

OEMs gradually realize independent supply amid the competitive landscape of VCUs for new energy passenger cars

The VCU is the "brain" of new energy vehicles. In the early development stage of China's new energy vehicle industry, VCUs were mainly supplied by foreign vendors. Afterwards, domestic automakers and automotive electronics suppliers have gradually mastered core technologies, so that their industrialization capabilities were greatly improved.

For example, BYD has fully realized independent supply of VCUs, Geely has continuously increased the proportion of self-produced VCUs to about 60%, almost 80% of Changan Automobile's VCUs are produced by itself, and Chery can produce more than 90% of its own VCUs.

### VCU of Changan Automobile



Source: Changan Automobile



The VCUs of some OEMs or some models are purchased from third-party suppliers like UAES, Bosch, Continental, Denso, G-Pulse Electronics Technology, Atech, Hefei Softec Auto Electronic, Hangsheng Electronics, etc. Suppliers can provide their own software and hardware directly to OEMs, or they can be the foundries of OEMs.

The VCU market size is related to the output of new energy vehicles. By 2025, China new energy vehicle VCU market size will hit RMB5.03 billion (including self-supply of automakers).





# Lightweight promotes the development of "electric drive + electric control + VCU" integrated system

In order to cater to the development trend of electrified, intelligent and lightweight vehicles, VCUs will tend to be highly integrated in the future. OEMs and Tier 1 suppliers have launched "all-in-one" electric drive systems, containing VCUs.

To further reduce the weight of new energy vehicles, improve product performance and ride comfort, BAIC started to try highly integrated products, followed by GM, Huawei, BYD, etc.. "Electric drive + electronic control + VCU" integrated systems have become the focus of OEMs and Tier 1 suppliers.





In September 2021, FinDreams Powertrain under BYD launched the "eight-in-one" electric powertrain, which deeply integrates drive motor, motor controller, reducer, automotive charger, DC converter, power distribution box, VCU, and battery manager.

One of the main purposes of BYD's "eight-in-one" integrated system is to reduce the weight of electric vehicles. It can realize the sharing of external high-voltage filters, external interface filter circuits and high-voltage sampling, as well as the in-depth integration of system DC, OBC, power distribution, transformers, inductors and VCU/BMC/MCU chips, so that an H-Bridge, transformers and a lot of high-voltage wiring harness are unnecessary, the magnetic module size is reduced by 40%, the overall volume is cut down by 16% (which can expand the riding space or increase the battery capacity), and the weight is slashed by 10% (which can further reduce power consumption).





In July 2021, Changan Automobile released the secondgeneration electric drive integrated system, which combines seven components: VCU, high-voltage junction box, motor controller, DC converter, charger, motor, and reducer. Compared with the first-generation "three-in-one" (integrated motor, electronic control, and reducer) system, the second generation has been significantly improved in comprehensive performance, with the size reduced by 5%, the weight reduced by 10%, the power density increased by 37%, and the efficiency improved by 5%.

Changan Automobile expects to mass-produce nextgeneration super integrated electric drive in the second quarter of 2022, and which will be first deployed on C385, the first strategic model of the dedicated electric platform (EAP1).

#### Next-generation Super Electric Drive System of Changan Automobile





#### Under the new EEA, VCU develops towards domain control integration

From the perspective of evolution process, automotive E/E architecture (EEA) will inevitably develop towards centralized EEA. From the perspective of mass-produced models, domain-centralized EEA prevail now. The quasi-central architecture consisting of the central computing platform + zonal controllers will be the next step for automakers who finally evolve towards the central computing architecture concentrating the functional logic to a central controller.

With the evolution of the vehicle's EEA, the "all-in-one" electric drive system will eventually be integrated into the domain control system. For example, Huawei's "seven-in-one" DriveONE electric drive system has the most eye-catching domain control solution. The integration of modules, systems, scenarios and solutions effectively improves the system security.

#### (1) VCUs are integrated into domain controllers

(2)

For the development of vehicle EEA, the VCUs of the domain control architecture can be integrated into domain controllers. For example, ENOVATE integrates VCU and BMS to form the first-generation power domain controller VBU with completely independent research and development.

