802.11b/g/n + BT4.0/HS + FM Radio 3 in One SiP Module

Data Sheet May. 22 2012 Rev 1.2.1

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Product Requirement
of
WM-BN-BM-04 WLAN +BT+FM 3 in One Module

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Introduction

The 802.11b/g/n + BT + FM Receiver Wireless SiP module WM-BN-BM-04 which refers as “SiP 3 in One module” is a small size module that provides full function of 802.11b/g/n (draft n), Bluetooth class 4.0 + HS and FM Receiver in a tiny module via 54 pins LGA Foot Print.

This multi- functionality and board to board physical interface provides SDIO/SPI/HSIC interface for WiFi, UART for Bluetooth and FM Receiver.

The small size & low profile physical design make it easier for system design to enable high performance wireless connectivity 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 Wi-Fi + Bluetooth features, such as, Wireless PDA, Smart phone, MP3, PMP, slim type Notebook, VoIP phone etc.

The module is based on Broadcom 4330 chipset which is a WiFi + BT + FM Receiver SoC. The Radio architecture & high integration MAC/BB chip provide excellent sensitivity with rich system performance. The module is designed as single antenna for WiFi and Bluetooth 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 OEM customers.

Features

- Lead Free design which supporting Green design requirement, RoHS Compliance.
- The module can support Halogen Free
- Support single Antenna for WiFi and Bluetooth
- Small size suitable for low volume system integration.
- Low power consumption & excellent power management performance extend battery life.
- 2.412-2.484 GHz two SKUs for worldwide market.
- Easy for integration into mobile and handheld device with flexible system configuration and antenna design.
- Supports per packet Rx Antenna diversity

Change Note					
Rev	Date	Page	Part	Description of changes	Approval & Date
1.2	2012-05-08	7,14,27		Describe the Purpose of SAW Filter; Keep Murata Model Only; Laser Mark Updated	
1.2.1	2012-05-22	10,12~16	5.2.1;5.4;5.5	Hardware Specification Updated	

.

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1 EXECUTIVE SUMMARY

The WM-BN-BM-04 module 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 defined the product specification for 802.11b/g/n WiFi, BT 4.0+HS and FM module WM-BN-BM-04. **All the data in this document is based on Broadcom 4330 data sheet and other documents provided from Broadcom. The data will be updated after implementing the measurement of the module.**

This product is designated for use in embedded applications mainly in the mobile device, which required small size and high data rate wireless connectivity. The application such as, Wireless PDA, slim type Notebook, Media Adapter, Barcode scanner, mini-Printer, VoIP phone, Data storage device could be the potential application for wireless WM-BN-BM-04.

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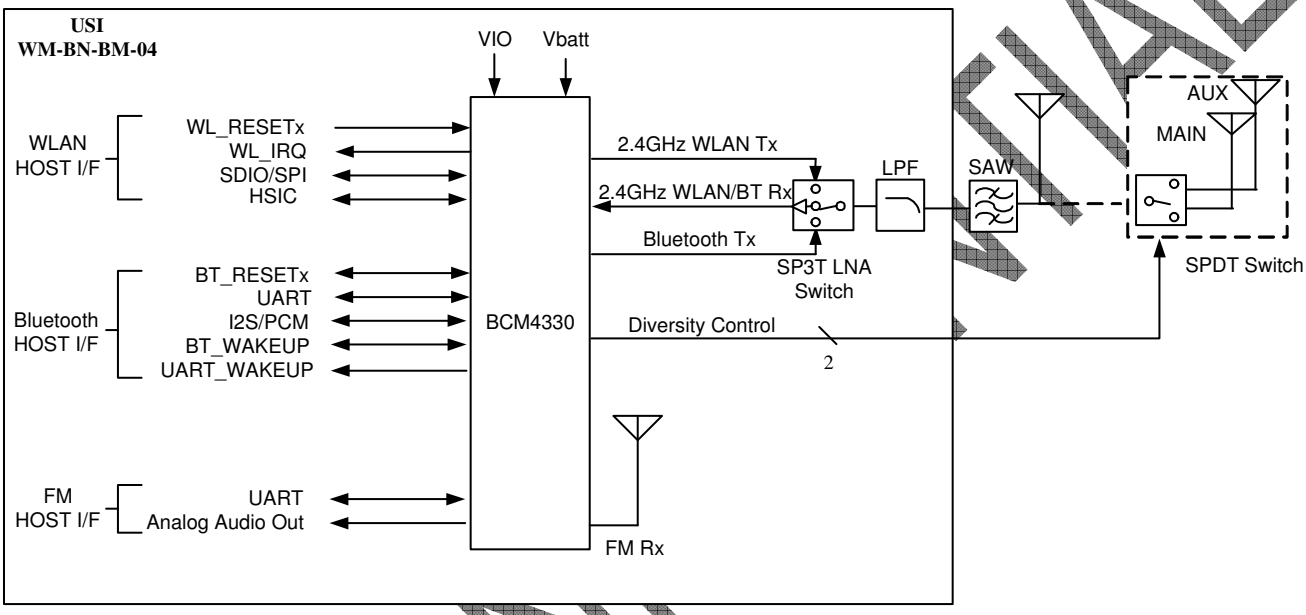
2 BLOCK DIAGRAM

The WM-BN-BM-04 module is designed based on Broadcom 4330 chipset solution.
It supports generic SDIO interface to connect the WLAN to the host processor. High speed UART is available to connect the Bluetooth 4.0+HS and FM to the host processor. A Bluetooth co-existence interface is supported for external, co-located Bluetooth devices. Antenna diversity should add one SPDT switch outside module and control by module.
A simple block diagram of the WM-BN-BM-04 module is depicted as below figure.



Note: In order to let customer products go through certificate related tests smoothly, and benefit greatly from the Time-to-Market point of view, here we strongly recommend customers to add one SAW filter on the system design. Please kindly refer to the attached application circuit for details. It had been proved that this recommendation can improve the WiFi transmitting spurious at the frequency of 2.6GHz according to our experiences in the field.

3 DELIVERABLES

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

- WM-BN-BM-04 Module with packaging
- Evaluation kits (with SDIO/SPI/HSIC/UART interface)
- Software utility which supporting customer for integration, performance test and homologation. Capable of testing, loading (firmware) and configuring (MAC, CIS) for the WM-BN-BM-04 module.
- 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.

5 TECHNICAL SPECIFICATION

5.1 ABSOLUTE MAXIMUM RATING

Supply Power	Max +4.5 Volt	
Storage 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-BN-BM-04 module has to withstand the operational requirements as listed in the table below.

Operating Temperature	-20° to 70° Celsius	
Relative Humidity range	Less than 60%	Storage
	Less than 85%	Operation

5.2.2 VOLTAGE

Power supply for the WM-BN-BM-04 module will be provided by the host via the power pins

Symbol	Parameter	Min	Typ	Max	Unit
VBAT	Battery Voltage Input	3.4[a]	3.8	4.5	V
VDDIO[b]	WLAN/BT Digital I/O Supply	1.2	1.8	2.5	V
				2.98[c]	V

- a: 3.4V is the minimum voltage to keep PA performance of TX path.
- b: I/O interface DC level depends on VDDIO
- c: When using a 2.9V±3% supply, a 2.98V to 3.09V rang is allowed for a duration not to exceed 1.5 seconds for each power-up cycle. After that, the VDDIO supply for the chip must have a steady state operating condition within the range 2.9V±3%.

5.2.3 CURRENT CONSUMPTION

	Power consumption	Typical	Max
WiFi	Tx @ 19dBm output power @ 25C (11b)	316mA	350mA
	Tx @ 19dBm output power @ 25C (11g)	285mA	325mA
	Tx@18dBm output power @ 25C (11n)	265mA	300mA
	Rx @25C (11b)	75mA	105mA
	Rx @25C (11g)	75mA	105mA
	Power Saving Mode(Average)[*a]	1.25mA	1.75mA
	Deep Sleep Mode[*a]	0.220mA	0.375mA
BT	Tx @ 12dBm output power @ 25C	60mA	70mA
	Rx (multi-sensitivity)@25C	30mA	40mA
	Deep Sleep Mode[*b]	0.145mA	0.155mA
WiFi/BT	Power off mode	0.025mA	0.05mA

Condition: 1.VBAT=3.8v, VDDIO=1.8V, WL_BT_REG_ON=H, WL_RST_ON=H, BT_RST_ON=H
2.Measuring output power at Pin.9 RF_BG pin of module.

Note: a. Bluetooth function disable condition.
b. WiFi function disable condition.

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5.3 WIRELESS SPECIFICATIONS

The WM-BN-BM-04 module complies with the following features and standards;

Features	Description
WLAN Standards	IEEE 802 Part 11b/g/n (802.11b/g/n[a])
Bluetooth	Bluetooth™ 4,0+HS compliance
Antenna Port	Support Single Antenna for both WiFi and BT
Frequency Band	2.400 GHz – 2.497 GHz

◆ a: 802.11n in this module only support HT20 Mode

5.4 RADIO SPECIFICATIONS 802.11B/G/N

The RF performance of WM-BN-BM-04 is given as follows.
Condition: VBAT= 3.8V 、 VDDIO=1.8V

5.4.1 802.11B TRANSMIT

Item	Condition	Min.	Typ.	Max.	Unit
Transmit power level	@ 1M / 2M / 5.5M / 11M bps	15.5	17	18.5	dBm
Transmit center frequency tolerance		-20*	-2	20*	ppm
Transmit spectral mask	Fc-22MHz<F<Fc-11MHz & Fc+11MHz<F<Fc+22MHz(1/2/5.5/ 11Mbps; channel 1~13)		-40	-30*	dBr
	F<Fc-22MHz & F>Fc+22MHz(1/2/5.5/11Mbps; channel 1~13)		-60	-50*	dBr
Transmit power -on	10% ~ 90 %		0.2	2*	us
Transmit power -down	90% ~ 10 %		0.2	2*	us
Transmit modulation accuracy	11 Mbps		-30	-9*	dB

* Refer to IEEE802.11 specification.

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5.4.2 802.11G TRANSMI

Item	Condition	Min.	Typ.	Max.	Unit
Transmit power level	@ 6/9/12/18/24/36Mbps	15.5	17	18.5	dBm
	@ 48Mbps	14.5	16	17.5	dBm
	@ 54Mbps	13.5	15	16.5	dBm
Transmit center frequency tolerance		-20*	-2	20*	ppm
Transmit modulation accuracy	54Mbps		-30	-25*	dB
	48Mbps		-30	-22*	dB
	36Mbps		-30	-19*	dB
	24Mbps		-30	-16*	dB
	18Mbps		-30	-13*	dB
	12Mbps		-30	-10*	dB
	9Mbps		-30	-8*	dB
	6Mbps		-30	-5*	dB
Spectrum Mask@6M	@ 11MHz		-27	-20*	dBr
	@ 20MHz		-46	-28*	dBr
	@ 30MHz		-57	-40*	dBr

* Refer to IEEE802.11 specification.

