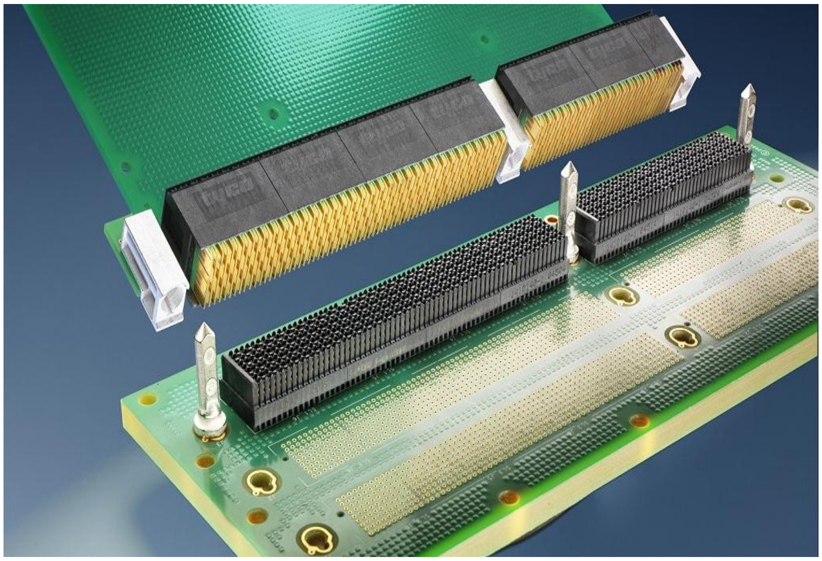
Electrical Performance Report

505-2 Rev A
August 21, 2014

MULTIGIG RT 2* and MULTIGIG RT 2-R* High-Speed Differential Connector—VPX (VITA 46)

Vertical Backplane to Right-Angle Daughter Card



▶ *This report supersedes TE Connectivity application brief 25GC001. The test data was gathered using MULTIGIG RT 2 and MULTIGIG RT 2-R connectors with differential pair wafers using VPX (VITA 46) configuration.*

Report Contents

Note: Dimensions in this report are in metric units [with U.S. customary units in brackets], unless otherwise specified.

Information regarding TE research into the transmission of electrical signals at gigabit speeds or general application notes is available at **www.te.com/products/simulation** or by calling Product Information at 1-800-522-6752 to contact the product manager.

* Trademark of TE Connectivity

General Overview

The MULTIGIG RT 2 high-speed differential connector is part of a backplane interconnect family that offers levels of flexibility and customization never before seen in the industry. This printed circuit (pc) based, pinless, interconnect family consists of modular components that can be used in a variety of combinations. The connectors in this innovatively flexible platform can be combined to provide the density, data throughput, and signal integrity required for the demanding applications in today's computer communications, military, medical, and industrial control industries.

This scalable backplane to daughter card connector family is a robust, “pinless” design, which eliminates the pin field on backplane boards and reduces the end user's exposure to field failure in card cage systems.

The MULTIGIG RT 2 connector family was selected for the VPX (VITA 46) standard to apply in rugged embedded computing applications.

MULTIGIG RT 2-R connectors include a new quad-redundant contact structure designed for high vibration levels.

Key Product Features

- Capable of meeting or exceeding 10-Gbps data rates
- Lightweight
- Nearly zero intra-pair skew
- Robust “pinless” interface provides reliability and durability
- Differential, single-ended, and power variations available
- Guide hardware available
- Flexible wafer layout options enables customization
- Staggered differential pairs minimizes footprint noise
- Electrostatic discharge (ESD) protection in unmated state
- Proven compliant pin board attachment facilitates manufacturing efficiency, reparability, and superior electrical performance
- Supports 0.8-in. card slot pitches

Application

- Commercial aerospace, ground defense systems, unmanned aerial vehicles, and aircraft
- Rugged mission-critical, mechanical, and electrical
- Motherboard/daughter card used in avionics, line replaceable unit (LRU)/line replaceable modular (LRM), and card cages
- Switches, servers, routers, and optical transport
- Telecommunications equipment, routers, switches, and storage

Electrical Characterization

Characterization Methodology

Connector electrical properties are characterized by either using 3-dimensional (3D) electromagnetic field solvers or by measuring with network analyzer or time domain reflectometer (TDR).

