

General Description

The Gotop GT-1612-SN is a complete GPS engine module that features super sensitivity, ultra low power and small form factor. The GPS signal is applied to the antenna input of module, and a complete serial data message with position, velocity and time information is presented at the serial interface with NMEA protocol or custom protocol.

Its -165dBm tracking sensitivity extends positioning coverage into place like urban canyons and dense foliage environment where the GPS was not possible before. The small form factor and low power consumption make the module easy to integrate into portable device like PNDs, mobile phones, cameras and vehicle navigation systems.

Applications

- LBS (Location Based Service)
- PND (Portable Navigation Device)
- Vehicle navigation system
- Mobile phone



Figure1: GT-1612-SN Top View

Features

- Build on high performance, low-power SONY CXD5603GF chip set
- Ultra high Track sensitivity: -165dBm
- Extremely fast TTFF at low signal level
- Built in high gain LNA
- Low power consumption: Max $8\text{ mA}@3.3\text{V}$
- NMEA-0183 compliant protocol or custom protocol
- Operating voltage: 2.8V to 5.0V
- Operating temperature range: -40 to 85°C
- SMD type with stamp holes
- Small form factor: $16.3 \times 12.5 \times 2.6\text{mm}$
- RoHS compliant (Lead-free)

1 Description

1.1. Key Features

Parameter	Specification
Power Supply	<ul style="list-style-type: none"> Supply voltage: 2.8V~5.0V Typical: 3.3V
Power Consumption	<ul style="list-style-type: none"> Acquisition: 8mA @VCC=3.3V Tracking: 6.5mA @VCC=3.3V Idle: 3mA @VCC=3.3V
Receiver Type	<ul style="list-style-type: none"> Code 66 search channels, GPS&QZSS L1 1575.42MHz C/A 22 simultaneous tracking channels
Sensitivity	<ul style="list-style-type: none"> Tracking: -165dBm Re-acquisition: -160dBm Acquisition: -147dBm
TTFF (Autonomous)	<ul style="list-style-type: none"> Cold start: 35s typ @-130dBm Warm start: 30s typ @-130dBm Hot start: 2s typ @-130dBm
Horizontal Position Accuracy (Autonomous)	<ul style="list-style-type: none"> <2.5m CEP @-130 dBm
Update Rate	<ul style="list-style-type: none"> 1Hz
Accuracy of 1PPS Signal	<ul style="list-style-type: none"> Typical accuracy: ±10ns, Time pulse width: 100ms
Acceleration Accuracy	<ul style="list-style-type: none"> Without aid: 0.1m/s²
Dynamic Performance	<ul style="list-style-type: none"> Maximum altitude: 18,000m Maximum velocity: 515m/s Acceleration: 4G
UART Port	<ul style="list-style-type: none"> UART Port: TXD and RXD Supports baud rate from 4800bps to 115200bps, 115200bps by default UART port is used for NMEA output, SONY proprietary commands input
Temperature Range	<ul style="list-style-type: none"> Normal operation: -40°C ~ +85°C Storage temperature: -45°C ~ +125°C
Physical Characteristics	<ul style="list-style-type: none"> Size: 16.3±0.2 × 12.5±0.2 × 2.6±0.2mm Weight: Approx. 0.5 g

