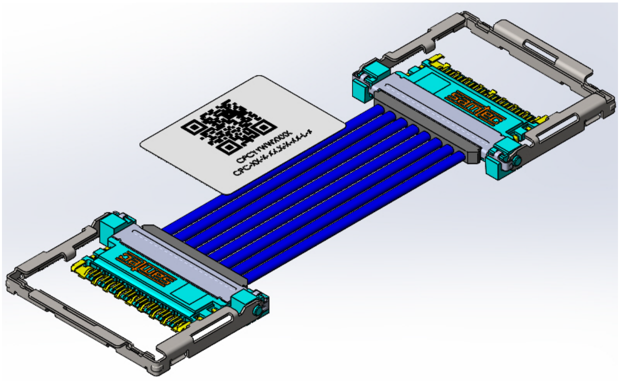
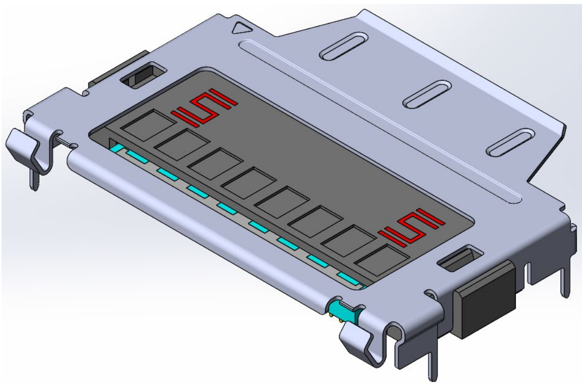
High Speed Characterization Report

CPC-08-1-XX.X-1-02-L-1



Mated with:

CPI-08-01-1-X-RA-0-1-XR



Description:

Copper Si-Fly® LP Low-Profile, High-Density Cable System, 8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

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Report Revision: 03/31/2025

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System,
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Table of Contents

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Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System,
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Cable Assembly Overview

The CPC Cable Assembly is constructed using 34 AWG ultra-low skew twinax cable, with up to 16 differential pairs. Si-Fly™ is an ultra-low-profile interconnect for placement adjacent to the IC package, under heat sinks or other cooling hardware. The data in this report is applicable to the single-row 8-pair assemblies with 06.0-, 10.0- and 14.0-inch-long cable, using 92-ohm twinax and Pin A1 to A25 wiring.

Each CPC cable assembly was tested by mating it to the CPI-08-01-1-S-RA-0-L-XR connector at both ends. One sample of each assembly was tested. The actual part numbers that were tested are shown in Table 1, which also identifies End 1 and End 2 of each assembly. A relative sample picture is shown in Figure1.

Length	Part Number	End 1	End 2
06.0 inches	CPC-08-1-06.0-1-02-L-1	CPC	CPC
10.0 inches	CPC-08-1-10.0-1-02-L-1	CPC	CPC
14.0 inches	CPC-08-1-14.0-1-02-L-1	CPC	CPC

Table 1: Sample Description

Figure 1: Test Sample

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System,
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Frequency Domain Data Summary
Bandwidth Figures – Differential Insertion Loss

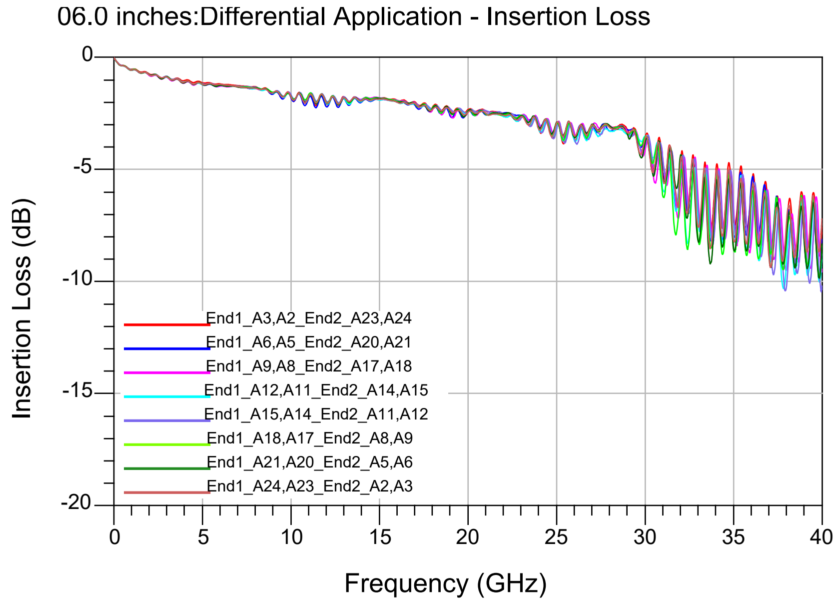

Figure 2

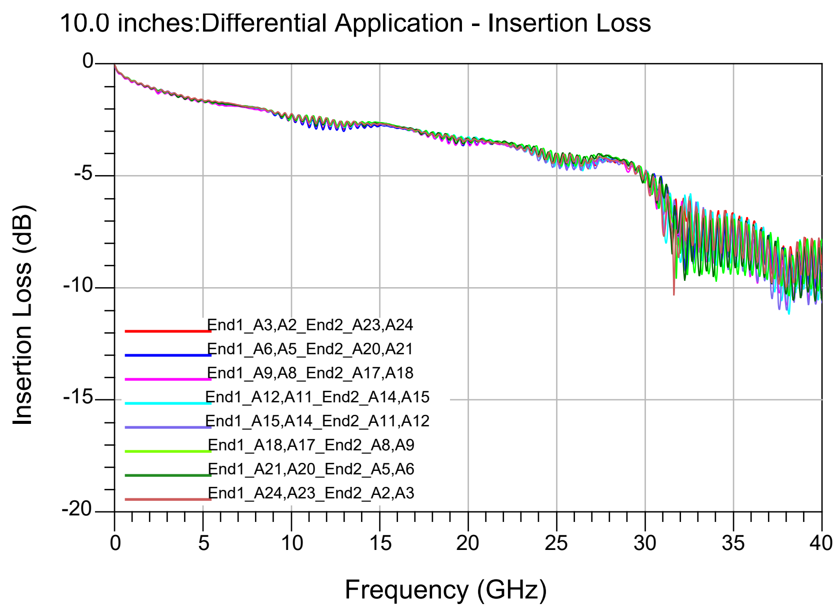

Figure 3

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System, 8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

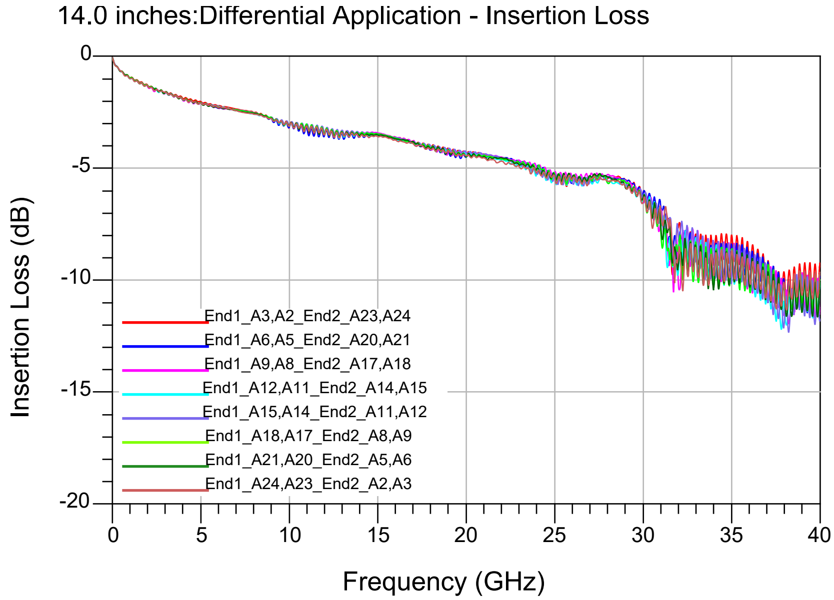

Figure 4

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System, 8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

Time Domain Data Summary

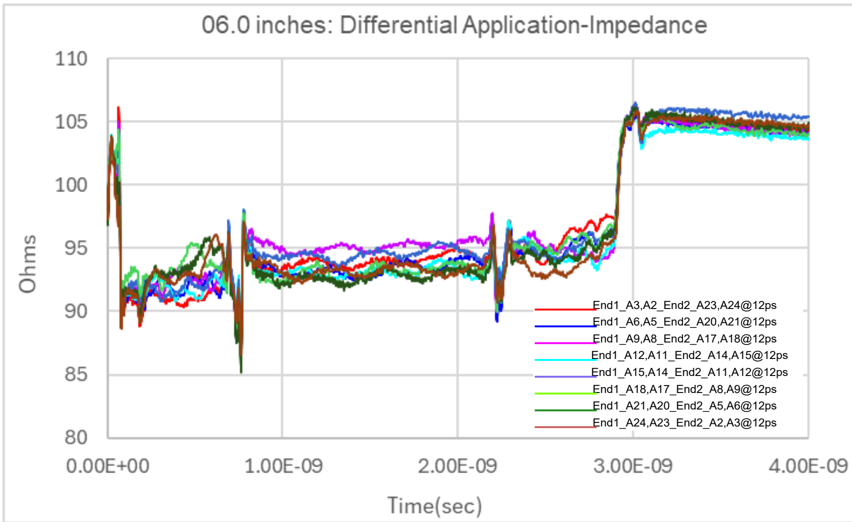

Figure 5

Because the same type of cable is used in the cable assemblies with different lengths, only the impedance profile of 06.0 inches cable assembly is reported.

Table 2 - Propagation Delay (Cable Assembly)				
Driver	**Receiver**	**06.0 inches**	**10.0 inches**	**14.0 inches**
End1_A3, A2	End2_A23, A24	0.855 ns	1.343 ns	1.828 ns
End1_A6, A5	End2_A20, A21	0.855 ns	1.341 ns	1.829 ns
End1_A9, A8	End2_A17, A18	0.853 ns	1.343 ns	1.823 ns
End1_A12, A11	End2_A14, A15	0.855 ns	1.337 ns	1.828 ns
End1_A15, A14	End2_A11, A12	0.854 ns	1.343 ns	1.824 ns
End1_A18, A17	End2_A8, A9	0.855 ns	1.337 ns	1.827 ns
End1_A21, A20	End2_A5, A6	0.856 ns	1.343 ns	1.829 ns
End1_A24, A23	End2_A2, A3	0.857 ns	1.343 ns	1.829 ns

Series: CPC
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8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

Characterization Details

This report presents data that characterizes the signal integrity response of a cable assembly 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 mating connectors, cable assembly, 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 cable assembly'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 cable assemblies 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 "GSSG" differential drive configuration.

