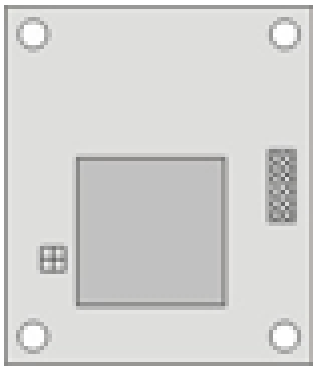
High Sensitivity GPS Receiver Module



Version History

Version	Date	Changes
V1.0	Sep. 20, 2011	1st. Edition

Function Introduction

WS-EB323 is a high performance and low cost GPS receiver module, Targeting mobile consumer and cellular handset applications.

It offers very low power consumption, high sensitivity, and best in class signal acquisition and time to first fix performance.

Dedicated massive correlator signal parameter search engine within the baseband enables rapid search off all the available satellites and acquisition of very weak signal. An advanced track engine allows weak signal tracking and positioning in harsh environments such as urban canyons and under deep foliage.

Features

- 2.5m accuracy
- -161dBm tracking sensitivity
- 1 second hot start
- 29 second cold start TTFF
- 10Hz update rate
- Multipath detection and suppression
- SBAS (WAAS / EGNOS) support
- Pb-free RoHS compliant

Absolute Maximum Rating

Minimum	Maximum	Units	Operating conditions
Supply voltages			
3	6	V	VDC
	0	V	GND
Backup voltage			
1.5	6	V	V_BAT

Technical specifications

Receiver Type

- L1 frequency
- GPS C/A code
- SBAS capable
- 51-channel architecture
- 14 Channel tracking
- 8 million time-frequency searches per second

Accuracy

- Position 2.5m CEP
- Velocity 0.1m/sec
- Timing 300ns

Open sky TTFF

- 29 second cold start
- 1 second hot start

Reacquisiton

- < 1 second

Sensitivity

- -161dBm tracking

Update Rate

- 1Hz standard (up to 10Hz)

Dynamics

- 4G

Operational Limits

- Altitude <18,000m
- Velocity <515m/s

Datum

- Default WGS-84

Interface

- UART TTL level 3.3V

Baud Rate

- 4800 / 9600 / 38400 / 115200

Protocol

- NMEA-0183 V3.01, GGA, GLL, GSA, GSV, RMC, VTG(default GGA, GSA, GSV, RMC, VTG)

