MINEWSEMI

GNSS Module

MS34SNA

DateSheet

V 1.1.0

Applicable Product Model
MS34SNA-4YY

Version Note

Version	Details	Contributor(s)	Date	Notes
1.0.0	First edit	Coral	2022.11.01	
1.1.0	Layout Changes	Michelle	2023.08.30	

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1 Product Introduction

1.1 General description

MS34SNA is a highly dynamic, five-star, ten-frequency, L1+L5 GNSS module with integrated RTK positioning engine. Built-in 12nm advanced process GNSS Soc chip, integrated dual-core Cortex A7 1.2GHz high-performance computing processor, the module supports GPS, BeiDou, GLONASS, Galileo and QZSS multi-satellite systems, and the internal integration of 6-axis sensors (3-axis gyroscope + 3-axis accelerometer) and the GNSS RTK tightly combined algorithm engine. The MS34SNA can achieve centimeter-level positioning accuracy, which greatly improves the positioning accuracy of the device and supports a maximum 20Hz fusion positioning refresh rate. The MS34SNA provides highly reliable and uninterrupted accurate positioning data even when there is severe satellite signal blockage, providing a real-time and reliable navigation and positioning solution for difficult scenarios such as urban canyons, tunnels and underground garages. The multi-star system combination greatly increases the number of visible satellites when driving in dense urban canyon environments, reducing the time to first-time positioning and improving positioning accuracy, reaching decimeter and even centimeter-level positioning accuracy in open roadways. The excellent positioning performance of the MS34SNA makes it ideal for industrial applications in the automotive field (e.g., T-Box, in-vehicle navigation, V2X), transportation (e.g., industrial vehicles, operational vehicle supervision), autonomous driving, surveying and mapping, shared motorcycle, and smart agriculture, etc.

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1.2 Key Parameter

MS34SNA Parameter	
engine (loanword)	MTK 530MHz ARM Cortex-M4 FPU and MPU, 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 G1：1601.71875MHz±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: ≤24 seconds; Hot start: 1 second; AGPS Assist: <6 seconds;
Fixed solution convergence time	≤10 seconds
Positional accuracy[2]	Single-point localization: Open sky: <1.5 meters CEP Complex urban environments: <2.5 m CEP RTK: Horizontal positioning accuracy: 0.8cm+1PPM CEP Elevation accuracy: 2cm+1PPM CEP
Speed Accuracy[2]	<0.05 m/s
time accuracy[2]	20 nanoseconds
Attitude Accuracy	Roll, pitch: 0.02° (1σ); heading: 0.2° (1σ)

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Gyro Accuracy	Range:±1000°/s; Zero-bias stability ±4.5°/h; Velocity random wander 0.75°/√h
Accelerometer Accuracy	Range:±16g; Zero-bias stability ±0.25mg/h; Velocity random wander 0.3m/s/√h
operating temperature	Operating temperature: -40°C to +85°C
refresh rate	GNSS RTK: 10Hz max; Attitude 10Hz max; Sensor: 50Hz max configurable;
baud	Main Serial Port 115200bps (factory default)
RTCM differential output	Supports RTCM2.x, RTCM3.x outputs, MSM4/MSM7 support
Supported Protocols	NMEA 0183 Protocol Ver. 4.0/4.1 RTCM 2.3/2.4/3.0/3.2

Remarks:

1. All satellites signal at -130 dBm

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

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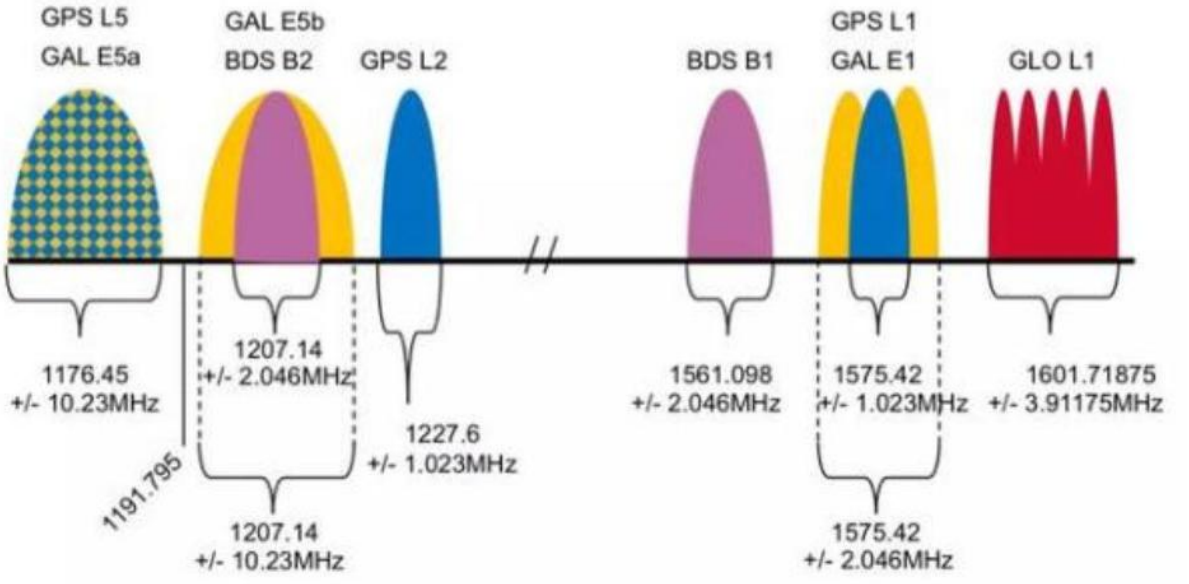
2 Technical Information

2.1 Supporting Constellations

Due to the multi-constellation RF front-end architecture, the MS34SNA 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 MS34SNA 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)	sino
	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

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2.5 Carrier phase technology - 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 MS34SNA can achieve centimeter-level positioning accuracy, which greatly improves the device's positioning accuracy 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 - Differential DGNSS)

The MS34SNA can also be downgraded to use the Code Differential function, D-GNSS, to access pseudo-range correction information in RTCM 2.3 or user-defined formats when RTK use is limited. The MS34SNA used as a mobile station will attempt to provide the best possible positional 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 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, it will operate as a stand-alone precision receiver for GNSS satellite-based or single-point positioning.

2.7 Odometer Access

Unlike traditional DR products, the MS34SNA has no mandatory requirement for odometer access and supports UDR. In vehicle carrier applications, the odometer input creates a forward constraint on the carrier for the combined navigation system, increasing the observability of the combined filtering and improving the speed, position and heading accuracy by about 20% to 30% for further accuracy improvement. The ADR function is currently under development.

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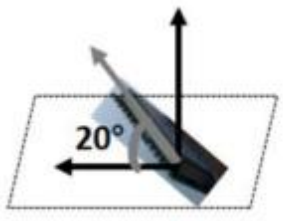
2.8 Fast online calibration

The zero bias of inertial devices is one of the main error sources of the combined navigation system, and the power-up repeatability of low-cost MEMS sensors cannot be compared with that of traditional liquid-float, mechanical, or optical inertial devices, and the difference in zero bias after each power-up is so large that it is not possible or meaningful to accomplish it by using the offline rotary table calibration method. Therefore, the MS34SNA adopts the online calibration technique, i.e., estimating the zero bias with the help of the gravity field information and the one-dimensional Kalman filtering technique after each power-up, and accelerating the convergence of the filters by using the satellite navigation information. The fast on-line calibration of the MS34SNA does not require special trajectories or curves in the form of carriers, and the calibration can be done under normal driving or riding conditions, thus allowing the system to enter the combined navigation state. In addition, since the module accepts a free angle mounting, the zero bias will be coupled to the gravity field projection, and the fast calibration technique also includes this decoupling process.

2.9 Free installation

The MS34SNA does not require a mounting position in the carrier and can be freely mounted in 360 degrees. An adaptive algorithm automatically recognizes and filters the estimated mounting error angle and compensates for it in the basic inertial guidance derivation equation. However, in order to maintain the optimal performance of the system, it is recommended that the angle between the module and the carrier in the pitch direction is less than 20 degrees when the installation is complete (front and rear directions are not required), thus ensuring that the mathematical model of small-angle linearization is valid as much as possible, i.e., try to avoid the installation as shown in the figure below.



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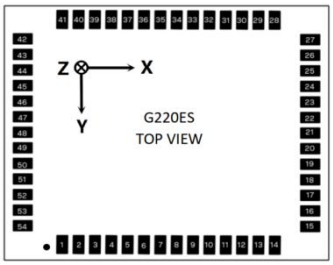
Please note that although the MS34SNA can be mounted freely, due to the inertial navigation characteristics, the module must be used in conjunction with the carrier, so please make sure that the module is mounted tightly and does not move or shake in order to ensure the performance of the module during use.

