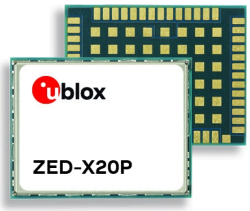
ZED-X20P-01B

All-band high precision GNSS module
Professional grade

Data sheet



Abstract

This data sheet describes the ZED-X20P high precision module with all-band GNSS receiver. The module provides all-band RTK with fast convergence times, reliable performance and easy integration of RTK for fast time-to-market. It has a high update rate for highly dynamic applications and centimeter-level accuracy in a small and energy-efficient module.

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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.

This document applies to the following products:

Product name	Type number	FW version	PCN reference	Product status
ZED-X20P	ZED-X20P-01B-00	HPG 2.10		Initial production

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1 Functional description

1.1 Overview

ZED-X20P is an innovative all-band receiver module designed to revolutionize positioning technology in industrial applications. Built upon the u-blox new generation receiver platform, this module offers all-band Global Navigation Satellite System (GNSS) capability, supporting bands including L1, L2, L5 and L6. With its comprehensive coverage, ZED-X20P ensures precise and reliable positioning even in challenging environments, setting a new standard in accuracy.

Equipped with integrated u-blox allband real-time kinematic (RTK) and precise point positioning real-time kinematic (PPP-RTK) technologies, ZED-X20P achieves centimeter-level accuracy, enabling precise navigation and automation in industrial and consumer-grade products. Despite its advanced capabilities, ZED-X20P maintains a compact surface-mounted form factor, measuring only 17.0 x 22.0 x 2.4 mm, ensuring seamless integration into various applications without compromising performance.

In this document, RTK refers to an observation state representation (OSR) based solution utilizing radio technical commission for maritime services (RTCM) corrections, while PPP-RTK refers to state space representation (SSR) based solution using secure position augmentation for real-time navigation (SPARTN). With its comprehensive features and advanced technologies, ZED-X20P offers unparalleled accuracy and reliability, making it the ideal choice for applications requiring high-performance positioning solutions.

1.2 Performance

Parameter	Specification	Value
Receiver type		All-band high precision GNSS receiver
Time pulse signal	Accuracy RMS	20 ns
	Accuracy 99%	60 ns
	Frequency	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]		0.03 m/s
Dynamic heading accuracy [2]		0.3 deg

Table 1: ZED-X20P functional specification

Parameter	Specification	GPS+GAL+BDS+GLO (default)
Acquisition[3]	Cold start	25 s
	Hot start	2 s
	Aided start[4]	2 s

1 Assuming Airborne 4 g platform.

2 Based on the single-antenna PVT solution during dynamic operation at speeds from 5 to 30 m/s (median).

3 Commanded starts. All satellites at -130 dBm. Measured at room temperature. All-band operation.

4 Depends on the speed and latency of the aiding data connection, commanded starts.

Parameter	Specification	GPS+GAL+BDS+GLO (default)
Sensitivity	Tracking and navigation	-165 dBm
	Reacquisition	-159 dBm
	Cold start	-148 dBm
	Hot start	-158 dBm
Convergence time[5]	RTK	< 7 s
	PPP-RTK (SPARTN)	< 40 s
	PPP-RTK (CLAS)[6]	< 70 s
Horizontal position accuracy (CEP)	PVT[7]	1.2 m
	SBAS[7]	0.6 m
	RTK[8]	0.006 m + 1 ppm
	PPP-RTK (SPARTN)	< 0.06 m
	PPP-RTK (CLAS)[6]	< 0.04 m
	PPP (Galileo HAS)	< 0.20 m
Vertical position accuracy (Median)	PVT[7]	2.0 m
	SBAS[7]	1.0 m
	RTK[8]	0.01 m + 1 ppm
	PPP-RTK (SPARTN)	< 0.10 m
	PPP-RTK (CLAS)[6]	< 0.06 m
	PPP (Galileo HAS)	< 0.40 m
Max navigation update rate[9]	PVT, SBAS	25 Hz
	RTK, PPP-RTK	25 Hz
	RAW	25 Hz
Moving base RTK heading	Accuracy (RMS)[10]	0.2 deg
	Max update rate	5 Hz

Table 2: ZED-X20P typical performance

☞ In a moving base application, and especially when the two antennas are mounted on the same platform, it is recommended to use identical antennas. Furthermore it is recommended these antennas are mounted with identical orientation, as this will minimize effects of phase center variation.

5 Depends on atmospheric conditions, baseline length, GNSS antenna, multipath conditions, satellite visibility and geometry

6 Requires the NEO-D9C module to provide QZSS L6 CLAS correction data via UBX-RXM-QZSSL6.

7 24-hour static measurement

8 Accuracy is based on empirical testing over a 1 km baseline using patch antennas mounted on stable ground planes. Antenna phase center offset errors are excluded. A + 1 ppm scale error typically contributes ~1 mm of error per km, applicable for baselines up to 20 km. At 20 km, the total positioning error is approximately 3 cm. These values are based on observed performance and are not guaranteed design limits.

9 Measured using primary navigation output.

10 Measured with 1 m baseline and patch antennas with good ground plane under static open-sky conditions.

1.3 Supported GNSS constellations

ZED-X20P is a concurrent GNSS receiver capable of simultaneously receiving and tracking signals from multiple global navigation satellite constellations. Signals are received across all supported bands, ensuring enhanced positioning accuracy and reliability.

All satellites in view can be processed to provide an RTK navigation solution when used with correction data.

System	Signal	Frequency
GPS	L1C/A	1575.420 MHz
	L2C	1227.600 MHz
	L5	1176.450 MHz
Galileo	E1-B/C	1575.420 MHz
	E5a	1176.450 MHz
	E6	1278.750 MHz
BeiDou	B1I	1561.098 MHz
	B1C	1575.420 MHz
	B2a	1176.450 MHz
	B3I	1268.520 MHz
GLONASS	L1OF	1602 MHz + k*562.5 kHz, k = −7,...,6
	L2OF	1246 MHz + k*437.5 kHz, k = −7,...,6
QZSS	L1C/A, L1C/B, L1S	1575.420 MHz
	L2C	1227.600 MHz
	L5	1176.450 MHz
NavIC	L1-SPS Data[11]	1575.420 MHz
	L5-SPS	1176.450 MHz

Table 3: Supported GNSS constellations and signals on ZED-X20P

☞ If power consumption is a key factor, the receiver can be configured for a subset of GNSS constellations.

1.4 Supported assisted GNSS (A-GNSS) services

ZED-X20P supports the GNSS assistance services listed in Table 4.

