GPS Engine Board

EB-600

EB-600 is a **18.4x13x2.2 mm** GPS engine that is capable of receiving both **GPS and Glonass** signal with single RF input and high receiving sensitivity. EB-600 provides superior navigation performance under dynamic conditions in areas with limited sky view like urban canyons. With up to **-162dBm** tracking sensitivity the GPS + Glonass dual system EB-600 enables better satellite coverage and superior position accuracy for your navigation need.

Pin locations backward compatible with TSI's EB-500, you can easily upgrade your system to latest high sensitivity GPS + Glonass receiver available in the industry.

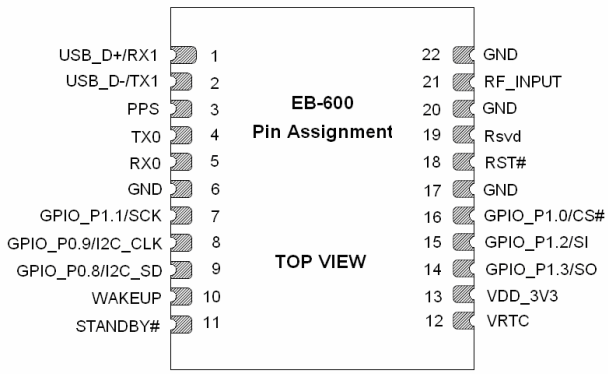
Key Features :

- Small form factor: 18.4 x13 x 2.2 mm
- Support GPS + Glonass dual system
- Lead-Free – RoHS/WEEE compliant
- High sensitivity -162dBm / Tracking
- Tracks 32-Channel of satellites
- Fast Position Fix
- Low power consumption
- USB & UART interface
- Backward compatible with EB-500

Applications :

- Automotive and Marine Navigation / Tracking
- Emergency Locator
- Geographic Surveying
- Personal Positioning
- Sporting and Recreation

PIN Assignment :



RoHS Compilant

ELECTROSTATIC SENSITIVE DEVICES

Ultimate EB

TRANSYSTEM INC.

An A+ supplier of RF microwave & GPS products

Revision History

Rev.	Date	Description
0.1	01-06-2012	Initial draft
0.2	02-08-2012	Update power consumption data
0.3	02-14-2012	Correct VDD_3V3 input range
	MM-DD-YYYY	

EB-600 is ESD (electrostatic discharge) sensitive device and may be damaged with ESD or spike voltage. Please handle with care to avoid permanent malfunction or performance degradation.

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Table of Contents

1 Introduction

EB-600 is a **18.4x13x2.2 mm** GPS engine that is capable of receiving both **GPS and Glonass** signal with single RF input and high receiving sensitivity. EB-600 provides superior navigation performance under dynamic conditions in areas with limited sky view like urban canyons. With up to **-162dBm** tracking sensitivity the GPS + Glonass dual system EB-600 enables better satellite coverage and superior position accuracy for your navigation need.

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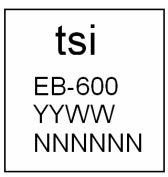
1.2 Applications

- Automotive and Marine Navigation / Tracking
- Emergency Locator
- Geographic Surveying
- Personal Positioning
- Sporting and Recreation

