WLAN Module W2SW0011

Product Datasheet

CAS-PDT-DOC Revision 1.32

May 14, 2012

Table of Contents

List of Figures:

List of Tables:

Revision History:

Revision	Revision Date	Originator	Changes
1.0	06/25/2010	WJL/EK	Initial Release
1.20	12/16/2010	WJL	Updated Pin List, removed non related content, updated diagrams
1.23	12/30/2010	WJL/EK	Inserted missing figures
1.3	08/24/2011	T.F./EK	Power measurements, Operating Temperature
1.31	10/19/2011	T.F./EK	Updated Min-Max values for measured performance parameters
1.32	05/14/2012	DDS	Removed chip antenna from test board reference schematic

1   General Description

This specification provides general information regarding performance and integration of W2SW0011, a complete wireless subsystem featuring 802.11 b/g/n WLAN capabilities in a small form factor module. The W2SW0011 device is designed to simplify the process of adding wireless capability without lengthy design cycles or complex RF design. It is completely tested for functionality and performance along with coexistence with other wireless standards. A full menu of certifications will also be provided, simplifying the certification process for your end product while further reducing valuable time-to-market.   Based on world-class silicon from Marvell, the W2SW0011 has been fully optimized for throughput and receive sensitivity using careful design practices.   Software development resources are available to create drivers for unique processors and operating systems if needed, and to optimize the wireless subsystem for your application.

The specification maximum and minimum limits presented herein are those guaranteed when the unit is integrated into the Wi2Wi's W2SW0011-DEV Development System. These limits are to serve as representative performance characteristics of the W2SW0011 when properly designed into a customer's product. Wi2Wi makes no warranty, implied or otherwise specified, with respect to design and performance characteristics presented in this specification when used in customer designs.

This device complies with part 15 of the FCC Rules.   Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules.   These limits are designed to provide reasonable protection against harmful interference in a residential installation.   This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.   However, there is no guarantee that interference will not occur in a particular installation.   If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with the FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

The latest revision of this document supersedes all previous versions of this document. Wi2Wi reserves the right to change this specification without notice.

2 Features

- Compact design for easy integration: 15mm x 15mm
- LGA with 60 pins
- WLAN technology based on Marvell's 88W8786
- Certified radio
- Optimized RF and electrical design for better performance in co-existence with other wireless standards
- Operates in 2.4 GHz ISM band
- ROHS Compliant
- Single supply of 3.3V
- SDIO HS up to 50 MHz, 4 bit
- 50-Ohm antenna launch
- Support for various operating systems
- 1, 2, 5.5 and 11 Mbps data rates for 802.11b (DSSS/CCK modulation)
- 6, 9, 12, 18, 24, 36, 48 and 54 Mbps data rates for 802.11g (OFDM modulation)
- 75, 150 Mbps for 802.11n

3 System Description

W2SW0011 is a complete module, combination of 88W8786 802.11b/g/n, 1 x 1 SISO device and all the components needed to operate the radio. It preserves characteristics from the Marvell chipset while providing optimized system level functionality and performance.

3.1 Block Diagram

Figure 1 shows a block diagram of W2SW0011 along with the interfaces.

Figure 1: Block Diagram

3.2 Pin Description

Table 1: Pin Description

Pin Number	Pin Name	Type	Supply	Description
1	GND1	Ground	GND	Ground
2	TR_P	O	3.3V	Transmit Switch Control Positive Output
3	GND3	Ground	GND	Ground
4	3.3V	Power	3.3V	3.3V