Pin Configuration

The CPx connector assembly follows a fixed pin assignment. For this cable assembly, the following configurations are evaluated.

TABLE 1
SIGNAL MAPPING FOR -1

END 1	TYPE	END 2
A1	GND	A25
A2	PAIR 1	A24
A3		A23
A4	GND	A22
A5	PAIR 2	A21
A6		A20
A7	GND	A19
A8	PAIR 3	A18
A9		A17
A10	GND	A16
A11	PAIR 4	A15
A12		A14
A13	GND	A13
A14	PAIR 5	A12
A15		A11
A16	GND	A10
A17	PAIR 6	A9
A18		A8
A19	GND	A7
A20	PAIR 7	A6
A21		A5
A22	GND	A4
A23	PAIR 8	A3
A24		A2
A25	GND	A1

ALL GROUNDS COMMON AND TIED TO CABLE SHIELD

NEXT

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System,
8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

TABLE 1		
SIGNAL MAPPING FOR -1		
END 1	TYPE	END 2
A1	GND	A25
A2	PAIR 1	A24
A3		A23
A4	GND	A22
A5	PAIR 2	A21
A6		A20
A7	GND	A19
A8	PAIR 3	A18
A9		A17
A10	GND	A16
A11	PAIR 4	A15
A12		A14
A13	GND	A13
A14	PAIR 5	A12
A15		A11
A16	GND	A10
A17	PAIR 6	A9
A18		A8
A19	GND	A7
A20	PAIR 7	A6
A21		A5
A22	GND	A4
A23	PAIR 8	A3
A24		A2
A25	GND	A1
ALL GROUNDS COMMON AND TIED TO CABLE SHIELD		

TABLE 1		
SIGNAL MAPPING FOR -1		
END 1	TYPE	END 2
A1	GND	A25
A2	PAIR 1	A24
A3		A23
A4	GND	A22
A5	PAIR 2	A21
A6		A20
A7	GND	A19
A8	PAIR 3	A18
A9		A17
A10	GND	A16
A11	PAIR 4	A15
A12		A14
A13	GND	A13
A14	PAIR 5	A12
A15		A11
A16	GND	A10
A17	PAIR 6	A9
A18		A8
A19	GND	A7
A20	PAIR 7	A6
A21		A5
A22	GND	A4
A23	PAIR 8	A3
A24		A2
A25	GND	A1
ALL GROUNDS COMMON AND TIED TO CABLE SHIELD		

FEXT

Differential Impedance (denoted by blue circles):

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

Differential Crosstalk (denoted by red circles):

- NEXT (Near End Crosstalk)
- FEXT (Far End Crosstalk)

See Appendix C – Product and Test System Descriptions for details

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 12 ps. Generally, this should demonstrate worst-case performance.

In many systems, the signal edge rate will be significantly slower at the cable assembly than at the driver launch point. To estimate interconnect performance at other edge rates, data is provided for several rise times between 12 ps and 100 ps.

Unless otherwise stated, measured rise times were at 20%-80% signal levels.

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Frequency Domain Data

Frequency Domain parameters are helpful in evaluating the cable assembly 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, Near-End and Far-End Crosstalk, and Mode Conversion. 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 and signal propagation time in a pulsed signal environment. The measured S-Parameters from the network analyzer are post-processed using Keysight ADS to obtain the time domain response for signal propagation time. The Time Domain procedure is provided in Appendix D 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 cable assembly, mating connectors, and connector footprint. It includes 2.3 mm of PCB trace on both sides of the CPI board connector. Delay is measured at 100 picoseconds signal rise-time. Delay is calculated as the difference in time measured between the 50% amplitude levels of the input and output pulses.

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 Responses

Differential Application – Insertion Loss

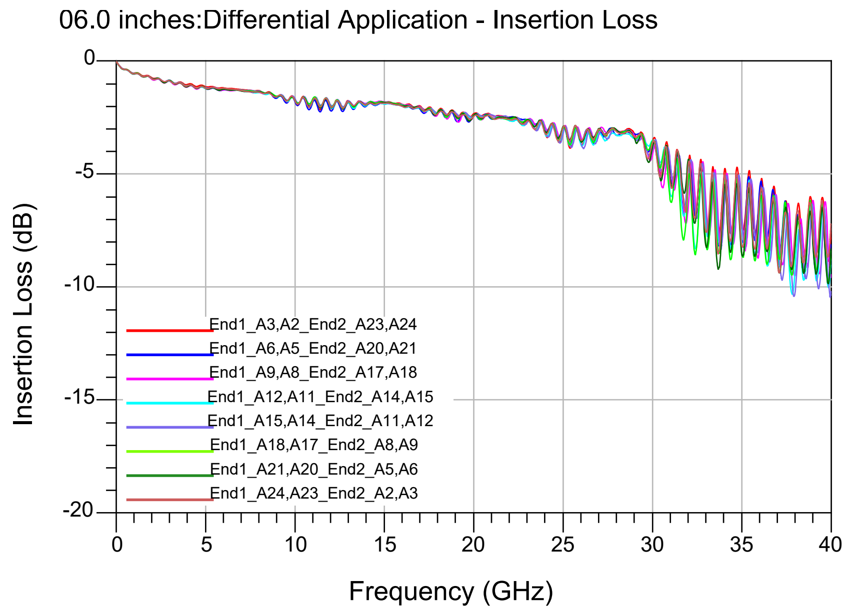

Figure 6

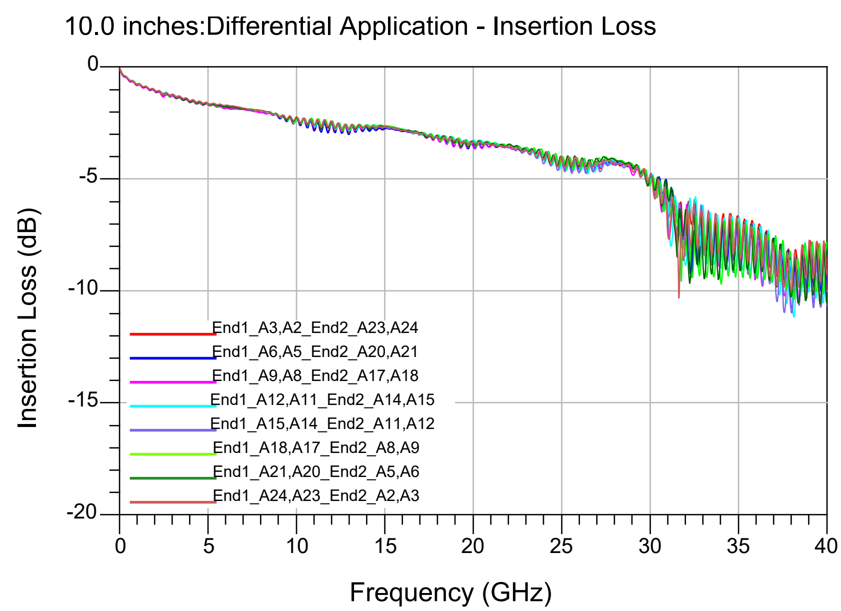

Figure 7

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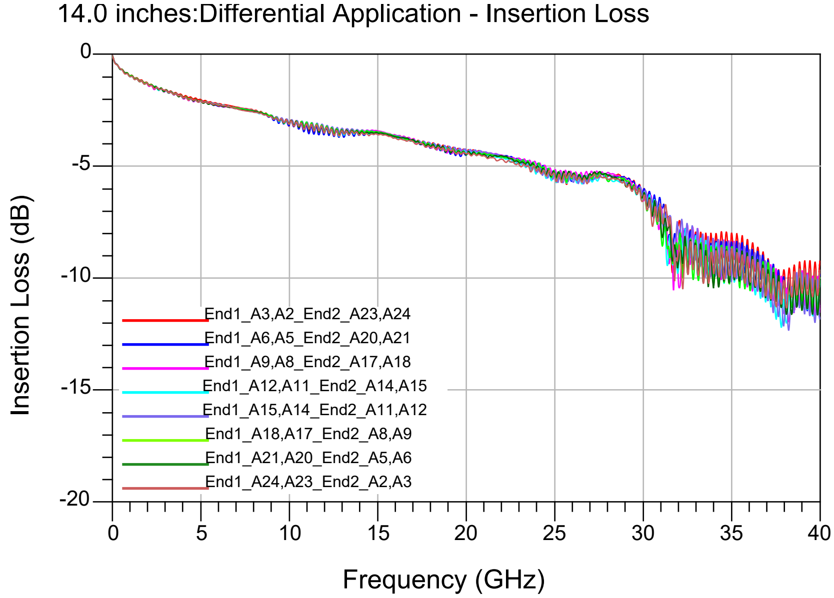

Figure 8

Differential Application – Return Loss

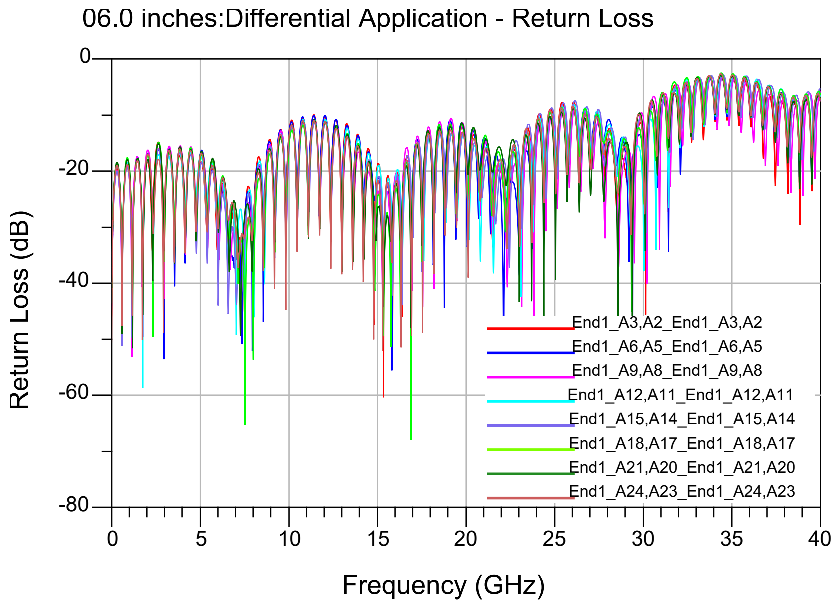

Figure 9

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System,
8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

