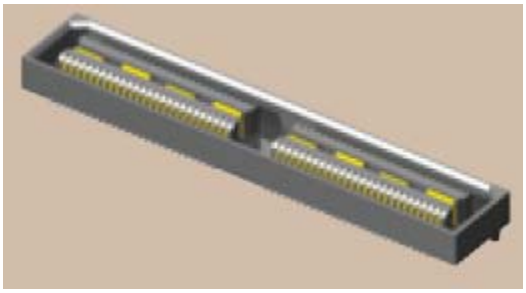
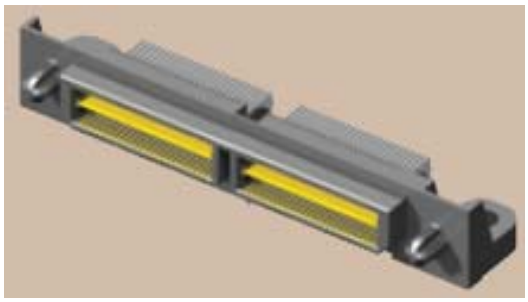
High Speed Characterization Report

QSS-050-01-L-D-A-GP



Mates with

QTS-050-01-L-D-RA-WT



Description:
Micro High Speed Interface, Q Strip, 0.635mm Centerline
Double Row Vertical Socket to Right Angle Terminal Connection

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Report Revision: 12/18/2009

Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

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Connector Overview

Micro High Speed Q Strip interfaces (QSS-DV socket & QTS-RA terminal) are available up to 125 contacts per row. QSS/QTS series connecters include double row vertical, right angle and edge-mount styles. The data presented in this report is applicable only to a QSS double row vertical socket connector mated with a QTS right angle terminal connector.

Connector System Speed Rating

QSS-DV / QTS-RA Series, 0.635mm (0.0250”) Centerline, QSS double row socket mated to a QTS right angle terminal connector

Signaling		Speed Rating
Single-Ended:	Long Path, Row 1	**4.5 GHz / 9Gbps**
	Short Path, Row 2	**5.5 GHz / 11Gbps**
Differential:	Long Path, Row 1	**4.5 GHz / 9Gbps**
	Short Path, Row 2	**6.0 GHz / 12Gbps**

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 trace losses are 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.

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Frequency Domain Data Summary

[Reference Appendix C of complete report for full description of test boards]

ROW 1

Table 1 - Single-Ended Signaling System Performance (row 1)				
Parameter	**Conf.**	**Source**	**Victim**	
Insertion Loss	sp3-57il	probe 3=QSS-DV_57, probe 5=QTS-RA_57		-3dB @ 4.5 GHz
Return Loss	sp3-57rl	probe 3=QSS-DV_57, probe 5=QTS-RA_57		≤ -5dB to 4.5 GHz
Near-End Crosstalk	sp3-55nw53	QSS-DV_55	QSS-DV_53	≤ -6dB to 4.5 GHz
	sp3-57nb53	QSS-DV_57	QSS-DV_53	≤ -24dB to 4.5 GHz
	sp3-98nx97	QSS-DV_98	QSS-DV_97	≤ -38dB to 4.5 GHz
Far-End Crosstalk	sp3-55fw53	QSS-DV_55	QTS-RA_53	≤ -15dB to 4.5 GHz
	sp3-57fb53	QSS-DV_57	QTS-RA_53	≤ -8dB to 4.5 GHz
	sp3-98fx97	QSS-DV_98	QTS-RA_97	≤ -36dB to 4.5 GHz

Table 2 - Differential Signaling System Performance (row 1)				
Parameter	**Conf.**	**Source**	**Victim**	
Insertion Loss	sp34-911il	probe34=QSS-DV_9-11, probe56=QTS-RA_9-11		-3dB @ 4.4 GHz
Return Loss	sp34-911rl	probe34=QSS-DV_9-11, probe56=QTS-RA_9-11		≤ -5dB to 4.4 GHz
Near-End Crosstalk	sp34-79nw35	QSS-DV_7-9	QSS-DV_3-5	≤ -19dB to 4.4 GHz
	sp34-911nb35	QSS-DV_9-11	QSS-DV_3-5	≤ -24dB to 4.4 GHz
	sp34-9698nx9597	QSS-DV_96-98	QSS-DV_95-97	≤ -46dB to 4.4 GHz
Far-End Crosstalk	sp34-79fw35	QSS-DV_7-9	QTS-RA_3-5	≤ -25dB to 4.4 GHz
	sp34-911fb35	QSS-DV_9-11	QTS-RA_3-5	≤ -20dB to 4.4 GHz
	sp34-9698fx9597	QSS-DV_96-98	QTS-RA_95-97	≤ -45dB to 4.4 GHz

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ROW 2

Table 3 - Single-Ended Signaling System Performance (row 2)				
Parameter	**Conf.**	**Source**	**Victim**	
Insertion Loss	sp3-78il	probe 3=QSS-DV_78 probe 5=QTS-RA_78		-3dB @ 5.4 GHz
Return Loss	sp3-78rl	probe 3=QSS-DV_78 probe 5=QTS-RA_78		≤ -12dB to 5.4 GHz
Near-End Crosstalk	sp3-86nw84	QSS-DV_86	QSS-DV_84	≤ -8dB to 5.4 GHz
	sp3-78nb74	QSS-DV_78	QSS-DV_74	≤ -12dB to 5.4 GHz
	sp3-98nx97	QSS-DV_98	QSS-DV_97	≤ -35dB to 5.4 GHz
Far-End Crosstalk	sp3-86fw84	QSS-DV_86	QTS-RA_84	≤ -7dB to 5.4 GHz
	sp3-78fb74	QSS-DV_78	QTS-RA_74-76	≤ -9dB to 5.4 GHz
	sp3-98fx97	QSS-DV_98	QTS-RA_97	≤ -34dB to 5.4 GHz

Table 4- Differential Signaling System Performance (row 2)				
Parameter	**Conf.**	**Source**	**Victim**	
Insertion Loss	sp34-1820il	probe 34=QSS-DV_18-20 probe 56=QTS-RA_18-20		-3dB @ 5.7 GHz
Return Loss	sp34-1820rl	probe 34=QSS-DV_18-20 probe 56=QTS-RA_18-20		≤ -7dB to 5.7 GHz
Near-End Crosstalk	sp34-1416nw1820	QSS-DV_14-16	QSS-DV_18-20	≤ -19dB to 5.7 GHz
	sp34-1820nb1214	QSS-DV_18-20	QSS-DV_12-14	≤ -26dB to 5.7 GHz
	sp34-9698nx9597	QSS-DV_96-98	QSS-DV_95-97	≤ -46dB to 5.7 GHz
Far-End Crosstalk	sp34-1416fw1820	QSS-DV_14-16	QTS-RA_18-20	≤ -23dB to 5.7 GHz
	sp34-1820fb1214	QSS-DV_18-20	QTS-RA_12-14	≤ -22dB to 5.7 GHz
	sp34-9698fx9597	QSS-DV_96-98	QTS-RA_95-97	≤ -40dB to 5.7 GHz

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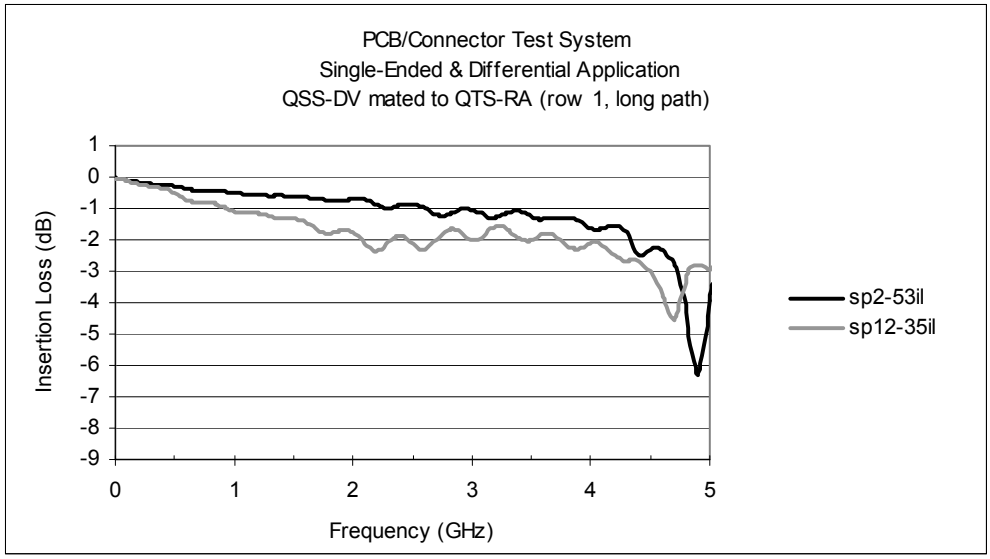
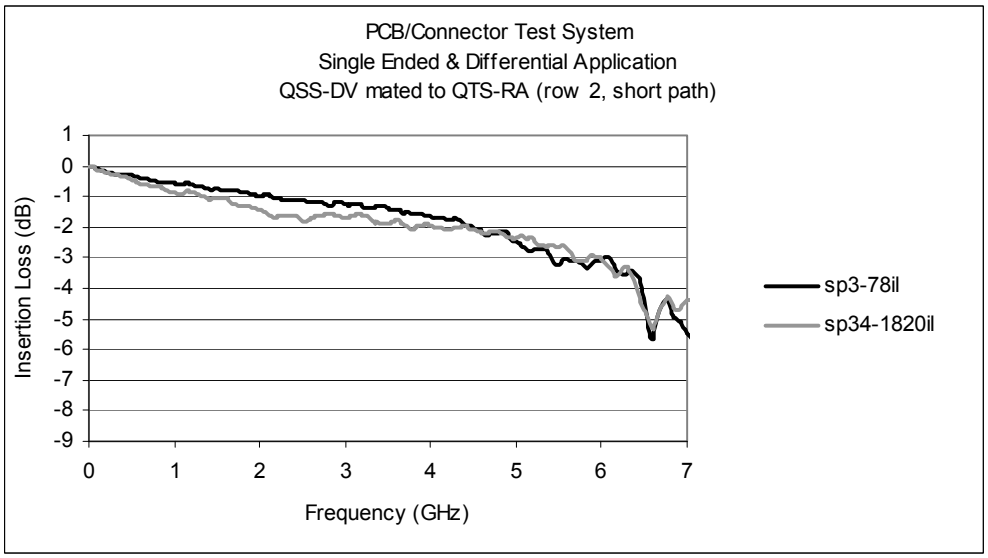
Bandwidth Chart – Single-Ended & Differential Insertion Loss

Row 1, long path



Row 2, short path



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250") Pitch, Two Row, Vertical to Right Angle Connection

Time Domain Data Summary

[Reference Appendix C of complete report for full description of test boards]

ROW 1

Table 5 - Single-Ended Impedance (Ω) – (row 1)							
Signal Risetime	**35±5ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**	**750 ps**	**1 ns**
Maximum Impedance	57.3	53.3	52.2	52.0	51.2	50.5	50.0
Minimum Impedance	39.1	40.9	43.1	47.0	48.9	49.6	49.7

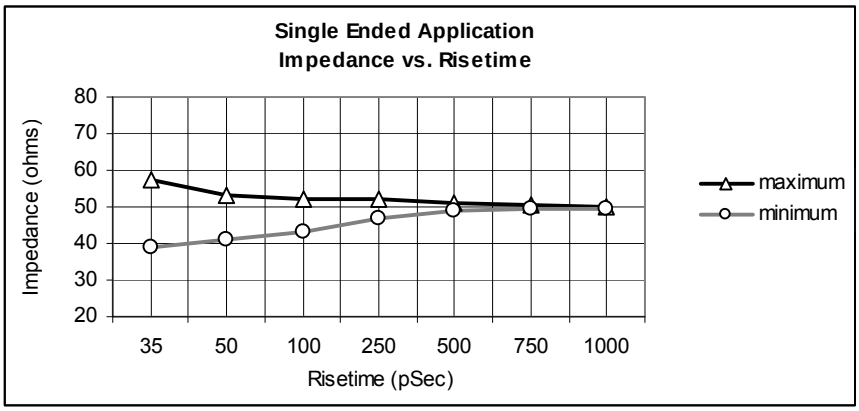
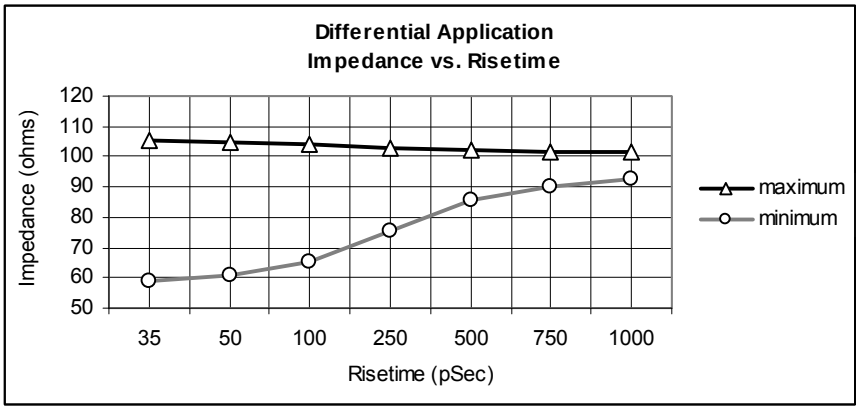


Table 6 - Differential Impedance (Ω) - (row 1)							
Signal Risetime	**35±5ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**	**750 ps**	**1 ns**
Maximum Impedance	105.1	104.4	104.1	103.0	102.1	101.7	101.6
Minimum Impedance	58.8	61.0	65.0	75.7	85.7	90.3	92.8



Series: QSS/QTS-RA Series
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ROW 2

Table 7 - Single-Ended Impedance (Ω) – (row 2)							
Signal Risetime	**35±5ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**	**750 ps**	**1 ns**
Maximum Impedance	57.4	55.4	53.1	52.1	52.0	51.4	51.1
Minimum Impedance	43.6	46.7	48.2	49.3	50.5	50.8	50.7

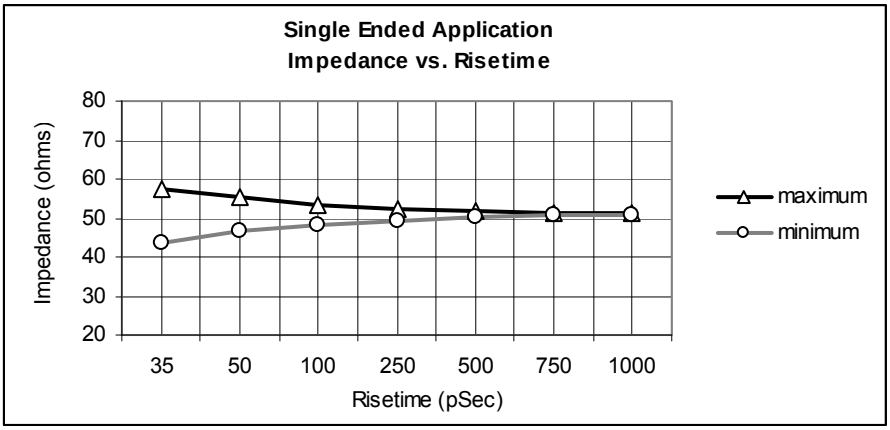

Table 8 - Differential Impedance (Ω) – (row 2)							
Signal Risetime	**35±5ps**	**50 ps**	**100 ps**	**250 ps**	**500 ps**	**750 ps**	**1 ns**
Maximum Impedance	103.6	103.3	103.0	102.4	101.8	101.1	100.1
Minimum Impedance	71.6	72.8	76.6	83.9	90.7	93.6	95.3

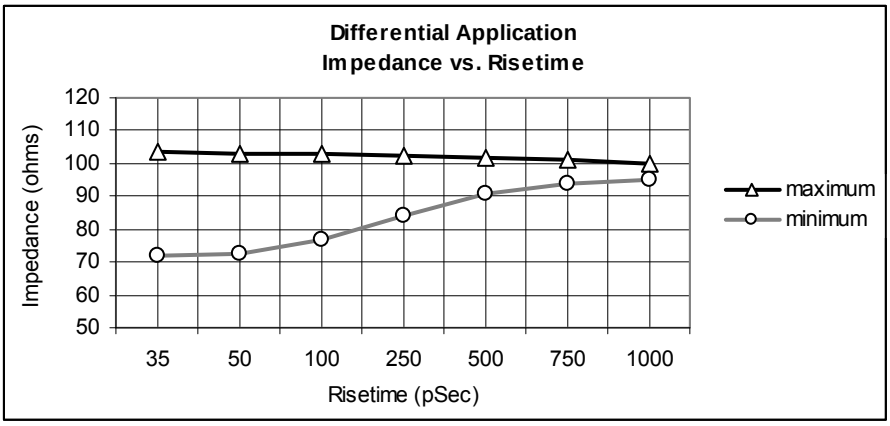

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Table 9 - Single-Ended Crosstalk (%), row 1

Input (t_r)		Source	Victim	35±5ps	50ps	100ps	250ps	500ps	750ps	1ns
NEXT	SE2 to SE1	QSS-DV_55	QSS-DV_53	20.8	20.0	19.0	13.7	8.5	6.1	4.8
	SE4 to SE3	QSS-DV_57	QSS-DV_53	4.6	3.1	2.5	1.9	1.2	< 1.0%	< 1.0%
	SE6 to SE5	QSS-DV_98	QSS-DV_97	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%
FEXT	SE2 to SE1	QSS-DV_55	QTS-RA_53	8.4	5.8	3.5	1.4	< 1.0%	< 1.0%	< 1.0%
	SE4 to SE3	QSS-DV_57	QTS-RA_53	6.7	4.8	3.0	1.3	< 1.0%	< 1.0%	< 1.0%
	SE6 to SE5	QSS-DV_98	QTS-RA_97	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%

Table 10 - Differential Crosstalk (%) row 1

Input (t_r)		Source	Victim	35±5ps	50ps	100ps	250ps	500ps	750ps	1ns
NEXT	DP2 to DP1	QSS-DV_7-9	QSS-DV_3-5	6.0	5.8	5.3	3.9	2.6	1.9	1.5
	DP4 to DP3	QSS-DV_9-11	QSS-DV_3-5	1.0	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%
	DP6 to DP5	QSS-DV_96-98	QSS-DV_95-97	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%
FEXT	DP2 to DP1	QSS-DV_7-9	QTS-RA_3-5	3.1	2.2	1.8	1.2	< 1.0%	< 1.0%	< 1.0%
	DP4 to DP3	QSS-DV_9-11	QTS-RA_3-5	1.2	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%
	DP6 to DP5	QSS-DV_96-98	QTS-RA_95-97	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%

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Table 11 - Single-Ended Crosstalk (%), row 2

Input (t_r)		Source	Victim	35±5ps	50ps	100ps	250ps	500ps	750ps	1ns
NEXT	SE2 to SE1	QSS-DV_86	QSS-DV_84	20.1	17.9	15.0	10.1	6.4	4.6	3.6
	SE4 to SE3	QSS-DV_78	QSS-DV_74	7.1	5.2	3.3	2.6	1.8	1.3	1.0
	SE6 to SE5	QSS-DV_98	QSS-DV_97	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%
FEXT	SE2 to SE1	QSS-DV_86	QTS-RA_84	15.1	11.3	7.1	3.2	1.7	1.2	< 1.0%
	SE4 to SE3	QSS-DV_78	QTS-RA_74	< 1.0%	8.6	5.5	2.4	1.3	< 1.0%	< 1.0%
	SE6 to SE5	QSS-DV_98	QTS-RA_97	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%

Table 12 - Differential Crosstalk (%), row 2

Input (t_r)		Source	Victim	35±5ps	50ps	100ps	250ps	500ps	750ps	1ns
NEXT	DP2 to DP1	QSS-DV_14-16	QSS-DV_18-20	4.8	4.5	4.0	2.8	1.8	1.3	1.1
	DP4 to DP3	QSS-DV_18-20	QSS-DV_12-14	1.6	1.2	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%
	DP6 to DP5	QSS-DV_96-98	QSS-DV_95-97	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%
FEXT	DP2 to DP1	QSS-DV_14-16	QTS-RA_18-20	4.1	2.6	1.5	< 1.0%	< 1.0%	< 1.0%	< 1.0%
	DP4 to DP3	QSS-DV_18-20	QTS-RA_12-14	3.5	2.4	1.6	< 1.0%	< 1.0%	< 1.0%	< 1.0%
	DP6 to DP5	QSS-DV_96-98	QTS-RA_95-97	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%	< 1.0%

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Table 13 - Propagation Delay (row 1)			
Configuration		**Signal Path**	(Mated Connector Only)
Single-Ended	SE4	probe 3=QSS-DV_57, probe 5=QTS-RA_57	108ps
Differential	DP4	probe34=QSS-DV_9-11, probe56=QTS-RA_9-11	108ps

Table 14 - Propagation Delay (row 2)			
Configuration		**Signal Path**	(Mated Connector Only)
Single-Ended	SE4	probe 3=QSS-DV_78 probe 5=QTS-RA_78	94ps
Differential	DP4	probe 34=QSS-DV_18-20 probe 56=QTS-RA_18-20	83 ps

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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 test PCB from drive side probe tips to receive side probe tips. PCB effects are not removed or de-embedded from test data. PCB designs with impedance mismatch, large losses, skew, cross talk, or similar impairments can have a significant impact on observed test data. Therefore, great design effort is put forth to limit these effects in the PCB utilized in these tests. Some board related effects, such as pad-to-ground capacitance and trace loss, are included in the data presented in this report. However, other effects, such as via coupling or stub resonance, are not evaluated here. Such effects are addressed and characterized fully by the Samtec Final Inch® products.

