MINEWSEMI

GNSS Module

MS36SN4

Datasheet

V 1.1.0

Applicable Product Model
MS36SN4

Version Note

Version	Details	Contributor(s)	Date	Notes
1.0.0	First edit	Michelle	2023.08.11	
1.1.0	Layout Changes	Michelle	2023.08.30	

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1 Product Introduction

1.1 General description

MS36SN4 is a full-system, five-star, ten-frequency, L1+L5 GNSS positioning and orientation module with integrated RTK positioning engine. Built-in 12nm advanced process GNSS Soc chip, integrated main frequency up to 530MHz ARM Cortex-M4 FPU and MPU, the module supports GPS, BeiDou, GLONASS, Galileo and QZSS multi-satellite systems, combined with RTK (Carrier Phase Difference) technology, the MS36SN4 can achieve centimeter level positioning accuracy, which greatly improves the device positioning accuracy while maintaining ultra-low power consumption. The MS36SN4 can achieve centimeter-level positioning accuracy in combination with RTK (Carrier Phase Differential Kinematics) technology, which greatly improves the device's positioning accuracy while maintaining ultra-low power consumption. The combination of the two chips enables precise azimuth output and posturing in static scenarios, and the MS36SN4's superior positioning performance makes it ideal for drones, lawnmowers, and precision agriculture applications.

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1.2 Key Parameter

MS36SN4 Parameter	
Engine (loanword)	MTK 530MHz ARM Cortex-M4 FPU and MPU*2, 12nm advanced process
Horoscope	GPS: L1 C/A, L5 BDS: B1I, B2a GLONASS: L1 GALILEO: E1, E5a QZSS: L1 C/A, L5 SBAS: WAAS,EGNOS,MSAS,GAGAN,SDCM NAVIC*: L5 (optional)
Operating Frequency	GPS/QZSS L1: 1575.42±1.023MHz L5: 1176.45MHz±10.23MHz BDS B1I: 1561.098MHz±2.046MHz B2a: 1176.45MHz±20.46MHz GLONASS L1: 1601.71875MHz±3.91175MHz GALILEO E1: 1575.42±2.046MHz E5a: 1176.45MHz±10.23MHz NAVIC*: L5 (optional) L5: 1176.45MHz±10.23MHz
(level of) sensitivity[1]	Cold Start: -148dBm; Recapture: -160dBm; Tracking: -165dBm;
First positioning time[1]	Cold start: ≤27 seconds; Hot start: ⩽2 seconds; AGPS Assist: <6 seconds;
Fixed solution convergence time	⩽10seconds
Positional accuracy[2]	Single-point localization: Open sky: <1.5 meters CEP Complex urban environments: <2.5 m CEP RTK: Horizontal positioning accuracy: 1cm+1ppm CEP Elevation accuracy: 2cm+1ppm CEP
Orientation accuracy	0.2 degrees/1m baseline
Speed Accuracy[2]	<0.05 m/s
Time accuracy[2]	20 nanoseconds

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Operating temperature	Operating temperature: -40°C to +85°C
Refresh rate	GNSS: 1-5Hz; IMU：50Hz/100Hz/200Hz
Connector	UART*3，PPS

Remarks:

