

Ultra Low Power GPS & GLONASS Receiver Module

1. Product Information

1.1 Product Name: MR71009EBGG



1.2 Product Description:

MR71009EBGG is a compact, high performance and ultra low power consumption, standalone multiple GNSS module. The module can simultaneously acquire and track multiple satellite constellations that include GPS, GLONASS, BEIDOU, GALILEO, QZSS and SBAS. It features low power and small form factor.

MR71009EBGG is suitable for the following applications:

- Wearable and portable
- Automotive navigation
- Personal positioning
- Fleet management
- Mobile phone navigation
- Marine navigation
- Any application requires ultra low power consumption

Product Features:

- Ultra low power consumption: 6mA typ.
- Accurate trajectory in harsh environments
- High performance and low power consumption GNSS Chipset
- Very high sensitivity
- Extremely fast TTFF (Time To First Fix) at low signal level
- Built-in LNA
- Embedded SPI flash
- Compact size suitable for space-sensitive application
- One size component, easy to mount on another PCB board
- Support NMEA 0183 and binary protocol
- SMD type with stamp holes

1.3 Product Specifications

GNSS Performance

GNSS Performance	
Chipset	Sony
Receiver type	GPS L1 C/A, GLONASS L10F QZSS L1 C/A, SBAS L1 C/A: WAAS, EGNOS, MSAS
Code	C/A Code
Protocol	NMEA 0183 1Hz : GGA,GSA,GSV, RMC,VTG,GLL,TXT,ZDA Support : Sony proprietary and NMEA Command
Available Baud Rate	9,600 bps (Default) , 4,800~115,200 bps available
Channels	66
Sensitivity	Tracking:-165dBm Reacquisition:-160dBm Acquisition:-148dBm
Cold Start	33 seconds, average
Hot Start	2 second, average
Accuracy	HorizontalPosition:Autonomous<2.5m average, SBAS < 2.0m average Velocity: 0.1 m/s Timepulse signal: ±10 ns
Maximum Altitude	18,000 m
Maximum Velocity	500 m/s(1000 knots)
Dynamics	≦ 4G
Update Rate	1Hz
Interface	
I/O Pins	1 serial ports
Physical Characteristic	
Type	18 pin stamp holes
Dimensions	10.1mm * 9.7 mm * 2.2mm ±0.2mm

