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EXPLOSIVE AI GROWTH DRIVING DEMAND FOR OPTICAL INTERCONNECTS AND ADVANCING LASER CHIP INDUSTRY DEVELOPMENT

Since the beginning of the 21st century, the development of cloud computing has promoted the expansion of data center scale, and the computing market has entered a stage of rapid development. In 2022, the emergence of large language models marked a milestone event, ushering in a new wave of computing revolution driven by AI. The demand for training and inference computing power has increased geometrically, driving the rapid expansion of high-performance, ultra-large-scale computing clusters and leading to explosive growth in AI infrastructure investment. The total global AI capital expenditure ("**CAPEX**") is expected to reach an aggregate of US$4.7 trillion from 2026 to 2030, representing more than five times that of the preceding five years. Such investments are primarily concentrated in AI infrastructure, including computing, transmission and storage scenarios.

In the transmission segment, in order to maximize the performance of computing clusters, the demand for high-speed, low-latency data transmission capabilities continues to increase. Compared with traditional copper-cable-based connections, optical interconnect solutions offer higher bandwidth, lower transmission loss and effective immunity to electromagnetic interference, and have thus become a key technological pathway for supporting computing cluster interconnection and can effectively meet the new-generation AI data center requirements for large-scale, high-speed and high-reliable interconnection. In 2025, the global optical interconnects market accounted for approximately 5% of global AI CAPEX, and such proportion is expected to continue to increase in the future, with the growth rate of the global optical interconnects market exceeding the overall growth rate of AI CAPEX.

Laser chips, as the generators of optical signals, are indispensable components of optical interconnect products. As optical interconnect products continue to iterate and upgrade toward higher data rates, and with the emergence of next-generation optical interconnect products and technologies such as silicon photonics ("**SiPh**") and CPO, performance requirements for laser chips in terms of data rate, power and other specifications continue to increase, underscoring the growing importance of laser chips. The laser chip market is currently characterized by overall supply-demand imbalance, which is particularly evident in the laser chips used for high-speed optical interconnect products where only a limited number of manufacturers possess stable supply capabilities.

OVERVIEW OF LASER CHIP INDUSTRY

Definition of Laser Chip

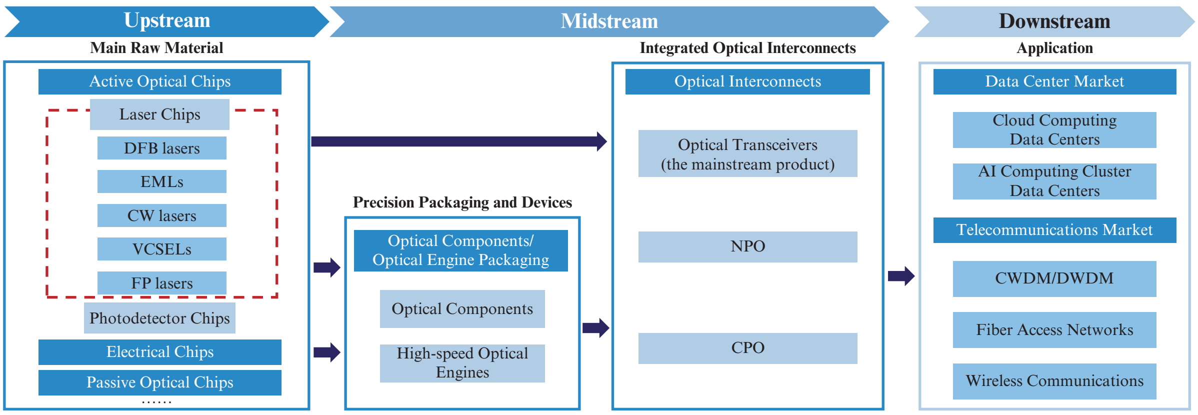
Optical chips are the most critical components for enabling the conversion between optical and electrical energy carriers and are widely applied in optical interconnects. They are primarily categorized into laser chips and photodetector chips. Among them, laser chips are active semiconductor devices that convert electrical energy into high-power, highly monochromatic light beams based on the principle of stimulated radiation. At the transmitting end of optical communications systems, laser chips serve as the critical light sources that carry information, making them indispensable and central to the field of optical chips.

Based on the modulation method, laser chips can be categorized into directly modulated lasers, integrated modulated lasers, and external modulation. From a material system perspective, laser chips are primarily divided into InP and GaAs. Additionally, based on their emission structure, they can be classified into surface-emitting and edge-emitting structures.

Industry Chain Positioning of Laser Chips in the Optical Interconnect Market

Laser chips are positioned at the upstream of the optical interconnect industry chain and represent the important segment with technological barriers and complex manufacturing processes within the entire industry chain. As the "heart" of optical communications systems, the performance of laser chips directly determines the transmission speed and energy efficiency of downstream optical components, optical transceivers and the overall optical communications systems.

Industry Chain Analysis of Optical Interconnect Market



Source: CIC

As the core carrier of optical communications systems, optical interconnect products exhibit materially different hardware cost structures (BOM) depending on the technological pathway adopted. Taking non SiPh-based optical transceivers as an example, their hardware cost structure primarily comprises four major components: optical chips, electrical chips, passive optical components, and PCB and mechanical parts. For SiPh-based optical interconnect products, the BOM structure undergoes structural reconfiguration. Discrete modulators and a substantial number of passive optical components are integrated into a single photonic integrated circuit (PIC), while PCB and mechanical parts are significantly simplified. In such cases, the BOM becomes concentrated on two core elements: the "SiPh chip" and the "laser". Whether utilizing the earlier-developed EML solutions or the emerging SiPh pathway, laser chips hold a critical position in the value chain, as they directly influence optoelectronic signal conversion and the quality of signal transmission.

Principal Types of Laser Chip Products

Laser chips, as core devices for optoelectronic conversion, are primarily categorized into five major types based on differences in material systems, physical structures and modulation mechanisms, namely DFB, EML, CW, VCSEL and FP, each possessing distinct technological advantages and application scenarios.

