

# FLEXIBLE PACKAGE MODELING FOR COM

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Richard Melitz – Samtec

Liav Ben Artsi – Marvell Israel Ltd.

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- Comparison between
  - 30 mm reference package candidates and COM using DFE16
- COM experiments with 2 channels and selection of packages
- COM 2.50 package spreadsheet syntax

# Purpose

Addresses the influence of COM package models introduced in healey\_3bs\_01\_0315

Illustrate how a new package design may improve 100 Gb/s PAM4 performance (COM)

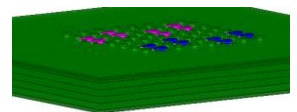
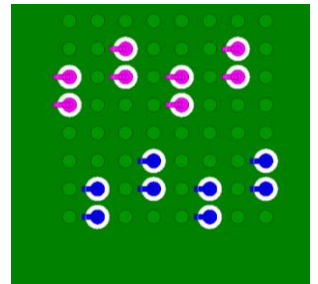
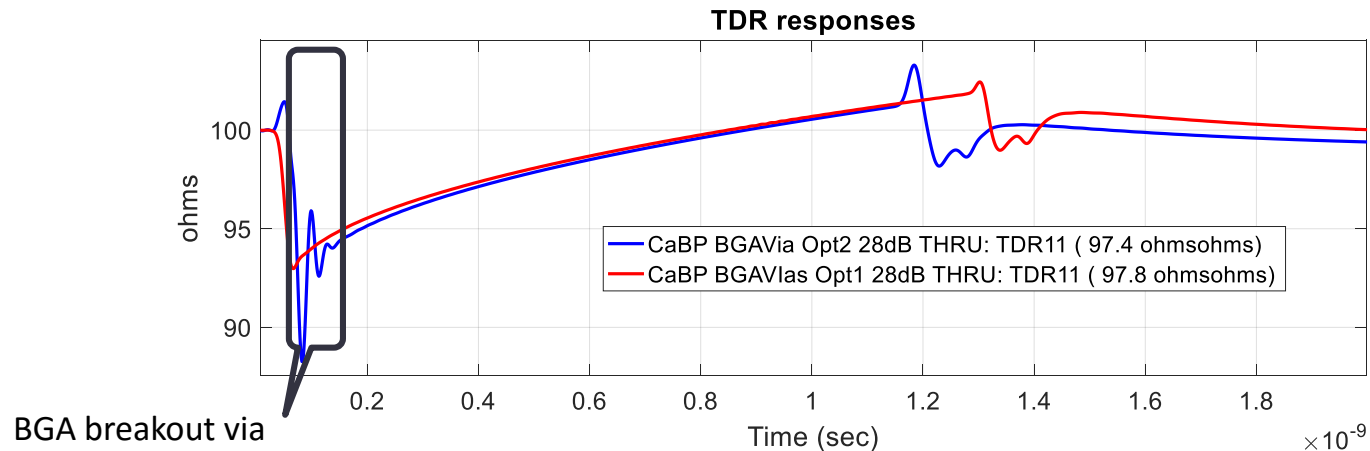
Introduce a flexible package model for COM 2.50

# 30 mm Reference Package COM Evaluations

- 30 mm package as in .3cd but with  $C_d = 130$  ff
- 30 mm package as in .3cd but with  $C_d = 110$  ff and  $Z_c = 87.5$  ohms
- 30 mm package with the plated through hole in the middle of the package

# Channels Used in Experiment

- Channel 1 is an ideal 100 ohm transmission line with no reflections.
  - mellitz\_...02\_072518\_channels\Z0d\_100\_14p25in\_2dBpi\_meg6\_rtf
  - IL = 28 dB @ 26.6 GHz
- Channel 2 is a cabled backplane channel with a via added at the BGA to aggregate package re-reflections
  - mellitz...081518/CaBP\_BGAVia\_Opt2\_28dB w/crosstalk
  - IL = 26.3 dB @ 26.6 GHz

