POSITIONING

LEA-M8S

u-blox M8 concurrent GNSS module

Data Sheet

Highlights:

- Concurrent reception of GPS/QZSS, GLONASS, BeiDou
- Industry leading –167 dBm navigation sensitivity
- Combines low power consumption and high sensitivity
- UART, USB and DDC (I^2C compliant) interfaces
- Easy migration from LEA-5 and LEA-6 modules

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Objective Specification	Document contains target values. Revised and supplementary data will be published later.
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Production Information	Document contains the final product specification.

This document applies to the following products:

Product name	Type number	ROM/FLASH version	PCN reference
LEA-M8S	LEA-M8S-0-00	ROM 2.01	N/A

Contents

1 Functional description

1.1 Overview

The LEA-M8S module delivers concurrent GNSS location capability together with high-performance u-blox M8 positioning technology in the industry proven LEA form factor. With its dual-frequency RF front-end, the u-blox M8 concurrent GNSS engine is able to intelligently use the highest number of visible satellites from two of the GNSS systems (GPS, GLONASS and BeiDou) for more reliable positioning. The LEA-M8S provides exceptional performance with low system power, and is optimized for cost sensitive applications.

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

This 6th generation module in the LEA form factor allows simple migration from LEA-5 / LEA-6 GPS and LEA-6N GPS/GLONASS modules.

The LEA-M8S module combines a high level of robustness and integration capability with flexible connectivity options. The DDC (I^2C compliant) interface provides connectivity and enables synergies with most u-blox cellular modules. For RF optimization, the LEA-M8S features a front-end SAW filter for increased jamming immunity.

LEA-M8S module uses u-blox GNSS chips qualified according to AEC-Q100 and 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".

u-blox' AssistNow Assistance supply aiding information, such as ephemeris, almanac, rough last position and time, reduce the time to first fix significantly and improve the acquisition sensitivity. AssistNow data are with u-blox M8 supporting both GPS and GLONASS constellation for faster acquisition than a GPS-only assistance. The extended validity of AssistNow Offline data (up to 35 days) and AssistNow Autonomous data (up to 6 days) provide faster acquisition after long off time.

☞ See section 1.6 for more information concerning the LEA-M8S module related AssistNow Assistance.

1.2 Product features

Model	Type								Supply			Interfaces				Features												Grade		
	GPS / QZSS	GLONASS	Galileo	BeiDou	Timing	Dead Reckoning	Precise Point Positioning	Raw Data	1.65 V – 3.6 V	2.7 V – 3.6 V	Lowest power (DC/DC)	UART	USB	SPI	DDC (I2C compliant)	Programmable (Flash)	Data logging	Additional SAW	Additional LNA	RTC crystal	Internal oscillator	Active antenna / LNA supply	Active antenna / LNA control	Antenna short circuit detection / protection pin	Antenna open circuit detection pin	Frequency output	Standard	Professional	Automotive
LEA-M8S	•	•		•						•	•	•	•		•			•		•	T	•			•	•			

C = Crystal / T = TCXO

1.3 Performance

Parameter	Specification			
Receiver type	72-channel u-blox M8 engine GPS L1C/A SBAS L1C/A QZSS L1C/A GLONASS L1OF BeiDou B1			
	GNSS	**GPS & GLONASS**	**GPS & BeiDou**	**GPS**
Time-To-First-Fix [1]	Cold start	26 s	27 s	29 s
	Hot start	1 s	1 s	1 s
	Aided starts [2]	2 s	3 s [3]	2 s
Sensitivity [4]	Tracking & Navigation	–167 dBm	–165 dBm	–166 dBm
	Reacquisition	–160 dBm	–160 dBm	–160 dBm
	Cold start	–148 dBm	–148 dBm	–148 dBm
	Hot start	–156 dBm	–156 dBm	–156 dBm
	GNSS	**GPS & GLONASS**	**GPS & BeiDou**	**GPS**
Max navigation update rate		10 Hz	10 Hz	18 Hz
Velocity accuracy [5]		0.05 m/s		
Heading accuracy [5]		0.3 degrees		
Horizontal position accuracy [6]	Autonomous SBAS	2.5 m 2.0 m		
Accuracy of time pulse signal	RMS 99%	30 ns 60 ns		
Frequency of time pulse signal		0.25 Hz…10 MHz (configurable)		
Operational limits [7]	Dynamics	≤ 4 g		
	Altitude	50,000 m		
	Velocity	500 m/s		

Table 1: LEA-M8S performance in different GNSS modes (default: concurrent reception of GPS and GLONASS)

[1] All satellites at -130 dBm
[2] Dependent on aiding data connection speed and latency
[3] BeiDou assisted acquisition is not available with FW 2.01
[4] Demonstrated with a good external LNA
[5] 50% @ 30 m/s
[6] CEP, 50%, 24 hours static, -130 dBm, > 6 SVs
[7] Assuming Airborne < 4 g platform

