BDS/GNSS Full Constellation Positioning and Navigation Module

ATGM336H-5N

User's Manual

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Version Update History

Version	Date and Time	Updated content
1.0	2015/7/01	First Draft
1.1	2015/12/1	Add the description of product selection; add the description of order model; Add the function description of single GPS module and single BDS module of the same series; add the description of Flash, online upgrade protocol and other features. Revise active antenna application circuit diagram; add passive antenna application circuit diagram; Revise the contact number to technical support number; Other text improvements;
1.2	1.2 2016/7/15	Text Improvement

1 Functional Description 功能描述

1.1 概述 Overview

ATGM336H-5N series modules are a series of 9.7X10.1 size high performance BDS/GNSS full constellation positioning and navigation modules. These modules are based on the fourth generation of low power GNSS SOC chip - AT6558, which supports a variety of satellite navigation systems, including China's BDS (BeiDou), U.S. GPS, Russia's GLONASS, EU's GALILEO, Japan's QZSS, and the satellite-based augmentation system SBAS (WAAS, EGNOS, EGNOS and SBAS). AT6558 is a true 6-in-1 multimode satellite navigation and positioning chip with 32 tracking channels, which can receive GNSS signals from six satellite navigation systems simultaneously and realize joint positioning, navigation and timing.

ATGM336H-5N This series of modules has the advantages of high sensitivity, low power consumption, low cost, etc. It is suitable for in-car navigation, handheld positioning, wearable devices, and can directly replace Ublox MAX series modules.

1.2 产品选购 Product Selection

Model	Multimode Function			Power supply		Interface		Characteristics						
	GPS	BDS	GLONASS	2.7V~3.6V	1.65V~3.6V	UART1	UART2	Flash	TCXO	Antenna Detection	Antenna	Overcurrent Protection	Front SAW	External LNA
ATGM336H-5N-1X	•			•		•	•	•	•	•	•	•	•	
ATGM336H-5N-2X		•		•		•	•	•	•	•	•	•	•	
ATGM336H-5N-3X	•	•		•		•	•	•	•	•	•	•	•	
ATGM336H-5N-5X	•		•	•		•	•	•	•	•	•	•	•	
ATGM336H-5N-7X	•	•	•	•		•	•	•	•	•	•	•	•	

