E108-GN01 User Manual

GK9501 GPS Module

Chengdu Ebyte Electronic Technology Co.,Ltd.

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1. Product overview

1.1 Production introduction

E108-GN01 is a high-performance, highly integrated, low-power, low-cost multi-mode satellite positioning and navigation chip. It can be used for GNSS positioning applications such as car navigation, smart wearable, and drone. It also provides software and hardware interfaces compatible with other module manufacturers, which greatly reduces the user's development cycle and supports BDS / GPS / GLONASS / GALILEO / QZSS / SBAS.

It adopts the integrated design of RF baseband, integrates DC / DC, LDO, RF front-end, low-power application processor, RAM, Flash storage, RTC, and power management, etc. It supports crystal or external pin clock input. A coin cell battery or a farad capacitor supplies power to the RTC and backup RAM to reduce the time to first fix. It also supports multiple ways to connect with other peripherals, such as UART, I2C, SPI or GPIO.

1.2 Features

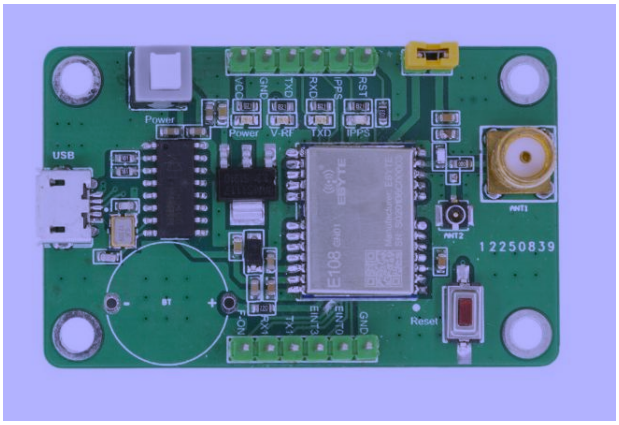
- BDS/GPS/GLONASS/GALILEO/QZSS/SBAS joint positioning and single system independent positioning;
- 10Hz D-GNSS differential positioning, A-GNSS assisted positioning, ephemeris prediction, DR integrated navigation application, the fastest data update rate is 10Hz;
- 32-bit application processor, with a maximum frequency of 133MHz, for dynamic frequency adjustment;
- PPS output;
- Built-in reset controller;
- UART 、 SPI 、 I2C 、 GPIO;
- RTC: Support 32.768 KHz ± 20 ppm crystal, 1.1V RTC clock output, support external signal wake-up；
- Output format: NMEA0183 V4.1 and previous versions, the maximum fixed update frequency can reach 10Hz；
- High sensitivity: -149dBm for cold start, -162dBm for hot start, -166dBm for tracking；
- Ultra-low power consumption: capture 30mA, track 20mA;
- The software and hardware are compatible with other manufacturers, which greatly reduces the user's development cycle.

1.3 Application

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

2 Quick start

For testing E108-GN01-TB，if there is no board available, please refer to schematic of it in reference file.



1. After the GPS antenna is connected, connect the computer with a USB cable at the same time. There is a USB port on the opposite side of the antenna of the board, and then press the switch button to turn on.

2. Note that when using an active antenna, the two RF_POWER pins need to be shorted with jumpers.

3. You can open the serial port assistant to view the data reported by the serial port, or you can use our naviTrack to view it.

