GPS Module W2SG0084i

Product Datasheet

ALT-PDT-DOC Revision 1.70
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Revision History

Rev.	Revision Date	Originator	Changes
1.0	June 12, 2010	WJL	Initial draft
1.1	June 23, 2010	WJL	Added current source for 1.8V Output
1.2	June 29, 2010	WJL	Added missing figures
1.21	September 30, 2010	WJL	Added missing Block diagrams
1.3	October 10, 2010	WJL	Added Wakeup, timing diagram, Receiver Sensitivity data
1.4	October 20, 2010	WJL	Added SRESET Pin label & WAAS-SBAS
1.45	December 2, 2010	WJL	Added SRESET description
1.6	August 29, 2011	WJL, SK, EK	Added Part Ordering Options, Updated Pin List, SRESET, Time Mark
1.65	February 22, 2012	DDS	Removed SRESET pin and corresponding text, Added Reference Schematic
1.66	November 5, 2012	DDS	Updated current and power consumption, default baud rate
1.68	June 6, 2013	DDS	Updated part ordering information
1.69	June 10, 2013	WJL	Added Internal LNA gain section
1.70	January 22, 2014	DDS	Updated command to switch internal LNA from high-gain mode to low-gain mode, updated to MSL1 package

1 General Description

This specification provides a general guideline on the performance and the integration of the Wi2Wi, Inc. NAVSTAR L1C/A Band, 48 Channel GPS Receiver Module Solution. The solder-down module, W2SG0084i, is targeted to assist companies to easily integrate GPS functionally into their products. This is accomplished by reducing their development times and cost by using a complete, small form factor, low power, ready to integrate GPS Receiver System Solution.

The specification maximum and minimum limits presented herein are those guaranteed when the unit is integrated into the Wi2Wi, Inc. Development System. These limits are to serve as the representative performance characteristics of the when properly designed into a customer's product. Wi2Wi makes no warranty, implied or otherwise specified, with respect to the customer's design and the performance characteristics presented in this specification.

2 Features

The W2SG0084i is a 48 Verification Channel Global Position System (GPS) receiver surface mount device (SMD) solution. Based upon the SiRFstar IV™ technology, the SMD features fast acquisition times, high receiver sensitivity and low power consumption in a small, compact form factor. The W2SG0084i is a flexible design that supports a broad range of applications where GPS functionality and location based services is required.

Key features are as follows:

- GPS technology based upon by the CSR/SiRF™ SiRFStar IV™
- W2SG0084i uses a SiRFStarIV™ Signature Series ROM v2.2
- Compact design for easy integration: 12 mm x 11.2 mm x 2.2 mm
- Fast acquisition time and high sensitivity GPS Receiver
- High sensitivity navigation engine (PVT) tracks as low as -163dBm
- Ultra-low power consumption (Only 50 to 500μA maintains hot start capability)
- Surface Mount Design (SMD)
- 50Ω Antenna Launch
- 48 verification channel GPS receiver
- Active Jammer Remover:
    - Removes in-band jammers up to 80 dB-Hz
    - Tracks up to 8 CW jammers
- Uses NAVSTAR GPS L1 C/A signal
- Single 3.3V DC supply input
- UART Interface (9600 BAUD Default)
- Auto Start Option: Immediate tracking after power up (see part order options)
- Format Selectable Output Data: NMEA and OSP
- RoHS Compliant

2.1 Pin Definition

The functional pin definition for the W2SG0084i is presented below in Table 1.

