
INDUSTRY OVERVIEW

The information and statistics set out in this section and other sections of this Document were extracted from the Frost & Sullivan Report prepared by Frost & Sullivan, which was commissioned by us, and from various official government publications and other publicly available publications. We engaged Frost & Sullivan to prepare the Frost & Sullivan Report, an independent industry report, in connection with the [REDACTED]. The information from official government sources has not been independently verified by us, the Sole Sponsor, the Overall Coordinators, [REDACTED], [REDACTED], [REDACTED], [REDACTED], any of their respective directors and advisers or any other persons or parties involved in the [REDACTED], and no representation is given as to its accuracy.

OVERVIEW OF IC SUBSTRATE INDUSTRY

Definition and Classification of IC Substrates

An IC substrate is a specialized, high-density interconnection platform used in semiconductor packaging, serving as a critical carrier that provides electrical connectivity, mechanical support and thermal management between the silicon die and the printed circuit board.

Classification by Packaging Method

- **FCBGA Substrates:** FCBGA substrate is an IC substrate (typically ABF-based) that carries the silicon die through flip-chip bonding on its top side, and provides an array of landing pads on its underside for BGA solder balls, which serve as the external terminals of the completed package for mounting onto the printed circuit board. They are mainly used for high-performance, high I/O chip packaging such as CPUs, GPUs, AI accelerators, server processors, and switching chips. FCBGA substrates are characterised by larger sizes, higher layer counts, low warpage, and high precision. They represent the highest-value and most technically challenging category of IC substrates.
- **FCCSP Substrates:** FCCSP substrate is an IC substrate (typically BT-based) that carries the silicon die through flip-chip bonding on its top side, enabling a completed package whose size is close to that of the die itself. They are mainly used for smart device chips such as smartphone AP, RFFE, PMICs, Wi-Fi, Bluetooth, and wearables. FCCSP substrates have relatively smaller size, lower layer counts, and fewer I/Os, adopting fine-line circuitry and micro-via structures, with an emphasis on thin and lightweight design.
- **WBCSP Substrates and Module Substrates:** WBCSP substrate is an IC substrate (typically BT-based) that carries the silicon die through wire bonding on its top side, enabling a completed package whose size is close to that of the die itself. Their technical difficulty and cost are generally lower than flip-chip packaging. They are mainly applied in mature-process areas such as memory chips (e.g., NAND Flash, DRAM), analog chips, power management chips, sensors, and MCUs. Module substrates mainly include SiP module substrates, camera module substrates, RF module substrates, memory module substrates and others.

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Classification by Downstream Application

