MIA-M10Q

Standard precision GNSS module
Professional grade

Data sheet



Abstract

This data sheet describes the MIA-M10Q module, an ultra-small form factor and ultra-low-power GNSS receiver for high-performance wearable and asset-tracking applications.

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* 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.

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1 Functional description

1.1 Overview

MIA-M10Q has an extremely small footprint to enable miniature product designs. Exceptional sensitivity and acquisition time for all L1 GNSS signals are attributed to its integrated M10 standard precision low power platform.

The M10 platform supports concurrent reception of four GNSSs (GPS, GLONASS, Galileo, and BeiDou). The high number of visible satellites enables the receiver to select the best signals. This maximizes the position availability, in particular under challenging conditions such as in deep urban canyons.

MIA-M10Q-01B-01 supports GNSS broadcast data and raw carrier-phase measurements.

u-blox Super-Signal (Super-S) technology offers great RF sensitivity and can improve the dynamic position accuracy with small antennas or in non-line-of-sight scenarios.

The extremely low power consumption of 25 mW in continuous tracking mode allows great power autonomy for all battery-operated devices, such as asset trackers, without compromising on GNSS performance.

For maximum sensitivity in passive antenna designs, MIA-M10Q integrates an LNA followed by a SAW filter in the RF path.

The small footprint and highly integrated System-in-Package (SiP) makes MIA-M10Q suitable for compact designs in wearable and tracking applications.

1.2 Performance

Parameter	Specification	Value
Receiver type		u-blox M10 receiver
Accuracy of time pulse signal	RMS	30 ns
	99%	60 ns
Frequency of time pulse signal		Default 1PPS (0.25 Hz to 10 MHz configurable)
Operational limits[1]	Dynamics	≤ 4 g
	Altitude	80,000 m
	Velocity	500 m/s
Velocity accuracy [2]		0.05 m/s
Dynamic heading accuracy [2]		0.3 deg

Table 1: MIA-M10Q specifications

1 Assuming Airborne 4 g platform.

2 50% at 30 m/s for dynamic operation.

Parameter		GPS+GAL	GPS+GAL +GLO	GPS+GAL +BDS B1I (default)	GPS+GAL +BDS B1C	GPS+GAL +BDS B1C +GLO
Max navigation update rate [3]	Default	10 Hz	6 Hz	3 Hz	8 Hz	4 Hz
	High performance [4]	20 Hz	16 Hz	12 Hz	16 Hz	10 Hz
Position accuracy (CEP) [5, 6]		1.5 m	1.5 m	1.5 m	1.5 m	1.5 m
Time To First Fix (TTFF) [5, 7, 8]	Cold start	28 s	23 s	27 s	28 s	23 s
	Hot start	1 s	1 s	1 s	1 s	1 s
	AssistNow Online [9]	1 s	1 s	1 s	1 s	1 s
	AssistNow Offline [10]	2 s	2 s	3 s	2 s	2 s
	AssistNow Autonomous [11]	3 s	4 s	4 s	4 s	4 s
Sensitivity [12]	Tracking and navigation	–167 dBm	–167 dBm	–167 dBm	–167 dBm	–167 dBm
	Reacquisition	–160 dBm	–160 dBm	–160 dBm	–160 dBm	–160 dBm
	Cold Start	–148 dBm	–148 dBm	–148 dBm	–148 dBm	–148 dBm
	Hot start [7]	–159 dBm	–159 dBm	–159 dBm	–159 dBm	–159 dBm

Table 2: MIA-M10Q typical performance in multi-constellation GNSS modes.

Parameter		GPS	GLONASS	BDS B1I	GALILEO	BDS B1C
Max navigation update rate [3]	Default	18 Hz	18 Hz	18 Hz	18 Hz	18 Hz
	High performance [4]	25 Hz	25 Hz	25 Hz	25 Hz	25 Hz
Position accuracy (CEP) [5, 6]		1.5 m	4 m	2 m	3 m	2 m
Time To First Fix (TTFF) [5, 7, 8]	Cold start	29 s	27 s	30 s	41 s	56 s
	Hot start	1 s	1 s	1 s	1 s	1 s
	AssistNow Online [9]	1 s	1 s	1 s	5 s	N/A
Sensitivity [12]	Tracking and navigation	–167 dBm	–166 dBm	–160 dBm	–161 dBm	–163 dBm
	Reacquisition	–160 dBm	–158 dBm	–158 dBm	–154 dBm	–156 dBm
	Cold Start	–148 dBm	–147 dBm	–146 dBm	–141 dBm	–136 dBm
	Hot start [7]	–159 dBm	–159 dBm	–159 dBm	–155 dBm	–157 dBm

Table 3: MIA-M10Q typical performance in single-GNSS modes

1.3 Supported GNSS constellations

MIA-M10Q is a concurrent GNSS receiver that can receive and track multiple GNSS systems. To achieve lower power consumption, the receiver can be configured for a subset of GNSS constellations.

3 Minimum 98% fix rate under typical conditions.
4 Configuration required.
5 GPS is always in combination with SBAS and QZSS.
6 CEP, 50%, 24 hours static, –130 dBm, > 6 SVs for each GNSS system.
7 Commanded starts.
8 All satellites at –130 dBm. Measured at room temperature.
9 Dependent on the speed and latency of the aiding data connection, commanded starts.
10 Using seven days old AssistNow Offline data. External memory may be required.
11 Using two days old orbital predicted data. External memory may be required.
12 Demonstrated with a good external LNA. Measured at room temperature.

The default configuration on MIA-M10Q is concurrent reception of GPS, Galileo, and BeiDou B1I with QZSS and SBAS enabled.

The following GNSS and their signals are supported:

System	Signals
GPS / QZSS	L1C/A (1575.42 MHz)
Galileo	E1-B/C (1575.42 MHz)
GLONASS	L1OF (1602 MHz + k*562.5 kHz, k = -7,..., 5, 6)
BeiDou[13]	B1I (1561.098 MHz), B1C (1575.42 MHz)

Table 4: Supported GNSS and signals on MIA-M10Q

The following GNSS assistance services are supported:

Service	Support
AssistNow Live Orbits	GPS L1C/A, Galileo E1, QZSS L1C/A, GLONASS L1OF, BeiDou B1I
AssistNow Predictive Orbits	GPS L1C/A, Galileo E1 , GLONASS L1OF
AssistNow Autonomous	GPS L1C/A, Galileo E1, GLONASS L1OF, QZSS L1C/A, BeiDou B1I

Table 5: Supported Assisted GNSS (A-GNSS) services

The following augmentation systems are supported:

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

Table 6: Supported augmentation systems

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

1.4 Broadcast navigation data and satellite signal measurements

The GNSS broadcast data is available in the UBX-RXM-SFRBX message for all supported GNSS signals as well as the QZSS and SBAS augmentation services. The satellite signal information is compatible with the Radio Resource LCS Protocol (RRLP) [4].

