Certain information and statistics set out in this section have been extracted from various official government publications, market data providers and a report commissioned by the Group and prepared by an independent third party, Frost & Sullivan. The information from official government sources has not been independently verified by the Group, the Sole Sponsor, [REDACTED], the [REDACTED] [REDACTED], the [REDACTED], the [REDACTED], [REDACTED] or any of their respective directors, officers, employees, agents, advisers or representatives or any other parties involved in the [REDACTED] (excluding Frost & Sullivan), and no representation is given as to its accuracy, fairness and completeness.

MEMORY PRODUCTS MARKET ANALYSIS

Definition and Classification of Memory Products

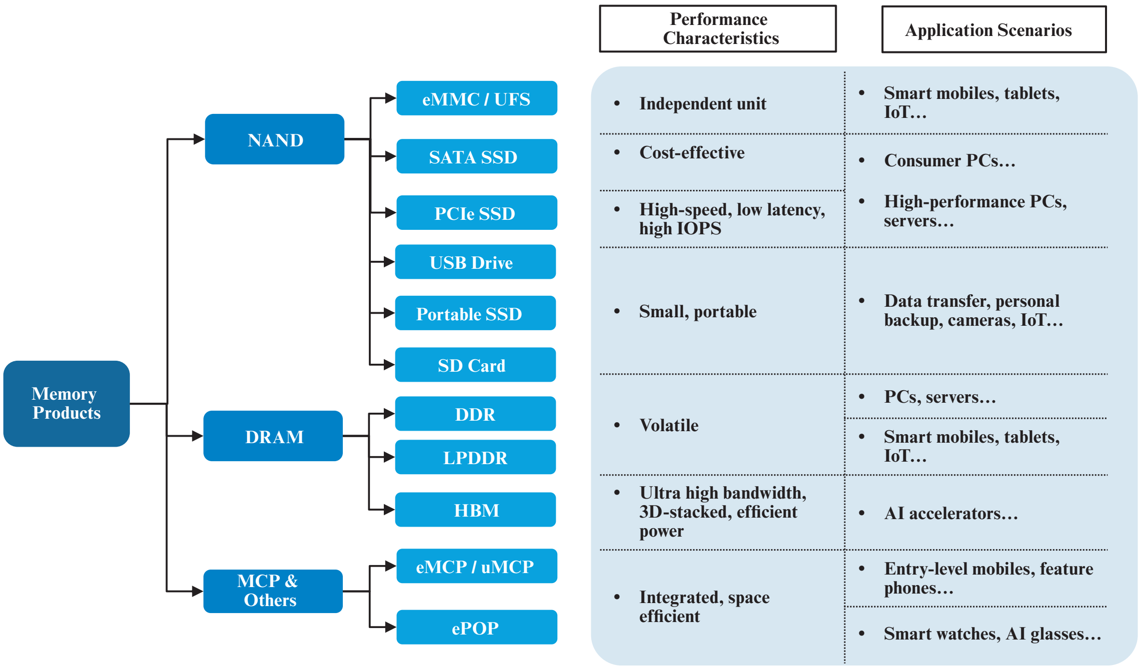
Memory products are hardware components designed for data memory and temporary or permanent access. There are mainly two core wafer types among memory products: DRAM and NAND Flash. DRAM is a volatile memory product that loses data when powered off, featuring ultra-high read/write speed and low latency, while NAND Flash is a non-volatile memory product that retains data without power, characterized by high storage density and lower unit cost. In terms of developing history, DRAM was invented in 1968 and has evolved through DDR generations (DDR2 to DDR5) for enhanced bandwidth and energy efficiency, while NAND Flash, developed in 1989, transitioned from 2D planar technology to 3D vertical stacking to boost density and reduce costs. In terms of use scenarios, DRAM is primarily used for real-time data processing in smart phones, AI servers, and PCs, while NAND Flash serves long-term data storage needs in SSDs, smart phones, IoT devices, and data centers. Based on core wafer type, product architecture, performance characteristics and application scenarios, memory products can be systematically classified into three major categories, namely NAND, DRAM, and MCP & Others.

NAND products are mainly used for non-volatile data storage, covering eMMC/UFS, SATA SSD, PCIe SSD, USB drives, portable SSDs and SD cards. eMMC/UFS products are commonly used in smart mobiles, tablets and IoT devices; SATA SSDs provide cost-effective storage for consumer PCs; PCIe SSDs offer high speed, low latency and high IOPS for high-performance PCs and servers; while USB drives, portable SSDs and SD cards emphasize portability and are mainly used for data transfer, personal backup, cameras and IoT devices.

DRAM products are volatile memory products mainly used for temporary data processing and high-speed data access, including DDR, LPDDR and HBM. DDR is widely used as system memory in PCs and servers; LPDDR features low power consumption and high bandwidth, making it suitable for smart mobiles, tablets and IoT devices; while HBM adopts 3D-stacked architecture to achieve ultra-high bandwidth and energy efficiency, and is primarily used in AI accelerators.

