POSITIONING

EVA-7M

u-blox 7 GNSS module

Data Sheet

Highlights:

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

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Contents

1 Functional description

1.1 Overview

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

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

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

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

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

1.2 Highlights

- Industry's smallest standalone GNSS module
- Minimal system cost
- Minimal power consumption
- Simple integration with u-blox cellular modules
- Eases design and manufacturing
- No host integration or external components needed
- Simple integration

1.3 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	Lowest power (DC/DC)	UART	USB	SPI	DDC (I²C compliant)	Programmable (Flash)	Data logger	Additional SAW	Additional LNA	RTC crystal	Internal oscillator	Active antenna / LNA supply	Active antenna / LNA control	Antenna short circuit detection / protection pin	Antenna open circuit detection pin	Frequency output	Standard	Professional	Automotive
EVA-7M	•	•							•	•	•	•	•	•					o	C	o	o	o	o		■		

o = Optional, or requires external components

C = Crystal

1.4 GNSS Performance

Parameter	Specification		
Receiver type	56-channel u-blox 7 engine GPS L1C/A, SBAS L1C/A, QZSS L1C/A GLONASS L1OF		
Time-To-First-Fix[1]		**GPS**	**GLONASS**
	Cold Start	30 s	32 s
	Warm Start	28 s	25 s
	Aided Start[2]	5 s	n.a
	Hot Start	1 s	1 s
Sensitivity [3]		**GPS**	**GLONASS**
	Tracking & Navigation	–160 dBm	–158 dBm
	Reacquisition	–160 dBm	–156 dBm
	Cold Start	–147 dBm	–139 dBm
	Warm Start	–148 dBm	–145 dBm
	Hot Start	–155 dBm	–155 dBm
Horizontal position accuracy[4]		**GPS**	**GLONASS**
	Autonomous	2.5 m	4.0 m
	SBAS	2.0 m	n.a.
Accuracy of time pulse signal		**GPS**	**GLONASS**
	RMS 99%	30 ns 60 ns	50 ns 100 ns
Frequency of time pulse signal		0.25 Hz … 10 MHz	
Max navigation update rate		10 Hz	
Velocity accuracy[5]		0.1 m/s	
Heading accuracy[5]		0.5 degrees	
Operational limits[6]	Dynamics Altitude Velocity	≤ 4 g 50,000 m 500 m/s	

Table 1: EVA-7M GNSS performance

[1] All satellites at -130 dBm
[2] Dependent on aiding data connection speed and latency
[3] Demonstrated with a good external LNA
[4] CEP, 50%, 24 hours static, -130 dBm, > 6 SVs
[5] 50% @ 30 m/s
[6] Assuming Airborne < 4 g platform

