

Global and Chinese Automakers' Modular Platforms and Technology Planning Research Report, 2022

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Research on Automakers' Platforms and Their Planning: the Strategic Layout Directions of 32 Automakers

At present, global automotive industry is in the midst of profound changes unseen in a century. This can be intensively demonstrated through energy, power system, E/E architecture, intelligence and connectivity, application scenarios, user experience, and more. In this context, major automakers are changing their strategic layout. They work hard on key areas from automotive manufacturing platforms, E/E architecture and software platforms to autonomous driving, intelligent cockpit and electrification, and attract consumers and satisfy their needs with differentiated products.

Key Strategic Layout Directions of Automakers



	Volkswagen	GM
Modular Platform	 SOP: represented by MQB and MEB. The ID family models are all built on the MEB platform. Planning: the Scalable Systems Platform (SSP) will be launched in 2024, and all Volkswagen's brands and models including BEV and ICE models will be built on the SSP. 	 SOP: GM boasts two BEV platforms: BEV3 are Ultium. The Ultium platform has built a high localized business chain system in Chin Nearly 100 components are purchased fro suppliers in China. Planning: the VSS architecture will I launched in 2025, and all vehicle models w be built on this architecture which is all compatible with fuel-powered and new energy vehicles.
E/E Architecture	 SOP: MEB three-domain integrated architecture (vehicle control domain, intelligent driving domain and intelligent cockpit domain) Planning: domain centralized architecture 	 SOP: the Vehicle Intelligent Platform (VIP) th adopts a relative fusion solution enables O' updates on more than 30 vehicle module Using CAN-FD buses, it delivers a da processing rate 5 times higher than th previous generation.
Software Defined Vehicle	 SOP: the software division CARIAD created a unified and scalable software platform—E3. In April 2022, CARIAD established a subsidiary in China, which specializes in OTA updates for the ID. Family in the country; the self-developed operating system VW.OS has been installed on ID.3 Planning: the version E3 2.0 will be introduced in 2025 and applicable to models of all brands under Volkswagen. This platform will carry L3 automated driving; NW.OS 2.0 will be unveiled together with the SSP. 	 SOP: Ultifi, the self-developed end-to-e software platform built on Linux, enables O updates and in-car subscription services. Planning: Ultifi will be available to GM's fur powered and electric vehicles from 2023.
Autonomous Driving	 SOP: IQ.Drive (L2) configured with 5V3R Planning: L2++ solutions, including 6V5R1D, are autonomous driving solutions with Chinese characteristics; also, it is planned to achieve L3 in 2025, and LiDAR will be used possibly. 	 SOP: the configuration of Super Cruise (L2) LiDAR + radar + camera. Planning: Ultra Cruise will begin to be deploy in 2023 (still L2). It is based on Qualcon Snapdragon Ride computing architecture, a consists of two Snapdragon SA8540P SoCs a one SA9000P AI accelerator. Its configuration LiDAR + radar + camera.
Intelligent Cockpit	 SOP: MIB and CNS systems used to be applied. Currently, the intelligent connection system is applied, and has been iterated to 4.0, a version that adopts Samsung Exynos Auto V7/9 chip and has AR-HUD capability. 	 SOP: the new-generation Virtual Cock System (VCS) integrates hardwa configuration and interaction technology a packs a Qualcomm 8195 chip and dual-deg laser AR-HUD.
Electrification (Battery)	 SOP: create battery systems in a standardized, modular and simplified way; use a scalable battery pack structure to increase the cruising range to 550km. The battery cells are CATL'S NCM811, and the other components are produced and assembled by the company itself. Planning: use standard cells to cut down the production cost of battery cells by 50% in 2030, and 80% batteries use unified cells. 	 SOP: the Ultium platform adopts replaceat and upgradeable battery modules. Ti embedment of battery components in modules can reduce 80% the amount of wirin Over 7 battery pack solutions are availab The NCMA quaternary lithium battery Ultiu developed with LG Energy Solution is effective solution to lowering to manufacturing cost. Planning: the next-generation Ultium batter will use dry electrode technology
Electrification (Electric Drive)	 SOP: the ID.4 X built on the MEB platform adopts a high-voltage electric drive system, and falls into RWD and 4WD editions. The inverter is designed under the concept of multi-layer vertical combination, helping automatic 	 SOP: three motors have been designed providing 5 possible motor layouts; up to different combinations of batteries and dri units will be available in the future

Comparison of Modular Platforms and Technology Planning between Volkswagen and GM



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1. Automakers keep upgrading their modular platform architectures.