MCP & Others mainly refer to integrated memory products such as eMCP/uMCP and ePOP, which combine NAND and DRAM in compact package architectures. These products feature high integration and space efficiency, and are commonly used in entry-level mobile phones, feature phones, smart watches, AI glasses and other compact smart terminals.

Definition and Classification of Memory Products



	Performance Characteristics	Application Scenarios
eMMC / UFS	Independent unit	Smart mobiles, tablets, IoT…
SATA SSD	Cost-effective	Consumer PCs…
PCIe SSD	High-speed, low latency, high IOPS	High-performance PCs, servers…
USB Drive Portable SSD SD Card	Small, portable	Data transfer, personal backup, cameras, IoT…
DDR	Volatile	PCs, servers…
LPDDR		Smart mobiles, tablets, IoT…
HBM	Ultra high bandwidth, 3D-stacked, efficient power	AI accelerators…
eMCP / uMCP	Integrated, space efficient	Entry-level mobiles, feature phones…
ePOP		Smart watches, AI glasses…

Source: Frost & Sullivan, CSIA

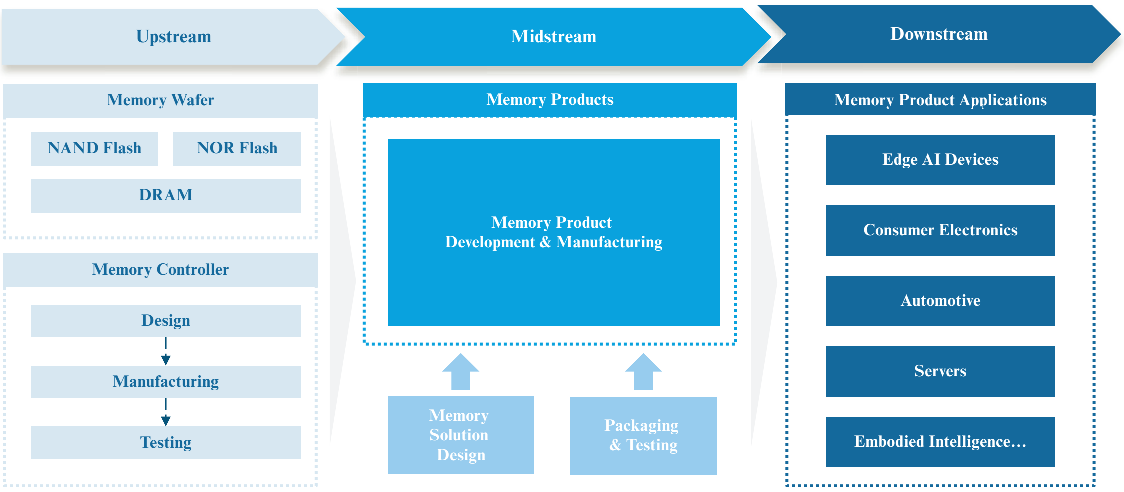
Industry Chain Analysis of Memory Products

The memory product industry chain can be divided into three main segments: upstream wafer and controller design and manufacturing, midstream memory product manufacturing, and downstream end applications. Among these, the midstream segment plays an important connecting role between the upstream and downstream sectors, serving as a key link for value creation within the industry chain.

The upstream segment primarily provides fundamental resources for the industry, including memory wafer manufacturers and controller suppliers. The midstream segment is the key link between upstream and end applications, mainly involving memory solution design and packaging and testing. There are two main industrial operating models: one is the independent memory product manufacturer model, where companies focus on memory solution design, packing and testing (in-house/outsourced) and large-scale delivery. The other model is the integrated memory manufacturer model, i.e. IDM model, which covers the entire process while focusing on wafer manufacturing — notably, it encompasses all processes undertaken by independent manufacturers (including memory solution design and packaging and testing) and operates across both upstream and midstream segments, a vertical integration that may provide advantages in wafer producing in cost efficiency through streamlined production coordination and stable supply capabilities amid industry cyclical fluctuations or supply chain disruptions.

Downstream applications are highly diversified, covering sectors such as edge AI devices (such as AI smart mobiles, AI PCs, AI glasses), consumer electronics, intelligent driving and industrial energy. Each end market has its own unique requirements, driving continuous upgrades and innovation in memory products in terms of capacity, speed, power consumption and reliability. Midstream manufacturers enhance product adaptability to the diverse needs of downstream applications through memory solution design and advanced packaging technologies, helping companies capture more market opportunities.

