



Global Direct-Writing Lithography Equipment Industry Report

Executive Summary

This report analyzes the global direct-writing lithography equipment market. Benefiting from industrial upgrading, technological iteration and policy support, the industry will sustain rapid growth across PCB and semiconductor segments, with high interdisciplinary R&D requirements forming key entry barriers.

Table of Contents

1. Market Overview

1.1 Market Definition

1.2 Market Size

2. Key Growth Drivers

2.1 Key Drivers

2.2 Sub-market Analysis: PCB Direct Imaging Equipment

2.3 Sub-market Analysis: Semiconductor-Related Applications

2.4 Entry Barriers and Key Success Factors

2.5 Future Outlook

1. Market Overview

1.1 Market Definition

Micro-nano manufacturing relies on lithography to transfer microscale fine patterns onto substrates. Lithography falls into two main branches: mask-based lithography, which adopts physical photomasks, and maskless direct-writing lithography, which realizes substrate exposure through direct beam irradiation.

The inherent unique technical features of direct-writing lithography grant it distinctive strengths for industrialization and generate practical value for relevant downstream industries. Its core advantages include: strong compatibility, high flexibility, shortened process chain, digitalization, energy saving and emission reduction.

1.2 Market Size

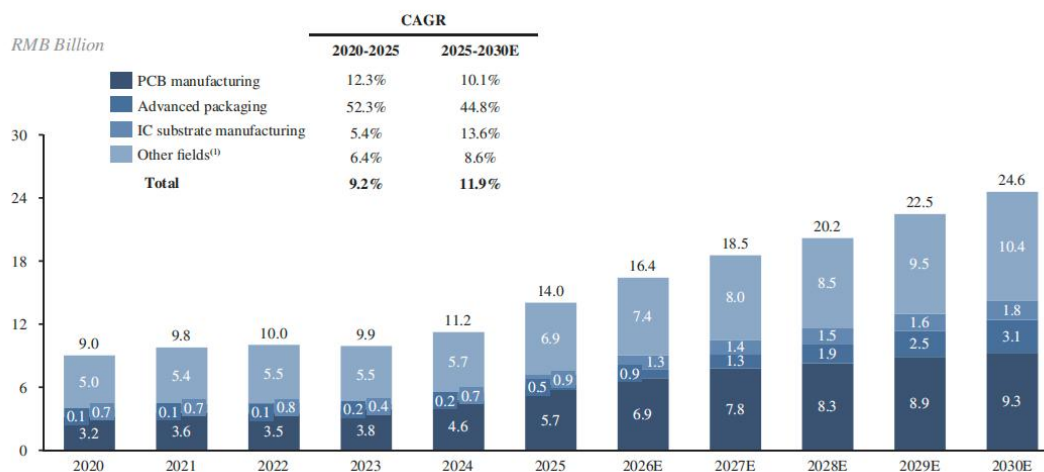
The global market size of direct-writing lithography equipment is projected to increase from approximately RMB14.0 billion in 2025 to RMB24.6 billion in 2030 (11.9% CAGR).

Since 2025, explosive growth in AI infrastructure has spiked demand for high-performance PCBs in AI servers and data centers, evidenced by global Cloud Service Provider capital expenditure exceeding

USD400 billion in 2025 and forecasted to top USD600 billion in 2026.

To meet this end-market surge, PCB manufacturers are aggressively accelerating capacity expansion and equipment procurement. Given the typical one-to-three-year factory construction and ramping cycle, these procurement activities are highly concentrated between 2025 and 2027, fueling a rapid 19.3% CAGR for the global PCB direct imaging equipment market from 2024 to 2027 before moderating to a steady expansion pace from 2028 onward.

Market Size of Global Direct-Writing Lithography Equipment Industry, in terms of Sales Revenue, 2020-2030E



Note: Other application fields include mask making, FPD, photovoltaic cells, MEMS, and power semiconductor devices.

