



ROHS, TS16949, ISO9001

ST110BL
Navigation and Positioning Module
Manual

June , 2022

www.xbteek.com

Revision History

Version NO.	Version	Date
V.1	New	June, 2022

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1. Module Description

1.1 Overview

ST110BL, a high-performance GNSS navigation and positioning module, supinterfaces Beidou (and Beidou three generations), GPS, QZSS and satellite augmentation System SBAS (WAAS, EGNOS, GAGAN, MSAS) with the basis on high-performance, low-power GNSS receiver chip. ST110BL has the advantages of high sensitivity, low power consumption and high cost performance.

- ✓ High integration, single chip receiver solution
- ✓ Module integration with external LNA
- ✓ Built-in Power On Reset, no need for peripheral Reset circuit
- ✓ Low power consumption

ST110BL, with compact size, using SMT pad, supinterface fully automatically integration of standard take& place and reflow welding , ROHS Process, having low cost, high performance, low power consumption and other characteristics. It can be widely used in interfaceable equipment, such as PND, PAD, transceiver , wearable device, outdoor GPS tracker, bicycle navigator, drones, navigation equipment, including vehicle-mounted terminal, automobile data recorder, OBD and traffic warning system and so on.

1.2 Key Index

Frequency ¹	GPS/QZSS: L1C/A BEIDOU: B1I, B1C GLONASS: L1 GALILEO: E1 SBAS: L1C(WAAS, EGNOS, MSAS, GAGAN, SDCM)	
Refresh rate	Default 1Hz, supinterface 1-5Hz	
Sensitivity	Tracking	-163dBm
	Capture	-146dBm
Positioning time ²	Hot Start	≤ 1s
	Cold start	≤30s
	A-GNSS auxiliary ³	≤ 10s
Horizontal positioning accuracy ⁴	Autonomous positioning	3m
	Wide area difference	2.5 m
Elevation positioning accuracy	3m	
Speed measurement accuracy ⁵	0.1 m/s	
Azimuth accuracy ⁵	0.5 degrees	
Height limit	> 18,000 m	
Speed limit	> 515 m/s	
Acceleration limit	>4G	

Output Protocol	NMEA 0183	9600 bps, 8 data bits, no parity, 1 stop bits (default) 1Hz: GGA, GLL, GSA, GSV, RMC, VTG
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- 1 Supinterface SBAS and QZSS
- 2 All satellite strength -130dBm
3. Depends on data network speed and latency 5.50% @ 30 m/s
4. CEP, 50%, 24 hours static, -130 dBm, > 6 SVs

2. Technical Index

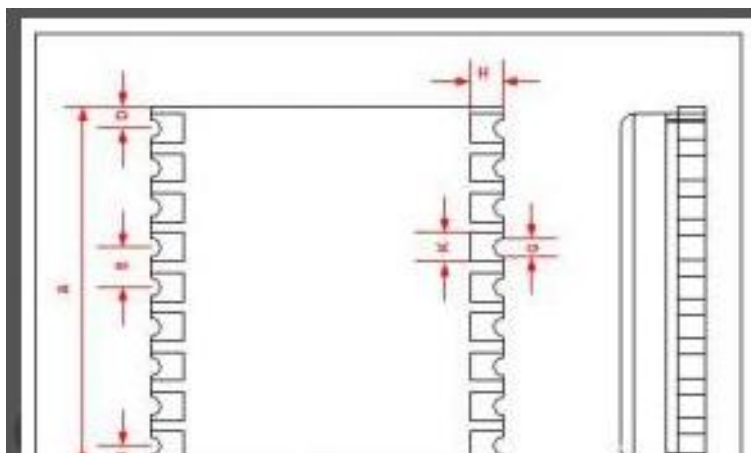
2.1 Electrical Characteristics

Parameters	Symbol	Minimum value	Maximum	Units
Module supply voltage (VCC)	Vcc	-0.3	3.6	V
Backup Battery voltage (VBAT)	Vbat	-0.3	3.6	V
Maximum acceptable ESD level	VESD(HBM)		2000	V
Storage temperature		- 40	+ 85	°C

2.2 Operating Conditions

Parameters	Symbols	Minimum value	Recommended value	Maximum value	Units
Supply voltage	Vcc	3.0	3.3	3.6	V
Vcc peak current (Except antenna)	Ipeak			60	mA
Capture phase current			22		mA
Tracking stage current			17		mA
Backup power supply	Vbat	1.5	3.0	3.6	V
Backup Power Supply (Vbat) current	Ibat		20		uA
Active antenna output voltage	VCC_RF		3.3		V
Antenna gain	Gant	15		30	dB
Operating temperature		- 40	25	+ 85	°C

