

## Features

- 65 channel engine for high performance acquisition
- GPS L1 C/A Code
- Perform 8 million time-frequency hypothesis testing per second
- Open sky hot start 3 sec
- Open sky cold start 36 sec
- Signal detection better than  $-157\text{dBm}$
- Reacquisition sensitivity  $-143\text{dBm}$
- Accuracy 5m CEP
- Tracking current  $< 50\text{mA}$
- Support active antenna
- SBAS (WAAS, EGNOS) support
- Small size 15.9 x 13.0 x 2.7 mm (LxWxH)

## GPS01

### Low Cost Very High Performance SMD GPS Module

The GPS01 is a small form factor GPS module solution intended for a broad range of Original Equipment Manufacturer (OEM) products, where fast and easy system integration and minimal development risk is required.

The GPS01 GPS receiver's  $-157\text{dBm}$  tracking sensitivity allows continuous position coverage in nearly all application environments. Its high performance search engine is capable of testing 8,000,000 time-frequency hypotheses per second, offering industry-leading signal acquisition and TTFF speed.

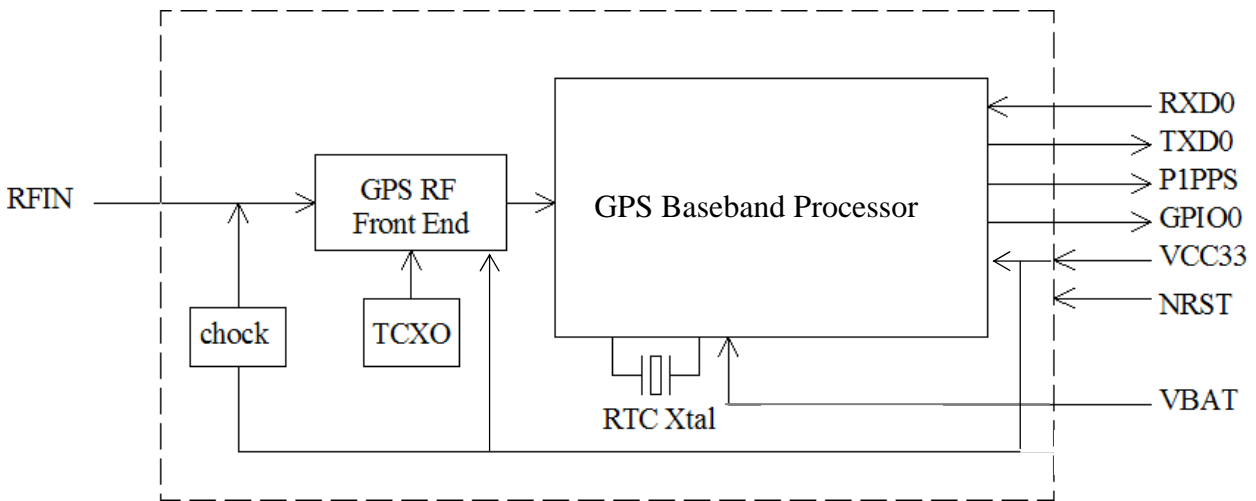
The receiver is optimized for applications requiring high performance, low power, and low cost; suitable for a wide range of OEM configurations including mobile phone, PND, asset tracking, and vehicle navigation products.

The very small 13mm x 16mm form factor and the SMT pads allow standard surface mount device pick-and-place process in fully automated assembly process; enabling high-volume, very cost-efficient production.