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5.4.3 2.4GHZ 802.11N TRANSMITTING – HT20

Item	Condition	Min.	Typ.	Max.	Unit
Transmit Output Power Level	MCS7	12.5	14	15.5	dBm
	MCS 4 ~ MCS 6	13.5	15	16.6	dBm
	MCS 0 ~ MCS 3	14.5	16	17.5	dBm
Transmit Center Frequency Tolerance		-20*	0	20*	ppm
Transmit Modulation Accuracy	MCS7	-	-30	-28*	dB
	MCS6	-	-30	-25*	dB
	MCS5	-	-30	-22*	dB
	MCS4	-	-30	-19*	dB
	MCS3	-	-30	-16*	dB
	MCS2	-	-30	-13*	dB
	MCS1	-	-30	-10*	dB
	MCS0	-	-30	-5*	dB
Transmit Spectral Mask	@ 11MHz	-	-	-20*	dBr
	@ 20MHz	-	-	-28*	dBr
	@ 30MHz	-	-	-45*	dBr

* Refer to IEEE802.11 specification.

5.4.4 802.11B RECEIVER

Item	Condition	Min.	Typ.	Max.	Unit
Receiver minimum input level sensitivity (PER<8 %)	11Mbps	-	-90	-85	dBm
	5.5Mbps	-	-93	-88	dBm
	2Mbps	-	-93	-88	dBm
	1Mbps	-	-93	-88	dBm
Receiver maximum input level (PER<8%)	1/2/5.5/11			-10	dBm

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5.4.5 802.11G RECEIVER

Item	Condition	Min.	Typ.	Max.	Unit
Receiver minimum input level sensitivity (PER<10 %)	54Mbps	-	-76	-66	dBm
	48Mbps	-	-78	-68	dBm
	36Mbps	-	-82	-72	dBm
	24Mbps	-	-85	-75	dBm
	18Mbps	-	-86	-76	dBm
	12Mbps	-	-87	-77	dBm
	9Mbps		-90	-80	dBm
	6Mbps	-	-91	-81	dBm
Receiver maximum input level (PER<10%)	6/9/12/18/24/36/48/ 54			-20	dBm

5.4.6 802.11N RECEIVER

Item	Condition	Min.	Typ.	Max.	Unit
2.4GHz – HT20 Receiver Input Level Sensitivity (PER<10%)	MCS7	-	-73	-64*	dBm
	MCS6	-	-75	-65*	dBm
	MCS5	-	-76	-66*	dBm
	MCS4	-	-80	-70*	dBm
	MCS3	-	-83	-74*	dBm
	MCS2	-	-87	-77*	dBm
	MCS1	-	-89	-79*	dBm
	MCS0	-	-91	-82*	

* Refer to IEEE802.11 specification.

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5.5 RADIO SPECIFICATIONS 802.15 BLUETOOTH

The Radio specification is compliant with the Bluetooth™ 2.1 + EDR specification

Features	Description
Frequency Band	2402 MHz ~ 2480 MHz
Number of Channels	79 channels
Modulation	FHSS (Frequency Hopping Spread Spectrum) , GFSK
Antenna Port	Single Antenna for WiFi and BT

5.6 BLUETOOTH RADIO CHARACTERISTICS

Features	Description		
	Min.	**Typical**	**Max.**
Maximum Receive Level	-20dBm		-
Output Power(Class-1.5)	0dBm	10dBm	13dBm
Output Power(Class-2)	-6dBm	3dBm	4dBm
Output Power(BLE)	-20dBm	7dBm	10dBm
Sensitivity (Basic)		-92dBm	-87dBm
Sensitivity(EDR)		-89dBm	-84dBm
Sensitivity(BLE)		-88dBm	-83dBm
Wide-Band Noise	-145 dBm/Hz (max.)@869 MHz~960 MHz -145 dBm/Hz (max.)@1800 MHz~1990 MHz -145 dBm/Hz (max.)@2110 MHz~ 2170MHz		

5.7 FM SPECIFICATIONS

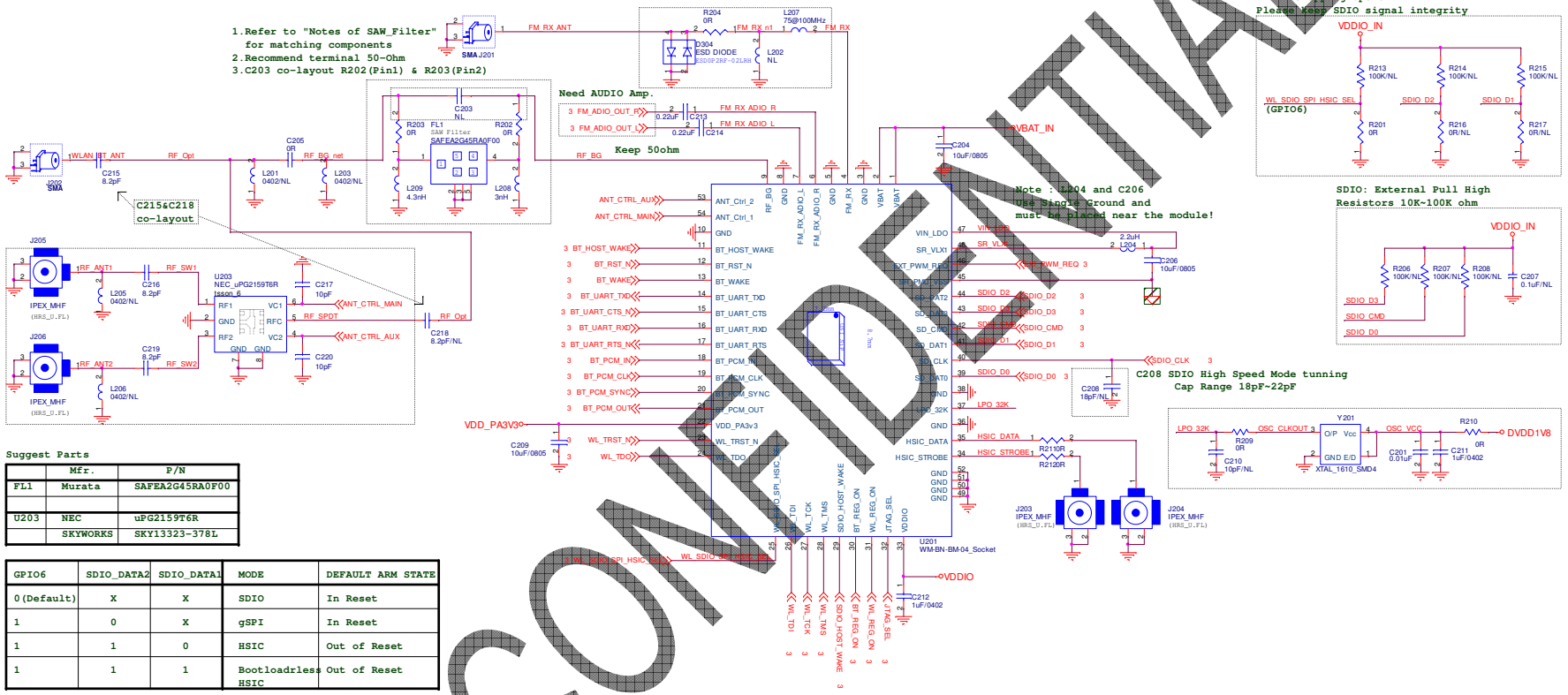
FM RX

FM receiver 76-MHz to 108-MHz bands supports the European Radio Data System (RDS) and the North American Radio Broadcast Data System (RBDS) standards.

Features	Description		
	Min.	**Typical**	**Max.**
Operating Frequency	76MHz	-	108MHz
Sensitivity*	-	-	-100dBm
Sensitivity(RDS)			-83dBm

Note: "*" test condition: Δf = 22.5KHz, pilot tone off, f_{mod} = 1KHz, (S+N/N)=26dB, pre-emphasis = 50us, B_{AF} = 0.3 ~ 15KHz

5.8 REFERENCE CIRCUIT



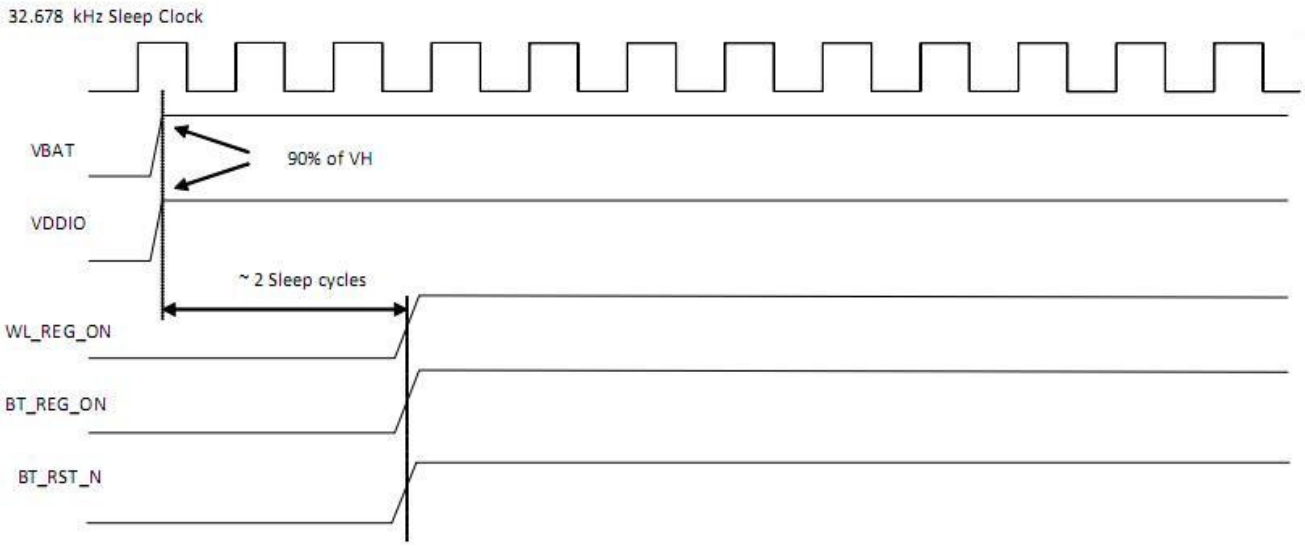
GPIO6	SDIO_DATA2	SDIO_DATA1	MODE	DEFAULT ARM STATE
0(Default)	X	X	SDIO	In Reset
1	0	X	gSPI	In Reset
1	1	0	HSIC	Out of Reset
1	1	1	Bootloadrless HSIC	Out of Reset

