Unictron Technologies Corp.

GNSS

RoHS Compliant

Product Name: GBMM1A L1+L5 Positioning Module

Part Number: GBMM1A

Features:

- Pin-to-Pin compatible with the mainstream industry module
- Support dual-frequency GNSS: GPS L1C/A/L5, QZSS L1/L5, Galileo E1/E5a, BDS B1I/B1C/B2a, and GLONASS L1
- Built-in dual-frequency RTK algorithm
- Support Qianxun Find CM real-time centimeter-level positioning service
- Support Qianxun accelerated positioning service
- Support BeiDou-3 satellite system

Applications:

- Automotive navigation
- Personal navigation devices
- Vehicle tracking and security system
- Drone

GBMM1A L1+L5 Positioning Module

MODEL: GBMM1A

Revision History

Version	Description	Date
A	First release	

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1. Product Overview

GBMM1A is a high-performance, highly integrated dual-frequency high-precision positioning module. GBMM1A supports all global civilian navigation satellite systems, including BeiDou, GPS, GLONASS, Galileo, and QZSS. It is capable of simultaneously tracking BDS B1I/B1C/B2a, GPS L1C/A/L5, Galileo E1/E5a, GLONASS L1, QZSS L1/L5, and SBAS signals.

The GBMM1A integrates a high-performance positioning processor with strong computational capability and features a built-in high-precision RTK positioning algorithm. It is designed to be pin-compatible with mainstream GNSS modules on the market, while also offering low power consumption and a compact form factor to enhance device battery endurance.

GBMM1A is widely applicable to the shared bicycles, unmanned aerial vehicles (UAVs), automotive navigation, and vehicle fleet management.

Figure 1: GBMM1A Front View

2. Performance Specifications

Table 1. Basic Parameters

Items	Specifications	
GNSS Tracking Channels	128	
Receiver type	GPS/QZSS: L1 C/A, L5 GLONASS: L1 BDS: B1I, B1C[1], B2a Galileo: E1, E5a	
Nav Update Rate	1 Hz	
Velocity Accuracy	<0.05m/s CEP50	
Positioning Accuracy[2]	Dual-frequency Single Point	1.5m CEP50
	Dual-frequency RTK	Horizontal 1cm+1ppm CEP50 Vertical 2cm+1ppm CEP50
Time to First Fix (TTFF)	Hot Start 1 sec Cold Start 28s	
Sensitivity	Cold Start-148dBm Reacquisition−158dBm Tracking-165dBm	
Operating Voltage	Main Supply Voltage:	1.8 ~ 3.6V
	Backup Supply Voltage	1.8 ~ 3.6V
Power Consumption	Operating Mode	122 mW @ 1.8 V 140 mW @ 3.3 V
Physical Construction		
Package Dimensions	L9.7mm x W10.1mm x H2.5 mm,	
Environmental Conditions		
Temperature(°C)	Operating: -30 ~ +80	
	Storage: -40 ~ +80	
Communication		
Protocol	NMEA 0183 V4.1 RTCM 3.2 Proprietary Protocol	
Interface	UART:2	
	I2C:1	

Note:

[1] Fixed positioning output.

[2] Accuracy is measured under open-sky conditions using dual-frequency satellite signals.

