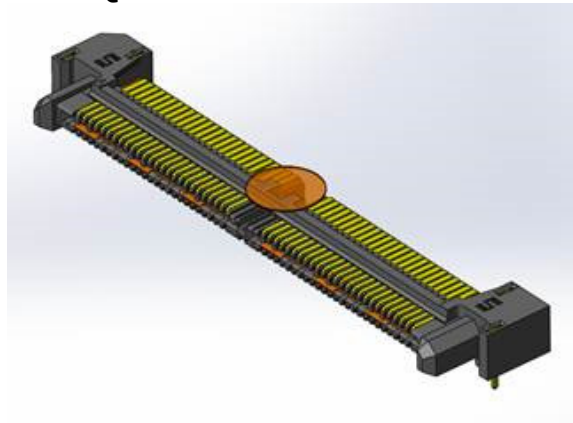


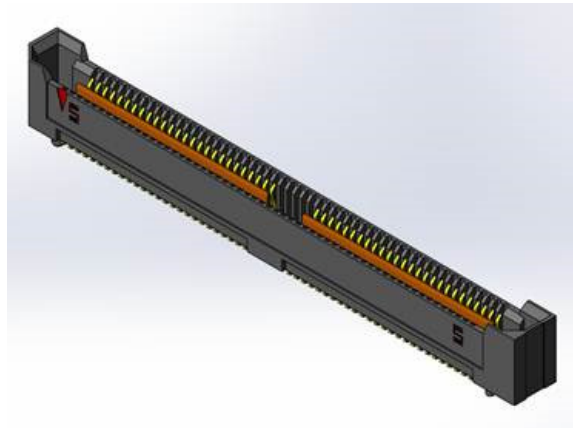


High Speed Characterization Report

QRM8-052-01-L-RA-GP



QRF8-052-05.0-S-D-A-GP



Description:
Q Rate® Slim Body Ground Plane 0.8mm (.0315") Pitch,
Right Angle Terminal to Vertical Socket Connection

Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

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Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

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Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Connector Overview

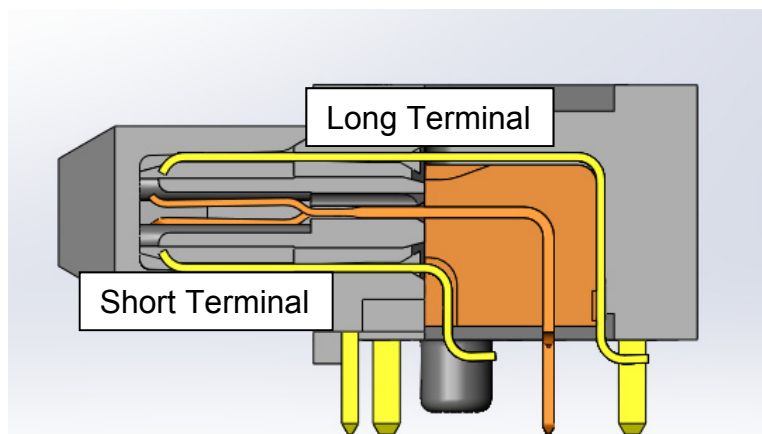
Q Rate® High Speed Socket and Terminal Strip with 0.8mm centerline and slim body ground plane. Socket and terminal strips are available up to 78 contacts per row. The QRF8/QRM8 series configuration styles include double row vertical and right-angle sections of either gender. Data presented in this report is applicable only to a QRM8-RA right angle terminal strip connector mated with QRF8-DV socket strip connector.

This is a two-terminal type right angle connector and each terminal has slightly different performance that is documented in this report. The terminology used in this report to define which connector terminal is as follows:

*The short terminal of the connector is referred to as “Case 1”

*The long terminal of the connector is referred to as “Case 2”

This is illustrated in the following figure.



Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Frequency Domain Data Summary

Table 1 - Single-Ended Connector System Performance Case 1 = Short Row; Case 2 = Long Row					
Case	Test Parameter	Configuration	Driver	Receiver	
1	Insertion Loss	GSG	QRM8_RA_38	QRF8_DV_38	3dB@ 15.0 GHz
	Return Loss	GSG	QRM8_RA_38	QRM8_RA_38	>10dB to 6.2 GHz
	Near-End Crosstalk	GAQG	QRM8_RA_36	QRM8_RA_38	<-20dB to 0.8 GHz
		GAGQG	QRM8_RA_38	QRM8_RA_42	<-20dB to 16.7 GHz
	Far-End Crosstalk	GAQG	QRM8_RA_36	QRF8_DV_38	<-20dB to 10.8 GHz
		GAGQG	QRM8_RA_38	QRF8_DV_42	<-20dB to 16.3 GHz
2	Insertion Loss	GSG	QRM8_RA_37	QRF8_DV_37	3dB@ 11.4 GHz
	Return Loss	GSG	QRM8_RA_37	QRM8_RA_37	>10dB to 8.9 GHz
	Near-End Crosstalk	GAQG	QRM8_RA_35	QRM8_RA_37	<-20dB to 0.5 GHz
		GAGQG	QRM8_RA_37	QRM8_RA_41	<-20dB to 17.2 GHz
		Xrow, GAG to GQG	QRM8_RA_37	QRM8_RA_38	<-20dB to 20.0 GHz
	Far-End Crosstalk	GAQG	QRM8_RA_35	QRF8_DV_37	<-20dB to 7.5 GHz
		GAGQG	QRM8_RA_37	QRF8_DV_41	<-20dB to 16.4 GHz
		Xrow, GAG to GQG	QRM8_RA_37	QRF8_DV_38	<-20dB to 20.0 GHz

Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Table 2 - Differential Connector System Performance
Case 1 = Short Row; Case 2 = Long Row

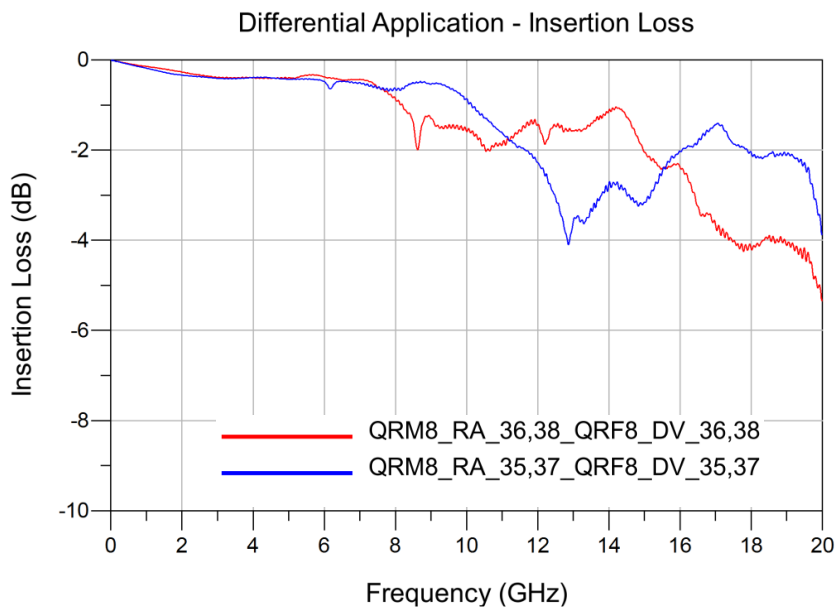
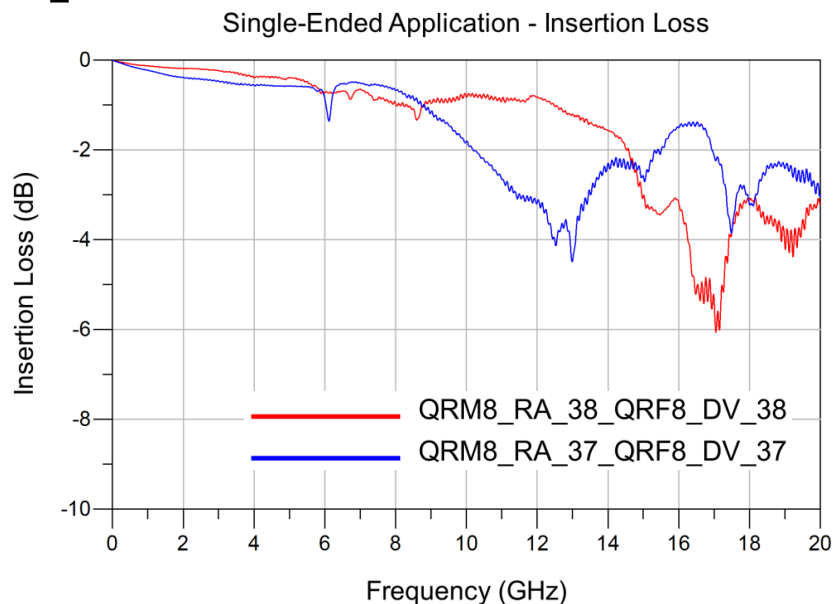
Case	Test Parameter	Configuration	Driver	Receiver	
1	Insertion Loss	GSSG	QRM8_RA_36,38	QRF8_DV_36,38	3dB@ 16.4 GHz
	Return Loss	GSSG	QRM8_RA_36,38	QRM8_RA_36,38	>10dB to 8.1GHz
	Near-End Crosstalk	GAAQQG	QRM8_RA_34,36	QRM8_RA_38,40	<-20dB to 7.7 GHz
		GAAGQQG	QRM8_RA_36,38	QRM8_RA_42,44	<-20dB to 20.0 GHz
	Far-End Crosstalk	GAAQQG	QRM8_RA_34,36	QRF8_DV_38,40	<-20dB to 20.0 GHz
		GAAGQQG	QRM8_RA_36,38	QRF8_DV_42,44	<-20dB to 19.6 GHz
2	Insertion Loss	GSSG	QRM8_RA_35,37	QRF8_DV_35,37	3dB@ 12.5 GHz
	Return Loss	GSSG	QRM8_RA_35,37	QRM8_RA_35,37	>10dB to 10.2 GHz
	Near-End Crosstalk	GAAQQG	QRM8_RA_33,35	QRM8_RA_37,39	<-20dB to 2.8 GHz
		GAAGQQG	QRM8_RA_35,37	QRM8_RA_41,43	<-20dB to 20.0 GHz
		Xrow, GAAG to GQQG	QRM8_RA_35,37	QRM8_RA_36,38	<-20dB to 20.0 GHz
	Far-End Crosstalk	GAAQQG	QRM8_RA_33,35	QRF8_DV_37,39	<-20dB to 20.0 GHz
		GAAGQQG	QRM8_RA_35,37	QRF8_DV_41,43	<-20dB to 20.0 GHz
		Xrow, GAAG to GQQG	QRM8_RA_35,37	QRF8_DV_36,38	<-20dB to 20.0 GHz

Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Bandwidth Chart – Single-Ended & Differential Insertion Loss

QRM8_RA/QRF8_DV Connector Series

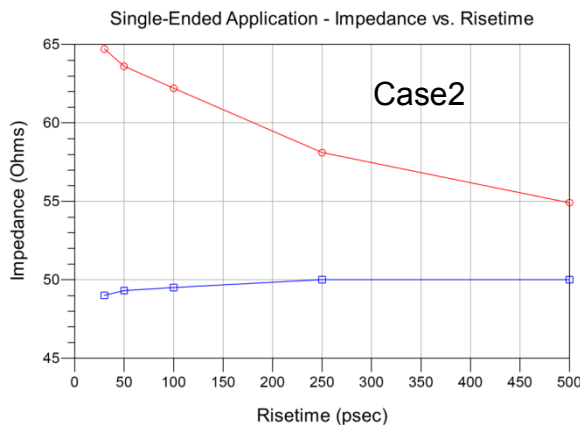
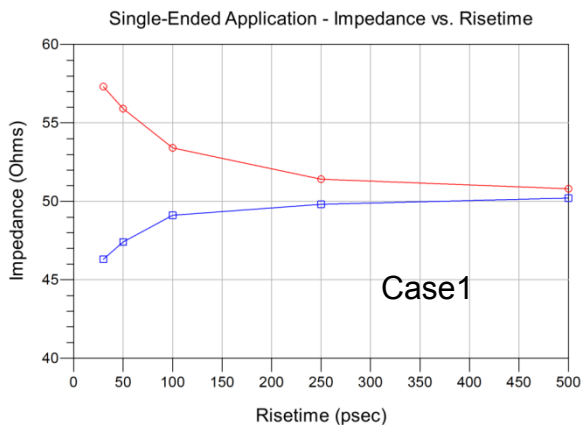


Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Time Domain Data Summary

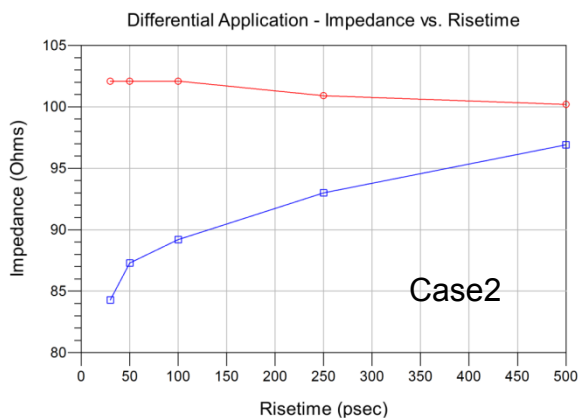
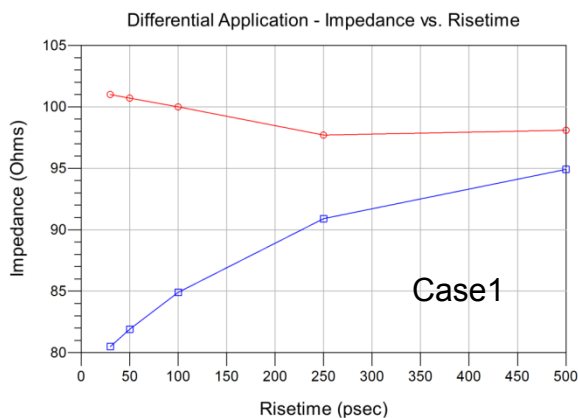
Table 3 – Single-End Impedance (Ω) Case 1 = Short Row; Case 2 = Long Row						
Case	Signal Risetime	30 ps	50 ps	100 ps	250 ps	500 ps
1	Maximum Impedance	57.3	55.9	53.4	51.4	50.8
	Minimum Impedance	46.3	47.4	49.1	49.8	50.2
2	Maximum Impedance	64.7	63.6	62.2	58.1	54.9
	Minimum Impedance	49.0	49.3	49.5	50.0	50.0



Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Table 4 - Differential Impedance (Ω) Case 1 = Short Row; Case 2 = Long Row						
Case	Signal Risetime	30 ps	50 ps	100 ps	250 ps	500 ps
1	Maximum Impedance	101.0	100.7	100.0	97.7	98.1
	Minimum Impedance	80.5	81.9	84.9	90.9	94.9
2	Maximum Impedance	102.1	102.1	102.1	100.9	100.2
	Minimum Impedance	84.3	87.3	89.2	93.0	96.9



Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Table 5 - Single-Ended Crosstalk (%)
Case 1 = Short Row; Case 2 = Long Row

Case	Input(tr)	Config	Driver	Receiver	30ps	50 ps	100 ps	250 ps	500 ps
1	NEXT	GAQG	QRM8_RA_36	QRM8_RA_38	19.56	16.91	14.48	7.94	4.28
		GAGQG	QRM8_RA_38	QRM8_RA_42	2.23	1.80	1.32	0.71	0.43
	FEXT	GAQG	QRM8_RA_36	QRF8_DV_38	4.68	3.35	2.56	1.29	0.75
		GAGQG	QRM8_RA_38	QRF8_DV_42	3.07	1.95	1.02	0.45	0.19
2	NEXT	GAQG	QRM8_RA_35	QRM8_RA_37	18.76	17.82	16.57	10.21	5.76
		GAGQG	QRM8_RA_37	QRM8_RA_41	2.23	1.68	1.30	0.86	0.62
		Xrow	QRM8_RA_37	QRM8_RA_38	0.28	0.11	<0.1	<0.1	<0.1
	FEXT	GAQG	QRM8_RA_35	QRF8_DV_37	5.66	4.42	3.72	2.50	1.52
		GAGQG	QRM8_RA_37	QRF8_DV_41	2.30	1.50	0.80	0.38	0.22
		Xrow	QRM8_RA_37	QRF8_DV_38	0.25	0.14	<0.1	<0.1	<0.1

Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Table 6 - Differential Crosstalk (%)
Case 1 = Short Row; Case 2 = Long Row

Case	Input(tr)	Config	Driver	Receiver	30ps	50 ps	100 ps	250 ps	500 ps
1	NEXT	GAAQQG	QRM8_RA_34,36	QRM8_RA_38,40	7.29	5.28	4.74	3.24	1.81
		GAAGQQG	QRM8_RA_36,38	QRM8_RA_42,44	0.57	0.34	0.17	0.17	0.13
	FEXT	GAAQQG	QRM8_RA_34,36	QRF8_DV_38,40	1.15	0.80	0.55	0.20	<0.1
		GAAGQQG	QRM8_RA_36,38	QRF8_DV_42,44	1.85	1.37	0.86	0.45	0.28
2	NEXT	GAAQQG	QRM8_RA_33,35	QRM8_RA_37,39	6.22	5.88	5.34	3.32	1.87
		GAAGQQG	QRM8_RA_35,37	QRM8_RA_41,43	0.54	0.34	0.26	0.16	<0.1
		Xrow	QRM8_RA_35,37	QRM8_RA_36,38	<0.1	<0.1	<0.1	<0.1	<0.1
	FEXT	GAAQQG	QRM8_RA_33,35	QRF8_DV_37,39	0.73	0.44	0.30	0.12	<0.1
		GAAGQQG	QRM8_RA_35,37	QRF8_DV_41,43	0.48	0.29	0.15	<0.1	<0.1
		Xrow	QRM8_RA_35,37	QRF8_DV_36,38	<0.1	<0.1	<0.1	<0.1	<0.1

Series: QRM8-RA/QRF8-DV**Description:** Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Table 7 - Propagation Delay (Mated Connector) Case 1 = Short Row; Case 2 = Long Row		
Case 1	Single-Ended	65 ps
	Differential	57 ps
Case 2	Single-Ended	92 ps
	Differential	81 ps

Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

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 differentially and single-ended driven scenarios.

Connector Signal to Ground Ratio

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

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

Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

For this connector, the following configurations were evaluated:

Single-Ended Impedance:

- GSG (Ground-Signal-Ground)

Single-Ended Crosstalk:

- Electrical “worst case”: GAQG (Ground-Active-Quiet-Ground)
- Electrical “best case”: GAGQG (Ground-Active-Ground-Quiet-Ground)
- Across row: “xrow case”: GAG to GQG (from one row of terminals to the other row)

Differential Impedance:

- GSSG (Ground-positive Signal-negative Signal-Ground)

Differential Crosstalk:

- Electrical “worst case”: GAAQQG (Ground-Active-Active-Quiet-Quiet-Ground)
- Electrical “best case”: GAAGQQG (Ground-Active-Active-Ground-Quiet-Quiet-Ground)
- Across row: “xrow case”: GAAG to GQQG (from one row of terminals to the other row)

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

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

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

Signal Edge Speed (Rise Time):

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

Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

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.

Time Domain Data

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

Impedance mismatch versus length is measured by DSA8300 Digital Serial Analyzer. Board related effects, such as pad-to-ground capacitance and trace loss, are included in the data presented in this report. The impedance data is provided in [Appendix E](#) of this report.

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

In this report, propagation delay is defined as the signal propagation time through the connector and connector footprint. It includes 10 mils of PCB trace on the both QRM8_RA and QRF8_DV connector side. Delay is measured at 30 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

Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

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.

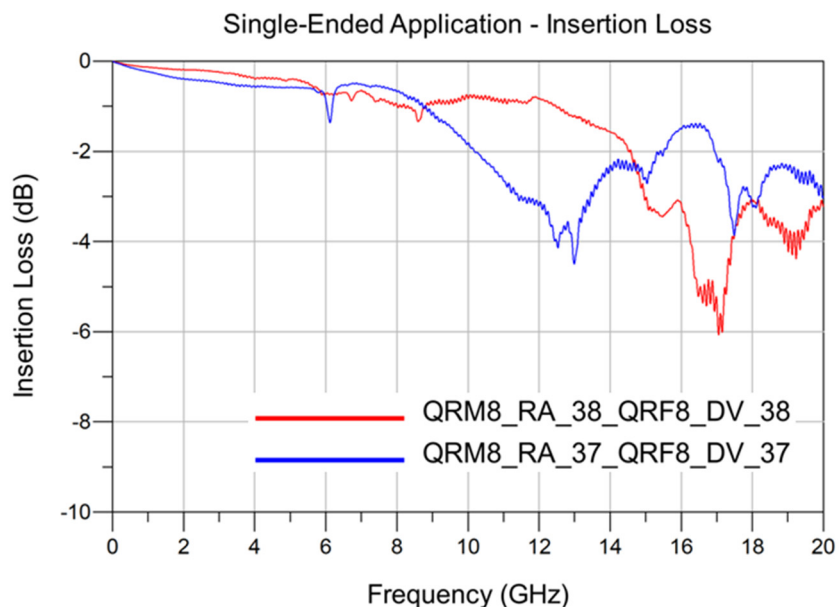
Additional information concerning test conditions and procedures is in the appendices of this report. Further information may be obtained by contacting our Signal Integrity Group at sig@samtec.com.

Series: QRM8-RA/QRF8-DV

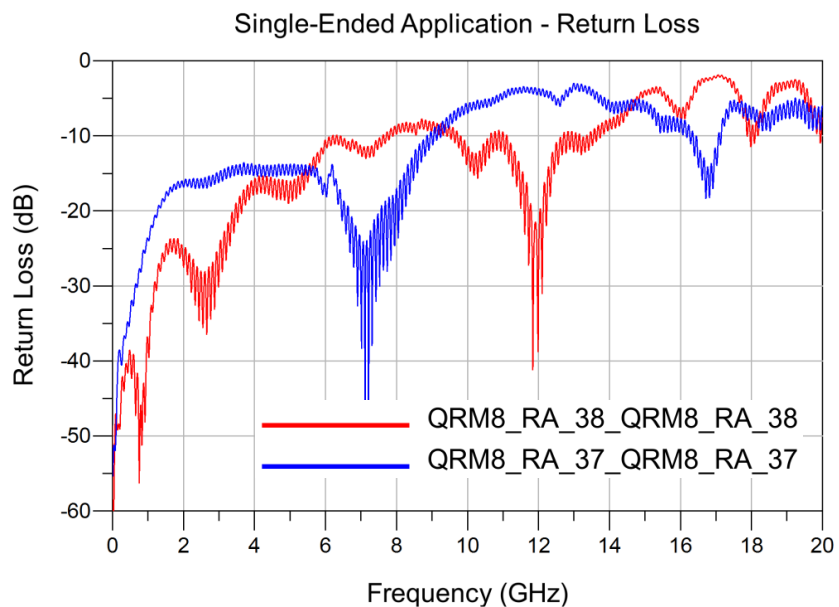
Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Appendix A – Frequency Domain Response Graphs

Single-Ended Application – Insertion Loss



Single-Ended Application – Return Loss

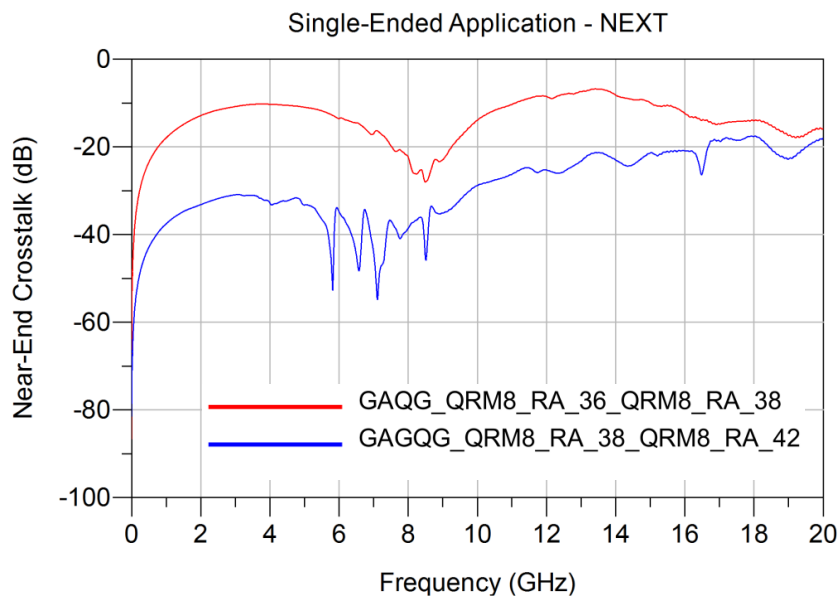


Series: QRM8-RA/QRF8-DV

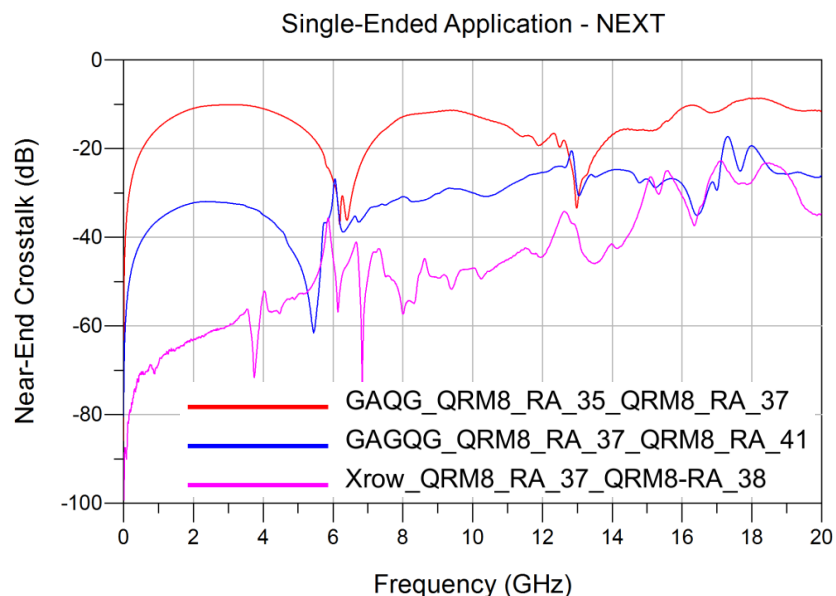
Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Single-Ended Application – NEXT Configurations

