ROHS, TS16949, ISO9001

ST902D

Multi-frequency High-precision Positioning Module Manual

Jan. 2022

www.xbteek.com

Revision History

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

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Catalogue

1. Product Description

1.1 Overview

ST902D is a high-precision navigation and positioning module of high-performance multi-frequency. Based on multi-band and multi-system GNSS receiver chip, it supports GPS, BEIDOU, GLONASS, GALILEO, IRNSS, QZSS and satellite enhancement system SBAS (WAAS, EGNOS, GAGAN, MSAS) with (L1, L5) frequency band, ST902D has the advantages of high spirit sensitivity and low power consumption.

- ✔ High integration, single chip receiver solution
- ✔ Supports BDS3 signals: BIC, B2A and B3I
- ✔ Simultaneously receive multi-band multi-system satellite signals
- ✔ Built-in ese/des/sm 4 data encoding/decoding encryption engine
- ✔ Module integration with external LNA
- ✔ Built-in Power On Reset, no need for peripheral Reset circuit
- ✔ Low power consumption

ST902D, compact size module, using SMT PAD, supports full automation integration of standard take and place and reflow welding, ROHS process, with low cost, high performance, low power consumption and other characteristics. It can be widely used in portable equipment, such as PND, PAD, interphone and so on; Wearable device, outdoor GPS tracker, bicycle navigator, Drones, navigation equipment such as vehicle terminal, automobile data recorder, OBD and traffic warning system.

1.2 Key Indicators

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GNSS engine	Cynosure III GNSS engine Total 136 channels & DSP accelerator	
GNSS Frequency	GPS/QZSS: L1 C/A, L5	
	BDS: B1C, B1I, B2A	
	GLONASS: L1OF	
	Galileo: E1, E5a	
	IRNSS: L5	
	SBAS: L1(WAAS, EGNOS, MSAS, GAGAN)	
Refresh rate	GNSS	Maximum 20Hz
Positioning Time 1(TTFF)	Hot start	≤ 1 sec
	Cold start	≤35secs
Positioning accuracy 2	GNSS	2.5m CEP
	SBAS	2.0m CEP
	D-GNSS	<1.0m CEP
	GNSS	0.1m/s CEP
	SBAS	0.05 m/s
	D-GNSS	0.05 m/s
	1PPS	20 ns
Sensitivity 4	Cold start	-147d Bm
	Hot start	-153d Bm
Speed limit	Velocity	515m/s
Height limit	Altitude	18000 m

1. The number of usable satellites is greater than 6, and the signal strength of all satellites is not less than -130dBm

2. CEP,50%, the number of satellites is greater than 8, 24 hours static positioning, and the signal strength of all satellites is not less than -130dBm

3. 50% @ 30 m/s

4. LNA test with good performance for external use

2. Technical indicators

2.1 Electrical Maximum

Parameters	Symbols	Minimum value	Maximum	Units
Module supply voltage (VCC)	Vcc	-0.5	3.63	V
Backup Battery voltage (VBAT)	Vbat	-0.5	3.63	V
Maximum acceptable ESD level	VESD(HBM)	- -	2000	V
Storage temperature		- 40	+ 85	℃

2.2 Operating Conditions

Parameters	Symbols	Minimum value	Typical value	Maximum value	Units
Supply voltage	Vcc	2.0	3.3	3.6	V
Vcc peak current (not including antenna)	Ipeak	- -	- -	200	mA
Capture phase average current		- -	46	- -	mA
Track the phase average current		- -	47	- -	mA
Active antenna output voltage	VCC_RF	- -	3.3	- -	V
Active antenna antenna gain	Gant	15	- -	30	dB
Operating temperature		- 40	25	+ 85	℃