3. Module Pin Definition

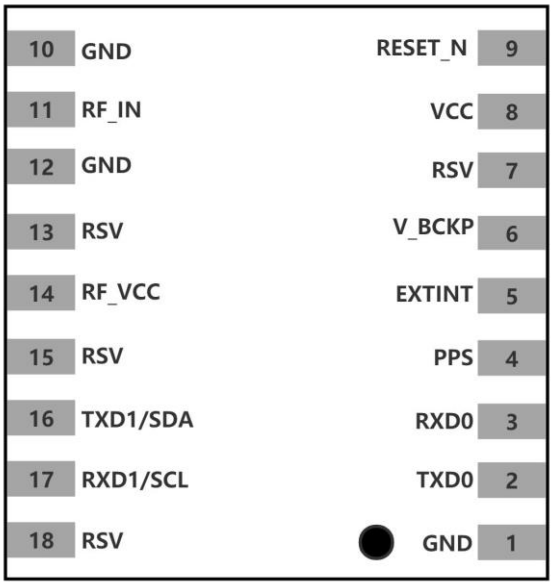


Figure 2 .Module Pin Diagram

Table 2 .Module Pin Description

Pin No.	Pin Name	I/O Type	Description
1	GND	-	Ground
2	TXD0[3]	O	UART0 transmit output
3	RXD0	I	UART0 receive input
4	PPS	O	Pulse-per-second signal output
5	EXTINT	I	External interrupt input. When an external high level >10 ms is applied, the module can exit standby mode (leave floating if unused).
6	V_BCKP	-	Backup power supply input
7	RSV	-	Reserved (leave floating if unused)

[3] TXD0 Pin Note

TXD0 is a boot pin and must be pulled low within 100 ms after power-on to prevent the module from entering engineering mode.

Pin No.	Pin Name	I/O Type	Description
8	VCC[4]	-	Power supply input
9	RESET_N	I	Reset input (active low). It is recommended to reserve an RC reset circuit in the design.
10	GND	-	Ground
11	RF_IN	I	Antenna signal input
12	GND	-	Ground
13	RSV	-	Reserved (leave floating if unused)
14	RF_VCC	O	RF power output, antenna bias voltage output. Can be used to supply power to an active antenna.
15	RSV	-	Reserved (leave floating if unused)
16	TXD1 / SDA	O	UART1 transmit output / I²C data
17	RXD1 / SCL	I	UART1 receive input / I²C clock
18	RSV	-	Reserved (leave floating if unused)

[4] The module power-on ramp rate must be greater than 0.5 mV/μs (500 V/s), and the power supply must start from 0 V.

4. Electrical Characteristics

4.1 Absolute Maximum Ratings

Table 3 .Absolute Maximum Ratings

Symbol	Parameter	Min	Max	Unit
VCC	Main Supply Voltage	−0.2	3.6	V
RF_VCC	Active Antenna Supply Voltage	−0.2	3.6	V
V_BCKP	Backup Supply Voltage	−0.2	3.6	V
$T_{storage}$	Storage Temperature	−40	85	°C
T_{solder}	Reflow Soldering Temperature	--	260	°C

4.2 I/O Port Characteristics

4.2.1 REEST_N

Table 4 .RESET_N Port Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
IIZ	Input Leakage Current	--	--	--	±1	μA
VIH	Input High Voltage	--	VCC*0.7	--	VCC	V
VIL	Input Low Voltage	--	0	--	VCC*0.3	V

4.2.2 RF_VCC Port Characteristics

Table 5 .RF_VCC Port Characteristics

Parameter	Condition	Min	Typ	Max	Unit
RF_VCC Supply Current	VCC = 3.3 V	--	--	55	mA
RF_VCC Output Voltage	VCC = 3.3 V	2.7	--	3.3	V

4.2.3 Other I/O Port Characteristics

Table 6 .Other I/O Port Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
IIZ	Input Leakage Current	--	--	--	±1	μA
VIH	Input High Voltage	--	VCC*0.7	--	VCC	V
VIL	Input Low Voltage	--	0	--	VCC*0.3	V
VOH	Output High Voltage	IOH = 17.8 mA, VCC = 3.3 V	--	VCC *0.8	--	V
RPU	Pull-up Resistance	VDD_IO = 3.3 V, Ta = 25°C	--	70	--	KΩ
		VDD_IO = 1.8 V, Ta = 25°C	--	160	--	KΩ
RPD	Pull-down Resistance	VDD_IO = 3.3 V, Ta = 25°C	--	88	--	KΩ
		VDD_IO = 1.8 V, Ta = 25°C	--	220	--	KΩ

3.3 DC Characteristics

3.3.1 Operating Conditions

Table 7 .Operating Conditions

Symbol	Parameter	Min	Typ	Max	Unit
VCC	Main Supply Voltage	1.62	3.3	3.6	V
V_BCKP	Backup Supply Voltage	1.62	3.3	3.6	V
T_{env}	Operating Ambient Temperature	40	--	85	°C

