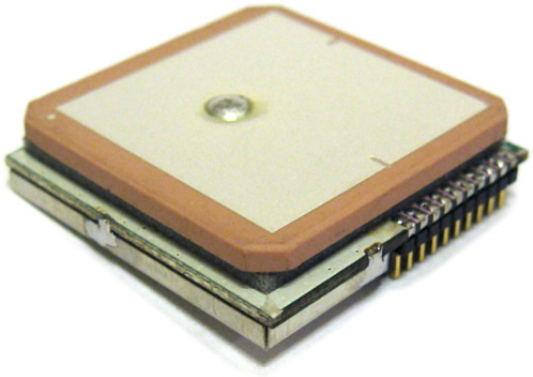
SkyTraq Venus 5 GPS Module
ST01SP

Datasheet



Revision History

Revision	Change
V1.0	Initial version

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Overview

The ST01SP is a compact size GPS module with high sensitivity and low power consumption.
It 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.
A dedicated massive-correlator (>>20,000) signal parameter search engine enables rapid search of all available satellites and acquisition of very weak signals.
This allows weak signal tracking and positioning in severe environments such as urban canyons and under deep foliage.

The ST01SP interfaces to the application system via TTL level serial port with NMEA protocol. This allows an easy integration in all kinds of navigation applications or products.

Key Features

- Built-in SkyTraq chipset with 44 channels "All-in-View" tracking.
- Cold/Warm/Hot start time: 30/28/1 sec. (average)
- Reacquisition time: 0.1 sec.
- High sensitivity: -159 dBm for superior urban canyon.
- Supports assisted GPS (A-GPS).
- Low power consumption (40mA, 3.3V)
- Support of SBAS (WAAS / EGNOS) satellites for navigation
- Compact size, easy integration into hand-held devices.
- 26.0 x 26.0 x 6mm (with 2mm patch antenna)
- Light weight, just 8 grams
- Cost efficient

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Specification

Chipset	Skytraq low power VENUS 5
Frequency	L1, 1575.42 MHz
C/A Code	1.023MHz chip rate
Channels	44
Datum	WGS-84
Antenna	Built-in 25x25x2mm patch antenna
Sensitivity	Down to -159dBm tracking with superior urban canyon performance
Time to First Fix (TTFF)	Cold start: 30sec average Warm start: 28sec average Hot start: 1sec average Reacquisition: 0.1sec
Update rate	1 Hz
Accuracy	Position: 5m CEM without SA, 10m 2D RMS Velocity: 0.1m/sec without SA Time: 1us synchronized to GPS time
Altitude	Up to 18km
Velocity	Up to 500m/s
Current draw	40mA average tracking current
Supply	3.3V +/- 5% DC
Operating temperature	-20 to +80 degrees Centigrade
Storage temperature	-20 to +85 degrees Centigrade
Device dimensions	26x26x6mm
Device weight	8 grams
Protocol	8 data bits, 1 stop bit, no parity NMEA-0183 (GGA, GSA, GSV, RMC), Skytraq Binary
Baud rate	9600 (default)

Specification can change without notice.
All values are preliminary.

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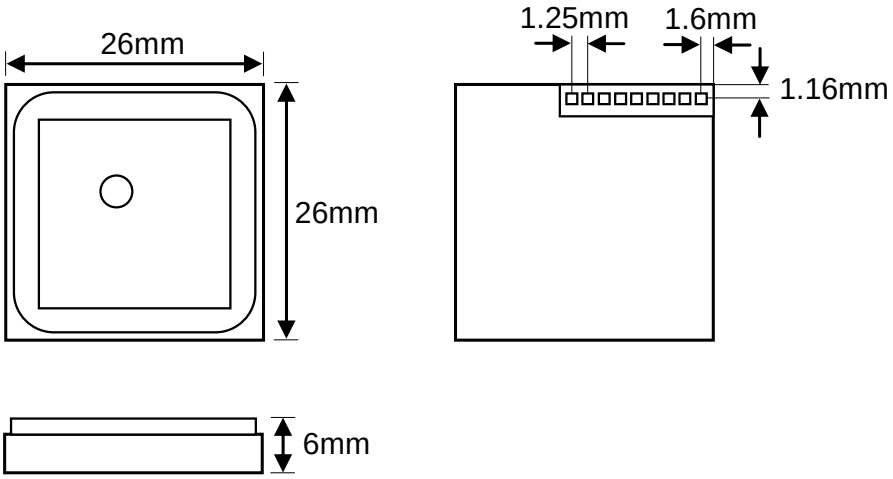
Mechanical Dimensions



