

光学收发机：光电共封装技术和中国参与者正在支持这一增长¹

概要：

- 市场预测：
2026 年预计光学收发机市场产生的收入会以 14% 的 2021-2026 年 CAGR²，将达到 209 亿美元。
这种增长是由高效数据传送率模块的采用，big cloud 服务及国家电信运营商来驱动
- 技术趋势：
今日的光学收发器使用了三种物质平台：GaAs³，InP⁴ 和 SiPh⁵..
技术与其他通信方案链接着并共同形成了生态系统。
今日的课题是增加数据处理量的同时缩小尺寸以及降低电力的消耗。
- 供应链：
生态系统可能会完全改变。
COVID-19 给全世界的光学制造带来了影响：中国和其他亚洲国家，欧洲和北美 fabs...
美国与中国：在过去的 3 年里，光学收发器行业在中国增长了 24%，而美国只有 1%。

“在过去的 50 年里，每隔十年推出了移动技术创新”。[Yole Développement \(Yole\)](#) 的半导体照明技术及市场分析家 **Martin Vallo** 博士断言。他补充到：“移动宽带要求从语音通话和短信进化到了 UHD⁶ 视频和各种 AR/VR⁷ 应用程序。虽然 COVID-19 对电信基础设施供应链造成了极大影响，但全球的消费者和商业用户继续为网络和云服务创造新的需求。社交网络，商务会议，UHD 视频流，电子商务和游戏将持续推动应用程序的增长”。

¹ Extracted from: 摘取

Optical Transceivers for Datacom & Telecom Market 2021 report, Yole Développement, 2021
InnoLight's 400G QSFP-DD Optical Transceiver report, System Plus Consulting, 2021

² CAGR: Compound Annual Growth Rate 复合年增长率

³ GaAs: Gallium Arsenide 砷化镓

⁴ InP: Indium Phosphide 磷化铟

⁵ SiPh: Silicon Photonics 硅光子

⁶ UHD: Ultra-High-Definition 超高清

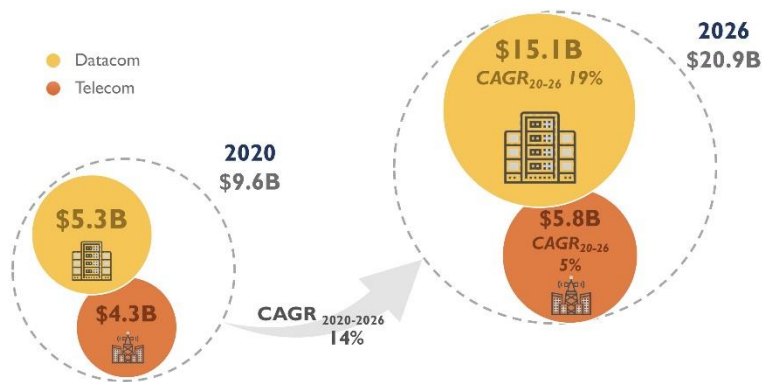
⁷ AR/VR: Augmented Reality/Virtual Reality 增强现实/虚拟现实

在这种情况下，Yole 深度调查了核心技术和相关市场，并指出最新的创新和强调了商机。

今日发布的 [Datacom & Telecom Market 2021 光学收发器报告](#) 有助于了解光纤通信的全球景观和在这个领域适合新人的技术分类。本研究还研究了应用程序的环境和相关技术，并仔细说明了 2017 年到 2026 年的数据通信和通信领域的光学收发器市场的前景。

2020-2026 optical transceiver revenue growth forecast by market segment

(Source: Optical Transceivers for Datacom & Telecom Market 2021 report, Yole Développement, 2021)



正如 Yole 团队分析的新 [Datacom & Telecom Market 2021 光学收发器报告](#)，每户以及每人的平均互联网设备数量正在增加。随着提升机能和智能的新型数字设备的出现，分析家们每年都在观察更高的采用率。如同智能电表，视频监控，医疗监控，链接的驱动器和自动化物流等这些机器与机器的应用程序的扩展能给设备和链接的增长带来巨大的贡献，并推动数据中心基础设施的扩展。

