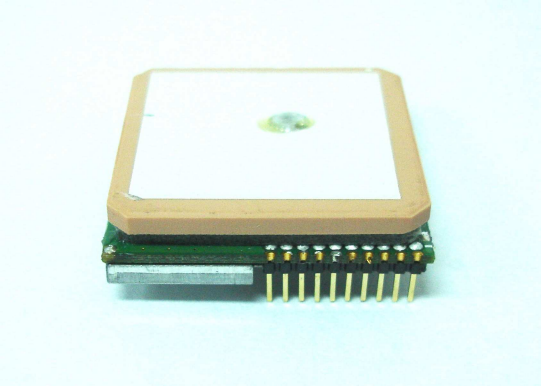
SkyTraq
GPS Module

MG-ST01SP



User's Manual Ver 1.03

No.208, Jhengkang 1st St., Taoyuan City,
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Item	Date	New Release Information	In Charge
1	**2007/05/02**	**New released.**	**Harry Lee**
3	**2007/10/25**	**Change SMT PIN to Connector PIN OUT**	**Godspeed**

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Contents

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1. Introduction

1.1. Overview

Modulestek GPS module MG-ST01SP is a high sensitivity, low power consumption; compact size GPS module designed for a broad spectrum of OEM system applications. The MG-ST01SP is based on Skytraq's VENUS521GPS/AGPS baseband processor (with on-chip Flash memory necessary to store the GPS firmware) and SiGe's RF receiver IC that allows easy integration to the target applications.

It supports both an on-board passive antenna and an external active antenna with auto detection of the external active antenna, when it gets connected. A dedicated massive-correlator(>>20,000) signal parameter search engine enables rapid search of all available satellites and acquisition of very weak signals. The MG-ST01SP allows weak signal tracking and positioning in severe environments such as urban canyons and under deep foliage.

The MG-ST01SP interfaces to the application system via TTL level serial port with NMEA protocol. A complete low-cost high-performance MG-ST01SP is an ideal GPS module, this makes MG-ST01SP easy to be integrated and used in all kinds of navigation applications or products.

1.2. Main Feature

- Built-in SkyTraq chipset. 44 channels "All-in-View" tracking.
- Cold/Warm/Hot start time: 30/28/1 sec. (average)
- Superior sensitivity: -159 dBm for Superior urban canyon.
- Support A-GPS function.
- Reacquisition time: 0.1 sec.
- Ultra Low power consumption.(40mA)
- Support of SBAS(WAAS / EGNOS) satellites for navigation
- < 4 seconds with AGPS support
- Compact Size, Easy integration into hand-held device.
  MG-ST01SP 26.0 x 26.0 x 6.8mm (2mm patch antenna)

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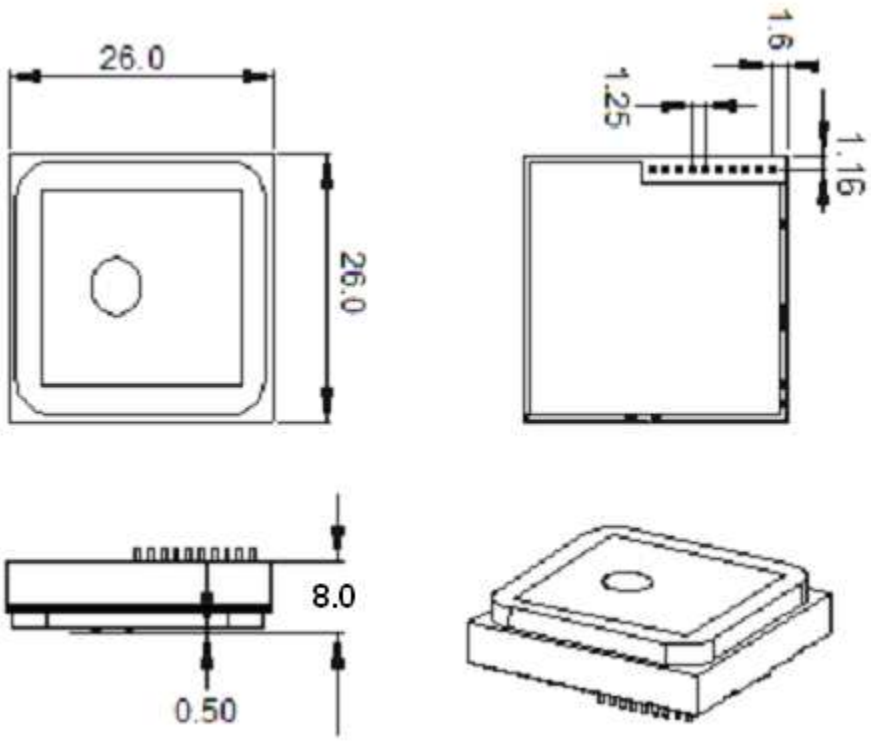
2. Technical Specifications

