



**ResearchInChina**  
www.researchinchina.com

June 2021

**Automotive Microcontroller Unit  
(MCU) Industry Report, 2021**

**Automotive MCU Research: Chinese vendors pursue replacement of foreign peers in the context of “shortage of chips”.**

***Concentrated capacity and repeated outbreaks of the COVID-19 make it hard to relieve the shortage of MCUs at once.***

MCU, a core chip for vehicle control, finds application in body control, driving control, infotainment and driving assistance. MCU is a mature market featuring a stable pattern. NXP, Infineon, Renesas, STMicroelectronics and Texas Instruments have long been the top five players in the global automotive MCU market where CR7 (hold by international giants) reached over 95% in 2020.

Automotive MCUs with multiple specifications are often produced with 40/45/65nm process, and the operating cost of production lines remains high. So most integrated device manufacturers (IDM) like NXP, Renesas, Infineon, Texas Instruments and Microchip Technology adopt the foundry strategy. Automotive MCU foundry is a highly concentrated industry. Globally, 70% of automotive MCUs are produced by TSMC. Yet MCU capacity makes up a mere 3% of TSMC’s total capacity.

As the pandemic in 2020 led to a slump in the demand from automotive industry, MCU vendors reduced their orders and digested their inventory. In 2021, the recovery of global automotive industry has caused a short-term short supply of automotive chips that need a long time to supply.

Since 2021Q2, Malaysia and Taiwan have underwent a much severer COVID-19 outbreak. Taiwan-based TSMC is a major MCU fab; Malaysia is home to OSAT companies of vendors such as NXP, Renesas and Infineon. As a result, automotive MCU industry may be hit hard again, taking a bigger toll on chip supply.

**Short Supply in Chip Industry**

Time	2020Q4			2021Q1		
	Normal Shipment	Moderate Shortage	Severe Shortage	Normal Shipment	Moderate Shortage	Severe Shortage
Automotive			v			v
Wireless Communication			v			v
Wired Communication	v					v
Computer Operation		v				v
Consumer Electronics		v				v
Overall		v				v

Source: Industrial Technology Research Institute (ITRI)

At present, most vehicle and component production suspensions are a result of the shortage of MCUs which are largely demanded by automakers. It is predicted that the lack of chips will last across 2021 but may be eased from 2022 for the following reasons.

- Suppliers and fabs race to expand their capacity. For example, Infineon will construct and put into use a new 12-inch fab in late 2021; in 2021, TSMC will produce MCUs 60% more than in 2020, and concentrate on the expansion of its Nanjing plant (28nm) for larger MCU capacity.
- Chinese companies are working to make deployments in MCU. They are expected to start mass production in 2022 to replace foreign products and mitigate the short supply of chips. An example is GigaDevice which plans to spawn its latest automotive MCU products in 2021.

In the long run, as vehicles tend to be intelligent, connected and electrified, the shortage of chips will become normal. The basic solution to the supply safety in China's intelligent connected vehicle industry chain is to build an independent chip industry chain.