2.3 Dimensions

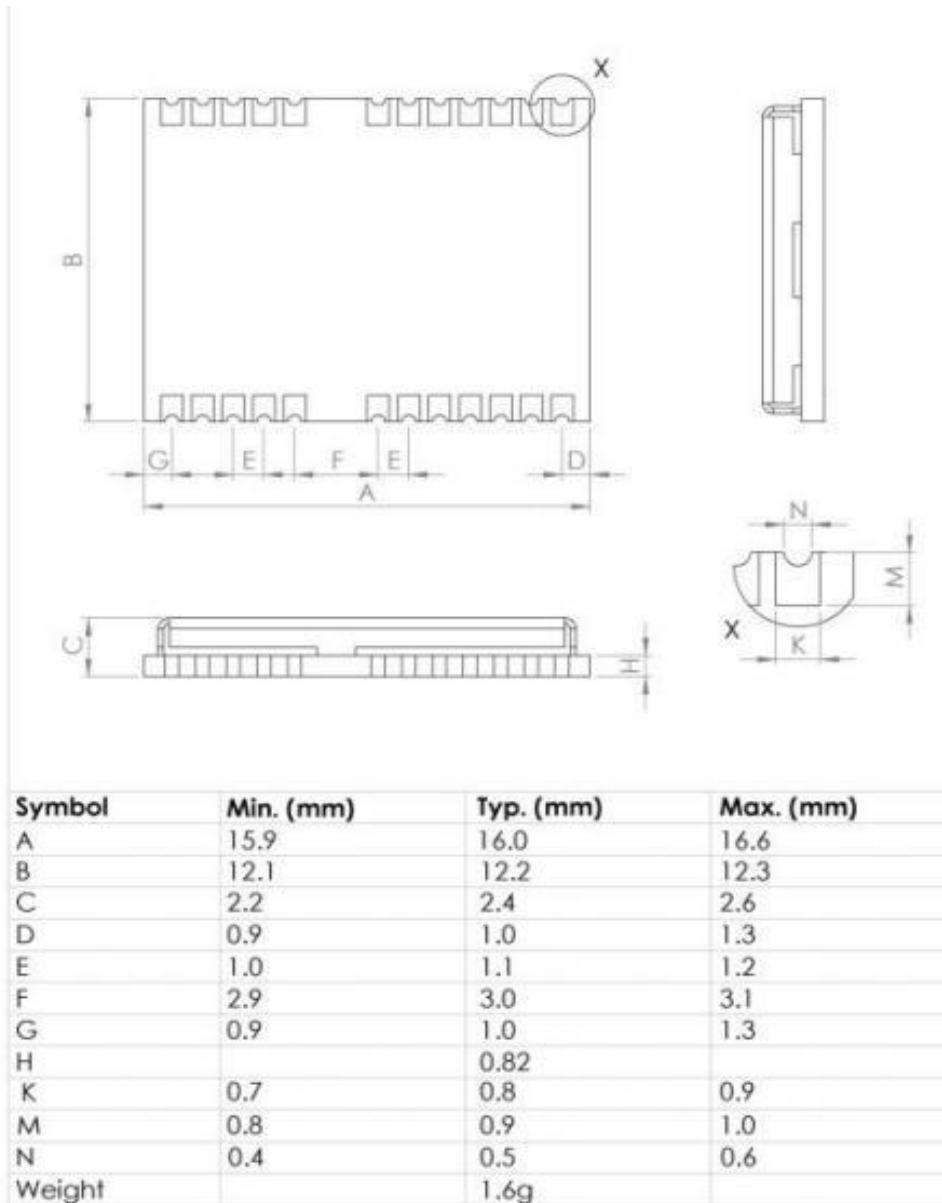| Symbol	Min. (mm)	Typ. (mm)	Max. (mm)
A	15.9	16.0	16.6
B	12.1	12.2	12.3
C	2.2	2.4	2.6
D	0.9	1.0	1.3
E	1.0	1.1	1.2
F	2.9	3.0	3.1
G	0.9	1.0	1.3
H		0.82	
K	0.7	0.8	0.9
M	0.8	0.9	1.0
N	0.4	0.5	0.6
Weight		1.6g	

Table 2-1 Dimensions

2.4 Pins Description

Figure 2-2 Pin diagram

NO.	Name	I/O	Description	Electrical characteristics
1	SPI_CS	I	SPI interface, chip select signal	Must be unconnected if not used
2	PRTRG	I	Module configuration pin	Used for module BOOT firmware upgrades and must be unconnected
3	TIMEPULSE	O	Second pulse	Time pulse(1PPS), TTL level
4	EXTINT	I	External interrupt	Must be unconnected if not used
5	USB_DM		USB_DM	Must be unconnected if not used
6	USB_DP		USB_DP	Must be unconnected if not used
7	AVDUSB	P	USB power input 3.3V	Support only 3.3V power supply. Must be unconnected if not used
8	nRESET	I	Module reset input, be active in low	Power-on self-reset. Recommended to be unconnected
9	RF_VCC	I	RF power output	Active antenna power supply: 3.3V

