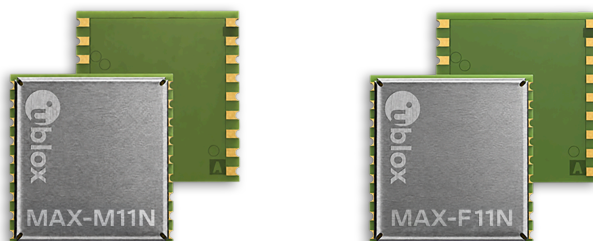


MAX F11/M11 series

Standard precision GNSS modules

Professional grade

Data sheet



Abstract

This data sheet describes the MAX-M11N and MAX-F11N modules, 10 mW ultra-low-power GNSS receivers with upgradable firmware and seamless L1/L5 dual-band operation, delivering best-in-class accuracy across all environments.

Document information

Title	MAX F11/M11 series	
Subtitle	Standard precision GNSS modules	
Document type	Data sheet	
Document number	UBXDOC-304424225-21561	
Revision and date	R01	18-Aug-2026
Disclosure restriction	C1-Public	

Product status	Corresponding content status	
Functional sample	Draft	For functional testing. Revised and supplementary data will be published later.
In development / prototype	Objective specification	Target values. Revised and supplementary data will be published later.
Engineering sample	Advance information	Data based on early testing. Revised and supplementary data will be published later.
Initial production	Early production information	Data from product verification. Revised and supplementary data may be published later.
Mass production / Not recommended for new designs* / End of life	Production information	Document contains the final product specification.

* In the not recommended for new designs (NRND) status, the product is still in production, but it is not recommended for new designs. For the latest product statuses, see the product website or contact u-blox.

This document applies to the following products:

Product name	Type number	FW version	IN/PCN reference	Product status
MAX-M11N	MAX-M11N-00B-00	EXT SPG 7.01	UBXDOC-304424225-21571	Engineering sample
MAX-F11N	MAX-F11N-00B-00	EXT SPG 7.01	-	In development

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Contents

Document information.....	2
Contents.....	3
1 Functional description.....	4
1.1 Overview.....	4
1.2 Performance.....	4
1.3 Supported GNSS constellations and signals.....	5
1.4 Product features.....	6
1.5 Supported protocols.....	6
2 Block diagram.....	8
3 Pin assignment.....	9
4 Electrical specifications.....	10
4.1 Absolute maximum ratings.....	10
4.2 Operating conditions.....	10
4.3 Digital I/O.....	11
4.4 RF parameters.....	11
4.5 Indicative power requirements.....	11
5 Communication interfaces.....	14
5.1 UART.....	14
5.2 Default interface settings.....	14
6 Mechanical specifications.....	15
7 Qualifications and approvals.....	16
8 Product marking and ordering codes.....	17
9 Packaging.....	18
10 Related documents.....	19
11 Revision history.....	20
Contact.....	21

1 Functional description

1.1 Overview

The MAX F11/M11 modules are GNSS receivers based on u-blox F11 dual-band technology that provides high performance and low power consumption. The product family includes two variants:

- **MAX-M11N**, which operates permanently in single-band L1 mode
- **MAX-F11N**, which supports flexible operation in L1-only and dual-band (L1/L5) modes

The modules provide the following features:

- **Multi-constellation support:** Simultaneous tracking of GPS, Galileo, and BeiDou signals for enhanced coverage and robustness.
- **Flexible operating modes**¹: Supports L1, selective L5, and dual-band (L1/L5) positioning.
- **Power save modes:** Supports Low Energy Accurate Positioning (LEAP) and Long Interval Tracking operation.
- **Very low power consumption in all modes:** Down to 10 mW in Low Energy Accurate Positioning (LEAP) mode.
- **Firmware upgradability:** Supports continuous firmware upgrades.
- **GNSS assistance:** Fast time-to-first-fix (TTFF) and accuracy enhancement with the AssistNow services.

 Due to the pre-operational status, the GPS L5 signals are not used for the navigation solution by default. However, it is possible to evaluate the GPS L5 signals before they become fully operational by changing the receiver configuration to override the GPS L5 health status. Please refer to the application note [GPS-L5-configuration_AppNote_UBX-21038688](#).

1.2 Performance

Parameter	Specification	Value
Operational limits ²	Dynamics	≤ Max 4 g
	Altitude	Max 80,000 m
Position accuracy (CEP) ³	Dual-band	0.8 m
	Single-band	0.8 m
	LEAP mode (L1)	1.2 m
Velocity accuracy ⁴	Dual/single-band	0.03 m/s
	LEAP mode	0.05 m/s
Dynamic heading accuracy ⁴	Dual/single-band	0.3 deg
	LEAP mode	0.5 deg
Time pulse frequency		1PPS (Min 0.25 Hz, Max 10 MHz)
Accuracy of time pulse signal	RMS	30 ns
	99%	60 ns

¹ Available only on the dual-band variant MAX-F11N.