## ***The short supply of chips will bring the window of opportunity to Chinese MCU industry***

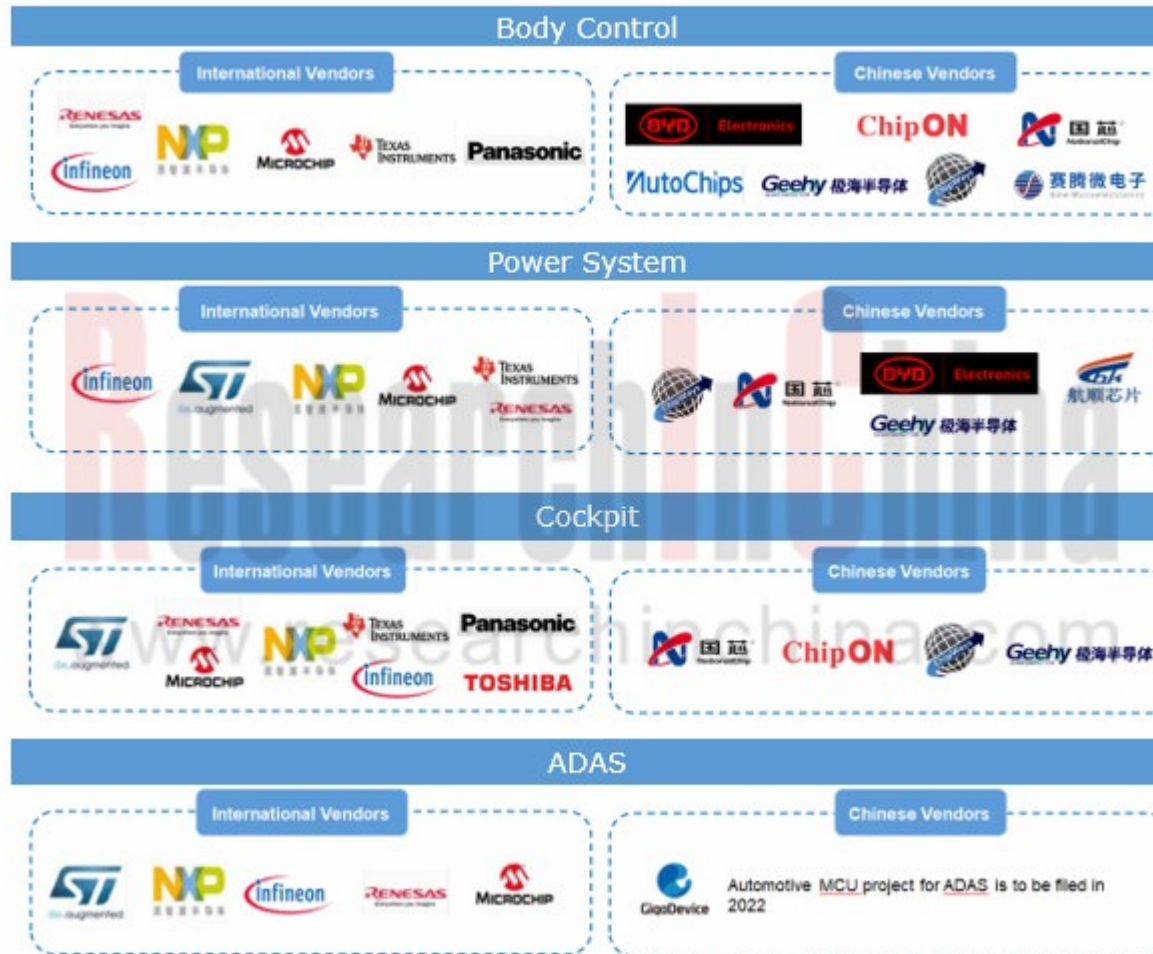
Through the lens of supply chain, MCU ecosystem covers a lot including a variety of software, hardware, development tools, and open source platforms used by end customers. China currently still depends heavily on foreign software and tools.

International manufacturers are in dire need of MCUs amid the short supply of chips. Automakers have begun to add purchase channels and candidate suppliers, which brings the window of opportunity to Chinese MCU vendors.

In China, few companies such as AutoChips, ChipON, Sine Microelectronics, Chipways, BYD and NationalChip can produce MCUs in quantities, among which BYD, Sine Microelectronics, ChipON and AutoChips can support OEMs, but their products are still used for controlling simple functions like windows, lighting and cooling system and rarely seen in power control, intelligent cockpit and ADAS, among other complex applications.



## Competitive Pattern of MCU Vendors by Segment (Part)



Source: ResearchInChina

MCU is a platform-based product. With abundant product lines, overseas vendors provide full range of products for customers. At present, Chinese vendors are working to deploying MCU product lines of all series.