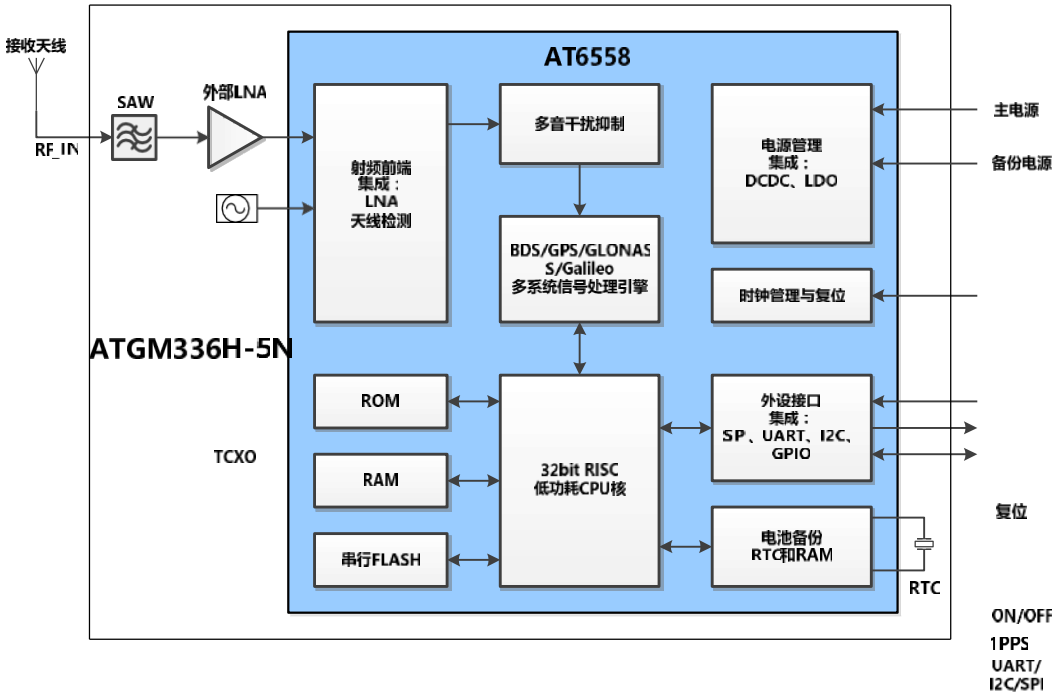
1.3 性能指标 Performance Indicators

- Outstanding positioning and navigation function, supports single system positioning of BDS/GPS/GLONASS satellite navigation system, as well as multi-system joint positioning of any combination, and supports QZSS and SBAS system.
- Support A-GNSS
- Cold start capture sensitivity: -148dBm
- Tracking sensitivity: -162dBm
- Positioning accuracy: 2.5 meters (CEP50)
- First positioning time: 32 seconds
- Low power consumption: continuous operation <25mA (@3.3V)
- Built-in antenna detection and antenna short circuit protection

Note 1: The above performance indicators are applicable to ATGM336H-5N-1X, ATGM336H-5N-3X, ATGM336H-5N-5X, ATGM336H-5N-7X modules.

Note 2: For performance specifications of ATGM336H-5N-2X module, please check with your sales representative.

1.4 Module Function Block Diagram 模块功能框图



1.5 应用领域 Applications Areas

- In-vehicle positioning and navigation
- Cell phones, tablets, handheld devices
- Embedded Positioning Devices
- Wearable devices

1.6 辅助 Assisted GNSS (AGNSS)

The ATGM336H-5N series modules all support Assisted GNSS (AGNSS), which provides the receiver with auxiliary information necessary for positioning, such as messages, rough position and time. In both strong and weak signal environments, this information can significantly reduce the time to first fix. For details on how to use this feature, please refer to the description of "CIMIC AGNSS Solution".

1.7 PPS

The ATGM336H-5N series modules support Precision Second Pulse output with the rising edge of the pulse aligned to UTC time.

1.8 输出协议 Output Protocol

ATGM336H-5N series modules use UART as the main output channel, and output according to the protocol format of NMEA0183, please refer to "CASIC Multimode Satellite Navigation Receiver Protocol Specification" for specific information.

1.9 FLASH

ATGM331C-5N series modules are equipped with Flash, which can be used to update the positioning functions and algorithms through the online upgrade function. This configuration function allows customers to configure the positioning update rate independently to obtain the applicable low power consumption; it allows customers to be updated with the latest optimization progress of global multimode positioning; and it allows customers to add new control functions, such as positioning records, regular geo-fencing, and customized output formats.

1.10 在线升级功能 Online Upgrade Function

ATGM336H-5N series modules support ZTE Micro's online upgrade protocol. Users can follow the upgrade protocol in the host computer to communicate with the module and upgrade the new software program provided by STMicro to the module in order to get the new software features. Users can also use remote command to remotely control the device to start the above upgrade process and realize remote online upgrade. For online upgrade protocol, please refer to "ATGM Module Online Upgrade Protocol".

1.11 天线 Antenna

ATGM336H-5N series modules support active and passive antennas.