² Assuming Airborne 4 g platform.

³ Median, 24 hours static, -130 dBm, > 6 SVs for each GNSS system. GPS and SBAS in combination with another GNSS constellation.

⁴ Median at 30 m/s for dynamic operation.

Parameter	Specification	Value
Max navigation rate ⁵	GPS L1 only	25 Hz
	Default GNSS L1 ⁶	12 Hz
	Default GNSS L1/L5 ⁶	7 Hz
	LEAP ⁶	1 Hz
Time to first fix (TTFF) ⁷	Cold start	27 s
	Hot start	2 s
	AssistNow Live Orbits	2 s
	AssistNow Predictive Orbits ⁸	3.5 s
	AssistNow Autonomous ⁹	3 s
Sensitivity ¹⁰	Cold start	-148 dBm
	Tracking and navigation ¹¹	-165 dBm
	Reacquisition	-158 dBm

Table 1: Typical performance

1.3 Supported GNSS constellations and signals

The RF front-end architecture enables concurrent tracking and reception of multiple GNSS constellations and bands.

System	Signals
GPS / QZSS	L1C/A (1575.42 MHz), L5 (1176.450 MHz) ¹²
Galileo	E1-B/C (1575.42 MHz), E5a (1176.450 MHz) ¹²
BeiDou	B1I (1561.098 MHz), B1C (1575.42 MHz), B2a (1176.450 MHz) ¹²
IRNSS/NavIC	L5 (1176.450 MHz) ¹² Contact u-blox regarding L1 (1575.42 MHz) support
Glonass	Contact u-blox regarding GLONASS L1 (1602.0–1615.5 MHz) support

Table 2: Supported GNSS and signals

Service	Support
AssistNow™ Live Orbits	GPS L1C/A, Galileo E1, BeiDou B1I, and QZSS L1C/A
AssistNow™ Predictive Orbits	GPS, Galileo, BeiDou, and QZSS
AssistNow™ Autonomous	GPS, Galileo, BeiDou, and QZSS

Table 3: Supported Assisted GNSS (A-GNSS) services

System	Support
SBAS	EGNOS, GAGAN, MSAS, WAAS, BDSBAS, KASS, and SouthPAN
QZSS	L1S (SLAS), L1Sb (SBAS)

Table 4: Supported augmentation systems

⁵ Minimum 98% fix rate under typical conditions.

⁶ GNSS configuration: GPS, Galileo, BeiDou, QZSS and SBAS enabled.

⁷ Commanded starts. All satellites at –130 dBm. Measured at room temperature.

⁸ Using 7 days old AssistNow Predictive Orbits data.

⁹ Using 2 days old self-generated predictive data.

¹⁰ Demonstrated with a good external LNA. Measured at room temperature.

¹¹ Ultra-high sensitivity mode.

¹² Not supported on MAX-M11N.

The augmentation systems SBAS and QZSS can be enabled only if GPS operation is also enabled.

1.4 Product features

Feature	Description
Upgradeable firmware	The firmware is upgradeable through the host interface.
Dual-band ¹³	Simultaneous reception of the best signals from the L1 and L5 bands provides improved position accuracy in urban environments.
Selective L5 operation ¹³	The receiver operates in single-band mode in open-sky conditions and switches to dual-band operation in more challenging signal environments to balance positioning accuracy and power consumption (L1 + Selective L5).
Low Energy Accurate Positioning (LEAP) ¹⁴	Reduces the power consumption while retaining superior position accuracy.
Long interval tracking	Scheduled power-off and wake-up operation.
AutoSave	Periodically stores GNSS data to a flash memory and restores it automatically at startup to reduce TTFF and improve position accuracy.
Antenna supervisor ¹⁵	Antenna supervisor for active antenna control and short circuit detection.
External LNA control	Automatic enable/disable of an external LNA or active antenna to save power.
Indoor detection	Identifies and reports to the host when the receiver enters an indoor environment.
CloudTrack	Reduces startup energy consumption by using a cloud service, saving up to 90% of startup energy.
Assisted GNSS	AssistNow Live Orbits, AssistNow Predictive Orbits and AssistNow Autonomous to improve time-to-first-fix and position accuracy after startup.
Dynamic models	Portable, stationary, pedestrian, automotive, at sea, airborne, wrist, wrist low power and swimming mode.
Backup modes	Hardware backup mode, hardware standby mode, and software standby mode, all with optional RTC.
Galileo return link messages	Galileo search and rescue (SAR) return link messages (RLM) via Galileo satellite signal.
Data batching	Stores position/velocity/time information over up to 5 min in RAM without host interaction.
Odometer	Measures traveled distance with support for different user profiles.
Data logging	Stores position/velocity/time information on the embedded or external flash memory without host interaction.
Geofencing	Up to 4 circular areas and up to five polygon-defined areas. GPIO for waking up external host.
Anti-jamming	RF interference and jamming detection and reporting.
Anti-spoofing	Spoofing detection and reporting.
Configuration lockdown	Receiver configuration can be locked by command.
Message integrity	All messages can be cryptographically signed.
Secure boot	Only signed firmware images are executed.