## Automotive MCU Layout and R&D Directions of Vendors in China (Part)

Vendor	Automotive MCU Business
AutoChips	It is a subsidiary of NavInfo. In December 2018, it introduced AC781X Series (32-bit MCU), its first vehicle body control MCU; it is developing China's first functional safety standard-compliant MCU and plans to launch it in 2021H2.
Chipsea	In January 2021, CSA37F62-LQFP48 high-performance signal chain MCUs, Chipsea's first automotive electronics project passed AEC-Q100 certification.
GigaDevice	The latest automotive MCU will start tape-out from June to July 2021, and go into mass production at the end of the year.
SinoWealth	Entering the automotive electronics field in 2019, it is still in the phase of R&D investment mainly in body control MCU. It has chip expertise for air conditioner control, inverter control, motor control and lithium battery management.
Zhixin Semiconductor	In April 2020, it completed the design of its first automotive MCU test chip which has been produced by entrusted foundry.
Fengchi Gaoxin	It plans six-year continuous investment in three phases, breaking the international automotive semiconductor vendors' monopoly of high-performance automotive chips and filling in the gap in China. It will set up a MCU R&D lab for developing and designing automotive chips.
Yuntu Semiconductor	It has built its own integrated circuit design and verification platform, formulated development process and standards, self-developed chips, started automotive functional safety certification and applied for several related patents.

Source: ResearchInChina

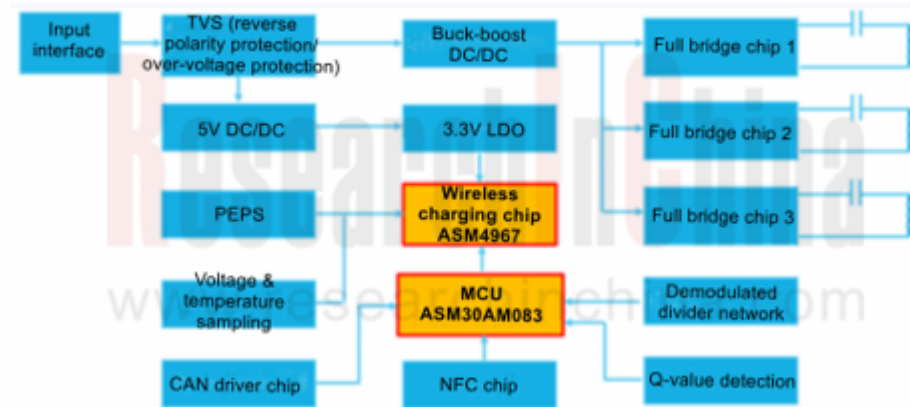
Chinese MCU vendors may make breakthroughs in the following two aspects:

**Body control:** MCU solutions for vehicle wireless charging, ambient light control and flowing water blinker rear light control, which were once available to high-class models, have now been largely used in low- and mid-class vehicles, and the demand will surge.

For example, Sine Microelectronics has rolled out MCUs for vehicle wireless charging and flowing water blinker rear light control, of which ASM87F0812T16CIT, a MCU master chip designed for vehicle LED flowing water blinker rear light has been shipped more than 1.5 million pieces as of January 2021.



## Architecture of Complete OEM Vehicle Wireless Charging Solution of Sine Microelectronics



Source: Sine Microelectronics

**Power control:** Chinese vendors have begun to introduce related products, but there are still no heavyweight products. Players that have products landed have more potential to replace foreign counterparts.

In May 2021, ChipON launched KF32A156, a new automotive MCU subject to AEC-Q100 standard and using kernel processor. KF32A156 is applicable to power supply, motor control and so on. With wider power domains than the previous products, the mass-produced MCU will be available to 70% body and power control unit modules compared with the previous 30%.

Building an independent industry chain is of vital importance in addition to improving layout of product lines. Coordinating the upstream and downstream resources of the industry chain from IP and chip design to foundry and OSAT helps to make homemade automotive MCUs safer, more stable and more reliable.

ResearchInChina's **Automotive Microcontroller Unit (MCU) Industry Report, 2021** highlights the following:

- ◆ Automotive MCU industry (favorable policies, market size, competitive pattern, industry chain, foundry, technology trends, etc.);
- ◆ China Automotive MCU industry (localization, industrial layout by domestic companies, and suggestions on how to accelerate replacement of foreign products);
- ◆ MCU vendors' supply relationships with automakers (body control MCU, power system MCU, intelligent cockpit MCU, ADAS MCU, etc.);
- ◆ Automotive-grade products of foreign and Chinese MCU vendors.