**TECHNICAL SPECIFICATIONS**

Receiver Type	65 parallel channel, L1 C/A code
Accuracy	Position 5m CEP Velocity 0.1m/sec 1PPS Timing +/-1us
Startup Time	3 second hot start under open sky 36 second cold start under open sky (average)
Reacquisition	2s
Sensitivity	-143dBm acquisition -157dBm tracking
Update Rate	1Hz
Dynamics	4G (39.2m/sec <sup>2</sup> )
Operational Limits	Altitude < 18,000m or velocity < 515m/s (COCOM limit, either may be exceeded but not both)
Serial Interface	3.3V LVTTTL level
Protocol	NMEA-0183 V3.01 GPGGA, GPGLL, GPGSA, GPGSV, GPRMC, GPVTG <sup>2</sup> Default 9600 baud rate, 8, N, 1
Datum	Default WGS-84 User definable
Input Voltage	3.3V DC +/-5%
Input Current	~70mA acquisition ~50mA tracking
Dimension	15.9mm L x 13mm W x 2.7mm H
Weight:	2g
Operating Temperature	-40°C ~ +85°C
Storage Temperature	-55 ~ +100°C
Humidity	5% ~ 95%

**BLOCK DIAGRAM**



**ANTENNA**

The GPS01 module is designed to work active antenna. Recommended active antenna should have gain of 20 ~ 30dB and noise figure less than 1.2dB, otherwise the active antenna should have SAW.

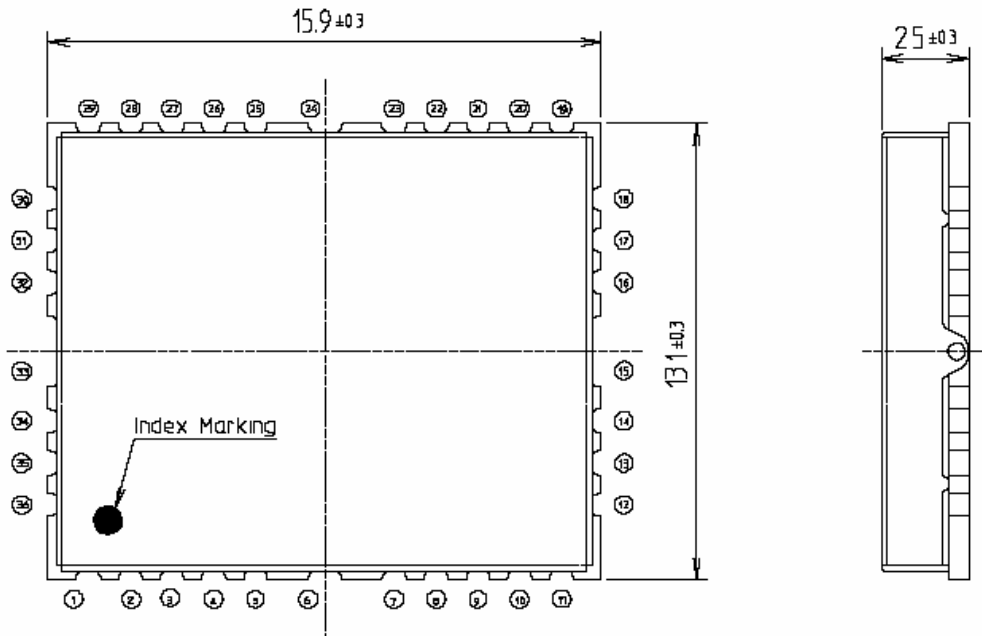
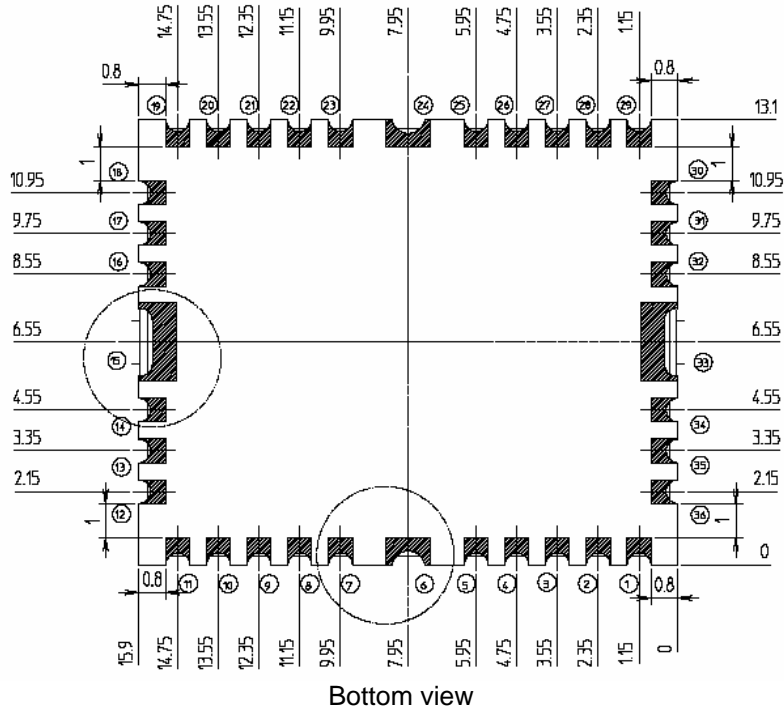
**Maximum Absolute Rating**

