ROHS，TS16949，ISO9001

ST126K

High Precision GNSS Navigation Positioning Module Manual

Jan. 2022

www.xbteek.com

Revision History

Version NO.	Version	Date
V.1	New	Jan. 2022

Disclaimer

This document only indicates the information of the products of Shenzhen Simple Technology Electronics Co., LTD without any transfer purposes, including has no transfer any patent, trademark, Copyright or ownership right or any rights or licenses under Company or any third party by implication, estoppel or other ways. We (Shenzhen Simple Technology Electronics Co., LTD) accepts no liability other than those stated in the terms and conditions of Sale of its products. Furthermore, regarding the sale and use of its products, Simple makes no any kinds of express or implied warranties including fitness for a particular purpose, marketability or liability for infringement of any patent, copyright or other intellectual property rights. If the connection or operation is not in accordance with the manual requirements, the company is exempt from liability. Simple perhaps make modifications to product specifications and descriptions at any time without prior notice. The products of our company may contain certain design defects or errors, which will be included in the corrigendum upon discovery, and may result in differences between the product and the published specifications. An updated erratum is available upon request.

Catalogue

1. Product Description

1.1 Overview

ST126K, designed and produced by Shenzhen Simple Technology Electronics Co., LTD., is a high-precision RTK navigation and positioning module, which supports all the civil navigation and positioning systems of the world, like, GPS, BEIDOU, GLONASS, QZSS and satellite enhanced system SBAS (WAAS, EGNOS, GAGAN, MSAS), and builds in single frequency RTK engine, can implement centimeter level positioning. It's suitable for industrial and consumer fields of navigation and positioning applications.

1.2 Main features

- Support GPS, BDS, QZSS, GLONASS\GALILEO system joint positioning;
- Single power supply wide voltage design, lower power consumption and high precision solution;
- Provides configurable peripheral IO pins;
- Built-in RTK for centimeter-level positioning accuracy;
- Support antenna detection and antenna short circuit protection;
- SMD surface mount package size of 16mm×12mm;
- Industrial grade standard (optional car gauge grade).

1.3 Main Applications

ST126K, with compact size, adopts SMT PAD, supports full automation integration of standard taking and placing and reflow welding, ROHS process, having low cost, high performance, low power consumption and other characteristics. It can be widely used in portable equipment, such as PND, PAD, interphone, wearable equipment, outdoor GPS tracker, bicycle navigator, drones, Vehicle-mounted navigation equipment (such as vehicle-mounted terminal, dashcam, OBD and traffic warning system. RTK application is suitable for surveying and mapping, high-precision map application and other fields.

1.4 Key Indicators

Frequency [1]	GPS L1 1575.42MHz, C/A code; BDS (COMPASS/BD2) B1 1561.098 MHz; GLONASS L1 1602MHz;	
Refresh rate	Default 1Hz, maximum 10Hz	
Sensitivity	Tracking	-160dBm
	Recapture	-156dBm
	Cold start	-147d Bm
	Hot Start	-153dBm
Convergence time	RTK	<60s
Positioning time [2]	Hot Start	1s
	A-GNSS Assist [3]	10s
	Cold start	28s
Horizontal positioning accuracy [4]	Autonomous positioning	3m
	Wide area difference	2.5 m
	RTK[6]	2.5cm+1ppm (V) 1.0cm+1ppm (H)
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	115200 bps, 8 data bits, no parity, 1 stop bits (default) 1Hz: GGA, GLL, GSA, GSV, RMC, VTG

1, Support SBAS and QZSS
2, All signal strength of satellites -130dBm
3, depend on the data network speed and latency.
4, CEP, 50%, static for 24 hours, -130dBm, > 6 SVs, RTK need to connect to the RTCM differential sevice.
5, 50% @30m/s

6, The indicators of open sky environment, tested by the surveying antenna. The specific precision will alter according to the shelter situation of the actual scenes.

