

u-blox Product Catalog 18.1

Wireless & Positioning Solutions



locate, communicate, accelerate

Issue 18.1 – June 2016





Thomas Seiler – CEO u-blox

Dear readers,

The Internet of Things (IoT) is expanding at a dizzying pace. This market depends on wireless connectivity via satellite positioning, short range radio and cellular technologies – our core competencies. At u-blox, we focus on The Internet of Things that Really Matter: on bringing to life solutions that will concretely benefit connected cities, connected industries and connected vehicles alike.

While IoT connectivity opens a wealth of possibilities, it also raises mobile users' expectations for enhanced connected experiences. This is particularly clear in the automotive industry, with the advent of the smart connected car. Market projections from the automotive research team at IHS Inc. indicate enormous growth potential. By 2022, 77 million passenger vehicles will be connected, accounting for more than 73% of the market. It is one of the fastest growing segments of the IoT. As a semiconductor company, our role is crucial in supporting a cloud-connected car.

For instance, recently the European Parliament decided to mandate an automatic-emergency-call alert system in all new cars and light vans sold within the EU as of 31st March 2018, which demonstrates a clear need for wireless communications devices. u-blox is well positioned to support road safety with our Short Range Radio products portfolio, in particular the new automotive grade V2X transceiver module, THEO-P1. LILY-W1 is another ultra-compact single band (2.4 GHz) Wi-Fi transceiver module providing 802.11n connectivity to a broad range of IoT applications with LTE connectivity (page 54). More on the topic of Short Range technology, Bluetooth and Wi-Fi, is on pages 138-139 of this catalog.

Cellular connectivity is also undergoing important changes in the IoT ecosystem. Major carriers are rolling out 4G LTE (Long Term Evolution) networks worldwide at an accelerated pace, considering the sunset of their existing 2G and 3G networks. Devices that are expected to operate for years need to incorporate LTE technology in order to ensure longevity. This is why we have expanded our product portfolio to include cost-effective low-speed LTE Cat 1 modules ideally suited for M2M non-bandwidth-critical applications, such as telematics and smart metering, as well as security and surveillance systems with the need for Voice-over-LTE (VoLTE). The complete line of 2G, 3G and 4G cellular modules starts on page 22.

Location and navigation continue to be crucial information for both people and things in our increasingly mobile society. We are proud to offer you our latest multi-GNSS positioning products with concurrent operation, including important features like integrated antenna and Untethered Dead Reckoning (UDR), all based on our 8th generation positioning platform, u-blox M8. u-blox high precision receivers now bring positioning down to centimeter level accuracy, with the new NEO-M8P GNSS module designed for commercial applications, precision agriculture and robotic guidance (page 88).

Finally, on page 140, we are delighted to introduce the embedded customer application concept, which will enable customers to program and extend the functionalities of ODIN-W2 multiradio module by loading their own code within an mbed environment. The ARM® mbed™ IoT Device Platform eases the creation and deployment of commercial, standards-based wireless IoT applications at any scale.

We look forward to helping you launch your next generation of IoT solutions!

Thomas Seiler
CEO u-blox

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Catalog 18.1 is the digital-only update to Catalog 18.0.
 The updated content is specific to the Products and Support sections, including the new product pages: [SARA-N203](#), [EVA-M8E](#), [NEO-M8Q-01A](#), [EVA-8M](#), [MAX-8 series](#), and [NEO-8Q](#).

Company

u-blox at a glance

Swiss-based u-blox (SIX:UBXN) is a leading provider of wireless and positioning semiconductors and modules for the automotive, industrial and consumer markets. Our solutions enable people, vehicles and machines to locate their exact position and wirelessly communicate via voice, text or video.

With a broad portfolio of chips, modules and services, u-blox solutions allow OEMs to quickly and cost-effectively develop innovative solutions.

Global presence

Our direct presence in 19 countries ensures that we can react quickly to changing customer demands. It also puts us in a very strong position to share knowledge and market requirements with our customers. u-blox has its headquarters in Thalwil, Switzerland, and is globally present with offices and R&D centers in Europe, Asia and the USA.

With approximately 750 employees worldwide, we support our customers from component evaluation and selection right through to product design, final production set-up, logistics and after-sales support.

Key facts

Foundation	Founded in 1997, Switzerland
Stock exchange listing	Listed on the SIX Swiss Exchange (UBXN)
Employees	Over 750
Sales	2014 revenue of CHF 270.0 million (approximately USD 277 million) H1 2015 revenue of CHF 161.9 million (approximately USD 166 million)
Markets served	Automotive, industrial and consumer
Market penetration	More than 4'000 customers worldwide benefit from our solutions More than 10'000 types of devices rely on our products More than 100'000'000 people and machines utilize our technology

u-blox strategy and values

Strategy

At the core of our strategy is our commitment to technology and innovation. We design rugged, business critical solutions to meet our customers' needs for long term 24/7 reliability. By focusing on research and development, and outsourcing production to only the very best suppliers, we can offer the quality and innovation that in turn help our customers to improve their productivity, respond more quickly to their own customers' needs and expand their operations.

The unmatched quality and reliability of our products helps us to acquire and retain customers while consolidating and expanding our position in new markets and geographical regions. u-blox's focus is on B2B business critical IoT applications in connected vehicles, connected cities and connected industries.

Our dedicated, professional workforce is key to operational excellence. People at every level of the company share a commitment to working towards the highest possible quality, enhancing efficiency and containing costs without compromising your exacting standards.

Our partners are also crucial to our success. We liaise closely with them to ensure ongoing improvements and efficiency. And we continuously evaluate strategic acquisitions of companies, technologies and products that we believe will accelerate one or more of the elements of our strategy.

Values

At u-blox we have five core values. They define what we believe and how we behave towards customers, partners and colleagues. They provide a framework for profitable, sustainable growth and act as a reliable guideline. They are, in essence, who we are.

Customer focus

All our activities must bring value to and earn the trust of our customers. By building positive partnerships, cooperating closely, and listening carefully, we aim to exceed our customers' expectations.

Passion

Passion is the lifeblood of our company. We are continuously moving forward and seeking ways to improve our products and services, either by ourselves or through partners and acquisitions.

All round reliability

The way we do things is accurate. From initial contact, through design-in, and on to prototypes and production, our customers can depend on us for technical and logistical support and excellence every step of the way.

Unmatched quality

Only by conforming to the industry's most demanding quality standards can we maintain the trust we have built with our customers.

Ethical standards

We commit to conduct ourselves in an ethical manner and act as a good corporate citizen in all environments in which our company operates. We listen to others, work together to achieve shared goals, treat each other with respect and dignity, and maintain high ethical standards.

Product grades

u-blox delivers products in three distinct product grades optimized for the specific needs of our customers:

	Standard Grade	Professional Grade	Automotive Grade
Tolerance to environmental conditions	Designed and tested for consumer environment	Designed and tested for industrial environment	Designed and tested for automotive environment
Operating temperature	–20 ... +65°C	–40 ... +85°C	–40 ... +85°C or extended
Product qualification	JESD47 (ICs) Subset of ISO 16750 (modules)	AEC-Q100 (ICs) ISO 16750 (modules)	AEC-Q100 (ICs) ISO 16750 (modules)
Process levels for design manufacturing and testing	<ul style="list-style-type: none">• 100% outgoing test• product traceability• PCN process• Failure analysis	Standard grade, plus: <ul style="list-style-type: none">• 100% Automatic X-Ray Inspection (AXI) and Automatic Optical Inspection (AOI) on modules	Professional grade, plus: <ul style="list-style-type: none">• PPAP• ISO/TS 16949 manufacturing• safe launch• automotive test flow• component traceability• 8D failure reporting• automotive PCN process• long product life cycles• 0-ppm program

Standard Grade

For consumer product applications where environmental conditions such as temperature, EMC and mechanical stresses are within light to moderate levels. Ideally suited to higher volume, price sensitive applications such as recreational devices, mobile computing, cameras, displays, routers, and test equipment.

This category of products is characterized by an excellent price to performance ratio and the industry renowned u-blox quality.

Professional Grade

For use in industrial and professional applications, where operating temperature range and mechanical durability are important for high reliability over the entire product service life.

This product category is suited for applications including industrial equipment, safety and alarm systems, broadcast and telecom equipment, asset tracking, and fleet management. These products are very robust electrically as well as mechanically. They are qualified according to ISO 16750 to ensure best in class quality.

Automotive Grade

For equipment in harsh environmental conditions, especially automotive applications, where the device is subjected to high levels of electromagnetic interference (EMI), bump, shock and vibration, and extremes of temperature. These products are designed for use in automotive, transportation and other mission critical applications. They meet industry standard automotive specifications and are qualified strictly according to ISO 16750 / AEC-Q100.

u-blox automotive products feature excellent immunity to severe mechanical and electrical stress. They are characterized by lowest possible field failure rate, have the long term product availability to support the automotive industry's product life cycles and come with automotive quality processes (PPAP, 8D, Failure Analysis).

Focus: Internet of Things and V2X

u-blox IoT connectivity vision

Our vision is to be the leading, industry-quality, supplier of communications and positioning components in the “Internet of Things that Really Matter”. We focus on business critical applications for which our customers need our products to perform 24/7 with exceptional reliability and to handle exceptions in a way that minimizes disruption to the overall system.

There are three main application areas in which IoT plays a major role. All of our product areas are imperative to successful IoT solutions in all of these areas.

Connected vehicles

The typical applications are in safety systems, vehicle diagnostics, infotainment, navigation, V2V, and V2X.

As an example, when a car breaks down, the rescue service is informed of the car's location via the positioning module or chip and arrives quickly. The driver and the preferred garage are informed of a problem in the motor block via the cellular module. At the garage, the mechanic links to the car's electronics via the Bluetooth module to efficiently find the cause.

Connected city

The typical applications are in metering, parking, traffic control, lighting, and real-time analysis.

Gas metering in urban surroundings highlights the benefits of our technologies in the connected city. Positioning products are used to locate gas meters. Our cellular products communicate the measured values to the utilities for billing purposes and the short range radio connection to the gas meter allows analysis in case of maintenance or malfunction.

Connected industry

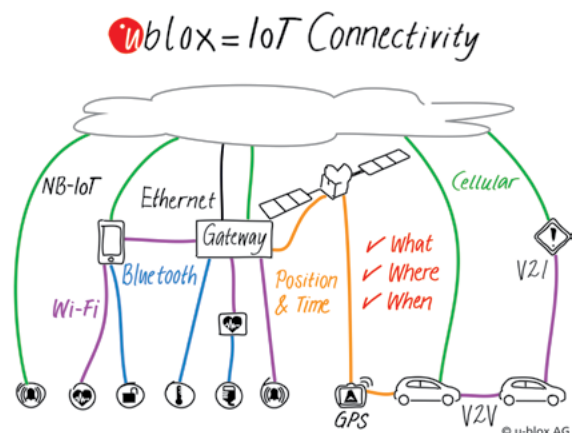
The typical applications are in aviation, transportation, manufacturing, healthcare, mining, and fleet management.

A typical healthcare example is the situation of an elderly woman living alone. Her behavior is constantly monitored via Bluetooth and Cellular modules, so when she behaves in an unusual way, her medication can be remotely adjusted via a Bluetooth module. When she needs help, the cellular module makes the call, and the medical assistance team can meet her wherever she is thanks to the positioning module.

Full IoT solution

Our complete wireless and positioning product offering gives the possibility to get the answers to the questions: What? Where? When?

As a result we can offer our customers improved productivity, fast response, and new business opportunities... to locate, communicate, accelerate.



Focus: Solutions

To stay competitive in a challenging market place, product developers continuously strive to reduce time to market, increase system integration and deliver enhanced product features. We deliver business advantage to our customers by offering system-level demonstration solutions that incorporate several u-blox components and related software. This utilizes synergies only available when using multiple u-blox products together. Further, it brings reduced risk, faster time to market, and increased system integration to our customers. As examples, eCall needs both u-blox cellular and positioning technology, and a wireless gateway requires both an LTE module (e.g. TOBY-L2) and a Wi-Fi module (e.g. ELLA-W1) along with an appropriate software stack.

We provide design proposals for different markets and challenges using a variety of wireless and positioning technologies. This enables the quick creation of top-performing solutions using u-blox products. We do not compete with our customers, therefore the listed solution examples are not offered as commercial products.

Automotive Solutions

Telematics box (eCall / ERA-GLONASS / SVT):

Beginning in 2018, eCall will be a mandatory feature for each new car sold in the European Union. Simply combining an LTE Cat4 smart-modem (e.g. TOBY-L2) with an automotive dead reckoning positioning module (e.g. NEO-M8L) yields a fully functional telematics/eCall system. It makes use of GNSS tunneling, which is included on all cellular u-blox modules. The same system also enables the Russian ERA-GLONASS emergency response system and can be used for other core services, such as stolen vehicle recovery and remote diagnostics.

Vehicle to ecosystem communication (V2x):

In preparation for self-driving cars and vehicle-to-environment communication, this solution enables a car to directly communicate with a nearby hotspot or another car, and quickly exchange information. By using a THEO-P1 802.11p module and an automotive dead reckoning positioning product (e.g. NEO-M8L) it is possible to optimize traffic during rush hour and even avoid crashes.

Industrial Solutions

Usage based insurance device (ODB-II):

An insurance device can be implemented as an independent consumer installed unit, fitting into any vehicle's on-board diagnostics (ODB) port, and thus can support the business model of a usage based insurance offering. By combining a cellular module (2G, 3G or LTE Cat1 depending on deployment region) with an untethered dead reckoning product (e.g. NEO-M8U) with best-in-class performance under weak signals, the solution will deliver a constant and reliable data stream on car usage and driver behavior.

LTE gateways and wireless routers

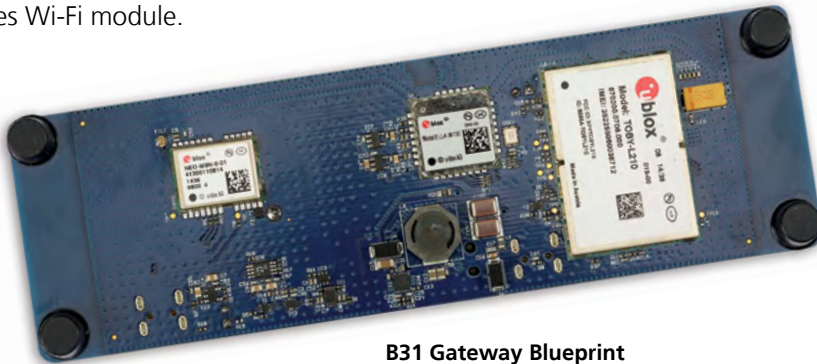
A u-blox wireless gateway solution is useful to developers of gateway solutions for professional markets, such as parking garage surveillance or road pricing. These solutions lead to shorter time to market and reduced risk thanks to a pre-integrated, validated and certified solution (hardware and software) as well as lower unit cost by exploiting the CPU and memory embedded in the module. In addition, such a solution delivers valuable features, such as voice, security, and antenna / RF co-existence.

The ideal solution for gateways and routers will contain an LTE Cat4+ module with a Wi-Fi module and will include as key features: LTE Cat4+ US, EMEA & APAC SKUs, 802.11 a/b/g/n/ac, 2.4GHz and 5GHz options, and RF co-existence between LTE and Wi-Fi.

Consumer Solutions

Mobile routers (Mi-Fi) and LTE access points

Increasingly, personal devices need access to the cloud wherever and whenever the user is located. The market for personal hotspots (so-called Mi-Fi devices) continues to grow, as do other examples of local internet connectivity, including cloud connected alarm panels and smart home or smart city devices. In such a device, a moderate bandwidth is usually deployed for the backhaul connection, such as a Cat1 (10 Mbps), or Cat4 (150 Mbps) LTE modem together with a local connection to a small number (up to 10) devices via a Wi-Fi modem. Suitable products from u-blox would be the TOBY-R2, or TOBY-L2 LTE modules paired with an ELLA-W1 series Wi-Fi module.



B31 Gateway Blueprint

u-blox already offers the B31 gateway blueprint as a solution. The PCB design includes LTE, Wi-Fi and optional GNSS modules. The software, which resides in the LTE modem, includes all necessary routing functions and provides a customizable html-based user interface together with a set of customizable GPIOs. External components are minimized leading to a very cost effective end-product.

Wearable devices (smart watches, fitness bands, glasses, infotainment)

The market for wearable devices is set to grow exponentially from the moderate volumes seen today in personal trackers (children, elderly people) and recreational devices (golfing, running, cycling). New high volume markets will include smart clothing, smarter watches (using speech and gesture interfaces with augmented reality) and personal infotainment devices such as lightweight glasses and interactive clothing.

Today, Bluetooth Smart local connectivity is commonplace and GNSS is becoming so. The upcoming deployment of LTE CAT-M and its low latency, low-cost, direct internet connection will enable faster and wider adoption of wearables. The smartphone "slab" in the user's back pocket will become a thing of the past. Key technical hurdles in this market are physical size, power consumption and cost. All of these are optimized by creating a holistic solution comprising Bluetooth, GNSS and LTE. Such solutions are already under development at u-blox, based on products such as NINA-B1 (Bluetooth Smart 4.1), EVA-7M (GNSS) and LARA-R2 (LTE Cat1).

Quality



Product design

A defining difference between u-blox and its close competitors lies in the company's core competency: u-blox is a cutting-edge semiconductor company with in-house IC design, test and quality operations. Many module vendors focus on packaging 3rd party chips into a module form factor, with no IC design know-how, or in-house control over the software stack. This fundamental difference means u-blox is in full control of its own product roadmap, features, quality and costs because we integrate our IP into our chips, including the software stack.

u-blox's sophisticated design flow adheres to state-of-the-art product development processes:

- **Requirements management** by structured tracing of requirements from our global market access and deep relationships with customers.
- **Technology development** for new key features and continual enhancement of features and functionality.
- **Frequent review of product development program** assures efficient use of R&D resources for successful products.
- **Structure product life cycle process** assures a stage by stage development of a product, with defined qualification criteria at each stage.
- **Simulation and Characterization** of all semiconductor designs to insure compliancy with functionality and performance.
- **Risk management** as standard procedure for all product development projects for minimizing time delays.
- **Chip design for test and assembly** to maximize quality and yield.
- **Failure Modes and Effects Analysis (FMEA):** Early identification of potential failures to determine actions to increase detection and reduce occurrence.
- **Design verification** before tape-out through simulation and integrity testing.
- **Built-in Self Test (BIST)** to accelerate testing of complex System-on-Chip designs, increase coverage and lower testing costs.
- **Environmental stress tests:** u-blox has invested millions in in-house testing equipment to simulate years of product operation in the field and identify causes of failure mechanisms.
- **Testing of firmware** fully automated hardware-in-the-loop continuous integration.

Customers can depend on u-blox for high-quality, cost-effective, reliable chip and modules with full confidence that the entire product definition, production, test and quality processes are under u-blox control.

u-blox quality system

u-blox has earned an industry-wide reputation as a best-in-class vendor of high-quality, reliable integrated circuits (ICs) and modules for the Automotive, Industrial and Consumer markets. We have achieved this distinction through a systematic, multi-pronged approach that emphasizes quality at every phase of our product's life cycle. This encompasses product development, prototyping, qualification, manufacturing and delivery.

u-blox quality philosophy is supported by five main pillars:

- **Understand and fulfill our customers' needs**

We strive to understand our customers' evolving design and quality requirements, and keep pace with their innovation cycles.

- **Continuous improvement**

We continuously improve our quality, product features, and cost-efficiency through cutting-edge design innovation, expansion and acquisition of know-how.

- **World-class partners**

u-blox operates as a fabless IC and module design-house, utilizing high-volume, state-of-the-art fabrication and packaging partners that adhere to the highest manufacturing standards.

- **Committed employees**

u-blox's leading technology, quality and reliability depends on our corporate environment that fosters teamwork, enthusiasm and dedication of our employees.

- **Environmental and social commitment**

u-blox is committed to environmental excellence and meeting or exceeding regulatory requirements with respect to the use of hazardous substances (e.g. RoHS, ELV, REACH compliancy etc.). All of our contract manufacturers are ISO 14001 certified. u-blox is also a signatory to the UN Global Compact meaning we comply with sustainable production, environmental friendliness as well as with human-rights and anti-corruption principles.



Our global quality program covers all aspects of our organization including R&D, module and IC manufacturing, testing, supply chain, and ultimately timely delivery to our global customers. The program spans a multi-continent manufacturing chain that includes semiconductor fabrication and assembly in Asia, module assembly in Europe and Asia and independent stock points in America, Europe and Asia.

We adhere to the industry's strictest standards. Our design-centers and manufacturing sites are dedicated to ISO/TS 16949, ISO 9001, ISO 14001 and ISO/IEC 80079-34 quality standards.

We are an established automotive supplier. u-blox has been a preferred vendor to the global automotive markets for many years, supplying key electronic components to many of the world's most prestigious car brands. To achieve this distinction, all our manufacturing sites are ISO/TS 16949 automotive certified.

- Our modules are ISO 16750 qualified and Automotive End of Life (ELV) compliant.
- Our automotive ICs are JESD47 and AEC-Q100 qualified.
- We are committed to meet automotive service levels as required by our customers.

Customer satisfaction through structured life cycle management

- **We maintain a well-planned, transparent product roadmap** that we develop with and share with our customers. We focus not only on our customer's current generation of products, but look at their product evolution years into the future. We make sure our product innovation and ease of upgrade are in-sync with our customer's evolving designs.
- **We communicate regularly with our customers** via a well-managed, customer-friendly Product change notification (PCN) process based on a comprehensive in-house CRM system.
- **Our End-of-life (EOL) process is a smoothly implemented procedure** that gives our customer sufficient time to place all-time-buys, while providing them with a clear upgrade path to our next generation product.

- **We address customer concerns through detailed reporting** in order to quickly analyze and solve any nonconformity or product quality issues.

u-blox modules: the highest quality on the market

Our modules have the highest quality level in the industry. Our qualification process includes stress tests such as temperature cycling, mechanical shock and vibration tests. Most of those tests are done at our laboratory facilities and are performed as stipulated in the ISO 16750 standard: Road vehicles – environmental conditions and testing for electrical and electronic equipment installed in automobiles.

Extensive software tests with GNSS, GSM, UMTS, LTE & CDMA simulators as well as challenging real-world environments around the world are carried out to make sure that our products perform to the high level of quality we and our customers expect.

Manufactured in an automatic assembly line, every u-blox module undergoes thorough production testing with maximum test coverage. This includes a full detection and processing path, from antenna input to data output. X-ray examination is performed on every module to identify and eliminate units with potentially faulty solder joints.

- 6 weeks safety stock of finished products at three different inventory locations.
- 2 month safety stock for all components.
- 1 month safety stock of wafers.
- Long-term committed production capacity from our contract manufacturers.

Zero defect policy

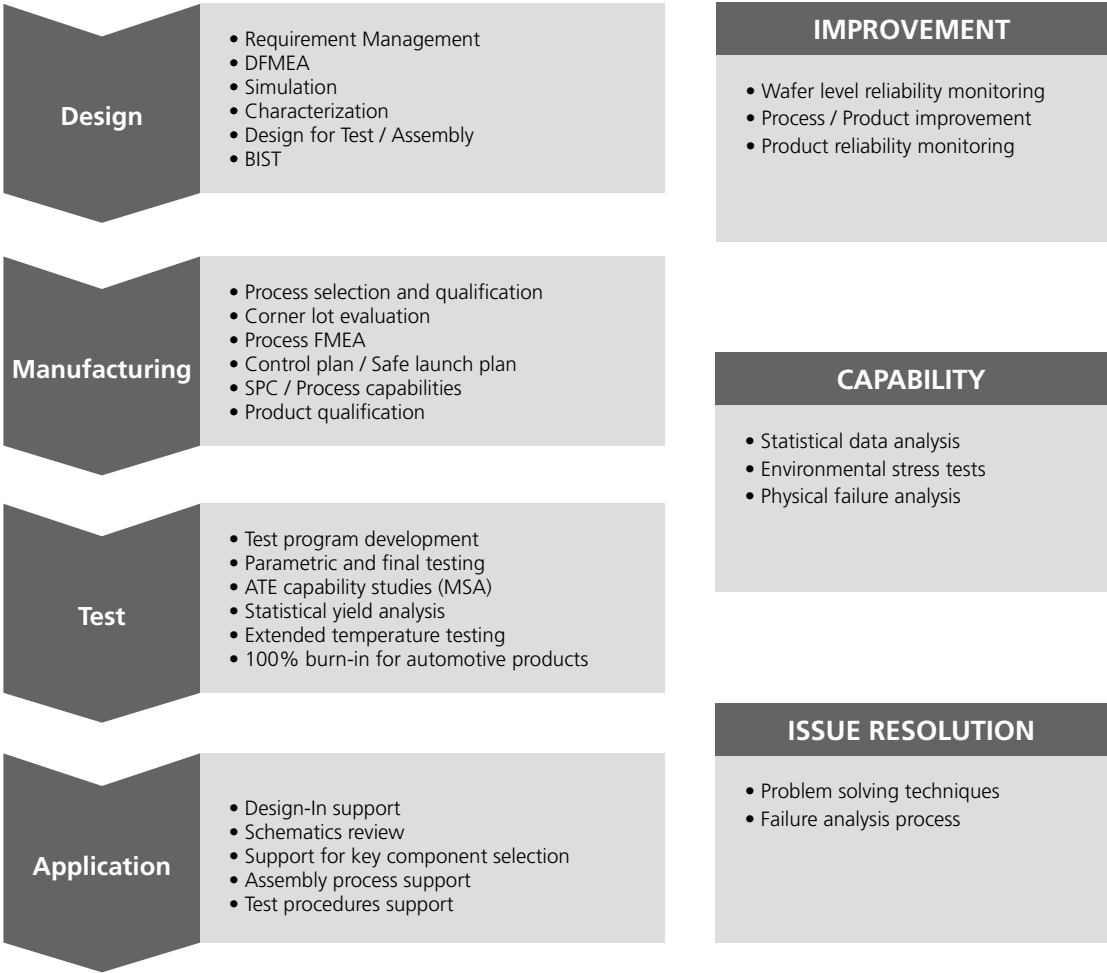
We work exclusively with world-class semiconductor fabrication partners that use the most reliable technologies to manufacture our chips. Our collaborative approach creates synergies, leveraging our product know-how and our partners' manufacturing expertise. This allows us to optimize our design, test and manufacturing processes in line with our zero defect strategy.

Our in-house team of highly-specialized Test and Production Engineers develop and verify all chip and module tests in-house before installation at mass-production assembly and testing facilities.

u-blox automotive-grade modules are qualified according to ISO 16750 which provides guidance regarding environmental conditions encountered by electrical and electronic in-car systems.

Our chip production process includes 100% wafer sorting, packaging, as well as 100% final testing. Our automotive-grade integrated circuits (ICs) are qualified according to AEC-Q100, the automotive standard that includes the requirements of the common JEDEC standard JESD47 for ICs.

Qualification tests are performed at our laboratory facilities following the zero defects flow for automotive grade semiconductors (see diagram below).



Zero defects flow diagram

Supply reliability

Packaging and delivery

u-blox delivers chips and modules packed into reels which are, in turn, packed into ESD (Electrostatic Sensitive Device) and moisture-shielding bags. Sample deliveries are packed onto trays and are also packaged into ESD and moisture-shielding bags.

Products are delivered on reels that are dry-sealed into ESD and moisture-shielding bags that come with detailed care instructions about moisture sensitivity levels and maximum factory floor times.

For Europe, Middle East, Africa and Asia Pacific regions, samples of modules are shipped from our headquarters in Switzerland or assembly center in Austria and chip-sets are sent from the Philippines. For the Americas, all shipments, regardless of quantity, are sent from our US headquarters in Reston, Virginia, USA.

Samples and pre-production quantities can be purchased directly from our online shop:

www.u-blox.com/online-shop

u-blox: a reliable supplier

Manufacturing quality products is only half the game. Delivering the right product in the right quantity at the required time is crucial for our customer's success. That is why we go to extreme measures to ensure that our products get to our customers when they need them.

We achieve this through multiple safety measures:

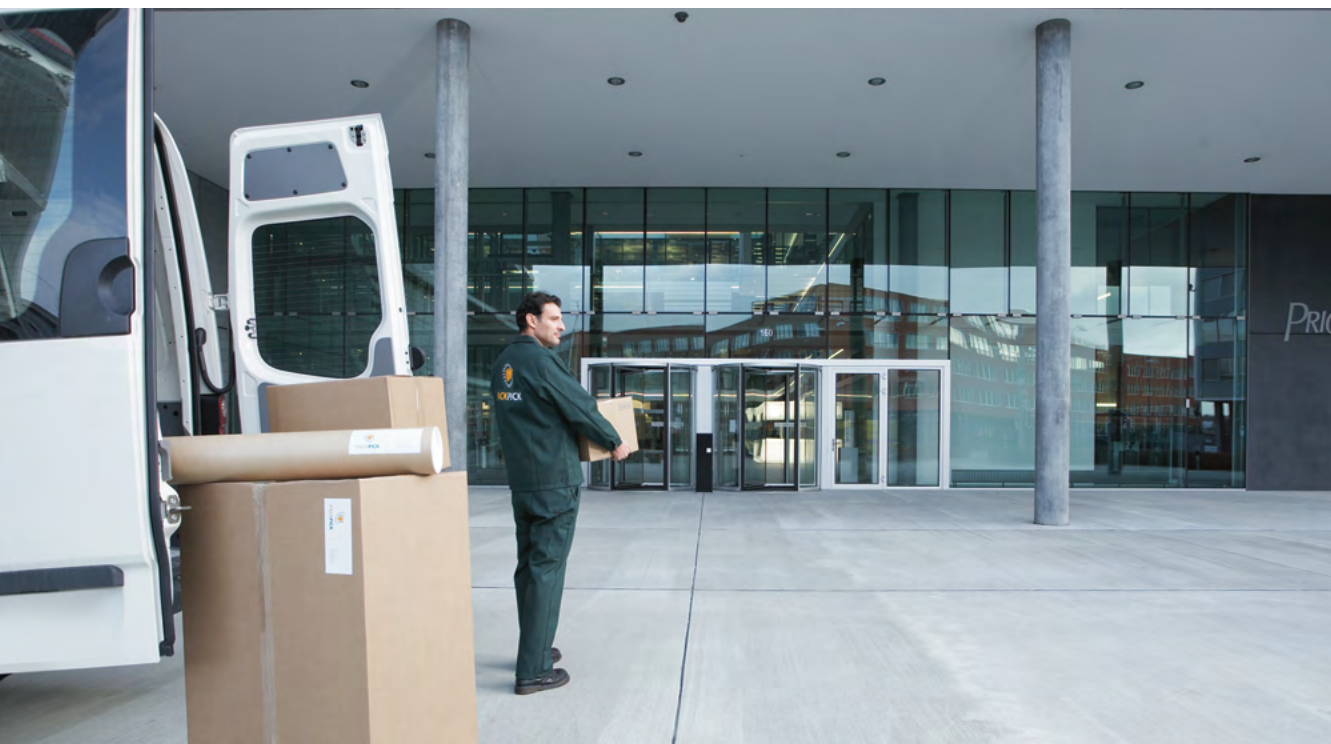
- We perform long-term capacity planning for modules and ICs 12 months into the future.
- Short term "Just-in-time" delivery planning for modules is performed weekly.

To make sure that all subcomponents for our products are available on time, our safety stock concept includes:

- 6 weeks safety stock of finished products at three different inventory locations.
- 2 month safety stock for all components.
- 1 month safety stock of wafers.
- Long-term committed production capacity from our contract manufacturers.

Our benefits:

- Excellent service level: our target is 98.5% of all delivery requests met
- Very short delivery lead time
- Flexible, responsive delivery for small, medium and high capacity requirements
- Total customer satisfaction



Markets and application sectors



Automotive

Positioning & wireless communications are at the heart of new in-vehicle services

Navigation is a standard feature in most cars of today. But getting drivers to where they want to go is just the beginning. u-blox's robust positioning and wireless components allow designers to put a whole new array of helpful and entertaining features as well as critical emergency services at the driver's fingertips. Features such as an automated trip advisor that instantly downloads details about the driver's surroundings to inform of live traffic and parking conditions, special attractions, hotels, service stations and restaurants along the route. Assistance can automatically be summoned in the event of an accident, emergency or breakdown, through built in eCall/ERA-GLONASS functions or any proprietary service.

Insurance, vehicle recovery and automotive "black-box" based on GNSS positioning

The ability to recover stolen vehicles is becoming a hot global issue. u-blox's ultra small, yet highly sensitive positioning solutions combined with wireless connectivity provide the perfect solution to this growing problem. Additionally, in-vehicle positioning can also be used to record location, speeds, and acceleration for use in insurance telematics applications that may dramatically reduce the insurance costs of drivers and reduce fraud.



**Recommended
product grade**

Professional

Automotive

Industrial

Machine-to-machine communications (M2M)

Our GSM, UMTS, CDMA and LTE modules support a diverse range of machine-to-machine applications such as remote industrial automation, mobile monitoring and control for health services, smart energy management and automatic meter reading. u-blox comprehensive cellular product portfolio includes solutions for wireless security systems, POS terminals and vending equipment monitoring. Our 3G and 4G modems support high-bandwidth applications such as car infotainment systems and mobile computing devices where high-speed wireless internet connection is essential.

Fleet management and asset tracking

Keeping accurate track of valuable assets via satellite positioning and wireless connectivity streamlines your supply chain. Whether for fleet management, vehicle recovery, locating people or shipments, u-blox has the right embedded solutions that combine high-sensitivity, small size and low power consumption with industrial temperature range. u-blox's asset tracking solutions let you combine satellite positioning with the power to communicate over the world's largest 2G, 3G and 4G networks.

Precision Timing

Our GNSS technology provides a precision reference clock accurate to 15 billionth of a second to support time-critical applications such as synchronization of distributed computer systems, mobile base-stations and femtocells.

**Recommended
product grade**

Standard

Professional

Automotive



Consumer

Location awareness

Embedded in navigation systems, mobile phones, cameras, tablets, notebooks and recreational devices, our positioning and wireless components enable devices to guide you to your destination, find your friends, your car, useful services and points of interest that are relevant to where you are, and where you are going.

Portable positioning and wireless for safety and recreation

Our products are used in a growing range of handheld tracking and recreational devices such as child and pet locators, golf range-finder, jogging, marine and fishing equipment. Whether for fun or for safety, u-blox's highly-integrated, ultra-sensitive positioning and wireless modules, chipsets, and services enable consumer devices to keep you aware of the world around you, no matter where you are. Our wireless modules also allow cost-effective, high-speed mobile connection to the internet.



**Recommended
product grade**

Standard

Professional

Products



Overview

Embedded products for wireless communications and global positioning

Our market-proven products can be found in demanding automotive and industrial applications, as well as in mobile and handheld consumer devices where size and power consumption are critical.

Combining industry-leading robustness, sensitivity, quality and performance with innovative features and packaging, u-blox offers the right products, software and solutions to suit your designs.

Cellular modules (Page 22)

GSM/GPRS modules: 2.5G voice and data modules

UMTS/HSPA(+) modules: 3 – 3.75G voice and data modules

CDMA modules: CDMA2000 voice and data modules

LTE modules: 4G voice and/or data modules



Short range modules (Page 42)

Stand-alone modules: Bluetooth and Multiradio

Host-based modules: Multiradio and Wi-Fi



Position and time modules and antennas (Page 60)

Standard precision GNSS: Receiver modules and antennas

High precision GNSS: Receiver modules with high precision positioning

Dead Reckoning: Receiver modules with integrated Automotive/Untethered Dead Reckoning

Timing: Precision time and reference frequency modules



Position and time chips (Page 104)

Standard precision GNSS chips: Receiver chips

Dead reckoning chips: GNSS receiver chips with integrated Automotive Dead Reckoning

Timing: Precision time and reference frequency chips

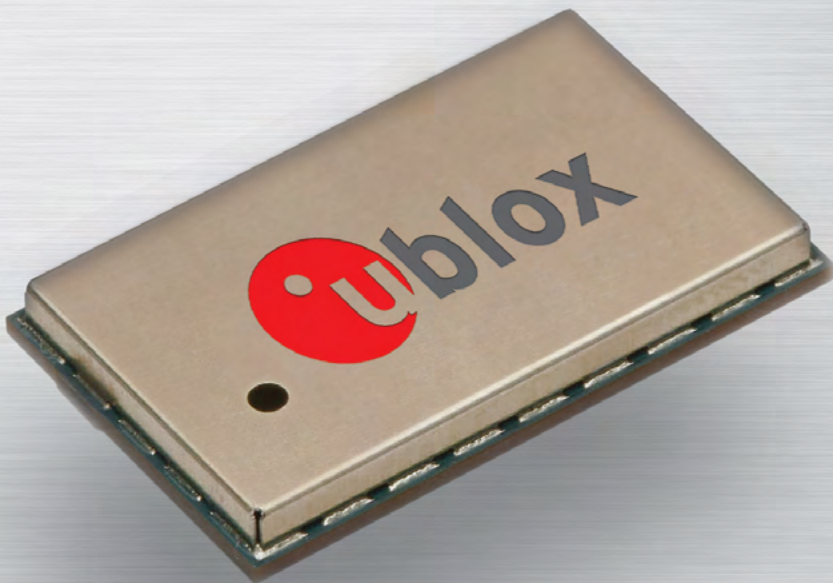


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Online Shop Europe

Cellular modules



GSM, UMTS, CDMA modules

Model	Region	Access Technology				Positioning		Interfaces		Audio		Features								Grade							
		GSM/GPRS bands	UMTS/HSPA [MHz]	CDMA [MHz]	Band data rates	GNSS via Modem	AssistNow Software	CellLocate®	eCall / ERA-GLONASS	UART	SPI	USB	GPIO	Analog audio	Digital audio	Antenna supervisor	Jamming detection	Embedded TCP/UDP	Embedded FTP/HTTP	Embedded SSL	FW update via serial	FOTA	Rx diversity	Dual stack IP4/IPv6	Standard	Professional	Automotive
GSM/GPRS modules																											
SARA-G300	Europe / APAC	D1			L					2										*							
SARA-G310	Global	Q			L					2										*							
SARA-G340	Europe / APAC	D1			L	*	*	*	*	2	4	1	1	*	*	*	*	*	*	*	*	*	*				
SARA-G350	Global	Q			L	*	*	*	*	2	4	1	1	*	*	*	*	*	*	*	*	*	*				
SARA-G350 ATEX	Global	Q			L	*	*	*	*	2	4	1	1	*	*	*	*	*	*	*	*	*	*				
UMTS/HSPA(+) and CDMA modules																											
SARA-U201	Global	Q	800,850,900,1900,2100		M	*	*	*	*	1	1	9		1	*	*	*	*	*	*	*	*	*				
SARA-U201 ATEX	Global	Q	800,850,900,1900,2100		M	*	*	*	*	1	1	9		1	*	*	*	*	*	*	*	*	*				
SARA-U260	N. & S. America	D2	850,1900		M	*	*	*	*	1	1	9		1	*	*	*	*	*	*	*	*	*				
SARA-U270	Europe / APAC	D1	900,2100		M	*	*	*	*	1	1	9		1	*	*	*	*	*	*	*	*	*				
SARA-U270 ATEX	Europe / APAC	D1	900,2100		M	*	*	*	*	1	1	9		1	*	*	*	*	*	*	*	*	*				
SARA-U280	N. & S. America		850,1900		M	*	*	*	*	1	1	9		1	*	*	*	*	*	*	*	*	*				
LISA-U200	Global	Q	800,850,900,1700,1900,2100		M	*	*	*	*	1	1	1	14	2	*	*	*	*	*	*	*	*	*				
LISA-U201	Global	Q	800,850,900,1900,2100		M	*	*	*	*	1	1	1	14	2	*	*	*	*	*	*	*	*	*				
LISA-U230	Global	Q	800,850,900,1700,1900,2100		+	*	*	*	*	1	1	1	14	2	*	*	*	*	*	*	*	*	*				
LISA-U260	N. & S. America	Q	850,1900		M	*	*	*	*	1	1	1	14	2	*	*	*	*	*	*	*	*	*				
LISA-U270	Europe / APAC	Q	900,2100		M	*	*	*	*	1	1	1	14	2	*	*	*	*	*	*	*	*	*				
LISA-U200 FOTA	Global	Q	800,850,900,1700,1900,2100		M	*	*	*	*	1	1	1	14	2	*	*	*	*	*	*	*	*	*				
LISA-U201 FOTA	Global	Q	800,850,900,1900,2100		M	*	*	*	*	1	1	1	14	2	*	*	*	*	*	*	*	*	*				
LISA-C200	N. America			800,1900	R	*	*	*	*	1	1	5	1	1	*	*	*	*	*	*	*	*	*				
LISA-C210	Europe			450	R	*	*	*	*	1	1	5	1	1	*	*	*	*	*	*	*	*	*				

LTE and NB-IoT modules

Model	Region	Access Technology				Positioning	Interfaces				Audio	Features										Grade					
		GSM/GPRS bands	UMTS/HSPA [MHz]	LTE bands	Band data rates	GNSS via Modem AssistNow Software CellLocate®	UART	USB	HSIC	DDC	SDIO (Master)	GPI	Digital audio	VoLTE	Antenna supervisor	Jamming detection	Embedded TCP/UDP	Embedded FTP/HTTP	Embedded TLS 1.2	FW update via serial	FOTA	Rx diversity	Dual stack IP4/IP6	MIMO 2x2	Standard	Professional	Automotive
LTE modules																											
LARA-R204	N. America			4,13	C1	• • •	1	1	1	1	10	1	1	• • • • • • • • • •													
LARA-R211	Europe	D1		3,7,20	C1	• • •	1	1	1	1	10	1	1	• • • • • • • • • •													
TOBY-R200	N. America	Q	850,900,1900,2100	2,4,5,12	C1	• • •	1	1		1	10	1	1	• • • • • • • • • •													
TOBY-R201	N. America		850,1900	2,4,5,12,13	C1	• • •	1	1		1	10	1	1	• • • • • • • • • •													
TOBY-R202	N. America		850,1900	2,4,5,12	C1	• • •	1	1		1	10	1	1	• • • • • • • • • •													
TOBY-L200	N. America	Q	850,900,1700,1900,2100	2,4,5,7,17	C4		1	1		1	14	1	1	• • • • • • • • • •													
TOBY-L201	N. America		850,1900	2,4,5,13,17	C4		1	1		1	14	1	1	• • • • • • • • • •													
TOBY-L210	Europe / APAC	Q	850,900,1900,2100	1,3,5,7,8,20	C4		1	1		1	14	1	1	• • • • • • • • • •													
TOBY-L220	Japan		850,900,2100	1,3,5,8,19	C4		1	1		1	14	1	1	• • • • • • • • • •													
TOBY-L280	APAC / S. America	Q	850,900,1900,2100	1,3,5,7,8,28	C4		1	1		1	14	1	1	• • • • • • • • • •													
MPCH-L200	N. America	Q	850,900,1700,1900,2100	2,4,5,7,17	C4		1							• • • • • • • • • •													
MPCH-L201	N. America		850,1900	2,4,5,13,17	C4		1							• • • • • • • • • •													
MPCH-L210	Europe / APAC	Q	850,900,1900,2100	1,3,5,7,8,20	C4		1							• • • • • • • • • •													
MPCH-L220	Japan		850,900,2100	1,3,5,8,19	C4		1							• • • • • • • • • •													
MPCH-L280	APAC / S. America	Q	850,900,1900,2100	1,3,5,7,8,28	C4		1							• • • • • • • • • •													
NB-IoT modules																											
SARA-N203	Global			5,8,20	C5		1		1	2				•	u				•	•							

D1 = Dual-band 900/1800 MHz
D2 = Dual-band 850/1900 MHz
Q = Quad-band

C1 = LTE Cat. 1 (10 Mb/s download, 5 Mb/s upload)
C3 = LTE Cat. 3 (100 Mb/s download, 50 Mb/s upload)
C4 = LTE Cat. 4 (150 Mb/s download, 50 Mb/s upload)
C5 = NB-IoT Cat NB1 (<227 kb/s download, <21 kb/s upload)

L = GPRS (85.6 kb/s)
R = 1xRTT (153 kb/s down and up)
M = 7.2 / 5.76 Mb/s down and up
+ = 21.1 / 5.76 Mb/s down and up

u = Only UDP/IP supported
f = in future firmware version

SARA-G3 series

GSM/GPRS modules

Standard

Professional

Automotive

Highlights

- GSM/GPRS functionality scalable to customer needs
- Seamless drop-in migration from SARA-U UMTS/HSPA modules
- Smallest footprint; lowest standby current: < 0.90 mA
- Extended temperature range: -40 to +85°C
- Simple integration of u-blox GNSS and A-GNSS
- CellLocate®: location based on cellular network
- Manufactured in ISO/TS 16949 certified production sites



SARA-G3 series
16.0 x 26.0 x 2.4* mm

Product description

The SARA-G3 series of GSM/GPRS modules feature extremely low power consumption and a miniature LGA form factor. SARA-G3 modules are interchangeable, and have been designed with the diverse needs of M2M customers in mind. Different functionalities and feature sets are available to meet different customer and application requirements.

SARA-G340/G350 are full-feature GSM/GPRS modules with a comprehensive feature set, including an extensive set of internet protocols (TCP, UDP, HTTP, FTP and SMTP). They have fully integrated access to u-blox GNSS positioning chips and modules, along with embedded A-GNSS (AssistNow Online and AssistNow Offline) functionality. SARA-G350 is the quad-band version for global connectivity and SARA-G340 (900/1800 MHz) is the dual-band version for cost optimized use in Europe and Asia. Their rich feature set enables customers to easily develop a wide range of M2M devices with minimum software development on the host processor.

SARA-G300/G310 modules target high volume, cost sensitive applications, and provide “bit pipe” GSM/GPRS functionalities while minimizing the customer’s total cost of ownership. Functionalities requiring dedicated and expensive hardware components are eliminated where they are not needed or can be implemented in the host processor.

The SARA-G350 ATEX is an ATEX / IECEx certified variant that further complements the product family by offering the ideal solution for the development of smart devices deployed in potentially explosive environments.

u-blox cellular modules are certified and approved by the main regulatory bodies and operators. RIL software for Android and Embedded Windows are available free of charge. SARA-G3 modules are manufactured in ISO/TS 16949 certified sites. Each module is tested and inspected during production. The modules are qualified according to ISO 16750 – Environmental conditions and electrical testing for electrical and electronic equipment for road vehicles.

