

INDUSTRY OVERVIEW

The information and statistics set out in this section and other sections of this document were extracted from the Frost & Sullivan Report, 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]. We believe that the sources of this information are appropriate sources for such information and have taken reasonable care in extracting and reproducing such information. We have no reason to believe that such information is false or misleading or that any fact has been omitted that would render such information false or misleading. The information from official government sources has not been independently verified by us, the Sole Sponsor, [REDACTED], any of their respective directors and advisors, or any other persons or parties involved in the [REDACTED], and no representation is given as to its accuracy.

SOURCE OF INFORMATION

We have commissioned Frost & Sullivan, an independent market research company, to analyze the automotive lighting and embodied intelligence market and compile a report. The information disclosed in this document regarding Frost & Sullivan is extracted from the Frost & Sullivan Report. We have agreed to pay Frost & Sullivan a fee of RMB580,000 (tax inclusive) for the preparation of the Frost & Sullivan Report.

The payment of this fee is not contingent upon our successful [REDACTED] or the outcome of the report. The Frost & Sullivan Report is based on both primary and secondary research obtained from various sources. Primary research includes interviews with key industry participants in the automotive lighting and embodied intelligence market and other experts relevant to our business. Secondary research includes a review of company reports, independent research reports, publicly reports from industry organizations, and data from Frost & Sullivan’s proprietary research database as well as government databases and other public information. Projected data were obtained from historical data analysis plotted against macroeconomic data with reference to specific industry-related factors. Except as otherwise noted, all of the data and forecasts contained in this section are derived from the Frost & Sullivan Report, various official government publications and other publications.

In compiling and preparing this report, Frost & Sullivan has made the following assumptions:

- During the forecast period, the social, economic and political environments of the PRC, and other major global markets will remain stable, ensuring the continued and steady development of the related industry;
- Government policies on the automotive lighting and embodied intelligence market will not undergo significant changes. Frost & Sullivan believes that the fundamental assumptions used in preparing this report, including those for future projections, are factual, accurate and not misleading.

Frost & Sullivan has conducted an independent analysis of the data; however, the accuracy of its review conclusions largely depends on the accuracy of the collected information.

OVERVIEW OF THE AUTOMOTIVE INDUSTRY

Current Development Status of the Global and Chinese Automotive Industry

From 2020 to 2025, global vehicle sales increased from 76.7 million units to 98.8 million units, representing a CAGR of 5.2%. In 2022, global vehicle sales recorded a temporary decline amid a slowing global economy, geopolitical tensions, key component shortages and pandemic-related disruptions. Supported by the recovery of the global automotive supply chain and economic rebound, global vehicle sales have since resumed growth. Looking ahead to 2025 to 2030, driven by rising penetration of new energy vehicles (NEVs), product upgrades and consumption structure optimization enabled by intelligent and connected technologies, continued demand growth in emerging markets and improved supply chain resilience, global vehicle sales are projected to reach 125.5 million units, with a CAGR of 4.9%.

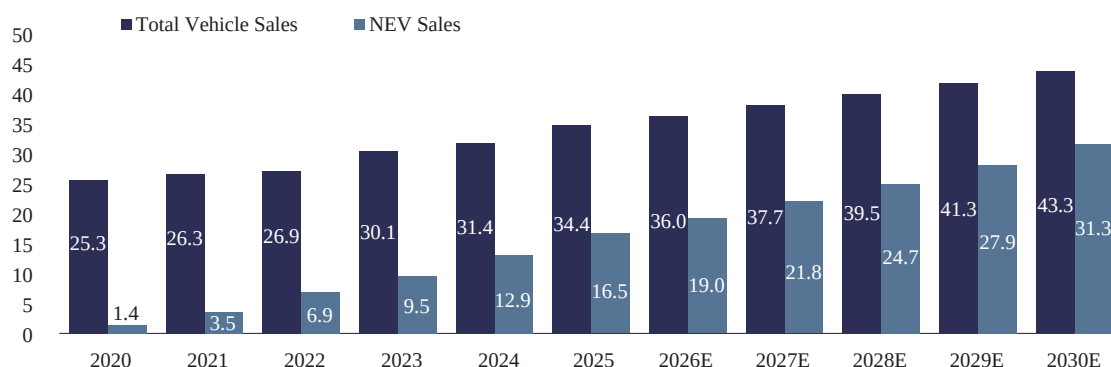
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From 2020 to 2025, China’s vehicle sales rose from 25.3 million to 34.4 million units, representing a CAGR of 6.3%. NEV sales surged from 1.4 million to 16.5 million units, with a CAGR of 64.5%, and penetration reached 47.9%. Driven by rising NEV penetration, replacement demand, consumption upgrading and expanding exports, China’s vehicle sales are projected to reach 43.3 million units by 2030 (CAGR 4.7%), with NEV sales at 31.3 million units (CAGR 13.7%) and penetration at 72.3%. NEVs will be the primary growth driver of China’s automotive market.

