



Data Sheet

of

WM-N-BM-02_D-REF1

Preliminary

802.11b/g/n Wireless LAN Daughter board V2.1

Introduction

This daughter card featured with full function of 802.11b/g/n including WM-N-BM-02.

This multi-functionality via LGA to connect and provides SDIO/SPI (option) interface for WiFi.

The small dimension and low profile physical design make it easier for system design to enable high performance wireless connection without space constrain. The low power consumption and excellent radio performance make it the best solution for OEM customers who require embedded 802.11b/g/n WiFi features, such as, Camera, Wireless PDA, Smart phone, MP3, PMP, slim type Notebook, VoIP phone etc.

The card is based on Broadcom BCM43362 chipset which is a WiFi SOC. The Radio architecture and high integration MAC/BB chip provide excellent sensitivity with rich system performance. The card is designed as single antenna for WiFi for the application of small size hand-held device.

In addition to WEP 64/128, WPA and TKIP, AES, CCX is supported to provide the latest security requirement on your network.

For the software and driver development, USI provides extensive technical document and reference software code for the system integration under the agreement of Broadcom International Ltd.

Hardware evaluation kit and development utilities will be released base on listed OS and processors to customers.



Features

- Lead Free design which supporting Green design requirement, RoHS Compliance
- Small size suitable for low volume system integration
- Low power consumption and excellent power management performance extend battery life
- Easy for integration into mobile and handheld device with flexible system configuration



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Change Sheet					
Rev.	Date	Description of change			Approval & Date
		Page	Par.	Change(s)	
1.0	02/06/13	All	All	Draft version for Review	
1.1	03/16/13	All	All	Add Rx item	
1.2	03/20/13	6	2	Add PMU account	
1.3	04/19/13	6	2	Modify the picture	
1.4	06/21/13	All	All	Customer requirement	
1.5	06/25/13	25	all	Recommended MSD baking specification	
1.6	07/02/13	11	5.5	Antenna spec. modify to Antenna parameter	
1.7	07/17/13	All	All	WM-N-BM-02_D-REF1	
1.8	07/19/13	All	All	Change WL_RST_N to WLAN RESETB and information correction	
1.9	07/23/13	8	5.2.1	Modify(Ambient)Temperature	
2.0	10/03/13	All	All	Information correction. VBAT and VDDIO Supply.	
2.1	11/18/13		5.2.2	Customer Requirement VBAT and VDDIO Supply	

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1. EXECUTIVE SUMMARY

The WM-N-BM-02_D-REF1 is one of the product families in USI's product offering, targeting for system integration requiring a smaller form factor. It also provides the standard migration to high data rate to USI's current SIP customers.

The purpose of this document is to define the product specification for 802.11b/g/n WiFi WM-N-BM-02_D-REF1. **All the data in this document is based on Broadcom BCM43362 data sheet and other documents provided from Broadcom. The data will be updated after implementing the measurement.**

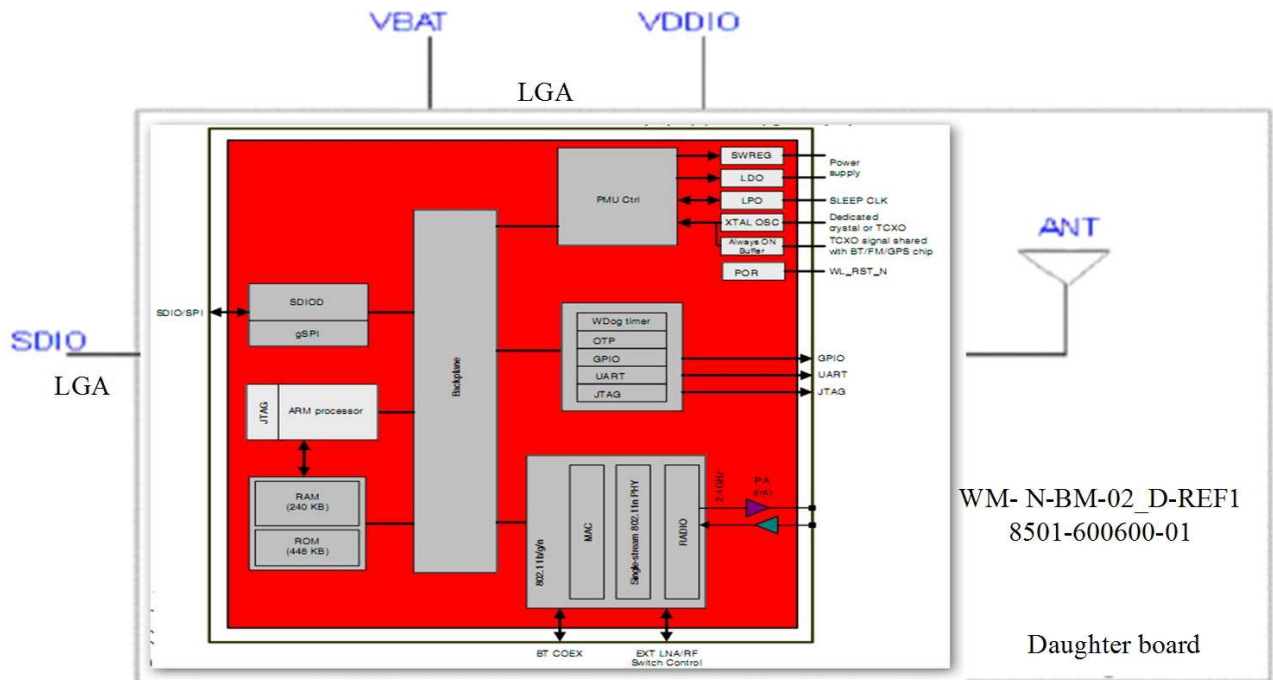
This product is designed for use in embedded applications mainly in the mobile device, which required small size and high data rate wireless connection, such as Camera, Wireless PDA, slim type Notebook, Media Adapter, Barcode scanner, mini-Printer, VoIP phone, Data storage device could be the potential application.

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2. BLOCK DIAGRAM

The WM-N-BM-02_D-REF1 is based on Broadcom BCM43362 solution. It supports generic SPI (G-SPI), SDIO interface to connect the WLAN to the host processor. Below is a simplified block diagram of WM-N-BM-02_D-REF1:



WM-N-BM-02_D-REF1 is WM-N-BM-02 on Daughter Board

The BCM43362 contains a Power Management Unit (PMU), a buck mode switching regulator, and three low noise LDOs. These integrated regulators simplify power supply design in WiFi embedded designs.

3. DELIVERABLES

The following products and software will be part of the product.