2. Technical Specifications

2.1 Absolute Maximum

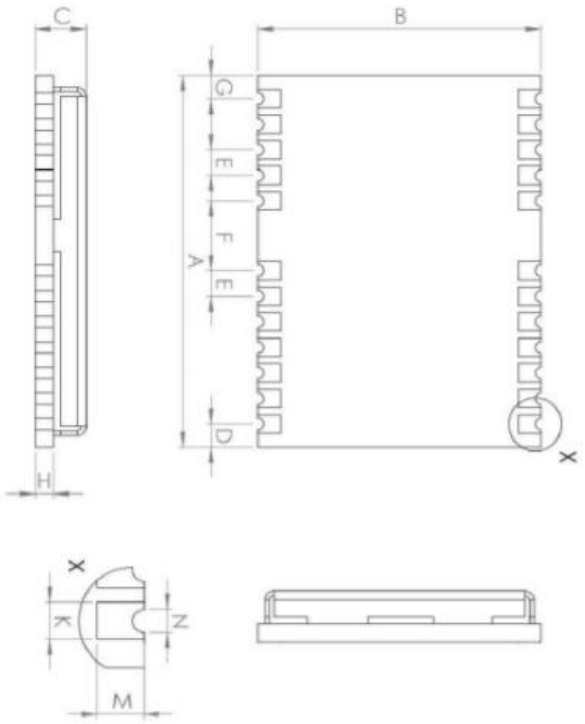
Parameters	Symbols	Minimum value	Maximum	Units	Conditions
Supply voltage (VCC)	Vcc	0	3.6	V	
VCC maximum ripple	Vrpp	0	50	mV	
Input pin voltage	Vin	0	Vcc +0.2	V	
Storage temperature	Tstg	- 45	85	℃	
ESD	VESD(HBM)		2000	V	All pins

2.2 Operating Conditions

Parameters	Symbols	Minimum value	Typical value	Maximum value	Units	Conditions
Supply voltage (VCC)	Vcc	1.8	3.3	3.6	V	
RTC Supply Voltage (VRTC)	Vrtc	1.8	3.0	3.6	V	
Peak current	Iccp			200	mA	Vcc = 3.3V
Input pin low	Vin_low			0.2 * Vcc	V	
Input pin high	Vin_high	0.7 * Vcc			V	
Output pin low	Vout_low			0.4	V	Iout = 8 mA
Output pin high	Vout_high	Vcc - 0.4			V	Iout = 8 mA
Antenna gain	Gant	15		30	dB	
Receiver link noise factor	NFtot		3		dB	
Operating temperature	Topr	- 40		85	℃	

Storage temperature		- 45		125		

2.3 Dimensions



Parameters	Numerical value (mm)	Parameters	Numerical value (mm)
A	16.0 + / - 0.1	G	1.0 + / - 0.1
B	12.2 + / - 0.1	H	0.82 + / - 0.1
C	2.4± 0.1	K (stamp hole outside edge)	0.8 + / - 0.1
D	1.0± 0.1	N (inside edge of stamp hole)	0.5 + / - 0.1
E	1. 1± 0.1	M	0.9 + / - 0.1
F	3.0± 0.1		

