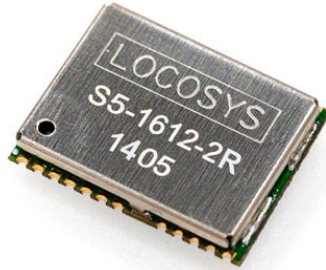


| Product name | Description                                    | Version |
|--------------|--|---------|
| S5-1612-xx   | Datasheet of S5-1612-xx standalone GNSS module | 1.1     |



## 1 Introduction

LOCOSYS S5-1612-xx GNSS module features high sensitivity, low power and small form factor. This module can track multiple satellite constellations that include GPS, GLONASS, QZSS and SBAS. It is powered by SiRFstarV, and can provide you with superior sensitivity and performance even in urban canyon and dense foliage environment. Optional Built-in EEPROM realizes SiRF CGEE (Client Generated Extended Ephemeris) function that predicts satellite positions for up to 3 days and delivers CGEE-start time of less than 15 seconds under most conditions, without any network assistance.

## 2 Features

- SiRFstarV high sensitivity solution
- Support GPS, GLONASS and QZSS
- Capable of SBAS (WAAS, EGNOS, MSAS, GAGAN)
- Support 52-channel GNSS
- Fast TTFF at low signal level
- Multiple interference mitigation strategies
- Support TricklePower Mode
- Aiding with both CGEE and SGEE for GPS and GLONASS (only for S5-1612-1E, S5-1612-2E)
- Built-in LNA (on chip) and SAW filter
- Small form factor 16 x 12.2 x 2.2 mm
- SMD type with stamp hole; RoHS compliant

## 3 Application

- Personal positioning and navigation
- Automotive navigation
- Marine navigation



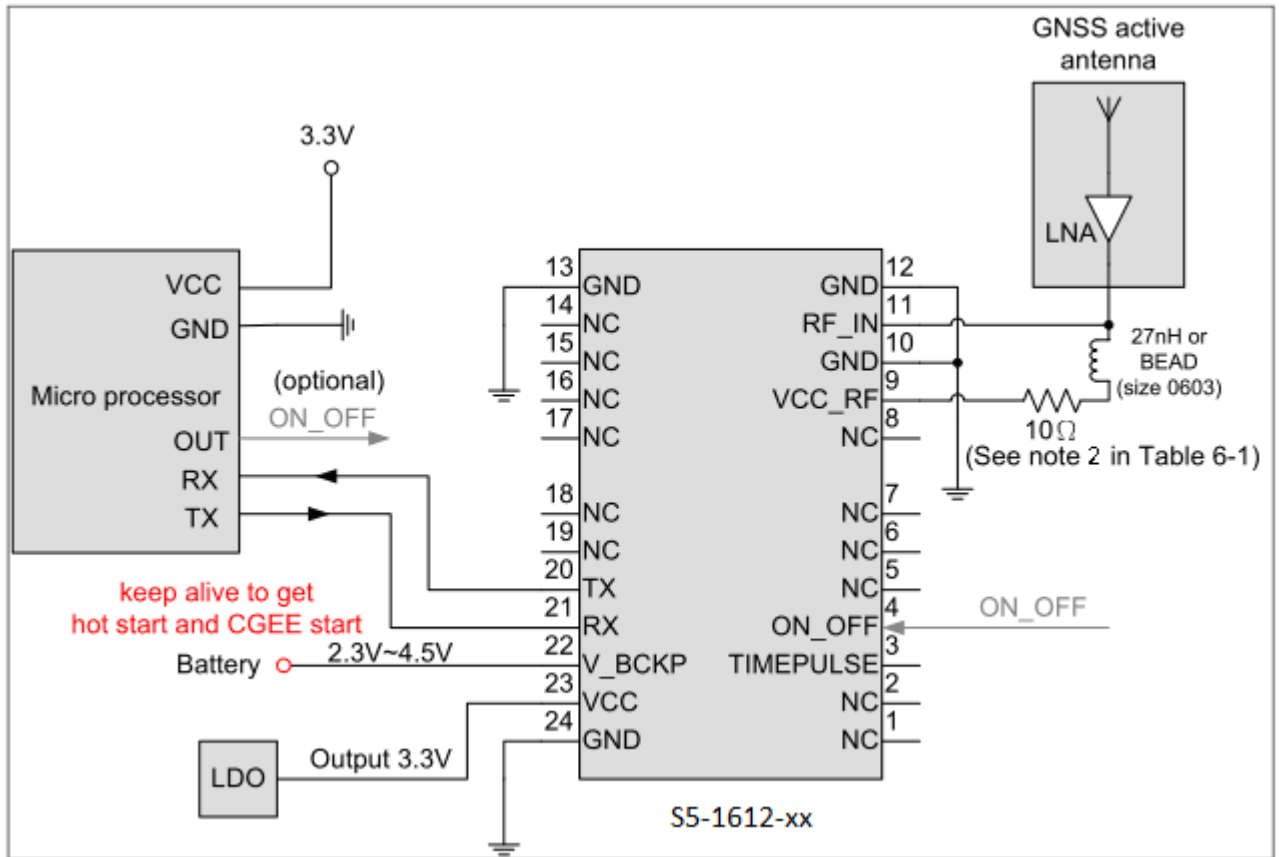


Fig 3-3 Typical application circuit that uses an active antenna



## 4 GNSS receiver

|                   |  |   |
|-------------------|--|---|
| Chip              | SiRFstarV, CSRG0530B01   |   |
| Frequency         | GPS, QZSS: L1 1575.42MHz, C/A code<br>GLONASS: L1 1598.0625MHz ~ 1605.375MHz, C/A code |   |
| Channels          | 52   |   |
| Update rate       | 1Hz, up to 5Hz   |   |
| Sensitivity       | Tracking   | -159dBm, up to -162dBm (with external LNA)  |
|                   | Navigation   | -158dBm, up to -160dBm (with external LNA) <sup>(1)</sup>   |
|                   | Cold start   | -145dBm, up to -148dBm (with external LNA)  |
| Acquisition Time  | Hot start (Open Sky)   | < 2s (typical)  |
|                   | Hot start (Indoor)   | < 15s   |
|                   | Cold Start (Open Sky)  | 22s (typical)   |
|                   |  | < 15s (typical), CGEE-start   |
| Position Accuracy | Autonomous   | < 2.5m CEP  |
|                   | SBAS <sup>(2)</sup>  | 2.5m (depends on accuracy of correction data)   |
| Max. Altitude     | < 18,000 m   |   |
| Max. Velocity     | < 515 m/s  |   |
| Protocol Support  | NMEA 0183 ver 4.0  | 4800/9600 bps <sup>(3)</sup> , 8 data bits, no parity, 1 stop bits (default)<br>1Hz: GGA, GSA, RMC, GNS<br>0.2Hz: GSV |
|                   | OSP Binary   | 115200 bps, 8 data bits, no parity, 1 stop bits   |

Note 1: For GPS mode.

Note 2: GNSS mode can't support SBAS.

Note 3: Both baud rate and output message rate are configurable.