Modular platforms remain superior in increasing the universality of components and lowering R&D and production costs. At present, most automakers have their own modular platforms, or even multiple platforms. Modular architecture outperforms a modular platform. It is an extension and expansion of the platform concept. With higher universality of components and higher scalability, modular architecture is compatible with vehicles of differing classes and power types. Automakers therefore have started gradual transition from modular platform to modular architecture.

Modular architecture favors higher productivity, lower procurement/manufacturing costs, and shorter R&D cycles. In current stage, the generalization rate of components in GAC Global Platform Modular Architecture (GPMA) surpass 60%, compared with 70% in Geely Sustainable Experience Architecture (SEA) and 70%-80% in Toyota New Global Architecture (TNGA).

At present, automakers in China deploy modular architectures relatively early. Among them, BYD, Geely, Chery, and Changan Automobile have launched their own modular architectures. The modular architecture launches of foreign peers are concentrated in the period from 2024 to 2025.

Taking Volkswagen as an example, the company plans to eventually integrate its platforms into SSP, a scalable mechatronics platform architecture applicable to all Volkswagen's brands and models. In the future, all brands and models at all levels under Volkswagen will be built on this super platform.

Volkswagen's Modular Platform Architecture Planning





Modular Architecture Implementation Plans of Some Automakers

Automaker	Architecture	Launch Time	Overview
Volkswagen	Scalable Systems Platform (SSP)	2024	It is a new-generation high-performance scalable platform with fixed high-value modules such as E/E architecture, autonomous driving, battery system, and powertrain. Volkswagen plans to combine 8 modules as different platforms such as SSP1 and SSP2, for varying brands and products to achieve differentiation. In the future, all brands and models under Volkswagen will be built on this super platform.
вмw	Neue Klasse	2025	It is compatible with all models ranging from 2 Series sedans to X7, as well as FWD, RWD and 4WD vehicles, and those with different battery packs, wheelbases, etc.
Mercedes- Benz	Mercedes Modular Architecture (MMA)	2024	The MMA is a compact and medium-sized modular platform designed for electric vehicles. In the future it will be adjusted to support gasoline and diesel powertrains. The architecture is likely to be used in the next-generation Mercedes-Benz A- Class and further available to CLA sedans, GLA/GLB compact SUVs, and B-Class compact MPVs.
Hyundai	Integrated Modular Architecture (IMA)	2025	The IMA highlights modularization of electric drive system and power battery system. It distinguishes 2C platform from 2B platform, so that they can be adaptable to different models
GM	Vehicle Strategy Set (VSS)	2025	The VSS architecture is a scalable and highly flexible architecture that allows development of both traditional energy (gasoline/diesel) vehicles and new energy vehicles. In the future, models of all GM brands will be integrated into the four modular platforms under the VSS architecture.
Stellantis	STLA	2023	The STLA architecture is divided into four platforms by application to models of different sizes. All future Stellantis brand electric vehicles will be built on one of the STLA platforms.
		Source: Re	esearchInChina

Modular Architecture Implementation Plans of Some Automakers



Through the lens of E/E architecture planning, most automakers plan to deploy centralized vehicle E/E architectures:

GAC projects installation of the centralized E/E architecture "Protoss" in 2023 Aion high-end Hongqi plans launch of its quasi-central architecture FEEA3.0 in 2023;

Great Wall Motor plans to introduce its central computing architecture GEEP 5.0 in 2024;

Changan Automobile is expected to complete the development of its domain centralized architecture in 2025.

For example, GAC has upgraded its E/E architecture in all aspects and has developed the Protoss E/E Architecture, its new vehicle-cloud integrated E/E architecture that enables centralized computing and is about to come out in 2023 at the earliest. This architecture consists of three core computer groups, i.e., central computer, intelligent driving computer and infotainment computer, and four zonal controllers. The intelligent driving domain carries Huawei Ascend 610, a 400TOPS high-performance chip.



3. Automakers transform from independent software platform developers to software service providers

As autonomous driving and intelligent connectivity boom, large automakers have set off a new round of "software-defined vehicle"-centric transformation and upgrading. Some transform themselves to software service providers by way of establishing software divisions/subsidiaries, independently developing operating systems (OS), and building software platforms.

Compared with the turnkey model in which Tier-1 suppliers take full charge in conventional vehicle supply chain, auto brands now take more active part. Joint R&D and flat cooperation gradually blur the boundaries of the supply chain ecosystem, and also diversifies the needs for business models. Modular services thus need providing to meet the individual needs of auto brands with differentiated configurations for different vehicle models. For example, Bosch adopts hardware modularization + middleware layer generalization + software individualization model and adjusts parameters to quickly address the needs of different functions.