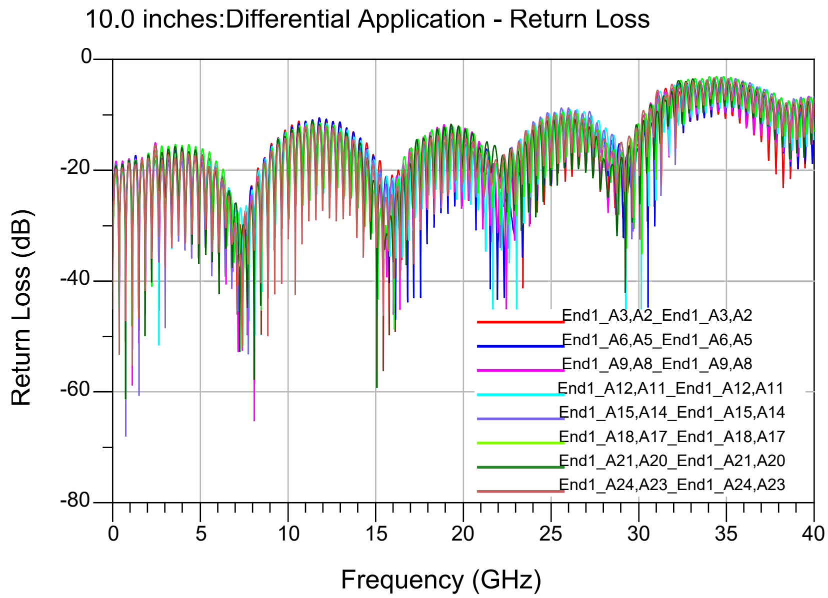

Figure 10

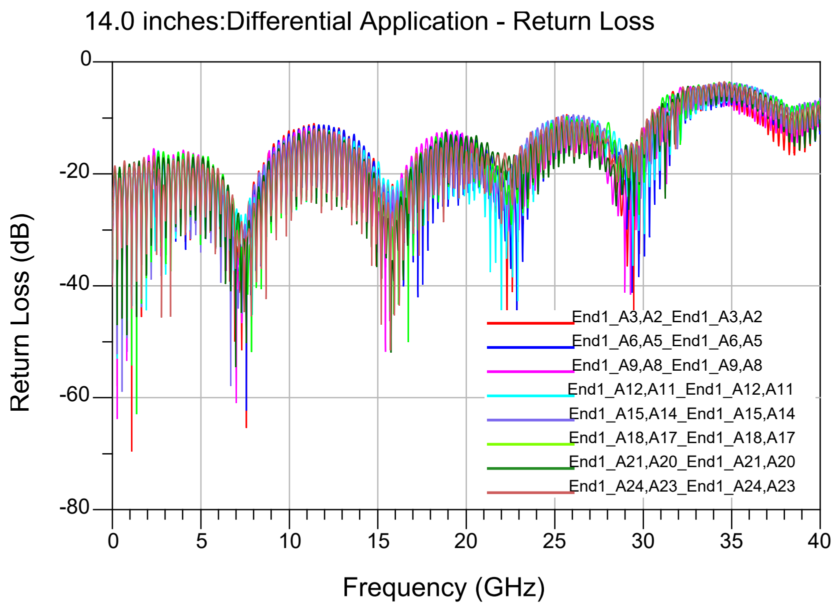

Figure 11

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System, 8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

Differential Application – NEXT Configurations

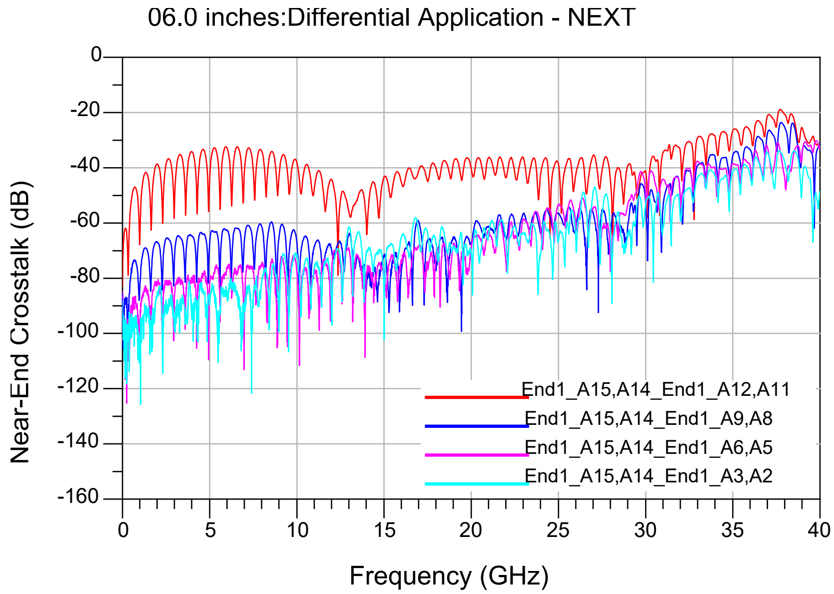

Figure 12

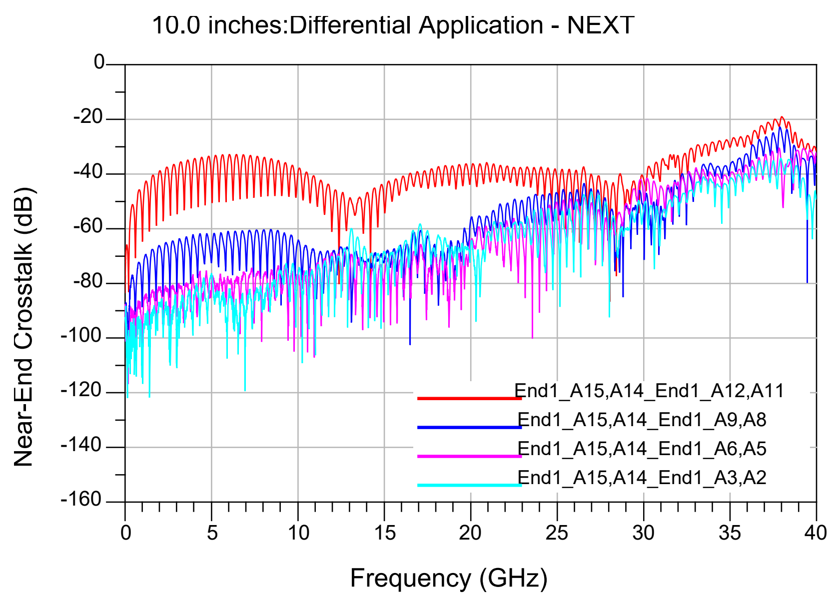

Figure 13

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System,
8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

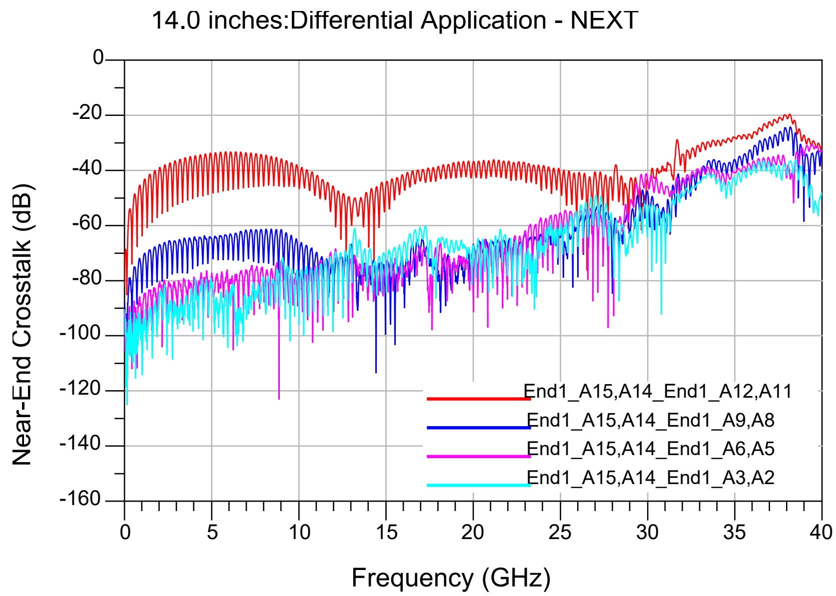

Figure 14

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System,
8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

Differential Application – FEXT Configurations

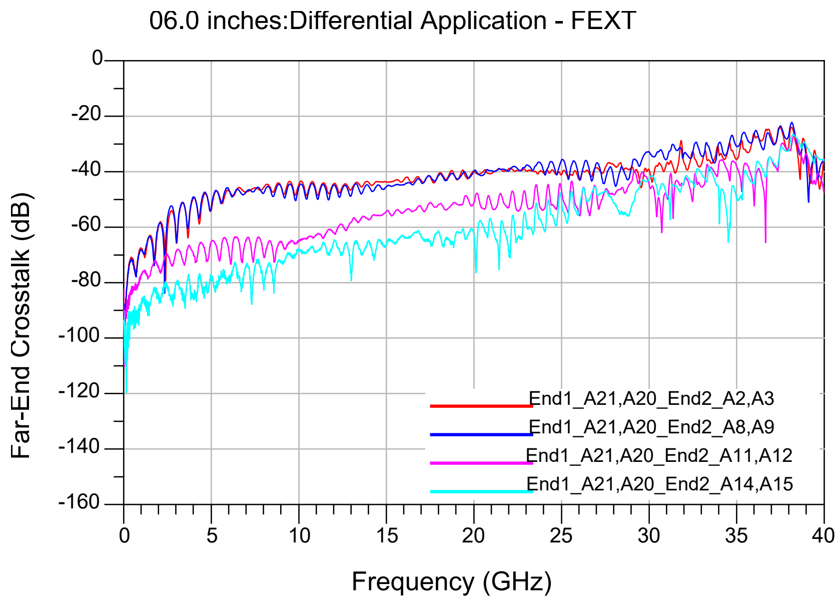

Figure 15

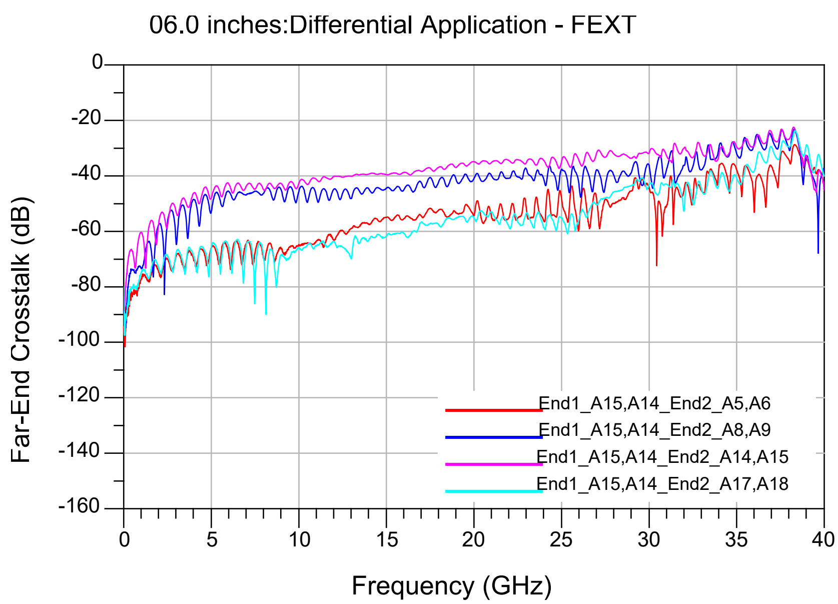

Figure 16

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System, 8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