Source: SEMI, IEA, Prismark, Yole, CIC Reports

2. Key Growth Drivers

2.1 Key Drivers

Industrial Upgrade

Rapid market expansion is expected across key sectors, including global AI industry expenditure, the AI server market, new energy passenger vehicles, and the robotics industry. The continuous evolution and upgrading of these high-tech sectors demand higher volume and performance from micro-nano devices, ensuring that lithography equipment—the core manufacturing technology for these components—will steadily benefit from this global industrial momentum.

Application Boundaries Expanded by Technological Iteration

The maturation of key technologies like multi-beam parallel writing, deep-ultraviolet light sources, and AI-based real-time pattern correction is significantly enhancing the efficiency and linewidth capabilities of direct-writing lithography. These advancements expand its application boundaries beyond the PCB industry into advanced packaging, IC substrates, and other semiconductor domains, unlocking substantial new market opportunities for

direct-writing lithography equipment.

New Materials and Processes in Micro-Nano Manufacturing

The adoption of new processes and materials like mSAP, PLP, 2.5D/3D packaging, and glass substrates introduces manufacturing challenges in substrate sizes, warpage, and multilayer alignment. Thanks to its superior material and size compatibility, combined with its mask-less operation, direct-writing lithography technology is uniquely positioned to overcome these challenges and meet the requirements of these advanced materials and processes.

Policy Support and Industry Shift Trends

Robust government policies, national investment funds, and equipment renewal initiatives provide strong regulatory and financial support for core technologies like lithography systems while driving digital and intelligent upgrading. Concurrently, the global migration of the PCB and semiconductor industries to the Chinese Mainland and Southeast Asia is advancing the regional industrial chain and accelerating market demand for manufacturing equipment.

2.2 Sub-market Analysis: PCB Direct Imaging Equipment

The growing global PCB market is undergoing a structural capacity

shift toward the Chinese Mainland and Southeast Asia, driven by product miniaturization and high performance. Driven by this momentum, the overall PCB market is projected to grow from RMB510.5 billion in 2025 to RMB730.5 billion in 2030 (7.4% CAGR), with the high-end segment expanding faster from RMB224.1 billion to RMB355.7 billion (9.7% CAGR). As demand for PCB direct-imaging equipment is tied to downstream capital expenditure, this regional migration and capacity expansion will continuously drive growth for equipment suppliers.

PCB direct imaging equipment is essential for the exposure process in PCB manufacturing. As electronic products advance toward intelligence and miniaturization, PCBs require finer line widths and higher precision. Thanks to its superior pattern resolution and alignment accuracy, mask-free, data-driven direct imaging technology has become the mainstream solution for high-end PCBs. This growing demand for high-density, high-precision integrated PCBs is driving market expansion, with the global market size forecast to rise from RMB5.7 billion in 2025 to RMB9.3 billion in 2030 (10.1% CAGR).

2.3 Sub-market Analysis: Semiconductor-Related

Applications

Direct-writing lithography equipment holds broad application potential across key semiconductor sub-scenarios, specifically in advanced packaging, IC substrate manufacturing, mask making, and FPD panel manufacturing. Parallel to technology penetration, global semiconductor capacity is shifting to Chinese Mainland and Southeast Asia, and regional industrial expansion backed by supportive policies, domestic demand and cost-efficient production ecosystems will continuously create strong new demand for direct-writing lithography equipment.

Advanced Packaging Field

Spurred by AI, HPC and 5G, advanced packaging serves as a critical solution to break Moore's Law limits, with its global market to expand from RMB342.5 billion (2025) to RMB546.4 billion (2030) at a 9.8% CAGR, lifting relevant IC capital expenditure to RMB142.7 billion with a 9.0% CAGR. Popular high-density packaging technologies require lithography tools to deliver finer lines, superior alignment and large-area patterning. Mask-free digital direct-writing lithography eliminates large-substrate stitching errors and warpage-related

yield loss of traditional mask lithography, suits glass TGV processes to lower costs and boost yields. Though newly industrialized, its dedicated equipment market for advanced packaging will jump from RMB0.5 billion to RMB3.1 billion by 2030 at a remarkable 44.8% CAGR.

