E108-GN03 Series User Manual

BDS/GPS/GLONASS MULTI-MODE SATELLITE POSITIONING AND NAVIGATION MODULE

Chengdu Ebyte Electronic Technology Co.,Ltd.

CONTENTS

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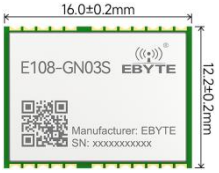
1 Product Overview

1.1 Introduction

The E108-GN03 series is a high-performance, highly integrated, low-power, low-cost multi-mode satellite positioning and navigation module based on the AT6558R solution. It supports BDS/GPS/GLONASS, has a small size and low power consumption, and can be used in GNSS positioning applications such as vehicle navigation, smart wearables, and drones. It also provides software and hardware interfaces compatible with other module manufacturers, greatly reducing the user's development cycle.

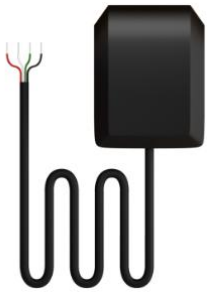
The module adopts the integrated design of RF baseband, integrating DCDC, LDO, RF front end, low power application processor, RAM, Flash storage, RTC and power management, etc. It can power RTC and backup RAM through button battery or farad capacitor to reduce the first positioning time. It also supports multiple ways to connect with other peripherals, supports UART, GPIO,RS232,RS485 interface, if you need I2C, SPI,USB interface, please contact customer service for customization.

E108-GN03



E108-GN03S

E108-GN03D



E108-GN03G-xxx

1.2 Features

- Supports BDS/GPS/GLONASS multi-system joint positioning and single-system independent positioning;
- Supports all BeiDou-2/3 satellites 1-63;
- Supports A-GNSS assisted positioning;
- The maximum positioning information update rate can reach 10Hz;
- Developed based on 32-bit RISC CPU;
- E108-GN03G series with shell, support IP67 waterproof;
- Supports PPS output;
- Built-in reset controller;
- Supports UART, GPIO,RS232,RS485 interface;
- With active antenna detection and protection;
- Supports power management function;
- Output format: support NMEA0183V4.1 and previous versions;
- High sensitivity: cold start -148dBm, hot start -156dBm, recapture -160dBm, tracking -162dBm;
- The software and hardware are compatible with those of other manufacturers, which greatly reduces the user's development cycle;

1.3 Application Scenario

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

2 Specifications

2.1 Working Parameters

The main parameters	Performance			Remark
	Minimum	Typical Value	Maximum	
E108-GN03 operating voltage (V)	2.7	3.3	3.6	Over 3.6V may burn the module
E108-GN03S operating voltage (V)	2.7	3.3	3.6	
E108-GN03D operating voltage (V)	2.7	5.0	5.5	Over 5.5 V may burn the module
E108-GN03G Series Operating Voltage (V)				
Communication level (V)		3.3		use 5V TTL has the risk of burning out
Operating temperature (℃)	- 40	-	+85	Industrial-grade design
humidity	5%	-	-95%RH	No condensation

2.2 Hardware Parameters

The main parameters	Describe	Remark
Baud rate (bps)	4800~115200	Default 9600
Data bits	8bit	-
Stop bits	1	-
E108-GN03 communication interface	UART	-
E108-GN03S communication interface		
E108-GN03D communication interface		
E108-GN03G-TTL communication interface		
E108-GN03G-232 communication interface	RS232	-
E108-GN03G-485 communication interface	RS485	-
E108-GN03 packaging	SMD	-
E108-GN03S packaging		-
E108-GN03 Dimensions	9.7*10.5*2.4mm	±0.2mm
E108-GN03S Dimensions	12.2*16.0*2.4mm	

E108-GN03D Dimensions		20.0*22.0*7.8mm	
E108-GN03G Series dimensions		50.4*38.4*17.0mm	
E108-GN03G series cable length		3000mm	±50mm
E108-GN03 Antenna Interface		Stamp Holes	-
E108-GN03S Antenna Interface			-
E108-GN03D Antenna Interface		Ceramic Antenna	-
E108-GN03G Series Antenna Interface			-
letter of agreement		Support NMEA0183 V4.10 and previous versions	-
Positioning update rate		1Hz	The maximum positioning update frequency can reach 10Hz
Supported positioning systems		BDS/GPS/GLONASS	BDS B1, GPS L1, GLONASS L1
product weight	E108-GN03	0.5	±0.1g
	E108-GN03S	0.9g	
	E108-GN03D	7.9g	
	E108-GN03G Series	65.2g	±2g