1.5 Block diagram

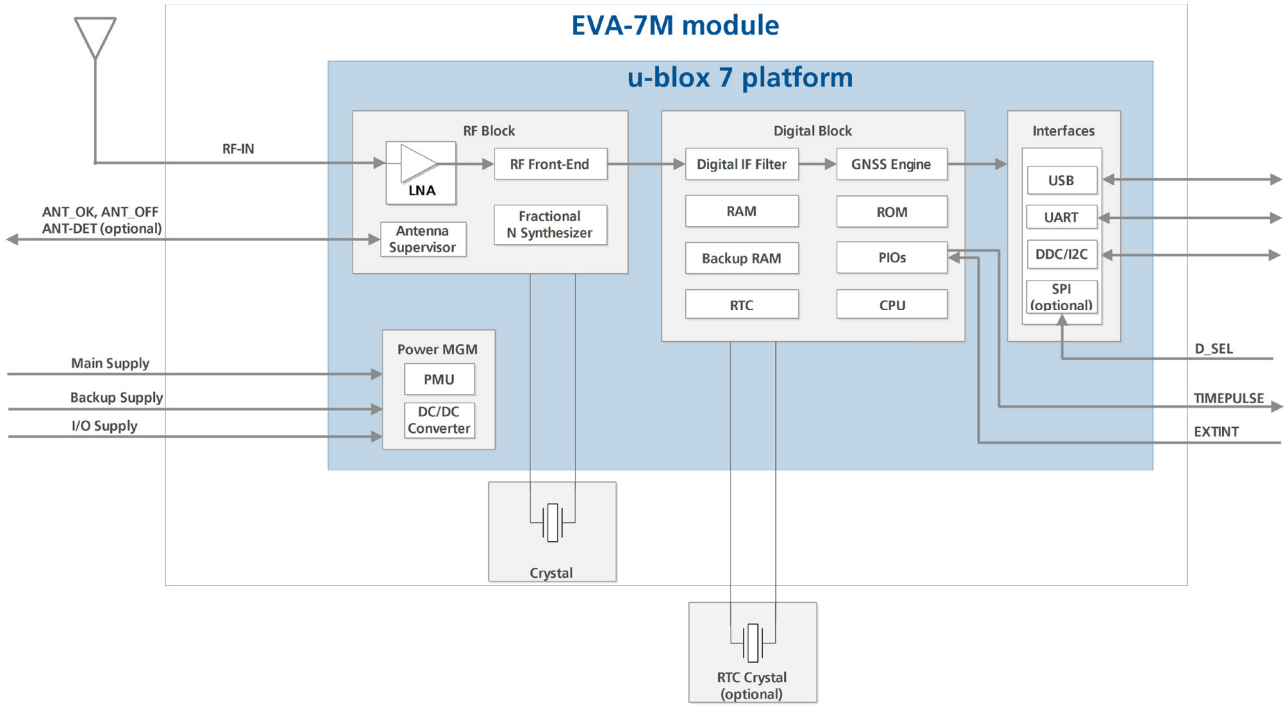


Figure 1: EVA-7M block diagram

1.6 GNSS

The EVA-7M GNSS positioning module is a multi-GNSS receiver and can receive and track GPS/QZSS or GLONASS.

1.6.1 GPS

The EVA-7M module is designed to receive and track the L1C/A signals provided at 1575.42 MHz by the Global Positioning System.

1.6.2 GLONASS

The Russian GLONASS satellite system is an alternative system to the US-based Global Positioning System (GPS). u-blox EVA-7M module can receive and process GLONASS signals using the same hardware. It provides the lowest power GLONASS functionality in the industry at low cost and with minimal integration effort. In order to take advantage of GPS and GLONASS reception, dedicated hardware must be prepared during the design-in phase. See the *EVA-7M Hardware Integration Manual* [1] for u-blox design recommendations.

The ability to receive and track GLONASS L1OF satellite signals with the same hardware results in an optimized hardware BOM and allows design of GLONASS ready receivers where required by regulations.

☞ GLONASS and GPS signals cannot be received and tracked simultaneously by u-blox 7 modules.

1.6.3 QZSS

The Quasi-Zenith Satellite System (QZSS) is a regional navigation satellite system that transmits, in addition to GPS, the L1C/A signals for the Pacific region covering Japan and Australia. The EVA-7M receiver is able to receive and to track these signals simultaneously to GPS resulting in better availability especially under bad signal conditions e.g. in urban canyons.

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

1.7 Augmentation Systems

1.7.1 Assisted GNSS (A-GPS)

A-GPS improves GNSS performance by delivering aiding data to the GNSS receiver via wireless networks or the Internet. Supplying information such as ephemeris, almanac, approximate last position, time and satellite status and an optional time synchronization signal significantly reduces Time to First Fix (TTFF) and improves acquisition sensitivity.

AssistNow Online and AssistNow Offline are u-blox' end-to-end A-GPS services for devices with or without network connectivity. AssistNow Online and AssistNow Offline can either be used alone or in combination. They are very easy to implement, require no additional hardware, and generate virtually no CPU load. All u-blox 7 modules support u-blox' AssistNow Online, AssistNow Offline and AssistNow Autonomous A-GPS services, and are OMA SUPL compliant.

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.

AssistNow™ Offline

With AssistNow Offline, users download u-blox' Differential Almanac Correction Data from the Internet at their convenience. The correction data can be stored 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.

AssistNow™ Autonomous

AssistNow Autonomous provides functionality similar to Assisted-GPS without the need for a host or external network connection. It is an embedded feature available free-of-charge that accelerates GNSS positioning by capitalizing on the periodic nature of GPS satellite orbits. GPS orbit predictions are directly calculated by the GNSS receiver and no external aiding data or connectivity is required. AssistNow Autonomous can be used alone, or together with AssistNow Online or AssistNow Offline for increased positioning speed and accuracy.

☞ For more details see the *u-blox 7 Receiver Description Including Protocol Specification V14* [2].

1.7.2 Satellite-Based Augmentation System (SBAS)

u-blox EVA-7M positioning module supports SBAS. These systems supplement GPS data with additional regional or wide area GPS augmentation data. The system broadcasts the augmentation data via satellite and this information can be used by GNSS receivers to improve the resulting GPS precision. SBAS satellites can be used as additional satellites for ranging (navigation), further enhancing precision. The following SBAS are supported with the EVA-7M: WAAS, EGNOS and MSAS.

☞ For more details see the *u-blox 7 Receiver Description Including Protocol Specification V14* [2].

1.7.3 Differential GPS (D-GPS)

The EVA-7M receiver supports Differential-GPS data according to 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 7 Receiver Description Including Protocol Specification V14* [2].

1.8 EXTINT: External interrupt

EXTINT is an external interrupt pin with fixed input voltage thresholds with respect to VCC_IO. 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 7 Receiver Description including Protocol Specification V14* [2] and the *EVA-7M Hardware Integration Manual* [1].

1.8.1 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 turned off and sent into Backup Mode using EXTINT when Power Save Mode is not active.

1.8.2 Aiding

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

For time aiding, the time can be supplied using hardware time synchronization where an accurate time pulse is connected 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, and providing the applied frequency value to the receiver using UBX messages.

1.9 TIMEPULSE

A configurable time pulse signal is available with the EVA-7M modules.

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 7 Receiver Description including Protocol Specification V14* [2].

1.10 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, messages 1, 2, 3, 9

Table 3: Available Protocols

All protocols are available on UART, USB, DDC (I^2C compliant) and SPI. For specification of the various protocols see the *u-blox 7 Receiver Description Including Protocol Specification V14* [2].