2020 年，光学收发器市场产生的收入达到了约 96 亿美元，预计 2026 年将会以 14% 的 CAGR 2020-2026，达到 209 亿美元。这一增长是因为 big cloud 服务运营商和电信运营商为了扩大光纤网络容量，采用了大量的 100G 以上的高速数据模组。

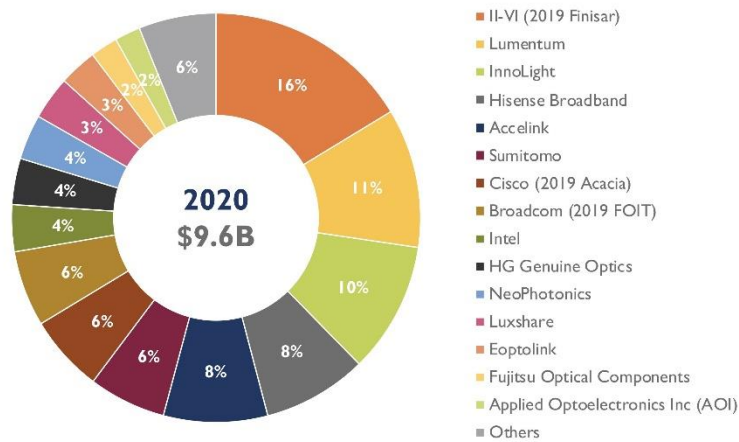
多种技术的演变，使长途及城域网以及数据中心基础设施的传送速度达到了 400G, 600G, 800G。

400GbE 的部署随着数据中心网络的上升逐步增加中。许多 Cloud 提供商和电信运营商为了扩大带宽容量并对应逐渐增加的数据需求，正在寻找 800Gbps 光学生态系统。800G 光学模组可以支持 2x 400GbE, 4x 200GbE 或 8x 100GbE 等更多的配置。

今天的以太网交换机 ASICs⁸ 以 50G PAM-4 调制技术驱动的 50Gbps lane 速度运行. 线卡中将 PAM-4 数据从开关同步到光学接口时通常需要 retimer. 在 400G 光学模组中为了连接到 100G 光学器件上, 可使用额外的硅齿轮箱芯片将 50GPAM-4 电气的功率 I/Os⁹ 转换成 100G. 根据应用程序和传输范围,400G 可提供 400G SR4, 400G DR4, 400G FR4 和 400G LR4 等各种光学接口.

2020 optical transceiver market shares

(Source: Optical Transceivers for Datacom & Telecom Market 2021 report, Yole Développement, 2021)



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根据 Yole 的 **Solid-State 照明及 Display 事业部经理 Pars Mukish** 所说: “我们期待 800G 模组的高人气. 因为他们已适用在 400GbE 系统中证明的 100G 单波长光学, 因此在 QSFP-DD¹⁰ 和 OSFP¹¹ 上技术和成本方面可以有效的实施”.

目前的形状因子在支持 800G 以上容量时其所需的电气及光学密度和热方面的能力有限. 功耗是另一种挑战. 最大的贡献是 开关 ASIC 和光学模组间的电接口, 特别是 QSFP-DD 和 OSFP. 实现个别电气设备的电力分散及热管理正在成为后续可插拔光学器件的限制因素.

在这方面, 身为 Yole 合作伙伴的逆向工程及成本核算公司 **System Plus Consulting** 在 [InnoLight’s 400G QSFP-DD Optical Transceiver](#) 分析中提供了 InnoLight 的 TDP4CNT-N00 400Gb QSFP-DD 光学收发器的技术数据, 制造费用及售价的洞察力