2.3 GPS performance parameters

Category	Indicator	Typical Value	Unit
Positioning time (test condition 1)	Cold start	≤32	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	<2.5	m
	Speed positioning accuracy	<0.1	m/s
	Timing accuracy	30	ns
Power consumption (test condition 4)	E108-GN03 Capture Current	25	mA
	E108-GN03S Capture Current	26	
	E108-GN03D Capture Current	24	
	E108-GN03G-TTL Capture Current	25	
	E108-GN03G-485 Capture Current	29	

	E108-GN03G-232 Capture Current	30	
	E108-GN03 Tracking Current	25	mA
	E108-GN03S Tracking Current	26	
	E108-GN03D Tracking Current	24	
	E108-GN03G-TTL Tracking Current	25	
	E108-GN03G-485 Tracking Current	29	
	E108-GN03G-232 Tracking Current	30	
	E108-GN03 Sleep Current	20	uA
	E108-GN03S Sleep Current	20	
	E108-GN03D Sleep Current	0.3	

Note: The above results are for GPS/ Beidou dual-mode working mode .

[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.

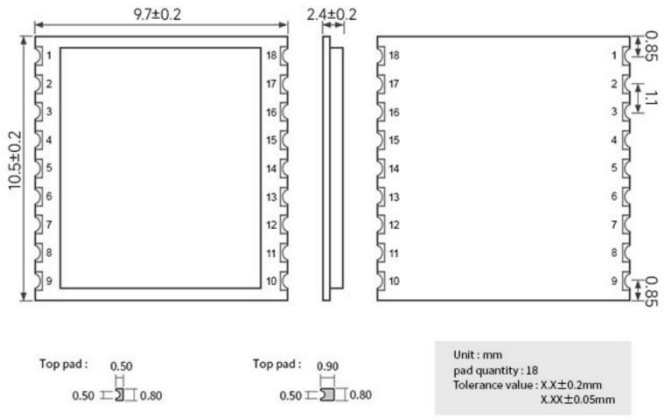
[Test Condition 2] : External LNA noise coefficient 0.8 , number of received satellites greater than 6 , received signal strength value under lock or no loss of lock conditions within 5 minutes.

[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 .

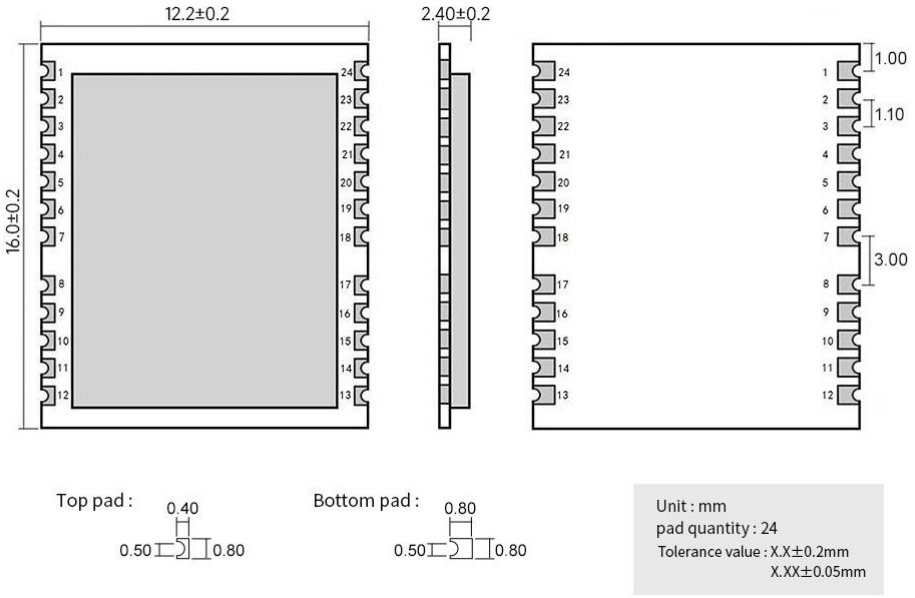
3 Mechanical dimensions and pin definition