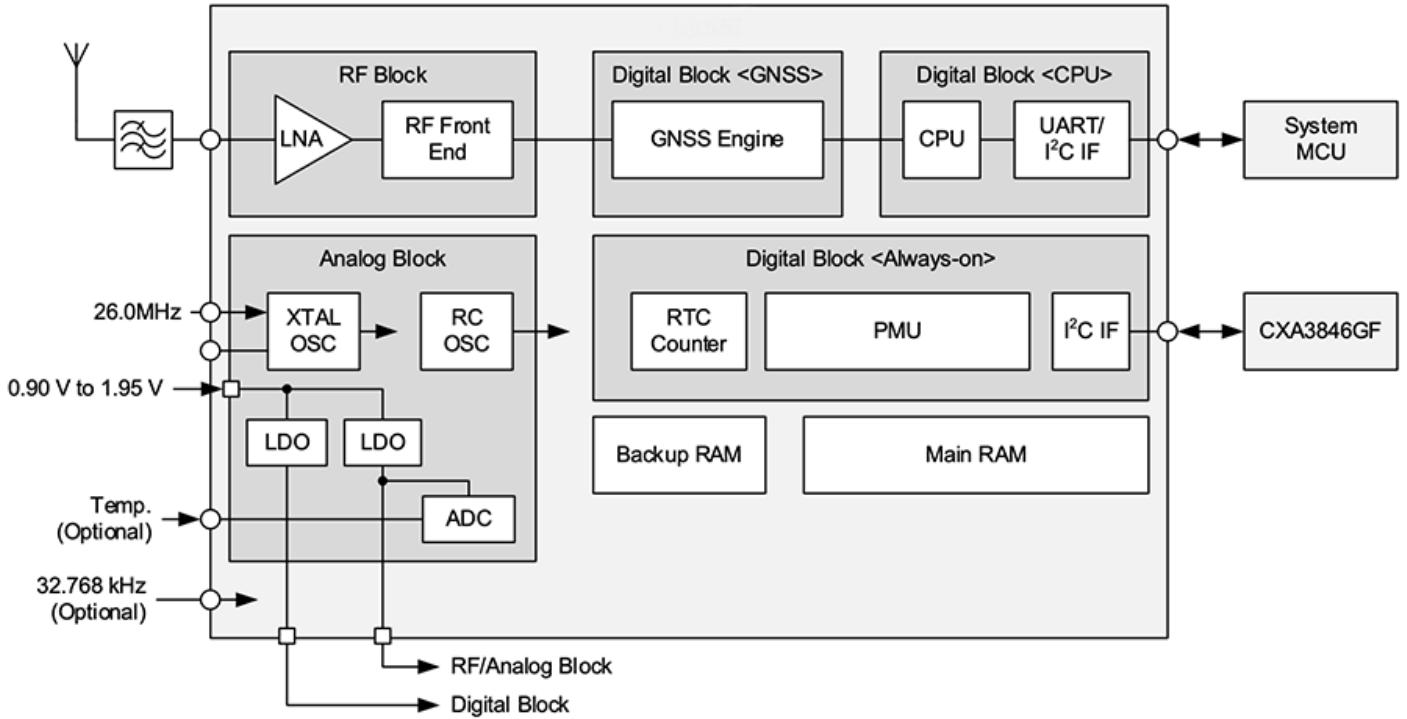
1.4 DC Electrical Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input Voltage	VCC		2.8	3.3	5.0	V
Supply Current	Iss	Acquisition		6.5	8	mA
		Tracking		6	8	mA
		Idel		1.5		mA
High Level Input Voltage	VIH		2.0		3.6	V
Low Level Input Voltage	VIL		-0.3		0.8	V
High Level Input Current	IIH	no pull-up or down	-1		1	uA
Low Level Input Current	IIL	no pull-up or down	-1		1	uA
High Level Output Voltage	VOH		2.4			V
Low Level Output Voltage	VOL				0.4	V
High Level Output Current	IOH			2		mA
Low Level Output Current	IOL			2		mA

Temperature characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Operating Temperature	Topr	-40	25	85	°C
Storage Temperature	Tstg	-40	25	85	°C