1.3 Look & Feel

1.4 Labeling

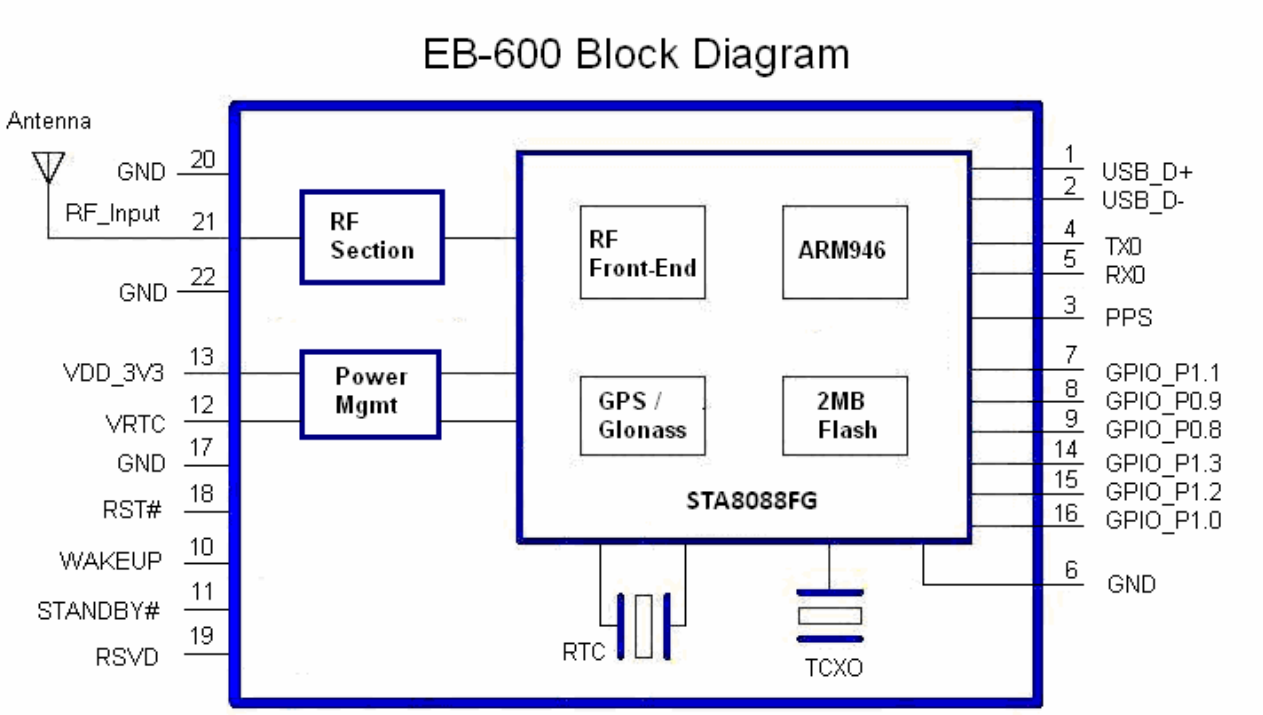
There are 4 lines of top marking on the GPS engine and they are :



Line #1: TSI company icon
Line #2: Model number, i.e. EB-600
Line #3: Date code, the year and week when the product is built
Line #4: Lot control code for TSI internal use

2 Technical Description

2.1 Block Diagram



2.2 Pin Definition

Pin#	Signal Name	Type	Description
1	USB_D+ / RX1	I	USB Data Plus ; UART port 1 input, leave open if not used
2	USB_D- / TX1	O	USB Data Minus ; UART port 1 output, leave open if not used
3	GPIO_P0.0 / PPS	O	Pulse per second output
4	TX0	O	UART port 0 output for NMEA
5	RX0	I	UART port 0 input
6	GND	P	Ground
7	GPIO_P1.1 / SP_SCK	I/O*	General input/ output ; SPI clock, leave open if not used
8	GPIO_P0.9 / GNSS Status / I2C_CLK	O	General input/ output ; GNSS status indication ; I2C clock
9	GPIO_P0.8 / I2C_SD	I/O*	General input/ output ; I2C serial data
10	WAKEUP	I	Wakeup from standby mode
11	STANDBY#	I	Active low to put module into standby mode, leave open if not used.
12	VRTC	P	RTC power 1.62~3.6VDC
13	VDD_3V3	P	Power supply 2.7~4.2VDC
14	GPIO_P1.3 / SSP_SO	I/O*	General input/ output ; SPI data output, leave open if not used
15	GPIO_P1.2 / SSP_SI	I/O*	General input/ output ; SPI data input, leave open if not used
16	GPIO_P1.0 / SP_CS#	I/O*	General input/ output ; SPI chip select, leave open if not used
17	GND	P	Ground
18	RST#	I	Reset input, active low with Schmitt-Trigger, leave open if not used.
19	Rsvd	I/O*	Reserve for future use, leave open if not used
20	GND	P	Ground
21	RF_Input	I	RF input port, L1 band, 50 ohm Active antenna power feed, same as VDD_3V3
22	GND	P	Ground