Type	Introduction	Major Application Scenarios
DFB *Mainstream data rate: 2.5GB/10GB/25GB/50GB*	Edge-emitting structure based on an InP substrate, incorporating an internal grating to achieve single-mode laser output. It features high wavelength stability, narrow linewidth and excellent extinction ratio. Its cost is higher than that of FP and VCSEL laser chips, and it serves as a core solution for mid- to low-speed long-distance optical communications.	5G fronthaul and midhaul core links, mid- to short-distance (2–10 km) interconnection within data centers, metropolitan area network access and aggregation layers, long-distance 10G links for industrial Ethernet, and as the core light-emitting unit of EMLs, among others.
EML *Mainstream data rate: 10GB/25GB/50GB/100GB/200GB*	Edge-emitting integrated structure based on an InP substrate, integrating a DFB laser (light emission) and an electro-absorption modulator (EAM, modulation) onto a single chip to achieve an integrated "emission + modulation" architecture. It features low chirp, high modulation rates and strong long-distance transmission capabilities. It serves as a core solution for high-speed and middle-to-long distance optical communications.	AI intelligent computing centers for 400G/800G/1.6T and above middle-to-long distance interconnection, east-west cross-campus links within data centers, 5G backhaul and core networks, fiber access networks, and interconnection of supercomputing center clusters, among others

Type	Introduction	Major Application Scenarios
CW *Mainstream power: 50mW/70mW/ 100mW*	A high-stability single-mode laser based on DFB architecture without an integrated modulation optical transceiver, providing continuous and stable laser output with low noise, high output power and excellent wavelength consistency. Based on an InP substrate, it serves as the core light source for SiPh and CPO external modulation architectures.	AI intelligent computing centers for 400G/800G/1.6T and above SiPh-based optical transceivers, and high-density packaged optical interconnects products such as NPO, CPO, among others.
VCSEL *Mainstream data rate: 25GB/50GB*	Surface-emitting structure based on a GaAs substrate. It features relatively simple manufacturing processes and low cost. The light emission direction is perpendicular to the chip surface, facilitating array integration. However, it is characterized by relatively short transmission distance, lower output power and limited high-speed modulation capability.	Consumer electronics 3D sensing (mobile phones, AR/VR), in-vehicle short-distance communication and LiDAR applications, as well as data centers, among others.
FP *Mainstream data rate: 2.5GB/10GB*	Edge-emitting structure based on InP or GaAs substrates. It features a simple structure and very low cost and is categorized as a multimode laser. However, it is characterized by relatively poor wavelength stability and a broad linewidth, with limited high-speed modulation and long-distance transmission capabilities.	Low-end 5G fronthaul links, broadcasting and television fiber-optic networks, broadband access in remote areas, and low-speed optical communications for traditional industrial control applications, among others.

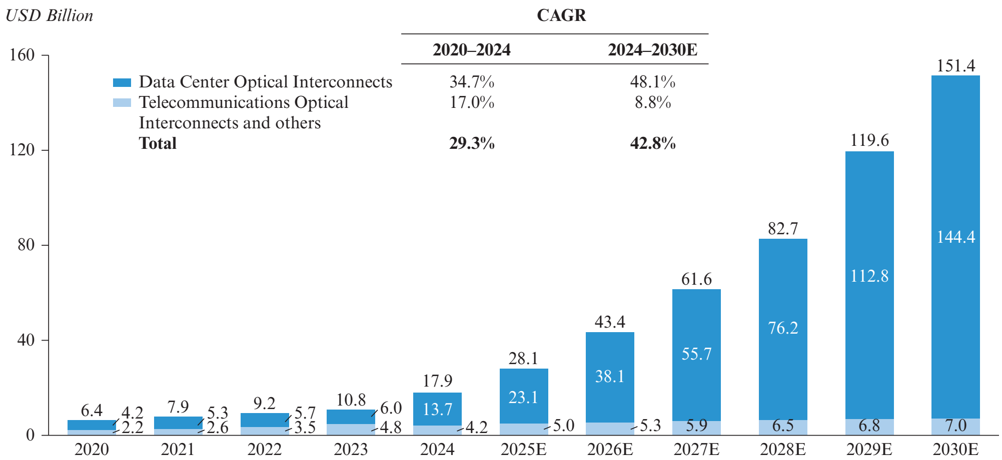
OVERVIEW OF OPTICAL INTERCONNECT MARKET

Optical interconnects utilize optical signals as the physical carrier for data transmission, with laser chips serving as the foundational core engine that provides the initial light source. The laser industry is highly correlated with the rapid expansion of the optical interconnect market. Currently, optical transceivers continue to dominate as the mainstream solution in optical interconnects.

Rapid Development of Key Application Scenarios in the Optical Interconnect Market Driving Demand for Laser Chips

The global optical interconnect market reached a market size of US$17.9 billion in 2024 and is expected to increase to US$151.4 billion in 2030, representing a CAGR of 42.8%. By application scenario, the optical interconnect market can be primarily categorized into data center optical interconnect market and telecommunications optical interconnect market. Growth in the data center optical interconnect segment represents the primary driving force. The global data center optical interconnect market was approximately US$13.7 billion in 2024 and is expected to reach US$144.4 billion in 2030, representing a CAGR of 48.1%.

Global Market Size of Optical Interconnect Industry, by Application Scenario, by Revenue, 2020–2030E



Source: LightCounting, Expert Interviews, CIC

Data Center Optical Interconnect Market — AI-Driven Demand Growth, Accelerated Product Iteration, and Evolving Data Center Network Architectures Driving Increasing Interconnection Density and Sustained Demand

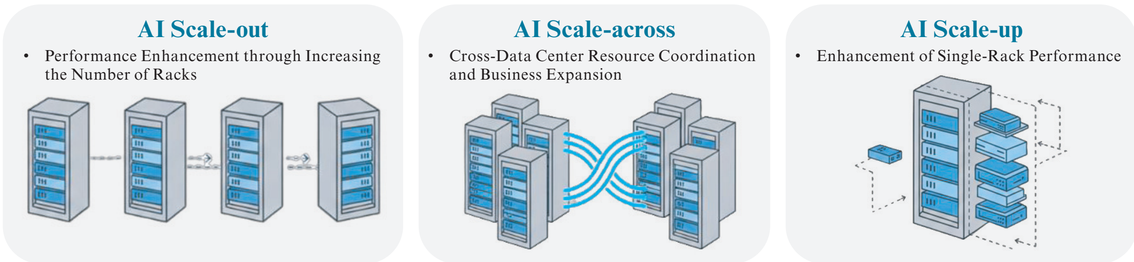
AI-Driven Growth — The demand for the training and inference of AI models is experiencing exponential growth. While the training and inference of AI models rely on highly interconnected clusters, thereby driving the development of the data center optical interconnects market. In addition to serving general-purpose data interconnection scenarios, optical interconnects play a more critical role in enabling increasing channels, high-bandwidth, low-latency data transmission for AI computing tasks, thereby facilitating interconnection across computing clusters and fully unlocking cluster performance potential.