Case 1



Case 2

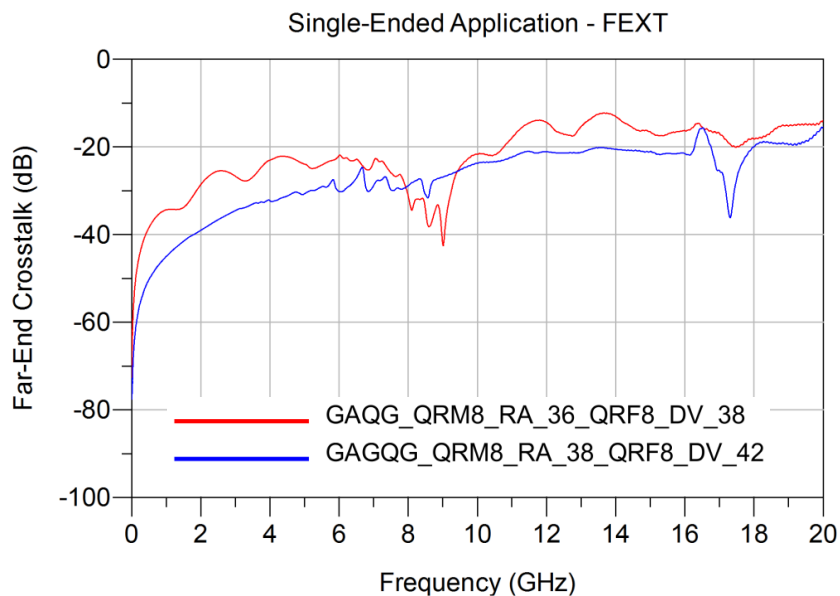


Series: QRM8-RA/QRF8-DV

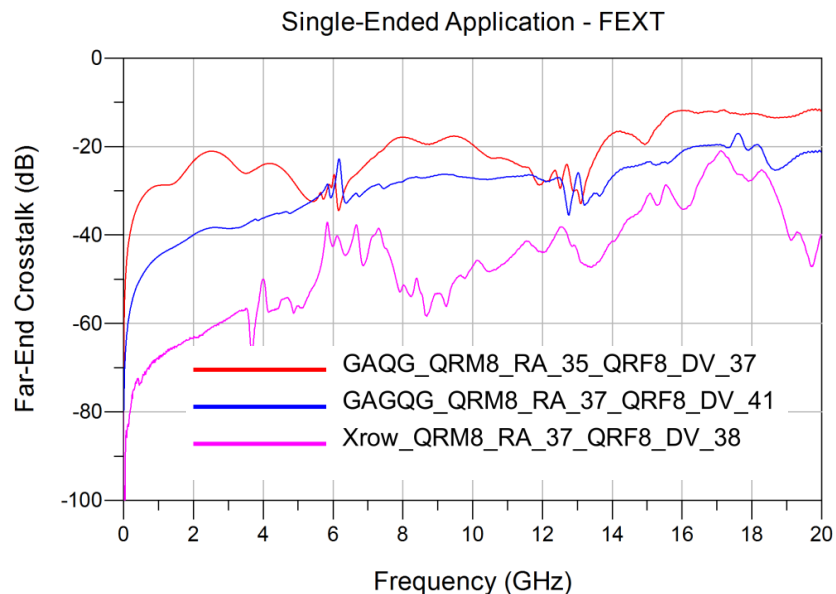
Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Single-Ended Application – FEXT Configurations

Case 1



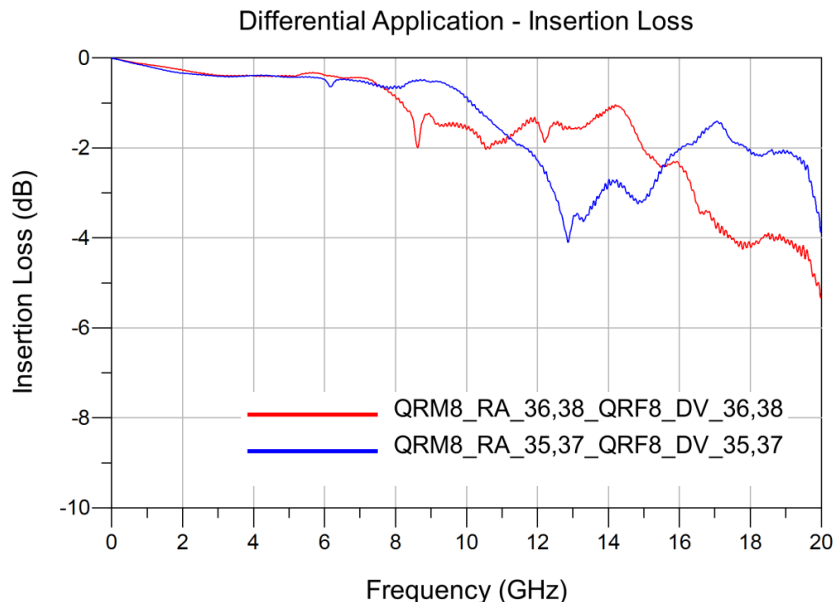
Case 2



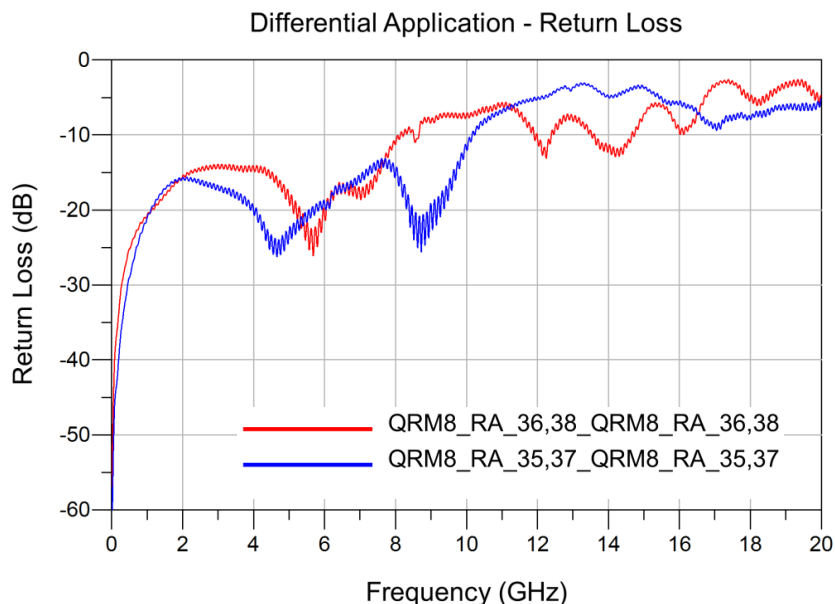
Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Differential Application – Insertion Loss



Differential Application – Return Loss

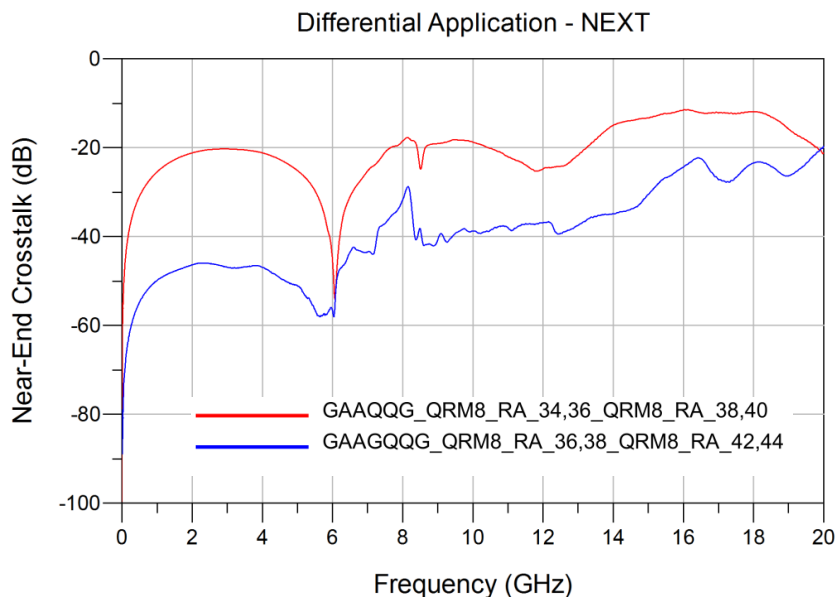


Series: QRM8-RA/QRF8-DV

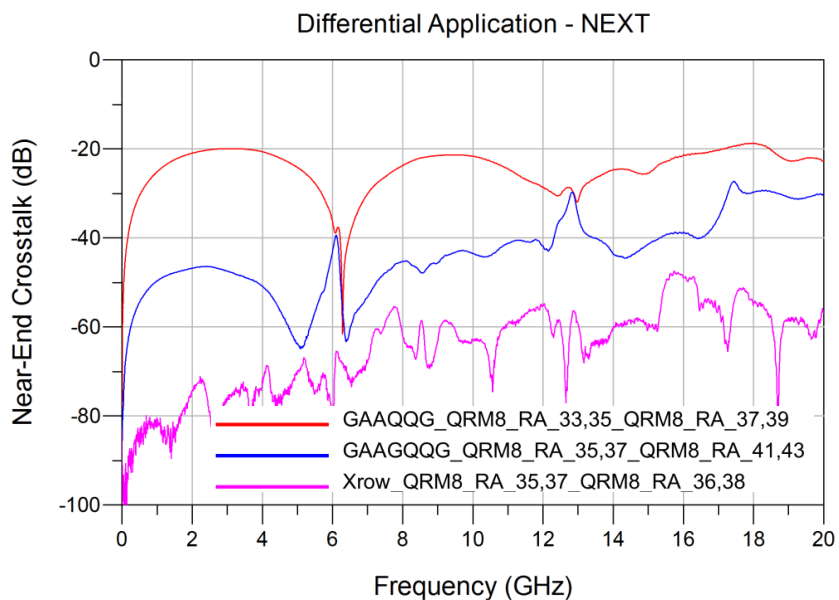
Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Differential Application – NEXT Configurations

Case 1



Case 2

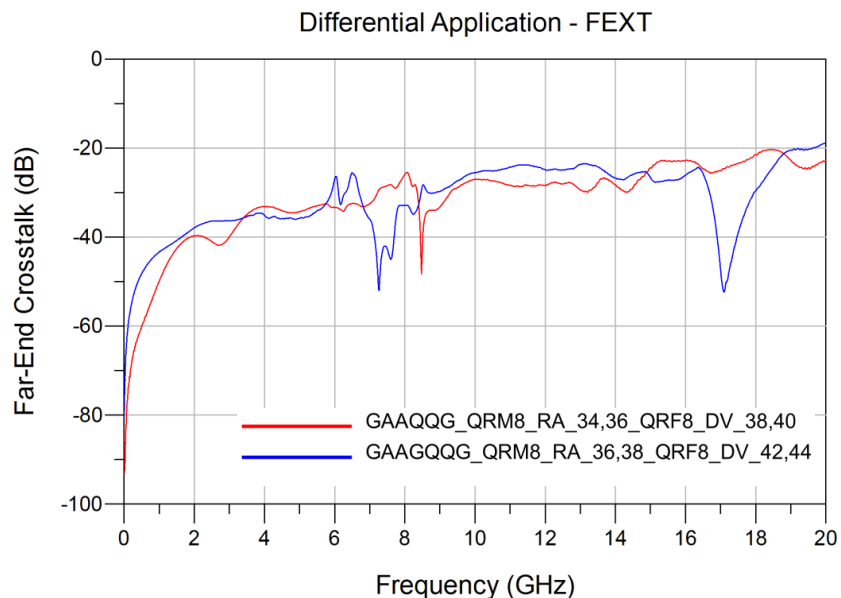


Series: QRM8-RA/QRF8-DV

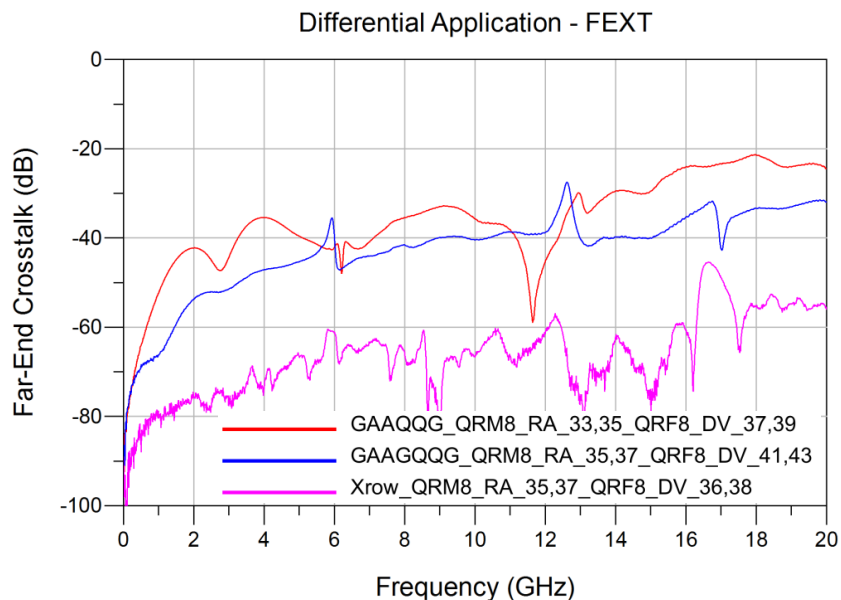
Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Differential Application – FEXT Configurations