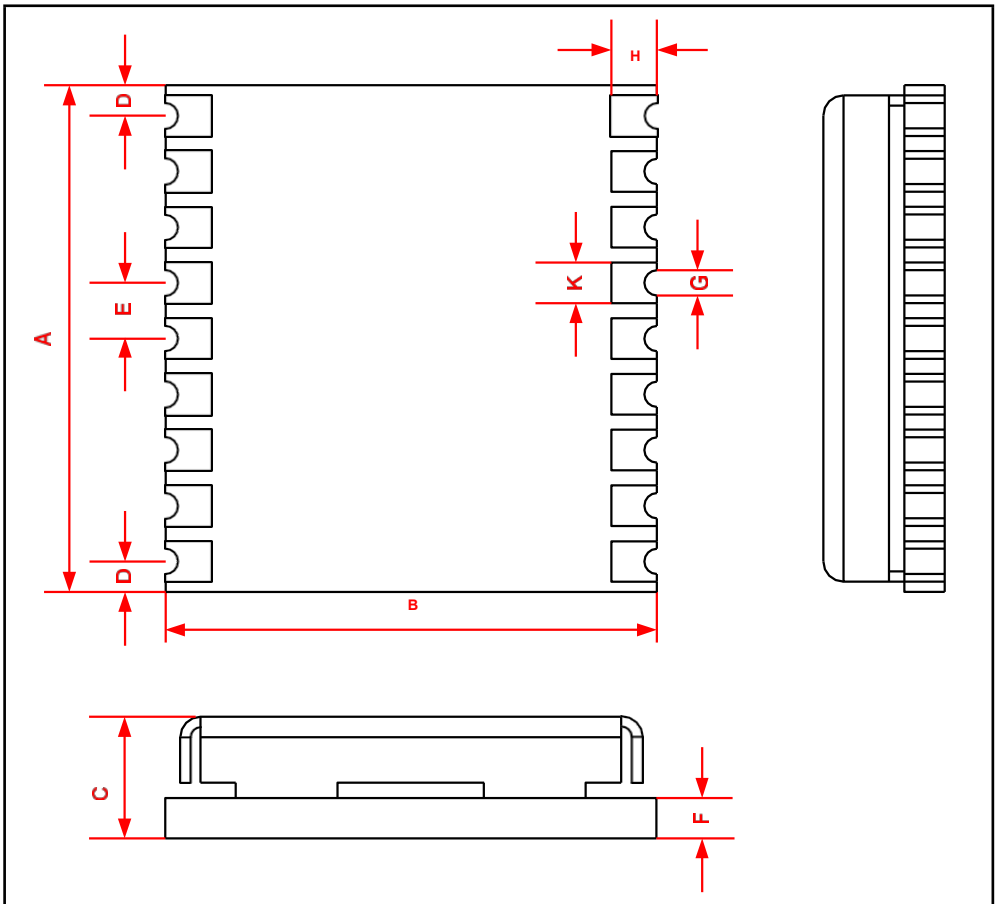
1.12 上位机工具 Upper Unit Tool

STMicroelectronics provides "GNSSToolKit" Lite version software package (Windows version, Android version) which is used for positioning output analysis and working mode configuration.

ST Micro provides "UBF Serial Upgrade Tool" software package (Windows version) for PC-based online upgrade tool. The online upgrade program based on the device needs to be developed by the customer.

