E108-GN03B Series User Manual

BDS Chinese single-mode multi-frequency satellite positioning and navigation module



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1 Introduction

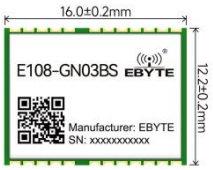
1.1 Brief Introduction

The E108-GN03B single Beidou series module is a high-performance positioning and navigation module based on the sixth-generation SOC single Beidou chip AT6668B of Zhongkewei. It applies the new navigation integrated SOC single-chip technology, which can meet the application of high-precision positioning and high-precision timing. It has the characteristics of high integration, high performance, low power consumption, and small size. It also supports Beidou-2 (B1I) and Beidou-3 (B1C) signals. This series of modules has three common packages and is compatible with the software and hardware interfaces of GNSS modules from other manufacturers. It can be used in vehicle navigation, wearable devices, mobile phones, IoT devices, drones and other application fields.

The E108-GN03B single Beidou series module is based on proprietary fast satellite search technology, which can quickly receive a large number of visible satellite signals, achieve fast and accurate positioning, and can significantly improve positioning performance in complex environments such as urban canyons; high integration High-performance embedded CPU, the maximum position update rate can reach 10Hz, suitable for highly dynamic applications that are sensitive to positioning delays; it integrates a proprietary anti-interference hardware acceleration circuit, which can quickly detect and suppress radio frequency interference. Among them, the E108-GN03BD model can power the RTC and backup RAM through a button battery or Farad capacitor to reduce the first positioning time. It also supports multiple ways to connect to other peripherals, and supports UART and GPIO interfaces. If you need I2C and SPI interfaces, please contact customer service for customization.



E108-GN03B



E108-GN03BS



E108-GN03BD

1.2 Features

- Domestic BDS single Beidou positioning and navigation module;
- Support BeiDou-2 and BeiDou-3 satellites;
- Support B1I/B1C frequency points;
- Support B1I or B1C independent positioning;
- Number of channels: 50 channels;
- Support A-BDS;
- The maximum positioning information update rate can reach 10Hz;
- Support PPS output;
- Support UART, GPIO interface;
- Support power management function;
- Typical power consumption during continuous operation: <42mA (@3.3V);
- Typical standby power consumption: <10uA (@3.3V);

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- Built-in antenna detection and antenna short circuit protection function;
- Output format: support NMEA0183V4.1 and previous versions;
- High sensitivity: cold start -148dBm, hot start -156dBm, recapture -160dBm, tracking -162dBm;
- The positioning chip has passed the single Beidou product certification;
- Compatible with software and hardware from other manufacturers, greatly reducing the user's development cycle;

1.3 Applications

- Vehicle positioning and navigation equipment;
- Wearable devices, such as location trackers;
- UAV positioning, industrial computers, etc.
- Industrial equipment that requires single Beidou BDS positioning or navigation;
- Portable devices such as mobile phones, tablets, etc.
- Asset tracking;

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2 Specification and parameter

2.1 Operating parameter

Main parameters	Performance			Remark
	Minimum	Typical Value	Maximum	
E108-GN03B operating voltage (V)	2.7	3.3	3.6	Over 3.6V may burn the module
E108-GN03BS operating voltage (V)	2.7	3.3	3.6	
E108-GN03BD operating voltage (V)	2.7	5.0	5.5	Over 5.5 V may burn the module
Communication level (V)		3.3		Except E108-GN03BD, use 5V TTL has the risk of burning out
Maximum Withstand ESD Level (V)	-	-	2000	HBM
Operating temperature (℃)	- 40	-	+85	Industrial-grade design
Storage temperature (℃)	- 40	-	+125	
Humidity (%RH)	5	-	-95	No condensation

2.2 Hardware Parameters

Main parameters	Describe	Remark
Baud rate (bps)	4800~115200	Default 115200
Data bits	8bit	-
Stop bits	1	-
Communication interface	UART	-
E108-GN03B packaging	SMD	-
E108-GN03BS packaging		-
E108-GN03BD package interface	6Pin terminal block, spacing 1.0mm	-
E108-GN03B Dimensions	9.7*10.5*2.4mm	±0.2mm
E108-GN03BS Dimensions	12.2*16.0*2.4mm	
E108-GN03BD Dimensions	20.0*22.0*7.8mm	
E108-GN03B Antenna Interface	Stamp Holes	-
E108-GN03BS Antenna Interface		-

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E108-GN03BD Antenna Interface		Ceramic Antenna	-
Communication Protocol		Support NMEA0183 V4.10 and previous versions	-
Positioning update rate		1Hz (default)	The maximum positioning update frequency can reach 10Hz
Supported positioning systems		BDS	BDS B1I, BDS B1C
Product Weight	E108-GN03B	0.5	±0.1g
	E108-GN03BS	0.9g	
	E108-GN03BD	7.9g	

2.3 BDS performance parameters

Category	Indicator	Typical Value	Unit
Positioning time (test condition 1)	Cold Start	≤23	s
	Hot Start	≤1	s
	Recapture	≤1	s
Sensitivity (Test Condition 2)	Cold Start	-148	dBm
	Hot Start	-156	dBm
	Recapture	-160	dBm
	track	-162	dBm
Accuracy (Test Condition 3)	Horizontal positioning accuracy (static)	<2.5	m
	Vertical positioning accuracy (static)	<3.0	m
	Speed positioning accuracy	<0.1	m/s
	Timing accuracy	30	ns
Power consumption (test condition 4)	E108-GN03B Capture Current	38	mA
	E108-GN03BS Capture Current	40	
	E108-GN03BD Capture Current	38	
	E108-GN03B Tracking Current	37	mA
	E108-GN03BS Tracking Current	40	
	E108-GN03BD Tracking Current	37	
	E108-GN03B Sleep Current	19	uA
	E108-GN03BS Sleep Current	20	
	E108-GN03BD Sleep Current	0.3	