5. Mechanical Specifications

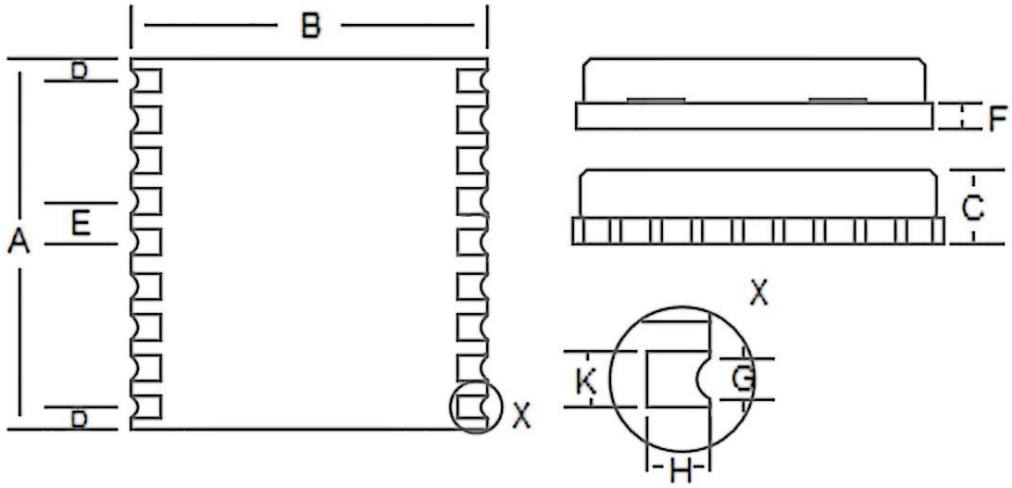


Figure 3. Module Mechanical Dimensions

Table 8. Module Mechanical Dimensions

Item	Min (mm)	Typ (mm)	Max (mm)
A	9.6	10.1	10.7
B	9.5	9.7	9.9
C	2.3	2.5	2.7
D	0.55	0.65	0.95
E	1.0	1.1	1.2
F	—	0.8	—
G	0.4	0.5	0.6
H	0.9	1.0	1.1
K	0.7	0.8	0.9

6. Reference Design

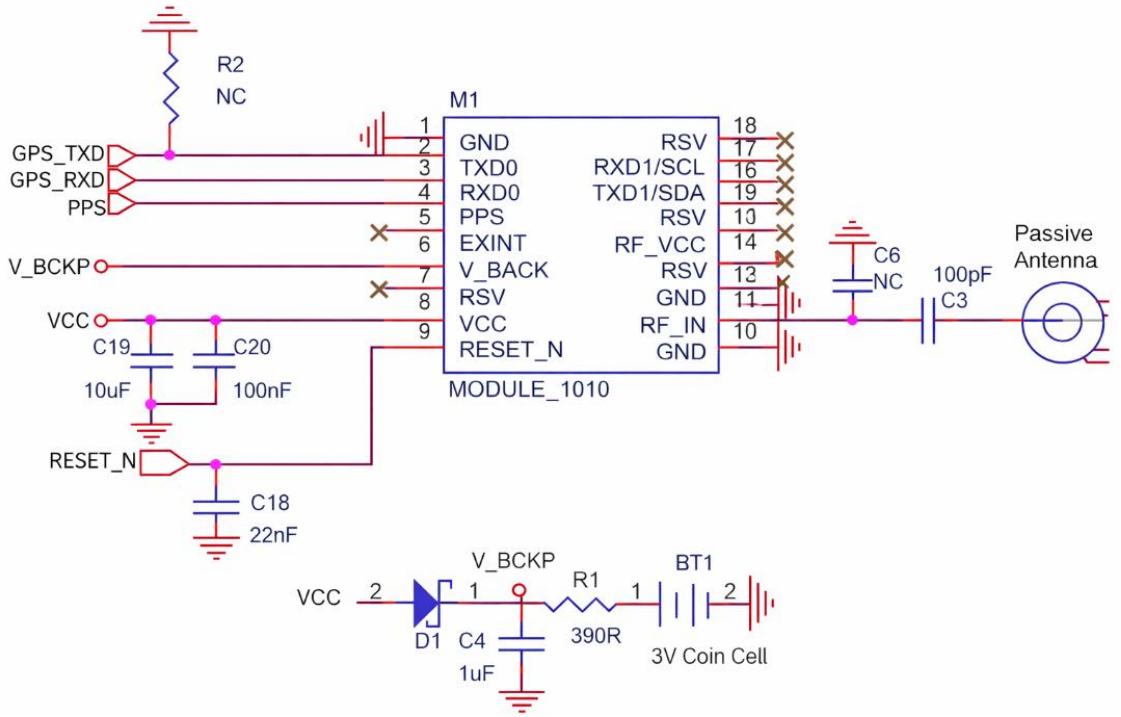


Figure 4 .Reference Design Schematic (Passive Antenna)