Rapid Product Iteration Cycles — Driven by the rapid growth in traffic and computing power demand, optical interconnect products in the data center market exhibit relatively short iteration cycles in order to meet increasingly diversified and performance-intensive downstream requirements. The iteration cycle of optical interconnect products in the data center market has accelerated significantly in recent years. For example, in the case of optical transceivers, the interval between the mass production of 400G and 800G transceivers was approximately four years. However, the gap between the mass production of 800G and 1.6T transceivers has shortened to less than three years, highlighting the rapid pace of technological advancements in the industry.

Evolution of Network Architectures — The rapid proliferation of machine learning and AI is fundamentally reshaping data center architectures, substantially increasing demand for optical interconnects across all network layers. The network topology of data centers has evolved from traditional three-tier hierarchical architectures characterized by bandwidth convergence toward high-bandwidth, non-blocking architectures represented by Fat-Tree designs. Such architectures aim to enhance communication efficiency and bandwidth utilization between any two nodes, eliminating bandwidth bottlenecks across nodes. The adoption of new network topologies has significantly increased the number of connections and overall interconnection density, resulting in exponential growth in demand for optical interconnects.

Evolution of Scalability Demand — In typical AI data center network architectures, optical interconnects are not only widely applied in traditional use cases, such as supporting external wide-area traffic access and transmission and serving as key front-end hubs connecting internet operator networks, metropolitan area networks and geographically distributed data centers, but also extend across multiple hierarchical layers within the data center network including scale-out, scale-across and scale-up.

Illustrative Diagram of Global Data Center Architecture



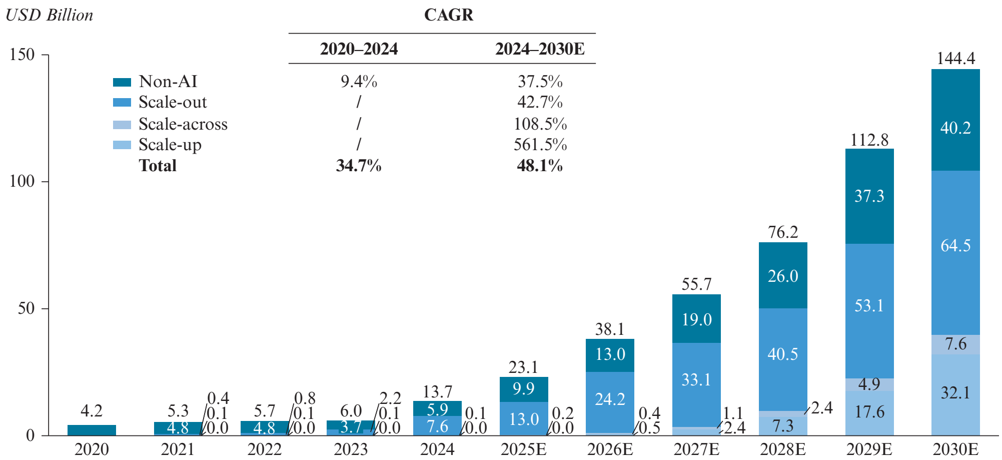
Source: CIC

- **Scale-out** refers to high-bandwidth connections between switches within a data center to enable high-speed data exchange between nodes. The emergence of large language models has led to a surge in computing power demand. Training of large language models generally requires massive computing power to process data concurrently, and the exponential growth in model parameters often exceeds the memory capacity of a single server. As a result, the computing power of a single server is no longer sufficient to independently support parallel training of large language models. With the maturation of distributed training technologies, collaboration among multiple AI servers has become feasible. The requirements for high bandwidth and low-latency data transmission have made intra-cluster optical interconnects (Scale-out) the mainstream approach for capacity expansion in AI data centers.

- **Scale-across** primarily refers to inter-data center interconnection scenarios. As AI enters the stage of globalized industrial application, two core demands have emerged: (i) globally distributed AI research and development teams jointly training ultra-large models; and (ii) global users' demand for low-latency access to AI inference services, which necessitates localized computing power deployment. With the advancement of cross-regional optical communications, remote data synchronization and computing power scheduling technologies, demand for Scale-across optical interconnect solutions that enable high-bandwidth, long-distance and highly reliable interconnection among multiple data centers continues to increase.

- **Scale-up** refers to interconnections between servers or between chips within a single node. Enhancement of a single server's performance represents the most direct method of improving computing capacity. At present, the mainstream interconnection method within a single server remains copper-based electrical. As computing density increases exponentially, demand for data exchange among chips, boards and servers within a single node or rack has grown substantially, especially the scaling of per-lane data rate. The traditional electrical interconnects are increasingly unable to meet such demands, thereby becoming bottlenecks in intra-node computing transmission. Short-distance optical interconnects within a single computing node (Scale-up) are expected to become a key area of development in the future, with the potential to reshape intra-node and intra-rack data interconnection architectures and to constitute a new application scenario generating significant incremental demand for optical interconnects.

Global Market Size of Data Center Optical Interconnect Market, by scaling use case, by Revenue, 2020–2030E



Source: LightCounting, Expert Interviews, CIC

Throughout the evolution of interconnection model requirements, laser chips, as indispensable foundational components of optical interconnects, are expected to benefit from the structural growth opportunities arising from the development of optical interconnect markets across different scaling use cases, thereby securing clear and sustainable growth potential.

Telecommunications Optical Interconnects Market — Demand Growth and Technological Evolution Supporting Stable Expansion of Optical Interconnects