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

Differential and Single-Ended Data

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

Connector Signal to Ground Ratio

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

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

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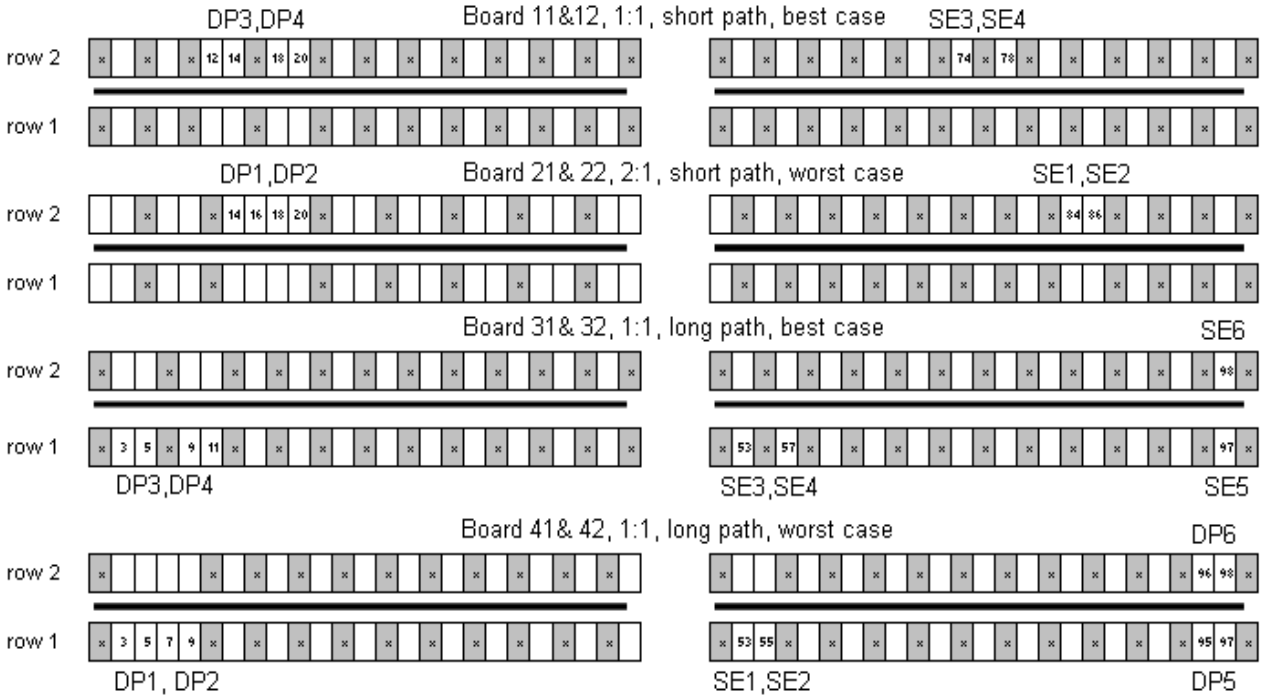
For this connector, the following array configurations are evaluated:

	open pin field	X	grounded pin field

P# signal aggressor or signal victim pins



Single-Ended Impedance:

- Well-referenced line (reference SE4, 1:1),

Single-Ended Crosstalk:

- Well-referenced line; mimics 1:1 S:G ratio (reference SE4, 1:1),
- 2:1 S:G ratio (reference SE2 to SE1),

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

Differential Impedance:

- Well-referenced line (reference DP4, 1:1)

Differential Crosstalk:

- Well-referenced line; mimics 1:1 S:G ratio (reference DP1)
- Higher Signal Density (reference DP2 to DP1)

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- Full-Row Differential (reference DP4 to DP3)

Only one differential pair was driven for crosstalk measurements.

*In all cases where a center ground blade is present in the connector it is always grounded to the PCB. Only one single-ended signal or differential pair was driven for crosstalk measurements.

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

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

Signal Edge Speed (Rise Time):
In pulse signaling applications, the perceived performance of the interconnect, can vary significantly depending on the edge rate or rise time of the exciting signal. For this report, the fastest rise time used was 35 +/-5 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 30 ps and 1.0 ns.

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 from time domain measurements using Fourier Transform calculations. Procedures and methods used in

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generating the SUT's frequency domain data are provided in the frequency domain test procedures in Appendix E of this report.

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

Reference plane impedance is 50 ohms for single-ended measurements and 100 ohms for differential measurements. The fastest risetime signal exciting the SUT is 35 ± 5 picoseconds.

In this report, propagation delay is defined as the signal propagation time through the PCB connector pads and connector pair. It does not include PCB traces. Delay is measured at 35 ± 5 picoseconds signal risetime. 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. But 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.

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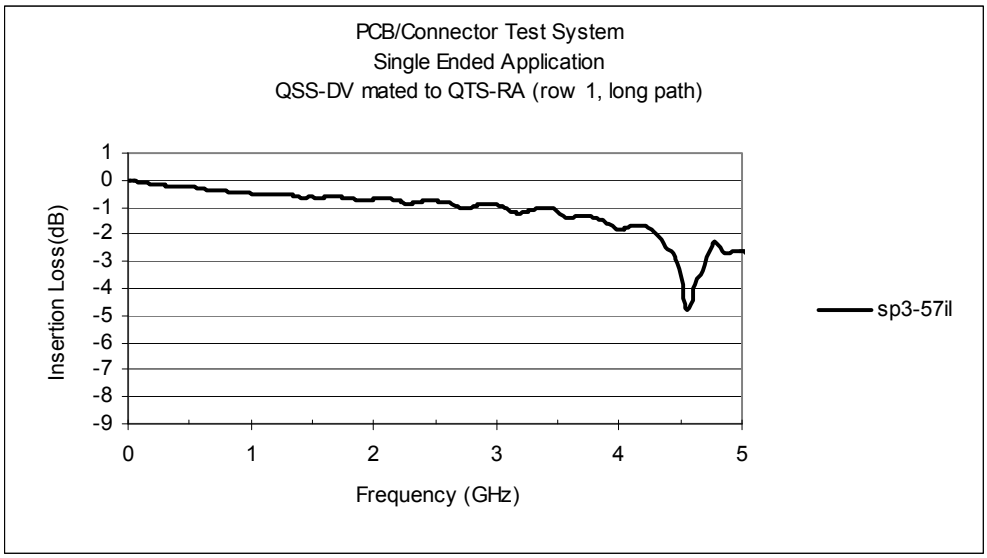
Appendix A – Frequency Domain Response Graphs

ROW 1, long path

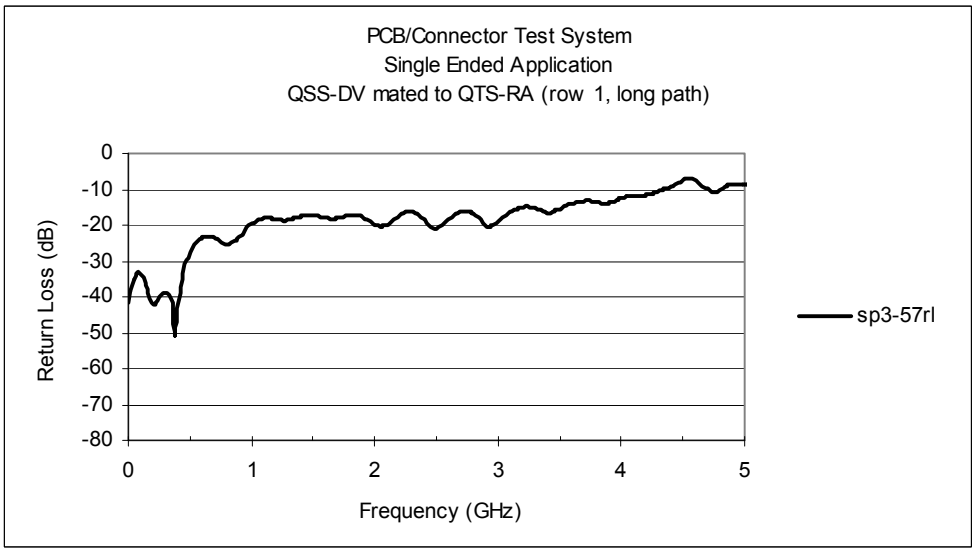
Single-Ended Application – Insertion Loss

Configuration: probe 3=QSS-DV_57, probe 5=QTS-RA_57



Single-Ended Application – Return Loss

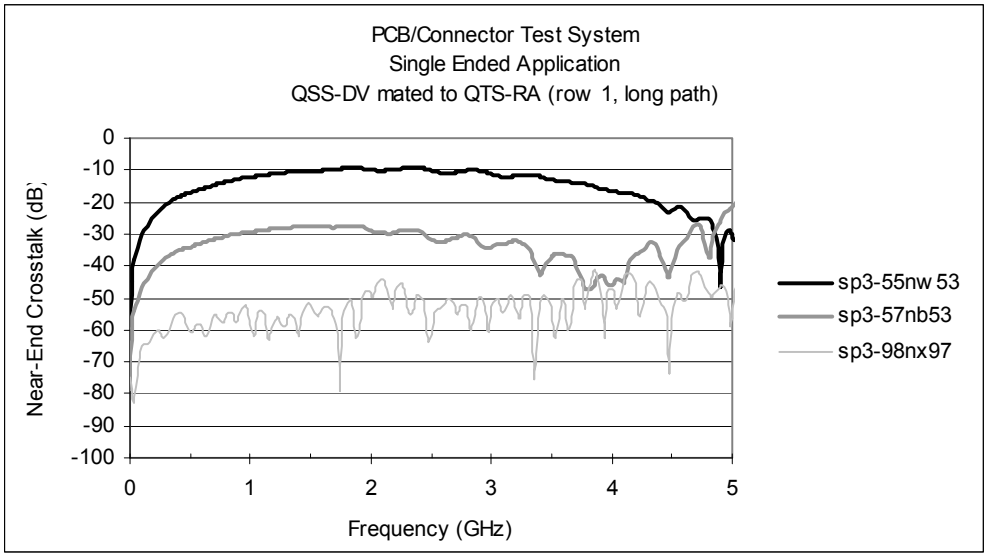
Configuration: probe 3=QSS-DV_57, probe 5=QTS-RA_57



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

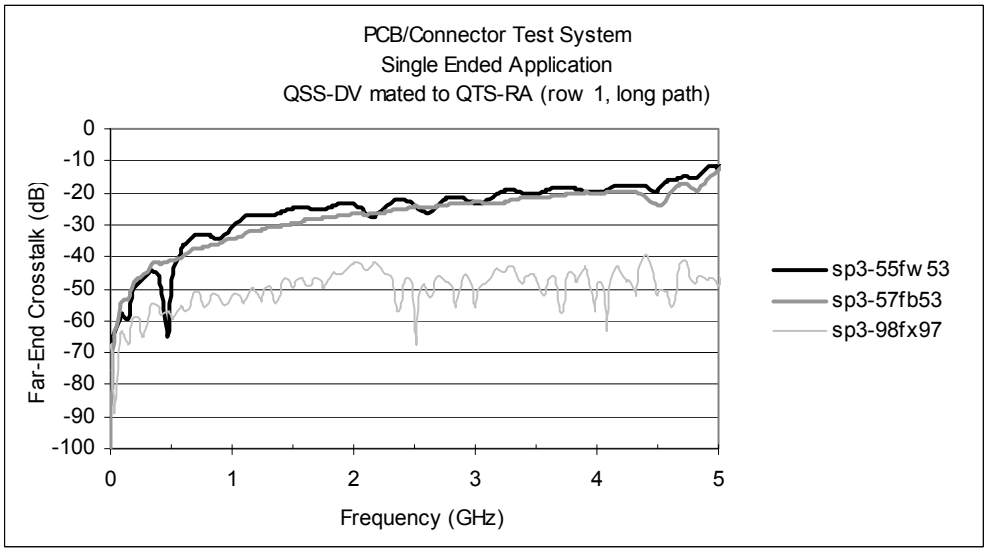
Single-Ended Application – NEXT Configurations

worse case	QSS-DV_55	QSS-DV_53
best case	QSS-DV_57	QSS-DV_53
row 2 to 1	QSS-DV_98	QSS-DV_97



Single-Ended Application – FEXT Configurations

worse case	QSS-DV_55	QTS-RA_53
best case	QSS-DV_57	QTS-RA_53
row 2 to 1	QSS-DV_98	QTS-RA_97

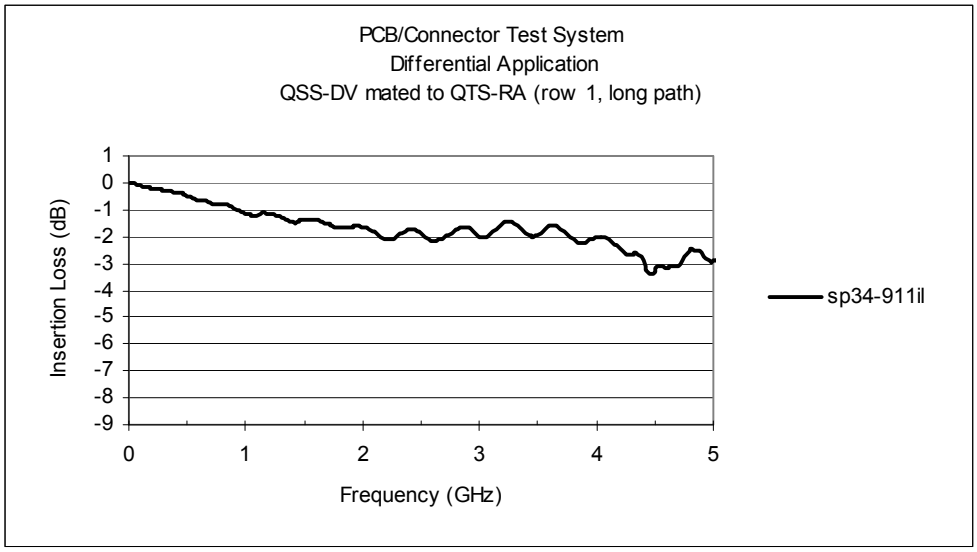


Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

ROW 1, long path

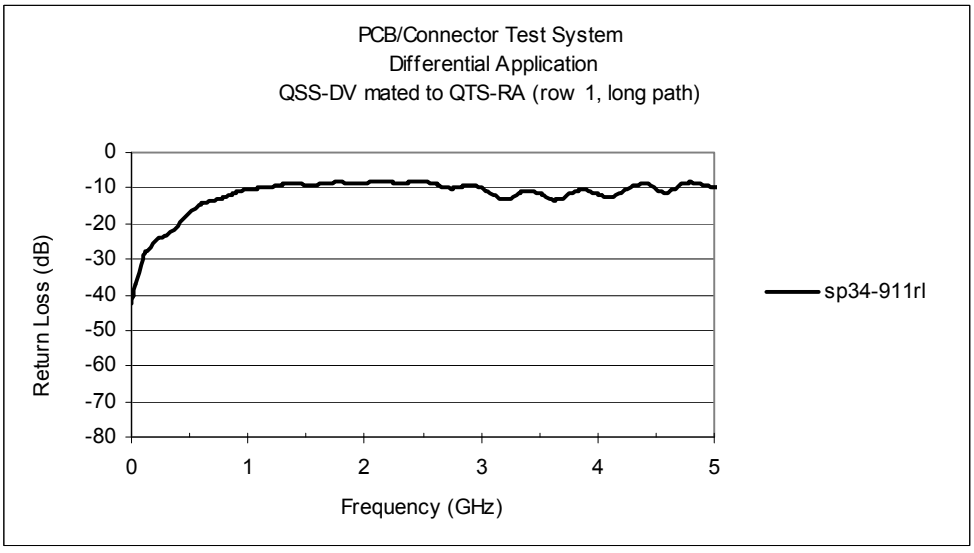
Differential Application – Insertion Loss

Configuration: probe34=QSS-DV_9-11, probe56=QTS-RA_9-11



Differential Application – Return Loss

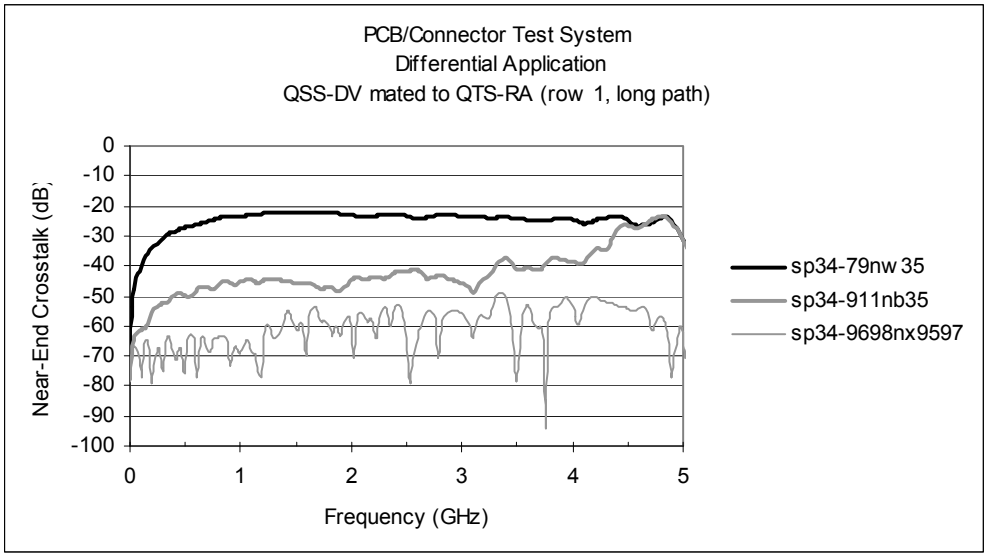
Configuration: probe34=QSS-DV_9-11, probe56=QTS-RA_9-11



