

# GPS-634R (ROM base)

65 channels with ultra-high sensitive

Smart GPS Antenna module

Technical Data Sheet

Version 1.4

## 1 Functional Description

### 1.1 Introduction

**GPS-634R** is a highly integrated smart GPS module with a ceramic GPS patch antenna. The antenna is connected to the module via an LNA. The module is with 51 channel acquisition engine and 14 channel track engine, which be capable of receiving signals from up to 65 GPS satellites and transferring them into the precise position and timing information that can be read over either UART port or RS232 serial port. Small size and high-end GPS functionality are at low power consumption, Both of the LVTTTL-level and RS232 signal interface are provided on the interface connector, supply voltage of 3.6V~6.0V is supported. The smart GPS antenna module is available as an off-the-shelf component, 100% tested. The smart GPS antenna module can be offered for OEM applications with the versatile adaptation in form and connection. Additionally, the antenna can be tuned to the final systems' circumstances.

### 1.2 Features

- **65 channels** to acquire and track satellites simultaneously
- Industry-leading TTFF speed
- Tracking sensitivity reaches **-161 dBm**
- 0.5 PPM TCXO for quick cold start
- Integral LNA with low power control
- SBAS (WAAS/EGNOS) capable
- Cold start  $\approx$  **29 sec** under clear Sky
- Hot start  $\approx$  **1 sec** under clear Sky
- Accuracy 5m CEP
- Operable at 3.6V-6V
- Both of RS232 and UART interface at CMOS level
- Small form factor of 32 mm W x 32 mm L x 8 mm H
- Mountable without solder process
- 6 pins wafer connector

### 1.3 Applications

- Automotive and Marine Navigation
- Automotive Navigator Tracking
- Emergency Locator
- Geographic Surveying
- Personal Positioning

## 2 Characteristics

2.1 **General Specification** The smart GPS antenna modules are characterized by the following parameters.

Parameter	Specification
Receiver Type	65 Channels
	GPS L1 frequency, C/A Code
Time-To-First-Fix	Cold Start (Autonomous) 29s (Average, under open sky)
	Warm Start (Autonomous) 28s (Average, under open sky)
	Hot Start (Autonomous) 1s (Average, under open sky)
Sensitivity	Tracking & Navigation -161 dBm
	Reacquisition -158 dBm
	Cold Start (Autonomous) -148 dBm
Accuracy	Autonomous 2.5 m CEP
	Velocity 0.1 m/sec (without aid)
	Time 300 ns
Update Rate	Supports 1 / 2 / 4 / 5 / 8 / 10 Hz update rate (1Hz default, ROM base only supports 1Hz)
Velocity Accuracy	0.1m/s
Heading Accuracy	0.5 degrees
Dynamics	□ 4 G (39.2 m/sec)
Operational Limits	Velocity 515 m/s (1000 knots)
	Altitude <18000 meters
	(COCOM limit, either may be exceeded but not both)
Serial Interface	Both RS232 and LVTTTL level
Datum User definable	Default WGS-84 User definable
Input Voltage	3.6V ~ 6V
Input Current	~23mA tracking
Dimension	32 mm L x 32 mm W x 8 mm H
Weight	28g

## 2.2 Serial Port Settings

The default configuration within the standard GPS firmware is:

- Standard configuration of serial port:
- Supporting 4800/9600 baud rate (**Default Value : 9600**), 8 data bits, no parity, 1 stop bit, no flow Control

## 2.3 Improved TTFF

In order to improve the TTFF (Time To First Fix), has been built with the back-up battery (SEIKO) to support the RTC with a back-up power when no system power is available.