GPS Features		**Datum**	
Chipset	Skytraq low power chipset	WGS-84	
Frequency	L1, 1575.42MHz		
C/A Code	1.023MHz chip rate	**Dynamic Conditions**	
Channels	Supports 44 channels	Altitude	<18,000 m (60,000feet)
Antenna	Built-in 25x25x2mm patch antenna	Velocity	<515 m/s (1000 knots)
		Acceleration	<4G
Sensitivity		Motional Jerk	20m/sec^3 max.
To – 159dBm Tracking,			
Superior Urban Canyon Performance		**Interface**	
		GPS Protocol: NMEA-0183 - GGA, GSA, GSV, RMC (Default)	
Time to First Fix (TTFF)		Data bit: 8, stop bit: 1, no parity	
Cold Start	30 sec, average	Skytraq Binary	
Warm Start	28 sec, average	Baud Rate: 9600 (Default)	
Hot Start	1 sec, average	**Device Size and Weight**	
Reacquisition	0.1 sec	26.0x26.0x8.0(mm)	
Update rate	1 Hz (std.)		
		Environmental Characteristics	
Accuracy		Operating Temperature	- 20°C to + 80°C
Position	5m CEP without SA, 10m 2D, RMS	Storage Temperature	- 20°C to + 85°C
Velocity	0.1m/sec, without SA		
Time	1μs synchronized to GPS time	**Power**	
		Tracking Current	40mA (Average)
		Power Input	3.3V ±5% VDC input

All specifications are subject to change without notice

3. Mechanical Dimensions

3.1. MG-ST01SP



4. Board connections

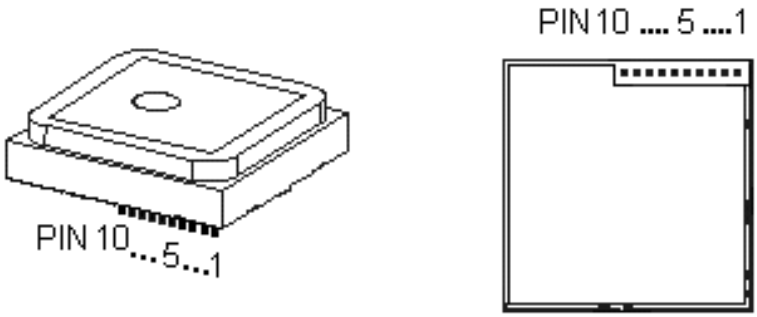


Figure 2: Board connections and placement diagram.

