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LEA-6N
u-blox 6 GLONASS, GPS & QZSS module
Data Sheet

Abstract

Technical data sheet describing the cost effective, low power, and high-performance LEA-6N GLONASS, GPS & QZSS module.
The versatile, standalone LEA-6N receiver combines an extensive array of features with flexible connectivity options. The ease of integration results in fast time-to-market for a wide range of automotive and industrial applications.

Document Information

Title	LEA-6N
Subtitle	u-blox 6 GLONASS, GPS & QZSS module
Document type	Data Sheet
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Document status

Document status information

Objective Specification	This document contains target values. Revised and supplementary data will be published later.
Advance Information	This document contains data based on early testing. Revised and supplementary data will be published later.
Preliminary	This document contains data from product verification. Revised and supplementary data may be published later.
	This document contains the final product specification.

This document applies to the following products:

Name	Type number	ROM/FLASH version	PCN reference
LEA-6N	LEA-6N-0-000	FW1.00	N/A

ARM

Contents

1 Functional description

1.1 Overview

The LEA-6N is a stand-alone GPS positioning module featuring the high performance u-blox 6 engine. This versatile, standalone receiver combines an extensive array of features with flexible connectivity options. LEA-6N modules maintain the industry standard 17.0 x 22.4mm form factor of the LEA-6 and LEA-5 families and have been designed to allow simple migration. The ease of integration results in reduced costs and short time to market for a wide range of automotive, consumer and industrial applications targeting the Russian market.

The LEA-6N adds GLONASS functionality to high performance u-blox 6 positioning. The Russian GLONASS satellite system is an alternative to the US-based Global Positioning System (GPS). GLONASS-based navigation systems are becoming a de-facto standard in Russia and beyond. The LEA-6N is designed for ERA-GLONASS. LEA-6N also provides u-blox 6 GPS performance with enhanced coverage and performance compared to previous firmware versions by supporting the Japanese QZSS regional satellite system.

The 50-channel u-blox 6 positioning engine features a Time-To-First-Fix (TTFF) of under 1 second. The dedicated acquisition engine, with over 2 million correlators, is capable of massive parallel time/frequency space searches, enabling it to find satellites instantly. Innovative design and technology suppresses interference sources and mitigates multipath effects, giving LEA-6N GPS receivers excellent navigation performance even in the most challenging environments. The LEA-6N allows simple integration with u-blox wireless modules.

All LEA-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.

The LEA-6N features the lowest power GLONASS functionality in the industry, at low cost and with minimal integration effort.

1.2 Product features

Model	Type						Supply		Interfaces				Features						
	GPS	GLONASS	QZSS	Galileo	Timing & Raw Data	Dead Reckoning	1.75 V - 2.0 V	2.7 V - 3.6 V	UART	USB	SPI	DDC (I2C compliant)	Programmable (Flash) FW update	Oscillator	RTC crystal	Antenna supply and supervisor	Configuration pins	Timepulse	External interrupt/ Wakeup
LEA-6N	•	•	•	R				•	•	•		•	•	T	•	•		1	•

R = HW Galileo ready, firmware upgrade required
Onboard RTC crystal for faster warm and hot starts

T = TCXO

Table 1: Features of the LEA-6N

☞ All LEA-6 modules are based on GPS chips qualified according to AEC-Q100. See Chapter 5.1 for further information.

1.3 GPS/GNSS performance

Parameter	Specification		GPS	GLONASS
Receiver type	50-channel u-blox 6 engine GPS/QZSS L1 C/A code GLONASS L1 FDMA SBAS: WAAS, EGNOS, MSAS			
Time-To-First-Fix[1]	Cold Start (without aiding)		29 s	36 s
	Warm Start (without aiding)		28 s	25 s
	Hot Start (without aiding)		1 s	2 s
	Aided Starts[2]		1 s	n.a.
Sensitivity[3]	Tracking & Navigation		-162 dBm	-158 dBm
	Cold Start (without aiding)		-148 dBm	-138 dBm
	Warm Start		-148 dBm	-145 dBm
	Hot Start		-155 dBm	-153 dBm
Max. Navigation update rate			2 Hz	1 Hz
Horizontal position accuracy[4]			2.5 m	4 m
	SBAS		2.0 m	n.a.
Accuracy for Timepulse signal[5]	RMS		30 ns	50 ns
	99%		<60 ns	100 ns
Frequency of time pulse signal		0.25 Hz to 1 kHz (configurable)		
Velocity accuracy[6]		0.1 m/s		
Heading accuracy[6]		0.5 degrees		
Operational Limits	Dynamics	$\leq$ 4 g		
	Altitude[7]	50,000 m		
	Velocity[7]	500 m/s		

