General Description

The Gotop GAM-2107-SN is a complete GPS engine module that features super sensitivity, ultra low power and small form factor. The GPS signal is applied to the antenna input of module, and a complete serial data message with position, velocity and time information is presented at the serial interface with NMEA protocol or custom protocol.

Its –165dBm tracking sensitivity extends positioning coverage into place like urban canyons and dense foliage environment where the GPS was not possible before. The small form factor and low power consumption make the module easy to integrate into portable device like PNDs, mobile phones, cameras and vehicle navigation systems.

Figure1: GAM-2107-SN Top View

Applications

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

Features

- Build on high performance, low-power SONY CXD-5603GF chip set
- Ultra high Track sensitivity: -165dBm
- Extremely fast TTFF at low signal level
- Built in high gain LNA
- Low power consumption: Max 8.5mA@3.3V
- NMEA-0183 compliant protocol or custom protocol
- Operating voltage: 2.8V to 5.5V
- Operating temperature range:-40 to 85℃
- Patch Antenna Size: 20x6x3.8mm
- Module Size: 21x7x6.53mm
- Communication type: UART/TTL
- RoHS compliant (Lead-free)

1 Description

1.1. Key Features

Parameter	Specification
Power Supply	• Supply voltage: 2.8V~5.5V Typical: 3.3V
Power Consumption	• Acquisition: 8.5mA @VCC=VBAT=3.3V • Tracking: 6.5mA @VCC=VBAT=3.3V • Idel mode: 3mA @VCC=VBAT=3.3V
Receiver Type	• Code 66 search channels, GPS&QZSS L1 1575.42MHz C/A • 22 simultan ous tracking channels
Sensitivity	• Tracking: -165dBm • Re-acquisition: -156dBm • Acquisition: -148dBm
TTFF (Autonomous)	• Cold start: 35s typ @-130dBm • Warm start : 30s typ @-130dBm • Hot start : 1s typ @-130dBm
Horizontal Position Accuracy (Autonomous)	• <2.5m CEP @-130 dBm
Update Rate	• 1Hz
Accuracy of 1PPS Signal	• Typical accuracy: ±10ns, Time pulse width: 100ms
Acceleration Accuracy	• Without aid: 0.1m/s²
Dynamic Performance	• Maximum altitude: 18,000m • Maximum velocity: 515m/s • Acceleration: 4G
UART Port	• UART Port: TXD and RXD • Supports baud rate from 4800bps to 115200bps,115200bps by default • UART port is used for NMEA output, SONY proprietary commands input
Temperature Range	• Normal operation: -40°C ~ +85°C • Storage temperature: -45°C ~ +125°C
Physical Characteristics	• Size: 21.0±0.50 ×7.0±0.50 ×6.53±0.50mm • Weight: Approx. 2.9g

1.2 Power Supply

Regulated power for the GAM-2107-SN 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 2.8V~5.5V, Recommended power supply voltage is 3.3V . maximum current is 8.5 mA. 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 115200bps, 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 SONY proprietary commands input.

2 Application

The module is equipped with a 5-pin pad that connects to your application platform. The GAM-2107-SN module It consists of a SONY CXD5603GF single chip GPS IC which includes the RF part and Baseband part, a patch antenna, a LNA, a SAW filter, a TCXO, a crystal oscillator.

2.1. Pin Assignment

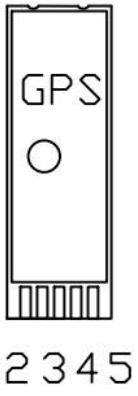


Figure 2: Pin Assignment

CON Pin Description

Pin No.	Pin name	I/O	Description	Remark
1	PPS	O	One pulse per second	
2	TXD	O	UART Serial Data output	
3	RXD	I	UART Serial Data Input	
4	VCC	I	Module Power Supply	Voltage range: 2.8V~5.5V
5	GND	G	Ground	

2.3 Mechanical Dimensions

This chapter describes the mechanical dimensions of the GAM-2107-SN module. Size unit（mm）

