



ROHS , TS16949 , ISO9001

ST210A

Multi-satellites Navigation Positioning Module
Manual

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1. Product Description

1.1 Overview

ST210A module, launched by Shenzhen Simple Technology Electronics Co., LTD, is a positioning and navigation module that supports multi-satellite system. Based on company's completely independent intellectual property rights of high precision navigation and positioning algorithm, it can support the BDS/ GPS/ GLONASS/ GALILEO/ QZSS/ SBAS, even fully support Beidou's three signals, which can provide users with high quality, strong anti-interference, low power consumption of navigation and positioning solution.

ST210A, with the size of 9.7mm x 10.1mm x 2.5mm, can meet the demand of module volume reduction in the design of positioning terminal products. The module is manufactured in accordance with IATF16949 and the module reliability test is in accordance with ISO 16750.

The module is packaged with 18 pin stamp holes to meet the need for quick module mounting in the production of positioning end products. ST210A has integrated power management function and built-in SAW+LNA. The ST210A module of the size 9.7mm x 10.1mm x 2.5mm, can meet the needs of module volume reduction when design the positioning terminal product. The module is manufactured in accordance with IATF16949 and the module reliability test is in accordance with ISO 16750.

1.2 Product Features

- ✓ 18pin stamp hole package, size 9.7mm x 10.1mm x 2.5mm
- ✓ Supports BDS B1I/B1C, GPS L1 C/A, GLO L1OF, Gal E1 frequency points
- ✓ Support QZSS/SBAS
- ✓ Support single-satellite dual-satellites, multi-satellites of BDS/GPS/GLONASS/Galileo and can switch to each other satellite through instructions. Support the BDS/GPS/GLO three satellites by default.
- ✓ Support for A-GNSS auxiliary positioning
- ✓ With backup power input interface, support hot start

- ✓ Support for active antenna power supply, with antenna status detection function
- ✓ With interference detection alarm function
- ✓ With UART, I²C peripheral interface
- ✓ Supports external reset
- ✓ Average maximum power consumption 28mA@3.3V
- ✓ Wide voltage input range, 3.0~ 3.6V
- ✓ High integration, simple peripheral application circuit
- ✓ The production process complies with IATF 16949
- ✓ Module reliability tests are in accordance with ISO 16750

1.3 Performance Indexes

Parameter	Descriptions	Performance Indexes				Remarks
		Min.	Recommended	Max.	Units	
Positioning accuracy ¹ (Open area)	Level		< 2		m	Default working satellite
	Height		< 3		m	
Speed measurement accuracy ¹			< 0.1		m/s	
First positioning time (TTFF) ²	Cold start		< 28		s	
	Hot start		1		s	
	Recapture		1		s	
Sensitivity ³	Capture		- 147.		dBm	
	Trace		- 163.		dBm	

Serial output baud rate		4800	115200	460800	bps	115200bps by default
Data update rate			1	20 (single satellite) 10 (three satellites)	Hz	Default 1Hz
Operating voltage	VCC		3.3		V	
	V_BCKP		3.3		V	
Average power consumption			28		mA	The main power supply VCC 3.3V
Standby power consumption			25		uA	Backup power 3.3V
External antenna gain				30	dB	
Temperature	Work	- 40		85	°C	
	Storage	- 40		125	°C	

Table 1-1 Main performance specifications

Parameters	Descriptions	Performance Indexes				Remark
		Min.	Recommended	Max.	Unit	
Weight			<1		g	

Notes:

1. Open area without occlusion scenario, the test antenna is 25mm*25mm, vehicle active antenna.
2. Greater than 8 stars, all satellite strength -130dBm, PDOP≤5, all time statistics as the average of 10 tests.
3. Have an external LNA noise factor of 0.8.

