FROST & SULLIVAN

Market Engineering

Independent Market Study on Global and China's BLDC Motor Control and Driver Chip Industry

Presented to

Fortior Tech
峰岹科技

Date : _____

For and on behalf of
Frost & Sullivan (Beijing) Inc., Shanghai Branch Co.

Name: Charles Lau
Title: Executive Director

Terms and Abbreviations

Terms:

- **Compound Annual Growth Rate (CAGR):** The term for interest rate at which a given Present Value (PV) would "grow" to a given Future Value (FV) in a given amount of time. The formula for calculating CAGR is: (FV/PV)^(1/number of years)
- **Motor:** A motor is a device that utilizes the principles of electromagnetic induction to achieve the mutual conversion between electrical energy and mechanical energy.
- **BLDC Motor**: A BLDC motor is a type of motor that eliminates carbon brushes and commutators, using electronic control to manage power supply commutation for motor operation.
- **BLDC Motor Control and Driver Chip:** BLDC motor chips are the key components of the BLDC motor control and driver system, which are mainly divided into control chips and driver chips.

Terms and Abbreviations

Abbreviations:

BLDC	Brushless Direct Current	**ME**	Motor Engine
EV	Electric Vehicles	**IoT**	Internet of Things
UAV	Unmanned Aerial Vehicle	**FOC**	Field Oriented Control
PC	Personal Computer	**EPS**	Electric Power Steering
MCU	Microcontroller Unit	**AI**	Artificial Intelligence
ASIC	Application Specific Integrated Circuit		
HVIC	High-Voltage Integrated Circuits		
MOSFET	Metal Oxide Semiconductor Field Effect Transistor		
IPM	Intelligent Power Module		
DC	Direct Current		
AC	Alternating Current		

Assumptions and Methodology

Assumptions:

The market size and forecasts were modeled by Frost & Sullivan based on the following assumptions.

- The social, economic and political conditions in globally currently discussed will remain stable during the forecast period;
- Government policies on BLDC motor control and driver chip industry globally will remain consistent during the forecast period;
- Global and China's BLDC motor control and driver chip industry will be driven by the factors which are stated in the report in the forecast period.

Methodology:

In preparing the report, Frost & Sullivan has relied on the statistics and information obtained through primary and secondary research.

- Primary research, which involved discussing the status of the industry with certain leading industry participants, and interviews with industry experts on a best-effort basis to collect information in aiding in-depth analysis.
- Secondary research, which involved reviewing company reports, independent research reports and data based on its own research database.

Content

1. Analysis of Macroeconomic Market

Analysis of Macroeconomic Market
Comparative Analysis among Major Types of Motors

- Motors are devices that utilize the principles of electromagnetic induction to achieve mutual conversion between electrical energy and mechanical energy, which can be categorized into direct current (DC) motors and alternating current (AC) motors. DC motors can be further divided into brushless DC (BLDC) motors and brushed DC (BDC) motors, while AC motors can be further divided into synchronous motors and asynchronous motors.
- Compared with other types of motors, BLDC motors have several advantages, including higher output power, higher efficiency, longer life span, lower power consumption, and ease of maintenance. While their disadvantages include the relatively higher R&D costs, higher control complexity, and higher requirements on algorithms.

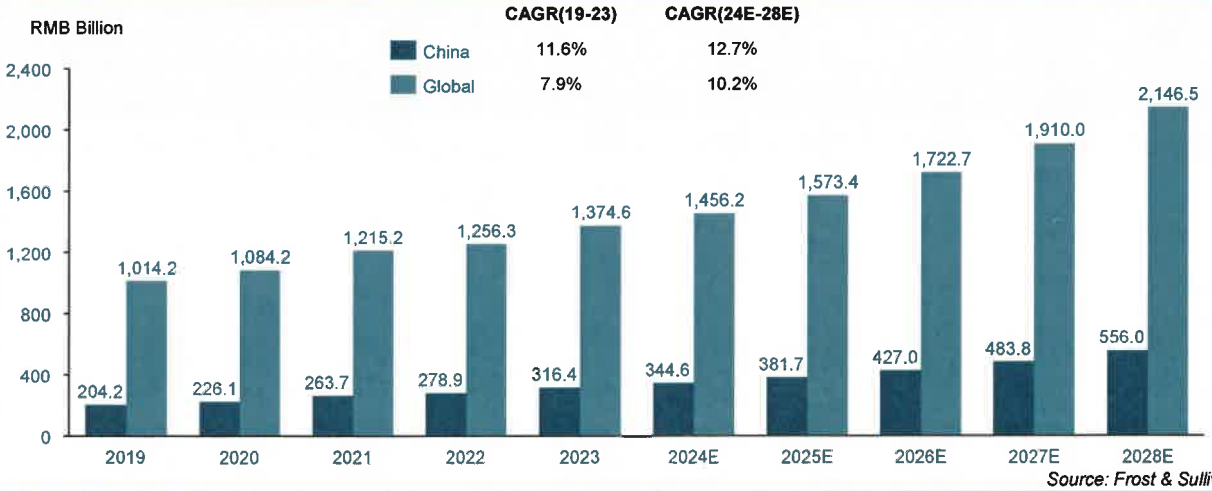
	DC Motor		AC Motor	
	BLDC Motor	BDC Motor	Synchronous Motor	Asynchronous Motor
Definition	A BLDC motor is a type of motor that uses electronic control, instead of carbon brushes and commutators, to manage power supply commutation for motor operation.	A BDC motor converts direct current into mechanical energy and incorporates an internal brush mechanism.	A synchronous motor is an AC motor where the rotor speed matches the rotating magnetic field speed of the stator.	An asynchronous motor is an AC motor where the rotor speed does not match the speed of the rotating magnetic field produced by the stator.
Output Power Per Unit Volume	High	Medium	Medium	Medium
Efficiency	High	Low	High	Low
Control Complexity	High	Low	High	Medium
Requirment of Algorithms	High	Low	High	Medium
Life Span	Long	Short	Long	Long
Maintenance Costs	Low	High	High	Low
R&D Costs	High	Low	High	Low

Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of Motors

- The global motor market expanded from RMB 1,014.2 billion in 2019 to RMB 1,374.6 billion in 2023, reflecting a CAGR of 7.9%, driven by advancements in chip technology and growing downstream demand. The market is expected to increase from RMB 1,456.2 billion in 2024 to RMB 2,146.5 billion in 2028, with a CAGR of 10.2%, driven by increased investment in infrastructure construction.
- China's motor market grew from RMB 204.2 billion in 2019 to RMB 316.4 billion in 2023, representing 23.0% of the global market share, with a CAGR of 11.6%, due to the ongoing progress in national infrastructure and rapid industrial development. In the future, driven by technological advancements and industrial upgrades, China's motor market is expected to rise from RMB 344.6 billion in 2024 to RMB 556.0 billion in 2028, capturing 25.9% of the global market share by 2028, with a CAGR of 12.7%.

Market Size of Motors (by sales value), Global and China, 2019-2028E

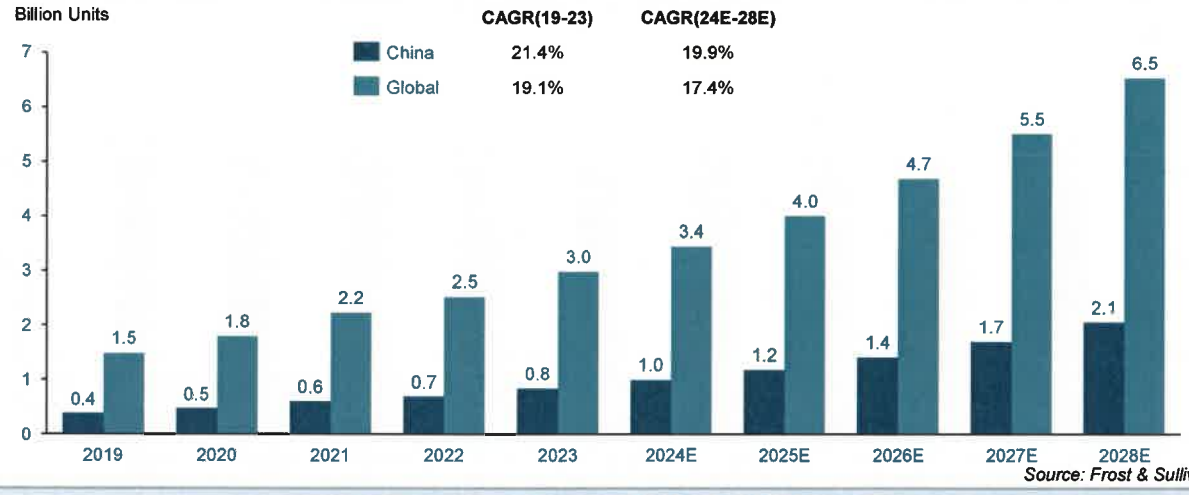


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of BLDC Motors (1/2)

- The sales volume of global and China's BLDC motor market shares the same trend with that of the sales value of BLDC motor market. The global BLDC motor sales volume increased rapidly from 1.5 billion units in 2019 to 3.0 billion units in 2023, with a CAGR of 19.1%, and is expected to further increase from 3.4 billion units in 2024 to 6.5 billion units in 2028, representing a CAGR of 17.4%. The China BLDC motor sales volume increased from 0.4 billion units in 2019 to 0.8 billion units in 2023, with a CAGR of 21.4% which is higher than that of global market and is expected to further grow from 1.0 billion units in 2024 to 2.1 billion units in 2028, representing a CAGR of 19.9% which is also higher than that of global market.

Market Size of BLDC Motor Market (by sales volume), Global and China, 2019-2028E

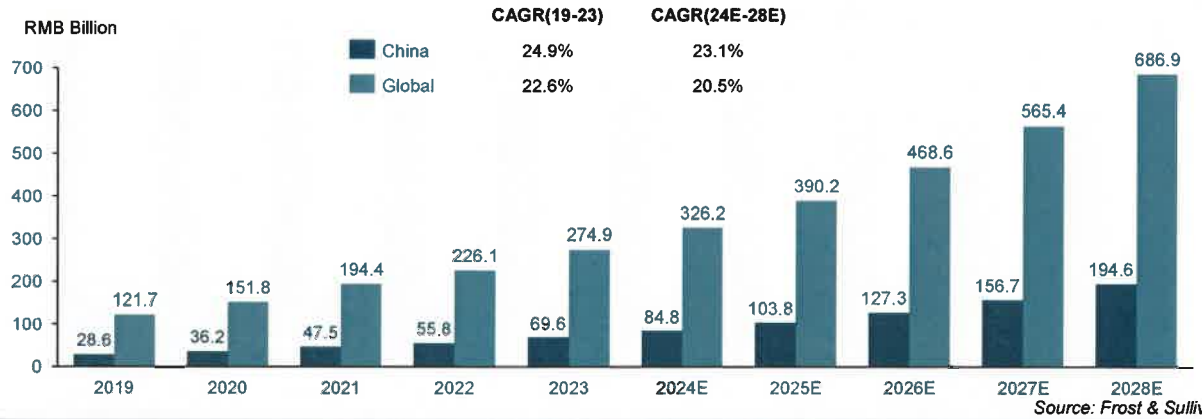


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of BLDC Motors (2/2)

- Due to higher energy efficiency and lower power consumption compared with other types of motors, BLDC motors meet the needs of energy conservation and emission reduction from downstream industries. Therefore, they have been more widely used in multiple fields such as home appliances, electric tools, intelligent robots and EVs. The global BLDC motor market increased rapidly from RMB121.7 billion in 2019 to RMB274.9 billion in 2023, with a CAGR of 22.6%, and is expected to further increase from RMB326.2 billion in 2024 to RMB686.9 billion in 2028, representing a CAGR of 20.5%. The global BLDC motor market accounts for 12% and 20% of the global motor market in 2019 and 2023 respectively. With the widespread use of BLDC motors in downstream applications, the penetration rate is expected to increase to 32% in 2028.
- China's BLDC motor market increased from RMB28.6 billion in 2019 to RMB69.6 billion in 2023, with a CAGR of 24.9%, and is expected to further grow from RMB84.8 billion in 2024 to RMB194.6 billion in 2028, representing a CAGR of 23.1%. China's BLDC motor market accounted for 14% and 22% of China's motor market in 2019 and 2023 respectively, and such a share is expected to increase to 35% in 2028.

Market Size of BLDC Motor Market (by sales value), Global and China, 2019-2028E

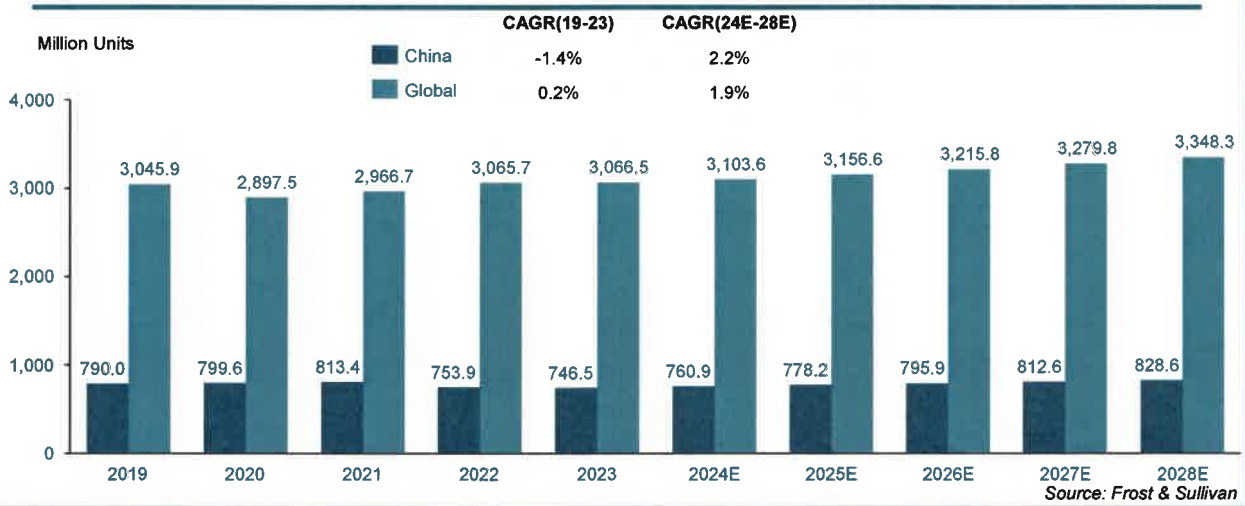


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of Home Appliances (1/2)

- Global home appliances sales volume increased from 3,045.9 million units in 2019 to 3,066.5 million units in 2023, representing a CAGR of 0.2%. Driven by technological innovation, consumer demand, policy incentives, and environmental awareness, the sales volume is forecasted to grow in the forecast period. The global sales volume of home appliances is expected to further increase to 3,348.3 million units by 2028, representing a 1.9% CAGR from 3,103.6 million units in 2024.
- Due to the tightening policy measures in the real estate sector, demand for home appliances was suppressed, resulting in a decline in the sales volume of China's home appliances from 790.0 million units to 746.5 million units, with a CAGR of -1.4% during 2019 to 2023, accounting for 24.3% of the global share. However, with the economic recovery, it is expected that the sales volume is anticipated to increase from 760.9 million units in 2024 to 828.6 million units in 2028, with China's global market share rising to 24.7%, with a CAGR of 2.2% from 2024 to 2028.

Market Size of Home Appliances (by sales volume), Global and China, 2019-2028E

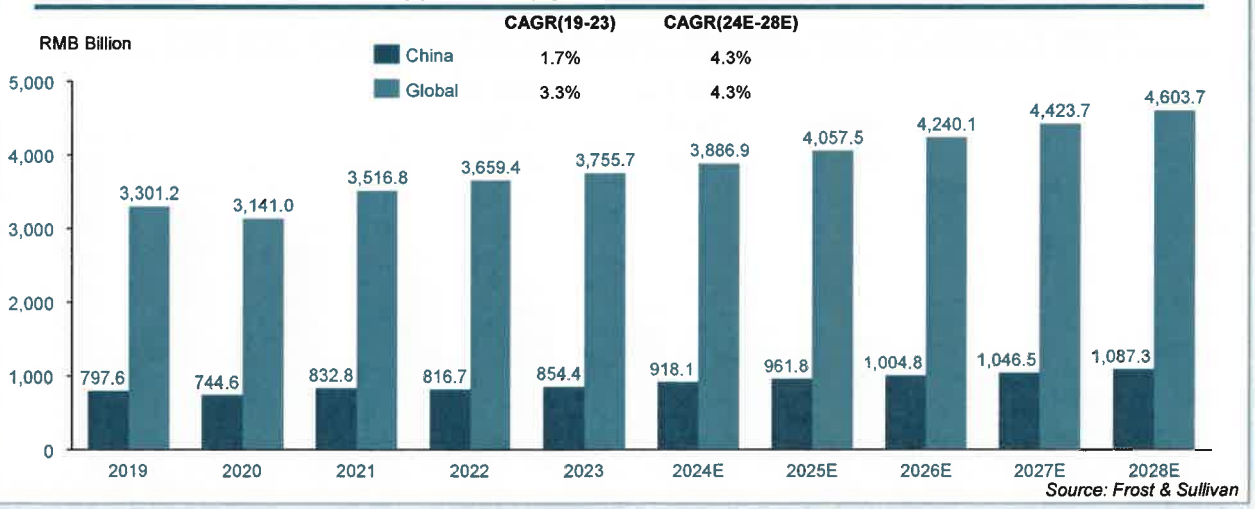


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of Home Appliances (2/2)

- Impacted by the COVID-19 pandemic, global home appliance sales value declined by 4.9% in 2020 compared to 2019. However, the market has generally experienced growth, increasing from RMB 3,301.2 billion in 2019 to RMB 3,755.7 billion in 2023, reflecting a CAGR of 3.3%. The global home appliance market is expected to reach RMB 4,603.7 billion by 2028, with a CAGR of 4.3% from 2024 to 2028, driven by the intelligent development of home appliances and the continuous growth of consumer purchasing power.
- Similarly, although China's home appliance market contracted initially, it has since rebounded, growing from RMB 797.6 billion in 2019 to RMB 854.4 billion in 2023, accounting for 22.7% of the global market, with a CAGR of 1.7%. Driven by technological and industrial advancements, the market is expected to expand from RMB 918.1 billion in 2024 to RMB 1,087.3 billion in 2028, capturing 23.6% of the global market and reflecting a CAGR of 4.3%. The penetration rate of BLDC motors in home appliances in the China market is expected to increase from approximately 40% in 2023 to approximately 60% in 2028. Particularly, the penetration rate of BLDC motors in white goods in the China market is expected to reach approximately 90% in 2028.

