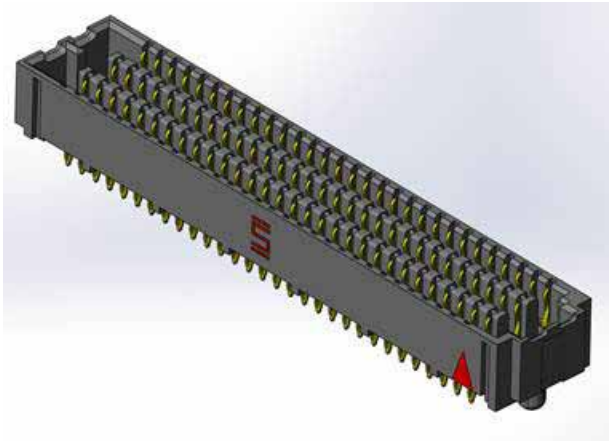
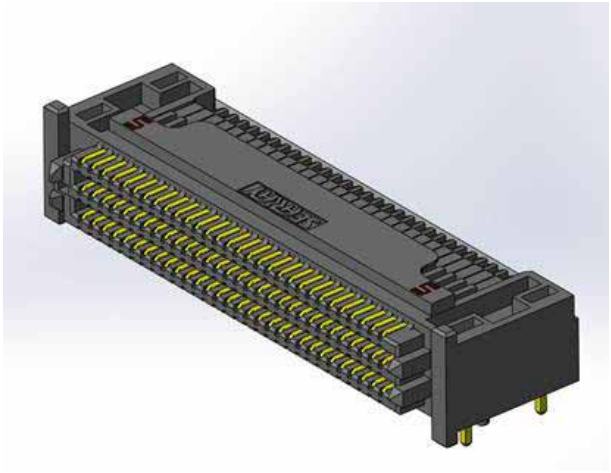
High Speed Characterization Report

SEAFP-XX-05.0-X-XX



Mates with

SEAM-XX-01-L-XX-2-RA



Description:
Open Pin Field Array, 1.27mm x 1.27mm Pitch
Vertical Array to Right Angle

Samtec Inc.
520 Park East Blvd.
New Albany IN 47151-1147 USA

WWW.SAMTEC.COM
1-800-SAMTEC-9 (US & Canada)
SIG@samtec.com

Phone: 812-944-6733
Fax: 812-948-5047
Report Revision: 12/6/2013

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

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Connector Overview

SEAFP/SEAM_RA is a 1.27mm x 1.27mm pitch interconnects system for elevated high-speed board-to-board applications. The open pin field design allows for dual signaling and is suitable for Fiber Channel, Rapid I/O, PCIe, SATA and Infiniband data rates. The SEAFP/SEAM_RA Series is available in 4, 6, 8, and 10 row open pin field arrays. Pins per row selections are 10, 20, 30, 40, or 50. This report reflects only the hi-speed electrical characteristics specific to a mated SEAFP/SEAM_RA test system.

Connector System Speed Rating

SEAFP/SEAM_RA Series, 1.27mm x 1.27mm (.050" x .050") pitch interconnect, Vertical Array to Right Angle

Signaling	Speed Rating
Single-Ended: 1:1 S/G, rowA	**7.5 GHz/ 15Gbps**
Single-Ended: 1:1 S/G, rowC	**9 GHz/ 18Gbps**
Single-Ended: 1:1 S/G, rowD	**8.5 GHz/ 17Gbps**
Single-Ended: 1:1 S/G, rowE	**7.5 GHz/ 15Gbps**
Single-Ended: 1:1 S/G, rowF	**10 GHz/ 20Gbps**
Single-Ended: 2:1 S/G, rowA	**6 GHz/ 12Gbps**
Single-Ended: 2:1 S/G, rowC	**9 GHz/ 18Gbps**
Single-Ended: 2:1 S/G, rowD	**11.5 GHz/ 23Gbps**
Single-Ended: 2:1 S/G, rowE	**7.5 GHz/ 15Gbps**
Single-Ended: 2:1 S/G, rowF	**10 GHz/ 20Gbps**
Differential: Optimal Horizontal, rowA	**11.5 GHz/ 23Gbps**
Differential: Optimal Horizontal, rowC	**9.5 GHz/ 19Gbps**
Differential: Optimal Horizontal, rowD	**8.5 GHz/ 17Gbps**
Differential: Optimal Horizontal, rowE	**7.5 GHz/ 15Gbps**

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential: Optimal Horizontal, rowF	**10.5 GHz/ 21Gbps**
Differential: Optimal Vertical, rowA,B	**9.5 GHz/ 19Gbps**
Differential: Optimal Vertical, rowC,D	**8.5 GHz/ 17Gbps**
Differential: Optimal Vertical, rowE,F	**10.5 GHz/ 21Gbps**
Differential: High Density Vertical, rowA,B	**8.5 GHz/ 17Gbps**
Differential: High Density Vertical, rowB,C	**10 GHz/ 20Gbps**
Differential: High Density Vertical, rowD,E	**9 GHz/ 18Gbps**
Differential: High Density Vertical, rowE,F	**7 GHz/ 14Gbps**

The Speed Rating is based on the -3 dB insertion loss point of the connector system. The -3 dB point can be used to estimate usable system bandwidth in a typical, two-level signaling environment.

To calculate the Speed Rating, the measured -3 dB point is rounded up to the nearest half-GHz level. The up-rounding corrects for a portion of the test board's trace loss, since a short length of trace loss is included in the loss data in this report. The resulting loss value is then doubled to determine the approximate maximum data rate in Gigabits per second (Gbps).

For example, a connector with a -3 dB point of 7.8 GHz would have a Speed Rating of 8 GHz/ 16 Gbps. A connector with a -3 dB point of 7.2 GHz would have a Speed Rating of 7.5 GHz/15 Gbps.

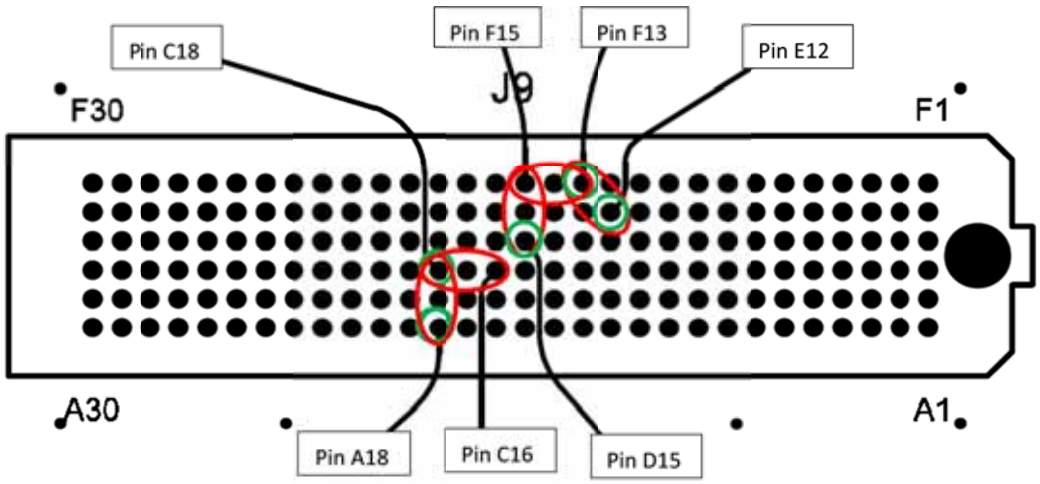
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Frequency Domain Data Summary

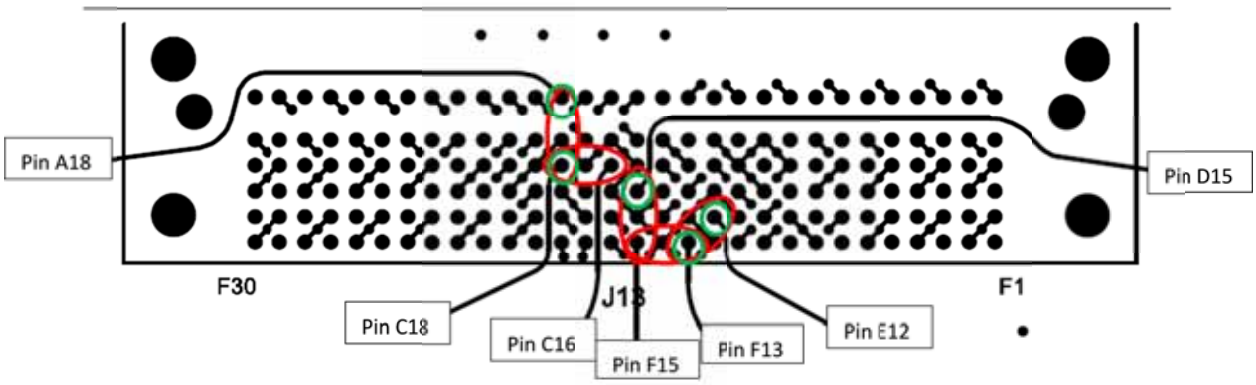
Table 1 - Single-Ended 1:1 S/G Pattern Performance			
Test Parameter	**Driver**	**Receiver**	
Insertion Loss	SEAM-RA_A18	SEAFp_A18	3dB@ 7.4 GHz
	SEAM-RA_C18	SEAFp_C18	3dB@ 9 GHz
	SEAM-RA_D15	SEAFp_D15	3dB@ 8.3 GHz
	SEAM-RA_E12	SEAFp_E12	3dB@ 7.5 GHz
	SEAM-RA_F13	SEAFp_F13	3dB@ 9.8 GHz
Return Loss	SEAM-RA_A18	SEAM-RA_A18	>10dB to 4.3 GHz
	SEAM-RA_C18	SEAM-RA_C18	>10dB to 7.5 GHz
	SEAM-RA_D15	SEAM-RA_D15	>10dB to 7.5 GHz
	SEAM-RA_E12	SEAM-RA_E12	>10dB to 6.3 GHz
	SEAM-RA_F13	SEAM-RA_F13	>10dB to 5.8 GHz
Near-End Crosstalk	SEAM-RA_A18	SEAM-RA_C18	<-20dB to 17.8 GHz
	SEAM-RA_C16	SEAM-RA_C18	<-20dB to 9.2 GHz
	SEAM-RA_D15	SEAM-RA_F15	<-20dB to 8.2 GHz
	SEAM-RA_E12	SEAM-RA_F13	<-20dB to 7.5 GHz
	SEAM-RA_F13	SEAM-RA_F15	<-20dB to 12.8 GHz
Far-End Crosstalk	SEAM-RA_A18	SEAFp_C18	<-20dB to 17.5 GHz
	SEAM-RA_C16	SEAFp_C18	<-20dB to 17.5 GHz
	SEAM-RA_D15	SEAFp_F15	<-20dB to 8.2 GHz
	SEAM-RA_E12	SEAFp_F13	<-20dB to 3.8 GHz
	SEAM-RA_F13	SEAFp_F15	<-20dB to 12.9 GHz

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Single-Ended 1:1 S/G Pattern Pin Map



SEAFP



SEAM-RA

Insertion Loss & Return Loss

Crosstalk

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Table 2 - Single-Ended 2:1 S/G Pattern Performance			
Test Parameter	**Driver**	**Receiver**	
Insertion Loss	SEAM-RA_A14	SEAFp_A14	3dB@ 5.8 GHz
	SEAM-RA_C17	SEAFp_C17	3dB@ 8.9 GHz
	SEAM-RA_D17	SEAFp_D17	3dB@ 11.2 GHz
	SEAM-RA_E10	SEAFp_E10	3dB@ 7.4 GHz
	SEAM-RA_F11	SEAFp_F11	3dB@ 9.6 GHz
Return Loss	SEAM-RA_A14	SEAM-RA_A14	>10dB to 5.9 GHz
	SEAM-RA_C17	SEAM-RA_C17	>10dB to 8.1 GHz
	SEAM-RA_D17	SEAM-RA_D17	>10dB to 7.8 GHz
	SEAM-RA_E10	SEAM-RA_E10	>10dB to 6.3 GHz
	SEAM-RA_F11	SEAM-RA_F11	>10dB to 5.9 GHz
Near-End Crosstalk	SEAM-RA_A14	SEAM-RA_A15	<-20dB to 0.7 GHz
	SEAM-RA_C17	SEAM-RA_D17	<-20dB to 0.8 GHz
	SEAM-RA_D17	SEAM-RA_D18	<-20dB to 0.6 GHz
	SEAM-RA_E10	SEAM-RA_F10	<-20dB to 0.6 GHz
	SEAM-RA_F10	SEAM-RA_F11	<-20dB to 0.4 GHz
Far-End Crosstalk	SEAM-RA_A14	SEAFp_A15	<-20dB to 5.1 GHz
	SEAM-RA_C17	SEAFp_D17	<-20dB to 8 GHz
	SEAM-RA_D17	SEAFp_D18	<-20dB to 8.1 GHz
	SEAM-RA_E10	SEAFp_F10	<-20dB to 4.3 GHz
	SEAM-RA_F11	SEAFp_F10	<-20dB to 7.8 GHz

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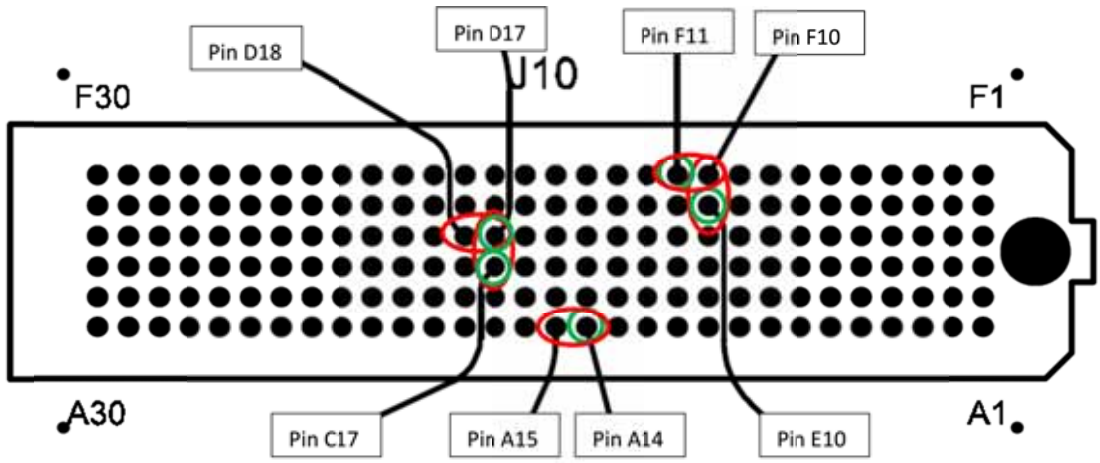
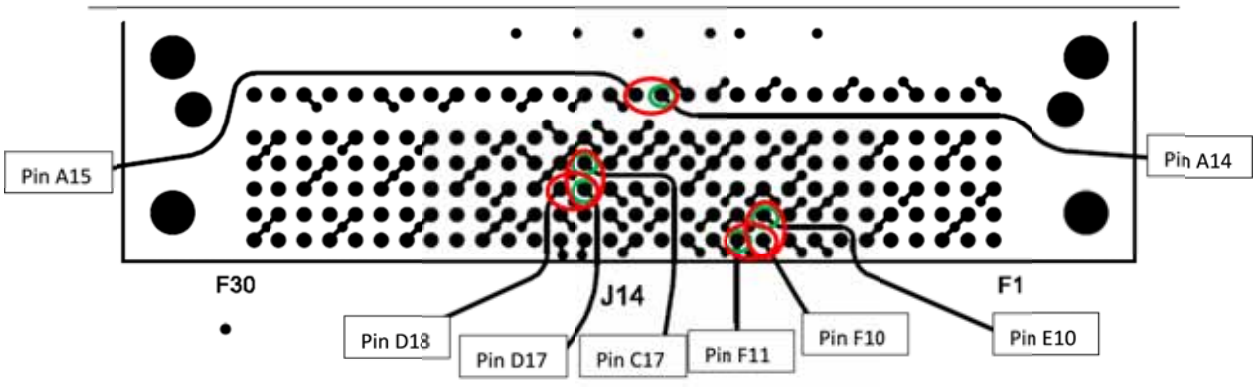
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Single-Ended 2:1 S/G Pattern Pin Map



SEAFP



SEAM-RA

Insertion Loss & Return Loss

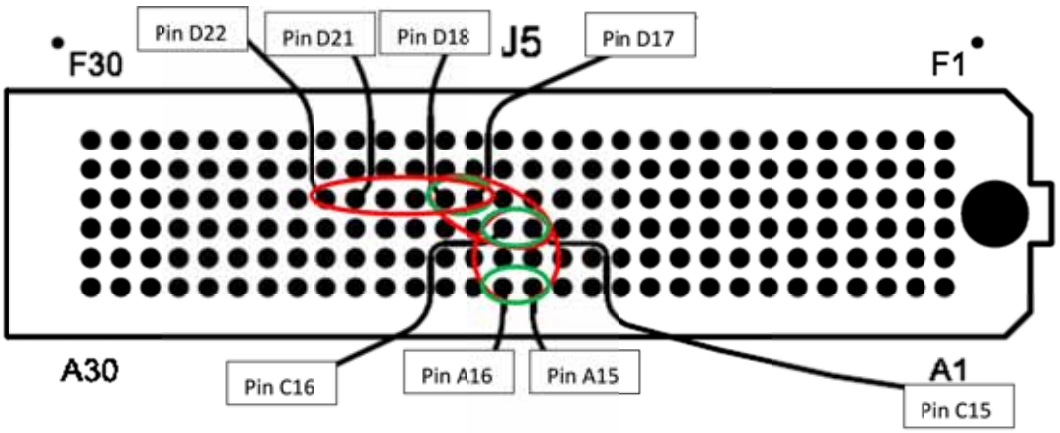
Crosstalk

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Table 3 - Differential Optimal Horizontal Performance			
Test Parameter	**Driver**	**Receiver**	
Insertion Loss	SEAM-RA_A15,A16	SEAFp_A15,A16	3dB@ 11.2 GHz
	SEAM-RA_C15,C16	SEAFp_C15,C16	3dB@ 9.1 GHz
	SEAM-RA_D17,D18	SEAFp_D17,D18	3dB@ 8.1 GHz
	SEAM-RA_E15,E16	SEAFp_E15,E16	3dB@ 7.3 GHz
	SEAM-RA_F21, F22	SEAFp_F21,F22	3dB@ 10.1 GHz
Return Loss	SEAM-RA_A15,A16	SEAM-RA_A15,A16	>10dB to 7.4 GHz
	SEAM-RA_C15,C16	SEAM-RA_C15,C16	>10dB to 8 GHz
	SEAM-RA_D17,D18	SEAM-RA_D17,D18	>10dB to 7.9 GHz
	SEAM-RA_E15,E16	SEAM-RA_E15,E16	>10dB to 6.5 GHz
	SEAM-RA_F21, F22	SEAM-RA_F21, F22	>10dB to 6.3 GHz
Near-End Crosstalk	SEAM-RA_A15,A16	SEAM-RA_C15,C16	<-20dB to 17.7 GHz
	SEAM-RA_C15,C16	SEAM-RA_D17,D18	<-20dB to 20 GHz
	SEAM-RA_D17,D18	SEAM-RA_D21,D22	<-20dB to 20 GHz
	SEAM-RA_E15,E16	SEAM-RA_F17,F18	<-20dB to 20 GHz
	SEAM-RA_F17, F18	SEAM-RA_F21,F22	<-20dB to 20 GHz
Far-End Crosstalk	SEAM-RA_A15,A16	SEAFp_C15,C16	<-20dB to 17.6 GHz
	SEAM-RA_C15,C16	SEAFp_D17,D18	<-20dB to 20 GHz
	SEAM-RA_D17,D18	SEAFp_D21,D22	<-20dB to 20 GHz
	SEAM-RA_E15,E16	SEAFp_F17,F18	<-20dB to 20 GHz
	SEAM-RA_F17, F18	SEAFp_F21,F22	<-20dB to 20 GHz

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Horizontal Pin Map



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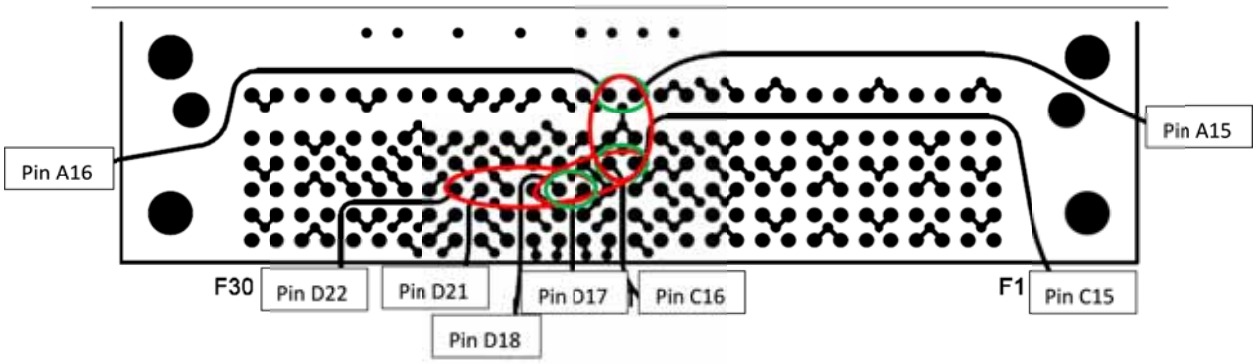
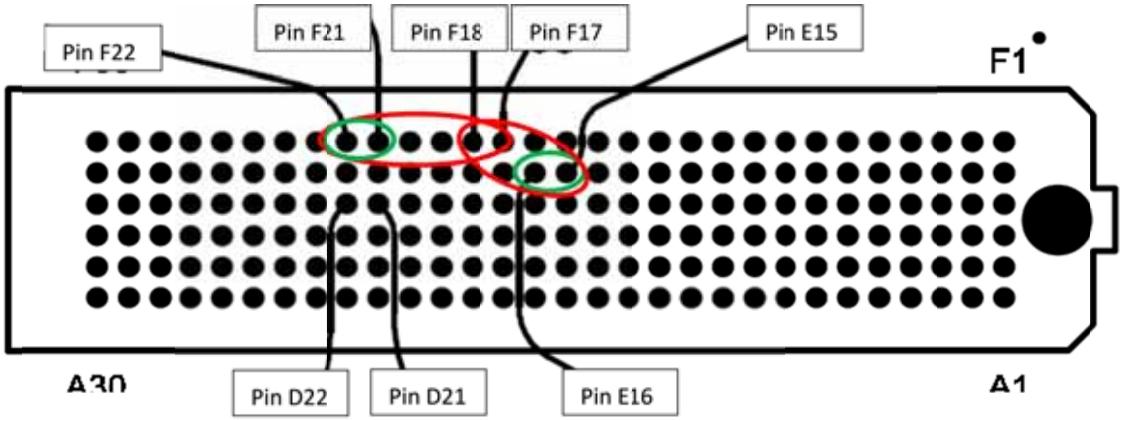


SEAM-RA

Insertion Loss & Return Loss

Crosstalk

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle



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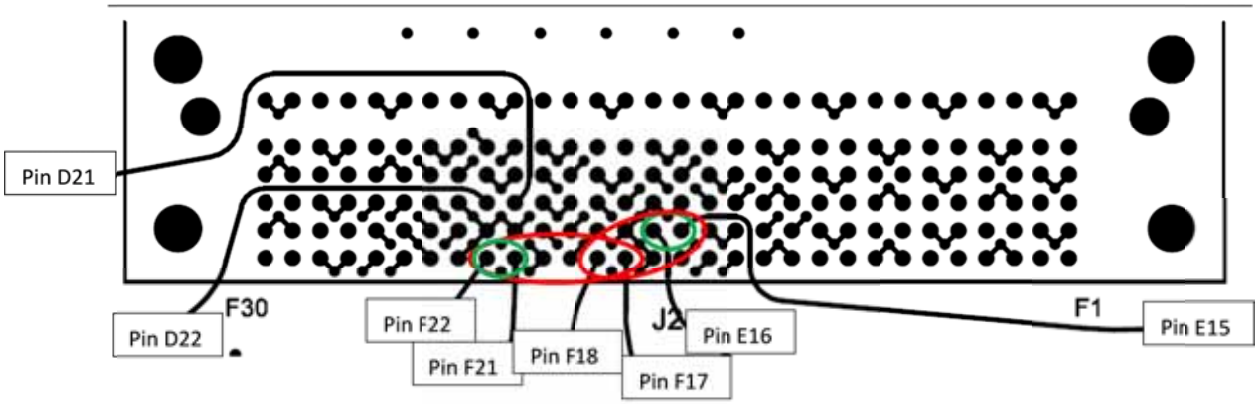


SEAM-RA

Insertion Loss & Return Loss

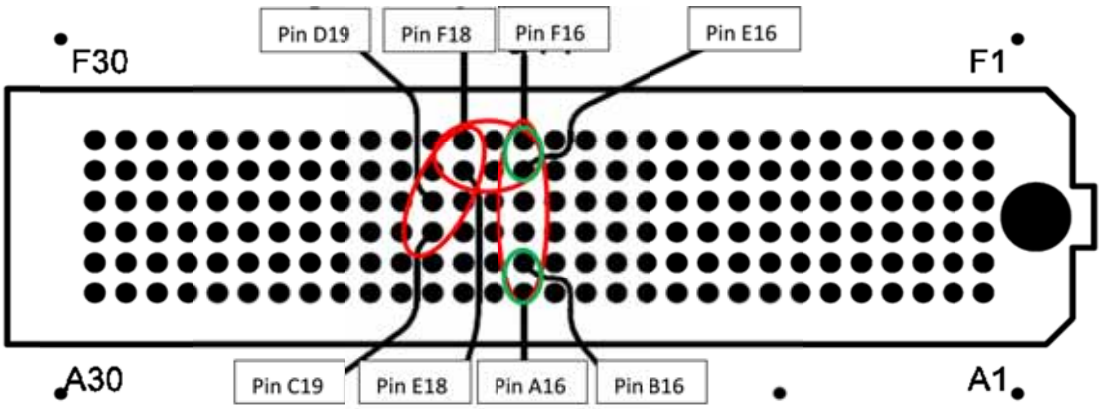
Crosstalk

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Table 4 - Differential Optimal Vertical Performance			
Test Parameter	**Driver**	**Receiver**	
Insertion Loss	SEAM-RA_A16,B16	SEAFp_A16,B16	3dB@ 9.3 GHz
	SEAM-RA_C17,D17	SEAFp_C17,D17	3dB@ 8.2 GHz
	SEAM-RA_E16,F16	SEAFp_E16,F16	3dB@ 10.5 GHz
Return Loss	SEAM-RA_A16,B16	SEAM-RA_A16,B16	>10dB to 9.1 GHz
	SEAM-RA_C17,D17	SEAM-RA_C17,D17	>10dB to 8.2 GHz
	SEAM-RA_E16,F16	SEAM-RA_E16,F16	>10dB to 9.9 GHz
Near-End Crosstalk	SEAM-RA_A14,B14	SEAM-RA_A16, B16	<-20dB to 20 GHz
	SEAM-RA_A16,B16	SEAM-RA_C17, D17	<-20dB to 20 GHz
	SEAM-RA_A16,B16	SEAM-RA_E16, F16	<-20dB to 20 GHz
	SEAM-RA_C19,D19	SEAM-RA_E18, F18	<-20dB to 20 GHz
	SEAM-RA_E16,F16	SEAM-RA_E18, F18	<-20dB to 20 GHz
Far-End Crosstalk	SEAM-RA_A14,B14	SEAFp_A16, B16	<-20dB to 20 GHz
	SEAM-RA_A16,B16	SEAFp_C17, D17	<-20dB to 20 GHz
	SEAM-RA_A16,B16	SEAFp_E16, F16	<-20dB to 20 GHz
	SEAM-RA_C19,D19	SEAFp_E18, F18	<-20dB to 20 GHz
	SEAM-RA_E16,F16	SEAFp_E18, F18	<-20dB to 20 GHz

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Vertical Pin Map



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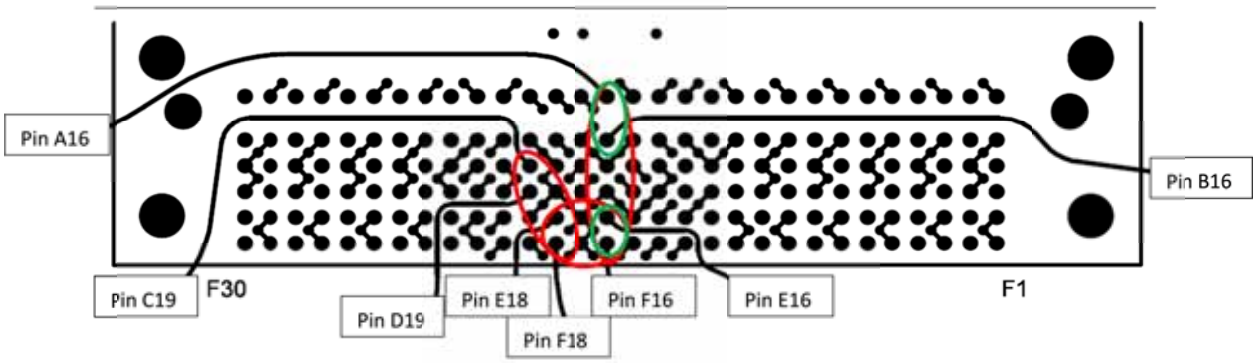
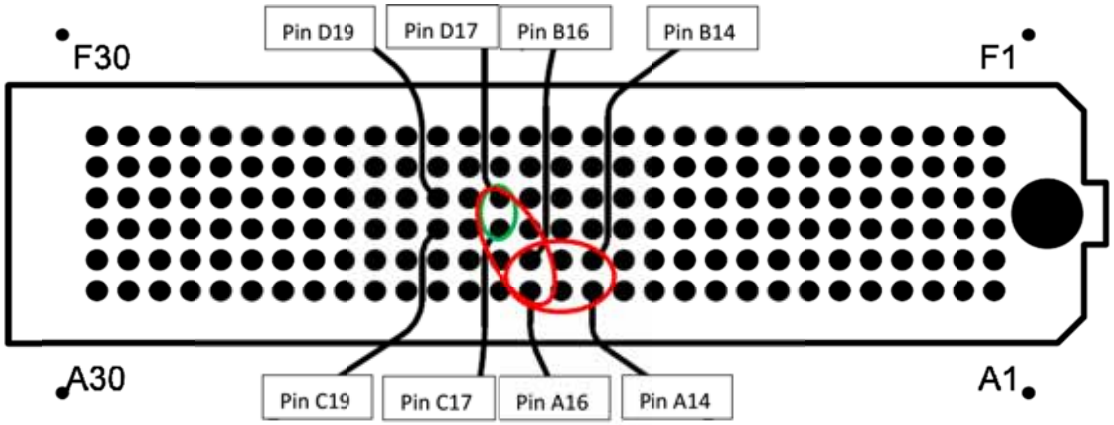


SEAM-RA

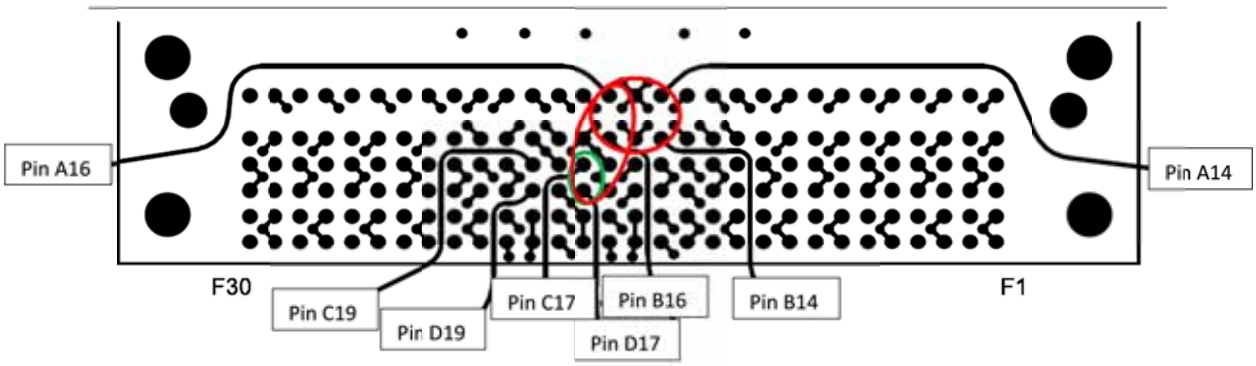
Insertion Loss & Return Loss

Crosstalk

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle



SEAFP



SEAM-RA

Insertion Loss & Return Loss

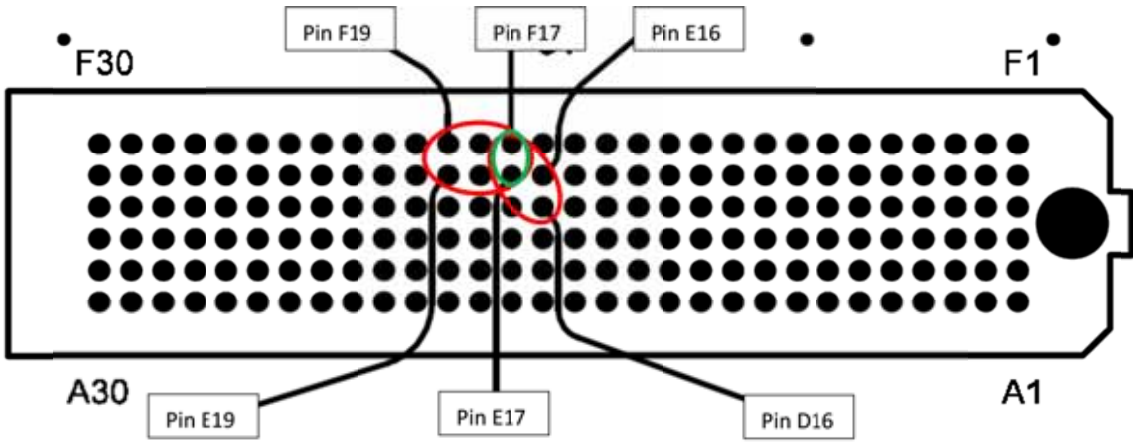
Crosstalk

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

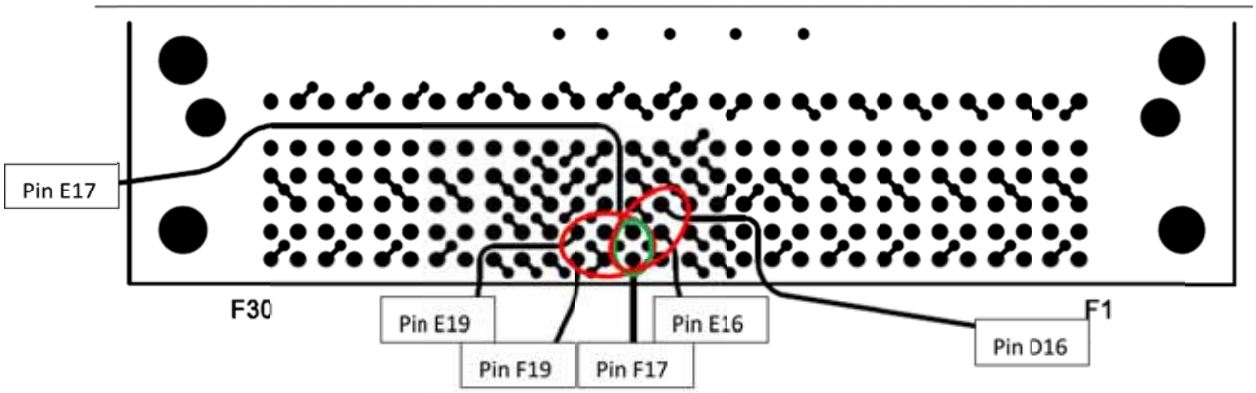
Table 5 - Differential High Density Vertical Performance			
Test Parameter	**Driver**	**Receiver**	
Insertion Loss	SEAM-RA_A14,B14	SEAFp_A14,B14	3dB@ 8.5 GHz
	SEAM-RA_B15,C15	SEAFp_B15,C15	3dB@ 9.7 GHz
	SEAM-RA_D16,E16	SEAFp_D16,E16	3dB@ 8.6 GHz
	SEAM-RA_E17, F17	SEAFp_E17, F17	3dB@ 7 GHz
Return Loss	SEAM-RA_A14,B14	SEAM-RA_A14,B14	>10dB to 9 GHz
	SEAM-RA_B15,C15	SEAM-RA_B15,C15	>10dB to 8.8 GHz
	SEAM-RA_D16,E16	SEAM-RA_D16,E16	>10dB to 8 GHz
	SEAM-RA_E17, F17	SEAM-RA_E17, F17	>10dB to 6.6 GHz
Near-End Crosstalk	SEAM-RA_A14,B14	SEAM-RA_B15,C15	<-20dB to 8 GHz
	SEAM-RA_B15,C15	SEAM-RA_D16,E16	<-20dB to 20 GHz
	SEAM-RA_D16,E16	SEAM-RA_D18,E18	<-20dB to 18.4 GHz
	SEAM-RA_D16,E16	SEAM-RA_E17,F17	<-20dB to 6.4 GHz
	SEAM-RA_E17, F17	SEAM-RA_E19, F19	<-20dB to 12.6 GHz
Far-End Crosstalk	SEAM-RA_A14,B14	SEAFp_B15,C15	<-20dB to 10.5 GHz
	SEAM-RA_B15,C15	SEAFp_D16,E16	<-20dB to 17.9 GHz
	SEAM-RA_D16,E16	SEAFp_D18,E18	<-20dB to 9.7 GHz
	SEAM-RA_D16,E16	SEAFp_E17,F17	<-20dB to 6.3 GHz
	SEAM-RA_E17, F17	SEAFp_E19, F19	<-20dB to 6.2 GHz

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential High Density Vertical Pin Map



SEAFP

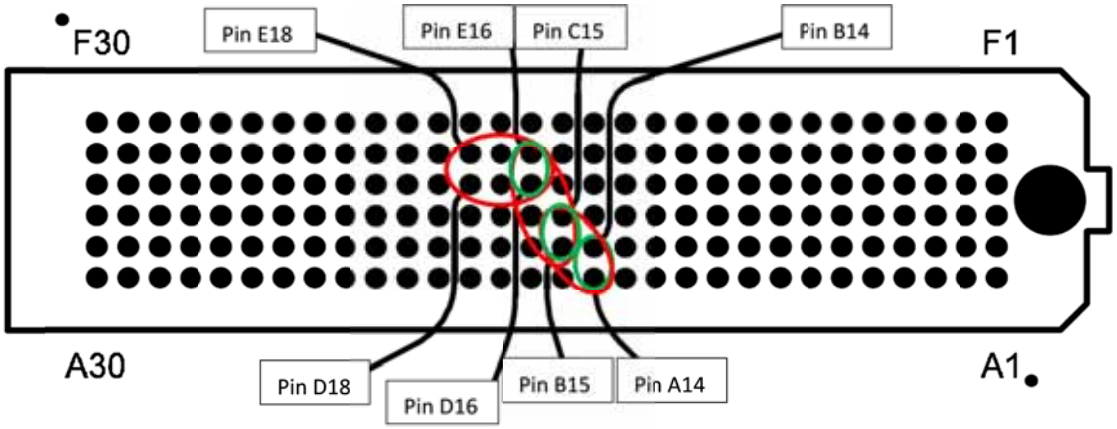


SEAM-RA

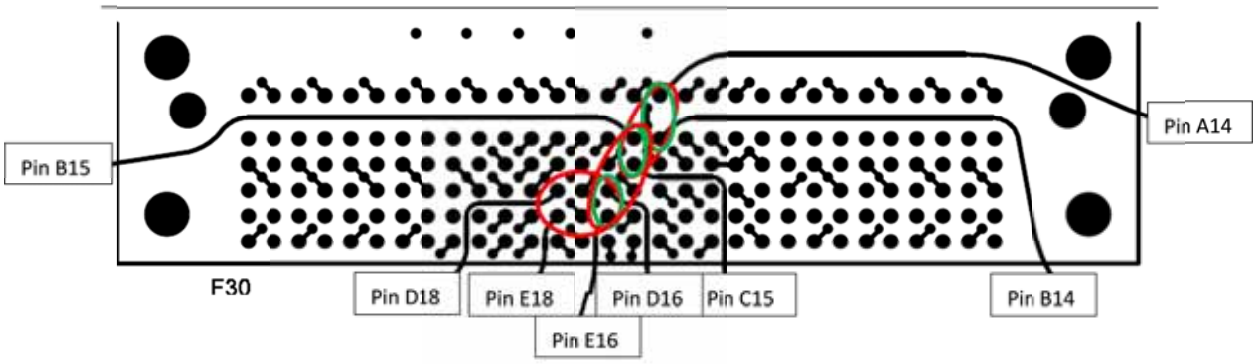
Insertion Loss & Return Loss

Crosstalk

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle



SEAFP



SEAM-RA

Insertion Loss & Return Loss

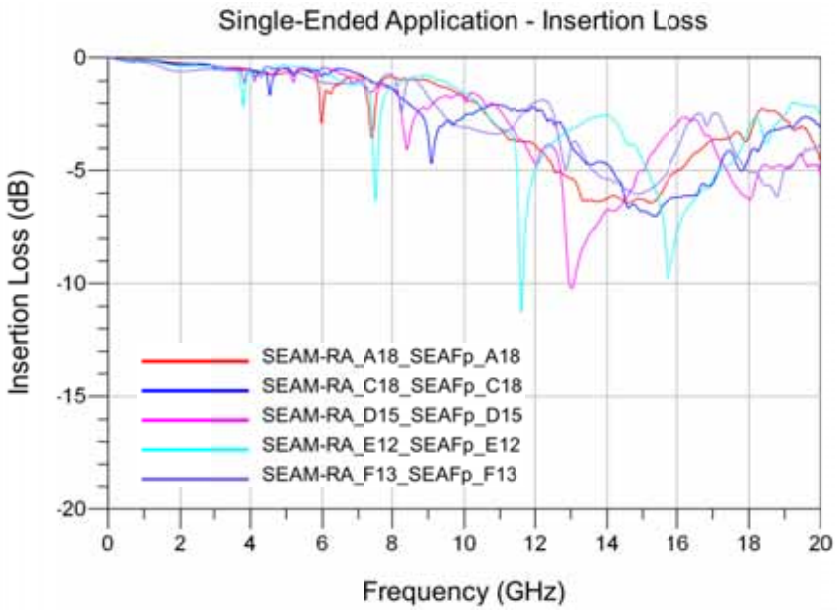
Crosstalk

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

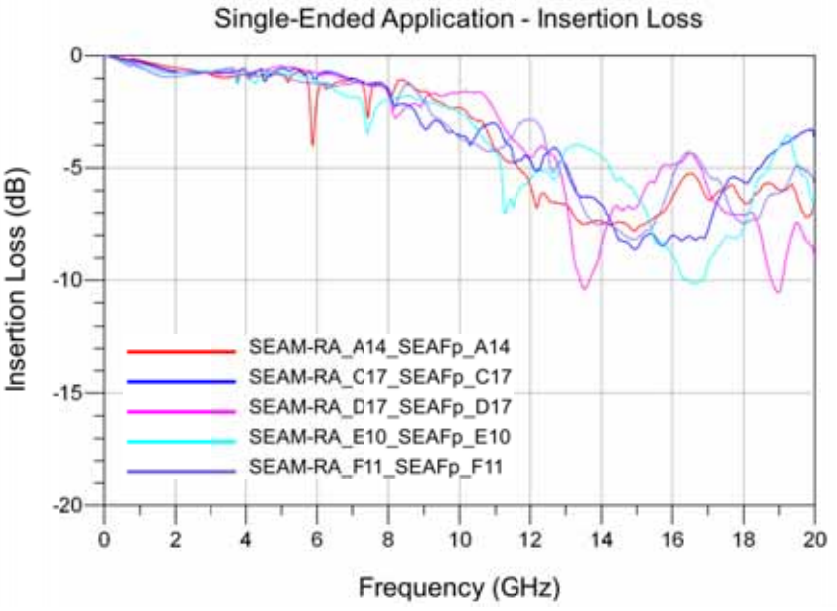
Bandwidth Charts – Single-Ended & Differential Insertion Loss