Table 2: LEA-6N GPS/GLONASS performance

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[1] All satellites at -130 dBm
[2] Dependant on aiding data connection speed and latency
[3] Demonstrated with a good active antenna
[4] CEP, 50%, 24 hours static, -130 dBm, SEP: < 3.5 m
[5] Under good GPS/GLONASS signal conditions
[6] 50% @ 30 m/s
[7] Assuming Airborne < 4g platform
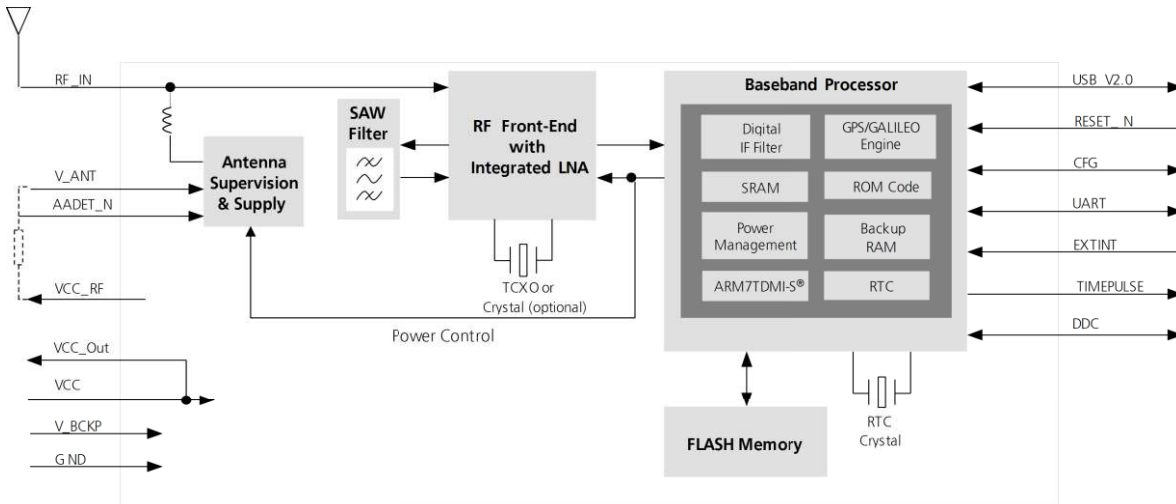
1.4 Block diagram

Figure 1 Block diagram (For available options refer to the product features table in section 1.2.)

1.5 Assisted GPS (A-GPS)

Supply of aiding information like ephemeris, almanac, approximate previous position and time, satellite status and an optional time synchronization signal will reduce time to first fix significantly and improve the acquisition sensitivity. All LEA-6 modules support the u-blox AssistNow Online and AssistNow Offline A-GPS services and are OMA SUPL compliant.

1.6 Galileo

When Galileo-L1 signals become available, LEA-6N receivers will be capable of receiving and processing them via a firmware upgrade. The ability to receive and track Galileo satellite signals will result in higher coverage, improved reliability and better accuracy.

1.7 GLONASS

The Russian GLONASS satellite system is an alternative system to the US-based Global Positioning System (GPS). The LEA-6N module is capable of receiving and processing GLONASS signals and provides the lowest power GLONASS functionality in the industry at low cost and with minimal integration effort. For more information about GLONASS and implementation see the LEA-6/NEO-6/MAX-6 Hardware Integration Manual [1] and the u-blox GPS Compendium [4].