1.4 Application Areas

- Personal positioning and navigation products;
- Vehicle and ship positioning and navigation;

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- Internet of Things, handheld portable devices;

1.5 Functional Block Diagrams and Recommended Applications

1.5.1 Functional Block Diagram

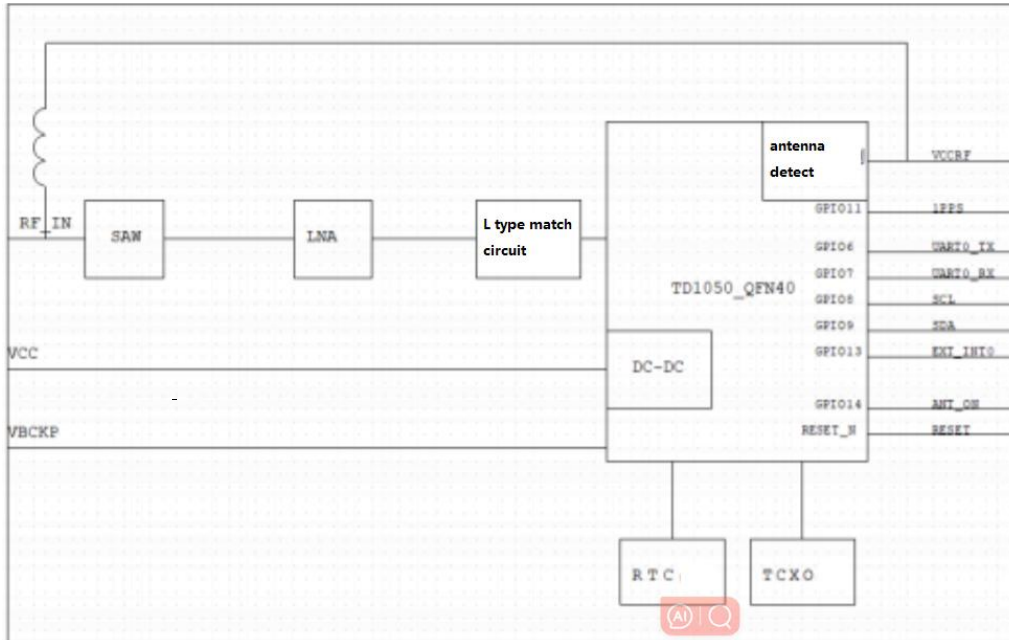


Figure 1-2 Functional Block Diagram

ST210A module receives multi-constellation signals, with the ability to receive BDS B1I frequency, GPS L1C frequency, GAL E1 frequency, and GLO L1OF frequency, and can carry out single satellite, double satellites, three satellites, four satellites positioning. The module has built-in SAW and LNA, and external active or passive antennas can be used. When active antennas are used, the status of antennas can be detected in real time through the module. After receiving satellite signals, the ST210A module is processed by RF signal. After a series of algorithms such as acquisition and tracking, positioning and calculation are processed, the serial port can output NMEA data and give 1PPS signal.

1.5.2 Typical Application

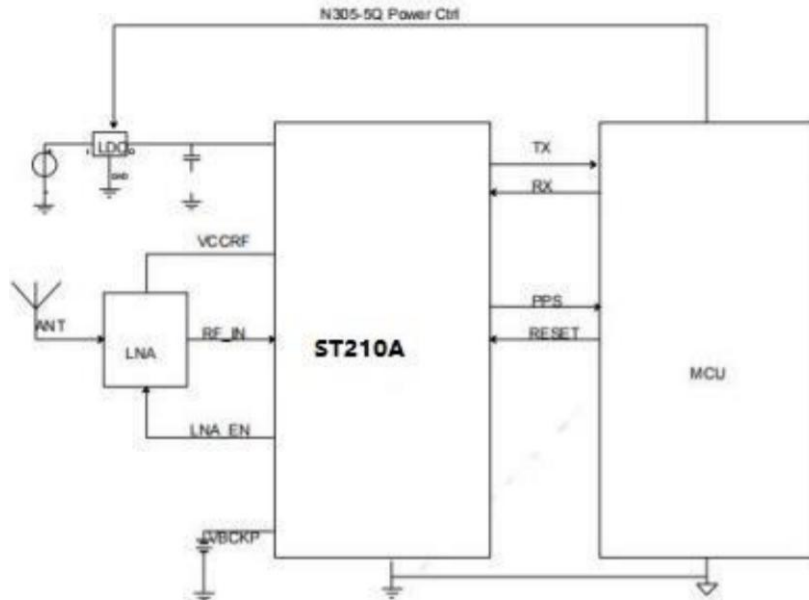


Figure 1-3 Typical Application

2. Interfaces Instructions

2.1 Hardware Interfaces

2.1.1 Power Supply

The module has two power input pins (VCC and VBCKP) and one antenna power output pin (VCC_ RF).