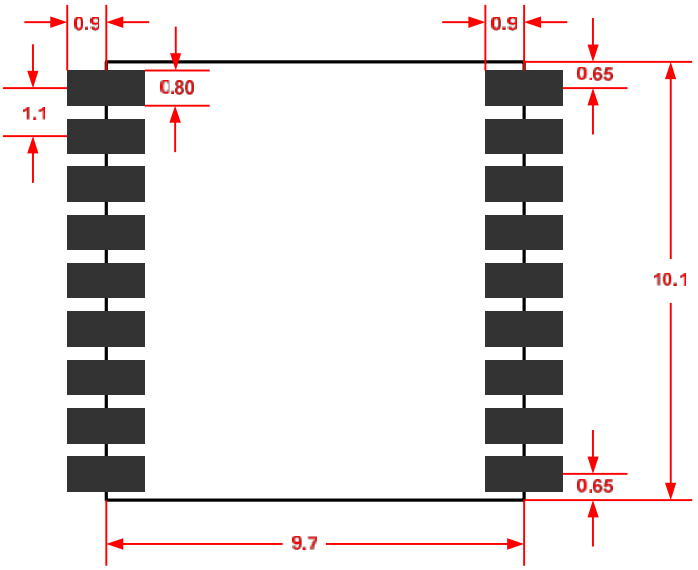
2 技术描述 Technical Description

2.1 Dimensions 外观尺寸（单位：mm）

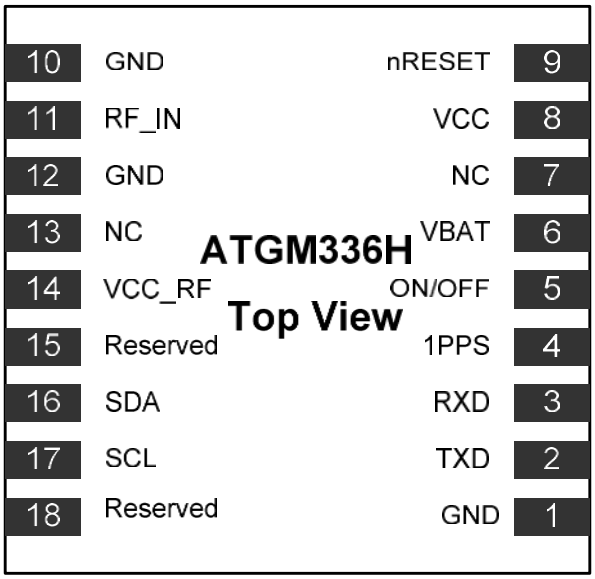


Symbol	Min.(mm)	Typ.(mm)	Max.(mm)
Max.(mm)	10.0	10.1	10.7
B	9.6	9.7	9.8
C	2.2	2.4	2.6
D	0.55	0.65	0.95
E	1.0	1.1	1.2
F		0.8	
F	0.4	0.4	0.6
H	0.8	0.9	1.0
K	0.7	0.8	0.8

2.2 PCB layout (unit: mm)(单位：)



2.3 PIN layout 排列图



2.4 Pin Definition 管脚定义

引脚编号	Pin Name 名称	I/O	I/O Description 描述	Electrical Characteristics 电气特性
1	GND	GND	GND	
2	TXD	TXD	Navigation Data Output	NMEA0183 Protocol
3	RXD	RXD	Interactive Command Input	Configuration Command Input
4	1PPS	O	Second pulse output	
5	ON/OFF	I	Module shutdown control, active low	
6	VBAT	I	RTC and SRAM Backup Power Supply	Provide 1.5~3.6V power supply to ensure the Module Hot Start
7	NC			
8 VCC	VCC	I	Module Power Input	DC 3.3V±10% ,100mA
9	nRESET	I	Module reset input, active low	Suspend when not in use
10	GND	GND	GND	
11	RF_IN	RF_IN	Antenna signal input	
12	GND	I	Ground	
13	NC			
14	VCC_RF	VCC_RF	Output power supply	+3.3V to power the antenna
15	retain			Suspension
16	SDA	I/O	I²C Data Interface	Overhead
17	SCL	O	I²C Clock Interface	Suspended
18	Reserved			Suspended

2.5 Electrical Parameters 电气参数

极限参数

Extreme Parameters

Parameter 参数	Symbol 符号	Minimum value 最小值	Maximum value 最大值	Unit 单位
Module supply voltage (VCC)	Vcc	-0.3	3.6	V
Backup Battery Voltage (VBAT)	Vbat	-0.3	3.6	V
Digital Input Pin Voltage	Vin		Vcc+0.2	V

Maximum tolerable ESD level	VESD(HBM)		2000	V

运行条件
Operating conditions

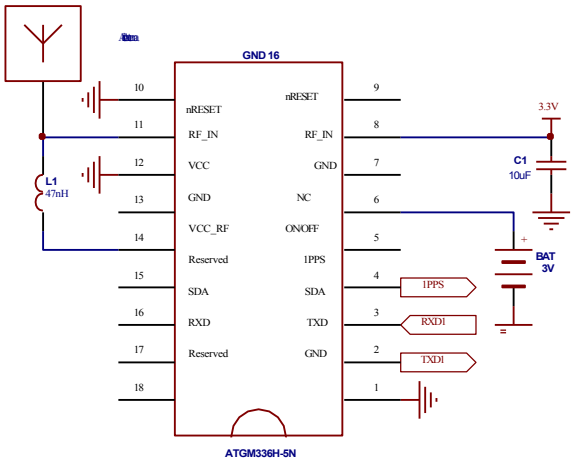
Parameter 参数	Symbol 符号	Minimumvalue 最小值	Typicalvalue 典型值	Maximumvalue 最大值	Unit 单位
Supply Voltage	Vcc	2.7	3.3	3.6	V
Vcc peak current (excluding antenna)	Ipeak			100 mA	mA
Backup power supply	Vbat	1.5	3.0	3.6	V
Backup power supply (Vbat) current	Ibat		10		uA
Input pins	Vil			0.2*Vcc	V
	Vih	0.7*Vcc			Vih
Output Pins	Vol Io=-12mA			0.4	V
	Voh Io=12mA	Vcc-0.5			V
Active antenna output voltage	VCC_RF		3.3		V
Antenna short circuit protection current Power from VCC_RF (=3.3V)	Iant short		50 mA		mA
Antenna open current Power from VCC_RF (=3.3V)	Iant open		3 mA		mA
Antenna Gain	Gant	Gant		30 dB	dB

