RET-3570LP User Manual

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RET-3570LP User Manual

Content

1. Introduction

RoyalTek RET-3570LP small form factor board is the newest generation of RoyalTek GPS plus TMC module. TMC can deliver real-time traffic and travel information to drivers. The driver can be notified of problems on the planned route, at the same time, TMC calculates and provide an alternative route to help driver avoid the incident. The combo module is powered by latest SiRF Star III single chip and RoyalTek proprietary navigation technology 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, and speed camera detector and vehicle locator.

1.1 Product Features

- ✧ 20 parallel channels
- ✧ TMC embedded
- ✧ TMC frequency 87.5MHz--108MHz
- ✧ 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/ Royaltek TMC protocol
- ✧ Enhanced algorithm for navigation stability
- ✧ Excellent sensitivity for urban canyon and foliage environments.
- ✧ DGPS (WAAS, EGNOS) support
- ✧ Auto recovery while RTC crashes
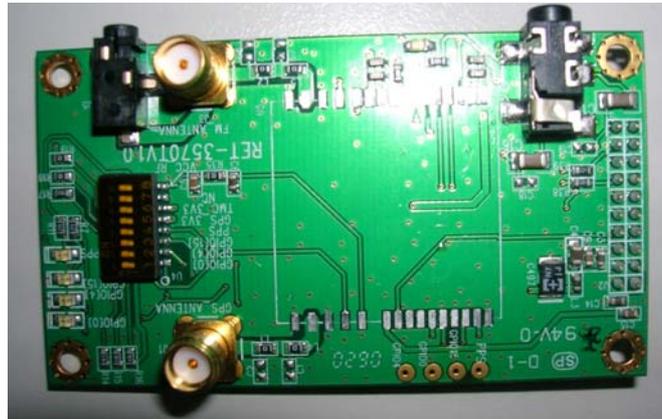
1.2 Product Applications

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

1.3 Product Pictures and Interface board

(1) RET-3570LP

← **Pin 1**
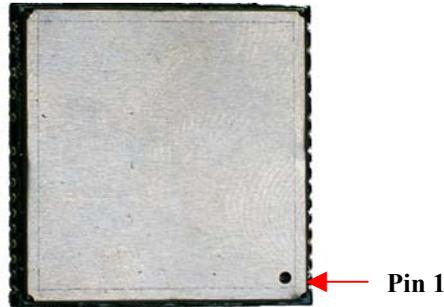
(2) RET-3570LP Interface board

The interface board pin definition

J2 CONNECTOR

Pin #	Signal Name	I/O	Description	Characteristics
1	N.C			
2	N.C			
3	Battery	I	Backup voltage supply	$DC + 2.5 \sim +3.6V$ $Current \leq 10uA$
4	VCC	I	DC Supply Voltage input	DC +3.3V±10%
5	Reset	I	Reset (Active low)	$V_{IH} > 2.3V ; V_{IL} < 0.8V$
6-10	N.C			
11	TXA	O	Serial port A	$2.375V \leq V_{OH} \leq 2.85V \qquad V_{OL} \leq 0.715V$ CMOS TTL level
12	RXA	I	Serial port A	$1.995V \leq V_{IH} \leq 3.15V \qquad -0.3V \leq V_{IL} \leq 0.855V$ CMOS TTL Level
13	N.C			
14	TXB	O	Serial port B	$2.375V \leq V_{OH} \leq 2.85V \qquad V_{OL} \leq 0.715V$ CMOS TTL level

15	RXB	I	Serial port B	$1.995V \leq V_{IH} \leq 3.15V$ $-0.3V \leq V_{IL} \leq 0.855V$ CMOS TTL Level
16	N.C			
17	Boot	I	Boot mode	$1.995V \leq V_{IH} \leq 3.15V$ $-0.3V \leq V_{IL} \leq 0.855V$
18	GND	G	Ground	
19	N.C			
20	N.C			

Switch U4

Pin #	Signal Name	0/1	Description	Characteristics
1	GPIO-0		GPIO input/output	Switch: 0: Low 1:High CMOS TTL Level
2	GPIO-4		GPIO input/output	Switch: 0: Low 1:High CMOS TTL Level
3	GPIO-15 (N.C for RET-3570)		GPIO input/output (N.C for RET-3570)	Switch: 0: Low 1:High CMOS TTL Level (N.C for RET-3570)
4	PPS		PPS output	Switch: 0: Low 1:PPS output
5	GPS_3V3		Power supply for GPS section	Switch: 0: Low 1: DC 3.3V output
6	TMC_3V3		Power supply for TMC section	Switch: 0: Low 1: DC 3.3V output
7	N.C			
8	RF_Bias		RF_Bias voltage switch	0: open. No voltage provide antenna. 1:Provide 2.85V to antenna.