The full raw data including code phase, doppler, pseudorange, carrier phase, and measurement quality information is available in the UBX-RXM-RAWX message for all supported GNSS signals. The UBX-RXM-RAWX message follows the conventions of a multi-GNSS RINEX 3 observation file.

This applies only to the product MIA-M10Q-01B-01.

☞ The raw measurement data is available after the receiver has established data bit synchronization and time-of-week.

1.5 Supported protocols

MIA-M10Q supports the following interface protocols:

[13] BeiDou B1I cannot be enabled simultaneously with BeiDou B1C or GLONASS L1OF.

Protocol	Type
UBX	Input/output, binary, u-blox proprietary
NMEA versions 2.1, 2.3, 4.0, 4.10 and 4.11 (default)	Input/output, ASCII

Table 7: Supported protocols

1.6 Firmware features

Feature	Description
Antenna supervisor[14]	Antenna supervisor for active antenna control and short detection
CloudLocate GNSS	Extends the life of energy-constrained IoT applications. Small payload messages supported.
Assisted GNSS	AssistNow Live Orbits, AssistNow Predictive Orbits, and AssistNow Autonomous
Backup modes	Hardware backup mode and software standby mode, both with optional RTC
Power save modes	On/off, cyclic tracking
Super-S	Improved accuracy with small antennas
Galileo return link messages	Galileo search and rescue (SAR) return link messages (RLM) via Galileo satellite signal
Carrier phase output[15]	GNSS broadcast data and raw carrier-phase measurements
Data batching	Stores position/velocity/time information over up to 10 min in RAM without host interaction
Odometer	Measures traveled distance with support for different user profiles

Table 8: Firmware features

Feature	Description
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 9: Security features

