

# SKG093N规格书

## L1+L5双频定位模块

### SKG093N Datasheet

#### L1+L5 Dual-band Positioning Module

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## 1 产品简介/Product Introduction

SKG093N 是一款高性能的面向车载导航领域的车载组合导航模块，模块能够同时支持 GPS、BDS、GLONASS、Galileo 以及 QZSS 的卫星定位系统、并且支持 L1+L5 双频定位。

SKG093N is a high-performance vehicle integrated navigation module for the field of vehicle navigation.

The module can simultaneously support GPS, BDS, GLONASS, Galileo and QZSS satellite positioning systems, and support L1+L5 dual frequency positioning.



图 1: SKG093N 正视图/Top view

## 2 典型应用/Application

- ◆ 汽车导航/ Auto navigation
- ◆ 个人导航设备/ Personal navigation equipment
- ◆ 车辆远程监控/Remote vehicle monitoring

## 3 产品特点/Features

- ◆ L1 支持 GPS, GLO, GAL, BDS, QZSS 系统/ L1 supports GPS, GLO, GAL, BDS, QZSS systems
- ◆ L5 支持 GPS, GAL, BDS, QZSS/ L5 supports GPS, GAL, BDS, and QZSS
- ◆ 支持 SBAS(WAAS, EGNOS, MSAS, GAGAN)/ Support SBAS(WAAS, EGNOS, MSAS, GAGAN)
- ◆ 支持 RTCM(v2.3 和 v3.3)/ Support RTCM(v2.3 和 v3.3)
- ◆ 标准通信协议 NEMA0183/Plug and play standard communication protocol NEMA0183
- ◆ 支持 AGPS: EPO, EASY, NVRAM, hotstill/ Support AGPS: EPO, EASY, NVRAM, hotstill
- ◆ 弱信号下具有较好的定位精度和位置有效性/ It has better positioning accuracy and location effectiveness under weak signals
- ◆ 符合 RoHS, FCC, CE /Compliance with RoHS, FCC, CE

## 5 传输及外设接口/Transmission and peripheral interface

### 5.1 PPS

秒脉冲 (PPS) : SKG093N 提供非常精准的时间脉冲 PPS 信号, PPS 信号可为外部系统提供授时功能, 脉冲宽度可调, 精度 15ns, 默认情况下每秒输出一个脉冲。

Second pulse (PPS): The SKG093N provides a very accurate time pulse PPS signal, the PPS signal can provide the timing function for the external system, the pulse width is adjustable, the accuracy is 15ns, by default, it output a pulse per second.

### 5.2 UART

SKG093N 模块提供了两个串口, 其中, UART0 用于发送卫星信息, UART2 用于输出差分信息。支持数据传输、固件升级功能, 输入/输出信号类型为 LVTTTL 电平(3.3V)。默认波特率为 115200bps, 最高可设为 921600bps, 串口波特率均可由用户自行配置。

The SKG093N module provides two serial ports. Serial UART0 is used to send satellite information, and serial port 2 is used to output differential information. Support data transmission, firmware upgrade function, input / output signal type is LVTTTL level(3.3V). The default port rate is 115200bps, which can be set up to 921600bps, and the serial port port rate can be configured by the user.

### 5.3 通信频率/Frequency of communication

目前, 系统支持输出 1hz 到 10hz 的数据刷新频率, 默认频率为 1HZ。

Currently, the system supports the output data refresh frequency of 1hz to 10hz. The default frequency is 1hz.

### 5.4 通信协议/Communication protocol

目前, SKG093N 模块输出常见的 NMEA0183 协议, 例如: GPGGA、GPRMC, GPGSV, GPGSA。

At present, THE SKG093N module outputs common NMEA0183 protocols, such as GPGGA, GPRMC, GPGSV and GPGSA.

### 5.5 控制命令/Control command

SKG093N 系统支持用户通过串口发送控制命令, 但是, SKG093N 无法保存设置, 即 SKG093N 每次上电都是按默认方式输出。

The SKG093N system supports the user to send control commands through the serial port, but SKG093N cannot save the settings, that is, SKG093N is output by default every time it is powered on.

