

Move with Intelligence, Navigate the Future

All About Auto

UNICORE COMMUNICATIONS, INC.

W Web: www.unicore.com

E Email: info@unicorecomm.com

Beijing, China

A Add: F3, No.7,
Fengxian East Road, Haidian, Beijing, 100094

T Tel: +86-10-69939800

F Fax: +86-10-69939888



Website



LinkedIn

Without prior written permission of Unicore Communications, Inc., any contents of this manual shall not be copied, disseminated, or stored in a retrievable system in any way. * We have made every effort to ensure the accuracy and completeness of the information contained in the manual up to the date of printing. If you find any errors or omissions, please contact us, for which we are very grateful. * Unicore reserves the right to change the product information in the manual at any time without prior notice. © Copyright 2009-2026 Unicore Communications, Inc. All rights reserved.



Automotive in Numbers

One notable advantage of GNSS satellite positioning, when compared to other sensors in assisted driving systems, lies in its capability to offer absolute positioning independent of external landmarks (such as road markings or surrounding infrastructure), without being affected by weather or lighting conditions.

According to Statista, the global automotive sensor market is projected to reach \$60 billion by 2030. Furthermore, the Advanced Driver Assistance Systems (ADAS) and Autonomous Driving Systems (ADS) sensor market is expected to grow significantly from \$13 billion in 2020 to \$43 billion in 2030.

It is forecast that the GNSS automotive market will reach 190 million units by 2030, accounting for 9.5% of the total GNSS market capacity.

\$60 billion

The global automotive sensor market is projected to reach \$60 billion by 2030.

\$43 billion

The automotive sensor market for Advanced Driver Assistance Systems (ADAS) and Autonomous Driving Systems (ADS) is expected to grow significantly, reaching \$43 billion by 2030.

190 million

It is forecast that the GNSS automotive market will reach 190 million units by 2030.

9.5%

The GNSS automotive market is projected to account for 9.5% of the total GNSS market capacity by 2030.

Our Advantages

Expertise in Automotive-Grade Product Delivery

With over a decade of experience in delivering automotive-grade products, we have cultivated a mature R&D framework, a robust supply chain, and expertise in mass-producing chips/modules. Recognized by leading clients, we deliver reliable product solutions.

Proven Adaptability in Diverse and Complex Application Scenarios

Building on numerous real-world experience in vehicle mass production, we consistently refine and enhance our positioning engine for various “corner cases”, such as improving the reconvergence time after exiting tunnels, enhancing the performance for uninterrupted driving under overpasses, and ensuring accurate navigation at intersections without lane markings. With more reliable and higher-precision absolute positioning, we enhance the overall capabilities of multi-source fusion in vehicles.

Customized Services for Key Clients

We cater to the specific needs of our key clients with deeply customized services.

More Comprehensive In-Vehicle GNSS Portfolio

With over a decade of expertise in the automotive sector, our vehicle positioning solutions encompass a broad technological spectrum—spanning from single-frequency to multi-frequency systems, from satellite navigation to multi-source fusion, and from meter-level to centimeter-level positioning accuracy.



More Convenient Chip-Cloud Integrated Solution

Our intelligent Location Digital Base (iLDB), featuring seamless integration of Chip-Cloud technology, delivers one-stop solution and application support.

GNSS Application Scenarios in Vehicle

Cockpit Navigation

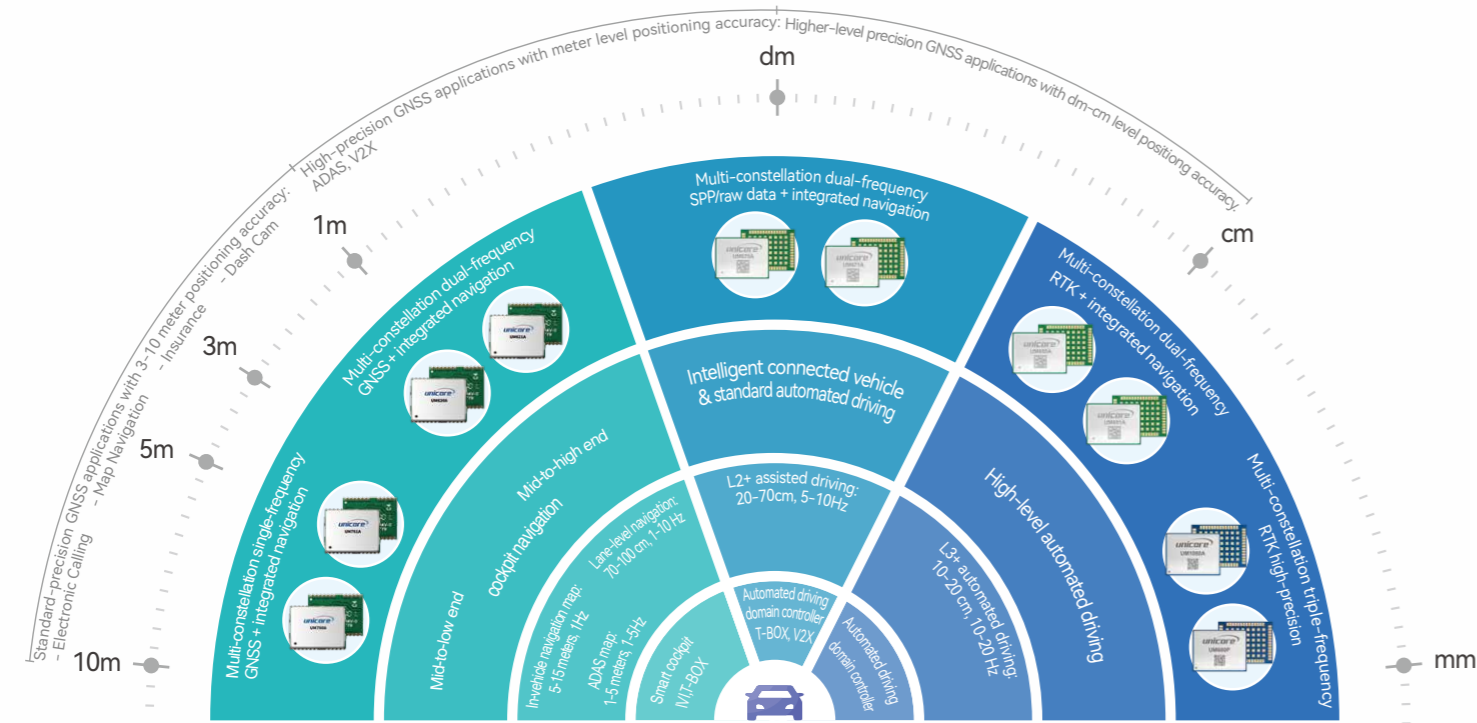
Cockpit Navigation applications cover the cockpit domain controller and In-Vehicle Infotainment (IVI) system. GNSS primarily provides navigation and positioning services with meter level accuracy, which is adequate for most requirements.

Intelligent Connected Vehicle

Intelligent connected vehicle applications cover T-BOX, TCU, V2X, RSU and more. Positioning accuracy typically reaches sub-meter level. Lane-level applications, such as vehicle-road coordination, require even higher precision. Road safety, traffic efficiency, and information services also have specific positioning performance requirements.