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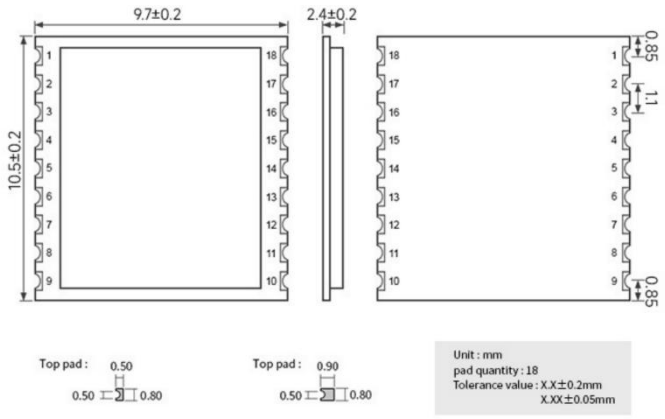
[Test condition 1] : The number of received satellites is greater than 6 , the signal strength of all satellites is -130dBm , the average value is taken after 10 tests , and the positioning error is less than 10 meters.
[Test Condition 2] : External LNA noise coefficient 0.8 , number of received satellites greater than 6 , received signal strength value under lock or no loss of lock conditions within 5 minutes.
[Test condition 3] : Open and unobstructed environment, 24 hours of continuous power-on test, 50% CEP .
[Test condition 4] : The number of received satellites is greater than 6 , and the signal strength of all satellites is -130dBm .

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3 Mechanical Dimensions and Pin Definition

3.1 E108-GN03B Pin Definition

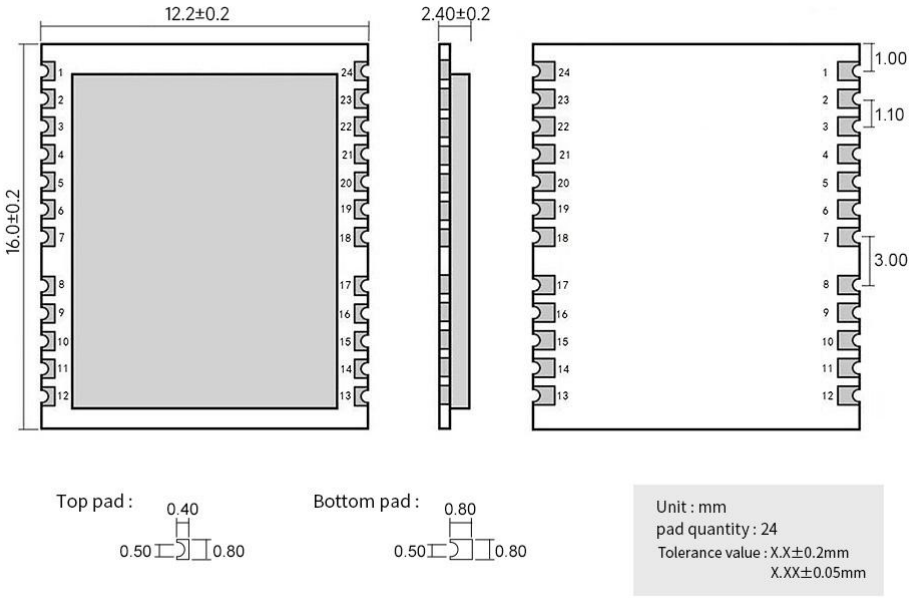


Pin number	Pin Name	Pin Direction	Pin Purpose
1	GND	-	Module Ground
2	TXD	Output	Serial port output, 3.3V level
3	RxD	enter	Serial port input, 3.3V level
4	1PPS	Output	1 Pulse Per Second
5	ON_OFF	enter	Sleep control pin, keep high level (internal pull-up) for normal operation, low level to enter sleep mode
6	V_BCKP	enter	RTC power supply, can charge external battery, internal series 100Ω resistor
7	NC	-	-
8	VCC	enter	Module power supply, power supply range: 2.7V-3.6V
9	RESET_N	enter	Reset pin, external reset input, internal pull-up, must be left floating if not used
10	GND	-	Module Ground
11	RF_IN	enter	Antenna interface
12	GND	-	Module Ground
13	ANT_ON	Output	Active antenna power supply control, for external active antenna switch control
14	VCC_RF	Output	RF power supply and detection, used to power active antennas (output power supply voltage equals VCC)
15	NC	-	-
16	NC	-	-
17	NC	-	-
18	MODEL_ SET	enter	Satellite system mode selection, high level or floating for BDS + GPS , low level for GPS + GLONASS

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3.2 E108-GN03BS Pin Definition



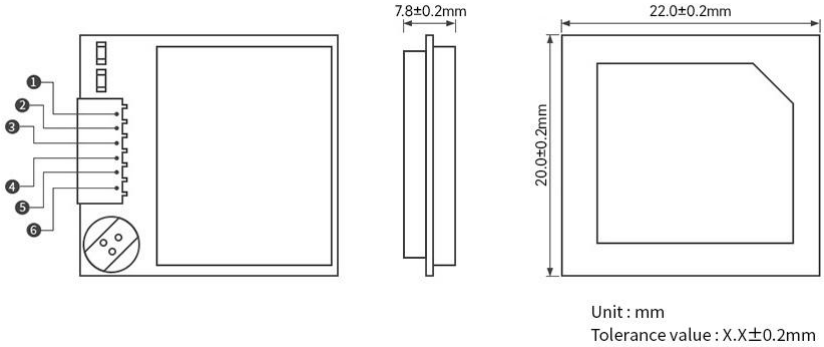
Pin number	Pin Name	Pin Direction	Pin Purpose
1	NC	-	-
2	MODEL_SET	enter	Satellite system mode selection, high level or floating for BDS + GPS , low level for GPS + GLONASS
3	1PPS	Output	1 Pulse Per Second
4	ON_OFF	enter	Sleep control, keep high level (internal pull-up) for normal operation, enter sleep mode at low level
5	NC	-	-
6	NC	-	-
7	NC	-	-
8	RESET_N	enter	Reset pin, external reset input, internal pull-up, must be left floating if not used
9	VCC_RF	Output	RF power output, used to power the active antenna (output power voltage equals VCC)
10	GND	-	Module Ground
11	RF_IN	enter	Antenna interface
12	GND	-	Module Ground
13	GND	-	Module Ground
14	ANT_ON	Output	Active antenna power supply control, for external active antenna switch control
15	NC	-	-
16	NC	-	-
17	NC	-	-
18	NC	-	-
19	NC	-	-
20	TXD	Output	Serial port output, 3.3V level
twenty one	RxD	enter	Serial port input, 3.3V level

