

## **GIGALIGHT Marketing Report**

# **800G/400G AI Data Center Architectures and Products**

Issue 6, 2023

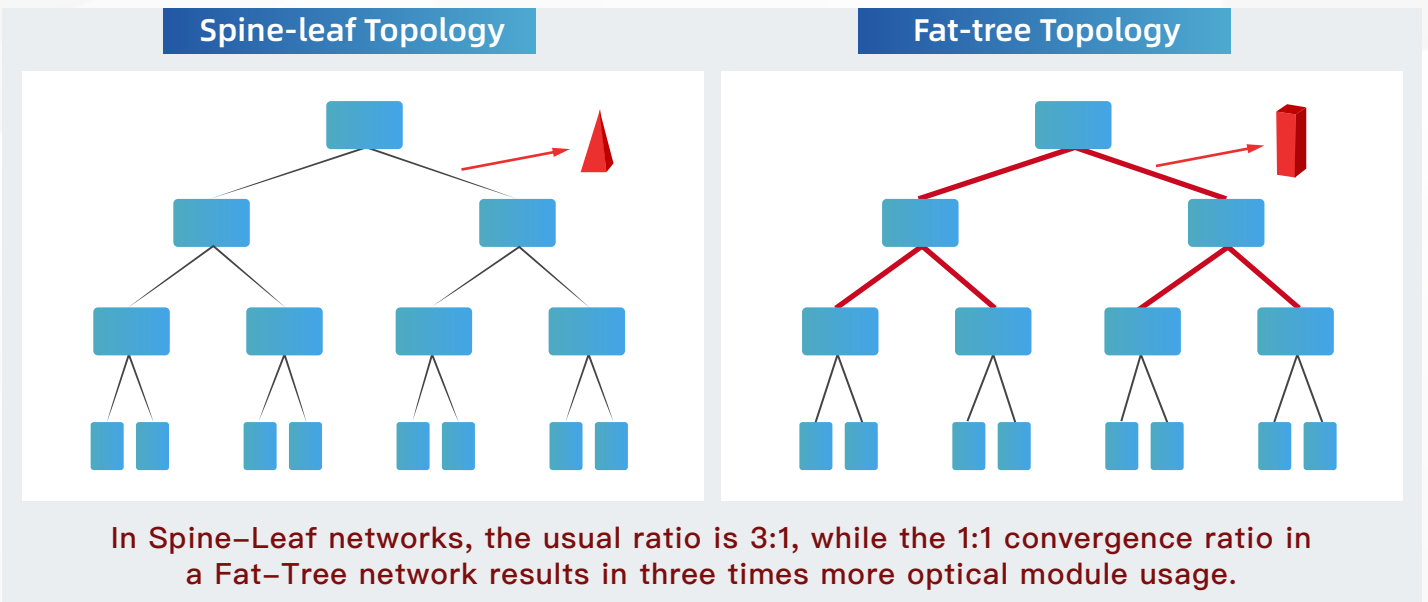
- 800G OSFP DAC/AOC/SR8 Optical Modules
- 800G QSFP-DD DAC/AOC/SR8 Optical Modules
- 400G OSFP-RHS DAC/AOC/SR4 Optical Modules
- 400G QSFP112 DAC/AOC/SR4 Optical Modules

## AI-Driven Growth Boosts 400G/800G Optical Module Market

On November 30, 2022, the American AI research company OpenAI released the ChatGPT chatbot model, which gained over a million users in five days and exceeded a billion users in two months, becoming the fastest-growing consumer application in history. On April 28, 2023, OpenAI completed a \$10.3 billion financing, leading to a post-investment valuation of \$27 billion to \$29 billion, making it the world's fastest-growing unicorn.

AI's advancement necessitates high-speed optical modules in AI servers to meet the stringent demands for data transmission rates and low latency due to the core constraints of large models, extensive datasets, and high computing power in AI-generated content applications. While AI relies heavily on parallel computing with GPUs as the primary processors, communication factors can become a bottleneck, leading to data delays if even one single network link congestion occurs. Therefore, there is a substantial demand for 800G optical modules in AI servers.