- WM-N-BM-02_D-REF1 with packaging
- Evaluation kits (with SDIO / SPI interface)
- Software utility which supporting customer for integration, performance test and homologation. Capable of testing, loading (firmware) and configuring (MAC, CIS) for the WM-N-BM-02_D-REF1
- Unit Test / Qualification report
- Product Specifications
- Agency certification pre-test report base on adapter boards

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4. REFERENCE DOCUMENTS

- C.I.S.P.R.
Pub. 22 "Limits and methods of measurement of radio interference characteristics of information technology equipment." International Special Committee on Radio Interference (C.I.S.P.R.), Third Edition, 1997.
- CB Bulletin
No. 96A "Adherence to IEC Standards: "Requirements for IEC 950, 2nd Edition and Amendments 1 (1991), 2(1993), 3 (1995) and 4(1996). Product Categories: Meas, Med, Off, Tron." IEC System for Conformity Testing to Standards for Safety of Electrical Equipment (IECEE), April 2000.
- CFR 47,
Part 15-B "Unintentional Radiators". Title 47 of the Code of Federal Regulations, Part 15, FCC Rules, Radio Frequency Devices, Subpart B.
- CFR 47,
Part 15-C "Intentional Radiators". Title 47 of the Code of Federal Regulations, Part 15, FCC Rules, Subpart C. URL: http://www.access.gpo.gov/nara/cfr/waisidx_98/47cfr15_98.html
- CSA C22.2
No. 950-95 "Safety of Information Technology Equipment including Electrical Business Equipment, Third Edition." Canadian Standards Association, 1995, including revised pages through July 1997.
- EN 60 950 "Safety of Information Technology Equipment Including Electrical Business Equipment." European Committee for Electrotechnical Standardization (CENELEC), 1996, (IEC 950, Second Edition, including Amendment 1, 2, 3 and 4).
- IEC 950 "Safety of Information Technology Equipment Including Electrical Business Equipment." European Committee for Electrotechnical Standardization, Intentional Electrotechnical Commission. 1991, Second Edition, including Amendments 1, 2, 3, and 4.
- IEEE 802.11 "Wireless LAN Medium Access Control (MAC) And Physical Layer (PHY) Specifications." Institute of Electrical and Electronics Engineers. 1999.**

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5. TECHNICAL SPECIFICATIONS

5.1 ABSOLUTE MAXIMUM RATING

Supply Power	Max +3.6 Volt	
Non Operating Temperature	- 40° to 85° Celsius	
Voltage ripple	+/- 2%	Max. Values not exceeding Operating voltage

5.2 RECOMMENDABLE OPERATION CONDITION

5.2.1 TEMPERATURE, HUMIDITY

The WM-N-BM-02_D-REF1 has to withstand the operational requirements as listed in below table:

Operating Ambient Temperature	-20° to 65° Celsius for SDIO/SPI version	
Humidity range	Max 95%	Non condensing, relative humidity

5.2.2 VOLTAGE

Power supply of WM-N-BM-02_D-REF1 will be provided by the host via the power pins

Symbol	Parameter	Min.	Typ.	Max.	Unit
VBAT	3.3V Power Supply	2.9	3.3	3.6	V
VDDIO	Host Interface Power Supply	2.9	3.3	3.6	V

5.2.3 POWER CONSUMPTION (SDIO, GSPI MODE)

	Power consumption	Typical	Max.
Manufacture WiFi	Tx @ 12dBm output power @ 25C (11b), 3.3V	250mA	310mA
	Tx @ 10dBm output power @ 25C (11g), 3.3V	180mA	250mA
	Tx @ 10dBm output power @ 25C (11n, HT20), 3.3V	180mA	250mA
	Rx @25C, 3.3V	70mA	130mA
Module Limit	The Module Maximum Current (for reference)	-	700mA

- For 1Mbps Max. current
 - For 6Mbps and 11n HT20 MCS0 Max. current
 - Include USB mode and SDIO mode max. current range
- Include EVB power consumption

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5.3 WIRELESS SPECIFICATIONS

The WM-N-BM-02_D-REF1 complies with the following features and standards on USI EVB:

Features	Description	
WLAN Standards	IEEE 802 Part 11b/g/n (802.11b/g/n)	
Frequency Channel Band	Channel 1 (2.412GHz) – Channel 14 (2.484GHz)	
Tx Power	+/- 2dB Tolerance of Power Setting	
	Standard	Power Setting
	IEEE 802 Part 11b	12dBm
	IEEE 802 Part 11g	10dBm
	IEEE 802 Part 11n	10dBm

5.4 RADIO SPECIFICATIONS

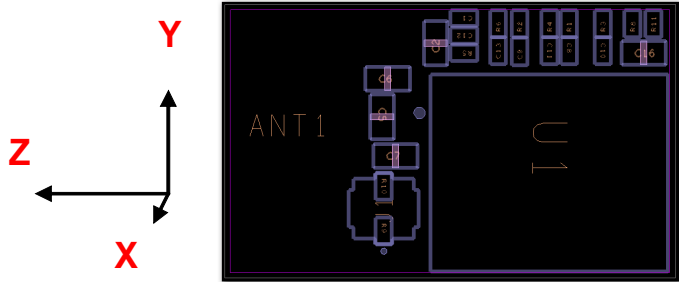
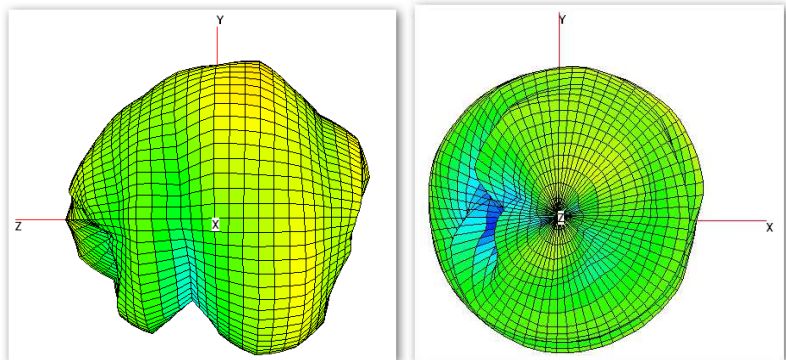
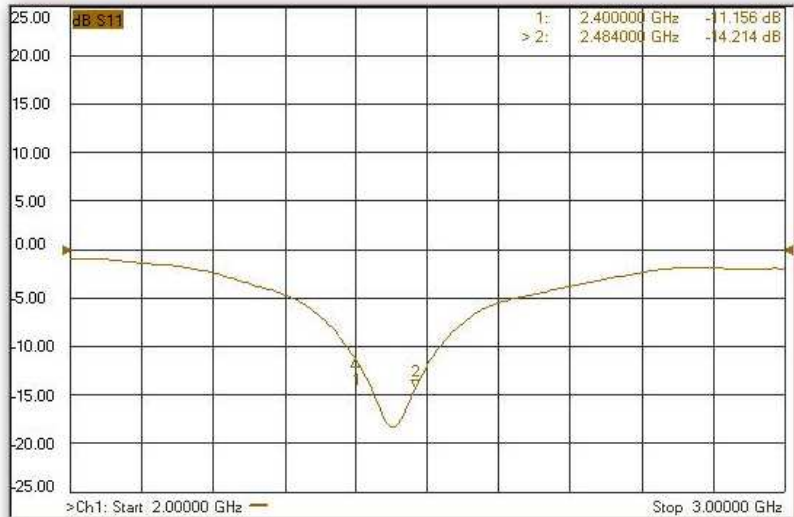
Features	Description
Frequency Band	2.412GHz – 2.484GHz (2.4GHz ISM Band)
Modulation	DBPSK, DQPSK, CCK, 16QAM, 64QAM
Multiplexing	OFDM, DSSS (Direct Sequence Spread Spectrum)
Supported rates	11b: 1, 2, 5.5, 11Mbps 11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps 11n: MCS 0 ~7
Supported Channel	US: CH1~11 EU(CE): CH1~13 JP : CH1~13 for 11b/g/n ; CH14 for IEEE 11b

Receiver Characteristics at RF connector (3.3V, 25 °C)	Typical	Max.	Unit
PER <8%, Rx Sensitivity @ 11 Mbps	-87	-82	dBm
PER <10%, Rx Sensitivity @ 54 Mbps	-72	-65	dBm
PER <10%, Rx Sensitivity @ MCS7	-69	-64	dBm