Table 5: Product features

1.5 Supported protocols

Protocol	Type
UBX	Input/output, binary, u-blox proprietary

¹³ Not supported on the MAX-M11N.

¹⁴ Available for L1 (single-frequency) and Selective L5 operation modes.

¹⁵ External components required, some pins need to be reconfigured.

Protocol	Type
NMEA versions 2.1, 2.3, 4.0, 4.10 and 4.11 (default)	Input/output, ASCII

Table 6: Supported protocols

2 Block diagram

The two module variants differ in supported frequency bands and the RF front-end architecture.

The **MAX-M11N** is a single-band module with a SAW-LNA-SAW RF architecture. The module is based on the UBX-F11170-CC chip and has a flash memory attached which allows firmware upgradability. The default communication interface to host is UART. The onboard DCDC brings power efficiency and the TCXO ensures reliable GNSS operation. The RTC ensures accurate time reference after resume from the backup modes.

The **MAX-F11N** only differs from the MAX-M11N on the RF front-end, which allows dual-band operation, with a SAW-LNA-SAW diplexer.

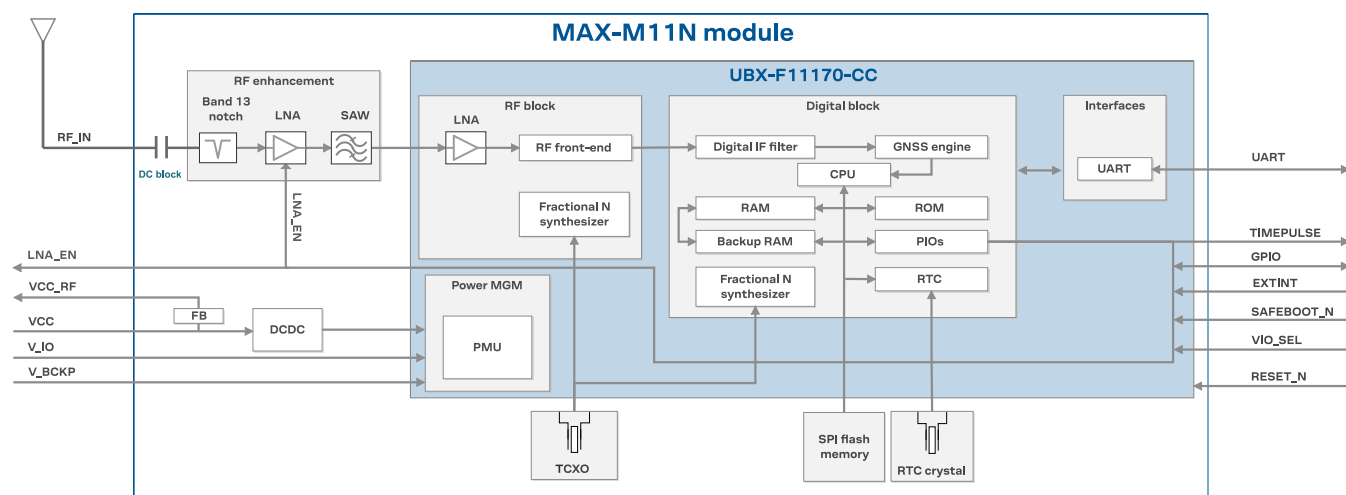


Figure 1: MAX-M11N block diagram

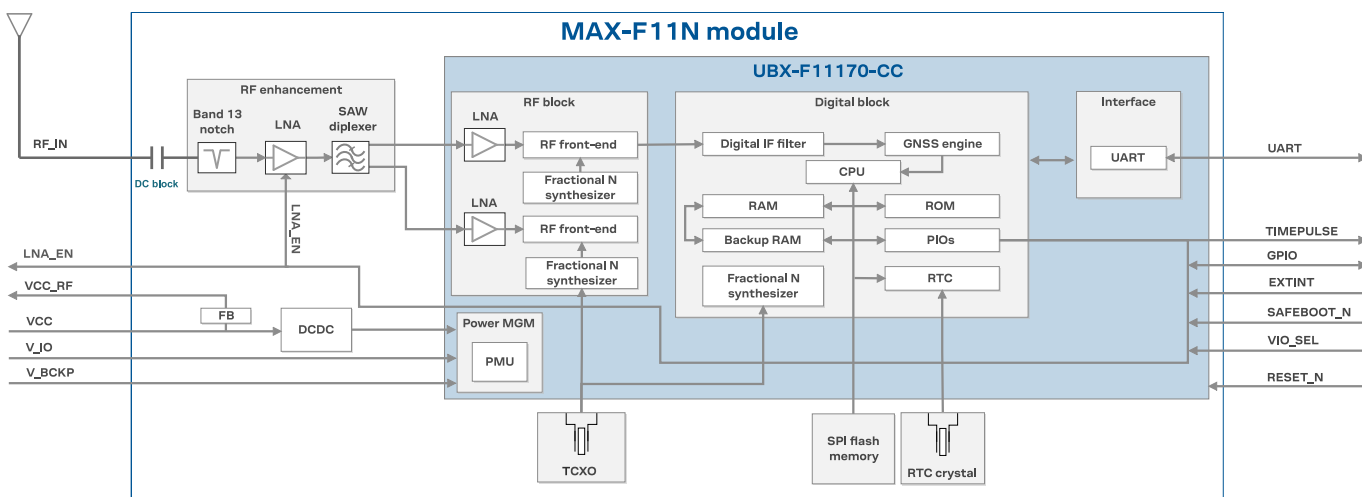


Figure 2: MAX-F11N block diagram

