IEEE 802.3ae
Interim Meeting - May 21st - 25th

XAUI Channel
Connector Noise Analysis - Z-Pack HM-Zd
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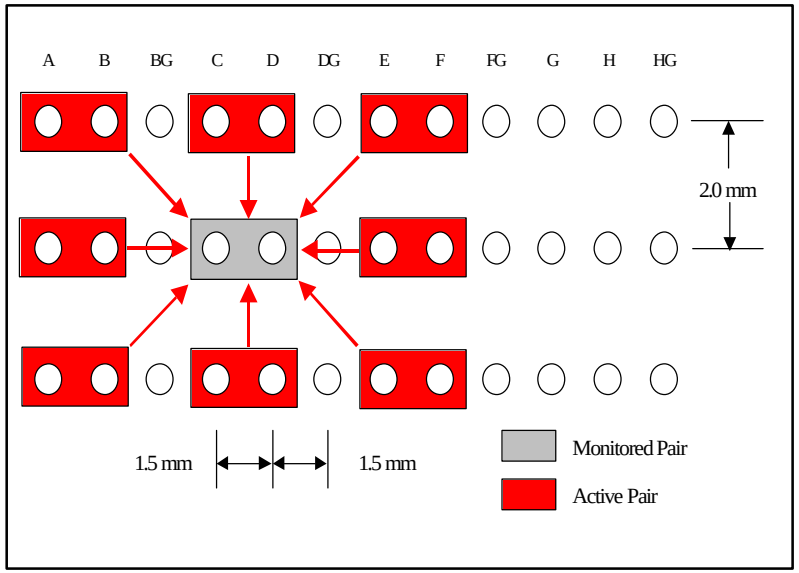
John D'Ambrosia
Tyco Electronics
john.dambrosia@tycoelectronics.com

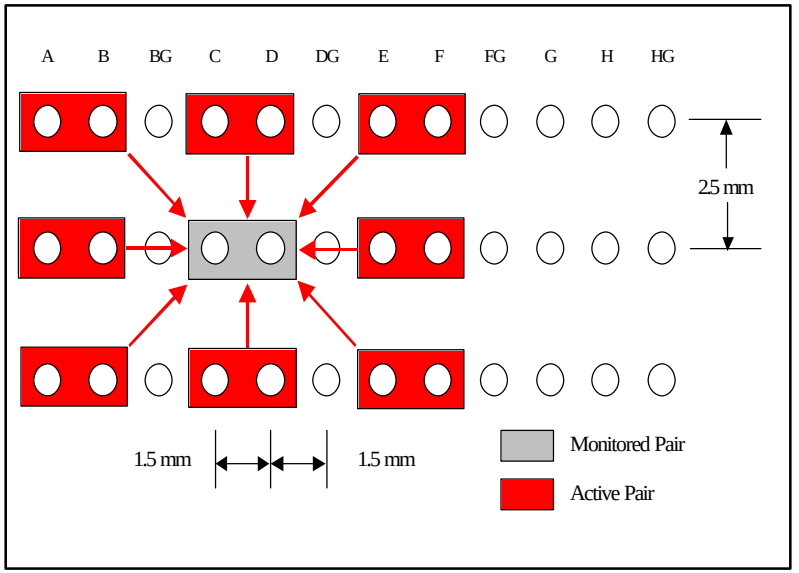
XAUI Channel - Connector Noise

- 1V swing (2V differential), 150 ps rise time (10% - 90%)
- Different footprints and board thickness examined
- HM-Zd Connector Noise Analysis
  - Different pinouts
    - “A/a” - signal launched from daughtercard
    - “B/b” - signal launched from backplane
  - Noise in connector alone examined
  - Noise in connector / PWB Footprint examined
    - Daughtercard thickness - 0.100”
    - Backplane thickness - 0.200”