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

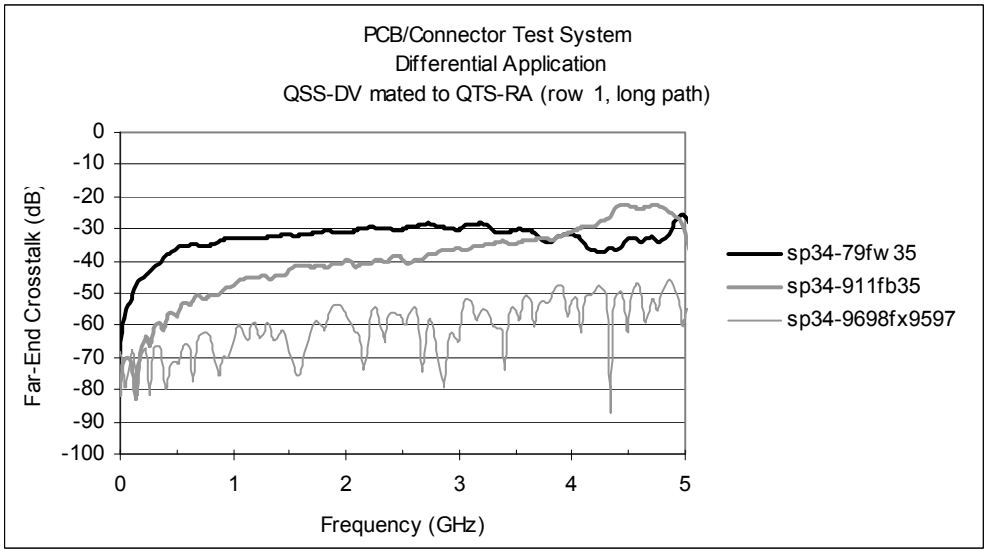
Differential Application – NEXT Configurations

worse case	QSS-DV_7-9	QSS-DV_3-5
best case	QSS-DV_9-11	QSS-DV_3-5
row 2 to 1	QSS-DV_96-98	QSS-DV_95-97



Differential Application – FEXT Configurations

worse case	QSS-DV_7-9	QTS-RA_3-5
best case	QSS-DV_9-11	QTS-RA_3-5
row 2 to1	QSS-DV_96-98	QTS-RA_95-97

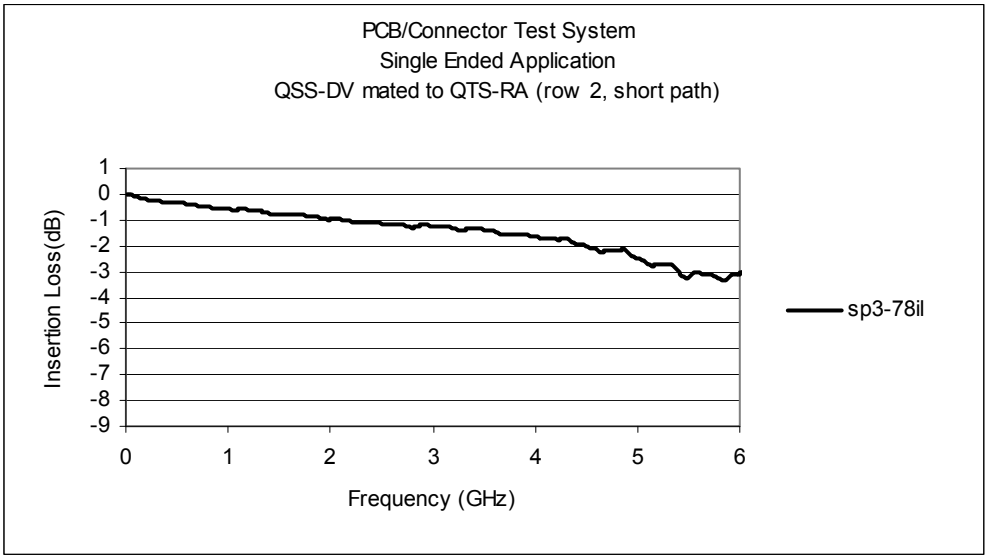


Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250") Pitch, Two Row, Vertical to Right Angle Connection

ROW 2, short path

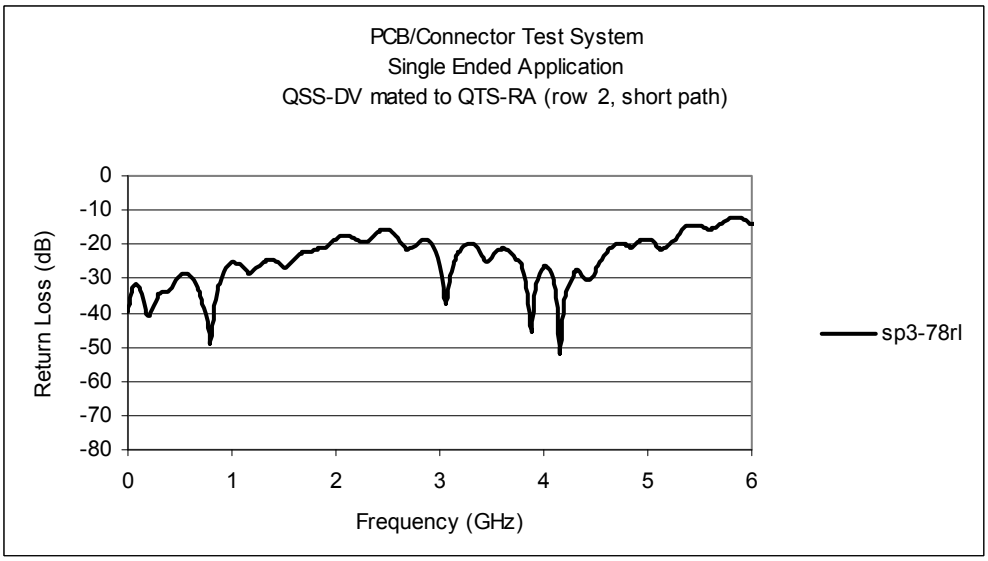
Single-Ended Application – Insertion Loss

Configuration: probe 3=QSS-DV_78, probe 5=QTS-RA_78



Single-Ended Application – Return Loss

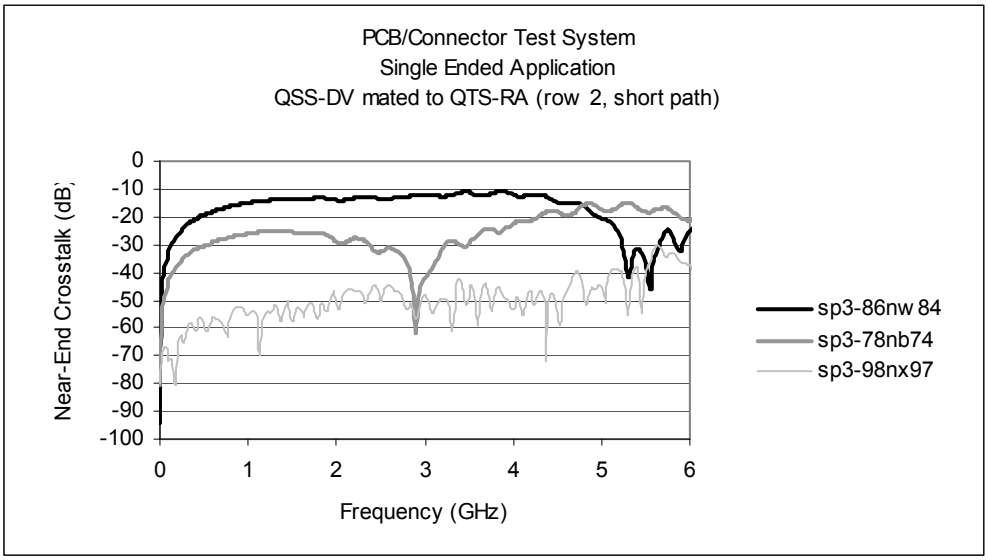
Configuration: probe 3=QSS-DV_78, probe 5=QTS-RA_78



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250") Pitch, Two Row, Vertical to Right Angle Connection

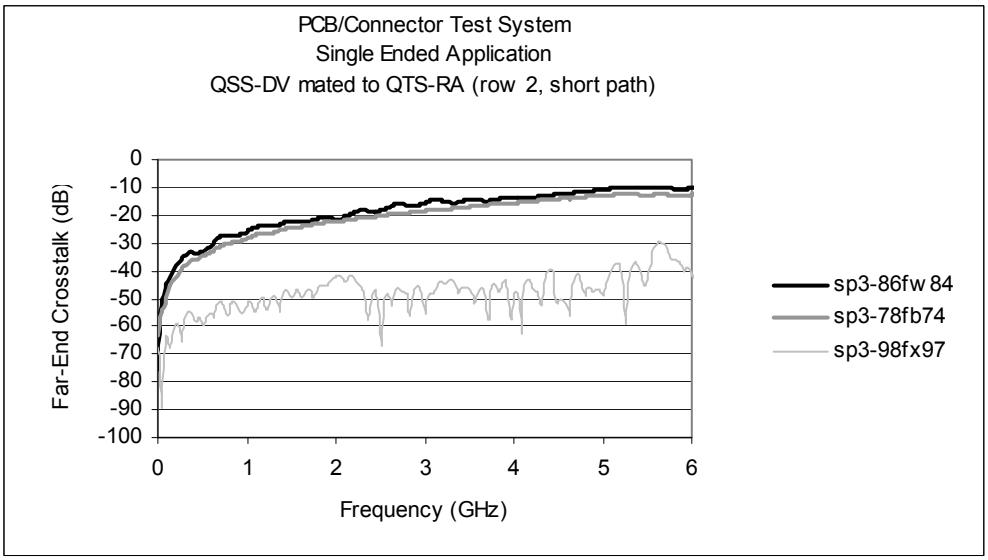
Single-Ended Application – NEXT Configurations

worse case	QSS-DV_86	QSS-DV_84
best case	QSS-DV_78	QSS-DV_74
row 2 to 1	QSS-DV_98	QSS-DV_97



Single-Ended Application – FEXT Configurations

worse case	QSS-DV_86	QTS-RA_84
best case	QSS-DV_78	QTS-RA_74
row 2 to 1	QSS-DV_98	QTS-RA_97

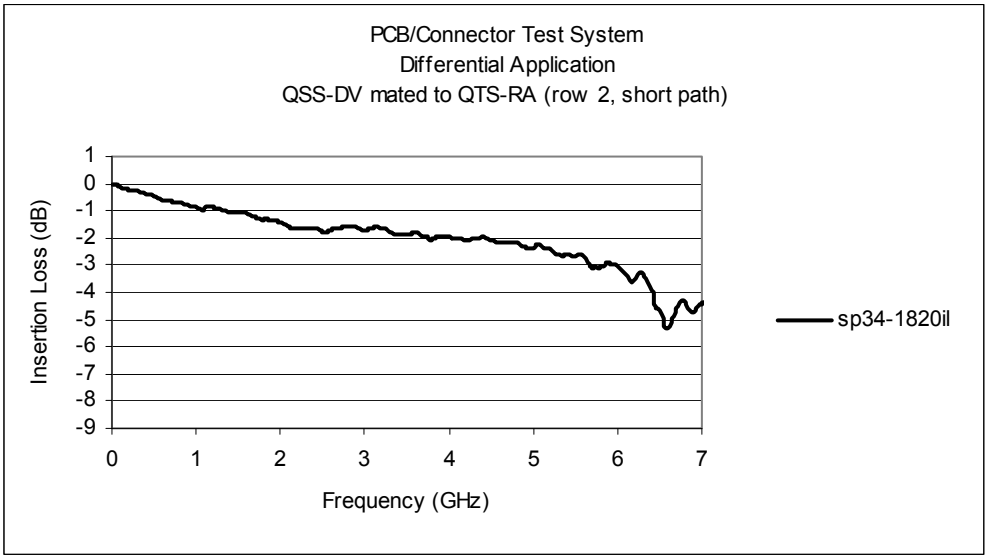


Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250") Pitch, Two Row, Vertical to Right Angle Connection

Row 2, short path

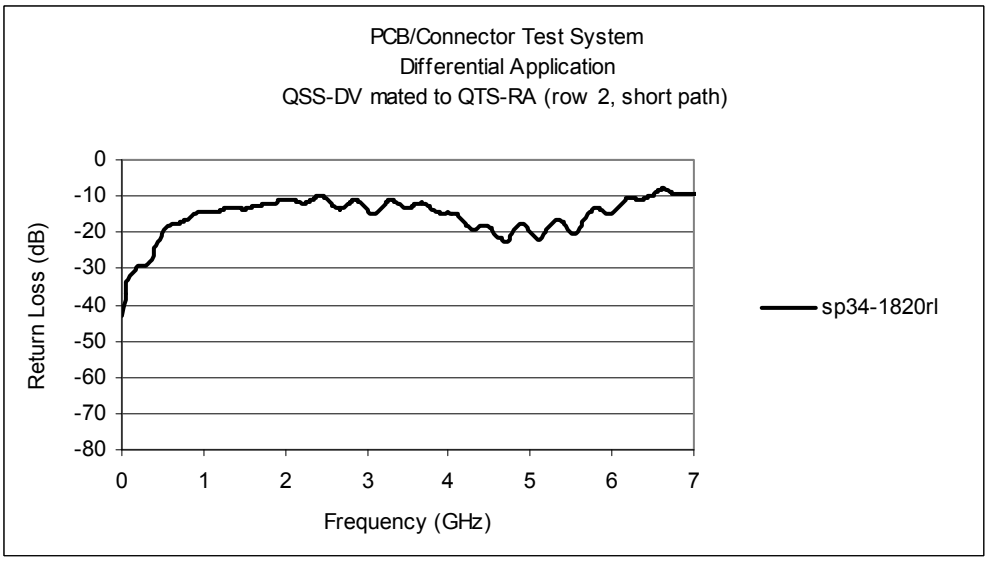
Differential Application – Insertion Loss

Configuration: probe 34=QSS-DV_18-20, probe 56=QTS-RA_18-20



Differential Application – Return Loss

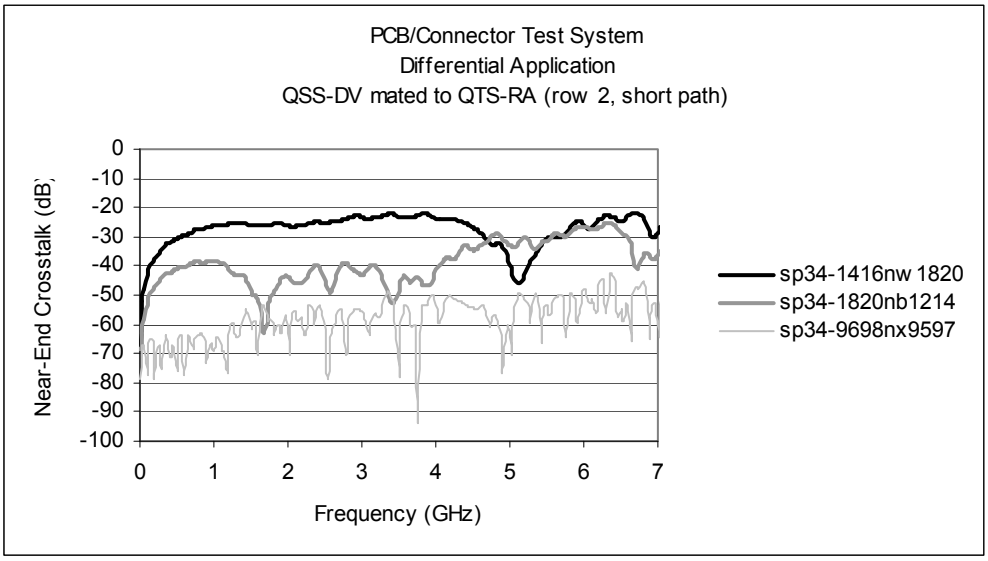
Configuration: probe 34=QSS-DV_18-20, probe 56=QTS-RA_18-20



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250") Pitch, Two Row, Vertical to Right Angle Connection

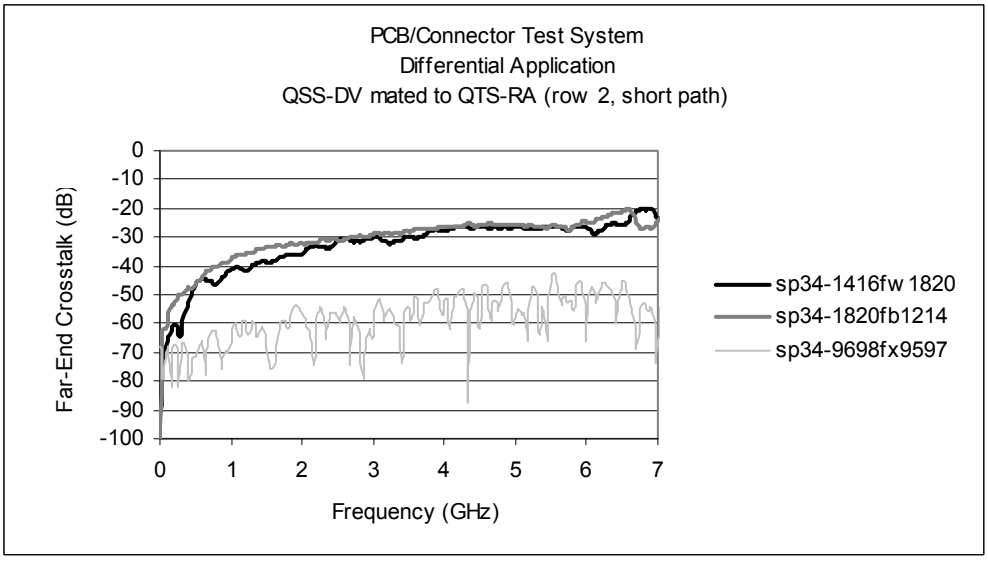
Differential Application – NEXT Configurations

worse case	QSS-DV_14-16	QSS-DV_18-20
best case	QSS-DV_18-20	QSS-DV_12-14
row 2 to 1	QSS-DV_96-98	QSS-DV_95-97