Market Size of Home Appliances (by sales value), Global and China, 2019-2028E

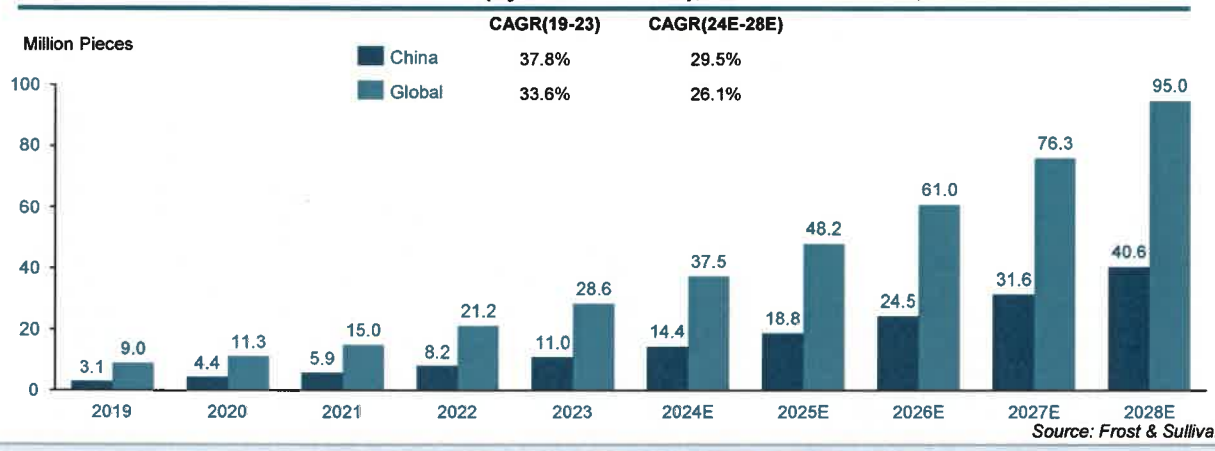


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of Civilian Unmanned Aerial Vehicles (1/2)

- Global sales volume of civilian UAVs rose from 9.0 million units in 2019 to 28.6 million units in 2023, representing a CAGR of 33.6%, driven by the growing normalization of UAV applications in agriculture and forestry plant protection, power inspection, aerial photography, and other sectors, which has stimulated market demand and fueled rapid growth in the global civilian UAV market. The sales volume is expected to further increase to 95.0 million units by 2028, reflecting a CAGR of 26.1% from 37.5 million units in 2024.
- The Chinese government has prioritized the development of the UAV industry, implementing policies and measures to support UAV research, development, and application, thereby ensuring the rapid expansion of China's UAV sector. China's civilian UAV sales volume increased from 3.1 million units in 2019 to 11.0 million units in 2023, accounting for 38.4% of the global market share, with a CAGR of 37.8%. Chinese UAV products now lead internationally in terms of performance, stability, and controllability, with growing commercial application. Looking ahead, with the integration of AI technology, China's UAV sales volume is expected to rise from 14.4 million units in 2024 to 40.6 million units in 2028, reflecting a CAGR of 29.5%, while China's global market share is forecast to increase to 42.8%.

Market Size of Civilian UAV (by sales volume), Global and China, 2019-2028E

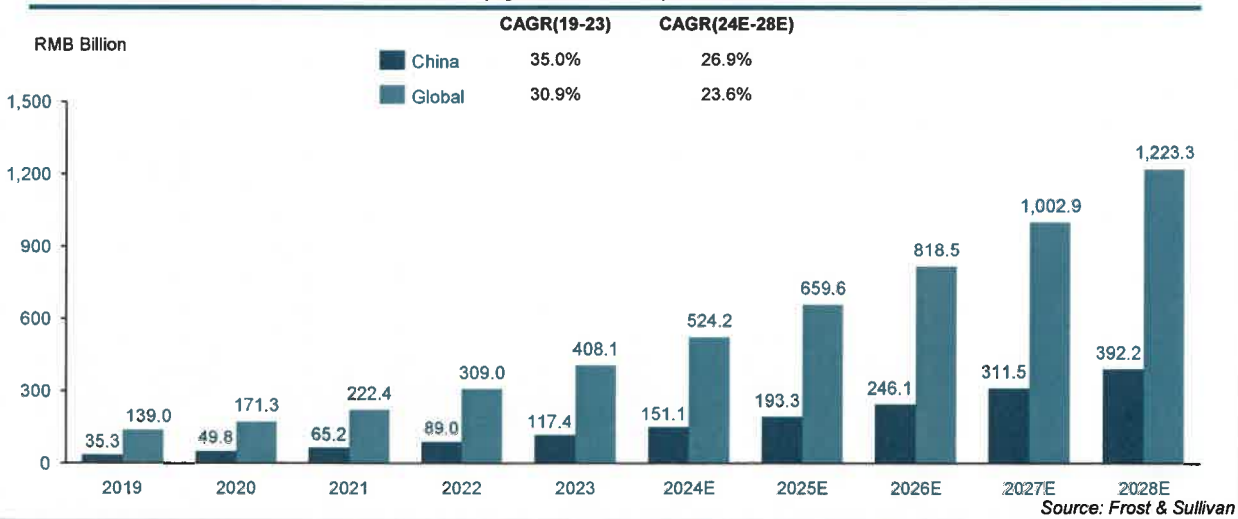


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of Civilian Unmanned Aerial Vehicles (2/2)

- BLDC motors are used in almost all civilian unmanned aerial vehicles. With the decline in UAV hardware costs and the integration of technologies such as artificial intelligence and 5G, UAV intelligence has improved, enabling broader applications. The global civilian UAV market size increased from RMB 139.0 billion in 2019 to RMB 408.1 billion in 2023, with a CAGR of 30.9%. It is expected to grow from RMB 524.2 billion in 2024 to RMB 1,223.3 billion in 2028, reflecting a CAGR of 23.6%.
- China, with a complete UAV industry chain, cost advantages, and robust foundational research, has extensive applications in various downstream sectors. China's UAV market size surged from RMB 35.3 billion in 2019 to RMB 117.4 billion in 2023, reflecting a CAGR of 35.0% and accounting for 28.8% of the global market. The market is expected to grow from RMB 151.1 billion in 2024 to RMB 392.2 billion in 2028, representing 32.1% of the global market, with a expected CAGR of 26.9%, driven by technological innovation and increasing demand.

Market Size of Civilian UAV (by sales value), Global and China, 2019-2028E

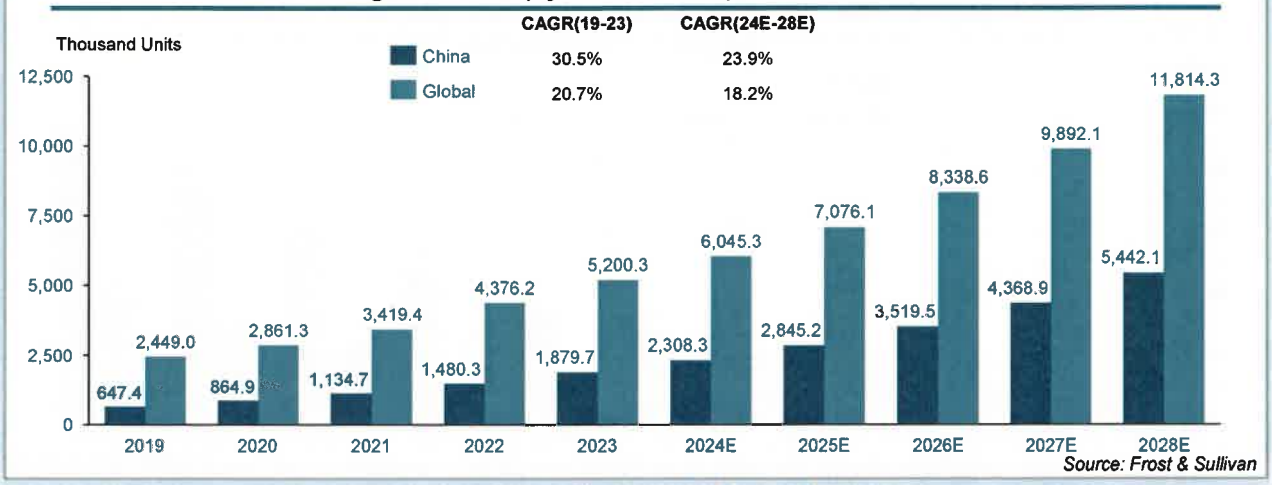


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of Intelligent Robots (1/2)

- Continuous advancements in sensing, computing, human-computer interaction, and other technologies have provided a solid technical foundation for the development of intelligent robots. Simultaneously, the increasing levels of digitization, automation, and intelligence in the global manufacturing industry have driven growing demand for intelligent robots. Global sales volume of intelligent robots rose from 2,449.0 thousand units in 2019 to 5,200.3 thousand units in 2023, reflecting a CAGR of 20.7%. In the forecast period, with the expansion of intelligent robot applications across industrial manufacturing, healthcare, agriculture, military, aerospace, and other sectors, sales volume is expected to increase from 6,045.3 thousand units in 2024 to 11,814.3 thousand units in 2028, with a CAGR of 18.2%.
- As one of the world's largest manufacturing nations, China has a strong demand for intelligent robots. The sales volume of intelligent robots in China grew from 647.4 thousand units in 2019 to 1,879.7 thousand units in 2023, accounting for 36.1% of the global market share, with a CAGR of 30.5%. During the forecast period, sales volume is expected to rise from 2,308.3 thousand units in 2024 to 5,442.1 thousand units in 2028, accounting for 46.1% of the global market share, with a CAGR of 23.9%.

Market Size of Intelligent Robots (by sales volume), Global and China, 2019-2028E

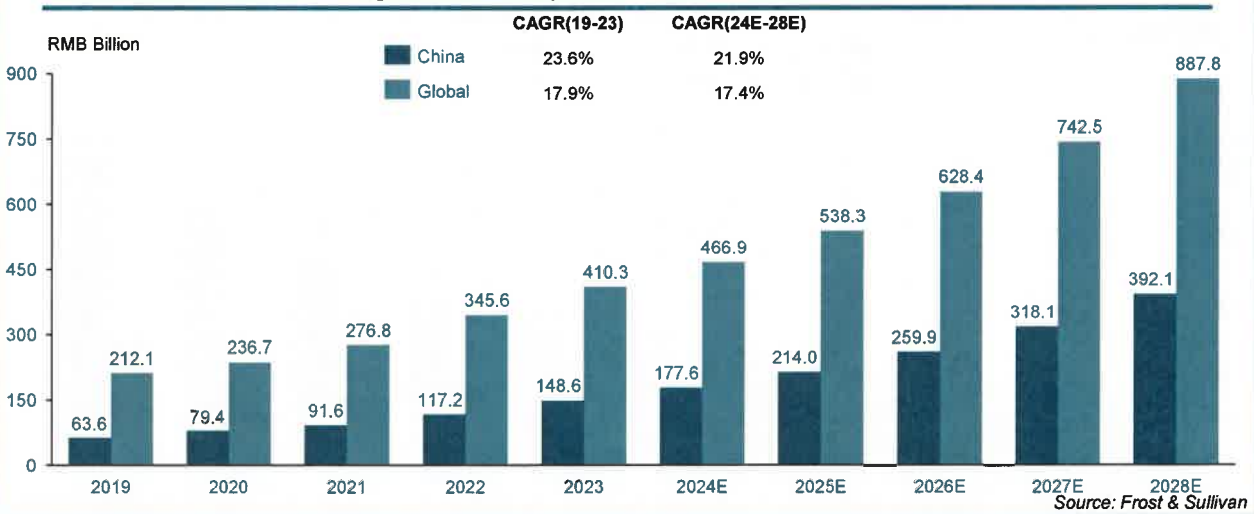


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of Intelligent Robots (2/2)

- BLDC motors are used in almost all intelligent robots. Driven by advancements in intelligent robot technology and the growth of downstream application demand, the market size of intelligent robots increased from RMB 212.1 billion in 2019 to RMB 410.3 billion in 2023, reflecting a CAGR of 17.9%. With improvements in the industrial chain and coordinated development, the market size is expected to rise from RMB 466.9 billion in 2024 to RMB 887.8 billion in 2028, with a CAGR of 17.4%.
- The transformation and upgrading of the manufacturing industry have spurred a surge in demand for intelligent robots. China's market size for intelligent robots grew from RMB 63.6 billion in 2019 to RMB 148.6 billion in 2023, accounting for 36.2% of the global market share, with a CAGR of 23.6%. The market size is expected to increase from RMB 177.6 billion in 2024 to RMB 392.1 billion in 2028, representing 44.2% of the global market share, with a CAGR of 21.9%. This growth is expected to drive the development of the BLDC motors market.

Market Size of Intelligent Robots (by sales value), Global and China, 2019-2028E

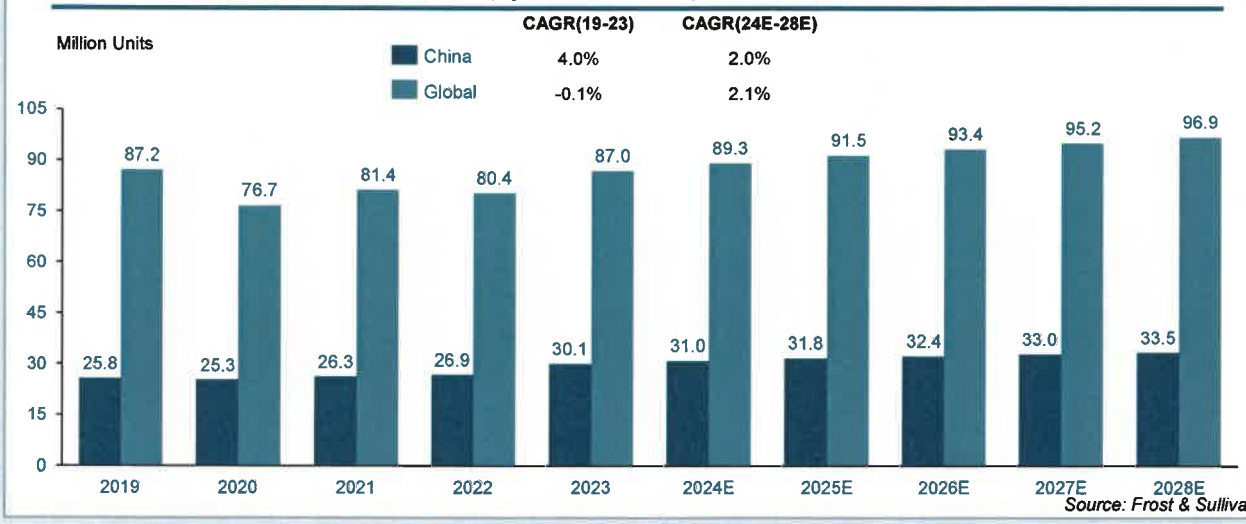


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of Automobile

- From 2019 to 2023, global automobile sales exhibited a fluctuating trend, with an overall CAGR of -0.1%. The decline in sales in 2020 and 2022 was primarily due to multiple factors, including the global and domestic impacts of the COVID-19 pandemic and the shortage of automobile chips. In the future, with the gradual recovery of the global economy, improvement in consumer purchasing power, and resolution of the chip shortage, automobile sales are expected to increase from 89.3 million units in 2024 to 96.9 million units in 2028.
- As the world's largest automobile market, China accounted for 34.6% of global automobile sales in 2023, with a total sales volume of 30.1 million units. With ongoing advancements and innovation in automotive technology, China's automobile sales are expected to grow from 31.0 million units in 2024 to 33.5 million units in 2028, reflecting a CAGR of 2.0%.