Downstream Areas	Key Applications	Core IC Substrate Requirements	Related Downstream Demands and Development Trends
Smart Device	CPUs, GPUs, application processors, baseband processors, Wi-Fi and connectivity chips, RF chips, and power management chips in smart devices such as smartphones, tablets, PCs and wearables	High wiring density; low power consumption; miniaturization; lightweight design	Global smart device shipments are expected to grow from 3.2 billion units in 2025 to 4.5 billion units by 2030, with sustained downstream demand providing stable support for the IC substrate market. As end devices evolve toward thinner, lighter and more highly integrated designs, the number of chips per device increases, while requirements for data transmission speed and power efficiency continue to rise. These trends drive IC substrates toward higher wiring density and higher inter-layer alignment accuracy.
AI and HPC	CPUs, GPUs and other AI accelerators (such as TPUs and other ASICs) in servers	High I/O density; high power delivery capability; high signal integrity; high thermal dissipation performance	Global AI infrastructure investment is expected to grow from approximately US\$335.0 billion in 2025 to US\$913.7 billion by 2030, at a CAGR of 22.2%, with sustained high growth in computing infrastructure investment providing strong support for FCBGA substrate demand. As AI evolves toward large models and multimodality, computing requirements and model complexity continue to rise; the number of accelerator cards per AI server increases, and system architectures evolve toward higher bandwidth and high-speed interconnection, driving upgrades in chip packaging specifications and imposing higher requirements on the precision, reliability and high-speed signal transmission capability of IC substrates.
Memory	DRAM, NAND Flash and HBM memory chips in areas such as smart devices, data centers and AI servers, automotive	High wiring density; high interconnection density; high signal integrity; low power consumption	Driven by growing data-storage demand from applications such as smart terminals, data centers and AI servers, memory chips continue to advance in capacity, bandwidth and performance, steadily increasing demand for IC substrates in the memory segment. In particular, as 3D NAND stacking layers increase and data center storage demand expands, standard memory devices such as DRAM and NAND Flash are being widely adopted, driving notable growth in demand for reliable and compact WBCSP substrates, which offer distinct advantages in ensuring stable electrical performance, efficient signal transmission and support for large-scale production.
Automotive and Robotics	Autonomous driving SoC, intelligent cockpit SoCs, vehicle MCUs, power management chips, robot main control chips, motion control chips, and vision perception chips	High layer counts; high interconnection density; automotive-grade reliability; high heat resistance	Global new energy vehicle sales are expected to increase from 22,594 thousand units in 2025 to 54,401 thousand units by 2030, at a CAGR of 19.2%; the global intelligent cockpit solution market is expected to grow from RMB370.5 billion in 2025 to RMB935.0 billion in 2030, at a CAGR of 20.3%. As vehicles evolve toward electrification and intelligence, autonomous driving and intelligent cockpits serve as key drivers, increasing the use of high-computing-power chips per vehicle and driving IC substrates toward higher layer counts, higher interconnection density and automotive-grade reliability. The global robotics market is expected to grow from US\$70.7 billion in 2025 to US\$140.0 billion by 2030, at a CAGR of 14.6%. In particular, embodied intelligent robots are emerging as a new growth area, raising requirements for real-time computing, environmental perception, motion control and low-latency communication, further driving demand for IC substrates with higher layer counts and high reliability.

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Downstream Areas	Key Applications	Core IC Substrate Requirements	Related Downstream Demands and Development Trends
Network Communications	Network switching chips, routing chips, base station processors, baseband and communication SoCs, and RF chips	High-speed signal transmission; high-frequency performance; low transmission loss; high signal integrity	With the evolution of 5G and subsequent communication technologies, the deployment of high-speed, high-frequency chips across base stations, switching equipment and optical communication systems continues to expand. In addition, co-packaged optics (CPO) integrates optical engines at the packaging level, serving as a structural driver of growing demand for IC substrates optimized for high-density interconnection and thermal dissipation.
Others	Commercial aerospace (satellite communication chips, onboard processors), industrial control, rail transit, power and energy, and medical equipment	High reliability; high precision; miniaturization	With the rapid development of low-earth-orbit satellites, satellite Internet and commercial rockets, aerospace electronics face rising requirements for miniaturization, lightweight design and high reliability; meanwhile, industrial control is upgrading toward higher density and higher reliability. As system integration and intelligence levels rise across these fields, demand for advanced packaging and high reliability interconnection continues to increase.

Source: Frost & Sullivan

Analysis of the IC Substrate Industry Chain

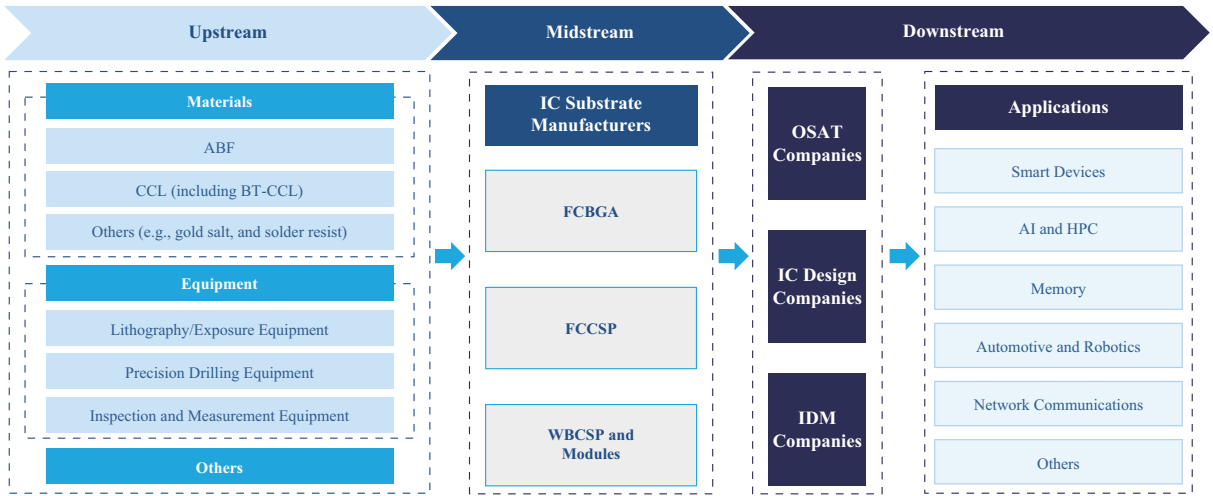
The IC substrate industry chain is generally characterized by high technological intensity, a high degree of collaboration, and a relatively detailed division of labor. It can typically be divided into three main links: upstream raw material and equipment supply, midstream IC substrate manufacturing, and downstream applications.

