RGM-3316 User Manual

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1 Introduction

RoyalTek RGM-3316 is a smart antenna GPS module (patch antenna embedded). The smart antenna GPS module is powered by SiRF Star III technology and RoyalTek proprietary navigation algorithm that providing you more stable navigation data. The excellent sensitivity of RGM-3316 gets the great performance when going though the urban canyon and foliage.

Product Features

- ✧ 20 parallel channels.
- ✧ -159 dBm high GPS sensitivity.
- ✧ TCXO design.
- ✧ GPS status light output.
- ✧ NMEA-0183 compliant protocol/custom protocol.
- ✧ Enhanced algorithm for navigation stability
- ✧ SBAS (WAAS, EGNOS and MSAS) support and the default SBAS is enable
- ✧ Lead-Free
- ✧ Backup battery (installed)

1.1 Product applications

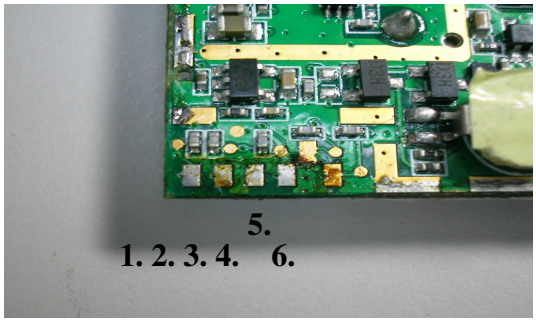
- ✧ Personal Navigation Device including GPS PDA and GPS Handheld
- ✧ GPS receiver including GPS mouse and Bluetooth GPS receiver
- ✧ Personal positioning and navigation
- ✧ Marine navigation
- ✧ Timing application

1.2 Product Picture

RGM-3316

Top

Bottom



Pin 6	green	BOOT
Pin 5	blue	GPS Status
Pin 4	red	VCC
Pin 3	black	GND
Pin 2	yellow	TX
Pin 1	white	RX

Figure 1-1 RGM-3316

1.3 RGM-3316 Series Block Diagram

System block diagram description:

a. Patch antenna with 1 Stage LNA
b. 4Mega bits flash memory on chip
c. 6pin I/O pin