⁸ ASIC: Application Specific Integrated Circuits 专用集成电路

⁹ I/O: Inputs and Outputs 输入和输出

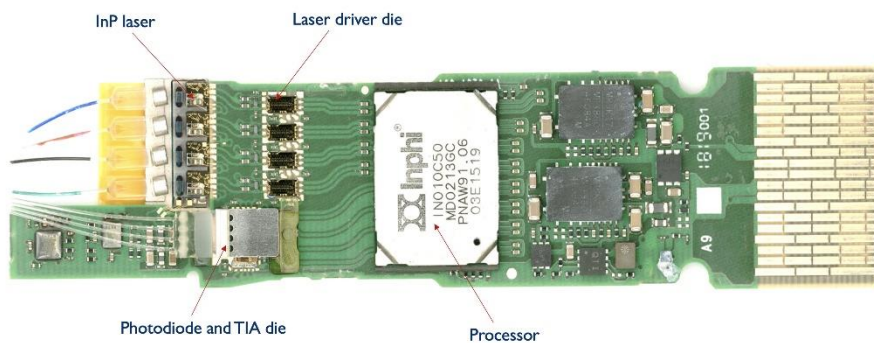
¹⁰ QSFP-DD: Quad Small Form-factor Double-density 双密度四通道小型可插拔

¹¹ OSFP: Octal Small Form-factor Pluggable 八进制小型系数可插拔

对于 **System Plus Consulting** 的首席技术及成本分析师 **Sylvain Hallereau**: “InnoLight 的 400G QSFP-DD 是市场上第一个 400G 光学收发器之一, 通过 PSM4 调制可在最长 2KM 内通讯. InnoLight 的处理手段基于 INO10C50 PAM4 DSP¹² 芯片组, 4 个 GaAs 激光驱动模组以及 TIA¹³ 模组. 而且都由 Inph 设计”.

Innolight 400G optical transceiver electronic board

(Source: InnoLight's 400G QSFP-DD Optical Transceiver report, System Plus Consulting, 2021)



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CPO¹⁴ 是将光学器件和开关 ASIC 一同提供且克服上述问题为目标的一种新的方法. 此外, CPO 技术被认为是整个生态系统的新部署模型, 也被认为是可插拔光学器件的替代品.

Yole Développement 和 System Plus Consulting 全年发布众多的报告和监控器. 此外, 专家还实现了各种关键演示文稿和组织关键会议.



在这方面, 请不要错过 2021 年 9 月 2 日, 在中国深圳和在线展开的光学收发器和第 4 届硅光子相关的 Yole Développement 和 CIOE 论坛. 将介绍:

- Yole Développement 的 Solid-State 照明部的技术及市场分析家 Martin Vallo
- Yole Développement 的 Solid-State 照明部的技术及市场分析家 Alexis Debray
- System Plus Consulting 的首席技术及成本分析家 Sylvain Hallereau
- SICOYA 的首席执行官 Sven Otte
- Shenzhen Gigalight Technology 的技术总监 Edison Huang
- Yuanjie Semiconductor Technology 的高级技术营销总监 Liangbo Wang

¹² DSP: Digital Signal Processor 数字信号处理器

¹³ TIA: Transimpedance Amplifier 跨阻抗放大器

¹⁴ CPO: Co-Packaged Optics 光电共封装技术

要与参与者讨论光学收发器技术的话，可以在[这里注册](#)。同时可以了解该行业的最新消息以及在 [i-Micronews](#) 上确认与相关领先企业的访谈和包含其他情报的我司活动。敬请关注！

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About our analysts

Martin Vallo, PhD serves as a Technology & Market Analyst specialized in solid-state lighting technologies, within the Photonics, Sensing & Display division at Yole Développement (Yole). With 9 years' experience within semiconductor technology, Martin is involved today in the development of technology & market reports as well as the production of custom consulting projects at Yole. Prior his mission at Yole, he worked at CEA (Grenoble, France), with a mission focused on the epitaxial growth of InGaN/GaN core-shell nanowire LEDs by MOCVD and their characterization for highly flexible photonic devices. Martin graduated from Academy of Sciences, Institute of Electrical Engineering (Slovakia) with an engineering degree in III-nitride semiconductors.