The baud rate is set to 9600 bps. Data will be reported after the serial port is closed. Common output formats are as follows:

GGA: time, location, number of satellites;

GSA: GPS receiver operating mode, satellite used for positioning, DOP value, positioning status;

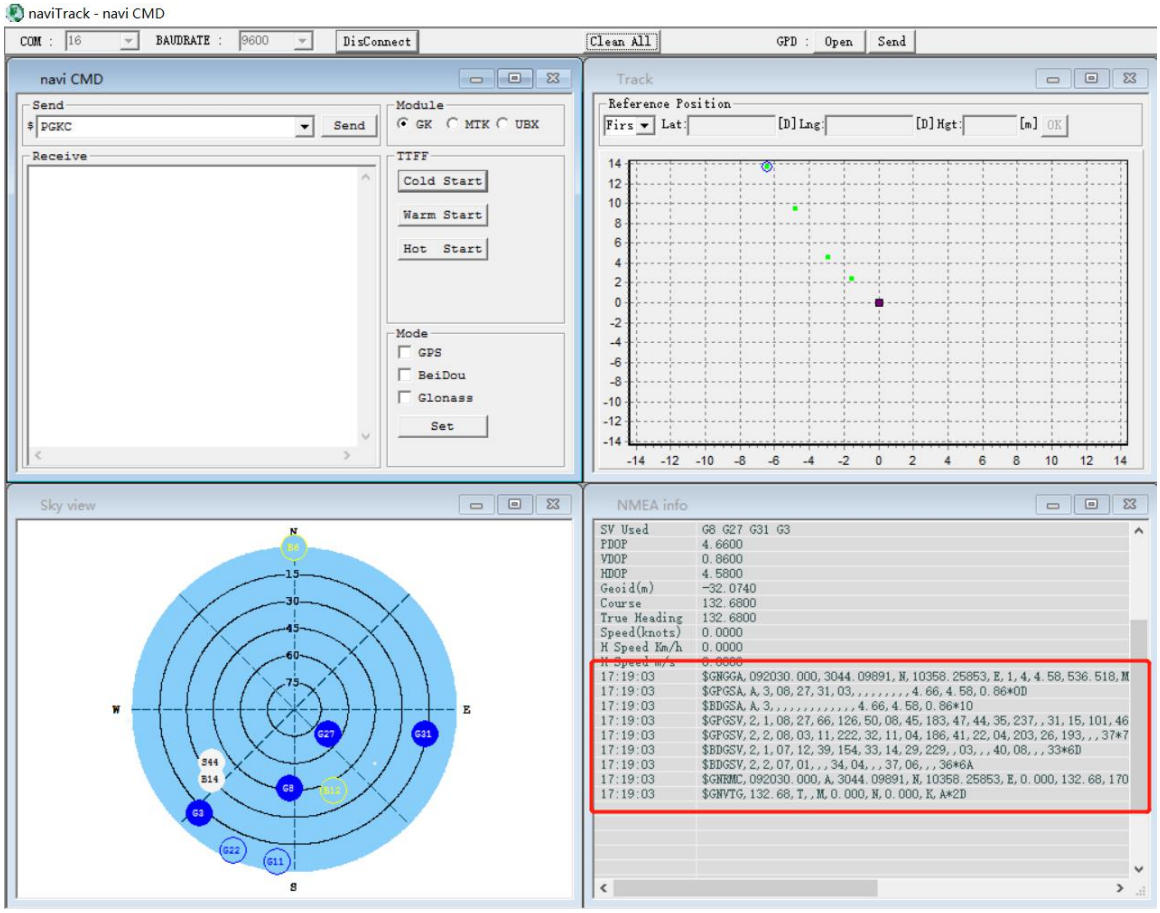
GSV: visible GPS satellite information, elevation, azimuth, signal-to-noise ratio;

RMC: time, date, location, speed;

VTG: ground speed information;

For detailed meaning, please refer to Section 3 NMEA0183 protocol;

For ease of use, we recommend using the exclusive tool TaviTrack for debugging. For detailed usage, please refer to the “naviTrack User Manual”



1. Run naviTrack. With administrator privileges, run as above;

2. Select the corresponding com port and click connect. After the connection is successful, you can see the reported data in the NMEA window.

