GS-2525 User Manual

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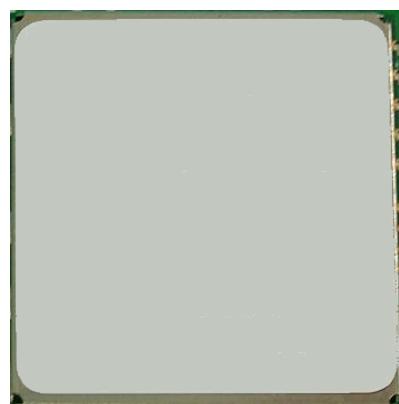
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GS-2525

Figure List

Table List

1   Introduction

Gstar GS-2525 low power and small form factor board is the newest generation of Gstar GPS module. The module is pow ered by latest SiRF Star III single chip and Gsatr proprietary navigation technol ogy that provides you with stable and accurate navigation data. The smallest form factor and miniature design is the best choice to be embedded in a device such as portable navigation device, personal locator, speed camera detector and vehicle locator.

Product Features

- ✧   20 parallel channels
- ✧   SMT type with stamp holes
- ✧   TCXO design
- ✧   0.1 second reacquisition time
- ✧   Small form factor with embedded SiRF Star III single chip technology.
- ✧   NMEA-0183 compliant protocol/customize protocol.
- ✧   Enhanced algorithm for navigation stability
- ✧   Excellent sensitive for urban canyon and foliage environments.
- ✧   DGPSBAS (WAAS, EGNOS and MSAS) support
- ✧   Auto recovery while RTC crashes
- ✧   Trickle power supported
- ✧   Build-in LNA and saw filter

1.1   Product applications

- ✧   Automotive navigation
- ✧   Personal positioning and navigation
- ✧   Marine navigation
- ✧   Timing application

1.2 Product Picture

GS-2525
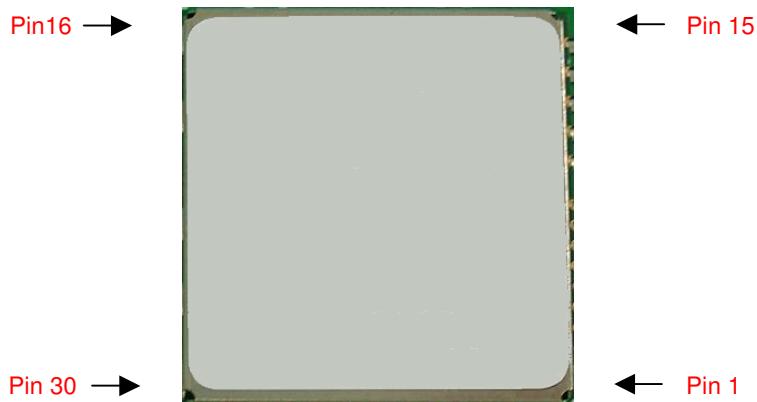
Figure 1-1 REB-3571LP Front View

GS-2525 Interface Board(Compatible with REB-3300   interface board)

Figure 1-2 GS-2525 Interface Board Front View

Table 1-1 The interface board pin definition

PIN	GS-2520	GS-2523	GS-2525
1	VCC	V_GPS_3V3	VCC
2	GND	GND	GND
3	Bootselect	Bootselect	Bootselect
4	RXA	RXA	RXA
5	TXA	TXA	TXA
6	TXB	TXB	TXB
7	RXB	RXB	RXB
8	GPIO14	N.C.	GPIO14

9	RF-ON	RF-ON	RF-ON
10	GND	GND	GND
11	GND	N.C.	GND
12	GND	N.C.	GND
13	GND	GND	GND
14	GND	N.C.	GND
15	GND	GND	GND
16	GND	GND	GND
17	RF-IN	GPS_RF_IN	RF-IN
18	GND	GND	GND
19	V-ANT	V-ANT_IN	V-ANT
20	VCC-RF	VCC_RF_OUT	VCC-RF
21	V-BAT	V_RTC_3V3	V-BAT
22	RESET-IN	RESET	RESET-IN
23	GPIO10	N.C.	GPIO10
24	GPIO1	N.C.	GPIO1
25	GPIO5	GPIO4	GPIO4
26	GPIO0	GPIO0	GPIO0
27	GPIO13	N.C.	GPIO13
28	GPIO15	N.C.	GPIO15
29	PPS	PPS	PPS
30	GND	GND	GND
31	NO PAD	N.C.	NO PAD