Market Size of Chinese Automotive Industry by Sales Volume, 2020–2030E

	CAGR	2020-2025	2025-2030E
Total Vehicle Sales		6.3%	4.7%
NEV Sales		64.5%	13.7%

Unit: Million Vehicles

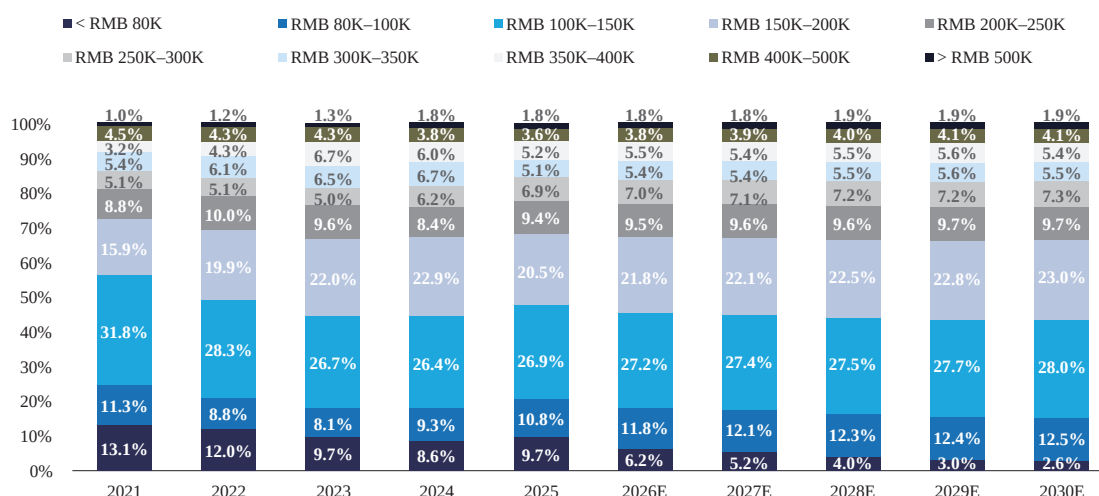


Source: CAAM, Expert interviews, Frost & Sullivan report

Note: Includes export sales.

From the perspective of the sales structure across different price segments of China’s passenger vehicles, the share of sales for passenger vehicles priced above RMB200,000 has tended to stabilize and is expected to consistently account for approximately one-third of China’s passenger vehicle sales market in the future.

Share of Passenger Vehicle Sales by Price Segment in China (Unit: %), 2021–2030E



Source: CAAM, Frost & Sullivan report

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Supportive Government Policies for the Automotive Industry

The automotive and components industry is governed by industrial policies, standards and regulations. These policies support NEV development, drive technological and green upgrading, and encourage the automotive lighting sector to advance toward high-quality, digitalized and intelligent development.

Supportive Government Policies for the Automotive Industry

Policy Name	Issuance Date	Issuing Authority	Key Content
Technology Roadmap for Energy-Efficient and New Energy Vehicles (Version 3.0) (《節能與新能源汽車技術路線圖3.0》)	Oct 2025	CSAE	By 2040, the penetration rate of NEVs will reach over 80%, accelerating the process of comprehensive electrification of the automotive industry.
GB 5920-2024 Road Vehicles and Trailers — Lighting and Light-signalling Devices and Systems (GB 5920-2024 《汽車和掛車光信號裝置及系統》)	Sep 2024	SAMR, SAC	For the first time, optical signal projection functions are introduced in national standards, systematically stipulating the definition, technical requirements, and scope of application of optical signal projection units.
Advanced Energy Efficiency Level, Energy-Saving Level and Access Level for Key Energy-Consuming Products and Equipment (2024 Edition) (《重點用能產品設備能效先進水平、節能水平和准入水平(2024年版)》)	Jan 2024	MIIT, NDRC, et al.	Comprehensively considering the technological level and development stage of relevant industries, and benchmarking against the advanced energy efficiency levels of similar products and equipment domestically and internationally, the energy efficiency levels of relevant products and equipment are divided into three tiers: Advanced Level, Energy-Saving Level, and Access Level. Among them, LED downlights, non-directional self-ballasted LED lamps, and LED luminaires for road and tunnel lighting are included.
Catalogue for Guiding the Adjustment of Industrial Structure (2024 Edition) (《產業結構調整指導目錄(2024年本)》)	Dec 2023	NDRC	Key automotive components such as adaptive front-lighting systems are listed in the encouraged category.
Implementation Opinions on Enhancing the Reliability of the Manufacturing Industry (《製造業可靠性提升實施意見》)	Jun 2023	MIIT, et al.	Focusing on industries such as machinery, electronics, and automotive, the country implements the “Foundation-Building” Project for basic product reliability, improving the reliability levels of core basic components, core basic parts, key basic software, key basic materials, and advanced basic processes.
Outline of the 14th Five-Year Plan for National Economic and Social Development of the People's Republic of China and the Long-Range Objectives Through the Year 2035 (《中華人民共和國國民經濟和社會發展第十四個五年規劃和2035年遠景目標綱要》)	Mar 2021	NPC	It speeds up efforts to address bottlenecks in basic components, basic software, basic materials, basic processes and industrial technologies, and improves the promotion mechanism for high-efficiency lighting products.

Source: Government website, Frost & Sullivan report

Overview of the Automotive Lighting Industry

Automotive lighting products are devices installed on the exterior or interior of a vehicle that emit visible light to fulfill functions such as road illumination, vehicle identification, signaling driving status, assisting environmental perception and enabling information interaction. Automotive lighting products, as one of the core automotive components, have a relatively high per-vehicle value (referring to the average total value of automotive lighting products installed per vehicle), and with the adoption of new lighting technologies such as HD and DLP, their technical complexity and per-vehicle value continue to rise.

Automotive lighting products encompass a diverse range of types spanning various light source technologies, installation positions, and levels of intelligence; specifically, they are classified by light source into halogen, xenon, LED, OLED, and Micro-LED lighting; by installation position into front, rear, and other lighting; and by intelligence level into conventional and intelligent lighting products. Among them, intelligent lighting products, with their core value in active safety, human-vehicle interaction and scenario-based experience, are gradually becoming an important direction for technological upgrading and product innovation in automotive lighting.

Intelligent automotive lighting products refer to automotive systems that, based on advanced optical hardware and intelligent software algorithms, realize adaptive illumination, light pattern control and information display through the coordinated operation of hardware and software. The functions of such products have gradually expanded to applications including intelligent lighting and interactive display, making them an important component in enhancing the intelligent mobility experience. At present, intelligent automotive lighting products mainly include HD and DLP front lighting systems with high-pixel light control capabilities, as well as OLED lamps and ISD lamps that support dynamic interaction and personalized lighting effects.

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The automotive lighting industry has gradually evolved from conventional functional lighting toward intelligent, pixelated and interactive products, with its core technologies comprising the following three categories.

