

ADASandDrivingTierReport,2023Companies

Autonomous

Research Foreign

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1. Global Tier 1 suppliers boast complete ADAS/AD product matrix, and make continuous efforts to grab the Chinese market.

From the ADAS/AD product matrix, it can be seen that some Tier 1 leaders have almost complete product matrix.

For example, Continental's latest products include: cockpit monitoring system (CMS, OMS), configured with an OMS camera and a cockpit radar and expected to be released in 2024; HRL131, a 1550nm long-range LiDAR with a detection range of more than 300m, 128° HFOV, 28° VFOV, expected to be mass-produced in 2024; and CUS320, a ultrasonic radar with a detection range of 0.1m-6m, expected to be spawned in 2024.

Bosch has a full range of ADAS/AD products except CMS. Its latest products include: a 1550nm long-range LiDAR, physically displayed at the CES 2023, with a detection range of over 200m and power consumption of less than 20W; an in-cabin monitoring system (IMS, OMS), configured with an OMS camera installed above the center console screen or integrated with the interior rearview mirror, and expected to come into mass production in 2024.

Yet in terms of solutions, currently few global Tier 1 suppliers deploy driving-parking integrated solutions that are hot in China, mainly because it takes them a period of about 2 or 3 years to launch the solutions after they put forward. One example is Continental's Ambarella CV3-based L2+ solution which was announced in January 2021 but will not be production-ready until 2026.

To cope with the current passive position, global Tier 1 suppliers are also trying to seek changes. For example, Wave3, Bosch's driving-parking integrated solution, is being developed simultaneously by the XC Division in China and the headquarters in Germany, of which the Chinese solution adopts dual Orin SoCs and is scheduled to be mass-produced in 2023 at the earliest; in June 2023, ZF announced the merger of the divisions for passenger car chassis technology and active safety technology to reduce the internal friction between divisions when making decisions and shorten the time-to-market of products and solutions. In the future, ZF may build a corporate architecture where the active safety integrates all the vehicle businesses such as cockpit and chassis.



Comparison of ADASIAD Product Matrix between Global Tier 1 Suppliers

	Aptiv	Bosch	Continental	Denso	Hyundai Mobis	Magna	Valeo	Veoneer	ZF
Classification	Product Name/Model	Product Name/Model	Product Name/Model	Product Name/Model	Product Name/Model	Product Name/Model	Product Name/Model	Product Name/Model	Product Name/Model
Front view camera	IFV410	MPC3	MFC500	Vision Sensor, Compact Stereo Vision Sensor (Front View Stereo)	MFC	ADAS Gen5	Front Camera	MVS4, SVS4 (Front View Stereo)	Smart Camera 6, Smart Camera 4.8, Tri- Cam4 (Front View Triple)
Surround view system		MCS	SVC210	Surround Monitoring Camera	SVM	Eyeris	360VUE		Satellite Camera
Rear view camera		Near-range camera	RVS3XX		Rear-view Camera				
CMS			Mirror Replacement	Digital Outer Mirror ECU		CLEARVIEW	Sightstream		
DMS	Interior Sensing	IMS	DMS	Driver Status Monitor	DSM, DDREM	Driver Monitoring System		Veoneer DMS	
OMS	Interior Sensing	IMS	CMS		ICM, ROA	Driver Monitoring System			Interior Observation System
4D radar	FLR7, FLR4+	LRR5 Premium	ARS540			ICON			FRGen21
Front/rear radar	FLR4	LRR5	ARS510, ARS441	Front Radar Sensor	MA <mark>R320</mark> , USRR			77V125CRN 77V13CRN 77V12FLR	MRGen21
Corner radar	SRR7, SRR7+, SRR6, S <mark>RR6+</mark> , SRR6 HD	Corner radar	SRR600, SRR520	Corner Radar Sensor	MAR <mark>110,</mark> MAR120		Radar	77V12BSM 77V12CRN 77MMRV1 77MMR	
LiDAR		Bosch Long- range LiDAR	HFL110, HRL131, SRL121	LiDAR	Velodyne LiDAR	Solid State Lidar	LiDAR		ibeoNEXT
Ultrasonic radar	W	Ultrasonic sensor	CUS320	Sonar Sensor	USS-PDW, USS-PA	Ultrasonic Sensors	.com		
ECU								ADAS ECU	Electronic Control Units
Domain controller	Zone Controllers	DASy	Continental Domain Controller			Domain Controller	HV, HP, USV	ADAS CCU	ProAl
Cross- domain/central computing platform	Central Vehicle Controller	DASy	AD HPC						ProAl
Driving-parking integration	Gen 6 ADAS Platform, Driving- parking Integrated Core/Pro								coPILOT
Autonomous driving	Satellite Architecture, Front View Camera + Front Radar Fusion Solution	Bosch driving assist	Continental Driving Assistance, L2+ Solution	Global Safety Package 3	Smart Cruise Control (SCC)	Magna MAX4 Platform, Fisker ADAS	Drive4U	ASP1.0	coASSIST, coDRIVE
Automated parking		AVP, GPA, PA, HZPA, RPA	Parking Companion, Garage Parking, Trained Parking , AVP		Auto Valet Parking (AVP), Memory Parking Assist (MPA)	Magna Automated Parking	Park4U, Fusion Park4U, Park4U Remote, Park4U Home, Valet Park4U		AVP

Comparison of ADAS/AD Product Matrix between Global Tier 1 Suppliers



4D radars begin to find mass adoption, and global Tier 1 suppliers grab first-mover advantages

2. 4D radars begin to find mass adoption, and global Tier 1 suppliers grab first-mover advantages.

