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China Electric Vehicle Motor Controller Industry Report, 2021

Abstract

Automotive motor controller industry is expected to grow at CAGR of 23.4%, and local manufacturers are rising.

1) The growing new energy vehicle market gives a boost to the motor controller market.

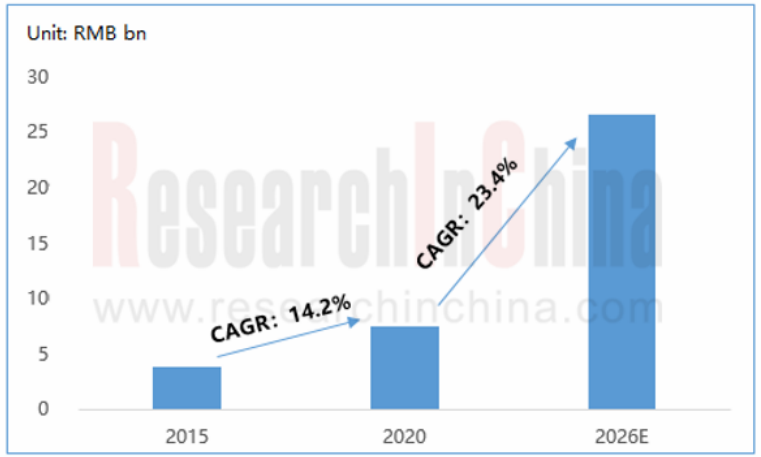
The supply and demand in the electric vehicle motor controller market is dependent on the expansion of new energy vehicle market.

At present, countries and automakers worldwide have formulated their plans and requirements for the development of new energy vehicles. In future, new energy vehicle sales will be bound to surge. As the new energy vehicle market booms, the motor controller market will make steady growth. It is predicted that China's motor controller market will sustain a CAGR of up to 23.4% between 2020 and 2026.

2) In the fiercely competitive motor controller market, local manufacturers lead the way.

Currently, China's electric vehicle motor controller market is intensely competitive. There are mainly three types of players: automaker-backed companies, local manufacturers, and foreign/joint-venture manufacturers. Among them, automaker-backed players support their own vehicles; local manufacturers are suppliers of Chinese independent auto brands; foreign/joint-venture companies build supply relationships with foreign/joint-venture auto brands.

China's Motor Controller Market Size, 2015-2026E



Source: ResearchInChina

Main Players in China's Motor Controller Market

Source: ResearchInChina

Abstract

Supply Relationships of Some Motor Controller Manufacturers

Company		Supported Auto Brands
Foreign/Joint-venture Manufacturers	Vitesco	Mercedes-Benz, Hyundai, Peugeot, Renault, Volkswagen, GM, SAIC, BAIC, Geely
	ZF	Mercedes-Benz, BMW, Audi
	Hitachi Astemo	Honda, Porsche, Changan Auto, Geely, Xiaopeng Motors
	NIDEC	GAC, Geely, Hozon
	Bosch	BMW, Mercedes-Benz, Porsche, Volkswagen, Peugeot, Citroen
	UAES	SAIC, Volkswagen, Great Wall Motor, Geely, Ford, Chery, BAIC, Mercedes-Benz, BMW, Nissan, Mitsubishi, Suzuki
Local Manufacturers	FinDreams Powertrain	BYD
	XPT	NIO
	Inovance Technology	GAC, Great Wall Motor, Geely, Weltmeister, Xiaopeng Motors, Leading Ideal
	Shanghai Edrive	Chery, JAC, FAW, Changan Auto, SAIC, Brilliance, Great Wall Motor, Zhonghua, GAC, Renault, GM
	Huawei	Changan Auto, SERES
	Jing-Jin Electric	FAW, Chery, Changan Auto, SAIC, Dongfeng Motor, Geely, JAC, Brilliance, Great Wall Motor, Zhonghua, GAC

Source: ResearchInChina

Local manufacturers now have the upper hand on the strength of the development of homegrown new energy vehicle brands, especially emerging automakers. In 2020, seven out of the top ten manufacturers by market share were local companies, among which BYD still dominated the list with a 13.5% share; Inovance Technology, Sungrow and Huayu E-drive first edged into the top-ten list.