## 6 电气特性/Electrical specification

### ◆ 极限参数/limit Parameter

参数/Parameter	符号/Symbol	最小值/Min.	最大值/Max.	单位/Unit
<b>电源/power supply</b>				
供电电压/Supply Voltage	VCC	-0.3	3.6	V
<b>输入输出/ IO</b>				
I/O 特性/I/O Features	VIO	-0.3	3.6	V
RF 输入功率/RF Input power	RF_IN		0	dBm
静电保护/ESD	RF_IN		2000	V
<b>环境/Environment</b>				
存储温度/Storage temperature	Tstg	-40	85	° C
湿度/Humidity			95	%

### ◆ 电气特性/Electrical specification

参数/Parameter	符号 /Symbol	条件 /Condition	最小值 /Min.	典型值 /Type	最大值 /Max.	单位 /Unit
电源电压/Supply voltage	VCC		3.0	3.3	3.6	V
电源电压/Supply voltage	V_BCKP		1.4	3.0	3.6	V
输入高压/input high voltage	VIH		2.4		3.6	V
输入低压/input low voltage	VIL		0		0.6	V
输出高压/output high voltage	VOH	Ioh=4mA	2.8			V
输出低压/output low voltage	VOL	Iol=4mA			0.4	V
工作温度/Operating temperature	Topr		-40		85	°C

注：本产品内部有复杂的组合导航算法，所以功耗比一般的导航模块高，请在设计硬件电路过程中，一定给本产品预留足够的功耗，即电流不小于 150mA。

Note: This product has a complex integrated navigation algorithm, so the power consumption is higher than that of ordinary navigation modules. Please reserve enough power consumption for this product during the design of hardware circuit, that is, the current is not less than 150mA.

## 7 性能指标/Performance evaluation

### ◆ 电气特性一倍标准差 ( $1\sigma$ ) 无里程计时/Electrical characteristics one standard deviation ( $1\sigma$ ) no mileage timing

GNSS 信号丢失时间/Time of GNSS signal loss	接收机定位方式/Receiver positioning mode	水平位置 <sup>1</sup> /Horizontal position 1	水平速度 <sup>1</sup> /Horizontal velocity 1	俯仰横滚 <sup>1</sup> /Pitch roll Angle 1	航向角 <sup>1</sup> /Course Angle 1
5 秒/5 seconds	标准定位/Standard setting	2.0-3.5m	0.05m/s	0.5deg	1.0deg
10 秒/10 seconds	标准定位/Standard setting	10.0m	N/A	N/A	N/A
60 秒/60 seconds	标准定位/Standard setting	25.0m	N/A	N/A	N/A
120 秒/120 seconds	标准定位/Standard setting	60.0m	0.5m/s	1.0deg	2.0deg

### ◆ 电气特性一倍标准差 ( $1\sigma$ ) GNSS 部分功能/Electrical characteristics one standard deviation ( $1\sigma$ ) GNSS partial function

参数/Parameter	描述/Description		
接收机类型/Receiver type	L1	1602 MHz	GLONASS L1OF
		1575.42 MHz	GPS L1CA QZSS L1CA SBAS L1 QZSS L1 SAIF Galileo E1 (E1B+E1C)
		1561.098 MHz	BeiDou B1I
	L5	1176.45 MHz	GPS L5 QZSS L5 Galileo E5a BeiDou B2a
首次定位时间 TTFF	冷启动/Cold Start $\leq$ 28s		
	热启动/Hot Start $\leq$ 1s		

	辅助启动/Auxiliary start≤5s
灵敏度/Sensitivity	跟踪/Tracking: -165dBm
	捕获/Acquisition: -160dBm
	冷启动/Cold Start: -148dBm
	温启/Warm Start: -148dBm
	热启动/Hot Start: -156dBm
水平定位精度/Horizontal positioning precision	自主定位/Autonomous positioning≤1.2m
	SBAS≤1m
PPS	15ns
速度精度/Speed precision	0.05m/s
功耗/ power dissipation	50mA (3.3V)
尺寸/Dimension	10.1 x 9.7 x 2.2mm
工作环境/Operational constraint	动态/Dynamic≤4g
	高度/Altitude≤50,000m
	速度/Speed≤500m/s

## 8 管脚定义/PIN Definition

<b>1</b>	<b>GND</b>	<b>GPIO2</b>	<b>18</b>
<b>2</b>	<b>UART0_TX</b>	<b>UART2_RXD</b>	<b>17</b>
<b>3</b>	<b>UART0_RX</b>	<b>UART2_TXD</b>	<b>16</b>
<b>4</b>	<b>PPS</b>	<b>VANT</b>	<b>15</b>
<b>5</b>	<b>WAKE_UP_IN</b>	<b>VCC_RF</b>	<b>14</b>
<b>6</b>	<b>V_BACKP</b>	<b>LNA_EN</b>	<b>13</b>
<b>7</b>	<b>NC</b>	<b>GND</b>	<b>12</b>
<b>8</b>	<b>VCC</b>	<b>RF_IN</b>	<b>11</b>
<b>9</b>	<b>RESET</b>	<b>GND</b>	<b>10</b>