1.4 Block diagram

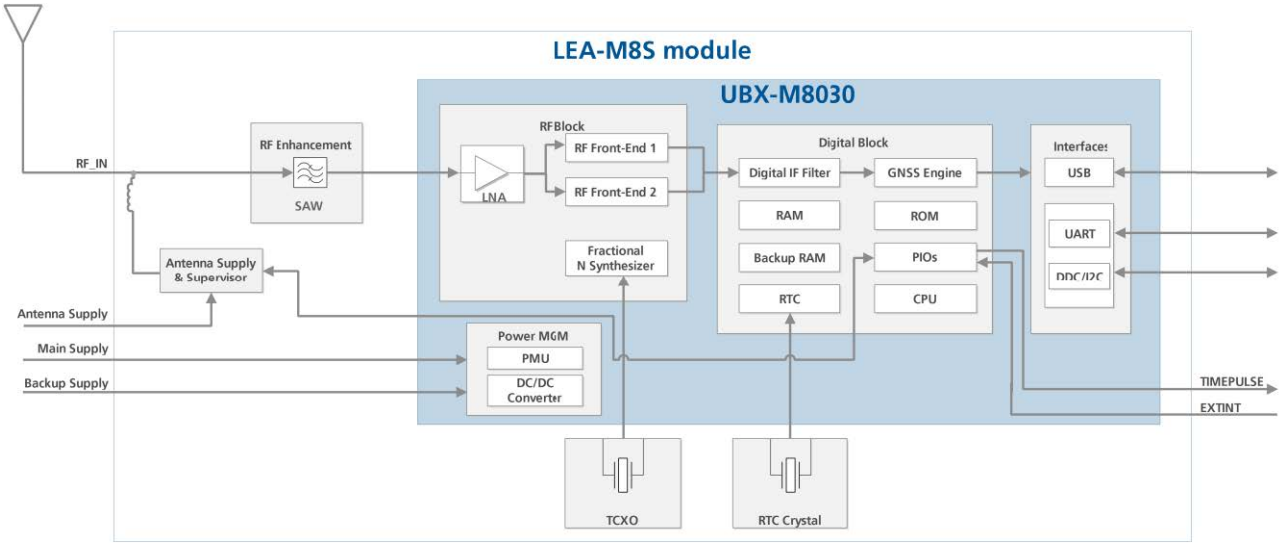


Figure 1: LEA-M8S block diagram

1.5 GNSS

The LEA-M8S module is a concurrent GNSS receiver and can receive and track multiple GNSS systems (e.g. GPS, GLONASS, BeiDou and QZSS signals). Because of the dual-frequency RF front-end architecture, two of the three signals (GPS L1C/A, GLONASS L1OF and BeiDou B1) can be received and processed concurrently. By default the LEA-M8S module is configured for concurrent GPS (includes SBAS and QZSS) and GLONASS reception. If power consumption is a key factor, then the LEA-M8S should be configured for single GNSS operation using either GPS or GLONASS or BeiDou and disabling QZSS and SBAS.

☞ QZSS and SBAS share the same frequency band as GPS and can always be processed in conjunction with GPS.

1.5.1 GPS

The LEA-M8S GNSS module is designed to receive and track the L1C/A signals provided at 1575.42 MHz by the Global Positioning System (GPS). The LEA-M8S module can receive and process GPS concurrently with GLONASS or BeiDou.

1.5.2 GLONASS

The LEA-M8S GNSS module can receive and process GLONASS concurrently with GPS or BeiDou. The Russian GLONASS satellite system is an alternative system to the US-based Global Positioning System (GPS). u-blox LEA-M8S positioning module is designed to receive and track the L1OF signals GLONASS provides at 1602 MHz + k*562.5 kHz, where k is the satellite's frequency channel number (k = −7,..., 5, 6). The ability to receive and track GLONASS L1OF satellite signals allows design of GLONASS receivers where required by regulations.

To take advantage of GPS and GLONASS, dedicated hardware preparation must be made during the design-in phase. See the *LEA-M8S/M8T Hardware Integration Manual* [1] for u-blox design recommendations.

1.5.3 BeiDou

The LEA-M8S GNSS module can receive and process BeiDou concurrently with GPS or GLONASS. u-blox LEA-M8S module is designed to receive and track the B1 signals provided at 1561.098 MHz by the BeiDou Navigation Satellite System. The ability to receive and track BeiDou B1 satellite signals in conjunction with GPS results in higher coverage, improved reliability and better accuracy. By the end of 2013 BeiDou is not fully operational and provides regional coverage only. Global coverage is scheduled for 2020.

1.5.4 QZSS

The Quasi-Zenith Satellite System (QZSS) is a regional navigation satellite system that transmits additional GPS L1C/A signals for the Pacific region covering Japan and Australia. LEA-M8S positioning module is able to receive and track these signals concurrently with GPS signals, resulting in better availability especially under bad signal conditions, e.g. in urban canyons. The L1-SAIF signal provided by QZSS is not supported.

1.6 Assisted GNSS (A-GNSS)

Supply of aiding information, such as ephemeris, almanac, rough last position and time, will reduce the time to first fix significantly and improve the acquisition sensitivity. All u-blox M8 products support the u-blox AssistNow Online and AssistNow Offline A-GNSS services, support AssistNow Autonomous, and are OMA SUPL compliant.

