Product Catalog 14

Positioning & Wireless solutions 2013

locate, communicate, accelerate

u-blox

Contents

Thomas Seiler – CEO u-blox

Dear readers,

2012 has been an exciting year for u-blox thus far, with major developments in both our positioning and wireless activities.

The launch of u-blox 7, our seventh generation positioning platform, firmly establishes our technology as "Beyond GPS". The platform, based on our new UBX-G7020 GNSS chip, is compatible with all deployed Global Navigation Satellite Systems (GNSS) including GPS, Russia's GLONASS, and Japan's QZSS. It is also hardware-ready for Europe's Galileo and China's Compass standards which are scheduled for deployment in the near future.

In addition to achieving global GNSS compatibility, we have managed to achieve a major technology breakthrough; the lowest power consumption on the market by a factor of 3. This is an extremely important feature for many applications, especially in the consumer markets.

Rest assured that as we upgrade our entire GNSS portfolio to u-blox 7, backwards compatibility with u-blox 5 and 6 products is a core aspect of our module philosophy.

On the wireless side of our business, our acquisition of Cognovo in June adds 4G LTE modem technology to our R&D expertise, positioning u-blox as a strategic supplier of 4G module products in addition to our existing line of GSM, UMTS and CDMA2000 modules. This will allow us to meet our customer's requirements for connected systems that require positioning, LTE connectivity and application specific functionality on a single integrated circuit. First 4G products are planned for 2013.

As we enter the second half of 2012, our positive results reflect our successful product strategy: our complementary positioning and wireless product portfolio has strengthened our leading position as vendor-of-choice for customers in the global automotive and industrial M2M markets.

In the consumer sector we look forward to continued success based on our new u-blox 7 products that deliver industry-leading positioning performance for compact, battery-powered devices.

As we complete another eventful year, we are proud that our hard work, innovation and global support allows you to design market-leading products quickly, and cost-effectively. We are keenly aware that our success depends on yours!

Thomas Seiler
CEO u-blox

Company

u-blox at a glance

Swiss-based u-blox (SIX:UBXN) is the global leader in positioning and wireless semiconductors for the consumer, industrial and automotive 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 software solutions, u-blox is uniquely positioned to enable OEMs to develop innovative personal, professional and M2M solutions quickly and cost-effectively. With headquarters in Thalwil, Switzerland, u-blox is globally present with offices in Europe, Asia and the USA.

Global presence
Our global presence 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.

With our staff of over 300 people worldwide, we support our customers from component evaluation and selection right through to product design and final production set-up.

u-blox is headquartered in Switzerland and has offices in Italy, UK, the USA, Singapore, China, India, Hong Kong, Taiwan, Korea and Japan.

Key facts

Foundation	Founded in 1997, Switzerland
Stock exchange listing	Listed on the SIX Swiss Exchange (UBXN)
Employees	Over 300
Sales	2011 revenue of CHF 124.7 million (approximately USD 132.9 million) H1 2012 revenue of CHF 77.7 million (approximately USD 82.0 million)
Markets served	Consumer, Industrial and Automotive
Market penetration	More than 3'500 customers worldwide benefit from our solutions More than 10'000 types of devices rely on our products More than 40'000'000 people and machines utilize our technology

Products and services

Overview

Positioning modules

u-blox' advanced, tested, off-the-shelf GPS, GLONASS, Galileo, Compass & QZSS receiver modules provide easy-to-implement solutions to add satellite navigation and positioning capability to end-products quickly and cost-effectively. u-blox' surface-mount satellite receiver modules are ideal for consumer, industrial and automotive applications. All products are designed for maximum sensitivity, small size, low-power consumption, minimal external components, cost-effectiveness and seamless operation with our wireless modules.
Read more on page 14

Positioning chips

u-blox' powerful range of Global Navigation Satellite Systems (GNSS) receiver chips and chipsets are ideal for consumer, industrial as well as automotive applications. Our products are designed for maximum sensitivity, extremely low power consumption, and cost-effectiveness as well as compatibility with all major satellite positioning and augmentation technologies. Available in standard and automotive grades.
Read more on page 34

Wireless modules

u-blox provides wireless surface-mount transceiver modules based on the GSM/GPRS (SARA and LEON series), UMTS/HSPA (LISA-U) and CDMA2000 (LISA-C and FW series) mobile communications standards. As stand-alone wireless modems or in conjunction with u-blox' GNSS receivers, our 2G and 3G modules are optimized for mass market and professional applications requiring mobile connectivity such as car infotainment systems, asset and people tracking, telehealth, fleet management, vehicle recovery, mobile emergency and location-based services. Available in standard and automotive grades.
Read more on page 42

Services

u-blox offers globally available service platforms for Assisted GPS (AssistNow) and hybrid cellular/GPS positioning (CellLocate™). These highly-reliable online services are hosted by u-blox and available worldwide via the Internet or wireless connection. AssistNow provides precise, up-to-date satellite aiding data to accelerate GPS positioning down to 1 second. CellLocate couples GPS receiver data with mobile network cell attributes to provide a level of positioning redundancy that can benefit numerous applications, especially in situations when GPS signals are blocked such as indoors.
Read more on page 58

Markets

Automotive

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

Navigation is a standard feature in today's cars. But getting you where you want to go is just the beginning. u-blox' robust positioning and wireless technologies 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 automated trip advisor wirelessly download details about your surroundings to inform you of up-to-the-minute traffic and parking conditions, special attractions, hotels, service stations and restaurants along your route. Assistance is automatically summoned in the event of an accident, emergency or breakdown.

Vehicle recovery and automotive "black-box" based on GPS/GNSS positioning

The ability to recover stolen vehicles is becoming a hot global issue. u-blox' ultra-small, yet highly sensitive positioning solutions combined with wireless connectivity provide the perfect solution to this growing problem. Additionally, in-vehicle telematics systems positioning can also be used to record location, speeds, and acceleration for use in "crash-logging." When chosen as an option, this feature can dramatically reduce insurance costs to the driver.

"Our in-car infotainment and navigation systems offer the highest level of performance in terms of design, quality, user-friendliness and satisfying user experience. Reliable navigation is a core feature of our products, and our customers expect uncompromising performance in demanding driving environments. That is why we rely on u-blox GPS technology."

Mr. Yang Dan, Head of Sourcing at Foryou General Electronics Corporation, China

Industrial

"Our WatchLock is a unique product that provides a whole new level of security and peace of mind for industrial as well as private users. u-blox' tight-integration of GPS and wireless communications technology has allowed us to develop a highly sensitive, location-aware padlock perfect for a wide range of high-security applications."

Mr. Doron Kedem, Founder of Starcom Systems, Israel

Machine-to-machine communications (M2M)

Our GSM, UMTS and CDMA modules support a diverse range of machine-to-machine applications such as remote automation and control, automatic meter reading, wireless security systems and vending equipment monitoring. Our 3G solutions support high-bandwidth applications such as car infotainment systems, telehealth, 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' asset tracking solutions let you combine satellite positioning with the power to communicate over the world's largest 2G and 3G networks.

Precision Timing

Our GPS 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 basestations and femtocells.

Consumer

Location awareness
Embedded in mobile phones, tablets, cameras, and portable computing devices, our positioning and wireless products and solutions do much more than guide you to your destination; they can help you find your family, friends and your car, as well as useful services and points of interest that are relevant to where you are, and where you are going.

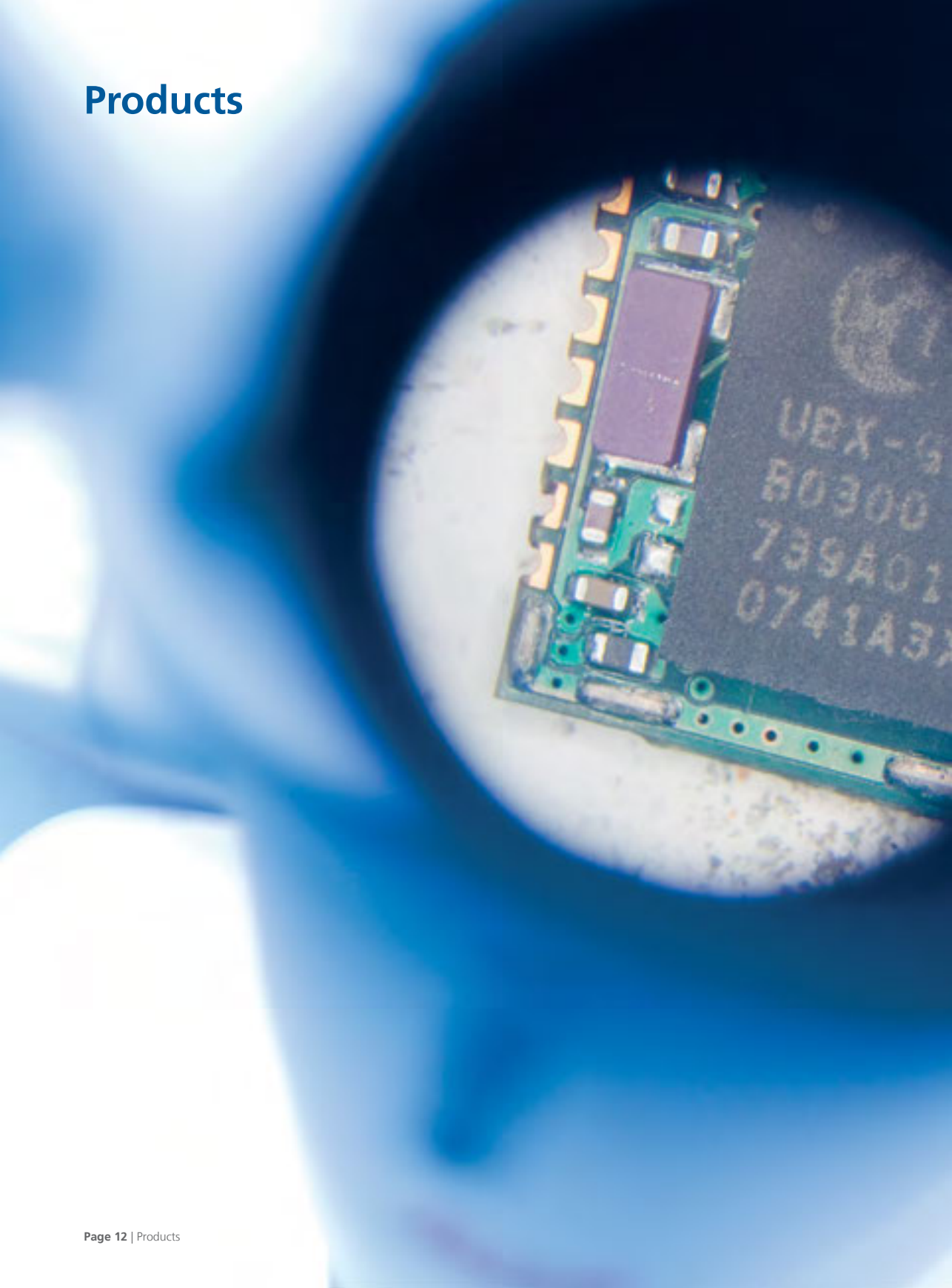
Portable positioning and wireless for safety and recreation
Our products are used in a diverse range of handheld safety and recreational devices such as child and pet locators, golf range-finder, hiking, biking and marine equipment. Whether for fun or for safety, u-blox' highly-integrated, ultra-sensitive GPS/GNSS and GSM/UMTS/CDMA modules, chipsets, software and services enable consumer devices to keep you aware of the world around you, no matter where you are.

Geotagging photo and videos
u-blox' compact, ultra-sensitive GPS/GNSS chips and modules are perfect for photography equipment, and are designed into a wide range of SLR, compact and video camera equipment.

"u-blox' quick time to market with QZSS receiver technology allowed us to be the first on the market with a highly accurate, highly reliable positioning device that already capitalizes on the first QZSS satellite in service. Our GWR73SD personal navigation device and radar detector is particularly attractive for drivers in urban environments in Japan where GPS satellites can be blocked by tall buildings."

Mr. Atsushi Ishibashi, Head of Marketing at Yupiteru Corporation, Japan

Products



Overview

Embedded products for global positioning and wireless communications
u-blox provides highly integrated solutions for embedded positioning and wireless applications. Our market-proven products can be found in demanding automotive and industrial environments, as well as in mobile and handheld consumer devices where size and power consumption are critical.

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

Category	Product
Positioning modules	**AMY:** Small, low-cost GPS module **MAX:** Compact GPS/GNSS modules **NEO:** Versatile GPS/GNSS modules **LEA:** GPS, GLONASS, Galileo and QZSS modules **Special function modules:** Dead Reckoning, Precision Timing and Precise Point Positioning
Positioning chips	**UBX-G7020:** GPS, GLONASS, Galileo, Compass and QZSS Standard and automotive grades
Wireless modules	**SARA:** Versatile GSM/GPRS modules **LEON:** Feature-rich GSM/GPRS modules **LISA:** Form factor consistent UMTS/HSPA/CDMA modules **FW series:** PCI/connectorized CDMA 1xRTT & EV-DO modules
Services	**AssistNow™:** Assisted-GPS services **CellLocate™:** Hybrid GPS/cellular positioning service

Standard grade products are ideal for handheld consumer as well as industrial applications.

Automotive grade products are perfect for demanding vehicle telematics, navigation and communication systems.

Positioning modules

Overview

Based on u-blox' proprietary high-performance architecture with 56 parallel channels, u-blox' powerful range of GPS/GNSS receiver modules is ideal for consumer, industrial and automotive applications. u-blox' advanced, thoroughly qualified and 100% tested GPS/GNSS receiver modules provide an easy-to-implement solution to add satellite navigation, precision timing and dead reckoning capability to end-products quickly and cost-effectively.

AMY
GPS module
6.5 x 8.0 x 1.2 mm

MAX
GPS/GNSS modules
9.7 x 10.1 x 2.5 mm

NEO
GPS/GNSS, special function modules
12.2 x 16.0 x 2.4 mm

LEA
GPS/GNSS, special function modules
17.0 x 22.4 x 2.4 mm

Model	Type						Supply				Interfaces				Features										
	GPS	QZSS	GLONASS	Timing	Dead Reckoning	Precise Point Positioning	2.7 V – 3.6 V	1.65 V – 3.6 V	1.75 V – 2.0 V	Lowest power (DC/DC)	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	Data logger	Extra front-end LNA	Front-end SAW filter	Oscillator	RTC crystal	Antenna supply	Antenna short circuit detection / protection	Antenna open circuit detection pin	Timepulse	External interrupt / Wakeup
MAX-7Q	•	•	•				•			•	•			•					T	•	o	o	o	•	•
MAX-7C	•	•	•					•		•	•			•					C	■	o	o	o	•	•
MAX-7W	•	•	•				•				•			•					T	•	•	•	o	•	•
NEO-7N	•	•	•				•			•	•	•	Sel	•	•	•	•	•	T	•		o	o	•	•
NEO-7M	•	•	•					•		•	•	•	Sel	•					C	•		o	o	•	•
LEA-7N	•	•	•				•			•	•	•		•	•	•		•	T	•	•	•	•	•	•
AMY-6M	•						•		•		•	•	•	•					C	o		o	o	•	•
NEO-6P	•					•	•				•	•	•	•					C	•		o	o	•	•
NEO-6T	•			•			•				•	•	•	•					T	•		o	o	•	•
NEO-6V[1]	•				•		•				•	•	•	•					C	•		o	o	•	•
LEA-6T-0	•			•			•				•	•		•					T	•	•	•	•	•	•
LEA-6T-1	•			•			•				•	•		•	•				T	•	•	•	•	•	•
LEA-6R[2]	•				•		•				•	•	X		•				C	•	•	•	•	•	•

o = Optional, not activated per default or requires external components
Sel = Select for either SPI or UART/DDC by HW configuration pin (D_SEL)
X = SPI available for communication with external sensors only

C = Crystal / T = TCXO
1) Software interface for sensor data

■ = Derived from main oscillator
2) Hardware interface for sensor data

For an overview of all u-blox 6 modules, see page 32.

MAX-7 series

Compact u-blox 7 GPS/GNSS modules

Highlights

- Smallest and lowest power multi-GNSS modules on the market
- Cost and performance optimized versions
- Combines low power consumption and high sensitivity
- Simple integration with u-blox wireless modules
- Easy migration from MAX-6 family

MAX-7 series
9.7 x 10.1 x 2.5 mm

Product description

The MAX-7 series is the newest family of standalone GPS/GNSS modules from u-blox. With the exceptional performance of the u-blox 7 multi-GNSS (GPS, GLONASS, Galileo, 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, while the MAX-7Q provides best performance and easy integration with passive 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 GPS-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 (I^2C compliant) interface provides connectivity and enables synergies with u-blox SARA, LEON and LISA wireless modules. For RF optimization the MAX-7Q features an additional front-end LNA for easier antenna integration and the MAX-7Q includes a front-end SAW filter for increased jamming immunity.

u-blox 7 modules use GPS/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											
	GPS	QZSS	GLONASS	Timing	Dead Reckoning	Precise Point Positioning	2.7 V – 3.6 V	1.65 V – 3.6 V	1.75 V – 2.0 V	UART	USB	SPI	DDC (I^2C compliant)	Programmable (Flash)	Data logger	Extra front-end LNA	Front-end SAW filter	Oscillator	RTC crystal	Antenna supply	Antenna short circuit detection / protection	Antenna open circuit detection pin	Timepulse	External interrupt / Wakeup
MAX-7Q	•	•	•				•			•			•			•	•	T	•		o	o	•	•
MAX-7C	•	•	•					•		•			•					C	■		o	o	•	•

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

C = Crystal / T = TCXO

■ = Derived from single crystal feature

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		
Cold starts:	29 s	30 s
Aided starts:	5 s	n.a.
Reaquisition:	1 s	3 s
Sensitivity		
Tracking:	–162 dBm	–158 dBm
Cold starts:	–148 dBm	–140 dBm
Warm starts:	–148 dBm	–145 dBm
Assistance	AssistNow Online AssistNow Offline AssistNow Autonomous OMA SUPL & 3GPP compliant	
Oscillator	TCXO (MAX-7Q), Crystal (MAX-7C)	
RTC crystal	Built-In (MAX-7Q)	
Anti jamming	Active CW detection and removal	
Memory	Onboard ROM	
Supported antennas	Active and passive	

Electrical data

Supply voltage	1.65 V – 3.6 V (MAX-7C) 2.0 V – 3.6 V (MAX-7Q)
Digital I/O voltage level	1.65 V – 3.6 V
Power consumption	47 mW @ 1.8 V (continuous)[3] 51 mW @ 3 V (continuous)[3] 14 mW @ 1.8 V Power Save Mode (1 Hz)[3]
Backup supply	1.4 V – 3.6 V

[3] MAX-7C

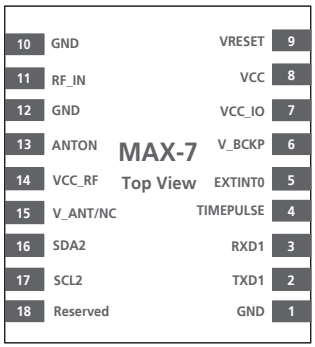
Interfaces

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

Package

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

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

Ordering information

MAX-7C-0	u-blox 7 GPS/GNSS module, 1.65 – 3.6V, 9.7 x 10.1 mm
MAX-7Q-0	u-blox 7 GPS/GNSS module, TCXO, SAW, LNA, 9.7 x 10.1 mm

Available as samples and tape on reel (500 pieces)

Samples available via u-blox' Online shop at
www.u-blox.com/en/online-shop.html

For latest product information please see the u-blox website.