3 Pin assignment

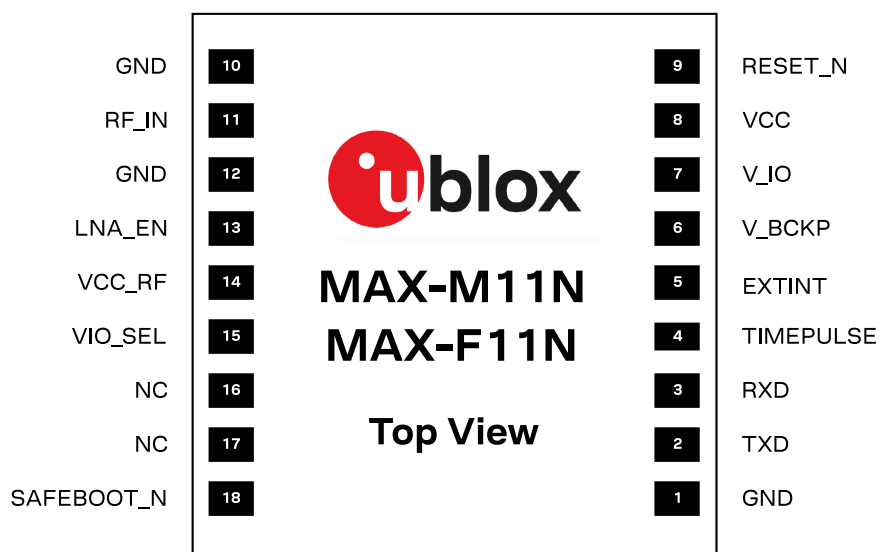


Figure 3: MAX-M11N and MAX-F11N pin assignment

Pin no.	Name	PIO no.	I/O	Description
1	GND	-	-	Connect to GND
2	TXD	1	O	UART TX. Leave open if not used.
3	RXD	0	I	UART RX. Leave open if not used.
4	TIMEPULSE	4	O	Time pulse signal (shared with SAFEBOOT_N pin) ¹⁶
5	EXTINT	5	I	External interrupt. Leave open if not used.
6	V_BCKP	-	I	Backup voltage supply
7	V_IO	-	I	IO voltage supply
8	VCC	-	I	Main voltage supply
9	RESET_N	-	I	System reset (active low). Has to be low for at least 1 ms to trigger a reset.
10	GND	-	-	Connect to GND
11	RF_IN	-	I	GNSS signal input
12	GND	-	-	Connect to GND
13	LNA_EN	-	O	On/Off external LNA or active antenna
14	VCC_RF	-	O	Output voltage RF section
15	VIO_SEL	-	I	Voltage selector for V_IO supply. Connect to GND for 1.8 V supply, or leave open for 3.3 V supply.
16	NC	-	-	Not connected
17	NC	-	-	Not connected
18	SAFEBOOT_N	-	I	Safeboot mode (active low). Leave open if not used. ¹⁶

Table 7: MAX-M11N and MAX-F11N pin assignment

¹⁶ The receiver enters safeboot mode if this pin is low at start up. The SAFEBOOT_N pin is internally connected to TIMEPULSE pin through a 1 kΩ series resistor.

