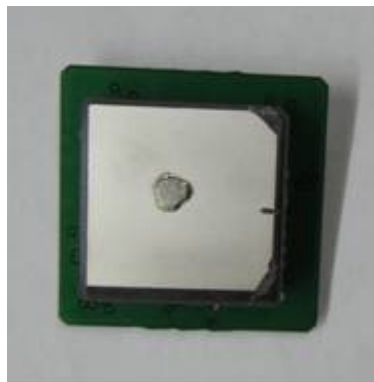


GPS Antenna Module for GPS08-30U



General Description

GPS08-30U is a high performance receiver module for the Global Positioning System (GPS) solution. It combines U-Blox 6 GPS single chip(UBX-G6010-ST),EEPROM,RS232 Transceiver IC,LNA circuit, SAW filter and Patch Antenna into a land grid array module. It can be easily plug-in to a device for GPS communication.

Features

- High Gain and low noise.
- U-Blox 6 position engine with over 2 million effective correlators featuring < 1s acquisition,-147dBm cold start acquisition sensitivity and 5Hz update rate
- Intelligent , user configurable power management for radically lower power consumption
- Open sky cold start 29 second
- Signal detection better than -160dBm
- Reacquisition sensitivity -160dBm
- Accuracy 2.5m CEP
- RoHS compliance.
- RS232/TTL/USB electrical level is available
- GPS Navigation Status LED Indicator is available
- SRAM backup battery is available

Applications

Automotive, recreational, marine, handheld system

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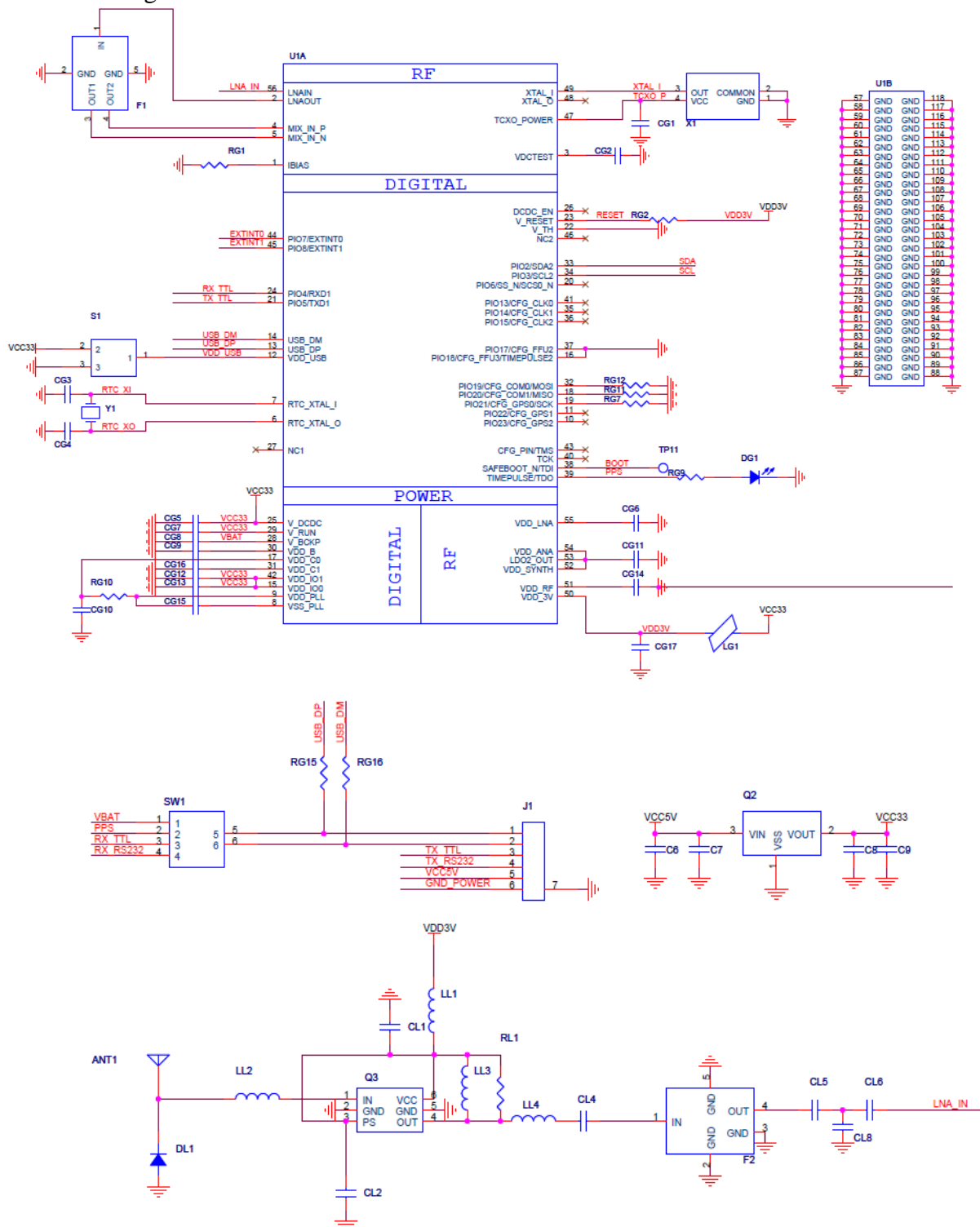
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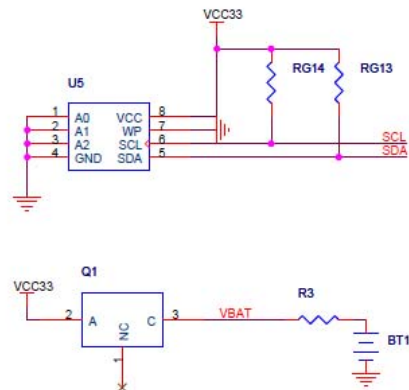
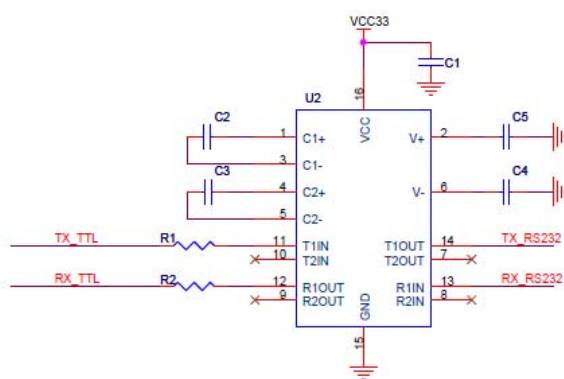
1 Introduction