2.3 Appearance and Dimensions



2.4 Pins Description

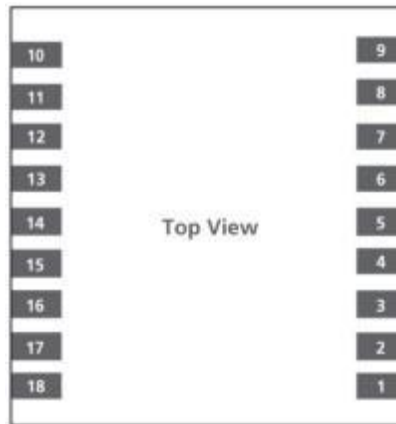


Figure 2-2 Pin diagram

Pins NO.	Name	I/O	Description	Characteristics
1	GND	I	Ground	
2	TXD	O	Navigation data output	NMEA0183 protocol, TTL level
3	RXD	I	Interactive command input	Configure command input, TTL level
4	TIMEPULSE	O	Second pulse	Time pulse(1PPS),TTL level
5	NC			No connection requirement
6	V_BAT	I	RTC and SRAM backup power supply	Provide 1.5~3.6V power supply to ensure module hot start
7	NC			No connection requirement
8	VCC	I	Module power input	Dc 3.3V
9	nRESET	I	Module reset input, active in low level	Power-on self-reset, it is recommended to be no connection
10	GND	I	Ground	
11	RF_IN	I	Antenna signal input	Pay attention to ESD protection
12	GND	I	Ground	

13	NC			No connection requirement
14	VCC_RF		Active antenna power supply	Output 3.3V to power the active antenna
15	NC			No connection requirement
16	NC			No connection requirement
17	NC			No connection requirement
18	PRTRG			Work mode selection, or input wake-up signal

2.5 PCB Dimensions

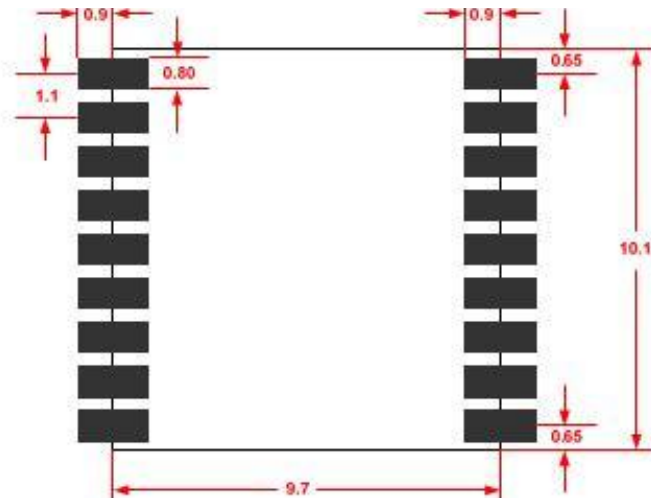


Figure 2-3 Recommended PCB package dimensions design (unit: mm)

Note: When designing the PC resistance welding, ensure that the area below the ST110BL module is completely covered with resistance welding.

3. Hardware Design

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3.1 Design considerations

To make ST110BL module work normally, need to correctly connect the following signals:

- ✓ Provide a reliable power supply to the VCC pins.
- ✓ Ground all GND pins of the module.
- ✓ Connect the RF_IN signal to the antenna, maintain a 50 ohm impedance match in the wire .
- ✓ Make sure serial interface 1 or I2C is connected to a PC or external processor, and the user can receive positioning information data through it.

