MINEWSEMI

GNSS Module

MS32SN1

DataSheet

V 1.1.0

Applicable Product Model
MS32SN1

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Version Note

Version	Details	Contributor(s)	Date	Notes
1.0.0	First edit	Coral	2020.05.21	
1.1.0	Layout Changes	Michelle	2023.08.30	

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1 Product Introduction

1.1 General description

The MS32SN1 is a complete GPS module featuring high sensitivity, low power consumption and small size. When a GPS signal is applied to the module's antenna input, it carries a complete message containing position, speed and time information, which is output through the serial port via the NMEA protocol or a customized protocol. Based on the high-performance features of MediaTek's MT3337 microcontroller architecture, the MS32SN1's -165dBm tracking sensitivity greatly expands its positioning coverage, allowing the MS32SN1 to operate normally where ordinary GPS receiver modules cannot locate, such as under narrow urban skies and in dense jungle environments. The small size and low power consumption make the module easy to integrate into portable devices such as PNDs, car loggers, trackers and vehicle navigation systems.

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1.2 Key Parameter

MS32SN1 Parameter	
Type of reception	GPS, QZSS L1 band, C/A code, 22 tracking channels / 66 capture channels
(level of) sensitivity	Tracking:-165dBm; Capture:-148dBm
accuracy	Positional accuracy: 3.0m CEP50% without SA (standard open sky) Velocity accuracy: 0.1m/s without SA Time Precision (PPS): 10ns RMS
positioning time	Cold start: 28s (open sky) Hot start: 1s Recapture: <1s
AGPS Assist	Average 10 seconds
power wastage	Tracking Phase: 18mA @3.3V Standard Capture phase: 21mA @3.3V
refresh rate	Maximum 10Hz; default 1Hz
operating parameter	Altitude: Maximum 18,000m Speed: Maximum 515m/s Acceleration: less than 4g

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2 Technical Information

2.1 Supported Constellations

The MinewSemi MS32SN1 supports the GPS and QZSS satellite constellations with a reception frequency of 1575.42 MHz.

2.2 AGPS2(Assisted GPS: Assisted Global Positioning System)

The MinewSemi MS32SN1 supports three AGPS acceleration solutions: EPO ™ , AlwaysLocate™, and EASY™.

2.3 EPOTM (Earth Parking Orbit Technology)

EPO™ provides predictive orbital data to accelerate TTFF (Time To First Fix). In case of insufficient satellite navigation information or weak signals, the user can download EPO data from an FTP server to the GPS engine via the Internet or wireless network, and the GPS engine will use the EPO data to assist in position calculation.

2.4 AlwaysLocate™ (power-saving technology)

AlwaysLocateTM is a cycle mode intelligent control technology. Depending on the environment and motion conditions, the GNSS module can adaptively adjust the working/standby time to achieve a balance between positioning accuracy and power consumption. In this mode, the host CPU does not need to control the GNSS module until the host CPU needs GPS position data.

2.5 EASY™ (orbit prediction technology)

EASY™ is an embedded aid for fast positioning, the GPS engine will automatically calculate and predict ephemeris data (up to 3 days) when power is applied and save

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the predicted information to memory, this feature will help in positioning and TTFF improvement in indoor or urban conditions using a backup power supply (V_backup) if there is not enough satellite positioning information available.

2.6 Quasi-Zenith Satellites (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 and L5 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.

2.7 crystal oscillator

The MS32SN1 uses TCXO to allow weak signal acquisition, resulting in faster start-up and re-acquisition times.TCXO allows the product to ensure that it is stable and immune to frequency interference over its entire operating range (-40° to + 85°C), making it a reliable positioning module for positioning.

2.8 real time clock

The RTC is driven by a 32 kHz oscillator using an RTC crystal. If the mains voltage fails, some parts of the receiver will shut down, but the RTC will still operate to provide a timing reference for the receiver. This mode of operation is called "Hardware Backup Mode" and allows all relevant data to be saved in backup RAM for later hot start.

2.9 Power supply mode

The MS32SN1 has a built-in automatic power saving function that minimizes power consumption for a given period of time. The receiver can be operated in two separate modes: high performance continuous operation mode, and power saving mode.

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2.10 standby mode

The user can place the GNSS module in standby mode via a software command with a power consumption of less than 200uA. This GNSS module will wake up after receiving any command.