2.4 Pins Descriptions

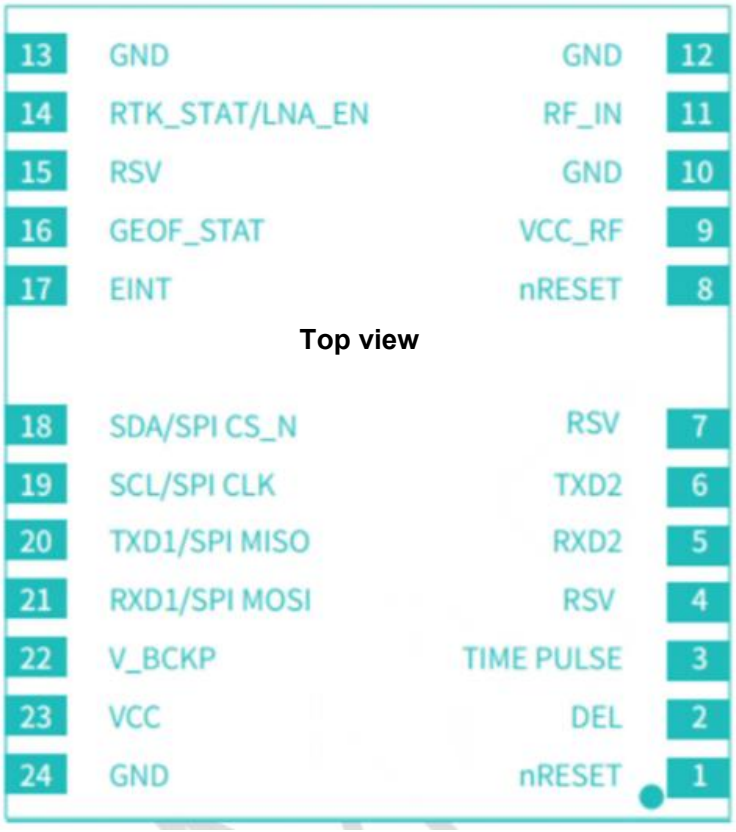


Figure 2-2 Pins Description

Pin NO.	Name	I/O	Level standards	Remarks
1	nRESET	I	LVTTL	Reset pin, low level valid (if not used, be unconnected)
2	DEL	I	---	The interface chosen Pin, the SPI interface is used for low level, and UART and I2C are used for high level or be unconnected
3	TIMEPULSE	O	LVTTL	Second pulse(1PPS)
4	RSV	---	---	Be unconnected)
5	RXD2	I	LVTTL	Serial 2, data receiving
6	TXD2	O	LVTTL	Serial 2, data sending
7	RSV			Be unconnected
8	nRESET	I	LVTTL	Reset pin, low level valid (if not used, be unconnected)
9	VCC_RF	O	---	The feed output of the antenna, this

				pin can be used as the input PIN of the antenna detection. The voltage is VCC- (antenna current) *10Ω, and the current range is 2.5~60mA during normal operation
10	GND	---	---	Ground
11	RF_IN	I	---	GNSS signal input
12	GND	---	---	Ground
13	GND	---	---	Ground
14	RTK_STAT/LNA_EN	O	---	External LNA enable Pin/RTK_STAT LAN_EN: high output, enable external LNA; low output, forbid external LNA RTK_STAT; high output, RTK fix; flash, receiving and using RTCM Calibration Data; low output, others
15	RSV	---	---	be unconnected
16	GEOF_STAT	---	---	Electric fence, user can configurate
17	EINT*	---	---	External interrupt input
18	SDA / SPI CS_N*	---	---	I^2C data (D_SEL=VCC or be unconnected)/ SPI chip selected (D_SEL=GND)
19	SCL / SPI CLK*	---	---	I^2C clock (D_SEL=VCC or be unconnected)/SPI clock (D_SEL=GND)
20	TXD1/ SPI MISO*	O	LVTTL	SPI interface MISO signal (D_SEL=GND); UART TXD signal (D_SEL=VCC or be unconnected)
21	RXD1/ SPI MOSI*	I	LVTTL	SPI interface MOSI signal (D_SEL=GND); UART RXD signal (D_SEL=VCC or be unconnected)
22	V_BCKP	I	1.7V~3.6V	Back-up power, use for hot-start function; when not use the hot start function, can be unconnected
23	VCC	---	2.7V~3.6V	power supply