Electromagnetic field solvers provide connector-only model data; however, measured data from connectors include the effects from the footprint. It is important to emphasize that a connector is not used in isolation and therefore, including the effect of the footprint, shows the practical performance of the connector mounted on the board.

It must be emphasized that connector performance is degraded by the board foot print; therefore, board design rules must be taken into account for connector selection to enhance signal integrity performance for high-speed and sensitive applications.

Note: Refer to TE 22GC009, "MULTIGIG RT 2 Connector Routing," for more information.

Electrical characteristics of the connector mounted on a test fixture and details of the test fixture and measurement equipment used are described under respective subheadings.

Note: The measured data does not show connector-only performance, but does includes both daughter card and backplane footprints.

Connector Characteristics

- Propagation delay
- Insertion loss and return loss
- Near-end signal crosstalk (NEXT) and far-end signal crosstalk (FEXT)
- Impedance
- Transient noise

Note: Eye pattern data supplied upon request. The data given is measured, unless otherwise specified.

Test Fixture Specifications

- Pc board is made of NELCO 4000-13SI and has a thickness of 1.27 mm [.05 in.] with 6 layers

NELCO is a trademark.

- Surface-mount SMA connectors
- Applied per application specification 114-13056

Measurement Equipment

- Time domain data: Tektronix DSA8200 Series TDR 80E04 sampling module

Tektronix is a trademark.

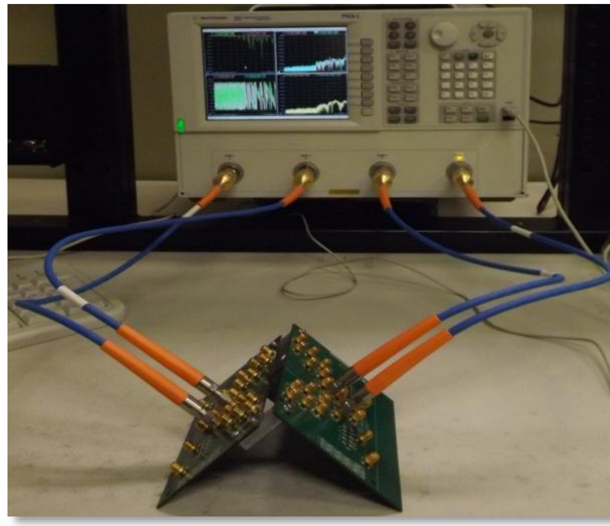
- Frequency domain data: Agilent PNA-L N5230C network analyzer

Agilent is a trademark.

Measurement Setup

Frequency Domain Setup

All S-parameters were measured using the Agilent PNA-L network analyzer. The thru-reflect-line (TRL) de-embedding technique was implemented to remove effects from the test fixtures as shown in the measurement setup. De-embedding the measured data provides connector characteristics that only include via footprint effects and removes all other effects. The use of premium pc board materials and precision designed test point foot prints enabled very accurate frequency domain measurements to 15 GHz.



