

RIVO MULTITRADE OPTICAL SYSTEMS

Industrial-grade optical switches energy-saving and cost-effective



Overview

In modern data centers, the energy required to move data is becoming as significant as the energy required to process it.

Key Takeaways

Industrial-grade optical switches offer significant energy savings and cost reductions by minimizing electrical conversions, optimizing bandwidth, and enabling scalable, high-speed network architectures.

Energy Efficiency

Modern optical switches, such as Optical Circuit Switches (OCS) and co-packaged optics (CPO), reduce the reliance on traditional electrical switches and optical-electrical-optical (OEO) conversions, which are major sources of power consumption in data centers and industrial networks. By keeping data in the optical domain, these switches lower energy usage while maintaining high throughput and low latency, particularly for GPU-intensive AI workloads and high-performance computing applications. Co-packaged optics further enhance efficiency by integrating optical components close to the switch ASICs, reducing electrical trace losses and improving bandwidth density.

Cost-Effectiveness



Industrial-grade optical switches are designed to be compact, scalable, and low-maintenance, which reduces both capital and operational expenses. Technologies like semiconductor optical amplifiers (SOAs) and MEMS-based switches allow for high port density and low insertion loss, minimizing the need for multiple electronic switches and complex cabling . Passive optical networks (PONs) in industrial settings also provide a point-to-multipoint architecture, reducing the number of required switches and simplifying network management while supporting time-sensitive networking (TSN) for critical industrial flows .

Technological Advantages

- **High Bandwidth and Low Latency:** Optical switches support terabit-level data rates and low-latency connections, essential for AI, IoT, and industrial automation .
- **Scalability:** Platforms like MEMS, MZI, and SOA-based switches allow for modular expansion and integration with photonic integrated circuits (PICs), enabling flexible network growth .
- **Broadband and Polarization Insensitivity:** Advanced switches handle multiple wavelengths and polarization modes, ensuring reliable performance across diverse industrial applications .
- **Energy-Aware Design:** By reducing OEO conversions and leveraging optical interconnects, these switches significantly cut energy costs, which is critical for large-scale data centers and industrial networks .

Applications

Industrial-grade optical switches are increasingly used in:

- Data centers and AI clusters for high-speed GPU interconnects
- Telecommunications and 5G networks for low-latency, high-bandwidth routing
- Industrial automation for converged IT/OT networks, supporting augmented reality, digital twins, and TSN-enabled time-critical flows
- Smart city and IoT infrastructures requiring scalable, energy-efficient connectivity

Conclusion

By combining optical circuit switching, co-packaged optics, and SOA-based designs, industrial-grade optical switches provide a cost-effective, energy-efficient, and high-performance solution for modern industrial and data center networks. Their adoption reduces operational costs, improves network scalability, and supports the growing demand for high-speed, low-latency communication in AI, IoT, and industrial automation environments .

Article Content

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Optical Switches

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Optical Switches Market

For this study, the optical switches market covers revenues earned from devices that switch optical signals across

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The key current challenges for the industrial application of all optical switching networks are energy consumption,

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3.2 Energy-Efficient Designs The EU-funded PHOENICS project unveiled optical switches consuming 0.5 pJ/bit – 90%

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This paper first summarizes the topologies and traffic characteristics in data centers and analyzes the reasons and importance of

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Optical switch technology offers a promising solution to these challenges by providing high-bandwidth, low-latency,

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Finally, the shift towards green technology and the need for energy-efficient network components have further accelerated market

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