2. Block Diagram

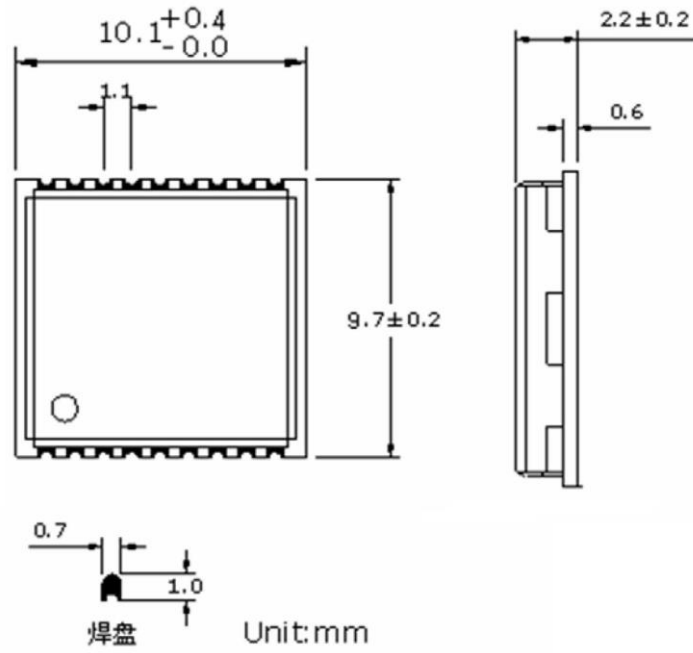


3. Module Pin Assignment

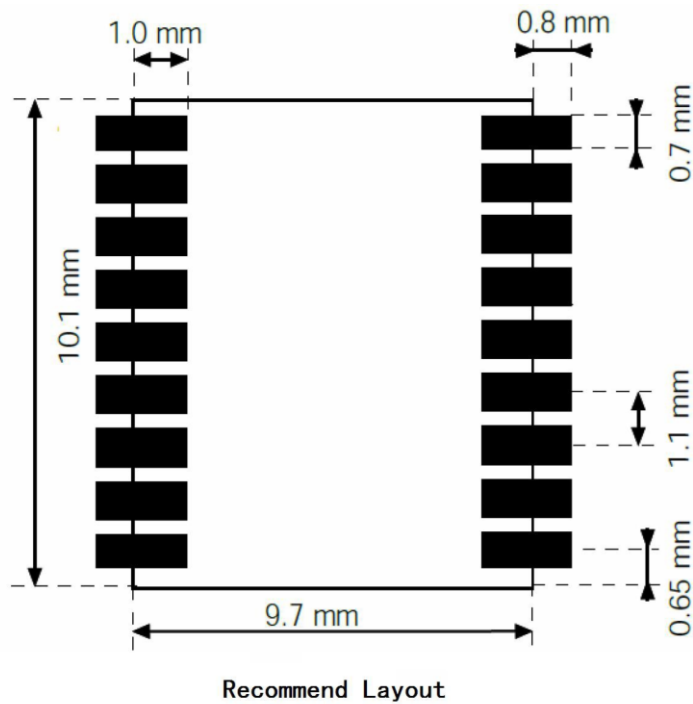
MR71009EBGG Top View			
10	GND	NC	9
11	RF IN	VCC 3.3V	8
12	GND	NC	7
13	NC	NC	6
14	VCC RF	NC	5
15	GND	PPS	4
16	NC	RXD	3
17	NC	TXD	2
18	GND	GND	1

Pin NO.	Pin Name	I/O	Remark
1.	GND	G	Ground.
2.	TXD	O	UART Serial Data Output
3.	RXD	I	UART Serial Data Input
4.	PPS	O	Time Pulse(1PPS)
5.	NC	N	Not Connect
6.	NC	N	Not Connect
7.	NC	N	Not Connect
8.	VCC	P	DC supply voltage
9.	GND	G	Ground.
10.	GND	G	Ground.
11.	RF IN	I	GNSS Signal Input
12.	GND	G	Ground.
13.	NC	N	Not Connect
14.	VCC RF	O	Output Voltage RF section
15.	GND	G	Ground.
16.	NC	N	Not Connect
17.	NC	N	Not Connect
18.	GND	G	Ground.

