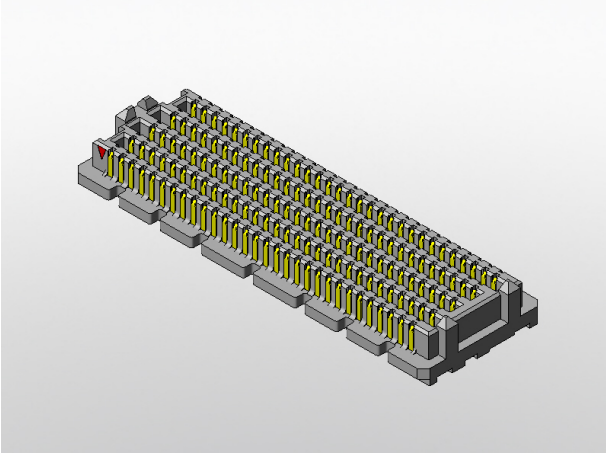
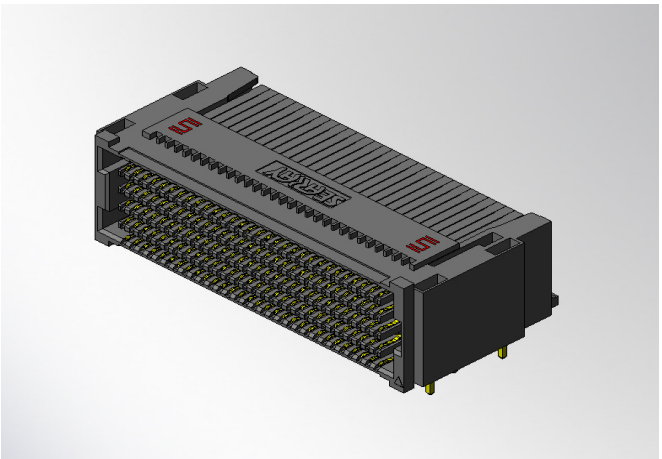
High Speed Characterization Report

SEAM-XX-02.0-S-XX-2



Mates with

SEAF-XX-01-S-XX-1-RA



Description:
Open Pin Field Array, 1.27mm x 1.27mm Pitch
Vertical 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: 10/19/2021

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Table of Contents

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Connector Overview

SEAM/SEAF-RA series is a 1.27mm x 1.27mm pitch interconnects system for elevated high-speed board-to-board applications. The SEAM/SEAF-RA Series is available in 4, 6, 8, and 10 row open pin field arrays. Pins per row selections are 20, 30, 40, or 50. This report reflects only the hi-speed electrical characteristics specific to a mated 20-50 contacts/row, 4-10 rows, SEAM-02/SEAF-RA test system.

Connector System Speed Rating

SEAM-02/ SEAF-RA Series, 1.27mm x 1.27mm (.050” x .050”) pitch interconnect	
Signaling	Speed Rating
Single-Ended: 1:1 S/G, row1	**6 GHz/ 12Gbps**
Single-Ended: 1:1 S/G, row4	**8.5 GHz/ 17Gbps**
Single-Ended: 1:1 S/G, row6	**7 GHz/ 14Gbps**
Single-Ended: 1:1 S/G, row8	**6 GHz/ 12Gbps**
Single-Ended: 1:1 S/G, row10	**6 GHz/ 12Gbps**
Single-Ended: 2:1 S/G, row1	**6 GHz/ 12Gbps**
Single-Ended: 2:1 S/G, row4	**12.5 GHz/ 25Gbps**
Single-Ended: 2:1 S/G, row6	**10 GHz/ 20Gbps**
Single-Ended: 2:1 S/G, row8	**6 GHz/ 12Gbps**
Single-Ended: 2:1 S/G, row10	**12 GHz/ 24Gbps**
Differential: Optimal Horizontal, row1	**13 GHz/ 26Gbps**
Differential: Optimal Horizontal, row4	**8.5 GHz/ 17Gbps**
Differential: Optimal Horizontal, row7	**6 GHz/ 12Gbps**
Differential: Optimal Horizontal, row8	**8.5 GHz/ 17Gbps**
Differential: Optimal Horizontal, row10	**11.5 GHz/ 23Gbps**

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Differential: Optimal Vertical, row1,2	**11 GHz/ 22Gbps**
Differential: Optimal Vertical, row3,4	**12.5 GHz/ 25Gbps**
Differential: Optimal Vertical, row5,6	**10 GHz/ 20Gbps**
Differential: Optimal Vertical, row7,8	**8.5 GHz/ 17Gbps**
Differential: Optimal Vertical, row9,10	**12.5 GHz/ 25Gbps**
Differential: High Density Vertical, row1,2	**12 GHz/ 24Gbps**
Differential: High Density Vertical, row4,5	**11 GHz/ 22Gbps**
Differential: High Density Vertical, row7,8	**11 GHz/ 22Gbps**
Differential: High Density Vertical, row8,9	**11 GHz/ 22Gbps**
Differential: High Density Vertical, row9,10	**12.5 GHz/ 25Gbps**

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.

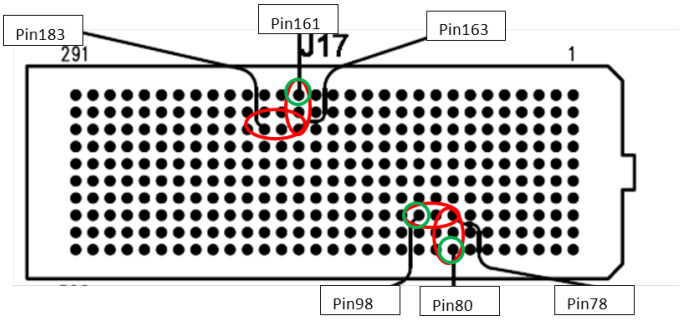
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Frequency Domain Data Summary

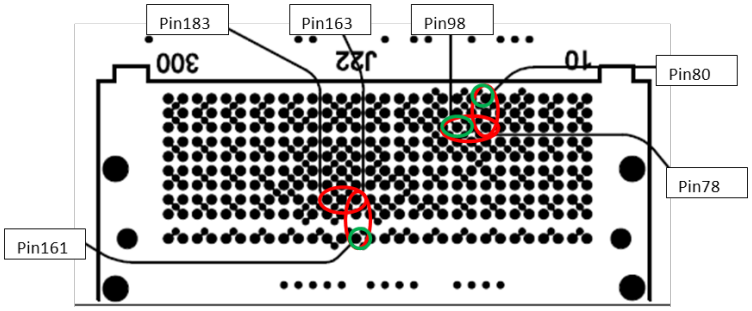
Table 1 - Single-Ended 1:1 S/G Pattern Performance			
Test Parameter	**Driver**	**Receiver**	
Insertion Loss	SEAM_161	SEAF-RA_161	3dB@ 6 GHz
	SEAM_124	SEAF-RA_124	3dB@ 8.3 GHz
	SEAM_126	SEAF-RA_126	3dB@ 6.6 GHz
	SEAM_98	SEAF-RA_98	3dB@ 5.6 GHz
	SEAM_80	SEAF-RA_80	3dB@ 5.7 GHz
Return Loss	SEAM_161	SEAM_161	>10dB to 3.8 GHz
	SEAM_124	SEAM_124	>10dB to 2.8 GHz
	SEAM_126	SEAM_126	>10dB to 5.7 GHz
	SEAM_98	SEAM_98	>10dB to 5.6 GHz
	SEAM_80	SEAM_80	>10dB to 1 GHz
Near-End Crosstalk	SEAM_161	SEAM_163	<-20dB to 20 GHz
	SEAM_163	SEAM_183	<-20dB to 15.8 GHz
	SEAM_124	SEAM_126	<-20dB to 20 GHz
	SEAM_78	SEAM_98	<-20dB to 20 GHz
	SEAM_78	SEAM_80	<-20dB to 5.5 GHz
Far-End Crosstalk	SEAM_161	SEAF-RA_163	<-20dB to 20 GHz
	SEAM_163	SEAF-RA_183	<-20dB to 20 GHz
	SEAM_124	SEAF-RA_126	<-20dB to 8.3 GHz
	SEAM_78	SEAF-RA_98	<-20dB to 20 GHz
	SEAM_78	SEAF-RA_80	<-20dB to 5.5 GHz

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

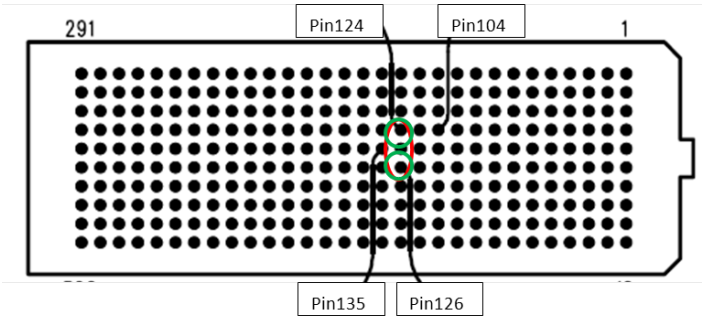
Single-Ended 1:1 S/G Pattern Pin Map



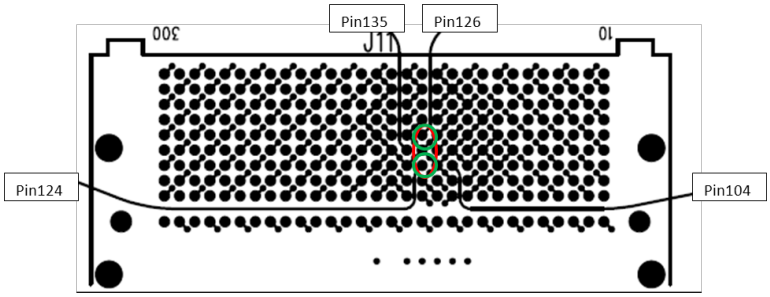
SEAM



SEAF_RA



SEAM



SEAF_RA

Insertion Loss & Return Loss

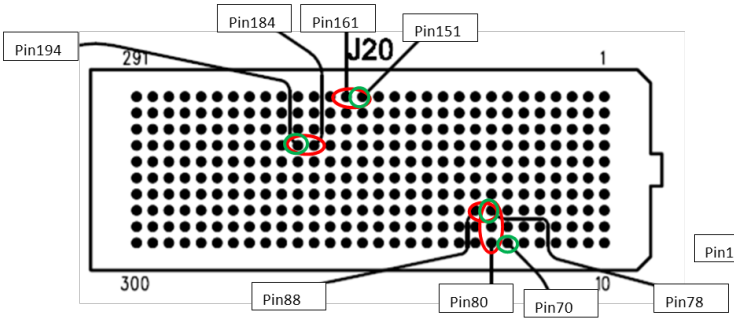
Crosstalk

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

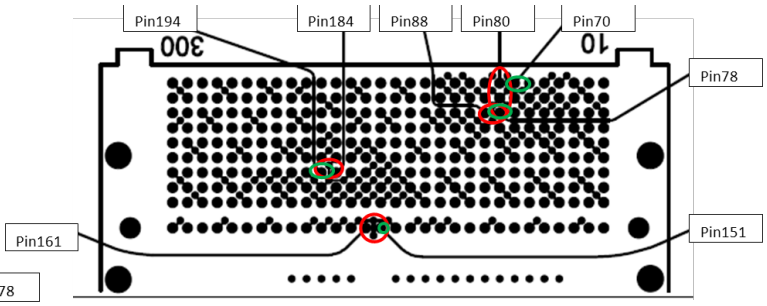
Table 2 - Single-Ended 2:1 S/G Pattern Performance			
Test Parameter	**Driver**	**Receiver**	
Insertion Loss	SEAM_151	SEAF-RA_151	3dB@ 5.8 GHz
	SEAM_194	SEAF-RA_194	3dB@ 12.1 GHz
	SEAM_166	SEAF-RA_166	3dB@ 9.7 GHz
	SEAM_78	SEAF-RA_78	3dB@ 5.7 GHz
	SEAM_70	SEAF-RA_70	3dB@ 11.9 GHz
Return Loss	SEAM_151	SEAM_151	>10dB to 4.9 GHz
	SEAM_194	SEAM_194	>10dB to 6.7 GHz
	SEAM_166	SEAM_166	>10dB to 5.4 GHz
	SEAM_78	SEAM_78	>10dB to 4.8 GHz
	SEAM_70	SEAM_70	>10dB to 4.0 GHz
Near-End Crosstalk	SEAM_151	SEAM_161	<-20dB to 0.8 GHz
	SEAM_184	SEAM_194	<-20dB to 0.7 GHz
	SEAM_155	SEAM_156	<-20dB to 0.7 GHz
	SEAM_78	SEAM_88	<-20dB to 0.5 GHz
	SEAM_78	SEAM_80	<-20dB to 2.9 GHz
Far-End Crosstalk	SEAM_151	SEAF-RA_161	<-20dB to 2.7 GHz
	SEAM_184	SEAF-RA_194	<-20dB to 6.2 GHz
	SEAM_155	SEAF-RA_156	<-20dB to 6.6 GHz
	SEAM_78	SEAF-RA_88	<-20dB to 5.5 GHz
	SEAM_78	SEAF-RA_80	<-20dB to 2.8 GHz

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

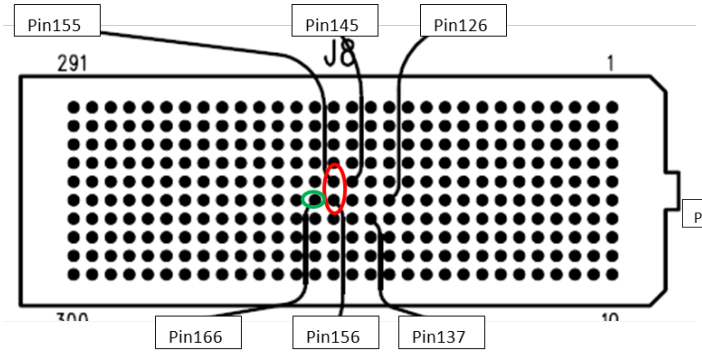
Single-Ended 2:1 S/G Pattern Pin Map



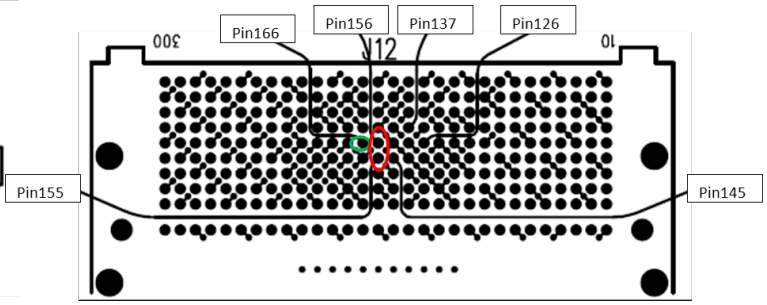
SEAM



SEAF_RA



SEAM



SEAF_RA

Insertion Loss & Return Loss

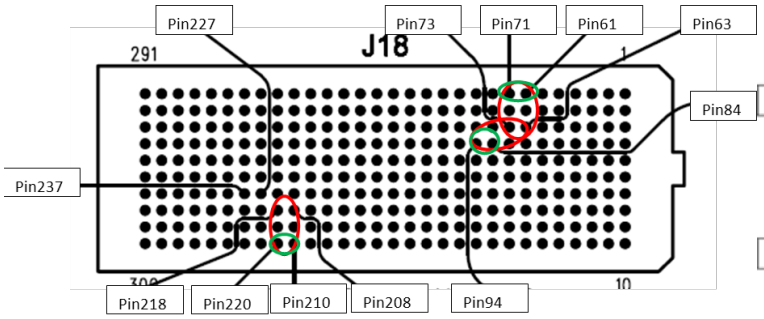
Crosstalk

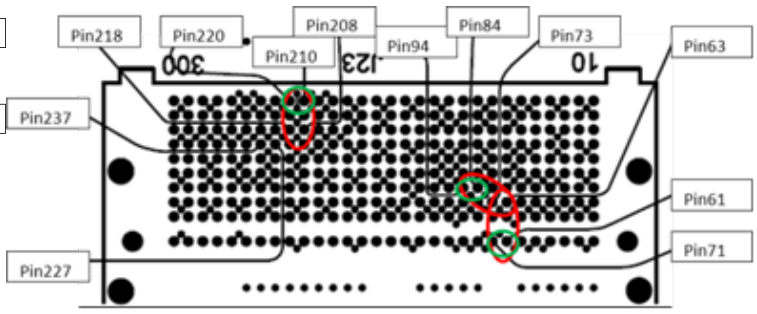
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Table 3 - Differential Optimal Horizontal Performance			
Test Parameter	**Driver**	**Receiver**	
Insertion Loss	SEAM_61,71	SEAF-RA_61,71	3dB@ 12.7 GHz
	SEAM_84,94	SEAF-RA_84,94	3dB@ 8.1 GHz
	SEAM_127,137	SEAF-RA_127,137	3dB@ 6.0 GHz
	SEAM_148,158	SEAF-RA_148,158	3dB@ 8.3 GHz
	SEAM_210, 220	SEAF-RA_210,220	3dB@ 11.5 GHz
Return Loss	SEAM_61,71	SEAM_61,71	>10dB to 10.1 GHz
	SEAM_84,94	SEAM_84,94	>10dB to 8.1 GHz
	SEAM_127,137	SEAM_127,137	>10dB to 6.0 GHz
	SEAM_148,158	SEAM_148,158	>10dB to 5.6 GHz
	SEAM_210, 220	SEAM_210, 220	>10dB to 8.5 GHz
Near-End Crosstalk	SEAM_61,71	SEAM_63,73	<-20dB to 20 GHz
	SEAM_63,73	SEAM_84,94	<-20dB to 20 GHz
	SEAM_106,116	SEAM_146,156	<-20dB to 20 GHz
	SEAM_106,116	SEAM_127,137	<-20dB to 20 GHz
	SEAM_127, 137	SEAM_148, 158	<-20dB to 20 GHz
	SEAM_208, 218	SEAM_210, 220	<-20dB to 5.6 GHz
Far-End Crosstalk	SEAM_61,71	SEAF-RA_63, 73	<-20dB to 20 GHz
	SEAM_63,73	SEAF-RA_84,94	<-20dB to 20 GHz
	SEAM_106,116	SEAF-RA_146,156	<-20dB to 20 GHz
	SEAM_106,116	SEAF-RA_127,137	<-20dB to 20 GHz
	SEAM_127, 137	SEAF-RA_148,158	<-20dB to 20 GHz
	SEAM_208, 218	SEAF-RA_210,220	<-20dB to 5.6 GHz

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

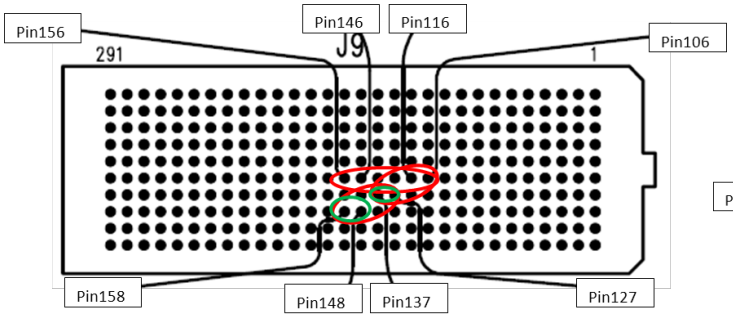
Differential Optimal Horizontal Pin Map

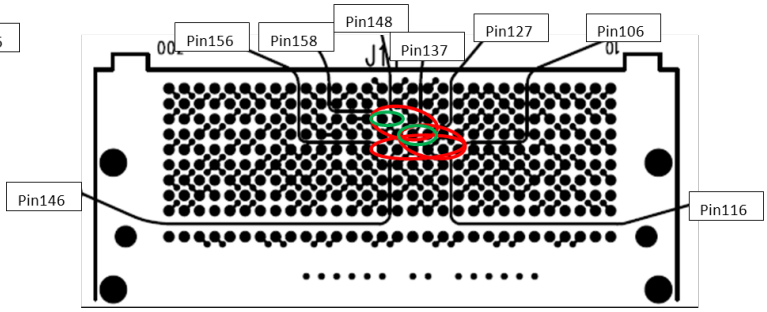




SEAM

SEAF_RA





SEAM

SEAF_RA

Insertion Loss & Return Loss

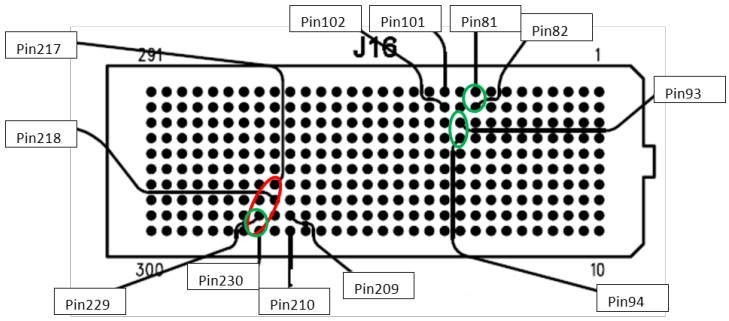
Crosstalk

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

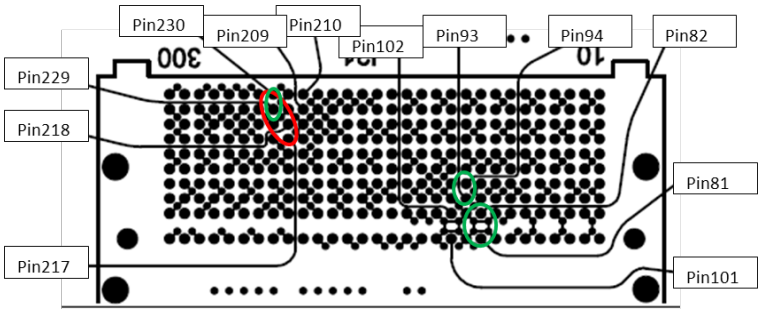
Table 4 - Differential Optimal Vertical Performance			
Test Parameter	**Driver**	**Receiver**	
Insertion Loss	SEAM_81,82	SEAF-RA_81,82	3dB@ 10.6 GHz
	SEAM_93,94	SEAF-RA_93,94	3dB@ 12.1 GHz
	SEAM_165,166	SEAF-RA_165,166	3dB@ 9.9 GHz
	SEAM_157,158	SEAF-RA_157,158	3dB@ 8.4 GHz
	SEAM_229, 230	SEAF-RA_229,230	3dB@ 12.3 GHz
Return Loss	SEAM_81,82	SEAM_81,82	>10dB to 8.3 GHz
	SEAM_93,94	SEAM_93,94	>10dB to 8.3 GHz
	SEAM_165,166	SEAM_165,166	>10dB to 6.7 GHz
	SEAM_157,158	SEAM_157,158	>10dB to 5.7 GHz
	SEAM_229, 230	SEAM_229, 230	>10dB to 7.2 GHz
Near-End Crosstalk	SEAM_145, 146	SEAM_165, 166	<-20dB to 20 GHz
	SEAM_145, 146	SEAM_157, 158	<-20dB to 20 GHz
	SEAM_165,166	SEAM_169, 170	<-20dB to 20 GHz
	SEAM_217,218	SEAM_229, 230	<-20dB to 20 GHz
Far-End Crosstalk	SEAM_145, 146	SEAF-RA_165, 166	<-20dB to 20 GHz
	SEAM_145, 146	SEAF-RA_157, 158	<-20dB to 20 GHz
	SEAM_165,166	SEAF-RA_169, 170	<-20dB to 20 GHz
	SEAM_217,218	SEAF-RA_229, 230	<-20dB to 20 GHz

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

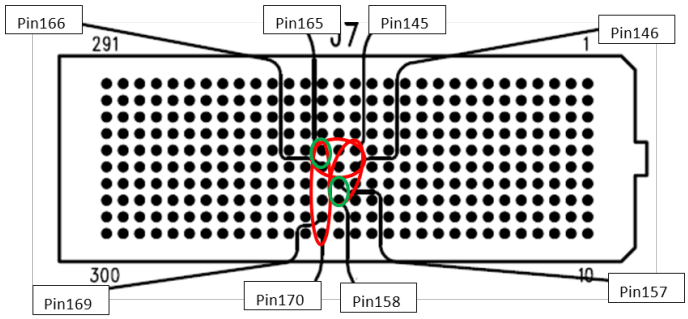
Differential Optimal Vertical Pin Map



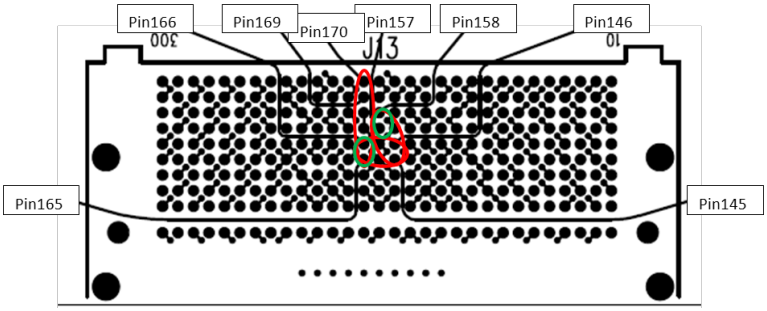
SEAM



SEAF_RA



SEAM



SEAF_RA

Insertion Loss & Return Loss

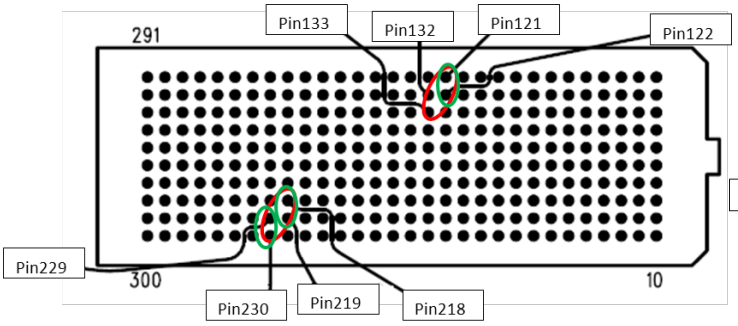
Crosstalk

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

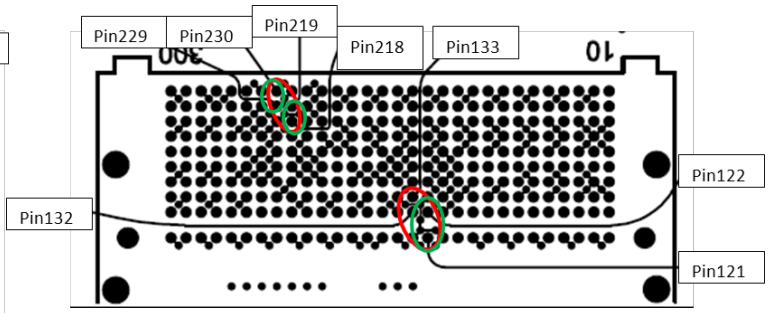
Table 5 - Differential High Density Vertical Performance			
Test Parameter	**Driver**	**Receiver**	
Insertion Loss	SEAM_121,122	SEAF-RA_121,122	3dB@ 11.8 GHz
	SEAM_134,135	SEAF-RA_134,135	3dB@ 10.9 GHz
	SEAM_157,158	SEAF-RA_157,158	3dB@ 11.0 GHz
	SEAM_218, 219	SEAF-RA_218, 219	3dB@ 10.7 GHz
	SEAM_229, 230	SEAF-RA_229,230	3dB@ 12.3 GHz
Return Loss	SEAM_121,122	SEAM_121,122	>10dB to 8.6 GHz
	SEAM_134,135	SEAM_134,135	>10dB to 9.0 GHz
	SEAM_157,158	SEAM_157,158	>10dB to 7.3 GHz
	SEAM_218, 219	SEAM_218, 219	>10dB to 10.7 GHz
	SEAM_229, 230	SEAM_229, 230	>10dB to 8.8 GHz
Near-End Crosstalk	SEAM_121,122	SEAM_132,133	<-20dB to 14.3 GHz
	SEAM_134,135	SEAM_154,155	<-20dB to 20 GHz
	SEAM_134,135	SEAM_145,146	<-20dB to 17.4 GHz
	SEAM_154,155	SEAM_157,158	<-20dB to 20 GHz
	SEAM_218, 219	SEAM_229, 230	<-20dB to 16.1 GHz
Far-End Crosstalk	SEAM_121,122	SEAF-RA_132, 133	<-20dB to 20 GHz
	SEAM_134,135	SEAF-RA_154,155	<-20dB to 17.6 GHz
	SEAM_134,135	SEAF-RA_145,146	<-20dB to 14.1 GHz
	SEAM_154,155	SEAF-RA_157,158	<-20dB to 20.0 GHz
	SEAM_218, 219	SEAF-RA_229, 230	<-20dB to 14.5 GHz

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

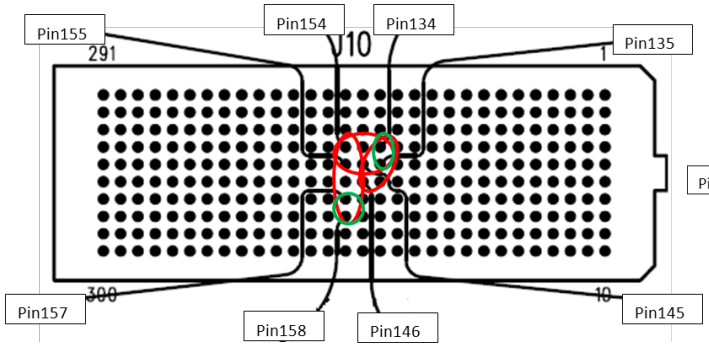
Differential High Density Vertical Pin Map



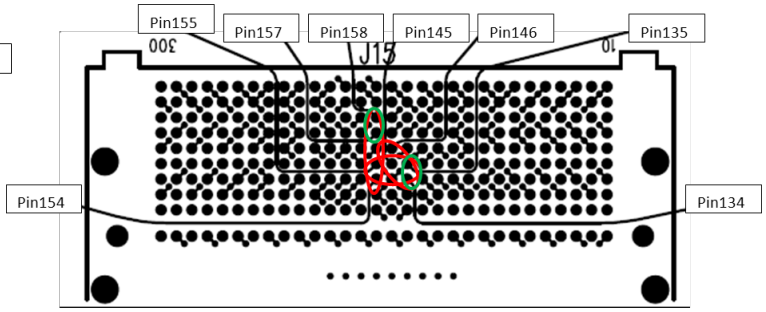
SEAM



SEAF_RA



SEAM



SEAF_RA

Insertion Loss & Return Loss

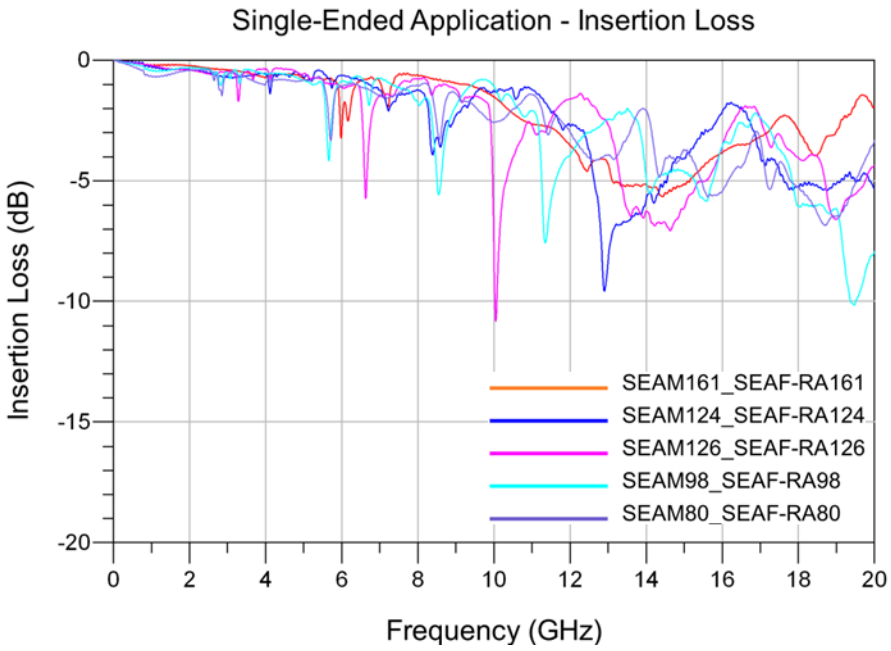
Crosstalk

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

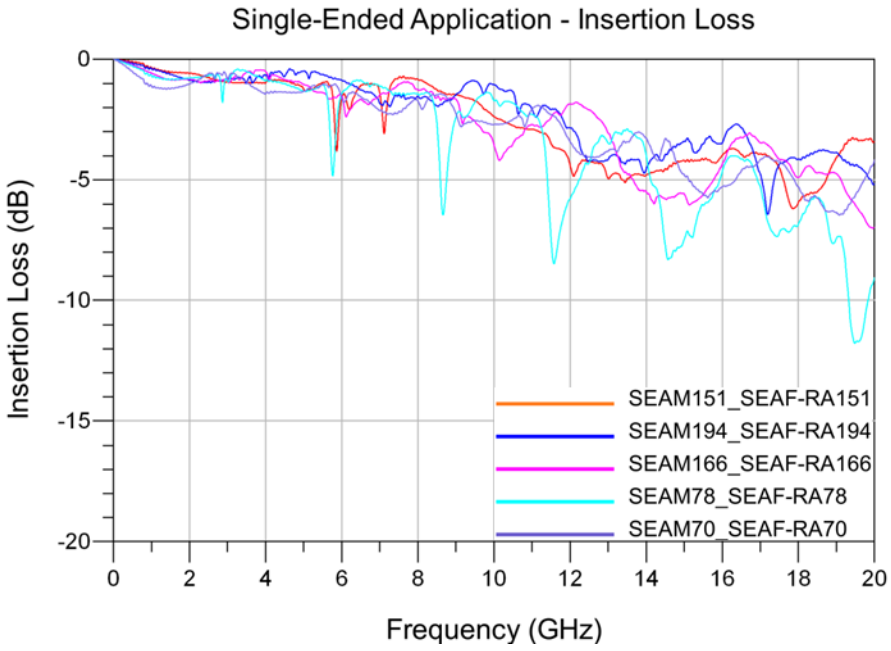
Bandwidth Charts – Single-Ended & Differential Insertion Loss

SEAM-2mm/SEAF-RA Array Series

Single-Ended 1:1 S/G Pattern

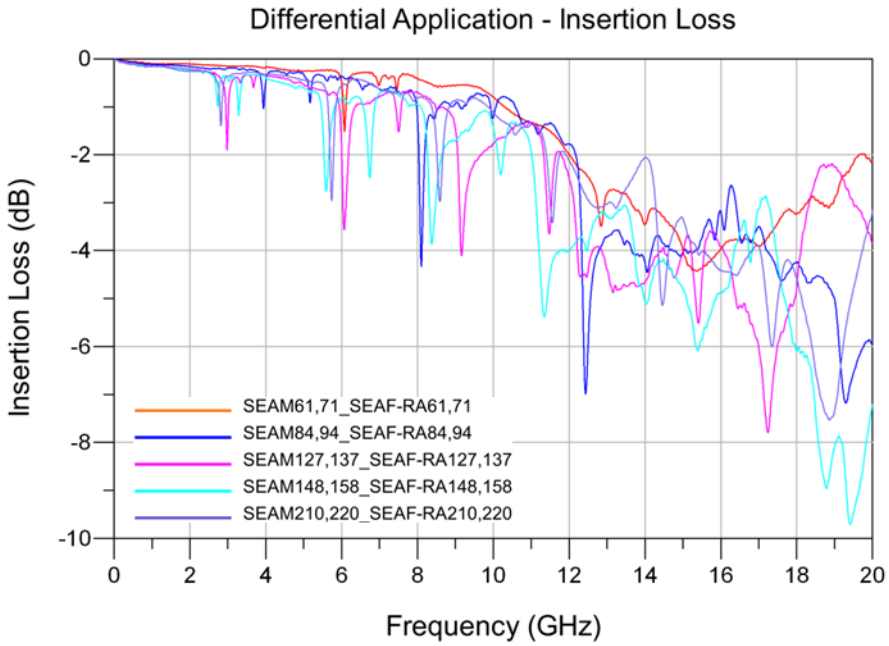


Single-Ended 2:1 S/G Pattern

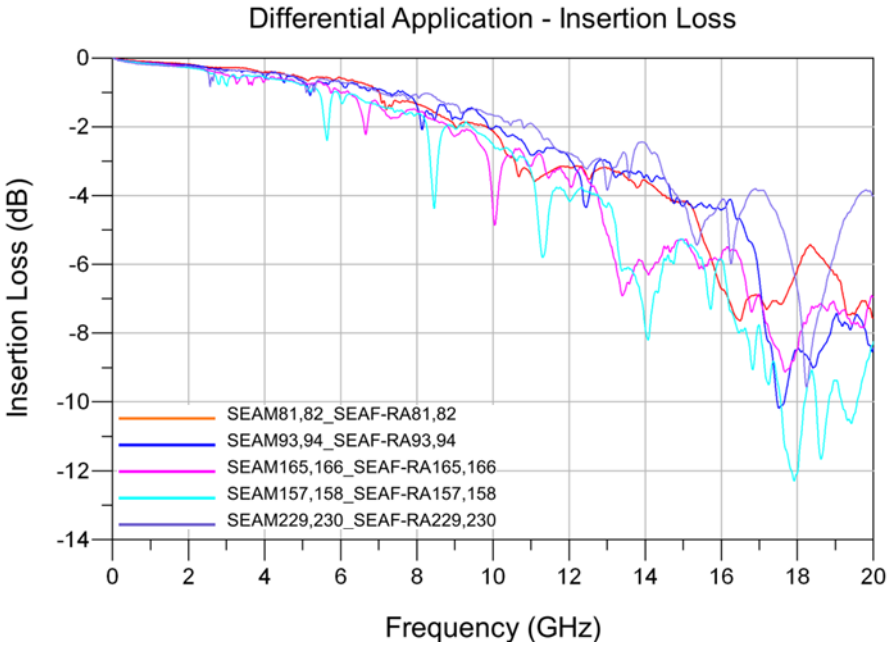


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Differential Optimal Horizontal

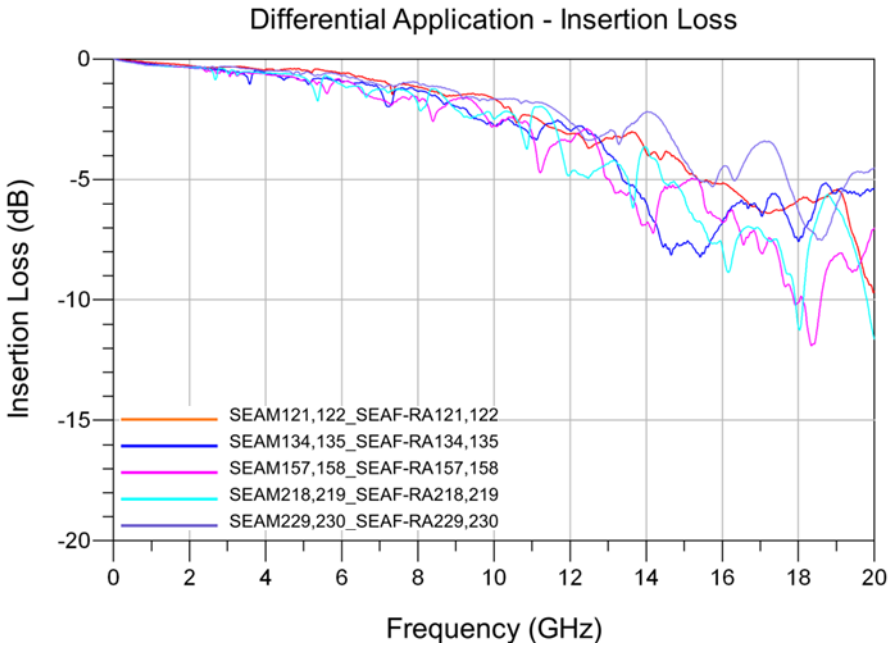


Differential Optimal Vertical



Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Differential High Density Vertical



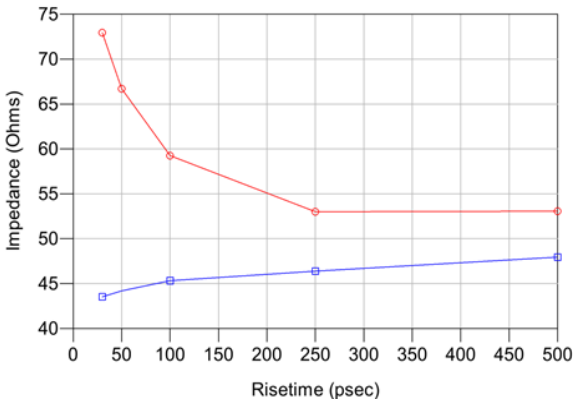
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Time Domain Data Summary

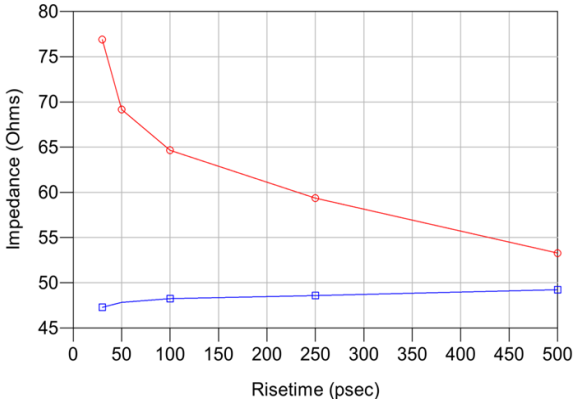
Table 6 – Single-End Impedance (Ω) – 1:1 S/G Pattern						
Driver	**Signal Risetime**	**30 ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**
SEAM 161	**Maximum Impedance**	72.9	66.7	59.2	53.0	53.1
	Minimum Impedance	43.5	44.2	45.3	46.4	47.9
SEAM 124	**Maximum Impedance**	76.9	69.2	64.6	59.4	53.3
	Minimum Impedance	47.3	47.8	48.2	48.6	49.2
SEAM 126	**Maximum Impedance**	75.2	68.3	63.0	59.5	55.3
	Minimum Impedance	42.4	46.9	49.5	49.8	50.0
SEAM 98	**Maximum Impedance**	68.4	64.0	61.0	59.3	55.1
	Minimum Impedance	44.9	45.2	46.1	47.2	48.5
SEAM 80	**Maximum Impedance**	76.2	70.3	68.1	65.3	59.6
	Minimum Impedance	45.3	46.4	46.6	47.5	48.8

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

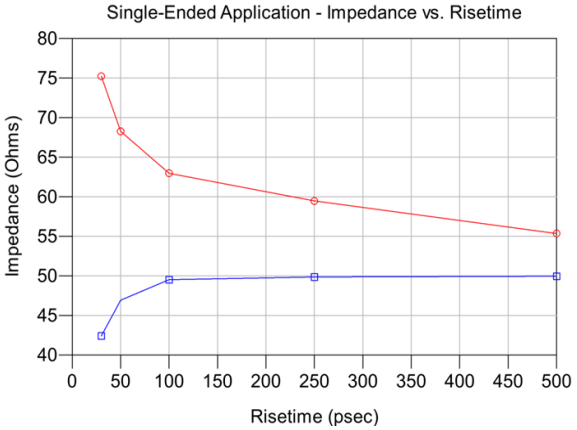
SEAM161



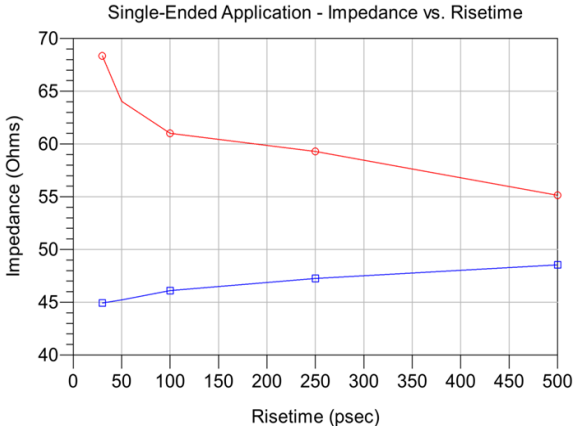
SEAM124



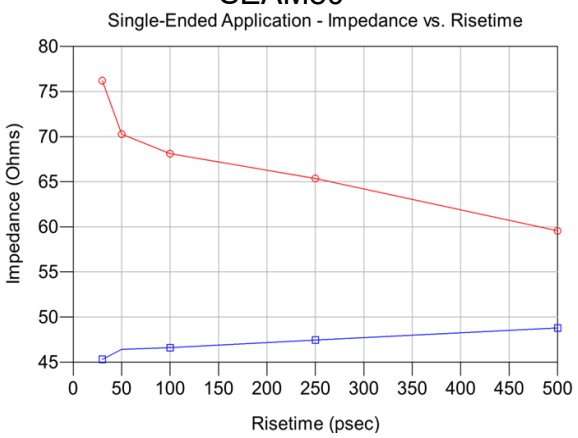
SEAM126



SEAM98



SEAM80

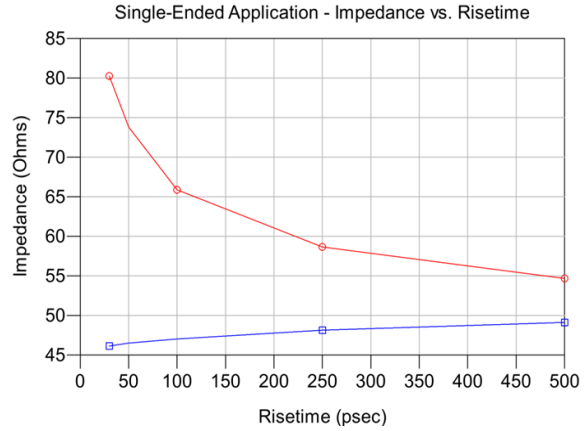


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

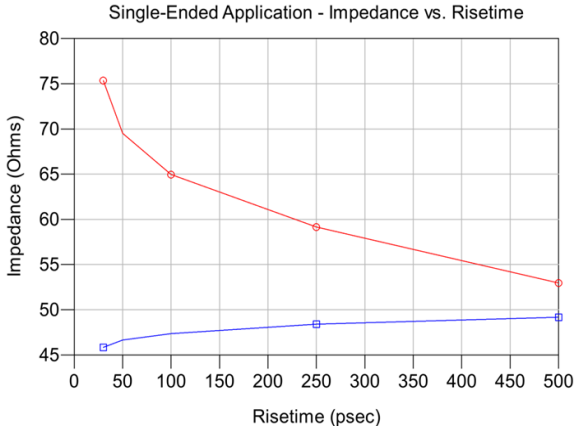
Table 7 – Single-End Impedance (Ω) – 2:1 S/G Pattern						
Driver	**Signal Risetime**	**30 ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**
SEAM 151	**Maximum Impedance**	80.3	73.8	65.9	58.6	54.7
	Minimum Impedance	46.1	46.5	47.0	48.1	49.1
SEAM 194	**Maximum Impedance**	75.3	69.5	65.0	59.2	53.0
	Minimum Impedance	45.8	46.7	47.4	48.4	49.2
SEAM 166	**Maximum Impedance**	78.4	71.0	65.6	61.9	56.6
	Minimum Impedance	48.7	48.8	49.0	49.6	50.0
SEAM 78	**Maximum Impedance**	75.1	70.4	66.1	63.0	56.3
	Minimum Impedance	46.2	47.1	47.8	48.7	49.7
SEAM 70	**Maximum Impedance**	79.9	74.1	72.4	70.1	63.6
	Minimum Impedance	47.6	49.4	49.8	50.0	50.0