NEO-7 series

Versatile u-blox 7 GPS/GNSS modules

Highlights

- Multi-GNSS engine for GPS, GLONASS, Galileo and QZSS
- Cost and performance optimized versions
- Combines low power consumption and high sensitivity
- Simple integration with u-blox wireless modules
- Backward compatible with NEO-6 and NEO-5 families

NEO-7
12.2 x 16.0 x 2.4 mm

Product description

The NEO-7 series is the newest family of standalone GPS/GNSS modules from u-blox. With the exceptional performance of the u-blox 7 multi-GNSS (GPS, GLONASS, Galileo, 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 SARA, LEON and LISA wireless 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 GPS/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										
	GPS	QZSS	GLONASS	Timing	Dead Reckoning	Precise Point Positioning	2.7 V – 3.6 V	1.65 V – 3.6 V	1.75 V – 2.0 V	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	Data logger	Extra front-end LNA	Front-end SAW filter	Oscillator	RTC crystal	Antenna supply	Antenna short circuit detection / protection	Antenna open circuit detection pin	Timepulse	External interrupt / Wakeup
NEO-7N	•	•	•				•			•	•	Sel	•	•	•	•	•	T	•		o	o	•	•
NEO-7M	•	•	•					•		•	•	Sel	•					C	•		o	o	•	•

o = Optional, not activated per default or requires external components C = Crystal / T = TCXO Sel = Select for either SPI or UART/DDC by HW configuration pin (D_SEL)

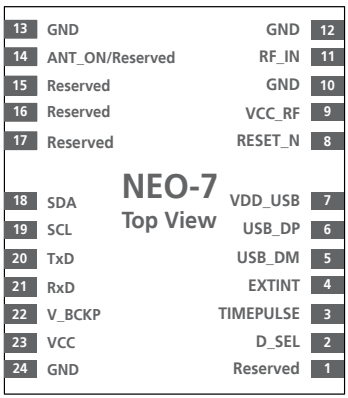
Features

Receiver type	56-channel u-blox 7 engine GPS L1 C/A, GLONASS L1 FDMA QZSS L1 C/A Galileo E1B/C, Compass ready SBAS: WAAS, EGNOS, MSAS	
Navigation update rate	up to 10 Hz	
Accuracy	GPS	GLONASS
Position	2.5 m CEP	4 m
SBAS	2.0 m CEP	n.a.
Acquisition		
Cold starts:	29 s	30 s
Aided starts:	5 s	n.a.
Reaquisition:	1 s	3 s
Sensitivity		
Tracking:	–162 dBm	–158 dBm
Cold starts:	–148 dBm	–140 dBm
Warm starts:	–148 dBm	–145 dBm
Assistance	AssistNow Online AssistNow Offline AssistNow Autonomous OMA SUPL & 3GPP compliant	
Oscillator	TCXO (NEO-7N), Crystal (NEO-7M)	
RTC crystal	Built-In	
Memory	ROM (NEO-7M) or Flash (NEO-7N)	
Supported antennas	Active and passive	

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

Electrical data

Supply voltage	1.65 V to 3.6 V (NEO-7M) 2.7 V to 3.6 V (NEO-7N)
Power consumption	47 mW @ 1.8 V (continuous)[2] 51 mW @ 3 V (continuous)[2] 14 mW @ 1.8 V Power Save Mode (1 Hz)[2]
Backup supply	1.4 V – 3.6 V

[2] NEO-7M

Interfaces

Serial interfaces	1 UART 1 USB V2.0 full speed 12 Mb/s 1 SPI (optional) 1 DDC (I²C compliant)
Digital I/O	Configurable timepulse 1 EXTINT input for Wakeup
Timepulse	Configurable: 0.25 Hz to 1 kHz
Protocols	NMEA, UBX binary, RTCM

Ordering information

NEO-7M-0	u-blox 7 GPS/GNSS module, 1.65 – 3.6V, 12.2 x 16.0 mm
NEO-7N-0	u-blox 7 GPS/GNSS module, Flash, TCXO, SAW, LNA, 12.2 x 16.0 mm

Available as samples and tape on reel (250 pieces)

Samples available via u-blox' Online shop at
www.u-blox.com/en/online-shop.html

LEA-7N

u-blox 7 GPS/GNSS module

Highlights

- Multi-GNSS engine for GPS, GLONASS, Galileo and QZSS
- Combines low power consumption and high sensitivity
- UART, USB and DDC (I²C compliant) interfaces
- Simple integration with u-blox wireless modules
- 5th generation LEA module
- Easy migration from LEA-6 GPS and GLONASS modules

LEA-7N
17.0 x 22.4 x 2.4 mm

Product description

The LEA-7N module delivers multi-GNSS location capability (GPS, GLONASS, Galileo, QZSS and SBAS) together with high performance u-blox 7 positioning technology in the industry proven LEA form factor. The LEA-7N provides exceptional performance with low system power, and is optimized for active antennas.

The LEA-7N features the lowest power GLONASS functionality in the industry and is designed for ERA-GLONASS. This 5th generation module in the LEA form factor allows simple migration from LEA-6 GPS and LEA-6N GPS/GLONASS modules. Sophisticated RF-architecture and interference suppression ensure maximum performance even in GPS-hostile environments.

The LEA-7N combines a high level of robustness and integration capability with flexible connectivity options. Future-proof the LEA-7N's internal Flash allows simple firmware upgrades for supporting additional GNSS systems. This makes it perfectly suited to industrial and automotive applications. The DDC (I²C compliant) interface provides connectivity and enables synergies with u-blox SARA, LEON and LISA wireless modules. For RF optimization the LEA-7N features a front-end SAW filter for increased jamming immunity.

u-blox 7 modules use GPS/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											
	GPS	QZSS	GLONASS	Timing	Dead Reckoning	Precise Point Positioning	2.7 V – 3.6 V	1.65 V – 3.6 V	1.75 V – 2.0 V	UART	USB	SPI	DDC (I2C compliant)	Programmable (Flash)	Data logger	Extra front-end LNA	Front-end SAW filter	Oscillator	RTC crystal	Antenna supply	Antenna short circuit detection / protection	Antenna open circuit detection pin	Timepulse	External interrupt / Wakeup
LEA-7N	•	•	•				•			•	•		•	•	•		•	T	•	•	•	•	•	•

B = Best RF performance

C = Crystal / T = TCXO

Features

Receiver type	56-channel u-blox 7 engine GPS L1 C/A, GLONASS L1 FDMA, QZSS L1 C/A Galileo E1B/C, Compass ready 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		
Cold starts:	29 s	30 s
Aided starts:	5 s	n.a.
Reaquisition:	1 s	3 s
Sensitivity		
Tracking:	–162 dBm	–158 dBm
Cold starts:	–148 dBm	–140 dBm
Warm starts:	–148 dBm	–145 dBm
Assistance	AssistNow Online AssistNow Offline AssistNow Autonomous OMA SUPL & 3GPP compliant	
LNA	Built-In	
Oscillator	TCXO	
RTC crystal	Built-In[1]	
Anti jamming	Active CW detection and removal	
Memory	Flash	
Supported antennas	Active and passive	

[1] For faster warm and hot starts

Electrical data

Power supply	2.7 V – 3.6 V
Power consumption	69 mW @ 3 V (continuous) 30 mW @ 3 V Power Save Mode (1 Hz)
Backup supply	1.4 V to 3.6 V

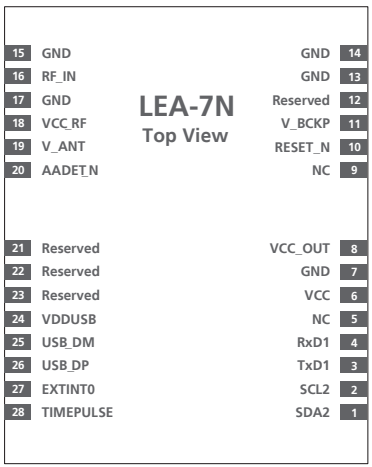
Interfaces

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

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 in ISO/TS 16949 certified production sites

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/GNSS performance.

EVK-7N	u-blox 7 GPS/GNSS Evaluation Kit with TCXO

Ordering information

LEA-7N-0	u-blox 7 GPS/GNSS module, Flash, TCXO, SAW, 17.0 x 22.4 x 2.4 mm

Available as samples and tape on reel (250 pieces)

Samples available via u-blox' Online shop at
www.u-blox.com/en/online-shop.html

AMY-6M

Small, low-cost u-blox 6 GPS module

Highlights

- Smallest GPS module
- No host integration required
- Basic GPS functionality for cost-sensitive applications
- Operates at 1.8 V and 3.0 V

AMY-6M
6.5 x 8.0 x 1.1 mm

Features

- u-blox 6 position engine:
  - o Navigates to –159 dBm and –146 dBm coldstart
  - o Faster acquisition with AssistNow Autonomous
  - o Hybrid GPS/SBAS engine (WAAS, EGNOS, MSAS)
  - o Anti-Jamming technology
- Simple integration with u-blox wireless modules
- A-GPS: AssistNow Online and AssistNow Offline services, OMA SUPL compliant
- Backward compatible (hardware and firmware); easy migration from AMY-5M
- LGA package for cost effective manufacturing

Product description

AMY-6M is the world's smallest standalone GPS module dedicated to consumer applications. It has been specifically developed to provide basic GPS functionality required by high-volume, portable products. It is a fully integrated, autonomous GPS solution requiring no host integration resulting in fast time-to-market.

AMY-6M offers four different serial interfaces. This module features an integrated GPS crystal, providing fast acquisition and excellent tracking performance at a competitive price. In addition, AMY-6M can be assembled on a 2-layer PCB, which saves production costs. AMY-6M is so small that it can be integrated into the smallest portable devices. Advanced interference suppression mechanisms and innovative RF architecture ensure maximum performance even in hostile signal environments.

Product selector

Model	Type						Supply			Interfaces				Features											
	GPS	QZSS	GLONASS	Timing	Dead Reckoning	Precise Point Positioning	2.7 V – 3.6 V	1.65 V – 3.6 V	1.75 V – 2.0 V	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	Data logger	Extra front-end LNA	Front-end SAW filter	Oscillator	RTC crystal	Antenna supply	Antenna short circuit detection / protection	Antenna open circuit detection pin	Timepulse	External interrupt / Wakeup
AMY-6M	•						•		•	•	•	•	•					C	o		o	o	•	•

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

C = Crystal

Receiver performance data

Receiver type	50-channel u-blox 6 engine GPS L1 C/A code SBAS: WAAS, EGNOS, MSAS	
Navigation update rate	up to 5 Hz	
Accuracy[1]	Position SBAS	2.5 m CEP 2.0 m CEP
Acquisition[1]	Cold starts: Aided starts[2]: Hot starts:	27 s 4 s 1 s
Sensitivity[3]	Tracking: Cold starts: Hot starts:	–159 dBm –147 dBm –156 dBm

[1] All SV @ –130 dBm
[2] Dependent on aiding data connection speed and latency
[3] Demonstrated with a good active antenna

Electrical data

Power supply	1.75 V – 2.0 V 2.5 V – 3.6 V
Power consumption[4]	67 mW @ 1.8 V (Eco Mode)
Backup power	1.4 V – 3.6 V, 22 µA
RTC input	32.768 kHz (optional)
Internal clock	26.0 MHz crystal
Antenna supervision	Short and open circuit detection supported with external circuit
Supported antennas	Active and passive with LNA

[4] Based on FW 7

Interfaces

Serial interfaces	1 UART 1 USB V2.0 full speed 12 Mb/s 1 DDC (I²C compliant) 1 SPI	
Digital I/O	Configurable timepulse 2 EXTINT interrupt inputs for Wakeup 2 configuration pins	
Serial and I/O	Voltages:	2.7 V – 3.6 V 1.75 V– 2.0 V
Protocols	NMEA, UBX binary	

Package

50 pin LGA: 6.5 x 8.0 x 1.1 mm, 0.14 g

Environmental data, quality & reliability

Operating temp. –40° C to +85° C

Storage temp. –40° C to +85° C

RoHS compliant (lead-free)

Support products

u-blox 6 Evaluation Kits:

Easy-to-use kits to get familiar with u-blox 6 positioning technology, evaluate functionality, and visualize GPS performance

EVK-6A	u-blox 6 Evaluation Kit for AMY-6M For ordering information contact u-blox

Ordering information

AMY-6M-0	u-blox 6 GPS module

Available as samples and tape on reel (2.000 pieces)

Samples available via u-blox' Online shop at
www.u-blox.com/en/online-shop.html

NEO-6P

u-blox 6 Precise Point Positioning GPS module

Highlights

- High precision of < 1 m
- Allows ultra small GPS designs
- High accuracy positioning at a fraction of the cost of other high precision solutions
- Raw data

NEO-6P
12.2 x 16.0 x 2.4 mm

Features

- u-blox 6 position engine:
  - o Navigate down to –160 dBm and –146 dBm coldstart
  - o Faster acquisition with AssistNow Autonomous
  - o Hybrid GPS/SBAS engine (WAAS, EGNOS, MSAS)
  - o Anti-jamming technology
- Simple integration with u-blox wireless modules
- A-GPS: AssistNow Online and AssistNow Offline services, OMA SUPL compliant
- LCC package for reliable and cost effective manufacturing
- Compatible with u-blox GPS solution for Android
- Based on GPS chips qualified according to AEC-Q100
- Manufactured in ISO/TS 16949 certified production sites
- Qualified according to ISO 16750

Product description

The NEO-6P module combines the high performance of the u-blox 6 position engine with Precise Point Positioning (PPP) technology. u-blox' industry proven PPP algorithm provides extremely high levels of position accuracy in static and slow moving applications, and makes the NEO-6P an ideal solution for a variety of high precision applications such as surveying, mapping, marine or agriculture.

Ionospheric corrections such as those received from local SBAS geostationary satellites (WAAS, EGNOS, MSAS) or from GPS enable the highest positioning accuracy with the PPP algorithm. The maximum improvement of positioning accuracy is reached with PPP+SBAS and can only be expected in an environment with unobstructed sky view during a period in the order of minutes.

All NEO-6 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	Type						Supply			Interfaces				Features											
	GPS	QZSS	GLONASS	Timing	Dead Reckoning	Precise Point Positioning	2.7 V – 3.6 V	1.65 V – 3.6 V	1.75 V – 2.0 V	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	Data logger	Extra front-end LNA	Front-end SAW filter	Oscillator	RTC crystal	Antenna supply	Antenna short circuit detection / protection	Antenna open circuit detection pin	Timepulse	External interrupt / Wakeup
NEO-6P	•					•	•			•	•	•	•					⊂	•		o	o	•	•

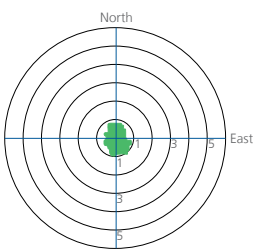
o = Optional, not activated per default or requires external components

⊂ = Crystal

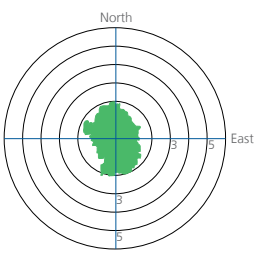
Receiver performance data

Receiver type	50-channel u-blox 6 engine GPS L1 C/A code SBAS: WAAS, EGNOS, MSAS	
Navigation update rate	up to 5 Hz	
Accuracy[1]	Autonomous SBAS SBAS + PPP[2]	2.5 m CEP 2.0 m CEP < 1 m (2D, R50) < 2 m (3D, R50)
Acquisition[1]	Cold starts: Aided starts[3]: Hot starts:	32 s < 3 s 1 s
Sensitivity[4]	Tracking: Cold starts: Hot starts:	–160 dBm –146 dBm –155 dBm

[1] All SV @ –130 dBm
[2] For required conditions see Data Sheet
[3] Dependent on aiding data connection speed and latency
[4] Demonstrated with a good active antenna



Accuracy with PPP+SBAS (units in m)



Accuracy with GPS and SBAS (units in m)

Electrical data

Power supply	2.7 V – 3.6 V
Power consumption	117 mW @ 3.0 V
Backup power	1.4 V – 3.6 V, 22 µA
Supported antennas	Active and passive

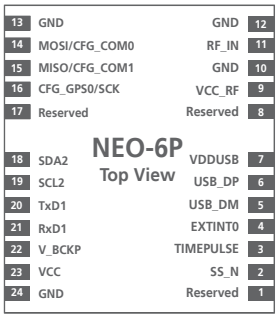
Interfaces

Serial interfaces	1 UART 1 USB V2.0 full speed 12 Mb/s 1 DDC (I^2C compliant) 1 SPI	
Digital I/O	Configurable timepulse 1 EXTINT input for Wakeup	
Serial and I/O	Voltages:	2.7 V – 3.6 V
Timepulse	Configurable:	0.25 Hz to 1 kHz
Protocols	NMEA, UBX binary	

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

Support products

Contact the u-blox sales team nearest you.

Ordering information

NEO-6P-0	u-blox 6 GPS Module, PPP, 12.2 x 16.0 x 2.4 mm

Available as samples and tape on reel (250 pieces)

Samples available via u-blox' Online shop at
www.u-blox.com/en/online-shop.html

LEA-6T/NEO-6T

u-blox 6 Precision Timing GPS/GNSS modules

Highlights

- Precision Timing:
  - o 1 or 2 timepulse outputs (up to 10 MHz)
  - o Single-satellite operation
  - o Stationary (survey-in) mode for enhanced timing accuracy
  - o Time mark of external event inputs
- Raw pseudo-range data output
- UART, USB and DDC (I²C compliant) interfaces
- Onboard RTC Crystal for faster warm and hot starts

LEA-6T
17.0 x 22.4 x 2.4 mm

NEO-6T
12.2 x 16.0 x 2.4 mm

Features

- u-blox 6 position engine:
  - o Navigate down to –162 dBm and –148 dBm coldstart
  - o Faster acquisition with AssistNow Autonomous
  - o Hybrid GPS/SBAS engine (WAAS, EGNOS, MSAS)
  - o Anti-Jamming technology
- Simple integration with u-blox wireless modules
- A-GPS: AssistNow Online and AssistNow Offline services, OMA SUPL compliant
- Backward compatible (hardware and firmware); easy migration from LEA-5T or LEA-4T (LEA-6T)
- LCC package for reliable and cost effective manufacturing
- Optional upgradeable Firmware support
- Compatible with u-blox GPS Solution for Android
- Based on GPS chips qualified according to AEC-Q100
- Manufactured in ISO/TS 16949 certified production sites
- Qualified according to ISO 16750

Product description

The LEA-6T/NEO-6T provide precision GPS timing for demanding synchronization applications such as basestations. This module features user configurable frequency and timepulse outputs. An accuracy of up to 15 ns is achievable by using the quantization error information to compensate the granularity of the time pulse. LEA-6T/NEO-6T feature a time mode function whereby the GPS receiver assumes a stationary 3D position, whether programmed manually or determined by an initial self-survey.

During stationary operation GPS timing is possible with only one visible satellite. This means that time can be maintained even under adverse signal conditions or in environments with poor sky visibility. A built-in time mark and counter unit provide precise time measurement of external event inputs. T-RAIM (Timing Receiver Autonomous Integrity Monitoring) is available to detect faulty GPS measurements. LEA-6T/NEO-6T deliver raw pseudo-range data for survey and specialist applications.

LEA-6T/NEO-6T 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	Type						Supply			Interfaces				Features									
	GPS	QZSS	GLONASS	Timing	Dead Reckoning	Precise Point Positioning	2.7 V – 3.6 V	1.65 V – 3.6 V	1.75 V – 2.0 V	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	Data logger	Extra front-end LNA	Front-end SAW filter	Oscillator	RTC crystal	Antenna supply	Antenna short circuit detection / protection	Antenna open circuit detection pin	Timepulse	External interrupt / Wakeup
NEO-6T	•			•			•			•	•	•	•					T	•		o	o	•	•
LEA-6T-0	•			•			•			•	•		•					T	•	•	•	•	•	•
LEA-6T-1	•			•			•			•	•		•	•				T	•	•	•	•	•	•

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

T = TCXO

Receiver performance data

Receiver type	50-channel u-blox 6 engine GPS L1 C/A code SBAS: WAAS, EGNOS, MSAS	
Navigation update rate	up to 5 Hz (2 Hz for LEA-6T-1)	
Accuracy[1]	Position	2.5 m CEP
	SBAS	2.0 m CEP
Acquisition[1]	Cold starts:	26 s
	Aided starts[2]:	1 s
	Hot starts:	1 s
Sensitivity[3]	Tracking:	–162 dBm
	Cold starts:	–148 dBm
	Hot starts:	–157 dBm

[1] All SV @ –130 dBm
[2] Dependent on aiding data connection speed and latency
[3] Demonstrated with a good active antenna

Timing performance data

Timing accuracy	RMS	30 ns
	99%	< 60 ns
	Granularity	21 ns
	Compensated	15 ns[4]

[4] Quantization error information can be used to compensate the granularity related error of the timepulse signal

Electrical data

Power supply	2.7 V – 3.6 V
Power consumption	123 mW @ 3.0 V (LEA-6T) 120 mW @ 3.0 V (NEO-6T)
Backup power	1.4 V – 3.6 V, 22 µA
Supported antennas	Active and passive
Antenna power	External or internal VCC_RF
Antenna supervision	Integrated short-circuit detection and antenna shutdown, open circuit detection with minimal external circuitry (LEA-6T)

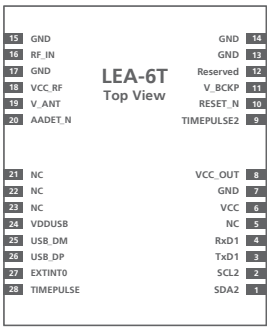
Interfaces

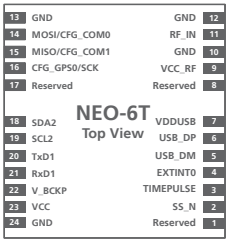
Serial interfaces	1 UART 1 USB V2.0 full speed 12 Mb/s 1 DDC (I²C compliant) 1 SPI (NEO-6T only)	
Digital I/O	2 configurable timepulse (1 for NEO-6T) 1 EXTINT input for Timemark 1 reset (LEA-6T only)	
Serial and I/O	Voltages:	2.7 V – 3.6 V
Timepulse	Configurable:	0.25 Hz to 10 MHz
Protocols	NMEA, UBX binary, RTCM	

Package

LEA-6T:	28 pin LCC (Leadless Chip Carrier): 17.0 x 22.4 x 2.4 mm, 2.1 g
NEO-6T:	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

Support product

u-blox 6 Evaluation Kits:

Easy-to-use kits to get familiar with u-blox 6 positioning technology, evaluate functionality, and visualize GPS performance.