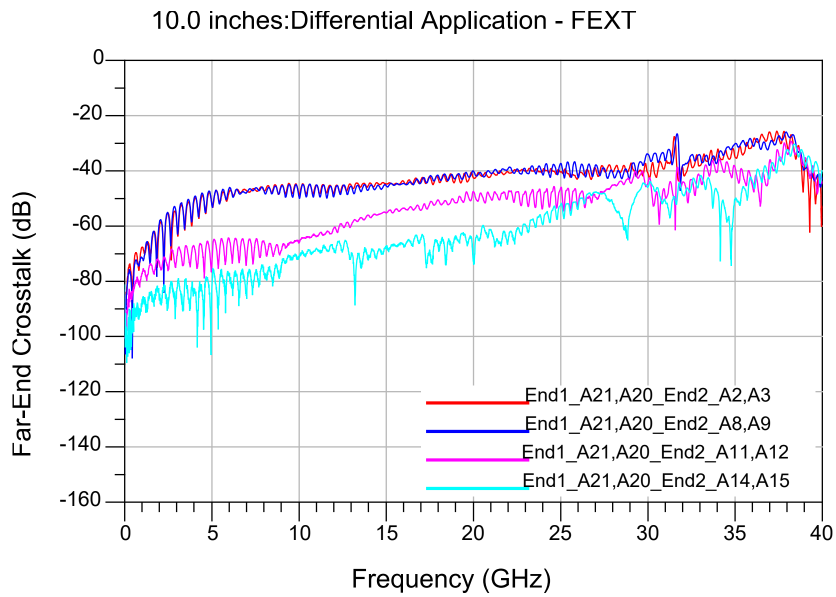

Figure 17

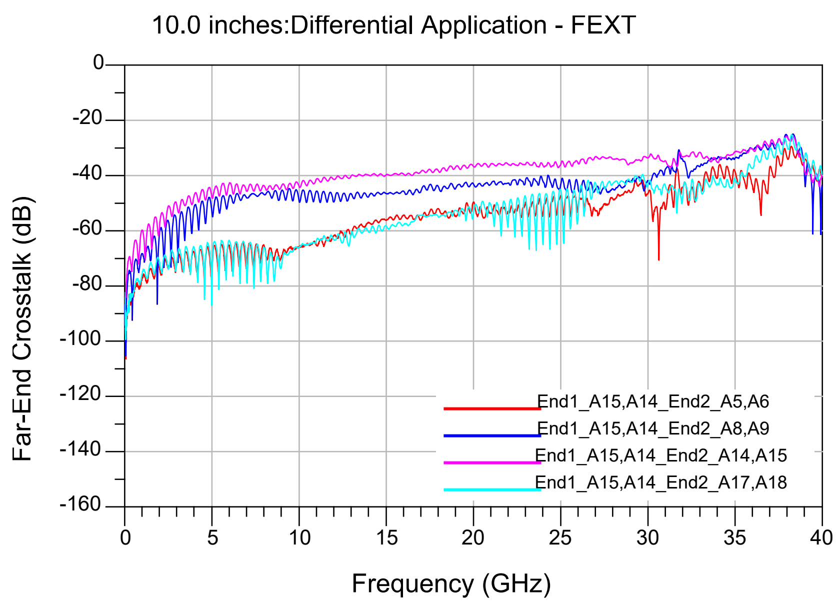

Figure 18

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System, 8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

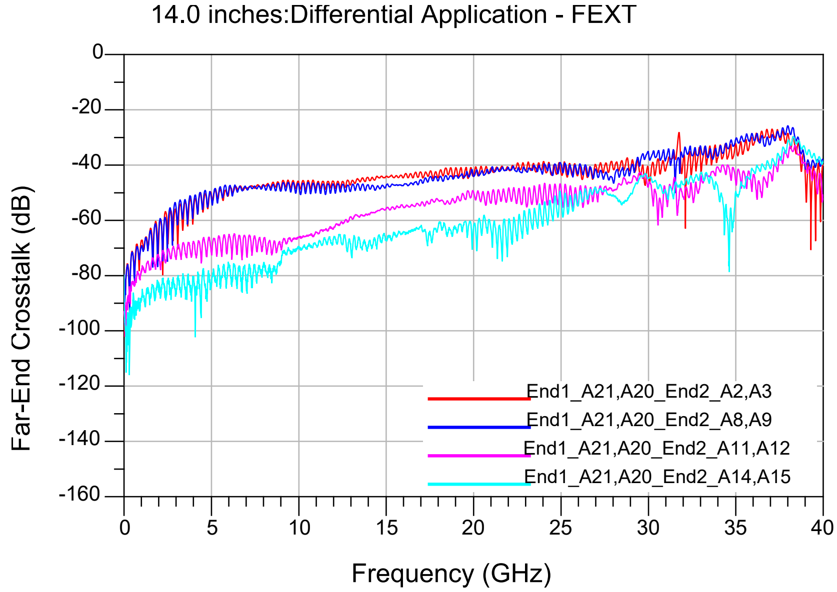

Figure 19

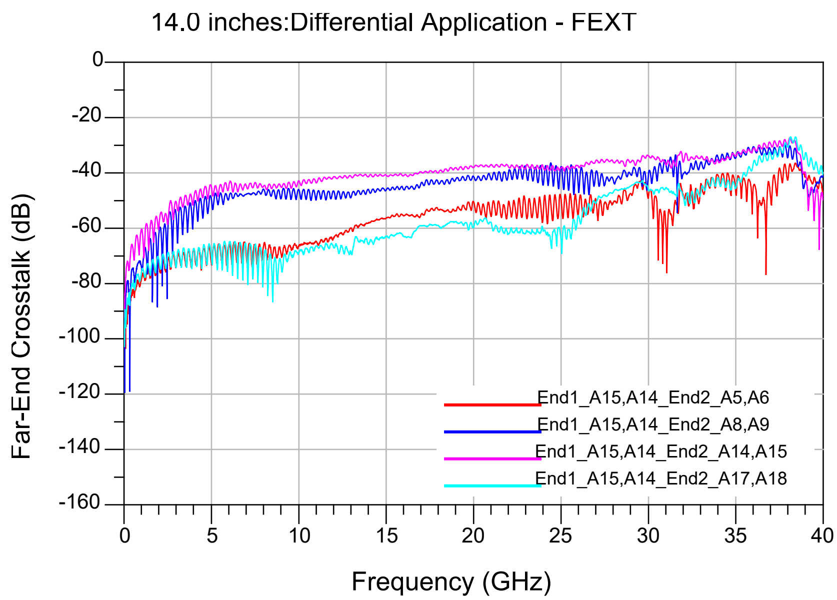

Figure 20

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Differential Application – Differential to Common Mode Conversion

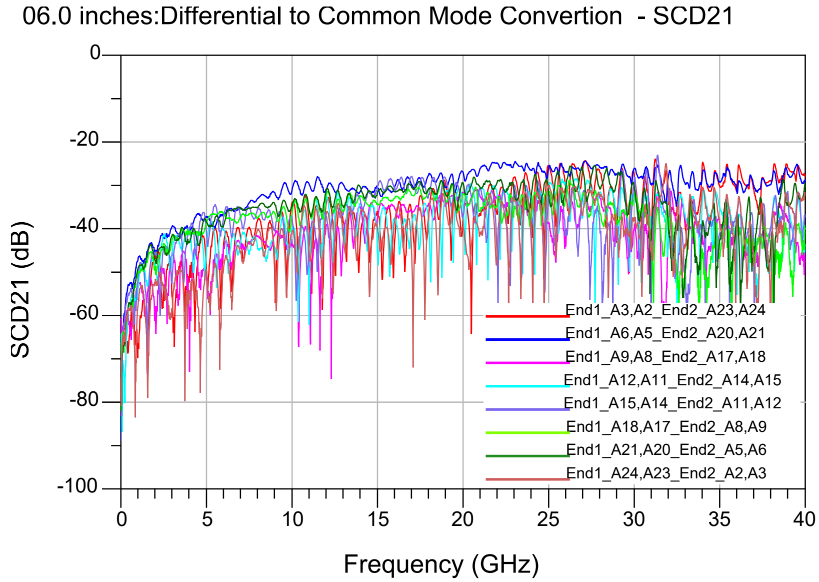

Figure 21

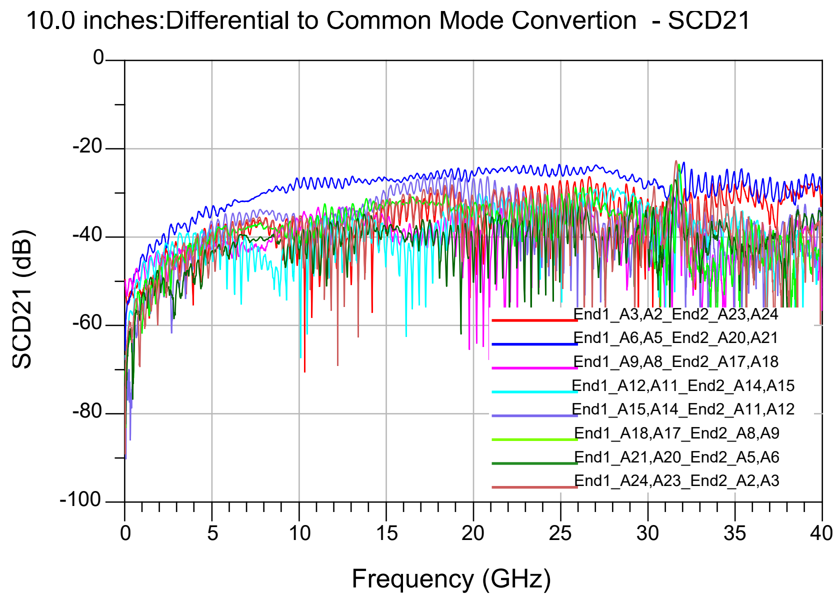

Figure 22

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System, 8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