1.8 Protocols and interfaces

Protocol	Type
NMEA	Input/output, ASCII, 0183, 2.3 (compatible to 3.0)
UBX	Input/output, binary, u-blox proprietary
RTCM	Input, 2.3[8]

Table 3: Available protocols

All listed protocols are available on UART, USB and DDC. For specification of the various protocols see the u-blox 6 Receiver Description including Protocol Specification [2].

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[8] Not available when using GLONASS mode.

LEA-6 modules support a number of peripheral interfaces for serial communication. The embedded firmware uses these interfaces according to their respective protocol specifications. For specific applications, the firmware also supports the connection of external memories.

1.8.1   UART

LEA-6 modules include one configurable UART interface for serial communication (for information about configuration see section 1.10).

1.8.2   USB

LEA-6 modules provide a USB version 2.0 FS (Full Speed, 12Mbit/s) interface as an alternative to the UART. The pull-up resistor on USB_DP is integrated to signal a full-speed device to the host. The VDDUSB pin supplies the USB interface.

u-blox provides a Microsoft® certified USB driver for Windows XP, Windows Vista and Windows 7 operating systems.

Operating System	Support level
Windows XP	Certified
Windows Vista	Certified
Windows 7	Certified

Table 4: Operating systems supported by USB driver

1.8.3   Display Data Channel (DDC)

The I^{2}C compatible DDC interface can be used either to access external devices with a serial interface or to interface with a host CPU. It is capable of master and slave operation. DDC is not available with LEA-6R. The DDC interface is I^{2}C Standard Mode compliant. For timing parameters consult the I^{2}C standard.

☞   The DDC Interface supports serial communication with u-blox wireless modules. See the specification of the applicable wireless module to confirm compatibility.

☞   The maximum bandwidth is 100kbit/s.

1.8.4   Data ready indication: TX Ready

u-blox 6 GPS modules include a data ready indication function for serial interfaces. The TX Ready signal[9] indicates that the receiver has data to transmit at the specified serial interface.

1.9   Antenna

LEA-6 modules are designed for use with passive and active antennas.

An antenna supervisor is available with all LEA-6 Modules. In the default operation mode the antenna supervisor is activated and enables the receiver to detect short circuits at the active antenna by checking the bias voltage level and can shut down the voltage bias immediately. A series resistor is needed in front of the **V_ANT** input. 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. For details, please refer to the LEA-6/NEO-6/MAX-6 Hardware Integration Manual [1].

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[9] For more information see the u-blox 6 Receiver Description including Protocol Specification [2].

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 5: Antenna specifications

1.9.1 Power Management

u-blox receivers support different power modes. These modes represent strategies of how to control the acquisition and tracking engines in order to achieve either the best possible performance or good performance with reduced power consumption.

☞ For more information about power management strategies, see the u-blox 6 Receiver Description including Protocol Specification [2].

1.9.2 Power Save Mode

Power Save Mode (PSM) allows a reduction in system power consumption by selectively switching parts of the receiver on and off.

☞ Power Save Mode is not supported in GLONASS mode.

1.10 Configuration

1.10.1 Configuration

With the LEA-6N configuration settings modified with UBX configuration messages can be saved permanently. In this case the modified settings remain effective even after power-down and don't require backup battery supply.

For more information, see the u-blox 6 Receiver Description including Protocol Specification [2].

1.11 Design-in

In order to obtain the necessary information to conduct a proper design-in, u-blox strongly recommends consulting the LEA-6/NEO-6/MAX-6 Hardware Integration Manual [1].

2 Pin Definition

2.1 Pin assignment

Figure 2 LEA-6 Pin Assignement

Pin Nr.	Name	I/O	Description
1	SDA2	I/O	DDC Data
2	SCL2	I/O	DDC Clock
3	TxD1	O	Serial Port 1
4	RxD1	I	Serial Port 1
5	NC		Not Connected
6	VCC	I	Supply voltage
7	GND	I	Ground (digital)
8	VCC_OUT	O	Output voltage
9	NC		Not Connected
10	RESET_N	I	External Reset
11	V_BCKP	I	Backup voltage supply
12	Reserved	I	Do not drive low
13	GND	I	Ground
14	GND	I	Ground
15	GND	I	Ground
16	RF_IN	I	GPS 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	VDDUSB	I	USB Supply

Pin Nr.	Name	I/O	Description
25	USB_DM	I/O	USB Data
26	USB_DP	I/O	USB Data
27	EXTINT0	I	External Interrupt Pin
28	TIMEPULSE	O	Timepulse (1PPS)

Table 6: Pinout

☞   Pins designated Reserved should only be used with caution. For more information about Pinouts see the LEA-6/NEO-6/MAX-6 Hardware Integration Manual [1].

