

Welcome!

Texas Instruments New Product Update

- This webinar will be recorded and available at www.ti.com/npu
- Phone lines are muted
- Please post questions in the chat or contact your TI sales contact or field applications engineer

BOOST SIGNAL INTEGRITY WITH PCI-SIG CERTIFIED PCIe 5.0 REDRIVERS

New Product
Update

Connie Lu
- Product Marketing Engineer

Agenda

- Overview of TI's PCIe Signal Conditioning Solutions
- TI PCI-SIG certified Gen 5 redriver features and performance
- PCIe Gen 5 Compliance and inter-operability testing

High-Speed Signal Conditioning (HSSC)

Ethernet / CPRI

(Comms Wired, Wireless, Enterprise)

Products

- Retimer, Repeater / Redriver
- Crosspoint, Mux / Fanout

- 10/40/100/400 GbE
- CPRI 7, eCPRI

Applications

- BTS RRU/ BBU
- Switches/Routers
- Telecom Backhaul



PCIe / SATA

(Enterprise, Client, Personal Electronics, Automotive)

Products

- Retimer, Redriver
- Passive Muxes

- 32Gbps+
- PCIe, SAS, SATA

Applications

- Enterprise Servers, Storage
- Automotive Data Backbone
- Notebooks, Desktops



USB/TypeC/DP

(Personal Electronics, Industrial, Automotive)

Products

- Repeater / Redriver
- Passive Muxes

- 480Mbps – 20Gbps+
- eUSB2, USB2, USB3.0, Type-C

Applications

- Notebooks, Docking, Monitor
- Tablets, VR, Smartphones
- Drones, Toys



SDI, HDMI, MIPI

(Broadcast, Prosumer, Personal Electronics)

Products

- Reclocker (Retimer), EQ, Redrivers
- Passive Muxes

- 3G, 6G, 12G (FHD → 4K)
- HDMI, MIPI DSI

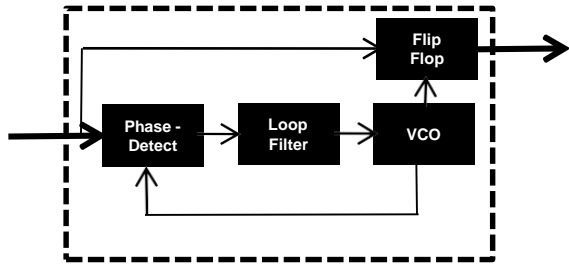
Applications

- Broadcast Switch, Router
- TV, Display wall, Signage
- A/V Distribution networks



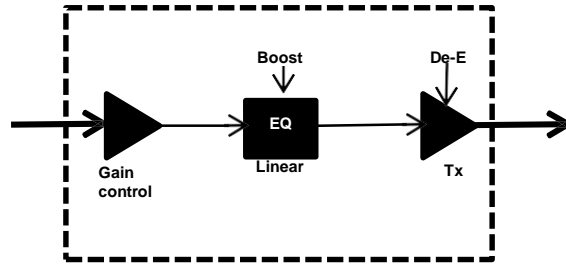
PCIe Signal Conditioning Solutions

Retimer



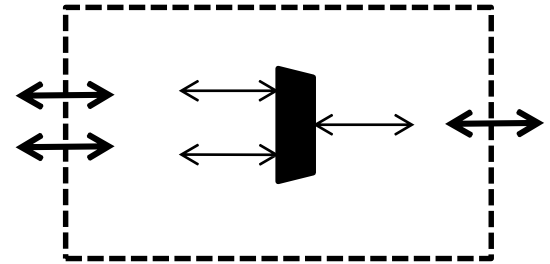
- ✓ Max reach extension
- ✓ Cleans up jitter, reflections, channel loss
- ✓ Diagnostics