5	NC	NC	NC	NC
6	NC	NC	NC	NC
7	TR3_N	O	3.3V	Transmit Switch 3 Negative Output
8	3.3V	Power	3.3V	3.3V
9	WL_ACTIVE	O	1.8VD	WLAN is Transmitting or Receiving Packets
10	GND10	Ground	GND	Ground
11	NC	NC	NC	NC
12	GND12	Ground	GND	Ground
13	NC	NC	NC	NC
14	NC	NC	NC	NC
15	TR_N	O	3.3V	Transmit Switch Control Negative Output
16	3.3V	Power	3.3V	3.3V
17	3.3V	Power	3.3V	3.3V
18	NC	NC	NC	NC
19	NC	NC	NC	NC
20	GND20	Ground	GND	Ground
21	NC	NC	NC	NC
22	NC	NC	NC	NC
23	NC	NC	NC	NC
24	NC	NC	NC	NC
25	RESETn	I	3.3V	Reset (active low)
26	NC	NC	NC	NC
27	NC	NC	NC	NC
28	GND28	Ground	GND	Ground
29	GND29	Ground	GND	Ground
30	NC	NC	NC	NC
31	NC	NC	NC	NC
32	NC	NC	NC	NC
33	NC	NC	NC	NC
34	NC	NC	NC	NC
35	NC	NC	NC	NC
36	GPIO0	O	3.3V	General Purpose Output 0
37	GND37	Ground	GND	Ground
38	SD_D2	I/O	3.3V	SD Data Line Bit[2]
39	SD_D3	I/O	3.3V	SD Data Line Bit[3]
40	SD_CLK	I	3.3V	SD Bus Clock
41	SD_CMD	I/O	3.3V	SD Command and Response
42	NC	NC	NC	NC
43	SD_D0	I/O	3.3V	SD Data Line Bit[0]
44	NC	NC	NC	NC
45	NC	NC	NC	NC
46	SD_D1	I/O	3.3V	SD Data Line Bit[1]
47	NC	NC	NC	NC

48	3.3V	Power	3.3V	3.3V
49	GPIO1	I/O	3.3V	General Purpose Input/Output 1
50	NC	NC	NC	NC
51	NC	NC	NC	NC
52	3.3V	Power	3.3V	3.3V
53	NC	NC	NC	NC
54	GND54	Ground	GND	Ground
55	3.3V	Power	3.3V	3.3V
56	3.3V	Power	3.3V	3.3V
57	NC	NC	NC	NC
58	GND58	Ground	GND	Ground
59	WLAN_RF1	RF		Wi-Fi RF
60	GND60	Ground	GND	Ground

4 Electrical Characteristics

Table 2: Electrical Characteristics

Parameter	Test Condition	MIN	TYP	MAX	UNITS
Absolute Maximum Ratings					
Storage Temperature		-40		85	°C
Supply Voltage +3V_IO		2.7	3.3	4.2	V
Recommended Operating Conditions					
Operating Temperature		0		70	°C
Supply Voltage +3V_IO		3.0	3.3	3.6	V
802.11b Current Consumption					
Initialization Current		155	162	175	mA
Continuous Transmit Mode	15 dBm, @11Mbps	260	268	280	mA
Continuous Receive Mode	@11Mbps	160	168	180	mA
IEEE 802.11 Power Save Mode		4.5	5	5.5	mA
Deep Sleep		1.1	1.3	1.5	mA
802.11b RF System Specifications					
Transmit Power Output		14	15	16	dBm
Receive Sensitivity	1 Mbps, 8% PER	-	-92	-87	dBm
	2 Mbps, 8% PER	-	-90	-85	dBm
	5.5 Mbps, 8% PER	-	-89	-83	dBm
	11 Mbps, 8% PER	-	-85	-82	dBm
Maximum Receive Level	PER<8%	-	IEEE Compliant	-	dBm
Transmit Frequency Offset	Low, Middle, High	-	±15	-	PPM