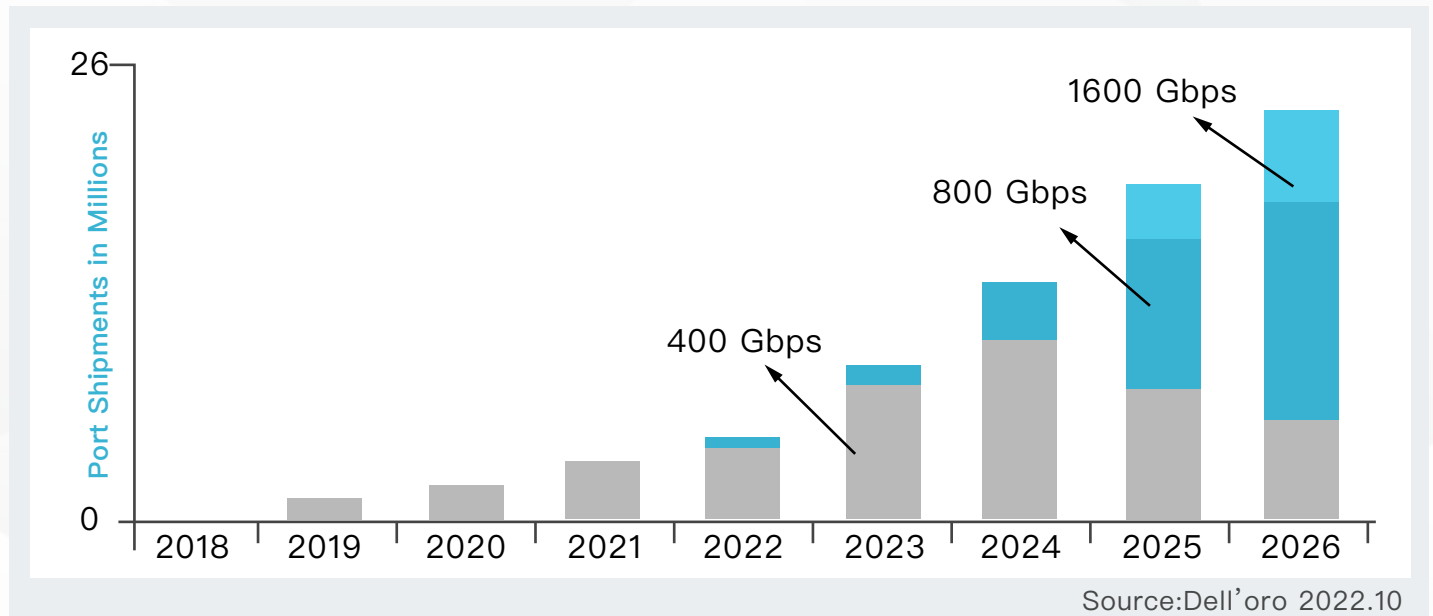
To solve resolution of AI network bandwidth bottlenecks, data center network architecture is evolving from the traditional spine-leaf to a fat-tree structure.