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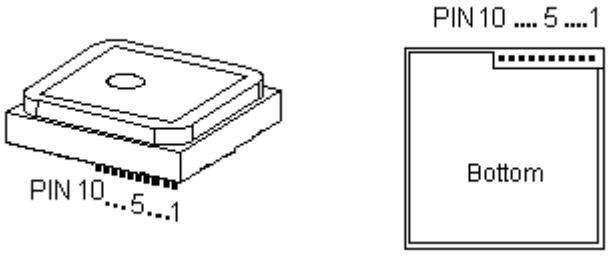
Pinout



Pin	Name	Description
1	LED	Status LED
2	NC	
3	TxD	TTL Tx
4	RxD	TTL Rx
5	NC	
6	/Reset	Active low reset
7	BBat	Backup battery supply (1.95 to 3.6V)
8	GND	Digital ground
9	VCC	3.3V power supply
10	TPS	Time pulse signal (1 pulse per second)

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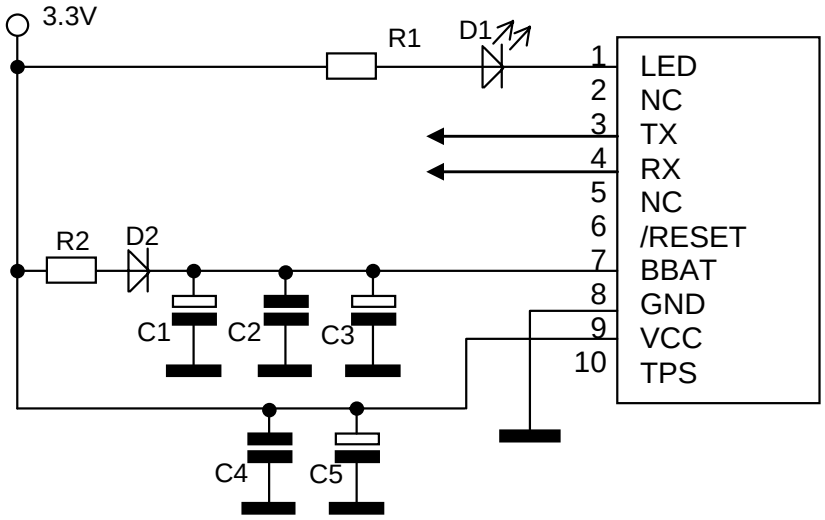
Application Circuit



D1 - LED
D2 – 1N4148
R1 – 470R
R2 – 470R
C1 – Goldcap 0.47F, 3.3V
C2 – 100nF
C3 – 10uF
C4 – 100nF
C5 – 10uF