1.All satellites signal at -130 dBm

2 CEP, 50%, 24 hours static, -130 dBm, > 20 SVs

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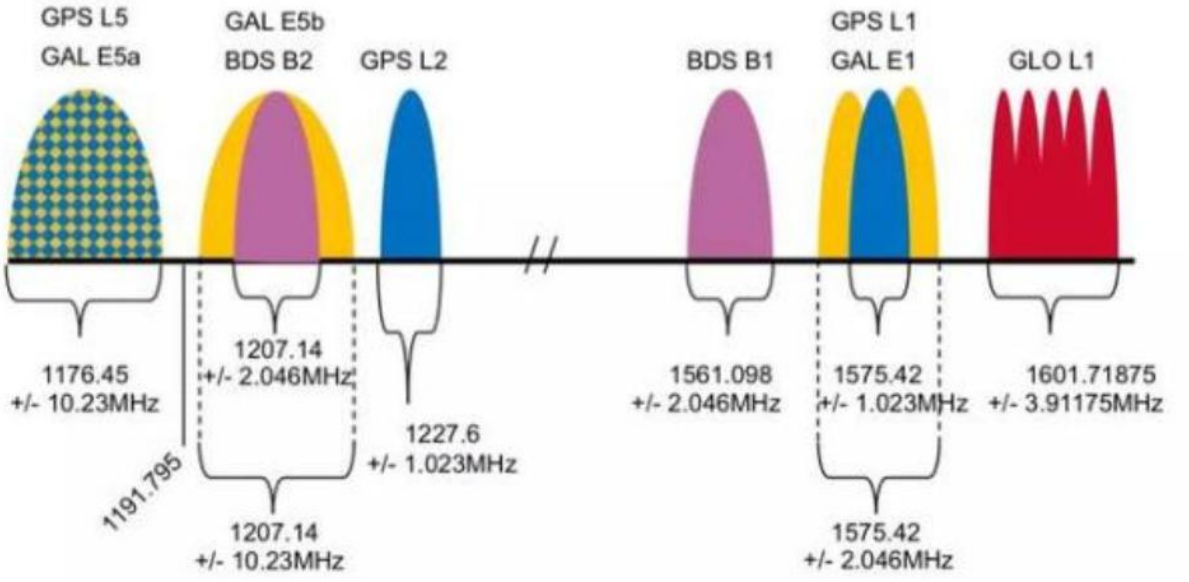
2 Technical Information

2.1 Supporting Constellations

Due to the multi-constellation RF front-end architecture, the MS36SN4 can simultaneously receive dual-band (L1+L5) satellite signals supporting GPS, BDS, GLONASS, GALILEO, IRNSS, QZSS, and the satellite-based augmentation systems SBAS (WAAS, EGNOS, GAGAN, and MSAS).The main frequencies of the GNSS are schematically shown in the figure below.



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2.2 Satellite-based Augmentation System (SBAS)

The MS36SN4 supports the reception of SBAS broadcast signals. These systems supplement GNSS data with other regional or wide area GPS augmentation data. The system broadcasts distance correction and integrity information via satellite, which can be used by GNSS receivers to improve the accuracy of results. SBAS satellites can be used as additional satellites for ranging (navigation) to further improve availability. The following SBAS types are supported: GAGAN, WAAS, EGNOS and MSAS.

typology	satellite navigation system	Operation and maintenance country/region
Master Navigation System (GNSS)	GPS	United States of America
	Beidou (BDS)	China
	GLONASS	Georgia
	GALILEO	EU
local navigation system	QZSS	Japanese
	NAVIC/IRNSS	India
Star-based Wide Area Strengthening (SBAS)	WASS	United States of America
	EGNOS	EU
	MSAS	Japanese
	GAGAN	India

2.3 Quasi-Zenith Satellite (QZSS)

The Quasi-Zenith Satellite System (QZSS) is a navigation satellite overlay system for the Pacific Ocean covering Japan and Australia that transmits other GPS L1C/A signals. The module is capable of receiving and tracking these signals simultaneously with GPS, which improves availability and maintains positioning especially in poor signal conditions such as urban canyons.

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2.4 satellite enhancement

With multi-mode dual-frequency L1+L5 carrier phase difference function, the received input base station information should follow RTCM3.2 protocol. The base station can be a directly connected station or a virtual CORS station. The supported differential message types are listed in the table below.

message type	typology
1005 / 1006	Base Station Antenna Location Information
1074	Base station GPS observation message group
1084	Base station GLONASS observation volume message sets
1124	Base station BDS observation volume message set
1094	Base station GALILEO observation volume message sets
1114	Base station QZSS observation volume message set

2.5 Real-time Kinematic（RTK）

The module supports GPS, BeiDou, GLONASS, Galileo and QZSS multi-satellite systems, as well as L1+L5 frequency points. Combined with RTK (carrier phase differential) technology, the MS36SN4 can achieve centimeter-level positioning accuracy, which greatly improves the positioning accuracy of the device while maintaining ultra-low power consumption. Differential positioning is a necessary condition for centimeter-level accuracy, and the application needs to ensure that the receiver receives stars well.