24	GND	---	---	Ground

2.5 PCB Dimensions

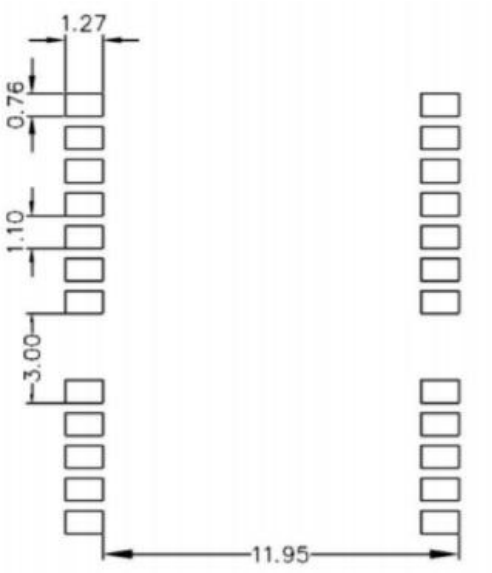


Figure 2-3 Recommended PCB layout (unit: mm)

3. Transmission and Peripheral Interfaces

3.1 PPS

Second pulse (PPS): The ST126K module, provides 1 output PPS signal with adjustable pulse width and polarity. The PPS signal can provide timing service for external systems, pulse edge trigger mode, and adjustable width, with one pulse per second output by default.

3.2 I2C

The I2C interface is used for serial data transmission. In order to reduce the use of external components of the system, ST126K has its own internal pull-up resistance, and the maximum speed is 400Kbps.

3.3 UART

The ST126K module has two sets of serial ports, namely UART0 and UART1. UART0 supports data transmission, firmware upgrade function, input/output signal type is of LVTTL level. The default baud rate is 115200bps, the maximum can be set to 230400bps, the serial port baud rate can be configured by the user. When designing the product, make sure that UART 0 is connected to a PC or external processor for firmware upgrades. UART1 only supports data transfer, not firmware upgrades, and is reserved for backup.

3.4 GPIO

The ST126K reserves 2 general purpose GPIO interfaces, which can be flexibly configured by the user.

3.5 EXTINT

The ST126K provides 1 External Interrupt input pin. This signal can be unconnected if not used.

4. Default Configuration

4.1 Serial Port Settings (CFGPRT)

Serial Port NO.	Parameter	Default configuration	Instructions
Serial Port	Baud Rate	115200	

0	Enter protocol instructions	7	MXT protocol +RTCM protocol
	Output protocol indication	1	NMEA Protocol
Serial Port 1	Baud Rate	115200	
	Enter protocol instructions	7	MXT protocol +RTCM protocol
	Output protocol indication	1	NMEA Protocol

4.2 Message Setup (CFGMSG)

Message Type	Parameter	Default configuration	Instructions
NMEA message	RMC	1	1Hz output
	VTG	1	1Hz output
	GGA	1	1Hz output
	GSA	1	1Hz output
	GSV	1	1Hz output
	GLL	1	1Hz output
	ZDA	0	Off
	GST	0	Off
	TXT	1	1Hz output

4.3 Satellite System Setup (CFGSYS)

Navigation Type	Default configuration	Instructions
NavSys	3	GPS navigation system + BDS navigation system

4.4 Navigation System Settings (CFGNAV)

Parameter	Default configuration	Instructions
NavRate	1000	1000ms Positioning frequency
MeasRate	0	No original observational data
DynMode	0	Receiver dynamic mode is automatic mode
FixMode	0	Receiver positioning mode is automatic
minElev	10	Satellite cutoff Angle of 10 degrees

4.5 NMEA Output Settings (CFGNMEA)

Parameter name	Default configuration	Instructions
nmeaVer	h40	Default output NMEA4.0 Extended Protocol Edition

5. Differential Data

ST126K supports RTK positioning, and the differential data can be sent to the chip through RTCM3.x protocol. The supported message types are 1005/1006 (reference station coordinates), 1074 (GPS observation quantity, need to include L1 frequency), 1124 (BDS observation measurement, need to include B1 frequency). Difference algorithm will be affected by the distance and environmental scenes. The module position is less than 20KM with the difference source position and the surrounding environment is relatively open, and the RTK high-precision positioning can be carried out. When the module position is less than 100KM with the difference source position, and the effective satellites are less than 6 in the system, the RTD positioning can be carried out.

ST126K in harsh environment (such as severely occluded overpasses or tall buildings), the environmental factor is the main error source, and

the differential positioning accuracy is comparable to that of single point positioning.