For detailed meaning, please refer to the description in the third section of NMEA0183 protocol;

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

3 Specification and parameters

3.1 GPS performance

Type	Indicator	Typ.	Unit
Positioning time（test condition 1）	Cold start	27.5	S
	Hot start	＜1	S
	Re-capture	＜1	S
	A-GNSS	＜10	S
Sensitivity（test condition 2）	Cold start	-148	dBm
	Hot start	-162	dBm
	Re-capture	-164	dBm
	Follow	-166	dBm
Accuracy（test condition 3）	Horizontal positioning accuracy	2.5	m
	Height positioning accuracy	3.5	m
	Speed positioning accuracy	0.1	m/s
	Timing accuracy	30	ns
Power consumption（test condition 4）	Capture current	30	mA
	Follow current	20	mA
Operating temperature	--	-35℃--85℃	--
Storage temperature	--	-55℃--100℃	--
Humidity	--	5%--95%RH（No condensation）	--

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

[Test condition 1]: The number of receiving satellites is greater than 6, the signal strength of all satellites is -130dBm, the average value is 10 times, and the positioning error is 10 meters.

[Test condition 2]: The noise figure of the external LNA is 0.8, the number of receiving satellites is greater than 6, and the received signal strength value is locked or not lost within five minutes.

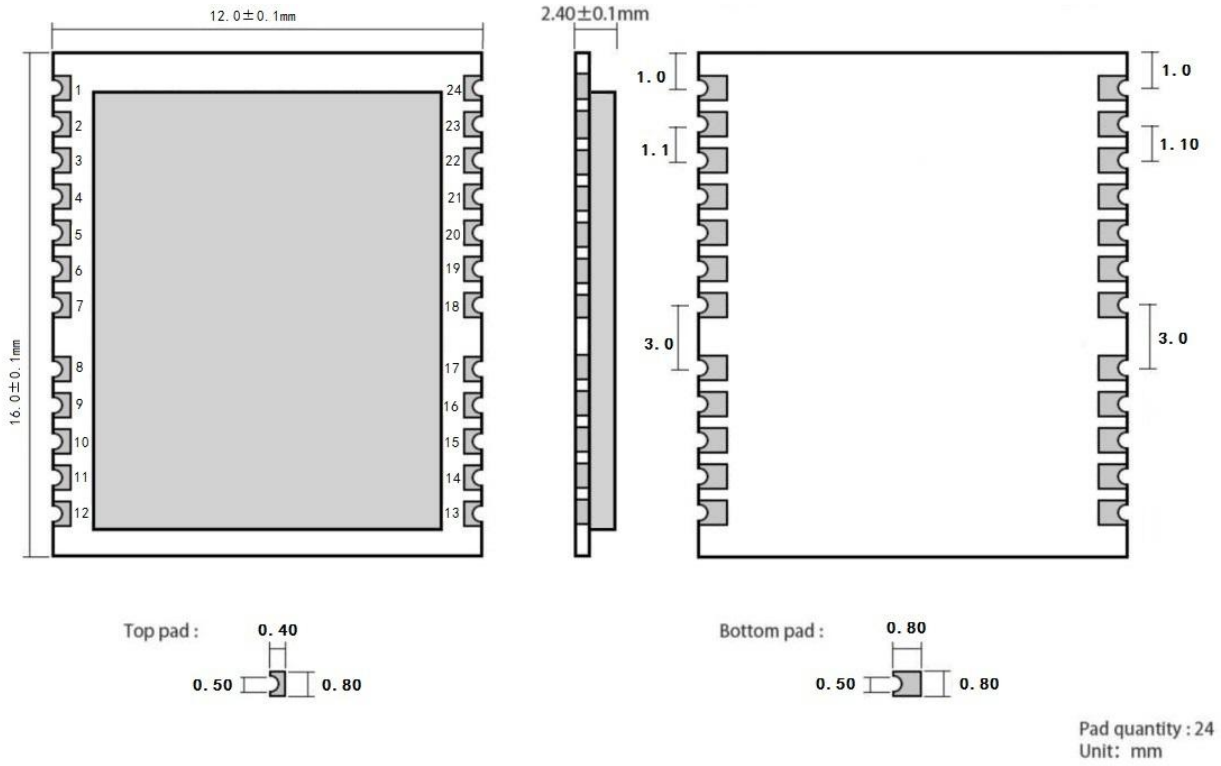
[Test condition 3]: Open and unobstructed environment, continuous power-on test for 24 hours, 50% CEP.