Case 1



Case 2

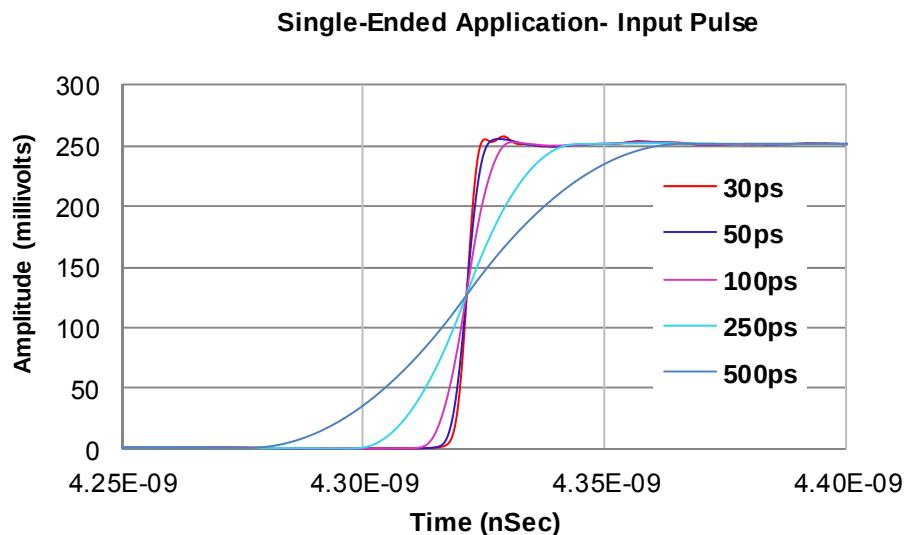


Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Appendix B – Time Domain Response Graphs

Single-Ended Application – Input Pulse

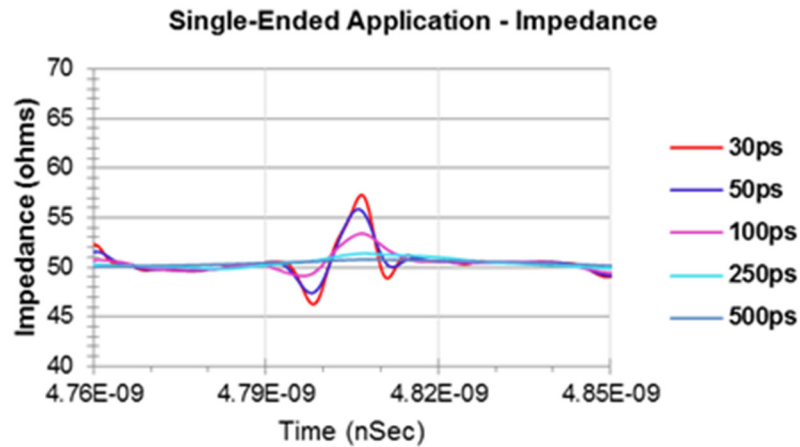


Series: QRM8-RA/QRF8-DV

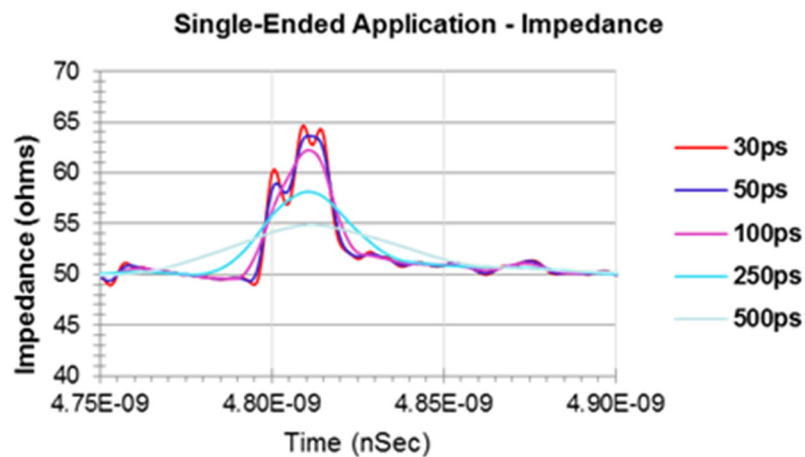
Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Single-Ended Application – Impedance

Case 1



Case 2

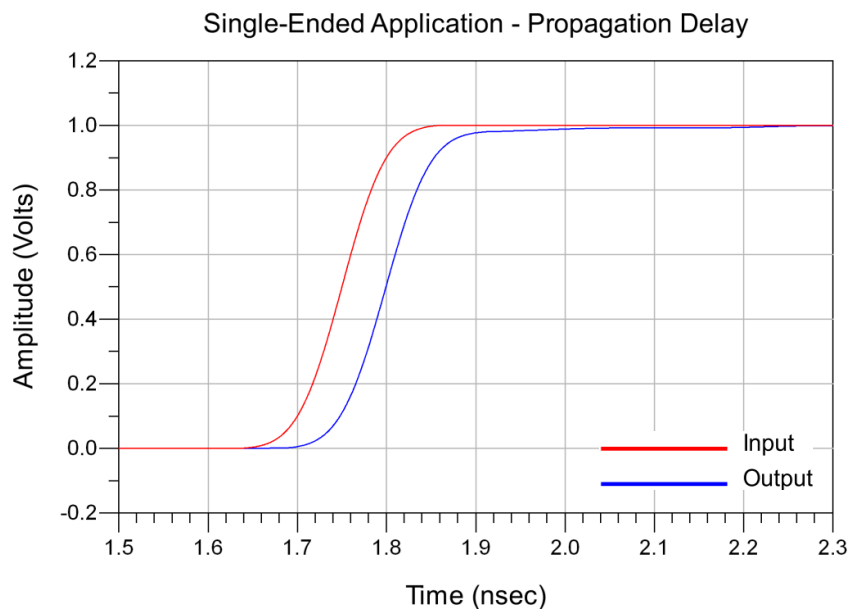


Series: QRM8-RA/QRF8-DV

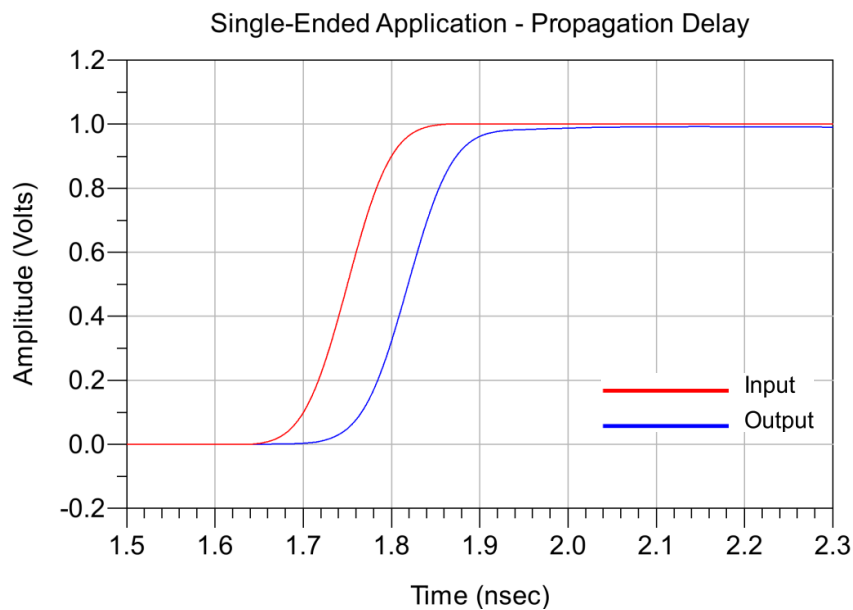
Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Single-Ended Application – Propagation Delay

Case 1



Case 2

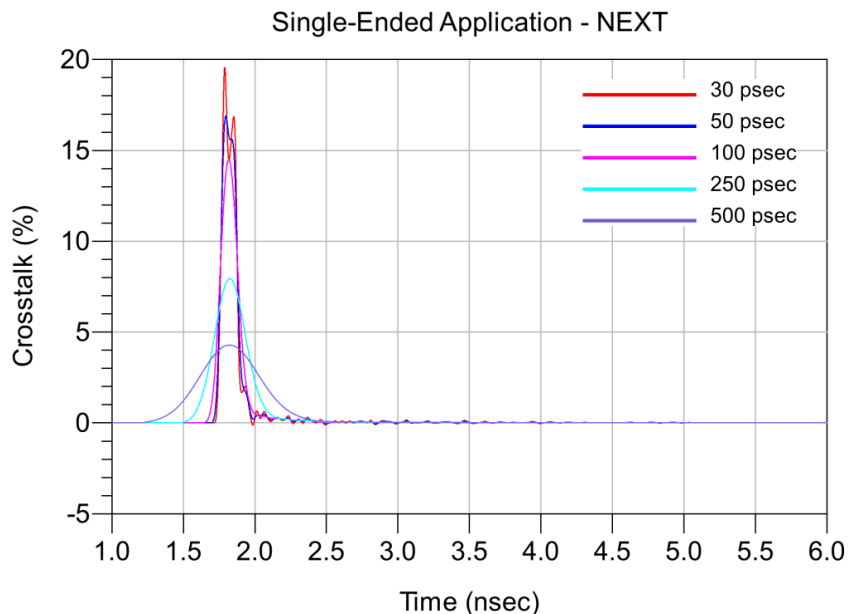


Series: QRM8-RA/QRF8-DV

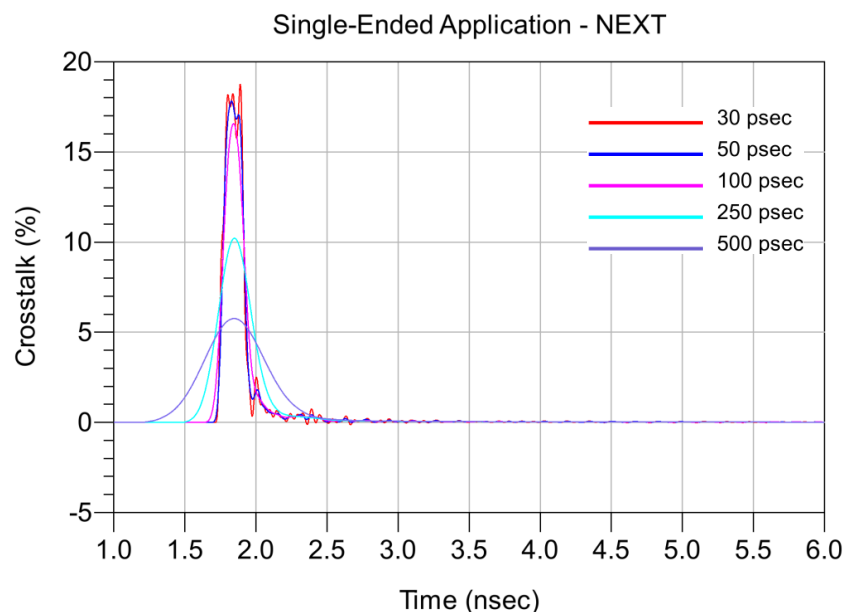
Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Single-Ended Application – NEXT, Worst Case Configuration

Case 1 (Short Row), QRM8-RA_36_QRM8-RA_38



Case 2 (Long Row), QRM8-RA_35_QRM8-RA_37

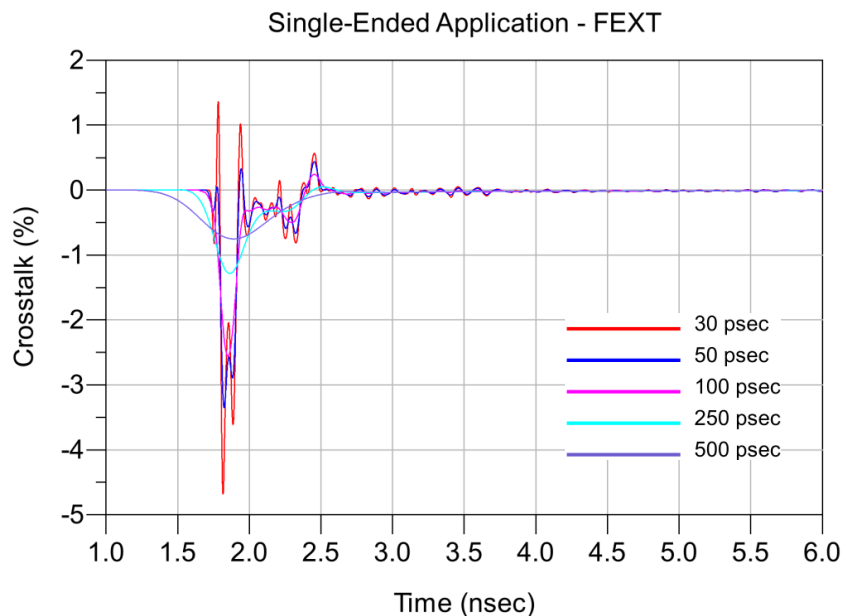


Series: QRM8-RA/QRF8-DV

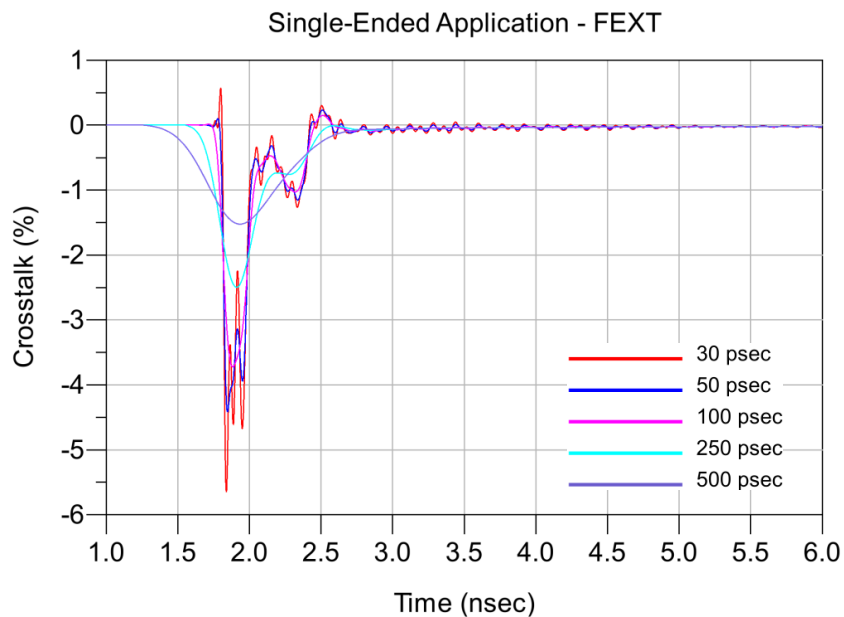
Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Single-Ended Application – FEXT, Worst Case Configuration