6. Hardware Design

6. 1 Considerations

To make the ST126K module work normally, the following signals need to be correctly connected:

---Provide reliable power supply for VCC pins.
---Ground all GND pins of the module.
---Connect the RF_IN signal to the antenna with the line maintaining a 50ohm impedance match.
---Ensure that serial port 1 is connected to a PC or an external processor. Location information receiving and software upgrading need to be done through this serial port.

In order to obtain good performance, the design should also pay special attention to the following:

- Power supply: Good performance need stable and low ripple power supply to ensure. The peaks difference between the max. and min. voltage ripple should not exceed 50mV.
- Use LDO to ensure pure power supply
- Place the LDO as close to the module as possible
- Widen the power supply traces 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 that the pin signals of the ST126K module and baud rates of the main device are consistent.
- Antenna interface: the antenna line should pay attention to impedance matching, as short and smooth as possible, and avoid going at acute angles
- Antenna position: To ensure a good signal-to-noise ratio, ensure that the antenna has a good isolation from the electromagnetic radiation source, especially the electromagnetic radiation in the 1559 ~ 1620MHz band
- Try to avoid running the wire directly below ST126K module.

This module is a temperature-sensitive equipment, the drastic change of temperature will reduce its performance. Try to stay away from high temperature airflow and high power heater in use

To achieve good differential positioning effect, and adopt RTK high-precision positioning accuracy scheme, it is recommended to access Qianxun Zhicun-FIND CM service.

6.2 Module reset signal

ST126K module can work normally only after it is powered on, and the chip provides self-reset function. In order to ensure effective reset, the following timing sequence requirements must be met between the reset pin nRESET of the module and the power supply VCC during power-on. ST126K module can be reset by lowering the nRESET pin for more than 5ms during the normal operation of the module.

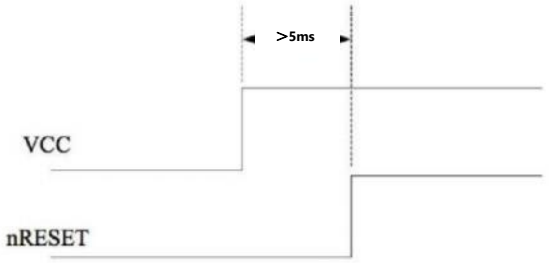


Figure 3-1 Reset signal of the module

6.3 Active Antenna Scheme

Adopt active antennas with a + 3/3.3V power supply, and use VCC_ RF to power the antenna.

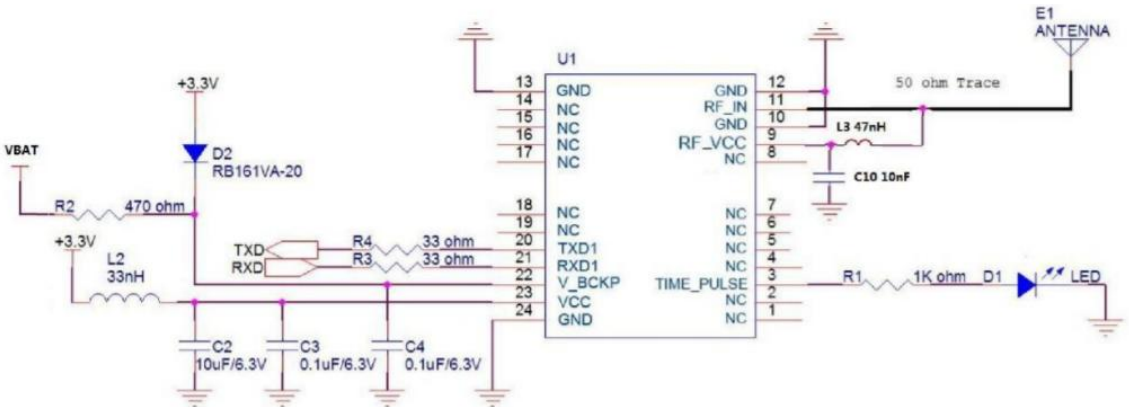


Figure 3-2 + 3/3.3V active antenna solution (If other voltages are used)

The required antenna bias voltage V_BIAS is used to power the antenna through the feed inductor.