Redriver



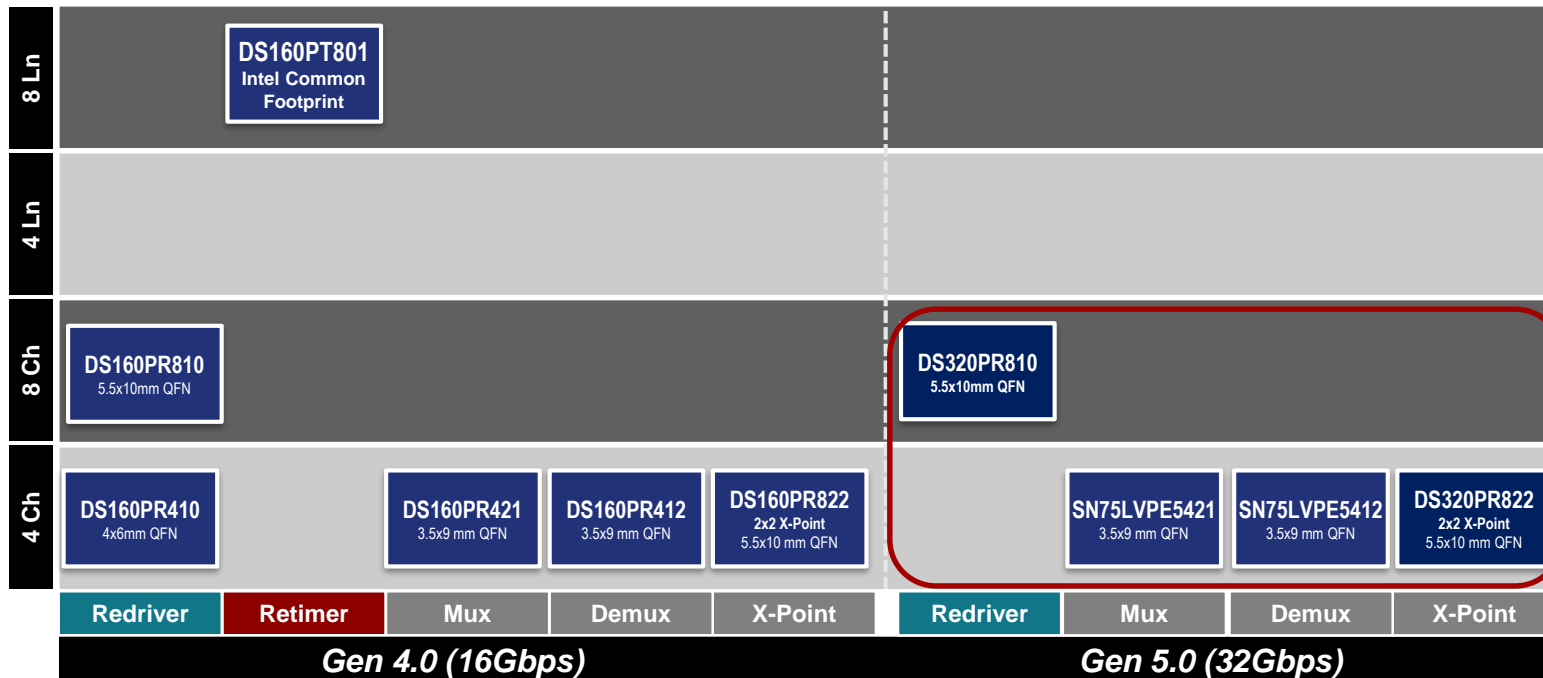
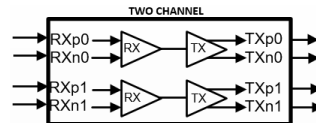
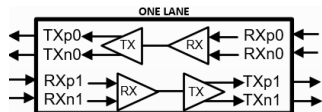
- ✓ Lowest latency
- ✓ Lowest power
- ✓ Short to med reach extension
- ✓ Cleans up channel loss
- ✓ No reference clock needed

Mux



- ✓ Signal routing & redundancy
- ✓ Can be used for 1:2 or 2:1 mux/de-mux
- ✓ Support constrained PCIe slot applications

