

General Description

The GAM-2525-UB8X module series is a family of stand alone GNSS receivers featuring the high performance u-blox M8 positioning engine. These flexible and cost effective receivers offer numerous connectivity options in a miniature 25.5x25.5x8.7mm package. Their compact architecture and power and memory options make GAM-2525-UB8X modules ideal for battery operated mobile devices with very strict cost and space constraints.

The 72-channel u-blox M8 positioning engine boasts a Time-To-First-Fix (TTFF) of under 1 second. The dedicated acquisition engine, with over 1 million correlators is capable of massive parallel time/frequency space searches, enabling it to find satellites instantly. Innovative design and technology suppresses jamming sources and mitigates multipath effects, giving GAM-2525-UB8X GNSS receivers excellent navigation performance even in the most challenging environments.

GAM-2525-UB8X modules are not designed for life saving or supporting devices or for aviation and should not be used in products that could in any way negatively impact the security or health of the user or third parties or that could cause damage to goods.

Applications

- LBS (Location Based Service)
- PND (Portable Navigation Device)
- Vehicle navigation system
- Mobile phone



Figure : GAM-2525-UB8X Top View

Features

- Built on high performance, low-power u-blox UBX-M8030-KT chip set
- Ultra high sensitivity: -167dBm
- Extremely fast TTFF at low signal level
- Built in high gain LNA
- Low power consumption: Max 40mA @ 3.3V
- NMEA-0183 compliant protocol or custom protocol
- Operating voltage: 3.0V--5.0V
- Operating temperature range: -40 to 85°C
- Patch Antenna Size: 25mmx25mmx4mm
- Small form factor: 25.5x25.5x8.7mm
- Communication type: UART/TTL
- RoHS compliant (Lead-free)

1 Description

1.1. Key Features

Parameter	Specification
Power Supply	<ul style="list-style-type: none"> Supply voltage: 3.0V~5.0V Typical: 3.3V
Power Consumption	<ul style="list-style-type: none"> Acquisition: 40mA @VCC=VBAT=3.3V Tracking: 35mA @VCC=VBAT=3.3V Backup: 20uA @VBAT=3.3V
Receiver Type	<ul style="list-style-type: none"> Code 72 search channels ,22 synchronous tracking channels GPS&QZSS L1 1575.42MHz C/A , Beidou B1 1561.098MHz, GALILEO E1B/C¹, GLONASS L1OF 1602MHz, SBAS: WAAS, EGNOS, MSAS, GAGAN
Sensitivity	<ul style="list-style-type: none"> Tracking: -167dBm Re-acquisition: -156dBm Acquisition: -146dBm
TTF (Autonomous)	<ul style="list-style-type: none"> Cold start: 35s typ @-130dBm Warm start: 30s typ @-130dBm Hot start: 1s typ @-130dBm
Horizontal Position Accuracy (Autonomous)	<ul style="list-style-type: none"> <2.5m CEP @-130 dBm
Max Update Rate	<ul style="list-style-type: none"> Up to 10Hz, 1Hz by fault
Accuracy of 1PPS Signal	<ul style="list-style-type: none"> not enabled
Acceleration Accuracy	<ul style="list-style-type: none"> Without aid: 0.1m/s²
Dynamic Performance	<ul style="list-style-type: none"> Maximum altitude: 18,000m Maximum velocity: 515m/s Acceleration: 4G
UART Port	<ul style="list-style-type: none"> UART Port: TXD and RXD Supports baud rate from 4800bps to 115200bps, 9600bps by default UART port for NMEA and UBX output, binary or ublox proper Agreement input
Temperature Range	<ul style="list-style-type: none"> Normal operation: -40°C ~ +85°C Storage temperature: -45°C ~ +125°C
Physical Characteristics	<ul style="list-style-type: none"> Size: 25.5±0.50 × 25.5±0.50 × 8.7±0.20mm Weight: Approx.10g

1.2 Power Supply

Regulated power for the GAM-2525-UB8X is required. The VCC Pin Need a stable DC voltage supply. Power supply ripple must be less than 30mV. The input voltage Vcc should be 3.0V~5.0V, Recommended power supply voltage is 3.3V . maximum current is 40mA. Suitable decoupling must be provided by external decoupling circuitry.