Footprint Comparison



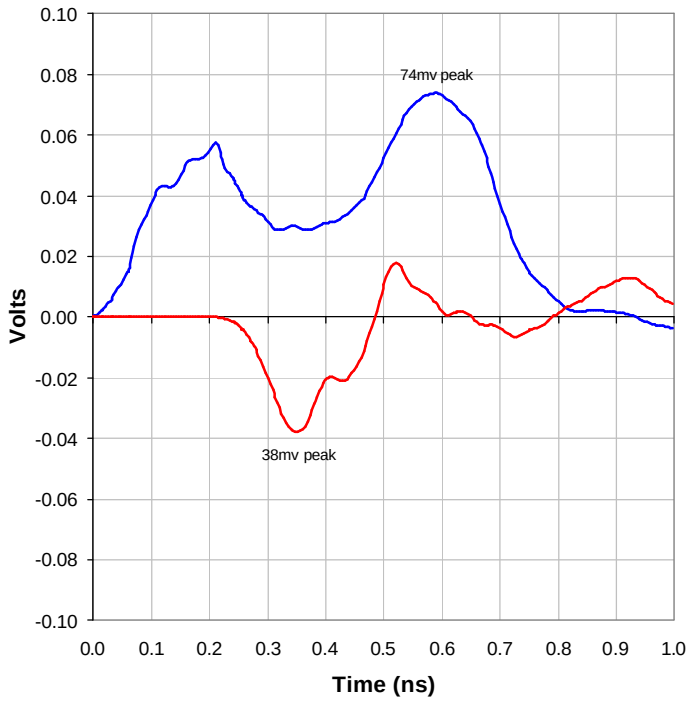
2mm Footprint



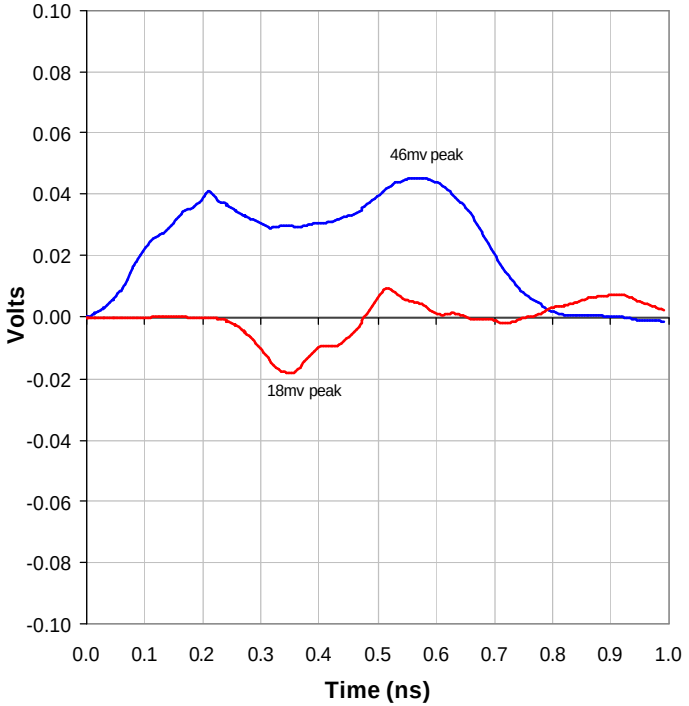
HM-Zd “Standard” Footprint

- Validated HM-Zd connector model (Optimistic for 2mm footprint)
- 0.200” and 0.300” backplanes

Connector Noise Analysis - Footprint Comparison - 0.200”