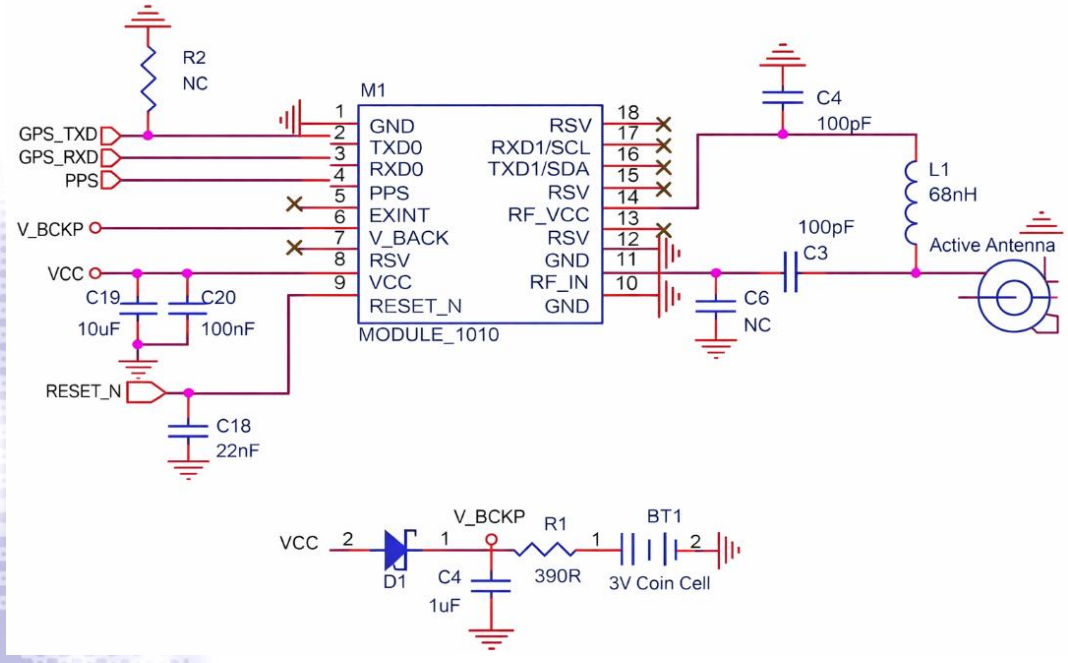


Figure 5 .Reference Design Schematic (Dual-Band Active Antenna)

7. Precautions

7.1 Hardware Design

To ensure proper operation of the GBMM1A module and fully achieve its performance, the following items must be noted during hardware design:

1. **Power Supply**: Use a low-ripple, highly stable power supply. The peak ripple voltage should not exceed 50mV.
   - Place a decoupling capacitor close to the module power pins. Power traces should be ≥ 0.5 mm in width.
   - Use an LDO to ensure clean power. The driving current should be greater than 400 mA. The LDO should be placed as close to the module as possible in the layout.
   - Widen power traces or use copper pour / plane to carry current.
   - Avoid routing power traces near high-power or high-impedance components such as inductors.
   - Connect all module GND pins to ground.
2. **UART Interface:**