HSSC PCIe Roadmap



PCIE GEN 5 REDRIVER

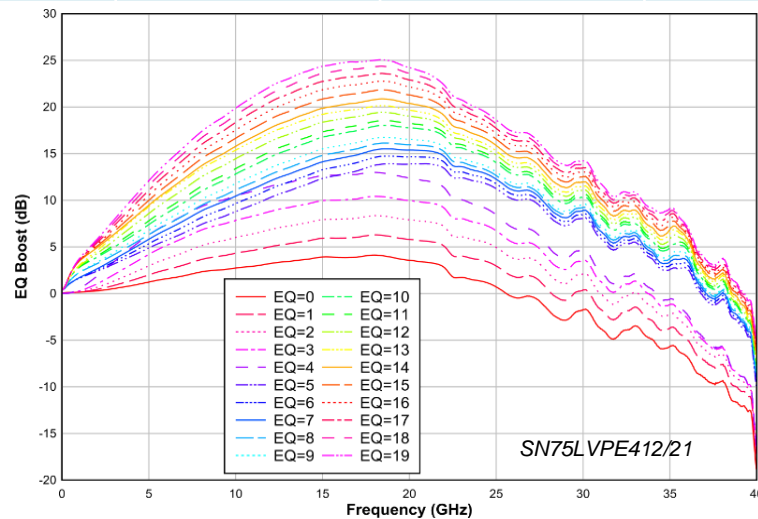
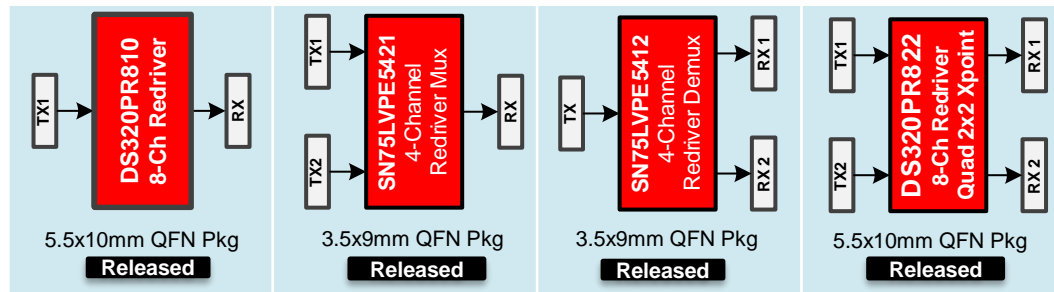
DS320PR810/822, SN75LVPE5412/421 PCIe 5.0 Linear Redriver

Features

- Linear redriver for 32-Gbps **PCIe 5.0, CXL, UPI 2.0**
- CTLE Boosts up to **24 dB at 16 GHz**
- Ultra-low **Latency of 100 ps**
- -10 dB @ 16 GHz return loss
- Low additive RJ 60fs with PRBS15 data
- Support for x4, x8, x16 PCIe bus width
- Single 3.3V supply – **can use PCIe power rail**
- Low active **power: 160 mW/chan**
- Pin-strap or I²C or EEPROM (PR8xx) programming
- Temp range of -40 to 85 °C

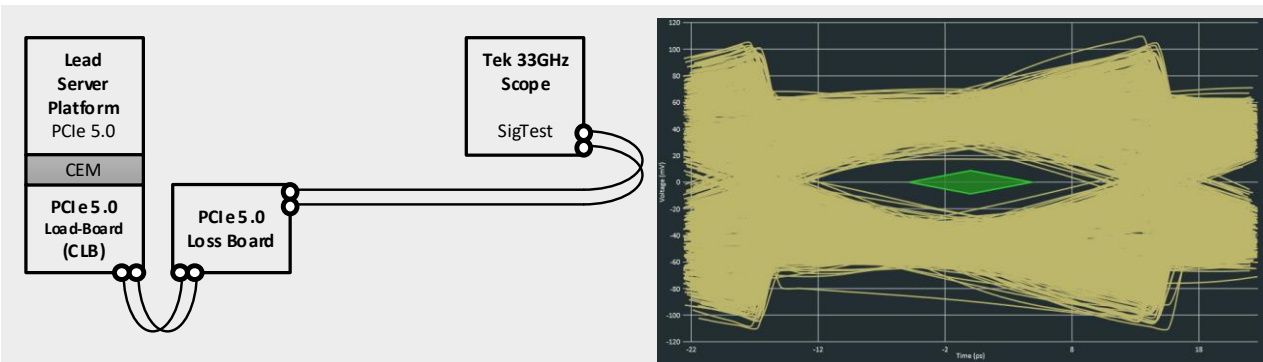
Benefits

- **Heatsink free operation** simplified BOM
- **High immunity to supply noise** - internal regulators
- **Low power/latency/cost alternate to retimers**
- High speed high volume manufacturing testing
- Low AC and DC gain variation over temperature
- Redriver transparently supports **PCIe link training**
- **Analog EyeScan** to aid redriver tuning