Technical Overview of Automotive Lighting Products

Core Technologies	Technology Overview
Pixel-level Light Source and Projection Imaging Technology	<ul style="list-style-type: none">• Micro-LED lamps feature 10,000 to 100,000 pixels• DLP lamps feature millions of pixels
Algorithm Control and Network Architecture Technology	<ul style="list-style-type: none">• Precisely adjust light patterns and projection through the “perception-decision-execution” algorithm closed loop and multi-sensor data fusion• The mainstream network architecture is shifting to centralized domain control based on automotive Ethernet• Adopt AI algorithms to realize personalized lighting• Support system-level Over-the-Air (“OTA”) updates
Cross-domain Collaboration Technology	<ul style="list-style-type: none">• Deeply integrated into the vehicle-road-cloud system, relying on V2X (Vehicle-to-Everything) to achieve real-time communication capabilities.

Source: 2025 Intelligent Automotive Lighting Industry White Paper, Expert interviews, Frost & Sullivan report

The rapid development of the NEV industry is exerting a profound and systemic impact on the automotive lighting sector across multiple dimensions, including technological evolution paths, product demands, and the competitive market landscape. Technological advances in NEVs’ upgraded electronic and electrical architecture and intelligentization have driven the development of algorithm-enabled intelligent automotive lighting. Meanwhile, the closed front-end design of NEVs has expanded the application scope of integrated styling and functional lighting, while growing consumer demand for brand recognition and interactive experience has accelerated the penetration of through-type lamps, smart welcome lights and HD interactive headlamps, lifting per-vehicle lighting value. In addition, the more open NEV industrial chain and faster product iteration have enabled domestic enterprises to penetrate the mid-to-high-end automotive lighting market through rapid response, cost advantages and modular delivery, further deepening domestic substitution.

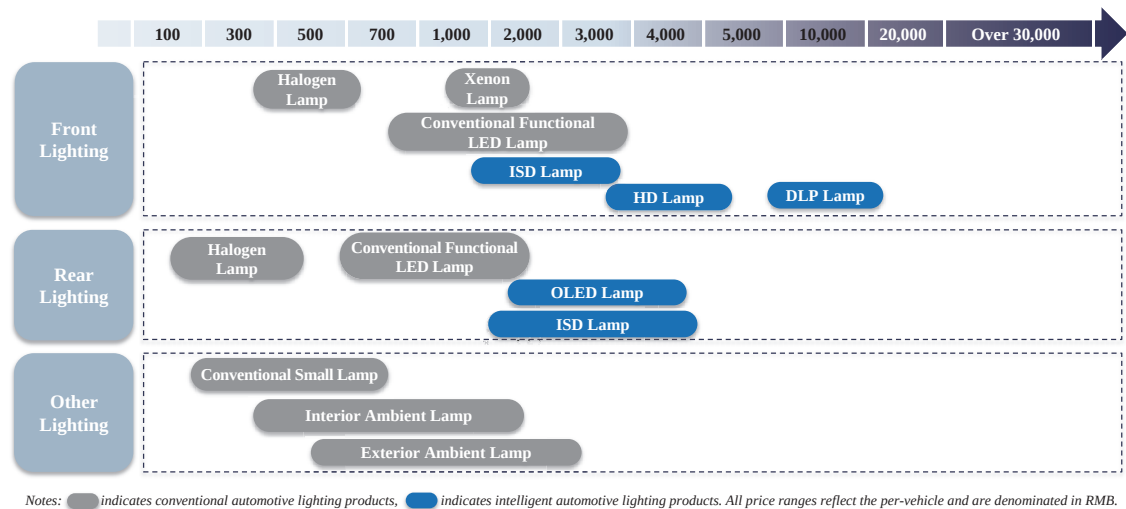
Overview of the Overseas and Chinese Automotive Lighting Industry

North America and Europe, the world’s second and third-largest automotive markets, boast stable sales and mature supply chains, attracting global lighting suppliers. In 2025, the North American market was dominated by European, Japanese and Korean players, while Europe was led by local players such as Valeo, Marelli and Hella with about 50% regional share. These markets offer higher per-vehicle lighting value than China, with prices 15%-30% higher in Europe and over 50% higher in North America, making them key high-value targets for Chinese suppliers. Supported by stronger supply chain competitiveness, Chinese firms achieved 3% penetration in North America and 4% in Europe in 2025, with market share expected to grow rapidly via technology and global layout.

As the world’s largest automotive market, China is seeing rapid intelligent upgrading of automotive lighting. Its intelligent lighting market share rose from 8.6% in 2025 and is projected to surge to 51.5% by 2030. Technological advances continue to lift per-vehicle lighting value. Front lighting is shifting from LEDs to pixel-level intelligent headlights (HD, DLP); rear lighting is upgrading from halogen to LED and OLED; and other lighting increasingly integrates ambient and interactive functions, all boosting overall system value.

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Price Analysis of Automotive Lighting Products in China, 2025



Source: Expert interviews, Frost & Sullivan report

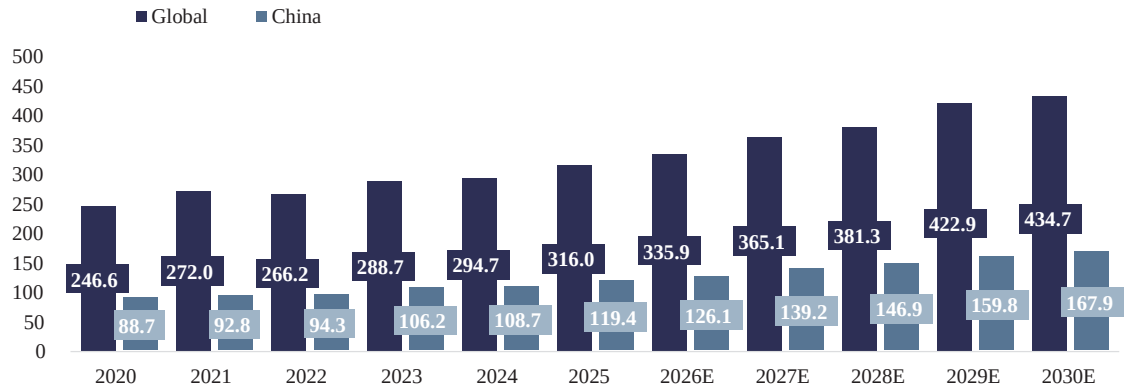
Market Size of the Automotive Lighting Industry