# Table of Content (1)

## 1 Overview of Automotive Semiconductor Industry

- 1.1 Status Quo of Automotive Semiconductor Industry
  - 1.1.1 Classification of Automotive Semiconductors
  - 1.1.2 First- and second-Class Classification of Automotive Semiconductors and Products
  - 1.1.3 Size and Structure of Global Automotive Semiconductor Market
  - 1.1.4 Competitive Pattern of Global Automotive Chip Companies
  - 1.1.5 Typical Companies in Automotive Chip Market Segments
  - 1.1.6 Application of Automotive Chips by Segment
  - 1.1.7 Automotive Semiconductor Production Modes
  - 1.1.8 Growth in Value of Automotive Chip in an Intelligent Connection Environment
- 1.2 Shortage of Automotive Chips and Its Impact
  - 1.2.1 Production Suspension of Fabs Leads to Shortage of Chips Worldwide
  - 1.2.2 Serious Shortage of 8-inch Wafers Hit Many Industries
  - 1.2.3 Shortage of Automotive MCU
  - 1.2.4 Out-of-stock Situation of Major Vendors
  - 1.2.5 Shortage of Automotive Chips
  - 1.2.6 Lack of Chips leads to Production Suspension of Some Auto Brands
  - 1.2.7 Short Supply Leads to Higher Price and Delays
  - 1.2.8 Lack of Chips Stimulates Countries to Establish Independent Chip Manufacturing Systems
  - 1.2.9 High Regional Concentration of the Industry Chain Makes it Hard to Alleviate Short Supply Shortly
  - 1.2.10 The COVID-19 Epidemic Affects OSAT, Aggravating the Shortage of Chips
  - 1.2.11 The Shortage of Chips will be Eased in 2022

## 2 Status Quo of Automotive MCU Market

- 2.1 Overview of MCU
  - 2.1.1 Definition of MCU
  - 2.1.2 Structure of MCU
  - 2.1.3 Core of MCU

- 2.1.4 Classification of MCU
- 2.1.5 Application of MCU
- 2.1.6 Development History and Trends of MCU
- 2.1.7 Intelligent Iteration of MCU Products

- 2.2 Overview of Automotive MCU
  - 2.2.1 Application of MCU in Vehicles
  - 2.2.2 Value of MCU per Vehicle
  - 2.2.3 Number of Digits of Automotive MCU
  - 2.2.4 Barriers to Automotive MCU

- 2.3 Industry Policies
  - 2.3.1 Summary of Favorable Policies for MCU Industry
  - 2.3.2 China Established the Automotive Chip Innovation Alliance
  - 2.3.3 China's Chip Industry Lacks Policy Support

- 2.4 Market size
  - 2.4.1 Global Automotive MCU Market Size
  - 2.4.2 Passenger Car MCU Market Size in China

- 2.5 Competitive Pattern
  - 2.5.1 Pattern of Companies
  - 2.5.2 Competitive Pattern of Global MCU Market
  - 2.5.3 Competitive Pattern of China's MCU Market

- 2.6 Industry Chain
  - 2.6.1 Industry Chain Map
  - 2.6.2 Low Market Share of Automotive MCU in China
  - 2.6.3 Deployments of Chinese Companies in MCU Industry Chain
  - 2.6.4 Chinese Companies Focus on Wafer Fabrication and OSAT
  - 2.6.5 China's Weak Links in MCU Industry Chain



# Table of Content (2)

## 2.7 Status Quo of MCU Foundry

2.7.1 Number of Production Bases of Major Foundry Companies

2.7.2 Competitive Pattern in Foundry Field

2.7.3 Foundry Capacity is Too Concentrated

2.7.4 Capacity Expansion Plans of Major Fabs

2.7.5 TSMC Expands Capacity to Cope With Shortage of Chips

2.8 Development Trends of MCU Technology

2.8.1 32-bit MCU Tends to be the Mainstream (1)

2.8.2 32-bit MCU Tends to be the Mainstream (2)