1.11 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.

1.11.1 UART

The EVA-7M makes use of a UART interface, which can be used for communication to a host. It supports configurable baud rates. For supported transfer rates see the *u-blox 7 Receiver Description Including Protocol Specification V14* [2].

1.11.2 USB

A USB interface, which is compatible to USB version 2.0 FS (Full Speed, 12 Mbit/s), 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 V_USB pin supplies the USB interface.

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

1.11.3 SPI

The SPI interface is designed to allow communication to a host CPU. The interface can be operated in slave mode only. The maximum transfer rate using SPI is 1 Mbit/s and the maximum SPI clock frequency is 5.5 MHz. Note that SPI is not available in the default configuration, because its pins are shared with the UART and DDC interfaces. The SPI interface can be enabled by connecting D_SEL to ground (see section *1.11.5*). In this case the DDC interface for data communication is no longer available.

1.11.4 Display Data Channel (DDC)

An I^2C compliant DDC interface is available for communication with an external host CPU. 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, thus the maximum transfer rate is 400 kbit/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 while serving interrupts, so real bit rates may be slightly lower.

1.11.5 Interface selection (D_SEL)

At startup the D_SEL pin determines which data interfaces are used for communication. If D_SEL is set to logical "1" or is not connected, UART and DDC become available. If D_SEL is set to logical "0", i.e. connected to GND, the EVA-7M can communicate to a host via SPI.

Pin #	(D_SEL)="1" (left open)	(D_SEL)="0" (connected to GND)
16	UART TX	SPI MISO
15	UART RX	SPI MOSI
29	DDC SCL	SPI CLK
30	DDC SDA	SPI CS_N

Table 4: Data interface selection by D_SEL

1.12 Configurable Input Output pins

Configuration settings can be modified for several Input/Output pins with either UBX configuration messages or pin selection. This flexible configuration options allow the receivers to be optimally configured for specific applications requirements. The modified settings remain either permanent or effective until power-down or reset depending on the case. Customer can activate or remap the following pins on EVA-7M:

1. Selection of either DDC or UART TX/RX pins interface using D_SEL pin. See section *1.11.5.*
2. Selection of antenna supervision pins. See section *1.16*.
3. Selection of external interrupt pins. See section *1.8*.
4. Configuration of Timepulse. See section *1.9*.

☞ For more information see the *EVA-7M Hardware Integration Manual* [1].

1.13 System reset

The EVA-7M provides a RESET_N pin to reset the system and Real-Time Clock (RTC). The RESET_N pin should be only used in critical situations to recover the system.

1.14 Clock generation

1.14.1 Oscillator

EVA-7M uses a 26 MHz crystal oscillator for lower system costs. Like other u-blox GNSS modules, the EVA-7M uses components selected for functioning reliably in the field over the full operating temperature range.

1.14.2 Real-Time Clock (RTC)

The use of the RTC Clock may be optionally used to maintain time in the event of power failure at VCC_IO. The RTC is required for Hotstart, Warmstart, AssistNow Autonomous, AssistNow Offline and in some Power Save Mode operations.

The use of RTC is optional. The time information can be generated in one of these ways:

- by connecting to an external RTC crystal (for lower battery current – default mode)
- by sharing from another RTC oscillator used within the application (for lowest system costs and smallest size)
- from deriving RTC time from the onboard 26 MHz crystal oscillator (for low system costs and small size)

If the main supply voltage fails and a battery is connected to V_BCKP, parts of the baseband section 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 later allow a hot or warm start.

☞ For more information about crystal operation and configuration, see the *EVA-7M Hardware Integration Manual* [1].

☞ If neither backup RAM nor RTC are used, the backup battery is not needed and V_BCKP should be connected to VCC_IO.

1.15 Power Management

u-blox 7 technology 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.

1.15.1 DC/DC converter

The EVA-7M module integrates a DC/DC converter, allowing reduced power consumption by up to 50%, especially when using a main supply voltage above 2.5 V.

☞ For more information, see the *EVA-7M Hardware Integration Manual* [1].

1.15.2 Operating modes

The EVA-7M module has two operating modes:

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

1.15.2.1 Continuous Mode

Continuous Mode uses the 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

1.15.2.2 Power Save Mode

For power sensitive applications, the EVA-7M module provides a Power Save Mode for reduced power consumption.

Power Save Mode uses two dedicated operations, called 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 7 Receiver Description Including Protocol Specification V14* [2].

☞ Power Save Mode is not available in GLONASS mode.

1.16 Antenna

The EVA-7M module is designed for use with passive[7] and active[8] antennas.

Parameter	Specification	
Antenna Type		Passive and active antenna For Passive antenna an external LNA is mandatory to achieve the performance specified in this document
Active Antenna Recommendations	Minimum gain Maximum gain Maximum noise figure	15 dB (to compensate signal loss in RF cable) 50 dB 2 dB

Table 5: Antenna recommendations and specifications for EVA-7M module

1.16.1 Active antenna control (ANT_OFF)

The ANT_OFF Pin can be used to turn on and off an external LNA or an active antenna. This reduces power consumption in Power Save Mode (Backup mode). This pin is available in EVA-7M module.