Market Size of Automobile (by sales volume), Global and China, 2019-2028E

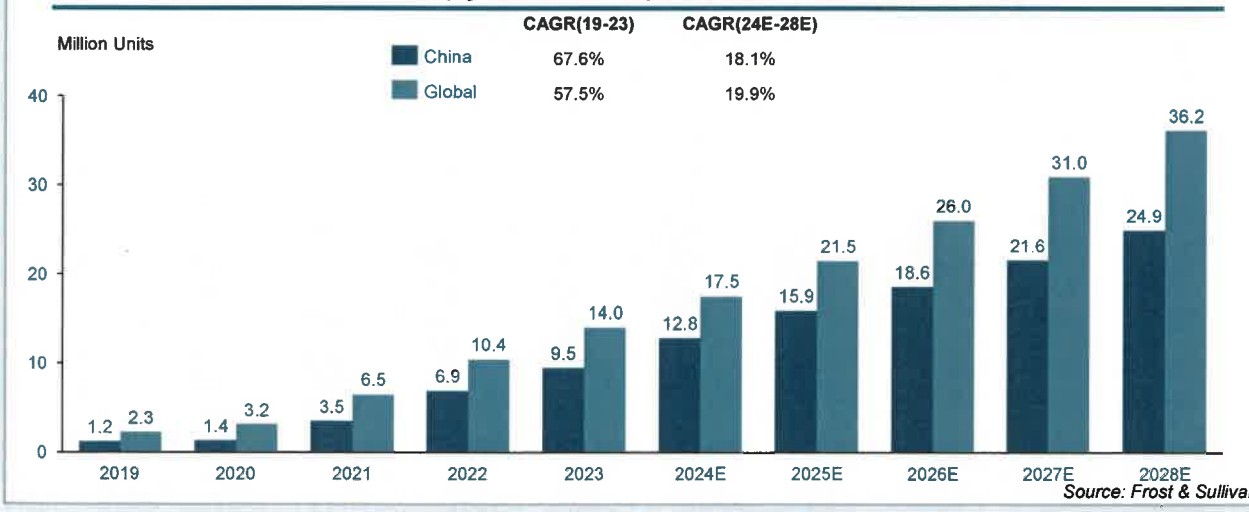


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of EVs

- Global EV sales volume increased from 2.3 million units in 2019 to 14.0 million units in 2023, representing a CAGR of 57.5%. Driven by longer driving ranges due to increased battery capacity, reduced costs and prices of EVs, more mature and accessible charging infrastructure, enhanced intelligent cabin experiences, and growing environmental awareness among consumers, the penetration rate of EVs within the total vehicle market is expected to continue rising in the forecast period. The global sales volume of EVs is expected to reach 36.2 million units by 2028, reflecting a 19.9% CAGR from 17.5 million units in 2024.
- Driven by advances in battery technology and supportive domestic policies, China's EV sales grew from 1.2 million units in 2019 to 9.5 million units in 2023, accounting for 67.6% of the global market share, with a CAGR of 67.6% from 2019 to 2023. With the extension of EV tax exemptions until 2027, sales volume is expected to increase from 12.8 million units in 2024 to 24.9 million units in 2028, reflecting a CAGR of 18.1%. The penetration rate of BLDC motors in EVs in the China market is expected to increase from approximately 50% in 2023 to approximately 80% in 2028.

Market Size of EVs (by sales volume), Global and China, 2019-2028E

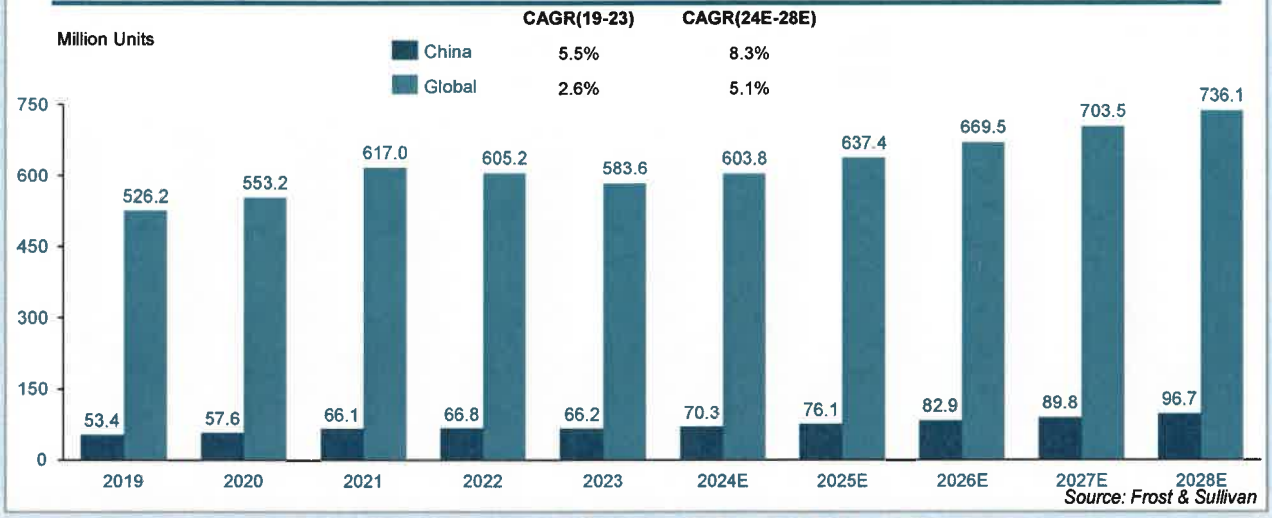


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of Electric Tools (1/2)

- Affected by industry destocking and the post-pandemic recovery, global power tool sales volume declined in 2022 and 2023. However, between 2019 and 2023, the global sales volume of electric power tools increased from 526.2 million units to 583.6 million units, reflecting a CAGR of 2.6%. In the forecast period, as downstream market demand continues to grow, sales volume is expected to rise from 603.8 million units in 2024 to 736.1 million units in 2028, reflecting a CAGR of 5.1%.
- Similar to the global market, China's electric tool sales volume grew from 53.4 million units in 2019 to 66.2 million units in 2023, accounting for 11.3% of the global market share, with a CAGR of 5.5%. It is expected to grow at a CAGR of 8.3%, reaching 70.3 million units in 2024 and 96.7 million units in 2028, capturing 13.1% of the global market share.

Market Size of Electric Tools (by sales volume), Global and China, 2019-2028E

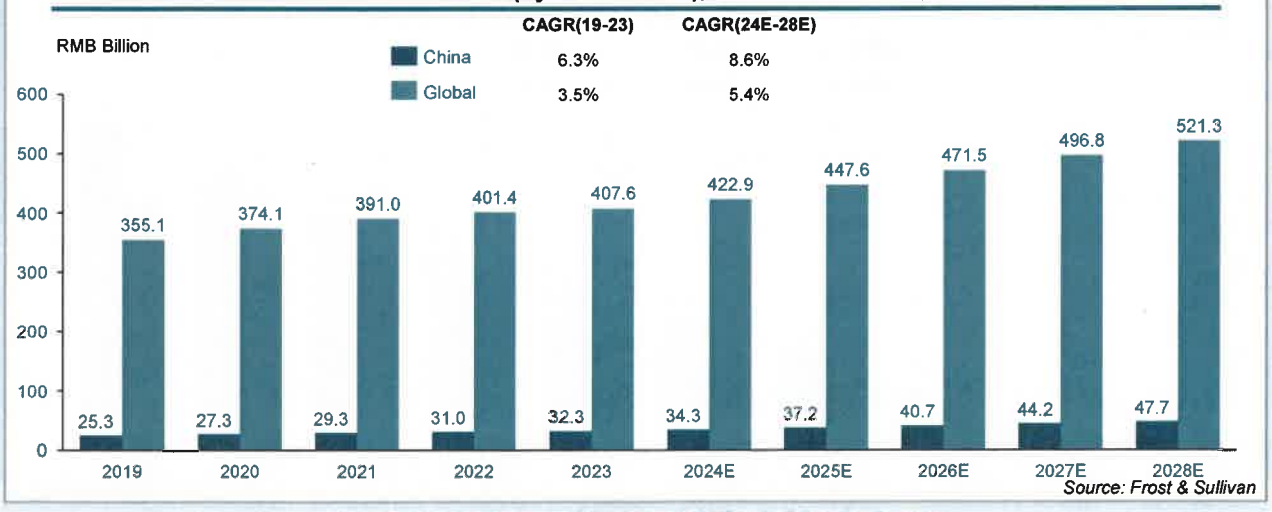


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of Electric Tools (2/2)

- The global market size of electric tools increased from RMB 355.1 billion in 2019 to RMB 407.6 billion in 2023, reflecting a CAGR of 3.5%, driven by growing demand from downstream sectors such as industrial manufacturing and agriculture. The market size is expected to grow from RMB 422.9 billion in 2024 to RMB 521.3 billion in 2028, representing a CAGR of 5.4%.
- In China, the market size of electric tools grew from RMB 25.3 billion in 2019 to RMB 32.3 billion in 2023, accounting for 7.9% of the global market share, with a CAGR of 6.3%, supported by the integration of intelligent and automation technologies. The market size is expected to increase from RMB 34.3 billion in 2024 to RMB 47.7 billion in 2028, representing 9.1% of the global market share , with a CAGR of 8.6%. The penetration rate of BLDC motors in electric tools in the China market is expected to increase from approximately 40% in 2023 to approximately 75% in 2028.

Market Size of Electric Tools (by sales value), Global and China, 2019-2028E

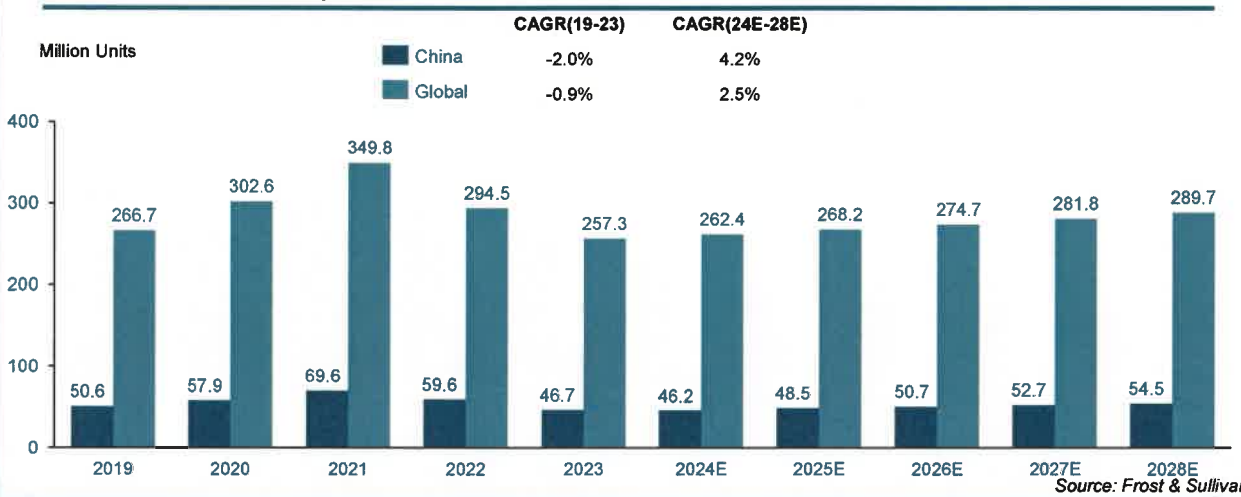


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Shipments of PC

- The outbreak of the COVID-19 pandemic in 2020 accelerated the adoption of home-based offices and distance learning, significantly driving up demand for PCs, with global PC shipment volume rising from 266.7 million units in 2019 to 349.8 million units in 2021. Looking ahead, with the ongoing global digital transformation and continuous hardware and software innovations in the PC industry, global PC shipments are expected to increase from 262.4 million units in 2024 to 289.7 million units in 2028, reflecting a CAGR of 2.5%.
- In comparison to the global market, China's PC market has been relatively mature. From 2019 to 2023, China's PC shipments peaked at 69.6 million units in 2021, then declined to 46.7 million units in 2023, with a CAGR of -2.0% during this period, representing 18.1% of global PC shipments in 2023. From 2024 to 2028, China's PC shipment volume is expected to grow at a CAGR of 4.2%, reaching 54.5 million units in 2028, accounting for 18.8% of the global total.

Shipment Volume of PC, Global and China, 2019-2028E

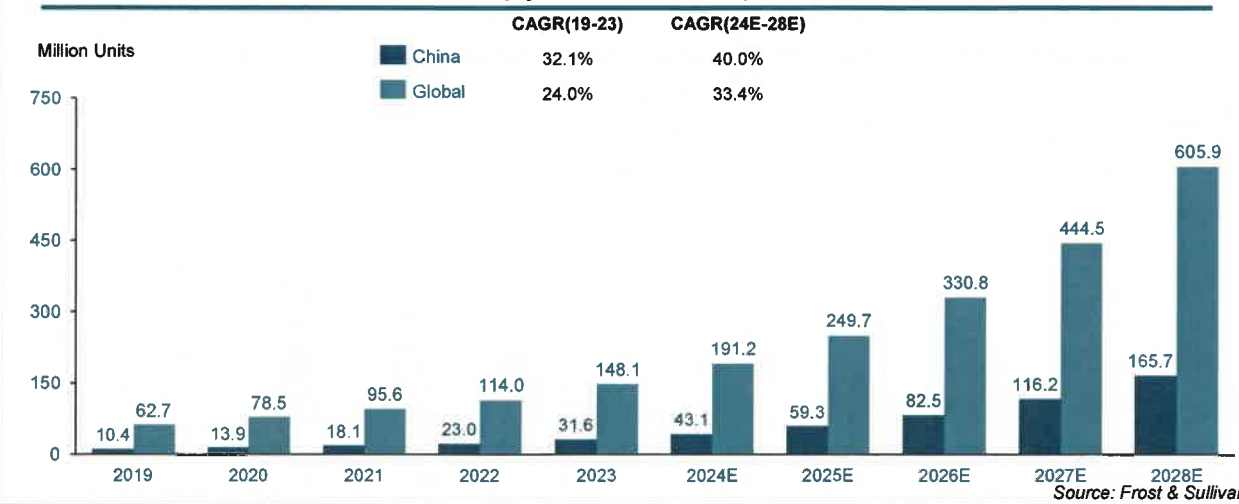


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of Data Center (1/2)

- Globally, the installed volume of data center servers increased from 62.7 million units in 2019 to 148.1 million units in 2023, reflecting a CAGR of 24.0%, driven by accelerated global digital transformation and growing demand for high-performance computing and AI. This upward trend is expected to persist, with the global installed volume of data center servers expected to grow from 191.2 million units in 2024 to 605.9 million units in 2028, representing a CAGR of 33.4%.
- As digital transformation advances across industries, demand for data centers has surged, driving the expansion of installed data center server volumes. In China, the installed volume of data center servers grew from 10.4 million units in 2019 to 31.6 million units in 2023, accounting for 21.4% of the global market, with a CAGR of 32.1% during this period. The installed volume is expected to increase from 43.1 million units in 2024 to 165.7 million units in 2028, representing 27.4% of the global market, with a CAGR of 40.0% in the forecast period.

Market Size of Data Center Server (by installed volume), Global and China, 2019-2028E

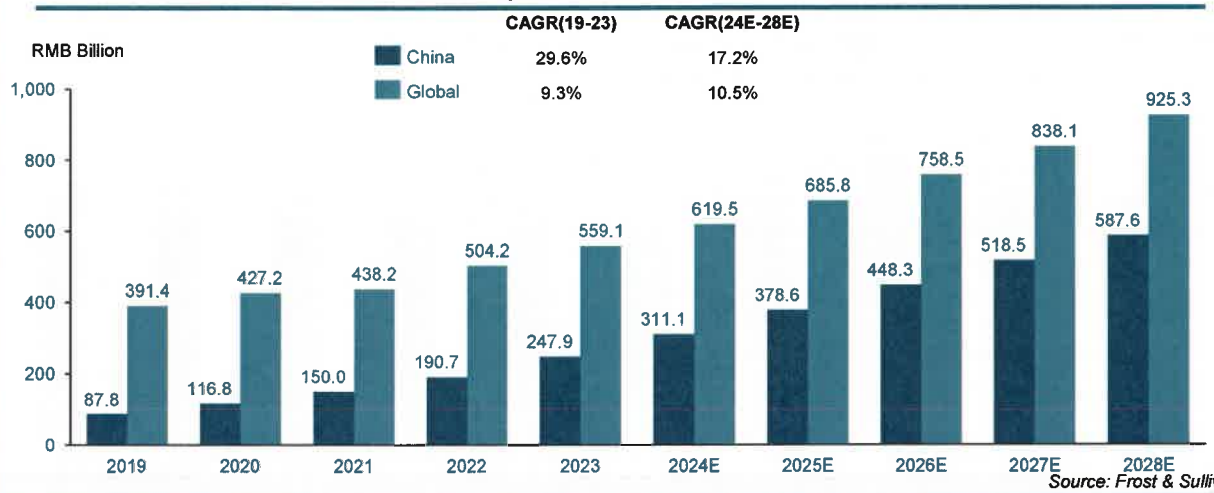


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of Data Center (2/2)

- With continuous innovations in data center technology and the in-depth promotion of digital transformation in downstream application industries, the global data center market size increased from RMB 391.4 billion in 2019 to RMB 559.1 billion in 2023, reflecting a CAGR of 9.3%. During the forecast period, further technological advancements are expected to drive revenue growth, with the market size expected to rise from RMB 619.5 billion in 2024 to RMB 925.3 billion in 2028, representing a CAGR of 10.5%.
- Driven by the development of China's Internet economy, industrial digital transformation, and national policy support, the market size of China's data centers increased from RMB 87.8 billion in 2019 to RMB 247.9 billion in 2023, achieving a CAGR of 29.6%. During the forecast period, the market size is expected to grow from RMB 311.1 billion in 2024 to RMB 587.6 billion in 2028, with a CAGR of 17.2%. China's share of the global data center market is expected to rise from 44.3% in 2023 to 63.5% in 2028. Data centers are anticipated to become a significant driver for the development of BLDC motors.