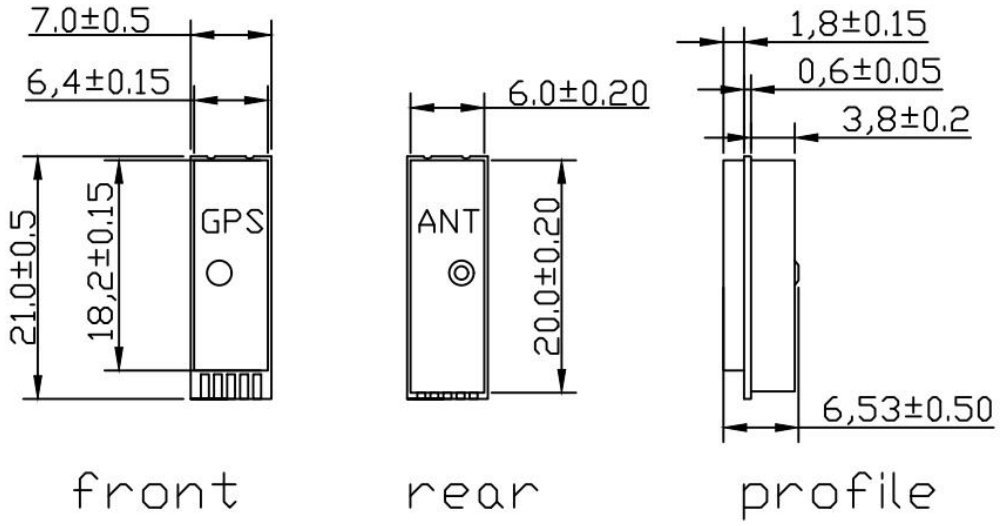


Figure 3: Specification size chart

2.4 Command specifications

the GAM-2107-SN module is to open the work by sending the command, and to implement any of the features.

2.4.1 @GCD：Cold start

This command is used to start the positioning with cold start

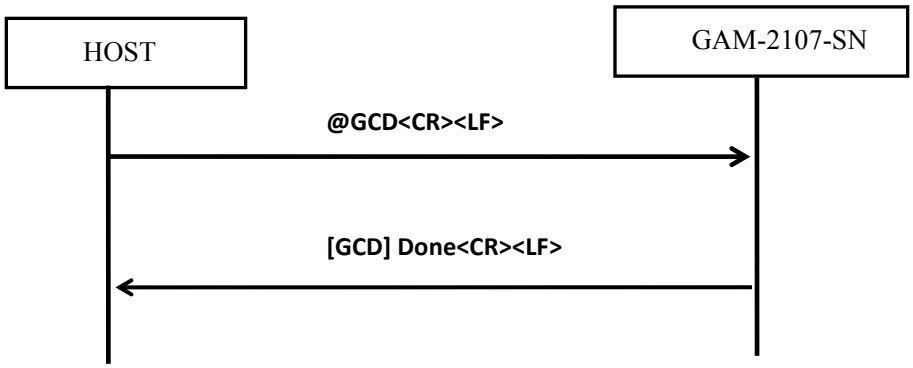
Format: @GCD<CR><LF>

Argument: None

Response:

Sentence	Description
“[GCD] Done”	This indicates that the command has been executed successfully.
“[GCD] Err n”	This indicates that an error has occurred. “n” is where the error code is entered.

Sequence:



2.4.2 @BUP: Backup data save

This command is used to save the backup data. The backup data contents are saved in the flash memory.

The backup data saved in the flash memory is automatically restored at boot-up from power OFF.