	Channels				
Spectral Mask	Max. TX Power	-44	-40@fc±11MHz	-30	dBc
		-60	-60@fc±22MHz	-50	
Error Vector Magnitude	Max. TX Power @ 11Mbps	-37	-36	-34	dB
Carrier Suppression	Max. TX Power	-28	-25	-21	dBc
Adjacent Channel Rejection	Desired channel is 3dB above sensitivity, 11Mbps, PER<8%	-	48	-	dBc
802.11g Current Consumption					
Initialization Current		155	162	175	mA
Continuous Transmit Mode	15 dBm, @54Mbps	260	268	280	mA
Continuous Receive Mode	@54Mbps	170	179	190	mA
IEEE 802.11 Power Save Mode		4.5	5	5.5	mA
Deep Sleep		1.1	1.3	1.5	mA
802.11g RF System Specifications					
Transmit Power Output		14	15	16	dBm
Receive Sensitivity	6 Mbps, 10% PER	-	-86	-83	dBm
	9 Mbps, 10% PER	-	-85	-83	dBm
	12 Mbps, 10% PER	-	-85	-82	dBm
	18 Mbps, 10% PER	-	-84	-81	dBm
	24 Mbps, 10% PER	-	-80	-77	dBm
	36 Mbps, 10% PER	-	-77	-74	dBm
	48 Mbps, 10% PER	-	-73	-71	dBm
	54 Mbps, 10% PER	-	-72	-69	dBm
Maximum Receive Level	PER<10%	-	IEEE Compliant	-	dBm
Transmit Frequency Offset	Low, Middle, High Channels	-	±15	-	PPM
Spectral Mask	Max. TX Power	-40	-30@fc±11MHz	-20	dBc
		-48	-40@fc±20MHz	-32	
		-56	-50@fc±30MHz	-44	
Error Vector Magnitude	Max. TX Power @ 54Mbps	-30	-29	-27	dB
Carrier Suppression	Max. TX Power	-28	-25	-18	dBc
Adjacent Channel Rejection	Desired channel is 3dB above sensitivity, 54Mbps, PER<10%	-	15	-	dBc
802.11n Current Consumption					
Initialization Current		150	165	180	mA
Continuous Transmit Mode	15 dBm, 20MHz, 72.2 Mbps MCS7	245	260	275	mA
Continuous Transmit Mode	15 dBm, 40MHz, 150 Mbps MCS7	255	270	285	mA
Continuous Receive Mode		205	220	235	mA

IEEE 802.11 Power Save Mode		4.5	5	5.5	mA
Deep Sleep		1.1	1.3	1.5	mA
802.11n RF System Specifications					
Transmit Power Output		14	15	16	dBm
Receive Sensitivity	50 Mbps	-	-28	-25	dBm
Maximum Receive Level	PER<10%		IEEE Compliant		dBm
Transmit Frequency Offset	Low, Middle, High Channels	-	±15	-	PPM
Spectral Mask	Max. TX Power	-40	-30@fc±11MHz	-20	dBc
Error Vector Magnitude	Max. TX Power @ 50Mbps	-30	-28	-26	dB
Carrier Suppression	Max. TX Power	-29	-25	-19	dBc
Adjacent Channel Rejection	Desired channel is 3dB above sensitivity, 54Mbps, PER<10%	-	15	-	dBc

5   Voltage Domains

Voltage domains and limits of all the signal pins are listed in Table 3 and Table 4.

Table 3: 3.3V Voltage Domain Signal Limits

	Min	Typ	Max	Units
Vih	2	-	3.6	V
Vil	-0.3	-	1	V
Vihys	300	-	-	mV
Voh	2.3	-	-	V
Vol	-	-	0.4	V

Table 4: 1.8V Voltage Domain Signal Limits

	Min	Typ	Max	Units
Vih	1.2	-	2.1	V
Vil	-0.3	-	0.6	V
Vihys	250	-	-	mV
Voh	1.22	-	-	V
Vol	-	-	0.4	V

6 WLAN External Host Interface

For connection to a host processor, W2SW0011 supports the SDIO HS 4 bit.

