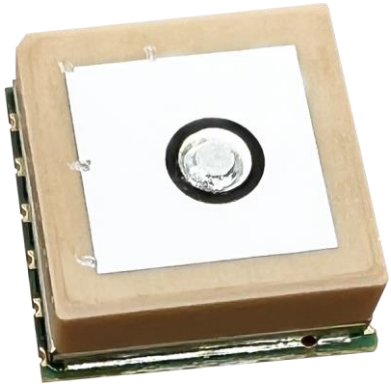
YIC



GPS & GLONASS Antenna Module

YIC31616GMSGG

Datasheet

www.yic.com.tw

Revision History

Date	Reversion	Description
2022/10/19	1.0	First Draft, Based on YIC31616GMGGS

Directory

1. Product Information

1.1 Product Description

YIC31616GMSGG is a complete standalone GPS/GLONASS antenna module. The module is powered by GOKE chip, which provides superior sensitivity and performance even in urban canyon and dense foliage environment. The miniature size makes the module easy to integrate into portable device like PDAs, camera and vehicle locators.

Applications

- Wearable and portable devices
- Automotive Navigation
- Personal Positioning
- Fleet Management
- Marine Navigation

1.2 Product Features

- Small size with antenna module
- Fast TTFF at low signal level
- Build on high performance, GOKE chip set
- SMD type with stamp holes
- Low power consumption: Max 35mA@3.3V
- Built-in high gain LNA
- NMEA-0183 compliant protocol
- Patch Antenna Size: 15x15x4mm
- Communication type: UART/TTL
- RoHS Compliant

1.3 Product Specifications

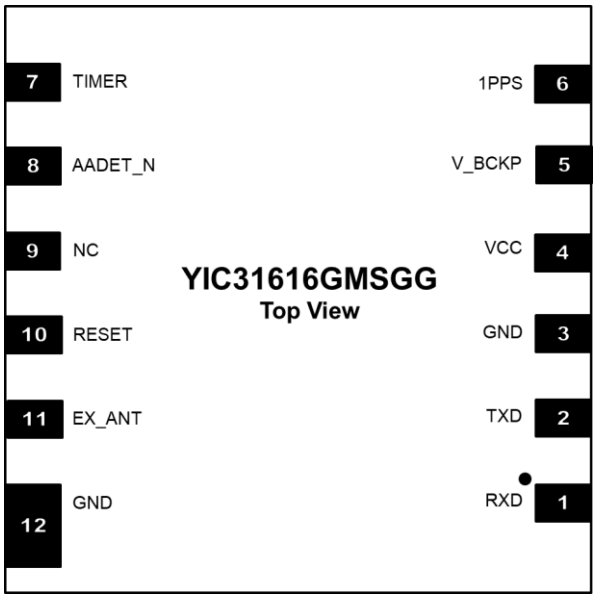
GPS Receiver		
Chip	GOKE	
Frequency	Code 66 search channels, 22 synchronous tracking channels GPS&, QZSS, GALILEO: L1 1575.42MHz C/A GLONASS: L1OF 1602MHz BeiDou: B1 1561.098MHz SBAS: WAAS, EGNOS, MSAS, GAGAN	
Update Rate	1Hz (default) , up to 10Hz	
Position Accuracy	Position	< 2.5m CEP @-130 dBm
	Acceleration Accuracy	Without aid: 0.1m/s²
Startup Time	Cold start	35s typ @-130dBm
	Warm start	30s typ @-130dBm
	Hot start	1s typ @-130dBm
Sensitivity	Acquisition	-148dBm
	Re-acquisition	-156dBm
	Tracking	-165dBm
GNSS Operating limit	Altitude	18,000m
	Velocity	515m/s
	Acceleration	4G
Protocol Support	UART Port: TXD and RXD 9600bps (default), Baud rate supports 4800bps to 115200bps NMEA 0183 and GK Protocol	
Environment	Operation temperature	-40°C ~ +85°C
	Storage temperature	-45°C ~ +125°C
Physical Characteristics	Size	16±0.15 × 16±0.15 × 6.95±0.1mm(H)
	Weight	Approx. 6.1g