To get good performance, the design should also pay special attention to the following:

- ✓ Power supply: Good performance needs stable and low ripple power supply to ensure. The peak((the Maximum/minimum)) of voltage ripple peak should not exceed 50mV.
 - Use LDO to ensure pure power supply
 - Place the LDO as close to the module as possible
 - Widen the power cables or use a split copper surface to transmit current
 - Do not route power cables through high-power and high-inductive devices such as magnetic coils
- ✓ UART interface: ensure the same signal and baud rate between the pins of the main device and the ST110BL module.
- ✓ Antenna interface: ensure that the impedance of the antenna line matches, and ensure that it is as short and smooth as possible, avoid acute angles.
- ✓ Antenna position: In order to ensure a good signal-to-noise ratio, ensure the antenna has a good isolation from the electromagnetic radiation source, especially Electromagnetic radiation in the band 1559 ~ 1620MHz
- ✓ Try to avoid running wires directly below ST110BL

- ✓ This module is temperature sensitive equipment, the drastic change of temperature will lead to its performance degradation, try to stay it away from high temperature airflow and large power heater

3.2 Signal Reset and Upgrade

After power-on, ST110BL module must be reset correctly to work normally, and the chip provides self-reset function.

To ensure effective reset, when power-on the following time-sequence requirements must be met between the reset pin nRESET of the module and the power supply VCC. ST110BL can be reset by lowering the nRESET pin for more than 5ms during the normal operation of the module.

- When the module is powered on or nRESET accepts the rising edge, the system will produce an external reset (if AVDD_BAK is powered continuously, this reset will not affect the ephemeris data in the backup area).
- If PRTRG detects a low level input when a reset occurs on the module, the module will enter the upgrade mode when the low level of PRTRG is released to the suspended state and receive the upgrade instruction.
- If PRTRG remains suspended while the module reset occurs, the module will enter normal operating mode.
- When nRESET and PRTRG are connected to IO of the main control system, the pull-up resistance and pull-down resistance of IO should be forbade, and the nRESET and PRTRG should be kept suspended when the module is in normal operating mode.

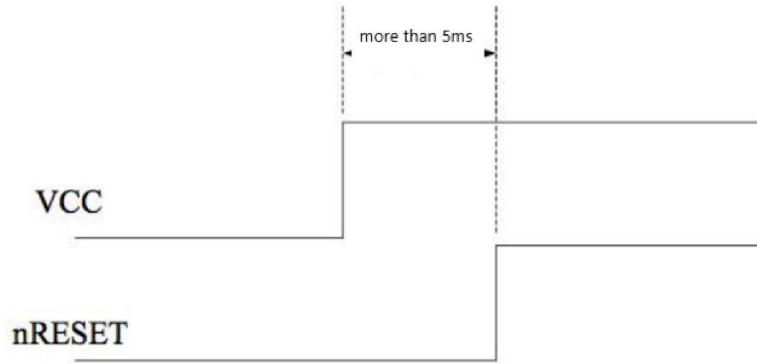


Figure 3-1 Module reset signal

3.3 Circuit Design Reference

1. An active antenna with a + 3/3.3V power supply, uses RF_VCC to power the antenna.

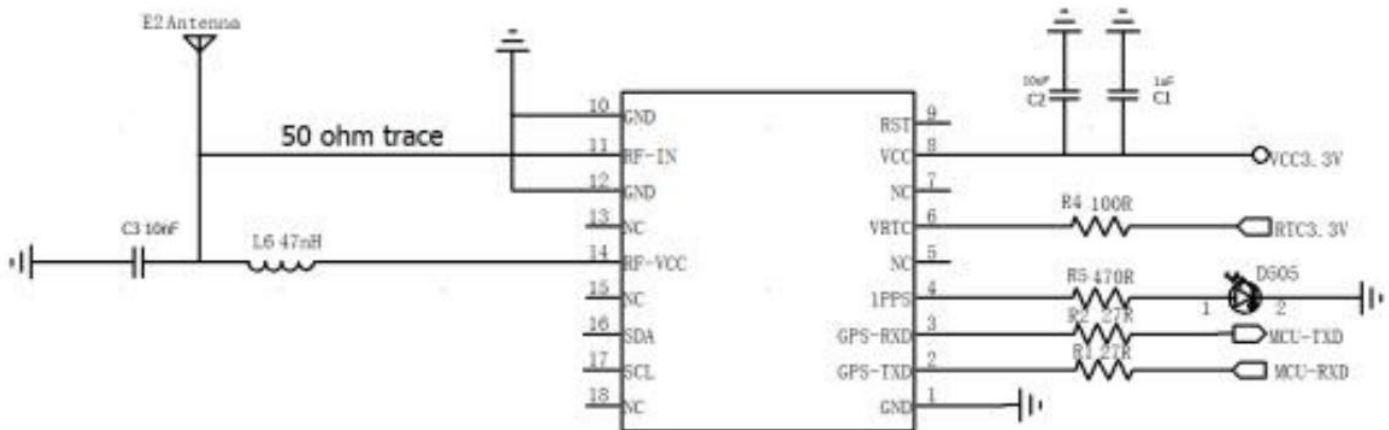


Figure 3-2+ 3/3.3V Active Antenna Scheme

2. If other voltage is used, the required antenna bias voltage V_{BIAS} is used to power the antenna through the feed inductance.