PIN	Voltage level/ active level	Description
P1	LED	LED status
P2	NC	
P3	TxD	TTL Tx
P4	RxD	TTL Rx
P5	NC	
P6	NReset	Low level force reset
P7	BBat	Backup battery supply(1.95~3.6V)
P8	DGND	Digital Ground
P9	3.3V	3.3V power supply
P10	1PPS	Time pulse signal

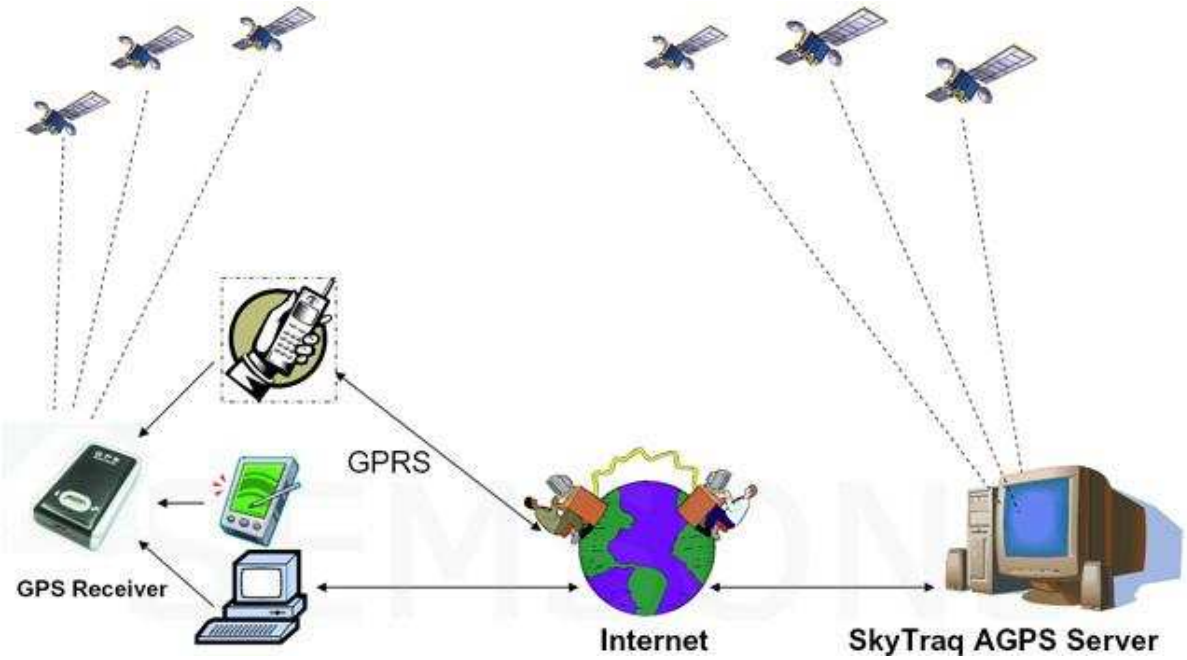
5. Applications

MG-ST01SP module board receiver is a high performance, ultra low power consumption, plug &play product. These applications are as follow.