2.6 Satellite Augmentation - Code Differential DGNSS

The MS35SN2 can also be downgraded to use the Code Differential function when RTK use is limited, D-GNSS, with access to pseudo-range correction messages in RTCM 2.3 or a user-defined format.The MS35SN2 is used as a mobile station, and will attempt to provide the best possible positioning accuracy depending on the correction data received. Upon receipt of the RTCM message input stream, it will immediately enter differential mode. Improvements in positioning accuracy can be expected

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after entering D-GNSS mode.

D-GNSS is a differential system in which mobile stations use reference data from a reference station. If the RTCM correction function is not available, they will operate as stand-alone precision receivers for GNSS satellite-based or single-point positioning.

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3 Electrical Specification

3.1 Absolute maximum rating

notation	parameters	minimum value	maximum values	unit (of measure)
VCC	Mains voltage	-0.5	3.63	V
VBAT	Backup power supply voltage	-0.5	3.63	V
VI-max	I/O Pin Input Voltage	-0.5	3.63	V
T-storage	Storage temperature	-40	+85	℃
T-solder	Reflow temperature	--	250	℃

Pressurizing the equipment beyond the "Absolute Maximum Rating" may cause permanent damage.

The above figures are pressure ratings only. Products are not overvoltage or reverse voltage protected. If necessary, voltage spikes exceeding the supply voltage specifications listed in the table above must be limited to the specified range using an appropriate protection diode.

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3.2 DC Characteristics

parameters	prerequisite	minimum value	typical value	maximum values	unit (of measure)
VCC	Mains voltage	1.8	3.3	3.6	V
VBAT	Backup power supply voltage	1.8	3.3	3.6	V
ICC_{max}	Maximum operating current on VCC	--	3.3	200	mA
T_{env}	Operating Temperature	-40	--	85	°C

3.3 power wastage

notation	parameters	Measurement Pins	typical value	unit (of measure)
ICCRX1 [1]	capture phase	VCC [2]	30	mA
ICCRX2 [1]	tracking stage	VCC [2]	25	mA

Remarks:

1. Under open sky, GNSS, L1 + L5 bands, tracking 32 satellites, successful positioning.
2. Conditions: VCC=3.3V, room temperature, all pins suspended

All of the above specifications are at 25°C ambient temperature. Extreme operating temperatures can seriously affect specification values. Applications operating near temperature limits.

The values in the table are for customer reference only and are intended as examples of typical power requirements. Values are characterized as samples and actual power requirements will vary depending on the firmware version used, external circuitry, number of satellites tracked, signal strength, type of activation as well as time, duration, and test conditions.