The upstream link mainly includes suppliers of key materials and manufacturing equipment. Key raw materials include ABF, CCL (including BT-CCL), gold salt, and solder resist. The midstream segment, led by IC substrate manufacturers, is the core of the industry chain, processing upstream materials into high-density, high-precision IC substrates. They are responsible for IC substrate design, prototype verification, and large-scale production.

The downstream segment mainly comprises OSAT, IC design, and IDM companies and end-use application industries. OSAT companies assemble, interconnect and test chips with IC substrates to form finished IC products; IC design companies define product specifications and may engage in early-stage collaborative development with IC substrate manufacturers; and IDM companies, which integrate chip design, manufacturing and packaging in-house, procure IC substrates directly for their own packaging operations. The finished IC products are ultimately used in downstream industries such as smart devices, AI and HPC, memory, automotive and robotics, and network communications.

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IC Substrate Market Industry Chain



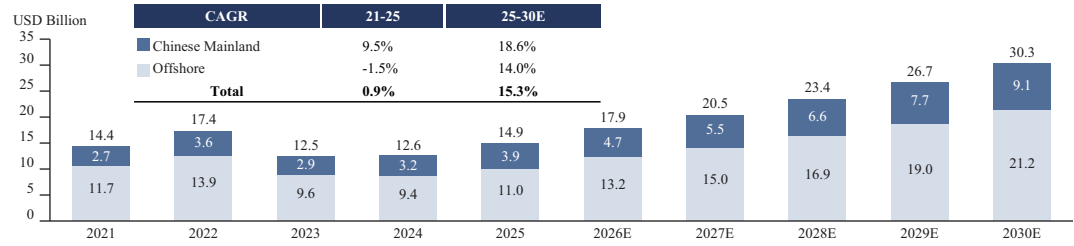
Source: Frost & Sullivan

IC SUBSTRATE MARKET SIZE

From 2021 to 2025, the global IC substrate market size increased from US\$14.4 billion to US\$14.9 billion, at a CAGR of approximately 0.9%. A cyclical downturn of the semiconductor industry, weak consumer electronics demand, and industry-wide inventory digestion led to a contraction in 2023, followed by a recovery in 2024 and 2025. The global IC substrate market size is expected to further increase to US\$30.3 billion by 2030, with a projected CAGR of 15.3% from 2025 to 2030, driven by surging AI computing demand, a sustained recovery in the server market and the rising penetration of advanced packaging.

Driven by global demand expansion, IC substrate manufacturers in Chinese Mainland continue to expand capacity. By production region, the IC substrate market size in Chinese Mainland increased from US\$2.7 billion in 2021 to US\$3.9 billion in 2025, at a CAGR of approximately 9.5%, and is projected to further increase to US\$9.1 billion by 2030, at a CAGR of 18.6%, outpacing the global average.

