

SSF1513

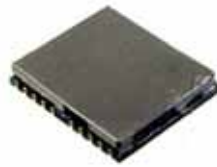
Ultra High Sensitivity SiRF StarIII 7989
GPS Module with Miniature Dimension

Documentation History

Revision	Description	Date	Remark
V0.1	SSF1513 release	Mar 2009	

Content

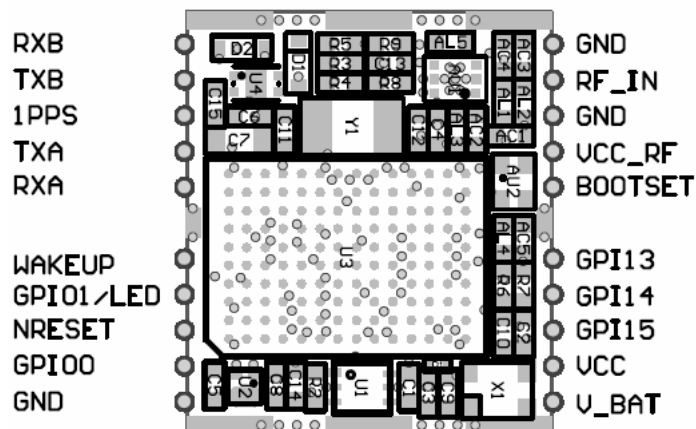
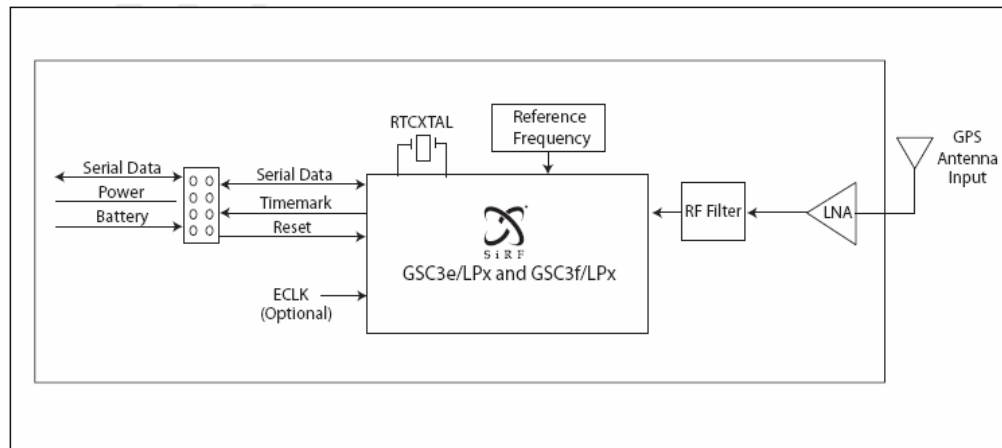
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Features

- ✓ 20 channel SiRF StarIII7989 positioning engine
- ✓ Ultra high sensitivity to -158 dBm
- ✓ SBAS (WAAS, MSAS, and EGNOS) support
- ✓ Supports Power saving modes
- ✓ 15 μ A backup current
- ✓ Support 2 UART ports
- ✓ Ultra low power consumption 60mW
- ✓ Ultra miniature 15 x 13 mm dimension with SMT pad package
- ✓ Operating temperature range: -30 to 85°C
- ✓ RoHS compliant (lead-free)

