

Article Overview

Low-noise optical components, including high-linearity CDRs, TIAs, and co-packaged optics, are critical for maintaining signal integrity in supercomputing centers.

Key Low-Noise Optical Components

1. Clock and Data Recovery (CDR) Modules Semtech's ClearEdge(R) and Tri-Edge(TM) CDRs are widely used in 100-400G optical modules, QSFP, OSFP, and Active Optical Cables (AOCs). These CDRs provide low noise, high linearity, and wide dynamic range, ensuring minimal signal degradation across high-speed optical links in HPC environments . The Tri-Edge CDRs integrate VCSEL drivers and TIAs, supporting quad 53G channels, while ClearEdge CDRs handle quad 25G channels, making them suitable for dense, high-bandwidth supercomputing interconnects . 2. Low-Noise Amplifiers (LNAs) Although primarily used in RF and wireless applications, Infineon's silicon-germanium (SiGe) LNAs demonstrate the advantages of low-noise amplification, including high gain and low power consumption . In optical networks, similar low-noise TIAs and amplifiers are essential to maintain signal fidelity over long-distance or high-density links in supercomputing centers. 3. Co-Packaged Optics (CPO) and Silicon Photonics Nvidia and other HPC vendors are integrating co-packaged optics with switches and GPUs to reduce noise and power consumption while increasing bandwidth . By embedding continuous-wave lasers and optical engines directly with switch ASICs, CPO reduces the total optical power per port from 30W to 9W, significantly lowering thermal noise and improving signal integrity across large-scale AI and HPC clusters .

Benefits in Supercomputing Centers

- o Reduced Signal Degradation: Low-noise CDRs and TIAs maintain high signal-to-noise ratios, critical for error-free data transmission in HPC workloads .
- o High Bandwidth and Low Latency: Co-packaged optics and photonic interconnects support multi-terabit per second links, enabling efficient GPU-to-GPU and CPU-to-memory communication .
- o Energy Efficiency: Low-noise optical components reduce the need for signal regeneration and lower overall power consumption, which is crucial in exascale computing environments .
- o Scalability: These components allow supercomputing centers to scale interconnects without compromising performance, supporting collective communication operations like AllReduce and AllGather across heterogeneous networks .

Conclusion

For supercomputing centers, low-noise ODN products such as Semtech ClearEdge/Tri-Edge CDRs, low-noise TIAs, and co-packaged silicon photonics solutions are essential to achieve high-bandwidth, low-latency, and



Low-noise ODN products used in supercomputing centers

energy-efficient optical interconnects. These technologies ensure reliable data transfer across dense HPC clusters and distributed AI computing environments, minimizing signal degradation and maximizing computational throughput.

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Defining ODN: Optical Distribution Network Definition under: Definitions What is Optical Distribution Network (ODN)? An Optical

They use low-latency interconnects (e.g., InfiniBand) and storage area networks. The supercomputer priority is performance rather

I. Abstract: Large-scale data centers generate substantial quantities of infrasonic and low-frequency noise (ILFN),

Data center noise reduction Data center cooling fan system noise control - low cost + efficiency gains Data center noise (or "data

The noise from the cooling fans in servers adversely affects employees' health, and reduces their productivity. In this

From measured noise levels and spectrum speech intelligibility measures are calculated and communication

With the Huawei QuickODN solution, operators do not need to splice fibers or open boxes during ODN deployment, which improves

Explore Low Noise Factory's range of ultra-low noise amplifiers designed for cutting-edge scientific applications including quantum

ZTE like Huawei is also evolving its ODN products. In October 2022 it announced a new product set called Light ODN which uses

Reduce harmful noise from data centers with SonaGuard® barriers, sound-absorptive walls engineered for

Learn about the 5 sources of noise in a data center and how to control it. Contact Ketchum & Walton Co. today.



Low-noise ODN products used in supercomputing centers

New Solutions Ubiquitous Fiber Networks with Huawei ODN 3.0 With Huawei's core concept for ODN construction centering on full

There is a large body of written material on ozone and the use of ozone indoors. However, much of this material

Passive optical network A fiber optic cable assembly with SC APC connectors, as commonly used to link

As high-tech companies ramp up construction of massive data centers to meet the business boom in artificial

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