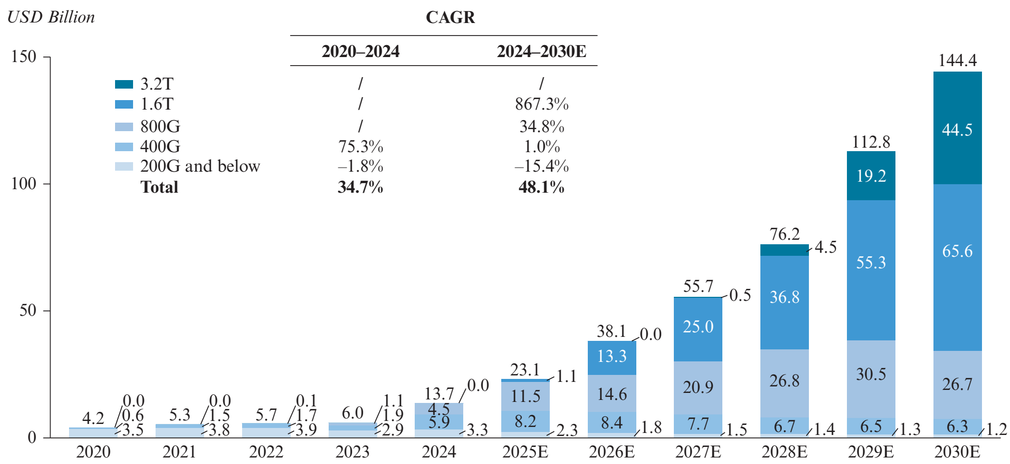
In the telecommunications sector, optical interconnects ensure high-speed interconnection across core networks, access networks and metropolitan area networks, thereby supporting the development of communications infrastructure and emerging services. Driven by network data rates and bandwidth upgrades, the proliferation of edge computing and ongoing technological evolution, the global telecommunications optical interconnects market has maintained steady growth and is expected to increase from US$4.2 billion in 2024 to US$7.0 billion in 2030, representing a CAGR of 8.8%.

The product iteration cycle of optical interconnects in the telecommunications market is closely aligned with the overall upgrade cycle of the telecommunications sector. The overall cycle is relatively long, typically ranging from approximately seven to ten years. However, it is also characterized by substantial upgrade volumes and continuous enhancement of product specifications, thereby providing laser chip enterprises with stable development opportunities.

Rising Transmission Rates of Optical Interconnects Products Driving New Performance Requirements and Structural Demand Shifts for Laser Chips

Driven by AI computing demand in the data center market, the optical interconnect market continues to undergo transformation, promoting iterative technological upgrades in optical interconnects. Such upgrades are primarily reflected in the continuous increase in transmission rates to meet the growing demand for higher data transmission efficiency. High-speed optical interconnects products with data rates of 400G and above holds a dominant position currently. As of 2025, 400G and 800G optical interconnect products have achieved comprehensive commercial deployment, with their combined sales volumes accounting for approximately 50% of total sales volume. 1.6T optical interconnects products have commenced mass production and shipment, while research and development of 3.2T optical interconnects products is rapidly advancing. It is expected that within the next five years, 1.6T optical interconnects products will become the mainstream specification, and 3.2T optical interconnects products will gradually achieve commercialization, thereby driving a new round of upgrades in optical interconnects transmission rates.

Global Market Size of Data Center Optical Interconnects, by Data Rates, by Revenue, 2020–2030E



Source: LightCounting, Expert Interviews, CIC

As the transmission rates of optical interconnects products continue to iterate and upgrade, both performance requirements and quantity demand for laser chips have increased correspondingly, thereby raising the value contribution of laser chips per unit of optical interconnects product. Taking the EML solution as an example, 400G optical transceiver typically adopt a '4-channel × 100G' architecture, requiring four 100G EMLs per transceiver. As products evolve to the 1.6T generation, they generally utilize an '8-channel × 200G' configuration, thereby necessitating eight 200G EMLs. Under the SiPh approach, a 400G optical transceiver typically requires only two 50mW or 70mW CW laser, while a 1.6T product requires four 70mW or 100mW CW laser.

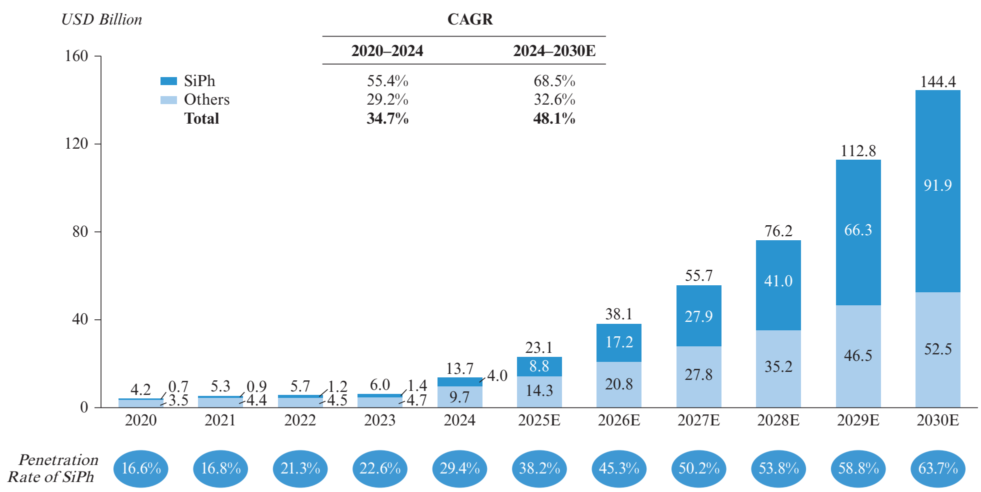
Continuous Innovation in Optical Interconnects Technological Pathways Reinforcing the Importance of Optical Links and Establishing a New Demand Paradigm for Laser Chips

As data center scale and computing interconnection demand continue to increase, market demand for optical interconnect technologies featuring low power consumption, high efficiency, high density, ease of integration and cost-effectiveness continues to rise, thereby driving the development of next-generation optical interconnect solutions, including SiPh technology, coherent optical communication technology, as well as next-generation optical interconnect integration technologies such as NPO and CPO.

SiPh Technology

Under the traditional technological pathway, optical interconnect products predominantly adopt laser chips based on III-V materials. Such materials demonstrate strong performance in light emission and high-speed signal modulation. However, their supply capacity is relatively constrained, making large-scale capacity expansion challenging and significantly increasing costs as transmission rates rise. In contrast, SiPh technology leverages mature silicon semiconductor processes to integrate electronic and photonic devices on a single silicon substrate, enabling optical interconnects products to achieve smaller form factors, lower power consumption and support for higher transmission rates. Currently, SiPh technology is widely adopted in data center optical interconnect market, particularly for high-speed optical interconnect products. In 2024, its penetration rate in the data center market reached 29.4%. Looking forward, with the continued iteration of SiPh technology and the evolution of optical interconnect products toward higher transmission rates, the penetration rate of SiPh technology in optical interconnects products in the data center market is expected to reach 63.7% in 2030.

Global Market Size of Data Center Optical Interconnects, by Technology, by Revenue, 2020–2030E



Source: LightCounting, Expert Interviews, CIC

Unlike products under the traditional technological pathway that rely on EMLs, SiPh-based interconnect products primarily depend on CW laser to provide stable and high-power continuous wave optical sources.