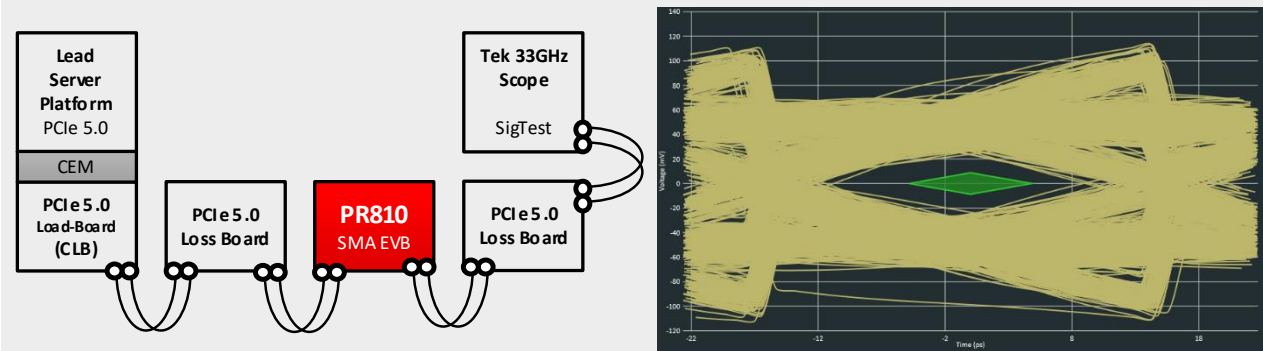
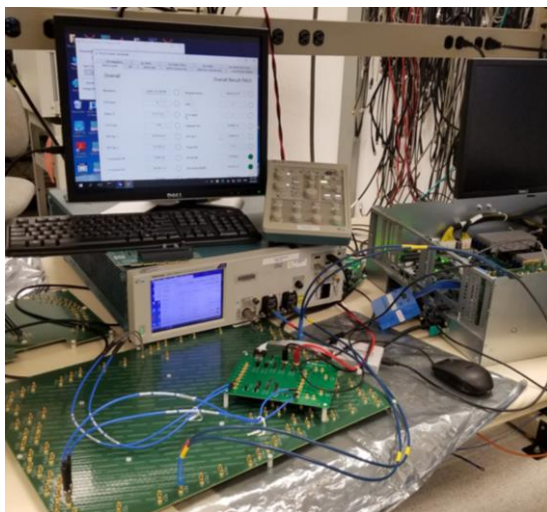


DS320PR810 | PCIe 5.0 Reach Extension - Lead Server Platform

	No DUT	With DUT
Pre ch loss	-	33dB
Post ch loss	-	22dB
Total loss	34dB	53dB
Eye @ 1E-12	11ps, 31mV	10ps, 29mV
SigTest Pass?	Yes	Yes



PCIe 5.0 link baseline setup without redriver. Left: the link elements, Right: eye using SigTest



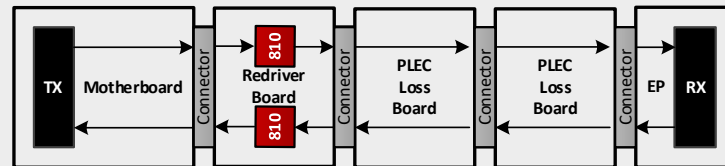
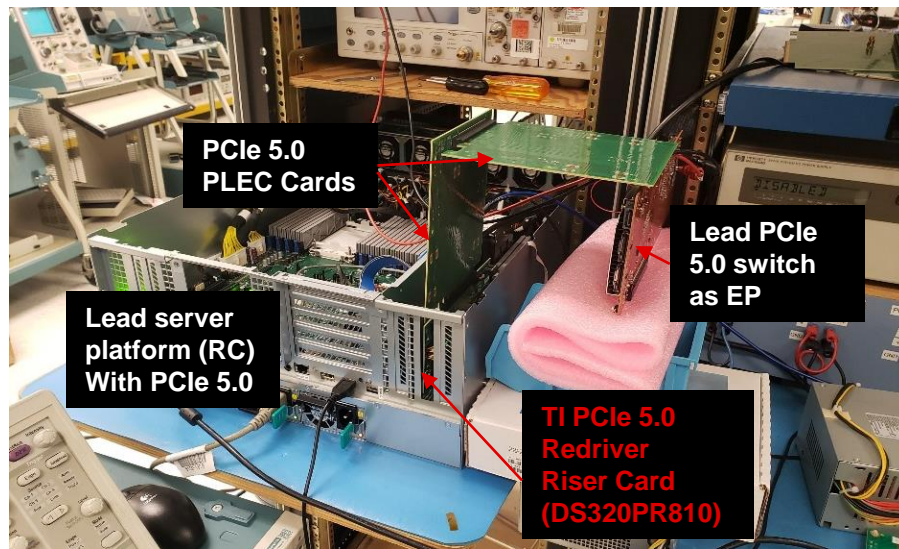
PCIe 5.0 link setup with DS320PR810. Left: the link elements, Right: eye diagram using SigTest