Note : 1) P: Power, I: Input, O: Output, I/O*: Input or Output, leave open if not used.
2) GPIO current output default：4mA, Max ：16mA

2.3 Specifications

Item	*Description*
General	L1 frequency, C/A code (SPS) 32 independent tracking channels
Sensitivity*	-162dBm /Tracking; -146dBm /Acquisition
Update Rate	1~10Hz
Accuracy	Position : 1.5m CEP 50% without SA(horizontal) Velocity : <0.1m/s Time : +/-1us
Acquisition (open sky)	Cold Start: 35sec Hot Start: 1sec typical
Reacquisition	< 1sec
Dynamics	Altitude: 18000m (max.) Velocity: 515m/sec (max.) Vibration: 4G (max.)
NMEA	NMEA0183 v3.1 GGA, GSA, GSV, RMC (Default) / GLL, VTG (Optional)
Datum	Default WGS-84
Antenna	External active or passive antenna
Power Supply	DC 2.7V ~ 4.2V
Current	42 mA @ 3.3V / Tracking
Interface	UART, Baud rate : 4800/9600(Default)/…/11520 USB 2.0 / 12Mbps
Mounting	SMT
Dimension	18.4 x 13 x 2.2 mm
Operating Temp.	-40˚C to 85˚C
Storage Temp.	-40˚C to 85˚C
Operating Humidity	≦95%, non condensing

* Refer to chip specification.
** Specifications subject to change without prior notice.

3 Electrical Characteristics

3.1 Absolute maximum ratings

Symbol	Parameter	Min	Max	Unit
Vcc	power supply	-0.3	+4.3	V
Vin	voltage to any pin	-0.3	+3.6	V
Iov	input current on any pin	-10	10	mA
Itdv	absolute sum of all input currents during overload condition		200	mA
Tst	storage temperature	-40	85	℃
Iant	antenna supply current	0	50	mA

Table 3-1 Absolute maximum ratings

Note:
(1) Stresses beyond absolute maximum ratings may cause permanent damage to the device.
(2) Exposure to absolute maximum rating conditions for extended period may affect device reliability.

3.2 Operating Conditions

Pin	Description	Min	Typical	Max	Unit
12	V_RTC	2.0		3.6	V
	Tracking Current (2)		TBD		uA
13	VDD_3V3	2.7	3.3	4.2	V
	Peak Acquisition Current (1)			66	mA
	Tracking Current (2)		42		mA
	Standby Current			8	mA

Table 3-2 Operating Conditions

Note:
(1) Peak acquisition current is the maximum current with passive antenna.
(2) Tracking current is the average current with passive antenna includes tracking and post acquisition portion.

3.3 DC Electrical Characteristics

Symbol	Parameter	Min	Max	Unit
PPS, GNSS Status, TX1, TX0, GPIO	Voh	2.4	3.1	V
	Vol	-0.3	0.4	V
RX1, RX0, STANDBY#, RST#, WAKEUP	Vih	2.0	3.6	V
	Vil	-0.3	0.8	V

Table 3-3 DC Electrical characteristics

4 Serial Port Interface

EB-600 provides 2- wire digital UART port for communication of GPS/Glonass position data using NMEA protocol or STM extension protocol. UART port is capable of 4800 to 115200 baud rate.

4.1 Protocol

EB-600 is default to support standard NMEA-0183 protocol. In addition, a series of STM extensions (PSTM messages) have been developed that can be used to provide extended capabilities common to many applications. Please contact TSI for detailed command information.