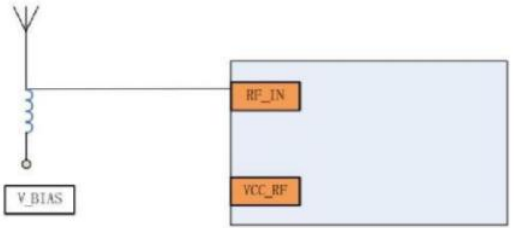


Figure 3-3 Active antenna schemes for other voltage ranges

6.4 Passive Antenna Scheme

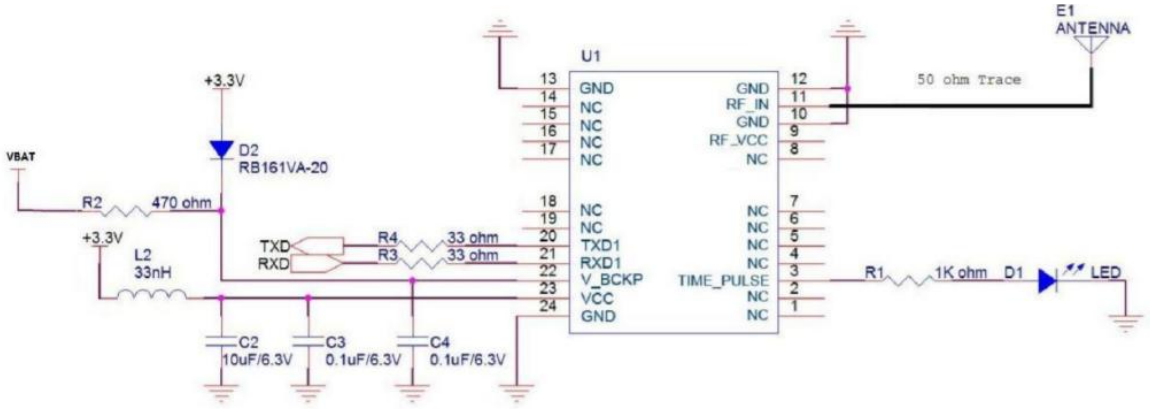


Figure 3-4 Passive antenna scheme

7. Processing Requirements

7.1 Humidity Control

Module belongs to MSL level 4. After unpacking the plastic sealing, it must be baked and dried for more than 72Hr before welding. The baking temperature should not exceed 80 degrees Celsius and the time should not be less than 4Hr.

7.2 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℃-183℃ range) less than 0.3 ℃/s;
	Up rate of temperature	(183℃-217℃ range) less than 3.5 ℃/s
	Time of constant temperature	60 – 120 seconds
	End temperature of constant temperature	217 ° C
Molten tin phase	Tin melting time	40-60 seconds
	Peak temperature	245℃
Cooling phase	Down rate of temperature	Not higher than 4℃/s