1.3 GS-2525 Series Block Diagram

GS-2525 engine board consists of SiRF star III single chipset technology; 4Mbits flash memory, and proprietary software. The system is described as follows.

a. External antenna.

b. 4 Mega bits flash memory

c. 30 pin I/O pin
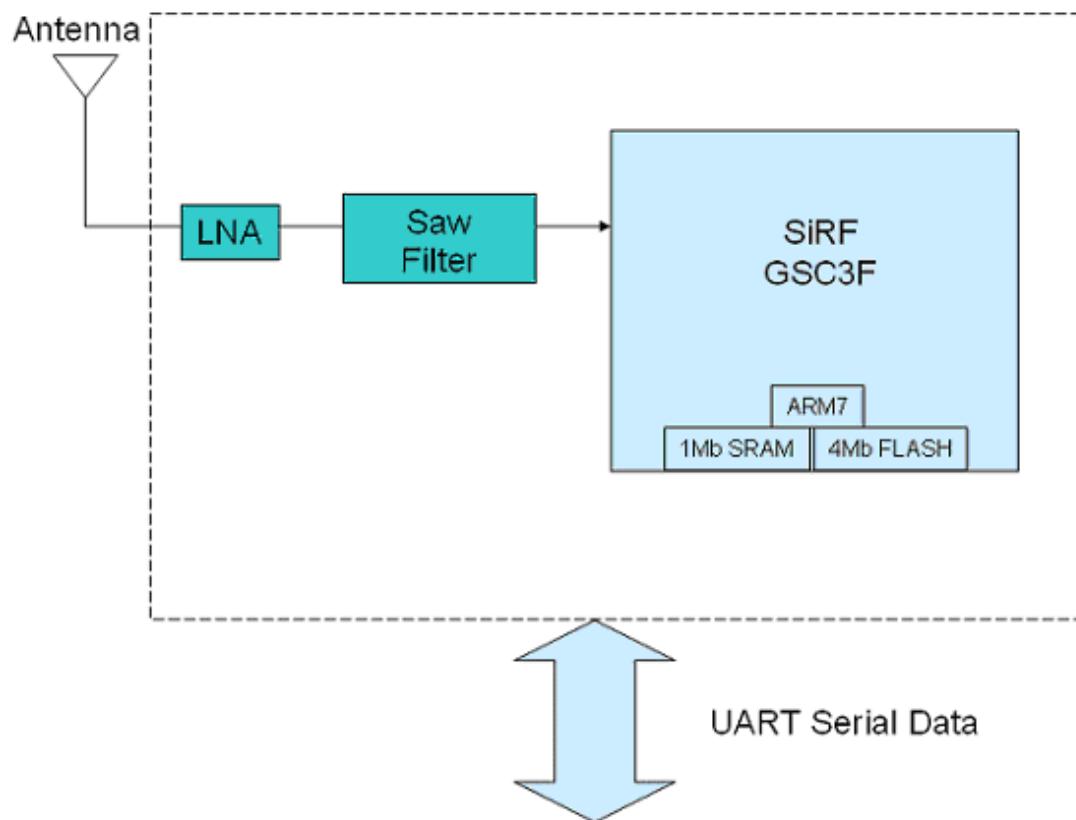
**Figure 1-5 System Block Diagram**