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

15 Applies only to the product MIA-M10Q-01B-01.

2 Block diagram

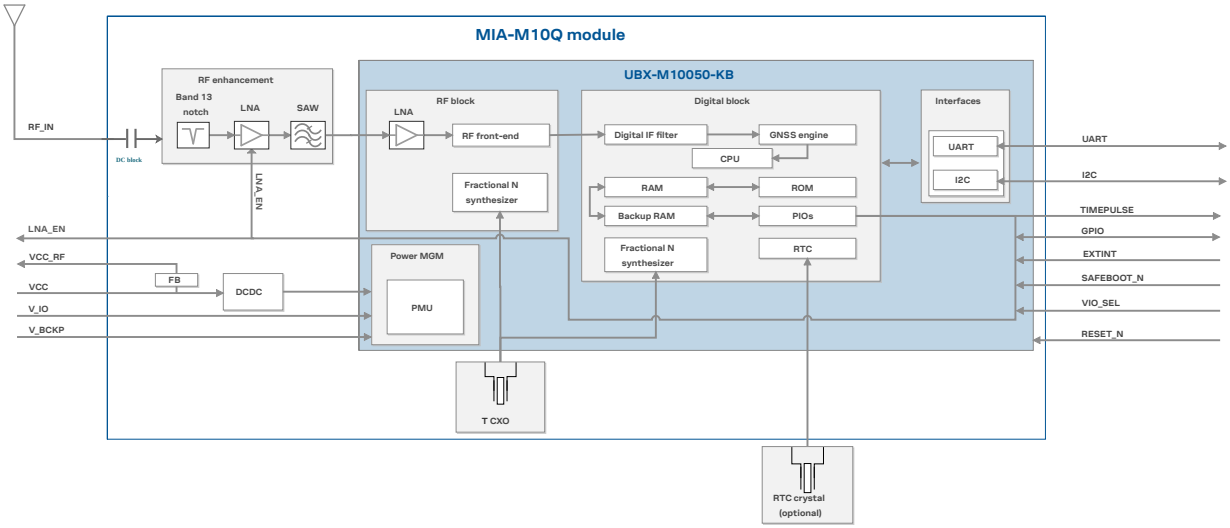


Figure 1: MIA-M10Q block diagram

3 Pin definition

3.1 Pin assignment

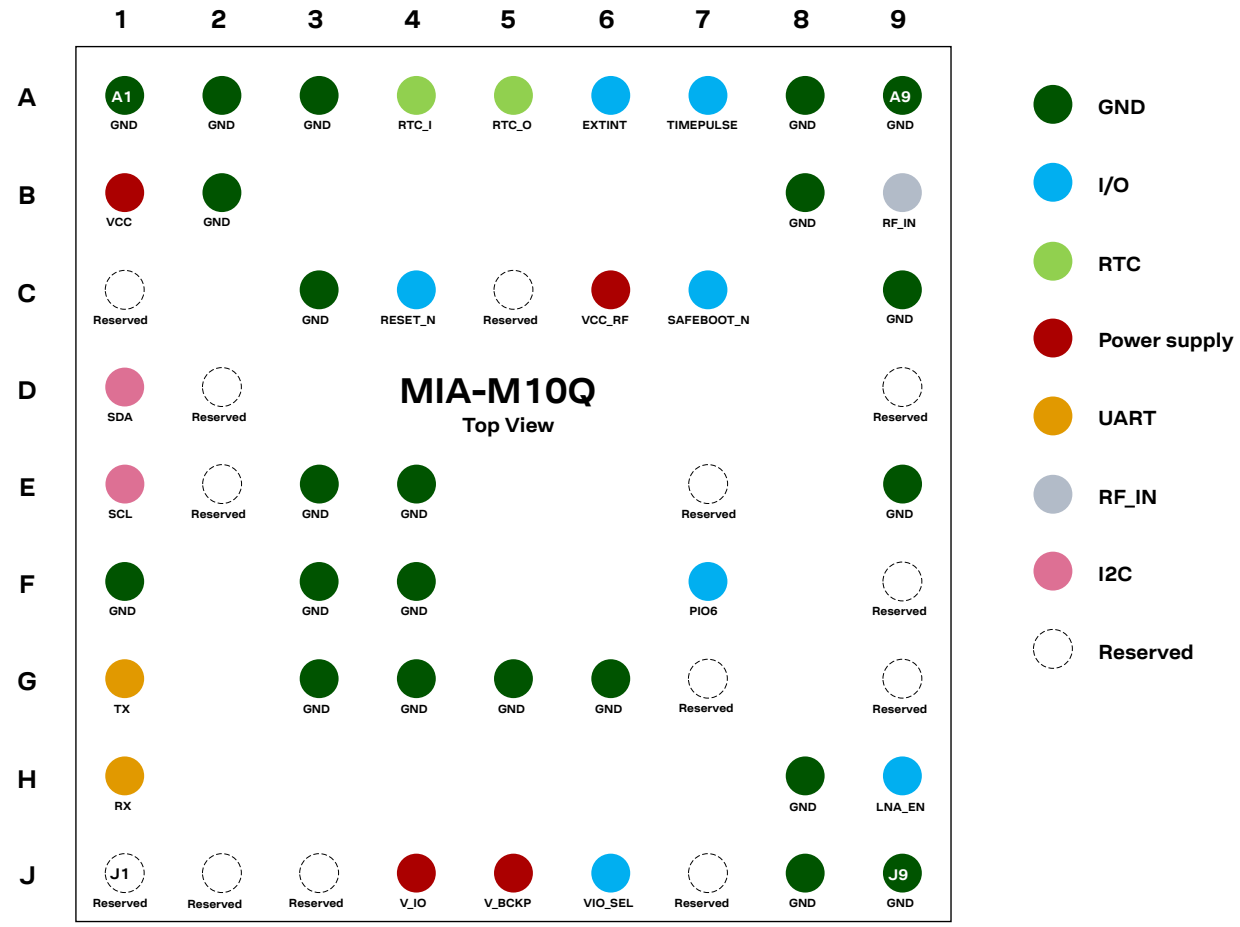


Figure 2: MIA-M10Q pin assignment

Pin no.	Name	PIO no.	I/O	Description
A1	GND	-	-	Connect to GND
A2	GND	-	-	Connect to GND
A3	GND	-	-	Connect to GND
A4	RTC_I	-	I	RTC input. Leave open if not used.
A5	RTC_O	-	O	RTC output. Connect to GND if not used.
A6	EXTINT	5	I	External interrupt. Leave open if not used.
A7	TIMEPULSE	4	O	Time pulse signal (shared with SAFEBOOT_N pin)[16]
A8	GND	-	-	Connect to GND
A9	GND	-	-	Connect to GND
B1	VCC	-	I	Main power supply input
B2	GND	-	-	Connect to GND
B8	GND	-	-	Connect to GND

Pin no.	Name	PIO no.	I/O	Description
B9	RF_IN	-	I	RF signal input
C1	Reserved	-	-	Leave open
C3	GND	-	-	Connect to GND
C4	RESET_N	-	I	System reset (active low). Has to be low for at least 1 ms to trigger a reset.
C5	Reserved	-	-	Leave open
C6	VCC_RF	-	O	Filtered power supply for RF active components like external active antenna or LNA, both optional
C7	SAFEBOOT_N	-	I	Safeboot mode (active low). Leave open if not used.[16]
C9	GND	-	-	Connect to GND
D1	SDA	2	I/O	I2C data. Leave open if not used.
D2	Reserved	-	-	Connect to E2
D9	Reserved	-	-	Leave open
E1	SCL	3	I	I2C clock. Leave open if not used.
E2	Reserved	-	-	Connect to D2
E3	GND	-	-	Connect to GND
E4	GND	-	-	Connect to GND
E7	Reserved	-	-	Leave open
E9	GND	-	-	Connect to GND
F1	GND	-	-	Connect to GND
F3	GND	-	-	Connect to GND
F4	GND	-	-	Connect to GND
F7	PIO6	6	I/O	Digital I/O. Leave open if not used.
F9	Reserved	-	-	Connect to GND[17]
G1	TX	1	O	UART TX. Leave open if not used.
G3	GND	-	-	Connect to GND
G4	GND	-	-	Connect to GND
G5	GND	-	-	Connect to GND
G6	GND	-	-	Connect to GND
G7	Reserved	-	-	Connect to GND[18]
G9	Reserved	-	-	Leave open
H1	RX	0	I	UART RX. Leave open if not used.
H8	GND	-	-	Connect to GND
H9	LNA_EN	-	O	On/Off external LNA or active antenna
J1	Reserved	-	-	Leave open
J2	Reserved	-	-	Leave open
J3	Reserved	-	-	Leave open
J4	V_IO	-	I	IO voltage supply
J5	V_BCKP	-	I	Backup voltage supply. Leave open if no external backup supply.

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.

17 For future compatibility with the MIA dual-band version, connect this pin to ground by placing a 0 Ω resistor to GND.

18 For compatibility with the crystal-based MIA variant, connect this pin to ground by placing a 0 Ω resistor to GND.

Pin no.	Name	PIO no.	I/O	Description
J6	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.
J7	Reserved	-	-	Leave open
J8	GND	-	-	Connect to GND
J9	GND	-	-	Connect to GND

Table 10: MIA-M10Q pin assignment

3.2 Pin state

Table 11 defines the state of the PIOs and RESET_N pins in different modes. The functions of the PIOs are as defined in the default configuration.

PIO no.	Pin no.	Default function	Continuous mode	Software standby mode	Safe boot mode
0	H1	RXD	Input pull-up	Input pull-up	Input pull-up
1	G1	TXD	Output	Input pull-up	Output
2	D1	SDA	Input pull-up	Input pull-up	Input pull-up
3	E1	SCL	Input pull-up	Input pull-up	Input pull-up
4[16]	C7	SAFEBOOT_N	Output	Input pull-up	Output (low)
	A7	TIMEPULSE	Output	Input pull-up	Output (low)
5	A6	EXTINT	Input pull-up	Input pull-up	Input pull-up
6	F7	Digital input	Input pull-up	Input pull-up	Input pull-up
7	H9	LNA_EN	Output (high)	Input pull-down	Input pull-up
-	C4	RESET_N	Input pull-up	Input pull-up	Input pull-up

Table 11: Pin state

☞ In reset mode (RESET_N = low), all PIOs are configured as input pull-up.

