

Article Overview

PAM4 active optical modules are experiencing strong growth, driven by 400G/800G Ethernet and AI infrastructure deployments, with major suppliers including Marvell, Broadcom, MaxLinear, MACOM, and NOEIC.

Market Overview

The global market for PAM4 optical DSPs and active optical modules is expanding rapidly due to increasing demand for high-speed data center connectivity and AI infrastructure. In 2024, hyperscalers' investments in AI drove significant growth in 400G and 800G Ethernet transceiver shipments, which directly increased demand for PAM4 chipsets, including DSPs, drivers, and TIAs . The market is projected to grow from around \$3.5 billion in 2024 to over \$11 billion by 2030, with a CAGR of approximately 17% .

Key Applications

PAM4 modules are primarily used in:

- o Ethernet transceivers for 400G, 800G, and 1.6T speeds
 - o Dense Wavelength Division Multiplexing (DWDM) for 400ZR/ZR+ and 800ZR modules
 - o Active Optical Cables (AOCs) and Active Electrical Cables (AECs)
 - o On-board retimers between switch ASICs and pluggable ports
- The growth is fueled by cloud providers like Amazon, Meta, and Chinese hyperscalers, which are deploying high-speed Ethernet modules to support AI workloads .

Leading Suppliers

The major companies supplying PAM4 active optical modules and DSPs include:

- o Marvell
 - o Broadcom
 - o MaxLinear
 - o MACOM
 - o NOEIC
- Credo These vendors dominate the market, with the top five accounting for a significant portion of revenue . Other players like Huawei, ZTE, Ciena, Fujitsu, Infinera, and Nokia are also active in developing high-speed PAM4 and coherent DSP solutions .



Direct Sales of PAM4 Active Optical Modules

Regional Market Insights

- o North America: Strong adoption in hyperscale data centers; projected growth continues through 2032 .
- o Asia-Pacific: Rapid expansion due to Chinese cloud providers; significant investments in AI infrastructure .
- o Europe: Moderate growth, primarily in telecom and enterprise networks .

Sales Trends and Forecast

- o Historical sales: First PAM4 DSP sales began in 2017-2018, with a boost from 400G Ethernet deployments in 2021-2022 .
- o Forecast: IC chipset sales for PAM4 modules are expected to grow from \$2.6 billion in 2022 to nearly \$7 billion by 2028, with Ethernet and DWDM accounting for the majority .
- o Future outlook: Deployments of 800G and 1.6T Ethernet transceivers will continue to drive growth, with coherent DSP shipments projected to exceed 5 million units by 2030 .

Market Drivers

- o AI infrastructure expansion: Increasing optical content per AI dollar spent, driving higher demand for PAM4 modules .
- o High-speed Ethernet adoption: 400G, 800G, and 1.6T transceivers require PAM4 modulation for efficient data transmission .
- o Cloud and hyperscaler investments: North American and Chinese cloud providers are major buyers, influencing global sales trends . In summary, direct sales of PAM4 active optical modules are robust and growing, with strong demand from hyperscale data centers, AI infrastructure, and high-speed Ethernet deployments. Leading suppliers dominate the market, and regional growth is particularly strong in North America and Asia-Pacific, with continued expansion expected through 2030.

Credo's low-power optical DSPs enable 50G 1.6T PAM4 transceivers and active optical cables for cloud-scale data centers and AI

Several Chinese companies are starting to offer PAM4 DSPs now and some of them may develop coherent DSPs in

LightCounting's latest report, Vendors and Markets for Optics in China, finds that while Chinese manufacturers of optical components

MaxLinear announces 5nm CMOS PAM4 DSP with integrated VCSEL drivers for 800G and 400G Multimode short



Direct Sales of PAM4 Active Optical Modules

High-capacity optical modules with integrated PAM4 DSPs support data center scalability. AI-enabled DSPs facilitate

For the PAM4 signal generator, it can provide excellent signal integrity because there is no external various passive or

Industry leaders including Broadcom Inc., Cisco Systems, Inc., and InnoLight Technology Corporation are rapidly

400G PAM4 QSFP-DD Straight Throughs and Breakouts Regional Availability -- Global Siemon's 50G per lane PAM4 Ethernet

Deployments of 800G and 1.6T Ethernet transceivers will drive growth in sales of PAM4 DSP chipsets in 2023-2028. Active optical

Sales of these modules will return the merchant market for coherent DSPs back to growth in 2020-2024. This market

Chapter 2: Provides a detailed analysis of the competitive landscape for PAM4 Optical Transceiver manufacturers, including prices,

Live demonstrations of the 800G 4x226.8G PAM4 FR4/LR4 QSFP-DD optical modules will be conducted during the

Sales of such devices in 2020 continued a pattern of steady growth (see chart above), LightCounting reports. PAM4 DSPs for

The highly integrated Telluride PAM4 DSPs offer superior overall performance, power, and cost enabling Centera's

The market for IC chipsets for optical communications is forecast to grow from 2025 through 2030 at a CAGR of 17%,

JPC Connectivity's new 800G active electrical cables will be powered by MaxLinear's 5nm PAM4 DSPs, which

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