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10	GND	G	Ground	
11	RF_IN	I	Antenna signal input	Pay attention to ESD protection
12	GND	G	Ground	
13	GND	G	Ground	
14	GPIO2	I/O	Universal I/O	Must be unconnected if not used
15	SPI_CLK	-	SPI interface clock signal	Must be unconnected if not used
16	SPI_D0	-	SPI interface data D0 signal	Must be unconnected if not used
17	SPI_DI	-	SPI interface data DI signal	Must be unconnected if not used
18	I2C-SDA	-	I2C data interface	Must be unconnected if not used
19	I2C-CLK	-	I2C clock interface	Must be unconnected if not used
20	TXD	O	Navigation data output	NMEA0183 protocol, TTL level
21	RXD	I	Interactive command input	Configured command input, TTL level
22	VBAT	I	RTC and SRAM backup power supply	Provide 2.5V ~3.6V power supply to ensure module hot start (must be connected)
23	VCC	I	Module power input	Dc 3.3V
24	GND	G	Ground	

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2.5 PCB Dimensions

Figure 2-3 Recommended Dimensions (unit: mm)

3. Hardware Design

3.1 Attentions

To make the ST902D module work normally, the following signals need to be correctly connected:

- ✓ Provide a reliable power supply to the VCC pins.

- ✓ Ground all GND pins of the module.

- ✓ Connect the RF_IN signal to the antenna with the line maintaining a 50 ohm impedance match.

- ✓ Make sure serial port 1 is connected to a PC or an external processor, the user can receive positioning information data and the software upgrades also 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: Ensure good performance by the stable and low ripple power supply. The peak 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 hypersensitive resistance devices such as magnetic coils

UART interface: Ensure that the signal and baud rate between the pins of the main device and the ST902D module are consistent.

Antenna interface: Ensure that the impedance matching of the antenna line, and ensure that the antenna line is as short and smooth as possible. Avoid to run the wire in sharp angles.

Antenna frequency: pay attention, should adopt the corresponding multi-band multi-system antenna.

Antenna position: In order to ensure a good signal-to-noise ratio, ensure that the antenna is well isolated from the electromagnetic radiation source, especially the electromagnetic radiation in the frequency band from 1.2G to 16MH.

✓ Try to avoid running lines directly below ST902D module

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

3.2 Module reset signal

After power-on, the ST902D module needs to be reset correctly to work normally, and the chip provides self-reset function. 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. Pull down the the nRESET pin over 5ms can similarly reset ST902D module during normal operation.
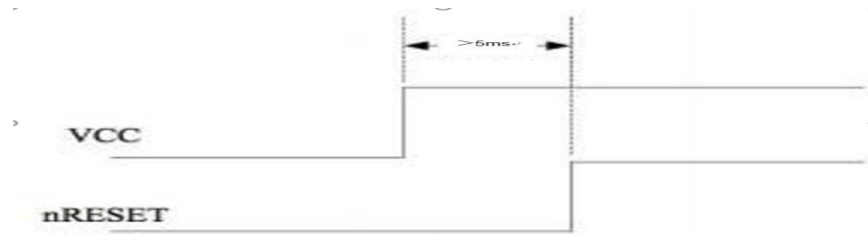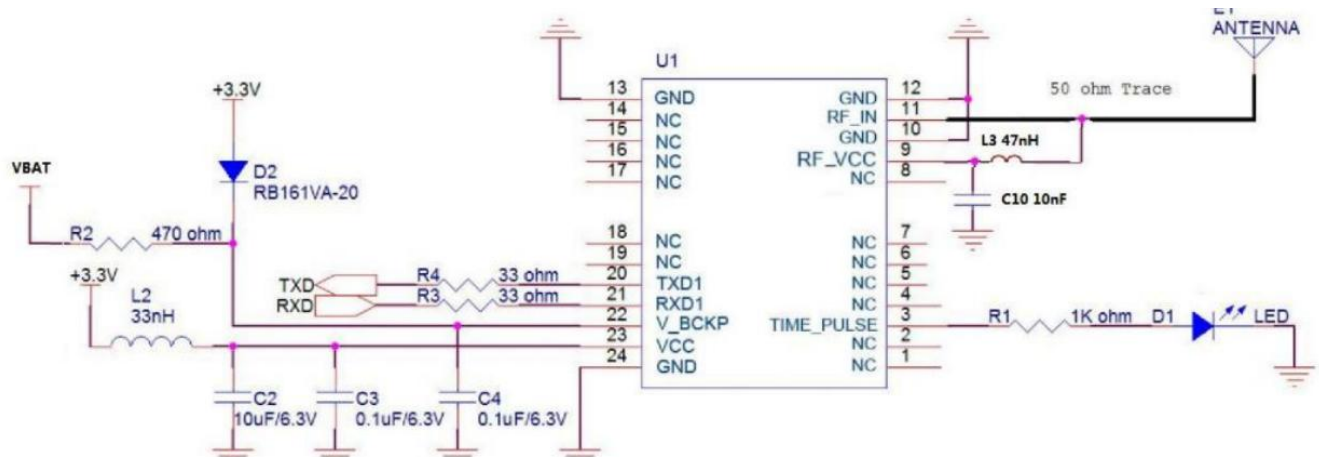