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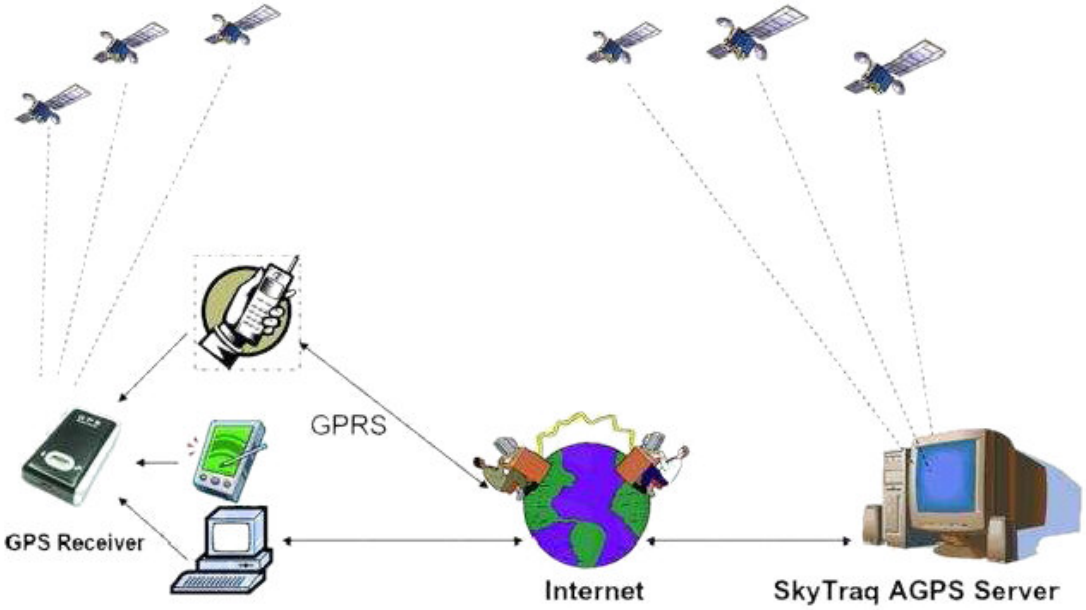
Information on Assisted GPS

With Assisted GPS technology, GPS Data (ephemeris data) will be downloaded from an A-GPS Server through internet and transferred to the GPS Module.

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 the GPS receiver is being used on daily basis, GPS data will also be downloaded from satellites and stored in the receiver (needs to be standby supplied).



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NMEA Format

The general NMEA format consists of an ASCII string beginning with a '$' character and terminating with a <CR><LF> sequence. NMEA standard messages begin with 'GP' then a 3-letter message identifier.
The message header is followed by a comma delimited list of fields optionally terminated with a checksum consisting of an asterisk '*' and a 2 digit hex value representing the checksum. There is no comma preceding the checksum field. When present, the checksum is calculated as a bitwise exclusive of the characters between the '$' 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.

NMEA Message $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	1,2,2.1	2, 2, 2.3	Fix time to 1ms accuracy
Latitude	float	1,2.1	3,2.4	Degrees * 100+minutes
N/S Indicator	char	1	1	N=North, S=South
Longitude	float	1,2.1	3,2.4	Degrees * 100+minutes
E/W Indicator	Char	1	1	E=East, W=West
Position Fix Indicator	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.

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NMEA Message $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	Degrees * 100+minutes
N/S Indicator	char	1	1	N=North, S=South
Longitude	float	1,2.1	3,2.4	Degrees * 100+minutes
E/W Indicator	Char	1	1	E=East, 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	Chat	1	1	A Autonomous
Checksum	*xx	(0) 3	3	2 digits
Message terminator	<CR> <LF>	2	2	ASCII 13, ASCII 10.

NMEA Message $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. A 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.

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NMEA Message $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	GSV 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	2 digits
Message terminator	<CR> <LF>	2	2	ASCII 13, ASCII 10.

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NMEA Message $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, S=South
Longitude	float	1,2.1	3,2.4	Degrees * 100+minutes
E/W Indicator	Char	1	1	E=East, 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	2 digits
Message terminator	<CR> <LF>	2	2	ASCII 13, ASCII 10.

NMEA Message $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
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	2 digits
Message terminator	<CR> <LF>	2	2	ASCII 13, ASCII 10.

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NMEA Message $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	2 digits
Message terminator	<CR> <LF>	2	2	ASCII 13, ASCII 10.