The program factory defaults to the X-axis as the vehicle's direction of travel.



2.10 MEMS Sensors and GNSS Raw Data Outputs

MS34SNA provides raw data output of gyro and accelerometer RAW DATA at 50Hz; MS34SNA also provides raw satellite navigation observations from base and mobile stations at 1Hz; contact support team for specific data output protocols; raw data output is non-standard and requires customization.

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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	500	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]	200	mA
ICCRX2 [1]	tracking stage	VCC [2]	160	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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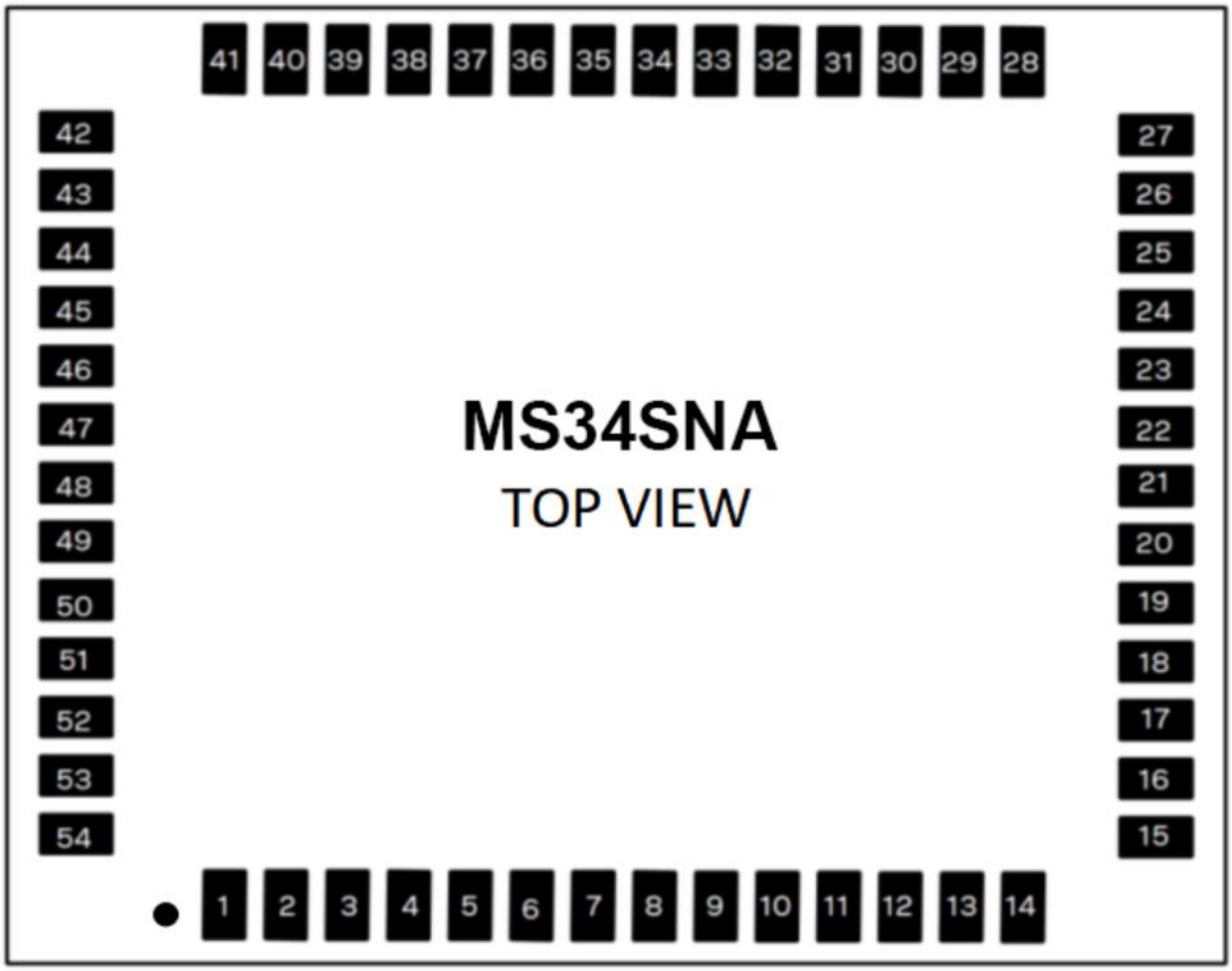
4 Package Definition