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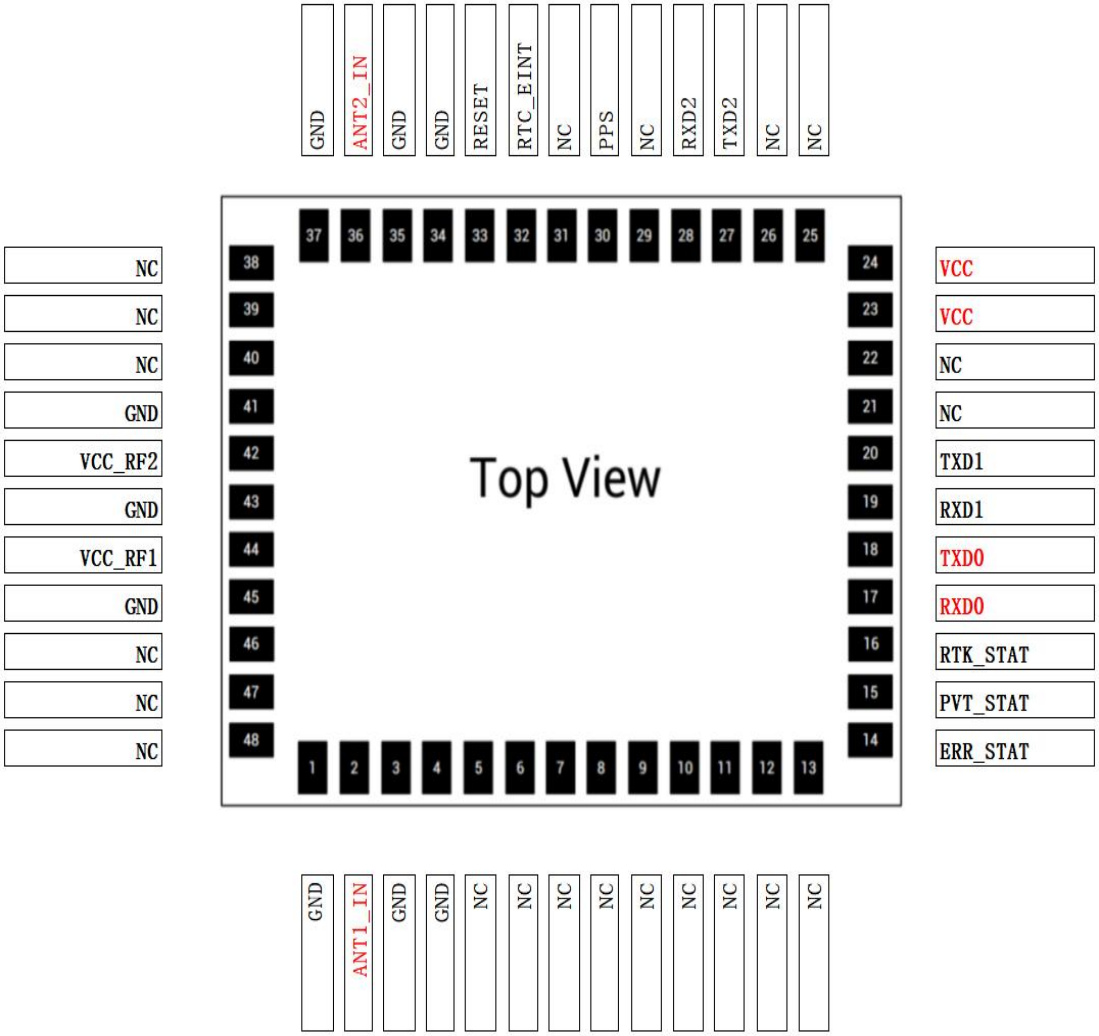
4 Package Definition

4.1 Module Pin Definitions

The MS36SN4 is available in a 121*16mm， LGA-48pin package and is defined as follows:



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serial number	name (of a thing)	I/O	descriptive
1	GND	—	GND
2	ANT1_IN	I	GNSS antenna signal input (main antenna)
3~4	GND	—	GND
5~13	NC	—	vacant
14	ERR_STAT	O	Abnormal status output, active high
15	PVT_STAT	O	PVT positioning indication, active high
16	RTK_STAT	O	RTK position indication, active high
17	RXD0	I	Serial port 0 receive
18	TXD0	O	Serial Port 0 Transmit
19	RXD1	I	Serial port 1 receive
20	TXD1	O	Serial Port 1 Transmit
21~22	NC	—	vacant
23	VCC	POWER	Power supply 3.3V
24	VCC	POWER	Power supply 3.3V
25~26	NC	—	vacant
27	TXD2	O	Serial Port 2 Transmit
28	RXD2	I	Serial port 2 receive
29	NC	—	vacant
30	PPS	O	second pulse (physics)
31	NC	—	vacant
32	RTC_EINT	I	Low Power Wakeup
33	RESET	I	system reset
34~35	GND	—	GND
36	ANT2_IN	I	GNSS antenna signal input (from antenna)