From 2020 to 2025, the global automotive lighting market grew from RMB246.6 billion to RMB316.0 billion at a CAGR of 5.1%, driven by recovering vehicle sales, rising NEV penetration and accelerated LED adoption. China’s market expanded faster, from RMB88.7 billion to RMB119.4 billion at a CAGR of 6.1%, supported by its leading automotive and NEV position, intelligent upgrading, advanced technologies, and a complete industrial chain with manufacturing, cost and R&D advantages. With deepening electrification and intelligence, intelligent lighting penetration will accelerate. The global and Chinese markets are projected to reach RMB434.7 billion and RMB167.9 billion by 2030, with CAGRs of 6.6% and 7.1% respectively for 2025-2030.

Global and Chinese Automotive Lighting Industry Market Size by Revenue, 2020–2030E

	CAGR	2020-2025	2025-2030E
Global	5.1%		6.6%
China	6.1%		7.1%

Unit: RMB Billion

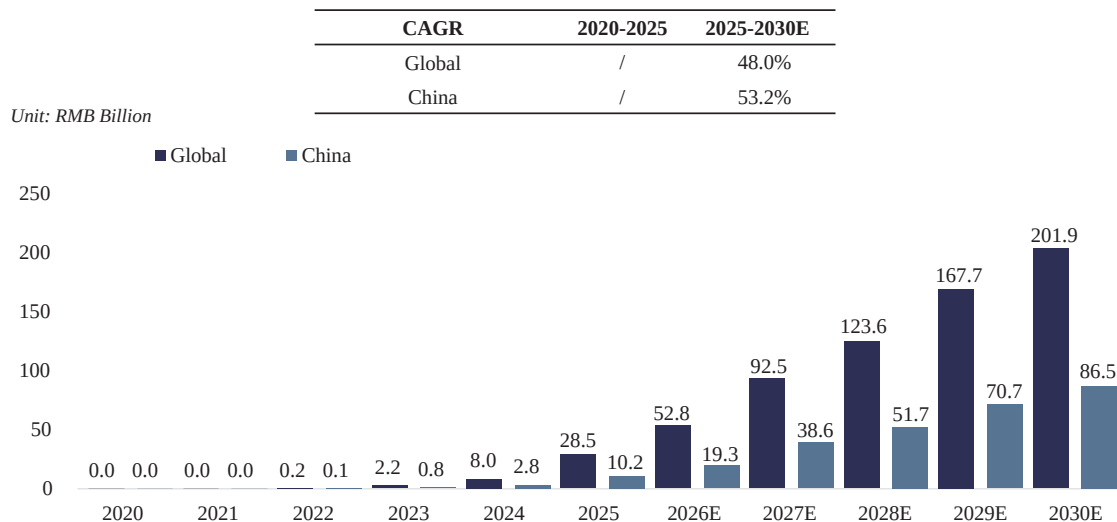


Source: Expert interviews, OICA, CAAM, Frost & Sullivan report

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From a structural evolution perspective, since 2022, the global and Chinese automotive lighting industries have been rapidly transitioning from a model dominated by conventional lighting products to one driven by intelligent lighting products. In the medium to long term, intelligent lighting products are expected to achieve rapid penetration across the automotive lighting sector. The global market for intelligent automotive lighting is projected to grow from RMB28.5 billion in 2025 to RMB201.9 billion by 2030, representing a CAGR of 48.0%. Meanwhile, China’s intelligent automotive lighting market is forecast to expand from RMB10.2 billion in 2025 to RMB86.5 billion by 2030, at a CAGR of 53.2%, positioning it as the core driver of industry growth.

Global and Chinese Intelligent Automotive Lighting Market Size by Revenue, 2020–2030E



Source: Expert interviews, OICA, CAAM, Frost & Sullivan report

Notes: Intelligent automotive lighting products include HD, DLP, ISD and OLED lighting.

By product type, from 2020 to 2025, the global market sizes of front lighting, rear lighting and other lighting rose from RMB105.8 billion, RMB91.7 billion and RMB49.1 billion to RMB131.1 billion, RMB106.2 billion and RMB78.7 billion, representing CAGRs of 4.4%, 3.0% and 9.9% respectively. Driven by rising NEV sales and intelligent lighting penetration, these segments are projected to reach RMB195.6 billion, RMB144.8 billion and RMB94.3 billion by 2030, with 2025-2030 CAGRs of 8.3%, 6.4% and 3.7% respectively. Over the same period, China’s market sizes of front lighting, rear lighting and other lighting expanded from RMB38.1 billion, RMB32.6 billion and RMB18.0 billion to RMB47.9 billion, RMB40.5 billion and RMB31.0 billion, at CAGRs of 4.7%, 4.4% and 11.5% respectively, and are expected to reach RMB74.9 billion, RMB55.6 billion and RMB37.5 billion by 2030, with 2025-2030 CAGRs of 9.4%, 6.5% and 3.9% respectively.