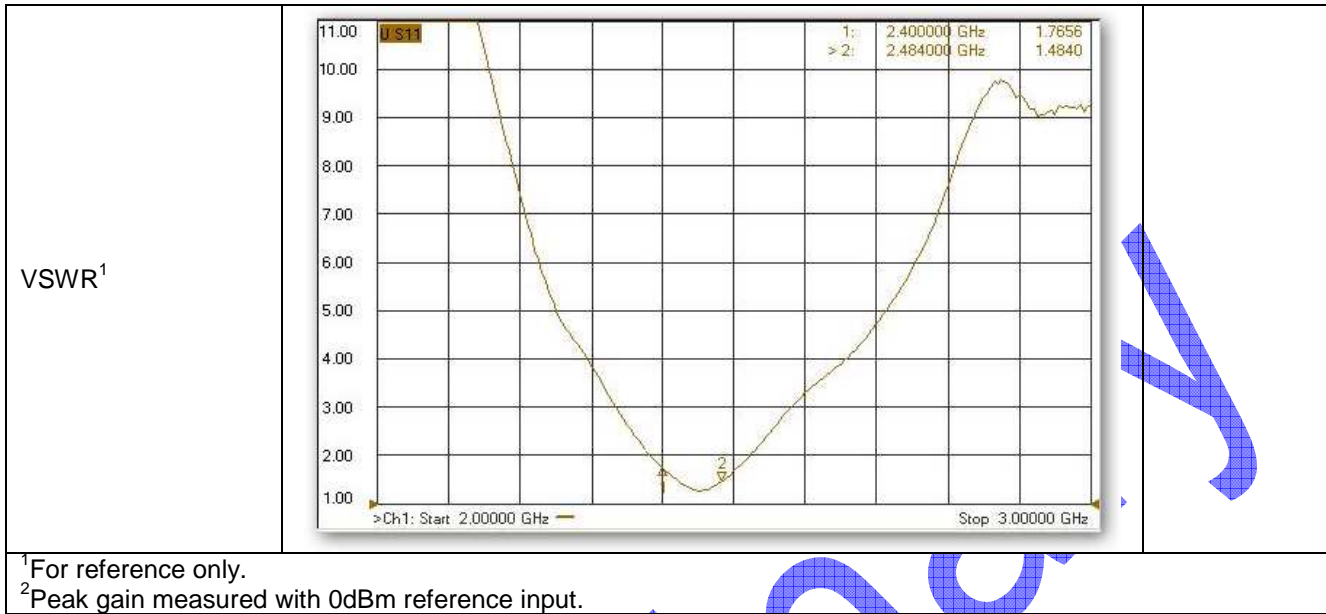
*** Receiver PER for 11B, 11G and 11N are Ch1~ Ch13 reference data***

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5.5 ANTENNA PARAMETER (REFERENCE ONLY)

Normal Impedance	50	Ohms
Operating Frequency	Channel 1 (2.412 GHz) – Channel 14 (2.484 GHz)	Hz
Radiated Efficiency ¹	Up to 55	%
Peak Gain ^{1,2}	$-3 \leq \text{Peak} \leq 3.8$	dBi
Gain pattern position		
Gain pattern ¹		
S11 ¹		

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5.6 THROUGHPUT CONDITION REFERENCE (REFERENCE ONLY)

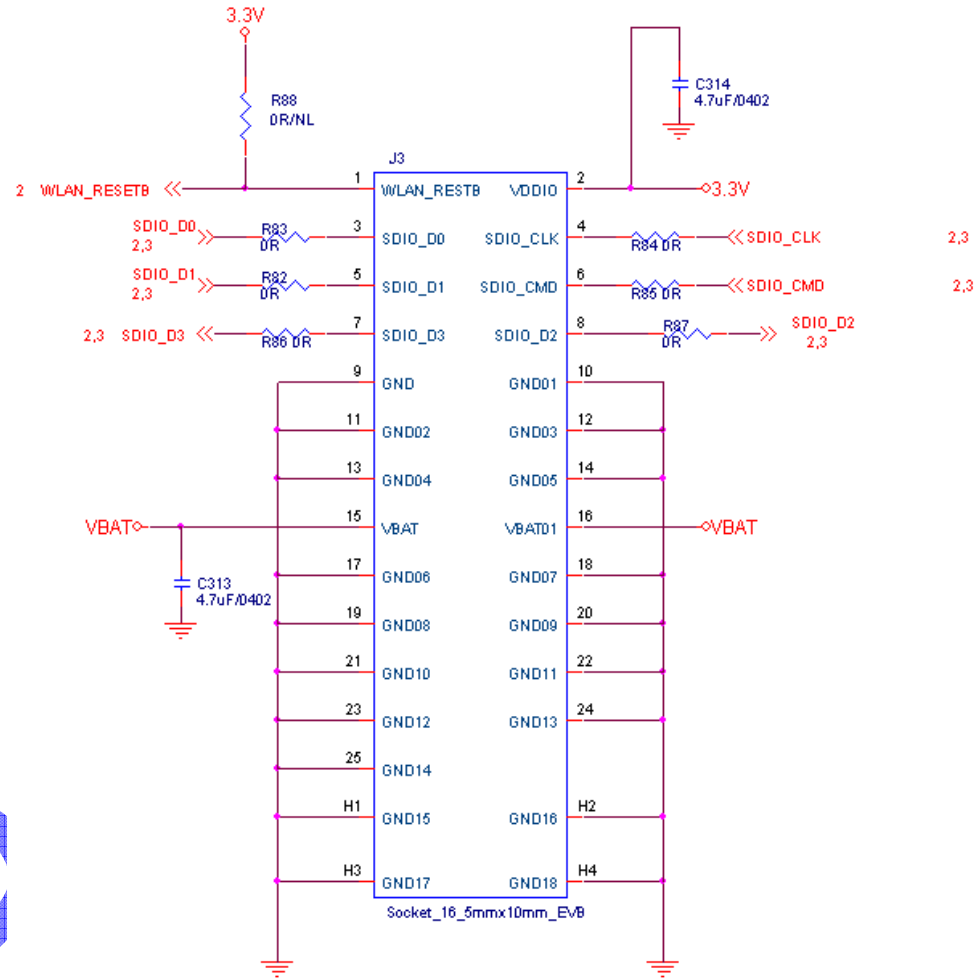
Data Rate	IEEE 802 Part 11n MCS7																		
HW Setting ¹	<ol style="list-style-type: none"> 1. Notebook (Dual Core 2GHz) 2. Access Point (Ralink RT3883) 3. Another Notebook with SDIO interface 4. WM-N-BM-02_D EVB 1.0 5. With 50 meter distance 																		
SW Setting ¹	<ol style="list-style-type: none"> 1. Ubuntu 12.10 2. BCM43362 Driver (Version:1.88.10) 3. Firmware Version:5.90.195.89.5 4. Iperf 2.0.5 5. EndPoint Iperf 2.0.5 																		
Reference Result ¹	<table border="1"> <thead> <tr> <th>Band</th> <th>Ch1</th> <th>Ch6</th> <th>Ch11</th> <th>Unit</th> </tr> </thead> <tbody> <tr> <td>11n MCS7 Tx</td> <td>33.4</td> <td>34.5</td> <td>34.3</td> <td>Mbps</td> </tr> <tr> <td>11n MCS7 Rx</td> <td>31.2</td> <td>31.6</td> <td>31.4</td> <td>Mbps</td> </tr> </tbody> </table>				Band	Ch1	Ch6	Ch11	Unit	11n MCS7 Tx	33.4	34.5	34.3	Mbps	11n MCS7 Rx	31.2	31.6	31.4	Mbps
Band	Ch1	Ch6	Ch11	Unit															
11n MCS7 Tx	33.4	34.5	34.3	Mbps															
11n MCS7 Rx	31.2	31.6	31.4	Mbps															
To communicate with an 802.11n Access Point in an open environment																			
¹ For reference only.																			