Automated driving

Automated driving applications cover ADAS, smart parking, RoboTaxi, etc., with the capability of comprehensive scenario perception. L2+ and higher-level advanced automated driving requires decimeter to centimeter level positioning accuracy in complex scenarios.



Cockpit Navigation

Higher Performance

More Secure

More Reliable

Intelligent Connected Vehicle

For cockpit navigation and intelligent connected vehicle applications, Unicore Communications has introduced a series of single-frequency and dual-frequency positioning chips and modules.

The UFirebird series of automotive GNSS chips and modules seamlessly integrate high reliability, low power consumption, and a compact form, tailored specifically for cockpit navigation and intelligent connected vehicles. This series

delivers high-precision positioning with multi-GNSS compatibility, supporting GPS, BDS, GLONASS, Galileo, QZSS, and SBAS. It features capabilities of rapid cold start and high sensitivity of signal reception, ensuring reliable positioning and navigation even in challenging environments. Its low-power design and ease of use make it an optimal choice for elevating driving experience and ensuring safety.

OBD

The OBD (On-Board Diagnostics) system is an on-board monitoring system designed to detect and report vehicle emission levels and potential technical issues. Integrated with GNSS, it can deliver precise positioning for vehicles. The synergy of GNSS precise positioning and OBD real-time vehicle performance monitoring not

only provides comprehensive information of vehicle status and location but also optimizes fleet management, boosting operational efficiency and safety. This provides robust data support for intelligent vehicle management and services.

OTA

With the advancement of technology, OTA (Over-the-air) and software-defined vehicles are steadily emerging as the new norm in the automotive industry. They not only elevate the intelligence quotient of vehicles but also unlock novel business models and revenue streams for automakers and service providers. With OTA technology, cars can undergo continuous upgrades just like

smartphones, while the software-defined approach unlocks endless possibilities for vehicle customization. Furthermore, OTA technology and software-defined vehicles offer enhanced flexibility and update capabilities when using GNSS in automobiles, enabling continuous evolution of vehicle navigation systems to meet increasingly growing demand for precise positioning.

T-Box

The T-Box delivers precise positioning and navigation services for vehicles, bolstering their remote communication and monitoring capabilities. By providing real-time vehicle location data, GNSS chip makes it possible for vehicle positioning and tracking, traffic flow monitoring, and intelligent traffic management. Additionally,

the T-Box continuously monitors vehicle condition and performs diagnostics in real time to ensure safety. Combining GNSS with 4G/5G communication modules, the T-Box transmits vehicle data to servers in the cloud, delivering diverse services and playing a pivotal role in intelligent connected vehicle.

HUD (Head-Up Display)

As part of the cockpit navigation, the HUD system utilizes GNSS to provide precise positioning data, enhancing the accuracy and real-time performance of navigation information. By projecting

these data directly onto the windshield in front of the driver, it improves both driving safety and convenience.







Streaming Rearview Mirror

Streaming rearview mirror integrates high-definition cameras and GNSS high-precision positioning to deliver real-time traffic and

navigation information, thereby boosting driving safety and convenience.