Global and Chinese Automotive Lighting Market Size by Product Type, 2020-2030E

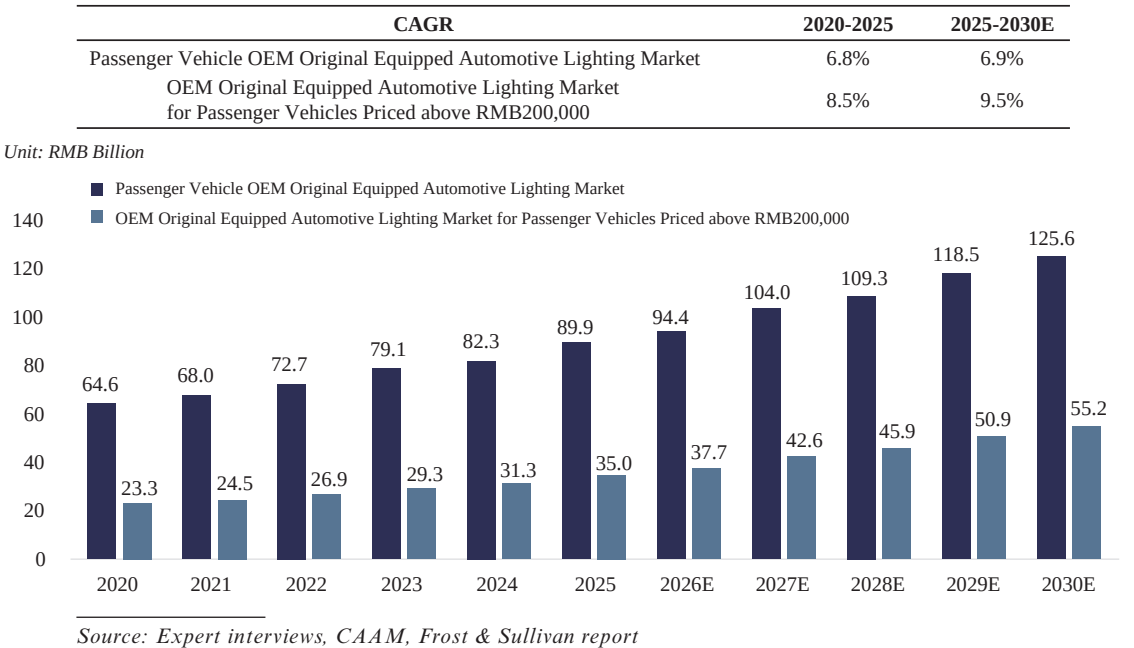
Unit: RMB Billion		2020	2021	2022	2023	2024	2025	2026E	2027E	2028E	2029E	2030E	2020-2025 CAGR	2025-2030E CAGR
Global	Front Lighting	105.8	112.4	108.6	119.8	121.5	131.1	138.7	155.2	164.7	188.1	195.6	4.4%	8.3%
	Rear Lighting	91.7	100.4	96.2	101.7	102.0	106.2	113.1	122.2	128.2	141.4	144.8	3.0%	6.4%
	Other Lighting	49.1	59.3	61.4	67.2	71.2	78.7	84.0	87.8	88.4	93.4	94.3	9.9%	3.7%
China	Front Lighting	38.1	39.7	39.4	43.4	43.6	47.9	50.4	60.5	64.2	72.5	74.9	4.7%	9.4%
	Rear Lighting	32.6	32.7	32.5	35.5	36.1	40.5	41.7	43.8	46.4	50.2	55.6	4.4%	6.5%
	Other Lighting	18.0	20.4	22.3	27.2	29.0	31.0	34.0	34.9	36.3	37.1	37.5	11.5%	3.9%

Source: Expert interviews, OICA, Frost & Sullivan report

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The OEM original equipped automotive lighting refers to lighting products procured and installed by automotive manufacturers during vehicle production, as distinguished from the aftermarket, and constitutes the core market segment for automotive lighting suppliers. From 2020 to 2025, China’s passenger vehicle OEM original equipped automotive lighting market grew steadily from RMB64.6 billion to RMB89.9 billion at a CAGR of 6.8%, higher than the 6.1% CAGR of the overall Chinese automotive lighting market, mainly driven by accelerated penetration of intelligent front and rear lighting, and is projected to reach RMB125.6 billion by 2030 with a 2025-2030 CAGR of 6.9%. Meanwhile, the OEM original equipped automotive lighting market for passenger vehicles priced above RMB200,000 expanded from RMB23.3 billion to RMB35.0 billion at a CAGR of 8.5% during 2020-2025, and is expected to grow further to RMB55.2 billion by 2030 at a CAGR of 9.5% for 2025-2030, supported by rising sales of mid-to-high-end intelligent electric vehicles and faster adoption of intelligent lighting technologies.

Chinese Passenger Vehicle OEM Original Equipped Automotive Lighting Market Size by Revenue, 2020–2030E



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Competitive Landscape of the Automotive Lighting Industry

Ranking of Automotive Lighting Suppliers

In 2025, the top ten global automotive lighting companies collectively held a 68.1% market share, while the top five companies in the Chinese automotive lighting market accounted for 35.2%. The Company ranked seventh globally in the automotive lighting industry by revenue, with a market share of 4.6%, making it the highest-ranked Chinese enterprise worldwide. Domestically, it ranked first in China’s automotive lighting market, holding an 11.6% market share.

Global Automotive Lighting Market Share by Revenue, 2025

Ranking	Company	Country	Revenue (RMB: 100 million)	Market Share, 2025
1	Company A ⁽¹⁾	Japan	410.5	13.0%
2	Company B ⁽²⁾	France	328.2	10.4%
3	Company C ⁽³⁾	Germany	299.6	9.5%
4	Company D ⁽⁴⁾	Italy	254.2	8.0%
5	Company E ⁽⁵⁾	Japan	213.3	6.8%
6	Company F ⁽⁶⁾	South Korea	206.2	6.5%
7	The Company	China	144.3	4.6%
8	Company H ⁽⁸⁾	Austria	115.1	3.6%
9	Company G ⁽⁷⁾	China	95.8	3.0%
10	Company I ⁽⁹⁾	France	86.0	2.7%

Source: Annual reports of listed companies, Expert interviews, Frost & Sullivan report