2mm Footprint



Standard Footprint

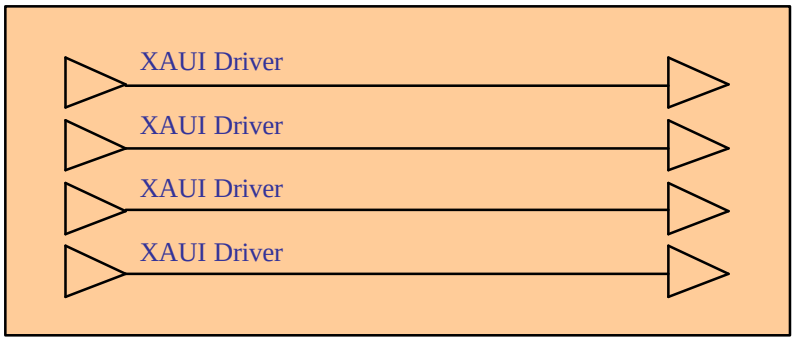
Pair E/F- Near-End Noise

Pair E/F- Far-End Noise

Summary

2mm Footprint
- Near-end Noise - 74 mV
- Far-end Noise - 38 mV

Standar Footprint
- Near-end Noise - 46 mV
- Far-end Noise - 18 mV



Row

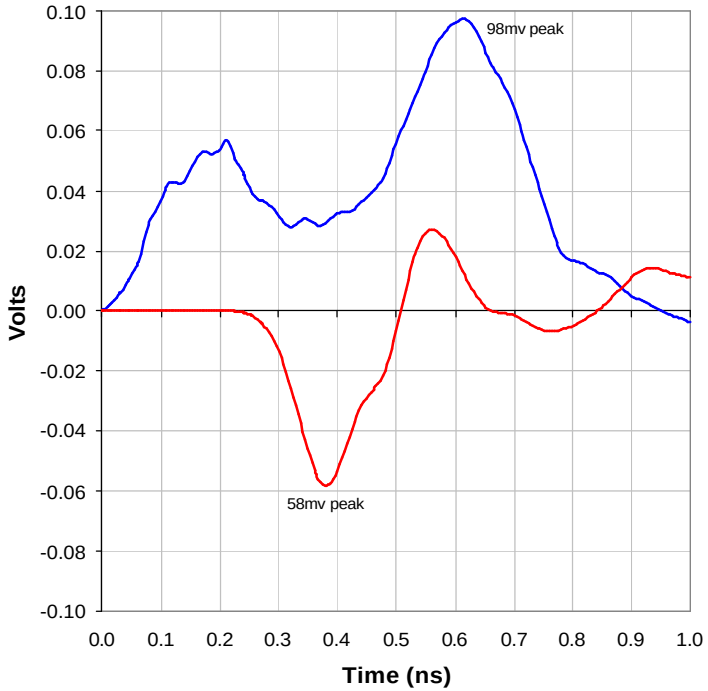
	B			D			F			H	
	A	B	G	C	D	G	E	F	G	G	H	G
	Q	Q	X	A	a	X	a	A	X	A	a	X
	Q	Q	X	A	a	X	Q	Q	X	A	a	X
	Q	Q	X	A	a	X	a	A	X	A	a	X
	Q	Q	X	Q	Q	X	Q	Q	X	Q	Q	X

Daughtercard thickness - 0.100”
Backplane thickness - 0.200”

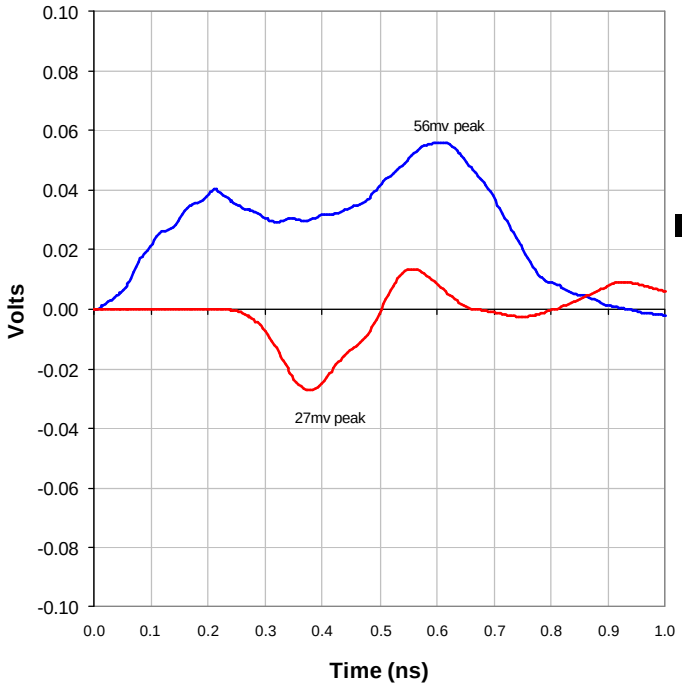
A – Near launch positive signal
a – Near launch negative signal
Q – Quiet pin
X – Ground pin

Voltage Swing - 1V (2V Diff)
Rise/Fall Time - 150 ps

Connector Noise Analysis - Footprint Comparison - 0.300”