☞ In hardware backup mode (VCC = 0 V and V_IO = 0 V), PIOs must not be driven.

4 Electrical specifications

4.1 Absolute maximum ratings

⚠ CAUTION. Risk of device damage. Exceeding the absolute maximum ratings may affect the lifetime and reliability of the device or permanently damage it. Do not exceed the absolute maximum ratings.

⚠ This product is not protected against overvoltage or reversed voltages. Use appropriate protection to avoid device damage from voltage spikes exceeding the specified boundaries.

Symbol	Parameter	Min	Max	Unit
VCC	Main supply voltage	–0.3	3.6	V
V_IO	IO supply voltage, VIO_SEL = GND	–0.3	VCC + 0.3 (max 1.98)	V
	IO supply voltage, VIO_SEL = open	–0.3	VCC + 0.3 (max 3.6)	V
	Voltage ramp on V_IO [19]	25	35000	µs/V
V_BCKP	Backup supply voltage	–0.3	3.6	V
RTC_I	Voltage on RTC_I	–0.3	1.155	V
V_PIO	Input voltage on RESET_N and digital pins VIO_SEL = GND	–0.3	V_IO + 0.3 (max 1.98)	V
	Input voltage on RESET_N and digital pins VIO_SEL = open	–0.3	V_IO + 0.3 (max 3.6)	V
I_PIO	Max source / sink current, digital pins [20]	–10	10	mA
ICC_RF	Max source current, VCC_RF		200	mA
V_DC_{rfin}	DC voltage at RF_IN	–5.5	+5.5	V
P_{rfin}	RF input power at RF_IN [21]		0	dBm
T_{amb}	Ambient temperature	–40	+85	°C
T_s	Storage temperature	–40	+85	°C

Table 12: Absolute maximum ratings

4.2 Operating conditions

Table 13 shows the general operating conditions. Table 14 shows the electrical parameters for digital I/O.

☞ The V_IO voltage range is selected with the VIO_SEL pin.

⚠ For designs with 1.8 V supply at V_IO and V_BCKP supplied, switch off the V_IO supply 100 ms before VCC when transitioning to the hardware backup mode. Alternatively, put the receiver to software standby mode by sending the UBX-RXM-PMREQ message before switching off V_IO and VCC. For designs with 3 V supplies, both supplies can be switched off simultaneously. Alternatively, switch off V_IO before VCC.

Symbol	Parameter	Min	Typical	Max	Unit
VCC	Main supply voltage	1.76	1.8, 3.3	3.6	V

19 Exceeding the voltage ramp speed may permanently damage the device.

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

21 Test conditions: source impedance = 50 Ω, continuous wave.

Symbol	Parameter	Min	Typical	Max	Unit
V_IO	IO supply voltage, VIO_SEL = GND	1.76	1.8	VCC (max 1.98)	V
	IO supply voltage, VIO_SEL = open	2.7	3.3	VCC (max 3.6)	V
V_BCKP	Supply voltage, backup domain	1.65		3.6	V
V_IO_{SWITCH}	V_IO voltage threshold to switch an internal supply for the backup domain from V_IO to V_BCKP		1.45		V
VCC_RF	VCC_RF output voltage		VCC - 0.1		V
ICC_RF	VCC_RF output current			50	mA
Z_{in} [22]	Input impedance at RF_IN		50		Ω
NF_{tot}	Receiver chain noise figure		1.5		dB
Ext_gain [23]	External gain at RF_IN, low gain mode (default)			30	dB
	External gain at RF_IN, bypass mode	10	25	40	dB
T_{opr}	Operating temperature	-40		+85	°C

Table 13: General operating conditions

Symbol	Parameter	Min	Typical	Max	Unit
I_{leak}	Leakage current input pins [24]		25		nA
V_{in}	Input pin voltage range	0		V_IO	V
V_{il}	Low-level input voltage			0.63	V
V_{ih}	High-level input voltage	0.68 x V_IO			V
V_{ol}	Low-level output voltage, Iout = -2 mA [25]			0.4	V
V_{oh}	High-level output voltage, Iout = 2 mA [25]	V_IO - 0.4			V
$R_{pu, IO}$	Pull-up resistance, Digital IO [26]. VIO_SEL = GND	6	17	72	kΩ
$R_{pu, IO}$	Pull-up resistance, Digital IO [26] . VIO_SEL = open	8	18	40	kΩ
$R_{pd, IO}$	Pull-down resistance, Digital IO	21	80	180	kΩ
$R_{pu, SAFEBOOT_N}$	Pull-up resistance, SAFEBOOT_N [27]	6	17	72	kΩ
$R_{pu, RESET_N}$	Pull-up resistance, RESET_N	7	10	13	kΩ

Table 14: Digital IO

4.3 Oscillator parameters

Table 15 shows the electrical parameters for the RTC (optional).

Parameter	Min	Typical	Max	Unit
RTC oscillator frequency		32768		Hz
RTC startup time		250	700	ms
RTC crystal ESR			100	kΩ
RTC input capacitance at RTC_I, RTC_O (per pin to GND)	7	10	14	pF

22 The RF_IN input integrates a built-in DC block.

23 The internal LNA gain is configurable.

24 V_{in} = V_IO, at room temperature.

25 TIMEPULSE (PIO4) has 4 mA current drive/sink capability.

26 TXD, RXD, TIMEPULSE, EXTINT, SCL, SDA, and LNA_EN.

27 The SAFEBOOT_N pin has an additional 1 kΩ series resistor.

Parameter	Min	Typical	Max	Unit
RTC_I input voltage, external clock				
V_{il_RTC}	0		0.22	V
V_{ih_RTC}	0.71		1.1	V

Table 15: RTC parameters

4.4 Indicative power requirements

This section provides examples of typical current requirements. They are characterized on samples using a cold start command. The actual power requirements may vary depending on the firmware version used, the external circuitry, the number of satellites tracked, the signal strength, the type and time of start, duration, internal LNA gain mode, and the test conditions.