6.1 SDIO Timing Diagrams

Figure 2 SDIO FS Timing

Figure 3 SDIO HS Timing
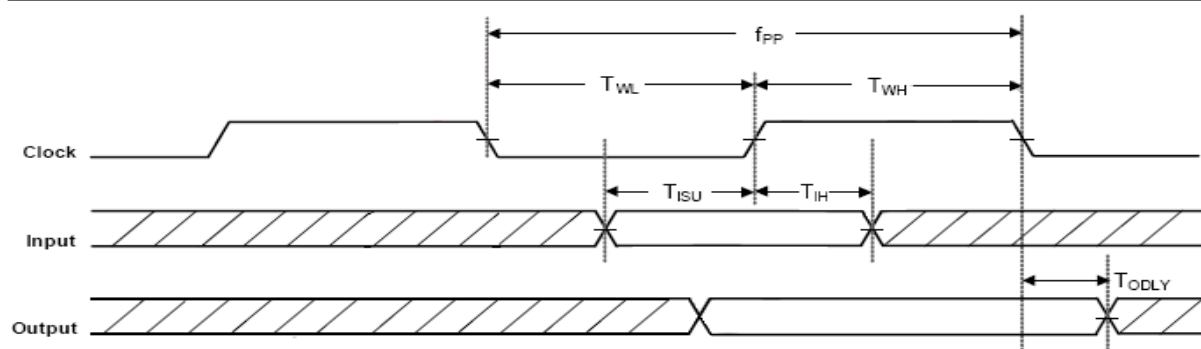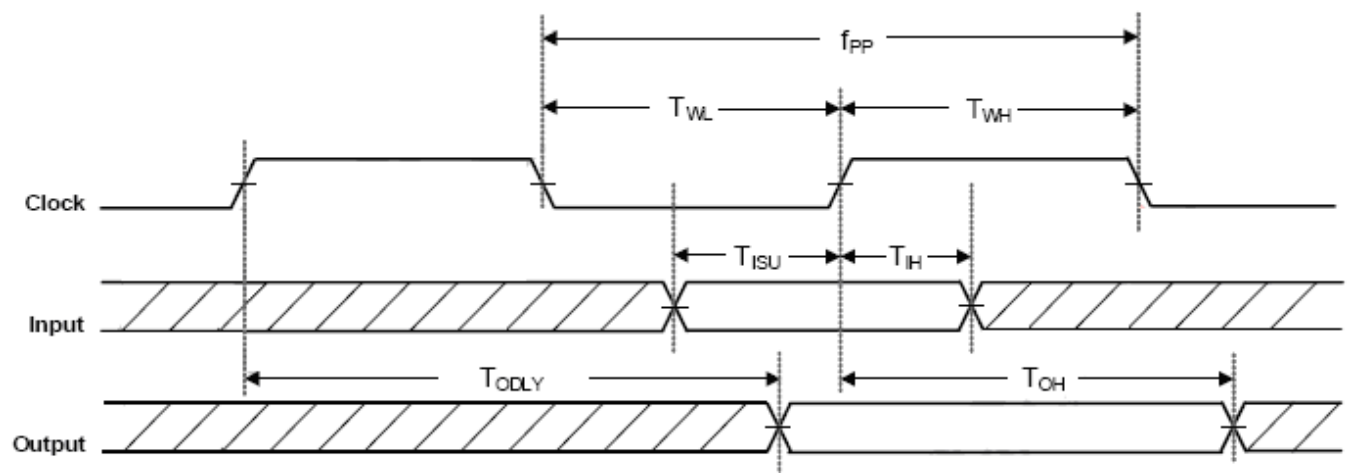

Note: The SDIO-SPI CS Signal timing is identical to all other SDIO inputs

Table 5: SDIO Timing Data

Note: Over full range of values specified in the Recommended Operating Conditions unless otherwise specified