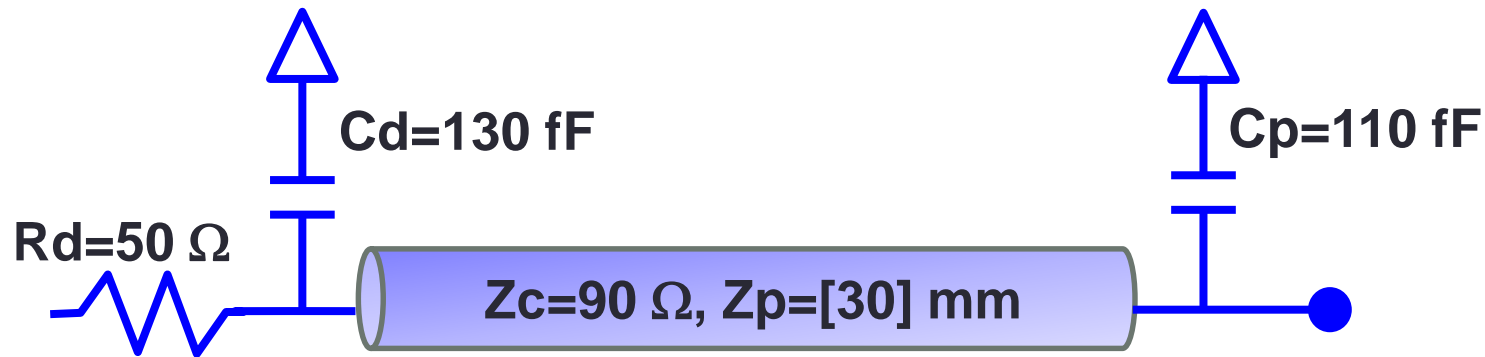


# COM= 2.38 dB

mellitz\_...02\_072518\_channels\Z0d\_100\_14p25in\_2dBpi\_meg6\_rtf

# COM= 2.29 dB

mellitz...081518/CaBP\_BGAVia\_Opt2\_28dB w/xtalk



filter and Eq			Table 93A–3 parameters		
			Parameter	Setting	Units
N_b	16	UI	package_tl_gamma0_a1_a2	[0 1.734e-3 1.455e-4]	
filter and Eq			package_tl_tau	6.141E-03	ns/mm
f_r	0.75	*fb	package_Z_c	90	Ohm (tdr sel)
c(0)	0.6	min			
c(-1)	[-0.3:0.025:0]	[min:step:max]			
c(-2)	[0:0.025:0.1]	[min:step:max]			
c(-3)	[-0.1:0.025:0]	[min:step:max]			
c(-4)	0	[min:step:max]			
c(1)	[-0.1:0.025:0]	[min:step:max]			