SKG093N  
Top view

图 3: SKG093N 管脚定义/pin definitions

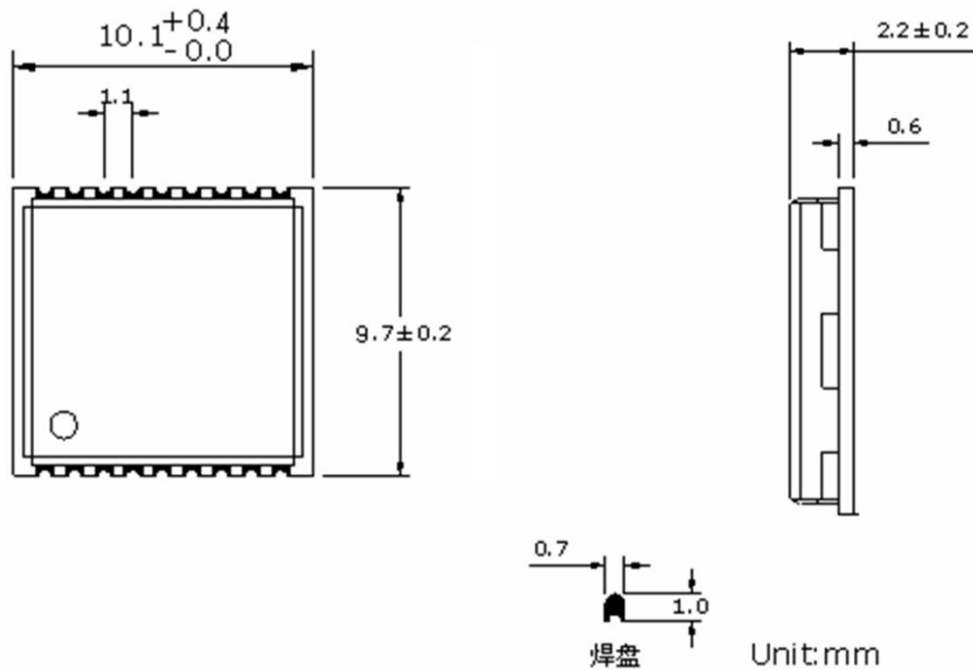


## 9 管脚描述/Pin description

管脚编号 /Pin No.	管脚定义/Pin name	使用说明/Description	备注/Remark
1	GND	电源地/GROUND	/
2	UART0_TX	UART0 串行数据输出/ UART serial data output	默认数据输出脚/ Default data output pin
3	UART0_RX	UART0 串行数据输入/ UART serial data input	默认数据输入脚/ Default data input pin
4	PPS	秒脉冲信号输出/ Second pulse signal output	不使用则悬空/ Leave open if not used
5	WAKE_UP_IN	中断脚, 唤醒信号输入/ Interrupt pin, wake-up signal input	不使用则悬空/ Leave open if not used
6	V_BCKP	备份电源输入/ Backup power input	不使用则悬空/ Leave open if not used
7	NC	/	/
8	VCC	电源输入/ Power input	不使用则悬空/ Leave open if not used
9	RESET	复位信号输入/ Reset signal input	不使用则悬空/ Leave open if not used
10	GND	电源地/Ground	/
11	RF_IN	GNSS 天线接口	输入端须 50Ω阻抗匹配/ The input must match 50Ω impedance
12	GND	电源地/Ground	/
13	LNA_EN	2.8V 输出/ 2.8V output	不使用则悬空/ Leave open if not used
14	VCC_RF	VCC 引脚电源输出/ VCC pin power output/	不使用则悬空/ Leave open if not used
15	VANT	有源天线供电输入/ Active antenna power supply input	不使用则悬空/ Leave open if not used
16	UART2_TXD	UART2 串行数据输出/ UART1 serial data output	不使用则悬空/ Leave open if not used

17	UART2_RXD	UART2 串行数输入/ UART1 serial data Input	不使用则悬空/ Leave open if not used
18	GPIO2	通用 I/O 口/General purpose I/O	不使用则悬空/ Leave open if not used