Connector:

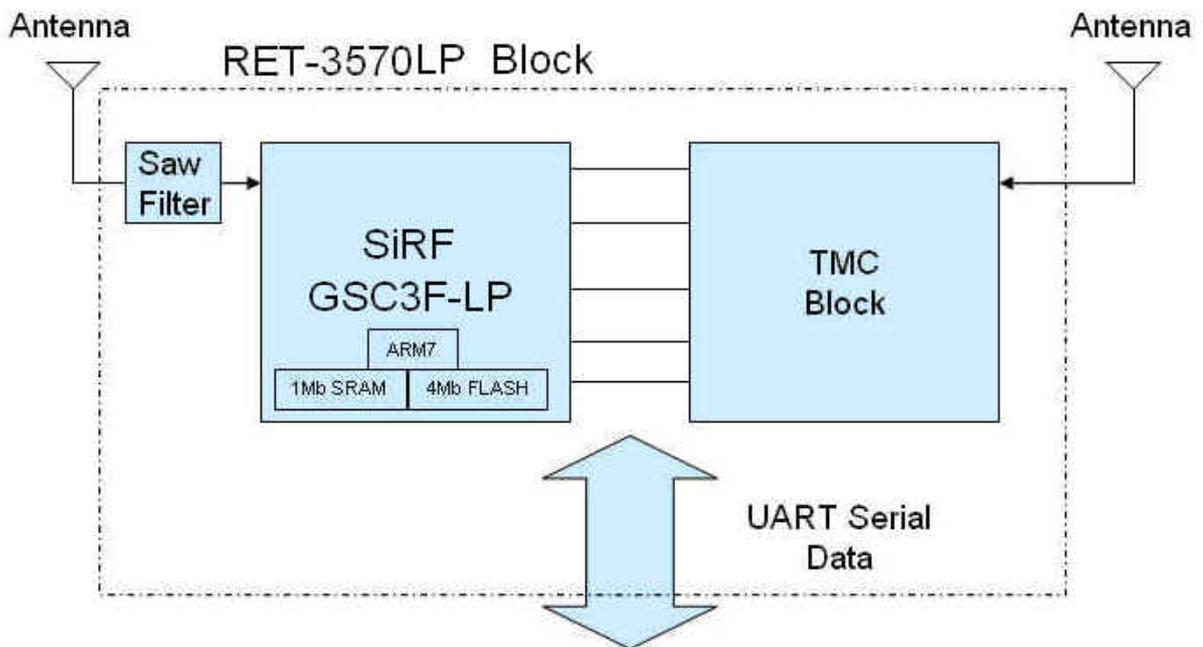| Pin #	Description	Characteristics
J1	GPS RF Connector	1575.42MHz
J5	FM RF Connector	87.5MHz~108MHz
J4	Stereo Jack	Audio output (Right and Left channel)

RoyalTek Evaluation Kit REV-2000 for RET-3570 LP

(Please refer to RoyalTek Evaluation Kit REV-2000 for RET-3570 Operational Manual for more information.)

1.4 System Block Diagram

System block diagram description:

    (1) External antenna.

    (2) 4 Mega bits flash memory

    (3) 31 pin I/O pin

1.5 Technical Specification

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	Chipset Cold start @open sky	35 sec
7	Chipset Warm start @open sky	35 sec
8	Chipset Hot start @open sky	1 sec
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 $\leqq$ 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	No LNA
19	I/O Pin	31pin
TMC/RDS receiver		
20	Frequency	87.5~108MHz. US/Europe
21	RDS sensitivity	24.7uV typical $\triangle$f=22.5kHz, fAF = 1kHz,L=R,　fRDS=1.2kHz, De-emphasis= 50us, Block Quality Rate $\geqq$85%
22	Right and Left audio output voltage	Conditions: $V_{RF} = 1mV$; $L = R$; $\Delta f = 22.5KHz$; $f_{mod} = 1KHz$; No pre-emphasis; $TC_{deem} = 75us$ Output voltage: Min= 55 mV Typ=66 mV Max=75mV
Mechanical requirements		
23	Weight	$\leqq$3.5g
Power consumption		
24	Vcc	DC 3.3 ±5%
25	Current	GPS: Fix mode Current 36mA average. RDS Current: 15mA typical
Environment		