1.4 GS-2525 Technique Specification

Impedance：50Ω

Table 1-2 Technical Specifications

| 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	Sensitivity (Acquisition)	It shall show C/No $\geq$ 40 dB-Hz when external power = -130dBm.
6	Chip set cold start	35s @ open sky (Typical)
7	Chip set warm start	35s @ open sky (Typical)
8	Chip set hot start	1s @ open sky (Typical)
9	Reacquisition	less than 1s
10	Position accuracy	10meters at 2D RMS.
11	Maximum altitude	18000 m
12	Maximum velocity	514 m/s
13	Trickle power mode	Duty cycle $\leq$ 34%. (Variable)
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	WAAS, EGNOS
Interface		
18	LNA	15dB Gain. (Typical)
19	I/O Pin	30pin
Power consumption		
21	Vcc	DC 3.3 ±5%
22	Current	Avg. Acquisition <50mA@3.3V(without ext. antenna) Avg. Tracking<48mA@3.3V(without ext. antenna)
Environment		
23	Temperature	Operating : -40 ~ 85℃ Storage : -40 ~ 85℃
24	Humidity	$\leq$95%

1.5 Application Circuit
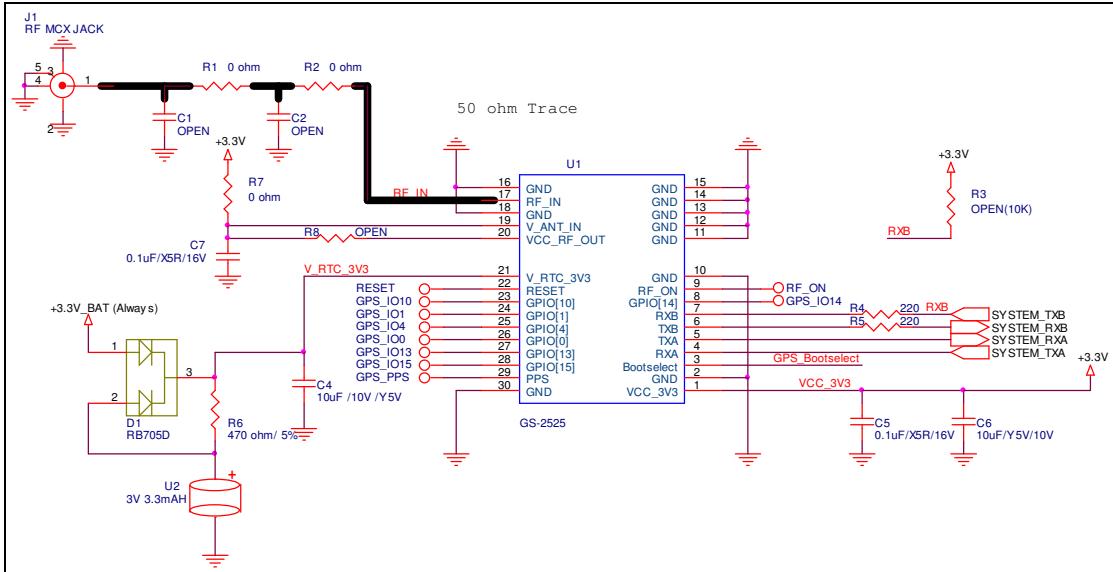
Figure 1-6 Application Circuit Reference

Note:

    (1) Ground Planes:

        These pin(2,10~16、18、30) should be connect to ground.

    (2) Serial Interface:

        (Ⅰ) The TXA pin is the serial output data (Default NMEA) .

        (Ⅱ) The TXB pin is the serial output data (Default Null) .

        (Ⅲ) The RXA pin is the serial input data (Default NMEA) .

        (Ⅳ) The RXB pin is the serial input data (Default Null).

    (3) Backup Battery:

        When module is working, must to supply VCC_3V3(P1) and

        V_RTC_3V3 (P21) power at the same time.

        It's recommended to connect a backup battery to V_RTC_3V3 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

        V_RTC_3V3 pin. It can reduce noise and increase the stability.

    (4) RF_IN:

        Connecting to the antenna has to be routed on the PCB. The transmission

        line must to controlled impedance to connect RF_IN to the antenna or

        antenna connector of your choice. (Impedance 50Ω)

    (5) Power:

        Connect VCC_3V3 pin to DC +3.3V. The power supply must add bypassing

        capacitor (10uF and 0.1uF).It can reduce the Noise from power supply and

increase power stability.