Figure 3-1 Module reset signal

3.3 Reference Circuit

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℃ 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 stage	Up rate of temperature	(150℃ -183℃ range) less than 0.3℃/s;
	Up rate of temperature	(183℃ -217℃ range) less than 3.5℃/s
	Constant temperature time	60 – 120 seconds

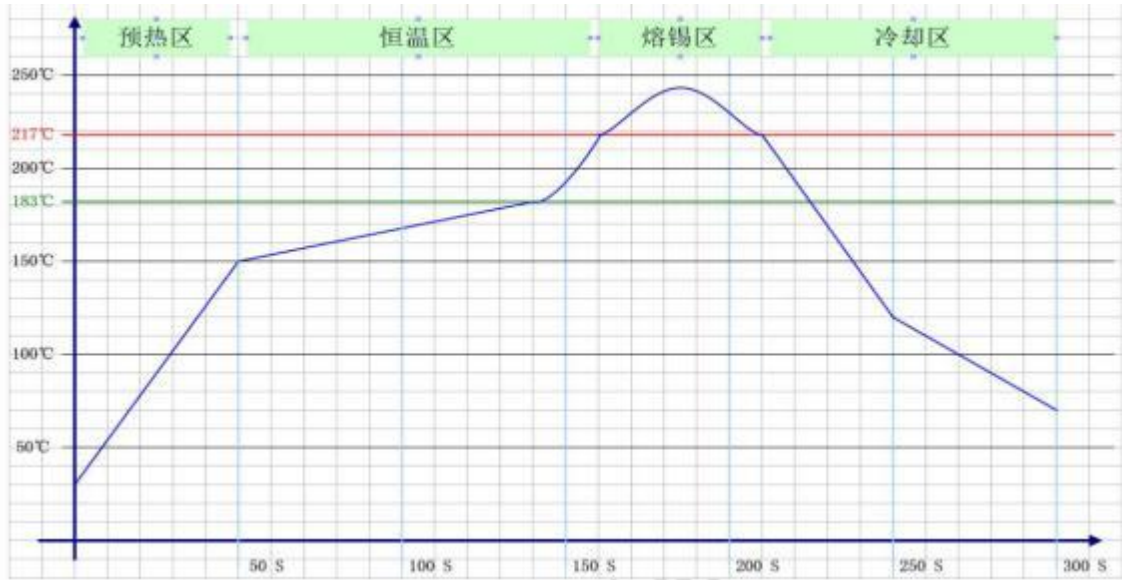|	End temperature of constant temperature	217°C
Molten tin phase	Tin melting time	40-60 seconds
	Peak temperature	245°C
Cooling stage	Down rate of temperature	Not higher than 4°C/ s