1.6.1 AssistNow™ Online

With AssistNow Online, an internet-connected GNSS device downloads assistance data from u-blox' AssistNow Online Service at system start-up. AssistNow Online is network-operator independent and globally available. u-blox only sends ephemeris data for those satellites currently visible to the device requesting the data, thus minimizing the amount of data transferred.

1.6.2 AssistNow™ Offline

With AssistNow Offline, users download u-blox' long-term orbit data from the Internet at their convenience. The orbit data must be stored in the memory of the application processor. Thus the service requires no connectivity at system start-up and enabling a position fix within seconds, even when no network is available. AssistNow Offline offers augmentation for up to 35 days.

1.6.3 AssistNow™ Autonomous

AssistNow Autonomous provides aiding information without the need for a host or external network connection. It is an embedded feature available free-of-charge that accelerates GPS positioning by capitalizing on the periodic nature of GPS satellite orbits: their position in the sky is basically repeated every 24 hours. GPS orbit predictions are directly calculated by the 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.

u-blox' AssistNow Autonomous benefits are:

- Faster fix in situations where GNSS satellite signals are weak
- No connectivity required
- Compatible with AssistNow Online and Offline (can work stand-alone, or in tandem with these services)
- No integration effort; calculations are done in the background, transparent to the user.

☞ The ROM based LEA-M8S GNSS module can use AssistNow Autonomous to calculate GPS only orbit predictions for up to 6 days (3 days by defaults). For best AssistNow Autonomous performance, it is recommended to use u-blox M8 flash-based receivers.

☞ For more details see the *u-blox M8 Receiver Description Including Protocol Specification* [2].

1.7 Augmentation Systems

1.7.1 Satellite-Based Augmentation System (SBAS)

The LEA-M8S GNSS module supports SBAS. These systems supplement GPS data with additional regional or wide area GPS augmentation data. The system broadcasts augmentation data via satellite and this information can be used by GNSS receivers to improve the resulting precision. SBAS satellites can be used as additional satellites for ranging (navigation), further enhancing precision and availability. The following SBAS types are supported by u-blox LEA-M8S module: WAAS, EGNOS and MSAS.

☞ For more details see the *u-blox M8 Receiver Description Including Protocol Specification* [2].

1.7.2 Differential GPS (D-GPS)

The LEA-M8S GNSS receiver supports Differential-GPS data according RTCM 10402.3: "RECOMMENDED STANDARDS FOR DIFFERENTIAL GNSS". The use of Differential-GPS data improves GPS position accuracy. RTCM cannot be used together with SBAS. The RTCM implementation supports the following RTCM 2.3 messages:

Message Type	Description
1	Differential GPS Corrections
2	Delta Differential GPS Corrections
3	GPS Reference Station Parameters
9	GPS Partial Correction Set

Table 2: Supported RTCM 2.3 messages

☞ For more details see the *u-blox M8 Receiver Description Including Protocol Specification* [2].

1.8 Odometer

The odometer provides information on travelled ground distance (in meter) using solely the position and Doppler-based velocity of the navigation solution. For each computed travelled distance since the last odometer reset, the odometer estimates a 1-sigma accuracy value. The total cumulative ground distance is maintained and saved in the BBR memory.

☞ The odometer feature is disabled by default. For more details see the *u-blox M8 Receiver Description Including Protocol Specification* [2].

1.9 EXTINT: External interrupt

EXTINT is an external interrupt pin with fixed input voltage thresholds with respect to VCC. It can be used for control of the receiver or for aiding.

For more information about how to implement and configure these features, see the *u-blox M8 Receiver Description including Protocol Specification* [2] and the *LEA-M8S/M8T Hardware Integration Manual* [1].

1.9.1 Pin Control

The pin control feature allows overriding the automatic active/inactive cycle of Power Save Mode. The state of the receiver can be controlled through the EXTINT pin.

The receiver can also be forced OFF using EXTINT when Power Save Mode is not active.

1.9.2 Aiding

The EXTINT pin can be used to supply time or frequency aiding data to the receiver.

For time aiding, hardware time synchronization can be achieved by connecting an accurate time pulse to the EXTINT pin.

Frequency aiding can be implemented by connecting a periodic rectangular signal with a frequency up to 500 kHz and arbitrary duty cycle (low/high phase duration must not be shorter than 50 ns) to the EXTINT pin. Provide the applied frequency value to the receiver using UBX messages.

1.10 TIMEPULSE

A configurable time pulse signal is available with the LEA-M8S module.

The TIMEPULSE output generates pulse trains synchronized with GPS or UTC time grid with intervals configurable over a wide frequency range. Thus it may be used as a low frequency time synchronization pulse or as a high frequency reference signal.

By default the time pulse signal is configured to 1 pulse per second. For more information see the *u-blox M8 Receiver Description including Protocol Specification* [2].