All values in Table 16, Table 17, and Table 18 have been measured at 25 °C ambient temperature with the default configuration unless otherwise stated. SBAS and QZSS are active in all measurements.

Table 16 shows indicative current consumption for VCC and V_IO with a 3.0 V supply.

Symbol (Parameter)	Conditions	GPS	GPS+GAL	GPS+GAL +GLO	GPS+GAL +BDS B1I (default)	GPS+GAL +BDS B1C	GPS+GAL +BDS B1C +GLO	Unit
I_{VCC} [28, 29] (Current at VCC)	Acquisition [30]	8.5	11.5	13	12.5	12.5	14.5	mA
	Tracking (Continuous mode)	8	8.5	10	10.5	9.5	10.5	mA
	Tracking (Power save mode) [31]	5	5	5.5	5.5	-	-	mA
I_{V_IO} [28] (Current at V_IO)	Acquisition and Tracking (Continuous mode)	2.2	2.3	2.4	2.4	2.3	2.4	mA
	Tracking (Power save mode) [31]	2	2.1	2.1	2.1	-	-	mA

Table 16: Typical currents for 3.0 V supply at VCC and V_IO

Table 17 shows indicative current consumption for VCC and V_IO with a 1.8 V supply.

Symbol (Parameter)	Conditions	GPS	GPS+GAL	GPS+GAL +GLO	GPS+GAL +BDS B1I (default)	GPS+GAL +BDS B1C	GPS+GAL +BDS B1C +GLO	Unit
I_{VCC} [28, 29] (Current at VCC)	Acquisition [30]	12	15	18.5	18.5	18	21.5	mA
	Tracking (Continuous mode)	11	12	14.5	15	13.5	15.5	mA
	Tracking (Power save mode) [31]	6	6.5	7	7	-	-	mA
I_{V_IO} [28] (Current at V_IO)	Acquisition and Tracking (Continuous mode)	2.1	2.2	2.3	2.3	2.2	2.4	mA
	Tracking (Power save mode) [31]	2	2	2	2	-	-	mA

Table 17: Typical currents for 1.8 V supply at VCC and V_IO

28 1 Hz navigation update rate.

29 Internal LNA set to low gain. Simulated signal using power levels of -130 dBm.

30 Average current from start-up until the first fix.

31 Cyclic tracking operation. BeiDou B1C is not supported in this mode.

☞ The inrush current can go up to 100 mA at startup. Ensure that the external power supply is able to deliver up to 100 mA.

Table 18 shows current consumption for the backup modes.

Symbol	Parameter	Conditions	Typ.	Unit
I_{V_BCKP} [32]	Total current in hardware backup mode	V_BCKP = 3.3 V, V_IO = VCC = 0 V	28	µA
I_{V_IO}	V_IO current in software standby mode	V_IO = 1.8 V	37	µA
		V_IO = 3.3 V	46	µA
I_{VCC}	VCC current in software standby mode	VCC = 3.3 V	120	nA

Table 18: Backup currents

☞ Extreme operating temperatures can significantly impact the specified values. If an application operates near the min or max temperature limits, ensure the specified values are not exceeded.

[32] I_{V_BCKP} current in normal operation (V_BCKP = 3.3 V, V_IO = VCC = 3.3V) is ~3 µA.

5 Communication interfaces

The receiver supports communication over the UART and I2C interfaces.

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 19.

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 19: UART specifications

5.2 I2C

An I2C interface is available for communication with an external host CPU in the I2C Fast-mode. Backwards compatibility with the Standard-mode I2C bus operation is not supported. The interface can be operated only in the peripheral mode with a maximum clock frequency of 400 kHz[33].

The interface can make use of clock stretching by holding the SCL line LOW to pause a transaction. In this case, the bit transfer rate is reduced. The maximum clock stretching time is 20 ms.

[33] External pull-up resistors may be needed to achieve 400 kbit/s communication speed, as the internal pull-up resistance can be very large.