## 2.4 Operating Conditions

Description	Min	Typical	Max
V <sub>cc</sub>	3.6V		6V
Enhanced-mode Acquisition Current		70 mA	
Low power Acquisition Current		50mA	
Tracking Current		23mA	

Table 2: Operating Conditions

## 2.5 DC Electrical Characteristics

Item		Min.	Max	Unit
V <sub>CC</sub>	Voltage	3.6	6	V
	Current	23-	70	mA

Table 3: DC Electrical characteristics

## 2.6 GPS Status Indicator

- Non-Fixed mode : LED is always on
- Fixed mode : LED toggle every second

### 3. Communication Specifications

Item	Description
Interface	Full duplex serial interface
Bit rate	4800/9600/38400/115200bps
Start bit	1bit
Stop bit	1bit
Data bit	8bit
Parity	None
Transmission data	SACII NMEA0183 Ver:3.01
Update rate	1Hz
Output sentence	GPGGA, GPGSA, GPGSV, GPRMC, GPVTG (typ)

Table 5: Communication Specifications

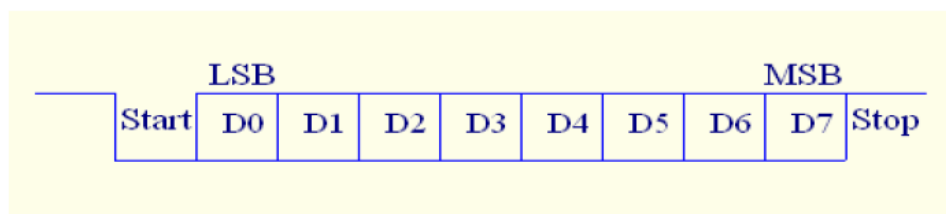


Fig. 1. Transmitting data stream

### 4. Connector

The connector mounted on the **GPS-634R** is the **Molex's** connector type, the part number is 51021-0600. The mating plugs part number is 53261-0671.

### 5. Pin Assignments Information

Pin	Pin Name	Type	Function description
1	FTXD0	O	Serial Data output UART
2	FRXD0	I	Serial Data input UART
3	TXD0	O	Serial Data output RS-232
4	RXD0	I	Serial Data input RS-232
5	VIN	I	3.6~6 supply input
6	GND	O	GND

I: Input O: Output

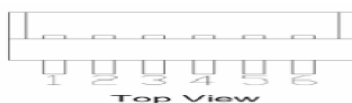


Table 6: Pin Assignments

## 9 NMEA protocol

The serial interface protocol is based on the National Marine Electronics Association's NMEA 0183 ASCII interface specification. This standard is fully defined in "NMEA 0183, Version 3.01". The standard may be obtained from NMEA, [www.nmea.org](http://www.nmea.org)

### 9.1 GGA-GLOBAL POSITIONING SYSTEM FIX DATA

Time, position and fix related data for a GPS receiver.

#### Structure:

\$GPGGA,hhmmss.sss,ddmm.mmmm,a,ddmm.mmmm,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx\*hh<CR><LF>

1 2 3 4 5 6 7 8 9 10 11 12 13

Field	Name	Example	Description
1	UTC Time	060932.448	UTC of position in hhmmss.sss format, (000000.00 ~ 235959.99)
2	Latitude	2447.0959	Latitude in ddmm.mmmm format Leading zeros transmitted
3	N/S Indicator	N	Latitude hemisphere indicator, 'N' = North, 'S' = South
4	Longitude	12100.5204	Longitude in dddmm.mmmm format Leading zeros transmitted
5	E/W Indicator	E	Longitude hemisphere indicator, 'E' = East, 'W' = West
6	GPS indicator	quality 1	GPS quality indicator 0: position fix unavailable 1: valid position fix, SPS mode 2: valid position fix, differential GPS mode 3: GPS PPS Mode, fix valid 4: Real Time Kinematic. System used in RTK mode with fixed integers 5: Float RTK. Satellite system used in RTK mode. Floating integers 6: Estimated (dead reckoning) Mode 7: Manual Input Mode 8: Simulator Mode
7	Satellites Used	08	Number of satellites in use, (00 ~ 12)
8	HDOP	1.1	Horizontal dilution of precision, (00.0 ~ 99.9)
9	Altitude	108.7	mean sea level (geoid), (-9999.9 ~ 17999.9)
10	Geoid Separation		Geoid separation in meters according to WGS-84 ellipsoid (-999.9 ~ 9999.9)
11	DGPS Age		Age of DGPS data since last valid RTCM transmission in xxx format (seconds) NULL when DGPS not used
12	DGPS Station ID	0000	Differential reference station ID, 0000 ~ 1023 NULL when DGPS not used
13	Checksum	0E	

## 9.2 GLL - LATITUDE AND LONGITUDE, WITH TIME OF POSITION FIX AND STATUS

Latitude and longitude of current position, time, and status.