EVK-6T	u-blox 6 Evaluation Kit with Precision Timing

Ordering information

LEA-6T-0	u-blox 6 GPS module, Precision Timing, TCXO, 17.0 x 22.4 x 2.4 mm
LEA-6T-1	u-blox 6 GPS module, Precision Timing, TCXO, Flash, 17.0 x 22.4 x 2.4 mm
NEO-6T-0	u-blox 6 GPS module, Precision Timing, TCXO, 12.2 x 16.0 x 2.4 mm

Available as samples and tape on reel (250 pieces)

Samples available via u-blox' Online shop at
www.u-blox.com/en/online-shop.html

LEA-6R

u-blox 6 Dead Reckoning GPS/GNSS module

Highlights

- Automotive Dead Reckoning (ADR) technology for aftermarket applications:
  - o 100% coverage, continuous positioning even in tunnels
  - o 1 Hz combined DR+GPS navigation rate
  - o Speedpulse sensor monitoring via I/O pin or as messages
  - o Gyroscope/Temperature sensor monitoring
  - o Automatic sensor calibration / temperature compensation
- UART and USB interfaces
- Integrated antenna supervisor
- Low noise figure LNA

Features

- u-blox 6 position engine:
  - o Navigate down to –162 dBm and –147 dBm coldstart
  - o Hybrid GPS/SBAS engine (WAAS, EGNOS, MSAS)
  - o Anti-jamming technology
- Simple integration with u-blox wireless modules
- A-GPS: AssistNow Online and AssistNow Offline services, OMA SUPL compliant
- Backward compatible (hardware and firmware); easy migration from LEA-4R
- LCC package for reliable and cost effective manufacturing
- Compatible with u-blox GPS solution for Android
- Based on GPS chips qualified according to AEC-Q100
- Manufactured in ISO/TS 16949 certified production sites
- Qualified according to ISO 16750

LEA-6R
17.0 x 22.4 x 2.4 mm

Product description

The LEA-6R provides 100 % coverage, combining the high performance u-blox 6 positioning engine with u-blox' ADR Dead Reckoning technology. ADR supplements GPS satellite position information with heading and distance data provided by additional sensors. When GPS satellites are out of sight, location is extrapolated using distance and angle information from the gyroscope and speedpulse sensors. The speedpulse sensor signal can be received either as a digital tick signal or as messages via the serial interface. The gyroscope is monitored via an external ADC over the SPI interface.

ADR enables accurate navigation even in locations with poor or absent GPS signals such as tunnels, indoor parking facilities and deep urban canyons. In addition, ADR effectively eliminates the impact of multipath effects in urban canyon environments. This makes the LEA-6R the ideal solution for applications requiring accurate, reliable positioning, all of the time.

LEA-6R 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	Type						Supply			Interfaces				Features										
	GPS	QZSS	GLONASS	Timing	Dead Reckoning	Precise Point Positioning	2.7 V – 3.6 V	1.65 V – 3.6 V	1.75 V – 2.0 V	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	Data logger	Extra front-end LNA	Front-end SAW filter	Oscillator	RTC crystal	Antenna supply	Antenna short circuit detection / protection	Antenna open circuit detection pin	Timepulse	External interrupt / Wakeup
LEA-6R[2]	•				•		•			•	•	X		•				C	•	•	•	•	•	•

X = SPI available for communication with external sensors only

C = Crystal

2 = Hardware interface for sensor data

Receiver performance data

Receiver type	50-channel u-blox 6 engine GPS L1 C/A code SBAS: WAAS, EGNOS, MSAS	
Navigation update rate	1 Hz (GPS + ADR)	
Accuracy[1]	Position SBAS ADR	2.5 m CEP 2.0 m CEP 5% of distance travelled without GPS
Acquisition[1]	Cold starts: Aided starts[2]: Hot starts:	27 s 3 s 1 s
Sensitivity[3]	Tracking: Cold starts: Hot starts:	–162 dBm –147 dBm –156 dBm

[1] All SV @ –130 dBm
[3] Dependent on aiding data connection speed and latency
[4] Demonstrated with a good active antenna

Electrical data

Power supply	2.7 V – 3.6 V
Power consumption	120 mW @ 3.0 V (continuous)
Backup power	1.4 V – 3.6 V, 22 µA
Supported antennas	Active and passive
Antenna power	External or internal VCC_RF
Antenna supervision	Integrated short-circuit detection and antenna shutdown, open circuit detection with minimal external circuitry

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

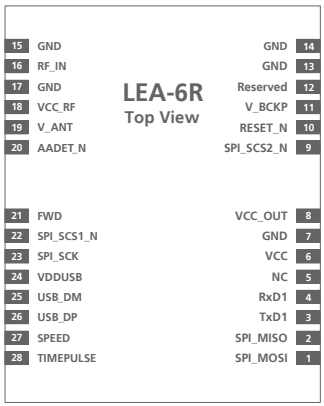
Interfaces

Serial interfaces	1 UART 1 USB V2.0 full speed 12 Mbit/s	
Speedpulse sensor	via digital I/O or as messages via serial interface	
Gyroscope sensor	via ADC and SPI (Temp. sensor mandatory)	
FWD sensor (optional)	via digital I/O pin	
Serial and I/O	Voltages	2.7 V – 3.6 V
Timepulse	Configurable	0.25 Hz to 1 kHz
Protocols	NMEA, UBX binary, RTCM	

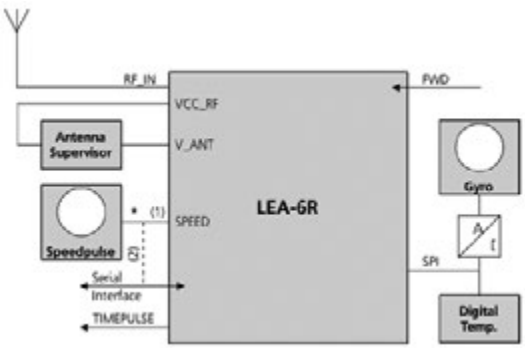
Package

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

Pinout



Block diagram



* Speedpulse monitoring via digital I/O pin (1) or serial interface (2)

Support product

u-blox 6 Evaluation Kits:

Easy-to-use kits to get familiar with u-blox 6 positioning technology, evaluate functionality, and visualize GPS performance.

EVK-6R	u-blox 6 Evaluation Kit with Dead Reckoning

Ordering information

LEA-6R-0	u-blox 6 GPS Module, Dead Reckoning, TCXO

Available as samples and tape on reel (250 pieces)

Samples available via u-blox' Online shop at
www.u-blox.com/en/online-shop.html

NEO-6V

u-blox 6 Dead Reckoning GPS/GNSS module

Highlights

- Automotive Dead Reckoning (ADR) technology for first mount applications:
  - o 100% coverage, continuous positioning even in tunnels
  - o Highly accurate and reliable navigation performance
  - o Automatic sensor calibration
- ROM-based for cost effectiveness
- Uses vehicle's onboard sensors
- UART, USB, DDC (I²C compliant) and SPI interfaces
- Onboard RTC crystal for faster warm and hot starts

NEO-6V
12.2 x 16.0 x 2.4 mm

Features

- u-blox 6 position engine:
  - o Navigate down to –161 dBm and –147 dBm coldstart
  - o Hybrid GPS/SBAS engine (WAAS, EGNOS, MSAS)
  - o 1 Hz combined ADR+GPS navigation rate
  - o Anti-jamming technology
- Simple integration with u-blox wireless modules
- A-GPS: AssistNow Online and AssistNow Offline services, OMA SUPL compliant
- LCC package for reliable and cost effective manufacturing
- Compatible with u-blox GPS solution for Android
- Based on GPS chips qualified according to AEC-Q100
- Manufactured in ISO/TS 16949 certified production sites
- Qualified according to ISO 16750

Product description

Automotive Dead Reckoning (ADR) is u-blox' industry proven off-the-shelf Dead Reckoning solution for tier-one automotive customers. u-blox' ADR solution combines GPS and sensor digital data using a tightly coupled Kalman filter. This improves position accuracy during periods of no or degraded GPS signal.

The NEO-6V provides ADR functionality over its software sensor interface. A variety of sensors (such as wheel ticks and gyroscope) are supported, with the sensor data received via UBX messages from the application processor. This allows for easy integration and a simple hardware interface, lowering costs. By using digital sensor data available on the vehicle bus, hardware costs are minimized since no extra sensors are required for Dead Reckoning functionality. ADR is designed for simple integration and easy configuration of different sensor options (e.g. with or without gyroscope) and vehicle variants, and is completely self-calibrating.

All NEO-6 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	Type						Supply			Interfaces				Features										
	GPS	QZSS	GLONASS	Timing	Dead Reckoning	Precise Point Positioning	2.7 V – 3.6 V	1.65 V – 3.6 V	1.75 V – 2.0 V	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	Data logger	Extra front-end LNA	Front-end SAW filter	Oscillator	RTC crystal	Antenna supply	Antenna short circuit detection / protection	Antenna open circuit detection pin	Timepulse	External interrupt / Wakeup
NEO-6V[1]	•				•		•			•	•	•	•					C	•		o	o	•	•

o = Optional, not activated per default or requires external components C = Crystal 1 = Software interface for sensor data

Receiver performance data

Receiver type	50-channel u-blox 6 engine GPS L1 C/A code SBAS: WAAS, EGNOS, MSAS	
Navigation update rate	1 Hz (GPS + ADR)	
Accuracy[1]	Position SBAS	2.5 m CEP[2] 2.0 m CEP[2]
Acquisition[1]	Cold starts: Aided starts[3]: Hot starts:	27 s < 3 s 1 s
Sensitivity[4]	Tracking: Cold starts: Hot starts:	–161 dBm –147 dBm –156 dBm

[1] All SV @ –130 dBm
[2] CEP, 50%, 24 hours static, –130 dBm, SEP: < 3.5 m
[3] Dependent on aiding data connection speed and latency
[4] Demonstrated with a good active antenna

Electrical data

Power supply	2.7 V – 3.6 V
Power consumption	117 mW @ 3.0 V (continuous)
Backup power	1.4 V – 3.6 V, 22 µA
Antenna supervision	Short and open circuit detection supported with external circuit
Supported antennas	Active and passive

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

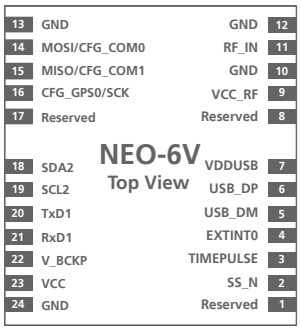
Interfaces

Serial interfaces	1 UART 1 USB V2.0 full speed 12 Mbit/s 1 DDC (I^2C compliant) 1 SPI	
Digital I/O	Configurable timepulse 1 EXTINT input for Wakeup	
Serial and I/O	Voltages	2.7 V – 3.6 V
Timepulse	Configurable	0.25 Hz to 1 kHz
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



ADR performance and requirement

u-blox ADR supports four standard sensor configurations: Rear wheel sensors, Front wheel sensors, 4 wheel sensors, and Gyro + speedpulse. The digital data provided by the sensors is converted to proprietary UBX messages by the application processor.

Sensor option	Typ. position error[5, 6]
Rear wheels:	12%[7]
Front wheels:	13%[7]
Four wheels:	10%[7]
Gyro + speedpulse:	5%[7]

[5] Values obtained with typical sensor latency of 40 ms and expected jitter of < 5 ms.
[6] With GPS reception: position error with ADR (GPS + Sensor) is as good as or better than u-blox standard GPS receiver (GPS only)
[7] Percentage of distance travelled without GPS

Sensor requirements

Wheel tick:	Resolution better than 2 cm/tick
Wheel info:	Free from deadband behavior and linear with wheel rotation
Gyro (optional):	Accuracy: < 0.02°/s
Dynamic range:	± 60°/s to ± 125°/s
Linearity:	± 0.5°/s (full scale)

Support product

EVK-6V:	u-blox 6 Evaluation Kit Dead Reckoning, SW sensor

Ordering information

NEO-6V-0	u-blox 6 GPS module, Dead Reckoning SW sensor

Available as samples and tape on reel (250 pieces)

Samples available via u-blox' Online shop at
www.u-blox.com/en/online-shop.html

u-blox 6 standalone modules

u-blox 7 modules are recommended for new designs, see overview on page 15.

MAX
GPS module
9.7 x 10.1 x 2.5 mm

NEO
GPS module
12.2 x 16.0 x 2.4 mm

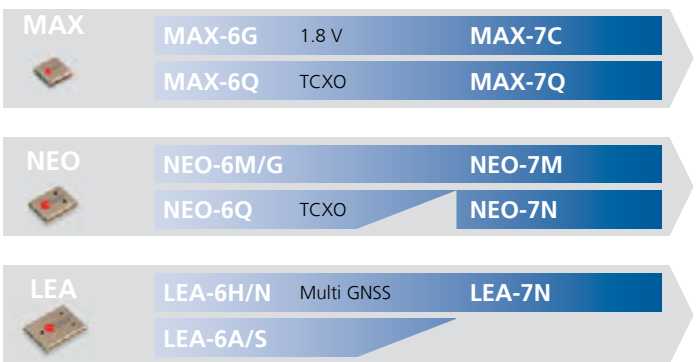
LEA
GPS/GNSS modules
17.0 x 22.4 x 2.4 mm

Model	Type						Supply			Interfaces				Features									
	GPS	QZSS	GLONASS	Timing	Dead Reckoning	Precise Point Positioning	2.7 V – 3.6 V	1.65 V – 3.6 V	1.75 V – 2.0 V	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	Data logger	Extra front-end LNA	Front-end SAW filter	Oscillator	RTC crystal	Antenna supply	Antenna short circuit detection / protection	Antenna open circuit detection pin	Timepulse	External interrupt / Wakeup
MAX-6G	•								•	•			•					T	•		o	o	•	•
MAX-6Q	•						•			•			•					T	•		o	o	•	•
NEO-6G	•								•	•	•	•	•					T	•		o	o	•	•
NEO-6M	•						•			•	•	•	•					C	•		o	o	•	•
NEO-6Q	•						•			•	•	•	•					T	•		o	o	•	•
LEA-6A	•						•			•	•		•					C	•	•	•	•	•	•
LEA-6H	•	F	F				•			•	•		•	•				T	•	•	•	•	•	•
LEA-6N	•	•	•				•			•	•		•	•				T	•	•	•	•	•	•
LEA-6S	•						•			•	•		•					T	•	•	•	•	•	•

O = Optional, not activated per default or requires external components
C = Crystal / T = TCXO

F = Firmware upgrade required

u-blox 6 to u-blox 7 module migration path



ANN-MS

High performance active GPS antenna

Highlights

- High performance active GPS antenna
- Low noise figure and high gain coverage
- Easy to use
- Fast and easy integration
- No antenna know-how necessary

Features

- High antenna gain coverage
- Low noise figure
- 5 m coaxial cable
- Magnetic base suitable for mounting on car roof
- Industrial temperature range: –40°C to +85°C
- Wide range of supply voltage: 2.7 V – 6 V

Patch antenna characteristics

Frequency	1575 ± 3 MHz
VSWR	Max. 2
Bandwidth	Min. 10 MHz
Impedance	50 Ω
Peak gain	Min. 4 dBic (over 7 x 7 cm ground plane)
Gain coverage	≥ –4 dBic at –90°C ≤ θ ≤ +90°C (over 75% volume)
Polarization	RHCP (Right-handed circular polarization)

Amplifier characteristics

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

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

ANN-MS
40 x 48 x 13 mm

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 V to 6 V.

Environmental data

Operating temperature	–40°C to +85°C
Storage temperature	–50°C to +85°C
Humidity	95% ~ 100% RH
Vibration	Sine sweep 1G (0-Peak), 10 – 150 – 10 Hz each axis

CE approval

Applicable standards	ETSI EN 301 489-19

Ordering information

ANN-MS-0-005-0	ANN active GPS antennas with 5m cable and SMA connector
ANN-MS-1-005-0	ANN Active GPS Antenna with 5m cable, SMB connector
ANN-MS-2-005-0	ANN Active GPS Antenna with 5m cable, MCX connector
ANN-MS-3-005-0	ANN Active GPS Antenna with 5m cable, FAKRA connector

Samples available via u-blox' Online shop at
www.u-blox.com/en/online-shop.html

Positioning chips

Overview

Based on a proprietary high-performance architecture with 56 parallel channels, u-blox' powerful range of GPS/GNSS positioning chips are ideal for consumer, industrial and automotive 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 –162 dBm and –148 dBm for coldstart
- Integrated Automotive Dead Reckoning and Precision Timing options
- Intelligent, user configurable power management for radically lower power consumption
- Low cost solution requires few external components and works with standard crystals
- Miniature outline packages ideal for small end products with tight space and low cost requirements
- Operating voltage down to 1.4 V
- Anti-Jamming architecture allows easy embedding in noisy electronics
- Automotive and standard grades
- GPS, GLONASS, QZSS; Compass & Galileo ready
- Assisted GPS support (AssistNow)

Product selector: GPS/GNSS positioning chips

GPS/GNSS receiver, chipscale package
UBX-G7020-CT
3.0 x 3.4 x 0.56 mm

GPS/GNSS receiver, single-chip
UBX-G7020-KT/KA
5.0 x 5.0 x 0.55 mm

Model	Package	Type						Supply			Interfaces				Features							
	Package	GPS	QZSS	GLONASS	Timing	Dead Reckoning	Compass & Galileo ready	1.4 V – 3.6 V	1.75 V – 2.0 V	2.5 V – 3.6 V	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	DC/DC Converter	Data logger	RTC crystal	Oscillator	Antenna supply and supervisor	Timepulse	External interrupt / Wakeup
UBX-G7020-CT	WL-CSP50	•	•	•			•	•			•	•	•	•	S	•	S	S	C/T	S	•	•
UBX-G7020-KT/KA	QFN40	•	•	•			•	•			•	•	•	•	S	•	S	S	C/T	S	•	•
UBX-G6010-ST-TM	QFN56	•			•				•	•	•	•	•	•				S	T*	S	•	•
UBX-G6010-SA-DR **UBX-G6010-ST-DR**	QFN56	•				•			•	•	•	•	•	•				S	C/T	S	•	•
UBX-G6010-NT	LGA45	•							•	•	•	•	•	•				S	C/T	S	•	•
UBX-G6010-SA **UBX-G6010-ST**	QFN56	•							•	•	•	•	•	•				S	C/T	S	•	•

C/T = Crystal and TCXO supported

T* = requires TCXO

S = supported, may require external components

UBX-G7020

u-blox 7 GPS, GLONASS & QZSS chips

Highlights

- Multi-GNSS engine for GPS, GLONASS, QZSS
- Galileo and Compass ready
- Minimal board space, <30 mm²
- Combines low power consumption and high sensitivity
- Minimal e-BOM, as few as 8 external parts
- Exceptional jamming immunity
- UART, USB, SPI, and DDC(I²C compliant) interfaces

UBX-G7020-CT
3.0 x 3.4 x 0.6 mm

UBX-G7020-KT
5.0 x 5.0 x 0.6 mm

UBX-G7020-KA
5.0 x 5.0 x 0.6 mm

Product description

The UBX-G7020 is the newest family of standalone positioning chips from u-blox. The high performance u-blox 7 multi-GNSS (GPS, GLONASS, QZSS, SBAS – Galileo and Compass ready) position engine 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 GPS/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								
	Package	GPS	QZSS	GLONASS	Timing	Dead Reckoning	Compass & Galileo ready	1.4 V – 3.6 V	1.75 V – 2.0 V	2.5 V – 3.6 V	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	DC/DC Converter	Data logger	RTC crystal	Oscillator	Antenna supply and supervisor	Timepulse	External interrupt / Wakeup
UBX-G7020-CT	WL-CSP50	•	•	•			•	•			•	•	•	•	S	•	•	S	C/T	S	•	•
UBX-G7020-KT/KA	QFN40	•	•	•			•	•			•	•	•	•	S	•	•	S	C/T	S	•	•

C/T = Crystal and TCXO supported

S = supported, may require external components

Receiver performance data

Receiver type	56-channel u-blox 7 engine GPS & QZSS L1 C/A, GLONASS L1OF, Galileo* E1B/C, Compass* ready SBAS: WAAS, EGNOS, MSAS	
Navigation update rate	up to 10 Hz	
Accuracy	GPS	GLONASS
Position	2.5 m CEP	4.0 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

Electrical data

Supply voltages	1.4 V – 3.6 V
Digital I/O voltage level	1.65 V – 3.6 V
Power consumption	35 mW @ 1.4 V (continuous) 9 mW @ 1.4 V Power Save Mode (1 Hz)
Backup supply	1.4 V to 3.6 V

Interfaces

Serial interfaces	1 UART 1 USB V2.0 full speed 12 Mb/s 1 DDC (I^2C compliant) 1 SPI
Digital I/O	Configurable time pulse 2 EXTINT interrupt inputs 2 GPIO for antenna supervision
Memory	SQI interface

Package

UBX-G7020-CT:	50 Pin WL-CSP 3.4 x 3.0 x 0.56 mm
UBX-G7020-KT/KA:	40 Pin MLF/QFN 5.0 x 5.0 x 0.55 mm

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)

Ordering information

UBX-G7020-CT	u-blox 7 GPS/GNSS chip, 50 Pin WL-CSP
UBX-G7020-KT	u-blox 7 GPS/GNSS chip, 40 Pin QFN
UBX-G7020-KA	u-blox 7 GPS/GNSS chip, 40 Pin QFN, automotive grade

UBX-G6010-ST-TM

u-blox 6 Precision Timing GPS/GNSS chip

Highlights

- Precision Timing:
  - o 2 timepulse outputs (up to 10 MHz)
  - o Single-satellite operation
  - o Stationary (survey-in) mode for enhanced timing accuracy
  - o Time mark of external event inputs
- Raw pseudo-range data output
- ROM-based for cost effectiveness
- High level of design flexibility
- Qualified according to AEC-Q100
- Manufactured in ISO/TS 16949 certified production sites

Features

- u-blox 6 position engine:
  - o Navigate down to –162 dBm and –148 dBm coldstart
  - o Configurable power management
  - o Hybrid GPS/SBAS engine (WAAS, EGNOS, MSAS)
  - o Anti-jamming technology
- Simple integration with u-blox wireless modules
- A-GPS: AssistNow Online and AssistNow Offline services, OMA SUPL compliant
- Operating temperature range: –40°C to +85°C
- Compatible with u-blox GPS Solution for Android

UBX-G6010-ST-TM
8.0 x 8.0 x 0.85 mm

Product description

The UBX-G6010-ST-TM provides precision GPS timing for demanding synchronization applications such as femto cells and WiMAX basestations. This GPS chip features user configurable frequency and timepulse outputs. An accuracy of up to 15 ns is achievable by using the quantization error information to compensate the granularity of the time pulse. The UBX-G6010-ST-TM features a time mode function whereby the GPS receiver assumes a stationary 3D position, whether programmed manually or determined by an initial self-survey.

