RSA-1500L User Manual

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RSA-1500L User Manual

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1   Introduction

RoyalTek RSA-1500L low power and small form factor board is the newest generation of RoyalTek smart antenna GPS module. The smart antenna GPS module is powered by SiRF Star III technology and RoyalTek proprietary navigation algorithm that providing you more stable navigation data. Parallel design is the major new feature of RSA-1500L.

The smallest form factor and parallel design is the best choice to be embedded in a portable device and receiver like PND, mobile phone, car holder, personal locator, digital camera and vehicle locator. The excellent sensitivity of RSA-1500L gets the great performance when going though the urban canyon and foliage

Product Features
✧   20 parallel channels
✧   Extreme fast TTFF at low signal level
✧   Operable from 3.3V/48mA continuous mode.
✧   Wire to board connector
✧   TCXO design
✧   0.1 second reacquisition time
✧   Small form factor with embedded SiRF Star III single chip technology.
✧   NMEA-0183 compliant protocol/custom protocol.
✧   4 Mbits Flash Memory
✧   Enhanced algorithm for navigation stability
✧   Excellent sensitive for urban canyon and foliage environments.
✧   SBAS (WAAS, EGNOS and MSAS) support
✧   Auto recovery while RTC crashes
✧   Trickle power supported

1.1   Product applications
✧   Automotive navigation
✧   Personal positioning and navigation
✧   Marine navigation
✧   Timing application

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RSA-1500L User Manual

### 1.2 Product Picture

RSA-1500L
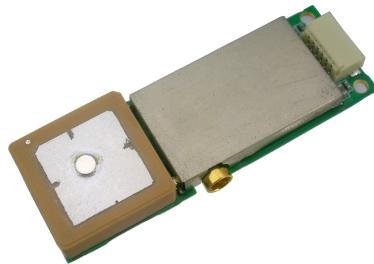
Figure 1-1 RSA-1500L Front View

Figure 1-2 RSA-1500L Bottom View

1.3 RSA-1500L System Block Diagram

System block diagram description :

    a. External antenna.

    b. 4 Mega bits flash memory

    c. 6 pin I/O pin
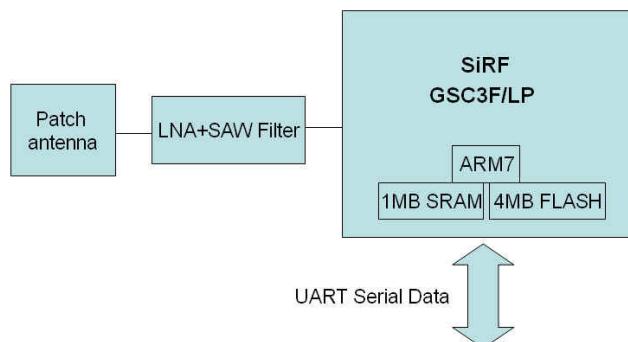
Figure 1-3 System Block Diagram

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1.4 RSA-1500L Technique Specification

Table 1-1 Technical Specifications

Impedance：50Ω

No	Function	Specification
GPS receiver		
1	Chipset	SiRF Star III, GSC3f/LP (Digital, RF in a single package)
2	Frequency	L1 1575.42MHz.
3	Code	C.A. Code.
4	Channels	20 parallel
5	Chipset Sensitivity	-159dBm.
6	Cold start	35 sec @ open sky
7	Warm start	35 sec @ open sky
8	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	40mA@Average
14	Update rate	Continuous operation: 1Hz
15	Testability	It shall be able to be tested by SiRF test IV and single channel simulator.
16	Protocol setup	It shall store the protocol setup in the SRAM memory.
17	DGPS	1.WAAS, EGNOS
Interface		
18	LNA	25dB Gain. (Typical)
19	I/O Pin	6pin
Mechanical requirements		
20	Weight	8.3g Typ.
Power consumption		
21	Vcc	DC +3.3 V±5%
22	Current	GPS : Avg Acquisition <50mA@3.3V without ext.Antenna Avg Tracking <48mA@3.3V without ext.Antenna
Environment		

23	Operating temperature	-25 ~ 85℃
24	Storage temperature	-40 ~ 85℃
25	Humidity	≦95%

MMCX edge mount Jack Receptacle specification (External Antenna)

Impedance	50ohm
Frequency range	0~6GHz
V.S.W.R	1.2max
Working voltage	175Vrms max
Durability	500 mating
External Antenna spec.	
DC supply	2.85V±2%
DC current	20mA max.
Input return Loss	≦-10dB
Output return Loss	≦-10dB
Gain	25 dB typical