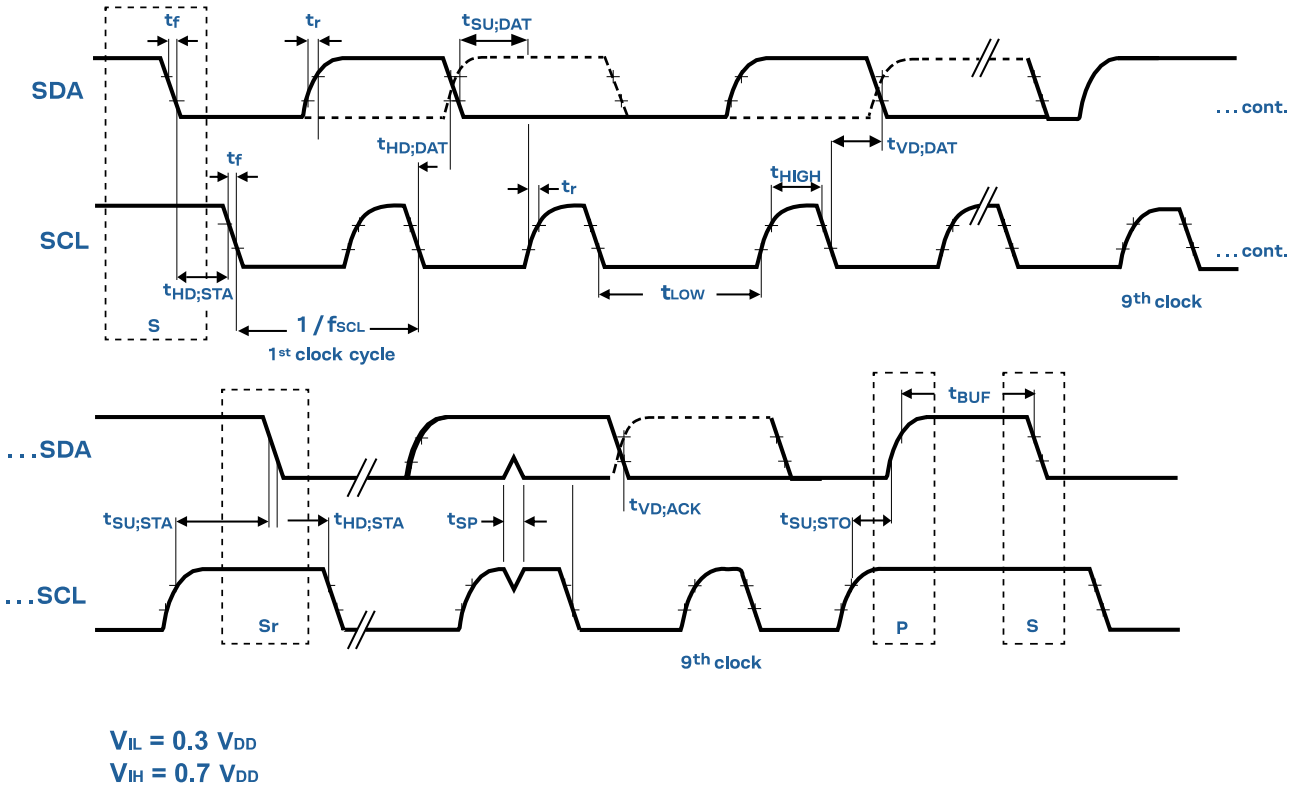


Figure 3: I2C peripheral specification

		I2C Fast-mode		
Symbol	**Parameter**	**Min**	**Max**	**Unit**
f_{SCL}	SCL clock frequency	0	400	kHz
$t_{HD;STA}$	Hold time (repeated) START condition	0.6	-	µs
t_{LOW}	Low period of the SCL clock	1.3	-	µs
t_{HIGH}	High period of the SCL clock	0.6	-	µs
$t_{SU;STA}$	Setup time for a repeated START condition	0.6	-	µs
$t_{HD;DAT}$	Data hold time	0 [34]	- [35]	µs
$t_{SU;DAT}$	Data setup time	100		ns
t_r	Rise time of both SDA and SCL signals	-	300 (for C = 400pF)	ns
t_f	Fall time of both SDA and SCL signals	-	300 (for C = 400pF)	ns
$t_{SU;STO}$	Setup time for STOP condition	0.6	-	µs
t_{BUF}	Bus-free time between a STOP and START condition	1.3	-	µs
$t_{VD;DAT}$	Data valid time	-	0.9 [35]	µs
$t_{VD;ACK}$	Data valid acknowledge time	-	0.9 [35]	µs
V_{nL}	Noise margin at the low level	0.1 V_IO	-	V

34 External device must provide a hold time of at least one transition time (max 300 ns) for the SDA signal (with respect to the min Vih of the SCL signal) to bridge the undefined region of the falling edge of SCL.

35 The maximum $t_{HD;DAT}$ must be less than the maximum $t_{VD;DAT}$ or $t_{VD;ACK}$ with a maximum of 0.9 µs by a transition time. This maximum must only be met if the device does not stretch the LOW period (tLOW) of the SCL signal. If the clock stretches the SCL, the data must be valid by the set-up time before it releases the clock.

		I2C Fast-mode		
Symbol	**Parameter**	**Min**	**Max**	**Unit**
V_{nH}	Noise margin at the high level	0.2 V_IO	-	V

Table 20: MIA-M10Q I2C peripheral timing and specifications

5.3 Default interface settings

Interface	Settings
UART	• 38400 baud[36], 8 bits, no parity bit, 1 stop bit. • Input messages: NMEA and UBX • Output messages: NMEA GGA, GLL, GSA, GSV, RMC, VTG and TXT
I2C	• 7-bit I2C address (0x42). • Input messages: NMEA and UBX • Output messages: NMEA GGA, GLL, GSA, GSV, RMC, VTG and TXT

Table 21: Default interface settings

[36] 9600 baud in the safe boot mode.