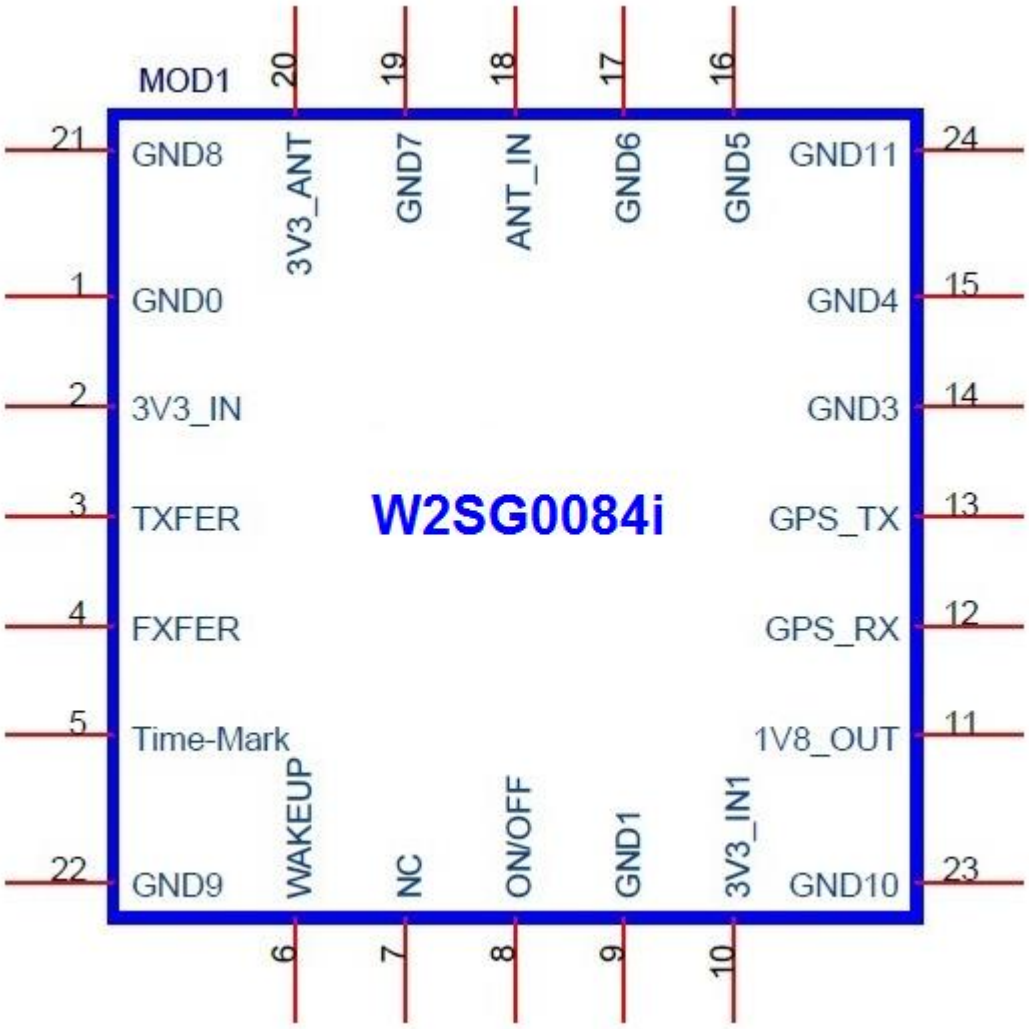
Table 1: Pin Definition

1	GND0	PWR	Ground
2	3V3_IN	PWR	3.3V Power Supply
3	TXFER	I	Time aiding input, 1.8V; Leave unconnected if it is not used
4	FXFER	I	Frequency Aiding input, 1.8V; Leave unconnected if it is not used
5	Time-Mark	O	Time Mark output; Leave unconnected if it is not used
6	WAKEUP	O	GPS is ready for full power mode
7	NC		No Connection
8	ON/OFF	I	Power On enabled by a rising edge or by interrupt, Power Off through software command 1.8V level
9	GND1	PWR	Ground
10	3V3_IN	PWR	3.3V Power supply
11	1V8_OUT	O	Regulator Output, 1.8V; Can source 10mA
12	GPS_RX	I	UART Receive input port, 1.8V (9600 BAUD)
13	GPS_TX	O	UART Transmit output port, 1.8V (9600 BAUD)
14	GND3	PWR	Ground
15	GND4	PWR	Ground
16	GND5	PWR	Ground
17	GND6	PWR	Ground
18	ANT_IN	I	Antenna RF input (50 ohm impedance)
19	GND7	PWR	Ground
20	3V3_ANT	PWR	Active antenna bias input; Connect to 3.3V if using active antenna; Leave it unconnected if using passive antenna
21	GND8	PWR	Ground
22	GND9	PWR	Ground
23	GND10	PWR	Ground
24	GND11	PWR	Ground

2.2 Pin Configuration

The W2SG0084i is a 24 pin SMD device with a board down antenna connection. The pin configuration is presented below in Figure 1.

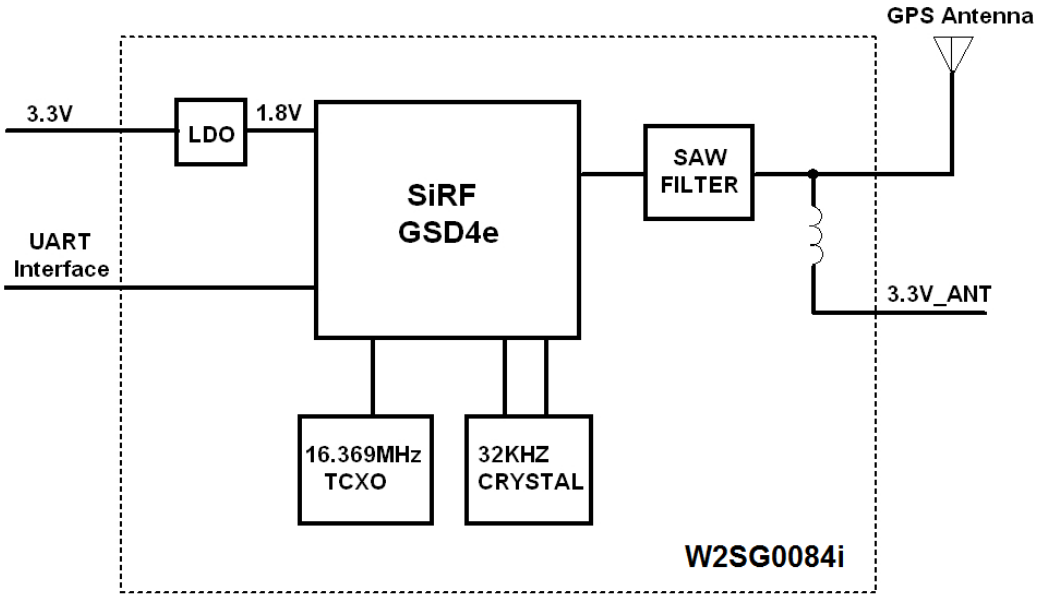
Figure 1: Pin Configuration



2.3 System Block Diagram

The System Block for the W2SG0084i is presented below in Figure 2.

Figure 2: System Block Diagram



The W2SG0084i provides an internal LNA, all required power regulation, and clocking. The TTL UART Interface is accessed via Pin 12 and 13.

3 Specifications

3.1 Clock Frequency

The W2SG0084i features an internal clock and crystal and requires no external clock sources.

Absolute Maximum Ratings:
The values presented in Table 2 are parameters beyond which permanent damage could result. These values *do not* imply functional operation and should be considered as stress ratings only.

Table 2: Absolute Maximum Ratings

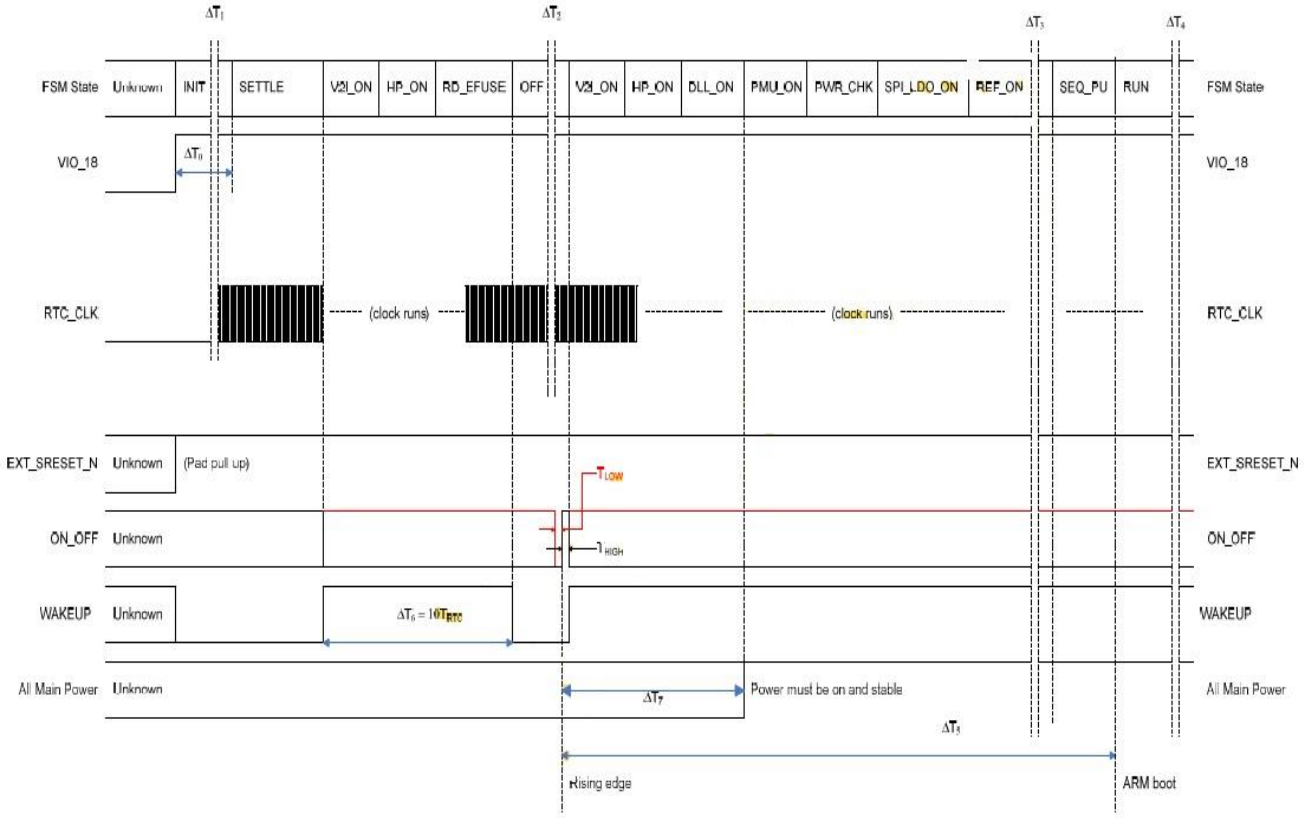
Parameter	Symbol	Rating	Units
Input Voltage	V_{DD}	5.5	V
RF Input	RF_{IN}	10	dBm
Case Temperature	T_{CASE}		°C
Lead Temperature (Soldering, 10sec)	T_{MFG}	260	°C
Operating Temperature Range	T_A	-40 to +85	°C
Storage Temperature Range	T_S	-40 to +150	°C