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

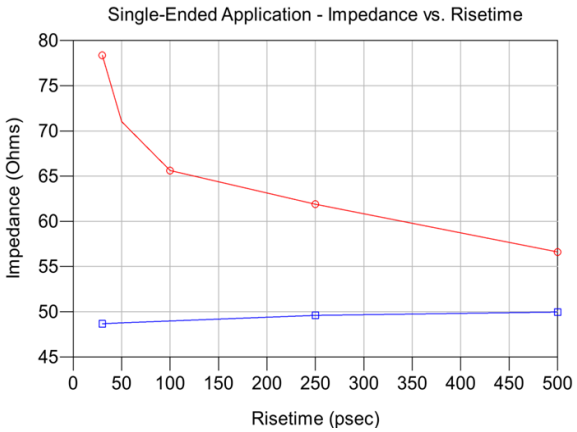
SEAM151



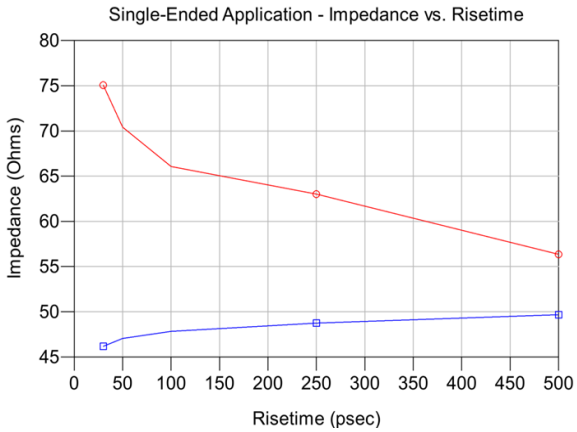
SEAM194



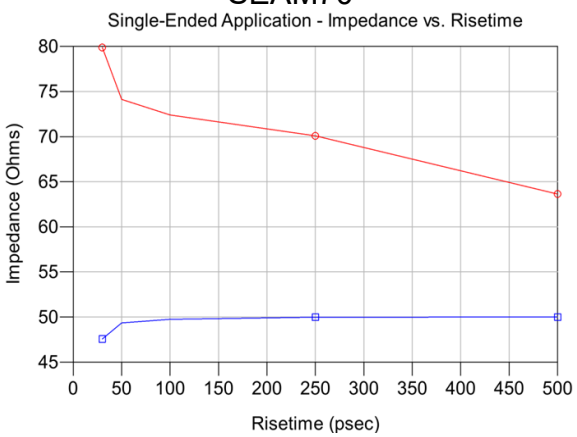
SEAM166



SEAM78



SEAM70

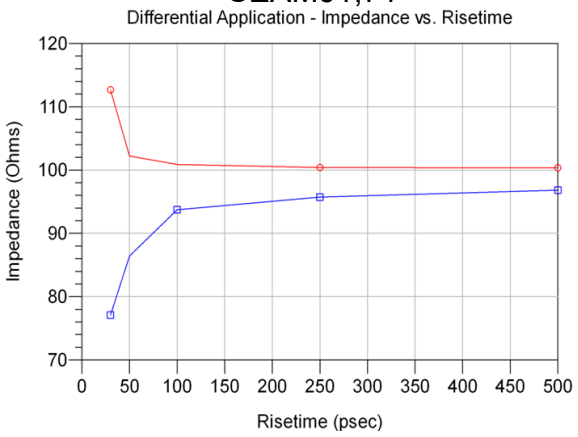


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

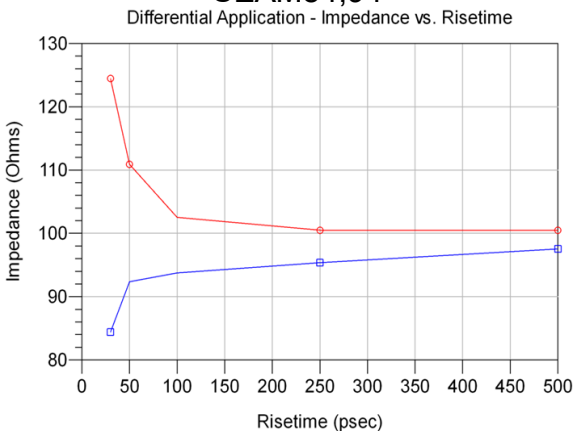
Table 8 – Differential Impedance (Ω) – Optimal Horizontal						
Driver	**Signal Risetime**	**30 ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**
SEAM 61,71	**Maximum Impedance**	112.7	102.2	100.9	100.4	100.3
	Minimum Impedance	77.1	86.4	93.7	95.7	96.8
SEAM 84,94	**Maximum Impedance**	124.4	110.9	102.5	100.5	100.5
	Minimum Impedance	84.4	92.4	93.8	95.4	97.5
SEAM 127,137	**Maximum Impedance**	121.4	110.8	104.9	102.4	101.9
	Minimum Impedance	86.4	93.4	97.4	98.6	99.5
SEAM 148,158	**Maximum Impedance**	122.5	110.4	103.0	100.6	100.7
	Minimum Impedance	83.6	91.7	96.6	98.8	99.2
SEAM 210,220	**Maximum Impedance**	117.5	104.4	102.6	101.1	102.3
	Minimum Impedance	78.7	88.1	95.1	97.1	98.8

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

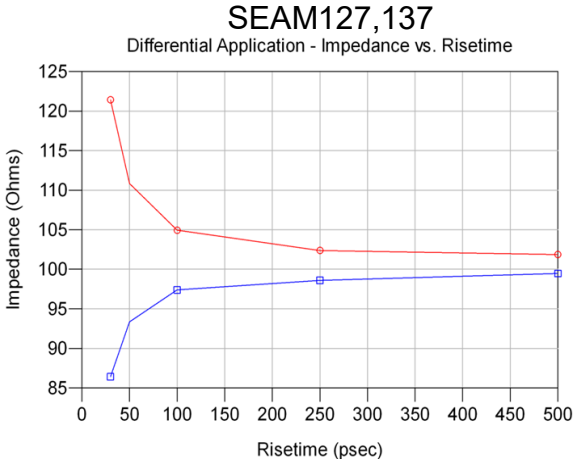
SEAM61,71



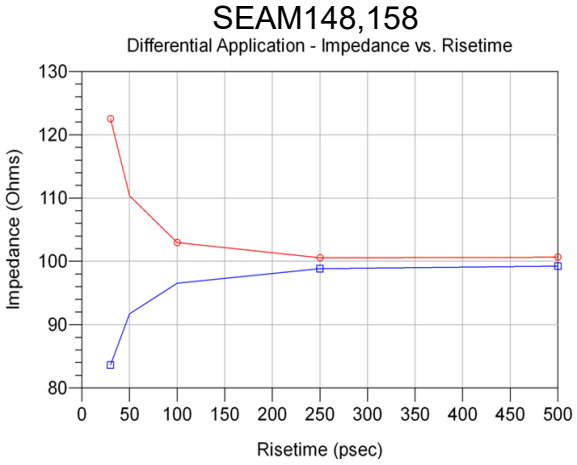
SEAM84,94



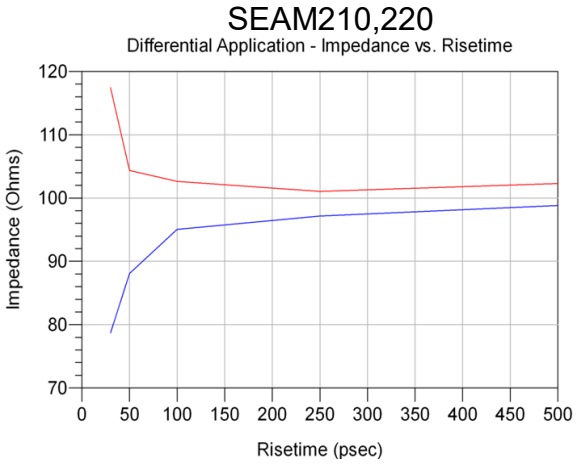
SEAM127,137



SEAM148,158



SEAM210,220

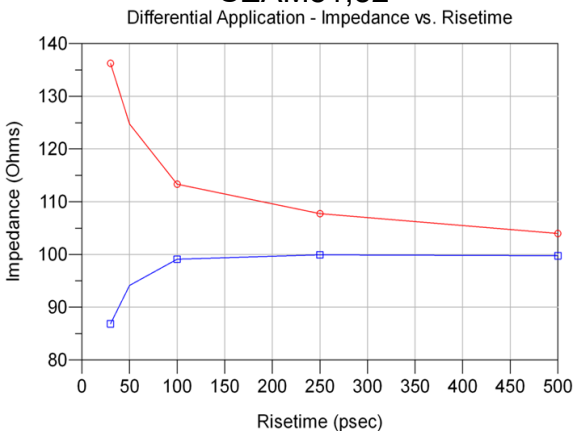


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

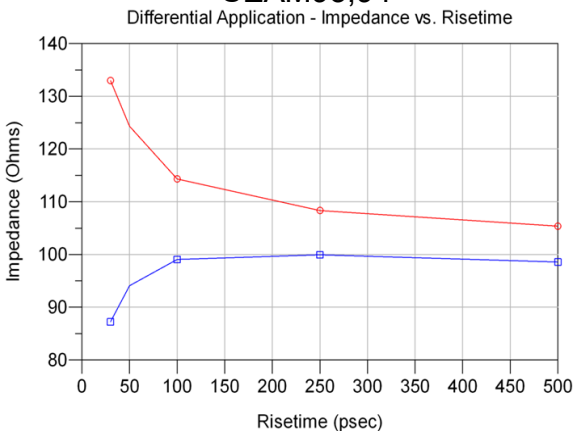
Table 9 – Differential Impedance (Ω) – Optimal Vertical						
Driver	**Signal Risetime**	**30 ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**
SEAM 81,82	**Maximum Impedance**	136.2	124.7	113.3	107.7	104.0
	Minimum Impedance	86.9	94.1	99.1	99.9	99.7
SEAM 93,94	**Maximum Impedance**	133.0	124.3	114.3	108.3	105.4
	Minimum Impedance	87.2	94.1	99.0	99.9	98.6
SEAM 165,166	**Maximum Impedance**	134.8	122.3	112.5	106.0	103.7
	Minimum Impedance	94.4	95.4	97.1	100.0	100.0
SEAM 157,158	**Maximum Impedance**	134.8	122.0	112.5	106.1	100.9
	Minimum Impedance	94.3	95.7	97.4	99.8	99.4
SEAM 229,230	**Maximum Impedance**	132.0	121.4	111.6	109.1	106.2
	Minimum Impedance	85.2	93.1	98.7	100.0	99.9

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

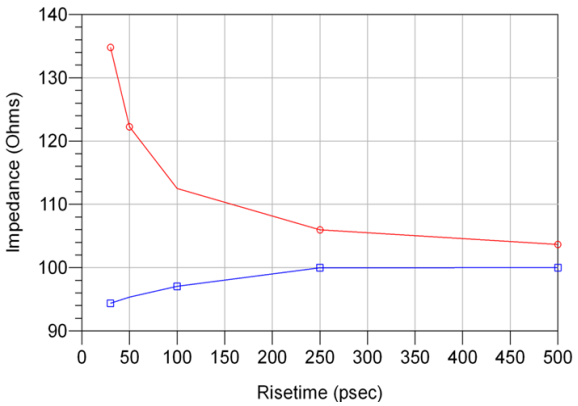
SEAM81,82



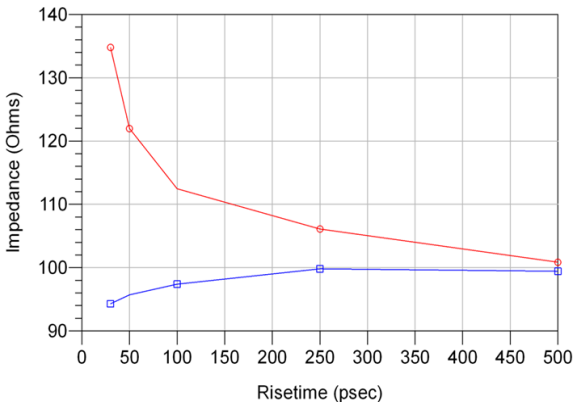
SEAM93,94



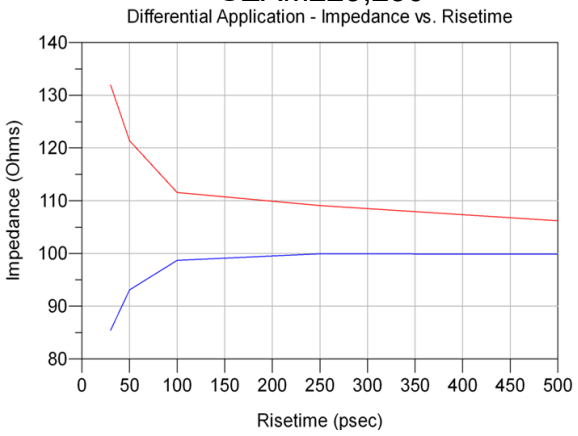
SEAM165,166



SEAM157,158



SEAM229,230

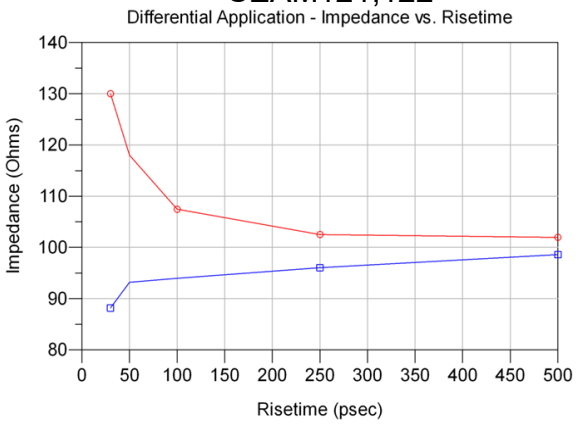


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

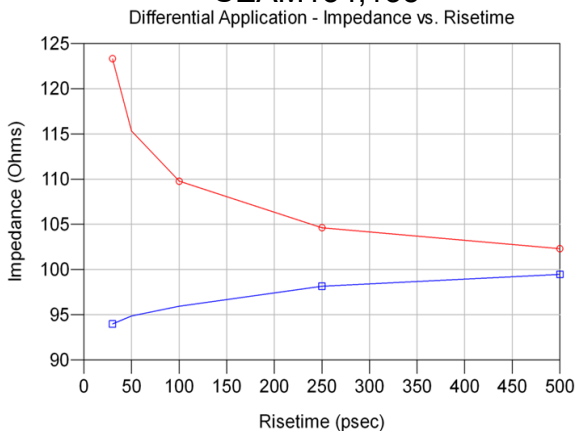
Table 10 – Differential Impedance (Ω) – High Density Vertical						
Driver	**Signal Risetime**	**30 ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**
SEAM 121,122	**Maximum Impedance**	130.0	118.0	107.4	102.5	101.9
	Minimum Impedance	88.2	93.2	93.9	96.0	98.6
SEAM 134,135	**Maximum Impedance**	123.3	115.3	109.8	104.6	102.3
	Minimum Impedance	94.0	94.9	95.9	98.1	99.5
SEAM 157,158	**Maximum Impedance**	132.6	121.0	111.6	105.4	101.9
	Minimum Impedance	92.3	97.2	98.4	98.8	99.4
SEAM 218,219	**Maximum Impedance**	118.3	109.4	103.5	100.8	100.7
	Minimum Impedance	87.6	93.9	96.5	97.5	98.7
SEAM 229,230	**Maximum Impedance**	125.7	115.7	106.4	103.2	102.3
	Minimum Impedance	80.0	89.6	97.1	99.3	99.8

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

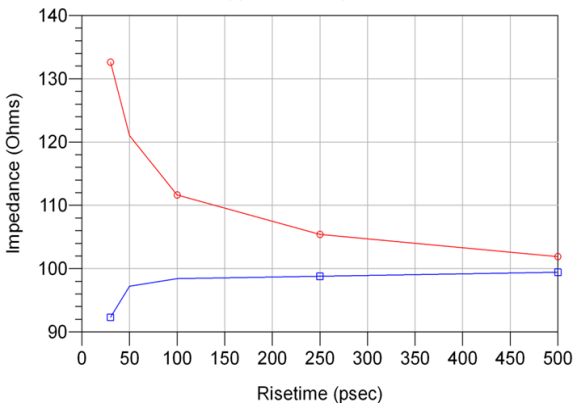
SEAM121,122



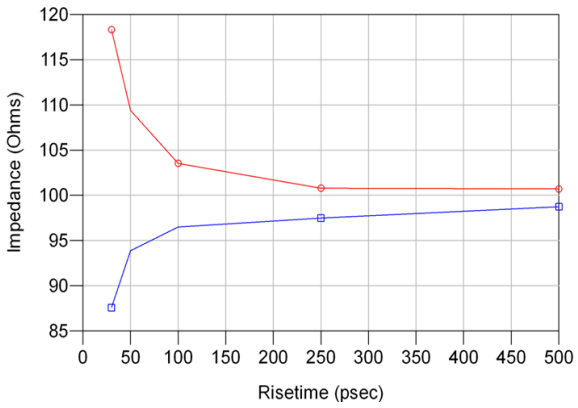
SEAM134,135



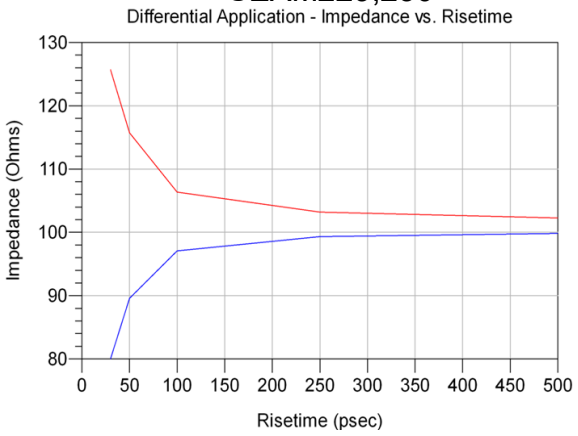
SEAM157,158



SEAM218,219



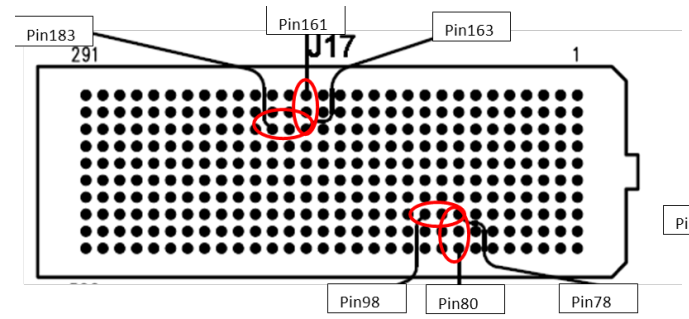
SEAM229,230

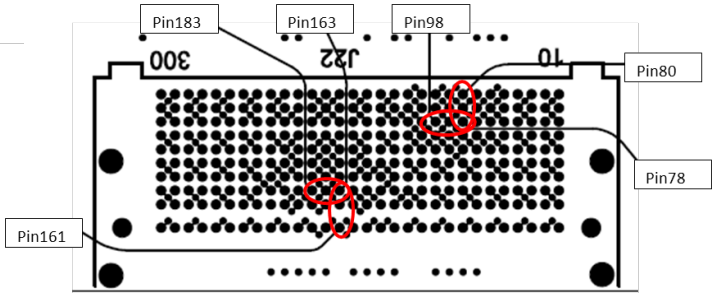


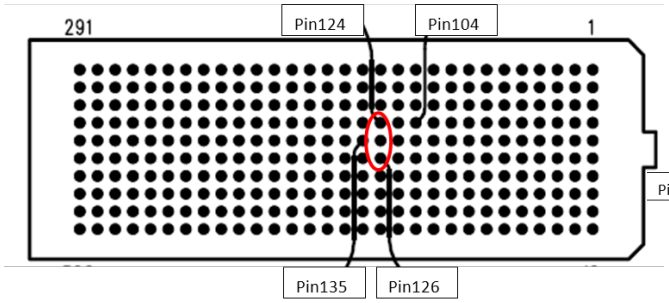
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

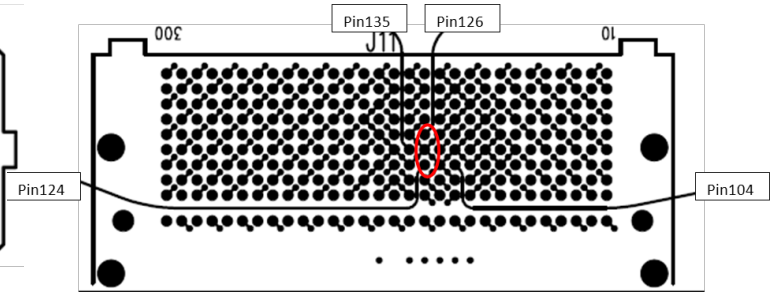
Table 11 - Single-Ended Crosstalk (%) – 1:1 S/G Pattern							
Input(t_r)	Driver	Receiver	30ps	50 ps	100 ps	250 ps	500 ps
NEXT	SEAM_161	SEAM_163	0.46	0.32	0.20	0.14	<0.1
	SEAM_163	SEAM_183	0.61	0.54	0.44	0.33	0.20
	SEAM_124	SEAM_126	0.52	0.40	0.28	0.21	0.14
	SEAM_78	SEAM_98	0.62	0.52	0.42	0.37	0.26
	SEAM_78	SEAM_80	1.82	1.09	0.50	0.29	0.22
FEXT	SEAM_161	SEAF-RA_163	0.41	0.29	0.24	0.13	<0.1
	SEAM_163	SEAF-RA_183	0.99	0.71	0.45	0.25	0.14
	SEAM_124	SEAF-RA_126	0.69	0.42	0.19	0.13	<0.1
	SEAM_78	SEAF-RA_98	1.65	1.18	0.70	0.45	0.25
	SEAM_78	SEAF-RA_80	2.01	1.46	0.60	0.22	0.14

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







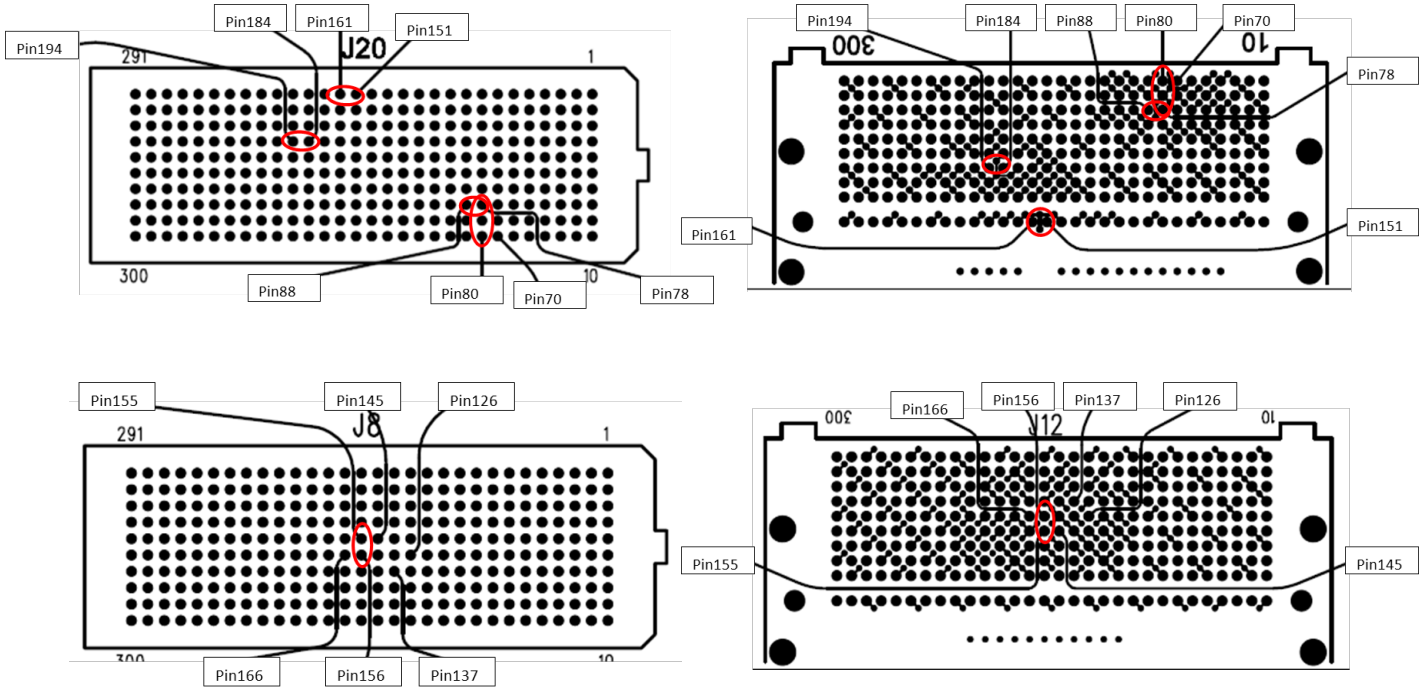


SEAM SEAF_RA

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical 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_151	SEAM_161	15.27	14.63	12.96	7.60	4.17
	SEAM_184	SEAM_194	11.90	11.55	11.01	7.94	4.72
	SEAM_155	SEAM_156	12.58	11.56	10.23	7.85	4.89
	SEAM_78	SEAM_88	11.65	11.44	11.13	9.39	6.24
	SEAM_78	SEAM_80	1.58	1.11	0.61	0.39	0.34
FEXT	SEAM_151	SEAF-RA_161	7.23	6.38	5.07	2.92	1.61
	SEAM_184	SEAF-RA_194	5.74	4.94	3.98	2.85	1.70
	SEAM_155	SEAF-RA_156	4.03	3.66	3.34	2.48	1.49
	SEAM_78	SEAF-RA_88	6.51	5.74	4.30	3.30	2.33
	SEAM_78	SEAF-RA_80	2.24	1.66	0.80	0.38	0.30

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

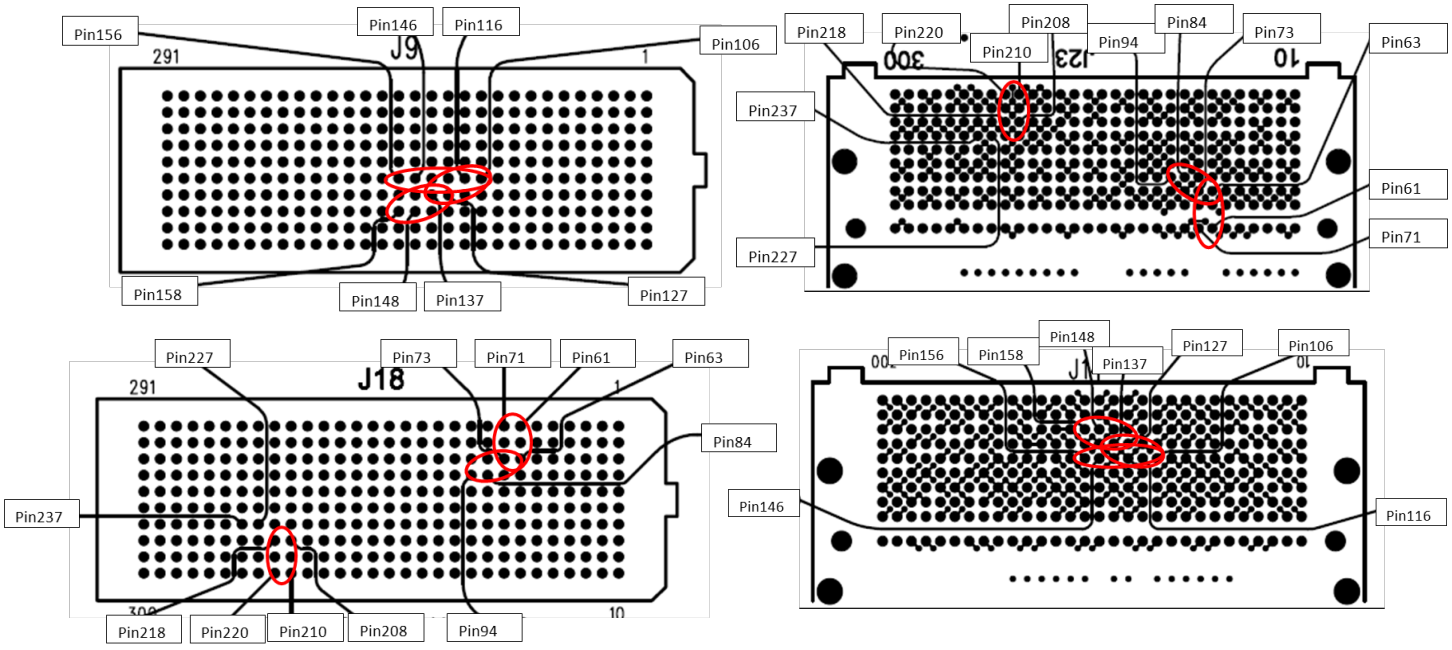


SEAM SEAF_RA

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Table 13 - Differential Crosstalk (%) – Optimal Horizontal							
Input(t_r)	Driver	Receiver	30ps	50 ps	100 ps	250 ps	500 ps
NEXT	SEAM_61,71	SEAM_63,73	0.12	<0.1	<0.1	<0.1	<0.1
	SEAM_63,73	SEAM_84,94	1.10	0.98	0.87	0.64	0.37
	SEAM_106,116	SEAM_146,156	0.16	<0.1	<0.1	<0.1	<0.1
	SEAM_106,116	SEAM_127,137	0.97	0.95	0.90	0.76	0.48
	SEAM_127, 137	SEAM_148, 158	1.07	0.95	0.85	0.76	0.50
	SEAM_208, 218	SEAM_210, 220	1.39	0.85	0.33	0.11	<0.1
FEXT	SEAM_61,71	SEAF-RA_63, 73	0.20	0.15	0.10	<0.1	<0.1
	SEAM_63,73	SEAF-RA_84,94	0.22	0.14	<0.1	<0.1	<0.1
	SEAM_106,116	SEAF-RA_146,156	0.20	0.14	<0.1	<0.1	<0.1
	SEAM_106,116	SEAF-RA_127,137	0.30	0.17	<0.1	<0.1	<0.1
	SEAM_127, 137	SEAF-RA_148,158	0.56	0.37	0.19	<0.1	<0.1
	SEAM_208, 218	SEAF-RA_210,220	1.56	1.03	0.36	0.12	<0.1

Differential Optimal Horizontal Crosstalk Pin Map

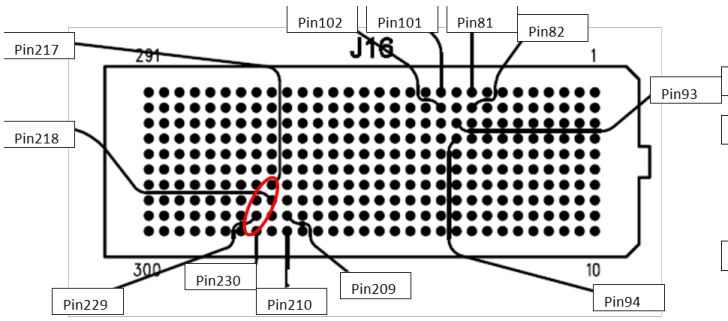


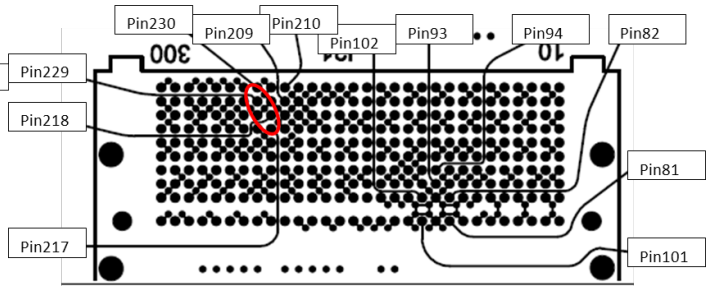
SEAM SEAF-RA

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

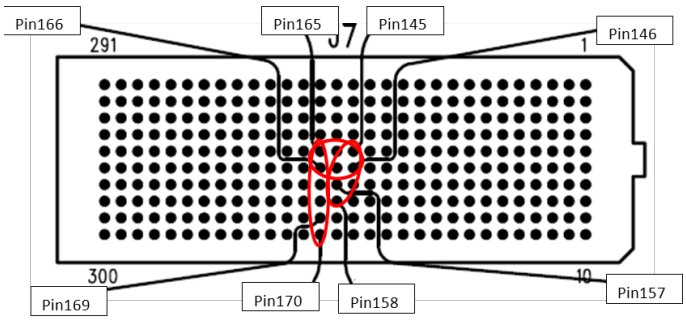
Table 14 - Differential Crosstalk (%) – Optimal Vertical							
Input(t_r)	**Driver**	**Receiver**	**30ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**
NEXT	SEAM_145, 146	SEAM_165, 166	0.40	0.28	0.21	0.15	<0.1
	SEAM_145, 146	SEAM_157, 158	1.04	0.98	0.94	0.79	0.50
	SEAM_165,166	SEAM_169, 170	0.28	0.18	<0.1	<0.1	<0.1
	SEAM_217,218	SEAM_229, 230	1.12	1.02	0.96	0.86	0.58
FEXT	SEAM_145, 146	SEAF-RA_165, 166	0.51	0.35	0.23	0.11	<0.1
	SEAM_145, 146	SEAF-RA_157, 158	0.34	0.23	0.16	0.11	<0.1
	SEAM_165,166	SEAF-RA_169, 170	0.37	0.27	0.14	<0.1	<0.1
	SEAM_217,218	SEAF-RA_229, 230	0.54	0.43	0.27	0.14	<0.1

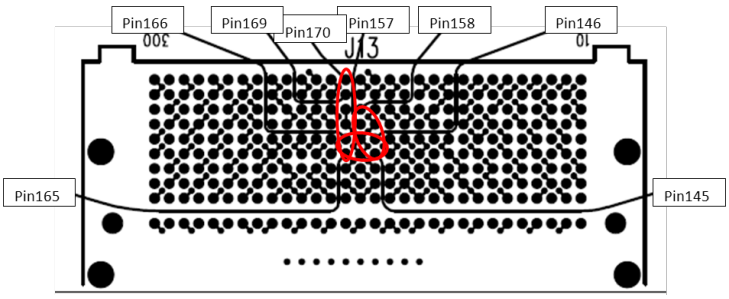
Differential Optimal Vertical Crosstalk Pin Map





SEAM



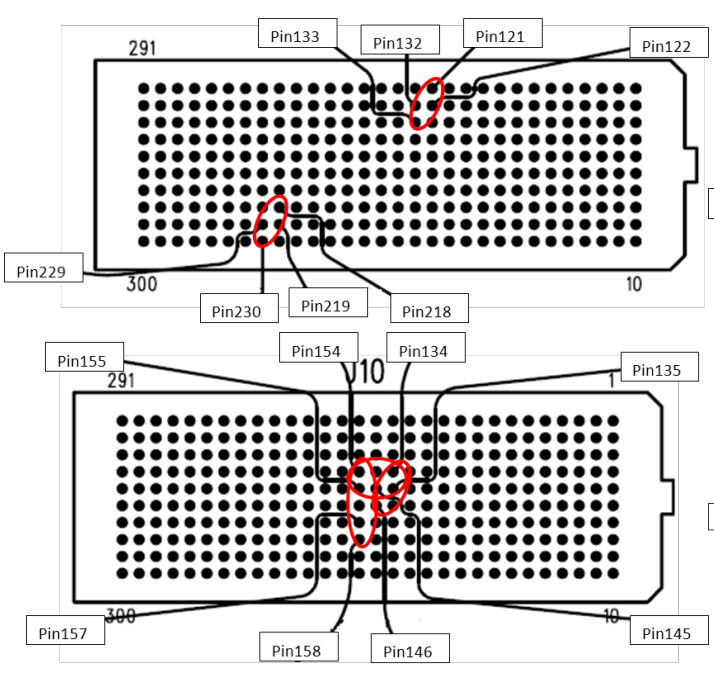


SEAF_RA

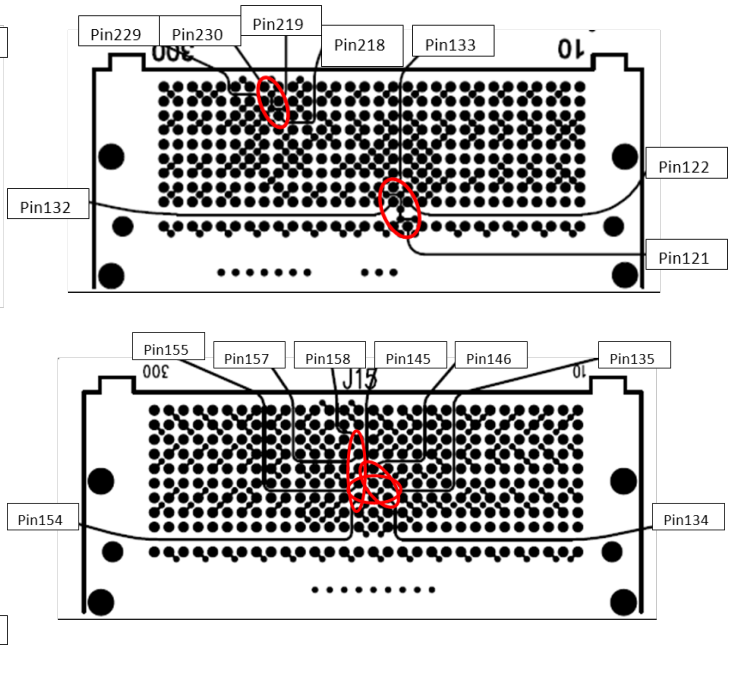
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Table 15 - Differential Crosstalk (%) – High Density Vertical							
Input(t_r)	**Driver**	**Receiver**	**30ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**
NEXT	SEAM_121,122	SEAM_132,133	3.02	2.74	2.54	1.60	0.86
	SEAM_134,135	SEAM_154,155	0.55	0.52	0.49	0.40	0.27
	SEAM_134,135	SEAM_145,146	2.92	2.77	2.61	1.86	1.08
	SEAM_154,155	SEAM_157,158	0.43	0.27	0.18	0.15	0.11
	SEAM_218, 219	SEAM_229, 230	2.91	2.77	2.60	2.05	1.31
FEXT	SEAM_121,122	SEAF-RA_132, 133	1.04	0.69	0.42	0.26	0.13
	SEAM_134,135	SEAF-RA_154,155	1.17	0.76	0.48	0.37	0.23
	SEAM_134,135	SEAF-RA_145,146	1.34	1.02	0.59	0.35	0.20
	SEAM_154,155	SEAF-RA_157,158	0.48	0.39	0.22	0.11	<0.1
	SEAM_218, 219	SEAF-RA_229, 230	2.65	1.78	0.97	0.42	0.25

Differential High Density Vertical Crosstalk Pin Map



SEAM



SEAF_RA

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Table 16 - Propagation Delay (Mated Connector)	
Single-Ended: 1:1 S/G, row1	80 ps
Single-Ended: 1:1 S/G, row4	120 ps
Single-Ended: 1:1 S/G, row6	145 ps
Single-Ended: 1:1 S/G, row8	177 ps
Single-Ended: 1:1 S/G, row10	204 ps
Single-Ended: 2:1 S/G, row1	84 ps
Single-Ended: 2:1 S/G, row4	121 ps
Single-Ended: 2:1 S/G, row6	150 ps
Single-Ended: 2:1 S/G, row8	179 ps
Single-Ended: 2:1 S/G, row10	201 ps
Differential: Optimal Horizontal, row1	69 ps
Differential: Optimal Horizontal, row4	112 ps
Differential: Optimal Horizontal, row7	154 ps
Differential: Optimal Horizontal, row8	167 ps
Differential: Optimal Horizontal, row10	172 ps
Differential: Optimal Vertical, row1,2	84 ps
Differential: Optimal Vertical, row3,4	111 ps
Differential: Optimal Vertical, row5,6	138 ps
Differential: Optimal Vertical, row7,8	167 ps
Differential: Optimal Vertical, row9,10	168 ps

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Differential: High Density Vertical, row1,2	81 ps
Differential: High Density Vertical, row4,5	124 ps
Differential: High Density Vertical, row7,8	168 ps
Differential: High Density Vertical, row8,9	180 ps
Differential: High Density Vertical, row9,10	179 ps

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical 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. However, 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.