1.11 Protocols and interfaces

Protocol	Type
NMEA 0183, version 4.0 (V2.3 or V4.1 configurable)	Input/output, ASCII
UBX	Input/output, binary, u-blox proprietary
RTCM 2.3	Input, message 1, 2, 3, 9

Table 3: Available Protocols

All protocols are available on UART, USB and DDC (I^2C compliant). For specification of the various protocols see the *u-blox M8 Receiver Description Including Protocol Specification* [2].

1.12 Interfaces

A number of interfaces are provided either for data communication or memory access. The embedded firmware uses these interfaces according to their respective protocol specifications.

1.12.1 UART

The LEA-M8S module includes one UART interface, which can be used for communication to a host. It supports configurable baud rates. For supported baud rates see the *u-blox M8 Receiver Description Including Protocol Specification* [2].

☞ Designs must allow access to the UART and the **SAFEBOOT_N** function pin for future service, updates and reconfiguration.

1.12.2 USB

A USB version 2.0 FS compatible interface can be used for communication as an alternative to the UART. The pull-up resistor on pin USB_DP is integrated to signal a full-speed device to the host. The VDD_USB pin supplies the USB interface.

u-blox USB (CDC-ACM) driver supports Windows Vista and Windows 7 and Windows 8 operating systems.

1.12.3 Display Data Channel (DDC)

An I^2C compliant DDC interface is available for communication with an external host CPU or u-blox cellular modules. The interface can be operated in slave mode only. The DDC protocol and electrical interface are fully compatible with Fast-Mode of the I^2C industry standard. Since the maximum SCL clock frequency is 400 kHz, the maximum transfer rate is 400 kb/s.

The DDC interface is I^2C Fast Mode compliant. For timing parameters consult the I^2C standard.

☞ The maximum bit rate is 400 kb/s. The interface stretches the clock when slowed down when serving interrupts, so real bit rates may be slightly lower.

1.13 Clock generation

1.13.1 Oscillators

LEA-M8S GNSS module is available in TCXO version. The TCXO allows accelerated weak signal acquisition, enabling faster start and reacquisition times.

1.13.2 Real-Time Clock (RTC)

The RTC is driven by a 32 kHz oscillator using an external RTC crystal. If the main supply voltage fails, and a battery is connected to V_BCKP, parts of the receiver switch off, but the RTC still runs providing a timing reference for the receiver. This operating mode is called Hardware Backup Mode, which enables all relevant data to be saved in the backup RAM to allow a hot or warm start later.

1.14 Power management

The LEA-M8S GNSS module offers a power-optimized architecture with built-in autonomous power saving functions to minimize power consumption at any given time. Furthermore, the receiver can be used in two operating modes: Continuous mode for best performance or Power Save Mode for optimized power consumption respectively. In addition, a high efficiency DC/DC converter is integrated to allow low power consumption even for higher main supply voltages.

1.14.1 DC/DC converter

The LEA-M8S GNSS module offers an integrated DC/DC converter, allowing reduced power consumption especially when using a main supply voltage above 2.5 V.

☞ For more information see the *LEA-M8S/M8T Hardware Integration Manual* [1]

1.14.2 Operating modes

The LEA-M8S GNSS module has two operating modes:

- Continuous Mode for best GNSS performance
- Power Save Mode to optimize power consumption

1.14.2.1 Continuous Mode

Continuous Mode uses the LEA-M8S acquisition engine at full performance resulting in the shortest possible TTFF and the highest sensitivity. It searches for all possible satellites until the Almanac is completely downloaded. The receiver then switches to the tracking engine to lower power consumption.

Thus, a lower tracking current consumption level will be achieved when:

- A valid GNSS position is obtained
- The entire Almanac has been downloaded
- The Ephemeris for each satellite in view is valid

1.14.2.2 Power Save Mode

For power sensitive applications, LEA-M8S GNSS module provides a Power Save Mode for reduced power consumption.

Power Save Mode provides two dedicated methods, ON/OFF and Cyclic tracking, that reduce average current consumption in different ways to match the needs of the specific application. These operations can be set by using a specific UBX message.

☞ For more information about power management strategies, see the *u-blox M8 Receiver Description Including Protocol Specification* [2].

☞ Power Save Mode is only available in GPS mode.

1.15 Antenna

The LEA-M8S module is designed for use with passive and active[8] antennas.

Parameter	Specification	
Antenna Type		Passive and active antenna
Active Antenna Recommendations	Minimum gain	15 dB (to compensate signal loss in RF cable)
	Maximum gain	50 dB
	Maximum noise figure	1.5 dB

Table 4: Antenna Specifications for LEA-M8S module

1.15.1 Antenna supervisor and short circuit detection

An antenna supervisor is available with LEA-M8S receiver. The antenna supervisor enables the receiver to detect short circuits at the active antenna and shut down the voltage bias immediately. A series resistor is needed in front of the V_ANT input to enable checking of the antenna bias voltage. UBX and NMEA messages are provided to report the condition of the antenna supply. Open circuit detection can also be supported with an additional external circuit.

☞ Antenna open circuit detection can be connected to AADET_N pin.

☞ For more information see the *LEA-M8S/M8T Hardware Integration Manual* [1].

