

Automotive Digital Power Supply and Chip Industry Report, 2024

Sept. 2024

Research on automotive digital power supply: looking at the digital evolution of automotive power supply from the power supply side, power distribution side, and power consumption side

This report focuses on automotive digital power supplies and chips, including:

- Power supply side, OBC, DC-DC, 12V & 48V lithium/sodium battery solutions and their digitalization;
- Power Distribution side, high-voltage distribution, low-voltage distribution solutions and their digitalization;
- Power consumption side, power solutions and digitalization for vehicle control, autonomous driving, intelligent cockpit, suspension, Brake-by-Wire, chassis, etc.;
- Digital power supply (power supply, power distribution, power consumption) digital solutions for OEM and Tier1s.







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At present, lead-acid batteries are the most widely used in the start-stop field, accounting for about 90%. However, lead-acid batteries are not the best choice for starting batteries in the future. With the development of vehicle electrification and intelligence, and the addition of a wide variety of sensors and chips, the original electrical architecture is increasingly weak, and applications such as 12V & 48V lithium/sodium batteries and low-voltage start-up battery BMS are accelerating.

Lithium iron battery (LFP) is configured as four single cells in series (4s1p), plus a battery management system (BMS) to form a typical 12V low-voltage battery network, which can support single monitoring and semiconductor battery main switch. BYD has fully switched from lead-acid batteries to lithium iron batteries. The new Tesla Model S Plaid, the new Model X, and the domestic Model Y performance version also use 12V lithium batteries.

In addition to lithium iron batteries that have been applied in large quantities, 12V sodium electricity has also entered the early stage of industrialization. On August 14, 2024, Beijing New Energy Automobile issued an invitation tenders announcement on "12V sodium electricity (sodium vanadium phosphate) new technology development service project selection".



Leading battery manufacturers such as CATL, BYD, EVE Energy, Wanxiang A123 System, and Zhuhai Battery have all expanded their product lines in the field of 12V/48V start-up batteries, and gradually expanded lines to redundant integrated systems and low-voltage power systems. From perspective CosMX Battery's vehicle power solution:





12V lithium battery solution

In 2023, Zhuhai CosMX Battery's lowvoltage lithium battery products have begun to be shipped in batches. 12V LFP startstop battery can reach 8000 times, much higher than lead-acid batteries, which can ensure that the battery does not need to be replaced during the life cycle of the car. The company has accelerated its overseas expansion in low-voltage start-stop business, and has successively obtained designation of many well-known OEMs such as Jaguar Land Rover (2025 SOP), Stellantis (2026 SOP), GM (2025 SOP), and IM (IM LS7 12V lithium battery, 2023 SOP).

48V lithium battery solution

The Cybertruck is located in the middle of the front cabin. The 48V power supply position of the Cybertruck is fixed to the vehicle by two bolts, and the torque of the bolts is 8Nm. From the disassembly point of view, Zhuhai CosMX is Tesla's 48V lithium battery supplier.





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Zhuhai CosMX Battery's dual-voltage integrated products basically expand the system architecture on the 12V system, retaining the original 12V system, adding a DC/DC conversion device and a 48V independent system. The entire system is very large. The 12V/48V dual-voltage system developed by Zhuhai CosMX Battery uses a battery pack to meet the 12V system function and 48V system function, and integrates DC/DC converter together. The integrated products can achieve 12V and 48V under the premise of fuel saving and consumption reduction. The cost is relatively low, the weight is relatively light, and the advantages are obvious.

Dual Voltage Redundant Power Solution of Zhuhai CosMX Battery - MODACS Multiple Output Dynamically Adjustable Capacity System (MODACS) COSMX 冠宇



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Power supply side: DC/DC, OBC and other vehicle power modules are developing towards integration, efficiency and digitalization to achieve cost reduction and efficiency increase



Development trend of BYD multi-in-one assembly

Source: ResearchInChina



Under this evolving trend, major Tier1 and Tier2 chip vendors have launched highly integrated solutions.

VMAX: Committed to becoming a world-class electric vehicle power domain overall solution provider, it has obtained the fixed points of many well-known enterprises at home and abroad such as SAIC Group, Great Wall Motors, and Sany Heavy Machinery, and has realized the mass production and shipment of motor controllers, electric drive three-in-one assembly products and "power + electric drive" all-in-one assembly products.