1.5   Application Circuit
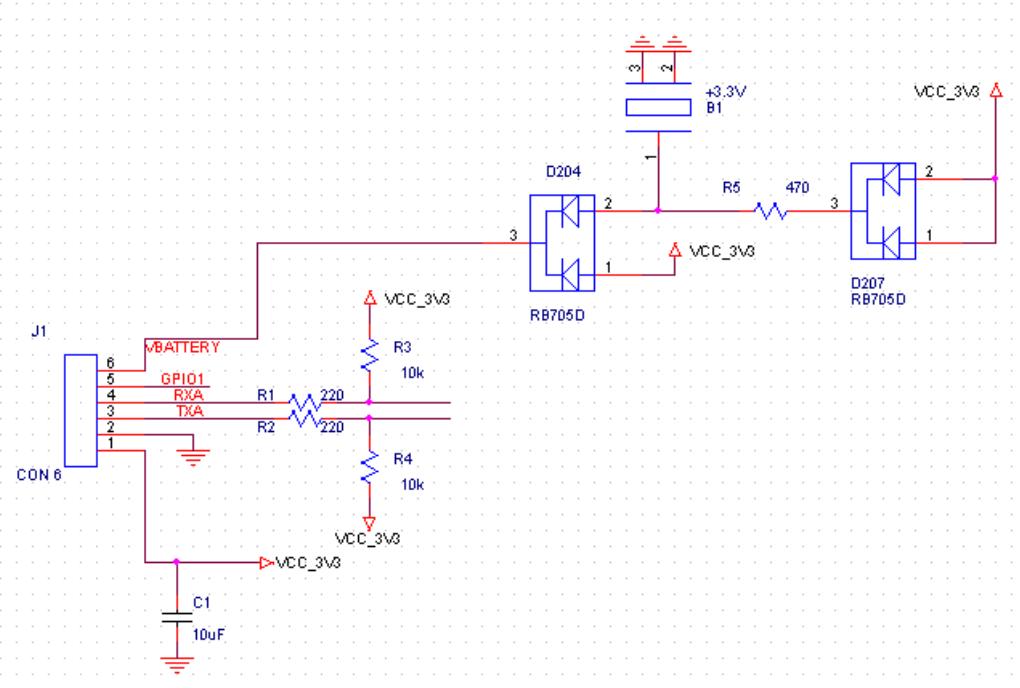
Figure 1-4 Application Circuit Reference

Note:

    (1) Ground Planes:

        This pin2 should be connect to ground.

    (2) Serial Interface:

        (Ⅰ) The TXA pin is recommended to connect to serial resistance(220Ω)

            and pull up (10KΩ). It can increase the stability of serial data. (Default

            NMEA)

        (Ⅱ) The RXA pin is recommended to connect to serial resistance(220Ω)

            and pull up (10KΩ). It can increase the stability of serial data. (Default

            NMEA)

    (3) Backup Battery:

        When module is working, must to supply VCC pin(Pin1) and VBATT

        pin(Pin6) power at the same time.

        It's recommended to connect a backup battery to VBATT pin.

        In order to enable the warm start and hot start features of the GPS receiver.

        If you use backup battery, should be add a bypassing capacitor (10uF) at

        VBATT pin. It can reduce noise and increase the stability.

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(4) Power:

Connect VCC pin to DC 3.3V. The power supply must add bypass
capacitor(10uF and 1uF).It can reduce the Noise from power supply and
increase power stability.

(5) GPIO:

The GPIOs function are for customer used.

If no use GPIO function, it don't connect anything.