Coherent Optical Communication Technology

Coherent optical communication technology enhances transmission capacity and signal-to-noise ratio by precisely measuring the phase and amplitude of optical waves, enabling a single optical fiber to carry a greater volume of data. With the rapid growth of intra-data center interconnection rates and network scale, coherent optical communication technology is gradually extending from the application in long-distance backbone networks into high-density, high-speed interconnection scenarios over longer distances, including cross-room or cross-cluster interconnection (Scale-across). In the future, coherent optical communication technology is expected to play an important role in high-performance and scalable network architectures.

Next-Generation Optical Interconnect Solutions

At present, optical interconnects products are predominantly in the form of optical transceivers, which feature plug-and-play capability, optical transceiver-level maintenance, a mature ecosystem with strong compatibility, flexible deployment, controllable risk and adaptability to long-distance transmission. However, they also face limitations in terms of functionality, efficiency and bandwidth density. As demand for optical interconnects continues to rise, there is an increasing need for next-generation optical interconnect integration technologies.

Comparative Analysis of Optical Interconnect Solutions

Technological Form	Optical Transceivers	NPO	CPO
Electrical Link Length	150–250 mm	30–100 mm	<15mm
Whether DSP is Integrated	YES	NO	NO
Power Consumption	●	◔	◔
Ease of Maintenance	◕	◕	◔
Signal Latency	◕	◔	◔
Interconnection Density	◑	◕	◕

Note: ◔ → ● *indicates the relevant parameters from low to high.*

Source: CIC

Overall, the core of next-generation optical interconnect solutions lies in achieving enhanced electrical performance through high levels of integration, shortening electrical signal transmission distances, reducing power consumption and improving signal integrity. In this process, the increasing adoption of optical interconnects and the higher requirements for optical transmission efficiency drive rising demand for high-performance laser chips.

OVERVIEW OF LASER CHIP INDUSTRY

Development Background of the Laser Chip Industry

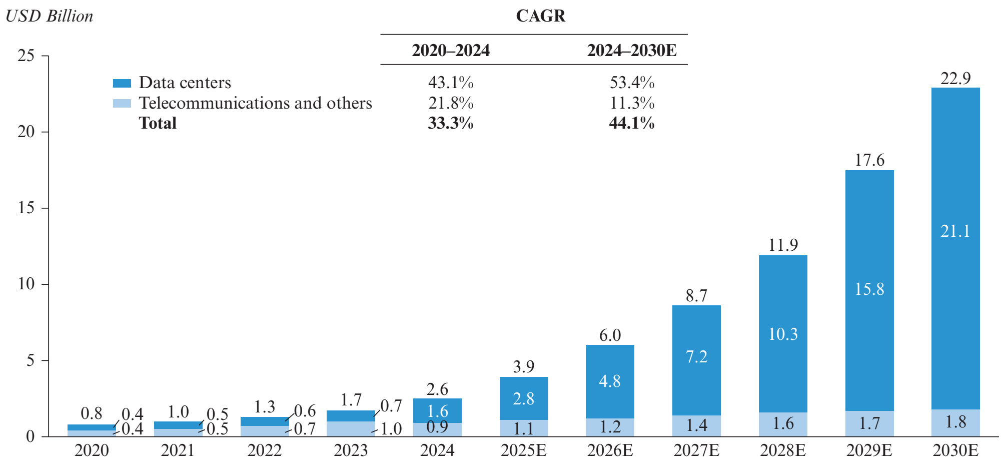
The laser chip industry has experienced significant growth, driven by favorable factors such as the explosive expansion of the optical interconnects market, the rapid adoption of emerging technologies like silicon photonics (SiPh) in optical interconnects, and the increasing demand from end customers for high-performance optical interconnect products. As indispensable core components of optical interconnect solutions, laser chips have directly benefited from these trends, fueling their accelerated development. In 2024, the global laser chip market reached a market size of US$2.6 billion and is expected to increase to US$22.9 billion in 2030, representing a CAGR of 44.1%.

The development of the laser chip industry is subject to objective constraints, including long capacity expansion cycles, high technological barriers and concentration of high-end production capacity, constraints on key materials and equipment in the short to medium term, and imbalances in the supply chain structure. As a result, the industry is unable to fully meet the rapidly growing downstream market demand, and the overall market is characterized by supply-demand imbalance. This imbalance is particularly evident in EMLs and CW lasers used for high-speed optical interconnects.

Major Application Scenarios of Laser Chips

Laser chips are primarily used in optical interconnect products, with their end-use application scenarios closely aligned to those of the optical interconnect solutions they enable. Based on different end-use application scenarios, the laser chip market can be categorized into the data center laser chip market and the telecommunications laser chip market. Among these, the data center laser chip market holds a dominant position, with a market size of US$1.6 billion in 2024, which is expected to increase to US$21.1 billion in 2030, representing a CAGR of 53.4%.

Global Market Size of Laser Chip, by Application, by Sales Revenue*, 2020–2030E



Source: LightCounting, Expert Interviews, CIC

Note: **Market size includes laser chips in both the external and internal sales market. The internal supply market refers to optical interconnects manufacturers that possess laser chip production capabilities and use such laser chips for internal consumption. The same definition applies hereinafter.*

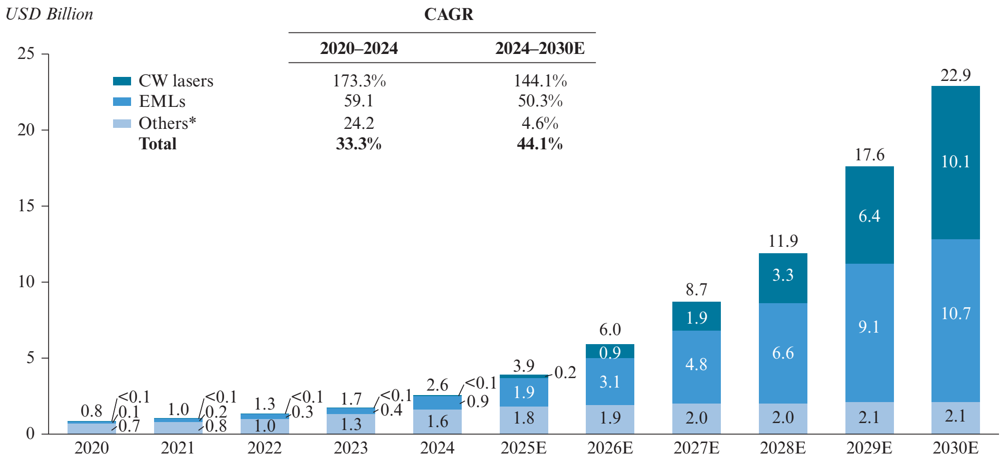
The data center laser chip and telecommunications laser chip markets exhibit differentiated technological landscapes. The data center laser chip market is characterized by a dual-driven technological landscape comprising EML and CW laser. EML, as an earlier-developed solution, is widely used in optical interconnect products for 400G and above. In recent years, SiPh-based solutions benefiting from the high level of integration and lower costs are emerging as the direction for high-speed evolution, requiring supporting high-power CW laser.