## 5 Pin assignment and descriptions

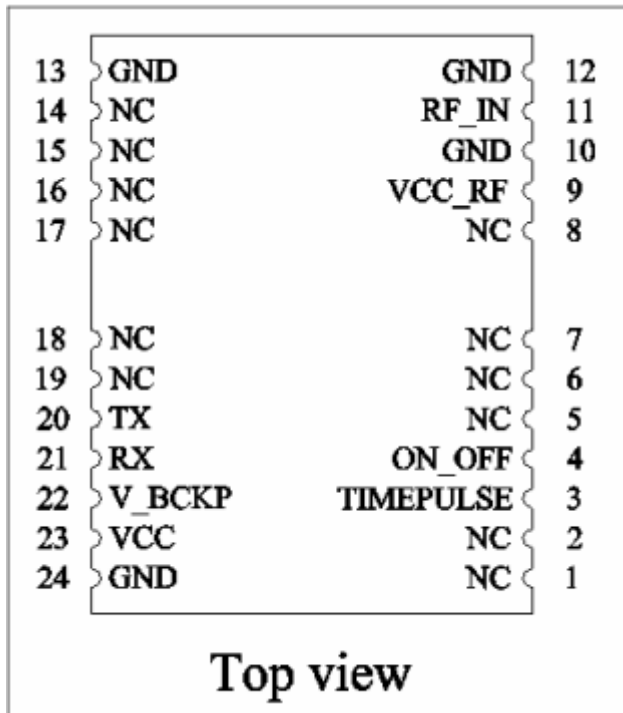


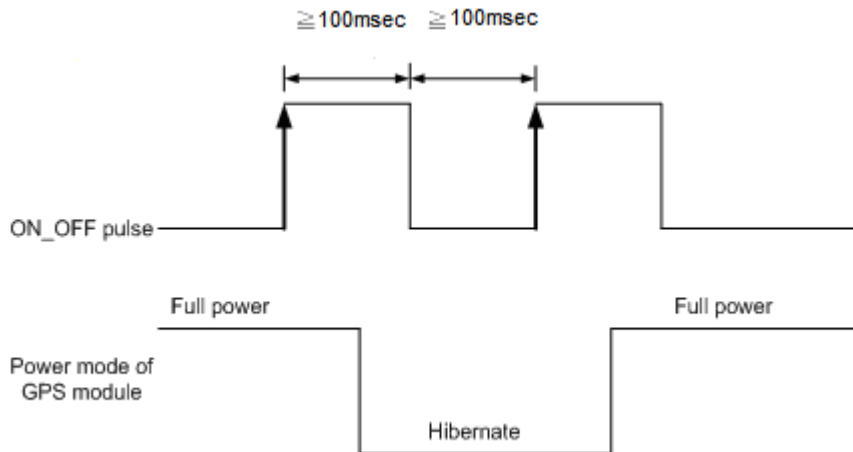
Table 5-1 Pin descriptions

| Pin # | Name      | Type | Description  | Note |
|-------|-----------|------|--|------|
| 1     | NC        |      | Not connected  |      |
| 2     | NC        |      | Not connected  |      |
| 3     | TIMEPULSE | O    | Time pulse (1PPS, 250 ms pulse/sec)  |      |
| 4     | ON_OFF    | I    | Power control pin.<br>If this pin is not used, leave it floating. GNSS module can start to work when DC power (VCC) is supplied. | 1    |
| 5     | NC        |      | Not connected  |      |
| 6     | NC        |      | Not connected  |      |
| 7     | NC        |      | Not connected  |      |
| 8     | NC        |      | Not connected  |      |
| 9     | VCC_RF    | O    | Output voltage for active antenna  | 2    |
| 10    | GND       | P    | Ground   |      |
| 11    | RF_IN     | I    | GNSS RF signal input   |      |
| 12    | GND       | P    | Ground   |      |
| 13    | GND       | P    | Ground   |      |
| 14    | NC        |      | Not connected  |      |
| 15    | NC        |      | Not connected  |      |
| 16    | NC        |      | Not connected  |      |

|    |        |   |  |   |
|----|--------|---|--|---|
| 17 | NC     |   | Not connected  |   |
| 18 | NC     |   | Not connected  |   |
| 19 | NC     |   | Not connected  |   |
| 20 | TX     | O | Serial output (Default NMEA)   |   |
| 21 | RX     | I | Serial input (Default NMEA)  |   |
| 22 | V_BCKP | P | Backup battery supply voltage<br><b>This pin must be powered to enable the module.</b> | 3 |
| 23 | VCC    | P | DC supply voltage  |   |
| 24 | GND    | P | Ground   |   |

<Note>

- Input pulse to switch the module between different power modes.
  - ON\_OFF pulse requires a rising edge and high level that persists for three cycles of the RTC clock in order to be detected. Resetting the ON\_OFF detector requires that ON\_OFF goes to logic low for at least 100 msec.
  - If the module is in hibernate state, an ON\_OFF high will move it to full-power mode.
  - If the module is in TricklePower mode, an ON\_OFF pulse will initiate one TricklePower cycle.
  - If the module is already in full-power mode, an ON\_OFF pulse will initiate orderly shutdown.



- In order to get the advantage of CGEE, this pin must be always powered during the period of effective ephemeris prediction.
- VCC\_RF does not have short circuit protection.

## 6 Ordering information

| Model      | Description                             |
|------------|---|
| S5-1612-1R | Baud rate: 4800 bps. Without SPI flash  |
| S5-1612-1E | Baud rate: 4800 bps. Built-in SPI flash |
| S5-1612-2R | Baud rate: 9600 bps. Without SPI flash  |
| S5-1612-2E | Baud rate: 9600 bps. Built-in SPI flash |

## 7 DC & Temperature characteristics

### 7.1 Absolute maximum ratings

| Parameter                    | Symbol | Ratings  | Units |
|------------------------------|--------|----------|-------|
| DC Supply Voltage            | VCC    | 4.5      | V     |
| Input Backup Battery Voltage | V_BCKP | 4.5      | V     |
| Operating Temperature Range  | Topr   | -40 ~ 85 | °C    |
| Storage Temperature Range    | Tstg   | -40 ~ 85 | °C    |

### 7.2 DC Electrical characteristics

| Parameter                    | Symbol          | Conditions                                 | Min.    | Typ. | Max. | Units |
|------------------------------|-----------------|--|---------|------|------|-------|
| Input Voltage                | VCC             |  | 3.0     | 3.3  | 3.6  | V     |
| Input Backup Battery Voltage | V_BCKP          |  | 2.3     |      | 4.5  | V     |
| VCC_RF Output Voltage        | VCC_RF          |  |         | VCC  |      | V     |
| Supply                       | Iss             | VCC = 3.3V,<br>w/o active antenna,<br>Peak |         |      | 57   | mA    |
|                              |                 | Acquisition                                |         | 26   |      | mA    |
|                              |                 | Tracking                                   |         | 20   |      | mA    |
|                              |                 | Hibernate                                  |         | 6    |      | uA    |
| Backup Battery Current       | Ibat            | Remove the power of<br>VCC                 |         | 35   |      | uA    |
| High Level Input Voltage     | V <sub>IH</sub> |  | 0.7*VCC |      | 3.6  | V     |
| Low Level Input Voltage      | V <sub>IL</sub> |  | -0.3    |      | 0.4  | V     |
| High Level Output Voltage    | V <sub>OH</sub> |  | 0.7*VCC |      | VCC  | V     |
| Low Level Output Voltage     | V <sub>OL</sub> |  |         |      | 0.4  | V     |
| High Level Output Current    | I <sub>OH</sub> |  |         | 2    |      | mA    |
| Low Level Output Current     | I <sub>OL</sub> |  |         | 2    |      | mA    |