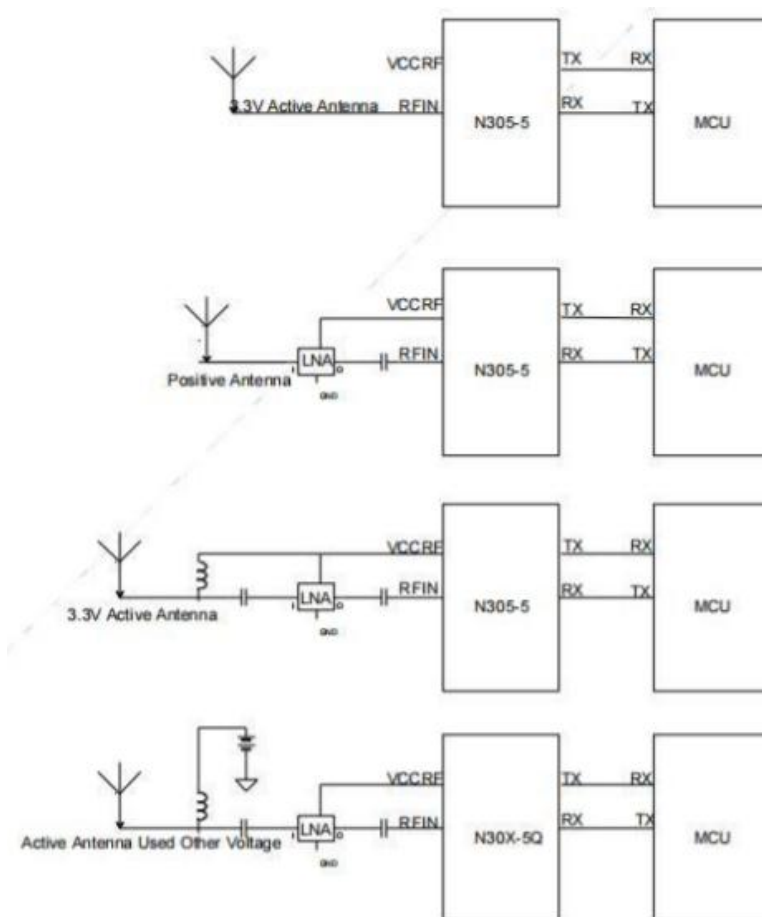
VCC is the main power supply of the module; VBCKP is the backup input power of the module, which supplies power to the RTC circuit when the main power VCC is powered off to ensure that the key satellite information is not lost. The hot start function relies on the uninterrupted power supply of the VBCKP. If the hot start function is required, an external rechargeable battery or large capacity capacitor can be connected. If the hot start function is not required, it is recommended to ground the VBCKP pin. In order to ensure that the backup circuit can work normally, the external need to design the backup power supply VBCKP charging circuit.

VCC_RF output +3.3V voltage, maximum 25mA output current, can be used for external active antenna power supply.

Power on again after the VCC is powered off. If the VBACKP has power supply and the ephemeris is still active, it will enter hot start mode by default. In hot start mode, the module will be booted based on the internally stored valid ephemeris, speeding up the positioning process.

It is recommended to select a single enabled LDO to power the module VCC. After the whole machine starts to work and the power supply is stable, use the GPIO of the host computer's main control chip to control the LDO and turn on the VCC power supply. When the positioning and navigation function is not required, use GPIO to turn off LDO to save power.

It is not recommended that navigation modules and other high-power digital/analog circuits share the same LDO power supply.



2.1.2 Antenna Interface

The antenna interface (RF_IN pin) of the module can be directly connected to the BD2 B1/GPS L1/GLO L1OF/GLA E1 multi-mode active antenna. 50Ω impedance matching is used inside the RF_IN pin. The module's PIN14 pin can provide a +3.3V antenna feed to the external antenna with a maximum current of 25mA.

When the antenna detection function is used, the RF_IN pin comes with a 3.3V DC supply that can power the antenna.