4 Electrical specifications

4.1 Absolute maximum ratings

Risk of device damage. Exceeding the absolute maximum ratings may affect device lifetime, reliability, or cause permanent damage. This product is not protected against overvoltage or reversed voltages. Use appropriate protection to prevent voltage spikes or incorrect polarity from exceeding the specified boundaries.

Symbol	Parameter	Min	Max	Unit
VCC	VCC input supply voltage	-0.3	3.6	V
V _{IO}	V _{IO} supply voltage for PIOs and backup domain	-0.3	3.6	V
	Voltage ramp on V _{IO} ¹⁷	25	3500	μs/V
V _{BCKP}	V _{BCKP} supply voltage for backup domain	-0.3	3.6	V
	Voltage ramp on V _{BCKP} ¹⁷	25		μs/V
VCC_RF	VCC_RF output supply voltage	-0.3	3.6	V
I _{VCC_RF}	Max source current, VCC_RF		250	mA
VIO_SEL	V _{IO} Voltage selector	-0.3	3.6	V
V _{PIO}	Input voltage when VIO_SEL = GND, IO pins ¹⁸	-0.3	V _{IO} + 0.3 (max 1.98)	V
	Input voltage when VIO_SEL = open, IO pins ¹⁸	-0.3	V _{IO} + 0.3 (max 3.6)	V
V _{RESET_N}	RESET_N pin input voltage when VIO_SEL = GND	-0.3	V _{IO} + 0.3 (max 1.98)	V
	RESET_N pin input voltage when VIO_SEL = open	-0.3	V _{IO} + 0.3 (max 3.6)	V
I _{PIO}	Digital I/O max source / sink current ¹⁹	-10	10	mA
V _{RF_IN}	Max DC voltage at RF_IN	-5.5	5.5	V
P _{rfin}	RF input power at RF_IN		+15	dBm
T _s	Storage temperature	-40	+85	°C

Table 8: Absolute maximum ratings

4.2 Operating conditions

The V_{IO} range is selected with the VIO_SEL pin.

Symbol	Parameter	Min	Typical	Max	Unit
Vcc	Main supply voltage	1.76		3.6	V
V _{IO}	Supply voltage, I/O, VIO_SEL = GND	1.76	1.8	1.98	V
	Supply voltage, I/O, VIO_SEL = open	2.85	3.3	3.6	V
V _{BCKP}	Supply voltage, backup domain	1.69		3.6	V
V _{GND}	Ground voltage level		0		V
VCC_RF	VCC_RF output voltage		VCC-0.1		V

¹⁷ Faster ramps might trigger the ESD protection and damage the device.

¹⁸ Pins RXD, TXD, EXTINT, TIMEPULSE, and SAFEBOOT_N.

¹⁹ The SAFEBOOT_N pin has an internal 1 kΩ series resistor.

Symbol	Parameter	Min	Typical	Max	Unit
I_{VCC_RF}	VCC_RF output current		50		mA
T_{opr}	Operating temperature	-40		+85	°C

Table 9: Power supplies

4.3 Digital I/O

Symbol	Parameter	Condition	Min	Typical	Max	Unit
I_{leak}	Leakage current input pins ²⁰			25		nA
V_{il}	Low-level input voltage	For both V_{IO} ranges	0		$0.3 \times V_{IO}$	V
V_{ih}	High-level input voltage	For both V_{IO} ranges	$0.7 \times V_{IO}$		V_{IO} (max 3.6V)	V
V_{ol}	Low-level output voltage	$VIO_SEL = open$			$0.2 \times V_{IO}$	V
		$VIO_SEL = GND$			0.45	V
V_{oh}	High-level output voltage	$VIO_SEL = GND$	$V_{IO} - 0.45$			V
		$VIO_SEL = open$	$0.8 \times V_{IO}$			V
$R_{pu, IO}$	Pull-up resistance	$VIO_SEL = GND$		40		kΩ
		$VIO_SEL = open$		57		kΩ
$R_{pd, IO}$	Pull-down resistance	$VIO_SEL = GND$		38		kΩ
		$VIO_SEL = open$		52		kΩ
R_{pu_resetn}	Pull-up resistance, RESET_N			50		kΩ
t_{il_resetn}	Time to trigger a RESET using the RESET_N pin		1			ms
$V_{ol_LNA_EN}$	Low-level output voltage, LNA_EN	$I_{out} = -10 \mu A$			0.06	V
$V_{oh_LNA_EN}$	High-level output voltage, LNA_EN	$I_{out} = 10 \mu A$	1.45	1.55	1.65	V