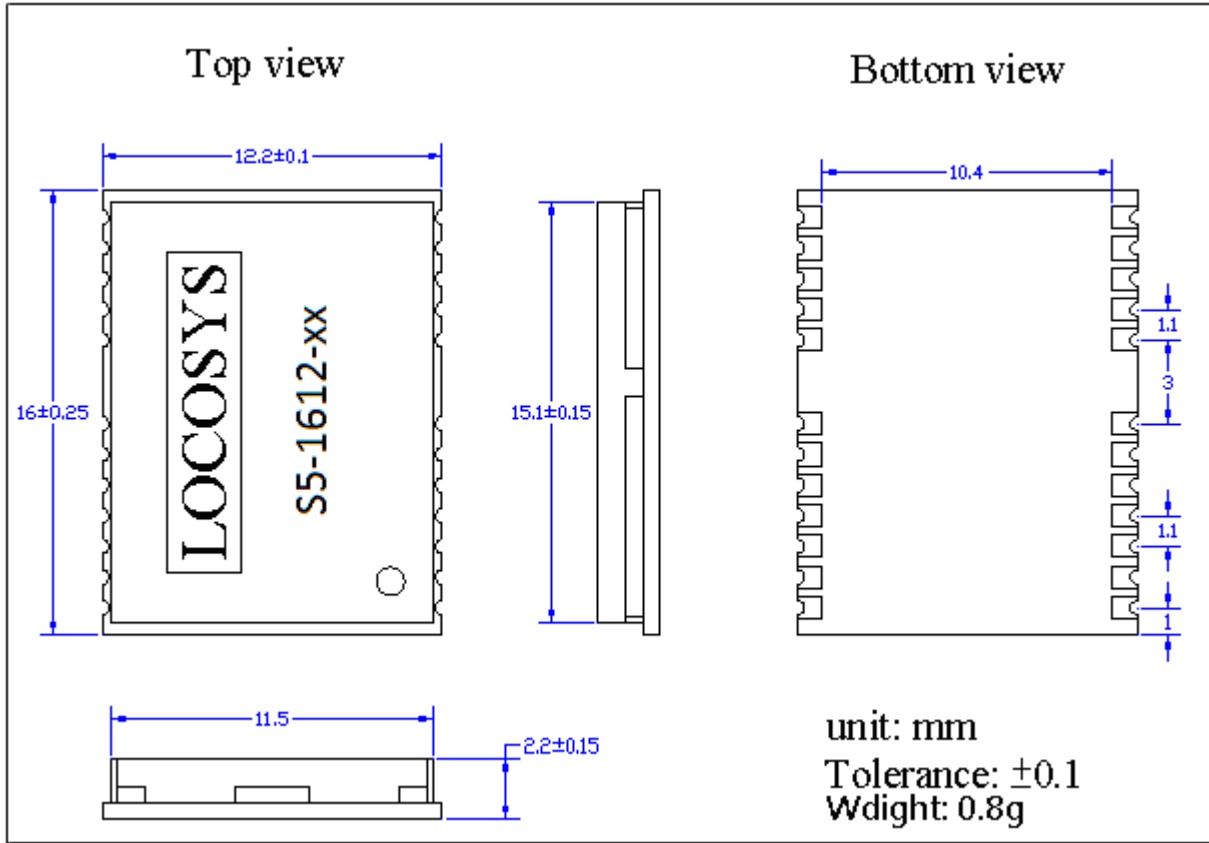


### 7.3 Temperature characteristics

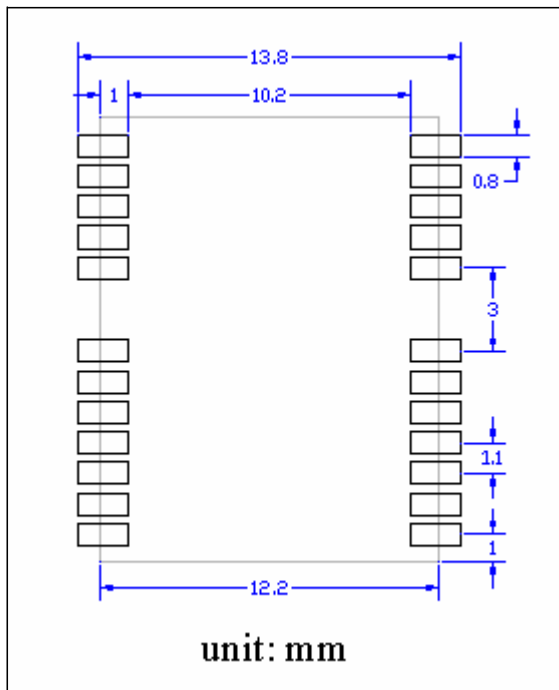
| Parameter             | Symbol | Min. | Typ. | Max. | Units |
|-----------------------|--------|------|------|------|-------|
| Operating Temperature | Topr   | -40  | -    | 85   | °C    |
| Storage Temperature   | Tstg   | -40  | 25   | 85   | °C    |

8 Mechanical specification

8.1 Outline dimensions



8.2 Recommended land pattern dimensions



## 9 Software interface

### 9.1 NMEA output message

Table 9.1-1 NMEA output message

| 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      |
| GNS         | GNSS fix data                            |

#### ● GGA--- Global Positioning System Fixed Data

Table 9.1-2 contains the values for the following example:

\$GPGGA,085006.000,2503.7227,N,12138.7296,E,1,11,0.6,81.5,M,15.3,M,,0000\*6D

Table 9.1- 2 GGA Data Format

| Name                   | Example    | Units  | Description  |
|------------------------|------------|--------|--|
| Message ID             | \$GPGGA    |        | GGA protocol header  |
| UTC Time               | 085006.000 |        | hhmmss.sss   |
| Latitude               | 2503.7227  |        | ddmm.mmmm  |
| N/S indicator          | N          |        | N=north or S=south   |
| Longitude              | 12138.7296 |        | dddmm.mmmm   |
| E/W Indicator          | E          |        | E=east or W=west   |
| Position Fix Indicator | 1          |        | See Table 8.1-3  |
| Satellites Used        | 11         |        | Range 0 to 12  |
| HDOP                   | 0.6        |        | Horizontal Dilution of Precision   |
| MSL Altitude           | 81.5       | mters  |  |
| Units                  | M          | mters  |  |
| Geoid Separation       | 15.3       | mters  | Geoid-to-ellipsoid separation.<br>Ellipsoid altitude = MSL Altitude + Geoid Separation |
| Units                  | M          | mters  |  |
| Age of Diff. Corr.     |            | second | Null fields when DGPS is not used  |
| Diff. Ref. Station ID  | 0000       |        |  |
| Checksum               | *6D        |        |  |
| <CR> <LF>              |            |        | End of message termination   |

Table 9.1-3 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 9.1-4 contains the values for the following example:

\$GNGLL,2503.7227,N,12138.7296,E,085006.000,A,A\*4B

Table 9.1-4 GLL Data Format

| Name          | Example    | Units | Description  |
|---------------|------------|-------|--|
| Message ID    | \$GNGLL    |       | GLL protocol header  |
| Latitude      | 2503.7227  |       | ddmm.mmmm  |
| N/S indicator | N          |       | N=north or S=south   |
| Longitude     | 12138.7296 |       | dddmm.mmmm   |
| E/W indicator | E          |       | E=east or W=west   |
| UTC Time      | 085006.000 |       | hhmmss.sss   |
| Status        | A          |       | A=data valid or V=data not valid   |
| Mode          | A          |       | A=autonomous, D=DGPS, E=DR, N=Data not valid, R=Coarse Position <sup>(1)</sup> , S=Simulator |
| Checksum      | *4B        |       |  |
| <CR> <LF>     |            |       | End of message termination   |

(1) Position was calculated based on one or more of the SVs having their states derived from almanac parameters, as opposed to ephemerides.

## ● GSA---GNSS DOP and Active Satellites

Table 9.1-5 contains the values for the following example:

\$GNGSA,A,3,26,15,05,02,57,18,24,09,29,08,21,,1.2,0.6,1.0\*2B

\$GNGSA,A,3,66,76,82,88,65,75,77,,,,,1.2,0.6,1.0\*22

Table 9.1-5 GSA Data Format

| Name                 | Example | Units | Description         |
|----------------------|---------|-------|---------------------|
| Message ID           | \$GNGSA |       | GSA protocol header |
| Mode 1               | A       |       | See Table 9.1-6     |
| Mode 2               | 3       |       | See Table 9.1-7     |
| ID of satellite used | 26      |       | Sv on Channel 1     |

|                      |     |  |                                  |
|----------------------|-----|--|----------------------------------|
| ID of satellite used | 15  |  | Sv on Channel 2                  |
| ....                 |     |  | ....                             |
| ID of satellite used |     |  | Sv on Channel 12                 |
| PDOP                 | 1.2 |  | Position Dilution of Precision   |
| HDOP                 | 0.6 |  | Horizontal Dilution of Precision |
| VDOP                 | 1.0 |  | Vertical Dilution of Precision   |
| Checksum             | *2B |  |                                  |
| <CR> <LF>            |     |  | End of message termination       |

Table 9.1-6 Mode 1

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

Table 9.1-7 Mode 2

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

## ● GSV---GNSS Satellites in View

Table 9.1-8 contains the values for the following example:

```
$GPGSV,3,1,11,26,54,023,43,15,67,284,42,05,40,057,41,02,32,140,39*7F
$GPGSV,3,2,11,57,74,091,37,18,08,291,36,24,28,179,36,09,15,044,36*75
$GPGSV,3,3,11,29,34,247,35,08,12,043,34,21,20,318,33*42
$GLGSV,3,1,09,66,38,342,39,76,35,117,37,82,15,325,36,88,33,201,35*64
$GLGSV,3,2,09,65,25,043,33,75,24,054,32,77,10,168,31,81,47,277,*6E
$GLGSV,3,3,09,67,14,289,*5B
```

Table 9.1-8 GSV Data Format

| Name                                  | Example | Units   | Description  |
|---------------------------------------|---------|---------|--|
| Message ID                            | \$GPGSV |         | GSV protocol header (GPGSV and GLGSV)              |
| Total number of messages <sup>1</sup> | 3       |         | Range 1 to 8                                       |
| Message number <sup>1</sup>           | 1       |         | Range 1 to 8                                       |
| Satellites in view                    | 11      |         |  |
| Satellite ID                          | 26      |         | Channel 1 (Range 01 to 196)                        |
| Elevation                             | 54      | degrees | Channel 1 (Range 00 to 90)                         |
| Azimuth                               | 023     | degrees | Channel 1 (Range 000 to 359)                       |
| SNR (C/No)                            | 43      | dB-Hz   | Channel 1 (Range 00 to 99, null when not tracking) |
| ....                                  |         |         | ....   |

|              |     |         |  |
|--------------|-----|---------|--|
| Satellite ID | 02  |         | Channel 4 (Range 01 to 196)                        |
| Elevation    | 32  | degrees | Channel 4 (Range 00 to 90)                         |
| Azimuth      | 140 | degrees | Channel 4 (Range 000 to 359)                       |
| SNR (C/No)   | 39  | dB-Hz   | Channel 4 (Range 00 to 99, null when not tracking) |
| Checksum     | *7F |         |  |
| <CR> <LF>    |     |         | End of message termination                         |

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

## ● RMC---Recommended Minimum Specific GNSS Data

Table 9.1-9 contains the values for the following example:

\$GNRMC,085006.000,A,2503.7227,N,12138.7296,E,0.00,0.00,191113,,,A\*76

Table 9.1-9 RMC Data Format

| Name               | Example    | Units   | Description  |
|--------------------|------------|---------|--|
| Message ID         | \$GNRMC    |         | RMC protocol header  |
| UTC Time           | 085006.000 |         | hhmmss.sss   |
| Status             | A          |         | A=data valid or V=data not valid   |
| Latitude           | 2503.7227  |         | ddmm.mmmm  |
| N/S Indicator      | N          |         | N=north or S=south   |
| Longitude          | 12138.7296 |         | dddmm.mmmm   |
| E/W Indicator      | E          |         | E=east or W=west   |
| Speed over ground  | 0.00       | knots   | True   |
| Course over ground | 0.00       | degrees |  |
| Date               | 191113     |         | ddmmyy   |
| Magnetic variation |            | degrees |  |
| Variation sense    |            |         | E=east or W=west (Not shown)   |
| Mode               | A          |         | A=autonomous, D=DGPS, E=DR, N=Data not valid, R=Coarse position <sup>(1)</sup> , S=Simulator |
| Checksum           | *76        |         |  |
| <CR> <LF>          |            |         | End of message termination   |

(1) Position was calculated based on one or more of the SVs having their states derived from almanac parameters, as opposed to ephemerides

## ● VTG---Course Over Ground and Ground Speed

Table 9.1-10 contains the values for the following example:

\$GNVTG,0.00,T,,M,0.00,N,0.0,K,A\*13

Table 9.1-10 VTG Data Format

| Name | Example | Units | Description |
|------|---------|-------|-------------|
|------|---------|-------|-------------|

|                    |         |         |   |
|--------------------|---------|---------|---|
| Message ID         | \$GNVTG |         | 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  | 0.00    | knots   | Measured speed  |
| Units              | N       |         | Knots   |
| Speed over ground  | 0.0     | km/hr   | Measured speed  |
| Units              | K       |         | Kilometer per hour  |
| Mode               | A       |         | A=autonomous, D=DGPS, E=DR, N=Data not valid,<br>R=Coarse position <sup>(1)</sup> , S=Simulator |
| Checksum           | *13     |         |   |
| <CR> <LF>          |         |         | End of message termination  |

(1) Position was calculated based on one or more of the SVs having their states derived from almanac parameters, as opposed to ephemerides

## ● GNS---GNSS Fix Data

Table 9.1-11 contains the values for the following example:

\$GNGNS,064411.000,2503.7136,N,12138.7427,E,AA,16,0.7,130.5,15.3,,0000\*66

Table 9.1-11 GNS Data Format

| Name                | Example    | Units  | Description   |
|---------------------|------------|--------|---|
| Message ID          | \$GNGNS    |        | GNS protocol header   |
| UTC of position fix | 064411.000 |        | hhmmss.sss  |
| Latitude            | 2503.7136  |        | ddmm.mmmm   |
| N/S Indicator       | N          |        | N=north or S=south  |
| Longitude           | 12138.7427 |        | dddmm.mmmm  |
| E/W Indicator       | E          |        | E=east or W=west  |
| Mode indicator      | AA         |        | Variable character field with one character for each supported constellation. First character is for GPS, second character is for GLONASS, subsequent characters will be added for new constellation.<br><br>Each character will be one of Table 9.1-12 |
| Satellites Used     | 16         |        | Range 0 to 99   |
| HDOP                | 0.7        |        | Horizontal Dilution of Precision  |
| Orthometric height  | 130.5      | meters | Orthometric height in meters (MSL reference)  |
| Geoid Separation    | 15.3       | meters | Geoid-to-ellipsoid separation.  |

|                          |      |        |  |
|--------------------------|------|--------|--|
|                          |      |        | Ellipsoid altitude = MSL Altitude + Geoid Separation |
| Age of differential data |      | second | Null fields when DGPS is not used                    |
| Diff. Ref. Station ID    | 0000 |        |  |
| Checksum                 | *13  |        |  |
| <CR> <LF>                |      |        | End of message termination                           |

Table 9.1-12 mode

| Value | Description   |
|-------|---|
| N     | No fix. Satellite system not used in position fix, or fix not valid                 |
| A     | Autonomous. Satellite system used in non-differential mode in position fix          |
| D     | Differential  |
| P     | Precise. Satellite system used in precision mode.                                   |
| R     | Real Time Kinematic. Satellite system used in RTK mode with fixed integers          |
| F     | Float RTK. Satellite system used in real time kinematic mode with floating integers |
| E     | Estimated (dead reckoning) Mode   |
| M     | Manual Input Mode   |
| S     | Simulator Mode  |

## 9.2 Proprietary NMEA input message

Table 9.2-1 Message Parameters

| Start Sequence           | Payload           | Checksum            | End Sequence          |
|--------------------------|-------------------|---------------------|-----------------------|
| \$PSRF<MID> <sup>1</sup> | Data <sup>2</sup> | *CKSUM <sup>3</sup> | <CR><LF> <sup>4</sup> |

1. Message Identifier consisting of three numeric characters. Input messages begin at MID 100.
2. Message specific data. Refer to a specific message section for <data>...<data> definition.
3. CKSUM is a two-hex character checksum as defined in the NMEA specification, *NMEA-0183Standard For Interfacing Marine Electronic Devices*. Use of checksums is required on all input messages.
4. Each message is terminated using Carriage Return (CR) Line Feed (LF) which is \r\n which is hex 0D0A. Because \r\n are not printable ASCII characters, they are omitted from the example strings, but must be sent to terminate the message and cause the receiver to process that input message.

Note: All fields in all proprietary NMEA messages are required, none are optional. All NMEA messages are comma delimited.

Table 9.2-2 Proprietary NMEA input messages

| MID <sup>1</sup> | Description  |
|------------------|--|
| 100              | Set PORT A parameters and protocol                     |
| 101              | Parameters required for start using X/Y/Z <sup>2</sup> |
| 102              | Set PORT B parameters for DGPS input                   |
| 103              | Query standard NMEA message and/or set output rate     |



|     |  |
|-----|--|
| 104 | Parameters to start using Lat/Lon/Alt <sup>3</sup> |
| 105 | Development Data messages On/Off                   |
| 106 | Selection of datum for coordinate transformation   |
| 112 | Set message rate                                   |
| 117 | System turn off                                    |
| 120 | Storage configuration setting                      |
| 121 | Data logging command                               |
| 122 | Data logging interval command                      |
| 123 | Data logging threshold command                     |
| 124 | Data logging memory management command             |
| 125 | Poll SW version string                             |

1. Message Identification (MID).
2. Input coordinates must be WGS84.
3. Input coordinates must be WGS84

### ● 100---SetSerialPort

This command message is used to set the protocol (SiRF binary or NMEA) and/or the communication parameters (Baud rate, data bits, stop bits, and parity). The command is used to switch the module back to SiRF binary protocol mode where a more extensive command message set is available. When a valid message is received, the parameters are stored in battery-backed SRAM and, after a reset, the receiver resumes using the saved parameters.

Table 9.2-3 contains the input values for the following example:

Switch to SiRF binary protocol at 9600,8,N,1

```
$PSRF100,0,9600,8,1,0*0C<CR><LF>
```

Table 9.2-3 Set Serial Port Data Format

| Name       | Example   | Units | Description                            |
|------------|-----------|-------|--|
| Message ID | \$PSRF100 |       | PSRF100 protocol header                |
| Protocol   | 0         |       | 0=SiRF binary, 1=NMEA                  |
| Baud       | 9600      |       | 4800,9600,19200,38400,57600, or 115200 |
| DataBits   | 8         |       | 8 only                                 |
| StopBits   | 1         |       | 1 only                                 |
| Parity     | 0         |       | 0 = None only                          |
| Checksum   | *0C       |       |  |
| <CR><LF>   |           |       | End of message termination             |

1. SiRF protocol is only valid for 8 data bits, 1 stop bit, and no parity.

### ● 101---Navigation Initialization

This command message restarts the receiver, as well as, specifies the type of restart. Optionally, it may also initialize

position (in X, Y, Z ECEF coordinates), clock drift, GPS Time Of Week and GPS Week Number. This enables the receiver to search for the correct satellite signals at the correct signal parameters. Correct initialization parameters enable the receiver to quickly acquire signals.