2mm Footprint



Standard Footprint

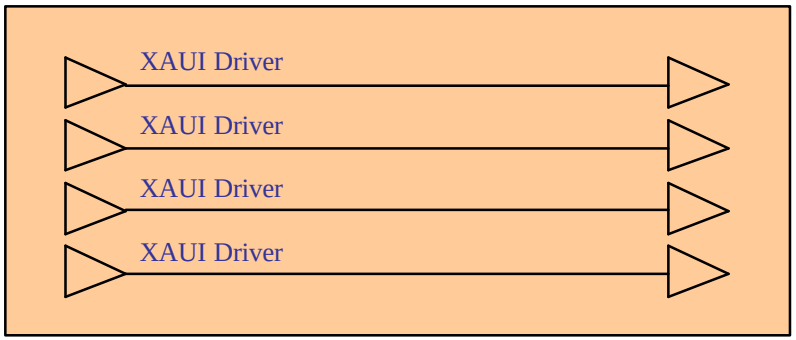
Pair E/F- Near-End Noise

Pair E/F- Far-End Noise

Summary

2mm Footprint
- Near-end Noise - 98 mV
- Far-end Noise - 58 mV

Standard Footprint
- Near-end Noise - 56 mV
- Far-end Noise - 27 mV



Row

	B			D			F			H	
	A	B	G	C	D	G	E	F	G	G	H	G
	Q	Q	X	A	a	X	a	A	X	A	a	X
	Q	Q	X	A	a	X	Q	Q	X	A	a	X
	Q	Q	X	A	a	X	a	A	X	A	a	X
	Q	Q	X	Q	Q	X	Q	Q	X	Q	Q	X

A – Near launch positive signal
a – Near launch negative signal
Q – Quiet pin
X – Ground pin

Daughtercard thickness - 0.100”
Backplane thickness - 0.300”

Voltage Swing - 1V (2V Diff)
Rise/Fall Time - 150 ps

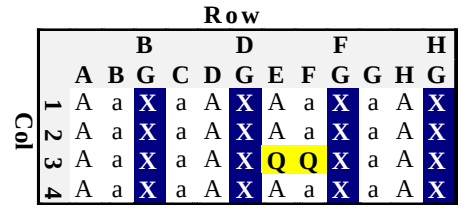
Impact of Footprint Summary

Item	Backplane Thickness	Footprint	Noise	Percent Noise
Near-End Noise	0.200"	2mm	74 mV	3.7%
		Standard	46 mV	2.3%
	0.300"	2mm	98 mV	4.9%
		Standard	56 mV	2.8%
Far-End Noise	0.200"	2mm	38 mV	1.9%
		Standard	18 mV	0.9%
	0.300"	2mm	58 mV	2.9%
		Standard	27 mV	1.4%

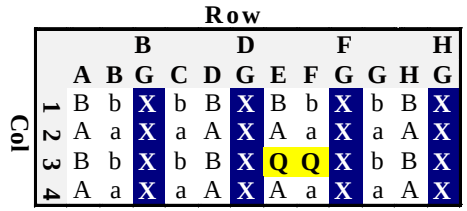
- PWB Footprint - can't be ignored
- Board thickness - can't be ignored
- How do device edge characteristics compare to assumed characteristics?

XAUI Simulations for TEC HM-Zd

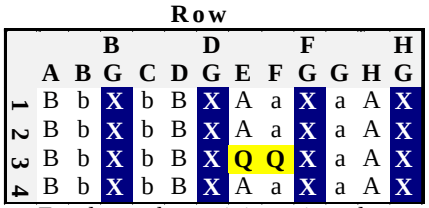
Pattern	Test Condition	Worst-Case Pair	Near-end Noise		Far-end Noise	
1	No Footprint	E/F	30 mV	1.5%	3 mV	0.2%
1	Footprint included	A/B	62 mV	3.1%	43 mV	2.1%
2	No Footprint	E/F	10 mV	0.5%	26 mV	1.3%
2	Footprint included	A/B	49 mV	2.4%	23 mV	1.1%
3	No Footprint	E/F	25 mV	1.2%	10 mV	1.0%
3	Footprint included	A/B	62 mV	3.1%	43 mV	2.1%



A – Positive switching signal
a – Negative switching signal
Q – Quiet pin
X – Ground pin



B – Far launch positive signal
b – Far launch negative signal
A – Near launch positive signal
a – Near launch negative signal
Q – Quiet pin
X – Ground pin



B – Far launch positive signal
b – Far launch negative signal
A – Near launch positive signal
a – Near launch negative signal
Q – Quiet pin
X – Ground pin