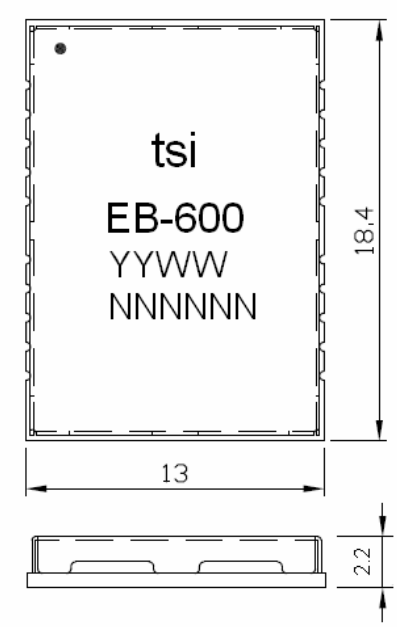
4.1.1 NMEA Protocol

EB-600 is capable of supporting following NMEA formats:

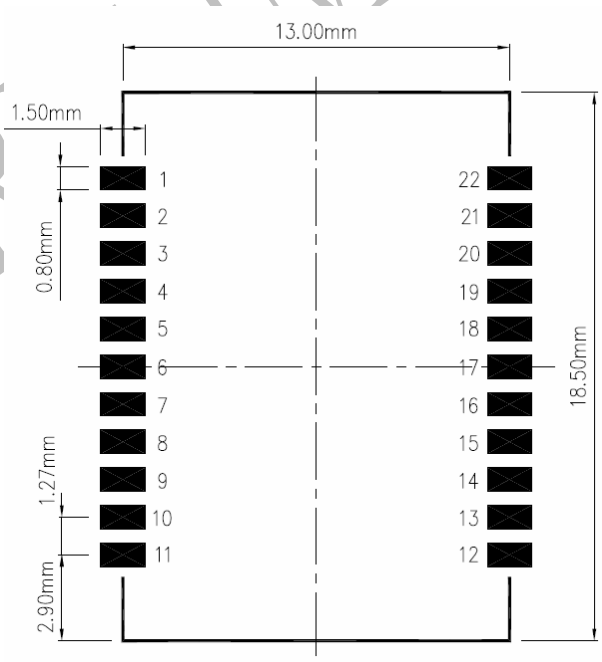
NMEA Prefix	Description	Direction
$GPGGA	GPS fix data	Out
$GPGSA	GNSS DOP and active satellites	Out
$GPGSV	GPS Satellites in view	Out
$GPRMC	Recommended minimum specific GNSS data	Out
$GPVTG	Velocity and track over ground	Out
$GLGSV	GLONASS satellites in view	Out
$PSTMTG	Time and Number of used satellites	Out
$PSTMTS	Tracked and Number of use satellites	Out
$PSTMSBAS	Augmentation system	Out