SEAFP/SEAM_RA Array Series

Single-Ended 1:1 S/G Pattern



Single-Ended 2:1 S/G Pattern



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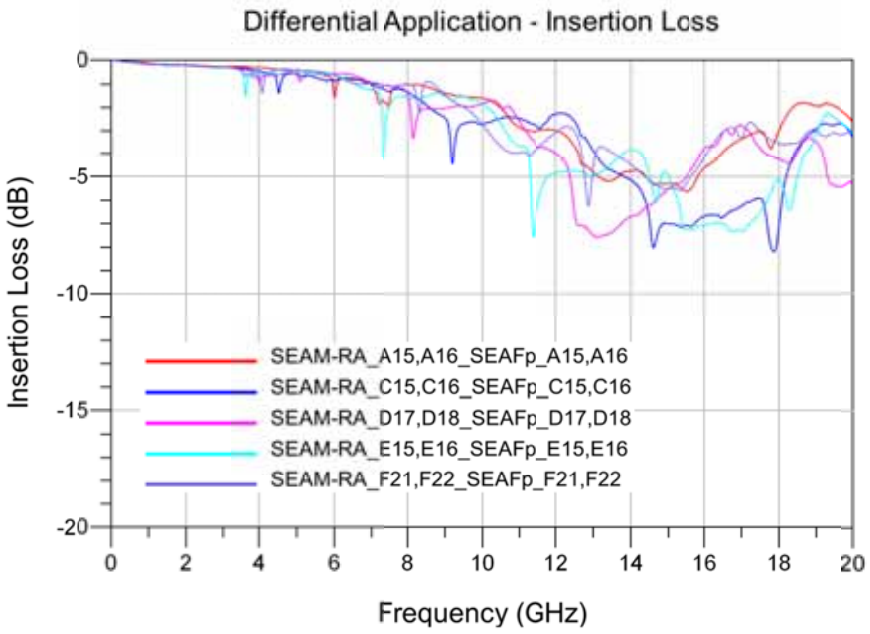
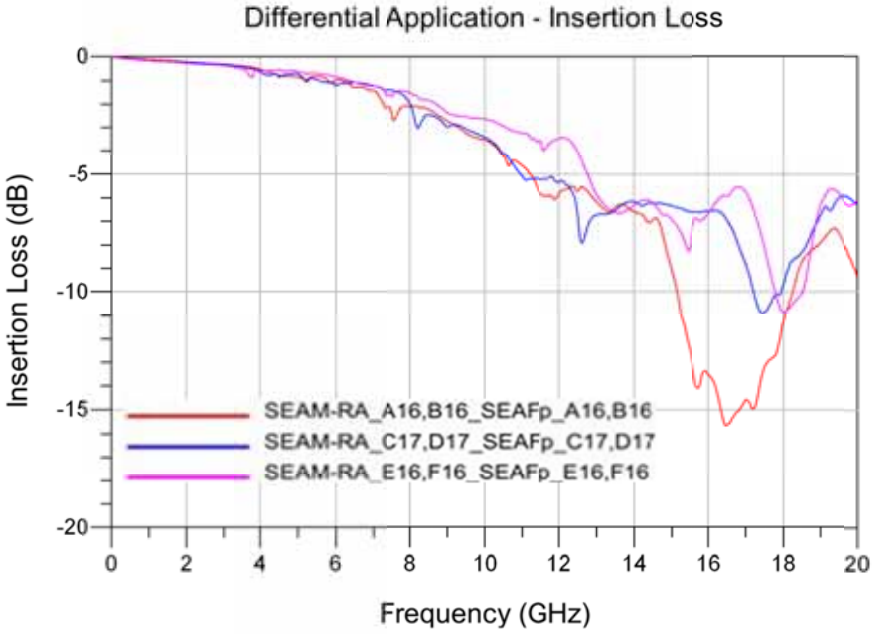
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Horizontal



Differential Optimal Vertical



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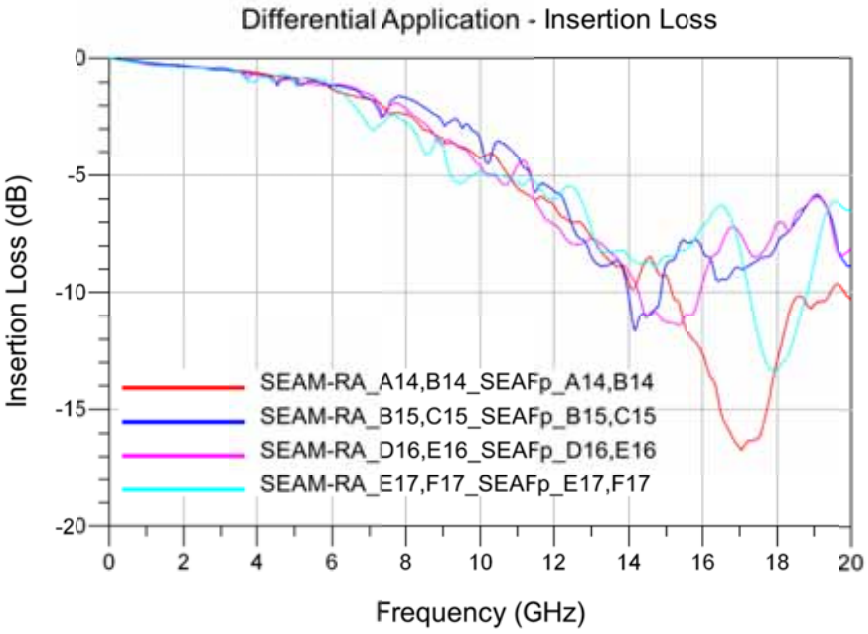
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential High Density Vertical



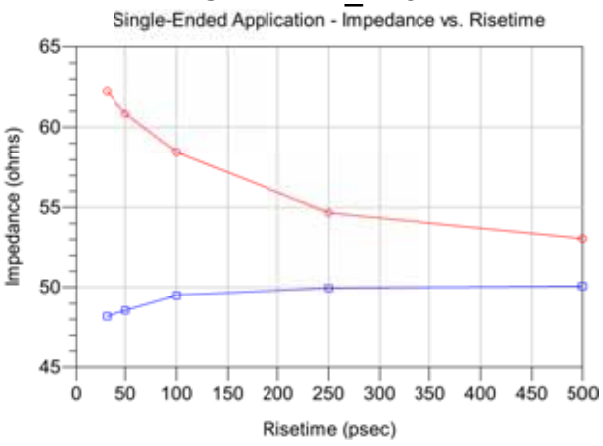
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Time Domain Data Summary

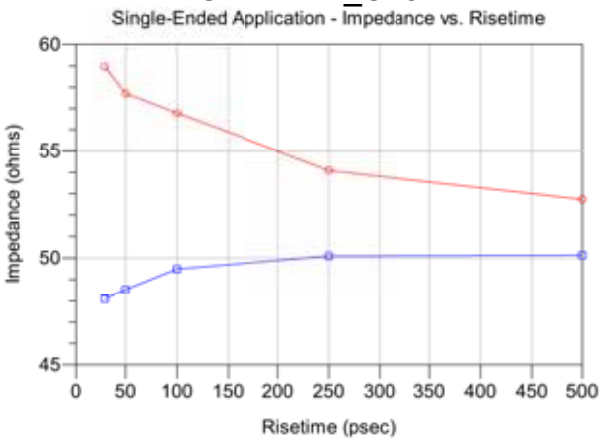
Table 6 – Single-End Impedance (Ω) – 1:1 S/G Pattern						
Driver	**Signal Risetime**	**30 ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**
SEAM-RA_A18	**Maximum Impedance**	62.23	60.84	58.45	54.65	53.03
	Minimum Impedance	48.18	48.55	49.49	49.94	50.06
SEAM-RA_C18	**Maximum Impedance**	58.95	57.71	56.78	54.08	52.73
	Minimum Impedance	48.10	48.51	49.48	50.09	50.13
SEAM-RA_D15	**Maximum Impedance**	60.50	59.31	58.27	55.49	53.53
	Minimum Impedance	47.79	48.10	49.07	49.40	49.72
SEAM-RA_E12	**Maximum Impedance**	61.15	59.89	58.59	56.06	54.16
	Minimum Impedance	48.17	48.55	49.59	50.03	50.26
SEAM-RA_F13	**Maximum Impedance**	65.07	64.12	63.56	60.55	56.93
	Minimum Impedance	48.02	48.34	49.32	50.20	50.34

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

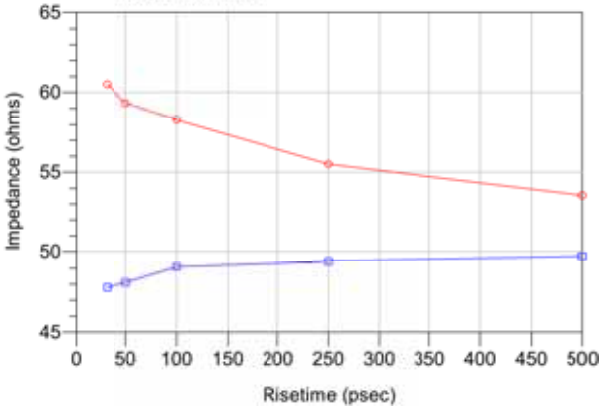
SEAM-RA_A18



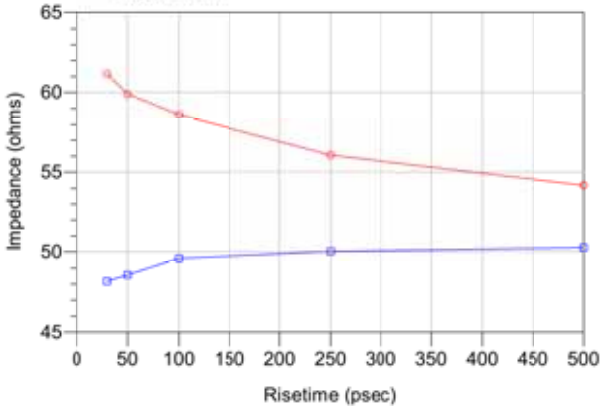
SEAM-RA_C18



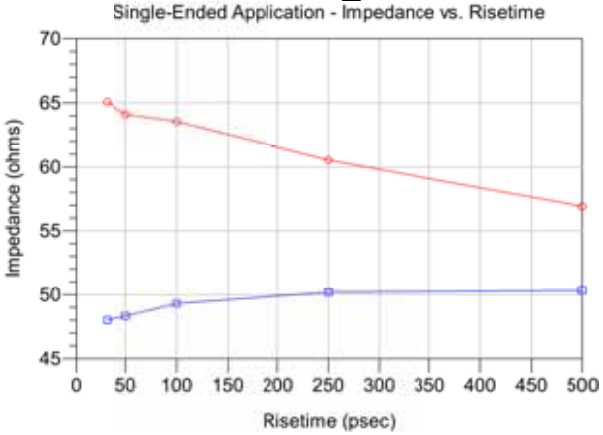
SEAM-RA_D15



SEAM-RA_E12



SEAM-RA_F13

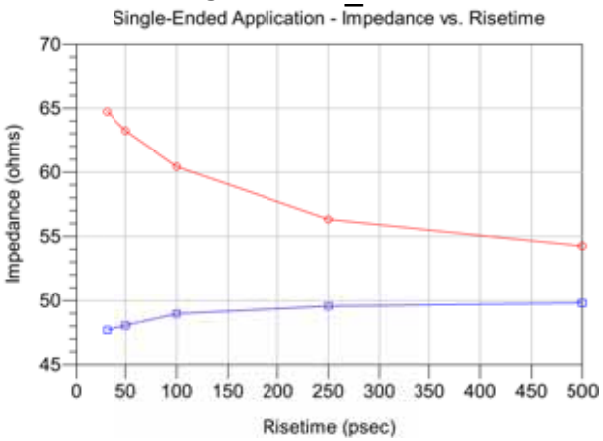


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

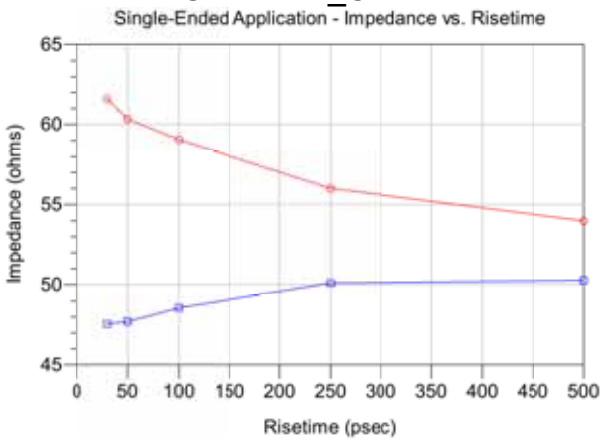
Table 7 – Single-End Impedance (Ω) – 2:1 S/G Pattern						
Driver	**Signal Risetime**	**30 ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**
SEAM-RA_A14	**Maximum Impedance**	64.75	63.23	60.44	56.33	54.25
	Minimum Impedance	47.69	48.07	48.99	49.58	49.82
SEAM-RA_C17	**Maximum Impedance**	61.60	60.33	59.02	56.00	53.98
	Minimum Impedance	47.54	47.70	48.55	50.10	50.26
SEAM-RA_D17	**Maximum Impedance**	61.92	60.85	60.38	57.36	55.11
	Minimum Impedance	47.93	48.35	49.48	49.98	50.29
SEAM-RA_E10	**Maximum Impedance**	61.81	60.69	59.99	57.87	55.53
	Minimum Impedance	47.70	48.08	49.23	49.96	50.23
SEAM-RA_F11	**Maximum Impedance**	73.45	70.98	67.12	63.85	59.49
	Minimum Impedance	47.97	48.33	49.35	49.88	50.26

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

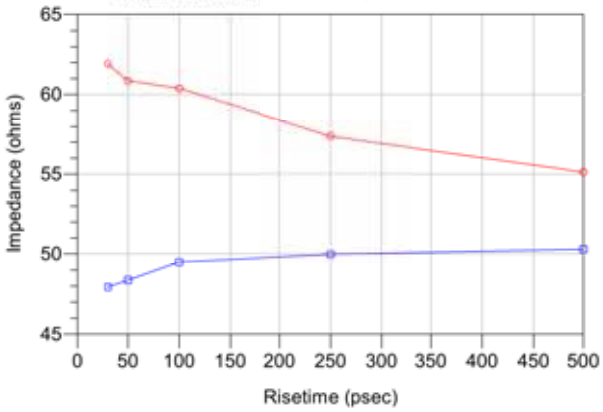
SEAM-RA_A14



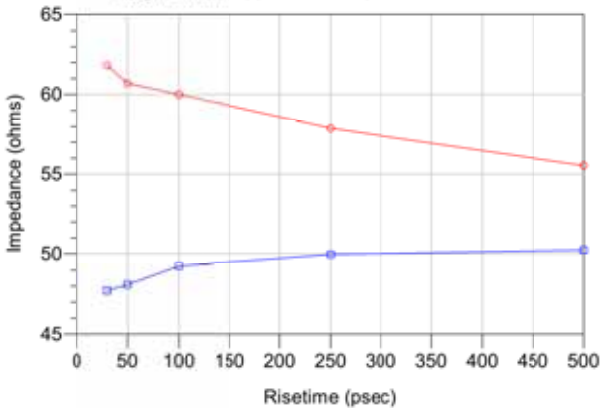
SEAM-RA_C17



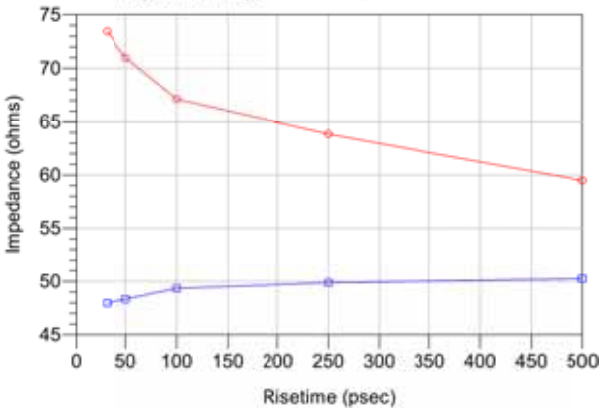
SEAM-RA_D17



SEAM-RA_E10



SEAM-RA_F11

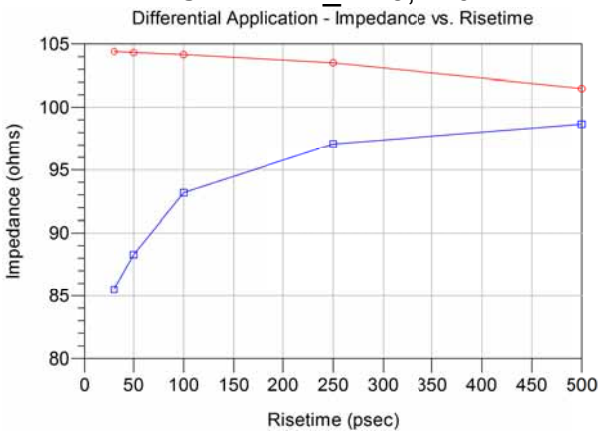


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

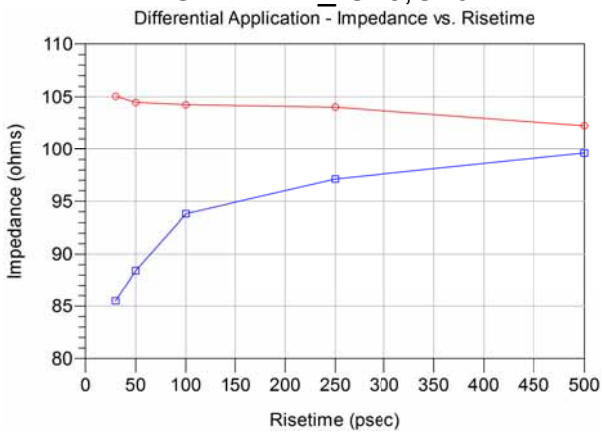
Table 8 – Differential Impedance (Ω) – Optimal Horizontal						
Driver	**Signal Risetime**	**30 ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**
SEAM-RA_A15,A16	**Maximum Impedance**	104.41	104.33	104.16	103.50	101.50
	Minimum Impedance	85.49	88.28	93.19	97.07	98.66
SEAM-RA_C15,C16	**Maximum Impedance**	105.07	104.49	104.26	104.03	102.25
	Minimum Impedance	85.50	88.42	93.81	97.11	99.61
SEAM-RA_D17,D18	**Maximum Impedance**	106.66	106.56	106.53	105.95	103.60
	Minimum Impedance	85.76	88.59	93.81	97.73	99.60
SEAM-RA_E15,E16	**Maximum Impedance**	104.93	104.84	104.74	103.93	102.34
	Minimum Impedance	85.90	88.90	94.00	97.47	99.23
SEAM-RA_F21,F22	**Maximum Impedance**	109.62	106.88	106.85	106.56	105.01
	Minimum Impedance	86.93	89.34	94.97	98.77	99.48

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

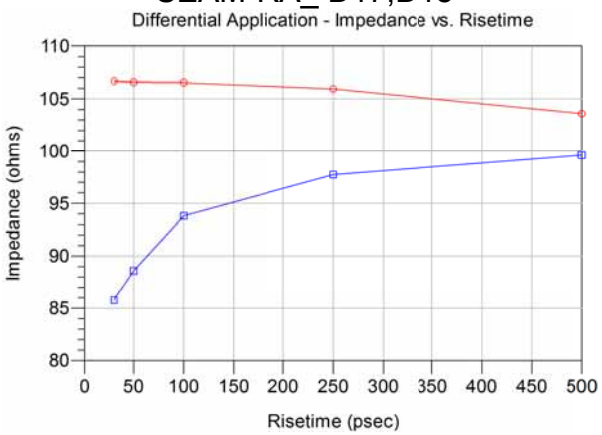
SEAM-RA_ A15,A16



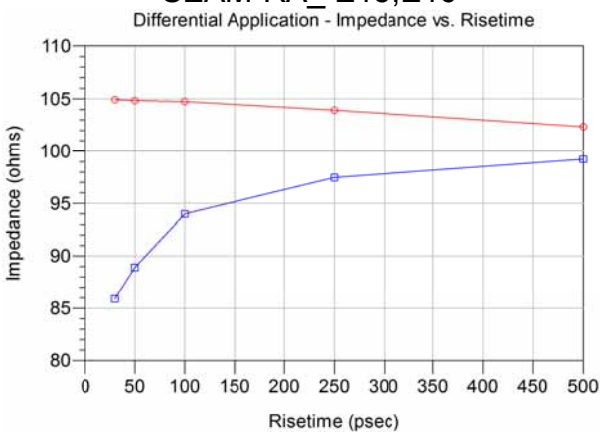
SEAM-RA_ C15,C16



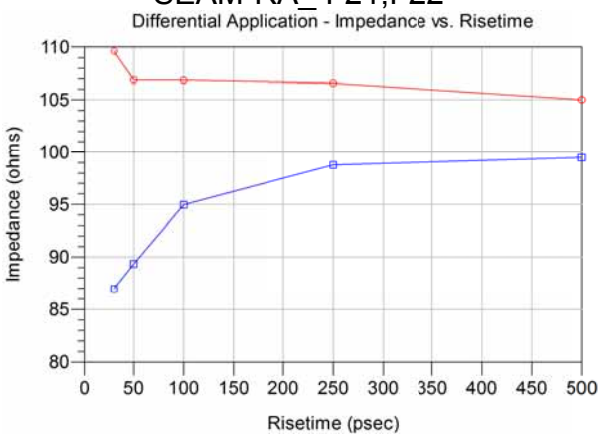
SEAM-RA_ D17,D18



SEAM-RA_ E15,E16



SEAM-RA_ F21,F22

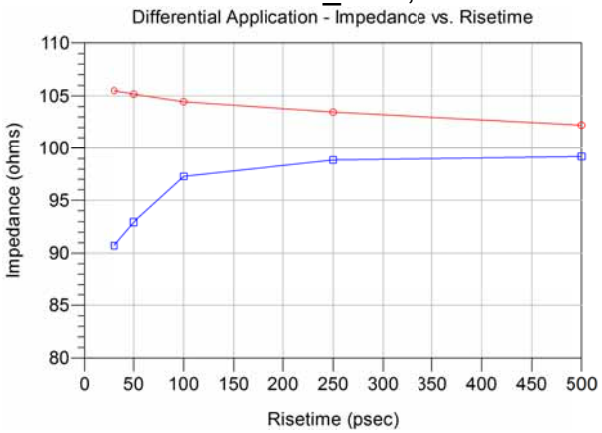


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

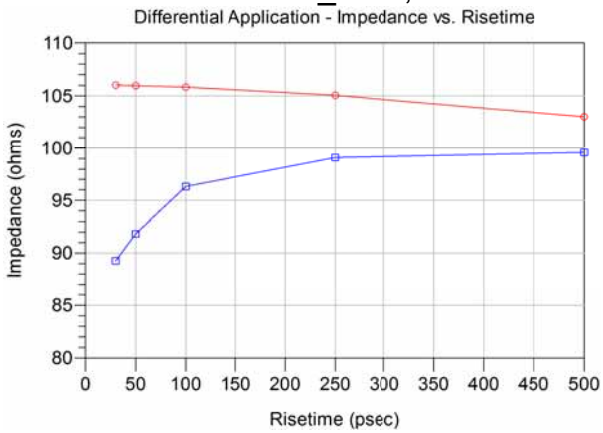
Table 9 – Differential Impedance (Ω) – Optimal Vertical						
Driver	**Signal Risetime**	**30 ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**
SEAM-RA_A16,B16	**Maximum Impedance**	105.51	105.17	104.44	103.46	102.20
	Minimum Impedance	90.71	92.93	97.28	98.84	99.18
SEAM-RA_C17,D17	**Maximum Impedance**	106.05	105.98	105.84	105.06	103.00
	Minimum Impedance	89.26	91.83	96.32	99.09	99.58
SEAM-RA_E16,F16	**Maximum Impedance**	107.44	105.88	104.23	102.20	101.31
	Minimum Impedance	90.37	92.44	96.52	98.87	99.17

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

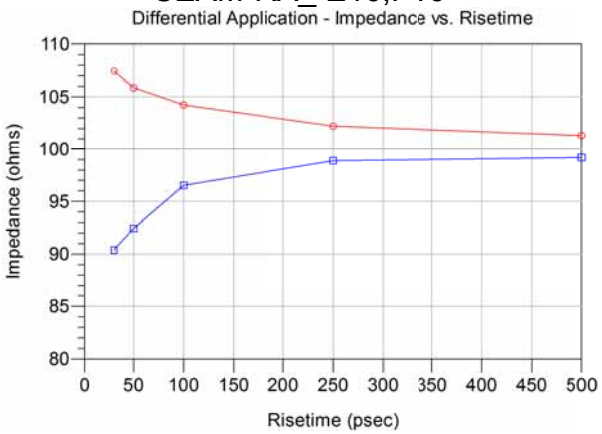
SEAM-RA_ A16,B16



SEAM-RA_ C17,D17



SEAM-RA_ E16,F16



Samtec Inc.
520 Park East Blvd.
New Albany IN 47151-1147 USA

WWW.SAMTEC.COM
1-800-SAMTEC-9 (US & Canada)
SIG@samtec.com

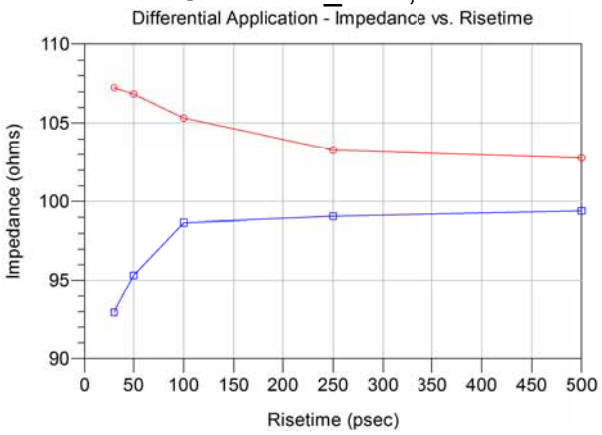
Phone: 812-944-6733
Fax: 812-948-5047
Report Revision: 12/6/2013

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

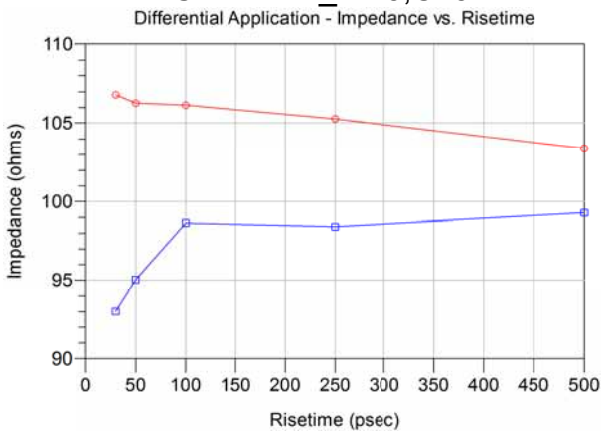
Table 10 – Differential Impedance (Ω) – High Density Vertical						
Driver	**Signal Risetime**	**30 ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**
SEAM-RA_A14,B14	**Maximum Impedance**	107.26	106.85	105.32	103.26	102.77
	Minimum Impedance	92.93	95.31	98.66	99.05	99.39
SEAM-RA_B15,C15	**Maximum Impedance**	106.80	106.27	106.14	105.26	103.37
	Minimum Impedance	93.00	95.03	98.63	98.40	99.28
SEAM-RA_D16,E16	**Maximum Impedance**	110.10	109.87	109.75	109.18	106.06
	Minimum Impedance	93.05	95.10	98.58	99.54	99.67
SEAM-RA_E17,F17	**Maximum Impedance**	108.79	107.39	104.87	103.33	101.96
	Minimum Impedance	90.37	92.01	94.87	98.18	99.16

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

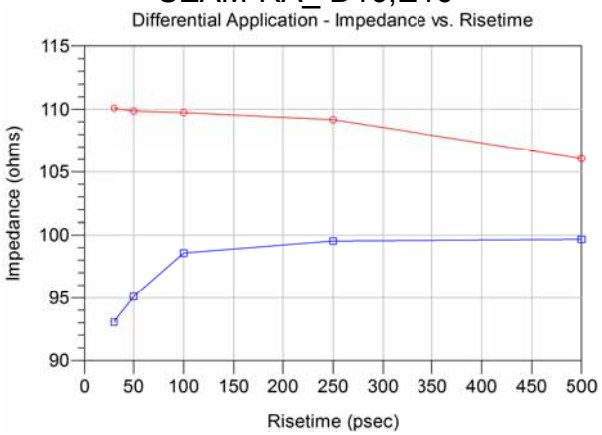
SEAM-RA_ A14,B14



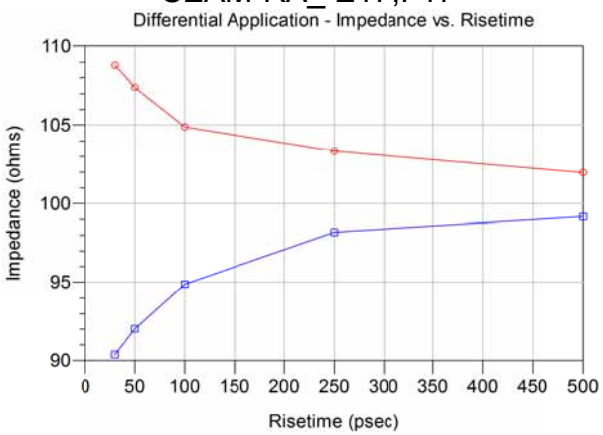
SEAM-RA_ B15,C15



SEAM-RA_ D16,E16



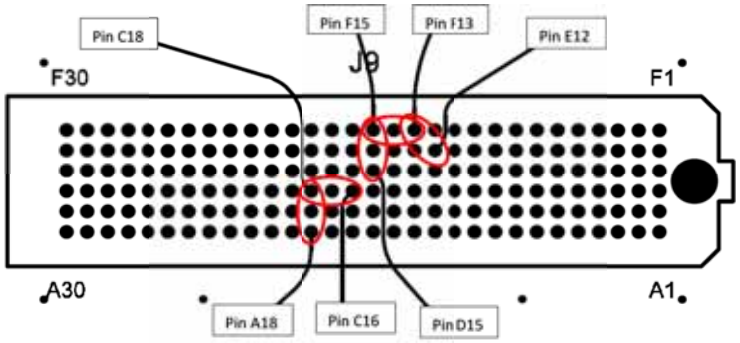
SEAM-RA_ E17,F17



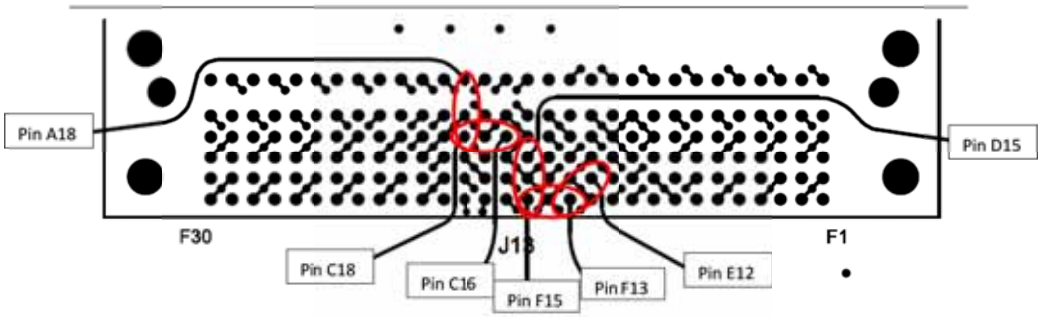
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Table 11 - Single-Ended Crosstalk (%) – 1:1 S/G Pattern							
Input(t_r)	**Driver**	**Receiver**	**30ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**
NEXT	SEAM-RA_A18	SEAM-RA_C18	0.55	0.46	0.32	0.18	0.10
	SEAM-RA_C16	SEAM-RA_C18	0.82	0.63	0.46	0.29	0.17
	SEAM-RA_D15	SEAM-RA_F15	1.26	0.87	0.42	0.24	0.16
	SEAM-RA_E12	SEAM-RA_F13	2.93	2.73	2.52	2.14	1.37
	SEAM-RA_F13	SEAM-RA_F15	2.21	1.88	1.52	1.23	0.79
FEXT	SEAM-RA_A18	SEAFp_C18	0.43	0.36	0.24	0.14	<0.1
	SEAM-RA_C16	SEAFp_C18	0.90	0.74	0.49	0.26	0.15
	SEAM-RA_D15	SEAFp_F15	0.76	0.49	0.29	0.16	0.11
	SEAM-RA_E12	SEAFp_F13	2.57	1.92	1.15	0.64	0.42
	SEAM-RA_F13	SEAFp_F15	2.91	2.16	1.28	0.66	0.42

Single-Ended 1:1 S/G Pattern Crosstalk Pin Map



SEAFP

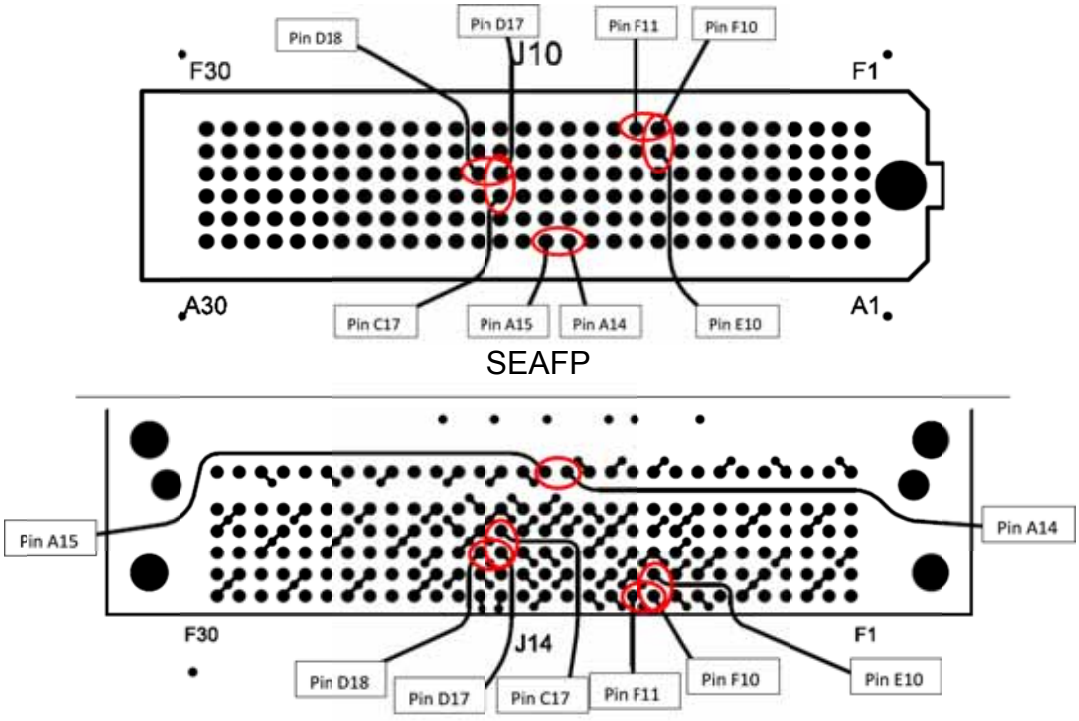


SEAM_RA

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Table 12 - Single-Ended Crosstalk (%) – 2:1 S/G Pattern							
Input(t_r)	**Driver**	**Receiver**	**30ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**
NEXT	SEAM-RA_A14	SEAM-RA_A15	16.16	15.10	13.78	8.77	4.86
	SEAM-RA_C17	SEAM-RA_D17	11.74	10.54	9.32	6.80	4.15
	SEAM-RA_D17	SEAM-RA_D18	13.34	12.14	11.36	8.50	5.12
	SEAM-RA_E10	SEAM-RA_F10	13.67	12.81	11.19	8.67	5.59
	SEAM-RA_F10	SEAM-RA_F11	16.36	15.58	15.09	12.71	8.25
FEXT	SEAM-RA_A14	SEAFp_A15	7.73	6.39	4.49	2.55	1.52
	SEAM-RA_C17	SEAFp_D17	3.81	3.18	2.32	1.33	0.73
	SEAM-RA_D17	SEAFp_D18	3.52	2.87	2.69	2.10	1.30
	SEAM-RA_E10	SEAFp_F10	4.51	3.70	3.27	2.37	1.46
	SEAM-RA_F11	SEAFp_F10	5.92	4.78	4.53	3.82	2.55

Single-Ended 2:1 S/G Pattern Crosstalk Pin Map



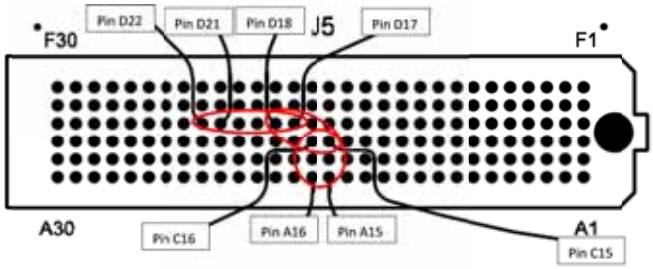
SEAFP

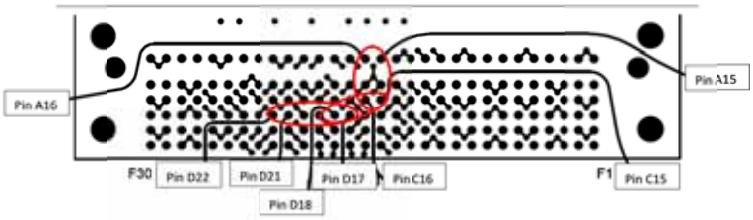
SEAM_RA

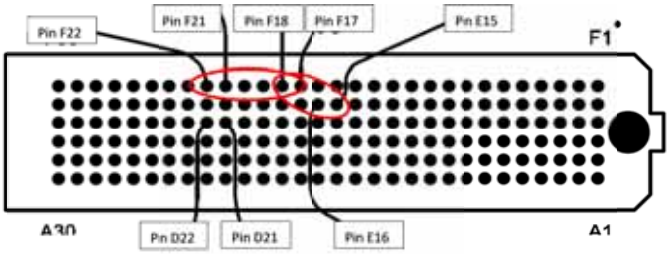
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

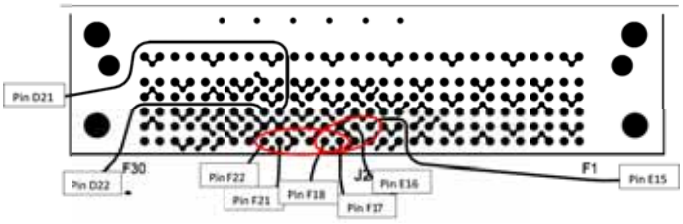
Table 13 - Differential Crosstalk (%) – Optimal Horizontal							
Input(tr)	**Driver**	**Receiver**	**30ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**
NEXT	SEAM-RA_A15,A16	SEAM-RA_C15,C16	0.22	0.12	<0.1	<0.1	<0.1
	SEAM-RA_C15,C16	SEAM-RA_D17,D18	0.98	0.85	0.79	0.57	0.33
	SEAM-RA_D17,D18	SEAM-RA_D21,D22	0.10	<0.1	<0.1	<0.1	<0.1
	SEAM-RA_E15,E16	SEAM-RA_F17,F18	1.00	0.95	0.84	0.69	0.43
	SEAM-RA_F17, F18	SEAM-RA_F21,F22	0.16	0.11	<0.1	<0.1	<0.1
FEXT	SEAM-RA_A15,A16	SEAFp_C15,C16	0.42	0.32	0.19	0.10	<0.1
	SEAM-RA_C15,C16	SEAFp_D17,D18	0.29	0.23	0.12	<0.1	<0.1
	SEAM-RA_D17,D18	SEAFp_D21,D22	0.24	0.20	0.12	<0.1	<0.1
	SEAM-RA_E15,E16	SEAFp_F17,F18	0.36	0.25	0.12	<0.1	<0.1
	SEAM-RA_F17, F18	SEAFp_F21,F22	0.27	0.19	0.10	<0.1	<0.1