Hardware: The VBU uses Infineon's tri-core processor, has rich I/O resources, and supports Fast Ethernet;

**Software:** AUTOSAR architecture. The software architecture and interface protocol comply with AUTOSAR 4.2.2;

Application: At present, the VBU has integrated vehicle control, battery management, charging control, and extended range control.



Huawei's CC architecture includes 3 central controllers (smart cockpit, vehicle control, and smart driving) and 4 zonal controllers. Among them, the vehicle domain control (VDC) integrates the original VCU, adopts VOS system, and is compatible with AutoSar.

On the VDC platform, Huawei will develop an MCU and a vehicle control operating system which will be open to automakers, allowing automakers to perform differentiated vehicle control based on the VDC platform.



Huawei integrates VCU functions into VDC under CC architecture

Source: ResearchInChina



report@researchinchina.com

In April 2021, BYD released the e-platform 3.0, which gradually integrates dozens of ECUs in the vehicle into domain controllers of intelligent domain, power intelligent vehicle control domain, intelligent cockpit domain and intelligent driving domain; wherein, intelligent power domain integrates the control part of VCU, BMS, Inverter, PDU, DC/DC and AC/DC.





#### (2) VCUs are integrated into central computing unit

Under the central computing architecture, the central gateway degenerates into multiple zonal gateways, and VCU functions will be integrated into the vehicle control unit of the central computing unit.

For example, Volvo's hybrid central architecture includes a central computing platform, an intelligent interconnection module (IHU), and an autonomous driving module (ADPM) to integrate the original domain controllers into a central computing platform.



#### Source: Volvo

**ResearchInChina's New Energy Vehicle VCU Industry Report, 2021** mainly studies the following contents:

- Industry overview, market size, competitive landscape, etc. of VCUs for new energy vehicles;
- Industry chain, status quo of upstream and downstream of VCUs for new energy vehicles;
- The impact of the EEA reform on VCUs for new energy vehicles, the development trend of VCU technology, etc.;
- VCU solutions of some OEMs (such as BYD, ENOVATE, Changan, etc.);
- VCU solutions of major domestic and foreign suppliers.



#### 1. VCU Market

1.1 Automotive ECU/DCU Controller Industry 1.1.1 Overview (1) 1.1.2 Overview (2) 1.1.3 Market Size (1) 1.1.4 Market Size (2) 1.1.5 Market Opportunities for ECU/DCU Controllers under New EEA 1.1.6 VCU Integration under New EEA (1) 1.1.7 VCU Integration under New EEA (2) 1.2 VCU for New Energy Vehicles 1.2.1 Overview 1.2.2 Development of VCU (1) 1.2.3 Development of VCU (2) 1.2.4 Structure of VCU (1) 1.2.5 Structure of VCU (2) 1.2.6 Basic Functions of VCU (1) 1.2.7 Basic Functions of VCU (2) 1.3 New Energy Vehicle VCU Market Size 1.3.1 China New Energy Vehicle VCU Market Size 1.4 New Energy Vehicle VCU Market Pattern 1.4.1 Global New Energy Vehicle VCU Market Pattern 1.4.2 China New Energy Vehicle VCU Market Pattern 1.4.3 Major VCU Suppliers for New Energy Passenger Cars in China 1.4.4 Competitive Landscape of VCU Companies for New Energy Passenger Cars in China