5 Dimension and Package

5.1 Mechanical Dimension



5.2 Recommend Layout Pattern



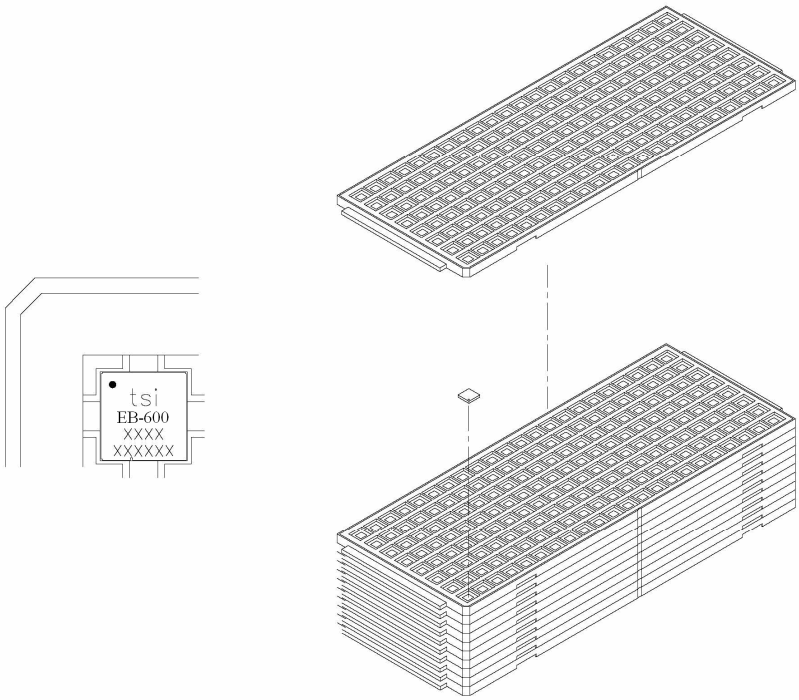
5.3 PIN Coordinates

Unit:mm

Pin #	X	Y	Pin #	X	Y
1	0.00	0.00	12	13.0	-12.70
2	0.00	-1.27	13	13.0	-11.43
3	0.00	-2.54	14	13.0	-10.16
4	0.00	-3.81	15	13.0	-8.89
5	0.00	-5.08	16	13.0	-7.62
6	0.00	-6.35	17	13.0	-6.35
7	0.00	-7.62	18	13.0	-5.08
8	0.00	-8.89	19	13.0	-3.81
9	0.00	-10.16	20	13.0	-2.54
10	0.00	-11.43	21	13.0	-1.27
11	0.00	-12.70	21	13.0	0.00

5.4 Package

EB-600 GPS modules come in tray package suitable for pick and place machines. Each tray contains total 72 pieces of EB-600 and maximum 10 trays are stacked together before sealed in ESD protective vacuum dry pack to provide protection against moisture and ESD during storage and shipment.



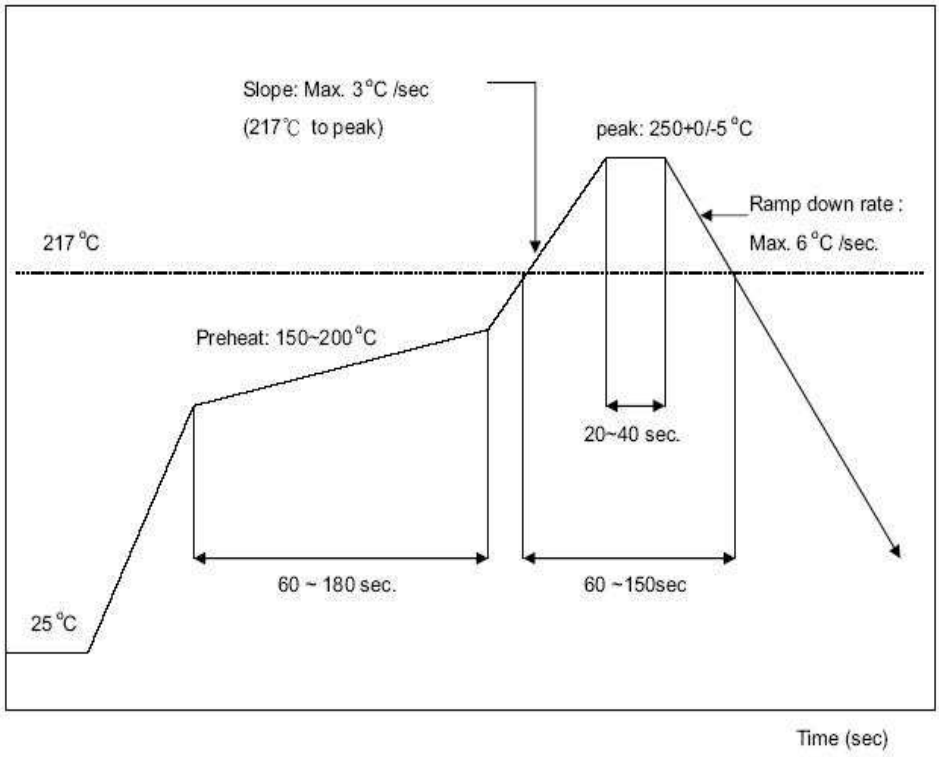
6 Recommended IR Profile

Follow below IR profile for reflow during SMT assembly for EB-600.