3.2 Interfaces

3.2.1 Host UART Interface

The TTL UART Interface (Pins 12, 13) has a bit rate range of 1.2 kbps to 115.2 kbps, though defaulted at 4800 BAUD. Protocol options for the W2SG0084i are NMEA and SiRFBINARY™ (OSP). Default setting for the UART Interface is 4800 BAUD/NMEA Protocol. Initial Power-On sequence is as follows:

Figure 3: Timing Diagram of initial application of power supply



3.2.2 Wake Up Pin

The Wake Up pin functions as follows: A short pulse on the WAKEUP output line indicates to a host that the W2SG0084i is ready to accept an ON_OFF pulse to start normal operation. When the module is in standby or hibernate mode, the WAKEUP output goes low and when the module is in Full power mode the WAKEUP output goes high.

3.2.3 Time Mark

The Time Mark pin [5] functions as follows: the Time Mark output provides a one pulse-per-second (1 PPS) signal to the customer's application processor. When the receiver provides a valid navigation solution which consists of five satellite vehicles, the rising edge of each TMARK pulse is synchronized with the UTC one second epochs to within ±1 microsecond. The

receiver software produces a binary format data message containing the UTC time associated with each time mark pulse. When the receiver's serial data communication port is set to 9600 bps. This signal is a positive logic, buffered CMOS level output pulse that transitions from a logic "low" condition to logic "high" at a 1 Hz rate. The TMARK output pulse rise time is typically less than 2 nanoseconds and the pulse duration is typically 200 milliseconds.

Patch Option:
A patch exists that allows the Time Mark to output the 1 PPS signal with only four satellite vehicles instead of the default of five satellites. This patch can be downloaded from the Wi2Wi Extranet and implemented with the GPS patch manager that will run on Windows 7[tm] and Linux operating systems. Please register at www.wi2wi.com to download from the extranet site.

3.3 GPS Power On/Off

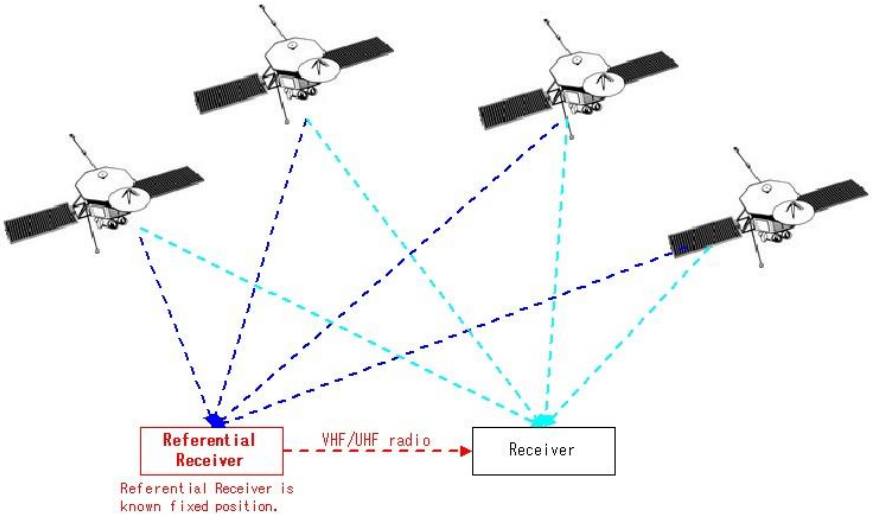
To enable the W2SG0084i a positive pulse for two RTC ticks (62 µS) must be applied. To place the module back into a hibernate state; the same pulse needs to be applied to the On/Off signal after the receiver has stabilized after a fix. **This can be verified with a message ID 18, called "OK to Send", that comes out when the receiver is receptive to commands.** Figure 3 above shows the internal state power up sequence of the SiRFStarIV™ inside the W2SG0084i, many of the signals listed are not accessible outside of the module, they are provided as reference only.

4 WAAS with SBAS or Wide Area Differential GPS

4.1 Differential GPS

Differential GPS (DGPS) is traditionally used with the fix of three to four satellites and the secondary fix from ground based GPS receiver based stations that retransmit the secondary fix via VHF/UHF and occasionally FM. DGPS can achieve positional accuracies of between 60 cm ~ 10 cm/s. See Figure 4 below.

Figure 4: Traditional DGPS System



DGPS requires at least two antennas, one for the NavStar L1 CA signal from the satellite and one antenna for the secondary fix from the VHF/UHF/FM transmitter. Also a secondary application processor is used to perform "Mixing" calculations between the two fixes. This increases the size and the expense of the system.