Case 1 (Short Row), QRM8-RA_36_QRF8-DV_38



Case 2 (Long Row), QRM8-RA_35_QRF8-DV_37

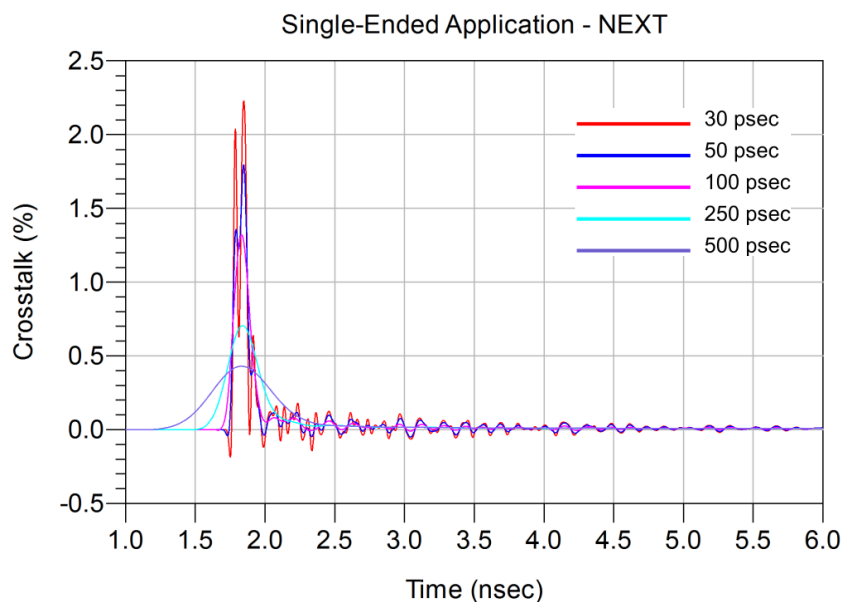


Series: QRM8-RA/QRF8-DV

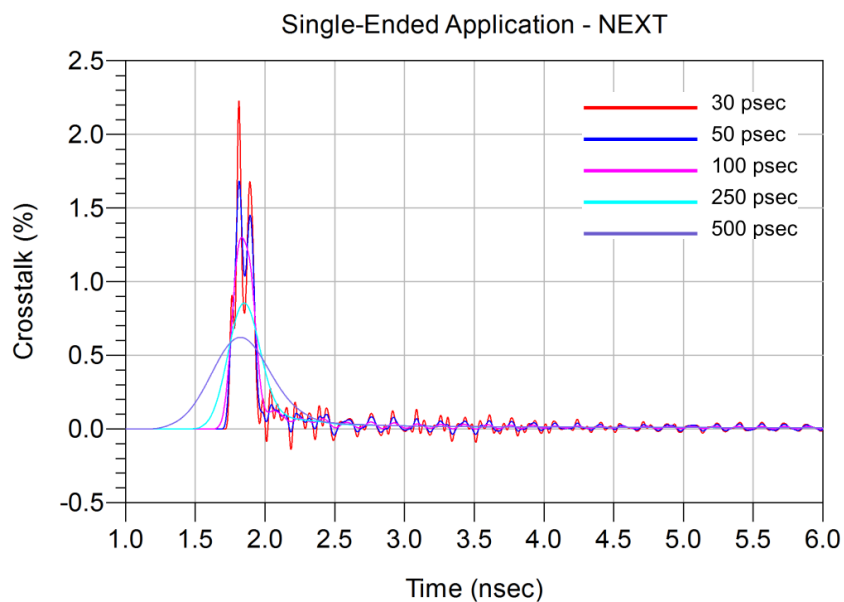
Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Single-Ended Application – NEXT, Best Case Configuration

Case 1 (Short Row), QRM8-RA_38_QRM8-RA_42



Case 2 (Long Row), QRM8-RA_37_QRM8-RA_41

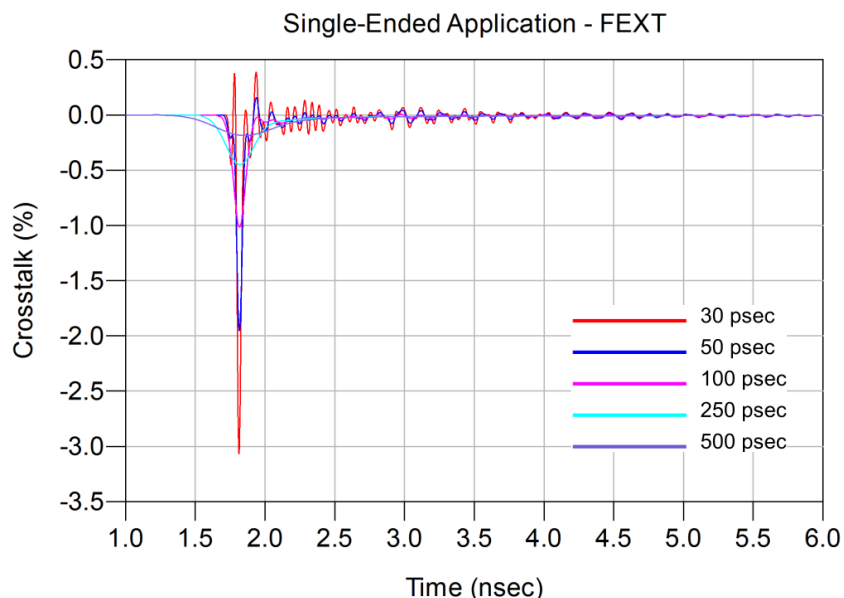


Series: QRM8-RA/QRF8-DV

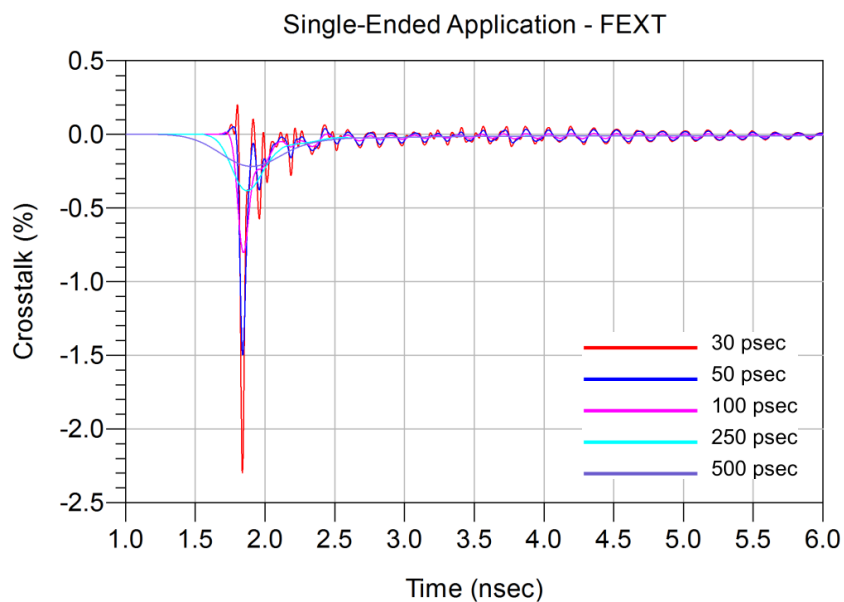
Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Single-Ended Application – FEXT, Best Case Configuration

Case 1 (Short Row), QRM8-RA_38_QRF8-DV_42



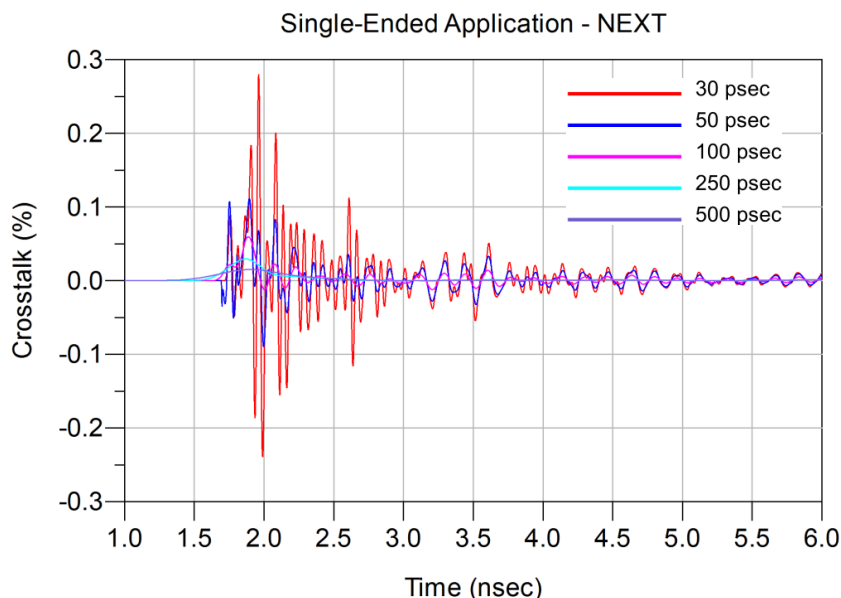
Case 2 (Long Row), QRM8-RA_37_QRF8-DV_41



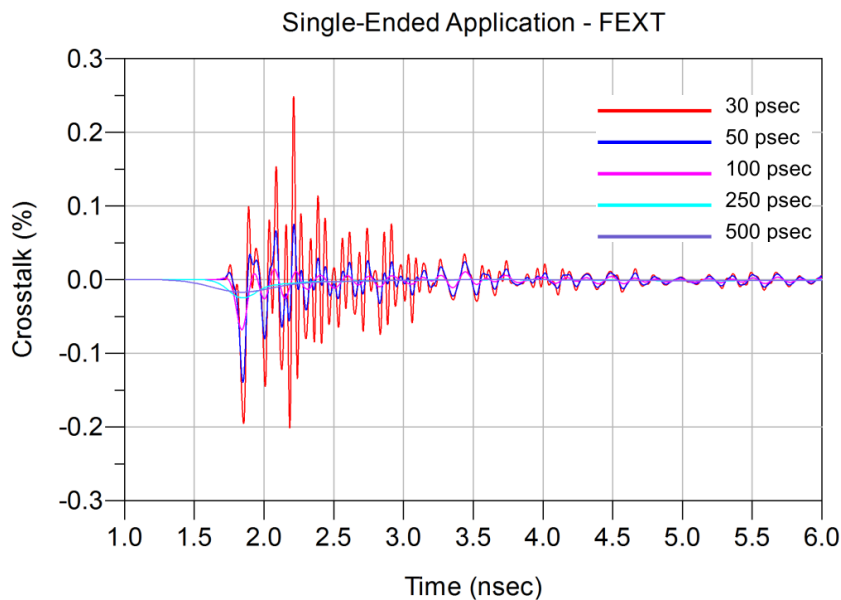
Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

**Single-Ended Application – NEXT, Across Row Configuration,
QRM8-RA_37_QRM8-RA_38**



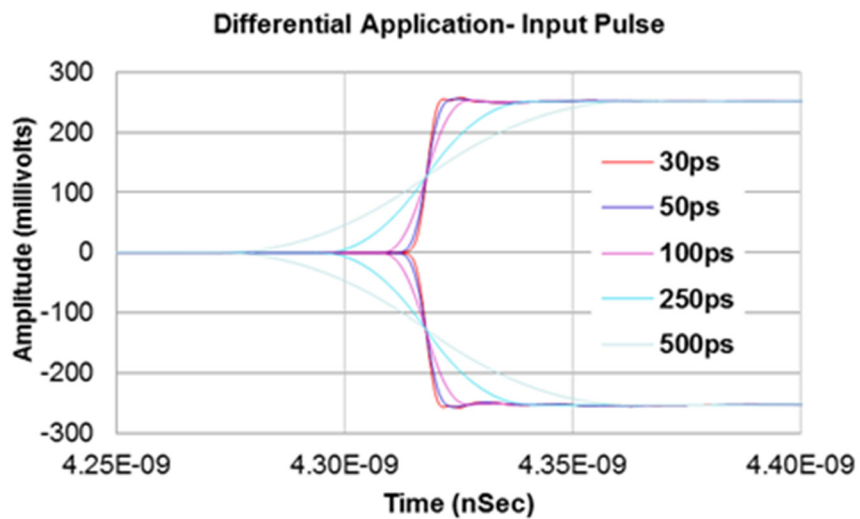
**Single-Ended Application – FEXT, Across Row Configuration
QRM8-RA_37_QRF8-DV_38**



Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Differential Application – Input Pulse