3.1 E108-GN03 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	Input	Serial port input, 3.3V level
4	1PPS	Output	1 Pulse Per Second
5	ON_OFF	Input	Sleep control pin, keep high level (internal pull-up) for normal operation, low level to Input sleep mode
6	V_BCKP	Input	RTC power supply, can charge external battery, internal series 100Ω resistor
7	NC	-	-
8	VCC	Input	Module power supply, power supply range: 2.7V-3.6V
9	RESET_N	Input	Reset pin, external reset input, internal pull-up, must be left floating if not used
10	GND	-	Module Ground
11	RF_IN	Input	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	Input	Satellite system mode selection, high level or floating for BDS + GPS , low level for GPS + GLONASS

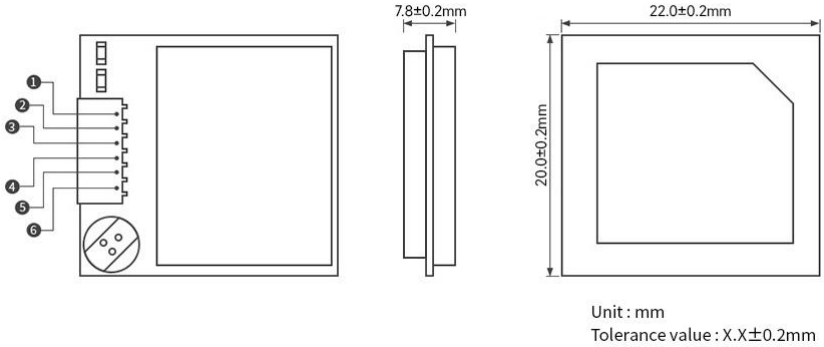
3.2 E108-GN03S Pin Definition



Pin number	Pin Name	Pin Direction	Pin Purpose
1	NC	-	-
2	MODEL_SET	Input	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	Input	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	Input	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	Input	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	Input	Serial port input, 3.3V level
twenty two	V_BCKP	input Output	RTC power supply, can charge external battery, internal series 100Ω resistor

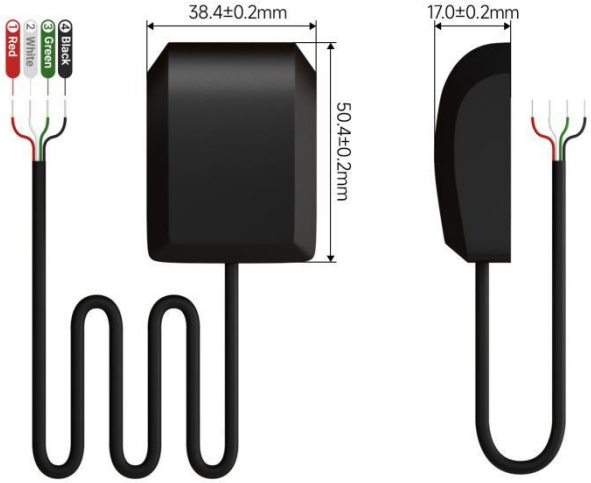
twenty three	VCC	Input	Power supply pin, power supply range: 2.7V-3.6V
twenty four	GND	-	Module Ground

3.3 E108-GN03D Pin Definition



Pin number	Pin Name	Pin Direction	Pin Purpose
1	ON_OFF	Input	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	Input	Serial port input, 3.3V level
6	VCC	Input	Module power supply, power supply range: 2.7V-5.5V