Product selector

Model	Bands	Positioning	Interfaces	Audio	Features	Grade
	GSM/GPRS quad-band GSM/GPRS dual-band (900/1800 MHz)	GNSS via Modem AssistNow Software CellLocate®	UART GPIO DDC for u-blox GNSS	Analog Audio Digital Audio	Network indication Antenna Supervisor Jamming Detection Embedded TCP/UDP Embedded FTP, HTTP, SMTP Embedded SSL Dual stack IPv4/IPv6 FW update via serial interface eCall / ERA-GLONASS Low power idle-mode ATEX certification	Standard Professional Automotive
SARA-G300	•		2		•	
SARA-G310	•		2		•	
SARA-G340	•	• • •	2 4 1	• •	• • • • • • • • • •	
SARA-G350	•	• • •	2 4 1	• •	• • • • • • • • • •	
SARA-G350 ATEX	•	• • •	2 4 1	• •	• • • • • • • • • •	

* Module height is 2.4 mm from version 02 onwards (3 mm in version 01)

Features

GSM	GSM 850/900/1800/1900 MHz ¹ GSM 900 /1800 MHz ² 3GPP Release 99
GPRS	GPRS Class 10, CS1-CS4 - up to 85.6 kb/s PBCCH support
CSD	GSM max 9.6 kb/s
AT Commands	3GPP 27.005, 3GPP 27.007 u-blox AT command extension 3GPP 27.010 MUX protocol
SMS	MT/MO Text/PDU mode
Firmware upgrade	Via UART
SARA-G340/G350 only:	
Voice	HR / FR / EFR / AMR Echo cancellation Noise reduction
Protocols	Embedded TCP/IP, UDP/IP, HTTP/FTP, SSL and TLS 1.2 support
Network	Jamming detection
GNSS Interfaces	Direct access to u-blox GNSS via module AssistNow software for faster acquisition CellLocate® & Hybrid Positioning
Special features	In-band modem Bearer Independent Protocol (BIP) IPv6 support over PPP eCall and ERA-GLONASS support

¹ SARA-G310/G350

² SARA-G300/G340

Package

96 pin LGA: 16.0 x 26.0 x 2.4* mm, < 3 g

* Module height is 2.4 mm from version 02 onwards (3 mm in version 01)

Environmental data, quality & reliability

Operating temperature -40 to +85°C (extended range)

RoHS compliant (lead-free)

Qualification according to ISO 16750

Manufactured in ISO/TS 16949 certified production sites

ATEX / IECEx certification (SARA-G350 ATEX)

Certifications and approvals

SARA modules offer a comprehensive set of regulatory certifications and approvals, including R&TTE, GCF, PTCRB, FCC, IC, NCC, ICASA, and Anatel. Contact your closest u-blox representative for latest approvals.

Electrical data

Power supply	3.00 to 4.50 V (extended)
Power consumption	Power Off: < 40 µA Idle mode ⁴ : < 0.9 mA Idle mode ⁵ : < 5.0 mA Connected: < 250 mA

⁴ SARA-G300 and SARA-G310: requires external 32 kHz signal

⁵ SARA-G300 and SARA-G310: without external 32 kHz signal

Support products

EVK-G35	Evaluation Kit for SARA-G340/G350
EVK-G31	Evaluation Kit for SARA-G300/G310
RIL software	Android 2.3 and 4.x Embedded Windows 6.x 7.x

Interfaces

Common to all modules:

Antenna	50 Ω SMT pad
Serial Port	1 UART for data and AT commands 1 UART for AT commands, tracing, and FW update
SIM	1.8V and 3V
SARA-G340/G350 only:	
GPIO	4, controllable over AT commands
GNSS serial	1 DDC (I2C)
Audio	1 analog 1 digital (I2S/PCM)

Product variants

SARA-G300	Cost optimized dual-band (900/1800 MHz) GSM/GPRS data module
SARA-G310	Cost optimized quad-band GSM/GPRS data module
SARA-G340	Dual-band (900/1800 MHz) GSM/GPRS module, extended feature set
SARA-G350	Quad-band GSM/GPRS module, extended feature set
SARA-G350 ATEX	Quad-band GSM/GPRS module, ATEX/IECEx certified

* Module height is 2.4 mm from version 02 onwards (3 mm in version 01)

SARA-U2 series

UMTS/HSPA modules

Standard

Professional

Automotive

Highlights

- UMTS/HSPA/GSM module in ultra-small LGA package
- Also available in cost-effective UMTS/HSPA-only variant
- Seamless drop-in migration from SARA-G GSM/GPRS modules
- Extended temperature range: -40 to +85°C
- Low idle mode current
- Simple integration of u-blox GNSS and A-GNSS
- CellLocate®: (indoor) positioning based on cellular network
- Manufactured in ISO/TS 16949 certified production sites



SARA-U2 series
16.0 x 26.0 x 3.0 mm

Product description

SARA-U2 UMTS/HSPA modules provide efficient and cost-effective high-speed mobile connectivity in an ultra-small LGA form factor. The SARA-U2 series offers seamless drop-in migration from GSM (SARA-G3 modules) and CDMA (LISA-C modules) as well as easy migration to LTE (TOBY-L modules).

SARA-U2 modules feature HSPA data-rates of 7.2 Mb/s (downlink) and 5.76 Mb/s (uplink). The modules have an extended operating temperature range of -40 to +85 °C, low power consumption, and a rich feature set including dual-stack IPv4 / IPv6.

The SARA-U2 series is ideal for a wide range of industrial and consumer applications, such as connected navigation systems, mobile-internet devices, security and surveillance systems, eCall, fleet management, metering, anti-theft systems, and other automotive applications.

SARA-U2 modules provide a fully integrated interface to u-blox satellite positioning chips and modules to support telematics applications.

The SARA-U2 series includes variants supporting a combination of global bands and band combinations for North America and Europe/Africa/Asia. There is also a cost-saving UMTS-only variant for North America.

An extensive set of national regulatory and operator certificates is available. RIL software for Android and Embedded Windows is available free of charge.

SARA-U2 modules are manufactured in ISO/TS 16949 certified sites. Each module is tested and inspected during production. The modules are qualified according to ISO 16750 – Environmental conditions and electrical testing for electrical and electronic equipment for road vehicles.

Product selector

Model	Regions	Bands	Positioning	Interfaces	Audio	Features	Grade																		
		UMTS/HSPA [MHz]	GPRS/EDGE [MHz]	GNSS via Modem	AssistNow Software	CellLocate®	UART	SPI	USB 2.0	GPIO	DDC for GNSS / I²C slave	Analog Audio	Digital Audio	Antenna Supervisor	Jamming Detection	Embedded TCP/UDP	Embedded HTTP, FTP	Embedded SSL	FW update via serial	eCall / ERA-GLONASS	ODIS	Dual stack IPv4/IPv6	Standard	Professional	Automotive
SARA-U201	Global	800/850/900/1900/2100	Q	• • •	1	1	9	1	1	• • • • • • • • •	1	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •
SARA-U201 ATEX	Global	800/850/900/1900/2100	Q	• • •	1	1	9	1	1	• • • • • • • • •	1	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •
SARA-U260	N./S. America	850/1900	D2	• • •	1	1	9	1	1	• • • • • • • • •	1	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •
SARA-U270	Europe / APAC	900/2100	D1	• • •	1	1	9	1	1	• • • • • • • • •	1	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •
SARA-U270 ATEX	Europe / APAC	900/2100	D1	• • •	1	1	9	1	1	• • • • • • • • •	1	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •
SARA-U280	N./S. America	850/1900		• • •	1	1	9	1	1	• • • • • • • • •	1	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •	• • • • • • • • •

Q = Quad-band

D1 = Dual-band 900/1800 MHz

D2 = Dual-band 850/1900 MHz

Features

UMTS/HSPA	850/1900 and 900/2100 MHz 800/850/900/1900/2100 MHz 3GPP Release 7 5.76 Mb/s uplink, 7.2 Mb/s downlink
GSM	GSM 850/1900 and 900/1800 MHz Quad-band, 850/1900, 900/1800 MHz
GPRS	Class 12, CS1-CS4, up to 85.6 kb/s
EDGE	Class 12, MCS1-9, up to 236.8 kb/s
CSD	GSM max 9.6 kb/s UMTS max 64 kb/s
SMS	MT/MO PDU / Text mode
Voice	HR/FR/EFR/AMR/AMR-WB Echo cancellation and noise reduction

Package

96 pin LGA: 16.0 x 26.0 x 3.0 mm, < 3 g

Environmental data, quality & reliability

Operating temperature -40 to +85°C (extended range)
RoHS compliant (lead-free)
Qualification according to ISO 16750
Manufactured in ISO/TS 16949 certified production sites

Software features

Protocols	Dual stack IPv4/IPv6 Embedded TCP/IP, UDP/IP HTTP/FTP/SSL (Secure Socket Layer) SSL TLS 1.2 (for embedded TCP/IP) Ethernet over USB eSIM and Bearer-Independent-Protocol
Network	Jamming detection
GNSS Interfaces	Direct access to u-blox GNSS via SARA AssistNow software for fastest GNSS Time-to-First-Fix CellLocate® & Hybrid Positioning
Emergency calling	E911 (USA) European eCall, eMLPP
Other	ODIS feature for AT&T (only for SARA-U201) Protect network from excessive signaling traffic
Firmware upgrade	Via UART and USB

Certifications and approvals

SARA-U201:	PTCRB, GCF, FCC, IC, R&TTE, RCM, Anatel, AT&T, Rogers (all planned)
SARA-U260, U280:	PTCRB, GCF, FCC, IC, AT&T
SARA-U270:	CCC, GCF, PTCRB, R&TTE, NCC (Taiwan), RCM (Australia), KCC (Korea), ATEX

Electrical data

Power supply	3.3 V to 4.4 V
Power consumption	
Power Off	65 µA
Idle (2G)	0.9 mA
Idle (3G)	0.9 mA
GPRS	215 mA (850 MHz, 900 MHz) 140 mA (1800 MHz, 1900 MHz)
HSDPA	580 mA
HSPA	460 mA

Support products

EVK-U201SARA	Evaluation kit specifically for SARA-U201
EVK-U26 / EVK-U27	Evaluation kits for SARA-U2 series
RIL software for	Android Embedded Windows 6.x, 7.x Windows Mobile 6.5
USB driver	Embedded Windows 6.x, 7.x Windows XP, Vista, 7, 8, 10 Windows Mobile 6.5

Interfaces

GPIO	9 GPIO, controllable via AT commands
(U)SIM	Supports 1.8 V and 3 V, SIM toolkit
Serial	1 UART, 1 USB 2.0 (high-speed, 480 Mb/s), 1 DDC (I ² C) for GNSS and other I ² C slaves
Audio	1 digital

Product variants

SARA-U201	HSPA/GSM for global coverage
SARA-U201 ATEX	HSPA/GSM for global coverage; ATEX
SARA-U260	HSPA/GSM modules for America
SARA-U270	HSPA/GSM modules for Europe and Asia
SARA-U270 ATEX	HSPA/GSM modules for Europe; ATEX
SARA-U280	HSPA modules for America

LISA-U2 series

UMTS/HSPA(+) modules

Standard

Professional

Automotive

Highlights

- Worldwide W-CDMA(UMTS) and GPRS/EDGE coverage
- HSDPA 21.1 Mb/s, HSUPA 5.76 Mb/s
- SMT form factor, small foot-print
- Easy migration to u-blox GSM/GPRS, CDMA and LTE modules
- Low idle mode current: 1.3 mA
- Extended temperature range: -40 to +85°C
- Simple integration of u-blox GNSS and A-GNSS
- CellLocate®: location based on cellular network



LISA-U2 series
22.4 x 33.2 x 2.6 mm

Product description

With 6-band W-CDMA(UMTS) and quad-band GPRS/EDGE, LISA-U2 modules are suited for networks worldwide. Features include data-rates of up to 21.1 Mb/s (downlink), a rich set of internet protocols, very small footprint, very low power consumption and extended operating temperature range. LISA-U2 modules provide fully integrated access to u-blox positioning products. Antenna diversity permits LISA-U2 modules to provide the highest data speeds.

LISA-U2 modules are ideal for consumer/industrial applications requiring high-speed data transmission, and machine-to-machine applications. They are the perfect choice for mobile Internet terminals, tablets, in-car infotainment, connected navigation systems, security and surveillance systems, eCall, fleet management, metering, anti-theft systems, and other automotive applications.

The compact SMT package enables easy manufacturing, and migration from u-blox SARA, LEON, and other LISA modules is simple. This allows customers to take maximum advantage of their hardware and software investments, and provides very short time-to-market. An extensive set of national regulatory and operator certificates is available. RIL software for Android and Embedded Windows is available free of charge.

LISA-U2 modules are manufactured in ISO/TS 16949 certified sites. Each module is tested and inspected during production. The modules are qualified according to ISO 16750 - Environmental conditions and electrical testing for electrical and electronic equipment for road vehicles.

Product selector

Model	Technology		Bands		Positioning			Interfaces				Audio	Functions										Grade				
	HSUPA [Mb/s]	HSDPA [Mb/s]	UMTS/HSPA [MHz]	GPRS/EDGE quad-band	GNSS via Modem	AssistNow	Software CellLocate®	UART	SPI	USB	GPIO	DDC for u-blox GNSS	Analog Audio	Digital Audio	Network indication	Antenna Supervisor	Jamming Detection	Embedded TCP/UDP	Embedded HTTP, FTP	Embedded SSL	FOTA	FW update via serial	eCall / ERA-GLONASS	Rx diversity	Standard	Professional	Automotive
LISA-U200	5.76	7.2	800/850/900/1700/1900/2100	•	•	•	•	1	1	1	14	1	2		•	•	•	•	•	•		•	•				
LISA-U201	5.76	7.2	800/850/900/1900/2100	•	•	•	•	1	1	1	14	1	2		•	•	•	•	•	•		•	•				
LISA-U230	5.76	21.1	800/850/900/1700/1900/2100	•	•	•	•	1	1	1	14	1	2		•	•	•	•	•	•		•		•			
LISA-U260	5.76	7.2	850/1900	•	•	•	•	1	1	1	14	1	2		•	•	•	•	•	•		•					
LISA-U270	5.76	7.2	900/2100	•	•	•	•	1	1	1	14	1	2		•	•	•	•	•	•		•	•				
LISA-U200 FOTA	5.76	7.2	800/850/900/1700/1900/2100	•	•	•	•	1	1	1	14	1	2		•	•	•	•	•	•	•	•	•	•			
LISA-U201 FOTA	5.76	7.2	800/850/900/1900/2100	•	•	•	•	1	1	1	14	1	2		•	•	•	•	•	•	•	•	•	•			

Features

UMTS/HSPA	800/850/900/1700/1900/2100 MHz (Bands VI, V, VIII, IV, II, I) 3GPP Release 7 5.76 Mb/s uplink, 21.1 Mb/s downlink or 5.76 Mb/s uplink, 7.2 Mb/s downlink
GSM	GSM 850 / 900 / 1800 / 1900 MHz 3GPP Release 7, PBCCH support
GPRS	Class 12, CS1-CS4 - up to 86.5 kb/s
EDGE	Class 12, MCS1-9 - up to 236.8 kb/s
CSD	GSM max 9.6 kb/s UMTS max 64 kb/s
SMS	MT/MO PDU / Text mode
Voice	HR/FR/EFR/AMR/AMR-WB

Software features

Protocols	Embedded TCP/IP, UDP/IP HTTP/FTP/SSL (Secure Socket Layer) SSL TLS 1.2 (for embedded TCP/IP) Ethernet over USB eSIM and Bearer-Independent-Protocol
Network	Jamming detection
GNSS Interfaces	Direct access to u-blox GNSS via LISA AssistNow software for fastest GNSS Time-to-First-Fix CellLocate® & Hybrid Positioning
Emergency calling	E911 (USA) European eCall, eMLPP
Other	Protect network from excessive signaling traffic
Firmware upgrade	Via UART, USB, and SPI Via FOTA for 83S versions

Environmental data, quality & reliability

Operating temperature	-40 to +85°C (extended range)
RoHS compliant (lead-free)	
Qualification according to ISO 16750	
Manufactured in ISO/TS 16949 certified production sites	

Electrical data

Power supply	3.3 V to 4.4 V
Power consumption	
Power Off	55 µA
Idle (2G, DRX5)	1.3 mA
Idle (3G, DRX7)	1.7 mA
GSM Voice	175 mA (Bands II & III)
UMTS Voice	385 mA (Band V)
GPRS Data	175 mA (1 Tx slot, Bands II & III) 400 mA (4 Tx slots, Bands II & III)
HSPA	500 - 800 mA (depends on frequency band)

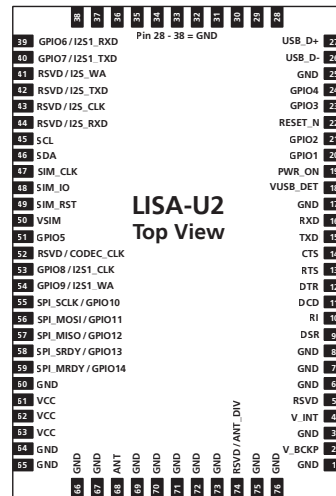
Interfaces

GPIO	Up to 14 GPIOs, configurable
(U)SIM	Supports 1.8 V and 3 V, SIM toolkit
Serial	1 UART, 1 SPI, 1 USB 2.0 (high-speed, 480 Mb/s)
Audio	2 digital

Package

76 pin LCC (Leadless Chip Carrier): 22.4 x 33.2 x 2.6 mm, < 7 g

Pinout



Certifications and approvals

GCF, R&TTE, PTCRB, FCC, IC, Giteki (Japan), RCM (Australia), CCC (China), NCC (Taiwan), KCC (Korea), IDA (Singapore), ANATEL (Brazil), ICASA (S. Africa)

AT&T, DoCoMo, Softbank, SKT, KT (S.Korea), Telstra (Australia), Vodafone, BellMobility, Telus, Rogers (Canada), ViVo (Brazil)

Support products

EVK-U20 / EVK-U23	Evaluation Kits for LISA-U2 series
RIL software	Android Embedded Windows 6.x, 7.x Windows Mobile 6.5
USB driver	Embedded Windows 6.x, 7.x Windows XP, Vista, 7, Windows Mobile 6.5

Product variants

LISA-U200	UMTS/HSPA, quad-band GPRS/EDGE, 800/850/900/1700/1900/2100 MHz
LISA-U201	UMTS/HSPA, quad-band GPRS/EDGE, 800/850/900/1900/2100 MHz
LISA-U230	UMTS/HSPA+, quad-band GPRS/EDGE, 800/850/900/1700/1900/2100 MHz
LISA-U260	UMTS/HSPA, quad-band GPRS/EDGE, 850/1900 MHz
LISA-U270	UMTS/HSPA, quad-band GPRS/EDGE, 900/2100 MHz
LISA-U200-83S	FOTA, UMTS/HSPA, quad-band GPRS/EDGE, 800/850/900/1700/1900/2100 MHz
LISA-U201-83S	FOTA, UMTS/HSPA, quad-band GPRS/EDGE, 800/850/900/1900/2100 MHz

LISA-C2 series

CDMA 1xRTT modules

Highlights

- CDMA 1xRTT module in LGA package for easy manufacturing
- Dual-band 800 MHz/1900 MHz and 450 MHz variants
- SMT form factor, extremely small foot-print
- Low power consumption
- Pin/pad compatible with u-blox GSM/GPRS, W-CDMA (UMTS) and LTE modules
- Simple integration of u-blox GNSS and A-GNSS
- USB 2.0 and serial interfaces (27.010 MUX support)
- Sprint, Verizon and Aeris approvals



LISA-C200
22.4 x 33.2 x 2.7 mm

Product description

The LISA-C2 series provides CDMA2000 1xRTT data and voice communication in a compact SMT form factor. These are fully qualified and certified modules, featuring low power consumption and a rich set of Internet protocols.

LISA-C2 modules are ideally suited to M2M applications such as fleet management, Automatic Meter Reading (AMR), people and asset tracking, surveillance and security and Point of Sales (PoS) terminals.

The LISA-C2 form factor is compatible with the LISA-U, TOBY, SARA and LEON module families, enabling straight-forward development of products supporting either CDMA,

UMTS/HSPA, LTE, or GSM/GPRS wireless technology with the same application board. This allows customers to take maximum advantage of their hardware and software investments.

The dual-band LISA-C200 modules are certified by Sprint, Verizon and Aeris. The LISA-C210, with 450 MHz band, will be certified according to R&TTED and CDMA certifications. Both variants are qualified according to ISO 16750 – Environmental conditions and electrical testing for electrical and electronic equipment for road vehicles.

Product selector

Model	Technology	Bands	Interfaces				Audio		Functions														Grade			
	CDMA 1xRTT [kb/s] (forward/reverse)	CDMA [MHz]	UART	SPI	USB	GPIO	DDC for u-blox GNSS		Analog Audio	Digital Audio	Network indication	Antenna Supervisor	Jamming Detection	Embedded TCP/IP, UDP/IP	Embedded FTP, HTTP	Embedded SSL	AssistNow software	CellLocate ®	FOTA	FW update via serial interface	eCall / ERA GLONASS	Rx diversity	GNSS via Modem	Standard	Professional	Automotive
LISA-C200	153	800/1900	1	1	5	•	1	1	•	•	•	•	•	•	•	•	S	•	•			•				
LISA-C210	153	450	1	1	5	•	1	1	•	•	•	•	•	•	•	•	•	•	•			•				

S = Sprint version only

Features

CDMA2000 1xRTT	LISA-C200: 800/1900 MHz (Sprint/Verizon) LISA-C210: 450 MHz, block designator C 153 kb/s forward/reverse
Voice	Analog / digital
SMS	Text mode
Carrier provisioning (LISA-C200)	Over the Air (Sprint) OTASP/OTAPA (Verizon)
GNSS Interfaces	Direct access to u-blox GNSS via LISA-C2, AssistNow software for faster acquisition

Software features

Protocols	Embedded UDP/IP, TCP/IP, HTTP and FTP
Network	OTA provisioning, software maintenance and device management (OTASP, OTAPA), OMA-DM / FOTA
AT commands	Enhanced AT command set IS-707.3 3GPP 27.005, 3GPP 27.007 and ITU-T V.25 u-blox proprietary AT commands 3GPP 27.010 MUX protocol
Firmware upgrade	Via UART and USB FOTA (LISA-C210 and LISA-C200 Sprint)

Interfaces

Antenna	50 Ω Antenna supervisor
Serial	1 UART (5-wire) 1 USB 2.0 (full-speed)
Audio	1 audio digital (PCM) interface 1 audio analog interface
GPIO	5

Electrical data

Power supply	3.3 V to 4.4 V
Power consumption	
Power Off	< 20 µA
Sleep mode	< 5 mA
Data traffic	< 750 mA

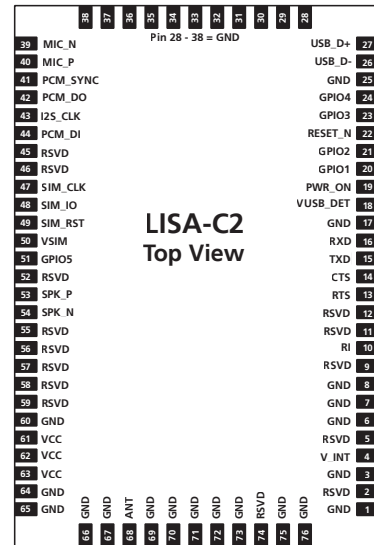
Certifications and approvals

FCC, IC, Sprint, Verizon, Aeris.
R&TTed, CCF
See the u-blox website for latest approvals.

Package

76 pin LCC (Leadless Chip Carrier): 22.4 x 33.2 x 2.7 mm, < 7 g

Pinout



Environmental data, quality & reliability

Operating temperature -30 to +85°C (extended range)
RoHS compliant (lead-free)
Qualification according to ISO 16750

Support products

EVK-C20-0xS	Evaluation Kit for LISA-C200 (Sprint)
EVK-C20-2xS	Evaluation Kit for LISA-C200 (Verizon)
EVK-C21-0xS	Evaluation Kit for LISA-C210

Product variants

LISA-C200	CDMA 2000 1xRTT 800/1900 MHz, data and voice • version for Sprint and Aeris • version for Verizon
LISA-C210	CDMA 2000 1xRTT 450 MHz, data and voice

TOBY-L2 series

Standard Professional Automotive

LTE/DC-HSPA+/GPRS modules

Highlights

- Powerful LTE module in LGA package, for easy manufacturing
- Highest throughput of up to 150 Mb/s with LTE Cat 4
- Variants for Americas, Europe-Africa, Asia-Pacific, and Japan
- Easy migration from u-blox W-CDMA, CDMA, GSM modules
- TOBY-L201 switches automatically between AT&T and Verizon



TOBY-L2 series
24.8 x 35.6 x 2.6 mm

Product description

TOBY-L2 series modules support multi-band LTE-FDD, along with DC-HSPA+ and GPRS/ EDGE in a very small LGA package.

With 3GPP Rel. 9 and LTE Cat 4, which provides data throughput up to 150 Mb/s, the modules are ideal for both industrial and consumer applications requiring the highest data-rates.

They are the perfect choice for vehicle infotainment systems, ruggedized mobile terminals, set top boxes, notebooks, tablets, as well as high-speed M2M applications such as digital signage, mobile health, remote security and video systems where backwards compatibility with 3G and 2G networks is desired.

The modules support Circuit-Switched-Fall-Back voice. They guarantee HSPA+ connectivity, also in areas that do not yet have LTE coverage.

The temperature range of -40 to +85 °C guarantees operation in harsh environments and in very compact designs.

The TOBY-L201 works on AT&T and Verizon networks and can switch between the operators, based on the SIM card used or via AT command.

The compact LGA package enables straightforward automated manufacturing. Easy migration from u-blox GSM/GPRS, HSPA and CDMA modules maximizes the investments of customers, simplify logistics, and have very short time-to-market.

TOBY-L2 modules are manufactured in ISO/TS 16949 certified sites, with the highest production standards and the highest quality and reliability. Each module is fully tested and inspected during production. Modules are qualified according to ISO16750 – for systems installed in vehicles.

USB drivers and RIL software for Android are free of charge.

Product selector

Model	Region	Access Technology						Interfaces				Audio	Features						Grade						
		3GPP Release Baseline		LTE FDD Category		LTE Bands	UMTS Bands	GSM Bands	MIMO	UART	USB 2.0	DDC	SDIO (Master)	GPIO	Analog audio	Digital audio	Antenna Supervisor	Jamming Detection *	Embedded TCP/UDP	Embedded HTTP, FTP, SSL	FOTA	Dual stack IPv4 / IPv6	Standard	Professional	Automotive
TOBY-L200	North America	9	4	2,4,5,7,17	850/900/AWS/1900/2100	Q	2x2	1	1	1	14		1	1	1	1	•	•	•	•	•	•			
TOBY-L201	North America	9	4	2,4,5,13,17	850/1900		2x2	1	1		1	14		1		1	•	•	•	•	•	•			
TOBY-L210	Europe / APAC	9	4	1,3,5,7,8,20	850/900/1900/2100	Q	2x2	1	1		1	14		1		1	•	•	•	•	•	•			
TOBY-L220	Japan	9	4	1,3,5,8,19	850/900/2100		2x2	1	1		1	14		1		1	•	•	•	•	•	•			
TOBY-L280	S.America / APAC	9	4	1,3,5,7,8,28	850/900/1900/2100	Q	2x2	1	1		1	14		1		1	•	•	•	•	•	•			

* Available in a subsequent firmware version Q = Quad-band

Features

LTE	Cat 4 (150 Mb/s DL, 50 Mb/s UL) 3GPP Release 9 FDD Bands: TOBY-L200: 2, 4, 5, 7, 17 (N. America) TOBY-L201: 2, 4, 5, 13, 17 (N. America) TOBY-L210: 1, 3, 5, 7, 8, 20 (EU/Asia/Africa) TOBY-L220: 1, 3, 5, 8, 19 (Japan) TOBY-L280: 1, 3, 5, 7, 8, 28 (APAC) All channel bandwidths: 1.4 - 20 MHz MIMO 2x2 Rx diversity
UMTS/DC-HSPA+	Bands (in MHz): TOBY-L200: 850/900/AWS/1900/2100 TOBY-L201: 850/1900 TOBY-L210: 850/900/1900/2100 TOBY-L220: 850/900/2100 TOBY-L280: 850/900/1900/2100 42 Mb/s downlink, 5.76 Mb/s uplink
GSM	Bands (in MHz): TOBY-L200: 850/900/1800/1900 TOBY-L210: 850/900/1800/1900 TOBY-L280: 850/900/1800/1900 GPRS & EDGE Class 12
SMS	MT/MO PDU / Text mode SMS over IMS and via SMS-C
Voice	CSFB Codec: HR/FR/EFR/AMR/AMR-WB Echo cancellation & noise reduction

Software features

Protocols	Dual stack IPv4 / IPv6 Embedded TCP/IP, UDP/IP HTTP/FTP/SSL (Secure Socket Layer) Bearer Independent Protocol (BIP)
Network	Jamming detection ¹
Wi-Fi interface	To ELLA-W1 module
Firmware upgrade	Via UART and USB Via FOTA

Interfaces

Serial	1 UART 1 USB 2.0 (high-speed, 480 Mb/s) 1 SDIO (Master)
GPIO	Up to 14 GPIOs, configurable
(U)SIM	Supports 1.8 V and 3 V, SIM toolkit
Audio	1 digital

¹ Available in a subsequent firmware version

Package

152-pin LGA (Land Grid Array): 24.8 x 35.6 x 2.6 mm, 4.8 g

Electrical data

Power supply	3.8 V nominal, range 3.4 V to 4.35 V
Consumption current	Connected mode LTE max power: 610 mA Idle mode: 1.1 mA

Environmental data, quality & reliability

Operating temperature -40 to +85°C (extended range)
RoHS compliant (lead-free)
Qualification according to ISO 16750
Manufactured in ISO/TS 16949 certified production sites

Certifications and approvals

TOBY-L200	PTCRB, GCF, FCC, IC, CE / R&TTE, AT&T, Anatel
TOBY-L201	PTCRB, GCF, FCC, IC, AT&T, Verizon
TOBY-L210	PTCRB, GCF, FCC, IC, CE / R&TTE, NCC, KCC (Korea), Giteki (Japan), Softbank (planned)
TOBY-L220	Giteki, DoCoMo (planned), Softbank (planned)
TOBY-L280	PTCRB, GCF, NCC, CE / R&TTE, RCM (Australia), Anatel (Brazil), Telstra (planned)

Support products

EVK-L2x	Evaluation Kits for TOBY-L2 series
RIL software	Available for Android
USB driver	Available for Embedded Windows 6.0, 7, 2013 and Windows 7, 8, 8.1, 10

Product variants

TOBY-L200	LTE/DC-HSPA+/GSM modules for North America Cat 4; LTE Bands 2, 4, 5, 7, 17
TOBY-L201	LTE/DC-HSPA+ modules for North America Cat 4; LTE Bands 2, 4, 5, 13, 17 Ability to switch between operators
TOBY-L210	LTE/DC-HSPA+/GSM modules for Europe, Asia Cat 4; LTE Bands 1, 3, 5, 7, 8, 20
TOBY-L220	LTE/DC-HSPA+ modules for Japan Cat 4; LTE Bands 1, 3, 5, 8, 19
TOBY-L280	LTE/DC-HSPA+/GSM modules for APAC, S. America Cat 4; LTE Bands 1, 3, 5, 7, 8, 28

MPCI-L2 series

Standard

Professional

Automotive

LTE/DC-HSPA+/GPRS Mini PCIe modules

Highlights

- Powerful LTE modules in industry-standard Mini PCIe package
- Highest throughput of up to 150 Mb/s with LTE Cat 4
- Variants for Americas, Europe, and APAC
- Industrial temperature range –40 to +85 °C
- Manufactured in ISO/TS 16949 certified production sites



MPCI-L2 series
30.0 x 51.0 x 3.7 mm

Product description

MPCI-L2 series modules support multi-band LTE-FDD, along with DC-HSPA+ and GPRS/EDGE.

With 3GPP Rel. 9 and LTE Cat 4, which provides data throughput up to 150 Mb/s, the modules are ideal for both industrial and consumer applications requiring the highest data-rates.

Typical applications are industrial computing, ruggedized terminals, video communication, wireless routers, alarm panels and surveillance, digital signage, and payment systems.

The temperature range of –40 to +85 guarantees operation in harsh environments, making the modules suitable for industrial applications.

The modules support DC-HSPA+ guaranteed connectivity, even in areas that do not yet have LTE coverage.

The industry standard Mini PCIe package enables easy integration onto an application board, and is also ideal for manufacturing of small series.

MPCI-L2 modules are manufactured in ISO/TS 16949 certified sites, with the highest production standards and the highest quality and reliability. Each module is fully tested and inspected during production.

The MPCI-L2 series comes in module variants for North America, Europe/ Asia/ Africa, APAC/ South America, and Japan.

USB drivers and RIL software for Android are free of charge.

Product selector

Model	Region	Access Technology						Interfaces					Audio	Features						Grade														
		3GPP Release Baseline		LTE FDD Category		LTE Bands		UMTS Bands (MHz)		GSM Bands		MIMO		UART	USB 2.0	DDC	SDIO (Master)		GPIO		Analog audio		Digital audio		Antenna Supervisor	Jamming Detection	Embedded TCP/UDP	Embedded HTTP, FTP, SSL	FOTA	Dual stack IPv4 / IPv6		Standard	Professional	Automotive
MPCI-L200	North America	9	4	2, 4, 5, 7, 17	850/900/AWS/1900/2100		quad-band	2x2		1														•	•	•	•	•						
MPCI-L201	USA	9	4	2, 4, 5, 13, 17	850/1900			2x2		1														•		•	•	•	•					
MPCI-L210	Europe/APAC	9	4	1, 3, 5, 7, 8, 20	850/900/1900/2100		quad-band	2x2		1														•		•	•	•	•					
MPCI-L280	APAC/S.America	9	4	1, 3, 5, 7, 8, 28	850/900/1900/2100		quad-band	2x2		1														•		•	•	•	•					

Features

LTE	Cat 4 (150 Mb/s DL, 50 Mb/s UL) 3GPP Rel. 9 FDD Bands: MPCI-L200: 2, 4, 5, 7, 17 (N.America) MPCI-L201: 2, 4, 5, 13, 17 (USA) MPCI-L210: 1, 3, 5, 7, 8, 20 (EU/Asia/Africa) MPCI-L280: 1, 3, 5, 7, 8, 28 (APAC/S.America) All channel bandwidths: 1.4 - 20 MHz MIMO 2x2 Rx diversity
UMTS/DC-HSPA+	Bands: MPCI-L200: 850/900/AWS/1900/2100 MHz MPCI-L201: 850/1900 MHz MPCI-L210: 850/900/1900/2100 MHz MPCI-L280: 850/900/1900/2100 MHz 42 Mb/s downlink, 5.76 Mb/s uplink
GSM	Bands: MPCI-L200: 850/900/1800/1900 MHz MPCI-L210: 850/900/1800/1900 MHz MPCI-L280: 850/900/1800/1900 MHz GPRS & EDGE Class 12
SMS	MT/MO PDU / Text mode SMS over IMS and via SMS-C

Package

52-pin PCI Express Full-Mini Card Type F2
30 x 51 x 3.7 mm, 9.7 g
(components on top side only)

Environmental data, quality & reliability

Operating temperature -40 to +85°C (extended range)
RoHS compliant (lead-free)
Manufactured in ISO/TS 16949 certified production sites

Software features

Protocols	Dual stack IPv4 / IPv6 Embedded TCP/IP, UDP/IP HTTP/FTP/SSL (Secure Socket Layer)
Firmware update	Via USB Via FOTA

Certifications and approvals

MPCI-L200	PTCRB, GCF, FCC, IC, CE / R&TTE, AT&T
MPCI-L201	FCC
MPCI-L210	PTCRB, GCF, FCC, IC, CE / R&TTE, NCC, KCC (Korea), Giteki (Japan), RCM (Australia) Operator approvals
MPCI-L280	GCF, NCC (Taiwan), RCM (Australia), Telstra (planned)

Electrical data

Power supply	DC 3.0 - 3.6 V
Consumption current	Connected mode LTE max power: 815 mA Idle mode: 1.8 mA

Support products

RIL software	Available for Android
USB driver	Available for Embedded Windows 6.0, 7, 2013 and Windows 7, 8, 8.1, 10

Interface

RF (antenna)	2 UFL (50 Ω) Connectors (main and diversity)
Data	1 USB 2.0 (high-speed, 480 Mb/s)
(U)SIM	Supports 1.8 V and 3 V, SIM toolkit

Product variants

MPCI-L200	LTE/DC-HSPA+/GSM modules for America Cat 4; LTE Bands 2, 4, 5, 7, 17 Mini PCI Express
MPCI-L201	LTE/DC-HSPA+ modules for USA Cat 4; LTE bands 2, 4, 5, 13, 17 Mini PCI Express
MPCI-L210	LTE/DC-HSPA+/GSM modules for Europe, Asia Cat 4; LTE Bands 1, 3, 5, 7, 8, 20 Mini PCI Express
MPCI-L280	LTE/DC-HSPA+/GSM modules for APAC, South America Cat 4; LTE Bands 1, 3, 5, 7, 8, 28 Mini PCI Express

TOBY-R2 series

Standard Professional Automotive

Performance optimised LTE/UMTS/GSM module with global coverage

Highlights

- LTE modem in LGA package, for easy manufacturing
- LTE Cat 1 with global 2G and 3G fallback
- Voice over LTE (VoLTE) or 3G voice service (CSFB)
- Full IP Stack embedded



TOBY-R2
24.8 x 35.6 x 2.6 mm

Product description

The TOBY-R2 module series supports multi-band LTE-FDD along with 3G (UMTS) and 2G (GSM) fallback in a very small LGA package.

The modules are ideal for applications that are transitioning to LTE from 2G and 3G, due to the long term availability and scalability of LTE networks. At the same time in areas with marginal LTE coverage, they also provide global 2G and 3G fallback.

With a range of interface options and an integrated IP stack, the module is designed to support a wide range of data-centric applications. The unique combination of performance, flexibility, and global coverage make the module ideally suited for medium speed M2M applications, such as smart energy gateways, remote access video cameras, digital signage, telehealth and telematics.

The temperature range of -40 to +85 °C guarantees operation in harsh environments and in very compact designs.

It supports Voice over LTE (VoLTE) and 3G voice service (CSFB) for applications where voice is required, such as in security and surveillance systems. Transport Layer Security (TLS) provides privacy and data integrity.

The compact LGA package enables straightforward automated manufacturing. Easy migration from u-blox GSM/GPRS, CDMA, and UMTS/HSPA maximizes the investments of customers, simplifies logistics, and enables very short time-to-market.

TOBY-R2 modules are manufactured in ISO/TS 16949 certified sites, with the highest production standards and the highest quality and reliability. Each module is fully tested and inspected during production. Modules are qualified according to ISO16750 – for systems installed in vehicles.

USB drivers and RIL software for Android are free of charge.

Product selector

Model	Region	Access Technology			Positioning			Interfaces					Audio		Features								Grade																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
		LTE Bands *		UMTS/HSPA+ Bands	GPRS/EDGE Bands		GNSS via Modem		AssistNow Software		CellLocate®		UART		USB 2.0		SDIO	DDC (I²C)		GPIO		Analog audio	Digital audio	Network indication		Antenna Supervisor		Rx Diversity		Jamming Detection		Embedded TCP/UDP stack		Embedded HTTP, FTP, SSL		FOTA		Dual stack IPv4 / IPv6		Standard	Professional	Automotive																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
TOBY-R200	North America	2, 4, 5, 12	1,2, 5, 8	quad	•	•	•	1	1	1	1	10	1	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Features

LTE	Cat 1 (10 Mb/s DL, 5 Mb/s UL) 3GPP Release 9 FDD Bands: TOBY-R200: 2, 4, 5, 12 TOBY-R201: 2, 4, 5, 12, 13 TOBY-R202: 2, 4, 5, 12 All channel bandwidths: 1.4 - 20 MHz Rx Diversity
UMTS	HSDPA category 24, HSUPA category 6 Bands (in MHz): TOBY-R200: 1, 2, 5, 8 TOBY-R201: 2, 5 TOBY-R202: 2, 5 Rx Diversity
GSM	GPRS/EDGE multi-slot class 12 Bands (in MHz): TOBY-R200: quad band
SMS	MT/MO PDU/Text mode SMS over IMS and via SMS-C
Voice	VoLTE or CSFB Codec: HR/FR/EFR/AMR/AMR-WB Echo cancelation & noise reduction

Software features

Protocols	Dual stack IPv4 / IPv6 Embedded TCP/IP, UDP/IP HTTP/FTP/SSL (Secure Socket Layer) Bearer Independent Protocol (BIP)
GNSS Interfaces ¹	Direct access to u-blox GNSS via TOBY AssistNow software for fastest GNSS Time-To-First-Fix CellLocate® & Hybrid Positioning
Firmware upgrade	Via UART and USB FOTA client (Firmware upgrade over the air)

Electrical data

Power supply	3.8 V nominal, range 3.3 V to 4.4 V
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Interfaces

Serial	1 UART 1 USB 2.0 (high-speed, 480 Mb/s) 1 I ² C 1 SDIO ¹
GPIO	Up to 10 configurable GPIOs
(U)SIM	Supports 1.8 V and 3 V, SIM toolkit
Audio	1 digital

Band and frequency reference

GSM Band	PCS		DCS		GSM		E-GSM							
LTE/UMTS Band	1	2	3	4	5	6	7	8	12	13	17*	19	20	28
MHz	2100	1900	1800	1700	850	850	2600	900	700	750	700	850	800	700

* Band 12 is a superset that includes Band 17

Features

152 pin LGA (Land Grid Array): 24.8 x 35.6 x 2.6 mm, < 7 g
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Environmental data, quality & reliability

Operating temperature	-40 to +85 °C (extended range)
RoHS compliant (lead-free)	
Qualification according to ISO 16750	
Manufactured in ISO/TS 16949 certified production sites	

Security

Transport Layer Security (TLS 1.2)
Jamming Detection ¹

Certifications and approvals

TOBY-R200	PTCRB, FCC, IC, AT&T
TOBY-R201	PTCRB, GCF, FCC, IC, AT&T, Verizon
TOBY-R202	PTCRB, FCC, IC, AT&T

Support products

EVK-R2x	Evaluation Kits for TOBY-R2 series
RIL software	Available for Android 4.2 and Embedded Windows 7.x
USB driver	Available for Windows 7, 8, 10 and for Embedded Windows 7.x, 8.x, 10.x

Product variants

TOBY-R200	LTE Cat 1 modules for AT&T with global 2G and 3G fallback; LTE Bands 2, 4, 5, 12
TOBY-R201	LTE Cat 1 modules for AT&T and Verizon Wireless with 3G fallback; LTE Bands 2, 4, 5, 12, 13
TOBY-R202	LTE Cat 1 modules for AT&T with 3G fallback; LTE Bands 2, 4, 5, 12

LARA-R2 series

Standard Professional Automotive

Size and performance optimised LTE/GSM modules

Highlights

- LTE modem in very small, compact LGA package
- LTE Cat 1, one variant with fallback to 2G
- Voice over LTE (VoLTE) or CSFB voice service
- Variants for America and Europe
- Full IP Stack embedded



LARA-R2 series
24.0 x 26.0 x 2.6 mm

Product description

LARA-R2 series modules support multi-band LTE-FDD in a very small LGA package. There are two variants, one with fallback to 2G and one LTE-only variant.

LARA-R211, with fallback to GPRS/EDGE (2G), is ideal for applications that are transitioning to LTE from 2G, due to the long term availability and scalability of LTE networks.

With a range of interface options and an integrated IP stack, the modules are designed to support a wide range of data-centric applications. The unique combination of performance, security and flexibility make these modules ideally suited for medium speed M2M applications, such as smart energy gateways, remote access video cameras, digital signage, telehealth and telematics.

LARA-R2 modules support Voice over LTE (VoLTE) or CSFB voice service for applications that require voice, such as security and surveillance systems.

The temperature range of -40 to +85 °C guarantees operation in harsh environments and in very compact designs.

The ultra-compact LGA package enables straightforward automated manufacturing. The LARA form factor follows the u-blox nested design principle and is compatible with u-blox SARA, LISA and TOBY module families. This facilitates easy migration from u-blox GSM/GPRS, CDMA, UMTS/HSPA, and multi-mode LTE modules, maximizes the investments of customers, simplifies logistics, and enables very short time-to-market.

LARA-R2 modules are manufactured in ISO/TS 16949 certified sites, with the highest production standards and the highest quality and reliability. Each module is fully tested and inspected during production. Modules are qualified according to ISO16750 – for systems installed in vehicles.

LARA-R2 modules come in variants for America and Europe.

USB drivers and RIL software for Android are free of charge.

Product selector

Model	Region	Access Technology	Positioning	Interfaces	Audio	Features	Grade
		LTE Bands * GPRS/EDGE Bands	GNSS via Modem AssistNow Software CellLocate®	UART USB 2.0 HSC SDIO DDC (I ² C) GPIOs	Analog audio Digital audio	Network indication Antenna Supervisor Rx Diversity Jamming Detection Embedded TCP/UDP stack Embedded HTTP, FTP, SSL FOTA Dual stack IPv4 / IPv6	Standard Professional Automotive
LARA-R204	North America	4, 13	• • •	1 1 1 1 1 10	1	• • • • • • • •	
LARA-R211	Europe	3, 7, 20 900, 1800	• • •	1 1 1 1 1 10	1	• • • • • • • •	

* = Band 12 is a superset that includes Band 17

Features

LTE	Cat 1 (10 Mb/s DL, 5 Mb/s UL) 3GPP Release 9 FDD bands: LARA-R204: 4, 13 (N. America) LARA-R211: 3, 7, 20 (Europe) All channel bandwidths: 1.4 - 20 MHz Rx Diversity
GSM	GPRS/EDGE multi-slot class 12 Bands (in MHz): LARA-R211: E-GSM 900 / DCS 1800
SMS	MT/MO PDU/Text mode SMS over IMS and via SMS-C
Voice	VoLTE or CSFB Codec: HR/FR/EFR/AMR/AMR-WB Echo cancelation & noise reduction

Package

100 pin LGA (Land Grid Array): 24.0 x 26.0 x 2.6 mm, < 5 g

Environmental data, quality & reliability

Operating temperature -40 to +85 °C (extended range)
RoHS compliant (lead-free)
Qualification according to ISO 16750
Manufactured in ISO/TS 16949 certified production sites

Security

Transport Layer Security (TLS 1.2)
Jamming Detection ¹

Software features

Protocols	Dual stack IPv4 / IPv6 Embedded TCP/IP, UDP/IP HTTP/FTP/SSL (Secure Socket Layer) Bearer Independent Protocol (BIP)
GNSS Interfaces ¹	Direct access to u-blox GNSS via LARA AssistNow software for fastest GNSS Time-To-First-Fix CellLocate® & Hybrid Positioning
Firmware upgrade	Via UART and USB FOTA client (Firmware upgrade over the air)

Certifications and approvals

LARA-R204	PTCRB, GCF, FCC, IC, Verizon
LARA-R211	PTCRB, GCF, FCC, CE / R&TTE

Electrical data

Power supply 3.8 V nominal, range 3.3 V to 4.4 V

Support products

EVK-R2xx	Evaluation Kits for LARA-R2 series
RIL software	Available for Android 4.2 and Embedded Windows 7.x
USB driver	Available for Windows 7, 8, 10 and for Embedded Windows 7.x, 8.x, 10.x

Interfaces

Serial	1 UART 1 USB 2.0 (high-speed, 480 Mb/s) 1 HSIC ¹ 1 SDIO ¹ 1 I ² C
GPIO	Up to 10 configurable GPIOs
(U)SIM	Supports 1.8 V and 3 V, SIM toolkit
Audio	1 digital

Product variants

LARA-R204	LTE Cat 1 modules for Verizon Wireless LTE Bands 4, 13
LARA-R211	LTE Cat 1 modules for Europe with 2G fallback LTE Bands 3, 7, 20

Band and frequency reference

GSM Band	PCS				DCS		GSM			E-GSM					
LTE/UMTS Band	1	2	3	4	5	6	7	8	12	13	17*	19	20	28	
MHz	2100	1900	1800	1700	850	850	2600	900	700	750	700	850	800	700	

* Band 12 is a superset that includes Band 17



SARA-N203

Coverage and power consumption optimized NB-IoT module

Highlights

- NB-IoT modem in a compact LGA package
- Low standby and operational power consumption
- Extended coverage
- Extended temperature range: -40 to +85°C
- Easy migration from u-blox 2G, 3G and LTE Cat 1 modules
- Manufactured in ISO/TS 16949 certified production sites



SARA-N203
16.0 x 26.0 x 2.4 mm

Product description

The SARA-N203 NB-IoT module features extremely low power consumption in both idle and connected modes of cellular operation. It is available in a small LGA form factor and has been designed explicitly with the needs of battery powered applications that need to communicate for long periods of time in challenging radio propagation conditions.