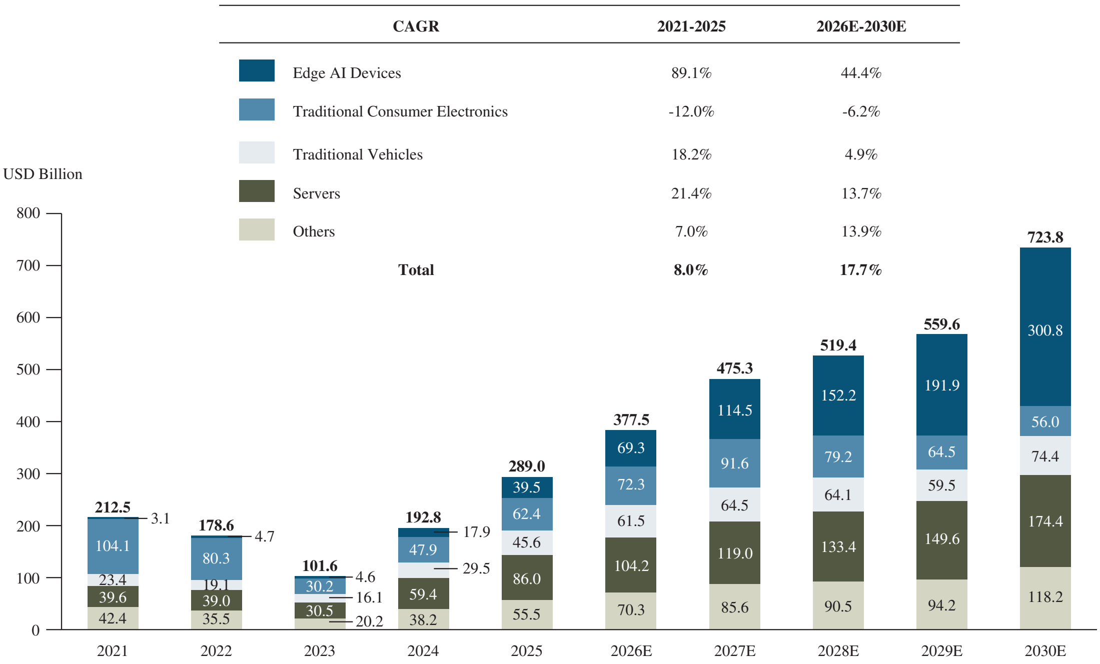
Industrial Chain of Memory Product Market



Source: Frost & Sullivan, CSIA

Market Size of Memory Products

Market Size of Memory Product Market (by downstream applications), by revenue, Global, 2021–2030E



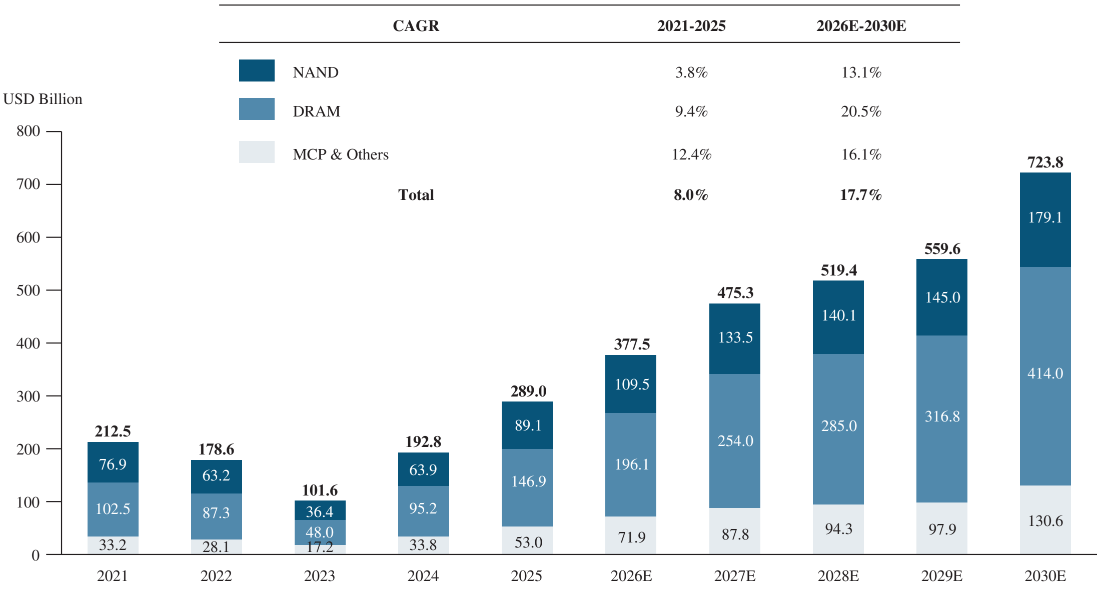
CAGR	2021-2025	2026E-2030E
Edge AI Devices	89.1%	44.4%
Traditional Consumer Electronics	-12.0%	-6.2%
Traditional Vehicles	18.2%	4.9%
Servers	21.4%	13.7%
Others	7.0%	13.9%
Total	**8.0%**	**17.7%**

Note: "Edge AI Devices" includes AI smart mobiles, AI PCs, AI glasses, and intelligent automotives.