The document is intended to provide the advanced information to assist customers in GPS08-30U GPS module design. Following this document, customers will be familiar with the application circuit and speed up the product development.

1-1 Circuit to GPS08-30U GPS Module

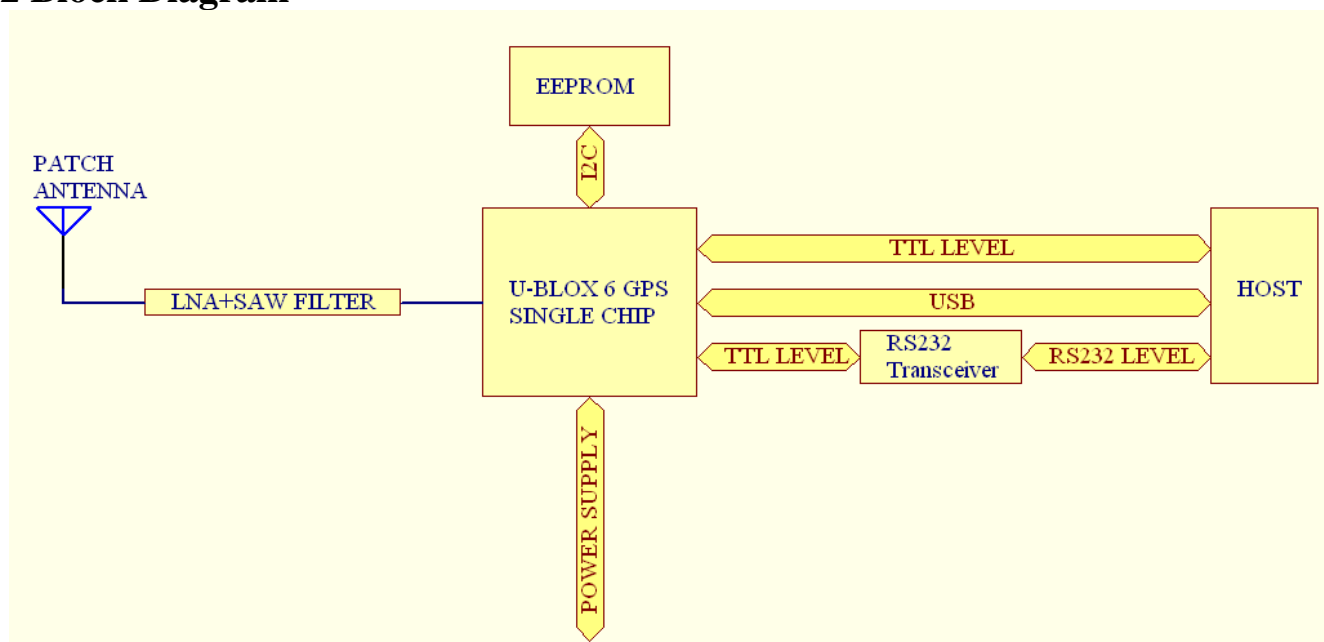
The following schematic illustrates the related GPS08-30U GPS module circuit.