(6) Active antenna bias voltage:

The VCC_RF_OUT pin (pin 20) is provide voltage 2.85V. If you use active antenna, you can connect this pin to V_ANT_IN pin (pin 19) to provide bias voltage of active antenna. The bias voltage will be through GPS_RF_IN pin to provide active antenna bias voltage from Vcc_RF_OUT pin.

If your bias voltage of active antenna isn't 2.85V, you can input bias voltage to V_ANT_IN pin (pin 19).And input bias voltage of you need. The input bias voltage will through GPS_RF_IN pin to provide active antenna bias voltage from V_ANT_IN pin.

PS:

(1) The maximum power consumption of active antenna is about 85mW.

(2) The input gain ranges are 19~ 22dB.

(7) GPIO:

The GPIO pin is recommended to connect to serial resistance(220Ω),if use the GPIO function.

If no use GPIO functions, it doesn't connect anything.

1.6 Recommended layout PAD
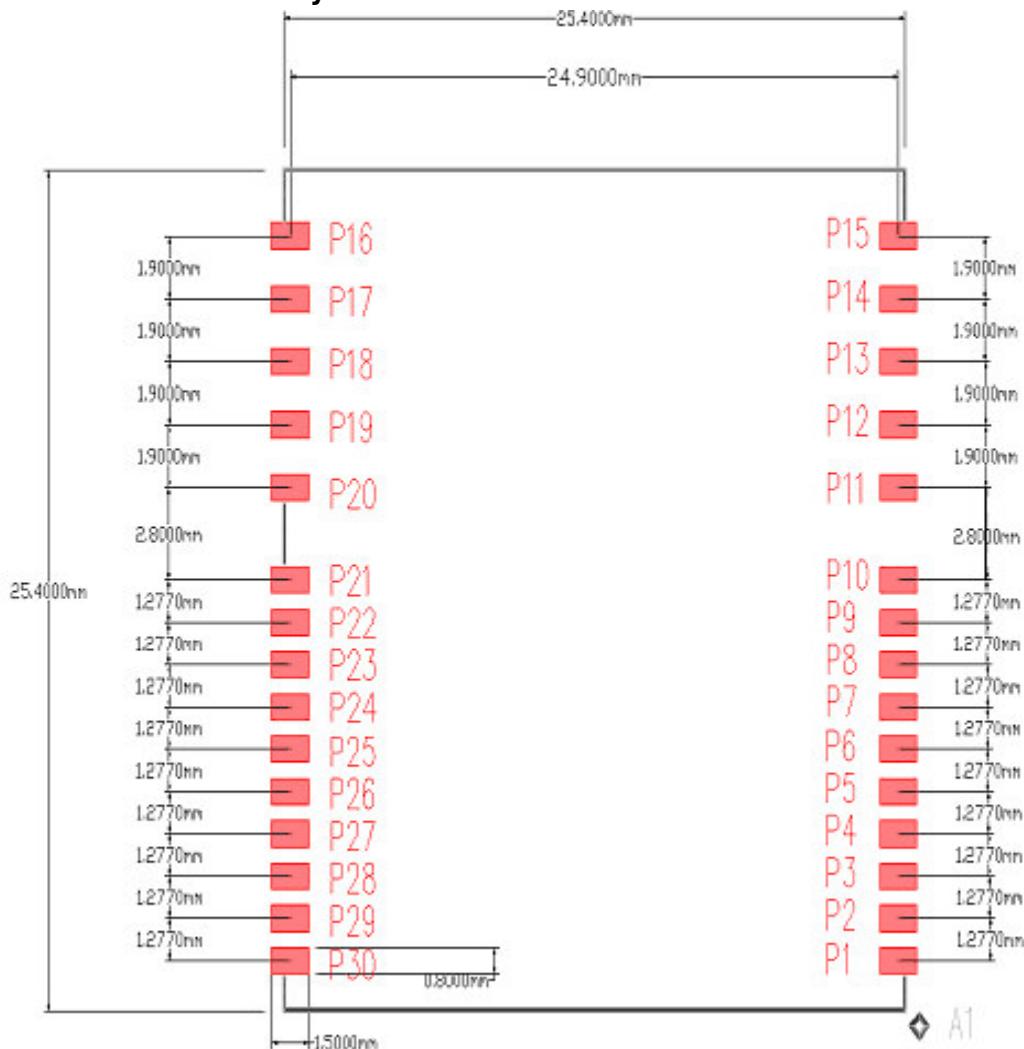
Figure 1-7 Recommended Layout Pad

1.7 Mechanical Layout
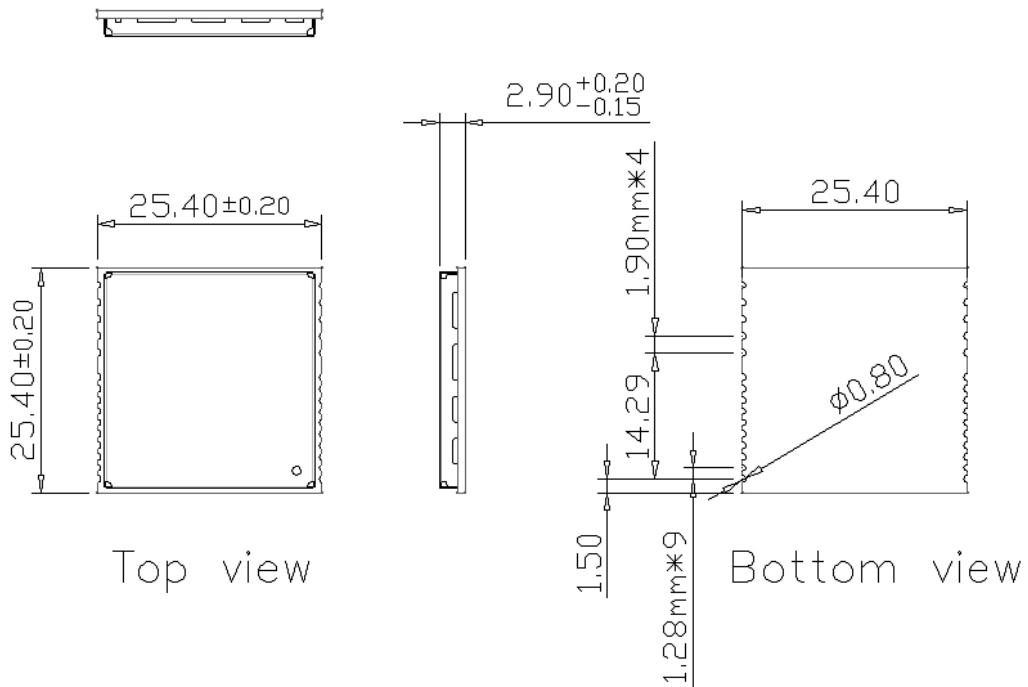
Figure 1-8 Mechanical Layout

1.8 GS-2525-Test Software Specification

No	Function	Specification
1	Clock offset	88000Hz≦量測值≦104000Hz
2	Clock Drift	量測值≦200Hz
3	C/No Hi Power Mean	量測值≧39dB
4	C/No Hi Power Sigma	量測值≦2dB
5	Bit Sync	量測值≦5 Sec
6	Frame Sync	量測值≦28 Sec
7	Phase Error	量測值≦0.22
8	RTC 測試	
	RTC Frequency 測試	31000≦量測值≦33500

可靠性及品質目標

MTBF > 10000 hours.