When the antenna detection function is used, the ST210A module can judge the states of antenna access/antenna open/antenna short circuit based on the current of RF_IN and VCC_RF pin for external power supply, and notify the host computer of the state through the software protocol sentence. And in the antenna short-circuit state, limit the output current, and protect.

Customers can choose different power supply modes according to the specific application requirements. For details, see Figure 2-1. To achieve the antenna detection function, power supply to the antenna from inside the module is required.

2.1.3 Reset the Interface

Module supports external RESETn pin reset (active at low level).

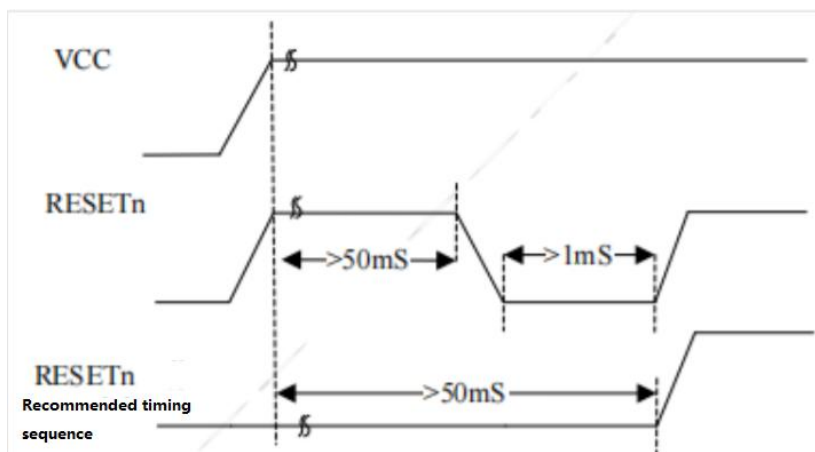


Figure 2-2 Timing Sequence Diagram of the Resetn Signal Proposal

As shown in Figure 2-2, it is recommended to use in complex application environments, or when the power-on waveform or reset signal has complex problems such as hook, spike, and long step, it is recommended

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that after the power-on is stable, delay at least 50mS. Lower the reset pin for at least 1mS, and release it for external reset, to ensure that the internal RESET circuit of the module is not affected by abnormal power-on /RESET waveforms.

It is recommended that in the above scenario, the power supply of the backup power supply VBCKP be grounded to achieve higher reliability, and the startup timing sequence does not depend on the data value saved in the backup power source domain. In this case, the module will be cold started every time, and all data will be obtained from the real-time received satellite signal, and the real-time satellite signal will be used to locate.

When you need to use the hot start function, you must ensure that the RESETn is unconnected, high level or placed in a high resistance state, and ensure the total capacitance of the external bypass capacitor of the RESETn must be less than 10nF; otherwise, cold start is possible.

When due to the power supply the external circuit must be used to control the reset signal, if the need for fast positioning after startup, it is recommended to use A-GNSS auxiliary startup to speed up the positioning process. In this process, the upper computer will obtain the latest ephemeris data through the network, and transmit to the module through the serial port, so as to achieve fast positioning.

2.1.4 1PPS Signal Interface

Pin 4th of the module, 1PPS, is the output of second pulse signal.

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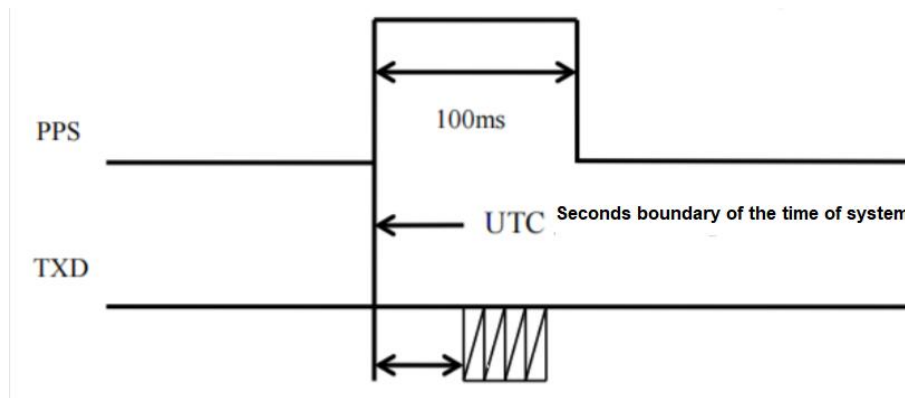


Figure 2-3 Schematic Diagram of 1PPS Second Pulse

The 1PPS second pulse signal is shown in Figure 2-3. The rising edge aligns the second boundary of UTC time.