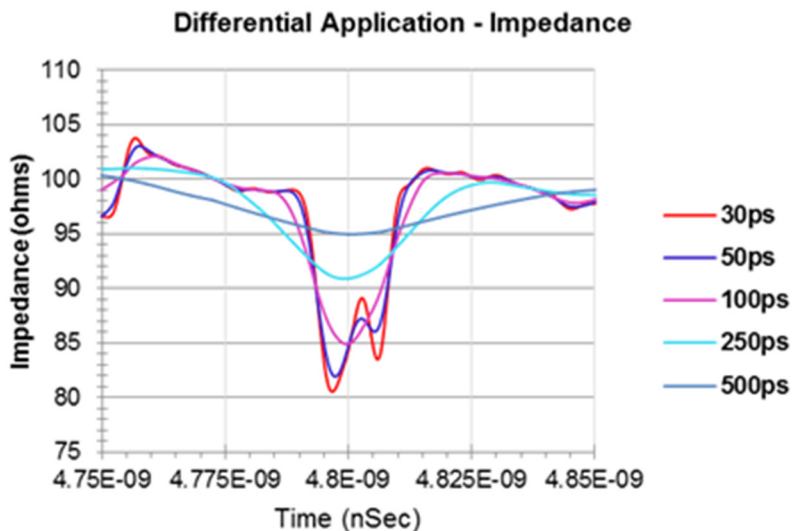


Series: QRM8-RA/QRF8-DV

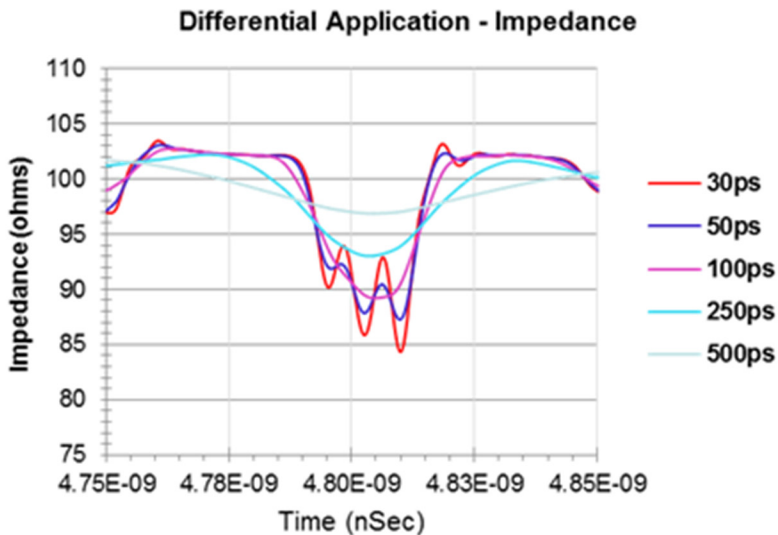
Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Differential Application – Impedance

Case 1



Case 2

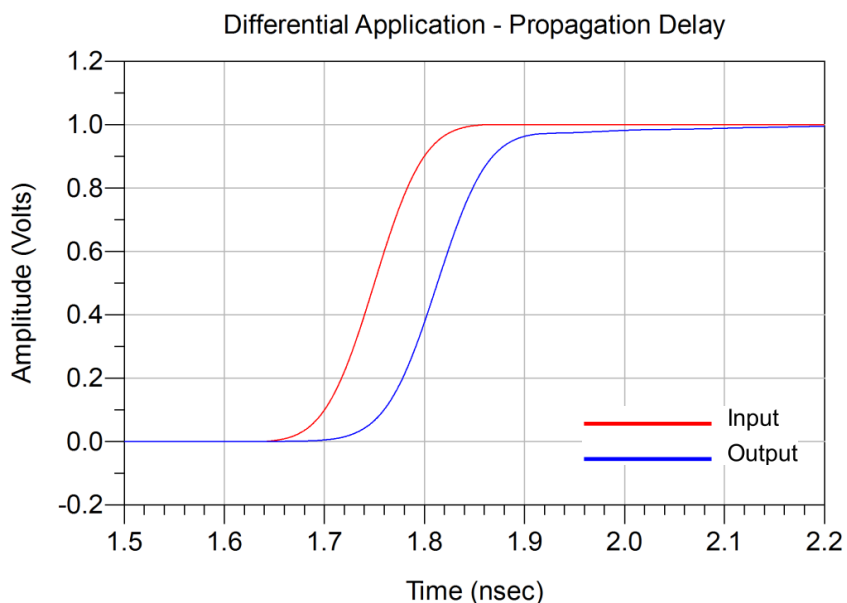


Series: QRM8-RA/QRF8-DV

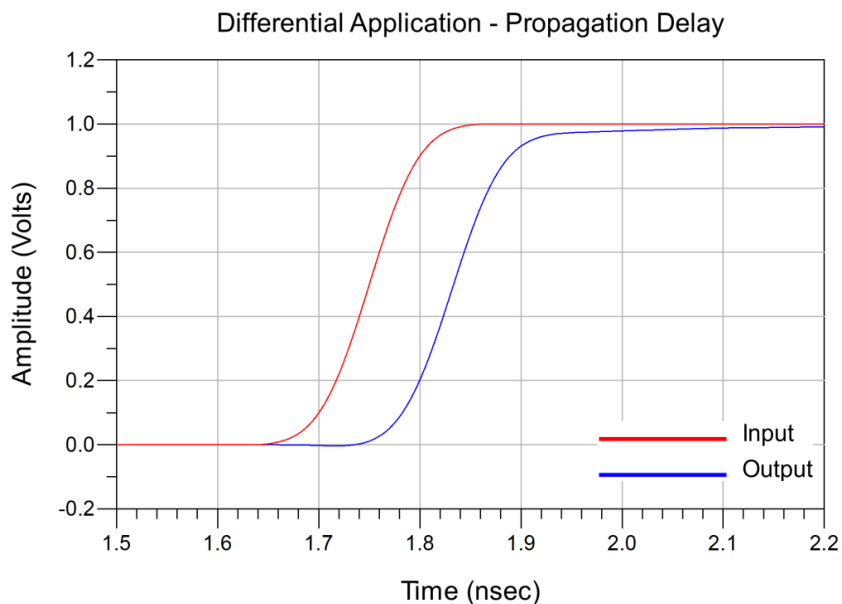
Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Differential Application – Propagation Delay

Case 1



Case 2

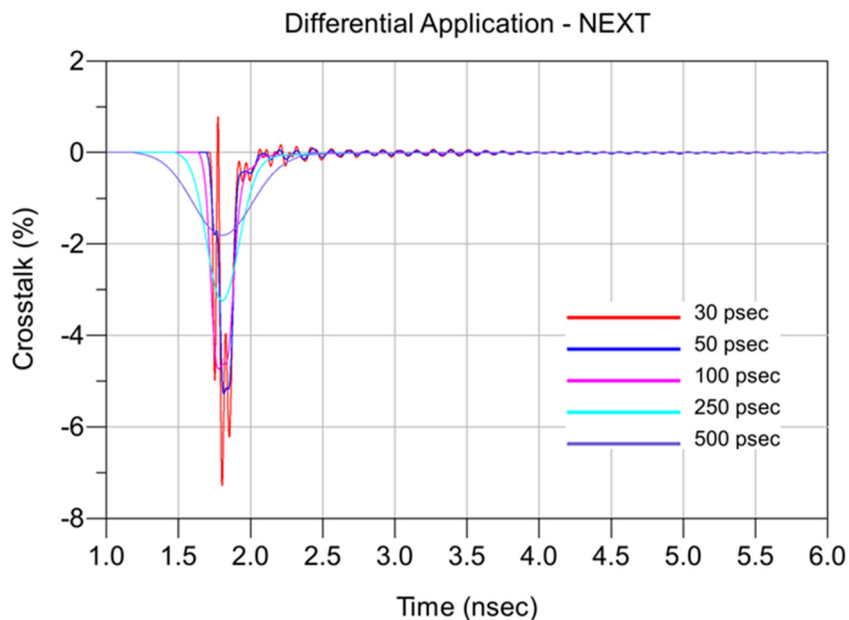


Series: QRM8-RA/QRF8-DV

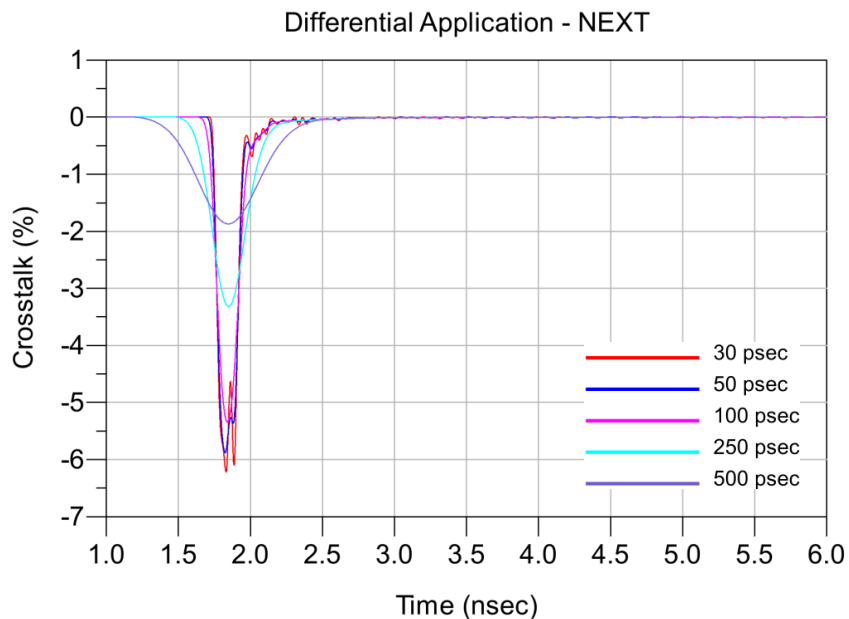
Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Differential Application – NEXT, Worst Case Configuration

Case 1 (Short Row), QRM8-RA_34,36_QRM8-RA_38,40



Case 2 (Long Row), QRM8-RA_33,35_QRM8-RA_37,39

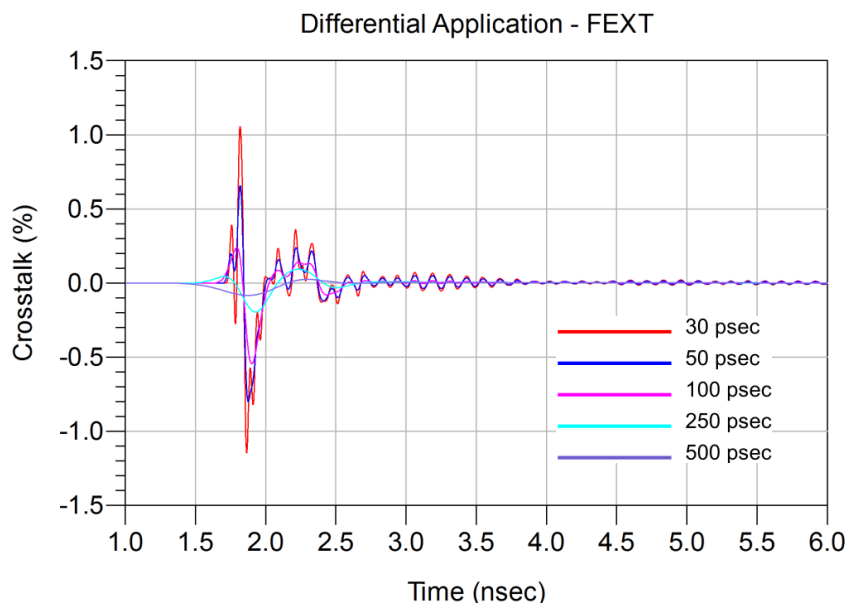


Series: QRM8-RA/QRF8-DV

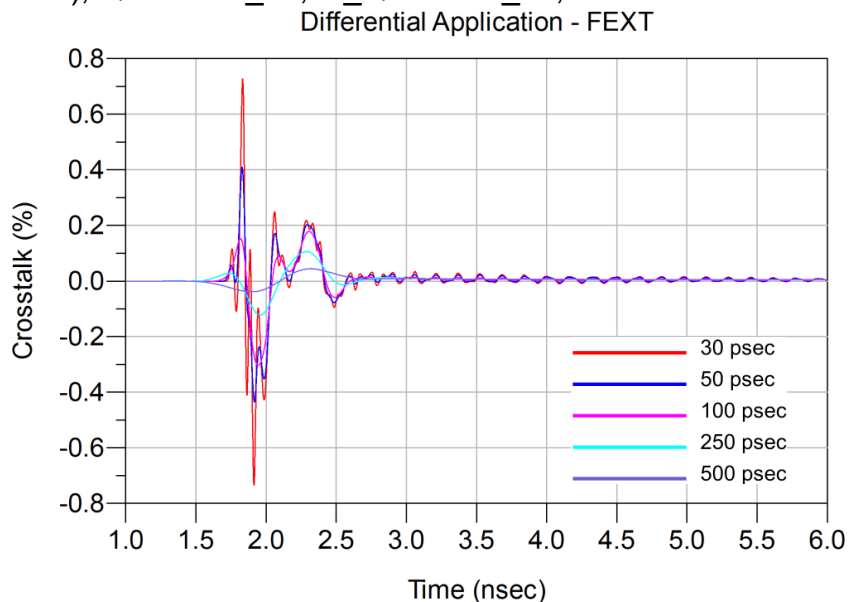
Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Differential Application – FEXT, Worst Case Configuration