Source: Frost & Sullivan, CSIA

From the perspective of product type, driven by a confluence of factors — including scenario-specific technical specifications, divergent technology iteration cycles, distinct value positioning, in addition to disparate downstream application demands such as AI servers, intelligent driving, and IoT — global memory products including NAND, DRAM, and MCP & Others, demonstrate differentiated growth trajectories, collectively fueling the market expansion.

Market Size of Memory Product Market (by product types), by revenue, Global, 2021–2030E



CAGR	2021-2025	2026E-2030E
NAND	3.8%	13.1%
DRAM	9.4%	20.5%
MCP & Others	12.4%	16.1%
Total	**8.0%**	**17.7%**

Source: Frost & Sullivan, CSIA

The Group's market share in Mainland China was 0.9% in 2025, while its global market share was 0.5% in 2025. The competitive landscape in China is broadly consistent with that of the global market, which has long been dominated by IDM manufacturers with a combined market share typically exceeding 90% to 95%.

Cyclical Analysis of the Memory Industry

The memory industry has historically followed a 3–4 year cyclical pattern. From the historical performance during 2020–2024, In 2021, strong demand from consumer electronics, plus pre-stocking by end manufacturers, paired with stable supply, pushed prices and market scale to peak. By 2022–2023, the capacity initiated in 2020–2021 came online, but a confluence of global economic headwinds — high inflation, geopolitical conflicts, and sluggish growth in major economies — weighed on market demand heavily. This supply-demand mismatch triggered a sharp drop in product prices. By the latter half of 2023, with demands driven by AI and lowering of inventory, the overall market began to show signs of recovery and prices started to rebound.

Looking ahead to 2025–2030, the amplitude of cyclical fluctuations in the memory industry is expected to narrow, which is rooted in structural supply-demand shifts: AI-driven enterprise demand has replaced volatile consumer electronics as the core driver, showing an overall upward trend with moderate volatility. On one hand, the continuous expansion of emerging application scenarios such as edge AI devices, intelligent automotives, and embodied intelligence will provide strong and sustained momentum for memory demand, supporting the long-term growth of the market. On the other hand, as industry-level large models deeply integrate with and empower various economic sectors, they will spawn substantial AI inference demand. The real-time data retrieval, temporary data memory, and efficient processing required during the inference phase will further drive incremental memory demand, serving as another key growth driver for the industry. These developments will help mitigate extreme imbalances, stabilize industry cycles, and enable steady market growth amid cyclical fluctuations. For the Chinese Mainland memory product market, their supply-demand dynamics, the underlying causes of historical and forecasted material fluctuations in the market, and the resulting impacts on overall product pricing and sales volume are broadly similar with global market.

Core Technological Trends in Memory Products

Advanced Packaging: Enabling Capacity and Performance Expansion in Memory Products

Packaging technologies in the memory industry mainly include chip-level packaging and wafer-level packaging (WLP). Chip-level packaging involves packaging a single bare chip through a packaging process, providing electrical interconnection, physical protection and performance optimization to form an independent chip package.

Among these, WLP has become one of the key directions for product advancement due to its technical advantages. As an advanced process that enables packaging without wafer dicing, WLP allows for wiring, protection and testing to be performed directly at the wafer stage. It enables compact integration of memory chips within limited space, achieving higher capacity and better performance while reducing energy consumption and costs during the packaging stage.

Controller Chips: Enhancing Data Processing Capability and Efficiency in Memory Products

Controller chips in memory products are responsible for key functions such as data read/write scheduling, error correction, lifespan monitoring and power management. Their performance directly determines the overall capability of a memory product. In practical applications, controllers integrate high-performance processors and dedicated algorithms to enable parallel data processing and intelligent scheduling.

From a technology development perspective, controller chips are rapidly evolving toward higher integration and greater intelligence. On one hand, the integration of AI-driven algorithms enables intelligent error correction, data compression and secure encryption, enhancing the autonomy and security of data management. On the other hand, controller chips are making continuous breakthroughs in energy efficiency optimization, thermal management and multi-chip collaboration to meet the performance requirements of high-bandwidth, large-capacity products.

Firmware Algorithms: Defining the Core Intelligence of Memory Product

Firmware algorithms are often referred to as the essential "intelligent layer" of memory products. They are carried by the controller chip and are responsible for key functions such as data scheduling optimization, wear leveling and error correction, while also requiring deep adaptation to the characteristics of the memory media.

Through close collaboration with hardware, the value of firmware algorithms is further amplified. In the industry trend of "algorithm-defined hardware," firmware must form a closed-loop development process with controllers and packaging technologies, optimizing data processing logic for different application scenarios.

Media Research: From Generalized Design to Scenario-Specific Adaptation

Media research is centered on memory wafers with a primary focus on analyzing the physical properties of memory media such as NAND Flash and DRAM. The research includes chip screening, characterization testing and failure mechanism analysis. By precisely understanding the performance boundaries of the media, researchers provide a scientific basis for product design and algorithm optimization which forms the foundation for ensuring the reliability of memory products.