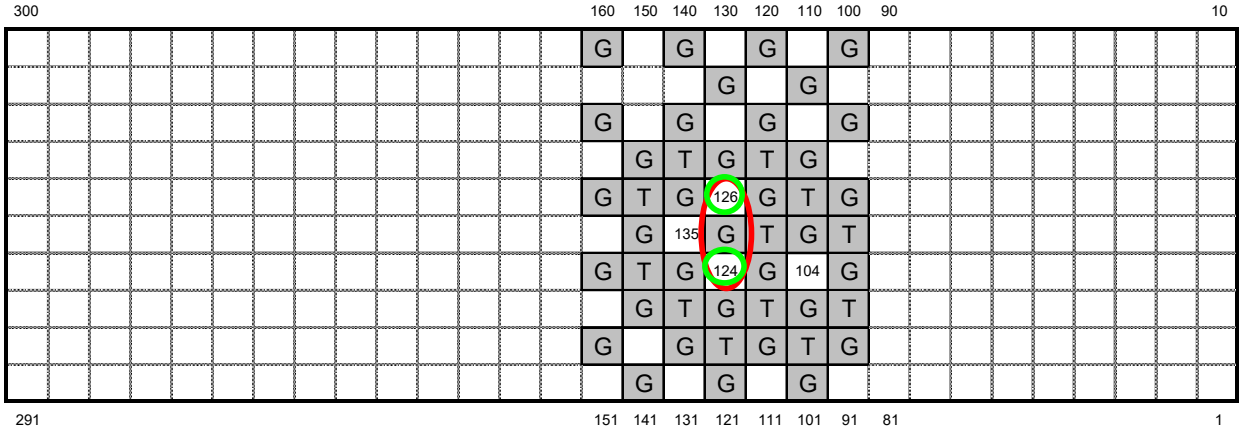
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

For this connector, the following array configurations are evaluated:

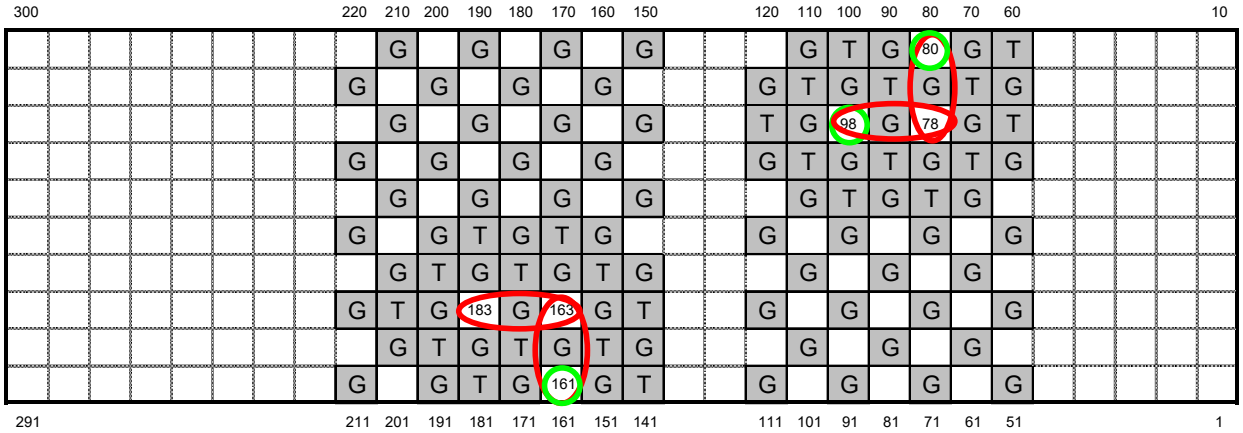
Open pin field — G Grounded pin field

Signal pin field — T 50 ohm termination field

Single-Ended 1:1 pattern

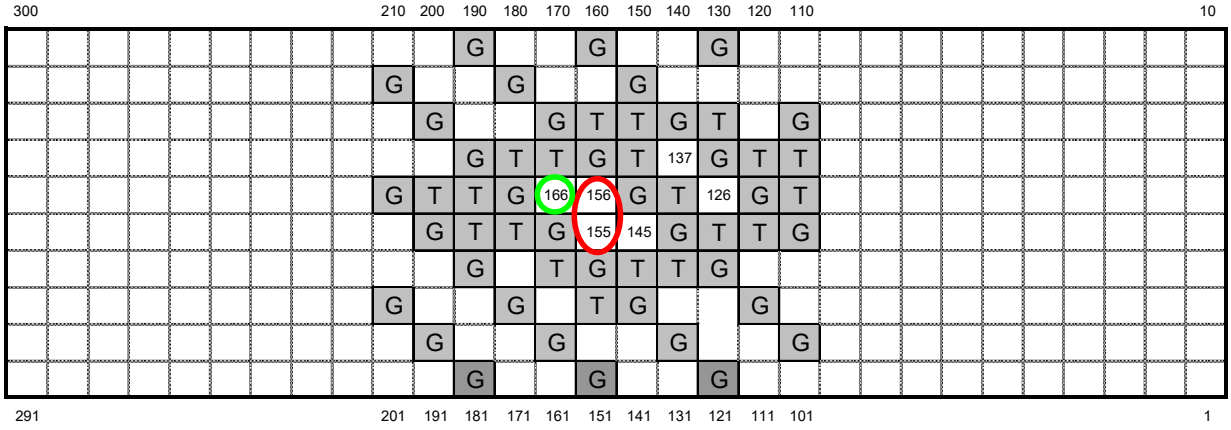


Single-Ended 1:1 pattern

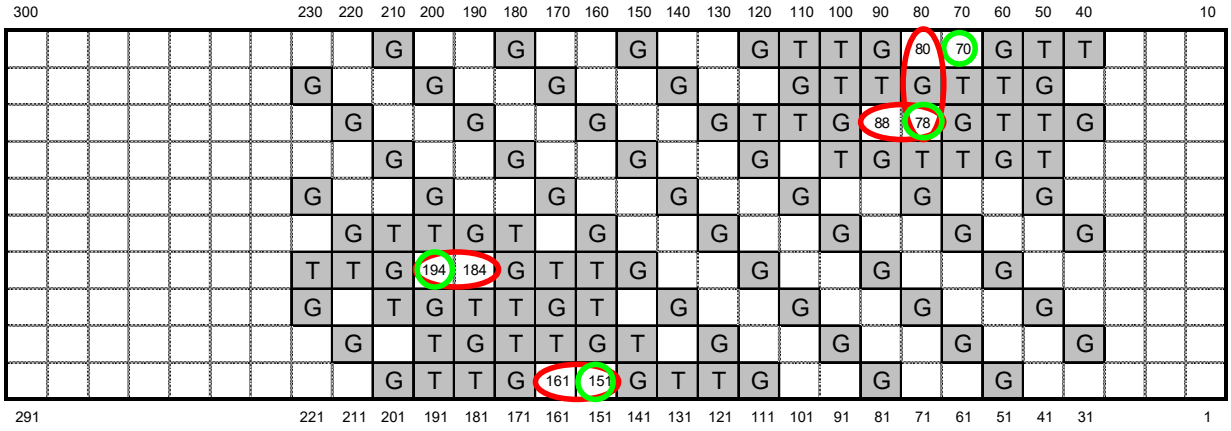


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Single-Ended 2:1 pattern



Single-Ended 2:1 pattern



Single-Ended Impedance (denoted by green circles):

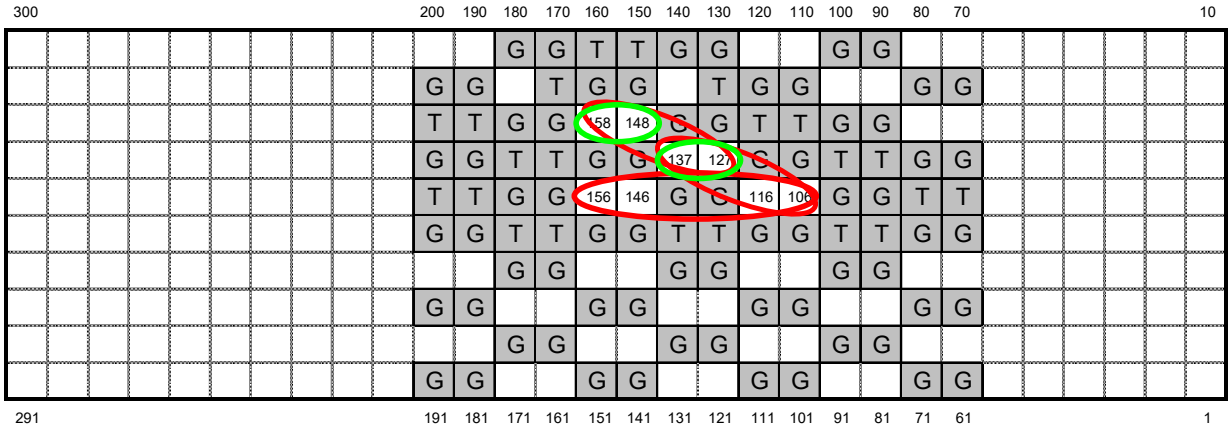
- 1:1 S:G ratio
- 2:1 S:G ratio

Single-Ended Crosstalk (denoted by red circles):

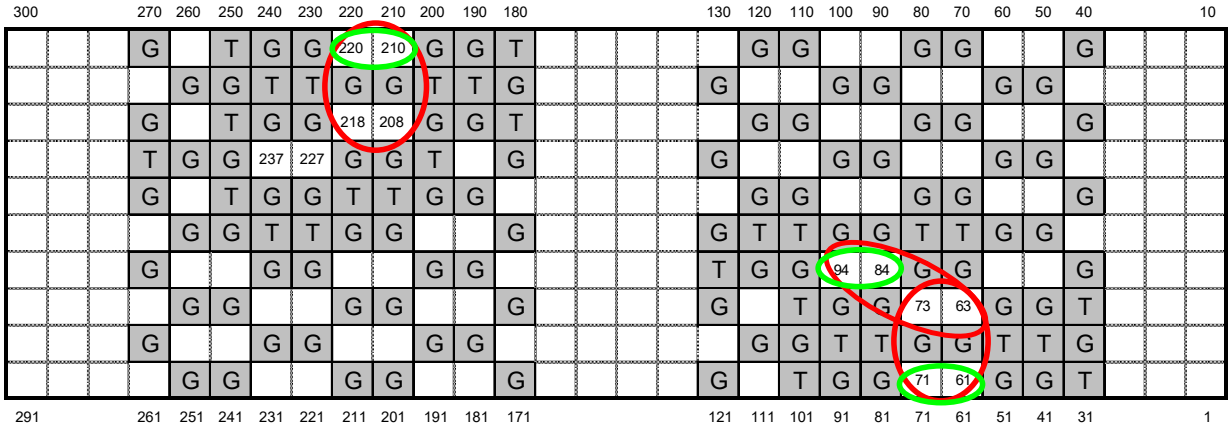
- 1:1 S:G ratio
- 2:1 S:G ratio

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Differential Optimal Horizontal

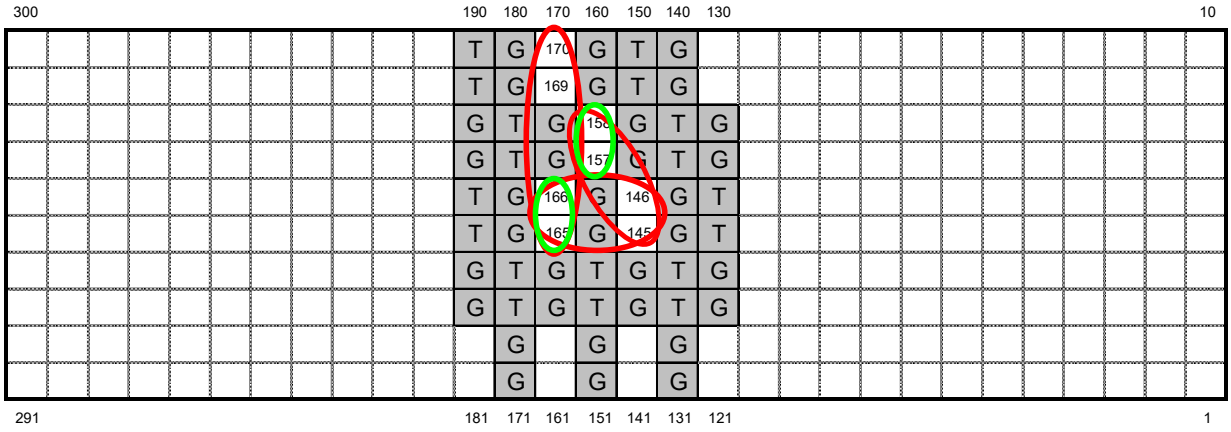


Differential Optimal Horizontal

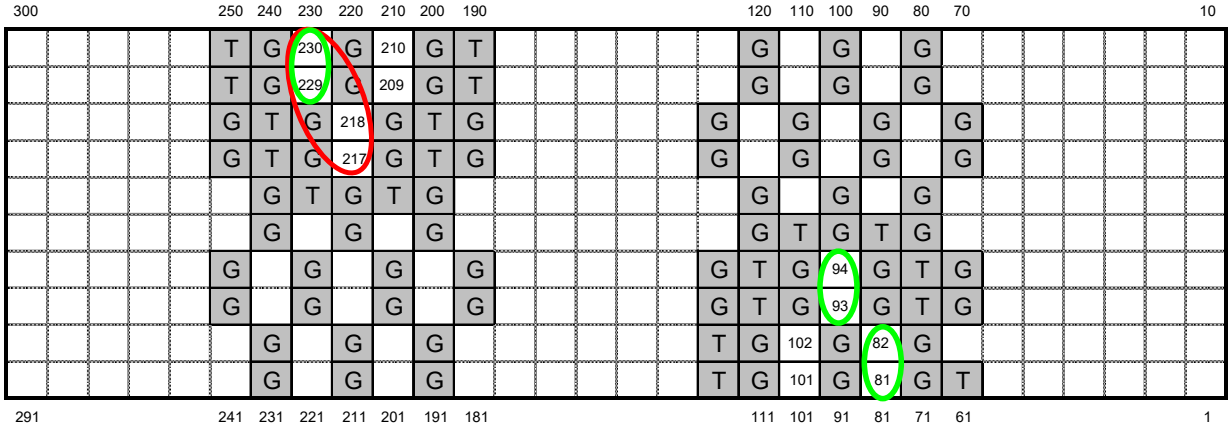


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Differential Optimal Vertical

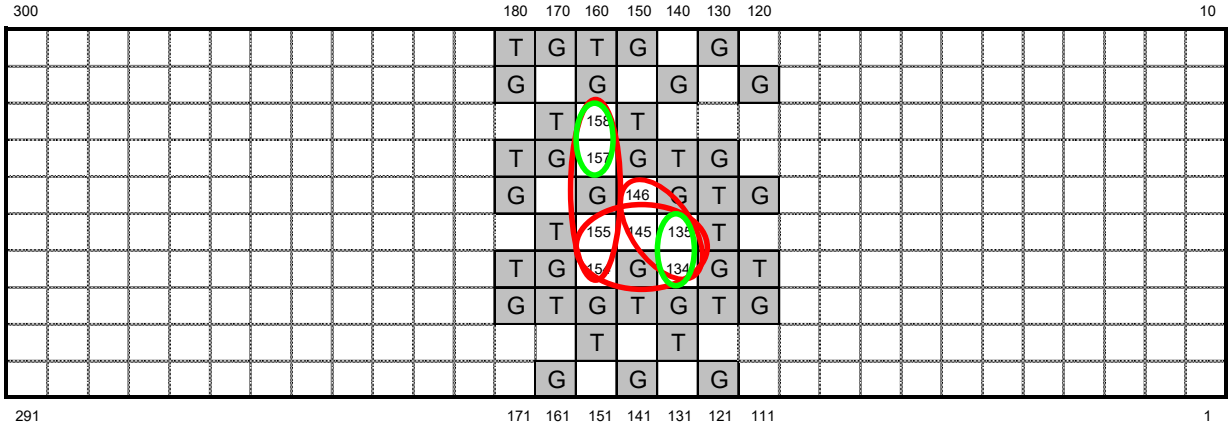


Differential Optimal Vertical

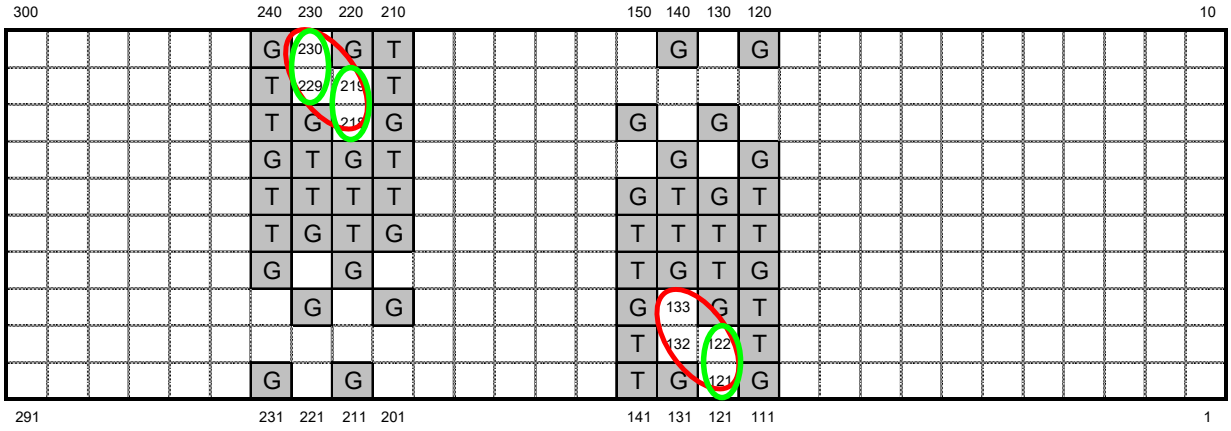


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

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: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical 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. However, 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: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Time Domain Data

Time Domain parameters indicate Impedance mismatch versus length, signal propagation time, and crosstalk in a pulsed signal environment. The measured S-Parameters from the network analyzer are post-processed using Agilent Advanced Design System to obtain the time domain response. 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.

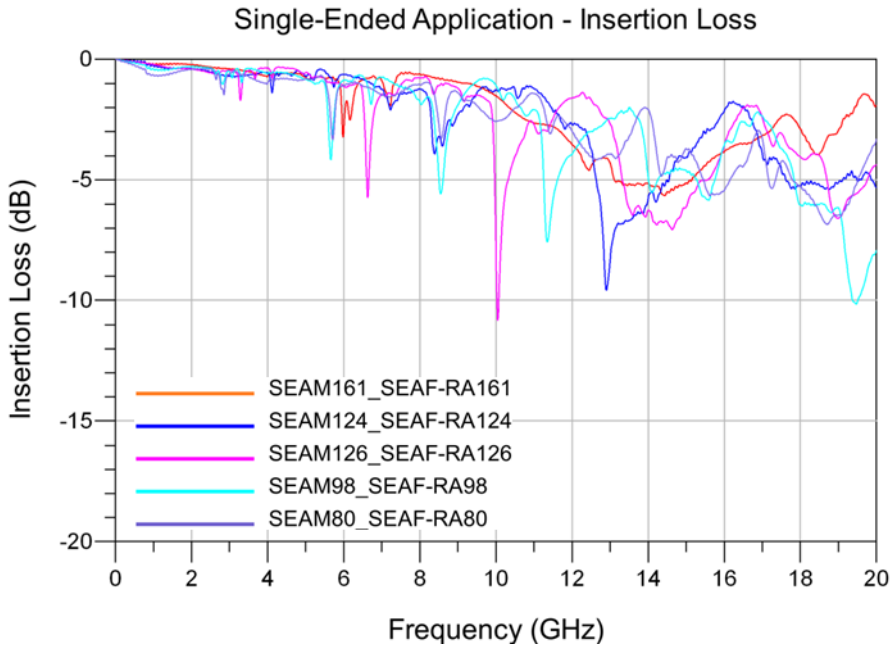
As a rule of thumb, 10% crosstalk levels are often used as a general first pass limit for determining acceptable interconnect performance. However, modern system crosstalk tolerance can vary greatly. For advice on connector suitability for specific applications, please contact our Signal Integrity Group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

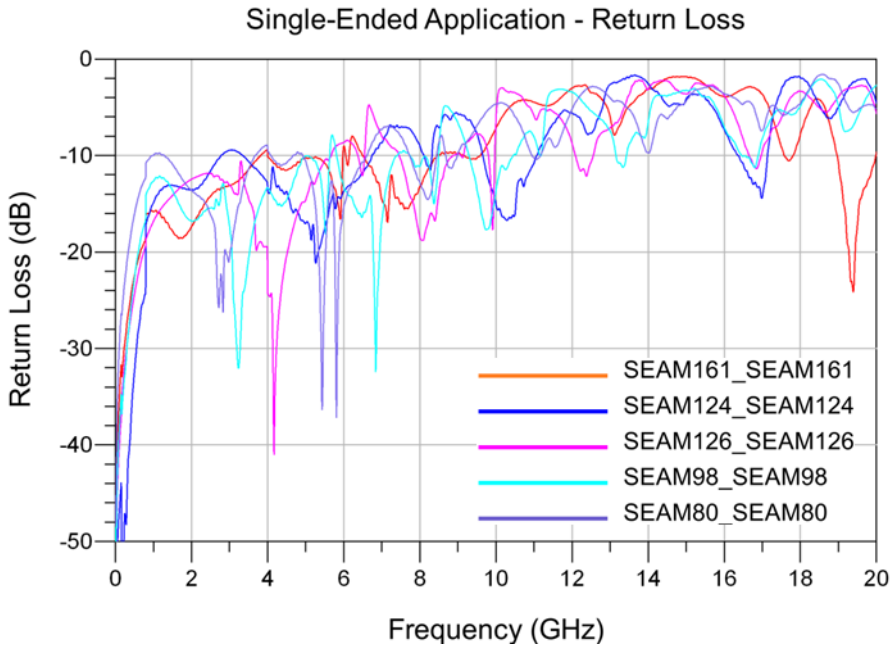
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Appendix A – Frequency Domain Response Graphs

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

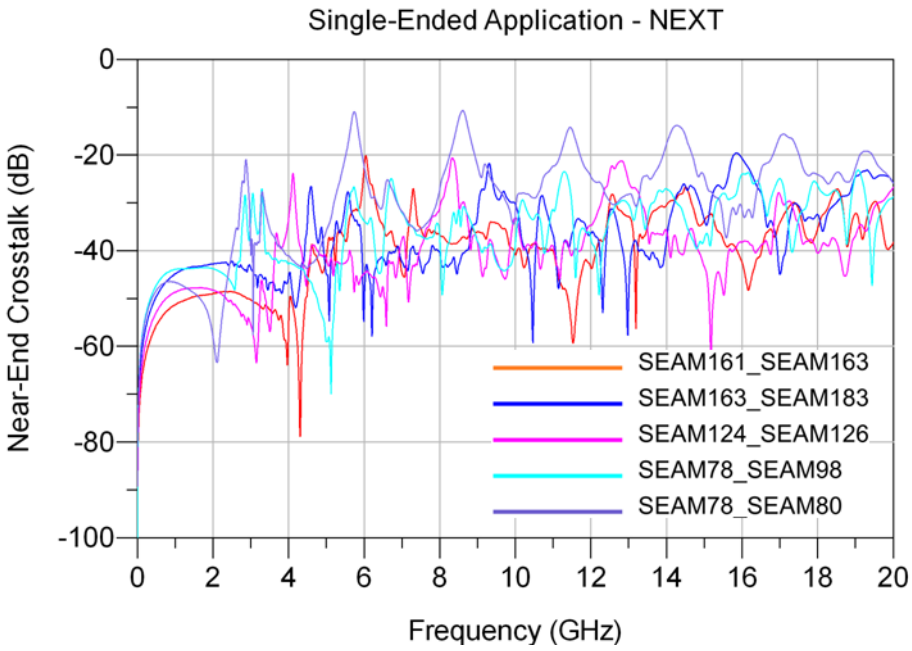


Single-Ended 1:1 S/G Pattern Application – Return Loss

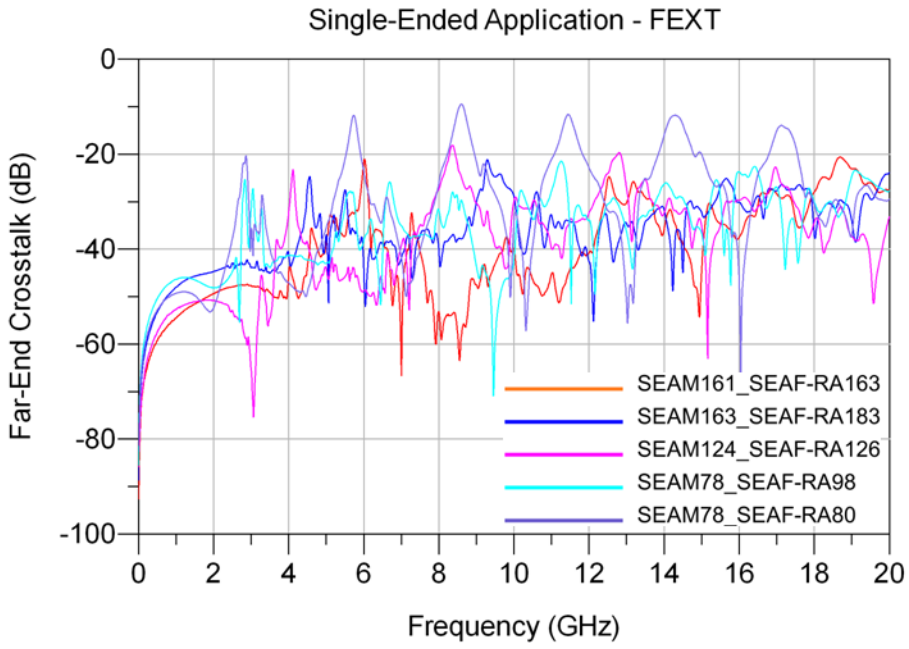


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

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

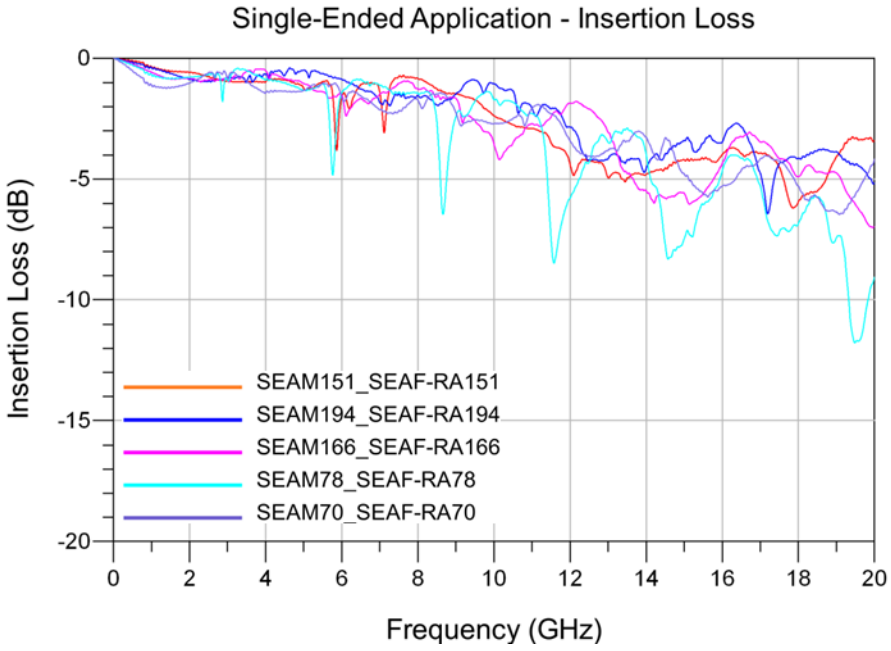


Single-Ended 1:1 S/G Pattern Application – FEXT

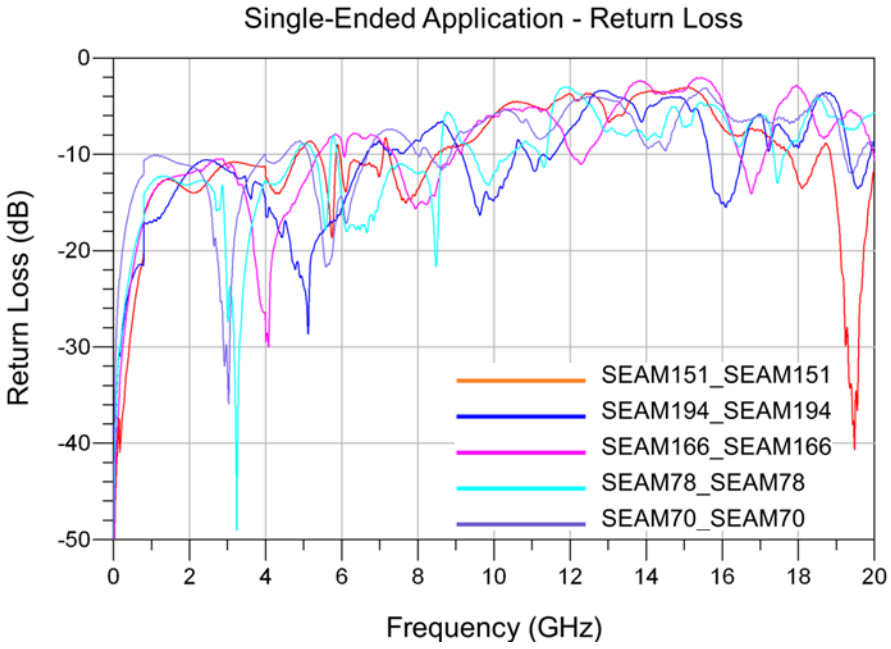


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

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

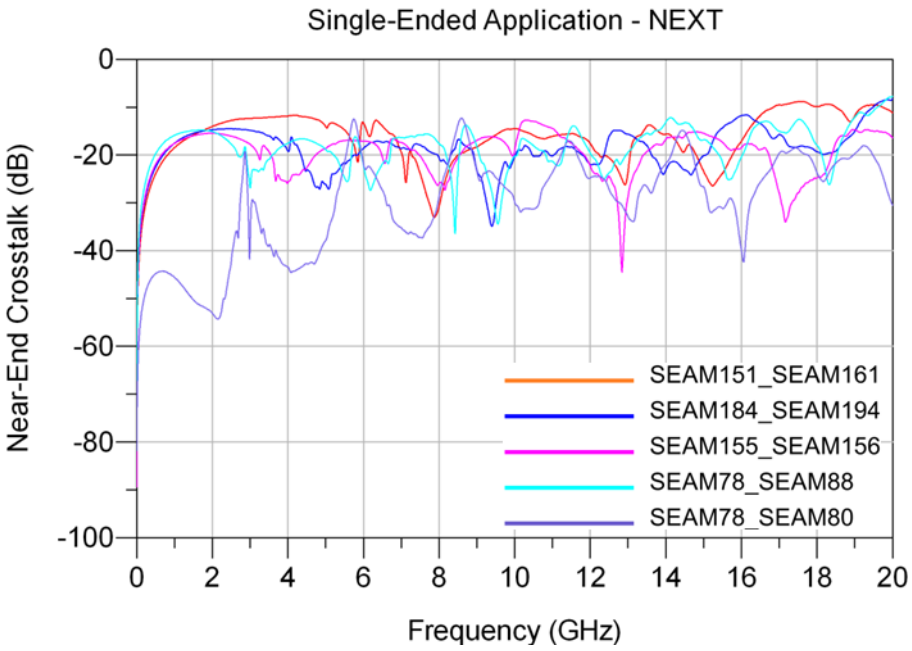


Single-Ended 2:1 S/G Pattern Application – Return Loss

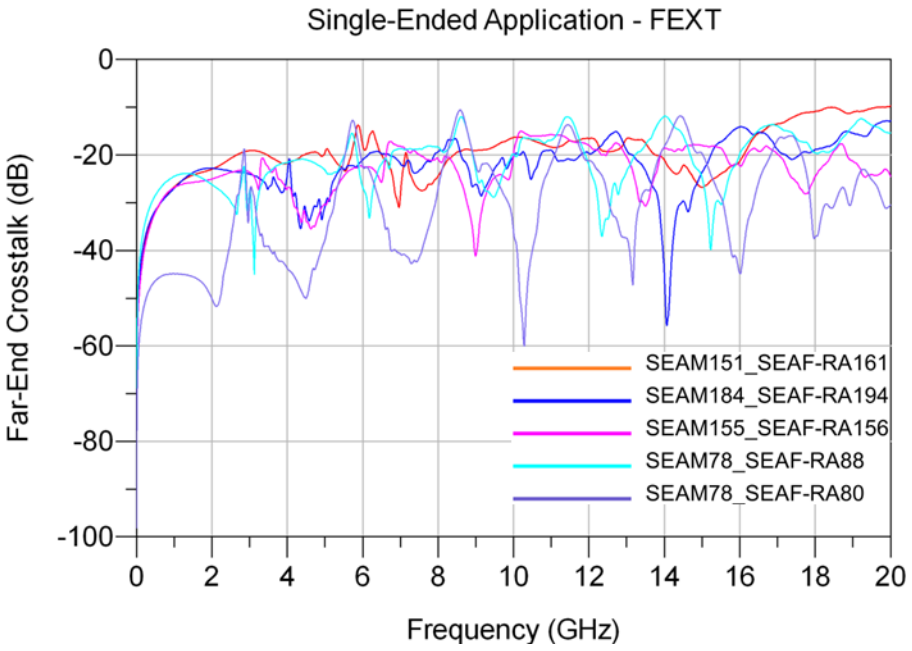


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

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

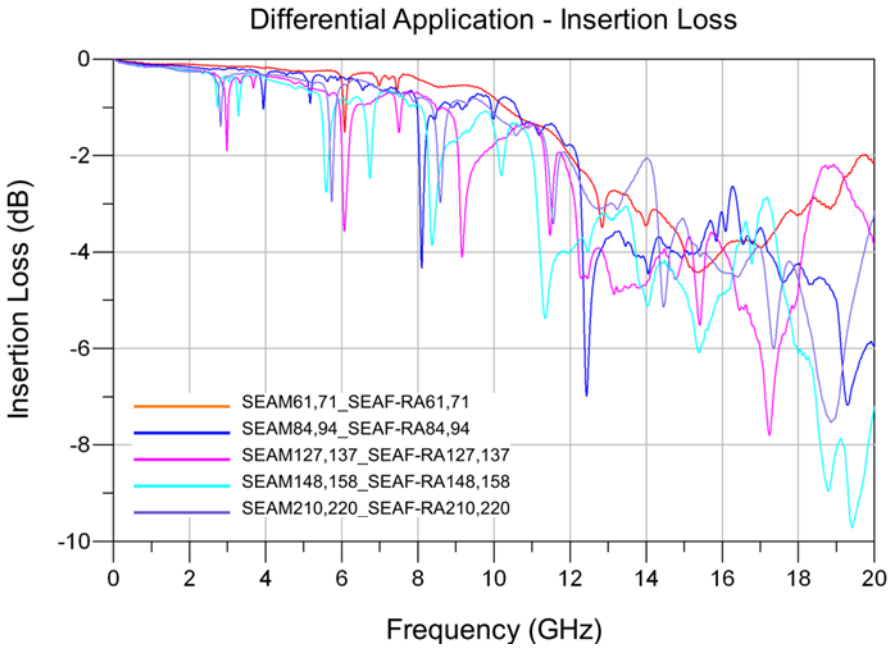


Single-Ended 2:1 S/G Pattern Application – FEXT

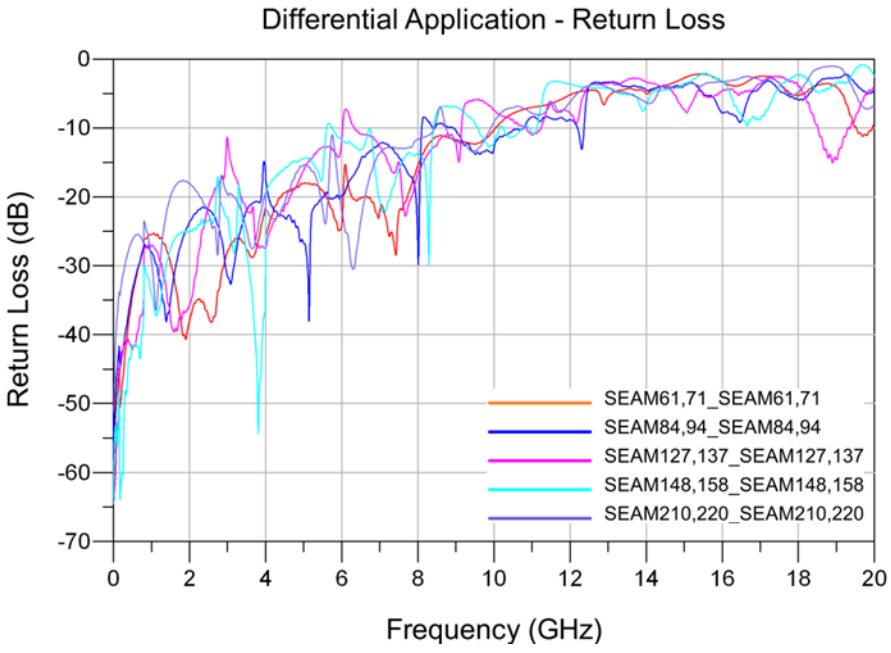


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Differential Optimal Horizontal Application – Insertion Loss

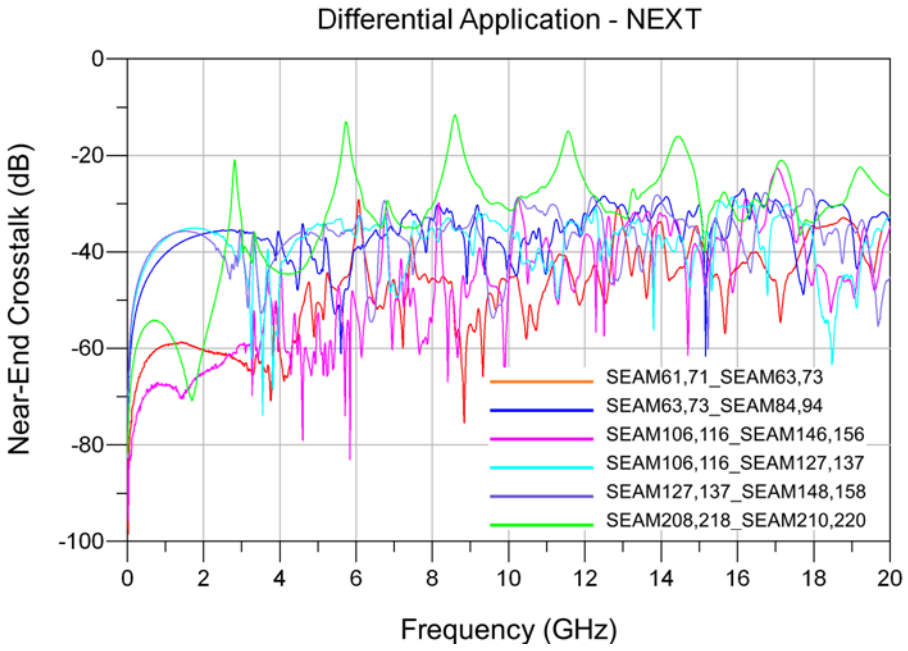


Differential Optimal Horizontal Application – Return Loss

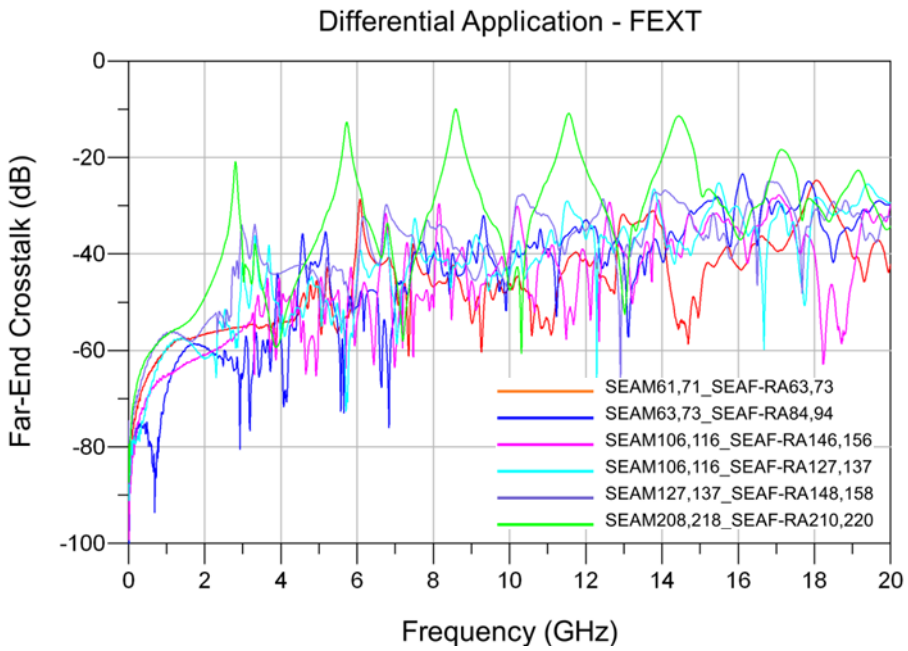


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Differential Optimal Horizontal Application – NEXT

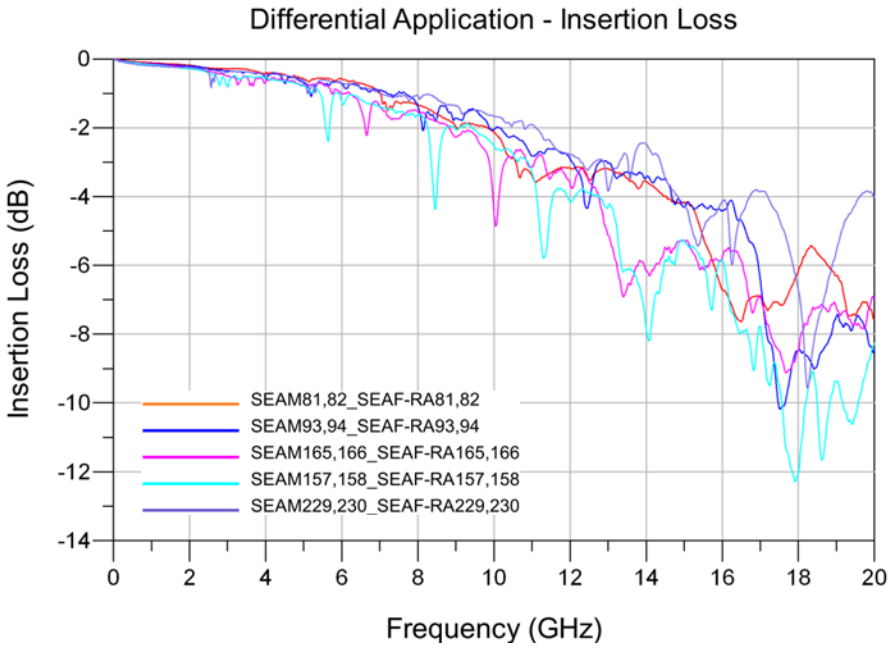


Differential Optimal Horizontal Application – FEXT

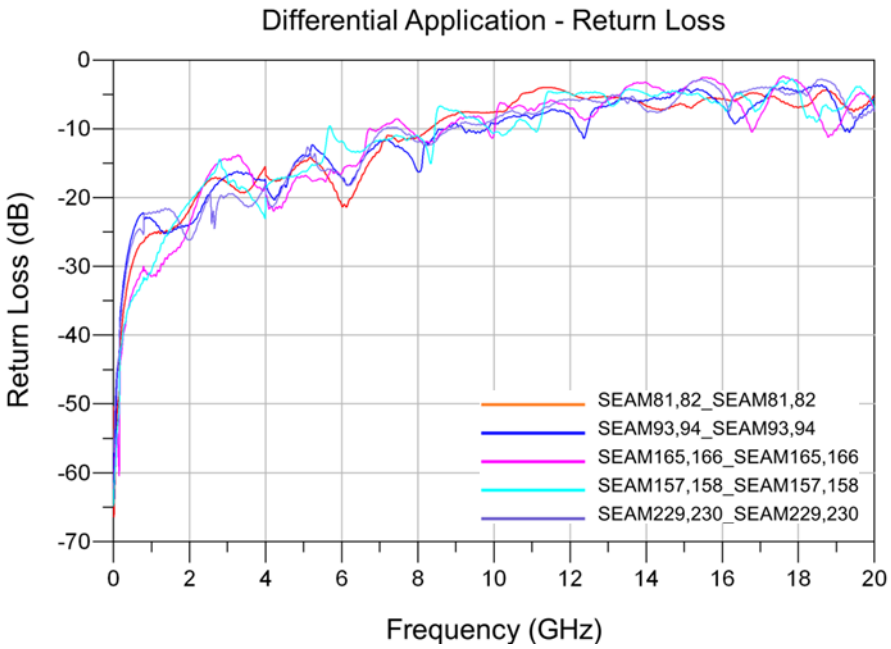


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Differential Optimal Vertical Application – Insertion Loss

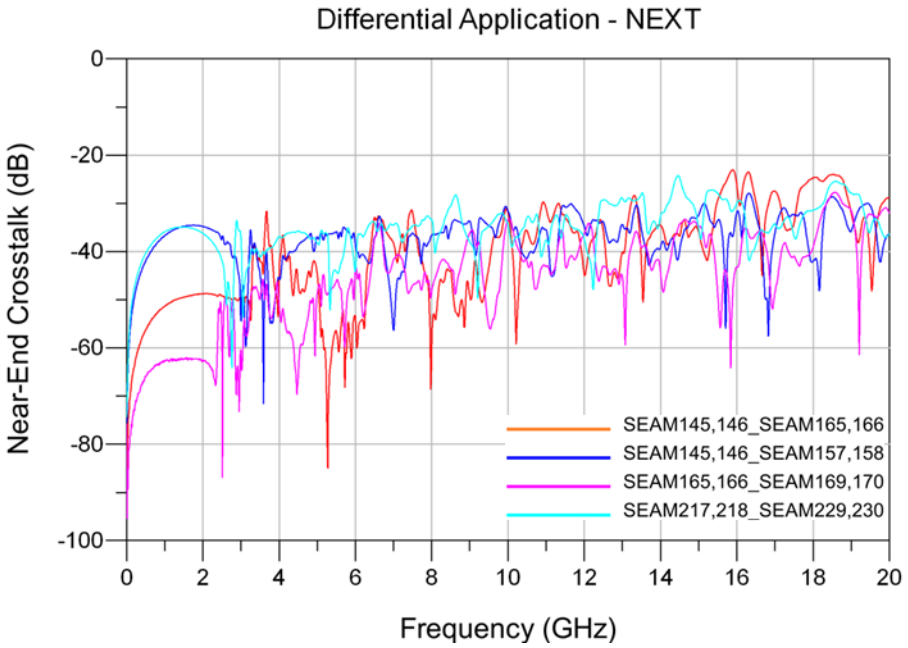


Differential Optimal Vertical Application – Return Loss

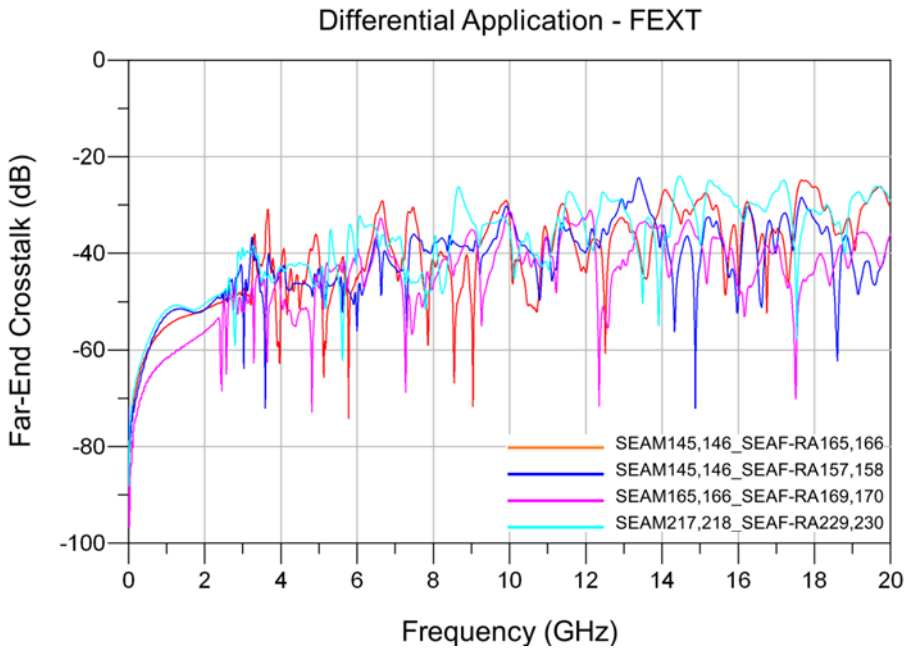


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Differential Optimal Vertical Application – NEXT

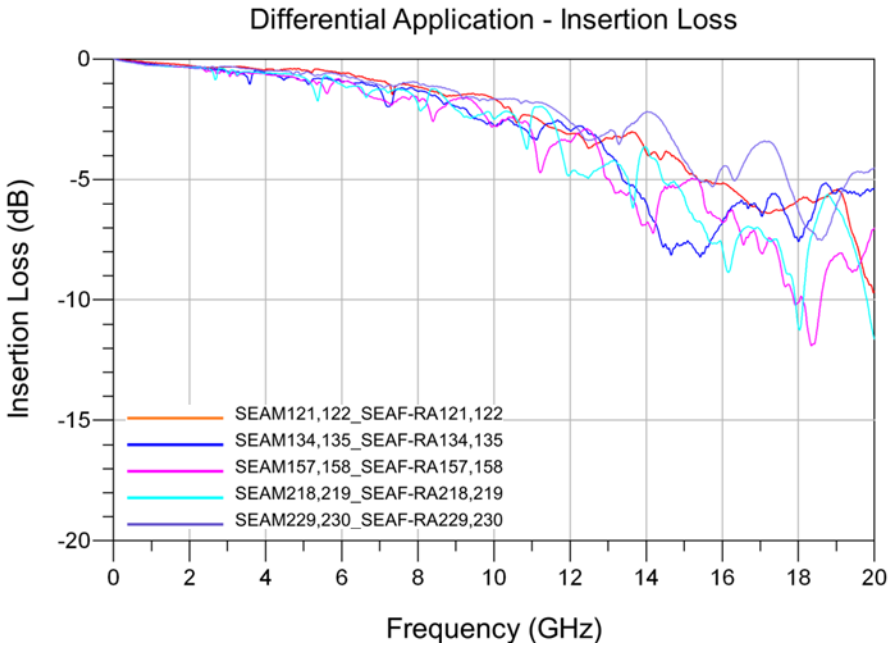


Differential Optimal Vertical Application – FEXT

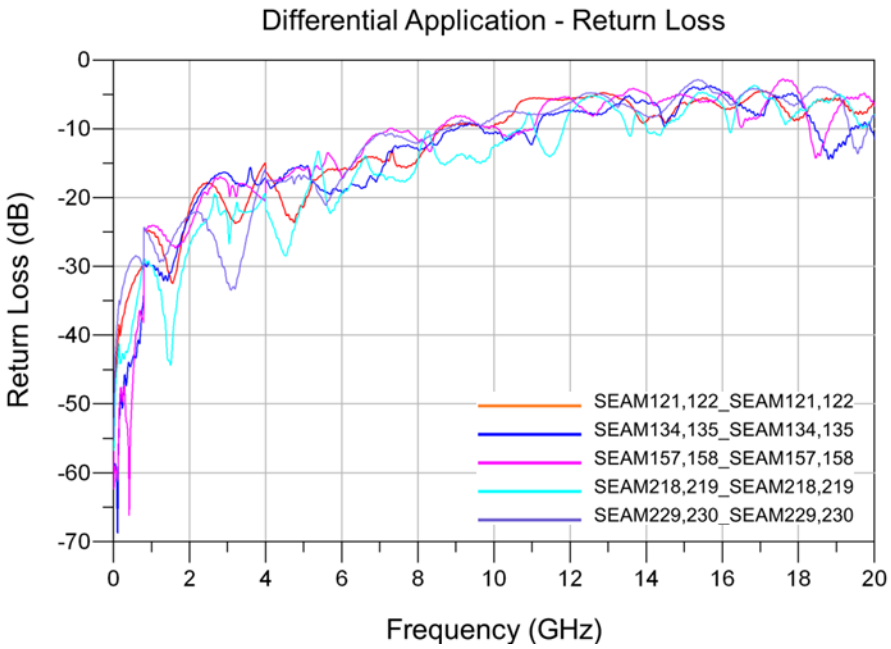


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Differential High Density Vertical Application – Insertion Loss