**** The throughput data is tested on USI EVB, it is just for reference only.**

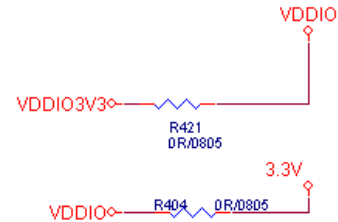
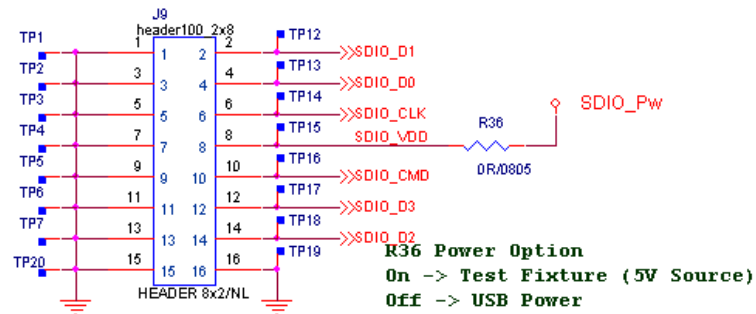
**** Please be noted that the throughput test result is much relied on customer's system platform and CPU's capability.**

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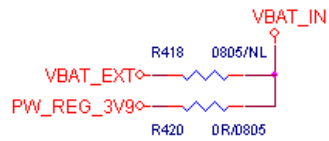
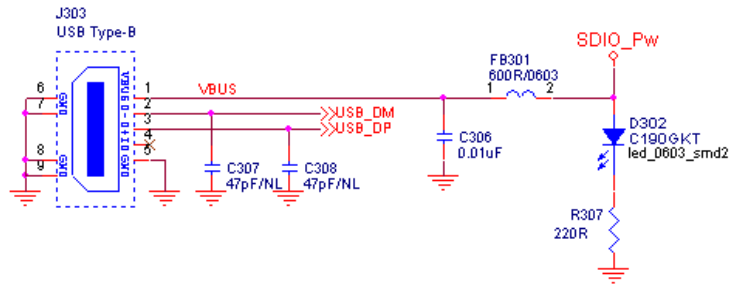
5.7 REFERENCE EVB CIRCUIT



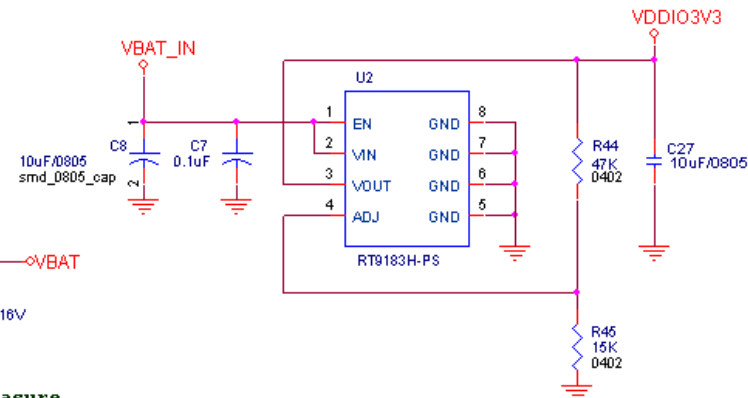
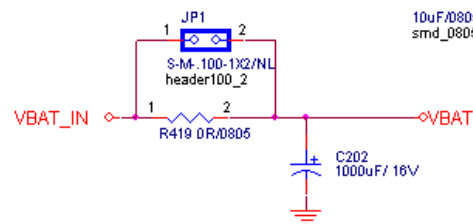
802.11b/g/n Wireless LAN Daughter board V2.1



FB301 Power Option
On -> USB Power
Off -> Test Fixture (5V Source)



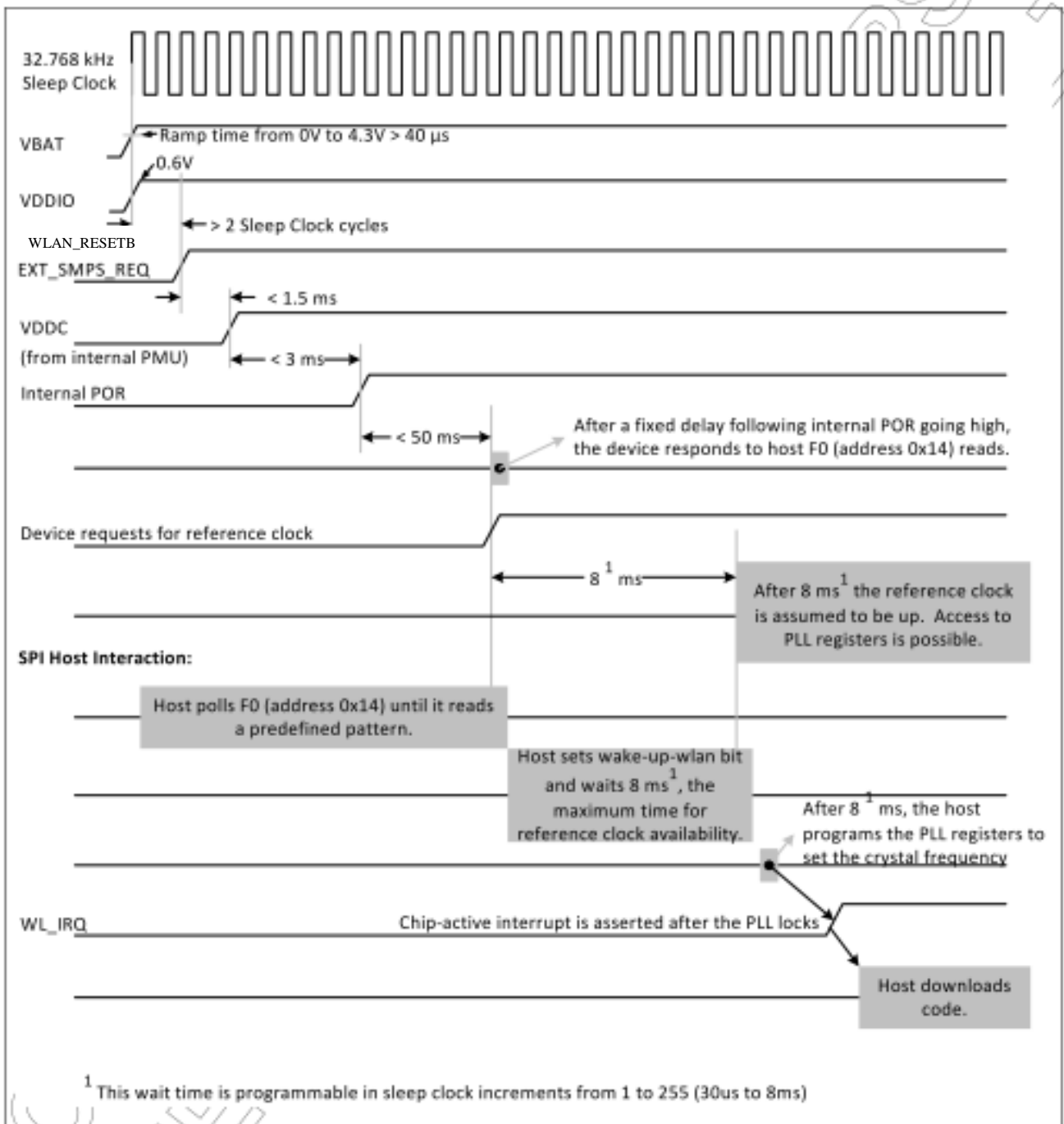
Ext-Power Option
R418 -> RD use (3.8V Source)
R420 -> Test Fixture (5V to 3.9V Source)