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twenty two	V_BCKP	Input/Output	RTC power supply, can charge external battery, internal series 100Ω resistor
twenty three	VCC	enter	Power supply pin, power supply range: 2.7V-3.6V
twenty four	GND	-	Module Ground

3.3 E108-GN03BD Pin Definition



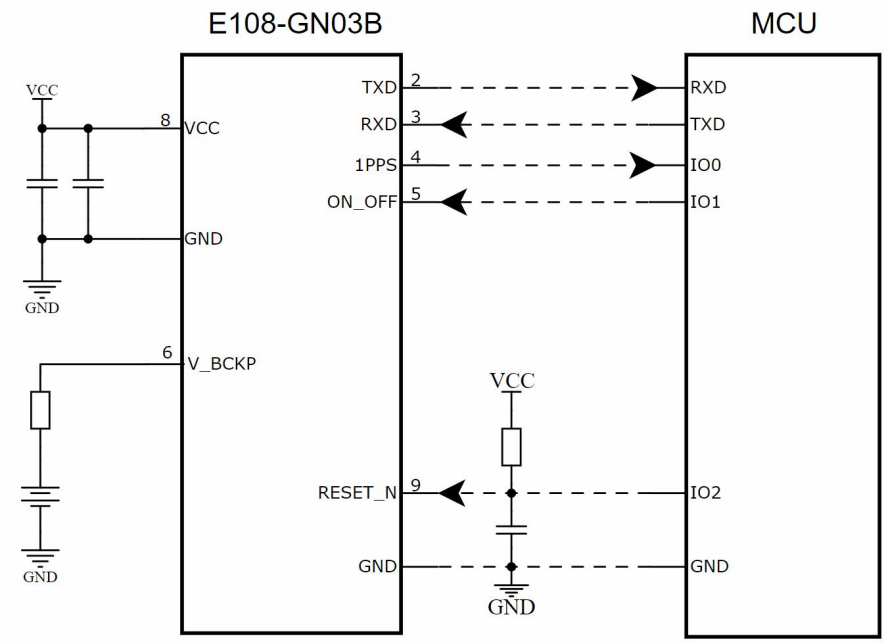
Pin number	Pin Name	Pin Direction	Pin Purpose
1	ON_OFF	enter	Sleep control, keep high level (internal pull-up) for normal operation, enter sleep mode at low level
2	1PPS	Output	1 Pulse Per Second
3	GND	-	Module Ground
4	TXD	Output	Serial port output, 3.3V level
5	RxD	enter	Serial port input, 3.3V level
6	VCC	enter	Module power supply, power supply range: 2.7V-5.5V

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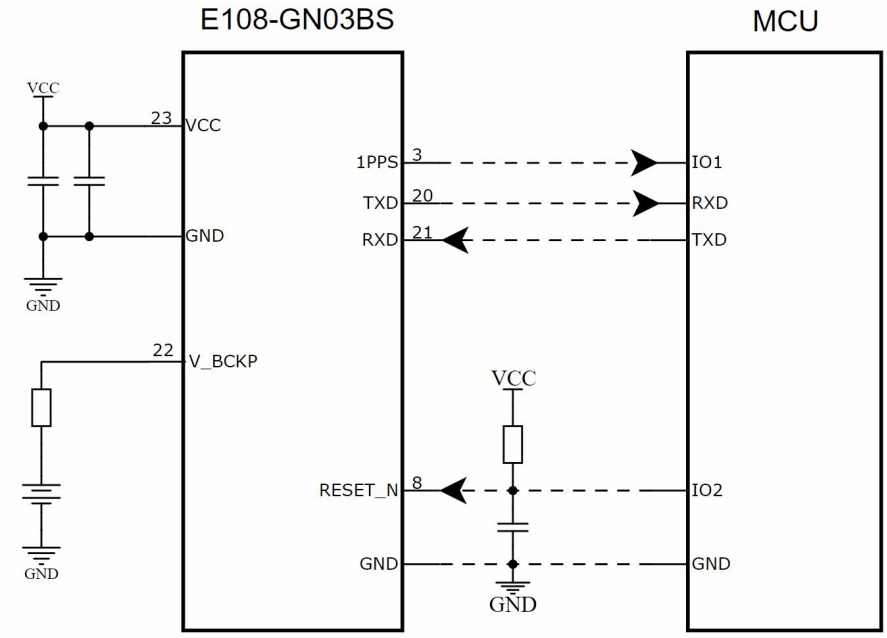
4 Recommended Connection Diagram

4.1 E108-GN03B



The battery charging current limiting resistor needs to be adjusted according to the battery parameters. A 200Ω resistor is connected in series inside the module.