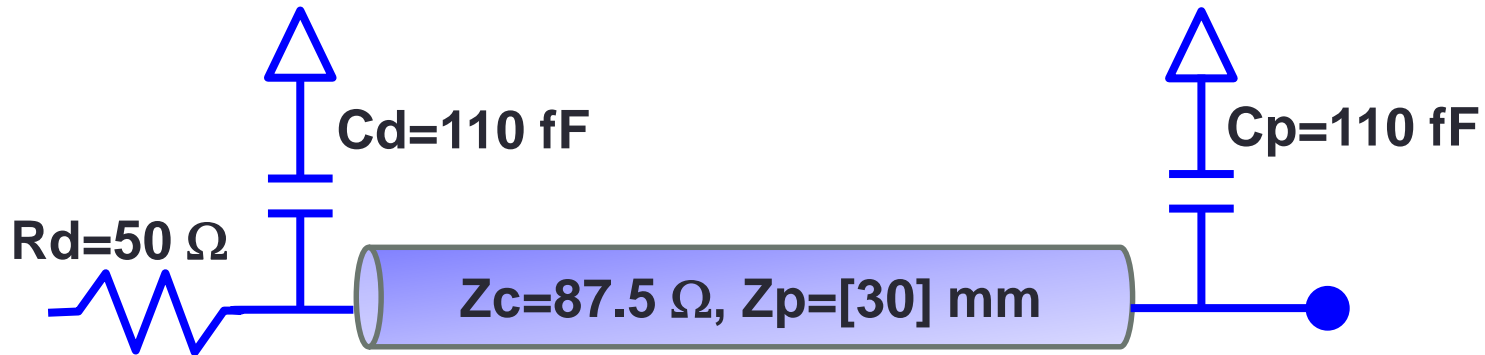
**Both channels do not pass COM**

# COM= 3.09 dB

mellitz\_...02\_072518\_channels\Z0d\_100\_14p25in\_2dBpi\_meg6\_rtf

# COM= 2.79 dB

mellitz...081518/CaBP\_BGAVia\_Opt2\_28dB w/xtalk



filter and Eq			Table 93A–3 parameters		
			Parameter	Setting	Units
N_b	16	UI	package_tl_gamma0_a1_a2	[0 1.734e-3 1.455e-4]	
filter and Eq			package_tl_tau	6.141E-03	ns/mm
f_r	0.75	*fb	package_Z_c	87.5	Ohm (tdr sel)
c(0)	0.6	min			
c(-1)	[-0.3:0.025:0]	[min:step:max]			
c(-2)	[0:0.025:0.1]	[min:step:max]			
c(-3)	[-0.1:0.025:0]	[min:step:max]			
c(-4)	0	[min:step:max]			
c(1)	[-0.1:0.025:0]	[min:step:max]			