3.4 E108-GN03G Series Pin Definition

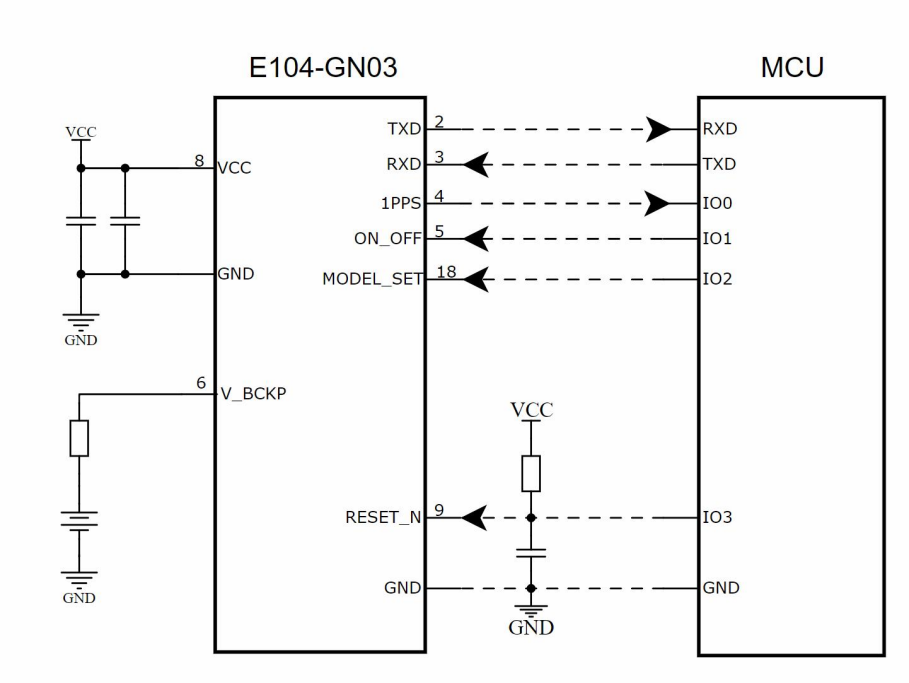


Pin number	Color of cable	Pin Name	Pin Direction	Pin Purpose
1	RED	VCC	-	Module power supply, power supply range: 2.7V-5.5V
2	WHITE	RXD/B	-	Serial input, 3.3V level /RS232 input /RS485-B line
3	GREEN	TXD/A	-	Serial output, 3.3V level /RS232 output /RS485-A line