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37	GND	—	GND
38~40	NC	—	vacant
41	GND	—	GND
42	VCC_RF2	POWER	Active Antenna Power Supply, 3.3V
43	GND	—	GND
44	VCC_RF1	POWER	Active Antenna Power Supply, 3.3V
45	GND	—	GND
46~48	NC	—	vacant

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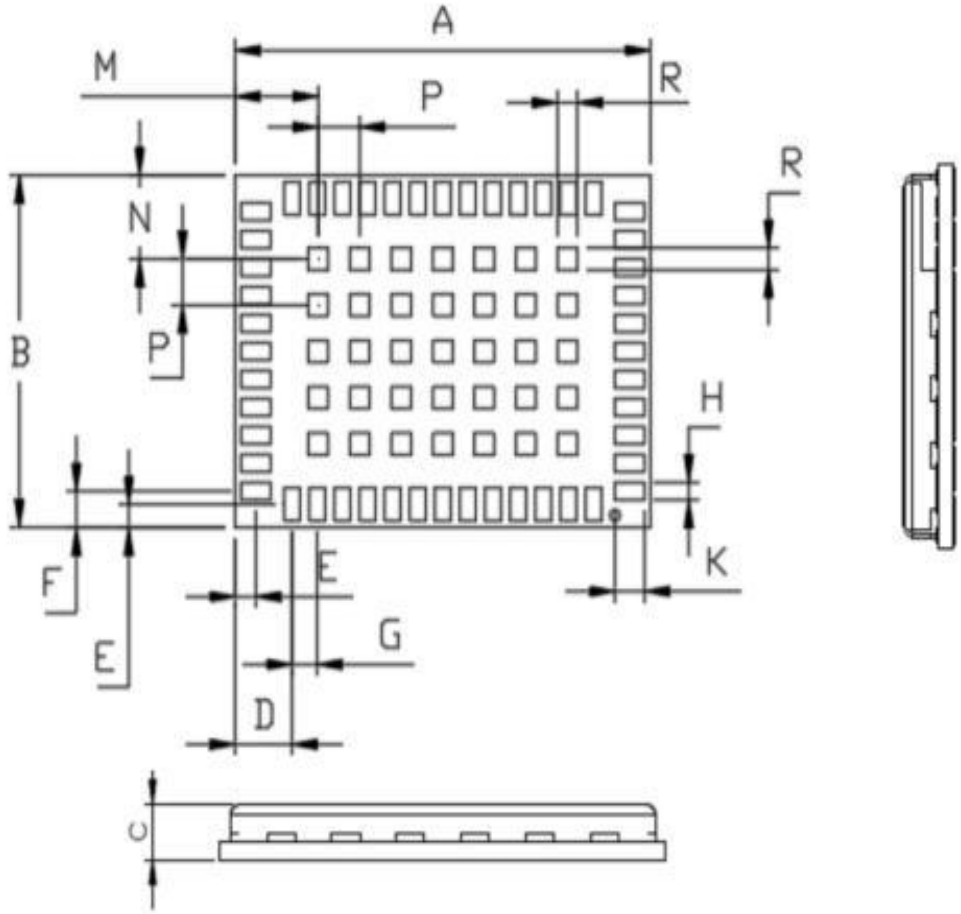
5 Package Specifications

5.1 Dimensions



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5.2 Mechanical dimensions

serial number	Minimum (mm)	Typical values (mm)	Maximum value (mm)
A	20.80	21.00	21.50
B	15.80	16.00	16.50
C	2.40	2.60	2.80
D	2.78	2.88	2.98
E	0.95	1.05	1.15
F	1.55	1.65	1.75
G	1.17	1.27	1.37
H	0.70	0.80	0.90
K	1.40	1.50	1.60
M	4.10	4.20	4.30
N	3.70	3.80	3.90
P	2.05	2.10	2.15
R	0.90	1.00	1.10