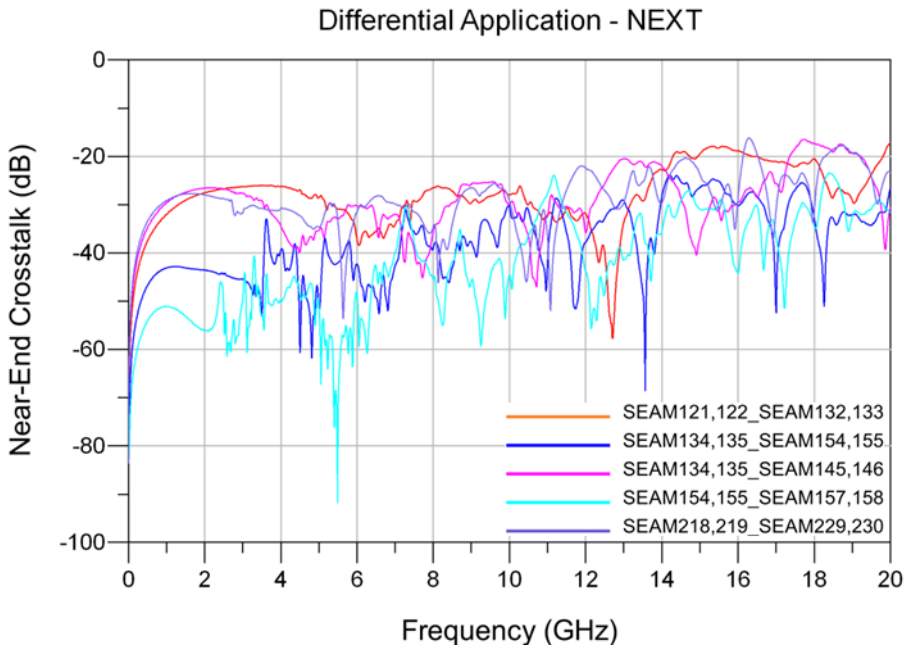


Differential High Density Vertical Application – Return Loss

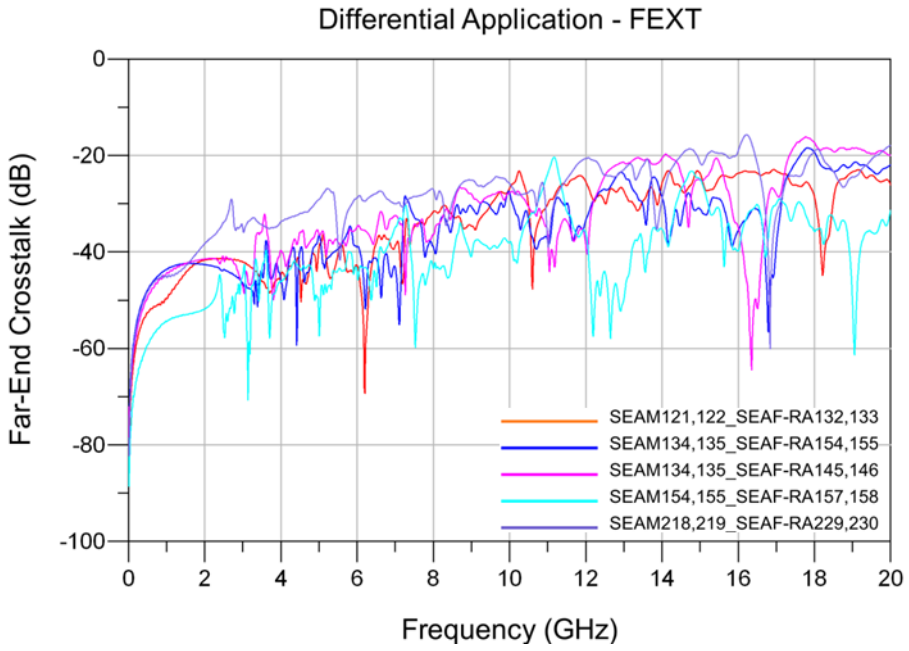


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Differential High Density Vertical Application – NEXT



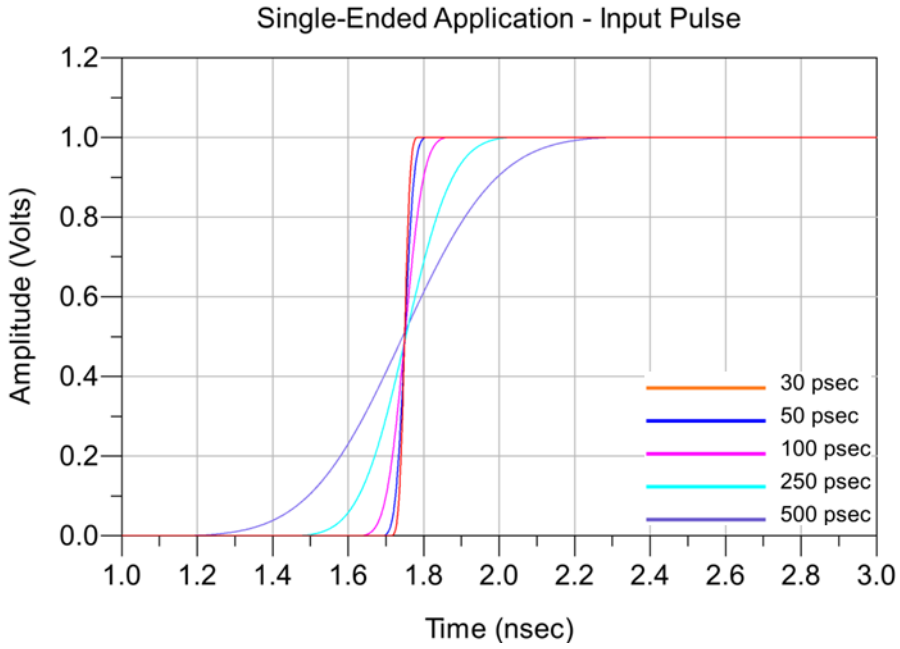
Differential High Density Vertical Application – FEXT



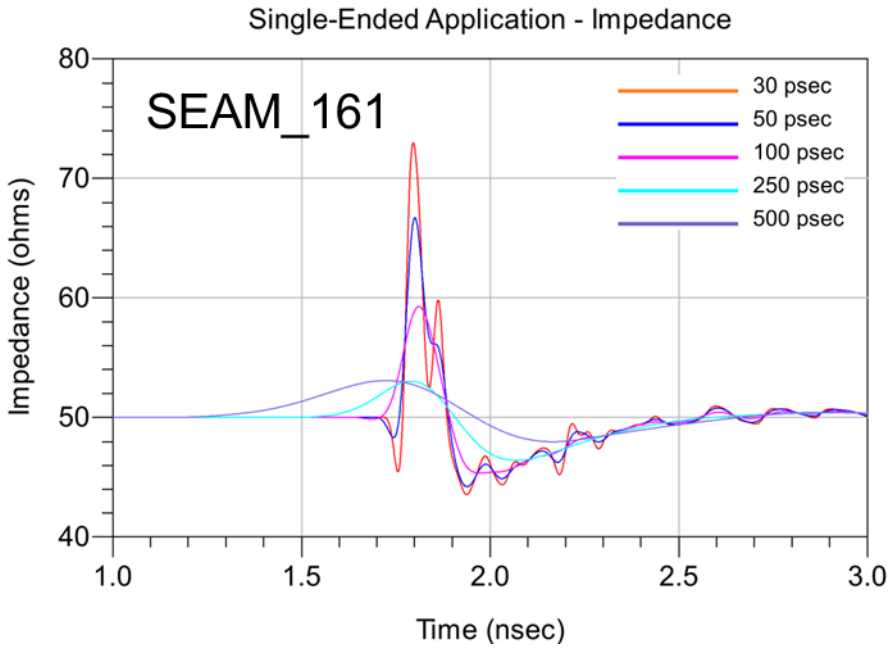
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Appendix B – Time Domain Response Graphs

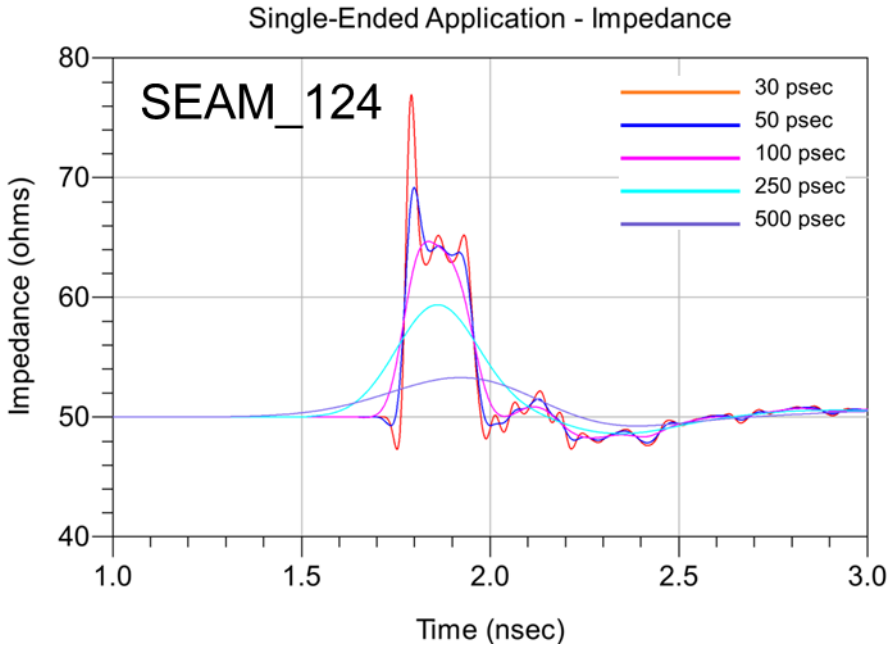
Single-Ended Application – Input Pulse

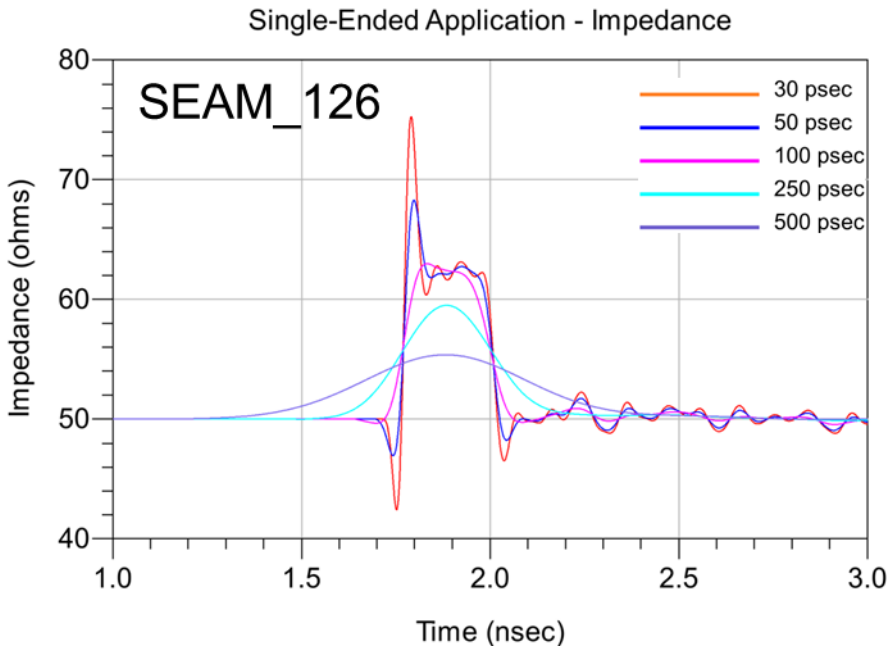


Single-Ended 1:1 S/G Pattern Application – Impedance

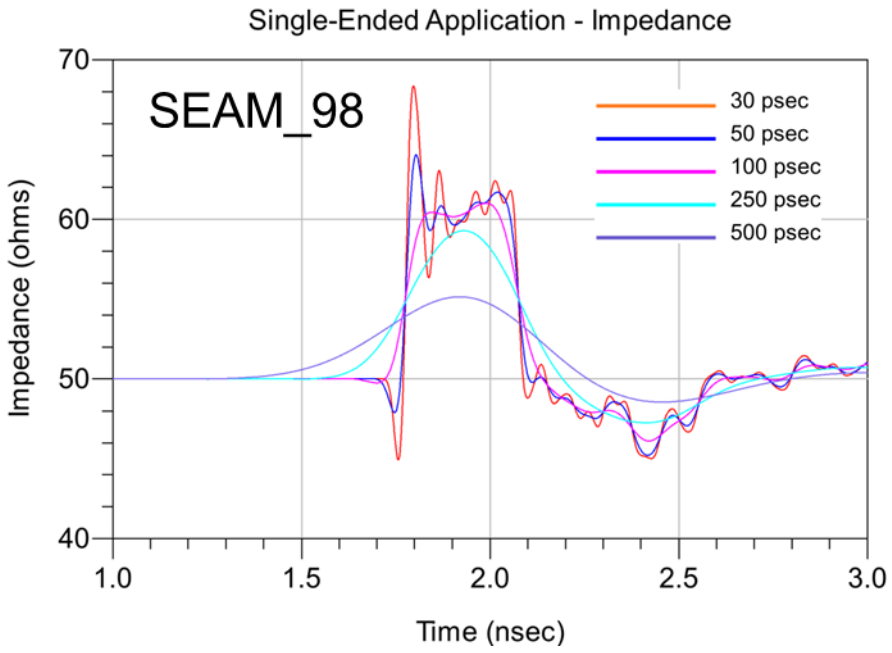


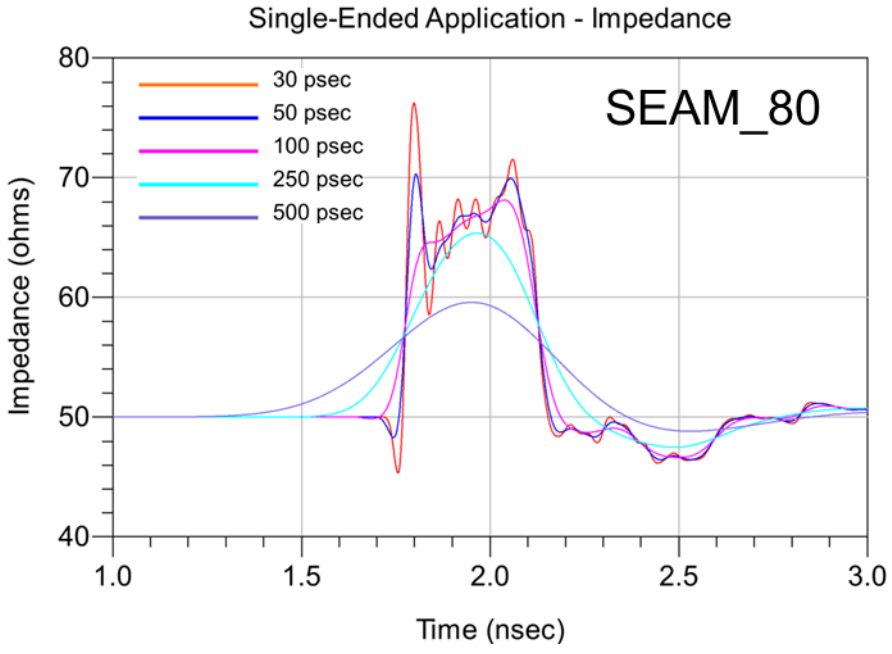
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle





Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle





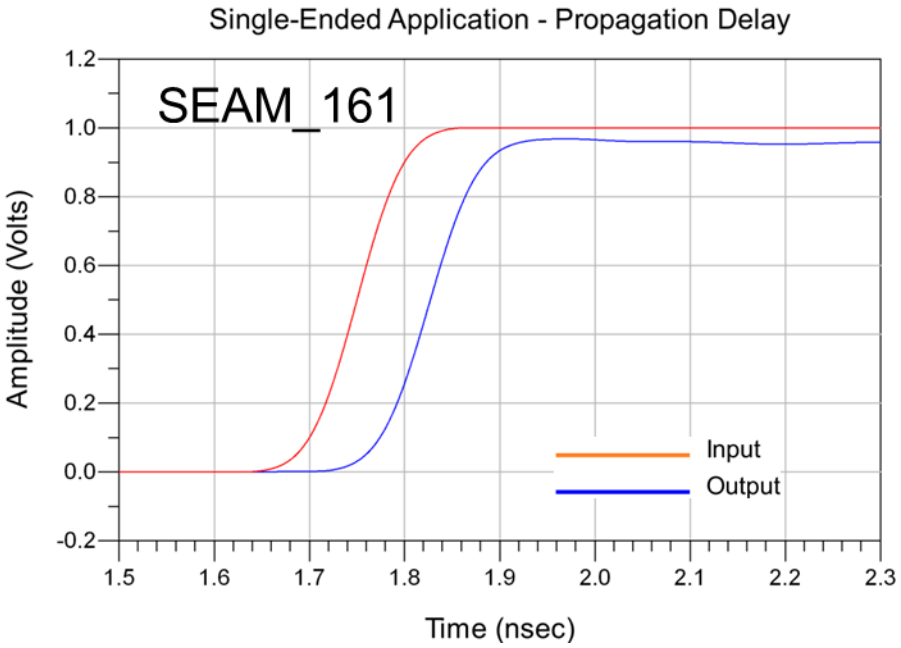
Samtec Inc.
520 Park East Blvd.
New Albany IN 47151-1147 USA

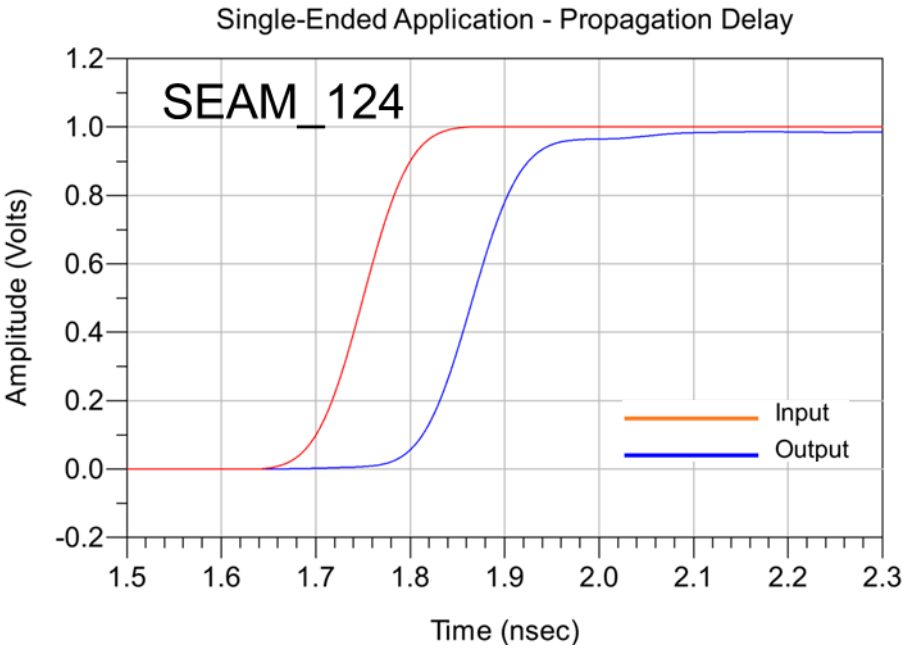
WWW.SAMTEC.COM
1-800-SAMTEC-9 (US & Canada)
SIG@samtec.com

Phone: 812-944-6733
Fax: 812-948-5047
Report Revision: 10/19/2021

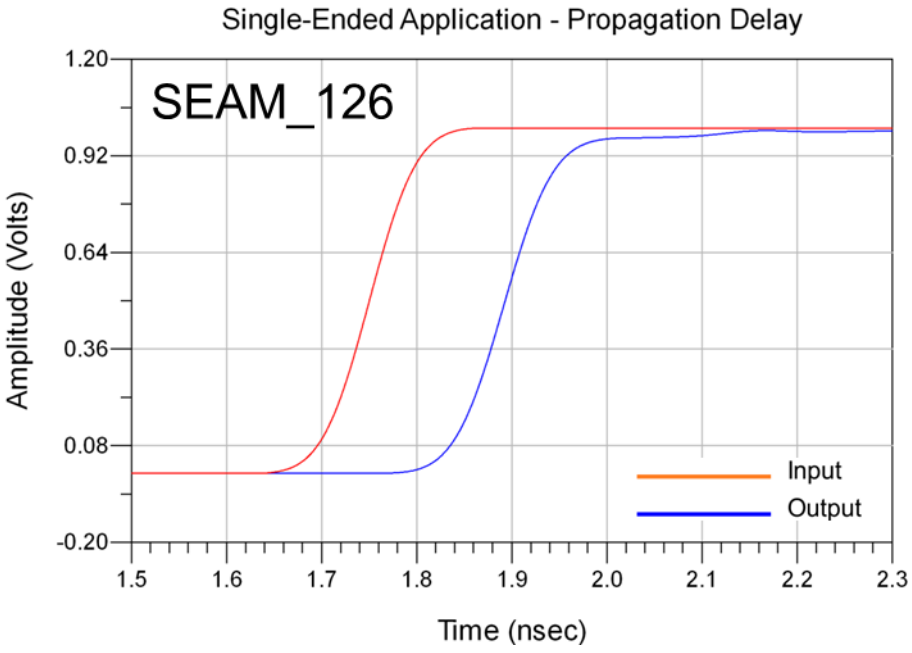
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

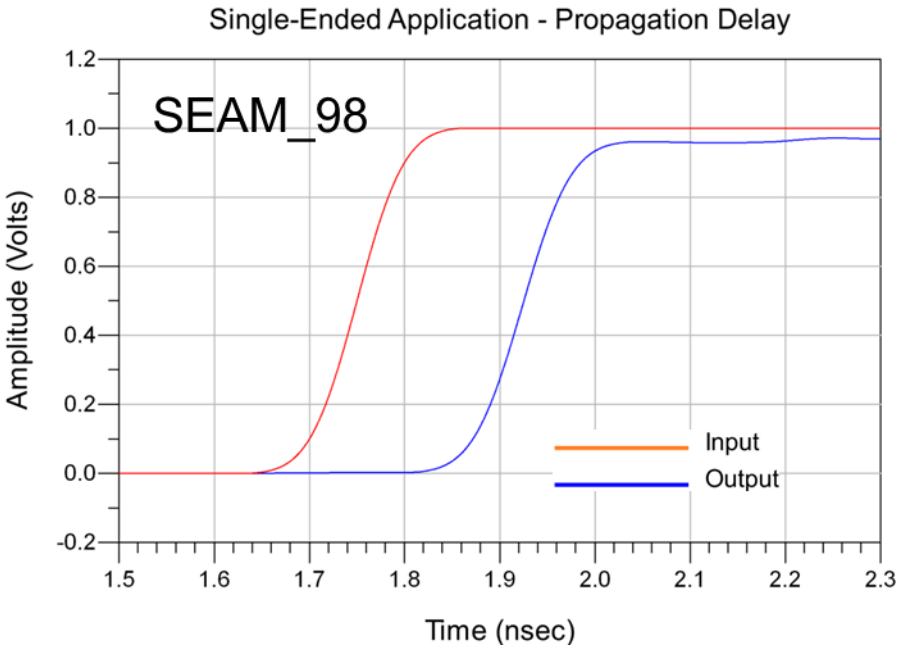
Single-Ended 1:1 S/G Pattern Application – Propagation Delay



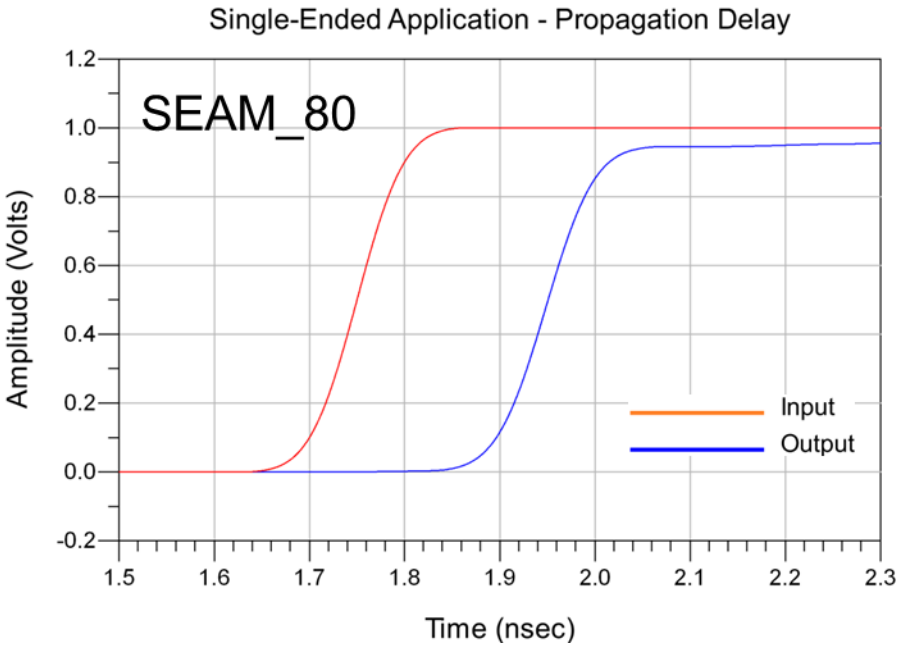


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle



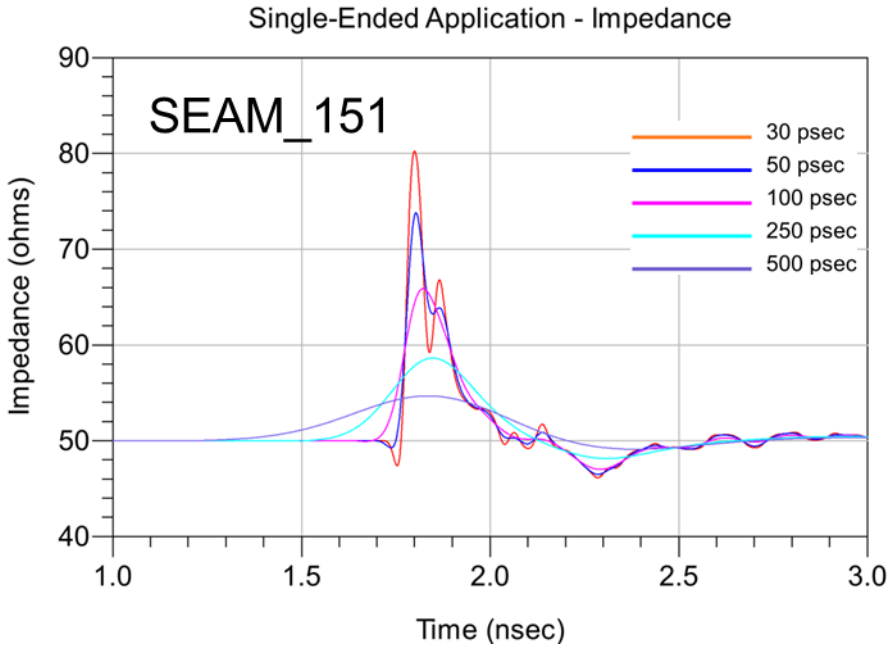


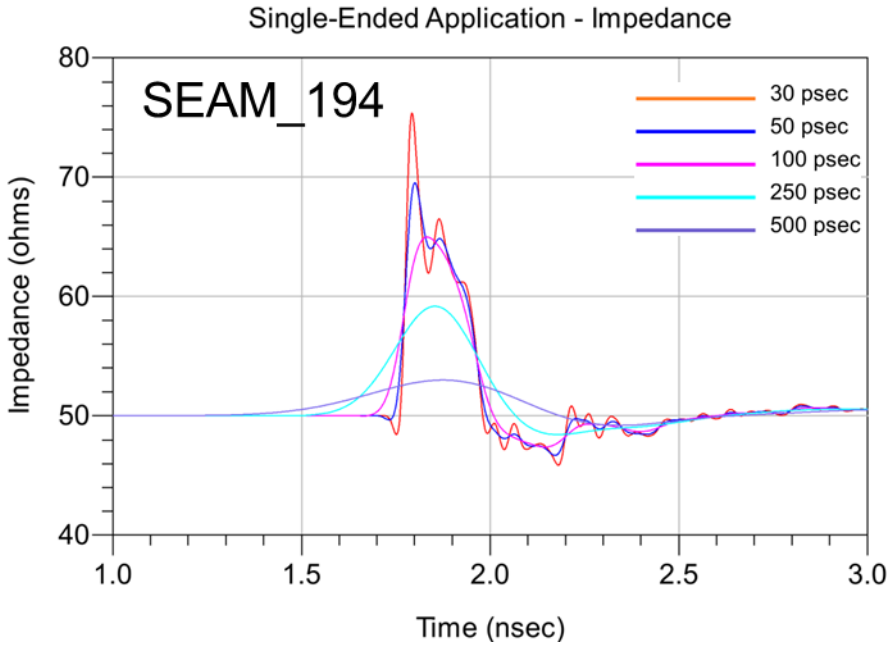
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle



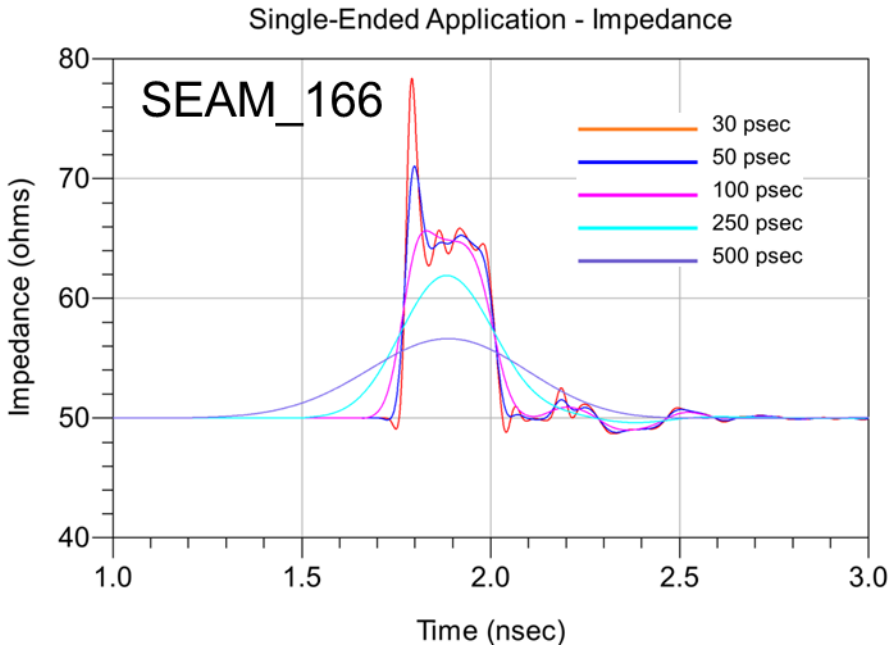
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

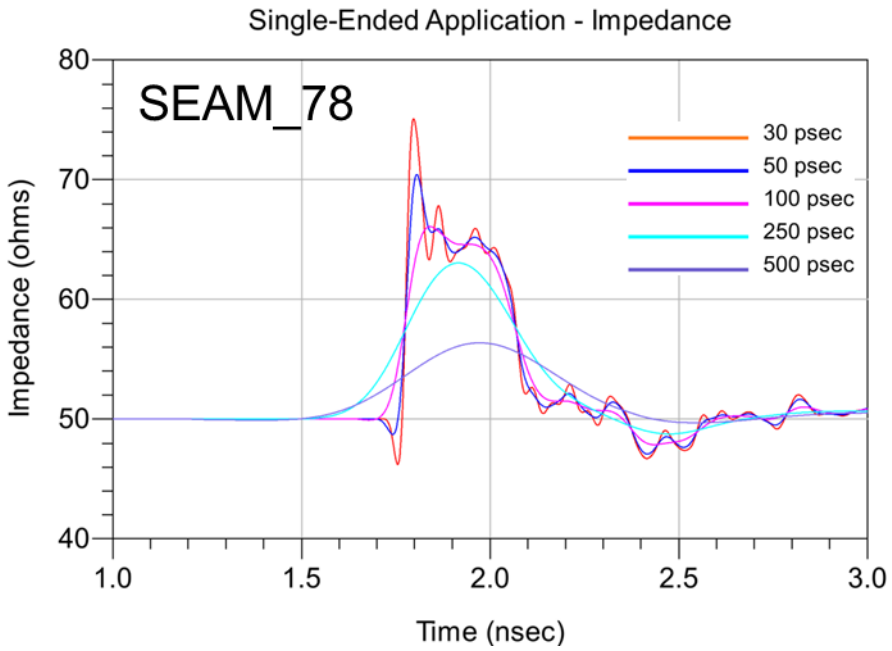
Single-Ended 2:1 S/G Pattern Application – Impedance



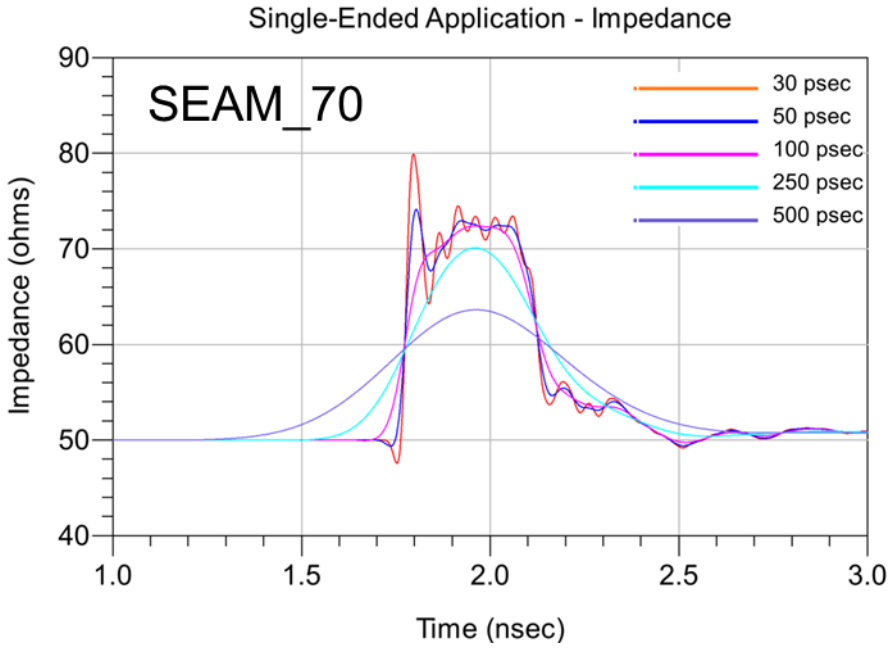


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle



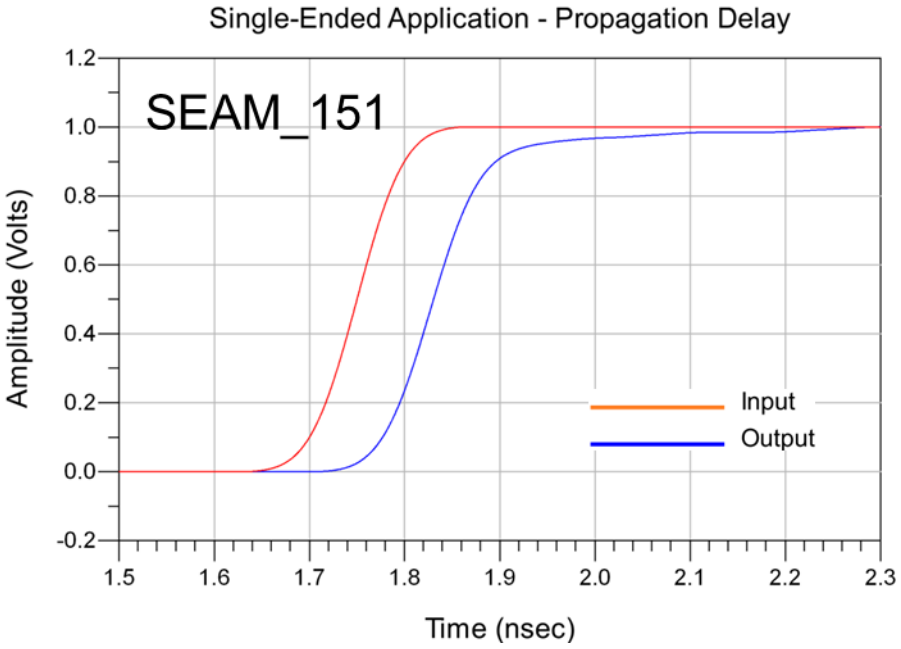


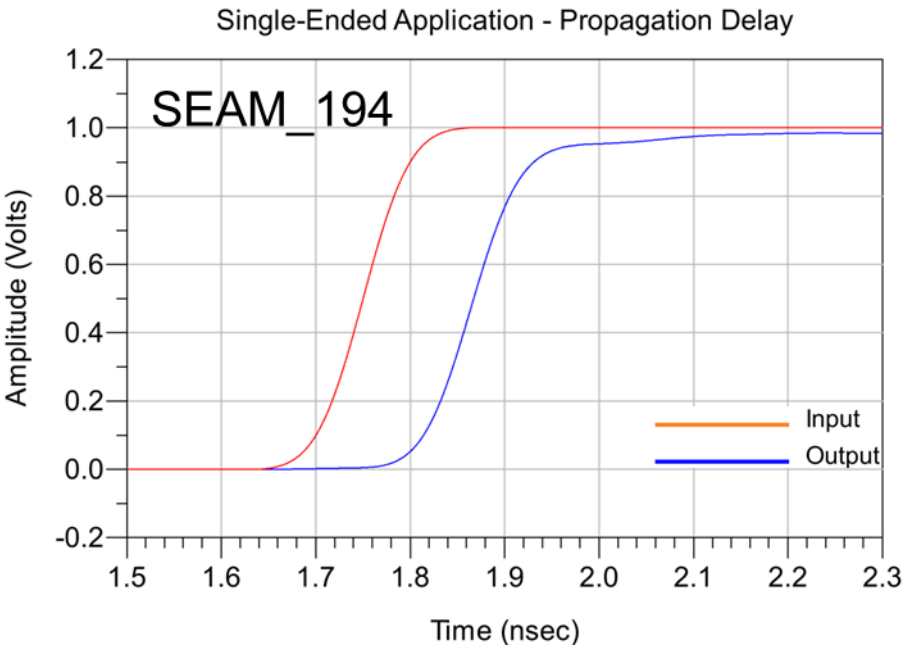
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle



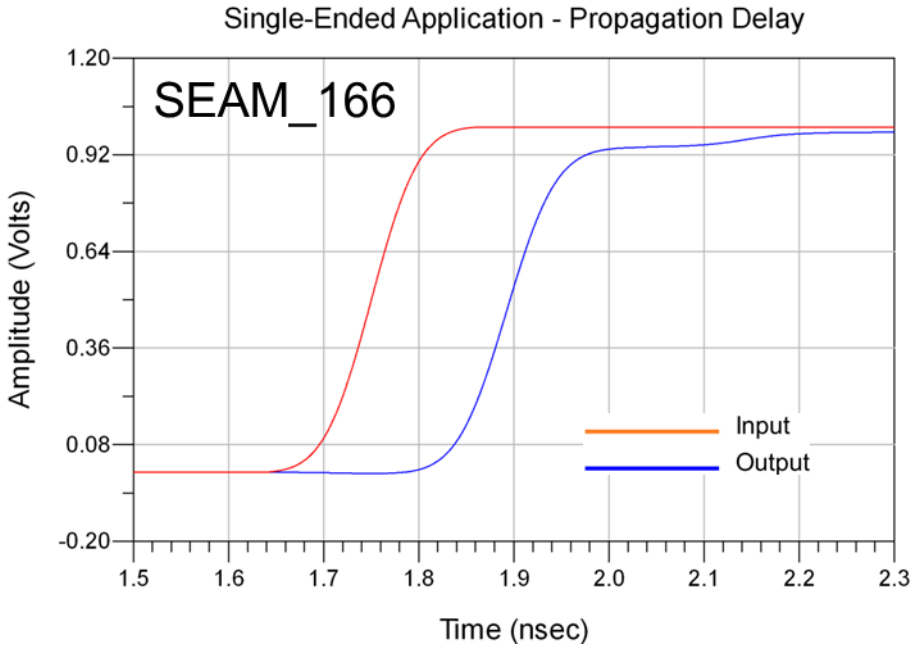
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

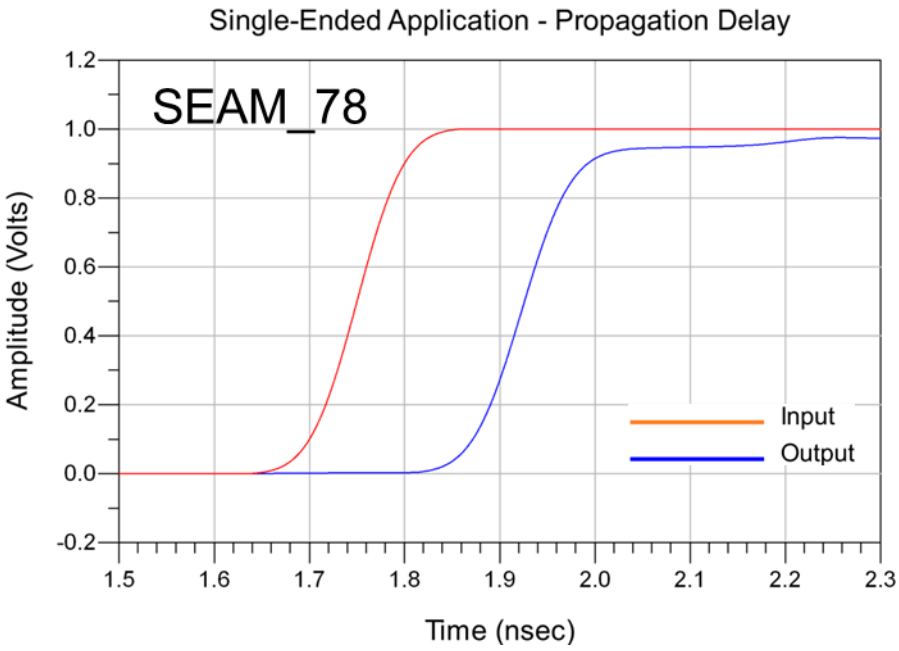
Single-Ended 2:1 S/G Pattern Application – Propagation Delay



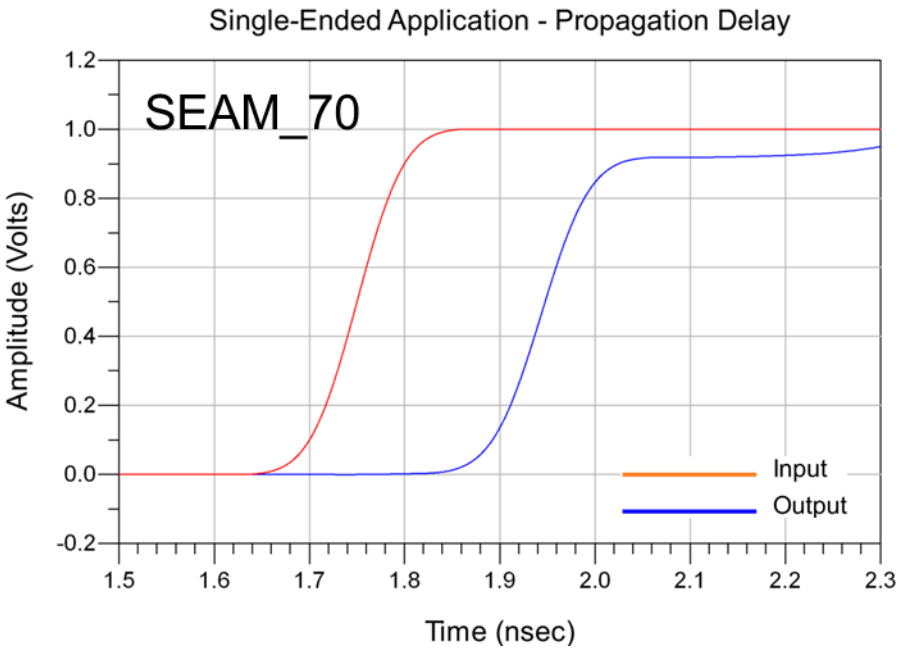


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle



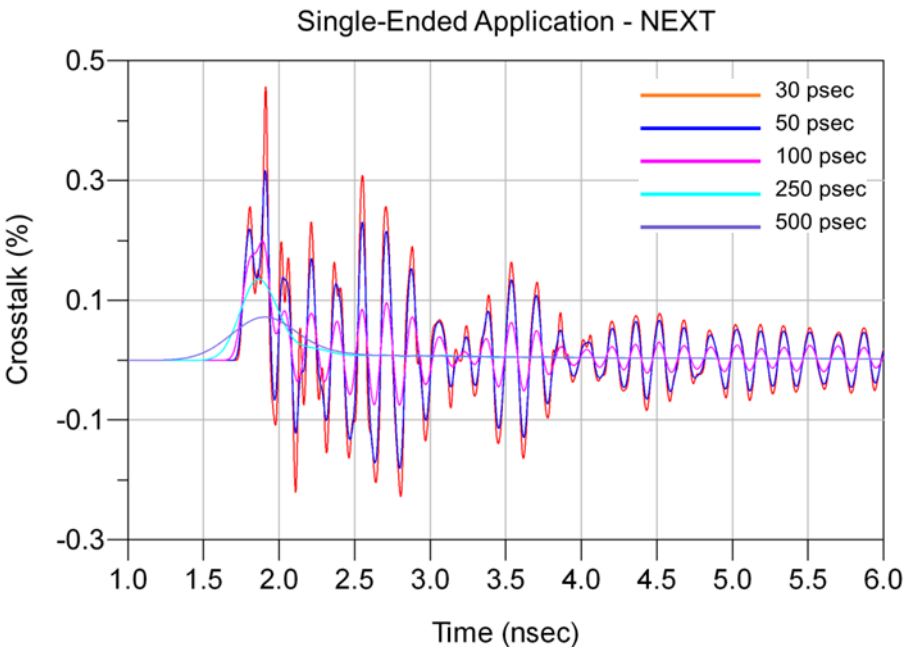


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

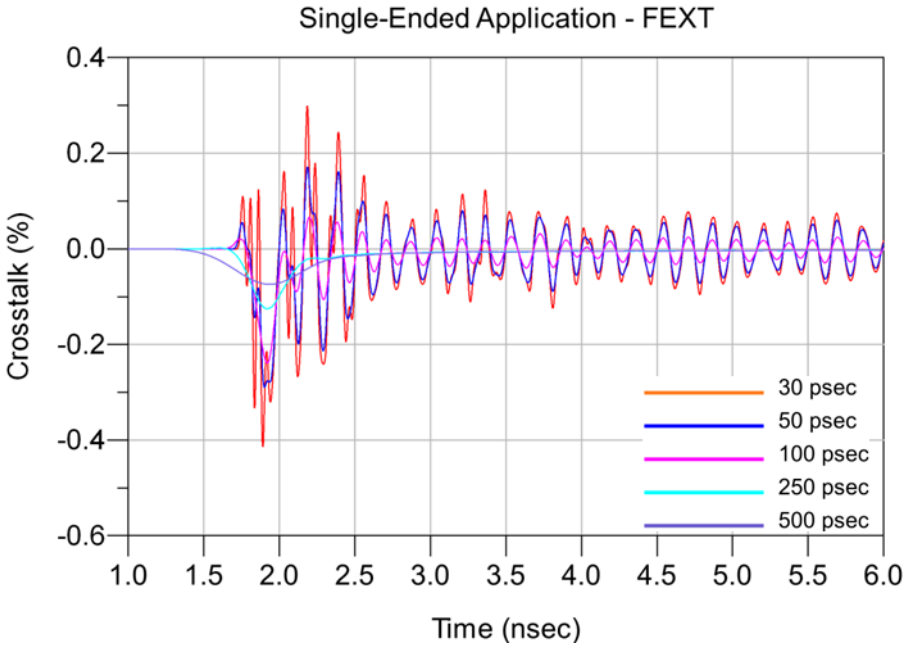


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Single-Ended 1:1 S/G Pattern Application – NEXT, SEAM_161_SEAM_163