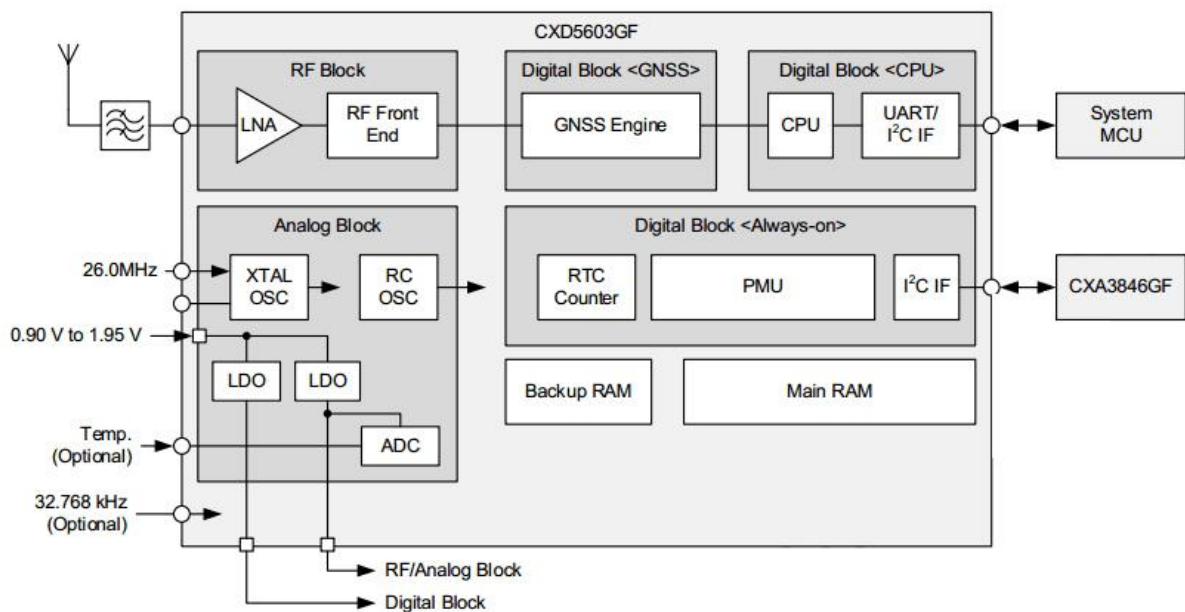
1.2 Power Supply

Regulated power for the GT-1612-SN is required. The VCC Pin Need a stable DC voltage supply. Power supply ripple must be less than 30mV. The input voltage Vcc should be 2.8V~5.0V, Recommended power supply voltage is 3.3V . maximum current is 8mA. Suitable decoupling must be provided by external decoupling circuitry.

1.3 UART Ports

The module supports two full duplex serial channels UART. All serial connections are at 3V CMOS logic levels, if need different voltage levels, use appropriate level shifters. The baud rate of both serial ports are fully programmable, the data format is however fixed: X, N, 8, 1, i.e. X baud rate, no parity, eight data bits and one stop bit, no other data formats are supported, LSB is sent first. The modules default baud rate is set up 115200bps, however, the user can change the default baud rate to any value from 4800 bps to 115kbps. UART port can be used for firmware upgrade, NMEA output and SONY proprietary commands input.

1.4 Block Diagram



2 Application

The module is equipped with a 24-pin pad that connects to your application platform. The GT-1612-SN module It consists of a SONY CXD5603GF single chip GPS IC which includes the RF part and Baseband part, a patch antenna, a LNA, a SAW filter, a TCXO, a crystal oscillator.

2.1. Pin Assignment

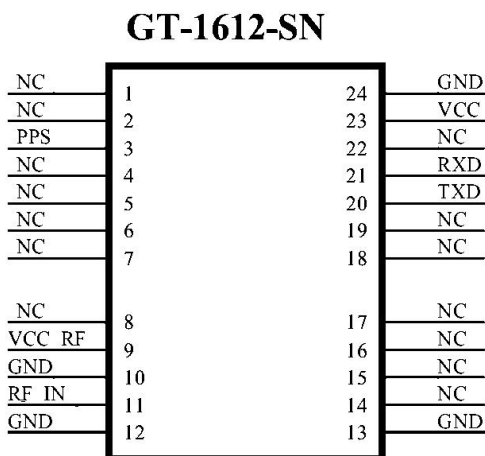


Figure 2: Pin Assignment

CON Pin Description

Power Supply					
Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
VCC 3.3V	23	I	Main power supply	V _{max} =3.3V V _{min} =2.8V V _{nom} =3.3V	Supply current not less than 100mA.
GND	10.12. 13.24	G	Ground.		Assure a good GND connection to all GND pins of the module, preferably with a large ground plane.
UART Port					
Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
RXD	21	I	Receive data	V _{ILmin} =-0.3V V _{ILmax} =0.8V V _{IHmin} =2.0V V _{IHmax} =3.3V	
TXD	20	O	Transmit data	V _{OLmin} =-0.3V V _{OLmax} =0.4V V _{OHmin} =2.4V V _{OHmax} =3.1V	

RF Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
RF_IN	11	I	External active antenna RF input		Characteristic impedance of 50Ω
VCC_RF	9	O	Active antenna power output	Vnom=3.3V	Output Voltage RF section.VCC_RF can be selected according to the type of antenna.