According to our data, from January to May 2023, the overall installations of 4D radars in new passenger cars in China were 65,500 units, of which 35,700 units were front view and rear view radars, and 29,800 units were corner radars. Models confirmed to pack 4D radars include Rising Auto R7, Li Auto L7 Pro and AITO M5.

Brand	Model	Reference Price (RMB)	Installations, JanMay 2023	Installation Location	Supplier	Product Model
276	2022	280,000-	1,049	Front (rear, optimal)	ZF	FRGen21
	Rising R7	390,000	4,19 <mark>6</mark>	Four comers	Hella	Undisclosed
▶ 理想	2023 Li L7 Pro	340,000	ean 16,438 ch	in a front	WHST	STA77-6
A I T O	2022 AITO M5	260,000- 332,000	25,596	Rear corners	Zongmu Technology	SDR1

Installations of 4D Radars in Some Models

Source: ResearchInChina



4D radars have passed through three development phases: infancy, growth and SOP.

Infancy: before 2022, foreign Tier 1 suppliers were the first to start upgrading from conventional 3D radar to 4D radar, for example, Continental went about developing ARS540 early in 2016.

Growth: during 2022-2024, Chinese suppliers set about deploying 4D radar products. For example, in 2022 Nova Electronics introduced 4D-S front radar and corner radar products, as well as a new 6-cascade product; Freetech released FVR40 in 2022.

SOP: beyond 2024, it is expected that 4D radars will begin to be spawned and mounted on vehicles.

Currently, 4D radars are still in the verification phase, and whether the installations will rise depends on the following:

- (1) Verify the cost performance of 4D radars (replacing ordinary radars) used in low-level driving assistance solutions (L2-L2+). Examples include Aptiv's satellite architecture-based sensing and computing system that supports L2 and L2+ with 5R5V12U.
- (2) Verify the feasibility of 4D radars replacing LiDAR in high-level intelligent driving solutions (L2.5-L2.9, that is, supporting ADAS in highway NOA and city NOA).

4D Radars of Some Suppliers

Company	Product Model	Lunch Time	Parameters
	FLR7	2022	Detection range: 290m; HFOV accuracy: 2°; VFOV accuracy: 4°
	FLR4+	2021	Detection range: 300m
	LRR5 Premium	Oct. 202 <mark>1</mark>	Detection range: 300m; angular accuracy 0.1°; angular resolution: 1°
Ontinental 3	ARS540	Sept. 2020	Detection range: 300m
HUAWEI	4D Radar	Apr. 2021	Detection range: 300m; HFOV accuracy: 1°; VFOV accuracy: 2°
い日気工	STA77-6	Oct. 2021	Detection range: 280m; HFOV accuracy: 2°; VFOV accuracy: 4°
Autoroad 🔕	ALRR300	Apr. 2023	Detection range: 300m; HFOV accuracy: 0.6°; VFOV accuracy: 0.8°



China's adjusted regulation allows CMS to be installed in vehicles, and the competition in the new market is fierce

3. China's adjusted regulation allows CMS to be installed in vehicles, and the competition in the new market is fierce.

On July 1, 2023, the GB 15084-2022 Motor Vehicles - Devices for Indirect Vision - Requirements of Performance and Installation came into effect, specifying that Class M/N motor vehicles are allowed to carry electronic rearview mirrors to replace conventional optical exterior rearview mirrors.

At present, a number of global Tier 1 suppliers, Chinese suppliers and automakers have already made layout of CMS products. Wherein, the global Tier 1 suppliers that have unveiled/mass-produced CMS products include Continental, Magna and Valeo; Chinese suppliers include Autocruis, Voyager Technology, Foryou Group and etc.

On the whole, global Tier 1 suppliers start CMS layout a little earlier than Chinese companies, due to early introduction of regulations.

From a technical point of view, the mainstream CMS solution currently adopted by global Tier 1 suppliers is 2 CMS cameras + 2 OLED displays, that is, replace the left and right rearview mirrors with 2 rearview CMS cameras (generally wide-angle cameras). Another solution of 3 CMS cameras + 2 OLED displays + streaming rearview camera/center console screen is adopted by relatively few companies, as it involves additional technologies such as image stitching/correction. A typical case is Magna CLEARVIEW that adopts the solution of 3 CMS cameras + streaming media rearview mirror tiled display. Noticeably, Magna also proposed a solution of 2 CMS cameras + 2 OLED displays in 2017, but the product Magna actually produces in quantities is still the current 3CMS solution.