3 Electrical specifications

3.1 Absolute maximum ratings

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	VDDUSB		-0.5	3.6	V
Input pin voltage	Vin		-0.5	3.6	V
	Vin_usb		-0.5	VDDUSB	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 7: Absolute maximum ratings

⚠️ **GPS receivers are Electrostatic Sensitive Devices (ESD) and require special precautions when handling. For more information see section 6.4.**

⚠️ **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. For more information see the *LEA-6/NEO-6/MAX-6 Hardware Integration Manual* [1].**

3.2 Operating conditions

☞ All specifications are at an ambient temperature of 25°C.

Parameter	Symbol	Min	Typ	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		22		µA	V_BCKP = 1.8V, VCC = 0V
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 -0.4V			V	Ioh=4mA
AADET_N low level input voltage	Vil		<0.6		V	Vo=2.1V
AADET_N high level input voltage	Vih		>0.75		V	Vo=0.6V
USB_DM, USB_DP	VinU	Compatible with USB with 22 Ohms 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 =50mA
VCC_RF voltage	VCC_RF		VCC-0.1		V	
VCC_RF output current	ICC_RF			50	mA	
Antenna gain	Gant			50	dB	
Receiver Chain Noise Figure	NFtot		3.2		dB	
Operating temperature	Topr	-40		85	°C	

Table 8: Operating conditions

☞ Operation beyond the specified operating conditions can affect device reliability.

3.3 Indicative power requirements

Table 9 lists examples of the total system supply current for a possible application.

Parameter		Symbol	Min	Typ	Max	Units	Condition
Peak supply current [10]		Iccp			67	mA	VCC = 3.6V
Average supply current	GPS	Icc Acquisition		45[11]		mA	VCC = 3.0V
		Icc Tracking		41.5[12]		mA	VCC = 3.0V
		Icc Tracking[13] (Power Save Mode)		14.5[12]		mA	VCC = 3.0V
	GLONASS	Icc Acquisition		45[12]		mA	VCC = 3.0V
		Icc Tracking		39.5[12]		mA	VCC = 3.0V

Table 9: Indicative power requirements

☞ Values in Table 9 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.

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[10] Use this figure to dimension maximum current capability of power supply. Measurement of this parameter with 1 Hz bandwidth.
[11] Current is averaged over the time from startup until the first fix. 6-8 GPS satellites, all at same signal strength of -130 dBm
[12] Values are measured with a simulated constellation of 8 satellites (GPS or GLONASS), all signals -130dBm, static user position
[13] Cyclic operation: Update rate 1 s.