Other Interfaces

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
PPS	3	O	One pulse per second	VOLmin=-0.3V VOLmax=0.4V VOHmin=2.4V VOHmax=3.1V	Synchronized at rising edge, the pulse width is 100ms. If unused, keep this pin open.

GPIO Interfaces

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
	1.2.4.5.6.7.8.				
NC	14.15.16.17. 18.19.22				

2.2 Command specifications

the GT-1612-SN module is to open the work by sending the command, and to implement any of the features.

2.2.1 @GCD: Cold start

This command is used to start the positioning with cold start

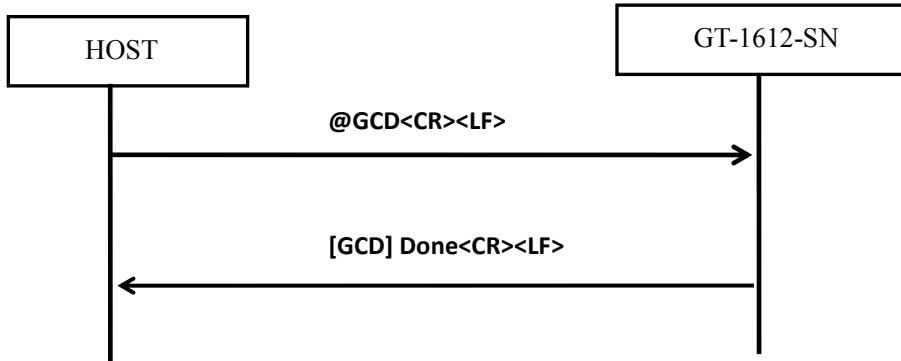
Format: @GCD<CR><LF>

Argument: None

Response:

Sentence	Description
"[GCD] Done"	This indicates that the command has been executed successfully.
"[GCD] Err n"	This indicates that an error has occurred. "n" is where the error code is entered.

Sequence:



2.2.2 @BUP: Backup data save

This command is used to save the backup data. The backup data contents are saved in the flash memory.

The backup data saved in the flash memory is automatically restored at boot-up from power OFF.

The receiver position, ephemeris, almanac, TCXO offset and other information required for hot start are included in the backup data, and by saving the backup data in the flash memory using this command, hot start can be initiated when the system is booted from power OFF. (The time must be injected.)

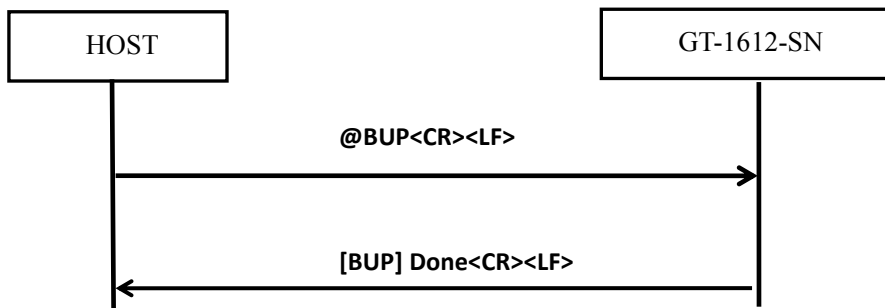
Format: @BUP<CR><LF>

Argument: None

Response:

Sentence	Description
"[BUP] Done"	This indicates that the command has been executed successfully.
"[BUP] Err n"	This indicates that an error has occurred.

Sequence:



2.2.3 @GPPS: 1PPS output setting

This command is used to control 1PPS output.

When 1PPS output is enabled, timing pulse is output in 1 sec period from 1PPS output port after clock information being received from GNSS. When 1PPS output is disabled, timing pulse is not output from 1PPS output port.

Format: @GPPS <arg 1><CR><LF>

Argument: None

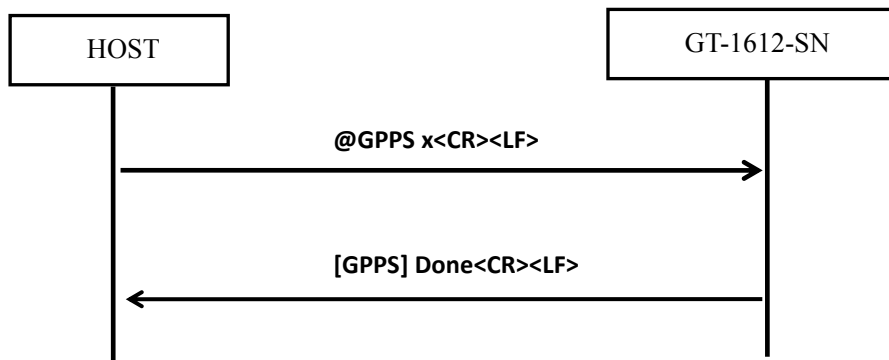
Argument:

Field	Description
arg 1	1PPS output control 0 : Disable 1PPS output (default value) 1 : Enable 1PPS output

Response:

Sentence	Description
“[GPPS] Done”	This indicates that the command has been executed successfully.
“[GPPS] Err n”	This indicates that an error has occurred. “n” is where the error code is entered.