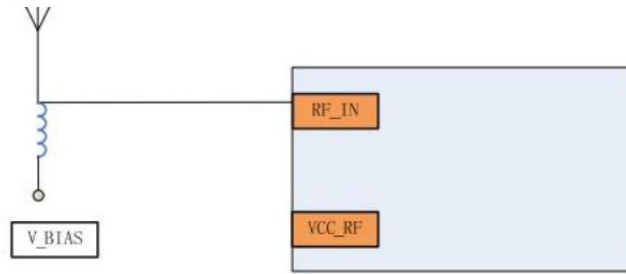


Figure 3-3 Active Antenna Scheme of Other Voltage Ranges

3. Use passive antenna to cancel L1 and C1, so that the antenna and the module feed through, RF routing must be 50 ohms impedance.

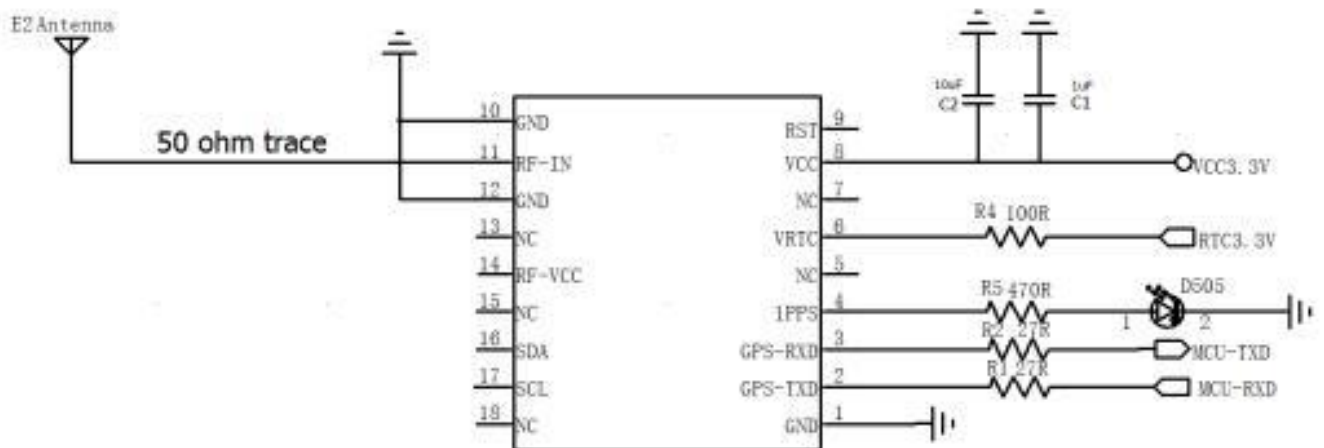


Figure 3-4 Passive Antenna Scheme

4. Processing Requirements

4.1 Humidity Control

Module belongs to MSL class 4. after unpacking the plastic sealing, it must be baked and dried before welding to use after more than 72Hr. Bake at no more than 80 °C and no less than 4Hr.

4.2 Requirements for Reflow Soldering

Preheating phase	Up Rate of temperature	Less than 3 ° C /s
	End temperature of preheat	150-160 ° C
Constant temperature phase	Up Rate of temperature	(150°C -183°C range) less than 0.3°C/s;
	Up Rate of temperature	(183°C -217°C range) less than 3.5°C/s
	Constant temperature time	60 – 120 seconds
	End temperature of constant temperature	217°C
Molten tin phase	Tin melting time	40-60 seconds
	Peak temperature	245°C
Cooling phase	Descent rate of temperature	Not higher than 4°C/ s