2.6 技术规范 Technical Specification

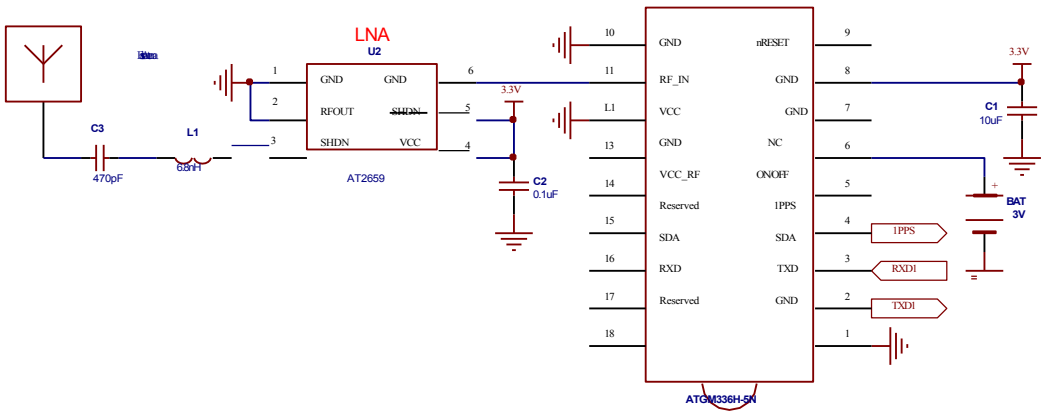
Specification 指标	Specification 技术参数
Signal reception	bds/gps/glonass/galileo/qzss/sbas
Number of RF channels	Three-channel RF, support full constellation BDS, GPS and GLONASS at the same time. Simultaneous reception
Cold start TTFF	≤35s
Hot start TTFF	≤1s
Recapture TTFF	≤1s
Cold Start Capture Sensitivity	-148dBm
Warm Start Capture Sensitivity	-156dBm
Recapture Sensitivity	-160dBm
Tracking Sensitivity	-162dBm
Positioning Accuracy	<2m (1σ)
Velocimetry Accuracy	<0.1m/s (1σ)
Timing Accuracy	<30ns (1σ)
Positioning update rate	1Hz (default) max. 10Hz
Serial Port Characteristics	Baud rate range: 4800 bps ~115200 bps, default 9600bps, 8 data bits, no parity, 1 stop bit. 8 data bits, no parity, 1 stop bit
Protocol: NMEA0183	NMEA0183
Maximum Altitude	18000m
Maximum speed	515m/s
Maximum Acceleration	4g
Backup Battery	1.5V~ 3.6V
Power supply	2.7V~ 3.6V
GPS&BD Typical Power Consumption	<25mA @3.3V
Operating Temperature	-40 to +85 degrees Celsius
Storage temperature	-45 to +125 degrees Celsius
Dimensions	10.1mm x 9.7mm x 2.4mm
Dimensions 10.1mm x 9.7mm x 2.4mm	0.6g

2.7 模块应用电路 Module Application Circuit

2.7.1 Active antenna application program (module internal antenna power supply, antenna detection and short-circuit protection)



2.7.2 Passive Antenna Application Program (add one level of LNA to RF_IN input of module)



2.8 Precautions for using the module 模块使用注意事项

In order to fully utilize the excellent performance of ATGM336H-5N, users need to pay attention to the following points when using this module:

- Adopt a low ripple LDO power supply and control the ripple within 50mVpp.
- Try not to run other high frequency and large amplitude digital signals in the vicinity of the module. It is better to fill all the ground lines under the module.
- The antenna connector should be located as close as possible to the module's RF input pins, with a 50-ohm impedance match.