IC Substrate Market Size (by production region in terms of manufacturers’ revenue), Global, 2021–2030E



Source: Public information, Frost & Sullivan

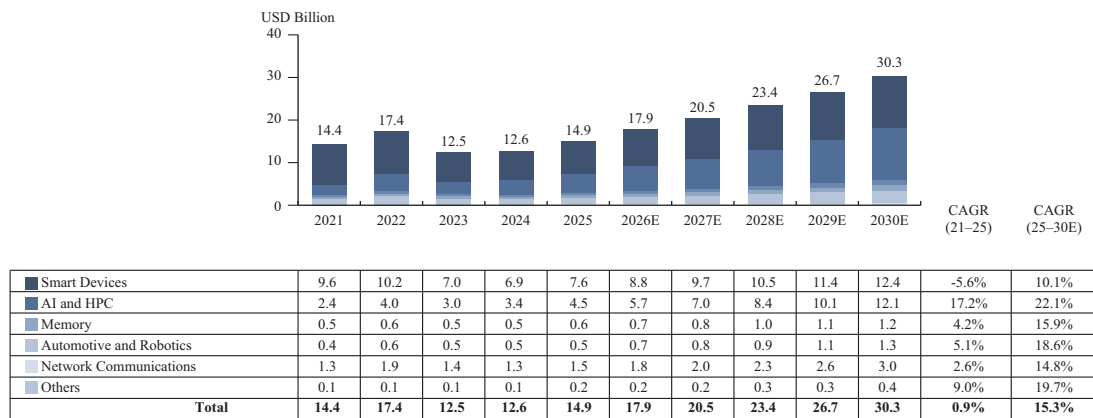
Note:

- (1) The market size of the Chinese Mainland refers to the revenue generated by IC substrate manufacturers located in the Chinese Mainland.

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By downstream application, from 2021 to 2025, the market size of IC substrates used in AI and HPC increased from US\$2.4 billion to US\$4.5 billion, recording the highest growth among all downstream segments. From 2025 to 2030, this market size is expected to further increase to US\$12.1 billion, with a projected CAGR of 22.1%. The market size of IC substrates used in smart device, memory, automotive and robotics and network communications are expected to increase to US\$12.4 billion, US\$1.2 billion, US\$1.3 billion and US\$3.0 billion, respectively, with projected CAGRs of 10.1%, 15.9%, 18.6% and 14.8%.

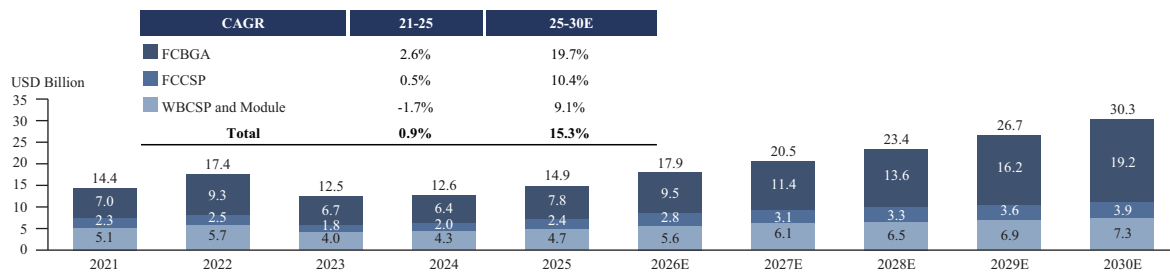
IC Substrate Market Size (by downstream application in terms of manufacturers’ revenue), Global, 2021–2030E



Source: Public information, Frost & Sullivan

Based on the breakdown by product of the global IC substrate market from 2021 to 2025, the FCBGA substrate market size increased from US\$7.0 billion to US\$7.8 billion, maintaining a dominant position among various product segments. Meanwhile, the FCCSP substrate market size grew from US\$2.3 billion to US\$2.4 billion. FCBGA substrate, benefiting from rapidly increasing demand for servers, GPUs, AI accelerators, and advanced packaging, has become the core driver of market growth. FCCSP substrate, mainly driven by demand for smartphone AP, 5G/6G basebands, and on-device AI SoCs, has maintained steady growth overall. From 2025 to 2030, the FCBGA substrate and FCCSP substrate market sizes are expected to increase to US\$19.2 billion and US\$3.9 billion, respectively, with projected CAGRs of 19.7% and 10.4%.