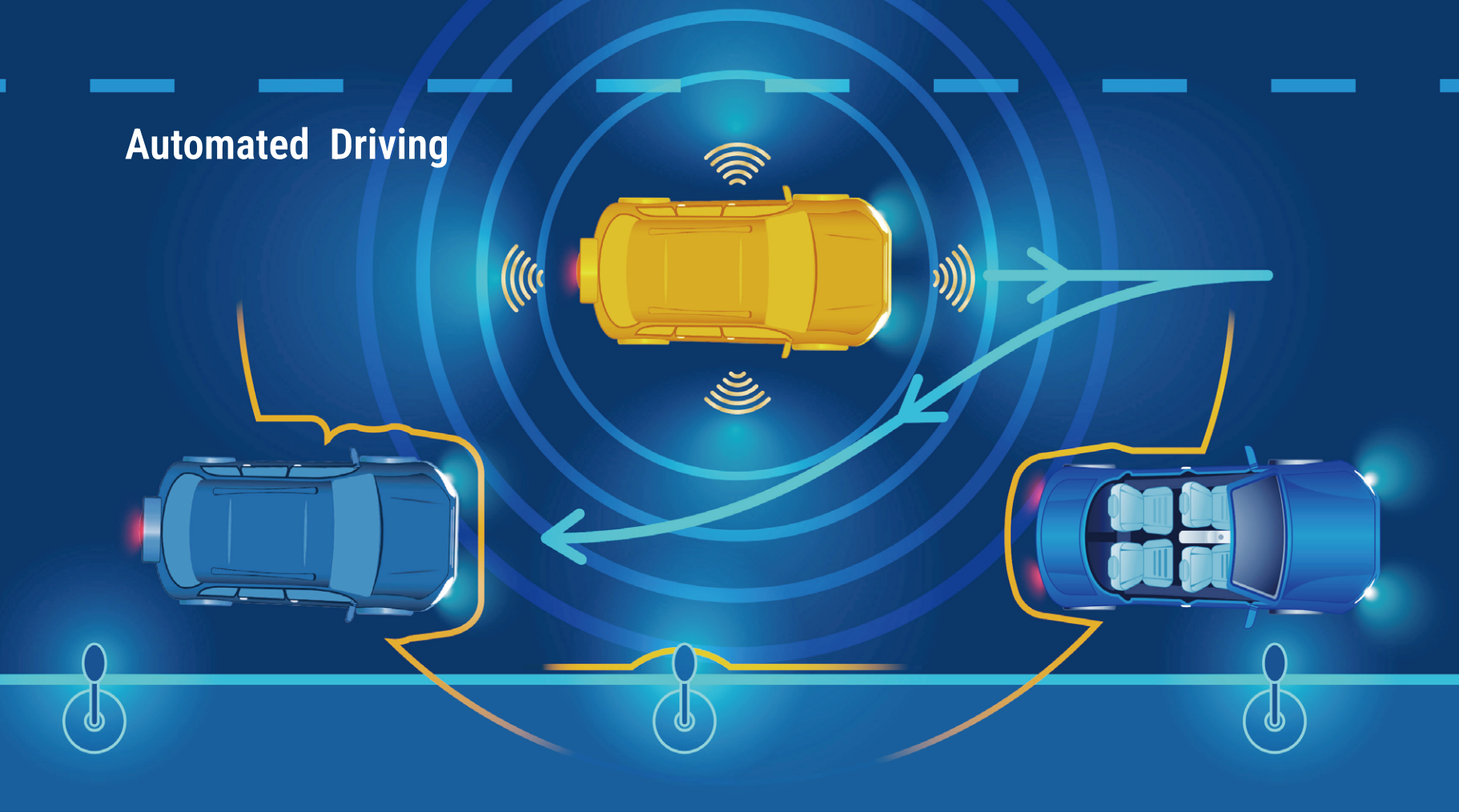
UFirebird IV Series Products

UFirebird II Series Products

	UC7510A 	UM761A 	UM760A 	UC6580A 	UM621A 	UM620A 
Product Name Automotive-Grade	Multi-GNSS Single-Frequency Positioning SoC	Multi-GNSS Single-Frequency Integrated Positioning Module	Multi-GNSS Single-Frequency Positioning Module	Multi-Constellation Dual-Frequency Positioning SoC	Multi-GNSS Dual-Frequency Integrated Positioning Module	Multi-GNSS Dual-Frequency Positioning Module
Dimensions	4.0 × 4.0 × 0.75 mm	12.2 × 16.0 × 2.4 mm	12.2 × 16.0 × 2.4 mm	5.0×5.0×0.85 mm	12.2 × 16.0 × 2.4 mm	12.2 × 16.0 × 2.4 mm
Packaging	QFN28	24-pin, LCC package	24-pin, LCC package	QFN40	24-pin, LCC package	24-pin, LCC package
Signal	GPS L1C/A	GPS L1C/A	GPS L1C/A	GPS L1C/A, L5	GPS L1C/A, L5	GPS L1C/A, L5
	BDS B1I, B1C	BDS B1I, B1C*	BDS B1I, B1C	BDS B1I, B1C, B2a	BDS B1I, B1C, B2a	BDS B1I, B1C, B2a
	GLONASS G1	GLONASS G1	GLONASS G1	GLONASS G1	GLONASS G1	GLONASS G1
	Galileo E1B/C	Galileo E1B/C	Galileo E1B/C	Galileo E1, E5a	Galileo E1B/C, E5a	Galileo E1B/C, E5a
	QZSS L1C/A, L1C/B, L1S	QZSS L1C/A, L1C/B*, L1S	QZSS L1C/A, L1S	QZSS L1C/A, L1S, L5	QZSS L1C/A, L1S, L5	QZSS L1C/A, L1S, L5
	SBAS L1C/A	SBAS L1C/A*	SBAS L1C/A	SBAS L1C/A	SBAS L1C/A	SBAS L1C/A
	-	-	-	NavIC L5*	NavIC L5*	NavIC L5*
Time to First Fix (TTFF)	Cold start < 26 s	Cold start < 26 s	Cold start < 26 s	Cold start < 26 s	Cold start < 26 s	Cold start < 26 s
	Hot start < 1 s	Hot start < 1 s	Hot start < 1 s	Hot start < 2 s	Hot start < 2 s	Hot start < 2 s
	Reacquisition < 1 s	Reacquisition < 1 s	Reacquisition < 1 s	Reacquisition < 2 s	Reacquisition < 2 s	Reacquisition < 2 s
Single Point Positioning (RMS)	Horizontal 1.5 m (with SBAS)	Horizontal 1.5 m (with SBAS)	Horizontal 1.5 m (with SBAS)	Horizontal 1.5 m	Horizontal 1.5 m (dual-frequency four-system, open sky)	Horizontal 1.5 m (dual-frequency four-system, open sky)
	Vertical 2.5 m	Horizontal 2.0 m (without SBAS)	Horizontal 2.0 m (without SBAS)	Vertical 2.5 m		
INS Positioning Error	-	< 2% x travel distance (no GNSS signal)	-	-	< 2% x travel distance (no GNSS signal)	-
Raw IMU Data Update Rate	-	50 Hz / 100 Hz	-	-	50 Hz / 100 Hz	-
Velocity Accuracy (RMS)	0.05 m/s	0.05 m/s	0.05 m/s	0.05m/s	0.05 m/s	0.05 m/s
1PPS(RMS)	20 ns	20 ns	20 ns	20 ns	20 ns	20 ns
Sensitivity (GNSS)	Tracking -165dBm	Tracking -165dBm	Tracking -165dBm	Tracking -162dBm	Tracking -162dBm	Tracking -162dBm
	Cold start -148 dBm	Cold start -148 dBm	Cold start -148 dBm	Cold start -148 dBm	Cold start -148 dBm	Cold start -148 dBm
	Hot start -156 dBm	Hot start -156 dBm	Hot start -156 dBm	Hot start -156 dBm	Hot start -156 dBm	Hot start -156 dBm
	Reacquisition -160 dBm	Reacquisition -160 dBm	Reacquisition -160 dBm	Reacquisition -160 dBm	Reacquisition -160 dBm	Reacquisition -160 dBm
Data Update Rate	1 Hz / 5 Hz / 10 Hz	1 Hz / 5 Hz / 10 Hz	1 Hz / 5 Hz / 10 Hz	1 Hz / 5 Hz / 10 Hz	1 Hz / 5 Hz / 10 Hz	1 Hz / 5 Hz / 10 Hz
Data Format	NMEA 0183, Unicore	NMEA 0183, Unicore	NMEA 0183, Unicore	NMEA 0183, Unicore	NMEA 0183, Unicore	NMEA 0183, Unicore
Operating Temperature	-40°C ~ +105°C	-40°C ~ +85°C	-40°C ~ +85°C	-40°C ~ +105°C	-40°C ~ +85°C	-40°C ~ +85°C
Storage Temperature	-40°C ~ +105°C	-45°C ~ +90°C	-45°C ~ +90°C	-40°C ~ +105°C	-40°C ~ +85°C	-40°C ~ +85°C
Voltage	V _{IO} 1.7 V ~ 3.6 V V _{CORE} 1.2 V ~ 1.98 V	2.7 V ~ 3.6 V DC	2.7 V ~ 3.6 V DC	1.7 V ~ 3.6 V DC	2.7 V ~ 3.6 V DC	2.7 V ~ 3.6 V DC
LNA Feed	-	2.7 V ~ 3.3 V < 100 mA	2.7 V ~ 3.3 V < 100 mA	2.7 V ~ 3.3 V < 40 mA	2.7 V ~ 3.3 V < 100 mA	2.7 V ~ 3.3 V < 100 mA
Power Consumption	Tracking 53 mA @ 1.2 V	Tracking 66 mA @ 3.3 V	Tracking 62 mA @ 3.3 V	120 mW DCDC Mode	330 mW	300 mW
	Acquisition 48 mA @ 1.2 V	Acquisition 75 mA @ 3.3 V	Acquisition 64 mA @ 3.3 V			
Functional Interfaces	1 × UART (LVTTTL)	1 × UART (LVTTTL)	1 × UART (LVTTTL)	2 × UART (LVTTTL)	2 × UART (LVTTTL)	2 × UART (LVTTTL)
	1 × I ² C	1xSPEED	1 × I ² C	1 × I ² C	1 × I ² C	1 × I ² C
	1 × SPI*	1xPWD	1 × SPI*	1 × SPI*	1 × SPI*	1 × SPI*
	-	1 × 1PPS (LVTTTL)	-	-	1xSPEED	1 × 1PPS (LVTTTL)
	-	-	-	-	1 × FWD	-
	-	-	-	-	1 × 1PPS (LVTTTL)	-

Note: Items marked with * are supported by specific firmware versions.

Automated Driving



With the advancement of automated driving, satellite-based positioning technology will play an increasingly significant role. Automated driving depends on absolute positioning information that is precise, reliable, fully functional, and secure.

To operate effectively, automated driving systems must accurately determine position and speed under all driving conditions. The key challenge lies in seamlessly integrating diverse and complex technologies, including Global Navigation Satellite Systems (GNSS), onboard sensors (such as radar and cameras), as well as secure and robust vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication.