4 Mechanical specifications

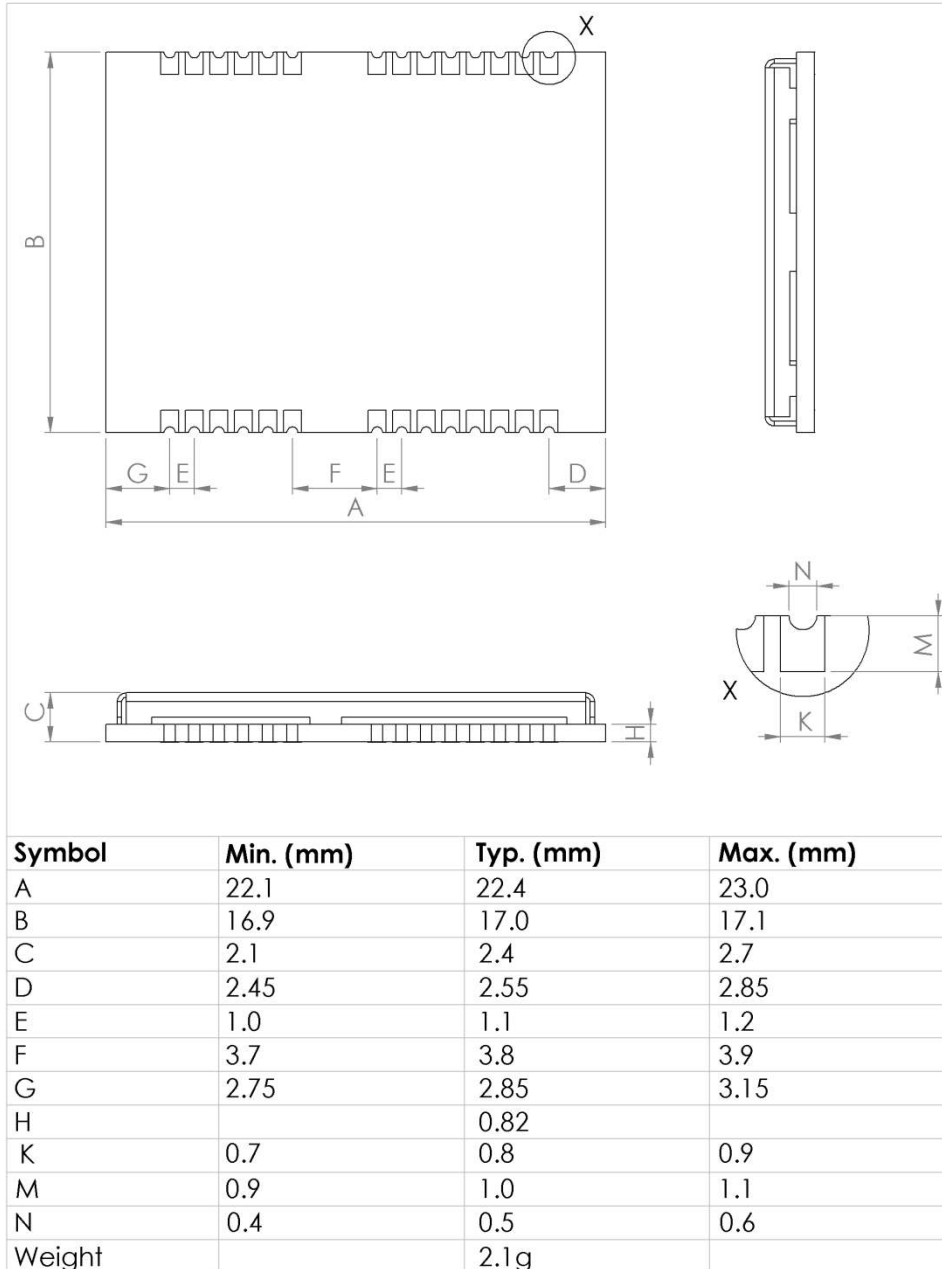| Symbol	Min. (mm)	Typ. (mm)	Max. (mm)
A	22.1	22.4	23.0
B	16.9	17.0	17.1
C	2.1	2.4	2.7
D	2.45	2.55	2.85
E	1.0	1.1	1.2
F	3.7	3.8	3.9
G	2.75	2.85	3.15
H		0.82	
K	0.7	0.8	0.9
M	0.9	1.0	1.1
N	0.4	0.5	0.6
Weight		2.1g	

Figure 3: Dimensions

☞ For information regarding the Paste Mask and Footprint see the LEA-6/NEO-6/MAX-6 Hardware Integration Manual [1].

5 Qualification and certification

5.1 Reliability tests

☞ All LEA-6 modules are based on GPS chips qualified according to AEC-Q100.

Tests for product family qualifications according to ISO 16750 "R"ad vehicles - –nvironmental conditions and testing for electrical and electronic equipment", and appropriate standards.

5.2 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 6 GPS modules are RoHS compliant.

6 Product handling & soldering

6.1 Packaging

LEA-6 modules are delivered as hermetically sealed, reeled tapes in order to enable efficient production, production lot set-up and tear-down. For more information about packaging, see the u-blox Package Information Guide [3].