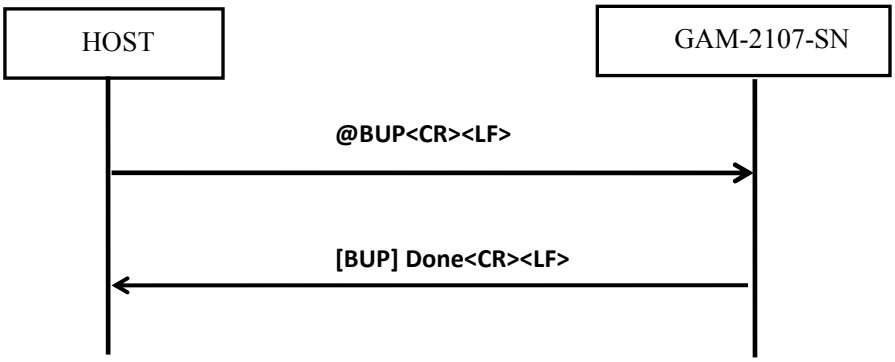
The receiver position, ephemeris, almanac, TCXO offset and other information required for hot start are included in the backup data, and by saving the backup data in the flash memory using this command, hot start can be initiated when the system is booted from power OFF. (The time must be injected.)

Format: @BUP<CR><LF>

Argument: None
Response:

Sentence	Description
“[BUP] Done”	This indicates that the command has been executed successfully.
“[BUP] Err n”	This indicates that an error has occurred.

Sequence:



2.4.3 @GPPS: 1PPS output setting

This command is used to control 1PPS output.
When 1PPS output is enabled, timing pulse is output in 1 sec period from 1PPS output port after clock information being received from GNSS. When 1PPS output is disabled, timing pulse is not output from 1PPS output port.

Format: @GPPS <arg 1><CR><LF>
Argument: None

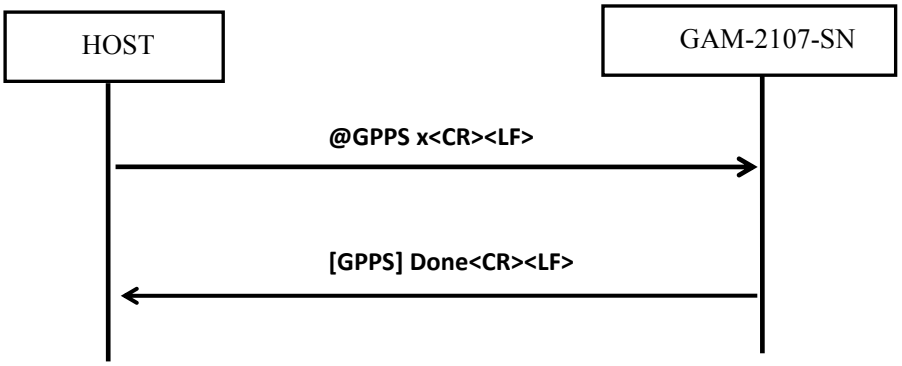
Argument:

Field	Description
arg 1	1PPS output control 0 : Disable 1PPS output (default value) 1 : Enable 1PPS output

Response:

Sentence	Description
“[GPPS] Done”	This indicates that the command has been executed successfully.
“[GPPS] Err n”	This indicates that an error has occurred. “n” is where the error code is entered.

Sequence:



3 NMEA 0183 Protocol

The NMEA protocol is an ASCII-based protocol, Records start with a $ and with carriage return/line feed. GPS specific messages all start with $GPxxx where xxx 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 GAM-2107-SN supports the following NMEA-0183 messages: $GPGSA, $GPGSV,$GPRMC,$GPVTG, $GPZDA and $GPGLL.

3.1 NMEA-0183 Output Messages

NMEA Record	DESCRIPTION
GGA	Global positioning system fixed data
GLL	Geographic position—latitude/longitude
GSA	GNSS DOP and active satellites
GSV	GNSS satellites in view
RMC	Recommended minimum specific GNSS data
VTG	Course over ground and ground speed
ZDA	Time and date information

3.1.1 GGA : Global Positioning System Fix Data

$GPGGA, 161229.487,3723.2475,N, 12158.3416,W, 1,07,1.0,9.0,M.0000*18

Fields:

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Position	161229.487		hhmmss.sss
Latitude	3723.2457		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Position Fix Indicator	1		See Table 1-1
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 1-1: 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

3.1.2 GLL : Geographic Position – Latitude / Longitude

$GPGLL , 3723.2475, N,12158.3416, W,161229.487, A*2C.