## 10 机械尺寸/Machine Dimension



Parameter	specification	Units
Coplanarity	$\leq 0.1$	mm

图 4: SKG093N 机械尺寸/Machine Dimension

## 10.1 推荐封装/ Recommend Layout

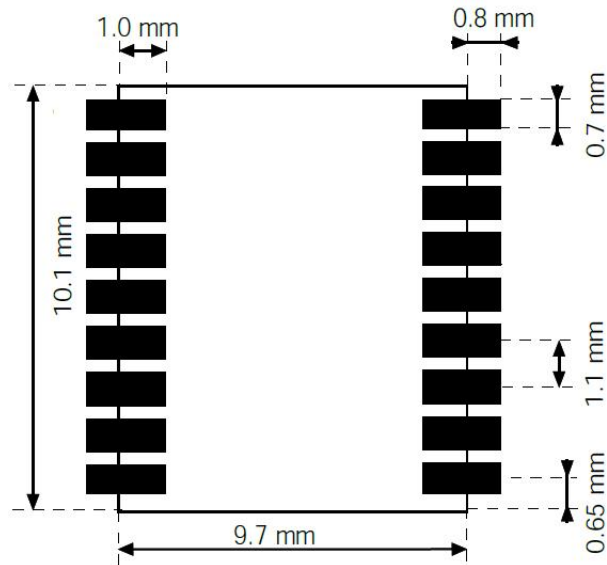


Figure 5: SKG093N Footprint

## 11 参考电路/Reference circuit

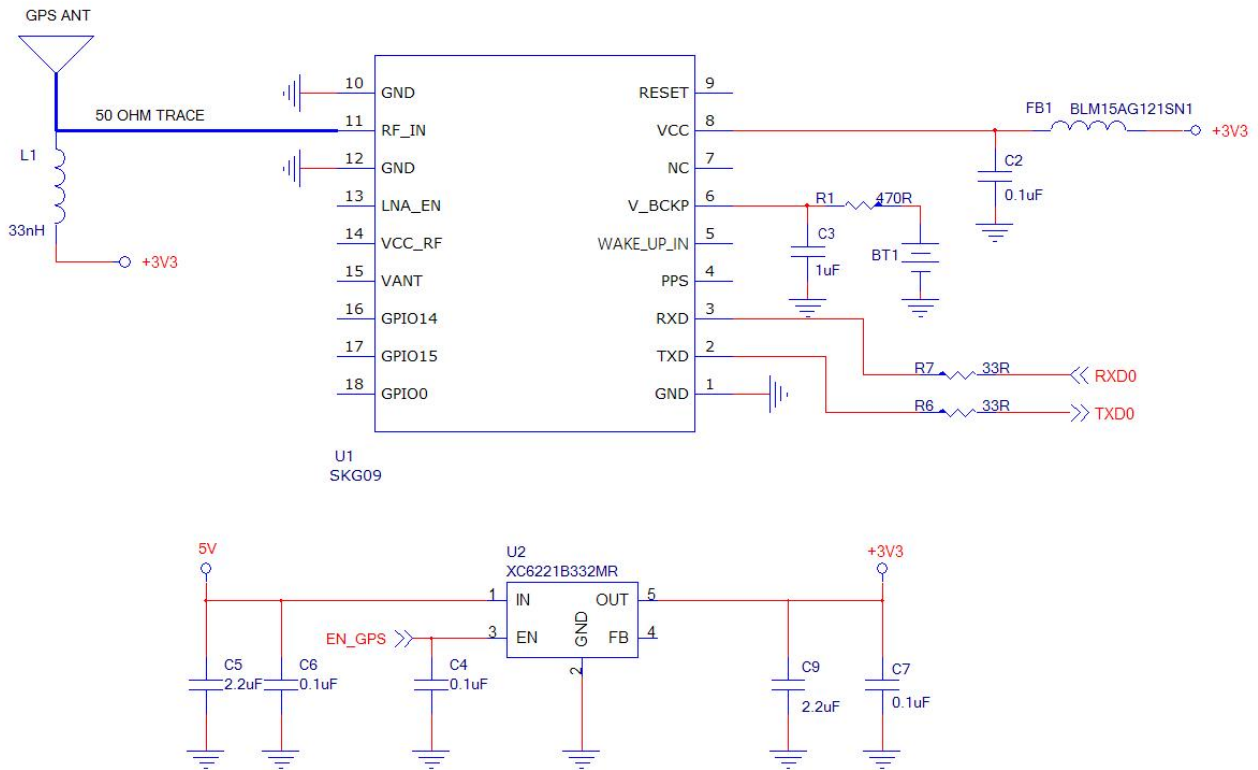


图 6: SKG093N 参考电路/Reference circuit

## 12 Layout 注意事项/ Layout Considerations

### 12.1 元件布局/ Placing Components

GNSS 模块在 PCB 上的布局对于获得最佳的 GNSS 性能来说是至关重要的。与天线的连接应越短越好，避免对信号造成过大的衰减。在系统板设计上，要确保射频电路跟其他数字电路严格分开，将模块远离 PCB 上的数字区域。同时还必须将 GNSS 模块远离发热量较大的区域。

The layout of GNSS modules on the PCB is critical for achieving optimal GNSS performance. The connection with the antenna should be as short as possible to avoid excessive attenuation of the signal. In the system board design, ensure that RF circuits are strictly separated from other digital circuits and that modules are kept away from the digital area on the PCB. At the same time, GNSS modules must be kept away from areas with high heat.