Service	Signal
AssistNow™ Live Orbits	GPS L1C/A
	Galileo E1
	BeiDou B1I
	GLONASS L1OF
	QZSS L1C/A

Table 4: Supported assisted GNSS (A-GNSS) services

1.5 Supported augmentation systems

ZED-X20P supports the augmentation systems listed in Table 5.

[11] Currently in development phase.

System	Support
SBAS	EGNOS GAGAN MSAS WAAS BDSBAS[12]

Table 5: Supported augmentation systems

☞ The SBAS augmentation system can be enabled only if GPS operation is also enabled.

1.6 Corrections protocols

Using RTCM version 3 messages, ZED-X20P can operate in the Real time kinematic (RTK) mode.

Operating as a rover, ZED-X20P can decode the RTCM 3.4 messages listed in Table 6.

Message type	Description
RTCM 1001	L1-only GPS RTK observables
RTCM 1002	Extended L1-only GPS RTK observables
RTCM 1003	L1/L2 GPS RTK observables
RTCM 1004	Extended L1/L2 GPS RTK observables
RTCM 1005	Stationary RTK reference station ARP
RTCM 1006	Stationary RTK reference station ARP with antenna height
RTCM 1007	Antenna descriptor
RTCM 1009	L1-only GLONASS RTK observables
RTCM 1010	Extended L1-only GLONASS RTK observables
RTCM 1011	L1/L2 GLONASS RTK observables
RTCM 1012	Extended L1/L2 GLONASS RTK observables
RTCM 1033	Receiver and antenna description
RTCM 1074	GPS MSM4
RTCM 1075	GPS MSM5
RTCM 1077	GPS MSM7
RTCM 1084	GLONASS MSM4
RTCM 1085	GLONASS MSM5
RTCM 1087	GLONASS MSM7
RTCM 1094	Galileo MSM4
RTCM 1095	Galileo MSM5
RTCM 1097	Galileo MSM7
RTCM 1124	BeiDou MSM4
RTCM 1125	BeiDou MSM5
RTCM 1127	BeiDou MSM7
RTCM 1230	GLONASS code-phase biases
RTCM 4072.0	Reference station PVT (u-blox proprietary RTCM Message)

Table 6: Supported RTCM 3.4 input messages

Operating as a base station, ZED-X20P can generate the RTCM 3.4 output messages listed in Table 7.

[12] BDSBAS is not operational and is in the test phase.

Message type	Description
RTCM 1005	Stationary RTK reference station ARP
RTCM 1006	Stationary RTK reference station ARP with antenna height
RTCM 1074	GPS MSM4
RTCM 1077	GPS MSM7
RTCM 1084	GLONASS MSM4
RTCM 1087	GLONASS MSM7
RTCM 1094	Galileo MSM4
RTCM 1097	Galileo MSM7
RTCM 1124	BeiDou MSM4
RTCM 1127	BeiDou MSM7
RTCM 1230	GLONASS code-phase biases
RTCM 4072.0	Reference station PVT (u-blox proprietary RTCM Message)

Table 7: Supported RTCM 3.4 output messages

Using SPARTN messages, ZED-X20P can operate in the precise point positioning real-time kinematic (PPP-RTK) mode.

Operating as a rover, ZED-X20P can decode the SPARTN 2.0.2 messages listed in Table 8.

Message type-subtype	Description
SM 0-0	GPS orbit, clock, bias (OCB)
SM 0-1	GLONASS orbit, clock, bias (OCB)
SM 0-2	Galileo orbit, clock, bias (OCB)
SM 0-3	BeiDou orbit, clock, bias (OCB)
SM 1-0	GPS high-precision atmosphere correction (HPAC)
SM 1-1	GLONASS high-precision atmosphere correction (HPAC)
SM 1-2	Galileo high-precision atmosphere correction (HPAC)
SM 1-3	BeiDou high-precision atmosphere correction (HPAC)
SM 2-0	Geographic area definition (GAD)

Table 8: Supported SPARTN version 2.0.2 input messages

1.7 Supported protocols

ZED-X20P supports the protocols listed in Table 9.

Protocol	Type
UBX	Input/output, binary, u-blox proprietary
NMEA 4.11 (default), 4.10 and 4.0	Input/output, ASCII
RTCM 3.4	Input/output, binary
SPARTN 2.0.2	Input, binary

Table 9: Supported protocols

For specification of the protocols, see the Interface description [2].

1.8 Firmware features

Table 10 summarizes the supported firmware features, while Table 11 outlines the available security features.

Feature	Description
Antenna supervisor[13]	Antenna supervisor for active antenna control and short circuit detection
RAW data	Provides carrier and code phase measurements of tracked signals
Assisted GNSS	AssistNow Live Orbits
RTK support	High precision positioning
Local base functionality	Base station functionality with RTCM output
Spectrum analyzer	Monitors RF environment for possible interference and anomalies
Geofencing	Supports location-restriction and anti-theft functionality
Monitoring and management functions	Extensive functions to monitor embedded system health such as I/O queues, pin status and correction status
Personalization	Individualized identity to access high value features and subscriptions
GLONASS Geoblocking	GLONASS Geoblocking is a functionality that restricts the use of GLONASS signals when the receiver's calculated position is inside predefined geographic regions.
Backup modes	Hardware backup mode and software standby

Table 10: Firmware features

Feature	Description
Anti-jamming	RF interference and jamming detection and reporting
Anti-spoofing	Spoofing detection and reporting
Galileo OSNMA	Galileo Open Service Navigation Message Authentication
Configuration lockdown	Receiver configuration can be locked by command
Secure boot	Only signed firmware images are executed
Secure storage	Tamper-resistant secure storage with end-to-end security
Navigation data validation	According to the DHS *GPS Receiver Allow List Development Guide*

Table 11: Security features

1.9 Broadcast navigation data and satellite signal measurements

ZED-X20P uses `UBX-RXM-SFRBX` message to output all the GNSS broadcast data upon reception from tracked satellites. This includes all the supported GNSS signals as well as the QZSS and SBAS augmentation services. For the `UBX-RXM-SFRBX` message specification, see the Interface description [2]. The receiver can provide satellite signal information in a form compatible with the Radio Resource LCS Protocol (RRLP).

1.10 Carrier-phase measurements

ZED-X20P provides raw carrier-phase data for all supported signals, along with pseudorange, Doppler and measurement quality information. The data contained in the `UBX-RXM-RAWX` message follows the conventions of a multi-GNSS RINEX 3 observation file. For the `UBX-RXM-RAWX` message specification, see Interface description [2].

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

[13] External components required, some pins may need to be reconfigured.