Abstract

3) N-in-one products hold the trend, and three-in-one drive system will become the mainstream

Motor and ECU integration is a way to not only reduce weight and size of products but cut costs of production and procurement and improve efficiency. In current stage, most companies still stay at the two-in-one phase, while the three-in-one drive system will become the mainstream.
In 2020, China shipped more than 500,000 sets of three-in-one electric drive systems for passenger cars, or around 37% of the total motor controller shipments. Companies including Bosch, BYD, Inovance Technology and Jing-Jin Electric have rolled out their three-in-one electric drive systems. One example is Huawei DriveONE three-in-one electric drive system which boasts peak power density of 3kW/kg, the highest in the industry.

Comparison of Three-in-one Electric Drive Systems of Main Manufacturers

Manufacturer	Bosch	Magna	ZF	BYD	Inovance Technology	Jing-Jin Electric	Huawei
Product	eAxle	eDS	Electric Axle Drive	180Kw Platform	Class A Three-in-one Powertrain System	JJE-EDM3000F Three-in-one	DriveONE Three-in-one Electric Drive System
Peak power range (kW)	50-300	140	90	180	130kW@320V	160	150-270
Peak torque range (Nm)	1000-6000	3700	2500	330	2315-2900	3000	3000-3900
Maximum rotating speed (rpm)	16000	18000	21000	14000	1450	16000	-
Total weight (kg)	90 (150kW)	100	45	92	-	95	≤88(270kW)
Peak power density (kW/kg)	1.67	1.4	2	1.9	1.37	1.68	3

Source: ResearchInChina

Through the lens of market share, the three-in-one system is still an oligopolistic market. In 2020, Tesla, BYD, XPT and NIDEC took a combined 82.1% of the total sales. Yet as Dongfeng SERES SF5 equipped with Huawei three-in-one system goes into mass production in 2021, the competition in the three-in-one electric drive system market will be more intense.

Abstract

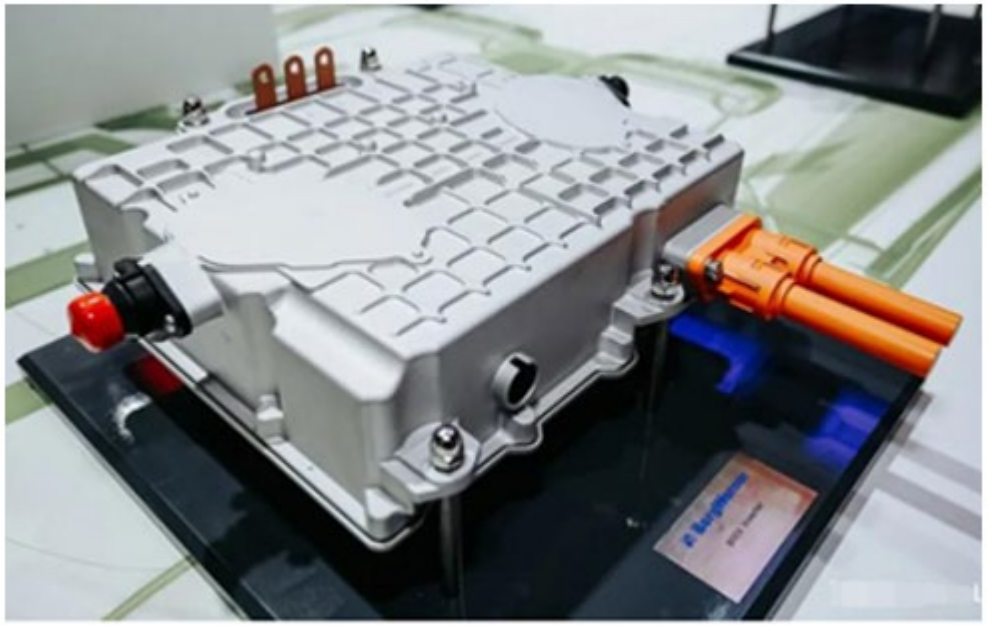
4) Power modules head in high voltage, and silicon carbide becomes a mainstream material.