** Notes of SAW_Filter:

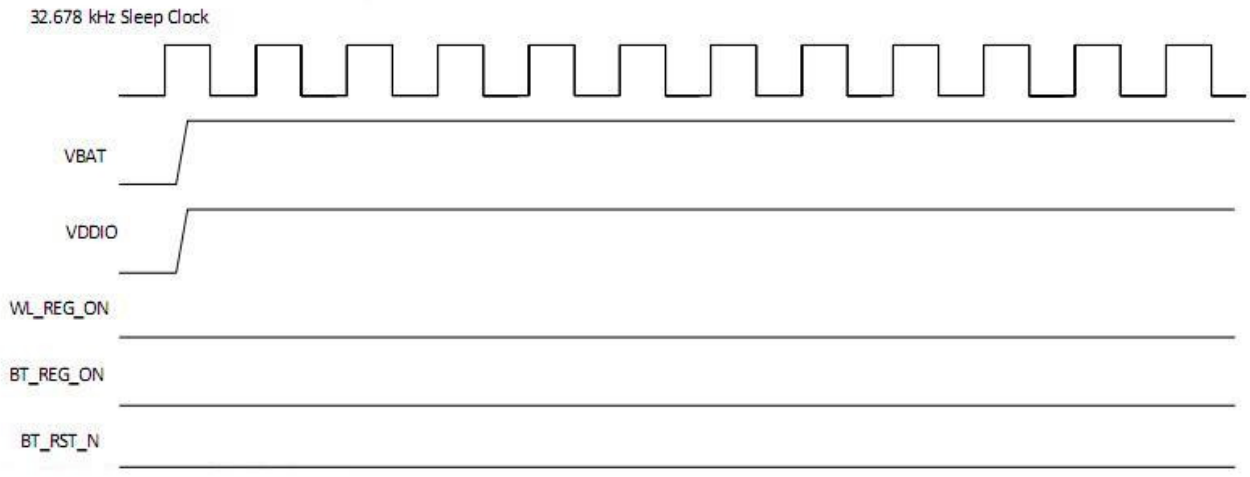
Option for filter outside of WM-BN-BM-04 module	L208	L209	R202	R203	C203
Murata SAW: SAFEA2G45RA0F00	3.0nH	4.3nH	0R	0R	No Use
Bypass Fliter	No Use	No Use	No Use	No Use	8.2pF

5.9 TIMING DIAGRAM OF INTEFACE

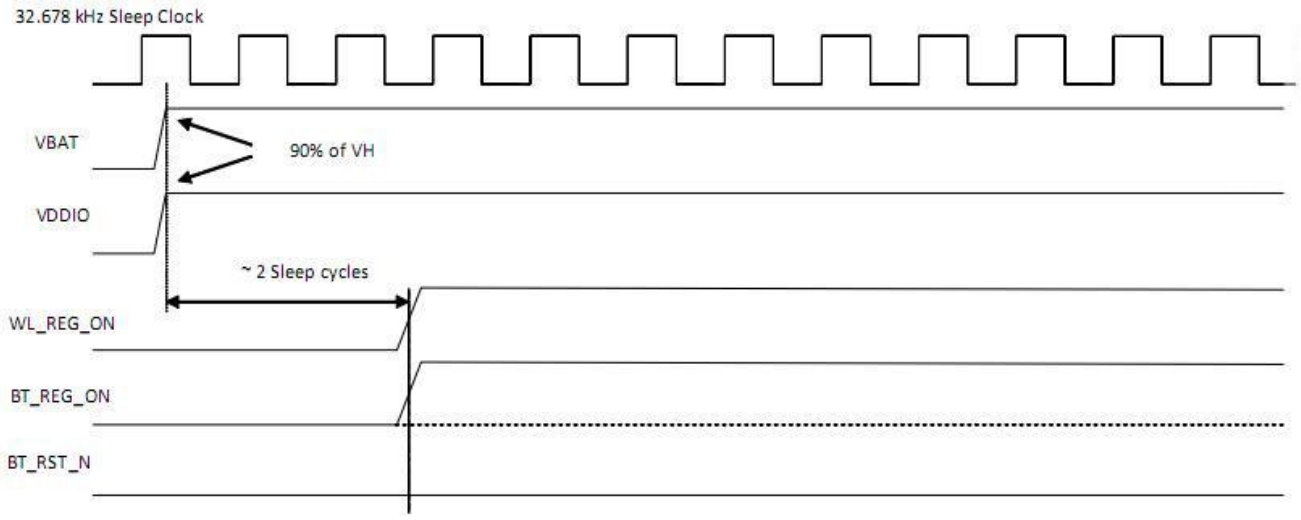
5.9.1 CONTROL SIGNAL TIMING DIAGRAMS



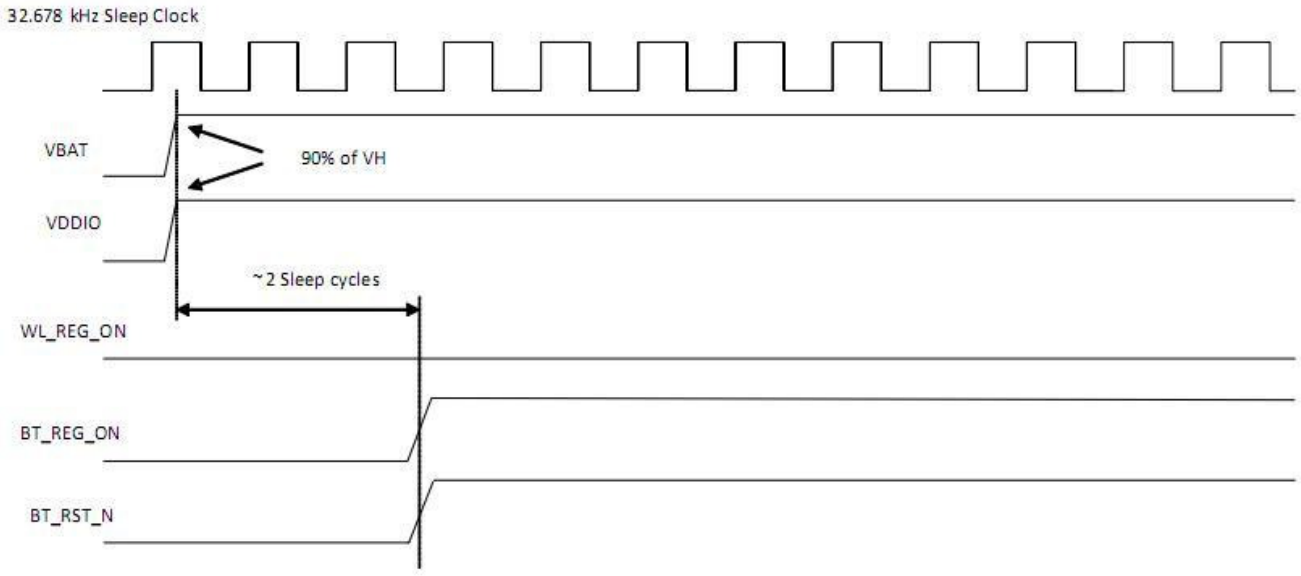
WLAN: **ON**; Bluetooth: **ON**



WLAN: **OFF**; Bluetooth: **OFF**



WLAN: **ON**, Bluetooth: **OFF**



WLAN: **OFF**, Bluetooth: **ON**

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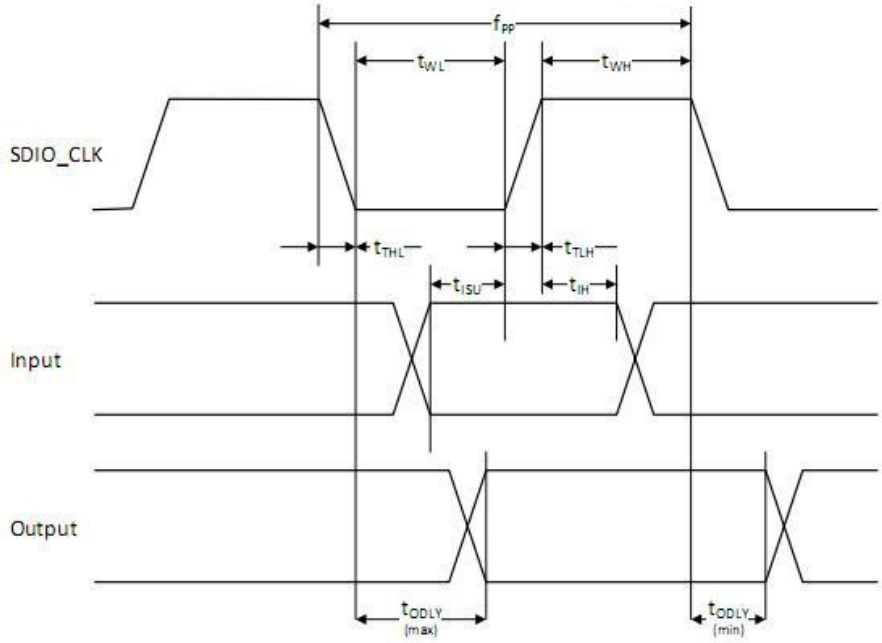
5.10 SDIO TIMING

The WM-BN-BM-04 WLAN section supports SDIO version 2.0. for both 1-bit (25 Mbps), 4-bit modes (100 Mbps), and high speed 4-bit (50 MHz clocks - 200 Mbps). It has the ability to map the interrupt signal onto a GPIO pin. This out-of-band interrupt signal notifies the host when the WLAN device wants to turn on the SDIO interface. The ability to force control of the gated clocks from within the WLAN chip is also provided.