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5.8 TIMING DIAGRAM OF INTEFACE

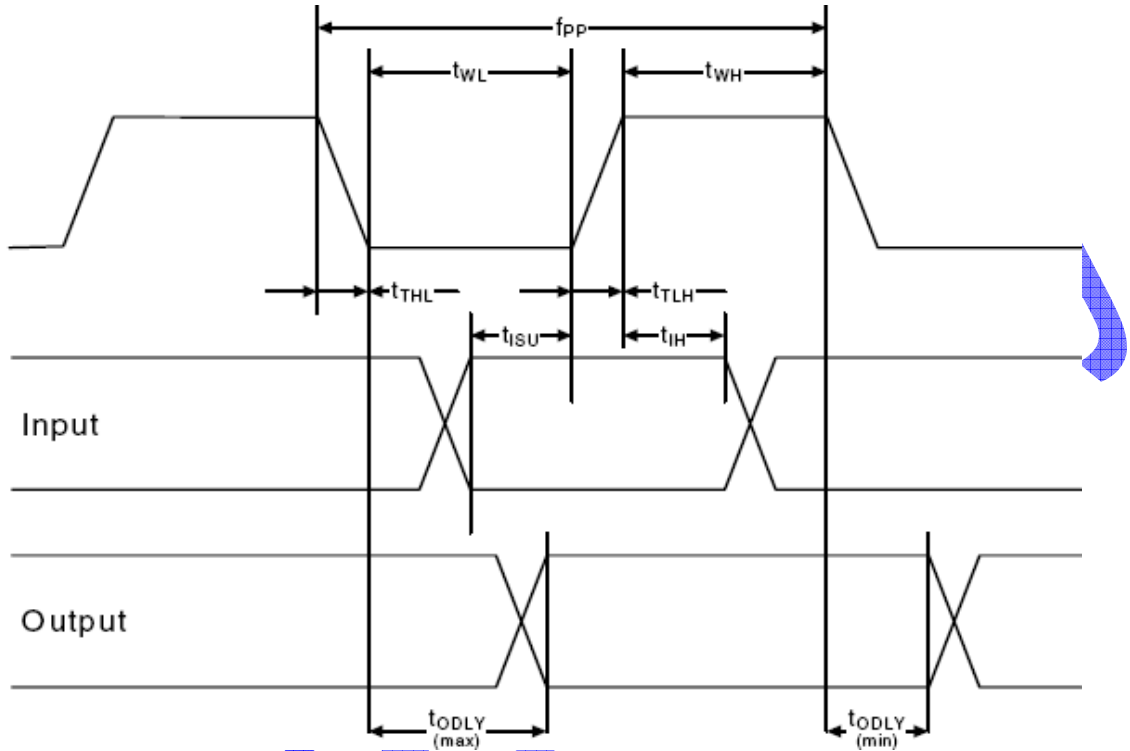
WIFI BOOT-UP Sequence



WIFI BOOT-UP Sequence

SDIO TIMING

SDIO timing in default mode

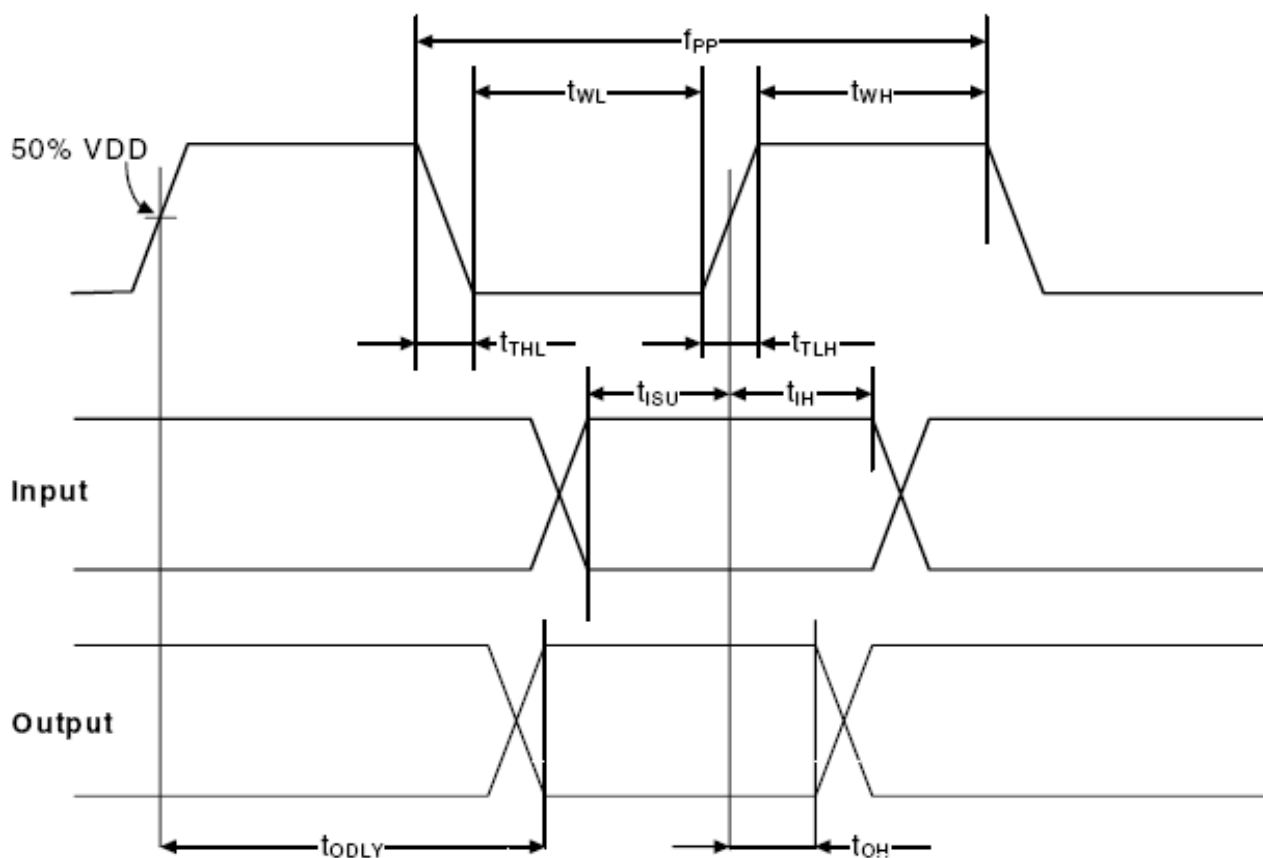


SDIO Bus Timing Parameters (Default Mode)