4.1 Module Pin Definitions

The MS34SNA is available in a 22*17mm， LGA-54pin package and is defined as follows:



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serial number	name (of a thing)	I/O	descriptive
2	RF_IN	I	Antenna Signal Input
7	VCC_RF	I	RF antenna power supply 3.3V
11	SDIO_D2	I/O	SDIO data line, 1.8V logic level
13	SDIO_CLK	I	SDIO data line, 1.8V logic level
15	SDIO_D1	I/O	SDIO data line, 1.8V logic level
16	SDIO_D3	I/O	SDIO data line, 1.8V logic level
17	SDIO_D0	I/O	SDIO data line, 1.8V logic level
18	SDIO_CMD	I/O	SDIO data line, 1.8V logic level
26	RXD2	I	Differential Data, AT Command, FOTA Upgrade
27	TXD2	O	NMEA-0183 , Base Station Mode RTCM3 Differential Outputs
33	VCC	I	main power
34	VCC	I	Main power supply, recommended two-way power supply, system stability
39	USB_DM	I/O	USB Differential to Negative
40	USB_DP	I/O	USB Differential Pair Positive
42	TXD1	O	Main serial port (same function as UART1_TXD)
43	RXD1	I	Differential Data, AT Command, FOTA Upgrade
49	RST_N	I	reset
53	1PPS	O	time pulse
	GND		Grounding, PIN 1/3/12/32/37/41/48

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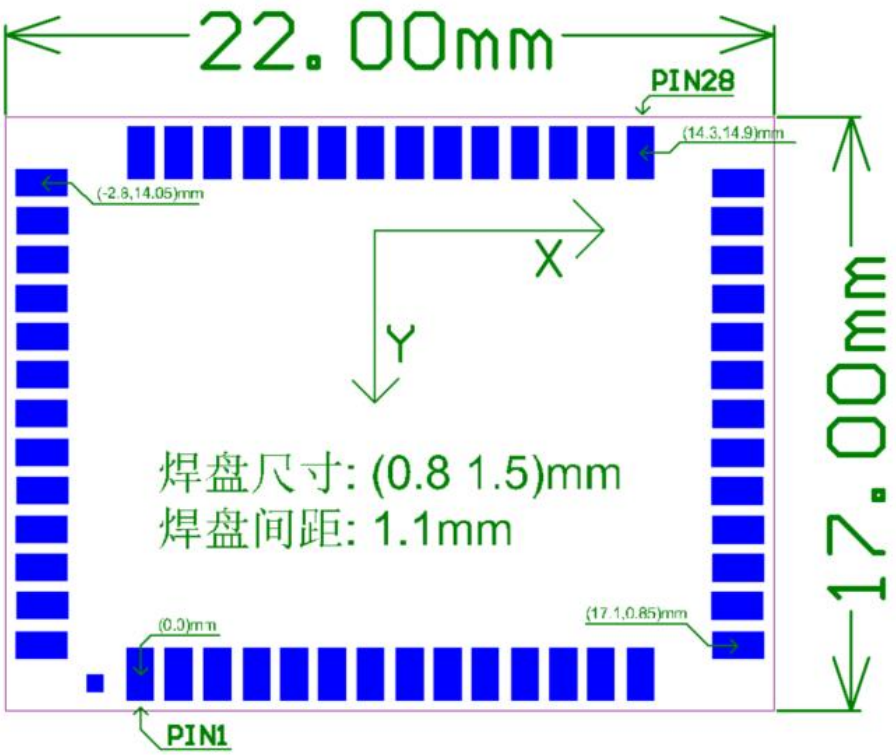
4.2 Mechanical dimensions