Supply Voltage

- 3~6V

Backup Voltage

- 1.5~6V

Current Consumption

- Tracking 29mA
- Low Power Acquisition 47mA
- Enhanced Acquisition 65mA

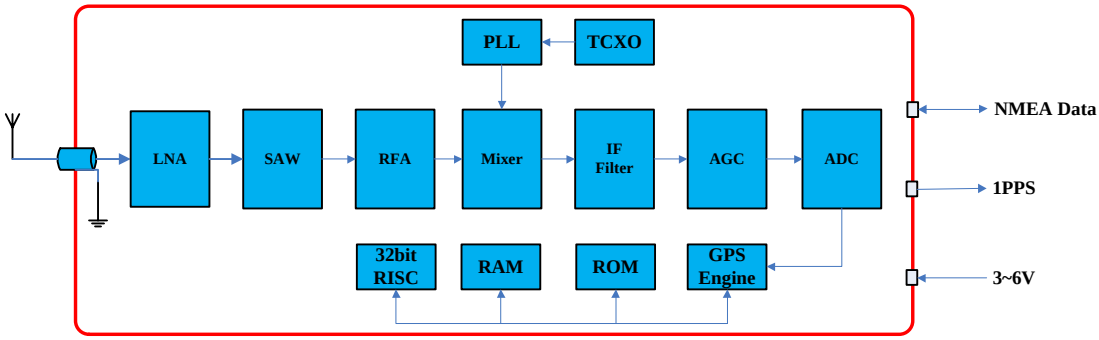
Operating Temperature

- -40~+85

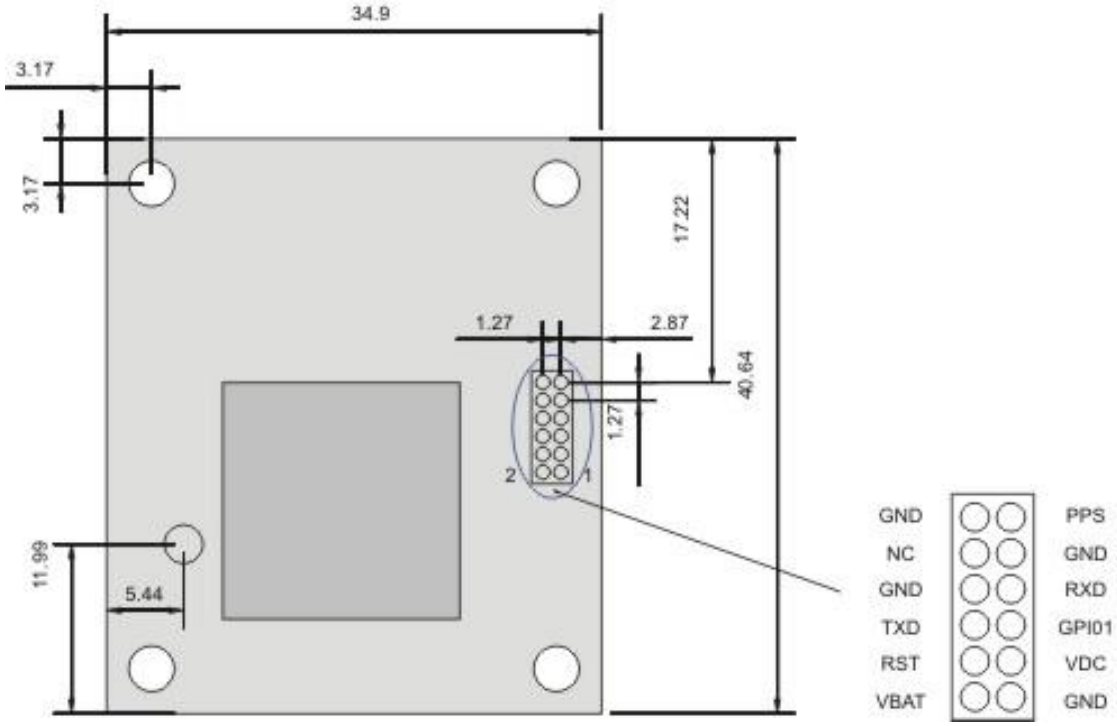
Storage Temperature

- -40~+125

Internal Block Diagram



Size



Pin Assignment

Pin	Name	I/O	Description
1	GND	GND	Ground
2	VBAT	POWER	1.5~6V VBAT should be powered by non-volatile supply voltage to have optimal performance. If VBAT is connected to VDC, powered off as VDC power is removed, then it well cold start every time. For applications that do not care lesser performance cold starting every time, this pin can be connected to VDC
3	VDC	POWER	Voltage supply input 3~6V
4	RST	I	Active LOW reset
5	GPIO1	O	Navigation status indicator
6	TXD	O	Transmit output of the asynchronous UART port. Used to output standard NMEA-0183 sentence or response to input binary command. 3.3V TTL
7	RXD	I	Received input of the asynchronous UART port. Used to input binary command to the GPS receiver. 3.3V TTL
8	GND	GND	Ground
9	GND	GND	Ground
10	NC	NC	Not connected, empty pin
11	PPS	O	1 pulse per second output. Active after position fix; goes HIGH for about 4msec, 3.3V TTL
12	GND	GND	Ground
13	RF_IN	ANT	GPS signal input, connect to GPS antenna.

NMEA MESSAGES

The full descriptions of supported NMEA messages are provided at the following paragraphs.