Parameter	Symbol	Min	Typical	Max	Unit
Clock CLK (All values are referred to min. VIH and max. VIL)					
Frequency--Data Transfer Mode	f _{PP}	0	-	25	MHz
Frequency--Identification Mode	f _{OD}	0	-	400	kHz
Clock Low Time	t _{WL}	10	-	-	ns
Clock High Time	t _{WH}	10	-	-	ns
Clock Rise time	t _{TLH}	-	-	10	ns
Clock Low Time	t _{THL}	-	-	10	ns
Inputs: CMD, DAT (referenced to CLK)					
Input Setup Time	t _{ISU}	5	-	-	ns
Input Hold Time	t _{IH}	5	-	-	ns
Outputs: CMD, DAT (referenced to CLK)					
Output Delay time--Data Transfer Mode	t _{ODLY}	0	-	14	ns
Output Delay time--Identification Mode	t _{ODLY}	0	-	50	ns

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SDIO timing in High-Speed Mode

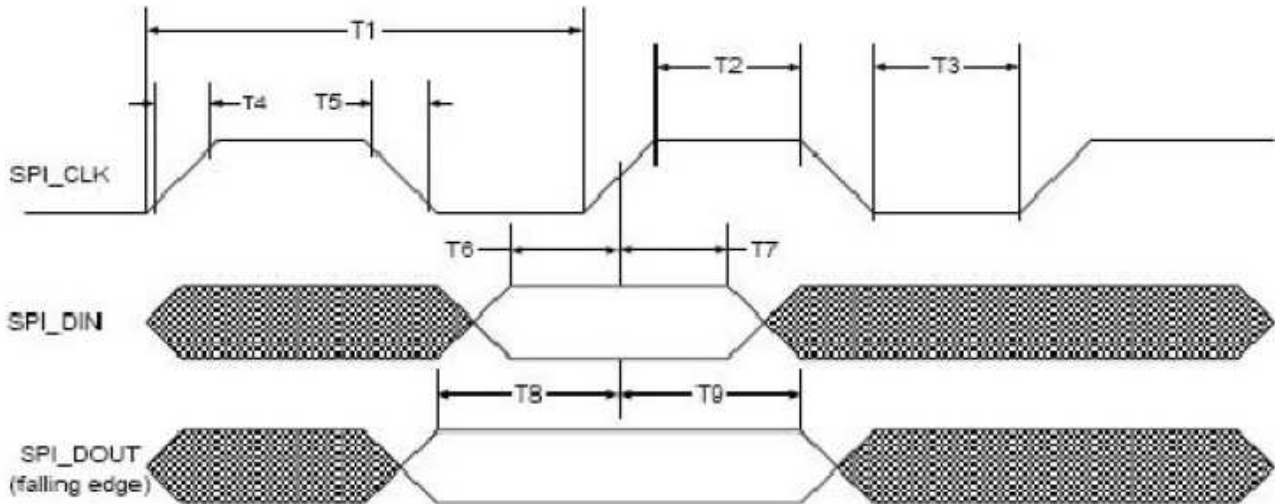


SDIO Bus Timing Parameters (High-Speed Mode)

Parameter	Symbol	Min	Typical	Max	Unit
Clock CLK (all values are referred to min. VIH and max. VIL)					
Frequency--Data Transfer Mode	f_{PP}	0	-	50	MHz
Frequency--Identification Mode	f_{OD}	0	-	400	kHz
Clock Low Time	t_{WL}	7	-	-	ns
Clock High Time	t_{WH}	7	-	-	ns
Clock Rise time	t_{TLH}	-	-	3	ns
Clock Low Time	t_{THL}	-	-	3	ns
Inputs: CMD, DAT (referenced to CLK)					
Input Setup Time	t_{ISU}	6	-	-	ns
Input Hold Time	t_{IH}	2	-	-	ns
Outputs: CMD, DAT (referenced to CLK)					
Output Delay time--Data Transfer Mode	t_{ODLY}	-	-	14	ns
Output Hold time	t_{OH}	2.5	-	-	ns
Total System Capacitance (each line)	CL	-	-	40	pF

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GSPI Timing



Parameter	Symbol	Minimum	Maximum	Units	Note
Clock period	T1	20.8	-	ns	Fmax= 48 MHz
Clock high/low	T2/T3	$(0.45 \times T1) - T4$	$(0.55 \times T1) - T4$	ns	-
Clock rise/fall time	T4/T5	-	2.5	ns	-
Input setup time	T6	5	-	ns	Setup time, SIMO valid to SPI_CLK active edge
Input hold time	T7	5	-	ns	Hold time, SPI_CLK active edge to SIMO invalid
Output setup time	T8	5	-	ns	Setup time, SOMI valid before SPI_CLK rising
Output hold time	T9	5	-	ns	Hold time, SPI_CLK active edge to SOMI invalid
CSX to clocka	-	7.86	-	ns	CSX fall to 1st rising edge
Clock to CSXa	-	-	-	ns	Last falling edge to CSX high

a. SPI_CSx remains active for entire duration of SPI read/write/write_read transaction (i.e., overall words for multiple word transaction)

Sleep mode

The radio, AFE, PLLS, and the crystal oscillator are powered down. The rest of the module remains powered up in an IDLE state. All main clocks are shut down. The 32.768 kHz LPO sleep clock is available only for the PMU sequencer. This condition is necessary to allow the PMU sequencer to wake up the chip and transition to Active mode. In Sleep mode, the primary power consumed is due to leakage current.

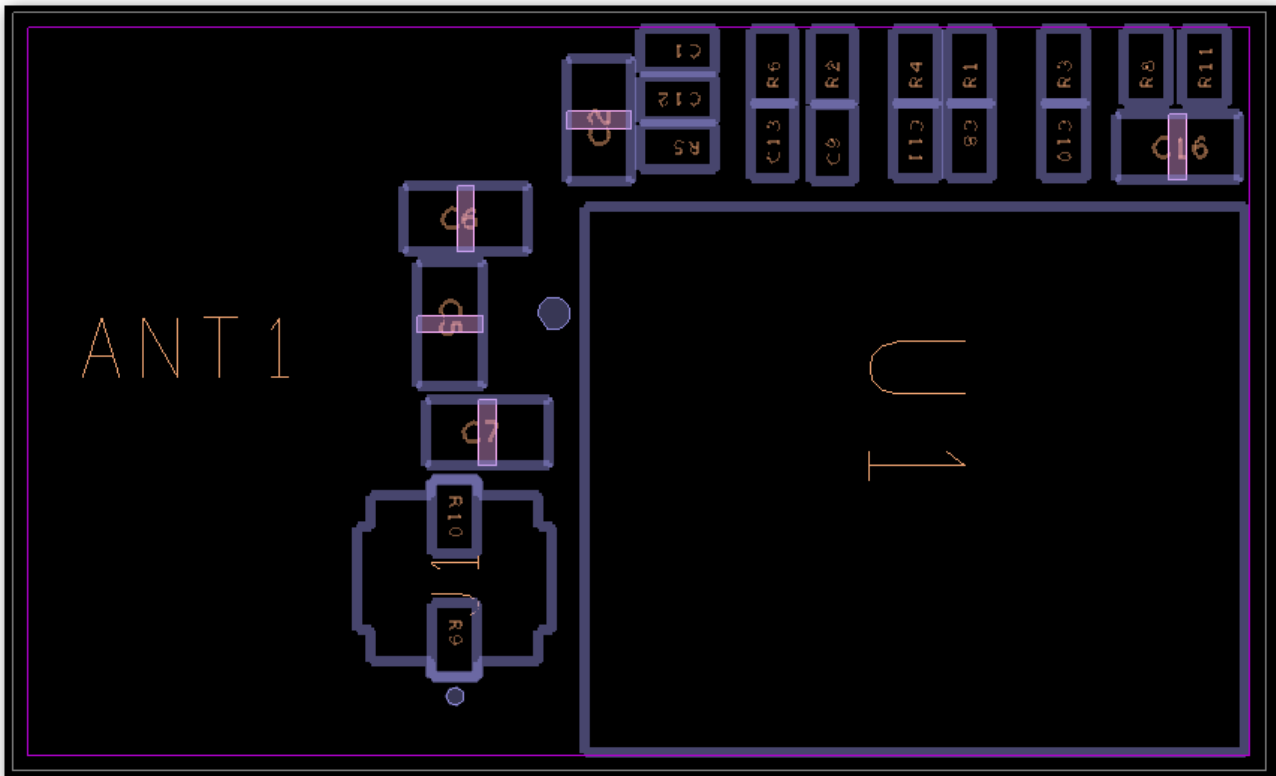
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5.9 DIMENSIONS, WEIGHT AND MOUNTING

The following paragraphs provide the requirements for the size, weight and mounting of the WM-N-BM-02_D-REF1.