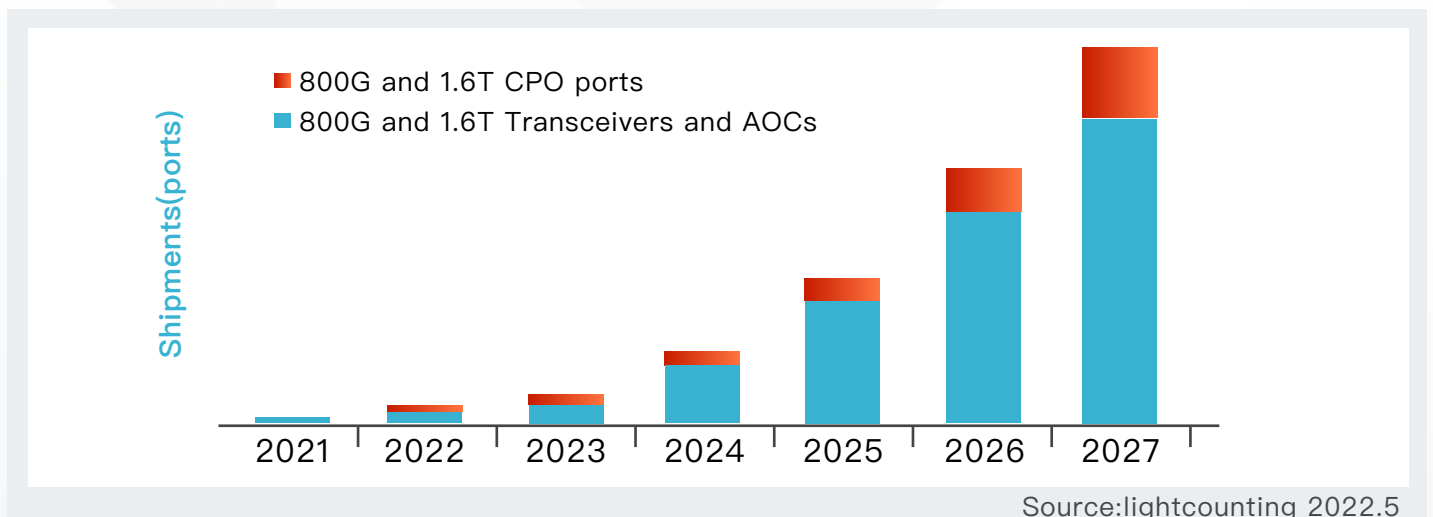
As AI's large model training gradually finds applications in various fields, traditional networks designed for HPC (High-Performance Computing) can no longer meet the bandwidth and latency requirements for large model cluster training. Distributed training of large models requires communication between GPUs, leading to a significant increase in east-west traffic within AI/ML data centers. The traffic patterns differ from traditional cloud computing.

AI data involves short bursts of high traffic. In the traditional cloud computing network architecture, spine network training can cause network delays and reduced training speed. In traditional tree network topologies, bandwidth converges layer by layer, with the network's bandwidth at the root far less than the sum of all bandwidth at the leaves. In contrast, the fat-tree topology resembles a real tree, with thicker branches closer to the root. In this design, network bandwidth doesn't converge from leaves to root, enhancing network efficiency and accelerating training speed. This is the foundation for a non-blocking network that the fat-tree architecture can support. Since there is no convergence, more optical ports are needed to ensure consistent upstream and downstream speeds, increasing the number of optical modules.

When switch chips upgrade to 112G electrical interfaces, it will enable the adoption of 400G/800G modules. Due to variations in AI data center topologies, we can estimate the impact of AI on optical module demand in a typical scenario. When the user base of GPT-like applications reaches 1 billion monthly active users, we estimate a need for 69.4 A100 GPUs. Assuming one A100 corresponds to a demand for three optical modules, this translates to approximately 2 million 800G optical modules. In practice, from the switch to the server, the network is often divided into 800G at the switch, 400G at the next level, and upgrading to 800G is likely to drive demand for 400G as well.