[Test condition 4]: The number of receiving satellites is greater than 6, and the signal strength of all satellites is -130dBm.

3.2 Basic parameter

Type	Details	
Protocol	NMEA0183 V4.1 and previous version，max updating frequency is 10Hz	
GPS system	BDS/GPS/GLONASS/GALILEO/QZSS/SBAS	
Peripheral interface	UART（TXD/RXD） or GPIO	
Low power	Available	
Ultra-low power	Available	
Periodical low power	Available	
Direct low power	Available	
Parameter setting software	Available	
Certification	Pending	
Size	16*12*2.4mm(L*W*H)	
Package	Half hole（SMT）	
Power supply	VCC	2.8V—4.3V（3.3V）
UART	Communication level	2.8V
	Baud rate（bps）	9600（default）、115200（customizable）
	Data bit	8bit
	Stop bit	1
	Parity	None

4 Dimension and pin definition



No.	Name	Details
1	NC	N/A
2	NC	N/A
3	1PPS	Positioning indicator, square wave will be output when positioning is successful
4	EINT3	External interrupt 3，default：pull down，8 ma driving current
5	FORCE_ON	Sleep wake-up pin, pulled high when the module enters ultra-low power consumption This pin exits the ultra-low power mode (the level of this pin is 1.1V, if the control pin level is not 1.1V, Partial pressure treatment is required)
6	EINT0	External interrupt 0，default：pull down，8 ma driving current
7	NC	N/A
8	RSTN	Reset pin， default pull up， pull down for resetting.
9	VCC_RF	RF power output， to power active antenna（equal to VCC）
10	GND	Ground
11	RF_IN	RF input
12	GND	Ground
13	GND	Ground
14	NC	N/A
15	NC	N/A

16	RSTN	Reset pin， default pull up， pull down for resetting.
17	EINT1	External interrupt 1，default：pull down，8 ma driving current
18	TX1	UART1 output（N/A， 2.8V communication level）
19	RX1	UART1 input（N/A， 2.8V communication level）
20	TXD	UART output（AT port， 2.8V communication level）
21	RXD	UART input（AT port， 2.8V communication level）
22	VBKP	RTC power input， RTC must be powered so module can work（2V-4.2V）
23	VCC	Power supply（2.8V—4.2V）
24	GND	Ground

5 Hardware design

- Check E108-GN01-TB-SCH in related file for schematic；
- It is recommended to use a DC stabilized power supply. The power supply ripple factor is as small as possible, 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 it is within the recommended voltage otherwise when it exceeds the maximum value the module will be permanently damaged；
- Please check the stability of the power supply, the voltage cannot be fluctuated frequently；
- When designing the power supply circuit for the module, it is often recommended to reserve more than 30% of the margin, so the whole machine is beneficial for long-term stable operation.
- The module should be as far away as possible from the power supply, transformers, high-frequency wiring and other parts with large electromagnetic interference
- High-frequency digital routing, high-frequency analog routing, and power routing must be avoided under the module. If it is necessary to pass through the module, assume that the module is soldered to the Top Layer, and the copper is spread on the Top Layer of the module contact part(well grounded), it must be close to the digital part of the module and routed in the Bottom Layer；
- Assuming the module is soldered or placed over the Top Layer, it is wrong to randomly route over the Bottom Layer or other layers, which will affect the module's spurs and receiving sensitivity to varying degrees；
- It is assumed that there are devices with large electromagnetic interference around the module that will greatly affect the performance. It is recommended to keep them away from the module according to the strength of the interference. If necessary, appropriate isolation and shielding can be done；
- Assume that there are traces with large electromagnetic interference (high-frequency digital, high-frequency analog, power traces) around the module that will greatly affect the performance of the module. It is recommended to stay away from the module according to the strength of the interference
- If necessary, appropriate isolation and shielding can be done.
- If the communication line uses a 5V level, a 1k-5.1k resistor must be connected in series (not recommended, still a risk of damage)；
- Try to stay away from some physical layers such as TTL protocol at 2.4GHz , for example: USB3.0；
- The mounting structure of antenna has a great influence on the performance of the module. It is necessary to ensure that the antenna is exposed, preferably vertically upward. When the module is mounted inside the case, use a good