Differential Application – FEXT Configurations

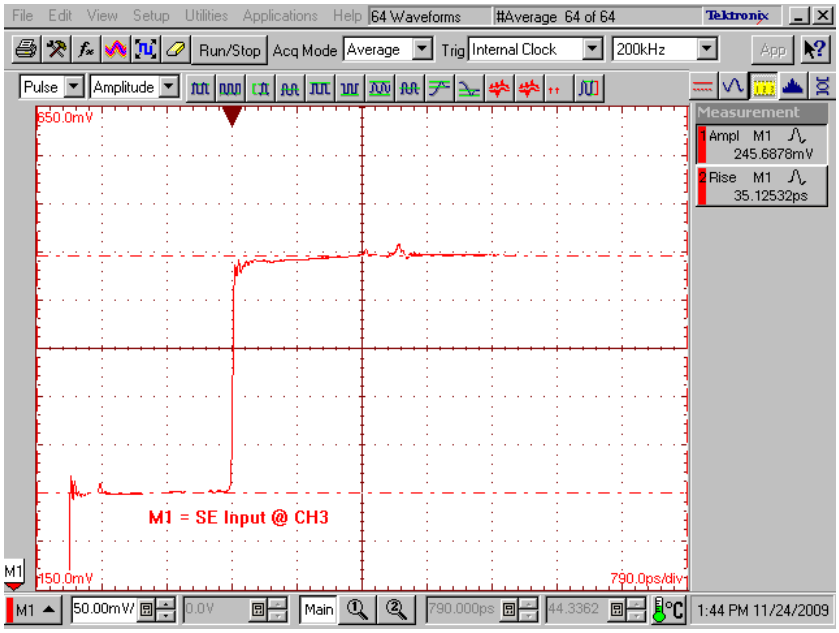
worse case	QSS-DV_14-16	QTS-RA_18-20
best case	QSS-DV_18-20	QTS-RA_12-14
row 2 to1	QSS-DV_96-98	QTS-RA_95-97



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250") Pitch, Two Row, Vertical to Right Angle Connection

Appendix B – Time Domain Response Graphs

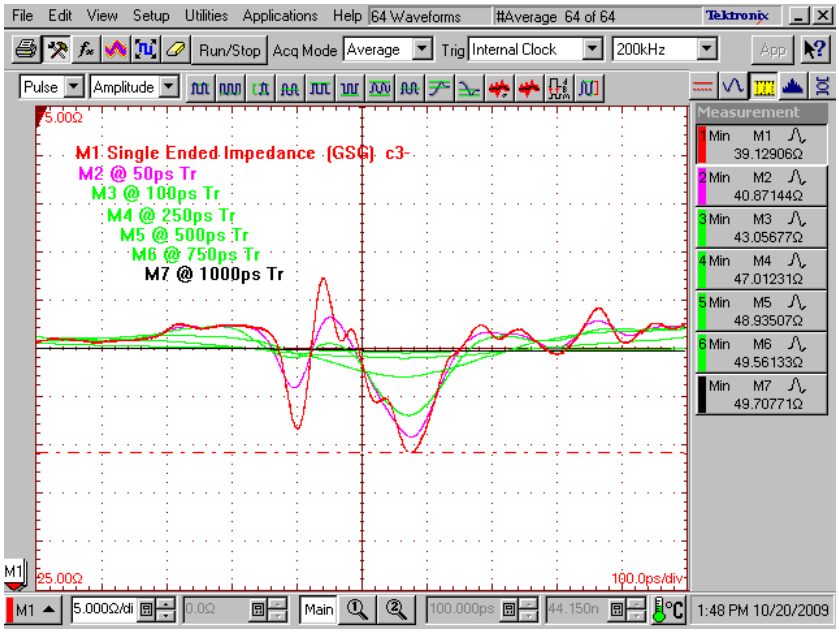
ROW 1, long path
Single-Ended Application – Input Pulse



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

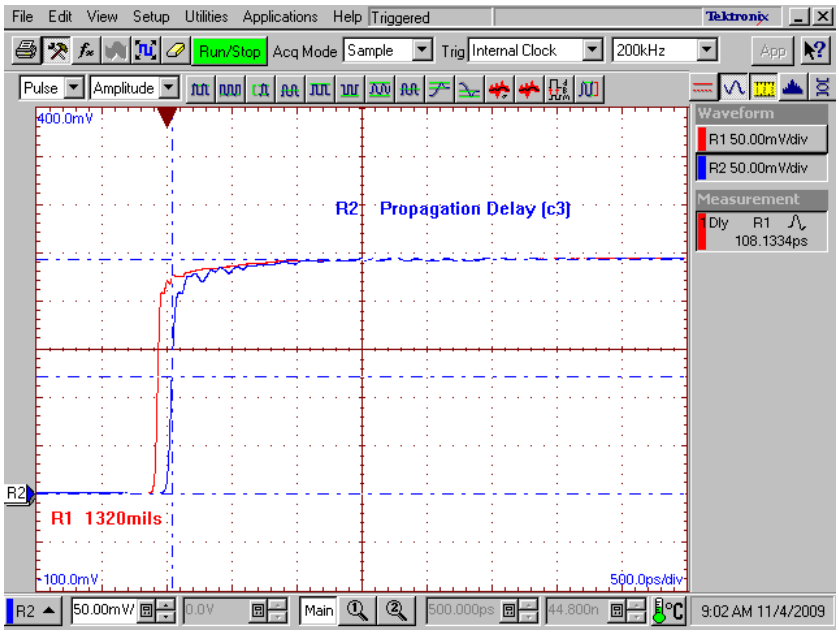
Single-Ended Application – Impedance

Configuration: probe 3=QSS-DV_57, probe 5=QTS-RA_57



Single-Ended Application – Propagation Delay

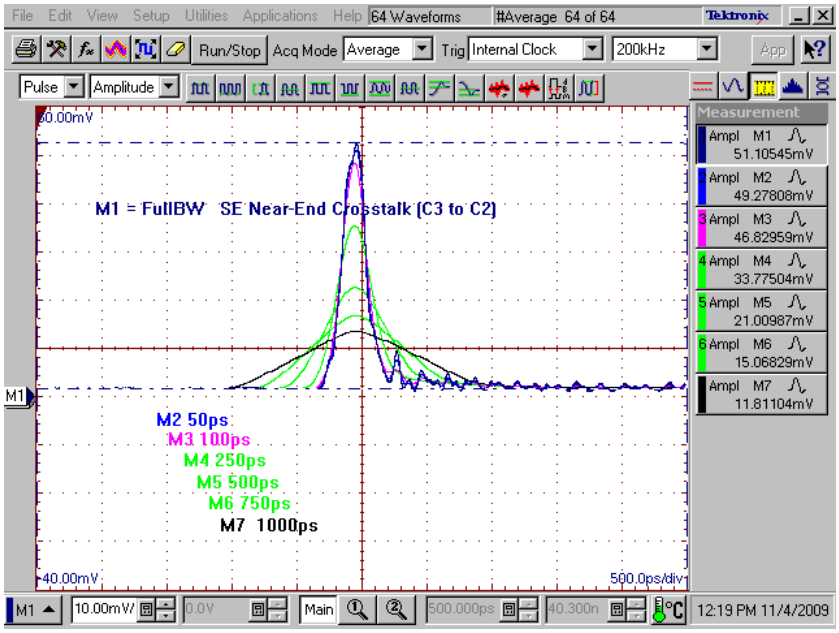
Configuration: probe 3=QSS-DV_57, probe 5=QTS-RA_57



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

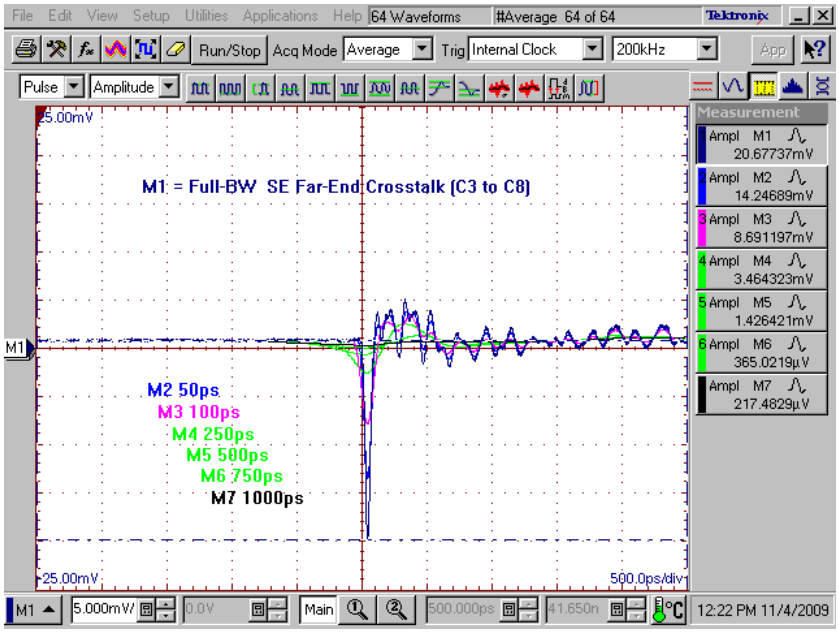
Single-Ended Application – NEXT, “Worst Case” Configuration

QSS-DV_55 QSS-DV_53



Single-Ended Application – FEXT, “Worst Case” Configuration

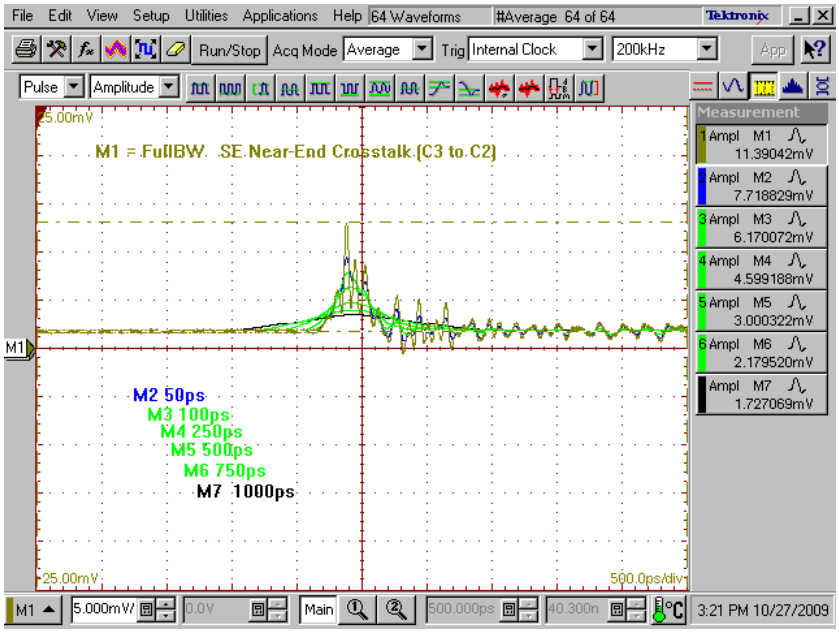
QSS-DV_55 QTS-RA_53



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

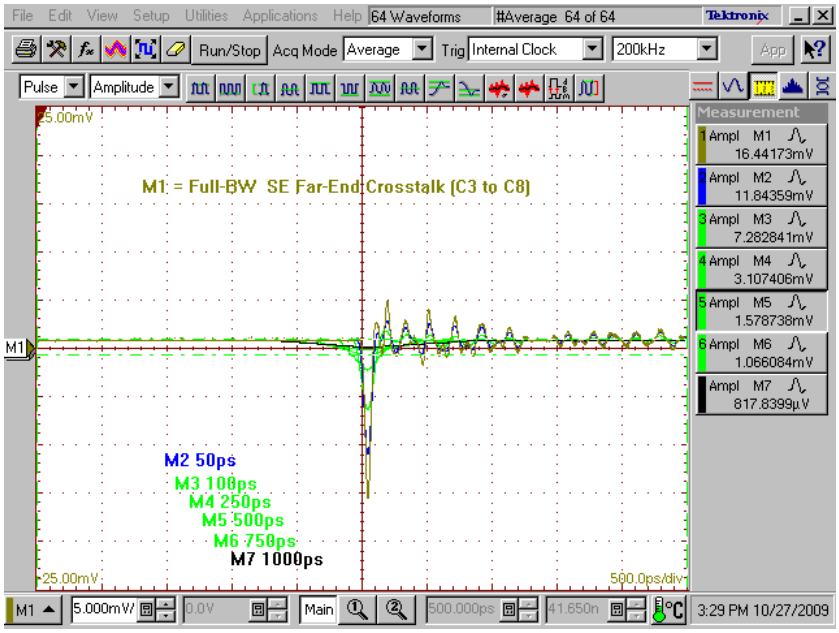
Single-Ended Application – NEXT, “Best Case” Configuration

QSS-DV_57 QSS-DV_53



Single-Ended Application – FEXT, “Best Case” Configuration

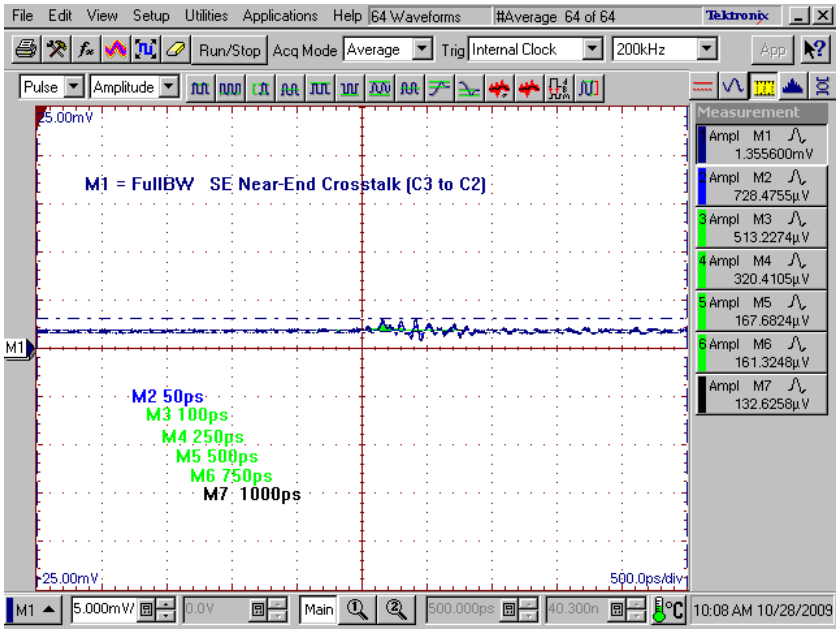
QSS-DV_57 QTS-RA_53



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

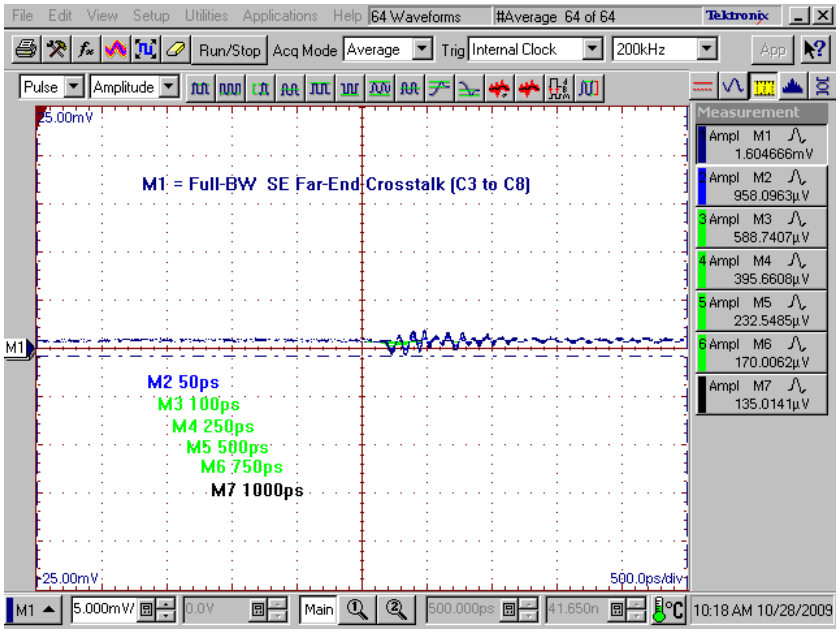
Single-Ended Application – NEXT, “Row 2 to Row 1” Configuration

QSS-DV_98 QSS-DV_97



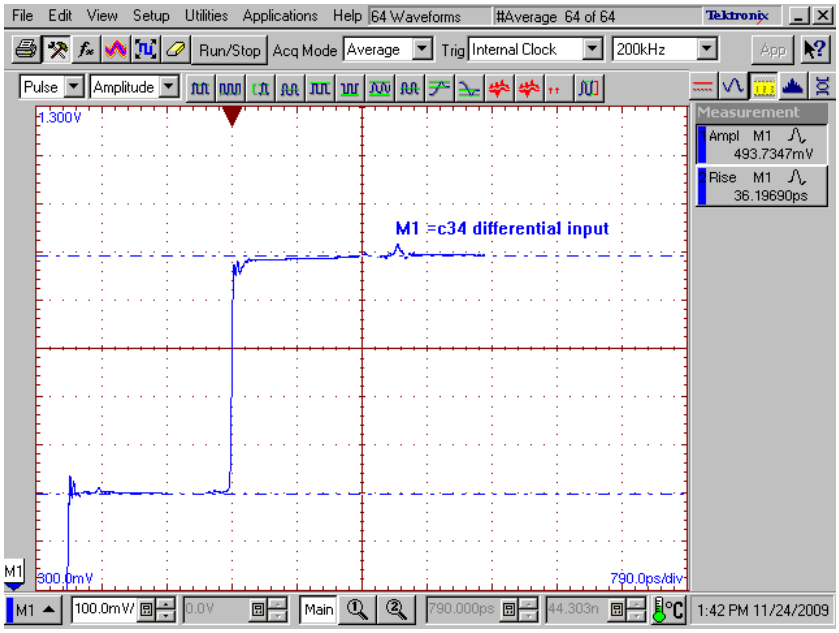
Single-Ended Application – FEXT, “Row 2 to Row 1” Configuration

QSS-DV_98 QTS-RA_97



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

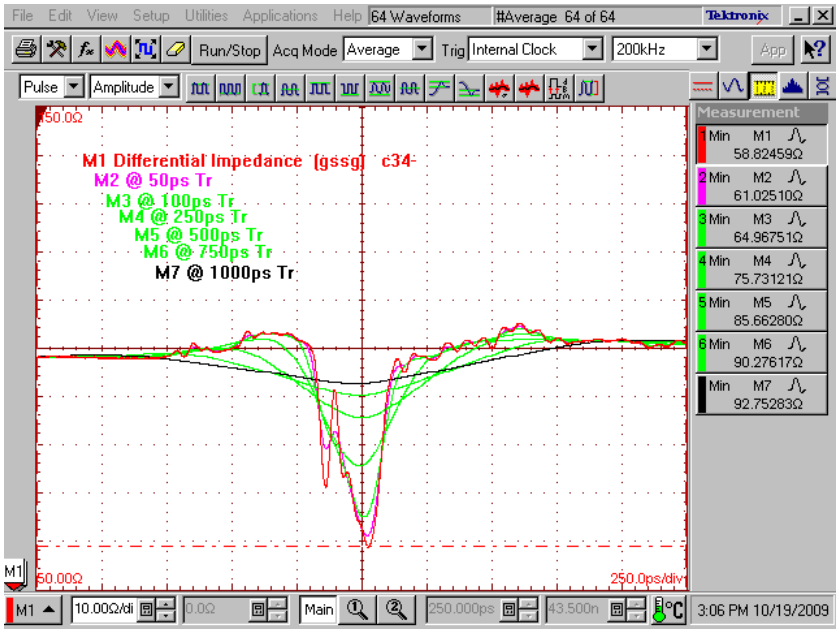
Row 1, long path
Differential Application – Input Pulse