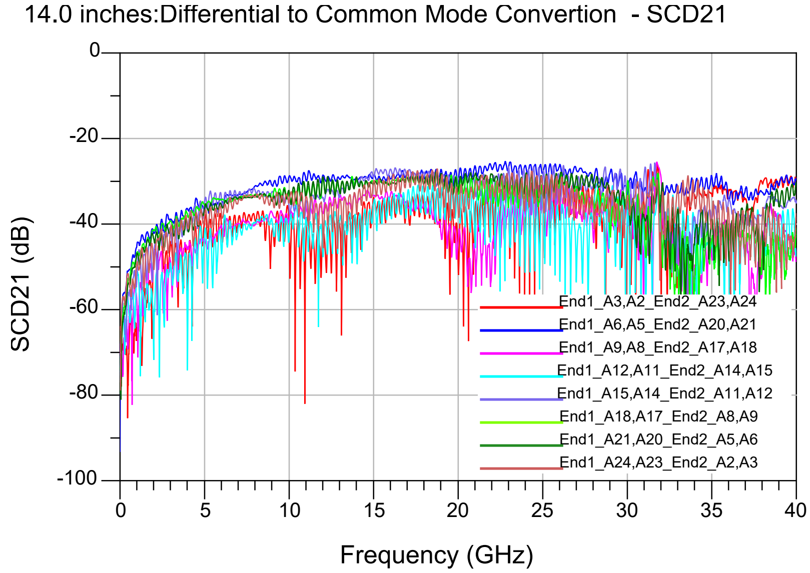

Figure 23

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System,
8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

Appendix B – Time Domain Responses

Differential Application – Input Pulse

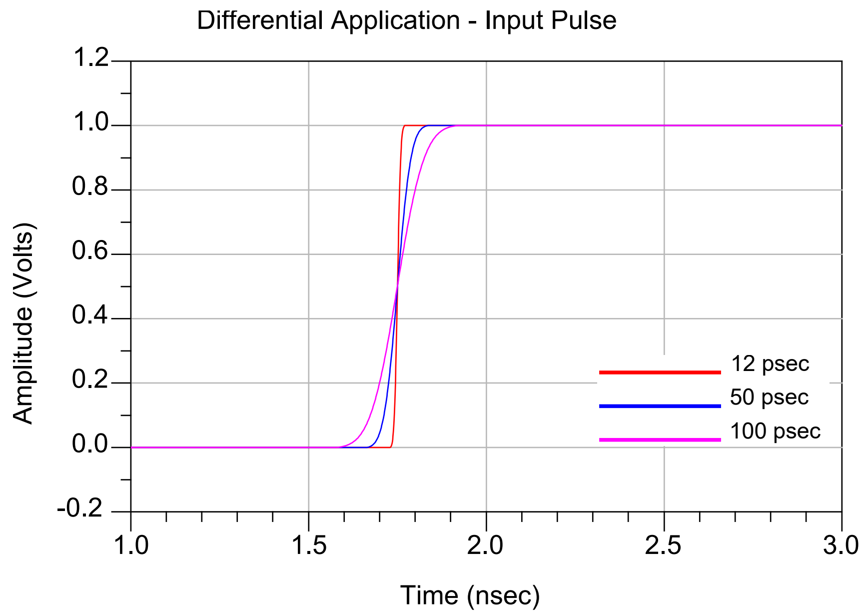

Figure 24

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System,
8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

Differential Application – Cable assembly Impedance

CPC-08-1-06.0-1-02-L-1

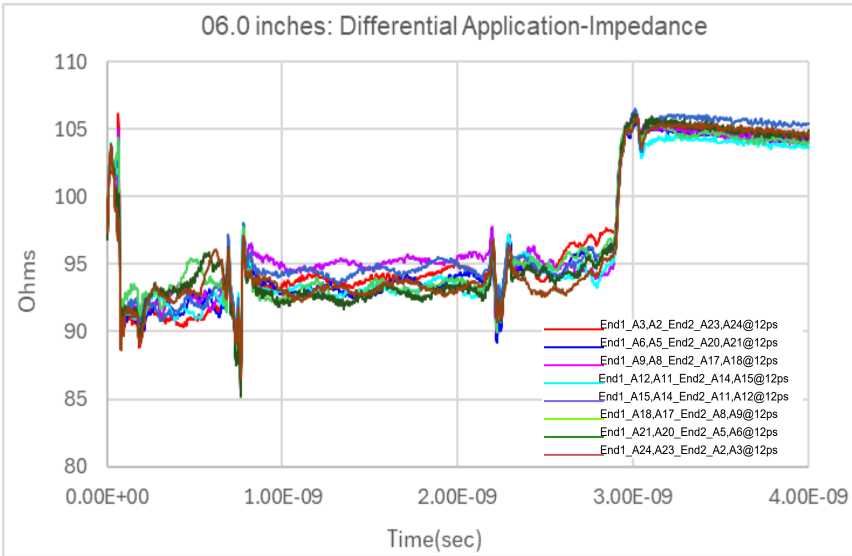

Figure 25

CPC-08-1-06.0-1-02-L-1

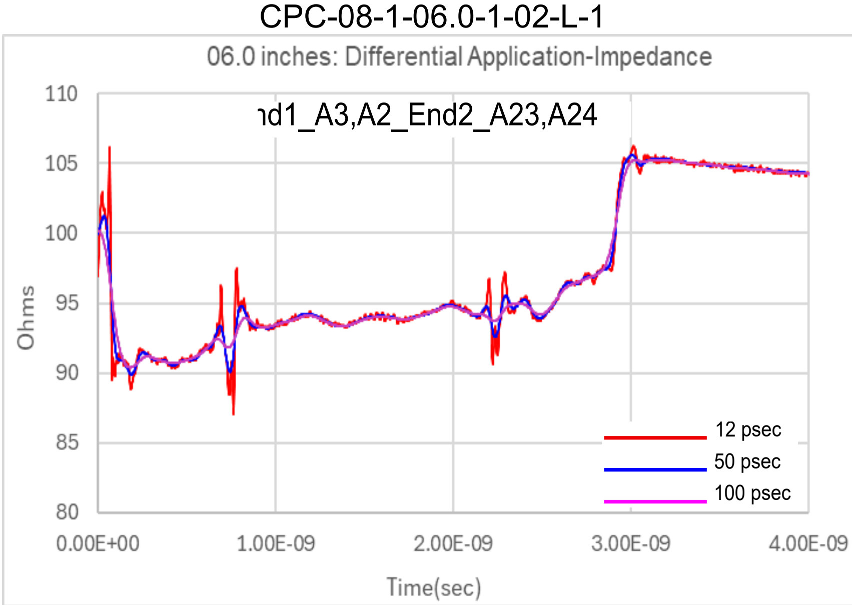

Figure 26

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System,
8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

CPC-08-1-06.0-1-02-L-1

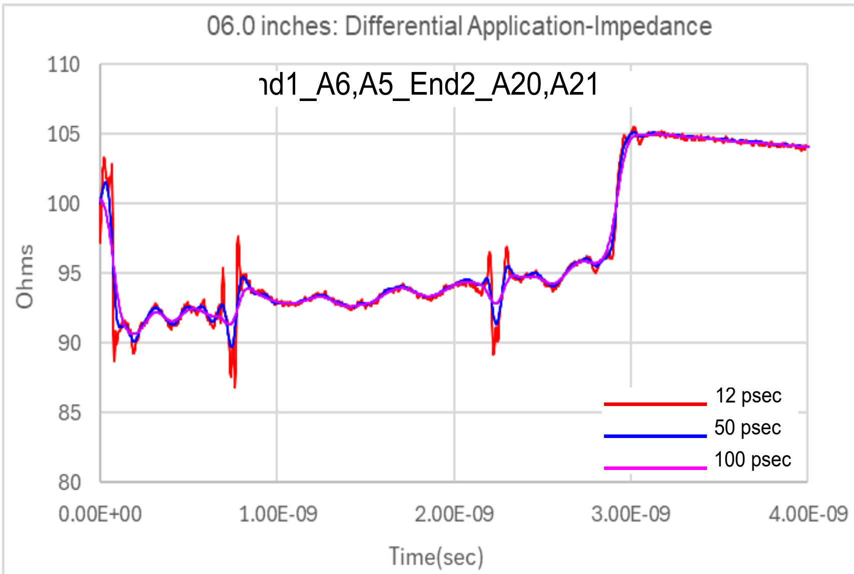

Figure 27

CPC-08-1-06.0-1-02-L-1

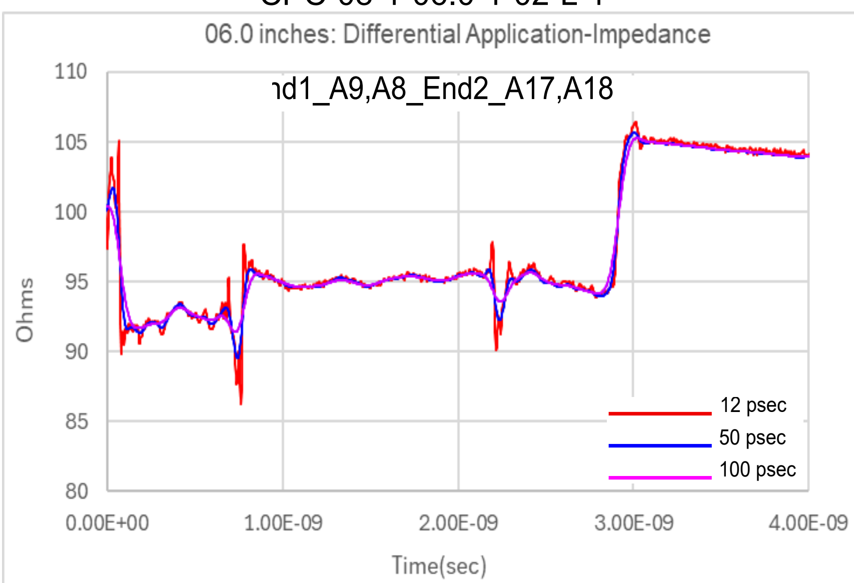

Figure 28

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System, 8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