4.2 E108-GN03BS

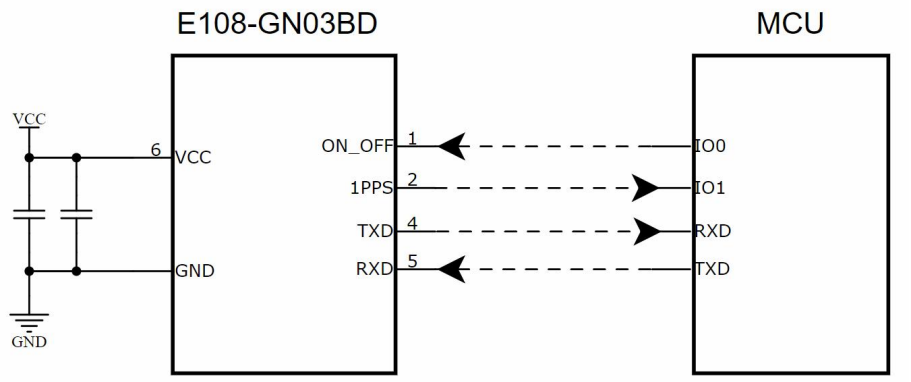


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The battery charging current limiting resistor needs to be adjusted according to the battery parameters. A 200Ω resistor is connected in series inside the module.

4.3 E108-GN03BD



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5 Hardware Design

- For the application schematic design of the module, please refer to E108-GN0 3 -TB-SCH or E108-GN0 3S -TB-SCH in the data package ;
- It is recommended to use a DC regulated power supply to power the module. The power ripple should not exceed 50mV, and the module needs to be reliably grounded.
- Please pay attention to the correct connection of the positive and negative poles of the power supply. Reverse connection may cause permanent damage to the module.
- Please check the power supply to ensure that it is within the recommended power supply voltage. If it exceeds the maximum value, the module will be permanently damaged.
- The serial port TXD and RXD are LVTTL level. If connected to a PC, RS232 level conversion is required. Users can use this serial port to receive positioning information data and software upgrades ;
- This module is a temperature-sensitive device. Drastic temperature changes will cause its performance to degrade. Keep it away from high-temperature airflow and high-power heating devices when using it .
- When designing the power supply circuit for the module, it is often recommended to retain more than 30% margin, which is conducive to long-term stable operation of the whole machine;
- The module should be kept as far away as possible from parts with large electromagnetic interference , such as power supplies, transformers, and high-frequency wiring. High-frequency digital wiring, high-frequency analog wiring, and power wiring must be kept away from under the module. If necessary, they must pass under the module .
- Assuming the module is soldered on the TopLayer, lay ground copper on the TopLayer of the module contact part (all copper is laid and well grounded), which must be close to the digital part of the module and routed on the BottomLayer;
- Assuming the module is soldered or placed on the TopLayer, it is also wrong to randomly route the wires on the BottomLayer or other layers, which will affect the module's spurious and receiving sensitivity to varying degrees;
- If there are devices with large electromagnetic interference around the module, it will also greatly affect the performance of the module. It is recommended to keep them away from the module according to the intensity of the interference. If possible, appropriate isolation and shielding can be performed.
- If there are traces with large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power traces), it will also greatly affect the performance of the module. It is recommended to keep them away from the module according to the intensity of the interference. If possible, appropriate isolation and shielding can be performed.
- The antenna installation structure has a great impact on the module performance. Make sure the antenna is exposed and preferably vertically upward;
- When the module is installed inside the case, you can use a high-quality antenna extension cable to extend the antenna to the outside of the case;
- The antenna must not be installed inside a metal shell, as this will greatly reduce the transmission distance.

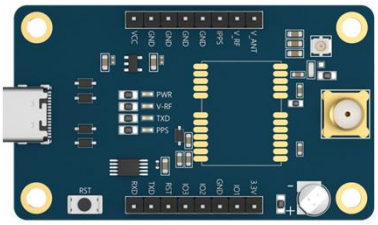
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6 E108-Product Testing

6.1 Serial Port Assistant

Testing is conducted based on E108-TB-01. Customers are required to purchase E108-GN03BS and perform the welding themselves before conducting the test. If there is no test board available, please refer to the board schematic diagram in the reference package (this testing content is applicable to the entire E108-GN03B series).



After connecting the GPS antenna, connect it to the computer via a USB cable. There is a USB port on the opposite side of the antenna on the board .

2. When using an active antenna, the two pins V_RF and V_ANT need to be short-circuited using a jumper cap.
3. You can open the serial port assistant to view the data reported by the serial port, or you can use GnssToolKit3 to view it.



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The baud rate is set to 9600bps and the serial port is opened, data will be reported continuously. The common output format is as follows:

GGA : time, position, number of satellites;

GSA : GPS receiver operation mode, satellites used for positioning, DOP value, positioning status;

GSV : visible GPS satellite information, elevation, azimuth, signal-to-noise ratio;

RMC : time, date, position, speed;

VTG : ground speed information (for detailed meaning, please refer to NMEA0183 protocol);