Pattern 1

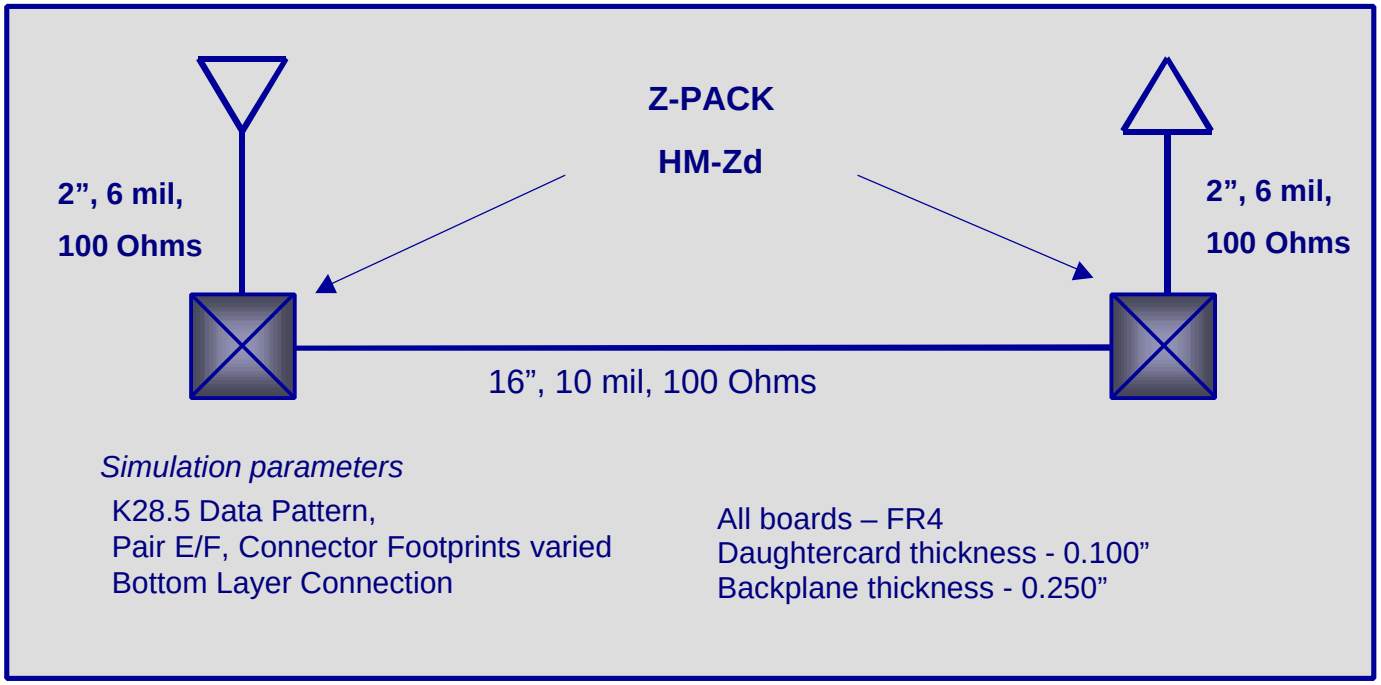
Pattern 2

Pattern 3

Daughtercard thickness - 0.100”
Backplane thickness - 0.200”