The schematic is subject to change without notice.

1-2 Block Diagram



1-3 Part Number

GPS 08 - 30 U

(1) (2) (3) (4)

(1) GPS Antenna Module Symbol.

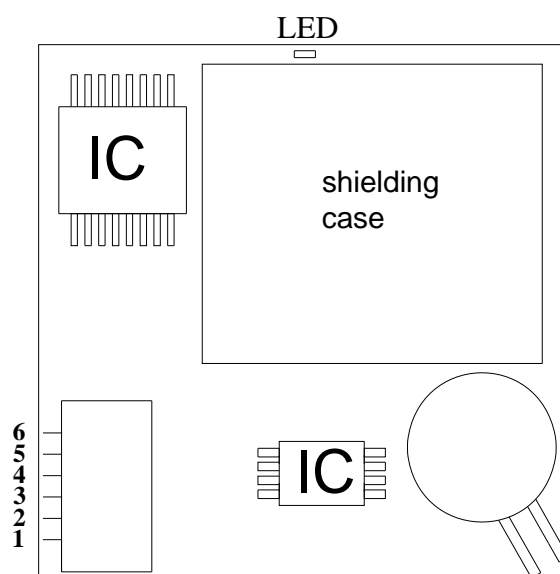
(2) Serial No.

(3) Assembly type: 00~99; **30**: JST P1.0mm SH Connector SM06B-SRSS-TB ;

USB DM2 ,DP3; P6, G1;

(4) Chip Company: U: U-BLOX.

1-4 Pin Definition



BOTTOM

Pin No.	Signal Name	Type	Description
1	GND	Power Input	System ground
2	USB-DM	I/O	USB port D- signal
3	USB-DP	I/O	USB port D+ signal
4	NC	NC	Empty Pin
5	TXD_TTL	Output	GPS_TXD_TTL-Level . Used to output standard NMEA-0183 sentence or response to input command. Baud rate:9600bps Output: GGA, GSA, GSV and RMC NMEA messages
6	VCC	Power Input	Main voltage supply input, 3.3V~5.3V;

Note:

See the USB 2.0 spec for details of **DP** and **DM** timing and signal levels.

GPS08-30U includes SRAM backup battery 3.3mAh Li-Ion rechargeable battery. Battery life at full charge is ≥ 7 days.

1-5 Power Supply

It is suggested that VCC should be connected to the 3.3V ~5.3V

The GPS08-30U includes SRAM backup battery 3.3mAh Li-Ion rechargeable battery. Battery life at full charge is ≥ 7 days.

1-6 LED Indicator

GPS Navigation Status Indicator: RED LED

- Flash: Position
- Blight: No Position

2 System Specifications

2-1 DC Characteristics

Parameter	Min	Typ	Max	Unit
Operating Current (Power Consumption)	-	45	70	mA

Note: Vcc = 5V

2-2 Environmental

Item	GPS08 Series
Operating Temperature	-40 to +85°C
Operating Humidity	10 to 95% RH
Storage Temperature	-40 to +90°C
Storage Humidity	10 to 95% RH

3 Electrical Characteristics .

* All value are defined at 25±15°C ,65±20 % RH, power handling 1 u watt, air pressure 960 ±100 HPA unless

* Patch characteristics are measured with 70x70 mm ground plane in an anechoic chamber.