1.9 Hardware interface
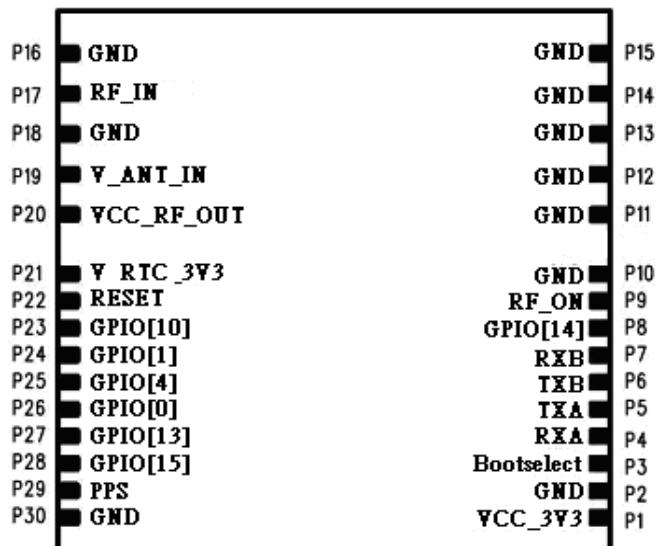
Figure 1-9 Hardware Interface

Table 1-3 Definition of Pin assignment

Pin #	Signal Name	I/O	Description	Characteristics	
1	VCC_3V3	I	DC Supply Voltage input	DC +3.3V±5%	
2	GND	G	Ground	Reference Ground	
3	Bootselect	I	Boot mode	$3.15V \geq V_{IH} \geq 2.0V$	$-0.3V \leq V_{IL} \leq 0.86V$
4	RXA	I	Serial port A	$3.15V \geq V_{IH} \geq 2.0V$	$-0.3V \leq V_{IL} \leq 0.86V$
5	TXA	O	Serial port A	$2.85V \geq V_{OH} \geq 2.14V$	$V_{OL} \leq 0.71V$
6	TXB	O	Serial port B	$2.85V \geq V_{OH} \geq 2.14V$	$V_{OL} \leq 0.71V$
7	RXB	I	Serial port B	$3.15V \geq V_{IH} \geq 2.0V$	$-0.3V \leq V_{IL} \leq 0.86V$
8	GPIO[14]	I/O	General purpose I/O	$3.15V \geq V_{IH} \geq 2.0V$ $2.85V \geq V_{OH} \geq 2.14V$	$-0.3V \leq V_{IL} \leq 0.86V$ $V_{OL} \leq 0.71V$
9	RF_ON	O	Indicates power state of RF part	$V_{OH} = 2.85V$	$V_{OL} = 0V$
10	GND	G	Ground	Reference Ground	
11	GND	G	Ground	Reference Ground	

12	GND	G	Ground	Reference Ground
13	GND	G	Ground	Reference Ground
14	GND	G	Ground	Reference Ground
15	GND	G	Ground	Reference Ground
16	GND	G	Ground	Reference Ground
17	RF_IN	I	GPS Signal input	50 Ω @1.57542GHz
18	GND	G	Ground	Reference Ground
19	V_ANT_IN	I	Active Antenna Bias voltage	Receiving DC power supply for active antenna bias.
20	VCC_RF_OUT	O	Supply Antenna Bias voltage	DC +2.85V ±2% Current<30mA
21	V_RTC_3V3	I	Backup voltage supply	DC + 2.5 ~ +3.6V Current ≤ 10uA
22	Reset	I	Reset (Active low)	$V_{IH} > 2.3V$ $V_{IL} < 0.8V$
23	GPIO[10]	I/O	General purpose I/O	$3.15V \geq V_{IH} \geq 2.0V$ $-0.3V \leq V_{IL} \leq 0.86V$ $2.85V \geq V_{OH} \geq 2.14V$ $V_{OL} \leq 0.71V$
24	GPIO[1]	I/O	General purpose I/O	$3.15V \geq V_{IH} \geq 2.0V$ $-0.3V \leq V_{IL} \leq 0.86V$ $2.85V \geq V_{OH} \geq 2.14V$ $V_{OL} \leq 0.71V$
25	GPIO[4]	I/O	General purpose I/O	$3.15V \geq V_{IH} \geq 2.0V$ $-0.3V \leq V_{IL} \leq 0.86V$ $2.85V \geq V_{OH} \geq 2.14V$ $V_{OL} \leq 0.71V$
26	GPIO[0]	I/O	General purpose I/O	$3.15V \geq V_{IH} \geq 2.0V$ $-0.3V \leq V_{IL} \leq 0.86V$ $2.85V \geq V_{OH} \geq 2.14V$ $V_{OL} \leq 0.71V$
27	GPIO[13]	I/O	General purpose I/O	$3.15V \geq V_{IH} \geq 2.0V$ $-0.3V \leq V_{IL} \leq 0.86V$ $2.85V \geq V_{OH} \geq 2.14V$ $V_{OL} \leq 0.71V$
28	GPIO[15]	I/O	General purpose I/O	$3.15V \geq V_{IH} \geq 2.0V$ $-0.3V \leq V_{IL} \leq 0.86V$ $2.85V \geq V_{OH} \geq 2.14V$ $V_{OL} \leq 0.71V$
29	PPS	O	One pulse per second	$3.15V \geq V_{IH} \geq 2.0V$ $-0.3V \leq V_{IL} \leq 0.86V$
30	GND	G	Ground	Reference Ground