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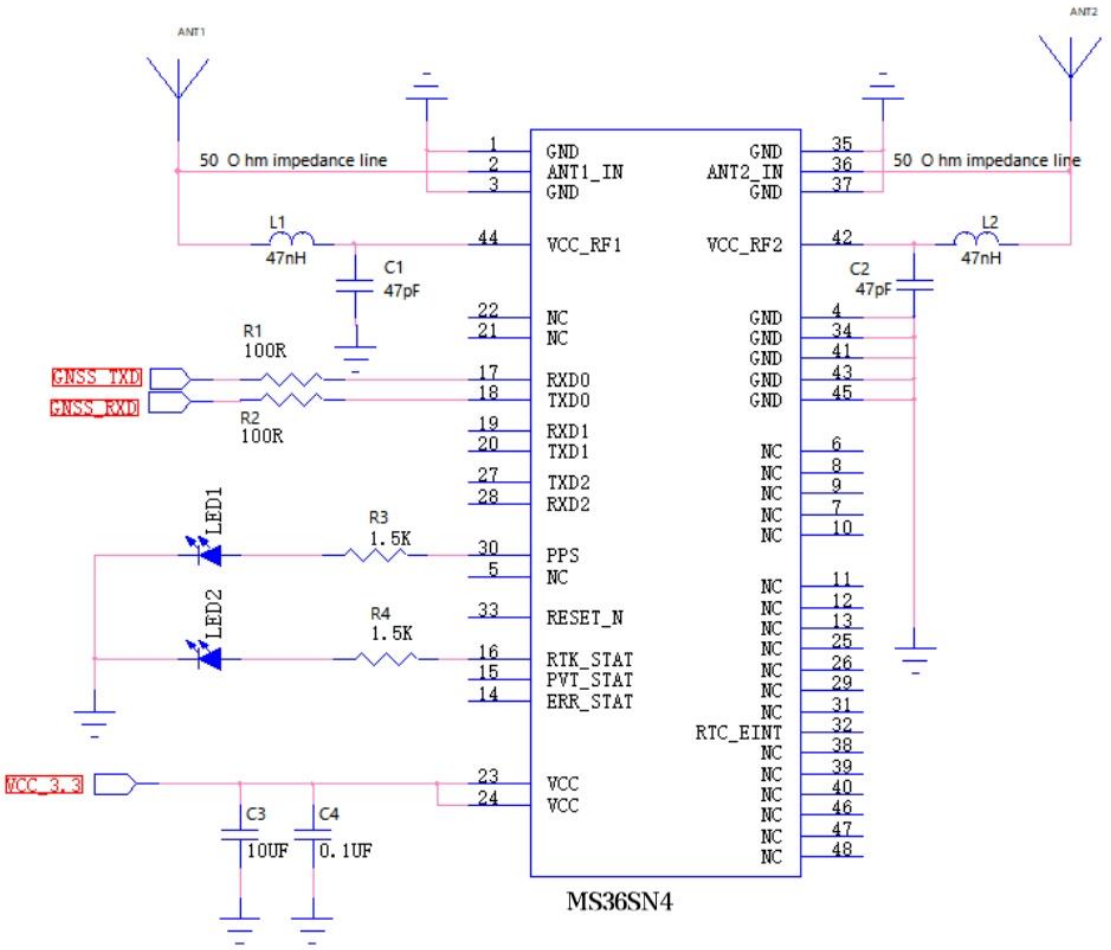
6 reference design

6.1 schematic design

The reference design of MS36SN4 is shown below. When connecting the active antenna, please make sure that the 47nH inductors at L1 and L2 are in the SMD state, which are used to supply power to the active antenna; the inductors need to be piggybacked on the RF line when PCB layout is done to avoid branching and affecting the signal; the characteristic impedance from the ANT pin to the antenna connector is 50Ω. When applying the antenna, the performance of the antenna is vital to the system, make sure to ensure that the technical parameter of the dual-band high-precision antenna is controlled 15-25dB in terms of the gain. MS36SN4 does not support hardware hot start, but supports RTC_EINT software wake-up, high level effective.