Differential Optimal Horizontal Crosstalk Pin Map







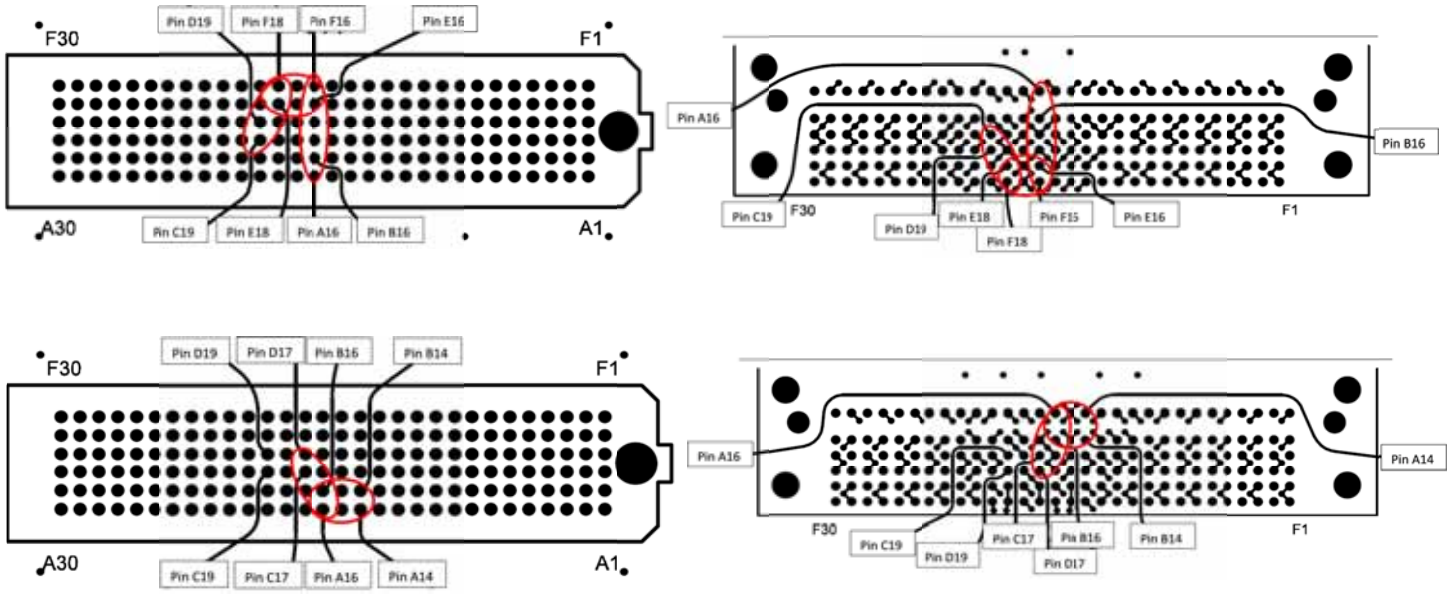


SEAFP SEAM_RA

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Table 14 - Differential Crosstalk (%) – Optimal Vertical							
Input(tr)	**Driver**	**Receiver**	**30ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**
NEXT	SEAM-RA_A14,B14	SEAM-RA_A16, B16	0.90	0.77	0.60	0.38	0.23
	SEAM-RA_A16,B16	SEAM-RA_C17, D17	1.14	1.00	0.94	0.60	0.32
	SEAM-RA_A16,B16	SEAM-RA_E16, F16	<0.1	<0.1	<0.1	<0.1	<0.1
	SEAM-RA_C19,D19	SEAM-RA_E18, F18	1.12	1.01	0.92	0.70	0.40
	SEAM-RA_E16,F16	SEAM-RA_E18, F18	1.30	0.91	0.62	0.49	0.31
FEXT	SEAM-RA_A14,B14	SEAFp_A16, B16	1.82	1.39	0.77	0.31	0.17
	SEAM-RA_A16,B16	SEAFp_C17, D17	1.51	0.20	0.15	<0.1	<0.1
	SEAM-RA_A16,B16	SEAFp_E16, F16	<0.1	<0.1	<0.1	<0.1	<0.1
	SEAM-RA_C19,D19	SEAFp_E18, F18	0.22	0.16	<0.1	<0.1	<0.1
	SEAM-RA_E16,F16	SEAFp_E18, F18	1.36	1.00	0.54	0.24	0.13

Differential Optimal Vertical Crosstalk Pin Map

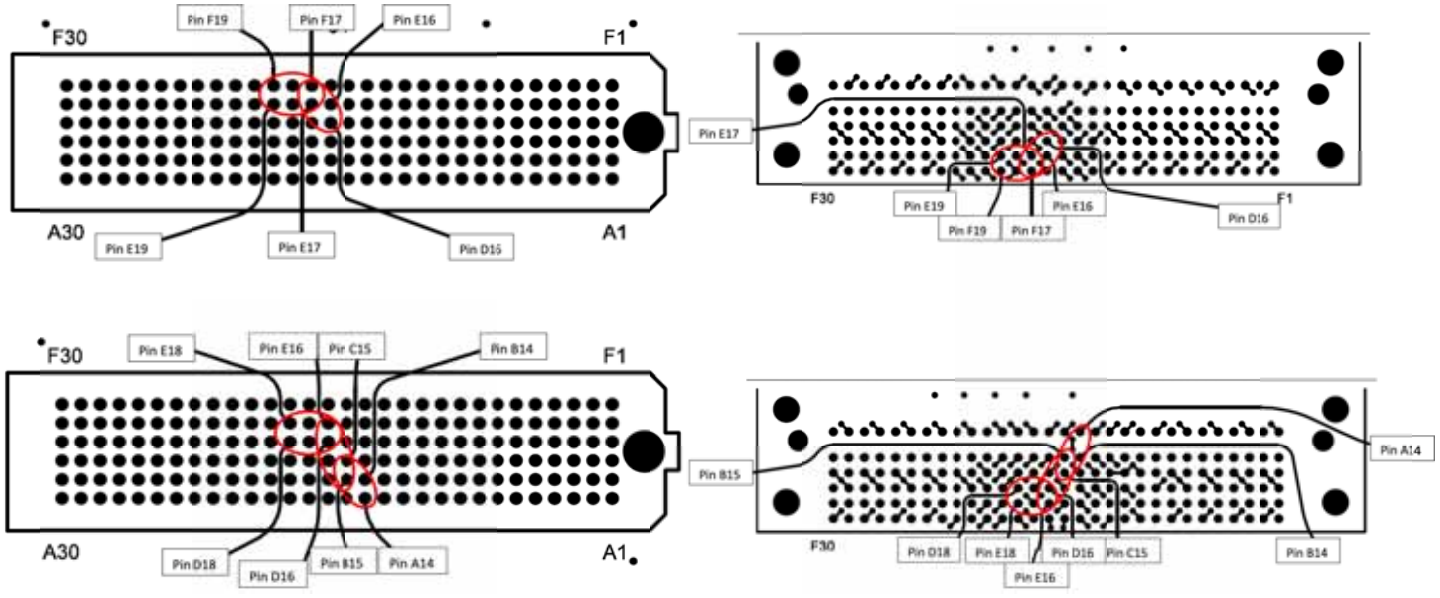


SEAFP SEAM_RA

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Table 15 - Differential Crosstalk (%) – High Density Vertical							
Input(t_r)	**Driver**	**Receiver**	**30ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**
NEXT	SEAM-RA_A14,B14	SEAM-RA_B15,C15	3.73	2.89	2.71	1.60	0.85
	SEAM-RA_B15,C15	SEAM-RA_D16,E16	2.05	1.67	0.96	0.53	0.22
	SEAM-RA_D16,E16	SEAM-RA_D18,E18	2.06	1.76	1.22	0.71	0.45
	SEAM-RA_D16,E16	SEAM-RA_E17,F17	3.35	2.85	2.58	1.81	0.95
	SEAM-RA_E17, F17	SEAM-RA_E19, F19	3.06	2.44	1.65	1.02	0.65
FEXT	SEAM-RA_A14,B14	SEAFp_B15,C15	4.43	3.43	1.91	0.78	0.35
	SEAM-RA_B15,C15	SEAFp_D16,E16	1.20	1.00	0.77	0.35	0.21
	SEAM-RA_D16,E16	SEAFp_D18,E18	3.80	2.65	1.39	0.66	0.42
	SEAM-RA_D16,E16	SEAFp_E17,F17	4.09	2.99	1.52	0.51	0.24
	SEAM-RA_E17, F17	SEAFp_E19, F19	4.73	3.71	2.04	0.89	0.51

Differential High Density Vertical Crosstalk Pin Map



SEAFP SEAM_RA

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Table 16 - Propagation Delay (Mated Connector)	
Single-Ended: 1:1 S/G, rowA	101 ps
Single-Ended: 1:1 S/G, rowC	130 ps
Single-Ended: 1:1 S/G, rowD	143 ps
Single-Ended: 1:1 S/G, rowE	155 ps
Single-Ended: 1:1 S/G, rowF	169 ps
Single-Ended: 2:1 S/G, rowA	104 ps
Single-Ended: 2:1 S/G, rowC	132 ps
Single-Ended: 2:1 S/G, rowD	146 ps
Single-Ended: 2:1 S/G, rowE	161 ps
Single-Ended: 2:1 S/G, rowF	173 ps
Differential: Optimal Horizontal, rowA	95 ps
Differential: Optimal Horizontal, rowC	125 ps
Differential: Optimal Horizontal, rowD	139 ps
Differential: Optimal Horizontal, rowE	153 ps
Differential: Optimal Horizontal, rowF	154 ps
Differential: Optimal Vertical, rowA,B	106 ps
Differential: Optimal Vertical, rowC,D	133 ps
Differential: Optimal Vertical, rowE,F	161 ps
Differential: High Density Vertical, rowA,B	109 ps
Differential: High Density Vertical, rowB,C	120 ps
Differential: High Density Vertical, rowD,E	148 ps
Differential: High Density Vertical, rowE,F	169 ps

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Characterization Details

This report presents data that characterizes the signal integrity response of a connector pair in a controlled printed circuit board (PCB) environment. All efforts are made to reveal typical best-case responses inherent to the system under test (SUT).

In this report, the SUT includes the connector pair and footprint effects on a typical multi-layer PCB. PCB effects (trace loss) are de-embedded from test data. Board related effects, such as pad-to-ground capacitance, are included in the data presented in this report.

Additionally, intermediate test signal connections can mask the connector's true performance. Such connection effects are minimized by using high performance test cables and adapters. Where appropriate, calibration and de-embedding routines are also used to reduce residual effects.

Differential and Single-Ended Data

Most Samtec connectors can be used successfully in both differential and single-ended applications. However, electrical performance will differ depending on the signal drive type. In this report, data is presented for both differential and single-ended drive scenarios.

Connector Signal to Ground Ratio

Samtec connectors are most often designed for generic applications and can be implemented using various signal and ground pin assignments. In high speed systems, provisions must be made in the interconnect for signal return currents. Such paths are often referred to as "ground". In some connectors, a ground plane or blade, or an outer shield, is used as the signal return, while in others, connector pins are used as signal returns. Various combinations of signal pins, ground blades, and shields can also be utilized. Electrical performance can vary significantly depending upon the number and location of ground pins.

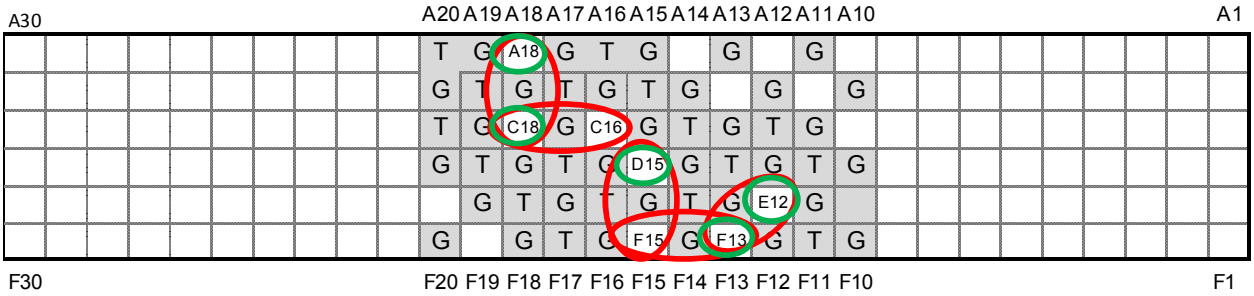
In general, the more pins dedicated to ground, the better electrical performance will be. But dedicating pins to ground reduces signal density of a connector. Therefore, care must be taken when choosing signal/ground ratios in cost or density-sensitive applications.

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

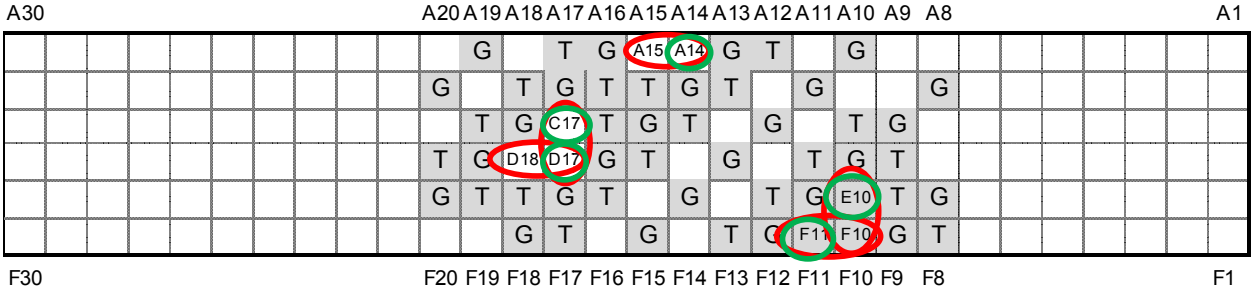
For this connector, the following array configurations are evaluated:

	Open pin field	G	Grounded pin field
	Signal pin field	T	50 ohm termination field

Single-Ended 1:1 S/G



Single-Ended 2:1 S/G



Single-Ended Impedance (denoted by green circles):

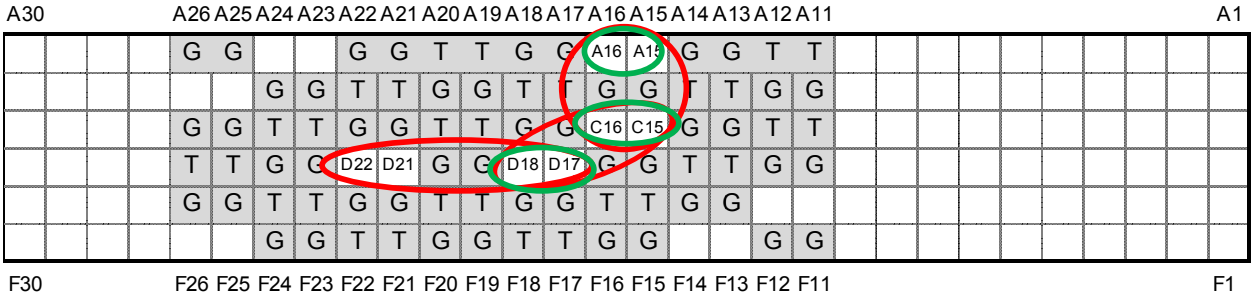
- 1:1 S/G ratio
- 2:1 S/G ratio

Single-Ended Crosstalk (denoted by red circles):

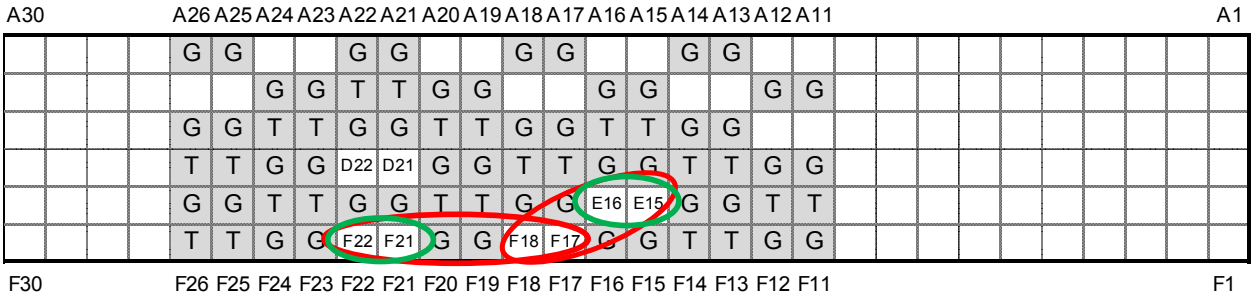
- 1:1 S/G ratio
- 2:1 S/G ratio

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

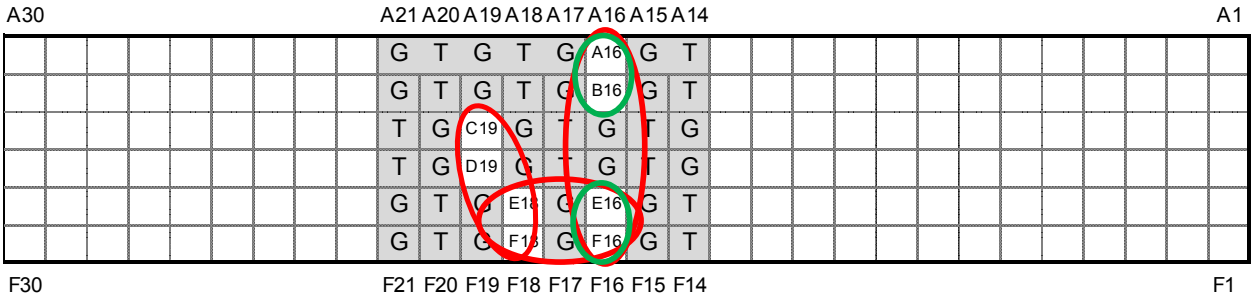
Differential Optimal Horizontal



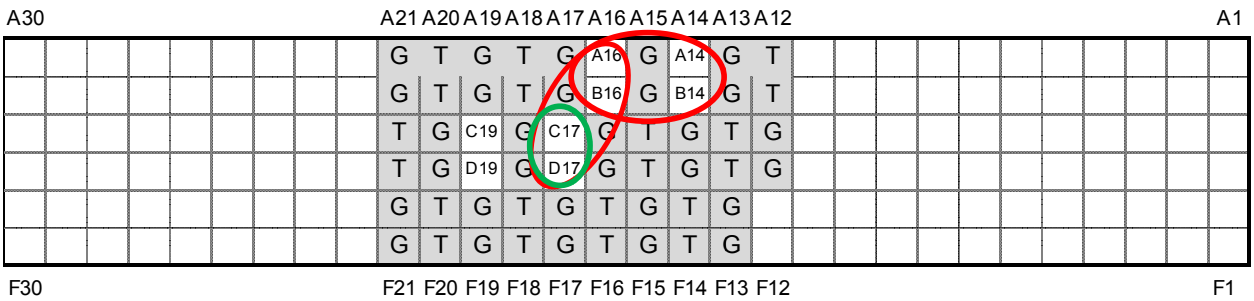
Differential Optimal Horizontal



Differential Optimal Vertical

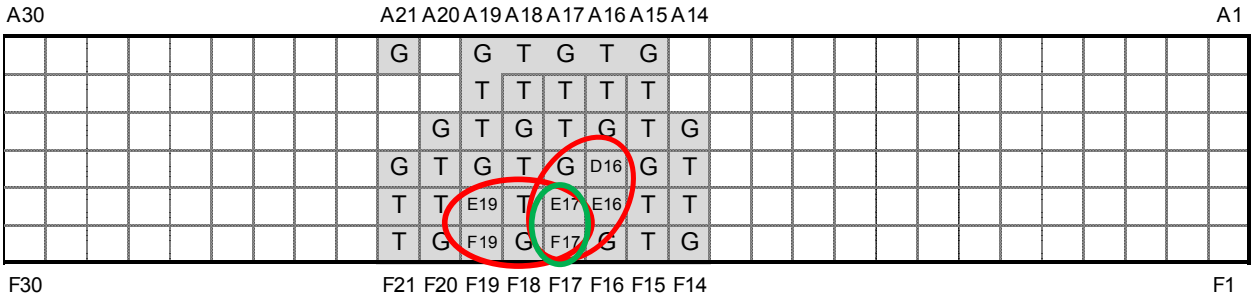


Differential Optimal Vertical

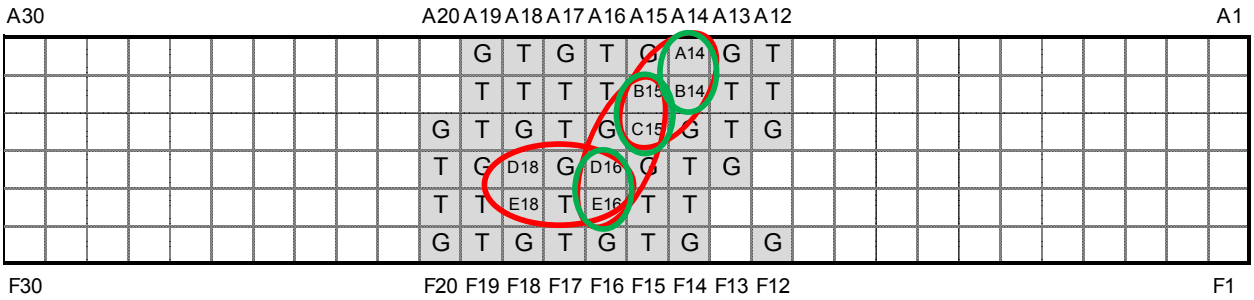


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential High Density Vertical



Differential High Density Vertical



Differential Impedance (denoted by green circles):

- Optimal Horizontal
- Optimal Vertical
- High Density Vertical

Differential Crosstalk (denoted by red circles):

- Optimal Horizontal
- Optimal Vertical
- High Density Vertical

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Only one single-ended signal or differential pair was driven for crosstalk measurements.

Other configurations can be evaluated upon request. Please contact sig@samtec.com for more information.

In a real system environment, active signals might be located at the outer edges of the signal contacts of concern, as opposed to the ground signals utilized in laboratory testing. For example, in a single-ended system, a pin-out of "SSSS", or four adjacent single ended signals might be encountered as opposed to the "GSG" and "GSSG" configurations tested in the laboratory. Electrical characteristics in such applications could vary slightly from laboratory results. But in most applications, performance can safely be considered equivalent.

Signal Edge Speed (Rise Time):
In pulse signaling applications, the perceived performance of the interconnect can vary significantly depending on the edge rate or rise time of the exciting signal. For this report, the fastest rise time used was 30 ps. Generally, this should demonstrate worst-case performance.

In many systems, the signal edge rate will be significantly slower at the connector than at the driver launch point. To estimate interconnect performance at other edge rates, data is provided for several rise times between 30ps and 500ps.

For this report, measured rise times were at 10%-90% signal levels.

Frequency Domain Data
Frequency Domain parameters are helpful in evaluating the connector system's signal loss and crosstalk characteristics across a range of sinusoidal frequencies. In this report, parameters presented in the Frequency Domain are Insertion Loss, Return Loss, and Near-End and Far-End Crosstalk. Other parameters or formats, such as VSWR or S-Parameters, may be available upon request. Please contact our Signal Integrity Group at sig@samtec.com for more information.

Frequency performance characteristics for the SUT are generated directly from network analyzer measurements.

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Time Domain Data

Time Domain parameters indicate Impedance mismatch versus length, signal propagation time, and crosstalk in a pulsed signal environment.

Impedance mismatch versus length is measured by DSA8200 Digital Serial Analyzer. Board related effects, such as pad-to-ground capacitance and trace loss, are included in the data presented in this report. The impedance data is provided in Appendix E of this report.

The measured S-Parameters from the network analyzer are post-processed using Agilent Advanced Design System to obtain the time domain response for signal propagation time and crosstalk. The Time Domain procedure is provided in Appendix E of this report. Parameters or formats not included in this report may be available upon request. Please contact our Signal Integrity Group at sig@samtec.com for more information.

In this report, propagation delay is defined as the signal propagation time through the connector and connector footprint. It includes 10 mils of PCB trace on each end of the connector. Delay is measured at 100 picoseconds signal rise-time. Delay is calculated as the difference in time measured between the 50% amplitude levels of the input and output pulses.

Crosstalk or coupled noise data is provided for various signal configurations. All measurements are single disturber. Crosstalk is calculated as a ratio of the input line voltage to the coupled line voltage. The input line is sometimes described as the active or drive line. The coupled line is sometimes described as the quiet or victim line. Crosstalk ratio is tabulated in this report as a percentage. Measurements are made at both the near-end and far-end of the SUT.

Data for other configurations may be available. Please contact our Signal Integrity Group at sig@samtec.com for further information.

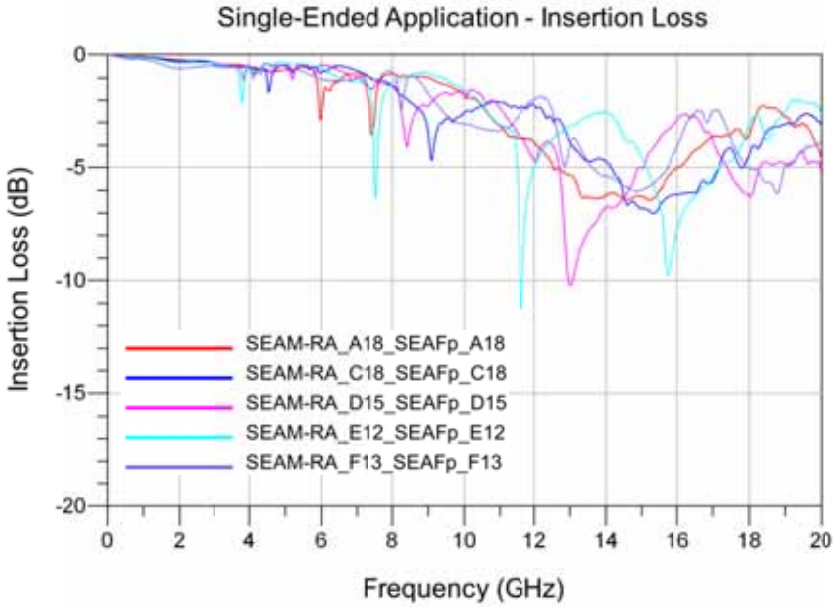
As a rule of thumb, 10% crosstalk levels are often used as a general first pass limit for determining acceptable interconnect performance. However, modern system crosstalk tolerance can vary greatly. For advice on connector suitability for specific applications, please contact our Signal Integrity Group at sig@samtec.com.

Additional information concerning test conditions and procedures is located in the appendices of this report. Further information may be obtained by contacting our Signal Integrity Group at sig@samtec.com.

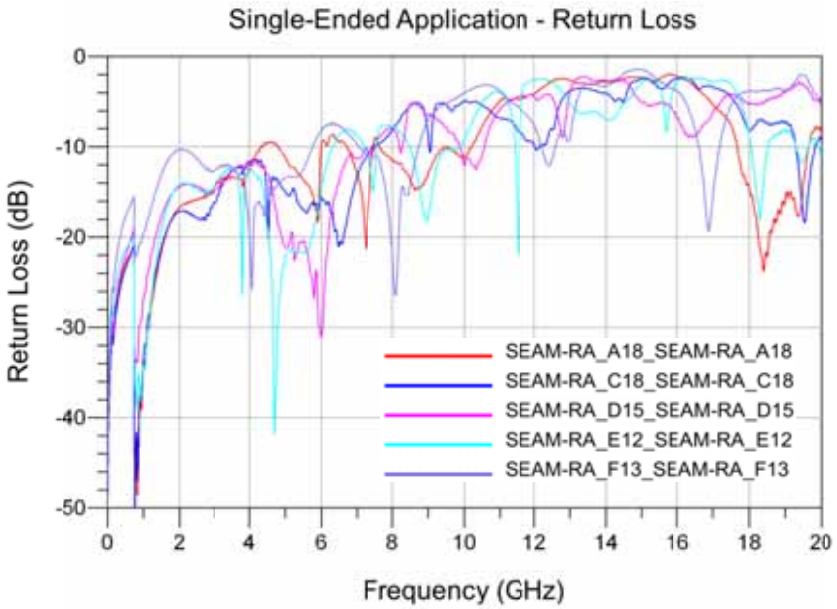
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Appendix A – Frequency Domain Response Graphs

Single-Ended 1:1 S/G Pattern Application – Insertion Loss

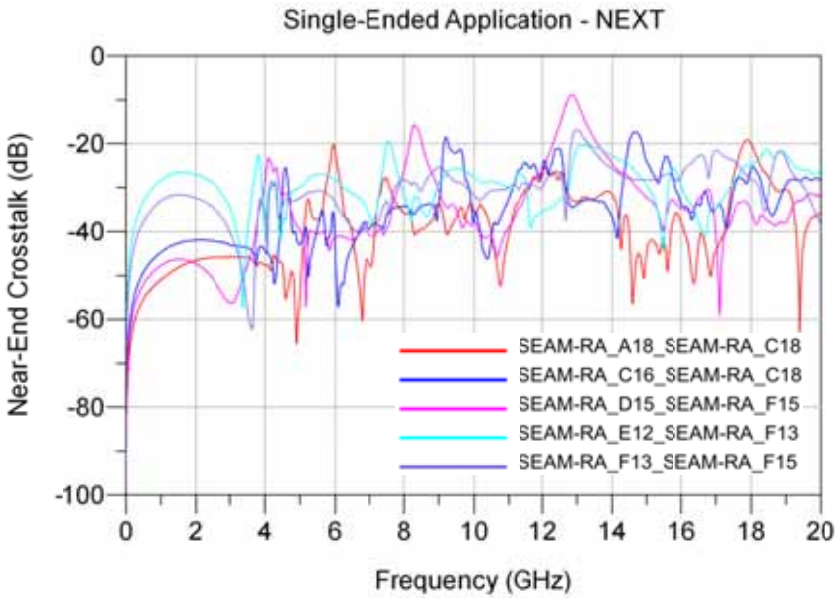


Single-Ended 1:1 S/G Pattern Application – Return Loss

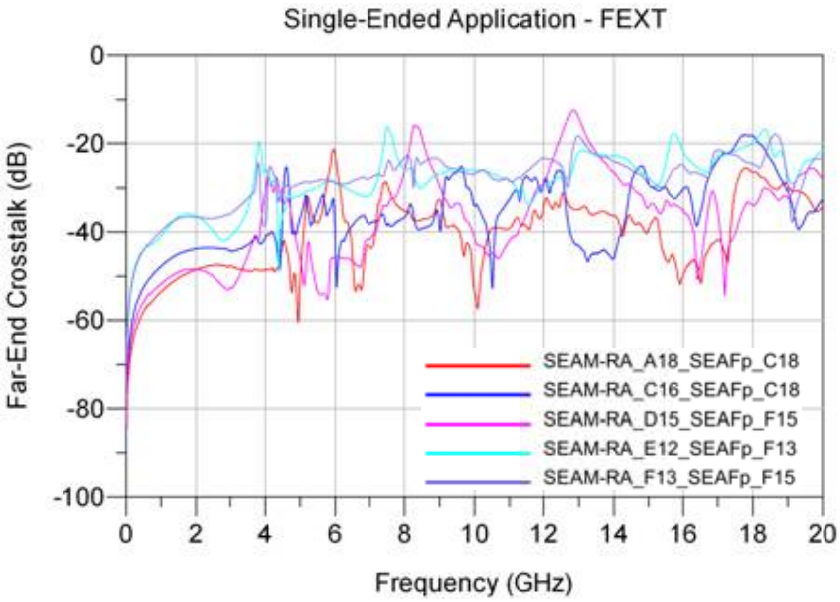


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Single-Ended 1:1 S/G Pattern Application – NEXT

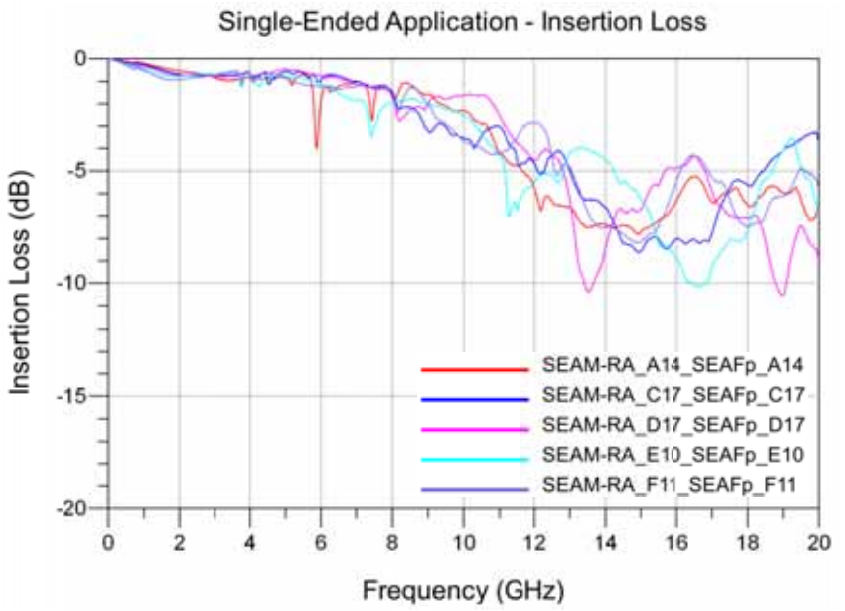


Single-Ended 1:1 S/G Pattern Application – FEXT

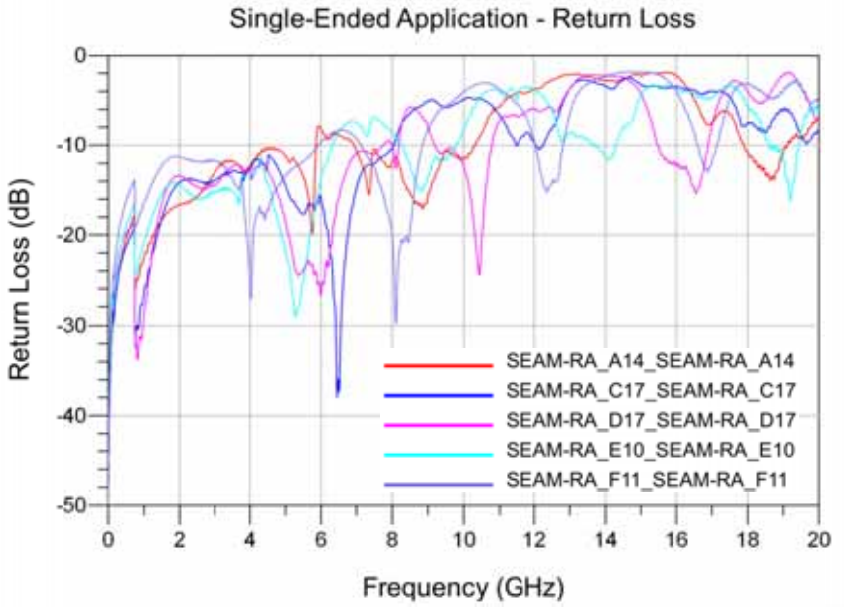


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Single-Ended 2:1 S/G Pattern Application – Insertion Loss

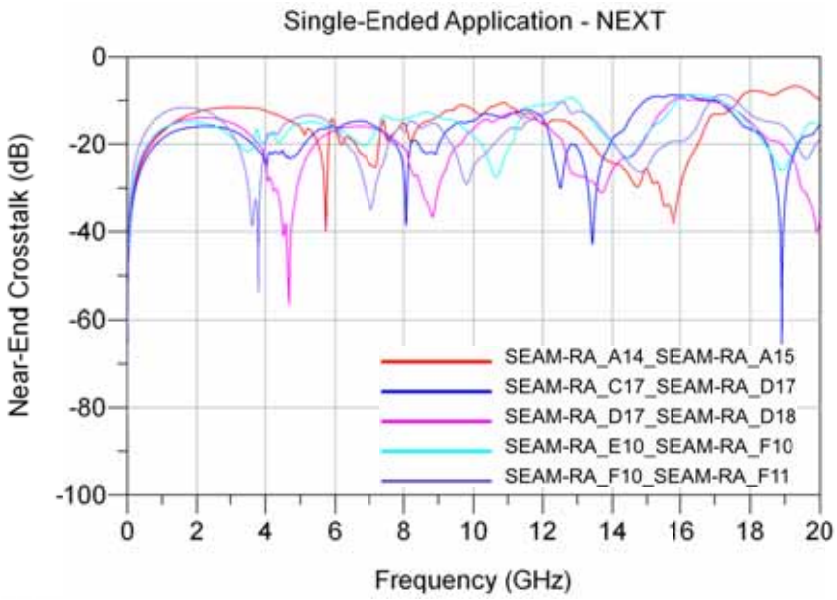


Single-Ended 2:1 S/G Pattern Application – Return Loss

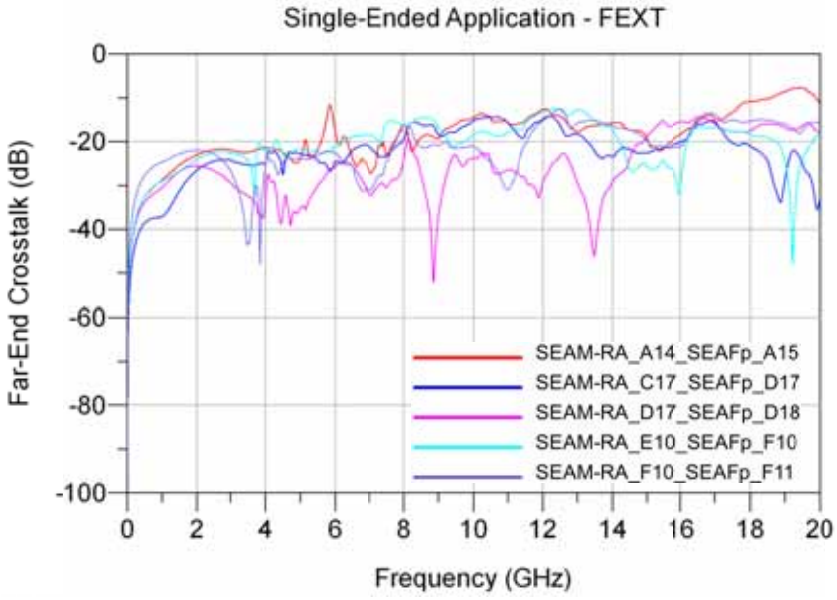


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Single-Ended 2:1 S/G Pattern Application – NEXT

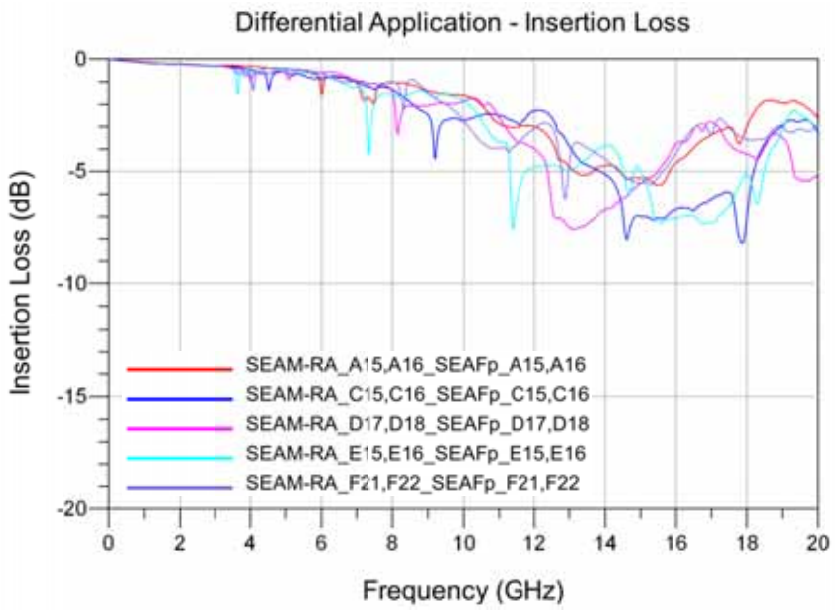


Single-Ended 2:1 S/G Pattern Application – FEXT

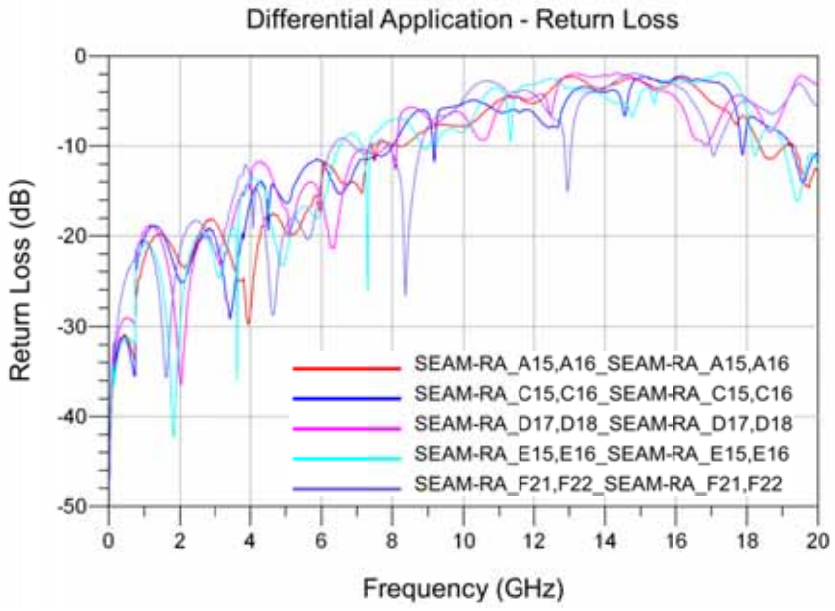


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Horizontal Application – Insertion Loss

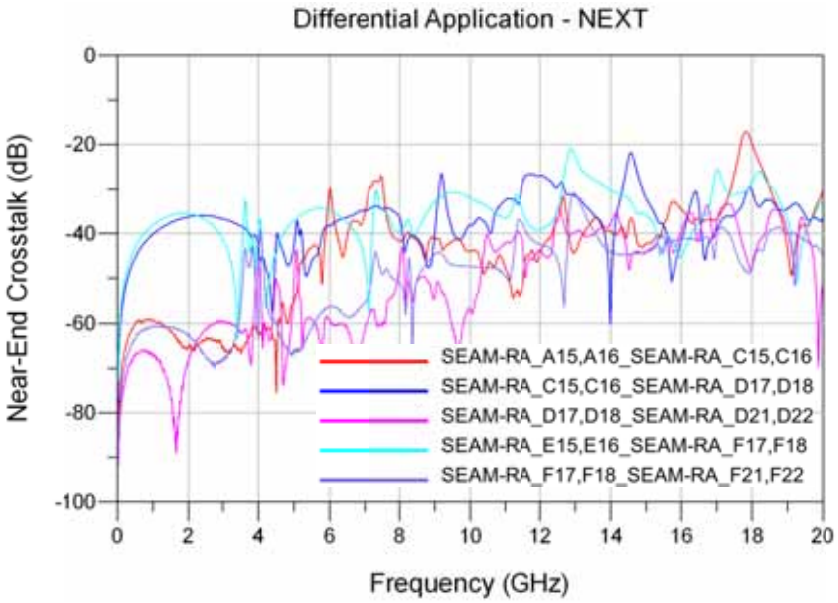


Differential Optimal Horizontal Application – Return Loss

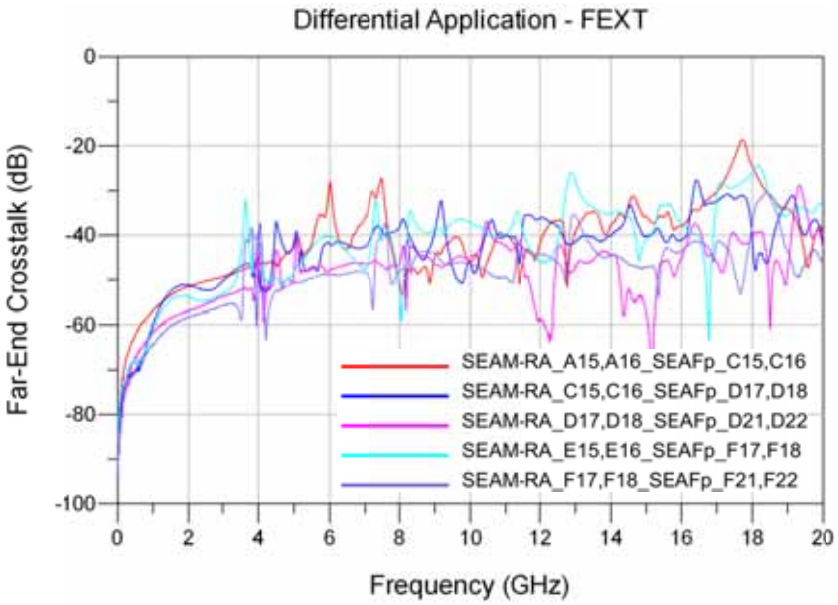


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Horizontal Application – NEXT