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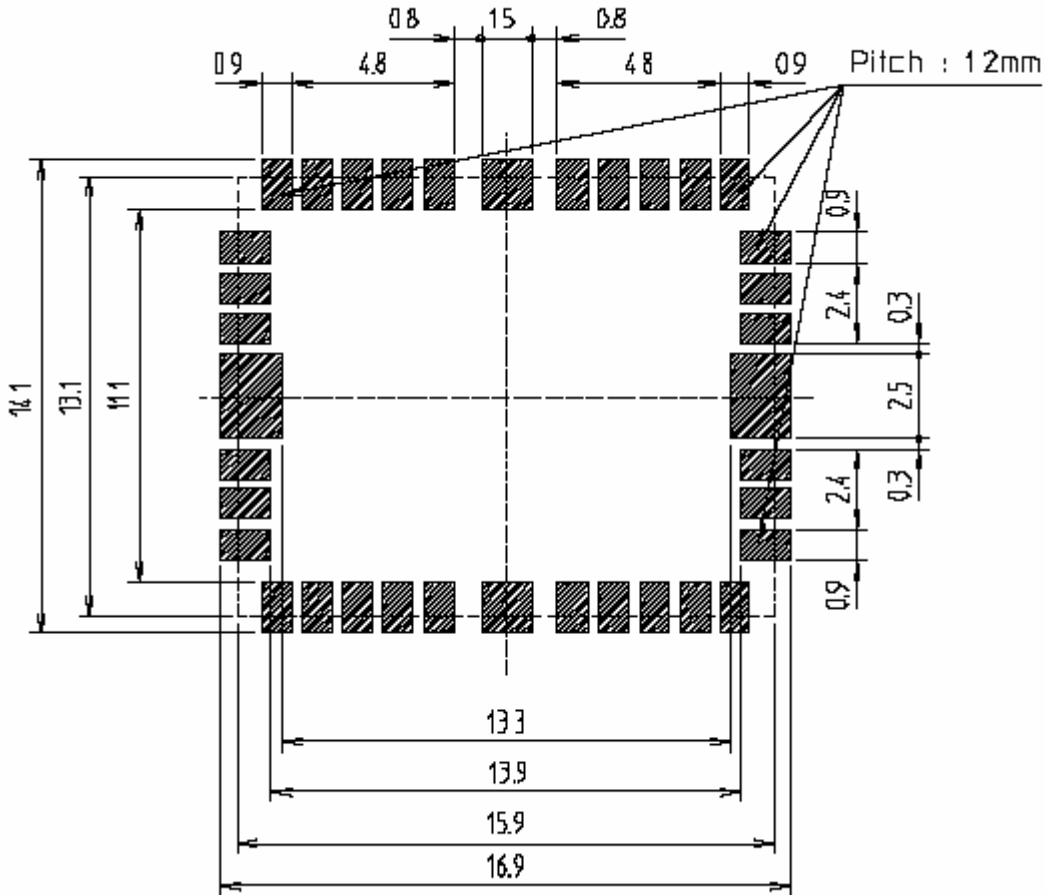
Symbol	Description	Rating	Unit
VCC	Power supply of 3.3V	-0.3 to 4.0	V
V <sub>IN</sub>	Input voltage of 3.3V	-0.3 to 4.0	V
I <sub>ant</sub>	Active antenna bias current	100	mA
T <sub>STG</sub>	Storage temperature	-40 to 150	°C