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6.2 LAYOUT Notes

(1) Decoupling capacitors are placed close to the module power supply pins, and ensure that the power supply alignment width is more than 0.5mm;

(2) No wires are allowed to be routed at the bottom of the module patch;

(3) The RF alignment between the RF port of the module and the antenna interface should be at least 0.2mm~0.3mm, and the coplanar waveguide impedance model should be adopted, and the spacing between the alignment and the ground copper skin should be controlled to be about 1 times of the spacing, and the impedance should be guaranteed to be 50Ω;

(4) The alignment from the module RF port to the antenna connector references Layer 2 ground and ensures that the Layer 2 ground plane is relatively complete;

(5) Modules should not be placed near sources of interference, such as communication module antennas, RF alignments, crystal oscillators, large inductors, and high-frequency digital signal lines.

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7 Packaging and Protection

7.1 wrap

The MS36SN4 is humidity and static sensitive. It is important that you follow the handling requirements and take appropriate precautions to minimize product damage during packaging and shipping of the product. The following table shows the standard packaging structure for product transportation.

offerings	reels	Sealed Bags	Shipping cartons
			
module (in software)	500pcs/roll	1 roll/bag	1 bag/box, 3 boxes/ctn

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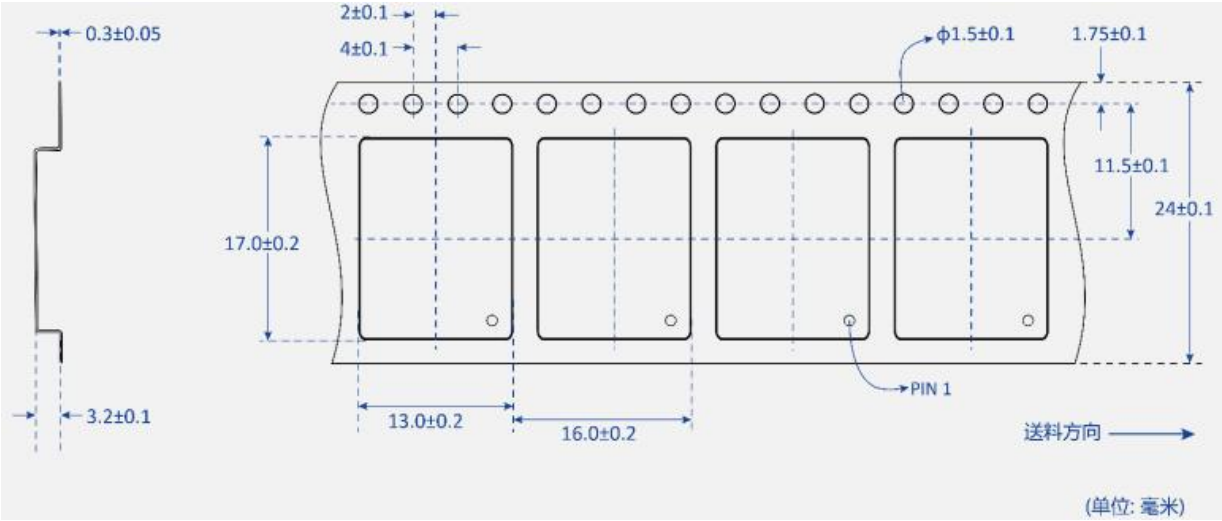
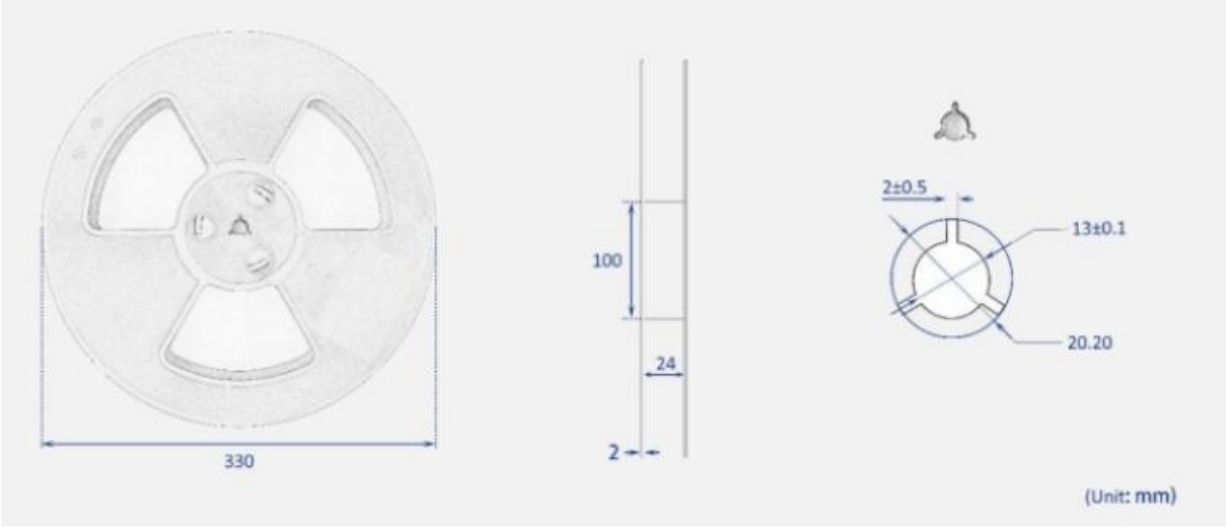
7.2 Carrier belts and trays