3. Automakers transform from independent software platform developers to software service providers

Volkswagen is a typical automaker that develops software on its own. In 2019, Volkswagen established a software division and planned to boost the in-house share of car software development from less than 10% to at least 60% in the five years to come. In 2021, Volkswagen changed the software division into CARIAD, a joint-stock company which will be responsible for independently developing the automotive operating system VW.OS and creating the software platform E3. In April 2022, CARIAD announced its China strategy. Its Chinese subsidiary was then established.

Volkswagen E3 Software Platform Development Roadmap

VOLKSWAGEN Our platforms E³ 1.1 and E³ 1.2 are technological front runners while E³ 2.0 will be the one platform in the Group starting 2025. E3 1.1 (e.g. ID.4) VOLUME E³ 1.2 Audi, Porsche PREMIUM E³ 2.0 SSP (e.g. Artemis) RIAD UNIFIED 2020 2021 2022 2023 2024 2025 2026

In addition to Volkswagen, GM, Toyota, Mercedes-Benz, Hyundai, SAIC and the like have also begun to self-develop operating systems and deploy their own software platforms, aiming to transform from an automaker to a software service provider. Toyota, which recently acquired the automotive operating system provider Renovo Motors, plans to roll out its own operating system, Arene, in 2025.

Toyota Arene Automotive Operating System





4. L3 automated driving of OEMs comes into service.

The mainstream automakers deploy autonomous driving in the following ways: Investing in acquiring autonomous driving startups Partnering with big tech firms

- Cooperating with other OEMs
- Self-developing, or combining the above ways

On this basis, these automakers have also introduced their own autonomous driving assistance systems, including Volkswagen IQ.Drive, Toyota Advanced Drive, Mercedes-Benz Drive Pilot, Geely G-Pilot, and GAC ADiGO. Among them, Mercedes-Benz is the world's first automotive company to meet the United Nations regulation UN-R157. Mercedes-Benz marketed its L3 automated driving system Drive Pilot in Germany in May 2022, and announced that it will be responsible for accidents caused by the system when activated.

Sensor configuration of Mercedes-Benz Drive Pilot:

1 LiDAR;

- 1 long-range radar;
- 4 short-range radars;
- 1 stereo camera;
- 1 rear view camera;
- 1 in-vehicle driver monitoring camera
- 1 differential GPS

Sensor configuration of automated parking: 4 surround view cameras 12 ultrasonic sensors

Sensor Configuration of Mercedes-Benz Drive Pilot





5. Intelligent cockpit interconnection platforms connect vehicles, people and everything, playing a more important role.

As the Internet thrives, major automakers show much enthusiasm intelligent for cockpits. Almost all of them have rolled out different intelligent cockpit interconnection platforms as selling points, in a bid to attract consumers. Examples include BMW iDrive and Mercedes-Benz MBUX, BYD DiLink and Geely GKUI.

Automaker	Cockpit System	Overview
Volkswagen	Volkswagen Connect	The Volkswagen Connect system has developed to Version 4.0, delivering five capabilities: Intelligent Voice System, Intelligent Navigation (Based on Amap Data), Intelligent Entertainment System, Intelligent Car Control System and Smart Mobility. It uses Samsung Exynos Auto V7 /V9 chip.
BMW iDrive		The BMW cockpit domain controller Headunit, or MGU, runs on the LINUX system redeveloped by BMW, that is, GENIVI+LINUX. In 2021, following the launch of the ID8.0 system, BMW introduced the new-generation MGU, MGU21. BMW iDrive human-computer interaction system has iterated to Version 8.0.
Mercedes- Benz	MBUX	Mercedes-Benz currently uses the MBUX system as the vehicle center console system. The latest MBUX generation Hyperscreen released in 2021 will be first mounted on EQS, a model to be mass-produced in 2022.
Geely	ZEEKER OS	The ZEEKER OS intelligent cockpit can respond to the user's driving needs at any time. It features a four-screen interconnection system, AI MATE intelligent assistant, and face ID recognition technology. At present, it has been upgraded to Version 2.0, adding such functions as adaptive cruise control, AEB and forward collision mitigation.
Great Wall Motor	Coffee Intelligence GC-OS	Coffee Intelligence that combines intelligent driving and intelligent cockpit into one is first available to Great Wall WEY Mocha. In terms of intelligent cockpit, diversified mobile space, "terminal-cloud integrated" computing platform, and cross-system open architecture constitute the core of Coffee Intelligence. It enables people-vehicle-infrastructure-environment cooperation, and 720-degree perception (360 degrees inside and outside the car, respectively), and allows integration of the vehicle into a city using "terminal-cloud integrated" ultra-long-range perception technology.
GAC	GIEC	The GIEC intelligent cockpit integrates more than 100 technologies, and enables forward-looking applications like multi-screen integration and smart surfaces. GIEC allows a vehicle to perceive just as people do, for example, hearing, speaking and seeing, by building a set of in-vehicle hardware sensing system and using AI recognition technology. Using AR-HUD technology and combining road conditions, GIEC can also actively present virtual arrows in real time to intuitively guide the vehicle forward.
	ADIGO	The ADiGO (intelligent driving interconnection) ecosystem is composed of several key supporting systems, including: ADiGO Autonomous Driving System, ADiGO Intelligent IoT System, and upcoming subsystems such as ADiGO Cloud Platform and ADiGO Big Data Platform. ADiGO now has been upgraded to Version 5.0.