[8] For information on using active antennas with LEA-M8S module, see the *LEA-M8S/M8T Hardware Integration Manual* [1].

2 Pin Definition

2.1 Pin assignment

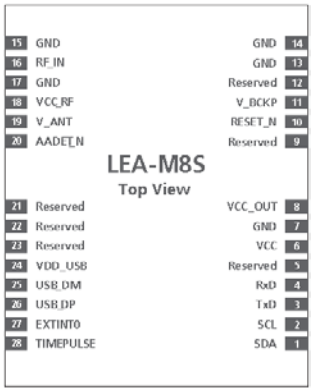


Figure 2: Pin Assignment

No	Name	I/O	Description
1	SDA	I/O	DDC Data
2	SCL	I/O	DDC Clock
3	TxD	O	Serial Port 1
4	RxD	I	Serial Port 1
5	Reserved		Not Connected
6	VCC	I	Supply voltage
7	GND	I	Ground (digital)
8	VCC_OUT	O	Output voltage
9	Reserved		Not Connected
10	RESET_N	I	External Reset
11	V_BCKP	I	Backup voltage supply
12	Reserved	I	SAFEBOOT_N (for future service, updates and reconfiguration, leave OPEN)
13	GND	I	Ground
14	GND	I	Ground
15	GND	I	Ground
16	RF_IN	I	GNSS signal input
17	GND	I	Ground
18	VCC_RF	O	Output Voltage RF section
19	V_ANT	I	Antenna Bias voltage
20	AADET_N	I	Active Antenna Detect
21	Reserved		Not Connected
22	Reserved		Not Connected
23	Reserved		Not Connected
24	VDD_USB	I	USB Supply
25	USB_DM	I/O	USB Data
26	USB_DP	I/O	USB Data
27	EXTINT0	I	External Interrupt Pin
28	TIMEPULSE	O	Timepulse (1 PPS)

Table 5: Pinout

☞ Pins designated Reserved should only be used with caution. For more information about Pinouts see the *LEA-M8S/M8T Hardware Integration Manual* [1].

3 Configuration management

Configuration settings can be modified with UBX configuration messages. The modified settings remain effective until power-down or reset. If these settings have been stored in battery-backup RAM, then the modified configuration will be retained, as long as the backup battery supply is not interrupted.

☞ For more information about configuration management, see the *u-blox M8 Receiver Description including Protocol Specification* [2].

4 Electrical specification

The limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the characteristics sections of the specification is not implied. Exposure to these limits for extended periods may affect device reliability.

Where application information is given, it is advisory only and does not form part of the specification. For more information see the *LEA-M8S/M8T Hardware Integration Manual* [1].

4.1 Absolute maximum rating

Parameter	Symbol	Condition	Min	Max	Units
Power supply voltage	VCC		–0.5	3.6	V
Backup battery voltage	V_BCKP		–0.5	3.6	V
USB supply voltage	VDD_USB		–0.5	3.6	V
Input pin voltage	Vin		–0.5	3.6	V
	Vin_usb		–0.5	VDD_USB	V
DC current trough any digital I/O pin (except supplies)	Ipin			10	mA
VCC_RF output current	ICC_RF			100	mA
Input power at RF_IN	Prfin	source impedance = 50 Ω, continuous wave		15	dBm
Antenna bias voltage	V_ANT			6	V
Antenna bias current	I_ANT			100	mA
Storage temperature	Tstg		–40	85	°C

Table 6: Absolute maximum ratings

Stressing the device beyond the "Absolute Maximum Ratings" may cause permanent damage. These are stress ratings only. The product is not protected against overvoltage or reversed voltages. If necessary, voltage spikes exceeding the power supply voltage specification, given in table above, must be limited to values within the specified boundaries by using appropriate protection diodes.

4.2 Operating conditions

All specifications are at an ambient temperature of 25°C. Extreme operating temperatures can significantly impact specification values. Applications operating near the temperature limits should be tested to ensure the specification.

Parameter	Symbol	Min	Typical	Max	Units	Condition
Power supply voltage	VCC	2.7	3.0	3.6	V	
Supply voltage USB	VDDUSB	3.0	3.3	3.6	V	
Backup battery voltage	V_BCKP	1.4		3.6	V	
Backup battery current	I_BCKP		15		µA	V_BCKP = 1.8 V, VCC = 0 V
Input pin voltage range	Vin	0		VCC	V	
Digital IO Pin Low level input voltage	Vil	0		0.2*VCC	V	
Digital IO Pin High level input voltage	Vih	0.7*VCC		VCC	V	
Digital IO Pin Low level output voltage	Vol			0.4	V	Iol = 4mA
Digital IO Pin High level output voltage	Voh	VCC–0.4			V	Ioh = 4mA
USB_DM, USB_DP	VinU	Compatible with USB with 27 Ω series resistance				
V_ANT antenna bias voltage	V_ANT	2.7		5.5	V	I_{ANT} < –50 mA
Antenna bias voltage drop	V_ANT_DROP		0.1		V	ICC_RF = 50 mA
VCC_RF voltage	VCC_RF		VCC–0.1		V	
VCC_RF output current	ICC_RF			50	mA	
Receiver Chain Noise Figure[9]	NFtot		4.0		dB	
Operating temperature	Topr	–40		85	°C	

Table 7: Operating conditions

Operation beyond the specified operating conditions can affect device reliability.