Symbol	Parameter	Condition	Min	Typ	Max	Units
f_{pp}	Clock Frequency	Normal	0	--	25	MHz
		High speed	0	--	50	MHz
T_{WL}	Clock Low Time	Normal	10	--	--	ns
		High speed	7	--	--	ns
T_{WH}	Clock High Time	Normal	10	--	--	ns
		High speed	7	--	--	ns
T_{ISU}	Input Setup Time	Normal	5	--	--	ns
		High speed	6	--	--	
T_{IH}	Input Hold Time	Normal	5	--	--	ns
		High speed	2	--	--	
T_{ODLY}	Output Delay Time	--	0	--	14	ns

7   WLAN Power-Save Modes

Three types of power save modes can be used by the Wi-Fi section of the W2SW0011. They are, Full Power Down, IEEE Power Save and Deep Sleep. The key difference between the three modes is the current consumption, and the time it takes to transition from the power save mode to normal Wi-Fi operation.

7.1 Full Power-Down Mode

This mode completely switches off power to the W2SW0011. Once in this mode, no power is supplied to the WiFi.

This mode is implemented using an active element such as a FET to control power to the W2SW0011.

To exit this mode, the FET is switched to supply power. Once power is applied, the host processor downloads firmware to the W2SW0011. Once firmware has been downloaded, Wi-Fi is considered to have exited this mode.

7.2 IEEE Power Save

This mode puts sections of the Wi-Fi into "sleep with periodic wake" mode. This mode is entered when the appropriate command is sent by the host processor to the Wi-Fi.

The device automatically wakes up to receive beacons periodically, and if there is no traffic indicated for the device, it will go back to sleep. Power consumption is dependent on the DTIM value of the AP it is connected to.

When DTIM=1, the device wakes up every 100ms to receive and acknowledge the beacon from AP to maintain association.

7.3 Deep Sleep

This mode puts the complete Wi-Fi section into deep sleep mode, which is the same as the IEEE mode above except there are no periodic wake-ups to receive beacons. Thus it offers lower power consumption than IEEE mode. This mode is entered when the host processor sends the appropriate command. In deep sleep mode, the device is not listening for packets or beacons from the AP, so it cannot maintain an association with it. When the host processor sends a command to take the device out of deep sleep mode, the device will have to re-associate with the AP.

8 Antenna and Clock

W2SW0011's antenna launch has 50 Ohm impedance.

W2SW0011 has an internal crystal oscillator and requires no external clock source.

9 Software Specifications

Wi2Wi can provide the end user driver needed for operating WLAN part of W2SW0011 for a fee. This driver is specific to the operating system, processor and host bus. It cannot be used for any other processors, operating systems or host buses. Since the operating system and platform matrix is quite large, it is not possible to have all the combinations available off the shelf. Please contact your sales representative for cost and availability. Wi2Wi also provides custom driver development services based on customers' requirements.

Following is a brief description of the driver features along with the processors, operating systems and host buses. Please contact your sales representative for an up-to-date list of supported OS's and platforms.

- Key Features
    - WEP encryption (64 bit/128 bit)
    - IEEE power save mode
    - Deep sleep mode
    - Infrastructure and ad-hoc mode
    - Rate adaptation
    - WPA TKIP security
    - WPA2
- Operating System Support
    - Linux
- Platform Support
    - Intel x86, Atom D2
    - TI OMAP 3530
- Host Interface
    - SDIO HS 50 Mhz 4 bit

In addition to the end user driver, Wi2Wi also provides, for a fee, engineering tools needed for production testing and certification.