Magna CLEARVIEW (Left) & Valeo Sightstream (Right)







Passenger	Car CN	IS Solutio	ns of Major	Suppliers	in China

Company	Product Name	Time	Features
@ntinental 3	Mirror Replacement	Released in Dec. 2019	CMS solution: 3 CMS cameras and 2 OLED displays, displaying the spliced images on the center console screen
Å MAGNA	CLEARVIEW	Released in Oct. 2020, and mass- produced in 2022	CMS solution: 3 CMS cameras and streaming media rearview mirror, splicing and displaying the images captured by the 3 CMS cameras
Valeo 法需與	Sightstream	Released in 2022	CMS solution: 2 exterior rearview mirrors to replace cameras, and 2 OLED displays
ADAYO 华阳集团	Passenger Car/Commercial Vehicle Exterior Electronic Rearview Mirrors	Expected SOP in 2023	CMS solution: 2 exterior rearview mirrors to replace cameras, and 7-inch AMOLED, having been designated by a Chinese independent auto brand and having yet to be designated by an emerging carmaker and the POC project of an overseas automaker
寅家科技	VTCMS	Exhibited at the Auto Shanghai 2023	Commercial vehicle and passenger car dual solution that features low wind resistance, supports driving in low visibility and at dark night, and fully observe the rear in the conditions of bad weathers, turning and passing through narrow spaces
AUTOCRUIS 自行科技	AUTOCRUIS		Mass-produced CMS solution: 2 exterior rearview mirrors to replace cameras (HFOV: 63.89, VFOV: 41.94), and 7-inch display (resolution: 1280*720)

Source: Above Companies



As decision products upgrade, a number of Tier 1 suppliers have launched crossdomain/central computing platforms

4. As decision products upgrade, a number of Tier 1 suppliers have launched crossdomain/central computing platforms.

As automotive architecture upgrades, the main control units of vehicle internal electronics have also evolved from hundreds of ECUs to several domain controllers. Next cross-domain computing platforms (e.g., cockpit-parking integrated domain controller and driving-parking integrated domain controller) will be used to meet the computing needs of vehicles. In the future, central computing platforms will be used to complete all the computing tasks and enable centralized E/E architecture.

In current stage, several global Tier 1 suppliers have released/iterated multi-domain/central computing platform solutions in 2022. In terms of time node, they are the next-generation alternative to domain controller products.

Passenger Car Domain Controllers and Central Computing Platform Solutions of Some Suppliers in China

Company	Product Name	Time	Features
• A P T I V	Custom Domain Controller: zFAS Intermediate Domain Controller: ASDM Advanced Domain Controller: OSPAS	2017 Jan. 2021	Customized domain controller zFAS for A8 in 2017, which packs EyeQ3 Launched a new domain controller in January 2021, and mass-produced it in 2022
	Cross-domain Computing + Multi-domain Controller Architecture	2022	Cross-domain computing platform + dual-, three-, or four-domain controller solution
Ontinental	ADCU	Iteration in 2021	The advanced ADCU chip uses 3 NVIDIA Xavier SoCs, with computing power of 90TOPS, coupled with NVIDIA DRIVE OS and DRIVE AV Software Stack
	AD HPC S C A	Iteration in 2022	Support L2-L4 autonomous driving and automated parking functions, and partner with Horizon Robotics and RECOGNI
Æ	Domain ECU	Iteration in Dec. 2021	By area of use, it can be designed as a decentralized device or as a part of the central control device, and has been supplied for several models of Dongfeng
	ProAl	Planned SOP in 2024	With computing power of 20-1000 TOPS, provide customized solutions according to the deployed configurations

Source: Above Companies



ZF ProAl

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The early solutions include ZF ProAI, which has gone through several iterations, with the computing power increased from 1-10 TOPS to the current 20-1500 TOPS. The latest version of ProAI, scheduled to start volume production in 2024, enables crossdomain computing, packs ZF's domain control middleware, and is optimized for deep learning. Aptiv, on the other hand, puts forward three solutions based on a cross-domain computing platform: a cross-domain computing platform + dual domain controllers, a cross-domain computing platform + three domain controllers, and a cross-domain computing platform + four domain controllers.

ZF ProAI



Source: ZF

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Iteration History of ZF ProAI

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Jpgrade: from Domain Controller to Central Computing Platform Jpgrade: from Automated Driving/Parking to Driving-parking Integration ction: Product Matrix Improvement + Product Iteration

In Autonomous Driving Tier 1 Suppliers

- titors/Main Customers
- Classification
- ion Products Front View Camera
- ion Products 4D Front Radar
- ion Products Corner Radar
- n Products Domain Controller/Central Computing Platform
- ns Driving-parking Integration
- ons Autonomous Driving
- omous Driving Layout
- ct/Market Planning
- ary
- Classification
- ion Products Front View Camera
- ion Products Surround View System
- ion Products 4D Front Radar
- ion Products Front Radar
- ion Products Corner Radar
- ion Products LiDAR



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