2. 1.5 UART interface

The module is designed with a UART serial port, which supports the baud rate range from 4800bps to 460800bps, and the default baud rate is 115200bps. The default data format is: start bit 1, data bit 8, stop bit 1, no validation bit.

2.1.6 ANT_ON

Unused by default, when turned on, you can use this pin to configure external LNA enable/disable.

2.1.7 I2C Interface

The module is designed with a set of I²C interfaces, which are PIN16 (data interface I²C_SDA) and PIN17 (clock interface I²C_SCL) of the module.

Support 100kbps, 400 kbps the I²C transmission rate, and 7bit address mode.

The I²C of the module has no internal pull-up resistance, and the external pull-up resistance must be added when used.

For details about how to use the I²C interface, refer to the "TD1050 Chip I²C Interface Application Description".

2.2 Software Interface Protocol

(1) The default output is NMEA0183V4.11.

(2) The software interface protocol and control instructions are detailed in TD_NMEA_ Instruction.

2.3 Interference Detection

The ST210A supports the function of interference detection and alarm. For details, please refer to the software interface protocol.

2.4 Interference Prevention

Since GNSS satellite signal is extremely weak, ST210A may be used in complex electromagnetic environment, so it is necessary to design application scheme to prevent satellite signal from being affected by strong interference signals near the application site. When the ST210A application product includes the transmission function of other frequency bands, the proper design is necessary, to make the ST210A module can still work normally under the interference signal of other frequency bands.

The recommended methods as below:

(1) Through the antenna position design, the GNSS antenna is far away from other frequency band transmitting antennas on the product;

(2) Use antennas with good anti-interference ability;

(3) Through the filter, attenuate other frequency band transmitted signals, so that the module RF_IN input interference signal can be near the GNSS chip frequency, and can reduce to an acceptable degree, to avoid the impact on GNSS antenna;

(4) The filter is placed in front of the LNA to avoid LNA saturation due to the strong transmission signal coupling in.

2.5 A-GNSS

The A-GNSS auxiliary function of ST210A module is to improve the first positioning time of the receiver by injecting the ephemeris of satellite systems such as BDS/GPS/GAL/GLO through serial port, especially in the scenario where weak signal ephemeris are difficult to receive. A-GNSS assistance can improve the first positioning time more significantly. For detailed usage instructions, see Taidou A-GNSS Service Application Instructions.

3. Mechanical Characteristics

3.1 Module Dimensions

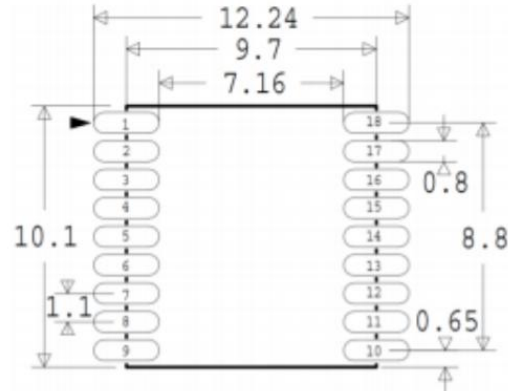


Figure 3-1 Dimensions

Table 3-1 Package dimensions

Remarks	Dimensions
A	9.7 ± 0.1
B	10.1 ± 0.1
C	$2.5 + / - 0.3$
D	0.46 ± 0.1
E	1.1 ± 0.1
F	0.65 ± 0.1
P	0.76 ± 0.1
K	0.8 ± 0.1
Instruction: Seal with stamp hole	