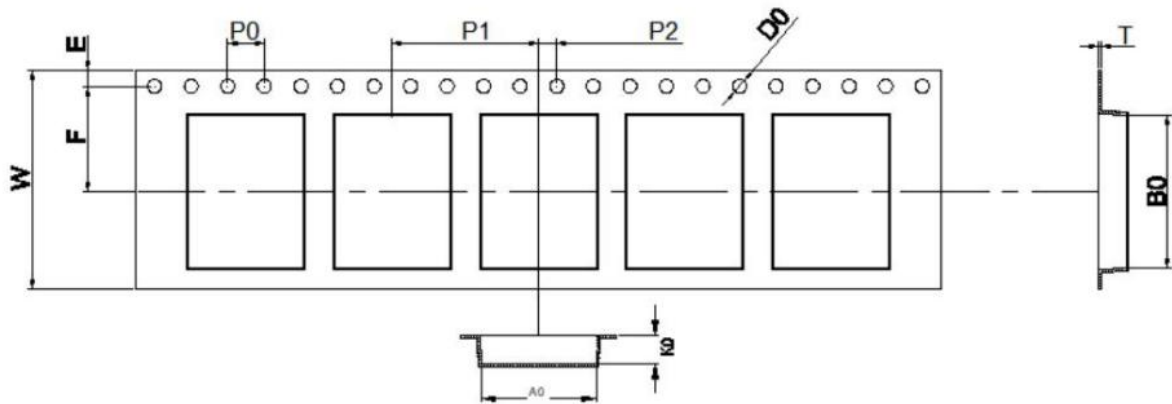Figure 4-1 Reflow temperature curve

5. Package and Transportation

5.1 Packing Dimension

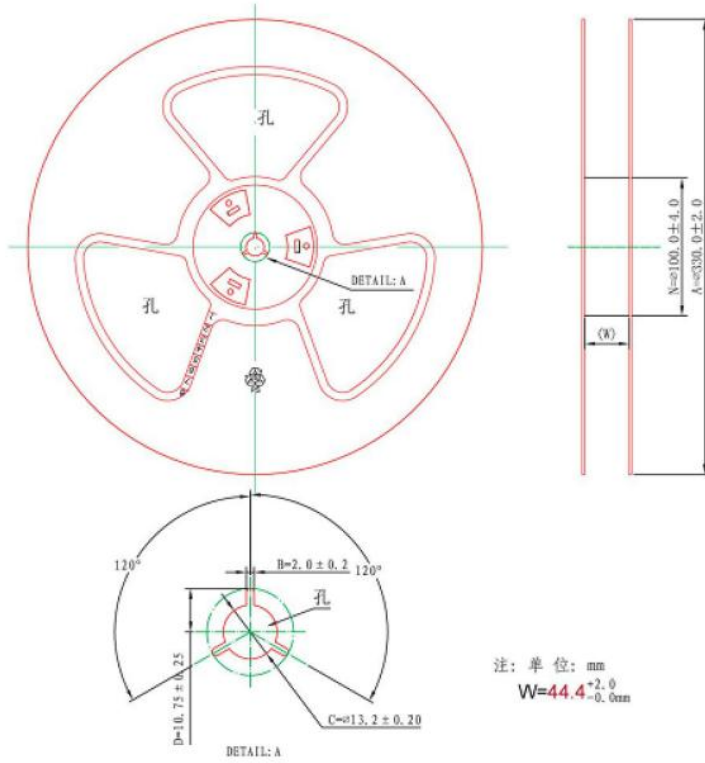The module is mounted on a reel, and the MPQ of 1 inner packing box is 1K;

1 outer packing box contains 3 inner packing boxes, and the MOQ quantity is 3K.
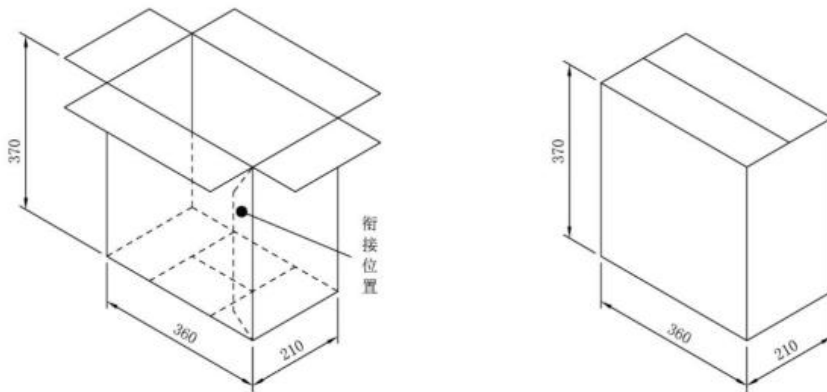
The carrier tape dimensions are as follows:

D	1.50±0.10	W	24.00±0.30
A	12.60±0.10	E	1.75±0.10
B	16.80±0.10	F	11.50±0.10
K	3.10±0.10	P	4.00±0.10
T	0.30±0.05	P	16.0±0.10
		P	2.00±0.10

The carrier dimensions are as follows:

孔
DETAIL: A

N=100.0±4.0
A=⌀330.0±2.0
(W)

120°
B=2.0±0.2 120°
孔
D=10.75±0.25
C=⌀13.2±0.20
DETAIL: A

注: 单位: mm
$W=44.4^{+2.0}_{-0.0}$mm

The outer box dimensions are as follows:

370
360
210
衔接位置

370
360
210

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.

ESD CAUTION

6. Ordering Information

Model number	Description	Satellite system	Default baud rate
ST902D	GNSS module	Multi-frequency multi-satellites GPS/BDS/GLONASS/Galileo/	115200

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