During stationary operation GPS timing is possible with only one visible satellite. This means that time can be maintained even under adverse signal conditions or in environments with poor sky visibility. A built-in time mark and counter unit provide precise time measurement of external event inputs. T-RAIM (Timing Receiver Autonomous Integrity Monitoring) is available to detect faulty GPS measurements. UBX-G6010-ST-TM delivers raw pseudo-range data for specialist applications.

The UBX-G6010-ST-TM is the ideal GPS chip solution for high-volume Timing applications.

Product selector

Model	Package	Type						Supply			Interfaces				Features								
	Package	GPS	QZSS	GLONASS	Timing	Dead Reckoning	Compass & Galileo ready	1.4 V – 3.6 V	1.75 V – 2.0 V	2.5 V – 3.6 V	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	DC/DC Converter	Data logger	RTC crystal	Oscillator	Antenna supply and supervisor	Timepulse	External interrupt / Wakeup
UBX-G6010-ST-TM	QFN56	•			•				•	•	•	•	•	•				S	T*	S	•	•

T* = TCXO required

S = supported, may require external components

Receiver performance data

Receiver type	50-channel u-blox 6 engine GPS L1 C/A code SBAS: WAAS, EGNOS, MSAS	
Navigation update rate	up to 5 Hz	
Accuracy[1]	Position SBAS	2.5 m CEP 2.0 m CEP
Acquisition[1]	Cold starts: Aided starts[2]: Hot starts:	26 s 1 s 1 s
Sensitivity[3]	Tracking: Cold starts: Hot starts:	–162 dBm –148 dBm –157 dBm
Operational limits	Velocity: Altitude:	500 m/s 50,000 m

[1] All SV @ –130 dBm
[2] Dependent on aiding data connection speed and latency
[3] Demonstrated with a good active antenna

Electrical data

Supply voltages	1.75 V – 2.0 V 2.5 V – 3.6 V
Digital I/O voltage level	1.65 V – 3.6 V
Power consumption	67 mW @ 1.8 V (continuous)
Backup supply	Voltage range: 1.4 V to 3.6 V
RTC input	32.768 kHz (optional)
Oscillator	TCXO required
Antenna supervision	Short and open circuit detection supported with external circuit
Antenna type	Active and passive

Interfaces

Supply voltages	1 UART 1 USB V2.0 full speed 12 Mbit/s 1 DDC (I^2C compliant) 1 SPI
Digital I/O	2 configurable timepulse 2 EXTINT interrupt inputs 10 configuration pins

Package

UBX-G6010-ST-TM	56 Pin MLF: 8.0 x 8.0 x 0.85 mm

Environmental data, quality & reliability

Operating temp.	–40° C to +85° C
Storage temp.	–40° C to +125° C

RoHS compliant (lead-free) and green (no halogens)

Qualification according to ISO 16750

Manufactured in ISO/TS 16949 certified production sites

Timing performance data

Timing accuracy	RMS	30 ns
	99%	< 60 ns
	Granularity	21 ns
	Compensated	15 ns[4]

[4] Quantization error information can be used to compensate the granularity related error of the timepulse signal

Support products

u-blox 6 Evaluation Kits:
easy-to-use kit to get familiar with u-blox 6.

EVK-6T:	u-blox 6 Evaluation Kit with Precision Timing

u-blox 6 Chipset Development Kit

CDK-6X:	For information contact u-blox.

Ordering information

UBX-G6010-ST-TM	u-blox 6 GPS Precision Timing chip, 56 Pin MLF

UBX-G6010-SA-DR/UBX-G6010-ST-DR

u-blox 6 Dead Reckoning GPS chip

Highlights

- ADR (Automotive Dead Reckoning) technology:
  - o 100% coverage, continuous positioning even in tunnels
  - o Highly accurate and reliable navigation performance
  - o Automatic sensor calibration
- Pin compatible with u-blox UBX-G6010-SA/ST GPS chips
- ROM-based for cost effectiveness
- Requires no additional sensors[1]
- Qualified according to AEC-Q100
- Manufactured in ISO/TS 16949 certified production sites

[1] When onboard sensors are accessible to application processor

Features

- u-blox 6 position engine:
  - o Navigate down to –162 dBm and –148 dBm coldstart
  - o Hybrid GPS/SBAS engine (WAAS, EGNOS, MSAS)
  - o 1 Hz combined ADR+GPS navigation rate
  - o Anti-jamming technology
- Simple integration with u-blox wireless modules
- A-GPS: AssistNow Online and AssistNow Offline services, OMA SUPL compliant
- Operating temperature range: –40°C to +85°C
- 3GPP compliant
- Compatible with u-blox GPS solution for Android

UBX-G6010-SA-DR/UBX-G6010-ST-DR
8.0 x 8.0 x 0.85 mm

Product description

ADR (Automotive Dead Reckoning) is u-blox' industry proven off-the-shelf Dead Reckoning solution. u-blox' ADR combines GPS and sensor digital data using a tightly coupled Kalman filter. This improves position accuracy during periods of no or degraded GPS signal.

ADR supports a variety of sensors (such as wheel ticks and gyroscope) and receives the sensor data via UBX messages from the application processor. Digital sensor data is available on the vehicle bus. This reduces hardware costs since no extra sensors are required for Dead Reckoning functionality. ADR is designed for simple integration and easy configuration of different sensor options (e.g. DR with or without gyroscope) and vehicle variants, and is completely self-calibrating.

u-blox ADR is available with UBX-G6010 single chips, or as an optional FW upgrade with the UBX-G6000/G0010 chipset. UBX-G6010-SA-DR is intended for tier-one automotive customers. UBX-G6010-SA-DR and UBX-G6010-ST-DR chips are pin compatible with standard UBX-G6010 chips.

Solution overview

The u-blox ADR solution consists of four functional elements:

- Sensors: Various combinations available in cars supported (e.g. gyroscope & speedpulse or differential wheel tick)
- Vehicle bus: Transmits the digital sensor data
- Application processor:
  Converts sensor data to UBX messages
- ADR chip: Processes GPS and sensor data into position

Product selector

Model	Package	Type						Supply			Interfaces				Features								
	Package	GPS	QZSS	GLONASS	Timing	Dead Reckoning	Compass & Galileo ready	1.4 V – 3.6 V	1.75 V – 2.0 V	2.5 V – 3.6 V	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	DC/DC Converter	Data logger	RTC crystal	Oscillator	Antenna supply and supervisor	Timepulse	External interrupt / Wakeup
UBX-G6010-SA-DR/ UBX-G6010-SA-DR	QFN56	•				•			•	•	•	•	•	•				S	C/T	S	•	•

C/T = Crystal and TCXO supported

S = supported, may require external components

Receiver performance data

Receiver type	50-channel u-blox 6 engine GPS L1 C/A code SBAS: WAAS, EGNOS, MSAS	
Navigation update rate	1 Hz (GPS + ADR)	
Accuracy[1]	Position SBAS	2.5 m CEP 2.0 m CEP
Acquisition[1] Cold starts: Aided starts[2]: Hot starts:	TCXO 26 s 1 s 1 s	Crystal 27 s < 3 s 1 s
Sensitivity[3] Tracking: Cold starts: Hot starts:	TCXO –162 dBm –148 dBm –157 dBm	Crystal –161 dBm –147 dBm –156 dBm
Operational limits	Velocity: Altitude:	500 m/s 50,000 m

[1] All SV @ –130 dBm
[2] Dependent on aiding data connection speed and latency
[3] Demonstrated with a good active antenna

Electrical data

Supply voltages	1.75 V – 2.0 V 2.5 V – 3.6 V
Digital I/O voltage level	1.65 V – 3.6 V
Power consumption	67 mW @ 1.8 V (continuous) 20 mW @ 1.8 V Power Save Mode (1 Hz)
Backup supply	Voltage range: 1.4 V to 3.6 V
RTC input	32.768 kHz (optional)
Antenna supervision	Short and open circuit detection supported with external circuit
Antenna type	Active and passive

Interfaces

Serial interfaces	1 UART 1 USB V2.0 full speed 12 Mb/s 1 DDC (I^2C compliant) 1 SPI
Digital I/O	Configurable time pulse 2 EXTINT interrupt inputs 10 configuration pins

Package

UBX-G6010-SA-DR/ UBX-G6010-ST-DR	56 Pin MLF: 8.0 x 8.0 x 0.85 mm

Environmental data, quality & reliability

Operating temp.	–40° C to +85° C
Storage temp.	–40° C to +125° C

RoHS compliant (lead-free) and green (ho halogens)

Qualification according to ISO 16750

Manufactured in ISO/TS 16949 certified production sites

ADR performance and requirements

u-blox ADR supports four standard sensor configurations: Rear wheel sensors, Front wheel sensors, 4 wheel sensors, and Gyro + speedpulse. The digital data provided by the sensors is converted to proprietary UBX messages by the application processor.

Sensor option	Typ. position error[4, 5]
Rear wheels:	12%[6]
Front wheels:	13%[6]
Four wheels:	10%[6]
Gyro + speedpulse:	5%[6]

[4] Values obtained with typical sensor latency of 40 ms and expected jitter of <5 ms.
[5] With GPS reception: position error with ADR (GPS + Sensor) is as good as or better than u-blox standard GPS receiver (GPS only).
[6] Percentage of distance travelled without GPS.

Sensor requirements

Wheel tick:	Resolution better than 2 cm/tick
Wheel info:	Free from deadband behavior and linear with wheel rotation.
Gyro (optional):	Accuracy: < 0.02°/s Dynamic range: ±60°/s to ±125°/s Linearity: ±0.5°/s (full scale)

Support products

EVK-6V	u-blox 6 Evaluation Kit Dead Reckoning with SW sensor

Ordering information

UBX-G6010-SA-DR	u-blox 6 ADR single chip (automotive grade), 56 Pin MLF
UBX-G6010-ST-DR	u-blox 6 ADR single chip (standard grade), 56 Pin MLF

Wireless modules

Overview

u-blox offers wireless transceiver modules based on GSM/GPRS, UMTS/HSPA(+) and CDMA mobile communications standards. Our SARA, LEON, LISA and FW series of wireless modules provide embedded GSM/GPRS, UMTS/HSPA and CDMA2000 modem functionality in ultra-small form factors. u-blox' advanced, thoroughly qualified, certified and 100% tested wireless modules provide an easy-to-implement solution to add cellular connectivity to end-products quickly and cost-effectively.

LISA series
22.4 x 33.2 x 2.7 mm

u-blox wireless modules are optimized for mass market machine-to-machine applications requiring mobile connectivity such as asset and personal tracking, fleet management, automatic vehicle locaters, network connected personal and car navigation systems, Automatic Meter Reading (AMR), Remote Monitoring Automation and Control (RMAC), security, vending machines, and Point of Sales (PoS) terminals.

FW75-C200
33.9 x 35.0 x 3.3 mm

SARA series
16.4 x 26.5 x 3.0 mm

High bandwidth applications requiring mobile broad-band Internet connectivity such as car infotainment and telehealth systems are also supported.

For telematics applications, the ability to communicate directly with u-blox positioning modules via a 2-wire I^2C interface allows for simple control of both components via a single UART.

LEON series
18.9 x 29.5 x 3.0 mm

Most u-blox wireless modules are also equipped with an embedded AssistNow client and TCP/IP stack to instantly enable Internet connectivity and assisted-GPS capabilities via u-blox' globally-available AssistNow online service. SARA, LEON and LISA also support u-blox' CellLocate hybrid cellular/GPS positioning service to facilitate indoor positioning, see page 76 for details.

Key benefits

- Off-the-shelf GSM/GPRS, UMTS/HSPA(+) and CDMA2000 connectivity
- Small footprint ideal for compact designs for applications with strict space constraints
- Low idle mode current for long battery life
- Embedded TCP/IP stack, multiple socket & multiple IP addresses
- Layout compatibility: SARA and LEON GSM module series migrate easily to u-blox UMTS/HSPA(+) & CDMA 1xRTT modules
- Embedded Assisted GPS client for faster GPS start-up
- Proprietary CellLocate hybrid positioning technology for indoor positioning
- PCI Express products for North American consumer markets
- Standard and automotive quality grades
- Approved and certified solutions
- Fast time-to-market: Reference designs and evaluation tools minimize design-in time and effort
- In-band modem versions support European eCall and Russian ERA-GLONASS emergency call systems

SARA-G3 series

Versatile 2.5G GSM/GPRS modules

Highlights

- GSM/GPRS functionality scalable to customer needs
- Easy migration to u-blox W-CDMA & CDMA 1xRTT modules
- Extremely small footprint
- Lowest standby current: < 0.99 mA
- Extended temperature range: –40 to +85°C
- Simple integration of u-blox GPS/GNSS and A-GPS
- CellLocate™: location based on cellular network
- ISO 16759 qualification
- Manufactured in ISO/TS 16949 certified production sites

SARA-G3 series
16.0 x 26.0 x 3.0 mm

Product description

The SARA-G3 series is the latest family of u-blox GSM/GPRS modules, featuring 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-G350 is a full feature quad-band GSM/GPRS module with a comprehensive feature set including an extensive set of internet protocols (TCP, UDP, HTTP and FTP). SARA-G350 also provides fully integrated access to u-blox GPS/GNSS positioning chips and modules, along with embedded A-GPS (AssistNow Online and AssistNow Offline) functionality. SARA-G350 allows customers to develop M2M devices with minimal 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.

u-blox wireless modules are certified and approved by the main regulatory bodies and operators, and 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

Module	Bands		Interface					Audio		Functions												
	GSM/GPRS quad band	GSM/GPRS dual band (900/1800 MHz)	UART	SPI	USB	DDC for u-blox GPS	GPIO	Analog Audio	Digital Audio	Network indication	Antenna Supervisor	Jamming Detection	Embedded TCP/UDP	FTP, HTTP, SMTP	SSL	GPS via Modem	AssistNow software	FW update via serial	FOTA	In-band modem	CellLocate	Idle mode
SARA-G300		•	2															•				E
SARA-G310	•		2															•				E
SARA-G350	•		2			•	4	•	•	•	•	•	•	•		•	•	•	A		•	•
SARA-G350 eCall	•		2			•	4	•	•	•	•	•	•	•		•	•	•	A	•	•	•

A = available upon request

E = external 32 kHz signal required

Features

GSM	GSM 850/900/1800/1900 MHz [1, 2] GSM 900 /1800 MHz [3] 3GPP Release 99
GPRS	GPRS Class 10, CS1-CS4 - up to 85.6 kb/s [1] GPRS Class 2, CS1-CS4 - up to 42.8 kb/s [2, 3] PBCCH support
CSD [1]	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
FW upgrade	Via UART
SARA-G350 only:	
Voice	HR / FR / EFR / AMR Echo cancellation Noise reduction
Protocols	Embedded TCP/IP, UDP/IP, HTTP/FTP
Network	Jamming detection
GNSS Interfaces	Direct access to u-blox GPS via SARA-G350 AssistNow software for faster acquisition CellLocate & Hybrid positioning
Special features [4]	inBand modem eCall and ERA/GLONASS support

[1] SARA-G350
[2] SARA-G310
[3] SARA-G300
[4] SARA-G350-51S

Package

96 pin LGA: 16.0 x 26.0 x 3.0 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

Certifications and approvals

SARA modules will offer a comprehensive set of regulatory certifications and approvals. Available certifications will be posted on the **u-blox website**.

Electrical data

Power supply	3.00 to 4.50 V (extended)	
Power consumption	Power Off:	< 60 µA
	Idle mode[5]:	< 2 mA
	GSM voice[6]:	< 240 mA
	GPRS Class 10[6]:	< 240 mA

[5] SARA-G300 and SARA-G310: requires external 32 kHz signal
[6] SARA-G350 only

Support product

EVK-G35	Evaluation Kit for SARA-G350
EVK-G31	Evaluation Kit for SARA-G300/G310
RIL software	Android 2.3, Embedded Windows 6.x, 7.x, Windows Mobile 6.5

Interfaces

Common to all modules:	
Antenna	50 Ω SMT pad
Serial Port	1 UART for data and AT Commands 1 UART for tracing and firmware update
SIM	1.8 V and 3 V
SAR-G350 only:	
GPIO	4, controllable over AT commands
GNSS serial	1 DDC (I^2C)
Audio	1 analog 1 digital (I^2S/PCM)

Ordering information

SARA-G350-xxS[7]	Quad-band GSM/GPRS module, extended feature set
SARA-G350-51S	Quad-band GSM/GPRS module, ready for eCall / ERA-GLONASS
SARA-G310-xxS[7]	Cost optimized quad-band GSM/GPRS data module
SARA-G300-xxS[7]	Cost optimized dual-band (900/1800 MHz) GSM/GPRS data modul

SARA-G350 automotive grade variant is available upon request.

[7] xx refers to firmware version.

LEON-G100/G200

2.5G quad-band GSM/GPRS modules

Highlights

- Full feature quad-band GSM/GPRS, class 10
- Easy forward migration to u-blox LISA UMTS/HSPA and CDMA 1xRTT modules
- Lowest standby current: < 0.99 mA
- Extended temperature range: –40 to +85°C
- Simple integration of u-blox GPS/GNSS and A-GPS
- CellLocate™: location based on cellular network
- ISO 16750 qualification
- Manufactured in ISO/TS 16949 certified production sites

LEON-G100/G200
18.9 x 29.5 x 3.0 mm

Product description

LEON-G100/G200 modules provide full feature quad-band GSM/GPRS data and voice communication in a compact and cost optimized SMT form factor. LEON modules are fully qualified and certified and feature extremely low power consumption and a rich set of Internet protocols. They are ideally suited to M2M and automotive applications such as: Fleet management, Automatic Meter Reading (AMR), people and asset tracking, surveillance and security and Point of Sales (PoS) terminals.

LEON modules implement fully integrated access to u-blox GPS receivers. Wireless and GPS are controlled through a single serial port from any host processor, and A-GPS (AssistNow Online and AssistNow Offline) functionality is integrated.

The compact SMT package enables easy manufacturing, and simple forward migration to u-blox LISA UMTS/HSPA and CDMA 1xRTT modules and seamless GSM to UMTS and GSM to CDMA handover. 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.

LEON 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

Module	Bands	Interface					Audio		Functions												
	GSM/GPRS quad band	UART	SPI	USB	DDC for u-blox GPS	GPIO	Analog Audio	Digital Audio	Network indication	Antenna Supervisor	Jamming Detection	Embedded TCP/UDP	FTP, HTTP, SMTP	SSL	GPS/GNSS via Modem	AssistNow software	FW update via serial interface	FOTA	In-band modem	Battery charging	CellLocate
LEON-G100	•	1			1	4	2	1	•	•	•	•	•		•	•	•	A			•
LEON-G100 eCall	•	1			1	4	2	1	•	•	•	•	•		•	•	•	A	•		•
LEON-G200	•	1			1	4	2	1	•	•	•	•	•		•	•	•	•		•	•

A = available upon request with LEON-G100 Automotive module

Features

GSM	GSM 850 / 900 / 1800 / 1900 MHz 3GPP Release 99 PBCCH support
GPRS	Class 10, CS1-CS4 – up to 85.6 kb/s
CSD	GSM max 9.6 kb/s
Voice	HR / FR / EFR / AMR Echo cancellation Noise reduction
AT Commands	3GPP 27.005, 3GPP 27.007 u-blox AT command extension 3GPP 27.010 MUX protocol
SMS	MT/MO PDU / Text mode

Software features

Protocols	Embedded TCP/IP, UDP/IP, HTTP/FTP
Network	Jamming detection
GPS Interfaces	Direct access to u-blox GPS via LEON AssistNow software for fastest GPS Time-to-First-Fix CellLocate & Hybrid positioning
AT commands	3GPP 27.005, 3GPP 27.007 u-blox proprietary AT command 3GPP 27.010 MUX protocol
Firmware upgrade	Via UART (Xmodem protocol) FOTA[1]
Special features[2]	InBand modem eCall and ERA-GLONASS support

[1] LEON-G200 only
[2] LEON-G100-ECALL

Electrical data

Power supply	3.0 V – 4.50 V (extended range)	
Power consumption	Power Off:	< 90 µA
	Idle mode[3]:	
	DRX9:	< 0.99 mA
	DRX5:	< 1.60 mA
	GSM Voice:	< 300 mA
	GPRS Class 10:	< 410 mA

[3] GSM and GPRS attach

Interfaces

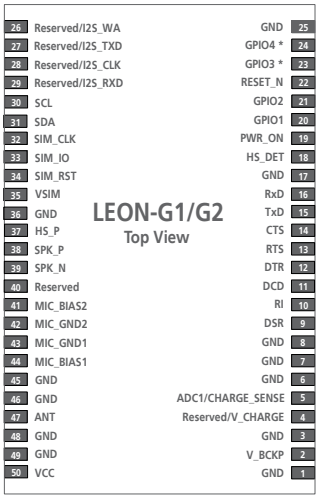
Antenna	50 Ω Antenna detection
Serial port	1 UART 1 DDC (I²C) for GPS communication
Audio lines	2 audio analog 1 audio digital (I²S/PCM) interface
SIM	1.8 V and 3.0 V
GPIO	4, controllable over AT commands
RTC	Internal
A/D converter	1, accessible via AT commands

[4] LEON-G100 only

Package

50 pin LCC (Leadless Chip Carrier):
18.9 x 29.5 x 3.0 mm, < 5 g

Pinout



* LEON-Gx00-06S only. Reserved on previous 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

Certifications and approvals

R&TTE, CE, GCF, PTCRB, FCC, IC, NCC, ICASA, A-Tick, AT&T, Rogers, Orange. See **website** for latest approvals.