6.2 Run GnssToolKit3

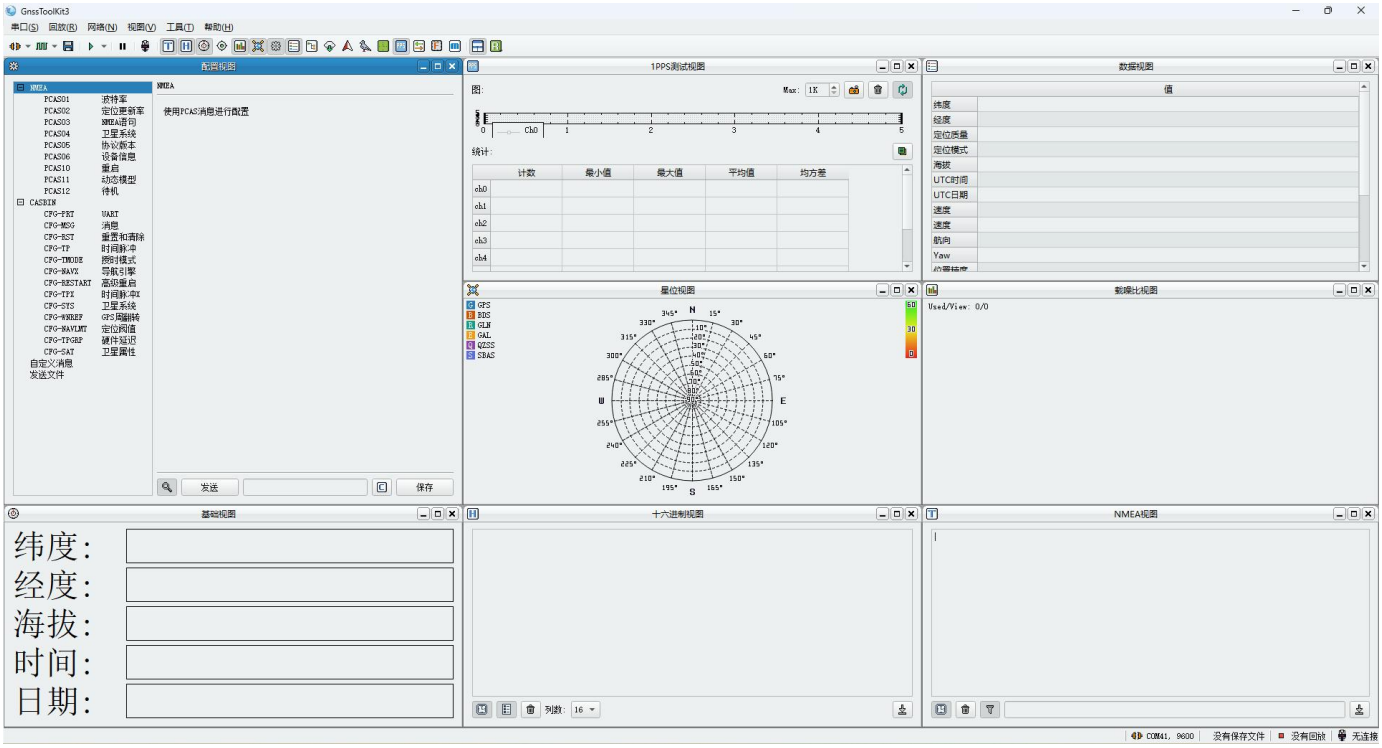
For ease of use, it is recommended to use the exclusive tool GnssToolKit3 for debugging. For detailed usage, see the "GnssToolKit3 User Manual" .

1. Run GnssToolKit3, as shown below :

2. Select the corresponding serial port and configure the baud rate . After the connection is successful, you can see the reported data in the NMEA window.

Note: For detailed meaning, please refer to the description in NMEA0183 protocol .

3. After successful positioning, you can get the longitude and latitude information in the $GPRMC field reported by the serial port. For more detailed tool usage information, please refer to the user manual in the tool kit.



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7 Instruction Format

7.1 NMEA Custom Messages

7.1.1 CAS01

Information	CAS01		
Describe	Set the serial communication baud rate		
Type	Enter		
Format	$PCAS01,br*CS<CR><LF>		
Example	$PCAS01,1*1D		
Parameter Description			
Fields	name	Format	Parameter Description
1	$PCAS01	String	Message ID, sentence header
2	br	number	Baud rate configuration: 0=4800bps 1=9600bps 2=19200bps 3=38400bps 4=57600bps 5=115200bps
3	CS	Hexadecimal value	Checksum, the XOR result of all characters between $ and * (excluding $ and *)
4	<CR><LF>	character	Carriage return and line feed

7.1.2 CAS02

Information	CAS02		
Describe	Set the positioning update rate.		
Type	enter		
Format	$PCAS02,fixInt*CS<CR><LF>		
Example	$PCAS02,1000*2E		
Parameter Description			
Fields	name	Format	Parameter Description
1	$PCAS02	String	Message ID, sentence header
2	fixInt	Numeric	Positioning update interval, in ms. 1000 = Update rate is 1Hz, outputting 1 positioning point per second 500 = Update rate 2Hz, output 2 positioning points per second 250 = Update rate is 4 Hz, outputting 4 positioning points per

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			second 200 = Update rate is 5 Hz, output 5 positioning points per second 100 = Update rate is 10 Hz, outputting 10 positioning points per second
3	CS	Hexadecimal value	Checksum, the XOR result of all characters between $ and * (excluding $ and *)
4	<CR><LF>	character	Carriage return and line feed

7.1.3 CAS03

Information	CAS03		
Describe	Set the NMEA sentence to output or stop output.		
Type	enter		
Format	$PCAS03,nGGA,nGLL,nGSA,nGSV,nRMC,nVTG,nZDA,nANT,nDHV,nLPS,res1,res2,nUTC,nGST,res3,res4,res5,nTIM*CS<CR><LF>		
Example	$PCAS03,1,1,1,1,1,1,1,1,1,0,0,,,1,1,,,,1*33		
Parameter Description			
Fields	name	Format	Parameter Description
1	$PCAS03	String	Message ID, sentence header
2	nG	Numeric	GGA output frequency, statement output frequency is based on positioning update rate n (0~9) means output once every n positioning times, 0 means no output If this statement is left blank, the original configuration will be retained.
3	nG	Numeric	GLL output frequency, same as nGGA
4	nG	Numeric	GSA output frequency, same as nGGA
5	nG	Numeric	GSV output frequency, same as nGGA
6	nR	Numeric	RMC output frequency, same as nGGA
7	nVTG	Numeric	VTG output frequency, same as nGGA
8	nD	Numeric	ZDA output frequency, same as nGGA
9	nANT	Numeric	ANT output frequency, same as nGGA
10	nDV	Numeric	DHV output frequency, same as nGGA
11	nLPS	Numeric	LPS output frequency, same as nGGA
12	res1	Numeric	reserve
13	res2	Numeric	reserve
14	UTC	Numeric	UTC output frequency, same as nGGA
15	nGST	Numeric	GST output frequency, same as nGST
16	res3	Numeric	reserve
17	res4	Numeric	reserve
18	res5	Numeric	reserve
19	nTIM	Numeric	TIM (PCAS60) output frequency, same as nGGA
20	CS	Hexadecimal value	Checksum, the XOR result of all characters between $ and *

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			(excluding $ and *)
21	<CR><LF>	character	Carriage return and line feed