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

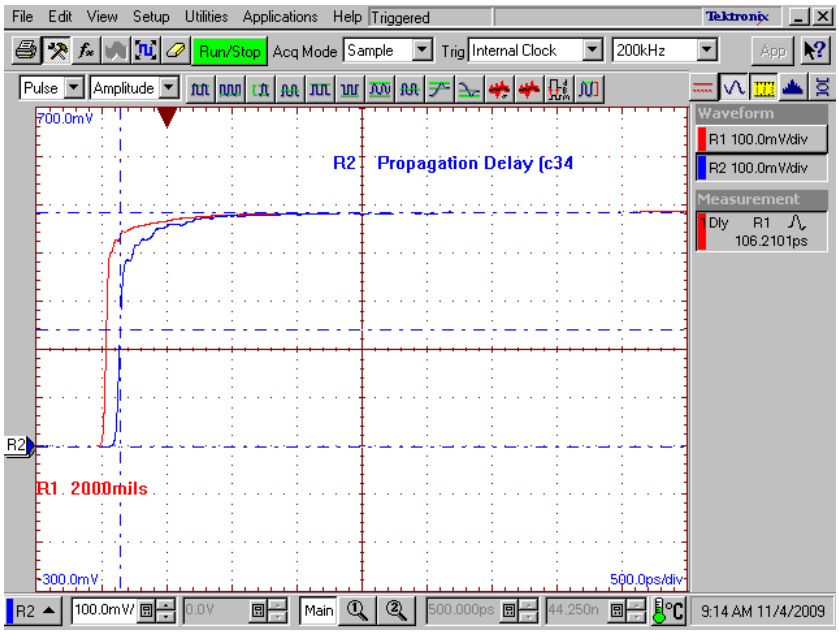
Differential Application – Impedance

Configuration: probe34=QSS-DV_9-11, probe56=QTS-RA_9-11



Differential Application – Propagation Delay

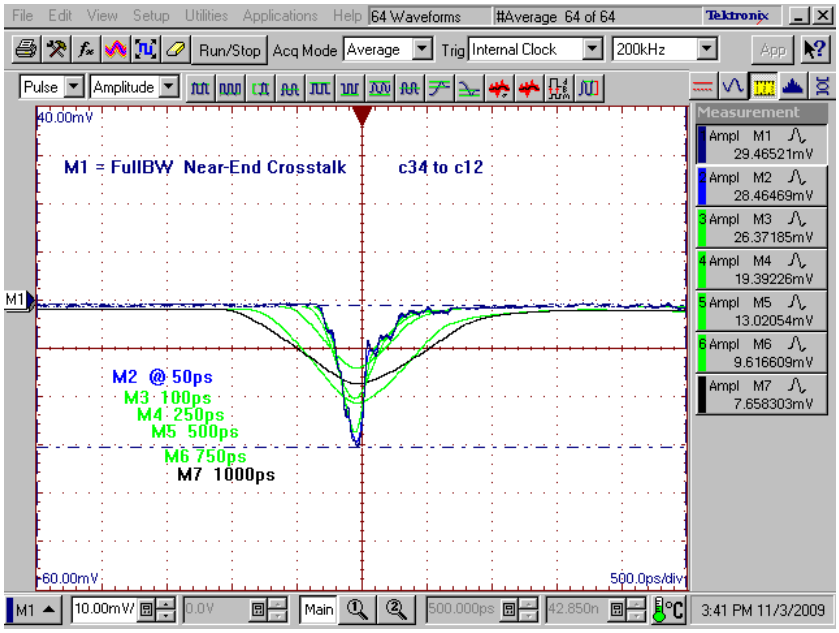
Configuration: probe34=QSS-DV_9-11, probe56=QTS-RA_9-11



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

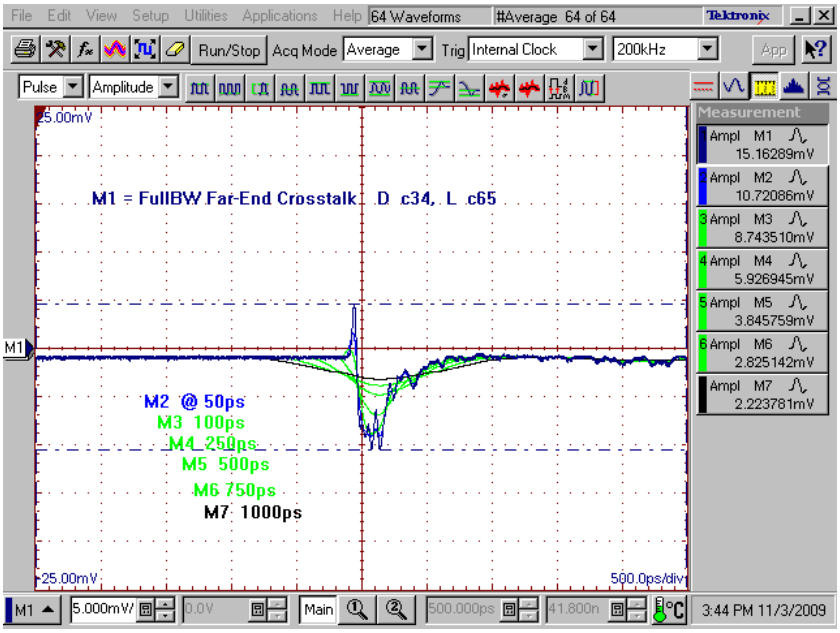
Differential Application – NEXT, “Worst Case” Configuration

QSS-DV_7-9 QSS-DV_3-5



Differential Application – FEXT, “Worst Case” Configuration

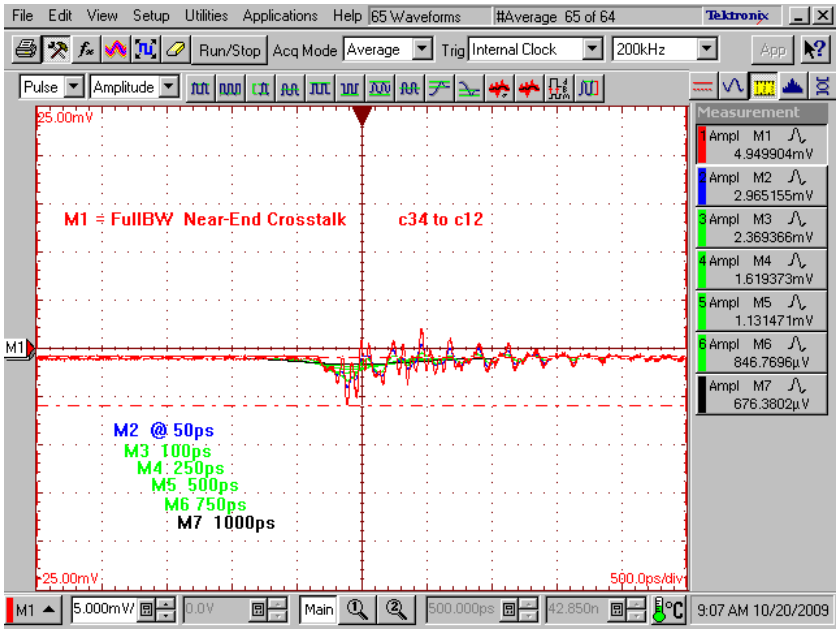
QSS-DV_7-9 QTS-RA_3-5



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

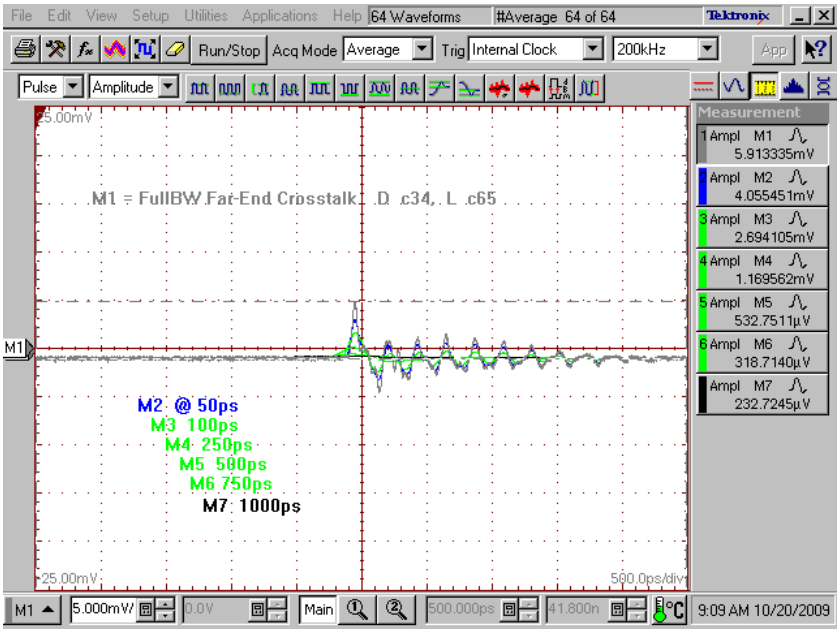
Differential Application – NEXT, “Best Case” Configuration

QSS-DV_9-11 QSS-DV_3-5



Differential Application – FEXT, “Best Case” Configuration

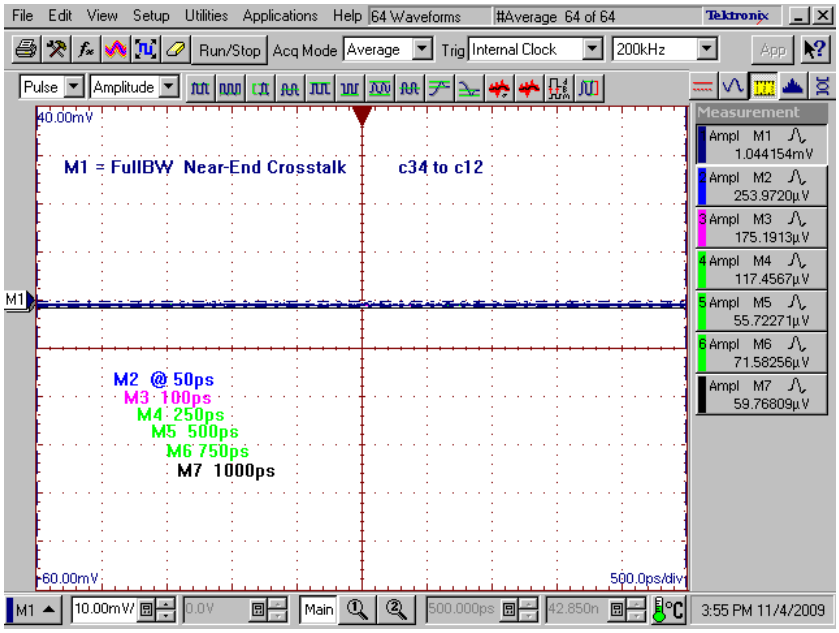
QSS-DV_9-11 QTS-RA_3-5



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

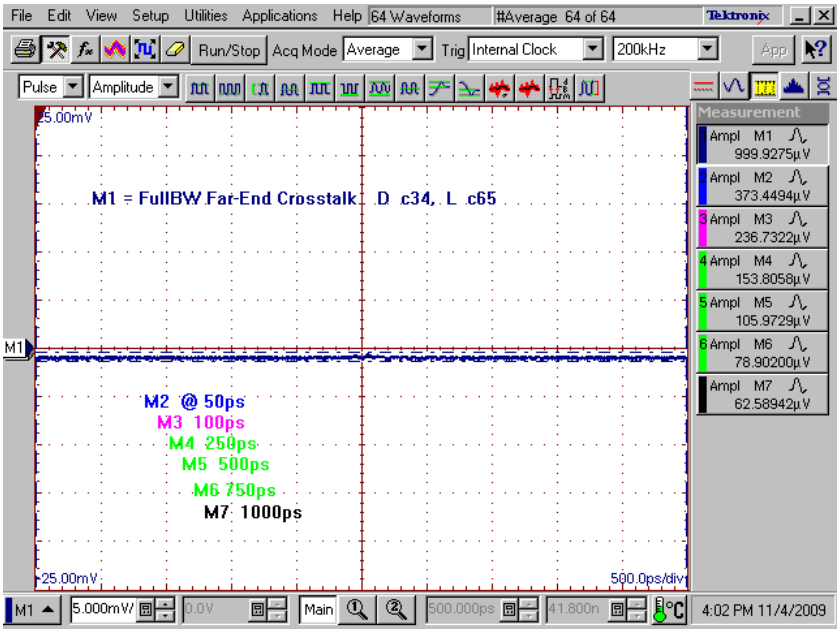
Differential Application – NEXT, “Row 2 to Row 1” Configuration

QSS-DV_96-98 QSS-DV_95-97



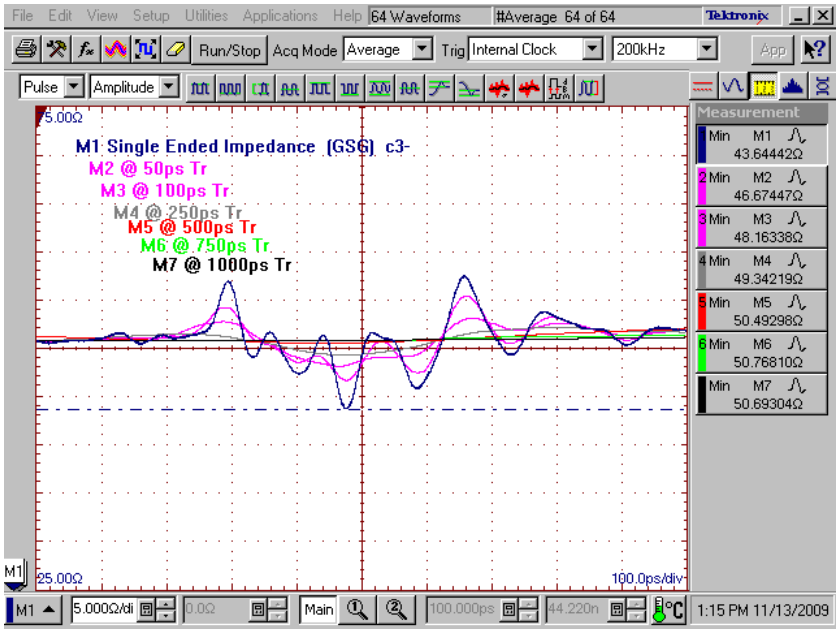
Differential Application – FEXT, “Row 2 to Row 1” Configuration

QSS-DV_96-98 QTS-RA_95-97

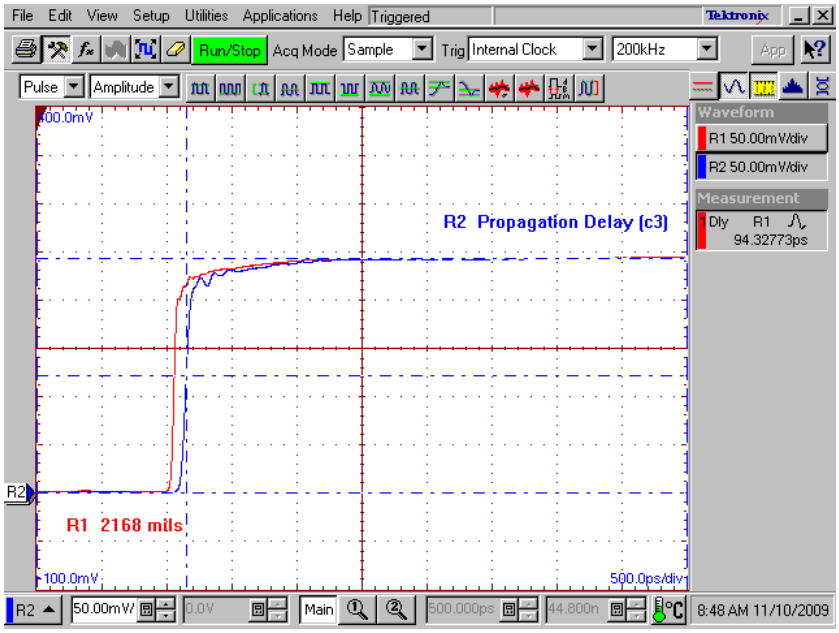


Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

ROW 2, short path
Single-Ended Application – Impedance
Configuration: probe 3=QSS-DV_78, probe 5=QTS-RA_78



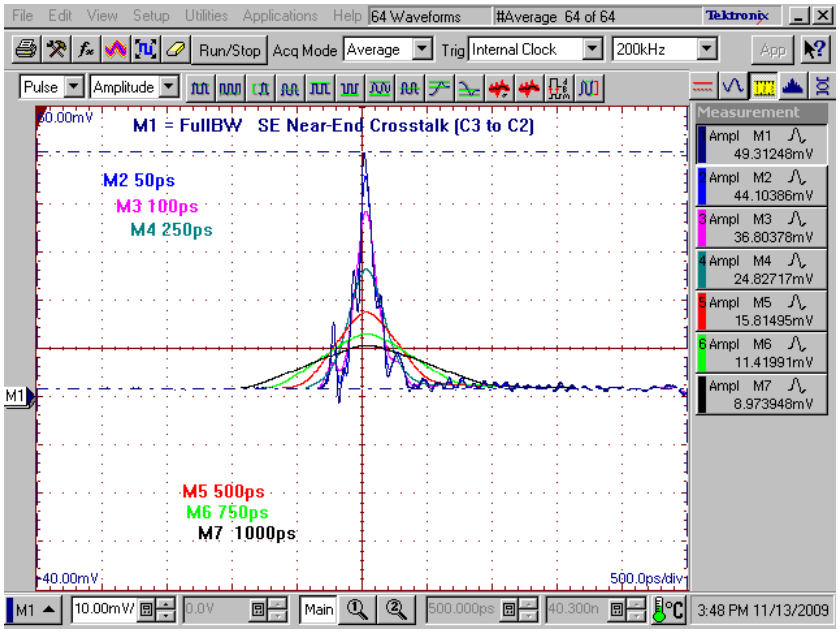
Single-Ended Application – Propagation Delay
Configuration: probe 3=QSS-DV_78, probe 5=QTS-RA_78



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

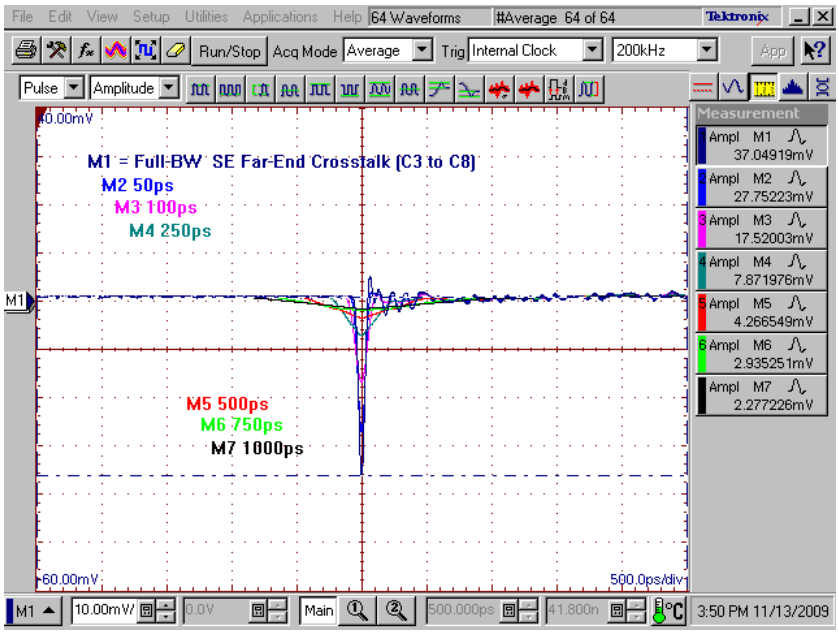
Single-Ended Application – NEXT, “Worst Case” Configuration