Sequence:



2.3 Mechanical Dimensions

This chapter describes the mechanical dimensions of the GT-1612-SN module. Size unit (mm)

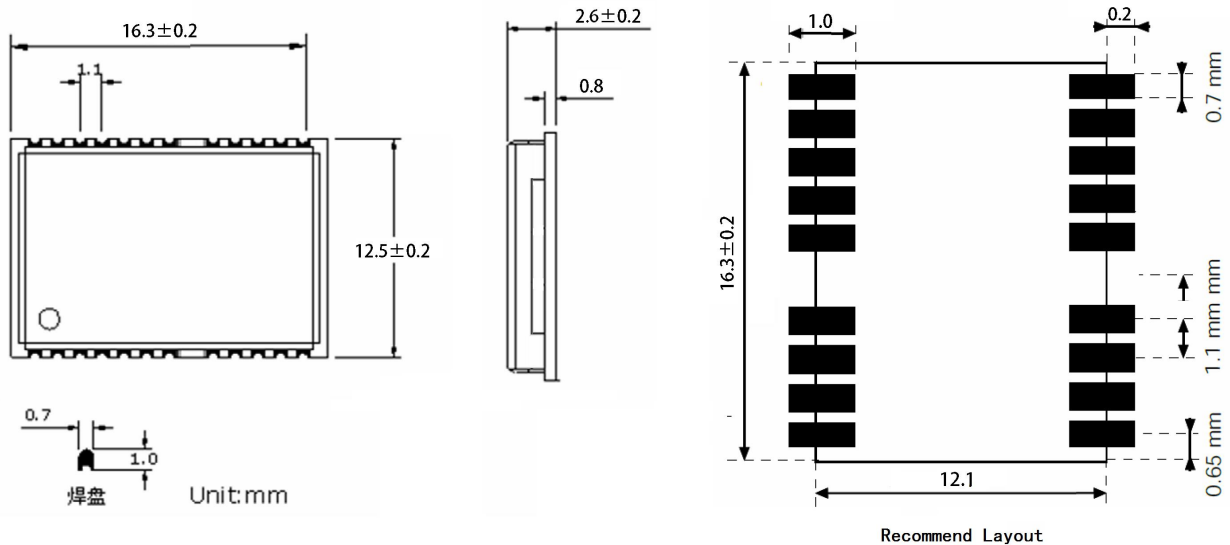


Figure 3: Specification size chart

3 Manufacturing, Packaging and Ordering Information

3.1. Assembly and Soldering

GT-1612-SN module is intended for SMT assembly and soldering in a Pb-free reflow process on the top side of the PCB. It is suggested that the minimum height of solder paste stencil is 100um to ensure sufficient solder volume. Pad openings of paste mask can be increased to ensure proper soldering and solder wetting over pads. It is suggested that the peak reflow temperature is 235~245° C (for SnAg3.0Cu0.5 alloy). The absolute maximum reflow temperature is 260° C. To avoid damage to the module when it is repeatedly heated, it is suggested that the module should be mounted after reflow soldering for the other side of PCB has been completed. Recommended reflow soldering thermal profile is shown below:

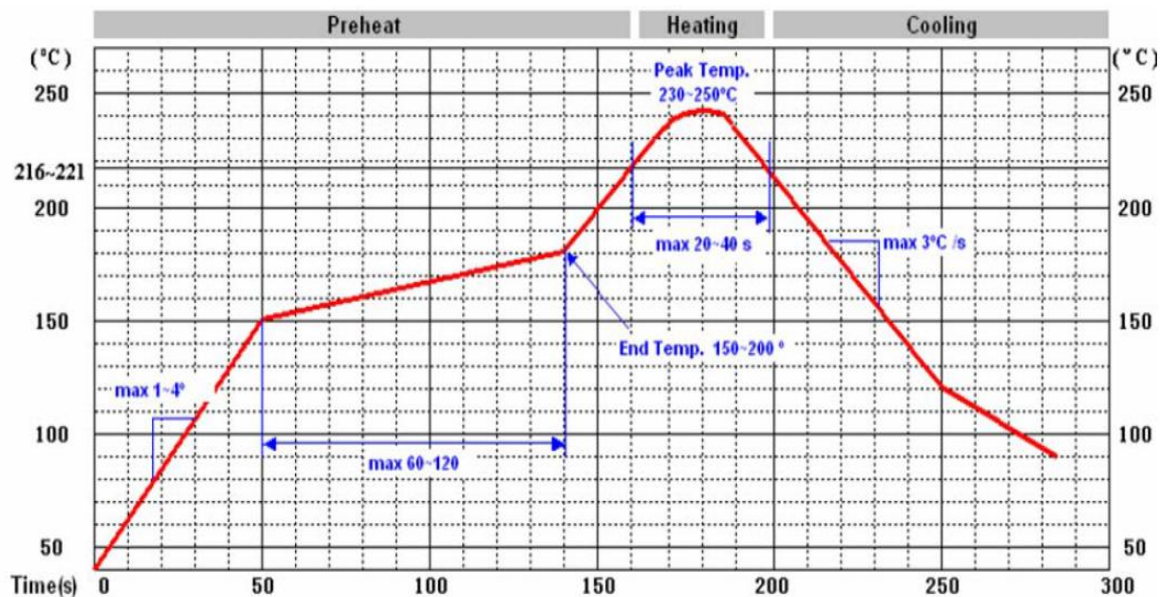


Figure 4: Recommended Reflow Soldering Thermal Profile

3.2. Moisture Sensitivity

GT-1612-SN module is sensitive to moisture. To prevent GT-1612-SN from permanent damage during reflow soldering, baking before reflow soldering is required in following cases:

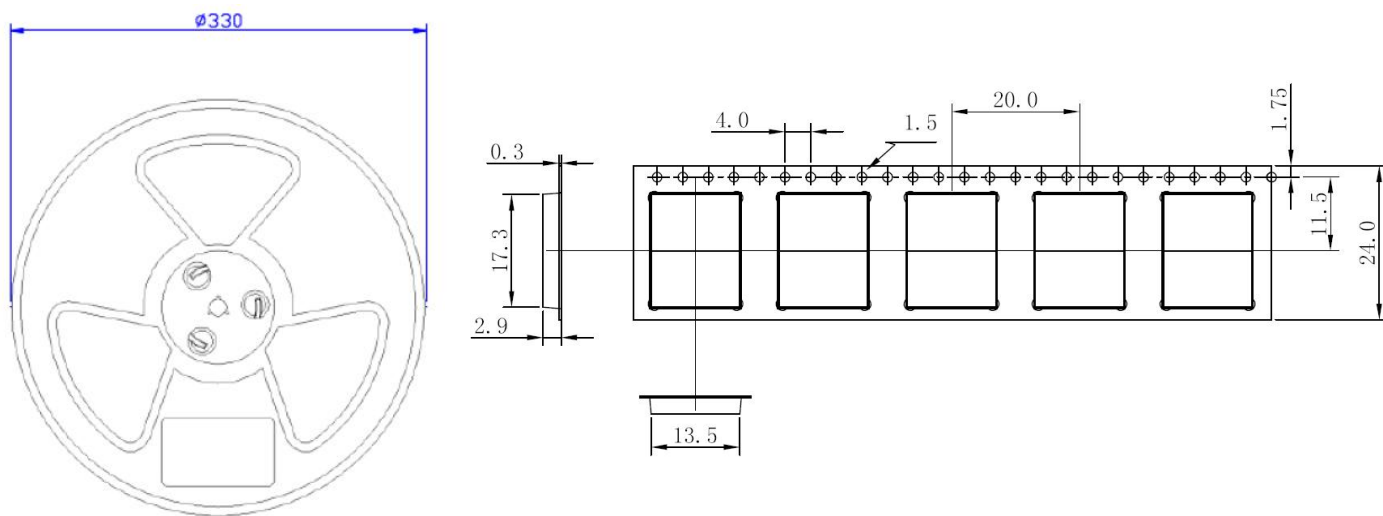
- ◇ Humidity indicator card: One or more indicating spots are no longer blue.
- ◇ The seal is opened and the module is exposed to excessive humidity.