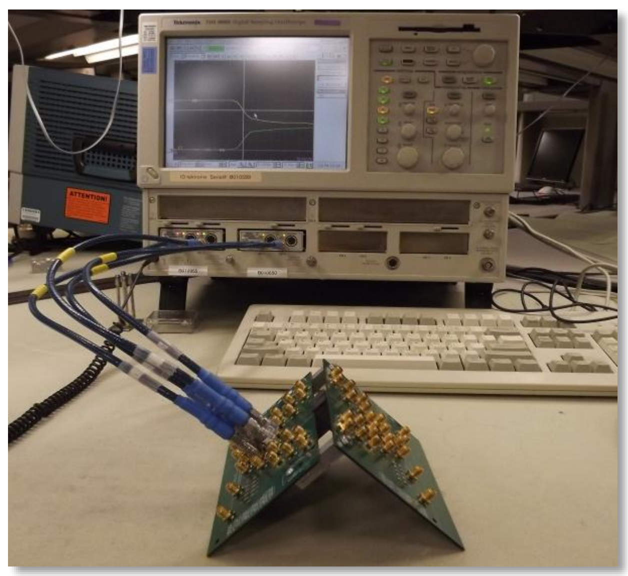
Agilent PNA-L Network Analyzer Test Set-Up

Time Domain Setup

Time domain measurements were made using the Tektronix TDR sampling module and are reported with a specified edge rate, which represents 20 to 80% of the signal amplitude at the location of device under test (DUT).

Time domain noise measurements given in this report are a summation of multiple aggressor signals aligned asynchronously in a worst-case timing resulting in maximum total noise. Noise totals and impedance profiles are provided for each unique signal (or pair) within the DUT.

Note: Skew associated with the TDR heads, fixture, and cabling was removed to provide representative performance.

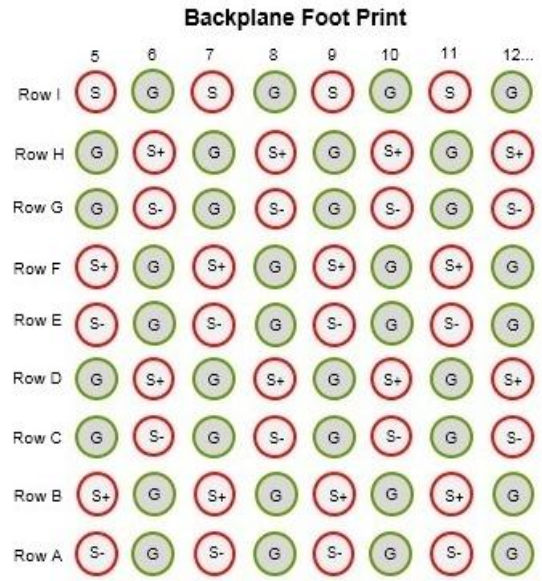


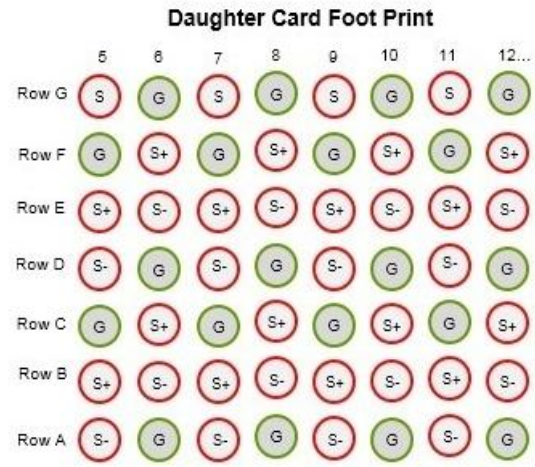
Tektronix TDR Sampling Module Test Set-Up

Measured Electrical Data

Measurement setup, DUT pin configuration, and complete electrical data of the connector, which includes propagation delay, differential pair (intra-pair) skew, return loss, insertion loss, NEXT and FEXT, impedance plots, and TDR data, is given below.

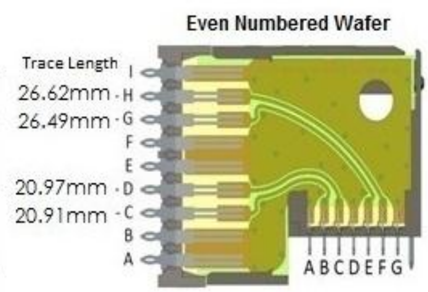
Note: The mated connector contact trace lengths are calculated from the top of the plated through holes.