Chinese Automotive Lighting Market Share by Revenue, 2025

Ranking	Company	Country	Revenue (RMB: 100 million)	Market Share, 2025
1	The Company	China	138.6	11.6%
2	Company G ⁽⁷⁾	China	81.4	6.8%
3	Company C ⁽³⁾	Germany	74.9	6.3%
4	Company B ⁽²⁾	France	68.2	5.7%
5	Company D ⁽⁴⁾	Italy	56.7	4.7%

Source: Annual reports of listed companies, Expert interviews, Frost & Sullivan report

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In 2025, the top five companies in the global intelligent automotive lighting market collectively held a 38.0% market share, while the top five companies in the Chinese intelligent automotive lighting market accounted for 65.6% of domestic sales. As intelligent lighting technology advances and intelligent products are increasingly adopted by automotive manufacturers, the global and Chinese automotive intelligent lighting markets feature a more diversified competitive landscape, with market structure and concentration evolving rapidly. The Company ranked first both globally and in China by revenue, with market shares of 10.2% and 28.4%, respectively.

Global Intelligent Automotive Lighting Market Share by Revenue, 2025

Ranking	Company	Country	Revenue (RMB: 100 million)	Market Share, 2025
1	The Company	China	29.1	10.2%
2	Company D ⁽⁴⁾	Italy	27.8	9.8%
3	Company B ⁽²⁾	France	25.6	9.0%
4	Company C ⁽³⁾	Germany	14.3	5.0%
5	Company G ⁽⁷⁾	China	11.4	4.0%

Source: Annual reports of listed companies, Expert interviews, Frost & Sullivan report

Chinese Intelligent Automotive Lighting Market Share by Revenue, 2025

Ranking	Company	Country	Revenue (RMB: 100 million)	Market Share, 2025
1	The Company	China	29.1	28.4%
2	Company D ⁽⁴⁾	Italy	15.7	15.3%
3	Company G ⁽⁷⁾	China	11.4	11.1%
4	Company B ⁽²⁾	France	8.8	8.6%
5	Company C ⁽³⁾	Germany	2.2	2.1%

Source: Annual reports of listed companies, Expert interviews, Frost & Sullivan report

In 2025, the top five companies in China’s passenger vehicle OEM original equipped automotive lighting market collectively held a 42.6% market share. The Company ranked first by revenue, with a 15.4% market share. The top five companies in China’s OEM original equipped automotive lighting market for passenger vehicles priced above RMB200,000 accounted for 62.3% of the segment’s total market share. The Company ranked first by revenue, capturing a 26.0% market share.

Chinese Passenger Vehicle OEM Original Equipped Automotive Lighting Market Share by Revenue, 2025

Ranking	Company	Country	Revenue (RMB: 100 million)	Market Share, 2025
1	The Company	China	138.6	15.4%
2	Company G ⁽⁷⁾	China	77.5	8.6%
3	Company C ⁽³⁾	Germany	68.6	7.6%
4	Company B ⁽²⁾	France	53.1	5.9%
5	Company D ⁽⁴⁾	Italy	45.4	5.1%

Source: Annual reports of listed companies, Expert interviews, Frost & Sullivan report

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Chinese OEM Original Equipped Automotive Lighting Market Share by Revenue for Passenger Vehicles Priced above RMB200,000, 2025

Ranking	Company	Country	Revenue (RMB: 100 million)	Market Share, 2025
1	The Company	China	91.0	26.0%
2	Company G ⁽⁷⁾	China	38.0	10.8%
3	Company C ⁽³⁾	Germany	34.3	9.8%
4	Company B ⁽²⁾	France	32.5	9.3%
5	Company D ⁽⁴⁾	Italy	22.7	6.5%

Source: Annual reports of listed companies, Expert interviews, Frost & Sullivan report

Notes:

(I) Intelligent automotive lighting products primarily include HD, DLP, ISD and OLED lighting, based on industry-standard revenue estimated from vehicle production and installation volumes; (II) In certain tables, the total figure may slightly differ from the sum of individual sub-items due to rounding of each component to a specified decimal precision. This discrepancy does not affect the authenticity, accuracy or completeness of the data. (III) The country listed indicates the location of the company's headquarters. (IV) The automotive lighting product revenue data for Companies A to I is estimated based on publicly available information such as revenue reports and other accessible resources, and has been verified to the best of our ability through consultations with industry professionals and experts. Therefore, discrepancies may exist between this data and the audited financial data of the aforementioned companies. (V) Publicly available information includes financial reports of listed companies, public industry reports and similar documents.

(1) Company A was founded in 1915 and is headquartered in Japan. It is listed on the Tokyo Stock Exchange, with operations covering in automotive lighting products, automotive electronics, electronic control systems and sensor systems. (2) Company B was founded in 1923 and is headquartered in France. It is listed on Euronext Paris, with operations covering automotive lighting products, powertrain systems and intelligent driving solutions. (3) Company C was founded in 1899 and is headquartered in Germany and listed on Frankfurt Stock Exchange, with operations covering automotive lighting products, body electronics, energy management and sensor systems. (4) Company D was founded in 1919 and is an unlisted company headquartered in Italy, with operations covering automotive lighting products, electronic systems and powertrain systems. (5) Company E was founded in 1920 and is headquartered in Japan. It is listed on the Tokyo Stock Exchange, with operations covering automotive lighting products, electronic components and automotive electronics. (6) Company F was founded in 1954 and is headquartered in South Korea. It is listed on the Korea Exchange, with operations covering automotive lighting products and body control modules. (7) Company G was officially restructured as a state-owned enterprise in 2018 and is headquartered in China. It is a wholly owned subsidiary of a company listed on the Shanghai Stock Exchange, with operations covering automotive lighting products, lighting controllers and digital projection technologies. (8) Company H was founded in 1938 and is an unlisted company headquartered in Austria, with operations covering automotive lighting products and lighting controllers. (9) Company I was founded in 1946 and is headquartered in France. It is listed on Euronext Paris, with operations covering automotive lighting systems, automotive tooling/molds and powertrain systems.