   Ensure that the host device and the GBMM1A module have matching logic levels and baud rate settings. TXD0 is an output pin. It must remain at a low level within 100 ms after power-on; otherwise, the module will enter engineering mode and fail to operate normally. It is recommended that the pin connected to TXD0 be held low within 100 ms after power-on, or be permanently configured as a pull-down input..
3. **Antenna:**
   - **Antenna Interface**: The antenna RF trace should be impedance-matched, kept as short and straight as possible, and avoid sharp corners. It is recommended that the RF trace width from the module RF pin to the antenna connector be greater than 0.2 mm, and placed as close as possible. The RF routing should adopt a coplanar waveguide impedance model, with the spacing between the trace and ground copper controlled at approximately 1× trace width to ensure the RF impedance is 50 Ω. It is recommended that the routing from the module RF pin to the antenna connector reference the second layer ground, and ensure the second-layer ground plane is continuous and complete.
   - **Antenna Placement:** To ensure good signal-to-noise ratio, the antenna should be well isolated from electromagnetic radiation sources, especially radiation in the 1559–1577 MHz frequency band. Avoid routing signal traces directly beneath the GBMM1A module.
   - **Antenna Gain:** When using an external active antenna, the recommended antenna

gain should be less than 30 dB.

- In the event of an antenna short circuit, promptly cut off the module power and remove the fault. After the issue is cleared, reapply power to resume module operation.
- Antenna short-circuit detection current threshold:

VCC / Antenna Status	3.3 V	1.8 V
Open → Normal	≈ 8 mA	≈ 4 mA
Normal → Short	≈ 60 mA	≈ 35 mA

- An active antenna used with the GBMM1A module shall have a maximum operating current of less than 60 mA. When an antenna short circuit occurs, the module outputs an alarm message (QXANTSTAT sentence, as shown below).

Command Sentence	STAT Value	Antenna Status
$QXANTSTAT,STAT	0	Normal
	1	Short Circuit
	2	Open Circuit

Note: Valid only for active antennas with a normal detection circuit.

4. Anti-Interference
   - This module is temperature-sensitive equipment. Rapid temperature changes may lead to performance degradation. During use, keep the module away from high-temperature airflow and high-power heat-generating devices as much as possible.
   - Do not place the module near interference sources, such as communication antennas, crystal oscillators, large inductors, or high-frequency signal traces. It is recommended that the bottom ground of the module be fully copper-poured and well grounded.

7.2 Module Reset Signal Description

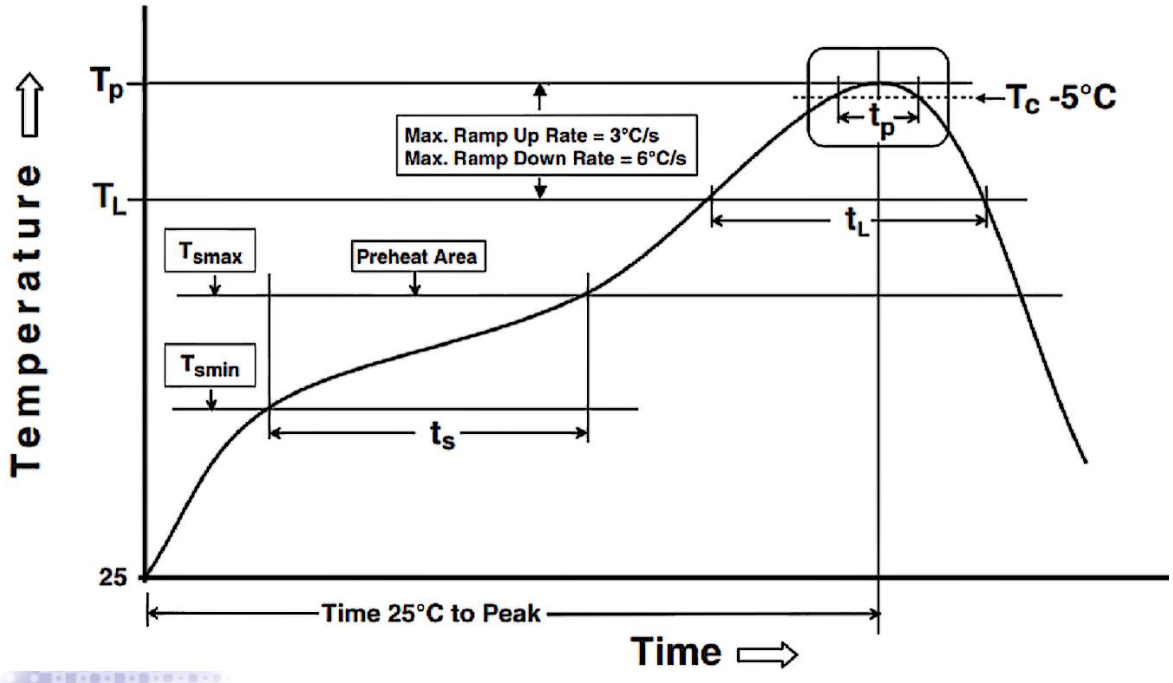
During normal module operation, pulling the RESET_N pin low for more than 100 μs will reset the GBMM1A.