3.2 Pins Descriptions

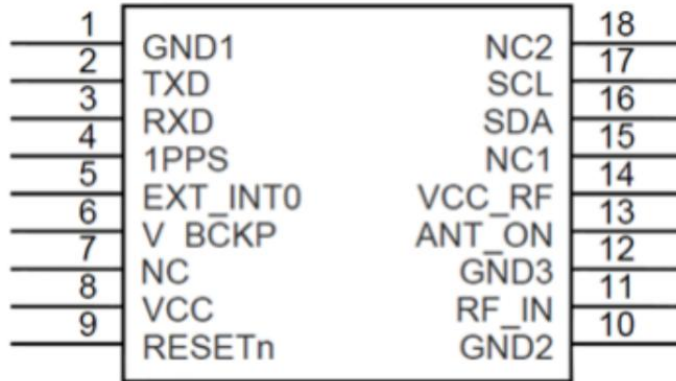


Figure 3-2 Pins Description

Table 3-2 Pins Description

Pins	Name	I/O	Standard Voltage Level	Description
1	GND	-		Ground
2	TXD	O	0-3.6 V	Serial 1 Send: NMEA data output, status output, etc
3	RXD	I	0-3.6 V	Serial 1 Receive: Control command receive, etc
4	1PPS	O	0-3.6 V	Second pulse output
5	EXT_INT0	I	0-3.6 V	Reserved ports
6	V_BCKP	I	2.5 3.6 V	Backup power input
7	NC	-	-	Spare pin, which is not currently connected to the inside of the module Note 1.
8	VCC	-	2.8 3.6 V	Main power supply
9	RESETn	I	0-3.6 V	External reset, active in low. The external of the reset pin module cannot be connected to ground capacitors.
10	GND	-		Ground

11	RF_IN	I		Antenna input (with 3.3V DC supply when antenna detection is turned on Electric) Note 1.
12	GND	-		Ground
13	ANT_ON	O	0-3.6 V	The function is disabled by default
14	VCC_RF	O	VCC	3.3V output, powered by module to antenna, The working current of the antenna recommends not exceed 20mA
15	NC	-	-	Spare pin, which is not currently connected to the inside of the module
16	SDA	IO	0-3.6 V	Data signal of two-wire DDC interface
17	SCL	I	0-3.6 V	Clock signal for two-wire DDC interface
18	NC	-	-	Spare pin, which is not currently connected to the inside of the module

4. Electrical and temperature characteristics

4.1 Module DC Characteristics

4.1.1 Limit Working Conditions

Table 4-1 Limit Working Conditions (Note 1)

Parameters	Symbols	Min.	Max.	Unit
Main power input voltage	VCC	-0.3	3.6	V
Backup power input voltage	VBACKP	-0.3	3.6	V
IO input voltage	VIO	-0.3	3.6	V
VCC_RF pin power supply electric current	ICC_RF	-	25	mA

Note 1: Use beyond the maximum limit value may result in permanent damage to the module.

4.1.2 Recommended Working Conditions

Table 4-2 Recommended Working Conditions

Parameter	Symbols	Min.	Recommended	Max.	Unit
Main power input voltage	VCC	3.0	3.3	3.6	V
Backup power input voltage	VBACKP	2.0	3.3	3.6	V
IO input high level	VIH	$0.7 * VCC$	-	VCC	V
IO input low level	VIL	-0.3	-	$0.2 * VCC$	V
IO output high level	VOH	$VCC - 0.4$	-	VCC	V
IO output low level	VOL	0	-	0.4	V

Note: It is not recommended to use beyond the recommended working conditions. Beyond the recommended working conditions for a long time may affect the reliability of the product.

4.2 Humidity Sensitivity Rating

This module belongs to MSL Grade 3. After unpacking the plastic sealing, it must be baked and dried if it is exposed to the air more than 168 hours before welding. Baking conditions refer to IPC/JEDEC J-STD-033 standard, the maximum temperature resistance of this module's package is 65°C, so do not do the high temperature baking with the package. When unpacking the coil package, place the module in the high temperature tray, and the baking temperature can be withstood up to 125 degrees. Only baking once is allowed for the module, repeated baking may lead to the risk of oxidation of the pipe pin, please avoid repeated baking.

4.3 Temperature Curve of Welding

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The recommended furnace temperature curve of ST210A module is shown in FIG. 7. The ST210A module as a whole can withstand the maximum temperature of 265°C for 10s.

During repair, it can withstand 340±20°C for no less than 5s.