**MECHANICAL CHARACTERISTICS**

Unit: mm



**RECOMMENDED PCB FOOTPRINT**



**PINOUT DESCRIPTION**

Pin No.	Name	Description
1	RFIN	GPS RF input, connect to active antenna
2	AGND	Ground
3	AGND	Ground
4	AGND	Ground
5	VBAT	Backup supply voltage for RTC and backup memory, 2.0V~5.0V
6	GND	Chassis ground
7	NC	No connection
8	AGND	Ground
9	AGND	Ground
10	AGND	Ground
11	VCC33	Main 3.3V supply input
12	AGND	Ground
13	RSTN	External active-low reset input. Only needed when power supply rise time is very slow.
14	AGND	Ground
15	GND	Chassis ground
16	NC	reserved
17	AGND	Ground
18	GPIO	General Purpose Input Output (reserved for GPS status LED indicator)
19	AGND	Ground
20	P1PPS	1 pulse per second time mark
21	AGND	Ground
22	AGND	Ground
23	AGND	Ground
24	GND	Chassis ground
25	NC	No connection
26	AGND	Ground
27	NC	No connection
28	AGND	Ground
29	AGND	Ground
30	TXD0	UART output, 3.3V I/O
31	RXD0	UART input, 3.3V I/O
32	NC	No connection
33	GND	Chassis ground
34	NC	No connection
35	AGND	Ground
36	AGND	Ground

## NMEA Messages

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

### GGA - Global Positioning System Fix Data

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

Structure:

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

1
2
3
4
5 6 7 8 9
10 11

Example:

\$GPGGA,111636.932,2447.0949,N,12100.5223,E,1,11,0.8,118.2,M,,,,,0000\*02<CR><LF>

Field	Name	Example	Description
1	UTC Time	111636.932	UTC of position in hhmmss.sss format, (000000.000 ~ 235959.999)
2	Latitude	2447.0949	Latitude in ddm.dddmm format Leading zeros transmitted
3	N/S Indicator	N	Latitude hemisphere indicator, 'N' = North, 'S' = South
4	Longitude	12100.5223	Longitude in dddmm.mmmm format Leading zeros transmitted
5	E/W Indicator	E	Longitude hemisphere indicator, 'E' = East, 'W' = West
6	GPS quality indicator	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	11	Number of satellites in use, (00 ~ 12)
8	HDOP	0.8	Horizontal dilution of precision, (00.0 ~ 99.9)
9	Altitude	108.2	mean sea level (geoid), (-9999.9 ~ 17999.9)
10	DGPS Station ID	0000	Differential reference station ID, 0000 ~ 1023 NULL when DGPS not used
11	Checksum	02	

**Note:** The checksum field starts with a '\*' and consists of 2 characters representing a hex number. The checksum is the exclusive OR of all characters between '\$' and '\*'.