Support product

EVK-G20	Evaluation Kit for LEON-G100/G200
RIL software	Android 2.3 Embedded Windows 6.x, 7.x, Windows Mobile 6.5

Ordering information

LEON-G100-xxS[5]	Quad-band GSM/GPRS module
LEON-G100-51S	Quad-band GSM/GPRS module, ready for eCall / ERA-GLONASS
LEON-G200-xxS[5]	Quad-band GSM/GPRS module with extended feature set

Automotive grade variants are available upon request.

[5] xx refers to firmware version.

Delivery packing Tape on reel (250 pieces)

Samples available via u-blox' Online shop at
www.u-blox.com/en/online-shop.html

LISA-U2 series

3.75G UMTS/HSPA modules

Highlights

- Worldwide WCDMA(UMTS) and GPRS/EDGE coverage
- HSDPA 21.1 Mb/s, HSUPA 5.76 Mb/s
- SMT form factor, small foot-print
- Easy migration from u-blox GSM/GPRS modules
- Low idle mode current: 1.5 mA
- Extended temperature range: –40 to +85°C
- Simple integration of u-blox GPS/GNSS and A-GPS
- CellLocate™: location based on cellular network
- Manufactured in ISO/TS 16949 certified production sites

LISA-U2 series
22.4 x 33.2 x 2.7 mm

Product description

With 6-band WCDMA(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 modules provide fully integrated access to u-blox GPS receivers.Antenna diversity permits LISA-U2 modules to provide the highest data speeds.

LISA modules are ideal for consumer and industrial applications requiring high-speed data transmission rates, 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 or LEON GSM/GPRS and LISA-C2 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

Module	Technology		Bands		Interface					Audio		Functions											
	HSUPA [Mb/s]	HSDPA [Mb/s]	UMTS/HSPA [MHz]	GPRS/EDGE quad-band	UART	SPI	USB	DDC for u-blox GPS	GPIO	Analog Audio	Digital Audio	Network indication	Antenna Supervisor	Jamming Detection	Embedded TCP/UDP	HTTP, FTP, SSL	GPS via Modem	AssistNow software	FW update via serial	FOTA	In-band modem	Rx diversity	CellLocate
LISA-U200	5.76	7.2	800/850/900/1700/1900/2100	•	1	1	1	1	14		2	•	•	•	•	•	•	•	•		R		•
LISA-U230	5.76	21.1	800/850/900/1700/1900/2100	•	1	1	1	1	14		2	•	•	•	•	•	•	•	•		R	•	•
LISA-U260	5.76	7.2	850/1900	•	1	1	1	1	14		2	•	•	•	•	•	•	•	•				•
LISA-U270	5.76	7.2	900/2100	•	1	1	1	1	14		2	•	•	•	•	•	•	•	•				•

R = Available upon request.

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)
Network	Jamming detection
GPS Interfaces	Direct access to u-blox GPS via LISA AssistNow software for fastest GPS Time-to-First-Fix CellLocate & Hybrid Positioning
Firmware upgrade	Via UART and USB

Electrical data

Power supply	3.3 V to 4.4 V
Power consumption	
Power Off	50 µA
Idle (2G, DRX5)	1.5 mA
Idle (3G, DRX7)	1.6 mA
GSM Voice	190 mA (Bands II & III)
UMTS Voice	460 mA (Band V)
GPRS Data	190 mA (1 Tx slot, Bands II & III) 450 mA (4 Tx slots, Bands II & III)
HSDPA (cat 8)	580 mA (Band V)
HSPA	460 mA (Band V)

Interfaces

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

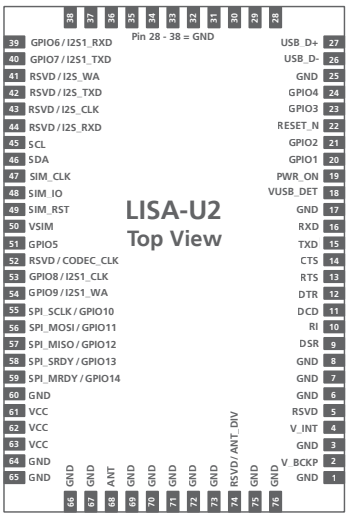
Certifications and approvals

GCF, R&TTE, PTCRB, FCC, IC, JATE/TELEC (Japan), A-tic (Australia), AT&T, DoCoMo, Telstra, Vodafone.

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

Support products

EVK-U20/-U23	Evaluation Kit for LISA-U2 series
RIL software	Android 2.3 & 4,0, 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

Ordering information

LISA-U200-xxS[3]	UMTS/HSPA, 800/850/900/1700/1900/2100 MHz, quad-band GPRS/EDGE
LISA-U230-xxS[3]	UMTS/HSPA+, 800/850/900/1700/1900/2100 MHz, quad-band GPRS/EDGE
LISA-U260-xxS[3]	UMTS/HSPA, 850/1900 MHz, quad-band GPRS/EDGE
LISA-U270-xxS[3]	UMTS/HSPA, 900/2100 MHz, quad-band GPRS/EDGE

3 xx refers to firmware version.

Samples available via u-blox' Online shop at
www.u-blox.com/en/online-shop.html

LISA-U1 series

3.75G UMTS/HSPA modules

Highlights

- Dual-band HSPA: HSUPA 5.76 Mb/s, HSDPA 7.2 Mb/s
- Quad-band GSM/GPRS/EDGE, class 12
- SMT form factor, small foot-print
- Easy migration from u-blox GSM/GPRS modules
- Low idle mode current: < 2 mA
- Extended temperature range: –40 to +85°C
- Simple integration of u-blox GPS/GNSS and A-GPS
- CellLocate™: location based on cellular network
- Manufactured in ISO/TS 16949 certified production sites

LISA series
22.4 x 33.2 x 2.7 mm

Product description

The LISA-U1 series provides dual-band HSPA high-speed data and voice communication, and quad-band GSM/GPRS/EDGE, in a compact SMT form factor.

Features include 7.2 Mb/s HSDPA download and 5.76 Mb/s HSUPA upload speeds, a rich set of Internet protocols, and very low power consumption. LISA offers fully integrated access to u-blox GPS receivers. Wireless and GPS are controlled through a single serial port from any host processor. LISA-U1 modules are ideal for all applications requiring very high data transmission rates such as mobile Internet terminals, in-car infotainment, connected navigation systems, eCall, Security and surveillance, anti-theft systems, and Internet Gateways.

The compact SMT package enables easy manufacturing, and migration from u-blox LEON GSM/GPRS 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-U1 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

Module	Technology		Bands		Interface					Audio		Functions											
	HSUPA [Mb/s]	HSDPA [Mb/s]	UMTS/HSPA [MHz]	GPRS/EDGE quad-band	UART	SPI	USB	DDC for u-blox GPS	GPIO	Analog Audio	Digital Audio	Network indication	Antenna Supervisor	Jamming Detection	Embedded TCP/UDP	FTP, HTTP, SSL	GPS via Modem	AssistNow software	FW update via serial	FOTA	In-band modem	Rx Diversity	CellLocate
LISA-U100	5.76	7.2	850/1900	•	1	1	1	1	5			•	•	•	•	•	•	•	•				•
LISA-U110	5.76	7.2	900/2100	•	1	1	1	1	5			•	•	•	•	•	•	•	•				•
LISA-U120	5.76	7.2	850/1900	•	1	1	1	1	5	1	1	•	•	•	•	•	•	•	•				•
LISA-U130	5.76	7.2	900/2100	•	1	1	1	1	5	1	1	•	•	•	•	•	•	•	•				•

Features

UMTS/HSPA	900/2100 MHz (Bands VIII, I), or 850/1900 MHz (Bands V, II) 3GPP Release 6 5.76 Mb/s uplink, 7.2 Mb/s downlink
GSM	GSM 850 / 900 / 1800 / 1900 MHz 3GPP Release 99, PBCCH support
GPRS	Class 12, CS1-CS4 – up to 85.6 kb/s
EDGE	Class 12, MCS1-MCS9 – up to 236.8 kb/s
CSD	GSM max 9.6 kb/s UMTS max 64 kb/s
Voice[1]	HR/FR/EFR/AMR/AMR-WB Echo cancellation, Noise reduction
SMS	MT/MO PDU / Text mode

[1] LISA-U120/U130 only.

Software features

Protocols	Embedded TCP/IP, UDP/IP HTTP/FTP/SSL (Secure Socket Layer)
Network	Jamming detection
GPS Interfaces	Direct access to u-blox GPS via LISA[2] AssistNow software for fastest GPS Time-to-First-Fix CellLocate & Hybrid Positioning
Firmware upgrade	Via UART and USB

Electrical data

Power supply	3.4 V – 4.2 V
Power consumption	
Power Off	< 90 µA
Idle (GSM/UMTS)	< 2 mA
GSM Voice	< 250 mA
UMTS Voice	< 640 mA
GPRS data	< 560 mA
EDGE Data	< 460 mA
HSDPA	< 670 mA
HSUPA	< 500 mA

Interfaces

Audio[1]	1 Audio, 1 Digital
GPIO	5 GPIOs, configurable
(U)SIM	Supports 1.8 V and 3.0 V, SIM toolkit
Serial	1 UART 1 DDC (I²C) for GPS communication 1 USB 2.0 (full speed, 480 Mb/s) 1 SPI

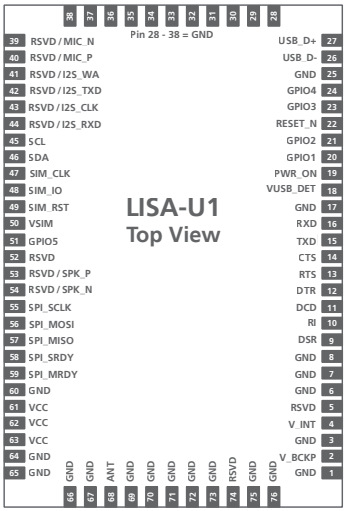
Certifications and approvals

R&TTE, CE, GCF, PTCRB, FCC, IC, JATE/TELEC, NCC, KC, ICASA, A-Tick, AT&T, Rogers, Softbank, SKT.
See **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 –40 to +85°C (extended range)
RoHS compliant (lead-free)
Qualification according to ISO 16750
Manufactured in ISO/TS 16949 certified production sites

Support products

EVK-U12, EVK-U13	Evaluation Kits for LISA-U1 series
RIL software	Android 2.3 & 4.0, 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

Ordering information

LISA-U100-xxS[3]	HSPA 850/1900 MHz, quad-band GPRS/EDGE, data only (no voice)
LISA-U110-xxS[3]	HSPA 900/2100 MHz, quad-band GPRS/EDGE, data only (no voice)
LISA-U120-xxS[3]	HSPA 850/1900 MHz, quad-band GPRS/EDGE, voice and data
LISA-U130-xxS[3]	HSPA 900/2100 MHz, quad-band GPRS/EDGE, voice and data

Versions available for Japan (Softbank) and Korea (SKT).

[2] xx refers to firmware version

Samples available via u-blox' Online shop at
www.u-blox.com/en/online-shop.html

LISA-C2 series

CDMA 1xRTT module

Highlights

- Dual-band CDMA2000 1xRTT 800 MHz/1900 MHz
- SMT form factor, extremely small foot-print
- Low power consumption
- Pin/pad compatible with u-blox LISA W-CDMA and LEON GSM/GPRS data modules
- USB 2.0 and serial interfaces
- 27.010 MUX support
- Sprint and Verizon approvals

LISA-C2 series
22.4 x 33.2 x 2.7 mm

Product description

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

LISA-C2 modules are ideally suited to M2M and automotive 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, SARA and LEON module families, enabling straight-forward development of products supporting either CDMA, UMTS/HSPA, or GSM/GPRS wireless technology with the same application board. This allows customers to take maximum advantage of their hardware and software investments.

Product selector

Module	Technology	Bands	Interface					Audio		Functions												
	CDMA 1xRTT [kb/s] (forward/reverse)	CDMA [MHz]	UART	SPI	USB	DDC for u-blox GPS	GPIO	Analog Audio	Digital Audio	Network indication	Antenna Supervisor	Jamming Detection	Embedded TCP/IP	Embedded UDP/IP	Embedded FTP	Embedded HTTP	GPS via Modem	AssistNow software	FW update via serial	FOTA	In-band modem
LISA-C200	153	800/1900	1		1		5	1	1				•	•	•	•			U	•	

U = via USB only

Features

CDMA2000 1xRTT	800/1900 MHz (Sprint and Verizon bands) 153 kb/s forward/reverse
Voice	Analog / digital*
SMS	Text mode
Carrier provisioning	Over-the-Air (Sprint) OTASP/OTAPA (Verizon)

* Digital audio available with FW 025 / 22S

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 USB FOTA (Sprint)

Electrical data

Power supply	3.3 V to 4.4 V
Power consumption	
Power Off	< 20 µA
Sleep mode	< 15 mA
Idle mode	< 100 mA
Data traffic	< 800 mA

Interfaces

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

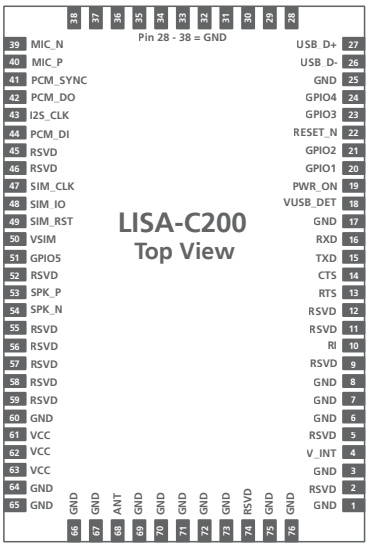
Certifications and approvals

FCC, IC, Sprint, Verizon.
See **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)

Support products

EVK-C20	Evaluation Kit for LISA-C200

Ordering information

LISA-C200-0xS[1]	CDMA 2000 1xRTT 800/1900 MHz, data and voice, Sprint
LISA-C200-2xS[1]	CDMA 2000 1xRTT 800/1900 MHz, data and voice, Verizon

[1] x refers to firmware version.

FW75-C200

CDMA 1xRTT module

Highlights

- Dual-band CDMA2000 1xRTT 800 MHz/1900 MHz
- Drop in compatible with existing GSM, GPRS, and EDGE modules
- Low power consumption
- USB 2.0 and serial interface
- 27.010 MUX support
- Sprint and Verizon approvals

FW75-C200
33.9 x 35.0 x 3.3 mm

Product description

The u-blox FW75-C200 module provides dual-band CDMA2000 1xRTT data and communication in an easy to integrate board to board form factor. The FW75-C200 features extremely low power consumption and a rich set of Internet protocols and is ideally suited to M2M and automotive applications such as: Fleet management, Automatic Meter Reading (AMR), people and asset tracking, surveillance and security and Point of Sales (PoS) terminals.

Supporting a comprehensive AT commands and drop in compatibility with existing GSM, GPRS, and EDGE modules, the FW75-C200 is the ideal solution to bring CDMA connectivity into existing GSM-based designs.

Product selector

Module	Technology	Bands	Interface				Audio		Functions											
	CDMA 1xRTT [kb/s] (forward/reverse)	CDMA	UART	SPI	USB	GPIO	Analog Audio	Digital Audio	Network indication	Antenna Supervisor	Jamming Detection	Embedded TCP/IP	Embedded UDP/IP	Embedded FTP	Embedded HTTP	GPS	AssistNow software	FW update via serial	FOTA	Rx Diversity
FW75-C200	153	800/1900	•		•							•	•	•	•			U	•	

U = via USB only

Features

CDMA 2000 1xRTT	800/1900 MHz (Sprint and Verizon bands) 153 kb/s
SMS	Text mode
Carrier provisioning	Over the Air (Sprint) OTASP/OTAPA (Verizon)

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 USB FOTA (Sprint)

Interfaces

Antenna	1 U.FL-R-SMT 50 Ω antenna connector
Board to board	80 pin connector Molex 0529910808
Serial	1 UART (5 wire) 1 USB 2.0 (full-speed)

Electrical data

Power supply	3.3 V to 4.4 V
Power consumption	Power Off <20 µA Sleep mode <15 mA Idle mode <100 mA Data traffic mode <800 mA
RF sensitivity	–107.0 dBm, ± 0.5 dBm (Typical)
Max. output	+25 dBm, ± 0.5 dBm (Typical)

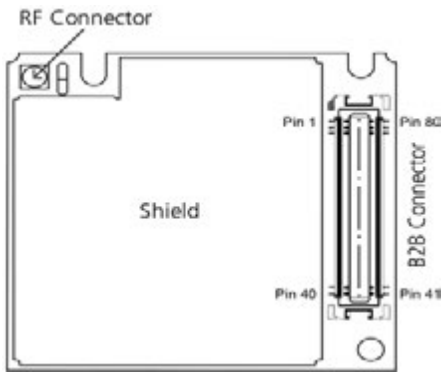
Approvals

FCC, IC, Sprint, Verizon.
See **website** for latest approvals.

Package

80 pin Board to Board Connector:
33.9 x 35.0 x 3.3 mm, < 10 g

Layout



Environmental data, quality & reliability

Operating temperature –30 to +85°C (extended range)

RoHS compliant (lead-free)

Supported standards

- IS-2000 (CDMA2000 Release 0) MOB_P_REV 6
- IS-95A/IS-95B (JSTD-008) backward compatibility (MOB_P_REV1,3,4,5)
- TIA/EIA-98F minimum RF performance
- TIA/EIA-637A; two-way SMS
- TIA/EIA-683A; OTASP and OTAPA

Support products

EVK-C21	Evaluation Kit for FW75 module

Ordering information

FW75-C200-0xS[1]	1xRTT module with B2B connector, data only, 800/1900 MHz, Sprint
FW75-C200-2xS[1]	1xRTT module with B2B connector, data only, 800/1900 MHz, Verizon

[1] x refers to firmware version.

FW2763p / FW2770p

CDMA PCI Express modules

Highlights

- FW2763p: CDMA2000 1xRTT modem supporfting data rates up to 153 kb/s (forward and reverse link)
- FW2770p: CDMA2000 EV-DO Rev A modem supporting data rates up to 3.1 Mb/s (forward link) and 1.8 Mb/s (reverse link)
- Dual band 800/1900 MHz
- PCI Express Mini Card form factor
- USB 2.0 interface
- A-GPS (optional)
- Rx diversity (FW2770p)
- Sprint and Verizon approvals

FW2763p
30.0 x 51.0 x 4.5 mm

FW2770p
30.0 x 51.0 x 4.5 mm

Product description

The u-blox FW2770p module provides a full-featured EV-DO Rev A dual band CDMA. This high speed module supports EV-DO Rel 0 and 1xRTT networks and is ideally suited to consumer applications requiring high data transmission rates such as laptop and tablet connectivity, mobile Internet terminals and internet gateways.

The u-blox FW2763p module provides a full-featured CDMA 2000 1xRTT solution. This module is ideally suited to consumer applications such as laptop and tablet connectivity, mobile Internet terminals, and internet gateways.

Both modules come in an easy to integrate PCI Express Mini Card form factor and are fully certified and available with or without GPS to meet customer requirements. Supporting a comprehensive AT command feature set, the module provide quick time to market and optimal performance.

Product selector

Module	Technology			Bands	Interface					Audio		Functions									
	CDMA EV-DO [Mb/s] (forward)	CDMA EV-DO [Mb/s] (reverse)	CDMA 1xRTT [kb/s] (forward/reverse)	CDMA	UART	SPI	USB	I²C	GPIO	Analog Audio	Digital Audio	Network indication	Antenna Supervisor	Jamming Detection	Embedded TCP/UDP	FTP, HTTP, SSL	GPS	AssistNow software	FW update via serial	FOTA	Rx Diversity
PCI-C100			153	800/1900			1					•			•				•	•	
PCI-C101			153	800/1900			1					•			•		•		•	•	
PCI-D100	3.1	1.8	153	800/1900			1					•			•				•	•	•
PCI-D101	3.1	1.8	153	800/1900			1					•			•		•		•	•	•

Features

FW2763p: CDMA2000 1xRTT	800/1900 MHz 153 kb/s uplink and downlink
FW2770p: CDMA EV-DO Rev A	800/1900 MHz 3.1 Mb/s (forward link) 1.8 Mb/s (reverse link)
SMS (all)	MT/MO PDU / Text mode

Software features

Protocols	Embedded TCP/IP and UDP/IP SMS Client with inbox functionality
Network	Over-the-Air (OTA) provisioning, software maintenance, and device management
AT commands	Enhanced AT command set: IS-707.3, GSM 07.05, GSM 07.07, ITU-T V.25 as applicable
Firmware upgrade	Via Serial FOTA

Interfaces

RF	2 Hirose UFL-R_XMT (50 Ω) Connectors (main and GPS)
Communication	1 USB 2.0 (high-speed, 480 Mb/s)
R-UIM	Supported

Electrical data

Power supply	VAUX for Mini PCIe (3.3 V)
Power consumption	Sleep mode < 2 mA Idle mode ~100 mA Data traffic mode ~800 mA
RF sensitivity	–106.5 dBm, ±0.5 dBm (Typical)
Max. output	+24 dBm, ±0.5 dBm (Typical)

Certifications and approvals

FCC, CDG1 and 2, CCF, Sprint and Verizon approvals. See **website** for latest approvals.