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3 Electrical Specification

3.1 Absolute maximum rating

parameters	markings	average value	maximum values	unit (of measure)
electricity supply				
Supply Voltage	VCC	-0.3	4.3	V
input leg				
Input Voltage	VIO	-0.3	3.6	V
Backup Battery Voltage	V_BCKP	-0.3	4.3	V
RF power input	RF_IN		-40	dBm
Human exposure to static electricity	RF_IN		2000	V
Anti-static capability	RF_IN		100	V
matrix				
Storage temperature	Tstg	-40	125	°C
Peak reflow temperature <10s	Tpeak		260	°C

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.

3.2 Electrical parameters

parameters	markings	descriptive	minimum value	average value	maximum values	unit (of measure)

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Supply Voltage	VCC		3	3.3	4.2	V
Backup Battery Voltage	V_BCKP		2	3.3	4.2	V
Supply Voltage Ripple	VCC_PP	VCC=3.3V			30	mV
Supply Current - Capture	Icc	VCC=3.3V		24		mA
Supply Current - Tracking	Icc	VCC=3.3V		18		mA
Supply Current - Backup Mode	Ibckp	VCC=3.3V		7		uA
VCC_RF Antenna bias power supply	VCC_RF			VCC		V
Input High Level	VIH		2		3.6	V
Input Low Level	VIL		-0.3		0.8	V
Output High Level	VOH		2.4		3.1	V
Output Low Level	VOL		-0.3		0.4	V
operating temperature	Topr		-40		85	℃

All specifications are made at an ambient temperature of 25°C. 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 only. 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 Pin Information

4.1 Pin assignment

The MS32SN1 is available in a 10.1*9.7mm, LGA-18pin package and is defined as follows:

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pin number	Pin Name	I/O	descriptive	note
1	GND	G	earth (wire)	GND
2	TXD	O	UART Serial Data Output	If not in use, leave it hanging
3	RXD	I	UART Serial Data Input	If not in use, leave it hanging
4	PPS	O	time pulse signal (TPS)	If not in use, leave it hanging
5	EXTINT	I	External Interrupt Configuration Pins	If not in use, leave it hanging
6	V_Backup	I	RTC and Backup SRAM Power Supply	Operating Range: 2.0V ~ 4.2V
7	NC			empty-handed
8	VCC	P	modular power supply	Operating range: 3.0V t~ 4.2V
9	RESET	I	Module reset (active low)	If not in use, leave it hanging
10	GND	G	earth (wire)	GND
11	RF_IN	I	GPS signal input	50Q@1.57542GHz, internal DC
12	GND	G	earth (wire)	GND
13	NC	O	.	If not in use, leave it hanging
14	VCC_RF	o	Active Antenna VCC Output	If not in use, leave it hanging
15	NC			empty-handed
16	NC			empty-handed
17	NC			empty-handed
18	NC			empty-handed

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5 Integration Guide

5.1 power supply

The MS32SN1 requires a regulated supply voltage. The supply voltage VCC is 3.0V ~ 4.2V, and the current shall not be less than 100mA. The power supply decoupling circuit shall provide proper decoupling. It can reduce the noise from the power supply and improve the stability of the power supply.

VCC current varies depending on processor load and satellite acquisition. The maximum peak VCC current during the position acquisition phase is approximately 25mA.

5.2 connection with high-ranking officials

The MS32SN1 has a built-in low noise figure LNA and SAW . It supports active or passive antennas connected to pin RF_IN. The gain of the active antenna should not exceed 25dB (typical value is 18~20dB). The maximum noise figure should not exceed 1.5dB and the output impedance is 50 ohms. To maintain ground integrity, it is recommended that no or as few wires as possible be routed under the module.

Note: Passive antennas minimize cable loss (<1dB).

5.3 serial port communication

TTL UART interface, data format: 1 start bit, 8 data bits, 1 stop bit, no parity bit, default baud rate is 9600 bps. after the module is normally powered on, the serial port will send NMEA data automatically. The host can set the module working mode and baud rate through the serial port. When the module is used in some specific application scenarios, the main power supply of the module may be turned off due to energy saving, thus further reducing power consumption.

In this case, in order to prevent the high level of the serial port from affecting the normal

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operation of the module, it is strongly recommended to disconnect the serial port connection at the same time as the main power supply is disconnected, or to set the serial port to the Input state + pull-down resistor or High impedance state + pull-down resistor state.