Pars Mukish serves as a Business Unit Manager, Solid-State Lighting (SSL) & Display at Yole Développement (Yole). Pars' mission is dedicated to the development of SSL and Display activities (ie laser diode, LED and OLED). Pars actively assists and supports the development of strategic projects, working with leading customers of the company. He manages the on-going expansion of technical and market expertise of the SSL & Display team. Prior to Yole, Pars has worked as Marketing Analyst and Techno-Economic Analyst for several years at the CEA (French Research Center). Pars holds a master's in Materials Science & Polymers (ITECH - France) and a master's in Innovation & Technology Management (EM Lyon - France).

With more than 25+ years' experience within the semiconductor industry, **Eric Mounier PhD**, is Director of Market Research at Yole Développement (Yole). Eric provides daily in-depth insights into current and future semiconductor trends, markets and innovative technologies (such as Quantum computing, Si photonics, new sensing technologies, new type of sensors ...). Based on relevant methodological expertise and a strong technological background, he works closely with all the teams at Yole to point out disruptive technologies and analyze and present business opportunities through technology & market reports and custom consulting projects. Previously, Eric held R&D and Marketing positions at CEA Leti (France). Eric Mounier has a PhD. in Semiconductor Engineering and a degree in Optoelectronics from the National Polytechnic Institute of Grenoble (France).

Sylvain Hallereau is Principal Technology & Cost Analyst at System Plus Consulting, part of Yole Développement (Yole). Working in close collaboration with the laboratory teams, Sylvain produces reverse engineering & costing reports while also contributing to custom projects, especially focused on solid-state lighting components, sensors, biotechnology devices, and ICs. In parallel, based on his significant technical and industrial knowledge, Sylvain supports the development of the semiconductor device activities and the related team at System Plus Consulting. He also contributes to the strategies of this department. He holds a master's degree in Microelectronics from the University of Nantes (France).

About the reports

Optical Transceivers for Datacom & Telecom Market 2021

Growth in optics is driven by expanding datacom infrastructure and accelerating deployment by Chinese suppliers. – Performed by Yole Développement

Companies cited:

Acacia Communication, Accelink, Adtran, ADVA, Alibaba, Amazon Web services, Apple, Applied optoelectronics Inc (AOI), Arista, ATOP, Baidu, Broadcom, Broadex, ChampionONE, Ciena (Cyan), CIGtech, Cisco, ColorChip, Crealights, E.C.I. Networks, , Emcore, Eoptolink, Facebook, Fiberhome, Finisar (now II-VI), Foxconn Interconnect Technology (FOIT), Fujitsu Networks, Fujitsu Optical components, Gigalight, Google, HG Genuine Optics, Hisense Broadband, Huawei, Huawei, HUBER+SUHNER Cube Optics AG, IBM+Softlayer cloud services , II-VI, Infinera (Coriant, Transmode), InnoLight, Inphi, Intel, IPG Photonics (Menara Network), J.P. Morgan, Juniper Networks, Lumentum, Luxshare, Macom, Mellanox, Microsoft, and more...

InnoLight's 400G QSFP-DD Optical Transceiver

Deep analysis of the 400Gb optical transceiver from a leading Chinese company. – Performed by System Plus Consulting

Related reports:

- [Silicon Photonics 2021](#)
- [Edge Emitting Lasers – Technology and Market Trends 2021](#)
- [VCSELs – Market and Technology Trends 2020](#)
- [Intel Silicon Photonic 100G PSM4 QFSP28 Transceiver](#)
- [Intel Silicon Photonic 100G CWDM4 QFSP28 Transceiver](#)

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Founded in 1998, Yole Développement (Yole) has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services, reverse engineering and reverse costing services and well as IP and patent analysis. With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole group of companies has expanded to include more than 80 collaborators worldwide... [More](#)

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System Plus Consulting specializes in the cost analysis of electronics, from semiconductor devices to electronic systems. Created more than 20 years ago, System Plus Consulting has developed a complete range of services, costing tools and reports to deliver in-depth production cost studies and estimate the objective selling price of a product... [More](#)

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