4	BLACK	GND	-	Module Ground

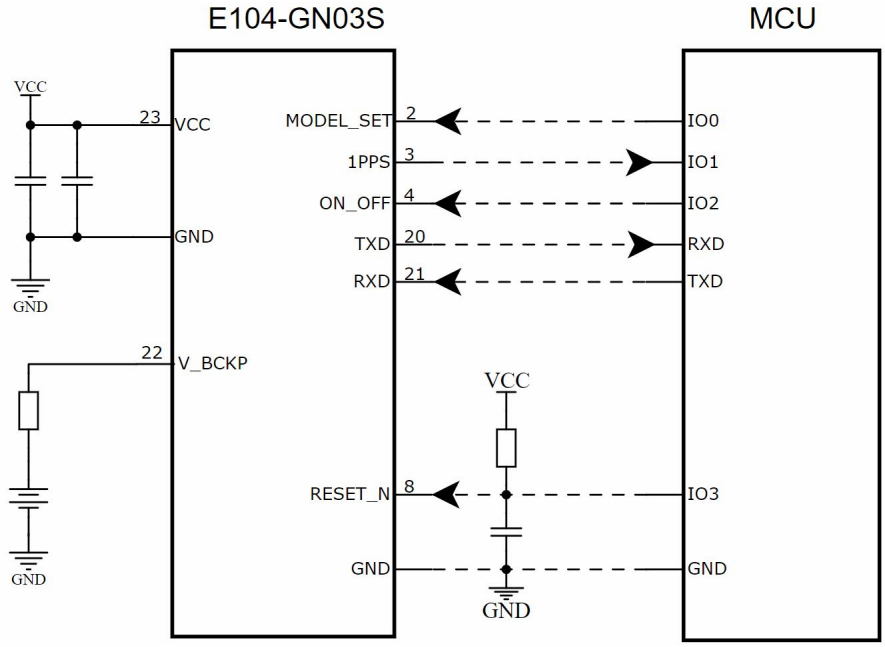
4 Recommended circuit diagram

4.1 E108-GN03



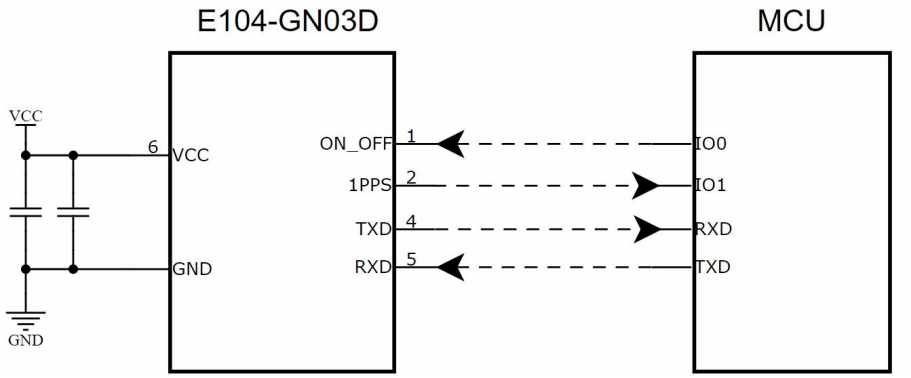
The battery charging current limiting resistor needs to be adjusted according to the battery parameters. A 200Ω resistor is connected in series inside the module.

4.2 E108-GN03S

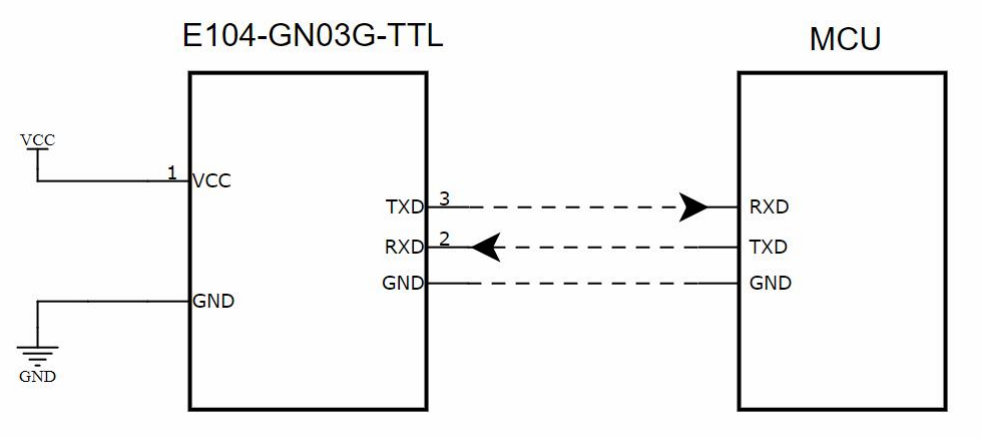


The battery charging current limiting resistor needs to be adjusted according to the battery parameters. A 200Ω resistor is connected in series inside the module.