ADAS

ADAS (Advanced Driver Assistance System) employs automated technologies such as sensors and cameras to detect surrounding obstacles or driver errors, responding accordingly to enhance vehicle and road safety.



SAE J3016™ Levels of Driving Automation™

	SAE LEVEL 0™	SAE LEVEL 1™	SAE LEVEL 2™	SAE LEVEL 3™	SAE LEVEL 4™	SAE LEVEL 5™
What does the human in the driver's seat have to do?	You are driving whenever these driver support features are engaged - even if your feet are off the pedals and you're not steering			You are not driving when these automated driving features are engaged - even if you are seated in "the driver's seat"		
	You must constantly supervise these support features; You must steer, brake, or accelerate, or steer as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	
	These are driver support features			These are automated driving features		
What do these features do?	These features are limited to providing warnings and momentary assistance	These features provide steering OR brake/acceleration support to the driver	These features provide steering AND brake/acceleration support to the driver	These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met	This feature can drive the vehicle under all conditions	
Example Features	Automatic emergency braking Blind spot warning Lane departure warning	Lane centering OR Adaptive cruise control	Lane centering AND adaptive cruise control at the same time	Traffic jam chauffeur	Local driverless taxi Pedals/steering wheel may or may not be installed	Same as level 4 but feature can drive everywhere in all conditions

The Society of Automobile Engineers (SAE) Levels of Driving Automation

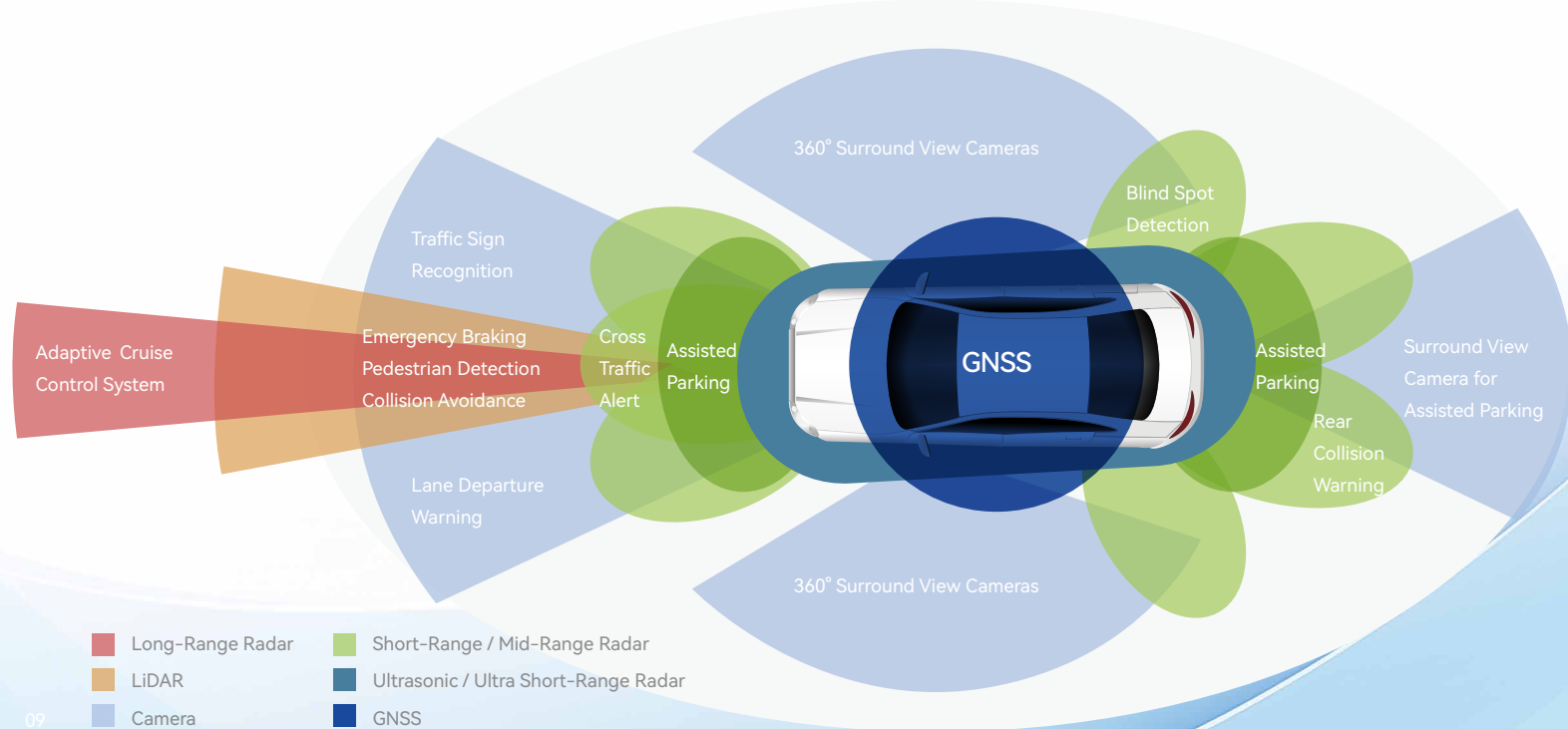
Entry-level driver assistance solutions typically focus on Level 2 driving assistance, employing a sensor combination of millimeter-wave radar and camera to deliver basic functionalities like Adaptive Cruise Control (ACC) and Lane Keeping Assisting (LKA). In contrast, advanced automated driving solutions target L2+ to L4 levels, leveraging lidar, high-performance computing chips, and high-precision GNSS/INS integrated positioning technology to deliver complex functionalities like highway NOA (Navigate on Autopilot) and urban NOA. GNSS is evolving from its absence in basic solutions to being a must-have in advanced applications like urban navigation, with dual-frequency/multi-frequency progressively emerging as the norm.

Entry-Level Solutions Upward Evolution

- ☑ Deliver a functionally viable solution of driver assistance
- ☑ Assisted parking, memory driving, highway pilot
- ☑ Hardware optimized for cost efficiency

Premium Solutions Reducing Hardware while Enhancing Algorithms

- ☑ Enable relatively advanced ADAS/automated driving
- ☑ Emphasize comfort, handling, and smoothness
- ☑ Reducing hardware configurations while enhancing algorithms and functionalities, reducing reliance on high-definition maps



Urban NOA

Urban NOA (Navigate on Autopilot) is an advanced driver assistance system. It represents a significant milestone in automated driving technology, which enhances driving comfort, convenience, and safety through advanced driver assistance features.