GT-1612-SN should be baked for 192 hours at temperature $40^{\circ}\text{C}+5^{\circ}\text{C}/-0^{\circ}\text{C}$ and $<5\%$ RH in low-temperature containers, or 24 hours at temperature $125^{\circ}\text{C}\pm 5^{\circ}\text{C}$ in high-temperature containers. Care should be taken that the plastic tape is not heat resistant. GT-1612-SN should be taken out from the tape before preheating; otherwise, the tape maybe damaged by high-temperature heating.

3.3. ESD Protection

GT-1612-SN module is sensitive to ESD and requires special precautions when handling. Particular care must be exercised when handling patch antenna, duo to the risk of electrostatic charges.

3.4. Tape and Reel Packaging



Unit: mm

Quantity per reel: 1000pcs

Length per reel: 16m

Figure 5: Tape and Reel Specifications



Figure 6: Packaging physical Figure

Reel Packaging

Model Name	MOQ for MP	Minimum Package: 1000pcs
GT-1612-SN	1000pcs	Size: 365mm × 350mm × 53mm N.W: 1.42kg G.W: 1.6kg

4 NMEA 0183 Protocol

The NMEA protocol is an ASCII-based protocol, Records start with a \$ and with carriage return/line feed. GPS specific messages all start with \$GPxxx where xxx is a three-letter identifier of the message data that follows. NMEA messages have a check sum, which allows detection of corrupted data transfers.

The Gotop GT-1612-SN supports the following NMEA-0183 messages: \$GPGSA, \$GPGSV,\$GPRMC,\$GPVTG, \$GPZDA and \$GPGLL.

4.1 NMEA-0183 Output Messages

NMEA Record	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
ZDA	Time and date information

4.1.1 GGA : Global Positioning System Fix Data

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

Fields:

Name	Example	Units	Description
Message ID	\$GPGGA		GGA protocol header
UTC Position	161229.487		hhmmss.sss
Latitude	3723.2457		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Position Fix Indicator	1		See Table 1-1
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude	9.0	meters	
Units	M	meters	
Geoids Separation		meters	
Units	M	meters	
Age of Diff.Corr.		second	Null fields when DGPS is not Used
Diff.Ref.Station ID	0000		

Check sum	*18		
<CR> <LF>			End of message termination

Table 1-1: Position Fix Indicators

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

4.1.2 GLL : Geographic Position – Latitude / Longitude

\$GPGLL , 3723.2475, N,12158.3416, W,161229.487, A*2C.

Fields:

Name	Example	Units	Description
Message ID	\$GPGLL		GLL protocol header
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
UTC Position	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Check sum	*2C		
<CR> <LF>			End of message termination

4.1.3 GSA-GNSS DOP and Active Satellites

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

Fields:

Name	Example	Units	Description
Message	\$GPGSA		GSA protocol header
Mode 1	A		See Table 1-2
Mode 2	3		See Table 1-3
Satellite Used	07		Sv on Channel 1
Satellite Used	02		Sv on Channel 2
...
Satellite Used			Sv on Channel 12
PDOP	1.8		Position Dilution of Precision
HDOP	1.0		Horizontal Dilution of Precision

VDOP	1.5		Vertical Dilution of Precision
Check sum	*33		
<CR> <LF>			End of message termination

Table 1-2: Mode 1

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

Table 1-3: Mode 2

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

4.1.4 GSV-GNSS Satellites in View

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

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

Fields:

Name	Example	Units	Description
Message ID	\$GPGSV		GSV protocol header
Number of Message	2		Range 1 to 3
Message Number	1		Range 1 to 3
Satellites in View	07		
Satellite ID	07		Channel 1(Range 1 to 32)
Elevation	79	degrees	Channel 1(Maximum 90)
Azinmuth	048	degrees	Channel 1(True, Range 0 to 359)
SNR(C/NO)	42	dBHz	Range 0 to 99,null when not tracking
...			...
Satellite ID	27		Channel 4(Range 1 to 32)
Elevation	27	degrees	Channel 4(Maximum 90)
Azimuth	138	degrees	Channel 4(True, Range 0 to 359)
SNR(C/NO)	42	dBHz	Range 0 to 99, null when not tracking
Check sum	*71		
<CR> <LF>			End of message termination

◇ Depending on the number of satellites tracked multiple messages of GSV data may be required.