CPC-08-1-06.0-1-02-L-1

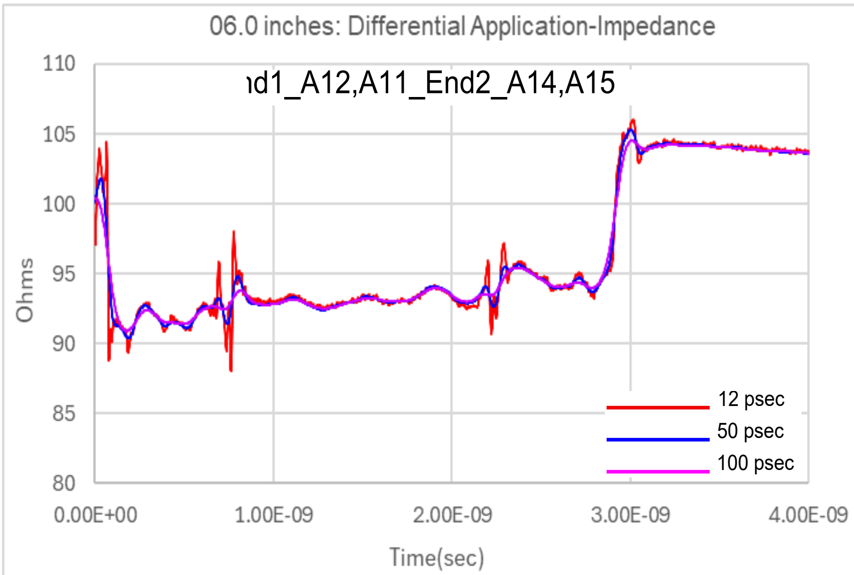

Figure 29

CPC-08-1-06.0-1-02-L-1

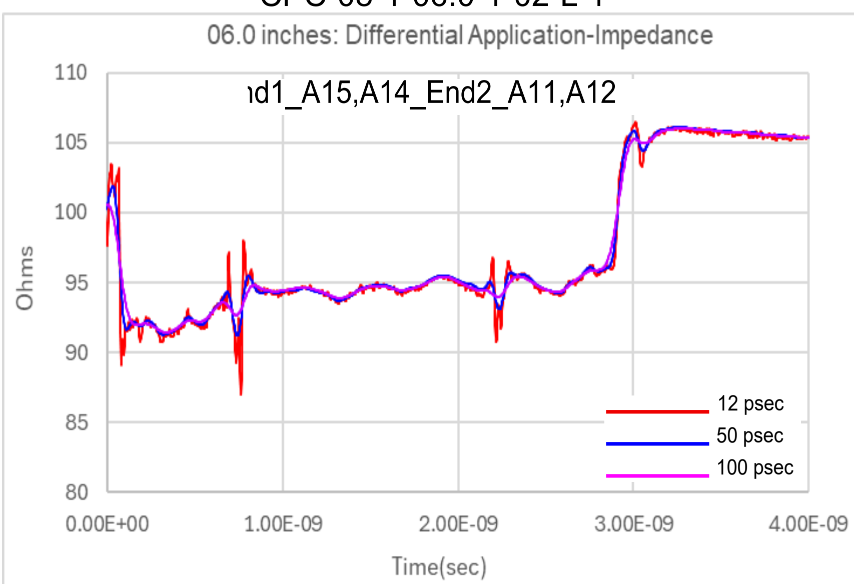

Figure 30

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System, 8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

CPC-08-1-06.0-1-02-L-1

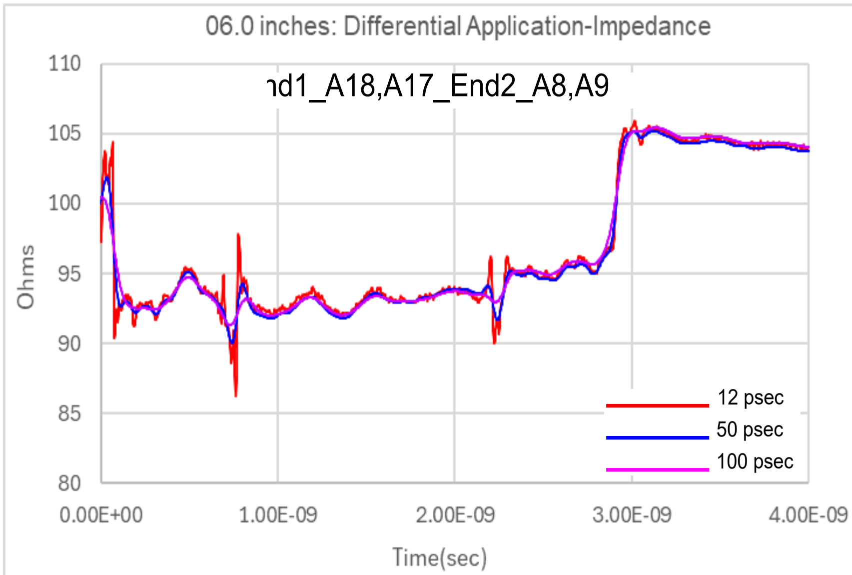

Figure 31

CPC-08-1-06.0-1-02-L-1

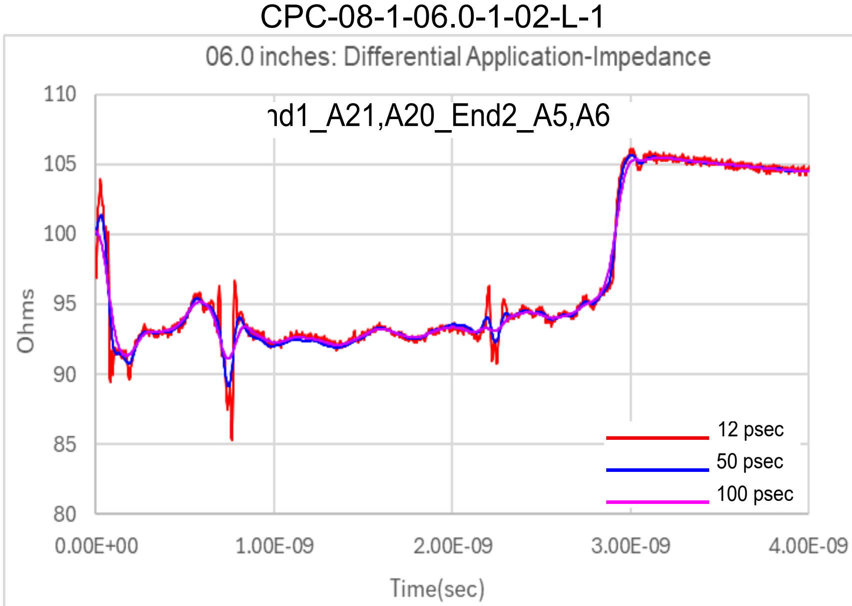

Figure 32

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System, 8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

CPC-08-1-06.0-1-02-L-1

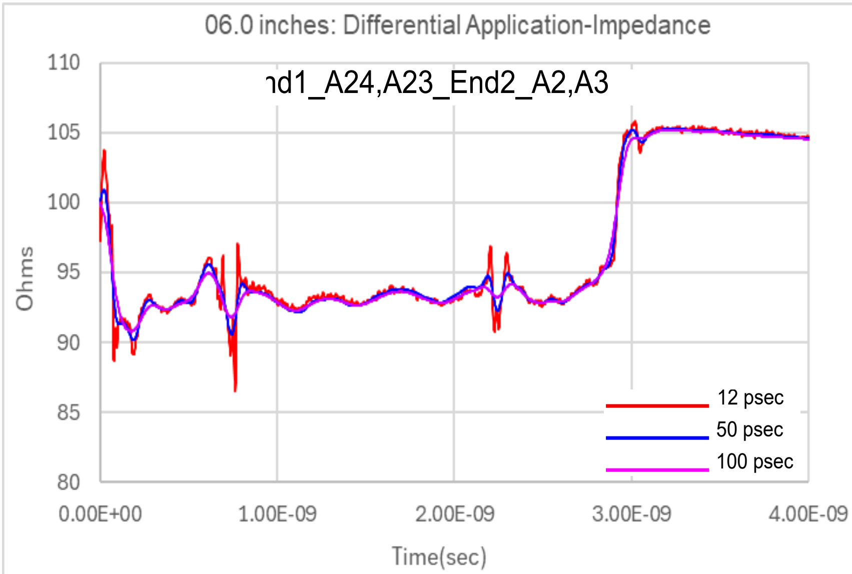

Figure 33

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System,
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Differential Application – Propagation Delay