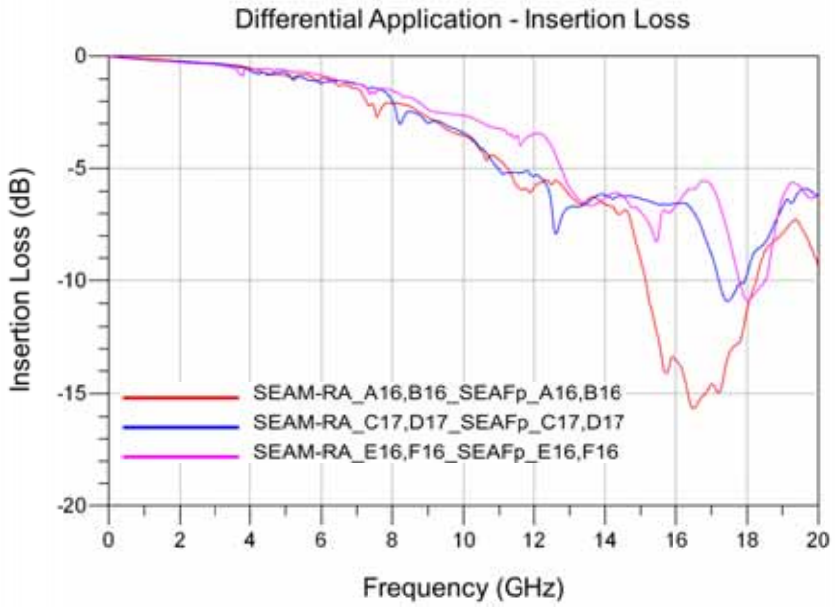


Differential Optimal Horizontal Application – FEXT

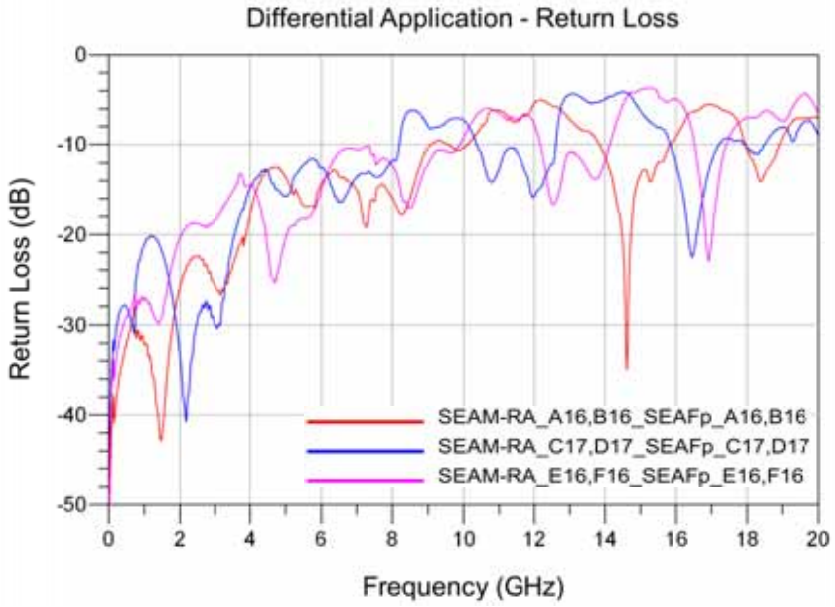


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Vertical Application – Insertion Loss

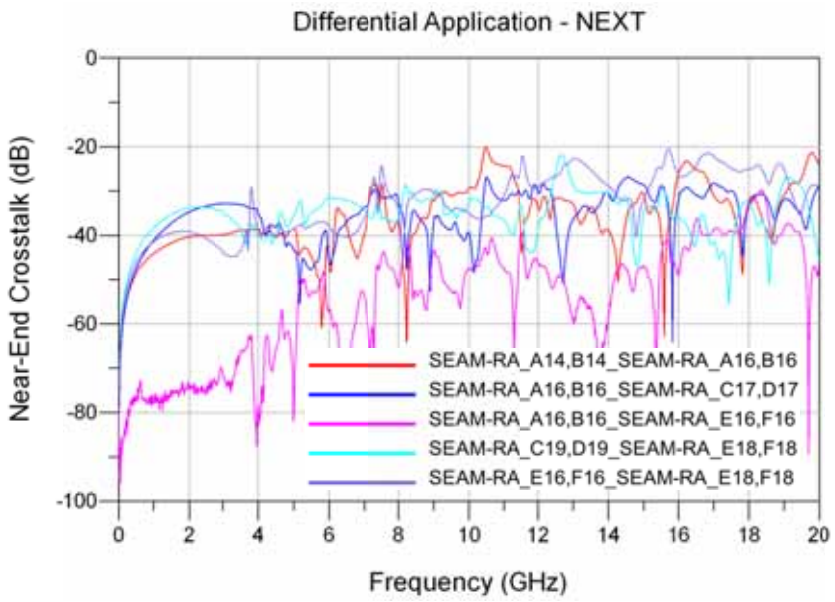


Differential Optimal Vertical Application – Return Loss

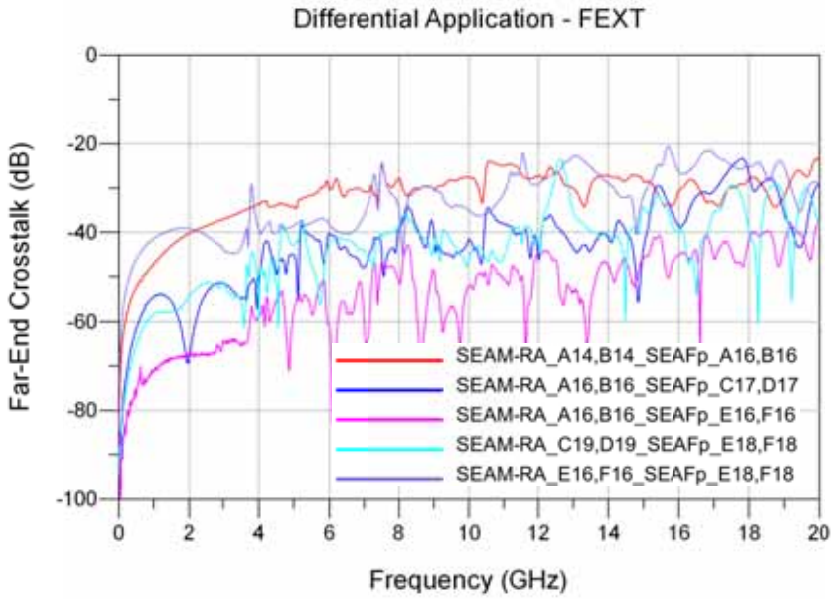


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Vertical Application – NEXT

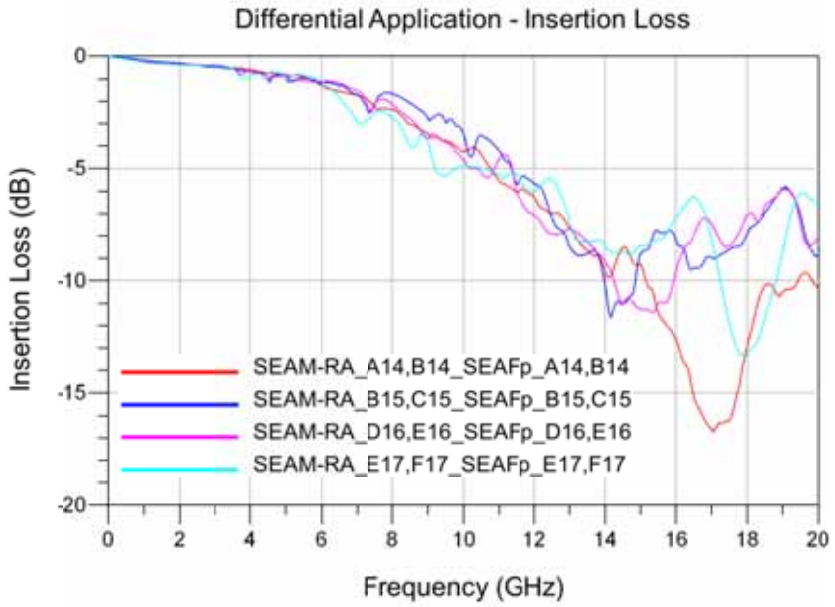


Differential Optimal Vertical Application – FEXT

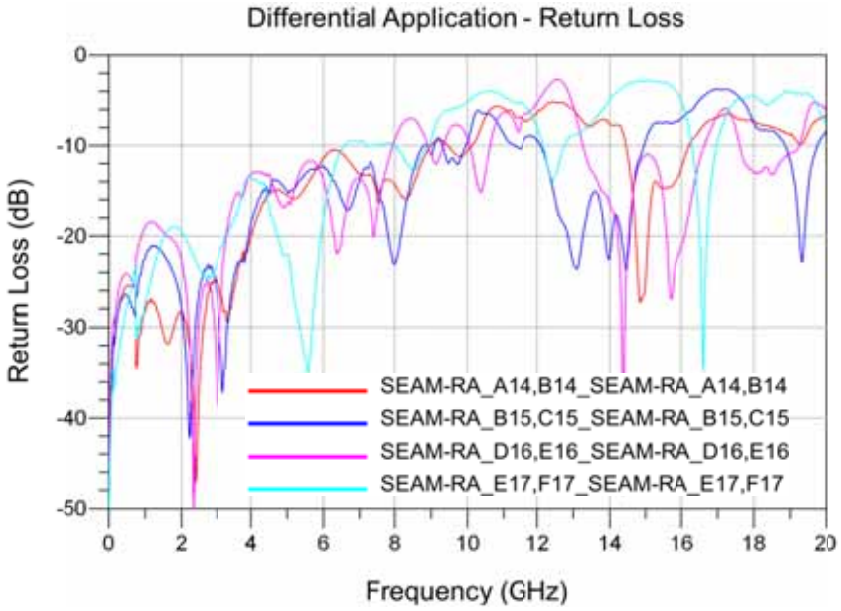


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential High Density Vertical Application – Insertion Loss

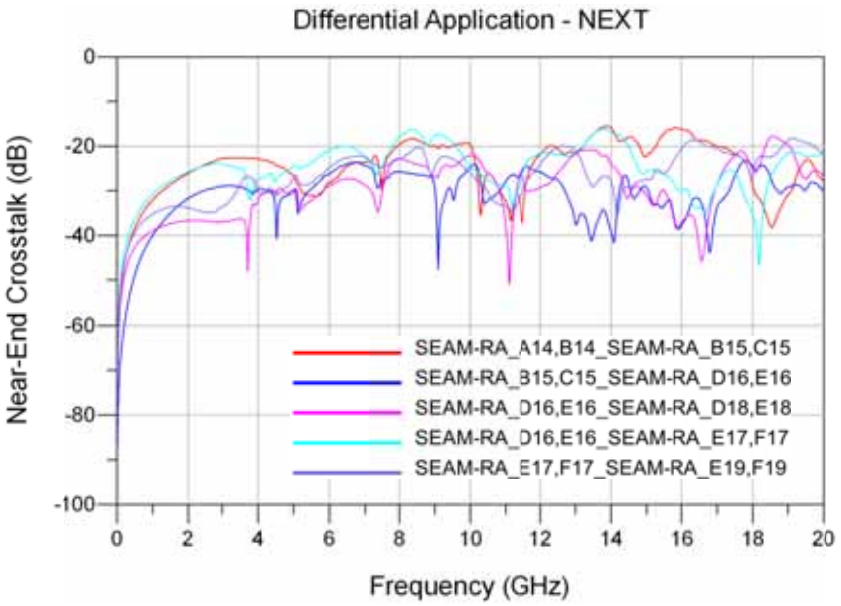


Differential High Density Vertical Application – Return Loss

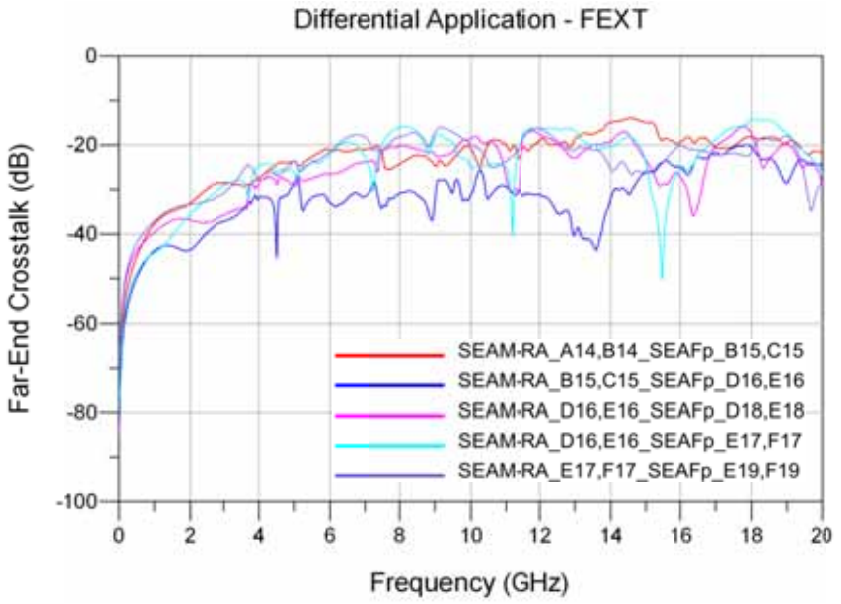


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential High Density Vertical Application – NEXT



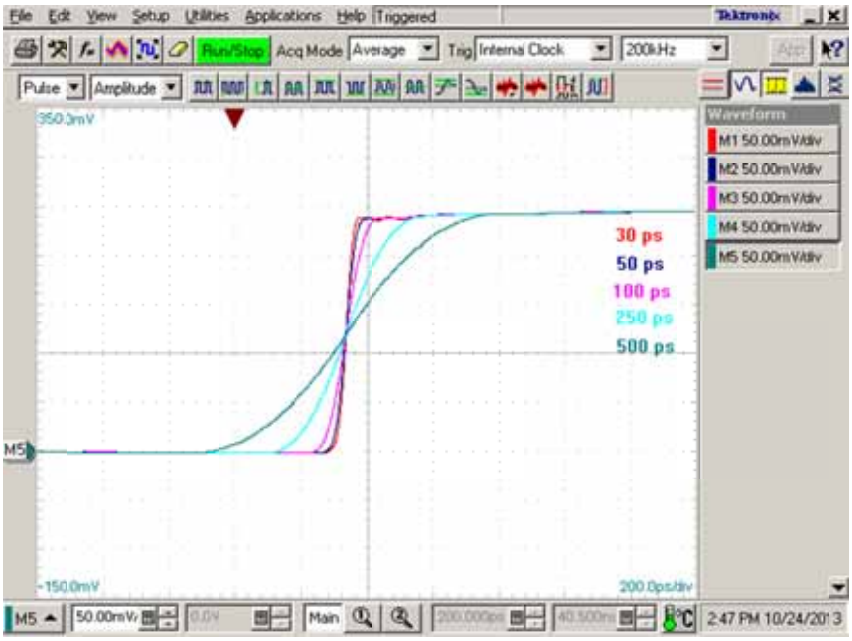
Differential High Density Vertical Application – FEXT



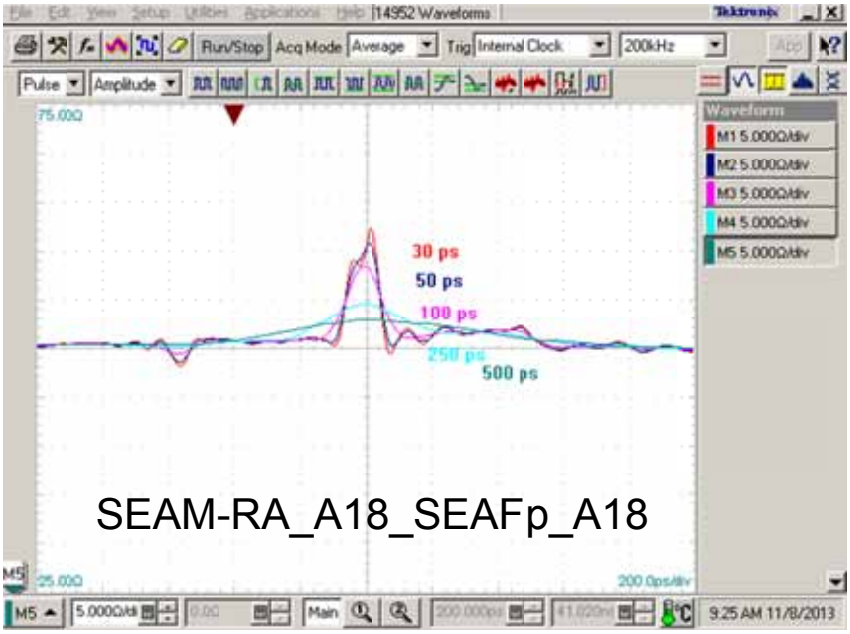
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Appendix B – Time Domain Response Graphs

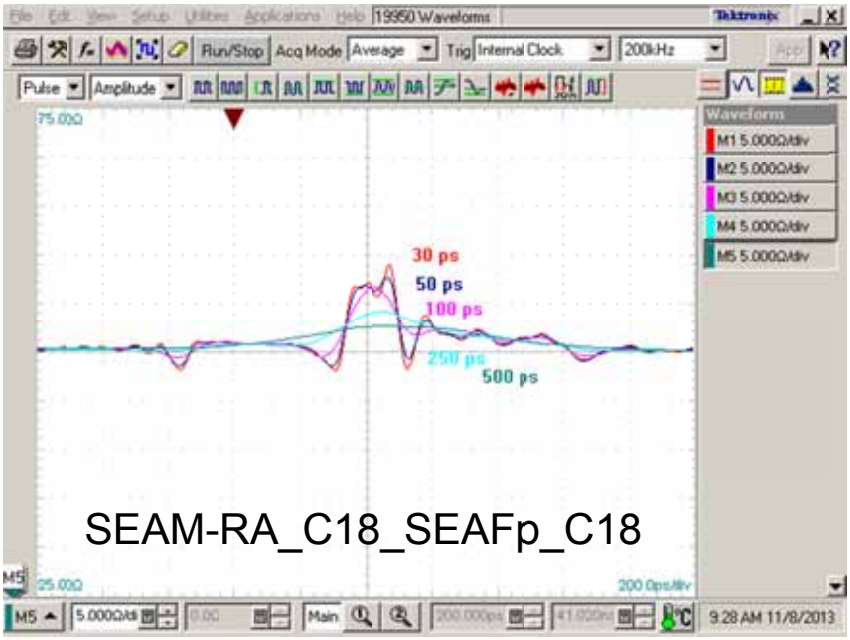
Single-Ended Application – Input Pulse

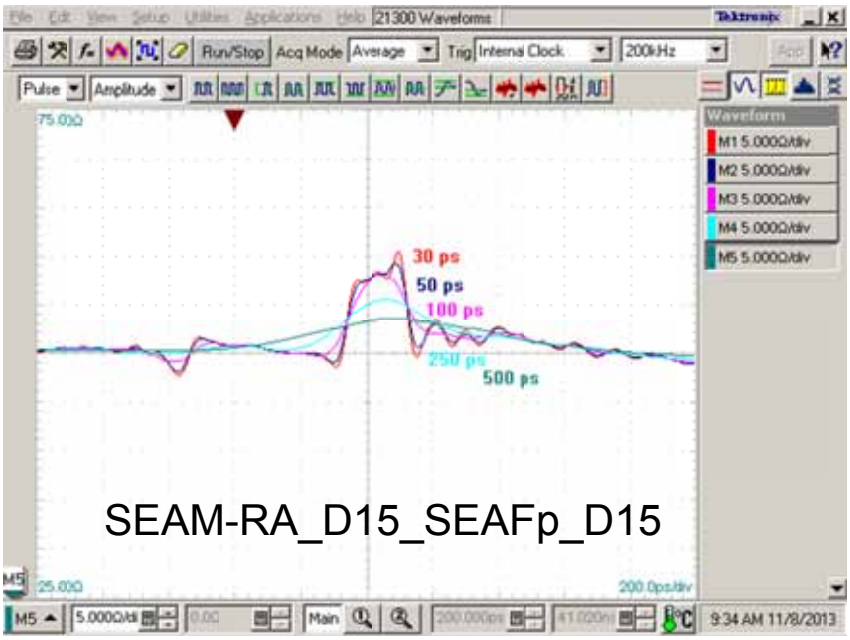


Single-Ended 1:1 S/G Pattern Application – Impedance

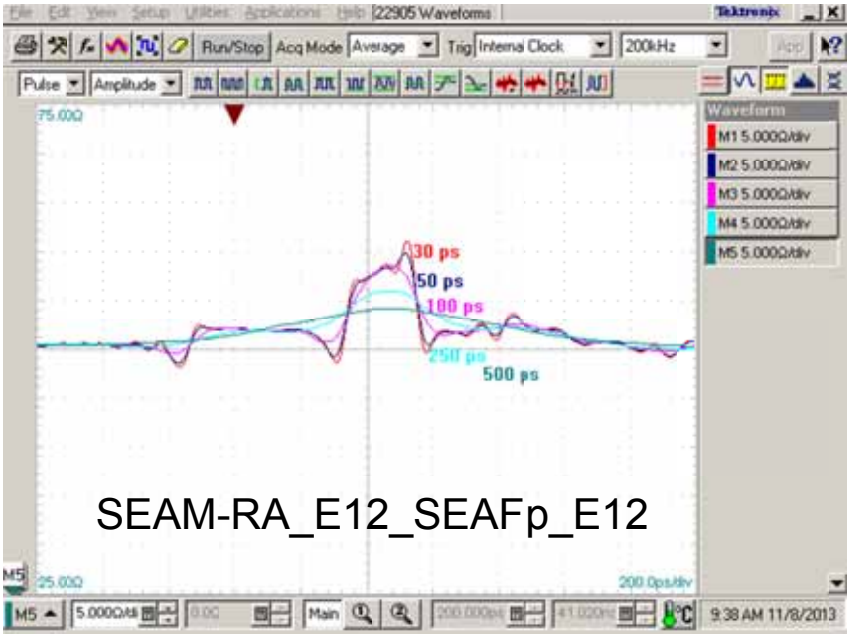


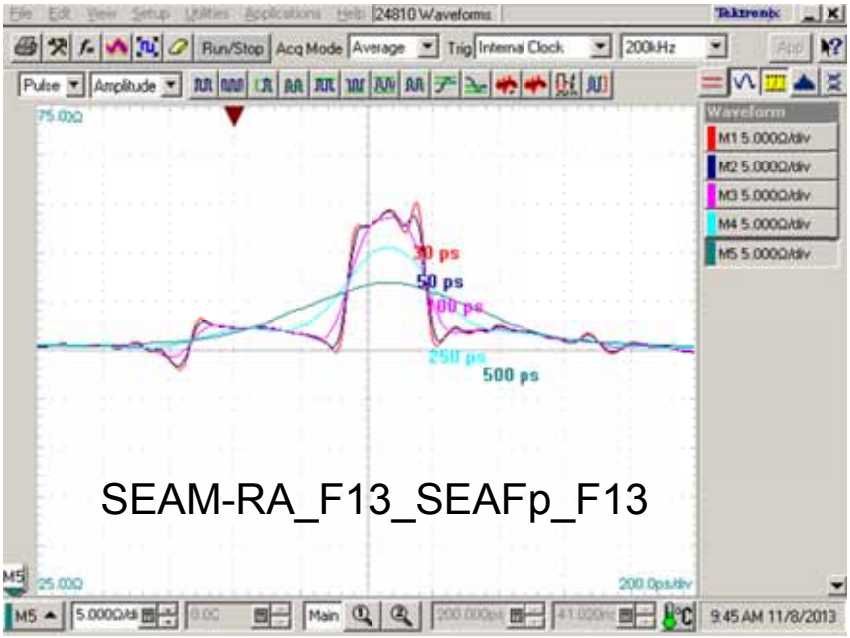
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle





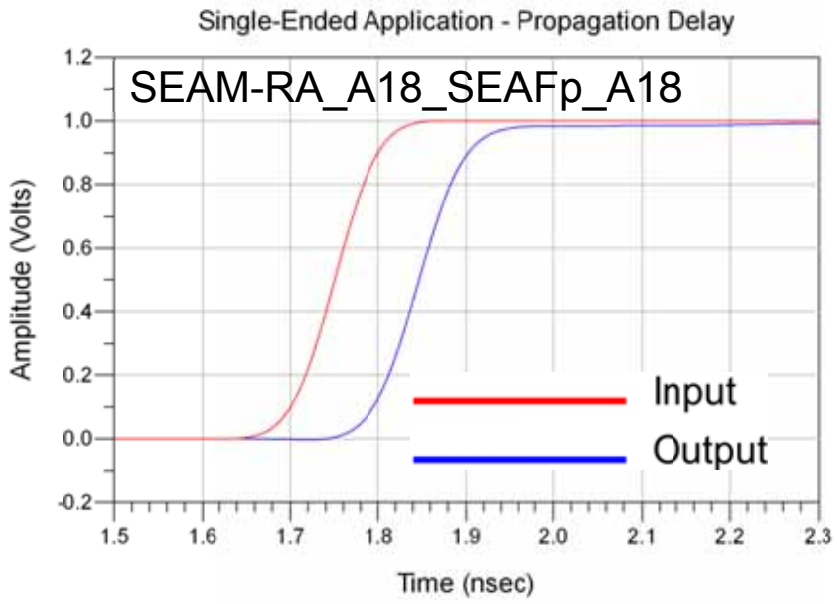
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

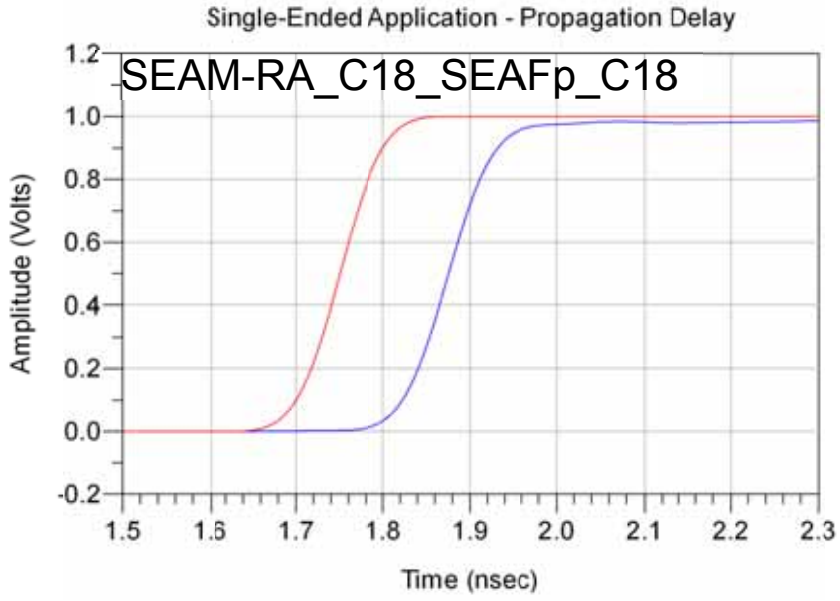




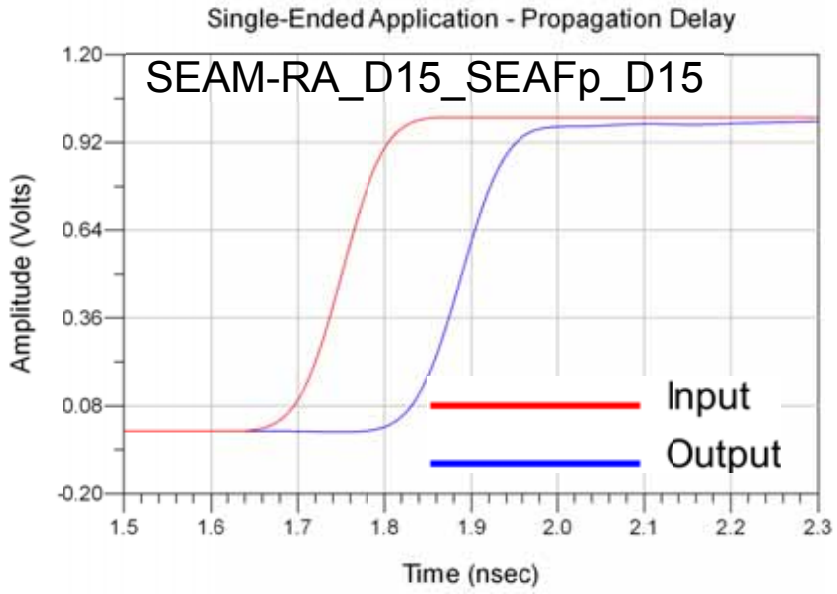
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

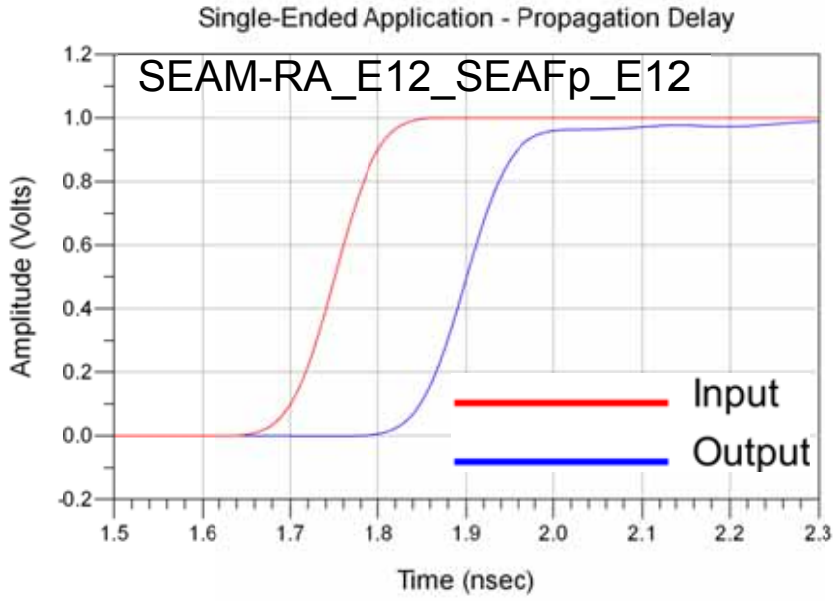
Single-Ended 1:1 S/G Pattern Application – Propagation Delay



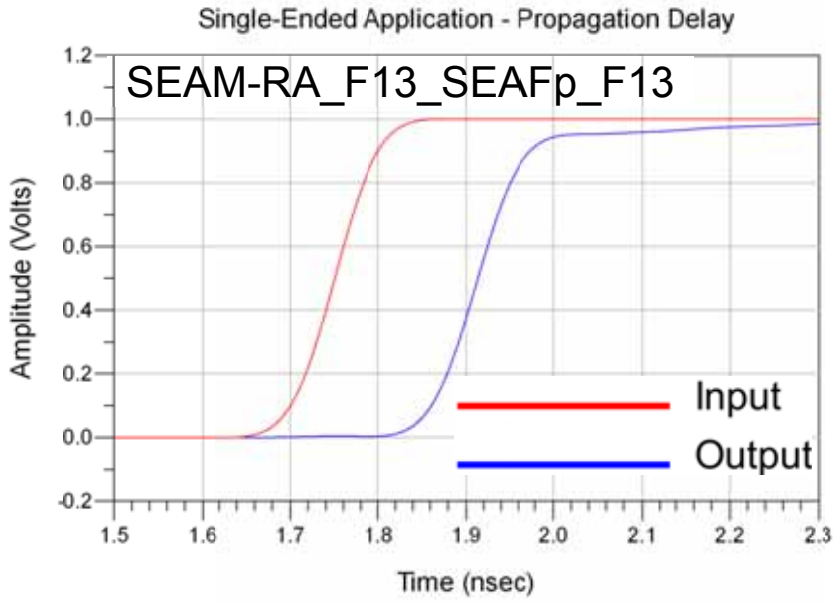


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

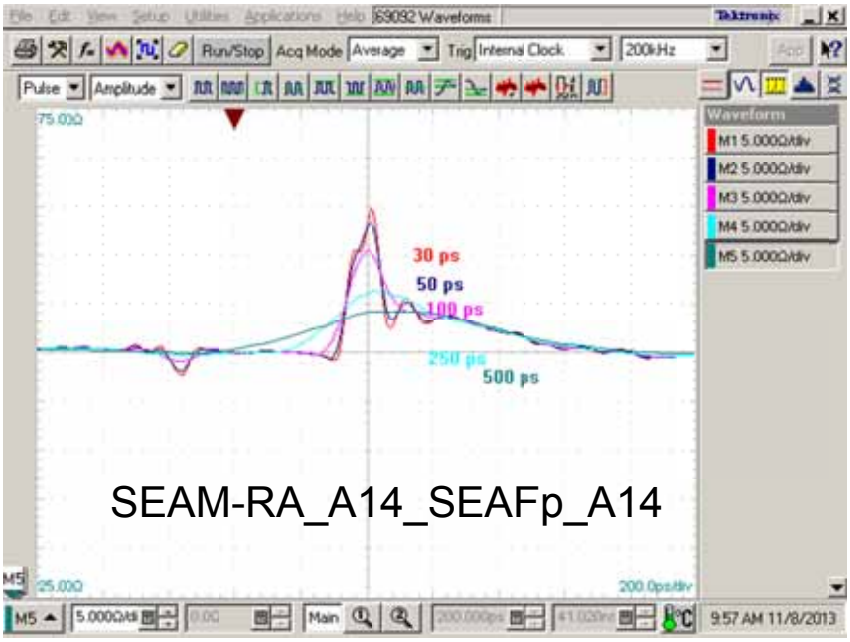




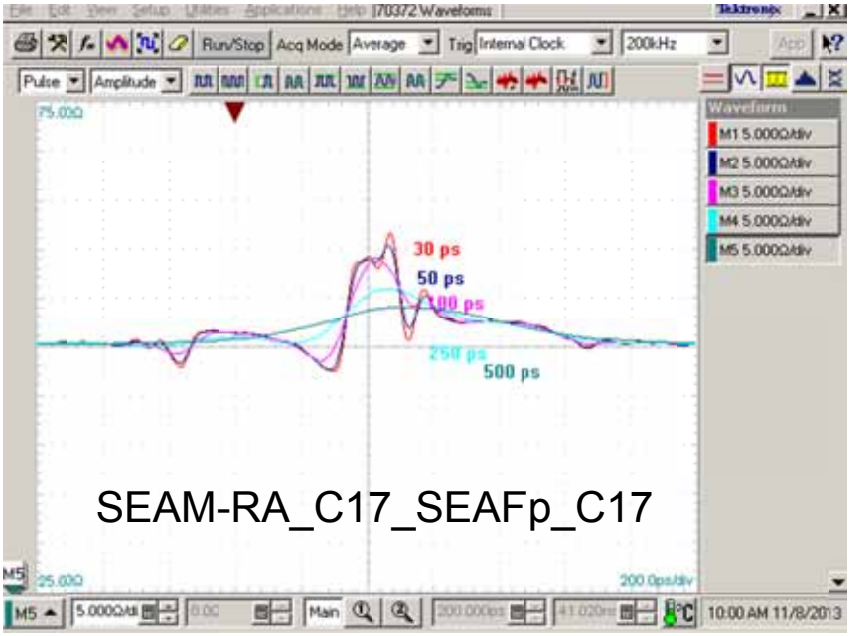
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

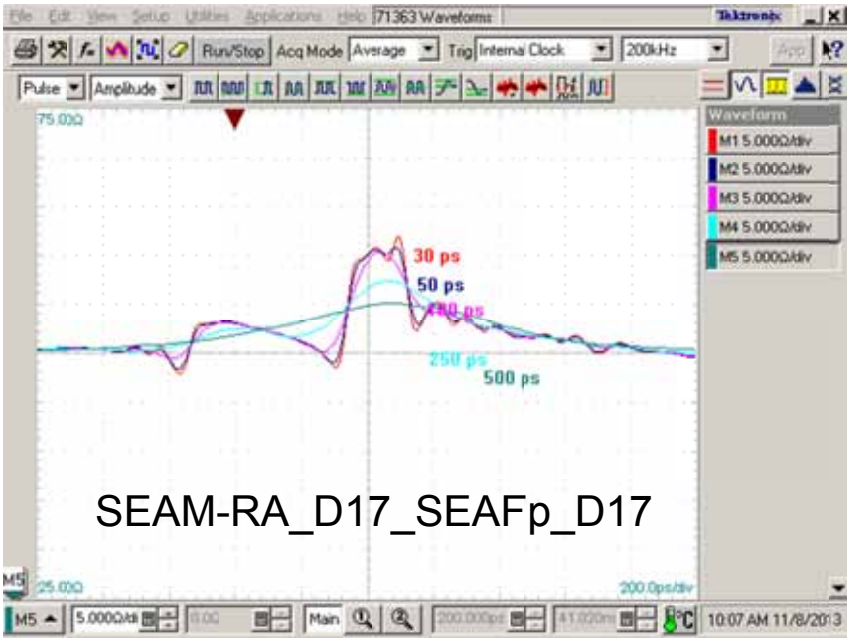


Single-Ended 2:1 S/G Pattern Application – Impedance

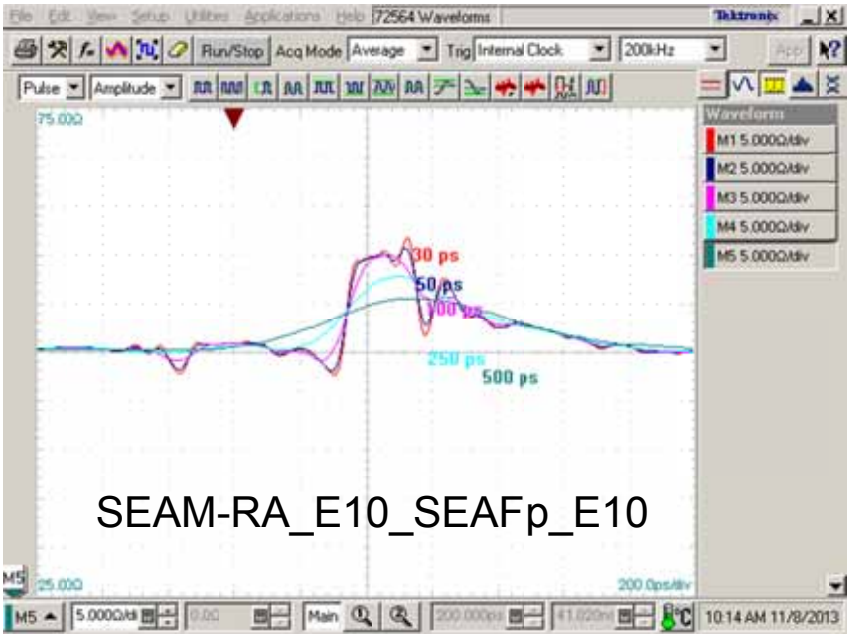


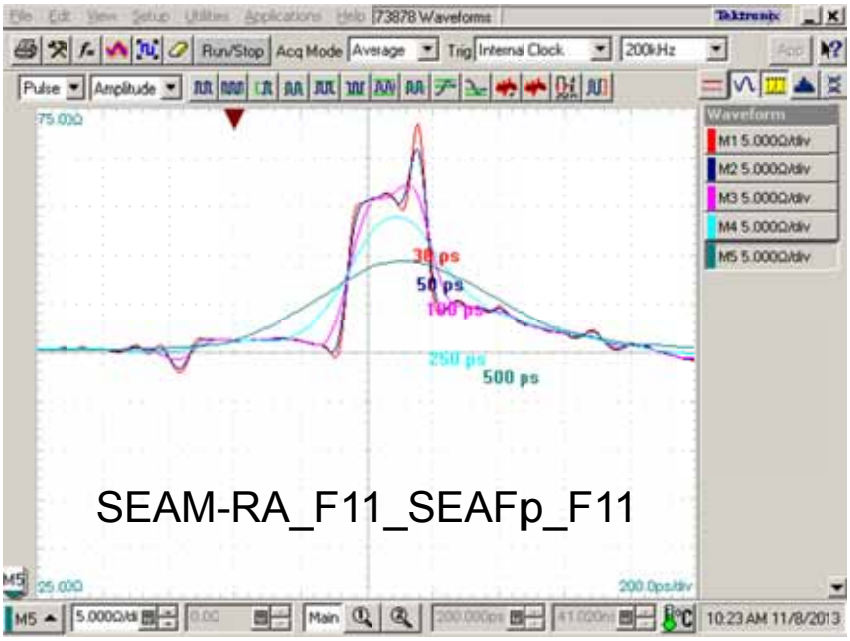
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle





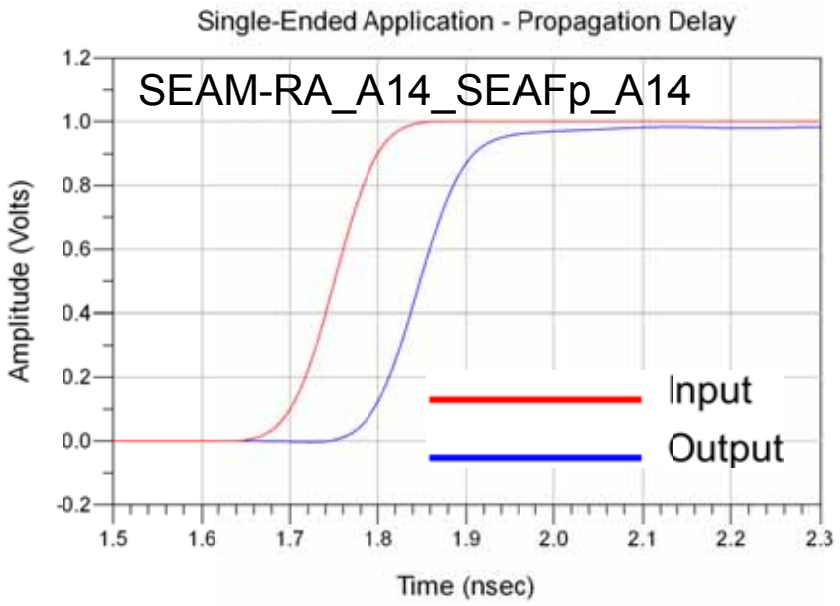
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

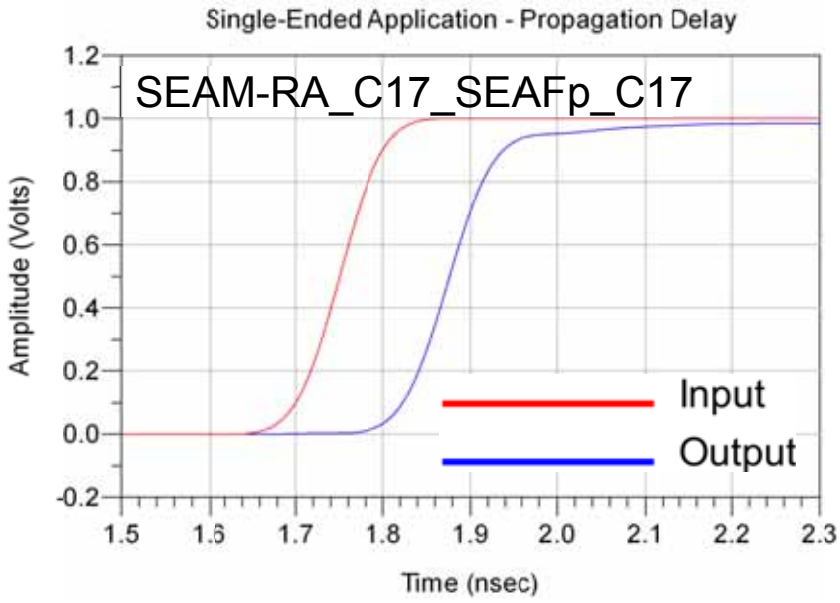




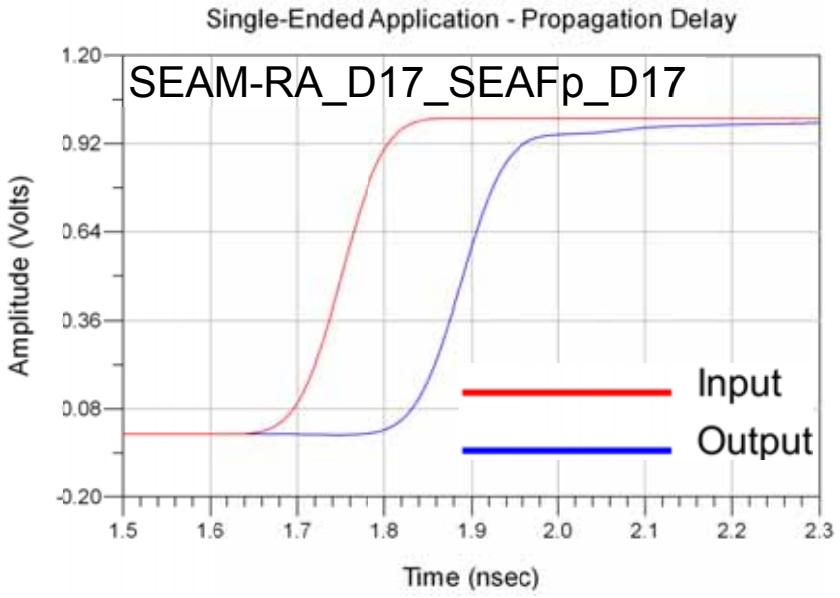
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

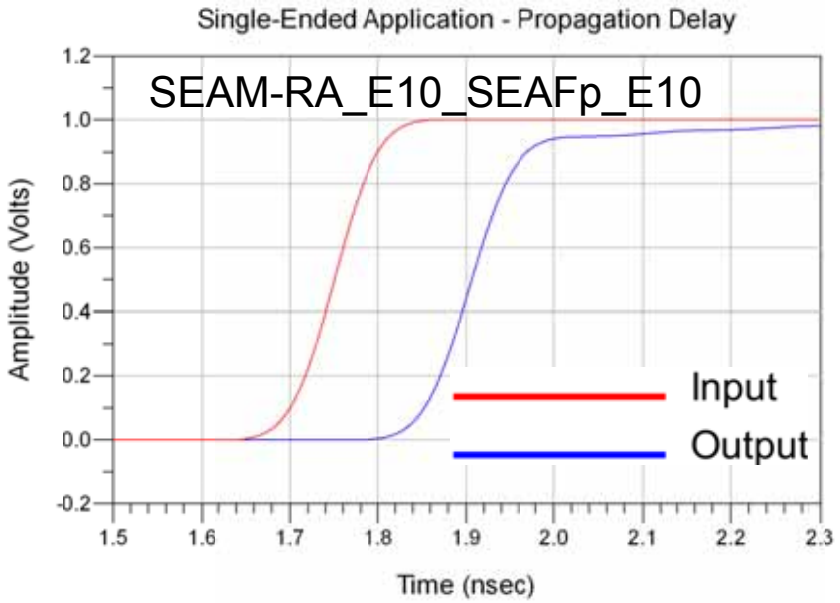
Single-Ended 2:1 S/G Pattern Application – Propagation Delay



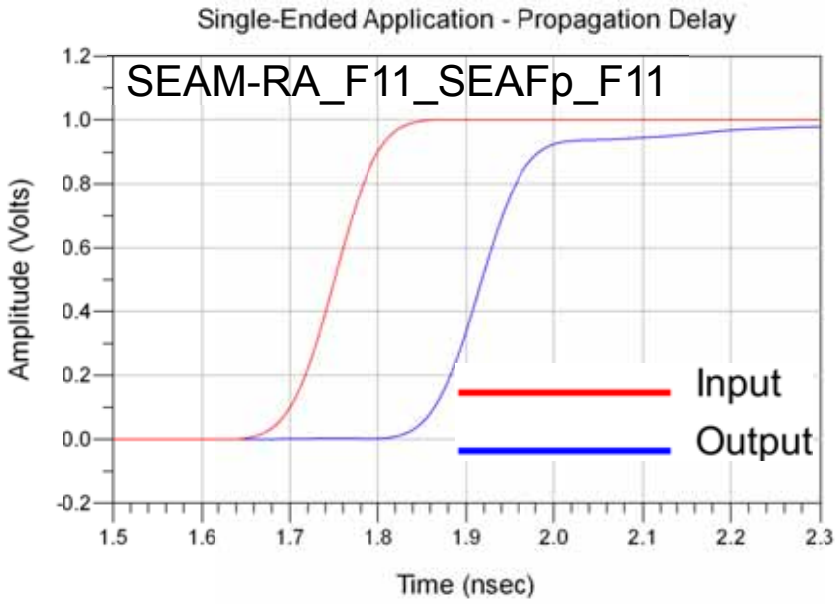


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

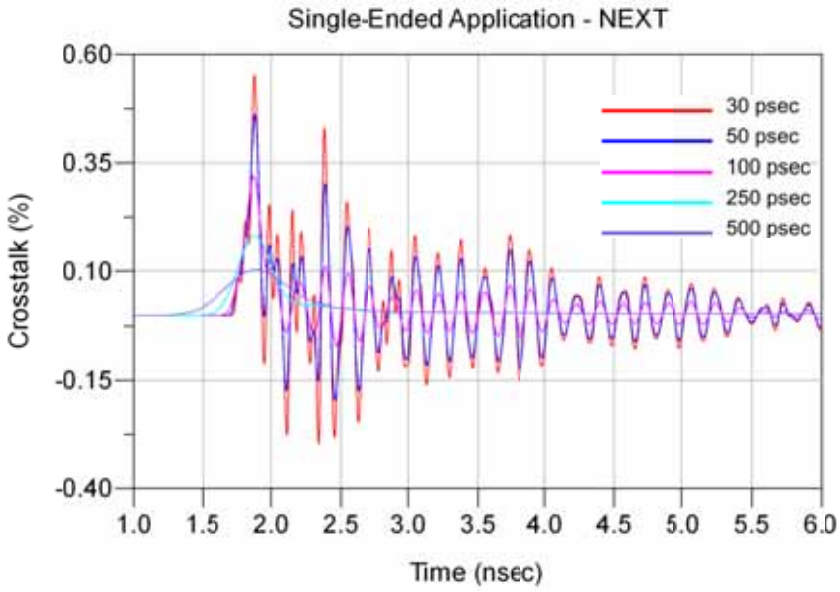




Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

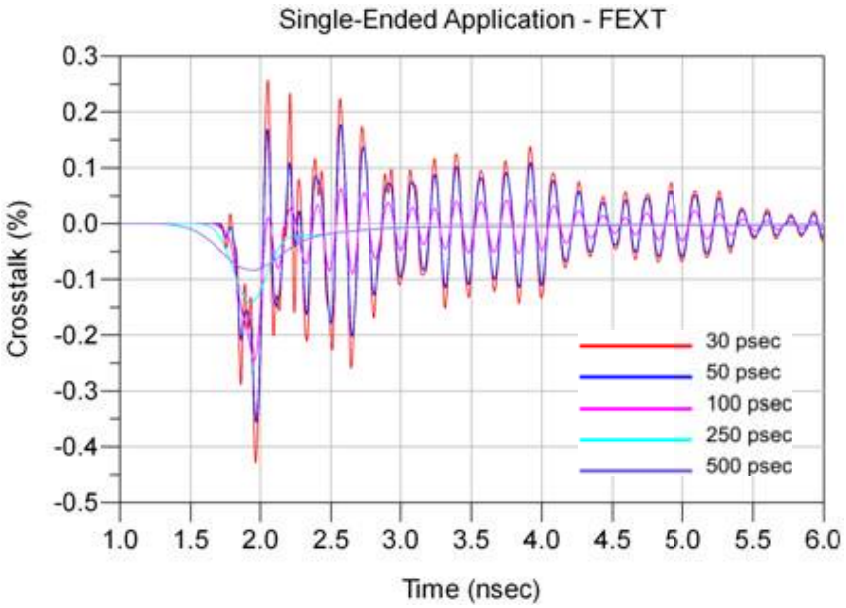


Single-Ended 1:1 S/G Application – NEXT, SEAM-RA_A18_SEAM-RA_C18

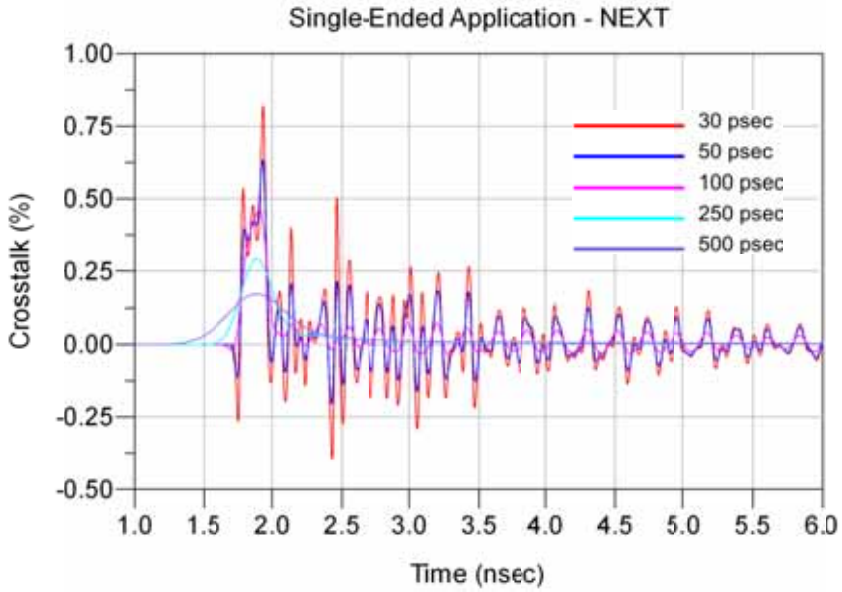


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Single-Ended 1:1 S/G Application – FEXT, SEAM-RA_A18_SEAFp_C18

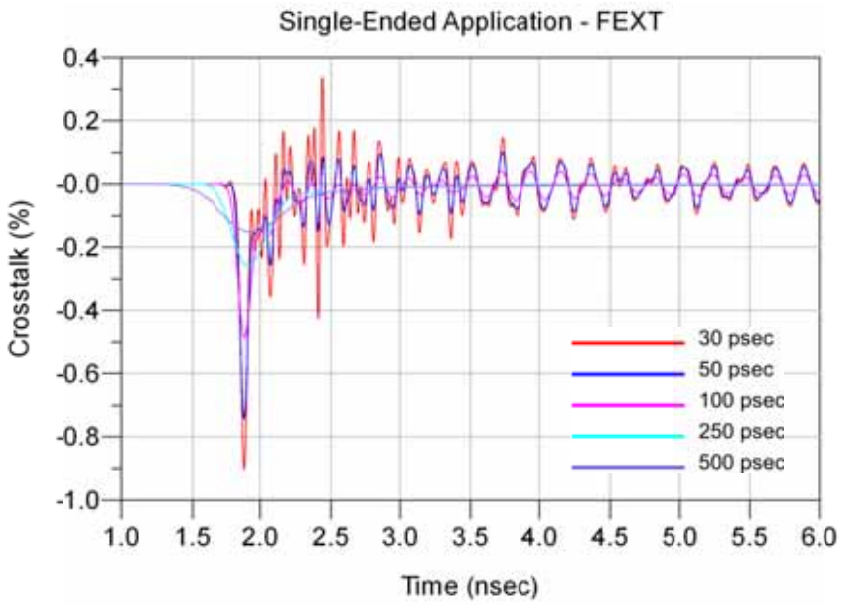


Single-Ended 1:1 S/G Application – NEXT, SEAM-RA_C16_SEAM-RA_C18

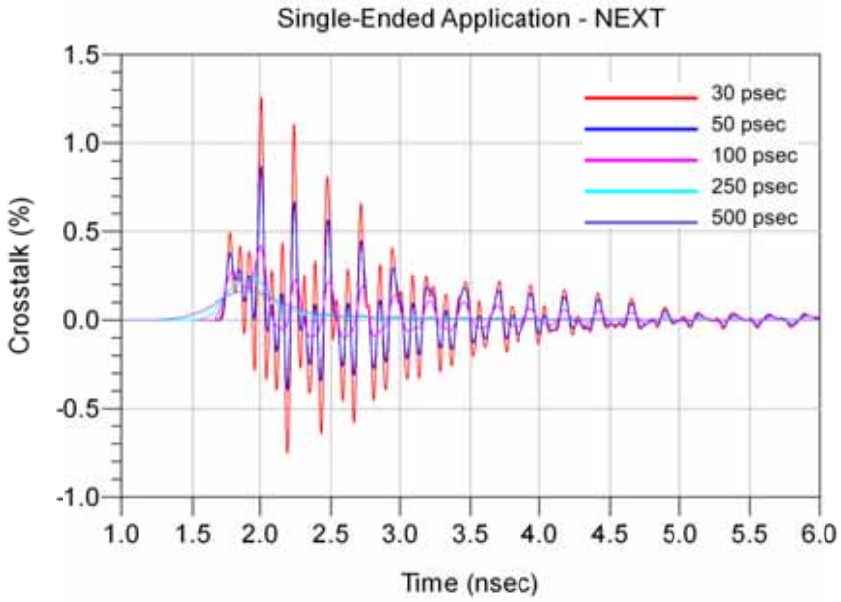


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Single-Ended 1:1 S/G Application – FEXT, SEAM-RA_C16_SEAFp_C18

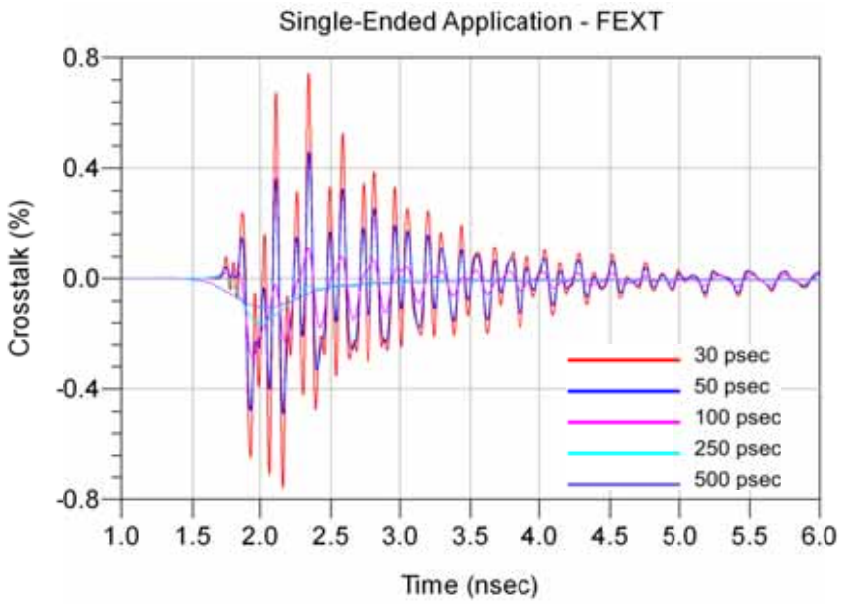


Single-Ended 1:1 S/G Application – NEXT, SEAM-RA_D15_SEAM-RA_F15

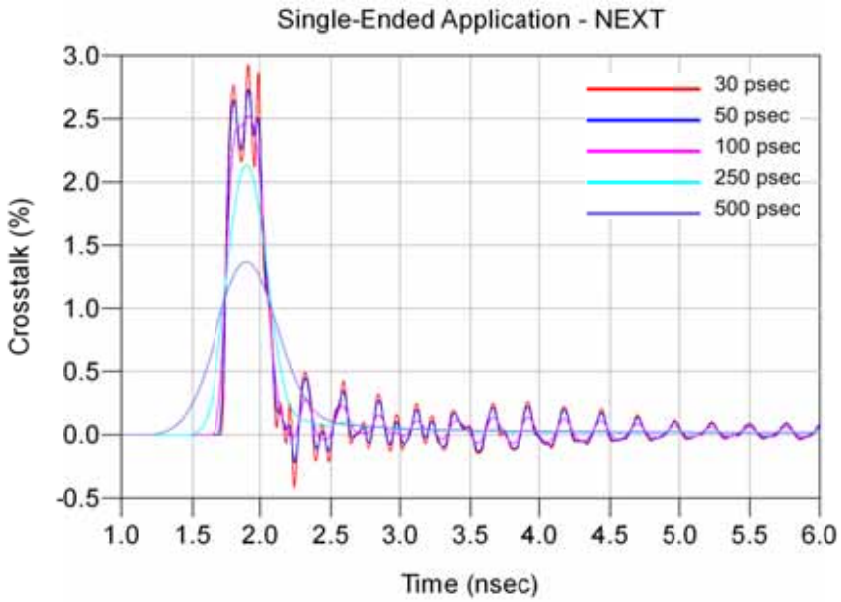


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Single-Ended 1:1 S/G Application – FEXT, SEAM-RA_D15_SEAFp_F15

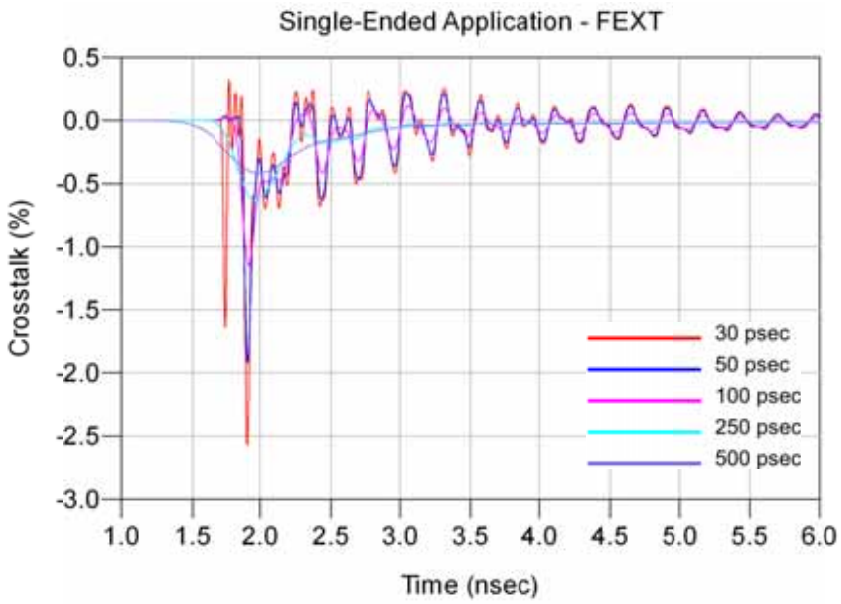


Single-Ended 1:1 S/G Application – NEXT, SEAM-RA_E12_SEAM-RA_F13

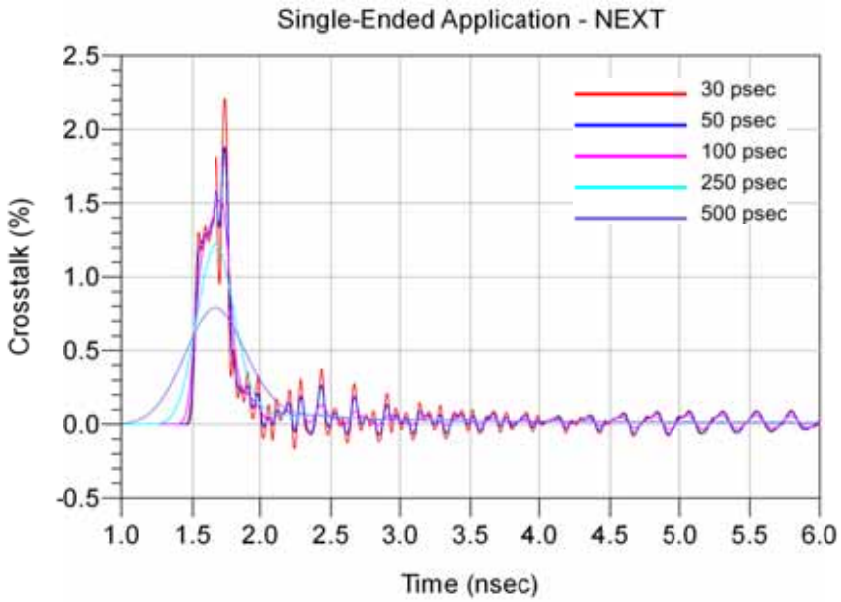


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Single-Ended 1:1 S/G Application – FEXT, SEAM-RA_E12_SEAFp_F13

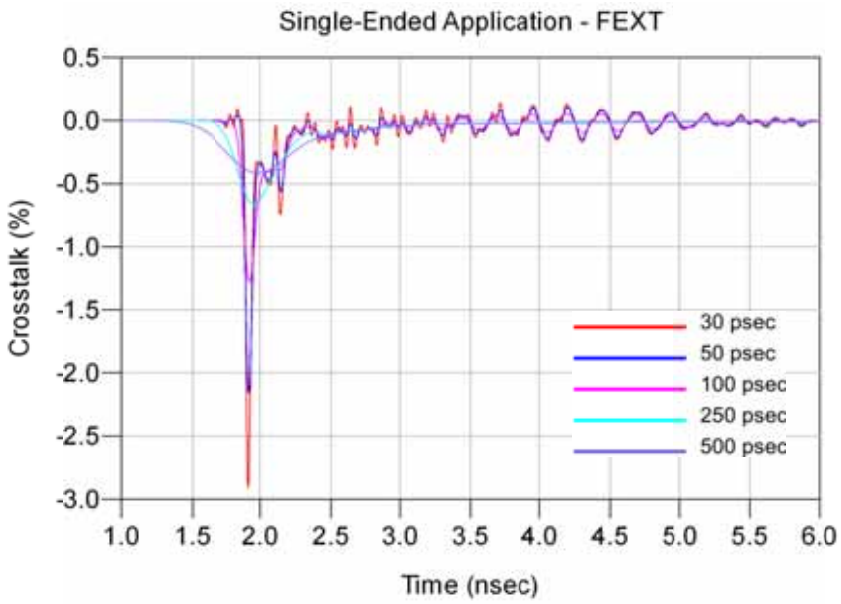


Single-Ended 1:1 S/G Application – NEXT, SEAM-RA_F13_SEAM-RA_F15

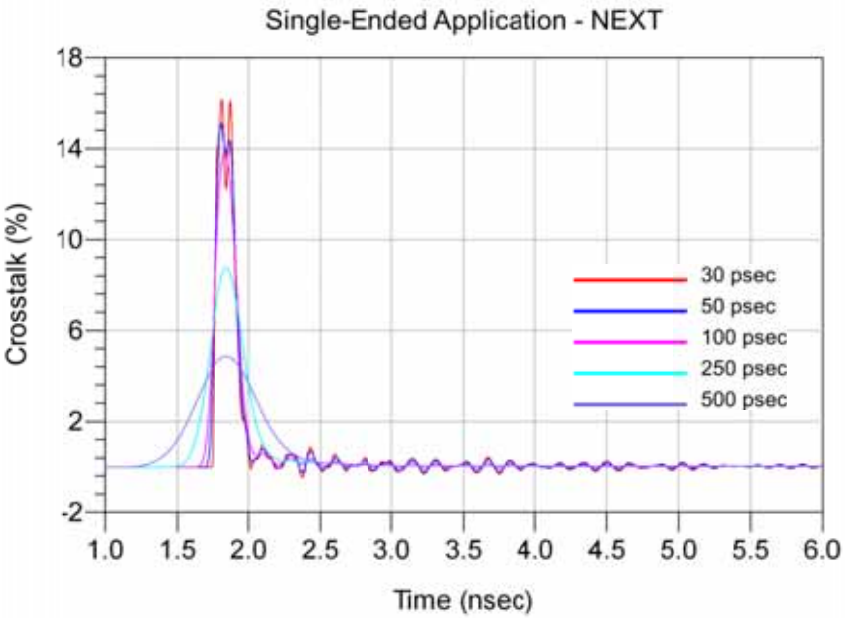


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Single-Ended 1:1 S/G Application – FEXT, SEAM-RA_F13_SEAFp_F15

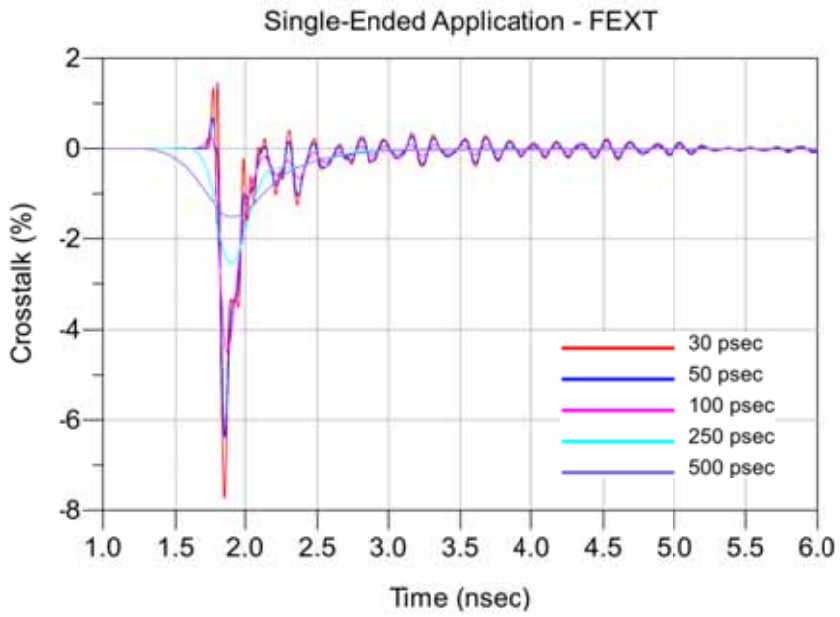


Single-Ended 2:1 S/G Application – NEXT, SEAM-RA_A14_SEAM-RA_A15

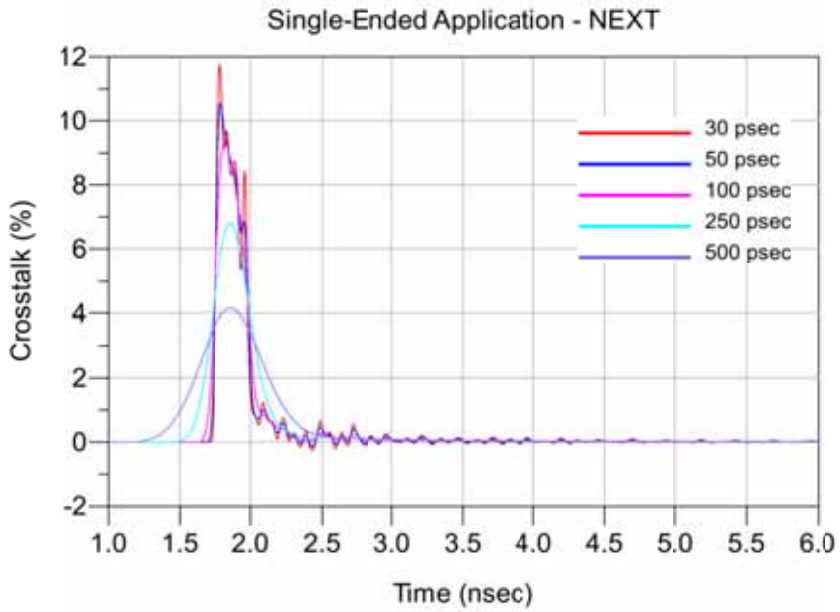


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Single-Ended 2:1 S/G Application – FEXT, SEAM-RA_A14_SEAFp_A15

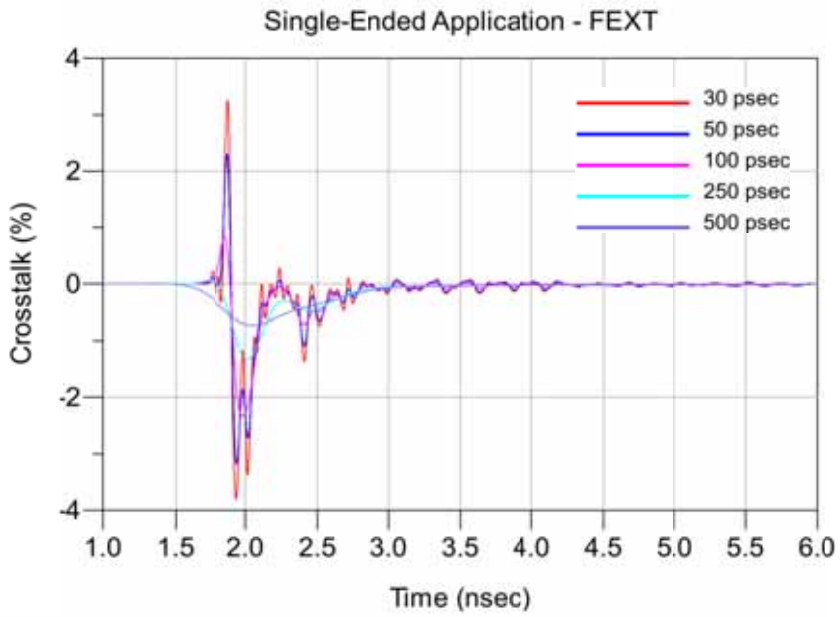


Single-Ended 2:1 S/G Application – NEXT, SEAM-RA_C17_SEAM-RA_D17

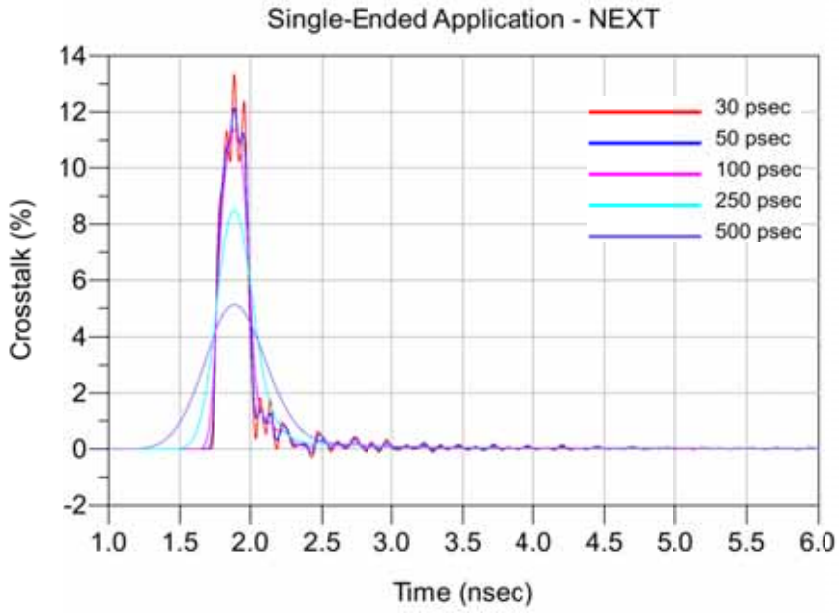


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Single-Ended 2:1 S/G Application – FEXT, SEAM-RA_C17_SEAFp_D17

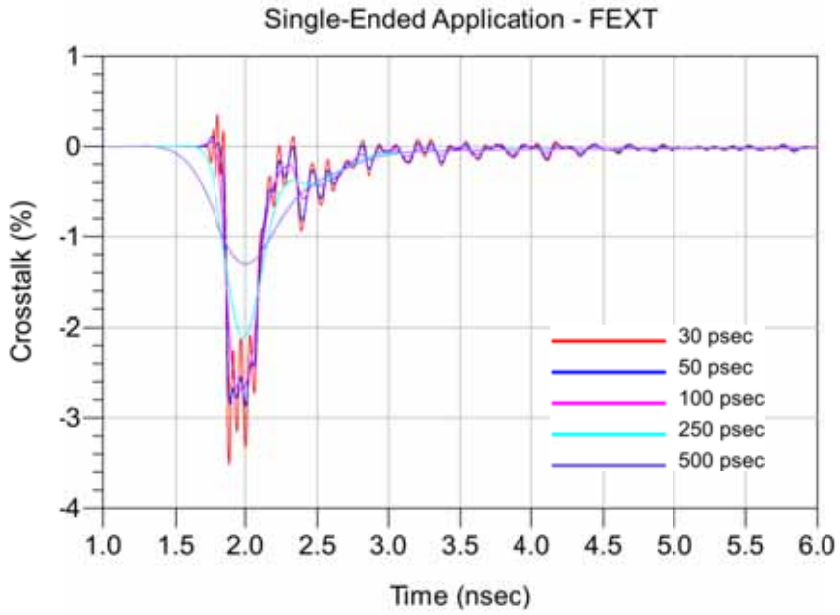


Single-Ended 2:1 S/G Application – NEXT, SEAM-RA_D17_SEAM-RA_D18

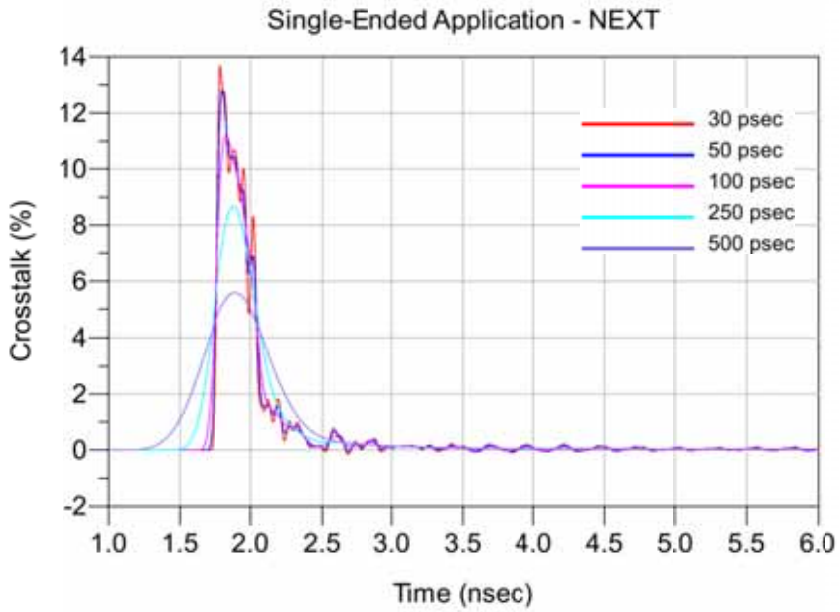


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Single-Ended 2:1 S/G Application – FEXT, SEAM-RA_D17_SEAFp_D18

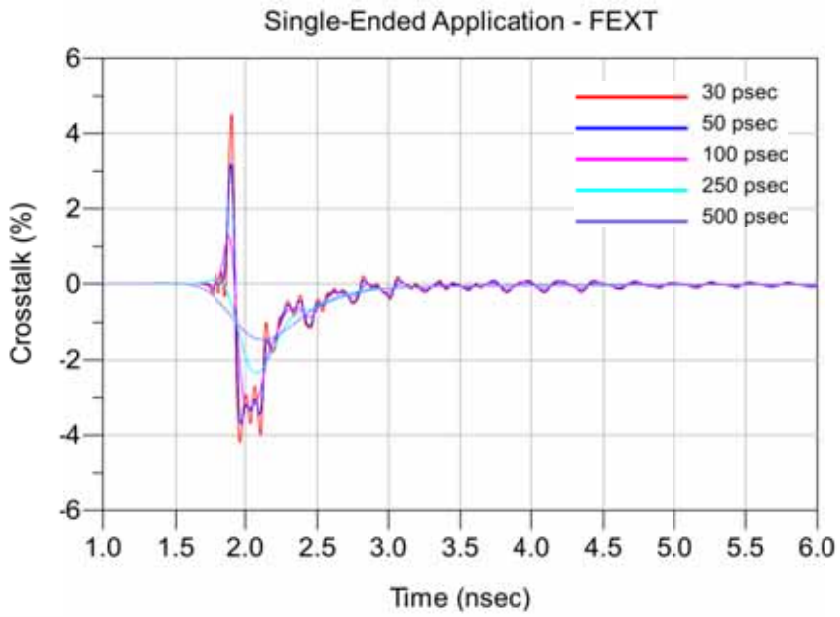


Single-Ended 2:1 S/G Application – NEXT, SEAM-RA_E10_SEAM-RA_F10

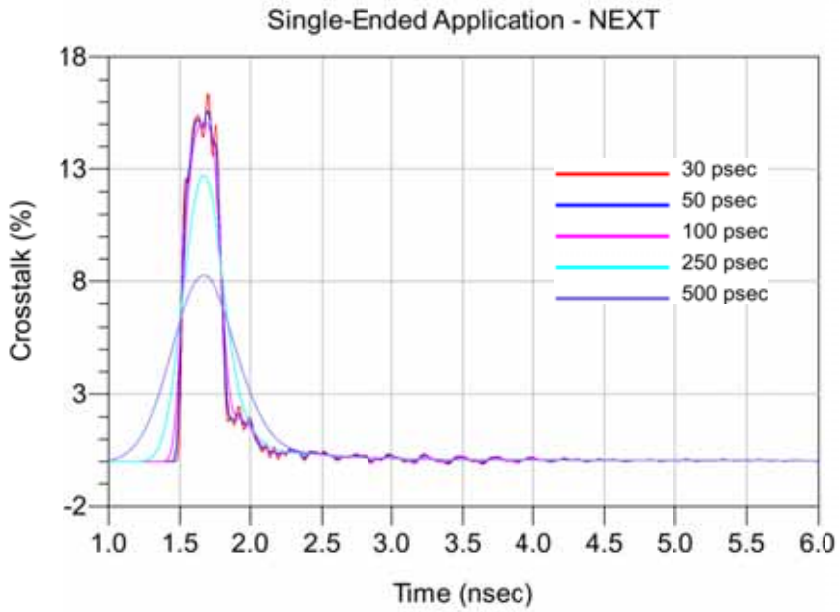


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Single-Ended 2:1 S/G Application – FEXT, SEAM-RA_E10_SEAFp_F10

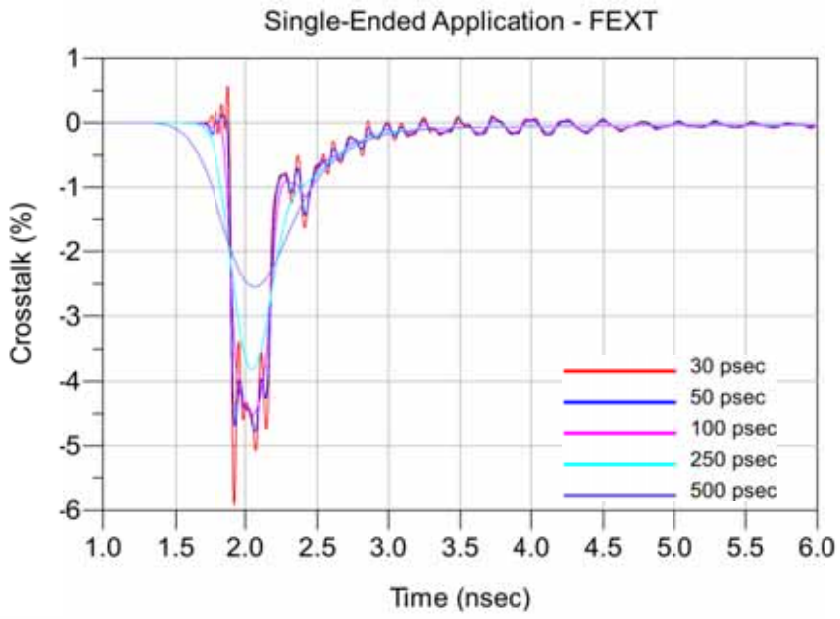


Single-Ended 2:1 S/G Application – NEXT, SEAM-RA_F10_SEAM-RA_F11

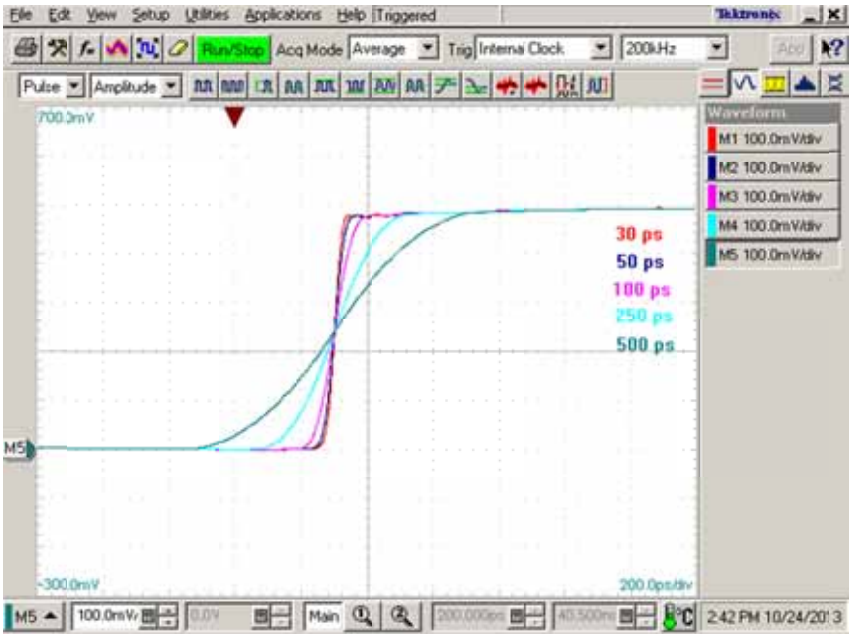


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Single-Ended 2:1 S/G Application – FEXT, SEAM-RA_F11_SEAFp_F10