### 12.2 无源天线设计/ Passive Antenna Design

天线馈线的长度应尽可能短，且无源天线的下方要有一块完整的地。建议无源天线与 GNSS 模块放在 PCB 板相对的另一面。

The length of the antenna feeder should be as short as possible, and the passive antenna should have a complete ground below. It is recommended that the passive antenna and GNSS module be placed on the opposite side of the PCB board.

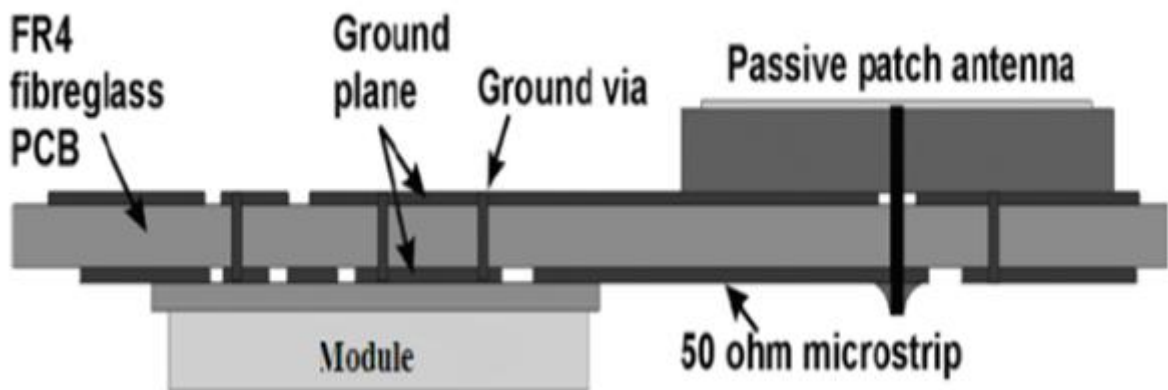


图 7: 无源天线参考设计/ Passive Antenna eference design

### 12.3 阻抗匹配/ Impedance Matching

天线馈线的阻抗需为 50Ohm，为了达到 50 Ohm 的阻抗，微带线的宽度  $W$  要根据导线和参考面的距离  $H$ ，PCB 介质板的介电常数 $\epsilon_r$ ，以及 PCB 的结构来选择。

The impedance of the antenna feeder shall be 50 Ohm. In order to achieve the impedance of 50 Ohm, the width  $W$  of the microstrip line shall be selected according to the distance  $H$  between the wire and the reference plane, the dielectric constant  $\epsilon_r$  of the PCB dielectric board, and the structure of the PCB.

### 12.4 微带线设计/ Microstrip line design

微带线的长度应该尽可能的短，标准 PCB 上应该尽量不选用超过 2.5 cm（1 inch）而又没有屏蔽层的微带线；

The length of microstrip lines should be as short as possible, and no microstrip lines exceeding 2.5cm (1 inch) without shielding layer should be selected on standard PCB as far as possible.

射频连接线的走线应避免靠近数字信号线；

Avoid routing RF cables close to digital signal cables.在连接地平面时要采用尽可能多的过孔；

在连接地平面时要采用尽可能多的过孔；

Wiring should be far away from noise sources, such as switching power supply, digital signal, crystal oscillator, processor, etc.

布线应远离噪声源，如:开关电源，数字信号，晶振，处理器等；

Wiring should be far away from noise sources, such as switching power supply, digital signal, crystal oscillator, processor, etc.

微带线相对应的参考地层应保持完整；

The reference strata corresponding to the microstrip line should be kept intact.

微带线特性阻抗必须为 50 ohm；

The characteristic impedance of microstrip line must be 50 ohm；

为了减小信号衰减，微带线走线时要避免锐角。

In order to reduce signal attenuation, the acute Angle should be avoided when microstrip lines are routed.