9.1 Host Processor

The TCP/IP stack, Ethernet Driver and the 802.11 extensions reside on the host processor. The Hardware Interface Driver is partitioned between the host and the firmware.
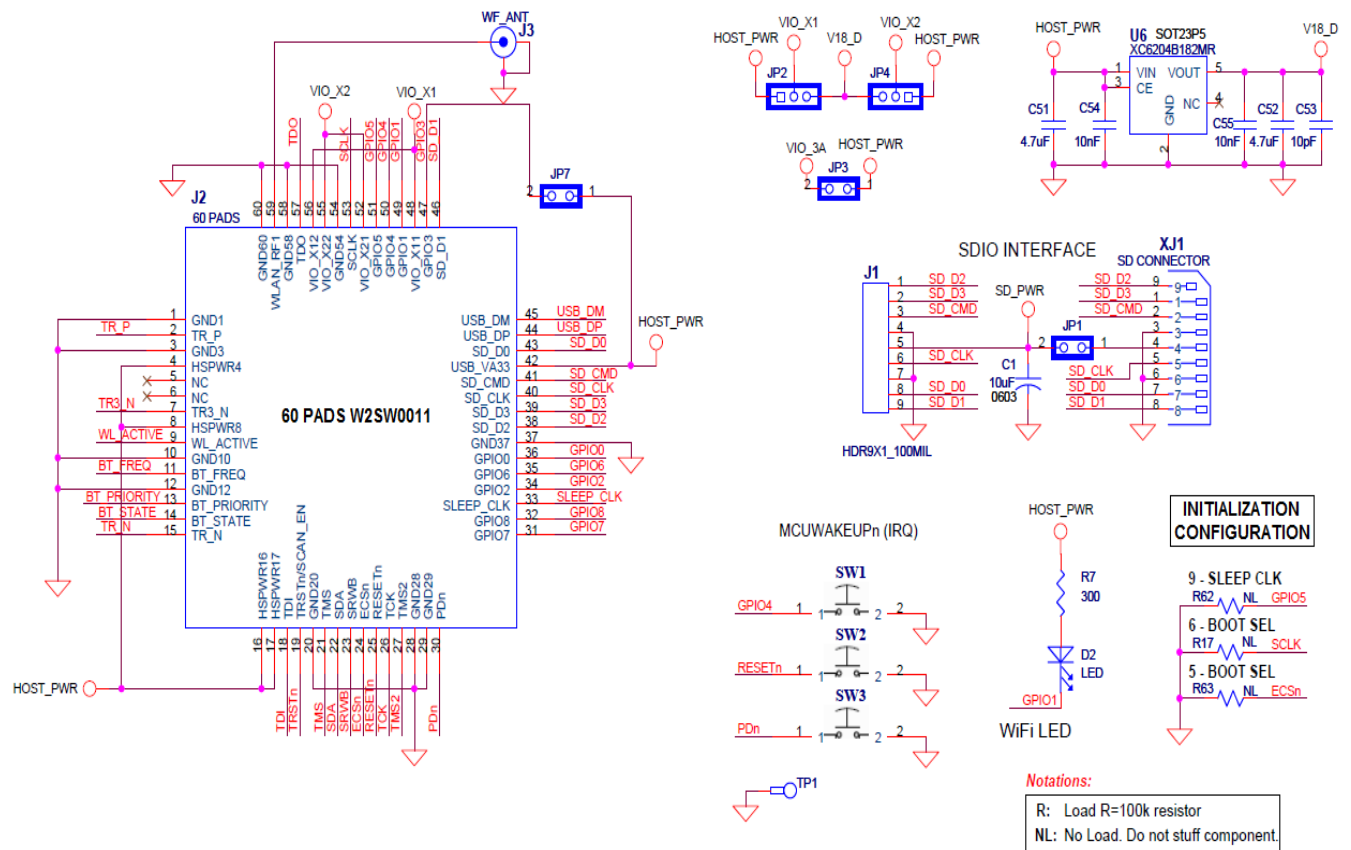
WLAN firmware for Wi-Fi is downloaded through the host interface by the Hardware Interface Driver at power up.

Once the firmware is downloaded, the Data Path and the Control Path between the host and Wi-Fi are established, and information can flow between the two devices.