4.2 Wide Area DGPS or WAAS

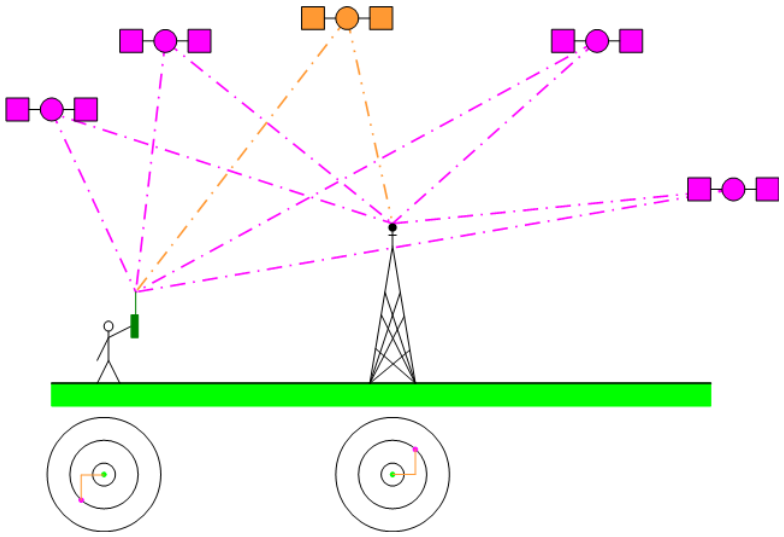
Wide Area DGPS or WAAS (Wide Area Augmentation System) uses the same concept but eliminates the need for the secondary RF signal. It accomplishes this by reusing the already orbiting satellites to re-broadcast other secondary fixes that have been established by ground based master stations in North America and Hawaii, to measure small variations in the GPS satellites' signals in the western hemisphere. Measurements from the reference stations are routed to master stations, which queue the received Deviation Correction (DC) and send the correction messages to geostationary WAAS satellites in a timely manner (every 5 seconds or better). These master stations rebroadcast the secondary fix to the NAVSTAR satellites which broadcast the secondary fix on unused channel space. This enables a GPS receiver to utilize the same antenna to reprocess both fixes internal to it also eliminating the need for a secondary application processor. WAAS enables a GPS receiver to provide positional accuracy to 300 cm ~ 200 cm. Of course a GPS receiver utilizing WAAS will need an expanded offering of GPS receiver channels to effective use this feature like the W2SG0084i which has 48 channels available for this function.

As noted this system was originally developed for the U.S. and Northern Hemisphere Geography. As GPS became ubiquitous in technology use throughout the world, similar systems called generically as Satellite-Based Augmentation System (SBAS). A SBAS is a system that supports wide-area or regional augmentation through the use of additional satellite-broadcast messages. Such systems are commonly composed of multiple ground stations, located at accurately-surveyed points. The ground stations take measurements of one or more of the GNSS satellites, the satellite signals, or other environmental factors which may impact the signal received by the users. Using these measurements, information messages are created and sent to one or more satellites for broadcast to the end users.

While SBAS designs and implementations may vary widely, with SBAS being a general term referring to any such satellite-based augmentation system, under the International Civil Aviation Organization (ICAO) rules a SBAS must transmit a specific message format and frequency which matches the design of the United State's Wide Area Augmentation System. See Figure 5 below.

Some examples of these are (GPS Aided GEO Augmented Navigation) GAGAN developed for the Indian Sub-Continent, European Geostationary Navigation Overlay Service (EGNOS) developed for the European Union, and the Japanese Multi-functional Satellite Augmentation System (MSAS), respectively.

Figure 5: SBAS Example System



4.3 How do we enable WAAS-SBAS on the W2SG0084i?

WAAS-SBAS is enabled by issuing Message ID 133, (MID 133) is supported in One Socket Protocol (Formerly SiRF Binary Protocol mode), and then the accuracy improves to 300 cm ~ 100 cm with SBAS enabled, depending on Open Sky Conditions (Multi-Path Interference). With SBAS not enabled, the accuracy is ~ 1500 cm.

5 NMEA Input Messages

The NMEA messages used to control the W2SG00084i modules are listed in Table 3. Messages 100 to 106 are OSP NMEA messages. The MSK NMEA string is as defined by the NMEA 0183 standard. See NMEA Reference Manual (CS-129435-MA-1) for further detail.

Table 3: NMEA Input Messages

Message	Message ID	Description
SetSerialPort	100	Set PORT A parameters and protocol
NavigationInitialization	101	Parameters required for start using X/Y/Z
SetDGPSPort	102	Set PORT B parameters for DGPS input
Query/Rate Control	103	Query standard NMEA message and/or set output rate
LLANavigationInitialization	104	Parameters required for start using Lat/Lon/Alt
Development Data On/Off	105	Development Data messages On/Off
Select Datum	106	Selection of datum to be used for coordinate transformations
Extended Ephemeris Proprietary 1	107	Extended Ephemeris Proprietary message
Extended Ephemeris Proprietary 2	108	Extended Ephemeris Proprietary message
Extended Ephemeris Debug	110	Extended Ephemeris Debug
MSK Receiver Interface	MSK	Command message to a MSK radio-beacon receiver

6 One Socket Protocol (OSP) Messages

6.1 OSP Output Messages

OSP Output Messages generated by the W2SG0084i are listed in Table 4. Please note that the support of individual commands is dependent upon the firmware loaded in the module.

Table 4: OSP Output Messages

Hex	Decimal	Name	Description
01	1	Reference Navigation Data	Not Implemented
02	2	Measured Navigation Data	Position, velocity, and time
03	3	True Tracker Data	Not Implemented
04	4	Measured Tracking Data	Satellite and C/No information
05	5	Raw Track Data	Not supported by SiRFstarII
06	6	SW Version	Receiver software
07	7	Clock Status	Current clock status
08	8	50 BPS Subframe Data	Standard ICD format
09	9	Throughput	Navigation complete data
0A	10	Error ID	Error coding for message failure
0B	11	Command Acknowledgment	Successful request
0C	12	Command NAcknowledgment	Unsuccessful request
0D	13	Visible List	Auto Output
0E	14	Almanac Data	Response to poll
0F	15	Ephemeris Data	Response to poll
10	16	Test Mode 1	For use with SiRFtest (Test Mode 1)
11	17	Differential Corrections	Received from DGPS broadcast
12	18	OkToSend	CPU ON / OFF (TricklePower)
13	19	Navigation Parameters	Response to Poll
14	20	Test Mode 2/3/4	Test Mode 2, 3, or 4 test data
1B	27	DGPS Status	Differential GPS status information
1C	28	Nav. Lib. Measurement Data	Measurement data
1D	29	Nav. Lib. DGPS Data	Differential GPS data
1E	30	Nav. Lib. SV State Data	Satellite state data
1F	31	Nav. Lib. Initialization Data	Initialization data
29	41	Geodetic Navigation Data	Geodetic navigation information
2B	43	Queue Command Parameters	Command parameters
2D	45	Raw DR Data	Raw DR data from ADC
2E	46	Test Mode 3	Additional test data (Test Mode 3)
30	48	Test Mode 4 for SiRFLoc v2.x only	Additional test data (Test Mode 4)
30	48	SiRFDRive-specific Class of Output Messages	The MID is partitioned into messages identified by Sub IDs
31	49	Test Mode 4 for SiRFLoc v2.x only	Additional test data (Test Mode 4)
32	50	SBAS Parameters	SBAS operating parameters
34	52	1 PPS Time Message	Time message for 1 PPS
37	55	Test Mode 4	Track Data
38	56	Extended Ephemeris Data	Extended Ephemeris Mask and Integrity Information
E1	225	SiRF internal message	Reserved
FF	255	Development Data	Various status messages

6.2 OSP Input Messages

OSP input commands for the W2SG0084i are listed in

Table 5. Please note that the support of individual commands is dependent upon the firmware loaded in the module.