Intelligent Cockpit Layout of Major Automakers



Table of Content (1)

1 Summary of Automakers' Platforms and Technology Planning

- 1.1 Status Quo of Strategic Layout of Automakers
- 1.1.1 Comparison of Strategic Planning between Foreign Automakers (1)
- 1.1.2 Comparison of Strategic Planning between Foreign Automakers (2)
- 1.1.3 Comparison of Strategic Planning between Foreign Automakers (3)
- 1.1.4 Comparison of Strategic Planning between Chinese Automakers (1)
- 1.1.5 Comparison of Strategic Planning between Chinese Automakers (2)
- 1.1.6 Comparison of Strategic Planning between Chinese Automakers (3)
- 1.1.7 Comparison of Strategic Planning between Emerging Carmakers (1)
- 1.1.8 Comparison of Strategic Planning between Emerging Carmakers (2)
- 1.2 Modular Platform Layout of Automakers
- 1.2.1 Definition of Automotive Modular Platform
- 1.2.2 Comparison of Advantages and Disadvantages between Automotive Modular Platforms
- 1.2.3 Status Quo of Modular Platforms of Automakers
- 1.2.4 Modular Platform is Being Upgraded to Modular Architecture
- 1.2.5 Comparison of Modular Architectures between Automakers (1)
- 1.2.6 Comparison of Modular Architectures between Automakers (2)
- 1.2.7 Business Models Derived from Modular Platforms
- 1.2.8 Modular Platforms Evolve Towards Skateboard Chassis
- 1.3 E/E Architecture Layout of Automakers
- 1.3.1 E/E Architecture Layout of Traditional Automakers
- 1.3.2 E/E Architecture Layout of Emerging Carmakers
- 1.3.3 Comparison of E/E Architectures between Main OEMs (1)
- 1.3.4 Comparison of E/E Architectures between Main OEMs (2)
- 1.3.5 Comparison of E/E Architectures between Main OEMs (3)
- 1.3.6 Comparison of E/E Architectures between Main OEMs (4)
- 1.4 Software Platform Layout of Automakers
- 1.4.1 Automakers Self-develop OS Ecosystem

- 1.4.2 Software Platform Layout of Major Automakers
- 1.4.3 Software Layout of Major Automakers
- 1.5 Autonomous Driving Layout of Automakers
- 1.5.1 Status Quo of Autonomous Driving Layout of Automakers
- 1.5.2 Autonomous Driving Layout of Foreign Automakers
- 1.5.3 Autonomous Driving Layout of Chinese Automakers (1)
- 1.5.4 Autonomous Driving Layout of Chinese Automakers (2)
- 1.5.5 Comparison of Autonomous Driving Systems/Vehicle Model Hardware Configurations between Automakers (1)
- 1.5.6 Comparison of Autonomous Driving Systems/Vehicle Model Hardware Configurations between Automakers (2)
- 1.6 Intelligent Cockpit Layout of Automakers
- 1.6.1 Intelligent Cockpit Layout of Major Automakers (1)
- 1.6.2 Intelligent Cockpit Layout of Major Automakers (2)
- 1.6.3 Intelligent Cockpit Layout of Major Automakers (3)
- 1.7 Electrification Layout of Automakers
- 1.7.1 Electrification Layout of Major Automakers (1)
- 1.7.2 Electrification Layout of Major Automakers (2)

2 Modular Platforms and Technology Planning of Foreign Automakers

- 2.1 Volkswagen
- 2.1.1 Modular Platform: MQB Platform
- 2.1.1 Modular Platform: Advantages of MQB Platform
- 2.1.1 Modular Platform: MQB Platform Application Case Golf VII
- 2.1.1 Modular Platform: BEV Platform
- 2.1.1 Modular Platform: MEB Platform
- 2.1.1 Modular Platform: MEB Platform Application Case
- 2.1.1 Modular Platform: MEB Platform Development History & PPE Platform
- 2.1.1 Modular Platform: Other Modular Platforms



Table of Content (2)