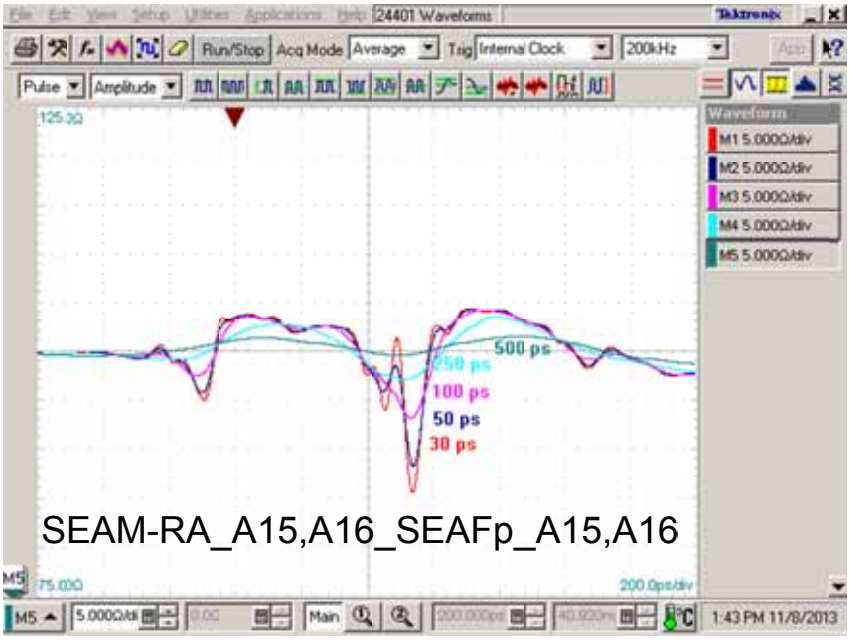


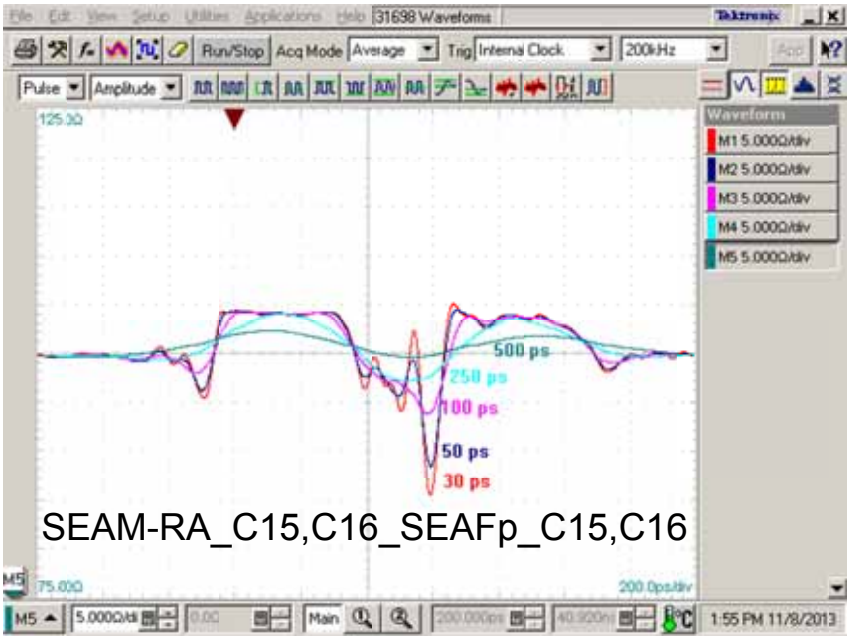
Differential Application – Input Pulse



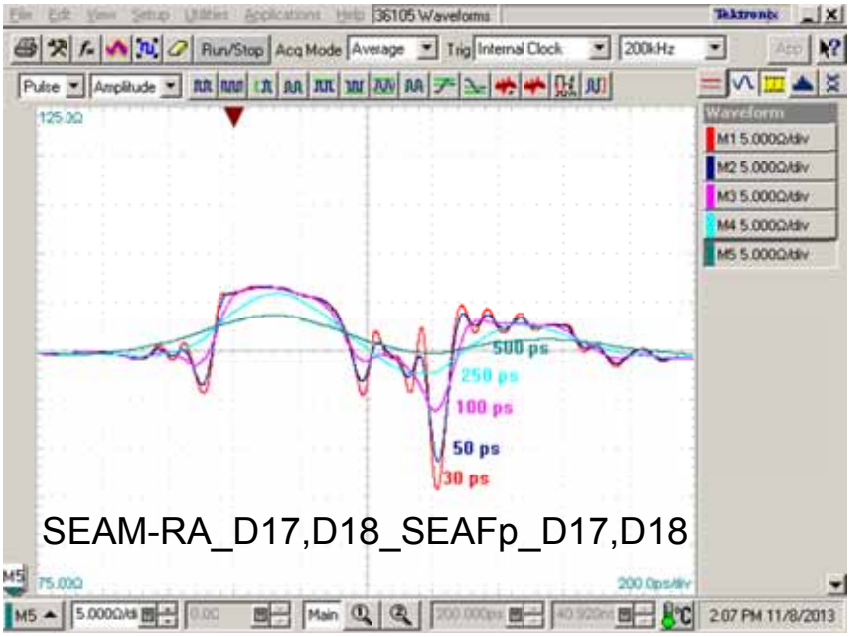
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

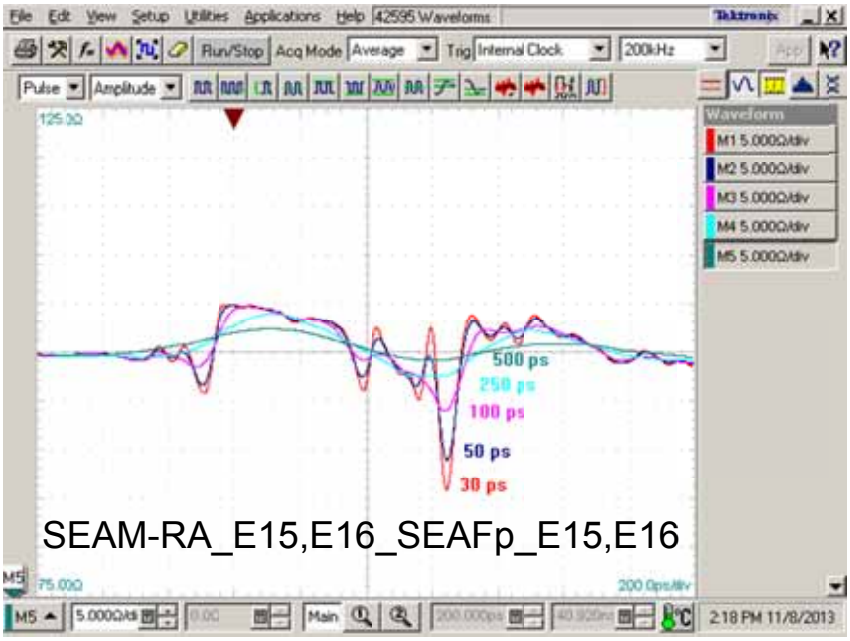
Differential Optimal Horizontal Application – Impedance



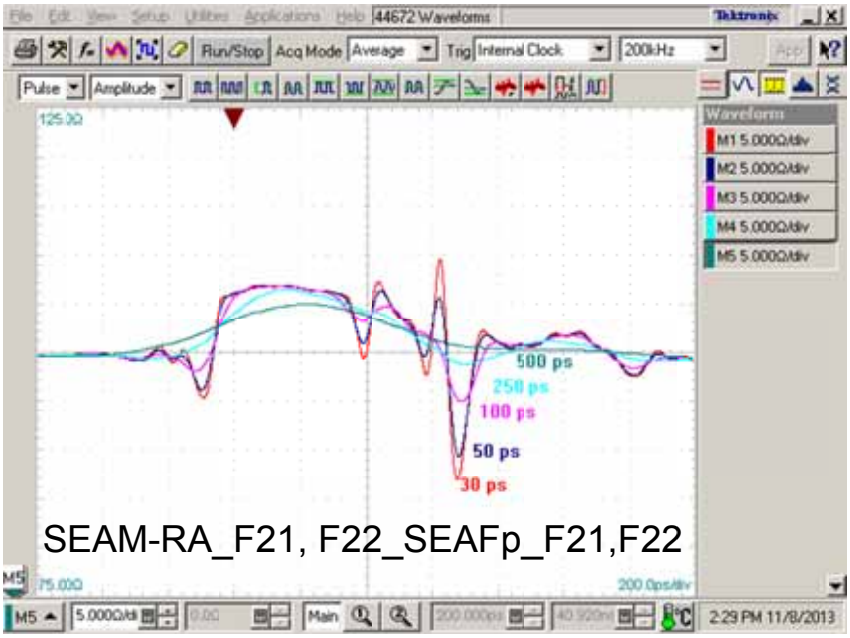


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

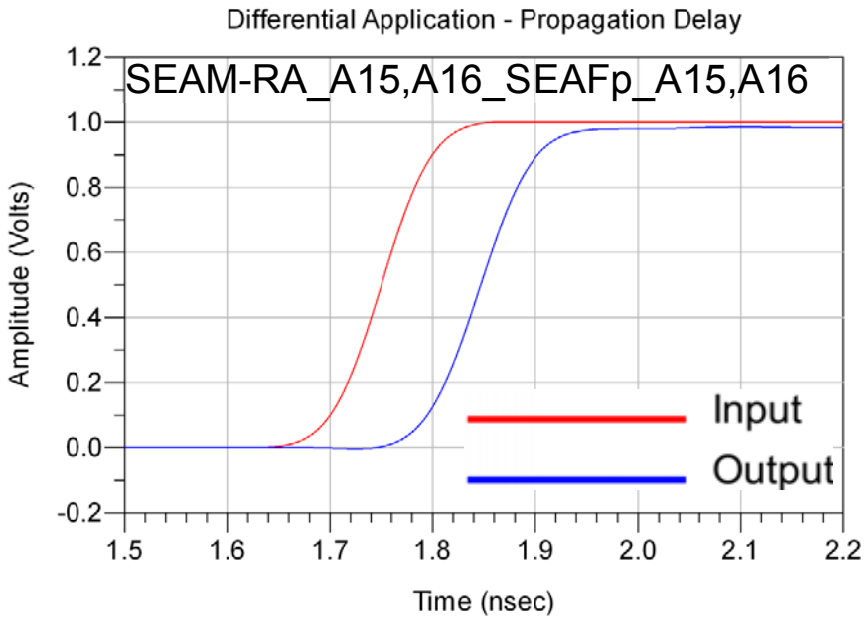




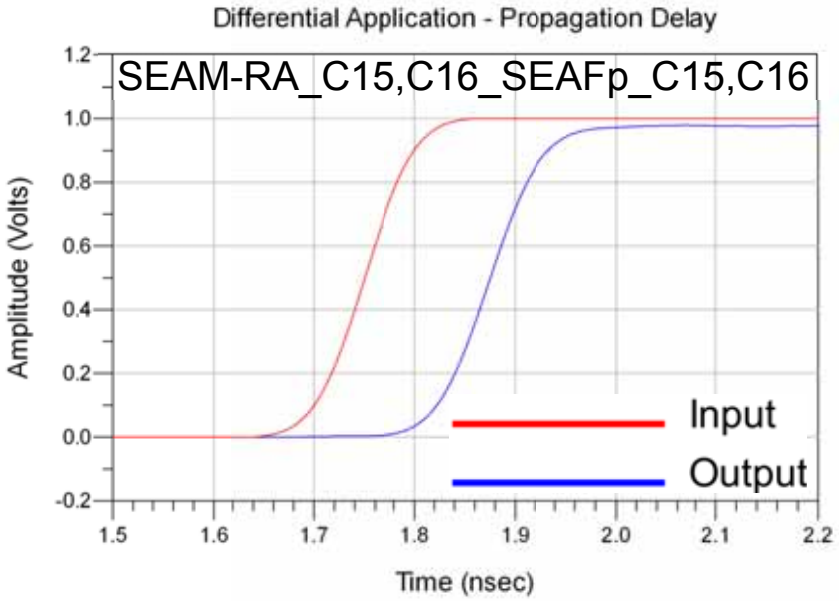
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

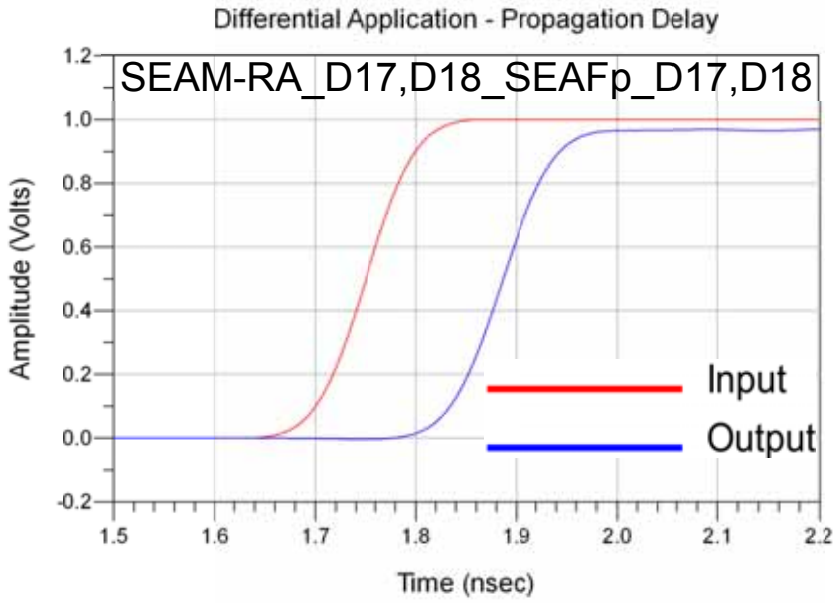


Differential Optimal Horizontal Application – Propagation Delay

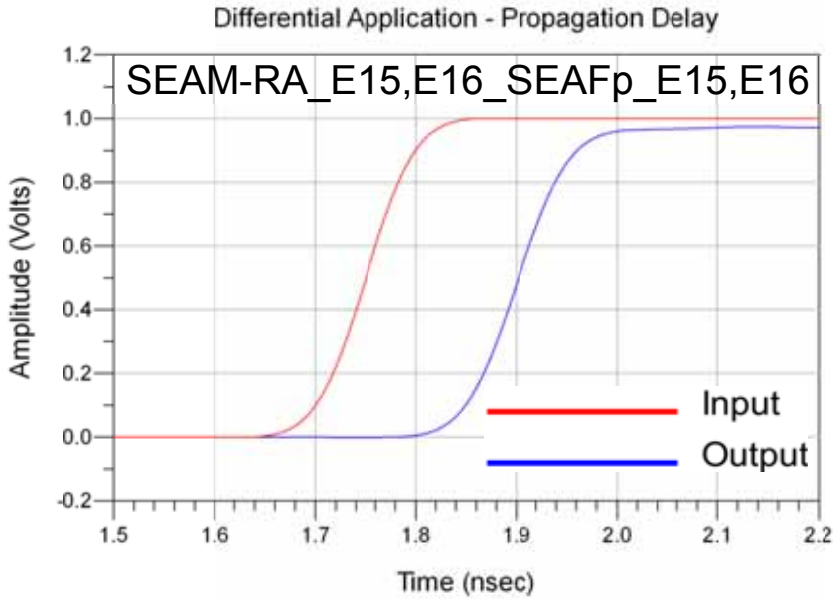


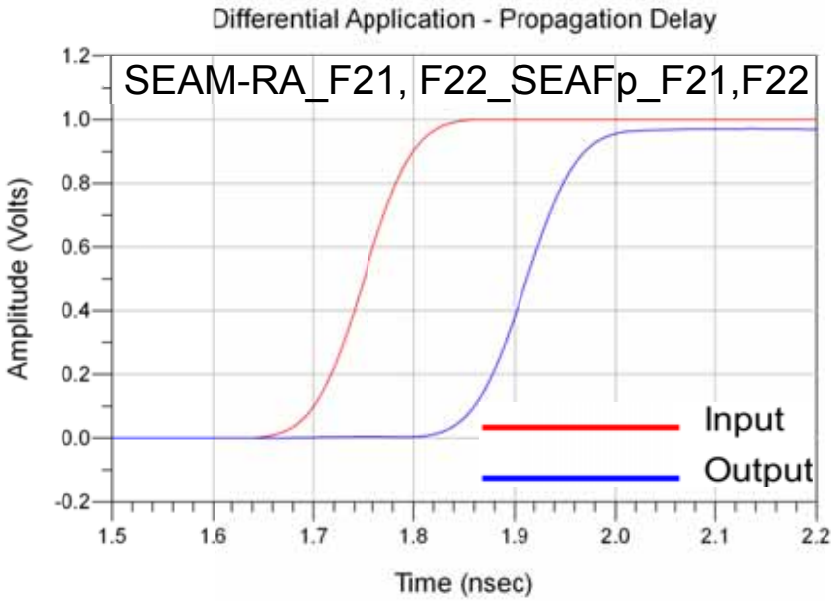
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle





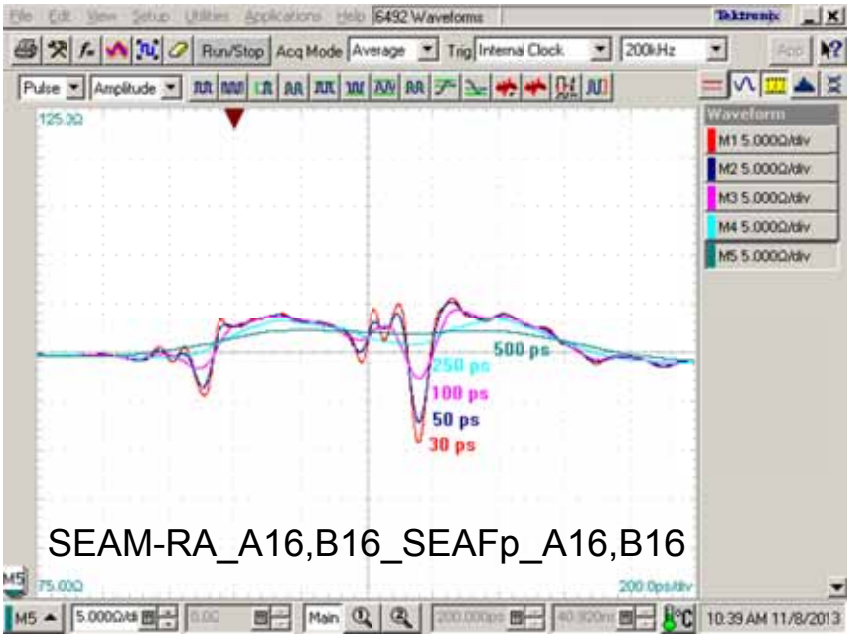
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

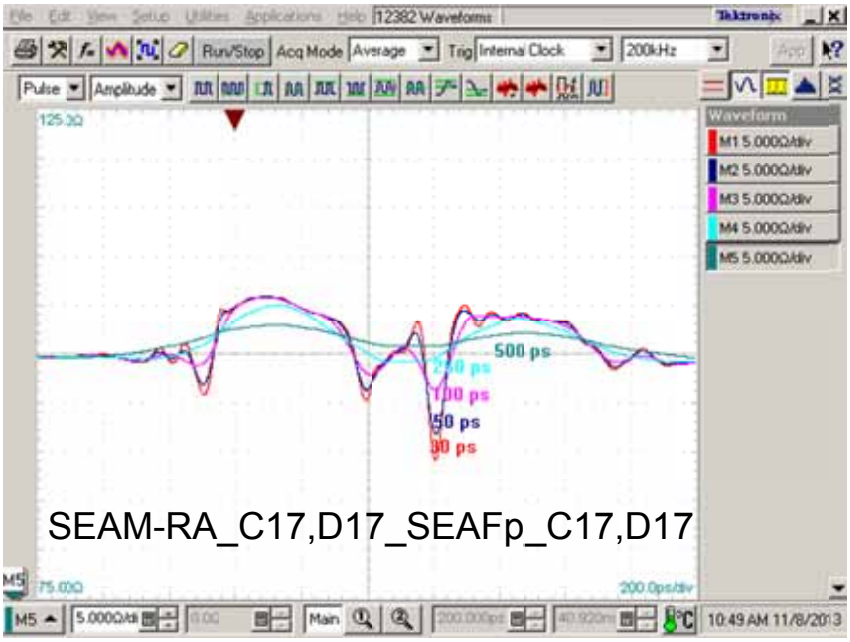




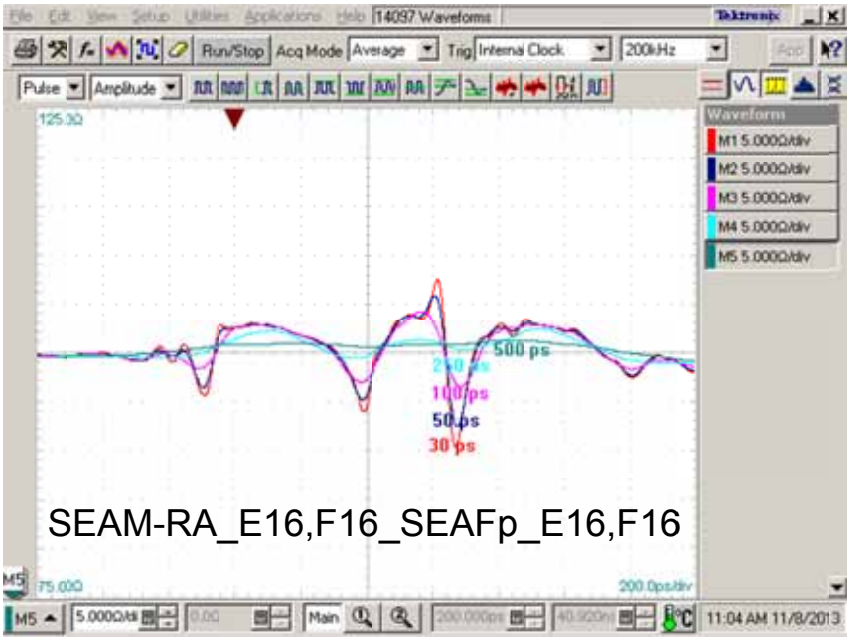
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Vertical Application – Impedance

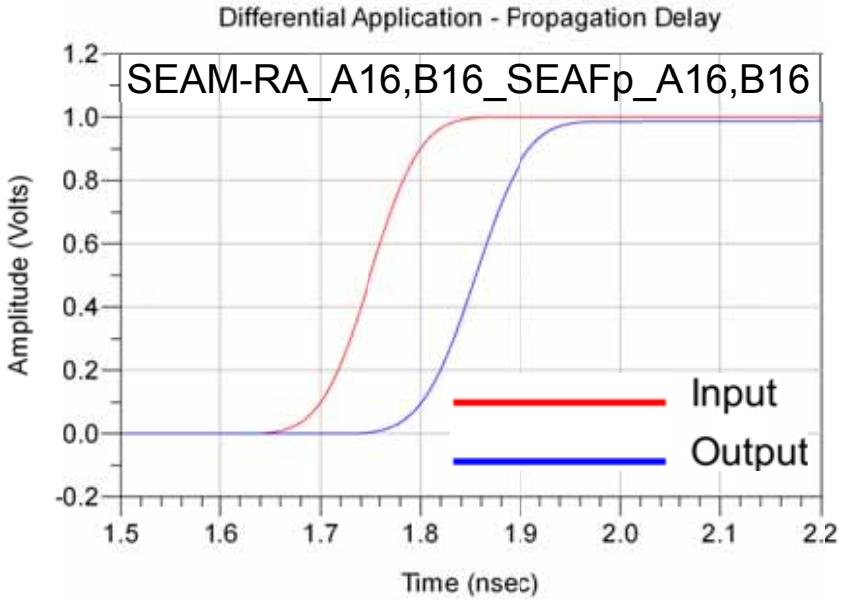




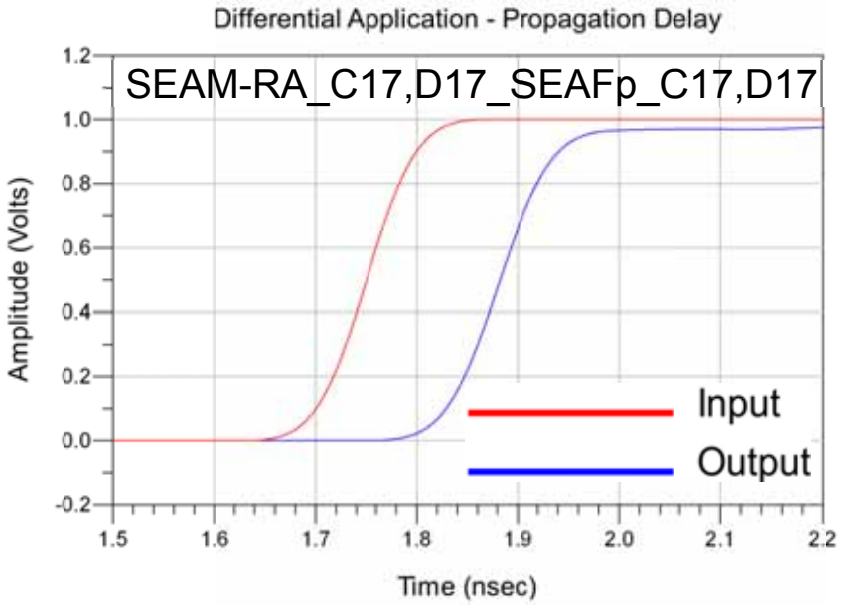
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

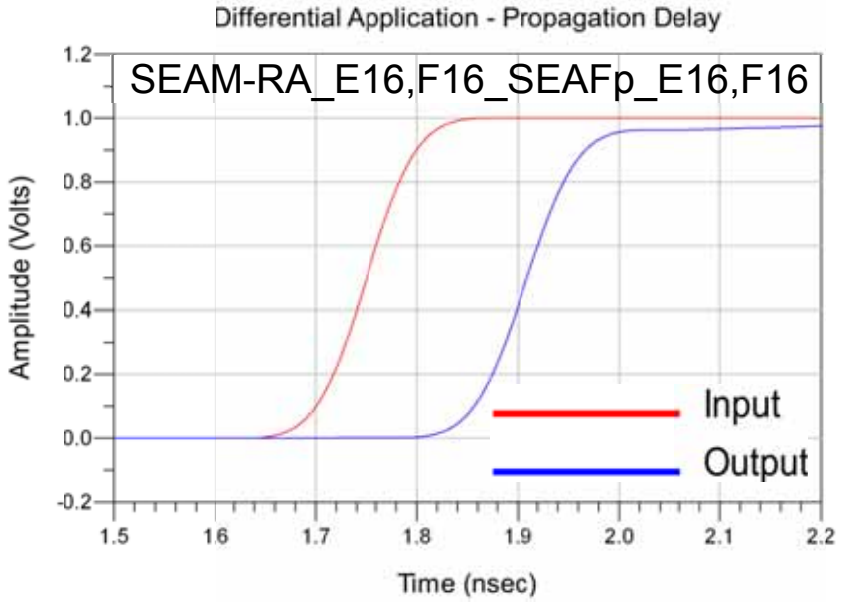


Differential Optimal Vertical Application – Propagation Delay



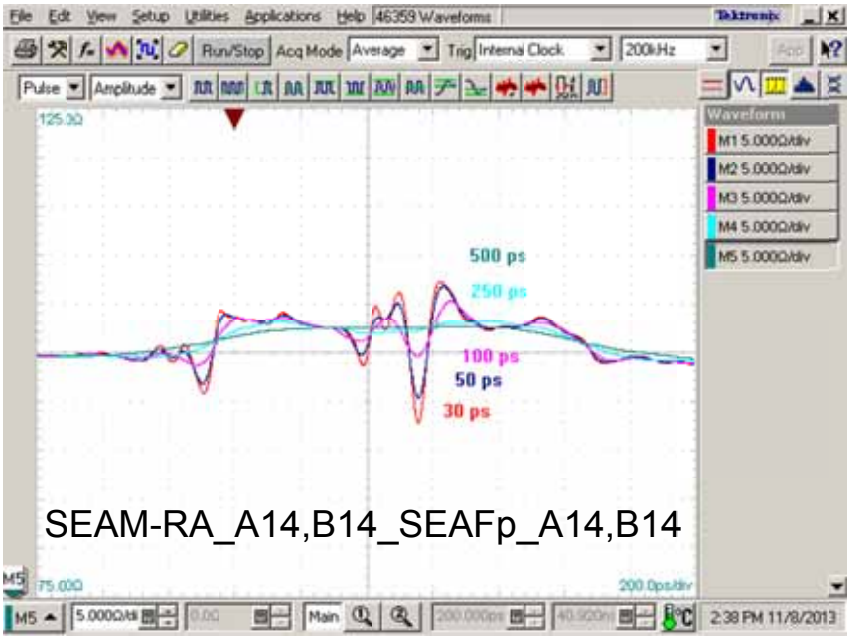
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

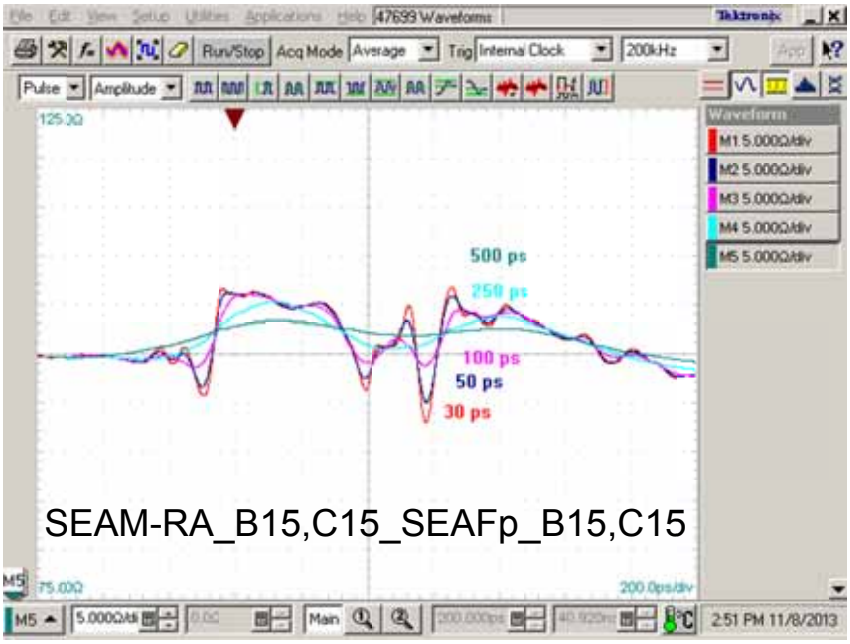




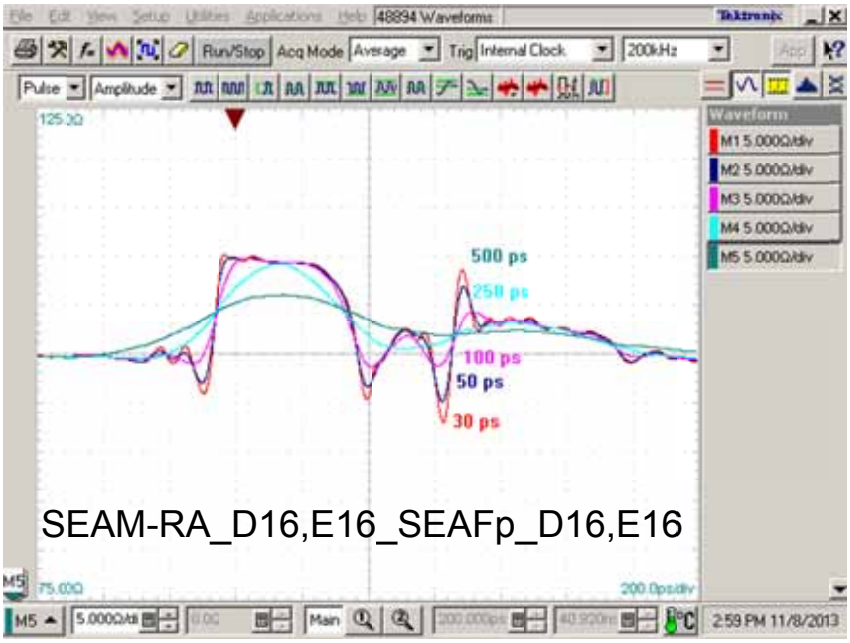
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

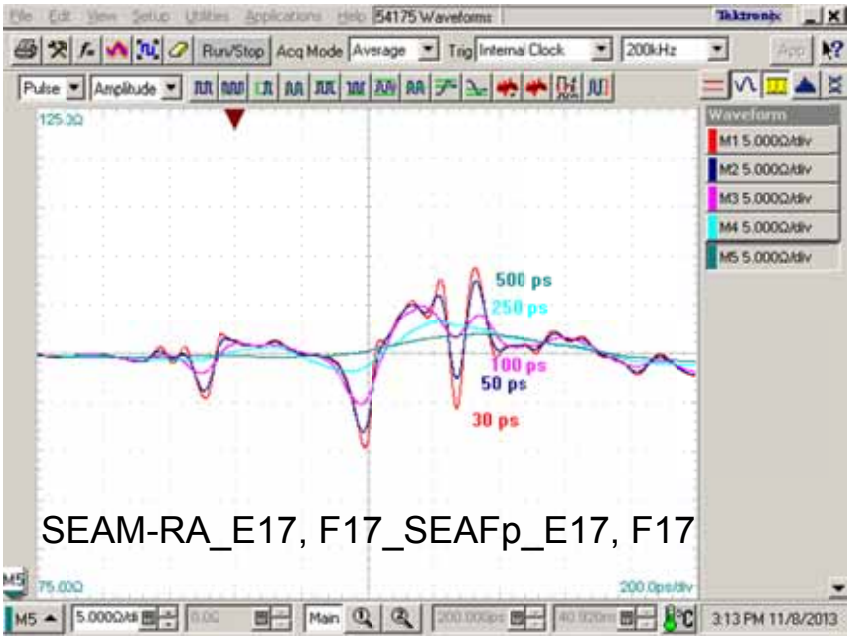
Differential High Density Vertical Application – Impedance





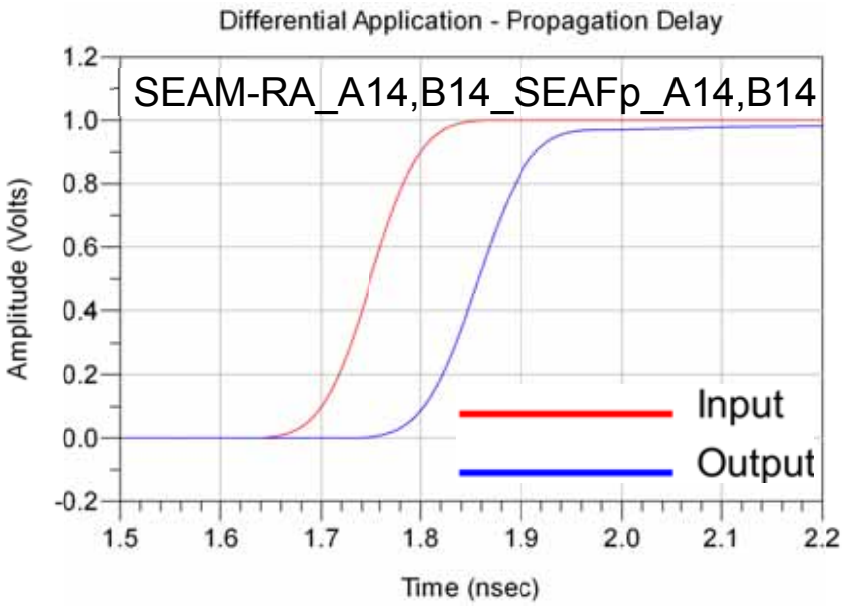
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

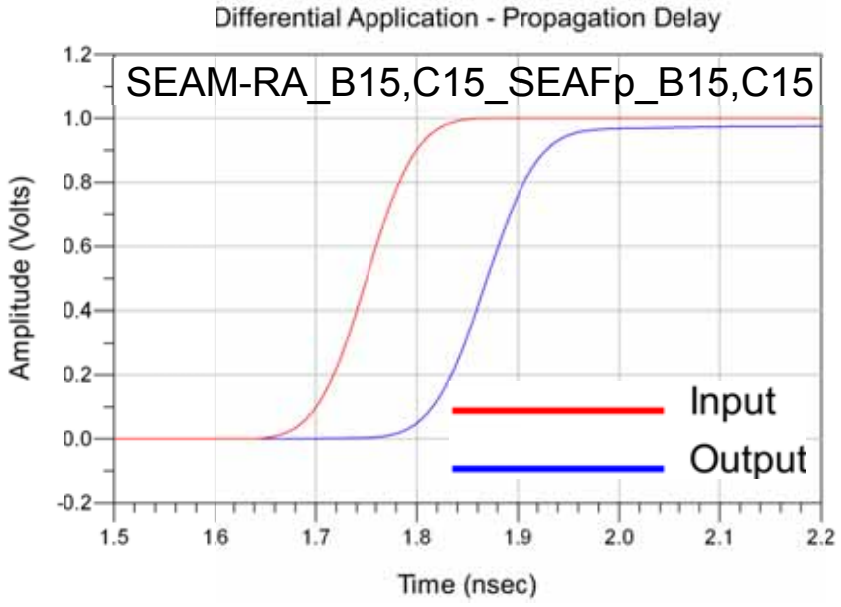




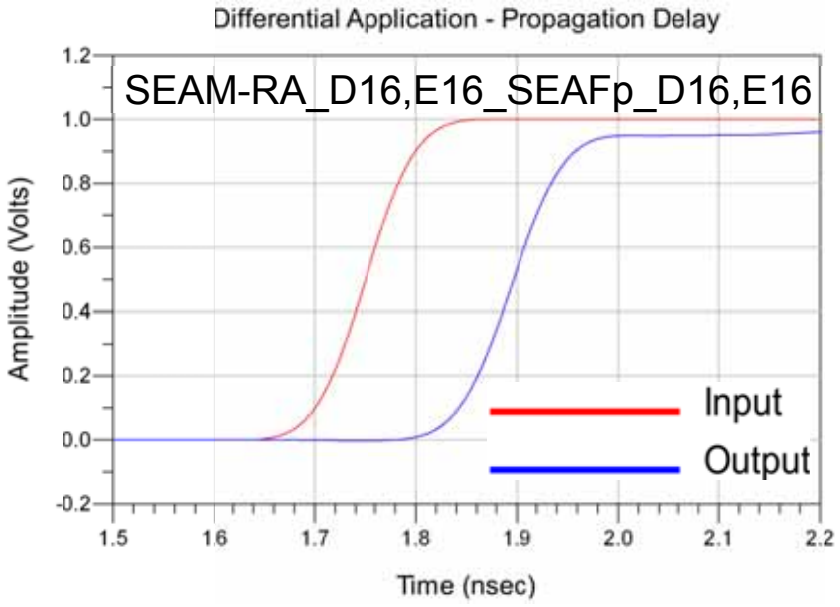
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

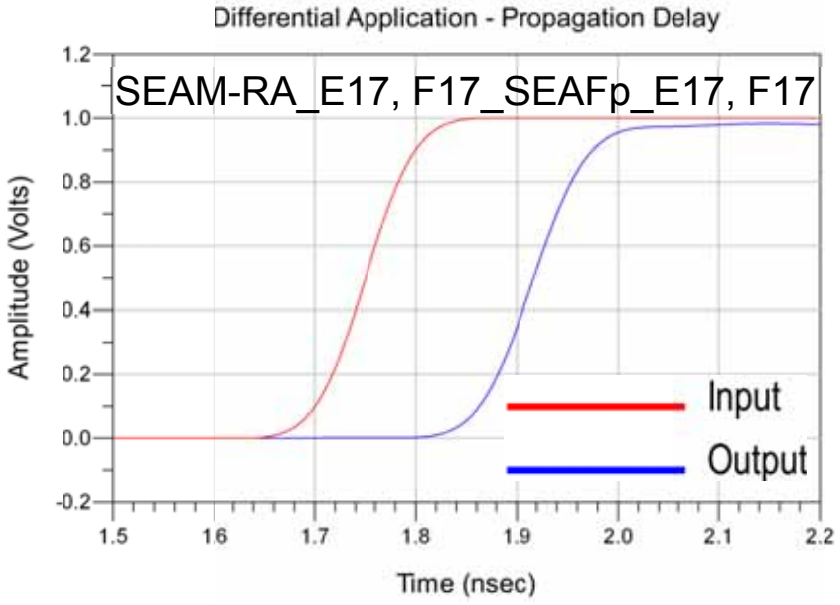
Differential High Density Vertical Application – Propagation Delay