### Structure:

\$GPGLL,ddmm.mmmm,a,ddmm.mmmm,a,hmmss.sss,A,a\*hh<CR><LF>

1 2 3 4 5 6 7 8

### Example:

\$GPGLL,4250.5589,S,14718.5084,E,092204.999,A,A\*2D<CR><LF>

Field	Name	Example	Description
1	Latitude	4250.5589	Latitude in ddmm.mmmm format Leading zeros transmitted
2	N/S Indicator	S	Latitude hemisphere indicator 'N' = North 'S' = South
3	Longitude	14718.5084	Longitude in dddmm.mmmm format Leading zeros transmitted
4	E/W Indicator	E	Longitude hemisphere indicator 'E' = East 'W' = West
5	UTC Time	092204.999	UTC time in hhmmss.sss format (000000.00 ~ 235959.99)
6	Status	A	Status, 'A' = Data valid, 'V' = Data not valid
7	Mode Indicator	A	Mode indicator 'N' = Data not valid 'A' = Autonomous mode 'D' = Differential mode 'E' = Estimated (dead reckoning) mode 'M' = Manual input mode 'S' = Simulator mode
8	Checksum	2D	

### 9.3 GSA - GPS DOP AND ACTIVE SATELLITES

GPS receiver operating mode, satellites used in the navigation solution reported by the GGA or GNS sentence and DOP values.

#### Structure:

\$GPGSA,A,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,x.x,x.x,x.x\*hh<CR><LF>

1 2 3 3 3 3 3 3 3 3 3 3 4 5 6 7

#### Example:

\$GPGSA,A,3,01,20,19,13,,,,,,,,,40.4,24.4,32.2\*0A<CR><LF>

Field	Name	Example	Description
1	Mode	A	Mode 'M' = Manual, forced to operate in 2D or 3D mode 'A' = Automatic, allowed to automatically switch 2D/3D
2	Mode	3	Fix type 1 = Fix not available 2 = 2D 3 = 3D
3	Satellite used 1~12	01,20,19,13,,,,, ,,,,,	Satellite ID number, 01 to 32, of satellite used in solution, up to 12 transmitted
4	PDOP	40.4	Position dilution of precision (00.0 to 99.9)
5	HDOP	24.4	Horizontal dilution of precision (00.0 to 99.9)
6	VDOP	32.2	Vertical dilution of precision (00.0 to 99.9)
7	Checksum	0A	

### 9.4 GSV - GPS SATELLITE IN VIEW

Numbers of satellites in view, PRN number, elevation angle, azimuth angle, and C/No. Four satellites details are

transmitted per message. Additional satellite in view information is send in subsequent GSV messages.

#### Structure:

\$GPGSV,x,x,xx,xx,xx,xxx,xx,...,xx,xx,xxx,xx \*hh<CR><LF>

1 2 3 4 5 6 7 4 5 6 7 8

#### Example:

\$GPGSV,3,1,09,28,81,225,41,24,66,323,44,20,48,066,43,17,45,336,41\*78<CR><LF>

\$GPGSV,3,2,09,07,36,321,45,04,36,257,39,11,20,050,41,08,18,208,43\*77<CR><LF>

Field	NaME	Example	Description
1	Number of message	3	Total number of GSV messages to be transmitted (1-3)
2	Sequence number	1	Sequence number of current GSV message
3	Satellites in view	09	Total number of satellites in view (00 ~ 12)
4	Satellite ID	28	Satellite ID number, GPS: 01 ~ 32, SBAS: 33 ~ 64 (33 = PRN120)
5	Elevation	81	Satellite elevation in degrees, (00 ~ 90)
6	Azimuth	225	Satellite azimuth angle in degrees, (000 ~ 359 )
7	SNR	41	C/No in dB (00 ~ 99) Null when not tracking
8	Checksum	78	

## 9.5 RMC - RECOMMENDED MINIMUM SPECIFIC GPS/TRANSIT DATA

Time, date, position, course and speed data provided by a GNSS navigation receiver.