The module supports a comprehensive set of communication protocols including SMS, IP and efficient IP-less data transmission all with minimal signaling overhead to preserve power consumption. The feature set makes these modules ideally suited for applications where longevity of operation and reachability in poor propagation conditions are mission critical. Smart water metering, smart gas metering, smart sensors for remote monitoring and nomadic asset tracking are perfect examples of applications where this module could be used.

The SARA-N203 module targets high volume, cost sensitive applications, and provides “bit pipe” communication functionalities while minimizing the customer’s total cost of ownership. SARA-N203 offers easy migration from u-blox GSM (SARA-G3 series), UMTS (SARA-U2 series), as well as LTE Cat 1 (LARA-R2 series) modules.

The temperature range of -40 to +85 °C guarantees operation in harsh environments and in very compact designs.

The modules are for global use and will be certified and approved by the main regulatory bodies.

The modules are manufactured in ISO/TS 16949 certified sites, with the highest production standards and the highest quality and reliability. Each module is fully tested and inspected during production.

Product selector

Model	Region	Bands	Positioning	Interfaces	Features	Grade
		3GPP Release Baseline 3GPP Category NB-IoT Bands	GNSS via Modem AssistNow Software CellLocate®	UART SPI USB 2.0 GPIO DDC for GNSS / I²C slave	Antenna Supervisor Deep sleep mode Embedded UDP stack FW update over AT (FOAT) FW update over the air (FOTA)	Standard Professional Automotive
SARA-N203	Global	13 NB1 5, 8, 20	•	1 1 2 1	• • • • •	<div></div>

Features

NB-IoT	Cat. NB1 (227 kb/s DL, 21 kb/s UL) 3GPP Release 13 FDD Bands: 5, 8, 20 Single tone uplink
SMS	MT/MO PDU / Text mode
Data Transfer	Non-IP based Small Data over NAS (SDoNAS) IP based SDoNAS
Network	Paging Idle and Connected DRX Deep sleep mode

Software features

Protocols	IPv4 and IPv6 ¹ Embedded UDP/IP Embedded SIM provisioning ¹
GNSS Interfaces ¹	Direct access to u-blox GNSS via module
Firmware upgrade	Via UART and Over the Air ¹

Electrical data

Power supply	3.6 V nominal, range 2.5 V to 4.2 V
Power consumption	TBD

Interfaces

Serial	1 UART 1 DDC (I ² C) ¹
GPIO	Up to 2 GPIOs, configurable
(U)SIM	Supports 1.8 V, SIM toolkit ¹

Package

96 pin LGA: 16.0 x 26.0 x 3.0 mm, < 3 g

Environmental data, quality & reliability

Operating temperature –40 to +85°C (extended range)
RoHS compliant (lead-free)
Qualification according to ISO 16750
Manufactured in ISO/TS 16949 certified production sites

Certifications and approvals

SARA-N203	GCF, PTCRB, FCC, IC, RED, RCM, KCC and operator approvals are pending
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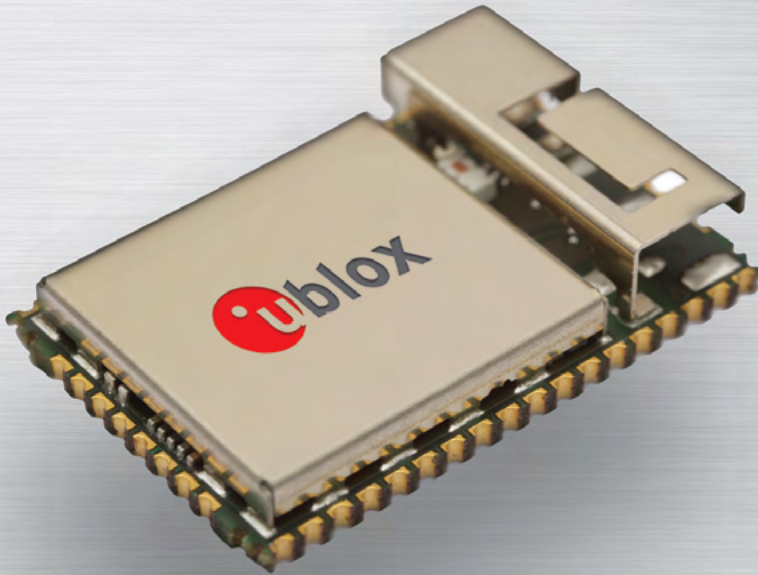
Support products

EVK-N203	Evaluation kit for SARA-N203
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Product variants

SARA-N203	NB-IoT module; Cat. NB1; Bands 5, 8, 20
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Short range radio modules



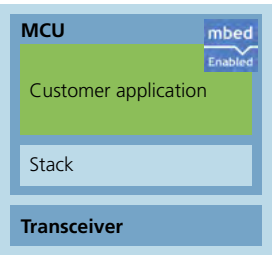
	Bluetooth Classic	Bluetooth Low Energy	Wi-Fi Wi-Fi	NFC	ARM mbed	Standard	Professional	Automotive
Stand-alone modules								
ODIN-W2		•	•	a/b/g/n 2.4 / 5 GHz	•			
NINA-B1			•		•			
OBS421		•	•					
OBS418 OBS419		•						
Host-based modules								
LILY-W1				b/g/n 2.4 GHz				
EMMY-W1		•	•	a/b/g/n/ac 2.4 / 5 GHz	•			
ELLA-W1		•		a/b/g/n 2.4 / 5 GHz				
THEO-P1				802.11p 5.9 GHz				

SHORT RANGE

Typical stand-alone and host-based architectures

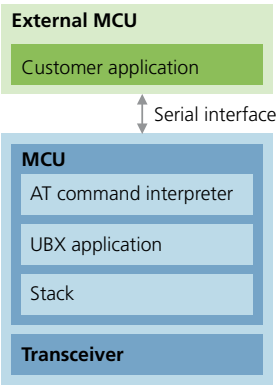
Stand-alone

- Stack runs on short range module
- Application runs on short range module



mbed enabled ODIN-W2

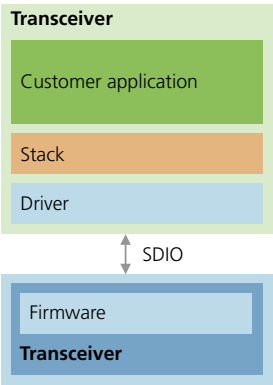
- Application runs on host processor



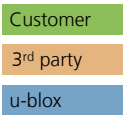
ODIN-W2

Host-based

- Third party stack runs on host processor with open OS
- Application runs on host processor



Short range module



ODIN-W2 series

Standard

Professional

Automotive

Stand-alone IoT gateway modules with Wi-Fi & Bluetooth

Highlights

- Dual-band Wi-Fi & dual-mode Bluetooth
- Micro access point
- High speed iAP2 support
- ARM mbed enabled for customer applications
- Embedded Wi-Fi driver and Bluetooth stack
- Global certification



ODIN-W260
14.8 x 22.3 x 3.2 mm



ODIN-W262
14.8 x 22.3 x 4.7 mm

Product description

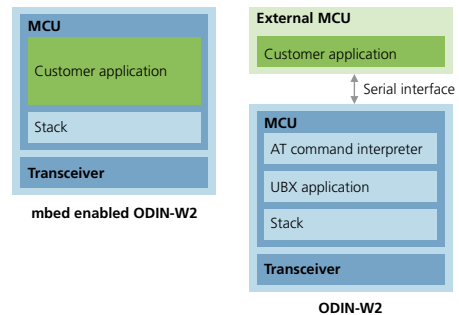
The ODIN-W2 is a compact and powerful stand-alone multiradio module, designed for Internet-of-Things gateway applications. The module is complete with embedded Bluetooth stack, Wi-Fi driver, IP stack and an application for wireless data transfer, all configurable using AT-commands. The wireless support includes dual-mode Bluetooth v4.0 (BR/EDR and Bluetooth low energy) and dual-band Wi-Fi (2.4 GHz and full 5 GHz bands).

The module supports point-to-point and point-to-multi-point configurations, either which can have concurrent Bluetooth and Wi-Fi connections. It can operate in Wireless Multidrop or Extended Data Mode for advanced multipoint capabilities. Operation in Point-to-Point Protocol (PPP) mode gives the host a UART-based IP interface for advanced use cases. The firmware 2.0 provides support for micro Access Point with RMII, iAP2, and low power modes.

Using the EVK-ODIN-W262 mbed evaluation kit, the modules' integrated Cortex M4F MCU can be accessed

for integration of the customer's application using ARM mbed. Additionally, interfaces like SPI, I²C, CAN, GPIO, ADC are made available through the software libraries provided by the ARM mbed development tool.

The module is professional grade with an extended temperature range and is radio type approved for multiple countries, which reduces the integration work and cost.



Product selector

Model	Radio	Interfaces	Features	Grade
	Wi-Fi IEEE 802.11 (a/b/g/n ¹) Wi-Fi output power (dBm) 2.4 GHz channels 1-13 5 GHz channels 36-165 Bluetooth BR/EDR v2.1 Bluetooth Low Energy v4.0 Bluetooth output power (dBm) Max range, in meters Antenna type	UART RMII SPI I ² C GPIO pins AD converters (ADC)	Micro access point Wi-Fi throughput (Mbps) Wi-Fi Enterprise Security Bluetooth throughput (Mbps) iAP2 throughput (Mbps) Bluetooth profiles Low Energy Serial Port Service Point-to-Point Protocol (PPP) Extended Data Mode protocol	Standard Professional Automotive
ODIN-W260	• 18 • • • • 14 300 U	• •	• 20 • 1.3 1 SDG • • •	
ODIN-W262	• 15 • • • • 11 250 I	• •	• 20 • 1.3 1 SDG • • •	
ODIN-W260 *	• 18 • • • • 14 300 U	• • • • • 29 3	• 20 • 1.3 SDPG	
ODIN-W262 *	• 15 • • • • 11 250 I	• • • • • 29 3	• 20 • 1.3 SDPG	

* For customer applications with ARM mbed
¹ Planned feature

U = U.FL connector(s) for external antenna
I = Internal antenna

S = SPP, D = DUN, P = PAN, G = GATT (planned for FW 3.0)

Features

Wi-Fi standards	IEEE 802.11a/b/g/n ¹ IEEE 802.11d/e/i/h
Wi-Fi channels	2.4GHz: 1-13 5 GHz: 36-165 (U-NII Band 1, 2, 2e, 3)
Wi-Fi maximum transfer rates	IEEE 802.11n ¹ SISO: 65 Mbps MIMO: 130 Mbps IEEE 802.11a/g: 54 Mbps IEEE 802.11b: 11 Mbps 2x2 MIMO ¹ (ODIN-W260 only)
Wi-Fi MIMO	
Bluetooth	v4.0 (Bluetooth low energy and Bluetooth BR/EDR)
Output power	Wi-Fi: 18 dBm EIRP Bluetooth BR/EDR: 14 dBm EIRP Bluetooth LE: 10 dBm EIRP
Sensitivity	Wi-Fi 2.4 GHz: -98 dBm EIRP Wi-Fi 5 GHz: -93 dBm EIRP Bluetooth BR/EDR: -93 dBm EIRP Bluetooth LE: -98 dBm EIRP
Antenna	Internal antenna or dual U.FL connectors for external antennas

Software features

Embedded software	u-blox Wi-Fi driver u-blox Bluetooth stack Serial port application Combined IPv4 and limited IPv6 stack
Wi-Fi Security	WEP 64/128 WPA and WPA2 TKIP and AES/CCMP hardware accelerator LEAP, PEAP, EAP-TLS ¹
Wi-Fi operational modes	μAP (DFS channels excluded) Station
Bluetooth profiles and services	u-blox Low Energy Serial Port Service GATT ² SPP DUN PAN ¹ roles: PANU & NAP Low energy roles: Central, Peripheral
Max. connections	7
Wireless Multidrop™	For concurrent connections to Wi-Fi, Bluetooth BR/EDR and Bluetooth Low Energy
Extended Data Mode™	For individually controlled multipoint data channels
Point-to-Point Protocol (PPP)	For UART-based IP connectivity between host and module, enables individually controlled data channels and AT commands in parallel
iOS connectivity	iAP2

Interfaces

UART	
RMII	
2 U.FL antenna connectors (external antenna version only)	
SPI, I ² C, CAN, GPIO, and ADC are available with ARM mbed only	

Package

Dimensions	14.8 x 22.3 x 4.7 mm (internal antenna) 14.8 x 22.3 x 3.2 mm (external antenna)
Mounting	Solder edge pins with castellations (visually inspectable)

Environmental data, quality & reliability

Operating temperature	-40 °C to +85 °C
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Electrical data

Power supply	3.0 - 3.6 VDC
I/O voltage	1.8 V
Power consumption	TBD

Certifications and approvals

Type approvals	Europe (ETSI R&TTE); US (FCC/CFR 47 part 15 unlicensed modular transmitter approval); Canada (IC RSS); Japan (MIC); Taiwan (NCC); China (SRRC); South Korea (KCC); Australia (ACMA)*
Health and safety	EN 62479, EN 60950-1, IEC 60950-1
Medical Electrical Equipment	EN 60601-1-2
Bluetooth Qualification v4.0	



* Pending approval

Support products

EVK-W262U	Evaluation kit with USB for ODIN-W262
EVK-ODIN-W2	Evaluation kit for ODIN-W2 (EVK-ODIN-W260 and EVK-ODIN-W262) mbed enabled IoT starter kit/evaluation kit with USB, Ethernet and pinlist for the ODIN-W2

Product variants

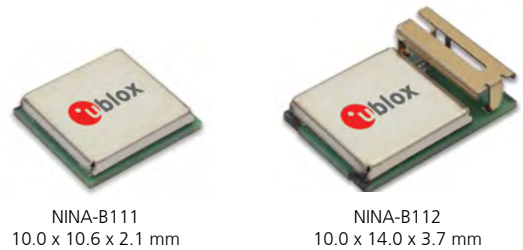
ODIN-W260	Module with dual U.FL connectors for external antennas for MIMO ² support
ODIN-W262	Module with internal antenna

NINA-B1 series

Stand-alone modules with Bluetooth low energy

Highlights

- Bluetooth low energy v4.2
- Powerful MCU for customer applications
- State of the art power consumption
- GPIO / SPI / I²C / UART / ADC interfaces
- Over-the-air firmware upgrade¹
- Concurrent peripheral and central role¹
- Serial port application for serial data



Product description

The NINA-B1 series modules are small stand-alone Bluetooth low energy (Bluetooth Smart) modules featuring Bluetooth v4.2 and the latest state-of-the-art power performance. The Bluetooth low energy profiles and services are embedded in the module. This module is offered in professional grade for applications such as health care, asset tracking, connected cities, home automation, smart energy, manufacturing and telematics.

The NINA-B1 is tailored for OEMs who wish to embed their own application on top of the available Bluetooth low energy stack and/or to embed Bluetooth services/attributes on top of the integrated software stack using the Nordic SDK. The NINA-B1 is a stand-alone product with no additional hardware required.

Additional sensors, including temperature sensor, LEDs, accelerometers, can be connected directly to the module via GPIO, ADC, I²C, SPI, and UART.

The NINA-B1 embeds firmware with the u-blox Low Energy Serial Port Service for replacing serial cables or accessing UART devices using Bluetooth low energy technology.

The modules are fully Bluetooth qualified and provide global modular approval. They are also compliant with Safety and Medical standards. The operating temperature range is -40 °C to +85 °C.

Product selector

Model	Radio						Interfaces	Power		Connectors	Features						Grade					
	Bluetooth qualification Bluetooth profiles NFC for “Touch to Pair” Maximum radiated output power (EIRP) Maximum range Antenna type						UART SPI and I ² C GPIO pins AD converters (ADC)	Power supply: 1.70 - 3.60 V Current consumption (idle) Current consumption (TX) @ 0 dBm Ultra low power		Solder pins	u-blox Low Energy Serial Port Service GATT server GATT client Throughput (kbps) AT command support Max number of connections Over-the-air firmware upgrade						Standard Professional Automotive					
NINA-B111	v4.2	G	7 dBm	300 m	P	•		•	2 μA < 7 mA	•	•	•	1	1	55	•	8 ¹	1				
NINA-B112	v4.2	G	6 dBm	280 m	I	•		•	2 μA < 7 mA	•	•	•	1	1	55	•	8 ¹	1				
NINA-B111*	v4.2	G	• 7 dBm	300 m	P	•	• 19 7	•	2 μA < 7 mA	•	•	•	•	•		8	•					
NINA-B112*	v4.2	G	• 6 dBm	280 m	I	•	• 19 7	•	2 μA < 7 mA	•	•	•	•	•		8	•					

¹ = Planned feature

* = For customer applications

Features

Bluetooth	v4.2 (Bluetooth low energy)
Range	NINA-B111: 300 m, antenna pin reference design with 1/2 wave antenna NINA-B112: 280 m, internal antenna
Max. conducted output power	4 dBm
Max. radiated output power (EIRP)	7 dBm with approved antennas
Receiver sensitivity	−96 dBm
Throughput	55 kbps

Electrical data

Power supply	1.70 to 3.60 VDC
Power consumption	1.70 to 3.60 VDC Max 7 mA @ 3.0 VDC (TX @ 0 dBm) 300 nA, wake-up on external event

Software features

Embedded software	Bluetooth stack Serial port application Customer implemented Bluetooth low energy profiles / services / attributes
GATT based service	u-blox Low Energy Serial Port Service
Max. number of connections	8
Configuration tools	AT commands s-center (Windows-based software)
Security	Secure Simple Pairing 128-bit AES encryption BLE Secure Connection

Interfaces

SPI	3*
I ² C	2*
UART	1
I ² S	1
GPIO pins	19
ADC channels	7
Quadrature decoder (QDEQ)	
Pulse density modulation interface (PDM)	
Pulse-width modulation (PWM) channels	12

* Not all simultaneously

Package

Dimensions	NINA-B111: 10.0 x 10.6 x 2.1 mm NINA-B112: 10.0 x 14.0 x 3.7 mm
Weight	< 1.0 g
Mounting	Machine mountable Solder pins

Environmental data, quality & reliability

Operating temperature	−40 °C to +85 °C
Storage temperature	−40 °C to +85 °C
Humidity RH	5-90% non-condensing

Certifications and approvals

Type approvals	Europe (ETSI R&TTE); US (FCC/CFR 47 part 15 unlicensed modular transmitter approval); Canada (IC RSS); Japan (MIC - formerly TELEC); Taiwan (NCC); Australia (ACMA); South Korea (KCC); China (SRRC); Brazil (Anatel)
Health and safety	EN 62479, EN 60950-1, IEC 60950-1
Medical Electrical Equipment	IEC 60601-1-2
Bluetooth Qualification	v4.2



Support products

The evaluation kits include a NINA-B1 module on an evaluation board with built-in debugging capabilities. To be used with Nordic SDK or ARM mbed as a development kit or with s-center to evaluate the serial port application.

EVK-NINA-B111	Evaluation kit for NINA-B111 module with antenna pin
EVK-NINA-B112	Evaluation kit for NINA-B112 module with internal antenna

Product variants

NINA-B111	With antenna pin
NINA-B112	With internal antenna

OBS421 series

Standard

Professional

Automotive

Stand-alone dual-mode Bluetooth modules

Highlights

- Bluetooth v4.0 with Bluetooth low energy and Classic Bluetooth (Bluetooth Smart Ready)
- Embedded stack (SPP, DUN, PAN, GATT)
- Low Emission Mode® limits interference with other 2.4GHz RF
- u-blox Low Energy Serial Port Service
- High throughput of 1.3 Mbps
- Advanced multipoint capability with 7 slaves
- High speed iAP2 connectivity



OBS421
16.0 x 36.0 x 2.6/3.2 mm

Product description

The powerful stand-alone Bluetooth module OBS421 is a dual-mode (Bluetooth Smart Ready) module complete with embedded Bluetooth dual mode stack and serial port application. The OBS421 features a UART interface for transparent serial data transmissions. It can be used as a Bluetooth Smart Ready client for any host and it can access any Bluetooth Smart device that implements services based on the Generic Attribute Profile (GATT).

The OBS421 can also be used in devices connected to smart-phones, tablets and laptops via the Serial Port Profile.

The module is fully Bluetooth qualified and provides modular radio type approvals for the US, Canada, Europe, Japan and China. The OBS421 is also compliant with EMC, Safety and Medical standards.

The robust module is easily configured via AT commands as well as cover a range of 300 meters, throughput up to 1.3 Mbps and operating temperatures of -30°C to +85°C.

Product selector

Model	Radio					Interfaces		Power	Connectors		Features							Grade				
	Bluetooth Low Energy v4.0	Classic Bluetooth v2.1 + EDR	Antenna type	Max output power incl. antenna	Max range	UART	I ² C	GPIO pins	Power supply: 3.0 - 6.0 V	Current consumption (idle)	Solder pads	Board-to-board	Throughput (Mbps)	iAP2 throughput (Mbps)	AT command support	Max number of slaves	Extended Data Mode protocol	Low Energy Serial Port Service	Bluetooth profiles	Standard	Professional	Automotive
OBS421i-24	•	•	I	11 dBm	250 m	•	•	9	•	0.6 mA	•	•	1.3	•	7	•	•	SDPG				
OBS421x-24	•	•	E	13 dBm	300 m	•	•	9	•	0.6 mA	•	•	1.3	1	•	7	•	•	SDPG			
OBS421i-i4	•	•	I	11 dBm	250 m	•	•	9	•	0.6 mA	•	•	1.3	•	7	•	•	SDPG				
OBS421x-i4	•	•	E	13 dBm	300 m	•	•	9	•	0.6 mA	•	•	1.3	•	7	•	•	SDPG				

S = SPP
D = DUN

P = PAN
G = GATT

E = External antenna
I = Internal antenna

Features

Bluetooth	v4.0 (Bluetooth low energy and Classic Bluetooth)
Range	250 m, internal antenna 300 m, external antenna
Output power	11 dBm, internal antenna 13 dBm, external antenna
Throughput	1.3 Mbps (Classic Bluetooth)
iAP2 throughput	1 Mbps
Microprocessor	72 MHz, ARM 32-bit Cortex M3 processor capacity with 64 kB RAM and 384 kB flash

Software features

Embedded software	u-blox dual mode Bluetooth stack Serial port application
Bluetooth profiles & services	u-blox Low Energy Serial Port Service Generic Attribute Profile (GATT) Serial Port Profile (SPP) Dial-up networking Profile (DUN GW, DUN DT) Personal Area Networking Profile (PAN) roles: PANU & NAP
Profile roles	Central Role, Peripheral Role
Max. number of slaves	7 Classic Bluetooth & Bluetooth low energy
Configuration tools	AT commands via Bluetooth or serial port Serial Port Toolbox (Windows-based SW)
Low Emission Mode®	Prevent disrupting other 2.4GHz radios
Wireless Multidrop™	For simultaneous connections to Bluetooth low energy and Classic Bluetooth devices
Extended Data Mode™	Individually controlled multipoint data channels
Quality of Service (QoS)	
Repeater functionality	Extended range
Security	Simple Pairing
iAP + iAP2	High speed iOS connectivity with Classic Bluetooth connections

Interfaces

UART Logic level	
RS232/RS422/RS485	Option via external transceiver
Baud rate	Max 1.5 Mbit/s Support for non-standard baud rates
Flow control	CTS/RTS (hardware) or none
GPIO pins	9 pins
U.fl antenna connector (external antenna version only)	

Electrical data

RF power supply	3.0 to 6.0 VDC
Power consumption	0.6 mA @ 3.0 V (min.) 44 mA @ 3.0 V (average Tx)

Package

Dimensions	16.0 x 36.0 x 3.2 mm (internal antenna) 16.0 x 36.0 x 2.6 mm (external antenna)
Weight	2 g
Mounting	Mounting holes, Machine mountable, Board-to-board connector, Solder land pads

Certifications and approvals

Type approvals	Europe (ETSI R&TTE); US (FCC/CFR 47 part 15 unlicensed modular transmitter approval); Canada (IC RSS); Japan (MIC - formerly TELEC)
R&TTE Directive 1999/5/EC	Effective use of frequency spectrum: EN 300 328 EMC: EN 301 489-1, EN 301 489-17, EN 61000-6-2 Health and safety: EN 62479, EN 60950-1, IEC 60950-1
Medical Electrical Equipment	EN 60601-1-2
Bluetooth Qualification v4.0	



Environmental data, quality & reliability

Operating temperature -30°C to +85°C

Support products

EVK-OB5421 Evaluation Kit

cB-OB5421i-26-B	Includes OB5421i-24 module with additional JST connector, USB module adapter (installs virtual COM-port), USB extension cable, JST to flying leads cable, configuration SW.
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Product variants

cB-OB5421i-24	OB5421 (rev B) with internal antenna
cB-OB5421x-24	OB5421 (rev B) with u.fl. connector for external antenna

Modules with iAP1 & iAP2 support for Classic Bluetooth connections to Apple iOS devices*

cB-OB5421i-i4	OB5421 (rev B) with iAP support and internal antenna
cB-OB5421x-i4	OB5421 (rev B) with iAP support and u.fl. connector for external antenna

* All current OB5421 module versions support Apple iOS connections via Bluetooth low energy. Classic Bluetooth connections are supported only by OB5421 versions with iAP support, but other special requirements also apply, see <http://tinyurl.com/ndk6vj2>.

OBS418/OBS419

Standard

Professional

Automotive

Stand-alone Classic Bluetooth module series

Highlights

- Bluetooth v2.1 / v2.1 + EDR
- Embedded Bluetooth stack
- Serial port application firmware for UART serial data
- Up to 1 Mbps throughput
- Advanced multipoint capability with up to three slaves
- u-blox Low Emission Mode®



OBS419
16.0 x 36.0 x 2.6/3.2 mm

Product description

The OBS418 and OBS419 are stand-alone Classic Bluetooth modules with UART logic level interface for fast, secure, and transparent serial data transmissions up to 150 meters. With the embedded Bluetooth stack, you can be up and running quickly as there is no need for a driver or stack in your host.

The modules are easily configured via AT commands, offer Google Android connectivity and have implemented the u-blox Low Emission Mode® to make sure that Classic Bluetooth operates smoothly in parallel with other wireless technologies.

The OBS418 features Bluetooth v2.1 (SPP, DUN), 350 kbps throughput, and one-slave connectivity.

The OBS419 features Bluetooth v2.1+EDR (SPP, DUN, PAN), deep power save mode, 950 kbps throughput, and three-slave multipoint connectivity. Further features implemented include Wireless Multidrop™ and Extended Data Mode™ for individually controlled multipoint data channels.

Options include internal antenna versions or versions with connector for external antenna. There is also a wide selection of certified external antennas to choose from.

The modules are fully Bluetooth qualified and provide modular radio type approvals for the US, Europe, Japan and Canada (FCC, R&TTE, MIC, IC). The modules are also compliant with EMC, Safety and Medical standards.

The operating temperature range is -30°C to +85°C.

Product selector

Model	Standard Specs		Radio			Interfaces		Power		Connectors		Features					Grade		
	Bluetooth qualification	Bluetooth profiles	Antenna type	Max output power including antenna	Max range	UART	GPIO pins	Power supply: 3.0 - 6.0 V	Current consumption (idle)	Solder pads	Board-to-board	Throughput	AT command support	Max number of slaves	Extended Data Mode protocol	Android connectivity	Standard	Professional	Automotive
OBS418i-04	v2.1	SD	I	6 dBm	75 m	•	9	• 12 mA	•	•	•	350 kbps	• 1	•					
OBS418x-04	v2.1	SD	E	8 dBm	150 m	•	9	• 12 mA	•	•	•	350 kbps	• 1	•					
OBS419i-04	v2.1+EDR	SDP	I	6 dBm	75 m	•	9	• 0.6 mA	•	•	•	950 kbps	• 3	•	•				
OBS419x-04	v2.1+EDR	SDP	E	8 dBm	150 m	•	9	• 0.6 mA	•	•	•	950 kbps	• 3	•	•				

D = DUN

P = PAN

E = External antenna

I = Internal antenna

Features

Bluetooth	OBS418: v2.1 (Classic Bluetooth) OBS419: v2.1 + EDR (Classic Bluetooth)
Range	75 m, internal antenna 150 m, external antenna
Output power	6 dBm, internal antenna 8 dBm, external antenna
Throughput	OBS418: 350 kbps OBS419: 950 kbps

Software features

Embedded software	u-blox Bluetooth stack Serial port application
Bluetooth profiles	OBS418/419: Serial Port Profile (SPP) OBS418/419: Dial-up networking Profile (DUN GW, DUN DT) OBS419: Personal Area Networking Profile (PAN) roles: PANU & NAP
Max. number of slaves	OBS418: 1 OBS419: 3
Configuration tools	AT commands via Bluetooth or serial port Serial Port Toolbox (Windows-based SW)
Low Emission Mode®	Prevent disrupting other 2.4GHz radios
Wireless Multidrop ¹	Possible with simultaneous connections to several devices without adding software to the host system.
Extended Data Mode ¹	Individually controlled multipoint data channels
Quality of Service (QoS)	Yes
Repeater functionality ¹	Extended range
Security	Simple Pairing
Android connectivity	SPP Classic Bluetooth with Android devices

¹ Applies to OBS419 only

Electrical data

RF power supply	3.0 to 6.0 VDC
Power consumption	OBS418: 12 mA @ 3.0 V (min.) OBS419: 0.6 mA @ 3.0 V (min.) 20 mA @ 3.0 V (average Tx)

Interfaces

UART Logic level	
RS232 (option via external transceiver)	
RS422/485 (option via external transceiver)	
Baud rate	OBS418: 460.8 kbit/s (max.) OBS419: 1.25 Mbit/s (max.) Support for non-standard baud rates
Flow control	CTS/RTS (hardware) or none
GPIO pins	9
U.FL antenna connector (external antenna version only)	

Package

Dimensions	16.0 x 36.0 x 3.2 mm (internal antenna) 16.0 x 36.0 x 2.6 mm (external antenna)
Weight	2 g
Mounting	Mounting holes Machine mountable Board-to-board connector Solder land pads

Environmental data, quality & reliability

Operating temperature –30°C to +85°C

Certifications and approvals

Type approvals	Europe (ETSI R&TTE) US (FCC/CFR 47 part 15 unlicensed modular transmitter approval) Canada (IC RSS) Japan (MIC - formerly TELEC)
R&TTE Directive 1999/5/EC	Effective use of frequency spectrum: EN 300 328 EMC: EN 301 489-1, EN 301 489-17, EN 61000-6-2 Health and safety: EN 62479, EN 60950-1, IEC 60950-1
Medical Electrical Equipment	IEC 60601-1-2
Bluetooth Qualification	OBS418: v2.1 OBS419: v2.1 + EDR



Support products

EVK-OBS419 Evaluation Kit

cB-OBS419i-06-B	Includes the OBS419i-04 module with additional JST connector, USB module adapter (installs virtual COM-port), USB extension cable, JST to flying leads cable, and configuration software. To evaluate the OBS418, order the module separately.
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Product variants

cB-OBS418i-04	OBS418 with internal antenna
cB-OBS418x-04	OBS418 with U.FL connector for external antenna
cB-OBS419i-04	OBS419 with internal antenna
cB-OBS419x-04	OBS419 with U.FL connector for external antenna

LILY-W1 series

Ultra-compact host-based Wi-Fi modules

Highlights

- Extremely small footprint
- On-board antenna
- Integrated LTE filter
- Micro access point feature for up to 8 clients
- Wi-Fi direct



LILY-W131
10.0 x 14.0 x 2.2 mm



LILY-W132
10.0 x 14.0 x 3.8 mm

Product description

The LILY-W1 series ultra-compact Wi-Fi frontend modules include an integrated MAC/baseband processor and RF front-end components. The modules connect to a host via SDIO or USB interface. They provide simultaneous operation as a station and a micro access point for up to 8 clients. Variant LILY-W132 further includes an internal antenna and LTE filter to enable in-device co-existence without jeopardizing Wi-Fi performance. All LILY-W1 modules will be globally certified for target markets accepting modular radio type approvals.

Key features

- Wi-Fi Standards IEEE 802.11b/g/n
- 802.11n 1x1 SISO
- 802.11 PHY data rates of up to 72 Mbps
- Station and micro access point operation with up to 8 clients
- AES-CCMP and WAPI hardware encryption
- MAC address and RF parameters stored on module
- 1.8 V or 3.3 V IO signal levels
- Extended operating temperature range of -40 °C to +85 °C

Product selector

Model	Radio						Interfaces	Power	Connectors	Features	Grade		
	2.4 GHz channels 1-13	Wi-Fi IEEE 802.11 version	Max output power incl. antenna	Max range	Antenna type	LTE filter	SDIO 2.0	USB 2.0	Power supply: 3.0 - 3.6 V	Solder pins	Wi-Fi Security and WAPI	RF parameters in OTP memory	MAC addresses in OTP memory
LILY-W131	• b/g/n	20 dBm	TBD	P			•	•	•	•	•	•	•
LILY-W132	• b/g/n	20 dBm	TBD	I	•		•	•	•	•	•	•	•

I = Internal antenna P = Antenna pin

Features

Wi-Fi IEEE 802.11	b/g/n (single-stream, 72 Mbps)
Channels	2.4 GHz channels 1-13
Channel bandwidth	20 MHz
Range (max)	TBD
Output power (max)	802.11b: 20 dBm including antenna gain 802.11g: 18 dBm including antenna gain 802.11n: 17 dBm including antenna gain
LTE filter	Embedded LTE frequency filter (LILY-W132 only)

Package

Dimensions	10.0 x 14.0 x 2.2 mm (LILY-W131) 10.0 x 14.0 x 3.8 mm (LILY-W132)
Weight	< 2 g
Mounting	Solder edge pins with castellations (visually inspectable)

Environmental data, quality & reliability

Operating temperature	−40°C to +85°C
Cold	EN 60068-2-1
Dry heat	EN 60068-2-2
Change of temperature	EN 60068-2-14 and EN 60068-2-27
Vibration	EN 60068-2-6
Road vehicles	ISO 16750
Production & design	IPC-a-610 class 3

Software features

RF parameters	Available in on-board OTP memory
MAC addresses	Available in on-board OTP memory
Security	WPA-PSK WPA2-PSK TKIP and AES hardware accelerator WAPI
Operational modes	Station (STA) / Client Micro-AP supports up to 8 stations Simultaneous STA and Micro-AP
Driver support	Free of charge drivers for: Android 4.4 Linux 2.6.x Linux 3.x

Certifications and approvals

Type approvals	Europe (ETSI R&TTE) US (FCC/CFR 47 part 15 unlicensed modular transmitter approval) Canada (IC RSS)
R&TTE Directive 1999/5/EC	EN 300 328, EN 301 893 EMC: EN 301 489-1, EN 301 489-17, EN 61000-6-2 Safety Compliance: IEC 60950-1, EN 60950-1

Electrical data

Power supply	3.0 VDC- 3.6 VDC
Power consumption	Idle (sleep) mode: < 2 mA @ 3.3 VDC Max (Rx/Tx) mode: < 350 mA @ 3.3 VDC

Support products

EVK-LILY-W131	Evaluation kit for LILY-W131. Includes LILY-W131 module mounted on adapter board with SDIO card interface, USB interface, and two external antennas.
EVK-LILY-W132	Evaluation kit for LILY-W132. Includes LILY-W132 module mounted on adapter board with SDIO card and USB interface.

Interfaces

Host interface	SDIO 2.0 USB 2.0 (slave)
I/O signals	1.8 or 3.3 V selectable

Product variants

LILY-W131	LILY-W1 module with antenna pin
LILY-W132	LILY-W1 module with internal antenna and LTE filter

EMMY-W1 series

Standard

Professional

Automotive

Host-based multiradio modules with Wi-Fi, Bluetooth & NFC

Highlights

- Automotive and professional grades
- Dual-band Wi-Fi with IEEE 802.11ac
- Dual-mode Bluetooth v4.2 with BR/EDR and Bluetooth low energy
- NFC (Near Field Communication)
- Simultaneous client and micro access point operation for up to 10 clients
- Integrated LTE filter



EMMY-W1
13.8 x 19.8 x 2.5 mm

Product description

EMMY-W1 is an ultra-compact multiradio module providing Wi-Fi, Bluetooth BR/EDR, Bluetooth low energy and NFC with an extended temperature range from -40 °C to +85 °C offered in automotive and professional grades. It is designed for both simultaneous and independent operations of:

- Wi-Fi IEEE 802.11ac and a/b/g/n
- Dual-mode Bluetooth v4.2
- NFC

EMMY-W1 is an SMD component and provides a complete wireless modem solution that can easily be integrated into the application. The RF module can be connected to a host processor through SDIO and High-Speed UART interfaces. The module is radio-type approved for Europe (CE), the United States (FCC) and Canada (IC) (approvals pending).

Key Features

- Wi-Fi Standards IEEE 802.11a/b/g/n/ac
- Support of Wi-Fi direct mode
- IEEE 802.11 PHY data rates of up to 433 Mbps
- Suitable for HD video streaming
- Concurrent multiradio connections
- Hardware encryption engine for 128-bit AES
- WAPI support
- Bluetooth v4.2 with Bluetooth low energy & Classic Bluetooth
- NFC
- PCM interface for audio
- Climatic, mechanical, and operating life qualification tests according to ISO 16750-4

Product selector

Model	Radio									Interfaces	Power	Connectors	Features	Grade							
	Wi-Fi 2.4 GHz channels 1-13	Wi-Fi 5 GHz channels 36-165	Wi-Fi IEEE 802.11 version	NFC	Bluetooth qualification	Bluetooth profiles	Max output power at antenna pin	Antenna type	LTE filter	High-speed UART	SDIO 3.0	PCM (Bluetooth audio)	Power supply: 3.0-3.6 V	Solder pins	Micro Access Point	AES hardware support	RF parameters in OTP memory	MAC addresses in OTP memory	Standard	Professional	Automotive
EMMY-W161	•	•	a/b/g/n/ac	•	v4.2	H	18 dBm	1p	•	•	•	•	•	•	•	•	•	•			
EMMY-W163	•	•	a/b/g/n/ac	•	v4.2	H	18 dBm	2p		•	•	•	•	•	•	•	•	•			
EMMY-W165	•	•	a/b/g/n/ac	•	v4.2	H	18dBm	1p		•	•	•	•	•	•	•	•	•			

H = HCI

1p = One pin for combined external antenna for Bluetooth and Wi-Fi

2p = Two pins for separate external antennas for Bluetooth and Wi-Fi

Features

Wi-Fi standards	IEEE 802.11a/b/g/n/ac IEEE 802.11d/e/h/i/k*/r/v*/w
Wi-Fi transfer rates	IEEE 802.11n/ac: max. 433 Mbps (80 MHz channel) max. 200 Mbps (40 MHz channel) max. 86 Mbps (20 MHz channel) IEEE 802.11g: 54,48,36,24,18,12,9,6 Mbps IEEE 802.11b: 11, 5.5, 2, 1 Mbps
Wi-Fi channels	2.4 GHz: 1-13 5 GHz: 36-165 (U-NII band 1, 2, 2e, 3)
NFC frequency	13.56 MHz
Bluetooth	v4.2 (Bluetooth low energy and Bluetooth BR/EDR)
Antenna	2 antenna pins for NFC antenna EMMY-W161 & EMMY-W165: 1 combined antenna pin for Bluetooth and Wi-Fi antennas EMMY-W163: 2 separate antenna pins for Bluetooth and Wi-Fi antennas
LTE filter	Integrated BAW filter (EMMY-W161 only)
Output power	Wi-Fi IEEE 802.11b: 18 dBm Wi-Fi IEEE 802.11a/g/n/ac: 16 dBm Bluetooth BR: 10 dBm Bluetooth EDR: 8 dBm

* Not currently supported by firmware

Software features

RF parameters	Available in on-board OTP memory
MAC addresses	Available in on-board OTP memory
Security	WEP64/128 WPA (TKIP, AES) WPA2 (CCMP, AES) WAPI 128-bit AES hardware support
Wi-Fi operational modes	Station (STA): Infrastructure & Direct mode μAP: Supports up to 10 stations Wi-Fi direct One single firmware for Wi-Fi STA, μAP and Bluetooth
Driver support	Free of charge driver for Linux 3.x
Wi-Fi / Bluetooth coexistence	Internal TDM mechanism

Interfaces

Wi-Fi	SDIO 3.0 (4-bit, up to 208 MHz clock)
Bluetooth	SDIO 3.0 (4-bit), High-speed UART
Bluetooth audio	PCM
NFC	SDIO 3.0, UART

Package

Dimensions	13.8 x 19.8 x 2.5 mm
Mounting	Solder pins (LGA)

Environmental data, quality & reliability

Operating temperature	−40 °C to +85 °C
Automotive qualification according to ISO 16750-4	

Electrical data

RF power supply	3.0-3.6 VDC
I/O power supply	3.3 VDC or 1.8 VDC

Certifications and approvals¹

Europe (ETSI R&TTE)
US (FCC CFR 47 part 15 unlicensed modular transmitter approval)
Canada (IC RSS)

¹ Pending approval

Support products

The EMMY-W1 evaluation kits include an evaluation board with full access to the module interfaces. The board includes antennas for Wi-Fi, Bluetooth and NFC. It also includes U.FL connectors for connecting external Wi-Fi and Bluetooth antennas. The kit has a standard SDIO connector for host communication.

EVK-EMMY-W161	Evaluation kit for EMMY-W161, EMMY-W161-A, EMMY-W165 and EMMY-W165-A
EVK-EMMY-W163	Evaluation kit for EMMY-W163 and EMMY-W163-A

Product variants

EMMY-W161	Professional grade module with 1 combined antenna pin for Wi-Fi and Bluetooth; integrated LTE filter
EMMY-W163	Professional grade module with 2 separate antenna pins for Wi-Fi and Bluetooth (no LTE filter)
EMMY-W165	Professional grade module with 1 combined antenna pin for Wi-Fi and Bluetooth (no LTE filter)
EMMY-W161-A	Automotive grade module with 1 combined antenna pin for Wi-Fi and Bluetooth; integrated LTE filter
EMMY-W163-A	Automotive grade module with 2 separate antenna pins for Wi-Fi and Bluetooth (no LTE filter)
EMMY-W165-A	Automotive grade module with 1 combined antenna pin for Wi-Fi and Bluetooth (noLTE filter)

ELLA-W1 series

Standard

Professional

Automotive

Host-based multiradio modules with Wi-Fi & Bluetooth

Highlights

- Automotive and professional grades
- Dual-band Wi-Fi 2.4 & 5 GHz
- Bluetooth v3.0 + HS
- High transmission power and sensitivity
- Simultaneous client and micro access for up to 10 clients
- Low power consumption



ELLA-W1 Professional grade
14.8 x 14.8 x 2.5 mm



ELLA-W1 Automotive grade
14.8 x 14.8 x 2.0 mm

Product description

ELLA-W1 is an ultra-compact, Wi-Fi & Bluetooth front-end module with an extended temperature range from -40 °C to +85 °C offered in automotive and professional grades. It is designed for both simultaneous and independent operations of:

- Wi-Fi 802.11a/b/g/n
- Bluetooth v3.0+HS

ELLA-W1 includes an integrated MAC / Baseband processor and RF front-end components and can connect to a host processor through its SDIO interface. The modules are radio type approved for Europe (CE), the United States (FCC), Canada (IC) and Taiwan (NCC). Approvals from other countries are pending.