5.9.1 DIMENSIONS

The size and thickness of the WM-N-BM-02_D-REF1 is “10 mm (W) x 16.5 mm (L) x 1.8 mm (Max)(H).”



Module layout placement

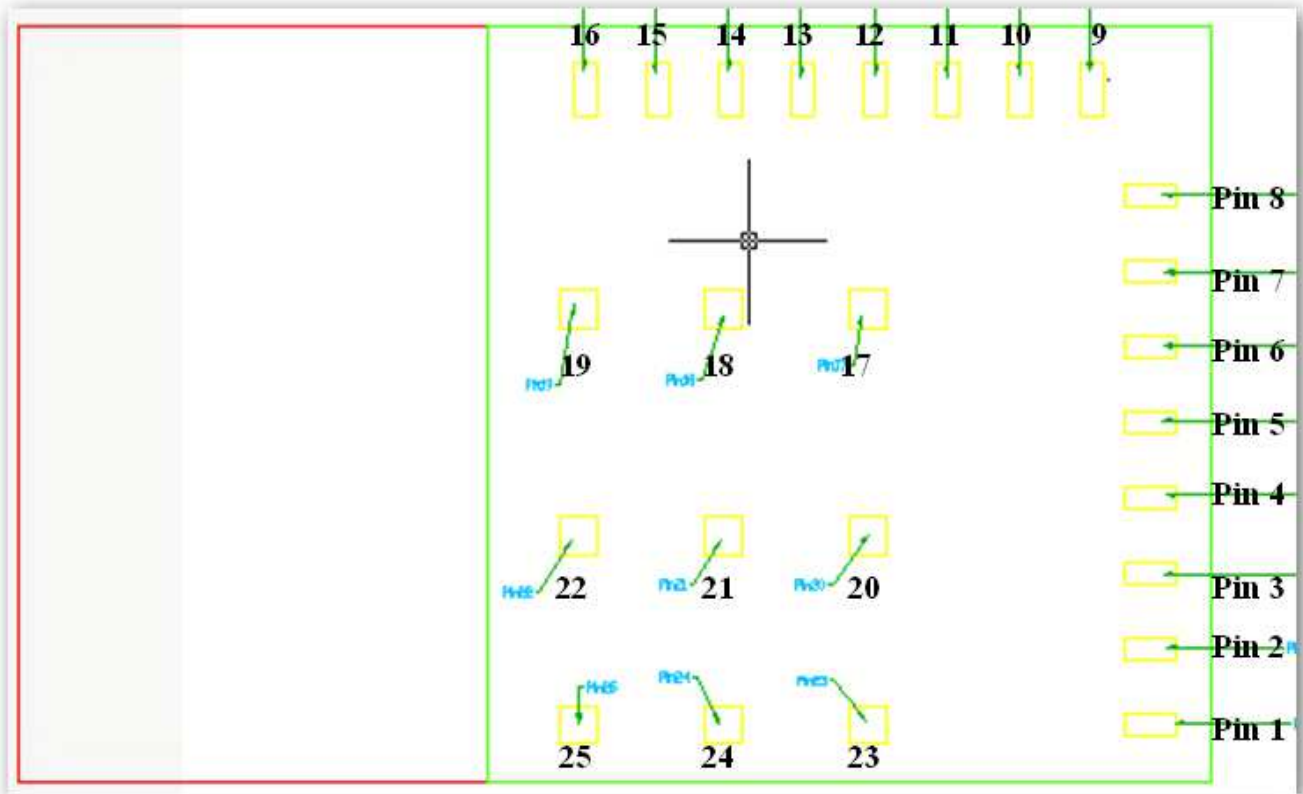
6. LEGAL, REGULATORY & OTHER TECHNICAL CONSTRAINTS

The WM-N-BM-02_D-REF1 is pre-tested to ensure that all requirements met as set forth in the following sections.

Final certification (certification) requires the antenna of targeted system with a lead-time of 6 weeks. The product deliverable shall be a pre-tested WM-N-BM-02_D-REF1 . No level certification on WM-N-BM-02_D-REF1 .

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7. PIN OUT AND PIN DESCRIPTION



Top View

Pin Description

Pin#	Pin Name	Type	Refer	Description
1	WLAN_RESETB	Signal	-	Active low WLAN reset signal
2	VDDIO	Power	3.3V	Digital I/O supply
3	SDIO D0	Signal	-	SDIO data 0.
4	SDIO CLK	Signal	-	SDIO clock.
5	SDIO D1	Signal	-	SDIO data 1.
6	SDIO CMD	Signal	-	SDIO data CMD.
7	SDIO D3	Signal	-	SDIO data 3.
8	SDIO D2	Signal	-	SDIO data 2.
9 to 14	GND	Power	GND	Ground
15	VBAT	Power	3.3V	Battery supply input
16	VBAT	Power	3.3V	Battery supply input
17 to 25	GND	Power	GND	Ground

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8. REFLOW PROFILE GUIDELINE

The reflow profile is dependent on many factors including flux selection, solder composition and the capability of user's reflow equipment.

USI does not request a specific reflow profile but provides the following general guidelines:

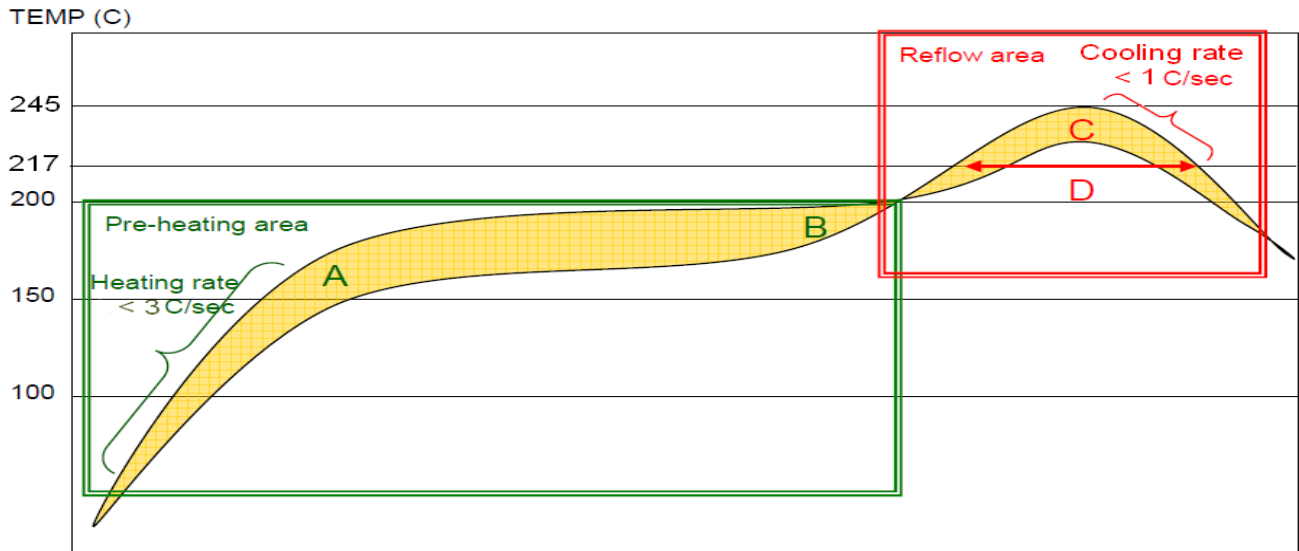
The solder composition typically sets the peak temperatures of the profile. Recommend lead free solder pastes SAC305: Type 4, water soluble or no clean are acceptable.