1.4 DC Electrical Characteristics

Parameter	Min.	Typ.	Max.	Units
Input Voltage	2.8	3.3	4.3	Volt
Acquisition		33		mA
Tracking		29		mA
Backup Battery		15		uA
Standby Mode		2		mA
Low Level Output Voltage (VOL)			0.4	Volt
High Level Output Voltage (VOH)	2.4			Volt
Low Level Input Voltage (VIL)			0.8	Volt
High Level Input Voltage (VIH)	2			Volt
Low Level Output Current (IOL)		2		mA
High Level Output Current (IOH)		2		mA

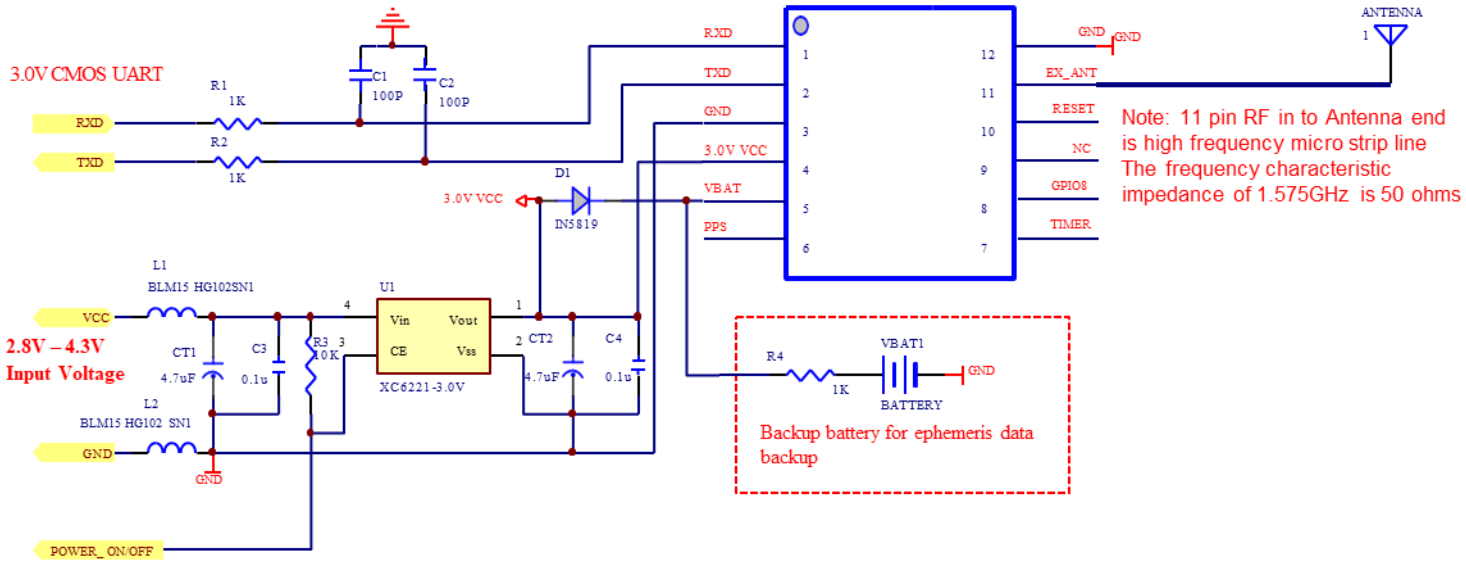
2. Technical Information

2.1 Module Pin Assignment



Pin No.	Pin Name	I/O	Remark
1	RXD	I	UART/TTL Serial Data Input
2	TXD	O	UART/TTL Serial Data Output
3	GND	G	Ground
4	VCC	I	Module Power Supply
5	V_BCKP	I	Backup power supply, The V_BCKP pin can be directly supplied power by battery or connect it to VCC
6	1PPS	O	One pulse per second, Synchronized at rising edge, the pulse width is100ms. If unused, keep this pin open
7	TIMER	O	Can be used to control GPS&GLONASS module main power on/off
8	AADET_N	I/O	Active antenna detection, If unused, keep this pin open
9	NC	N	Not connected
10	RESET	I	Low level active. If unused, keep this pin open or connect in to Vcc
11	EX_ANT	I	External active antenna RF input. If unused, keep this pin open
12	GND	G	Ground

3. Application Circuit：(Example)



3.1 Standby Mode

Standby mode is a low-power consumption mode. In standby mode, the internal core and I/O power domain are still active, but RF and TCXO are powered off, and the module stops satellites search and navigation. UART is still accessible through PGK commands or any other data, but there is no NMEA messages output.