Specifically designed for city road navigation, Urban NOA excels in congested urban areas, offering intelligent automated driving assistance features such as automated lane changing, overtaking, smart following, traffic light navigation, and automated parking. The system monitors

V2X

V2X (Vehicle to Everything) is an advanced vehicle connectivity solution that enables communication between vehicles and their surroundings, including other vehicles, infrastructure, pedestrians, and networks. GNSS plays a central role in V2X systems, providing vehicles with accurate positioning and speed information. Such information is vital for real-time navigation, route planning, and safe interaction with other traffic participants in complex driving environments. For example, GNSS-enabled high-precision positioning allows vehicles to anticipate

Cockpit and Driving Integration

Cockpit and Driving Integration represents the integration of a vehicle's smart cockpit and automated driving into a unified high-performance computing platform. This architecture simultaneously enables both automated driving capabilities and smart cockpit functionalities while minimizing hardware redundancy, optimizing system performance, and reducing costs. Within such system, GNSS not only provides precise positioning and timing information but also supports a variety of safety and efficiency applications, ensuring effective system operation and reliability. The Cockpit and Driving Integration imposes more compre-

real-time traffic conditions via in-vehicle data processing components and various sensors (such as ultrasonic radar, millimeter-wave radar, environmental perception cameras, and LiDAR). This enables safe and efficient driving assistance under various scenarios. Urban NOA leverages LiDAR for real-time environmental scanning, capturing dynamic data including vehicle speed, lane markings, and distance to preceding vehicle. Integrated with GNSS navigation, it performs real-time path planning to ensure seamless travel from point A to point B.

upcoming traffic conditions and adjust routes proactively to avoid congestion or potential hazards. Additionally, GNSS ensures precise time synchronization in V2X systems. Accurate time stamp is essential for reliable and timely communication between vehicles (V2V) and between vehicles and infrastructure (V2I). This time synchronization is essential for enabling advanced features such as cooperative driving and traffic signal optimization.

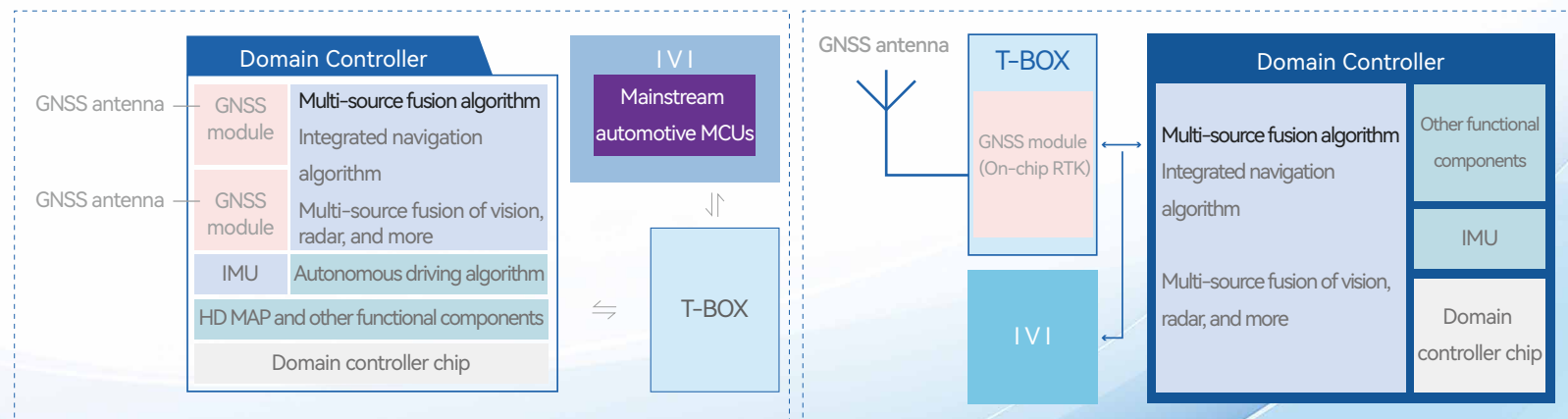
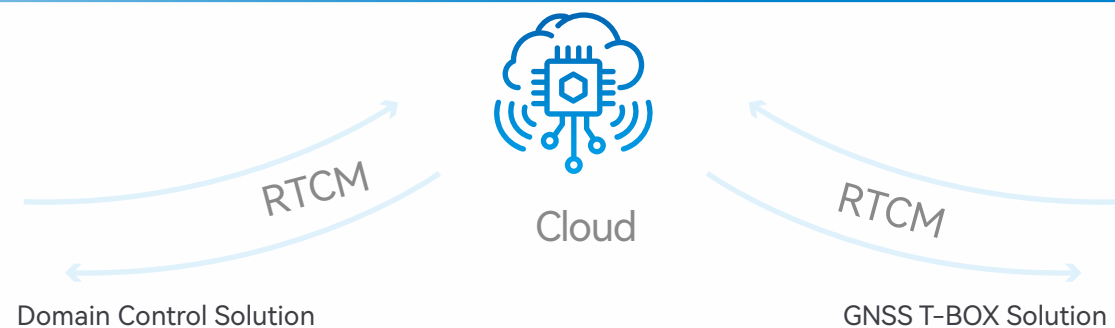
hensive and stringent requirements on GNSS components, which must simultaneously meet the demands of diverse functional needs, hardware design specifications, as well as functional safety and information security standards across both the cockpit and automated driving domains. Specifically, GNSS components are required to: provide high-precision positioning and timing data, support efficient data transmission and synchronization, achieve optimal balance between power consumption and thermal dissipation while guaranteeing system-level stability and reliability.

Mainstream Solutions



Recommended Products:

UM1080A / UM680P / UM680A / UM681A / UM670A / UM671A



	Unicore Nebulas Series Products		UFirebird II Series Products			
Product Name	UM1080A Multi-Constellation Multi-Frequency High-Precision RTK Positioning Module	UM680P Multi-Constellation Multi-Frequency Navigation and Positioning Module	UM680A Multi-Constellation Dual-Frequency High-Precision RTK Positioning Module	UM681A Multi-Constellation Dual-Frequency High-Precision RTK&INS Integrated Positioning Module	UM670A Multi-Constellation Dual-Frequency Navigation and Positioning Module	UM671A Multi-Constellation Dual-Frequency GNSS&INS Integrated Positioning Module
Automotive-Grade						
Dimensions	22.0 × 17.0 × 2.6 mm	22.0×17.0 × 2.6 mm	22.0 × 17.0 × 2.6 mm		22.0 × 17.0 × 2.6 mm	
Packaging	54-pin, LGA surface mounting	54-pin, LGA surface mounting	54-pin, LGA surface mounting		54-pin, LGA surface mounting	
Signal	GPS L1C/A, L2C, L5C BDS B1I, B1C, B2a, B2b*, B3I GLONASS G1, G2 Galileo E1, E5a, E5b, E6* QZSS L1C/A, L2C, L5, L6* SBAS L1C/A NavIC L5* L-Band*	GPS L1C/A, L2C, L5C BDS B1I, B1C, B2a, B2b, B3I GLONASS G1, G2 Galileo E1, E5a, E5b, E6* QZSS L1C/A, L2C, L5, L6* SBAS L1C/A NavIC L5* L-Band*	GPS L1C/A, L1C*, L5 BDS B1I, B1C*, B2a GLONASS G1* Galileo E1, E5a QZSS L1C/A, L5 SBAS L1C/A NavIC L5* -		GPS L1C/A, L5 BDS B1I /B1C*, B2a GLONASS G1* Galileo E1, E5a QZSS L1C/A, L5 SBAS L1C/A NavIC L5* -	
Time to First Fix (TTFF)	Cold start < 10 s Hot start < 2 s Reacquisition < 2 s	Cold start < 10 s Hot start < 2 s Reacquisition < 2 s	Cold start < 26 s Hot start < 2 s Reacquisition < 2 s		Cold start < 26 s Hot start < 2 s Reacquisition < 2 s	
Single Point Positioning (RMS)	Horizontal 1.5 m (open sky) Vertical 2.5 m (open sky)	Horizontal 1.5 m (open sky) Vertical 2.5 m (open sky)	Horizontal 1.5 m (open sky) Vertical 2.5 m (open sky)		Horizontal 1.5 m (open sky) Vertical 2.5 m (open sky)	
RTK(RMS)	Horizontal 0.8 cm + 1 ppm (open sky) Vertical 1.5 cm + 1 ppm (open sky)	Horizontal 0.8 cm + 1 ppm (open sky) Vertical 1.5 cm + 1 ppm (open sky)	Horizontal 1 cm + 1 ppm (open sky) Vertical 2 cm + 1 ppm (open sky)		-	
Velocity Accuracy (RMS)	0.03 m/s (open sky)	0.03 m/s (open sky)	0.05 m/s (open sky)		0.05 m/s (open sky)	
INS Positioning Error	-	-	-	< 1% × travel distance (no GNSS signal)	-	< 1% × travel distance (no GNSS signal)
Raw IMU Data Update Rate 1PPS (RMS)	- 20 ns	- 20 ns	-	50 Hz / 100 Hz	-	50 Hz / 100 Hz
Sensitivity (GNSS)	Tracking -162 dBm Cold start -147 dBm Hot start -157 dBm Reacquisition -158 dBm	Tracking -162 dBm Cold start -147 dBm Hot start -157 dBm Reacquisition -158 dBm	Tracking -162 dBm Cold start -147 dBm Hot start -157 dBm Reacquisition -158 dBm		Tracking -162 dBm Cold start -147 dBm Hot start -157 dBm Reacquisition -158 dBm	
Data Update Rate	1 Hz / 5 Hz / 10 Hz / 20 Hz / 50 Hz*	1 Hz / 5 Hz / 10 Hz / 20 Hz / 50 Hz*	1 Hz / 5 Hz / 10 Hz		1 Hz / 5 Hz / 10 Hz	
Differential Data	RTCM V3.X	RTCM V3.X	RTCM V3.X		-	
Data Format	NMEA 0183, Unicore	NMEA 0183, Unicore	NMEA 0183, Unicore		NMEA 0183, Unicore	
Operating Temperature	-40°C ~ +105°C	-40°C ~ +105°C	-40°C ~ +85°C / 105°C		-40°C ~ + 105°C	
Storage Temperature	-55°C ~ +115°C	-55°C ~ +115°C	-40°C ~ +85°C / 105°C		-40°C ~ + 105°C	
Voltage	3.0 V ~ 3.6 V DC	3.0 V ~ 3.6 V DC	2.7 V ~ 3.6 V DC		2.7 V ~ 3.6 V DC	
Power Consumption	230 mW	350 mW	240 mW		150 mW	
Functional Interfaces	3 x UART (LVTTTL) 1 x I2C* 1 x SPI* 1 x 1PPS (LVTTTL) 1 x RESET_N 1 x CAN*-	3 x UART (LVTTTL) 1 x I2C* 1 x SPI* 1 x 1PPS (LVTTTL) 1 x RESET_N 1 x CAN*	2 x UART (LVTTTL) 1 x I2C* 1 x SPI* 1 x 1PPS (LVTTTL) 1 x RESET_N -		2 x UART (LVTTTL) 1 x I2C* 1 x SPI* 1 x 1PPS (LVTTTL) 1 x RESET_N -	

Note: Items marked with * are supported by specific firmware versions.

Vehicle-Embedded Technologies

GNSS Only + DR Dual-Engine Technology

The increasing diversity of in-vehicle navigation and positioning solutions is posing greater challenges for the absolute positioning information provided by navigation modules. The GNSS Only + DR Dual-Engine technology, on the one hand, can output GNSS-only positioning data and IMU raw measurements to the map side for backend fusion; on the other hand, it can leverage the module's built-in integrated navigation algorithm to provide tightly coupled GNSS+DR positioning information, serving both as redundancy for backend fusion and as direct absolute position of the vehicle for reporting. This satisfies the positioning service requirements of automotive electronic modules such as cockpit navigation IVI and automated driving domain controllers.

EDIF Extended Dual-Frequency Ionosphere-Free Technology

During periods of intense ionospheric activity, the correction parameters based on wide-area models often fail to accurately represent actual ionospheric errors. These residual errors, frequently exceeding tens of meters, directly compromise positioning accuracy. The dual-frequency ionosphere-free combination exploits the mechanism that electromagnetic wave propagation delay in space is inversely proportional to the square of the wave frequency, and by leveraging dual-frequency observations, it constructs a new observation combination—the extended dual-frequency ionosphere-free combination, to mitigate ionospheric errors. This method dramatically improves positioning accuracy under identical observation conditions.

Centimeter-Level Positioning for All-Scenario Automated Parking

By integrating IMU, odometer, chassis data with vehicle motion error modeling and compensation algorithms, it delivers centimeter-level real-time positioning accuracy relative to the starting point, providing relative position, attitude, and heading data to meet mechanical parking space requirements. More importantly, all computations can be executed on a single MCU, enabling low-cost safe automated parking in all scenarios (including GNSS-denied environments like underground parking) through integration with ultrasonic radars and vision systems.

Multi-Sensor Fusion Technology

Ultrasonic or millimeter-wave radar can detect low obstacles around the vehicle and collaborate with wide-angle cameras to help the vehicle exit a parking space and merge into traffic. During roadway navigation, the synergistic combination of cameras, radars, and lidars continuously captures data about traffic signs, obstacles, and other road users. Simultaneously, connected vehicle sensors monitor both the vehicle's performance and the driver's readiness to take over the steering wheel if necessary.

In complex urban and natural environments such as overpasses, tunnels, dense foliage, mountainous regions, and urban canyons, GNSS positioning performance may degrade. One of the approaches to overcome these limitations is by integrating satellite positioning with inertial sensor data to recon-

struct vehicle trajectories through dead reckoning, which can effectively bridge GNSS coverage gaps.

This approach can be further expanded by integrating data from cameras, LiDAR, and radar, enabling vehicles to be located relative to landmarks while using high-definition maps.

In adverse weather or feature-scarce environments, cameras and radars struggle to identify characteristics, while GNSS signals become unreliable in urban canyons and multipath conditions. GNSS and feature-based positioning are complementary technologies, both essential for L2+ assisted driving systems.

High-Precision Onboard Integrated Navigation Error Compensation Technology

Although current integrated navigation systems have overcome major technical barriers, they still face challenges in maintaining high-precision positioning during maneuvers like sustained circling and sharp turns in urban environments.

To address heading errors induced by gyro scale factors during circular

maneuvers, the High-Precision Onboard Integrated Navigation Error Compensation Technology constructs an error propagation chain connecting GNSS velocity, heading error, gyro drift, and heading gyro scale factor. Remarkably, it achieves this without requiring additional sensors or higher-grade IMUs. By designing criteria for estimation accuracy, it enhances the positioning precision of integrated navigation system.