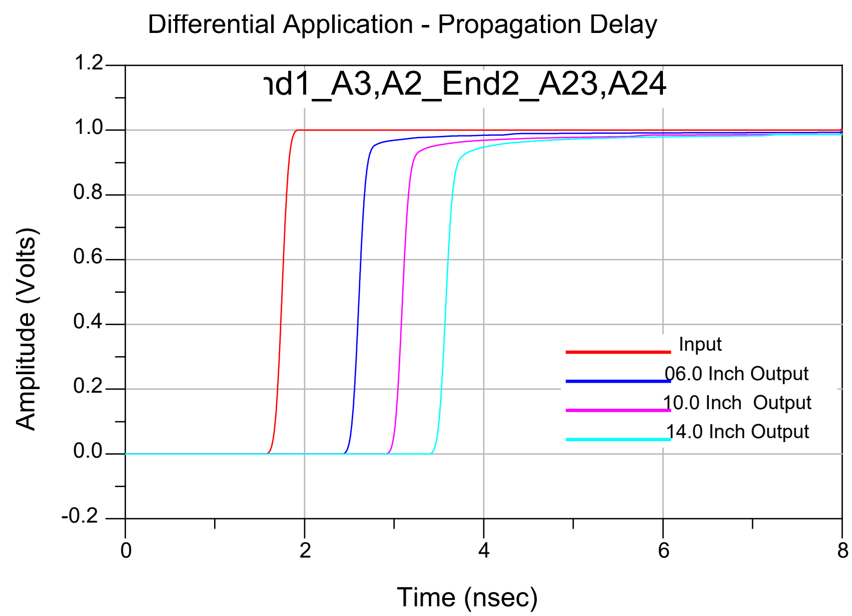

Figure 34

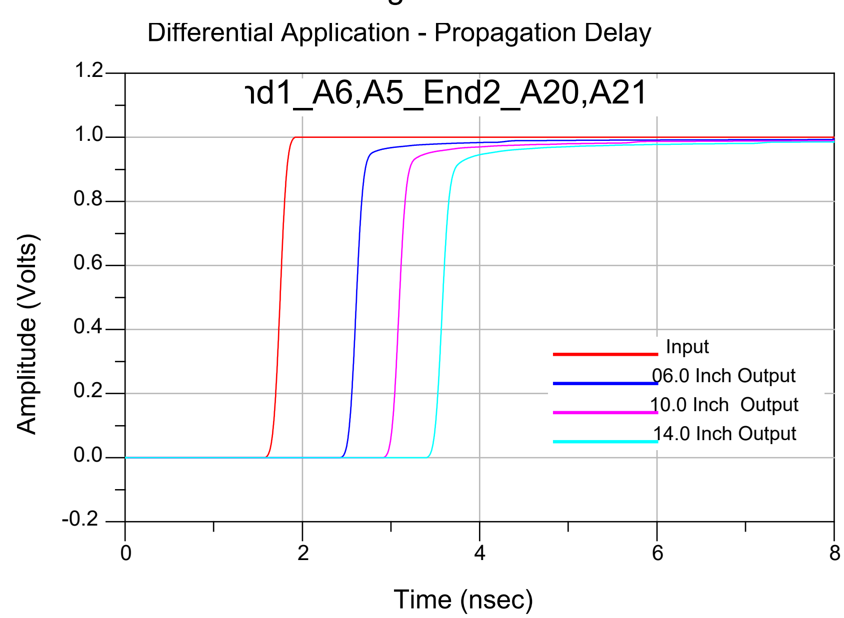

Figure 35

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System, 8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

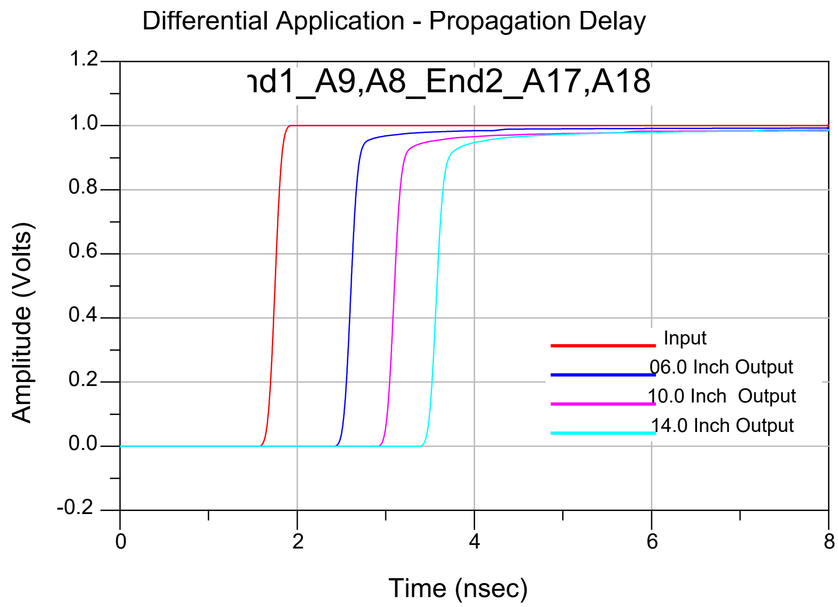

Figure 36

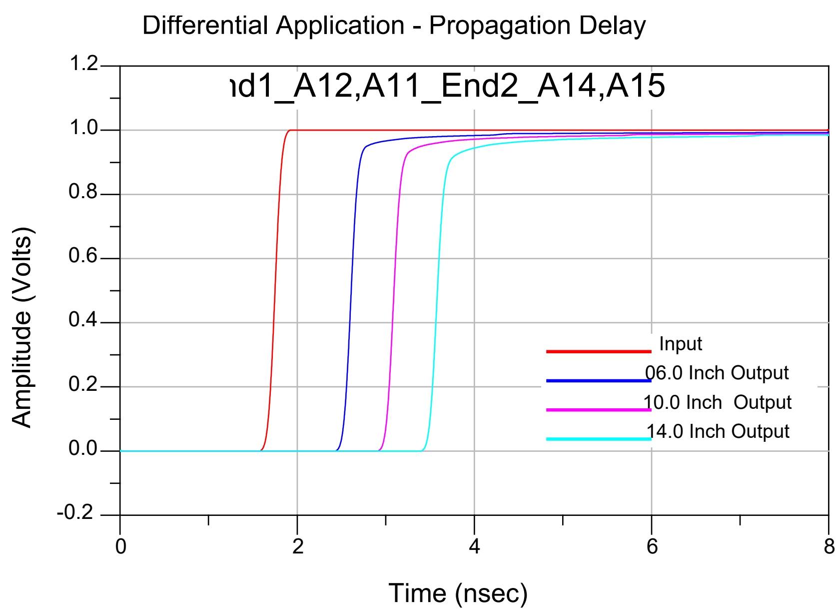

Figure 37

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System, 8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

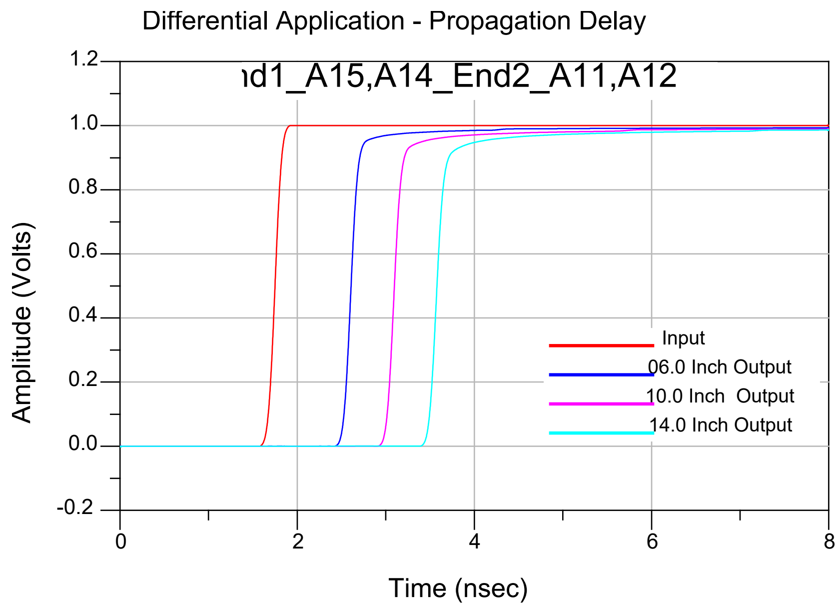

Figure 38

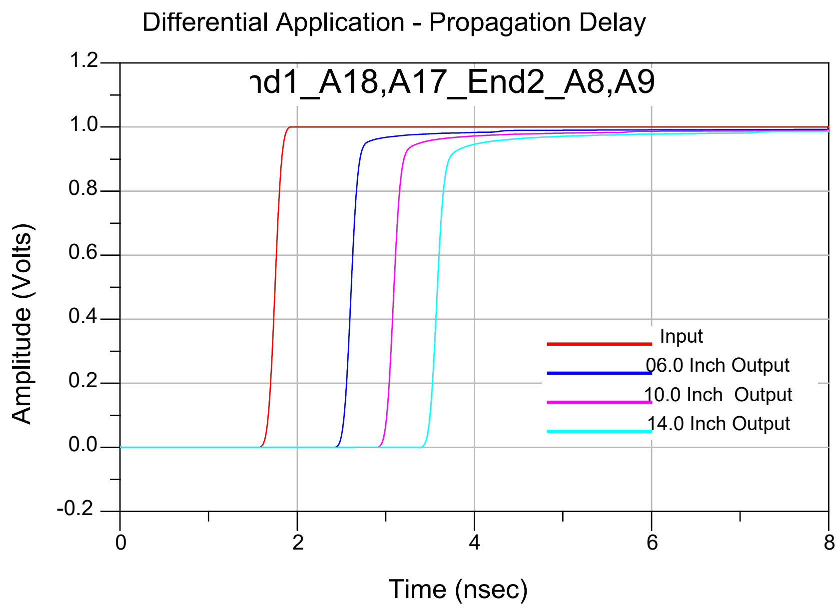

Figure 39

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System, 8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

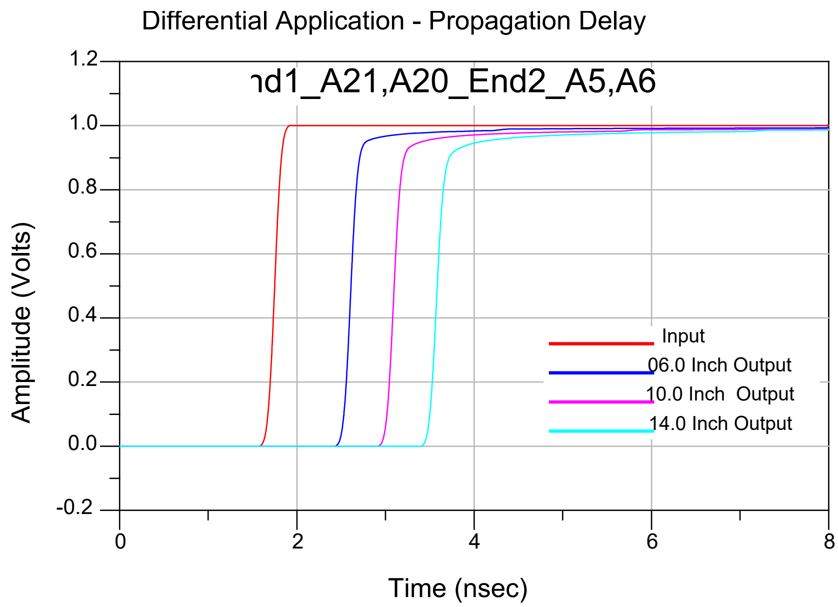

Figure 40

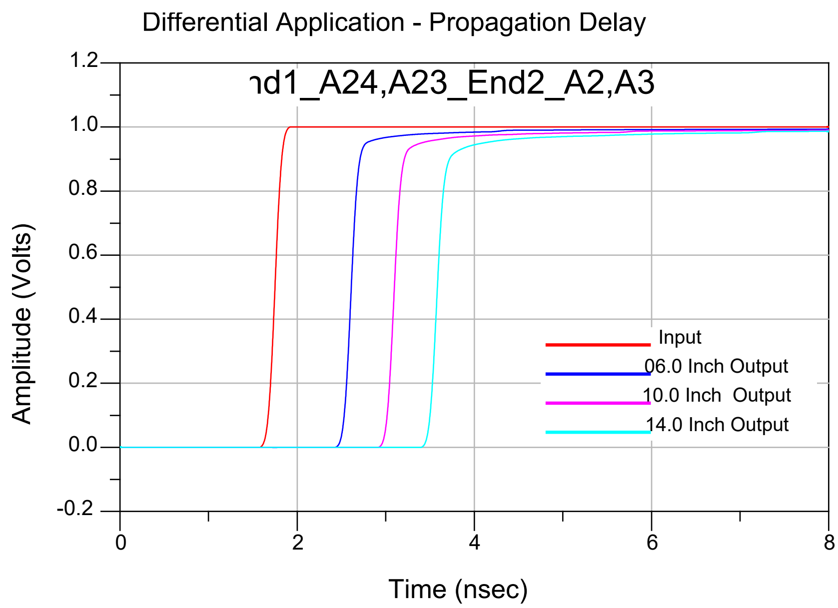

Figure 41

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System, 8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

Appendix C – Product and Test System Descriptions

Product Description

Product test samples are CPC Cable Assemblies. The part numbers are CPC-08-1-06.0-1-02-L-1, CPC-08-1-10.0-1-02-L-1and CPC-08-1-14.0-1-02-L-1. These assemblies mate with CPI-08-01-1-S-RA-0-L-XR. A photo of the mated test article mounted to SI test boards is shown in this appendix.