2 Block diagram

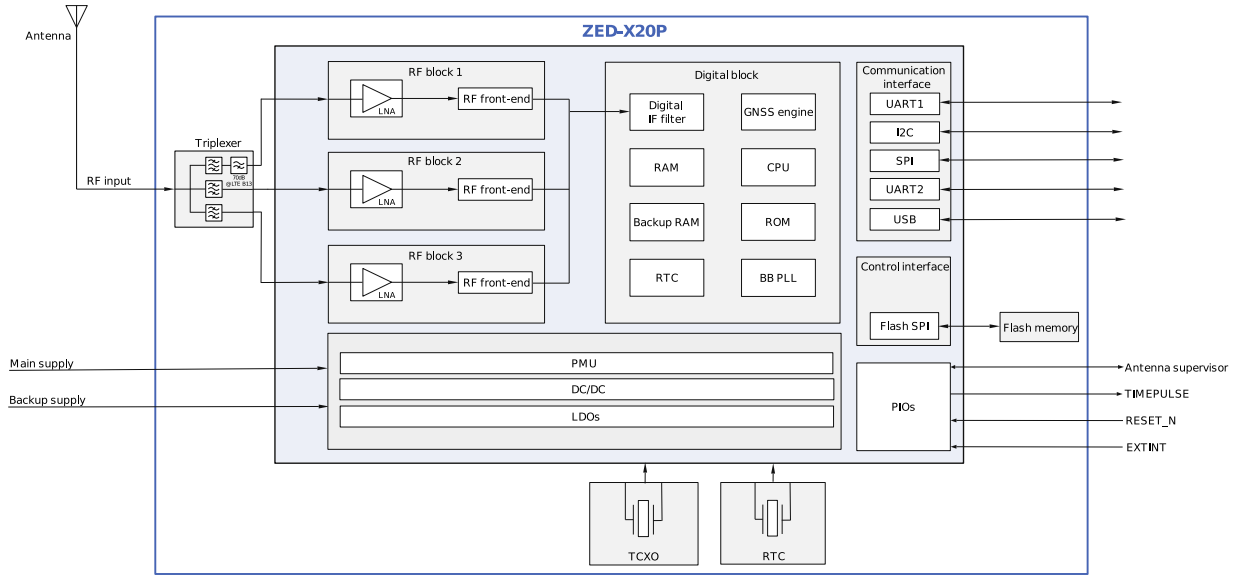

Figure 1: ZED-X20P block diagram

3 Pin definition

3.1 Pin assignment

The pin assignment of the ZED-X20P module is shown in Figure 2. The defined configuration of the programmable input/outputs (PIOs) is listed in Table 12.

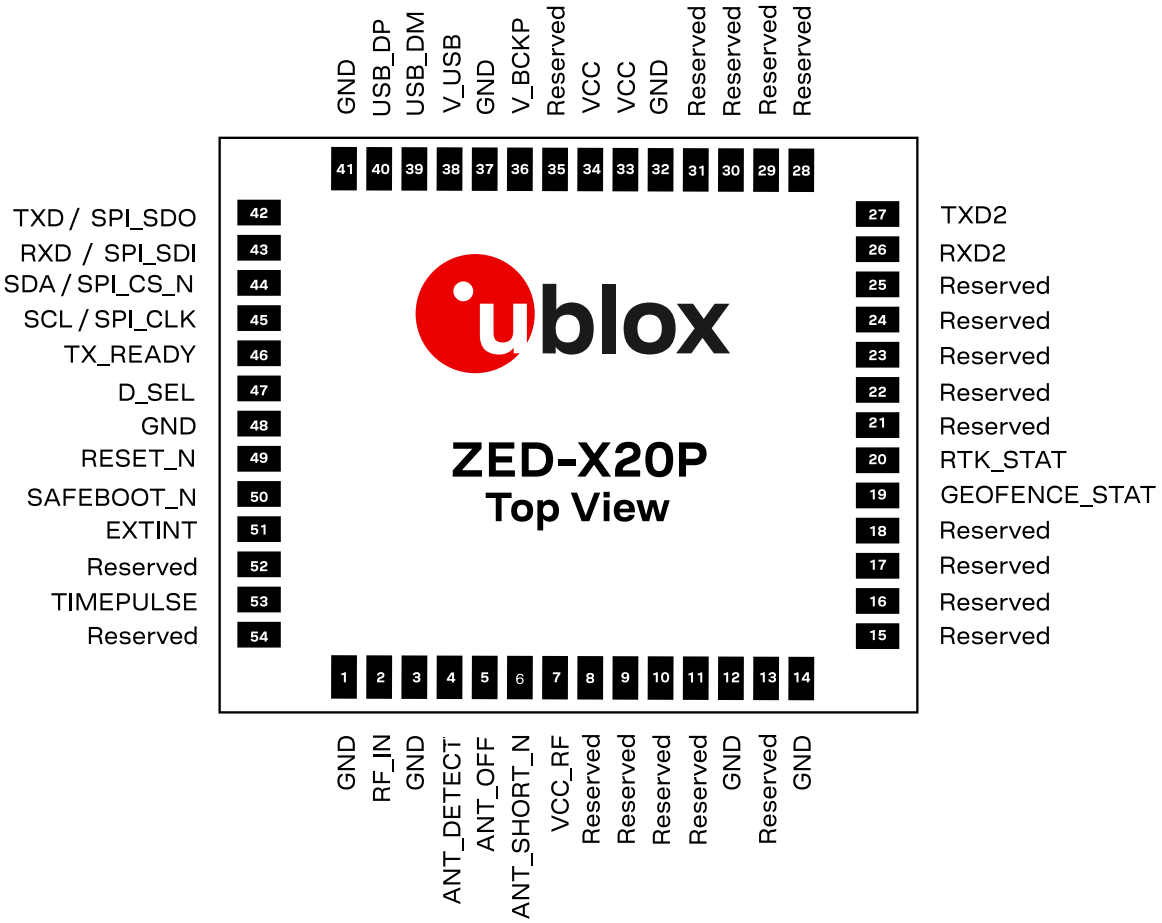

Figure 2: ZED-X20P pin assignment

Pin no.	Name	I/O	Description
1	GND	-	Ground
2	RF_IN	I	RF input
3	GND	-	Ground
4	ANT_DETECT	I	Active antenna detect - default active high
5	ANT_OFF	O	External LNA disable - default active high
6	ANT_SHORT_N	I	Active antenna short detect - default active low
7	VCC_RF	O	Voltage for external LNA
8	Reserved	-	Reserved
9	Reserved	-	Reserved
10	Reserved	-	Reserved