Block diagram



Technical Specifications

1. Electrical Characteristics

1.1 Chipset	SiRF StarII GSC3eLP	7989
1.2 General	Frequency L1, Channels, C/A code	1575.42MHz 16, 1.023 MHz chip rate, 8192 time/frequency search windows
1.3 Accuracy	Position Time	5 meters CEP 50 nanosecond rms (1 PPS)
1.4 DGPS Accuracy	Position	2.0 meters CEP
1.5 Acquisition Rate	Reacquisition Cold start Warm start Hot start	< 1 sec, typical 35 sec, typical 35 sec, typical 1 sec, typical
1.6 Sensitivity	Tracking	-159dBm
Acqui	sition/Reacquisition	-155dBm
Cold	start	-144dBm
1.7 Dynamic Condition	Altitude Velocity	18,000 meters (60,000 Feet) max. 515 meters /sec (1000 Knots) max.
1.8 Power	Main Power Supply current	3.3 VDC typical 30 mA
	Backup power Backup current	1.4 ~ 5V 15µA typical
1.9 Serial Port Protocols	Electrical interface	2 X UART, NMEA0183 v3.0

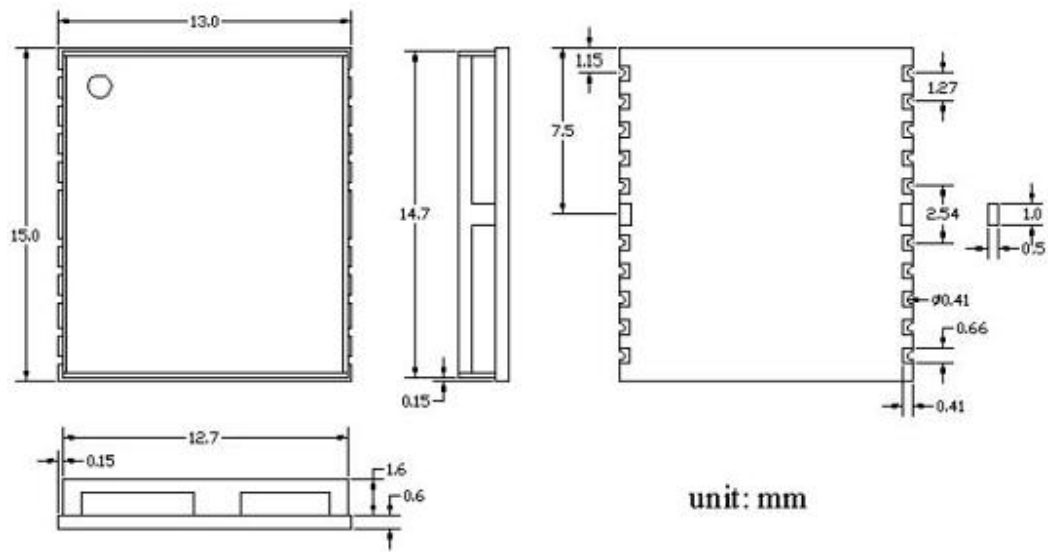
2. Environmental Characteristics

2.1 Temperature	Operating range	- 30 to + 85
2.2 Mechanical dimensions	L x W x H	15.0 x 13.0 x 2.2 mm
2.3 Interface	I/O connector	20 pin SMD micro package

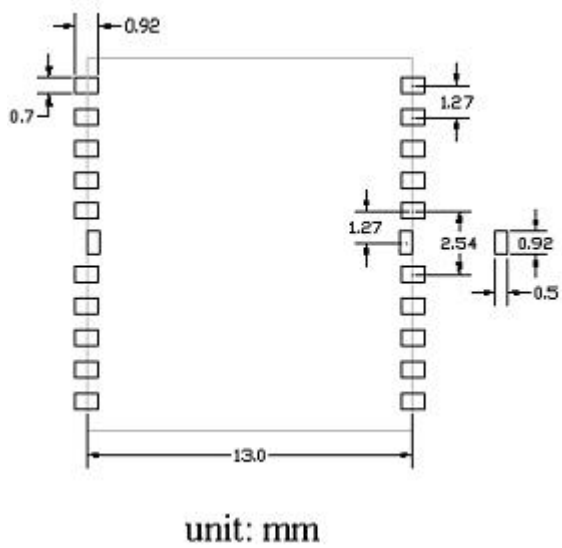
3 Antenna

Parameter	Specification
3.1 Antenna type	Passive and/or active antenna
3.2 Active Antenna	15 ~ 25 dB Gain recommended 1.5 dB noise figure max.
3.3 Antenna Supply	Using VCC_RF (pin #17) output pin to provide antenna bias voltage to RF_IN (pin #19)