3-1 Antenna

Characteristics	Specification
Center Frequency	1575.42±1.023 MHz (when covered with a radome on LNA ground plane.)
Bandwidth (10dB return loss)	10 MHz min
Gain at Zenith	5.0dBic typ.
Gain at 10° elevation	-1.0dBic typ.
Polarization	R.H.C.P
Axial Ratio	3.0dB MAX.

3-2 LNA

Characteristics	Specification	
Center Frequency	1575.42±1.023 MHz	
Power Gain	Total:30dB typ	External LNA: 15dB typ Chip build-in LNA:15dB typ
Noise Figure	1.5 dB max	
Output V.S.W.R	1.5 max	

3-3 GPS Module

Characteristics	Specification	
Receiver Type	50 Channels GPS L1 frequency, C/A Code	
Time-To-First-Fix	Cold Start(Autonomous):	29s
	Warm Start(Autonomous):	29s
	Hot Start(Autonomous):	<1s
Sensitivity	Tracking & Navigation:	-160dBm
	Reacquisition:	-160dBm
	Cold Start(autonomous):	-147dBm
Horizontal position accuracy	Autonomous:	<2.5m
	SBAS:	<2.0m
Accuracy of Timepulse signal	RMS	30ns
	99%	<60ns
	TimePulse:	Configurable f=0.25Hz...1kHz (Tp=1/f=4s...1ms)
Velocity accuracy	0.1m/s	
Heading accuracy	0.5 degrees	
Dynamics	≤4g	
Operational limits	Altitude	50000m
	Velocity	500m/s

4 Output Messages

The GPS08-30U provides USB solutions. Moreover, NMEA messages sent by the GPS receiver are based on NMEA 0183 Version 2.3. For further information on the NMEA Standard please refer to *NMEA 0183 Standard For Interfacing Marine Electronic Devices*, Version 2.30, March 1, 1998. See <http://www.nmea.org/> for ordering instructions.

4 -1 Latitude and Longitude Format

According to the NMEA Standard, Latitude and Longitude are output in the format Degrees, Minutes and (Decimal) Fractions of Minutes. To convert to Degrees and Fractions of Degrees, or Degrees, Minutes, Seconds and Fractions of seconds, the 'Minutes' and 'Fractional Minutes' parts need to be converted. In other words: If the GPS Receiver reports a Latitude of 4717.112671 North and Longitude of 00833.914843 East, this is Latitude 47 Degrees, 17.112671 Minutes
Longitude 8 Degrees, 33.914843 Minutes

or

Latitude 47 Degrees, 17 Minutes, 6.76026 Seconds

Longitude 8 Degrees, 33 Minutes, 54.89058 Seconds

or

Latitude 47.28521118 Degrees

Longitude 8.56524738 Degrees

4 -2 Position Fix Flags in NMEA Mode

The following list shows how GPS08-30U implements the NMEA protocol, and the conditions determining how flags are set in version 2.3 and above.

NMEA Message: Field	No position fix (at power-up, after losing satellite lock)	Valid position fix with GPS, but user limits exceeded	Valid dead reckoning fix, but user limits exceeded	Dead reckoning (linear extrapolation, ADR with external sensors, or map matching)	2D position fix	3D position fix	combined GPS/SFDR position fix (ADR with external sensors)
GLL, RMC: Status	V	V	V	A	A	A	A
	A=Data VALID, V=Data Invalid (Navigation Receiver Warning)						
GGA: Quality Indicator	0	0	6	6	1 / 2	1 / 2	1 / 2
	0=Fix not available/invalid, 1=GPS SPS Mode, Fix valid, 2=Differential GPS, SPS Mode, Fix Valid, 6=Estimated/Dead Reckoning						
GSA: Nav Mode	1	1	2	2	2	3	3
	1=Fix Not available, 2=2D Fix, 3=3D Fix						
GLL, RMC, VTG: Mode Indicator	N	N	E	E	A / D	A / D	A / D
	N=No Fix, A=Autonomous GNSS Fix, D=Differential GNSS Fix, E=Estimated/Dead Reckoning Fix						
UBX GPSTFixOK	0	0	0	1	1	1	1
UBX GPSTFix	0	>1	1	1	2	3	4

The following list shows how GPS08-30U implements the NMEA protocol, and the conditions determining how flags are set in version 2.2 and below.