In telecommunications, edge-emitting laser chips continue to dominate, driven by their ability to meet stringent performance requirements. Specifically, DFB lasers are widely deployed in medium-to-short-reach scenarios such as 5G fronthaul and fiber access. Conversely, EMLs overcome chromatic dispersion limitations through their low chirp and high extinction ratio, thereby dominating long-haul, high-speed nodes such as backbone networks and high-speed fiber access.

EML and CW Lasers Dominate Market Share and Gain Increasing Strategic Importance

In 2024, the combined market size of EMLs and CW lasers amounted to US$970 million, representing approximately 38.1% of the total market. Looking forward, revenue from such products is expected to maintain a high growth rate, with their market share continuing to increase. In 2030, combined revenue is projected to reach US$20.80 billion, representing a CAGR of 66.6%, with market share expected to rise to 90.9%.

Global Market Size of Laser Chip, by Technology, by Revenue, 2020–2030E



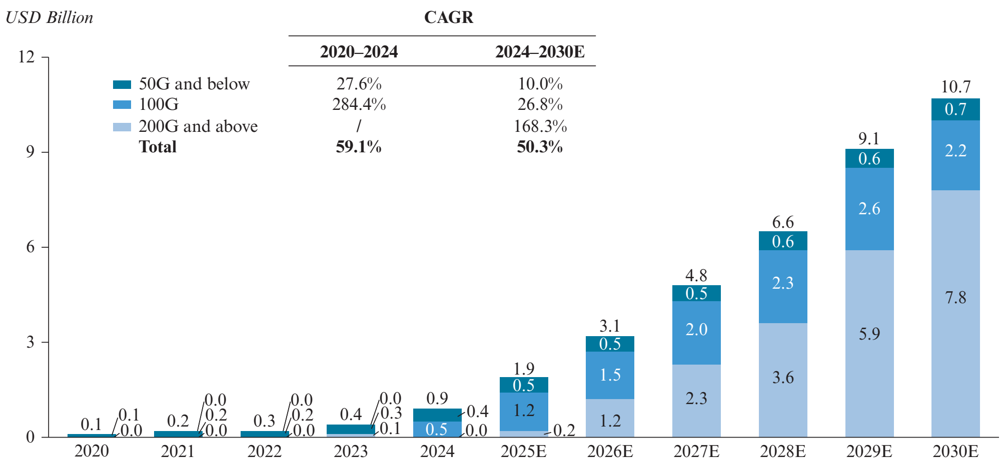
Source: LightCounting, Expert Interviews, CIC

Note: "Others" primarily includes the FP lasers, DFB lasers and VCSELs.

EMLs

EMLs are primarily categorized by data rates from lower to higher specifications, including 50G, 100G and 200G, and are principally adapted for optical interconnect products ranging from 100G to 1.6T. Currently, 100G EMLs dominate as the mainstream products, which are widely applied in high-speed optical interconnect products such as 400G and 800G optical transceivers. As 1.6T and higher-speed optical interconnects products are progressively commercialized, 200G EMLs, as the corresponding laser chip solution, are expected to experience rapid growth.

Global Market Size of EMLs, by Data Rates, by Revenue, 2020–2030E

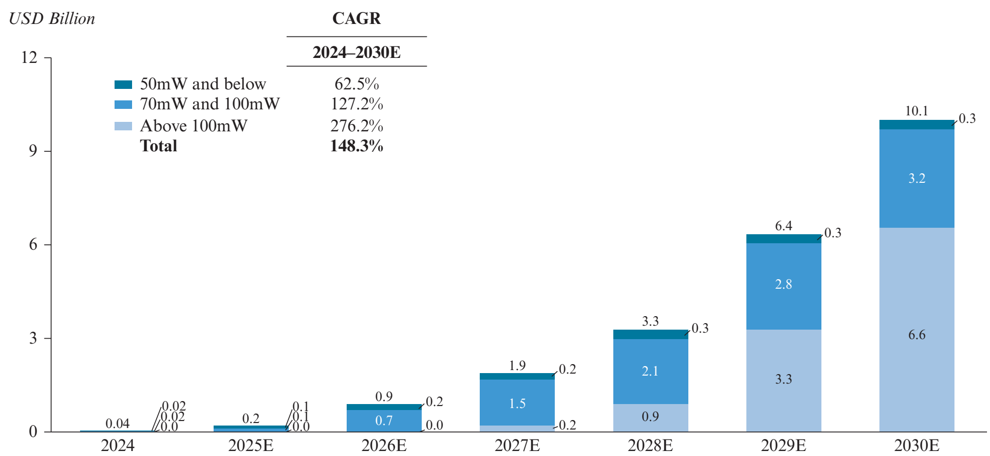


Source: LightCounting, Expert Interviews, CIC

CW lasers

The development of CW laser primarily benefits from the application of SiPh technology. Under SiPh-based solutions, CW laser serve as external or heterogeneously integrated light sources and operate in conjunction with SiPh-based modulators to enable optoelectronic signal conversion and modulation functions in SiPh-based optical interconnects products. In high-speed optical interconnects products, SiPh-based solutions and CW laser are widely adopted by virtue of their superior cost-performance advantages. In current mainstream SiPh-based high-speed optical interconnects products, including 400G, 800G and 1.6T, the principal CW laser adopted include power specifications of 50 mW, 70 mW and 100 mW. In addition, driven by the emerging technologies such as NPO and CPO, higher-power CW lasers, including 150mW, 300mW, and 400mW variant, are progressively being integrated into the commercialization of next-generation optical interconnect products. From 2025 to 2030, demand for CW laser with power specifications of above 100mW is expected to experience explosive growth. By 2030, the market size of CW lasers with power specifications of above 100mW is projected to reach US$6.6 billion, representing approximately 65.3% of the total market.