Supply Relationships Between Automotive Lighting Suppliers and Automotive Manufacturers

Automotive lighting suppliers typically build deep partnerships with automotive manufacturers based on specific vehicle programs, covering the full process of product development, validation, mass production and supply, thereby ensuring long-term business stability and sustainable growth. As of 2025, the Company has established stable supply relationships for automotive lighting products with nine of the world's top ten automotive manufacturers ranked by group-level sales volume. These customers collectively accounted for approximately 50.1% of global vehicle sales in 2025, reflecting the Company's high-quality customer base and strong global supporting capabilities, and further strengthening its position as a core supplier in the global automotive lighting market.

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The Impact of Raw Material Price Volatility on the Automotive Lighting Industry

The upstream raw materials for automotive lighting mainly comprise electronic components, dedicated lighting electronic parts and resins, accounting for 80%–85% of total costs. From 2023 to the first half of 2026, affected by petrochemical supply conditions, geopolitical risks, and the supply-demand dynamics of semiconductors, the procurement prices of engineering plastics such as PP and PC, alongside electronic components including LED light sources and integrated circuits, generally followed a trajectory of initial decline and subsequent volatility. Meanwhile, prices of PMMA optical materials and wiring harnesses trended upward overall. This was driven by rising demand and higher quality standards for high-transmittance optical materials, sustained copper price fluctuations, and greater complexity of wiring harnesses resulting from deepening vehicle electrification. Specifically, the average price of PP first fell from RMB7,531.0/ton in 2023, then fluctuated to RMB8,285/ton in the first half of 2026, while the average price of PMMA climbed from RMB14,574.8/ton to RMB15,624.0/ton.

Although upstream material prices fluctuate moderately, their volatility remains controllable. Going forward, key raw material prices for automotive lighting are expected to stay dynamically volatile, affected by petrochemical supply patterns, semiconductor supply-demand shifts and metal price movements. No substantial basis exists for sharp unilateral swings, and the overall impact on industry participants’ costs and selling prices will remain manageable.

Raw material price fluctuations have limited impact on the historical and future final-product selling prices. The primary reason is that automotive lighting products feature high technical added value, and their pricing is predominantly affected by R&D and design, optical performance, intelligent function configuration and other factors. In addition, automotive lighting manufacturers typically sign medium and long-term cooperation agreements or annual framework pricing agreements with major raw material suppliers. Via appropriate price negotiation and cost transmission mechanisms, they cushion the impact of raw material price fluctuations on end-product prices, thereby weakening the direct transmission of raw material price volatility to the final selling prices of products.

Entry Barriers in the Automotive Lighting Industry

Customer Barriers: As key components of vehicle intelligent systems, automotive lighting products require in-depth matching with vehicle platforms and electronic and electrical architectures. Incumbent suppliers have a first-mover advantage due to close cooperation with automotive manufacturers. New entrants lack cooperative development experience and need 2 to 3 years of certification and review, making it hard to quickly achieve project awarding and mass production delivery.

Technical Barriers: Automotive lighting technology system has evolved from traditional optical and structural design to multi-disciplinary integration. Intelligent lighting products (e.g., HD, DLP) demand high light control precision, response speed and system collaboration, and deep integration with Advanced Driver Assistance Systems (“ADAS”) and vehicle software platforms, creating a high technical threshold for new entrants to catch up.

Cost Barriers: Automotive lighting production requires dedicated lines for high-precision injection molding, vacuum coating, automated assembly, and optical inspection, with a single line investment reaching up to RMB100 million level. Such high upfront investment means only enterprises with stable orders and large-scale production capabilities can effectively dilute costs and achieve profitability, while small and medium-sized manufacturers struggle to realize economies of scale.

Certification Barriers: As critical components for driving safety, automotive lighting products must meet national technical regulations, industry standards, quality management and functional safety certifications, with complex and long procedures. Automotive manufacturers have strict requirements on reliability, consistency and safety, and suppliers must pass rigorous inspections to become qualified.

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Drivers of the Automotive Lighting Market

Policy-Driven Factors: Global policies drive technological upgrading of the automotive lighting industry. Europe has gradually eased regulations on driver assistance and signal light projection, approving front headlight, reverse light and turn signal projection functions, driving upgrades in optical modules and algorithms. North America has adopted ADB technology allowing static cues such as turn arrows, while SAE standards regulate external lighting and animations, providing a framework for intelligent lighting. China has set ADB testing rules and permitted driver assistance projection, accelerating the industry’s shift to intelligent and pixelated lighting. The improving regulatory framework in emerging markets also provides institutional safeguards for industry development. These new standards have raised technical thresholds, driving industry-wide upgrading and structural optimization.

Rapid Growth in NEV Sales Drives Higher Lighting Value per Vehicle: NEVs have higher flexibility in design, electrical architecture and body styling, and tend to adopt intelligent lighting products such as ISD, HD, DLP and OLED, significantly boosting per-vehicle lighting system value.

Rapid Rise of Domestic Suppliers and Strengthening Industry Leadership: Chinese domestic manufacturers have made continuous technological breakthroughs in optical design, electronic control and system integration, gradually entering high-end vehicle supply chains. They have formed leading mass production capabilities and application scales over foreign enterprises in high-end intelligent and pixelated front headlights, strengthening industry leadership.

Intelligent and Software-Defined Vehicles Accelerate Adoption, creating a New Growth Arena in Intelligent Lighting: With the development of China’s automotive ADAS and Software-Defined Vehicles, intelligent lighting products supporting OTA upgrades and scenario-based interaction are rapidly penetrating, evolving from high-end optional to standard equipment across more vehicle classes, with great industry potential.

Expanding Global Market and Deepening Overseas Layout: Global automotive manufacturers are accelerating electrification, creating strong demand for intelligent lighting. Chinese enterprises leverage industrial chain advantages to expand overseas, deepening layout by building overseas production bases or acquiring foreign automotive lighting businesses.