Package

52 pin PCI Express Mini Card, 30 x 51 x 4.5 mm, 12 g

Environmental data, quality & reliability

Operating temp.	–30°C to +85°C
Storage temp.	–40°C to +105°C

RoHS compliant (lead-free)

Supported standards

- IS-856-A (CDMA1xEV-DO Rev A) – FW2770p only
- IS-856 (CDMA1xEV-DO Rel 0) – FW2770p only
- IS-2000 (CDMA2000 Release 0) MOB_P_REV 6
- IS-95A/IS-95B (JSTD-008) backward compatibility (MOB_P_REV1,3,4,5)
- TIA/EIA-98F minimum RF performance
- TIA/EIA-637A; two-way SMS
- TIA/EIA-683A; OTASP and OTAPA
- TIA/EIA-707A; data service options, CSD
- OMA-DM version 1.2

Support products

EVK-C10	Evaluation Kit for FW2763p
EVK-D10	Evaluation Kit for FW2770p

Ordering information

PCI-C100-xxS[1]	FW2763p: 1xRTT PCI Express Mini Card, 800/1900 MHz
PCI-C101-xxS[1]	FW2763p: 1xRTT PCI Express Mini Card, 800/1900 MHz, with GPS
PCI-D100-xxS[1]	FW2770p: EV-DO PCI Express Mini Card, 800/1900 MHz
PCI-D101-xxS[1]	FW2770p: EV-DO PCI Express Mini Card, 800/1900 MHz, with GPS.

[1] xx refers to firmware version.

Services

Overview

AssistNow™ global online service for accelerated positioning

Users expect instant position information. During coldstart 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.

u-blox' AssistNow online service delivers global satellite position data 24/7

Assisted GPS (A-GPS) accelerates calculation of position by instantly delivering the necessary satellite data such as Ephemeris, Almanac, accurate time and satellite status to GPS receivers via wireless networks such as GSM/GPRS or the Internet. The aiding data enables a GPS receiver to compute a position within seconds, even under poor GPS satellite signal conditions.

Based on information gathered from its global network of satellite tracking stations, u-blox offers AssistNow service to its customers worldwide via the Internet based on a highly reliable online AssistNow Server. Both Online and Offline option are available.

u-blox also supports a new feature, AssistNow Autonomous. Available on all u-blox 6/7 GPS receivers, this feature adds embedded GPS satellite orbit prediction capability for even faster positioning without relying on any external aiding data.

Read about u-blox' AssistNow service on page 60.

CellLocate™: hybrid solution for indoor positioning

u-blox' proprietary cellular/GPS positioning service merges mobile phone cell information with GPS/GNSS to improve positioning in areas where GPS signals are weak, jammed, or completely blocked.

CellLocate combines mobile cell and/or GPS 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

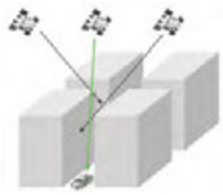
u-blox' CellLocate cellular positioning technology is a feature implemented in u-blox SARA, LEON and LISA GSM and UMTS wireless modem families.

Increased reliability and indoor positioning based on mobile network attributes

AssistNow™

u-blox A-GPS services

The challenge of stand-alone GPS



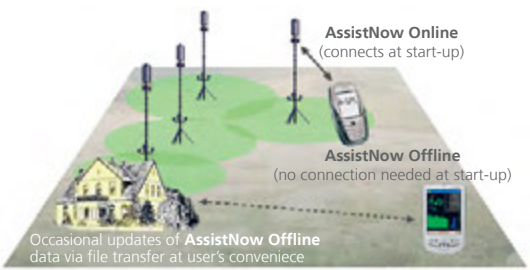
GPS users expect instant position information. With standard GPS this is often not possible because at least four satellites must be identified, and their complete orbital position data (called Ephemeris) received. Under adverse signal conditions, data downloads from the satellites to the receiver can take minutes, hours or even fail altogether. Assisted GPS (A-GPS) accelerates calculation of position by delivering satellite data such as Ephemeris, Almanac, accurate time and satellite status to the GPS receiver via wireless networks or the Internet. This aiding data enables a GPS receiver to compute a position within seconds, even under poor signal conditions.

AssistNow A-GPS

AssistNow Online and AssistNow Offline are u-blox' end-to-end A-GPS services for OEM customers and their end users. These services boost GPS acquisition performance for devices with or without network connectivity. AssistNow Online and AssistNow Offline can either be used alone or in combination.

AssistNow A-GPS 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 wireless modules feature an embedded AssistNow client making integration simple.

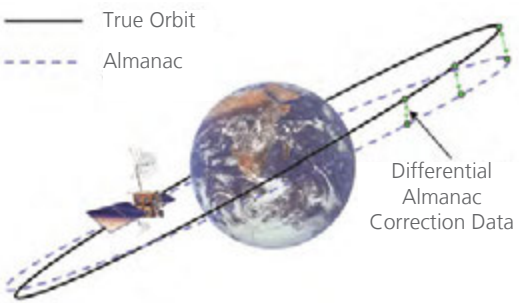


AssistNow Online

With AssistNow Online, an internet-connected GPS device downloads assistance data from u-blox' 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

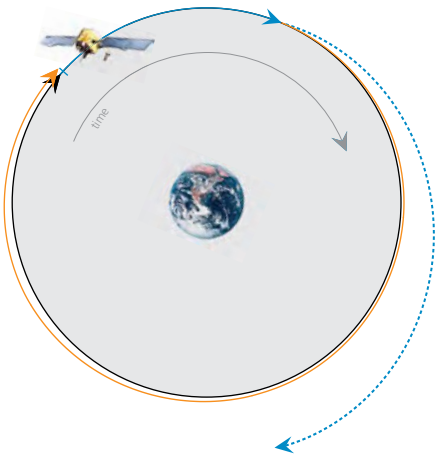
With AssistNow Offline, users download u-blox' Differential Almanac Correction Data from the Internet at their convenience. The correction data is then transferred to the mobile terminal via TCP/IP, serial port, memory card, etc, and can either be stored in the GPS receiver's memory or in the memory 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 14 days. The size of these files increases with the length of the prediction period, from as little as 3 kB to 90 kB. Positioning accuracy decreases with the length of the correction data duration, with 1–3 day data providing relatively high accuracy and 10–14 day data progressively less accuracy. Regular updates help to ensure a high level of position accuracy.

AssistNow Autonomous

AssistNow Autonomous is an embedded feature available free-of-charge that accelerates GPS positioning by capitalizing on the periodic nature of GPS satellite orbits. GPS orbit predictions are directly calculated by the GPS 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)
- Assist**Now** 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 GPS products
- Easy to install and use
- u-blox wireless modules include an embedded AssistNow client for effortless implementation

Free and premium service options

AssistNow data is collected by u-blox' 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

Please contact u-blox to obtain access to the free AssistNow service.

This service is available to u-blox OEM customers and their end-customers.

	AssistNow Online	AssistNow Offline	AssistNow Autonomous
Data download frequency	At every startup	Once every 14 days	Never
Data retrieval at start-up	Data downloaded from server	Pre-downloaded data from local memory	Retrived from local memory
Aiding data type	Ephemeris, almanac, time, health	Differential almanac correction data	Automatically generated
Data validity period	2 – 4 hours	14 days	Up to 3 days
Size of downloaded data	1 – 3 kB	10 kB (1 day) ... 90 kB (14 days)	None
Acquisition (TTFF) performance	As low as 1 second	As low as 5 seconds	As low as 10 seconds
Standard service	Best-effort	Best effort	Embedded best effort
Premium service	Guaranteed availability based on service level agreement	Guaranteed availability based on service level agreement	Not applicable

CellLocate™

Mobile network-based hybrid positioning

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 wireless data modules and GNSS receivers, has developed and embedded a cellular positioning technology, CellLocate, into its SARA and LEON families of GSM/GPRS and LISA family of UMTS wireless 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 wireless network coverage (GSM/GPRS and/or UMTS), a specific combination of wireless cells will be visible. The proprietary CellLocate feature allows u-blox GSM/GPRS and UMTS wireless modules to report to the CellLocate server those cells which are visibile 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 output by the module to the host processor via its serial port.

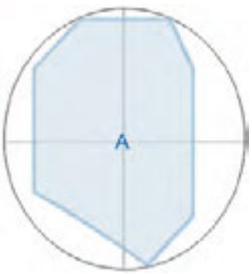
Cellular location

Wireless cells are widely available in urban and rural environments enabling the CellLocate service to provide a position estimate virtually everywhere and under any conditions.

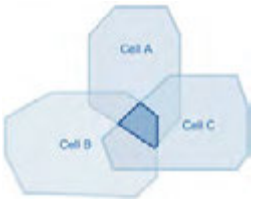
The service is offered free of charge on a best effort basis and the performance depends on the density of network cells and database population. A self learning mechanism is implemented allowing continuous database improvement and update in order to increase performance over time and prevent database aging.

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



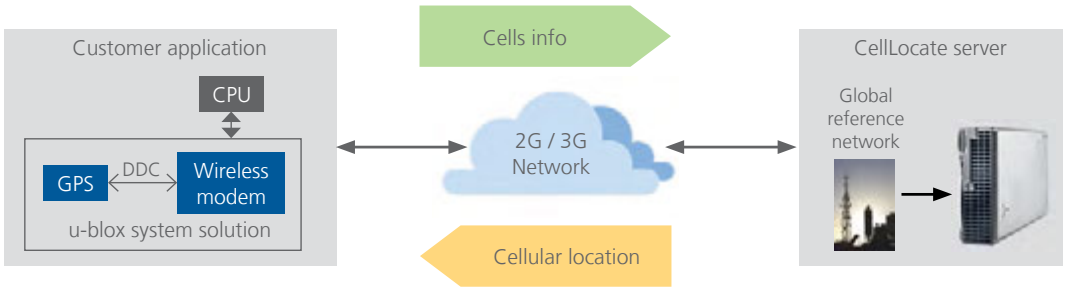
Visibility of multiple cells provides even better coverage and accuracy

CellLocate and hybrid positioning

CellLocate and hybrid positioning are u-blox' end-to-end services for OEM customers and their end-users. These services enhance and complement stand-alone GNSS acquisition performance when u-blox wireless modules and GNSS modules or chips are used.

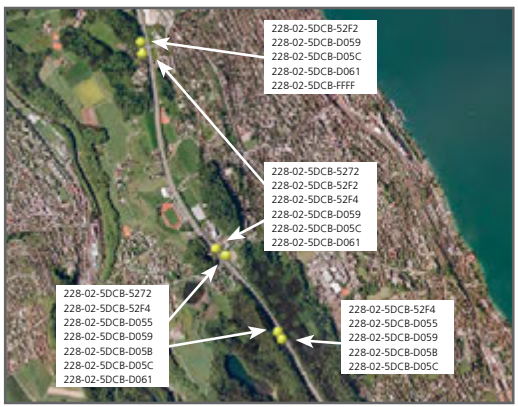
u-blox implementation provides a single AT command interface enabling full control of the GNSS receiver and cellular positioning functionality in order to maximize performance and virtually eliminate any "no position scenario". Through the single AT command interface it is possible to define all the positioning settings (cellular, stand-alone GNSS, GNSS aiding data) and enable the wireless module to optimize positioning performance.

CellLocate and hybrid services are fully integrated into u-blox wireless 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 and UMTS/HSPA modules



CellLocate enabled devices	SARA-G350 (from version 01 onwards) LEON-G100 (from version 06 onwards) LISA-U1x0 (from version 01 onwards) LISA-U2x0 (from version 01 onwards)
Supported network technologies	GSM/GPRS 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' worldwide offices provide you with GPS/GNSS and wireless technology experts to ensure the success of your designs (see list of our global locations on page 86). 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 and m-center PC software supports our GPS/GNSS and wireless modules and may be downloaded free-of-charge from our website. See pages 66 and 67 for details.

Evaluation Kits for u-blox' GPS/GNSS receivers, GSM, UMTS and CDMA modem families plus complete reference designs are also available. For more information please visit our website at **www.u-blox.com/en/support-section.html.**

Evaluation Kits and samples can be ordered via our Online shop or ordered directly from u-blox.

Visit our Online shop at **www.u-blox.com/en/online-shop.html**.

C16 telematics reference design

Global online services

u-blox also provides globally accessible, highly-reliable Internet-based online services for Assisted GPS (AssistNow, see page 60). AssistNow provides optional support to all u-blox GPS receivers worldwide with accurate satellite position aiding data to dramatically reduce GPS Time-To-First-Fix, especially during cold start and weak signal conditions.

u-blox also provides it's CellLocate online service free of charge to facilitate indoor positioning. The service capitalizes on hybrid GPS/cellular positioning to provide a fix when GPS signals are weak or absent. CellLocate supports u-blox' SARA, LEON GSM and LISA UMTS wireless 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
- 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**.

u-center

GPS/GNSS evaluation software

Highlights

- Interactive and easy to use
- Extensive GPS/GNSS configuration and control features
- Supports all u-blox positioning products
- Access to all controls and output messages
- Enables comparative performance analysis of positioning products that output NMEA messages
- Free of charge

u-center includes

- Support for NMEA and u-blox UBX binary protocol
- Integrated AssistNow A-GPS client functionality
- Structured and graphical data visualization in real-time:
  - o Satellite summary view (SV)
  - o Navigation summary view
  - o Compass, speedometer, clock, altimeter
  - o Chart view of any two parameters of choice
  - o Data recording and playback functionality
- Docking views (real-time cockpit instruments): Satellite constellation, compass, clock, altimeter, speedometer, GPS 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 u-blox positioning products.

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. Output position to Google Maps and Google Earth.

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 GPS/GNSS evaluation Software provides a powerful platform for product evaluation, configuration, testing and real-time performance visualization of u-blox GPS/GNSS receiver products. u-center provides AssistNow client functionality for A-GPS. 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 GPS/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 7, WIndows Vista, or Windows XP.

Ordering information

u-center is available free of charge and can be downloaded from our website **www.u-blox.com**:
Support -> Kits & tools -> Evaluation software section

m-center

Wireless evaluation software

Highlights

- Allows simple evaluation of **SARA, LEON** and **LISA-U** wireless 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 module activity
- 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/GNSS modules
- Intelligent driver detection

Visualization

The very simple graphical user interface allows the user to perform common GSM/GPRS/UMTS 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 module activity to facilitate sending of binary data to u-blox customer support.

Product description

The m-center wireless evaluation software is a powerful and easy to use tool for evaluating, configuring, and testing of u-blox wireless modules. It includes an intuitive, easy to understand and easy to use graphical interface. m-center is available free-of-charge.

Configuration and control options

m-center provides a convenient means to configure u-blox' wireless modules and save the configuration in the module Flash. It is also possible to view and edit SIM phonebook entries, send text messages, and communicate with the wireless module using AT commands.

m-center can be used to restore the wirless module's factory default settings and to perform traces. In addition, when using u-blox wireless Evaluation Kits, m-center allows for simple communication with the onboard GPS/GNSS module.

Hardware platform

m-center supports PCs running Windows 7, WIndows Vista, or Windows XP.

Ordering information

m-center is available free of charge and can be downloaded from our website **www.u-blox.com**:
Support -> Kits & tools -> Evaluation software section.

Android solution / u-center Android

Evaluation & integration software for Android GPS/GLONASS

Highlights

- Allows easy integration of GPS/GLONASS functionality in Android-based products
- Royalty-free GPS/GLONASS library, licensed for reuse in customer products
- GPS/GLONASS evaluation and visualization app

u-blox Android solution includes

- GPS/GLONASS driver library
- u-center Android GPS/GLONASS evaluation App
- Documentation explaining implementation

Solution description

u-blox' GPS/GLONASS Android solution enables customers to easily integrate and evaluate GPS/GLONASS functionality in their Android-based end products. The solution includes A-GPS capabilities for high performance GPS as well as Terminal and Network based positioning on mobile operator networks.

u-blox Android GPS/GLONASS solution is available free of charge. The royalty-free GPS/GLONASS hardware driver library is licensed for re-use in customer products and available upon request.

u-center Android GPS/GLONASS evaluation App

The u-blox Android solution includes u-center Android, a specially modified Android version of u-blox' powerful GPS/GLONASS evaluation tool. u-center Android enables the visualization of location data and GPS/GLONASS status published by the Android framework.

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 GPS/GLONASS satellites including signal strength and position, heading, altitude, velocity and GPS/GLONASS time-of-day.

Messages and satallite information

u-center Android allows you to check the NMEA messages from the receiver and the basic information of each satellite (e.g. azimuth, elevation, status).

Visualization

u-center Android allows you to visualize GPS/GLONASS traces on top of picture files of maps of any scale. A quick look at a trace on a map reveals a lot about the GPS/GLONASS receiver's performance. This feature is only available with devices supporting Google Maps.

Supported Products

Solution supports all u-blox positioning products.

Ordering information

For further details and to obtain u-blox' GPS/GLONASS Driver Library, please contact the u-blox sales representative nearest you. To download u-center Android visit our website or the Android Market:
market.android.com/details?id=com.ublox.ucenter

System requirements

u-center Android supports Android versions 2.1 and above. GPS/GLONASS Driver Library supports Android versions 2.3 to 4.0.

RIL software for wireless modules

Radio interface layer for u-blox wireless modems

Highlights

- Quick and easy integration of u-blox wireless modules into Android and Windows Embedded based designs
- Free of charge for u-blox customers

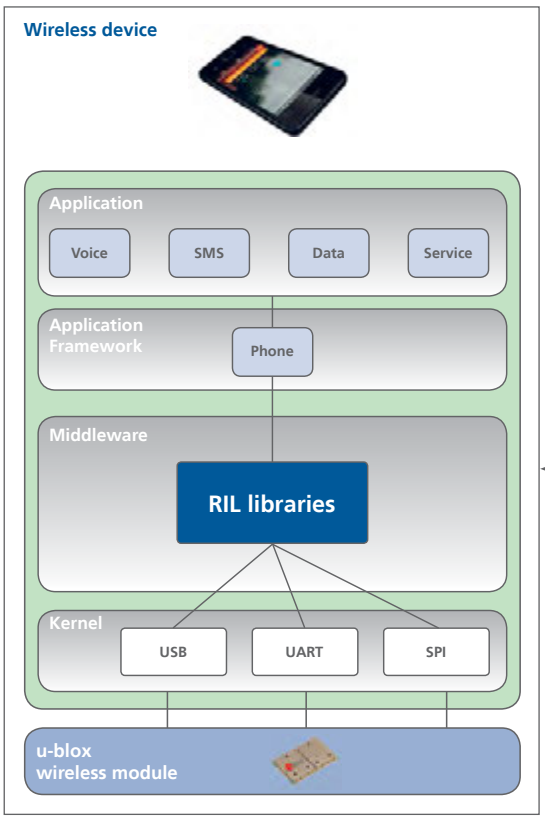
Features

- 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 wireless modules into Android and Windows Embedded based designs.

The software is available free of charge for u-blox customers.



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 environment.

- **Operating systems supported**
  Android 2.3 (Gingerbread)
  Android 4.0 (Ice cream sandwich)
  Windows Embedded 6.0 (Win CE)
  Windows Embedded 7.0

- **Wireless modules supported**
  SARA-G3 series
  LEON-G100 (only Windows Embedded)
  LISA-U1 series
  LISA-U2 series
  FW2763p (Android 2.3)
  FW2770p (Android 2.3)

For more details, visit **www.u-blox.com/en/support-section.html** or contact the u-blox sales representative nearest you.

SUPPORT

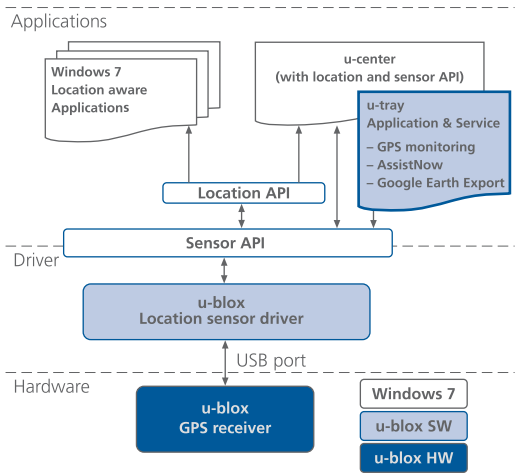
u-tray

GPS tray application for Windows 7

Highlights

- Provides basic GPS Monitoring: Satellite coordinates, altitude, speed, quality of GPS signal reception
- Easy A-GPS:
  Instantaneous connection to u-blox AssistNow A-GPS server
- Satellite View
  - o Sky and GPS satellite View
  - o Satellite signal strength Graph
- Location View
  - o Latitude, longitude, altitude, velocity
  - o GPS Status (Acquisition, Tracking)
  - o Export of current position for display on Google Earth
- Supports all USB based u-blox positioning products
- Free of charge

u-tray framework



u-tray screenshots and interface to Google Earth

Product description

u-tray is a tray application developed by u-blox to support real-time GPS satellite monitoring in Windows 7. u-tray provides a convenient graphical view of visible satellite parameters provided by a USB-connected u-blox GPS receiver. The receiver communicates to u-tray via the Windows 7 Sensor and Location platform. u-tray also provides automatic support for u-blox' AssistNow assisted-GPS service available worldwide via the Internet.

u-tray for Windows 7 is either available as freeware or can be customized to specific customer requirements.

System requirements

- Supports PCs running Microsoft Windows 7 Home Premium, Professional and Ultimate (32 bit, 64 bit)
- u-blox USB Windows 7 Sensor driver
- Internet connection for A-GPS functionality

Support products

u-tray supports all USB based u-blox positioning products

Ordering information

u-tray is available free of charge and can be downloaded from our website.

For OEM-customized options of u-tray please contact the u-blox sales representative nearest you.