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

1.6 Application Circuit

Reference:
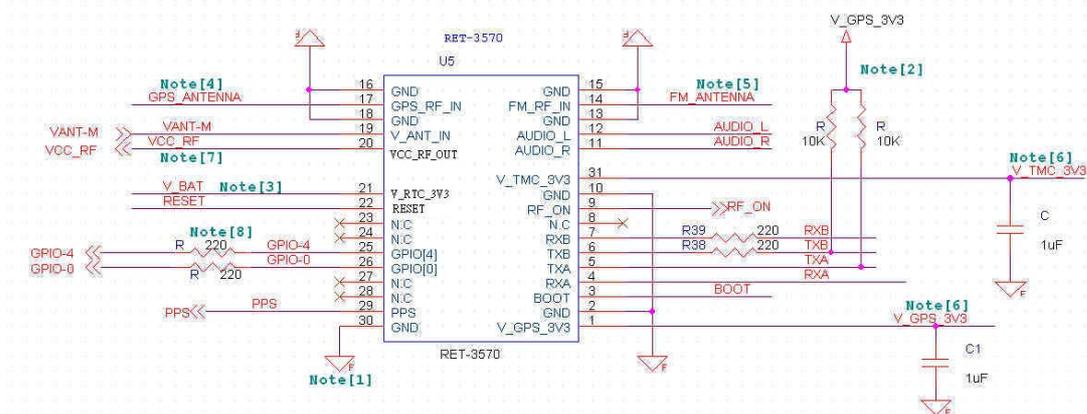
Note:

(1) Ground Planes:

RET3570LP GPS receiver needs two different ground planes.

These pins(13、15、16、18) should be connected to analog ground.

These pins(2、10、30) should be connected to digital ground.

(2) Serial Interface:

(I)The TXA pin is recommended to pull up (10KΩ). It can increase the stability of serial data.

(II) The TXB pin is recommended to connect to serial resistance(220Ω) and pull up (10KΩ), if use the DGPS output.

If the DGPS output is not used, it won't connect anything.

(III) The RXB pin is recommended to connect to serial resistance(220Ω), if the DGPS output is used.

If the DGPS output is not used, it won't connect anything.

(3) Backup Battery:

It's recommended to connect a backup battery to V_RTC_3V3 in order to enable the warm start and hot start features of the GPS receiver. If you don't intend to use a backup battery, connect this pin to GND or float it.

If you use a backup battery, you should add a bypassing capacitor (10uF) at V_RTC_3V3 pin to reduce noise and increase the stability.

(4) GPS_RF_IN:

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

impedance to connect RF_IN to the antenna or any antenna connectors that you prefer. (Impedance 50Ω)

(5) FM_RF_IN:

Connecting to the antenna has to be routed on the PCB. The transmission line must control impedance to connect FM_RF_IN to the antenna or any antenna connectors that you prefer. (Impedance 50Ω)

(6) Power:

Connect V_GPS_3V3 and V_TMC_3V3 pin to DC 3.3V. The power supply must add a bypassing capacitor (10uF and 1uF) to reduce the noise from power supply and increase power stability.

(7) Active antenna bias voltage:

The Vcc_RF_OUT pin (pin 20) provides voltage 2.85V. If you use an active antenna, you can connect this pin to V_ANT_IN pin (pin 19) for providing bias voltage of an active antenna. The bias voltage will run through GPS_RF_IN pin to provide active antenna bias voltage from Vcc_RF_OUT pin.

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

PS:

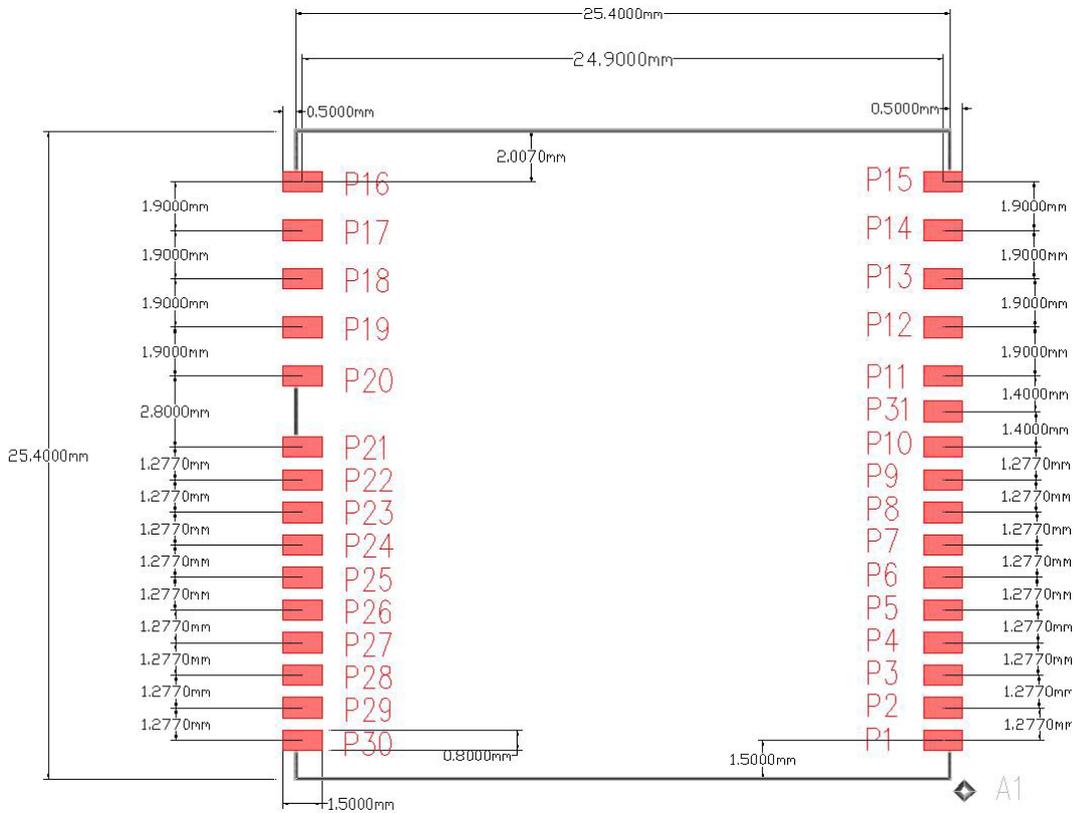(Ⅰ). The maximum power consumption of active antenna is around 85mW.

(Ⅱ). The input gain ranges from 12 to 26dB.

(8) GPIO:

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

If GPIO function is not used, it won't connect anything.

1.7 Recommended layout PAD

Top View

1.8 Mechanical Layout

Unit: mm
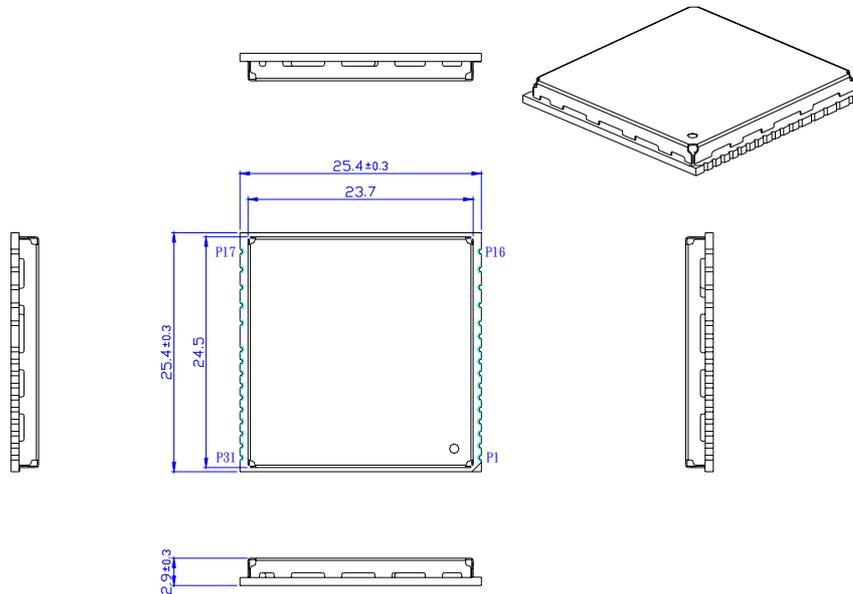
1.9 Test Software Specification

No	Function	Specification
1	Clock offset	88000Hz≦Measurement≦104000Hz
2	Clock Drift	Measurement≦200Hz
3	C/No Hi Power Mean	Measurement≧38dB
4	C/No Hi Power Sigma	Measurement≦2dB
5	Bit Sync	Measurement≦5 Sec
6	Frame Sync	Measurement≦28 Sec
7	Phase Error	Measurement≦0.22°