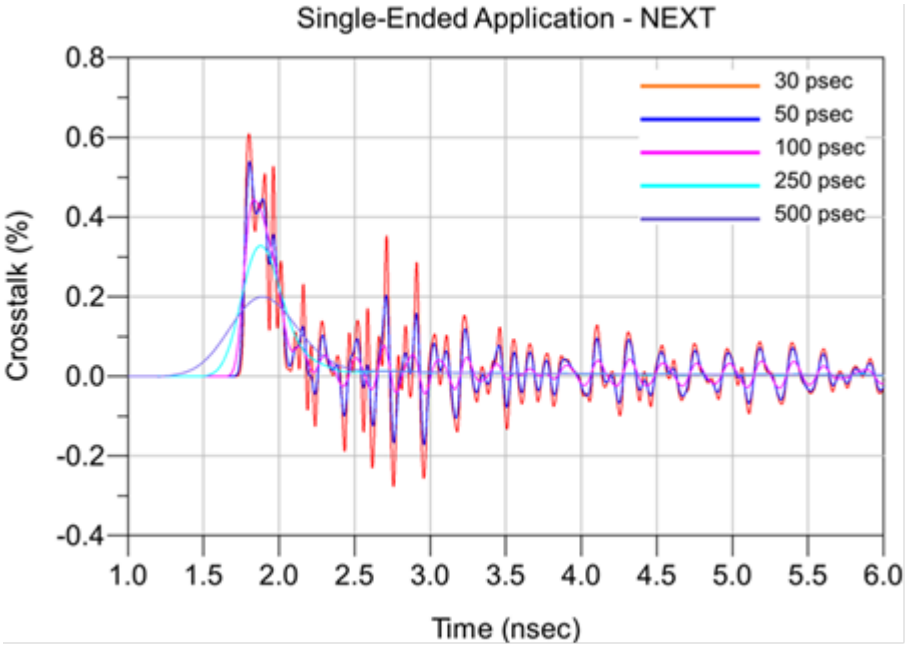


Single-Ended 1:1 S/G Pattern Application – FEXT, SEAM_161_SEAF-RA_163

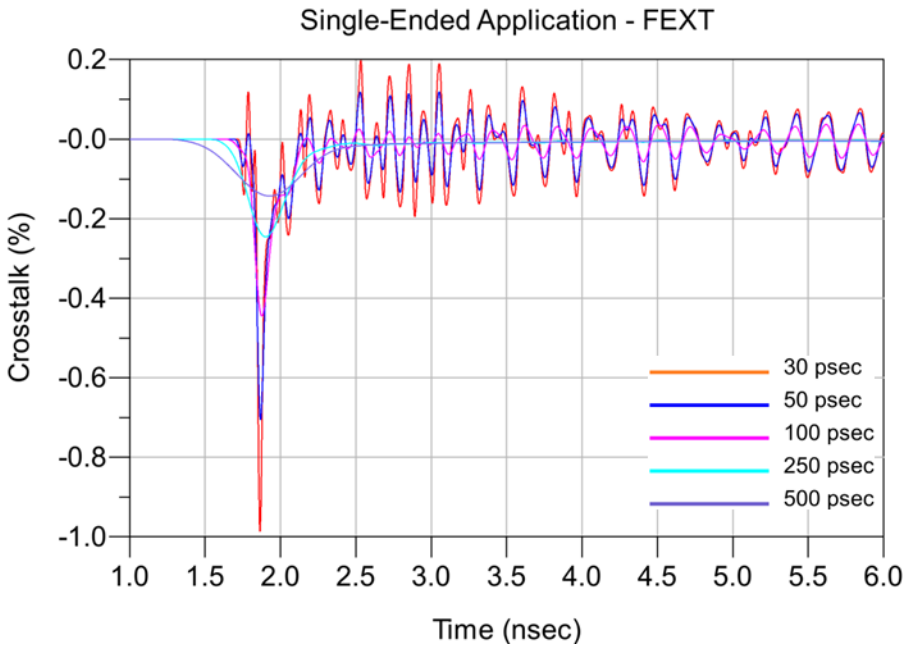


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Single-Ended 1:1 S/G Pattern Application – NEXT, SEAM_163_SEAM_183

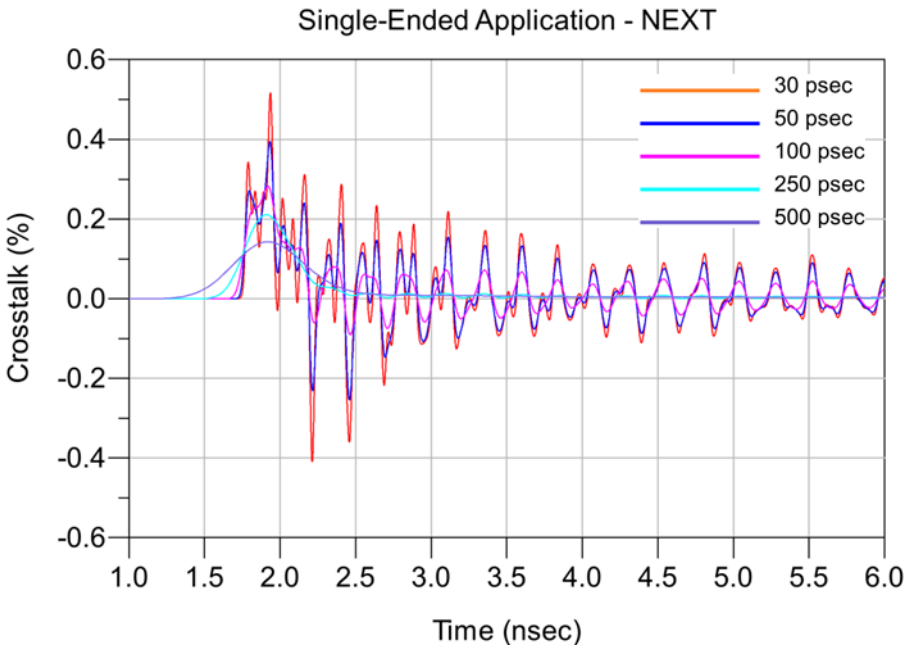


Single-Ended 1:1 S/G Pattern Application – FEXT, SEAM_163_SEAF-RA_183

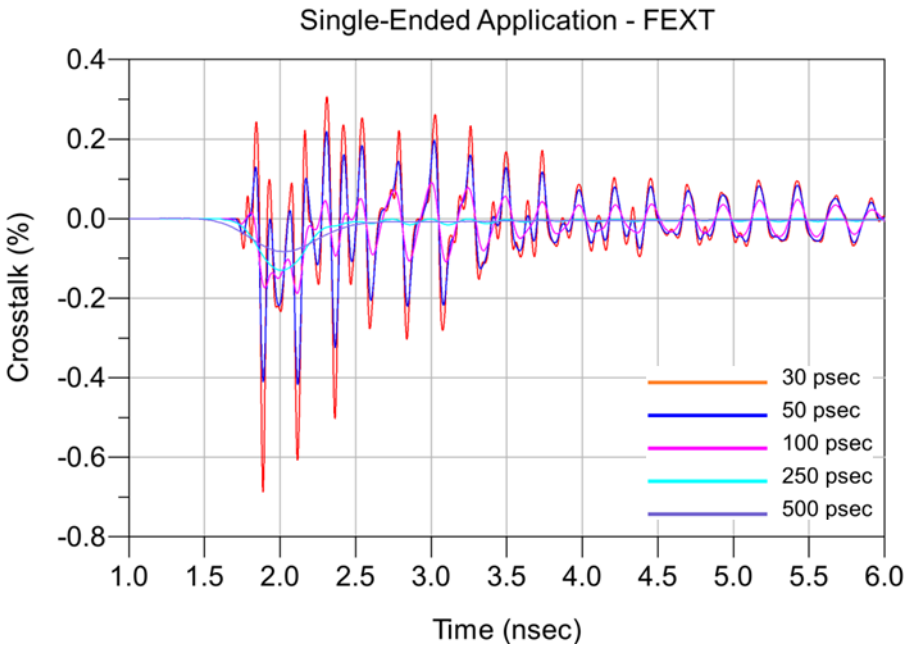


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Single-Ended 1:1 S/G Pattern Application – NEXT, SEAM_124_SEAM_126

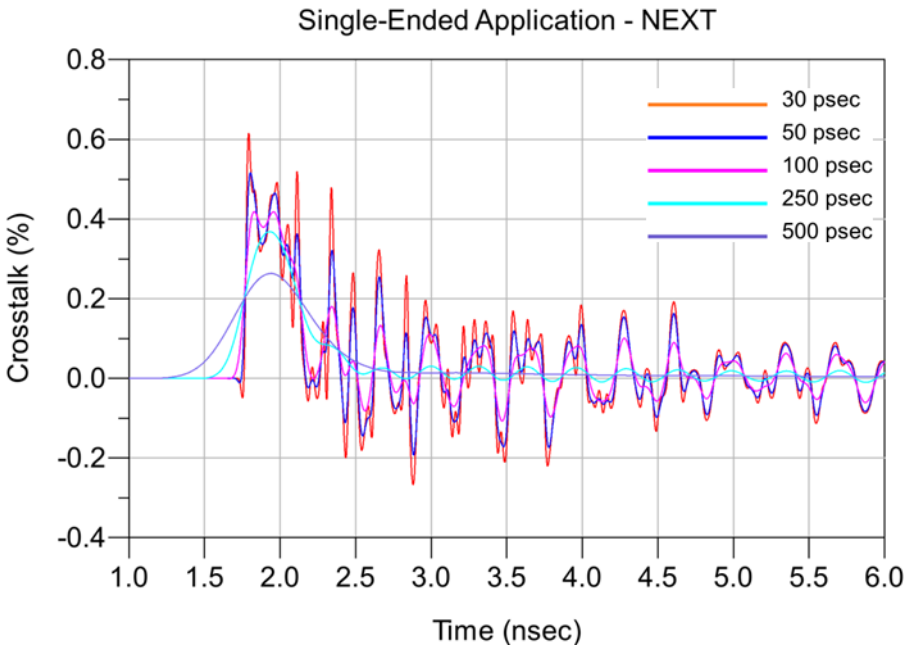


Single-Ended 1:1 S/G Pattern Application – FEXT, SEAM_124_SEAF-RA_126

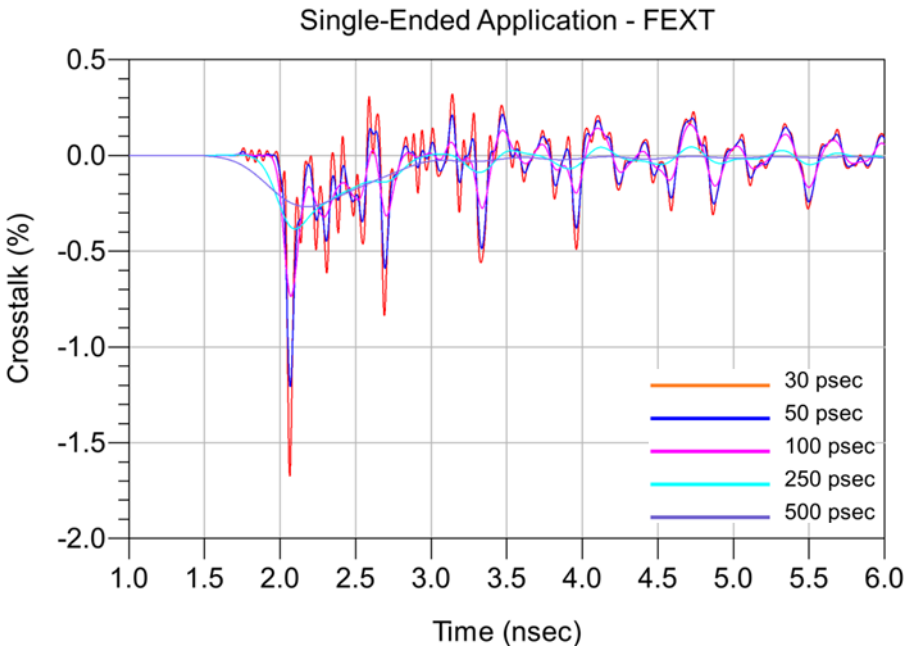


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Single-Ended 1:1 S/G Pattern Application – NEXT, SEAM_78_SEAM_98

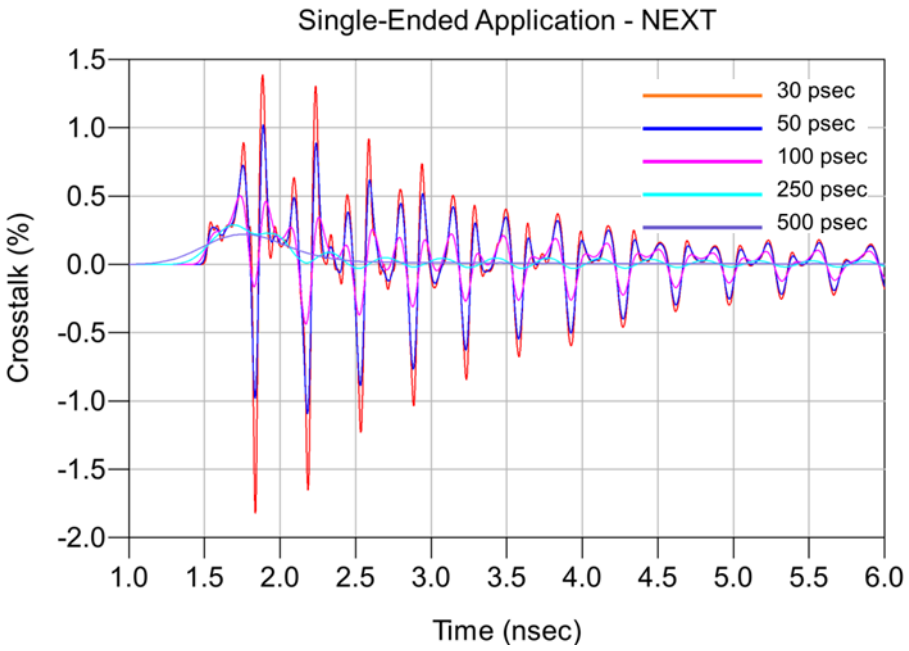


Single-Ended 1:1 S/G Pattern Application – FEXT, SEAM_78_SEAF-RA_98

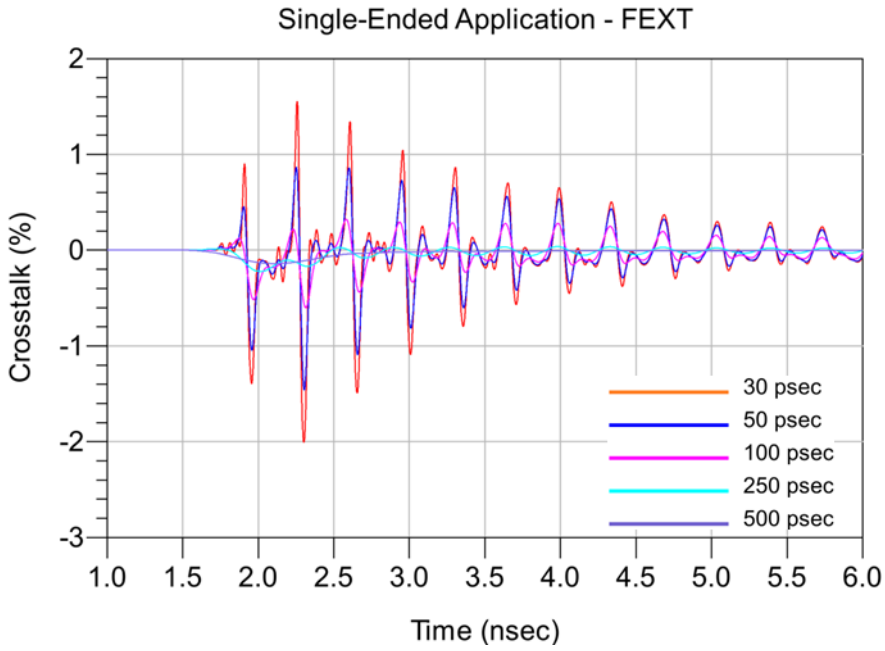


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Single-Ended 1:1 S/G Pattern Application – NEXT, SEAM_78_SEAM_80

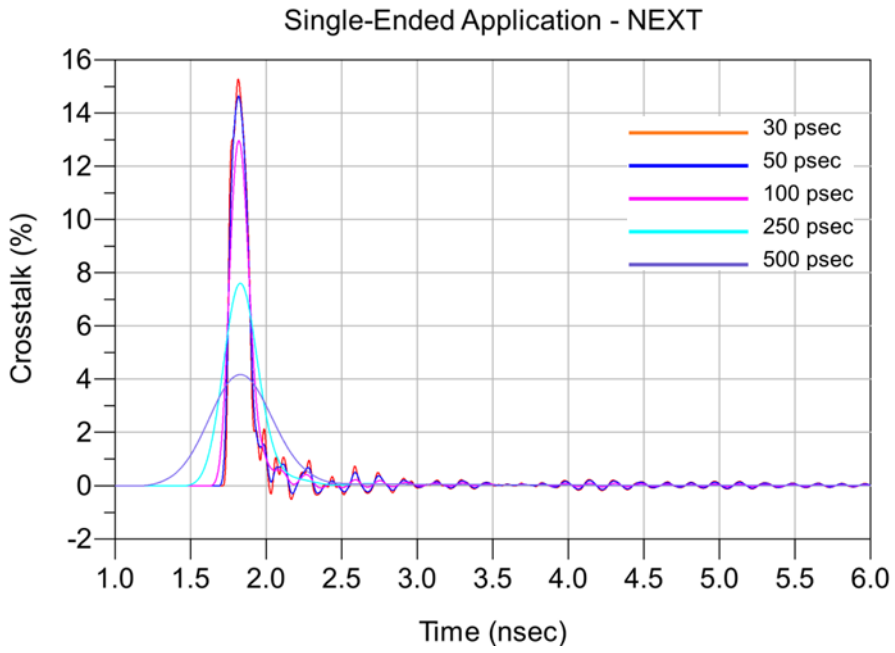


Single-Ended 1:1 S/G Pattern Application – FEXT, SEAM_78_SEAF-RA_80

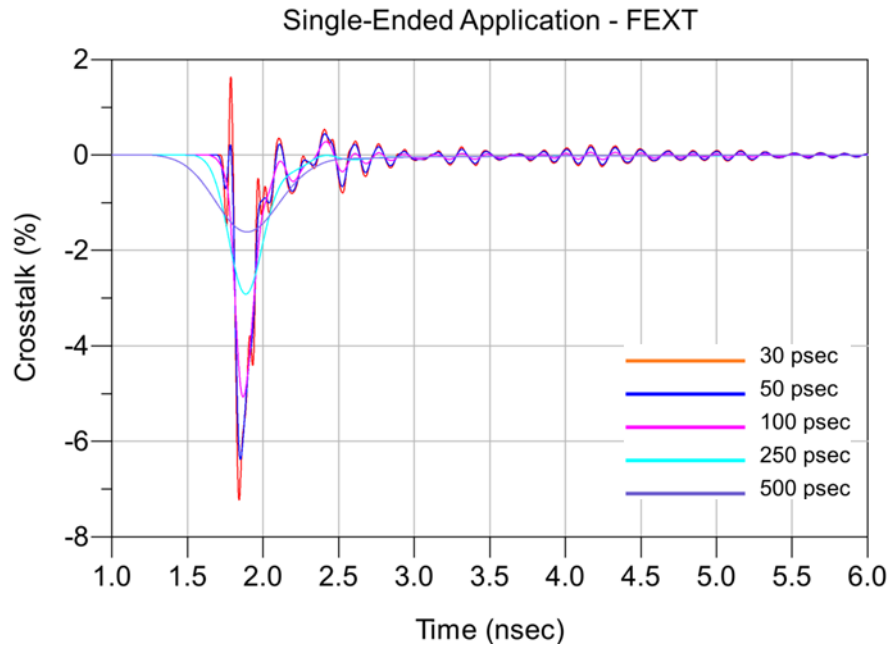


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Single-Ended 2:1 S/G Pattern Application – NEXT, SEAM_151_SEAM_161

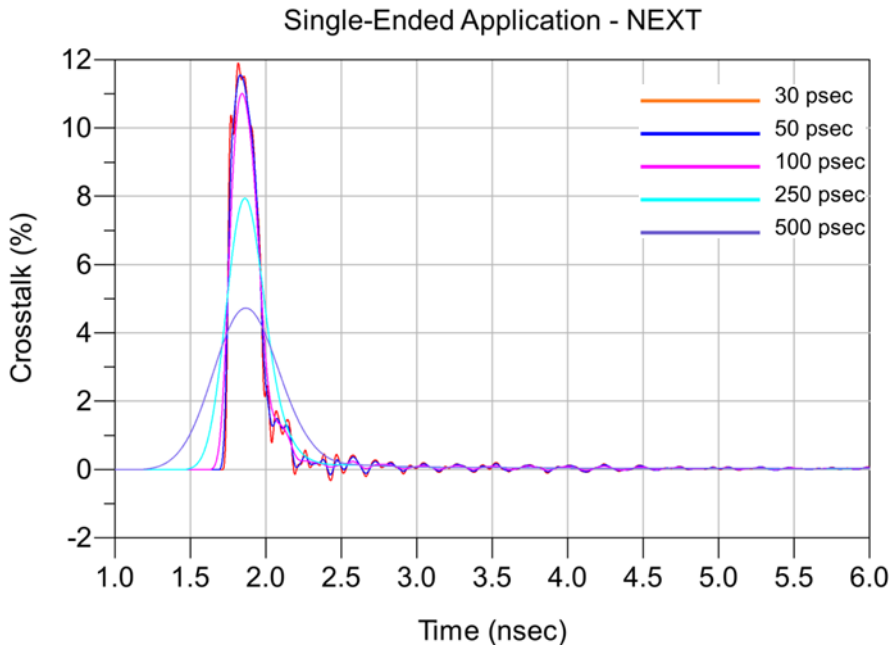


Single-Ended 2:1 S/G Pattern Application – FEXT, SEAM_151_SEAF-RA_161

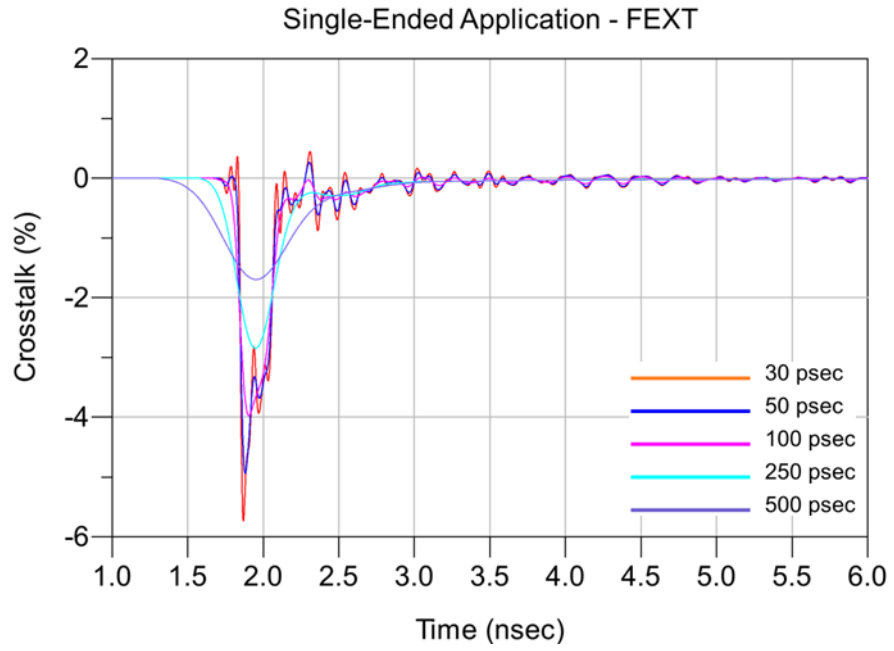


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Single-Ended 2:1 S/G Pattern Application – NEXT, SEAM_184_SEAM_194

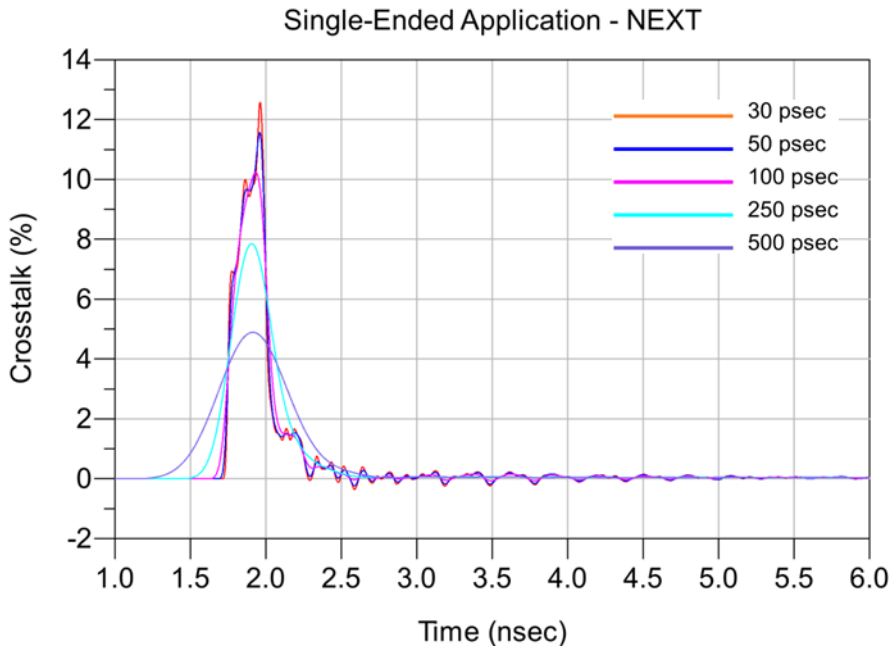


Single-Ended 2:1 S/G Pattern Application – FEXT, SEAM_184_SEAF-RA_194

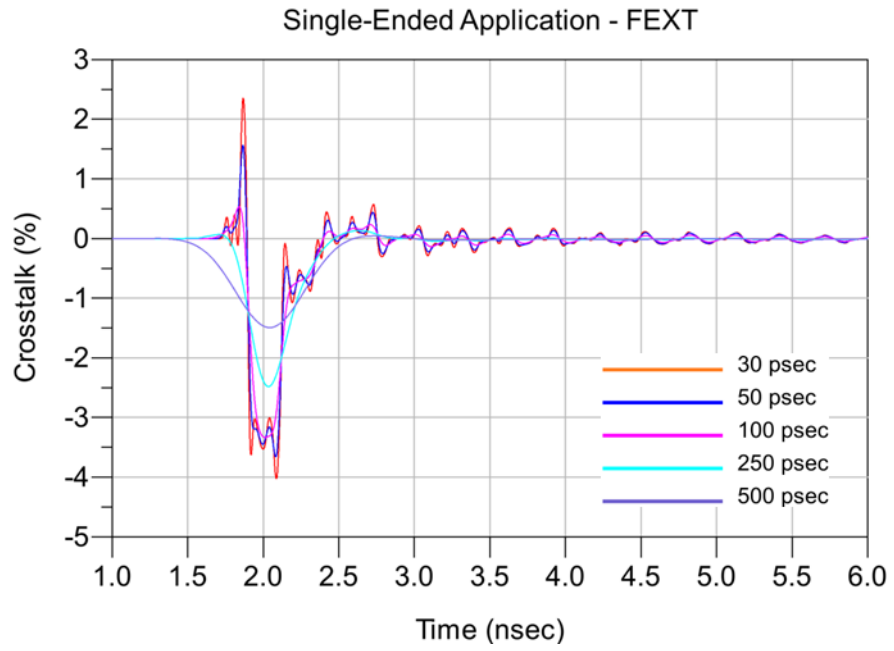


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Single-Ended 2:1 S/G Pattern Application – NEXT, SEAM_155_SEAM_156

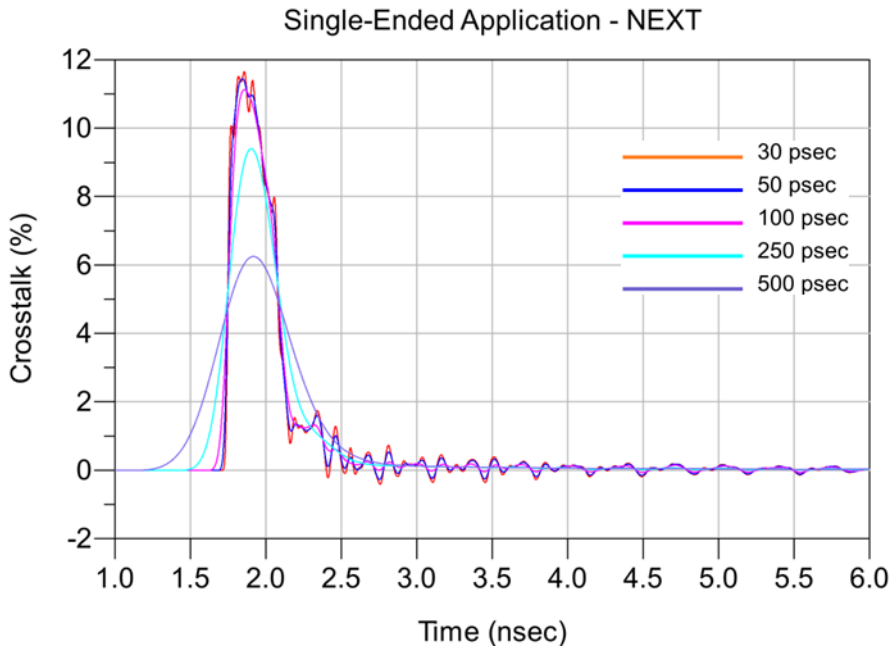


Single-Ended 2:1 S/G Pattern Application – FEXT, SEAM_155_SEAF-RA_156

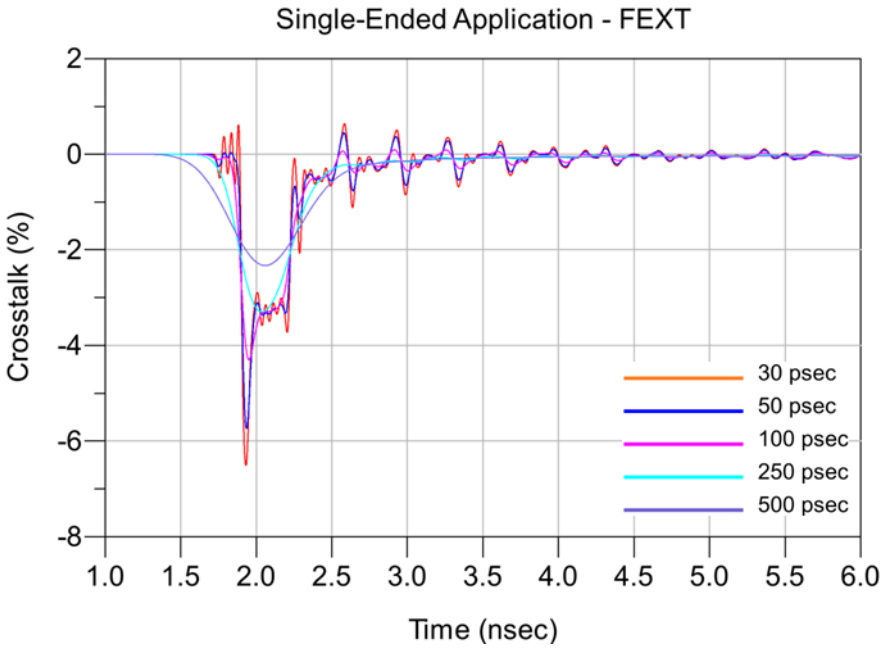


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Single-Ended 2:1 S/G Pattern Application – NEXT, SEAM_78_SEAM_88

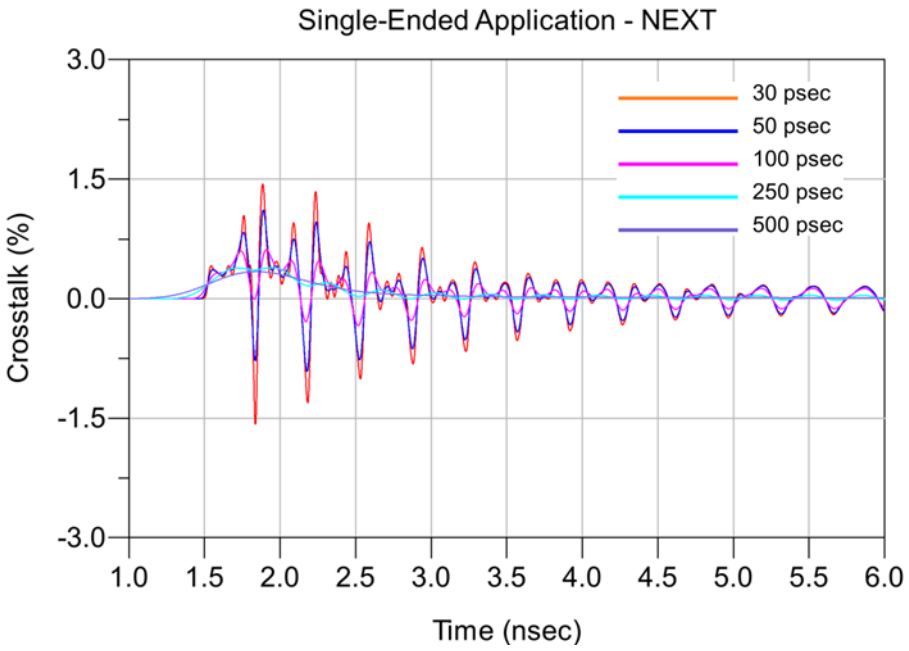


Single-Ended 2:1 S/G Pattern Application – FEXT, SEAM_78_SEAF-RA_88

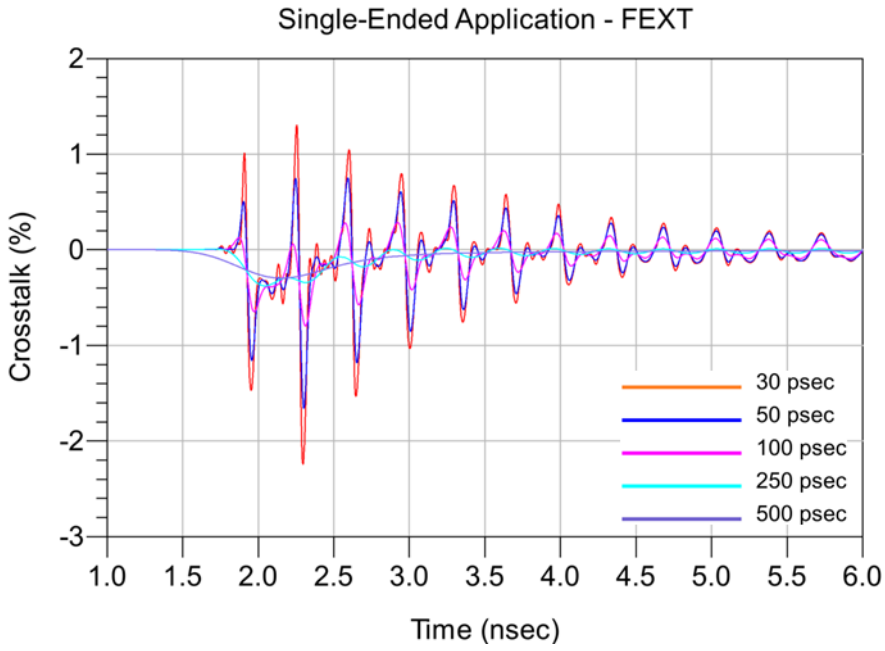


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Single-Ended 2:1 S/G Pattern Application – NEXT, SEAM_78_SEAM_80

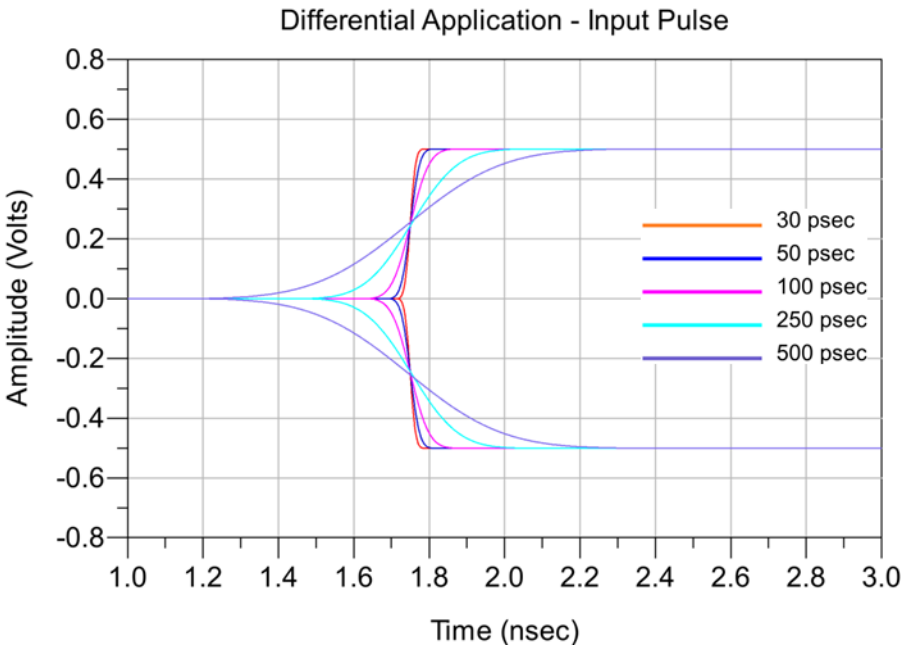


Single-Ended 2:1 S/G Pattern Application – FEXT, SEAM_78_SEAF-RA_80

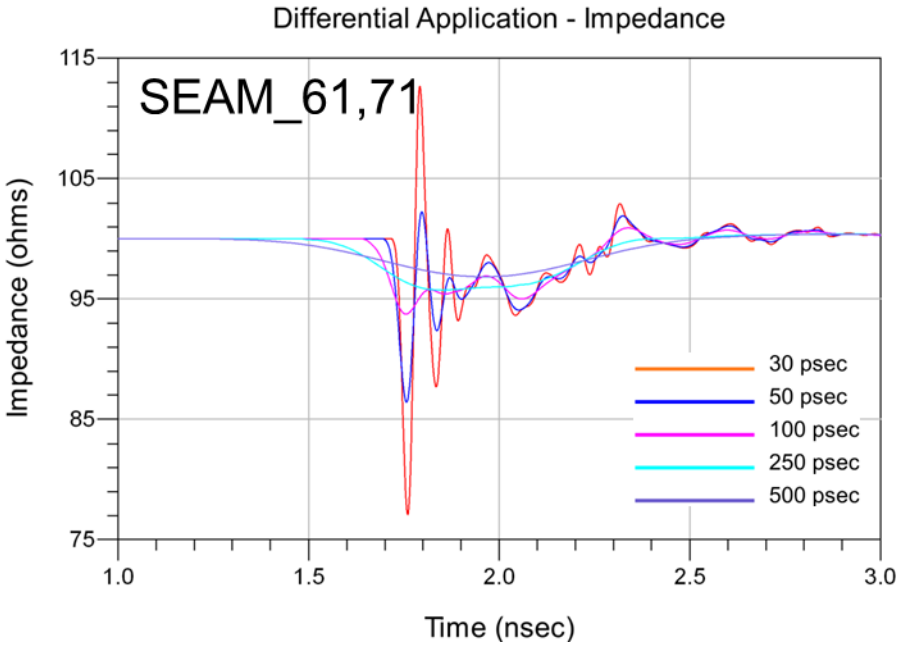


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

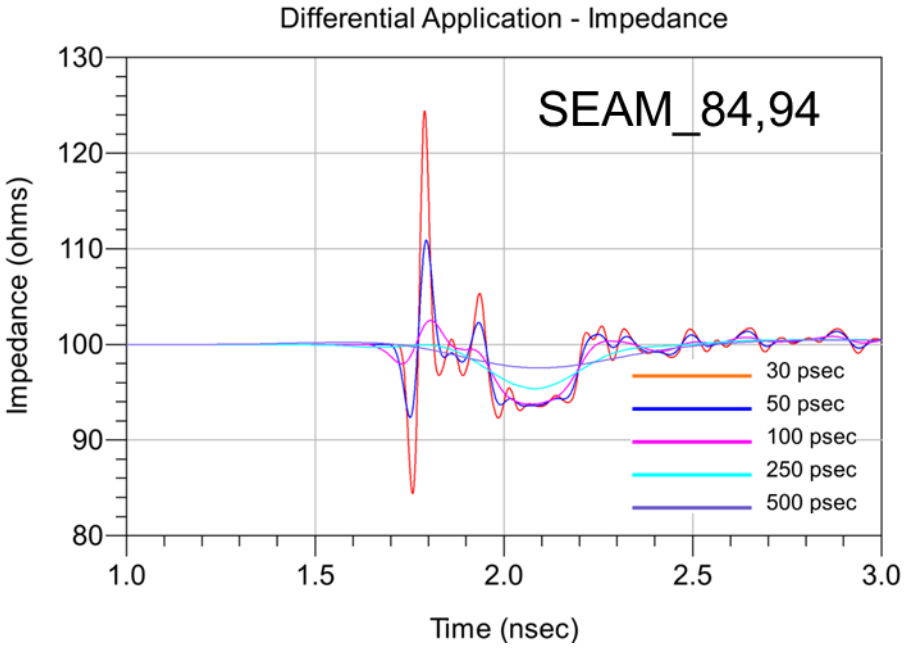
Differential Application – Input Pulse

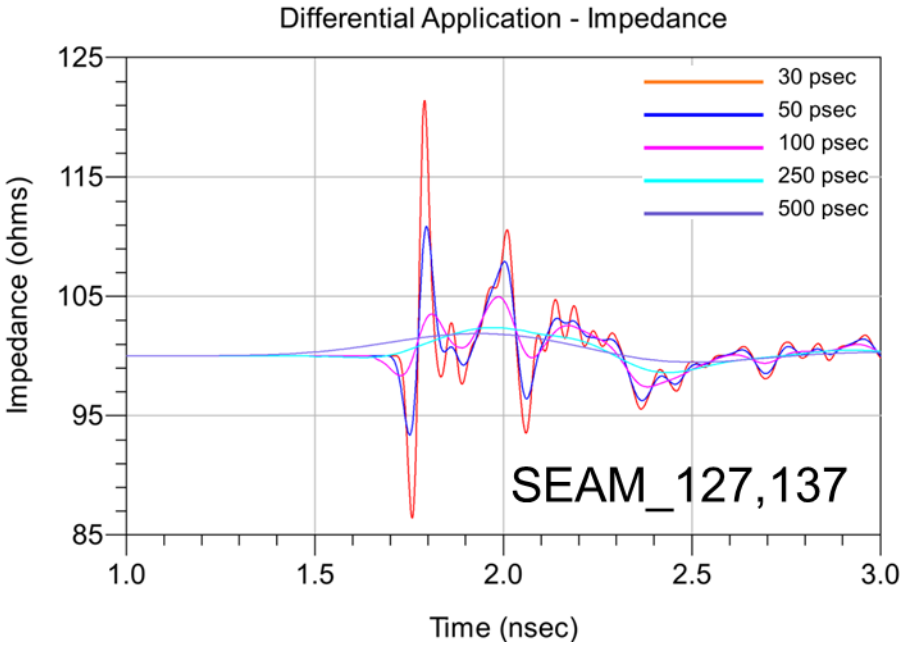


Differential Optimal Horizontal Application – Impedance

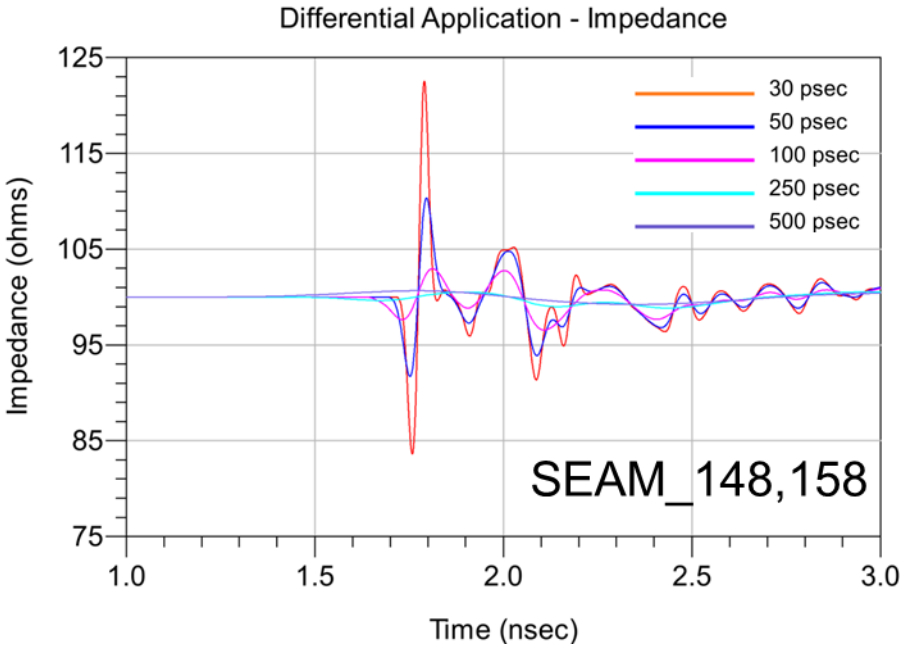


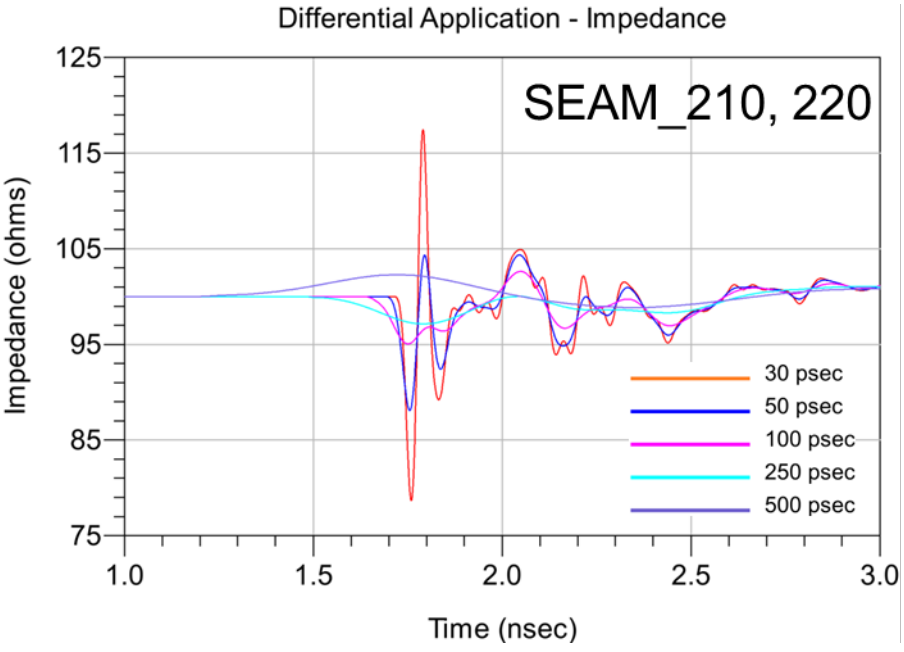
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle





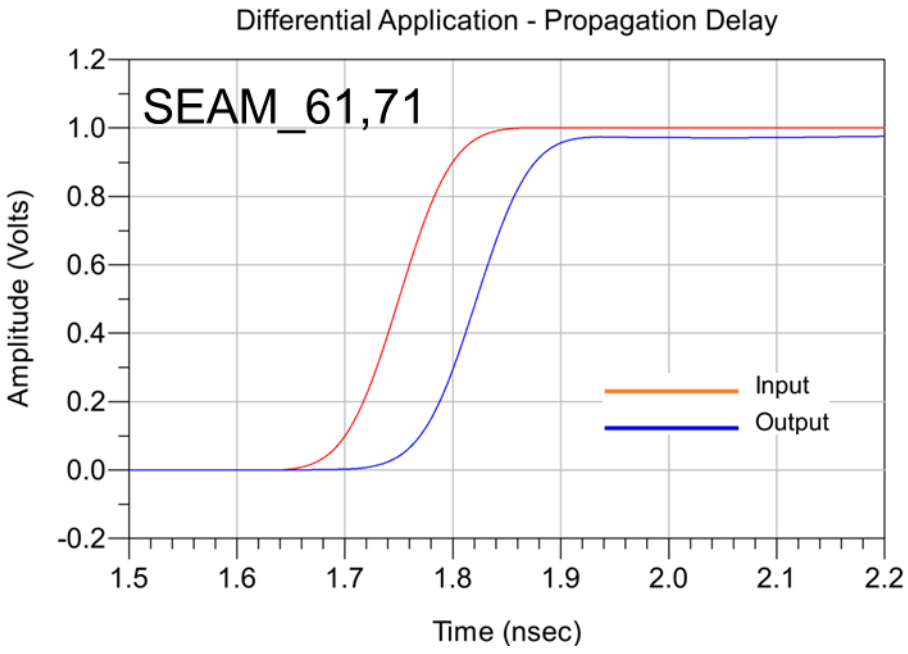
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

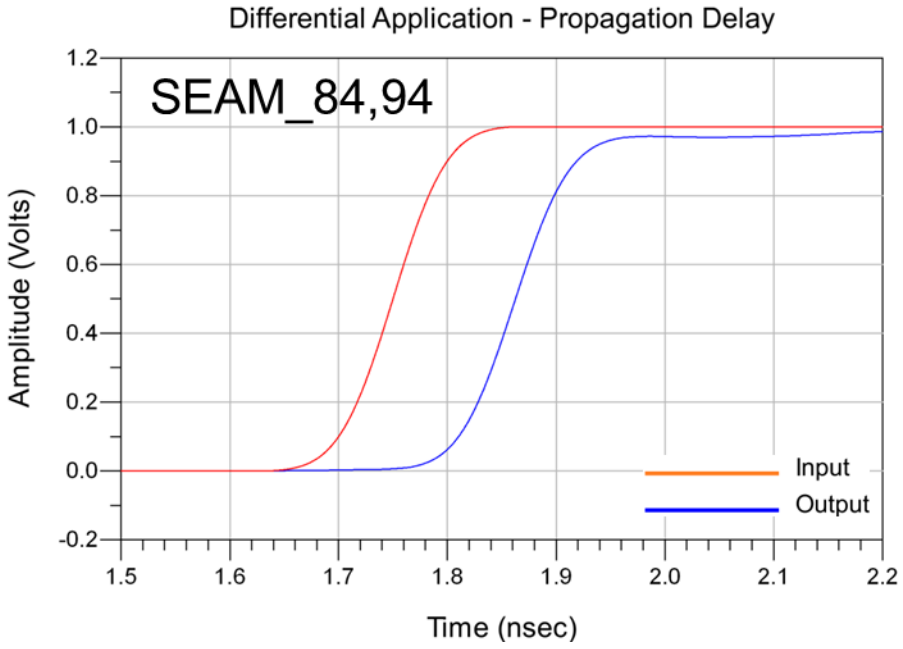




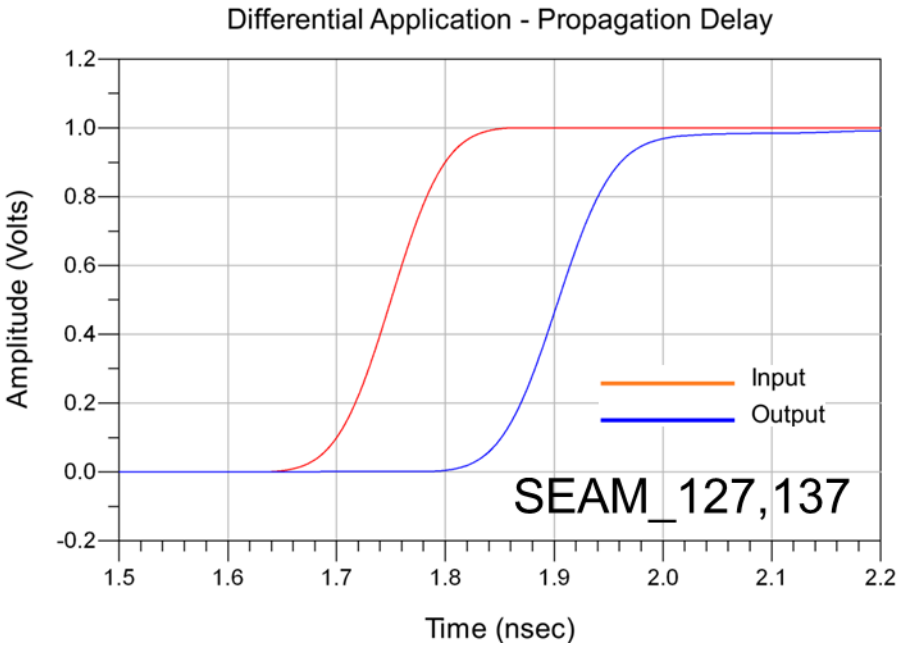
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

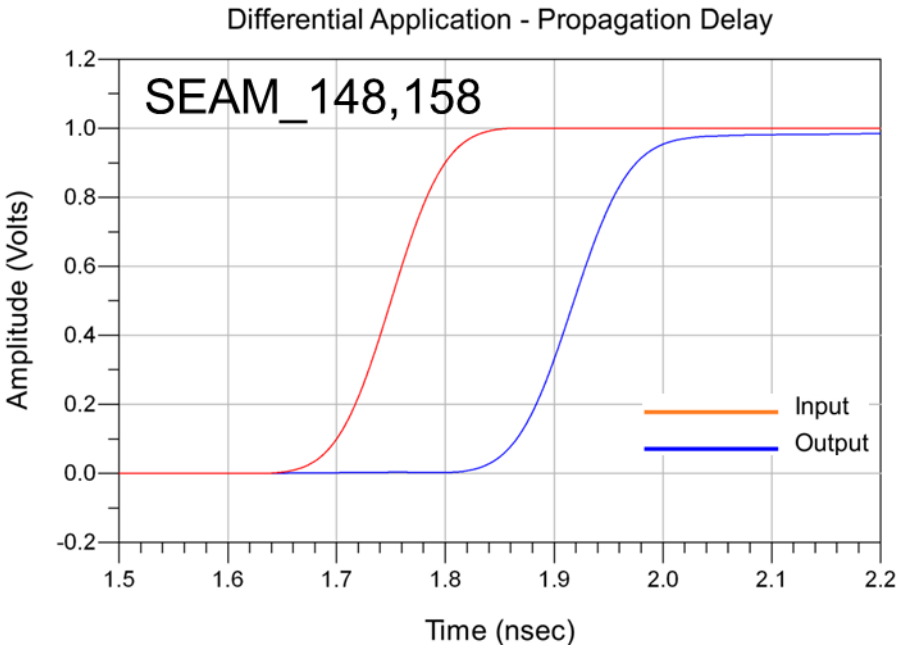
Differential Optimal Horizontal Application – Propagation Delay



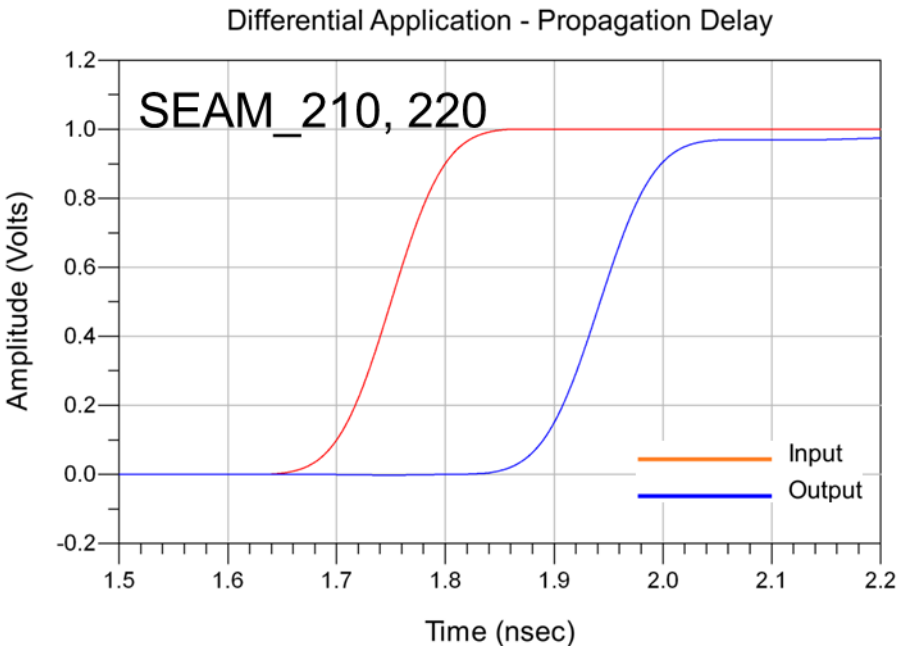


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle



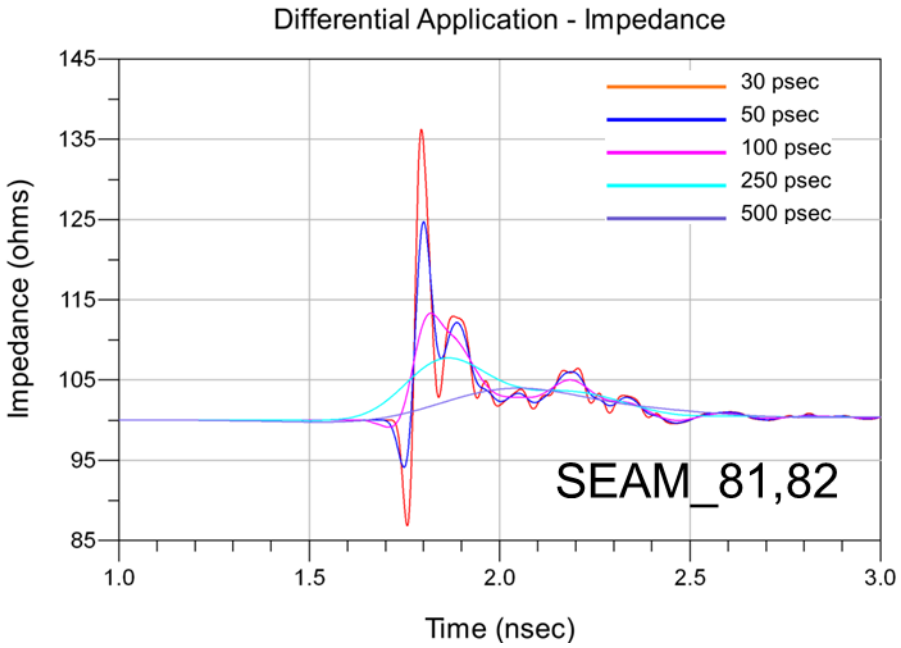


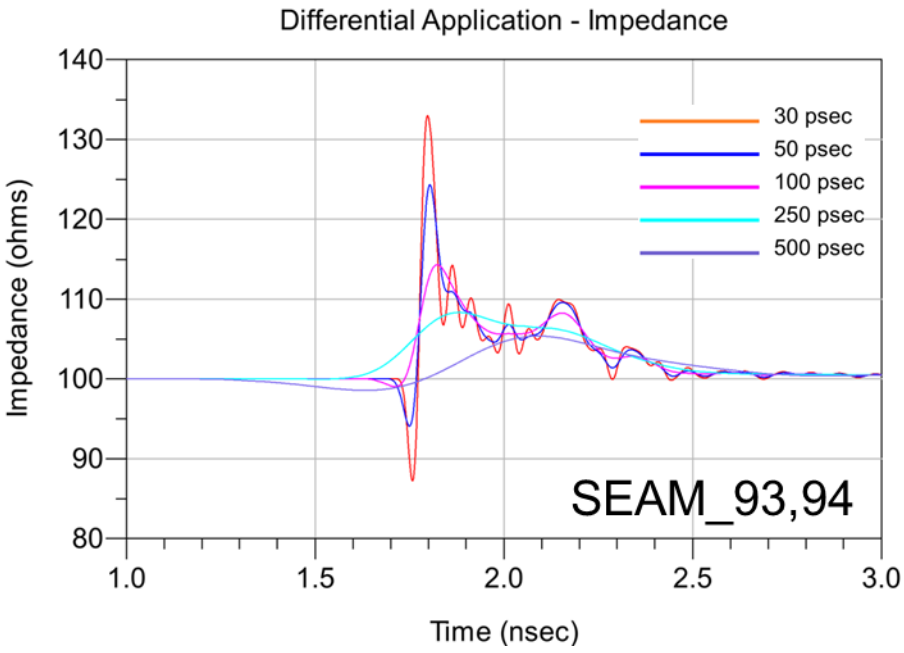
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle



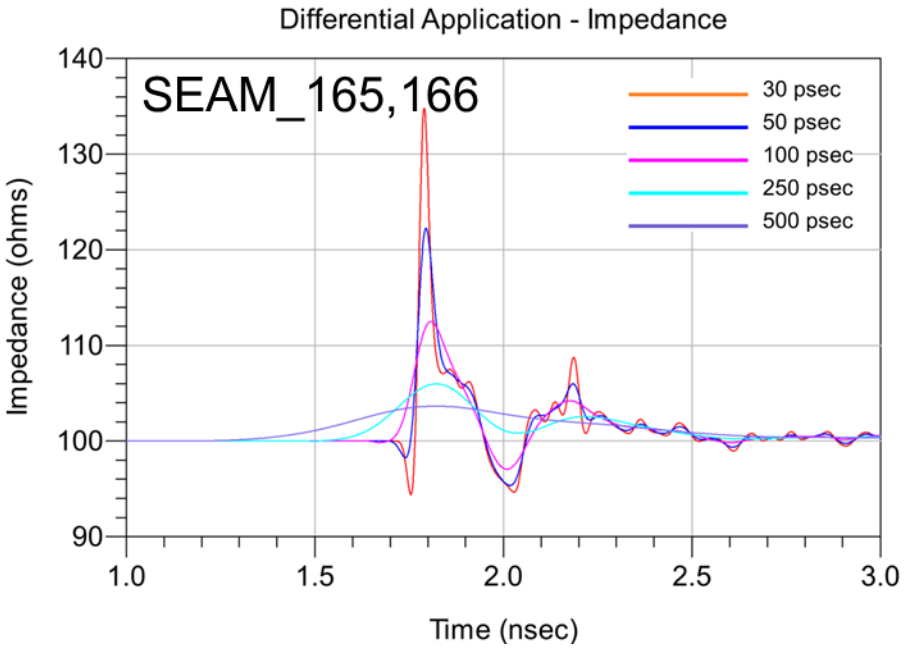
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

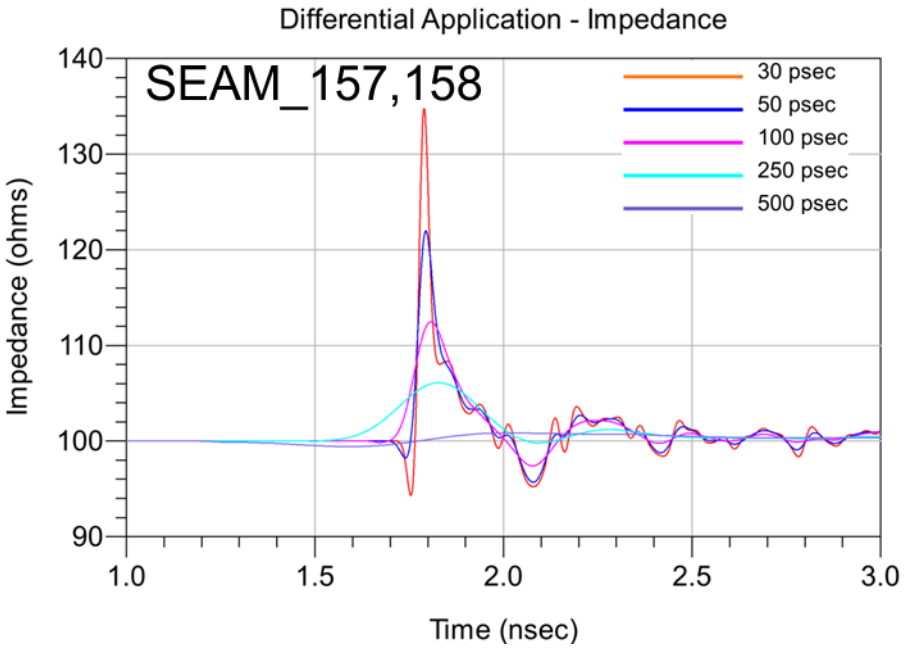
Differential Optimal Vertical Application – Impedance



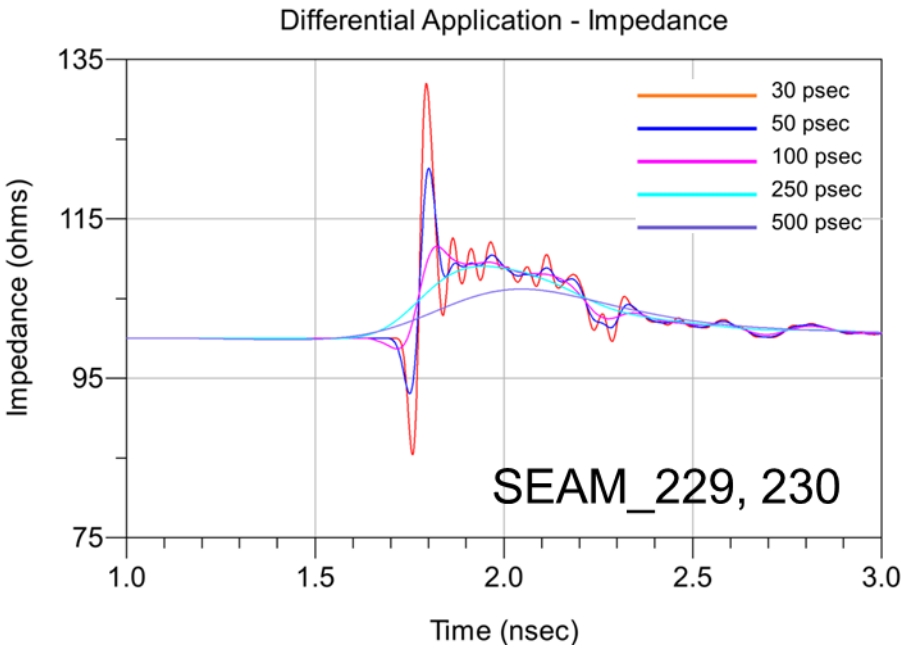


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle



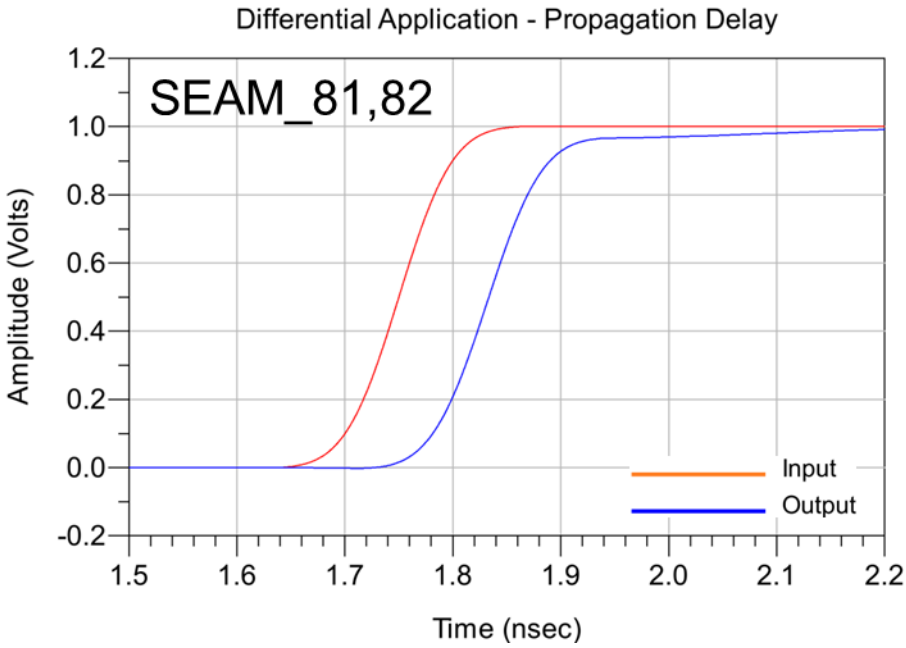


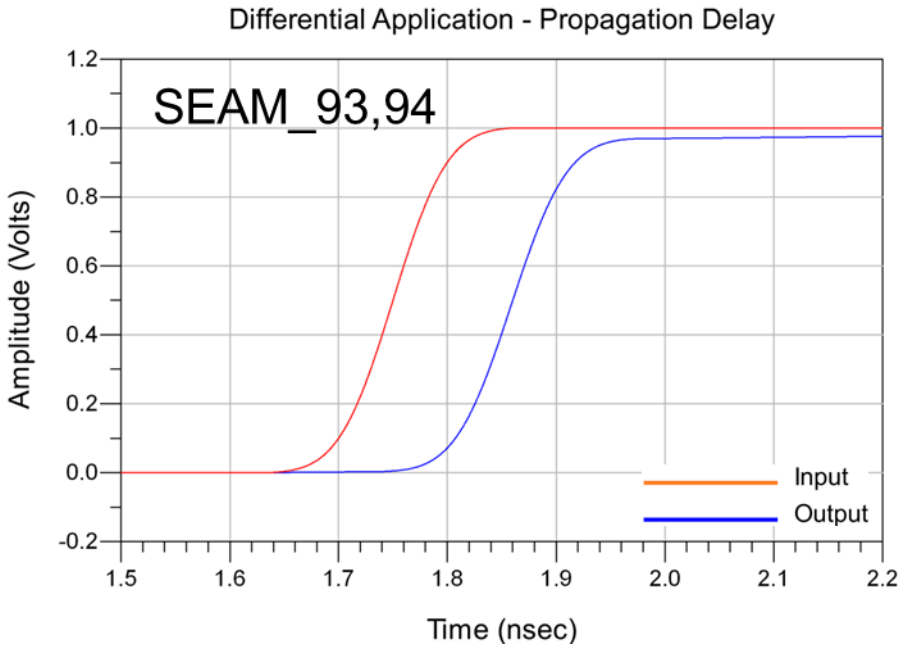
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle



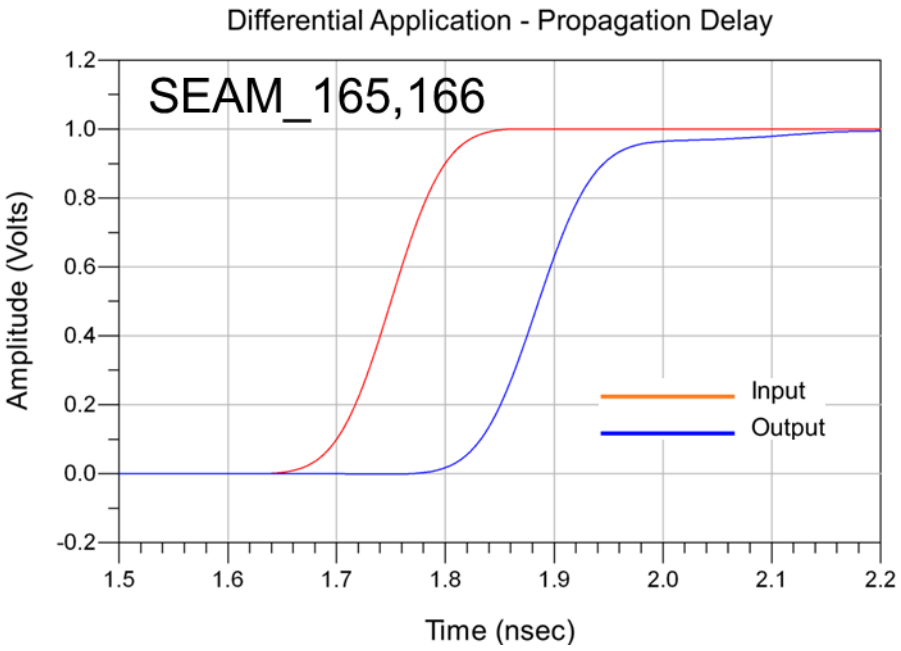
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

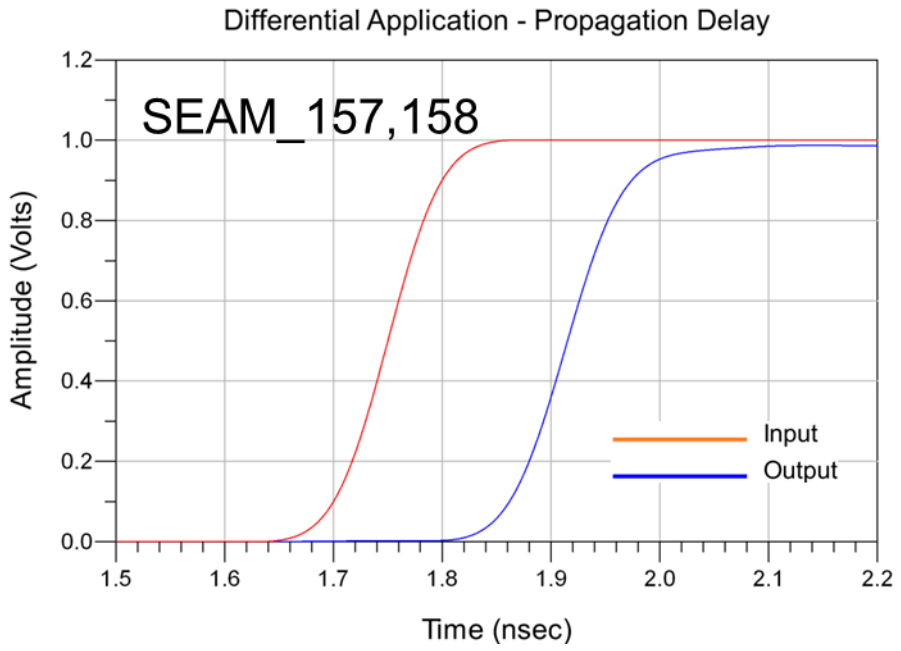
Differential Optimal Vertical Application – Propagation Delay



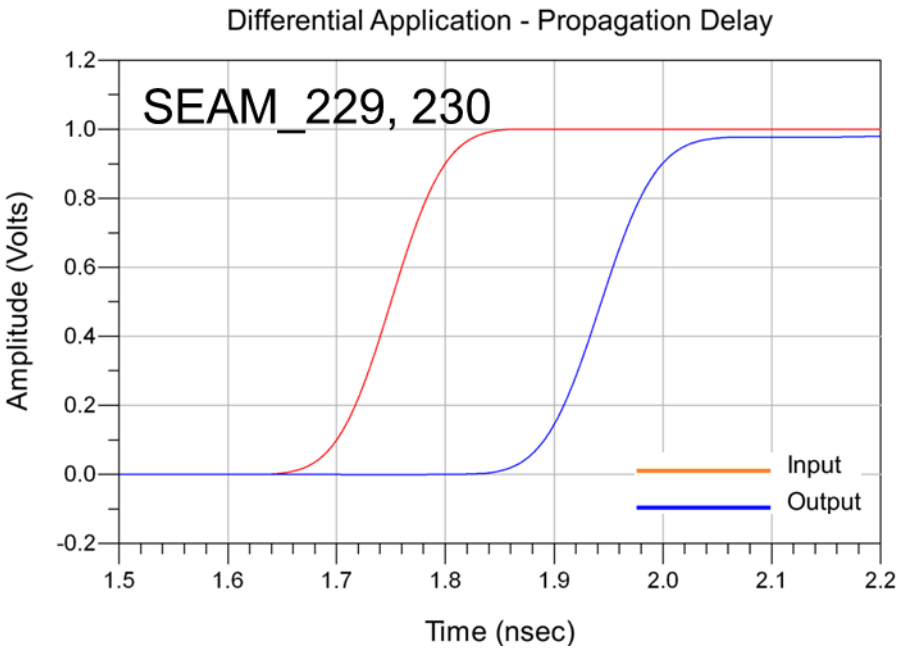


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle



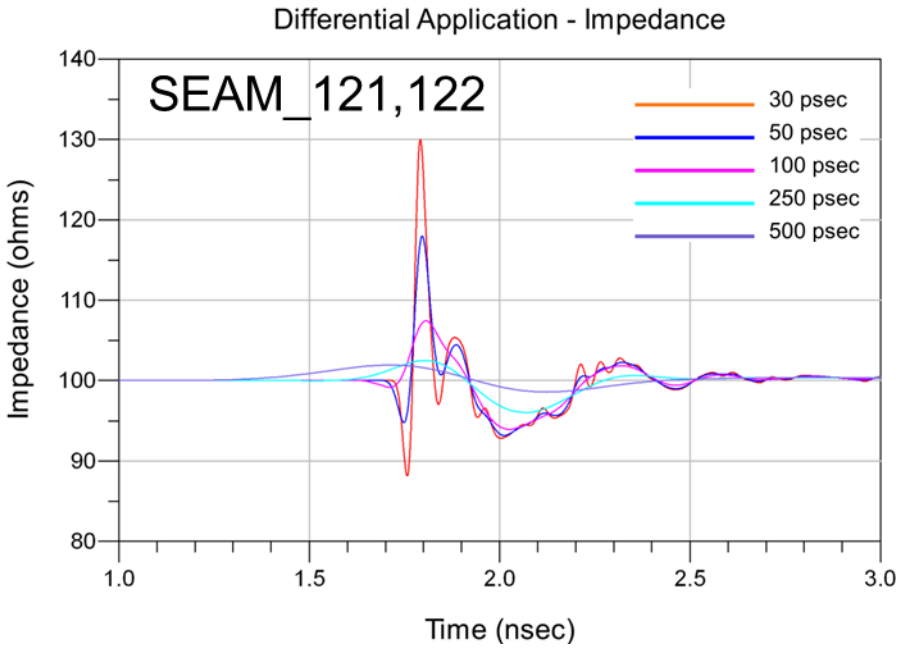


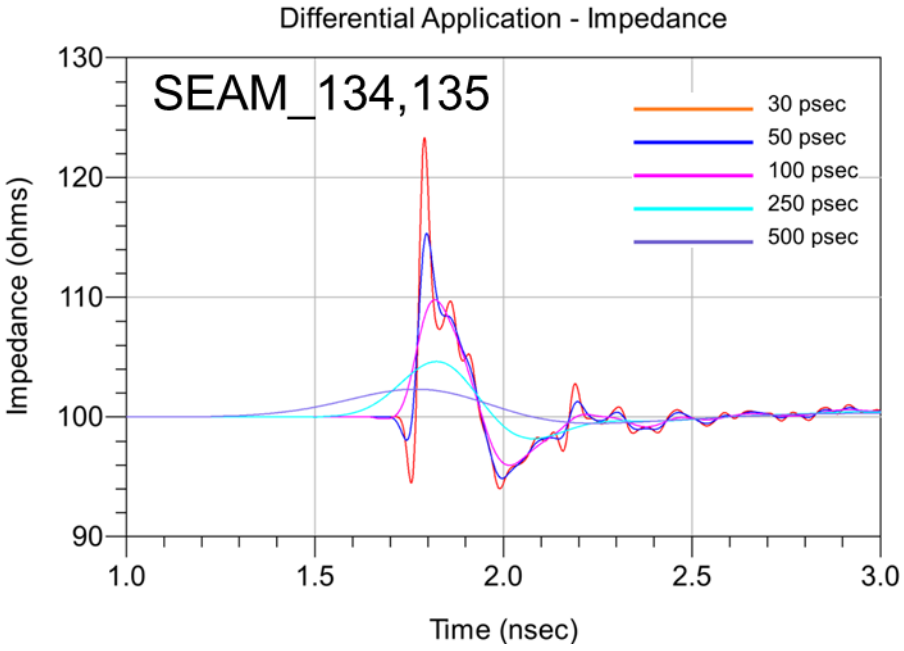
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle



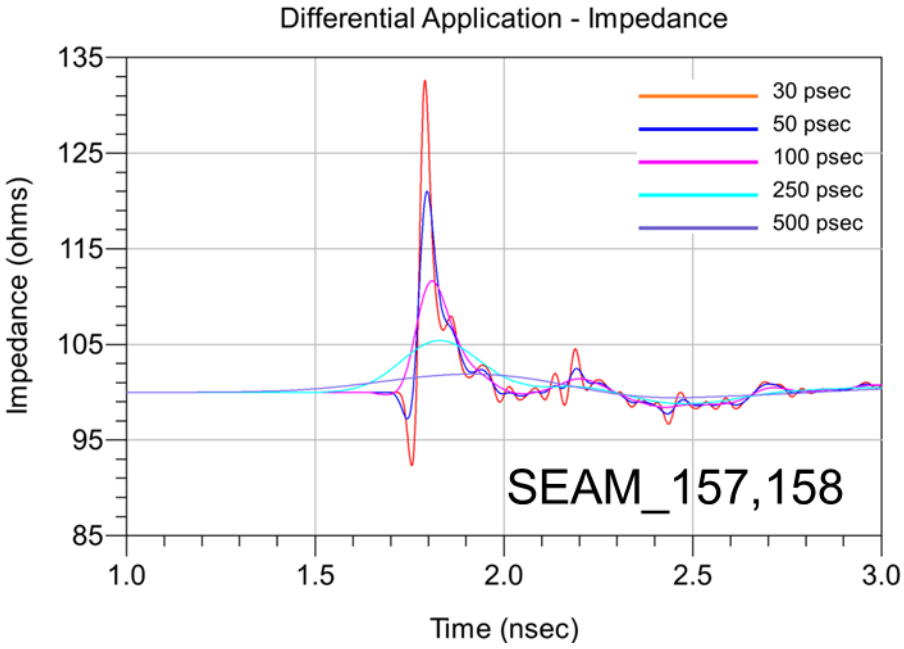
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

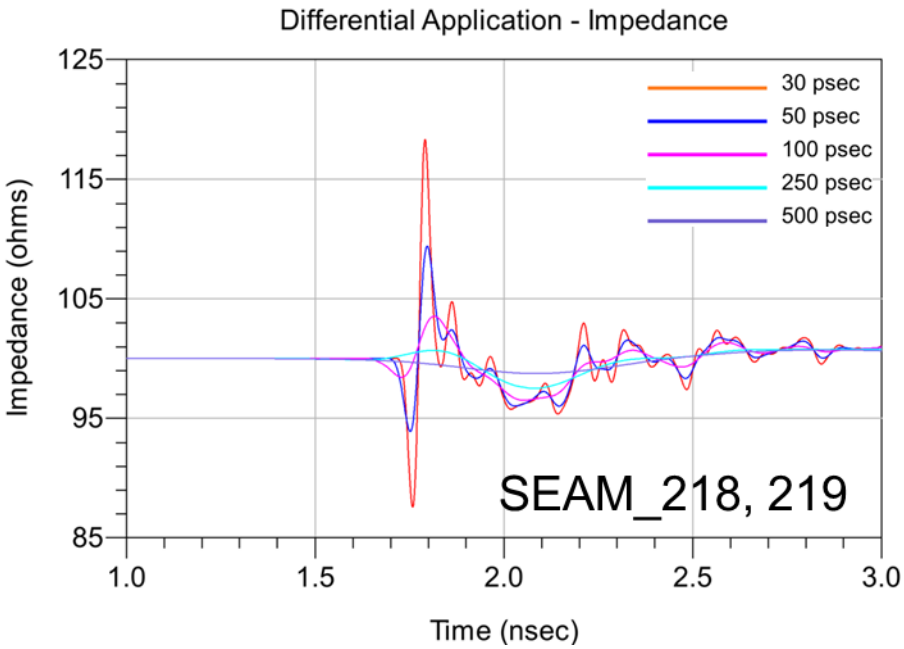
Differential High Density Vertical Application – Impedance



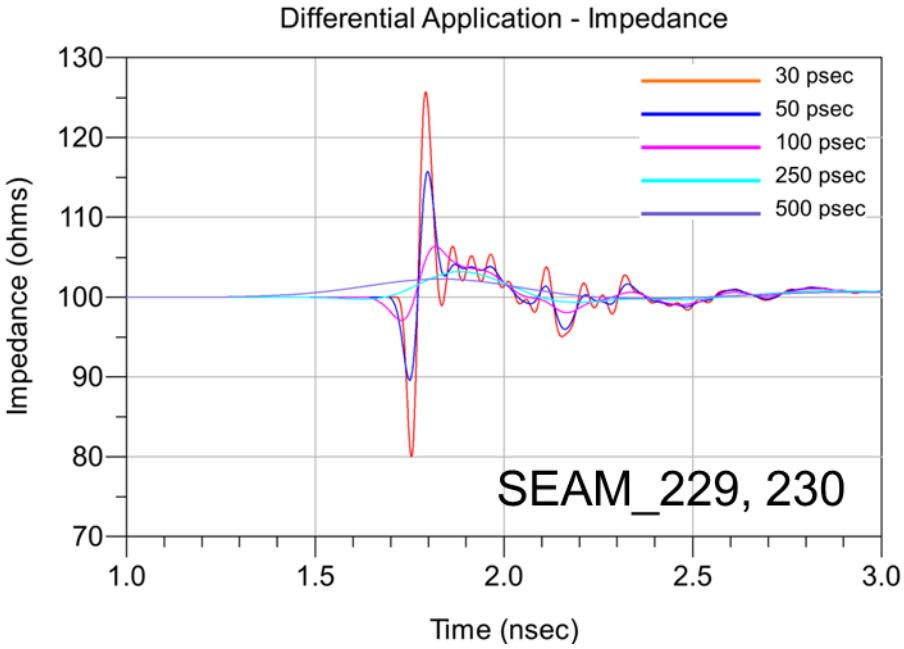


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle



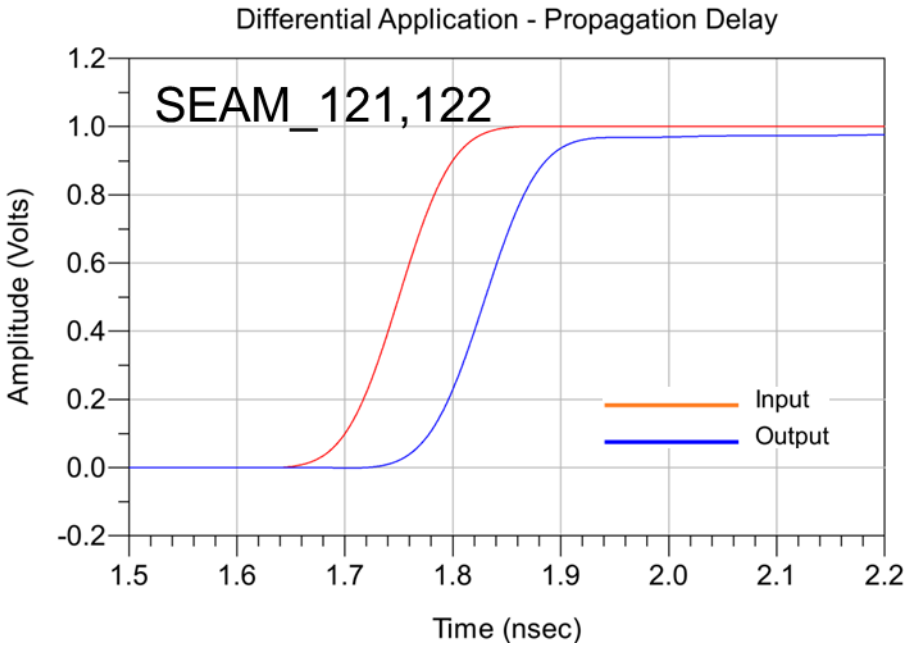


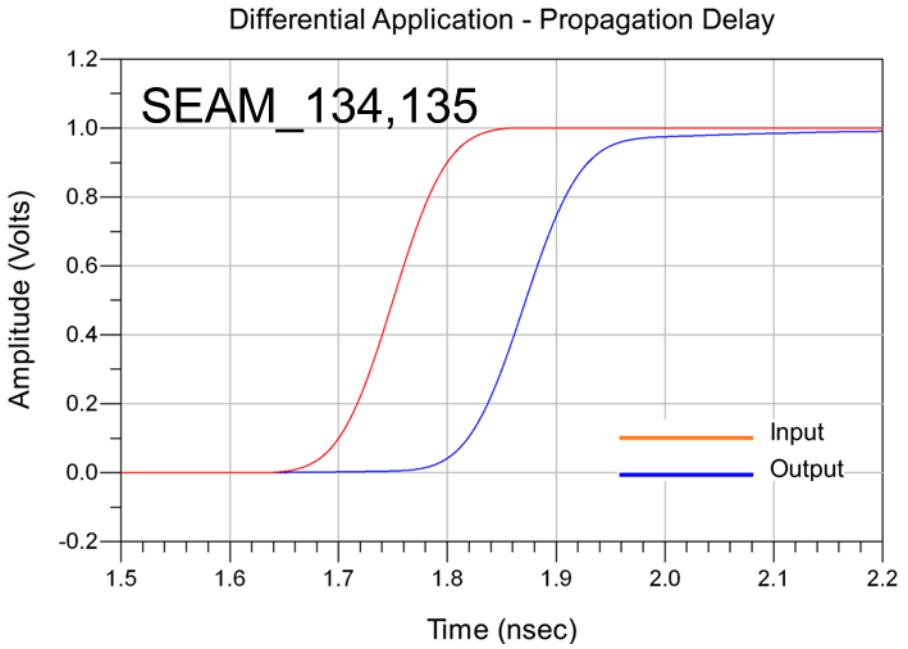
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle



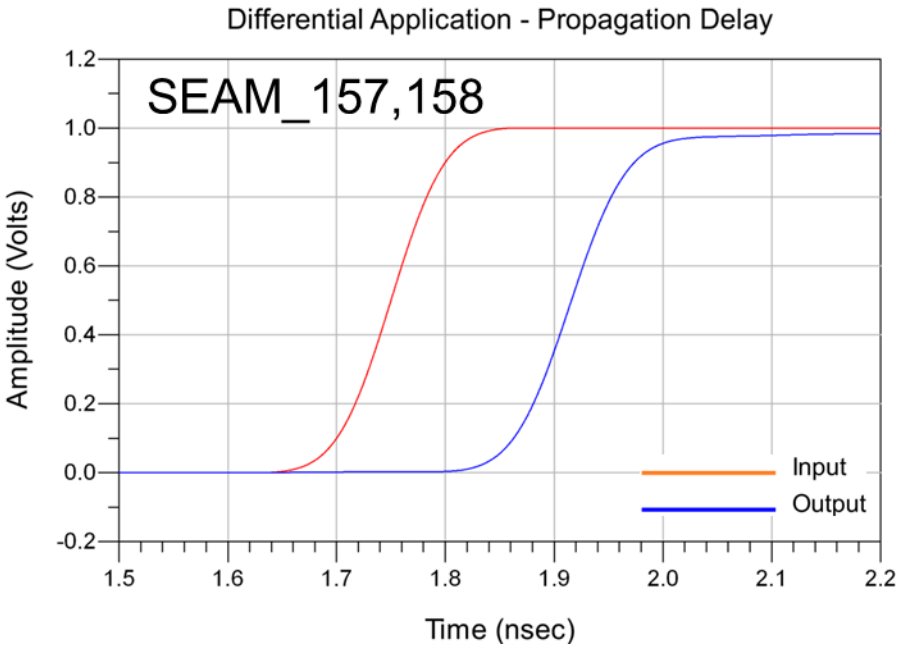
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

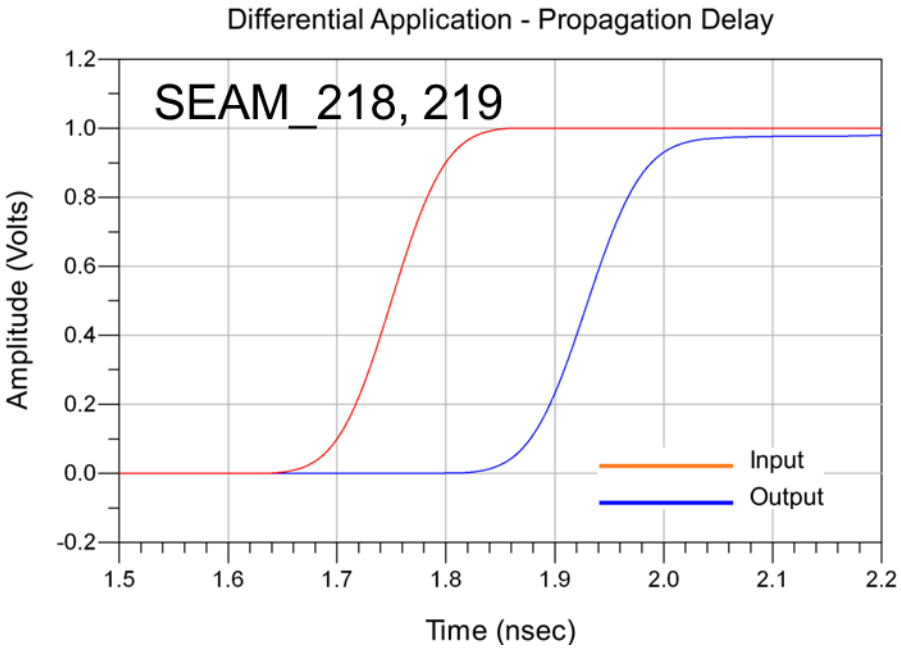
Differential High Density Vertical Application – Propagation Delay