Definition of Pin assignment

· **VCC_3V3 (+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 ground .

 · Boot

Set this pin to high for programming flash.

 · 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.

 · RXB

This is the auxiliary receiving channel and is used to input differential corrections to the board to enable DGPS navigation.

 · TXA

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

 · TXB

For user's application (not currently used).

 · RF_ON

This pin indicates state of RF voltage.

 · GPS_RF_IN

This pin receives GPS analog signal. The line on the PCB between the antenna(or antenna connector) has to be a controlled impedance line (Microstrip at 50Ω).

 · V_ANT_IN

This pin is reserved as external DC power supply input for active antenna.

If using 2.85V active antenna, pin 20 has to be connected to pin 19.

If using 3.3V or 5V active antenna ,this pin has to be connected to 3.3V or 5V power supply.

PS: The current must be $\leqq$100mA and voltage $\leqq$12V,if using external power supply.

 · VCC_RF_OUT

This pin can provide power 30mA@2.85V for active antenna.

 · Reset

This pin provides an active-low reset input to the board. It causes the board to reset and start searching for satellites. If not utilized, it may be left open.

 · PPS

This pin provides one pulse-per-second output from the board, which is synchronized to GPS time. This is not available in Trickle Power mode.

 · V_RTC_3V3 (Backup battery)

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 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	

20

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 and Order Information

Shipment Method: Tape and reel
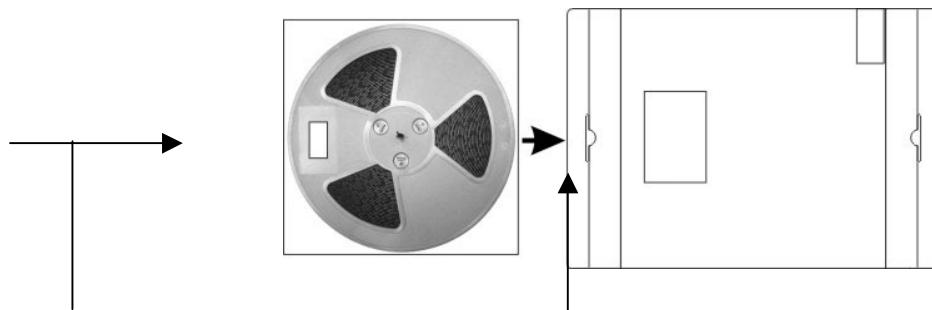
Figure 3-1 Package Specifications