1.6 Mechanical Layout
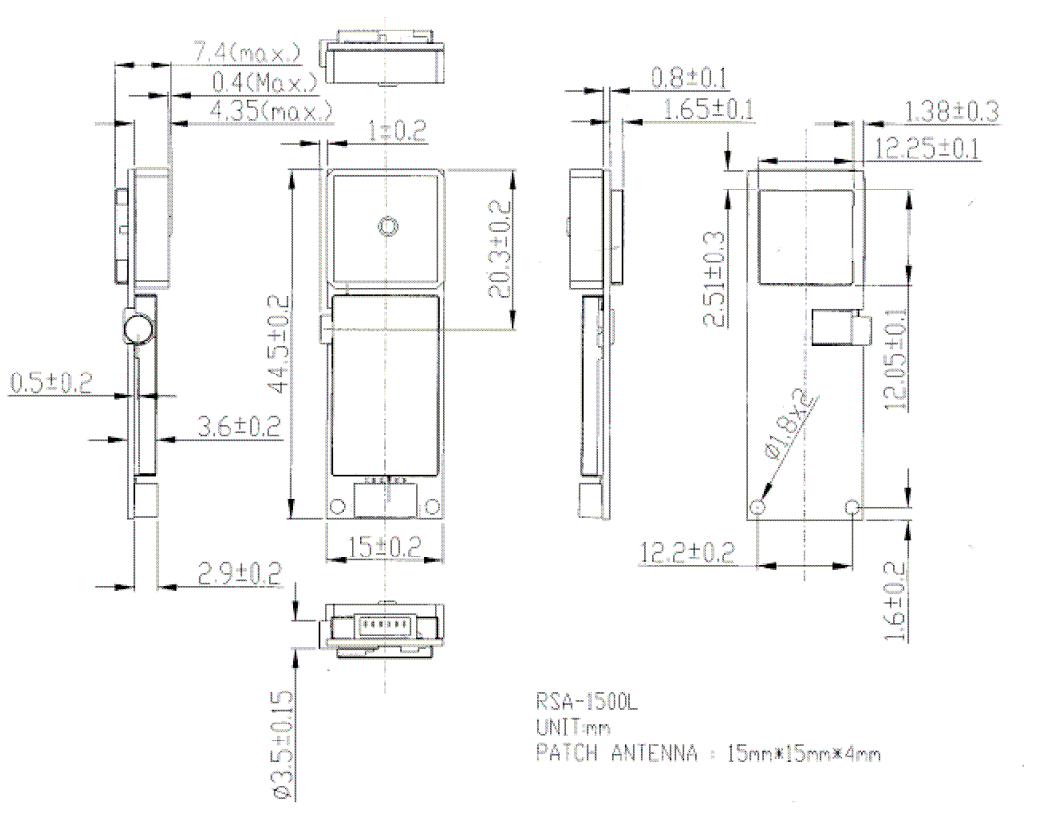
Figure 1-5 Mechanical Layout

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1.7 Hardware interface
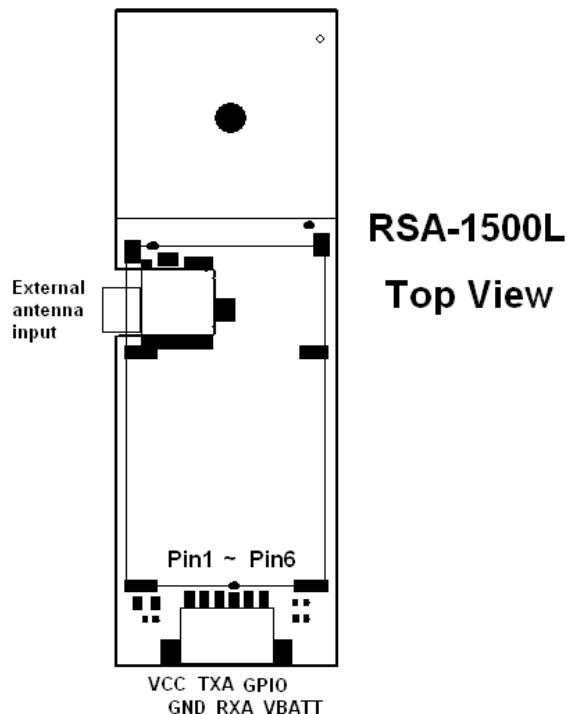
Figure 1-6 Hardware Interface

Table 1-2 Definition of Pin assignment

Pin Defined

Pin	Signal Name	I/O	Description	Characteristics
1	VCC	I	DC Supply Voltage input	DC +3.3V±5%
2	GND	G	Ground	Reference Ground
3	TXA	O	Serial port A	$2.85V \geq V_{OH} \geq 2.38V$ $\qquad V_{OL} \leq 0.7V$
4	RXA	I	Serial port A	$3.15V \geq V_{IH} \geq 2.0V$ $\quad -0.3V \leq V_{IL} \leq 0.86V$
5	GPIO-1	I/O	General purpose I/O	$3.15V \geq V_{IH} \geq 2.0V$ $\quad -0.3V \leq V_{IL} \leq 0.86V$ $2.85V \geq V_{OH} \geq 2.14V$ $\qquad V_{OL} \leq 0.71V$
6	VBATT	I	Backup voltage supply	$DC + 2.5 \sim +3.6V$ $Current \leq 10uA$

Definition of Pin assignment

VCC(+3.3V DC power Input)

This is the DC power supply input pin for GPS system. It provides voltage to module.

GND

GND provides the reference ground.

TXA

This is the main transmitting channel and is used to output navigation and measurement data to SiRFdemo or user written software

RXA

This is the main receiver channel and is used to receive software commands to the board from SIRFdemo software or from user written software.

VBATT   (Backup battery)

When module is working, must to supply VCC pin(Pin1) and VBATT pin(Pin6) power at the same time.

This is the battery backup input that powers the SRAM and RTC when main power is removed. Typical current draw is 10uA.

The supply voltage should be between 2.5V and 3.6V.

GPIO Functions

Several I/Os are connected to the digital interface connector for custom applications.

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 GSV 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 RMC 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	

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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   Package

3.1   Package Specification

Shipment Method: PE Bag
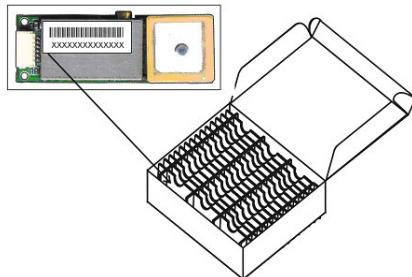
Figure 3-1 Package Specifications

4   Contact Information Section

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5   Revision History

Title	RSA-1500L GPS Module		
Doc Type	User Manual		
Revision Number	Date	Author	Change notice
1.0	2007/08/08	Linda Fan	Initial Release
1.1	2007/09/21	Linda Fan	Current
1.2	2008/01/24	Linda Fan	Revised mechanical drawing