Pin no.	Name	I/O	Description
11	Reserved	-	Reserved
12	GND	-	Ground
13	Reserved	-	Reserved
14	GND	-	Ground
15	Reserved	-	Reserved
16	Reserved	-	Reserved
17	Reserved	-	Reserved
18	Reserved	-	Reserved
19	GEOFENCE_STAT	O	Geofence status, user defined
20	RTK_STAT	O	0 = RTK/PPP-RTK fixed Toggling = receiving and using corrections 1 = no corrections
21	Reserved	-	Reserved
22	Reserved	-	Reserved
23	Reserved	-	Reserved
24	Reserved	-	Reserved
25	Reserved	-	Reserved
26	RXD2	I	UART2 input
27	TXD2	O	UART2 output
28	Reserved	-	Reserved
29	Reserved	-	Reserved
30	Reserved	-	Reserved
31	Reserved	-	Reserved
32	GND	-	Ground
33	VCC	I	Voltage supply
34	VCC	I	Voltage supply
35	Reserved	-	Reserved
36	V_BCKP	I	Backup supply voltage
37	GND	-	Ground
38	VDD_USB	I	USB supply
39	USB_DM	I/O	USB data
40	USB_DP	I/O	USB data
41	GND	-	Ground
42	TXD / SPI_SDO	O	UART1 output if D_SEL = 1 (or open). SPI_SDO if D_SEL = 0
43	RXD / SPI_SDI	I	UART1 input if D_SEL = 1 (or open). SPI_SDI if D_SEL = 0
44	SDA / SPI_CS_N	I/O	I2C Data if D_SEL = 1 (or open). SPI Chip Select if D_SEL = 0
45	SCL / SPI_CLK	I/O	I2C Clock if D_SEL = 1 (or open). SPI Clock if D_SEL = 0
46	TX_READY	O	TX_Buffer full and ready for TX of data
47	D_SEL	I	Interface select for pins 42-45
48	GND	-	Ground
49	RESET_N	I	RESET_N
50	SAFEBOOT_N	I	If held LOW during power-up, the receiver enters safeboot mode.
51	EXTINT	I	External interrupt pin
52	Reserved	-	Reserved

Pin no.	Name	I/O	Description
53	TIMEPULSE	O	Time pulse
54	Reserved	-	Reserved

Table 12: ZED-X20P pin assignment

3.2 Pin state

Table 13 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.

Pin no.	Default function	Continuous mode	Software standby mode	Safe boot mode
47	D_SEL = open	Input pull-up	Input pull-up	Input pull-up
	D_SEL = GND	High-Z	Input pull-down	High-Z
43	RXD	Input pull-up	Input pull-up	Input pull-up
	SPI_SDI	High-Z	Input pull-up	Input pull-up
42	TXD	Output	Input pull-up	Output
	SPI_SDO	Output[14]	Input pull-up	Output[14]
44	SDA	Input pull-up / Output	Input pull-up	Input pull-up / Output
	SPI_CS_N	High-Z	High-Z	High-Z
45	SCL	Input pull-up	Input pull-up	Input pull-up
	SPI_CLK	High-Z	High-Z	High-Z
53	TIMEPULSE	Output	Input pull-up	Input pull-up
50	SAFEBOOT_N	Input pull-up	Input pull-up	Input pull-up
51	EXTINT	Input pull-up	Input pull-up	Input pull-up
26	RXD2	Input pull-up	Input pull-up	Input pull-up
27	TXD2	Output	Input pull-up	Output
49	RESET_N	Input pull-up	Input pull-up	Input pull-up

Table 13: Pin state

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

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

[14] If SPI CS = low. Otherwise it is configured as an input pull-up.

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.

⚠ CAUTION. 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
V_{CC}	Main supply voltage at **VCC**	–0.3	3.6	V
	Voltage ramp at **VCC**[15]	20	35,000	µs/V
V_{USB}	USB supply voltage at **V_USB**	–0.3	3.6	V
	Voltage ramp at **V_USB**[15]	20	35,000	µs/V
V_{BCKP}	Backup supply voltage at **V_BCKP**	–0.3	5.5	V
V_{IN}	Input voltage at digital IO pins	–0.3	V_{CC} + 0.3 (max 3.6)	V
I_{IN}	Source / sink current at digital IO pins[16]	–10	10	mA
V_{USB_DP}, V_{USB_DM}	Input voltage at USB signal pins **USB_DP, USB_DM**	–0.3	V_{USB} + 0.3 (max 3.6)	V
V_{RF_IN}	DC voltage at **RF_IN**	–5.5	+5.5	V
P_{RF_IN}	RF input power at **RF_IN**[17]		+15	dBm
T_s	Storage temperature	–40	+85	°C

Table 14: Absolute maximum ratings

4.2 Operating conditions

☞ 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.

Symbol	Parameter	Condition	Min	Typical	Max	Unit
V_{CC}	Main supply voltage at **VCC**		2.7	3.3	3.6	V
V_{USB}	USB supply voltage at **V_USB**		3.0	3.3	3.6	V
V_{BCKP}	Backup supply voltage at **V_BCKP**		1.4	3.3	5.5	V
V_{CC_RF}	External antenna/LNA supply voltage at **VCC_RF**			V_{CC}-0.1		V
I_{CC_RF}	Source current at **VCC_RF**				50	mA
V_{USB_DP}, V_{USB_DM}	Input voltage at USB signal pins **USB_DP, USB_DM**		0		V_{USB}	V
Z_{RF_IN}	Input impedance at **RF_IN**			50		Ω
NF_{RF_IN}	Receiver chain noise figure at **RF_IN**					
	L1, L band	Normal gain (default)		6.5		dB

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

16 **SAFEBOOT_N** has an internal 1 kΩ series resistor.

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

Symbol	Parameter	Condition	Min	Typical	Max	Unit
		Low gain		11		dB
	L2, E6 band	Normal gain (default)		6		dB
		Low gain		10		dB
	L5 band	Normal gain (default)		5		dB
		Low gain		8.5		dB
G_{RF_IN}[18]	External gain at **RF_IN**	Normal gain (default)	17		40	dB
		Low gain	20		50	dB
T_{opr}	Operating temperature		–40	+25	+85	°C

Table 15: General operating conditions

Symbol	Parameter	Condition	Min	Typical	Max	Unit
V_{IN}	Voltage range		0		V_{CC}	V
V_{IL}	Low-level input voltage				0.63	V
V_{IH}	High-level input voltage		0.68 * V_{CC}			V
V_{OL}	Low-level output voltage	I_{out} = –2 mA[19]			0.4	V
V_{OH}	High-level output voltage	I_{out} = 2 mA[19]	V_{CC} – 0.4			V
R_{PD}	Pull-down resistance		34	62	142	kΩ
R_{PU}	Pull-up resistance at **SCL/SPI_CLK, SDA/SPI_CS_N, ANT_DETECT, ANT_OFF, RXD2, TXD2, TX_READY, TIMEPULSE**		8	16	40	kΩ
R_{PU}	Pull-up resistance at **D_SEL, RXD/ SPI_SDI, TXD/SPI_SDO, SAFEBOOT_N, EXTINT, ANT_SHORT_N, GEOFENCE_STAT, RTK_STAT**		35	67	205	kΩ
R_{PU}	Pull-up resistance at **RESET_N**		7	10	13	kΩ

Table 16: Digital IO pins specific for operating conditions

4.3 Indicative current consumption

Table 17 provides examples of typical current requirements. The given values are total system supply current for a possible application including RF and baseband sections. The values have been measured at 25 °C ambient temperature.