SD 4-Bit Mode		SD 1-Bit Mode		gSPI Mode	
DATA0	Data line 0	DATA	Data line	DO	Data output
DATA1	Data line 1 or Interrupt	IRQ	Interrupt	IRQ	Interrupt
DATA2	Data line 2 or Read Wait	RW	Read Wait	NC	Not used
DATA3	Data line 3	N/C	Not used	CS	Card select
CLK	Clock	CLK	Clock	SCLK	Clock
CMD	Command line	CMD	Command	DI	Data input

SDIO Pin Description Table

5.10.1 SDIO TIMING IN DEFAULT MODE

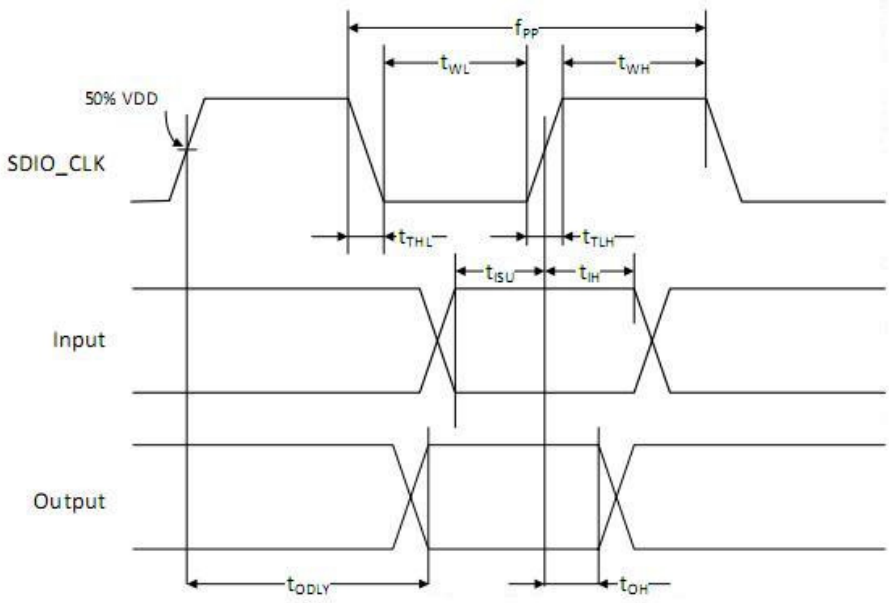


5.10.2 SDIO BUS TIMING PARAMETERS (DEFAULT MODE)

Parameter	*Symbol*	*Minimum*	*Typical*	*Maximum*	*Unit*
Inputs: CMD, DAT (referenced to CLK)					
Input setup time	tISU	5	–	–	ns
Input hold time	tIH		–	–	ns
Outputs: CMD, DAT (referenced to CLK)					
Output delay time – Data Transfer mode	tODLY		–	14	ns
Output delay time – Identification mode	tODLY	0	–	50	ns

a. Timing is based on CL ≤40pF load on CMD and Data.
b. min(Vih) = 0.7 × VDDIO and max(Vil) = 0.2 × VDDIO.

5.10.3 SDIO TIMING IN HIGH-SPEED MODE



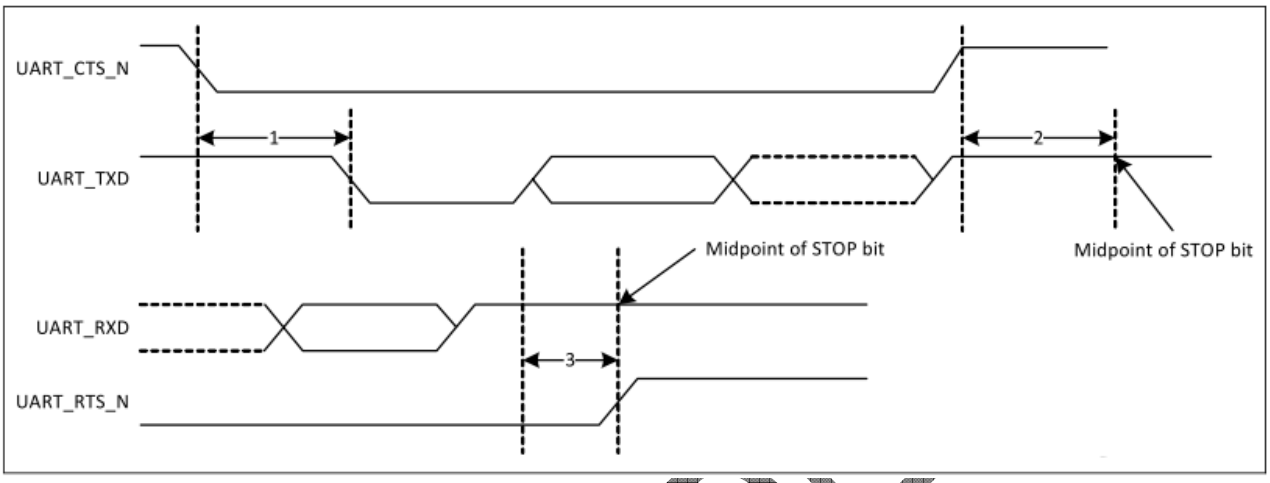
5.10.4 SDIO BUS TIMING PARAMETERS (HIGH-SPEED MODE)

Parameter	*Symbol*	*Minimum*	*Typical*	*Maximum*	*Unit*
SDIO CLK (all values are referred to minimum VIH and maximum VIL[b])					
Frequency – Data Transfer Mode	fPP	0	–	50	MHz
Frequency – Identification Mode	fOD	0	–	400	kHz
Clock low time	tWL	7	–	–	ns
Clock high time	tWH	7	–	–	ns
Clock rise time	tTLH	–	–	3	ns
Clock low time	tTHL	–	–	3	ns
Inputs: CMD, DAT (referenced to CLK)					
Input setup Time	tISU	6	–	–	ns
Input hold Time	tIH	2	–	–	ns
Outputs: CMD, DAT (referenced to CLK)					
Output delay time – Data Transfer Mode	tODLY	–	–	14	ns
Output hold time	tOH	2.5	–	–	ns
Total system capacitance (each line)	CL	–	–	40	pF

a. Timing is based on CL ≤40pF load on CMD and Data.
b. min(Vih) = 0.7 × VDDIO and max(Vil) = 0.2 × VDDIO.

5.11 UART TIMING

The UART interface is a standard 4-wire interface (RX, TX, RTS, and CTS) with adjustable baud rates from 9600 bps to 4.0 Mbps. The default baud rate is 115.2 Kbaud coming out of reset. The baud rate may be selected through a vendor-specific UART HCI command.



Ref No.	*Characteristics*	*Minimum*	*Typical*	*Maximum*	*Unit*
1	Delay time, UART_CTS_N low to UART_TXD valid	–	–	1.5	Bit periods
2	Setup time, UART_CTS_N high before midpoint of stop bit	–	–	0.5	Bit periods
3	Delay time, midpoint of stop bit to UART_RTS_N high	–	–	0.5	Bit periods

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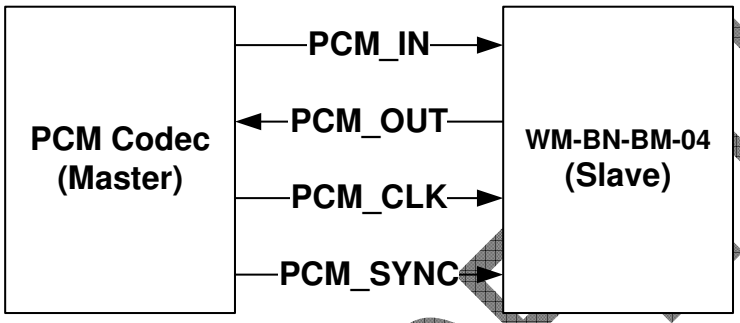
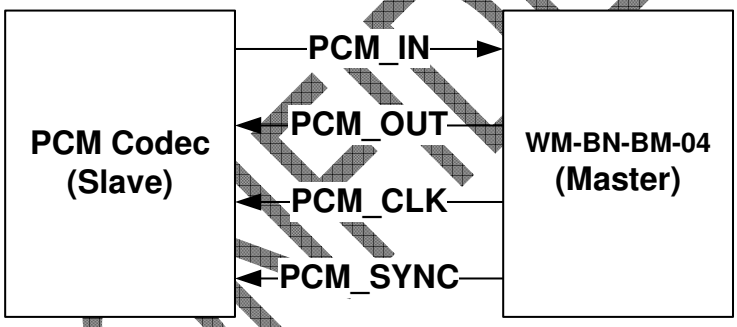
5.12 PCM TIMING

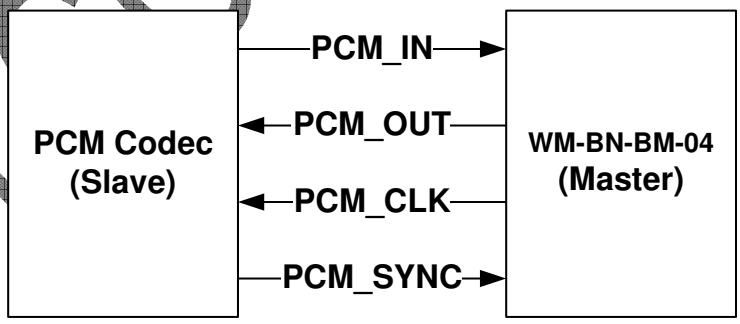
The PCM Interface on the WM-BN-BM-04 can connect to linear PCM Codec devices in master or slave mode. In master mode, the WM-BN-BM-04 generates the PCM_CLK and PCM_SYNC signals, and in slave mode, these signals are provided by another master on the PCM interface and are inputs to the WM-BN-BM-04. The configuration of the PCM interface may be adjusted by the host through the use of vendor-specific HCI commands.