### Structure:

\$GPRMC,hhmmss.sss,A,dddmm.mmmm,a,dddmm.mmmm,a,x.x,x.x,ddmmyy,x.x,a,\*hh<CR>

><LF>

1 2 3 4 5 6 7 8 9 10 11 12 13

### Example:

\$GPRMC,092204.999,A,4250.5589,S,14718.5084,E,0.00,89.68,211200,,A\*25<CR>><LF>

Field	NaME	Example	Description
1	UTC time	092204.999	UTC time in hhmmss.sss format (000000.00 ~ 235959.999)
2	Status	A	Status 'V' = Navigation receiver warning 'A' = Data Valid
3	Latitude	4250.5589	Latitude in dddmm.mmmm format Leading zeros transmitted
4	N/S indicator	S	Latitude hemisphere indicator 'N' = North 'S' = South
5	Longitude	14718.5084	Longitude in dddmm.mmmm format Leading zeros transmitted
6	E/W Indicator	E	Longitude hemisphere indicator 'E' = East 'W' = West
7	Speed over ground	000.0	Speed over ground in knots (000.0 ~ 999.9)
8	Course over ground	000.0	Course over ground in degrees (000.0 ~ 359.9)
9	UTC Date	211200	UTC date of position fix, ddmmyy format
10	Magnetic variation		Magnetic variation in degrees (000.0 ~ 180.0)
11	Magnetic Variation		Magnetic variation direction 'E' = East 'W' = West
12	Mode indicator	A	Mode indicator 'N' = Data not valid 'A' = Autonomous mode 'D' = Differential mode 'E' = Estimated (dead reckoning) mode 'M' = Manual input mode 'S' = Simulator mode
13	checksum	25	



## 9.6 VTG - COURSE OVER GROUND AND GROUND SPEED

The Actual course and speed relative to the ground.

### Structure:

GPVTG,x.x,T,x.x,M,x.x,N,x.x,K,a\*hh<CR><LF>

1 2 3 4 5 6

### Example:

\$GPVTG,89.68,T,,M,0.00,N,0.0,K,A\*5F<CR><LF>

Field	Name	Example	Description
1	Course	89.68	True course over ground in degrees (000.0 ~ 359.9)
2	Course		Magnetic course over ground in degrees (000.0 ~ 359.9)
3	Speed	0.00	Speed over ground in knots (000.0 ~ 999.9)
4	Speed	0.00	Speed over ground in kilometers per hour (0000.0 ~ 1800.0)
5	Mode	A	Mode indicator 'N' = not valid 'A' = Autonomous mode 'D' = Differential mode 'E' = Estimated (dead reckoning) mode 'M' = Manual input mode 'S' = Simulator mode
6	Checksum	5F	

## 9.7 ZDA- TIME AND DATE

### Structure:

\$GPRMC,hhmmss.sss,dd,mm.yyyy, , ,xxx<CR><LF>

1 2 3 4 5 6 7

### Example:

\$GPZDA,104548.04,25,03,2004,,\*6C<CR><LF>

Field	Name	Example	Description
1	UTC time	104548.04	UTC time in hhmmss.ss format, 000000.00 ~ 235959.99
2	UTC time: day	25	UTC time day (01 ... 31)
3	UTC time: month	03	UTC time: month (01 ... 12)
4	UTC time: year	2004	UTC time: year (4 digit year)
5			Local zone hour Not being output by the receiver (NULL)
6			Local zone minutes Not being output by the receiver (NULL)
7	6C	6C	Checksum