Sending PGK command “$PGK161,0*28” enter into standby mode. Sending any data via UART can wake the module up. When the module exits from standby mode, it will use all internal aiding information like GPS&GLONASS time, Ephemeris, Last Position, etc., resulting to the fastest possible TTFF in either Hot or Warm start. The typical standby current consumption in this way is about 2mA @VCC=3.3V.

☆ When the external active antenna is used, an additional 11mA will be consumed because the VCC still supplies power for external active antenna in standby mode.

3.2 Default Configurations

Item	Configuration	Comment
Baud Rate	9600bps	Can be configured as 4800bps~115200bps
Protocol	NMEA	RMC, VTG, GGA, GSA, GSV, GLL and GPTXT（GK proprietary protocol）
Update Rate	1Hz	Can be configured as 1~10Hz
SBAS	Enable	
AIC	Enable	
Locus	Disable	
Easy	Enable	Easy will be disabled automatically when update rate exceeds 1Hz.

3.3 AIC

Module provides an advanced technology called multi-tone AIC (Active Interference Cancellation) to reject RF interference which comes from other active components on the main board.

Up to 12 multi-tone AIC embedded in the module can provide effective narrow -band interference and jamming elimination. The GPS&GLONASS signal could be recovered from the jammed signal, which can ensure better navigation quality. AIC is enabled by default, closing it we save about 1mA @VCC=3.3V consumption. The following commands can be used to set AIC.

Enable AIC function: “$PGK 286, 1*23”. Disable AIC function: “$PGK 286,0*22”.

3.4 Locus

Module supports the embedded logger function called LOCUS. It can log position information to the internal flash memory automatically when this function is enabled by sending PGK command “$PGK183,0*22”.Due to this function, the host can go to sleep to save power consumption and does not need to receive the NMEA information all the time. The module can provide a log capacity of more than 16 hours.

The detail procedures of this function are illustrated bellow:

- The module has fixed the position (only 3D_fixed is available);
- Sending PGK command “$PGK184,1*22” to erase internal flash;
- Sending PGK command “$PGK185,0*22” to start log;
- Module logs the basic information (UTC time, latitude, longitude and height) every 15 seconds to internal flash memory;
- Stop logging the information by sending “$PGK185,1*23”;
- Host can get the data from the module via UART by sending“$PGK622,1*29”.

3.5 Easy

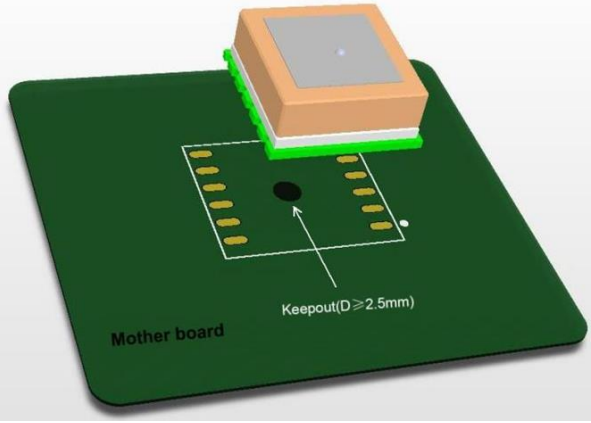
EASY technology works as embedded software which can accelerate TTFF by predicting satellite navigation messages from received ephemeris. The GPS&GLONASS engine will calculate and predict orbit.

Information automatically up to 3 days after first receiving the broadcast ephemeris, and then save the predicted information into the internal memory. GPS&GLONASS engine will use the information for positioning if no enough information from satellites, so the function is helpful for positioning and TTFF improvement.

The EASY function can reduce TTFF to 5s in warm start. In this case, RTC domain should be valid. In order to get enough broadcast ephemeris information from GPS&GLONASS satellites, the GPS&GLONASS module should receive the information for at least 5 minutes in good signal conditions after fixing the position.

EASY function is enabled by default. Command “$PGK869,1,0*34” can be used to disable EASY.