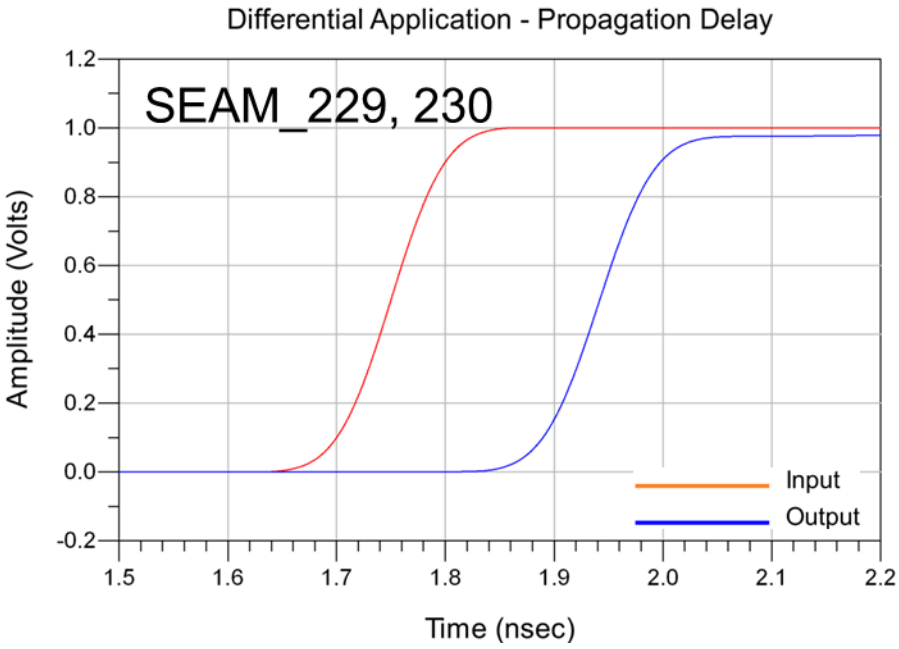


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle



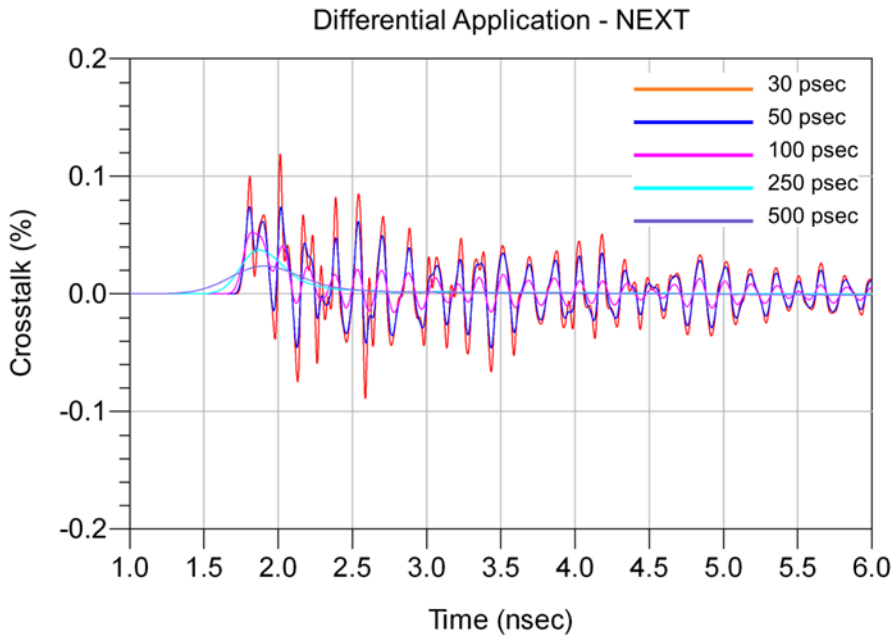


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

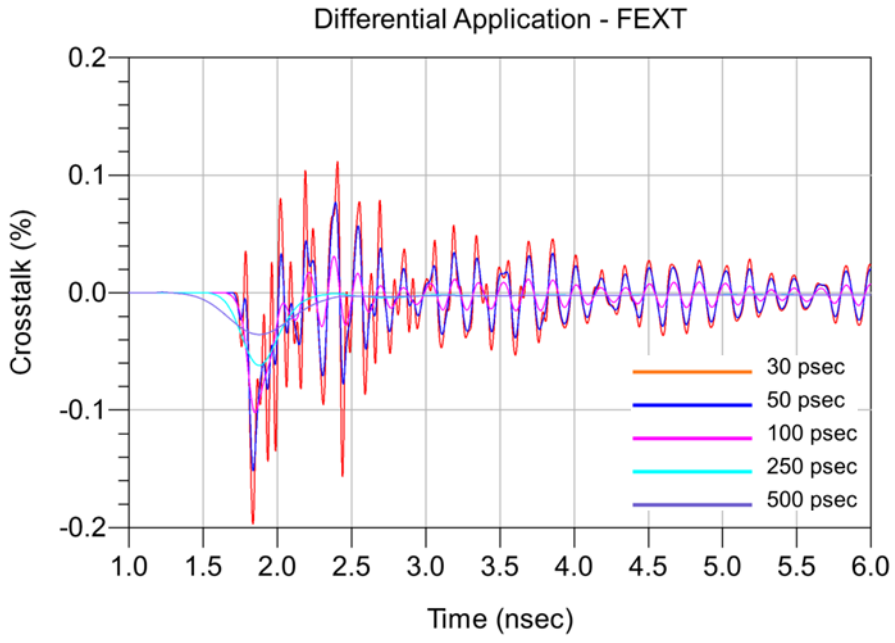


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Diff Optimal Horizontal Application – NEXT, SEAM_61,71_SEAM_63,73

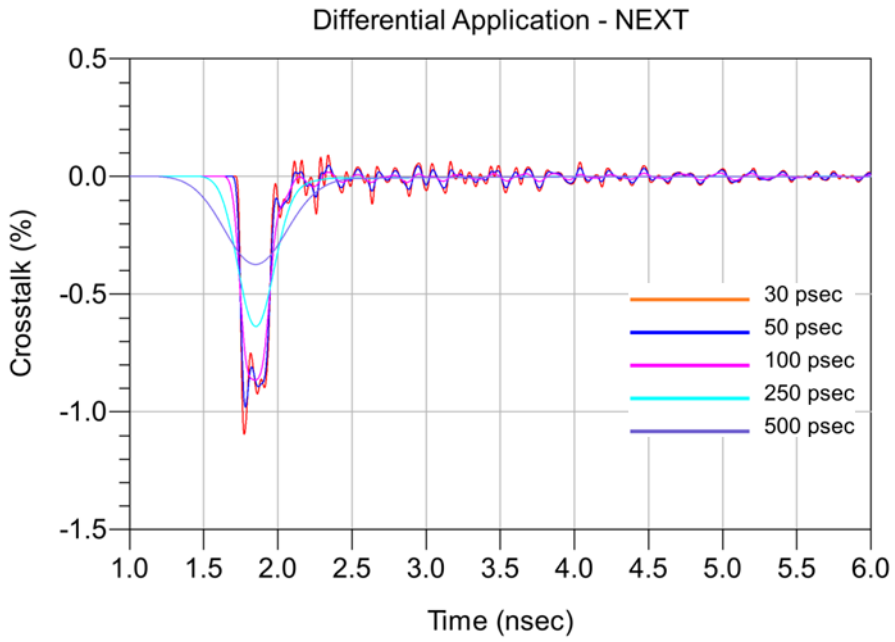


Diff Optimal Horizontal Application – FEXT, SEAM_61,71_SEAMF-RA_63,73

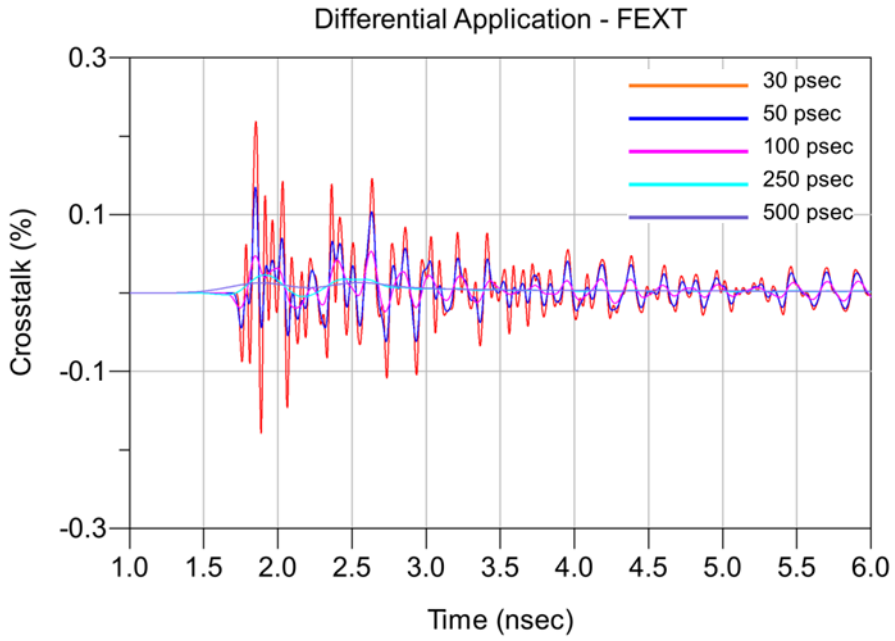


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Diff Optimal Horizontal Application – NEXT, SEAM_63,73_SEAM_84,94

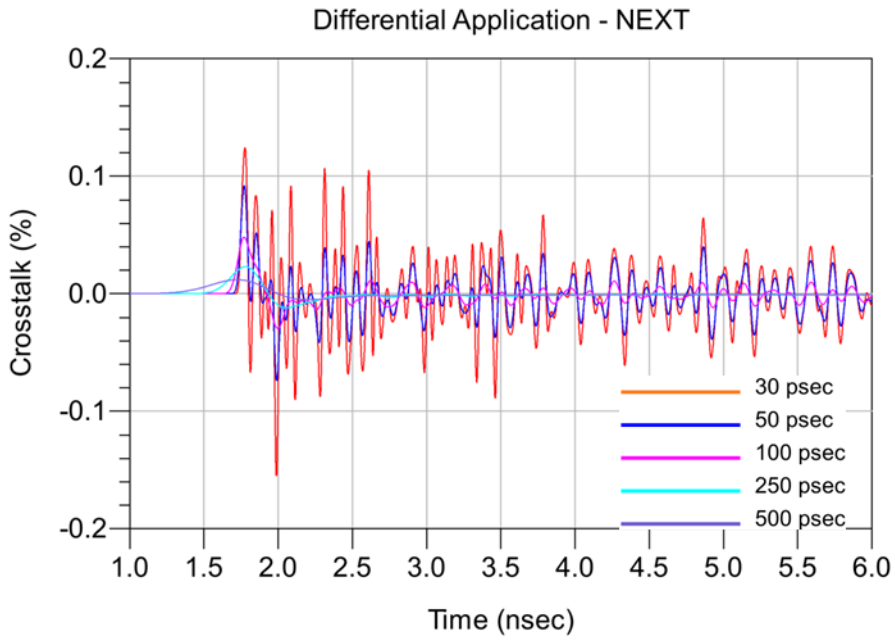


Diff Optimal Horizontal Application – FEXT, SEAM_63,73_SEAF-RA_84,94

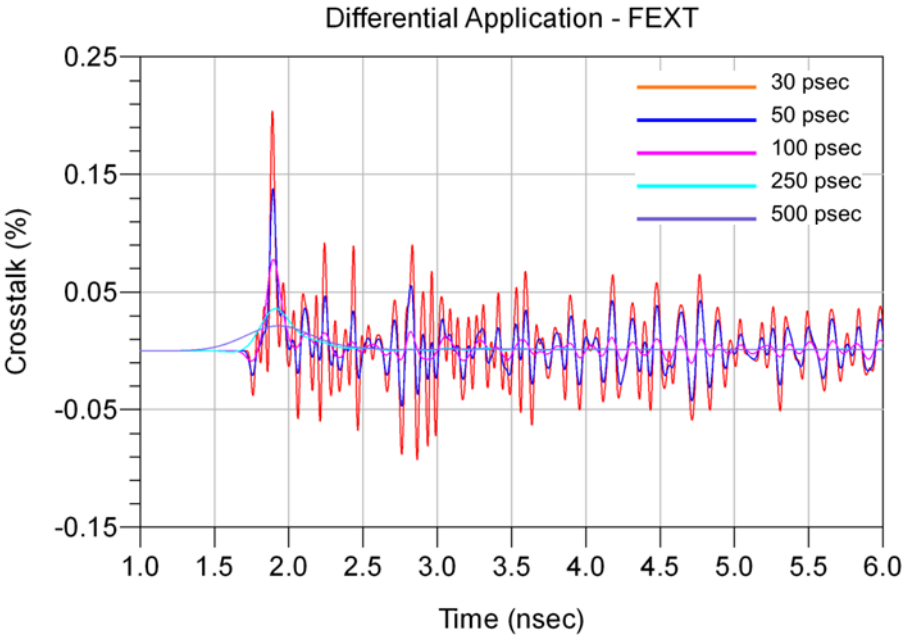


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Diff Optimal Horizontal Application – NEXT, SEAM_106,116_SEAM_146,156

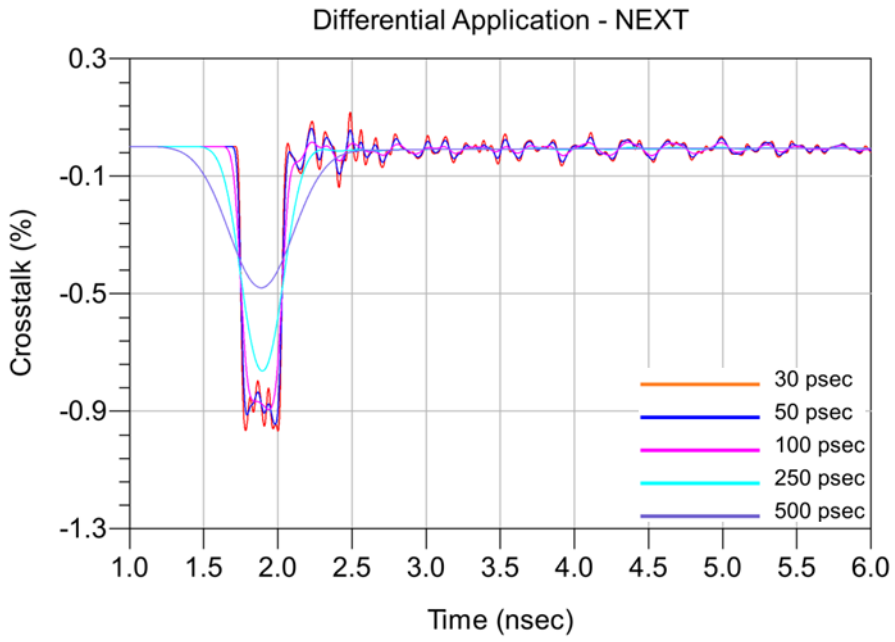


Diff Optimal Horizontal Application – FEXT, SEAM_106,116_SEAF-RA_146,156

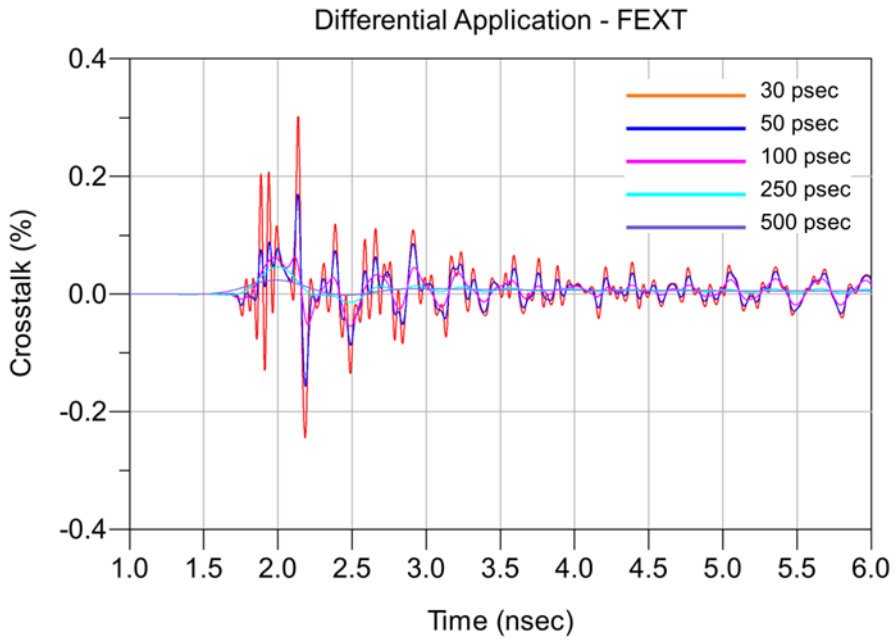


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Diff Optimal Horizontal Application – NEXT, SEAM_106,116_SEAM_127,137

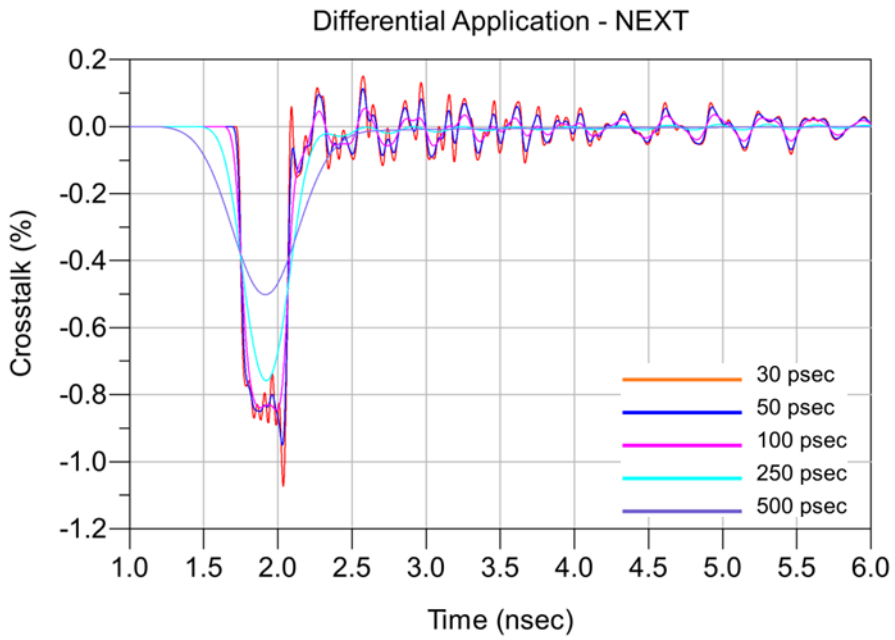


Diff Optimal Horizontal Application – FEXT, SEAM_106,116_SEAF-RA_127,137

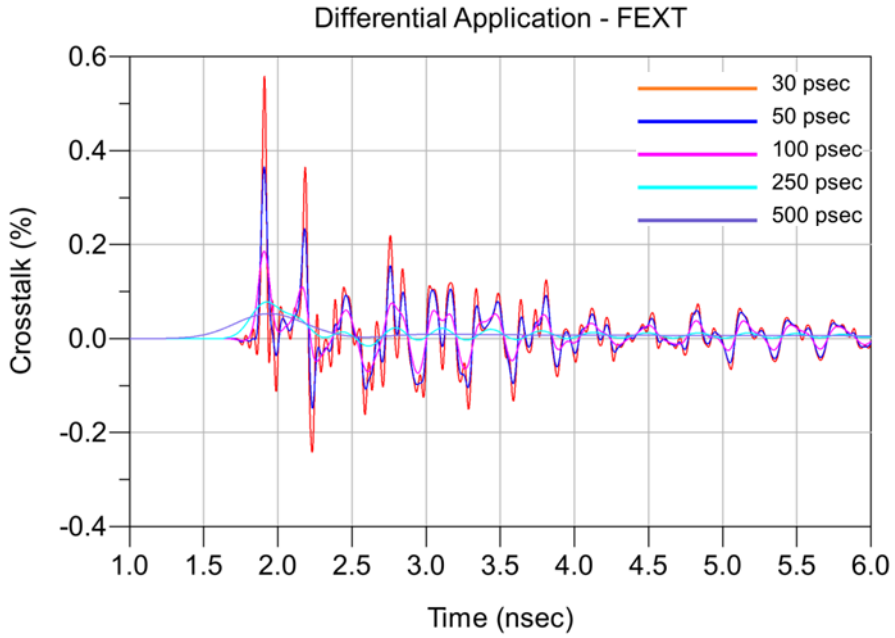


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Diff Optimal Horizontal Application – NEXT, SEAM_127, 137_SEAM_148, 158

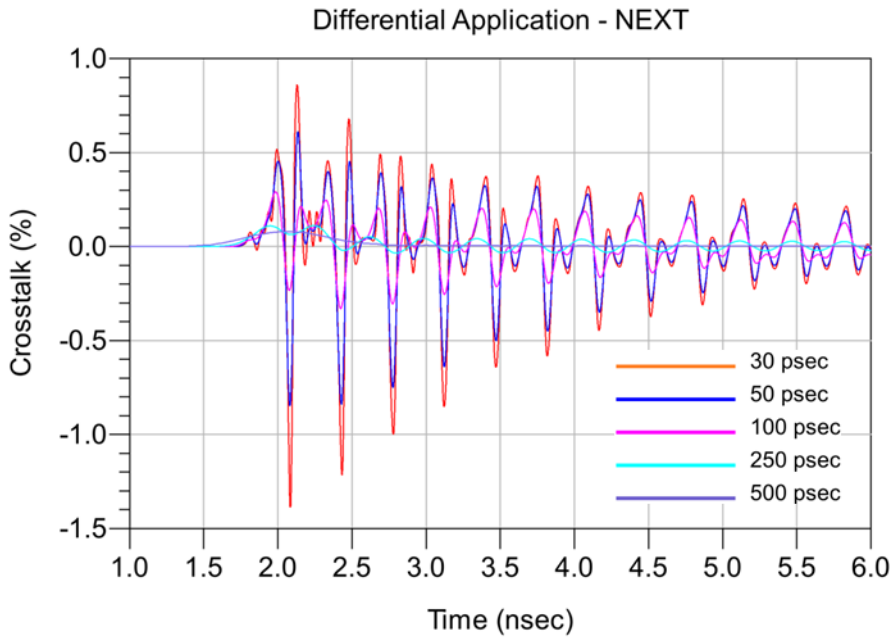


Diff Optimal Horizontal Application – FEXT, SEAM_127, 137_SEAF-RA_148,158

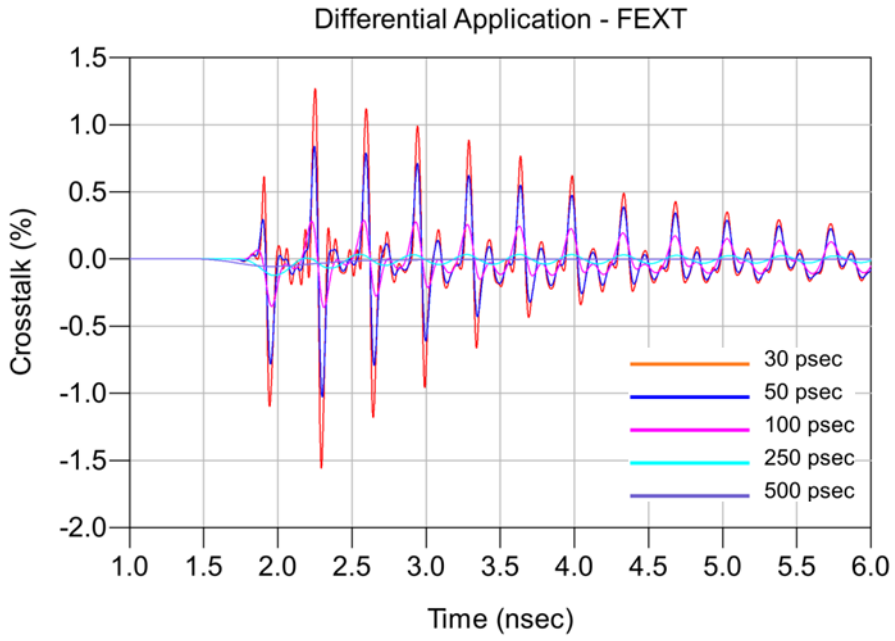


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Diff Optimal Horizontal Application – NEXT, SEAM_208, 218_SEAM_210, 220

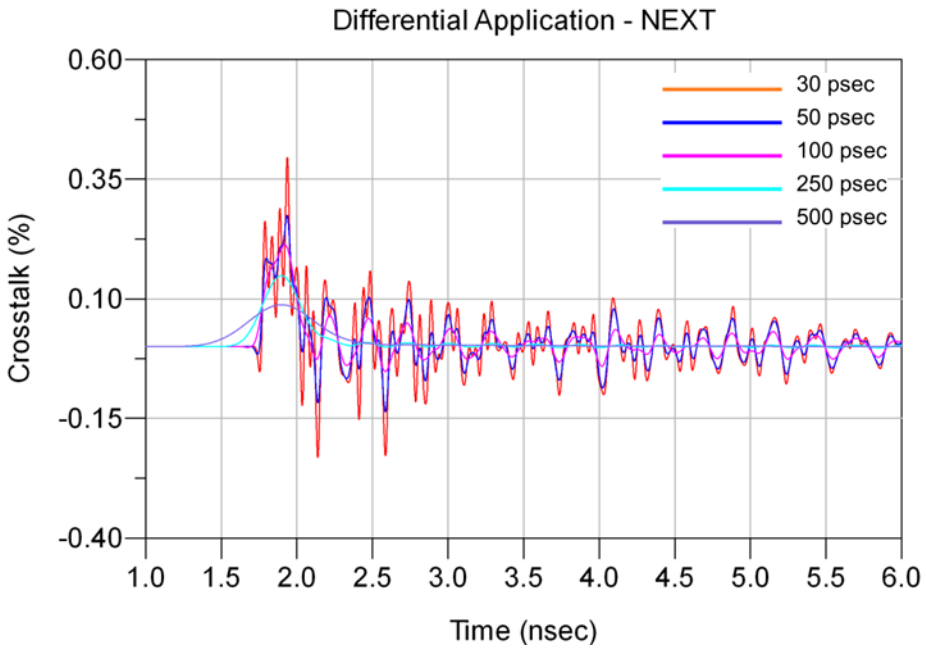


Diff Optimal Horizontal Application – FEXT, SEAM_208, 218_SEAF-RA_210,220

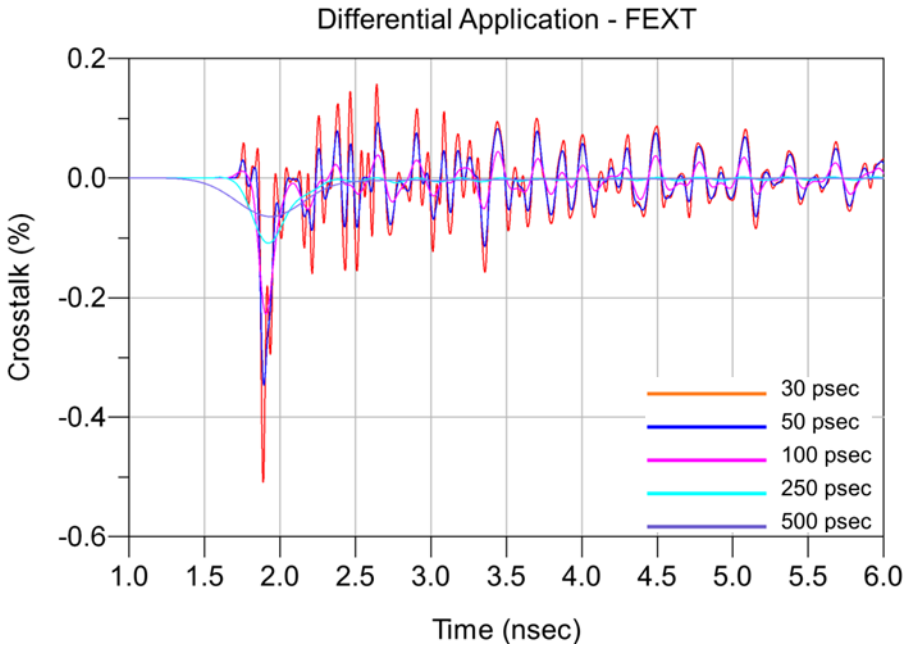


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Diff Optimal Vertical Application – NEXT, SEAM_145, 146_SEAM_165, 166

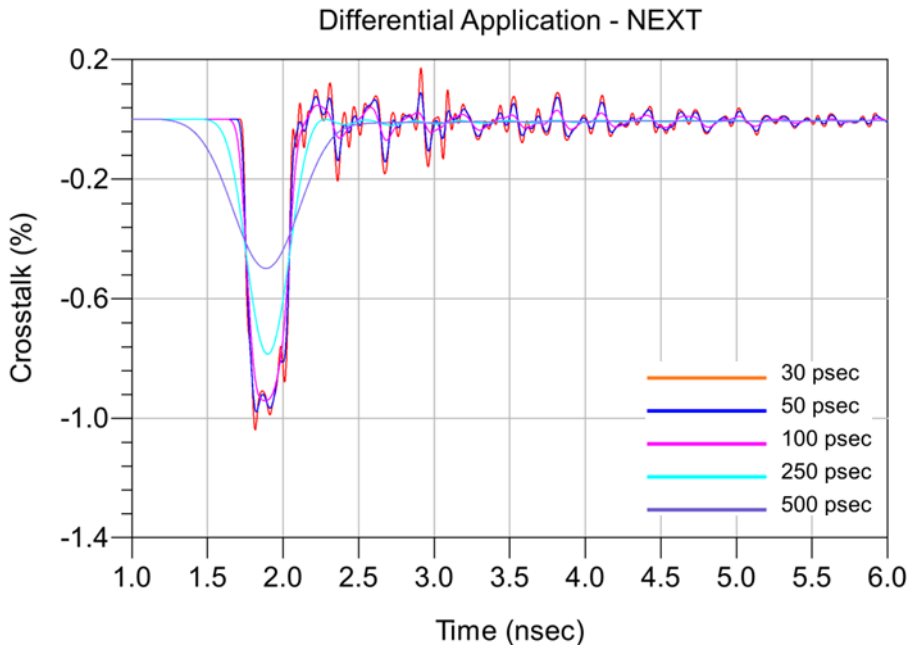


Diff Optimal Vertical Application – FEXT, SEAM_145, 146_SEAF-RA_165, 166

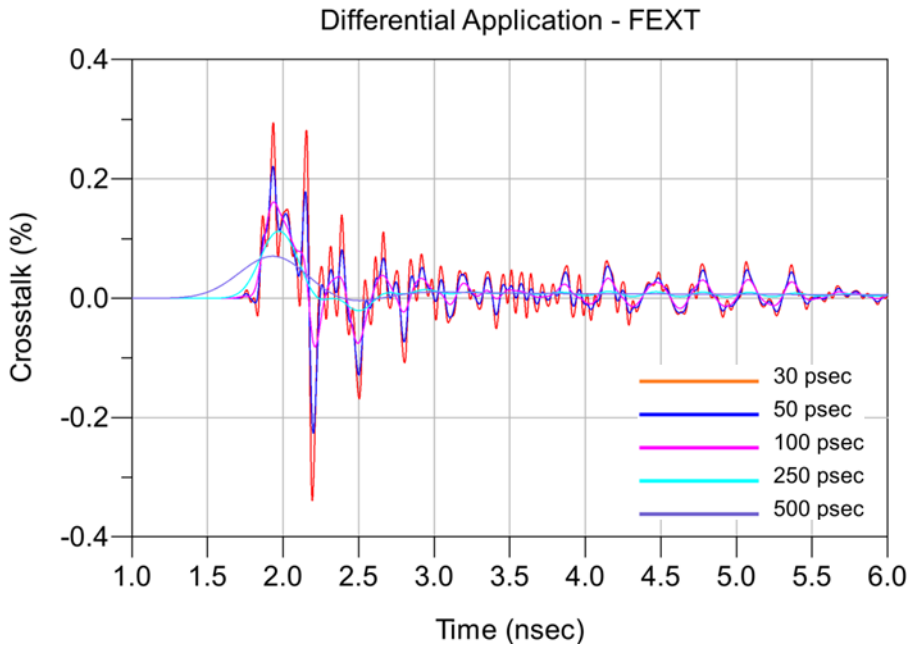


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Diff Optimal Vertical Application – NEXT, SEAM_145, 146_SEAM_157, 158

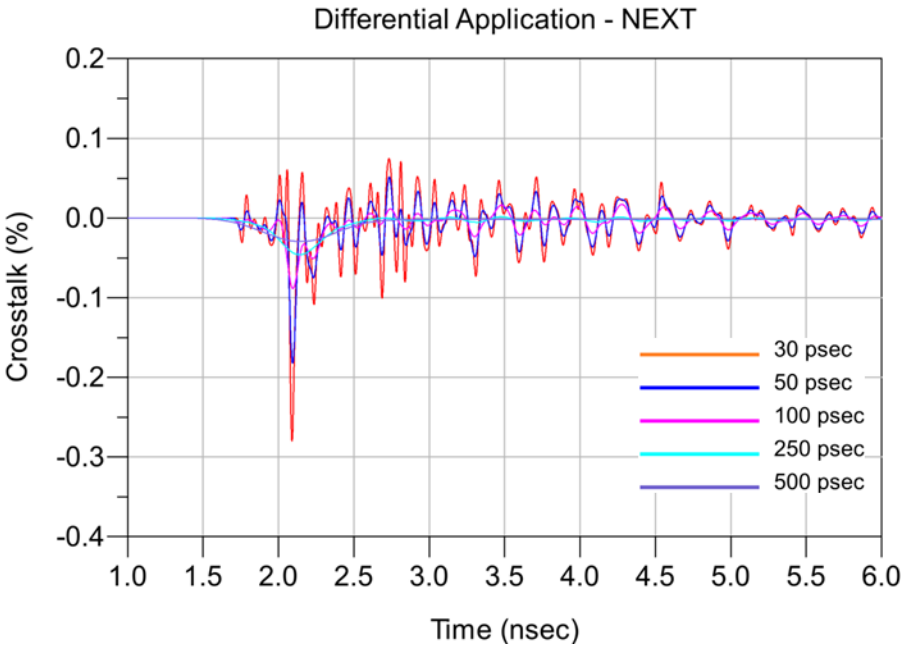


Diff Optimal Vertical Application – FEXT, SEAM_145, 146_SEAF-RA_157, 158

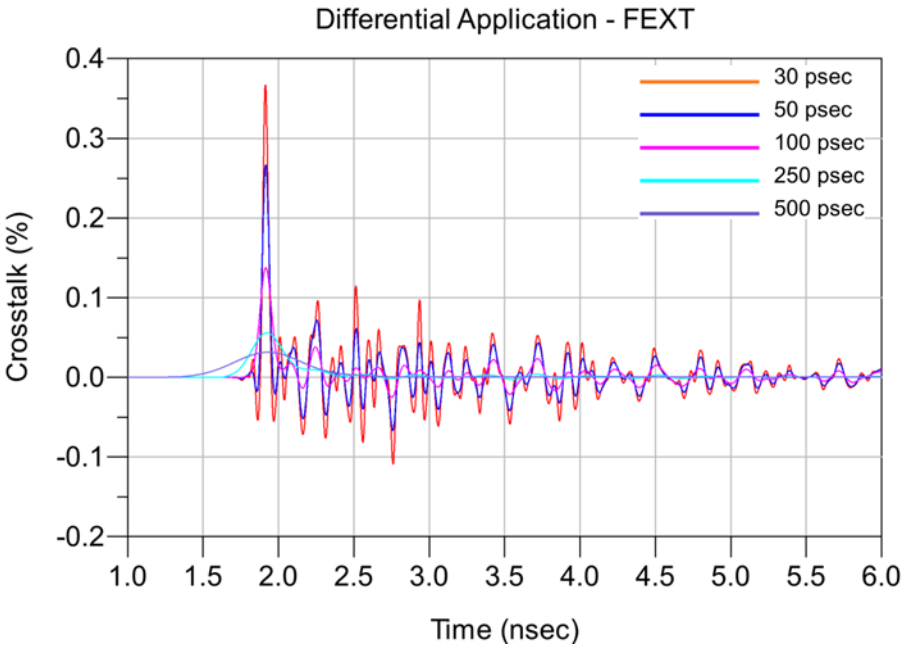


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Diff Optimal Vertical Application – NEXT, SEAM_165,166_SEAM_169, 170

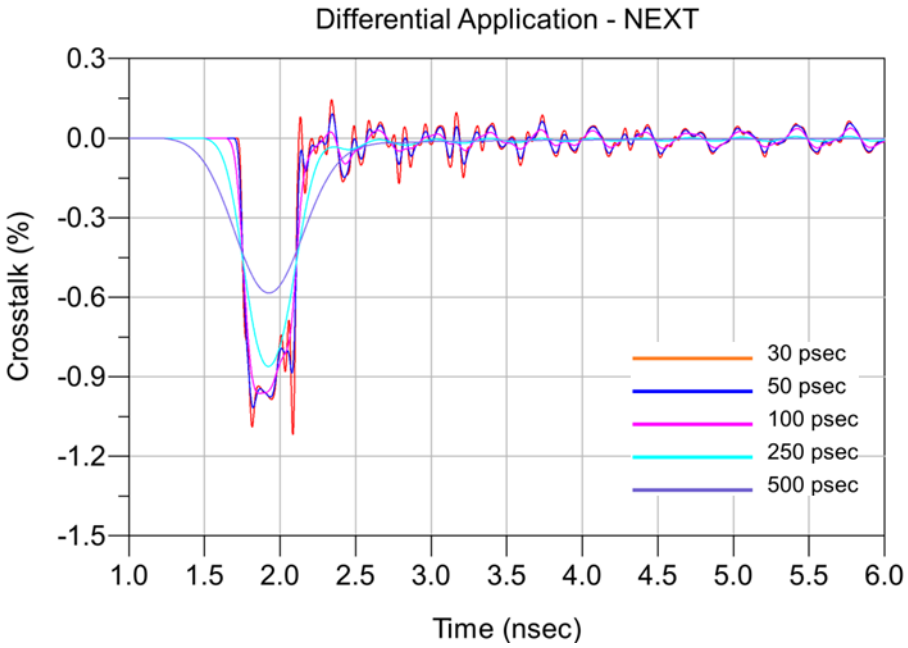


Diff Optimal Vertical Application – FEXT, SEAM_165,166_SEAF-RA_169, 170

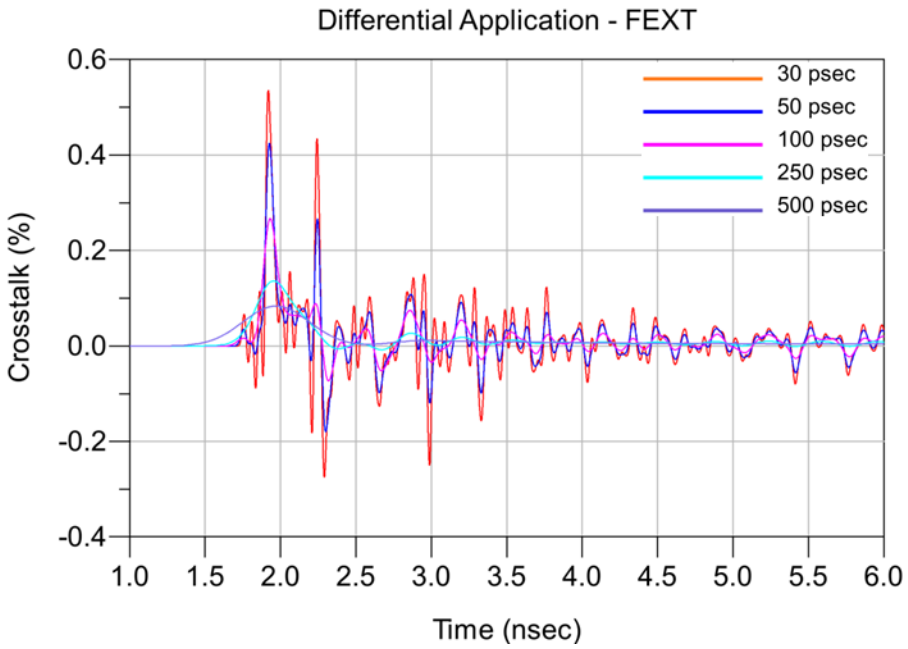


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Diff Optimal Vertical Application – NEXT, SEAM_217,218_SEAM_229, 230

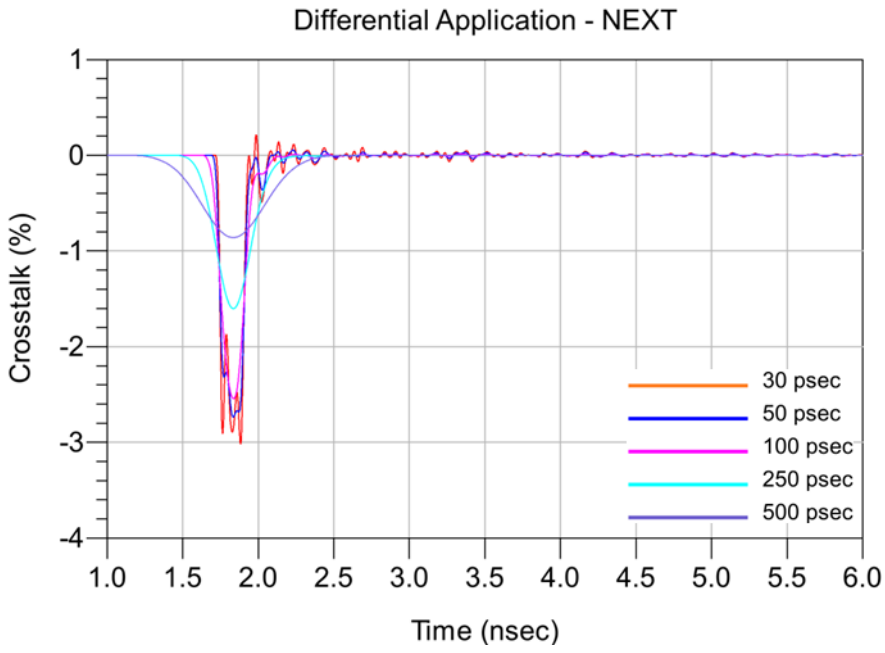


Diff Optimal Vertical Application – FEXT, SEAM_217,218_SEAF-RA_229, 230

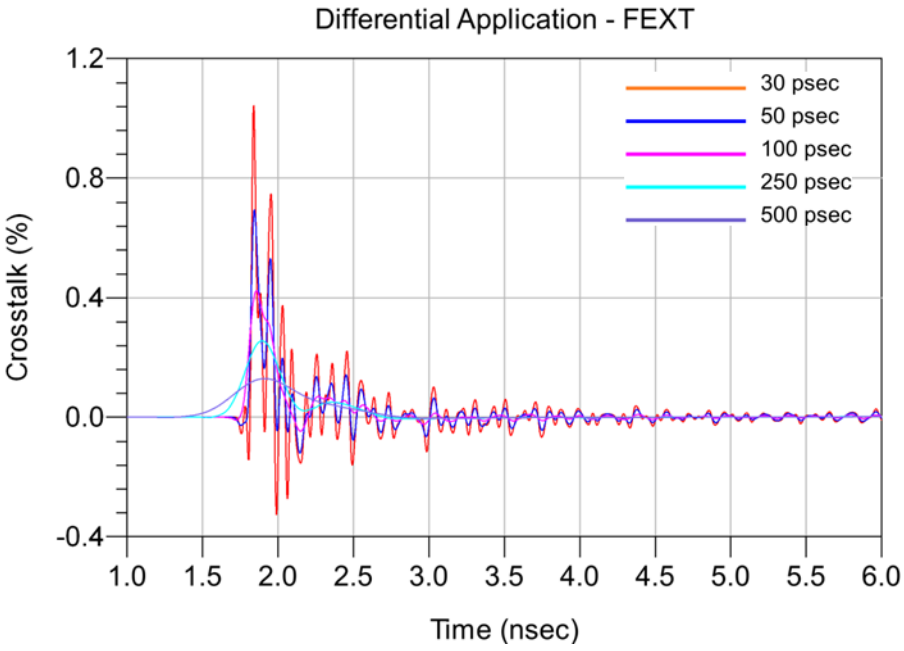


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Diff High Density Vertical Application – NEXT, SEAM_121,122_SEAM_132,133

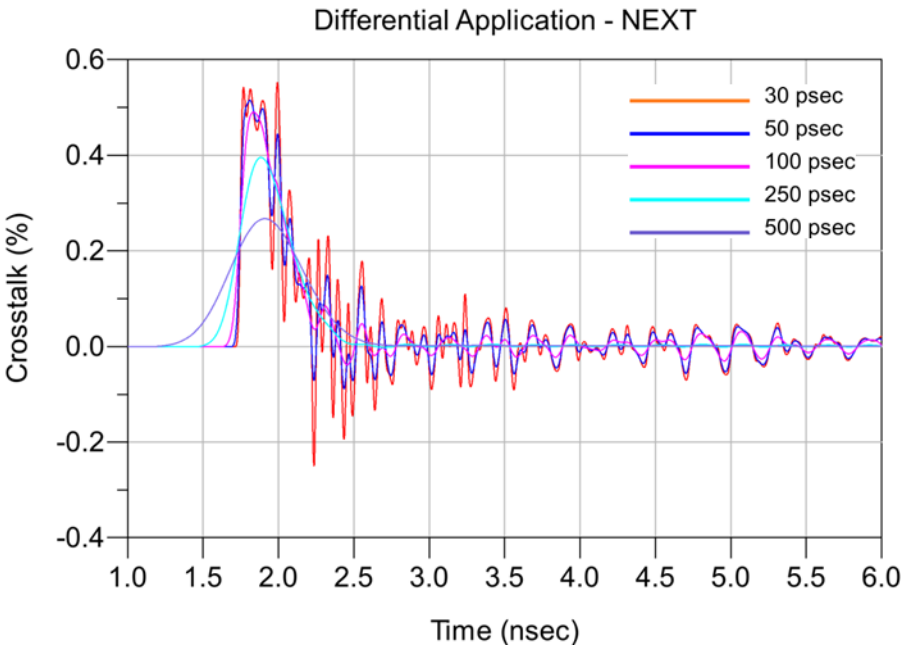


Diff High Density Vertical Application – FEXT, SEAM_121,122_SEAF-RA_132, 133

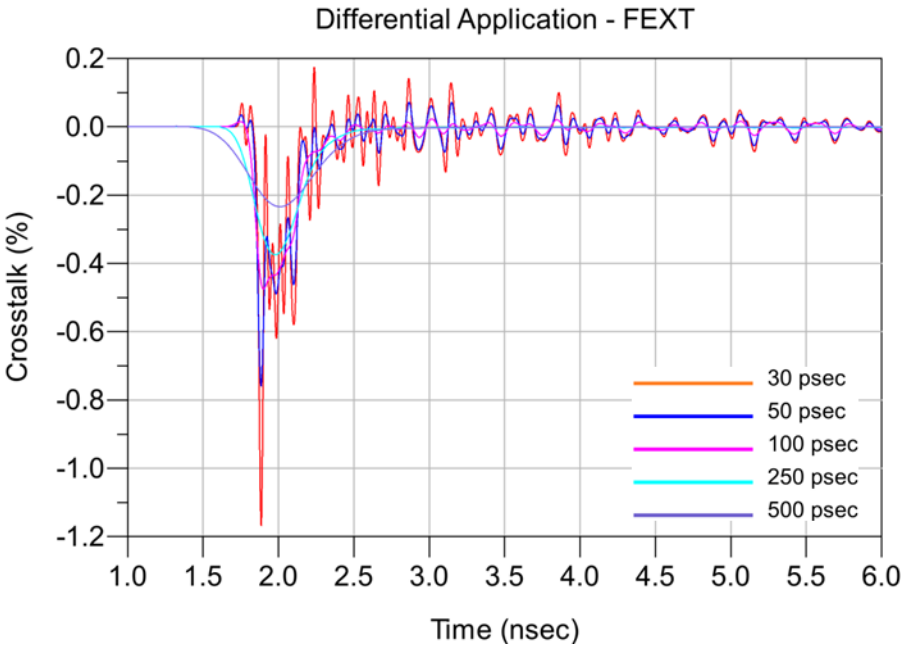


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Diff High Density Vertical Application – NEXT, SEAM_134,135_SEAM_154,155