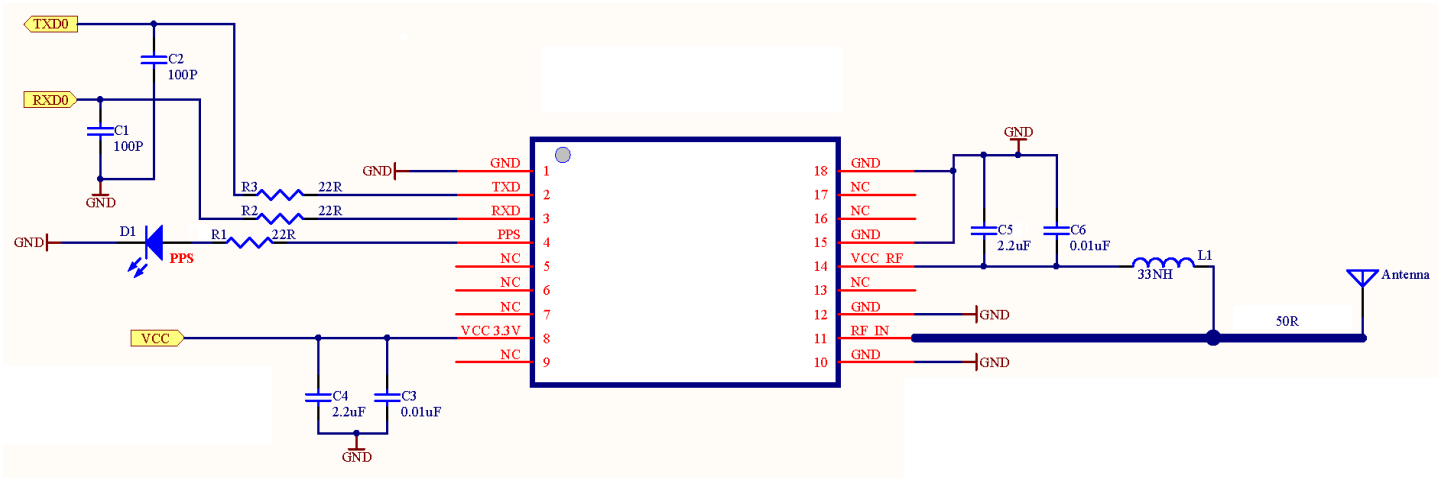
4. Dimensions



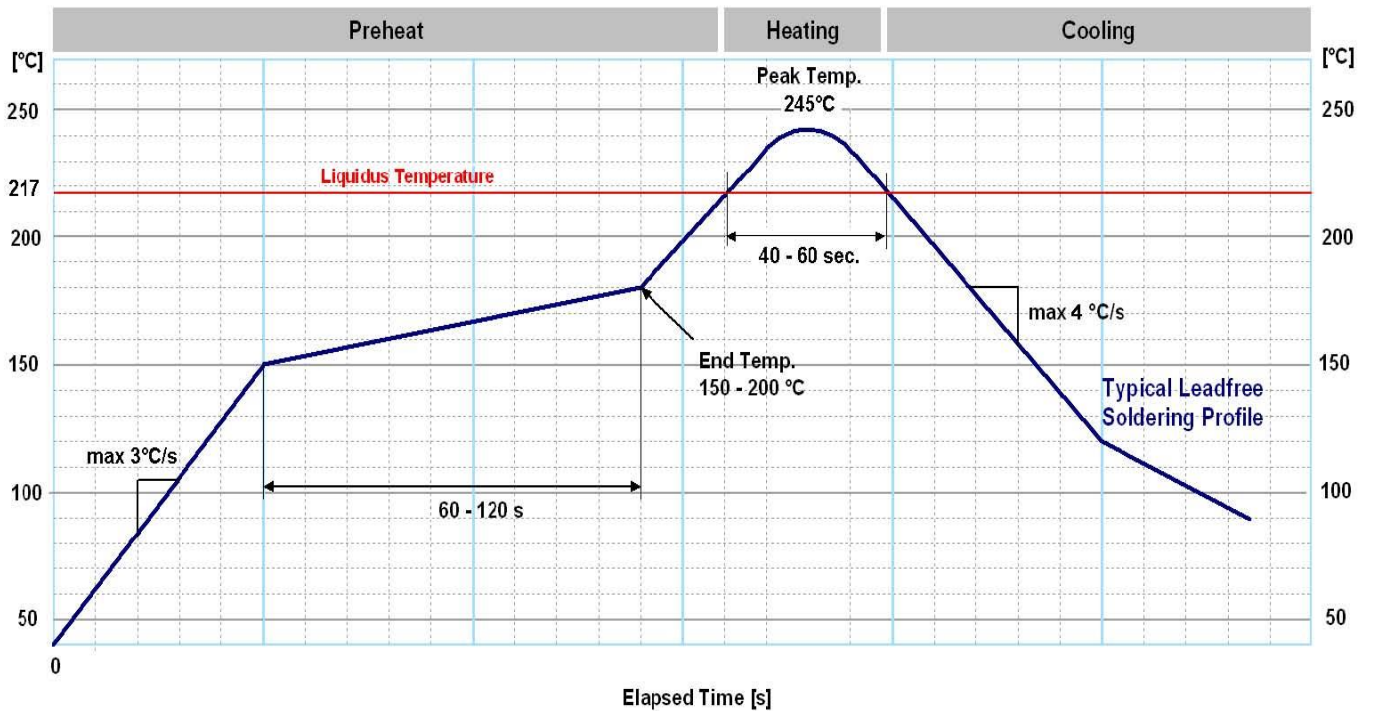
5. Recommended Footprint



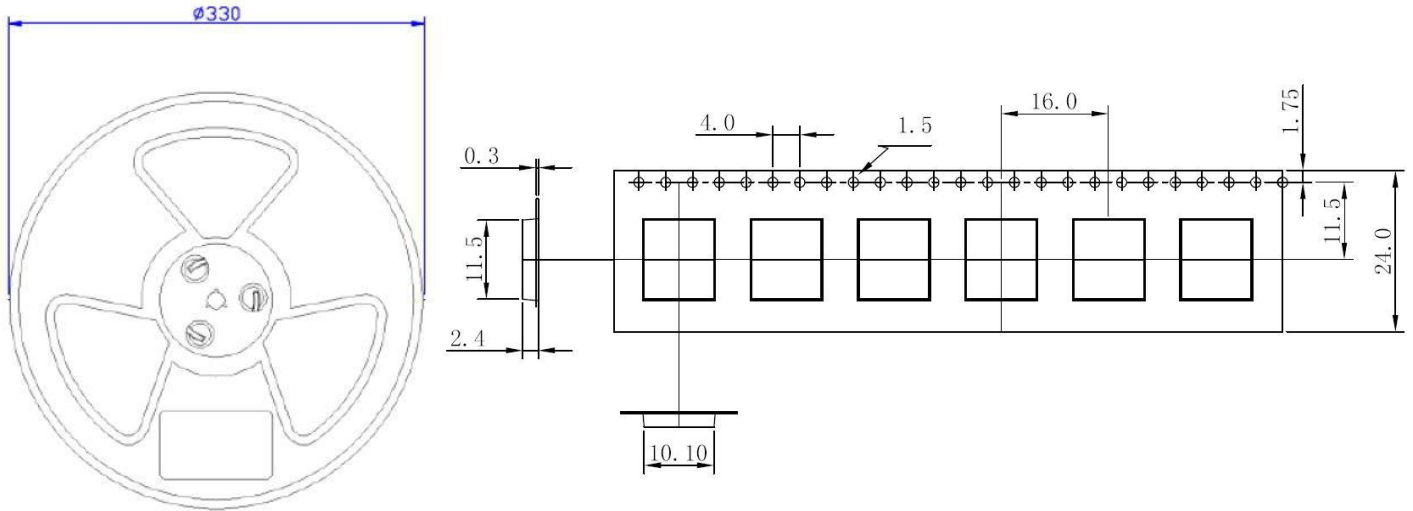
6. Application Circuit



7. Reflow Profile



8. Tape & Reel (unit : mm)



9. Software Protocol

NMEA output message

Table 9.1 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
ZDA	UTC, day, month and year and time zone.

GGA--- Global Positioning System Fixed Data

Table 9.2 contains the values for the following example:

\$GPGGA,060406.000,2503.7148,N,12138.7451,E,2,17,0.71,116.7,M,15.3,M,0000,0000*6D

Table 9.2 GGA Data Format

Name	Example	Units	Description
Message ID	\$GPGGA		GGA protocol header
UTC Time	060406.000		hhmmss.sss
Latitude	2503.7148		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	12138.7451		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Position Fix Indicator	2		See Table 9.3
Satellites Used	17		Range 0 to 33
HDOP	0.71		Horizontal Dilution of Precision
MSL Altitude	116.7	meters	
Units	M	meters	
Geoid Separation	15.3	meters	
Units	M	meters	
Age of Diff. Corr.	0000	second	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
Checksum	*6D		
<CR> <LF>			End of message termination