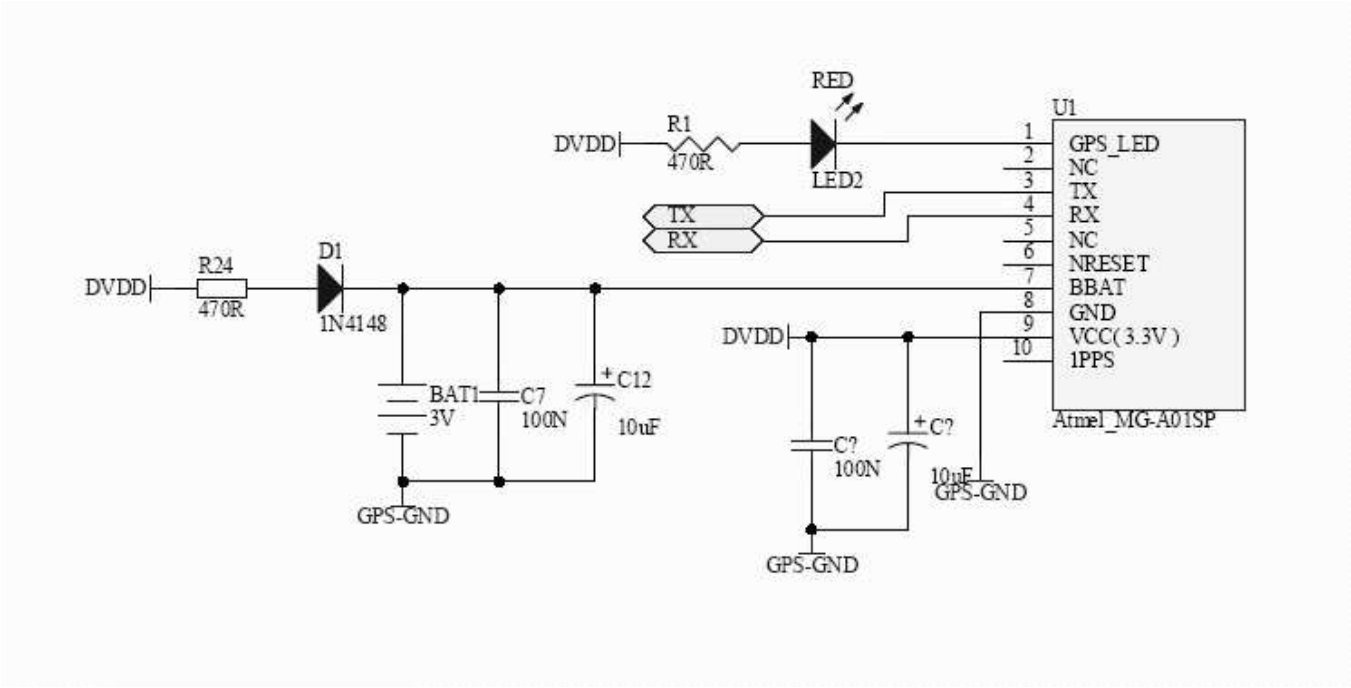
- Car Navigation
- Wrist Watch
- Solar Operated Device
- Marine Navigation
- Fleet Management
- AVL and Location-Based Services
- Radar detector with GPS function
- Hand-Held Device for Personal Positioning and Navigation
- Ideal for PDA, Pocket PC and Other Computing Devices at GPS Application

6. Assisted GPS

With Assisted GPS technology, GPS Data (ephemeris data) will be downloaded from an A-GPS Server through internet and transferred to the GPS Module via Wire or Wireless like Bluetooth. This will greatly reduce the TTFF since the positions of the satellites are known. The downloaded GPS data will expire in 7 days if the GPS is not being used. If GPS receiver is being used on daily basis, GPS data will also be downloaded from satellites.



7. Schematics



Appendix A: GENERAL NMEA FORMAT

The general NMEA format consists of an ASCII string commencing with a '$' character and terminating with a <CR><LF> sequence. NMEA standard messages commence with 'GP' then a 3-letter message identifier.

The message header is followed by a comma delimited list of fields optionally terminated with a checksum consisting of an asterisk '*' and a 2 digit hex value representing the checksum. There is no comma preceding the checksum field. When present, the checksum is calculated as a bitwise exclusive of the characters between the '$' and '*'. As an ASCII representation, the number of digits in each number will vary depending on the number and precision, hence the record length will vary. Certain fields may be omitted if they are not used, in which case the field position is reserved using commas to ensure correct interpretation of subsequent fields.

The tables below indicate the maximum and minimum widths of the fields to allow for buffer size allocation.

No.208, Jhengkang 1st St., Taoyuan City,
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$GPGGA

This message transfers global positioning system fix data.