- 2.1.1 Modular Platform: Planning of Modular Platform-based Vehicle Models
- 2.1.1 Modular Platform: SSP Architecture
- 2.1.2 E/E Architecture (EEA): Overall Planning
- 2.1.2 E/E Architecture (EEA): MEB Platform
- 2.1.3 Software Defined Vehicle (SDV): E3 Platform
- 2.1.3 Software Defined Vehicle (SDV): Partners
- 2.1.3 Software Defined Vehicle (SDV): VW.OS
- 2.1.4 Autonomous Driving: Overall Layout
- 2.1.4 Autonomous Driving: IQ.Drive Intelligent Driving Assistance System
- 2.1.4 Autonomous Driving: 6V5R1D, MEB-based Intelligent Driving Solution with Chinese Characteristics
- 2.1.4 Autonomous Driving: Two-Step Strategy
- 2.1.4 Autonomous Driving: Cooperation with Huawei
- 2.1.5 Intelligent Cockpit: All-New Intelligent Vehicle Connection System
- 2.1.6 Electrification Platform: Overall Strategic Planning
- 2.1.6 Electrification Platform: NEW AUTO Strategic Planning
- 2.1.6 Electrification Platform: Cells
- 2.1.6 Electrification Platform: Battery System
- 2.1.6 Electrification Platform: Charging System
- 2.1.6 Electrification Platform: High Voltage Electric Drive System
- 2.2 Toyota
- 2.2.1 Modular Platform: TNGA
- 2.2.1 Modular Platform: Key Features of TNGA
- 2.2.1 Modular Platform: Main TNGA-based Vehicle Models
- 2.2.1 Modular Platform: e-TNGA
- 2.2.1 Modular Platform: e-TNGA Platform Application Cases
- 2.2.2 E/E Architecture (EEA): Overall Planning
- 2.2.3 Software Defined Vehicle (SDV): Arene Operating System
- 2.2.4 Autonomous Driving: Development History

- 2.2.4 Autonomous Driving: Subsidiary Woven Planet
- 2.2.4 Autonomous Driving: Advanced Drive
- 2.2.5 Electrification Platform: Overall Strategic Planning
- 2.2.5 Electrification Platform: Battery Development Plan
- 2.2.5 Electrification Platform: Solid State Batteries
- 2.2.5 Electrification Platform: Battery Cost Reduction Strategy
- 2.2.5 Electrification Platform: Battery Strategy 2030
- 2.2.5 Electrification Platform: Battery Supply Chain Plan
- 2.3 Renault-Nissan Alliance
- 2.3.1 Renault-Nissan Modular Platform: CMF Platform
- 2.3.1 Renault-Nissan Modular Platform: CMF EV Platform
- 2.3.1 Renault-Nissan Modular Platform: CMF BEV Platform
- 2.3.2 Renault Electrification Platform: Overall Strategic Planning
- 2.3.2 Renault Electrification Platform: Battery Standardization and Modularization
- 2.3.2 Renault Electrification Platform: Battery Cost Reduction Path
- 2.3.2 Renault Electrification Platform: Battery Full Life Cycle
- 2.3.2 Renault Electrification Platform: Electric Drive "Three-Electric In One" Drives In-house Development
- 2.4 BMW
- 2.4.1 Modular Platform: UKL Platform
- 2.4.1 Modular Platform: CLAR Platform
- 2.4.1 Modular Platform: CLAR Platform Application Cases
- 2.4.1 Modular Platform: Neue Klasse Architecture
- 2.4.2 E/E Architecture (EEA): Overall Planning
- 2.4.3 Autonomous Driving: Overall Layout
- 2.4.3 Autonomous Driving: System Architecture
- 2.4.3 Autonomous Driving: L2+ Assistance System PRO
- 2.4.4 Intelligent Cockpit: Overall Layout
- 2.4.4 Intelligent Cockpit: MGU Head Unit



Table of Content (3)