IC Substrate Market Size (by product in terms of manufacturers’ revenue), Global, 2021–2030E

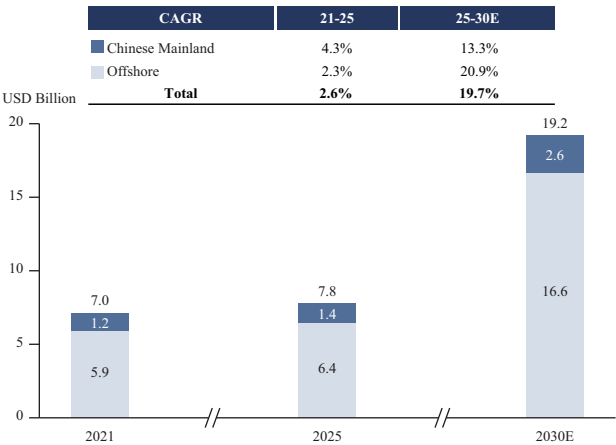


Source: Public information, Frost & Sullivan

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By sales region, offshore markets accounted for the majority of global FCBGA substrate demand. In 2025, the offshore FCBGA substrate market reached US\$6.4 billion, at approximately 82% of the global total, and is expected to increase to US\$16.6 billion by 2030, at a CAGR of 20.9% from 2025 to 2030, significantly higher than the 13.3% for the Chinese Mainland over the same period. Such growth is primarily attributable to the concentration of advanced packaging capacity in offshore regions such as Chinese Taiwan and South Korea, which has established offshore regions as the core hub of FCBGA substrate demand.

FCBGA Substrate Market Size (by sales region in terms of manufacturers’ revenue), Global, 2021–2030E



Source: Public information, Frost & Sullivan

Note:

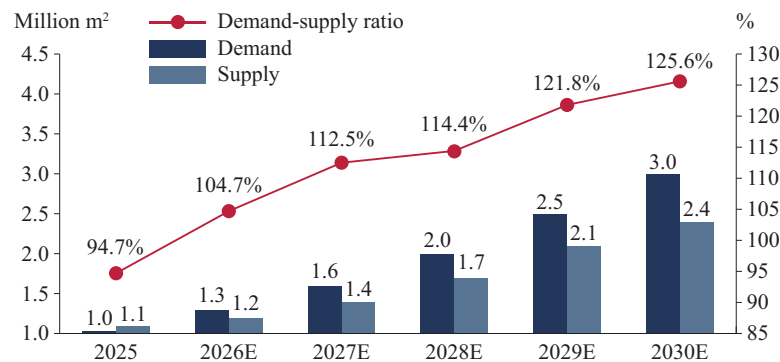
(1) The market size of the Chinese Mainland refers to the product sales revenue generated within the Chinese Mainland.

Supply and Demand Analysis of FCBGA Substrate Market

The demand-supply ratio is calculated as total unconstrained market demand divided by total manufacturing output. The global FCBGA substrate market remained in oversupply in 2025, with the ratio at 94.7%, below the equilibrium threshold of 100%. Supported by accelerating investment in AI infrastructure and the rapid expansion of high-performance computing applications, the ratio is expected to increase steadily over the long term, signaling a structural tightening in supply-demand balance. By 2030, the ratio is projected to reach 125.6%, indicating a transition from oversupply to a persistent undersupply condition in the global FCBGA substrate market.

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Demand-Supply Ratio of FCBGA Substrate, Global, 2021–2030E



Source: Frost & Sullivan

Market Drivers and Development Trends of the IC Substrate Industry

The upgrading of applications across multiple downstream industries jointly drives the growth in IC substrate demand. The rapid development of fields such as AI and HPC, memory, network communications, and automotive and robotics imposes higher performance requirements on chips, thereby driving the continuous increase in demand for IC substrates. In AI and HPC, demand for high bandwidth, high computing power and low power consumption in AI servers and accelerated computing platforms is driving greater integration in advanced packaging, creating sustained demand for IC substrates with high-density interconnection, high-speed transmission and high-reliability packaging. In automotive and smart devices, electrification and intelligence are pushing autonomous driving platforms, intelligent cockpits, high-performance application processors and communication chips toward higher performance and integration, expanding demand for automotive-grade and consumer-grade IC substrates.