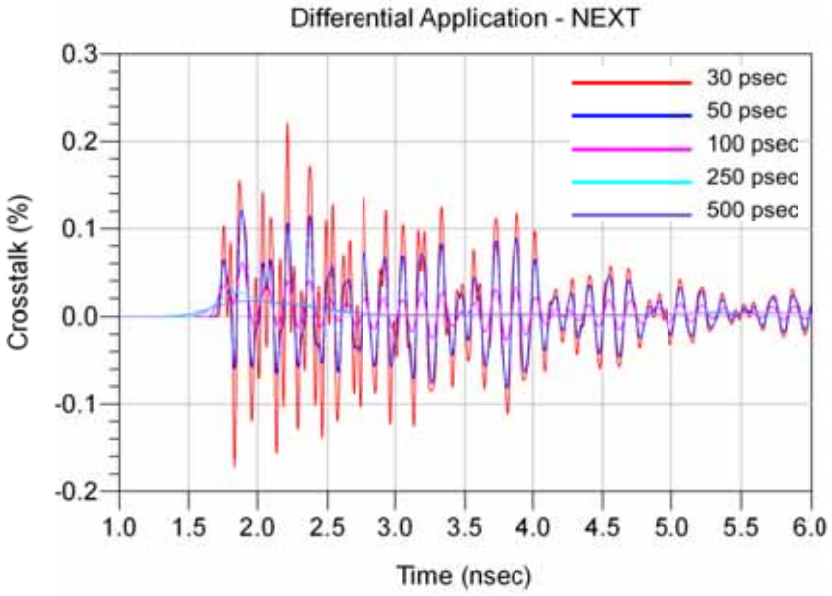
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle



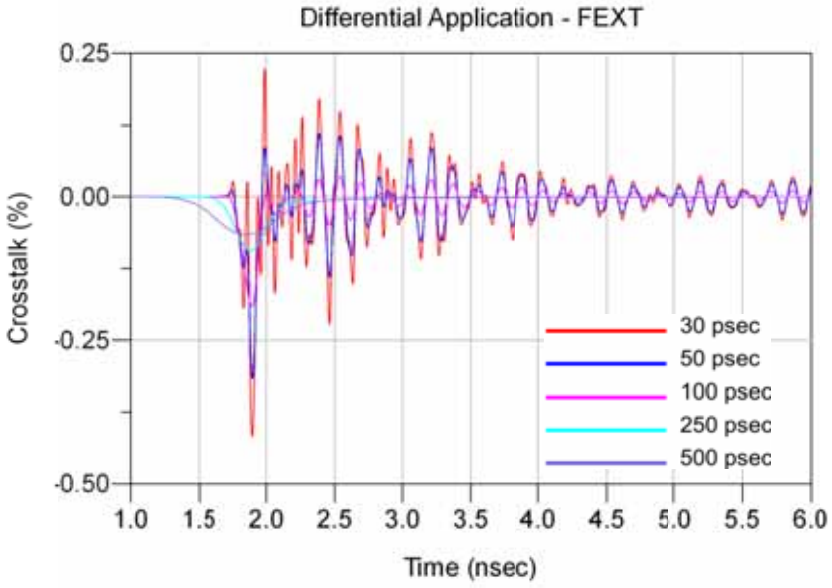


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Horizontal Application – NEXT, SEAM-RA_A15,A16_SEAM-RA_C15,C16

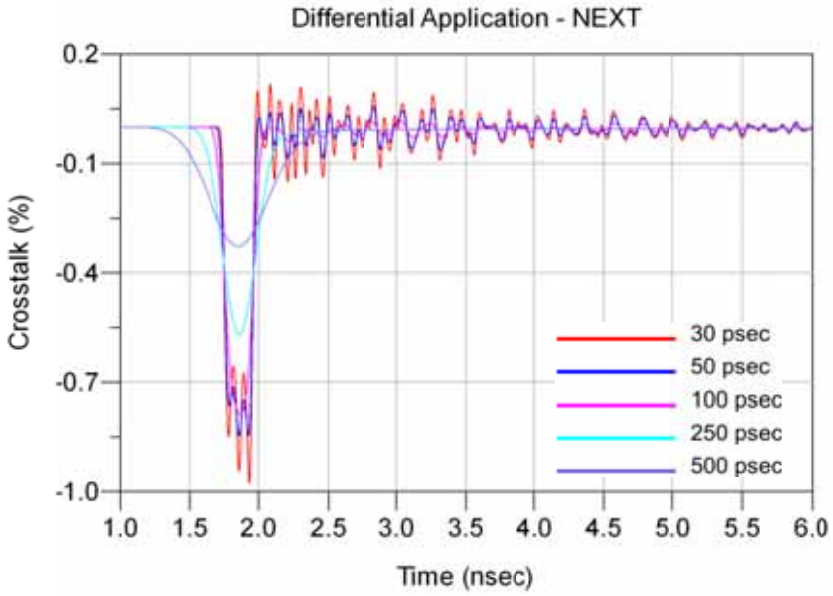


Differential Optimal Horizontal Application – FEXT, SEAM-RA_A15,A16_SEAFp_C15,C16

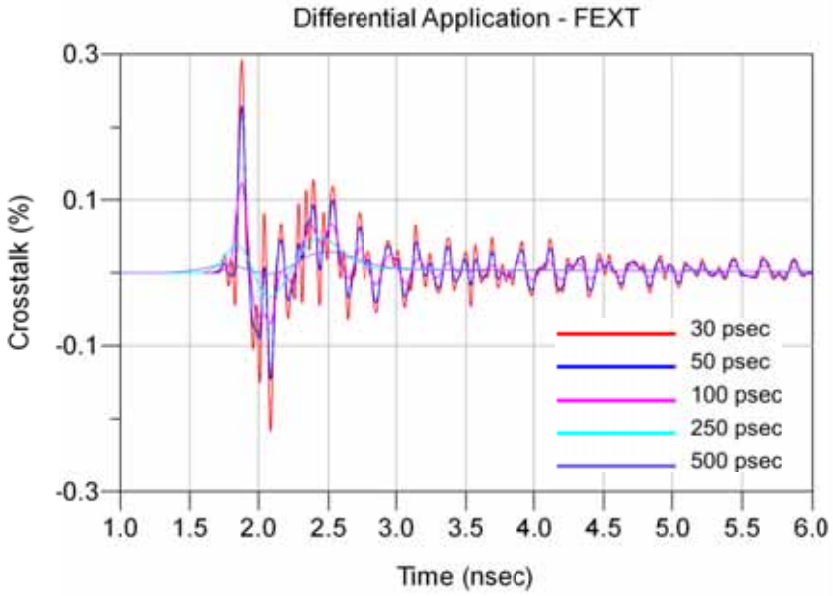


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Horizontal Application – NEXT, SEAM-RA_C15,C16_SEAM-RA_D17,D18

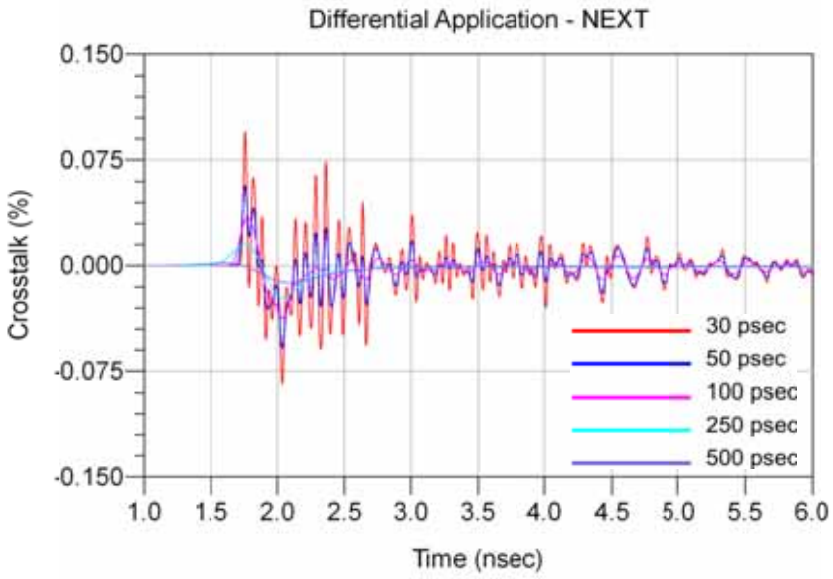


Differential Optimal Horizontal Application – FEXT, SEAM-RA_C15,C16_SEAFp_D17,D18

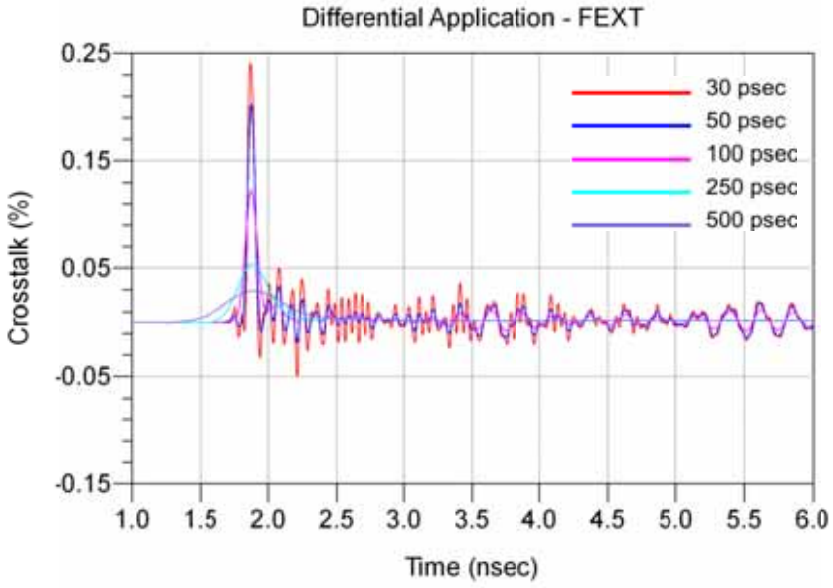


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Horizontal Application – NEXT, SEAM-RA_D17,D18_SEAM-RA_D21,D22

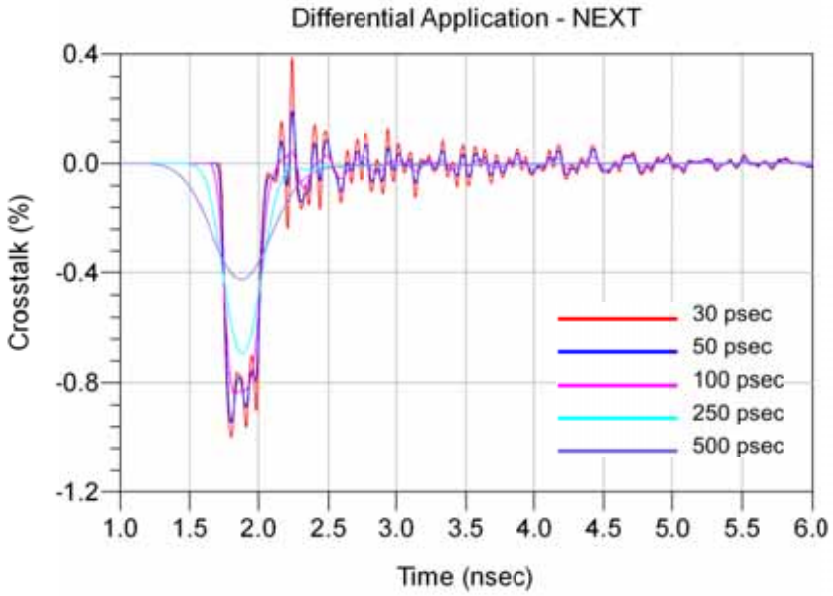


Differential Optimal Horizontal Application – FEXT, SEAM-RA_D17,D18_SEAFp_D21,D22

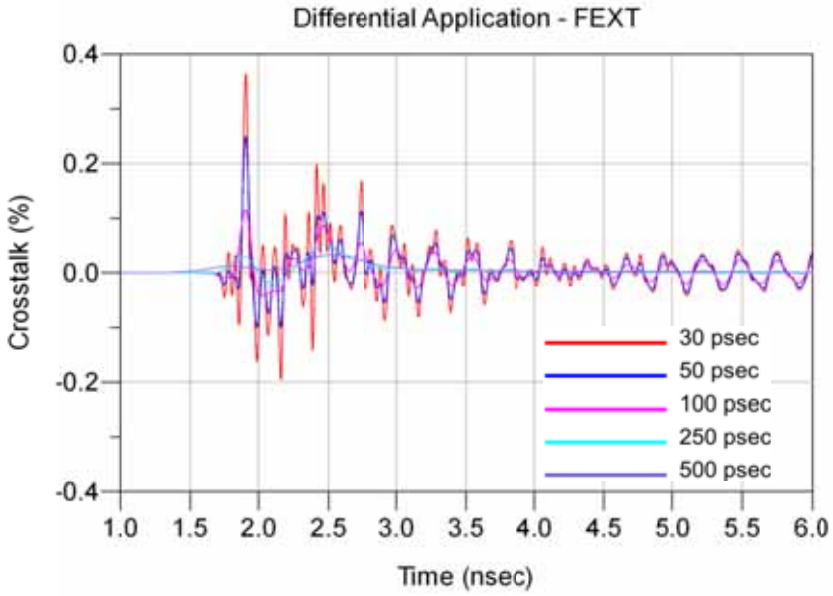


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Horizontal Application – NEXT, SEAM-RA_E15,E16_SEAM-RA_F17,F18

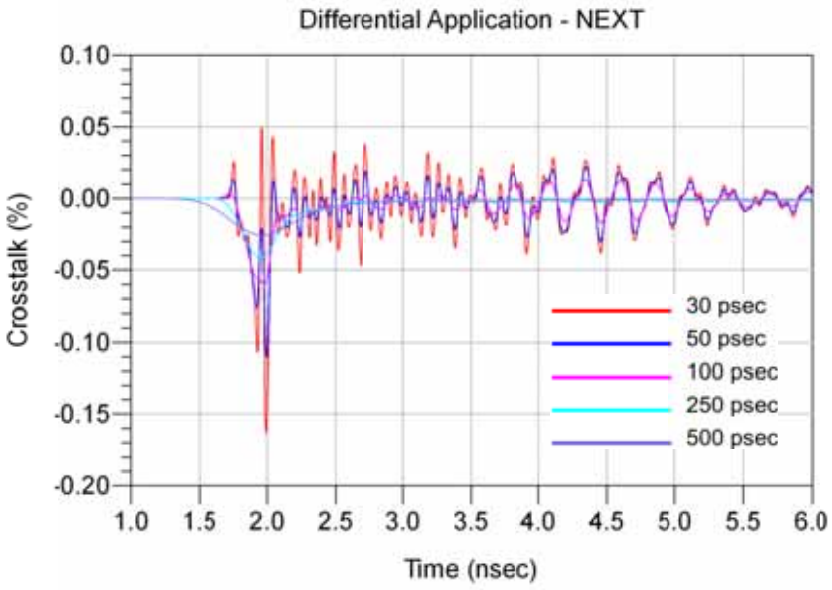


Differential Optimal Horizontal Application – FEXT, SEAM-RA_E15,E16_SEAFp_F17,F18

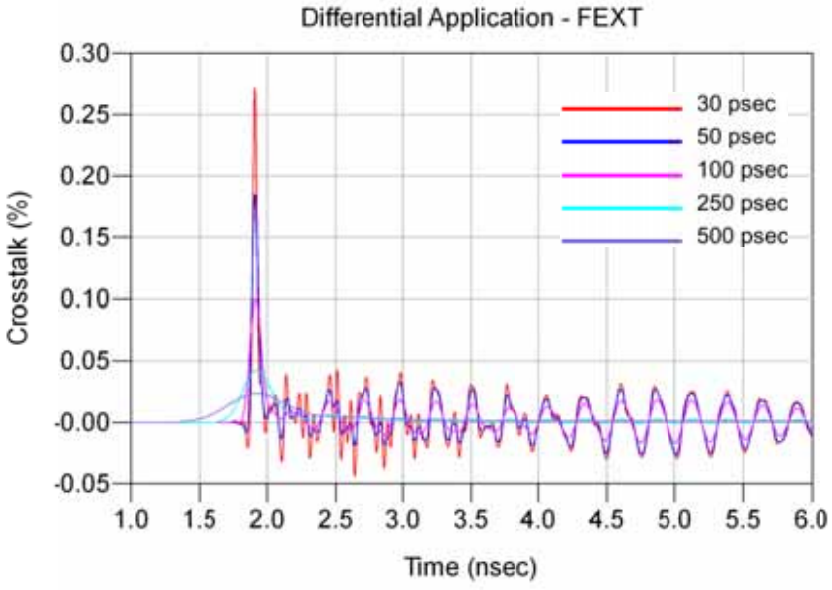


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Horizontal Application – NEXT, SEAM-RA_F17, F18_SEAM-RA_F21,F22

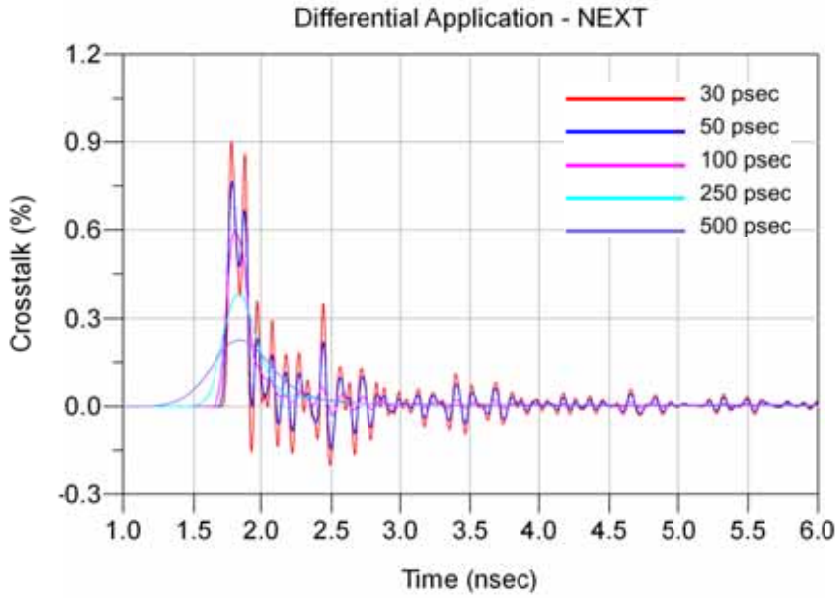


Differential Optimal Horizontal Application – FEXT, SEAM-RA_F17, F18_SEAFp_F21,F22

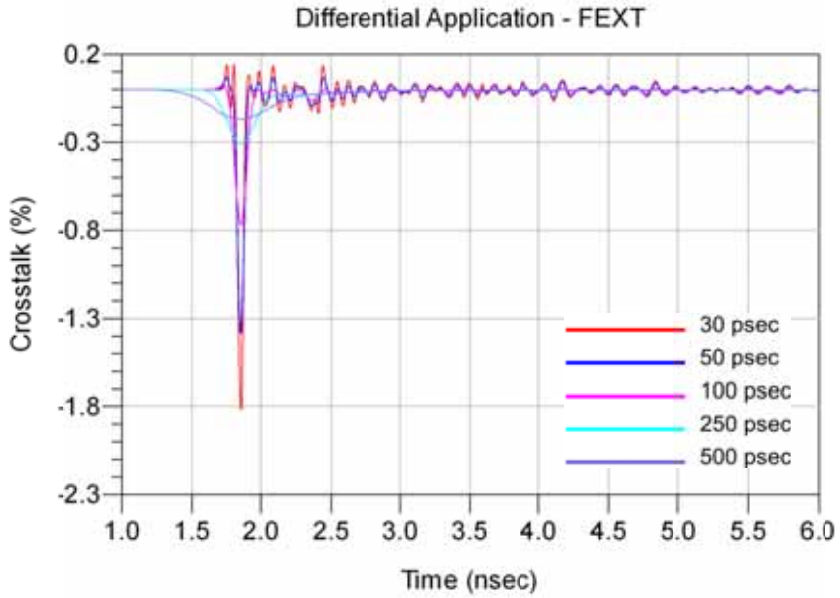


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Vertical Application – NEXT, SEAM-RA_A14,B14_SEAM-RA_A16, B16

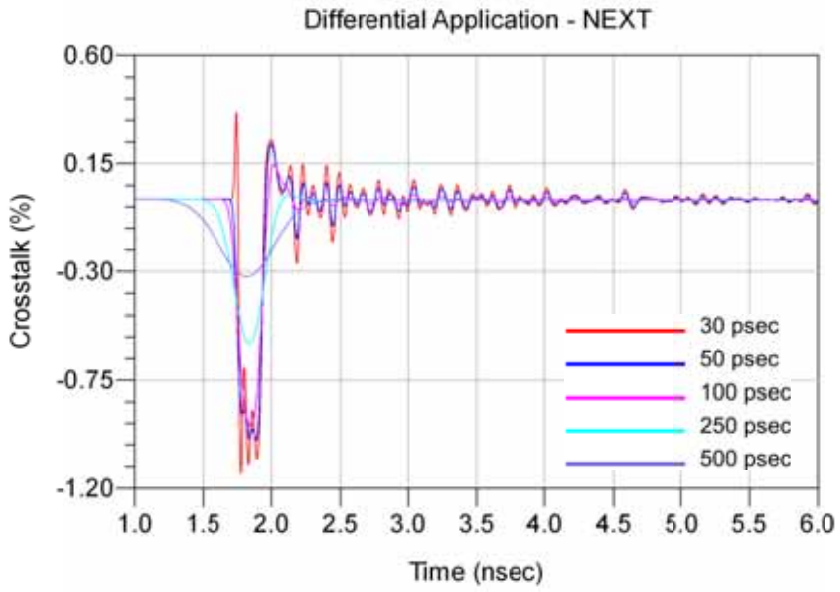


Differential Optimal Vertical Application – FEXT, SEAM-RA_A14,B14_SEAFp_A16, B16

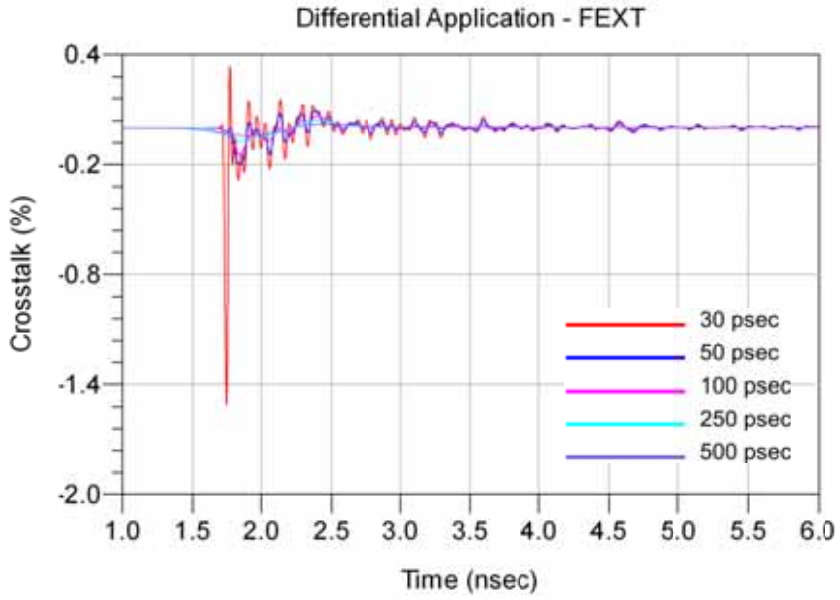


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Vertical Application – NEXT, SEAM-RA_A16,B16_SEAM-RA_C17, D17

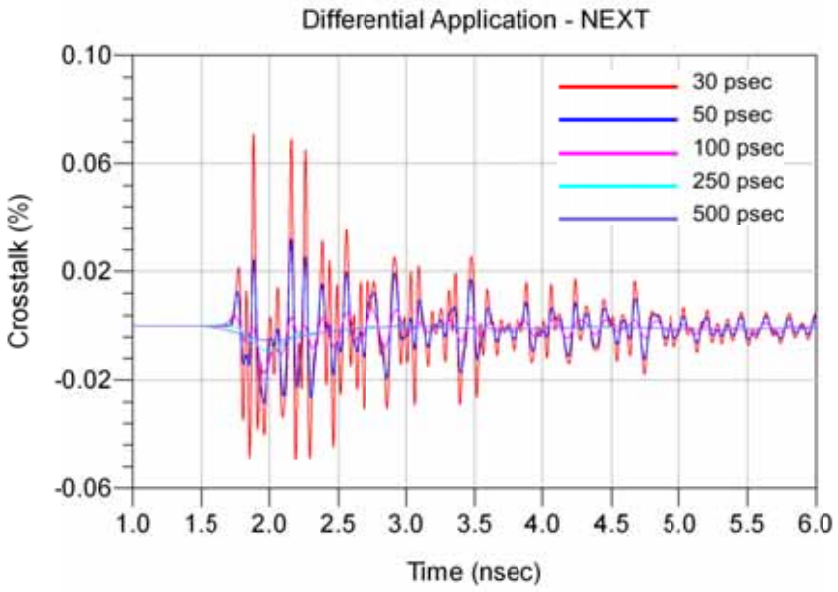


Differential Optimal Vertical Application – FEXT, SEAM-RA_A16,B16_SEAFp_C17, D17

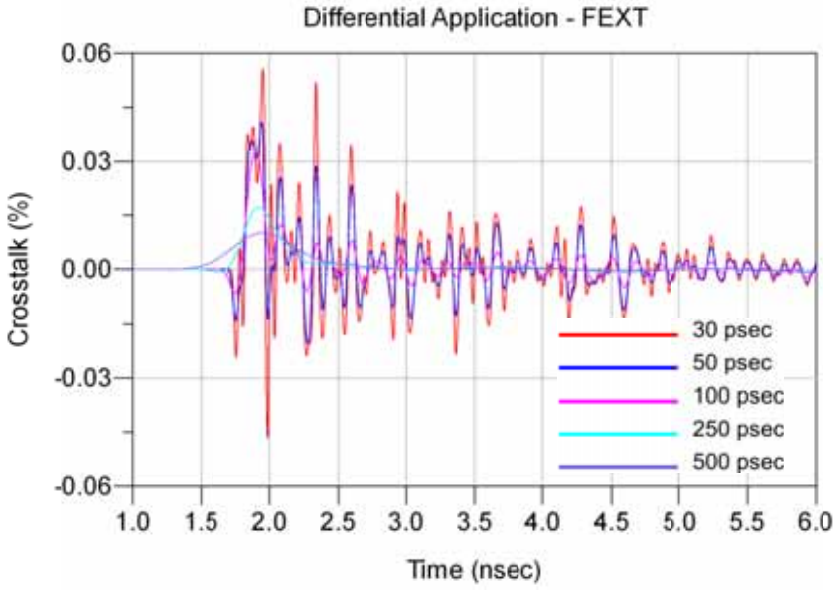


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Vertical Application – NEXT, SEAM-RA_A16,B16_SEAM-RA_E16, F16

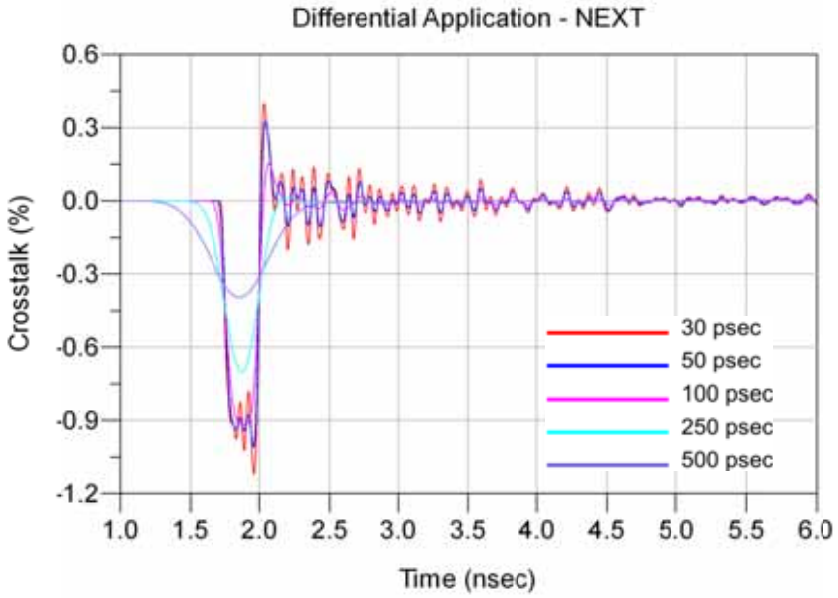


Differential Optimal Vertical Application – FEXT, SEAM-RA_A16,B16_SEAFp_E16, F16

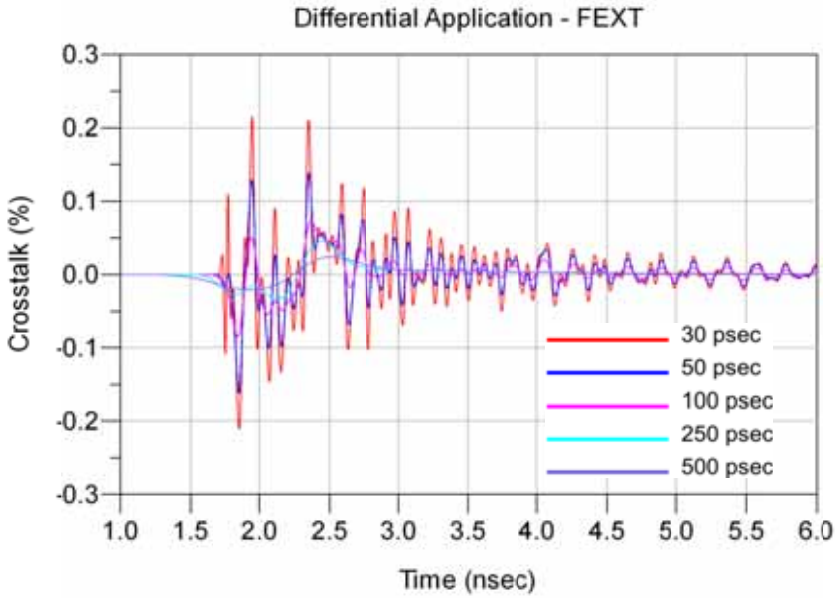


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Vertical Application – NEXT, SEAM-RA_C19,D19_SEAM-RA_E18,F18

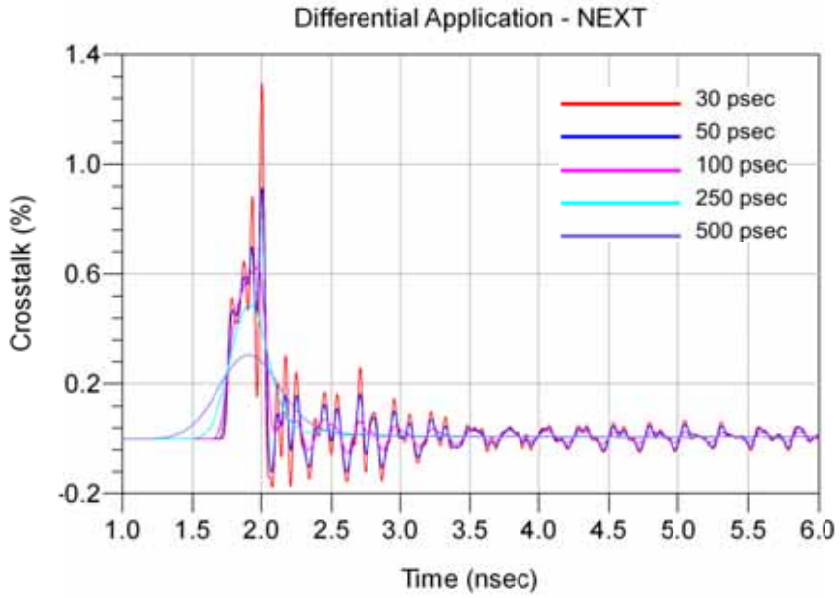


Differential Optimal Vertical Application – FEXT, SEAM-RA_C19,D19_SEAFp_E18, F18

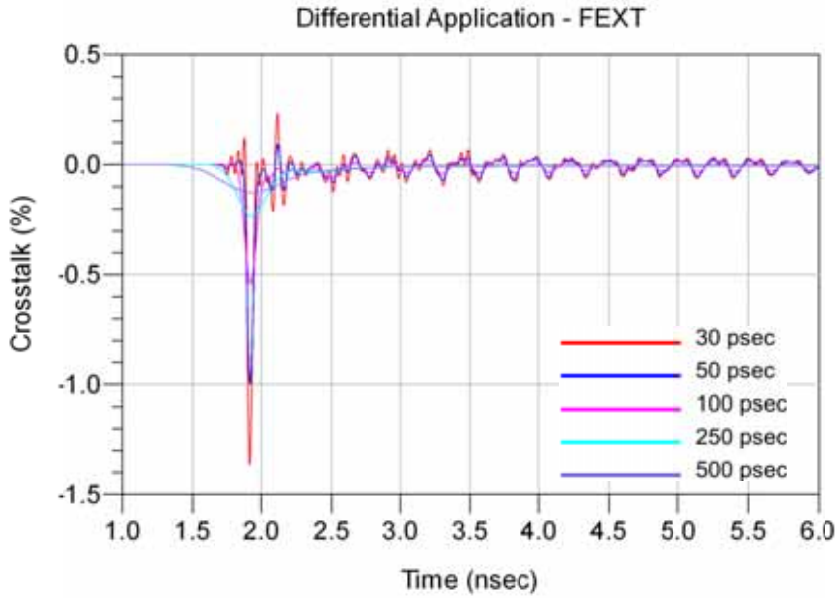


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential Optimal Vertical Application – NEXT, SEAM-RA_E16,F16_SEAM-RA_E18, F18

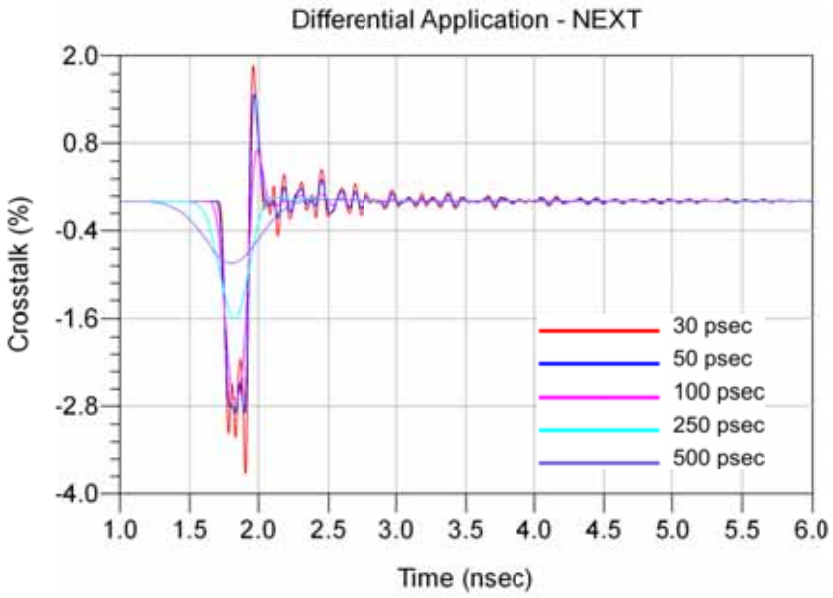


Differential Optimal Vertical Application – FEXT, SEAM-RA_E16,F16_SEAFp_E18, F18

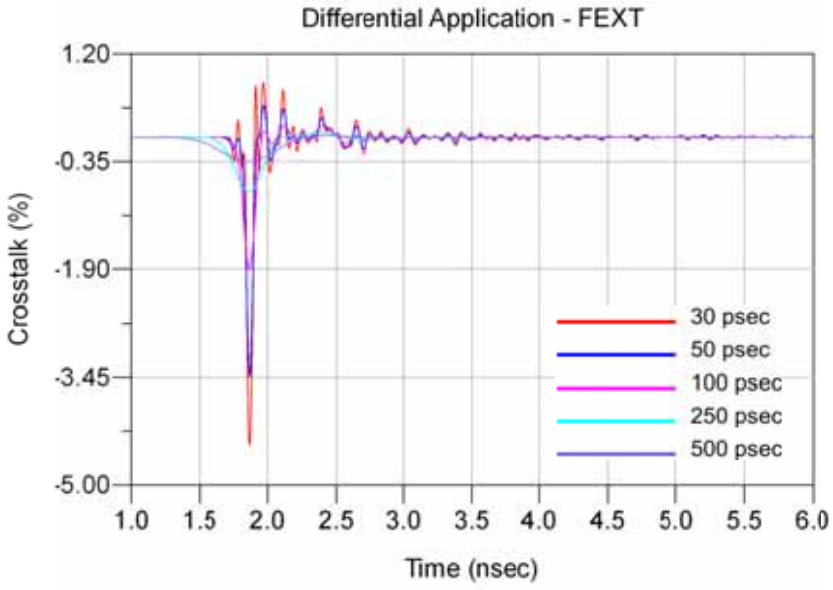


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential High Density Vertical Application – NEXT, SEAM-RA_A14,B14_SEAM-RA_B15,C15

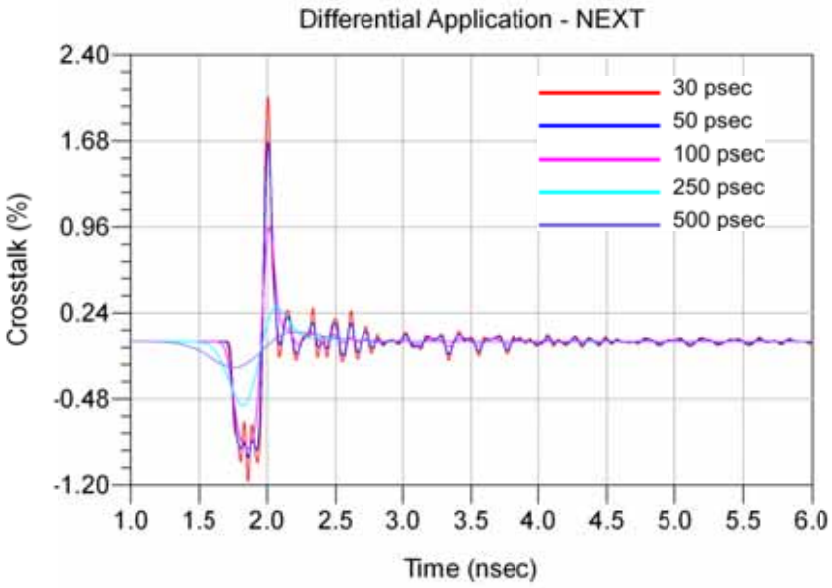


Differential High Density Vertical Application – FEXT, SEAM-RA_ A14,B14_SEAFp_ B15,C15

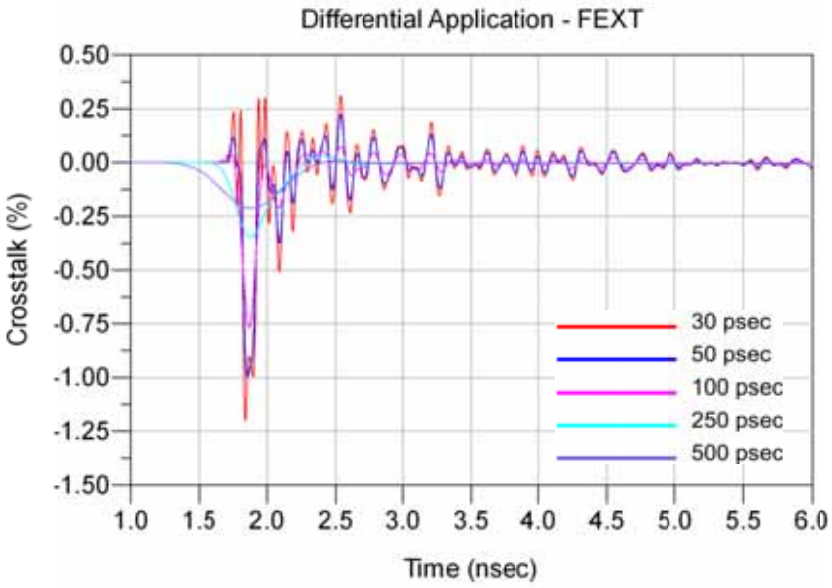


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential High Density Vertical Application – NEXT, SEAM-RA_B15,C15_SEAM-RA_D16,E16

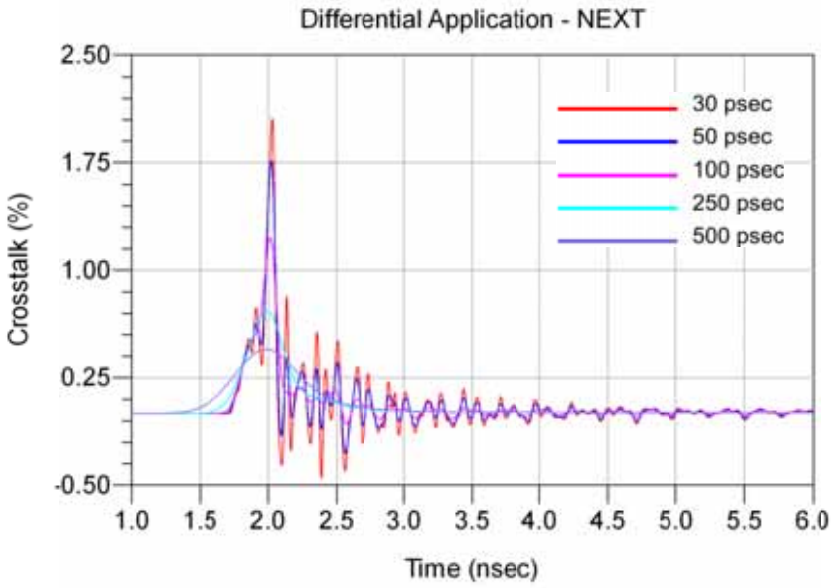


Differential High Density Vertical Application – FEXT, SEAM-RA_ B15,C15_SEAFp_ D16,E16

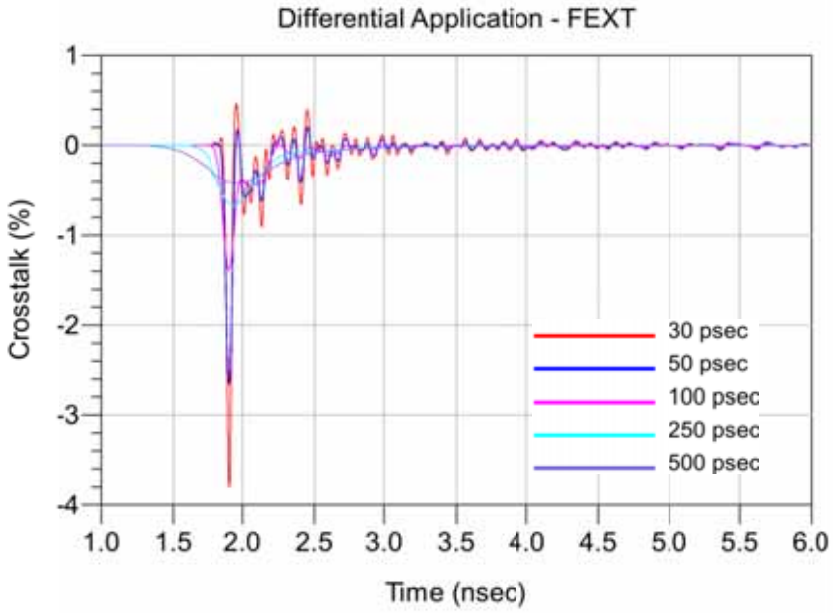


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential High Density Vertical Application – NEXT, SEAM-RA_D16,E16_SEAM-RA_D18,E18