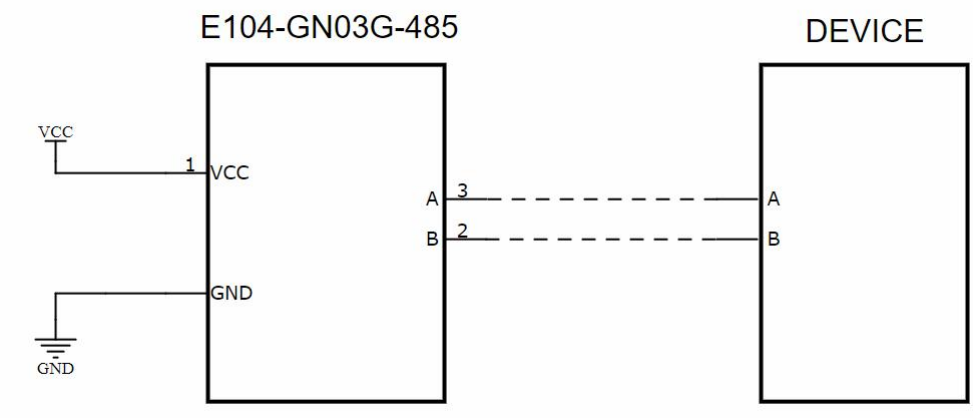
4.3 E108-GN03D



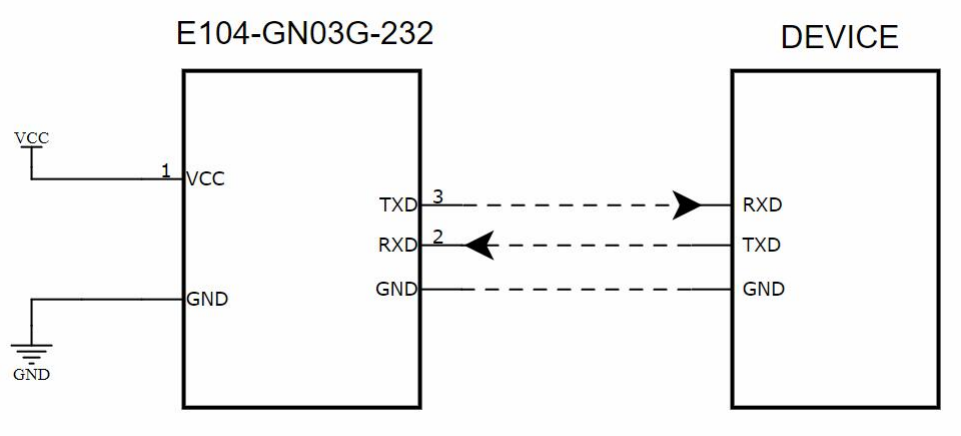
4.4 E108-GN03G-TTL



4.5 E108-GN03G-485



4.6 E108-GN03G-232



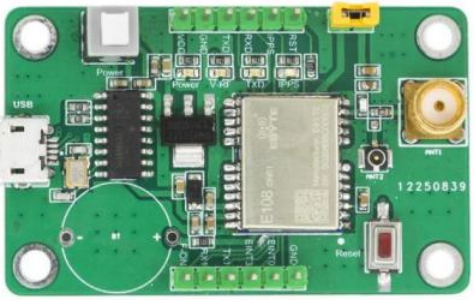
5 Hardware Design

- The application schematic design of the module can be directly referred to E108-GN03-TB-SCH or E108-GN03S-TB-SCH in the Resources 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, so that the whole machine can work stably for a long time;
- , 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 Top Layer, 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 Bottom Layer;
- Assuming the module is soldered or placed on the Top Layer, it is also wrong to randomly route the wires on the Bottom Layer 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 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.

6 E108-Product Testing

6.1 Serial Port Assistant

Based on E108-GN03 -TB . If there is no test baseboard, you can refer to the baseboard schematic diagram in the data package (this test content is applicable to the entire E108-GN03 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 . Then press the power button to turn it on.

2. Note that when using an active antenna, the two RF_POWER pins need to be short-circuited with a jumper.

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.