Market Size of Data Center (by sales value), Global and China, 2019-2028E

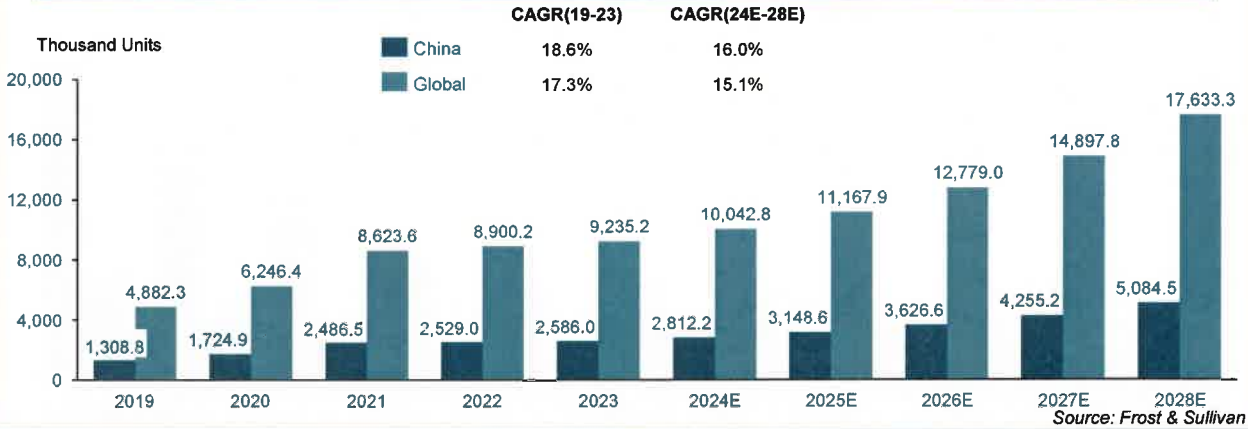


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of Servo Systems (1/2)

- With the development of the global manufacturing industry in the direction of industrial automation and intelligent manufacturing, the demand for servo systems as one of the core components of automation equipment continues to grow. Global demand for servo systems grew from 4,882.3 thousand units in 2019 to 9,235.2 thousand units in 2023, reflecting a CAGR of 17.3%. In the forecast period, with the continued deepening of industrial automation and intelligent manufacturing, alongside technological innovation and product upgrades in servo systems, global sales volume is expected to increase from 10,042.8 thousand units in 2024 to 17,633.3 thousand units in 2028, maintaining a CAGR of 15.1%.
- China's manufacturing industry is undergoing a critical phase of transformation and upgrading. Rapid growth in downstream applications such as 3C electronics, robotics, photovoltaic, textile machinery, and packaging machinery is driving increasing demand for automation and intelligent equipment, thereby boosting the servo system market. The sales volume of servo systems in China grew from 1,308.8 thousand units in 2019 to 2,586.0 thousand units in 2023, accounting for 28.0% of the global market, with a CAGR of 18.6%. During the forecast period, demand for servo systems is expected to continue growing, from 2,812.2 thousand units in 2024 to 5,084.5 thousand units in 2028, capturing 28.8% of the global market share, with a CAGR of 16.0%.

Market Size of Servo Systems (by sales volume), Global and China, 2019-2028E

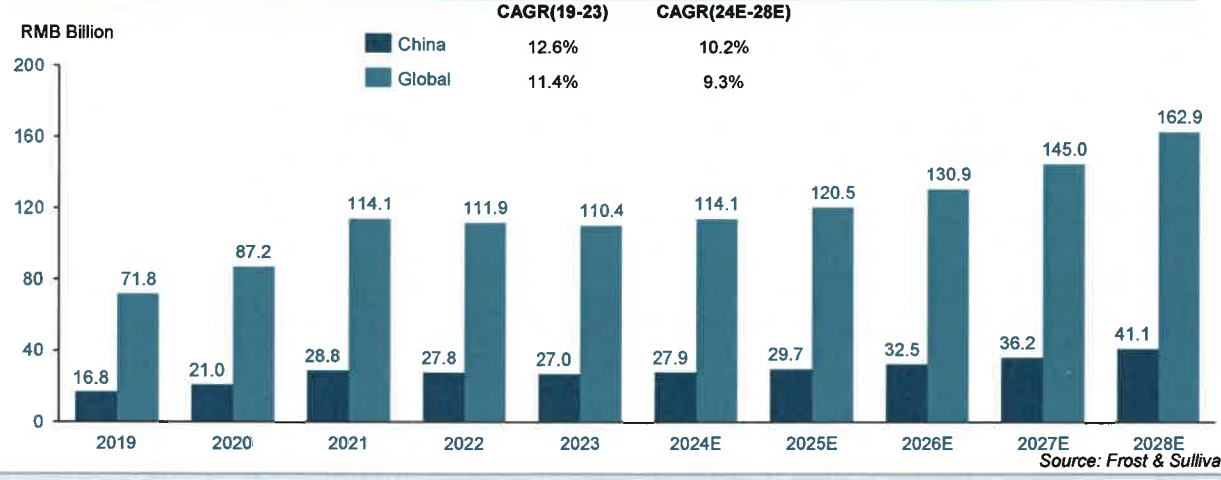


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of Servo Systems (2/2)

- Due to factors such as increases in upstream raw material prices and chip supply constraints, the global servo system market experienced a brief downturn in 2022 and 2023. However, overall, the global market size for servo systems grew from RMB 71.8 billion in 2019 to RMB 110.4 billion in 2023, with a CAGR of 11.4%. In the forecast period, with the continued advancement of industrial automation and intelligent manufacturing, servo systems are expected to expand their applications across various sectors, including industrial automation and robotics. The market size is expected to grow from RMB 114.1 billion in 2024 to RMB 162.9 billion in 2028, reflecting a CAGR of 9.3%.
- Driven by technological advancements and innovations, as well as the intelligent upgrading of the manufacturing industry, China's servo system market grew from RMB 16.8 billion in 2019 to RMB 27.0 billion in 2023, capturing 24.5% of the global market, with a CAGR of 12.6%. The integration with high-end equipment manufacturing is expected to drive the servo system market toward higher performance and precision. The market is anticipated to reach RMB 27.9 billion in 2024 and RMB 41.1 billion in 2028, representing 25.2% of the global market share, with a CAGR of 10.2%. The penetration rate of BLDC motors in servo systems in the China market is expected to increase from approximately 90% in 2023 to approximately 98% in 2028.

Market Size of Servo Systems (by sales value), Global and China, 2019-2028E



Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's BLDC Motor Penetration Rate in Major Downstream Markets(1/2)

- There is a growing trend towards the adoption of BLDC motors in various downstream applications globally. In the field of smart small household appliances, the penetration rate of BLDC motor in vacuum cleaners will increase from 32% in 2019 to 90% in 2028. The penetration rate of BLDC motor in white goods will increase from 42.3% in 2019 to 88.5% in 2028. Besides, the penetration rate of BLDC motor in electric tools will increase from 18.8% in 2019 to 73.9% in 2028. In the field of sports and leisure, the penetration rate of BLDC motor in UAV is 100%, the penetration rate in electric two-wheeler will increase from 30% in 2019 to 70% in 2028. In industrial field, the penetration rate of BLDC motor in PC is 100%, the penetration rate in industrial servo system will increase from 80% in 2019 to 98% in 2028. In the field of automotive, the penetration rate in EV will increase from 40% in 2019 to 80% in 2028, higher than that of fuel car. In the field of robot, the penetration rate of BLDC motor in intelligent robot is 100%.

Penetration Rate of BLDC Motor in Main Downstream Markets, Global, 2019-2028E

Main Downstream Application	Main Segment Application	Penetration Rate in 2019	Penetration Rate in 2023	Penetration Rate in 2028E
Smart Small Household Appliance	Vacuum Cleaner	32%	62%	90%
	Electric Fan	42%	80%	90%
White Goods		42.3%	69.1%	88.5%
Electric Tools		18.8%	40.8%	73.9%
Sports and Leisure	Unmanned Aerial Vehicle (UAV)	100%	100%	100%
	Electric Two-wheeler	30%	50%	70%
Industrial	Industrial Servo System	80%	92%	98%
	Personal Computer (PC)	100%	100%	100%
	Data Center	100%	100%	100%
Automotive	Fuel Car	10%	30%	50%
	Electric Vehicles (EV)	40%	50%	80%
Robots		100%	100%	100%

Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's BLDC Motor Penetration Rate in Main Downstream Markets(2/2)

- There is a growing trend towards the adoption of BLDC motors in various downstream applications in China. In the field of smart small household appliance, the penetration rate of BLDC motor in vacuum cleaners will increase from 30% in 2019 to 90% in 2028. The penetration rate of BLDC motor in white goods will increase from 38.9% in 2019 to 88.9% in 2028. Besides, the penetration rate of BLDC motor in electric tools will increase from 18.6% in 2019 to 74.9% in 2028. In the field of sports and leisure, the penetration rate of BLDC motor in UAV is 100%, the penetration rate in electric two-wheeler will increase from 30% in 2019 to 70% in 2028. In industrial field, the penetration rate of BLDC motor in PC is 100%, the penetration rate in industrial servo system will increase from 80% in 2019 to 98% in 2028. In the field of automotive, the penetration rate in EV will increase from 40% in 2019 to 80% in 2028, higher than that of fuel car. In the field of robot, the penetration rate of BLDC motor in intelligent robot is 100%.

Penetration Rate of BLDC Motor in Main Downstream Markets, China, 2019-2028E

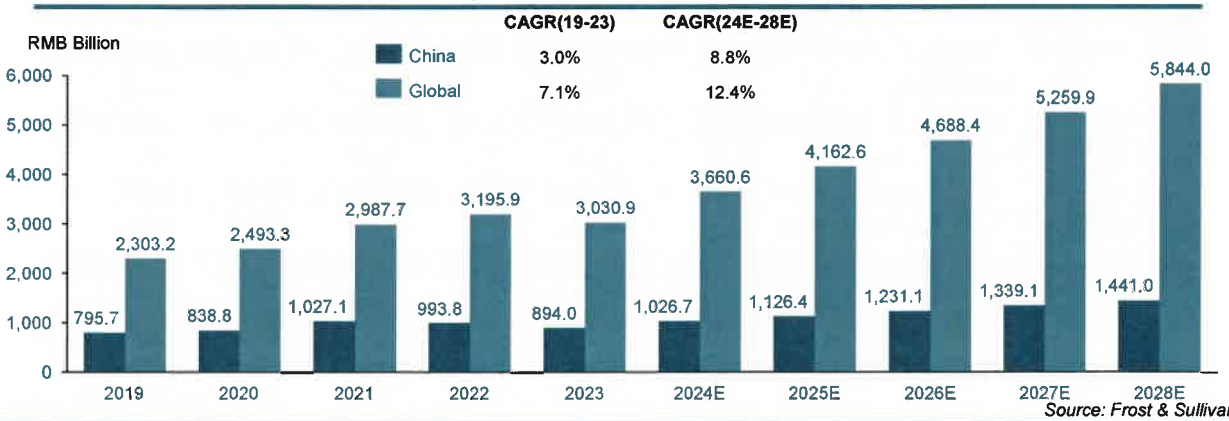
Main Downstream Application	Main Segment Application	Penetration Rate in 2019	Penetration Rate in 2023	Penetration Rate in 2028E
Smart Small Household Appliance	Vacuum Cleaner	30%	60%	90%
	Electric Fan	40%	78%	90%
White Goods		38.9%	68.9%	88.9%
Electric Tools		18.6%	41.1%	74.9%
Sports and Leisure	Unmanned Aerial Vehicle (UAV)	100%	100%	100%
	Electric Two-wheeler	30%	50%	70%
Industrial	Industrial Servo System	80%	92%	98%
	Personal Computer (PC)	100%	100%	100%
	Data Center	100%	100%	100%
Automotive	Fuel Car	10%	30%	50%
	Electric Vehicles (EV)	40%	50%	80%
Robots		100%	100%	100%

Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of Chips

- Benefiting from advancements and innovations in chip technology, as well as increasing market demand, the global chip market size grew from RMB 2,302.2 billion in 2019 to RMB 3,195.9 billion in 2022. However, in 2023, due to stockpiling by downstream companies and a short-term decline in consumer demand resulting from the global economic downturn, the market size decreased to RMB 3,030.9 billion. Overall, the CAGR from 2019 to 2023 was 7.1%. During the forecast period, the global chip market is expected to continue its growth trajectory, with the market size expected to increase from RMB 3,660.6 billion in 2024 to RMB 5,844.0 billion in 2028, reflecting a CAGR of 12.4%.
- Driven by advances in semiconductor processing technology and the rising demand from downstream sectors such as consumer electronics, network communications, automotive, and IoT, China's chip market grew rapidly from 2019 to 2021. From 2022 to 2023, however, the market size contracted due to inventory adjustments by downstream enterprises and a temporary drop in consumer demand. The market began to recover in the second half of 2023. Overall, China's chip market increased from RMB 795.7 billion in 2019 to RMB 894.0 billion in 2023, with a CAGR of 3.0%. Between 2024 and 2028, the market is expected to grow at a CAGR of 8.8%, reaching RMB 1,441.0 billion by 2028, driven by favorable government policies, rising downstream demand, and technological advancements.

Market Size of Chips (by sales value), Global and China, 2019-2028E

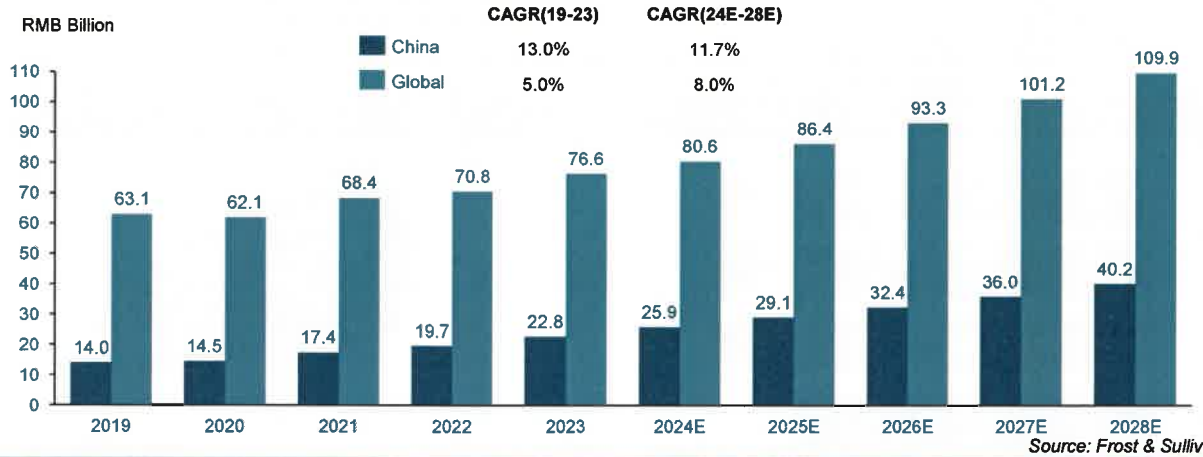


Source: Frost & Sullivan

Analysis of Macroeconomic Market
Global and China's Market Size of Motor Control and Driver Chips

- Driven by technological developments in integrated circuit, downstream consumer demands from consumer electronics, automotive, Internet of Things (IoT), etc., the global and China motor control and driver chip market grow steadily from 2019 to 2023. The global motor control and driver market gradually increased from RMB 63.1 billion in 2019 to RMB 76.6 billion in 2023, with a CAGR of 5.0%, and is expected to further increase from RMB 80.6 billion in 2024 to RMB 109.9 billion in 2028, representing a CAGR of 8.0%. The China motor control and driver market increased from RMB 14.0 billion in 2019 to RMB 22.8 billion in 2023, with a CAGR of 13.0% which is higher than that of global market and is expected to further grow from RMB 25.9 billion in 2024 to RMB 40.2 billion in 2028, representing a CAGR of 11.7% which is also higher than that of global market.