2.4.4 Intelligent Cockpit: iDrive Human-Computer Interaction System	2.6.4 Electrification
2.4.5 Electrification Platform: FAAR and CLAR Architectures	2.6.4 Electrification
2.4.5 Electrification Platform: Vehicle Model Planning	2.6.4 Electrification
2.4.5 Electrification Platform: eDrive System	2.7 GM
2.4.5 Electrification Platform: Battery Technology	2.7.1 Modular Plat
2.5 Mercedes-Benz	2.7.1 Modular Plat
2.5.1 Modular Platform: BEV Platform	2.7.1 Modular Plat
2.5.1 Other Modular Platforms	2.7.1 Modular Plat
2.5.1 Modular Platform: MMA Architecture	2.7.1 Modular Plat
2.5.2 E/E Architecture (EEA): STAR 3	2.7.1 Modular Plat
2.5.3 Software Defined Vehicle (SDV): MB.OS	2.7.1 Modular Plat
2.5.4 Autonomous Driving: Overall Planning	2.7.1 Modular Plat
2.5.4 Autonomous Driving: Drive Pilot	2.7.2 E/E Architect
2.5.5 Intelligent Cockpit: MBUX System	2.7.2 E/E Architect
2.5.6 Electrification Platform: Overall Strategy	2.7.3 Software Det
2.5.6 Electrification Platform: BEV Platform Architecture	2.7.3 Software Det
2.5.6 Electrification Platform: Power Batteries	2.7.4 Autonomous
2.5.6 Electrification Platform: Electric Drive System	2.7.4 Autonomous
2.5.6 Electrification Platform: Charging Technology	2.7.4 Autonomous
2.6 Hyundai	2.7.4 Autonomous
2.6.1 Modular Platform: E-GMP Platform	2.7.4 Autonomous
2.6.1 Modular Platform: E-GMP Platform Application Cases	2.7.4 Autonomous
2.6.1 Modular Platform: i-GMP Platform	2.7.4 Autonomous
2.6.1 Modular Platform: IMA Architecture	2.7.5 Intelligent Co
2.6.1 Modular Platform: IMA Architecture - Standardized Batteries	2.7.6 Electrification
2.6.1 Modular Platform: IMA Architecture - Battery and Electric Drive System	2.7.6 Electrification
2.6.2 Autonomous Driving: Overall Strategic Planning	2.8 Stellantis
2.6.3 Software Defined Vehicle (SDV): ccOS	2.8.1 Modular Plat
2.6.3 Software Defined Vehicle (SDV): Software Services Strategy	2.8.1 Modular Plat



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Table of Content(4)

2.8.1 Modular Platform: STLA Architecture 2.8.2 E/E Architecture (EEA): STLA Brain Architecture 2.8.3 Software Defined Vehicle (SDV): Five Business Directions 2.8.3 Software Defined Vehicle (SDV): Technology Partners 2.8.4 Electrification Platform: Overall Layout 2.8.4 Electrification Platform: Strategy 2030 2.8.4 Electrification Platform: Strategy 2030: Foundation 2.8.4 Electrification Platform: Strategy 2030: Foothold 2.8.4 Electrification Platform: Strategy 2030: Technology Strategy 2.9 Ford 2.9.1 E/E Architecture (EEA): Blue Oval Intelligence 2.9.2 Autonomous Driving: Overall Layout 2.9.2 Autonomous Driving: Development History 2.9.2 Autonomous Driving: Blue Cruise/Co-Pilot 360 2.9.3 Electrification Platform: Overall Strategy 2.9.3 Electrification Platform: Battery Solutions 2.9.3 Electrification Platform: Lower Battery Pack Cost 2.9.3 Electrification Platform: Modular EV Platform 2.9.3 Electrification Platform: European Electrification Strategy 2.9.4 Mobility Services: Ford Pro 2.9.4 Mobility Services: Ford Live 2.10 KIA 2.10.1 Electrification Platform: Strategy 2030 2.10.2 Electrification Platform: Vehicle Model Planning 2.10.2 Electrification Platform: Sales Planning 2.10.2 Electrification Platform: Battery Technology 2.10.2 Electrification Platform: Charging Facilities 2.10.3 Passenger Car Technology Strategy 2.10.3 Passenger Car Technology Strategy: Intelligent Connectivity 2.10.3 Passenger Car Technology Strategy: Autonomous Driving 2.10.4 Commercial Vehicle Technology Strategy 2.10.4 Commercial Vehicle Technology Strategy: Product Line Planning 2.10.4 Commercial Vehicle Technology Strategy: Variant PBV 2.10.4 Commercial Vehicle Technology Strategy: Dedicated PBV 2.10.4 Commercial Vehicle Technology Strategy: PBV Services 2.10.5 Flying Car Technology Strategy 2.11 Volvo 2.11.1 E/E Architecture (EEA): Overall Planning 2.11.1 E/E Architecture (EEA): Zonal Architecture 2.11.1 E/E Architecture (EEA): New E/E Architecture Planning 2.11.1 E/E Architecture (EEA): SPA2 E/E Architecture 2.11.2 Software Defined Vehicle (SDV): SOA Software for SPA2 E/E Architecture 2.11.2 Software Defined Vehicle (SDV): VolvoCars.OS 2.11.3 Autonomous Driving: L3 Ride Pilot 2.11.4 Electrification: 10-Year Mid-Term Plan