AI demand and advanced packaging are jointly driving demand for high-end IC substrates. As AI computing demand continues to be released, shipments of AI accelerator chips — including GPUs and various ASICs represented by TPUs — are growing rapidly; these chips feature high I/O density and large form factors and are primarily packaged using FCBGA substrates. At the same time, as Moore’s Law slows, performance gains increasingly rely on advanced packaging, with 2.5D/3D packaging, Chiplet, Fan-Out and SiP enabling heterogeneous integration, multi-chip stacking and high-density interconnection. Together, these trends drive IC substrates toward higher layer counts, higher interconnection density, larger form factors and stricter warpage and reliability control, raising technical barriers and unit value, and underpinning demand for high-end FCBGA substrates in particular, as well as FCCSP substrates.

Tight supply-demand conditions in the high-end IC substrate market are driving capacity expansion. Driven by surging AI computing demand and the accelerated adoption of advanced packaging technologies, demand for IC substrates, particularly FCBGA substrates, is increasing rapidly. Meanwhile, long expansion cycles, high technical barriers, and constraints in the supply of key equipment and materials are expected to result in a supply shortage across the industry. In response, major manufacturers in Chinese Mainland are accelerating capacity expansion to meet growing demand from servers, GPUs, AI accelerators, and other downstream applications.

Production growth in the Chinese Mainland and demand-driven expansion. Against the backdrop of the regionalisation of the global semiconductor supply chain, the IC substrate industry exhibits a pattern of coordinated development across the Chinese Mainland and offshore markets. In the Chinese Mainland, domestic capacity continues to expand, driving rapid growth in production. In the offshore market, leveraging their concentration of chip-design and advanced packaging capacity, regions undertake global AI chip packaging demand, sustaining continued expansion in IC substrate demand.

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Technology continues to advance toward higher-end and higher-precision solutions. With the development of advanced packaging technologies, key technical parameters of IC substrates continue to advance. Line width/spacing (L/S) is evolving from 10/10μm towards 8/8μm, 5/5μm, and below. Layer count structure, wiring density, and inter-layer alignment accuracy are constantly improving. At the same time, to accommodate multi-chip system integration and ultra-large package requirements, the size of IC substrates is continuously expanding, imposing higher demands on warpage control, structural stability, and manufacturing precision, pushing the industry towards high-end and precision directions.

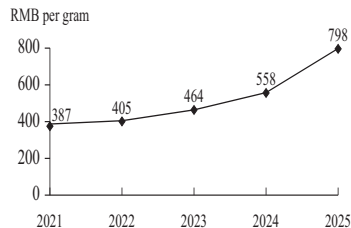
Accelerated advancement of intelligent manufacturing. As the complexity of IC substrate manufacturing increases, the degree of collaborative innovation across the industry chain continues to grow. At the same time, the application of automation equipment, industrial internet, and data analysis technology in the manufacturing process is accelerating, driving the upgrade of production processes towards digitalization and intelligent operations. Through process data management and intelligent scheduling systems, companies can continuously improve product quality and production efficiency.

Analysis of Raw Material Prices in the IC Substrate Industry

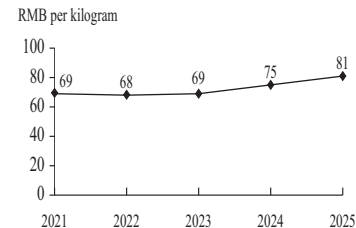
IC substrate production relies heavily on various high-performance materials, some of which, such as ABF, are supplied by only a limited number of manufacturers globally. Fluctuations in upstream raw material prices, together with the relatively concentrated supply of certain key materials, have a certain impact on the industry’s cost structure.