PCM Interface Slave Mode



PCM Interface Master Mode



PCM Interface Hybrid Mode

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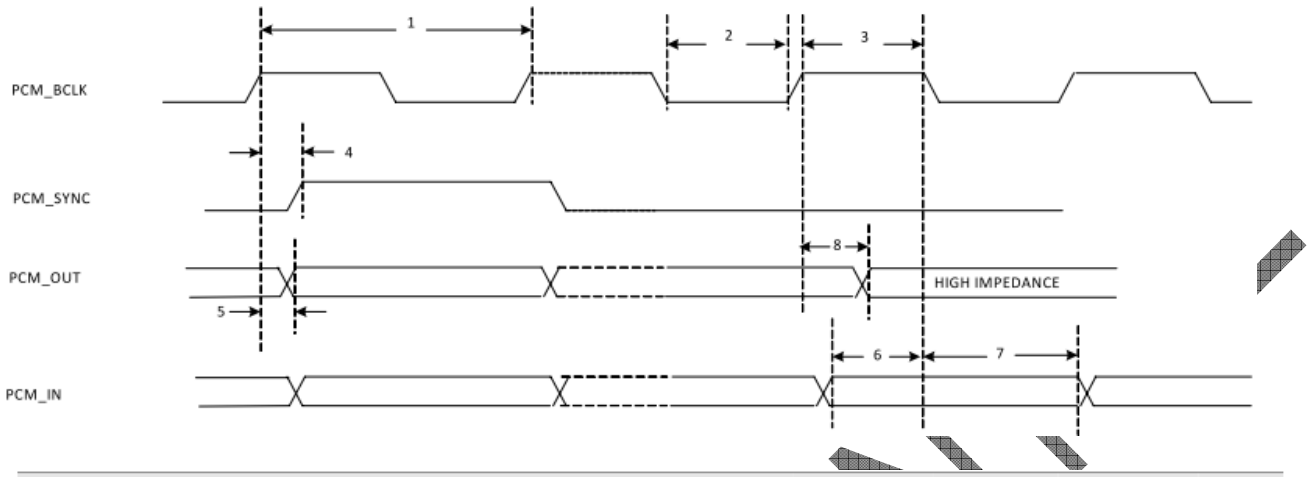
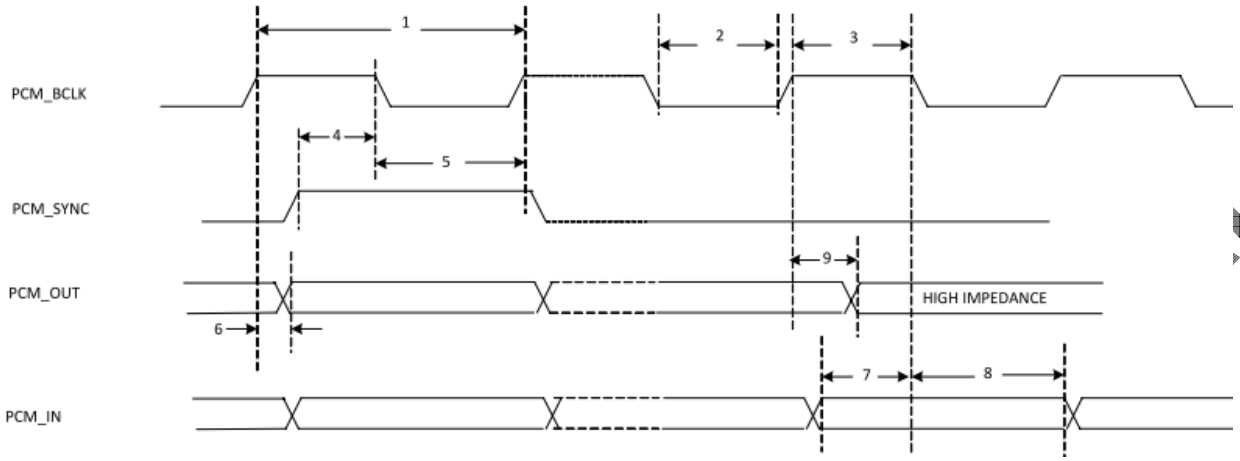
5.12.1 SHORT FRAME SYNC, MASTER MODE



Ref No.	*Characteristics*	*Minimum*	*Typical*	*Maximum*	*Unit*
1	PCM bit clock frequency	–	–	12	MHz
2	PCM bit clock HIGH	41	–	–	ns
3	PCM bit clock LOW	41	–	–	ns
4	PCM_SYNC delay	0	–	25	ns
5	PCM_OUT delay	0	–	25	ns
6	PCM_IN setup	8	–	–	ns
7	PCM_IN hold	8	–	–	ns
8	Delay from rising edge of PCM_BCLK during last bit period to PCM_OUT becoming high impedance	0	–	25	ns

.

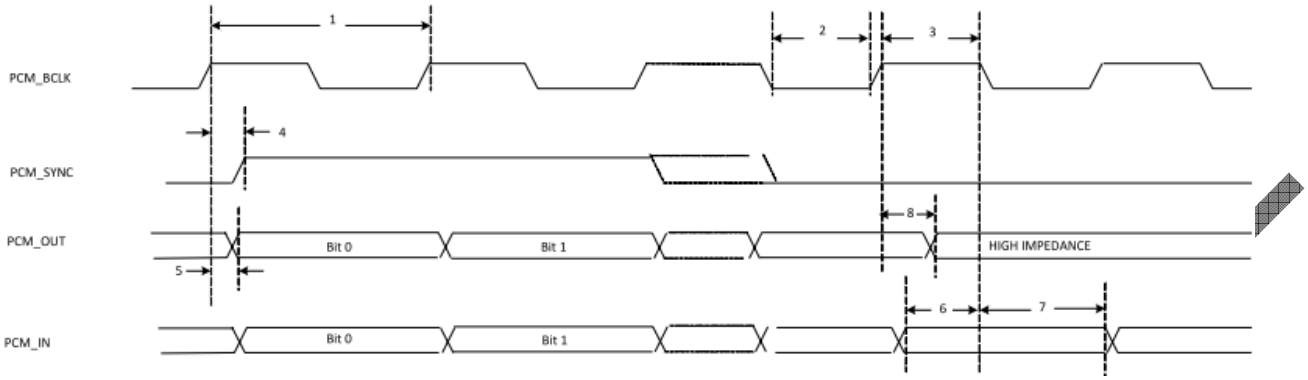
5.12.2 SHORT FRAME SYNC, SLAVE MODE



Ref No.	*Characteristics*	*Minimum*	*Typical*	*Maximum*	*Unit*
1	PCM bit clock frequency	–	–	12	MHz
2	PCM bit clock HIGH	41	–	–	ns
3	PCM bit clock LOW	41	–	–	ns
4	PCM_SYNC setup	8	–	–	ns
5	PCM_SYNC hold	8	–	–	ns
6	PCM_OUT delay	0	–	25	ns
7	PCM_IN setup	8	–	–	ns
8	PCM_IN hold	8	–	–	ns
9	Delay from rising edge of PCM_BCLK during last bit period to PCM_OUT becoming high impedance	0	–	25	ns

.

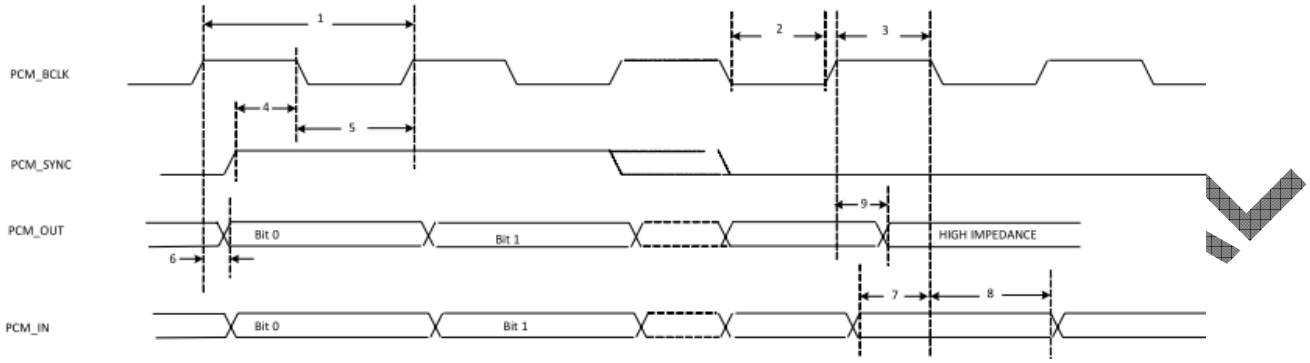
5.12.3 LONG FRAME SYNC, MASTER MODE



Ref No.	*Characteristics*	*Minimum*	*Typical*	*Maximum*	*Unit*
1	PCM bit clock frequency	–	–	12	MHz
2	PCM bit clock HIGH	41	–	–	ns
3	PCM bit clock LOW	41	–	–	ns
4	PCM_SYNC delay	0	–	25	ns
5	PCM_OUT delay	0	–	25	ns
6	PCM_IN setup	8	–	–	ns
7	PCM_IN hold	8	–	–	ns
8	Delay from rising edge of PCM_BCLK during last bit period to PCM_OUT becoming high impedance	0	–	25	ns

.

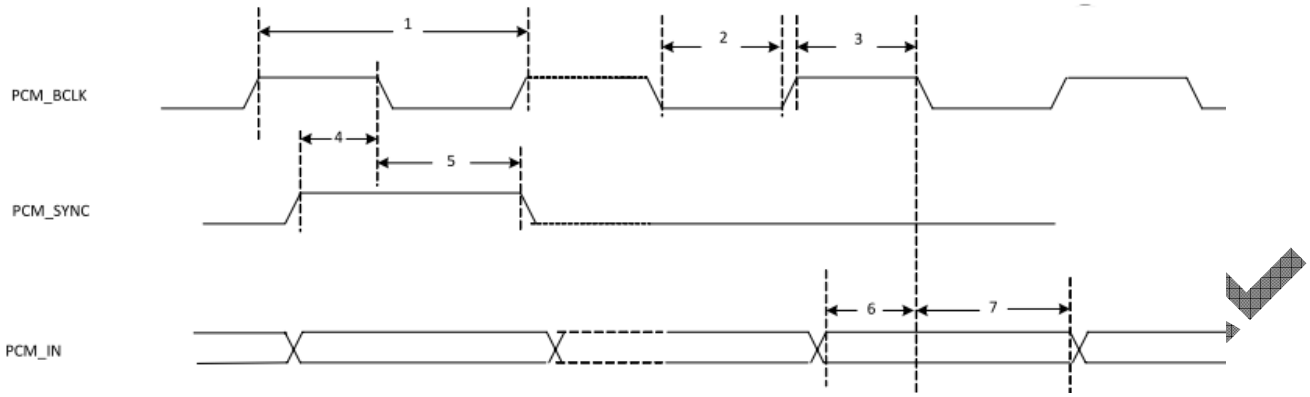
5.12.4 LONG FRAME SYNC, SLAVE MODE



Ref No.	*Characteristics*	*Minimum*	*Typical*	*Maximum*	*Unit*
1	PCM bit clock frequency	–	–	12	MHz
2	PCM bit clock HIGH	41	–	–	ns
3	PCM bit clock LOW	41	–	–	ns
4	PCM_SYNC setup	8	–	–	ns
5	PCM_SYNC hold	8	–	–	ns
6	PCM_OUT delay	0	–	25	ns
7	PCM_IN setup	8	–	–	ns
8	PCM_IN hold	8	–	–	ns
9	Delay from rising edge of PCM_BCLK during last bit period to PCM_OUT becoming high impedance	0	–	25	ns

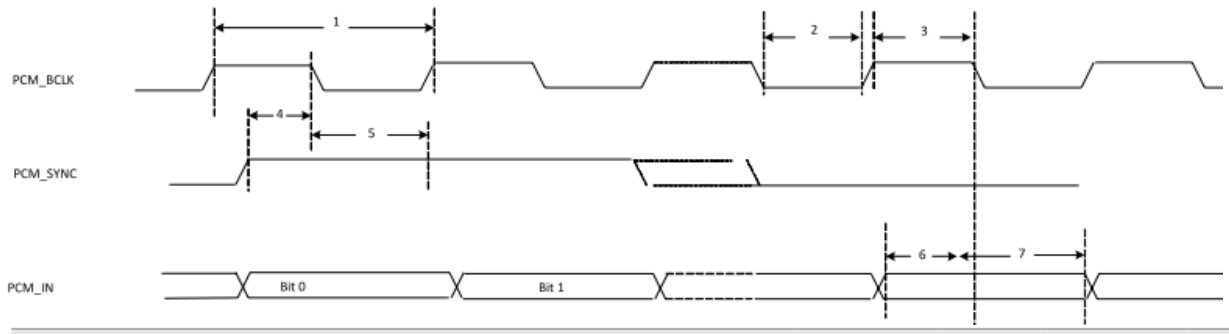
.