DS320PR810 | PCIe 5.0 Reach Extension – Server Platform

Setup	Downstream			Upstream			Successful PCIe 5.0 Link @ BER 1E-12?	
	Redriver pre-loss (dB)	Redriver post-loss (dB)	Total link loss (dB)	Redriver pre-loss (dB)	Redriver post-loss (dB)	Total link loss (dB)		
1	RC-PLEC-EP	NA	NA	30.7	NA	NA	35.3	Yes
2	RC-PLEC-EP	NA	NA	34.7	NA	NA	39.3	No
3	RC-Redriver-PLEC-EP	21.6	31.1	52.7	31.1	26.2	57.3	Yes
4	RC-Redriver-2X PLEC-EP	21.6	40.6	62.2	40.6	26.2	66.8	Yes
5	RC-Redriver-2X PLEC-EP	21.6	44.1	65.9	44.1	26.2	70.3	No
6	RC-PLEC-Redriver-EP	32.6	13.1	45.7	13.1	37.2	50.3	Yes
7	RC-PLEC-Redriver-PLEC-EP	32.6	20.6	53.2	20.6	37.2	57.8	Yes
8	RC-PLEC-Redriver-PLEC-EP	32.6	27.6	60.2	27.6	37.2	64.8	Yes

Notes:

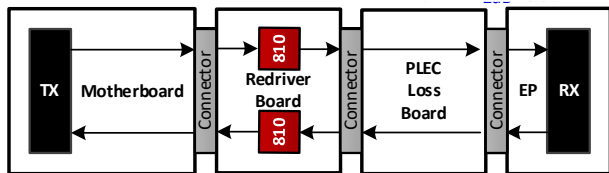
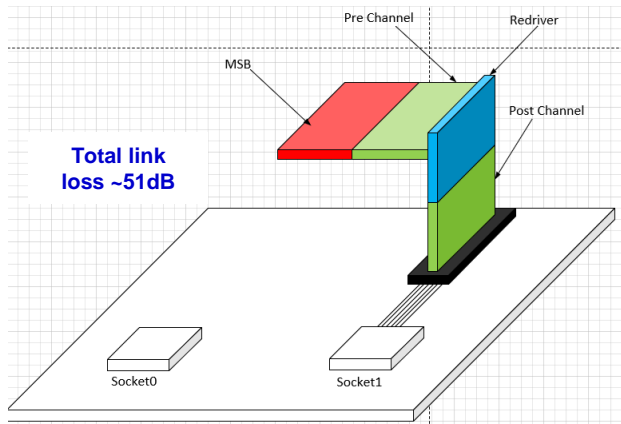
- Setup: lead server CPU, Redriver: TI PCIe 5.0 redriver DS320PR810, EP: lead PCIe switch
- This evaluation was done at ambient temperature using DS320PR810EVM
- TI redriver provides >24dB reach extension