☞ The actual current requirements vary depending on the firmware (FW) version used, external circuitry, number of satellites tracked, signal strength, type and time of start, duration, and conditions of test.

Symbol	Parameter	Conditions	Nominal	GPS+GAL+BDS +GLO	GPS	Unit
I_{VCC}	Average VCC current in acquisition mode [20]	VCC = 3.3V		68	62	mA
I_{VCC}	Average VCC current in tracking mode	VCC = 3.3V		65	60	mA
I_{VCC}	Peak VCC current for supply dimensioning	VCC = 3.3V	250			mA

18 Design compatibility with L-band correction service signals requires a minimum external gain of 25 dB (normal gain) and TBD (low gain).

19 TIMEPULSE has 4 mA current drive/sink capability

20 Measured typically from cold-start to first fix

Symbol	Parameter	Conditions	Nominal	GPS+GAL+BDS +GLO	GPS	Unit
I_{V_BCKP}	Typical current in hardware backup mode	VCC = 0V / V_BCKP = 3.3V	26			µA
I_{VCC}	Typical current in software standby mode	VCC = 3.3V	85			µA

Table 17: Typical currents to calculate the indicative power requirements

5 Communications interfaces

The ZED-X20P receiver supports communication over UART, USB, SPI, and I2C.

All the inputs have internal pull-up resistors in normal operation and can be left open if not used. All the PIOs are supplied by **VCC**, and therefore all the voltage levels of the PIO pins are related to the **VCC** supply voltage.

5.1 UART

The UART interfaces support configurable baud rates as in Table 18. The UART interfaces do not support hardware flow control.

The UART1 is enabled if **D_SEL** pin is left open or HIGH.

Symbol	Parameter	Min	Max	Unit
R_u	Baud rate	4800	8000000	bit/s
Δ_{Tx}	Tx baud rate accuracy	-1%	+1%	-
Δ_{Rx}	Rx baud rate tolerance	-2.5%	+2.5%	-

Table 18: ZED-X20P UART specifications

5.2 SPI

The SPI interface is disabled by default. The SPI interface shares pins with UART1 and I2C and can be selected by setting **D_SEL** to LOW. The SPI interface can be operated in peripheral mode only. The SPI transfer rate based on load capacitance is shown in Table 19.

Load capacitance (pF)	Min transfer rate (kB/s)	Max transfer rate (kB/s)	Max clock frequency (MHz)
2	880	950	12.80
20	770	920	10.20
60	620	880	7.25

Table 19: SPI transfer rate based on load capacitance for ZED-X20P

The SPI timing parameters for peripheral operation are defined in Figure 3. Default SPI configuration is CPOL = 0 and CPHA = 0.

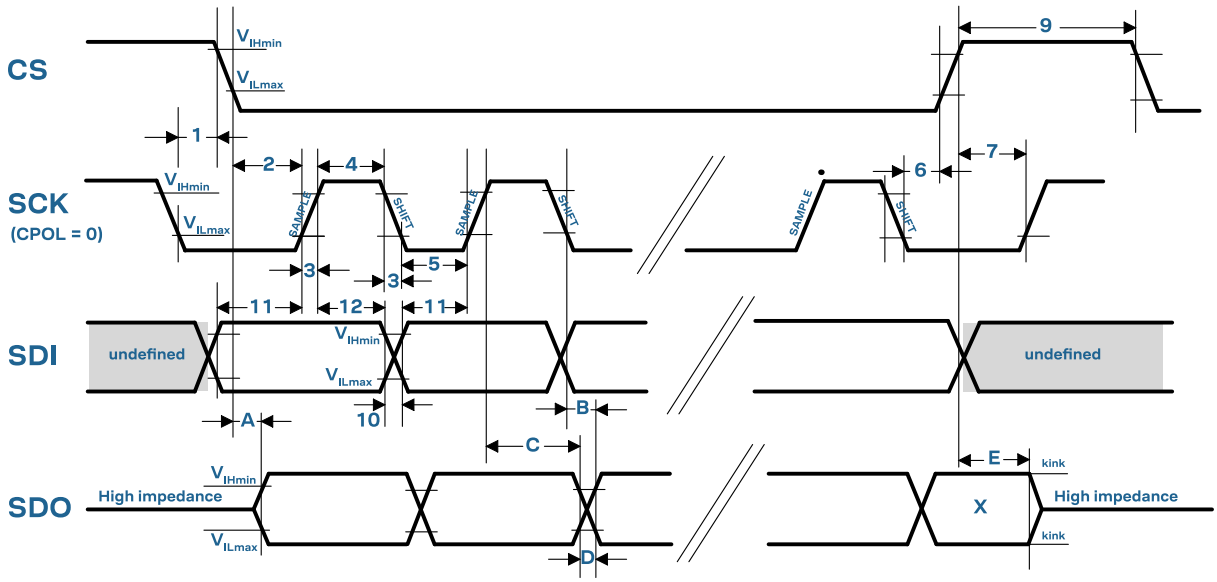

Figure 3: ZED-X20P SPI specification mode 1: CPHA=0 SCK = 5.33 MHz

Symbol	Parameter	Min	Max	Unit
1	CS deassertion hold time	8	-	ns
2	Chip select time (CS to SCK)	11	-	ns
3	SCK rise/fall time	-	5	ns
4	SCK high time	39	-	ns
5	SCK low time	39	-	ns
6	Chip deselect time (SCK falling to CS)	3	-	ns
7	Chip deselect time (CS to SCK)	510	-	ns
9	CS high time	511	-	ns
10	SDI transition time	-	5	ns
11	SDI setup time	6	-	ns
12	SDI hold time	3	-	ns

Table 20: SPI peripheral input timing parameters 1 - 12

Symbol	Parameter	Min	Max	Unit
A	SDO data valid time (CS)	15	31	ns
B	SDO data valid time (SCK), weak driver mode	15	29	ns
C	SDO data hold time	49	68	ns
D	SDO rise/fall time, weak driver mode	3	8	ns
E	SDO data disable lag time	7	20	ns