☞ ANT_OFF pin polarity can be changed. For more information about active antenna control, see the *EVA-7M Hardware Integration Manual* [1].

1.16.2 Active Antenna supervisor and short circuit detection

An antenna supervisor is available with EVA-7M and requires external components. The antenna supervisor enables the receiver to detect short circuits at the active antenna using the ANT_OFF and ANT_OK pins (activated per default) and to shut down the voltage bias immediately. The antenna supervisor can be extended to also detect condition of open circuit by activating the ANT_DET pin and including external components for antenna open circuit detection. UBX and NMEA messages are provided to report the condition of the antenna supply. Open circuit detection can also be supported.

☞ For more information see the *EVA-7M Hardware Integration Manual* [1].

[7] For integration EVA-7M module with Cellular products, see the *EVA-7M Hardware Integration Manual* [1].
[8] For information on using active antennas with EVA-7M module, see the *EVA-7M Hardware Integration Manual* [1].

2 Pin definition

2.1 Pin assignment

This section shows the pin assignments. Most PIOs are configurable and have shared functions. Use special care when designing with these pins since the overall function of the device can be affected.

The default configuration of the PIOs is listed in Table 6 below.

☞ For more information see the *EVA-7M Hardware Integration Manual* [1].

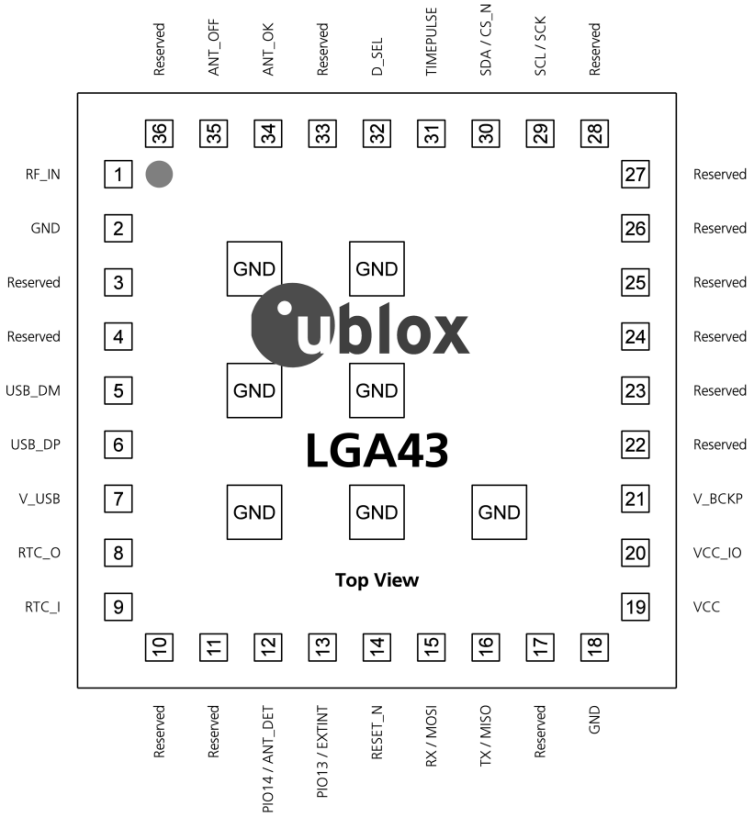


Figure 2: Pin assignment of EVA-7M (LGA43)

☞ For multiple function PIOs, select the specific signal by sending the specific configuration message or by e-fusing.

#	Name	I/O	Description	Remark
35	ANT_OFF	O	Antenna control	Leave open if not used.
34	ANT_OK	I	Antenna status	Leave open if not used.
32	D_SEL	I	Interface selector	See section *1.11.5*.
2	GND	I	Ground	
18	GND	I	Ground	
37	GND	I	Ground	Inner ground pins
38	GND	I	Ground	Inner ground pins
39	GND	I	Ground	Inner ground pins
40	GND	I	Ground	Inner ground pins
41	GND	I	Ground	Inner ground pins
42	GND	I	Ground	Inner ground pins
43	GND	I	Ground	Inner ground pins
13	PIO13 / EXTINT	I	External interrupt	Leave open if not used.
12	PIO14 / ANT_DET	I	Antenna detection	Leave open if not used.
3	Reserved	I/O	Reserved	Do not connect. Must be left open!
4	Reserved	I/O	Reserved	Do not connect. Must be left open!
10	Reserved	I/O	Reserved	Do not connect. Must be left open!
11	Reserved	I/O	Reserved	Do not connect. Must be left open!
17	Reserved	I/O	Reserved	Do not connect. Must be left open!
22	Reserved	I/O	Reserved	Do not connect. Must be left open!
23	Reserved	I/O	Reserved	Do not connect. Must be left open!
24	Reserved	I/O	Reserved	Do not connect. Must be left open!
25	Reserved	I/O	Reserved	Do not connect. Must be left open!
26	Reserved	I/O	Reserved	Do not connect. Must be left open!
27	Reserved	I/O	Reserved	Do not connect. Must be left open!
28	Reserved	I/O	Reserved	Do not connect. Must be left open!
33	Reserved	I/O	Reserved	Do not connect. Must be left open!
36	Reserved	I/O	Reserved	Do not connect. Must be left open!
14	RESET_N	I	System reset	See section *1.13*.
1	RF_IN	I	RF Input	Add external LNA and SAW if no active antenna used.
8	RTC_O	O	RTC Output	Leave open if no RTC Crystal attached.
9	RTC_I	I	RTC Input	Connect to GND if no RTC Crystal attached.
15	RX / MOSI	I	Serial interface	See section *1.11.5*.
29	SCL / SCK	I	Serial interface	See section *1.11.5*.
30	SDA / CS_N	I/O	Serial interface	See section *1.11.5*.
31	TIMEPULSE	O	Time pulse output	Leave open if not used.
16	TX / MISO	O	Serial interface	See section *1.11.5*.
5	USB_DM	I/O	USB data	Leave open if not used.
6	USB_DP	I/O	USB data	Leave open if not used.
21	V_BCKP	I	Backup supply	
19	VCC	I	Main supply	
20	VCC_IO	I	I/O Supply	
7	V_USB	I	USB Interface power	Connect to GND if not used.