Table 5: OSP Input Messages

Hex	Decimal	Name	Description
35	53	Advanced Power Management	Power management scheme for SiRFLoc and SiRFXTrac
80	128	Initialize Data Source	Receiver initialization and associated parameters
81	129	Switch to NMEA Protocol	Enable NMEA messages, output rate and baud rate
82	130	Set Almanac (upload)	Sends an existing almanac file to the receiver
83	131	Handle Formatted Dump Data	Outputs formatted data
84	132	Poll Software Version	Polls for the loaded software version
85	133	DGPS Source Control	DGPS correction source and beacon receiver information
86	134	Set Binary Serial Port	Baud rate, data bits, stop bits, and parity
88	136	Mode Control	Navigation mode configuration
89	137	DOP Mask Control	DOP mask selection and parameters
8A	138	DGPS Mode	DGPS mode selection and timeout value
8B	139	Elevation Mask	Elevation tracking and navigation masks
8C	140	Power Mask	Power tracking and navigation masks
8F	143	Static Navigation	Configuration for static operation
90	144	Poll Clock Status	Polls the clock status
91	145	Set DGPS Serial Port	DGPS port baud rate, data bits, stop bits, and parity
92	146	Poll Almanac	Polls for almanac data
93	147	Poll Ephemeris	Polls for ephemeris data
94	148	Flash Update	On the fly software update
95	149	Set Ephemeris (upload)	Sends an existing ephemeris to the receiver
96	150	Switch Operating Mode	Test mode selection, SV ID, and period.
97	151	Set TricklePower Parameters	Push to fix mode, duty cycle, and on time
98	152	Poll Navigation Parameters	Polls for the current navigation parameters
A5	165	Set UART Configuration	Protocol selection, baud rate, data bits, stop bits, and parity
A6	166	Set Message Rate	SiRF Binary message output rate
A7	167	Set Low Power Acquisition Parameters	Low power configuration parameters
A8	168	Poll Command Parameters	Poll for parameters:
			0x80: Receiver initialized & associated params
			0x85: DGPS source and beacon receiver info
			0x88: Navigation mode configuration
			0x89: DOP mask selection and parameters
			0x8A: DGPS mode selection and timeout values
			0x8B: Elevation tracking and navigation masks
			0x8C: Power tracking and navigation masks
			0x8F: Static navigation configuration
			0x97: Low power parameters
AA	170	Set SBAS Parameters	SBAS configuration parameters
AC	172	SiRFDRive-specific Class of Input Messages	The MID is partitioned into messages identified by Sub IDs.
B4-C7	180-199	MID_UserInputBegin - MID_UserInputEnd	SDK user input messages only.
B4	180	Marketing Software Configuration	Selection of the Marketing Software Configurations as defined in bits [3:2] of the GSC2xr chip configuration register
B6	182	Set UART Configuration	Obsolete.
E4	228	SiRF internal message	Reserved
E8	232	Extended Ephemeris Proprietary	Extended Ephemeris and Debug Flag

7 Electrical/RF Characteristics: Operating

The Table 6 below presents the normal limits of operation for the W2SG0084i. Operation of the W2SG0084i beyond the limits of this table is not recommended and may result in permanent damage of the device. Unless otherwise specified, operating conditions are over T_A = -40°C to +85°C. Typical is defined as T_A = +25°C.

Table 6: Operating Electrical Characteristics

Parameter[1]	Symbol	Min	Typ.	Max.	Units
Power Supply (3V3_IN)					
Power Supply Voltage	V_{CC}	3.25	3.3	3.6	V
I/O Supply Voltage	V_{IO}	1.62	1.8	1.98	V
Power Supply Ripple	V_{RIP}			100	mV
Peak Supply Current[2]	I_{CCP}			50	mA
Power Supply Input Current[3]	I_{CC}			35	mA
I/O Input Current	I_{IO}		1.5	2.0	mA
Hibernate Current	I_H		20		µA
Current Consumption (I_{CC})					
Acquisition Mode Current	I_{CC_ACQ}	40	44	50	mA
Tracking Mode Current	I_{CC_TR}	30	34	40	mA
Power Save Mode Current	I_{CC_PS}	25	27	30	µA
UART Interface (GPS_TX, GPS_RX)					
Input Pin Voltage	VRX		1.8	3.6	V
Output Pin Voltage	VTX		1.8		V
GPIO Interface					
GPIO Pin Voltage	V_{GPIO}	1.62	1.8	1.98	V
GPS Enable (GPS_ON/OFF)					
Input Pin Low Voltage	V_{IL}	0		0.45	V
Input Pin High Voltage	V_{IH}	1.35	1.8	3.6	V
RF Input					
Input Impedance	R_{ANT}		50		Ω
Operating Frequency	F_{OPR}		1.575		GHz
Antenna Bias Voltage	V_{ANT}		3.3		V
Antenna Bias Voltage Drop	V_{ANTD}		200		mV
RF Antenna Voltage	V_{CCRF}	3.0	3.3	5.4	V
RF Antenna Output Current	I_{CCRF}			22	mA
RF Characteristics					
Power In @1.5745 GHz	P_{IN}	-157	-131	10	dBm
Noise Figure	NF		2.5		dB
Input Return Loss	RL_{IN}		-10.0		dB
Input VWR	VWR_{IN}		TBD	1.8:1	
Reverse Isolation	ISL		TBD		dB
Stability (100 -10000 MHz)					
Receiver Sensitivity:					
•Signal Acquisition @ 31dBHz	P_{AQC}		-148		dBm
•Signal Tracking	P_{TKS}		-163	-	dBm

Notes:
[1] All parameters are at T_A = 25°C, unless otherwise specified.
[2] Defined as peak current drawn during initial acquisition operation of GPS Receiver.
[3] Defined as current drawn during continuous operation at a 10Hz update rate.

7.1 Performance

7.1.1 Acquisition Time

The average Time to First Fix (TTFF) for the W2SG0084i when integrated with the W2SG0084i-DEV Development System is presented in Table 7 below:

Table 7: Average Time to First Fix

Parameter[1]	Symbol	Min	Typ.	Max.	Units
Hot Start – Typ. @ -140 dBm	$TTFF_{TYP}$	-	0.7	-	s
Hot Start – Low @ - 146 dBm	$TTFF_{LOW}$	-	1.0	-	s
Hot Start – Weak @ - 150 dBm	$TTFF_{WEAK}$	-	2.0	-	s
Cold Start @ -130 dBm	$TTFF_{CLD}$	-	35	-	s
Cold Start @ -140 dBm	$TTFF_{CLD}$	-	37	-	s
Cold Start @ -146 dBm	$TTFF_{CLD}$	-	38	-	s
Cold Start @ -150 dBm	$TTFF_{CLD}$	-	45	-	s

Notes:
[1] Stationary receiver, unless otherwise specified.
[2] All parameters are at T_A = 25°C, unless otherwise specified.