Figure 4: Reeled u-blox modules

6.1.1 Reels

LEA-6 GPS modules are deliverable in quantities of 250pcs on a reel. LEA-6 modules are delivered using reel Type B as described in the u-blox Package Information Guide [3].

Parameter	Specification
Reel Type	B
Delivery Quantity	250

Table 11: Reel information for LEA-6 modules

6.1.2 Tapes

Figure 5 shows the position and orientation of LEA-6 modules as they are delivered on tape. The dimensions of the tapes are specified in Figure 6.
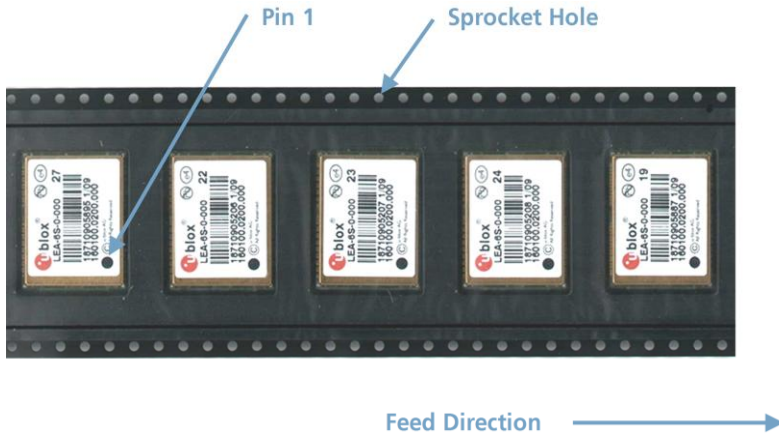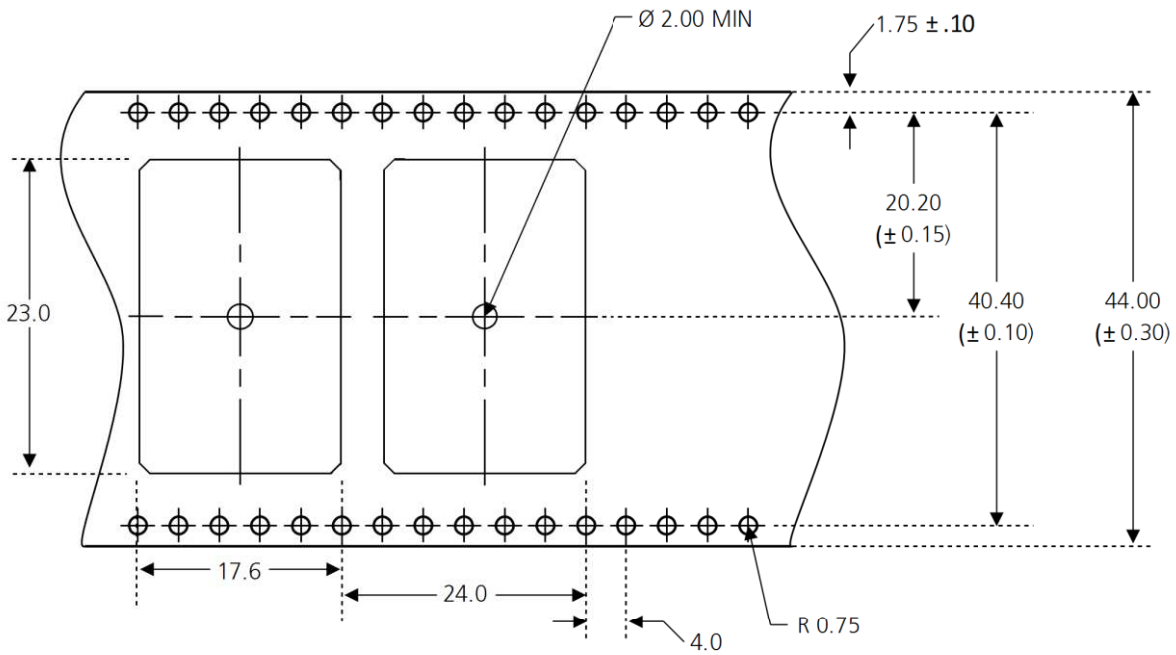

Figure 5: Orientation for LEA-6 modules on tape

Figure 6: LEA tape dimensions (mm)

6.2 Moisture Sensitivity Levels

⚠️ **LEA-6 modules are Moisture Sensitive Devices (MSD) in accordance to the IPC/JEDEC specification.**

LEA-6 modules are rated at MSL level 4. For more information regarding moisture sensitivity levels, labeling, storage and drying see the u-blox Package Information Guide [3].