Copper is the main raw material for copper foil and related conductive materials. The average copper price in Chinese Mainland was approximately RMB69 per kilogram in 2021. From 2021 to 2023, it remained at a relatively high level overall with periodic fluctuations. Driven by growing demand from the semiconductor and new energy industries, copper prices trended upward from 2023 to 2025. By 2025, the copper price reached approximately RMB81 per kilogram. Gold is a core material for the surface finishing process of IC substrates. Its average price was approximately RMB387 per gram in 2021. Subsequently, driven by factors such as global inflation, geopolitical disturbances, and increased safe-haven demand, it generally showed an upward trend, reaching approximately RMB798 per gram in 2025. CCL is one of the key base materials used in the manufacture of IC substrates. Supported by strong downstream demand from the electronics industry and rising upstream raw material costs, the CCL price index remained at a relatively high level in 2021. From 2022 to 2023, weakening downstream demand led to a significant decline in the CCL price index, which reached a cyclical low in 2023. During 2024 and 2025, driven by recovering demand from AI servers, high-speed communications, and intelligent terminal devices, together with a rebound in certain upstream raw material prices, the CCL price index gradually recovered and exceeded its 2021 level in 2025. Driven by both robust downstream demand and rising upstream raw material prices, the prices of IC substrates are expected to increase accordingly.

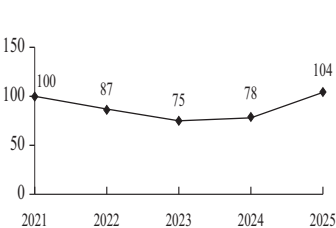
Average Gold Market Price,
Chinese Mainland, 2021–2025



Average Copper Market Price,
Chinese Mainland, 2021–2025



CCL Price Index,
2021–2025



Source: Frost & Sullivan

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COMPETITIVE ANALYSIS OF THE IC SUBSTRATE INDUSTRY

Ranking and Market Share Analysis of IC Substrate Manufacturers

The IC substrate market in the Chinese Mainland is relatively concentrated and highly competitive. In 2025, the top three manufacturers in the Chinese Mainland IC substrate market held a combined market share of 37.9%. Based on revenue in 2025, the Company ranked third among Chinese Mainland IC substrate manufacturers with RMB2.8 billion, holding a market share of 10.3%.

The global IC substrate market is also relatively concentrated and competitive, with the top three manufacturers accounting for 37.4% of the market in 2025. Among the top 20 IC substrate suppliers globally by revenue in 2025 , the Company ranked first in revenue CAGR from 2023 to 2025.

Ranking of IC Substrate Manufacturers in Chinese Mainland, By Revenue, 2025

Rank	Company	Revenue (RMB Billion)	Market Share (%)
1	Company A ⁽¹⁾	4.1	15.1%
2	Company B ⁽²⁾	3.4	12.5%
3	The Company	2.8	10.3%
	Others	17.1	62.1%
	Total	27.5	100.0%

Source: Public company announcements, expert interviews, Frost & Sullivan

Notes:

- (1) Company A is a publicly listed company founded in 1984, headquartered in Shenzhen, China and listed on the SZSE, primarily engaged in printed circuit boards, IC substrates and electronic assembly.
- (2) Company B, a subsidiary of a publicly listed company that was founded in 1990 and listed on the TWSE, is headquartered in Suzhou, China, and primarily engaged in IC substrates for advanced IC packaging.

In 2025, the top three manufacturers in the Chinese Mainland FCBGA substrate market held a combined market share of 58.7%. Based on revenue in 2025, the Company ranked third among Chinese Mainland FCBGA substrate manufacturers with RMB1.0 billion, holding a market share of 12.5%. In 2025, the top three manufacturers in the Chinese Mainland FCCSP substrate market held a combined market share of 38.2%. Based on revenue in 2025, the Company ranked third among Chinese Mainland FCCSP substrate manufacturers with RMB1.1 billion, holding a market share of 11.9%. The FCBGA substrate market in the Chinese Mainland is more concentrated than the FCCSP substrate market, primarily due to its higher technical and capital barriers.