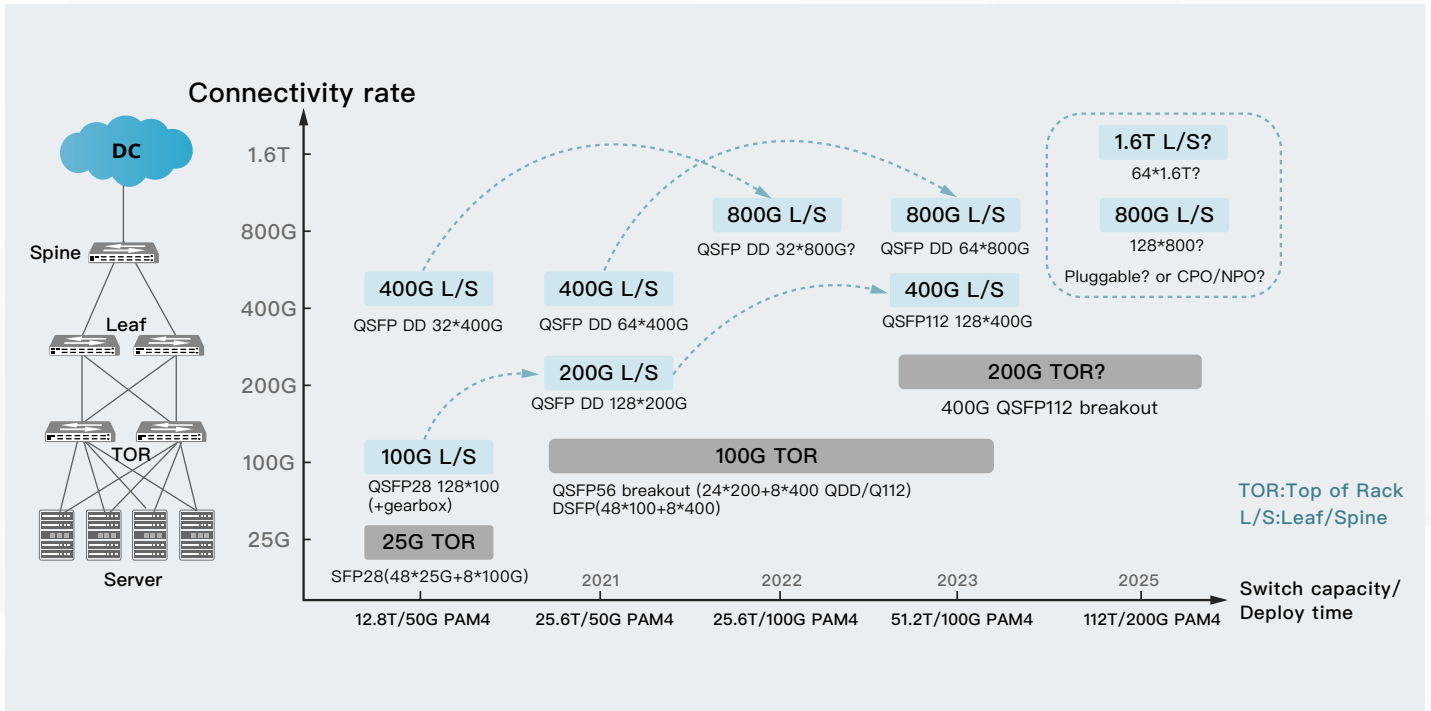


From the North American optical module market perspective, it is expected to split into two segments in the coming years. One part will be traditional data center demand, while the other will be new demand driven by the rise of AI. It is projected that AI-driven demand may surpass traditional data center demand between 2024 and 2025. In the domestic Chinese optical module market, 200G/400G deployments will continue to be dominant and maintained for some time. Currently, the demand for 400G and 800G in China has not increased rapidly. This is due to relatively stable demand in traditional data centers and the slow development of the telecommunications sector. Therefore, the growth of 400G and 800G in 2024 will largely stem from increased demand driven by supercomputing, and both CPO (Co-Packaged Optics) and pluggable modules will coexist for an extended period.



# Data Center Interconnect Speed Evolution and Varied Options

Divergent evolutionary paths with multiple coexisting options; users choose based on business needs, network architecture, and deployment timing.



## Both scale-up and scale-out methods are needed



# Typical Applications of 400G/800G Product Lines

## >>> 400G/800G DAC

### Case1, 800G switch direct connection or linking to DGX-H100

800G Switch

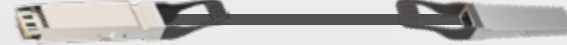


800G switch direct connection



800G OSFP DAC(Twin port OSFP)

800G switch link to DGX-H100



800G OSFP to 800G OSFP-RHS(Flat-top)

800G Switch

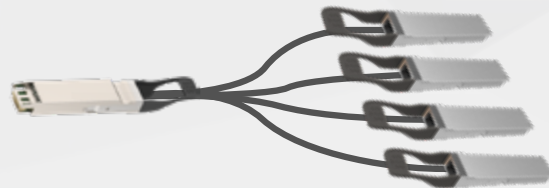


### Case2, 800G switch to breakout application

800G Switch

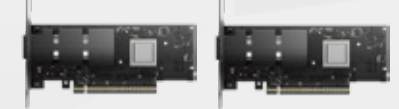


800G OSFP to 2x400G OSFP-RHS(Flat-top)DAC

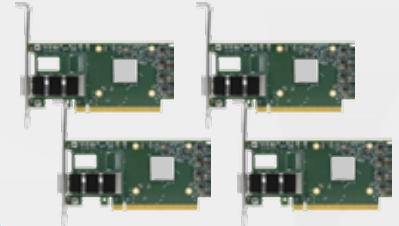


800G OSFP to 4x200G OSFP-RHS(Flat-top)DAC

400G NIC



200G NIC



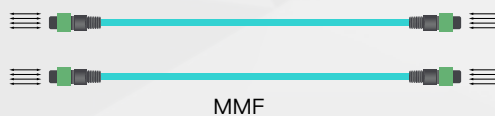
## >>> 400G/800G Multi-mode optical modules