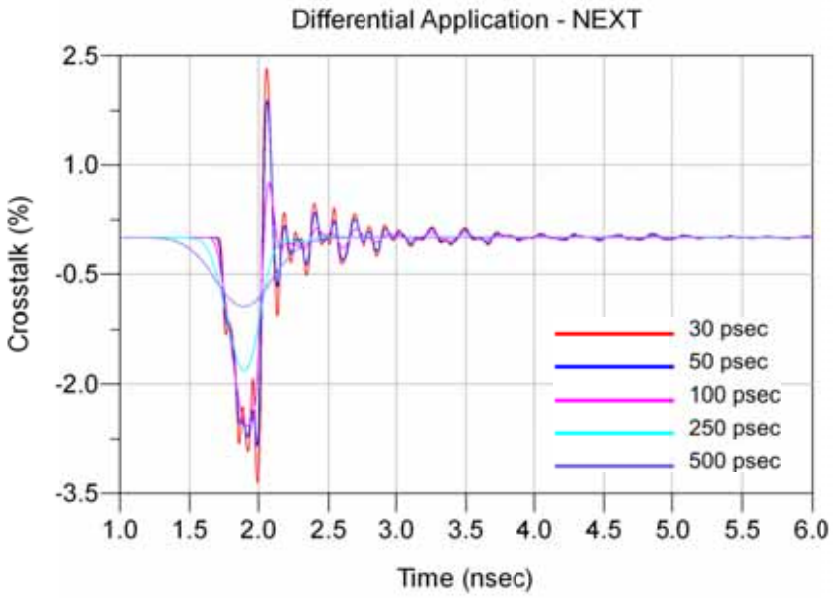


Differential High Density Vertical Application – FEXT, SEAM-RA_ D16,E16_SEAFp_ D18,E18

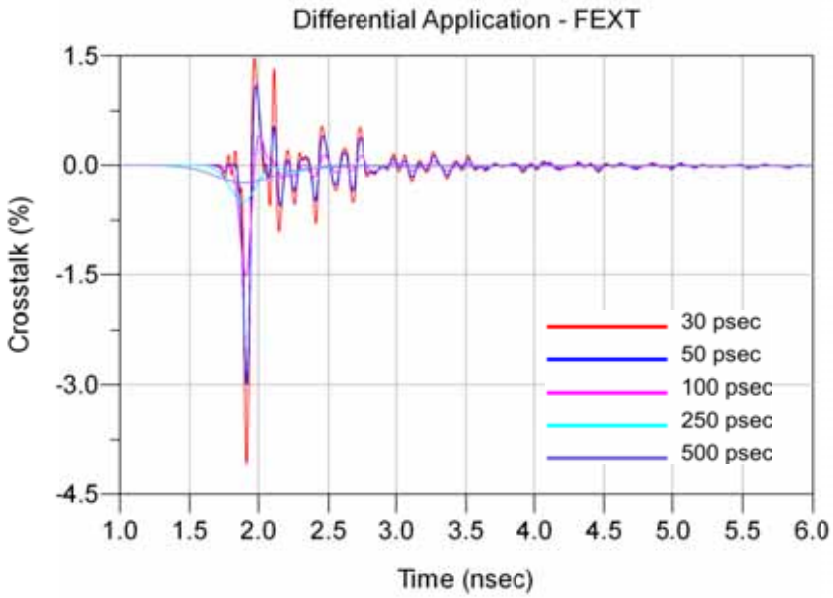


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential High Density Vertical Application – NEXT, SEAM-RA_D16,E16_SEAM-RA_E17,F17

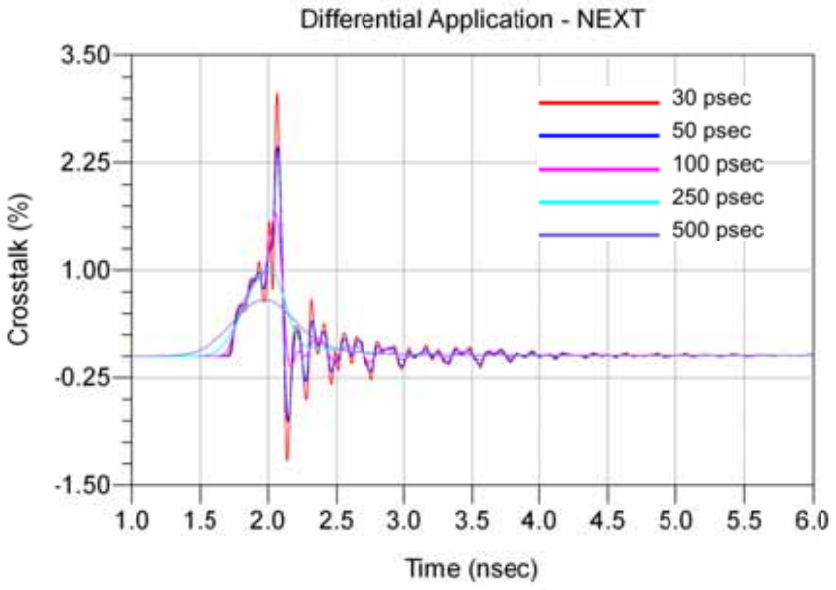


Differential High Density Vertical Application – FEXT, SEAM-RA_ D16,E16_SEAFp_ E17,F17

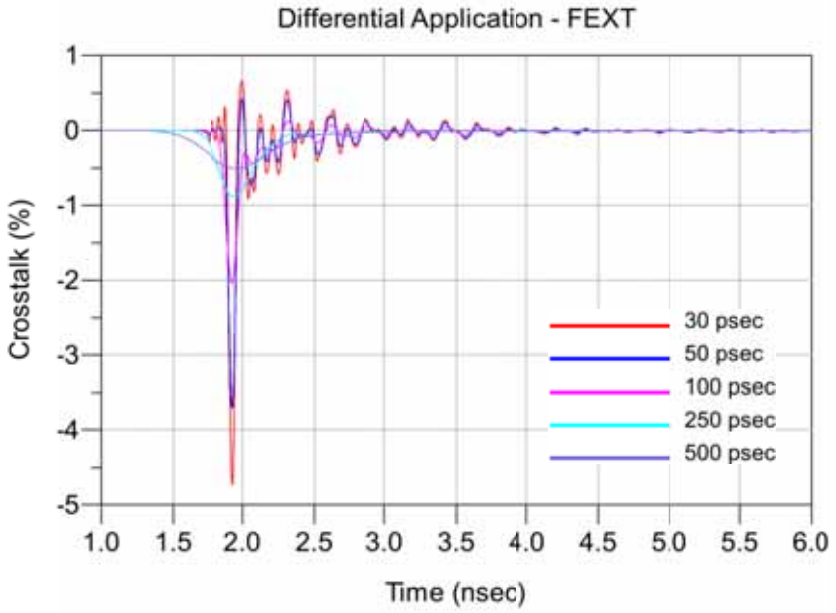


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Differential High Density Vertical Application – NEXT, SEAM-RA_E17, F17_SEAM-RA_E19, F19



Differential High Density Vertical Application – FEXT, SEAM-RA_ E17, F17_SEAFp_ E19, F19



Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Appendix C – Product and Test System Descriptions

Product Description

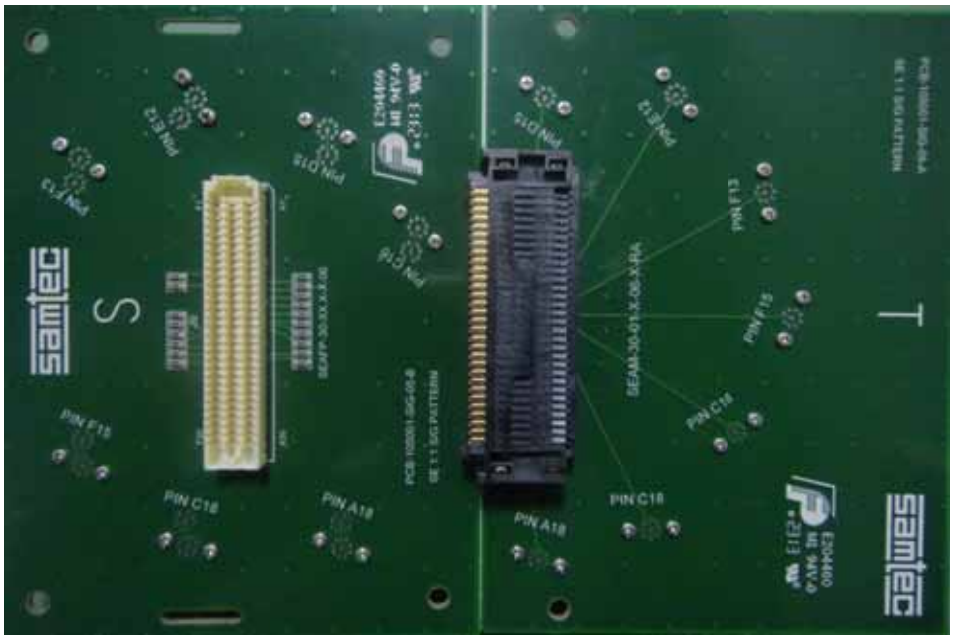
Product test samples are SEAFP/SEAM_RA Series connectors. The part numbers are SEAFP-30-05.0-L-06 and SEAM-30-01-L-06-2-RA-TR. The SEAFP/SEAM_RA Series is an open pin field connector designed for single-ended signals with various options for differential signaling configurations. The open pin field array is 6 row providing 30 signal pins per row. A photo of the test articles mounted to SI test boards is shown below.

Test System Description

The test fixtures are composed of four-layer FR4 material with 50Ω signal trace and pad configurations designed for the electrical characterization of Samtec high speed connector products. A PCB mount SMA connector is used to interface the VNA test cables to the test fixtures. Optimization of the SMA launch was performed using full wave simulation tools to minimize reflections. Ten test fixtures are specific to the SEAFP/SEAM_RA Series connector set and identified by part numbers PCB-105001-TST-01-A and B to PCB-105001-TST-08 A and B. Calibration standards specific to the SEAFP/SEAM_RA Series are located on the calibration board PCB-105001-TST-09. To keep trace lengths short, five different test board sets were required to access the necessary signal pins.

PCB-105001-TST-XX Test Fixtures

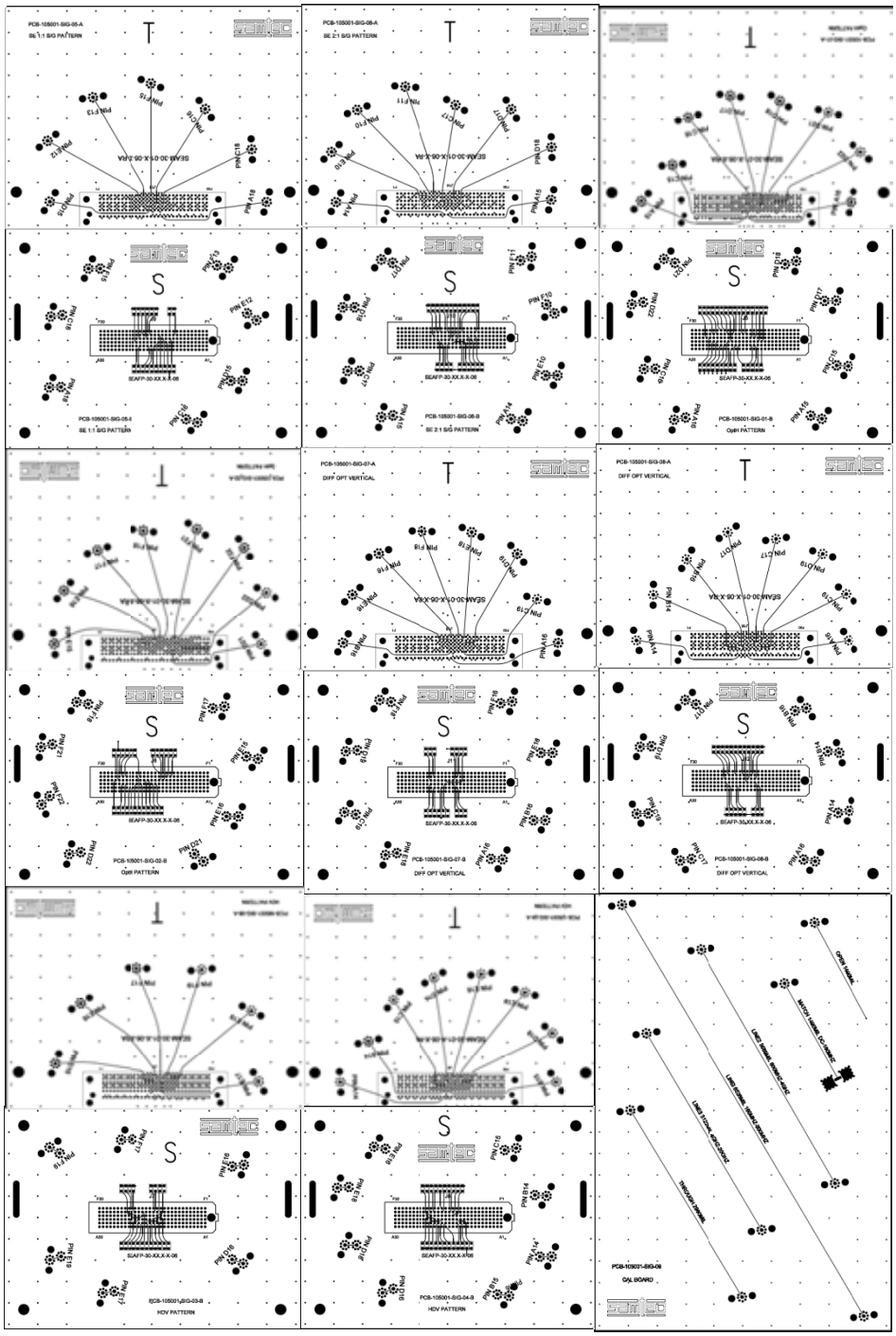
Shown below is a photograph of one of the eight test board sets.



Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

PCB-105001-TST-XX PCB Layout Panel

Artwork of the PCB design is shown below.

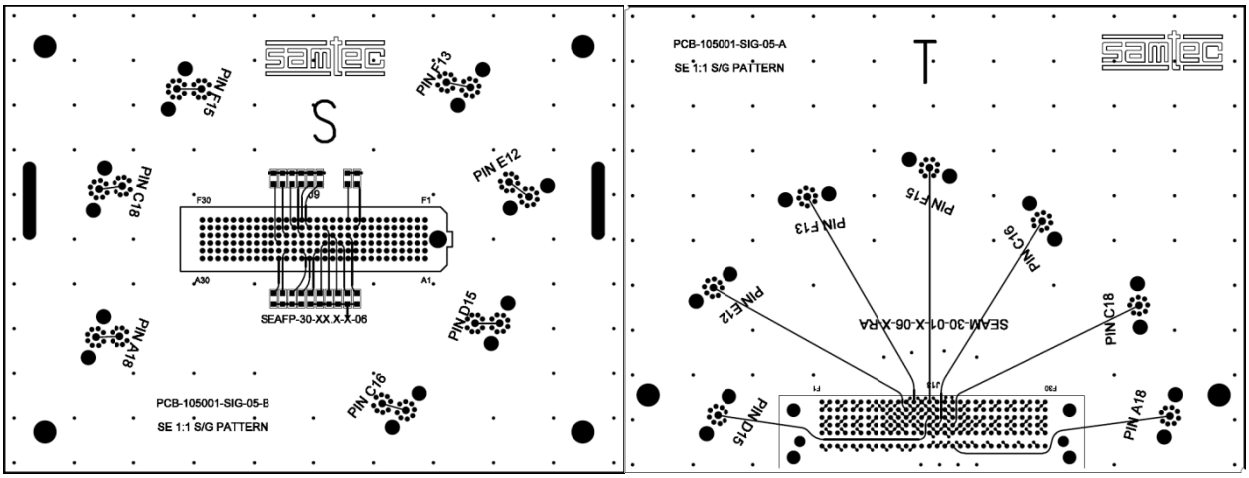


Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

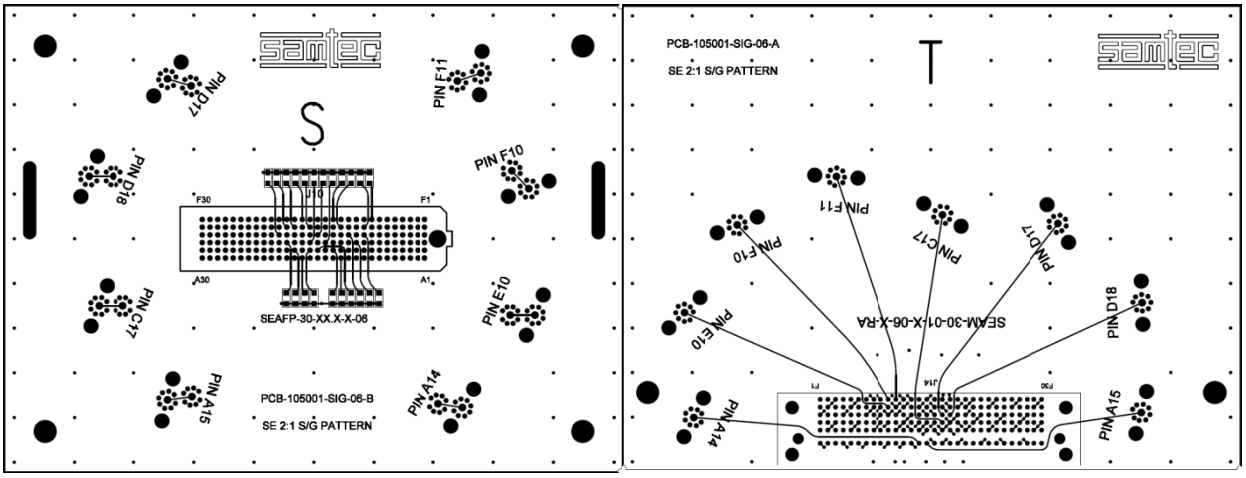
PCB Fixtures

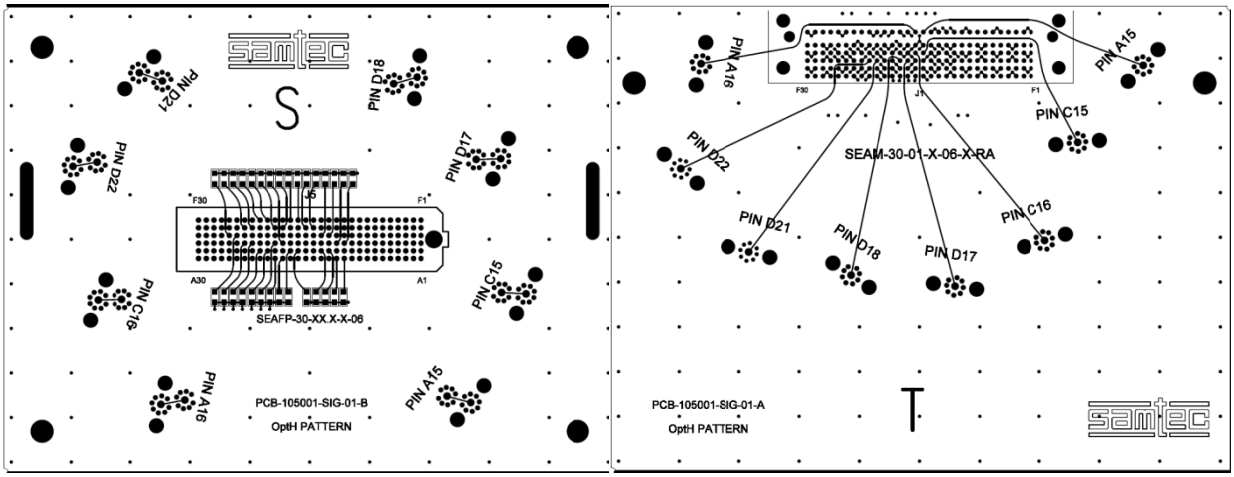
The test fixtures used are as follows:

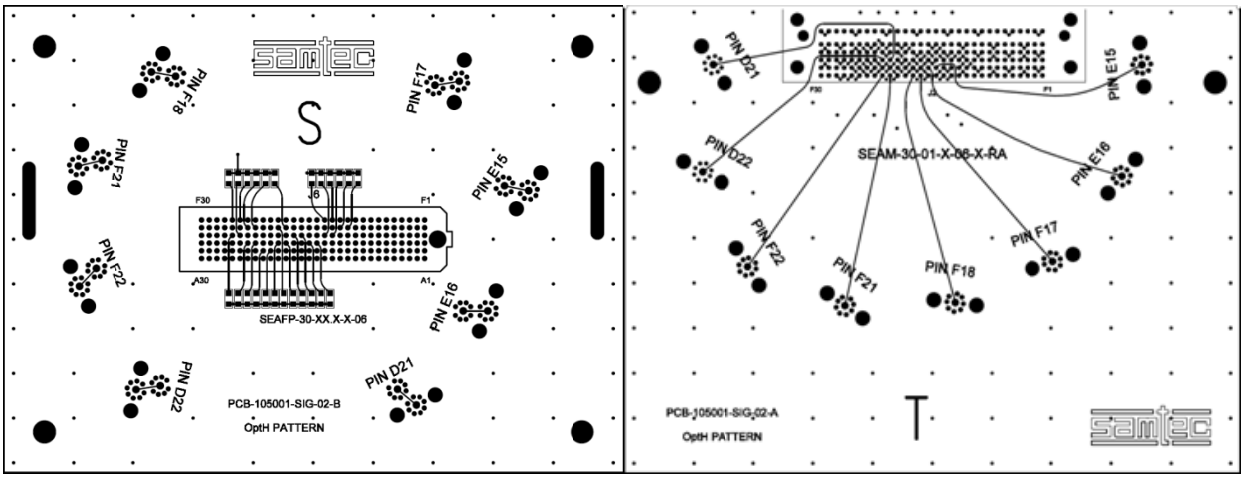
PCB-105001-SIG-01-A – SEAM-RA Series Test Board for Differential Optimal Horizontal
PCB-105001-SIG-01-B – SEAFP Series Test Board for Differential Optimal Horizontal
PCB-105001-SIG-02-A – SEAM-RA Series Test Board for Differential Optimal Horizontal
PCB-105001-SIG-02-B – SEAFP Series Test Board for Differential Optimal Horizontal
PCB-105001-SIG-03-A – SEAM-RA Series Test Board for Differential High Density Vertical
PCB-105001-SIG-03-B – SEAFP Series Test Board for Differential High Density Vertical
PCB-105001-SIG-04-A – SEAM-RA Series Test Board for Differential High Density Vertical
PCB-105001-SIG-04-B – SEAFP Series Test Board for Differential High Density Vertical
PCB-105001-SIG-05-A – SEAM-RA Series Test Board for SE 1:1 S/G Pattern
PCB-105001-SIG-05-B – SEAFP Series Test Board for SE 1:1 S/G Pattern
PCB-105001-SIG-06-A – SEAM-RA Series Test Board for SE 2:1 S/G Pattern
PCB-105001-SIG-06-B – SEAFP Series Test Board for SE 2:1 S/G Pattern
PCB-105001-SIG-07-A – SEAM-RA Series Test Board for Differential Optimal Vertical
PCB-105001-SIG-07-B – SEAFP Series Test Board for Differential Optimal Vertical
PCB-105001-SIG-08-A – SEAM-RA Series Test Board for Differential Optimal Vertical
PCB-105001-SIG-08-B – SEAFP Series Test Board for Differential Optimal Vertical



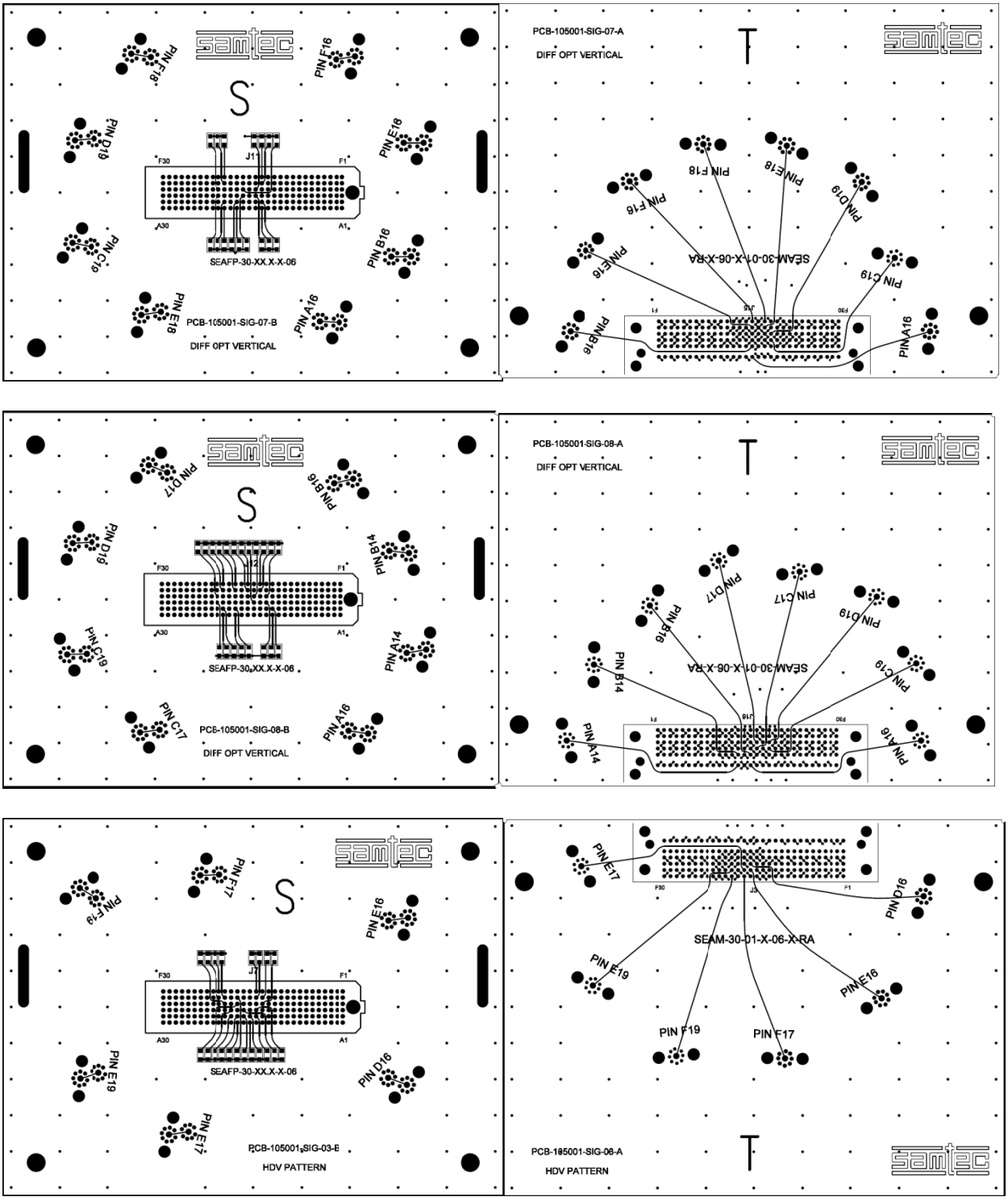
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle



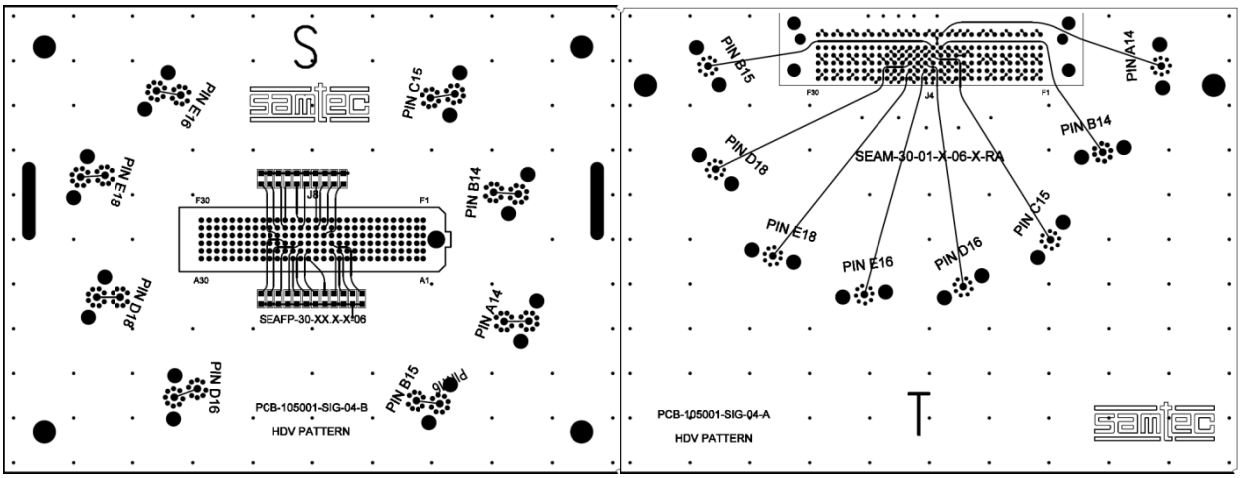




Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle



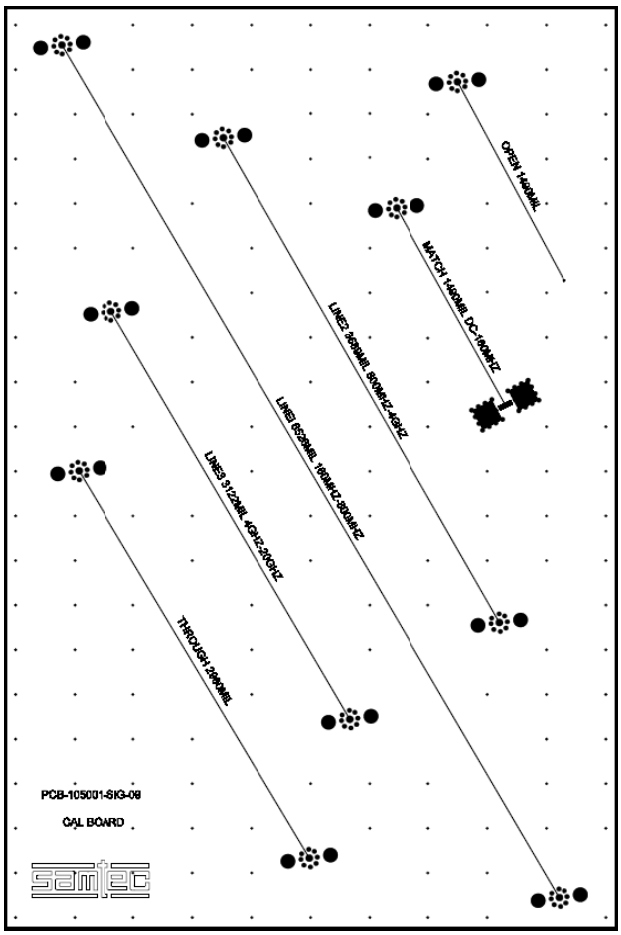
Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle



Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Calibration Board

Test fixture losses and test point reflections were removed from the data by use of TRL calibration. The calibration board is shown below. Prior to making any measurements, the calibration board is characterized to obtain parameters required to define the calibration kit. Once a cal kit is defined, calibration using the standards on the calibration board can be performed. Finally, the device can be measured and the test board effects are automatically removed.



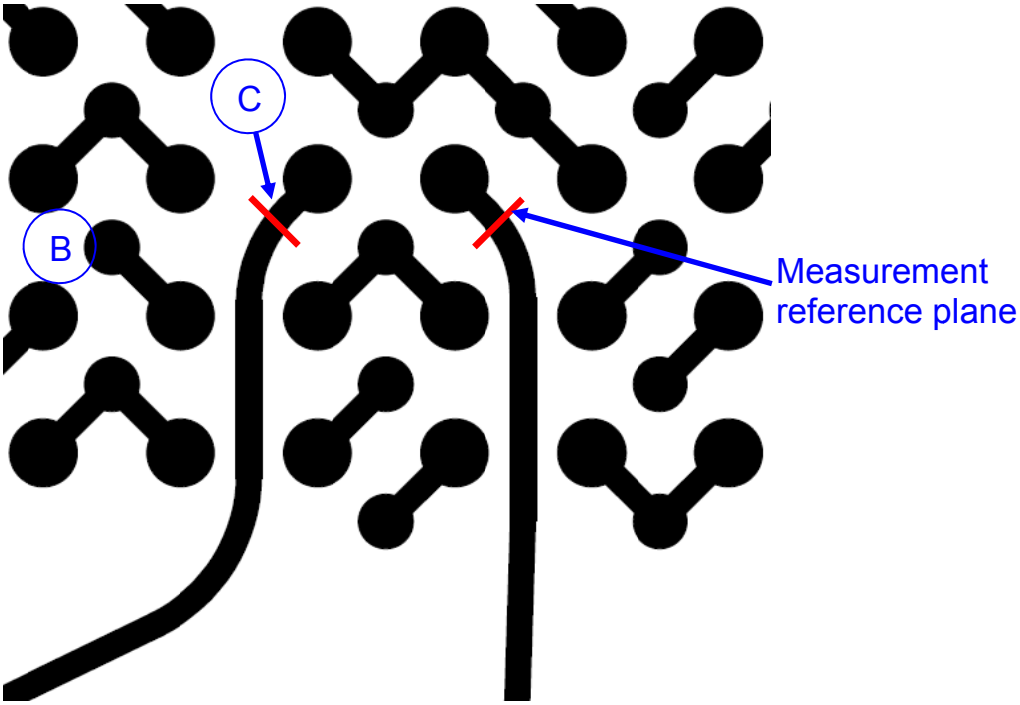
Thru line – 2980 mils
Open Reflect – 1490 mils
Line 1 – 6526 mils
Line 2 – 3689 mils
Line 3 – 3122 mils
Match – 1490 mils

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

All traces on the test boards are length matched to 1.5” measured from the edge of the pad to the SMA. The TRL calibration effectively removes 1.490” of test board trace effects. This means that 10 mils of test board trace length effects are included in the measurement. The S-Parameter measurement includes:

A- The SEAFP/SEAM_RA Series connector set
B- Test board vias, pads (footprint effects)
C- 10 mils of 9.5 mil wide microstrip trace

The figure below shows the location of the measurement reference plane.



Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

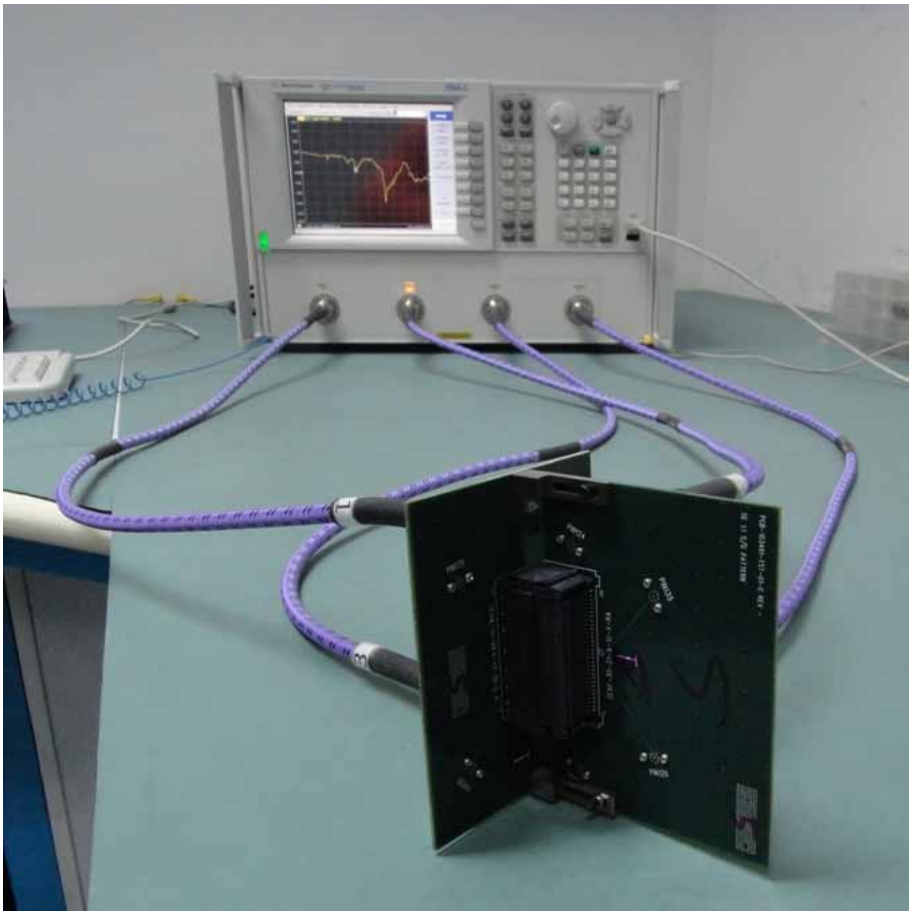
Appendix D – Test and Measurement Setup

For frequency domain measurements, the test instrument is the Agilent N5230C PNA-L network analyzer. Frequency domain data and graphs are obtained directly from the instrument. Post-processed time domain data and graphs are generated using convolution algorithms within Agilent ADS. The network analyzer is configured as follows:

Start Frequency – 300 KHz
Stop Frequency – 20 GHz
Number of points -1601
IFBW – 1 KHz

With these settings, the measurement time is approximately 20 seconds.

N5230C Measurement Setup



Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Test Instruments

QTY	Description
1	Agilent N5230C PNA-L Network Analyzer (300 KHz to 20 GHz)
1	Agilent N4433A ecal module (300 KHz to 20 GHz)

Test Cables & Adapters

QTY	Description
4	Gore 0WD01D02039-4 (DC-50 GHz)

For impedance measurements, the test instrument is the Tektronix DSA8200 Digital Serial Analyzer mainframe and 80E04 sampling module. The impedance data and profiles are obtained directly from the instrument. The Digital Analyzer is configured as follows:

	Single-Ended Signal	Differential Signal
Vertical Scale:	5 ohm / Div	5 ohm / Div
Offset:	Default / Scroll	Default / Scroll
Horizontal Scale:	200ps/ Div	200ps/ Div
Record Length:	4000	4000
Averages:	≥ 16	≥ 16

DSA8200 Measurement Setup

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Test Instruments

QTY	Description
1	Tektronix DSA8200 Digital Serial Analyzer
2	Tektronix 80E04 Dual Channel 20 GHz TDR Sampling Module

Test Cables & Adapters

QTY	Description
2	Samtec RF405-01SP1-01SP1-0305 (DC-20 GHz)

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Appendix E - Frequency and Time Domain Measurements

Frequency (S-Parameter) Domain Procedures

The quality of any data taken with a network analyzer is directly related to the quality of the calibration standards and the use of proper test procedures. For this reason, extreme care is taken in the design of the LRM calibration standards, the SI test boards, and the selection of the PCB vendor.

The measurement process begins with a measurement of the LRM calibration standards. A coaxial SOLT calibration is performed using an N4433A ecal module. This measurement is required in order to obtain precise values of the line standard offset delay and frequency bandwidths. Measurements of the reflect and 2x through line standard can be used to determine the maximum frequency for which the calibration standards are valid. For the SEAFP/SEAM_RA Series test boards, this is greater than 20 GHz.

From the LRM calibration standard measurements, a user defined calibration kit is developed and stored in the network analyzer. Calibration is then performed on all 4 ports following the calibration wizard within the Agilent N5230C. This calibration is saved and can be recalled at any time. Calibration takes roughly 30 minutes to perform.

Time Domain Procedures

Mathematically, Frequency Domain data can be transformed to obtain a Time Domain response. Perfect transformation requires Frequency Domain data from DC to infinity Hz. Fortunately, a very accurate Time Domain response can be obtained with bandwidth-limited data, such as measured with modern network analyzer.

The Time Domain responses were generated using Agilent ADS 2009 update 1. This tool has a transient convolution simulator, which can generate a Time Domain response directly from measured S-Parameters. An example of a similar methodology is provided in the Samtec Technical Note on domain transformation.
http://www.samtec.com/Technical_Library/reference/articles/pdfs/tech-note_using-PLTS-for-time-domain-data_web.pdf

Propagation Delay (TDT)
The Propagation Delay is a measure of the Time Domain delay through the connector and footprint. A step pulse is applied to the touchstone model of the connector and the transmitted voltage is monitored. The same pulse is also applied to a reference channel

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

with zero loss, and the Time Domain pulses are plotted on the same graph. The difference in time, measured at the 50% point of the step voltage is the propagation delay.

Near-End Crosstalk (TDT) & Far End Crosstalk (TDT)

A step pulse is applied to the touchstone model of the connector and the coupled voltage is monitored. The amplitude of the peak-coupled voltage is recorded and reported as a percentage of the input pulse.

Impedance (TDR)

Measurements involving digital pulses are performed using either Time Domain Reflectometer (TDR) or Time Domain Transmission (TDT) methods. The TDR method is used for the impedance measurements in this report.

The signal line(s) of the SUT's is energized with a TDR pulse and the far-end of the energized signal line is terminated in the test systems characteristic impedance (e.g.; 50Ω or 100Ω terminations). By terminating the adjacent signal lines in the test systems characteristic impedance, the effects on the resultant impedance shape of the waveform is limited. The "best case" signal mapping was tested and is presented in this report.

Series: SEAFP/SEAM_RA Array Series
Description: 1.27mm x 1.27mm grid interconnect system, Vertical Array to Right Angle

Appendix F – Glossary of Terms

ADS – Advanced Design Systems
BC – Best Case crosstalk configuration
DUT – Device under test, term used for TDA IConnect & Propagation Delay waveforms
FD – Frequency domain
FEXT – Far-End Crosstalk
GSG – Ground–Signal-Ground; geometric configuration
GSSG - Ground–Signal-Signal-Ground; geometric configuration
HDV – High Density Vertical
NEXT – Near-End Crosstalk
OV – Optimal Vertical
OH – Optimal Horizontal
PCB – Printed Circuit Board
PPO – Pin Population Option
SE – Single-Ended
SI – Signal Integrity
SUT – System Under Test
S – Static (independent of PCB ground)
SOLT – acronym used to define Short, Open, Load & Thru Calibration Standards
TD – Time Domain
TDA – Time Domain Analysis
TDR – Time Domain Reflectometry
TDT – Time Domain Transmission
WC – Worst Case crosstalk configuration
Z – Impedance (expressed in ohms)