Table 9.3 Position Fix Indicators

Value	Description
0	Fix not available or invalid
1	GPS SPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
3-5	Not supported
6	Dead Reckoning Mode, fix valid

GLL--- Geographic Position – Latitude/Longitude

Table 9.4 contains the values for the following example:

\$GNGLL,2503.7148,N,12138.7451,E,060406.000,A,D*46

Table 9.4 GLL Data Format

Name	Example	Units	Description
Message ID	\$GNGLL		GLL protocol header (GPGLL or GNGLL; GP indicates the device receives GPS satellites signal only and GN indicates the position is calculated with BEIDOU satellite signal)
Latitude	2503.7148		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	12138.7451		dddmm.mmmm
E/W indicator	E		E=east or W=west
UTC Time	060406.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Mode	D		A=autonomous, D=DGPS, E=DR, N=Data not valid, R=Coarse Position, S=Simulator
Checksum	*46		
<CR> <LF>			End of message termination

GSA---GNSS DOP and Active Satellites

Table 9.5 contains the values for the following example:

```
$GNGSA,A,3,22,21,18,12,24,25,14,15,193,,,,,1.18,0.71,0.95*2C
```

```
$GNGSA,A,3,205,207,210,202,201,203,209,208,,,,,1.18,0.71,0.95*1C
```