7.1.4 CAS04

Information	CAS04		
Describe	Configure a working system.		
Type	enter		
Format	$PCAS04,mode*hh<CR><LF>		
Example	$PCAS04,3*1A Beidou and GPS dual mode $PCAS04,1*18 single GPS working mode $PCAS04,2*1B single Beidou working mode		
Parameter Description			
Fields	name	Format	Parameter Description
1	$PCAS04	String	Message ID, sentence header
2	mode	number	Working system configuration. For specific product models, the following parts are supported Configuration. 1 = GPS 2 = BDS 3=GPS+BDS 4=GLONASS 5=GPS+GLONASS 6=BDS+GLONASS 7=GPS+BDS+GLONASS Note: Since it is a single Beidou frequency band, data will be output when other parameters are set, but the data is meaningless.
3	CS	Hexadecimal value	Checksum, the XOR result of all characters between $ and * (excluding $ and *)
4	<CR><LF>	character	Carriage return and line feed

7.1.5 CAS05

Information	CAS05		
Describe	Set the NMEA protocol type selection. There are many protocol types for multi-mode navigation receivers, and the data protocol standards are also This receiver product can support multiple protocols *(optional configuration)* .		
Type	Enter		
Format	$PCAS05,ver*CS<CR><LF>		
Example	$PCAS05,1*19		
Parameter Description			
Fields	Name	Format	Parameter Description

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1	$PCAS05	String	Message ID, sentence header
2	mode	number	NMEA protocol type selection (Note [1])
3	CS	Hexadecimal value	Checksum, the XOR result of all characters between $ and * (excluding $ and *)
4	<CR><LF>	character	Carriage return and line feed
Note [1] NMEA protocol type selection			
2	Compatible with NMEA 4.1 and above . (Default, no need to change)		
5	Compatible with BDS/GPS dual-mode protocol of China Transportation Information Center, compatible with NMEA 2.3 and above, compatible with NMEA4.0 protocol .		
9	Compatible with single GPS NMEA0183 protocol and NMEA 2.2 version . (Single Beidou does not support this item)		

7.1.6 CAS06

Information	CAS06		
Describe	Query product information		
Type	enter		
Format	$PCAS06,info*CS		
Example	$PCAS06,0*1B		
Parameter Description			
Fields	name	Format	Parameter Description
1	$PCAS06	String	Message ID, sentence header
2	info	number	Query the product information type. For information content, refer to 1.5.8. 0 = Query the firmware version number 1 = Query the hardware model and serial number 2 = Query the working mode of the multi-mode receiver 3 = Query the product customer number 5 = Query the upgrade code information
3	CS	Hexadecimal value	Checksum, the XOR result of all characters between $ and * (excluding $ and *)
4	<CR><LF>	character	Carriage return and line feed

7.1.7 CAS010

Information	CAS10
Describe	Receiver Restart
Type	enter
Format	$PCAS10,rs*CS
Example	$PCAS10,0*1C hot start $PCAS10,1*1D Warm start $PCAS10,2*1E Cold start $PCAS10,3*1F Factory start

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Parameter Description			
Fields	name	Format	Parameter Description
1	$PCAS10	String	Message ID, sentence header
2	rs	number	Startup mode configuration. 0 = Hot start. No initialization information is used, and all data in the backup storage is valid. 1 = Warm start. No initialization information is used, and the ephemeris is cleared. 2 = Cold start. No initialization information is used, and all data in the backup storage except the configuration is cleared. 3 = Factory start. Clear all data in the memory and reset the receiver to the factory default configuration.
3	CS	Hexadecimal value	Checksum, the XOR result of all characters between $ and * (excluding $ and *)
4	<CR><LF>	character	Carriage return and line feed

7.3 Support NMEA0183 protocol

GK9501 supports NMEA0183 V4.1 protocol and is compatible with previous versions. For detailed information about NMEA0183 V4.1, please refer to the official document of NMEA 0183 V4.1. Common output formats are as follows:

GGA: time, location, number of satellites

GSA: GPS receiver operation mode, satellites used for positioning, DOP value, positioning status

GSV: visible GPS satellite information, elevation, azimuth, signal-to-noise ratio RMC: time, date, position, speed

VTG: Ground speed information

7.3.1 Statement Identifiers

Identifier	Meaning
BD	BeiDou Navigation Satellite System (BDS)
GP	GPS
GL	GLONASS
GA	Galileo
GN	GNSS, Global Navigation Satellite System

7.3.2 GGA

$--GGA,hhmmss.ss,llll.ll,a,yyyyy.yy,a,x,xx,xx,xx,M,xx,M,xx,xxxx*hh

Sample data: $GPGGA,065545.789,2109.9551,N,12023.4047,E,1,9,0.85,18.1,M,8.0,M,,*5E

Name	Example	Unit	Describe
Message ID	$GPGGA		GGA protocol header
UTC time	065545.789		hhmmss.sss

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latitude	2109.9551		ddmm.mmmm
N/S Indication	N		N=North, S=South
longitude	12023.4047		ddddmm.mmmm
E/W indication	E		W=West, E=East
Positioning Instructions			0: Not positioned 1: SPS mode, positioning is valid 2: Differential, SPS mode, positioning valid 3:PPS mode, positioning is valid
Number of satellites	9		Range 0 to 12
HDOP	0.85		Horizontal accuracy
MSL Amplitude	18.1	rice	
unit	M	rice	
Earth	-2.2	rice	
unit	M		-
Differential Time	8.0	Second	Invalid when there is no DGPS
Differential ID	0000		
Checksum	*5E		
<CR><LF>			End of message