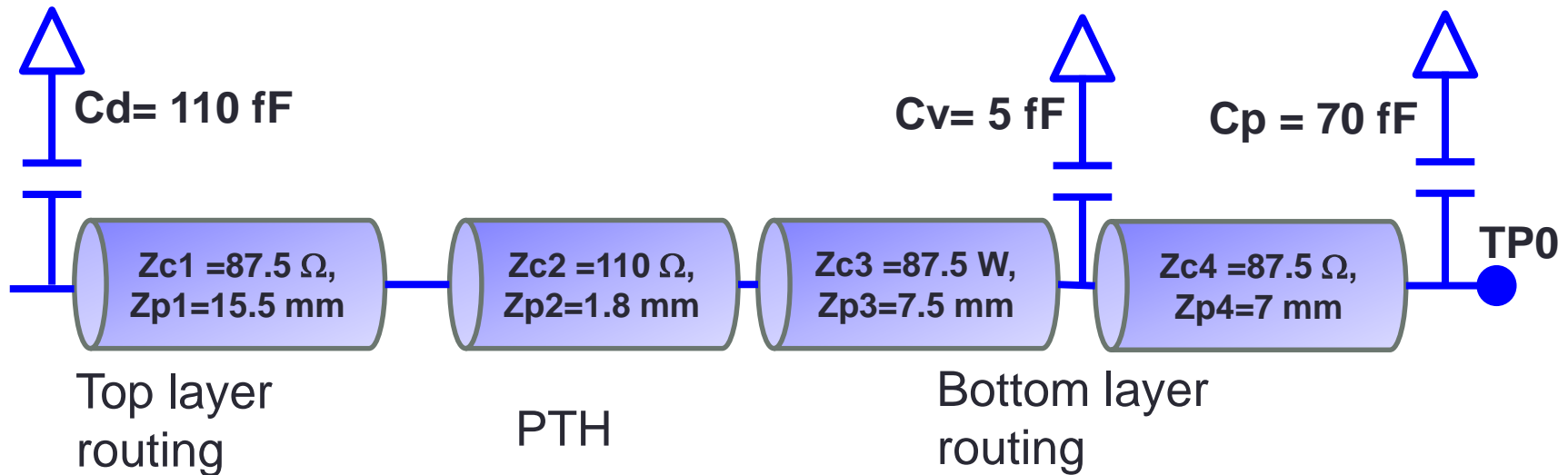
An improvement

# COM= 3.110 dB

mellitz\_...02\_072518\_channels\Z0d\_100\_14p25in\_2dBpi\_meg6\_rtf

# COM= 3.148 dB

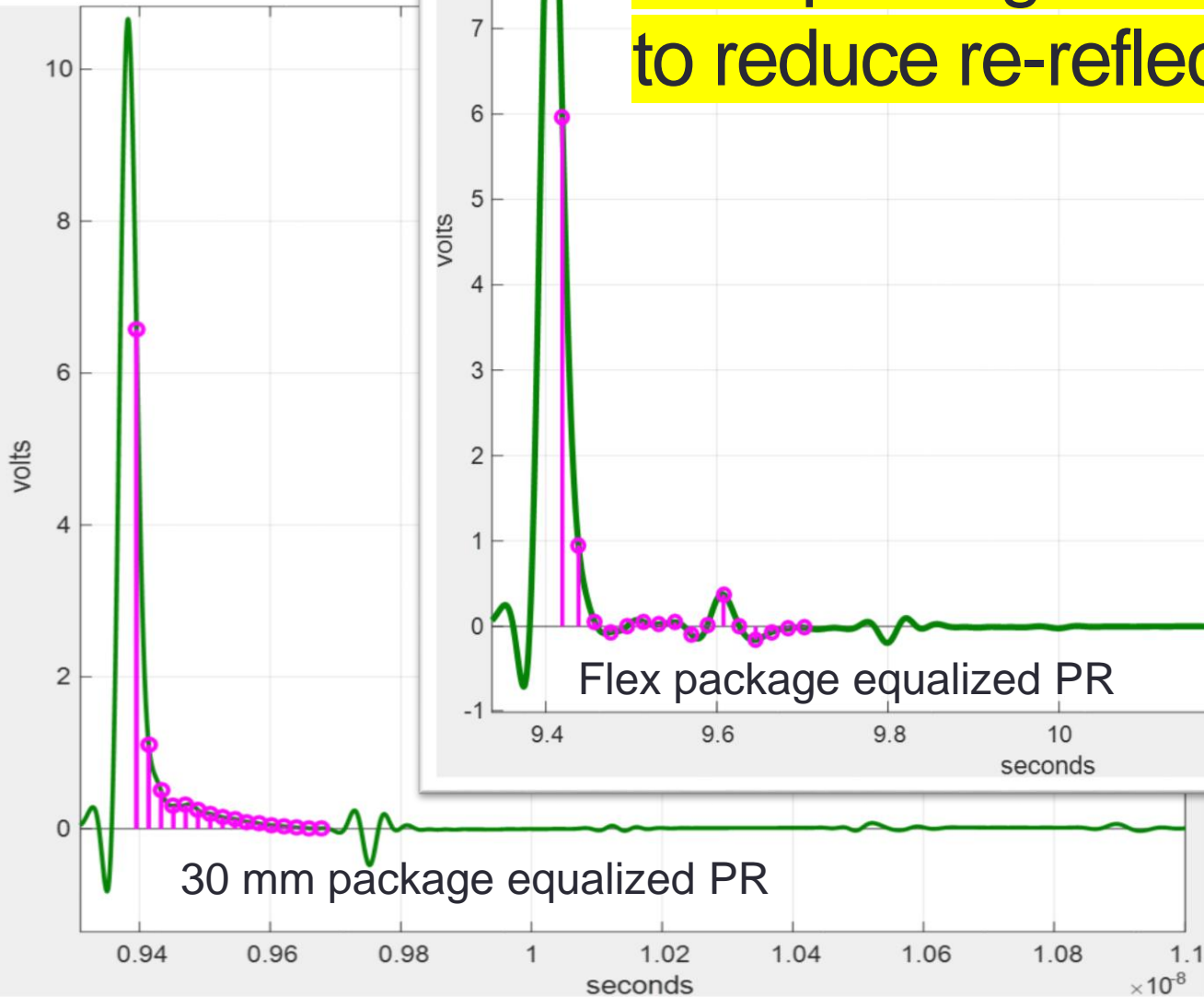
mellitz...081518/CaBP\_BGAVia\_Opt2\_28dB w/xtalk



filter and Eq			Table 93A-3 parameters		
N_b	16	UI	Parameter	Setting	Units
filter and Eq			package_tl_gamma0_a1_a2	[0 1.0404e-3 4.201e-4]	
f_r	0.75	*fb	package_tl_tau	6.325E-03	ns/mm
c(0)	0.6	min	package_Z_c	87.5	Ohm (tdr sel)
c(-1)	[-0.3:0.025:0]	[min:step:max]			
c(-2)	[0:0.025:0.1]	[min:step:max]			
c(-3)	[-0.1:0.025:0]	[min:step:max]			
c(-4)	0	[min:step:max]			
c(1)	[-0.1:0.025:0]	[min:step:max]			

**Both channels pass COM**





New package has potential to reduce re-reflections

# Conclusions and COM

- Lower Cd for the 30 mm package improves COM a little
- The “Flex” package results are promising
  - COM can be improved by 1 dB with the package described in mellitz\_3ck\_03\_081518
    - Preserves the large high radix long trace route requirements
- COM 2.50 incorporates the “flex” package model
- Flex package parameters values are WIP and will be vetted further in the .3ck ad hoc meetings
- The FLEX parameters were not yet adjusted to represent the PKG model in ben-artsi\_ck\_01\_0918

# COM 2.50 CONFIGURATION SPREADSHEET UPDATE

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For the “Flex Package Model”