antenna extension cable to extend the antenna to the outside；

6. Operating mode

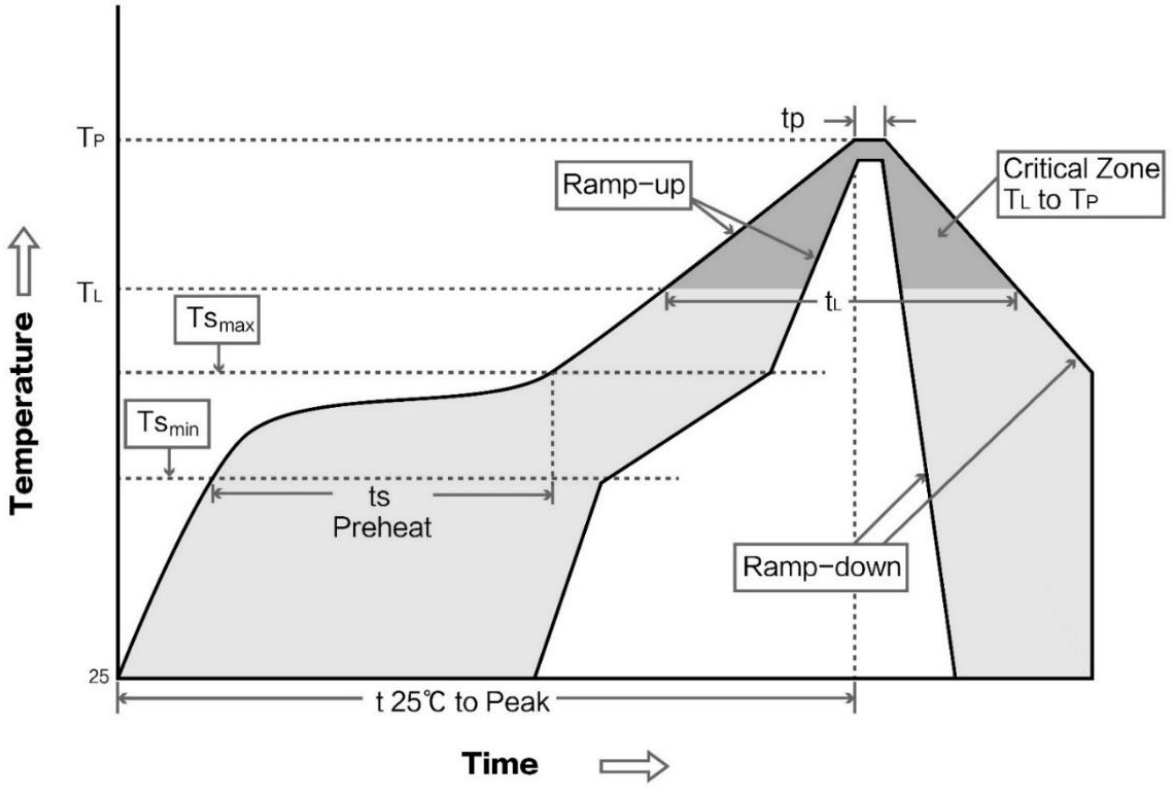
1. Please refer to the “GK9501 Input and Output Format” in the data package for the command format of the module-related functions.
2. This module supports AGPS settings. For detailed setting methods, please refer to the “Goke AGPS User Manual” in the package.