Table 10: Digital IO

4.4 RF parameters

Symbol	Parameter	Min	Typical	Max	Unit
f_{RF_IN}	L1 input frequency of RF_IN	1558		1610	MHz
	L5 input frequency of RF_IN	1157.5		1200	MHz
$ S_{11} _{RF_IN}$	Input reflection with external matching components		-10		dB
Z_{RF_IN}	Input impedance of RF_IN		50		Ω
$NF_{RF_IN_tot}$	Receiver chain noise figure, MAX-M11N		3		dB
	Receiver chain noise figure, MAX-F11N				dB
G_{RF_IN}	External gain at RF_IN			30	dB

Table 11: RF parameters

4.5 Indicative power requirements

This chapter presents typical current-consumption figures for continuous operation in dual-band (L1/L5), single-band (L1), LEAP power save mode, and backup modes. Actual power consumption

²⁰ $V_{in} = V_{IO}$.

may vary with firmware version, satellite visibility, signal strength, receiver configuration, and temperature.

All values were measured at an ambient temperature of 25 °C, with QZSS and SBAS enabled at 1 Hz navigation rate, unless stated otherwise.

-  The inrush current at **VCC** can reach up to 100 mA during startup. Ensure that the external power supply is able to deliver up to 100 mA.
-  Current figures for dual-band operation are not yet available. Measurements will be provided for the MAX-F11N variant, which is still under development.

Dual band L1/L5 operation

Symbol (Parameter)	Condition	GPS+GAL+BDS	GPS+GAL	GPS	Unit
I_{VCC} (VCC current)	Acquisition ²¹	VCC = 3.3V			mA
		VCC = 1.8V			mA
	Tracking ²²	VCC = 3.3V			mA
		VCC = 1.8V			mA
I_{IO} (V_IO current)	Acquisition and tracking				mA

Table 12: Typical currents in dual band L1/L5 configuration

Single band L1 operation

Symbol (Parameter)	Condition		GPS+GAL +BDS	GPS+GAL +BDS B1C	GPS+GAL	GPS	Unit
I_{VCC} (VCC current)	Acquisition ²¹	VCC = 3.3V	7.5	7.6	6	4.8	mA
		VCC = 1.8V	13	13	9.7	7.5	mA
	Tracking ²²	VCC = 3.3V	5.9	6	5.1	4.7	mA
		VCC = 1.8V	9.2	9.5	7.6	6.9	mA
I_{IO} (V_IO current)	Acquisition and tracking		2.0	1.9	1.9	1.9	mA

Table 13: Typical currents in single band L1 configuration

LEAP power save mode operation

Symbol (Parameter)	Condition		GPS+GAL +BDS	GPS+GAL +BDS B1C	GPS+GAL	GPS	Unit
I _{VCC} (VCC current)	Acquisition ²¹	VCC = 3.3V	7.5	7.6	6	4.8	mA
		VCC = 1.8V	13	13	9.7	7.5	mA
	Tracking ²² : - 1 Hz navigation rate	VCC = 3.3V	2.3	2.3	2.3	2.1	mA
		VCC = 1.8V	3.9	3.6	3.7	3.3	mA
		VCC = 3.3V	1.5	1.4	1.4	1.2	mA
		VCC = 1.8V	2.7	2.5	2.3	2.0	mA
		VCC = 3.3V	2.3	2.3	2.3	2.1	mA
		VCC = 1.8V	3.9	3.6	3.7	3.3	mA

²¹ Average current value from startup until the first position fix.

²² Average current value from the first position fix to the next 45 minutes.

Symbol (Parameter)	Condition	GPS+GAL +BDS	GPS+GAL +BDS B1C	GPS+GAL	GPS	Unit
I_{IO} (V _{IO} current)	Acquisition	2.0	2.0	2.0	1.9	mA
	Tracking	1.8	1.8	1.8	1.8	mA