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

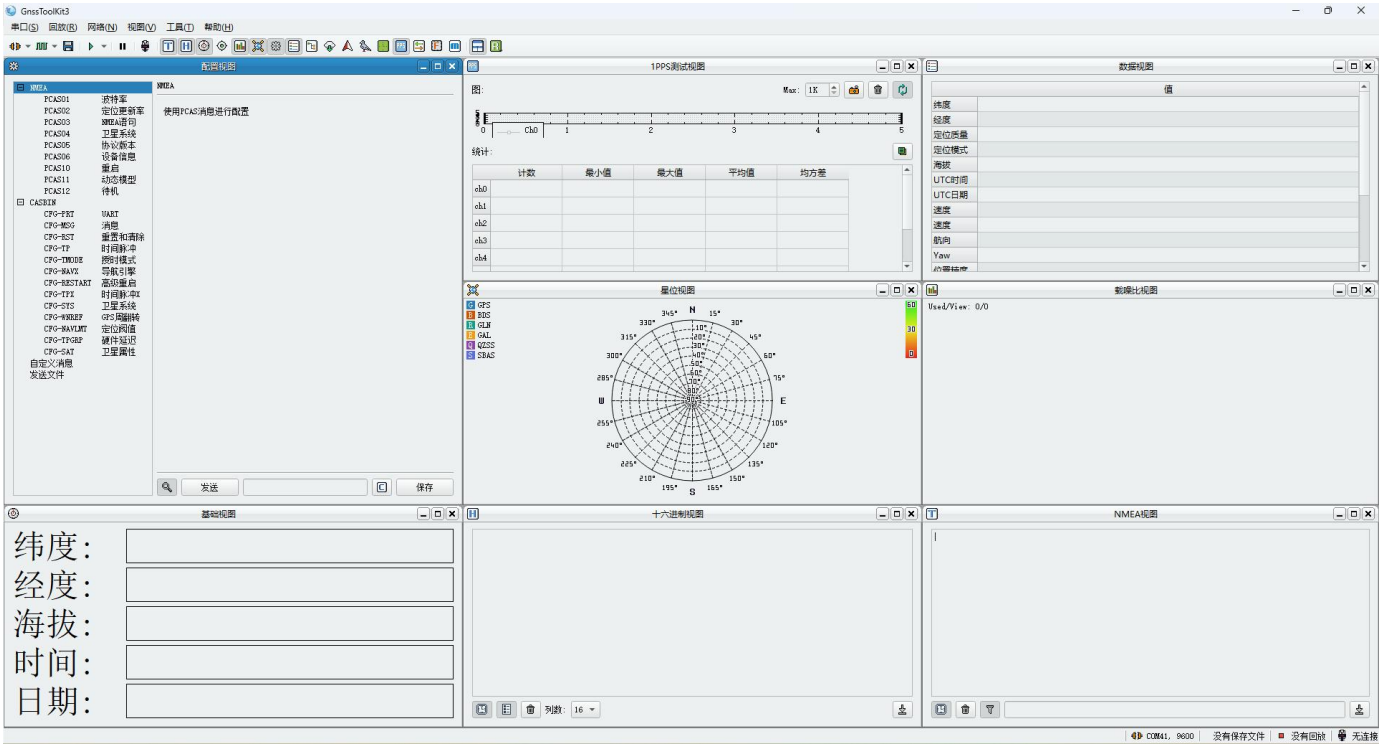
For ease of use, it is recommended to use the exclusive tool GnssToolKit3 for debugging. For detailed usage, see the "GnssToolKit3 User Manual" .

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.



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 = 19200 bps 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 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 * (excluding $ and *)
twenty one	<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
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
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		
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, compatible with NMEA 2.2 version		

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 customer number of the product 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		
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

7.2 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

7.2.1 Statement identifiers

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

7.2.2 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
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

7.2.3 GSA

$--GSA,a,a,x,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
VDOP	0.91		Vertical accuracy
Checksum	*04		
<CR><LF>			End of message

7.2.4 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

7.2.5 RMC

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

$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

7.2.6 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

8 Frequently Asked Questions

8.1 The transmission distance is not ideal

- When there is a straight-line communication obstacle, the communication distance will be attenuated accordingly ;
- Temperature, humidity, and co-channel interference can increase the communication packet loss rate ;
- The ground absorbs and reflects radio waves, so the test results are poor when close to the ground ;
- Seawater has a strong ability to absorb radio waves, so the test effect at the seaside is poor ;
- If there are metal objects near the antenna, or the antenna is placed in a metal shell, the signal attenuation will be very serious ;
- The power register is set incorrectly, or the air rate is set too high (the higher the air rate, the closer the distance) ;
- The power supply voltage is lower than the recommended value at room temperature. The lower the voltage, the lower the power output .