The MS36SN4 is supplied on a reel (consisting of a tape and reel) and packaged in a ziplock bag with an anti-static effect to meet the customer's needs for efficient production, batch installation and removal. The following picture shows the dimensional details of the tape reel.





7.3 stockpile

In order to prevent the product from moisture and electrostatic discharge, the sealed bag of the product is equipped with desiccant and humidity indicator card, which allows the user to know the humidity condition of the environment in which the product is located. The product has a moisture sensitivity rating of MSL3.

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7.4 ESD protection

The GNSS positioning module contains highly sensitive electronics and is an electrostatic sensitive device (ESD). Please note the following precautions, as failure to follow these precautions may result in serious damage to the module!

- Ground yourself before patching the antenna. Do not touch any charged capacitors and other devices (e.g., antenna patch ~10 pF; coaxial cable ~50 -80 pF/m; soldering iron) when bringing out the RF pin;
- To prevent electrostatic discharge, do not expose the antenna area; if exposed by design, take appropriate ESD precautions and do not touch any exposed antenna area;
- Be sure to use an ESD safe soldering iron when soldering RF connectors and antenna patches.
- Add ESD diode to RF input to prevent ESD; add ESD diode to UART interface

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8 Ordering Information

8.1 Ordering Model

Ordering Model	Pseudolaric acid	Default Baud Rate	characterization	Default satellite reception frequency	physical interface
MS36SN4	GNSS Module	115200	Dual-frequency RTK + directional posturing	GPS/BDS/GLO/GAL/QZSS L1+L5 five stars and ten frequencies	21*16, LGA48

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Quality

Cognizant of our commitment to quality, we operate our own factory equipped with state-of-the-art production facilities and a meticulous quality management system. We hold certifications for ISO9001, ISO14001, ISO27001, OHSA18001, BSCI.

Every product undergoes stringent testing, including transmit power, sensitivity, power consumption, stability, and aging tests. Our fully automated module production line is now in full operation, boasting a production capacity in the millions, capable of meeting high-volume production demands.

Contact Us

Shenzhen Minewsemi Co., Ltd. is committed to swiftly delivering top-quality connectivity modules to our customers. For assistance and support, please feel free to contact our relevant personnel, or contact us as follows:

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