Market Size of Motor Control and Driver Chip Market (by sales value), Global and China, 2019-2028E



Source: Frost & Sullivan

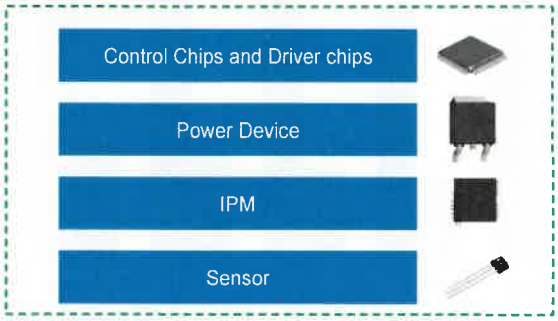
2. Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

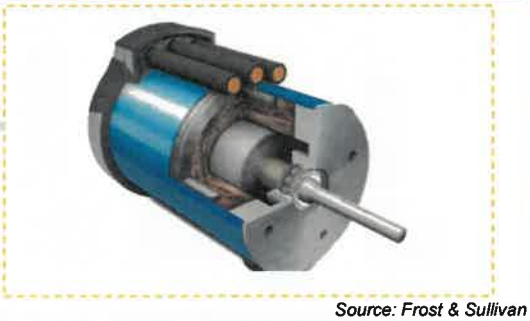
Definition and Classification of BLDC Motor Control and Driver Products

- The BLDC motor control and driver product constitutes a comprehensive suite of components specifically engineered for the precise regulation, driving, and safeguarding of BLDC motors. Such a product typically encompasses control chips, driver chips, power devices, Intelligent Power Modules (IPMs), and sensors, all functioning synergistically to ensure the stable operation and optimal performance of the BLDC motor.
  - **Control chips.** The "brains" of the BLDC motor control system, and are responsible for electrical signal detection, motor driver control algorithm processing and control instruction generation. They can be classified into MCUs and ASICs. MCUs contain a general-purpose processor core, memory, input/output interfaces, and other modules for a variety of applications. And ASICs are a type of motor control chips that are customized to the needs of a specific application.
  - **Driver chips**. Responsible for converting the low-power signal from the motor control chips into a high-power output signal to drive the motor. HVICs are a typical type of motor driver chips that can convert the low voltage control signal of the control chips into a high voltage signal to drive the power devices and realize the control of the motor.
  - **Power Devices.** Used to convert electrical energy into mechanical energy to drive motors. Common power devices include MOSFETs and IGBTs.
  - **IPMs.** Modules that combine power devices, drive circuits and protection circuits into a simple, compact package to simplify the design of BLDC motor control systems. IPMs can reduce the number of components and system costs, as well as improve the stability and reliability of the BLDC motor drive system.
  - **Sensors.** Used to detect status of BLDC motors, including rotor position and speed, and transit the data back to the chips, in order to realize accurate control and stable operation of motors.

BLDC Motor Driver Control Architecture



BLDC Motor



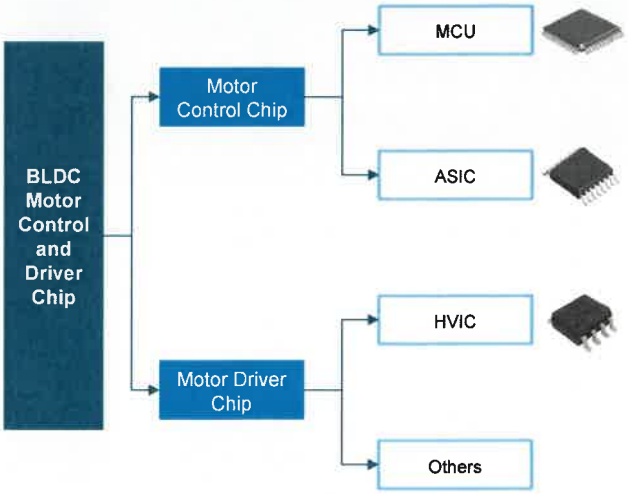
Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Definition and Classification of BLDC Motor Control and Driver Chips

- BLDC motor chips are the key components of the BLDC motor control and driver system, which are mainly divided into control chips and driver chips.
  - **Motor control chips.** The "brains" of the BLDC motor control system, and are responsible for electrical signal detection, motor drive control algorithm processing and control instruction generation. They can be classified into MCUs and ASICs.
  - **Motor driver chips.** Responsible for converting the low-power signal from the motor control chips into a high-power output signal to drive the motor. HVICs are a typical type of motor driver chips.

Classification of BLDC Motor Control and Driver Chips



MCUs are a type of motor control chips that contain a general-purpose processor core, memory, input/output interfaces, and other modules for a variety of applications.

ASICs are a type of motor control chips that are customized to the needs of a specific application. Their internal circuits and logic are designed for specific algorithms and tasks.

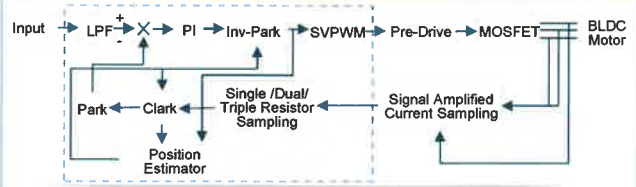
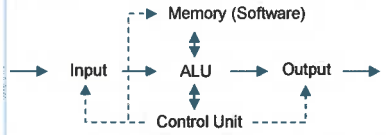
Since the motor control chip is unable to directly drive the high-power MOSFET, the HVIC chips can provide high and low voltage isolation while increasing driving capacity. This allows the motor control chip to indirectly drive the MOSFET through the HVIC chips, enabling effective control of the BLDC motor.

Other types of motor driver chips include LVICs, non-isolated driver chips.

Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry
Technology Analysis of BLDC Motor Control and Driver Products (1/4)

- In terms of the coverage of applications, BLDC motor control chips can be classified into specific-purpose control chips and general-purpose control chips. Some specific-purpose chips have a dual-core structure consisting of a general-purpose core as well as a specific-purpose core. Such chips have higher processing power and parallel computing capability. By contrast, general-purpose chips such as ARM-based chips only have a general-purpose core, and their application fields are not limited to motors. General-purpose chips are typically based on mature IP architectures. Therefore, manufacturers of general-purpose chips can conduct secondary development based on the mature IP architectures.

	Specific-Purpose Chips	General-Purpose Chips
Algorithm Implementation Diagram		
Performance Metrics	➢ The dedicated chip fulfills motor control via hardware and possesses complete IP rights. ➢ The chips design selects the best data bit number (16, 24, or 32-bit) based on BLDC motor, providing more flexible products.	➢ Existing Mature IP architectures can be adopted and licensed for both architecture and software. ➢ When using third-party IP cores, the data width of the IP core is already determined.
Advantage	**High Integration Brings High Reliability** ✓ Specific-purpose chips typically offers higher integration, reducing peripheral components, control board area, and enhancing system reliability. **High Customization and Flexibility** ✓ Specific-purpose chips can optimize control efficiency, cost, and performance selecting the best data bit size and algorithm for specific motor control scenarios.	**Simple Architecture** ✓ General-purpose chips are relatively simple, requiring only secondary development based on mature kernel architectures and software programs. **Wide Application Scenarios** ✓ General-purpose chips based on mature IP architectures, suit various applications but may not meet high motor control requirements.

Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry
Technology Analysis of BLDC Motor Control and Driver Products (2/4)

- Based on the number of processor cores inside the BLDC motor control chips, they can be classified into single-core chips and dual-core chips.
- Based on the different position sensors and control methods, BLDC control chip algorithms can be classified into sensored square wave, sensorless square wave, sensored SVPWM, sensored FOC and sensorless FOC.

Different Technical Routes of BLDC Motor Control and Driver Chips (by core quantity)

	Single-core Chip	Dual-core Chip
Processing Capabilities	Low	High
Memory	Limited	Large
Cost and Space	Low	Low
Functional Complexity	Simple	Complex

Different Technical Routes of BLDC Motor Control and Driver Chips (by algorithm type)

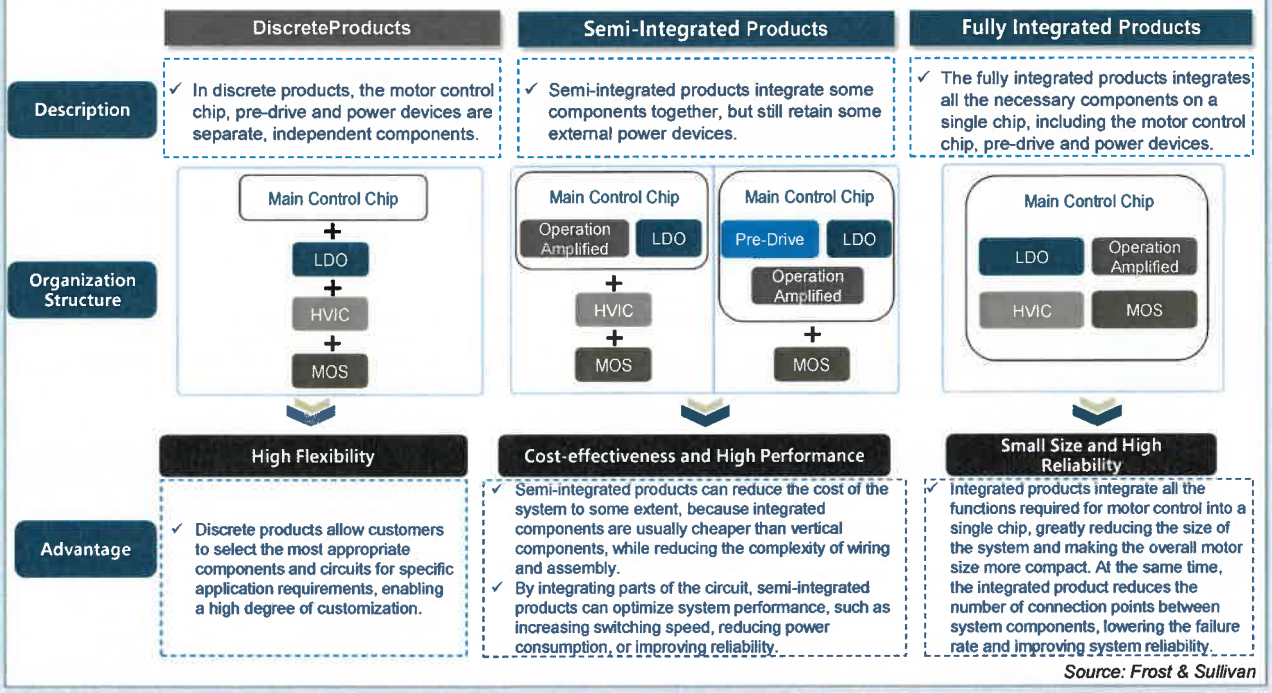
	sensored Square Wave	Sensorless Square Wave	sensored SVPWM	sensored FOC	Sensorless FOC
Advantage	✓ Simple control algorithm ✓ High starting torque	✓ Small motor size	✓ Low Torque Ripple ✓ Low Electromagnetic Noise	✓ Low torque ripple ✓ high efficiency ✓ low noisefast ✓ dynamic response ✓ low electromagnetic noise	✓ Save Hall devices ✓ Small motor size
Cost of Controllers	Medium	Low	Medium	High	Higher
Complex of Algorithms	Low	Medium	Medium	Medium	High
Development Cycle	Shortest	Short	Short	Longer	Short

Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Technology Analysis of BLDC Motor Control and Driver Products (3/4)

- BLDC motor control and driver chip products can be classified into those with lower level of integration and those with higher level of integration.



Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Technology Analysis of BLDC Motor Control and Driver Products (4/4)

- **Specific-Purpose Chips and General-Purpose Chips.** In terms of the coverage of applications, BLDC motor control chips can be classified into specific-purpose control chips and general-purpose control chips. General-purpose chips refer to chips with a general-purpose core as well as software algorithms, while specific-purpose chips convert software algorithms to hardware. And specific-purpose chips are designed specifically for the BLDC motor application area. Compared with general-purpose chips which execute algorithms through software, specific-purpose chips can complete the same computing task in a shorter time through hardware algorithms. Therefore, the operating frequency needed to ensure the processing speed is lower for specific-purpose chips. And thus, the power consumption of specific-purpose chips is also lower. Furthermore, specific-purpose chips have more advanced real-time performance, as they are able to complete one round of FOC computation in 6-7 μs, which is faster than the general-purpose chips. By contrast, general-purpose chips have higher flexibility as customers can independently select the software algorithms.

- **Sensorless FOC and Other Algorithms.** Based on the different position sensors and control methods, BLDC control chip algorithms can be classified into sensored square wave, sensorless square wave, sensored SVPWM, sensored FOC and sensorless FOC. Comparing sensored algorithms with sensorless algorithms, sensored ones obtain the precise position information of the rotor in the motor through the position sensor, while sensorless ones estimate the position of the rotor through algorithms. Therefore, sensorless algorithms can avoid system failures caused by sensor failures and improve the reliability of the system. Compared with other types of control algorithms, FOC control algorithms can accurately control the size and direction of the magnetic field, improving the efficiency of the motor and the overall efficiency of the system. Sensorless FOC algorithms combine the dual characteristics of sensorless algorithms and FOC algorithms, and have the advantages of high system reliability and high system efficiency. Meanwhile, sensorless FOC algorithms are more complex and therefore have higher requirements on chip design companies.

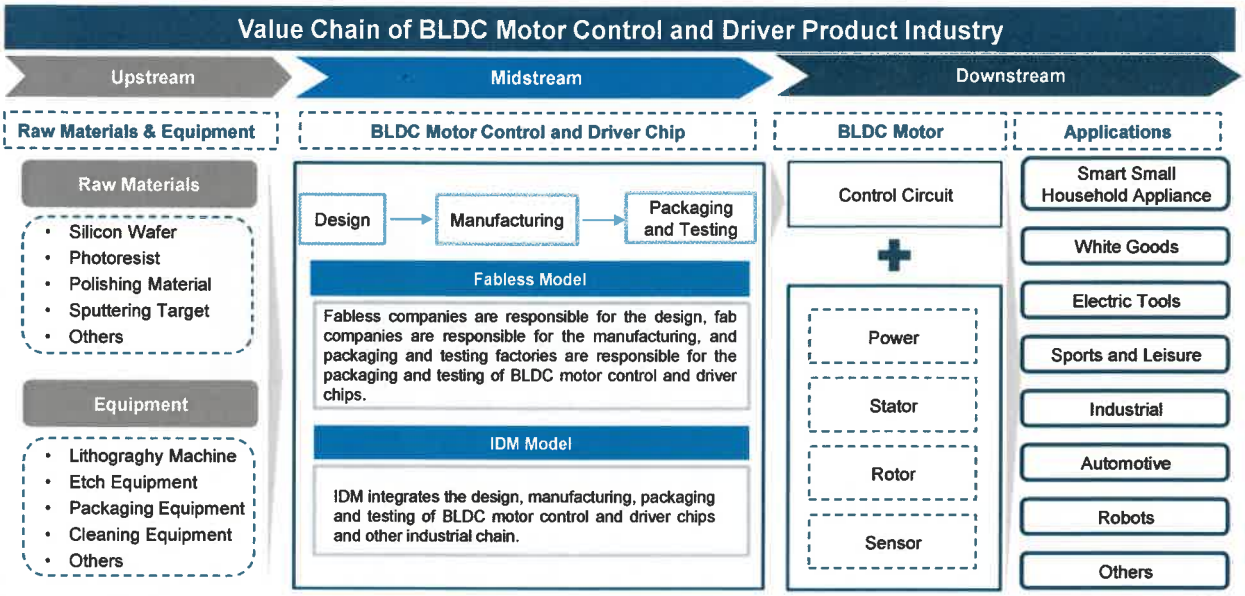
- **Control Chips with Different Levels of Integration.** Some control chips can integrate a large number of functions of other components such as LDOs and op-amps, and even those of HVICs and MOSEETs. Such a design reduces the number of connection points between components, thereby improving system stability and reliability. By contrast, there are also control chips that do not integrate a large number of functions of other components. Such a design allows downstream customers to select the most suitable components for specific application requirements with greater flexibility.

Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Value Chain of BLDC Motor Control and Driver Product Industry

- Major participants in the upstream of the BLDC control and driver product industry include raw material and equipment suppliers. The BLDC control and driver product companies in the midstream of the value chain are responsible for designing, manufacturing, packaging and testing of the BLDC control and driver chips. There are primarily two business models in the midstream, namely integrated device manufacturer (IDM) model and fabless model. In the downstream, the control circuits which include the BLDC motor control and driver chips are integrated with power supply, stators, rotors and sensors into BLDC motors. BLDC motors can be used in a wide range of application scenarios, including smart small household appliance, white goods, electric tools, sports and leisure, industrial, automotive and robots, etc.