10 Normal Operation Mode

The schematic in Figure 4 shows the W2SW0011 connections.
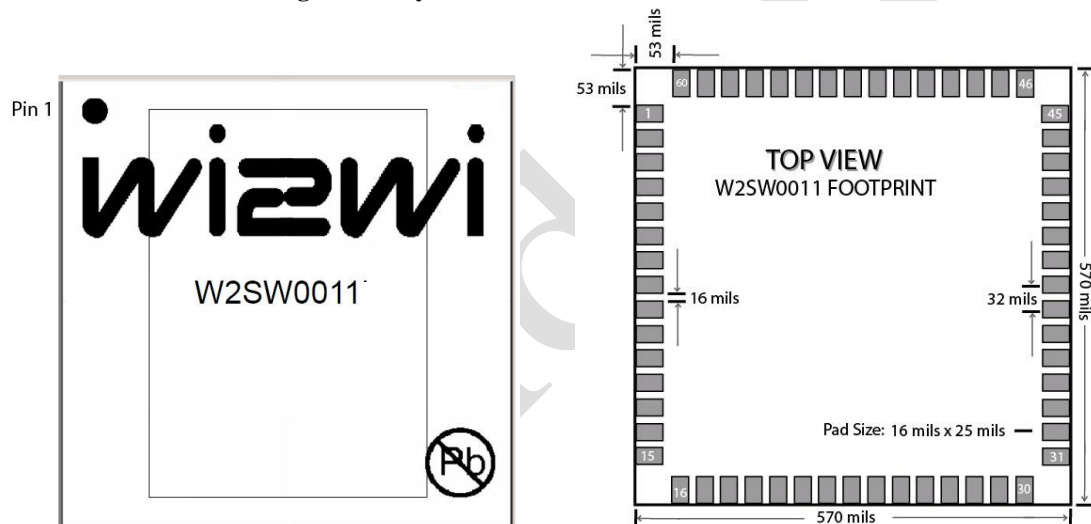
Figure 4: Normal Operation Mode

11 Manufacturing Notes

11.1 Physical Dimensions and Pad Locations

- Module Physical Size: 570 x 570 x 100 mils (14.5 x 14.5 x 2.5 mm) (including shield)
- Solder Pad Size: 16 x 25 mils (0.41 x 0.63 mm)
- Pad to pad space: 16 mils (0.41 mm)
- Pad Pitch: 32 mils (0.81 mm)
- Last pad to Module edge: 53 mils (1.35 mm)
- Pad Finish: ENIG (Electro-less Nickel Immersion Gold)
- Pads: 60 (4 x 15)

Figure 5: Physical Dimensions and Pad Locations

11.2 Shield Note

The W2SW0011 has an integrated shield; as such a secondary shield is not required.

11.3 Storage and Baking Instructions

W2SW0011 is an MSL3 qualified package. After opening the bag, the parts should be:

a. Stored as per J-STD-033 standard and
b. Mounted within 168 hours of factory conditions ($\leq 30°C$, 60% RH)
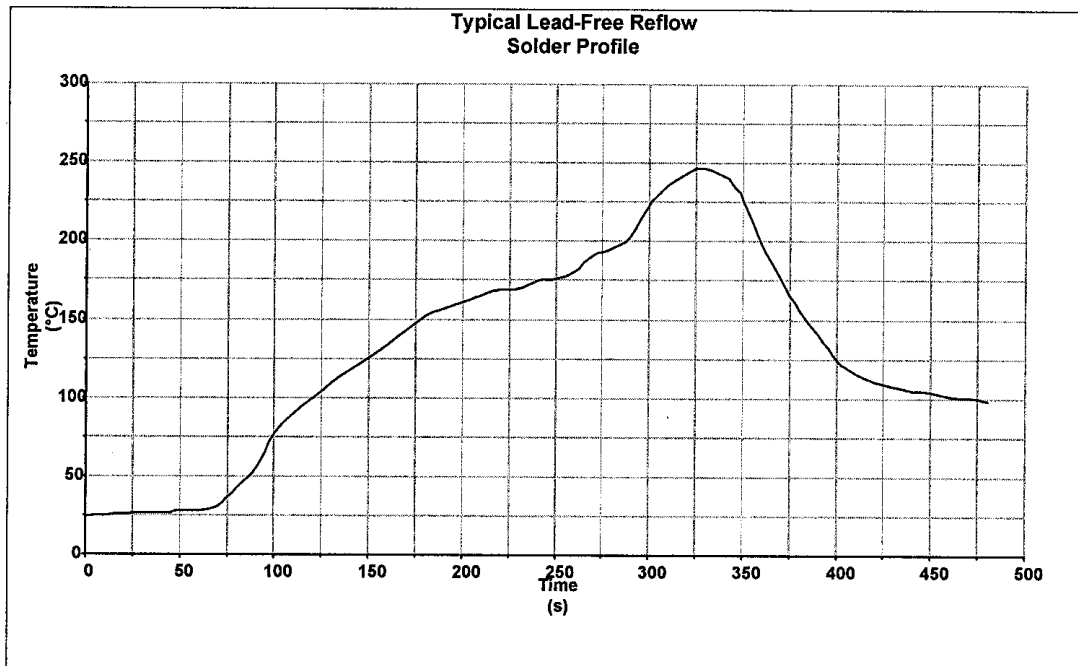
If the parts have been exposed in transit, they need to be baked at 125C for 16 hours.

11.4 Recommended Reflow Profile

Assembly Guidelines:

1. Follow solder paste manufacturers recommended profile
   a. All RoHS solder pastes contain the same basic chemistry; however, each manufacturer may have a recommended reflow profile that performs best for their product.
2. The profile illustrated in JESD-020 and below is for reference only.
   a. **There is no one profile that fits all scenarios.**
3. Profiles must be dialed in to the specific assembly type.
4. ENIG finishes are more susceptible to voids and air entrapment.
   a. Selecting a RoHS solder paste that is "ENIG" compatible is recommended.
5. Recommended finishes for LGA/BGA inclusive assemblies include HASL, OSP, Tin, & Silver.

Figure 6: Reflow Profile

Key features of the profile:
- Initial Ramp = 1 -2.5°C/Sec to 175°C +/- 25°C equilibrium
- Equilibrium = 60-180 seconds
- Ramp to Maximum (Peak) temperature (245°C) = 3°C/sec max.
- Time above liquidus temperature (217°C): 45-90 seconds

12 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.

The definitions used herein are:

a) Life support devices or systems are devices which (1) are intended for surgical implant into the body, or (2) support or sustain life and whose failure to perform when properly used in accordance with the instructions for use provided in the labeling can reasonably be expected to result in a significant injury to the user. b) A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

Wi2Wi does not assume responsibility for use of any of the circuitry described, no circuit patent licenses are implied and Wi2Wi reserves the right at any time to change without notice said circuitry and specifications.

12.1 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.

13 Ordering Information

The following part numbering scheme is used for the W2SW0011:

- Part with default firmware settings: W2SW0011-Y, where "Y" stands for packaging information (explained below)
- Part W2SW0011

"Y" specifies the packaging information. It can take two values:
- "T" for Tray, and
- "TR" for Tape & Reel.

14 Certifications

W2SW0011 conforms to the following standards when integrated to the W2SW0011-DEV development system.

- EMC/Immunity
  TBD

- Product Safety
  TBD

15 References

15.1 Specifications

- IEEE 802.11 b/g/n Wireless LAN Specification
- SDIO HS 4-bit Specification

15.2 Trademarks, Patents and Licenses

- Trademarks: Wi-Fi
- Licenses: 88W8786 Software from Marvell

15.3 Other

- W2SW0011-DEV: Development Kit