1.3 UART Ports

The module supports two full duplex serial channels UART. All serial connections are at 3V CMOS logic levels, if need different voltage levels, use appropriate level shifters. The baud rate of both serial ports are fully programmable, the data format is however fixed: X, N, 8, 1, i.e. X baud rate, no parity, eight data bits and one stop bit, no other data formats are supported, LSB is sent first. The modules default baud rate is set up 9600bps, however, the user can change the default baud rate to any value from 4800 bps to 115kbps. UART port can be used for firmware upgrade, NMEA output and ublox proprietary commands input.

2 Application

The module is equipped with a 4-pin 1.25mm distance Connector that connects to your application platform. The GAM-2525-UB8X module It consists of a ublox M8 single chip GNSS IC which includes the RF part and Baseband part, a patch antenna, a LNA, a SAW filter, a TCXO, a crystal oscillator, Also comes with a 0.22F crystal capacitor ,can backup satellite ephemeris about 2 hour.

2.1. Pin Assignment

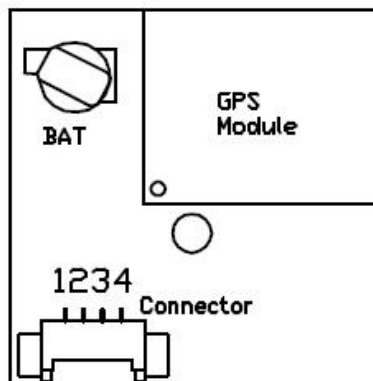


Figure 2: Connector Pin Assignment

CON Pin Description

Pin No.	Pin name	I/O	Description	Remark
1	VCC	I	Module Power Supply	Voltage range: 3.0V~5.0V
2	TXD	O	UART Serial Data Output	
3	RXD	I	UART Serial Data Input	
4	GND	G	Ground	

2.2 Mechanical Dimensions

This chapter describes the mechanical dimensions of the GAM-2525-UB8X module. Size unit (mm)