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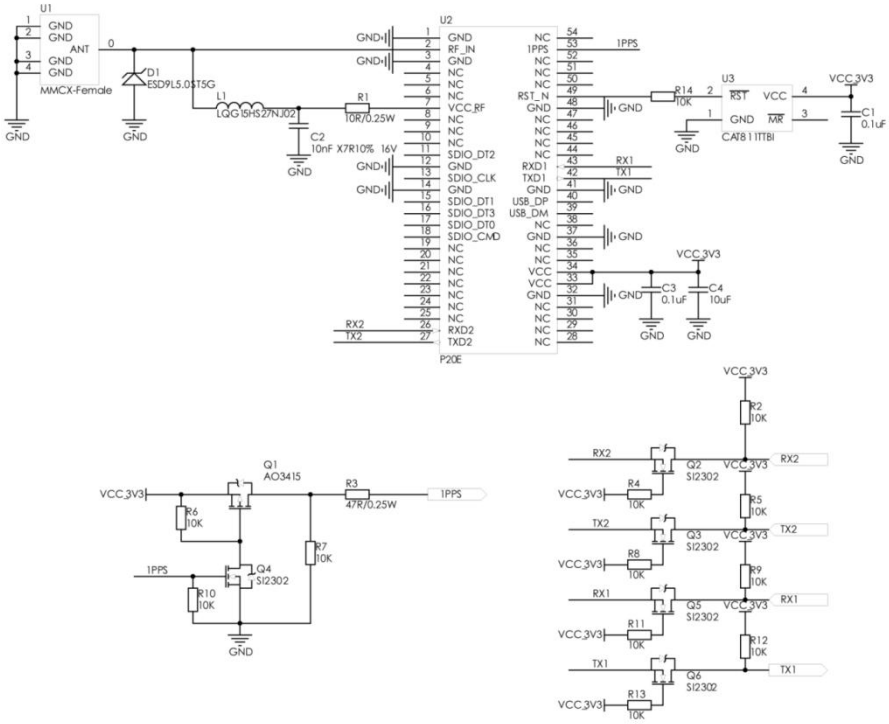
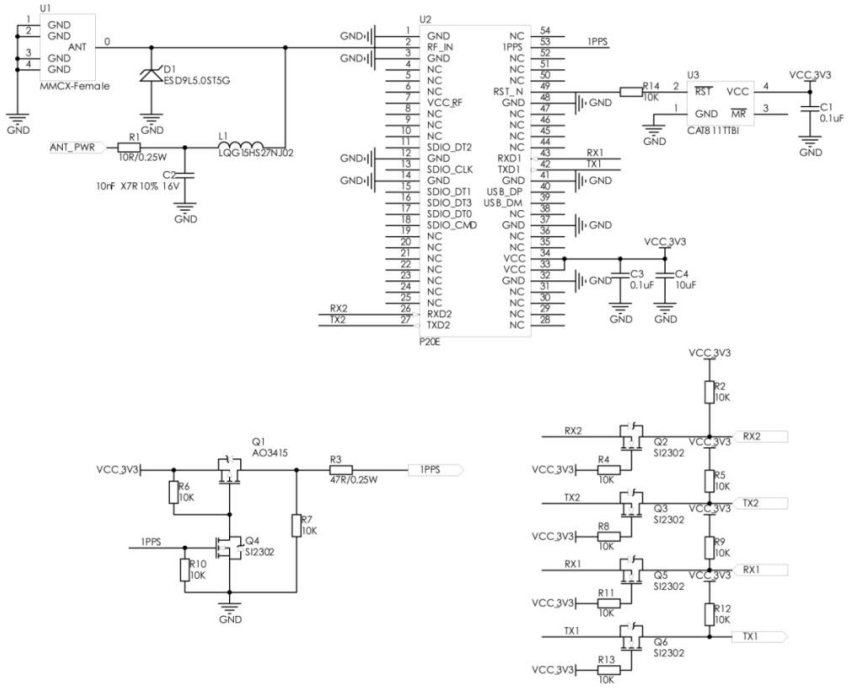
5 reference design

5.1 schematic design

The application schematic of the MS34SNA using a module to power the antenna (internal power supply) is shown below:



Of course, the high-precision antenna can be externally powered. When the antenna is externally powered, the reference schematic is as:



follows:

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5.2 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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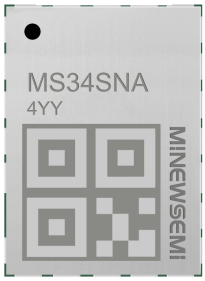
6 Packaging and Protection

6.1 wrap

The MS34SNA 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

6.2 Carrier belts and trays

The MS34SNA 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 disassembly.

6.3 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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6.4 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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7 Ordering Information

7.1 Ordering Model

Ordering Model	Pseudolaric acid	Default Baud Rate	characterization	Default satellite reception frequency	physical interface
MS34SNA	GNSS Module	115200	Dual-frequency RTK+INS	GPS/BDS/GLO/GAL/QZSS L1+L5 five stars and ten frequencies	22*17, LGA54

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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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