01_061219.pdf)

## Changes to Annex 93A to implement this proposal (2 of 3)

*Insert the following subclause after 93A.1.2.2:*

### **93A.1.2.2a Two-port network for a series inductance**

The scattering parameters for a series inductance with value  $L$  are defined by Equation (93A–8a)

$$S(L) = \frac{1}{2 + j\omega L/R_0} \begin{bmatrix} j\omega L/R_0 & 2 \\ 2 & j\omega L/R_0 \end{bmatrix} \quad (93A-8a)$$

The scattering parameters for the series inductance  $L_s$  are denoted as  $S^{(s)}(L_s)$ . When a value for  $L_s$  is not provided by the clause that invokes this method,  $L_s$  is set to 0.

# Reference package change

From Adam Healey presentation.

[http://www.ieee802.org/3/ck/public/adhoc/jun12\\_19/healey\\_3ck\\_adhoc\\_01\\_061219.pdf](http://www.ieee802.org/3/ck/public/adhoc/jun12_19/healey_3ck_adhoc_01_061219.pdf)

## Changes to Annex 93A to implement this proposal (3 of 3)

### 93A.1.2.4 Assembly of transmitter and receiver device package models

The scattering parameters for the transmitter device package model  $S^{(tp)}$  are the result of the cascade connection of the device [capacitance model](#), package transmission line, and board capacitance as defined by Equation (93A–15) [and Equation \(93A–15a\)](#).

$$\underline{S^{(td)} = \text{cascade}(\text{cascade}(S^{(d)}, S^{(s)}), S^{(b)})} \quad \underline{(93A-15)}$$

$$S^{(tp)} = \text{cascade}(\text{cascade}(S^{(td)}, S^{(l)}), S^{(p)}) \quad (93A-15a)$$

Similarly, the scattering parameters for the receiver device package model  $S^{(rp)}$  are the result of the cascade connection of the board capacitance, package transmission line, and device [capacitance model](#) as defined by Equation (93A–16) [and Equation \(93A–16a\)](#).

$$\underline{S^{(rd)} = \text{cascade}(\text{cascade}(S^{(b)}, S^{(s)}), S^{(d)})} \quad \underline{(93A-16)}$$

$$S^{(rp)} = \text{cascade}(\text{cascade}(S^{(p)}, S^{(l)}), S^{(rp)}) \quad (93A-16a)$$

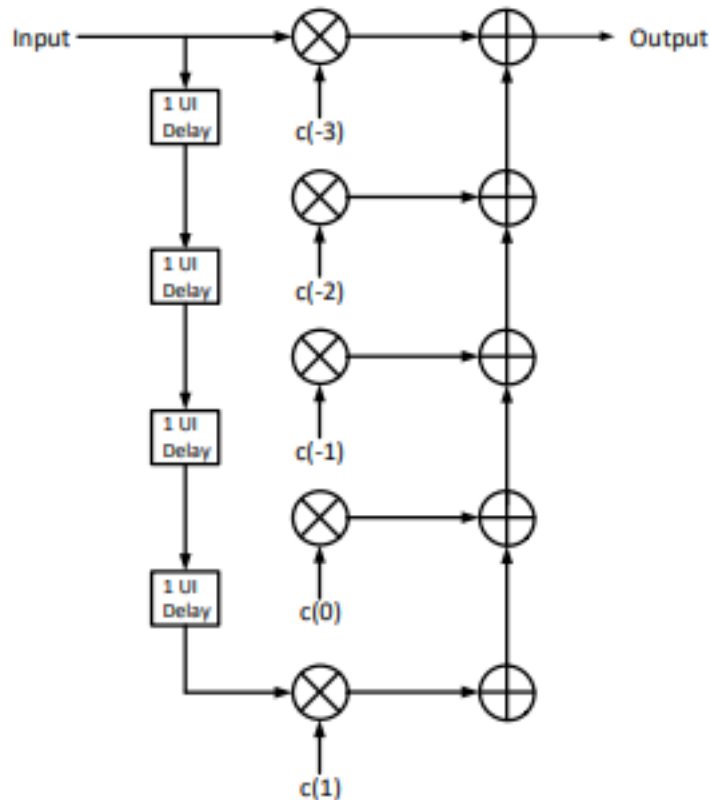
# Rx noise figure ( $\eta_0$ )

- Rx noise figure parameters go into COM Table (refer to Table 137-6 for an example)
- This matches value in draft 0.2 table 162-10

Parameter	Symbol	Value	Units
.....			
One-sided noise spectral density	$\eta_0$	8.20e-9	$V^2 / GHz$

# Transmitter Equalization

- TxEQ values go in the COM Table (refer to Table 137-6 for an example)
- This matches what is in Draft 0.2 table 163-10. There is an editors note that further works needed to be done. This work has now been completed



Parameter	Symbol	Value	Units
.....			
Transmitter equalizer, 3 <sup>rd</sup> pre-cursor coefficient	$c(-3)$		—
Minimum value		-0.06	
Maximum value		0	
Step size		0.02	

# Proposal

- Propose that 802.3ck task force adopt these baseline proposals contained on slides 6-12.

Thank You!