Table 6: EVA-7M pinout

3 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 limiting values 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 regarding power management see the *EVA-7M Hardware Integration Manual* [1].

3.1 Absolute maximum rating

Symbol	Parameter	Min	Max	Unit
VCC	Supply voltage	–0.5	3.6	V
VCC_IO	Supply voltage I/O ring	–0.5	3.6	V
V_USB	Supply voltage USB	–0.5	3.6	V
V_BCKP	Supply voltage baseband backup core	–0.5	3.6	V
Vi_{RTC}	Input voltage on RTC_I	–0.5	1.6	V
Vi_{DIG}	Input voltage on Configurable Inputs , RESET_N	–0.5	3.6	V
Prfin	RF Input power on RF_IN		+15	dBm
Ptot	Total power dissipation		500	mW
Ts	Storage temperature	–40	+105	°C

Table 7: 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.

3.2 Operating conditions

☞ The test conditions specified in Table 8 apply to all characteristics defined in this section.

Symbol	Parameter	Min	Typical	Max	Unit	Remarks
Tamb	Ambient temperature	-30	+25	+85	°C	
		-30		+75	°C	Normal operating temperature range. See section *3.2.1*
		+75		+85	°C	Extended operating temperature range 1. See section *3.2.2*
GND	Ground		0		V	
VCC	Core supply voltage		3.3		V	
V_BCKP	Backup battery supply voltage		3.3		V	
VCC_IO	Supply voltage I/O ring		3.3		V	
V_USB	Supply voltage USB		3.3		V	
NFtot	Receiver Chain Noise Figure		5.0		dB	

Table 8: Test 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.

3.2.1 Normal operating temperature range

The module is fully functional and meets the specified performance across the specified temperature range.

3.2.2 Extended operating temperature range 1

The module is fully functional across the specified temperature range. Occasional deviations from the specified performance may occur.

3.2.3 DC electrical characteristic

For block diagrams of the Power Management Unit (PMU) see the *EVA-7M Hardware Integration Manual* [1].

Symbol	Parameter	Min	Typical	Max	Unit
VCC_IO	Supply voltage for PIOs and input voltage for LDO_B and LDO_X	1.65	3.3	3.6	V
V_USB	Supply voltage USB	3.0	3.3	3.6	V
V_BCKP	Input voltage for LDO_B and LDO_X (backup mode)	1.4		3.6	V
VCC	Input voltage	1.65		3.6	V

Table 9: Power supply pins

Symbol	Parameter	Condition	Min	Typical	Max	Unit
Ileak	Leakage current input pins			< 1		nA
Vil	Low level input voltage		0		0.2*VCC_IO	V
Vih	High level input voltage		0.7*VCC_IO		VCC_IO+0.5	V
Vol	Low level output voltage for TX/MISO, RX/MOSI , SDA/CS_N, SCL/SCK, D_SEL, TIMEPULSE, PIO13/EXTINT, PIO14/ANT_DET, ANT_OK, ANT_OFF	Iol = 4 mA			0.4	V
Voh	High level output voltage for TX/MISO, RX/MOSI , SDA/CS_N, SCL/SCK, D_SEL, TIMEPULSE, PIO13/EXTINT, PIO14/ANT_DET, ANT_OK, ANT_OFF	Ioh = 4 mA	VCC_IO-0.4			V
Rpu	Pull-up resistor for configurable SDA/CS_N, SCL/SCK, TIMEPULSE, PIO13/EXTINT, PIO14/ANT_DET			11		kΩ
Rpu	Pull-up resistor for TX/MISO, RX/MOSI, D_SEL, ANT_OK, ANT_OFF			115		kΩ

Table 10: Digital IO pins

3.3 Indicative power requirements

Table 11 lists examples of the total system supply current for a possible application.