Table 9.2-4 contains the input values for the following example:

Start using known position and time

```
$PSRF101,-2686700,-4304200,3851624,96000,497260,921,12,3*1C<CR><LF>
```

Table 9.2-4 Navigation Initialization Data Format

| Name         | Example   | Units   | Description                                |
|--------------|-----------|---------|--|
| Message ID   | \$PSRF101 |         | PSRF101 protocol header                    |
| ECEF X       | -2686700  | meters  | X coordinate position                      |
| ECEF Y       | -4304200  | meters  | Y coordinate position                      |
| ECEF Z       | 3851624   | meters  | Z coordinate position                      |
| ClkOffset    | 96000     | Hz      | Clock Drift of the Receiver <sup>(1)</sup> |
| TimeOfWeek   | 497260    | seconds | GPS Time Of Week                           |
| WeekNo       | 921       |         | GPS Week Number                            |
| ChannelCount | 12        |         | Range 1 to 12                              |
| ResetCfg     | 3         |         | See Table 9.2-5                            |
| Checksum     | *1C       |         |  |
| <CR><LF>     |           |         | End of message termination                 |

(1) Use 0 for last saved value if available. If this is unavailable, use a default value of 96250.

Table 9.2-5 Reset Configuration

| Value | Description            |
|-------|------------------------|
| 1     | Hot Start              |
| 2     | Warm Start (no init)   |
| 3     | Warm Start (with Init) |
| 4     | Cold Start             |
| 8     | Factory start          |

## ● 102---SetDGPSPort

This command is used to control the serial port used to receive RTCM differential corrections. Differential receivers may output corrections using different communication parameters. If a DGPS receiver is used that has different communication parameters, use this command to allow the receiver to correctly decode the data. When a valid message is received, the parameters are stored in battery-backed SRAM and the receiver restarts using the saved parameters.

Table 9.2-6 contains the input values for the following example:

Set DGPS Port to be 9600,8,N,1.

```
$PSRF102,9600,8,1,0*12
```

Table 9.2-6 Set GPS Port Data Format

| Name       | Example   | Units | Description                            |
|------------|-----------|-------|--|
| Message ID | \$PSRF102 |       | PSRF102 protocol header                |
| Baud       | 9600      |       | 4800,9600,19200,38400, 57600 or 115200 |
| DataBits   | 8         |       | 8,7                                    |
| StopBits   | 1         |       | 0,1                                    |
| Parity     | 0         |       | 0=None, 1=Odd, 2=Even                  |
| Checksum   | *12       |       |  |
| <CR><LF>   |           |       | End of message termination             |

Note: RTCM is not supported, i.e. this command is not supported.

### ● 103---Query/Rate Control

This command is used to control the output of only standard NMEA messages GGA, GLL, GSA, GSV, RMC, and VTG. It also controls the ZDA message in software that supports it. Using this command message, standard NMEA messages may be polled once, or setup for periodic output. Checksums may also be enabled or disabled depending on the needs of the receiving program. NMEA message settings are saved in battery-backed memory for each entry when the message is accepted.

Table 9.2-7 contains the input values for the following example:

1. Query the GGA message with checksum enabled

```
$PSRF103,00,01,00,01*25<CR><LF>
```

2. Enable VTG message for a 1 Hz constant output with checksum enabled

```
$PSRF103,05,00,01,01*20<CR><LF>
```

3. Disable VTG message

```
$PSRF103,05,00,00,01*21<CR><LF>
```

Table 9.2-7 Query/Rate Control Data Format (See example 1)

| Name       | Example   | Units | Description  |
|------------|-----------|-------|--|
| Message ID | \$PSRF103 |       | PSRF103 protocol header  |
| Msg        | 00        |       | See Table 9.2-8 <sup>(1)</sup>   |
| Mode       | 01        |       | 0 = Set Rate<br>1 = Query one time<br>2 = ABP On<br>3 = ABP Off<br>4 = Reverse EE On<br>5 = Reverse EE Off<br>6 = 5Hz Navigation On<br>7 = 5Hz Navigation Off<br>8 = SBAS Ranging On |

|             |     |         |  |
|-------------|-----|---------|--|
|             |     |         | 9 = SBAS Ranging Off<br>10 = FTS (Fast Time Sync) Mode On<br>11 = FTS Mode Off |
| Rate        | 00  | seconds | Output Rate, 0 = Off<br>1 to 255 = seconds between messages <sup>(2)</sup>     |
| CksumEnable | 01  |         | 0=Disable Checksum, 1=Enable Checksum  |
| Checksum    | *25 |         |  |
| <CR><LF>    |     |         | End of message termination   |

(1) The Msg field is ignored if the Mode field has values other than 1 (query).

(2) The Rate field is ignored unless the Mode field is set to 0 (Set Rate).

Table 9.2-8 Messages

| Value | Description                           |
|-------|---------------------------------------|
| 0     | GGA                                   |
| 1     | GLL                                   |
| 2     | GSA                                   |
| 3     | GSV                                   |
| 4     | RMC                                   |
| 5     | VTG                                   |
| 6     | MSS (If internal beacon is supported) |
| 7     | Not defined                           |
| 8     | ZDA (if 1PPS output is supported)     |
| 9     | Not defined                           |

**Note:** In TricklePower mode, the update rate specifies TricklePower cycles rather than seconds. If the TricklePower cycle is set at 5 seconds, then an update rate of 2 indicates to output the message every 2 cycles, or 10 seconds.

## ● 104---LLANavigationInitialization

This command is used to cause a restart of the receiver, and to specify the type of restart. Optionally, it may also initialize position (in latitude, longitude, and altitude), clock drift, GPS Time Of Week and GPS Week Number. This enables the receiver to search for the correct satellite signals at the correct signal parameters. Correct initialization parameters enable the receiver to quickly acquire signals.

Table 9.2-9 contains the input values for the following example:

Start using known position and time.

```
PSRF104,37.3875111,-121.97232,0,96000,237759,1946,12,1*07<CR><LF>
```

Table 9.2-9 LLA Navigation Initialization Data Format

| Name | Example | Units | Description |
|------|---------|-------|-------------|
|------|---------|-------|-------------|

|              |            |         |  |
|--------------|------------|---------|--|
| Message ID   | \$PSRF104  |         | PSRF104 protocol header                                  |
| Lat          | 37.3875111 | degrees | Latitude position (Range 90 to -90), +: North, -: South  |
| Lon          | -121.97232 | degrees | Longitude position (Range 180 to -180), +: East, -: West |
| Alt          | 0          | meters  | Altitude position  |
| ClkOffset    | 96000      | Hz      | Clock Drift of the Receiver <sup>(1)</sup>               |
| TimeOfWeek   | 237759     | seconds | GPS Time Of Week   |
| WeekNo       | 1946       |         | Extended GPS Week Number (1024 added)                    |
| ChannelCount | 12         |         | Range 1 to 12  |
| ResetCfg     | 1          |         | See Table 9.2-10   |
| Checksum     | *07        |         |  |
| <CR><LF>     |            |         | End of message termination                               |

(1) Use 0 for last saved value if available. If this is unavailable, a default value of 96250 is used.

Table 9.2-10 Messages

| Value | Description            |
|-------|------------------------|
| 1     | Hot Start              |
| 2     | Warm Start (no init)   |
| 3     | Warm Start (with Init) |
| 4     | Cold Start             |
| 8     | Factory start          |

## ● 105---Development Data On/Off

This command turns development data (debug messages) on and off. Development data can be used to help diagnose system problems since many parts of the software contain messages that are output when problems are detected.

Table 9.2-11 contains the input values for the following example:

1. Debug On  
`$PSRF105,1*3E`
2. Debug Off  
`$PSRF105,0*3F`

Table 9.2-11 Development Data On/Off Data Format

| Name       | Example   | Units | Description                |
|------------|-----------|-------|----------------------------|
| Message ID | \$PSRF105 |       | PSRF105 protocol header    |
| Debug      | 1         |       | 0=Off, 1=On                |
| Checksum   | *3E       |       |                            |
| <CR><LF>   |           |       | End of message termination |

● **106---Select Datum**

This message allows the selection of an alternate map datum. The receiver software may contain one or more alternate datums in addition to WGS84, the default GPS datum.

Table 9.2-12 contains the input values for the following example:

Datum selects TOKYO\_MEAN

\$PSRF106,178\*32<CR><LF>

Table 9.2-12 Development Data On/Off Data Format

| Name       | Example   | Units | Description   |
|------------|-----------|-------|---|
| Message ID | \$PSRF106 |       | PSRF106 protocol header   |
| Datum      | 178       |       | 21=WGS84<br>178=TOKYO_MEAN<br>179=TOKYO_JAPAN<br>180=TOKYO_KOREA<br>181=TOKYO_OKINAWA |
| Checksum   | *32       |       |   |
| <CR><LF>   |           |       | End of message termination  |

● **112---Set Message Rate**

This message is intended only for SiRFInstantFix and must not be used otherwise.