Global Market Size of CW Laser, by Power, by Revenue, 2024–2030E



Source: LightCounting, Expert Interviews, CIC

Key Drivers and Future Trends of the Laser Chip Industry

- **Sustained Increase in Demand with High-Speed Growth.** The development of AI training clusters has driven a surge in demand for computing power and high-speed data transmission, resulting in exponential growth in demand for downstream high-speed optical interconnects products. As core components of optical interconnects products, market demand for laser chips has correspondingly increased at a rapid pace.

- **Dual-Engine Growth Driven by EML and CW laser.** On the one hand, EMLs, with advantages in high bandwidth, low dispersion and long-distance transmission, have become the important solution for achieving single-wavelength rates of 100G/200G and are widely applied in high-speed optical transceivers of 400G, 800G and even 1.6T. On the other hand, under the emerging SiPh technological pathway, CW laser paired with SiPh modulators, by virtue of their high integration level, cost-reduction potential and compatibility with advanced architectures such as CPO, are gradually becoming key core components supporting next-generation optical interconnects products and ultra-high-speed data center networks.

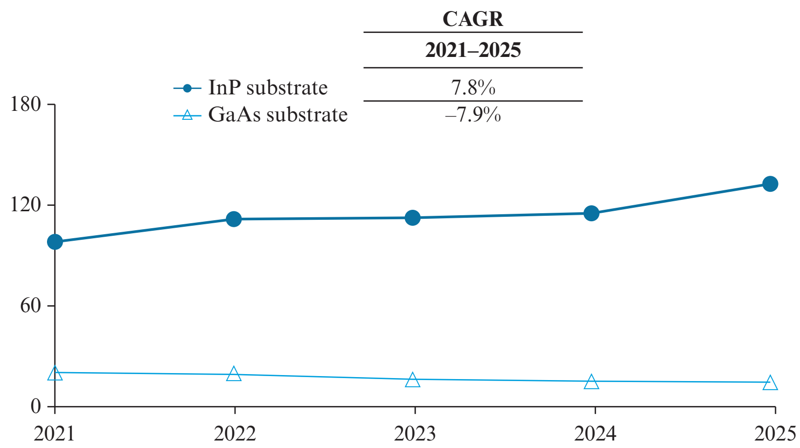
- **Evolution Toward Higher Performance with Continuous Increase in Unit Value.** As optical interconnects products continue to evolve toward higher rates and new integration technologies are explored and adopted, higher performance requirements are imposed on laser chips. Taking the EML solution as an example, higher transmission rates usually require higher performance and quantity of laser chips per optical interconnects product, thereby driving up the value contribution of laser chips per unit of optical interconnects product. Under the SiPh-based solution, although SiPh technology reduces the cost of the modulation component through CMOS processes, in order to drive higher-speed SiPh engines and effectively compensate for complex on-chip optical path losses, transceivers must be equipped with higher-power and higher monochromaticity CW laser as external light sources. In addition, as the industry evolves toward next-generation integration technologies such as NPO and CPO, demand for laser chips is expected to undergo fundamental transformation, and the value contribution of laser chips within overall hardware costs is expected to further increase.

- **Diversification of Supply Chain.** The AI-fueled expansion of global computing infrastructure imposes significant demands on the scale, stability, and timeliness of the supply chain, creating strategic opportunities for high-quality laser chip manufacturers. Crucially, manufacturers possessing advanced technological capabilities, including epitaxial growth, high-precision grating etching and etc., alongside the advantages in operational efficiency and agile responsiveness, can better meet the stringent requirements and join the core international supply chain, forming a diversified global supply networks and capturing significant international market share. In particular, an increasing number of laser chip manufacturers are implementing going-global strategies by locating production bases in proximity to downstream optical interconnects manufacturers or end customers, thereby building more resilient and diversified global supply chain networks.

Cost Structure of Laser Chips

The cost structure of laser chips primarily consists of manufacturing overhead, direct labor, and material costs. Material costs mainly comprise substrates, gold targets, specialty gases, and chemicals, typically contributing 10% to 20% of the total cost based on different products. Currently, the primary substrate materials for laser chips are InP and GaAs. Over the past few years, the price of InP has steadily increased due to rising raw material prices. In contrast, owing to its relatively simpler production process, the price of GaAs has gradually declined alongside process optimization and technological iteration.

Price Index of the Main Raw Material of Laser Chips, 2021–2025



Source: Annual Reports, SMM, CIC

COMPETITIVE LANDSCAPE OF GLOBAL LASER CHIP MARKET

Currently, the laser chip market is largely defined by a supply-demand imbalance. Aside from a small number of manufacturers that produce both laser chips and optical interconnect products — partially fulfilling their laser chip needs through internal supply — the majority of optical interconnect solution providers rely on external suppliers to meet their laser chip requirements.

Ranking of Global Laser Chip Market

In terms of revenue from external sales in 2025, the Company was the sixth-largest provider of laser chips globally and ranked first among PRC players, with a market share of 3.1%.

Ranking	Company	Sales Revenue[1] (RMB100 million)	Market Share
1	Company A	32.4	16.7%
2	Company B	28.1	14.5%
3	Company C	25.9	13.4%
4	Company D	25.7	13.3%
5	Company E	7.2	3.7%
6	**The Company**	**6.0**	**3.1%**
7	Company F	5.7	2.9%
8	Company G	5.0	2.6%
9	Company H	2.9	1.5%
10	Company I	1.7	0.9%
Total of Top 10		**140.7**	**72.7%**
Others		**52.8**	**27.3%**
Market Total		**193.5**	**100.0%**

Source: Expert Interviews, annual reports, CIC

Note:

(1) Sales revenue refers to revenue generated from external sales in the external sales market and excludes internal sales revenue in the captive supply market. The same definition applies hereinafter.

(2) Company A, founded in 2015 and headquartered in USA. It was listed on the NASDAQ Stock Market. It is a global provider of innovative optical and photonic products serving artificial intelligence, cloud and data center networking, telecommunications, industrial and 3D sensing markets.

Company B, founded in 1961 and headquartered in USA. It was listed on the NASDAQ Stock Market. It is a global technology leader that designs, develops and supplies semiconductor and infrastructure software solutions.

Company C, founded in 1921 and headquartered in Japan. It was listed on the Tokyo Stock Exchange. It is a diversified global electrical and electronics manufacturer operating across infrastructure systems, factory automation, building systems and semiconductor devices.