☞ Values in Table 11 are provided for customer information only as an example of typical current 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	Conditions	Min	Typ	Max	Units
Max. supply current [9]	Iccp				67	mA
Average supply current [10]	Icc Acquisition[11]	VCC_IO = VCC = 3 V		21		mA
	Icc Tracking (Continuous mode)	VCC_IO = VCC = 3 V		16.5		mA
	Icc Tracking (Power Save mode / 1 Hz)	VCC_IO = VCC = 3 V		4		mA
Backup battery current [12]	I_BCKP using the RTC crystal	HW Backup mode, VCC_IO = VCC = 0 V		15		µA
	I_BCKP using the 26 MHz XTO in "single crystal" operation	HW Backup mode, VCC_IO = VCC = 0 V		300		µA
SW Backup current	I_SWBCKP using the RTC crystal	SW Backup mode, VCC_IO = VCC = 3 V		20		µA
	I_SWBCKP using the 26 MHz XTO in "single crystal" operation	SW Backup mode, VCC_IO = VCC = 3 V		305		µA

Table 11: Currents to calculate the indicative power requirements

For more information about power requirements, see the *EVA-7M Hardware Integration Manual* [1].

☞ All values in Table 11 are measured at 25°C ambient temperature.

[9] Use this figure to dimension maximum current capability of power supply. Measurement of this parameter with 1 Hz bandwidth.
[10] Simulated constellation of 8 satellites is used. All signals are at -130 dBm. VCC= 3 V
[11] Average current from start-up until the first fix.
[12] Use this figure to determine required battery capacity.

3.4 SPI timing diagrams

In order to avoid incorrect operation of the SPI, the user needs to comply with certain timing conditions. The following signals need to be considered for timing constraints:

Symbol	Description
SPI CS_N (SS_N)	Slave select signal
SPI CLK (SCK)	Slave clock signal

Table 12: Symbol description

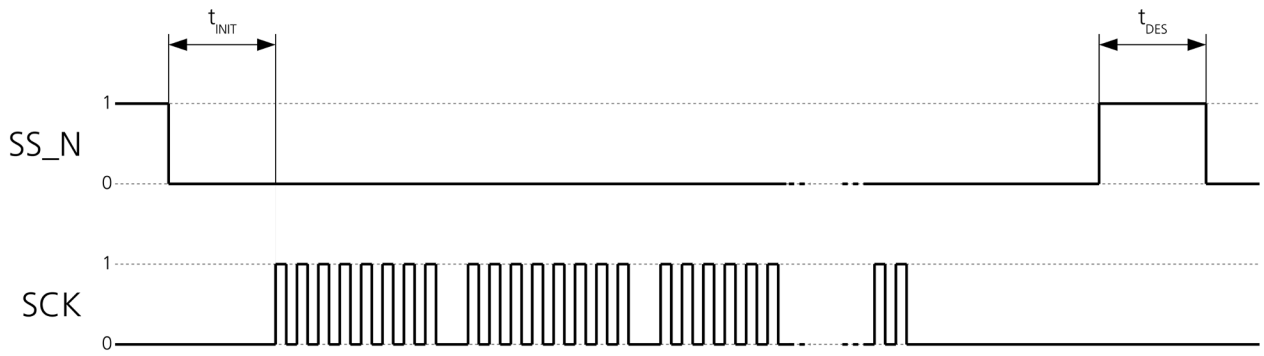


Figure 3: SPI timing diagram

3.4.1 Timing recommendations

Parameter	Description	Recommendation
t_{INIT}	Initialization Time	500 µs
t_{DES}	Deselect Time	1 ms.
Bit rate		1 Mb/s

Table 13: SPI timing recommendations

☞ The values in the above table result from the requirement of an error-free transmission. By allowing just a few errors and disabling the glitch filter, the bit rate can be increased considerably.