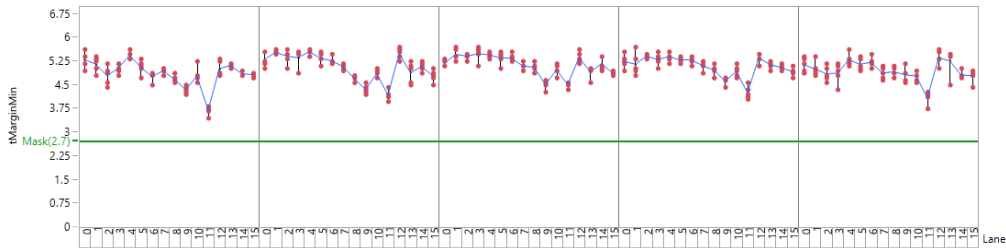
DS320PR810 | PCIe 5.0 RX Lane Margining Tests

Test Setup

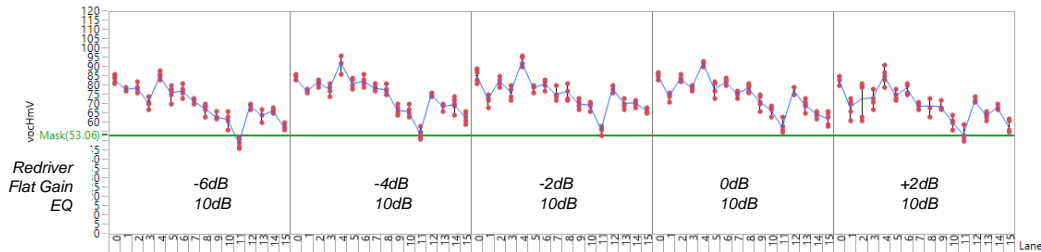
Performed by a lead server chipset vendor in their lab using their server platform