Key Features

- Wi-Fi standards IEEE 802.11a/b/g/n
- Concurrent Wi-Fi and multiradio connections
- Support of Wi-Fi direct mode
- 802.11 PHY data rates up to 150 Mbps (40 MHz channel)
- Hardware encryption engine for 128-bit AES
- WAPI support
- Bluetooth v3.0+HS (High Speed)
- Driver support for Linux and Android
- Automotive qualification tests according to ISO 16750-4

Product selector

Model	Radio							Interfaces		Power	Connectors	Features				Grade		
	Wi-Fi 2.4 GHz channels 1-13	Wi-Fi 5 GHz channels 36-165	Wi-Fi IEEE 802.11 version	Bluetooth qualification	Bluetooth profiles	Max output power at antenna pin	Antenna type	SDIO	PCM (Bluetooth audio)	Power supply: 1.8 and 3.3 V	Solder pins	Micro Access Point	AES hardware support	RF parameters in OTP memory	MAC addresses in OTP memory	Standard	Professional	Automotive
ELLA-W131	•	b/g/n	v3.0+HS	H	18 dBm	1p	•	•	•	•	•	•	•	•	•	T	T	
ELLA-W133	•	b/g/n	v3.0+HS	H	18 dBm	2p	•	•	•	•	•	•	•	•	•			
ELLA-W161	•	•	a/b/g/n	v3.0+HS	H	18 dBm	1p	•	•	•	•	•	•	•	•			
ELLA-W163	•	•	a/b/g/n	v3.0+HS	H	18 dBm	2p	•	•	•	•	•	•	•	•			

H = HCI

1p = One pin for combined external antenna for Bluetooth and Wi-Fi
2p = Two pins for separate external antennas for Bluetooth and Wi-Fi

T = Can be combined with u-blox LTE module TOBY-L2 for router functionality

Features

Wi-Fi standards	IEEE 802.11a(optional)/b/g/n IEEE 802.11d/e/h/i/k*/r*/w
Wi-Fi transfer rates	IEEE 802.11n: max. 150 Mbps (40 MHz channel) max. 72 Mbps (20 MHz channel) IEEE 802.11g: 54,48,36,24,18,12,9,6 Mbps IEEE 802.11b: 11, 5.5, 2, 1 Mbps
Wi-Fi channels	2.4 GHz: 1-13 5 GHz: 36-165 (U-NII band 1, 2, 2e, 3)
Bluetooth	v3.0+HS (High Speed) v2.1+EDR (Enhanced Data Rate)
Antenna	1 combined or 2 separate antenna pins for Bluetooth and Wi-Fi
Output power	Wi-Fi IEEE 802.11b: 18 dBm Wi-Fi IEEE 802.11a/g/n: 15 dBm Bluetooth: 7 dBm for single antenna variant; 10 dBm for dual antenna variant

* Not supported by firmware currently

Software features

RF parameters	Available in on-board OTP memory
MAC addresses	Available in on-board OTP memory
Security	WEP64/128 WPA (TKIP, AES) WPA2 (CCMP, AES) WAPI hardware support 128 bit AES hardware support
Wi-Fi operational modes	Station (STA): Infrastructure & ad-hoc mode μAP: Supports up to 10 stations Wi-Fi direct One single firmware for Wi-Fi STA, μAP and Bluetooth
Driver support	Free of charge drivers for: Android 4.4, Linux 2.6.x, and Linux 3.x Third party drivers for: Windows Embedded CE 6.0, Windows Embedded Compact 7 and Windows Embedded Compact 2013
Wi-Fi / Bluetooth coexistence	Internal TDM mechanism
Support for low power modes	

Electrical data

Power supply	3.3 VDC and 1.8 VDC
Power consumption	125 mA (average) @ 3.3 VDC 210 mA (max) @ 3.3 VDC

Interfaces

Host interface	SDIO (4-bit)
Audio interface	PCM (Bluetooth audio)

Package

Dimensions	14.8 x 14.8 x 2.5 mm for professional grade 14.8 x 14.8 x 2.0 mm for automotive grade
Mounting	Solder edge pins with castellations (visually inspectable)

Environmental data, quality & reliability

Operating temperature	-40 °C to +85 °C
Automotive qualification according to ISO 16750-4	

Certifications and approvals

Europe (ETSI R&TTE)
US (FCC CFR 47 part 15 unlicensed modular transmitter approval)
Canada (IC RSS)
Taiwan (NCC)

Approvals from other countries are pending

Support products

The ELLA-W1 evaluation kits include an evaluation board which is a ready-made reference design. Users can either work with its onboard antenna or an external antenna connected via coaxial connector. The board offers a standard SDIO connector for host communication.

EVK-ELLA-W161	Evaluation kit for versions with 1 antenna pin (ELLA-W131, ELLA-W131-A, ELLA-W161 and ELLA-W161-A)
EVK-ELLA-W163	Evaluation kit for versions with 2 antenna pins (ELLA-W133, ELLA-W133-A, ELLA-W163 and ELLA-W163-A)

Product variants

ELLA-W131	Professional grade, with RF shield box, single-band (2.4 GHz), 1 antenna pin. Can be combined with TOBY-L2 LTE module for router functionality.
ELLA-W133	Professional grade, with RF shield box, single-band (2.4 GHz), 2 antenna pins
ELLA-W161	Professional grade, with RF shield box, dual-band (2.4 and 5 GHz), 1 antenna pin
ELLA-W163	Professional grade, with RF shield box, dual-band (2.4 and 5 GHz), 2 antenna pins
ELLA-W131-A	Automotive grade, single-band (2.4 GHz), 1 antenna pin. Can be combined with TOBY-L2 LTE module for router functionality.
ELLA-W133-A	Automotive grade, single-band (2.4 GHz), 2 antenna pins
ELLA-W161-A	Automotive grade, dual-band (2.4 and 5 GHz), 1 antenna pin
ELLA-W163-A	Automotive grade dual-band (2.4 and 5 GHz), 2 antenna pins

THEO-P1 series

Host-based V2X transceiver module

Highlights

- Automotive grade V2X transceiver module for infrastructure and vehicles
- Compliance with WAVE and ETSI ITS G5 for US and Europe operation
- Single-channel 802.11p diversity
- Multi-channel operation
- Communication range of more than 1 km



THEO-P1
30.0 x 40.0 x 4.0 mm

Product description

THEO-P1 is a compact, embedded transceiver module that facilitates development of electronics for Vehicle-to-Everything (V2X) communication systems. This module is offered in automotive grade for applications such as traffic safety, intelligent traffic management and entertainment. It provides superior performance in comparison with V2X systems based on consumer-grade Wi-Fi chipsets (COTS), especially at high vehicle speeds and in non-line-of-sight conditions.

THEO-P1 includes an integrated MAC/LLC/Baseband processor and the required RF front-end components. It is connected to a host processor through the USB interface.

Key Features

- Compliance with V2X both in Europe and US
- Best performance radio
- Multiple operating modes with single-channel and multiple channels
- Transmit mask meeting IEEE 802.11p Class C (5 GHz band)
- Integrated security acceleration

Product selector

Model	Radio			Interfaces				Power	Features		Grade		
	802.11p	Max output power at antenna pin	Antenna type	USB 2.0	GPIO	1PPS	SPI ¹	Power supply: 3.3 V and 5 V	Single channel with antenna diversity	Multi-channel operation	Standard	Professional	Automotive
THEO-P173	•	23 dBm	2p	•	1	•	•	•	•	•			

2p = Two pins for separate external antennas

¹ SPI Planned for version 03A

Features

Standards conformance	IEEE 802.11p - 2010 ETSI ES 202 663 IEEE 1609.4 - 2010
Frequency band	5.9 GHz
Antenna	2 antenna pins for external 5 GHz antennas
Output power	-10 to +23 dBm
Receive sensitivity	-97 dBm
Data rates	3 to 54 Mbps

Environmental data, quality & reliability

Operating temperature	-40°C to +85°C
Automotive qualification according to Baseband/radio AEC-Q100 and ISO 16750-4	

Software features

Operating modes	Single radio Single channel Multi-channel
Radio channel measurements	Channel utilization Channel active ratio Per-channel statistics Received signal and noise power levels

Electrical data

Power supply	3.3 V and 5 V
Power consumption	4 W (max)

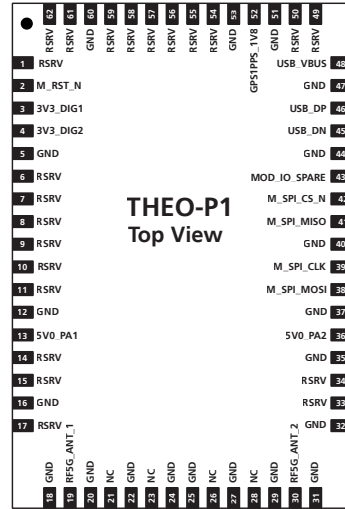
Interfaces

Host interfaces	USB 2.0 and SPI ¹
Other interfaces	GPIO and 1PPS

¹ SPI Planned for version 03A

Package

Dimensions	30.0 x 40.0 x 4.0 mm
Pin-out	62 pin LCC (Leadless Chip Carrier)



Certifications and approvals

FCC and IC Canada²

² Pending certification and approval

Support products

The THEO-P1 evaluation kit includes an evaluation board with full access to the module interfaces. The board has SMA connectors for connecting external antennas.

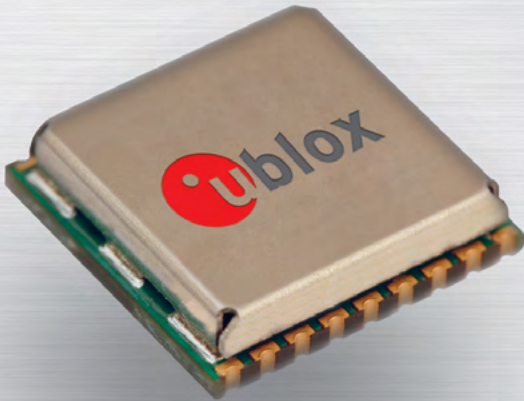
EVK-THEO-P1 Evaluation kit for THEO-P173

Product variants

THEO-P173	Automotive grade
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Note: THEO-P1 series was formerly known as Cohda MK5.

Position and time modules & antennas



Standard Precision GNSS modules

Model	Category	GNSS				Number of Concurrent GNSS	Interfaces				Features										Grade		
	Standard Precision GNSS High Precision GNSS Dead Reckoning Timing	GPS / QZSS	GLONASS	Galileo	BeiDou		UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	Data logging	Additional SAW	Additional LNA	RTC crystal	Oscillator	Built-in antenna	Built-in antenna supply and supervisor	Timepulse	Standard	Professional	Automotive	
EVA-M8M	•	•	•	•	•	3	•	•	•	•	FF	FF	•	•	•	•	•	•	1	•	•	•	
EVA-8M	•	•	•			1	•	•	•	•	FF		•	•	•	•	•	•	1	•	•	•	
LEA-M8S	•	•	•	•	•	3	•	•	•			•	•	•	T		•	•	1	•	•	•	
MAX-M8C	•	•	•	•	•	3	•		•					•	•	•	•	•	1	•	•	•	
MAX-M8Q	•	•	•	•	•	3	•		•					•	•	T		•	1	•	•	•	
MAX-M8W	•	•	•	•	•	3	•		•					•	•	T		•	1	•	•	•	
MAX-8C	•	•	•			1	•		•					•	•	•	•	•	1	•	•	•	
MAX-8Q	•	•	•			1	•		•					•	•	T		•	1	•	•	•	
NEO-M8N	•	•	•	•	•	3	•	•	•	•	•	•	•	•	•	T		•	1	•	•	•	
NEO-M8Q-0	•	•	•	•	•	3	•	•	•	•		•	•	•	•	T		•	1	•	•	•	
NEO-M8Q-01A [•]	•	•	•	•	•	3	•	•	•	•				•	•	T		•	1	•	•	•	
NEO-M8M	•	•	•	•	•	3	•	•	•	•				•	•	C		•	1	•	•	•	
NEO-8Q	•	•	•			1	•	•	•	•		•	•	•	•	T		•	1	•	•	•	
CAM-M8Q [§]	•	•	•	•	•	3	•		•	•		•	•	•	•	T	•	•	1	•	•	•	
CAM-M8C [§]	•	•	•	•	•	3	•		•	•		•	•	•	•	C	•	•	1	•	•	•	
PAM-7Q	•	•				1	•		•					•	T	•		•	1	•	•	•	

* = Operating temperature -40° to +105°C

E = External Flash Required

○ = Optional, or requires external components

C = Crystal / T = TCXO

‡ = with Galileo and 3 concurrent GNSS mid-Q3 2016

◆ = Yes, but with a higher backup current

High Precision GNSS, ADR/UDR, and Timing modules

Model	Category	GNSS				Interfaces				Features												Grade																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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+ = ultra-high precision at cm-level

ADR = Automotive Dead Reckoning
UDR = Untethered Dead Reckoning

○ = Optional, or requires external components

E = External Flash required

C = Crystal / T = TCXO
V = VCTCXO

u-blox M8 concurrent GNSS module

Highlights

- Industry's smallest GNSS module
- Concurrent reception of up to 3 GNSS (GPS, Galileo, GLONASS, BeiDou)
- Security and integrity protection
- Supports all satellite augmentation systems
- Advanced jamming and spoofing detection
- Backward compatible with EVA-7M



EVA-M8M
7.0 x 7.0 x 1.1 mm

Product description

The EVA-M8M GNSS modules feature the exceptional performance of the u-blox M8 concurrent positioning engine, supporting GPS, Galileo, GLONASS and BeiDou. The EVA-M8M modules deliver high sensitivity in the ultra compact EVA form factor.

The EVA-M8M series is an ideal solution for cost and space-sensitive applications. It is easy to design-in, only requiring an external GNSS antenna in most applications. The layout of the EVA-M8M is especially designed to ease the customer's design and limit near field interferences since RF and digital domains are kept separate.

The EVA-M8M modules use a crystal oscillator for lower system costs. Like other u-blox GNSS modules, the EVA-M8M modules use components selected for functioning reliably in the field over the full operating temperature range.

With dual-frequency RF front-end, the u-blox M8 concurrent GNSS engine is able to intelligently use the highest number of visible satellites from three GNSS (GPS/Galileo together with GLONASS or BeiDou) systems for reliable

positioning. In addition, the EVA-M8M modules provide an SQI interface for optional external FLASH, which can be used for future firmware upgrades and improved A-GNSS performance. EVA-M8M series supports message integrity protection, geofencing and spoofing detection.

The EVA-M8M can be easily integrated in manufacturing, thanks to the QFN-like package. The modules are available in 500 pcs/reel, ideal for small production batches. The EVA-M8M modules combine a high level of integration capability with flexible connectivity options in a miniature package. This makes the EVA-M8M modules perfectly suited for small size and cost-sensitive industrial and wearable devices. The DDC (I²C compliant) interface provides connectivity and enables synergies with most u-blox cellular modules.

The EVA-M8M modules are manufactured in ISO/TS 16949 certified sites and qualified as stipulated in the JESD47 standard.

Product selector

Model	Category	GNSS				Supply	Interfaces				Features					Grade		
	Standard Precision GNSS High Precision GNSS Dead Reckoning Timing	GPS / QZSS GLONASS Galileo BeiDou		Number of Concurrent GNSS		1.65 V – 3.6 V	UART USB SPI DDC (I ² C compliant)				Programmable (Flash) Data logging Additional SAW Additional LNA RTC crystal Oscillator Built-in antenna Built-in antenna supply and supervisor Timepulse					Standard Professional Automotive		
EVA-M8M	•	• • • •		3	•		• • • •	E	E		•	C		1				

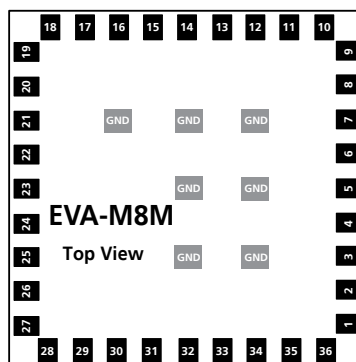
E = External Flash required
○ = Optional, or requires external components

C = Crystal

Package

43 pin LGA (Land Grid Array): 7.0 x 7.0 x 1.1 mm, 0.13 g

Pinout



Environmental data, quality & reliability

Operating temp. -40° C to 85° C
Storage temp. -40° C to 105° C
RoHS compliant (lead-free) and green (no halogens)
Qualification according to standard JESD47
Manufactured in ISO/TS 16949 certified production sites
Moisture sensitivity level 3

Interfaces

Serial interfaces	1 UART 1 USB 1 SPI (Optional) 1 DDC (I ² C compliant) 1 SQI interface (For Flash update)
Digital I/O	Configurable timepulse 1 EXTINT input for Wakeup
Timepulse	Configurable: 0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM

Electrical data

Supply voltage	1.65 V to 3.6 V
Digital I/O voltage level	1.65 V to 3.6 V
Power Consumption ¹	22 mA @ 3 V (Continuous) 5.3 mA @ 3V Power Save mode (1 Hz)
Backup Supply	1.4 to 3.6V

Support products

Evaluation kit to get familiar with u-blox M8 positioning technology, evaluate functionality, and visualize GNSS performance.

EVK-M8MEVA	u-blox M8 GNSS Evaluation Kit for EVA-M8M (crystal)
C88-M8M	NEO adaptor board using EVA-M8M for easy evaluation of existing NEO-xM designs

Product variants

EVA-M8M-0	u-blox M8 concurrent GNSS LGA module, crystal, ROM (Default: GPS + GLONASS)
EVA-M8M-1	u-blox M8 concurrent GNSS LGA module, crystal, ROM (Default: GPS + BeiDou)

1 EVA-M8M-0 default mode: GPS/SBAS/QZSS+GLONASS
2 External LNA and SAW recommended for passive antenna applications
3 External Flash required



EVA-8M

u-blox 8 GNSS module

Highlights

- Industry's smallest GPS/QZSS and GLONASS module
- High sensitivity of -164 dBm
- Cost-efficient system
- Minimal power consumption
- Superior anti-spoofing and anti-jamming
- Pin-compatible to EVA-7M



EVA-8M
7.0 x 7.0 x 1.1 mm

Product description

The EVA-8M standard precision GNSS module features the reliable performance of the u-blox 8 positioning engine (receiving GPS, GLONASS, QZSS and SBAS signals). The EVA-8M delivers high sensitivity in the ultra compact EVA form factor.

The EVA-8M supports advanced Power Save Modes and provides message integrity protection, geofencing, spoofing detection, and odometer functionalities.

The EVA-8M is an ideal solution for cost and space-sensitive applications. It is easy to design-in, only requiring an external GNSS antenna in most applications. The layout of the EVA-8M is especially designed to ease the customer's design and limit near field interferences, since RF and digital domains are kept separated.

The EVA-8M uses a crystal oscillator for lower system costs. Like other u-blox GNSS modules, the EVA-8M uses components selected for functioning reliably in the field over the full operating temperature range.

The EVA-8M is easily integrated in manufacturing, thanks to its QFN-like package and low moisture sensitivity level. The modules are available in 500 pcs/reel, ideal for small production batches.

The EVA-8M module combines a high level of integration capability with flexible connectivity options in a miniature package. This makes it perfectly suited for industrial and mass-market end products with strict size and cost requirements. The DDC (I²C compliant) interface provides connectivity and enables synergies with most u-blox cellular modules.

The EVA-8M module is manufactured in ISO/TS 16949 certified sites and qualified as stipulated in the JESD47 standard.

By offering backward compatibility to EVA-7M, migration to EVA-8M is easy.

Product selector

Model	Category	GNSS		Supply	Interfaces				Features						Grade
	Standard Precision GNSS High Precision GNSS Dead Reckoning Timing	GPS / QZSS GLONASS Galileo BeiDou	Number of Concurrent GNSS	1.65 V – 3.6 V	UART USB SPI DDC (I²C compliant)	Programmable (Flash) Data logging Additional SAW Additional LNA RTC crystal Oscillator Built-in antenna Built-in antenna supply and supervisor Timepulse				E o C			1	Standard Professional Automotive	
EVA-8M	•	• •	1	•	• • • •										

E = External Flash required
o = Optional, or requires external components

C = Crystal

u-blox 7 GNSS module

Highlights

- Industry's smallest standalone GPS/QZSS, GLONASS module
- Minimal system cost
- Minimal power consumption
- Eases design and manufacturing
- No host integration or external components needed



EVA-7M
7.0 x 7.0 x 1.1 mm

Product description

The EVA-7M standalone GNSS module features the reliable performance of the u-blox 7 positioning engine (receiving GPS, GLONASS, QZSS and SBAS signals). The EVA-7M delivers high sensitivity and minimal acquisition times in the ultra compact EVA form factor.

The EVA-7M is an ideal solution for cost and space-sensitive applications. It is easy to design-in, only requiring an external GNSS antenna in most applications. The layout of the EVA-7M is especially designed to ease the customer's design and limit near field interferences since RF and digital domains are kept separated.

EVA-7M uses a crystal oscillator for lower system costs. Like other u-blox GNSS modules, the EVA-7M uses components selected for functioning reliably in the field over the full operating temperature range.

The EVA-7M is easily integrated in manufacturing, thanks to its QFN-like package and low moisture sensitivity level. The modules are available in 500 pcs/reel, ideal for small production batches. The EVA-7M module combines a high level of integration capability with flexible connectivity options in a miniature package. This makes it perfectly suited for industrial and mass-market end products with strict size and cost requirements. The DDC (I²C compliant) interface provides connectivity and enables synergies with u-blox cellular modules.

The EVA-7M module is manufactured in ISO/TS 16949 certified sites and qualified as stipulated in the JESD47 standard.

Product selector

Model	Type	Supply	Interfaces	Features	Grade
	GPS / QZSS GLONASS Galileo BeiDou Timing Dead Reckoning Precise Point Positioning Raw Data	1.65 V – 3.6 V Lowest power (DC/DC)	UART USB SPI DDC (I ² C compliant)	Programmable (Flash) Data logger Additional SAW Additional LNA RTC crystal Internal oscillator Active antenna / LNA supply Active antenna / LNA control Antenna short circuit detection / protection pin Antenna open circuit detection pin Frequency output	Standard Professional Automotive
EVA-7M	• •	• •	• • • •	• • • • • • • • • •	

○ = Optional, or requires external components

C = Crystal

Features

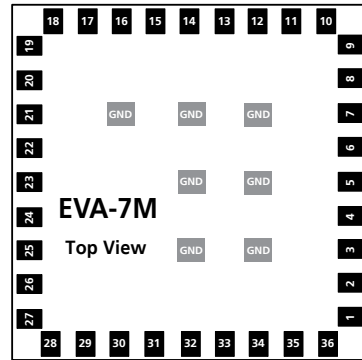
Receiver type	56-channel u-blox 7 GNSS engine GPS/QZSS L1 C/A, GLONASS L1 FDMA, SBAS: WAAS, EGNOS, MSAS		
Max nav. update rate	10 Hz		
Accuracy	Position	GPS 2.5 m CEP	GLONASS 4.0 m CEP
	SBAS	2.0 m CEP	n.a.
Acquisition	Cold starts:	30 s	32 s
	Aided starts:	5 s	n.a.
	Reacquisition:	1 s	3 s
Sensitivity	Tracking and Nav:	-160 dBm	-158 dBm
	Cold starts:	-147 dBm	-139 dBm
	Warm starts:	-148 dBm	-145 dBm
Assistance GPS	AssistNow Online		
	AssistNow Offline		
	AssistNow Autonomous		
	OMA SUPL & 3GPP compliant		
Oscillator	Crystal		
Real time clock (RTC)	Can be derived either from onboard GNSS crystal (for lowest system costs and smallest size) or from external RTC Clock (Default mode, for lower battery current)		
Anti jamming	Active CW detection and removal		
Memory	Onboard ROM		
Supported antennas	Active and passive ¹		
Antenna supervision	Short and open circuit detection supported with external circuit		

¹ An external LNA is recommended

Package

43 pin LGA (Land Grid Array): 7.0 x 7.0 x 1.1 mm, 0.13 g

Pinout



Environmental data, quality & reliability

Operating temp. -30° C to 85° C
 Storage temp. -40° C to 105° C
 RoHS compliant (lead-free) and green (no halogens)
 Qualification according to standard JESD47
 Manufactured in ISO/TS 16949 certified production sites
 Moisture sensitivity level 3

Electrical data

Supply voltage	1.65 V to 3.6 V
Digital I/O voltage level	1.65 V to 3.6 V
Power Consumption	16.5 mA @ 3 V (Continuous) 4 mA @ 3 V Power Save mode (1 Hz)
Backup Supply	1.4 to 3.6 V

Interfaces

Serial interfaces	1 UART
	1 USB
	1 SPI (Optional)
	1 DDC (I ² C compliant)
Digital I/O	Configurable timepulse 1 EXTINT input for Wakeup
Timepulse	Configurable 0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM

Support products

Evaluation kit to get familiar with u-blox 7 positioning technology, evaluate functionality, and visualize GPS performance.

EVK-7EVA: u-blox 7 Evaluation Kit for EVA-7M (crystal)

C88-7M: NEO adaptor board using EVA-7M for easier evaluation for existing NEO-xM designs.

Product variants

EVK-7M: u-blox 7 GNSS LGA module, Crystal, ROM

MAX-M8 series

u-blox M8 concurrent GNSS modules

Highlights

- Concurrent reception of up to 3 GNSS (GPS, Galileo, GLONASS, BeiDou)
- Industry leading –167 dBm navigation sensitivity
- Product variants to meet performance and cost requirements
- Miniature LCC package
- Superior anti-spoofing and anti-jamming
- Pin-compatible to MAX-7 and MAX-6



MAX-M8 series
9.7 x 10.1 x 2.5 mm

Product description

The MAX-M8 series of concurrent GNSS modules is built on the exceptional performance of the u-blox M8 engine in the industry proven MAX form factor.

The MAX-M8 modules utilize concurrent reception of up to three GNSS systems (GPS/Galileo together with BeiDou or GLONASS) for more reliable positioning. The MAX-M8 series provides high sensitivity and minimal acquisition times while maintaining low system power. It also supports message integrity protection, geofencing, and spoofing detection.

The MAX-M8C is optimized for cost sensitive applications and has the lowest power consumption, the MAX-M8Q provides best performance for passive and active antennas designs, while the MAX-M8W is optimized for active antennas with best performance. The industry-proven MAX form factor allows easy migration from previous MAX generations. Sophisticated RF-architecture and interference

suppression ensure maximum performance even in GNSS-hostile environments.

The MAX-M8 series combines a high level of integration capability with flexible connectivity options in a miniature package. This makes MAX-M8 perfectly suited for industrial applications with strict size and cost requirements. The MAX-M8Q is also halogen free (green) which makes it a perfect solution for consumer applications. The DDC (I2C compliant) interface provides connectivity and enables synergies with most u-blox cellular modules.

u-blox M8 modules use GNSS chips qualified according to AEC-Q100, are manufactured in ISO/TS 16949 certified sites, and fully tested on a system level. Qualification tests are performed as stipulated in the ISO16750 standard: “Road vehicles – Environmental conditions and testing for electrical and electronic equipment”.

Product selector

Model	Category				GNSS				Supply	Interfaces				Features								Grade					
	Standard Precision GNSS	High Precision GNSS	Dead Reckoning	Timing	GPS / QZSS	GLONASS	Galileo	BeiDou	Number of Concurrent GNSS	1.65 V – 3.6 V	2.7 V – 3.6 V	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	Data logging	Additional SAW	Additional LNA	RTC crystal	Oscillator	Built-in antenna	Built-in antenna supply and supervisor	Timepulse	Standard	Professional	Automotive
MAX-M8C	•				•	•	•	•	3	•		•			•					♦ C				1			
MAX-M8Q	•				•	•	•	•	3		•	•			•					•	T			1			
MAX-M8W	•				•	•	•	•	3		•	•			•					•	T		•	1			

♦ = Yes, but with a higher backup current

C = Crystal / T = TCXO

Features

Receiver type	72-channel u-blox M8 engine GPS/QZSS L1 C/A, GLONASS L10F BeiDou B1I, Galileo E1B/C SBAS L1 C/A: WAAS, EGNOS, MSAS, GAGAN		
Nav. update rate	Single GNSS:	up to 18 Hz	
	2 Concurrent GNSS:	up to 10 Hz	
Position accuracy	Autonomous	2.5 m CEP	
	MAX-M8Q/W	MAX-M8C	
Acquisition ¹	Cold starts:	26 s	26 s
	Aided starts:	2 s	3 s
	Reacquisition:	1 s	1 s
Sensitivity ¹	Tracking:	-167 dBm	-164 dBm
	Cold starts:	-148 dBm	-148 dBm
	Hot starts:	-157 dBm	-157 dBm
Assistance GNSS	AssistNow Online AssistNow Offline (up to 35 days) AssistNow Autonomous (GPS only, up to 3 days) OMA SUPL & 3GPP compliant		
Oscillator	TCXO (MAX-M8Q/M8W) crystal (MAX-M8C)		
RTC crystal	Built-In (MAX-M8Q/M8W), Cost efficient solution with higher Backup current (MAX-M8C)		
Anti jamming	Active CW detection and removal		
Memory	Onboard ROM		
Supported antennas	Active and passive		
Raw Data	Code phase output		
Odometer	Integrated in navigation filter		
Geofencing	Up to 4 circular areas GPIO for waking up external CPU		
Spoofing detection	Built-in		
Signal integrity	Signature feature with SHA 256		

¹ For default mode: GPS/SBAS/QZSS+GLONASS

Electrical data

Supply voltage	1.65 V to 3.6 V (MAX-M8C) 2.7 to 3.6 V (MAX-M8Q/M8W)
Digital I/O voltage level	1.65 – 3.6 V
Power Consumption ²	23 mA @ 3 V (Continuous) 5.4 mA @ 3V Power Save mode (1 Hz)
Backup Supply	1.4 to 3.6 V

² MAX-M8C, GPS/SBAS/QZSS+GLONASS (default mode)

Interfaces

Serial interfaces	1 UART 1 DDC (I ² C compliant)
Digital I/O	Configurable timepulse 1 EXTINT input for Wakeup
Timepulse	Configurable: 0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM

Package

18 pin LCC (Leadless Chip Carrier): 9.7 x 10.1 x 2.5 mm, 0.6 g

Pinout

10	GND	RESET_N	9
11	RF_IN	VCC	8
12	GND	VCC_IO	7
13	LNA_EN / Reserved	V_BCKP	6
14	VCC_RF	EXTINT	5
15	V_ANT / Reserved	TIMEPULSE	4
16	SDA	RXD	3
17	SCL	TXD	2
18	SAFEBOOT_N	GND	1

Environmental data, quality & reliability

Operating temp.	-40° C to 85° C
Storage temp.	-40° C to 85° C (MAX-M8Q/M8W) -40° C to 105° C (MAX-M8C)
RoHS compliant (lead-free)	
Green (halogen-free):	MAX-M8Q
Qualification according to ISO 16750	
Manufactured in ISO/TS 16949 certified production sites	
Uses u-blox M8 chips qualified according to AEC-Q100	

Support products

u-blox M8 Evaluation Kits:

Easy-to-use kits to get familiar with u-blox M8 positioning technology, evaluate functionality, and visualize GNSS performance.

EVK-M8N	u-blox M8 GNSS Evaluation Kit, with TCXO, supports MAX-M8Q/M8W
EVK-M8C	u-blox M8 GNSS Evaluation Kit, with Crystal, supports MAX-M8C

Product variants

MAX-M8C	u-blox M8 GNSS LCC Module, crystal, ROM
MAX-M8Q	u-blox M8 GNSS LCC Module, TCXO, ROM
MAX-M8W	u-blox M8 concurrent GNSS LCC module, TCXO, active antenna supply, ROM



MAX-8

u-blox 8 GNSS modules

Highlights

- High sensitivity of –166 dBm for single GNSS reception
- Cost-efficient system
- TCXO-based variant for fastest time to first fix
- Low power consumption
- Superior anti-spoofing and anti-jamming
- Pin-compatible to MAX-7



MAX-8 series
9.7 x 10.1 x 2.5 mm

Product description

The MAX-8 series of standard precision GNSS modules features the reliable performance of the u-blox 8 positioning engine, which receives GPS, GLONASS, QZSS and SBAS signals. The MAX-8 series delivers high sensitivity and minimal acquisition times in the ultra compact MAX form factor.

The economical MAX-8 series provides high sensitivity while featuring low power consumption and supporting advanced Power Save Modes. It also provides message integrity protection, geofencing, spoofing detection, and odometer functionalities.

The MAX-8C is optimized for cost sensitive applications with lowest power, while the MAX-8Q provides best performance. The industry proven MAX form factor allows easy migration from MAX-7 and MAX-6 modules by offering backward compatibility. Sophisticated RF-architecture

and interference suppression ensure maximum performance even in GNSS-hostile environments.

The MAX-8 series combines a high level of integration capability with flexible connectivity options in a miniature package. This makes it perfectly suited for industrial and mass-market end products with strict size and cost requirements. The DDC (I²C compliant) interface provides connectivity and enables synergies with most u-blox cellular modules.

u-blox 8 modules use GNSS chips qualified according to AEC-Q100 and are manufactured in ISO/TS 16949 certified sites. Qualification tests are performed as stipulated in the ISO16750 standard: “Road vehicles – Environmental conditions and testing for electrical and electronic equipment”. MAX-8Q complies with green/halogen free standards.

Product selector

Model	Category	GNSS				Supply	Interfaces				Features					Grade
	Standard Precision GNSS High Precision GNSS Dead Reckoning Timing	GPS / QZSS GLONASS Galileo BeiDou	Number of Concurrent GNSS		1.65 V – 3.6 V 2.7 V – 3.6 V		UART USB SPI DDC (I ² C compliant)				Programmable (Flash) Data logging Additional SAW Additional LNA RTC crystal Oscillator Built-in antenna Built-in antenna supply and supervisor Timepulse					Standard Professional Automotive
MAX-8C	•	• •	1		•	•	•				♦ C	1				
MAX-8Q	•	• •	1		•	•	•				• T	1				

♦ = Yes, but with a higher backup current

C = Crystal / T = TCXO

Features

Receiver type	72-channel u-blox 8 engine GPS/QZSS L1 C/A, GLONASS L1 FDMA, SBAS: WAAS, EGNOS, MSAS		
Nav. update rate	Up to 18 Hz		
Position accuracy	Autonomous	GPS 2.5 m CEP	GLONASS 4.0 m CEP
Acquisition ¹	Cold starts:	29 s	30 s
	Aided starts:	2 s	2 s
	Reacquisition:	1 s	1 s
Sensitivity ¹	Tracking:	−166 dBm	−166 dBm
	Cold starts:	−148 dBm	−145 dBm
	Hot starts:	−157 dBm	−156 dBm
Assistance GNSS	AssistNow Online AssistNow Offline (up to 35 days) AssistNow Autonomous (GPS only, up to 3 days) OMA SUPL & 3GPP compliant		
Oscillator	TCXO (MAX-8Q), crystal (MAX-8C)		
RTC crystal	Built-In (MAX-8Q), Cost efficient solution with higher Backup current (MAX-8C)		
Anti jamming	Active CW detection and removal		
Memory	Onboard ROM		
Supported antennas	Active and passive		
Raw Data	Code phase output		
Odometer	Integrated in navigation filter		
Geofencing	Up to 4 circular areas GPIO for waking up external CPU		
Spoofing detection	Built-in		
Signal integrity	Signature feature with SHA 256		

¹ MAX-8Q

Electrical data

Supply voltage	1.65 V to 3.6 V (MAX-8C) 2.7 to 3.6 V (MAX-8Q)
Digital I/O voltage level	1.65 – 3.6 V
Power Consumption ²	16 mA @ 3 V (Continuous) 3.8 mA @ 3 V Power Save mode (1 Hz)
Backup Supply	1.4 to 3.6 V

² MAX-8C, default mode: GPS incl. QZSS, SBAS

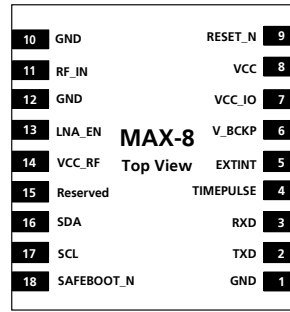
Interfaces

Serial interfaces	1 UART 1 DDC (I ² C compliant)
Digital I/O	Configurable timepulse 1 EXTINT input for Wakeup
Timepulse	Configurable: 0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM

Package

18 pin LCC (Leadless Chip Carrier): 9.7 x 10.1 x 2.5 mm, 0.6 g

Pinout



Environmental data, quality & reliability

Operating temp.	−40° C to 85° C
Storage temp.	−40° C to 85° C
RoHS compliant (lead-free)	
Green (halogen-free):	MAX-8Q
Qualification according to ISO 16750	
Manufactured in ISO/TS 16949 certified production sites	
Uses u-blox 8 chips qualified according to AEC-Q100	

Support products

u-blox 8 Evaluation Kits:

Easy-to-use kits to get familiar with u-blox 8 positioning technology, evaluate functionality, and visualize GNSS performance.

EVK-8N	u-blox 8 GNSS Evaluation Kit, with TCXO, supports MAX-8Q
EVK-M8C	u-blox M8 GNSS Evaluation Kit (in single GPS or single GLONASS mode), with Crystal, supports MAX-8C

Product variants

MAX-8C	u-blox 8 GNSS LCC Module, crystal, ROM
MAX-8Q	u-blox 8 GNSS LCC Module, TCXO, ROM

MAX-7 series

Standard

Professional

Automotive

u-blox 7 GNSS modules

Highlights

- Miniature LCC package
- GNSS engine for GPS/QZSS, GLONASS
- Low power consumption
- Product variants to meet performance and cost requirements
- Pin-to-pin and software compatible with MAX-M8 and MAX-6



MAX-7 series
9.7 x 10.1 x 2.5 mm

Product description

The MAX-7 series of standalone GNSS modules is built on the exceptional performance of the u-blox 7 multi-GNSS (GPS, GLONASS, QZSS and SBAS) engine. The MAX-7 series delivers high sensitivity and minimal acquisition times in the ultra compact MAX form factor.

The MAX-7 series provides maximum sensitivity while maintaining low system power. The MAX-7C is optimized for cost sensitive applications. The MAX-7Q provides best performance and lowest power, while the MAX-7W provides best performance and is optimized for active antennas. The industry proven MAX form factor allows easy migration from MAX-6 modules. Sophisticated RF-architecture and interference suppression ensure maximum performance even in GNSS-hostile environments.

The MAX-7 series combines a high level of integration capability with flexible connectivity options in a miniature package. This makes it perfectly suited for industrial and mass-market end products with strict size and cost requirements. The DDC (I²C compliant) interface provides connectivity and enables synergies with u-blox cellular modules.

u-blox 7 modules use GNSS chips qualified according to AEC-Q100 and are manufactured in ISO/TS 16949 certified sites. Qualification tests are performed as stipulated in the ISO16750 standard: "Road vehicles – Environmental conditions and testing for electrical and electronic equipment". MAX-7Q complies with green/halogen free standards.

Product selector

Model	Type	Supply	Interfaces	Features	Grade
	GPS / QZSS GLONASS Galileo BeiDou Timing Dead Reckoning Precise Point Positioning Raw Data	1.65 V – 3.6 V 2.7 V – 3.6 V Lowest power (DC/DC)	UART USB SPI DDC (I ² C compliant)	Programmable (Flash) Data logging Additional SAW Additional LNA RTC crystal Internal oscillator Active antenna / LNA supply Active antenna / LNA control Antenna short circuit detection / protection pin Antenna open circuit detection pin Frequency output	Standard Professional Automotive
MAX-7C	• •	• •	• •	◆ C • • •	
MAX-7Q	• •	• •	• •	• T • • •	
MAX-7W	• •	• •	• •	• T • • •	

○ = Optional, not activated per default or requires external components

◆ = Yes, but with a higher backup current

C = Crystal / T = TCXO

Features

Receiver type	56-channel u-blox 7 engine GPS/QZSS L1 C/A, GLONASS L1 FDMA, SBAS: WAAS, EGNOS, MSAS		
Navigation update rate	up to 10 Hz		
Accuracy		GPS	GLONASS
	Position	2.5 m CEP	4.0 m
	SBAS	2.0 m CEP	n.a.
Acquisition ¹	Cold starts:	29 s	30 s
	Aided starts:	5 s	n.a.
	Reacquisition:	1 s	1 s
Sensitivity ¹	Tracking:	-161 dBm	-158 dBm
	Cold starts:	-148 dBm	-140 dBm
	Warm starts:	-148 dBm	-145 dBm
Assistance GPS	AssistNow Online AssistNow Offline AssistNow Autonomous OMA SUPL & 3GPP compliant		
Oscillator	TCXO (MAX-7Q/7W), crystal (MAX-7C)		
RTC crystal	Built-In (MAX-7Q/7W) or cost efficient solution with higher Backup current (MAX-7C)		
Anti jamming	Active CW detection and removal		
Memory	Onboard ROM		
Supported antennas	Active and passive		

¹ MAX-7Q/W

Electrical data

Supply voltage	1.65 V to 3.6 V (MAX-7C) 2.7 to 3.6 V (MAX-7Q/7W)
Digital I/O voltage level	1.65 – 3.6 V
Power Consumption	16.5 mA @ 3 V (Continuous) ² 4.5 mA @ 3 V Power Save mode (1 Hz) ²
Backup Supply	1.4 to 3.6 V

² MAX-7C

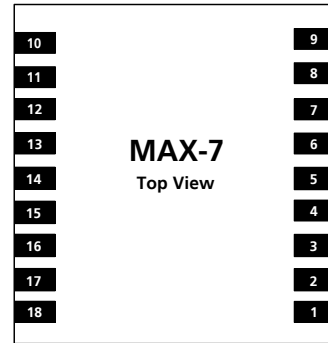
Interfaces

Serial interfaces	1 UART 1 DDC (I ² C compliant)
Digital I/O	Configurable timepulse 1 EXTINT input for Wakeup
Timepulse	Configurable: 0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM

Package

18 pin LCC (Leadless Chip Carrier): 9.7 x 10.1 x 2.5 mm, 0.6 g

Pinout



Environmental data, quality & reliability

Operating temp. –40° C to 85° C
Storage temp. –40° C to 85° C
RoHS compliant (lead-free)
Green (halogen-free): MAX-7Q
Qualification according to ISO 16750
Manufactured in ISO/TS 16949 certified production sites
Uses u-blox 7 chips qualified according to AEC-Q100

Support products

u-blox 7 Evaluation Kits:

Easy-to-use kits to get familiar with u-blox 7 positioning technology, evaluate functionality, and visualize GNSS performance.

EVK-7N: u-blox 7 GNSS Evaluation Kit, with TCXO, supports MAX-7Q, MAX-7W

EVK-7C: u-blox 7 GNSS Evaluation Kit, with Crystal, supports MAX-7C

Product variants

MAX-7C	u-blox 7 GNSS LCC Module, crystal, ROM
MAX-7Q	u-blox 7 GNSS LCC Module, TCXO, ROM
MAX-7W	u-blox 7 GNSS LCC Module, TCXO, ROM, short-circuit protection

NEO-M8 series

Standard Professional Automotive

u-blox M8 concurrent GNSS modules

Highlights

- Concurrent reception of up to 3 GNSS (GPS, Galileo, GLONASS, BeiDou)
- Industry leading –167 dBm navigation sensitivity
- Security and integrity protection
- Supports all satellite augmentation systems
- Advanced jamming and spoofing detection
- Product variants to meet performance and cost requirements
- Backward compatible with NEO-7 and NEO-6 families



NEO-M8 series
12.2 x 16.0 x 2.4 mm

Product description

The NEO-M8 series of concurrent GNSS modules is built on the high performing u-blox M8 GNSS engine in the industry proven NEO form factor.

The NEO-M8 modules utilize concurrent reception of up to three GNSS systems (GPS/Galileo together with BeiDou or GLONASS), recognize multiple constellations simultaneously and provide outstanding positioning accuracy in scenarios where urban canyon or weak signals are involved. For even better and faster positioning improvement, the NEO-M8 series supports augmentation of QZSS, GAGAN and IMES together with WAAS, EGNOS, MSAS. The NEO-M8 series also supports message integrity protection, geofencing, and spoofing detection with configurable interface settings to easily fit to customer applications.

The NEO-M8M is optimized for cost sensitive applications, while NEO-M8N and NEO-M8Q provide best performance

and easier RF integration. The NEO-M8N offers high performance also at low power consumption levels. The future-proof NEO-M8N includes an internal Flash that allows future firmware updates. This makes NEO-M8N perfectly suited to industrial and automotive applications.

The DDC (I²C compliant) interface provides connectivity and enables synergies with most u-blox cellular modules. For RF optimization the NEO-M8N/Q features an additional front-end LNA for easier antenna integration and a front-end SAW filter for increased jamming immunity.

u-blox M8 modules use GNSS chips qualified according to AEC-Q100, are manufactured in ISO/TS 16949 certified sites, and fully tested on a system level. Qualification tests are performed as stipulated in the ISO16750 standard: “Road vehicles – Environmental conditions and testing for electrical and electronic equipment”.

Product selector

Model	Category	GNSS				Supply	Interfaces				Features						Grade
	Standard Precision GNSS High Precision GNSS Dead Reckoning Timing	GPS / QZSS GLONASS Galileo BeiDou		Number of Concurrent GNSS	1.65 V – 3.6 V 2.7 V – 3.6 V		UART USB SPI DDC (I ² C compliant)				Programmable (Flash) Data logging Additional SAW Additional LNA RTC crystal Oscillator Built-in antenna Built-in antenna supply and supervisor Timepulse						Standard Professional Automotive
NEO-M8N	•	• • • •		3	•	• • • •					• • • • • T					1	
NEO-M8Q	•	• • • •		3	•	• • • •					• • • T					1	
NEO-M8M	•	• • • •		3	•	• • • •					• C					1	

C = Crystal / T = TCXO

Features

Receiver type	72-channel u-blox M8 engine GPS/QZSS L1 C/A, GLONASS L10F BeiDou B1I, Galileo E1B/C SBAS L1 C/A: WAAS, EGNOS, MSAS, GAGAN		
Nav. update rate ¹	Single GNSS:	up to 18 Hz	
	2 Concurrent GNSS:	up to 10 Hz	
Position accuracy	2.0 m CEP		
Acquisition ²		NEO-M8N/Q	NEO-M8M
	Cold starts:	26 s	26 s
	Aided starts:	2 s	3 s
	Reacquisition:	1 s	1 s
Sensitivity ²	Tracking & Nav:	-167 dBm	-164 dBm
	Cold starts:	-148 dBm	-148 dBm
	Hot starts:	-157 dBm	-157 dBm
Assistance	AssistNow GNSS Online AssistNow GNSS Offline (up to 35 days) AssistNow Autonomous (up to 6 days) OMA SUPL & 3GPP compliant		
Oscillator	TCXO (NEO-M8N/Q) crystal (NEO-M8M)		
RTC crystal	Built-In		
Anti jamming	Active CW detection and removal. Extra onboard SAW band pass filter (NEO-M8N/Q)		
Memory	ROM (NEO-M8M/Q) or Flash (NEO-M8N)		
Supported antennas	Active and passive		
Raw Data	Code phase output		
Odometer	Integrated in navigation filter		
Geofencing	Up to 4 circular areas GPIO for waking up external CPU		
Spoofing detection	Built-in		
Signal integrity	Signature feature with SHA 256		
Data-logger ³	For position, velocity, time, and odometer data		

¹ NEO-M8M/Q

² For default mode: GPS/SBAS/QZSS+GLONASS

³ NEO-M8N

Electrical data

Supply voltage	1.65 V to 3.6 V (NEO-M8M)
	2.7 V to 3.6 V (NEO-M8N/Q)
Power consumption ⁴	21 mA @ 3.0 V (Continuous)
	5.3 mA @ 3.0 V (PSM, 1 Hz)
Backup Supply	1.4 to 3.6 V

⁴ NEO-M8M in default mode: GPS/SBAS/QZSS+GLONASS

Interfaces

Serial interfaces	1 UART
	1 USB V2.0 full speed 12 Mbit/s
	1 SPI (optional)
	1 DDC (I ² C compliant)
Digital I/O	Configurable timepulse 1 EXTINT input for Wakeup
Timepulse	Configurable 0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM

Package

24 pin LCC (Leadless Chip Carrier): 12.2 x 16.0 x 2.4 mm, 1.6 g

Pinout

13	GND	GND	12
14	LNA_EN / Reserved	RF_IN	11
15	Reserved	GND	10
16	Reserved	VCC_RF	9
17	Reserved	RESET_N	8
NEO-M8 Top View			
18	SDA / SPI CS_N	VDD_USB	7
19	SCL / SPI SLK	USB_DP	6
20	TXD / SPI MISO	USB_DM	5
21	RXD / SPI MOSI	EXTINT	4
22	V_BCKP	TIMEPULSE	3
23	VCC	D_SEL	2
24	GND	SAFEBOOT_N	1

Environmental data, quality & reliability

Operating temp.	-40° C to 85° C
Storage temp.	-40° C to 85° C (NEO-M8N/Q)
	-40° C to 105° C (NEO-M8M)

RoHS compliant (lead-free)

Qualification according to ISO 16750

Manufactured and fully tested in ISO/TS 16949 certified production sites

Uses u-blox M8 chips qualified according to AEC-Q100

Support products

u-blox M8 Evaluation Kits:

Easy-to-use kits to get familiar with u-blox M8 positioning technology, evaluate functionality, and visualize GNSS performance.