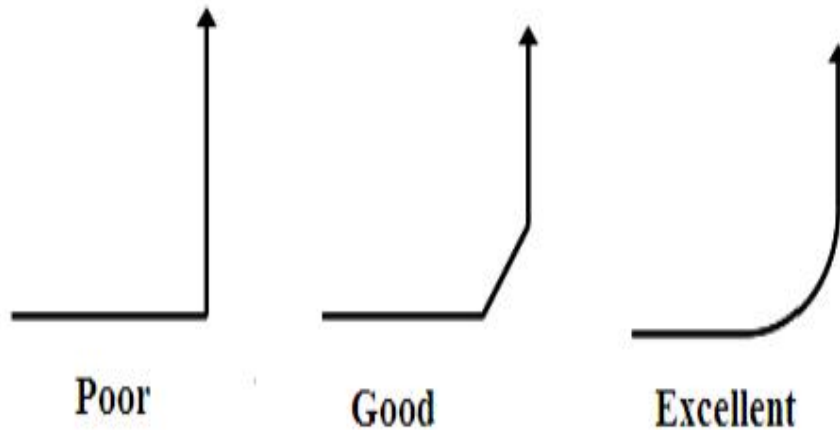


图 8: 微带线设计推荐/ :microstrip cable design

## 13 软件说明/ Software description

### 13.1 NMEA 0183 协议/ The NMEA 0183 protocol is available

表 1-1 NMEA-0183 输出信息/ NMEA-0183 Output information

NMEA 协议/NMEA protocol	描述/Description	默认/Default
GGA	定位数据信息/ Global positioning system fixed data	打开/Y
GSA	当前卫星信息/ DOP and active satellites	打开/Y
GSV	可见卫星信息/ Satellites in view	打开/Y
RMC	推荐定位信息/Recommended minimum specific data	打开/Y
GLL	大地坐标信息/Geographic position—latitude/longitude	打开/Y
VTG	地面速度信息/ Course over ground and ground speed	打开/Y
ZDA	当前时间(UTC1)信息/Date and Time	打开/Y

表 1-2 标识符助记码/Identifier mnemonic code

标识符/Identifier	数据类型/ Data type
GB	北斗模式/ Beidou mode
GP	GPS 模式/ GPS mode
GN	GNSS 模式/ GNSS mode
GA	Galileo 模式/ Galileo mode
GL	GLONASS 模式/ GLONASS mode

## 13.2 GGA-定位数据信息/GGA- Location information

此语句包含定位位置、定位时间、定位精度。

Contains the location, time, and precision factor of navigation positioning.

\$GNGGA,022326.000,2238.3443,N,11403.0962,E,1,22,0.72,104.0,M,-2.2,M,,\*69

表 2-1 GGA 语句格式/GGA Data Format

名称/Name	举例/Example	单位/Units	描述/Description
语句 ID/Message ID	\$GNGGA		表明语句为 GGA 信息/ GGA protocol header
UTC 时间/UTC Position	022326.000		hhmmss.sss 时分秒格式/Time seconds format
纬度/ Latitude	2238.3443		ddmm.mmmm 度分格式/Degree split format
纬度 N/S / N/S indicator	N		N=北纬 S=南纬/ N= north S= South
经度/ Longitude	11403.0962		dddmm.mmmm 度分格式/Degree split format
经度 E/W / E/W Indicator	E		E=东经 W=西经/ N=north or S=south
定位状态/ Position Fix Indicator	1		见附表 2-2/ See Table 2-2
已使用卫星数量 /Satellites Used	22		范围 0 到 24/ Range 0 to 12
HDOP 水平精度因子	0.72		
海拔高度/MSL Altitude	104.0	米/M	
单位/Unit	M		
大地水准面高度/ Geoidal height	-2.2		
水准面划分单位/Level surface division unit	M	米/M	
校验值/ Checksum	*69		
EOL	<CR> <LF>		结束标志符/ End of message termination

表 2-2 定位状态描述/ Position Fix Indicators

数值/Value	描述//Description
0	未定位或定位信息不可用/ Unpositioned or positioned information is not available
1	GNSS 定位/ GNSS fix
2	差分 GNSS 定位(DGNSS, SBAS) / Differential GNSS fix(DGNSS, SBAS)
3	PPS 模式/ PPS model

### 13.3 GSA-当前卫星信息/GSA- GNSS satellites in using

此条语句包含模块的选定工作模式，定位类型，已使用卫星的 PRN 信息及 PDOP, HDOP, VDOP 等信息。

This statement contains the selected working mode of the module, positioning type, PRN information of used satellites, PDOP, HDOP, VDOP and other information.