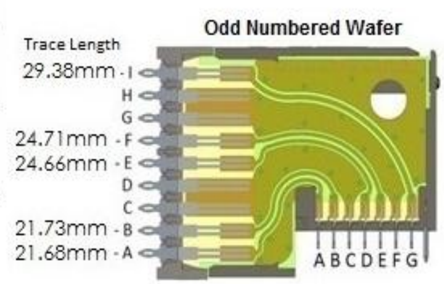




Propagation Delay Table

Pair Backplane Side		Pair Daughter Card Side		Prop Delay	Skew	Wafer
AB	Row A	AB	Row A	131ps	1ps	Odd Column
	Row B		Row B	132ps		
CD	Row C	BC	Row B	128ps	1ps	Even Column
	Row D		Row C	129ps		
EF	Row E	DE	Row D	148ps	1ps	Odd Column
	Row F		Row E	149ps		
GH	Row G	EF	Row E	160ps	1ps	Even Column
	Row H		Row F	161ps		

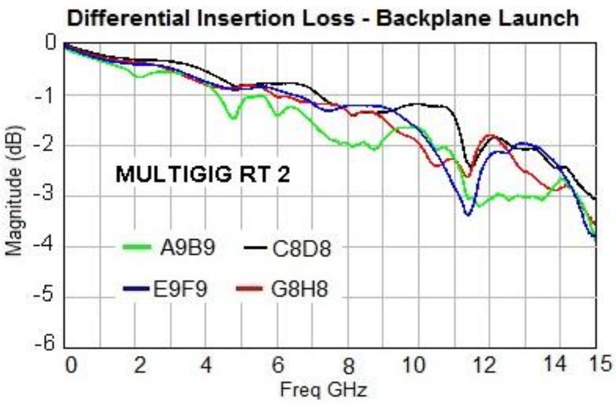


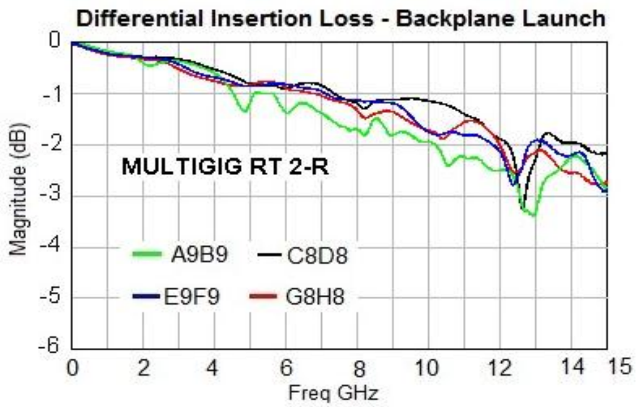


Measured Frequency Data

Differential Insertion Loss

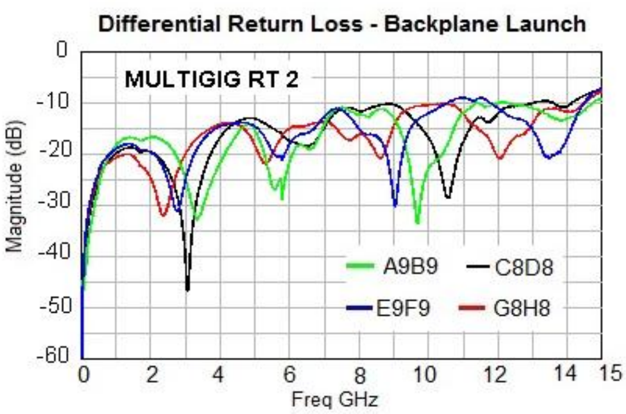
Insertion loss, also referred to as attenuation, is the measure of loss in power due to the insertion of a component, in this case the MULTIGIG connector, into a transmission system.