Variability Chart for tMarginMin

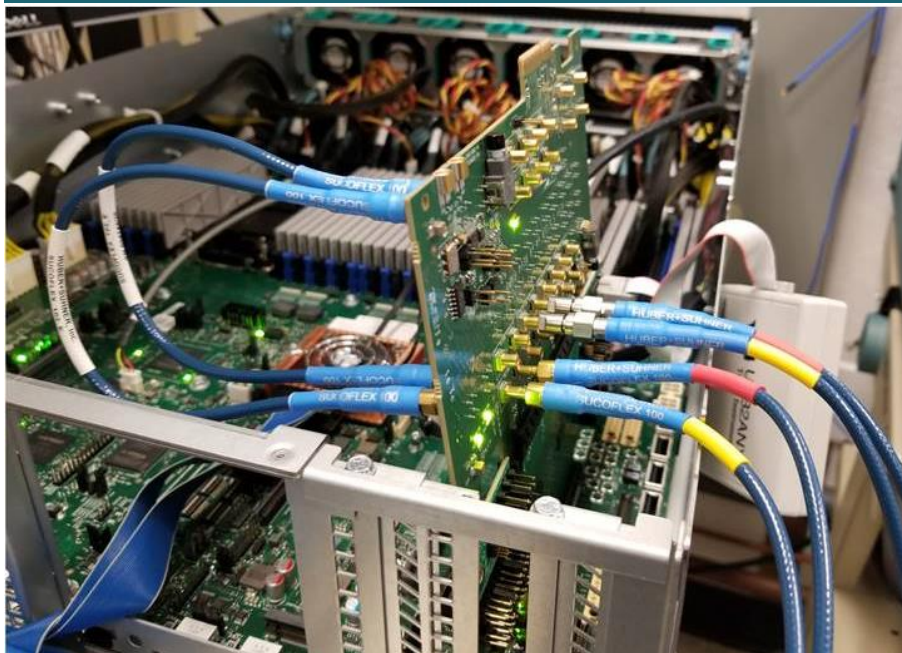


Variability Chart for vchmV



DS320PR810 | PCIe 5.0 TX Compliance Tests - Server

End Point Compliance Test Setup



EQ ~10dB

~50dB loss including simulated loss at scope

TX Jitter Compliance Report



TekExpress PCI Express System-Board Test Report

Setup Information			
DUT ID	DUT001	DPOJET Version	10.4.0.7
Date/Time	2022-05-31 14:11:05	Scope Model	DP077002SX
Device Type	CEM	Scope Serial Number	B000001
TekExpress Version	PCI Express:10.7.1.21	SPC_FactoryCalibration	PASS,PASS
TekExpress Framework Version	5.7.0.33	Scope F/W Version	10.12.0 Build 26
TekExpress Execution Mode	Live	SSC Status	On
Test Mode	Compliance	Channel Info	Non-ATI
Spec Version	Gen5 - 5.0	Probe1 Model	TCA292D
SigTest Version	3.2.0.3(Gen1,2,3) SigTest Phoenix 5.1.03 (Gen5)-Signal Tests SigTest Phoenix 5.1.03 (Gen5)-Preset Tests	Probe1 Serial Number	N/A
		Probe2 Model	none
		Probe2 Serial Number	N/A
		Probe3 Model	TCA292D
Sigtest Template	Gen5 Optimize_CTLLE.dat	Probe3 Serial Number	N/A
Voltage Swing	Full	Probe4 Model	none
Gen5 Acquisition Count	1	Probe4 Serial Number	N/A
Embed Filter File	Gen5 NRC_TL_6p5dB.ftt		
Slot Number	01		
Overall Test Result	Pass		

Signal Tests Summary Table

Test Name	Lane Number	Equalization	Status	Value
Eye_Height@BER Gen5	Lane0	P0 Gen5	Pass	28.605 mV
Eye_Width@BER Gen5	Lane0	P0 Gen5	Pass	13.496 ps
Eye_Height@BER Gen5	Lane0	P01 Gen5	Pass	28.061 mV
Eye_Width@BER Gen5	Lane0	P01 Gen5	Pass	14.490 ps
Eye_Height@BER Gen5	Lane0	P02 Gen5	Pass	26.207 mV
Eye_Width@BER Gen5	Lane0	P02 Gen5	Pass	15.085 ps
Eye_Height@BER Gen5	Lane0	P03 Gen5	Pass	26.636 mV
Eye_Width@BER Gen5	Lane0	P03 Gen5	Pass	15.247 ps
Eye_Height@BER Gen5	Lane0	P04 Gen5	Pass	33.966 mV
Eye_Width@BER Gen5	Lane0	P04 Gen5	Pass	15.036 ps
Eye_Height@BER Gen5	Lane0	P05 Gen5	Pass	34.337 mV
Eye_Width@BER Gen5	Lane0	P05 Gen5	Pass	17.284 ps
Eye_Height@BER Gen5	Lane0	P06 Gen5	Pass	36.842 mV
Eye_Width@BER Gen5	Lane0	P06 Gen5	Pass	17.375 ps
Eye_Height@BER Gen5	Lane0	P07 Gen5	Pass	29.089 mV
Eye_Width@BER Gen5	Lane0	P07 Gen5	Pass	16.064 ps
Eye_Height@BER Gen5	Lane0	P08 Gen5	Pass	33.440 mV
Eye_Width@BER Gen5	Lane0	P08 Gen5	Pass	17.309 ps
Eye_Height@BER Gen5	Lane0	P09 Gen5	Pass	37.141 mV
Eye_Width@BER Gen5	Lane0	P09 Gen5	Pass	16.889 ps

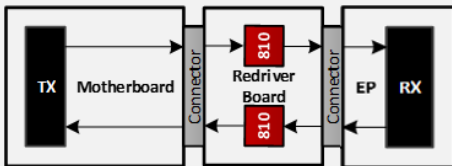
PCIe 5.0 | Successful linear redriver implementations

>10 OEMs using TI's PCIe 5.0 redrivers successfully – some in volume production

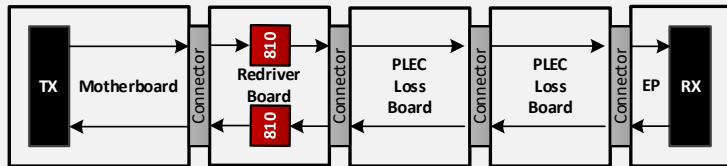
PCI-SIG Integrator's list:

- DS320PR810 (8 Ch) – industry's only 8 channel PCIe 5.0 signal conditioner
- SN75LVPE5421/12 (4 Ch) – 4 channel mux and demux for constrained PCIe slot applications

PCI-SIG Test Setup:



TI Lab Test Setup:



DS320PR810 PCI-SIG / TI lab interoperability report

PCIe 5.0 Hosts	PCIe 5.0 End Points	Result	Site
Intel platform	Broadcom	Pass	PCI-SIG
Microchip	Broadcom	Pass	PCI-SIG
Alibaba	Broadcom	Pass	PCI-SIG
Cadence	Broadcom	Pass	PCI-SIG
Broadcom	Broadcom	Pass	PCI-SIG
Xilinx	Broadcom	Pass	PCI-SIG
AMD Genoa	Broadcom	Pass	PCI-SIG
Marvel Cavium	Broadcom	Pass	PCI-SIG
Intel platform	Samsung SSD	Pass	TI Lab

- Many more testing pending

PCI-SIG compliant PCIe Redrivers

Find TI redrivers in [**PCI-SIG integrators list**](#)

- Only silicon vendor with approved redrivers for PCIe 3.0, 4.0, & 5.0



PCI Express 5.0

CEM Add-in Cards

Company	Product Name	Identifier	Spec Revision	Max Lane Width Tested	Function	Date Added
Texas Instruments	DS320PR810	SN75LVPE5412 , SN75LVPE5421 , DS320PR822, DS320PR401	PCIe 5.0 at 32GT/s	x16	PCI-Express Gen5 Linear Redriver	Sep 24, 2022

PCI Express 4.0

CEM Add-in Cards

Company	Product Name	Identifier	Spec Revision	Max Lane Width Tested	Function	Date Added
Texas Instruments Incorporated	DS160PR410 Quad-Channel PCI-Express Gen-4 Linear Redriver		PCIe 4.0 at 16GT/s	x16	Linear Redriver with RX CTLE	Aug 17, 2019
Texas Instruments	DS160PR810 PCI-Express Gen-4 Linear Redriver	DS160PR810, DS160PR822, DS160PR412, DS160PR421, DS160PR401	PCIe 4.0 at 16GT/s	x16	PCI-Express Gen-4 Linear Redrivers	Sep 11, 2020

PCI Express 3.0

CEM Add-in Cards

Company	Product Name	Identifier	Spec Revision	Max Lane Width Tested	Function	Date Added
Texas Instruments	DS80PCI810	Low-Power 8 Gbps 8- Channel Linear Redriver	PCIe 3.0 at 8GT/s	x16	Link Extension to support PCIe Gen 3 Applications	Jan 18, 2015

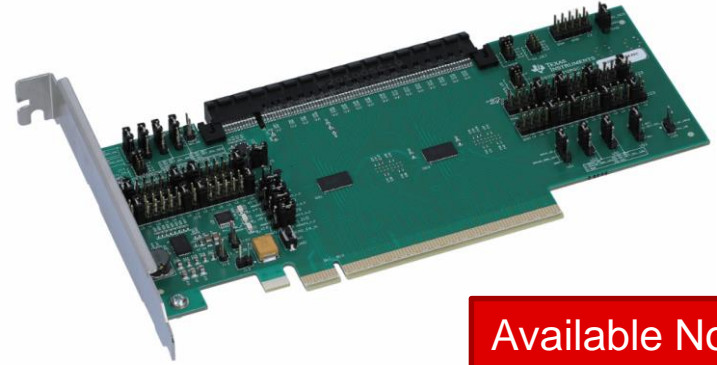
DS320PR810RSCEVM x16 PCIe Gen5 redriver evaluation module

Features

- PCI-Express® 5.0 x16 Riser Card with four octal-channel unidirectional redrivers operating at rates up to 32 Gbps
- Linear equalization for seamless support of link training and PCIe® channel extension
- CTLE boosts up to 24 dB at 16 GHz
- 2x4 bifurcation available
- Programmability through GPIO, I2C / SMBus, or on-board EEPROM

Collateral

- [DS320PR810 Configuration Guide](#)
- Python API for development
- Schematic and layout guide
- IBIS-AMI and S-parameter model for SI simulation
- Compliance and interoperability report
- [E2E Technical Support Forum](#)



Available Now

SigCon Architect GUI





Thank You!



© Copyright 2022 Texas Instruments Incorporated. All rights reserved.

This material is provided strictly “as-is,” for informational purposes only, and without any warranty.
Use of this material is subject to TI's **Terms of Use**, viewable at [TI.com](https://www.ti.com)

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2023, Texas Instruments Incorporated