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

6.3 Reflow soldering

Reflow profiles are to be selected according to u-blox recommendations (see LEA-6/NEO-6/MAX-6 Hardware Integration Manual [1]).

6.4 ESD handling precautions

⚠️ **LEA-6 modules contain highly sensitive electronic circuitry and are Electrostatic Sensitive Devices (ESD). Observe precautions for handling! Failure to observe these precautions can result in severe damage to the GPS receiver!**

GPS 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 ~10pF, coax cable ~50-80pF/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).

7 Default settings

Interface	Settings
Serial Port 1 Output	9600 Baud, 8 bits, no parity bit, 1 stop bit. Configured to transmit both NMEA and UBX protocols, but only 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 following NMEA and no UBX messages have been activated at start-up: **GGA, GLL, GSA, GSV, RMC, VTG, TXT** USB Power Mode: Bus-Powered.
Serial Port 1 Input	9600 Baud, 8 bits, no parity bit, 1 stop bit Automatically accepts following protocols without need of explicit configuration: **UBX, NMEA** The GPS 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.
TIMEPULSE (1Hz Nav)	1 pulse per second, synchronized at rising edge, pulse length 100ms.

Table 12: Default Settings

Refer to the LEA-6/NEO-6/MAX-6 Hardware Integration Manual [1] for information about further settings.

8 Labeling and ordering information

8.1 Product labeling

The labeling of u-blox 6 GPS modules includes important product information. The location of the product type number is shown in Figure 7.

Figure 7: Location of product type number on u-blox 6 module label

8.2 Explanation of codes

3 different product code formats are used. The **Product Name** is used in documentation such as this data sheet and identifies all u-blox 6 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 13 below details these 3 different formats:

Format	Structure
Product Name	PPP-GV
Ordering Code	PPP-GV-T
Type Number	PPP-GV-T-XXX

Table 13: Product Code Formats

The parts of the product code are explained in Table 14.

Code	Meaning	Example
PPP	Product Family	LEA
G	Product Generation	6 = u-blox 6
V	Variant	T = Timing, R = DR, etc.
T	Option / Quality Grade	Describes standardized functional element or quality grade such as different RF connector, FLASH size, automotive grade etc.
XXX	Product Detail	Describes product details or options such as hard- and software revision, cable length, etc.

Table 14: part identification code

8.3 Ordering information

Ordering No.	Product
LEA-6N-0	u-blox 6 GPS/GLONASS/QZSS Module, TCXO, Flash, 17 x 22mm, 250 pcs/reel

Table 15: Product Ordering Codes

☞ Product changes affecting form, fit or function are documented by u-blox. For a list of Product Change Notifications (PCNs) see our website at: http://www.u-blox.com/en/notifications.html.

Related documents

[1]   LEA-6/NEO-6/MAX-6 Hardware Integration Manual, Docu. GPS.G6-HW-09007

[2]   u-blox 6 Receiver Description including Protocol Specification, Docu. No GPS.G6-SW-12013

[3]   u-blox Package Information Guide, Docu. No GPS-X-11004

[4]   GPS Compendium, Docu. No GPS-X-02007

All these documents are available on our homepage (http://www.u-blox.com).

☞   For regular updates to u-blox documentation and to receive product change notifications please register on our homepage.

Revision history

Revision	Date	Name	Status / Comments
	03/31/2012	dhur	Initial Release
1	04/10/2012	dhur	Update section 1.3: Horizontal position accuracy
2	16/07/2012	dhur	Updated section 1.3. Added section 1.8.4. Changed status to Preliminary.
3	09/08/2012	dhur	Updated section 1.3
4	05/09/2012	cbib	Changed status for Mass Production

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