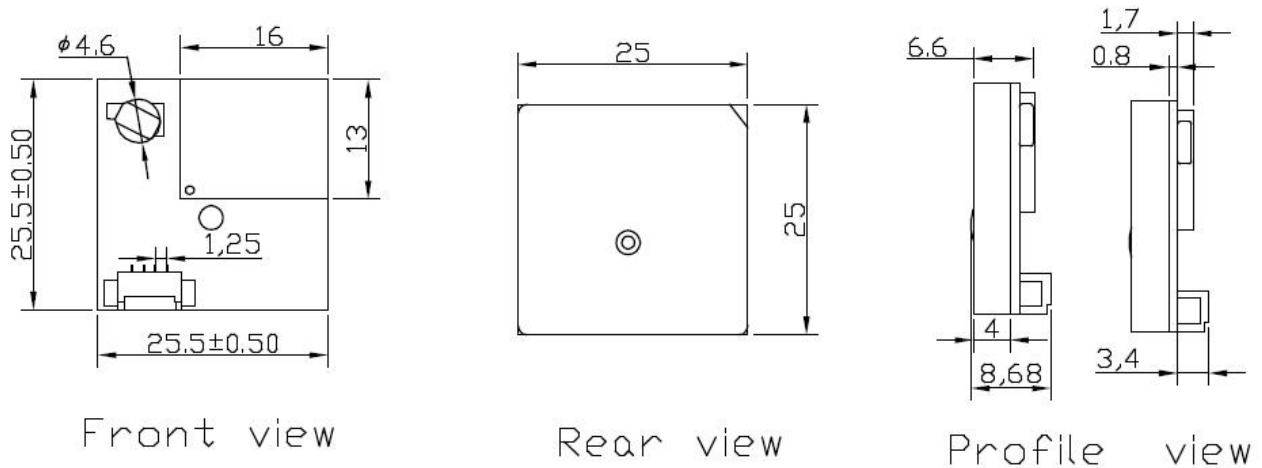


Figure 3: Specification size chart

3 Configuration instruction Explain

The module supports the commonly used commands in configuration, The following table describes some of the parameters of the UART port configuration command, baud rate setting: NMEA data refresh rate is set, the NMEA statement output set, positioning mode setting etc.

The Module power up initialization requires 300ms, Please send the sixteen system from CPU via serial port.

Baud rate configuration command:

Common commands	Instructions
Cold star	B5 62 06 04 04 00 FF FF 02 00 0E 61
Hot start	B5 62 06 04 04 00 00 00 02 00 10 68
Reset	B5 62 06 04 04 00 FF 87 01 00 95 F7
Restore factory settings	B5 62 06 09 0D 00 FF FF 00 00 00 00 00 00 FF FF 00 00 07 1F 9E
Save configuration	B5 62 06 09 0D 00 00 00 00 00 FF FF 00 00 00 00 00 00 17 31 BF
Baud rate is 4800bps	b5 62 06 00 14 00 01 00 00 00 d0 08 00 00 c0 12 00 00 07 00 07 00 00 00 00 00 d3 fc b5 62 06 00 01 00 01 08 22
Baud rate is 9600bps	b5 62 06 00 14 00 01 00 00 00 d0 08 00 00 80 25 00 00 07 00 07 00 00 00 00 00 a6 cd b5 62 06 00 01 00 01 08 22
Baud rate is 38400bps	b5 62 06 00 14 00 01 00 00 00 d0 08 00 00 96 00 00 07 00 07 00 00 00 00 00 97 a8 b5 62 06 00 01 00 01 08 22
Baud rate is 115200bps	b5 62 06 00 14 00 01 00 00 00 d0 08 00 00 c2 01 00 07 00 07 00 00 00 00 00 c4 96 b5 62 06 00 01 00 01 08 22
NMEA data refresh rate is 1Hz	B5 62 06 08 06 00 E8 03 01 00 01 00 01 39
NMEA data refresh rate is 2Hz	B5 62 06 08 06 00 F4 01 01 00 01 00 0B 77
NMEA data refresh rate is 4Hz	B5 62 06 08 06 00 FA 00 01 00 01 00 10 96
NMEA data refresh rate is 5Hz	B5 62 06 08 06 00 C8 00 01 00 01 00 DE 6A B5 62 06 08 00 00 0E 30
NMEA data refresh rate is 10Hz	B5 62 06 08 06 00 64 00 01 00 01 00 7A 12 B5 62 06 08 00 00 0E 30

NMEA statement content output configuration:

Statement conten	Instructions
Close GGA OutPut	24 45 49 47 50 51 2c 47 47 41 2a 32 37 0d 0a b5 62 06 01 03 00 f0 00 00 fa 0f
Close GLL OutPut	24 45 49 47 50 51 2c 47 4c 4c 2a 32 31 0d 0a b5 62 06 01 03 00 f0 01 00 fb 11
Close GSA OutPut	24 45 49 47 50 51 2c 47 53 41 2a 33 33 0d 0a b5 62 06 01 03 00 f0 02 00 fc 13
Close GSV OutPut	24 45 49 47 50 51 2c 47 53 56 2a 32 34 0d 0a b5 62 06 01 03 00 f0 03 00 fd 15
Close RMC OutPut	24 45 49 47 50 51 2c 52 4d 43 2a 33 41 0d 0a b5 62 06 01 03 00 f0 04 00 fe 17
Close VTG OutPut	24 45 49 47 50 51 2c 56 54 47 2a 32 33 0d 0a b5 62 06 01 03 00 f0 05 00 ff 19
Open GGA OutPut	24 45 49 47 50 51 2c 47 47 41 2a 32 37 0d 0a b5 62 06 01 03 00 f0 00 01 fb 10
Open GLL OutPut	24 45 49 47 50 51 2c 47 4c 4c 2a 32 31 0d 0a b5 62 06 01 03 00 f0 01 01 fc 12
Open GSA OutPut	24 45 49 47 50 51 2c 47 53 41 2a 33 33 0d 0a b5 62 06 01 03 00 f0 02 00 fc 13
Open GSV OutPut	24 45 49 47 50 51 2c 47 53 56 2a 32 34 0d 0a b5 62 06 01 03 00 f0 03 00 fd 15
Open RMC OutPut	24 45 49 47 50 51 2c 52 4d 43 2a 33 41 0d 0a b5 62 06 01 03 00 f0 04 00 fe 17
Open VTG OutPut	24 45 49 47 50 51 2c 56 54 47 2a 32 33 0d 0a b5 62 06 01 03 00 f0 05 00 ff 19
GSV 5S Output once	B5 62 06 01 08 00 F0 03 00 05 00 00 00 00 07 51
Output only RMC	B56206010300F00100FB11B56206010300F00200FC13B56206010300F00300FD1 5B56206010300F00500FF19B56206010300F00000FA0F

Positioning system switch command:

The module supports Varied work mode of instruction configuration, each mode corresponding to the Configuration instruction such as Table.

Pattern	Instructions
GPS	B5 62 06 3E 24 00 00 00 16 04 00 04 FF 00 00 00 00 00 01 01 03 00 00 00 00
GLONASS	00 05 00 03 00 00 00 00 00 06 08 FF 00 01 00 00 00 A0 D9 B5 62 06 3E 00 00 42 D2 B5 62 06 17 0C 00 00 23 00 02 00 00 00 00 01 00 00 00 4F F8
BeiDou	B5 62 06 3E 2C 00 00 00 20 05 00 08 10 00 00 00 01 01 01 01 03 00 00 00 01 01 03 08 10 00 01 00 01 01 05 00 03 00 00 00 01 01 06 08 0E 00 00 00 01 01 FC 01 B5 62 06 17 0C 00 00 23 00 02 00 00 00 00 01 00 00 00 4F F8
BeiDou+GLONASS	B5 62 06 3E 2C 00 00 00 16 05 00 04 FF 00 00 00 01 01 01 01 03 00 00 00 01 01 03 08 10 00 01 00 01 01 05 00 03 00 00 00 01 01 06 08 FF 00 01 00 01 01 CF E5 B5 62 06 17 0C 00 00 23 00 02 00 00 00 00 01 00 00 00 4F F8
GPS+QZSS+Beidou	Enable SBAS: B5 62 06 3E 2C 00 00 00 20 05 00 08 10 00 01 00 01 01 01 01 03 00 01 00 01 01 03 08 10 00 01 00 01 01 05 00 03 00 01 00 01 01 06 08 0E 00 00 00 01 01 FF 4D B5 62 06 17 0C 00 00 23 00 02 00 00 00 00 01 00 00 00 4F F8
	Disable SBAS: B5 62 06 3E 2C 00 00 00 20 05 00 08 10 00 01 00 01 01 01 01 03 00 00 00 01 01 03 08 10 00 01 00 01 01 05 00 03 00 01 00 01 01 06 08 0E 00 00 00 01 01 FE 31 B5 62 06 17 0C 00 00 23 00 02 00 00 00 00 01 00 00 00 4F F8
GPS+QZSS+GLONASS	Enable SBAS: B5 62 06 3E 2C 00 00 00 20 05 00 08 10 00 01 00 01 01 01 01 03 00 01 00 01 01 03 08 10 00 00 00 01 01 05 00 03 00 01 00 01 01 06 08 0E 00 01 00 01 01 FF 3D B5 62 06 17 0C 00 00 23 00 02 00 00 00 00 01 00 00 00 4F F8
	Disable SBAS: B5 62 06 3E 2C 00 00 00 20 05 00 08 10 00 01 00 01 01 01 01 03 00 00 00 01 01 03 08 10 00 00 00 01 01 05 00 03 00 01 00 01 01 06 08 0E 00 01 00 01 01 FE 21 B5 62 06 17 0C 00 00 23 00 02 00 00 00 00 01 00 00 00 4F F8