7.3.3 GSA

$--GSA,a,a,x,x,x,x,x,x,x,x,x,x,x,x,x,x,xx,xx,xx*hh

Sample data: $GPGSA,A,3,10,24,12,32,25,21,15,20,31,,,,1.25,0.85,0.91*04

Name	Example	Unit	Describe
Message ID	$GPGS		GSA protocol header
Mode 1	A		M = Manual, force 2D or 3D mode A=Automatic
Mode 2	3		1: Positioning invalid ; 2: 2D positioning ; 3: 3D positioning
Satellite use	10		Channel 1
Satellite use	twenty four		Channel 2
Satellite use	12		Channel 3
Satellite use	32		Channel 4
Satellite use	25		Channel 5
Satellite use	twenty one		Channel 6
Satellite use	15		Channel 7
Satellite use	20		Channel 8
...	...	...	...
Satellite use			Channel 12
PDOP	1.25		Position accuracy
HDOP	0.85		Horizontal accuracy

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VDOP	0.91		Vertical accuracy
Checksum	*04		
<CR><LF>			End of message

7.3.4 GSV

$--GSV,x,x,x,x,x,x,x,...*hh

Sample data:

$GPGSV,3,1,12,14,75,001,31,32,67,111,38,31,57,331,33,26,47,221,20*73

$GPGSV,3,2,12,25,38,041,29,29,30,097,32,193,26,176,35,22,23,301,30*47

$GPGSV,3,3,12,10,20,185,28,44,20,250,,16,17,217,21,03,14,315,*7D

Name	Example	Unit	Describe
Message ID	$GPGSV		GSV protocol header
Number of messages	3		Range 1 to 3
Message number	1		Range 1 to 3
Number of satellites	12		
Satellite ID	14		Range 1 to 32
Elevation	75	Spend	Max. 90°
Azimuth	001	Spend	Range 0 to 359°
Carrier to Noise Ratio (C/No)	31	dBHz	Range 0 to 99, empty if no trace is found
Satellite ID	32		Range 1 to 32
Elevation	67	Spend	Max. 90°
Azimuth	111	Spend	Range 0 to 359°
Carrier to Noise Ratio (C/No)	38	dBHz	Range 0 to 99, empty if no trace is found
Satellite ID	31		Range 1 to 32
Elevation	57	Spend	Max. 90°
Azimuth	331	Spend	Range 0 to 359°
Carrier to Noise Ratio (C/No)	33	dBHz	Range 0 to 99, empty if no trace is found
Satellite ID	26		Range 1 to 32
Elevation	47	Spend	Max. 90°
Azimuth	221	Spend	Range 0 to 359°
Carrier to Noise Ratio (C/No)	20	dBHz	Range 0 to 99, empty if no trace is found
Checksum	*73		
<CR><LF>			End of message

7.3.5 RMC

$--RMC,hhmmss.ss,A,llll.ll,a,yyyyy.yy,a,xx,xx,xxxx,xx,a*hhSample data:

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$GPRMC,100646.000,A,3109.9704,N,12123.4219,E,0.257,335.62,291216,,,A*59

Name	Example	Unit	Describe
Message ID	$GPRMC		RMC protocol header
UTC time	100646.000		hhmmss.ss
state	A		A = data is valid; V = data is invalid
latitude	2109.9704		ddmm.mmmm
N/S Indication	N		N=North, S=South
longitude	11123.4219		ddddmm.mmmm
E/W indication	E		W=West, E=East
Ground speed	0.257	Knot	
position	335.62	Spend	
date	291216		ddmmyy
Magnetic variables			-
Checksum	*59		
<CR><LF>			End of message

7.3.6 VTG

$--VTG,xx,T,xx,M,xx,N,xx,K*hh

Sample data: $GPVTG,335.62,T,,M,0.257,N,0.477,K,A*38

Name	Example	Unit	Describe
Message ID	$GPVTG		VTG protocol header
position	335.62	Spend	
refer to	T		True
position	335.62	Spend	
refer to	M		Magnetic
speed	0.257	Knot	
unit	N		Festival
speed	0.477	km/h	
unit	K		km/h
unit	A		Positioning system mode indication: A—autonomous mode; D—differential mode; E—Estimation (dead reckoning) mode; M—Manual input mode; S—Simulator mode; N—The data is invalid.
Checksum	*10		
<CR><LF>			End of message

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8 FAQ

8.1 Communication range is too short

- The communication distance will be affected when obstacle exists;
- Data lose rate will be affected by temperature, humidity and co-channel interference;
- The ground will absorb and reflect wireless radio wave, so the performance will be poor when testing near ground;
- Sea water has great ability in absorbing wireless radio wave, so performance will be poor when testing near the sea;
- The signal will be affected when the antenna is near metal object or put in a metal case;
- Power register was set incorrectly, air data rate is set as too high (the higher the air data rate, the shorter the distance);
- The power supply low voltage under room temperature is lower than 2.5V, the lower the voltage, the lower the transmitting power;
- Due to antenna quality or poor matching between antenna and module.

8.2 Module is easily damaged

- Please check the power supply source, ensure it is 2.0V~3.6V, voltage higher than 3.6V will damage the module;
- Please check the stability of power source, the voltage cannot fluctuate too much;
- Please make sure antistatic measure are taken when installing and using, high frequency devices have electrostatic susceptibility;
- Please ensure the humidity is within limited range, some parts are sensitive to humidity;
- Please avoid using modules under too high or too low temperature.

8.3 BER(Bit Error Rate) is high

- There are co-channel signal interference nearby, please be away from interference sources or modify frequency and channel to avoid interference;
- Poor power supply may cause messy code. Make sure that the power supply is reliable;
- The extension line and feeder quality are poor or too long, so the bit error rate is high.