1.10 Hardware interface

Interface Pin Number:
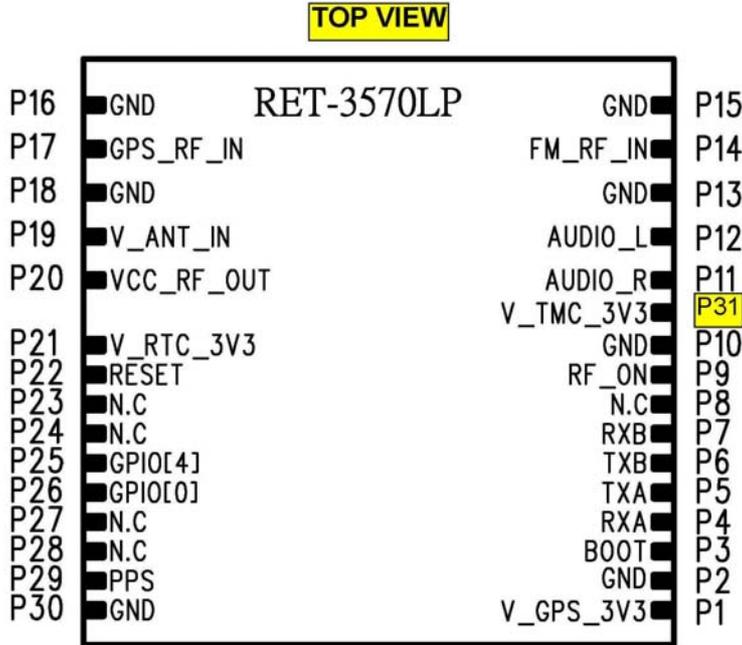
Pin #	Signal Name	I/O	Description	Characteristics
1	V_GPS_3V3	I	DC Supply Voltage input	DC +3.3V±5%
2	GND	G	Ground	Reference Ground
3	BOOT	I	Boot mode	$1.995V \leq V_{IH} \leq 3.15V$ $-0.3V \leq V_{IL} \leq 0.855V$
4	RXA	I	Serial port A	$1.995V \leq V_{IH} \leq 3.15V$ $-0.3V \leq V_{IL} \leq 0.855V$
5	TXA	O	Serial port A	$2.375V \leq V_{OH} \leq 2.85V$ $V_{OL} \leq 0.715V$
6	TXB	O	Serial port B	$2.375V \leq V_{OH} \leq 2.85V$ $V_{OL} \leq 0.715V$
7	RXB	I	Serial port B	$1.995 \leq V_{IH} \leq 3.15V$ $-0.3V \leq V_{IL} \leq 0.855V$
8	N.C			
9	RF_ON	O	Indicates power state of RF part	$V_{OH} = 2.85V$; $V_{OL} = 0V$
10	GND	G	Ground	Reference Ground
11	AUDIO_R	O	Audio right channel output	V_{AFL} Output voltage 66mV(typical) ~75mV(max) R_{AFL} Output resistance 50Ω (min) $\sim 100\Omega$
12	AUDIO_L	O	Audio Left channel output	V_{AFL} Output voltage 66mV(typical) ~75mV(max) R_{AFL} Output resistance 50Ω (min) $\sim 100\Omega$
13	GND	G	Ground	Reference Ground
14	FM_RF_IN	I	FM antenna input	FM antenna input

				(Input impedance 50Ω; Frequency 87.5~108MHz)
15	GND	G	Ground	Reference Ground
16	GND	G	Ground	Reference Ground
17	GPS_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	$V_O = 2.85V \pm 5\%$ Current<30mA
21	V_RTC_3V3	I	Backup voltage supply	$DC + 2.5 \sim +3.6V$ Current $\leq$ 10uA
22	RESET	I	Reset (Active low)	$V_{IH} > 2.3V$; $V_{IL} < 0.8V$
23	N.C			
24	N.C			
25	GPIO4	I/O	General purpose I/O	$1.995V \leq V_{IH} \leq 3.15V$ $- 0.3V \leq V_{IL} \leq 0.855V$ $2.375V \leq V_{OH} \leq 2.85V$ $V_{OL} \leq 0.715V$
26	GPIO0	I/O	General purpose I/O	$1.995V \leq V_{IH} \leq 3.15V$ $- 0.3V \leq V_{IL} \leq 0.855V$ $2.375V \leq V_{OH} \leq 2.85V$ $V_{OL} \leq 0.715V$
27	N.C			
28	N.C			
29	PPS	O	One pulse per second	$2.375V \leq V_{OH} \leq 2.85V$ $V_{OL} \leq 0.715V$
30	GND	G	Ground	Reference Ground
31	V_TMC_3V3	I	DC Supply Voltage input	DC +3.3V±5%

V_GPS_3V3 (+3.3V DC power Input)

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

GND

GND provides the ground.