EVK-M8N u-blox M8 GNSS Evaluation Kit,
with TCXO, supports NEO-M8N/Q

EVK-M8C: u-blox M8 GNSS Evaluation Kit,
with crystal, supports NEO-M8M

Product variants

NEO-M8N	u-blox M8 concurrent GNSS LCC module, TCXO, Flash, SAW, LNA
NEO-M8Q	u-blox M8 concurrent GNSS LCC module, TCXO, ROM, SAW, LNA
NEO-M8M	u-blox M8 concurrent GNSS LCC module, crystal, ROM



NEO-M8Q-01A

u-blox M8 concurrent GNSS modules, Automotive Grade

Highlights

- Concurrent reception of up to 3 GNSS (GPS, Galileo, GLONASS, BeiDou)
- TCXO, operational temperature range –40° C to +105° C
- Security and integrity protection
- ROM based automotive grade GNSS receiver
- Supports industry leading navigation sensitivity
- Low PPM strategy



NEO-M8 series
12.2 x 16.0 x 2.4 mm

Product description

The NEO-M8Q-01A is a ROM-based Automotive Grade concurrent GNSS module, targeted for use in hazardous environments such as automotive applications.

The module is built on the exceptional performance of u-blox M8 GNSS (GPS/QZSS, Galileo, GLONASS, BeiDou) engine in the industry proven NEO form factor.

The NEO-M8Q-01A provides high sensitivity and minimal acquisition times while maintaining low system power. The automotive grade module is optimized for applications where an extended operational temperature range (-40 to +105°C) is required. The sophisticated RF architecture and interference suppression ensure maximum performance even in GNSS-hostile environments.

The NEO-M8Q-01A combines a high level of robustness and integration capability along with flexible connectivity options via USB, I²C, UART and SPI. The DDC (I²C compliant) interface provides connectivity and enables synergies with most u-blox cellular modules.

With sophisticated message signature capabilities and spoofing detection, the NEO-M8Q-01A automotive grade module offers high protection against malicious positioning interference.

The NEO-M8Q-01A uses GNSS chips qualified according to AEC-Q100. The modules are manufactured in ISO/ TS 16949 certified sites and fully tested on a system level. Qualification tests are performed as stipulated in the ISO16750 standard: “Road vehicles – Environmental conditions and testing for electrical and electronic equipment”.

The NEO-M8Q-01A automotive grade module adheres to automotive industry standard quality specifications and production flow.

Product selector

Model	Category	GNSS				Supply	Interfaces				Features							Grade					
	Standard Precision High Precision Dead Reckoning Timing	GPS / QZSS	GLONASS	Galileo	BeiDou	Number of Concurrent GNSS	2.7 V – 3.6 V	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	Data logging	Additional SAW	Additional LNA	RTC crystal	Oscillator	Built-in antenna	Built-in antenna supply and supervisor	Timepulse	Standard	Professional	Automotive
NEO-M8Q-01A*	•	•	•	•	•	3	•	•	•	•	•	•	T							1			

* = Operating temperature –40° to +105°C

C = Crystal / T = TCXO

Features

Receiver type	72-channel u-blox M8 engine GPS/QZSS L1 C/A, GLONASS L10F, BeiDou B1, Galileo E1B/C SBAS L1 C/A: WAAS, EGNOS, MSAS, GAGAN
Nav. update rate	Single GNSS: up to 18 Hz Concurrent GNSS: up to 10 Hz
Position accuracy	2.0 m CEP
Acquisition ¹	Cold starts: 26 s Aided starts: 2 s Reacquisition: 1 s
Sensitivity ¹	Tracking & Nav: -167 dBm Cold starts: -148 dBm Hot starts: -157 dBm
Assistance	AssistNow GNSS Online AssistNow GNSS Offline (up to 35 days)
	AssistNow Autonomous (up to 6 days) OMA SUPL & 3GPP compliant
Oscillator	TCXO
RTC crystal	Built-in
Noise figure	On-chip LNA
Anti jamming	Active CW detection and removal
Memory	ROM
Supported antennas	Active and passive ²
Raw Data	Code phase output
Odometer	Integrated in navigation filter
Geo-fencing	Up to 4 circular areas GPIO for waking up external CPU
Spoofing detection	Built-in
Signal integrity	Signature feature with SHA 256

¹ For default mode: GPS/SBAS/QZSS+GLONASS with TCXO

² External LNA and SAW is recommended for passive antenna applications

Package

24 pin LCC (Leadless Chip Carrier): 12.2 x 16.0 x 2.4 mm, 1.6 g

Pinout

13	GND	GND	12
14	PIO16	RF_IN	11
15	PIO14	GND	10
16	PIO15	VCC_RF	9
17	Reserved	RESET_N	8
NEO-M8Q-01A			
18	SDA	VDD_USB	7
19	SCL	USB_DP	6
20	TxD	USB_DM	5
21	RxD	EXTINT	4
22	V_BCKP	TIMEPULSE	3
23	VCC	D_SEL	2
24	GND	SAFEBOOT_N	1

Top View

Environmental data, quality & reliability

Operating temp. -40° C to 105° C

Storage temp. -40° C to 105° C

RoHS compliant (lead-free)

Qualification according to ISO 16750

Manufactured and fully tested in ISO/TS 16949 certified production sites

Uses u-blox M8 chips qualified according to AEC-Q100

Electrical data

Supply voltage	2.7 V to 3.6 V
Power consumption	24.5 mA @ 3.0 V (continuous, concurrent) 6 mA @ 3.0 V (PSM, 1 Hz, GPS only)
Backup Supply	1.4 to 3.6 V

Interfaces

Serial interfaces	1 UART 1 USB V2.0 full speed 12 Mbit/s 1 SPI (optional) 1 DDC (I ² C compliant)
Digital I/O	Configurable timepulse 1 EXTINT input for Wakeup
Timepulse	Configurable 0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM

Support products

u-blox M8 evaluation kit:

Easy-to-use kit to get familiar with u-blox M8 positioning technology, evaluate functionality, and visualize GNSS performance.

EVK-M8N³: u-blox M8 GNSS Evaluation Kit, supports NEO-M8Q-01A

³ The EVK supports a temperature range of -40° to +65°C

Product variants

NEO-M8Q-01A	u-blox M8 concurrent GNSS LCC module, TCXO, ROM, Automotive Grade
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NEO-8Q

u-blox 8 GNSS module

Highlights

- High sensitivity of –166 dBm for single GNSS reception
- Cost-efficient system
- TCXO-based product enables fastest time to first fix
- Low power consumption
- Superior anti-spoofing and anti-jamming



NEO-8Q
12.2 x 16.0 x 2.4 mm

Product description

The NEO-8Q standard precision GNSS module is built on the reliable performance of the u-blox 8 GNSS engine, which receives GPS, GLONASS, QZSS and SBAS signals. The NEO-8Q delivers high sensitivity and minimal acquisition times in the industry proven NEO form factor.

The NEO-8Q features low power consumption and supports advanced Power Save Modes. It also provides message integrity protection, geofencing, spoofing detection, and odometer functionalities.

NEO-8Q is an economical choice for best performance and easier RF integration. For RF optimization the NEO-8Q features an additional front-end LNA for easier antenna integration and a front-end SAW filter for increased jamming immunity. The industry proven NEO form factor

allows easy migration from previous NEO generations. Sophisticated RF-architecture and interference suppression ensure maximum performance even in GNSS-hostile environments.

The NEO-8Q combines a high level of robustness and integration capability with flexible connectivity options. The DDC (I²C compliant) interface provides connectivity and enables synergies with most u-blox cellular modules.

u-blox 8 modules use GNSS chips qualified according to AEC-Q100 and are manufactured in ISO/TS 16949 certified sites. Qualification tests are performed as stipulated in the ISO16750 standard: “Road vehicles – Environmental conditions and testing for electrical and electronic equipment”.

Product selector

Model	Category	GNSS		Supply	Interfaces		Features					Grade
	Standard Precision GNSS High Precision GNSS Dead Reckoning Timing	GPS / QZSS GLONASS Galileo BeiDou	Number of Concurrent GNSS	2.7 V – 3.6 V	UART USB SPI DDC (I2C compliant)		Programmable (Flash) Data logging Additional SAW Additional LNA RTC crystal Oscillator Built-in antenna Built-in antenna supply and supervisor Timepulse					Standard Professional Automotive
NEO-8Q	•	• •	1	•	• • • •		• • • •	T		1	•	

C = Crystal / T = TCXO

Features

Receiver type	72-channel u-blox 8 engine GPS L1 C/A, GLONASS L1 FDMA, QZSS L1 C/A SBAS: WAAS, EGNOS, MSAS		
Nav. update rate	Up to 18 Hz		
Position accuracy	Autonomous	GPS 2.5 m CEP	GLONASS 4 m CEP
Acquisition	Cold starts:	29 s	30 s
	Aided starts:	2 s	2 s
	Reacquisition:	1 s	1 s
Sensitivity	Tracking & Nav:	-166 dBm	-166 dBm
	Cold starts:	-148 dBm	-145 dBm
	Hot starts:	-157 dBm	-156 dBm
Assistance GNSS	AssistNow Online AssistNow Offline (up to 35 days) AssistNow Autonomous (GPS only, up to 3 days) OMA SUPL & 3GPP compliant		
Oscillator	TCXO		
RTC crystal	Built-In		
Anti jamming	Active CW detection and removal; Extra onboard SAW band pass filter		
Memory	ROM		
Supported antennas	Active and passive		
Raw Data	Code phase output		
Odometer	Integrated in navigation filter		
Geofencing	Up to 4 circular areas GPIO for waking up external CPU		
Spoofing detection	Built-in		
Signal integrity	Signature feature with SHA 256		

Package

24 pin LCC (Leadless Chip Carrier): 12.2 x 16.0 x 2.4 mm, 1.6 g

Pinout

13	GND	GND	12
14	LNA_EN	RF_IN	11
15	Reserved	GND	10
16	Reserved	VCC_RF	9
17	Reserved	RESET_N	8
NEO-8Q			
Top View			
18	SDA	VDD_USB	7
19	SCL	USB_DP	6
20	TXD	USB_DM	5
21	RXD	EXTINT	4
22	V_BCKP	TIMEPULSE	3
23	VCC	D_SEL	2
24	GND	SAFEBOOT_N	1

Environmental data, quality & reliability

Operating temp.	-40° C to 85° C
Storage temp.	-40° C to 85° C
RoHS compliant (lead-free)	
Qualification according to ISO 16750	
Manufactured in ISO/TS 16949 certified production sites	
Uses u-blox 8 chips qualified according to AEC-Q100	

Electrical data

Supply Voltage	2.7 V to 3.6 V
Power Consumption ¹	22 mA @ 3 V (Continuous) 10 mA @ 3 V Power Save mode (1 Hz)
Backup Supply	1.4 V to 3.6 V

¹ For default mode: GPS incl. QZSS, SBAS

Support products

u-blox 8 Evaluation Kits:	
Easy-to-use kits to get familiar with u-blox 8 positioning technology, evaluate functionality, and visualize GNSS performance.	
EVK-8N	u-blox 8 GNSS Evaluation Kit, with TCXO, supports NEO-8Q

Interfaces

Serial interfaces	1 UART 1 USB V2.0 full speed 12 Mbit/s 1 SPI (optional) 1 DDC (I ² C compliant)
Digital I/O	Configurable timepulse 1 EXTINT input for Wakeup
Timepulse	Configurable 0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM

Product variants

NEO-8Q	u-blox 8 GNSS LCC Module, TCXO, ROM, SAW, LNA
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NEO-7 series

u-blox 7 GNSS modules

Highlights

- GNSS engine for GPS/QZSS, GLONASS
- Product variants to meet performance and cost requirements
- Combines low power consumption and high sensitivity
- Backward compatible with NEO-6 and NEO-5 families



NEO-7 series
12.2 x 16.0 x 2.4 mm

Product description

The NEO-7 series of standalone GNSS modules is built on the exceptional performance of the u-blox 7 GNSS (GPS, GLONASS, QZSS and SBAS) engine. The NEO-7 series delivers high sensitivity and minimal acquisition times in the industry proven NEO form factor.

The NEO-7 series provides maximum sensitivity while maintaining low system power. The NEO-7M is optimized for cost sensitive applications, while NEO-7N provides best performance and easier RF integration. The industry proven NEO form factor allows easy migration from previous NEO generations. Sophisticated RF-architecture and interference suppression ensure maximum performance even in GPS-hostile environments.

The NEO-7 combines a high level of robustness and integration capability with flexible connectivity options. Future-proof the NEO-7N's internal Flash allows simple

firmware upgrades for supporting additional GNSS systems. This makes NEO-7 perfectly suited to industrial and automotive applications. The DDC (I²C compliant) interface provides connectivity and enables synergies with u-blox cellular modules. For RF optimization the NEO-7N features an additional front-end LNA for easier antenna integration and a front-end SAW filter for increased jamming immunity.

u-blox 7 modules use GNSS chips qualified according to AEC-Q100 and are manufactured in ISO/TS 16949 certified sites. Qualification tests are performed as stipulated in the ISO16750 standard: "Road vehicles – Environmental conditions and testing for electrical and electronic equipment".

Product selector

Model	Type	Supply	Interfaces	Features	Grade
	GPS / QZSS GLONASS Galileo BeiDou Timing Dead Reckoning Precise Point Positioning Raw Data	1.65 V – 3.6 V 2.7 V – 3.6 V Lowest power (DC/DC)	UART USB SPI DDC (I ² C compliant)	Programmable (Flash) Data logging Additional SAW Additional LNA RTC crystal Internal oscillator Active antenna / LNA supply Active antenna / LNA control Antenna short circuit detection / protection pin Antenna open circuit detection pin Frequency output	Standard Professional Automotive
NEO-7N	• •	• •	• • • •	• • • • • T •	
NEO-7M	• •	• •	• • • •	• C •	

○ = Optional, not activated per default or requires external components

C = Crystal / T = TCXO

Features

Receiver type	56-channel u-blox 7 engine GPS L1 C/A, GLONASS L1 FDMA, QZSS L1 C/A SBAS: WAAS, EGNOS, MSAS		
Navigation update rate	up to 10 Hz		
Accuracy	Position	GPS 2.5 m CEP	GLONASS 4 m
	SBAS	2.0 m CEP	n.a.
Acquisition	Cold starts:	29 s	30 s
	Aided starts:	5 s	n.a.
	Reacquisition:	1 s	3 s
Sensitivity	Tracking & Nav:	-162 dBm	-158 dBm
	Cold starts:	-148 dBm	-139 dBm
	Warm starts:	-148 dBm	-145 dBm
Assistance GPS	AssistNow Online AssistNow Offline AssistNow Autonomous OMA SUPL & 3GPP compliant		
Oscillator	TCXO (NEO-7N), crystal (NEO-7M)		
RTC crystal	Built-In		
Noise figure	On-chip LNA (NEO-7M); Extra LNA for lowest noise figure (NEO-7N)		
Anti jamming	Active CW detection and removal; Extra onboard SAW band pass filter (NEO-7N)		
Memory	ROM (NEO-7M) or Flash (NEO-7N)		
Supported antennas	Active and passive		

Electrical data

Supply voltage	1.65 V to 3.6 V (NEO-7M) 2.7 V to 3.6 V (NEO-7N)
Power Consumption	17 mA @ 3 V (Continuous) ¹ 5 mA @ 3 V Power Save mode (1Hz) ¹
Backup Supply	1.4 V to 3.6 V

¹ NEO-7M

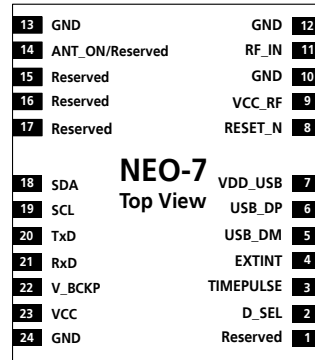
Interfaces

Serial interfaces	1 UART 1 USB V2.0 full speed 12 Mbit/s 1 SPI (optional) 1 DDC (I ² C compliant)
Digital I/O	Configurable timepulse 1 EXTINT input for Wakeup
Timepulse	Configurable 0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM

Package

24 pin LCC (Leadless Chip Carrier): 12.2 x 16.0 x 2.4 mm, 1.6 g

Pinout



Environmental data, quality & reliability

Operating temp.	-40° C to 85° C
Storage temp.	-40° C to 85° C
RoHS compliant (lead-free)	
Qualification according to ISO 16750	
Manufactured in ISO/TS 16949 certified production sites	
Uses u-blox 7 chips qualified according to AEC-Q100	

Support products

u-blox 7 Evaluation Kits:	
Easy-to-use kits to get familiar with u-blox 7 positioning technology, evaluate functionality, and visualize GNSS performance.	
EVK-7N:	u-blox 7 GNSS Evaluation Kit, with TCXO, supports NEO-7N
EVK-7C:	u-blox 7 GNSS Evaluation Kit, with Crystal, supports NEO-7M

Product variants

NEO-7N	u-blox 7 GNSS LCC Module, TCXO, Flash, SAW, LNA
NEO-7M	u-blox 7 GNSS LCC Module, Crystal, ROM

u-blox M8 concurrent GNSS module

Highlights

- Concurrent reception of up to 3 GNSS (GPS, Galileo, GLONASS, BeiDou)
- Industry leading –167 dBm navigation sensitivity
- Combines low power consumption and high sensitivity
- Superior anti-spoofing and anti-jamming
- UART, USB and DDC (I²C compliant) interfaces
- Easy migration from LEA-6 modules



LEA-M8S
17.0 x 22.4 x 2.4 mm

Product description

The LEA-M8S module delivers concurrent GNSS location capability together with high-performance u-blox M8 positioning technology in the industry proven LEA form factor.

With its dual-frequency RF front-end, the LEA-M8S concurrent GNSS module is able to intelligently use the highest number of visible satellites from up to three GNSS systems (GPS/Galileo together with BeiDou or GLONASS) for more reliable positioning. The LEA-M8S provides exceptional performance with low system power, and is optimized for cost sensitive applications. It also supports message integrity protection, geofencing, and spoofing detection.

The LEA-M8S has sophisticated RF-architecture and interference suppression ensuring maximum performance even in GNSS-hostile environments. It features very low

power GLONASS functionality. This 6th generation module in the LEA form factor allows simple migration from LEA-6x GPS and LEA-6N GPS/GLONASS modules.

The LEA-M8S combines a high level of robustness and integration capability with flexible connectivity options. The DDC (I²C compliant) interface provides connectivity and enables synergies with most u-blox cellular modules. For RF optimization, the LEA-M8S features a front-end SAW filter for increased jamming immunity.

LEA-M8S module uses u-blox GNSS chips qualified according to AEC-Q100 and is manufactured in ISO/TS 16949 certified sites. Qualification tests are performed as stipulated in the ISO16750 standard: “Road vehicles – Environmental conditions and testing for electrical and electronic equipment”.

Product selector

Model	Category	GNSS			Supply	Interfaces	Features					Grade
	Standard Precision GNSS High Precision GNSS Dead Reckoning Timing	GPS / QZSS GLONASS Galileo BeiDou	Number of Concurrent GNSS		2.7 V – 3.6 V	UART USB SPI DDC (I ² C compliant)	Programmable (Flash) Data logging Additional SAW Additional LNA RTC crystal Oscillator Built-in antenna Built-in antenna supply and supervisor Timepulse					Standard Professional Automotive
LEA-M8S	•	• • • •	3		•	• • •	• • • T •					<div></div>

C = Crystal / T = TCXO

Features

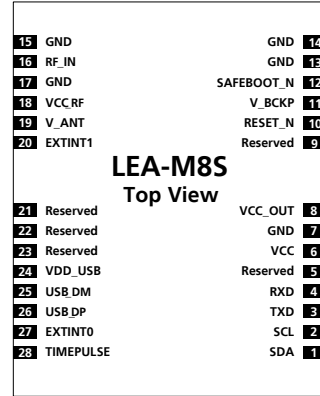
Receiver type	72-channel u-blox concurrent M8 engine GPS/QZSS L1 C/A, GLONASS L10F, BeiDou B11, Galileo E1B/C SBAS L1 C/A: WAAS, EGNOS, MSAS, GAGAN
Nav. update rate	Single GNSS: up to 18 Hz 2 Concurrent GNSS: up to 10 Hz
Accuracy	Position 2.5 m CEP SBAS 2.0 m CEP
Acquisition ¹	Cold starts: 26 s Aided starts: 2 s Reacquisition: 1 s
Sensitivity ¹	Tracking & Nav.: -167 dBm Cold starts: -148 dBm Hot starts: -157 dBm
Assistance GNSS	AssistNow Online AssistNow Offline (up to 35 days) AssistNow Autonomous (GPS only, up to 3 days) OMA SUPL & 3GPP compliant
Oscillator	TCXO
RTC crystal	Built-In
Anti-jamming	Active CW detection and removal. Extra onboard SAW band pass filter
Memory	Onboard ROM
Supported antennas	Active and passive
Raw Data	Code phase output
Odometer	Integrated in navigation filter
Geofencing	Up to 4 circular areas GPIO for waking up external CPU
Spoofing detection	Built-in
Signal integrity	Signature feature with SHA 256

¹ For default mode: GPS/SBAS/QZSS+GLONASS

Package

28 pin LCC (Leadless Chip Carrier): 17.0 x 22.4 x 2.4 mm, 2.1 g

Pinout



Environmental data, quality & reliability

Operating temp. -40° C to 85° C

Storage temp. -40° C to 85° C

RoHS compliant (lead-free)

Qualification according to ISO 16750

Manufactured and fully tested in ISO/TS 16949 certified production sites.

Uses u-blox M8 chips qualified according to AEC-Q100.

Electrical data

Supply voltage	2.7 V to 3.6 V
Power Consumption ¹	22 mA @ 3 V (continuous) 6.2 mA @ 3 V (Power Save mode, 1 Hz)
Backup Supply	1.4 V to 3.6 V

Support products

u-blox M8 Evaluation Kits:

Easy-to-use kits to get familiar with u-blox M8 positioning technology, evaluate functionality, and visualize GNSS performance.

EVK-M8N: u-blox M8 GNSS Evaluation Kit, with TCXO, supports LEA-M8S

Interfaces

Serial interfaces	1 UART 1 USB V2.0 full speed 12 Mbit/s 1 DDC (I ² C compliant)
Digital I/O	Configurable timepulse 2 EXTINT inputs for Wakeup
Timepulse	Configurable 0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM

Product variants

LEA-M8S	u-blox M8 concurrent GNSS Module, TCXO, ROM, SAW
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CAM-M8 series

Standard Professional Automotive

u-blox M8 concurrent GNSS antenna modules

Highlights

- Concurrent reception of GPS/QZSS, GLONASS, BeiDou
- Miniature size and weight with low power consumption
- Embedded, omnidirectional and wideband antenna
- Industry leading -167 dBm navigation sensitivity
- Optional external antenna
- Product variants to meet performance and cost requirements



CAM-M8 series
9.6 x 14.0 x 1.95 mm

Product description

The u-blox CAM-M8Q and CAM-M8C chip antenna modules have the exceptional performance of the u-blox M8 multi-GNSS (GPS/QZSS, GLONASS and BeiDou) engine in industry proven form factor. The CAM-M8 series offers high sensitivity and strong signal levels in an ultra compact form factor.

Incorporating the CAM-M8 series modules into customer designs is simple and straightforward, thanks to the embedded GNSS antenna, small footprint of 9.6 x 14 x 1.95 mm, and sophisticated interference suppression that ensures maximum performance even in GNSS-hostile environments. The low power consumption and thin design allow end devices to be slimmer and smaller.

Despite of miniature size, the chip antenna in the CAM-M8Q and CAM-M8C performs extremely well against traditional patch antennas. Optimal performance is achieved by following design instructions available in the Hardware Integration Manual as customer PCB is part of the antenna solution. The omnidirectional radiation

pattern increases flexibility for device installation. Optionally, CAM-M8 series modules can be connected to an external GNSS antenna. The SMD design keeps manufacturing costs to a minimum and the small mass ensures high reliability.

The CAM-M8 series targets industrial and consumer applications that require concurrent GPS and GLONASS or BeiDou reception. The CAM-M8Q and CAM-M8C are form-factor compatible to UC530 and UC530M modules, allowing the upgrade of existing designs with minimal effort.

CAM-M8 series modules use GNSS chips qualified according to AEC-Q100 and are manufactured in ISO/TS 16949 certified sites. Qualification tests are performed as stipulated in the ISO16750 standard: "Road vehicles – Environmental conditions and testing for electrical and electronic equipment".

Product selector

Model	Type	Supply	Interfaces	Features	Grade
	GPS / QZSS GLONASS Galileo BeiDou Timing Dead Reckoning Precise Point Positioning Raw Data	1.65 V - 3.6 V 2.7 V - 3.6 V Lowest power (DC/DC)	UART USB SPI DDC (I ² C compliant)	Programmable (Flash) Data logger Additional SAW Additional LNA RTC crystal Oscillator Active antenna / LNA supply Active antenna / LNA control Antenna short circuit detection / protection pin Antenna open circuit detection pin Frequency output	Standard Professional Automotive
CAM-M8Q	• • •	• •	• • •	• • • T •	
CAM-M8C	• • •	• •	• • •	• • ♦ C •	

C = Crystal / T = TCXO

♦ = Yes, but with a higher backup current

Features

Receiver type	72-channel u-blox M8 engine GPS/QZSS L1 C/A, GLONASS L10F BeiDou B1 SBAS L1 C/A: WAAS, EGNOS, MSAS	
Max nav. update rate	Single GNSS	up to 18 Hz
	Concurrent GNSS	up to 10 Hz
Position accuracy	2.0 m CEP	
Acquisition	CAM-M8Q	CAM-M8C
	Cold start:	26 s 27 s
	Aided start:	2 s 4 s
	Hot start:	1 s 1 s
Sensitivity	Tracking & Navigation: -167 dBm -164 dBm Cold start: -148 dBm -147 dBm Hot start: -156 dBm -156 dBm	
Assistance	AssistNow GNSS Online AssistNow GNSS Offline (up to 35 days) AssistNow Autonomous (up to 6 days) OMA SUPL & 3GPP compliant	
Oscillator	TCXO (CAM-M8Q) Crystal (CAM-M8C)	
RTC crystal	Built-In (CAM-M8Q) or cost efficient solution with higher Backup current (CAM-M8C)	
Noise figure	On-chip LNA and extra LNA for lowest noise figure	
Anti jamming	Active CW detection and removal; Extra onboard SAW band pass filter	
Memory	Onboard ROM	
Odometer	Integrated in navigation filter	

Electrical data

Supply voltage	1.6 V to 3.6 V (CAM-M8C) 2.7 V to 3.6 V (CAM-M8Q)
Digital I/O voltage level	1.6 V to 3.6 V (CAM-M8C) 2.7 V to 3.6 V (CAM-M8Q)
Power consumption	29 mA @ 3.0 V (Continuous) ¹ 7 mA @ 3.0 V Power Save Mode (1 Hz, GPS only)
Backup Supply	1.4 V to 3.6 V

¹ CAM-M8C

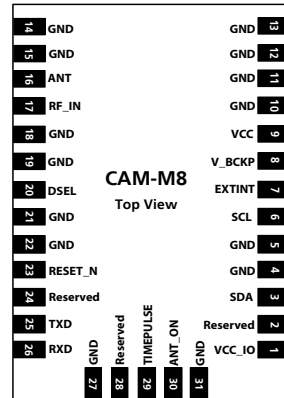
Interfaces

Serial interfaces	1 UART 1 SPI (Optional) 1 DDC (I ² C compliant)
Digital I/O	Configurable timepulse 1 EXTINT input for WAKEUP
Timepulse	Configurable 0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM

Package

31 pin LCC (Leadless Chip Carrier): 9.6 x 14.0 x 1.95 mm, 0.5 g

Pinout



Environmental data, quality & reliability

Operating temp.	-40° C to 85° C
Storage temp.	-40° C to 85° C
RoHS compliant (lead-free)	
Qualification according to ISO16750	
Manufactured in ISO/TS 16949 certified production site	
Uses u-blox M8 chips qualified according to AEC-Q100	

Support products

u-blox M8 Evaluation Kits:

Easy-to-use kits to get familiar with u-blox M8 positioning technology, evaluate functionality, and visualize GNSS performance.

EVK-M8QCAM:	u-blox M8 concurrent GNSS evaluation kit, (TCXO), supports CAM-M8Q
EVK-M8CCAM:	u-blox M8 concurrent GNSS evaluation kit, (Crystal), supports CAM-M8C

Product variants

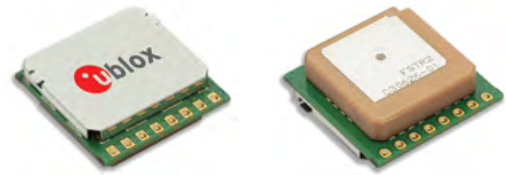
CAM-M8Q	u-blox concurrent GNSS LCC antenna module, TCXO, SAW, LNA
CAM-M8C	u-blox concurrent GNSS LCC antenna module, Crystal, SAW, LNA

PAM-7Q

u-blox 7 GPS antenna module

Highlights

- Embedded GPS antenna
- Excellent antenna performance
- Low power consumption
- Form-factor compatible with UP501
- Easy integration into design



Bottom view
(shield side)

Top view
(patch antenna side)

PAM-7Q
22.0 x 22.0 x 8.0 mm

Product description

The u-blox PAM-7Q patch antenna module has the exceptional performance of the u-blox 7 GNSS engine and delivers high sensitivity and minimal acquisition times in an industry proven form factor.

Incorporating the PAM-7Q into customer designs is simple and straightforward, thanks to the embedded antenna, low power consumption, simple interface, and sophisticated interference suppression that ensures maximum performance even in GPS-hostile environments.

The 18 x 18 mm patch antenna of PAM-7Q provides RHCP polarization, which is not achievable with smaller patch antenna elements. The simple design and easy interfacing keeps installation costs to a minimum.

PAM-7Q targets industrial and consumer applications that require small and cost efficient smart antenna solutions. It is form factor compatible with UP501 module, allowing the upgrade of existing designs with minimal effort.

PAM-7Q modules use GPS chips qualified according to AEC-Q100 and are manufactured in ISO/TS 16949 certified sites. Qualification tests are performed as stipulated in the ISO16750 standard: "Road vehicles – Environmental conditions and testing for electrical and electronic equipment".

Product selector

Model	Type	Supply	Interfaces	Features	Grade
	GPS / QZSS GLONASS Galileo BeiDou Timing Dead Reckoning Precise Point Positioning Raw Data	2.7 V – 3.6 V Lowest power (DC/DC)	UART USB SPI DDC (I ² C compliant)	Programmable (Flash) Data logger Additional SAW Additional LNA RTC crystal Internal oscillator Active antenna / LNA supply Active antenna / LNA control Antenna short circuit detection / protection pin Antenna open circuit detection pin Frequency output	Standard Professional Automotive
PAM-7Q	•	• •	•	• • • T	<div></div> <div></div> <div></div>

T = TCXO

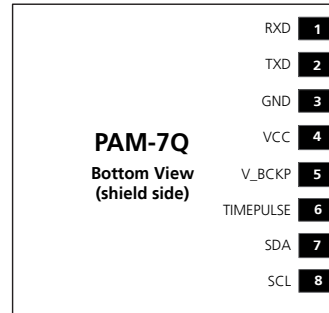
Features

Receiver type	56-channel u-blox 7 engine GPS/ QZSS L1 C/A SBAS: WAAS, EGNOS, MSAS	
Navigation update rate	up to 10 Hz	
Accuracy	Position	2.5 m CEP
	SBAS	2.0 m CEP
Acquisition	Cold starts:	29 s
	Aided starts:	5 s
	Reacquisition:	1 s
Sensitivity	Tracking & Nav:	-161 dBm
	Cold starts:	-147 dBm
	Warm starts:	-147 dBm
Assistance GPS	AssistNow Online AssistNow Offline AssistNow Autonomous OMA SUPL & 3GPP compliant	
Oscillator	TCXO	
RTC crystal	Built-In	
Anti jamming	Active CW detection and removal, onboard SAW band pass filter	
Memory	Onboard ROM	

Package

8 pin contact header: 22 x 22 x 8 mm, 9 g

Pinout



Environmental data, quality & reliability

Operating temp. -40° C to 85° C

Storage temp. -40° C to 85° C

RoHS compliant (lead-free)

Qualification according to ISO16750

Manufactured in ISO/TS 16949 certified production site

Uses u-blox 7 chips qualified according to AEC-Q100

Electrical data

Supply voltage	2.7 V to 3.6 V
Digital I/O voltage level	2.7 V to 3.6 V
Power Consumption	22 mA @ 3 V (Continuous)
Backup Supply	1.4 V to 3.6 V

Support products

u-blox 7 Evaluation Kits:

Easy-to-use kits to get familiar with u-blox 7 positioning technology, evaluate functionality, and visualize GPS performance.

EVK-7PAM: u-blox 7 GPS Evaluation Kit, supports PAM-7Q

Interfaces

Serial interfaces	1 UART, 1 DDC (I ² C compliant)
Digital I/O	Configurable timepulse
Timepulse	Configurable 0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM

Product variants

PAM-7Q	u-blox GPS Antenna Module, TCXO, SAW, LNA
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u-blox M8 high precision GNSS modules

Highlights

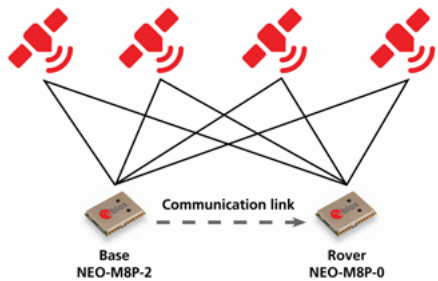
- Centimeter-level GNSS positioning for the mass market
- Integrated Real Time Kinematics (RTK) for fast time-to-market
- Small, light, and energy-efficient RTK module
- Complete and versatile solution due to base and rover variants
- World-leading GNSS positioning technology



NEO-M8P
12.2 x 16.0 x 2.4 mm

Product description

The NEO-M8P module combines the high performance u-blox M8 positioning engine with u-blox’s Real Time Kinematic (RTK) technology. The NEO-M8P provides cm-level GNSS performance designed to meet the needs of unmanned vehicles and other machine control applications requiring high precision guidance.



u-blox’s RTK technology introduces the concept of a “rover” (NEO-M8P-0) and a “base” (NEO-M8P-2) on the M8 platform for stunning cm-level accuracy in clear sky environments. The base station module sends corrections via the RTCM protocol to the rover module via a communication link enabling the rover to output its position relative to the base station down to centimeter-level precision.

The NEO-M8P is ideal for applications requiring vehicles to move faster and more accurately, operate more efficiently, and automatically return to base station platforms. Such applications include UAV, unmanned vehicles (e.g. robotic lawn mowers), and Precision Agriculture guidance.

The NEO-M8P module enables the system integrator to access u-blox’s complete end-to-end RTK solution including the stationary “survey-in” functionality that is designed to reduce the setup time and increase the flexibility of the application. NEO-M8P modules are compatible with a wide range of communication technologies (Cellular, Wi-Fi, Bluetooth, UHF) enabling the user to select the communication link best suited to their application. With u-blox’s RTK technology, integration and software development efforts can be reduced, ensuring a minimal cost of ownership.

u-blox M8 modules use GNSS chips qualified according to AEC-Q100, are manufactured in ISO/TS 16949 certified sites, and fully tested on a system level. Qualification tests are performed as stipulated in the ISO16750 standard: “Road vehicles – Environmental conditions and testing for electrical and electronic equipment”.

Product selector

Model	Category	GNSS				Supply	Interfaces				Features							Grade
	Standard Precision GNSS High Precision GNSS Dead Reckoning Timing	GPS / QZSS GLONASS Galileo BeiDou		Number of Concurrent GNSS	2.7 V – 3.6 V	UART USB SPI DDC (I ² C compliant)				Programmable (Flash) Data logging Carrier phase output Additional SAW Additional LNA RTK rover Base station with survey-in Timepulse							Standard Professional Automotive	
NEO-M8P-0	•	• • •		2	•	• • • •				• • • • • • •						1		
NEO-M8P-2	•	• • •		2	•	• • • •				• • • • • • •						1		

Features

Receiver type	72-channel u-blox M8 engine GPS L1 C/A, GLONASS L1OF, BeiDou B1I	
Nav. update rate	RTK	up to 8 Hz ¹
	Carrier phase data	up to 10 Hz
Position accuracy ²	Standalone	2.5 m CEP
	RTK	0.025 m + 1 ppm CEP ³
Convergence time ²	RTK	2 min
Acquisition	Cold starts	26 s
	Aided starts	2 s
	Reacquisition	1 s
Sensitivity	Tracking & Nav	-160 dBm ⁴
	Cold starts	-148 dBm
	Hot starts	-156 dBm
	Reacquisition	-158 dBm
Assistance	AssistNow GNSS Online OMA SUPL & 3GPP compliant	
Oscillator	TCXO	
Noise figure	On-chip LNA with extra LNA for lowest noise figure	
Anti jamming	Active CW detection and removal. Extra onboard SAW band pass filter.	
Memory	Flash	
Supported antennas	Active and passive	
Survey-in base station	For generating sub-meter base station positions (for NEO-M8P-2)	

¹ Limited to 5 Hz for multi-GNSS RTK

² Depends on atmospheric conditions, baseline length, GNSS antenna, multipath conditions, satellite visibility, and geometry

³ ppm limited to baselines up to 10 km

⁴ Limited by FW for best performance

Package

24 pin LCC (Leadless Chip Carrier): 12.2 x 16.0 x 2.4 mm, 1.6 g

Pinout

13	GND	NEO-M8P	GND	12
14	LNA_EN	TOP VIEW	RF_IN	11
15	RTK_STAT		GND	10
16	GEOFENCE_STAT		VCC_RF	9
17	Reserved		RESET_N	8
18	SDA / SPI CS_N		VDD_USB	7
19	SCL / SPI CLK		USB_DP	6
20	TXD / SPI MISO		USB_DM	5
21	RXD / SPI MOSI		EXTINT	4
22	V_BCKP		TIMEPULSE	3
23	VCC		D_SEL	2
24	GND		SAFEBOOT_N	1

Environmental data, quality & reliability

Operating temp. -40° C to 85° C

Storage temp. -40° C to 85° C

RoHS compliant (lead-free)

Qualification according to ISO 16750

Manufactured and fully tested in ISO/TS 16949 certified production sites

Uses u-blox M8 chips qualified according to AEC-Q100

Electrical data

Supply voltage	2.7 V to 3.6 V
Power consumption	25 mA @ 3.0 V (continuous, GPS only)
Backup Supply	1.4 V to 3.6 V

Support products

Application board provides reference design, and allows efficient integration and evaluation of u-blox M8 high precision GNSS technology.

C94-M8P Two application boards, each with NEO-M8P-2 (rover and base station functionality), for evaluating RTK applications

Interfaces

Serial interfaces	1 UART 1 USB V2.0 full speed 12 Mbit/s 1 SPI (optional) 1 DDC (I ² C compliant)
Digital I/O	Configurable timepulse 1 EXTINT input for Wakeup RTK Fix Status GEOFENCE Status
Timepulse	Configurable 0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM version 3.x

Product variants

NEO-M8P-0	u-blox M8 high precision module with rover functionality
NEO-M8P-2	u-blox M8 high precision module with rover and base station functionality

NEO-7P

u-blox 7 high precision GNSS module

Highlights

- High precision GNSS < 1 m
- SBAS-based PPP technology
- GPS by SBAS or RTCM
- Combines low power consumption and high sensitivity
- Simple integration with u-blox cellular modules
- Backward compatible with NEO-6 and NEO-5 families
- Raw measurement data (GPS)



NEO-7P
12.2 x 16.0 x 2.4 mm

Product description

The NEO-7P module combines the high performance of the u-blox 7 GNSS engine with SBAS-based precise point positioning (PPP) technology for GPS. u-blox’s industry-proven PPP algorithm, in combination with SBAS, provides sub-meter level precision in clear-sky applications without the need for a reference station. This makes NEO-7P the ideal solution for many applications in surveying, marine navigation, agriculture, sports and leisure.

For world-wide applications, the NEO-7P supports Differential GPS (DGPS) operation as an alternative to SBAS and PPP, using RTCM correction messages from a local reference station or aiding network. Ionospheric corrections received from regional SBAS satellites (WAAS, EGNOS, MSAS) enable the highest stand-alone positioning accuracy from the PPP algorithm. u-blox’s PPP also provides useful improvements in stand-alone precision even without SBAS. PPP delivers its full benefits after the first few minutes of operation with an unobstructed sky view.

The entire NEO-7 series combines excellent sensitivity with low power and includes variants optimised for cost and performance. The industry-proven NEO form factor allows easy migration from previous NEO generations. The NEO-7P features a front-end SAW RF filter for increased jamming immunity. This is reinforced by sophisticated RF-architecture and interference suppression, ensuring maximum performance even in hostile signal environments. UART, USB and DDC (I²C compliant) interfaces provide flexible connectivity and synergies with u-blox cellular modules. The NEO-7P’s internal Flash allows simple firmware upgrades.

u-blox 7 modules use GNSS chips qualified according to AEC-Q100 and are manufactured in ISO/TS 16949 certified sites. Qualification tests are performed as stipulated in the ISO16750 standard: “Road vehicles – Environmental conditions and testing for electrical and electronic equipment”.

Product selector

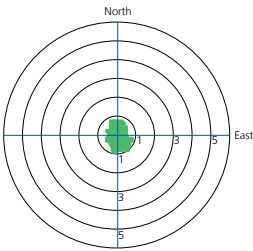
Model	Type								Supply	Interfaces				Features								Grade			
	GPS / QZSS	GLONASS	Galileo	BeiDou	Timing	Dead Reckoning	High Precision	Raw Data	1.65 V – 3.6 V	2.7 V – 3.6 V	UART	USB	SPI	DDC (I2C compliant)	Programmable (Flash)	Additional SAW	Additional LNA	Internal Oscillator	DGNSS	SBAS-based PPP	RTK rover	Basestation with survey-in	Standard	Professional	Automotive
NEO-7P	•	•					•	•		•	•	•	•	•	•	•	C	*	•						

○ = Optional, not activated per default or requires external components

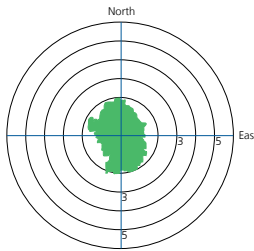
C = Crystal / T = TCXO
* = GPS only

Features

Receiver type	56-channel u-blox 7 engine GPS L1 C/A, GLONASS L1 FDMA, QZSS L1 C/A, SBAS: WAAS, EGNOS, MSAS		
Navigation update rate	Up to 10 Hz		
Accuracy	Position:	GPS 2.5 m CEP	GLONASS 4 m
	SBAS:	2.0 m CEP	n.a.
	SBAS + PPP:	< 1 m CEP	n.a.
Acquisition	Cold starts:	30 s	32 s
	Aided starts:	5 s	n.a.
	Reacquisition:	1 s	1 s
Sensitivity	Tracking:	-161 dBm	-158 dBm
	Cold starts:	-147 dBm	-139 dBm
	Warm starts:	-148 dBm	-145 dBm
Assistance GPS	AssistNow Online AssistNow Offline AssistNow Autonomous OMA SUPL & 3GPP compliant		
Oscillator	Crystal		
RTC crystal	Built-In		
Anti jamming	Active CW detection and removal		
Memory	Flash		
Supported antennas	Active		



Accuracy with PPP+SBAS
(units in m)



Accuracy with GPS and SBAS
(units in m)

Interfaces

Serial interfaces	1 UART 1 USB V2.0 full speed 12 Mbit/s 1 SPI (optional) 1 DDC (I ² C compliant)
Digital I/O	Configurable timepulse 1 EXTINT input for Wakeup
Timepulse	Configurable 0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM

Package

24 pin LCC (Leadless Chip Carrier): 12.2 x 16.0 x 2.4 mm, 1.6 g

Pinout

13	GND	GND	12
14	ANT_ON	RF_IN	11
15	Reserved	GND	10
16	Reserved	VCC_RF	9
17	Reserved	RESET_N	8
NEO-7P			
Top View			
18	SDA	VDD_USB	7
19	SCL	USB_DP	6
20	TxD	USB_DM	5
21	RxD	EXTINT	4
22	V_BCKP	TIMEPULSE	3
23	VCC	D_SEL	2
24	GND	Reserved	1

Environmental data, quality & reliability

Operating temp.	-40° C to 85° C
Storage temp.	-40° C to 85° C
RoHS compliant (lead-free)	
Qualification according to ISO 16750	
Manufactured in ISO/TS 16949 certified production sites	
Uses u-blox 7 chips qualified according to AEC-Q100	

Electrical data

Supply Voltage	2.7 V to 3.6 V
Power Consumption	22 mA @ 3 V (Continuous) 9 mA @ 3 V Power Save mode (1 Hz)
Backup Supply	1.4 to 3.6 V

Product variants

NEO-7P	u-blox 7 LCC Module, GNSS Precise Point Positioning, Raw Data
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u-blox M8 ADR module including 3D sensors

Highlights

- Leading performance under poor signal conditions
- Continuous navigation during signal loss
- Complete solution with integrated 3D sensors
- Automatic configuration of wheel-tick/speed input
- Real-time positioning up to 20 Hz rate
- GPS/QZSS, GLONASS, BeiDou, Galileo
- Low PPM strategy for automotive grade NEO-M8L-01A



NEO-M8L
12.2 x 16.0 x 2.4 mm

Product description

The NEO-M8L 3D Automotive Dead Reckoning (ADR) modules combine GNSS, inertial sensing, and speed information from the vehicle to provide continuous and accurate 3D positioning for road vehicles.

Incorporating u-blox’s latest advancements in multi-GNSS signal processing (now including Galileo), the latest version of NEO-M8L delivers the ideal solution where navigation performance is the priority, regardless of GNSS signal quality or availability. In addition to the on-board sensors, NEO-M8L further eases installation with automatic configuration of speed or wheel-tick inputs, and compensation for in-vehicle antennas.

The intelligent combination of GNSS and sensor measurements enables accurate, real-time positioning, speed and heading information at rates up to 20 Hz, as essential for smooth and responsive interactive display. Access to native, high rate sensor data enables host applications to make full use of the receiver’s assets.