Ranking of FCBGA Substrate Manufacturers in Chinese Mainland, By Revenue, 2025

Company	Revenue (RMB Billion)	Market Share (%)
Company B	2.0	25.3%
Company C ⁽¹⁾	1.6	20.9%
The Company	1.0	12.5%
Others	3.2	41.3%
Total	7.7	100.0%

Ranking of FCCSP Substrate Manufacturers in Chinese Mainland, By Revenue, 2025

Company	Revenue (RMB Billion)	Market Share (%)
Company B	1.2	13.4%
Company A	1.2	12.9%
The Company	1.1	11.9%
Others	5.6	61.8%
Total	9.1	100.0%

Source: Expert interviews, Frost & Sullivan

Note:

- (1) Company C, a subsidiary of a publicly listed company that was founded in 1987 and listed on the Vienna Stock Exchange, is headquartered in Shanghai, China, and primarily engaged in printed circuit boards and IC substrates.

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Analysis of Entry Barriers in the IC Substrate Market

High capital investment, scale-up capability and intelligent manufacturing requirements. IC substrate production demands high equipment precision, cleanroom standards and automation, with substantial fixed-asset investment and long payback periods that continue to rise as products move toward higher layer counts and precision. Mass-production capacity directly affects cost control and profitability, and companies must also rapidly expand capacity and ramp up production to capture demand. As the semiconductor industry evolves toward greater automation, intelligent manufacturing capabilities — achieved through production-line automation, equipment interconnection (e.g., standards such as SECS) and data analytics — have become essential to ensuring stable production, giving established players a significant scale and capability advantage that new entrants struggle to match.

High technology, process, quality and talent barriers. IC substrate manufacturing involves high-density interconnection, multi-layer fine-line routing and compatibility with complex packages, imposing stringent requirements on line width/spacing control, inter-layer alignment accuracy and long-term reliability. It requires the coordination of materials, processes, equipment and quality management, as well as interdisciplinary technical talent. As 2.5D/3D packaging and Chiplet architectures gain traction and technological iteration accelerates, achieving stable mass production requires long-term R&D, accumulated process know-how and experienced technical and management teams — capabilities new entrants find hard to build quickly.

Long customer qualification cycles and stable customer relationships. IC substrates are widely used in fields such as AI and HPC, network communications, automotive and robotics, where downstream customers have high requirements for product consistency and reliability. Companies typically need to undergo multiple rounds of testing and verification before being admitted to a customer’s approved supplier system. Once established, partnerships tend to be stable, making it difficult for new entrants to achieve breakthroughs in the short term.

Increasing importance of supply chain collaboration capabilities. High-end IC substrates rely heavily on upstream key materials, and the supply of some core materials is still relatively concentrated. Companies with stable material access and supply chain management capabilities have advantages in cost and delivery. While the supply environment is gradually improving with domestic substitution, overall requirements remain high.

SOURCE OF INFORMATION

We commissioned Frost & Sullivan, an independent market research consultant, to conduct an analysis of and prepare a report on the global IC substrate industry for use in this document, for which we paid a fee of RMB600,000. The Frost & Sullivan Report was compiled based on the following assumptions: (i) global and China’s social, economic and political environment will remain stable during the forecast period; and (ii) the key drivers of the relevant industry will continue to drive the market during the forecast period. All forecasts in relation to market size are based on the general economic conditions as of the Latest Practicable Date. Unless otherwise indicated, all data and forecasts contained in this section are derived from the Frost & Sullivan Report. The Frost & Sullivan Report was independently prepared by Frost & Sullivan and was not influenced by us or other interested parties.

Frost & Sullivan is an independent global consulting company founded in New York in 1961, whose services include, among others, industry consulting, market strategy consulting and corporate training. Frost & Sullivan conducted (i) primary research, including discussions with certain leading industry participants on the industry’s current status and interviews with industry experts on a best-effort basis to collect data to assist in its in-depth analysis; and (ii) secondary research, including reviewing company reports, independent research reports and data from its own research databases.

Our Directors, after taking reasonable care, confirm that to the best of their knowledge, there is no material adverse change in the market information since the date of the relevant data contained in the Frost & Sullivan Report and up to the Latest Practicable Date which may qualify, contradict or have an impact on the information in this section.