NMEA Message: Field	No position fix (at power-up, after losing satellite lock	Valid position fix with GPS, but user limits exceeded	Valid dead reckoning fix, but user limits exceeded	Dead reckoning (linear extrapolation, ADR with external sensors, or map matching)	2D position fix	3D position fix	combined GPS/SFDR position fix (ADR with external sensors)
GLL, RMC: Status	V	V	V	A	A	A	A
	A=Data VALID, V=Data Invalid (Navigation Receiver Warning)						
GGA: Quality Indicator	0	0	1	1	1 / 2	1 / 2	1 / 2
	0=Fix not available/invalid, 1=GPS SPS Mode, Fix valid, 2=Differential GPS, SPS Mode, Fix Valid						
GSA: Nav Mode	1	1	2	2	2	3	3
	1=Fix Not available, 2=2D Fix, 3=3D Fix						
GLL, RMC, VTG: Mode Indicator. This field is not output by this NMEA version.							
UBX GPSTfixOK	0	0	0	1	1	1	1
UBX GPSTfix	0	>1	1	1	2	3	4



By default GPS08-30U will output invalid data.

- A valid position fix is reported as follows:

```
$GPGGA,062905.000,2428.6390,N,11806.6716,E,1,06,1.5,2.9,M,8.6,M,,0000*6B
```

```
$GPGLL,2428.6390,N,11806.6716,E,062905.000,A,A*59
```

```
$GPRMC,062906.000,A,2428.6390,N,11806.6716,E,0.00,348.98,130312,,,A*61
```

- An invalid position fix is reported as follows(e.g. during a cold-start):

```
$GPGGA,005753.640,0000.0000,N,00000.0000,E,0,00,99.9,-17.0,M,17.0,M,,0000*7F
```

```
$GPGLL,0000.0000,N,00000.0000,E,005753.640,V,N*47
```

```
$GPRMC,005753.640,V,0000.0000,N,00000.0000,E,0.00,0.00,060180,,,N*7F
```

4 -3 NEMA Protocol

The full descriptions of supported NMEA messages are provided at the following paragraphs. GPS08-30U will output GGA, GSA, GSV and RMC NMEA messages. For more details, please refer to Online's document.

4-3-1 GGA - Global Positioning System Fix Data

Message	GGA		
Description	Global positioning system fix data		
Firmware	Supported on u-blox 6 from firmware version 6.00 up to version 7.03.		
Type	Output Message		
Comment	The output of this message is dependent on the currently selected datum (Default: WGS84) Time and position, together with GPS fixing related data (number of satellites in use, and the resulting HDOP, age of differential data if in use, etc.).		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x00	17	

Message Structure:

```
$GPGGA,hhmmss.sss,Latitude,N,Longitude,E,FS,NoSV,HDOP,msl,m,Altref,m,DiffAge,DiffStation*cs<CR><LF>
```

Example:

```
$GPGGA,062905.000,2428.6390,N,11806.6716,E,1,06,1.5,2.9,M,8.6,M,,0000*6B
```

Field No.	Example	Format	Name	Unit	Description
0	\$GPGGA	string	\$GPGGA	-	Message ID, GGA protocol header
1	062905.000	hhmmss.sss	hhmmss.ss ss	-	UTC Time, Current time
2	2428.6390	ddmm.mmmm	Latitude	-	Latitude, Degrees + minutes, see Format description
3	N	character	N	-	N/S Indicator, N=north or S=south
4	11806.6716	dddmm. mmmm	Longitud e	-	Longitude, Degrees + minutes, see Format description
5	E	character	E	-	E/W indicator, E=east or W=west
6	1	digit	FS	-	Position Fix Status Indicator, See Table below and Position Fix Flags description
7	06	numeric	NoSV	-	Satellites Used, Range 0 to 12
8	1.5	numeric	HDOP	-	HDOP, Horizontal Dilution of Precision
9	2.9	numeric	msl	m	MSL Altitude
10	M	character	uMsl	-	Units, Meters (fixed field)
11	8.6	numeric	Altref	m	Geoid Separation
12	M	character	uSep	-	Units, Meters (fixed field)
13	-	numeric	DiffAge	s	Age of Differential Corrections, Blank (Null) fields when DGPS is not used
14	0000	numeric	DiffStat ion	-	Diff. Reference Station ID
15	*6B	hexadecimal	cs	-	Checksum
16	-	character	<CR><LF>	-	Carriage Return and Line Feed

Table Fix Status

Fix Status	Description, see also Position Fix Flags description
0	No Fix / Invalid
1	Standard GPS (2D/3D)
2	Differential GPS
6	Estimated (DR) Fix