The NEO-M8L includes u-blox’s latest generation GNSS technology which adds Galileo to the multi-constellation reception that already includes GPS, GLONASS, BeiDou and QZSS. The module provides high sensitivity and fast GNSS signal acquisition and tracking.

UART, USB, DDC (I2C compliant) and SSI interface options provide flexible connectivity and enable simple integration with most u-blox cellular modules.

NEO-M8L modules use GNSS chips qualified according to AEC-Q100 and are manufactured in ISO/TS 16949 certified sites. Qualification tests are performed as stipulated in the ISO16750 standard: “Road vehicles – Environmental conditions and testing for electrical and electronic equipment”.

The NEO-M8L-01A automotive grade module adheres to automotive industry standard quality specifications and production flow.

Product selector

Model	Category	GNSS				Supply	Interfaces				Features				Grade							
	Standard Precision GNSS High Precision GNSS Dead Reckoning Timing	GPS / QZSS	GLONASS	Galileo	BeiDou	Number of Concurrent GNSS	2.7 V – 3.6 V	UART	USB	SPI	DDC (I2C compliant)	Programmable (Flash)	Data logging	Additional SAW	Additional LNA	RTC crystal	Oscillator	Built-in sensor	Timepulse	Standard	Professional	Automotive
NEO-M8L-0	ADR	•	•	•	•	3	•	•	•	•	•	•	•	•	•	C	•	1				
NEO-M8L-01A	ADR	•	•	•	•	3	•	•	•	•	•	•	•	•	•	C	•	1				

ADR = Automotive Dead Reckoning / UDR = Untethered Dead Reckoning

C = Crystal / T = TCXO

Features

Receiver type	72-channel u-blox M8 engine GPS/QZSS L1 C/A, GLONASS L10F, BeiDou B1I, Galileo E1B/C SBAS L1 C/A: WAAS, EGNOS, MSAS, GAGAN
Nav. update rate	Up to 20 Hz
Position accuracy	2.0 m CEP
ADR position error	(Estimated) 2 % of distance travelled without GNSS
Acquisition	Cold starts: 26 s Aided starts: 3 s Reacquisition: 1 s
Sensitivity	Tracking & Nav: -160 dBm ¹ Cold starts: -148 dBm Hot starts: -157 dBm
Assistance	AssistNow GNSS Online AssistNow GNSS Offline (up to 35 days) AssistNow Autonomous (up to 6 days) OMA SUPL & 3GPP compliant
Oscillator	Crystal
RTC	Built-in
Sensor	Onboard 3D accelerometer and 3D gyroscope
Supported antennas	Active or passive antenna
Raw Data	Code phase output
Navigation outputs	Position, speed, acceleration, heading, heading rate, attitude, time
Data-logger	For position, velocity, time, and odometer data

¹ Limited by FW for best DR performance

Package

24 pin LCC (Leadless Chip Carrier): 12.2 x 16.0 x 2.4 mm

Pinout

13	GND	NEO-M8L TOP VIEW	GND	12
14	LNA_EN		RF_IN	11
15	FWD		GND	10
16	RESERVED		VCC_RF	9
17	RESERVED		RESET_N	8
18	SDA / SPI CS_N		VDD_USB	7
19	SCL / SPI CLK		USB_DP	6
20	TXD / SPI MISO		USB_DM	5
21	RXD / SPI MOSI		WHEELTICK	4
22	V_BCKP		TIMEPULSE	3
23	VCC		D_SEL	2
24	GND		SAFEBOOT_N	1

Environmental data, quality & reliability

Operating temp. -40° C to 85° C

Storage temp. -40° C to 85° C

RoHS compliant (lead-free)

Qualification according to ISO 16750

Manufactured and fully tested in ISO/TS 16949 certified production sites

Uses u-blox M8 chips qualified according to AEC-Q100

Electrical data

Supply voltage	2.7 V to 3.6 V
Power consumption	29 mA @ 3.0 V (Continuous, default concurrent mode)
Backup Supply	1.4 to 3.6 V

Interfaces

Serial interfaces	1 UART 1 USB V2.0 full speed 12 Mbit/s 1 SPI (optional) 1 DDC (I ² C compliant)
Digital I/O	Configurable timepulse
Timepulse	Configurable 0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM

Support products

u-blox M8 Evaluation Kits:

Easy-to-use kits to get familiar with u-blox M8 positioning technology, evaluate functionality, and visualize GNSS performance.

EVK-M8L u-blox M8 3D Dead Reckoning GNSS Evaluation Kit; supports NEO-M8L modules

Product variants

NEO-M8L-0	u-blox M8 GNSS LCC module with 3D Dead Reckoning and onboard sensors, Professional Grade
NEO-M8L-01A	u-blox M8 GNSS LCC module with 3D Dead Reckoning and onboard sensors, Automotive Grade

u-blox M8 UDR module including 3D inertial sensors

Highlights

- World’s first untethered dead reckoning GNSS solution
- Independent of any electrical connection to the car
- Positioning accuracy in dense cities and covered areas
- Complete positioning solution with integrated 3D sensors
- Compatible with all modules of the NEO family
- Real-time positioning update rate of up to 20 Hz



NEO-M8U
12.2 x 16.0 x 2.4 mm

Product description

The NEO-M8U module introduces u-blox’s Untethered Dead Reckoning (UDR) technology, which provides continuous navigation without requiring speed information from the vehicle. This innovative technology brings the benefits of dead reckoning to installations previously restricted to using GNSS alone and significantly reduces the cost of installation for after-market dead reckoning applications.

The strength of UDR is particularly apparent under poor signal conditions, where it brings continuous positioning in urban environments, even to devices with antennas installed within the vehicle. Useful positioning performance is also available during complete signal loss, for example in parking garages and short tunnels. With UDR, positioning starts as soon as power is applied to the module, before the first GNSS fix is available.

The NEO-M8U may be installed in any position within the vehicle without configuration. In addition to its freedom from any electrical connection to the vehicle, the on-board accelerometer and gyroscope sensors result in a fully self-contained solution, perfect for rapid product development with reliable and consistent performance.

The intelligent combination of GNSS and sensor measurements enables accurate, real-time positioning at rates up to 20 Hz, as needed for smooth and responsive interactive applications. Native high rate sensor data is made available to host applications such as driving behaviour analysis or accident reconstruction.

The NEO-M8U includes u-blox’s latest generation GNSS receiver, which adds Galileo to the multi-constellation reception that already includes GPS, GLONASS, BeiDou and QZSS. The module provides high sensitivity and fast GNSS signal acquisition and tracking. UART, USB, DDC (I²C compliant) and SPI interface options provide flexible connectivity and enable simple integration with most u-blox cellular modules.

u-blox M8 modules use GNSS chips qualified according to AEC-Q100 and are manufactured in ISO/TS 16949 certified sites. Qualification tests are performed as stipulated in the ISO16750 standard: “Road vehicles – Environmental conditions and testing for electrical and electronic equipment”.

Product selector

Model	Category	GNSS				Supply	Interfaces				Features				Grade							
	Standard Precision GNSS High Precision GNSS Dead Reckoning Timing	GPS / QZSS	GLONASS	Galileo	BeiDou	Number of Concurrent GNSS	2.7 V – 3.6 V	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	Data logging	Additional SAW	Additional LNA	RTC crystal	Oscillator	Built-in sensor	Timepulse	Standard	Professional	Automotive
NEO-M8U	UDR	•	•	•	•	3	•	•	•	•	•	•	•		•	C	•	1				

ADR = Automotive Dead Reckoning / UDR = Untethered Dead Reckoning

C = Crystal / T = TCXO

Features

Receiver type	72-channel u-blox M8 engine GPS/QZSS L1 C/A, GLONASS L10F, BeiDou B1I, Galileo E1B/C SBAS L1 C/A: WAAS, EGNOS, MSAS, GAGAN
Nav. update rate	Up to 20 Hz
Position accuracy	2.0 m CEP
Acquisition	Cold starts: 26 s Aided starts: 3 s Reacquisition: 1 s
Sensitivity	Tracking & Nav: -160 dBm ¹ Cold starts: -148 dBm Hot starts: -157 dBm
Assistance	AssistNow GNSS Online AssistNow GNSS Offline (up to 35 days) AssistNow Autonomous (up to 6 days) OMA SUPL & 3GPP compliant
Oscillator	Crystal
RTC	Built-in
Sensor	Onboard accelerometer and gyroscope
Supported antennas	Active or passive antenna
Raw Data	Code phase output
Odometer	Integrated in navigation filter
Geofencing	Up to 4 circular areas GPIO for waking up external CPU
Spoofing detection	Built-in
Signal integrity	Signature feature with SHA 256
Data-logger	For position, velocity, time, and odometer data

¹ Limited by FW for best DR performance

Package

24 pin LCC (Leadless Chip Carrier): 12.2 x 16.0 x 2.4 mm

Pinout

13	GND	NEO-M8U	GND	12
14	LNA_EN	TOP VIEW	RF_IN	11
15	RESERVED		GND	10
16	RESERVED		VCC_RF	9
17	RESERVED		RESET_N	8
18	SDA / SPI CS_N		VDD_USB	7
19	SCL / SPI CLK		USB_DP	6
20	TXD / SPI MISO		USB_DM	5
21	RXD / SPI MOSI		EXTINT	4
22	V_BCKP		TIMEPULSE	3
23	VCC		D_SEL	2
24	GND		SAFEBOOT_N	1

Environmental data, quality & reliability

Operating temp. -40° C to 85° C

Storage temp. -40° C to 85° C

RoHS compliant (lead-free)

Qualification according to ISO 16750

Manufactured and fully tested in ISO/TS 16949 certified production sites

Uses u-blox M8 chips qualified according to AEC-Q100

Electrical data

Supply voltage	2.7 V to 3.6 V
Power consumption	29 mA @ 3.0 V (Continuous, default concurrent mode)
Backup Supply	1.4 to 3.6 V

Interfaces

Serial interfaces	1 UART 1 USB V2.0 full speed 12 Mbit/s 1 SPI (optional) 1 DDC (I ² C compliant)
Timepulse	Configurable 0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM

Support products

u-blox M8 Evaluation Kits:

Easy-to-use kits to get familiar with u-blox M8 positioning technology, evaluate functionality, and visualize GNSS performance.

EVK-M8U u-blox M8 Untethered Dead Reckoning GNSS evaluation kit, supports NEO-M8U

Product variants

NEO-M8U	u-blox M8 GNSS LCC module with Untethered Dead Reckoning and onboard sensors
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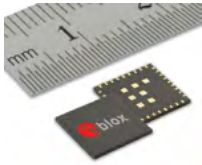


EVA-M8E

u-blox M8 miniature UDR module

Highlights

- Industry's smallest UDR module form-factor
- Leading performance under poor signal conditions
- Continuous navigation during signal interruptions
- Independent of any electrical connection to the car
- Real-time positioning at rates up to 20 Hz
- Low cost of ownership, ideal for high volume projects



EVA-M8E
7.0 x 7.0 x 1.1 mm

Product description

The EVA-M8E module introduces u-blox's Untethered Dead Reckoning (UDR) technology in the ultra-compact EVA form-factor. Measuring merely 7 x 7 mm, EVA offers the designer flexibility in the selection and placement of peripheral components. The EVA-M8E only requires Flash memory, an inertial sensor, and an optional real-time clock (RTC) crystal. The EVA-M8E's sensor may be installed in any position within the vehicle without configuration.

UDR provides the benefits of Dead Reckoning (DR) without requiring speed information from the vehicle. This significantly reduces the cost of installation for after-market Dead Reckoning applications and brings DR performance to applications where previously only GNSS was possible. The strength of UDR compared with GNSS alone is particularly apparent under poor signal conditions in urban environments, where it brings continuous positioning even to devices with antennas installed within the vehicle. Useful positioning performance is also available during complete signal loss, for example in parking garages and short tunnels. UDR positioning starts as soon as power is

applied to the module, even before the first GNSS fix is available. Inertial sensing enables vehicle yaw, pitch, and roll to be calculated and reported directly.

The intelligent combination of GNSS and sensor measurements enables accurate, real-time positioning at rates up to 20 Hz, as needed for smooth and responsive interactive applications. Native high-rate sensor data can be relayed to the host for applications such as driving behaviour analysis or accident reconstruction.

The EVA-M8E includes u-blox's latest generation GNSS receiver, which adds Galileo to the multi-constellation reception that already includes GPS, GLONASS, BeiDou and QZSS. The module provides high sensitivity and fast GNSS signal acquisition and tracking. UART, USB, DDC (I2C compliant) and SSI interface options provide flexible connectivity and enable simple integration with most u-blox cellular modules.

EVA-M8E modules are qualified as stipulated in the JESD47 standard.

Product selector

Model	Category	GNSS				Supply	Interfaces	Features						Grade
	Standard Precision GNSS High Precision GNSS Dead Reckoning Timing	GPS / QZSS GLONASS Galileo BeiDou	Number of Concurrent GNSS		2.7 V – 3.6 V	UART USB SPI DDC (I2C compliant)	Programmable (Flash) Data logging Additional SAW Additional LNA RTC crystal Oscillator Built-in sensor Timepulse	Standard Professional Automotive						
EVA-M8E	UDR	• • • •	3	•	• • • •	E E	• C	1						

ADR = Automotive Dead Reckoning / UDR = Untethered Dead Reckoning
• = Optional, or requires external components

E = External Flash required
C = Crystal / T = TCXO

Features

Receiver type	72-channel u-blox M8 engine GPS/QZSS L1 C/A, GLONASS L10F, BeiDou B1I, Galileo E1B/C SBAS L1 C/A: WAAS, EGNOS, MSAS, GAGAN
Nav. update rate	Up to 20 Hz
Position accuracy	2.0 m CEP
Acquisition ¹	Cold starts: 26 s Aided starts: 3 s Reacquisition: 1 s
Sensitivity ¹	Tracking & Nav: -160 dBm ² Cold starts: -148 dBm Hot starts: -157 dBm
Assistance	AssistNow GNSS Online AssistNow GNSS Offline (up to 35 days) AssistNow Autonomous (up to 6 days) OMA SUPL & 3GPP compliant
Oscillator	Crystal
Real time clock (RTC)	Can be derived either from onboard GNSS crystal (for lowest system costs and smallest size) or from external RTC Clock (Default mode, for lower battery current)
SQL Flash	Required
Sensor	External DDC gyro/accelerometer required
Supported antennas	Active and passive ³
Antenna supervision	Short and open circuit detection supported with external circuit
Raw Data	Code phase output
Odometer	Integrated in navigation filter
Geofencing	Up to 4 circular areas GPIO for waking up external CPU
Spoofing detection	Built-in
Signal integrity	Signature feature with SHA 256
Data-logger ⁴	For position, velocity, time, and odometer data

¹ For default mode: GPS/SBAS/QZSS+GLONASS

² Limited by FW for best DR performance

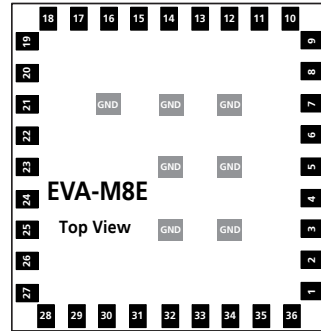
³ An external LNA and SAW recommended for passive antenna applications

⁴ External Flash required

Package

43 pin LGA (Land Grid Array): 7.0 x 7.0 x 1.1 mm, 0.13 g

Pinout



Environmental data, quality & reliability

Operating temp.	-40° C to 85° C
Storage temp.	-40° C to 105° C
RoHS compliant (lead-free) and green (no halogens)	
Qualification according to standard JESD47	
Moisture sensitivity level 3	

Electrical data

Supply voltage	2.7 V to 3.6 V
Power consumption	29 mA @ 3.0 V (Continuous, default concurrent mode)
Backup Supply	1.4 to 3.6 V

Support products

These u-blox M8 support tools are for getting familiar with u-blox M8 positioning technology, evaluating functionality, and visualizing GNSS performance.

EVK-M8U	u-blox M8 Untethered Dead Reckoning GNSS Evaluation Kit, supports NEO-M8U and EVA-M8E
C93-M8E	EVA-M8E application board, miniature EVA-M8E design example with integrated antenna

Interfaces

Serial interfaces	1 UART 1 USB 1 SPI (Optional) 1 DDC (I ² C compliant) 1 SQL interface (For Flash update)
Digital I/O	Configurable timepulse 1 EXTINT input for Wakeup
Timepulse	Configurable 0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM

Product variants

EVA-M8E	u-blox M8 GNSS LCC module with Untethered Dead Reckoning, external Flash and sensor
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u-blox M8 time & frequency reference GNSS module

Highlights

- Concurrent reception of GPS/QZSS, GLONASS, BeiDou
- Integral disciplined low phase-noise 30.72 MHz system reference oscillator
- Accurate measurement and control of external oscillators
- Industry leading acquisition sensitivity and single-satellite timing
- Autonomous 100 ppb hold-over, all effects, including full operating temperature range
- Prepared for integration with external PTP, Sync-E and network listen



LEA-M8F
17.0 x 22.4 x 3.5 mm

Product description

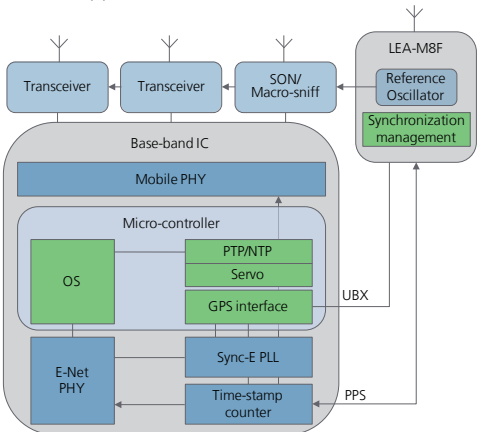
u-blox time and frequency products provide multi-GNSS synchronisation for cost-sensitive network edge equipment including Small Cell and Femto wireless base-stations. The LEA-M8F module is a fully self-contained phase and frequency reference based on GNSS, but can also be used as part of a complete timing sub-system including macro-sniff Synchronous Ethernet and packet timing.

The LEA-M8F module includes a low-noise 30.72 MHz VCTCXO meeting the master reference requirements for LTE Small Cells and provides 100 ppb autonomous hold-over across its full operating temperature range. The LEA-M8F module can also measure and control an external TCXO or OCXO for TD-LTE, LTE Advanced and other applications requiring extended hold-over. External sources of synchronization are supported through time-pulse and frequency inputs and a message interface. This allows measurements from macro-sniff, Sync-E or packet timing to be combined with measurements from GNSS.

u-blox time and frequency products include timing integrity alarms that report phase and frequency uncertainty both during normal operation and hold-over. They feature a high dynamic range radio with both analog and digital interference mitigation supporting their inclusion as an integral part of a local area base station design.

Example application (Small Cell)

In a wireless Small Cell application, the LEA-M8F can distribute a disciplined low-phase noise 30.72 MHz reference signal directly to the RF transceivers. GNSS synchronisation is combined with network sources by an exchange of synchronisation signals, status and control messages with the base-band processor. Source selection and hold-over may be controlled by either the LEA-M8F or base-band application.



Product selector

Model	Category	GNSS			Supply	Interfaces			Features					Grade
	Standard Precision GNSS High Precision GNSS Dead Reckoning Timing	GPS / QZSS GLONASS Galileo BeiDou	Number of Concurrent GNSS	3.0 V – 3.6 V	UART USB SPI	DDC (i ² C compliant)	Programmable (Flash) Data logger Additional SAW Additional LNA RTC crystal Internal oscillator Active antenna / LNA supply Active antenna / LNA control Antenna short circuit detection / protection pin Antenna open circuit detection pin Frequency output							Standard Professional Automotive
LEA-M8F	•	• • •	2	•	• D • •	•	• • •	V •	P	•				

P = Short circuit protection only
V = VCTCXO

D = Development use

Features – GNSS

Receiver type	72-channel u-blox M8 engine GPS/QZSS L1 C/A, GLONASS L10F, BeiDou B1 SBAS L1 C/A: WAAS, EGNOS, MSAS	
	GPS	GLONASS
Accuracy	2.5 m CEP	4.0 m CEP
Acquisition	Cold starts: 26 s Aided cold starts: 2 s	30 s 8 s
Sensitivity	Tracking: -165 dBm Cold start (aided): -157 dBm (autonomous): -148 dBm Reacquisition: -160 dBm	-165 dBm -148 dBm -145 dBm -157 dBm
Assistance GNSS	AssistNow Online OMA SUPL & 3GPP compliant interface	
Internal oscillator	VCTCXO	
Noise figure	On-chip LNA; Extra LNA for lowest noise figure	
Anti jamming	Active CW detection and removal; Extra onboard SAW band pass filter	
Supported antennas	Active and passive	
Internal SQI Flash	For firmware update	

Features – synchronization

Frequency output:	30.72 MHz disciplined	
Phase noise:	10 Hz: -90 dBc/Hz 100 Hz: -120 dBc/Hz 1 kHz: -130 dBc/Hz	10 kHz: -143 dBc/Hz 100 kHz: -145 dBc/Hz 1 MHz: -149 dBc/Hz
Jitter (100 Hz - 1 MHz):	0.15 ps	
EVM (100 Hz - 1 MHz @ 2100 MHz):	< 0.2%	
Frequency control (internal oscillator)	GNSS locked: 5 ppb Hold-over: 100 ppb, 24 hr, -40° C to 85° C	
Frequency control (external oscillator)	Resolution: < 5 ppb Frequencies: 10, 13, 19.2, 20, 26, 30.72, 40 MHz Hold-over: Determined by external oscillator	
Phase control	Clear sky: < 20 ns Indoor: < 500 ns typ.	
Time-pulse input	Resolution: < 50 ns	
Time-pulse output	Jitter: < 2 ns	
Time-pulse frequency:	0.5 Hz to 2 Hz	

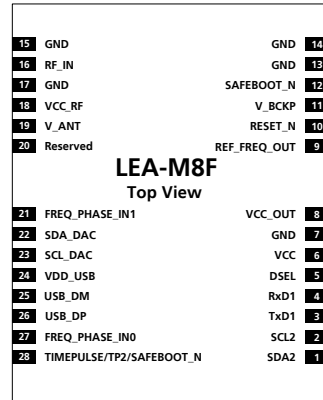
Electrical data

Supply voltage	3.0 V to 3.6 V
Power Consumption	41 mA @ 3.3 V

Package

28 pin LCC (Leadless Chip Carrier): 17.0 x 22.4 x 3.5 mm, 2.0 g

Pinout



Environmental data, quality & reliability

Operating temp: -40° C to 85° C

RoHS compliant (lead-free)

Qualification according to ISO 16750

Manufactured in ISO/TS 16949 certified production sites

Interfaces

Serial interfaces	SPI or UART and DDC (I ² C compliant) USB v2.0 full speed (ext. voltage regulator)
Protocols	NMEA, UBX binary, RTCM
Timing interfaces	Timepulse output 2x timepulse/frequency inputs

Support products

u-blox M8 Evaluation kits:

Evaluation kit to get familiar with u-blox M8 positioning technology, evaluate functionality, and visualize GNSS performance.

EVK-M8F: u-blox M8 Time & Frequency Reference Evaluation Kit, supports LEA-M8F

Product variants

LEA-M8F	u-blox M8 Time & Frequency Reference module, Flash, VCTCXO, dual SAW, LNA
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NEO/LEA-M8T

u-blox M8 concurrent GNSS timing modules

Highlights

- Concurrent reception of GPS/QZSS, GLONASS, BeiDou, Galileo
- Market leading acquisition and tracking sensitivity
- Optimized accuracy and availability with Survey-in and single-satellite timing
- Minimized power consumption with low duty-cycle operation
- Maximized reliability with integrity monitoring and alarms
- Backward compatible with LEA-5T, LEA-6T and NEO-6T



NEO-M8T
12.2 x 16.0 x 2.4 mm



LEA-M8T
17.0 x 22.4 x 2.4 mm

Product description

The NEO-M8T and LEA-M8T concurrent GNSS modules deliver high integrity, precision timing in demanding applications world-wide. Support for BeiDou, GLONASS and Galileo constellations enables compliance with national requirements. Enhanced sensitivity and concurrent constellation reception extend coverage and integrity to challenging signal environments. Survey-in and fixed-position navigation reduce timing jitter, even at low signal levels, and enable synchronization to be maintained with as few as one single satellite in view. Support for low duty cycle operation reduces power consumption for battery-powered applications.

u-blox timing products include timing integrity measures with Receiver Autonomous Integrity Monitoring (RAIM) and continuous phase uncertainty estimation. They feature high dynamic range radios with both analog and digital interference mitigation, supporting applications in wireless communications equipment.

The M8T timing modules are delivered in u-blox's established LEA and NEO form-factors with standard pin-out, allowing ready migration from previous product generations.

u-blox timing products can make use of u-blox AssistNow or industry standard aiding data. This reduces the time to first fix and delivers exceptional acquisition sensitivity, even on first installation before precise location, time or frequency are known.

u-blox M8 modules use GNSS chips qualified according to AEC-Q100, are manufactured in ISO/TS 16949 certified sites, and are fully tested on a system level. Qualification tests are performed as stipulated in the ISO16750 standard: "Road vehicles – Environmental conditions and testing for electrical and electronic equipment".

Product selector

Model	Category	GNSS				Supply	Interfaces				Features								Grade	
	Standard Precision GNSS High Precision GNSS Dead Reckoning Timing	GPS / QZSS	GLONASS	Galileo	BeiDou	Number of Concurrent GNSS	2.7 V – 3.6 V	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	Data logging	Carrier phase output	Additional SAW	Additional LNA	Oscillator	Timepulse	Frequency output	Standard Professional Automotive
NEO-M8T		•	•	•	•	3	•	•	•	•	•	•	•	•	•	•	T	2		
LEA-M8T		•	•	•	•	3	•	•	•	•	•	•	•	•	•		T	2		

T = TCXO

Features - GNSS

Receiver type	72-channel u-blox M8 engine GPS/QZSS L1 C/A, GLONASS L10F, BeiDou B1 SBAS L1 C/A: WAAS, EGNOS, MSAS, GAGAN Galileo E1B/C	
Nav. update rate	Concurrent GNSS: up to 4 Hz	
Position accuracy	2.5 m CEP (Autonomous)	
Acquisition	GPS & GLONASS	GPS & BeiDou
	Cold starts: 25 s	28 s
	Aided cold starts: 2 s	2 s
Sensitivity	Tracking & Nav: -167 dBm	-166 dBm
	Cold starts (aided): -157 dBm	-157 dBm
	(autonomous): -148 dBm	-148 dBm
	Reacquisition: -160 dBm	-160 dBm
Assistance	AssistNow GNSS Online AssistNow GNSS Offline (up to 35 days) AssistNow Autonomous (up to 6 days) OMA SUPL & 3GPP compliant	
Oscillator	TCXO	
RTC crystal	Built-in	
Noise figure	On-chip LNA (LEA-M8T) Extra LNA for passive antenna (NEO-M8T)	
Anti jamming	Active CW detection and removal. On-board SAW band pass filter	
Memory	Internal SQI Flash for Firmware update	
Supported antennas	Active and passive	

Features - Timing

Timing accuracy	Clear sky: ≤ 20 ns
Time-pulse frequency	0.25 Hz – 10 MHz
Time-pulse jitter	±11 ns
Time-mark resolution	21 ns
Integrity reports	RAIM active, phase uncertainty time-pulse rate/duty-cycle

Features - Power management

Power-save modes	On/off low duty-cycle
Off control	Hardware, message interface
On control	Hardware, wake-on UART activity, Timer (using low power RTC)
Automatic on/off with configurable period (GPS-only)	

Environmental data, quality & reliability

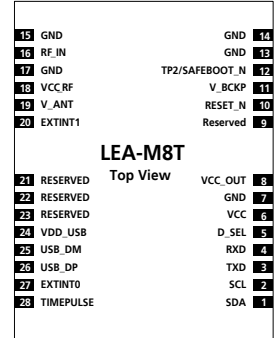
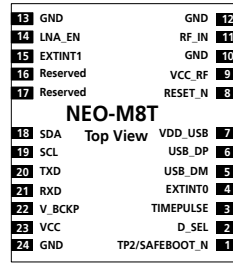
Operating temp.	-40° C to 85° C
Storage temp.	-40° C to 85° C
RoHS compliant (lead-free)	
Qualification according to ISO 16750	
Manufactured and fully tested in ISO/TS 16949 certified production sites	
Uses u-blox M8 chips qualified according to AEC-Q100	

Interfaces

Serial interfaces	SPI or UART and DDC (I ² C compliant) USB V2.0 full speed 12 Mbit/s
Protocols	NMEA, UBX binary, RTCM
Time-pulse outputs	2
Time-mark inputs	2

Package

NEO-M8T: 24 pin LCC (Leadless Chip Carrier): 12.2 x 16.0 x 2.4 mm, 1.6 g
LE-M8T: 28 pin LCC (Leadless Chip Carrier): 17.0 x 22.4 x 2.4 mm, 2.6 g
Pinouts



Features - Raw data and IMES

Measurement data	GPS, GLONASS, BeiDou, SBAS and QZSS (Carrier phase; Code phase & pseudo- range; Doppler)
Message data	GPS, GLONASS, BeiDou, SBAS, QZSS L1S and IMES beacons (50/250 bps auto-baud)

Features - Antenna management

NEO-M8T	External with logic-level antenna switching output, filtered continuous supply.
LEA-M8T	Internal antenna bias supply with switching, over-current protection and alarm. Optional input for external open-circuit detection.

Electrical data

Supply voltage	2.7 V to 3.6 V
Power consumption	15 µA (Battery backup, NEO-M8T) 30 µA (Software backup, NEO-M8T) 32 mA @ 3.0 V (Operational, NEO-M8T) 28 mA @ 3.0 V (Operational, LEA-M8T)
Backup Supply	1.4 to 3.6 V

Support products

EVK-M8T:	u-blox M8 Timing GNSS Evaluation Kit
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Product variants

NEO-M8T	u-blox M8 GNSS LCC module in NEO form factor, Timing, TCXO, flash, SAW, LNA
LEA-M8T	u-blox M8 GNSS LCC module in LEA form factor, Timing, TCXO, flash, SAW

Positioning antennas



ANN-MS

High performance active GPS antennas

Highlights

- High performance active GPS antenna
- Low noise figure and high gain coverage
- Fast and easy integration
- No antenna know-how necessary
- Magnetic base suitable for mounting on car roof
- Industrial temperature range: -40°C to $+85^{\circ}\text{C}$

Product description

The high performance ANN-MS active GPS antenna with integrated low-noise amplifier (LNA) is the perfect match to u-blox GPS receivers where high sensitivity and optimum sky coverage are essential. ANN-MS offers the high performance to exploit the full capabilities of all u-blox GPS receivers, and can be operated at a supply voltage of 2.7 to 6 V.



ANN-MS
40 x 48 x 13 mm, 5 m coaxial cable

Patch antenna characteristics

Frequency	1575 ± 3 MHz
VSWR	Max. 2
Bandwidth	Min. 10 MHz
Impedance	$50\ \Omega$
Peak gain	Min. 4 dBic (over 7×7 cm ground plane)
Gain coverage	≥ -4 dBic at $-90^{\circ}\text{C} \leq \theta \leq +90^{\circ}\text{C}$ (over 75% volume)
Polarization	RHCP (Right-handed circular polarization)

Mechanical data

Weight	42 g (without cable)
Size	40 x 48 x 13 mm
Cable	5 m RG174 standard
Connectors (choice)	SMA, SMB, MCX, FAKRA
Mounting	Magnetic base
Housing color	Black

CE approval

Applicable standards	ETSI EN 301 489-19
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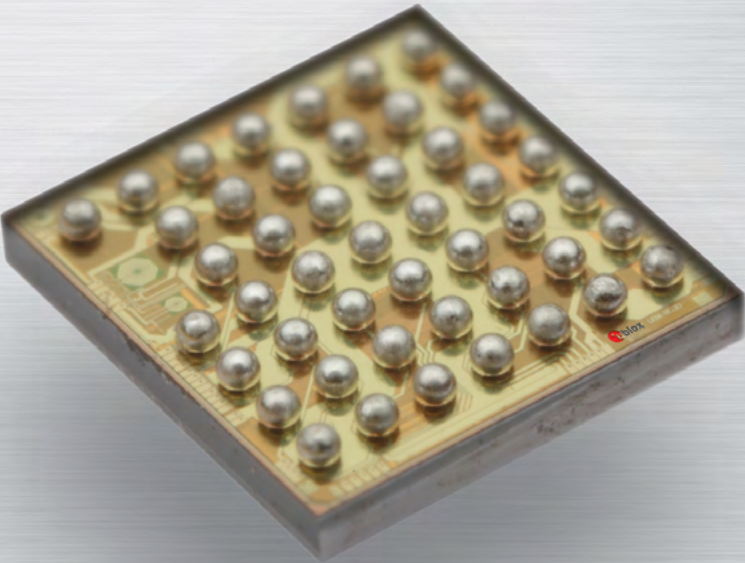
Amplifier characteristics

Gain without cable	Typ. 27 dB
Noise figure	Max. 1.8 dB
Output VSWR	Max. 2.0
DC voltage	2.7 V – 6 V
DC current	Typ 8.5 mA, ± 4.5 mA

Environmental data

Operating temperature	-40°C to $+85^{\circ}\text{C}$
Storage temperature	-50°C to $+85^{\circ}\text{C}$
Humidity	40% to 95% RH
Vibration	Sine sweep 1G (0-Peak), 10 – 150 – 10 Hz each axis

Positioning chips



Based on a proprietary high-performance architecture with 72 parallel channels, u-blox's powerful range of GNSS positioning chips are ideal for automotive, industrial and consumer applications.

Key benefits include

- Ultra-fast acquisition time: Time-To-First-Fix (TTFF) down to 1 second for hot and aided starts
 - High sensitivity: Down to -167 dBm and -148 dBm for coldstart
 - Automotive Dead Reckoning and Precision Timing options
 - Intelligent, user configurable power management for radically lower power consumption
 - Minimal board space, < 30 mm², ideal for small end products with tight space and low cost requirements
- Minimal e-BOM, as few as 8 external parts
 - Works with crystal or TCXO
 - Anti-Jamming architecture allows easy embedding in noisy electronics
 - Automotive grade versions
 - Concurrent reception of GPS/QZSS, GLONASS, BeiDou, Galileo
 - Assisted GNSS support (AssistNow)

Product selector: Positioning chips



UBX-M8030-CT
2.99 x 3.21 x 0.36 mm



UBX-G8020-KT
5.00 x 5.00 x 0.59 mm



UBX-M8030-KT/KA
5.00 x 5.00 x 0.59 mm

Model	Package	Category	GNSS				Interfaces				Features					Grade
	Package	Standard Precision GNSS High Precision GNSS Dead Reckoning Timing	GPS / QZSS GLONASS Galileo BeiDou		Number of Concurrent GNSS	UART USB SPI DDC (I2C compliant)					Programmable (Flash) Data logging RTC crystal Oscillator Antenna supply and supervisor Timepulse					Standard Professional Automotive
Standard Precision GNSS chips																
UBX-M8030-CT	WL-CSP47	•	• • • •		3	• • • •		S	S	S	C/T	S	2			
UBX-M8030-KT	QFN40	•	• • • •		3	• • • •		S	S	S	C/T	S	2			
UBX-M8030-KA*	QFN40	•	• • • •		3	• • • •		S	S	S	C/T	S	2			
UBX-G8020-KT	QFN40	•	• •		1	• • • •		S	S		C/T	S	2			
UBX-G7020-CT	WL-CSP50	•	• •		1	• • • •		S	S	S	C/T	S	2			
UBX-G7020-KA	QFN40	•	• •		1	• • • •		S	S	S	C/T	S	2			
Dead Reckoning chips																
UBX-M8030-KT-DR	QFN40		ADR, E	• • • •	3	• • • •		• • •	S		C/T	S	2			
UBX-M8030-KA-DR*	QFN40		ADR, E	• • • •	3	• • • •		• • •	S		C/T	S	2			
Timing chip																
UBX-M8030-KT-FT	QFN40			E	• •	•	2	•	D	• •	•		V	2		

* = Operating temperature
-40° C to +105° C

ADR = Automotive Dead Reckoning
E = External Flash required

S = supported, may require ext. components
D = Utility and development use only

C/T = Crystal & TCXO supported
V = VCTCXO supported

Note: for details about previous generation chips not shown, please visit our website.

UBX-M8030

u-blox M8 concurrent GNSS chips

Highlights

- Concurrent reception of up to 3 GNSS (GPS, Galileo, GLONASS, BeiDou)
- Industry leading –167 dBm navigation sensitivity
- Industry lowest current consumption
- Superior position accuracy in urban canyons
- Security and integrity protection
- Support for all satellite augmentation systems
- Operating temperature range of -40° to +105°C for automotive grade chip



Product description

The UBX-M8030 high performance standard precision GNSS chips from u-blox, provide exceptional sensitivity and acquisition times for all GNSS systems. The chips utilize concurrent reception of up to three GNSS systems (GPS/Galileo together with Beidou or GLONASS). Reception from more than one constellation simultaneously allows extraordinary positioning accuracy in urban canyons, even with weak signals and high dynamics.

The UBX-M8030 chips feature low power consumption in concurrent reception mode and support advanced Power Save Modes for all GNSS, the power consumption remains low even for weak signals. The UBX-M8030 chips also support message integrity protection, geofencing and spoofing detection with configurable interface settings to easy fit to customer applications. The firmware supports QZSS, GAGAN and IMES together with WAAS, EGNOS, MSAS.

UBX-M8030 chips are available in miniature WL-CSP and QFN packages. Featuring built-in LNA, LDOs and DC/DC converter, and a small external BOM, the UBX-M8030 enables ultra-small solutions with a footprint of only 30 mm². Supporting TCXOs or lower price oscillators further ensures a minimal Total-Cost-of-Ownership.

The ultra small UBX-M8030-CT is a perfect choice for portable consumer applications with demanding size and cost constraints. Including rigorous automotive quality and manufacturing standards, extended testing and low failure rate make the UBX-M8030-KA chip ideal for automotive applications. With UBX-M8030-KA's operational temperature from -40° to +105°C, a new industry standard is set.

Migration from existing FW2 based u-blox M8030 chip designs are simple, since the upgraded UBX-M8030 offers backward compatibility.

Product selector

Model	Package	Category	GNSS				Supply	Interfaces				Features					Grade		
	Package	Standard Precision GNSS High Precision GNSS Dead Reckoning Timing	GPS / QZSS	GLONASS	Galileo	BeiDou	Number of Concurrent GNSS	1.4 V – 3.6 V	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	Data logging	RTC crystal	Oscillator	Antenna supply and supervisor	Timepulse	Standard Professional Automotive
UBX-M8030-CT	WL-CSP47	•	•	•	•	•	3	•	•	•	•	S	S	S	C/T	S	2	<div></div>	
UBX-M8030-KT	QFN40	•	•	•	•	•	3	•	•	•	•	S	S	S	C/T	S	2	<div></div>	<div></div>
UBX-M8030-KA*	QFN40	•	•	•	•	•	3	•	•	•	•	S	S	S	C/T	S	2	<div></div>	<div></div>

C/T = Crystal and TCXO supported
* = Operating temperature -40° to +105°C

S = supported, may require external components

Features

Receiver type	72-channel u-blox M8 engine GPS/QZSS L1 C/A, GLONASS L10F BeiDou B1, Galileo E1B/C SBAS L1 C/A: WAAS, EGNOS, MSAS, GAGAN
Time to first fix ¹	
Cold start:	26 s
Aided start:	2 s
Hot start:	1 s
Sensitivity ¹	
Tracking & Nav.	–167 dBm
Reacquisition	–160 dBm
Cold start	–148 dBm
Hot start	–157 dBm
Max nav. update rate ²	
Single GNSS	up to 18 Hz
2 Concurrent GNSS	up to 10 Hz
Horizontal Pos. Accuracy ¹	2.0 m CEP
Multi-GNSS Assistance	AssistNow Online AssistNow Offline (up to 35 days) AssistNow Autonomous (up to 6 days)
Oscillator	Supports crystal or TCXO
LNA	Built-in
RTC input	32.768 kHz (optional), RTC can be derived from GNSS Crystal or TCXO
Antenna supervision	Short and open circuit detection supported with external circuit
DC/DC converter	Built-in, external component required
Anti Jamming	Active CW detection and removal
SQI Flash (optional) for	FW update AssistNow Offline AssistNow Autonomous
Raw Data	Code phase output
Odometer	Integrated in navigation filter
Geo-fencing	Up to 4 circular areas GPIO for waking up external CPU
Spoofing detection	Built-in
Signal integrity	Signature feature with SHA 256
Data-logger ³	For position, velocity, time, and odometer data

1 For default mode: GPS/SBAS/QZSS+GLONASS with TCXO

2 ROM

3 External Flash required

Packages

UBX-M8030-CT	47 Pin WL-CSP, 2.99 x 3.21 x 0.36 mm
UBX-M8030-KT/KA	40 Pin QFN, 5.00 x 5.00 x 0.59 mm

Environmental data, quality & reliability

Operating temp.	–20° C to +70° C (UBX-M8030-CT) –40° C to +85° C (UBX-M8030-KT) –40° C to +105° C (UBX-M8030-KA)
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Storage temp.	–40° C to +125° C
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Humidity	JEDEC MSL 1
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RoHS compliant (lead-free) and green (no halogens)

Qualification according to AEC-Q100

Manufactured in ISO/TS 16949 certified production sites

Interfaces

Serial interfaces	1 UART 1 USB V2.0 compatible 1 DDC (I ² C compliant) 1 SPI
Digital I/O	2 configurable time pulses 2 EXTINT interrupt inputs 2 PIO for antenna supervision
Memory	SQI interface for optional Flash

Support products

u-blox M8 Evaluation Kits:

Easy-to-use kits to get familiar with u-blox M8 positioning technology, evaluate functionality, and visualize GNSS performance.

EVK-M8N u-blox M8 GNSS Evaluation Kit, which supports TCXO-based u-blox M8 designs

EVK-M8C u-blox M8 GNSS Evaluation Kit, which supports crystal-based u-blox M8 designs

Electrical data

Supply voltage	1.4V to 3.6V
Digital I/O voltage level	1.65V to 3.6V
Power consumption (2 concurrent GNSS)	22 mA @ 3.0 V (Continuous) 5.5 mA @ 3.0 V (PSM, 1 Hz)
Backup Supply	1.4V to 3.6V

Product variants

UBX-M8030-CT	u-blox M8 GNSS chip, 47 Pin WL-CSP
UBX-M8030-KT	u-blox M8 GNSS chip, 40 Pin QFN
UBX-M8030-KA	u-blox M8 GNSS chip, 40 Pin QFN

UBX-G8020-KT

u-blox 8 GNSS chip

Standard Professional Automotive

Highlights

- GNSS engine for GPS/QZSS and GLONASS
- High sensitivity of -166 dBm
- Low power consumption
- Advanced jamming and spoofing detection
- Superior performance for wrist worn devices
- Pin-compatible to UBX-G7020-KT and UBX-M8030-KT



UBX-G8020-KT
5.00 x 5.00 x 0.59 mm

Product description

The UBX-G8020-KT GNSS chip, based on the latest u-blox 8 position engine, supports GPS/QZSS, GLONASS, and SBAS. With superior sensitivity and acquisition times it sets new standards for single constellation receivers.

UBX-G8020-KT chip is targeted for applications where small size, high performance, minimal power, and low system costs all are a must. With a dedicated mode for wrist worn applications, UBX-G8020-KT is a perfect choice for wearable devices.

UBX-G8020-KT features low power consumption and supports advanced Power Save Modes. It also provides message integrity protection, geofencing, spoofing detection, odometer, and data logging functionalities.

The UBX-G8020-KT is available in an industry standard QFN package. Featuring built-in LNA, LDOs and DC/DC converter, and a small external BOM, the UBX-G8020-KT enables ultra-small solutions with a footprint of only ~50 mm². By supporting TCXOs or lower price oscillators, the UBX-G8020-KT further ensures a minimal Total-Cost-of-Ownership.

UBX-G8020-KT was built with backward compatibility in mind, thus simplifying migration from existing u-blox G7020-KT designs.

With its rigorous quality and manufacturing standards (AEC-Q100, ISO/TS 16949), UBX-G8020-KT meets the requirements for industrial and consumer applications.

Product selector

Model	Package	Category	GNSS				Supply	Interfaces	Features						Grade
	Package	Standard Precision GNSS High Precision GNSS Dead Reckoning Timing	GPS / QZSS GLONASS Galileo BeiDou	Number of Concurrent GNSS	1.4 V – 3.6 V	UART USB SPI DDC (I²C compliant)	Programmable (Flash)	Data logging RTC crystal Oscillator Antenna supply and supervisor Timepulse	Standard Professional Automotive						
UBX-G8020-KT	QFN40	•	• •	1	•	• • • •	S S C/T S 2								

S = supported, may require external components

C/T = Crystal and TCXO supported

Features

Receiver type	72-channel u-blox 8 engine GPS/QZSS L1 C/A, GLONASS L10F SBAS L1 C/A: WAAS, EGNOS, MSAS	
	GPS	GLONASS
Time to first fix ¹		
Cold start:	29 s	30 s
Aided start:	2 s	2 s
Hot start:	1 s	1 s
Sensitivity ¹		
Tracking & Nav.:	-166 dBm	-166 dBm
Reacquisition:	-160 dBm	-156 dBm
Cold start:	-148 dBm	-145 dBm
Hot start:	-157 dBm	-156 dBm
Max nav. update rate	up to 18 Hz	
	GPS	GLONASS
Horizontal Pos. Accuracy	2.5 m CEP	4.0 m CEP
Multi-GNSS Assistance	AssistNow Online AssistNow Offline (up to 35 days) AssistNow Autonomous (up to 6 days)	
Oscillator	Supports crystal or TCXO	
LNA	Built-in	
RTC input	32.768 kHz (optional), RTC can be derived from GNSS crystal	
Antenna supervision	Short and open circuit detection supported with external circuit	
DC/DC converter	Built-in, external component required	
Anti Jamming	Active CW detection and removal	
Raw Data	Code phase output	
Odometer	Integrated in navigation filter	
Geo-fencing	Up to 4 circular areas; GPIO for waking up external CPU	
Spoofing detection	Built-in	
Signal integrity	Signature feature with SHA 256	
Data logging ²	For position, velocity, time, and odometer data	

- 1 with TCXO
2 External Flash required

Packages

UBX-G8020-KT:	40 Pin QFN, 5.00 x 5.00 x 0.59 mm
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Environmental data, quality & reliability

Operating temp.	-40°C to +85°C
Storage temp.	-40°C to +125°C
Humidity	JEDEC MSL 1
RoHS compliant (lead-free) and green (no halogens)	
Qualification according to AEC-Q100	
Manufactured in ISO/TS 16949 certified production sites	

Interfaces

Serial interfaces	1 UART 1 USB V2.0 compatible 1 DDC (I ² C compliant) 1 SPI
Digital I/O	2 configurable time pulses 2 EXTINT interrupt inputs 2 PIO for antenna supervision

Electrical data

Supply voltage	1.4V to 3.6V
Digital I/O voltage level	1.65V to 3.6V
Power consumption	16 mA @ 3.0 V (continuous mode) 3.7 mA @ 3.0 V (PSM, 1 Hz update)
Backup Supply	1.4V to 3.6 V

Support products

Easy-to-use kit to get familiar with u-blox 8 positioning technology, evaluate functionality, and visualize GNSS performance.