Ramp-down rate : 6 °C /sec. max.

Time 25 °C to peak temperature : 8 minutes max.

Cycle interval : 5 minus



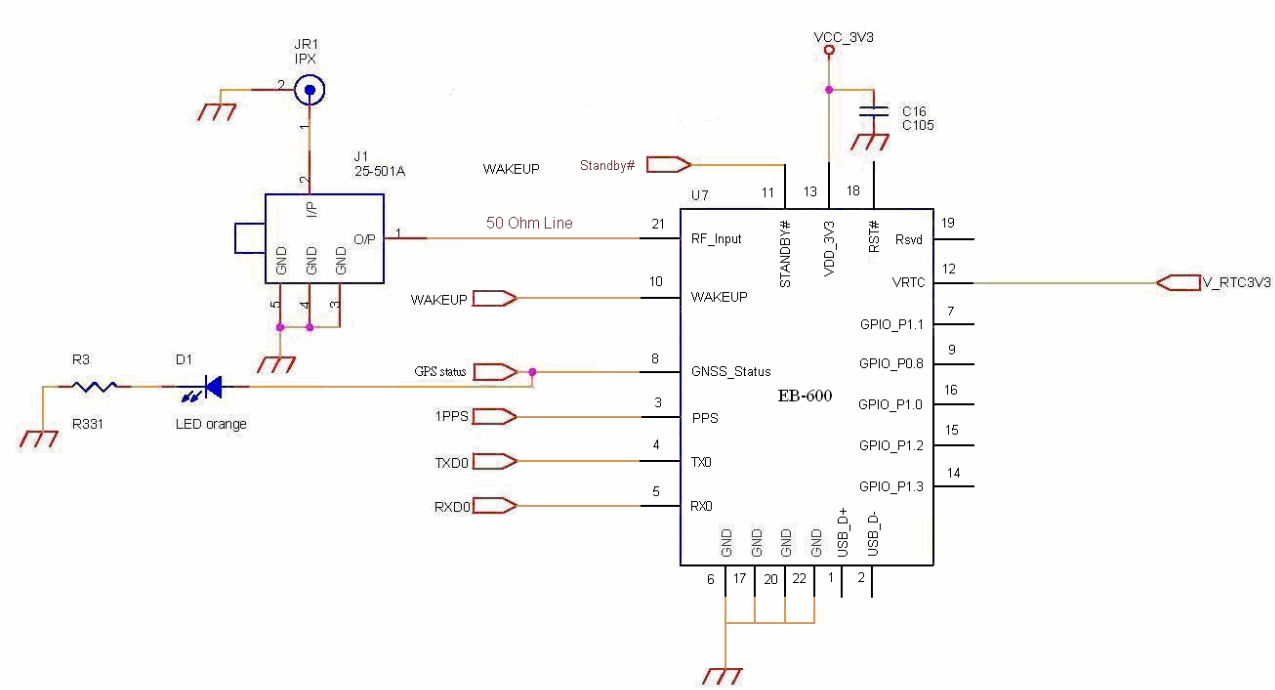
7 Application Information

7.1 GPS Antenna Recommendations

Follow below recommendations when choosing GPS / Glonass dual band antenna for EB-600 for best system performance. Transystem also offers active antenna products for optimal performance with EB-600. For details, please contact your Transystem sales contact directly.