7.3 Reflow Soldering Profile

Table 9. Reflow Soldering Profile Characteristics

Profile Characteristics	Pb-Free Process
Preheat / Soak Minimum Temperature (Tmin) Maximum Temperature (Tmax) Time t (from Tmin to Tmax)	 150 °C 200 °C 60 ~ 120 s
Ramp-up Rate (TL to TP)	3 °C/sec (Max)
Liquidus Temperature (TL) Time tL (Time Above TL)	217 °C 60 ~ 150 s
Peak Package Temperature (TP)	Must not exceed Tc**[5]**
Time within 5°C of Tc (tp)	30 *sec**[6]**
Ramp-down Rate (TP to TL)	6 °C/sec (Max)
Time from 25°C to Peak Temperature	8 minutes (Max)

Figure 6 .Reflow Soldering Profile (Reference: IPC/JEDEC J-STD-020E Standard)



[5] Tc = 260 °C

[6] The time above 255 °C shall not exceed 30 seconds.

8. Packaging and Handling

8.1 Packaging

8.1.1 Packaging Notes

The GBMM1A positioning module is sensitive to both moisture and electrostatic discharge (ESD). During product packaging and transportation, all relevant handling requirements must be strictly followed, and appropriate preventive measures shall be taken to minimize the risk of product damage.

8.1.2 Module Packaging

The GBMM1A positioning module is packaged in tape-and-reel form (consisting of carrier tape and reel) and sealed in an anti-static moisture-barrier bag. This packaging method is designed to meet customers' requirements for high-efficiency production, mass assembly, and automated pick-and-place operations.
The figure below shows the dimensional details of the carrier tape.