Table 21: SPI peripheral timing parameters A - E, 2 pF load capacitance

Symbol	Parameter	Min	Max	Unit
A	SDO data valid time (CS)	17	42	ns
B	SDO data valid time (SCK), weak driver mode	16	39	ns
C	SDO data hold time	52	88	ns
D	SDO rise/fall time, weak driver mode	2	21	ns
E	SDO data disable lag time	7	20	ns

Table 22: SPI peripheral timing parameters A - E, 20 pF load capacitance

Symbol	Parameter	Min	Max	Unit
A	SDO data valid time (CS)	20	62	ns
B	SDO data valid time (SCK), weak driver mode	19	59	ns
C	SDO data hold time	58	128	ns
D	SDO rise/fall time, weak driver mode	7	38	ns
E	SDO data disable lag time	7	20	ns

Table 23: SPI peripheral timing parameters A - E, 60 pF load capacitance

5.3 I2C

An I2C interface is available for communication with an external host CPU in I2C standard mode, fast mode and fast mode plus. The interface can be operated only in peripheral mode with the maximum bit rate of 1000 kbit/s.

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. The I2C timing parameters are defined in Figure 4 and specified in Table 24.

☞ The I2C interface is only available with the UART default mode (**D_SEL** = HIGH). If the SPI interface is selected by setting the **D_SEL** pin to LOW, the I2C interface is not available.

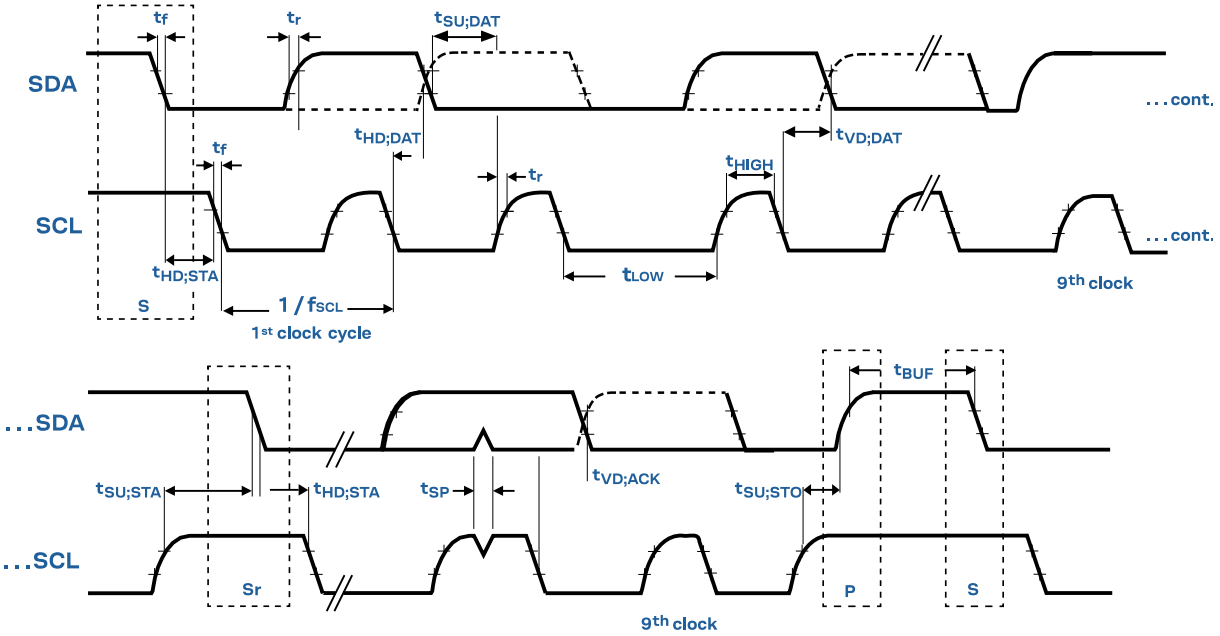

Figure 4: ZED-X20P I2C peripheral specification

Symbol	Parameter	Standard mode		Fast mode		Fast mode plus		Unit
		Min	Max	Min	Max	Min	Max	
f_{SCL}	SCL clock frequency	-	100	-	400	-	1000	kHz
$t_{HD;STA}$	Hold time (repeated) START condition	4.0	-	0.6	-	0.26	-	µs
t_{LOW}	Low period of the SCL clock	4.7	-	1.3	-	0.26	-	µs
t_{HIGH}	High period of the SCL clock	4.0	-	0.6	-	0.5	-	µs

Symbol	Parameter	Standard mode		Fast mode		Fast mode plus		Unit
		Min	Max	Min	Max	Min	Max	
$t_{SU;STA}$	Setup time for a repeated START condition	4.7	-	0.6	-	0.26	-	µs
$t_{HD;DAT}$ [21, 22]	Data hold time	0	-	0	-	0	-	µs
$t_{SU;DAT}$	Data setup time	250	-	100	-	50	-	ns
t_r	Rise time of both SDA and SCL signals	-	1000	-	300	-	120	ns
t_f	Fall time of both SDA and SCL signals	-	300	-	300	-	120	ns
$t_{SU;STO}$	Setup time for STOP condition	4.0	-	0.6	-	0.26	-	µs
t_{BUF}	Bus-free time between a STOP and START condition	4.7	-	1.3	-	0.5	-	µs
$t_{VD;DAT}$ [22]	Data valid time	-	3.45	-	0.9	-	0.45	µs
$t_{VD;ACK}$ [22]	Data valid acknowledge time	-	3.45	-	0.9	-	0.45	µs
V_{nL}	Noise margin at the low level	0.1 VCC	-	0.1 VCC	-	0.1 VCC	-	V
V_{nH}	Noise margin at the high level	0.2 VCC	-	0.2 VCC	-	0.2 VCC	-	V
C_b	Capacitive load for each bus line	-	400	-	400	-	550	pF

Table 24: ZED-X20P I2C peripheral timings and specifications

5.4 USB

The USB 2.0 FS (full speed, 12 Mbit/s) interface can be used for host communication.

Due to the hardware implementation, it may not be possible to certify the USB interface. The **V_USB** pin supplies the USB interface.

5.5 Default interface settings

Interface	Settings
UART1 output	38400 baud, 8 bits, no parity bit, 1 stop bit. NMEA protocol with **GGA, GLL, GSA, GSV, RMC, VTG, TXT** messages are output by default. UBX protocols are enabled by default but no output messages are enabled by default.
UART1 input	38400 baud, 8 bits, no parity bit, 1 stop bit. UBX, NMEA, RTCM 3.4 and SPARTN input protocols are enabled by default.
UART2 output	38400 baud, 8 bits, no parity bit, 1 stop bit. RTCM 3.4 protocol is enabled by default but no output messages are enabled by default. NMEA protocol is disabled by default. UBX protocol is disabled by default.
UART2 input	38400 baud, 8 bits, no parity bit, 1 stop bit. RTCM 3.4 and SPARTN protocols are enabled by default. NMEA protocol is enabled by default. UBX protocol is enabled by default.
USB	Default messages activated as in UART1. Input/output protocols available as in UART1.