DR Protection Level Calculation Technology Based on RAIM

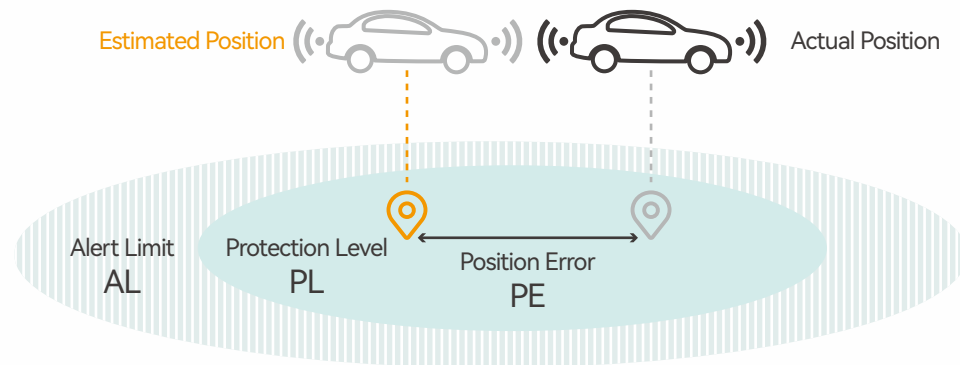
GNSS integrity and confidence data constitute a key enabler for in-vehicle positioning subsystems to achieve their safety objectives.

For assisted driving systems, the positioning receiver must satisfy not only high-precision demands but also functional safety requirements. At its core, it features: (1) the capability to detect and exclude failures; (2) real-time monitoring and quantification of safety metrics for positioning outputs. The safety of navigation results is fundamentally assessed through integrity metrics, which essentially quantify the confidence level in the accuracy of the positioning information provided by the system. Integrity is typically quanti-

fied using the Protection Level (PL).

This technology addresses challenges such as complex application scenarios, limited computational resources, and distorted error models when deploying receiver autonomous integrity monitoring (RAIM) for embedded integrated navigation systems. It offers an integrity monitoring algorithm with low cost, high adaptability and high output precision.

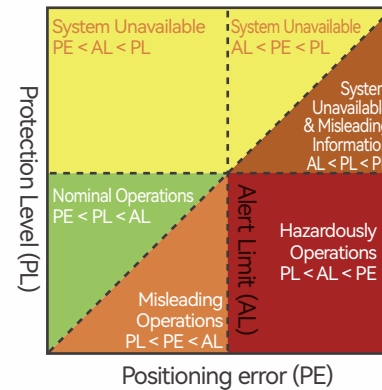
Safety Integrity of Assisted Driving



AL (Alert Limit): A predefined vehicle parameter indicating the maximum permissible position deviation without triggering an alarm.

PL (Protection Level): The maximum possible positioning error at a specified confidence level. Continuously providing the upper bound of GNSS expected errors, the system enables applications to adapt their operations based on the received PL and discarding untrustworthy data.

Stanford Diagram



Protection Level (PL)

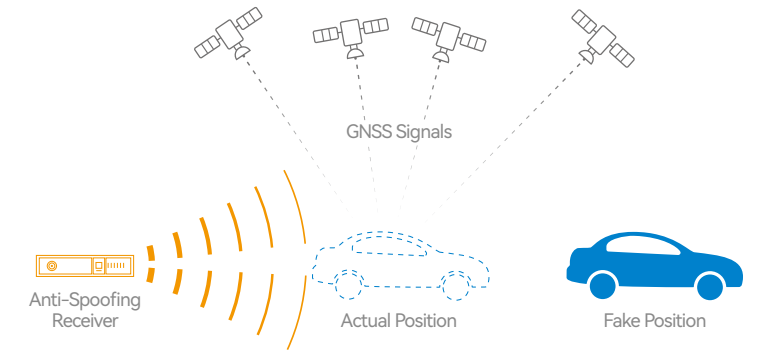
Positioning error (PE)

PE (Position Error): The deviation between the actual vehicle position and the estimated position, resulting from cumulative error sources across the GNSS signal propagation path (orbit to receiver).

Anti-Jamming & Anti-Spoofing

In urban canyons, tree-lined avenues, tunnels, and similar environments, satellite signals are prone to be blocked, reflected, and interfered with, resulting in degraded signal quality and positioning accuracy. In densely built-up urban areas with high-rises, GNSS multipath signal interference can cause significant positioning deviations, compromising navigation accuracy. Along with the widespread adoption of satellite navigation technology, malicious jamming and spoofing activities, however, are also on the rise. Jamming signals may hinder receivers from properly acquiring satellite signals, while spoofing signals can lead to incorrect positioning results, posing serious security risks to systems reliant on satellite navigation.

Unicore's anti-jamming technology, URAIM algorithm, and strategies leveraging OSNMA capabilities enable simultaneous detection and processing of jamming and spoofing signals while tracking multi-frequency, multi-constellation signals. These technologies significantly enhance signal acquisition and tracking performance in single-tone and narrowband jamming environments, effectively countering jamming and spoofing signals to ensure the reliability and normal operation of GNSS chips and modules.

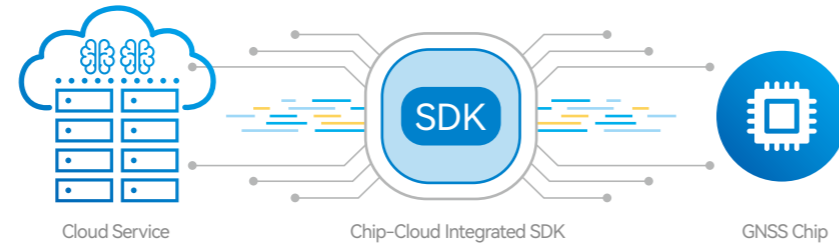


Chip-Cloud Integration

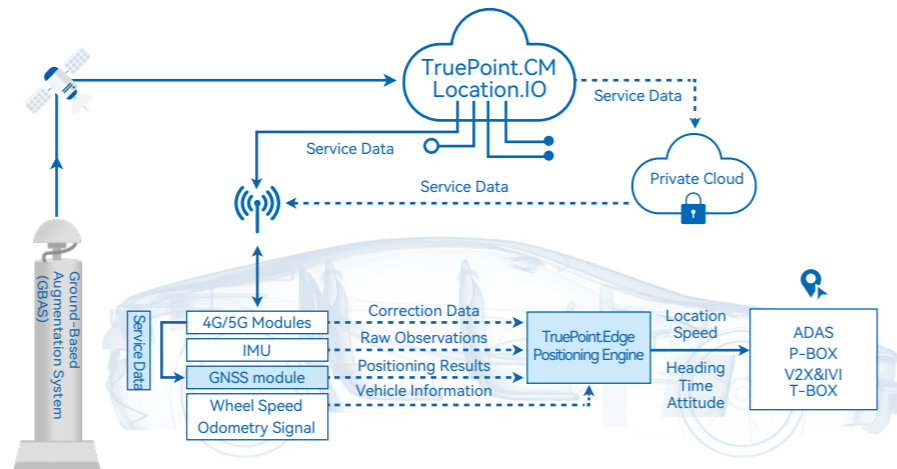
GNSS Chip + High-Precision Positioning Service Integrated Solution

- **Deep Integration of Algorithms**
Enhanced positioning performance and reliability
- **High Flexibility and Customization**
The Chip-Cloud integrated SDK delivers diverse and advanced capabilities
- **Massive Data Aggregation**
Continuously optimized algorithms and models enable AI applications
- **Compatible with Traditional Service Models**
Accessible to general consumers

Paired with TruePoint high-precision positioning services, Unicore's chips deliver more accurate, reliable, and user-friendly location data. The Chip-Cloud integrated solution significantly enhances the positioning performance and usability of user terminals in complex scenarios through collaborative design, deep fusion, model optimization, and data training of cloud-based and chip-based algorithms.