Table 9.5 GSA Data Format

Name	Example	Units	Description
Message ID	\$GNGSA		GSA protocol header (GNGSA or GPGSA; GP indicates the device receives GPS satellites signal only and GN indicates the position is calculated with BEIDOU satellite signal). First row of GSA message contains GPS & QZSS satellites and second row of GSA message contains BEIDOU satellites.
Mode 1	A		See Table 9.6
Mode 2	3		See Table 9.7
ID of satellite used	22		Sv on Channel 1
ID of satellite used	21		Sv on Channel 2
....		
ID of satellite used			Sv on Channel 12
PDOP	1.18		Position Dilution of Precision
HDOP	0.71		Horizontal Dilution of Precision
VDOP	0.95		Vertical Dilution of Precision
Checksum	*2C		
<CR> <LF>			End of message termination

Table 9.6 Mode 1

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

Table 9.7 Mode 2

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

GSV---GNSS Satellites in View

Table 9.8 contains the values for the following example:

\$GPGSV,6,1,21,18,78,169,36,209,72,273,36,22,63,309,38,207,63,328,38*7B

\$GPGSV,6,2,21,203,58,205,39,25,56,138,39,201,55,141,34,206,50,168,*45

\$GPGSV,6,3,21,210,49,282,34,12,48,076,39,204,39,118,,14,38,322,37*77

\$GPGSV,6,4,21,193,37,180,34,202,36,246,29,24,23,041,34,31,21,244,*71

\$GPGSV,6,5,21,21,17,198,33,205,16,258,28,15,12,092,33,208,09,169,30*7B

\$GPGSV,6,6,21,51,,,*7E

Table 9.8 GSV Data Format

Name	Example	Units	Description
Message ID	\$GPGSV		GSV protocol header
Total number of messages1	6		Range 1 to 6
Message number1	1		Range 1 to 6
Satellites in view	21		
Satellite ID	18		Channel 1 (Range 01 to 237), GPS Satellites ID : 01~32,SBAS Satellites ID : 33~64, QZSS Satellites ID:193~196, &BEIDOU Satellites ID : 201~214
Elevation	78	degrees	Channel 1 (Range 00 to 90)
Azimuth	169	degrees	Channel 1 (Range 000 to 359)
SNR (C/No)	36	dB-Hz	Channel 1 (Range 00 to 99, null when not tracking)
....
Satellite ID	207		Channel 4 (Range 01 to 237) , GPS Satellites ID : 01~32,SBAS Satellites ID : 33~64, QZSS Satellites ID:193~196, &BEIDOU Satellites ID : 201~214
Elevation	63	degrees	Channel 4 (Range 00 to 90)
Azimuth	328	degrees	Channel 4 (Range 000 to 359)
SNR (C/No)	38	dB-Hz	Channel 4 (Range 00 to 99, null when not tracking)
Checksum	*7B		
<CR> <LF>			End of message termination

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

RMC---Recommended Minimum Specific GNSS Data

Table 9.9 contains the values for the following example:

\$GNRMC,060406.000,A,2503.7148,N,12138.7451,E,0.01,0.00,180313,,D*78

Table 9.9 RMC Data Format

Name	Example	Units	Description
Message ID	\$GNRMC		RMC protocol header (GNRMC or GPRMC; GP indicates the device receives GPS satellites signal only and GN indicates the position is calculated with BEIDOU satellite signal)
UTC Time	060406.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	2503.7148		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12138.7451		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Speed over ground	0.01	knots	True
Course over ground	0.00	degrees	
Date	180313		ddmmyy
Magnetic variation		degrees	
Variation sense			E=east or W=west (Not shown)
Mode	D		A=autonomous, D=DGPS, E=DR, N=Data not valid,R=Coarse Position, S=Simulator
Checksum	*78		
<CR> <LF>			End of message termination

VTG---Course Over Ground and Ground Speed

Table 9.10 contains the values for the following example:

\$GPVTG,0.00,T,,M,0.01,N,0.02,K,D*3B

Table 9.10 VTG Data Format

Name	Example	Units	Description
Message ID	\$GPVTG		VTG protocol header
Course over ground	0.00	degrees	Measured heading
Reference	T		True
Course over ground		degrees	Measured heading
Reference	M		Magnetic
Speed over ground	0.01	knots	Measured speed
Units	N		Knots
Speed over ground	0.02	km/hr	Measured speed
Units	K		Kilometer per hour
Mode	D		A=autonomous, D=DGPS, E=DR, N=Data not valid, R=Coarse Position, S=Simulator
Checksum	*3B		
<CR> <LF>			End of message termination

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	