3 Modular Platforms and Technology Planning of Chinese Automakers

3.1 Geely

- 3.1.1 Smart Geely 2025 Strategy
- 3.1.2 "Nine Great Dragon Bay Actions"
- 3.1.2 "Nine Great Dragon Bay Actions": New Energy Products Planning
- 3.1.2 "Nine Great Dragon Bay Actions": To Launch A Battery Swap Mobility Brand
- 3.1.3 "4.2.3" Strategy for Commercial Vehicles
- 3.1.4 Modular Platform: Sustainable Experience Architecture (SEA)
- 3.1.4 Modular Platform: Key Features of SEA
- 3.1.4 Modular Platform: SEA Application Cases
- 3.1.4 Modular Platform: Compact Modular Architecture (CMA)
- 3.1.4 Modular Platform: CMA Supermatrix



Table of Content (5)



Table of Content(6)

3.5.4 E/E Architecture (EEA): CIIA 2.0 3.5.5 Autonomous Driving: Development History 3.5.5 Autonomous Driving: Development Planning 3.5.5 Autonomous Driving: APA Parking Route 3.5.6 Intelligent Cockpit: Overall Layout 3.5.6 Intelligent Cockpit: UIN-T Intelligent Cockpit Platform 3.5.7 Electrification Platform: EPA1 Electric Drive Platform: Overall Efficiency 3.5.7 Electrification Platform: EPA1 Electric Drive Platform: Electric Drive System 3.6 BYD 3.6.1 Modular Platform: e Platform 3.6.1 Modular Platform: e Platform 3.0 3.6.1 Modular Platform: BYD New Architecture (BNA) 3.6.2 E/E Architecture (EEA) 3.6.2 E/E Architecture (EEA): Integrated Body Controller 3.6.2 E/E Architecture (EEA): Summary of Solutions 3.6.3 Software Defined Vehicle (SDV): BYD OS 3.6.4 Autonomous Driving: Overall Layout 3.6.4 Autonomous Driving: DiPilot Intelligent Driving Assistance System 3.6.5 Intelligent Cockpit: Overall Architecture 3.6.5 Intelligent Cockpit: DiLink System 3.6.5 Intelligent Cockpit: Function Iteration of DiLink System 3.6.6 Electrification Platform: 8-in-1 Electric Drive Assembly 3.7 BAIC 3.7.1 Modular Platform: Beijing Modular Functional Architecture (BMFA) 3.7.1 Modular Platform: BE22 3.7.2 Intelligent Cockpit 3.7.3 Electrification: Three-Electric Technology 3.8 FAW 3.8.1 FAW Bestune Modular Platform: FAW Modular Architecture (FMA)

3.8.1 FAW Bestune Modular Platform: FMA Application Cases 3.8.2 FAW Hongqi E/E Architecture (EEA): E/E Architecture 3.8.2 FAW E/E Architecture (EEA): Summary of E/E Architecture Schemes 3.8.3 FAW Honggi Intelligent Cockpit: Layout of Core Intelligent Cockpit Businesses 3.8.3 FAW Honggi Intelligent Cockpit: Intelligent Cockpit Platform 3.8.3 FAW Honggi Intelligent Cockpit: HC3.0 Intelligent Cockpit 3.8.3 FAW Hongqi Intelligent Cockpit: Intelligent Cockpit Application Cases 3.8.3 FAW Hongqi Intelligent Cockpit: Smile Intelligent Cockpit 3.8.3 FAW Hongqi Intelligent Cockpit: Future Intelligent Cockpit Layout 3.8.4 FAW Honggi Autonomous Driving: Autonomous Driving Layout 3.9 SAIC 3.9.1 Modular Platform: Development History 3.9.1 Modular Platform: SAIC Intelligence Global Modular Architecture (SIGMA) 3.9.2 E/E Architecture (EEA) 3.9.3 "Galaxy" Full Stack Solution for Smart Cars 3.9.4 Software Defined Vehicle (SDV): Z-ONE's SOA 3.9.5 Autonomous Driving 3.9.6 Intelligent Cockpit: Development Planning 3.9.6 Intelligent Cockpit: R-TECH High Energy Intelligent Body 3.9.7 Electrification Platform: Electric Drive System Platform

3.9.7 Electrification Platform: All-in-one Electric Drive Assembly

4 Modular Platforms and Technology Planning of Emerging Carmakers

4.1 Tesla

- 4.1.1 E/E Architecture (EEA): Architecture Evolution
- 4.1.1 E/E Architecture (EEA): Model 3 EEA
- 4.1.1 E/E Architecture (EEA): Features of Model 3 EEA
- 4.1.1 E/E Architecture (EEA): Model X EEA



Table of Content(7)