Memory Wafers: Continuously Pushing the Performance Ceiling

The improvement in memory chips rely on the joint development of wafer process innovation and back-end technology optimization. At the wafer level, 3D NAND continues to expand memory capacity by increasing the number of stacked layers, while DRAM keeps breaking through capacity and speed limits through process upgrades. These advancements provide a solid hardware foundation for massive data memory and high-speed processing.

As leading manufacturers narrow the gap in advanced wafer process technologies, the focus of industry competition is gradually shifting to post-wafer processing. Among these, memory testing has become one of the key stages for ensuring product quality. Manufacturers independently develop comprehensive testing equipment and algorithms to simulate extreme working conditions, conducting chip screening and reliability verification. This not only ensures stable performance of products in diverse application environments but also serves as a core guarantee for memory chips to enter high-reliability application fields.

Key Drivers of Memory Product Industry

Demand-side

The memory product industry's demand is primarily fueled by the global AI boom and expansion of digital infrastructure, which create urgent needs for high-performance memory chips. AI training and inference workloads from large language models (LLMs) and AI computing clusters have spurred explosive demand for high-bandwidth memory and high-capacity memory products, driving cloud providers to ramp up related procurement.

Supply-side

The memory industry's supply-side growth is underpinned by industry-wide technological advancements and strategic capacity optimization initiatives that elevate overall production efficiency and product value. Continuous innovations in core manufacturing processes have improved memory chip density and performance while driving down unit production costs, strengthening the industry's ability to meet evolving downstream requirements.

Challenges of Memory Product Industry

The memory product industry faces two key challenges that impact its steady operational and growth trajectory, rather than posing insurmountable barriers to development. First, the industry grapples with the balancing act of sustained R&D investment and the pace of technological iteration, as whilst advancing memory performance and density requires significant capital and talent input into next-generation manufacturing and design technologies, they create pressure on short-term cost structures and capital efficiency. Second, the industry is addressing the matching challenge between composite talent echelon construction and differentiated technological advancement.

GLOBAL MEMORY PRODUCTS INDUSTRY COMPETITIVE ANALYSIS

Competitive Landscape Overview

In the memory product industry, the key distinction between independent manufacturers and IDM manufacturers lies in whether they produce NAND or DRAM wafers. IDMs typically control the full value chain from wafer fabrication to finished products, which enables stronger upstream-downstream integration, scale advantages, and greater resilience amid market cyclicality or supply chain disruptions. Independent manufacturers, by contrast, do not engage in wafer production and instead focus on memory solution design as well as packaging and testing, resulting in a more flexible cost structure and greater adaptability in product planning. They can rapidly adjust capacity, performance, interface configurations and firmware to meet diverse application requirements, and their firmware and system-level integration capabilities allow performance and reliability differentiation even when using the same memory wafers. Overall, independent manufacturers benefit from flexibility, system integration capability and cost elasticity, while IDMs derive their advantages from vertical integration and stable upstream supply.

Independent Memory Manufacturers in the In-House Packaging Memory Product Market

Independent memory manufacturers focus on the customized development and scenario-specific adaptation of memory products. Leveraging the advantages of in-house packaging capabilities and flexible supply chain integration, they can provide memory solutions that are more tailored to customers' specific needs and quickly respond to diverse and evolving market demands.

According to Frost & Sullivan's data, the Group is the world's only independent memory solution provider with wafer-level packaging technologies.

Ranking of Independent Memory Manufacturers of Memory Products with In-House Packaging (by Revenue), Global, 2025

Ranking	Company	Revenue (US$ Million)
1	The Group	1,511.3
2	Company B	1,183.8
3	Company A	961.0

Source: Frost & Sullivan, Expert Interview

Memory Solution Providers for Emerging Edge AI Devices

Ranking of Memory Solution Providers for Emerging Edge AI Devices (by Revenue), Global, 2025

Ranking	Company	Revenue (US$ Million)	Market Share (%)
1	The Group	353.9	9.0
2	Company A	96.1	2.4

Source: Frost & Sullivan, Expert Interview

Notes:

1. The exchange rate used for converting USD amounts in the table is 1 USD = 7.18 CNY.
2. Company A is a listed company on the Shenzhen Stock Exchange, specializing in the development of flash memory products such as eMMC/UFS and SSDs.
3. Company B is a listed company on the Taiwan Stock Exchange, specializing in the development of controller chips such as USB flash controllers and solid-state drive controllers.