The cable assembly terminations had a particular signal line configuration. The respective signal line numbers are shown in table 3 below. There are a total of 8 pairs per row. 2.4mm jack numbers on the test boards correspond to the assembly line numbers. All adjacent lines are terminated where applicable.

TABLE 1		
SIGNAL MAPPING FOR -1		
END 1	TYPE	END 2
A1	GND	A25
A2	PAIR 1	A24
A3		A23
A4	GND	A22
A5	PAIR 2	A21
A6		A20
A7	GND	A19
A8	PAIR 3	A18
A9		A17
A10	GND	A16
A11	PAIR 4	A15
A12		A14
A13	GND	A13
A14	PAIR 5	A12
A15		A11
A16	GND	A10
A17	PAIR 6	A9
A18		A8
A19	GND	A7
A20	PAIR 7	A6
A21		A5
A22	GND	A4
A23	PAIR 8	A3
A24		A2
A25	GND	A1
ALL GROUNDS COMMON AND TIED TO CABLE SHIELD		

Table 3: Respective signal line numbers

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System,
8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

Test System Description

The test fixtures are composed of twelve-layer Tachyon 100G material with 46.25Ω signal trace and pad configurations designed for the electrical characterization of Samtec high speed connector products. A PCB mount 2.4mm connector is used to interface the PNA test cables to the test fixtures. Optimization of the 2.4mm launch was performed using full wave simulation tools to minimize reflections. The test fixtures and calibration kit are specific to the CPI series connector set and identified by part number PCB-113680-SIG-01. Displayed on the following pages is information for the CPI/AFR calibration structure and directives for mating CPC fixtures.

PCB-113680-SIG-01 Test Fixtures

Figure 42

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System,
8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

PCB Fixtures

The test fixtures used are as follows:

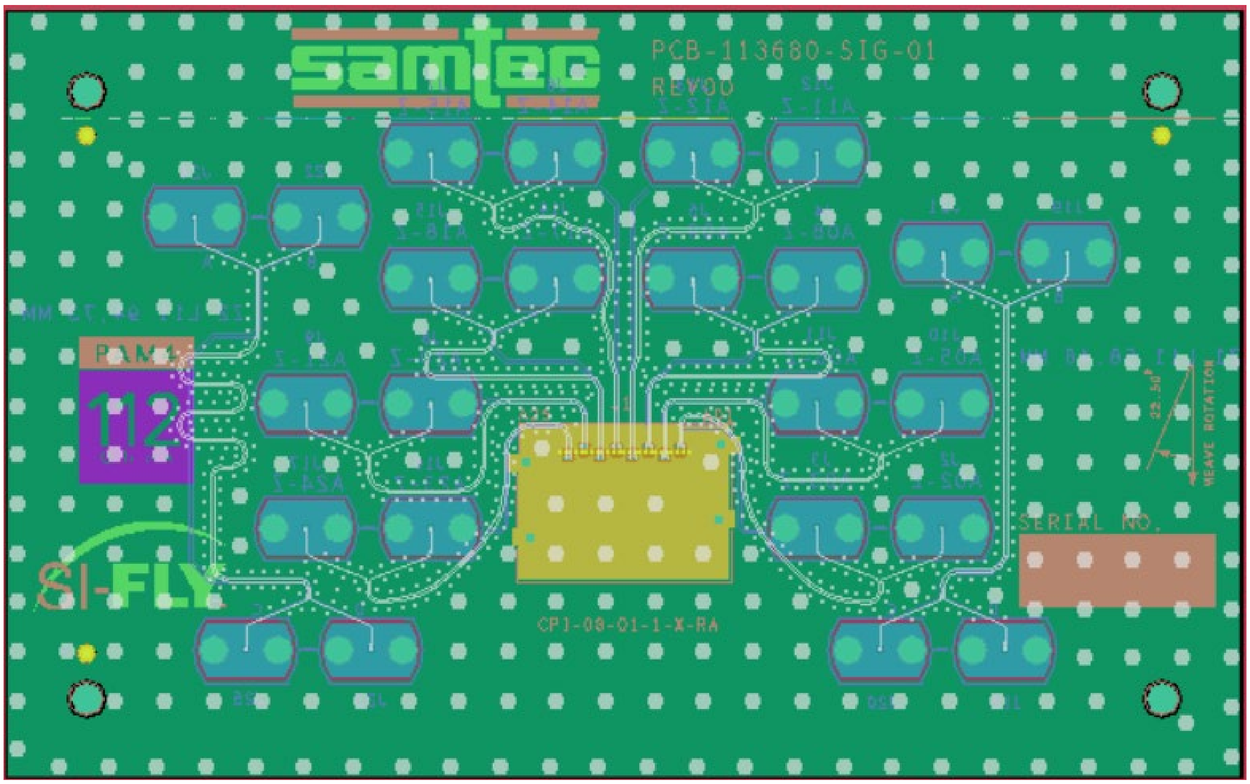

Figure 43

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System,
8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

Appendix D – Test and Measurement Setup

For frequency domain measurements, the test instrument is the Keysight N5225B PNA-L network analyzer. Frequency domain data are obtained directly from the instrument and figures are generated by Keysight ADS. The network analyzer is configured as follows:

Start Frequency – 10 MHz
Stop Frequency – 40 GHz
Number of points – 4000
IFBW – 1 KHz

N5225B Measurement Setup

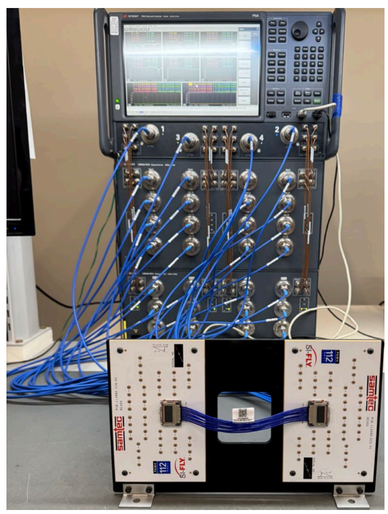

Figure 44

Test Instruments

QTY	Description
1	Keysight N5225B PNA Network Analyzer
1	2.4 mm 85056D

Test Cables & Adapters

QTY	Description
32	1m Gore 1.85mm male to female test cables

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

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

Phone: 812-944-6733
Fax: 812-948-5047
Report Revision: 03/31/2025

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System,
8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

For impedance measurements, the test instrument is the Keysight DCA-X86100D Wide-Bandwidth Oscilloscope Mainframe. The impedance data and profiles are obtained directly from the instrument. The Digital Analyzer is configured as follows:

Vertical Scale: 5 ohm / Div
Horizontal Resolution: 2.5ps
Averages: 128

DCA-X86100D Measurement Setup

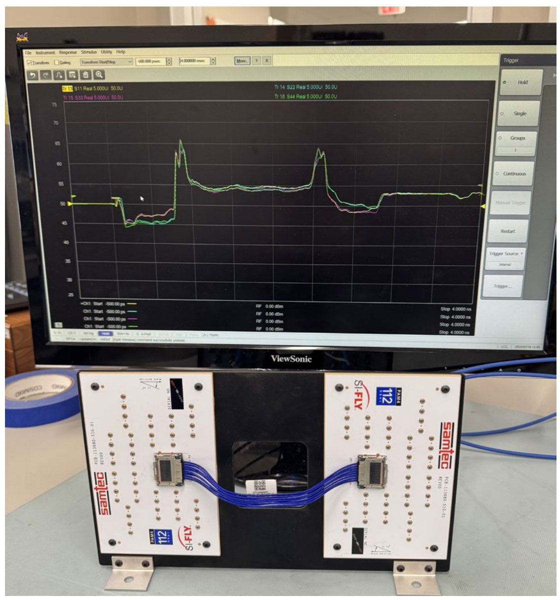

Figure 45

Test Instruments

QTY	Description
1	Keysight DCA-X86100D Wide-Bandwidth Oscilloscope Mainframe

Test Cables & Adapters

QTY	Description
4	Junkosha J12J103834-00

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System, 8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

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 AFR calibration standards, the SI test boards and the selection of the PCB vendor.

A coaxial SOLT calibration is performed using 85056D MCAL module. Then DUT measurements are performed under SOLT calibration. The measurements include the effect of test fixture. The measurements of the 2X THRU line standards are required to remove the test fixture effect.

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 Keysight ADS 2023. 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/Documents/WebFiles/Technical_Library/Reference/Articles/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 cable assembly and footprint. A step pulse is applied to the touchstone model of the cable assembly 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 figure. The difference in time, measured at the 50% point of the step voltage, is the propagation delay.

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System,
8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

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 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 are limited.

Series: CPC
Description: Copper Si-Fly® LP Low-Profile, High-Density Cable System,
8-Pair, 34AWG 92-ohm Twinax Cable, Pin A1 to A25 Pinout

Appendix F – Glossary of Terms

ADS – Keysight Advanced Design System
AFR – Automatic Fixture Removal
PCB – Printed Circuit Board
SUT – System Under Test
SOLT – acronym used to define Short, Open, Load & Thru Calibration Standards
TDR – Time Domain Reflectometry
TDT – Time Domain Transmission