## GLL – Latitude/Longitude

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

Structure:

```
$GPGLL,ddmm.mmmm,a,dddmm.mmmm,a,hhmmss.sss,A,a*hh<CR><LF>
```

1            2            3            4            5    6 7 8

Example:

```
$GPGLL,2447.0944,N,12100.5213,E,112609.932,A,A*57<CR><LF>
```

Field	Name	Example	Description
1	Latitude	2447.0944	Latitude in ddmm.mmmm format Leading zeros transmitted
2	N/S Indicator	N	Latitude hemisphere indicator 'N' = North 'S' = South
3	Longitude	12100.5213	Longitude in dddmm.mmmm format Leading zeros transmitted
4	E/W Indicator	E	Longitude hemisphere indicator 'E' = East 'W' = West
5	UTC Time	112609.932	UTC time in hhmmss.sss format (000000.000 ~ 235959.999)
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	57	



### GSA – GNSS 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,xx,xx,x.x,x.x,x.x*hh<CR><LF>
  1 2 3 3 3 3 3 3 3 3 3 3 3 3 4 5 6 7
```

Example:

```
$GPGSA,A,3,05,12,21,22,30,09,18,06,14,01,31,,1.2,0.8,0.9*36<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	05,12,21,22,30,09,18,06,14,01,31,,	Satellite ID number, 01 to 32, of satellite used in solution, up to 12 transmitted
4	PDOP	1.2	Position dilution of precision (00.0 to 99.9)
5	HDOP	0.8	Horizontal dilution of precision (00.0 to 99.9)
6	VDOP	0.9	Vertical dilution of precision (00.0 to 99.9)
7	Checksum	36	

**GSV – GNSS Satellites in View**

Number of satellites (SV) in view, satellite ID numbers, elevation, azimuth, and SNR value. Four satellites maximum per transmission.

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,3,1,12,05,54,069,45,12,44,061,44,21,07,184,46,22,78,289,47*72<CR><LF>
$GPGSV,3,2,12,30,65,118,45,09,12,047,37,18,62,157,47,06,08,144,45*7C<CR><LF>
$GPGSV,3,3,12,14,39,330,42,01,06,299,38,31,30,256,44,32,36,320,47*7B<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	12	Total number of satellites in view (00 ~ 12)
4	Satellite ID	05	Satellite ID number, GPS: 01 ~ 32, SBAS: 33 ~ 64 (33 = PRN120)
5	Elevation	54	Satellite elevation in degrees, (00 ~ 90)
6	Azimuth	069	Satellite azimuth angle in degrees, (000 ~ 359 )
7	SNR	45	C/No in dB (00 ~ 99) Null when not tracking
8	Checksum	72	

## RMC – Recommended Minimum Specific GNSS Data

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

Structure:

```
$GPRMC,111636.932,A,2447.0949,N,12100.5223,E,000.0,000.0,030407,,A*61<CR><LF>
```

1    2    3    4    5    6 7 8    9    10 11

Example:

```
$GPRMC,111636.932,A,2447.0949,N,12100.5223,E,000.0,000.0,030407,,A*61<CR><LF>
```

Field	Name	Example	Description
1	UTC time	0111636.932	UTC time in hhmmss.sss format (000000.00 ~ 235959.999)
2	Status	A	Status 'V' = Navigation receiver warning 'A' = Data Valid
3	Latitude	2447.0949	Latitude in dddmm.mmmm format Leading zeros transmitted
4	N/S indicator	N	Latitude hemisphere indicator 'N' = North 'S' = South
5	Longitude	12100.5223	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	030407	UTC date of position fix, ddmmyy format
10	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
11	checksum	61	

**VTG – Course Over Ground and Ground Speed**

The actual course and speed relative to the ground.

Structure:

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

1 2 3 4 5

Example:

\$GPVTG, 000.0,T,,M,000.0,N,0000.0,K,A\*3D<CR><LF>

Field	Name	Example	Description
1	Course	000.0	True course over ground in degrees (000.0 ~ 359.9)
2	Speed	000.0	Speed over ground in knots (000.0 ~ 999.9)
3	Speed	0000.0	Speed over ground in kilometers per hour (0000.0 ~ 1800.0)
4	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
5	Checksum	3D	

**ORDERING INFORMATION**

<b>Model Name</b>	<b>Description</b>
GPS01	Default 9600 baud rate