

General Description

The Gotop GAM-1513P-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

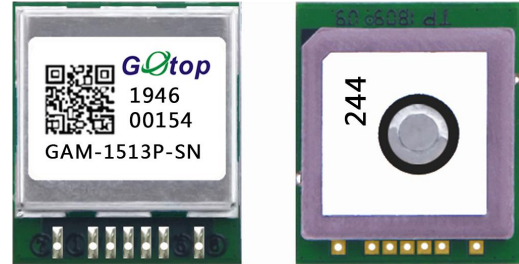


Figure1: GAM-1513P-SN Top View

Features

- Build on high performance, low-power SONY CXD5603GF chip set
- Ultra high Track sensitivity: -165dBm
- Extremely fast TTFB 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 5.5V
- Operating temperature range: -40 to 85°C
- Patch Antenna Size: $12\times 12\times 4\text{mm}$
- Module Size: $15.25\times 13.1\times 6.55\text{mm}$
- Communication type: UART/TTL
- RoHS compliant (Lead-free)

1 Description

1.1. Key Features

| Parameter | Specification |
|---|--|
| Power Supply | <ul style="list-style-type: none"> Supply voltage: 2.8V~5.5V Typical: 3.3V |
| Power Consumption | <ul style="list-style-type: none"> Acquisition: 8mA @VCC=3.3V Tracking: 6mA @VCC=3.3V Idle mode: 1.5mA @VCC=3.3V Sleep mode: 100uA@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 |
| TTF (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: ± 30ns, Time pulse width: 100ms |
| Acceleration Accuracy | <ul style="list-style-type: none"> Without aid: 0.1m/s^2 |
| 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: $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$ Storage temperature: $-45^{\circ}\text{C} \sim +125^{\circ}\text{C}$ |
| Physical Characteristics | <ul style="list-style-type: none"> Size: $15.25 \pm 0.50 \times 13.1 \pm 0.50 \times 6.55 \pm 0.50\text{mm}$ Weight: Approx. 3.8g |

1.2 Power Supply

Regulated power for the GAM-1513P-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~5.5V, Recommended power supply voltage is 3.3V . maximum current is 8 mA. 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.

2 Application

The module is equipped with a 7-pin pad that connects to your application platform. The GAM-1513P-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

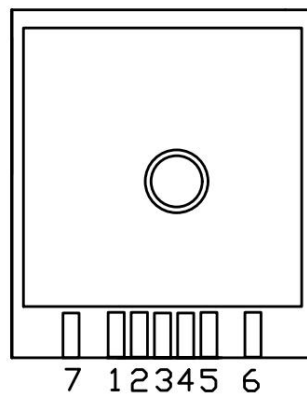


Figure 2: Pin Assignment

CON Pin Description

| Pin No. | Pin name | I/O | Description | Remark |
|---------|----------|-----|-------------------------|--------------------------|
| 1 | NC | | | |
| 2 | TXD | O | UART Serial Data output | |
| 3 | RXD | I | UART Serial Data Input | |
| 4 | VCC | I | Module Power Supply | Voltage range: 2.8V~5.5V |
| 5 | GND | G | Ground | |
| 6 | PPS | O | One pulse per second | |
| 7 | GPIO1 | I/O | General purpose I/O | |

2.2 Mechanical Dimensions

This chapter describes the mechanical dimensions of the GAM-1513P-SN module. Size unit (mm)