[9] Only valid for the GPS band

4.3 Indicative current requirements

Table 8 lists examples of the total system supply current for a possible application.

Values in Table 8 are provided for customer information only as an example of typical power requirements. Values are characterized on samples, actual power requirements can vary depending on FW version used, external circuitry, number of SVs tracked, signal strength, type of start as well as time, duration and conditions of test.

Parameter	Symbol	Typ GPS & GLONASS	Typ GPS / QZSS / SBAS	Max	Units	Condition
Max. supply current [10]	Iccp			67	mA	
Average supply current [11, 12]	Icc Acquisition [13]	27	21		mA	Estimated at 3 V
	Icc Tracking (Continuous mode)	26	19.5		mA	Estimated at 3 V
	Icc Tracking (Power Save mode / 1 Hz)	n.a. [14]	6		mA	Estimated at 3 V

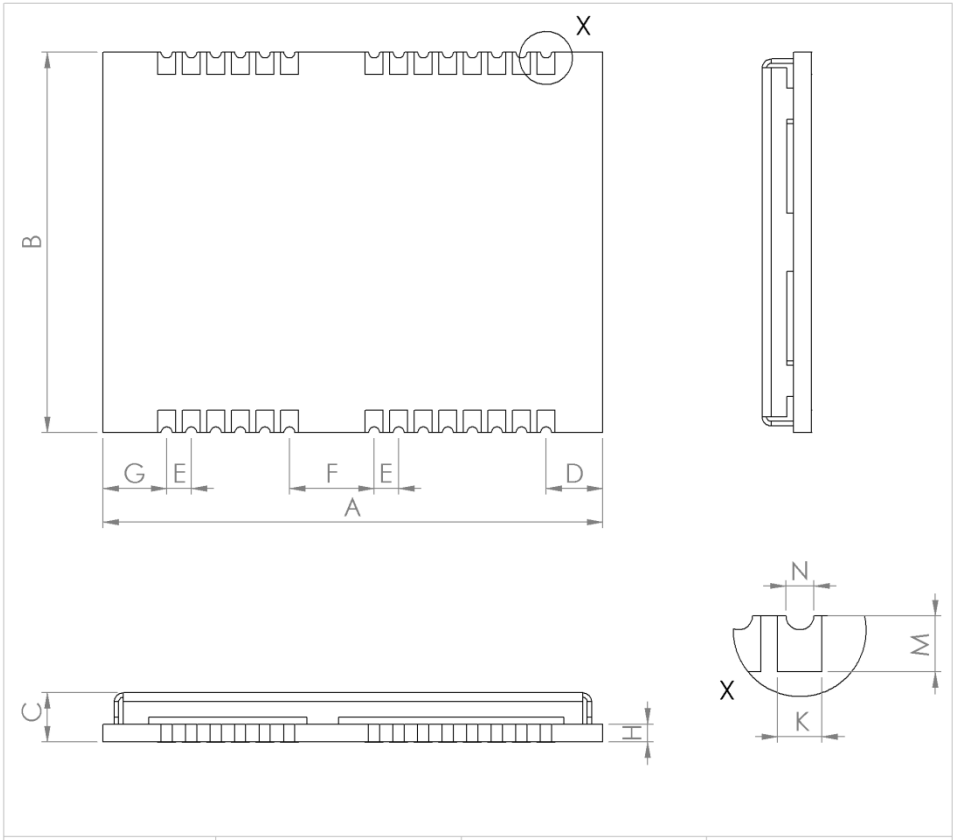
Table 8: Indicative power requirements at 3.0 V

For more information about power requirements, see the *LEA-M8S/M8T Hardware Integration Manual* [1].

For more information on how to noticeably reduce current consumption, see the *Power Management Application Note* [4].

[10] Use this figure to dimension maximum current capability of power supply. Measurement of this parameter with 1 Hz bandwidth.
[11] Use this figure to determine required battery capacity.
[12] Simulated GNSS constellation using power levels of -130 dBm. VCC = 3.0 V
[13] Average current from start-up until the first fix.
[14] Not applicable

5 Mechanical specifications



Symbol	Min. (mm)	Typ. (mm)	Max. (mm)
A	22.1	22.4	23.0
B	16.9	17.0	17.1
C	2.1	2.4	2.7
D	2.45	2.55	2.85
E	1.0	1.1	1.2
F	3.7	3.8	3.9
G	2.75	2.85	3.15
H		0.82	
K	0.7	0.8	0.9
M	0.9	1.0	1.1
N	0.4	0.5	0.6
Weight		2.1g	

Figure 3: Dimensions

For information about the paste mask and footprint, see the *LEA-M8S/M8T Hardware Integration Manual* [1].