SemiDrive Technology: In February 2023, SemiDrive cooperated with Kotei to create a domestic power domain solution based on E3 "Control Core". The solution will also cover the all-in-one design of the power system in the future, and deeply integrate high-voltage electrical accessories such as DC/DC, OBC, and PDU.

ST: Introduced a new generation of high-performance MCU products based on Arm architecture - the Stellar family, including three categories of Stellar E, Stellar G and Stellar P. Includes a 22kW OBC-DC/DC 2-in-1 solution based on Stellar E, a Stellar G-based ZCU, and a new all-in-one Stellar P-based powertrain domain controller at Munich Shanghai Electronics Show in 2023.

ST aims to achieve "replacing the respective MCUs in multiple ECUs with a single Stellar P-series MCU, realizing the centralization of computing power, and users can develop and maintain products with only one software toolchain."

Stellar P-series MCUs support up to 6 Cortex ? R52 + cores, provide more than 10K DMIPS computing power, and support OBC, DC/DC, inverter, BMU and VCU function integration. The highly integrated form allows the entire controller size to be further reduced, the degree of integration will be higher, and the system BOM cost can be further optimized.



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Based on Stellar E's 22KW OBC with 3KW DC-DC combo system two-in-one solution, compatible with 3.3KW & 6.6KW & 11KW on the market, its Stellar-E1 is a dual-core MCU with 300MHz computing power, rich peripherals, the biggest advantage is that the chip has security functions, no need to be designed with a security chip, in line with the security function requirements of ISO26262 ASIL-D, and also has OTA functions.

22KW OBC with 3KW DC-DC combo system based on Stellar E

Target Spec 22KW OBC spec **3phase AC input charging** Parameter 304Vac~456Vac, **Input Voltage** @380V,50Hz 450-900V DC **Output voltage** →450-900V @800V battery Output power →22kW 36A max @800V DC bus voltage 650-900V DC Switching frequency, 50kHz/200kHz PFC/CLLC

3KW DCDC spec

Parameter	Value
Input Voltage	450-900V DC@800V
Output voltage	9-16V @14V
Output power	3kW
Power stage frequency	100kHz

Source: ST Semiconductor



In the vehicle power system, the DC/DC converter traditional generally has problems such as low conversion efficiency and large size. It can achieve small size and high performance of DC/DC by using advanced technology controllers. Digital power solution provider "Wuhan Leishi Tech" Senmu has launched a self-developed PPEC (programmable power electronic controller) digital power control chip.

PPEC-based Vehicle DC/DC Converter



Source: Senmu Leishi



Power consumption side: safety power solutions for autonomous driving HPC, intelligent cockpit HPC, ECU, etc

The technological progress of SoCs in automotive intelligent cockpits puts forward higher requirements for computing power, main frequency and dynamic response speed. At the same time, the power consumption of the whole board continues to increase. and the power conversion efficiency needs to be higher to save energy; the dynamic response speed is faster, and the functional safety level requirements of power modules continue to increase (generally ASIL-B or above). These factors all bring various challenges to the design of automotive power supplies.

Lierda and ST Launch ADAS Power Solution for Intelligent Driving

The core components of this solution include large computing power chip, ST's PMIC power chip, DCDC chip, LDO chip and ST's SPC series MCU. The power management chip solution can ensure that the ADAS domain controller can still provide stable and reliable power supply in the face of high current power consumption.







The reference design mainly covers SemiDrive Technology's smart cockpit SoC * 1 "X9M" and "X9E" products, which are equipped with ROHM's PMIC * 2, SerDes IC * 3 and LED drivers.

In addition to the SerDes IC used in the "X9H" reference board. ROHM further provided "BD96801Q12-C" SoC PMIC and "BD9SA01F80-C" buck converter IC for driving the SoC, as well as "BD39031MUF-C" generalpurpose PMIC for ADAS that supplies power to the SerDes IC. This solution supports operation of up to three display projections and four ADAS cameras (Surroundview camera).



Source: ROHM



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