QSS-DV_86 QSS-DV_84



Single-Ended Application – FEXT, “Worst Case” Configuration

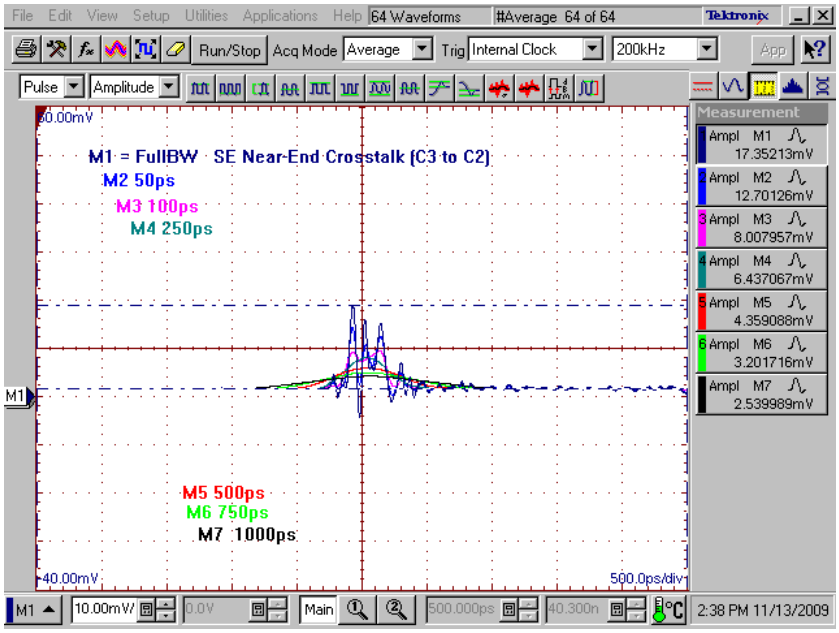
QSS-DV_86 QTS-RA_84



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

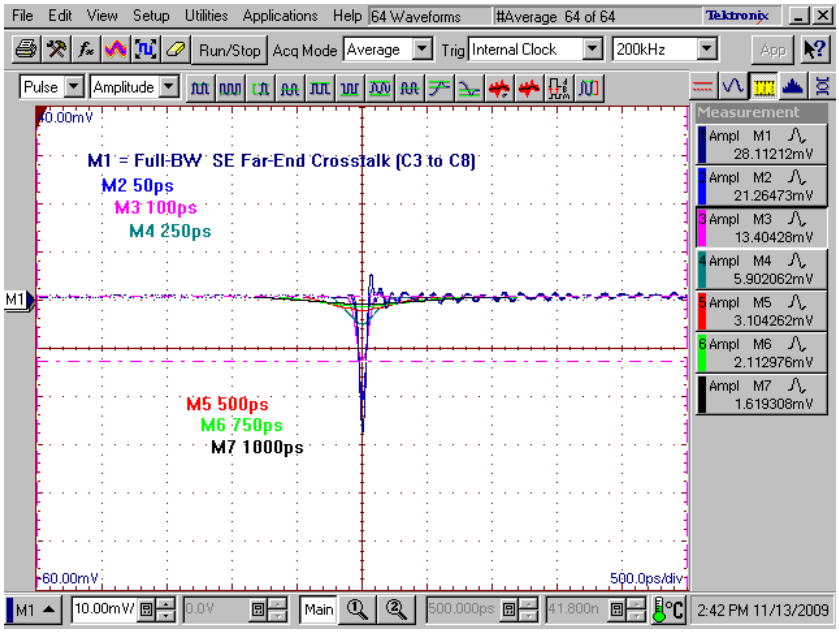
Single-Ended Application – NEXT, “Best Case” Configuration

QSS-DV_78 QSS-DV_74



Single-Ended Application – FEXT, “Best Case” Configuration

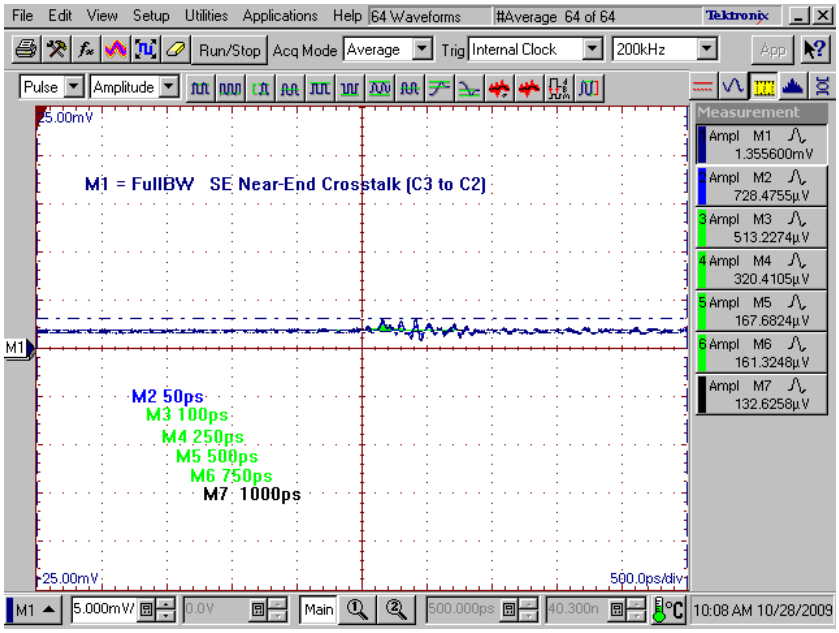
QSS-DV_78 QTS-RA_74



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

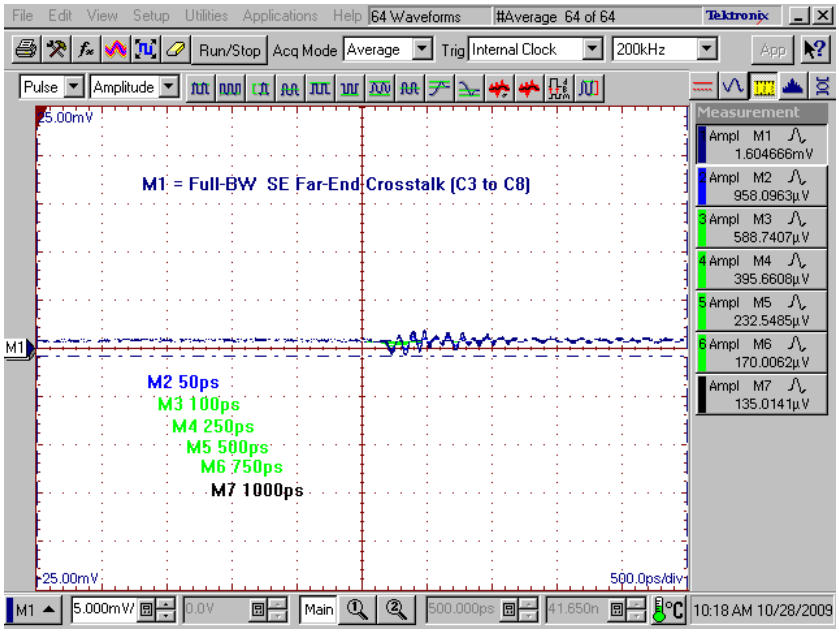
Single-Ended Application – NEXT, “Row 2 to Row 1” Configuration

QSS-DV_98 QSS-DV_97



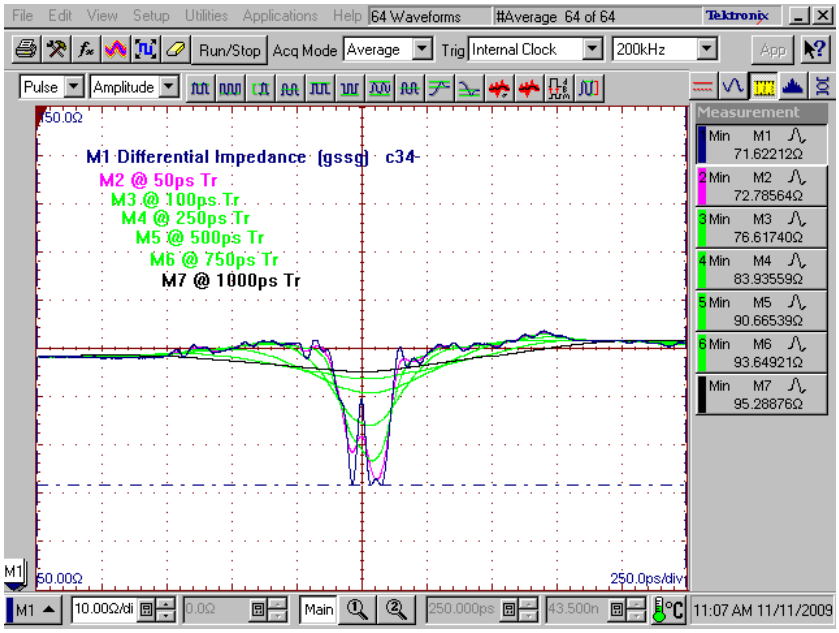
Single-Ended Application – FEXT, “Row 2 to Row 1” Configuration

QSS-DV_98 QTS-RA_97

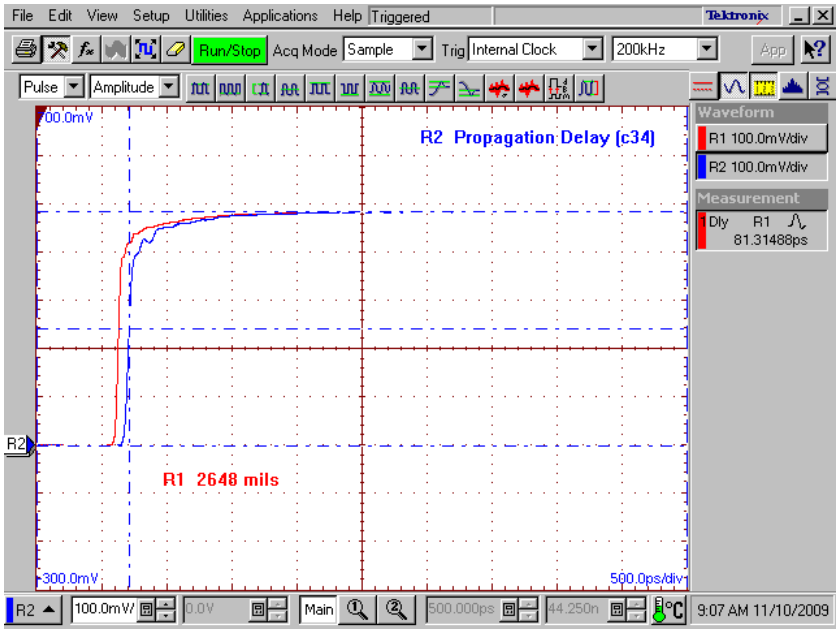


Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

ROW 2, short path
Differential Application – Impedance
Configuration: probe 34=QSS-DV_18-20, probe 56=QTS-RA_18-20



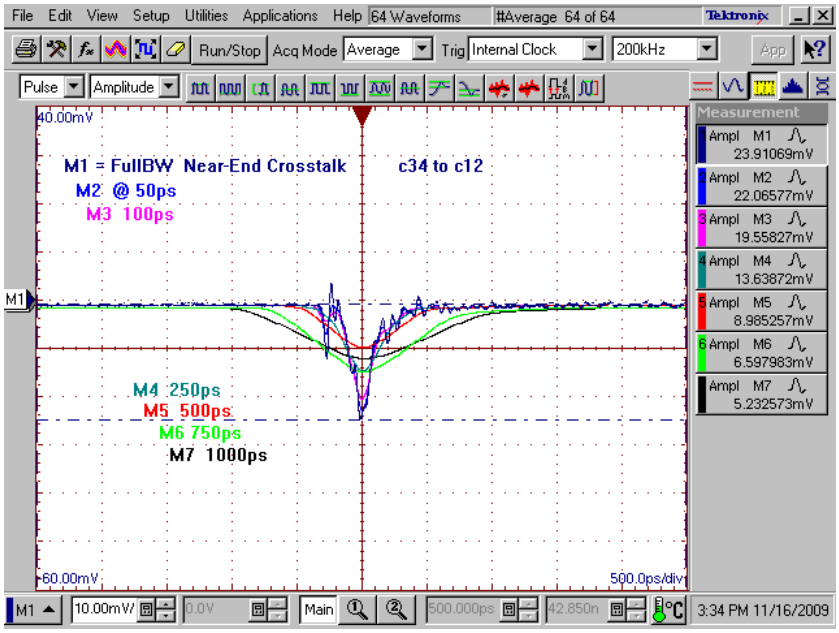
Differential Application – Propagation Delay
Configuration: probe 34=QSS-DV_18-20, probe 56=QTS-RA_18-20



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

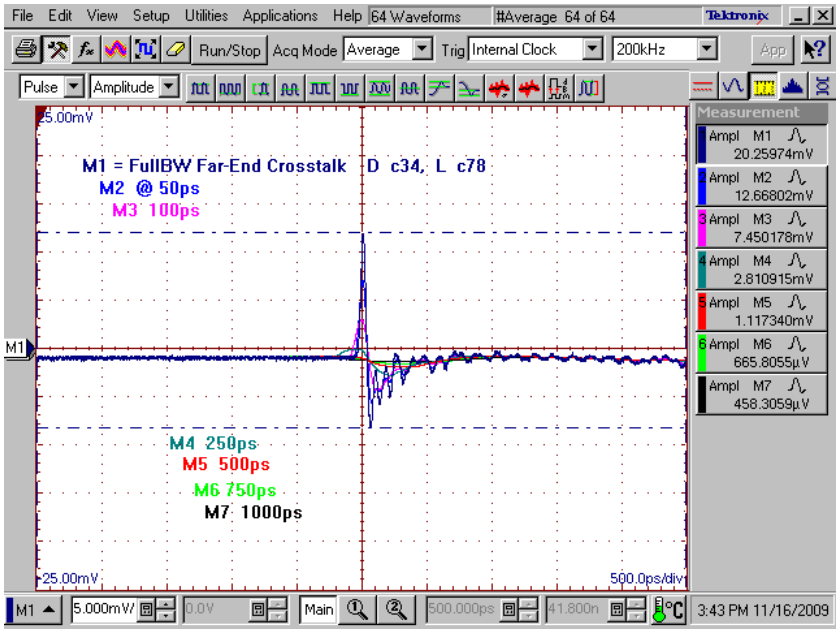
Differential Application – NEXT, “Worst Case” Configuration

QSS-DV_14-16 QSS-DV_18-20



Differential Application – FEXT, “Worst Case” Configuration

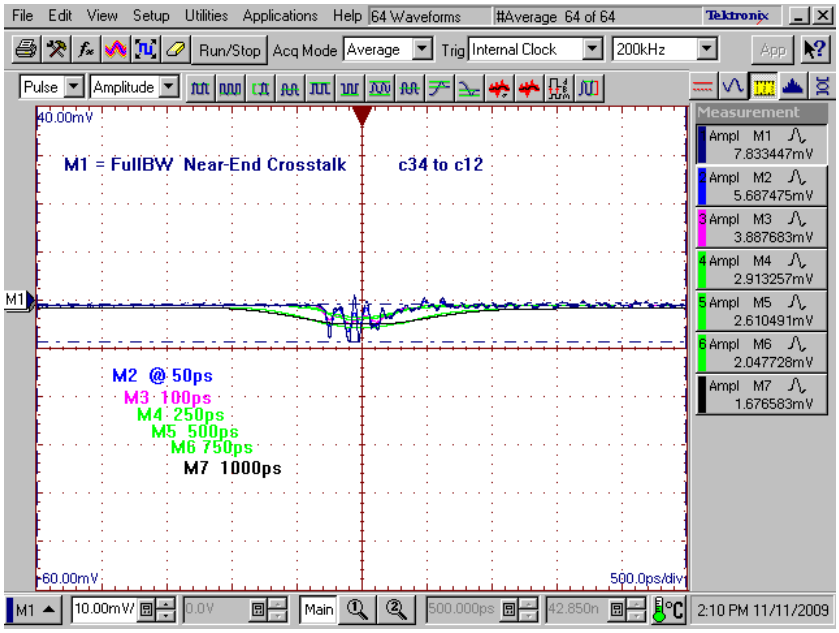
QSS-DV_14-16 QTS-RA_18-20



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

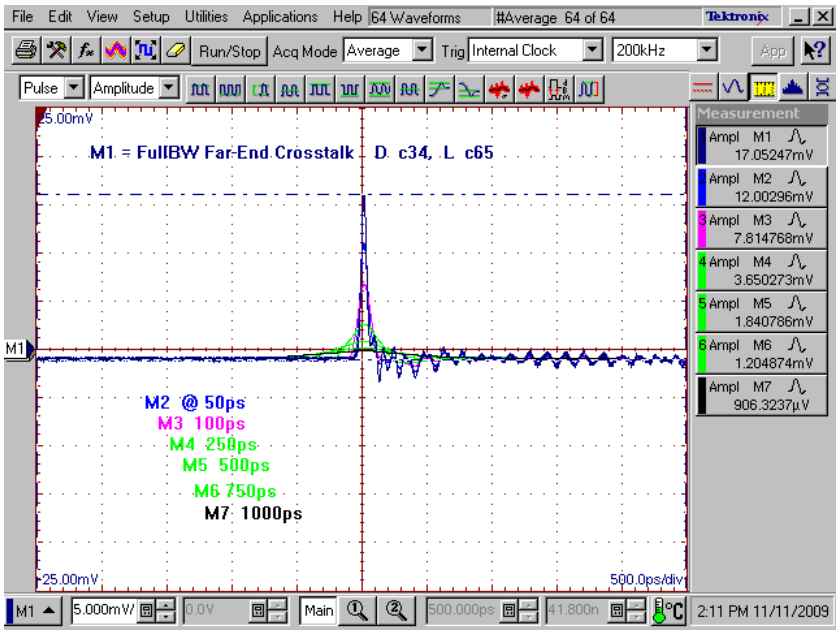
Differential Application – NEXT, “Best Case” Configuration