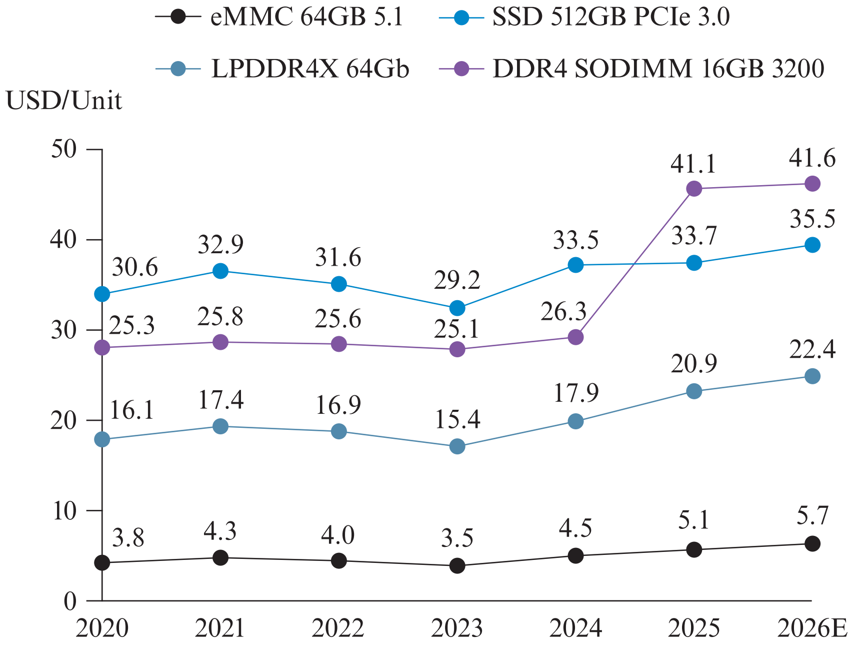
Source: Frost & Sullivan, Expert Interview

Overall Price Trend of Memory Products

The average prices of memory products followed a cyclical trajectory, driven by shifting market supply-demand dynamics each year. In 2020, prices across all categories remained at relatively low baseline levels, as global consumer electronics demand was stable and supply chains operated with balanced capacity. By 2021, prices ticked upward across the board: factors like boosted PC shipments, and mild supply tightness pushed. Between 2022 and 2023, the market turned: weakened end-device sales and bloated supply chain inventories triggered a price pullback. Most products saw declines, reflecting manufacturers' efforts to clear stock. 2024 marked a turning point: as inventory levels normalized and demand for mid-tier electronics/data center upgrades picked up, prices stabilized and edged higher. Looking ahead to 2025E, prices are projected to continue recovering, fueled by the rebounding DRAM industry cycle and renewed demand for device upgrades.

The price range of memory products is broad, with significant variation across product categories and configurations, reflecting a wide dispersion. This variation is driven by factors such as differences in product types, specifications including capacity and bandwidth, application scenarios, as well as advancements in manufacturing processes, packaging technologies and performance requirements. As memory products continue to penetrate high-performance computing, AI terminals and automotive applications, the proportion of high-end products is increasing, leading to a more differentiated overall pricing structure.

Memory Products Price Trend, 2020-2026E



Source: Frost & Sullivan

Wafer Pricing Analysis

Core wafer, the foundational substrate for memory products, has its pricing closely aligned with the overall semiconductor cycle rather than exhibiting an independent pricing trend, with core drivers rooted in supply-demand fundamentals, production capacity dynamics, and technology iteration. From 2020 to 2022, supported by strong global semiconductor demand and constrained production capacity, core wafer prices trended upward; in 2023, weak demand in consumer electronics and smart mobiles led to idle production capacity, exerting downward pressure on certain core wafer prices; since 2024, as the consumer electronics market has gradually recovered and demand for AI training, automotive-grade ICs, and computing has sustained growth, core wafer pricing has stabilized — with the penetration of advanced nodes in computing ICs and automotive applications supporting price [REDACTED] and modest increases, while mature nodes have faced intensified competition and a downward pricing trend due to the rapid expansion of domestic production capacity. Looking ahead, core wafer pricing is expected to remain broadly stable in the mid-to-long term, continuing to mirror the semiconductor cycle and being shaped by fluctuations in downstream demand and the pace of production capacity build-out.

Analysis of Entry Barriers in the Memory Products Industry

- **Technical Barriers**

  In the memory product industry, technical barriers mainly arise from the difficulty of achieving coordinated breakthroughs across multiple technical systems. The development of core memory chips requires expertise spanning materials science, precision manufacturing and circuit design. For example, chip architecture design demands high-density integration of multi-level memory cells while also optimizing lithography precision, etching processes and bonding technologies. At the system level, integrated solutions for data encryption, fault tolerance and power management must be developed to meet the strict standards for data integrity and reliability required by critical industries.

- **Supply Chain Barriers**

  The key supply chain barriers in the memory product industry lie in the ability to integrate global resources and build a comprehensive service network. Upstream, companies with global supply chains can source materials and allocate production capacity across multiple regions using coordinated processes to reduce risks and ensure quality. Downstream, global supply chain enterprises meet customized demands and provide timely service through warehousing and logistics hubs as well as localized teams, whereas new entrants without a global service network face significant limitations in fulfilling cross-border orders.