Case 1 (Short Row), QRM8-RA_34,36_QRF8-DV_38,40



Case 2 (Long Row), QRM8-RA_33,35_QRF8-DV_37,39

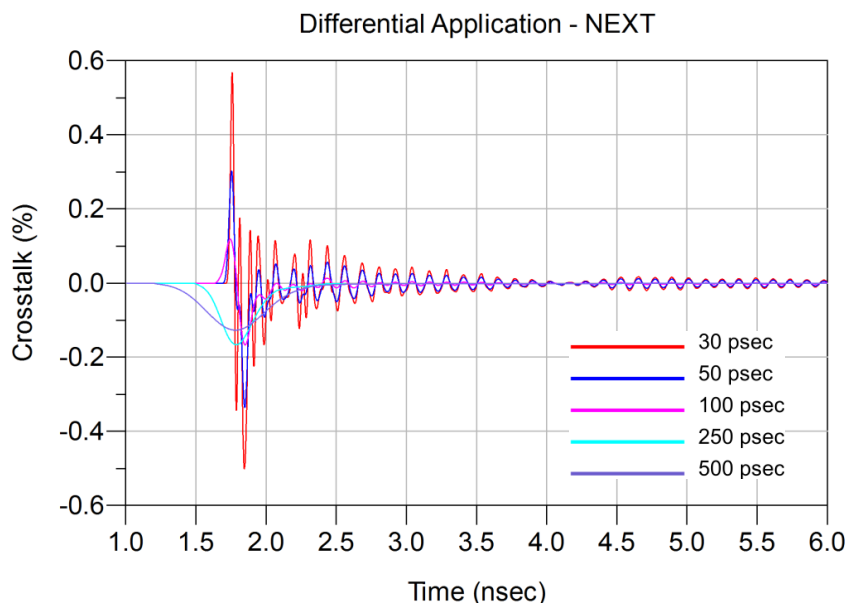


Series: QRM8-RA/QRF8-DV

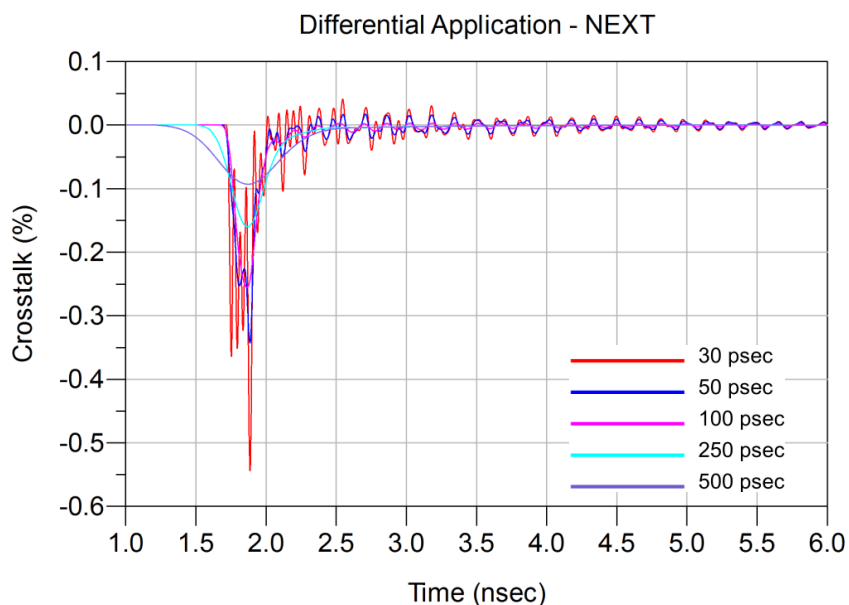
Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Differential Application – NEXT, Best Case Configuration

Case 1 (Short Row), QRM8-RA_36,38_QRM8-RA_42,44



Case 2 (Long Row), QRM8-RA_35,37_QRM8-RA_41,43

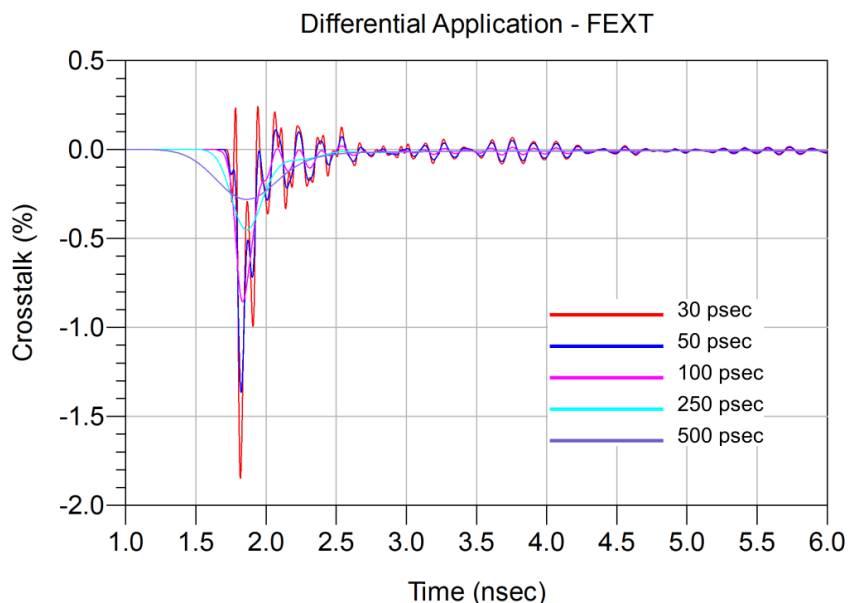


Series: QRM8-RA/QRF8-DV

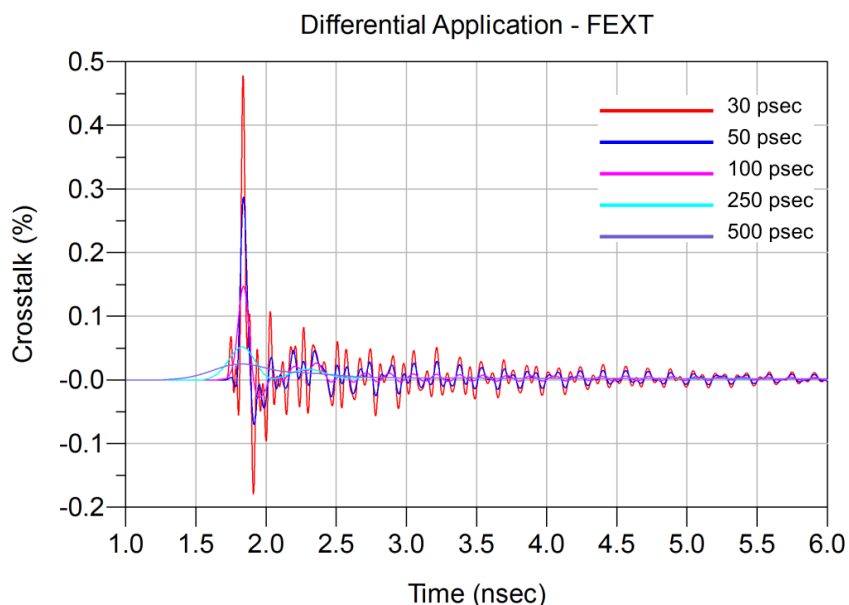
Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Differential Application – FEXT, Best Case Configuration

Case 1 (Short Row), QRM8-RA_36,38_QRF8-DV_42,44



Case 2 (Long Row), QRM8-RA_35,37_QRF8-DV_41,43

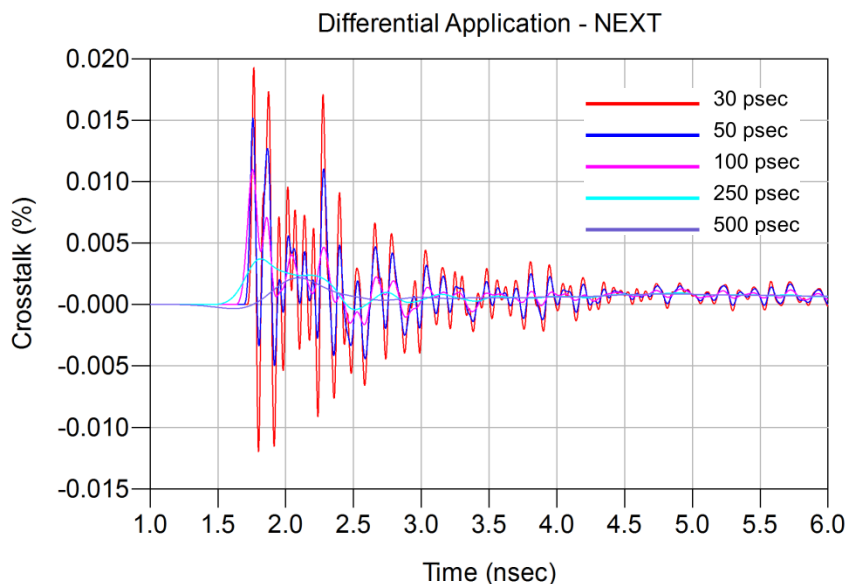


Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

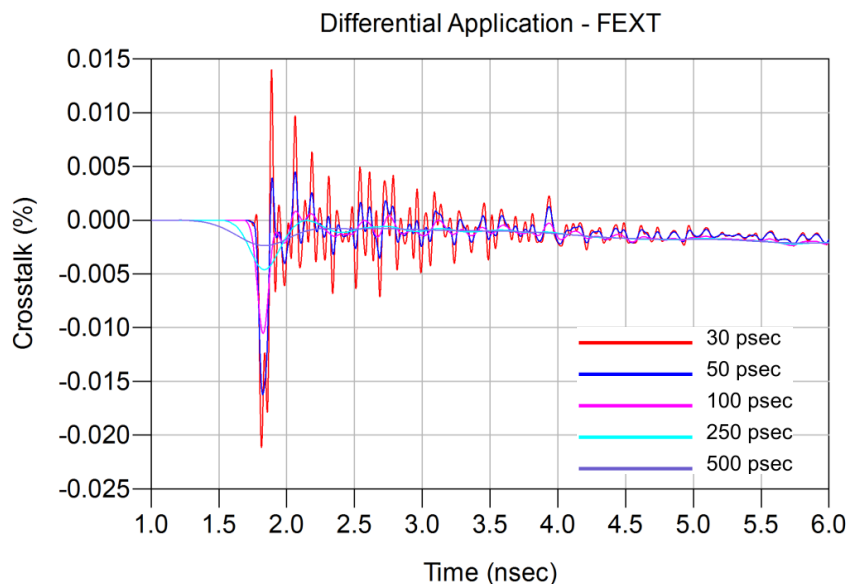
Differential Application – NEXT, Across Row Case Configuration

QRM8-RA_35,37_QRM8-RA_36,38



Differential Application – FEXT, Across Row Case Configuration

QRM8-RA_35,37_QRF8-DV_36,38



Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Appendix C – Product and Test System Descriptions

Product Description

Product test samples are QRM8_RA/QRF8_DV Q Rate® Slim Body Ground Plane Connector. The part number is QRM8-052-01-L-RA-GP and it mates to QRF8-052-05.0-S-D-A-GP. The connector has two rows of 26 contacts evenly spaced on a 0.8 mm (0.0315") pitch. 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 test cables to test fixtures. Optimization of the SMA launch was performed using full wave simulation tools to minimize reflections. Six test fixtures are specific to the QRM8_RA/QRF8_DV series connector set and identified by part numbers PCB-104078-TST-02, PCB-104078-TST-04, PCB-104078-TST-06, PCB-104078-TST-09, PCB-104078-TST-11, PCB-104078-TST-13. Calibration standards specific to the QRM8_RA/QRF8_DV series are located on the calibration boards PCB-104078-TST-99. To keep trace lengths short, three different test board sets were required to access the necessary signal pins.

PCB-104078-TST-XX Test Fixtures

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

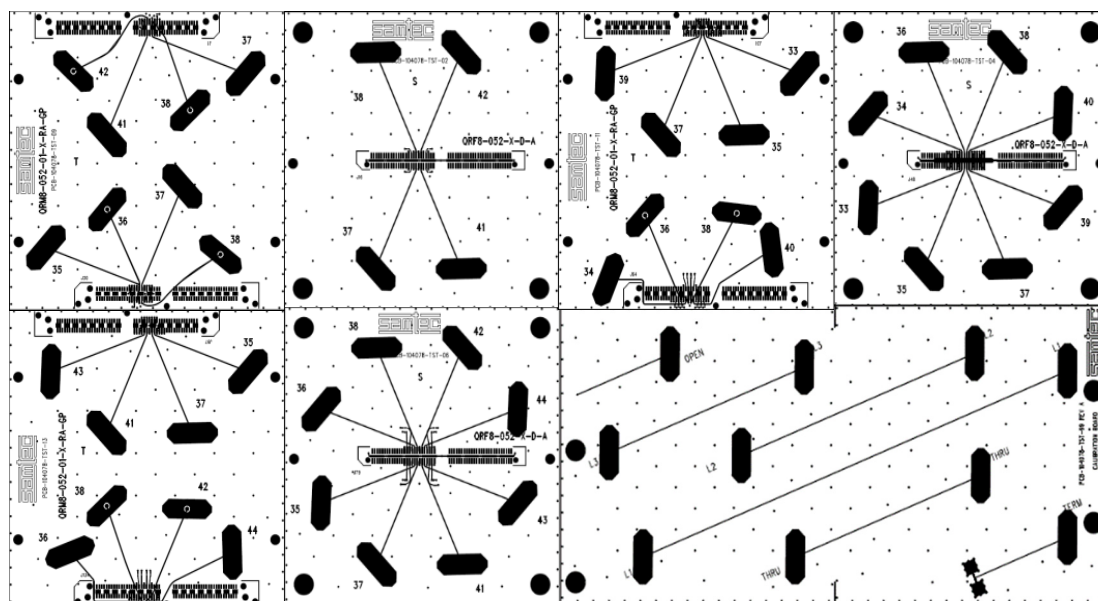


Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

PCB-104078-TST-XX PCB Layout Panel

Artwork of the PCB design is shown below.