2.8.3 Multi-core MCU Holds the Trend

2.8.4 System-on-chip (SoC) (Master Chip) becomes a Competitive Edge of Next-generation Vehicles (1)

2.8.5 System-on-chip (SoC) (Master Chip) becomes a Competitive Edge of Next-generation Vehicles (2)

2.8.6 Heterogeneous Fusion of Different "MCU + SoC" Chips

## 3 Localization of Automotive MCU in China

### 3.1 Localization Process

3.1.1 China is Heavily Dependent on Imported Chips

3.1.2 The Window of Opportunity for Replacing Foreign MCUs Comes

3.1.3 Challenges in Localization

3.1.4 Degree of Localization in MCU Segments

### 3.2 Deployments of Related Companies in MCU Field

3.2.1 Automotive MCU Product Line Layout of International Vendors

3.2.2 Comparison of Mass-produced Automotive MCU Products in China (1)

3.2.3 Comparison of Mass-produced Automotive MCU Products in China (2)

3.2.4 R&D Layout of Major Chinese Chip Vendors in Automotive MCU

3.2.5 Chinese OEMs' Layout of MCU—Self-development

3.2.6 Chinese OEMs' Layout of MCU—Investment/Cooperation

3.2.7 Deployments of Technology Companies in MCU Field

3.3 Suggestions on Accelerating Replacement of Foreign Products

3.3.1 Improve Weak Links of Chinese MCU

3.3.2 Establish an Independent Industry Chain

3.3.3 Seize the New Track of System-on-chip (SoC) (Master Chip)

## 4 MCU Supply Relationships with OEMs

4.1 Major Vendors and Their Supply Relationships in Body Control MCU (1)

4.2 Major Vendors and Their Supply Relationships in Body Control MCU (2)

4.3 Major Vendors and Their Supply Relationships in Power System MCU (1)

4.4 Major Vendors and Their Supply Relationships in Power System MCU (2)

4.5 Major Vendors and Their Supply Relationships in Intelligent Cockpit MCU (1)

4.6 Major Vendors and Their Supply Relationships in Intelligent Cockpit MCU (2)

4.7 Major Vendors and Their Supply Relationships in ADAS MCU

4.8 MCU Supply Relationships with OEMs: Audi Q7

4.9 MCU Supply Relationships with OEMs: Honda Accord

4.10 MCU Supply Relationships with OEMs: Tesla

## 5 Foreign Automotive MCU Vendors

### 5.1 Renesas

5.1.1 MCU Business

5.1.2 RL78 Product Line

5.1.3 RL78/F1x Series MCUs

5.1.4 RH850 Product Line

5.1.5 Features of RH850

5.1.6 RH850/F1Kx Series MCUs

5.1.7 RH850/V1R Series MCUs

5.1.8 R-Car Automotive System-on-Chip

5.1.9 Decline in Capacity Utilization

5.1.10 Capacity is Tight, Inventory is Declining



# Table of Content (3)

- 5.2 NXP
    - 5.2.1 MCU Business
    - 5.2.2 S32K Series MCUs
    - 5.2.3 KEA Series MCUs
    - 5.2.4 Launched Supported MCUs
    - 5.2.5 Production Bases
    - 5.2.6 Serious Shortage of Chips Leads to the Increase in Prices of All Product Lines
  - 5.3 Infineon
    - 5.3.1 Layout of Full Range of Automotive Electronics
    - 5.3.2 A Leading Position in MCU Industry
    - 5.3.3 Automotive MCU Business
    - 5.3.4 Acquisition of Cypress to Add MCU Product Lines
    - 5.3.5 Cypress Traveo? II Series MCUs
    - 5.3.6 Application of Cypress Traveo? II Series MCUs
    - 5.3.7 Cypress PSoC Series MCUs
    - 5.3.8 Architecture of AURIX? TC 2 Series
    - 5.3.9 Architecture of AURIX? TC 3 Series