BOOT

Set this pin to high for programming flash.

RXA

This is the main receiver channel. The main function is to receive software commands from SIRFdemo software or other user's application.

RXB

This is the auxiliary receiving channel. The main function is to input differential corrections, then deliver them to the board for DGPS navigation.

TXA

This is the main transmitting channel and is used to output navigation and measurement data to SiRFdemo or from user's application.

TXB

For user's application.(Not current use).

RF_ON

This pin indicates the status of RF voltage.

V_TMC_3V3 (+3.3V DC power Input)

This is the DC power supply input pin for TMC function. It provides voltage for TMC section of the module.

AUDIO_R

This pin is the function of audio right channel output.

AUDIO_L

This pin is the function of audio left channel output.

FM_RF_IN

This pin can receive FM analog signal. The trace on the PCB from the antenna(or antenna connector) has to be   controlled impedance line (Micro strip at 50Ω).

GPS_RF_IN

This pin can receive GPS analog signal. The trace on the PCB between the antenna(or antenna connector) has to be a controlled impedance line (Micro strip at 50Ω).

V_ANT_IN

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

If using 2.85V active antenna, the 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 $\leqq100$mA and voltage $\leqq12$V, if external power supply is used.

VCC_RF_OUT

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

RESET

This pin provides an active-low reset input for the board. It causes that the board resets and starts to search for satellites. If RESET pin is not used, it won't connect anything.

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 the 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 customer applications.

2. Software Interface

NMEA V3.0 Protocol

Its output signal level is TTL: 38400 bps (default), 8 bit data, 1 stop bit and no parity. It supports the following NMEA-0183

Messages: GGA, GSA, GSV, RMC .

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

Table 1 NMEA-0183 Output Messages

NMEA Record	Description
GGA	Global positioning system fixed data
GSA	GNSS DOP and active satellites
GSV	GNSS satellites in view
RMC	Recommended minimum specific GNSS data

GGA-Global Positioning System Fixed Data

Table 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 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 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

GSA-GNSS DOP and Active Satellites

Table 2-4 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 4 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 5 Mode 1

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

Table 6 Mode 2

Value	Description

RoyalTek Confidential

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

GSV-GNSS Satellites in View

Table 7 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 7 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.

RMC-Recommended Minimum Specific GNSS Data

Table 8 contains the values of the following example:

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

Table 8 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		

3. GPS Receiver User's Tip

A. GPS signal will be affected by weather and environment conditions, so it is recommended 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 it is recommended to wait for the satellite signals 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.

4. Package Specification and Order Information

Shipment Method: Tape and reel
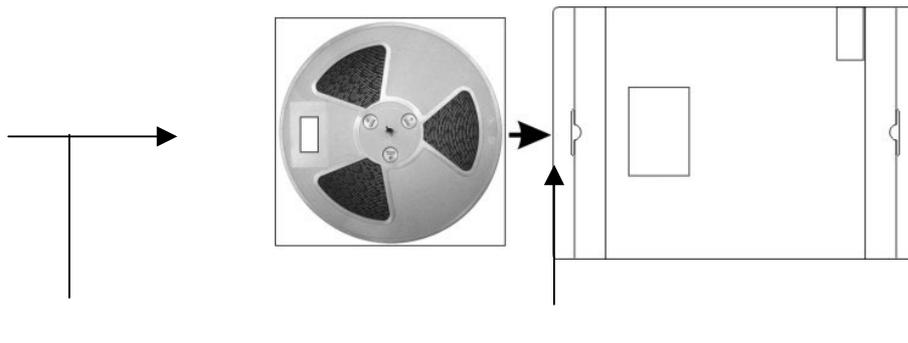
5. Contact Royaltek

Contact: sales@royaltek.com

Headquarter:

     Address: 8F, 256 Yang Guang Street, Neihu Chiu, Taipei, Taiwan

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

6. Revision History

Title	RET-3570LP			
Doc Type	User Manual			
Revision Number	Date	Author	Change notice	
0.1	20076/03/26	May Chen	Initial Release	
0.2	2007/03/28	May Chen	Remove RTCM Protocol	
1.0	2007/03/29	May Chen	Final Release	
1.1	2007/07/09	May Chen	Modify the chipset TTFF @open sky	