The $GPGGA message structure is shown below:

Field	Format	Min chars	Max chars	Notes
Message ID	$GPGGA	6	6	GGA protocol header.
UTC Time	hhmmss.sss	2,2,2.3	2,2,2.3	Fix time to 1ms accuracy.
Latitude	float	3,2.4	3,2.4	Degrees * 100 + minutes.
N/S Indicator	char	1	1	N=north or S=south
Longitude	float	3,2.4	3,2.4	Degree * 100 + minutes.
E/W indicator	Char	1	1	E=east or W=west
Position Fix Indictor	Int	1	1	0: Fix not available or invalid. 1: GPS SPS mode. Fix available.
Satellites Used	Int	2	2	Number of satellites used to calculate fix.
HDOP	Float	1.1	3.1	Horizontal Dilution of Precision.
MSL Altitude	Float	1.1	5.1	Altitude above mean seal level
Units	Char	1	1	M Stands for “meters”.
Geoid Separation	Int	(0) 1	4	Separation from Geoids can be blank.
Units	Char	1	1	M Stands for “meters”.
Age of Differential Corrections	int	(0) 1	5	Age in seconds Blank (Null) fields when DGPS is not used.
Diff Reference Corrections	int	4	4	0000.
Checksum	*xx	(0) 3	3	2 digits.
Message terminator	<CR> <LF>	2	2	ASCII 13, ASCII 10.

$GPGLL

This message transfers Geographic position, Latitude, Longitude, and time.

The $GPGLL message structure is shown below:

Field	Format	Min chars	Max chars	Notes
Message ID	$GPGLL	6	6	GLL protocol header.
Latitude	Float	1,2.1	3,2.4	Degree * 100 + minutes.
N/S Indicator	Char	1	1	N=north or S=south.
Longitude	Float	1,2.1	3,2.4	Degree * 100 + minutes.
E/W indicator	Character	1	1	E=east or W=west.
UTC Time	hhmmss.sss	1,2,2.1	2,2,2.3	Fix time to 1ms accuracy.
Status	Char	1	1	A Data Valid. V Data invalid.
Mode Indicator	Char	1	1	A Autonomous
Checksum	*xx	(0) 3	3	2 digits.
Message terminator	<CR><LF>	2	2	ASCII 13, ASCII 10.

$GPGSA

This message transfers DOP and active satellites information.

The $GPGSA message structure is shown below:

Field	Format	Min chars	Max chars	Notes
Message ID	$GPGSA	6	6	GSA protocol header.
Mode	Char	1	1	M Manual, forced to operate in selected mode. An Automatic switching between modes.
Mode	Int	1	1	1 Fix not available. 2 2D position fix. 3 3D position fix.
Satellites Used	Int	2	2	SV on channel 1.
Satellites Used	Int	2	2	SV on channel 2.
…	.	..	..	..
Satellites Used	Int	2	2	SV on channel 12.
PDOP	Float	1.1	3.1	
HDOP	Float	1.1	3.1	
VDOP	Float	1.1	3.1	
Checksum	*xx	0	3	2 digits
Message terminator	<CR> <LF>	2	2	ASCII 13, ASCII 10

$GPGSV

This message transfers information about satellites in view. The $GPGSV message structure is shown below. Each record contains the information for up to 4 channels, allowing up to 12 satellites in view. In the final record of the sequence the unused channel fields are left blank with commas to indicate that a field has been omitted.