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5.4 Battery Backup

In the event of a pin VCC power failure, the real-time clock and backup RAM are provided via pin V_BCKP. This enables the MS32SN1 GPS module to recover from a power failure whether it is a hot start or a cold start (depending on the duration of the VCC power failure). If no battery backup is connected, the receiver powers up and cold starts.

The battery backup power supply V_BCKP typically produces 7uA of current in the backup state.

5.5 reset (a dislocated joint, an electronic device etc)

The MS32SN1 module has a RESET pin.The RESET pin is active low and drives a hardware reset of the system. RESET is an input only and does not reset the external circuitry. It forces a reset when VCC drops below 2.7V during a power failure.

Note: If not used, keep RESET unconnected (dangling).

5.6 PPS signal

The PPS signal (1-second pulse) is an electrical signal by which the start of a 1-second signal can be accurately known.The accuracy of the PPS signal ranges from 10 ns.The PPS signal can be used for precise timing and time measurement.

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6 software protocol

6.1 NMEA0183 protocol

The NMEA protocol is an ASCII-based protocol where records begin with a $ and start with a carriage return/line feed.

GPS-specific messages all begin with $GPxxx, where xxx is the three-letter identifier of the message data that follows.NMEA messages have checksums that can be used to detect corrupted data transmissions.The MS32SN1 supports the following NMEA-0183 messages:

NMEA records	descriptive	default (setting)
GGA	Global Positioning System (GPS) fixed data	Y
GLL	Geographic location - latitude/longitude	Y
GSA	GNSS DOP and active satellites	Y
GSV	GNSS visual satellite information	Y
RMC	Recommended minimum specific GNSS data	Y
VTG	Passing ground heading and ground speed	Y

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6.2 Common Commands

CMD TYPE	CMD Example
Hot Restart	$PMTK101*32<CR><LF>
Warm Restart	$PMTK102*31<CR><LF>
Cold Restart	$PMTK103*30<CR><LF>
Full Cold Restart	$PMTK104*37<CR><LF>
System Sleep Mode	$PMTK161,1*29<CR><LF>
System Wake up	$PMTK161,0*28<CR><LF>.
Set baud rate	$PMTK251,baudrate*CRC<CR><LF>

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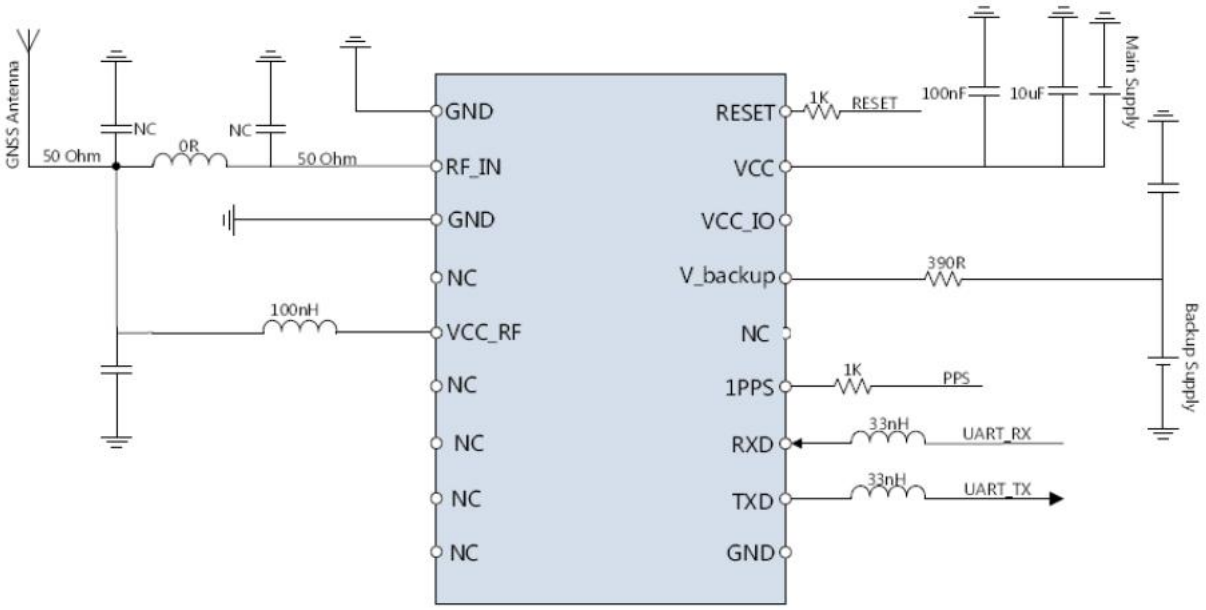
7 reference design