7.1.2 Position Accuracy (3-D NAV)

Table 8 below presents the Positional Accuracy for the W2SG0084i when integrated with the W2SG0084i-DEV Development System.

Table 8: Positional Accuracy

Parameter[1]	Typ.	Units
Horizontal Position Accuracy: CEP (50%)[3]	3	m
Horizontal Position Accuracy: 2dRMS (95%)[3]	5	m
Vertical Position Accuracy: CEP (50%)[3]	3	m
Vertical Position Accuracy: 2dRMS (95%)[3]	5	m
Horizontal Velocity Accuracy: Deviation[3]	0.8	m/s
Vertical Velocity Accuracy: Deviation[3]	0.4	m/s

Notes:
[1] Stationary receiver in the Open Sky at -130dBm, unless otherwise specified.
[2] All parameters are at T_A = 25°C, unless otherwise specified.
[3] WAAS, SBAS must be enabled

7.2 Environmental Characteristics

Table 9 establishes the environmental limits for operational use of the W2SG0084i.

Table 9: Environmental Characteristics

Parameter	Symbol	Min	Typ.	Max.	Units
Storage Temperature	T_{STR}	-40	-	+150	°C
Operating Temperature	T_{OPR}	-40	+25	+85	°C
Humidity		5	-	95	%/Non-condensing
Altitude		-	-	60,000/18,288	ft/m
Acceleration		-	-	6.0	g
Velocity				<1,000	knots

7.3 Power Consumption

Table 10 indicates the power consumption values in different modes of operation for W2SG0084i.

Table 10: Power Consumption

Mode of Operation	Power			Units
	Min.	Typ.	Max.	
Acquisition Mode	72	79	90	mW
Tracking Mode	54	61	72	mW
Power Save Mode	45	48	54	µW

7.3.1 Internal LNA Gain

The W2SG008i is provided with an internal LNA amplifier with two selectable gain levels. In general, the high gain mode is intended for use with passive antennas, while the low gain mode is used when there is an external LNA as part of the RF front end (e.g. active antenna).

Note: By default, the internal LNA is configured in high gain mode.

The internal LNA must be configured in low gain mode, when an active antenna with an external LNA has to be used. To change the internal LNA to low gain mode, use the following steps:

1. Switch GPS Communication Protocol from NMEA to OSP mode.
2. Send Tracker Configuration Message (OSP MID 178, 02) - (Disable Internal LNA and drive GPS_EXT-LNA_EN signal):
   A0 A2 00 39 B2 02 00 F9 C5 68 03 FF 00 00 0B B8 00 01 77 FA 01 01 03 FC 03 FC 00 04 00 00 00 00 00 7C 00 00 00 00 00 00 00 00 00 00 00 00 00 01 C2 00 00 00 62 00 60 01 01 01 F4 2A 01 0B 38 B0 B3

3. Wait for SiRFStarIV ACK: **A0 A2 00 03 0B B2 00 00 BD B0 B3**
4. Perform a Hot Start reset; Tracker Configuration setting requests in message (OSP MID 178, 02) will apply after performing this reset.
5. Wait for SiRFStarIV ACK: **A0 A2 00 03 0B 80 00 00 8B B0 B3**
6. Switch GPS Communication Protocol back to NMEA mode.

7.3.2 Maximum RF Gain

- In high gain mode, a passive antenna acts as input. Total RF gain (sum of internal LNA gain, cable and filter losses) of ≤ 5 dB is considered acceptable.
- In low gain mode, an active antenna acts as input. Total RF gain (sum of external antenna gain, internal LNA gain, cable and filter losses) of 14 to 24 dB is considered acceptable.

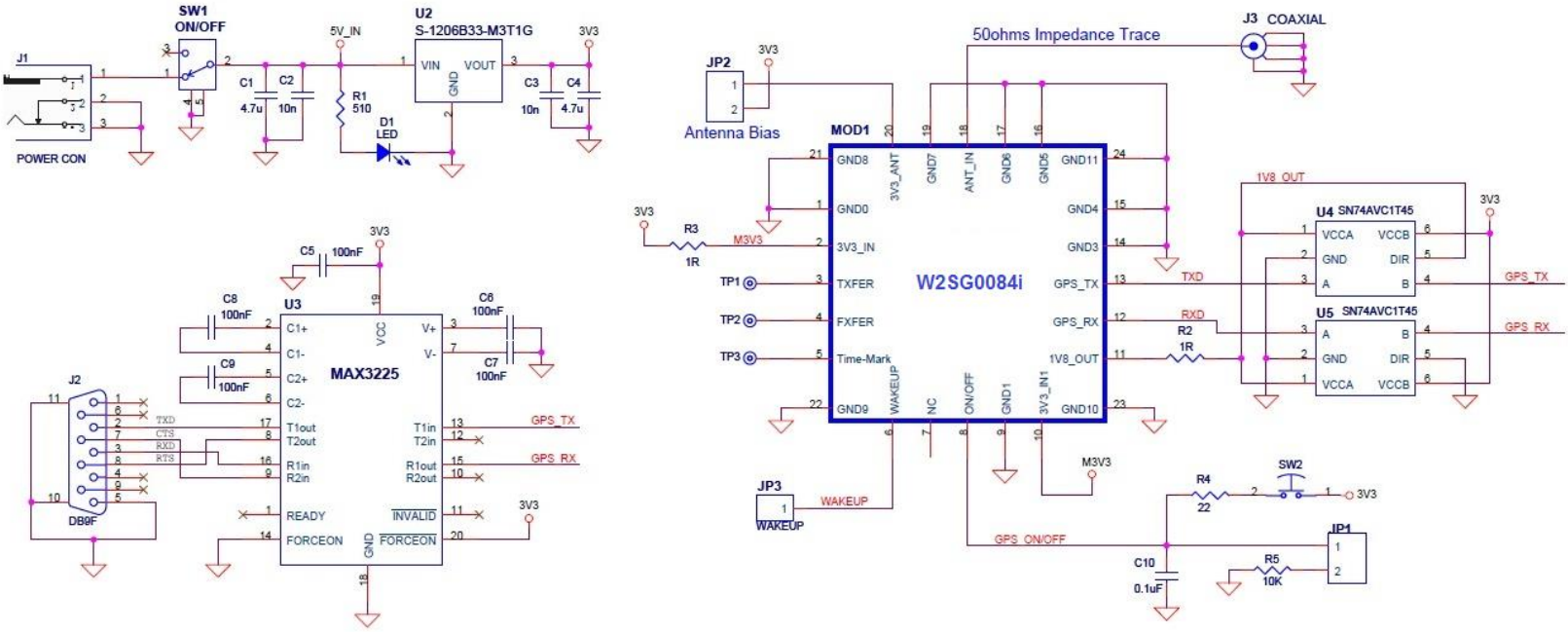
8 Antenna

The W2SG0084i is designed for connection to either a passive or an active antenna. The GPS module includes an internal LNA and is designed to work with the passive antenna, but provides the bias voltage supply for an active antenna to improve the receiver sensitivity. If the design is to work with an Active Antenna; Pin 20 (3V3_ANT) is tied to a 3.3V DC power supply.