New energy vehicles now use 400V electrical voltage systems. 80% SOC for a battery takes about 30 minutes, but the use of an 800V voltage system will cut the time down to 10 minutes. The need for fast charge makes high voltage power modules an inevitable trend.

Manufacturers like Hitachi Astemo, BorgWarner, Vitesco, Inovance Technology and ZF currently have introduced their 800V inverter/electric drive system products to meet fast charge needs, and all use silicon carbide (SiC) material except for Hitachi Astemo.

In BorgWarner's case, its SiC inverter mass-produced in 2019 is the first 800V inverter using SiC power switch. The double-sided cooling structure makes the inverter 40% lighter and 30% smaller, improves its power density by 25%, and allows the inverter to perform better in thermal conductivity, high temperature stability and efficiency for shortening the charging time and extending the range.

BorgWarner 800V SiC Inverter



Abstract

Electric Controller Upstream Market

1) Automotive IGBT market—local companies gear up to scramble

IGBT module which plays a crucial role in new energy vehicles makes up roughly 45% of the cost of electric vehicle motor controller.

Current local companies such as BYD Semiconductor, StarPower Semiconductor and CRRC Times Electric already work hard on new energy vehicle IGBT development, and race to expand their capacity to rival their foreign peers.

China's automotive IGBT market is dominated by international vendors like Infineon, Mitsubishi Electric, Semikron and Denso, among which Infineon shares over half the market, up to 58.2% in 2019. BYD Semiconductor, StarPower Semiconductor and CRRC Times Electric were however on the list of the top ten automotive IGBT vendors in 2019, especially BYD Semiconductor which became the runner-up with market share of 18%, far higher than the third-ranking Mitsubishi Electric which occupied just 5.2%.

Automotive IGBT Capacity Expansion Plans of Major Chinese IGBT Vendors

	Technology	Partners	New Energy Vehicle IGBT Capacity Expansion Plan
StarPower Semiconductor	IGBT 6	Changjiang Automobile, JAC, etc.	In February 2020, StarPower Semiconductor listed its shares successfully. After production, its fundraising project, the new energy vehicle IGBT module capacity expansion project will produce up to 1.2 million units a year.
BYD Semiconductor	IGBT 5	Self-supply	In March 2020, BYD IGBT project was kicked off in Changsha. With a capacity of 250,000 8-inch wafers, the project can meet the needs of 500,000 new energy vehicles a year as it becomes operational.
CRRC Times Electric	IGBT 6	Dongfeng Motor, FAW, GAC, Changan Auto, etc.	In September 2020, China's first 8-inch automotive IGBT production line came into operation, with annual capacity of 240,000 units (mainly low and medium voltage products for new energy vehicles).