- Reflow equipment needed at least nine heater zones. Recommend forced air type reflow oven with Nitrogen.
- It is recommended that the peak temperature at the solder joint be within 245°C and the maximum component temperature should not exceed 245°C.
- It is recommended that time above 217°C for the solder joints is between 40-90s, and with a minimum of 40s.
- Optimal cooling rate is $<1^{\circ}\text{C}/\text{sec.}$ from peak to 217 °C
- To develop the reflow profile, it is recommended that the user place thermocouples at various locations on the assembly to confirm that all locations meet the profile requirements. The critical locations are the solder joints of SiP Module.

When developing the reflow profile, it is recommended that the actual fully loaded assembly be used to make sure that the total thermal mass is accounted for.

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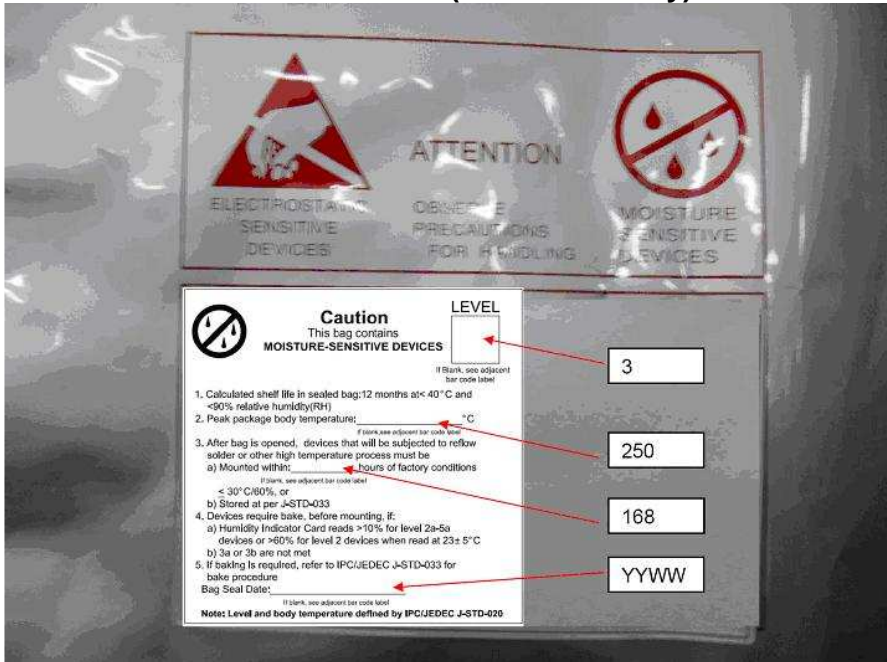
RECOMMENDED REFLOW PROFILE



- (1) Solder paste alloy : SAC305 (Sn96.5/Ag3.0/Cu0.5) (Lead Free solder paste.)
 - (2) A-B. Temp.: 150~200°C; soak time:60~120sec.(Base on Flux type, reference only)
 - (3) C. Peak temp: <245°C
 - (4) D. Time above 217 °C : 40~90sec.(Base on SAC305)
 - (5) Suggestion: Optimal cooling rate is <1°C/sec. from peak to 217 °C .
 - (6) Nine heater zones at least for Reflow equipment.
 - (7) Nitrogen usage is recommended and be controlled the value less than 1500 ppm.
- Note: Need to inspect solder joint by X-ray post reflow.

9. PACKAGE AND STORAGE CONDITION

9.1 PACKAGE DIMENSION (Reference only)




9.2 EMC/ESD LEVEL (Reference only)

According to FCC and CE standard
Surface Resistivity:
Interior: $10^9 \sim 10^{11} \Omega/\text{SQUARE}$
EXTERIOR: $10^8 \sim 10^{12} \Omega/\text{SQUARE}$
Dimension: 475*420mm
Tolerance: +5,0mm
Color:
Background : Gray
Text : Red

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9.3 MSL Level/Storage condition (Reference only)

	<p style="text-align: center;">CAUTION This bag contains MOISTURE-SENSITIVE DEVICES</p>	<p style="text-align: center;">LEVEL</p> <table border="1" style="margin: auto;"><tr><td style="text-align: center; vertical-align: middle;">3</td></tr></table> <p style="text-align: center;"><small>If Blank, see adjacent bar code label</small></p>	3
3			
<p>1. Calculated Shelf life in sealed bag: 12 months at < 40°C and < 90%Relative humidity (RH)</p> <p>2. Peak package body temperature <u>250</u> °C <small>If Blank, see adjacent bar code label</small></p> <p>3. After bag is opened, Devices that will be subjected to reflow solder or other high temperature process must (a) Mounted within: <u>168</u> hrs. Of factory conditions ≤ 30°C/60% RH, OR <small>If Blank, see adjacent bar code label</small> (b) Stored at < 10°C RH.</p> <p>4. Devices require bake, before mounting, it: (a) Humidity indicator Card is >10% when read at 23±5°C (b) 3a or 3b not met.</p> <p>5. If baking is required, Devices may be baked for 24 hrs at 125±5°C Note: If device containers cannot be subjected to high temperature Or shorter bake times are desired. Reference IPC/JEDEC J-STD-033 for bake procedure Bag Seal Date: _____ Note: Level and body temperature defined by IPC/JEDEC J-STD-020 <small>If Blank, see adjacent bar code label</small></p>			

Pre-release

802.11b/g/n Wireless LAN Daughter board V2.1

9.4 Recommended MSD baking Specification (Reference only)

If the MSD control over the MSD Level standard (MSD level standard refer IPC/ JEDEC), please reference below request to make baking.

種類 Kind	須烘烤條件 Need to baking status	烘烤條件 Baking specification.
MSD Component	超出管制期限或氣密 包裝拆封後 濕度指示卡超出規定 Over the control date or sealed package didn't work	Reel 60°C +5/-0 °C×60 小時(hrs)

For Additional information, please contact the following:

Universal Scientific Industrial Co., Ltd.

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Federal Communication Commission Interference Statement

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 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.

FCC Caution:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter.

This End equipment should be installed and operated with a minimum distance of 2 millimeter between the radiator and your body.

IMPORTANT NOTE:

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

本產品符合低功率電波輻射性電機管理辦法：

第十二條

經形式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十四條

低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前項合法通信，指依電信規定作業之無線電信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。