EVK-8N: u-blox 8 GNSS Evaluation Kit with TCXO

Product variants

UBX-G8020-KT	u-blox 8 GNSS chip, 40 Pin QFN
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UBX-G7020

u-blox 7 GNSS chips

Standard

Professional

Automotive

Highlights

- GNSS engine for GPS/QZSS, GLONASS
- Minimal board space, <30 mm²
- Combines low power consumption and high sensitivity
- Minimal e-BOM, as few as 8 external parts
- Exceptional jamming immunity
- Pin-compatible to UBX-M8030



Product description

The high performance UBX-G7020 multi-GNSS chip supports GPS, GLONASS, QZSS and SBAS. It delivers exceptional sensitivity and acquisition times.

u-blox 7 features ultra low power consumption, thanks to innovative single die architecture and enhanced software algorithms. This gives the UBX-G7020 best in class power consumption for GLONASS reception.

The extended voltage supply range and 1.8 V and 3.0 V I/O compliance supports a wide variety of user applications. Sophisticated RF-architecture and interference suppression using active continuous wave detection ensure maximum performance even in GNSS-hostile environments.

The UBX-G7020 is available in your choice of miniature WL-CSP and QFN packages and features an ultra small solution footprint of only 30 mm². The built-in LNA, LDOs and DC/DC converter, and on-chip ROM mean that only the smallest possible external BOM is required. By supporting TCXOs or lower price GNSS oscillators the UBX-G7020 further ensures a minimal Total-Cost-of-Ownership.

The ultra small UBX-G7020-CT is the perfect choice for portable consumer applications with demanding size and cost constraints. With its rigorous Automotive quality and manufacturing standards (AEC-Q100, ISO/TS 16949) the UBX-G7020-KA is ideal for automotive applications.

Product selector

Model	Package	Type	Supply	Interfaces	Features	Grade
	Package	GPS / QZSS GLONASS Galileo BeiDou Timing Dead Reckoning Precise Point Positioning Raw Data	1.4 V – 3.6 V	UART USB SPI DDC (I ² C compliant)	Programmable (Flash) Data logging RTC crystal Internal oscillator Antenna supply and supervisor	Standard Professional Automotive
UBX-G7020-CT	WL-CSP50	• •	•	• • • •	S S S C/T S	
UBX-G7020-KT/KA	QFN40	• •	•	• • • •	S S S C/T S	

C/T = Crystal and TCXO supported

S = supported, may require external components

Features

Receiver type	56-channel u-blox 7 engine GPS & QZSS L1 C/A, GLONASS L1OF, SBAS: WAAS, EGNOS, MSAS		
Navigation update rate	up to 10 Hz		
Accuracy		GPS	GLONASS
	Position	2.5 m CEP	4 m CEP
	SBAS	2.0 m CEP	
Acquisition	Cold starts:	29 s	30 s
	Hot starts:	1 s	3 s
Sensitivity	Tracking:	-162 dBm	-158 dBm
	Cold starts:	-148 dBm	-140 dBm
	Reacquisition:	-160 dBm	-156 dBm
Assistance	AssistNow Online AssistNow Offline AssistNow Autonomous OMA SUPL & 3GPP compliant		
LNA	Built-In		
Oscillator	Crystal or TCXO		
RTC input	32.768 kHz (optional). Real time clock can be derived from GPS crystal or TCXO.		
Antenna Supervision	Short and open circuit detection supported with external circuit		
DC/DC converter	Integrated		
Anti jamming	Active CW detection and removal		
Memory	Optional SQI Flash		
Data logger*	Continuous log of position, velocity & time		

* External FLASH required

Packages

UBX-G7020-CT:	50 Pin WL-CSP, 3.4 x 3.0 x 0.36 mm 11.9 mg
UBX-G7020-KT/KA:	40 Pin MLF/QFN, 5.0 x 5.0 x 0.59 mm 75 mg

Environmental data

Operating temp.	-40° C to 85° C
Storage temp.	-40° C to 125° C
Humidity	JEDEC MSL 1
RoHS compliant (lead-free) and green (no halogens)	

Electrical data

Supply voltage	1.4 V to 3.6 V
Digital I/O voltage level	1.65 – 3.6 V
Power Consumption	41 mW @ 1.4V (Continuous) 9 mW @ 1.4V Power Save mode (1 Hz)
Backup Supply	1.4 to 3.6V

Support products

u-blox 7 Evaluation Kits:	
Easy-to-use kits to get familiar with u-blox 7 positioning technology, evaluate functionality, and visualize GNSS performance.	
EVK-7N:	u-blox 7 GNSS Evaluation Kit, with TCXO, supports u-blox 7 chips
EVK-7C:	u-blox 7 GNSS Evaluation Kit, with Crystal, supports u-blox 7 chips

Interfaces

Serial interfaces	1 UART 1 USB 1 DDC (I ² C compliant) 1 SPI
Digital I/O	2 configurable time pulses 2 EXTINT interrupt inputs 2 GPIO for antenna supervision
Memory	SQI interface

Product variants

UBX-G7020-CT	u-blox 7 GNSS chip, 50 Pin WL-CSP
UBX-G7020-KT/KA	u-blox 7 GNSS chip, 40 Pin QFN

UBX-M8030-Kx-DR

Standard

Professional

Automotive

u-blox M8 3D Dead Reckoning GNSS chips

Highlights

- Leading performance under poor signal conditions
- Continuous navigation during signal loss
- Support for directly connected 3D sensors
- Automatic configuration of wheel-tick/speed input
- Real-time positioning up to 20 Hz rate
- GPS/QZSS, GLONASS, BeiDou, Galileo
- Operating temperature range -40°C...+105°C for automotive grade chip



UBX-M8030-KA-DR
5.0 x 5.0 x 0.59 mm



UBX-M8030-KT-DR
5.0 x 5.0 x 0.59 mm

Product description

The M8030-KT-DR and automotive-grade M8030-KA-DR chips offer u-blox's fourth generation ADR technology designed to meet the needs of the latest interactive navigation systems and displays. The performance of these products benefits from experience in demanding, first-fit passenger-car applications, the latest multi-axis sensor technology and advancements in u-blox's multi-GNSS signal processing, particularly in highly urban environments.

u-blox's latest ADR technology introduces a new High Navigation Rate class of positioning outputs. The intelligent combination of GNSS and sensor measurements enables accurate, real-time position, speed, and heading information at rates up to 20 Hz, as essential for smooth and responsive interactive display.

u-blox's ADR chips support Dead Reckoning with single

and differential wheel-ticks, gyroscope, and accelerometer sensors, and they incorporate map-matching feedback where available. The latest generation supports wheel ticks and 3D sensors connected directly to the receiver, which provides a useful saving in eBOM and the benefits of reduced latency. Flexible automatic configuration reduces the number of product variants required to support multiple applications.

The M8030 family includes u-blox's latest generation GNSS technology, which adds Galileo to the multi-constellation reception that already includes GPS, GLONASS, BeiDou and QZSS. These chips provide high sensitivity and fast GNSS signal acquisition and tracking.

The UBX-M8030-Kx chips are qualified according to AEC-Q100, and are manufactured in ISO/TS 16949 certified sites.

Product selector

Model	Package	Category	GNSS				Supply	Interfaces				Features				Grade		
	Package	Standard Precision GNSS High Precision GNSS Dead Reckoning Timing	GPS / QZSS GLONASS Galileo BeiDou	Number of Concurrent GNSS	1.4 V – 3.6 V	UART USB SPI DDC (I2C compliant)	Programmable (Flash) Data logging RTC crystal Oscillator Antenna supply and supervisor Timepulse	Standard Professional Automotive										
UBX-M8030-KT-DR	QFN40	ADR, E	• • • •	3	•	• • • •	• • S C/T S 2											
UBX-M8030-KA-DR*	QFN40	ADR, E	• • • •	3	•	• • • •	• • S C/T S 2											

ADR = Automotive Dead Reckoning

E = External Flash required

* = Extended temperature -40°C to +105°C

S = supported, may require external components

C/T = Crystal and TCXO supported

Features

Receiver type	72-channel u-blox M8 engine GPS/QZSS L1 C/A, GLONASS L10F, BeiDou B11, Galileo E1B/C SBAS L1 C/A: WAAS, EGNOS, MSAS, GAGAN
Time to first fix ¹	
Cold start:	26 s
Aided starts:	2 s
Hot starts:	1 s
Sensitivity ¹	
Tracking & Nav.:	−160 dBm ²
Reacquisition:	−160 dBm
Cold start:	−148 dBm
Hot start:	−157 dBm
Operational limits	
Max nav. update rate	20 Hz
Max. velocity	500 m/s
Velocity accuracy	0.05 m/s
Heading accuracy	0.3 degrees
Horizont. pos. accuracy	2.0 m CEP
Sensor configuration	Wheel ticks, gyro, accelerometer Differential wheel ticks, Map-match feedback
Multi-GNSS Assistance	AssistNow Online AssistNow Offline (up to 35 days) AssistNow Autonomous (up to 6 days)
Oscillator	Supports crystal or TCXO
LNA and outband filtering	On-chip LNA
RTC input	32.768 kHz (optional), RTC can be derived from GNSS Crystal or TCXO
Antenna supervision	Short and open circuit detection supported with external circuit.
DC/DC converter	Built-in, external component required
Anti Jamming	Active CW detection and removal
SQL flash supported	Required for ADR AssistNow Offline, AssistNow Autonomous improved performance, and data logger

¹ GPS + GLONASS

² Limited by FW for best DR performance

Packages

UBX-M8030-KA-DR/	40 Pin QFN:
UBX-M8030-KT-DR:	5.0 x 5.0 x 0.59 mm

Environmental data, quality & reliability

Operating temp.	−40° C to +85° C (UBX-M8030-KT-DR) −40° C to +105° C (UBX-M8030-KA-DR)
Storage temp.	−40° C to +125° C
Humidity	JEDEC MSL 1
RoHS compliant (lead-free) and green (no halogens)	

ADR performance and requirements

u-blox ADR supports standard sensor configurations: Rear wheel sensors, front wheel sensors, four wheel sensors, gyro + speedpulse + accelerometer (optional).

Sensor option	Typical position error
Front wheels (2D):	14%
Rear wheels (2D):	12%
Four wheels (2D):	10%
Gyro + speedpulse (2D):	3%
Gyro + speedpulse + accelerometer (3D):	3%

Electrical data

Supply voltage	1.4 V to 3.6 V
Digital I/O voltage	1.65 V to 3.6 V
Power Consumption	18 mA @ 3.0 V (single GNSS) (continuous mode) 22 mA @ 3.0 V (concurrent GNSS)
Backup Supply	1.4 V to 3.6 V

Interfaces

Serial interfaces	1 UART 1 USB V2.0 full speed 12 Mbit/s 1 DDC (I ² C compliant) 1 DDC (I ² C compliant) sensor interface 1 SPI
Digital I/O	Configurable time pulse 1 EXTINT interrupt inputs 10 configuration pins
Memory	SQL interface

Support products

Contact nearest u-blox representative.

Product variants

UBX-M8030-KT-DR	u-blox M8 3D ADR chip, Professional Grade
UBX-M8030-KA-DR	u-blox M8 3D ADR chip, Automotive Grade

UBX-M8030-KT-FT

Standard Professional Automotive

u-blox M8 time & frequency reference GNSS chip

Highlights

- Concurrent reception of GPS/QZSS, GLONASS, BeiDou
- Direct control of system reference oscillator disciplined by GNSS
- Accurate measurement and control of external oscillators
- Industry leading acquisition sensitivity and single-satellite timing
- Automatic hold-over
- Prepared for integration with external PTP, Sync-E and network listen



UBX-M8030-KT-FT
5.00 x 5.00 x 0.59 mm

Product description

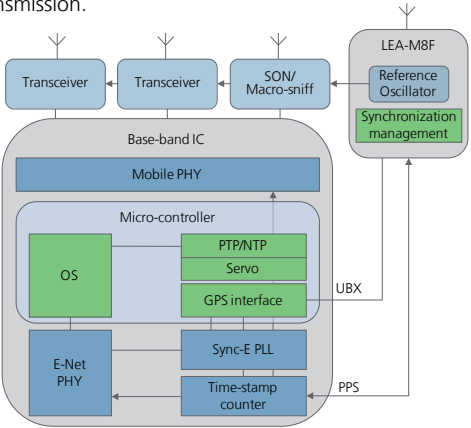
u-blox time and frequency products provide multi-GNSS synchronization for cost-sensitive network edge equipment including Femto wireless base-stations. The M8030-KT-FT IC provides a complete GNSS receiver and reference frequency control function. This single-chip RF and base-band IC requires few external components: just a low-cost SQI Flash for program and parameter storage and passive components.

The M8030-KT-FT can control a system reference VCTCXO directly via its in-built PWM DAC, providing both frequency and phase coherence with the best available source of synchronization. Additional remote oscillators may be controlled via a second DAC (DDC) or via the host system. External sources of synchronization are supported through time-pulse and frequency inputs and a message interface. This allows measurements from macro-sniff, Sync-E, or packet timing to be combined with measurements from GNSS.

u-blox time and frequency products include timing integrity alarms that report phase and frequency uncertainty both during normal operation and hold-over. They feature a high dynamic range radio with both analog and digital interference mitigation supporting their inclusion as an integral part of a local area base station design.

Example application (Residential Femto Cell)

In a Femto-Cell application, the M8030-KT-FT can make fine adjustments to the master reference frequency oscillator to precisely align the Femto-cell transmit framing with a phase reference from GNSS or PTP. In the absence of a reliable source of synchronization, the M8030-KT-FT automatically manages hold-over based on the stability of the oscillator selected, allowing the Femto-cell to continue transmissions. The M8030-KT-FT estimates phase and frequency uncertainty continuously during hold-over so the host system can decide when to discontinue transmission.



Product selector

Model	Package	Type	Supply	Interfaces	Features	Grade
	Package	GPS / QZSS GLONASS Galileo BeiDou Timing Dead Reckoning Precise Point Positioning Raw Data	3.0 V – 3.6 V	UART USB SPI DDC (i2C compliant)	Programmable (Flash) Data logging RTC crystal Oscillator Antenna supply & supervisor VCTCXO support	Standard Professional Automotive
UBX-M8030-KT-FT	QFN40	• • • • •	•	• D • •	S V •	

D = Utility and development use only

S = supported, requires external components

V = VCTCXO support

Features – GNSS

Receiver type	72-channel u-blox M8 engine GPS/QZSS L1 C/A, GLONASS L10F, BeiDou B1 SBAS L1 C/A: WAAS, EGNOS, MSAS		
		GPS	GLONASS
Accuracy		2.5 m CEP	< 4 m CEP
Time to fix	Cold starts:	26 s	30 s
	Hot/Aided starts:	1 s	3 s
Sensitivity	Tracking:	–165 dBm	–165 dBm
	Cold start (aided):	–157 dBm	–148 dBm
	(autonomous):	–148 dBm	–145 dBm
	Reacquisition:	–160 dBm	–157 dBm
Assistance	AssistNow Online OMA SUPL & 3GPP compliant interface		
Oscillator	Supports VCTCXO		
LNA	Built-in		
Anti jamming	Active CW detection and removal		
Supported antennas	Active and passive		
External SQI Flash	Required for firmware storage and upgrade		

Package

UBX-M8030-KT-FT:	40 Pin QFN, 5.00 x 5.00 x 0.59 mm
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Environmental data, quality & reliability

Operating temp.	–20° C to +70° C
Storage temp.	–40° C to +125° C
Humidity	JEDEC MSL 1
RoHS compliant (lead-free) and green (no halogens)	
Manufactured in ISO/TS 16949 certified production sites	

Features – synchronization

Frequency control:	PWM DAC to control external VCTCXO		
Frequency control (primary oscillator)	GNSS locked:	< 5 ppb	
	Frequencies:	19.2, 26, 30.72 MHz	
	Hold-over:	Determined by	
oscillator			
Frequency control (additional oscillator option)	GNSS locked:	< 5 ppb	
	Frequencies:	10, 13, 19.2, 20, 26, 30.72, 40 MHz	
	Hold-over:	Determined by oscillator	
Phase control	Clear sky:	< 20 ns	
	Indoor:	< 500 ns typ.	
Time-pulse input	Resolution:	< 50 ns	
Time-pulse output	Jitter:	< 2 ns	

Interfaces

Serial interfaces	SPI or UART and DDC (I ² C compliant)
	USB v2.0 full speed (ext. voltage regulator)
Protocols	NMEA, UBX binary, RTCM
External DAC	Dedicated DDC (master)
Timing interfaces	Timepulse output
	2x timepulse/frequency inputs

Support products

u-blox M8 Evaluation Kits:

Easy-to-use kits to get familiar with u-blox M8 positioning technology, evaluate functionality, and visualize GNSS performance.

EVK-M8F:	u-blox M8 GNSS Evaluation Kit for Time and Frequency reference
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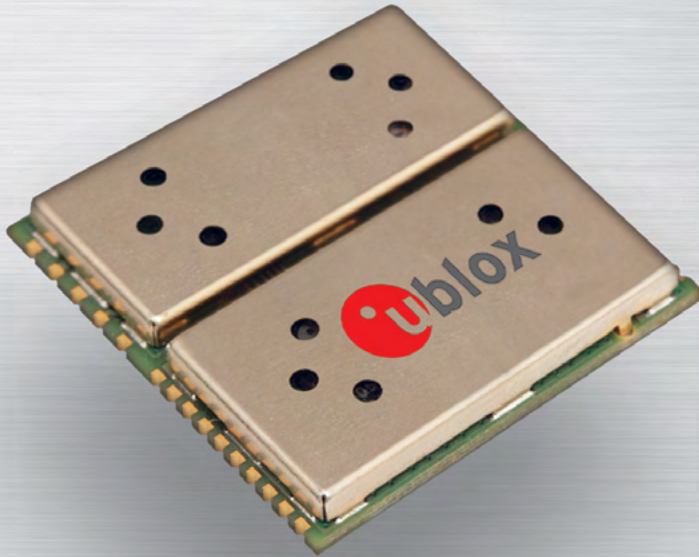
Electrical data

Supply voltage	3.0 V to 3.6 V
Power Consumption	30 mA @ 3.3 V

Product variants

UBX-M8030-KT-FT	u-blox M8 GNSS chip, Time & Frequency reference, 40 Pin QFN
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Previous generation modules



Overview

u-blox cellular modules

Previous modules	Recommended for new designs
LEON-G1 series	SARA-G3 series
FW2763p and FW2770p	LISA-C2 series

For new designs, please refer to the cellular module overview table on page 23.

u-blox short range modules

Previous modules	Recommended for new designs
OLS425/OLP425 series	NINA-B1
OWL221, OWL253	ODIN-W1
OWL222	ODIN-W1 or EMMY-W161
OWS451	ODIN-W2

For new designs, please refer to the short range module overview table on page 43.

u-blox 6 modules

Previous modules	Recommended for new designs
MAX-6G	MAX-8C, MAX-M8C
MAX-6Q, MAX-M5Q	MAX-8Q, MAX-M8Q
NEO-6M/6G, NEO-7M	NEO-8Q, NEO-M8M
NEO-6Q	NEO-8Q, NEO-M8N
LEA-6N/S/A/H	LEA-M8S
LEA-6R, NEO-6V, AMY-6	Please contact u-blox
NEO/LEA-6T	NEO/LEA-M8T
NEO-6P	NEO-7P, NEO-M8P

For new designs, please refer to the position and time module overview tables on page 61.

Fastrax modules

Previous modules	Recommended for new designs
UP501	PAM-7Q
IT530, IT530M	MAX-8Q, MAX-M8Q
UC530, UC530M	CAM-M8Q

For new designs, please refer to the position and time module overview tables on page 61.

Services



Overview

AssistNow™ global online service for accelerated positioning

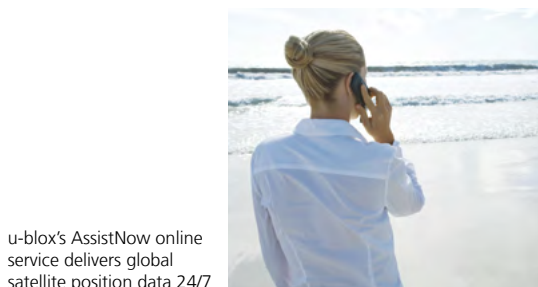
Users expect instant position information. During cold start conditions, this is sometimes not possible because at least four satellites must be identified, and their complete orbital position data, called Ephemeris, received. Due to the low data rate of satellite signals (only 50 baud!) together with adverse geographical or city conditions, downloads from satellites can be unacceptably long, or even fail altogether.

Assisted GNSS (A-GNSS) accelerates calculation of position by instantly delivering the necessary satellite data. Ephemeris, Almanac, accurate time and satellite status are delivered to GNSS receivers via cellular networks, such as GSM/GPRS, or the Internet. The aiding data enables a GNSS receiver to compute a position within seconds, even under poor satellite signal conditions.

Based on information gathered from its global network of satellite tracking stations, u-blox offers AssistNow service to its worldwide customers via the Internet based on a highly reliable online AssistNow Server. Both Online and Offline option are available.

u-blox also supports AssistNow Autonomous. Available on all u-blox 6/7/8/M8 GNSS receivers, this feature adds embedded satellite orbit prediction capability for even faster positioning without relying on any external aiding data.

Read about u-blox's AssistNow service on page 120.



u-blox's AssistNow online service delivers global satellite position data 24/7

CellLocate®: hybrid solution for indoor positioning

u-blox's proprietary cellular/GNSS positioning service merges mobile phone cell information with GNSS to improve positioning in areas where satellite signals are weak, jammed, or completely blocked.

CellLocate® combines mobile cell and GNSS positioning data to deliver better results than either technology can accomplish alone:

- Positioning performance can be improved and extended to areas where satellite signals are 100% blocked, especially within buildings
- Eliminate "no-fix" scenarios by providing at least an approximate fix wherever cell phone coverage is available
- Overcome jamming scenarios to improve antitheft system performance

CellLocate® cellular positioning technology is a feature implemented in u-blox SARA, LEON and LISA GSM, UMTS and CDMA cellular module families.



Increased reliability and indoor positioning based on mobile network attributes

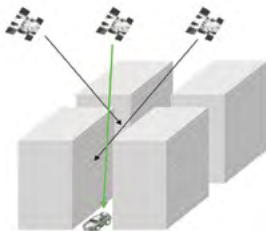
Read about u-blox's CellLocate® service on page 122.

Assisted GNSS

u-blox Multi-GNSS AssistNow services

The challenge of stand-alone GNSS

GNSS users expect instant position information. With standard positioning this is often not possible because at least four satellites must be identified, and their complete orbital position data (called Ephemeris) received. Under adverse signal conditions, data downloads from the satellites to the receiver can take minutes, hours or even fail altogether.



Assisted GNSS (A-GNSS) accelerates calculation of position by delivering the necessary satellite data, including Ephemeris, Almanac, accurate time and satellite status, to the GNSS receiver via cellular networks or the internet. This aiding data enables a GNSS receiver to compute a position within seconds, even under poor signal conditions.

AssistNow A-GNSS Services

AssistNow Online and AssistNow Offline are u-blox's end-to-end A-GNSS services for OEM customers and their end users. These services boost GNSS acquisition performance for devices with or without network connectivity. AssistNow Online and AssistNow Offline can either be used alone or in combination.

AssistNow A-GNSS services require no additional hardware and generate virtually no CPU load. The system is very easy to implement and can be installed and operational within a day.

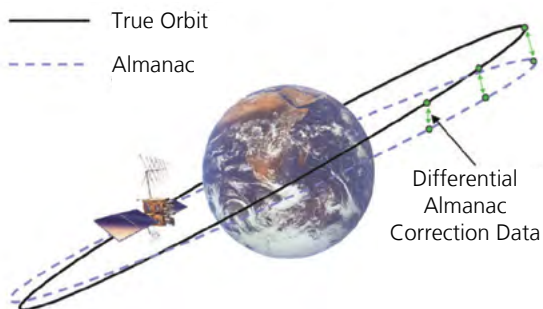
u-blox cellular modules feature an embedded AssistNow client making integration simple.

AssistNow Online

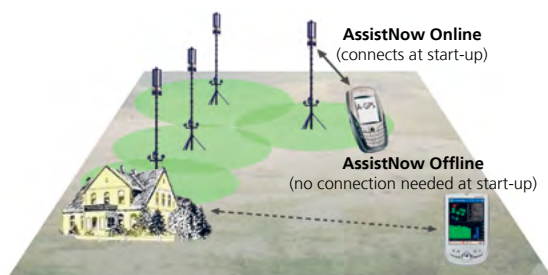
With AssistNow Online, an internet-connected GNSS device downloads assistance data from u-blox's AssistNow Online Service at system start-up. The service works on all standard mobile communication networks that support Internet access, including GPRS, UMTS and Wireless LAN. No special arrangements with mobile network operators are needed to enable AssistNow Online, making this solution network operator independent and globally available. u-blox only sends ephemeris data for those satellites currently visible to the mobile device requesting the data, thus minimizing the amount of data transferred.

AssistNow Offline

With AssistNow Offline, users download u-blox's Differential Almanac Correction Data from the internet at their convenience. The correction data is then transferred to the mobile terminal via TCP/IP, serial port, memory card, etc. and can either be stored in the GNSS receiver's Flash EPROM (if available) or in the memory of the application processor. Therefore, the service requires no connectivity at system start-up and enables a position fix within seconds, even when no network is available.



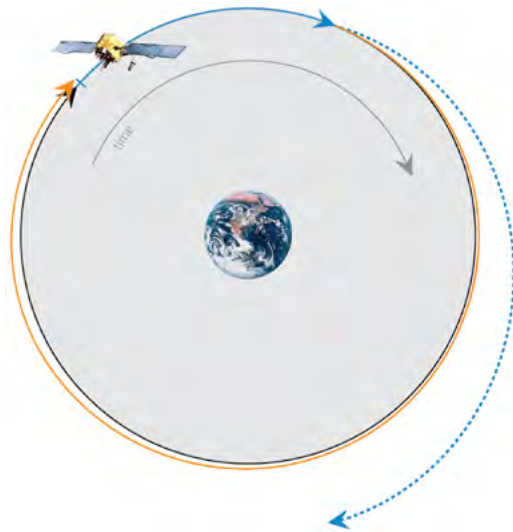
u-blox provides correction data valid from 1 to 35 days. The size of these files increases with the length of the prediction period, from as little as 3 kB to 125 kB. Positioning accuracy decreases with the length of the correction data duration, with 1–3 day data providing relatively high accuracy and 10–35 day data progressively less accuracy. Regular updates help to ensure a high level of position accuracy.



Occasional updates of **AssistNow Offline** data via file transfer at user's convenience

AssistNow Autonomous

AssistNow Autonomous is an embedded feature available free-of-charge that accelerates GNSS positioning by capitalizing on the periodic nature of GNSS satellite orbits. GNSS orbit predictions are directly calculated by the GNSS receiver and no external aiding data or connectivity is required. AssistNow Autonomous can be used alone, or together with AssistNow Online or AssistNow Offline for increased positioning speed and accuracy.



Legend

- True satellite orbit
- Broadcast ephemeris orbit (downloaded from the satellite)
- - - Broadcast eph. used beyond validity period (unusable for navigation)
- AssistNow Autonomous orbit (autonomously generated from broadcast ephemeris)

Benefits of AssistNow

- Fast Time-To-First-Fix, even under poor signal conditions
- Global coverage
- Network operator independent
- No additional hardware required
- Free best-effort service
- Guaranteed QoS option for premium customers
- Low CPU load
- Available for all u-blox GNSS products
- Easy to install and use
- u-blox cellular modules include an embedded AssistNow client for effortless implementation

Free and premium service options

AssistNow data is collected by u-blox's global array of satellite receivers, and maintained in real-time on u-blox AssistNow servers accessible via the Internet. For best-effort applications, u-blox provides AssistNow free-of-charge to its customers.

For applications requiring a guaranteed minimum Quality of Service (QoS), u-blox provides AssistNow Premium which provides guaranteed availability based on a service level agreement and 24/7 support.

Ordering information

This service is available to u-blox OEM customers. Use our online form (www.u-blox.com/services-form) or contact u-blox to obtain access to the free AssistNow service.

	AssistNow Online	AssistNow Offline	AssistNow Autonomous
Data download frequency	At every startup	Daily or less often	Never
Data retrieval at start-up	Data downloaded from server	Pre-downloaded data from local memory	Retrieved from local memory
Aiding data type	Ephemeris, almanac, time, health	Differential almanac correction data	Automatically generated
Data validity period	2 – 4 hours	35 days	Up to 6 days
Size of downloaded data	1 – 3 kB	10 kB (1 day) ... 125 kB (35 days)	N.A.
Acquisition (TTFF) performance	As low as 1 second	As low as 5 seconds	As low as 10 seconds
Free service	Best-effort	Best effort	N.A.
Premium service	Guaranteed availability based on service level agreement	Guaranteed availability based on service level agreement	N.A.

Mobile network-based hybrid positioning



Cellular location

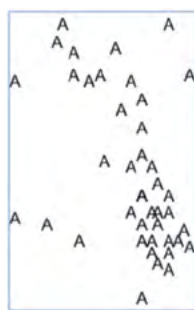
Network cells are widely available in urban and rural environments enabling the CellLocate® service to provide a position estimate virtually everywhere and under any conditions.

The service is offered free of charge on a best effort basis and the performance depends on the density of network cells and database population. A self learning mechanism is implemented allowing continuous database improvement and update in order to increase performance over time and prevent database aging.

Increased reliability and indoor positioning based on mobile network information

Although it is a widespread and very effective technology, Global Navigation Satellite System (GNSS) positioning is not always possible, particularly in challenging signal environments such as urban canyons, indoors, in enclosed park houses, or when GNSS jamming signals are present. Performance can be improved by complementing the GNSS receiver data with information from mobile network cells that can benefit numerous applications. u-blox, through its in-house development of cellular data modules and GNSS receivers, has developed and embedded a cellular positioning technology, CellLocate®, into its GSM, UMTS and CDMA cellular modules. This technology enables stand-alone location estimation based on surrounding mobile network information in conjunction with GNSS positioning data to improve positioning.

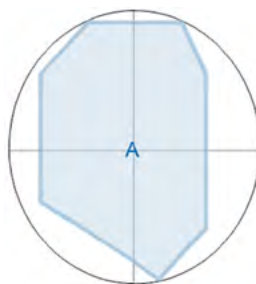
For any given location with cellular network coverage (GSM/GPRS, UMTS, CDMA), a specific combination of network cells will be visible. The proprietary CellLocate® feature allows u-blox GSM/GPRS, CDMA and UMTS cellular modules to report to the CellLocate® server all cells that are visible at any specific location. This enables the server to estimate a coarse position on the basis of previous observations from other modules reporting the same cell visibility pattern, and this position is reported back to the module. The estimated position is then sent as output by the module to the host processor via its serial port.



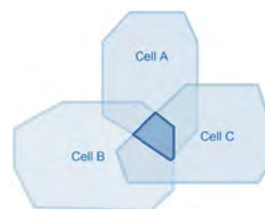
CellLocate® database contains historic observations of cell A reported by several devices



CellLocate® server defines area of cell visibility



New device observes cell A, position is estimated from the previous observations



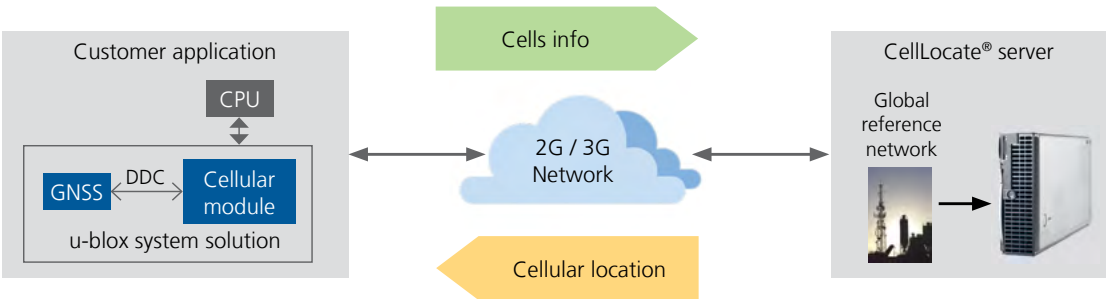
Visibility of multiple cells provides even better coverage and accuracy

CellLocate® and hybrid positioning

CellLocate® and hybrid positioning are u-blox's end-to-end services for OEM customers and their end-users. These services enhance and complement stand-alone GNSS acquisition performance when u-blox cellular modules and GNSS modules or chips are used.

u-blox implementation provides a single AT command interface enabling full control of the GNSS receiver and cellular positioning functionality in order to maximize performance and virtually eliminate any “no position scenario”. Through the single AT command interface it is possible to define all the positioning settings (cellular, stand-alone GNSS, GNSS aiding data) and enable the cellular module to optimize positioning

performance. CellLocate® and hybrid services are fully integrated into u-blox cellular modules and work in parallel to normal module functionality. While stand-alone CellLocate® is able to estimate position even when the GNSS signal is completely absent, hybrid positioning technology provides even better performance by using a combination of complementary positioning methods.



Benefits of CellLocate® and hybrid positioning

- Position available even in areas of poor or no GNSS signal reception
- Network operator independent
- Easy to integrate into end applications
- No additional hardware required
- Free best-effort service
- Supported by all u-blox GSM/GPRS, UMTS/HSPA and CDMA 1xRTT modules



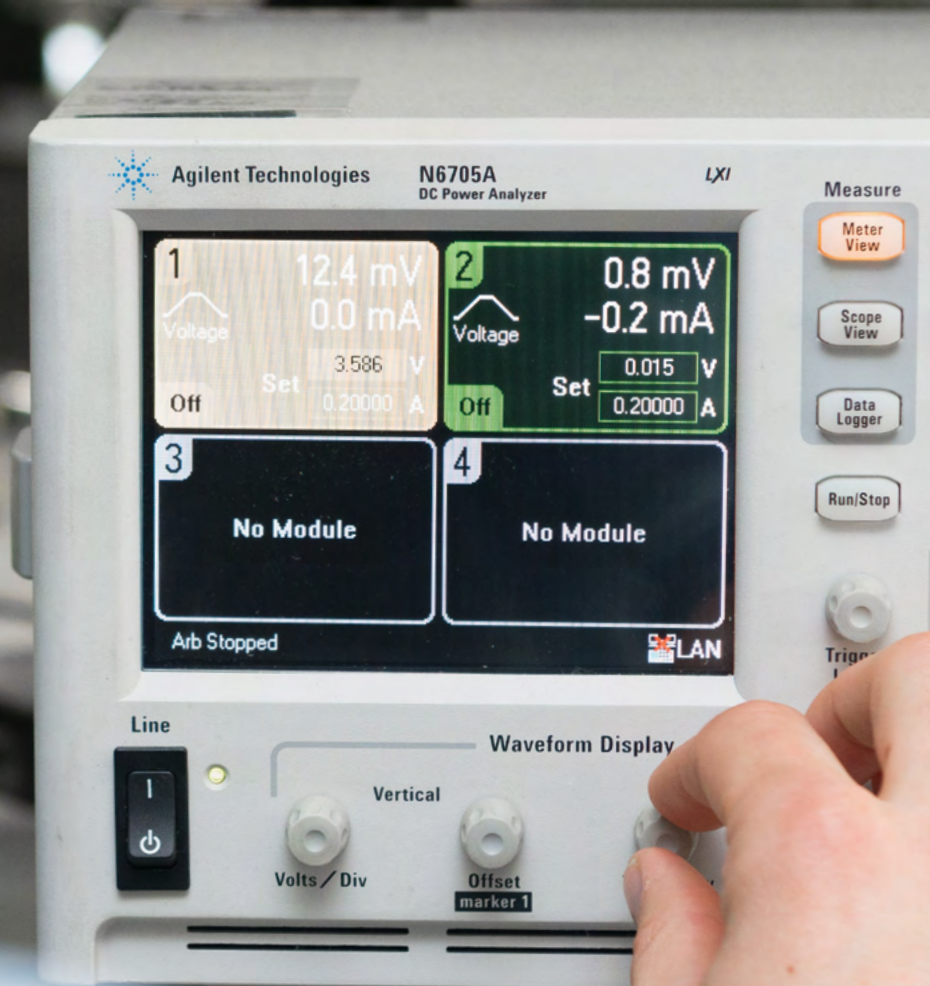
CellLocate® enabled devices	SARA-G340, SARA-G350 (GSM/GPRS) LISA-C200 (CDMA 1xRTT) LISA-U2xx (UMTS/HSPA) SARA-U2xx (UMTS/HSPA)
Supported network technologies	GSM/GPRS CDMA 1xRTT UMTS/HSPA
GNSS aiding settings	Stand-alone, AssistNow Online/Offline/Autonomous
Data size*	Uplink: 100-200 Bytes Downlink (position only): 150 Bytes Downlink (including GNSS aiding data): 1 – 3 kB

*) Data size depends on the number of visible cells and user selected GNSS aiding data

Ordering information

Please contact u-blox for more information.

Support



Overview

Support and evaluation tools

u-blox's worldwide offices provide you with wireless and positioning technology experts to ensure the success of your designs (see list of our global locations on page 146). u-blox also gives you comprehensive interactive support software for evaluation, design-in, testing and performance visualization of all its wireless and positioning products. Based on a sophisticated graphical user interface, the u-center, m-center, and s-center PC software supports our GNSS and wireless modules and may be downloaded free-of-charge from our website. See the following pages for details.

Evaluation kits for u-blox's wireless and positioning products plus application boards are also available. Software tools for the evaluation, visualization and configuration of our cellular, Wi-Fi, Bluetooth and positioning products can be downloaded from our website free-of-charge. For more information please visit our website at **www.u-blox.com/support**.

Evaluation kits and samples can be ordered via our online shop or ordered via an authorized u-blox representative or sales office.

Visit our online shop at **www.u-blox.com/online-shop**.



TOBY-L2 LTE evaluation kit EVK-L2x

Global online services

u-blox provides globally accessible, highly-reliable internet-based online services for Assisted GNSS (AssistNow, see page 120). AssistNow provides optional support to all u-blox satellite receivers worldwide with accurate satellite position aiding data to dramatically reduce Time-To-First-Fix, especially during cold start and weak signal conditions.

u-blox provides its CellLocate® online service free of charge to facilitate indoor positioning. The service capitalizes on hybrid GNSS/cellular positioning to provide a fix when satellite signals are weak or absent. CellLocate® supports u-blox's SARA GSM and UMTS, LISA CDMA and UMTS, and TOBY LTE cellular modem series.

Complete documentation

u-blox provides our customers with a complete set of technical documentation and support firmware supporting all u-blox based products including:

- Datasheets
- Application notes
- System integration manuals
- Protocol specifications
- Module firmware and USB device drivers
- Evaluation and integration software for Android
- GPS tutorial
- Field test reports
- Product change notifications

Documentation and software are available free-of-charge via our website. Our extensive archive of technical documents is searchable via the "Search Website" field at the upper right of every page of our website, **www.u-blox.com**.

Evaluation kits and tools

Design tools for u-blox wireless and positioning products

Cellular evaluation kits



The following evaluation kits support u-blox cellular products:

GSM/GPRS evaluation kits:

- EVK-G31/G35 supports SARA-G3 module series

UMTS/HSPA (WCDMA) evaluation kits:

- EVK-U20/U23 supports LISA-U2 module series
- EVK-U26/U27 supports SARA-U2 module series

CDMA2000 evaluation kits:

- EVK-C20 supports LISA-C200

LTE evaluation kits:

- EVK-L10 supports TOBY L100
- EVK-L10M supports MPC1-L100
- EVK-L2x supports TOBY-L2 module series
- EVK-R2x supports TOBY-R201 and LARA-R2 module series

Cellular adapter boards:

- ADP-G350/G310 supports SARA-G3 modules
- ADP-C200 supports LISA-C200
- ADP-U200 supports LISA-U200, ADP-U230 supports LISA-U230
- ADP-U260 supports SARA-U260, ADP-U270 supports SARA-U270
- ADP-L200 supports TOBY-L200, ADP-L210 supports TOBY-L210
- ADP-L201 supports TOBY-L201, ADP-L280 supports TOBY-L280

Short range wireless evaluation kits



The following evaluation kits support u-blox short range products:

Classic Bluetooth and Bluetooth low energy kits:

- EVK-OBS421 supports OBS421 module
- EVK-NINA-B1 supports NINA-B1 and NINA-B1 ARM mbed

Wi-Fi and Multiradio kits:

- EVK-ODIN-W2 supports ARM mbed for ODIN-W2
- EVK-W262U supports ODIN-W2 series
- EVK-ELLA-W1 supports ELLA-W1 modules
- EVK-EMMY-W1 supports EMMY-W1 modules
- EVK-W16 supports ODIN-W16 module series
- EVK-LILY-W1 supports LILY-W1 series

Most evaluation kits and application boards can be ordered via the **u-blox online shop**.

GNSS evaluation kits



The following evaluation kits support u-blox position and time products:

GNSS chips & modules with TCXO:

- EVK-M8N supports UBX-M8030 chips with TCXO, MAX-M8Q, MAX-M8W, NEO-M8N, NEO-M8Q, LEA-M8S
- EVK-8N supports UBX-G8020 chips, MAX-8Q, NEO-8Q
- EVK-7N supports UBX-G7020 chips, MAX-7Q, MAX-7W, NEO-7N

GNSS chips & modules with crystal:

- EVK-M8C supports UBX-M8030 chips with crystal, MAX-M8C, NEO-M8M
- EVK-M8MEVA supports EVA-M8M
- EVK-7C supports UBX-G7020 chips, MAX-7C, NEO-7M
- EVK-7EVA supports EVA-7M

GNSS antenna modules:

- EVK-M8CCAM supports CAM-M8C
- EVK-M8QCAM supports CAM-M8Q
- EVK-7PAM supports PAM-7Q

GNSS chips & modules with Dead Reckoning:

- EVK-M8L supports ADR module NEO-M8L
- EVK-M8U supports UDR module NEO-M8U and EVA-M8E

GNSS module with Precise Point Positioning:

- EVK-7P supports NEO-7P

GPS chip & modules with Precision Timing:

- EVK-M8F supports UBX-M8030-KT-FT, LEA-M8F
- EVK-M8T supports LEA-M8T, NEO-M8T

Application boards and blueprints



u-blox application boards are complete, integrated solutions.

Positioning solutions:

- C88-7M/M8M application board in NEO form factor with EVA-7M or EVA-M8M
- C94-M8P application board with NEO-M8P module, enabling easy and fast prototyping of u-blox RTK solution
- C93-M8E UDR application example with EVA-M8E module

Telematics solutions:

u-blox telematics application boards are for applications such as fleet management, asset tracking, road pricing, and security/surveillance.

- C16-U20/C20/G35 application board with u-blox GNSS receiver, LISA-U2 or LISA-C2 or SARA-G350 cellular module, and integrated GNSS and cellular antennas

Internet of Things solutions:

- C027-C20/U20/G35 mbed enabled Internet of Things starter kit with u-blox GNSS receiver and LISA or SARA cellular module

Gateway solution:

- B31 Gateway blueprint demonstrates the integration of all u-blox technologies (cellular, GNSS and Short Range) in a single board with integrated antennas

Upon request to regional sales channels, u-blox provides reference designs and blueprints dedicated to specific applications.

u-center

GNSS evaluation software

Highlights

- Interactive and easy to use
- Extensive GNSS configuration, control features and output messages
- Supports all u-blox GNSS receivers
- Enables comparative performance analysis of GNSS receivers that output NMEA messages
- Free of charge

u-center includes

- Support for NMEA and u-blox UBX binary protocol
- Integrated AssistNow A-GNSS client functionality
- Structured and graphical data visualization in realtime:
 - Satellite summary view (SV)
 - Navigation summary view
 - Compass, speedometer, clock, altimeter
 - Chart view of any two parameters of choice
 - Data recording and playback functionality
- Docking views (real-time cockpit instruments):
Satellite constellation, compass, clock, altimeter, speedometer, GNSS and satellite information views
- Full cut-and-paste functionality to transfer information to standard PC application software
- Firmware update feature for u-blox receivers

Visualization

Docking views with real-time cockpit instruments and satellite status charts allow easy observation of the static and dynamic behavior of the GNSS receiver.

To visualize positions and traveled routes on maps, easy-to-use interactive functions are provided that enable importing a map file and entering three geodetic positions in order to calibrate the map so the measured positions are placed correctly on the map.

Data analysis

u-center allows the user to choose from a large number of parameters to create tabular views, 2D charts, histograms and compute statistics. Tabular views can be copied and inserted into commercial software like Microsoft Excel spreadsheets.



Product description

The u-center GNSS evaluation software provides a powerful platform for product evaluation, configuration, testing and real-time performance visualization of u-blox GNSS receiver products. u-center provides AssistNow client functionality for A-GNSS. Its unique flexibility makes u-center the ideal tool through the entire system integration process.

Configuration and control options

u-center provides a convenient means to configure the GNSS receiver, to save customized configuration settings in the receiver Flash and to restore factory settings if needed. Toolbar buttons are available to control settings, such as to force cold, warm and hot starts.

Hardware platform

u-center supports PCs running Windows Vista onwards (x86 and x64)

Ordering information

u-center is available free of charge and can be downloaded from our website, www.u-blox.com.

Android solution / u-center Android

Evaluation & integration software for Android positioning

Highlights

- Allows easy integration of GNSS functionality in Android-based products
- Royalty-free GNSS library, licensed for reuse in customer products
- GNSS evaluation and visualization application

u-blox Android solution includes

- u-blox Android GNSS driver
- u-center for Android GNSS evaluation application
- Documentation explaining the implementation

Solution description

u-blox's GNSS Android solution enables customers to easily integrate and evaluate GNSS functionality in their Android-based end products. The solution includes A-GNSS capabilities for high performance GNSS as well as terminal and network based positioning on mobile operator networks.

u-center Android GNSS evaluation App

The u-blox Android Solution includes u-center for Android, a powerful evaluation tool. u-center for Android enables the visualization of location data and GNSS status published by the Android framework.

Messages and GNSS information

With u-center Android you can check the NMEA messages from the receiver and the basic information of each satellite (e.g. azimuth, elevation, status).