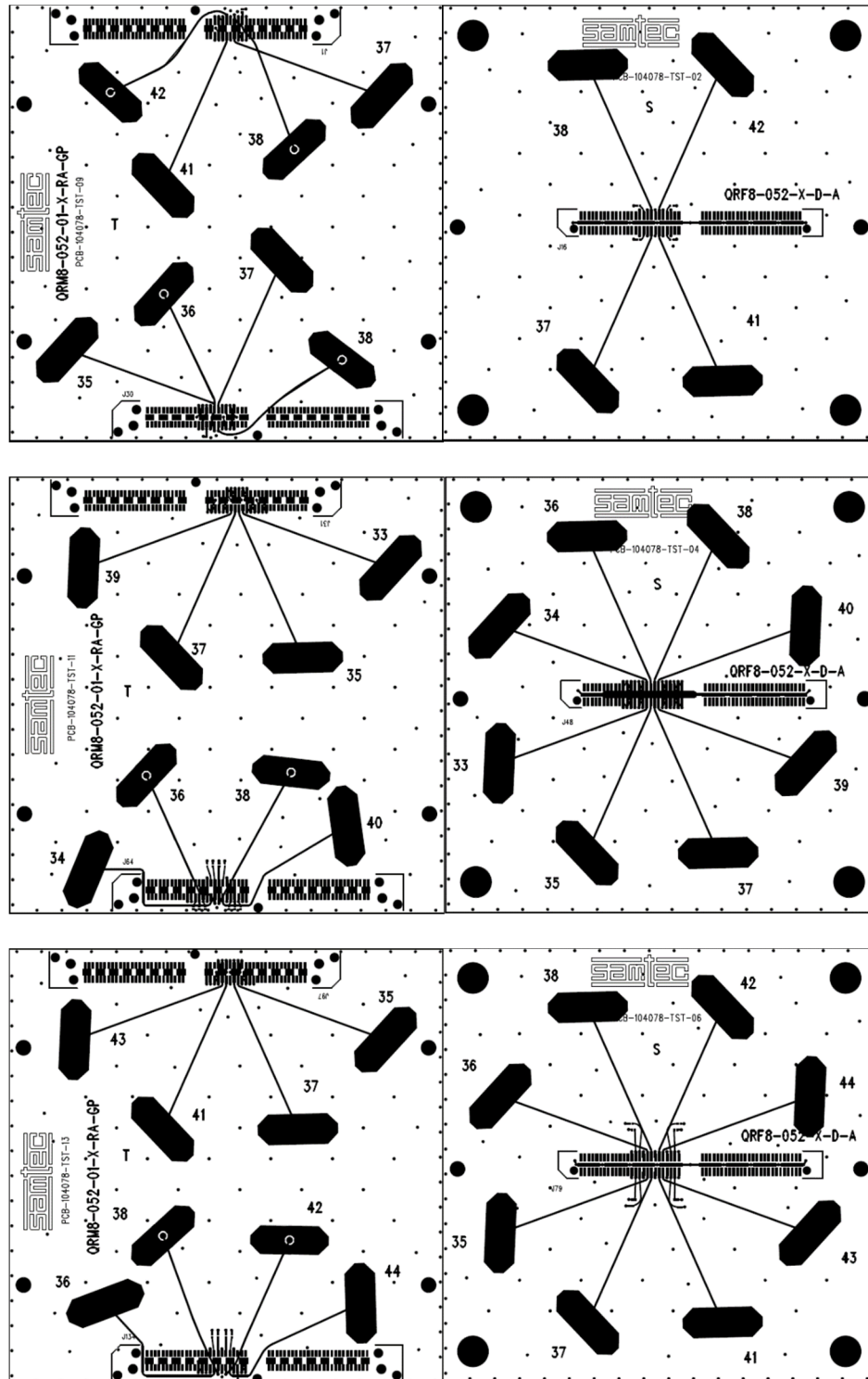
PCB Fixtures

The test fixtures used are as follows:

- PCB-104078-TST-09 – QRM8-RA, Single Ended Short Row and Long Row Best Case, Single Ended and Differential Across-row
- PCB-104078-TST-02 – QRF8 Vertical, Single Ended Best Case and Across-row
- PCB-104078-TST-11 – QRM8-RA, Differential Short Row and Long Row Worst Case
- PCB-104078-TST-04 – QRF8 Vertical, Differential Worst Case
- PCB-104078-TST-13 – QRM8-RA, Single Ended Short Row and Long Row Worst Case, Differential Best Case
- PCB-104078-TST-06 – QRF8 Vertical, Single Ended Worst Case, Differential Best Case and Across-row
- PCB-104078-TST-99 – Calibration Board

Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

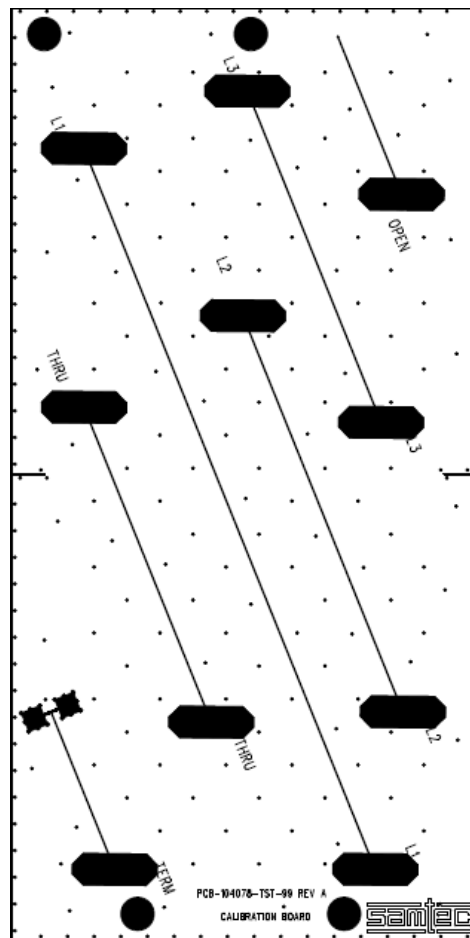


Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

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 – 2548.54 mils
Open Reflect – 1274.27 mils
Line 1 – 5833.66 mils
Line 2 – 3205.56 mils
Line 3 – 2679.94 mils
Match – 1274.27 mils

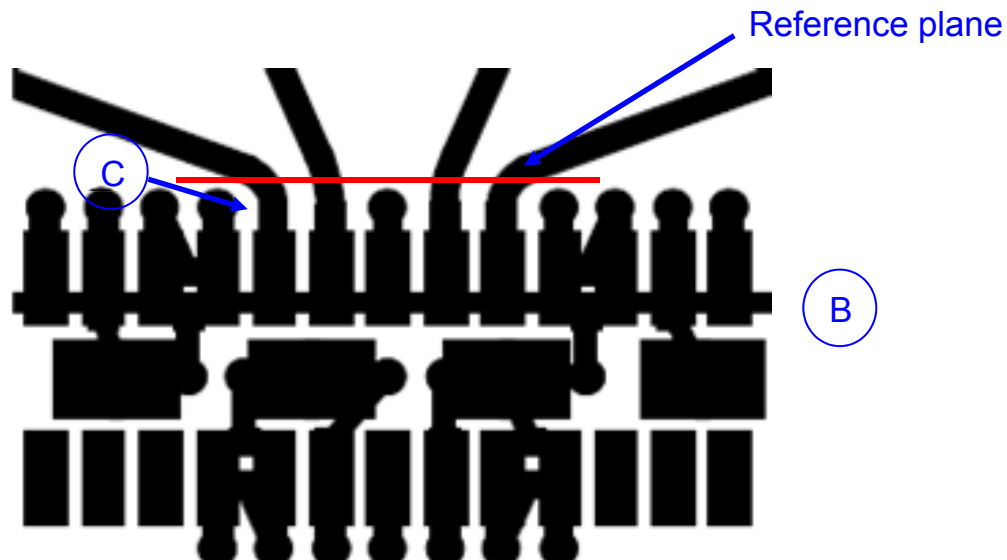
Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

All traces on the test boards are length matched to 1284.27 mils measured from the edge of the pad to the SMA. The TRL calibration effectively removes 1274.27 mils of test board trace effects. This means that 10 mils of test board trace length effects are included in the both sides of test boards in the measurement. The S-Parameter measurement includes:

- A- The QRM8_RA/QRF8_DV Series connector set
- B- Test board vias, pads (footprint effects)
- C- 10 mils of 16 mil wide microstrip trace

The figure below shows the location of the reference plane.



Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

Appendix D – Test and Measurement Setup

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

Start Frequency – 300 KHz

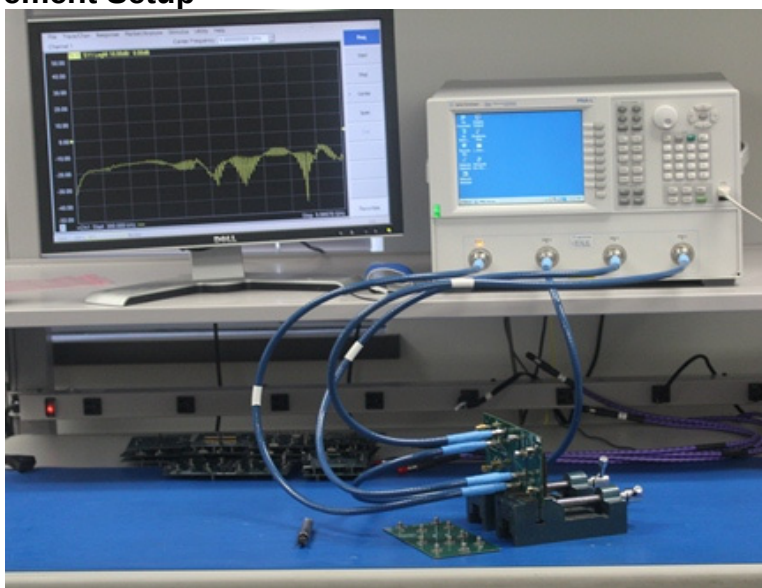
Stop Frequency – 20 GHz

Number of points -1601

IFBW – 1 KHz

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

N5230C Measurement Setup



Test Instruments

<u>QTY</u>	<u>Description</u>
------------	--------------------

- | | |
|---|---|
| 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

<u>QTY</u>	<u>Description</u>
------------	--------------------

- | | |
|---|--|
| 4 | Huber Suhner SF104PE11PC3511PC35, 457MM (18.0"), DC - 26.5 GHz |
|---|--|

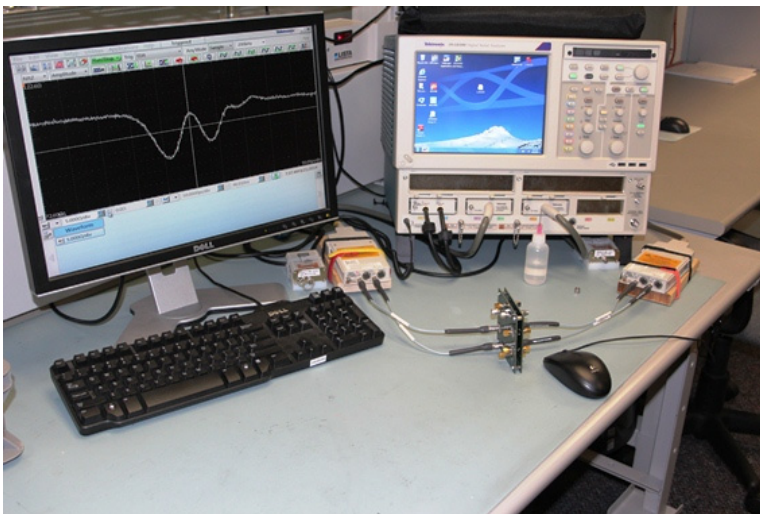
Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

For impedance measurements, the test instrument is the Tektronix DSA8300 Digital Serial Analyzer mainframe and 80E04 sampling module. The impedance data and profiles are obtained directly from the instrument. The Digital Analyzer is configured as follows:

Vertical Scale: 5 ohm / Div
Offset: Default / Scroll
Horizontal Scale: 200ps/ Div
Record Length: 4000
Averages: ≥ 16

DSA8300 Measurement Setup



Test Instruments

<u>QTY</u>	<u>Description</u>
1	Tektronix DSA8300 Digital Serial Analyzer
2	Tektronix 80E04 Dual Channel 20 GHz TDR Sampling Module

Test Cables & Adapters

<u>QTY</u>	<u>Description</u>
4	MegaPhase CM26-3131-12-M

Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

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 through 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 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 QRM8_RA/QRF8_DV Series test boards, this is greater than 20 GHz.

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

Time Domain Procedures

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

The Time Domain responses were generated using Agilent ADS 2009 update 1. This tool has a transient convolution simulator, which can generate a Time Domain response directly from measured S-Parameters. An example of a similar methodology is provided in the Samtec Technical Note on domain transformation.

http://www.samtec.com/Technical_Library/reference/articles/pdfs/tech-note_using-PLTS-for-time-domain-data_web.pdf

Propagation Delay (TDT)

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

Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

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

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

Impedance (TDR)

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

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

Series: QRM8-RA/QRF8-DV

Description: Q Rate® Slim Body Ground Plane Connector, R/A Terminal to Vertical Socket

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)