4-3-2 GLL – Latitude/Longitude

Message	GLL		
Description	Latitude and longitude, with time of position fix and status		
Firmware	Supported on u-blox 6 from firmware version 6.00 up to version 7.03.		
Type	Output Message		
Comment	The output of this message is dependent on the currently selected datum (Default: WGS84)		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x01	(9) or (10)	

Message Structure:

```
$GPGLL, Latitude, N, Longitude, E, hhmmss.sss, Valid, Mode*cs<CR><LF>
```

Example:

```
$GPGLL, 2428.6390, N, 11806.6716, E, 062905.000, A, A*59
```

Field No.	Example	Format	Name	Unit	Description
0	\$GPGLL	string	\$GPGLL	-	Message ID, GLL protocol header
1	2428.6390	ddmm.mmmmm	Latitude	-	Latitude, Degrees + minutes, see Format description
2	N	character	N	-	N/S Indicator, hemisphere N=north or S=south
3	11806.6716	dddmm.mmmmm	Longitude	-	Longitude, Degrees + minutes, see Format description
4	E	character	E	-	E/W indicator, E=east or W=west
5	062905.000	hhmmss.sss	hhmmss.sss	-	UTC Time, Current time
6	A	character	Valid	-	V = Data invalid or receiver warning, A = Data valid. See Position Fix Flags description
Start of optional block					
7	A	character	Mode	-	Positioning Mode, see Position Fix Flags description
End of optional block					
7	*59	hexadecimal	cs	-	Checksum
8	-	character	<CR><LF>	-	Carriage Return and Line Feed

4-3-3 GSA – GNSS DOP and Active Satellites

Message	GSA		
Description	GNSS DOP and Active Satellites		
Firmware	Supported on u-blox 6 from firmware version 6.00 up to version 7.03.		
Type	Output Message		
Comment	<ul style="list-style-type: none"> If less than 12 SVs are used for navigation, the remaining fields are left empty. If more than 12 SVs are used for navigation, only the IDs of the first 12 are output. The SV Numbers (Fields 'Sv') are in the range of 1 to 32 for GPS satellites, and 33 to 64 		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x02	20	

Message Structure:

```
$GPGSA,Smode,FS{ ,sv},PDOP,HDOP,VDOP*cs<CR><LF>
```

Example:

```
$GPGSA,A,3,12,22,09,27,15,14,,,,,,,,,3.6,1.5,3.2*3C
```

Field No.	Example	Format	Name	Unit	Description
0	\$GPGSA	string	\$GPGSA	-	Message ID, GSA protocol header
1	A	character	Smode	-	Smode, see first table below
2	3	digit	FS	-	Fix status, see second table below and Position Fix Flags description
Start of repeated block (12 times)					
3 + 1*N	12,22,09,27,15,14,,,,,,	numeric	sv	-	Satellite number
End of repeated block					
15	3.6	numeric	PDOP	-	Position dilution of precision
16	1.5	numeric	HDOP	-	Horizontal dilution of precision
17	3.2	numeric	VDOP	-	Vertical dilution of precision
18	*3C	hexadecimal	cs	-	Checksum
19	-	character	<CR><LF>	-	Carriage Return and Line Feed

Table Smode

Smode	Description
M	Manual - forced to operate in 2D or 3D mode
A	Allowed to automatically switch 2D/3D mode

Table Fix Status

Fix Status	Description, see also Position Fix Flags description
1	Fix not available
2	2D Fix
3	3D Fix

4-3-4 GSV – GNSS Satellites in View

Message	GSV		
Description	GNSS Satellites in View		
Firmware	Supported on u-blox 6 from firmware version 6.00 up to version 7.03.		
Type	Output Message		
Comment	The number of satellites in view, together with each PRN (SV ID), elevation and azimuth, and C/No (Signal/Noise Ratio) value. Only four satellite details are transmitted in one		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x03	7..16	

Message Structure:

```
$GPGSV, NoMsg, MsgNo, NoSv, { , sv, elv, az, cno } *cs <CR> <LF>
```

Example:

```
$GPGSV, 3, 1, 10, 09, 41, 032, 31, 12, 40, 105, 13, 14, 27, 295, 37, 15, 23, 066, 28*71
```

```
$GPGSV, 3, 2, 10, 18, 80, 035, , 21, 38, 208, 16, 22, 41, 323, 29, 25, 33, 156, 12*71
```

```
$GPGSV, 3, 3, 10, 27, 20, 037, 26, 31, 09, 225, 10*70
```