    - 5.3.10 Trends of AURIX? TC Series MCU Technology
    - 5.3.11 Production Bases
  - 5.4 TI
    - 5.4.1 MCU Business
    - 5.4.2 Arm?-based SimpleLink?
    - 5.4.3 C2000? Real-time MCU
    - 5.4.4 Jacinto? 7 MCU Integrated Processor
    - 5.4.5 Advantages of Jacinto 7 MCU Integration
    - 5.4.6 Production Bases
  - 5.5 Microchip Technology
    - 5.5.1 MCU Business
    - 5.5.2 PIC24 MCU and dsPIC? Digital Signal Controller
    - 5.5.3 32-bit PIC? and SAM Microcontrollers
    - 5.5.4 SAMDA1 Series Automotive MCUs
    - 5.5.5 SAMV7x Series Automotive MCUs
  - 5.6 ST
    - 5.6.1 Automotive MCU Business
    - 5.6.2 ST8 Series Automotive MCUs
    - 5.6.3 SPC5 Series MCUs
    - 5.6.4 Application of SPC5 Series MCUs
    - 5.6.5 Ecosystem of SPC5 Series MCUs
    - 5.6.6 Stellar MCU
    - 5.6.7 Launched New MCU Products
    - 5.6.8 Development Route of Automotive MCU
    - 5.6.9 Development Route of Automotive MCU
    - 5.6.10 Automotive MCU Ecological Partners
    - 5.6.11 Production Bases
- ## 6 Chinese Automotive MCU Vendors
- 6.1 ChipON
    - 6.1.1 Automotive MCU Business
    - 6.1.2 Exploration in Automotive MCU Field
    - 6.1.3 KF8A Series MCUs
    - 6.1.4 KF32A Series MCUs
    - 6.1.5 Innovations of 32-bit Automotive MCU
    - 6.1.6 Product Roadmap of 32-bit Automotive MCU
    - 6.1.7 Introduced New MCUs
    - 6.1.8 Self-developed KungFu kernel
    - 6.1.9 Application Scenarios
    - 6.1.10 Application
    - 6.1.11 Other Application Solutions
    - 6.1.12 Major Customers

# Table of Content (4)

## 6.2 BYD Semiconductor

- 6.2.1 MCU Business
- 6.2.2 Main Automotive MCU Products
- 6.2.3 MCU Development Plan
- 6.2.4 Production and Application

## 6.3 AutoChips

- 6.3.1 MCU Business
- 6.3.2 AC781x Series Automotive MCUs
- 6.3.3 AC7801x Series Automotive MCUs

## 6.4 NationalChip

- 6.4.1 MCU Business
- 6.4.2 Automotive Electronics Platform

## 6.5 Sine Microelectronics

- 6.5.1 MCU Business
- 6.5.2 Automotive MCU Product Lines
- 6.5.3 New-generation Complete OEM Wireless Charging Solution
- 6.5.4 Application—Power Window

## 6.6 Hangshun Chip

- 6.6.1 MCU Business
- 6.6.2 Automotive MCU Products

## 6.7 Chipways

- 6.7.1 Automotive MCU Business
- 6.7.2 Automotive MCU Product Lines

## 6.8 Geehy Semiconductor

- 6.8.1 MCU Business

## 6.8.2 Automotive MCU—APM32F103x4x6x8xB

- 6.8.3 Automotive MCU—APM32F072x8xB
- 6.8.4 Automotive MCU—APM32F030xC
- 6.8.5 Application

## 6.9 Allystar

- 6.9.1 MCU Products (1)
- 6.9.2 MCU Products (2)

## 6.10 GigaDevice

- 6.10.1 Business Layout
- 6.10.2 Deployments in Automotive MCU

## 6.11 Others

- 6.11.1 Automotive MCU of Chipsea
- 6.11.2 Automotive MCU of Huada Semiconductor
- 6.11.3 MCU Business of MindMotion Microelectronics



## Beijing Headquarters

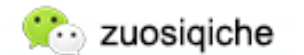
TEL: 010-82601561, 82863481

FAX: 010-82601570

Email: [report@researchinchina.com](mailto:report@researchinchina.com)

Website:  
[www.researchinchina.com](http://www.researchinchina.com)

WeChat: [zuosiqiche](https://www.wechat.com/p/zuosiqiche)



## Chengdu Branch

TEL: 028-68738514

FAX: 028-86930659