### Case3, 800G switch with 2x 400G NICs

800G Switch



800G OSFP SR8(Dual MPO)



MMF

400G OSFP-RHS SR4



400G OSFP NIC

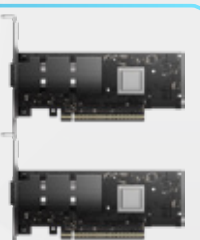


or

400G QSFP112 SR4



400G QSFP112 NIC



In August, GIGALIGHT announced the release of 800G QSFP-DD VR8/SR8, 800G OSFP VR8/SR8, 400G QSFP112 VR4/SR4, and 400G OSFP112 VR4/SR4 optical modules and active optical cables. This product series is equipped with high-performance 112Gbps VCSEL lasers and 7nm DSP technology, with an electrical host interface supporting 112Gbps PAM4 signals per channel. It also complies with the CMIS 4.0 protocol.

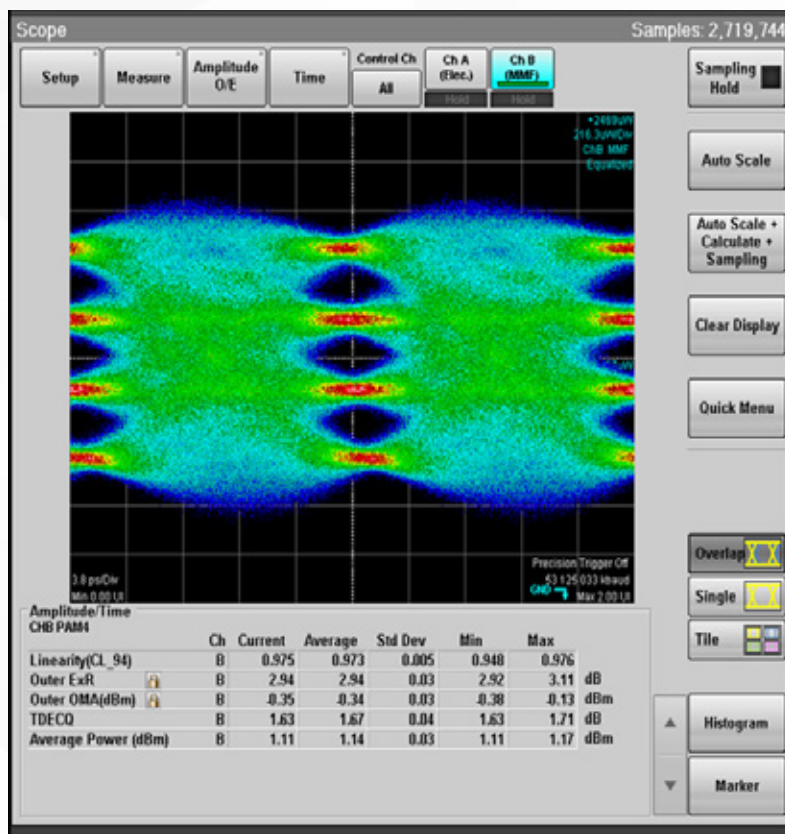
## Relevant performance

### Key Performance Metrics

Eye diagram and sensitivity indicators:

TDECQ per channel is less than 3dB.

OMA RXsen sensitivity meets  $-5.2\text{dBm}$  @  $2.4\text{E}-4$  Pre-FEC 53.125GBd.



### Transmission Distance

VR8/VR4 supports transmission distances of 30 meters (OM3 MMF) and 50 meters (OM4 MMF). SR8/SR4 supports transmission distances of 60 meters (OM3 MMF) and 100 meters (OM4 MMF).