9 Normal Mode of Operation

Figure 6 shows the normal mode of operation of W2SG0084i.

Figure 6: Normal Mode of Operation



10 Development Support

The W2SG0084i device is embedded with GPS software. This software is optimized to work in very weak signal environments to improve navigation availability and accuracy.

To enable GPS performance testing, Wi2Wi provides a W2SG0084i GPS evaluation board, along with the SiRFLive v2.02 software. SiRFLive is a PC tool that provides real-time monitoring of an attached GPS receiver's operation such as satellites being tracked, observed signal strength and current position.

11 Manufacturing Notes

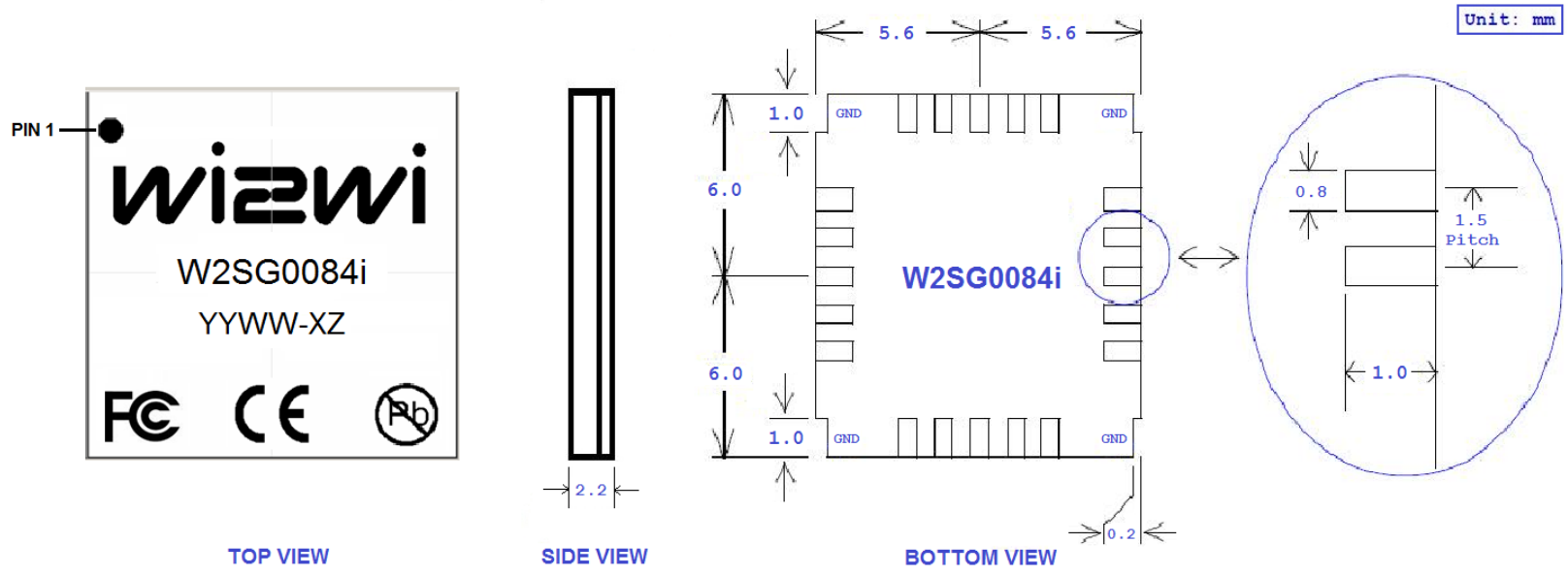
11.1 Physical Dimensions

The module is a Surface Mount Device (SMD). Table 11 presents the physical characteristics of the W2SG0084i. The overall dimensions of the W2SG0084i are 12 mm x 11.2 mm x 2.2 mm. The module includes a shield. All dimensions shown in Figure 7 are in mm, and are not to scale.

Table 11: Physical Characteristics

Parameter	Dimension	Tolerance	Unit
Size	12 x 11.2 x 2.2	±0.1	mm
Pad Pitch	1.5	±0.05	mm

Figure 7: Package Outline Drawing



Note: Refer to Ordering Information in Section 12.

- YY indicates Year, WW indicates Work Week
- X indicates ROM version (e.g. B = ROM v2.2)
- Z indicates Baud Rate (e.g. 1 = 4800 Baud Rate)

11.2 Storage and Baking Instructions

W2SG0084i module is qualified as moisture sensitivity level MSL1 package, in accordance with JEDEC J-STD-020 standard.