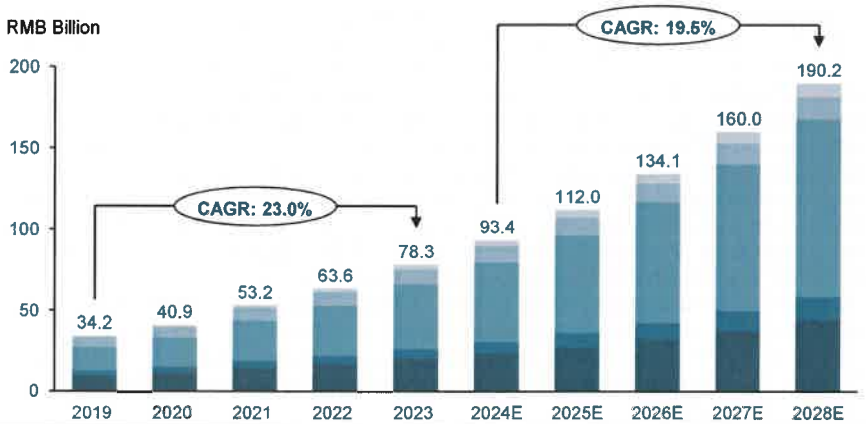


Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Global and China's Market Size of BLDC Motor Control and Driver Products (1/3)

Market Size of BLDC Motor Control and Driver Product Market (by sales value), Global, 2019-2028E



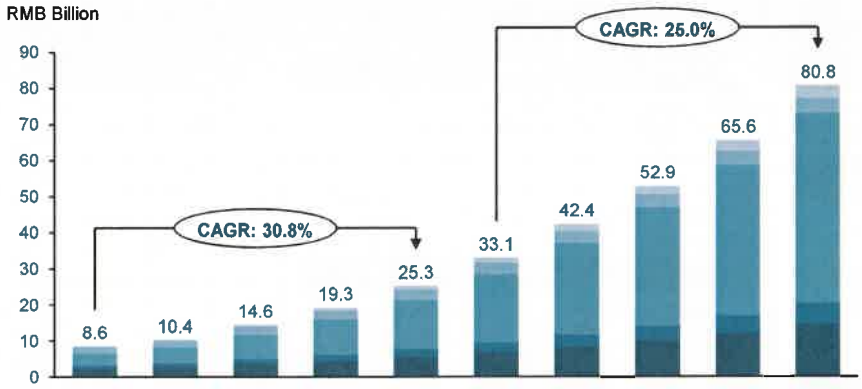
	2019	2020	2021	2022	2023	2024E	2025E	2026E	2027E	2028E	CAGR 19-23	CAGR 24E-28E
Control Chips	9.8	11.7	14.7	16.9	20.3	23.5	27.5	32.3	37.8	44.4	19.8%	17.2%
Driver Chips	3.1	3.5	4.4	5.1	6.0	7.2	8.6	10.2	12.0	14.1	18.3%	18.4%
Power Devices	14.5	17.9	24.5	31.0	39.8	48.9	60.3	74.1	90.3	109.5	28.7%	22.3%
IPMs	6.1	6.8	8.0	8.5	9.4	10.1	11.0	11.9	12.9	13.9	11.5%	8.2%
Sensors	0.7	1.0	1.5	2.1	2.9	3.6	4.6	5.7	6.9	8.3	41.5%	22.8%

Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Global and China's Market Size of BLDC Motor Control and Driver Products (2/3)

Market Size of BLDC Motor Control and Driver Product Market (by sales value), China, 2019-2028E



	2019	2020	2021	2022	2023	2024E	2025E	2026E	2027E	2028E	CAGR 19-23	CAGR 24E-28E
Control Chips	2.4	2.9	3.8	4.6	5.7	6.9	8.4	10.1	12.1	14.5	24.2%	20.2%
Driver Chips	0.8	0.9	1.3	1.6	2.0	2.6	3.3	4.0	4.9	5.9	26.6%	22.6%
Power Devices	3.4	4.3	6.7	9.8	13.6	18.9	25.4	32.8	41.7	52.7	41.5%	29.1%
IPMs	1.9	2.0	2.4	2.5	2.9	3.1	3.4	3.7	3.9	4.2	11.4%	7.7%
Sensors	0.2	0.3	0.5	0.8	1.1	1.5	1.9	2.4	2.9	3.5	52.6%	24.1%

Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Global and China's Market Size of BLDC Motor Control and Driver Products (3/3)

Highlights of Global and China's BLDC Motor Control and Driver Chip Market

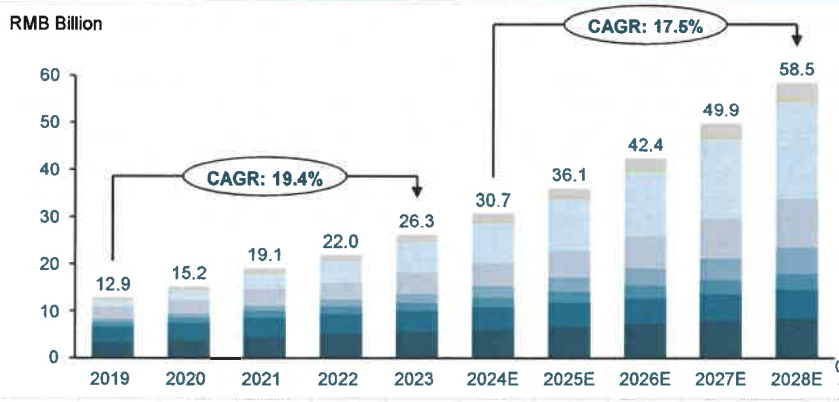
- The BLDC motor control and driver product market encompasses control chips, driver chips, power devices, IPMs, and sensors. Benefiting from various driving factors including technological innovation, growing downstream demand, favorable policy environment, etc., BLDC motor control and driver product market has shown broad development prospects worldwide. The global BLDC motor control and driver product market increased rapidly from RMB34.2 billion in 2019 to RMB78.3 billion in 2023, with a CAGR of 23.0%, and is expected to further increase from RMB93.4 billion in 2024 to RMB190.2 billion in 2028, representing a CAGR of 19.5%. In 2023, power devices and control and driver chips accounted for 50.8% and 33.6% of global BLDC control and driver product market, respectively.
- The downstream application scenarios of specific-purpose and general-purpose chips are interchangeable. Customers from different downstream application scenarios can choose from the two types of chips based on specific requirements such as real-time performance and flexibility. Within the global BLDC motor control chip market which size reached RMB20.3 billion in 2023, specific-purpose chips accounted for about 30%.
- The China BLDC motor control and driver product market increased from RMB8.6 billion in 2019 to RMB25.3 billion in 2023, with a CAGR of 30.8%, and is expected to further grow from RMB33.1 billion in 2024 to RMB80.8 billion in 2028, representing a CAGR of 25.0%. Power devices and control and driver chips occupy the largest market share in the market. In 2023, power devices and control and driver chips accounted for 53.8% and 30.6% of China's BLDC control and driver product market, respectively.

Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Global and China's Market Size of BLDC Motor Control and Driver Chips (1/8)

Market Size of BLDC Motor Control and Driver Chip Market (by sales value), Global, 2019-2028E



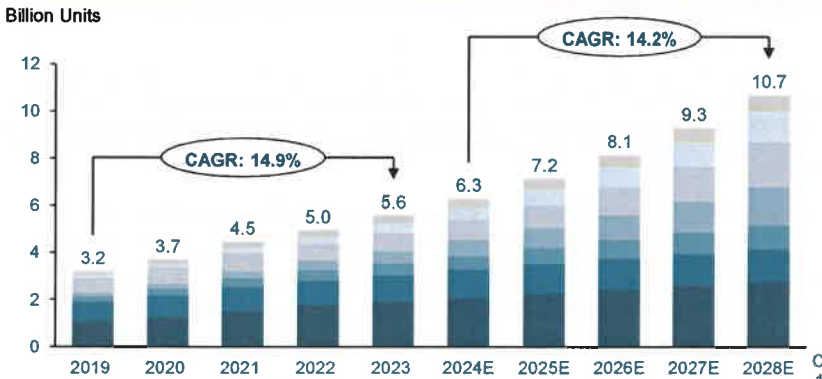
	2019	2020	2021	2022	2023	2024E	2025E	2026E	2027E	2028E	CAGR 19-23	CAGR 24E-28E
Smart Small Household Appliance	3.4	3.9	4.5	5.2	5.6	6.2	6.7	7.3	7.9	8.5	13.7%	8.5%
White Goods	3.4	3.6	4.1	4.2	4.4	4.8	5.1	5.4	5.8	6.1	7.1%	6.4%
Electric Tools	0.9	1.2	1.5	1.6	1.7	2.0	2.3	2.7	3.0	3.4	17.0%	13.8%
Sports and Leisure	0.7	0.9	1.1	1.5	1.9	2.4	3.0	3.7	4.6	5.6	27.6%	23.2%
Industrial	2.5	2.9	3.5	3.6	4.5	4.9	5.7	6.8	8.3	10.4	16.0%	20.4%
Automotive	1.3	1.9	3.1	4.5	6.4	8.4	10.8	13.6	16.9	20.6	49.0%	25.1%
Robots	0.2	0.2	0.3	0.3	0.4	0.5	0.5	0.7	0.8	1.0	22.6%	21.8%
Others	0.6	0.7	1.0	1.1	1.4	1.6	1.9	2.2	2.6	3.1	22.2%	17.5%

Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Global and China's Market Size of BLDC Motor Control and Driver Chips (2/8)

Market Size of BLDC Motor Control and Driver Chip Market (by sales volume), Global, 2019-2028E



	2019	2020	2021	2022	2023	2024E	2025E	2026E	2027E	2028E	CAGR 19-23	CAGR 24E-28E
Smart Small Household Appliance	1.1	1.3	1.5	1.8	1.9	2.1	2.3	2.4	2.6	2.7	15.5%	7.1%
White Goods	0.8	0.9	1.0	1.1	1.1	1.2	1.3	1.3	1.4	1.4	7.7%	4.0%
Electric Tools	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.9	1.0	22.4%	15.7%
Sports and Leisure	0.2	0.2	0.3	0.4	0.5	0.7	0.8	1.1	1.3	1.6	34.7%	24.6%
Industrial	0.6	0.7	0.8	0.7	0.8	0.9	1.0	1.2	1.5	1.9	5.2%	22.4%
Automotive	0.1	0.1	0.2	0.3	0.4	0.5	0.7	0.8	1.1	1.3	39.9%	25.1%
Robots	0.02	0.03	0.03	0.04	0.04	0.06	0.07	0.09	0.11	0.14	19.2%	26.0%
Others	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.6	17.5%	14.2%

Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Global and China's Market Size of BLDC Motor Control and Driver Chips (3/8)

Highlights of Global BLDC Motor Control and Driver Chip Market

- The BLDC motor control and driver chip market encompasses BLDC motor control chips (e.g.MCUs and ASICs) and BLDC motor driver chips (e.g. HVICs). It is also common practice in the industry to use BLDC motor control ICs to refer to BLDC motor control and driver chips. Driven by the increasing penetration of BLDC motors in downstream industries, as well as the advantages of BLDC motor control and driver chips including high efficiency, high reliability, low vibration, low noise, and quick response, the global BLDC motor control and driver chip market grew promptly from RMB 12.9 billion in 2019 to RMB 26.3 billion in 2023, with a CAGR of 19.4%, and the market is expected to grow from RMB 30.7 billion in 2024 to RMB 58.5 billion in 2028, with a CAGR of 17.5%. The sales volume of BLDC motor control and driver chips in the global market also rose from 3.2 billion units in 2019 to 5.6 billion units in 2023, with a CAGR of 14.9%, and is expected to grow from 6.3 billion units in 2024 to 10.7 billion units in 2028, with a CAGR of 14.2%.
- The global BLDC motor control and driver chip market in the smart small household appliance and white goods sectors grew steadily from both RMB 3.4 billion in 2019 to RMB 5.6 billion and RMB 4.4 billion in 2023, respectively, with CAGRs of 13.7% and 7.1%, respectively. And the two markets are expected to further grow to RMB 8.5 billion and RMB 6.1 billion in 2028, respectively, with CAGRs of 8.5% and 6.4% between 2024 and 2028, respectively. This growth is mainly attributed to the ability of BLDC motor control and driver chips to improve energy efficiency and performance of home appliances, as well as consumers' demand for better performance of home appliances with the advancement of technology.
- The global BLDC motor control and driver chip market in the electric tools sector rose from RMB 0.9 billion in 2019 to RMB 1.7 billion in 2023, with a CAGR of 17.0%. Since BLDC motors are better suited to meet the demand for integrated control and wireless operation in electric tools, the market is expected to further grow from RMB 2.0 billion in 2024 to RMB 3.4 billion in 2028, with a CAGR of 13.8%.
- The global BLDC motor control and driver chip market in the sports and leisure sector increased from RMB 0.7 billion in 2019 to RMB 1.9 billion in 2023, with a CAGR of 27.6%. Due to their advantages in high efficiency, low energy consumption, long life and low noise, BLDC motors are gradually replacing traditional motors in the fields of UAVs, electric bikes, treadmills, and intelligent balance bikes. Therefore, the market is expected to further grow from RMB 2.4 billion in 2024 to RMB 5.6 billion in 2028, with a CAGR of 23.2%.
- The global BLDC motor control and driver chip market in the industrial sector grew swiftly from RMB 2.5 billion in 2019 to RMB 4.5 billion in 2023, with a CAGR of 16.0%. The market is expected to grow further from RMB 4.9 billion in 2024 to RMB 10.4 billion in 2028 with a CAGR of 20.4%, primarily due to the widespread use of BLDC motors in the fields of servo system, PC, and data center.

Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Global and China's Market Size of BLDC Motor Control and Driver Chips (4/8)

Highlights of Global BLDC Motor Control and Driver Chip Market

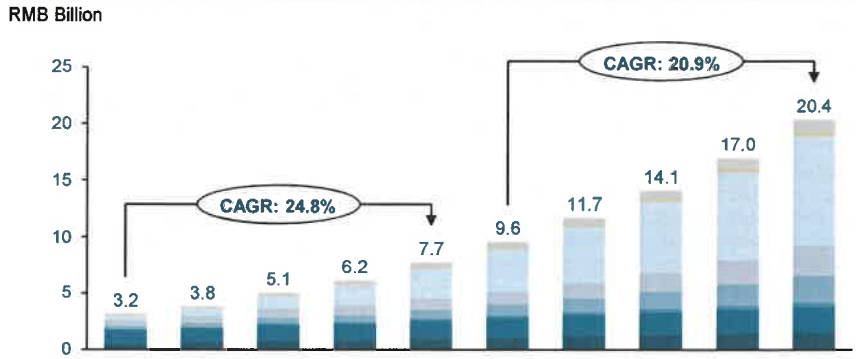
- In the automotive sector, the global BLDC motor control and driver chips market grew rapidly from RMB 1.3 billion in 2019 to RMB 6.4 billion in 2023, with a CAGR of 49.0%. Benefiting from the increasing penetration rate of BLDC motor in the automotive field and the expansion of BLDC motor application scenarios to areas including main driver and auxiliary components, the market size of BLDC motor control and driver chips in automotive is expected to increase rapidly from RMB 8.4 billion in 2024 to RMB 20.6 billion in 2028, with a CAGR of 25.1%.
- In the robots sector, the global BLDC motor control and driver chip market increased from RMB 0.2 billion in 2019 to RMB 0.4 billion in 2023, with a CAGR of 22.6%. With the rapid development of the global intelligent robotics market, the demand for high-performance motors is also increasing. And with advantages such as high energy efficiency and control accuracy, BLDC motors have great application potential in this field, which greatly drive the demand for BLDC motor control and driver chips in the future. The market is expected to grow from RMB 0.5 billion in 2024 to RMB 1.0 billion in 2028, with a CAGR of 21.8%.

Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Global and China's Market Size of BLDC Motor Control and Driver Chips (5/8)

Market Size of BLDC Motor Control and Driver Chip Market (by sales value), China, 2019-2028E



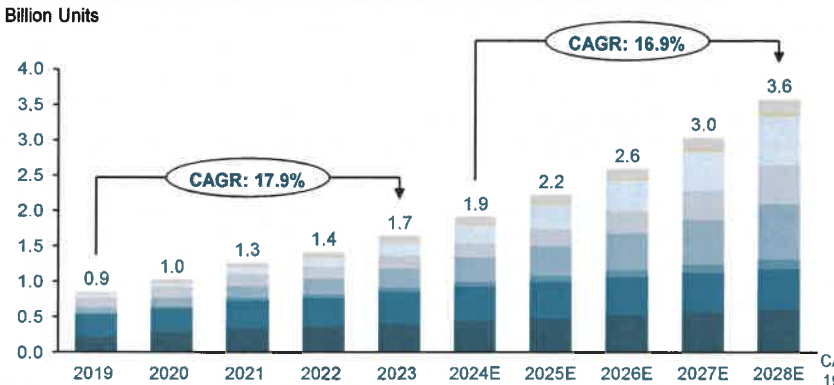
	2019	2020	2021	2022	2023	2024E	2025E	2026E	2027E	2028E	CAGR 19-23	CAGR 24E-28E
Smart Small Household Appliance	0.5	0.7	0.8	0.9	0.9	1.1	1.2	1.3	1.4	1.6	15.9%	10.2%
White Goods	1.2	1.2	1.4	1.5	1.7	1.8	1.9	2.0	2.1	2.3	8.0%	6.0%
Electric Tools	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.4	20.7%	18.1%
Sports and Leisure	0.3	0.4	0.5	0.6	0.8	1.0	1.2	1.5	1.9	2.4	30.2%	25.1%
Industrial	0.5	0.6	0.8	0.9	1.0	1.2	1.4	1.7	2.1	2.7	18.4%	23.2%
Automotive	0.4	0.6	1.1	1.8	2.6	3.7	4.9	6.3	7.8	9.6	62.1%	26.9%
Robots	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.5	31.3%	27.4%
Others	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.9	1.1	27.6%	20.9%

Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Global and China's Market Size of BLDC Motor Control and Driver Chips (6/8)

Market Size of BLDC Motor Control and Driver Chip Market (by sales volume), China, 2019-2028E



	2019	2020	2021	2022	2023	2024E	2025E	2026E	2027E	2028E	CAGR 19-23	CAGR 24E-28E
Smart Small Household Appliance	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.6	16.4%	8.4%
White Goods	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	9.9%	3.8%
Electric Tools	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	26.4%	19.2%
Sports and Leisure	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.8	34.4%	23.4%
Industrial	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.4	0.5	7.4%	28.3%
Automotive	0.0	0.1	0.1	0.1	0.2	0.3	0.3	0.4	0.5	0.7	50.7%	28.0%
Robots	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	29.1%	31.3%
Others	0.04	0.05	0.06	0.07	0.09	0.10	0.12	0.14	0.16	0.19	20.6%	16.9%

Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Global and China's Market Size of BLDC Motor Control and Driver Chips (7/8)

Highlights of China's BLDC Motor Control and Driver Chip Market

- China's BLDC motor control and driver chip market grew significantly from RMB 3.2 billion in 2019 to RMB 7.7 billion in 2023 with a CAGR of 24.8%, and is expected to grow from RMB 9.6 billion in 2024 to RMB 20.4 billion in 2028 with a CAGR of 20.9%. The sales volume of the market also increased from 0.9 billion units in 2019 to 1.7 billion units in 2023, with a CAGR of 17.9%, and is expected to further grow from 1.9 billion units in 2024 to 3.6 billion units in 2028, with a CAGR of 16.9% in the forecast period.
- China's BLDC motor control and driver chip market in the smart small household appliance and white goods sectors grew steadily from RMB0.5 billion and RMB1.2 billion in 2019 to RMB0.9 billion and RMB1.7 billion in 2023, respectively, with CAGRs of 15.9% and 8.0%, respectively. And the two markets are expected to further grow to RMB1.6 billion and RMB2.3 billion in 2028, respectively, with CAGRs of 10.2% and 6.0% between 2024 and 2028, respectively. The growth is mainly attributed to the ability of BLDC motor control and driver chips to improve energy efficiency and performance of home appliances, as well as consumers' demand for better performance of home appliances with the advancement of technology.
- China's BLDC motor control and driver chip market in the electric tools sector increased from RMB0.1 billion in 2019 to RMB0.2 billion in 2023, with a CAGR of 20.7%. Since BLDC motors are better suited to meet the demand for integrated control and wireless operation in electric tools, the market is expected to further grow from RMB0.2 billion in 2024 to RMB0.4 billion in 2028, with a CAGR of 18.1% during the period.
- China's BLDC motor control and driver chip market in the sports and leisure sector increased from RMB 0.3 billion in 2019 to RMB 0.8 billion in 2023, with a CAGR of 30.2% during the period. Due to the advantages in high efficiency, low energy consumption, long life and low noise, BLDC motors are gradually replacing traditional motors in the fields of UAVs, electric bikes, treadmills, and intelligent balance bikes. Therefore, the market is expected to further grow from RMB 1.0 billion in 2024 to RMB 2.4 billion in 2028, with a CAGR of 25.1% in the forecast period.
- China's BLDC motor control and driver chip market in the industrial sector grew swiftly from RMB 0.5 billion in 2019 to RMB 1.0 billion in 2023, with a CAGR of 18.4%. The market is expected to grow further from RMB 1.2 billion in 2024 to RMB 2.7 billion in 2028 with a CAGR of 23.2%, primarily due to the widespread use of BLDC motors in the fields of servo system, PC, and data center.

Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Global and China's Market Size of BLDC Motor Control and Driver Chips (8/8)

Highlights of China's BLDC Motor Control and Driver Chip Market

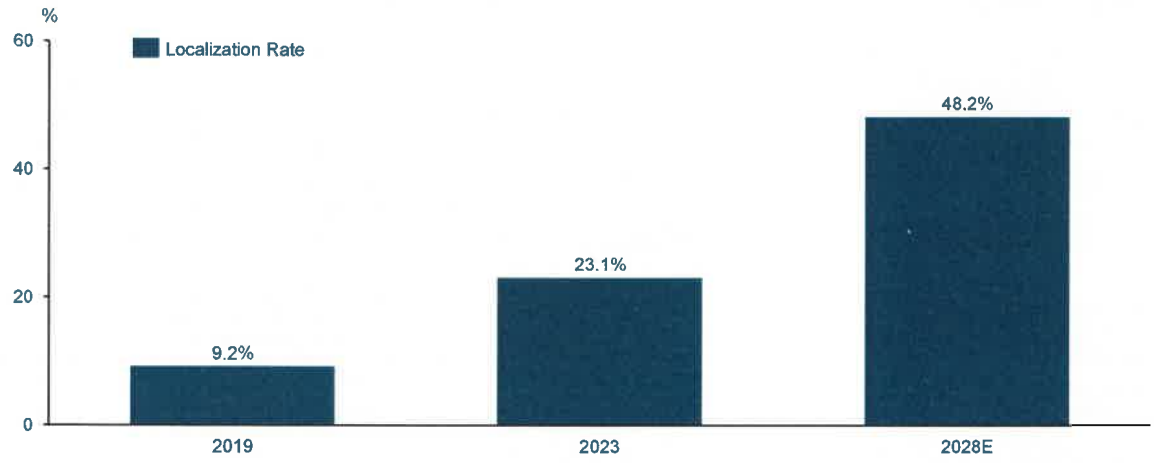
- In the automotive sector, China's BLDC motor control and driver chips market grew rapidly from RMB 0.4 billion in 2019 to RMB 2.6 billion in 2023, with a CAGR of 62.1%. Benefiting from the increasing penetration rate of BLDC motor in the automotive field and the expansion of BLDC motor application scenarios to areas including main driver and auxiliary components, the market size of BLDC motor control and driver chips in automotive is expected to increase rapidly from RMB 3.7 billion in 2024 to RMB 9.6 billion in 2028, with a CAGR of 26.9%.
- In the robots sector, China's BLDC motor control and driver chip market increased from RMB 0.05 billion in 2019 to RMB 0.14 billion in 2023, with a CAGR of 31.3%. With the rapid development of China's intelligent robotics market, the demand for high-performance motors is also increasing. And with advantages such as high energy efficiency and control accuracy, BLDC motors have great application potential in the field, which greatly drive the demand for BLDC motor control and driver chips in the future. The market is expected to grow from RMB 0.18 billion in 2024 to RMB 0.47 billion in 2028, with a CAGR of 27.4% during the period.

Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry
Analysis of China's Localization Rate of BLDC Motor Control and Driver Chips

- Domestic enterprises entered the BLDC motor control and driver chip market relatively late, and initially relied on the technology and products of foreign manufacturers. In 2019, the localization rate of China's BLDC motor control and driver chip market was only 9.2%. In recent years, with the support of national policies and domestic enterprises' efforts in technological innovation and market expansion, the pace of domestic substitution has accelerated, reaching a localization rate of 23.1% in 2023. In the future, with technological advancements and the continuous growth of market demand, the localization rate is expected to further increase to 48.2% in 2028.

Localization Rate of BLDC Motor Control and Driver Chips, China, 2019&2023&2028E



Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry
Policies and Regulations of BLDC Motor Control and Driver Chip Market (1/3)

Key Policies and Regulations

Name	Issued Time	Issued Department	Key Information
2024-2025 Energy Conservation and Carbon Reduction Action Plan 《2024-2025年节能降碳行动方案》	2024.05	State Council	• Accelerate the renovation of energy-consuming products, equipment and facilities. Dynamically update the advanced energy efficiency, energy-saving level and access level of key energy-consuming products and equipment, and promote the renovation and upgrading of key energy-consuming equipment.
Implementation Program for Promoting the Modernization of Equipment in the Industrial Sector 《推动工业领域设备更新实施方案》	2024.03	MIIT, NDRC, MoF, etc	• Emphasizing the promotion of energy efficiency upgrading of key energy-using equipment, focusing on energy efficiency level upgrading, promoting the upgrading of key energy-using equipment such as motors, and promoting the application of energy-efficient equipment with energy efficiency level 2 and above.
Guiding Opinions on Quality Infrastructure to Facilitate the Linkage and Improvement of the Quality of the Industrial Chain and Supply Chain 《关于质量基础设施助力产业链供应链质量联动提升的指导意见》	2024.01	SAMR, NDRC, etc	• Carry out standardization to help key industries to stabilize the chain project, focusing on the whole chain of production, distribution, circulation and consumption, accelerating the development and application of standards for key links, key areas and key products, and promoting the effective convergence of standards in the upstream and downstream of the industrial chain. Accelerate the development of key technology standards in integrated circuits and other fields, and promote industrial change. Implement standardization of the whole industrial chain.

Source: Government documents, Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Policies and Regulations of BLDC Motor Control and Driver Chip Market (2/3)

Key Policies and Regulations

Name	Issued Time	Issued Department	Key Information
Action Plan for Stable Growth of Electronic Information Manufacturing Industry from 2023 to 2024 《电子信息制造业2023—2024年稳增长行动方案》	2023.09	MIIT, MoF	• Accelerate the innovation and iterative application of key core technologies in the field of information technology. Promote breakthroughs in electronic materials, electronic specialized equipment, and electronic measurement instrument technologies in key areas such as personal computing, new displays, 5G communication, and intelligent connected vehicles.
Action Plan for Industrial Energy Efficiency Improvement 《工业能效提升行动计划》	2022.07	MIIT, NDRC, MoF, etc	• The document emphasizes the need to continue to carry out special actions to improve energy efficiency around the motor and other general energy-using equipment, increase the application of high-efficiency energy-using equipment, and strengthen the key energy-using equipment system to match energy-saving renovation and optimization of operation control.
Guidelines on Tax Incentives for Software Enterprises and Integrated Circuit Enterprises 《软件企业和集成电路企业税费优惠政策指引》	2022.05	SAT	• Software industry and integrated circuit industry is the core of information industry, and is the key force leading the new round of scientific and technological revolution and industrial change. In recent years, the Party Central Committee and the State Council have attached great importance to the development of software enterprises and integrated circuit enterprises, and introduced a series of tax support policies.

Source: Government documents, Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry

Policies and Regulations of BLDC Motor Control and Driver Chip Market (3/3)

Key Policies and Regulations

Name	Issued Time	Issued Department	Key Information
Tax Laws Amendment Act 2024 《2024年税法修正案》	2024.07	Korean Ministry of Economy and Finance	• Extends the National Strategic Technology Tax Credit, which was due to expire at the end of this year, for three years until the end of 2027. Facility investments in semiconductors and circuits, which are designated as national strategic technologies, will receive a 15 percent tax credit, and R&D investments will receive a 30 to 50 percent tax credit.
National Semiconductor Strategy 《国家半导体战略》	2023.05	UK Department for Science, Innovation and Technology	• Sixteen semiconductor projects were announced that will provide chip companies with up to 1 billion pounds over the next decade to scale up development and reduce the cost of integrated circuits, aiming to boost the resilience of the UK chip industry.
Semiconductor and Digital Industry Strategy 《半导体与数字产业战略》	2021.06	the Ministry of Economy, Trade and Industry	• The strategy identifies four major directions: ensuring joint development and production capabilities for cutting-edge semiconductor manufacturing technologies, accelerating digital investment and strengthening the design and development of logic chips, promoting green innovation, and ensuring investment resilience in the semiconductor industry.
Commission Regulation (EU) 2019/1781 《委员会条例 (EU) 2019/1781》	2019.10	European Commission	• Lay down ecodesign requirements for electric motors and variable speed drives pursuant. Improvements in the electricity consumption of electric motors and variable speed drives should be achieved by applying existing, non-proprietary and cost-effective technologies that can reduce the total combined costs of purchasing and operating them.

Source: Government documents, Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry
Market Drivers of BLDC Motor Control and Driver Chip Market(1/2)

Market Drivers of Motor Control and Driver Chip Market

	Main Drivers	Influence (1-2 years)	Influence (3-5 years)
1	Increasing Penetration Rate of BLDC Motor	High	High
2	Growing Downstream Industries	High	High
3	Technological Advancement and Innovation of BLDC Motor Control and Driver Chip	High	High
4	Supportive Policies	High	Medium

Drivers	Description
Increasing Penetration Rate of BLDC Motor	BLDC motor control and driver chips are expected to be more widely used in downstream application fields in the forecast period, including automotive, household appliances, and UAVs. Firstly, BLDC motors can meet the higher requirements of automotives for reliability, energy consumption, and power density, thus are expected to gradually replace traditional motors and expand application into more scenarios, including main drive, auxiliary components (EPS, electronic suspension system, vehicle stability control system, body system, etc.), and air-conditioning systems. In the field of automotive, the penetration rate of BLDC motors in EV in the China market is expected to increase from approximately 40% in 2019 to approximately 80% in 2028. Secondly, consumers' requirements for home appliances are continuously increasing, with a greater focus on the intelligence and high-end nature of the products. The advantages of BLDC motors in terms of control precision and noise levels make them an indispensable part of high-end products. Benefiting from consumption upgrades and the iteration and upgrading of the household appliance market, the BLDC motor market is expected to have a broader space in smart small household appliance industry. For instance, the penetration rate of BLDC motors in vacuum cleaners in the China market is expected to increase from approximately 30% in 2019 to approximately 90% in 2028. Furthermore, BLDC motors are widely used in UAVs due to their performance advantages such as high reliability, low vibration, high efficiency, and low noise. Its integration and customization trends help reduce the size and weight of UAVs while improving efficiency and response speed. As BLDC motor expands its application to more downstream markets, the demand for BLDC motor control and driver chips is also expected to experience explosive growth.
Growing Downstream Industries	Downstream industries of the BLDC motor control and driver chip market has been continuously expanding. In China, with the increase in domestic residents' disposable income as well as technological improvements in products, the overall home appliances market is expected to grow from RMB60.4 billion in 2023 to RMB76.9 billion in 2028. Besides, driven by longer driving range with increasing battery capacity, decreasing price, more mature and convenient charging infrastructure and the stronger environmental consciousness of consumers, the sales volume of EVs in China is expected to grow from 9.5 million units in 2023 to 24.9 million units in 2028, at a CAGR of 21.3%. Additionally, with the continuous development of new intelligent technologies, including 5G, AI, and big data, etc., China's civilian UAV market is expected to grow from RMB117.4 billion in 2023 to RMB392.2 billion in 2028, with a CAGR of 27.3%. The growing development of these downstream markets provides opportunities for the development of the BLDC motor market and the BLDC motor control and driver chip market.

Source: Frost & Sullivan

Analysis of Global and China's BLDC Motor Control and Driver Product Industry
Market Drivers of BLDC Motor Control and Driver Chip Market(2/2)

Market Drivers of Motor Control and Driver Chip Market

	Main Drivers	Influence (1-2 years)	Influence (3-5 years)
1	Increasing Penetration Rate of BLDC Motor	High	High
2	Growing Downstream Industries	High	High
3	Technological Advancement and Innovation of BLDC Motor Control and Driver Chip	High	High
4	Supportive Policies	High	Medium

Drivers	Description
Technological Advancement and Innovation of BLDC Motor Control and Driver Chip	The realm of BLDC motor control and driver chip has made significant advancements in technological innovation and algorithmic refinement. For instance, leading companies in the industry have developed proprietary ME (Motor Engine) core and hardware-based motor control algorithms, effectively improving the operation speed of algorithm and the reliability of control and driver chip reliability. In addition, advanced control and driver technologies such as highly integrated chip solutions and intelligent control algorithms are constantly emerging, further improving the performance of BLDC motors and driving the continuous expansion of the BLDC motor control and driver chip market.
Supportive Policies	Governments in different countries have shown strong support for energy efficiency improvement, especially for high-efficiency and low-energy-consumption equipment such as BLDC motors. In March 2024, China's MIIT and other departments issued the "Implementation Program for Promoting the Modernization of Equipment in the Industrial Sector," which clearly emphasizes the promotion of energy efficiency upgrading of key energy-using equipment including motors, focusing on energy efficiency level upgrading. In October 2019, the European Commission issued the "Commission Regulation (EU) 2019/1781," which sets clear requirements for the energy efficiency of the electric motors and variable speed drives pursuant. The scope of the regulation has been further expanded and the requirements have been raised from July 1, 2023. Therefore, it further promotes the technological progress and energy efficiency improvement of the motor and variable speed drive industry, and the development of the BLDC motor industry. Furthermore, various countries have also introduced supportive policies in the field of chips. In 2023, China released "the Action Program for Stabilizing Growth of Electronic Information Manufacturing Industry in 2023-2024", which proposes to focus on improving chip supply capacity and actively promoting the cooperation between chip enterprises and downstream application industries. In 2023, the UK released the "National Semiconductor Strategy", which aims to reduce the cost of integrated circuits and boost the resilience of the UK chip industry. In 2021,the Japanese government released the "Semiconductor and Digital Industry Strategy", which proposes to strengthen the design and development of cutting-edge semiconductor manufacturing technologies and promote green innovation. The development of the BLDC motor control and driver chip market, as a rapidly growing sub-segment of the chip industry, has been promoted by these supportive policies.

Source: Frost & Sullivan

Development Trends of BLDC Motor Control and Driver Chip Market

1 Increasing Domestic Substitution

- In January 2024, China's MIIT and other departments issued the "Implementation Opinions on Promoting Innovation and Development of Future Industries," which promotes industrial terminal products that adapt to the general intelligent trend. With the support of government policies and the technological innovation made by domestic companies in the industry, their market share has gradually increased. In 2023, the domestic supplying rate of China's BLDC motor control and driver chip market was 23.1%, increasing from 9.2% in 2019. In the forecast period, with technological advancements and the continuous growth of market demand, the domestic supplying rate is expected to further increase to 48.2% in 2028.