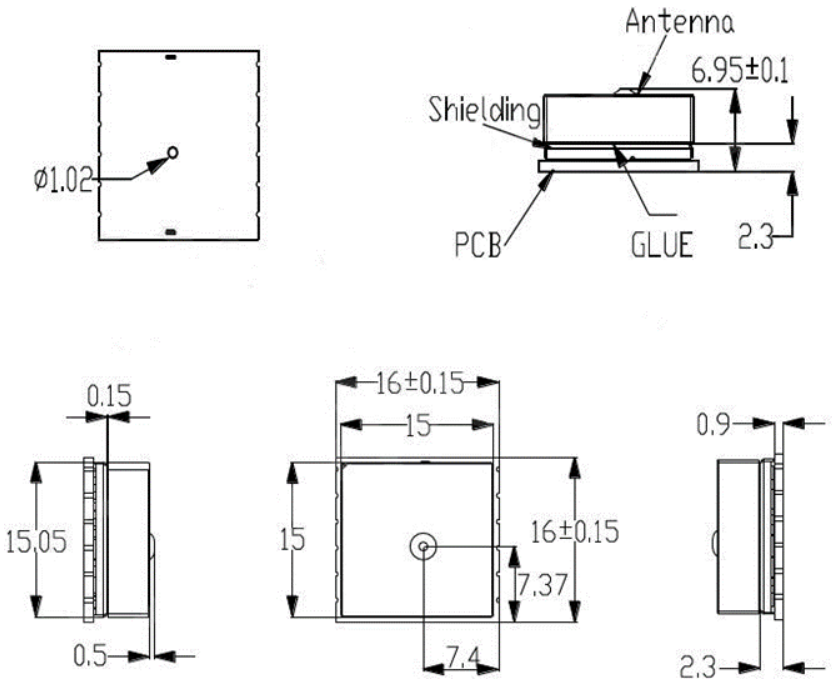
4. PCB Design Guide



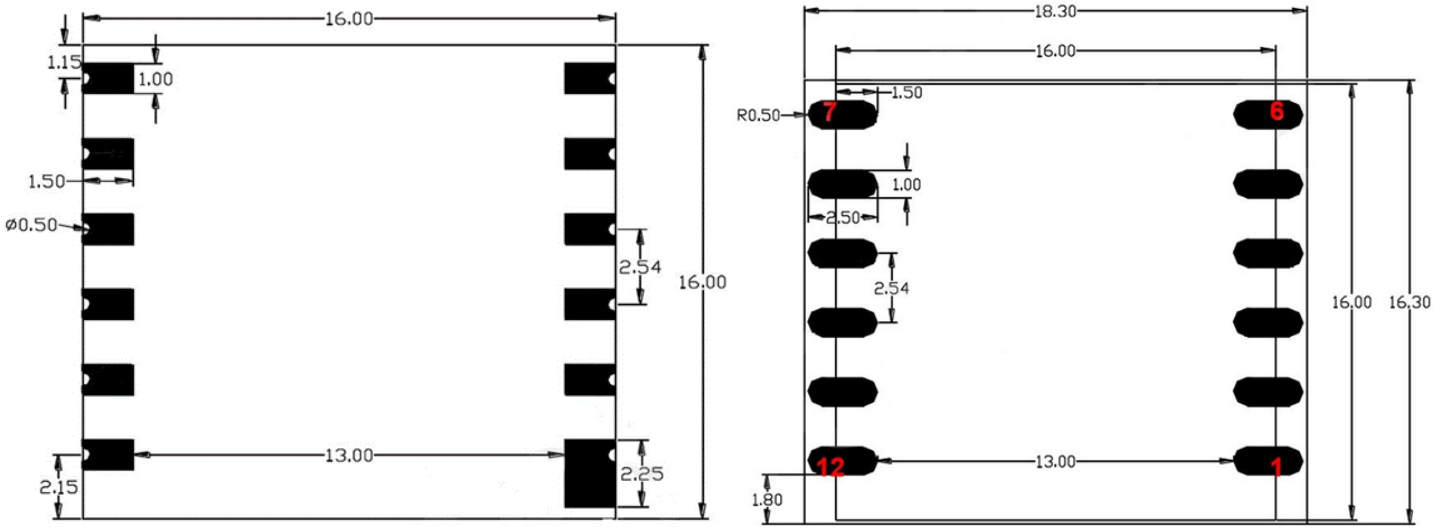
Note:

The position on the motherboard corresponding to the feed point of the patch antenna should be kept out on each layer, and the diameter of the keep out area should be not less than 2.5mm.