- Use active antenna that works with 3.3V power supply
- Receiving frequency 1573MHz ~1610MHz
- Polarization RHCP (right hand circular polarized)
- Output impedance = 50 Ohm
- 15dB ≦ LNA Gain ≦ 20dB
- Noise figure ≦ 1.5dB
- Connector: surface mounted on main PCB, Ipex or MMCX

7.2 Application Circuit



【Note 1】: VRTC (pin#12) could connect to 3.3V DC power supply or battery directly. (EB-600)

7.3 PPS pin

GPS also provides accurate timing information due to the synchronized atomic clocks in the GPS / Glonass satellites. In addition to the current date and time is transmitted in NMEA sentences (UTC), an accurate timing signal is provided via the PPS pin (pin #3) of the EB-600 GPS / Glonass receiver.
Under good signal conditions the 1PPS signal comes between 620ns and 710ns after the full GPS system second which is accurately (around 10ns) synchronized to UTC. Therefore the 1 second clock can be derived and maintained within around 90ns under good signal conditions.

The 1PPS signal accuracy directly relates to the position accuracy. The GPS / Glonass signals travel at the speed of light, therefore a position inaccuracy directly translates into 1PPS inaccuracies.

10 m position deviation ≈ 33 ns 1PPS deviation (typically)
100 m position deviation ≈ 333 ns 1PPS deviation (typically)

The 1PPS signal is provided on an “as it is” basis with no accuracy specification.

7.4 Reset Signal

The RST# pin (pin #18) can be used to reset the EB-600 module. Resetting the module will result in a restart of the complete firmware.

The EB-600 is equipped with a voltage monitoring circuit that generates a proper power-on reset signal at the appropriate threshold and delay. Usually there is no need to deal with the reset input externally, thus the general advice is to leave this pin open.

7.5 Battery Back-up

VRTC input (pin #12) provides back-up power for the RTC and SRAM of the GPS / Glonass receiver module. Typical quiescent current 2uA allows the use of a separate battery or a “Supercap”. The VRTC pin draws 20uA typical under normal operation

7.6 General GPS / Glonass Receiver User's Tips

In general, GPS / Glonass receiver performs best in open space where it can see clean sky. Weather condition will affect satellite signals reception – rain & snow contribute to worsen sensitivity.

If the satellite signals can not be locked or experiencing receiving problem (while in urban area), following steps are suggested:

- Use of external active antenna if that option exists.
- Move to another open space or reposition GPS / Glonass receiver toward the direction with least blockage.
- Move the GPS / Glonass receiver away from the interference sources.
- Wait until the weather condition is improved.

Some vehicles using heavy metallic sun protecting coating on windshields may affect satellite signal reception.

- Driving in and around high buildings may affect signal reception.
- Driving in tunnels or in building structure may affect signal reception.
- When GPS / Glonass receiver is moving, it will take longer time to get position fix. Wait for satellite signals to be locked at a fixed point when first power-on the GPS / Glonass receiver to ensure quick position fix.

8 Quality and Reliability

Each module is electrically tested prior to packing and shipping to ensure state of the art product quality and best GPS receiver performance and accuracy.

8.1 Environmental Conditions

Operating temperature	-40 ~ +85℃
Operating humidity	Max. 95%, non-condensing
MSL JEDEC (Moisture Sensitivity Level)	3
Storage temperature	-40 ~ +85℃
Storage	12 months in original package.

8.2 How to avoid ESD damage to module

- Any person handling the module should be grounded either with a wrist strap or ESD-protective footwear used in conjunction with a conductive or static-dissipative floor or floor mat.
- The work surface where devices are placed for handling, processing, testing, etc., must, be made of static-dissipative material and be grounded to ESD ground.
- All insulator materials must either be removed from the work area or must be neutralized with an ionizer. Static-generating clothing must be covered with an ESD-protective smock.
- When module are being stored, transferred between operations or workstations, or shipped, they must be kept in a Faraday shield container with inside surfaces (surfaces touching the module) that are static-dissipative.

Contact Information

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