Voltage Swing - 1V (2V Diff)
Rise/Fall Time - 150 ps

Footprint Impact on Jitter
Channel Simulation



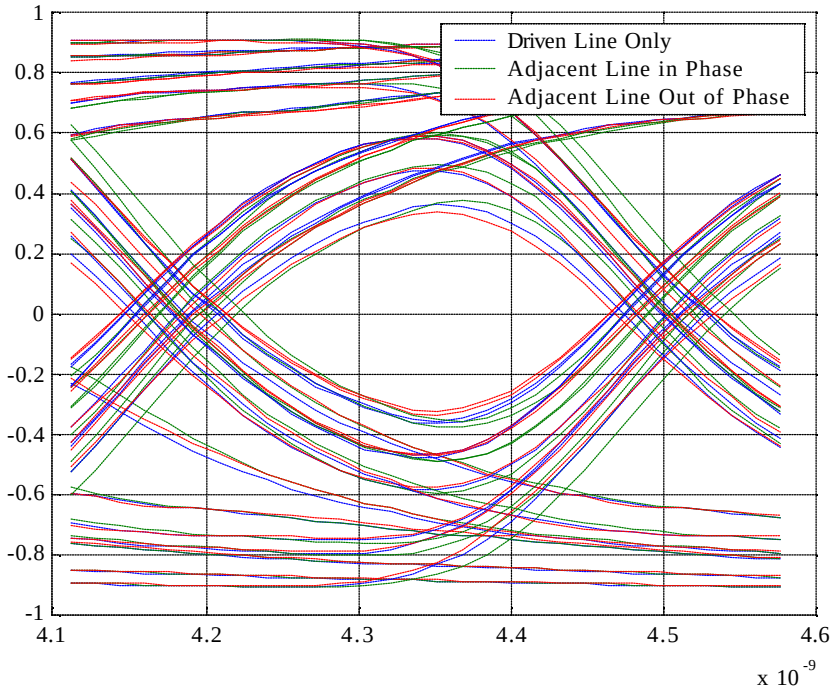
Simulation parameters

K28.5 Data Pattern,
Pair E/F, Connector Footprints varied
Bottom Layer Connection

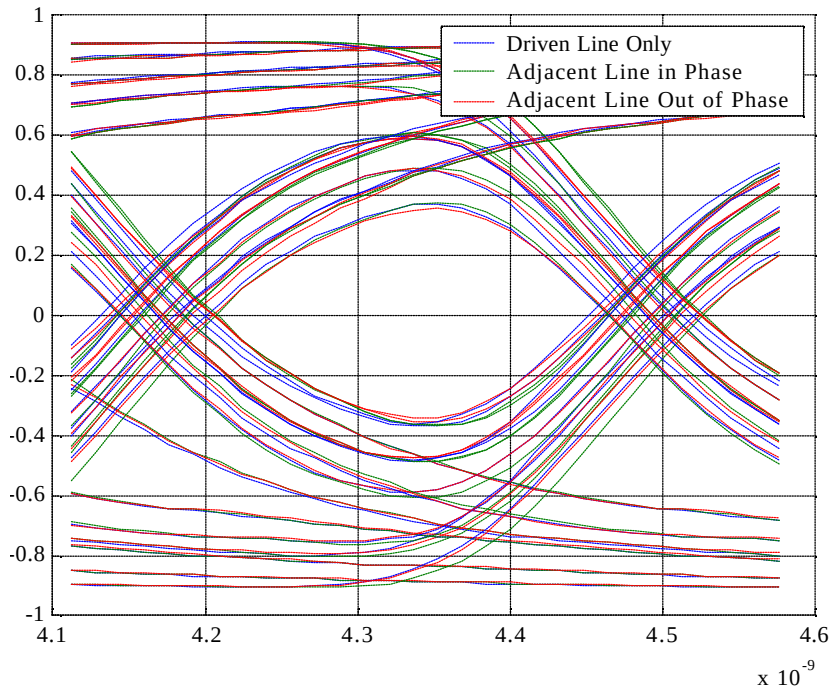
All boards – FR4
Daughtercard thickness - 0.100"
Backplane thickness - 0.250"