IC Substrate Manufacturing Field

As a key connection between chips and PCBs, IC substrates will see 9.4% CAGR market growth from 2025 to 2030. Shrinking line widths and larger panels highlight flaws of traditional mask lithography. Maskless direct-writing lithography solves such issues, and its dedicated equipment market is set to grow at a 13.6% CAGR over the period.

Mask-making Field

As core pattern-transfer consumables for semiconductors and FPDs, photomasks will see their global market expand at an 8.2% CAGR. With digital pattern adjustment and intelligent dynamic correction, direct-writing lithography is well-suited for mask production, and its dedicated equipment market will grow from RMB4.9 billion to RMB6.3 billion at a 5.3% CAGR.

FPD Panel Manufacturing Field

Driven by OLED and Mini/Micro LED, the global FPD market is projected to rise from RMB1.4 trillion to RMB1.9 trillion by 2030 at a 5.9% CAGR. Mask-free, high-precision direct-writing lithography shortens production cycles, reduces costs and improves yields for complex panels, fueling its FPD equipment market to grow from RMB0.3 billion to RMB0.7 billion at a 17.0% CAGR.

2.4 Entry Barriers and Key Success Factors

Strong R&D Capabilities

Direct-writing lithography equipment is a technology-intensive industry integrating cross-disciplinary technologies such as precision machinery, UV optics, graphic processing, deep learning and automatic control. New entrants can hardly master these diversified technologies and build a complete R&D system in a short timeframe.

Extensive Understanding of Application Scenarios and Differentiation Capabilities

Different fields have varying demands for direct-writing lithography equipment. This requires suppliers to have an extensive and

comprehensive understanding of different customer needs and application scenarios, and to provide differentiated solutions. New entrants, lacking industry experience and customer feedback, often find it challenging to quickly and accurately grasp the specific needs of customers in different fields.

Comprehensive Talent Development System and Visionary Management Team

The direct-writing lithography equipment industry suffers severe talent shortages. Suppliers must build sound talent training systems to attract and cultivate professional personnel. In addition, forward-looking management teams are essential to capture industry trends, pre-plan R&D and application layouts, and sustain competitive edges in technological innovation and industrial expansion.

High Quality Customer Base and Value Co-creation Systems

Clients impose strict standards on equipment performance, stability and reliability. Long-term stable customer partnerships require lengthy R&D iteration, process matching and product verification. Such ties are built on premium equipment and services, as well as

deep value co-creation mechanisms covering joint innovation, data sharing and industrial chain integration. This moat of customer resources is hard for new entrants to replicate rapidly.

Comprehensive Service System and Rapid Response Capabilities

Equipment suppliers need a full after-sales network with dedicated technical teams to respond to client demands in a timely manner. New market players struggle to build a matching service system within a short timeframe.

Advanced Manufacturing Capabilities

Suppliers must uphold rigorous manufacturing standards to deliver consistent, high-quality products, relying on precision engineering, complex component integration and strict quality control. These stringent requirements form major hurdles for new entrants.

2.5 Future Outlook

Looking ahead, the global direct-writing lithography equipment industry will maintain robust growth supported by industrial upgrading, continuous technological iteration and favorable industrial policies. Near-term robust demand for PCB direct imaging equipment stems from AI infrastructure, while semiconductor sectors



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will become the major growth driver as advanced packaging, IC substrates and new displays widely adopt maskless lithography. Besides, high industry barriers will keep market concentration steady, and leading firms will consolidate edges through tech innovation, customer cooperation and full service systems.



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All statistical data presented is verifiable and grounded in information available as of the date of this report.



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Extracts are refined summaries of in-depth CIC industry research reports, highlighting supply and demand trends, key growth drivers, R&D trends and future outlook, etc. of various segmented fields, integrating multi-dimensional insights such as expert interviews, market surveys and industry data analysis.

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