2. VCU Industry Chain

2.1 VCU Industry Chain2.1.1 VCU Upstream and Downstream Industries

2.1.2 Main VCU Parts and Materials 2.2 The Upstream Core Component MCU in Short Supply 2.2.1 Definition of MCU 2.2.2 Application of MCU in Cars 2.2.3 Shortage of Automotive MCU 2.2.4 Out-of-stock Situation of Major Suppliers 2.2.5 Domestic MCU Market is Occupied by Foreign Vendors 2.2.6 Domestic Vendors Actively Deploy MCU Segments 2.2.7 R&D Layout of Major Domestic Chip Suppliers in Automotive MCU 2.3 Midstream of Industry Chain: VCU Design and Development 2.3.1 Basic Software Architecture of VCU 2.3.2 Software Functions of VCU 2.3.3 VCU Hardware Design 2.3.4 VCU Functional Safety 2.3.5 VCU Functional Safety Architecture Design (1) 2.3.6 VCU Functional Safety Architecture Design (2) 2.3.7 VCU Power Circuit Design 2.3.8 VCU PCB Design 2.3.9 VCU Strategic Development 2.3.10 Core Work of VCU Development 2.3.11 VCU Hardware Development 2.3.12 VCU Software Development 2.4 Downstream New Energy Vehicle Industry 2.4.1 Development of New Energy is a Global Common Goal 2.4.2 Number of Electric Vehicles in Major Countries/Regions in the World 2.4.3 Global New Energy Vehicle Sales Ranking, 2021 2.4.4 Status Quo of China's New Energy Vehicle Industry 2.4.5 China's New Energy Vehicle Output and Sales Volume

ResearchInChina

report@researchinchina.com

3. VCU Technology Trend 3.1 Impact of EEA Reform on VCU 3.1.1 Centralization of Controllers under Centralized EEA 3.1.2 VCU Reform under Organizational Agility (1) 3.1.3 VCU Reform under Organizational Agility (2) 3.1.4 Hybrid Architecture Promotes the Development of Vehicles Control Domain 3.2 From VCU Integration to Electric Drive System 3.2.1 Integration Trend of All-in-one Electric Drive System 3.2.2 Comparison of Main All-in-one Electric Drive Products 3.2.3 Huawei's "Seven-in-One" Electric Drive 3.2.4 All-in-one Integrated Controller of HY-BRIDER TECH (1) 3.2.5 All-in-one Integrated Controller of HY-BRIDER TECH (2) 3.2.6 BYD's "Eight-in-one" Electric Drive (1) 3.2.7 BYD's "Eight-in-one" Electric Drive (2) 3.2.8 Leapmotor's Electric Drive Assembly Heracles 3.2.9 Geely's Electric Drive System 3.3 VCU is Integrated in Domain Controller 3.3.1 Domain Controllers are More and More Widely Used 3.3.2 EEA Evolution Promotes Development of Domain Controllers 3.3.3 Location of VCU in EEA 3.3.4 VCU is Gradually Integrated in Domain Controller 3.3.5 VCU Tends to be Integrated in Vehicles Control Domain 3.3.6 VCU Integrated Solution under Domain Control Architecture: Huawei VDC 3.3.7 VCU Integrated Solution under Domain Control Architecture: EVPT VBU 3.3.8 VCU Integrated Solution under Domain Control Architecture: ECOTRON AVCU 3.3.9 VCU Integrated Solution under Domain Control Architecture: ENOVATE VBU 3.3.10 VCU Integrated Solution under Domain Control Architecture: Neta Power **Domain Controller** 

3.4 Main Technical Direction of VCU under the Trend of Vehicles Control Domain

- 3.4.1 Requirements of Intelligent Connectivity on MCU
- 3.4.2 The Backbone Network Uses Ethernet Communication
- 3.4.3 CAN FD Technology Improves Communication Speed
- 3.4.4 Dual Core Control Architecture
- 3.4.5 VCU Should Support OTA
- 3.4.6 VCU for Autonomous Driving

#### 4. VCU Solutions of OEMs

- 4.1 VCU Structure of Major Automakers (1) 4.2 VCU Structure of Major Automakers (2) 4.3 Layout of OEMs in the VCU Field 4.4 Changan Automobile 4.4.1 VCU 4.4.2 VCU Integration 4.5 BYD 4.5.1 Integrated Body Controller 4.5.2 Eight-in-one Controller 4.6 ENOVATE 4.6.1 VBU 4.6.2 VBU Architecture Design 4.6.3 VBU System Architecture 4.6.4 VBU Software Integration 4.6.5 VBU System Function Integration 4.7 Skywell
- 4.7.1 Overview of VCU SVCU
- 4.7.2 Advantages of VCU SVCU