21 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 V_{IH} of the SCL signal) to bridge the undefined region of the falling edge of SCL.

22 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. The maximum must only be met if the device does not stretch the low period t_{LOW} 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.

Interface	Settings
I2C	Available for communication with an external host CPU in peripheral mode only. Default messages activated as in UART1. Input/output protocols available as in UART1.
SPI	Allows communication to a host CPU, operated in peripheral mode only. Default messages activated as in UART1. Input/output protocols available as in UART1. SPI is not available unless **D_SEL** pin is set to LOW. (see section **D_SEL** interface in Integration manual[1]).

Table 25: Default interface settings

☞ Refer to the applicable Interface description for information about further settings.

☞ By default, ZED-X20P outputs NMEA messages that include satellite data for all GNSS bands being received. This results in a high NMEA output load for each navigation period. Make sure the UART baud rate used is sufficient for the selected navigation rate and the number of GNSS signals being received.

6 Mechanical specifications

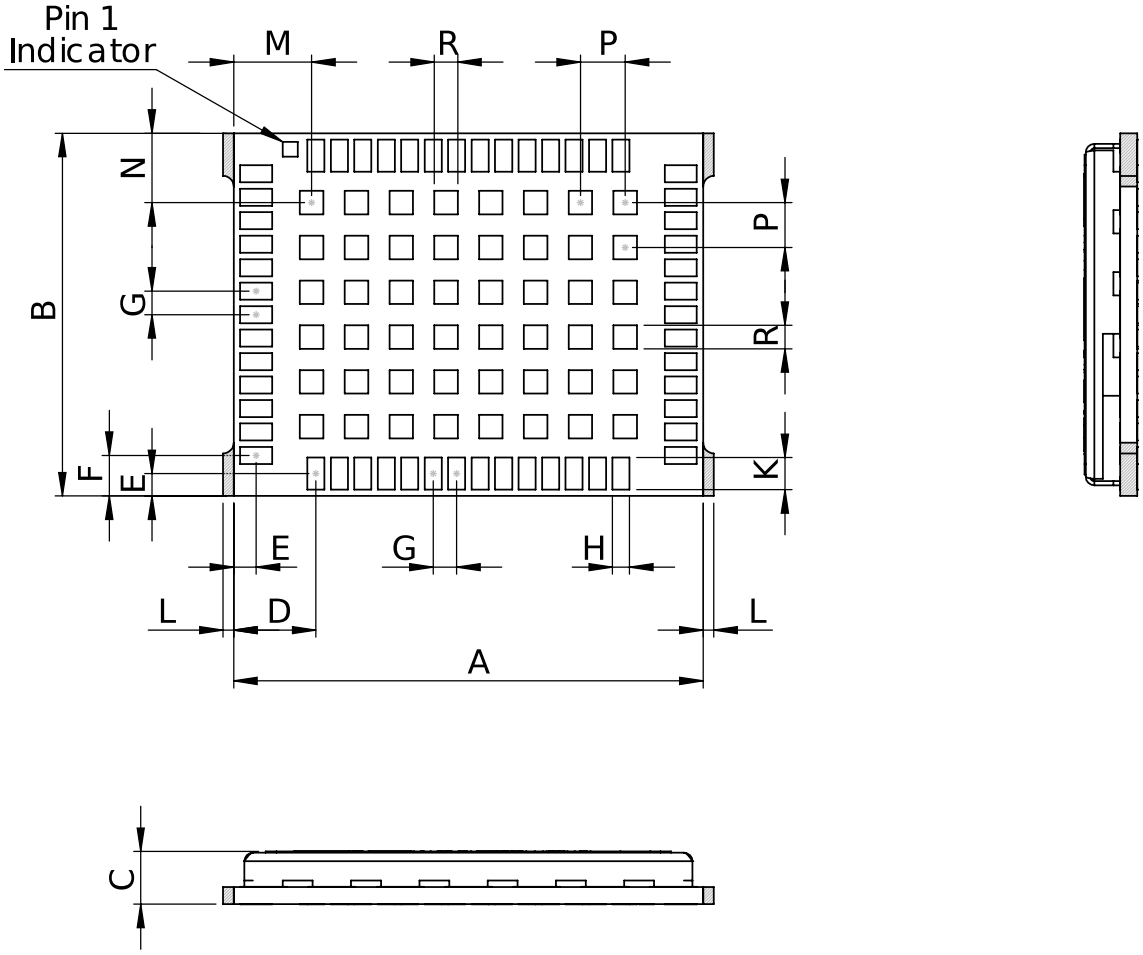

Figure 5: ZED-X20P mechanical drawing

Symbol	Min (mm)	Typical (mm)	Max (mm)
A	21.80	22.00	22.20
B	16.80	17.00	17.20
C	2.20	2.40	2.60
D	3.65	3.85	4.05
E	0.85	1.05	1.25
F	1.70	1.90	2.10
G	1.05	1.10	1.15
H	0.70	0.80	0.96
K	1.20	1.50	1.80
M	3.45	3.65	3.85
N	3.05	3.25	3.45
P	2.05	2.10	2.15

Symbol	Min (mm)	Typical (mm)	Max (mm)
R	0.88	1.10	1.32
L	0.00		0.30
Weight		1.6 g	

Table 26: ZED-X20P mechanical dimensions

☞ The mechanical picture of the de-paneling residual tabs (L) is an approximate representation. The shape and position may vary, but the overall size of the residual tabs remains within the maximum dimensions even when the tab sizes differ.

☞ Take the size of the de-paneling residual tabs into account when designing the component keep-out area.

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.
Chip qualification	Modules are based on AEC-Q100 qualified GNSS chips.
Manufacturing	Manufactured at ISO/TS 16949 certified sites.
Environmental	
RoHS compliance	Yes
Moisture sensitivity level (MSL)[23, 24]	4
Type approvals	
European RED certification (CE)	Yes
UK conformity assessment (UKCA)	Yes

Table 27: Qualifications and approvals

23 For the MSL standard, see IPC/JEDEC J-STD-020 and J-STD-033 [3].

24 For more information regarding moisture sensitivity levels, labeling, storage, and drying, see the Product packaging reference guide [4].

8 Packaging

The ZED-X20P 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 Product packaging reference guide [4].

8.1 Reels

Table 28 presents the reel type and delivery quantity.