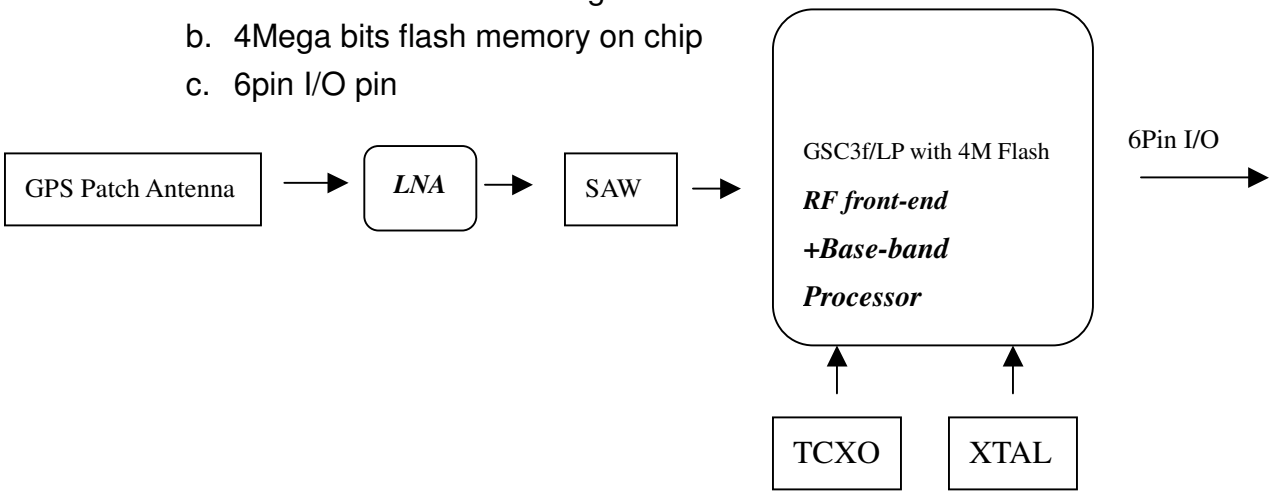


Figure 1-2 System Block Diagram

1.4 RGM-3316 Technique Specification

Impedance：50Ω

Table 1-1 Technical Specifications

No	Function	Specification
GPS receiver		
1	Chipset	SiRF GSC3f/LP
2	Frequency	L1 1575.42MHz.
3	Code	C.A. Code.
4	Channels	20.
5	Chipset Sensitivity	-159dBm
6	Chipset cold start	35 sec @ open sky
7	Chipset warm start	35 sec @ open sky
8	Chipset hot start	1 sec @ open sky
9	Reacquisition	0.1sec typical
10	Position accuracy	10meters at 2D RMS.
11	Maximum altitude	18000 m
12	Maximum velocity	514 m/s
13	Trickle power mode	Duty cycle ≦ 34%. (Variable)
14	Update rate	Continuous operation: 1Hz
17	Testability	It shall be able to be tested by SiRF test mode IV and single channel simulator.
18	Protocol setup	It shall store the protocol setup in the SRAM memory.
Interface Description		
19	I/O Pin	Pin1:RX Pin2:TX Pin3:GND Pin4:VCC Pin5:GPS status Pin6: BOOT
Mechanical requirements		
20	Dimension	30 ± 0.3 x 30 ± 0.3 x 8.0 ± 0.3 mm
21	Weight	15±1g
Power consumption		
22	Vcc	3.3V
23	Current	55mA (typical)
24	SRAM backup battery	3.3mAhr Li-Ion rechargeable battery. Battery life at full charge is ≥ 7 days.
Environment		
25	Operating temperature	-40 ~ +85 ℃ (w/o backup battery)

26	Storage temperature	-40 ~ +85 ℃
27	Humidity	≦95%

1.5 RGM-3316 Hardware Interface

(VDD=2.85V±2%)

Pin #	Signal Name	I/O	Description	**Characteristics**
1	RX	I	UART	TTL: $V_{IH} \geq 0.7*VDD$ $V_{IL} \leq 0.3*VDD$ RS-232 $V_{IH} \geq 2.4V$ $V_{IL} \leq 0.6V$
2	TX	O	UART	TTL: $V_{OH} \geq 0.75*VDD$ $V_{OL} \leq 0.25VDD$ RS-232 $V_{OH} \geq 5V$ $V_{OL} \leq -5V$
3	GND	G	System Power Ground	Reference Ground
4	VCC	I	System Power	VCC:5V±5%
5	GPS status	O	GPS Status	$V_{OH} \geq 0.75*VDD$ $V_{OL} \leq 0.25VDD$
6	Boot	I	Boot mode	$V_{IH} \geq 0.7*VDD$ $V_{IL} \leq 0.3*VDD$

- ***VCC(3.3V DC power Input)***

  This is the main DC power supply input pin. That provides voltage to the module.

- ***GND***

  GND provides the reference ground

- ***RXA***

  This is the main receiver channel and is used for receiving software commands to the board from SiRFdemo software or software written by users themselves.

  PS: Pull up if not used.

- ***TXA***

  This is the main transmitting channel and is used for outputting navigation and measurement data for SiRFdemo software or software written by users themselves.

- ***Status***

  GPS Status Pin can be connected to a LED to indicate the status of GPS signal

  1. Solid: Power ON/ Tracking for Satellite
  2. Blinking: 3D Fix Found

- ***Boot***

  Set this pin to high for programming flash.

2 Software Interface

2.1 NMEA V3.0 Protocol

Its output signal level is TTL: 4800 bps (default), 8 bit data, 1 stop bit and no parity. It supports the following NMEA-0183

Messages: GGA, GLL, GSA, GSV, RMC and VTG.