6 Mechanical specifications

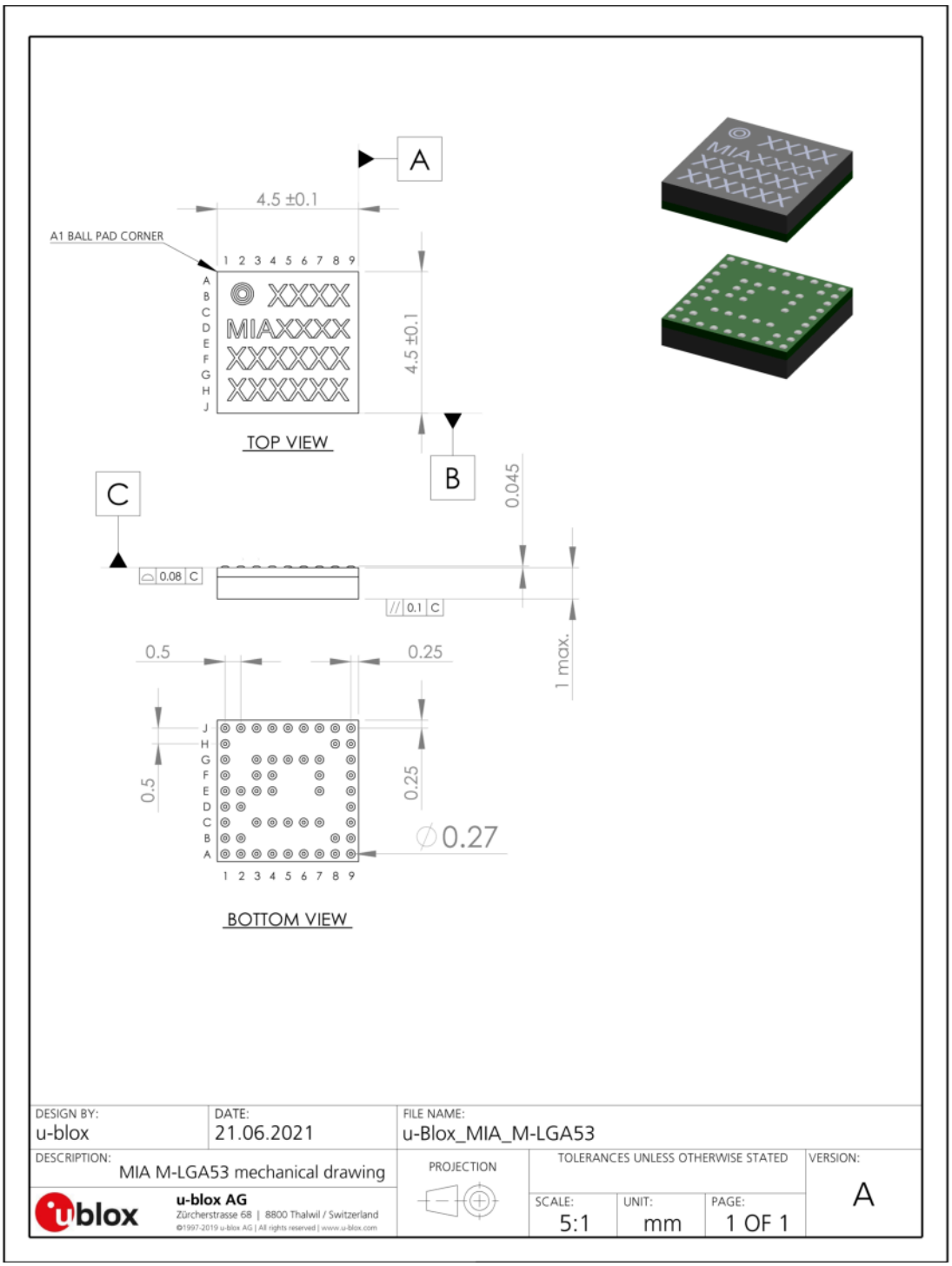


Figure 4: MIA-M10Q mechanical drawing

Typical weight: 0.07 g.

7 Qualifications and approvals

Type	Description
Quality and reliability	
Product qualification	Qualified according to u-blox qualification policy, based on a subset of AEC-Q104
Manufacturing	Manufactured at IATF 16949 certified sites
Environmental	
RoHS compliance	Yes
Moisture sensitivity level (MSL)[37, 38]	3
Type approvals	
European RED certification (CE)	Declaration of Conformity (DoC) is available on the u-blox website.
UK conformity assessment (UKCA)	Yes

Table 22: Qualifications and approvals

37 For MSL standard see IPC/JEDEC J-STD-020 and J-STD-033 [6].

38 For more information regarding moisture sensitivity levels, labeling, storage, and drying, see the Product packaging reference guide [5].

8 Product handling

8.1 Packaging

The MIA-M10Q modules are delivered as hermetically sealed, reeled tapes to enable efficient production, production lot set-up and tear-down. For more information, see the Product packaging reference guide [5].

8.1.1 Reels

MIA-M10Q modules are deliverable in quantities of 1000 pieces on a reel. They are shipped on reel type A1, as specified in the Product packaging reference guide [5].

8.1.2 Tapes

Figure 5 shows the feed direction and illustrates the orientation of the components on the tape.

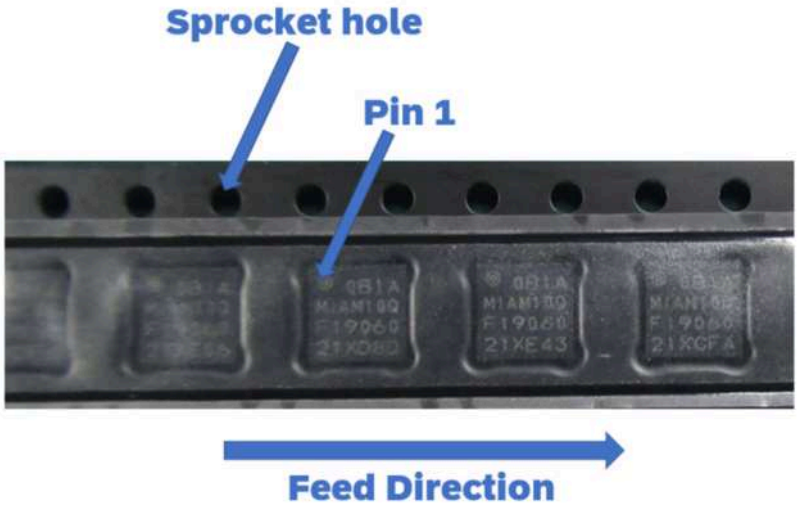


Figure 5: Orientation of the components on the tape

The feed direction into the pick and place pick-up is from the reel (located on the left of the figure) towards right, and the tape is fed to the right.

The dimensions of the tape are specified in Figure 6 (measurements in mm).

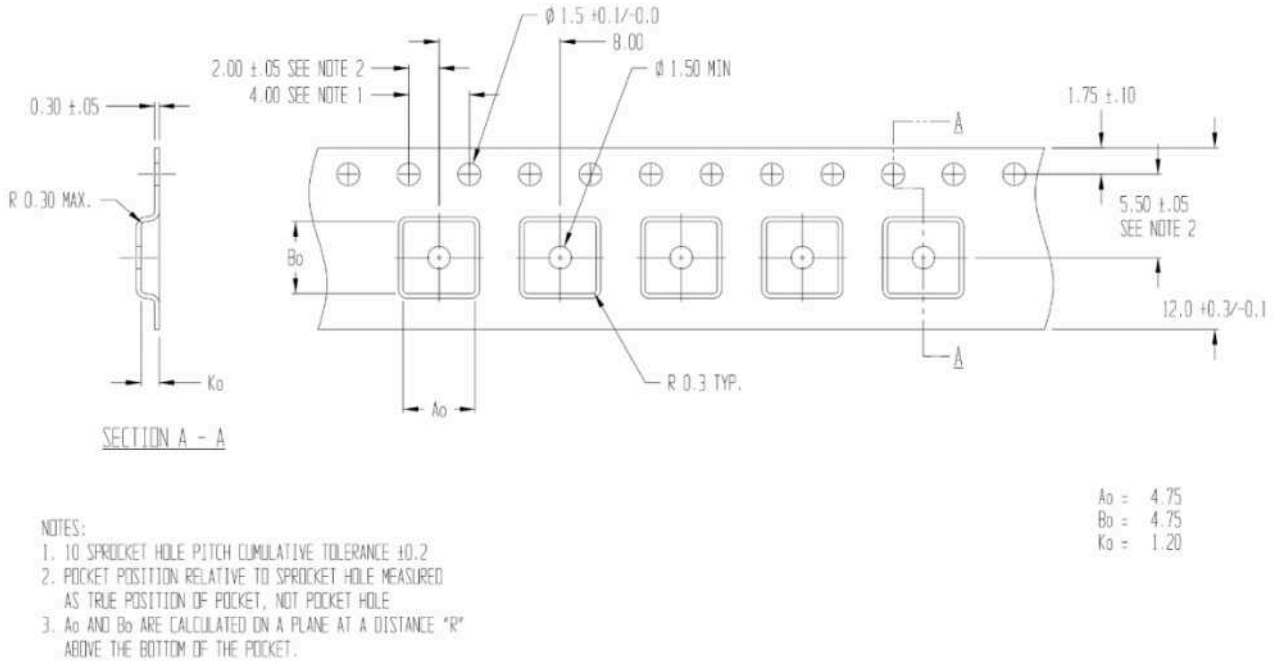


Figure 6: Tape specification

8.2 Soldering

Reflow soldering is described in the IPC/JEDEC J-STD-020 standard [6].