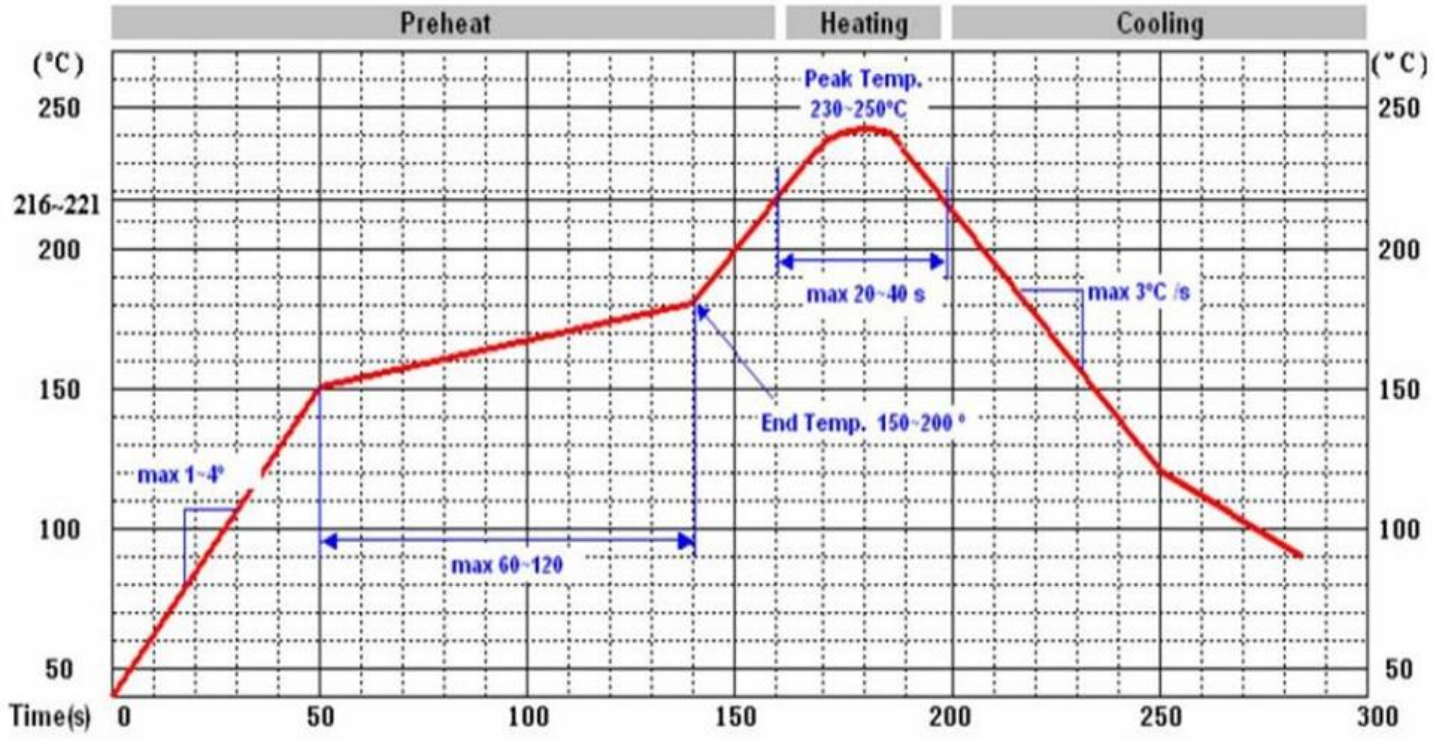
4.1 Dimensions



4.2 Recommended Footprint



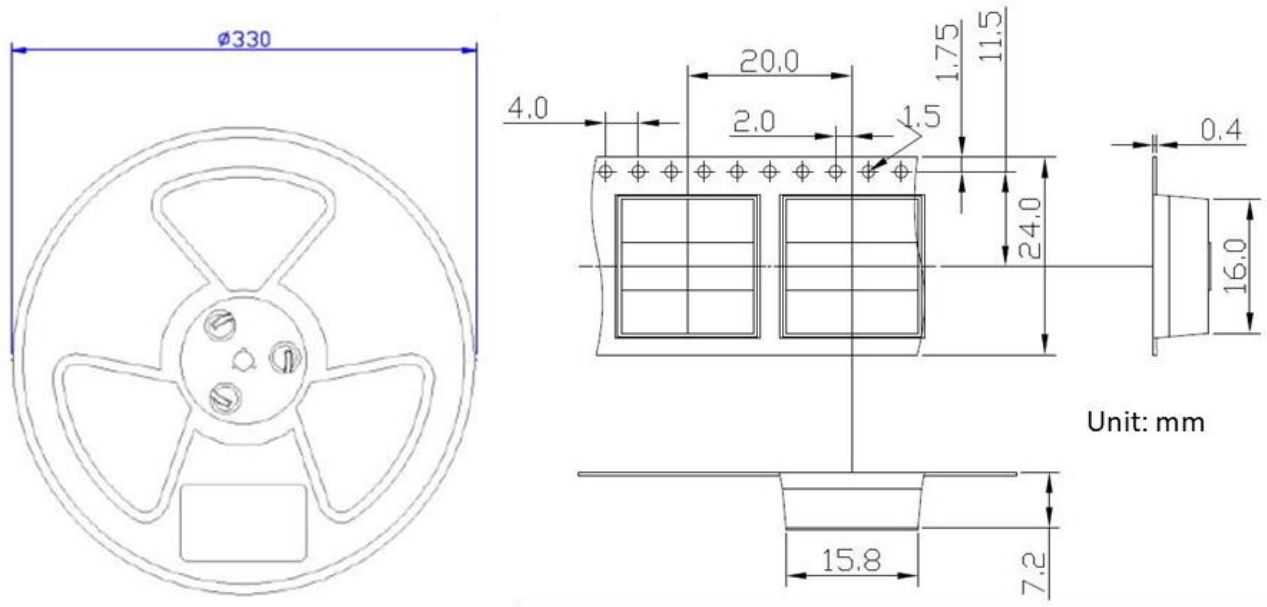
5. Reflow Profile



☆ The absolute maximum reflow temperature is 260℃. Repeated reflow soldering processes or soldering the module upside down are not recommended.

☆ Modules must not be soldered with a damp heat process.

6. Tape & Reel



7. Software Interface

Table 7.1 NMEA output message

NMEA	Description
GGA	Global positioning system fixed data
GLL	Geographic position - latitude/longitude
GSA	GNSS DOP and active satellites
GSV	GNSS satellites in view
RMC	Recommended minimum specific GNSS data
VTG	Course over ground and ground speed

8. Protocol

8.1 GGA – Global Positioning System Fix Data

For example:

$xxGGA, 161229.487,3723.2475,N, 12158.3416,W, 1,07,1.0,9.0,M.0000*18

Field	Name	Example	Units	Description
1	Message ID	$xxGGA		GGA protocol header
2	UTC Position	161229.487		hhmmss.sss
3	Latitude	3723.2457		ddmm.mmmm
4	N/S indicator	N		N=north or S=south
5	Longitude	12158.3416		dddmm.mmmm
6	E/W Indicator	W		E=east or W=west
7	Position Fix Indicator	1		See Table 8.1-1
8	Satellites Used	07		Range 0 to 12
9	HDOP	1.0		Horizontal Dilution of Precision
10	MSL Altitude	9.0	meters	
11	Units	M	meters	
12	Geoids Separation		meters	
13	Units	M	meters	
14	Age of Diff.Corr.		second	Null fields when DGPS is not Used
15	Diff.Ref.Station ID	0000		
16	Check sum	*18		
18	<CR> <LF>			End of message termination

Table 8.1-1 Position Fix Indicators

Value	Description
0	Fix not available or invalid
1	GPS & Glonass SPS Mode, fix valid
2	Differential GPS & Glonass, SPS Mode, fix valid
3	GPS & Glonass PPS Mode, fix valid

8.2 GLL – Latitude/Longitude

For example:

$xxGLL, 3723.2475, N,12158.3416, W,161229.487, A*2C

Field	Name	Example	Units	Description
1	Message ID	$xxGLL		GLL protocol header
2	Latitude	3723.2475		ddmm.mmmm
3	N/S Indicator	N		N=north or S=south
4	Longitude	12158.3416		dddmm.mmmm
5	E/W Indicator	W		E=east or W=west
6	UTC Position	161229.487		hhmmss.sss
7	Status	A		A=data valid or V=data not valid
8	Check sum	*2C		
9	<CR> <LF>			End of message temination

8.3 GSA – GPS & GLONASS DOP and Active Satellites

For example:

$xxGSA, A, 3, 07, 02, 26,27, 09, 04,15, , , , , , 1.8,1.0,1.5*33

Field	Name	Example	Units	Description
1	Message	$xxGSA		GSA protocol header
2	Mode 1	A		See Table 8.3-1
3	Mode 2	3		See Table 8.3-2
4	Satellite Used	07		Sv on Channel 1
5	Satellite Used	02		Sv on Channel 2
6	…	…		…
7	Satellite Used			Sv on Channel 66
8	PDOP	1.8		Position Dilution of Precision
9	HDOP	1.0		Horizontal Dilution of Precision
10	VDOP	1.5		Vertical Dilution of Precision
11	Check sum	*33		
12	<CR> <LF>			End of message termination

Table 8.3-1 Mode 1

Value	Description
1	Fix not available
2	2D
3	3D

Table 8.3-2 Mode2

Value	Description
M	Manual-forced to operate in 2D or 3D mode
A	Automatic-allowed to automatically switch 2D/3D

8.4 GSV – GPS & GLONASS Satellites in View

For example：

$xxGSV, 2, 1, 07, 07, 79,048, 42, 02, 51,062, 43, 26, 36,256, 42, 27, 27, 138,42*71

$xxGSV, 2, 2, 07, 09, 23,313, 42, 04, 19, 159, 41, 15,12,041, 42*41.

Field	Name	Example	Units	Description
1	Message ID	$xxGSV		GSV protocol header
2	Number of Message	2		Range 1 to 3
3	Message Number	1		Range 1 to 3
4	Satellites in View	07		
5	Satellite ID	07		Channel 1(Range 1 to 66)
6	Elevationb	79	degrees	Channel 1(Maximum 90)
7	Azinmuth	048	degrees	Channel 1(True, Range 0 to 359)
8	SNR(C/NO)	42	dBHz	Range 0 to 99,null when not tracking
9	…			…
10	Satellite ID	27		Channel 4(Range 1 to 66)
11	Elevation	27	degrees	Channel 1(Maximum 90)
12	Azimuth	138	degrees	Channel 1(True, Range 0 to 359)
13	SNR(C/NO)	42	dBHz	Range 0 to 99,null when not tracking
14	Check sum	*71		
15	<CR> <LF>			End of message termination

8.5 RMC – Recommended Minimum Specific GNSS Data

For example:
$xxRMC, 161229.487, A, 3723.2475, N, 12158.3416, W, 0.13,309.62, 120598,, *10

Field	Name	Example	Units	Description
1	Message ID	$xxRMC		RMC protocol header
2	UTS Position	161229.487		hhmmss.sss
3	Status	A		A=data valid or V=data not valid
4	Latitude	3723.2475		ddmm.mmmm
5	N/S Indicator	N		N=north or S=south
6	Longitude	12158.3416		dddmm.mmmm
7	E/W Indicator	W		E=east or W=west
8	Speed Over Ground	0.13	Knots	
9	Course Over	309.62	Degrees	True
10	Ground			
11	Date	120598		Dummy
12	Magnetic variation		Degrees	E=east or W=west
13	Check sum	*10		
14	<CR> <LF> End of			End of message termination

8.6 VTG – Course Over Ground and Ground Speed

For example:

$xxVTG, 309.62, T, M, 0.13, N, 0.2, K*6E

Field	Name	Example	Units	Description
1	Message ID	$xxVTG		VTG protocol header
2	Course	309.62	Degrees	Measured heading
3	Reference	T		True
4	Course		Degrees	Measured heading
5	Reference	M		Magnetic
6	Speed	0.13	Knots	Measured horizontal speed
7	Units	N		Knots
8	Speed	0.2	Km/hr	Measured horizontal speed
9	Units	K		Kilometer per hour
10	Check sum	*6E		
11	<CR> <LF>			End of message termination