Table 14: Typical currents in LEAP mode

Backup modes

Backup mode	Conditions	Symbol	Typical	Unit		
Hardware backup mode	VCC supply OFF	I _{BCKP}	29	μA		
	V _{IO} supply OFF					
	V _{BCKP} = 3.3 V					
	T _{opr} = 25°C					
Hardware standby mode	VCC supply OFF	I _{IO}	V _{IO} = 1.8 V	44	μA	
	V _{IO} supply ON		V _{IO} = 3.3 V	340	μA	
	T _{opr} = 25°C	I _{BCKP} ²³	V _{BCKP} = 3.3 V	3	μA	
	Software standby mode	VCC supply ON	I _{IO}	V _{IO} = 1.8 V	40	μA
				V _{IO} = 3.3 V	330	μA
V _{IO} supply ON		I _{VCC}		3	μA	
T _{opr} = 25°C		I _{BCKP} ²³		3	μA	

Table 15: Typical currents in the backup modes

²³ No voltage supply is required at V_{BCKP} in this mode. When V_{BCKP} is not supplied, the $I_{BCKP} = 0 \mu A$.

5 Communication interfaces

The modules support communication over the UART interface.

All the inputs have an internal pull-up resistor in normal operation and can be left open if not used. The voltage level at the PIO pins is related to the V_{IO} supply voltage.

5.1 UART

The UART interface supports configurable baud rates. Hardware flow control is not supported. UART specifications are described in [Table 16](#).

Symbol	Parameter	Min	Max	Unit
R _u	Baud rate	9600	921600	bit/s
Δ _{Tx}	Tx baud rate accuracy	-1%	+1%	-
Δ _{Rx}	Rx baud rate tolerance	-2.5%	+2.5%	-

Table 16: UART specifications

5.2 Default interface settings

Interface	Settings
UART	9600 baud, 8 bits, no parity bit, 1 stop bit. - Input messages: NMEA and UBX - Output messages: NMEA GGA, GLL, GSA, GSV²⁴, RMC, VTG and TXT

Table 17: Default interface settings

²⁴ In the default configuration, the NMEA-GSV messages are sent at 5-second intervals to avoid overflow in the TX buffer.

6 Mechanical specifications

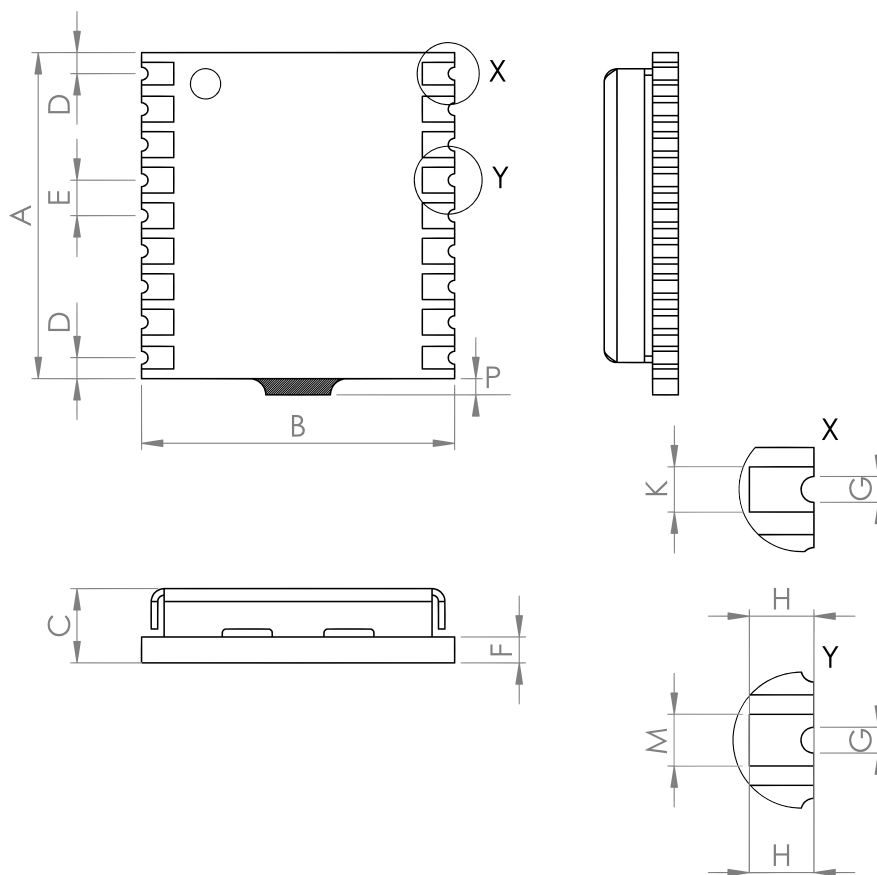


Figure 4: MAX modules mechanical drawing

Symbol	Min (mm)	Typical (mm)	Max (mm)
A	10.0	10.1	10.7
B	9.6	9.7	9.8
C	2.2	2.5	2.7
D	0.55	0.65	0.95
E	1.0	1.1	1.2
F	-	0.76	-
G	0.3	0.4	0.5
H	0.9	1.0	1.1
K	0.6	0.7	0.8
M	0.7	0.8	0.9
P	-	0.3	0.6
Weight		0.5 g	

Table 18: MAX modules mechanical dimensions

7 Qualifications and approvals

Type	Description
Manufacturing	Manufactured at IATF 16949 certified sites
RoHS compliance	Yes
Moisture sensitivity level (MSL) ^{25, 26}	4

Table 19: Qualifications and approvals

²⁵ For MSL standard see IPC/JEDEC J-STD-020 and J-STD-033 [4].