QSS-DV_18-20 QSS-DV_12-14



Differential Application – FEXT, “Best Case” Configuration

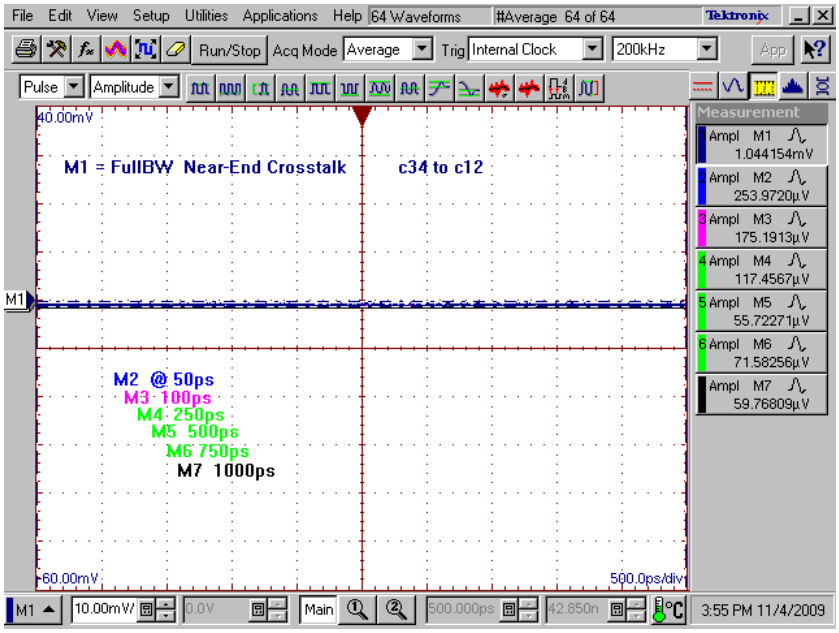
QSS-DV_18-20 QTS-RA_12-14



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

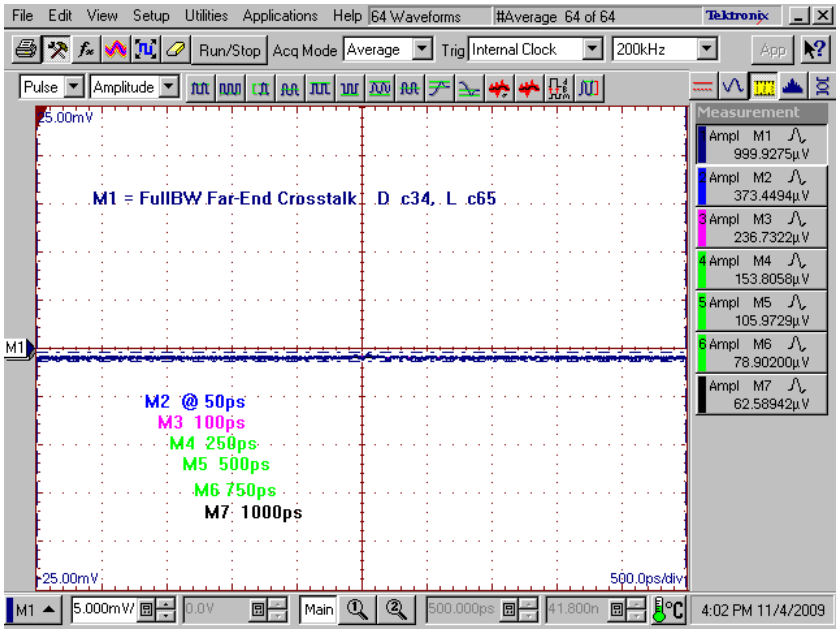
Differential Application – NEXT, “Row 2 to Row 1” Configuration

QSS-DV_96-98 QSS-DV_95-97



Differential Application – FEXT, “Row 2 to Row 1” Configuration

QSS-DV_96-98 QTS-RA_95-97



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

Appendix C – Product and Test System Descriptions

Product Description

Product test samples were Q series double row vertical socket style QSS-050-01-L-D-GP and the right angle terminal style QTS-050-01-L-D-RA. Both double vertical & right angle style connectors are PCB surface mount. The right angle surface mount design forces the top row terminals to have a longer electrical length than those of the bottom row, hence, electrical characteristics between the short row and longer row do differ. When mated the connectors are probed on a perpendicular. Each connector structure consists of two rows of 50 contact terminals. Contact centerline pitch is 0.635mm (.0250”).

Test System Description

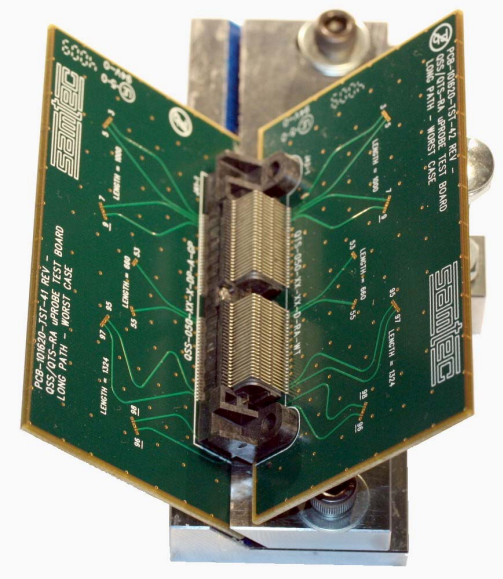
The test fixtures are composed of 4-layer FR-4 material with 50Ω and100Ω signal trace and pad configurations designed for the electrical characterization of Samtec hi-speed connector products. Test fixtures are specific to the part numbers described above under Product Description. The mating fixtures are acknowledged in the table below.

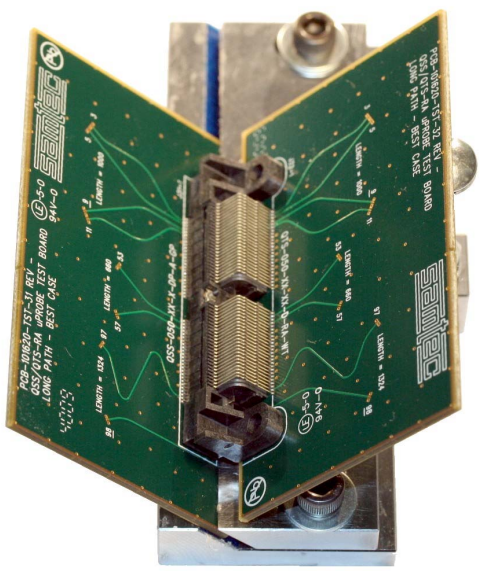
Printed Circuit Board Fixture Identification		
PCB-101620-TST-11, best case	mates with	PCB-101620-TST-12, best case
PCB-101620-TST-21, worst case	mates with	PCB-101620-TST-22, worst case
PCB-101620-TST-31, best case	mates with	PCB-101620-TST-32, best case
PCB-101620-TST-41, worst case	mates with	PCB-101620-TST-42, worst case

S-parameter and time domain data is available from all test points. Data contained within this report comes from one of the two socket paths measured. Bandwidth ratings will sometimes vary between signal paths. When rating differences occur, worst case performance characteristics are reported.
Electrical continuity exists between like labeled test points when mated as designated. Reference plane and calibration standards are specific to PCB101620-TST where each cal standard on the calibration board marked PCB101620-TST-99 Rev can be found. Pictured under “Test System Description” are the mated test samples and schematics for easy identification.

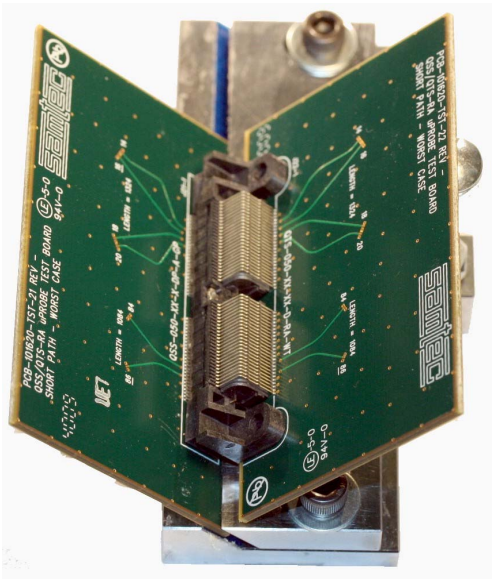
Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

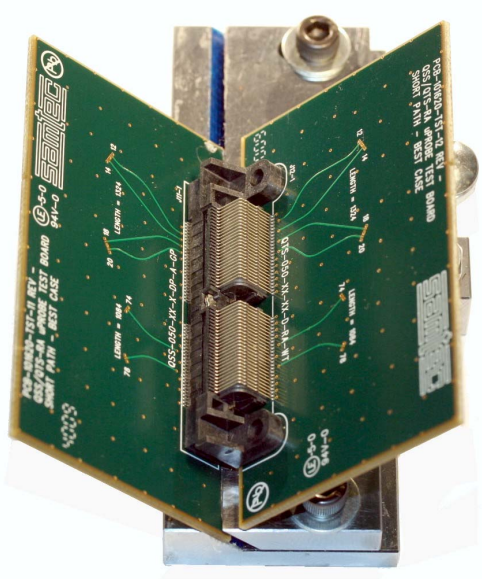
PCB-101620-TST Test Fixtures, Row 1, Longer Terminal Contact





PCB-101620-TST- Test Fixtures, Row 2, Shorter Terminal Contact





Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250") Pitch, Two Row, Vertical to Right Angle Connection

PCB Fixture Set I

Fixture Identity - Worst Case, Long Path, Row 1
PCB-101620-TST-41 Rev – QSS-DV
PCB-101620-TST-42 – Rev – QTS-RA

Worst Case In Row & Across Row Crosstalk Test Parameters –
DP2 to DP1, Differential, GAAVVG, 2:1 Signal to Ground Ratio,

Near-End Aggressor:	QSS-DV_7-9	Victim;	QSS-DV_3-5
Far-End Aggressor:	QSS-DV_7-9	Victim;	QTS-RA_3-5

SE2 to SE1, Single-Ended, GAVG, 2:1 Signal to Ground Ratio,

Near-End Aggressor:	QSS-DV_53	Victim;	QSS-DV_55
Far-End Aggressor:	QSS-DV_53	Victim;	QTS-RA_55

DP6 to DP5, Differential, GAAG/GVVG, 1:1 Signal to Ground Ratio,

Near-End Aggressor:	QSS-DV_96-98	Victim;	QSS-DV_95-97
Far-End Aggressor:	QSS-DV_96-98	Victim;	QTS-RA_95-97

Fixture Identity - Best Case, Long Path, Row 1
PCB-101620-TST-31 Rev – QSS-DV
PCB-101620-TST-32 – Rev – QTS-RA

Best Case In Row & Across Row Crosstalk Test Parameters –
DP4 to DP3, Differential, GAAVVG, 2:1 Signal to Ground Ratio,

Near-End Aggressor:	QSS-DV_9-11	Victim;	QSS-DV_3-5
Far-End Aggressor:	QSS-DV_9-11	Victim;	QTS-RA_3-5

SE4 to SE3, Single-Ended, GAVG, 2:1 Signal to Ground Ratio,

Near-End Aggressor:	QSS-DV_57	Victim;	QSS-DV_53
Far-End Aggressor:	QSS-DV_57	Victim;	QTS-RA_53

SE6 to SE5, Differential, GAAG/GVVG, 1:1 Signal to Ground Ratio,

Near-End Aggressor:	QSS-DV_98	Victim;	QSS-DV_97
Far-End Aggressor:	QSS-DV_98	Victim;	QTS-RA_97

Transmission & Reflection Test Parameters

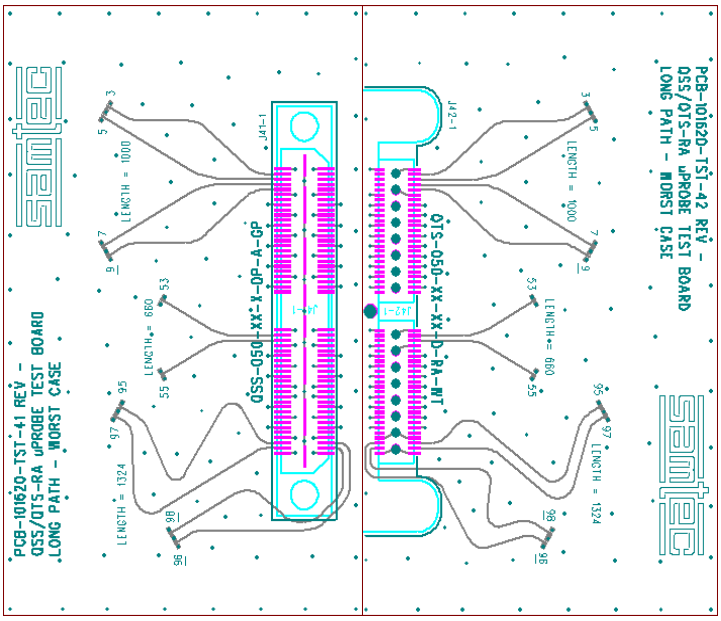
SE4, Single-Ended	probe 3=QSS-DV_57, probe 5=QTS-RA_57
DP4, Differential	probe34=QSS-DV_9-11, probe56=QTS-RA_9-11
*SE3, Single-Ended**	*probe 2=QSS-DV_53, probe 8=QTS-RA_53*
*DP3, Differential**	*probe 12=QSS-DV_3-5 probe 78=QTS-RA_3-5*

** not reported*

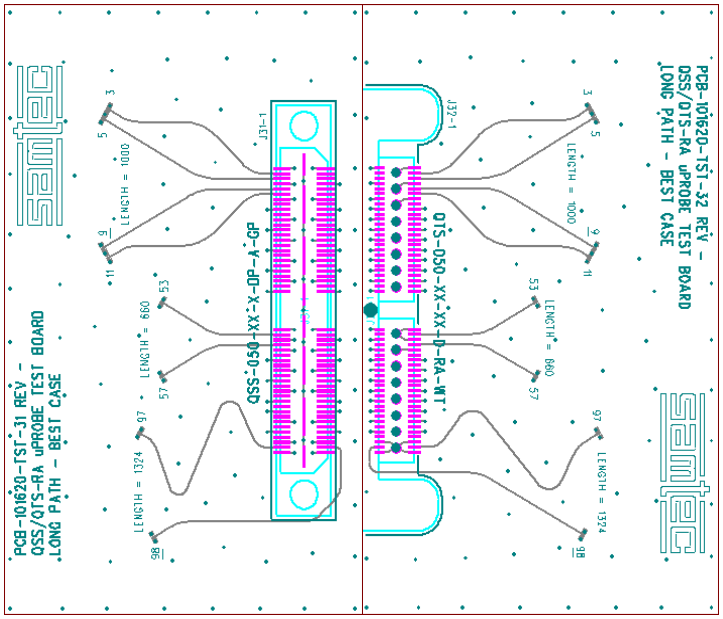
Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

Preparation: Row One Fixtures

PCB-101620-TST-41, worst case	mates with	PCB-101620-TST-42, worst case



PCB-101620-TST-31, best case	mates with	PCB-101620-TST-32, best case



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

PCB Fixture Set II

Fixture Identity - Worst Case, Short Path, Row 2
PCB-101620-TST-11 Rev – QSS-DV
PCB-101620-TST-12 – Rev – QTS-RA

Worst Case In Row & Across Row Crosstalk Test Parameters –
DP2 to DP1, Differential, GAAVVG, 2:1 Signal to Ground Ratio,

Near-End Aggressor:	QSS-DV_14-16	Victim;	QSS-DV_18-20
Far-End Aggressor:	QSS-DV_14-16	Victim;	QTS-RA_18-20

SE2 to SE1, Single-Ended, GAVG, 2:1 Signal to Ground Ratio,

Near-End Aggressor:	QSS-DV_86	Victim;	QSS-DV_84
Far-End Aggressor:	QSS-DV_86	Victim;	QTS-RA_84

DP6 to DP5, Differential, GAAG/GVVG, 1:1 Signal to Ground Ratio,

Near-End Aggressor:	QSS-DV_96-98	Victim;	QSS-DV_95-97
Far-End Aggressor:	QSS-DV_96-98	Victim;	QTS-RA_95-97

Fixture Identity - Best Case, Short Path, Row 2
PCB-101620-TST-21 Rev – QSS-DV
PCB-101620-TST-22 – Rev – QTS-RA

Best Case In Row & Across Row Crosstalk Test Parameters –
DP4 to DP3, Differential, GAAVVG, 2:1 Signal to Ground Ratio,

Near-End Aggressor:	QSS-DV_18-20	Victim;	QSS-DV_12-14
Far-End Aggressor:	QSS-DV_18-20	Victim;	QTS-RA_12-14

SE4 to SE3, Single-Ended, GAVG, 2:1 Signal to Ground Ratio,

Near-End Aggressor:	QSS-DV_78	Victim;	QSS-DV_74
Far-End Aggressor:	QSS-DV_78	Victim;	QTS-RA_74

SE6 to SE5, Differential, GAAG/GVVG, 1:1 Signal to Ground Ratio,

Near-End Aggressor:	QSS-DV_98	Victim;	QSS-DV_97
Far-End Aggressor:	QSS-DV_98	Victim;	QTS-RA_97

Transmission & Reflection Test Parameters

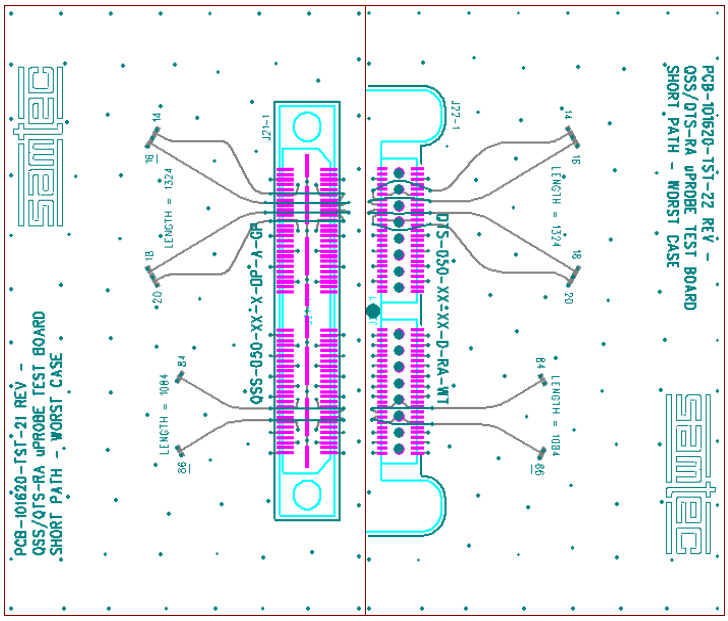
SE4, Single-Ended	probe 3=QSS-DV_78, probe 5=QTS-RA_78
DP4, Differential	probe 34=QSS-DV_18-20, probe 56=QTS-RA_18-20
*SE3, Single-Ended**	*probe 2=QSS-DV_74, probe 8=QTS-RA_74*
*DP3, Differential**	*probe 12=QSS-DV_12-14, probe 78=QTS-RA_12-14*

** not reported*

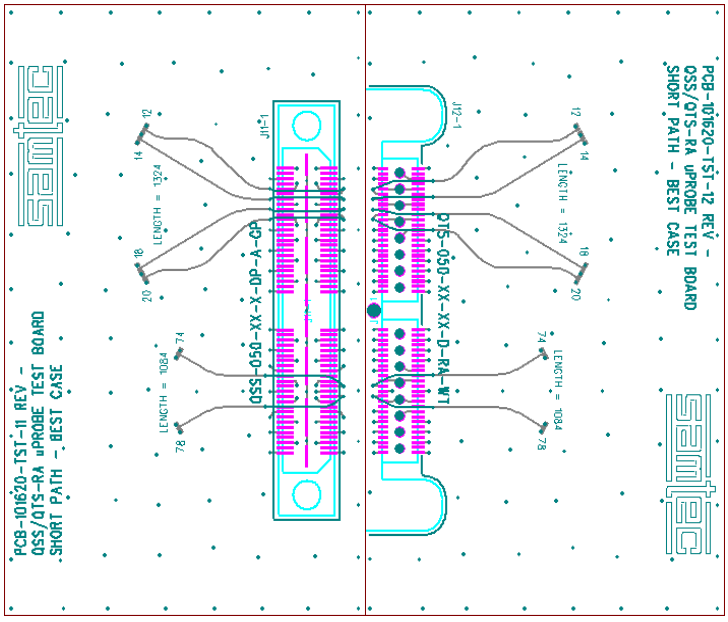
Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