5.12.5 SHORT FRAME SYNC, BURST MODE



Ref No.	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency	–	–	24	MHz
2	PCM bit clock HIGH	20.8	–	–	ns
3	PCM bit clock LOW	20.8	–	–	ns
4	PCM_SYNC setup	8	–	–	ns
5	PCM_SYNC hold	8	–	–	ns
6	PCM_IN setup	8	–	–	ns
7	PCM_IN hold	8	–	–	ns

5.12.6 LONG FRAME SYNC, BURST MODE



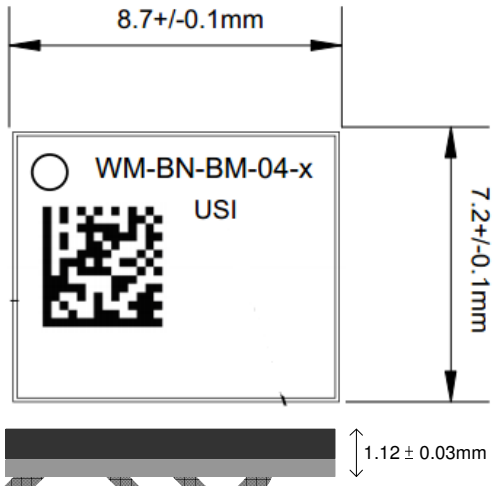
Ref No.	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency	–	–	24	MHz
2	PCM bit clock HIGH	20.8	–	–	ns
3	PCM bit clock LOW	20.8	–	–	ns
4	PCM_SYNC setup	8	–	–	ns
5	PCM_SYNC hold	8	–	–	ns
6	PCM_IN setup	8	–	–	ns
7	PCM_IN hold	8	–	–	ns

5.13 DIMENSIONS, WEIGHT AND MOUNTING

The following paragraphs provide the requirements for the size, weight and mounting of the WM-BN-BM-04 module.

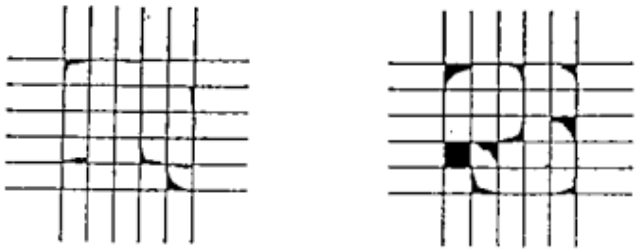
5.13.1 DIMENSION

The size and thickness of the WM-BN-BM-04 module is 8.7 mm ± 0.1(L) x 7.2 mm ± 0.1(W) x 1.12 ± 0.03mm"(H), With Conformal Metal Shielding



5.13.2 SURFACE COATING STRENGTH

Surface coating strength meets Level 3B ASTM D3359-09.
3B define: Small flakes of the coating are detached along edges and at intersections of cuts.

CLASSIFICATION	PERCENT AREA REMOVED	SURFACE OF CROSS-CUT AREA FROM WHICH FLAKING HAS OCCURRED FOR SIZ PARALLEL CUTS AND ADHESION RANGE BY PERCENT
3B	5 - 15%	

LEGAL, REGULATORY & OTHER TECHNICAL CONSTRAINTS

The WM-BN-BM-04 module is pre-tested to ensure that all requirements meet as set forth in the following sections.

Final certification (module certification) requires the antenna of targeted system with a lead-time of 6 weeks. The product deliverable shall be a pre-tested WM-BN-BM-04 module. No module level certification on WM-BN-BM-04 module.

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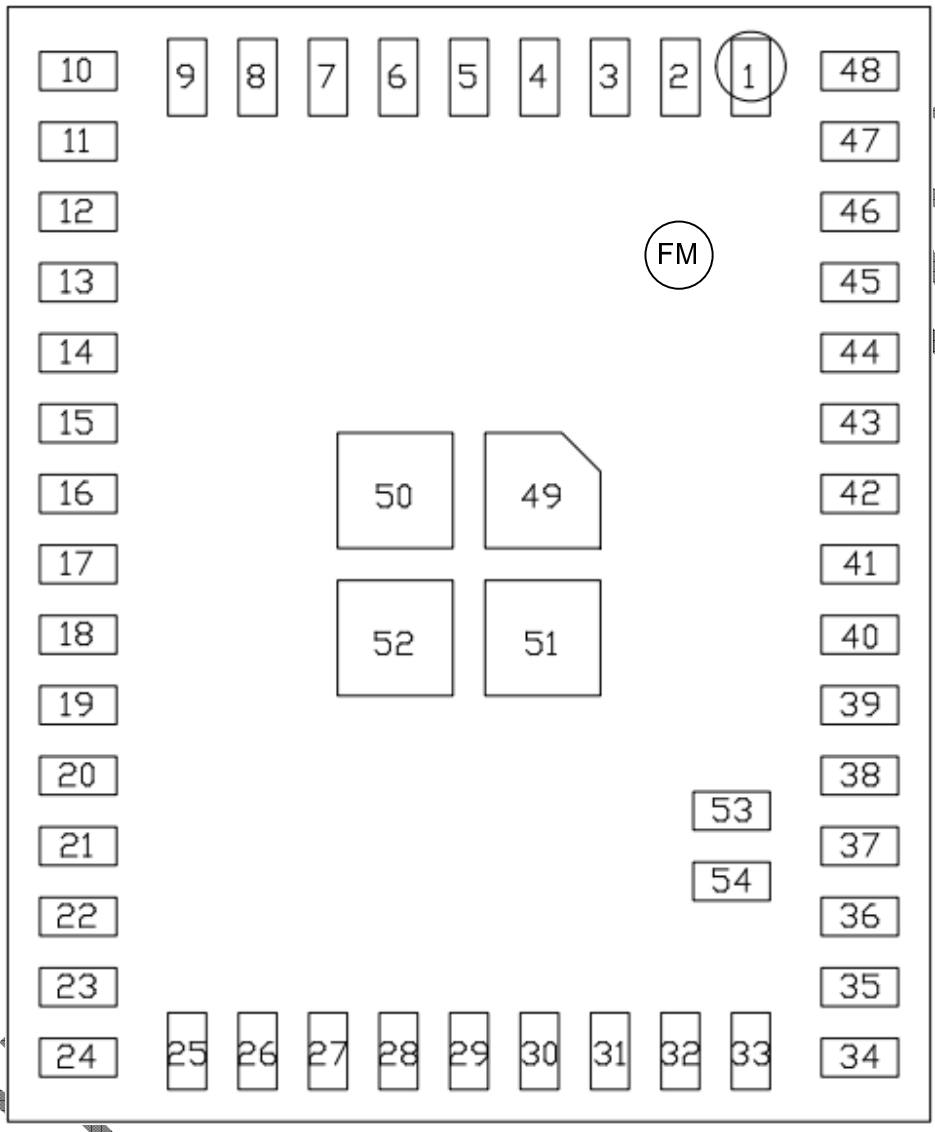
6 PIN OUT AND PIN DESCRIPTION



Top View

Pin Description

P/N	Pin Definition	Type	Description
1	VBAT	I	Battery supply input (3.4V~4.5V)
2	VBAT	I	Battery supply input (3.4V~4.5V)
3	GND	I	Ground
4	FM_RX	I	FM radio RF antenna port
5	GND	I	Ground
6	FM_RX_ADIO_R	O	FM analog audio output channel 2
7	FM_RX_ADIO_L	O	FM analog audio output channel 1
8	GND	I	Ground
9	RF_BG	I/O	Antenna port for WLAN and Bluetooth
10	GND	I	Ground
11	BT_HOST_WAKE	O	*BT_HOST_WAKE* Host UART wake up. Signal from the module to the host indicating that the module requires attention. • Asserted: Host device must wake-up or remain awake. • Deserted: Host device may sleep when sleep criteria are met. The polarity of this signal is software configurable and can be asserted high or low.
12	BT_RST_N	I	Low asserting reset for BT core
13	BT_WAKE	I	*BT_WAKE* Bluetooth device wake-up: Signal from the host to the module indicating that the host requires attention. • Asserted: Bluetooth device must wake-up or remain awake. • Deserted: Bluetooth device may sleep when sleep criteria are met. The polarity of this signal is software configurable and can be asserted high or low.
14	BT_UART_TXD	O	Bluetooth UART Serial Output. Serial data output for the HCI UART Interface.
15	BT_UART_CTS	I/O	Bluetooth UART Clear to Send. Active-low clear-to-send signal for the HCI UART interface.
16	BT_UART_RXD	I	Bluetooth UART Serial Input. Serial data input for the HCI UART Interface
17	BT_UART_RTS	I/O	Bluetooth UART Request to Send. Active-low request-to-send signal for the HCI UART interface.
18	BT_PCM_IN	I	PCM data input
19	BT_PCM_CLK	I/O	PCM clock, can be master (output) or slave (input)
20	BT_PCM_SYNC	I/O	PCM sync signal, can be master (output) or slave (input)
21	BT_PCM_OUT	O	PCM data output
22	VDD_PA3V3	I	VDD power supply (from VBAT) for the internal WLAN power amplifier.

23	WL_TRST_N	I	For normal operation, connect as described in the JTAG specification. Otherwise, if JTAG is not used, this pin can be left unconnected (NC) as it has an internal weak pull-up resistor.
24	WL_TDO	I	For normal operation, connect as described in the JTAG specification. Otherwise, if JTAG is not used, this pin can be left unconnected (NC). This pin is also muxed with UART_TX, which can be enabled by software.
25	WL_SDIO_SPI_HSIC_SEL	I	This pin is used as a strapping option to select between SDIO mode (pull low) or SPI mode(pull high)
26	WL_TDI	I	For normal operation, connect as described in the JTAG specification. Otherwise, if JTAG is not used, this pin can be left unconnected (NC) as it has an internal weak pull-up resistor. This pin is also muxed with UART_RX, which can be enabled by software.
27	WL_TCK	I	For normal operation, connect as described in the JTAG specification. Otherwise, if JTAG is not used, this pin can be left unconnected (NC) as it has an internal weak pull-up resistor.
28	WL_TMS	I	For normal operation, connect as described in the JTAG specification. Otherwise, if JTAG is not used, this pin can be left unconnected (NC) as it has an internal weak pull-up resistor.
29	SDIO_HOST_WAKE	I/O	General purpose interface pin. This pin is high-impedance on power up and reset. Subsequently, it becomes an input or output through software control. This pin has a programmable weak pull-up/down.
30	BT_REG_ON	I	Used by PMU (OR-gated with WL_REG_ON) to power up or power down internal BCM4330 regulators used by the BT/FM section
31	WL_REG_ON	I	Used by PMU (OR-gated with BT_REG_ON) to power up or power down internal BCM4330 regulators used by the WLAN section. This pin is also a low-asserting reset for WLAN only (Bluetooth is not affected by this pin).
32	JTAG_SEL	I	JTAG selection pin.
33	VDDIO	I	Digital I/O supply (1.8V or 2.5V)
34	HSIC_STROBE	I/O	HSIC bidirectional data strobe signal
35	HSIC_DATA	I/O	HSIC bidirectional DDR data signal
36	GND	I	Ground
37	LPO_32K	I	Input for external low-power 32.768kHz Clock (Sleep Clock).
38	GND	I	Ground
39	SD_DAT0	I/O	SDIO data 0. This pin has an internal weak pull-up resistor.
40	SD_CLK	I/O	SDIO clock. This pin has an internal weak pull-up resistor.
41	SD_DAT1	I/O	SDIO data 1. This pin has an internal weak pull-up resistor.
42	SD_CMD	I/O	SDIO command. This pin has an internal weak pull-up resistor.
43	SD_DAT3	I/O	SDIO data 3. This pin has an internal weak pull-up resistor.