Development Trends in the Automotive Lighting Industry

Continuous Technological Advancement: Automotive lighting technology iterates rapidly. Micro LED, OLED and other new light sources are gradually applied to mass-produced models. With enhanced intelligent control, optimized modular supply chain and rising DLP and HD lighting penetration in high-end models, lighting systems’ functionality, safety and intelligence are further improved.

Diverging Market Demand: Automotive lighting demand is obviously differentiated. Traditional fuel and entry-level models maintain stable demand for mature, cost-effective traditional LED lighting focusing on functions; mid-to-high-end and NEV models value comprehensive value in styling, interaction and function integration, driving up intelligent lighting penetration.

Domestic Suppliers Accelerate Entry into Mid- to High-End Automotive Manufacturer Supply Chains: As Chinese passenger vehicles accelerate global expansion, domestic manufacturers are accelerating into mid-to-high-end supporting fields previously dominated by foreign enterprises, evolving from low-end substitution to high-end breakthrough, and shifting focus from “supporting follow-up” to “technological leadership”.

Manufacturing Model Upgrade: Chinese automotive lighting enterprises upgrade production via Manufacturing Execution System (“MES”) , digital twin, robot clusters and AI, building smart factories and flexible lines to realize multi-model simultaneous production and quick switching, improving capacity utilization and delivery efficiency.

INDUSTRY OVERVIEW

Deepening Vertical Integration: Manufacturers are evolving from conventional lamp suppliers to providers of intelligent lighting and automotive electronics solutions. Extending upstream into light source modules, controllers, and algorithms enhances cost control and delivery stability. Business models are transforming from pure hardware supply to comprehensive solutions covering controllers, algorithms, and system integration.

Embodied Intelligence Industry Overview

Background of Development and Definition

Intelligent vehicles are highly correlated with embodied intelligence, a key physical carrier for future Physical AI, and developing embodied intelligence via the automotive sector has become an emerging industry trend driven by technological commonality and growth needs. Major automotive component suppliers are expanding into robotics by transferring core strengths in system engineering, reliability and large-scale manufacturing to create new growth drivers and competitive advantages. Meanwhile, the automotive industry’s high-reliability standards, cost control capabilities and system-level engineering experience match the requirements for scalable commercialization of embodied intelligence, which is expected to accelerate industry maturation and large-scale application.

Embodied intelligence is a frontier field that integrates artificial intelligence with multiple scientific domains. Its core is that agents interact with the real environment through physical embodiments, and learn and perform tasks with the support of sensory feedback.

Market Size of the Embodied Intelligence Components Industry

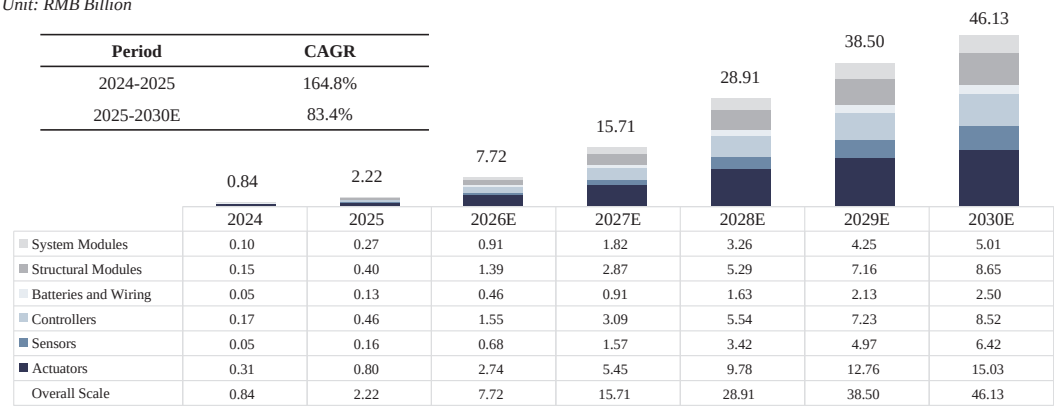
China’s embodied intelligence industry is expanding rapidly, with humanoid robots as a key growth driver. From 2020 to 2023, the sector remained at the R&D stage with minimal scale; 2024-2025 saw a shift from technical validation to initial commercialization with high growth, and 2025 recorded explosive expansion with 12,750 units shipped and small-batch mass production, marking a transition from lab research to industrial deployment. From 2026 to 2030, the market is expected to enter large-scale expansion supported by domestic core component substitution, wider application scenarios, mature standards and supply chains; meanwhile, the core components and modules market will see rapid scaling, technological progress and cost reduction, evolving from demand-driven growth to full-industry-chain coordination.

Key growth drivers include rising technological maturity and cost advantages of domestic core components, increasing demand for mass-produced humanoid robots, and accelerated iteration toward high performance, high reliability and low power consumption, enabling broader application scenarios.

INDUSTRY OVERVIEW

Chinese Humanoid Robot Core Components and Modules Market Size by Revenue, 2024–2030E

Unit: RMB Billion



Source: Interviews with industry experts, Frost & Sullivan report

Notes: According to the standard system framework of the National Technical Committee for Robotics Standardization, core components include actuators, sensors, controllers, batteries and wiring; modules cover structural modules and system modules. Among these, actuators consist of reducers, lead screws and motors; sensors include visual, tactile, auditory and force sensors; controllers comprise chips, controllers and encoders. Structural modules include human head modules, electronic skin, dexterous hands, trunk structures and upper and lower limb structures; system modules cover basic software, application software, as well as development and testing phases.

At present, China’s market for sensors, structural modules and core components of embodied intelligence is generally in the early stage of technical verification and prototype cooperation, with no stable or quantifiable competitive landscape formed. Most enterprises remain at the stages of prototype installation, designated customer testing and small-scale technical cooperation, and a competitive market has not yet taken shape.