● The module itself has active antenna access, pull out, short circuit detection circuit, at the same time in the antenna accidental short circuit, the antenna power supply current limit (50mA), play a protective role. When the status of the above three antenna ports changes, corresponding information can be output from the serial port. For example

$GPTXT,01,01,01,ANTENNA SHORT*63

$GPTXT,01,01,01,ANTENNA OPEN*25

$GPTXT,01,01,01,ANTENNA OK*35

3 Reliability Testing and Certification 可靠性测试与认证

3.1 RoSH 认证 Certif icatio ns

ATGM336H-5N series modules are RoSH certified.

4 模块传送与焊接 Module Transfer and Soldering

4.1 模块包装 Module Packaging

ATGM336H-5N series modules are packaged in vacuum tape and reel, which is moisture-proof, anti-static, and compatible with major mounters in the industry. The modules are packed according to 1000 pieces per tray.

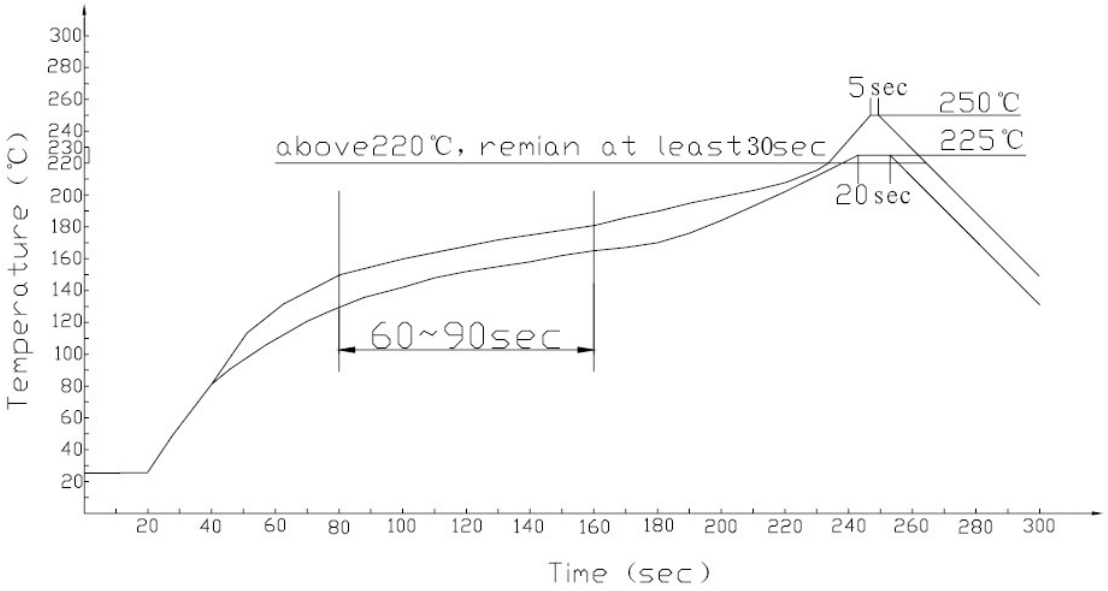
4.2 模块传送与存储 Module Transfer and Storage

4.2.1 Moisture Sensitivity Level (MSL)

Moisture Sensitivity Level (MSL): Level 4

MSL Refer to IPC/JEDEC J-STD-020 standard.

4.2.2 Reflow profile:



！注意

Adjust the equilibrium time to ensure that the gas is rationalized when the solder paste is melted. If there are excessive voids on the PCB board, the equilibrium time can be increased.

Considering that the product is placed in the soldering area for a long period of time (at a temperature of 180°C or more), the placement time should be kept as short as possible in order to prevent damage to the components and the backplane.