7.1 schematic design

The reference design of the MS31SN1 is shown below. When connecting an active antenna, please make sure the 100nH inductor is in the SMD state for powering the active antenna; when connecting a passive antenna, the 100nH inductor is not required.

The characteristic impedance from the RF_IN pin to the antenna connector is 50 Ω.

RESET can be left dangling due to the MS32SN1 power-on self-reset.



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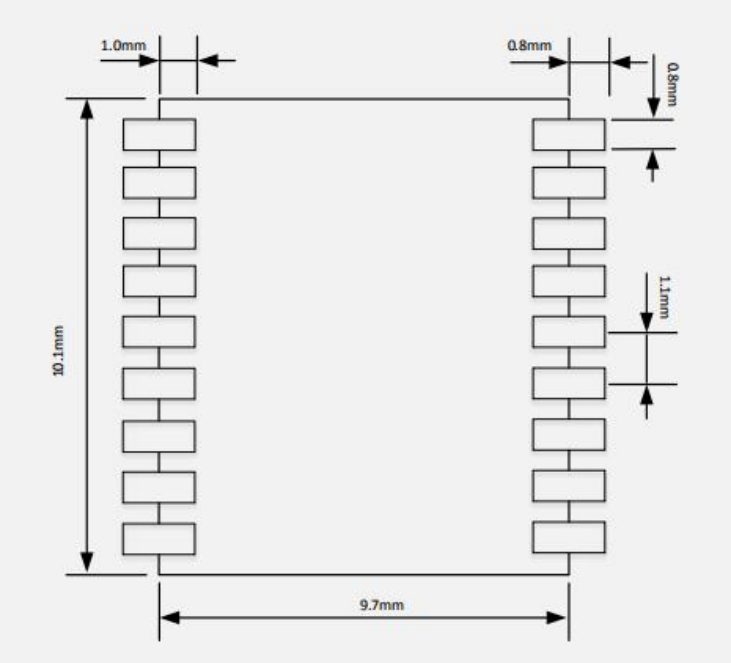
7.2 PCB Package Reference

The package reference recommendations for the MS32SN1 are as follows:



7.3 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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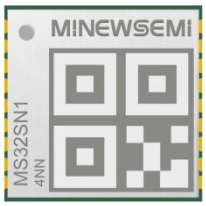
8 Packaging and Protection

8.1 wrap

The MS32SN1 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)	1500pcs/roll	1 roll/bag	1 bag/box, 3 boxes/ctn