System requirements

- u-center Android Supports Android versions 2.3 to 5.1
- u-blox Android GNSS driver v3.20
 Supports Android versions 4.0 to 6.0
- u-blox Android GNSS driver v2.3
 Supports Android versions 2.3 to 4.4



The u-blox Android GNSS solution is available free of charge. The royalty-free u-blox Android GNSS driver is licensed for reuse in customer products and is available upon request.

Testing and analysis

Cockpit type instruments, a wide range of tabular and graphical viewing tools, as well as statistics functions are available to make testing and analysis easy. Features include visualization of all visible GNSS satellites including signal strength and position, heading, altitude, velocity, and UTC time.

Visualization

u-center for Android allows you to visualize GNSS traces. A quick look at a trace on a map reveals a lot about the GNSS receiver's performance. This feature is only available with devices supporting Google Maps.

Supported Products

The u-center Android solution supports all u-blox 5 to u-blox 8/M8 GNSS receivers with USB/UART, DDC, or SPI connections.

Ordering information

For further details and to obtain the u-blox Android GNSS driver, please contact the u-blox sales representative nearest you. To download u-center Android visit our website or the Google Store:
play.google.com/store/apps/details?id=com.ublox.ucenter

m-center

Cellular evaluation software for Windows

Highlights

- Allows simple evaluation of u-blox cellular modules
- Interactive and easy to use
- Access to main functionality and configuration parameters
- Learn AT commands using the GUI interfaces thanks to embedded AT Terminal
- Trace GSM/GPRS/UMTS/LTE module activity
- PIN, call, and SMS management
- Communication with u-blox GNSS modules
- Free of charge

m-center includes

- AT Command terminal with user defined commands
- PIN management
- Call management
- SMS management
- GPRS context configuration
- Communication with u-blox GPS modules
- Intelligent driver detection
- firmware download over the air (FOTA)
- eCall PSAP simulator

Configuration and control options

m-center provides a convenient means to configure u-blox cellular modules and save the configuration in the module EPROM. It is also possible to view and edit SIM phonebook entries, send text messages, and communicate with the cellular module using AT commands.

m-center can be used to restore the cellular module's factory default settings and to perform traces. In addition, when using u-blox cellular evaluation kits, m-center allows for simple communication with the onboard GPS module.

m-center implements an eCall Public Safety Answering Point simulator; using it, customers can easily test their own eCall applications.



Product description

The m-center cellular evaluation software is a powerful and easy to use tool for evaluating, configuring, and testing of u-blox cellular modules. It includes an intuitive, easy to understand and easy to use graphical interface. m-center is available free-of-charge.

Visualization

The very simple graphical user interface allows the user to perform common GSM/GPRS/UMTS/LTE tasks and the embedded AT terminal shows all the AT commands trace in order to decrease the learning curve of the AT commands set. All the AT terminal activity can be saved to a text file.

Enabling the trace feature allows users to save internal GSM/GPRS/UMTS/LTE module activity to facilitate sending of binary data to u-blox customer support.

Hardware platform

m-center supports PCs running Windows 7, Windows 8.1, or Windows XP.

Ordering information

m-center is available free of charge and can be downloaded from our website.

RIL software for cellular modules

Radio interface layer for u-blox cellular modems

Highlights

- Quick and easy integration of u-blox cellular modules into Android, Windows Embedded and Windows Mobile based designs
- Free of charge for u-blox customers

Features

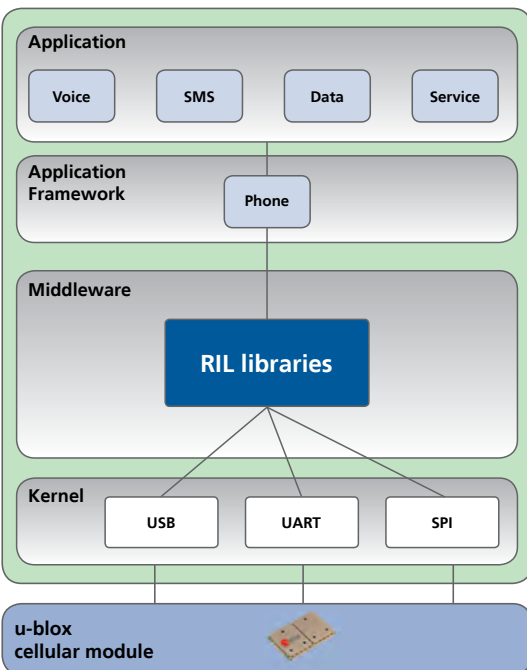
- Complete source-code of RIL library
- PC-based simulator
- Comprehensive documentation explaining implementation

Product description

u-blox RIL (“Radio Interface Layer”) software allows easy integration of u-blox cellular modules into Android and Windows Embedded based designs.

The software is available free of charge for u-blox customers.

Cellular device



The solution includes

PC-based simulator

This simulator enables quick evaluation of u-blox RIL software. The simulator is a stand-alone tool that can be installed on a PC running Windows XP, or Windows Vista. An evaluation kit can be connected to the PC and customers can run an application on the simulator.

RIL libraries

This is the source code of u-blox RIL libraries. The source code can be integrated into an Android or Windows Embedded / Windows Mobile environment.

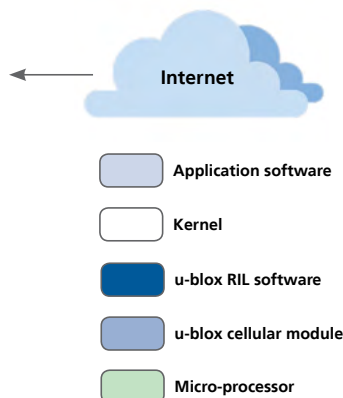
Supported operating systems

- Android 2.3, 4.0, 4.1, 4.2, 4.3, 4.4, 5.0
- Windows Embedded 6.0 (Win CE)
- Windows Embedded 7.0
- Windows Mobile 6.5

Supported cellular modules

- SARA-G3 series – Android, Windows Mobile 6.5, Embedded Windows 6.x 7.x
- SARA-U2 series – Android, Windows Mobile 6.5, Embedded Windows 6.x 7.x
- LISA-U2 series – Android, Windows Mobile 6.5, Embedded Windows 6.x 7.x
- TOBY-L1 – Android
- TOBY-L2 series – Android, Windows CE 6.0, Windows EC 7

For more details, contact the u-blox sales representative nearest you.



s-center

Wi-Fi / Bluetooth stand-alone module evaluation software

Highlights

- Interactive and easy to use
- Integrated performance measurements
- Support for Wi-Fi, classic Bluetooth and Bluetooth low energy
- Free download from u-blox website
- Enables storing current configuration as a text file and supports downloading of this configuration file

s-center includes

- AT command terminal with user defined commands
- Support for UART, TCP client and TCP server interface
- Firmware update feature for u-blox short range modules
- Chat tool
- TCP reflector
- Data pump for performance evaluation

Visualization

The very simple graphical user interface allows the user to configure Wi-Fi, classic Bluetooth and Bluetooth low energy modules. The embedded AT command terminal shows all the AT commands used. The current configuration can be saved to a text file for analysis or backup.

The file with current configuration can also be used to copy the configuration to multiple devices using the download configuration file option.

Data analysis

s-center has built in tools for throughput measurements and data validation using COM ports as well as TCP server and client. It can also be used to send packets with different sizes and intervals to emulate a specific use case.



Product description

The s-center Wi-Fi, Bluetooth and Bluetooth low energy module and configuration software is a powerful and easy-to-use tool for evaluating, configuring, and testing u-blox short range stand-alone modules. It includes an intuitive, easy-to-understand and easy-to-use graphical interface.

Configuration and control options

s-center provides a convenient means to configure the u-blox short range modules, to save the configuration in the flash memory of the module, and to restore factory settings if needed. Toolbar buttons are available to control settings. Each command that is executed by s-center is an AT command that is described in the AT command specification.

Operating systems

s-center supports PCs running Windows XP onwards (x86 and x64) with .Net Framework 4.5 or later.

Short range modules supported

s-center can be used with NINA-B1 and ODIN-W2.

Ordering information

s-center is available free of charge and can be downloaded from the s-center page on our website www.u-blox.com.

Bluetooth Smart iOS and Android App

Bluetooth low energy demo app for NINA-B1 and OLP425

Highlights

- Supports NINA-B1 and OLP425 Bluetooth low energy modules
- Powerful Bluetooth Low energy evaluation and visualization App
- Source code available on request
- Free of charge for u-blox customers

Operating systems supported

- Android 4.3 or later
- iOS 7.1 or later

Product description

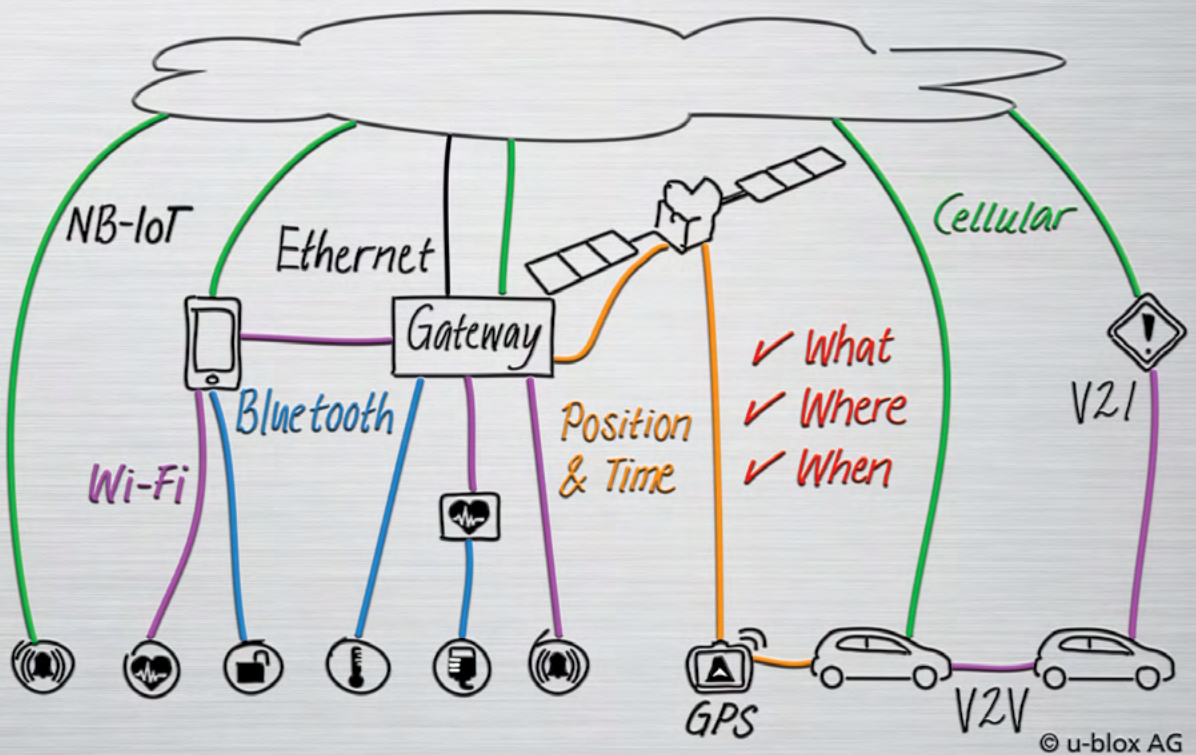
The u-blox Bluetooth Smart app allows developers to evaluate the NINA-B1 and OLP425 stand-alone Bluetooth low energy modules from u-blox. The Bluetooth Smart app reads and controls 3-axis accelerometer, temperature sensor, battery level sensor, and LEDs.

For more details, visit www.u-blox.com/en/support or contact the u-blox sales representative nearest you.



Technology

u-blox = IoT Connectivity












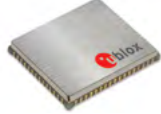


u-blox module roadmap philosophy

Form factor and layout consistency

When it comes to modules, u-blox adheres to a core design philosophy: maintain form factor and software continuity to allow customers to easily upgrade their products with each new generation of u-blox modules.

Customers do not need to change their PCB designs when u-blox introduces a new version of a module. Simply drop in the next generation module on the existing PCB and start testing! u-blox has established compact module form factors as de-facto industry standards.

Position and time modules			
Series		Package/dimensions	Type of module
EVA		43-pin LGA ² 7.0 x 7.0 mm	Industry's smallest standalone GNSS modules
MAX		18-pin LCC ¹ 9.7 x 10.1 mm	High-performance, compact GNSS modules
NEO		24-pin LCC ¹ 12.2 x 16.0 mm	Flexible, configurable GNSS modules
LEA		28-pin LCC ¹ 17.0 x 22.4 mm	Feature-rich GNSS modules
CAM		31-pin LCC ¹ 9.6 x 14.0 mm	Concurrent GNSS antenna modules

Short range radio modules			
Series		Package/dimensions	Type of module
ELLA		30-pin LCC ¹ 14.8 x 14.8 mm	Small host-based multiradio modules
EMMY		46-pin LGA ² 13.8 x 19.8 mm	Host-based multiradio modules with NFC
ODIN		30-pin LCC ¹ 14.8 x 22.3 mm	Stand-alone / host-based multiradio modules
LILY		25-pin LCC ¹ 10.0 x 14.0 mm	Compact host-based modules
THEO		62-pin LCC ¹ 30.0 x 40.0 mm	Automotive grade V2X transceiver module for infrastructure and vehicles
NINA		30-pin LGA ² 10.0 mm x 14.0 mm / 10.0 mm x 10.6 mm	Compact stand-alone modules
OBS		36-pin LGA ² 16.0 mm x 36.0 mm	Stand-alone Bluetooth modules

¹⁾ Leadless Chip Carrier

²⁾ Land Grid Array

Cellular module layout compatibility

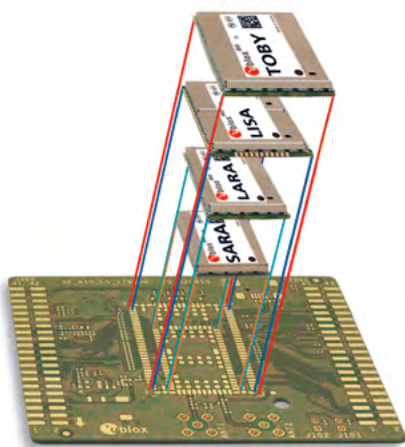
Upgrade smoothly with nested GSM/UMTS/CDMA/LTE designs

When designing cellular modem products that must accommodate GSM, UMTS, CDMA, or LTE variants as well as region-specific versions requiring different frequency bands, PCB layout issues can generate a long list of expensive design and logistic problems.






The best way to avoid this issue is simple: layout compatibility across the entire range of cellular modules. With this solution, a single PCB layout can be designed for use by all end-product variations.

This is why u-blox has maintained form-factor compatibility throughout its GSM/GPRS (SARA/LEON), UMTS/HSPA/CDMA2000 (LISA/SARA), and LTE (TOBY/LARA) cellular module families.

To facilitate nested designs, u-blox provides application notes and PCB reference designs with schematics, Gerber files and bill of materials for 1.8 V and 3.0 V systems.



Example of 2G/3G/4G layout compatibility: nested design accommodates SARA GSM/UMTS, LARA LTE, LISA UMTS/CDMA and TOBY LTE modules on the same footprint

Cellular modules				
Series		Package/dimensions		Type of module
SARA		96-pin LGA ² 16.0 x 26.0 mm	Small, scalable, low-power GSM/GPRS, UMTS, and NB-IoT modules	
LARA		100-pin LGA ² 24.0 x 26 x 2.6 mm	Very small, compact LTE modules	
LISA		76-pin LCC ¹ 22.4 x 33.2 mm	Universal UMTS/HSPA(+) and CDMA200 modules	
TOBY		152-pin LGA ² 24.8 x 35.6 mm	High-speed LTE modules	
MPCI		52-pin PCI Express Full-Mini Card Type F2 30 x 51 x 3.7 mm	Powerful LTE modules in industry-standard Mini PCIe package	

¹⁾ Leadless Chip Carrier

²⁾ Land Grid Array

LTE

Fastest growing standard in telecom history

Data has taken over as the driver of mobile network technology. Voice, now a commodity, has been replaced by latency-sensitive multimedia and video-rich applications and services as the main revenue generator. LTE is also extremely efficient in terms of spectrum, enabling operators to allocate more users per frequency band. This explains why carriers are rapidly rolling out 4G LTE, making it the fastest growing telecommunications standard in history.

LTE M2M applications

Ultimately, the number of LTE connected M2M devices will exceed all other types by 2020, even overtaking human mobile phone users. Although typical data rates for M2M communication today are much lower than those for which LTE is designed, specific M2M applications will be either created or enhanced to take advantage of the available bandwidth.

New LTE-based M2M applications cover two markets:

- Bandwidth critical applications such as in-car infotainment systems, wireless routers and gateways, and mobile computing.
- Longevity and battery critical applications, where the LTE bandwidth is less important than the technology's longevity. M2M applications that transmit a relatively small amount of data intermittently do not need high data rates. Many of these applications will last for at least 10 years, a longevity that older cellular technologies such as GSM, CDMA and UMTS cannot guarantee.

LTE-based M2M applications include:

- Wireless router for in-car infotainment systems
- Smart metering / smart grid
- Smart cities
- Telehealth terminals for remote diagnosis and healthcare
- Multimedia signage and advertisement displays
- Remote wireless surveillance cameras
- Asset tracking
- Alarm panels
- Vending machine monitoring with video commercial display
- Retail terminals displaying product demonstrations or live helpdesk

LTE categories and data rates

- High speed Cat 4 modules, TOBY-L2 and MPC1-L2, are now available for high bandwidth applications.
- Higher LTE categories have been specified by 3GPP and modules will be available in the very near future.

- Low speed Cat 1 modules, TOBY-R2 and LARA-R2, provide lower data rates (DL/UL at 10/5 Mbps) at a low system cost for "LTE enabling" M2M non-bandwidth-critical devices, such as smart meters, asset tracking, and alarm panels. Voice over LTE is also fully supported by LTE Cat 1.
- 3GPP Release 12 (frozen) and Release 13 (ongoing) specify new device classes (Rel. 12 Cat 0 and Rel. 13 Cat 0, also called Cat M or Cat MTC) offering lower data rates and lower power consumption, and are still fully compatible with the LTE network. They also enable operators to fully leverage the 4G consumer focused investments into M2M and IoT.

Analysts agree that the combination of high speed and low speed/machine optimized LTE technology will represent a major breakthrough leading to a multitude of new products and business models.

Software defined modem (SDM)

u-blox is addressing this rapidly expanding market for LTE connectivity through in-house 4G modem chip technology. Based on "Software Defined Modem" (SDM) design methodology, u-blox's strategy is to design and test advanced modem products with specific M2M/IoT functionality in their software. The SDM approach significantly shortens development time as iterative silicon fabrication cycles can be eliminated. Ultimately, SDM will allow u-blox to deliver IoT/M2M tailored products which are able to meet user, market or local environmental conditions as they arise.

In-house 4G LTE protocol stack

u-blox has also developed 4G LTE protocol stack technology. Together with SDM modem design capability, u-blox aims to become a leading 4G LTE multimode modem provider based on in-house intellectual property. This will allow us to quickly address demands of the dynamically changing markets for M2M modems. At u-blox we are excited about the 4G LTE-connected future and are working with pioneering companies right now to bring new products to market.

TOBY-L2 series modules support multi-band LTE-FDD, along with HSPA+ and GPRS/ EDGE in a very small LGA package. The modules support LTE Cat 4 which provides data throughput up to 150Mb/s, the modules are ideal for both industrial and consumer applications requiring the highest data rates, as well as 2G and 3G network coverage. Mini PCI form factor is also supported (MPC1-L2).

See pages 32-41 for our full line of LTE multimode and LTE-only module products.

Bluetooth technology

Robust connectivity in a globally deployed ecosystem



Bluetooth (IEEE 802.15.1) is a short range wireless technology that operates in the 2.4 GHz band, today available in two flavors, Classic Bluetooth for streaming applications and Bluetooth low energy for intermittent transmission of sensor data.

Robustness

Bluetooth uses adaptive frequency hopping to automatically avoid channels potentially in use by other technologies operating in the 2.4 GHz band. As a result Bluetooth is well-suited not only for the consumer market, but also in industrial and medical applications, where the reliability data throughput provided by Bluetooth is key.

Unprecedented eco-system

With over two billion devices shipping annually, Bluetooth has become a de-facto standard for wireless connectivity between mobile consumer devices. It now has an unmatched eco-system, which is important for connecting hand-held devices such as smart phones to other devices. Bluetooth low energy is ideal for connecting several types of devices in different functionality areas, as would be the case with IoT applications.

u-blox Bluetooth dual mode stack

u-blox uses an in-house developed dual mode Bluetooth stack providing state-of-the art performance. It gives us full control of future feature development and provides long-term compatibility for our customers.

Classic Bluetooth vs Bluetooth low energy

Bluetooth low energy technology is ideal for applications requiring episodic or periodic transfer of small amounts of data where low cost and ultra low power consumption is the focus. It is particularly useful for Internet of Things (IoT) applications.

In a Bluetooth application where streaming data is used, Classic Bluetooth technology is the preferred choice as it achieves substantially greater throughput than Bluetooth low energy.

Highlights of u-blox Bluetooth standalone solutions

- Low emission mode, minimizes the interference caused by Bluetooth during connection set-up
- u-blox Bluetooth Low Energy Serial Port Service enables BLE devices to transmit serial data over Bluetooth low energy connections
- On-board support for Apple iAP2 protocol providing world-class throughput
- Configurable for optimized performance based on throughput, latency, low power and range



OBS421 module

Examples of solutions using Classic Bluetooth and Bluetooth low energy technologies

- Bluetooth low energy end-devices (Bluetooth Smart) include actuators and sensors.
- Dual-mode Bluetooth end-devices (Bluetooth Smart Ready) include gateways and laptops.
- Classic Bluetooth end-devices include PLCs and patient monitoring devices.

Wi-Fi technology

Ideal for wireless connectivity with existing LAN infrastructure



Wi-Fi (IEEE 802.11) is a short range wireless technology that enables data exchange or internet connectivity over the public 2.4 GHz and 5 GHz bands. Wi-Fi is the preferred short range wireless technology to connect to existing LAN infrastructure or imple-

ment high throughput ad-hoc networks. Its use is quickly spreading from consumer to commercial and industrial applications driven by the benefits of the Internet of Things (IoT). Hardware designers are required to address a number of challenges to successfully implement Wi-Fi. u-Blox provides solutions to address these challenges.

Devices with a long life

Industrial or automotive devices with Wi-Fi usually have long life times. A replacement of a Wi-Fi chipset or a transceiver module in the product life cycle is a time-consuming and costly undertaking integrators want to avoid. With its range of industrial and automotive grade Wi-Fi transceiver with long-term availability, u-Blox addresses these needs.

In-device co-existence with other wireless standards

Today's devices often use multiple radio technologies at the same time. Wi-Fi and LTE radios, whose antennas are located close to each other, are a typical design challenge. The operation of the two standards in close proximity within a single device, so called in-device coexistence, can at times cause considerable interference and affect throughput.

u-blox offers Wi-Fi and multiradio modules equipped with specific filters to limit such effects and minimize the design effort to integrate Wi-Fi and LTE in the same device. EMMY series modules are available in versions that include LTE filters designed to be used in such applications.

Congested 2.4 GHz band

Current Wi-Fi device as well as other wireless technologies, such as Bluetooth or ZigBee, also operate in the 2.4 GHz band. As a result, this band easily becomes crowded, especially in urban environments. u-blox provides dual-frequency Wi-Fi transceiver modules enabling device makers to allocate critical applications to the 5 GHz band instead.



The ODIN-W160 multiradio module is ready-to-embed in industrial, medical and demanding IoT applications.

Plug & play Wi-Fi to LTE router solutions

The ELLA and EMMY series short range modules form a complete solution with the TOBY LTE modules from u-blox, enabling integrators to efficiently develop router products. The Wi-Fi module's driver, TCP/IP stack and a customizable router application are factory integrated in the LTE modules. The solution can be operated stand-alone or with an external micro controller.

u-blox Wi-Fi module features

- Dual-band functionality 2.4 GHz (channels 1-13) and the full 5 GHz ISM band (U-NII Band 1, 2, 2e, 3 channels 36-165)
- Tested and certified for industrial temperature range (-40°C to +85°C)
- Ultra low power consumption in compact design
- Range up to 500 meters
- Enterprise security modes: supports WEP, TKIP, AES, WPA, WPA2 security, EAP-TLS

Embedded customer applications

ARM® mbed™ for customer applications

ARM mbed enables customers to integrate and run their application on Cortex-M microcontrollers onboard u-blox stand-alone modules.

ARM mbed is a platform and operating system for internet-connected devices based on 32-bit ARM Cortex-M microcontrollers. The project is collaboratively developed by ARM and its technology partners. The platform provides:

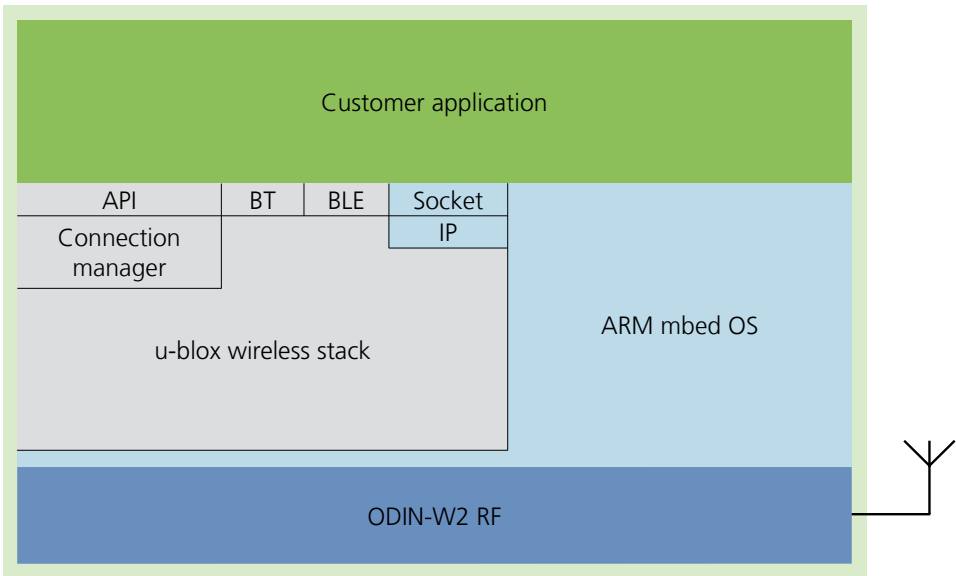
- The operating system
- Cloud services
- Tools
- Developer ecosystem



For more information, see:
www.mbed.com/en/about-mbed/what-mbed/#

Benefits of ARM mbed to the customer

- All programmable u-blox short-range modules will use the same ARM mbed environment
- u-blox peripheral drivers will be portable across all programmable platforms
- Open source software and open standards
- Standardized well structured peripheral and component APIs
- Consistent interface for wireless connectivity
- Built-in security:
 - Pre-integrated implementations of TLS and DTLS (a.k.a SSL)
 - Security schemes needed to securely bootstrap devices
 - Protection of things such as keys and certificates
- Built in power management



u-blox M8 and u-blox 8

A new level of multi-GNSS positioning

With the launch of the u-blox 8 platform and the firmware upgrade (FW 3.01) for the u-blox M8 platform, u-blox strengthened its leadership in embedded global satellite positioning.

Combining advanced chip technology, sophisticated software algorithms, true concurrent GNSS satellite reception and multi GNSS aiding services, u-blox M8 sets the benchmark for navigation and positioning.

u-blox 8 complements u-blox M8: the two platforms offer new solution alternatives depending on application needs – whether for high performance or for competitive low power consumption. The u-blox M8 platform is based on the UBX-M8030 concurrent GNSS chip family, and the u-blox 8 platform is based on the UBX-G8020 single GNSS chip family.



UBX-M8030: Concurrent, high performance positioning



UBX-G8020: Low-power positioning

u-blox M8: high performance positioning

u-blox M8 acquires and tracks three GNSS systems concurrently (e.g. GPS/Galileo and GLONASS or BeiDou). Optimized signal reception circuitry in combination with software algorithms, advanced tracking and search engines capitalize on the quality, as well as quantity, of satellites used. This method enables favorable solutions in GNSS hostile environments.

With market leading –167 dBm dynamic sensitivity, 1 second TTFF, and 2 meter positioning accuracy, u-blox M8 is the perfect solution for performance critical applications such as car navigation, drive recorder or emergency call systems. For such applications, high performance is key. By utilizing the u-blox Multi-GNSS AssistNow service and local satellite augmentation services (SBAS, QZSS), u-blox M8 provides even more accurate position information within seconds – virtually anywhere. u-blox M8 also offers ADR and UDR for applications that require positioning in areas where GNSS signal is temporarily obstructed, such as in tunnels or car parks.

Introduction of FW3.01 for u-blox M8 and u-blox 8 brings a lot of innovative features to mass market GNSS receivers. The list of additional features is impressive: message integrity, geo-fencing, PSM for all GNSS, advanced spoofing detection, improved anti-jamming, Galileo (including SAR downlink decoding), IMES, GAGAN and advanced methods for compensating arm-swinging in sports applications.

All in all, u-blox M8 is the right choice for high performance positioning applications, bringing the increased performance of concurrent GNSS reception to practical application. By using an external SPI flash, u-blox M8 is also future-proof, as firmware updates can easily be made.

u-blox 8: low-power, competitive positioning

For applications where the important key parameter is low power consumption, u-blox 8 is the perfect answer. u-blox 8 sets a new standard in the market for accurate, low power multi-GNSS operation, which is particularly attractive for small battery powered devices like asset and vehicle tracking boxes. In the case of rural or suburban areas, the u-blox 8 single GNSS reception is more than sufficient to provide accurate and reliable positioning information. u-blox 8 supports single reception of either GPS or GLONASS, selectable on start-up. u-blox 8 is available in ROM in order to achieve a competitive solution.

u-blox GNSS chips

Both receiver chips come in QFN40 packages in standard and automotive grades. Chip scale packages are also available for commercial applications. The u-blox M8 QFN package is pin compatible with u-blox 8 and u-blox 7 QFN packages, and extensive documentation makes migration easy. The Automotive grade u-blox M8 chip supports wide operating temp. range of –40 ... +105°C and comes with AEC-Q100 grade 2 qualification.

u-blox GNSS modules

u-blox chips are at the heart of our industry-standard GNSS module families: EVA, MAX, NEO, LEA, CAM and PAM. These are designed to satisfy size versus feature requirements of a large range of applications.



EVA



MAX



NEO



CAM

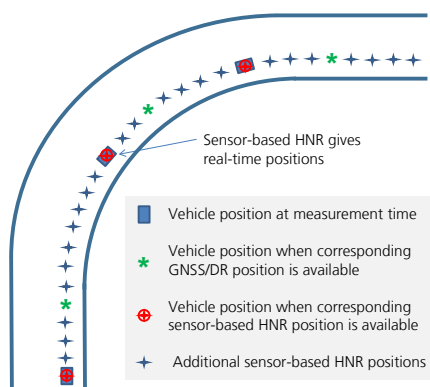
All u-blox GNSS products continue to leverage the synergies with our broad portfolio of GSM, UMTS, CDMA and LTE cellular modules to enable location awareness, including support for our unique CellLocate® hybrid indoor positioning system. With our comprehensive portfolio of GNSS chips and modules, our goal is simple: to support your product innovation while making it easy to upgrade from one product generation to the next.

Dead Reckoning for Road Vehicles

Never lose track of where you are

u-blox has added Untethered Dead Reckoning (UDR) to its portfolio of positioning technologies for road vehicles. UDR offers many of the advantages of dead reckoning without the need for an electrical connection to the vehicle. This advancement brings the combined benefits of ease of installation and improved urban positioning to applications including insurance Telematics, dispatch, delivery and road tolling.

ADR adds information on absolute speed or distance covered from the vehicle wheels, making the relative information from accelerometer and gyroscope sensors useful in the absence of good GNSS signals. u-blox ADR remains the technology-of-choice for demanding navigation applications. It delivers exceptional performance using a sophisticated fusion of speed information from the vehicle, inertial sensor data, GNSS and map information if available. The performance of u-blox's fourth generation ADR technology benefits from experience in demanding, first-fit passenger car applications, the latest multi-axis sensor technology and advancements in u-blox's multi-GNSS signal processing, particularly in highly urban environments.



u-blox introduces a new High Navigation Rate class of positioning output with the latest generation of ADR and UDR products. Designed to enable interactive, "heads up display" (HUD), and real-time applications, these outputs combine low-latency data from sensors with accurate fused fixes to deliver exceptionally responsive reports of position, speed, heading, acceleration, rate of turn and vehicle attitude.

UDR combines inertial sensor data with GNSS to improve the accuracy of positioning in town. Compared with standard precision GNSS, the benefit of UDR is particularly apparent in high-rise cities where sensor data helps to mitigate the effects of GNSS signal reflections and ensure navigation to the correct street and block. In many cases, good positioning can be maintained when GNSS signals are lost completely, for example in tunnels, loading-bays and parking garages.

Sensor support

u-blox's dead-reckoning technology is available in module form and IC packages, with integrated inertial sensors and support for vehicle or system sensors. The latest generation supports directly-connected sensors and wheel-ticks, reducing the cost of implementation and allowing the receiver to exploit the benefits of reduced latency and jitter in data direct from the sensor. ADR products also continue to support the full range of differential wheel-tick and vehicle sensor modes with data delivered via the message bus.

u-blox's UDR products are completely self-configuring during normal driving, avoiding the need for vehicle-specific variants or special steps during installation. The latest ADR products adapt automatically to the most common installation types and can be pre-configured if necessary for rapid testing and verification. Both product families provide clear alerts of installation problems.

Evaluation tools

Evaluation kits for u-blox ADR and UDR technology can be ordered via a u-blox sales-representative.

For more details, visit our UDR webpage at:

www.u-blox.com/en/dead-reckoning.html

GNSS antenna modules

Global positioning made easy



PAM-7Q
22.0 x 22.0 x 8.0 mm



CAM-M8x
9.6 x 14.0 x 1.95 mm

More and more end-products are integrating global positioning as a necessary and central feature. In addition to familiar navigation systems, “Global Navigation Satellite System” (GNSS) receivers are required in vehicle and asset tracking systems, personal locators, security systems, vending machines, health monitoring and recreational devices.

As many customers do not have the RF/antenna tuning expertise or the sourcing capability, a performance optimized “GNSS antenna module” which combines both satellite receiver chip and antenna on the same module can be a good solution. These modules provide fast time-to-market and an economically viable solution for “instant” global positioning. A GNSS antenna module is also significantly smaller in size than a GNSS module plus an external antenna. This makes a GNSS antenna module with integrated chip antenna a very attractive and hassle-free option for very thin designs.

For small and medium production runs, sourcing external antennas in low quantities may not be practical in terms of cost and lead times. Custom tuning would also be needed, especially with patch antennas. For these customers, pre-tuned GNSS antenna modules are an attractive choice. Currently u-blox offers two different kinds of GNSS Antenna Modules: **CAM** (Chip antenna Module) which can track GPS, GLONASS or BeiDou satellites, and **PAM** (Patch Antenna Module) which is dedicated to GPS positioning. Both types have been designed for optimal antenna performance independent of orientation and provide high sensitivity and jamming immunity as they include integrated SAW filters.

The CAM-M8 series, is a really interesting alternative when customers require both small size or multi-GNSS capability. It is based on a u-blox M8 chip and includes an integrated chip antenna plus SAW filter, LNA, TCXO or Crystal, RTC crystal and passives.

The chip antenna element used in CAM-M8 series can handle all L1 frequencies ranging from BeiDou (1560 MHz) and GPS (1575 MHz) up to GLONASS (1606 MHz). CAM-M8 modules are also extremely low in height making very thin customer designs possible. Chip antenna modules require care in design implementation as the PCB forms part of the overall antenna (half of the dipole). For this reason, u-blox provides all necessary design-in support including System Integration Manual plus Application Engineers with many years experience in designing with chip antennae modules.

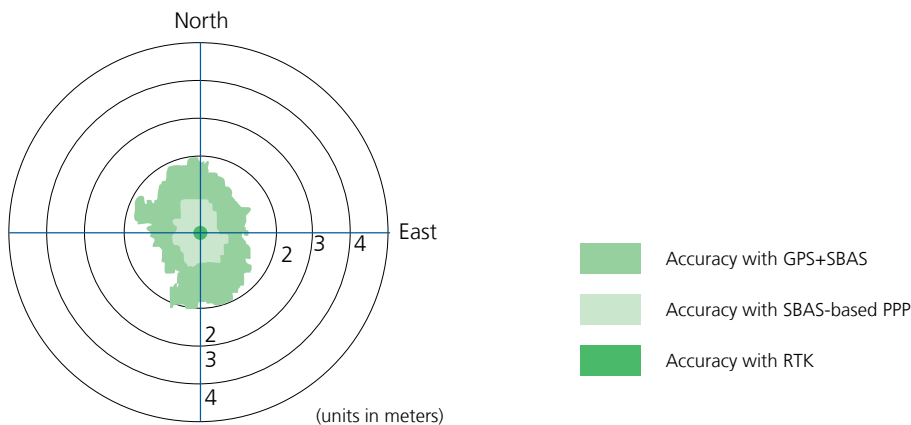
CAM-M8 series has a feature whereby the internal chip antenna can be used as a backup antenna if the customer chooses to use an external antenna. This is useful in applications where there is a risk that the primary antenna may malfunction or suffer damage. CAM-M8 series is targeted for all applications requiring good multi-GNSS performance in a compact form factor.

The PAM-7Q is a highly popular form factor due to its installation flexibility. It can be mounted ‘as is’ in pre-existing designs or soldered with a pin-header to a customized PCB. The 18 x 18 mm patch antenna of PAM-7Q provides RHCP polarization not achievable with smaller patch antenna elements. The simple design and easy interfacing keeps installation costs to a minimum. PAM-7Q targets industrial and consumer applications that require a small, fast and cost efficient solution to GPS positioning.

Samples of CAM-M8C, CAM-M8Q and PAM-7Q, and evaluation kits EVK-M8CCAM, EVK-M8QCAM, and EVK-7PAM can be ordered via the u-blox online shop.

High Precision GNSS Positioning

Navigation on the sub-meter and centimeter level



Today many guidance and precise geo-location applications require higher accuracy than traditional GNSS can provide. Examples include prosumer and commercial UAVs, survey and mapping applications, and machine guidance in agriculture and construction. Various leisure and sport applications are also looking for accuracies beyond standard GNSS precision to improve user experience.

u-blox has integrated Real Time Kinematic (RTK) and SBAS-based Precise Point Positioning (PPP) technologies together with u-blox GNSS receivers in the NEO module form factor. These modules perform precisely and at a fraction of the cost, size and power of existing alternatives.

SBAS-based Precise Point Positioning (PPP)

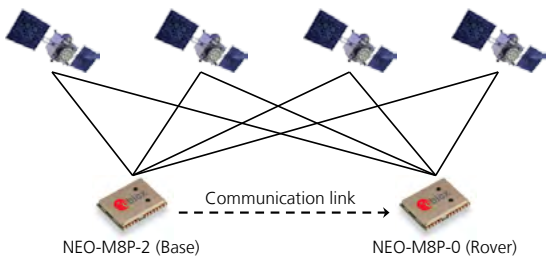
Sub-meter level performance is possible by using u-blox's SBAS-based PPP technology. This stabilizes the measurements of the distance between GNSS satellites and the receiver by using carrier phase tracking and ionospheric correctional data received from satellite-based augmentation systems, such as WAAS (USA), EGNOS (Europe) and MSAS (Japan).

This stand-alone high-precision implementation delivers sub-meter level performance in regions with SBAS coverage, and it requires no base receiver deployment. It is available with the NEO-7P module.

Real-Time Kinematic (RTK)

RTK is a well-established satellite navigation technique used to reach centimeter-level accuracies in dynamic applications. The technology relies on the use of a local base station receiver that provides corrections

to a moving device, which in this context typically is referred to as the "rover". The rover uses the satellite signal's carrier wave and attempts to solve the "carrier integer ambiguity" problem. Once this computational challenge is solved and carrier ambiguities are fixed, then centimeter-level accuracies can be delivered. For the successful fixing of carrier integer ambiguities, the distance between the local base station and the rover receiver must be limited. This so called "baseline" is typically recommended to be less than 10 km.



The RTK high precision implementation is available with the NEO-M8P module. The NEO-M8P-2 module variant supports the needed base station functionality.

Evaluation Tools

For the evaluation of u-blox's PPP and RTK technologies, evaluation kits and application boards can either be ordered at the u-blox online webshop or via a u-blox sales representative.

Precision Timing and Frequency Reference

Accurate reference based on GNSS technologies

In addition to positioning and navigation applications, GNSS signals are widely used as low-cost precision time or frequency references in remote or distributed wireless communication, industrial, financial, and power-distribution equipment.

By capitalizing on atomic clocks onboard positioning satellites, GNSS signals can be used to synchronize equipment to within 15 ns, as well as provide UTC time to an accuracy of 90 ns. For wireless communication standards that utilize Time Division, such as TD-LTE, or that aid spectrum efficiency in LTE Advanced and quasi-synchronous broad-cast services including MBMS, a precision time reference is essential. For these and other systems, GNSS signals are utilized to provide an accurate reference frequency to within 1 part in 100 billion and phase to a fraction of a microsecond.

u-blox's range of multi-GNSS precision timing chips and modules are able to fulfill this important reference function for a fraction of the cost, power consumption, maintenance, size and weight of other technologies with comparable performance. These stand-alone products provide accurate time pulses wherever GNSS signals are available, as well as precise disciplined frequency references with hold-over.

u-blox precision timing products benefit from the company's extensive applications experience and advanced technologies including:

- Fast satellite acquisition using u-blox intelligent multi-GNSS signal capture algorithms
- Location-independent clock synchronization, even when only one satellite is in view
- Weak-signal optimization, interference removal and multi-path mitigation enabling deployment in more difficult environments
- Flexible GNSS-synchronised time-pulse and frequency outputs aligned to GNSS time or UTC
- Low cost
- Time integrity monitoring
- Energy-optimised timing for battery-powered applications

Frequency/Time modules and reference designs add:

- Disciplined internal or external master reference oscillators with automatic hold-over
- Time-pulse inputs and message-based APIs for integration with host-based sources of synchronization



LEA-M8F/M8T

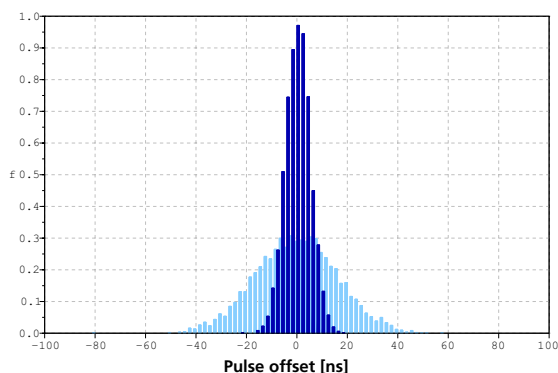


NEO-M8T



UBX-M8030-KT-FT

The histogram below shows the distribution of PPS time pulse time offsets for a u-blox LEA-6T receiver (light blue) and u-blox LEA-M8F receiver (dark blue).



Each PPS pulse edge from the LEA-M8F is precisely aligned with a disciplined reference frequency controlled by GPS. The result is excellent short- and long-term phase stability and the elimination of quantisation errors. The graph illustrates the very low standard deviation and maximal error of u-blox timing receivers.

u-blox products for Precision Timing:

- LEA-M8F GNSS frequency reference module with Precision Timing, automatic hold-over
- UBX-M8030-KT-FT GNSS Precision Time and Frequency Chip
- LEA-M8T GNSS receiver module with Precision Timing, raw data and antenna supervision
- NEO-M8T low power GNSS receiver module with Precision Timing compact form factor

Evaluation kit:

- EVK-M8F Precision Timing evaluation kit for evaluation of LEA-M8F and M8030-KT-FT
- EVK-M8T Precision Timing evaluation kit for evaluation of LEA-M8T and NEO-M8T



Samples of u-blox precision timing modules and evaluation kit can be ordered via the **u-blox online shop**.

Reference design:

- B81-FTS Reference Design for LEA-M8F, contact u-blox for details.

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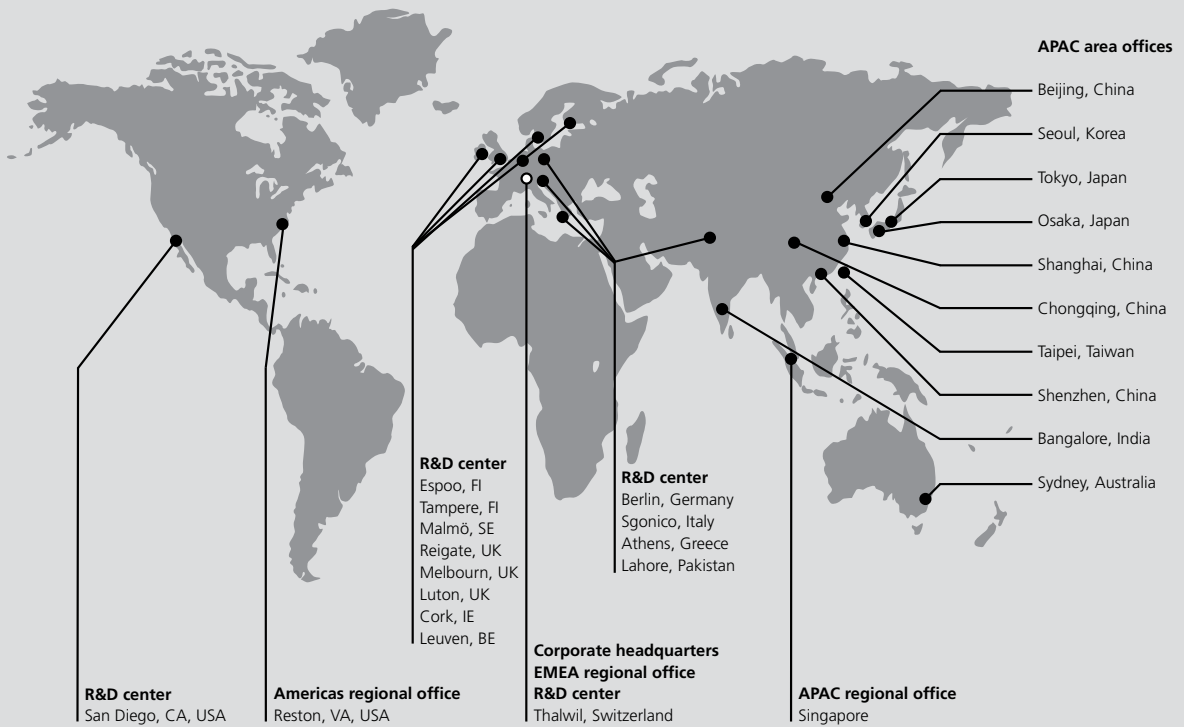
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Worldwide presence



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