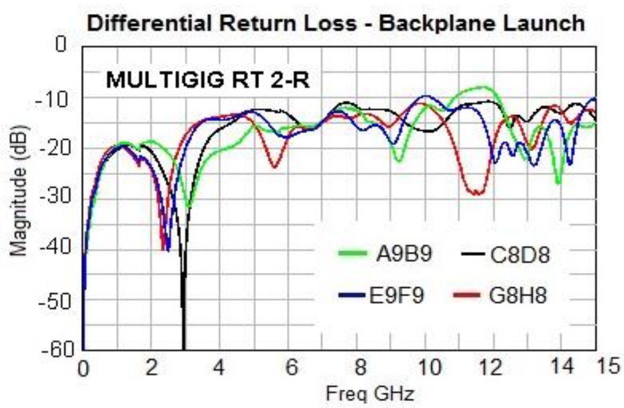




Differential Return Loss

Return loss is the measure of signal power reflected back to the input as a result of discontinuities in a transmission system.



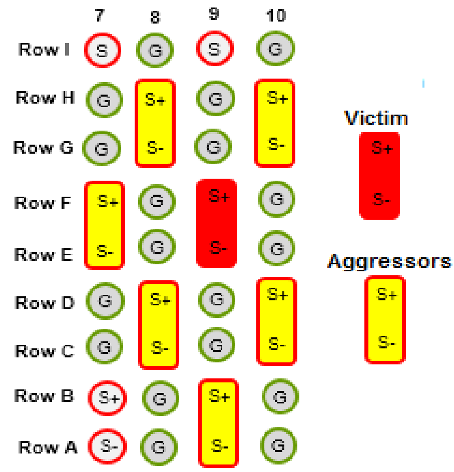


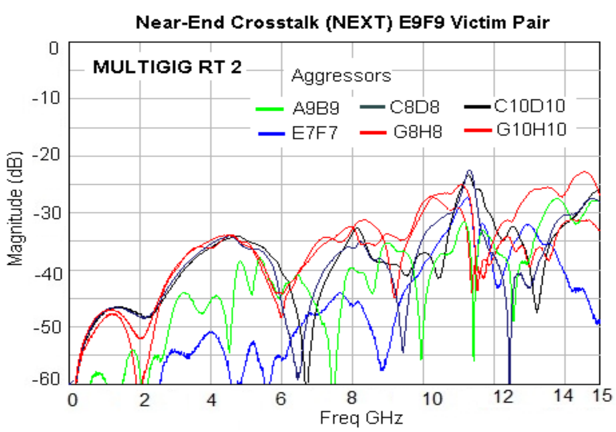
Measured Frequency Data

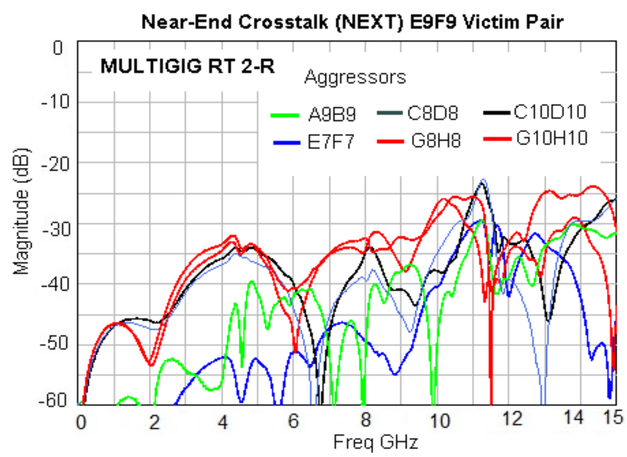
Differential Crosstalk

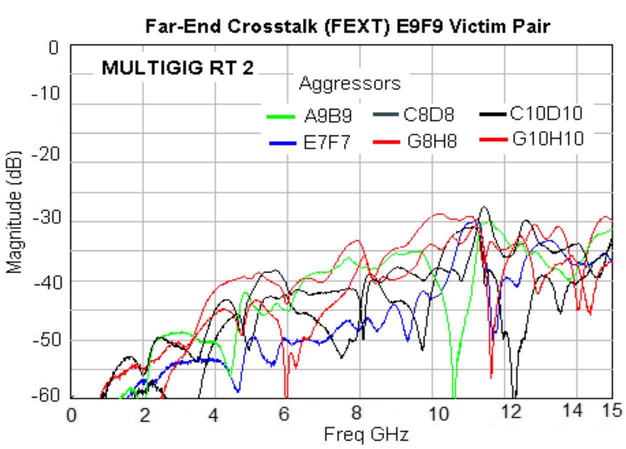
Crosstalk is a measure of signal power coupled to victim pair in the connector when a signal is injected into an aggressor pair.

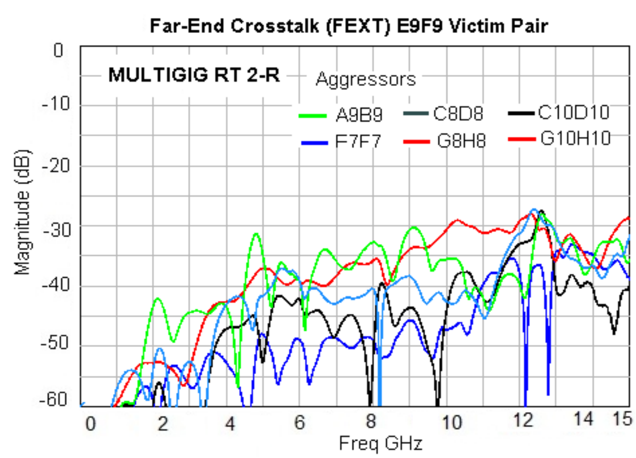
In general, there are two types of crosstalk: NEXT, which is coupled power measured at the same end of the victim pair as the launched *or* injected aggressor pair, and FEXT, which is coupled power measured at the opposite ends of the victim pair and the aggressor pair.







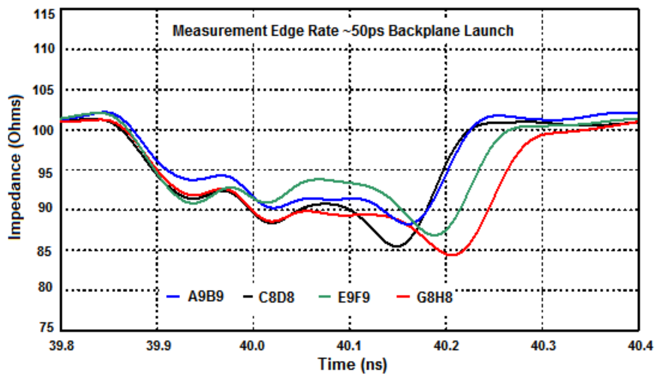




Measured Time Data

Differential Impedance

Connector differential impedance is shown for multiple pairs launched from the backplane side. The differential impedance is filtered to a 50 ps rise, 20 to 80%, as measured at the connector. Test board impedances are approximately 103 ohms in the measurements.



Noise Summary

Noise or crosstalk is voltage measured on victim pair when a signal is injected into the aggressor pair. Design engineers can use the total noise data for selecting the best pin assignment options.

Total Asynchronous Noise – Edge Rate 50ps	
BP – Backplane	DC – Daughter Card
Victim Pair (BP-BP)	NEXT (BP –BP) Maximum Total Noise
A9B9 - A9B9	2.12%
C8D8 - C8D8	2.62%
E9F9 - E9F9	2.43%
G8H8 - G8H8	1.37%

Total Asynchronous Noise – Edge Rate 50ps	
BP – Backplane	DC – Daughter Card
Victim Pair (BP-DC)	FEXT (BP –DC) Maximum Total Noise
A9B9 - A9B9	1.40%
C8D8 -B8C8	0.95%
E9F9 - D9E9	1.21%
G8H8 - E8F8	0.98%

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