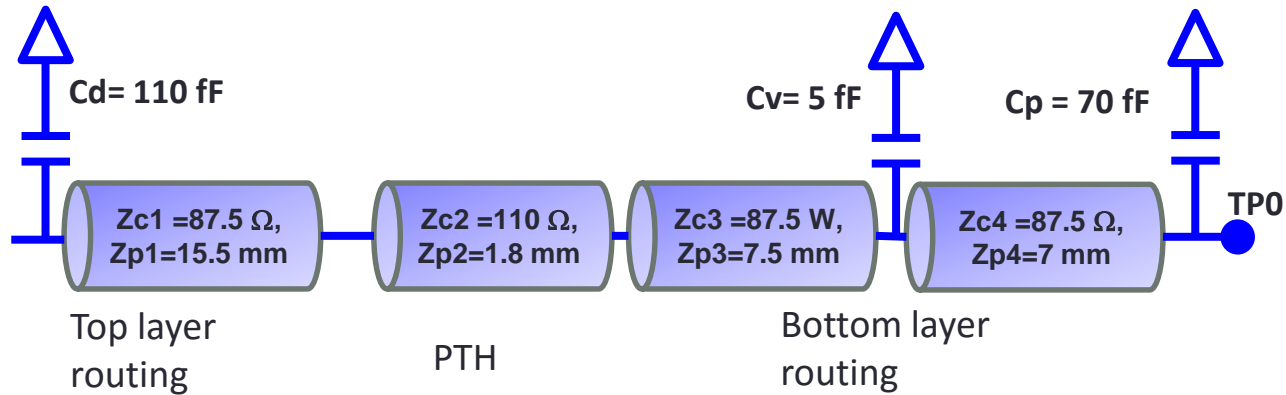
# COM 2.5 includes all in COM 4.41 plus

- Added support for flexible package model

FFE model described in

- [http://www.ieee802.org/3/ck/public/18\\_05/mellitz\\_3ck\\_02\\_0518.pdf](http://www.ieee802.org/3/ck/public/18_05/mellitz_3ck_02_0518.pdf)  
slide 18 to end
- [http://www.ieee802.org/3/ck/public/adhoc/aug15\\_18/mellitz\\_3ck\\_adhoc\\_01\\_081518.pdf](http://www.ieee802.org/3/ck/public/adhoc/aug15_18/mellitz_3ck_adhoc_01_081518.pdf)