！曲线的重要特征

！Important features of the curve:！

Rising speed = 1～ 4°C /sec, 25°C to 150°C Average preheating temperature = 140°C to 150°C, 60sec ～ 90sec Temperature fluctuation = 225°C to 250°C, approx. 30sec

Decline rate = 2～ 6°C/sec, to 183°C, approx. 15sec

Total time= approx. 300sec

4.2.3 Electrostatic protection:

The ATGM336H-5N module series are electrostatic sensitive devices. Frequent electrostatic contact can lead to accidental damage to the module. In addition to the standard ESD requirements, the following points should be followed as much as possible:

1） Unless the PCB The first point of contact with the module should be PCB GND unless it is well grounded.

2) When connecting the antenna, connect GND first, then the signal line.

3) When touching the RF part of the circuit, do not touch the charging capacitors, and keep away from devices and equipment that can generate static electricity, such as dielectric antennas, coaxial wires, soldering irons, and so on.

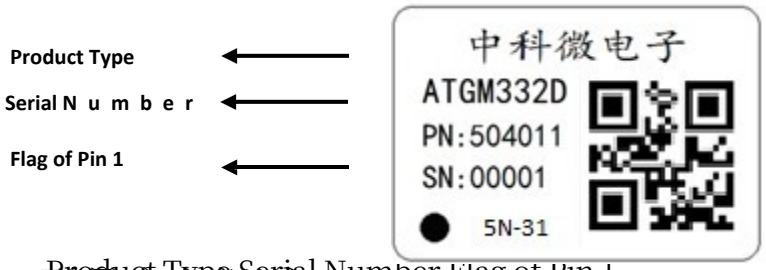
4) To avoid charge discharge through the RF input, do not touch the exposed part of the antenna dielectric. In case of possible contact with the exposed antenna dielectric, antistatic protection circuitry should be added to the design.

5) Be sure to use a static-free soldering gun when soldering connectors and antennas connected to the RF input.

5 Module Labeling and Ordering Model 模块标签与下单型号

5.1 模块标签 Module Labeling

The label of ATGM336H-5N contains important product information in the following format:



5.2 型号命名规则: Product Type Serial Number Flag of Pin 1

Take ATGM336H-5N-31-0 as an example, explained below:

Fields	Example	Explanation
Product code Product code	ATGM336H	9.7mmX10.1mm Module Series
Type code Type code	5N	Navigation Module with AT6558 Hardware Platform

Hardware code Hardware function name	31	Hardware with GPS+BDS Hardware Version=1
Software code Software function name	0	Standard software function version

5.3 List of general order models:
通用订单型号一览：

General Order Models	Product name: ATGM336H-5N-11-0
ATGM336H-5N-11-0	9.7X10.1 Size, AT6558 Chip, Navigation Module, Single GPS Positioning, 16.369M Crystal, Standard Outputs Bit, 16.369M Crystal, Standard Outputs
ATGM336H-5N-21-0	9.7X10.1 Size, AT6558 Chip, Navigation Module, Single BDS Location, 16.369M Crystal, Standard Outputs 16.369M Crystal, Standard Output
ATGM336H-5N-31-0	9.7X10.1 Size, AT6558 Chip, Navigation Module, GPS+BDS Positioning, 16.369M Crystal, Standard Output
ATGM336H-5N-51-0	9.7X10.1 Size, AT6558 Chip, Navigation Module. GPS+GLONASS positioning, 16.369M crystal, standard output
ATGM336H-5N-71-0	9.7X10.1 Size, AT6558 Chip, Navigation Module. GPS+BDS+GLONASS positioning, 16.369M crystal, standard output

5.4 Customized order model:
定制订单型号：

Zhongke Micro Module provides software function customization service to domestic customers. For specific cooperation and product order naming, please contact the sales representative.

References
参考文献

1. CASIC AGNSS Solution
2. CASIC Multimode Satellite Navigation Receiver Protocol Specification

3. ATGM Module Online Upgrade Protocol
4. AT6558 Chip Datasheet
5. GNSSToolKitLite Tool User's Manual
6. GNSSToolKitLite Utility User's Manual