4.1.1 E/E Architecture (EEA): Model S EEA 4.4.1 E/E Architecture (EEA): Iteration History 4.1.1 E/E Architecture (EEA): Summary of Architectural Schemes 4.4.1 E/E Architecture (EEA): Planning 4.1.2 Intelligent Cockpit: Hardware Iteration 4.4.1 E/E Architecture (EEA): Communication Support 4.4.1 E/E Architecture (EEA): Zonal Controllers 4.1.2 Intelligent Cockpit: MCU 4.1.3 Autonomous Driving: Technology Development Path 4.4.2 Software Defined Vehicle (SDV): Self-developed OS 4.1.3 Autonomous Driving: System Iteration 4.4.3 Autonomous Driving: Development Path 4.4.3 Autonomous Driving: AD Max Intelligent Driving System 4.1.4 Electrification Platform: Battery System 4.4.4 Intelligent Cockpit 4.2 Xpeng Motors 4.5 NETA Auto 4.2.1 Modular Platform 4.5.1 Automotive Products Planning 4.2.2 E/E Architecture (EEA): Overall Planning 4.5.2 Modular Platform: Shanhai Platform 4.2.2 E/E Architecture (EEA): EE1.0-EE3.0 Evolution 4.2.2 E/E Architecture (EEA): X-EEA 3.0 4.5.3 E/E Architecture (EEA) 4.2.2 E/E Architecture (EEA): Summary of Architecture Schemes 4.5.4 Autonomous Driving: TA PILOT Intelligent Driving System 4.5.4 Autonomous Driving: Core Configuration of TA PILOT 4.0 4.2.3 Software Defined Vehicle (SDV): Software Architecture Evolves Towards SOA 4.5.4 Autonomous Driving: Self-developed Full-stack Solutions Service 4.5.5 Intelligent Cockpit: PIOVT 2.0 4.2.4 Autonomous Driving: Technology Roadmap 4.5.5 Intelligent Cockpit: Cockpit Domain Controllers 4.2.4 Autonomous Driving: XPILOT Intelligent Driving Assistance System 4.2.4 Autonomous Driving: XPILOT Autonomous Driving Software Architecture 4.6 ENOVATE 4.2.4 Autonomous Driving: XPU2.5-XPU5.0 Domain Controller Hardware 4.6.1 Modular Platform: iMA Digital Architecture 4.6.2 E/E Architecture (EEA) Architecture Upgrade 4.6.2 E/E Architecture (EEA): Power Domain Control Products 4.2.5 Intelligent Cockpit: Xmart OS Evolution 4.2.5 Intelligent Cockpit: Xmart OS 2.0 4.6.2 E/E Architecture (EEA): Upgrade Route of Power Domain Control Products 4.3 NIO 4.3.1 NP BEV Platform 4.6.3 Intelligent Cockpit: 5+X Intelligent Cockpit 4.7 Weltmeister 4.3.2 E/E Architecture (EEA): Evolution History 4.3.3 Autonomous Driving: Evolution Path 4.7.1 Released the New Technology Strategy IdeaL4 4.7.2 Intelligent Cockpit: WMConnect Intelligent Digital Cockpit 4.3.3 Autonomous Driving: NIO Autonomous Driving (NAD) 4.7.3 Autonomous Driving: Realized the Implementation of L4 Autonomous 4.3.4 Intelligent Cockpit: ET7 Intelligent Cockpit 4.4 Li Auto Driving



Table of Content (8)

4.8 Leapmotor 4.8.1 R&D Strength 4.8.2 Modular Platform 4.8.3 Autonomous Driving: Leapmotor Pilot 4.8.4 Intelligent Cockpit: Leapmotor OS 4.8.5 Electrification Platform: Leapmotor Power 4.8.5 Electrification Platform: Battery Technology 4.8.5 Electrification Platform: Electric Drive System 4.9 Voyah 4.9.1 Modular Platform: Electric Smart Secure Architecture (ESSA) 4.9.2 E/E Architecture (EEA): SOA 4.9.3 Autonomous Driving 4.9.4 Intelligent Cockpit 4.9.5 Electrification: Battery System Technology 4.9.5 Electrification: Powertrain 4.9.5 Electrification: Powertrain - BEV Version 4.9.5 Electrification: Powertrain - EREV Version 4.9.6 Recent Dynamics 4.10 IM Motors 4.10.1 E/E Architecture (EEA): Overall Planning 4.10.2 Intelligent Cockpit 4.11 ARCFOX 4.11.1 Modular Platform: BE21 4.11.1 Modular Platform: IMC Intelligent Module Architecture 4.11.1 Modular Platform: IMC Architecture Application Cases 4.11.2 E/E Architecture (EEA) 4.11.3 Autonomous Driving Layout

4.12 Foxconn4.12.1 MIH Alliance4.12.2 MIH Platform4.12.3 Software Layout





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