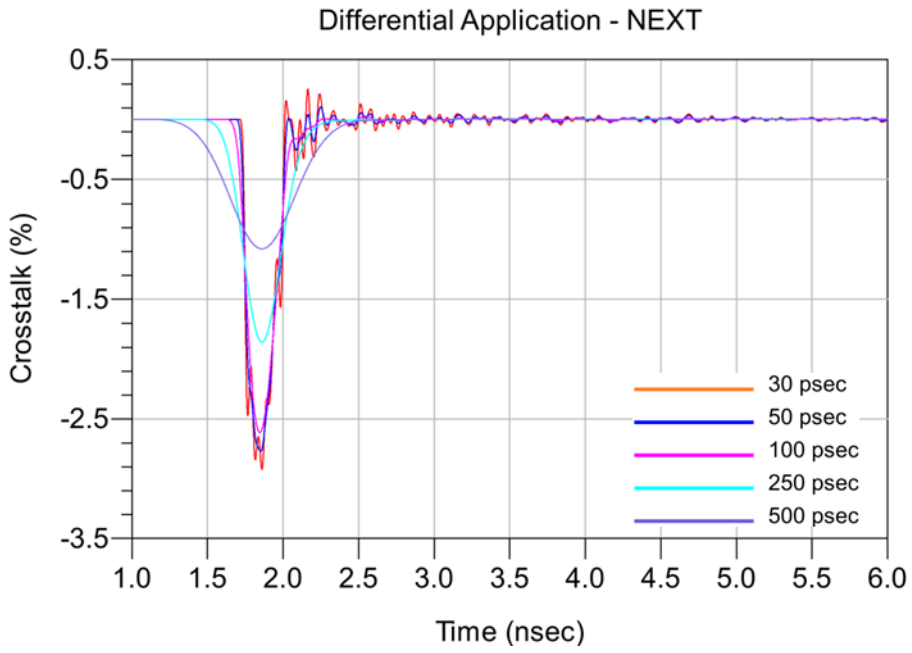


Diff High Density Vertical Application – FEXT, SEAM_134,135_SEAF-RA_154,155

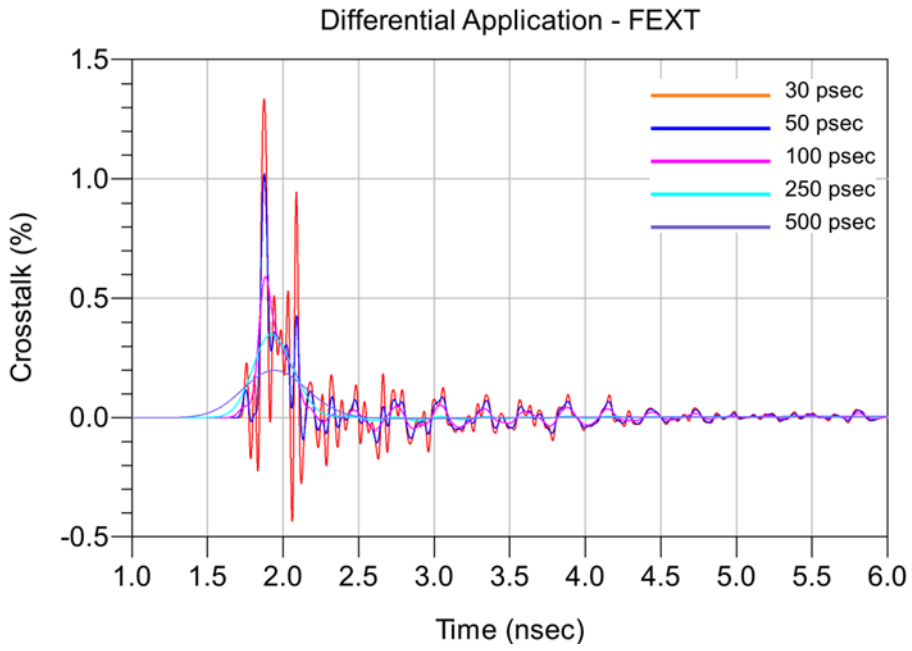


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Diff High Density Vertical Application – NEXT, SEAM_134,135_SEAM_145,146

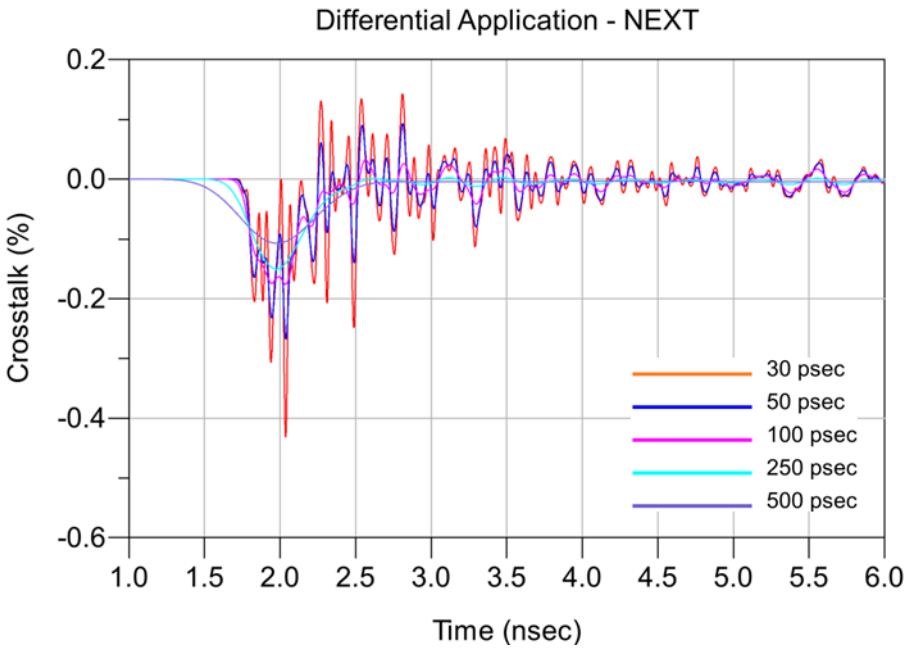


Diff High Density Vertical Application – FEXT, SEAM_134,135_SEAF-RA_145,146

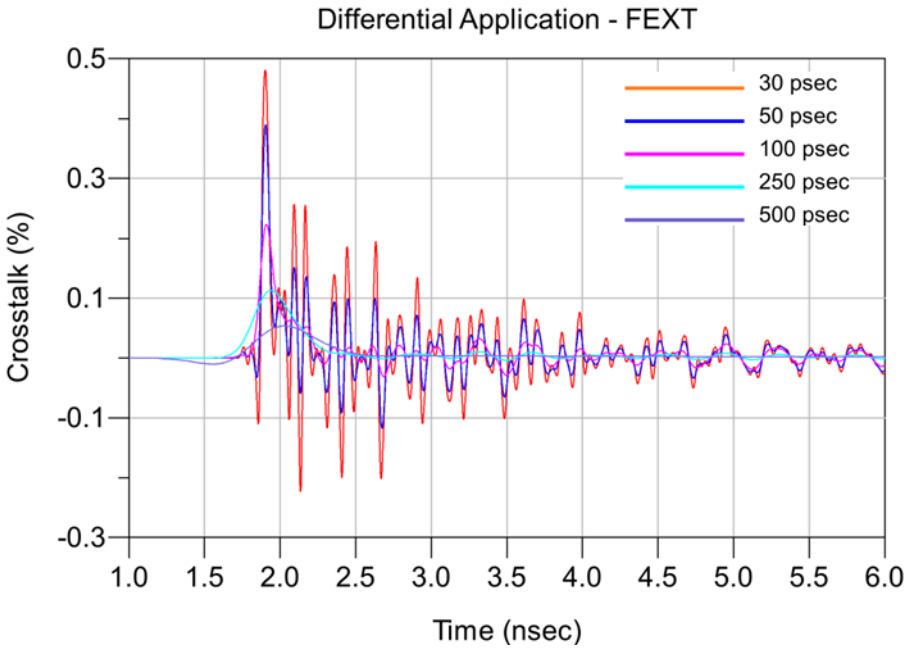


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Diff High Density Vertical Application – NEXT, SEAM_154,155_SEAM_157,158

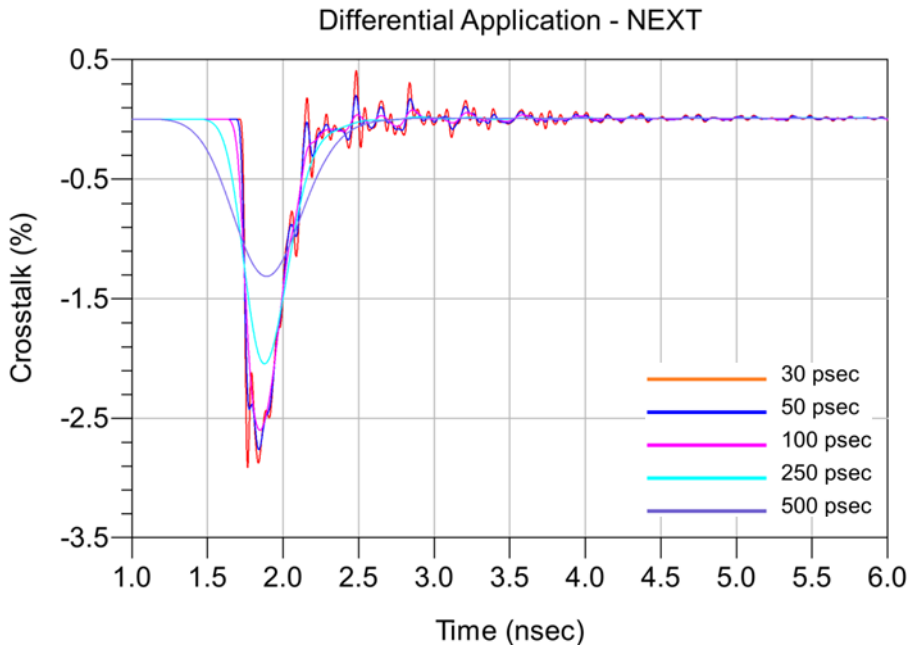


Diff High Density Vertical Application – FEXT, SEAM_154,155_SEAF-RA_157,158

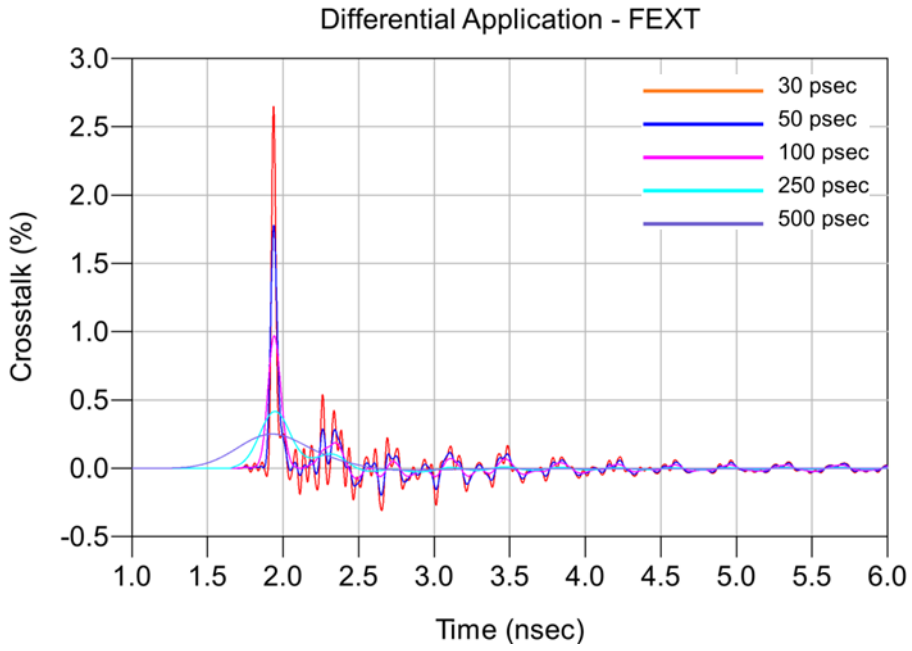


Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Diff High Density Vertical Application – NEXT, SEAM_218, 219_SEAM_229, 230



Diff High Density Vertical Application – FEXT, SEAM_218, 219_SEAF-RA_229, 230



Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

Appendix C – Product and Test System Descriptions

Product Description

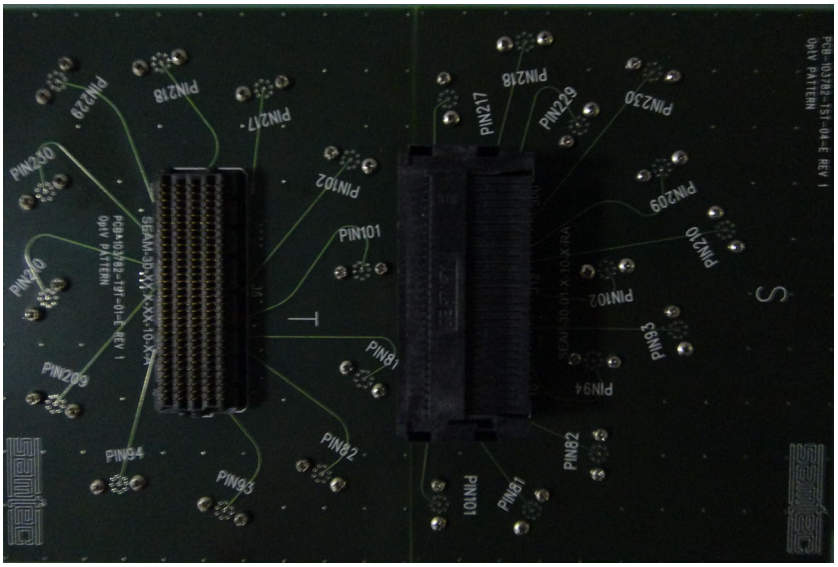
Product test samples are SEAM-2mm/SEAF-RA Series connectors. The part numbers are SEAM-30-02.0-SM-10-2-A-.F/H and SEAF-30-01-S-10-1-RA-TR. The SEAM-2mm/SEAF-RA Series is an open pin field connector designed for single-ended signals with various options for differential signaling configurations. The open pin field array is 10 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 FR-4 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 SEAM-2mm/SEAF-RA Series connector set and identified by part numbers PCB-103782-TST-01-A to E to PCB-103782-TST-04-A to E and PCB-103491-TST-01-B and C to PCB-103491-TST-05-B and C. Calibration standards specific to the SEAM-2mm/SEAF-RA Series are located on the calibration boards PCB-103782-TST-01-F and PCB-103491-TST-06. To keep trace lengths short, five different test board sets were required to access the necessary signal pins.

PCB-103782-TST-XX and PCB-103491-TST-XXTest Fixtures

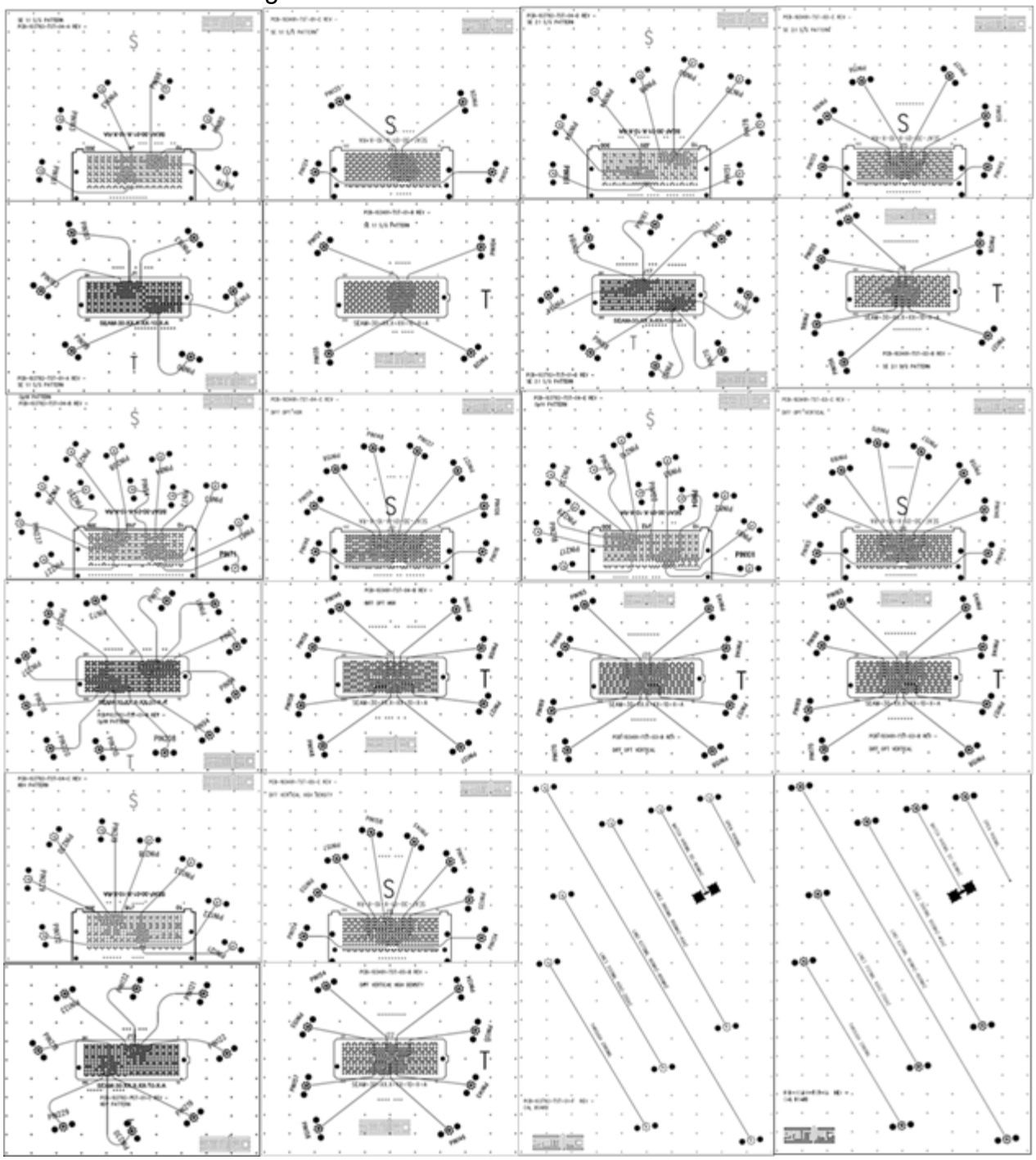
Shown below is a photograph of one of the five test board sets.



Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

PCB-103782-TST-XX and PCB-103491-TST-XXTest Layout Panel

Artwork of the PCB design is shown below.



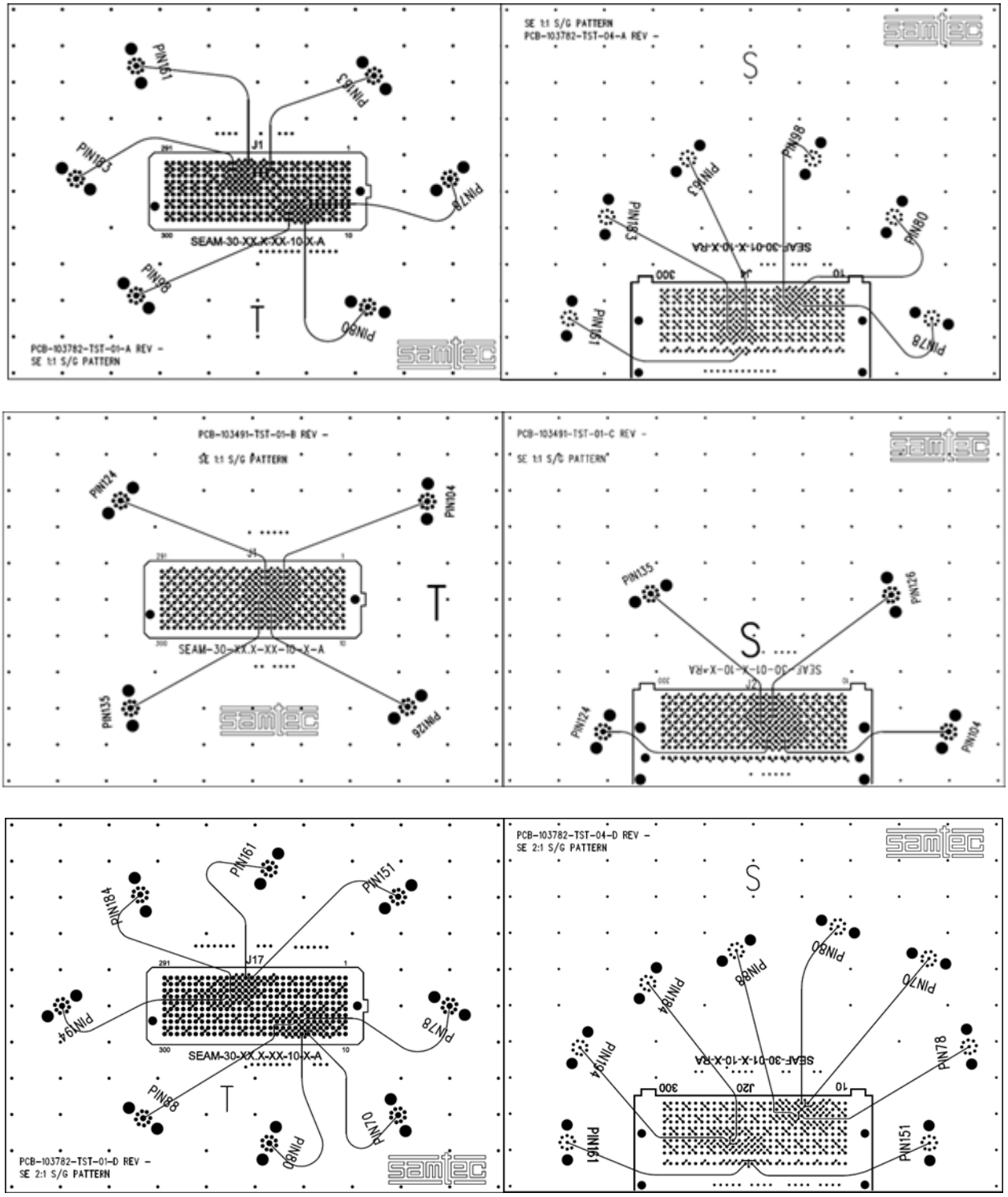
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

PCB Fixtures

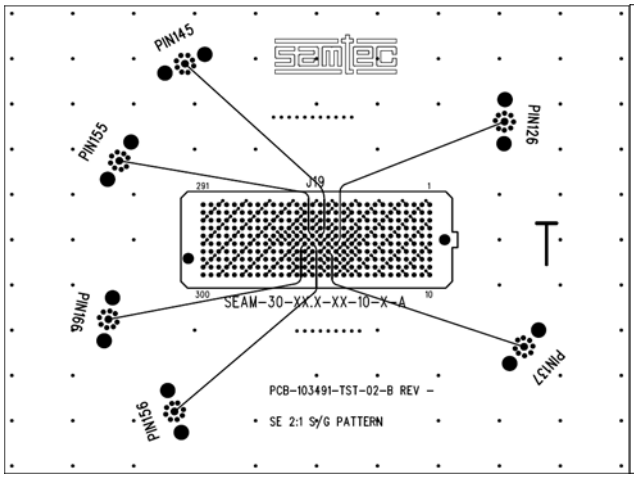
The test fixtures used are as follows:

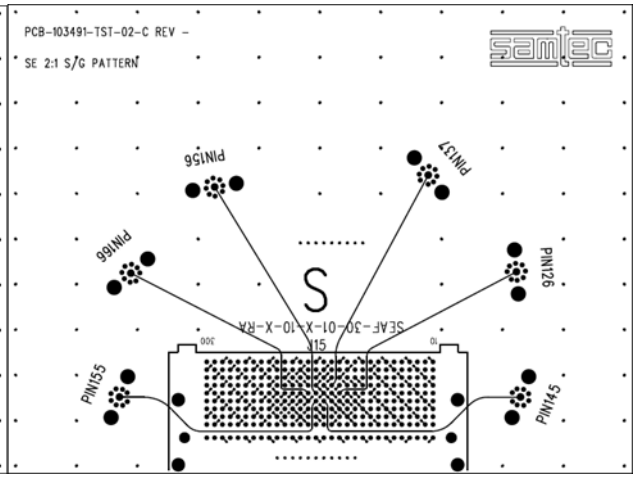
PCB-103782 -TST-01-A Rev – SEAM Series Test Board for SE 1:1 S/G Pattern
PCB-103782 -TST-04-A Rev – SEAF-RA Series Test Board for SE 1:1 S/G Pattern
PCB-103782 -TST-01-D Rev – SEAM Series Test Board for SE 2:1 S/G Pattern
PCB-103782 -TST-04-B Rev – SEAF-RA Series Test Board for SE 2:1 S/G Pattern
PCB-103782 -TST-01-B Rev – SEAM Series Test Board for Differential Optimal Horizontal
PCB-103782 -TST-04-C Rev – SEAF-RA Series Test Board for Differential Optimal Horizontal
PCB-103782 -TST-01-E Rev – SEAM Series Test Board for Differential Optimal Vertical
PCB-103782 -TST-04-D Rev – SEAF-RA Series Test Board for Differential Optimal Vertical
PCB-103782 -TST-01-C Rev – SEAM Series Test Board for Differential High Density Vertical
PCB-103782 -TST-04-E Rev – SEAF-RA Series Test Board for Differential High Density Vertical
PCB-103491 -TST-01-B Rev – SEAM Series Test Board for SE 1:1 S/G Pattern
PCB-103491 -TST-01-C Rev – SEAF-RA Series Test Board for SE 1:1 S/G Pattern
PCB-103491 -TST-02-B Rev – SEAM Series Test Board for SE 2:1 S/G Pattern
PCB-103491 -TST-02-C Rev – SEAF-RA Series Test Board for SE 2:1 S/G Pattern
PCB-103491 -TST-04-B Rev – SEAM Series Test Board for Differential Optimal Horizontal
PCB-103491 -TST-04-C Rev – SEAF-RA Series Test Board for Differential Optimal Horizontal
PCB-103491 -TST-03-B Rev – SEAM Series Test Board for Differential Optimal Vertical
PCB-103491 -TST-03-C Rev – SEAF-RA Series Test Board for Differential Optimal Vertical
PCB-103491 -TST-05-B Rev – SEAM Series Test Board for Differential High Density Vertical
PCB-103491 -TST-05-C Rev – SEAF-RA Series Test Board for Differential High Density Vertical

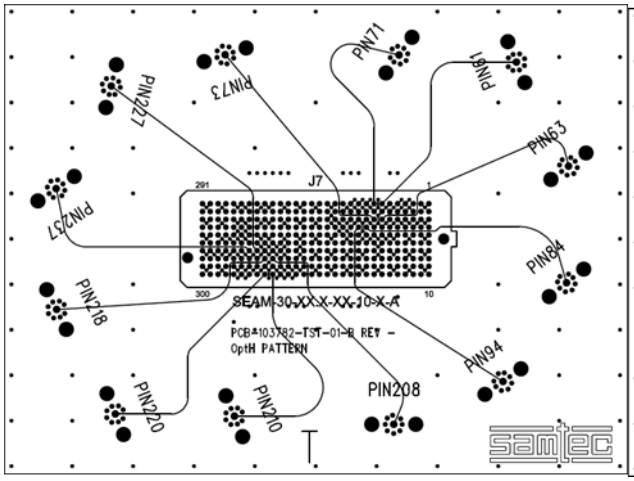
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

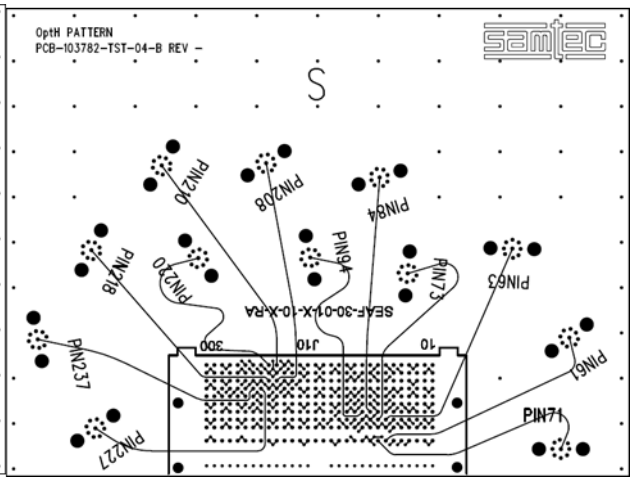


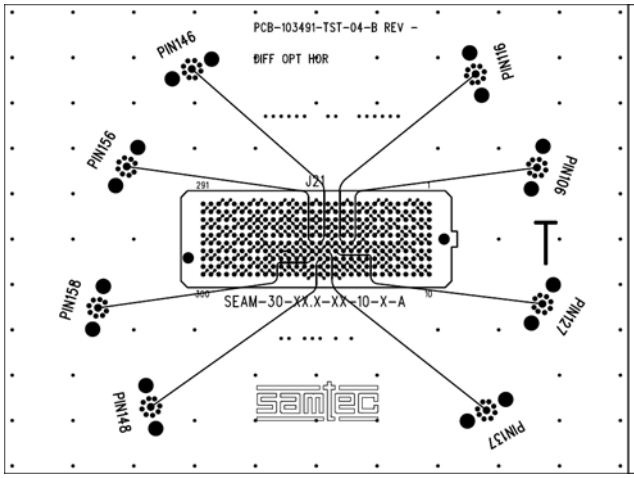
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

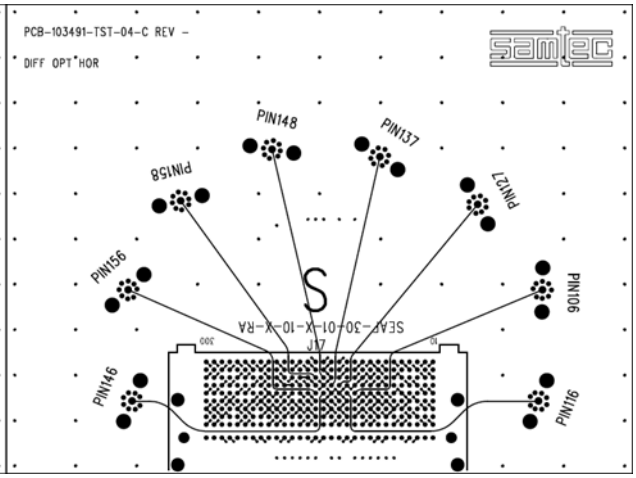




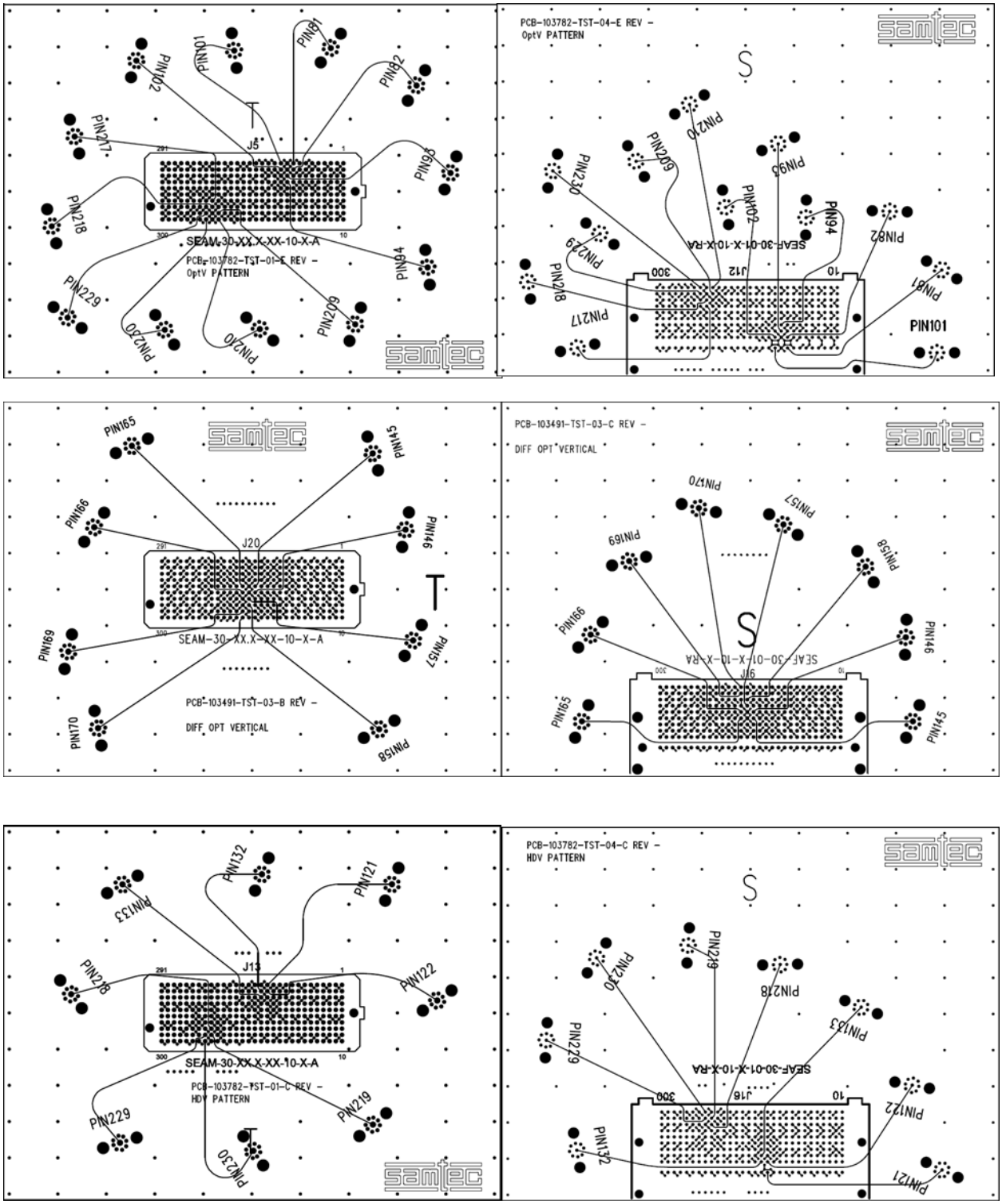




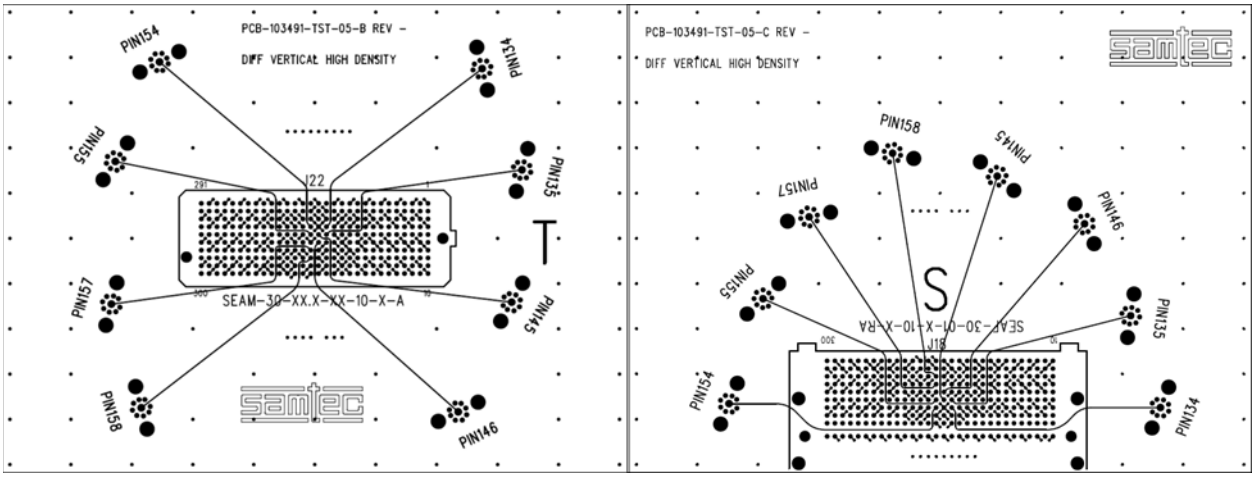




Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle



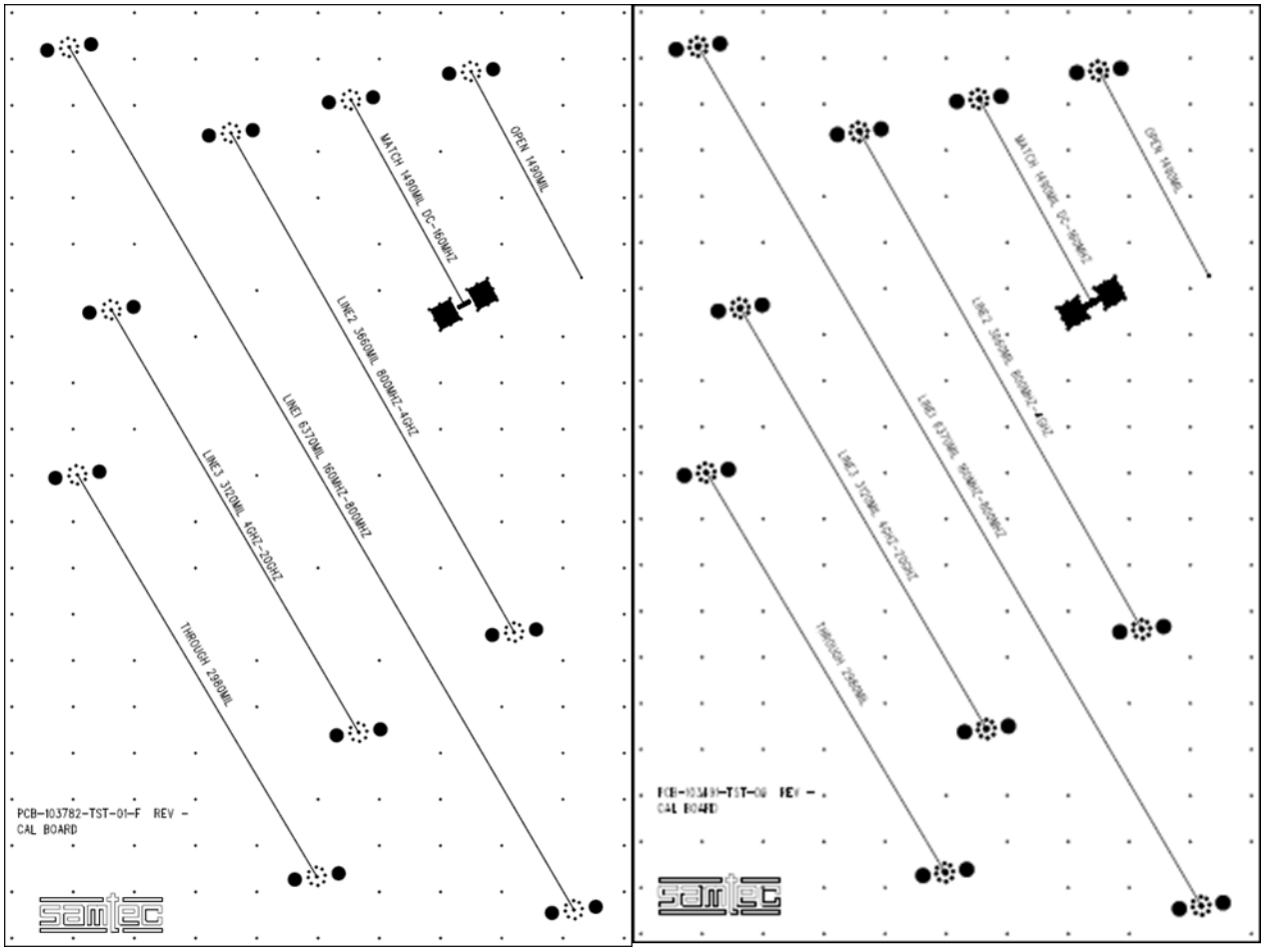
Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle



Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical 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.



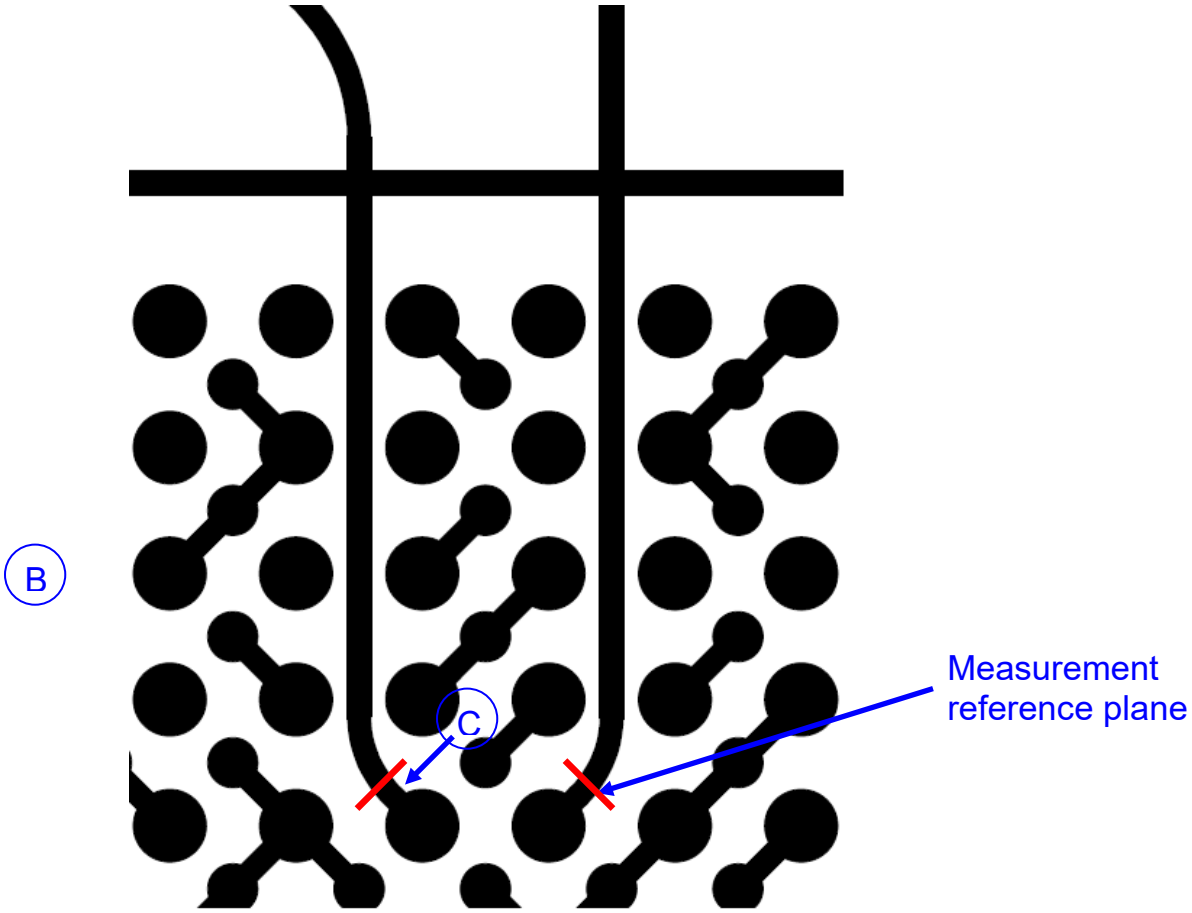
Thru line – 2980 mils
Open Reflect – 1490 mils
Line 1 – 6370 mils
Line 2 – 3660 mils
Line 3 – 3120 mils
Match – 1490 mils

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical 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 SEAM-2mm/SEAF-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: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

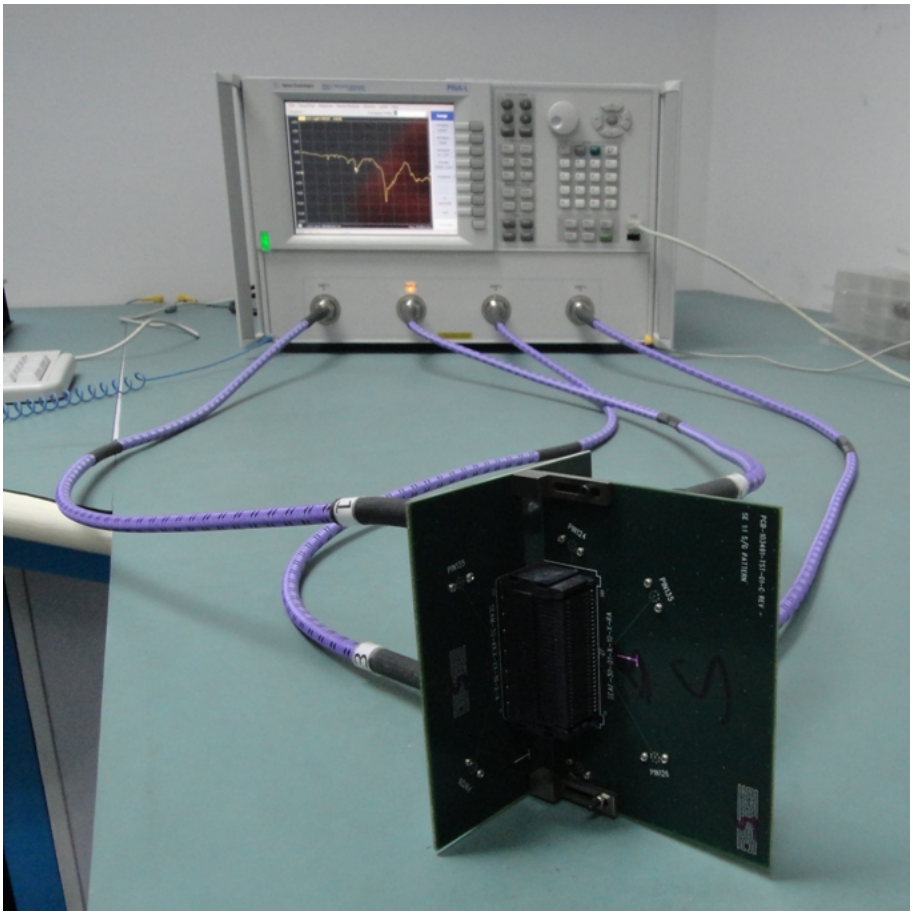
Appendix D – Test and Measurement Setup

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: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical 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 OWD01D02039-4 (DC-50 GHz)

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical 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 SEAM-2mm/SEAF-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 2011.05. 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

Impedance (TDR)
A step pulse is applied to the touchstone model of the connector and the reflected voltage is monitored. The reflected voltage is converted to a reflection coefficient and then transformed into an impedance profile. All ports of the Touchstone model are terminated in 50 ohms.

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical to Right Angle

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 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.

Series: SEAM/SEAF-RA
Description: 1.27mm x 1.27mm grid interconnect system, Vertical 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)