4 Mechanical specification

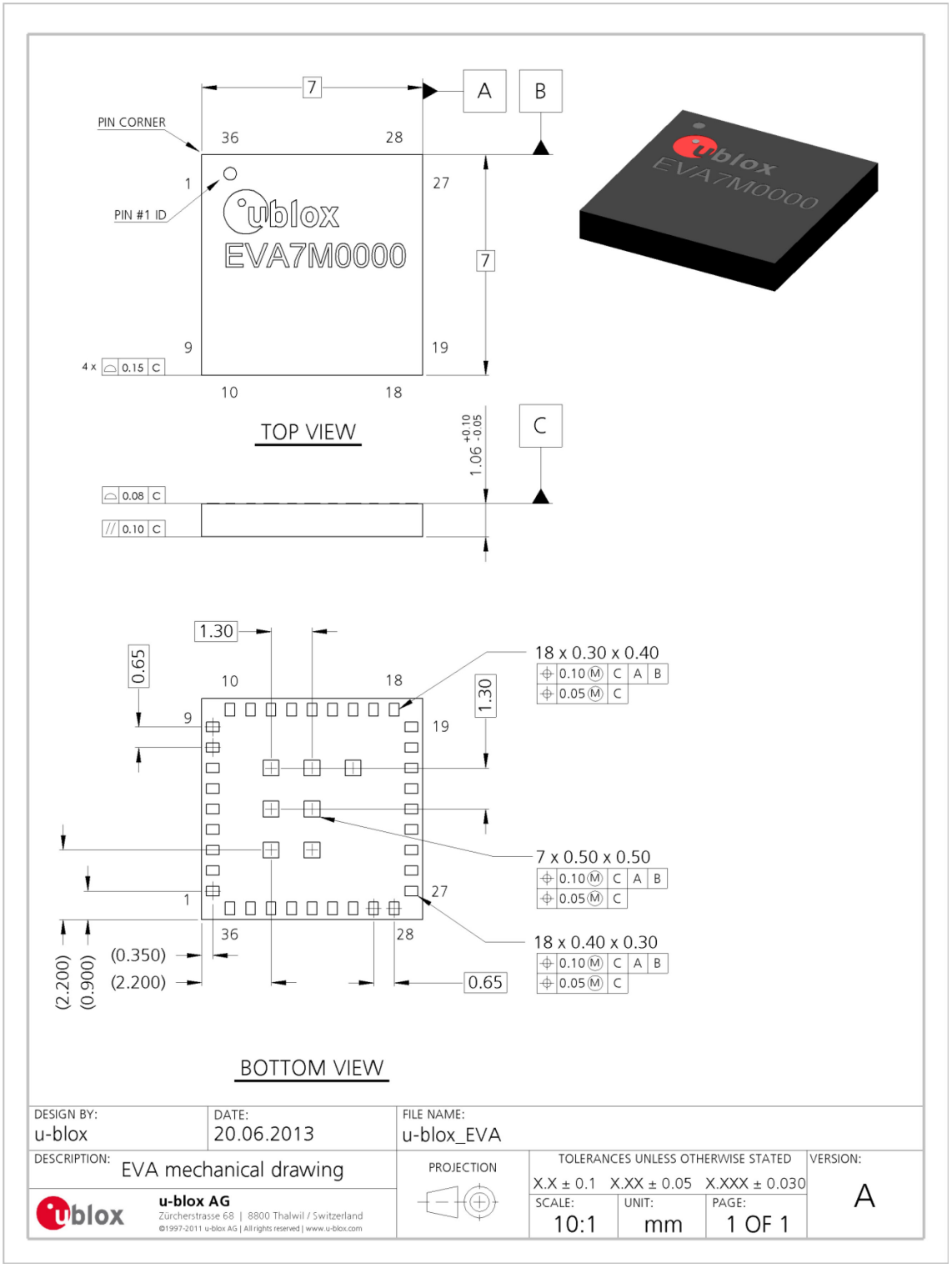


Figure 4: Mechanical drawing for EVA-7M (LGA43)

5 Reliability tests and approvals

5.1 Reliability tests

Qualification requirements according JEDEC standards JESD47 "*Stress-Test-Driven Qualification of Integrated Circuits*".

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).

EVA-7M is RoHS compliant and green (no halogens).

6 Product handling

6.1 Packaging

EVA-7M positioning 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].

6.1.1 Reels

EVA-7M modules are deliverable in quantities of 500 pcs on a reel. EVA-7M receivers are shipped on Reel Type D, as described in the *u-blox Package Information Guide* [3].

6.1.2 Tapes

Figure 5 shows the feed direction and the orientation of the EVA-7M positioning modules on the tape. The positioning modules are placed such that the pin 1 is at the upper right for the LGA43. The dimensions of the tapes are specified in Figure 6.