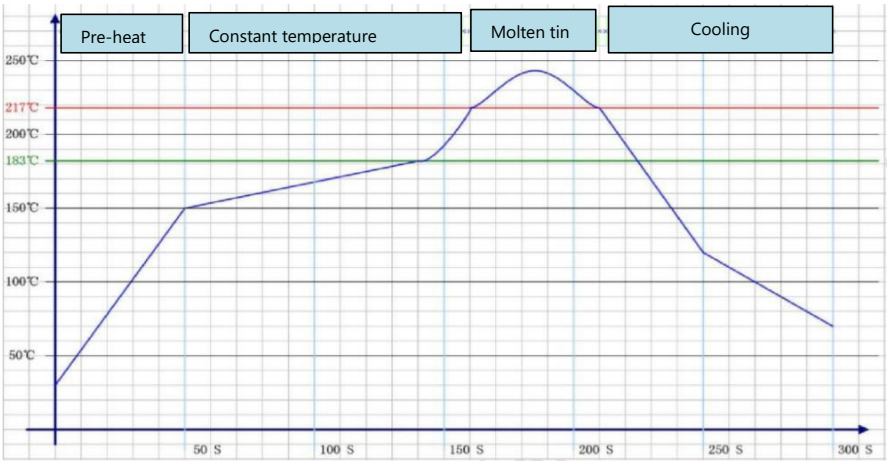


Figure 4-1 Temperature curve of reflow welding

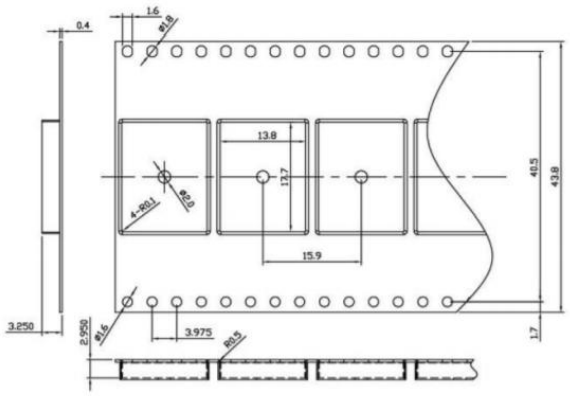
8. Package and Transportation

8.1 Packaging Dimensions

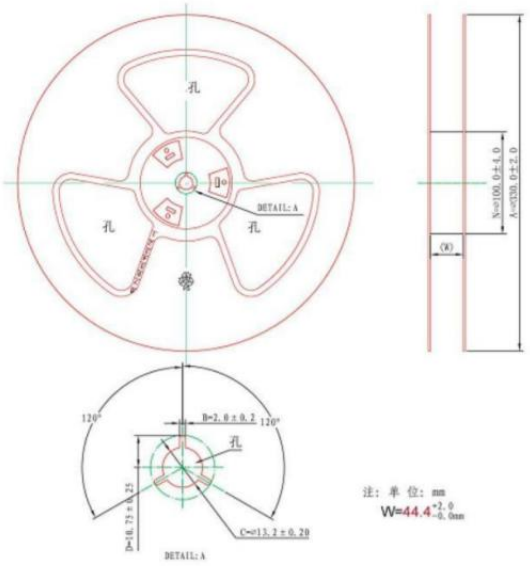
The module is mounted on a reel, and the MPQ of 1 inner packing box is 1K;

1 outer packing box contains 3 inner packing boxes, and the MOQ quantity is 3K.

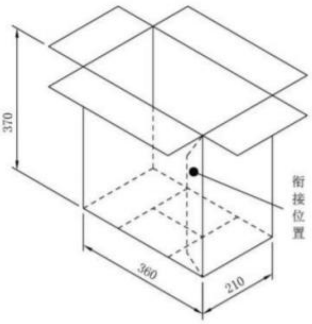
The carrier tape sizes are as follows:



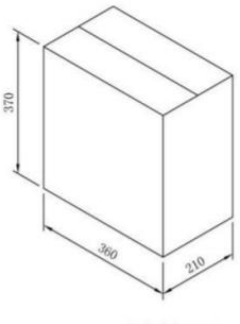
The carrier dimensions are as follows:



The outer box dimensions are as follows:



Before packing



After packing

8.2 ESD requirements

The module is electrostatic sensitive. 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, in case of the module damaged.

ESD CAUTION

9. Ordering Information

Ordering Model NO.	Description	Default Frequency	Low noise amplifier	Filters	Crystal oscillator
ST126K	High precision GNSS module	Single frequency RTK	*	*	TCXO

Shenzhen Simple Technology Electronics Co., LTD.

Focus on Precise Space-time, Assist in Smart Service Worldwide

Address: 23rd Floor, Xinlikang Building,QianHai Nanshan District, Shenzhen City, Guangdong Province

Website: https://xbteek.com