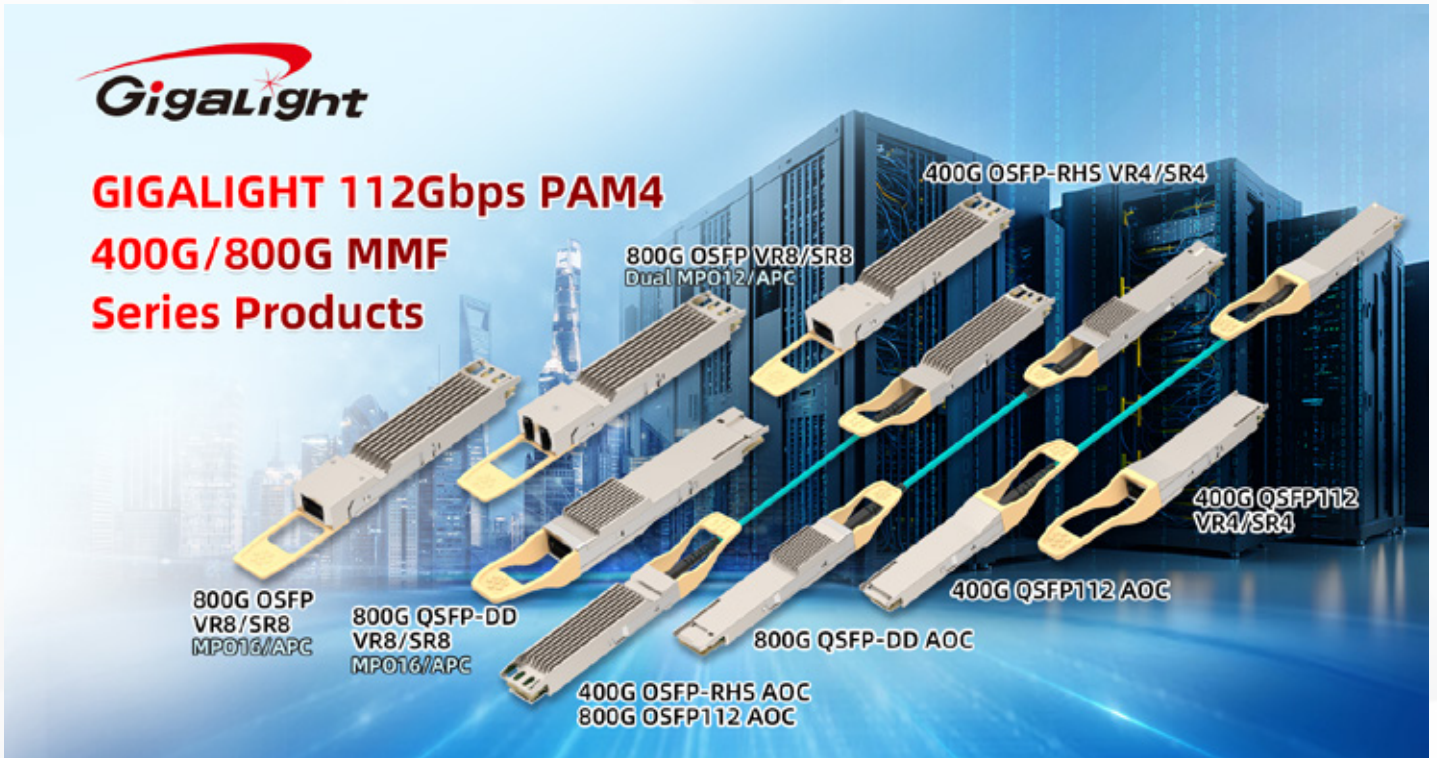
### Form Factors

400G/800G optical modules support two form factor: QSFP-DD and OSFP.

### Power Consumption Design

Power consumption is less than 14W for 800G optical modules/AOCs, and less than 8W for 400G optical modules/AOCs.