The proprietary Chip-Cloud integrated SDK fully utilizes both cloud and chip data streams. Combined with highly available and high-precision positioning services, it reliably delivers wide-area precision positioning to meet diverse user requirements.



Chip-Cloud Technology

1 Chip-to-Cloud Integrated Service

This technology enables deep, collaborative development and optimization between cloud-based data processing algorithms and chip-based computing algorithms. By jointly modeling the error processing of various GNSS frequencies, a seamless compatibility between data services and chip algorithms is achieved. In the cloud, NRTK and PPP-RTK achieve seamless integration to deliver richer and more precise data. On the chip, the adaptive algorithms intelligently process NRTK and PPP-RTK service data, offering users a highly available, reliable, and precise positioning experience.

2 Low-Traffic Data Compression

Leveraging the Chip-Cloud integrated SDK compatible with multiple platforms, this technology ensures real-time synchronization between cloud and chip. Driven by the demand for optimal positioning accuracy, chip-based and cloud-based algorithms collaborate to define a data transmission protocol that is both simplified and highly compressed. This approach not only adapts to various complex operational scenarios, but also enables flexible broadcasting capabilities in the cloud under different conditions. While preserving positioning accuracy, we minimize the data transmission volume and bandwidth for high-precision services, effectively lowering the data traffic and operational costs for users.

4 Chip-Cloud Remote Diagnostics

Utilizing fault identification algorithms in the Chip-Cloud integrated SDK, the positioning anomalies can be rapidly detected in user terminals. Upon detecting an issue, the system promptly captures abnormal data and—with user authorization—uploads it to the cloud for in-depth analysis. Verified faults are promptly resolved via seamless OTA updates, which significantly reduces troubleshooting time. This technology elevates user experience by maintaining optimal positioning performance and delivering consistent, high-accuracy location services.

3 Chip-Cloud Ionospheric Interference Suppression

By combining cloud-based ionospheric precise modeling with chip-based quality factor optimization algorithms, this technology effectively ensures positioning availability in highly active ionospheric conditions. In complex scenarios with active ionospheric disturbances, this technology significantly improves fix rates and positioning accuracy for user terminals, ensuring stable and reliable positioning results. It maintains uninterrupted user operations while delivering reliable technical support for all activities in ionosphere-affected regions, effectively eliminating workflow disruptions from ionospheric interference.

Quality System



Quality is the cornerstone of Unicore's products. Automotive applications impose exceedingly stringent requirements for quality and reliability, as products must operate stably under harsh conditions such as electromagnetic interference, vibration, shock, and extreme temperatures for extended periods.

Unicore employs a professional systematic management approach to implement comprehensive quality management throughout the product lifecycle, ensuring every stage meets automotive-grade standards. Our chips are manufactured by world-leading wafer foundries, following automo-

tive-grade reliability testing standards in the industry to guarantee exceptional performance and stability. Our modules undergo rigorous third-party validation and reliability testing, complemented by 100% factory testing, ensuring high reliability and availability in practical applications.

In addition, our products have undergone rigorous testing and certification by authoritative third-party institutions both domestically and internationally. Automotive-grade products meet AEC-Q100, AEC-Q104 certification requirements and have passed BDS Basic Product Certification and ISO-26262 Functional Safety System Certification. The

products feature a long lifecycle within a temperature range of -40°C to +105°C, making it well-suited for the automotive industry. It is fully compliant with automotive quality processes (APQP, PPAP, SPC, PCN).

Unicore consistently upholds its quality policy of "meeting customer needs with rapid response, balancing risks and respecting processes, driving excellence through continuous improvement and collaborating for mutual success." We are committed to delivering high-quality, highly reliable products to our customers.

Production & Supply Chain

Unicore Communications boasts an extensive supply chain and partner network in the automotive sector, with its products and solutions widely adopted across various automotive applications. Unicore maintains collaborative relationships with a wide array of leading global automakers and Tier 1 suppliers, jointly advancing innovation and development in vehicle technologies while fulfilling its commitments to technological innovation, product quality, and sustainable supply.

- ✓ **Continuous Supply** Secure production, inventory, and supply channels
- ✓ **Efficiency Boost** Optimized management and support, dedicated in-vehicle supply chain, quality assurance management, quality objective management

Ecosystem



* The above showcases only a selection of our partners. For more information, please contact Unicore.

Unicore's Vehicle Journey

2010

Unicore
Nebulas-UC260



Multi-Costellation
Multi-Frequency
High-Performance
GNSS SoC

2013



Smart Driving Test

2015

Unicore
NebulasII-UC4C0



Multi-Costellation
Multi-Frequency
High-Performance
GNSS SoC

2017



Low-Speed
Automated Vehicles

2020

Unicore
NebulasIV-UC9810



All-in-One GNSS SoC
Integrating RF, Baseband,
and High-Precision
Algorithms

2023



ADAS

2023

Functional
Safety Process Certification
ISO26262
ASIL-D

2025

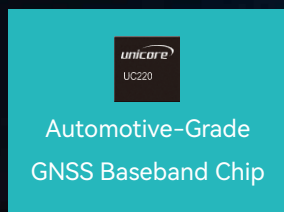


Shipments of intelligent
driving products reached
millions of units



Fleet Tracking

2011



Automotive-Grade
GNSS Baseband Chip

2013

Unicore
Humbird-UC220



Factory-Installed Navigation
System (Domestic)
AEC-Q100

2015



Automotive-Grade
Multi-GNSS
Navigation and
Positioning Chip

2017

UFirebird-UC6226



Factory-Installed
Navigation System
(Joint Venture)

2018



Dual-Frequency
Multi-GNSS
Positioning Chip

2021

UFirebird II-UC6580



Automated Driving
Large-Scale Shipment

2022



Quad-Costellation
Single-Frequency
RF-Baseband
Integrated GNSS SoC

2024

UFirebird IV-UC7510

Unicore Communications has years of profound expertise in the field of automotive navigation and positioning. From the integration of its technology into fleet tracking in 2011 to its presence in multi-brand mass-produced automated driving models in 2023, and from becoming the first to pass AEC-Q100 certification in 2015 to passing functional safety system process certification in 2023, Unicore Communications has consistently provided high-quality, highly reliable, and high-performance products. This is made possible through its innovative R&D capabilities, stringent quality control, extensive mass-production experience, robust supply chain strength, and a professional service team.