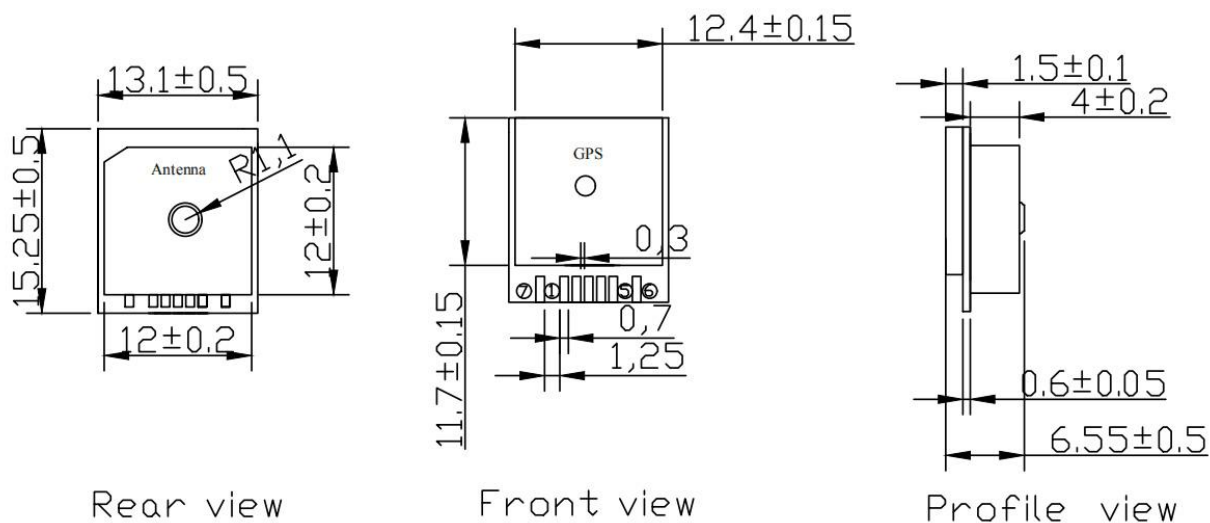


Figure 3: Specification size chart

2.4 Command specifications

the GAM-1513P-SN module is to open the work by sending the command, and to implement any of the features.

2.4.1 @GCD: Cold start

This command is used to start the positioning with cold start

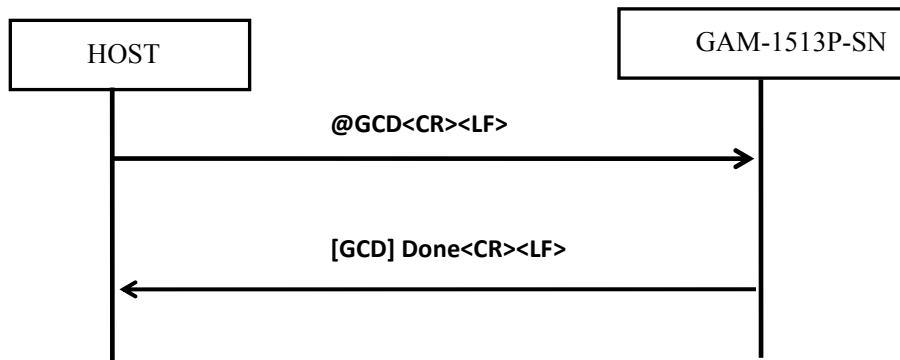
Format: @GCD<CR><LF>

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:



2.4.2 @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.)

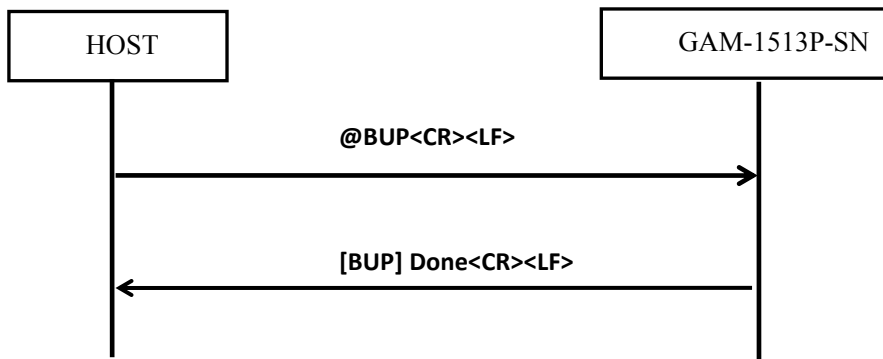
Format: @BUP<CR><LF>

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:



2.4.3 @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

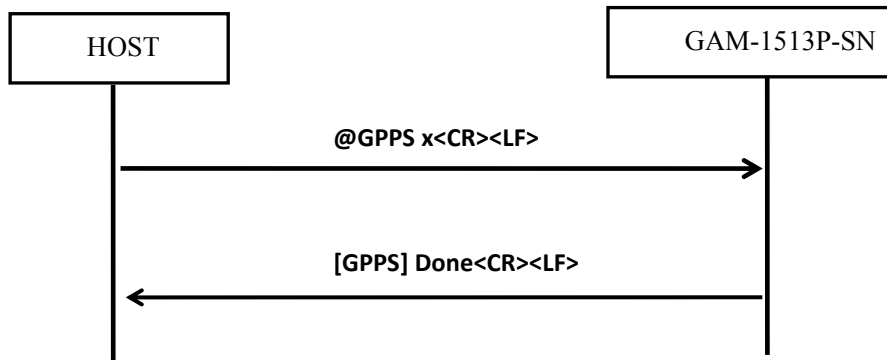
Argument:

| 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:



3 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 GAM-1513P-SN supports the following NMEA-0183 messages: \$GPGSA, \$GPGSV,\$GPRMC,\$GPVTG, \$GPZDA and \$GPGLL.

3.1 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 |

3.1.1 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 |

3.1.2 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 |

3.1.3 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 |

3.1.4 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.

3.1.6 RMC: Recommended Minimum Specific GNSS Data

Format : \$-RMC,hhmmss.ss,A,llll.ll,a,yyyy.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> | |

3.1.7 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> | |

3.1.8 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 | |

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