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44	SD_DAT2	I/O	SDIO data 2. This pin has an internal weak pull-up resistor.
45	SR_PMU_VSS	I	Switching regulator ground & PMU block analog ground
46	EXT_PWM_REQ	I	Auxiliary PMU control inputs. The pin has internal pull-down resistors and should be no-connect when not used.
47	VIN_LDO	I	Buck regulator: Battery Voltage Input
48	SR_VLX1	O	Core buck regulator: output to inductor and capacitor tank (2.2uH & 4.7uF are required).
49	GND	I	Ground
50	GND	I	Ground
51	GND	I	Ground
52	GND	I	Ground
53	ANT_CTRL_AUX	O	Antenna Switch control line. Default setting is high.
54	ANT_CTRL_MAIN	O	Antenna Switch control line. Default setting is high.
FM	FIDUCIAL MARK	N/A	The FM mark is used for USI manufacture only.

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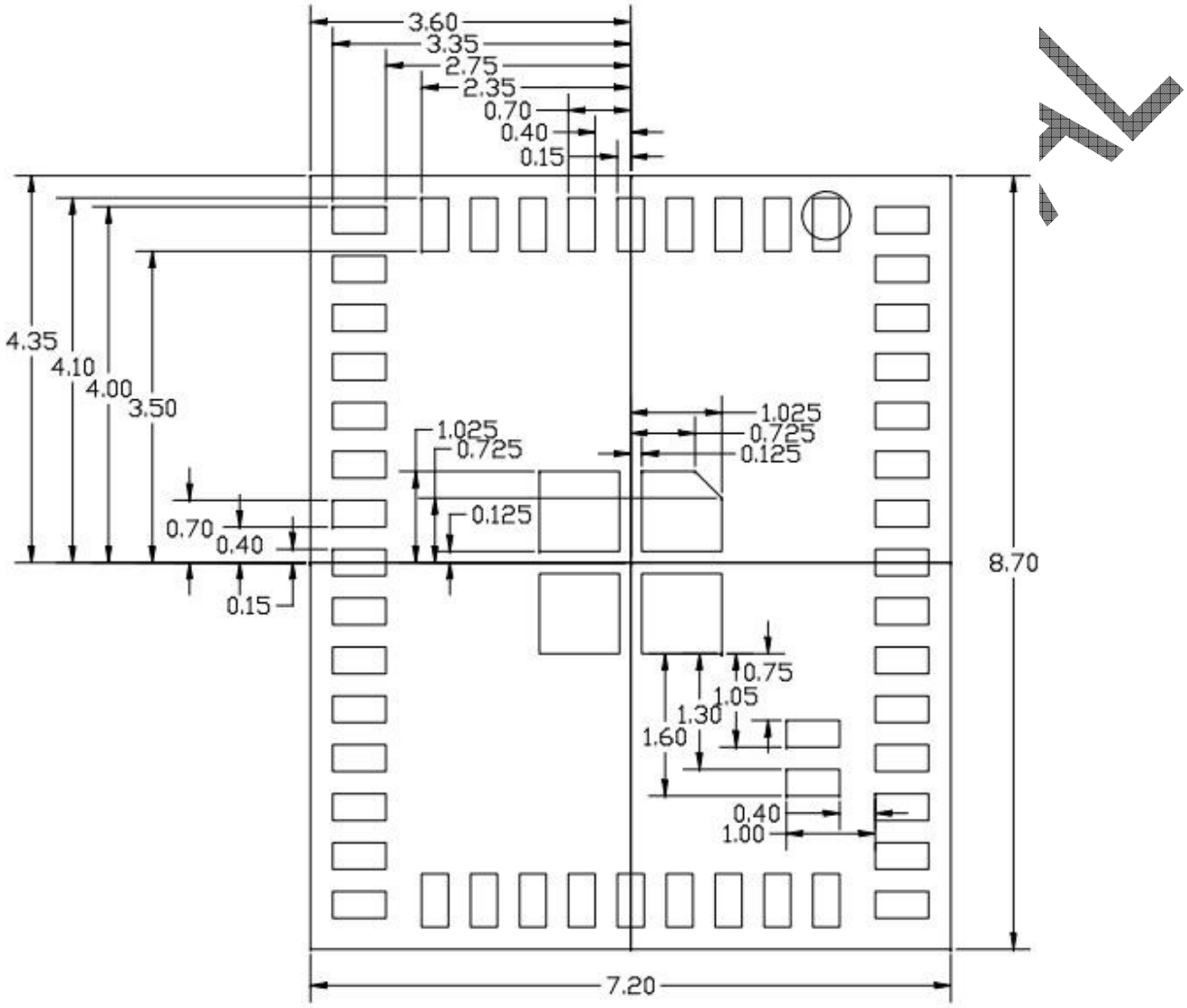
7 GUIDELINE TO PERFORM SMT WITH WM-BN-BM-04 MODULE

7.1 PCB FOOTPRINT RECOMMENDATION



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7.2 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 240℃ ~ 250℃ and the maximum component temperature should not exceed 250℃.
- It is recommended that time above 220℃ for the solder joints is between 50-80s, and with a minimum of 50s.
- Excessive ramp/cooling rates (>3℃/s) should be avoided.
- 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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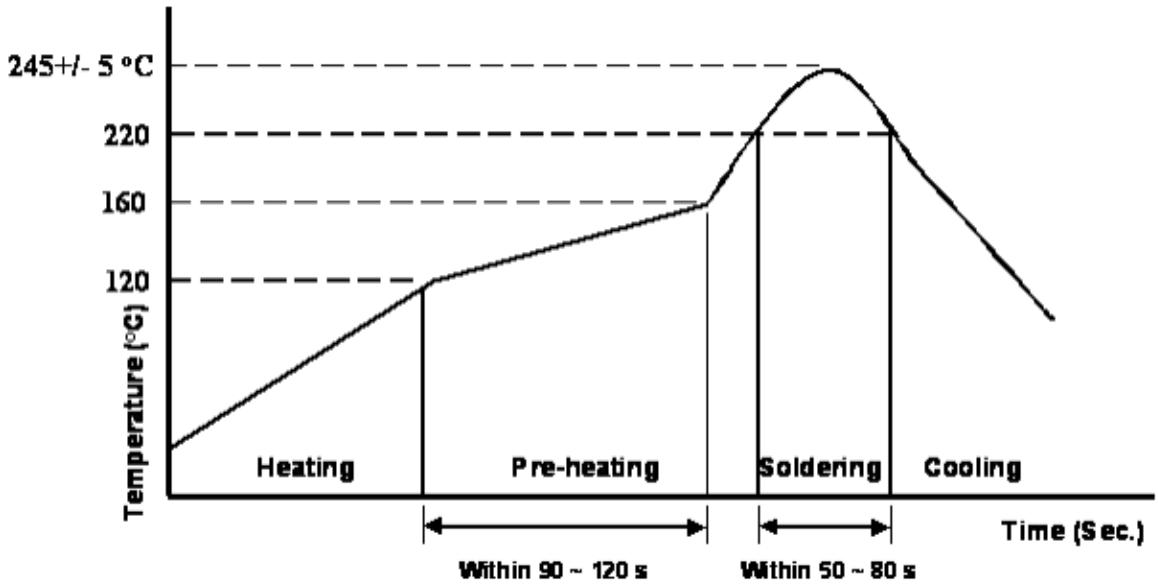
7.3 RECOMMENDED REFLOW PROFILE



(1) Solder paste alloy : SAC305 (Sn96.5/Ag3.0/Cu0.5) (Lead Free solder paste.)
(2) Peak temperature 245+/- 5 °C.
(3) Above melting point 220 °C, 50 ~80 Seconds.
(4) Pre-heat 120 to 160 °C, 90 ~120 Seconds.
(5) Nine heater zones at least for Reflow equipment.
(6) Nitrogen usage is recommended and be controlled the value less than 1500 ppm.
Note: Need to inspect solder joint by X-ray post reflow.