Evaluation kits and reference designs

Design tools for u-blox positioning and wireless products

Positioning evaluation kits 	Evaluation kits are available to support the following u-blox positioning products: **Positioning chips & modules with TCXO:** • EVK-7N: supports UBX-G7020 chips, MAX-7Q, NEO-7N, LEA-7N • EVK-6H: supports LEA-6H, LEA-6S, MAX-6G, MAX-6Q, NEO-6G and NEO-6Q **Positioning chips & modules with crystal:** • EVK-7C: supports UBX-G7020 chips, MAX-7C,NEO-7M • EVK-6P: supports LEA-6A and NEO-6M **Positioning chips & modules with Dead Reckoning:** • EVK-6R: supports LEA-6R • EVK-6V: supports NEO-6V and UBX-G6010-ST/SA-DR **Positioning module with Precise Point Positioning:** • EVK-6PPP: supports NEO-6P **GPS chip & modules with Precision Timing:** • EVK-6T: supports LEA-6T, NEO-6T and UBX-G6010-ST-TM
Wireless evaluation kits 	u-blox wireless evaluation kits are available to support the following GSM, UMTS (WCDMA) and CDMA2000 modems: **GSM/GPRS evaluation kit:** • EVK-G20 supports SARA-G3 series and LEON-G100/G200 GSM/GPRS modules **UMTS (WCDMA) evaluation kits:** • EVK-U20 supports LISA-U200, LISA-U260 and LISA-U270 • EVK-U23 supports LISA-U230 **CDMA2000 evaluation kits:** • EVK-C20 supports LISA-C200 (Sprint & Verizon versions) • EVK-C21 supports FW75-C200 (Sprint & Verizon versions) • EVK-C10 supports FW2763p (Sprint & Verizon versions) • EVK-D10 supports FW2770p (Sprint & Verizon versions) **Wireless adapter boards:** • ADP-G200 supports LEON-G100/G200 • ADP-G350 supports SARA-G3 • ADP-C200 supports LISA-C200 • ADP-U200 supports LISA-U200 • ADP-U230 supports LISA-U230
Wireless and GPS reference designs 	u-blox reference designs for telematics are complete, integrated solutions for telematics applications such as fleet management, asset tracking, road pricing, and security/surveillance: **GSM/GPRS/GPS reference designs:** • C16 telematics reference design with integrated SMT antennas and SIM card holder (LEON-G200 GSM/GPRS module plus NEO-6Q GPS module) Includes populated PCB, schematics, gerber files, application note, and documentation. Sold in small quantities only.

Note: most evaluation kits and reference designs can be ordered via **u-blox' Online Shop.**
For detailed information: visit our **website.**

Technology & quality

Overview

At the core of our philosophy is our passion to deliver high-performance, small-profile, low power, and cost-effective embedded wireless and GPS/GNSS receiver components and solutions to our customers. Whether for professional applications such as fleet management or asset tracking, vehicle services such as eCall/ERA-GLONASS, remote metering, security and surveillance systems or consumer devices such as smartphones, tablets and personal trackers, u-blox has the right technology to deliver the sensitivity, connectivity, noise immunity, low-power and compact size required by today's and tomorrow's demanding applications.

Beyond GPS: u-blox 7

To help system designers address the expanding range of GNSS systems, plus demanding criteria such as low-power and small size, u-blox has introduced u-blox 7, the company's seventh-generation GNSS receiver platform based on the new UBX-G7020 multi-GNSS receiver chip.
Read more on Page 74

Hybrid positioning

u-blox' proprietary CellLocate™ cellular/GPS positioning architecture merges mobile phone cell information with GPS to improve positioning in areas where GPS signals are weak, jammed, or completely blocked.
Read more on Page 76

eCall / ERA-GLONASS

u-blox' GPS and GLONASS receivers combined with verified eCall and ERA-GLONASS compatible wireless modems and test environments are ideal for the latest vehicle emergency call systems being deployed in Europe and Russia.
Read more on Page 77

Multi-GNSS support

With Russia's GLONASS satellite navigation system now full operational, u-blox has developed GLONASS receiver technology based on the u-blox 7 satellite positioning platform. In addition to GPS, u-blox 7 is also compatible with QZSS and is Galileo and Compass-ready.
Read more on Page 78

Automotive Dead Reckoning

When GPS signals are blocked (e.g. in tunnels or indoor car parks) u-blox' Automotive Dead Reckoning (ADR) technology allows uninterrupted vehicle navigation based on heading and distance data provided by external sensors.
Read more on Page 79

Precise Point Positioning (PPP)

For mapping, marine, and recreational applications, PPP provides sub-meter accuracy based on u-blox' proprietary algorithm combined with ionospheric correctional data such as SBAS.
Read more on Page 80

Precision Timing and Reference Frequency

u-blox' GPS clock synchronization technology allows globally distributed computer and telecom systems to synchronize their clocks as well as generate accurate reference frequences continuously and cost effectively.
Read more on Page 81

u-blox' module roadmap philisophy

When it comes to GPS/GNSS modules, u-blox adheres to a core design philosophy: maintain module form factor and footprint continuity to allow customers to easily upgrade their products with each successive generation of u-blox positioning modules.
Read more on Page 82

Wireless module layout compatibility

When designing wireless modem products that must accommodate GSM, UMTS, and/or CDMA2000 variants, 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 wireless modems.
Read more on Page 83

u-blox 7

Beyond GPS

u-blox multi-GNSS chip
UBX-G7020-CT
3.0 x 3.4 x 0.6 mm
(Chip Scale Package)

u-blox multi-GNSS chip
UBX-G7020-KT
5.0 x 5.0 x 0.6 mm
(QFN-40)

u-blox multi-GNSS chip
UBX-G7020-KA
5.0 x 5.0 x 0.6 mm
(QFN-40, automotive)

To help system designers address the expanding range of GNSS systems and augmentation services, as well as other demanding criteria such as low-power consumption and small size, u-blox has paid special attention to the following design considerations with the release of u-blox 7, the company's seventh-generation GNSS receiver platform based on the new UBX-G7020 multi-GNSS receiver chip:

- **Low-power consumption:** as GNSS is mainly used in small, battery-powered mobile devices (positional information, after all, is most useful when tracking moving objects with no access to the power mains), power consumption is the most important feature of u-blox' multi-GNSS receiver chip. Consuming only one-third the power of the nearest competing solution, as low as 9 mW in power-saving mode, the UBX-G7020 is the lowest power multi-GNSS receiver IC on the market. It supports GPS/GLONASS/Galileo/COMPASS/QZSS and all SBAS augmentation services.
- **Small size and flexible interfacing:** for chip-based designs, a small yet easily mountable chip with low eBOM and flexible interfacing results in the most compact design. The UBX-G7020-CT provides these features in a 3.0 x 3.4 mm chip scale package (CSP) supporting USB, I^2C, SPI and UART interfaces. With built-in LNA, LDOs and DC/DC converter and on-chip ROM, a complete GNSS system can be realized with only 8 external components on a PCB area of less than 30 mm^2.
- **Module form-factor continuity:** for module-based designs, the constantly moving target of GNSS systems and their availability means each successive design upgrade should be possible without expensive hardware change: simply interchange the receiver module on the same footprint and upload new firmware. u-blox continues this "future-proof" tradition of form-factor and layout consistency with u-blox 7 and its industry standard LEA, NEO and MAX modules.
- **Design flexibility:** u-blox supports all deployed GNSS systems while at the same time providing "hardware-ready" receivers that can adapt to systems that are not yet available or fully characterized. u-blox supports this philosophy as it allows designers to create devices supporting deployed standards on ROM-based modules, yet with flash versions available to adapt to satellite systems which are still in the trial phase such as Galileo and Compass.
- **Standard and automotive grade:** the UBX-G7020 continues u-blox' support of applications in consumer, industrial as well as automotive markets (UBX-G7020-KA conforms to AEC-Q100 and ISO/TS 16949 quality and manufacturing standards).

u-blox 7: features for Telematics

Next generation multi-GNSS modules raise the bar for tracking performance

Positioning modules based on the new u-blox 7 multi-GNSS platform bring numerous attractive features to a wide range of telematics applications. In particular, they support the newly operational Russian GLONASS satellite navigation system in addition to GPS.

Based on u-blox' industry standard and backward compatible form factors MAX (the industry's smallest GLONASS module!), NEO and LEA, they integrate all necessary passive components. The three module series cover a range of cost and performance optimized features to perfectly suit your designs. All are fully

tested, drop-in positioning solutions; just add power and antenna!

Extremely low power consumption also means u-blox 7 modules are the best solution for battery or solar powered tracking applications used for fleet and asset management, security applications, anti-theft, emergency call, and people tracking systems.

u-blox 7 and indoor positioning
The modules are also compliant with u-blox' CellLocate™ hybrid "indoor positioning" technology. When used together with u-blox' GSM or UMTS wireless modules (LEON/LISA series), the unique solution enables standalone location estimation based on surrounding 2G/3G cell information in conjunction with GPS positioning data. CellLocate™ delivers better results than GPS technology can accomplish alone, even when GPS satellite signals are 100% blocked, such as within buildings.

The bottom line: for telematics applications, u-blox GNSS receiver chips and modules provide market-leading value when it comes to size, power consumption, performance, features and cost. Contact u-blox for more details!

u-blox 7: perfect for Digital Still Cameras

u-blox 7 has been designed with multi-GNSS compatibility, low-power and small size as prime considerations. This is especially attractive to manufacturers of Digital Still Cameras (DSCs) where compact, sleek designs have integrated tracking and photo-geotagging capabilities while still supporting long battery life, a tall order!

With dimensions of only 3.0x3.5x0.56 mm in Chip Scale Package, the UBX-G7020 is among the smallest standalone GNSS receive chips on the market. Together with only 8 necessary external components, this results in a complete standalone GNSS receiver design occupying a PCB area of less than 30 mm^2, a key feature for integration into extremely small, cost-conscious DSC designs.

To support camera features such as historical tracking of locations, showing where the photographer has been, the chip supports continuous output of position, velocity and time via a data logging port. The dedicated logging interface supports SQI flash, giving DSC manufacturers the option to use small size, low cost, flash memory with densities up to 64MB. With various options for datalogging frequency, a large amount of positional data can be stored.

u-blox 7: features for Mobile Computing

With u-blox GPS technology a standard feature in many of today's mobile computing products such as notebooks, tablets and smartphones, consumer expectations continue to focus on rich location-based apps, instantaneous position fix, long battery life and small, sleek product designs.

To minimize space requirements, the UBX-G7020-CT is among the world's smallest standalone multi-GNSS chips resulting in a standalone positioning subsystem that fits within 30 mm^2 of PCB space. The chip is also available in QFN40 whose pinout will remain static for future generations, facilitating ease of hardware and feature upgrade.

Interfacing applications with the chip is made easy by the availability of drivers for Windows 7/8 based on the Intel platform with additional drivers for Windows 8 for ARM available soon. USB, I^2C, UART, SPI, and SQI interfaces are included, making system integration simple and flexible.

u-blox supports the chip with a complete Android solution which enables easy integration of u-blox GPS/GNSS functionality in Android-based end-products such as smartphones and tablets. It includes a royalty-free GPS library, licensed for reuse in customer products.

With complete documentation and reference designs available, module versions for quick evaluation, and a well-defined product roadmap, the UBX-G7020 is a perfect solution to enable location based features in all mobile computing products.

Hybrid positioning

Combining GPS with cellular attributes

Although GPS is a widespread technology, GPS positioning is not always possible, particularly in shielded environments such as indoors and enclosed park houses, or when a GPS jamming signal is present. The situation can be improved by augmenting GPS receiver data with mobile network cell attributes to provide a level of redundancy that can benefit numerous applications.

u-blox, through its in-house development of wireless transceiver modules, has embedded cellular positioning technology, CellLocate, into its SARA, LEON family of 2G and LISA-U family of 3G wireless modules. The technology enables stand-alone location estimation based on surrounding GSM cell information in conjunction with GPS positioning data to improve positioning in several use cases:

- **GPS signals are blocked:** a GPS receiver cannot determine a position when satellite signals are unavailable, such as within tunnels, buildings, or metallic containers. For fleet and supply chain management, this condition can be unacceptable. In this case a cell-based positioning system using GSM cell information can provide an estimated position. This is attractive for vehicle or container tracking applications where an approximate location of valuable assets is preferable to no position fix at all. This system is functional within warehouses, rail stations, airports and tunnels.
- **GPS signals are jammed:** GPS jamming devices are easily obtained for less than a hundred dollars. These devices can neutralize GPS receivers, and are often employed during vehicle theft. A backup cell-based system in this case acts as a secondary system, as GSM cell signals are available even when satellite signals are blocked by jamming. The GPS receiver can also add intelligence to the system as u-blox GPS receivers can detect when a jamming signal is present, putting the system into an "attempted theft" condition.
- **Machine-to-Machine (M2M) applications:** Many M2M applications require positioning capability within a bounded area such as within a city, along main vehicle or rail links, or within specific venues such as an exhibition, entertainment or healthcare facilities. Positioning reliability in these areas can be improved by using cellular signals as well as GPS to provide accurate positioning. Based on an extension of u-blox' AssistNow Online GPS assistance service, u-blox' CellLocate technology is used to match cellular positioning data coupled with previously successful GPS fixes.

This "learning" solution can be practical for M2M applications where units are repeatedly used in specific areas such as a taxi fleet in a city, or containers and palettes travelling between warehouses. In these cases a specific database of useful cell data is quickly generated and the service is able to reliably give the current position to the user.

The above scenarios exploit the combination of Cellular and GPS positioning data (Hybrid positioning) to deliver better results than GPS technology could accomplish alone:

- Positioning performance can be improved and extended to areas where GPS 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 GPS jamming scenarios to improve anti-theft system performance

u-blox' CellLocate cellular positioning technology is an embedded feature implemented in u-blox SARA, LEON and LISA-U wireless modem families.
Click here to download the whitepaper: "Hybrid Positioning and CellLocate".

Read more about u-blox' CellLocate service on page 62.

eCall / ERA-GLONASS

Automated emergency response systems

eCall and ERA-GLONASS are a European, respectively Russian initiative to combine mobile communications and satellite positioning to provide rapid assistance to motorists in the event of a collision. The systems, the first based on GPS the latter on GLONASS, monitor in-vehicle sensors for such events as airbag deployment to automatically transmit location details and summon assistance via emergency cellular service. The motivation for both systems is the reduction of the consequences of road accidents in Europe and Russia.

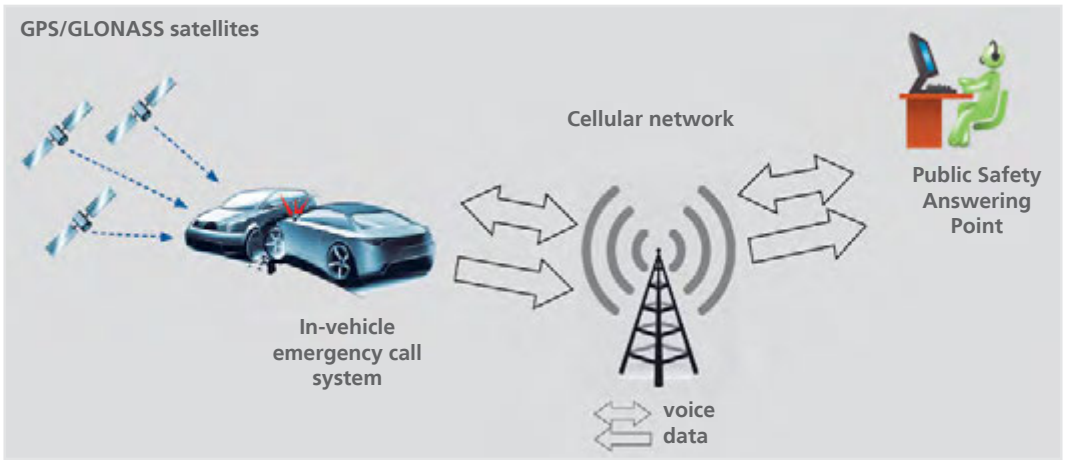
When activated, the in-vehicle systems automatically initiate an emergency call carrying both voice and data (including location data) directly to the nearest Public Safety Answering Point to determine whether rescue services should be dispatched to the known position.

The core functionality of both systems is an embedded computer that continuously monitors crash sensors and satellite positioning receiver in order to initiate an automated data and full duplex voice call via a dedicated wireless modem (e.g. GSM, UMTS) in case of an emergency condition. In-band modem capability, the ability to transmit data over the voice channel, is a key requirement for both systems.

The goal is to equip all cars in the EU and Russia with dedicated hardware either as firstmount unit in new cars, or installed in pre-existing vehicles (after market devices).

With the imminent deployment of ERA-GLONASS and eCall, development of in-vehicle terminals is in full swing. The correct choice of components has a large affect on time-to-market. Important factors to consider are the supplier's know-how and ability to support design-in requirements of GPS/GLONASS and GSM/UMTS subsystems, comprehensive software support, certification of the wireless modem, forward compatibility with future technologies, as well as the ability to deliver high-quality automotive-grade components in high-volume.

u-blox provides wireless and GPS/GLONASS receiver components for both eCall and ERA-GLONASS that meet these criteria. For more details about u-blox' solutions and test enviroment for eCall and ERA-GLONASS, contact u-blox.



Emergency call concept

Multi-GNSS support

u-blox' comprehensive approach to multi-standard positioning

GPS is the global defacto standard for navigation and positioning. This situation is rapidly changing. To reduce the reliance on the US-based GPS satellite network, Russia, China and the EU are deploying their own Global Navigation Satellite Systems ("GNSS").

The reasons are clear: many countries do not want to be reliant on the US controlled GPS system which could in theory be deactivated or restricted. Designers of GNSS systems are now faced with new motives for designing systems that support multiple GNSS standards:

- Government mandate and legal requirements to support own GNSS system inside one's country
- Availability / redundancy: increased reliability by removing the dependence on a single system
- Increased performance in cities where visibility of satellites belonging to any one system may be poor, in which case simply use a different one
- Accuracy: the (often perceived) increase in accuracy derived from using multiple systems simultaneously

To address these new GNSS systems, u-blox has introduced u-blox 7, the firm's seventh generation positioning platform. Supporting all GNSS systems, the u-blox 7 family of chips and modules focus on two core features: multi-GNSS compatibility and easy upgradability with previous and future product generations.

The state of GNSS

Russia

The first additional GNSS system to come online is Russia's **GLONASS** (**GLO**bal **NA**vigation **S**atellite **S**ystem). GLONASS became fully operational in 2011 with 24 satellites. GLONASS provides global coverage, with positional accuracy typically less than 7 meters in Russia, and less than 9 meters outside of Russia. One of the first applications is ERA-GLONASS, an automated vehicle emergency response system similar to the EU's eCall system. Functional today, GLONASS compatibility is supported by all u-blox 7 based chips and modules.

European Union

The EU is deploying its own satellite network called **Galileo.** There are currently 2 satellites in orbit with 2 more planned for 2012. The final deployment of a total of 30 satellites is planned for around 2019. Based on an advanced version of CDMA, Galileo will operate over a similar frequency band as GPS and support sub-meter accuracy. u-blox 7 is hardware-ready to support Galileo, and firmware-ready via external flash memory support.

China

China is developing their own GNSS system called **BeiDou-2,** also called **Compass.** The system currently has 12 satellites in orbit, offering navigation and positioning services in China and Southeast Asia. It will ultimately rely on 35 satellites to provide global positioning capability to within 10 meters. Compass is scheduled for completion in 2020. u-blox 7 is hardware-ready to support Compass, and firmware-ready via external flash memory support.

Japan

Due to the high-rise nature of many of Japan's cities, **QZSS** (**Q**uasi-**Z**enith **S**atellite **S**ystem) was designed as an augmentation system to aid GPS in urban canyons. The system will consist of 3 satellites which will transmit correctional data to improve GPS performance to sub-meter accuracy. The first QZSS satellite was launched in Sept. 2010 with the full complement of 3 satellites expected to be completed by 2013. QZSS supports devices operating in Japan, parts of Southeast Asia and Australia. QZSS service is available and supported by all u-blox 7 based chips and modules.

Other GNSS augmentation systems

Accurate positioning is highly dependent on atmospheric conditions, specifically the delay of GNSS signals while traversing the ionosphere. The 3 augmentation systems listed below (systems that aid GPS) are routinely used by GPS receivers to improve accuracy in specific geographic regions:

- WAAS (Wide Area Augmentation System, available in North America)
- EGNOS (European Geostationary Navigation Overlay Service, available in Europe and Russia),
- MSAS (Multi-functional Satellite Augmentation System, available in Japan)

u-blox 7 supports all of these civilian SBAS systems.

Automotive Dead Reckoning

Never lose track of where you are

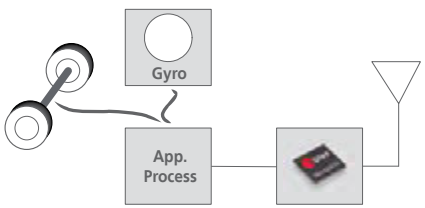
GPS positioning works well when at least four satellites are within a GPS receiver's line-of-sight. However, in urban environments where the accuracy of GPS navigation is crucial, the view to the sky is often obstructed, or high-rise buildings reflect GPS signals causing severe multipath effects, degrading the quality of GPS. In tunnels or underground parking garages, GPS positioning may not work at all.

u-blox' proprietary Automotive Dead Reckoning (ADR) solution solves this problem: based on the last known position; vehicle sensors feed information to the u-blox receiver indicating how far and in what direction the vehicle has travelled. Sensor data and GPS position are both processed, achieving 100% coverage, highly accurate and continuous positioning even in GPS hostile environment (e.g. urban canyons) or in case of GPS absence (e.g. tunnels and parking garages).

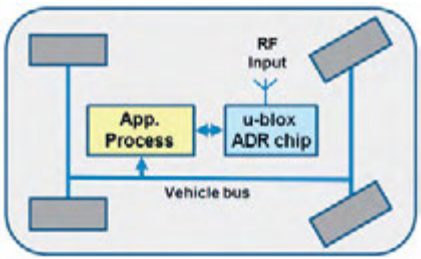
u-blox' ADR supports different sensor inputs. The classical setup, called "Gyroscope plus Wheel Tick" (GWT), consists of a gyroscope providing the heading information and wheel tick providing the speed information.