Field	Format	Min chars	Max chars	Notes
Message ID	$GPGSV	6	6	GSA protocol header.
Number of messages	Int	1	1	Number of messages in the message sequence from 1 to 3.
Message number	Int	1	1	Sequence number of this message in current sequence, form 1 to 3.
Satellites in view	Int	1	2	Number of satellites currently in view.
Satellite Id	Int	2	2	Satellite vehicle 1.
Elevation	Int	1	3	Elevation of satellite in degrees.
Azimuth	Int	1	3	Azimuth of satellite in degrees.
SNR	Int	(0) 1	2	Signal to noise ration in dBHz, null if the sv is not in tracking.
Satellite Id	Int	2	2	Satellite vehicle 2.
Elevation	Int	1	3	Elevation of satellite in degrees.
Azimuth	Int	1	3	Azimuth of satellite in degrees.
SNR	Int	(0) 1	2	Signal to noise ration in dBHz, null if the sv is not in tracking.
Satellite Id	Int	2	2	Satellite vehicle 3.
Elevation	Int	1	3	Elevation of satellite in degrees.
Azimuth	Int	1	3	Azimuth of satellite in degrees.
SNR	Int	(0) 1	2	Signal to noise ration in dBHz, null if the sv is not in tracking.
Satellite Id	Int	2	2	Satellite vehicle 4.
Elevation	Int	1	3	Elevation of satellite in degrees.
Azimuth	Int	1	3	Azimuth of satellite in degrees.
SNR	Int	(0) 1	2	Signal to noise ration in dBHz, null if the sv is not in tracking.
Checksum	*xx	(0) 3	3	2 digits.
Message terminator	<CR> <LF>	2	2	ASCII 13, ASCII 10.

$GPRMC

This message transfers recommended minimum specific GNSS data.

The $GPRMC message format is shown below.

Field	Format	Min chars	Max chars	Notes
Message ID	$GPRMC	6	6	RMC protocol header.
UTC Time	hhmmss.sss	1,2,2.1	2,2,2.3	Fix time to 1ms accuracy.
Status	char	1	1	A Data Valid. V Data invalid.
Latitude	Float	1,2.1	3,2.4	Degrees * 100 + minutes.
N/S Indicator	Char	1	1	N=north or S=south.
Longitude	Float	1,2.1	3,2.4	Degrees * 100 + minutes.
E/W indicator	Char	1	1	E=east or W=west.
Speed over ground	Float	1,1	5.3	Speed over ground in knots.
Course over ground	Float	1.1	3.2	Course over ground in degrees.
Date	ddmmyy	2,2,2	2,2,2	Current date.
Magnetic variation	Blank	(0)	(0)	Not used.
E/W indicator	Blank	(0)	(0)	Not used.
Mode	Char	1	1	A Autonomous
Checksum	*xx	(0) 3	3	2 digits.
Message terminator	<CR> <LF>	2	2	ASCII 13, ASCII 10.

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$GPVTG

This message transfers Velocity, course over ground, and ground speed.

The $GPVTG message format is shown below.

Field	Format	Min chars	Max chars	Notes
Message ID	$GPVTG	6	6	VTG protocol header.
Course (true)	Float	1.1	3.2	Measured heading in degrees.
Reference	Char	1	1	T = true heading.
Course (magnetic)	Float	1.1	3.2	Measured heading (blank).
Reference	Char	1	1	M = magnetic heading.
Speed	Float	1.1	4.2	Speed in knots.
Units	Char	1	1	N = knots.
Speed	Float	1.1	4.2	Speed
units	Char	1	1	K = Km/h.
Mode	Char	1	1	A Autonomous
Checksum	*xx	(0) 3	3	2 digits.
Message terminator	<CR> <LF>	2	2	ASCII 13, ASCII 10.

$GPZDA

This message transfers UTC Time and Date. Since the latency of preparing and transferring the message is variable, and the time does not refer to a particular position fix, the second precision is reduced to 2 decimal places.

The $GPZGA message format is shown below.

Field	Format	Min chars	Max chars	Notes
Message ID	$GPZDA	6	6	ZDA protocol header.
UTC time	hhmmss.ss	2,2,2.2	2,2,2.2	00000000.00 to 235959.99
UTC day	dd	2	2	01 to 31, day of month.
UTC month	mm	2	2	01 to 12.
UTC Year	yyyy	4	4	1989-9999.
Local zone hours	Int	(-)2	(-)2	Offset of local time zone (-13) to 13.
Local zone minutes	Unsigned	2	2	
Checksum	*xx	(0) 3	3	2 digits.
Message terminator	<CR> <LF>	2	2	ASCII 13, ASCII 10.