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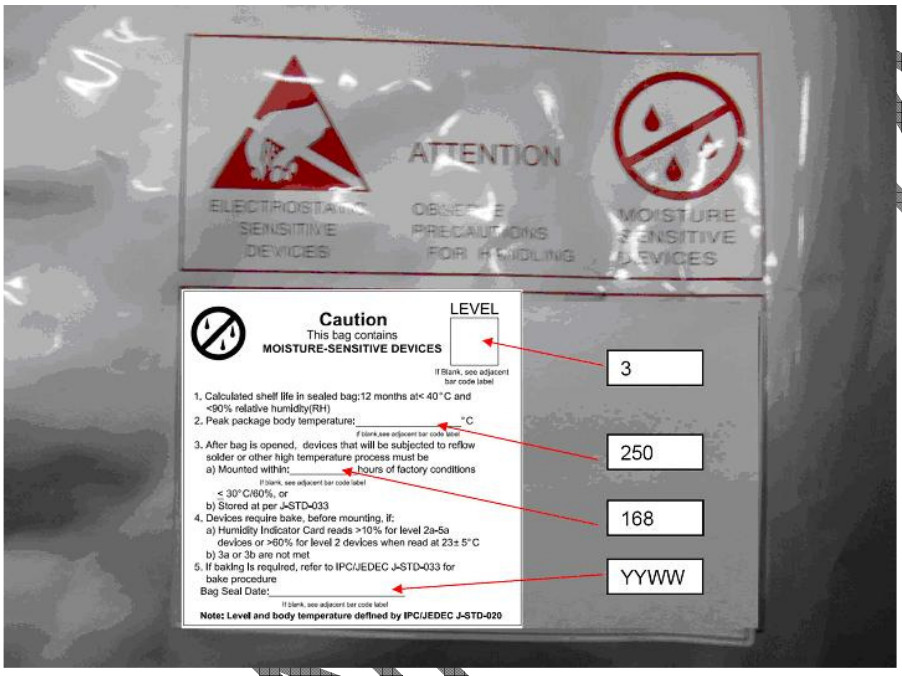
8 PACKAGE AND STORAGE CONDITION

8.1 PACKAGE DIMENSION



8.2 ESD LEVEL

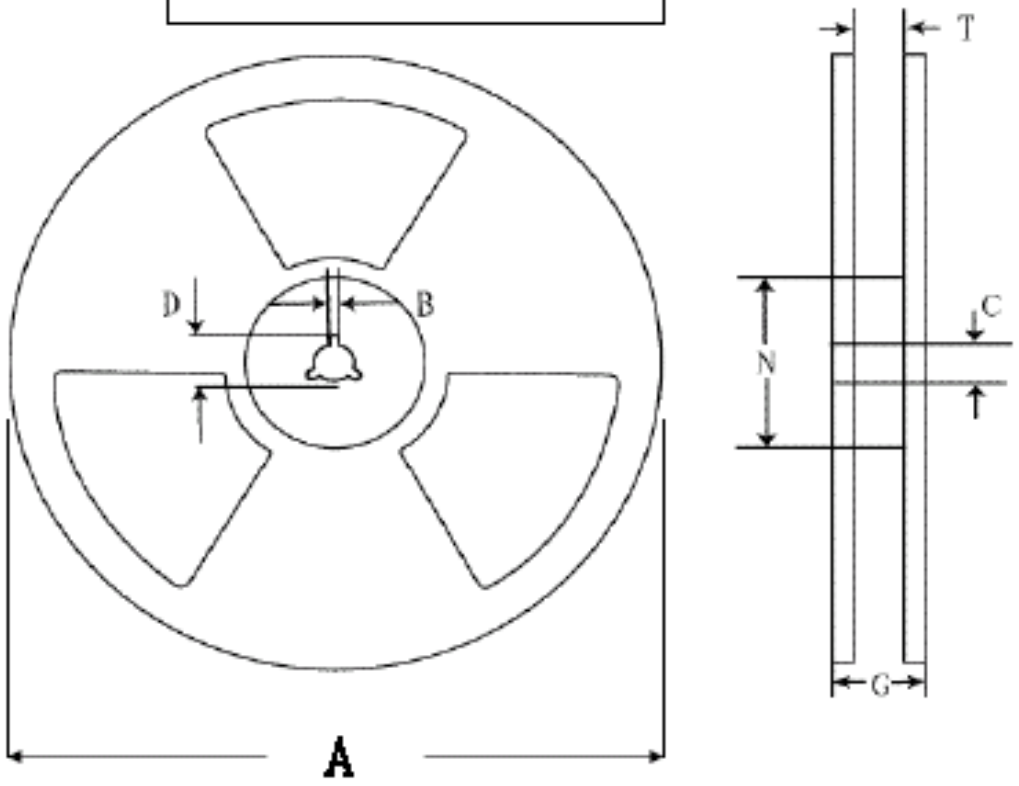
Note:

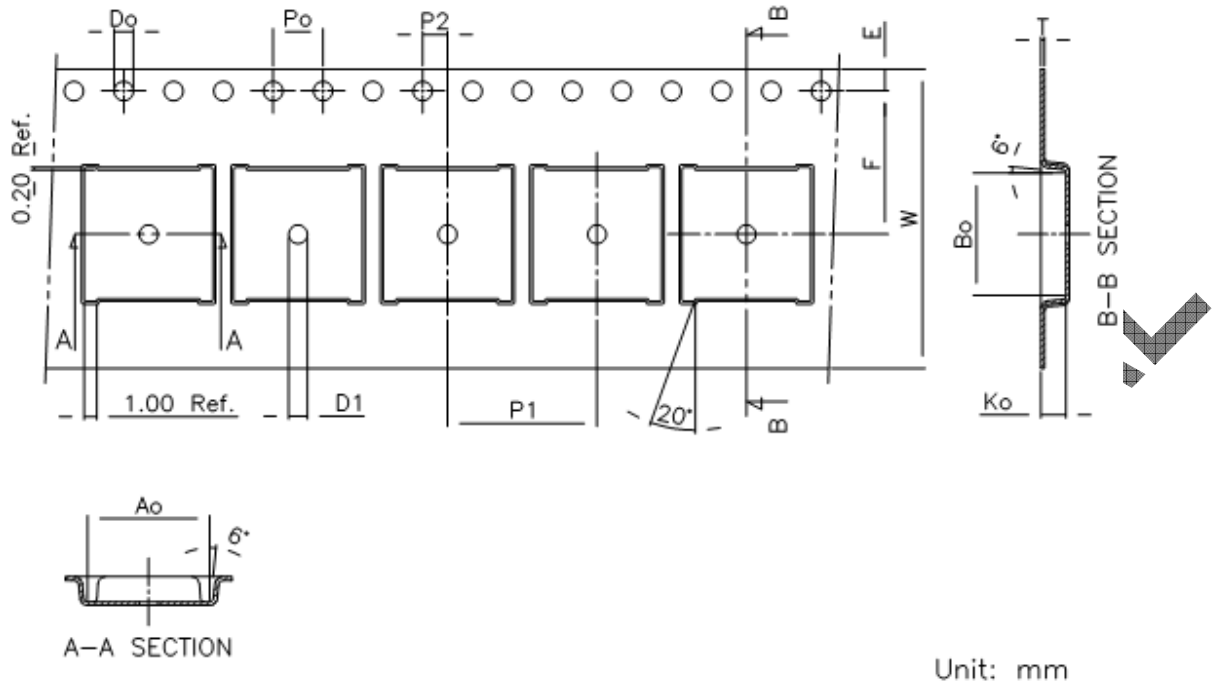
1. Surface Resistivity:
   Interior:10^{9}~10^{11}Ω/SQUARE
   EXTERIOR:10^{8}~10^{12}Ω/SQUARE
2. Dimension:475*420mm
3. Tolerance:+5,0mm
4. Color:
   Background : Gray
   Text : Red

8.3 TAP/REEL DIMENSION

Embossed carrier tape	Top cover tape	Each Item Size						
W±0.15m/m	W±0.15m/m	A	B±0.5	D±1.0	C±0.2	N±1.0	T±0.1	G±2.0
8	5.3/5.5	330	2.2	20.2	13	100	8.5	13.1
12	9.3	330	2.2	20.2	13	100	12.5	17.1
16	13.3	330	2.2	20.2	13	100	16.5	21.1
24	21.3	330	2.2	20.2	13	100	24.5	29.1
32	25.5	330	2.2	20.2	13	100	32.5	37.1
44	37.5	330	2.2	20.2	13	100	44.5	49.1
56	49.5	330	2.2	20.2	13	100	56.5	61.1

USI P/N:59-730113-02





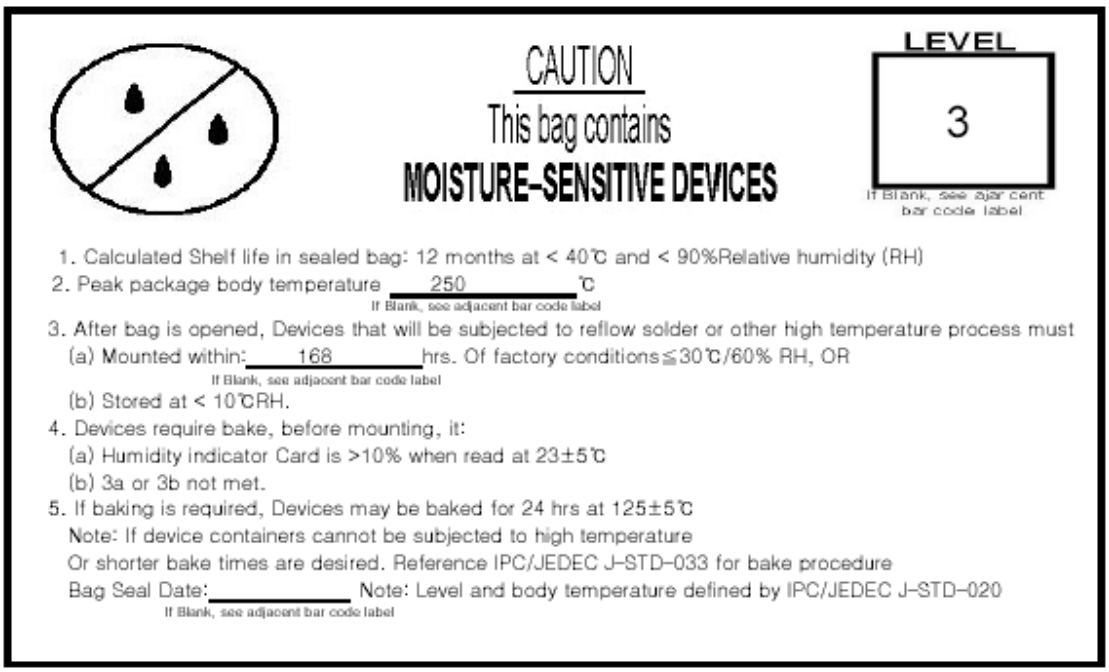
Unit: mm

Symbol	Ao	Bo	Ko	Po	P1	P2	T
Spec	9.0±0.10	7.5±0.10	1.6± 0.10	4.0±0.10	12.0±0.10	2.0±0.10	0.30±0.10
Symbol	E	F	Do	D1	W	10Po	
Spec	1.75±0.10	11.50±0.10	1.55±0.05	1.50±0.10	24.0±0.30	40.0±0.20	

Length leader / trailer tape:
Leader tape: ≥550mm which includes ≥100mm of carrier tape with empty compartments and covered with tape; remaining part might be of cover tape only.
Trailer tape: ≥160mm with empty compartments and covered with tape.

NOTES:
1.Material: Conductive Polystyrene (Recycle)
2.Color: Black
3.Surface resistance: 10^6 Ohms/square 以下
3.Cumulative tolerance per 10 pitches(P_0) is ±0.2mm.
4.Carrier camber shall be not more than 1mm per 100mm,noncumulative over 250mm
5.A_0 & B_0 are measured on the plane by 0.3 mm above the bottom of the pocket.
6.K_0 is measured from the inside bottom of the pocket to the top surface of the carrier.
7.Pocket position relative to sprocket hold is measured as true position of pocket, not sprocket hold.

8.4 MSL LEVEL / STORAGE CONDITION



Life cycle: 2 years
Broadcom is Trademark of 3'rd Party.

For Additional information, please contact the following:
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