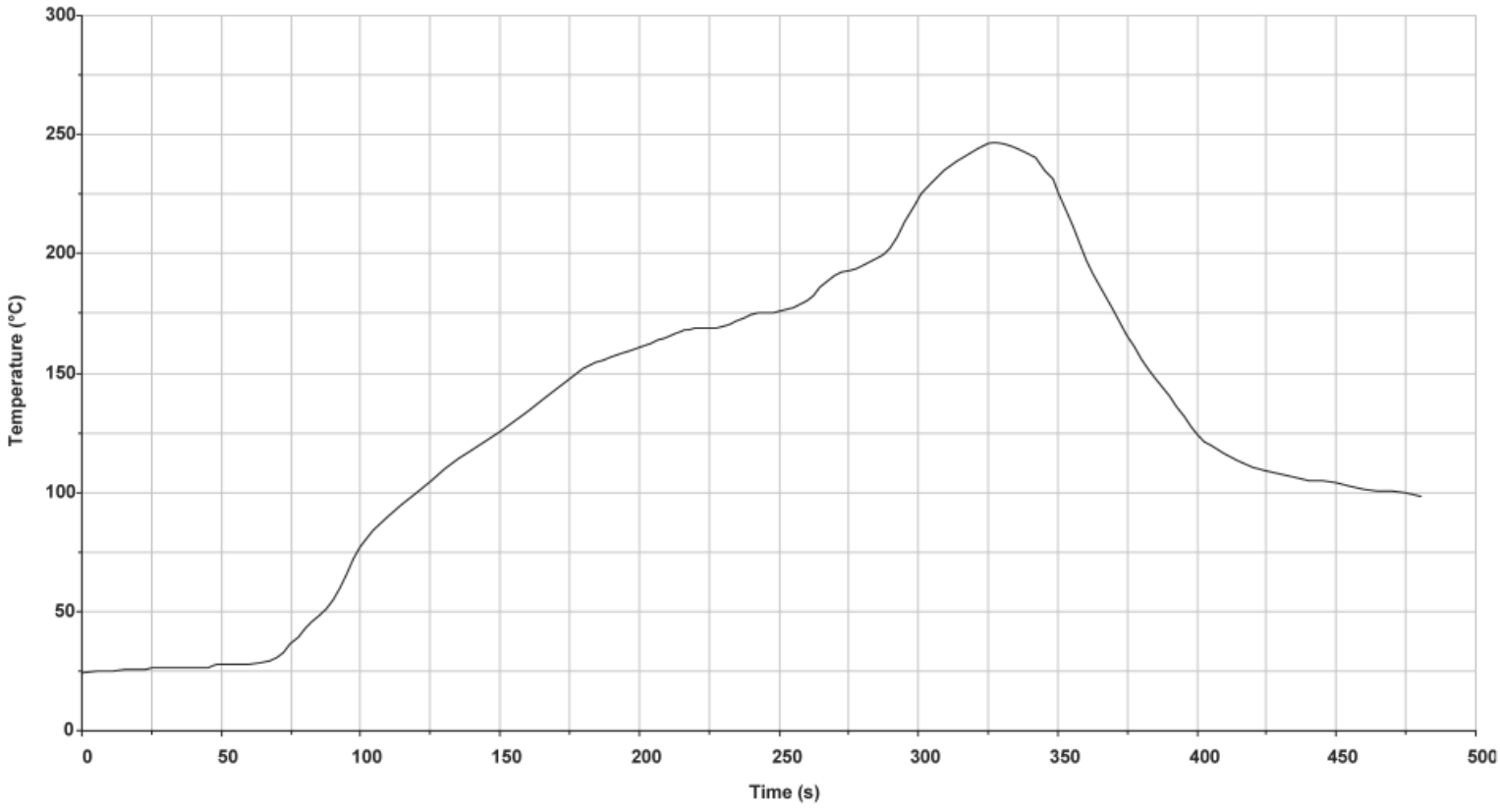
MSL1 indicates that there are no special dry pack requirements or time limits from opening of static bag to reflow for floor conditions of ≤ 30°C and 85% RH.

11.3 Recommended Reflow Profile

The soldering profile depends on various parameters necessitating a setup for each application. The data here is given only for guidance on solder re-flow. There are four zones:

- Preheat Zone: This zone raises the temperature at a controlled rate, typically 1-2.5°C/s.
- Equilibrium Zone: This zone brings the board to a uniform temperature and also activates the flux. The duration in this zone (typically 2-3 minutes) will need to be adjusted to optimize the out gassing of the flux.
- Reflow Zone: The peak temperature should be high enough to achieve good wetting but not so high as to cause component discoloration or damage. Excessive soldering time can lead to intermetallic growth which can result in a brittle joint.
- Cooling Zone: The cooling rate should be fast, to keep the solder grains small which will give a longer lasting joint. Typical rates will be 2-5°C/s.

Figure 8: Typical Lead-free Reflow Solder Profile



Key features of the profile:

- Initial ramp = 1-2.5°C/sec to 175°C ± 25°C equilibrium
- Equilibrium time = 60 to 180 seconds
- Ramp to maximum temperature (245°C) = 3°C/sec max.
- Time above liquidus temperature (217°C) = 45-90 seconds
- Device absolute maximum reflow temperature = 260°C

12 Ordering Information

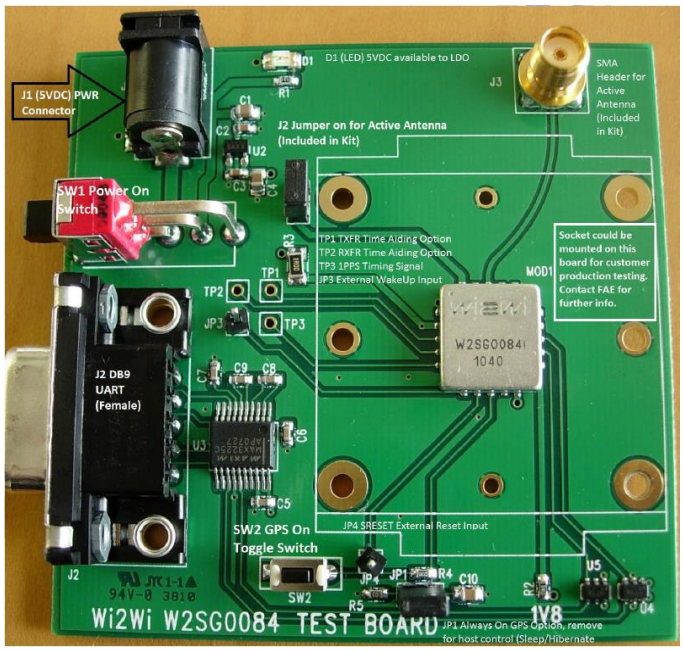
Table 12: Ordering Information

Part Order Number	Description	Packing Method
W2SG0084i-B-T	Baud Rate = 9600 bps	Tray
W2SG0084i-B1-T	Baud Rate = 4800 bps	Tray
W2SG0084i-B2-T	Auto Start, Baud Rate = 9600 bps	Tray
W2SG0084i-B4-T	Auto Start, Baud Rate = 4800 bps	Tray
W2SG0084i DEV	Test Board with Active Antenna	Box

12.1 Development Kits

- W2SG0084i_DEV: W2SG0084i Development Kit with Test-Board and Active Antenna This development kit is designed to provide a quick evaluation with the customer's host processor. It includes a test-board with W2SG0084i module mounted on it, an active antenna and an evaluation CD with Application Notes, Datasheet, Product Brief, Schematic, Quick Start Guide, SiRFLive software and other supporting documents.

Figure 9: W2SG0084i module mounted on test-board



13 Disclaimers

Wi2Wi, Inc. PRODUCTS ARE NOT AUTHORISED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE MANAGING DIRECTOR OF Wi2Wi, Inc.

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13.1 Data Sheet Status

Wi2Wi, Inc. reserves the right to change the specification without prior notice in order to improve the design and supply the best possible product. Updated information, firmware and release notes will be made available on www.wi2wi.com. Please check with Wi2Wi Inc. for the most recent data before initiating or completing a design.

14 Certifications

The W2SG0084i shall conform to the following standards when integrated to the W2SG0084i-DEV development system.

EMC/Immunity

- FCC Part 15 Chapter B (USA)
- IC Canada (Canada)
- CE Mark (Europe)

15 References

15.1 Specifications

- System Specification, SiRFStarIV GSD4e BGA, Issue 5
- NMEA 0183 Version 3.01, January 2002, Addendum NMEA 0183-HS Version 1.0
- OSP Issue 15
- FAA WAAS Specification FAA-E 2892b

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