The complete product portfolio of 400G/800G MMF series is as follows:



### 800G (8x112G) MMF Products

- 800G OSFP VR8 (Dual MPO12/APC or MPO16/APC)
- 800G OSFP SR8 (Dual MPO12/APC or MPO16/APC)
- 800G OSFP AOC
- 800G QSFP-DD VR8 (MPO16/APC)
- 800G QSFP-DD SR8 (MPO16/APC)
- 800G QSFP-DD AOC

### 400G (4x112G) MMF Products

- 400G OSFP-RHS VR4 (MPO12/APC)
- 400G OSFP-RHS SR4 (MPO12/APC)
- 400G OSFP-RHS AOC
- 400G QSFP112 VR4 (MPO12/APC)
- 400G QSFP112 SR4 (MPO12/APC)
- 400G QSFP112 AOC

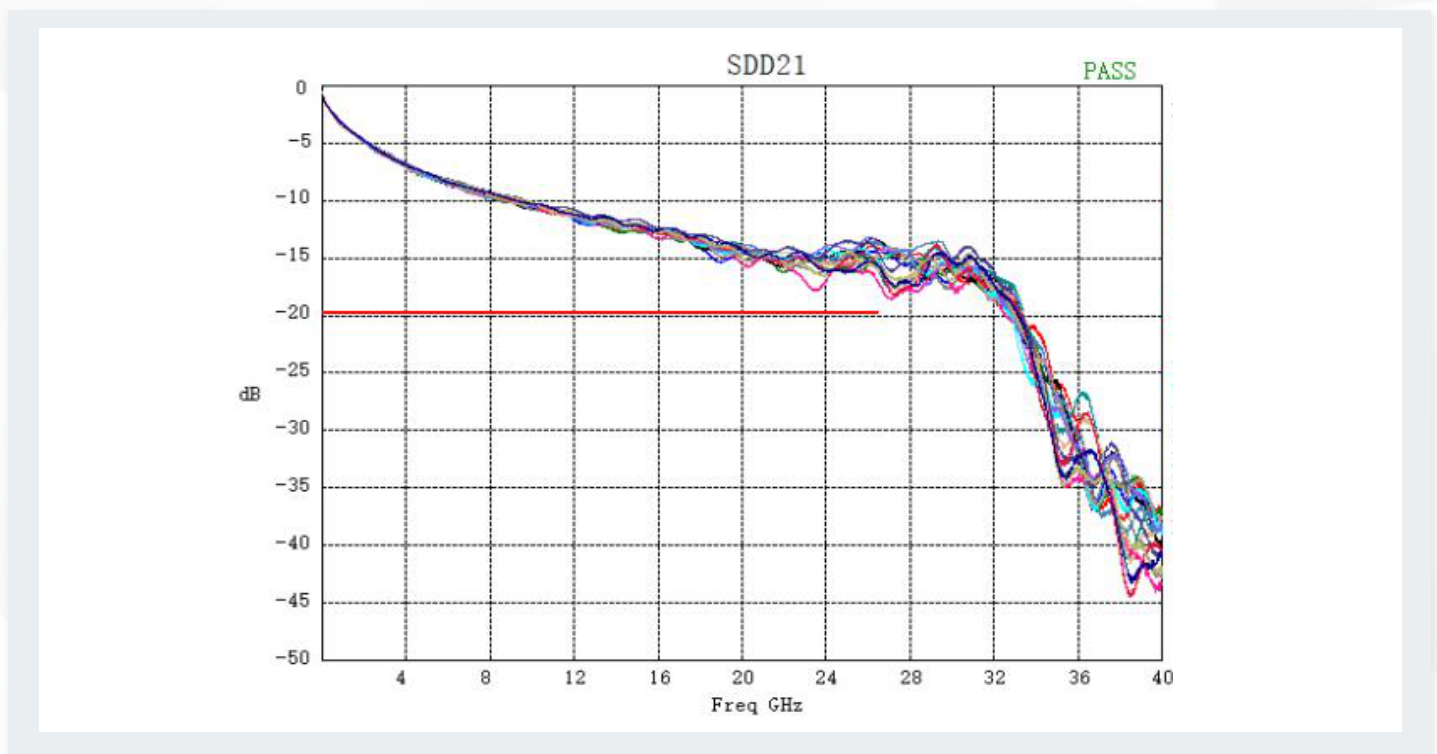
In May, GIGALIGHT launched its first 800G active copper cable product, the 800G QSFP-DD ACC, to support high-speed data centers and AI high-performance applications. In June, GIGALIGHT received the "CFCF 2023 Optical Interconnect Conference" "Product Innovation Award of the Year" for this DAC.