MACRO BACKGROUND OF MEMORY PRODUCT DEVELOPMENT IN THE AI ERA

Analysis of the Development History of AI

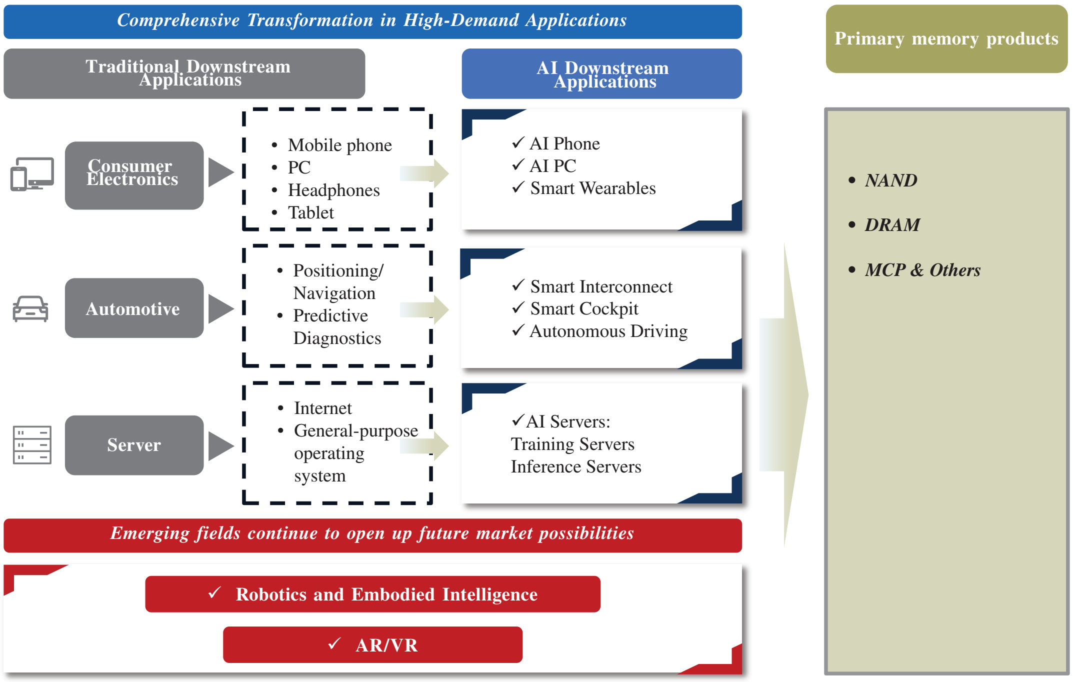
The development of artificial intelligence can be divided into distinct stages. The early stage was characterized by breakthroughs in perceptual tasks such as image and speech recognition achieved through large-scale data and algorithm optimization. Since 2011, AI has entered a new phase marked by the rise of large language models, with deep learning driven by deep neural networks becoming mainstream. Looking ahead, the direction of AI development will be collaborative edge-cloud computing. Intelligent applications will be able to run certain AI models locally for rapid response while the cloud leverages its powerful computing capacity to handle complex tasks. This edge-cloud collaboration model is driving upgrades in the performance and capacity of memory products, expanding their applications and market space and bringing new opportunities for growth.

Analysis of the transformation trend of downstream industries led by AI technology

With the rapid development of AI technology, its influence is penetrating downstream sectors in both depth and breadth. End-user applications and cloud infrastructure are shifting toward intelligent, scenario-driven solutions. In consumer electronics, smart mobiles and wearable devices now identify user habits and environments to deliver personalized experiences. In the automotive sector, upgrades in autonomous driving and smart cockpits enable vehicles to make real-time decisions, improving safety and user experience. On the cloud side, rising computing power and memory capacity, combined with AI-driven scheduling and data processing, provide strong backend support for AI services.

Driven by these trends, major downstream markets are expanding. Consumer electronics are accelerating their upgrade toward intelligence, and the penetration of smart vehicles is increasing, while the server market is growing rapidly with AI adoption. At the same time, AI-enabled AR/VR and robots are being deployed at scale and generate massive, diverse data. As functions become more complex and data volumes surge, memory products, as the core carrier of data storage, face higher performance requirements and are expected to fully benefit from this AI-driven transformation.

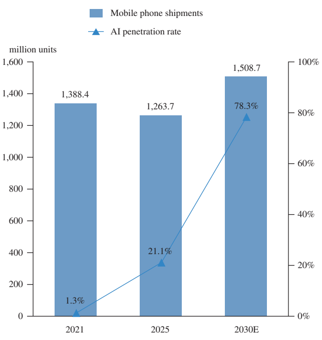
Downstream fields and applications of memory products



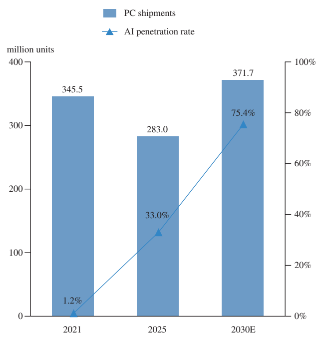
Source: Frost & Sullivan, CSIA

Demand Analysis in the Field of Edge AI

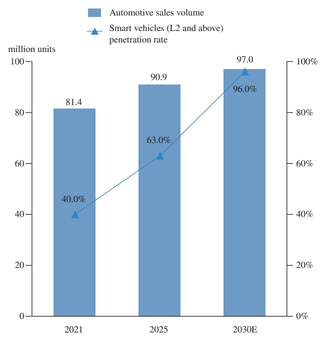
Mobile phone shipments and AI penetration rate, global, 2021, 2025 & 2030E