6 Reliability tests and approvals

6.1 Reliability tests

LEA-M8S modules are based on AEC-Q100 qualified GNSS chips.

Tests for product family qualifications are according to ISO 16750 "Road vehicles – environmental conditions and testing for electrical and electronic equipment", and appropriate standards.

6.2 Approvals

Products marked with this lead-free symbol on the product label comply with the "Directive 2002/95/EC of the European Parliament and the Council on the Restriction of Use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS).

All u-blox M8 GNSS modules are RoHS compliant.

7 Product handling & soldering

7.1 Packaging

The LEA-M8S GNSS modules are delivered as hermetically sealed, reeled tapes in order to enable efficient production, production lot set-up and tear-down. For more information see the *u-blox Package Information Guide* [3].

7.1.1 Reels

The LEA-M8S GNSS modules are deliverable in quantities of 250 pcs on a reel. The LEA-M8S receivers are shipped on Reel Type B, as specified in the *u-blox Package Information Guide* [3].

7.1.2 Tapes

The dimensions and orientations of the tapes for LEA-M8S modules are specified in Figure 4.

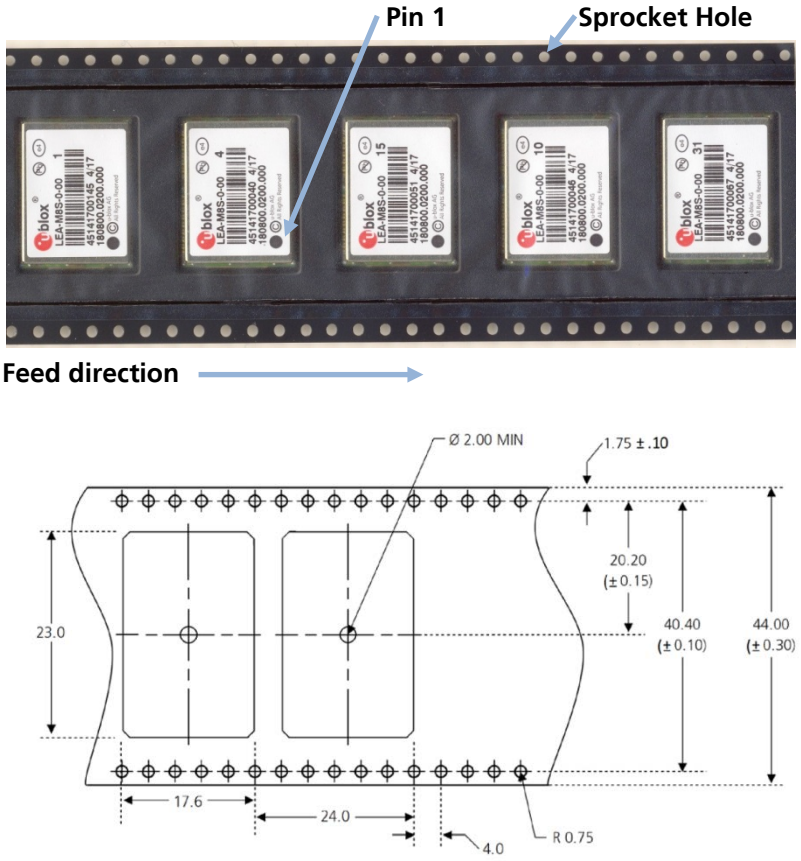


Figure 4: Dimensions and orientation for LEA-M8S modules on tape

7.2 Shipment, storage and handling

For important information regarding shipment, storage and handling see the *u-blox Package Information Guide* [3].

7.2.1 Moisture Sensitivity Levels

The Moisture Sensitivity Level (MSL) relates to the packaging and handling precautions required. The LEA-M8S modules are rated at MSL level 4.

☞ For MSL standard see IPC/JEDEC J-STD-020, which can be downloaded from www.jedec.org.

☞ For more information regarding MSL see the *u-blox Package Information Guide* [3].

7.2.2 Reflow soldering

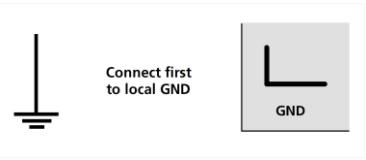
Reflow profiles are to be selected according u-blox recommendations (see the *LEA-M8 Hardware Integration Manual* [1]).

7.2.3 ESD handling precautions

⚠ **LEA-M8S module is Electrostatic Sensitive Devices (ESD). Observe precautions for handling!Failure to observe these precautions can result in severe damage to the GNSS receiver!**

⚠ GNSS receivers are Electrostatic Sensitive Devices (ESD) and require special precautions when handling. Particular care must be exercised when handling patch antennas, due to the risk of electrostatic charges. In addition to standard ESD safety practices, the following measures should be taken into account whenever handling the receiver:

- Unless there is a galvanic coupling between the local GND (i.e. the work table) and the PCB GND, then the first point of contact when handling the PCB must always be between the local GND and PCB GND.
- Before mounting an antenna patch, connect ground of the device
- When handling the RF pin, do not come into contact with any charged capacitors and be careful when contacting materials that can develop charges (e.g. patch antenna ~10 pF, coax cable ~50-80 pF/m, soldering iron, …)
- To prevent electrostatic discharge through the RF input, do not touch any exposed antenna area. If there is any risk that such exposed antenna area is touched in non ESD protected work area, implement proper ESD protection measures in the design.
- When soldering RF connectors and patch antennas to the receiver's RF pin, make sure to use an ESD safe soldering iron (tip).