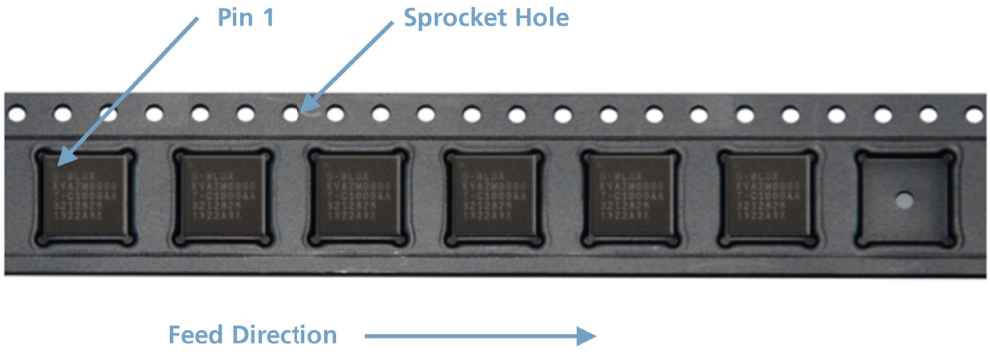


Figure 5: Orientation of EVA-7M modules on the tape

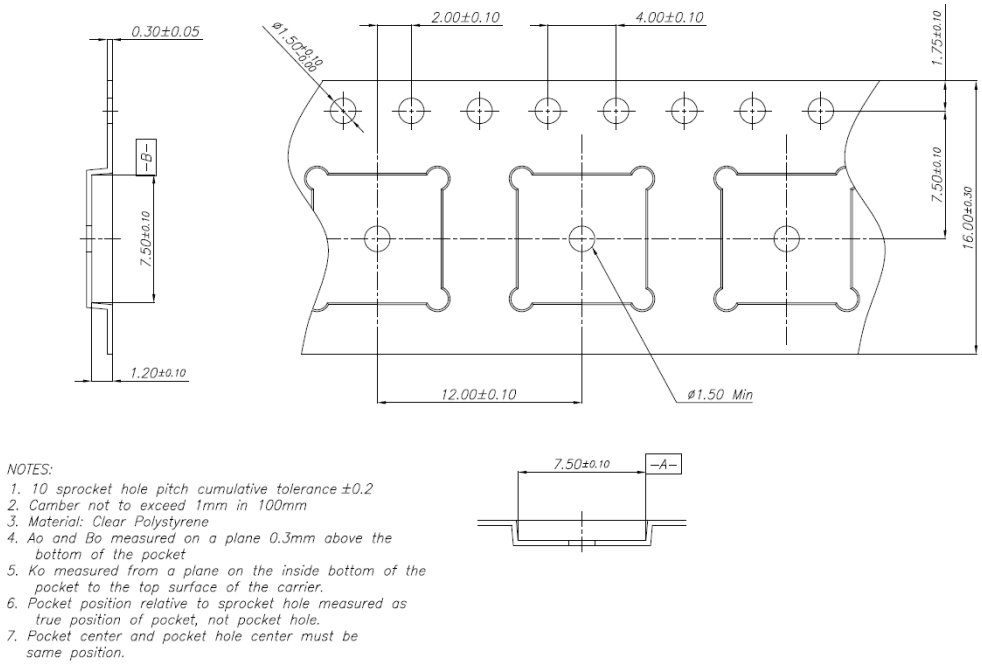


Figure 6: EVA-7M tape dimensions

6.2 Moisture Sensitivity Levels

The Moisture Sensitivity Level (MSL) relates to the packaging and handling precautions required. EVA-7M modules are rated at MSL level 3.

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

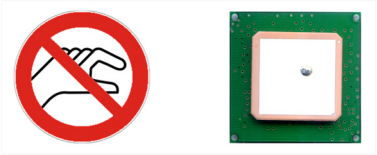
For more information regarding MSL see the *u-blox Package Information Guide* [3].

6.3 ESD handling precautions

EVA-7M positioning 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 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 ~10pF, 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).



7 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 following NMEA (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 (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, RTCM The GNSS receiver supports interleaved UBX and NMEA messages. USB Power Mode: Bus Powered

Table 14: Default messages

☞ Please refer to the *u-blox 7 Receiver Description Including Protocol Specification V14* [2] for information about further settings.

8 Labeling and ordering information

8.1 Product labeling

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

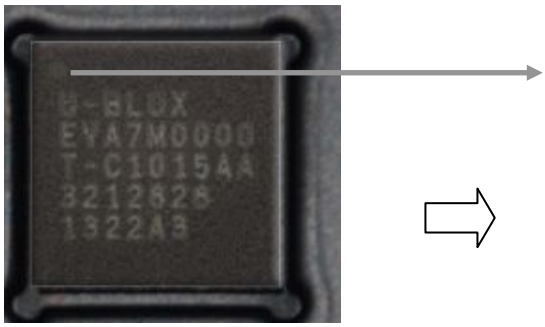


Figure 7: Description of EVA-7M product label

8.2 Explanation of product 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 7 products, independent of packaging and quality grade. The **Ordering Code** includes packaging and quality, while the **Type Number** includes the hardware and firmware versions. Table 15 below details these three different formats:

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

Table 15: Product code formats

The parts of the product code are explained in Table 16.

Code	Meaning	Example
PPP	Product Family	EVA
TG	Technology & Generation	7 = u-blox 7
V	Variant	Function set (A-Z)
T	Grade or functional element	Describes standardized functional element or quality grade (Default = "0")
XXX	Product Detail	Describes product details or options such as hardware and software revision, cable length, etc.

Table 16: Part identification code

8.3 Ordering codes

Ordering No.	Product
EVA-7M-0	u-blox 7 GNSS LGA Module, crystal, ROM, green, 7.0x7.0 mm, 500 pcs/reel

Table 17: Product ordering codes for standard grade positioning modules

☞ 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] EVA-7M Hardware Integration Manual, Docu. No. UBX-12003235

[2] u-blox 7 Receiver Description Including Protocol Specification V14 (NDA version), Docu. No. GPS.G7-SW-12002

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

☞ 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
R01	17-Jan-2014	julu	Objective Specification
R02	23-Jan-2014	julu	Updated Table 5 (passive antenna related statement)
R03	25-Mar-2014	julu	Aligned product selector table in section 1.3; added recommendation for using passive antenna (footnote in Table 5)
R04	26-Jun-2014	julu	Advance Information. Updated Table 8 (added Noise Figure value).
R05	13-Aug-2014	julu	Early Production Information. Updated Table 11 (added SW Backup current)
R06	19-Nov-2014	julu	Updated section 1.3 (added product grade information to selector table).
R07	30-Jan-2015	julu	Production Information. Updated Figure 6 (Tape dimensions) and changed Reel package to Type D (section 6.1.1).

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