9 Production guidance

9.1 Reflow Temperature

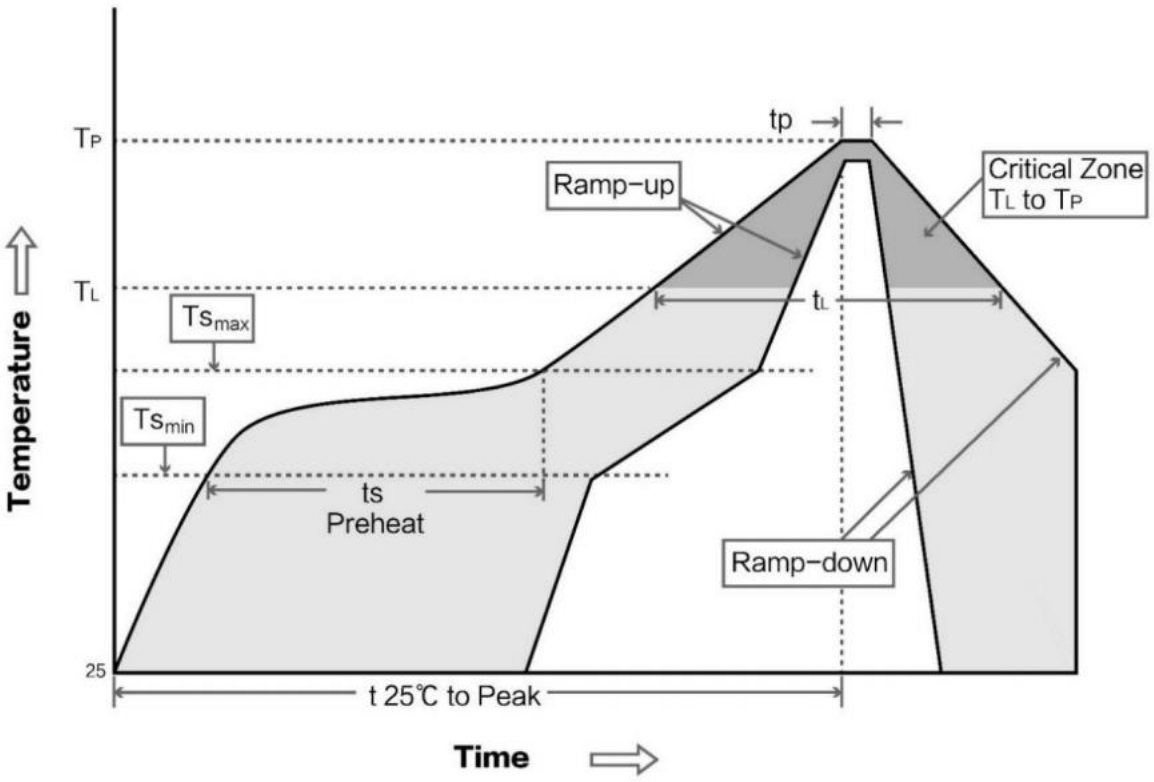
Profile Feature	Curve characteristics	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min(Tsmin)	Minimum preheating	100℃	150℃

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	temperature		
Preheat temperature max(Tsmax)	Maximum preheating temperature	150℃	200℃
Preheat Time(Tsmin to Tsmax)(ts)	Warm-up time	60-120 sec	60-120 sec
Average ramp-up rate(TsmaxtoTp)	Average ascent rate	3℃/second max	3℃/second max
Liquidous Temperature(TL)	Liquidus temperature	183℃	217℃
Time(tL)MaintainedAbove(TL)	Time above liquidus	60-90 sec	30-90 sec
Peak temperature(Tp)	Peak temperature	220-235℃	230-250℃
Aveage ramp-downrate(TptoTsmax)	Average descent rate	6℃/second max	6C/second max
Time 25° to peak temperature 25℃	Time to peak temperature	6 minutes max	8 minutes max

9.2 Reflow Oven Curve



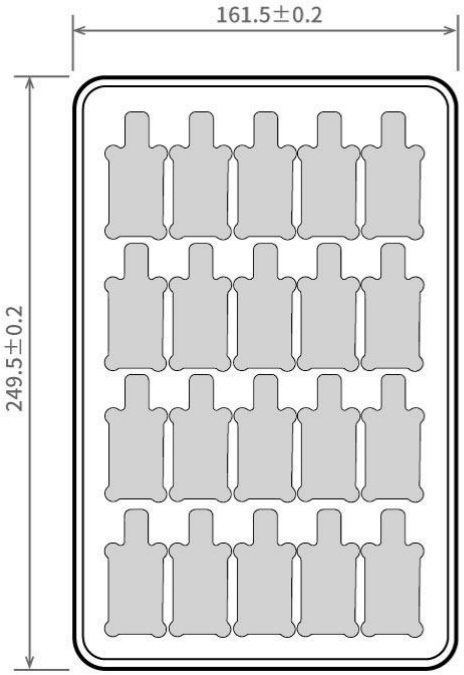
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10 Related Models

Product Model	Chip Solution	Support Satellite	Package	Product size mm	Communication Interface
E108-GN02	-	BDS/GPS/GLONASS	Patches	10.1*9.7*2.4	UART/GPIO
E108-GN02D	-	BDS/GPS/GLONASS	-	22*20* 7 .8	UART
E108-GN01	-	BDS/GPS/GLONASS	Patches	16*12*2.4	UART/GPIO
E108-GN03	AT6558R	BDS/GPS/GLONASS	Patches	9.7*10.5*2.4	UART/GPIO
E108-GN03S	AT6558R	BDS/GPS/GLONASS	Patches	12.2*16.0*2.4	UART/GPIO
E108-GN03D	AT6558R	BDS/GPS/GLONASS	-	20.0*22.0*7.8	UART
E108-GN04	-	BDS/GPS/GLONASS/GALILEO	SMD	9.7*10.5*2.4	UART/GPIO
E108-GN04S	-	BDS/GPS/GLONASS/GALILEO	SMD	12.2*16.0*2.4	UART/GPIO
E108-GN04D	-	BDS/GPS/GLONASS/GALILEO	-	20.0*22.0*7.8	UART

11 Bulk Packaging Methods





Unit: mm
Each Layer: 20 pcs
Each Package: 5 layers

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Revision history

Version	Revision Date	Revision Notes	Maintainer
V1.0	2024-11-14	First edition	Bin
V1.1	2025-02-08	Correct the model annotation of the recommended wiring diagram	Bin
V1.2	2025-11-28	Content revision	Bin

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