Dimension



Recommended Solder Pad Layout



Pin Definition

Pin#	Name	Type	Description
1	RXB Input		UART RXB input
2	TXB Output		UART TXB output
3	1PPS Output		Time plus
4	TXA Output		UART TXA output
5	RXA Input		UART RXA output
6	WAKEUP Input		Wakeup
7	GPIO1/LED Output		General purpose I/O
8	NRESET Input		Baseband RESET input. '0' = reset and '1' = normal operation
9	GPIO0 I/O		General purpose I/O
10	GND PWR		Ground
11	V_BAT	PWR	Linear regulator battery input voltage: 1.4 - 5V.
12	VCC PWR		DC power input 3.3 – 5V
13	GPIO15 I/O		General purpose I/O
14	GPIO14 I/O		General purpose I/O
15	GPIO13 I/O		General purpose I/O
16	BOOTSET	Input	High Boot from Flash, Low Boot from serial port
17	VCC_RF PWR		Input power. Range 3 – 5 V
18	GND PWR		Ground
19	RF_IN Input		GPS RF signal input
20	GND PWR		Ground

Output NMEA Messages

Table 3 NMEA-0183 V3.0 Output Messages

NMEA Sentence	Description
GGA (default)	Global Positioning System Fixed Data
GLL (default)	Geographic Position - Latitude/Longitude
GSA (default)	GNSS DOP and Active Satellites
GSV (default)	GNSS Satellites in View
RMC (default)	Recommended Minimum Specific GNSS data
VTG (default)	Course Over Ground and Ground Speed
ZDA (default) T	Time and Date

GGA--- Global Positioning System Fixed Data

Table 4 contains the values for the following example:

\$GPGGA,092725.00,4717.11399,N,00833.91590,E,1,8,1.01,499.6,M,48.0,M,,0*5B

Table 4 GGA Data Format

Name	Example	Units	Description
Message ID	\$GPGGA		GGA protocol header
UTC Time	092725.00		hhmmss.ss, Current time
Latitude	4717.11399		ddmm.mmmmm, Degrees + minutes
N/S Indicator	N		N=north or S=south
Longitude	00833.91590		dddmm.mmmmm, Degrees + minutes
E/W Indicator	E		E=east or W=west
Position Fix Indicator	1		See Table 5
Satellites Used	8		Range 0 to 12
HDOP	1.01		Horizontal Dilution of Precision
MSL Altitude	499.6	m	
Units M		meters	Meters (fixed field)
Geoid Separation	48.0	m	
Units M		meters	Meters (fixed field)
Age of Differential Corrections		second	Blank (Null) fields when DGPS is not used
Diff. Ref. Station ID	0		
Checksum *5B			
<CR> <LF>			End of message termination

Table 5 Position Fix Indicator

Value	Description
0	No fix or invalid
1	Standard GPS (2D/3D)
2	Differential GPS
6	Estimated (DR) Fix

GLL--- Geographic Position – Latitude/Longitude

Table 6 contains the values for the following example:

\$GPGLL,4717.11364,N,00833.91565,E,092321.00,A,A*60

Table 6 GLL Data Format

Name	Example	Units	Description
Message ID	\$GPGLL		GLL protocol header
Latitude	4717.11364		ddmm.mmmmm, Degrees + minutes
N/S Indicator	N		N=north or S=south
Longitude	00833.91565		dddmm.mmmmm, Degrees + minutes
E/W Indicator	E		E=east or W=west
UTC Time	092321.00		hhmmss.ss, Current time
Status	A		V = Data Invalid / Receiver Warning, A=Data Valid
Status	A		N=No Fix, A=Autonomous GNSS Fix, D=Differential GNSS Fix, E=Estimated/Dead Reckoning Fix
Checksum *60			
<CR> <LF>			End of message termination