NMEA Output Messages: the Engine board outputs the following messages as shown in Table 2-1:

Table 2-1 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

2.1.1 GGA-Global Positioning System Fixed Data

Table 2-2 contains the values of the following example:

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

Table 2-2 GGA Data Format

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Position	161229.487		hhmmss.sss
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
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	

Geoid Separation		meters	
Units	M	meters	
Age of Diff. Corr.		second	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
Checksum	*18		
＜CR＞＜LF＞			End of message termination

Table 2-3 Position Fix Indicators

Value	Description
0	Fix not available or invalid
1	GPS SPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
3-5	Not Supported GPS PPS Mode, fix valid
6	Dead Reckoning Mode, fix valid

2.1.2 GLL-Geographic Position –Latitude/Longitude

Table 2-4 contains the values of the following

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

Table 2-4 GLL Data Format

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.ss
Status	A		A=data valid or V=data not valid
Mode	A		A=Autonomous, D=DGPS, E=DR
Checksum	*2C		
＜CR＞＜LF＞			End of message termination

2.1.3 GSA-GNSS DOP and Active Satellites

Table 2-5 contains the values of the following example:

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

Table 2-5 GSA Data Format

Name	Example	Units	Description
Message ID	$GPGSA		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
Checksum	*33		
<CR><LF>			End of message termination

Table 2-6 Mode 1

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

Table 2-7 Mode 2

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

2.1.4 GSV-GNSS Satellites in View

Table 2-8 contains the values of the following example:

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

Table 2-8 GGA Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Messages[1]	2		Range 1 to 3
Messages Number[1]	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)
Azimuth	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
Checksum	*71		
＜CR＞＜LF＞			End of message termination

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

2.1.5 RMC-Recommended Minimum Specific GNSS Data

Table 2-9 contains the values of the following example:

$GPRMC, 161229.487, A, 3723.2475, N, 12158.3416, W, 0.13, 309.62, 120598, ,*10

Table 2-9 GGA Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Position	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
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
Speed Over Ground	0.13	knots	

Course Over Ground	309.62	degrees	True
Date	120598		ddmmyy
Magnetic Variation		degrees	E=east or W=west
Mode	A		A=Autonomous, D=DGPS, E=DR
Checksum	*10		

2.1.6 VTG-Course Over Ground and Ground Speed

Table 2-10 contains the values of the following example:

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

Table 2-10 VTG Data Format

Name	Example	Units	Description
Message ID	$GPVTG		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
Mode	A		A=Autonomous, D=DGPS, E=DR
Checksum	*6E		
＜CR＞＜LF＞			End of message termination

3 GPS Receiver User's Tip

A. GPS signal will be affected by weather and environment conditions, thus suggest to use the GPS receiver under less shielding environments to ensure GPS receiver has better receiving performance.

B. When GPS receiver is moving, it will prolong the time to fix the position, so suggest to wait for the satellite signals to be locked at a fixed point when first power-on the GPS receiver to ensure to lock the GPS signal at the shortest time.

C. The following situation will affect the GPS receiving performance:
   i. Solar control filmed windows.
   ii. Metal shielded, such as umbrella, or in vehicle.
   iii. Among high buildings.
   iv. Under bridges or tunnels.
   v. Under high voltage cables or near by radio wave sources, such as mobile phone base stations.
   vi. Bad or heavy cloudy weather.

D. If the satellite signals can not be locked or encounter receiving problem (while in the urban area), the following steps are suggested:
   i. Please plug the external active antenna into GPS receiver and put the antenna on outdoor or the roof of the vehicle for better receiving performance.
   ii. Move to another open space or reposition GPS receiver toward the direction with less blockage.
   iii. Move the GPS receiver away from the interferences resources.
   iv. Wait until the weather condition is improved.

E. While a GPS with a backup battery, the GPS receiver can fix a position immediately at next power-on if the build-in backup battery is full-recharged.

3.1 Package Specification

Shipment Method: Industry package

4 Contact Information Section

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5 Revision History

Title	RGM-3316 GPS Receiver Module		
Doc Type	User Manual		
Revision Number	Date	Author	Change notice
1.0	2007/12/25	Amy Liu	Initial Release