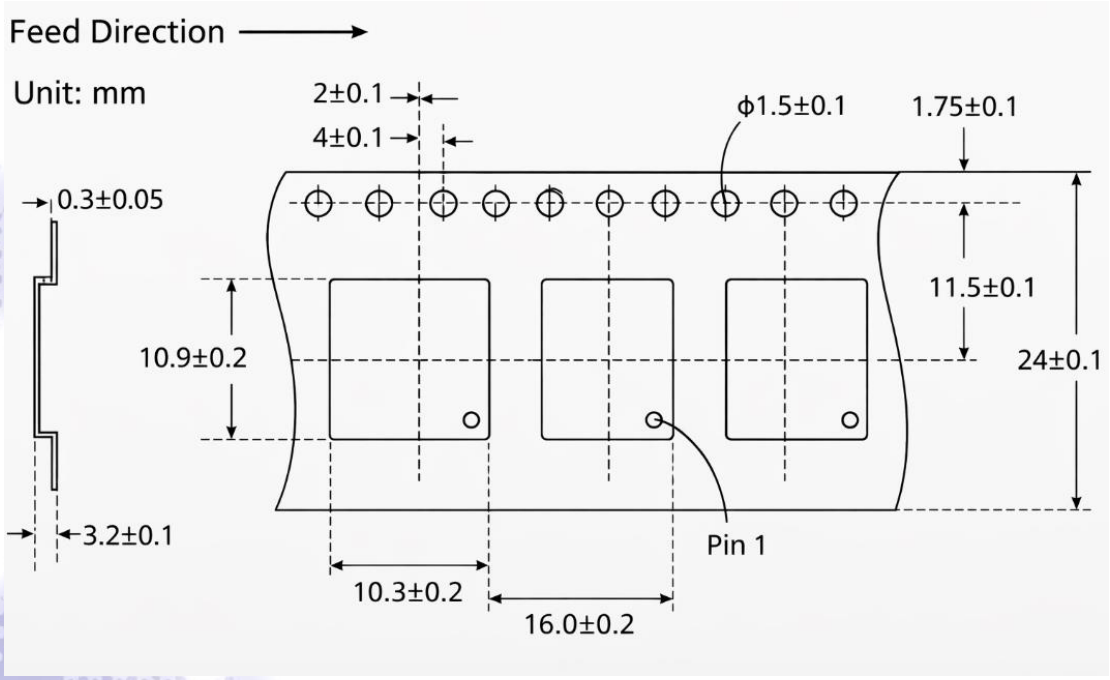


Figure 7 .Carrier Tape Dimensions

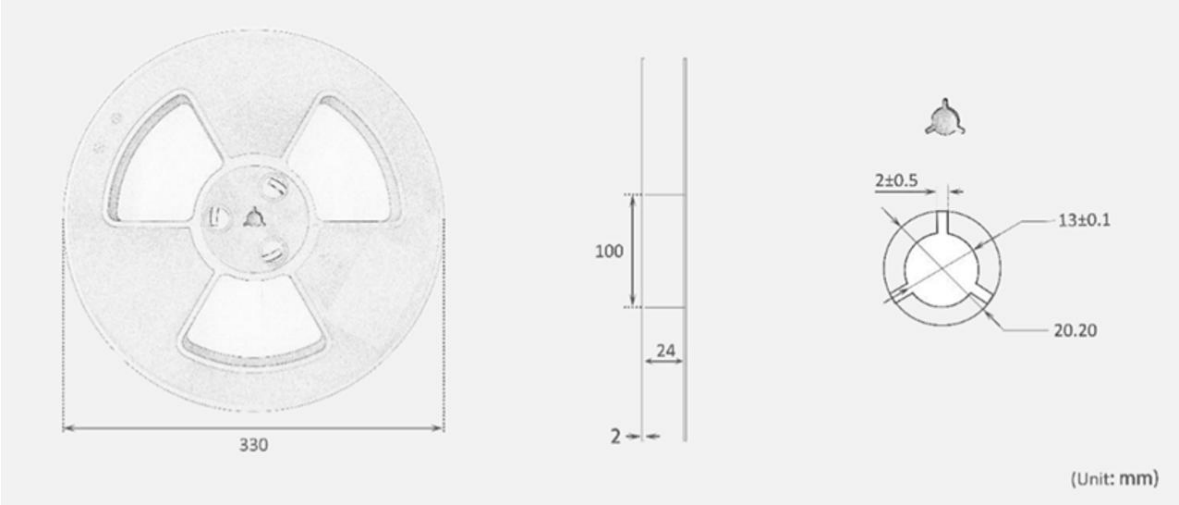


Figure 8. Reel Dimensions

8.2 Storage

To prevent moisture absorption and electrostatic discharge (ESD), the sealed packaging bag contains desiccant and a humidity indicator card. Users can monitor the humidity condition of the storage environment through the humidity indicator card.

8.3 ESD Handling

8.3.1 ESD Precautions

The GBMM1A positioning module contains highly sensitive electronic circuitry and is classified as an electrostatic discharge–sensitive device (ESD). Please observe the following handling precautions. Failure to follow the preventive measures described below may result in severe damage to the module.

- Before mounting or attaching the antenna patch, ensure proper grounding first.
- When handling or routing the RF pin, avoid contact with any charged capacitors or other energized components (e.g., antenna patch: 10 pF; coaxial cable: 50–80 pF/m; soldering iron).
- To prevent electrostatic discharge, do not expose the antenna area. If exposure is unavoidable due to design constraints, appropriate ESD protection measures must be implemented.

- When soldering the RF connector and antenna patch, ensure that an ESD-safe soldering iron is used.

8.3.2 ESD Protection Measures

The GBMM1A positioning module is an electrostatic discharge–sensitive device. Extra care must be taken during operation and handling of the receiver to minimize the risk of electrostatic discharge.In addition to standard ESD safety precautions, the following measures should also be considered:

- Add ESD protection diodes at the RF input to prevent electrostatic discharge.
- Do not touch any exposed antenna areas.
- Add ESD protection diodes to the UART interface.

8.4 Moisture Sensitivity Level (MSL)

The moisture sensitivity level of the GBMM1A is MSL 3.