Table 9.2-13 contains the values for the following example:

\$PSRF112,140,1,1\*3B<CR><LF>

Table 9.2-13 Development Data On/Off Data Format

| Name         | Example   | Units | Description  |
|--------------|-----------|-------|--|
| Message ID   | \$PSRF112 |       | PSRF112 protocol header  |
| MID to set   | 140       |       | This is the only NMEA MID supported  |
| Message rate | 1         | SEC   | 140 = valid rate is 1 (i.e. occurring once at every periodic EE event, in every 6 seoncds) or 0 (to disable) |
| Send Now     | 1         |       | Poll NMEA MID once   |
| Checksum     | *3B       |       |  |
| <CR><LF>     |           |       | End of message termination   |

● **117---System Turn Off**

This message requests that the GPS receiver perform an orderly shutdown and switch to hibernate mode.

Table 9.2-14 contains the values for the following example:

\$PSRF117,16\*0B<CR><LF>

Table 9.2-14 System Turn Off

| Name | Example | Units | Description |
|------|---------|-------|-------------|
|------|---------|-------|-------------|

|            |           |  |                            |
|------------|-----------|--|----------------------------|
| Message ID | \$PSRF117 |  | PSRF117 protocol header    |
| Sub ID     | 16        |  | 16: System turn off        |
| Checksum   | *0B       |  |                            |
| <CR><LF>   |           |  | End of message termination |

## ● 120---Storage Configuration Setting

This command sets storage configuration options to determine on which storage media the different types of system data are physically stored.

Table 9.2-15 contains the values for the following example:

Store both firmware patches and extended ephemeris (EE) data on SPI flash.

```
$PSRF120,F,F*24<CR><LF>
```

Table 9.2-15 Store patches and EE on SPI flash

| Name                     | Example   | Units | Description   |
|--------------------------|-----------|-------|---|
| Message ID               | \$PSRF120 |       | PSRF120 protocol header   |
| FW Patch Storage Setting | F         |       | N = Do not store to SPI flash<br>F = Store to SPI flash (default)<br>0 = No change applied to patch   |
| EE Data Storage Setting  | F         |       | H = Storage available on host<br>R = I <sup>2</sup> C EEPROM provided for access<br>F = Store to SPI flash (default) or parallel flash<br>N = No storage<br>0 = No change applied to patch storage settings |
| Checksum                 | *24       |       |   |
| <CR><LF>                 |           |       | End of message termination  |

## ● 121---Data Logging Command

This message controls the state of the data logger allowing it to be started, stopped, cleared, retrieve logged data, and retrieve general status. The minimum logging interval is specified as a parameter of the start command. Current position data is logged if the interval and other threshold criteria are met.

Table 9.2-16 contains the values for the following examples:

1. Start log with 2-second interval  
 \$PSRF121,0,2\*27<CR><LF>
2. Ask to retrieve data  
 \$PSRF121,3,0\*26<CR><LF>
3. Ask to retrieve data log status  
 \$PSRF121,4,0\*21<CR><LF>

Table 9.2-16 Start log with 2-second interval

| Name | Example | Units | Description |
|------|---------|-------|-------------|
|------|---------|-------|-------------|

|                  |           |  |   |
|------------------|-----------|--|---|
| Message ID       | \$PSRF121 |  | PSRF121 protocol header   |
| Command          | 0         |  | 0 = Start <sup>(1)</sup><br>1 = Stop <sup>(1)</sup><br>2 = Clear <sup>(1)</sup><br>3 = Retrieve Data <sup>(2)</sup><br>4 = Retrieve Status <sup>(3)</sup> |
| Logging Interval | 2         |  | Minimum seconds between logging each record. Only applicable to the Start command. Range: 1 to 65535.   |
| Checksum         | *27       |  |   |
| <CR><LF>         |           |  | End of message termination  |

- (1) No response message. Please issue command \$PSRF121,4,0\*21<CR><LF> to get status.
- (2) The response is PSRF190 and PSRF191. Requesting this message while the data logger is active stops data logging. To start data logging again, issue a new Start Log command.
- (3) The response is PSRF192.

● **122---Data Logging Interval Command**

This message sets the minimum data logging interval and overrides the ‘minimum logging interval’ value set in the Data Logger Command Message. When this time is exceeded, data records are logged if other threshold criteria are also met. This interval can be changed at any time even while data logging is active.

Table 9.2-17 contains the values for the following example:

```
$PSRF122,10*0B<CR><LF>
```

Table 9.2-17 Set 10 seconds logging interval

| Name             | Example   | Units  | Description   |
|------------------|-----------|--------|---|
| Message ID       | \$PSRF122 |        | PSRF122 protocol header   |
| Logging Interval | 10        | second | Minimum seconds between logging each record. Range: 0 to 65535. |
| Checksum         | *0B       |        |   |
| <CR><LF>         |           |        | End of message termination                                      |

● **123---Data Logging Threshold Command**

This message sets the minimum distance and speed thresholds that must be met before logging a record. The data are logged when:

- ◆ The distance change from the last logged record exceeds the distance threshold or
- ◆ The current record’s speed over ground exceeds the speed threshold and the minimum time interval has been exceeded

These thresholds can be changed at any time even while data logging is active. Zero threshold values are always exceeded. Threshold results are OR'ed with each other. When any threshold is exceeded, logging occurs at the interval controlled rate. Default distance threshold is 0 meters. Default speed threshold is 0 m/s.



Table 9.2-18 contains the values for the following example:

\$PSRF123,15,2\*11<CR><LF>

Table 9.2-18 Set 15 meter and 2 m/s as threshold

| Name               | Example   | Units | Description   |
|--------------------|-----------|-------|---|
| Message ID         | \$PSRF123 |       | PSRF123 protocol header   |
| Distance Threshold | 15        | Meter | Distance between current record and the previously logged record that must be exceeded to log the current record.<br>Range: 0 to 65535. |
| Speed Threshold    | 2         | m/s   | The speed the current record must exceed to be logged.<br>Range: 0 to 65535.  |
| Checksum           | *11       |       |   |
| <CR><LF>           |           |       | End of message termination  |

## ● 124---Data Logging Memory Management Command

This message sets the type of memory management and format of the data record to be stored. The command must be issued when the data logger is NOT active in order to have any effect.

The memory management types include:

- ◆ circular data buffering: the oldest data is over written by the new data for continuous logging
- ◆ stop-on-memory-full

Logged data is stored and read back using the specified record type. Changing the record type invalidates all stored data and logging starts from the beginning of the allocated area. Default management type is circular buffering. Default record type is type 0.

Table 9.2-19 contains the values for the following example:

\$PSRF124,1,4\*25<CR><LF>

Table 9.2-19 Set record type 4 and stop record on memory full.

| Name                            | Example   | Units | Description  |
|---------------------------------|-----------|-------|--|
| Message ID                      | \$PSRF124 |       | PSRF124 protocol header  |
| Stop On Memory Full             | 1         |       | 0 = Circular Buffering (default)<br>1 = Stop on memory full (one pass)   |
| Data Record Type <sup>(1)</sup> | 4         |       | 0 = Compatibility format (default)<br>1 = Position<br>2 = Position + Altitude<br>3 = Position + Altitude + Speed<br>4 = Position + Altitude + Speed + Accuracy |
| Checksum                        | *25       |       |  |
| <CR><LF>                        |           |       | End of message termination   |

(1) Each record occupies 24, 20, 24, 28 and 36 bytes of memory for record type 0, 1, 2, 3 and 4, respectively.

## ● 125---Poll SW Version String

This message polls the version string when in NMEA mode. The response is PSRF195. If a customer version string is defined, this request generates two PSRF195, one with the SW Version String, and the second one with the customer-specific version string.

Table 9.2-20 contains the values for the following example:

```
$PSRF125*21<CR><LF>
```

Table 9.2-20 Poll SW Version String

| Name       | Example   | Units | Description                |
|------------|-----------|-------|----------------------------|
| Message ID | \$PSRF125 |       | PSRF125 protocol header    |
| Checksum   | *21       |       |                            |
| <CR><LF>   |           |       | End of message termination |

## 9.3 Proprietary NMEA output message

Table 9.3-1 Proprietary NMEA output messages

| MID <sup>1</sup> | Description                        |
|------------------|------------------------------------|
| 150              | OkToSend                           |
| 190              | Data Log Record Output             |
| 191              | Data Log Terminator Output         |
| 192              | Data Log Status Output             |
| 195              | Response to Poll SW Version String |

## ● 150---OkToSend

This message is sent out during power-saving mode, such as TricklePower™ and Push-to-Fix™, to indicate when the receiver is ready to receive messages or when it is going into low-power mode. When power is restored, it is the first message sent, and when it is going to be reduced, it is the last message sent.

Table 9.3-1 contains values for the following examples:

- ◆ OkToSend  
\$PSRF150,1\*3E<CR><LF>
- ◆ not OkToSend  
\$PSRF150,0\*3F<CR><LF>

Table 9.3-2 OkToSend

| Name       | Example   | Units | Description                          |
|------------|-----------|-------|--------------------------------------|
| Message ID | \$PSRF150 |       | PSRF150 protocol header              |
| OkToSend   | 1         |       | 1 = OK to send<br>0 = not OK to send |
| Checksum   | *3F       |       |                                      |
| <CR><LF>   |           |       | End of message termination           |

## ● 190---Data Log Record Output

This message consists of data read from the data log store using a single record type of 0 through 4, and is a subset of fields from OSP MID 41 and uses the same units, precision, and ranges for all values. Not all fields are populated for all record types. Applicable fields that are empty are indicated by adjacent commas.