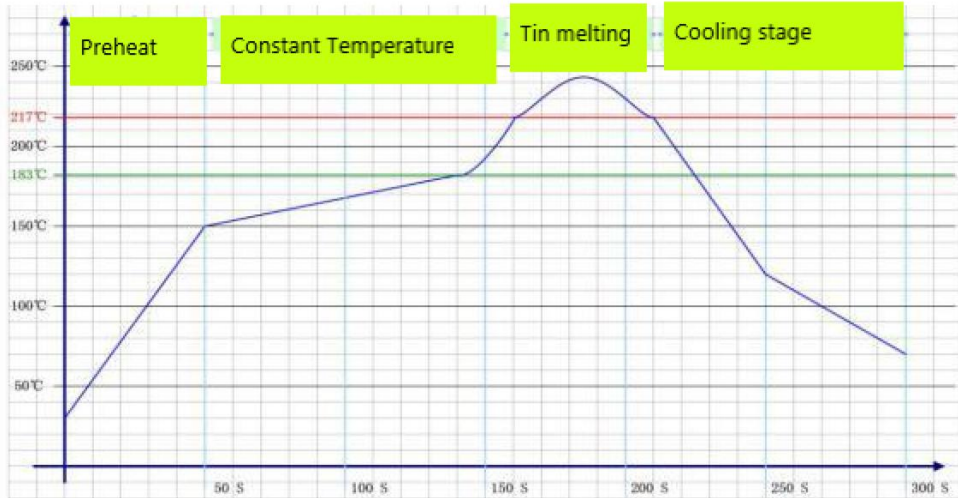


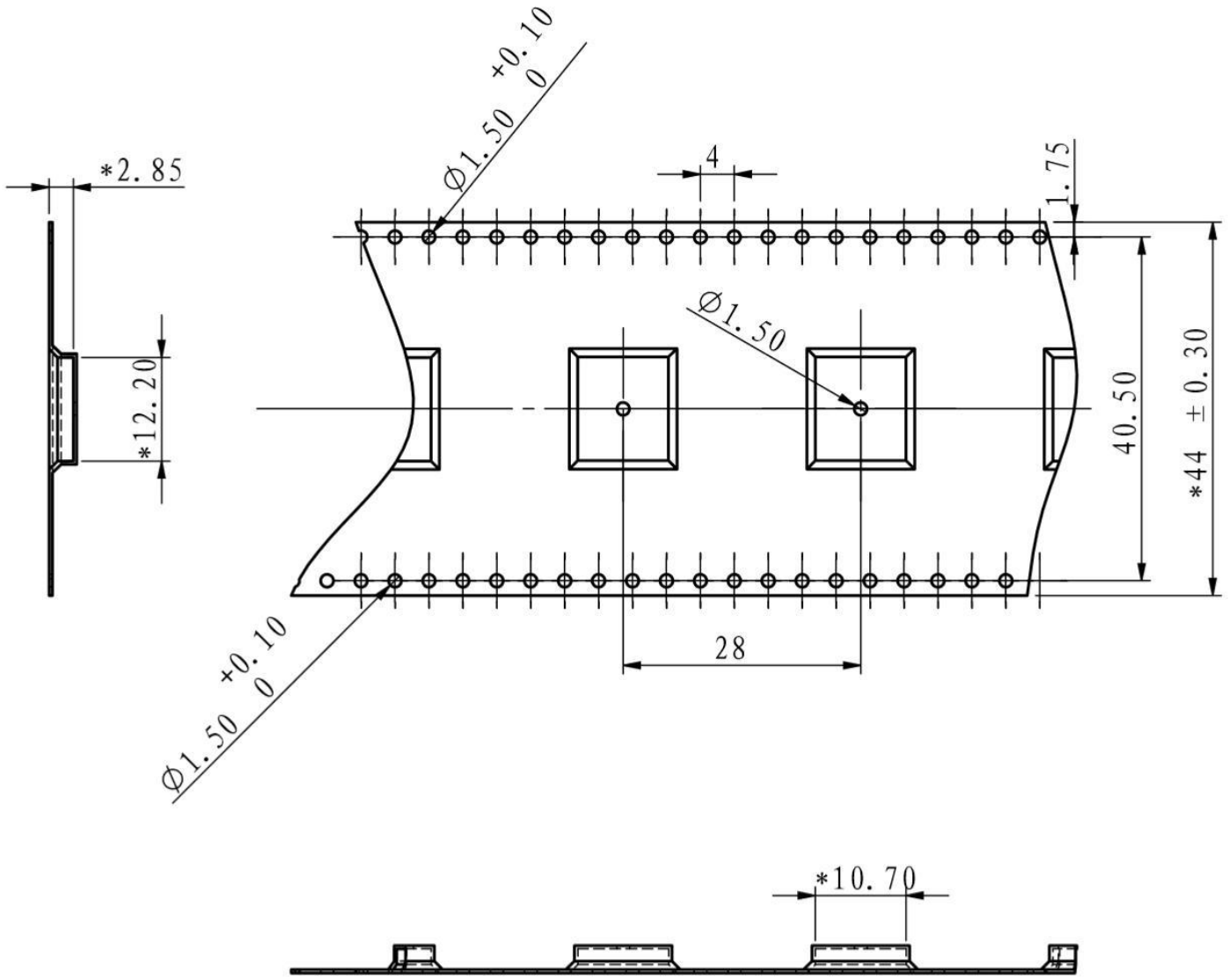
Figure 4-1 Reflow Temperature Curve

5. Package and Transportation

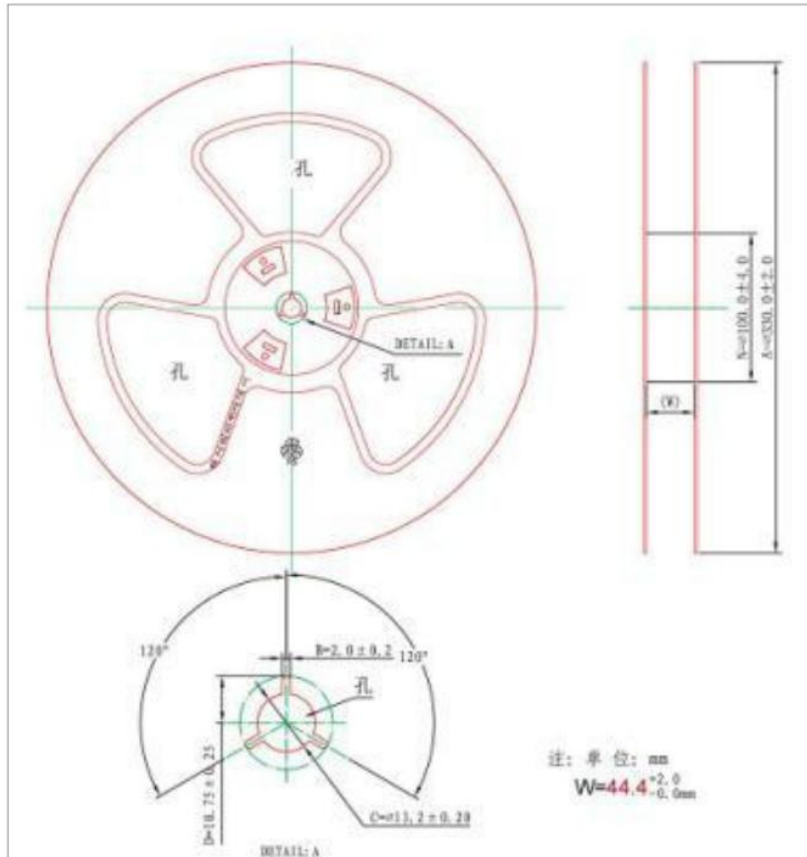
5.1 Packing Dimension

The module pack on the reel, and the MPQ of 1 inner packing box is 1K;
 1 outer packing box contains 3 inner packing boxes, and the MOQ quantity is 3K.

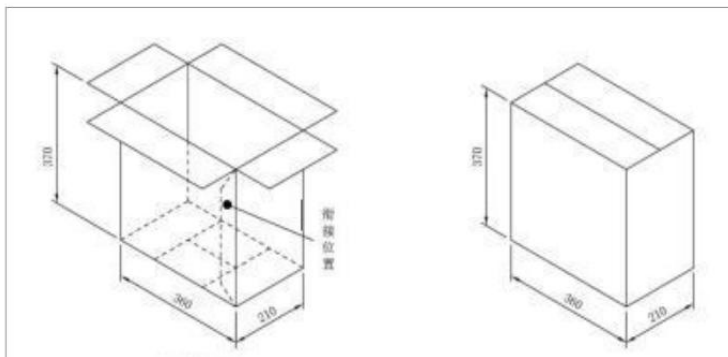
Carrier tape Dimension as below:



Carrier Dimension as below:



Outer Box Dimension as below:



5.2 Anti-static Protection Requirement

The module is electrostatic sensitive product. The RF circuit on the module contains electrostatic sensitive components. Pay attention to ESD protection during welding, installation, and transportation. Do not touch the RF_IN or other pins with bare hands; otherwise, the module may be damaged.



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