4 NMEA 0183 Protocol

The NMEA protocol is an ASCII-based protocol, Records start with a \$ and with carriage return/line feed. GNSS specific messages all start with \$GPxxx/\$BDxxx where \$GNxxx is a three-letter identifier of the message data that follows. NMEA messages have a check sum, which allows detection of corrupted data transfers.

The module supports a variety of single system positioning as well as multi system positioning, Each mode and the corresponding NMEA such as *Table 1*.

Table 1: NMEA-0183 Output Messages

NMEA Record	DESCRIPTION
BD only mode NMEA Out Put: GBRMC.GBGGA.GBGSV.GBGSA.GBGLL.GBVTG	
GPS only mode NMEA Out Put: GPRMC.GPGGA.GPGSV.GPGSA.GPGLL.GPVTG	
Galileo only mode NMEA Out Put: GARMC.GAGGA.GAGSV.GAGSA.GAGLL.GAVTG	
GLONASS only mode NMEA Out Put: GLRMC.GLGGA.GLGSV.GLGSA.GLGLL.GLVTG	
GPS+BD only mode NMEA Out Put: GNRMC.GNGGA.GPGSV.GBGSV.GNGSA.GNGSA.GNGLL.GNVTG	
GPS+GLONASS only mode NMEA Out Put: GNRMC.GNGGA.GPGSV.GLGSV.GNGSA.GNGSA.GNGLL.GNVTG	
GPS+Galileo only mode NMEA Out Put: GNRMC.GNGGA.GPGSV.GAGSV.GNGSA.GNGSA.GNGLL.GNVTG	

- ✧ The Gotop GAM-2525-UB8X Initialization location mode for GPS+GLONASS dual mode,
Output data: \$GNRMC.\$GNGGA.\$GPGSV.\$GLGSV.\$GNGSA.\$GNGSA.\$GNGLL.\$GNVTG

4.1 GGA-Global Positioning System Fixed Data

\$xxGGA,161229.487,3723.24751,N, 12158.34160,W, 1,07,1.0,9.0,M.0000*18

Table 2: GGA Data Format

Name	Example	Units	Description
Message ID	\$xxGGA		GGA protocol header
UTC Position	161229.487		hhmmss.sss
Latitude	3723.24571		ddmm.mmmmm
N/S indicator	N		N=north or S=south

Longitude	12158.34160		dddmm.mmmmm
E/W Indicator	W		E=east or W=west
Position Fix Indicator	1		See Table 2-1
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude	9.0	meters	
Units	M	meters	
Geoids Separation		meters	
Units	M	meters	
Age of Diff.Corr.		second	Null fields when DGPS is not Used
Diff.Ref.Station ID	0000		
Check sum	*18		
<CR> <LF>			End of message termination

Table 2-1: Position Fix Indicators

Value	Description
0	Fix not available or invalid
1	GPS SPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
3	GPS PPS Mode, fix valid

4.2 GLL-Geographic Position – Latitude/Longitude

\$xxGLL , 3723.24755, N,12158.34161, W,161229.487, A*2C.