GSA---GNSS DOP and Active Satellites

Table 7 contains the values for the following example:

\$GPGSA,A,3,23,29,07,08,09,18,26,28,,,,,1.94,1.18,1.54*0D

Table 7 GSA Data Format

Name	Example	Units	Description
Message ID	\$GPGSA		GSA protocol header
Mode 1 (Smode)	A		See Table 8
Mode 2 (Fix Status)	3		See Table 9
Satellite Used	23		SV on Channel 1
Satellite Used	29		SV on Channel 2
			Repeated for each channel
Satellite Used			Sv on Channel 12
PDOP	1.94		Position Dilution of Precision (00.0 to 99.99)
HDOP 1.18			Horizontal Dilution of Precision (00.0 to 99.99)
VDOP	1.54		Vertical Dilution of Precision (00.0 to 99.99)
Checksum *0D			
<CR> <LF>			End of message termination

Table 8 Mode 1 (Smode)

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

Table 9 Mode 2 (Fix Status)

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

GSV---GNSS Satellites in View

Table 10 contains the values for the following example:

\$GPGSV,3,1,10,23,38,230,44,29,71,156,47,07,29,116,41,08,09,081,36*7F

\$GPGSV,3,2,10,10,07,189,,05,05,220,,09,34,274,42,18,25,309,44*72

\$GPGSV,3,3,10,26,82,187,47,28,43,056,46*77

Table 10 GSV Data Format

Name	Example	Units	Description
Message ID	\$GPGSV		GSV protocol header
Number of Messages	3		Total number of GPGSV messages being output , Range 1 to 3
Message Number	1		Number of this message, Range 1 to 3
Satellites in View	10		
Satellite ID	23		SV ID (GPS: 1-32, SBAS 33-64 (33=PRN120))
Elevation 38		degree	Maximum 90
Azimuth	230	degree	Range 0 to 359
SNR (C/No)	44	dBHz	Range 0 to 99, null when not tracking
			Data of 2nd, 3rd Satellite (same as above)
Satellite ID	29		SV ID
Elevation 71		degree	Maximum 90
Azimuth	156	degree	Range 0 to 359
SNR (C/No)	47	dBHz	Range 0 to 99, null when not tracking
Checksum *7F			
<CR> <LF>			End of message termination

RMC---Recommended Minimum Specific GNSS Data

Table 11 contains the values for the following example:

\$GPRMC,083559.00,A,4717.11437,N,00833.91522,E,0.004,77.52,091202,,A*57

Table 11 RMC Data Format

Name	Example	Units	Description
Message ID	\$GPRMC		RMC protocol header
UTC Time	083559.00		hhmmss.ss, Current time
Status	A		A=data valid or V=data not valid
Latitude	4717.11437		ddmm.mmmmm, Degrees + minutes
N/S Indicator	N		N=north or S=south
Longitude	00833.91522		dddmm.mmmmm, Degrees + minutes
E/W Indicator	E		E=east or W=west
Speed	0.004	knots	Speed Over Ground
COG	77.52	degree	Course Over Ground (true)
Date	091202		Ddmmyy, Current Date in Day, Month Year format
Magnetic Variation		degrees	E=east or W=west (Not being output by receiver)
Magnetic variation E/W indicator			Not being output by receiver
Mode Indicator	A		N=No Fix, A=Autonomous GNSS Fix, D=Differential GNSS Fix, E=Estimated/Dead Reckoning Fix
Checksum *53			
<CR> <LF>			End of message termination

VTG---Course Over Ground and Ground Speed

Table 12 contains the values for the following example:

\$GPVTG,77.52,T,,M,0.004,N,0.008,K,A*06

Table 12 VTG Data Format

Name	Example	Units	Description
Message ID	\$GPVTG		VTG protocol header
COG	77.52	degrees	Course Over Ground (true)
T			True
COG		degrees	Course Over Ground (maganetic) (Not being output by receiver)
M			Magnetic
Speed	0.004	knots	Speed over ground
Units N			Knots
Speed	0.008	km/hr	Speed over ground
Units	K		Kilometer per hour
Mode A			N=No Fix, A=Autonomous GNSS Fix, D=Differential GNSS Fix, E=Estimated/Dead Reckoning Fix
Checksum *0B			
<CR> <LF>			End of message termination

ZDA---Time and Date

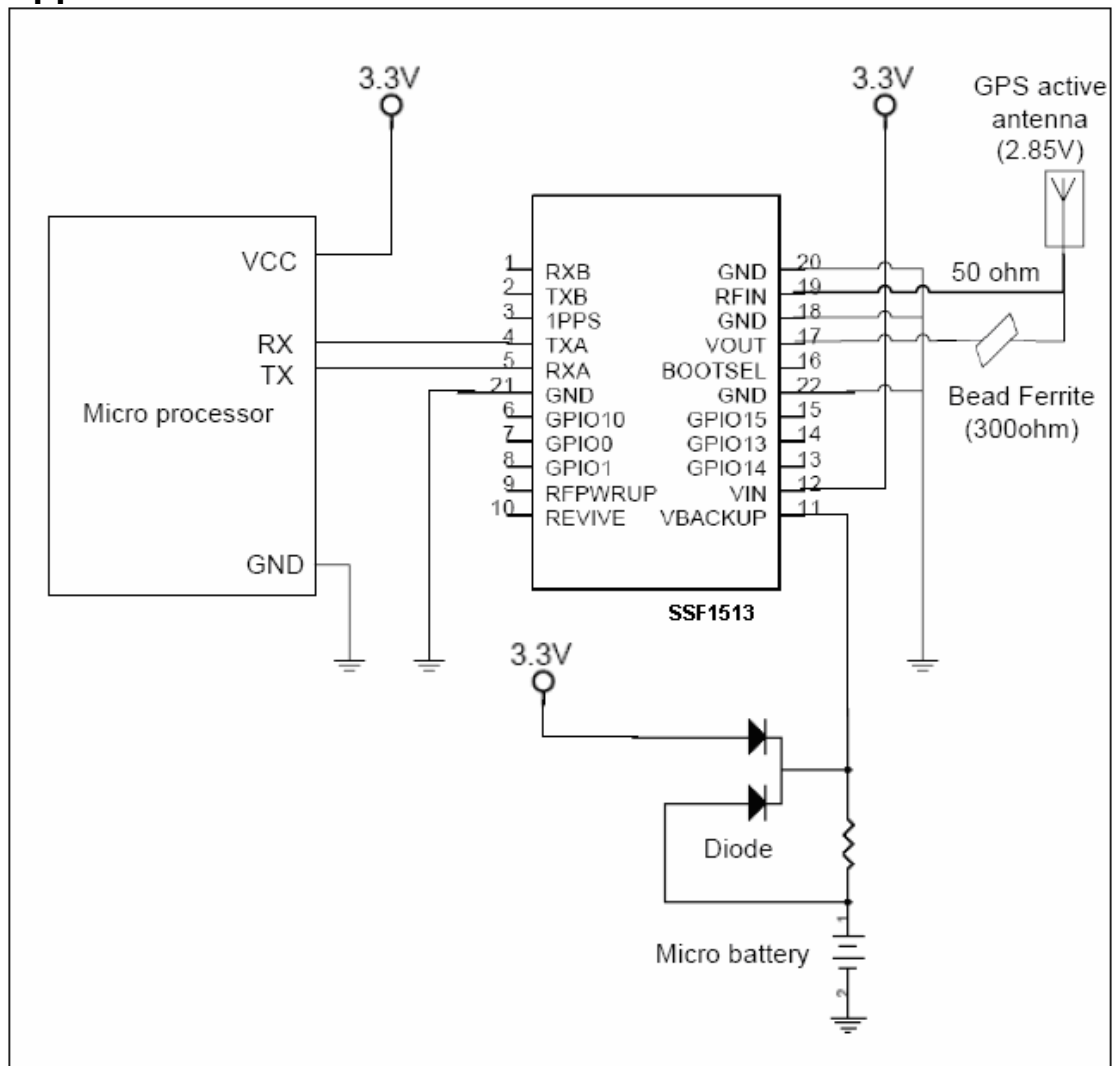
Table 13 contains the values for the following example:

\$GPZDA,082710.00,16,09,2002,00,00*64

Table 13 ZDA Data Format

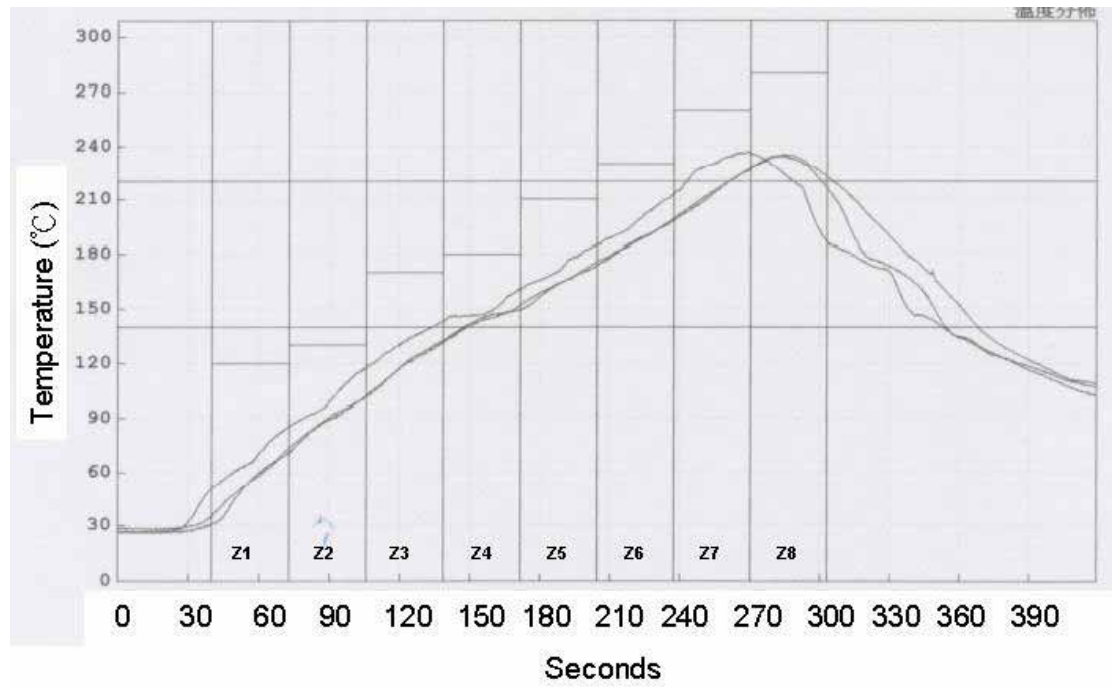
Name	Example	Units	Description
Message ID	\$GPZDA		ZDA protocol header
UTC Time	081727.00	degrees	hhmmss.ss
Day	16		01 to 31
Month	09		01 to 12
Year	2002		4 digit year
Local zone hours	00		(Not being output by receiver) (fixed to 00)
Local zone minutes	00		(Not being output by receiver) (fixed to 00)
Checksum *64			
<CR> <LF>			End of message termination

Application Circuit



Note: It is recommended to add Low Pass filter circuitry prior to main power input pin#12 (VCC pin) as well.

Reflow Profile



Setpoints (°C)

Zone	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8
Top	120	130	170	180	210	230	260	280
Bottom	120	130	170	180	210	230	260	280

Conveyer Speed (cm/min): 73