3.2 Lead-Free Standard Reflow Profile
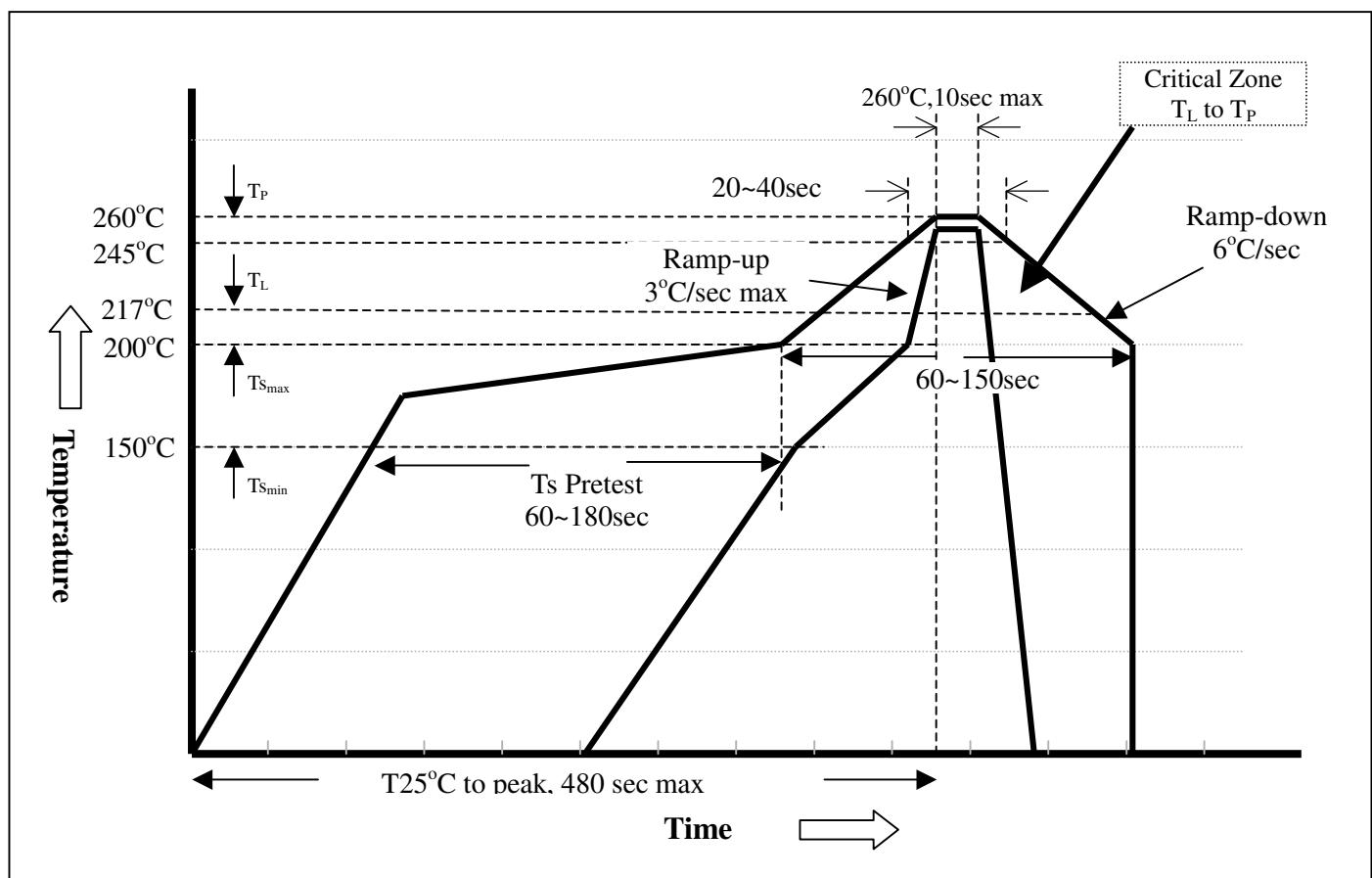
GS-2525 Lead Free Standard Reflow Profile

4   Contact Information Section

Contact: sales@royaltek.com

. Headquarter:

 Address: 1071, Chung Cheng Rd., Suite 9F-1, Tao Yuan City, Taiwan
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  FAX: 886-3-3580050

. Web Site: http://www.royaltek.com

. Web Site Customer Service: http://www.royaltek.com/contact

5   Revision History

Title	REB-3571LP GPS Module		
Doc Type	User Manual		
Revision Number	Date	Author	Change notice
1.0	2007/09/29	Amy Liu	Initial Release