Alternatively, sensor information from left and right wheels (front or rear) or all wheels are used differentially to deduce heading, called "Differential Wheel Tick" (DWT). This results in slightly lower performance compared to GWT, but has the big advantage of saving the cost of a gyroscope.

Software sensor interface

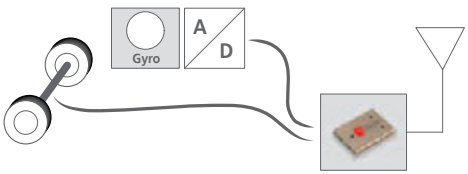


The industry proven u-blox ADR solution is highly flexible. The application processor can support a vast array of sensors, and must only convert the sensor data into UBX messages and pass them to the GPS receiver via a standard serial interface (USB, SPI, UART, DDC). This makes the u-blox ADR solution very portable between various vehicle platforms and reduces development effort and time-to-market. u-blox ADR is completely self-calibrating, and requires only pre-configuration to the specific vehicle platform.



u-blox' ADR with software sensor interface is available as a single chip UBX-G6010-SA-DR or as a chipset UBX-G6000/G0010, or as NEO-6V module. The chips are qualified according to AEC-Q100 and manufactured according ISO/TS-16949 to meet demanding automotive quality requirements. These components are ideal for factory installed navigation and eCall systems since they use sensor data (wheel tick and gyroscope data) taken directly from the CAN bus.

Hardware sensor interface



The standard quality grade LEA-6R and module is a dedicated ADR solutions (GWT only) for after market installations with no access to the vehicle bus and no application processor for sensor data processing. Sensors are connected directly to the module: gyroscopes via SPI and ADC and the speedpulse information from the tachometer.

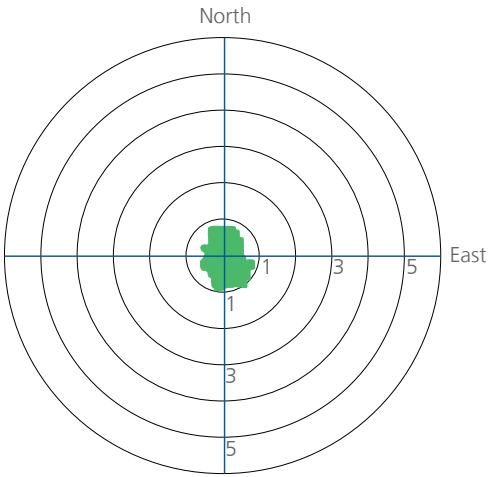
Evaluation tools

u-blox' ADR technology can be evaluated with the EVK-6V (for NEO-6V and ADR chips) and EVK-6R (for the LEA-6R module) Evaluation Kits which can be ordered via our Online shop at: **www.u-blox.com/en/online-shop.html or via a u-blox sales-representative.**

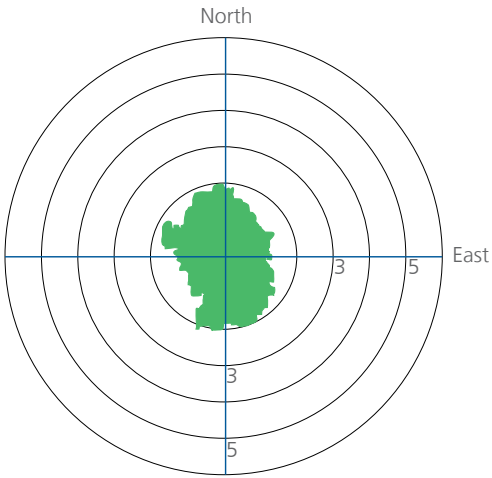
For more details, visit our ADR webpage at:
www.u-blox.com/en/dead-reckoning.html

Precise Point Positioning (PPP)

Ultra-precise GPS accuracy



Accuracy with PPP+SBAS
(units in m)



Accuracy with GPS and SBAS
(units in m)

Many stationary or slow-moving applications require higher accuracy than traditional GPS provides, for example mapping, agricultural, marine construction, open-sky warehouse management and location-based recreational applications such as geocaching and hand-held golf rangefinders.

These types of activities can allow for several minutes of data gathering and processing in order to provide much higher accuracy, typically below one meter. This can be achieved with expensive solutions such as Real Time Kinematic (RTK) systems that require a base station and multiple mobile units.

A much lower-cost solution is based on Precise Point Positioning (PPP), a method that performs precise position determination using a single GPS receiver.

u-blox' PPP technology is made possible by an advanced algorithm that improves the accuracy of the perceived distance between GPS satellites and the receiver (GPS pseudorange) via carrier phase measurement.

Additional accuracy is achieved via ionospheric correctional data received from satellite based augmentation systems such as WAAS (USA), EGNOS (Europe) and MSAS (Japan).

Unlike other PPP solutions that require a dual-frequency receiver, u-blox' PPP solution requires only a single-frequency GPS receiver resulting in lower costs.

u-blox has implemented PPP in its NEO-6P GPS module. The standalone module requires no mobile units, is compact (12.2 x 16.0 x 2.4 mm LCC package) and integrates easily with u-blox wireless modules to support high-accuracy telematics applications.

NEO-6P
GPS module with PPP

The NEO-6P can be evaluated with the EVK-6PPP kit with Precise Point Positioning.

Precision Timing and Reference Frequency

Accurate reference based on GPS technology

In addition to positioning and navigation applications, GPS/GNSS signals are widely used as low-cost precision time or frequency references used by remote or distributed wireless communication, industrial, financial, and power-distribution equipment. By capitalizing on atomic clocks onboard positioning satellites, GPS/GNSS signals can be used to synchronise equipment to within 15 ns, as well as provide UTC time to an accuracy within 90 ns. For wireless communication standards that utilize Time Division Multiplex (TDM) and for CDMA2000 in applications such as femtocell basestations, a precision time reference is mandatory. For these and other systems, GPS/GNSS signals are utilized to provide an accurate reference frequency to within 1 part in 100 billion.

u-blox' range of 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. The stand-alone products provide accurate time pulses wherever GPS/GNSS signals are available, as well as precise disciplined frequency references with hold-over.

All of u-blox' precision timing products benefit from the company's extensive applications experience and advanced technologies including:

- Fast satellite acquisition by u-blox' intelligent signal capture algorithms
- Location-independent clock synchronization, even when only one satellite is in view
- Weak-signal optimization, interference removal and multi-path mitigation allowing a small, low cost GPS antenna to be used indoors or within machinery
- Flexible GPS-synchronised time-pulse outputs at user-defined frequencies aligned to GPS time or UTC
- Very low cost

Frequency-Time modules and reference designs add:

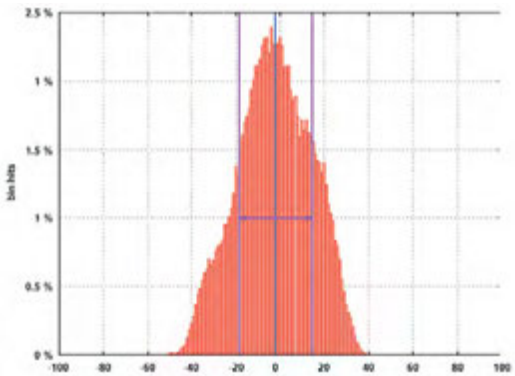
- Disciplined internal or external master reference oscillators with automatic hold-over
- Time-pulse inputs and message-based APIs for integration with host-based sources of synchronization

LEA-6T

NEO-6T

UBX-G6010-ST-TM

The histogram below shows the time accuracy frequency distribution of the LEA-6T precision timing module, measured over 24 hours.



Time offset (in nanoseconds)

For this test, the GPS receiver was placed on a building rooftop and its accuracy was measured without compensating the quantization error. The graph illustrates the very low standard deviation and maximal error of u-blox timing receivers.

u-blox products for Precision Timing:

- LEA-6T GPS receiver module with Precision Timing, raw data and antenna supervision (see page 26)
- NEO-6T GPS receiver module with Precision Timing in compact form factor (see page 26)
- UBX-G6010-ST-TM precision timing chip with raw data (see page 38)

Evaluation kit:

- EVK-6T Precision Timing Evaluation Kit for evaluation of LEA-6T and NEO-6T (see page 71)

Samples of u-blox precision timing modules and evaluation kit can be ordered via **u-blox' Online Shop.**

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 positioning or wireless modules.

The key benefit is simple: customers do not need to keep changing their PCB designs whenever u-blox introduces an improved version of its module products. Simply drop in the next generation module on the existing PCB and start testing! As a leading global supplier of GPS/GNSS and Wireless modules, u-blox has established these compact Leadless Chip Carrier (LCC) form factors as de-facto industry standards:

Positioning modules			
Series		**Package/dimensions**	**Features**
MAX		18-pin LCC[1] 9.7 x 10.1 mm	High-performance, compact GPS/GNSS[2] modules
NEO		24-pin LCC[1] 12.2 x 16.0 mm	Flexible, configurable GPS/GNSS[2] modules
LEA		28-pin LCC[1] 17.0 x 22.4 mm	Feature-rich GPS/GNSS[2] modules
Wireless modules			
Series		**Package/dimensions**	**Features**
SARA		96-pin LGA[3] 16.0 x 26.0 mm	Small, scalable, low-power GSM/GPRS modules
LEON		50-pin LCC 18.9 x 29.5 mm	Full-featured GSM/GPRS modules
LISA		76-pin LCC 22.4 x 33.2 mm	Universal UMTS/HSPA(+) and CDMA200 modules

[1]) Leadless Chip Carrier
[2]) GPS, GLONASS, QZSS; Galileo and Compass ready
[3]) Land Grid Array

These form factors form the base of our positioning and wireless module families, a philosophy that has been consistently applied over previous generations. In addition to providing a smooth upgrades path for your designs, form factor consistency allows for easy interchanging of module family members to adapt to end-product variants targeted at specific regions or feature-sets. This applies especially to the wireless module products; see "Wireless module layout compatibility" on page 83.

Wireless module layout compatibility

Upgrade smoothly with nested GSM/UMTS/CDMA designs

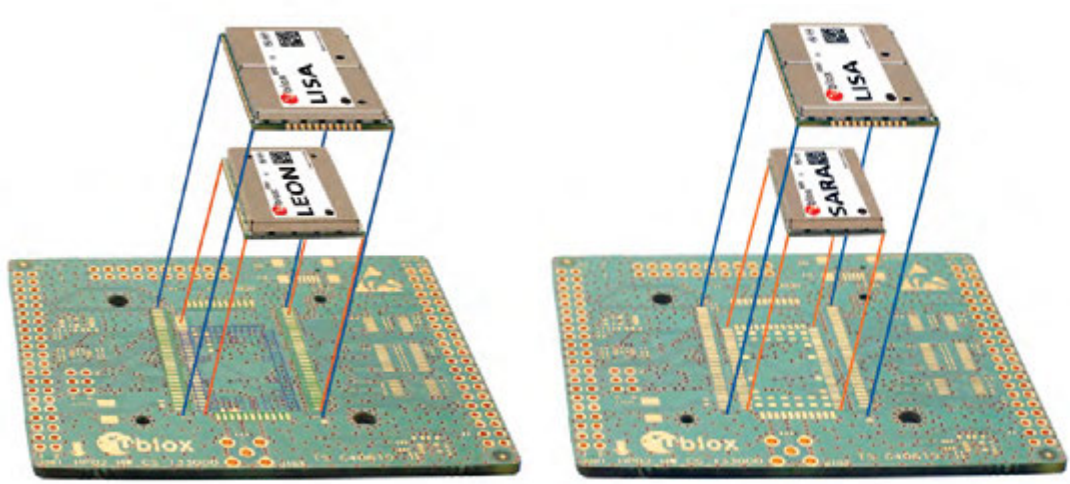
When designing wireless modem products that must accommodate GSM, UMTS, and/or CDMA2000 variants or region-specific versions requiring different frequency bands, PCB layout issues can generate a long list of expensive design and logistic problems.

The best way to avoid this issue is simple: layout compatibility across the entire range of wireless modems. 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) and UMTS/HSPA and CDMA2000 (LISA) wireless module families.

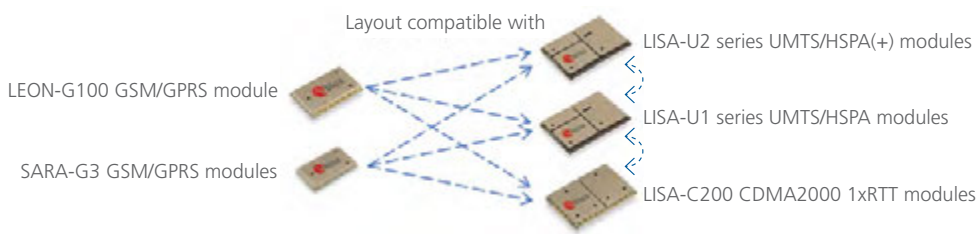
To facilitate nested designs, u-blox provides an application note and PCB reference designs with schematics, Gerber files and bill of materials for both 1.8 V and 3.0 V systems.

For more information, refer to u-blox' Application note "Nested Design: reference for SARA/LEON/LISA modules", document number 3G.G2-CS-10001.



Examples of 2G/3G layout compatibility: nested design accommodates both SARA/LEON GSM and LISA UMTS/CDMA modules on the same footprint.

Nested design combination chart for u-blox wireless modules



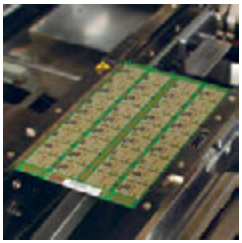
Production & quality

Quality system

u-blox strives to achieve best-in-class quality and reliability performance in all products through a systematic approach that emphasizes quality at every phase of the product life cycle including development, prototyping, product qualification and manufacturing.

Our quality management system is ISO 9001 certified, which reflects u-blox' process driven approach to innovation. u-blox has carefully selected strategic suppliers who meet the ISO/TS 16949 standard, which was developed by the automotive industry to ensure the highest level of quality in the automotive supply chain.

u-blox modules



u-blox develops high quality positioning and wireless modules, produced using world-renowned contract manufacturing partners with the highest commitment to quality. Manufactured in a fully automatic assembly line, every u-blox GPS/GNSS and wireless module undergoes thorough production testing with maximum test coverage. This includes a full detection and processing path, from antenna input to data output.

A subsequent x-ray examination, performed on every module using automatic image analysis, identifies and discards units with potentially faulty solder joints.

Our module qualification process includes climatic tests such as temperature cycling and mechanical shock and vibration tests. These tests are performed as stipulated in the ISO 16750 standard: Road vehicles – environmental conditions and testing for electrical and electronic equipment standard.

Extensive software tests with GPS/GNSS, GSM, UMTS & 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 pride ourselves in.

u-blox chips

We work with world-class foundries that use the most innovative, market-leading technologies to manufacture our chips. Our collaborative approach creates synergies, leveraging our positioning know-how and our partners' manufacturing expertise. This allows us to optimize our design, test and manufacturing processes and, ultimately, to achieve the best results in the manufacturing of our products.

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. Production process include 100% wafer sorting, packaging, as well as 100% final testing and drop-shipment services. This accelerates our products' time-to-market substantially, allowing us to quickly enter the market with our latest innovations and offer our customers a competitive edge in their markets.

Our automotive-grade GPS integrated circuits (ICs) are qualified according to AEC-Q100, the automotive standard that includes the requirements of the common JEDEC standard JESD47 for ICs.

Packaging

Chips and modules are moisture-sensitive devices. When reflow soldering, these products must be moisture-free to avoid defects that can arise under the hot temperatures used by reflow soldering machines. When soldering by hand with a soldering iron, moisture levels are not an issue.

Chips
u-blox delivers chips 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.

Modules
Modules 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. Sample quantities of less than 1 reel (which are typically soldered by hand) are shipped in ESD-protected cartons but are not moisture-protected as moisture levels are not an issue when hand-soldering. Baking instructions must be closely observed if reflow soldering is used.

Shipping of samples
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 chipsets are sent from the Philippines.

For the Americas, all shipments, regardless of quantity, are sent from our US headquarters in Reston, Virginia, USA.

Samples can be purchased directly from our Online shop: **www.u-blox.com/en/online-shop.html**.

RoHS compliance
The use and disposal of six environmentally hazardous materials including lead has been banned in Europe under the EU's 'Restrictions on Hazardous Substances' (RoHS) directive and the directive on 'Waste Electrical and Electronic Equipment' (WEEE). Since July 1, 2006, electronic components and systems must be lead-free to be traded in the EU.

An additional restriction on hazardous substances has been issued by the Chinese goverment resulting in the China RoHS standard which applies to all products manufactured from March 1st, 2007 onwards.

In addition, u-blox supports the IMDS initiative to report materials used in automotive products for recycling purposes and environmental sustainability.
u-blox therefore reports substances included in each product to satisfy automotive customer demands (e.g. GADSL) as well as to comply with the global legislative requirements (e.g. REACH, SVHC, RoHS).

All u-blox chips in MLF-Packages listed in this catalogue are "Green", i.e. both EU and China RoHS compliant and halogen free.

For further information, please visit our website at **www.u-blox.com**.

Contacts

Europe, Middle East, Africa

Headquarters
u-blox AG, Switzerland

Phone: +41 44 722 74 44
Fax: +41 44 722 74 47
E-mail: info@u-blox.com
Support: support@u-blox.com

Corporate Address

u-blox AG
Zürcherstrasse 68
8800 Thalwil
Switzerland

Americas

North and South America
u-blox America, Inc.

Phone: +1 (703) 483 3180
E-mail: info_us@u-blox.com
Support: support_us@u-blox.com

USA
West Coast Office, CA

Phone: +1 (408) 573 3640
E-mail: info_us@u-blox.com
Support: support_us@u-blox.com

Asia, Australia, Pacific

Singapore
u-blox Singapore Pte. Ltd.

Phone: +65 6734 3811
E-mail: info_ap@u-blox.com
Support: support_ap@u-blox.com

China
u-blox Beijing Rep. Office

Phone: +86 10 68 133 545
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com

China
u-blox Shenzhen Rep. Office

Phone: +86 755 8627 1083
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com

Japan
u-blox Japan KK, Tokyo

Phone: +81 3 5775 3850
E-mail: info_jp@u-blox.com
Support: support_jp@u-blox.com

Korea
u-blox Korea Branch Office, Seoul

Phone: +82 2 542 0861
E-mail: info_kr@u-blox.com
Support: support_kr@u-blox.com

Taiwan
u-blox Taiwan Rep. Office, Taipei

Phone: +886 2 2657 1090
E-mail: info_tw@u-blox.com
Support: support_tw@u-blox.com

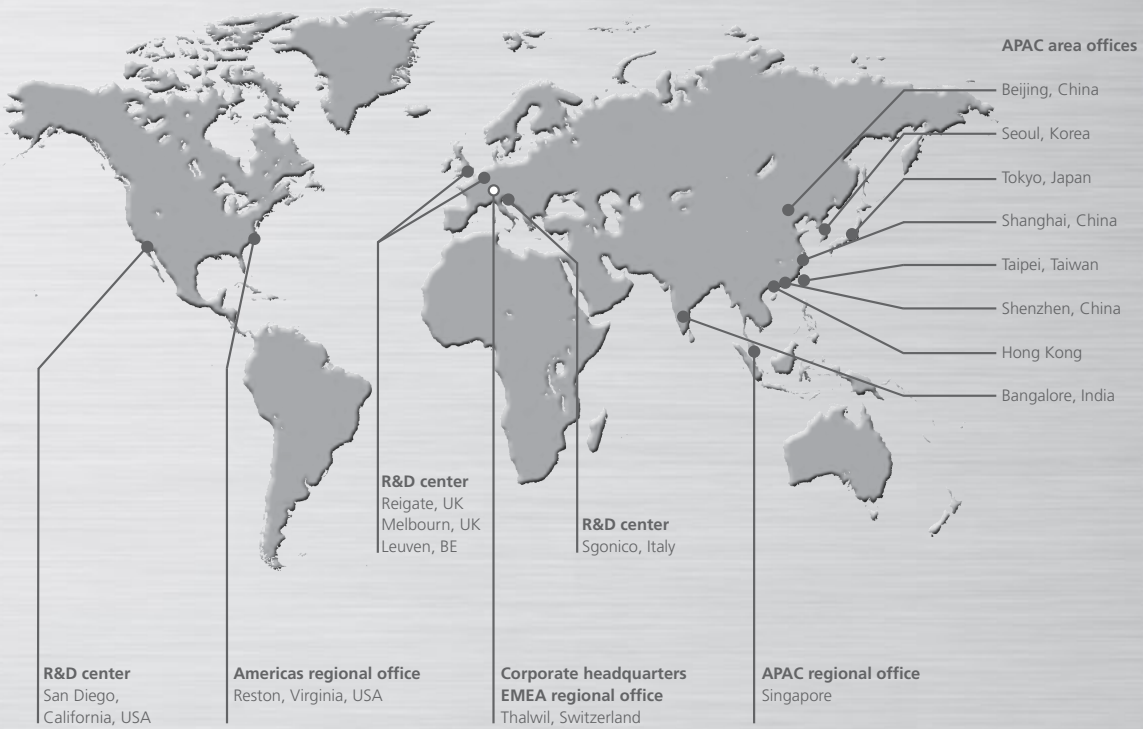
India
u-blox Liaison Office India, Bangalore

Phone: +91 959 1302 450
E-mail: info_in@u-blox.com
Support: support_in@u-blox.com

Website

www.u-blox.com

Worldwide presence



www.u-blox.com