8 Default messages

Interface	Settings
UART Output	9600 Baud, 8 bits, no parity bit, 1 stop bit Configured to transmit both NMEA and UBX protocols, but only the following NMEA (and no UBX) messages have been activated at start-up: **GGA, GLL, GSA, GSV, RMC, VTG, TXT**
USB Output	Configured to transmit both NMEA and UBX protocols, but only the following NMEA (and no UBX) messages have been activated at start-up: **GGA, GLL, GSA, GSV, RMC, VTG, TXT** USB Power Mode: Bus Powered
UART Input	9600 Baud, 8 bits, no parity bit, 1 stop bit, Autobauding disabled Automatically accepts following protocols without need of explicit configuration: UBX, NMEA, RTCM The GNSS receiver supports interleaved UBX and NMEA messages.
USB Input	Automatically accepts following protocols without need of explicit configuration: UBX, NMEA The GPS receiver supports interleaved UBX and NMEA messages. USB Power Mode: Bus Powered
DDC	Fully compatible with the I^2C industry standard, available for communication with an external host CPU or u-blox cellular modules, operated in slave mode only. Default messages activated. NMEA and UBX are enabled as input messages, only NMEA as output messages. Maximum bit rate 400 kb/s.
TIMEPULSE (1 Hz Nav)	1 pulse per second, synchronized at rising edge, pulse length 100 ms.

Table 9: Default messages

☞ Refer to the *u-blox M8 Receiver Description Including Protocol Specification* [2] for information about further settings.

9 Labeling and ordering information

9.1 Product labeling

The labeling of u-blox M8 GNSS modules includes important product information. The location of the LEA-M8S product type number is shown in Figure 5.

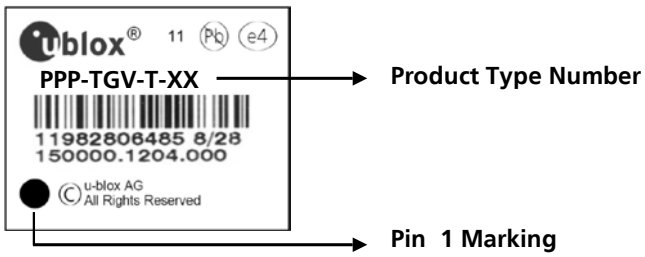


Figure 5: Location of product type number on u-blox LEA-M8S module label

9.2 Explanation of codes

Three different product code formats are used. The **Product Name** is used in documentation such as this data sheet and identifies all u-blox M8 products, independent of packaging and quality grade. The **Ordering Code** includes options and quality, while the **Type Number** includes the hardware and firmware versions. Table 10 shows the structure of these three different formats.

Format	Structure
Product Name	PPP-TGV
Ordering Code	PPP-TGV-T
Type Number	PPP-TGV-T-XX

Table 10: Product Code Formats

The parts of the product code are explained in Table 11.

Code	Meaning	Example
PPP	Product Family	LEA
TG	Platform	M8 = u-blox M8
V	Variant	Function set (A-Z), T = Timing, R = DR, etc.
T	Option / Quality Grade	Describes standardized functional element or quality grade 0 = Default variant, A = Automotive
XX	Product Detail	Describes product details or options such as hard- and software revision, cable length, etc.

Table 11: part identification code

9.3 Ordering codes

Ordering No.	Product
LEA-M8S-0	u-blox M8 Concurrent GNSS LCC Module, TCXO, ROM, SAW, 17.0x22.4 mm, 250 pcs/reel

Table 12: Product ordering codes for professional grade modules

☞ Product changes affecting form, fit or function are documented by u-blox. For a list of Product Change Notifications (PCNs) see our website.

Related documents

[1] LEA-M8S/M8T Hardware Integration Manual, Docu. No. UBX-13003140

[2] u-blox M8 Receiver Description including Protocol Specification (Public version), Docu. No UBX-13003221

[3] u-blox Package Information Guide, Docu. No. UBX-14001652

[4] Power Management Application Note, Docu. No. UBX-13005162

☞ For regular updates to u-blox documentation and to receive product change notifications, register on our homepage (http://www.u-blox.com).

Revision history

Revision	Date	Name	Status / Comments
R01	17-Mar-2014	julu	Objective Specification.
R02	04-Jul-2014	julu	Advance Information. Added section 1.15.1 (Antenna supervisor and short circuit detection)
R03	26-Aug-2014	julu	Early Production Information. Updated NF value in Table 7; added SAFEBOOT_N description in section 1.12.1 and Table 5 (PIN 1).
R04	17-Nov-2014	julu	Updated section 1.2 (added product grade information to selector table)
R05	07-Jan-2015	julu	Production Information

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