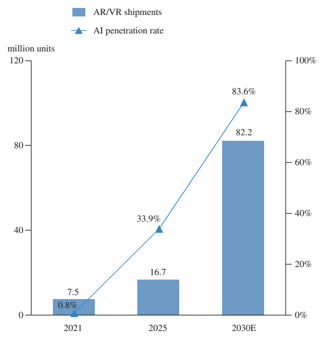
PC shipments and AI penetration rate, global, 2021, 2025 & 2030E



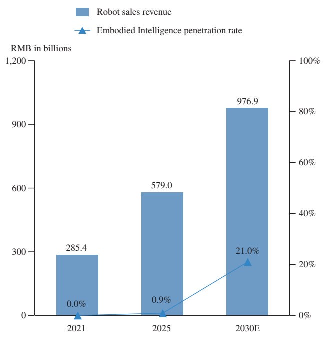
Automotive sales volume and smart vehicle*penetration rate, global, 2021, 2025 & 2030E



AR/VR shipments and AI penetration rate, global, 2021, 2025 & 2030E



Robot sales revenue and embodied intelligence penetration rate, global, 2021, 2025 & 2030E

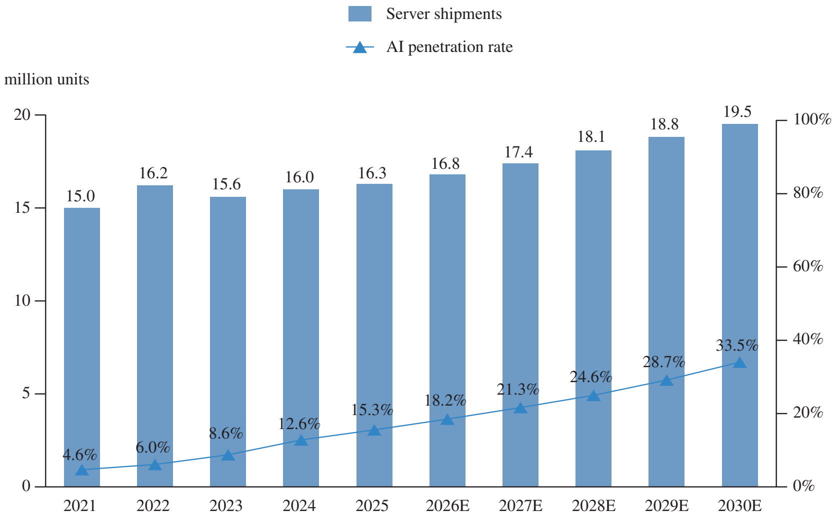


* *Smart vehicles with autonomous driving functions at L2 or above.*

Source: Frost & Sullivan, CSIA

Demand Analysis in the Cloud-side AI Field

Server shipments and AI penetration rate, global, 2021–2030E



Source: Frost & Sullivan, CSIA

SOURCE OF INFORMATION

In connection with the [REDACTED], we engaged Frost & Sullivan, an independent market research consultant, to conduct an analysis of, and to prepare the Frost & Sullivan Report about, the memory product market. Founded in New York in 1961, Frost & Sullivan is an independent global consulting firm providing services such as industry research, strategic market consulting, and corporate training. In connection with the market research services provided, the fee we need to pay to Frost & Sullivan is RMB519,400, which we believe is consistent with prevailing market rates.

In compiling and preparing the Frost & Sullivan Report, Frost & Sullivan conducted (i) primary research, including interviews with industry participants, competitors, downstream customers and recognized third-party industry associations, and (ii) secondary research, including reviews of corporate annual reports, databases of relevant official authorities, as well as the exclusive database established by Frost & Sullivan over the past decades. The market projections set out in the Frost & Sullivan Report are based on the following key assumptions: (i) social, economic and political conditions in the global markets discussed will remain stable during the forecast period; (ii) government policies relating to the global memory product market will remain consistent during the forecast period; and (iii) the memory product market will continue to bedriven by the factors described in the Frost & Sullivan Report.

Except as otherwise noted, all the data and forecasts contained in this section are derived from the Frost & Sullivan Report. The commissioned report has been prepared by Frost & Sullivan independently without influence from the Group or any other interested parties. Our Directors confirm that, to the best of their knowledge and after making reasonable inquiries, there has been no material adverse change in the market information since the date of the Frost & Sullivan Report that would qualify, contradict or otherwise affect the information contained in this section.

There has been no adverse change in the market information since December 31, 2024 that may qualify, contradict, or impact the information disclosed.