\$GNGSA,A,3,199,195,08,26,09,31,16,194,193,27,03,04,1.07,0.72,0.79,1\*05

\$GNGSA,A,3,67,66,,,,,,,,,1.07,0.72,0.79,2\*0E

\$GNGSA,A,3,,,,,,,,,1.07,0.72,0.79,3\*0E

\$GNGSA,A,3,37,20,07,,,,,,,,,1.07,0.72,0.79,4\*08

表 3-1 GSA 语句格式/GSA Data Format

名称/Name	举例/Example	单位/Units	描述/Description
语句 ID/ Message ID	\$GNGSA		表明语句为 GSA 信息/ Indicates that the statement is GSA information
模式 1/ Mode 1	A		表 3-3/ See Table 3-3
模式 2/ Mode 2	3		表 3-2/ See Table 3-2
已使用卫星 ID 信息/ ID of satellite used	199		第一信道的 Sv 信息/Sv on Channel 1
已使用卫星 ID 信息/ ID of satellite used	195		第二信道的 Sv 信息/Sv on Channel 2
...	...		...
已使用卫星 ID 信息/ ID of satellite used	<Null>		十二信道的 Sv 信息（未使用则为空）/ Sv on Channel 12 (Null fields when it is not Used)
PDOP	1.07		综合位置精度因子/Position Dilution of Precision
HDOP	0.72		水平精度因子/Horizontal Dilution of Precision
VDOP	0.79		垂直精度因子/Vertical Dilution of Precision
校验值	*05		
EOL	<CR> <LF>		结束标志符/End of message termination

表 3-2/Table 3-2

值/Value	描述/Description
1	未定位
2	2D 定位
3	3D 定位



表 3-3 /Table 3-3

值/Value	描述/Description
M	手动选择 2D 或者 3D 模式
A	自动选择 2D 或者 3D 模式

### 13.4 GSV-可见卫星信息//GSV- GNSS Satellites in View

此语句包含可见卫星的 PRNs, 方位角和仰角等信息。

This sentence contains the mode of operation, type of fix, PRN of the satellites used in the solution as well as PDOP, HDOP and VDOP.

\$GPGSV,4,1,13,27,78,149,46,199,60,149,39,04,59,289,43,194,56,045,44,1\*64

\$GPGSV,4,2,13,195,54,108,43,16,50,008,43,08,45,203,42,26,33,038,40,1\*5A

\$GPGSV,4,3,13,09,28,313,33,31,28,098,42,193,26,167,39,03,11,233,39,1\*52

\$GPGSV,4,4,13,22,,,35,1\*60

\$GPGSV,3,1,10,27,78,149,50,199,60,149,48,04,59,289,46,194,56,045,45,8\*6C

\$GPGSV,3,2,10,195,54,108,46,08,45,203,48,26,33,038,36,09,28,313,31,8\*54

\$GPGSV,3,3,10,193,26,167,44,03,11,233,43,8\*55

\$GLGSV,1,1,02,66,38,231,37,67,31,297,33,1\*7A

\$GAGSV,1,1,02,05,,,41,24,,,41,7\*72

\$GAGSV,1,1,02,05,,,45,24,,,41,1\*70

\$GBGSV,3,1,11,07,65,346,40,37,50,357,43,23,33,068,26,10,32,262,41,1\*7A

\$GBGSV,3,2,11,20,28,264,35,01,,,42,02,,,36,16,,,42,1\*48

\$GBGSV,3,3,11,03,,,40,05,,,28,32,,,38,1\*74

\$GBGSV,1,1,04,37,50,357,41,23,33,068,45,20,28,264,37,32,,,41,4\*44

表 4-1 GSV 语句格式/ GSV Data Format

名称/Name	举例/Example	单位/Units	描述/Description
语句 ID/Message ID	\$GPGSV		表明此语句为 GSV 信息/GSV protocol header
GSV 总数信息/ Number of Message	4		本次 GSV 语句的总条数/ Total number of GSV sentences
GSV 条数信息/	1		本条语句为 GSV 语句中的第几条/

Message Number			Sentence number of the total
可见卫星信息/ Satellites in View	13		当前可见卫星总数/Number of satellites in view
卫星 ID/Satellite ID	27		
卫星仰角/Elevation	78	度/degrees	范围 00 到 90/ Range 00 to 90
卫星方位角/Azinmuth	149	度/degrees	范围 000 到 359/ Range 000 to 359
信噪比(C/NO)/SNR(C/NO)	46	dB-Hz	范围 00 到 90 (未使用则为空) / Range 00 to 99, null when not tracking
...			...
可见卫星信息/ Satellites in View	194		
卫星 ID/Satellite ID	56	度/degrees	范围 00 到 90/ Range 00 to 90
卫星仰角/Elevation	045	度/degrees	范围 000 到 359/ Range 000 to 359
卫星方位角/Azinmuth	44	dB-Hz	范围 00 到 90 (未使用则为空) / Range 00 to 99, null when not tracking
校验值/Checksum	*64		
EOL	<CR> <LF>		结束标志符/End of message termination

### 13.5 RMC-推荐定位信息/ RMC- Recommended locating information

此语句包含推荐定位的卫星定位信息。

This statement contains the satellite positioning information for the recommended location.