4.3.1 Preheating Phase

Temperature rise rate: less than 3°C/s

End temperature of preheating: 150-160 °C

4.3.2 Constant Temperature Phase

Temperature rise rate: (150°C - 183 °C range) less than 0.3°C/s;

(183°C-217°C range) less than 3.5°C/s

Constant temperature time: 60-120 seconds

End temperature of constant temperature: 217°C

4.3.3 Molten Tin Phase

Tin melting time: 60-75 seconds

Peak temperature: 240°C (+ 5 °C)

4.3.4 Cooling Phase

Temperature drop rate: No higher than 4°C/s

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4.3.5 Recommended Furnace Temperature Curve

The recommended furnace temperature curve as below:

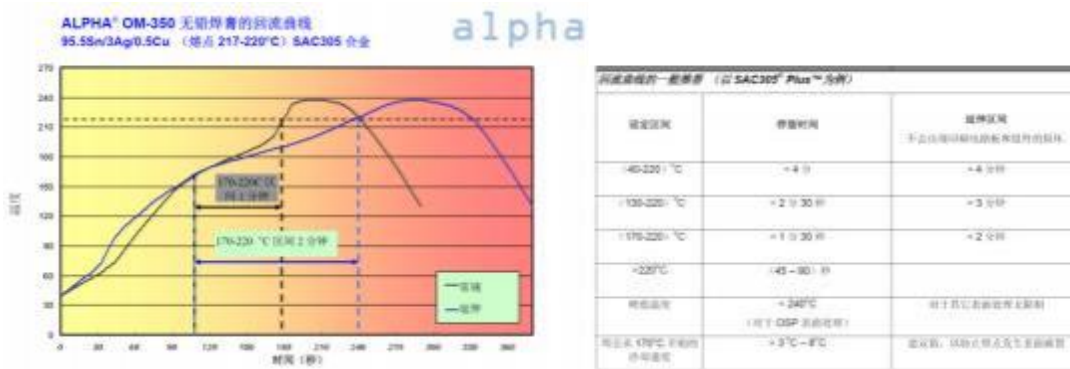


Figure 4-1 Recommended Furnace Temperature Curve

When weld with lead process, it is recommended to use the furnace temperature parameters of the mixed process for production.

For the detailed process requirements of our recommended package, furnace temperature curve and steel mesh opening of the module, please refer to the document "ST210A Positioning and Navigation Module Application Process Requirements", and pay special attention to the module cannot be arranged on the secondary reflow surface.

5. Precautions

5.1 Antenna Power Supply

The 14th pin of the module VCC_RF is the power supply pin of the external antenna, which can provide the module with a +3.3V power supply output with a maximum current of 25mA.

5.2 Requirements of Power-on the Main Power

(1) From 0 to 3.3V, the time cannot be greater than 10ms;

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- (2) There can be no backhook in power-on waveform, especially the time of staying around 1.8V can not exceed 2ms;
- (3) The ripple of the VCC power supply of the module should be controlled within 100mV as far as possible, and there should be no disturbance on the power supply;
- (4) If the V_BACKUP pin is not used, it is recommended to be unconnected, do not ground (at this time the hot start function is invalid);

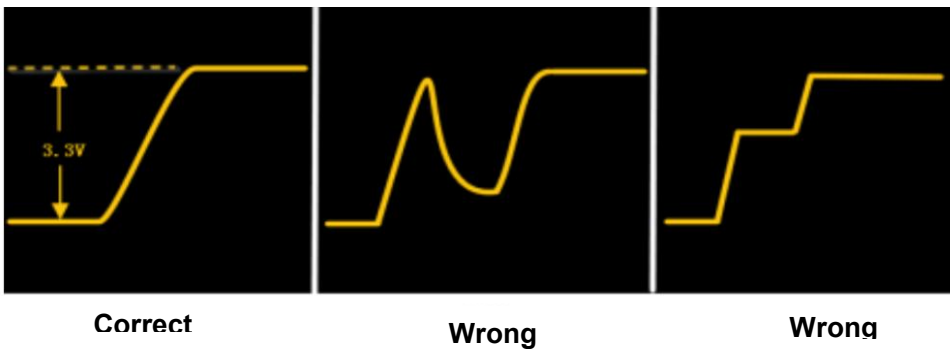


Figure 5-1 Powering on the Main Power Supply

5.3 IO Anti Reverse Current

When the module is in hibernation or powered off, if the module RX and RESETn pins are directly input high levels, the reverse current will be caused, and the module may start abnormally.