4.1.6 RMC: Recommended Minimum Specific GNSS Data

Format : \$--RMC,hhmmss.ss,A,llll.ll,a,yyyyy.yy,a,x.x,x.x,xxxxxx,x.x,a,a*hh<CR><LF>

Fields:

Field	Format	Description
Header	\$	
Talker ID	--	GP : Using only GPS for positioning GL : Using only GLONASS for positioning QZ : Using only QZS for positioning GN : Using combined satellite systems for positioning
Sentence ID	RMC	
UTC of position fix	hhmmss.ss	hh [hour] mm [min] ss.ss [sec]
Status	A	A : Data valid, V : Data not valid
Latitude	llll.ll	dd [degree] mm.mmmm [min]
Latitude – N/S	a	N : North latitude, S : South latitude
Longitude	yyyyy.yy	ddd [degree] mm.mmmm [min]
Longitude – E/W	a	E : East longitude, W : West longitude
Speed over ground	x.x	[knot]
Course over ground	x.x	[degree]
Date	xxxxxx	dd [day] mm [month] yy [year]
Magnetic variation	x.x	[degree]
Magnetic variation – E/W	a	E : East, W : West
Mode Indicator	a	A : Autonomous mode D : Differential mode E : Dead reckoning mode N : Data not valid
Checksum	*hh	
Termination	<CR><LF>	

4.1.7 VTG: Course Over Ground & Ground Speed

Format : \$--VTG,x.x,T,x.x,M,x.x,N,x.x,K,a*hh<CR><LF>

Fields:

Field	Format	Description
Header	\$	
Talker ID	--	GP : Using only GPS for positioning GL : Using only GLONASS for positioning QZ : Using only QZS for positioning

		GN : Using combined satellite systems for positioning
Sentence ID	VTG	
Course over ground - True	x.x,T	[degrees]
Course over ground - Magnetic	x.x,M	NULL
Speed over ground	x.x,N	[knot]
Speed over ground	x.x,K	[km/h]
Mode Indicator	a	A : Autonomous mode D : Differential mode E : Dead reckoning mode N : Data not valid
Checksum	*hh	
Termination	<CR><LF>	

4.1.8 ZDA: Time & Date

Format : \$--ZDA,hhmmss.ss,xx,xx,xxxx,xx,xx*hh<CR><LF>

Fields :

Field	Format	Description
Header	\$	
Talker ID	--	GP : Using only GPS for positioning GL : Using only GLONASS for positioning QZ : Using only QZS for positioning GN : Using combined satellite systems for positioning
Sentence ID	ZDA	
UTC	hhmmss.ss	hh [hour] mm [min] ss.ss [sec]
Day	xx	
Month	xx	
Year	xxxx	
Local zone hours	xx	NULL
Local zone minutes	xx	NULL
Checksum	*hh	
Termination	<CR><LF>	

©Copyright 2020 Gotop Technology Co., Ltd. All Right Reserved

The information contained herein is subject to change without notice.

Gotop Technology Co. , LTD

Add:AreaC,4th layer,A1 building,QingHu Silicon Valley Power,LongHua district ,Shenzhen ,China

Phone: 86-755-23804156

fax: 86-755-23804155

N 22° 40' 42", E 114° 02' 42"

<http://www.gotop-zzu.com>

Not to be reproduced in whole or part for any purpose without written permission of Gotop Technology Inc ('Gotop'). Information provided by Gotop is believed to be accurate and reliable. These materials are provided by Gotop as a service to its customers and may be used for informational purposes only. Gotop assumes no responsibility for errors or omissions in these materials, nor for its use. Gotop reserves the right to change specification at any time without notice.

These materials are provides 'as is' without warranty of any kind, either expressed or implied, relating to sale and/or use of Gotop products including liability or warranties relating to fitness for a particular purpose, consequential or incidental damages, merchantability, or infringement of any patent, copyright or other intellectual property right. Gotop further does not warrant the accuracy or completeness of the information, text, graphics or other items contained within these materials. Gotop shall not be liable for any special, indirect, incidental, or consequential damages, including without limitation, lost revenues or lost profits, which may result from the use of these materials.

Gotop products are not intended for use in medical, life-support devices, or applications involving potential risk of death, personal injury, or severe property damage in case of failure of the product.