\$GNRMC,022326.000,A,2238.3443,N,11403.0962,E,0.01,169.33,120421,,A,V\*07

表 5-1: RMC 语句格式/ RMC Data Format

名称/Name	举例/Example	单位/Units	描述/Description
语句 ID/Message ID	\$GNRMC		表明此语句为 RMC 信息/RMC protocol header
UTC 时间/UTS Position	022326.000		hhmmss.sss
使用状态/Status	A		A=数据已使用 V=数据未使用/A=data valid or V=data not valid
纬度/ Latitude	2238.3443		ddmm.mmmm
纬度 N/S/ N/S Indicator	N		N=北纬 S=南纬/N=north or S=south
经度/Longitude	11403.0962		dddmm.mmmm

经度 E/W /E/W Indicator	E		E=东经 W=西经/E=east or W=west
速度/ Speed Over Ground	0.01	节	
方位角/Course Over Ground	169.33	度	
UTC 日期/Date(UTC)	120421		ddmmyy
磁偏角/Magnetic variation	<Null>	度	未使用则为空/Null fields when it is not Used
磁偏角方位/Magnetic Variation Direction	<Null>		E=东经 W=西经 /E=east or W=west
定位模式/Fix Mode	A		A=自动, N=未定位, D=DGPS, E=DR/ A=autonomous, N = No fix, D=DGPS, E=DR
校验值/Checksum	*07		
EOL	<CR> <LF>		结束标志符/End of message termination

### 13.6 GLL-地理定位信息/Geographic Position – Latitude/Longitude

包含纬度和经度信息。

This sentence contains the fix latitude and longitude.

\$GNGLL, 2238.3443,N, 11403.0962,E, 022326.000,A,A\*4F

表 6-1: GLL 数据格式/GLL Data Format

名称/Name	举例/Example	单位/Units	描述/Description
语句/ Message ID	\$GNGLL		GLL protocol header
纬度/ Latitude	2238.3443		ddmm.mmmm
南北纬度/N/S Indicator	N		N=north or S=south
经度/ Longitude	11403.0962		dddmm.mmmm
东西经度/ E/W Indicator	E		E=east or W=west
UTC 定位/ UTC Position	022326.000		hhmms.sss
Fix 状态/Fix Status	A		A=data valid or V=data not valid
Fix 模式/Fix Mode	A		A=autonomous, N = No fix, D=DGPS, E=DR
校验和/ Checksum	*4F		
EOL	<CR> <LF>		信息结束标志符/End of message

## 13.7 VTG-地面速度信息/VTG- Course Over Ground and Ground Speed

此语句包含地面速度信息。

This statement contains the ground speed information.

\$GNVTG,169.33,T,,M,0.01,N,0.02,K,A\*2E

表 7-1: VTG 语句格式/VTG statement format

名称/Name	举例/Example	单位/Units	描述/Description
语句 ID/Message ID	\$GNVTG		表明此语句为 VTG 信息/VTG protocol header
以真北为参考的地面航向 /Ground course with true north as reference	169.33		000~359 度，前面的 0 也将被传输/At 000~359 degrees, the front 0 will also be transmitted
间隔符/Blank character	T		
以磁北为参考的地面航向 /Ground heading with magnetic north as reference	<Null>		000~359 度，前面的 0 也将被传输/At 000~359 degrees, the front 0 will also be transmitted
间隔符/Blank character	M		
地面速率/Ground rate	0.01	Knots	000.0~999.9
间隔符 /Blank character	N		
地面速率/Ground rate	0.02	Km / h	0000.0~1851.8Km / h
间隔符 /Blank character	K		
模式指示/Mode indication	A		A=自主定位，D=差分，E=估算，N=数据无效/ A= autonomous localization, D= difference, E= imputation, and N= invalid data
EOL	<CR> <LF>		结束标志符/ End of message termination

## 13.8 ZDA-时间日期信息/ ZDA- Date and Time

此语句包含时间和日期信息

This sentence contains UTC date & time, and local time zone offset information.

```
$GNZDA,022326.000,12,04,2021,,*49
```

表 8-1: ZDA 语句格式/ ZDA Data Format

名称/Name	举例/Example	单位/Units	描述/Description
语句 ID/Message ID	\$GNZDA		表明此语句为 ZDA 信息/ZDA protocol header
UTC 时间/UTC Time	022326.000		hhmmss (时分秒) 格式
UTC 日期/UTC data	12		日
UTC 日期/UTC Month	04		月
UTC 日期/UTC Year	2021		年
时区/local zone hours	<Null>		
校验值/Checksum	*49		
EOL	<CR> <LF>		结束标志符/ End of message termination

## 14 联系方式/ Contact Information

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