Preparation: Row Two Fixtures

PCB-101620-TST-21, worst case	mates with	PCB-101620-TST-22, worst case

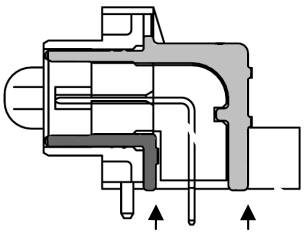


PCB-101620-TST-11, best case	mates with	PCB-101620-TST-12, best case



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

PCB101620-TST-99 Calibration Standards



Short Path Long Path

Propagation Delay Reference Length
Single-Ended, Long Path, 1320 mils

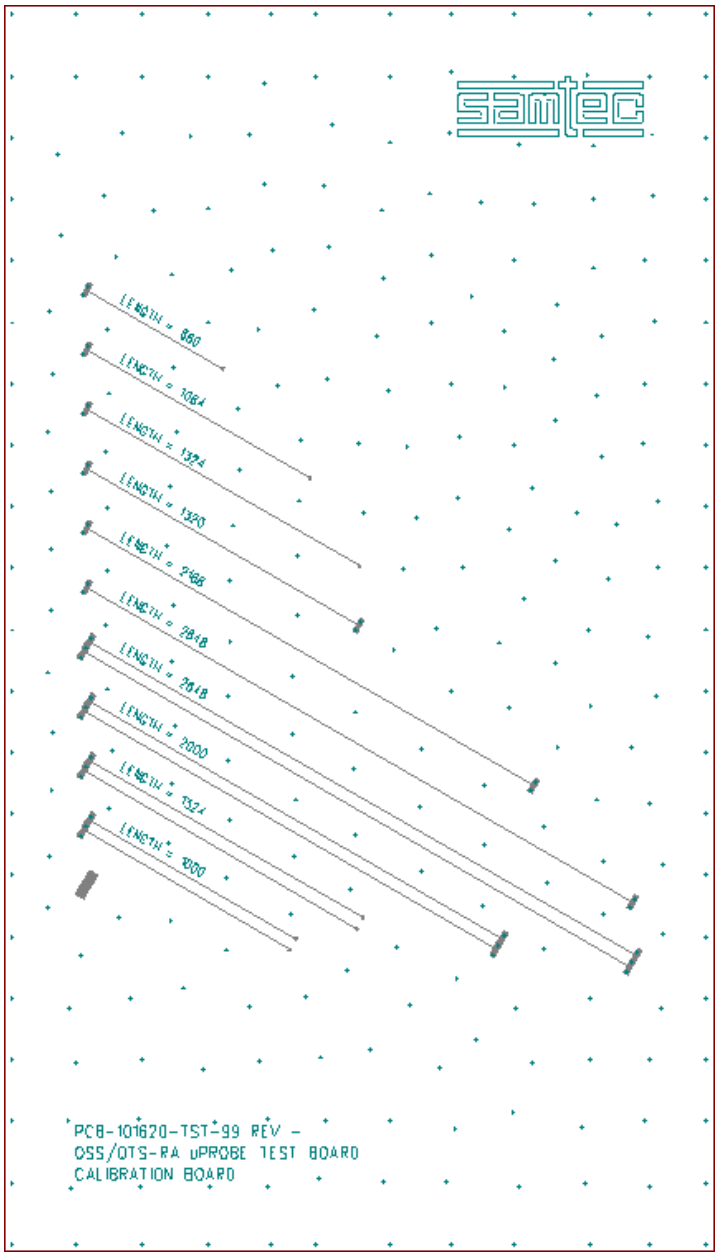
Propagation Delay Reference Length
Single-Ended, Short Path, 2168 mils

Propagation Delay Reference Length
Differential, Short Path, 2648 mils

Propagation Delay Reference Length
Differential, Long Path, 2000 mils

TDA Step Waveform
Transmission/Reflection Standard

Note: Open Standards are used for connector only de-embedding purposes. All Performance data, with the exception of propagation delay, include effects of PCB signal launch traces.

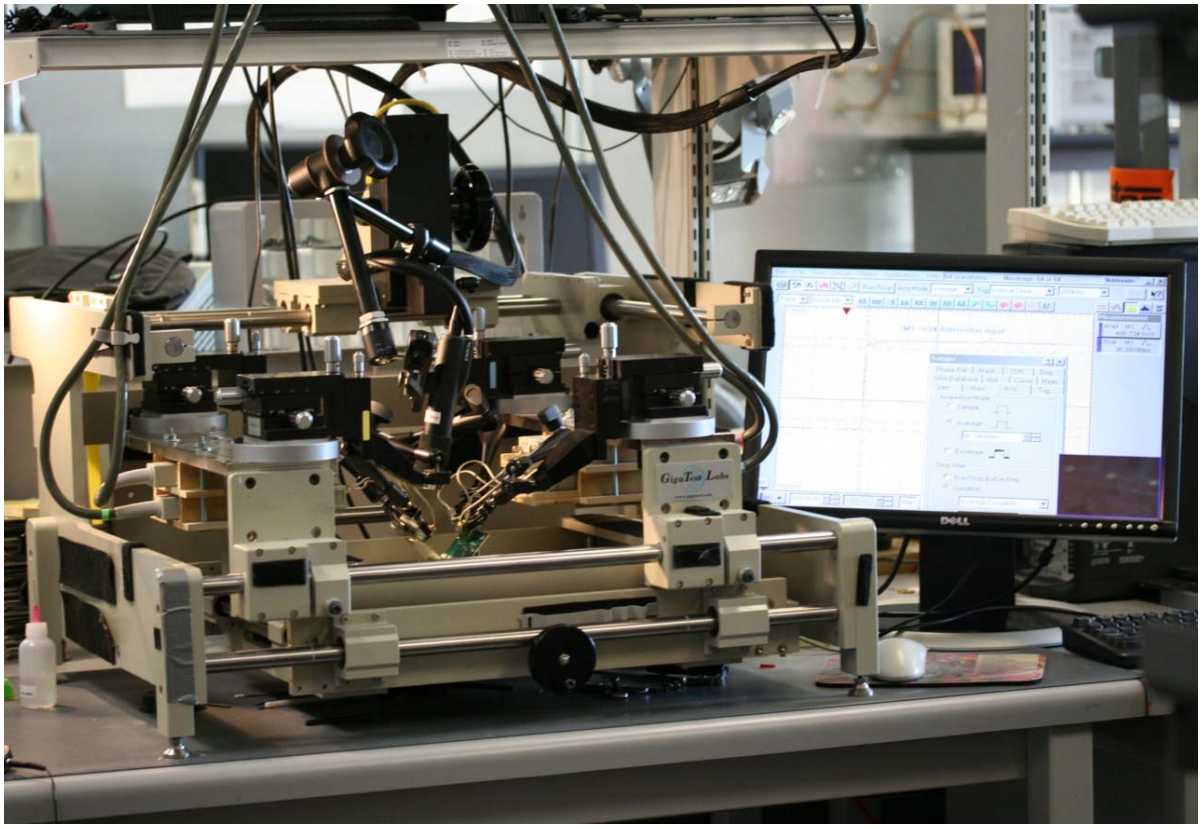


Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

Appendix D – Test and Measurement Setup

The test instrument is the Tektronix CSA8000 Communication Signal Analyzer Main-frame. Four bays of the CSA8000 use four Tektronix 80E04 TDR/Sampling Heads. Time domain data and graphs are real-time. Post-processed s-parameter data and graphs extend from a TDR based software tool called I-Connect Probing uses a video microscopy system, microprobe positioners, and 40GHz capable probes. Four hundred and fifty micron pitch probes are located to PCB launch points with 25X to 175X magni-fication and XYZ fine positioning adjustments available from both the probe table and micro-probe positioners. Electrically the microwave probes rate a < 1.0 dB insertion loss, a ≥18 dB return loss, and an isolation of 38 dB providing high-bandwidth and low parasitic measurement results. Combined, the above technology provides a stable measurement environment along with the electrical accuracies for obtaining precise calibrations and signal launch capabilities

CSA8000/TDA IConnect Measurements Capability



Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

Eight Channel Right Angle 40 GHz Microprobing Setup

Test Instruments

QTY	Description
1	Tektronix CSA8000 Communication Signal Analyzer
4	Tektronix 80E04 Dual Channel 20 GHz TDR Sampling Module
1	Tektronix 80E03 Dual Channel 20 GHz Sampling Module

Measurement Station Accessories

QTY	Description
1	GigaTest Labs Model (GTL3030) Probe Station
4	GTL Micro-Probe Positioners (2)
4	Picoprobe by GGB Ind. Dual Model 40A GSG-GSG (differential applications)
1	Keyence VH-5910 High Resolution Video Microscope
1	Keyence VH-W100 Fixed Magnification Lens 100 X
1	Keyence VH-Z25 Standard Zoom Lens 25X-175X

Test Cables & Adapters

QTY	Description
8	Pasternack Enterprises 2.9mm Semi-Rigid (.086) 6” Cable Assemblies (4)
4	Tektronix 1 Meter Module Extenders (2)

Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

Appendix E - Frequency and Time Domain Measurements

In a two row connector series where terminal geometry and dimensions are equal, only one row is measured. The following test procedures are written for same geometry equal length double row connector series’. In two row connector design where contact geometry and/or length may differ (right angle terminal) between terminal rows it is necessary to measure SI performance for both rows. This condition effectively doubles the number of measurements needed to characterize the connector series. It is also important to note before gathering measurement data that TDA Systems IConnect measurements and CSA8000 measurements are virtually the same measurements using diverse formats. This means that the operator being extremely aware, can obtain SI time and frequency characteristics in an almost simultaneous fashion

Since IConnect setup procedures are specific to the frequency information sought, it is mandatory that the sample preparation and CSA8000 functional setups be consistent throughout the waveform gathering process. If the operators test equipment permits recall sequencing between the various test parameter setups, it insures IConnect functional setups remain consistent with the TDR/TDT waveforms previously recorded.

Sample Preparation

Determine signal launch and test points by referencing test parameter fixture tables and schematic layout maps.

Calibration Board, **CAL**
PCB Fixture Sets **I** & **II**

Wherever practical it is a good practice to terminate all non-active signal lines immediately adjacent to the designated active or quiet signal lines under test.

Frequency (S-Parameter) Domain Procedures

Frequency data extraction involves a two-step process. The first step creates the TDR based waveform relationships utilizing a Tektronix CSA8000 time based instrument. The second step involves the conversion of these time-based waveforms into s-parameter format using the TDA Systems IConnect software tool. TDA Systems labels time related conversion waveforms as the *Step* and *DUT* waveform references. This section establishes the setup procedures for defining the *Step* and *DUT* reference for conversion to frequency s-parameters presented in this report.

CSA8000 Setup

Listed below is the CSA 8000 functional menu setups used for single-ended and differential frequency response extractions. Both signal types utilize I-Connect software tools to generate S-parameter upper and lower frequency boundaries along with the step fre-

Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250") Pitch, Two Row, Vertical to Right Angle Connection

quency. Functional settings such as window length, number of points and averaging capability determines the instruments frequency boundaries. Once window length, number of points and averaging functions are set, maintain the same instrument settings throughout the extraction process. The single channel pulsed source processes s-parameters in single-ended format. A dual channel differential pulsed source processes s-parameters in differential format.

	Single-Ended Signal	Differential Signal
Vertical Scale:	100 mV/ Div:	100 mV/ Div:
Offset:	Default / Scroll	Default / Scroll
Horizontal Scale:	1nSec/ Div = 20 MHz step frequency	1nSec/ Div = 20 MHz step frequency
Max. Record Length:	4000 = Min. Resolution	4000 = Min. Resolution
Averages:	≥ 128	≥ 128

Insertion Loss (TDA conversion)

Step Waveform - determine TD waveform by making a TDT transmission measurement that includes all cables, adapters, and probes connected in the test systems transmission path. Complete the transmission path by inserting a negligible length of transmission standard between the system test probes. Calibration or waveform referencing utilizes a six pad cal structure for each of the probe touchdowns (ie; se thru = 3 pads or diff thru = 6 pads). Reference the calibration board **CAL**, and use the 1mm (0.390") length calibration reflect/transmission structure for TDA step waveform characterization.

DUT Waveform - determine TD waveform by making an active TDT transmission measurement that includes all cables, adapters, and probes connected in the test systems transmission path. Insert the SUT between the probes in place of the reflection/transmission standard and record the measurement. The QSS-DV/QTS-RA characterization reports one single-ended and one differential insertion loss application. Single-ended and differential line measurement possibilities are SE3, SE4, DP3 and DP4. Reference both PCB fixture set **I** and fixture set **II** for an appropriate signal path.

Return Loss (TDA conversion)

Step Waveform – determine TD waveform by making an active TDR reflection measurement that includes all cables, adapters, and probes connected in the test systems electrical path up to and including an open standard. Calibration or waveform referencing utilizes three pads for each probe touchdown (ie; se reflect = 3 pads or diff reflect =

Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250") Pitch, Two Row, Vertical to Right Angle Connection

6 pads). Reference **CAL** calibration board and use the 1mm (0.390") length calibration reflect/transmission standard for TDA step waveform characterization.

DUT Waveform – determine waveform by making an active TDR reflection measurement that includes all cables, adapters, and probes connected in the test systems transmission path. Insert the SUT between the probes in place of the reflection/transmission standard and record the measurement. In this condition cables and adapters located at the far-end of the inserted SUT function as the systems 50Ω single-ended and/or 100Ω differential matching impedance. The QSS-DV/QTS-RA characterization reports one single-ended and one differential return loss application. Single-ended and differential line measurement possibilities are SE3 & SE4, and DP3 & DP4. Reference both PCB fixture set **I** and fixture set **II** for an appropriate signal path.

Near-End Crosstalk (TDA conversion)

Step Waveform – Use Return Loss (RL) step waveform.

DUT Waveform - determine waveform by driving specified signal type and monitoring coupled energy levels at the configurations adjacent near-end signal line. QSS-DV/QTS-RA examines three single-ended and three differential near-end XT configurations. Single-ended crosstalk measurements are SE2 to SE1, SE4 to SE3, and SE6 to SE5. Differential crosstalk measurements are DP2 to DP1, DP4 to DP3, and DP6 to DP5. Reference both PCB fixture set **I** and fixture set **II** for crosstalk configurations.

Far-End Crosstalk (TDA conversion)

Step Waveform - Use Insertion Loss (IL) step waveform.

DUT Waveform - determine waveform by driving specified signal type and monitoring coupled energy levels at the configurations adjacent far-end signal line. QSS-DV/QTS-RA examines three single-ended and three differential far-end XT configurations. Single-ended crosstalk measurements are SE2 to SE1, SE4 to SE3, and SE6 to SE5. Differential crosstalk measurements are DP2 to DP1, DP4 to DP3, and DP6 to DP5. Reference both PCB fixture set **I** and fixture set **II** for crosstalk configurations.

Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250") Pitch, Two Row, Vertical to Right Angle Connection

Time Domain Procedures

Utilize the Time Domain Reflectometer (TDR) or Time Domain Transmission (TDT) method for digital type pulse measurements. Impedance and propagation delay characterization utilize TDR measurement methods. Crosstalk measurements utilize TDT methods. The Tektronix 80E04 TDR/ Sampling Head provide both the signaling type and sampling capability necessary to characterize the SUT.

Impedance(TDR)

Energize the SUT's signal line(s) with a TDR pulse. The far-end of the energized signal lines are terminated in the test systems characteristic impedance (e.g.; 50Ω or 100Ω termination) or use quality cables and adapters located at the far-end of the inserted SUT function as the systems 50Ω single-ended and/or 100Ω differential matching impedance. The QSS-DV/QTS-RA characterization reports one single-ended and one differential impedance application. Single-ended and differential line measurement possibilities are SE3, SE4, DP3, and DP4. Reference both PCB fixture set **I** and fixture set **II** for an appropriate signal path.

Propagation Delay (TDT)

This test reports differential or single-ended signal delay as the measured difference of propagation between a combined electrical length of the input/output signal pads and signal traces (35 ± 5 ps edge rate) and the device under test (DUT) plus a referenced electrical length of the signal pads and signal traces ($PD^{pads/traces}$- $\mathbf{PD^{DUT}}$ + $PD^{pads/traces}$). The recorded delay is the signal delay of the connector only. $PD^{pads/traces}$ is the nomenclature representing the electrical length of PCB signal pads & traces equal to physical lengths of PCB pads & traces entering and leaving the device under test (DUT). The PD^{DUT} + $PD^{pads/traces}$ variable is the mated DUT fixture. Measure the risetime of $PD^{pads/traces}$ waveform & $\mathbf{PD^{DUT}}$ + $PD^{pads/traces}$ waveforms. Record the 50% amplitude of each rising edge. The distance in time between the rising edges is the propagation delay of the device under test (DUT= mated connector only). Single-ended and differential line measurement possibilities are SE3, SE4, DP3, and DP4. Consult the calibration board **CAL** for input/output signal line reference traces. Reference both PCB fixture set **I** and fixture set **II** for an appropriate signal path.

Near-End Crosstalk (TDT)

Energize the pre-determined signal line(s) with the appropriate signal type. Monitor the configurations adjacent quiet signal line at the near-end for magnitudes of coupled energy. Terminate adjacent signal lines not under test in the test systems characteristic impedance. QSS-DV/QTS-RA examines three single-ended and three differential near-end XT configurations. Single-ended crosstalk measurements are SE2 to SE1, SE4 to SE3, and SE6 to SE5. Differential crosstalk measurements are DP2 to DP1, DP4 to

Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250") Pitch, Two Row, Vertical to Right Angle Connection

DP3, and DP6 to DP5. Reference both PCB fixture set I and fixture set II for crosstalk configurations.

Far-End Crosstalk (TDT)
Energize the pre-determined signal line(s) with the appropriate signal type. Monitor the configurations adjacent quiet signal line at the far-end for magnitudes of coupled energy. Terminate adjacent signal lines not under test in the test systems characteristic impedance. QSS-DV/QTS-RA examines three single-ended and three differential far-end XT configurations. Single-ended crosstalk measurements are SE2 to SE1, SE4 to SE3, and SE6 to SE5. Differential crosstalk measurements are DP2 to DP1, DP4 to DP3, and DP6 to DP5. Reference both PCB fixture set I and fixture set II for crosstalk configurations.

Series: QSS/QTS-RA Series
Description: , 0.635mm (0.0250”) Pitch, Two Row, Vertical to Right Angle Connection

Appendix F – Glossary of Terms

TD – Time Domain
FD – Frequency Domain
PD – Propagation Delay
DUT – Device under test, term used for TDA IConnect & Propagation Delay waveforms
EC6 – Edge Card with a .635mm signal pad pitch
FEXT – Far-End Crosstalk
GSG – Ground–Signal-Ground; geometric configuration
GSSG - Ground–Signal-Signal-Ground; geometric configuration
LEC6 – Signal Launch Edge Card with a .635 mm signal pad pitch
NEXT – Near-End Crosstalk
PCB – Printed Circuit Board
SE – Single-Ended
SI – Signal Integrity
SUT – System Under Test
TDR – Time Domain Reflectometry
TDT – Time Domain Transmission
WC – Worst Case crosstalk configuration
BC – Best Case crosstalk configuration
Z – Impedance (expressed in ohms)
OV – Optimal Vertical
OH – Optimal Horizontal
HDV – High Density Vertical
PPO – Pin Population Option
S – Static (independent of PCB ground)