4.8 Others 4.8.1 VCU Solution of Tesla 4.8.2 Vehicles Control System of GAC NE 5. VCU Solutions of Tier 1 Suppliers 5.1 NXP 5.1.1 VCU Products 5.1.2 VCU and BMS Integrated Solution (1) 5.1.3 VCU and BMS Integrated Solution (2) 5.1.4 VCU Customers and Cases 5.2 Continental 5.2.1 VCU (1) 5.2.2 VCU (2) 5.2.3 General VCU for Commercial Vehicles 5.2.4 Vehicles Control System 5.3 Bosch 5.3.1 VCU (1) 5.3.2 VCU (2) 5.3.3 VCU (3) 5.3.4 Cross-domain VCU 5.4 ST 5.4.1 VCU (1) 5.4.2 VCU (2) 5.4.3 Performance of L9788 for VCU 5.4.4 IDH VCU Development Solution (1) 5.4.5 IDH VCU Development Solution (2) 5.4.6 VCU+BMC Two-in-one Solution 5.5 Ecotron 5.5.1 Profile

5.5.2 VCU for Battery-electric Vehicles (1) 5.5.3 VCU for Battery-electric Vehicles (2) 5.5.4 VCU for Hybrid Vehicles (1) 5.5.5 VCU for Hybrid Vehicles (2) **5.6 UAES** 5.6.1 VCU Integrated Solution 5.6.2 Major VCU Customers 5.7 G-Pulse Electronics Technology 5.7.1 Profile 5.7.2 VCU 5.8 Neusoft Reach 5.8.1 Custom Control Unit 5.8.2 EV Power Domain Control Solution 5.8.3 Thermal Management Solution 5.8.4 Big Data Intelligent Application Solution 5.8.5 Vehicles Domain Control Based on SOA Development 5.9 Jingwei Hirain 5.9.1 VCU 5.9.2 VCU Parameters 5.9.3 VCU for Commercial Vehicles 5.10 Hangsheng Electronics 5.10.1 Product Layout 5.10.2 VCU 5.11 Huahai Technologies 5.11.1 VCU Development Solution 5.11.2 Controller Models for VCU 5.12 Wuhan LinControl Automotive Electronics 5.12.1 VCU Business 5.12.2 VCU Products



5.13 ECOTRON 5.13.1 Profile 5.13.2 VCU HCU for Hybrid Vehicles (1) 5.13.3 VCU HCU for Hybrid Vehicles (2) 5.13.4 VCU for Battery-electric Vehicles (1) 5.13.5 VCU for Battery-electric Vehicles (2) 5.13.6 Two-in-one Controller VBCU (1) 5.13.7 Two-in-one Controller VBCU (2) 5.13.8 Intelligent Vehicles Controller VACU (1) 5.13.9 Intelligent Vehicles Controller VACU (2) 5.14 EVPT 5.14.1 Profile 5.14.2 VCU 2000 5.14.3 VCU 3000 (1) 5.14.4 VCU 3000 (2) 5.15 EON 5.15.1 VCU Development Platform (1) 5.15.2 VCU Development Platform (2) 5.15.3 VCU Development Platform (3) 5.15.4 VCU HiL Simulation Test System 5.15.5 VCU End-of-line (EoL) Test System 5.15.6 VCU Development Case 5.16 Tsinghua University Suzhou Automotive Research Institute 5.16.1 VCU (1) 5.16.2 VCU (2) 5.17 Future Mobility Technology 5.17.1 Profile 5.17.2 VCU 5.17.3 Second-generation VCU



5.19.1 Infineon's VCU for new energy vehicle & HCU Solution

5.19.2 KUS VCU

5.19.3 VCU of Hefei Softec Auto Electronic





## **Beijing Headquarters** TEL: 13718845418 FAX: 010-82601570 Email: report@researchinchina.com

Website: www.researchinchina.com

WeChat: zuosiqiche



## Chengdu Branch

TEL: 028-68738514 FAX: 028-86930659