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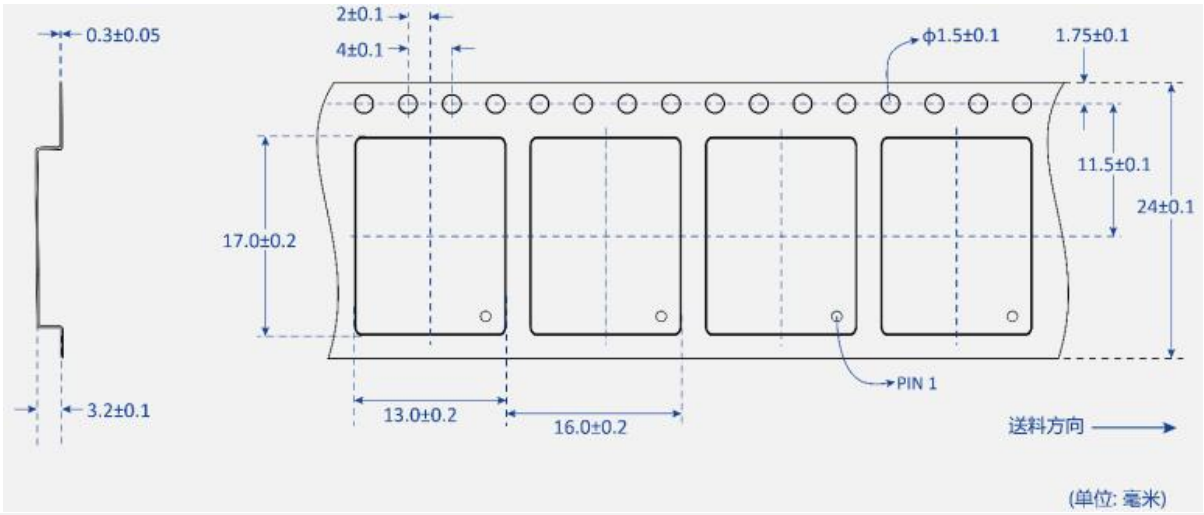
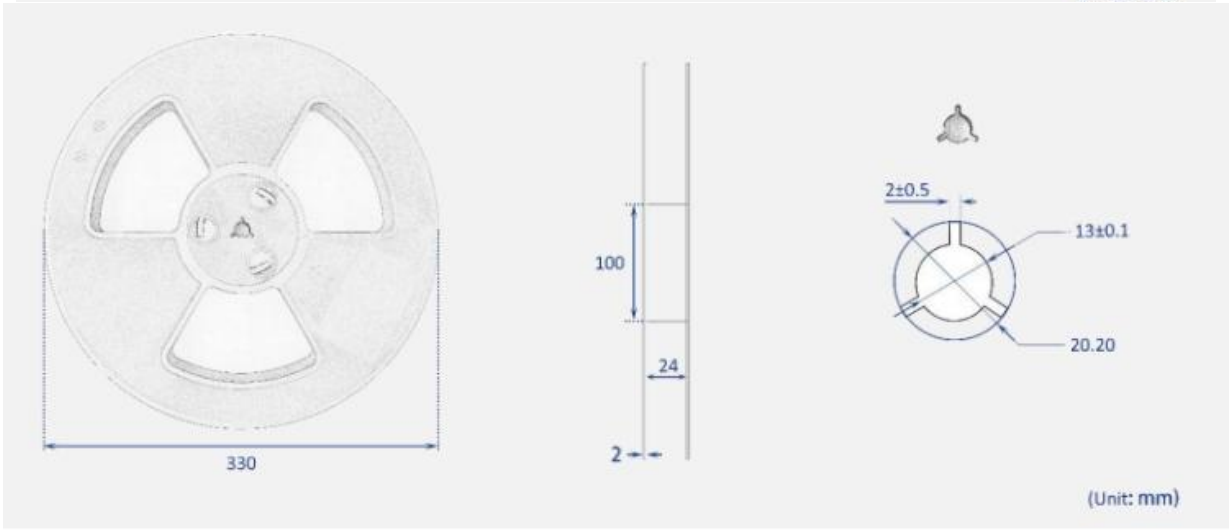
8.2 Tape and Reel

MS32SN1 adopts the method of reel (consisting of tape and reel), and is packed in sealed bag with anti-static effect to meet the needs of customers for efficient production, batch installation and disassembly. The picture below shows the size details of the tape.





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8.3 Storage

In order to prevent the product from being damp and electrostatic discharge, a desiccant and a humidity indicator card are attached in the sealed packaging bag of the product. The user can know the humidity condition of the environment where the product is located through the humidity indicator card. The moisture sensitivity level of the product is MSL3.

8.4 ESD protection

GNSS positioning modules contain highly sensitive electronics and are classified as electrostatic sensitive devices (ESD). Please pay attention to the following operation matters.

- If the following precautions are not followed, it may cause serious damage to the module!
- Do not touch any live capacitors and other devices when pulling out the RF pins (e.g. antenna patch ~10 pF; coaxial cable ~50 –80 pF/m; soldering iron);
- To prevent electrostatic discharge, do not expose the antenna area; if it is exposed due to design reasons, please take appropriate ESD protection measures and do not touch any exposed antenna area;
- When soldering RF connectors and antenna patches, please make sure to use an ESD safe soldering iron.
- Add an ESD diode to the RF input section and UART interface to prevent electrostatic discharge;

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9 Ordering Information

9.1 Order Part Number

Ordering Model	Pseudolaric acid	Default Baud Rate	Default refresh rate	Default satellite reception frequency	physical interface
MS32SN1	GNSS Module	9600	1Hz	GPS/QZSS L1 C/A	10.1*9.7mm, LGA18

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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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