These fields are not included in the CRC. Record type one is the smallest, and each subsequent type includes the previous with additional fields. All fields within the message remain in the same position. Record type 0 is for previous compatibility. Longer record types (e.g. types 0 and 4) are split into multi-sentence messages to maintain length limits. Total sentences and unique sequence number fields in each sentence facilitate multi-part management. Requesting this message while the data logger is active stops data logging before output begins. No other NMEA messages are outputted while retrieving logged data.

Table 9.3-3 and 98.3-4 contains values for the following examples:

\$PSRF190,2,1,4,131125,101745,2503.7153,N,12138.7443,E,119.8,M,0.0,,\*65<CR><LF>

\$PSRF190,2,2,10,0.6,2.8,M,123481000,570212894\*64<CR><LF>

Table 9.3-3 Data Log Record Output. Sentence number 1.

| Name                | Example    | Units                    | Description   |
|---------------------|------------|--------------------------|---|
| Message ID          | \$PSRF190  |                          | PSRF190 protocol header   |
| Total Sentences     | 2          |                          | Number of sentences for full data. (Range: 1 to 255)  |
| Sentence Number     | 1          |                          | Sentence sequence number out of total sentences. (Range: 1 to 255)  |
| Record Type         | 4          |                          | Record Type (rec type 0 to 4)   |
| UTC Date            | 131125     | Year<br>Month<br>Day     | YYMMDD Date (rec type 0 to 4)   |
| UTC Time            | 101745     | Hour<br>Minute<br>Second | HHMMSS Time (rec type 0 to 4)   |
| Latitude            | 2503.7153  | Degree<br>Minute         | DDMM.mmm (rec type 0 to 4), range: 0.0 to 8959.999  |
| Latitude Direction  | N          |                          | N or S (rec type 0 to 4)  |
| Longitude           | 12138.7443 | Degree<br>Minute         | DDDMM.mmm (rec type 0 to 4), range: 0.0 to 17959.999  |
| Longitude Direction | E          |                          | E or W (rec type 0 to 4)  |
| Altitude            | 119.8      | Meter                    | Altitude from man sea level (rec type 0, 2 to 4)  |
| Altitude Units      | M          |                          | Meters (rec type 0, 2 to 4)   |
| Speed               | 0.0        | m/s                      | (rec type 3 to 4)   |
| CRC-32              |            |                          | CRC-32 value of non-zero-padded payload (rec type 1 to 3).<br>Not populated for multi-part rec type 0 or 4. |

|          |     |  |                            |
|----------|-----|--|----------------------------|
| Checksum | *65 |  |                            |
| <CR><LF> |     |  | End of message termination |

Table 9.3-4 Data Log Record Output. Sentence number 2.

| Name            | Example   | Units | Description  |
|-----------------|-----------|-------|--|
| Message ID      | \$PSRF190 |       | PSRF190 protocol header  |
| Total Sentences | 2         |       | Number of sentences for full data. (Range: 1 to 255)                           |
| Sentence Number | 2         |       | Sentence sequence number out of total sentences. (Range: 1 to 255)             |
| SV Count        | 10        |       | Count of SVs in fix (rec type 0, 4), range: 1 to 255.                          |
| HDOP            | 0.6       |       |  |
| EHPE            | 2.8       |       |  |
| EHPE Units      | M         |       |  |
| TOW             | 123481000 | ms    | Time of Week (rec type 4)  |
| CRC             | 570212894 |       | CRC-32 value of non-zero-padded payload for rec type 4; CRC-16 for rec type 0. |
| Checksum        | *64       |       |  |
| <CR><LF>        |           |       | End of message termination   |

\$PSRF190,2,2,10,0.6,2.8,M,123481000,570212894\*64

### ● 191---Data Log Terminator Output

This message indicates data log output is complete and outputs once after all valid data records have been read from the data log store and sent out. When the log output is complete, regular NMEA messaging resumes. This message contains no payload data. To start data logging again, issue a new Start Log command.

Table 9.3-5 contains values for the following example:

\$PSRF191\*2E<CR><LF>

Table 9.3-5 Data Log Terminator Output

| Name       | Example   | Units | Description                |
|------------|-----------|-------|----------------------------|
| Message ID | \$PSRF191 |       | PSRF191 protocol header    |
| Checksum   | *2E       |       |                            |
| <CR><LF>   |           |       | End of message termination |

### ● 192---Data Log Status Output

This message provides the current data logger status including; threshold settings, memory usage, record type, and activity. It can be requested at anytime even while the data logger is active. Memory used indicates the amount of memory written to that has not yet been read back. It is valid only for stop-on-memory-full management and zero. When all data has been read or the data logger is restarted after a memory full condition, memory used returns to zero.

Memory available as with memory used, indicates memory available for writing. It is used for stop-on-memoryfull management and shows the full store size. When all data has been read or the data logger is restarted, after a memory full condition, memory available returns to the full store size.

Table 9.3-6 contains values for the following example:

`$PSRF192,0,0,10,0,0,86016,0,0,0,0,0,0,0,0,0*15<CR><LF>`

Table 9.3-6 Data Log Status Output

| Name                | Example   | Units | Description  |
|---------------------|-----------|-------|--|
| Message ID          | \$PSRF192 |       | PSRF192 protocol header  |
| Active              | 0         |       | 0 = Not Active (default)<br>1 = Logging Active                                 |
| Record Type         | 0         |       | Record Type  |
| Logging Interval    | 10        |       | Minimum seconds between logging each record. Range: 1 to 65535.                |
| Distance Threshold  | 0         | m     | Current distance threshold setting. Range: 0 to 65535.                         |
| Speed Threshold     | 0         | m/s   | Current speed threshold setting. Range: 0 to 65535.                            |
| Memory Available    | 86016     | Bytes | Size of the data store, or if stopping on full, unused memory.                 |
| Memory Used         | 0         | Bytes | If stopping on full, indicates memory used, zero otherwise.                    |
| Stop On Memory Full | 0         |       | 0 = Circular buffering<br>1 = Stop logging at end of first pass through store. |
| Memory Full         | 0         |       | 0 = Not full. If stopping on full.<br>1 = memory is full (logging stopped).    |
| Reserved            | 0         |       | Always zero.   |
| Reserved            | 0         |       | Always zero.   |
| Reserved            | 0         |       | Always zero.   |
| Reserved            | 0         |       | Always zero.   |
| Reserved            | 0         |       | Always zero.   |
| Reserved            | 0         |       | Always zero.   |
| Reserved            | 0         |       | Always zero.   |
| Reserved            | 0         |       | Always zero.   |
| Checksum            | *15       |       |  |
| <CR><LF>            |           |       | End of message termination   |

## ● 195---Response to Poll SW Version String

This message is the response to the Poll SW version message (PSRF125).

Table 9.3-7 contains values for the following example:

`$PSRF195,5xp_5.5.2-R32+5xpt_5.5.2-R32*06<CR><LF>`

Table 9.3-7 Response to Poll SW Version String

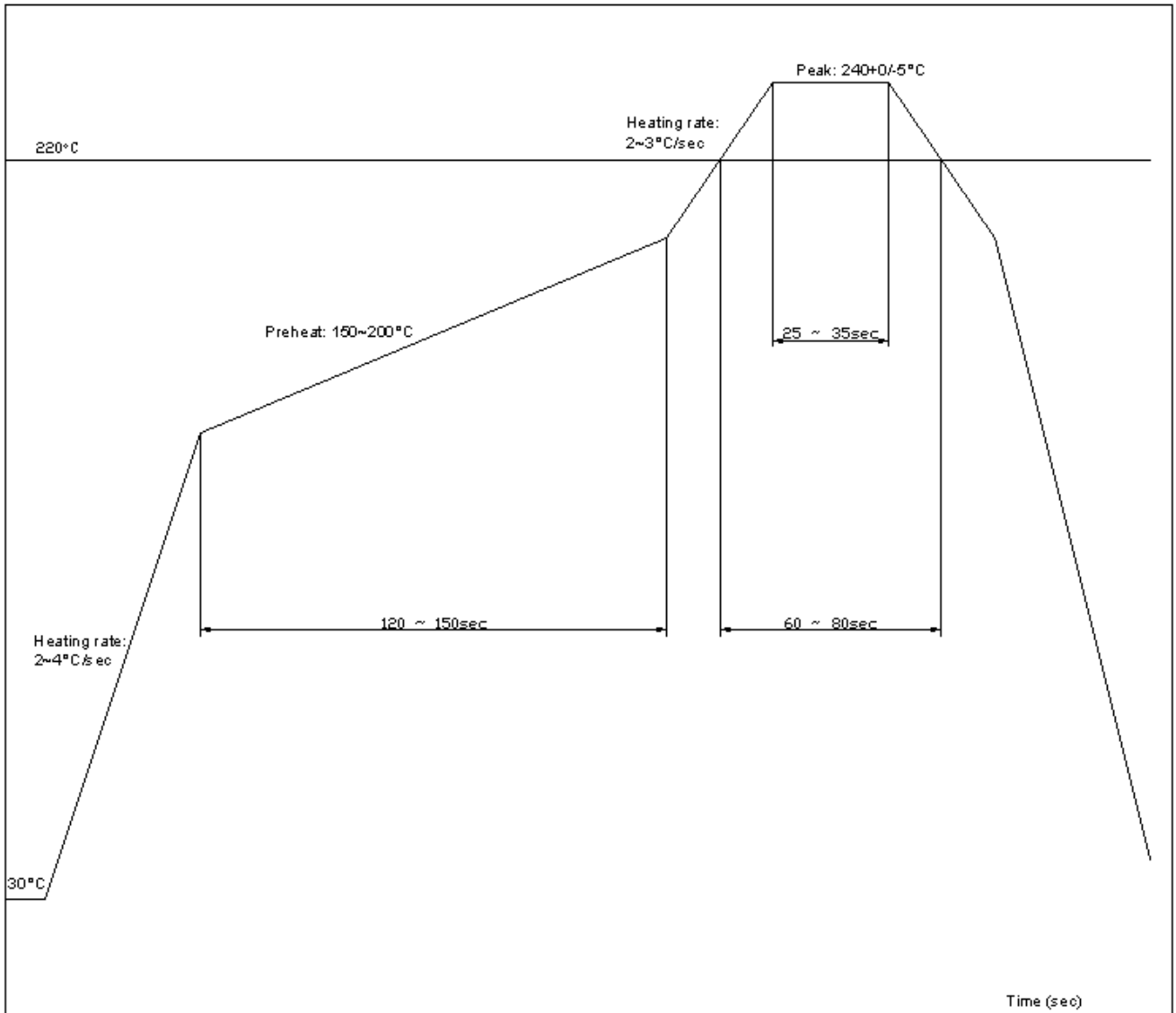
| Name | Example | Units | Description |
|------|---------|-------|-------------|
|------|---------|-------|-------------|

|               |                               |  |                            |
|---------------|-------------------------------|--|----------------------------|
| Message ID    | \$PSRF195                     |  | PSRF195 protocol header    |
| Version Sting | 5xp__5.5.2-R32+5xpt_5.5.2-R32 |  |                            |
| Checksum      | *06                           |  |                            |
| <CR><LF>      |                               |  | End of message termination |

## 10 Recommended Soldering Temperature Profile

The module belongs to RoHS compliant. The maximum of peak temperature, real on top of PCB, is not over 240 Celsius.

### Lead-free Processes



Lead-Free Solder Paste (Sn 96.5-Ag 3.0-Cu 0.5)

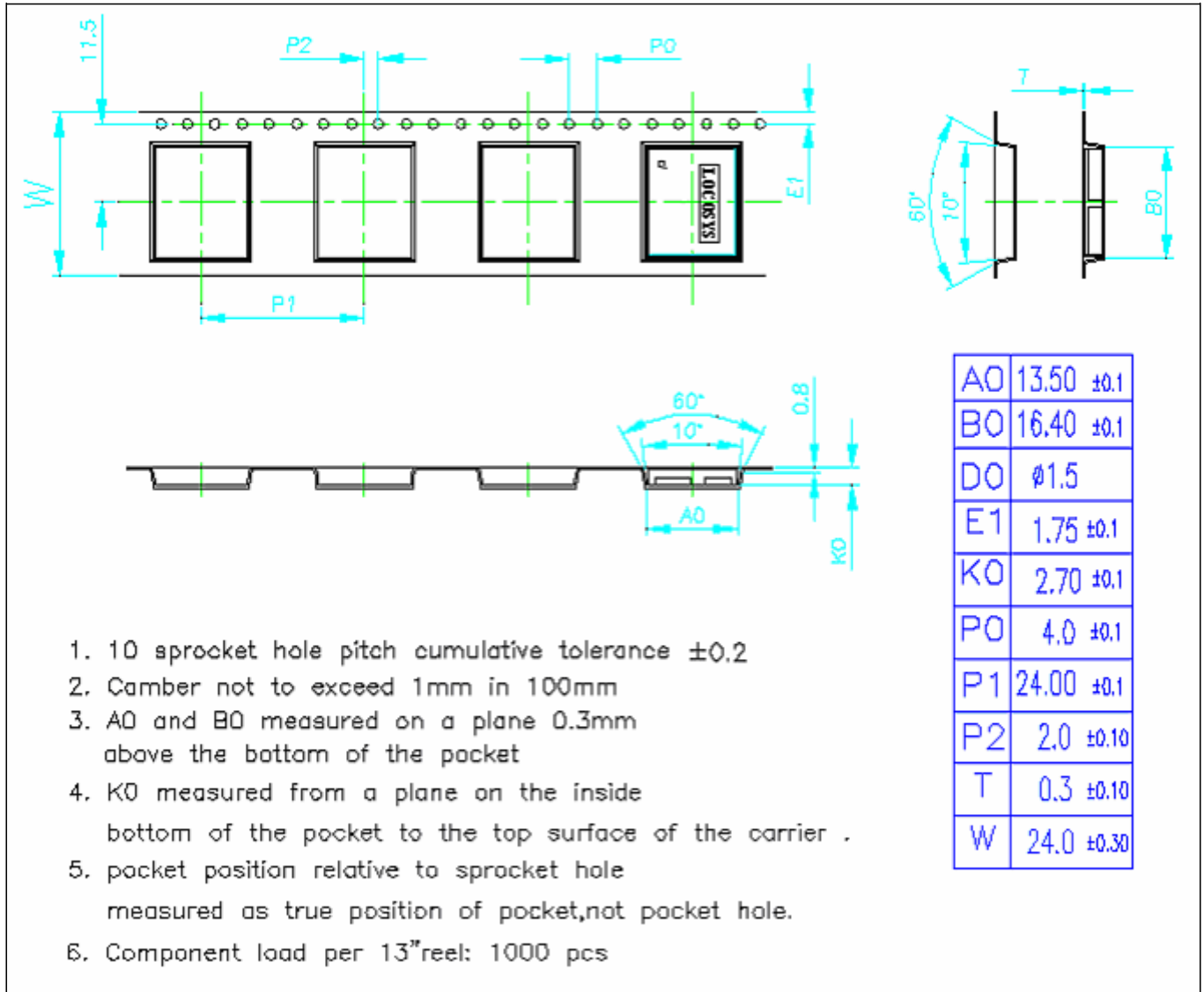
Cycle Interval: 300 sec

Note:

The S5-1612-xx module should be soldered on the topside in the soldering process to prevent from falling down.

## 11 Reel Packing information

S5-1612-xx modules are deliverable in quantities of 1000 pcs on a reel.





## 12 Packing and Handling

GNSS modules, like any other SMD devices, are sensitive to moisture, electrostatic discharge, and temperature. By following the description sketched in the document for LOCOSYS GNSS module storage and handling, it is possible to reduce the chances of them being damaged during production.

### 12.1 Moisture Sensitivity

The module belongs to moisture sensitive device (IPC/JEDEC J-STD-020C Level III). If it is not used by then, we strong recommended storing the GNSS modules in dry places such as dry cabinet. The approximate shelf life for LOCOSYS GNSS modules packages is 6 months from the bag seal date, when store in a non-condensing storage environment (<30°C/60% RH)

### 12.2 ESD Handling



**Please carefully follow the following precautions to prevent severe damage to GNSS modules.**

LOCOSYS GNSS modules are sensitive to electrostatic discharges, and thus are Electrostatic Sensitive Devices (ESD). Careful handling of the GNSS modules and in particular RF\_IN pin must follow the standard ESD safety protections:

- Unless there is a galvanic coupling between the local GND and the PCB GND, then the first point of contact when handling the PCB shall always be between the local GND and PCB GND.
- Before working with RF\_IN pin, please make sure the GND is connected
- When working with RF\_IN pin, do not contact any charges capacitors or materials that can easily develop or store charges such as patch antenna, coax cable, soldering iron.
- When soldering RF\_IN pin, please make sure to use an ESD safe soldering iron (tip).

## Document change list

### Revision 1.0

- First release on December 17, 2014

### Revision 1.1 (January 06, 2015)

- Revised product introduction