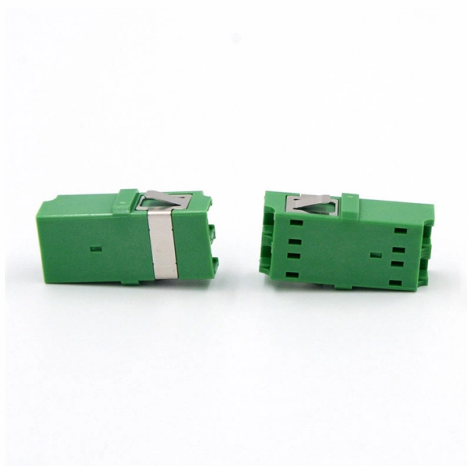


Pcieswitch connects to optical module



Overview

How to Implement PCI Express®-over-Optics in Embedded SystemsIn a new white paper, authors from Samtec and Dolphin ICS explain the use of PCIe for backplan.

Key Takeaways

A PCIe switch connects to an optical module via electrical-to-optical interfaces, enabling high-speed PCIe lanes to extend over fiber for long-distance, low-latency communication. OverviewPCIe switches, such as the Microchip Switchtec PAX or PLX PEX series, manage multiple PCIe lanes and route traffic between host CPUs and peripheral devices. When connecting to optical modules, the switch outputs standard PCIe lanes (Tx/Rx differential pairs) to an electro-optical interface, which converts electrical signals into optical signals for transmission over fiber optics.

Hardware Integration

Switch Card: The PCIe switch resides on a host or adapter card, providing multiple PCIe lanes (x4, x8, x16) for downstream devices. Optical Transceiver Module: Modules like Avago MiniPOD, MicroPOD, or QSFP+ contain arrays of vertical-cavity surface-emitting lasers (VCSELs) and photodiodes to transmit and receive optical signals.

Electro-

Optical Interface: The PCIe lanes from the switch are routed to the optical module via a daughterboard or integrated connector. The module converts the electrical PCIe signals into optical signals for fiber transmission. Fiber Connection: Standard MPO-based multi-mode or single-mode fiber cables carry the optical signals to a remote PCIe endpoint or expansion chassis.

Distances can reach tens to hundreds of meters, far exceeding copper limitations.

System Configuration

Lane Mapping: A PCIe x16 switch output can be split into multiple x4 or x8 links to match the optical module channels. **Expansion Boards:** At the remote end, another optical module receives the signals and converts them back to electrical PCIe lanes, which connect to expansion boards or devices. **Performance:** Optical links maintain high bandwidth, low latency, and signal integrity, supporting PCIe Gen3, Gen4, and even Gen7 speeds.

Applications

Data Centers: Extending PCIe devices like GPUs, NICs, or storage over fiber between racks. **Embedded Systems:** Remote PCIe expansion in industrial or HPC environments. **AI/ML Clusters:** High-throughput, low-latency interconnects for distributed computing.

Key Considerations

Ensure compatibility between the PCIe switch, optical module, and fiber type. Maintain signal integrity and lane alignment for high-speed operation. Consider power consumption and thermal management of optical modules.

Use standardized modules to simplify upgrades and interoperability. By integrating PCIe switches with optical modules, systems can achieve long-distance, high-bandwidth PCIe connectivity while preserving low latency and scalability, enabling flexible and high-performance architectures.

Article Content

How to Implement PCI Express®-over-Optics in Embedded Systems

In a new white paper, authors from Samtec and Dolphin ICS explain the use of PCIe for backplane expansion using fiber optics, including its applications and limitations for high-performance

PCIe OVER FIBER GUIDE

Unlike other optical based solutions, these Active Optical Cables are truly interchangeable with existing copper cables as they support PCIe® auxiliary signals (CPWRON, CPERST#, CPRSNT# and

Optical to PCIe Adaptor Module

Optical to PCIe Adaptor Module enables PCIe Gen4 connectivity over optical links with Leap OBT modules, OcuLink expansion, and I2C/UART diagnostics

LKML: Bjorn Andersson: Re: [PATCH v2 0/2] arm64: dts: qcom: eliza

> via a TCA9538 I/O expander on I2C4. The slot hosts a WLAN module > (connected over PCIe) and a Bluetooth device (connected over UART5), > modelled with the pcie-m2-e-connector

PCIe Over Optics Explained | Synopsys IP

Different optical architectures can be employed for PCIe over optics, leading to improved latency. For instance, linear direct drive optics avoids an extra timer in the link, resulting in reduced

PCIe Over Optics Explained: PCIe 7.0 & Beyond | Synopsys Blog

Learn how we're working with PCI-SIG to transition PCIe to optical interfaces and explore our demo of the PCIe 7.0 standard over fiber optics with OpenLight.

Optical Interface Interconnection Is Abnormal on CE Switches ...

Perform a self-loop test on the optical module to check whether the optical module or optical fiber is faulty. Use a normal optical fiber to connect the receive end (Rx) and transmit end (Tx)

Installing an Optical Module

A copper transceiver module is installed in the same way as an optical module, except that the copper transceiver module connects to a network cable instead of optical fibers.

PXle-8280 Getting Started

This document provides reference information and instructions for installing and configuring your PXle-8280 module. Unpacking The PXle-8280 ships in an antistatic package to

GB200 Hardware Architecture

Since there will be no ConnectX-7/8 or Bluefield-3, which both have integrated PCIe switches, a dedicated PCIe switch from Broadcom / Astera Labs will be required to connect the

How do You Connect Fiber Optic Cable to SFP?

Learn how to connect a fiber optic cable to an SFP module correctly. Follow our step-by-step guide, avoid common mistakes, and troubleshoot connection issues.

NADDOD NVIDIA/Mellanox MMS4C11 (980-9IAU1-00XM01)

NVIDIA/Mellanox MMS4C11 (980-9IAU1-00XM01) Compatible 1.6TBASE-2xDR4 OSFP224 IHS/Closed Finned Top 8x200G PAM4 Broadcom 3nm DSP (Sian3 | BCM83628) 1310nm 500m SMF DOM Dual

OCP PCIe Extended Connectivity Requirements

1. Introduction This document charter is to document the various industry usage-model scenarios and requirements for disaggregated NVMe and CXL inter-connected devices including Switch, Compute,

Switchtec™ PCIe® Switches | Microchip Technology

Switchtec Gen 5 PCIe Switch Reference Validation Board Our Switchtec Gen 5 PCIe switch reference validation board allows you to evaluate the functionality of

White Paper

Using separate transmitter and receiver modules provides design flexibility and lowers the total solution cost for the optical interconnect. Incorporating programmable equalization and de-emphasis into the

NVIDIA ConnectX-8 SuperNIC User Manual

About This Manual This User Manual describes NVIDIA® ConnectX®-8 SuperNICs. It provides details as to the interfaces of the board, specifications, required software and firmware for operating the

How to Implement PCI Express®-over-Optics in Embedded Systems

Traditionally perceived as a chip-to-chip, single-host interconnect technology, PCIe (PCI Express) over fiber is making inroads into switch fabrics, challenging and potentially replacing

PCI Express over optical cabling: Performance, simplicity, efficiency

Optical solutions can be a key enabler for network architects who see value in using PCI Express (PCIe) as an I/O technology for data center connectivity. Using PCIe to natively connect

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This document is for preliminary research. Verify specifications against current standards, product documentation and project requirements.