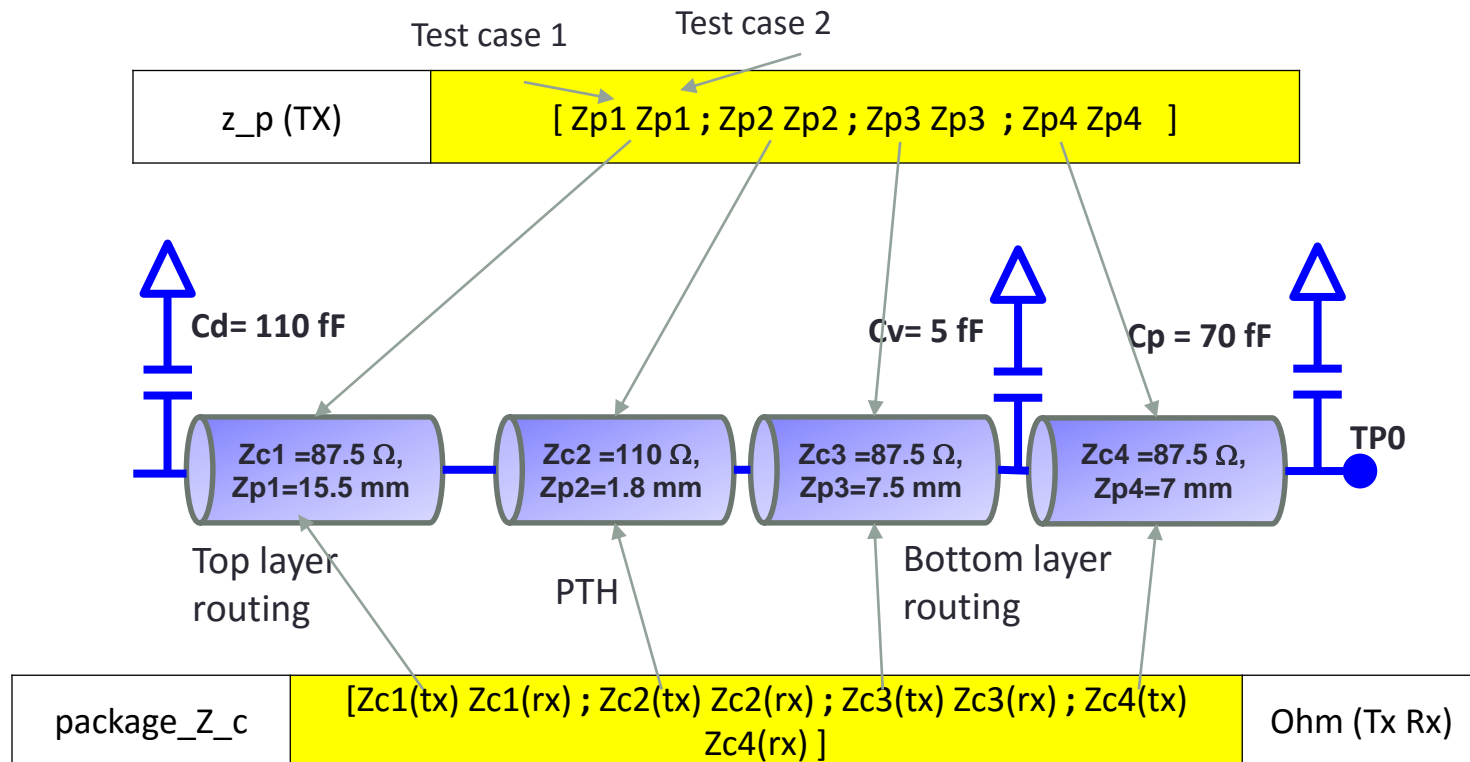
# Flexible Package Example



$C_d$	[1.1e-4 1.1e-4]
$z_p$ select	1
$z_p$ (TX)	[15.5 20 30; 1.8 0 0; 7.5 0 0; 7 0 0]
$z_p$ (NEXT)	[15.5 20 30; 1.8 0 0; 7.5 0 0; 7 0 0]
$z_p$ (FEXT)	[15.5 20 30; 1.8 0 0; 7.5 0 0; 7 0 0]
$z_p$ (RX)	[15.5 20 30; 1.8 0 0; 7.5 0 0; 7 0 0]
$C_p$	[0.7e-4 0.7e-4]
$C_v$	[ 5e-6 5e-6 ]

Table 93A-3 parameters		
Parameter	Setting	Units
package_tl_gamma0_a1_a2	[0 1.0404e-3 4.201e-4]	
package_tl_tau	6.325E-03	ns/mm
package_Z_c	[87.5 87.5 ; 110 110; 87.5 87.5; 87.5 87.5 ]	Ohm (Tx Rx)

# More detailed look at syntax



# Compatible with older spreadsheets

z_p (TX)	[12 30 ]		1 set entry
package_Z_c	90	Ohm (Tx Rx)	

**is equivalent to**

z_p (TX)	[12 30; 0 0 ; 0 0 ; 0 0 ]		4 set entry
package_Z_c	[90 90; 100 100; 100; 100 100 ; 100 100 ]	Ohm (Tx Rx)	

Either 1 or 4 set entry is valid. Other combination not implemented

# The 2 syntaxes are equivalent too

C_d	[1.1e-4 1.1e-4]
z_p select	1
z_p (TX)	[15.5 20 30; 1.8 0 0; 7.5 0 0; 7 0 0]
z_p (NEXT)	[15.5 20 30; 1.8 0 0; 7.5 0 0; 7 0 0]
z_p (FEXT)	[15.5 20 30; 1.8 0 0; 7.5 0 0; 7 0 0]
z_p (RX)	[15.5 20 30; 1.8 0 0; 7.5 0 0; 7 0 0]
C_p	[0.7e-4 0.7e-4]
C_v	[ 5e-6 5e-6 ]

C_d	[1.1e-4 1.1e-4]
z_p select	1
z_p (TX)	[15.5; 1.8; 7.5; 7]
z_p (NEXT)	[15.5; 1.8; 7.5; 7]
z_p (FEXT)	[15.5; 1.8; 7.5; 7]
z_p (RX)	[15.5; 1.8; 7.5; 7]
C_p	[0.7e-4 0.7e-4]
C_v	[ 5e-6 5e-6 ]