Impact of Coupling in Footprint

2mm Pattern

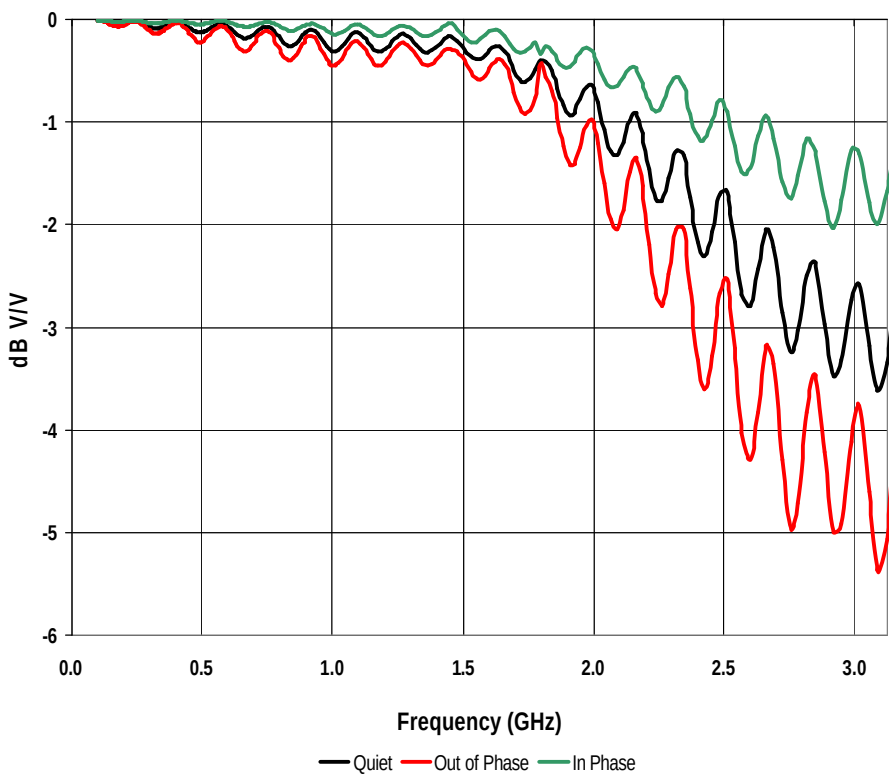


Standard Pattern

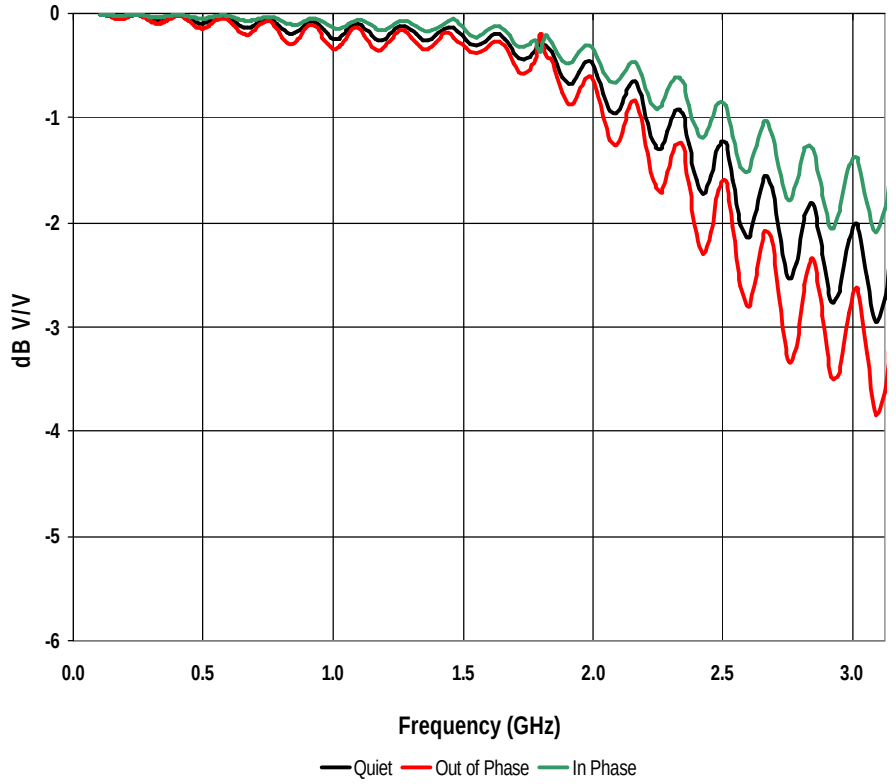


Condition	0 Crossover Jitter 2mm Footprint	0 Crossover Jitter Standard Footprint
Quiet	62 ps	69 ps
In Phase	77 ps	75 ps
Out of Phase	82 ps	77 ps
Variation	20 ps	8 ps

Impact of Coupling in Footprint



2mm Pattern



Standard Pattern

Summary

- Z-Pack HM-Zd
  - meets 4% crosstalk budget (3.1% maximum) under assumed conditions
    - different board thicknesses
    - different pinouts
  - consistent jitter performance with crosstalk
- Connector / PWB footprint / layer connection impacts
  - noise
  - jitter
- Z-Pack HM-Zd Information
  - www.amp.com/simulation
  - http://www.amp.com/simulation/files/papers/20GC014_Revb.pdf
  - http://www.amp.com/simulation/files/papers/20GC015_1_RevA.pdf