Company D, founded in 1897 and headquartered in Japan. It was listed on the Tokyo Stock Exchange. It operates as a diversified manufacturer of advanced materials and electronic products, covering environment and energy, information and communications, automotive, electronics and industrial materials.

Company E, founded in 1971 and headquartered in USA. It was listed on the New York Stock Exchange. It is a vertically integrated photonics technology platform serving data center, communications, industrial, electronics and instrumentation markets.

Company F, founded in 2004 and headquartered in Guangdong province, China. It is a private company, providing chips, components, transceivers and board-level solutions.

Company G, founded in 1950 and headquartered in USA. It was listed on the NASDAQ Stock Market. It designs and manufactures semiconductor products for RF, microwave, millimeter-wave and optical applications.

Company H, founded in 2018 and headquartered in Hubei province, China. It was quoted on the National Equities Exchange and Quotations (NEEQ). It specializes in the research, development and manufacturing of optical communication chips, including 10G/25G/50G laser and photodetector chips and related packaging products.

Company I, founded in 2016 and headquartered in Hubei province, China. It is a private company engaged in the research, development, manufacturing and sales of semiconductor optoelectronic chips.

Ranking of Global Laser Chip Market for High-Speed Optical Interconnect Products

Laser chips for high-speed optical interconnects products with data rates of 400G and above, include 100G and above EMLs, as well as CW lasers with output power of 50mW or above. In terms of revenue from external sales in 2025, the Company was the sixth-largest provider of laser chips applied in high-speed optical interconnect products globally and ranked first among PRC players, with a market share of 4.3%.

Ranking	Company	Sales Revenue (RMB100 million)	Market share
1	Company A	28.8	33.0%
2	Company D	20.0	23.0%
3	Company B	18.8	21.5%
4	Company C	7.0	8.0%
5	Company E	4.5	5.2%
6	**The Company**	**3.8**	**4.3%**
Total of Top 6		**82.9**	**94.9%**
Others		**4.4**	**5.1%**
Market total		**87.3**	**100.0%**

Source: Expert Interviews, annual reports, CIC

Ranking of Global Laser Chip Market for SiPh-based High-speed Optical Interconnect Products

CW lasers are primarily applied in SiPh-based high-speed optical interconnect products of 400G and above. In terms of revenue from external sales in 2025, the Company was the second-largest provider of laser chips applied in SiPh-based high-speed optical interconnect products globally and ranked first among PRC players, with a market share of 23.6%.

Ranking	Company	Sales Revenue (RMB100 million)	Market share
1	Company D	5.0	31.7%
2	**The Company**	**3.8**	**23.6%**
3	Company B	2.8	17.6%
4	Company A	1.8	11.1%
5	Company C	0.8	5.0%
Total of Top 5		**14.2**	**89.1%**
Others		**1.7**	**10.9%**
Market total		**15.9**	**100.0%**

Source: Expert Interviews, annual reports, CIC

Entry Barriers of Laser Chips Industry

- **Manufacturing Know-How.** The production of laser chips relies heavily on advanced core processes, such as epitaxial growth, high-precision grating etching, as well as complex designs for high-speed modulation. Given the scarcity of foundries equipped with full-process manufacturing capabilities, most laser chip suppliers should operate under an IDM model, which imposes stringent requirements on their ability to exert absolute control over the entire production cycle and accumulate deep industry know-how. Furthermore, the rapid upgrading and iteration of downstream optical interconnect products drive continuous technological upgrades at the chip level. Consequently, manufacturers shall possess the proprietary know-how to rapidly transition from R&D to mass production, continuously optimize process recipes, and maintain consistently high yield rates to ensure product reliability.

- **Customer Trust and Cooperation.** The optical interconnects market is characterized by exceptionally rigorous, time-consuming qualification processes and high switching costs imposed by top-tier optical interconnect solutions and cloud service providers, creating formidable barriers to entry for new competitors. However, for successfully integrated suppliers, these exact dynamics foster deeply entrenched, rarely altered relationships. By establishing long-term, trusted partnerships with industry leaders, laser chip manufacturers can achieve deep integration into the global supply chain and gain critical early visibility into evolving AI and data center architectures.

- **Research and Development Capabilities.** The optical interconnects industry is characterized by rapid technological iteration, which imposes exceptionally high requirements on the forward-looking strategic planning and systematic research and development capabilities of upstream laser chip manufacturers. Leading enterprises typically deploy early in the research and development of core technologies, to continuously meet the requirement of next-generation downstream products. Laser chip manufacturers possessing such systematic and forward-looking research and development capabilities are able not only to maintain a leading pace of technological advancement, but also to establish technological barriers that are difficult to replicate within the industry, thereby sustaining leadership in product performance and reliability.

- **Supply Chain Management Capabilities.** The dynamic nature of the optical interconnects market places extremely high demands on supply chain management and operational agility. Manufacturers are required to demonstrate the capability to flexibly expand capacity, optimize resource utilization, and meet strict customer delivery schedules. A mature and resilient supply chain system is critical for mitigating risks associated with rapid market iterations and volatile order fluctuations. By building a robust supply network and maintaining capacity stability, laser chip manufacturers can achieve economies of scale, fulfill stringent delivery requirements, and maintain a sustainable cost advantage in a highly competitive global market.

SOURCES AND RELIABILITY

We commissioned CIC to conduct an analysis and report on the global laser chip market. CIC is a market research and consulting firm founded in Hong Kong, engaged in providing professional consulting services across various industries. We have agreed to pay CIC a fee of RMB0.45 million for the preparation of the CIC Report. The data cited in this section, as well as in the "Summary," "Risk Factors," "Business," "Financial Information" and other sections of this document, are provided to enable potential [REDACTED] to gain a more comprehensive understanding of the industries in which we operate. Unless otherwise stated, all data and forecasts contained in this section are derived from the CIC Report. The data collected by CIC have been analyzed, assessed and validated using CIC's in-house analysis models and techniques. Primary research was conducted through interviews with key industry experts and leading industry participants. Secondary research involves analyzing data from public data sources. The market forecast in the CIC Report is based on the following key assumptions: (i) during the forecast period, the overall social, economic and political environment in the world and China is expected to remain stable; (ii) during the forecast period, relevant key industry drivers may continue to drive the growth of the global laser chip market, such as increasing downstream demand, technological advancements, policy support, etc.; and (iii) during the forecast period, there will be no extreme force majeure or unforeseen industry regulations that may have a drastic or fundamental impact on the market.