GIGALIGHT 800G QSFP-DD ACC follows the QSFP-DD800 MSA and IEEE802.3ck specifications, using 16 pairs of copper cables to support bidirectional transmission of 8 channels at a rate of 112GB/s. Compared to the 2m maximum transmission distance of the 800G QSFP-DD PCC, the ACC extends up to 4m, which meets the cabling needs of typical data center short distance interconnects.

The product features of 800G QSFP-DD ACC are as follows:



Shows superior SI performance and excellent consistency in 44GHz network splitting.



- Tested on an 800G network tester with KP4-FEC enabled, it meets the IEEE Auto-Negotiation and Link Training requirements, with a Post-FEC BER < 1E-15 and an FEC margin of more than 27%. The entire process FEC Frame Loss Ratio is 0.
- The product adopts a Re-Driver scheme, with the power consumption of about 2.5W and the latency less than 20ns. Balance and signal-to-noise ratio balance are crucial, and the power consumption and delay are far superior to the Re-Timer scheme.
- Utilizing innovative production technology ensures good reliability, and the 800G QSFP-DD ACC 26AWG 4m weighs only about 600g.



## Price Inquiry

Currently, GIGALIGHT has already released a variety of 400G/800G PCC/AOC/optical modules, and the ordering information is as follows. Feel free to inquire!

P/N	Description
GQS-PC401-xxC	400G QSFP112 PCC, 1m (30AWG) /2m (26AWG)
GQS-PC801-xxC	800G QSFP112-DD PCC, 1m (30AWG) /2m (26AWG)
GOS-PC801-DXXC	800G OSFP PCC, 0.5m/1m (30AWG) /2m (26/25AWG)
GQD-AC801-DXXC	800G QSFP-DD ACC, 5m
GQS-MDO401-xxxC	400G QSFP112 AOC, 60m (OM3) /100m (OM4)
GQS-MPO401-SR4C	400G QSFP112 SR4 Optical Modules, MPO-12 APC, 850nm, 60m (OM3) /100m (OM4)
GQS-MPO401-VR4C	400G QSFP112 VR4 Optical Modules, MPO-12 APC, 850nm, 30m (OM3) / 50m (OM4)
GOP-MDO401-xxxC	400G OSFP-RHS AOC, 60m (OM3) /100m (OM4)
GOP-MPO401-SR4C	400G OSFP-RHS SR4 Optical Modules, MPO-12 APC, 850nm, 60m (OM3) /100m (OM4) , OSFP-RHS, Flat Top
GOP-MPO401-VR4C	400G OSFP-RHS VR4 Optical Modules, MPO-12 APC, 850nm, 30m (OM3) / 50m (OM4) , OSFP-RHS, Flat Top
GOS-MDO801-xxxC	800G OSFP AOC, 60m (OM3) /100m (OM4)
GOS-MPO801-SR8C	800G OSFP112 SR8 Optical Modules, dual MPO-12 APC, 850nm, 60m (OM3) /100m (OM4) , Finned Top, Pull tab
GOS-MPO801-VR8C	800G OSFP112 VR8 Optical Modules, dual MPO-12 APC, 850nm, 30m (OM3) / 50m (OM4) , Finned Top, Pull tab
GQD-MDO801-xxxC	800G QSFP-DD AOC, 60m (OM3) /100m (OM4)
GQD-MPO801-SR8C	800G QSFP-DD SR8 Optical Modules, MPO-16 APC, 850nm, 60m (OM3) /100m (OM4)
GQD-MPO801-VR8C	800G QSFP-DD VR8 Optical Modules, MPO-16 APC, 850nm, 30m (OM3) / 50m (OM4)

In December, GIGALIGHT will release the **400G QSFP-DD SR4/AOC** (8x50G PAM4/4x100G PAM4). Stay tuned and feel free to inquire!



**Open Optical Network Device Explore**

For any needs, please contact [sales@gigalight.com](mailto:sales@gigalight.com). Thanks!

<https://www.gigalight.com/>