GGA - Global Positioning System Fix Data

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

Structure:

$GPGGA,hhmmss.sss,ddmm.mmmmm,a,dddmm.mmmmm,a,x,xx,x.x,x.xx,M,x.xx,M,,xxxx*hh<CR><LF>
1 2 3 4 5 6 7 8 9 10 11 12

Example:

$GPGGA,212742.954,2448.13492,N,12058.16712,E,1,09,1.0,19.31,M,19.40,M,,0000*60<CR><LF>

Field	Name	Example	Description
1	UTC Time	212742.954	UTC of position in hhmmss.sss format, (000000.000 ~ 235959.999)
2	Latitude	2448.13492	Latitude in ddmm.mmmmm format Leading zeros transmitted
3	N/S Indicator	N	Latitude hemisphere indicator, 'N' = North, 'S' = South
4	Longitude	12058.16712	Longitude in dddmm.mmmmm 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	09	Number of satellites in use, (00 ~ 12)
8	HDOP	1.0	Horizontal dilution of precision, (00.0 ~ 99.9)
9	Altitude	19.31	mean sea level (geoid), (-9999.99 ~ 17999.99)
10	Geodal Separation	19.40	Geoidal separation (-9999.99 ~ 17999.99)
11	DGPS Station ID	0000	Differential reference station ID, 0000 ~ 1023 NULL when DGPS not used
12	Checksum	60	

GLL – Latitude/Longitude
Latitude and longitude of current position, time, and status.

Structure:
$GPGLL,ddmm.mmmmm,a,dddmm.mmmmm,a,hhmmss.sss,A,a*hh<CR><LF>
1 2 3 4 5 6 7 8

Example:
$GPGLL,2447.96928,N,12059.63137,E,211903.945,A,A*5F<CR><LF>

Field	Name	Example	Description
1	Latitude	2447.96928	Latitude in ddmm.mmmmm format Leading zeros transmitted
2	N/S Indicator	N	Latitude hemisphere indicator 'N' = North 'S' = South
3	Longitude	12059.63137	Longitude in dddmm.mmmmm format Leading zeros transmitted
4	E/W Indicator	E	Longitude hemisphere indicator 'E' = East 'W' = West
5	UTC Time	211903.945	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	5F	

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 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,hhmmss.sss,A,dddmm.mmmmm,a,dddmm.mmmmm,a,x.xx,x.xx,ddmmyy,,,a*hh<CR><LF>

1 2 3 4 5 6 7 8 9 10 11

Example:
$GPRMC,211904.745,A,2447.96772,N,12059.63052,E,0008.04,203.92,170726,,,A*51<CR><LF>

Field	Name	Example	Description
1	UTC time	211904.745	UTC time in hhmmss.sss format (000000.000 ~ 235959.999)
2	Status	A	Status 'V' = Navigation receiver warning 'A' = Data Valid
3	Latitude	2447.96772	Latitude in dddmm.mmmmm format Leading zeros transmitted
4	N/S indicator	N	Latitude hemisphere indicator 'N' = North 'S' = South
5	Longitude	12059.63052	Longitude in dddmm.mmmmm format Leading zeros transmitted
6	E/W Indicator	E	Longitude hemisphere indicator 'E' = East 'W' = West
7	Speed over ground	0008.04	Speed over ground in knots (0000.00 ~ 0971.92)
8	Course over ground	203.92	Course over ground in degrees (000.00 ~ 359.99)
9	UTC Date	170726	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	51	

VTG – Course Over Ground and Ground Speed

The Actual course and speed relative to the ground.

Structure:

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

1 2 3 4 5

Example:

$GPVTG,317.20,T,,M,0017.68,N,00032.75,K,A*01<CR><LF>

Field	Name	Example	Description
1	Course	317.20	True course over ground in degrees (000.00 ~ 359.99)
2	Speed	0017.68	Speed over ground in knots (0000.00 ~ 0971.92)
3	Speed	00032.75	Speed over ground in kilometers per hour (00000.00 ~ 01800.00)
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	01	