7. Production Guidance

7.1 Reflow soldering 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(Tsmax to Tp)	3℃/second max	3℃/second max
Liquidous Temperature (TL)	183℃	217℃
Time（tL）Maintained Above（TL）	60-90 sec	30-90 sec
Peak temperature（Tp）	220-235℃	230-250℃
Aveage ramp-down rate（Tp to Tsmax）	6℃/second max	6℃/second max
Time 25℃ to peak temperature	6 minutes max	8 minutes max

7.2 Reflow soldering curve



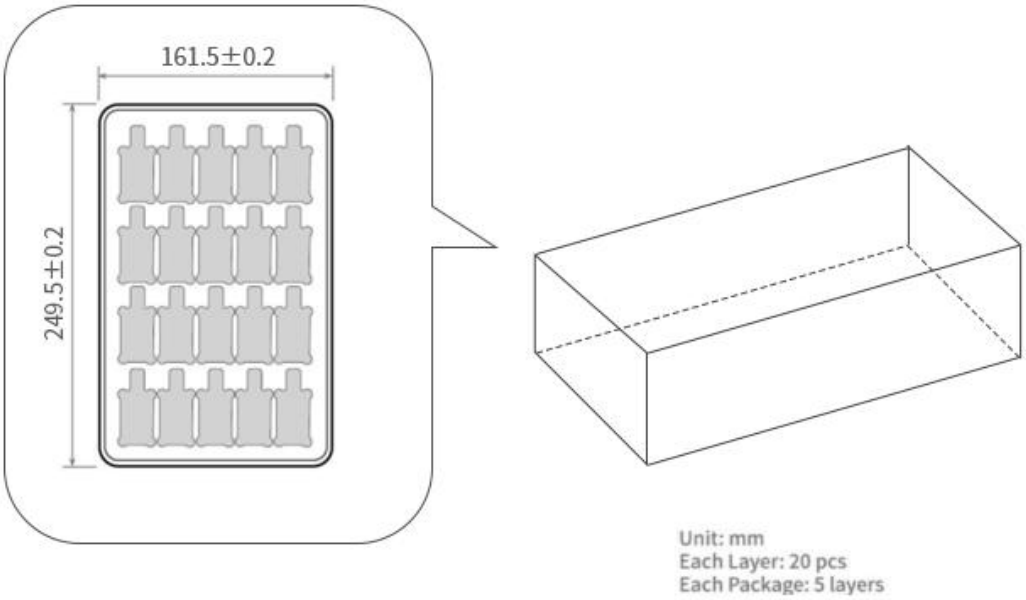
8 E108 Series

Model	RF IC	Satellite	Package	Size mm	Communication interface
E108-GN01-V1.0	GK9501	BDS/GPS/GLONASS/GALILEO/QZSS/SBAS	SMD	16*12*2.4	UART/GPIO

9 Antenna guidance

Model	Type	Frequency Hz	Interface	Gain dBi	Size mm	Feeder cm	Function
TXGB-AZ-300	Sucker antenna	1575.042±1.023MHz~1561.098±2.046MHz	SMA-J	4.0	50*38*16.7	300	Directional antenna，LNA gain 28dBi
TXGPS-XP-300	Sucker antenna	For Beidou /GPS/Galileo/Glonass	SMA-J	5.0	100*30	300	Small, cost effective

10 Package for bulk order



About Us

Technical support: support@cdebyte.com;
Documents and RF Setting download link: www.ebyte.com
Tel：+86-28-61399028
Fax：028-64146160
Web：www.ebyte.com
Address: Building B5, Mould Industrial Park, 199# Xiqu Avenue, Chengdu, Sichuan

Chengdu Ebyte Electronic Technology Co.,Ltd.