Field No.	Example	Format	Name	Unit	Description
0	\$GPGSV	string	\$GPGSV	-	Message ID, GSV protocol header
1	3	digit	NoMsg	-	Number of messages, total number of GPGSV messages being output
2	1	digit	MsgNo	-	Number of this message
3	10	numeric	NoSv	-	Satellites in View
Start of repeated block (1..4 times)					
4 + 4*N	09	numeric	sv	-	Satellite ID
5 + 4*N	41	numeric	elv	degrees	Elevation, range 0..90
6 + 4*N	032	numeric	az	degrees	Azimuth, range 0..359
7 + 4*N	31	numeric	cno	dBHz	C/N0, range 0..99, null when not tracking
End of repeated block					
5.. 16	*71	hexadecimal	cs	-	Checksum
6.. 16	-	character	<CR><LF>	-	Carriage Return and Line Feed

4-3-5 RMC – Recommended Minimum Data

Message	RMC		
Description	Recommended Minimum data		
Firmware	Supported on u-blox 6 from firmware version 6.00 up to version 7.03.		
Type	Output Message		
Comment	The output of this message is dependent on the currently selected datum (Default: WGS84)		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x04	15	

Message Structure:

```
$GPRMC,hhmmss.sss,status,latitude,N,longitude,E,spd,cog,ddmmyy,mv,mvE,mode*cs<CR><LF>
```

Example:

```
$GPRMC,062906.000,A,2428.6390,N,11806.6716,E,0.00,348.98,130312,,A*61
```

Field	Example	Format	Name	Unit	Description
0	\$GPRMC	string	\$GPRMC	-	Message ID, RMC protocol header
1	062906.000	hhmmss.sss	hhmmss.sss	-	UTC Time, Time of position fix
2	A	character	Status	-	Status, V = Navigation receiver warning, A = Data valid, see Position Fix Flags description
3	2428.6390	ddmm.mmmm	Latitude	-	Latitude, Degrees + minutes, see Format
4	N	character	N	-	N/S Indicator, hemisphere N=north or S=south
5	11806.6716	dddmm.mmmm	Longitude	-	Longitude, Degrees + minutes, see Format description
6	E	character	E	-	E/W indicator, E=east or W=west
7	0.00	numeric	Spd	knots	Speed over ground
8	348.98	numeric	Cog	degrees	Course over ground
9	130312	ddmmyy	date	-	Date in day, month, year format
10	-	numeric	mv	degrees	Magnetic variation value, not being output
11	-	character	mvE	-	Magnetic variation E/W indicator, not being
12	-	character	mode	-	Mode Indicator, see Position Fix Flags description
13	*61	hexadecimal	cs	-	Checksum
14	-	character	<CR><LF>	-	Carriage Return and Line Feed

4-3-6 VTG – Course Over Ground and Ground Speed

Message	VTG		
Description	Course over ground and Ground speed		
Firmware	Supported on u-blox 6 from firmware version 6.00 up to version 7.03.		
Type	Output Message		
Comment	Velocity is given as Course over Ground (COG) and Speed over Ground (SOG).		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x05	12	

Message Structure:

```
$GPVTG,cogt,T,cogm,M,sog,N,kph,K,mode*cs<CR><LF>
```

Example:

```
$GPVTG,348.98,T,,M,0.00,N,0.0,K,A*03
```

Field	Example	Format	Name	Unit	Description
0	\$GPVTG	string	\$GPVTG	-	Message ID, VTG protocol header
1	348.98	numeric	cogt	degrees	Course over ground (true)
2	T	character	T	-	Fixed field: true
3	-	numeric	cogm	degrees	Course over ground (magnetic), not output
4	M	character	M	-	Fixed field: magnetic
5	0.00	numeric	sog	knots	Speed over ground
6	N	character	N	-	Fixed field: knots
7	0.0	numeric	kph	km/h	Speed over ground
8	K	character	K	-	Fixed field: kilometers per hour
9	A	character	mode	-	Mode Indicator, see Position Fix Flags description
10	*03	hexadecimal	cs	-	Checksum
11	-	character	<CR><LF>	-	Carriage Return and Line Feed

5 Package Diagram (Unit: mm)

5-1 Patch & PCB & Shielding