Table 3: GLL Data Format

Name	Example	Units	Description
Message ID	\$xxGLL		GLL protocol header
Latitude	3723.24755		ddmm.mmmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.34161		dddmm.mmmmm
E/W Indicator	W		E=east or W=west
UTC Position	161229.487		hhmmss.sss

Status	A		A=data valid or V=data not valid
Check sum	*2C		
<CR> <LF>			End of message termination

4.3 GSA-GNSS DOP and Active Satellites

\$xxGSA , A, 3, 07, 02, 26,27, 09, 04,15, , , , , , 1.8,1.0,1.5*33.

Table 4: GSA Data Format

Name	Example	Units	Description
Message	\$xxGSA		GSA protocol header
Mode 1	A		See Table 4-2
Mode 2	3		See Table 4-1
Satellite Used	07		Sv on Channel 1
Satellite Used	02		Sv on Channel 2
...
Satellite Used			Sv on Channel 12
PDOP	1.8		Position Dilution of Precision
HDOP	1.0		Horizontal Dilution of Precision
VDOP	1.5		Vertical Dilution of Precision
Check sum	*33		
<CR> <LF>			End of message termination

Table 4-1: Mode 1

Value	Description
1	Fix not available
2	2D
3	3D

Table 4-2: Mode 2

Value	Description
M	Manual-forced to operate in 2D or 3D mode
A	Automatic-allowed to automatically switch 2D/3D

4.4 GSV-GNSS Satellites in View

\$xxGSV , 2, 1, 07, 07, 79,048, 42, 02, 51,062, 43, 26, 36,256, 42, 27, 27, 138,42*71
 \$xxGSV, 2, 2, 07, 09, 23,313, 42, 04, 19, 159, 41, 15,12,041, 42*41.

Table 5: GGA Data Format

Name	Example	Units	Description
Message ID	\$xxGSV		GSV protocol header
Number of Message	2		Range 1 to 3
Message Number	1		Range 1 to 4
Satellites in View	07		
Satellite ID	07		Channel 1(Range 1 to 32)
Elevation	79	degrees	Channel 1(Maximum 90)
Azinmuth	048	degrees	Channel 1(True, Range 0 to 359)
SNR(C/NO)	42	dBHz	Range 0 to 99,null when not tracking
...			...
Satellite ID	27		Channel 4(Range 1 to 32)
Elevation	27	degrees	Channel 4(Maximum 90)
Azimuth	138	degrees	Channel 4(True, Range 0 to 359)
SNR(C/NO)	42	dBHz	Range 0 to 99, null when not tracking
Check sum	*71		
<CR> <LF>			End of message termination

Depending on the number of satellites tracked multiple messages of GSV data may be required.

4.5 RMC-Recommended Minimum Specific GNSS Data

\$xxRMC, 161229.487, A, 3723.24751, N, 12158.34161, W, 0.13,309.62, 120598,, *10

Table 6: RMC Data Format

Name	Example	Units	Description
Message ID	\$xxRMC		RMC protocol header
UTS Position	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	3723.24751		ddmm.mmmmm

N/S Indicator	N		N=north or S=south
Longitude	12158.34161		dddmm.mmmmm
E/W Indicator	W		E=east or W=west
Speed Over Ground	0.13	Knots	
Course Over	309.62	Degrees	True
Ground			
Date	120598		dummy
Magnetic variation		Degrees	E=east or W=west
Check sum	*10		
<CR> <LF>			End of message termination

4.6 VTG-Course Over Ground and Ground Speed

\$xxVTG, 309.62, T, M, 0.13, N, 0.2, K*6E

Table 7: VTG Data Format

Name	Example	Units	Description
Message ID	\$xxVTG		VTG protocol header
Course	309.62	Degrees	Measured heading
Reference	T		True
Course		Degrees	Measured heading
Reference	M		Magnetic
Speed	0.13	Knots	Measured horizontal speed
Units	N		Knots
Speed	0.2	Km/hr	Measured horizontal speed
Units	K		Kilometer per hour
Check sum	*6E		
<CR> <LF>			End of message termination

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