²⁶ For more information regarding moisture sensitivity levels, labeling, storage, and drying, see the Product packaging reference guide [3].

8 Product marking and ordering codes

The product marking is done by laser etching on the module metal shield cover.

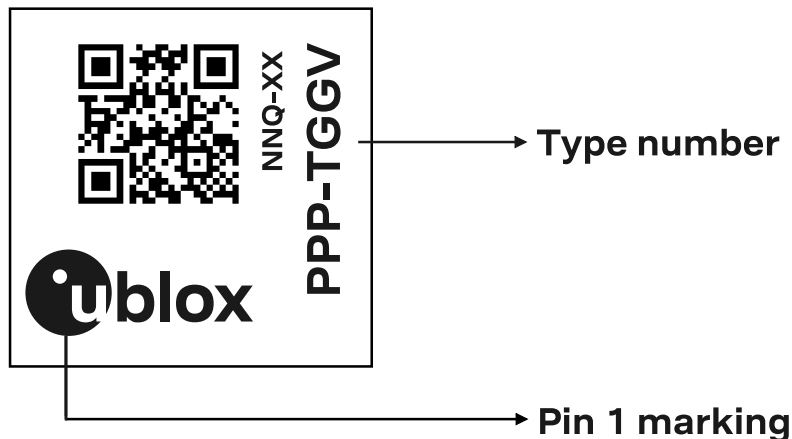


Figure 5: Example of product marking

Code	Meaning	MAX-M11N-00B-00	MAX-F11N-00B-00
PPP	Form factor	MAX	MAX
T	GNSS bands supported	M = L1 single-band	F = L1/L5 dual-band
GG	Platform	11 = u-blox 11	11 = u-blox 11
V	Variant	N = Flash, TCXO, SAW filter, and LNA	N = Flash, TCXO, SAW filter, and LNA
NN	Major product version	00, 01, 02, ...	00, 01, 02, ...
Q	Product grade	B = Professional	B = Professional
XX	Hardware and firmware versions	00, 01, 02, ...	00, 01, 02, ...

Table 20: Description of product marking

Ordering code	Type number	Product description
MAX-M11N	MAX-M11N-00B-00	LCC u-blox M11 module, 18 pin MAX form factor 9.7 x 10 mm ² , professional grade, L1 single-band operation, firmware upgradable.
MAX-F11N	MAX-F11N-00B-00	LCC u-blox F11 module, 18 pin MAX form factor 9.7 x 10 mm ² , professional grade, L1/L5 dual-band operation, firmware upgradable.

Table 21: Product ordering codes

The MAX modules are delivered in hermetically sealed tape-and-reel packaging to support efficient production and simplify production lot setup and teardown.

Table 22: Reel information

The dimensions of the tape for each package type are specified in [Figure 6](#) (measurements in mm).

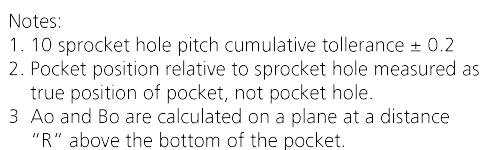


Figure 6: Tape specification

For more information, see the Product packaging reference guide [3].

10 Related documents

- [1] SPG 7.0x Interface description, [UBXDOC-304424225-21098](#)
- [2] u-blox SPG 7.01 firmware release note, UBXDOC-304424225-21620
- [3] Product packaging reference guide, [UBX-14001652](#)
- [4] MSL standard IPC/JEDEC J-STD-020, www.jedec.org
- [5] AssistNow user guide, <https://support.thingstream.io/hc/en-gb/categories/18850353313692-AssistNow>
- [6] AssistNow service specifications, <https://support.thingstream.io/hc/en-gb/articles/19691890148892-AssistNow-service-specifications>



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11 Revision history

Revision	Date	Comments
R01	18-Aug-2026	Initial release. Values based on preliminary data.

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For further support and contact information, visit us at www.u-blox.com/support.