Product	Reel type	Delivery quantity
ZED-X20P	B2	250

Table 28: Reel information for modules

For the reel specification, see Product packaging reference guide [4].

8.2 Tapes

Figure 6 illustrates the feed direction, component orientation, and tape dimensions (mm). The tape feeds into the pick-and-place machine from the reel on the left side of the figure and moves to the right.

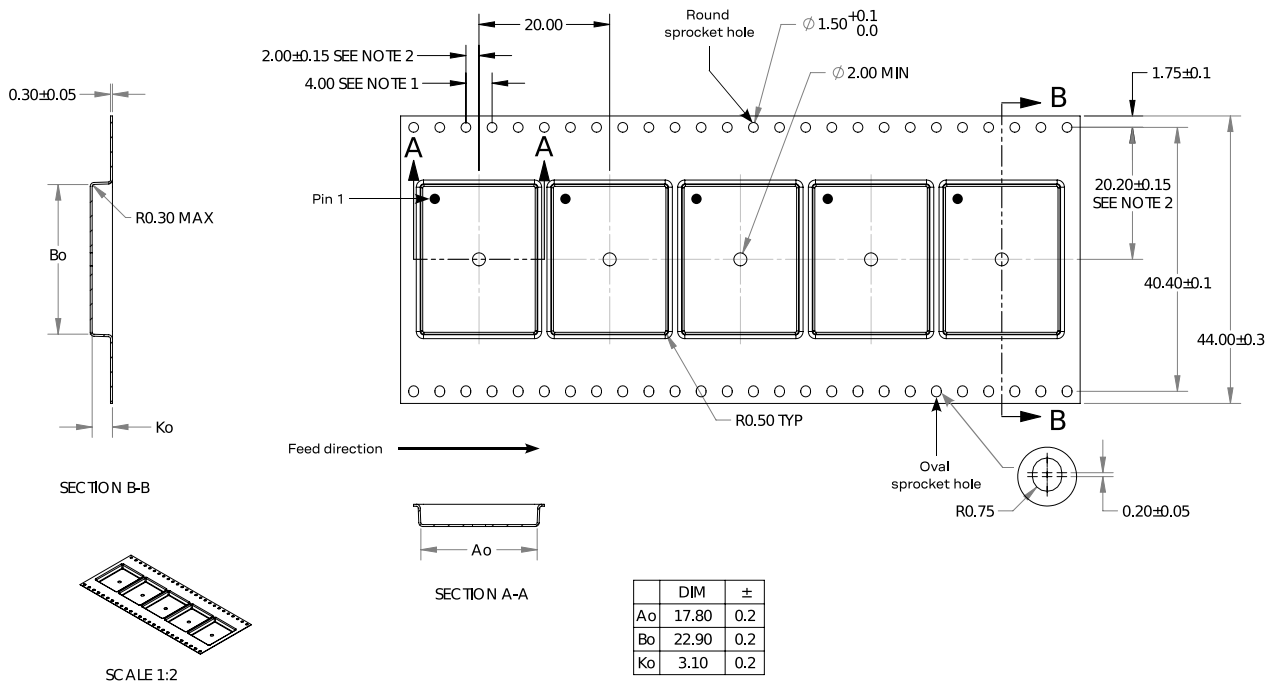

Figure 6: ZED-X20P tape dimensions (mm)

9 Soldering

For information on reflow soldering, see IPC/JEDEC J-STD-020 [3] and Integration manual [1].

10 Product marking and ordering information

This section provides information about product marking and ordering.

10.1 Product marking

The product marking provides information on ZED-X20P and its revision, as in Figure 7. For a description of the product marking, see Table 29.

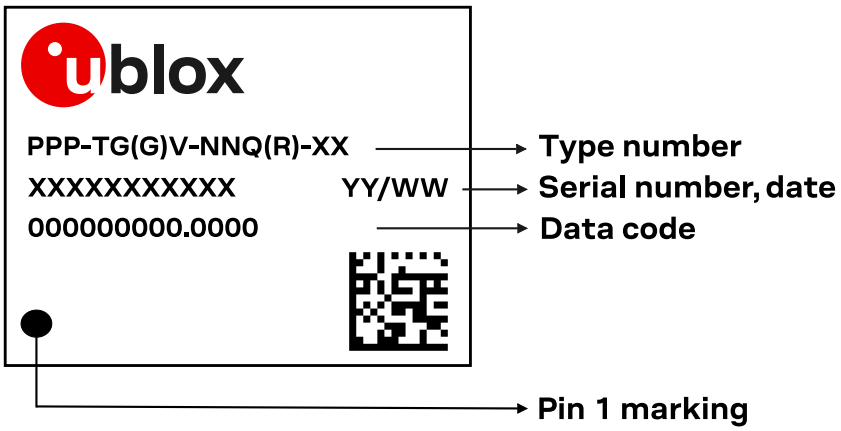

Figure 7: Example of ZED-X20P marking

Code	Meaning	Example
PPP	Form factor	ZED
TG(G)	Platform	X20 = u-blox X20
V	Variant	P = High precision
NN	Major product version	00, 01, ..., 99
Q	Product grade	A = Automotive B = Professional C = Standard
(R)	Production site	No character = global variant, 1 = regional variant
XX	Revision	Hardware and firmware versions
XXXXXXXXXXX	Serial number	Alphanumeric characters, e.g. BN600001181
000000000.0000	Data code	Alphanumeric characters
YY/WW or YYWW	Production date	Year/week, e.g. 24/04 or 2404
QR code	For internal/technical use	

Table 29: Description of product marking

10.2 Product identifiers

The ZED-X20P 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 30 describes the three different product identifiers used in the ZED-X20P product marking.

Identifier	Format	Example
Product name	PPP-TGGV	ZED-X20P
Ordering code	PPP-TGGV-NNQ(R)	ZED-X20P-01B
Type number	PPP-TGGV-NNQ(R)-XX	ZED-X20P-01B-00

Table 30: Product identifiers

10.3 Ordering codes

Table 31 provides information about applicable ordering codes and related products.

Ordering code	Product	Remark
ZED-X20P-01B	ZED-X20P	Shipped with firmware HPG 2.10

Table 31: 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), follow our website at: https://www.u-blox.com/en/product-resources.

Related documents

[1] Integration manual, UBXDOC-963802114-12901
[2] Interface description, UBXDOC-304424225-21263
[3] MSL standard IPC/JEDEC J-STD-020, www.jedec.org
[4] Product packaging reference guide UBX-14001652

For product change notifications and regular updates of u-blox documentation, register on our website, https://www.u-blox.com.

Revision history

Revision	Date	Comments
R01	05-Jun-2026	Initial revision
R02	21-Sept-2026	Updated sections: • Performance

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