2 Higher Integration Level and Further Improving Performance

- With increasing performance requirements from terminal markets on motor control, BLDC motor control and driver chips are developing towards higher integration levels and further improving performance. Highly integrated chip design can integrate more devices and functions on a single chip, thereby greatly simplifying peripheral circuits, reducing the number of peripheral devices, reducing the overall size of the control system, as well as its cost. By reducing the number of connection points between system components, they can greatly improve the stability and reliability of the system. Furthermore, highly integrated solutions can also effectively reduce the difficulty of designing subsequent application programs for chip products. In addition, the sensorless FOC control algorithm has been widely adopted especially in the fields of white goods, smart small household appliance and industrial automation due to its advantages of high efficiency, low vibration, low noise and high response speed.

3 Intelligent Development Trend

- With the continuous development of AI technology, new intelligent functions such as intelligent algorithms and adaptive control are constantly being applied into the BLDC motor control and driver industry. BLDC motors are accelerating their penetration into multiple emerging application fields, such as smart homes, EVs, industrial automation, etc., and such fields have put forward higher requirements on the performance, efficiency and intelligence level of motors. By introducing AI and intelligent algorithm technology, BLDC motors can achieve more efficient energy management, more precise position control and smarter fault diagnosis.

4 Provision of System-level Services

- As downstream end customers have increasingly higher requirements on the diversity and complexity of BLDC motor control and driver systems, suppliers that only provide BLDC motor chips can no longer meet their needs. Therefore, it is expected to be a trend in the industry that BLDC motor control and driver chip companies provide system-level motor control services, which includes not only IC design, but also motor control algorithms and motor design technologies. And companies with such comprehensive system-level service capabilities are poised to gain a competitive edge in the market.

Source: Frost & Sullivan

3. Competitive Analysis of China's BLDC Motor Control and Driver Chip Market

Competitive Analysis of China's BLDC Motor Control and Driver Chip Market

Competitive Landscape of China's BLDC Motor Control and Driver Chip Market

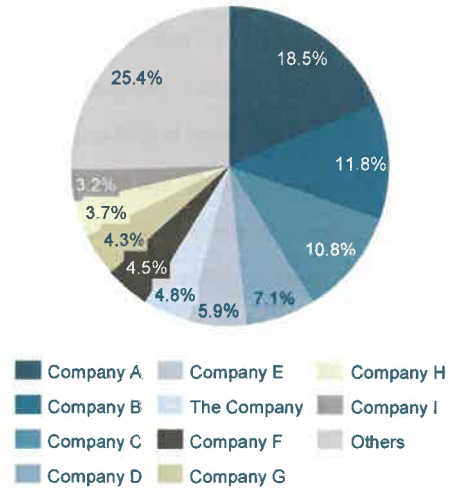
- In the Global and China's BLDC motor control and driver chip market, foreign companies hold the major market share, leveraging on their technical accumulation from other segments of the semiconductor market. While Chinese companies have experienced rapid growth in recent years, and have advantages in providing tailored products that meet specific industry requirements.
- The Company's MCU, ASIC and HVIC segments constitute its BLDC motor control and driver chip business. In 2023, the Company's revenue generated from sales of MCU, ASIC and HVIC products to customers in China amounted to RMB373 million. Based on BLDC motor control and driver chip revenue in 2023, the Company ranked sixth in the Chinese market, including domestic and overseas companies, with a market share of 4.8%. Based on BLDC motor control and driver chip revenue in 2023, the Company is the largest domestic company in the Chinese market. The Company's revenue growth is in line with industry trend.
- BLDC motor control and driver product companies adopt either IDM model or fabless model. Based on BLDC motor control and driver chip revenue in 2023, six out of the top ten companies in the Chinese market adopt IDM model, and the remaining four companies adopt the fabless model. Semiconductor giant companies in the market generally adopt the IDM model.
- Furthermore, based on BLDC motor control and driver chip revenue in 2023, six out of the top ten companies in the Chinese market fully provide general-purpose chips. The other four companies are able to provide specific-purpose chips, and among them, the Company fully provides specific-purpose chips, and Company E mainly provides specific-purpose chips.

Competitive Analysis of China's BLDC Motor Control and Driver Chip Market

Ranking of China BLDC Motor Control and Driver Chip Companies

Top 10 BLDC Motor Control and Driver Chip Companies (by Revenue), China, 2023

Total revenue: RMB 7,738 million



Rank	Company	Country	BLDC Motor Control and Driver Chip Revenue (in RMB Million)	Market Share
1	Company A	Germany	1,431	18.5%
2	Company B	US	910	11.8%
3	Company C	Switzerland	835	10.8%
4	Company D	Netherlands	550	7.1%
5	Company E	Japan	454	5.9%
6	**The Company**	**China**	**373**	**4.8%**
7	Company F	Belgium	350	4.5%
8	Company G	US	333	4.3%
9	Company H	Germany	286	3.7%
10	Company I	Japan	251	3.2%
	Others		1,964	25.4%
	Total		**7,738**	**100.0%**

Source: Frost & Sullivan

Competitive Analysis of China's BLDC Motor Control and Driver Chip Market
Entry Barriers

1 Technology Barrier

- The BLDC motor control and driver chip industry is a highly specialized, technology-intensive field with applications across various sectors. Leading companies have accumulated extensive technical expertise and proprietary designs, while new entrants would face significant challenges, particularly in mastering complex motor control algorithms and achieving high-performance chip integration. Therefore, the gap in technologies between new entrants and leading companies would be a huge challenge for new entrants in their early stages of development. And companies that have accumulated technological advantages hold a first-mover advantage within the competitive landscape.

2 Product Reliability Barrier

- In the BLDC motor control and driver chip industry, product reliability is a critical determinant of consistent operational performance. Established companies benefit from extensive testing, product refinement, and accumulated performance data, ensuring high reliability and minimizing failure rates. Such companies possess a clear first-mover advantage in the competitive landscape. While new entrants face considerable challenges in achieving similar levels of product reliability.

3 Customer Stickiness Barrier

- The number and quality of downstream clients have significant impact on the long-term growth of BLDC motor control and driver chip companies. Customer stickiness in the industry is high because companies in the industry have to undergo rigorous evaluations before entering the supply chain of major clients and securing long-term partnerships. Moreover, large-scale clients, especially recognized brands, have low willingness in changing suppliers due to the lengthy qualification process and high switching costs. As a result, the lack of established customer relationships creates a substantial barrier for new entrants, establishing a significant first-mover advantage for existing industry leaders.

4 Talent Barrier

- The BLDC motor control and driver chip industry requires a highly specialized talent pool covering complex hardware, software, and production processes. Moreover, some of the leading companies in the industry have built talent teams in IC design, motor control algorithms, and motor design, so as to provide system-level services. As the BLDC motor control and driver chip market continues to expand, the demand for high-end talent with both technical knowledge and practical experience is increasing. For new entrants, recruiting and retaining the necessary technical expertise across multiple areas poses a significant challenge.

Source: Frost & Sullivan

Appendix (1/5)

Company A, a company headquartered in Germany and listed on the Frankfurt Stock Exchange, was established in 1999 and primarily offers semiconductors, system solutions, and others.
Company B, a company headquartered in the US and listed on the NASDAQ Exchange, was established in 1951 and primarily offers semiconductors, calculators, and other electronic components.
Company C, a company headquartered in Switzerland and listed on the New York Stock Exchange, Euronext Paris Exchange, and Borsa Italiana Exchange, was established in 1987 and primarily offers semiconductors, power ICs, and others.
Company D, a company headquartered in the Netherlands and listed on the NASDAQ Exchange, was established in 2006 and primarily offers semiconductors, embedded systems, and others.
Company E, a company headquartered in Japan and listed on the Tokyo Stock Exchange, was established in 1958 and primarily offers semiconductors, power devices, and others.
Company F, a company headquartered in Belgium and listed on the Euronext Brussels Exchange, was established in 1988 and primarily offers semiconductor-based sensor ICs, signal conditioning devices, and others.
Company G, a company headquartered in the US and listed on the NASDAQ Exchange, was established in 1990 and primarily offers power ICs, sensors, and others.
Company H, a company headquartered in Germany and listed on the Frankfurt Stock Exchange, was established in 1984 and primarily offers analog ICs, sensors, and others.
Company I, a company headquartered in Japan and listed on the Tokyo Stock Exchange, was established in 2002 and primarily offers semiconductors, microcontrollers, and others.

Source: Frost & Sullivan

Appendix (2/5)

- Compared with traditional motors, BLDC motors offer advantages such as high efficiency, low power consumption, high control precision and low noise, and are widely used in various applications.
- The Company's product portfolio covers all key components of a typical motor control system, including (i) motor control chips such as MCUs and ASICs, (ii) motor driver chips such as HVICs, (iii) IPMs, and (iv) power devices such as MOSFETs.
- The Company is the first Chinese IC Company that focuses on the design of BLDC motor control ICs ; The Company is the first IC Company in the world to achieve large-scale production of specific-purpose motor control chips with hardware-based FOC algorithms ; As of December 31, 2023, the Company ranked sixth with a 4.8% market share in terms of revenue in the BLDC motor control and driver chip market in China and was the only Chinese Company among the top ten companies in the same market.
- The Company is the first motor control IC Company in China with dedicated teams specializing in all these three technological fields.
- The fabless business model is consistent with the increasing trend of specialized division of labor within the semiconductor industry, allowing fabless companies to focus attention and resources on design and R&D.
- Foreign companies maintain a dominant position in the market.
- Many of the Company's competitors use Cortex-M series core licensed by ARM for their MCU products.
- The semiconductor industry has historically experienced rapid fluctuations, including cyclical downturns due to constant and rapid technological changes, short product life cycles, and fluctuations in product supply and demand.
- As of December 31, 2023, the Company ranked sixth with a 4.8% market share in terms of revenue in the BLDC motor control and driver chip market in China and was the only Chinese Company among the top ten companies in the same market.
- Compared with traditional motors, BLDC motors offer advantages such as high efficiency, low power consumption, high control precision, and low noise, and are widely used in various applications.
- The Company's product portfolio covers all key components of a typical motor control system, including (i) motor control chips such as MCUs and ASICs, (ii) motor driver chips such as HVICs, (iii) IPMs, and (iv) power devices such as MOSFETs.
- The Company is the first Chinese IC Company that focuses on the design of BLDC motor control ICs; The Company is the first IC Company in the world to achieve large-scale production of specific-purpose motor control chips with hardware-based FOC algorithms; As of December 31, 2023, the Company ranked sixth with a 4.8% market share in terms of revenue in the BLDC motor control and driver chip market in China and was the only Chinese Company among the top ten companies in the same market.
- The Company is the first motor control IC Company in China with dedicated teams specializing in all these three technological fields.
- BLDC motors are increasingly popular in a growing number of applications due to their advantages in energy efficiency, performance, and control.

Source: Frost & Sullivan

Appendix (3/5)

- The Company had higher revenue growth than the average level of its Chinese market peers during the Track Record Period.
- For the nine months ended September 30, 2024, the Company achieved a gross profit margin of 52.2%, higher than the average gross profit margin level of its Chinese market peers.
- The Company is the first Chinese IC Company that focuses on the design of BLDC motor control ICs; The Company is the first IC Company in the world to achieve large-scale production of specific-purpose motor control chips with hardware-based FOC algorithms.
- The majority of motor control IC companies in the industry develop general-purpose MCU chips, and their chip core architectures are typically based on ARM's licensed Cortex-M cores.
- With the continuous upgrading of electronic and electrical products, the requirements for motor control are becoming increasingly stringent, including high efficiency, low noise, rapid response to load and environment changes, and intelligent interconnection with peripheral systems.
- As of December 31, 2023, the Company ranked sixth with a 4.8% market share in terms of revenue in the BLDC motor control and driver chip market in China and was the only Chinese Company among the top ten companies in the same market.
- The Company has achieved strong market positions in multiple application sectors such as smart small household appliances and electric tools.
- The Company is the first motor control IC Company in China with dedicated teams specializing in all these three technological fields.
- To enhance the reliability and control performance of motor control ICs while reducing the size of motor control systems to accommodate the miniaturization and customization trends in BLDC motors, the industry trend is gradually towards products with greater levels of functional integration.
- Sensorless FOC algorithms can best achieve objectives such as high efficiency, low vibration, low noise, and quick response, making it the mainstream trend in BLDC motor control technology for applications such as white goods, smart small household appliances, and industrial automation.
- The Company's product upgrade speed surpasses the average speed of its domestic peers and is among the leading levels in the industry.
- End customers typically develop their products around a pre-selected motor control chip model, which is typically developed by a specific motor control IC Company.
- With the development of artificial intelligence and automation technologies, the application sectors the Company has deeply cultivated, such as smart small household appliances and white goods, are expected to have broad prospects.
- BLDC motors have emerged as the preferred choice in the small and medium-sized motor industry due to their outstanding performance characteristics, including high reliability, low vibration, high efficiency, low noise, and energy-saving capabilities.

Source: Frost & Sullivan

Appendix (4/5)

- The market for BLDC motors continues to expand, driven by their widespread adoption in various industries and application scenarios such as smart small household appliances, white goods, sports and leisure, electric tools, industrial and automotive sectors.
- To enhance the reliability and control performance of motor control ICs while reducing the motor control system's size to accommodate the miniaturization and customization trends in BLDC motors, the industry is gradually shifting towards products with greater levels of functional integration.
- Compared with MCUs, which typically contain a general purpose processor core, memory, input/output interfaces and other modules, ASICs are designed for specific control scenarios with their internal circuits and logic designed for specific algorithms and tasks.
- The average unit selling price of our main products during the Track Record Period was generally comparable with the price ranges observed in the industry.
- DC inverter technology represents the trend in the kitchen and bathroom appliance industry towards high-end product upgrade.
- The fabless business model is consistent with the increasing trend of specialized division of labor within the semiconductor industry, allowing fabless companies to focus attention and resources on design and R&D.
- Many of the Company's market peers typically rely on the ARM Cortex-M processor core architecture for their MCU products.
- The Company is the only BLDC motor control and driver chip Company adopting the ME core technology and accounted for approximately 5% of market share in terms of revenue in the BLDC motor control and driver chip market in China in 2023.
- Companies that use ARM's licensed Cortex-M core accounted for approximately 70% of market share in the same market, with companies adopting other technology approaches accounting for the remaining 25%.
- Many competitors in the industry using processor cores licensed from ARM implement their motor control algorithms through software programming.
- There are industry competitors who have developed or are developing similar technologies in these areas.
- The Company is the first motor control IC Company in China with dedicated teams specializing in all these three technological fields.
- Supplier A's parent Company and Supplier B are among the top five in terms of wafer manufacturing revenue in the global wafer manufacturing market during the Track Record Period.
- Based on the wafer manufacturing revenue in 2023, the parent Company of Supplier A ranked third in the global wafer manufacturing market with a market share of approximately 6%, and Supplier B ranked first with a market share of approximately 60%.
- To ensure consistently high-quality products and centralized management of manufacturing demands, it is in line with industry practice for chip design companies to rely on a limited number of foundry partners.

Source: Frost & Sullivan

Appendix (5/5)

- It is the industry norm that overseas foundries, such as Supplier A and Supplier B, generally sign contracts with fabless companies on a project basis instead of entering into framework agreements.
- The engagement of distributors for the sales of products is in line with the industry norm in the semiconductor industry. To a lesser extent, the Company also makes direct sales to customers.
- It is an industry norm for motor control IC companies in China to engage distributors for the sales of products.
- Foreign companies maintain a dominant position in the market. However, Chinese companies have achieved rapid growth by leveraging their technological innovation capabilities.
- For the nine months ended September 30, 2024, the Company achieved a gross profit margin of 52.2%, higher than the average gross profit margin level of its Chinese market peers.
- The Company's product portfolio covers all key components of a typical motor control system, including (i) motor control chips such as MCUs and ASICs, (ii) motor driver chips such as HVICs, (iii) IPMs, and (iv) power devices such as MOSFETs.
- The Company chooses to strategically focus on developing products for BLDC motors, which have emerged as the preferred choice in the small and medium-sized motor industry.
- The global BLDC motor control and driver chip market grew promptly from RMB 12.9 billion in 2019 to RMB 26.3 billion in 2023, with a CAGR of 19.4%. The market is expected to grow from RMB 30.7 billion in 2024 to RMB 58.5 billion in 2028, with a CAGR of 17.5%.
- Foreign companies dominate the market. However, Chinese companies, including the Company, have demonstrated rapid growth through continued R&D and development of new products to meet market demand.
- In 2023, the Company ranked sixth in terms of market share in the BLDC motor control and driver chip market in China, being the largest domestic player in the industry.
- China's BLDC motor control and driver chip market is expected to grow from RMB9.6 billion in 2024 to RMB20.4 billion in 2028, with a CAGR of 20.9%, primarily driven by the anticipated increase in demand from the automotive, industrial sectors, and artificial intelligence applications.

Source: Frost & Sullivan

Thank You

Partner with you on the Road to Growth