Solution:

- (1) Software solution: Before the chip is powered on, set the IO port connected to the pin to a low level or high resistance state
- (2) If the relevant functions are not used, the two pins can be unconnected;

5.4 Electrostatic Protection

The RF circuit on the module contains electrostatic sensitive components. Pay attention to ESD prevention during welding, installation, and transportation. Do not touch the module pins with bare hands in case of the module damaged.

5.5 PCB Design Suggestions

The connection line of product application to the 11th pin RF_IN, need to carry out 50Ω impedance matching. Should not route the line in right Angle or sharp Angle, and try not to replace the signal layer, and the adjacent layer below the connection line is best to have a complete ground plane. Play two rows of holes on the ground of the radio frequency signal on both sides and the following layer. pay attention to the interference of the RF signal noise in the single plate. Avoid multiple harmonics in the board near the frequency point of the satellite signal, as shown in Figure 5-2, at least to ensure that the identification area corresponds to the lower layer of the region to have a complete ground plane.

Do not route the cables from the module to the antenna under the module or other components. Should follow the principle of shortest, and away from other circuit.

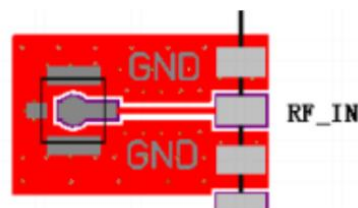


Figure 5-2 RF_IN Cable on pin 11th

5.6 Reset Interface

To ensure the normal operation of the module, it is recommended to wait for the VCC voltage to stabilize for 50ms after powering on, and then reset the module. The reset signal should be kept at a low level for more than 1ms.

When using reset, you can only enter the warm start or cold start, and you cannot use the hot start.

Make sure that the reset pin is unconnected when the hot start function is required.

5.7 Moisture Sensitive

The module belongs to the moisture sensitive components, MSL level 3.

5.8 Maintenance

The module does not contain maintenance spare parts. Please hand them over to qualified personnel for maintenance.

When removing, use an electric soldering iron to heat and remove from the side pins. Do not use hot air heating disassembly to avoid internal component displacement damage.

5.9 Recommended Antenna Indexes

Parameters		Active Antenna	Passive Antenna
Frequency Range	BDS B1I	1561.098±2.046 MHz	1561.098±2.046 MHz
	BDS B1C	1575.42±1.023 MHz	1575.42±1.023 MHz
	GPS L1	1575.42±1.023 MHz	1575.42±1.023 MHz
	GLONASS L1	1602.0±4 MHz	1602.0±4 MHz
	GALILEO E1	1575.42±1.023 MHz	1575.42±1.023 MHz
Input Impedance		50Ω	50Ω
Gain		≤30dB	
Inner Gain Flatness		≤1.5dB	
Noise Factor		≤1.5dB	
Input standing Wave		≤1.5	≤1.5
Output Standing Wave		≤2	≤2

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Out-of band rejection:1568±30MHz	≤30dB	
Recommended Working Voltage	3.0V±0.3	
Temperature Range	-40~85°C	-40~85°C

5.10 Others

- 1) The ripple of the VCC power supply of the module is controlled within 50mV as far as possible, and should avoid the disturbance on the power supply.
- 2) Please ensure that the baud rate set by the upper computer and the module is consistent.
- 3) It is recommended to choose a quality guaranteed multi-mode active antenna, and ensure that the antenna power supply.
- 4) When welding the module, please control the temperature and operation mode to avoid the module damaged.

6. Order Information and Identification

6.1 Ordering Information

Table 6-1 Ordering Information

Module	Package			
	Way	Qty	Dimension	
ST210A	Roll tape	1000	45*40*7cm	

6.2 Rules for Identification



[Line 1] Module Type Number

[Line 2] Company LOGO and the module QR code

[Line 3] The Module Series Number

Shenzhen Simple Technology Electronics Co., LTD.



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