Fields:

Name	Example	Units	Description
Message ID	$GPGLL		GLL protocol header
Latitude	3723.2475		ddmm.mmmm

N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
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 temination

3.1.3 GSA-GNSS DOP and Active Satellites

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

Fields:

Name	Example	Units	Description
Message	$GPGSA		GSA protocol header
Mode 1	A		See Table 1-2
Mode 2	3		See Table 1-3
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 1-2: Mode 1

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

Table 1-3: Mode 2

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

3.1.4 GSV-GNSS Satellites in View

$GPGSV , 2, 1, 07, 07, 79,048, 42, 02, 51,062, 43, 26, 36,256, 42, 27, 27, 138,42*71

$GPGSV, 2, 2, 07, 09, 23,313, 42, 04, 19, 159, 41, 15,12,041, 42*41.

Fields:

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Message	2		Range 1 to 3
Message Number	1		Range 1 to 3
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.

3.1.6 RMC: Recommended Minimum Specific GNSS Data

Format : $--RMC,hhmmss.ss,A,llll.ll,a,yyyyy.yy,a,x.x,x.x,xxxxxx,x.x,a,a,a*hh<CR><LF>

Fields:

Field	Format	Description
Header	$	
Talker ID	--	GP : Using only GPS for positioning GL : Using only GLONASS for positioning QZ : Using only QZS for positioning GN : Using combined satellite systems for positioning
Sentence ID	RMC	
UTC of position fix	hhmmss.ss	hh [hour] mm [min] ss.ss [sec]
Status	A	A : Data valid, V : Data not valid

Latitude	llll.ll	dd [degree] mm.mmmm [min]
Latitude – N/S	a	N : North latitude, S : South latitude
Longitude	yyyyy.yy	ddd [degree] mm.mmmm [min]
Longitude – E/W	a	E : East longitude, W : West longitude
Speed over ground	x.x	[knot]
Course over ground	x.x	[degree]
Date	xxxxxx	dd [day] mm [month] yy [year]
Magnetic variation	x.x	[degree]
Magnetic variation – E/W	a	E : East, W : West
Mode Indicator	a	A : Autonomous mode D : Differential mode E : Dead reckoning mode N : Data not valid
Checksum	*hh	
Termination	<CR><LF>	

3.1.7 VTG: Course Over Ground & Ground Speed

Format : $--VTG,x.x,T,x.x,M,x.x,N,x.x,K,a*hh<CR><LF>

Fields:

Field	Format	Description
Header	$	
Talker ID	--	GP : Using only GPS for positioning GL : Using only GLONASS for positioning QZ : Using only QZS for positioning GN : Using combined satellite systems for positioning
Sentence ID	VTG	
Course over ground - True	x.x,T	[degrees]
Course over ground - Magnetic	x.x,M	NULL
Speed over ground	x.x,N	[knot]
Speed over ground	x.x,K	[km/h]
Mode Indicator	a	A : Autonomous mode D : Differential mode E : Dead reckoning mode N : Data not valid
Checksum	*hh	
Termination	<CR><LF>	

3.1.8 ZDA: Time & Date

Format : $--ZDA,hhmmss.ss,xx,xx,xxxx,xx,xx*hh<CR><LF>

Fields :

Field	Format	Description
Header	$	
Talker ID	--	GP : Using only GPS for positioning GL : Using only GLONASS for positioning QZ : Using only QZS for positioning GN : Using combined satellite systems for positioning
Sentence ID	ZDA	
UTC	hhmmss.ss	hh [hour] mm [min] ss.ss [sec]
Day	xx	
Month	xx	
Year	xxxx	
Local zone hours	xx	NULL
Local zone minutes	xx	NULL
Checksum	*hh	
Termination	<CR><LF	

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