Source: ResearchInChina

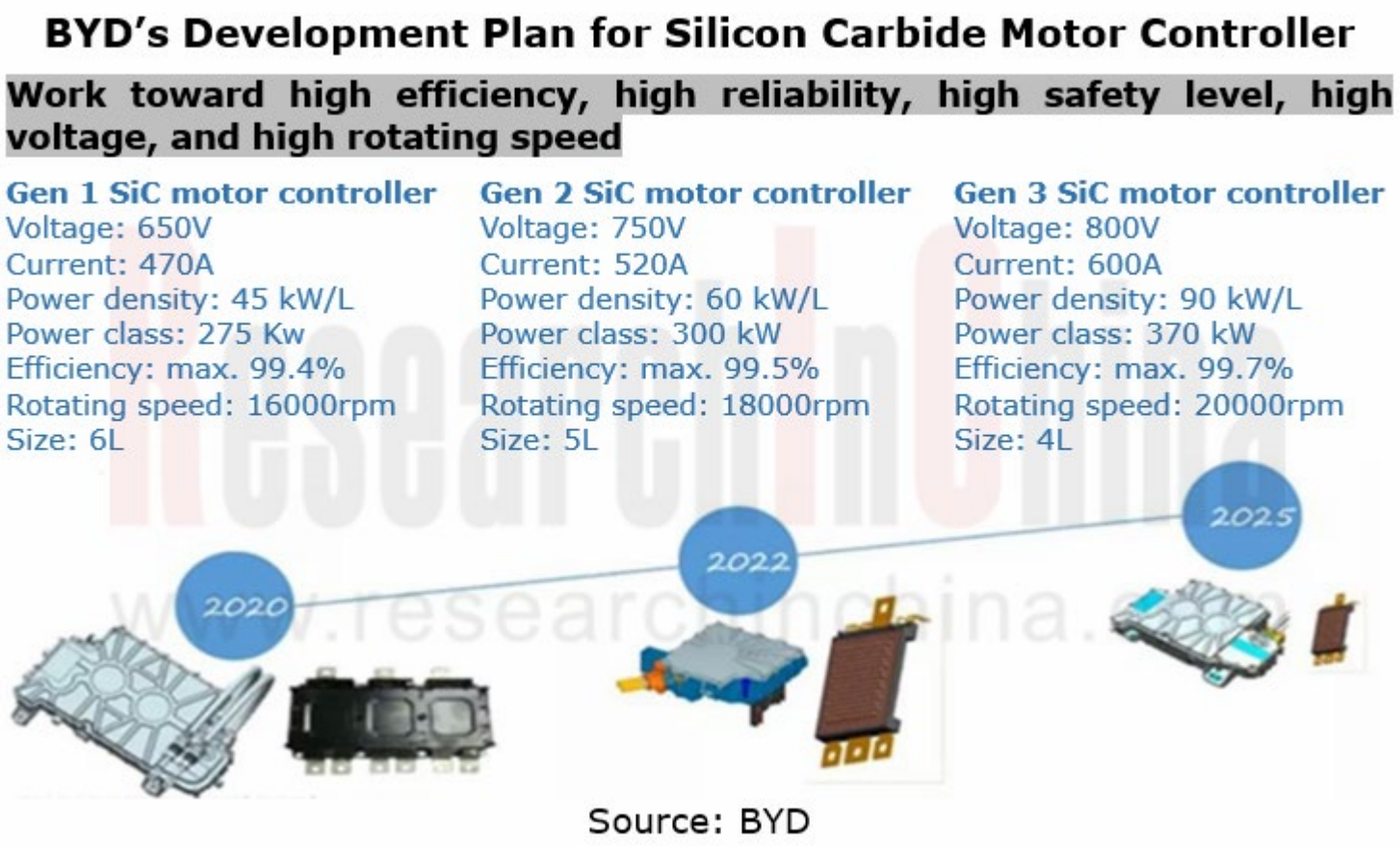
Abstract

2) Silicon carbide power devices are expected to be an alternative to IGBT, a key component of motor controller.

Globally, there is a belief that silicon carbide is the next-generation semiconductor material.

Compared with Si-based IGBT power devices, silicon carbide (SiC) power devices feature lighter weight, smaller size, higher power density, longer range, lower controller loss, better thermal conductivity, and stronger high temperature resistance. Motor controllers using SiC power devices are an effective way for new energy vehicles to improve range, power mass density, and electric energy conversion efficiency. So SiC power devices are expected to replace IGBT as a key component of motor controller.

Manufacturers such as Delphi and BYD have set about making deployments in SiC motor controller. BYD indicated that from 2020 to 2025, its SiC motor controllers will have three iterations, with applicable voltage platforms up to 800V, power density up to 90kW/L, efficiency up to 99.7%, and rotating speed up to 20,000 rpm.



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