8.2 Module is easily damaged

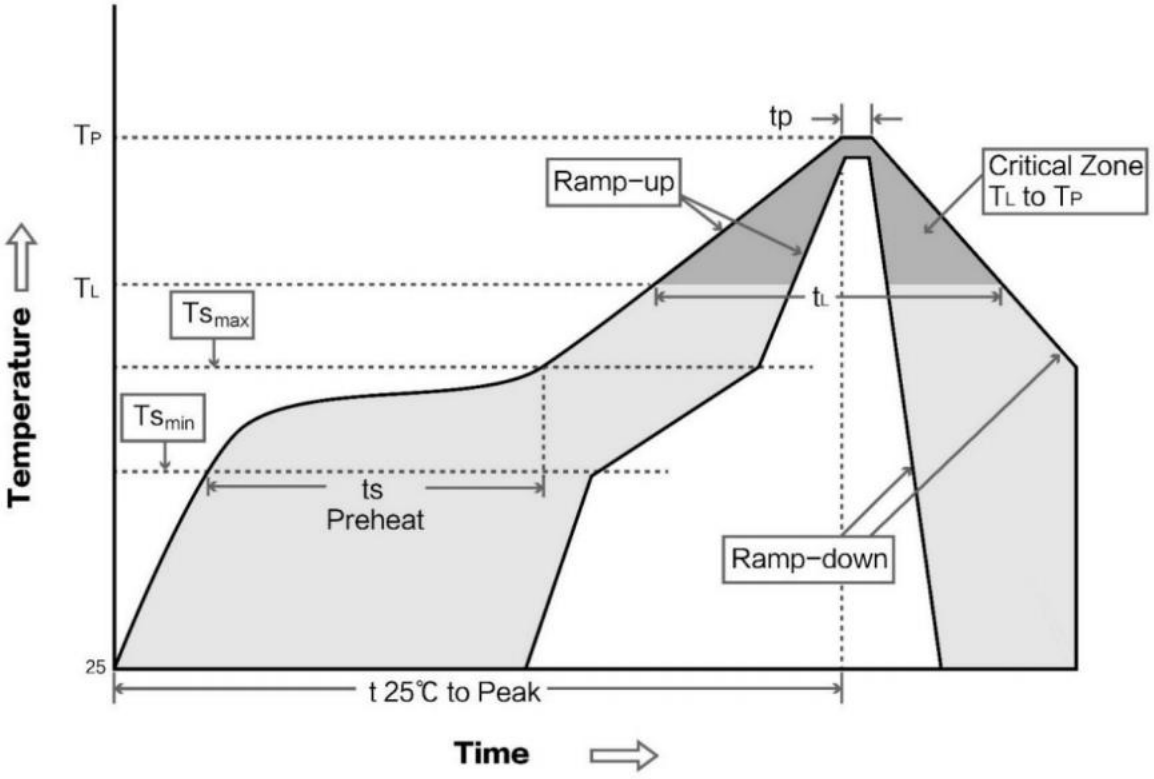
- Please check the power supply to ensure that it is within the recommended power supply voltage. If it exceeds the maximum value, the module will be permanently damaged .
- Please check the stability of the power supply. The voltage should not fluctuate greatly or frequently .
- Please ensure anti-static operation during installation and use, as high-frequency components are sensitive to static electricity ;
- Please ensure that the humidity is not too high during installation and use, as some components are humidity sensitive devices ;
- If there is no special requirement, it is not recommended to use it at too high or too low temperature.

9Welding operation instructions

9.1 Reflow Temperature

Profile Feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min(Tsmin)	100℃	150℃
Preheat temperature max(Tsmax)	150℃	200℃
Preheat Time(Tsmin to Tsmax)(ts)	60-120 sec	60-120 sec
Average ramp-up rate(TsmaxtoTp)	3℃/second max	3℃/second max
Liquidous Temperature(TL)	183℃	217℃
Time(tL)MaintainedAbove(TL)	60-90 sec	30-90 sec
Peak temperature(Tp)	220-235℃	230-250℃
Average ramp-downrate(TptoTsmax)	6℃/second max	6C/second max
Time 25° to peak temperature 25℃	6 minutes max	8 minutes max

9.2 Reflow Oven Curve



10 Related models

Model number	Chip Solution	Support satellite	Package	Product Size mm	Communication Interface
E108-GN02	-	BDS/GPS/GLONASS	SMD	10.1*9.7*2.4	UART/GPIO
E108-GN02D	-	BDS/GPS/GLONASS	-	22*20*7.8	UART
E108-GN01	-	BDS/GPS/GLONASS	SMD	16*12*2.4	UART/GPIO
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	DIP	20.0*22.0*7.8	UART

Revise history

Version	Revision Date	Revision Notes	Maintained by
V1.0	2024-06-25	First edition	Bin
V1.1	2024-11-01	New E108-GN03G-TTL, E108-GN03G-232, E108-GN03G-485	Bin

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