9 Product marking and ordering information

This section provides information about product marking and ordering.

9.1 Product marking

The product marking provides information on MIA-M10Q and its revision, as in Figure 7. For a description of the product marking, see Table 23

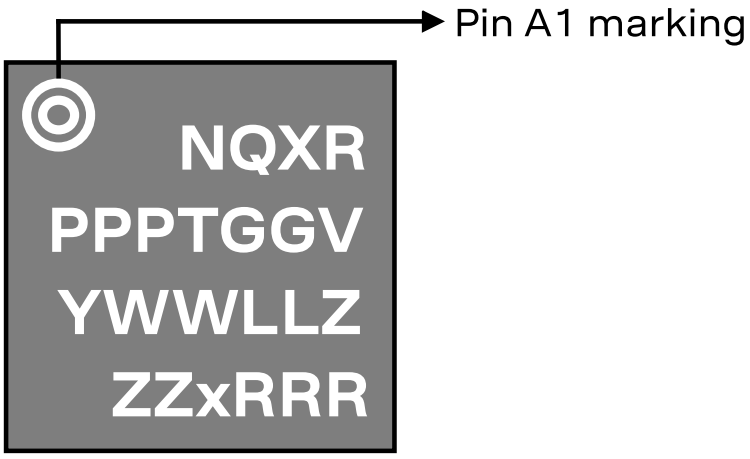


Figure 7: Example of MIA-M10Q product marking

Code	Meaning	Example
PPP	Form factor	MIA
TGG	Platform	M10 = u-blox M10
V	Variant	Q = Standard precision, ROM, TCXO, LNA, and SAW filter
YWWLL	Date code and lot number	Y = production year, A = 2017, B = 2018,..., G =2023, H= 2024 etc. WW = calendar week LL = lot number
ZZZ	Other production information	-
N	Major product version	0 = 00, 1 = 01, ...
Q	Product grade	A = Automotive, B = Professional
X	Revision	Hardware and firmware versions
R	Other production code	-
x	Engineering samples (No X = serial production)	-

Table 23: Description of product marking

9.2 Product identifiers

The MIA-M10Q marking features three product identifiers: product name, ordering code and type number. The product name identifies all u-blox products, independent of packaging and product grade, and it is used in documentation such as this data sheet. The ordering code includes the major product version and product grade, while the type number additionally includes the hardware and firmware versions.

Table 24 describes the three different product identifiers used in the MIA-M10Q module product marking.

Identifier	Format	Example
Product name	PPP-TGGV	MIA-M10Q
Ordering code	PPP-TGGV-NNQ	MIA-M10Q-00B
Type number	PPP-TGGV-NNQ-XX	MIA-M10Q-00B-02

Table 24: Product identifiers

9.3 Ordering codes

Ordering code	Product	Remark
MIA-M10Q-00B	u-blox M10 GNSS receiver module, professional grade	
MIA-M10Q-01B	u-blox M10 GNSS receiver module, professional grade	Carrier phase raw data

Table 25: Product ordering codes

u-blox provides information on product changes affecting the form factor, size or function of the product. For the Product change notifications (PCNs), see our website at: https://www.u-blox.com/en/product-resources.

Related documents

[1] MIA-M10Q Integration manual, UBX-21028173
[2] u-blox M10 SPG 5.10 Release notes, UBX-22001426
[3] u-blox M10 SPG 5.10 Interface description, UBX-21035062
[4] Radio Resource LCS Protocol (RRLP), (3GPP TS 44.031 version 11.0.0 Release 11)
[5] Product packaging reference guide, UBX-14001652
[6] Joint IPC/JEDEC standard, www.jedec.org

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

Revision history

Revision	Date	Comments
R01	15-Jun-2022	Objective specification
R02	31-Aug-2022	Document status replaced by Product status in Document information. Engineering sample. Changed default GNSS configuration to GPS, Galileo and BeiDou B1I with QZSS and SBAS. Updated maximum navigation update rate, AssistNow aided TTFF, and Indicative power requirements.
R03	05-May-2023	Updated maximum navigation update rate in section Performance, ICC_RF in section Absolute maximum ratings, VCC and V_IO supply timing requirements in Operating conditions, and section Indicative power requirements.
R04	26-Jun-2023	Product status changed to initial production Added Pin state section. Updated pin A6 in Pin assignment section.
R05	08-Apr-2024	Added sections: • Product handling: Soldering Updated sections: • Supported GNSS constellations: Supported Assisted GNSS (A-GNSS) services • Pin assignment: pin A6 and F7 description • Pin state • Absolute maximum ratings: V_IO for VIO_SEL = GND • Communication interfaces • Qualifications and approvals Change in document structure • Moisture sensitivity level (MSL) included in chapter Qualifications and approvals
R06	16-Jan-2025	Added sections: • Product handling: Packaging Updated sections: • Communication interfaces • Document information: Corrected Product status error in R05 to Initial production and updated IN/PCN reference.
R07	24-Jun-2025	Added sections • Broadcast navigation data and satellite signal measurements Updated sections: • Document information: added RAW variant type number MIA-M10Q-01B and updated IN/PCN reference. • Ordering codes: added MIA-M10Q-01B • Firmware features: added carrier phase output feature for MIA-M10Q-01B
R08	30-Jan-2026	New manufacturing site. Updated sections: • Document information: new type numbers. • Supported GNSS constellations: correction in documentation – removed BDSBAS from supported augmentation systems. • Firmware features: AssistNow service. Legacy AssistNow services Online and Offline have been replaced with the corresponding new services Live Orbits and Predictive Orbits.

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