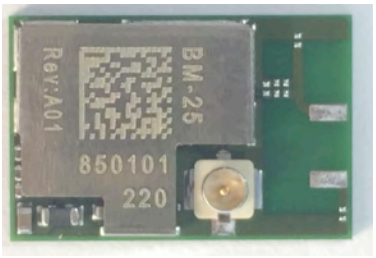
Data Sheet May 3, 2018 Rev 1.6

Datasheet of WM-BAC-BM-25 Module with U.FL



USI P/N	8501-601225-01
	8501-601220-01

Introduction

The 802.11a/b/g/n/ac + BT 4.2 Wireless Sip module WM-BAC-BM-25 which is a small size module based on mental shielding package that provides full function of 802.11a/b/g/n/ac with Bluetooth 4.2 in a tiny module via 65 pins LGA Footprint.

This multi-functionality and board to board physical interface provides SDIO v3.0 interfaces for Wi-Fi, UART/PCM for Bluetooth.

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 802.11a/b/g/n/ac dual-band Wi-Fi + Bluetooth features, such as, Wireless PDA, Smart phone, MP3, PMP, slim type Notebook, VoIP phone etc.

The module is based on Cypress 43455 chipset. The Radio architecture & high integration MAC/BB chip provide excellent sensitivity. The module is designed as a single dual-band antenna shared between Wi-Fi and Bluetooth for the application of small size hand held device.

In addition to WPA, WPA2 and TKIP, AES, CCX, WPS 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 Cypress International Ltd.

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

Features

- Support explicit IEEE 802.11ac transmit beamforming.
- Supports 20, 40, and 80 MHz channels with optional SGI (256QAM modulation).
- Full IEEE 802.11a/b/g/n legacy compatibility with enhanced performance.
- Lead Free design which supporting Green design requirement, RoHS Compliance, and halogen-free.
- Small size suitable for low volume system integration with Low power consumption and excellent power management performance to extend battery life.
- Easy for integration into mobile and handheld device with flexible system configuration and antenna design.

Change Sheet

Rev.	Date	Description of change			Prepared by
		Page	Par	Change(s)	
1.0	2017.01.13	All	All	Preliminary version for Review	Jacal Tseng/rk
1.1	2017.03.27	10	10	Update power consumption of BT	Jacal Tseng
1.2	2017.05.8	10	10	Update power consumption	Jacal Tseng/Jason
1.3	2017.08.18	35	35	Update dimension of footprint	Jacal Tseng
1.4	2017.08.21	9	9	Update Technical Specification	Jacal Tseng
1.4	2017.08.21	1	1	Add USI P/N	Jacal Tseng
1.5	2018.01.18	9	9	Update operation temperature range	Jacal Tseng
1.6	2018.05.03	Front Page	Front Page	New P/N to add in	Jason Tsai

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The WM-BAC-BM-25 module is one of the product families in USI's product offering, targeting for system integration requiring the module with antenna together for verification.

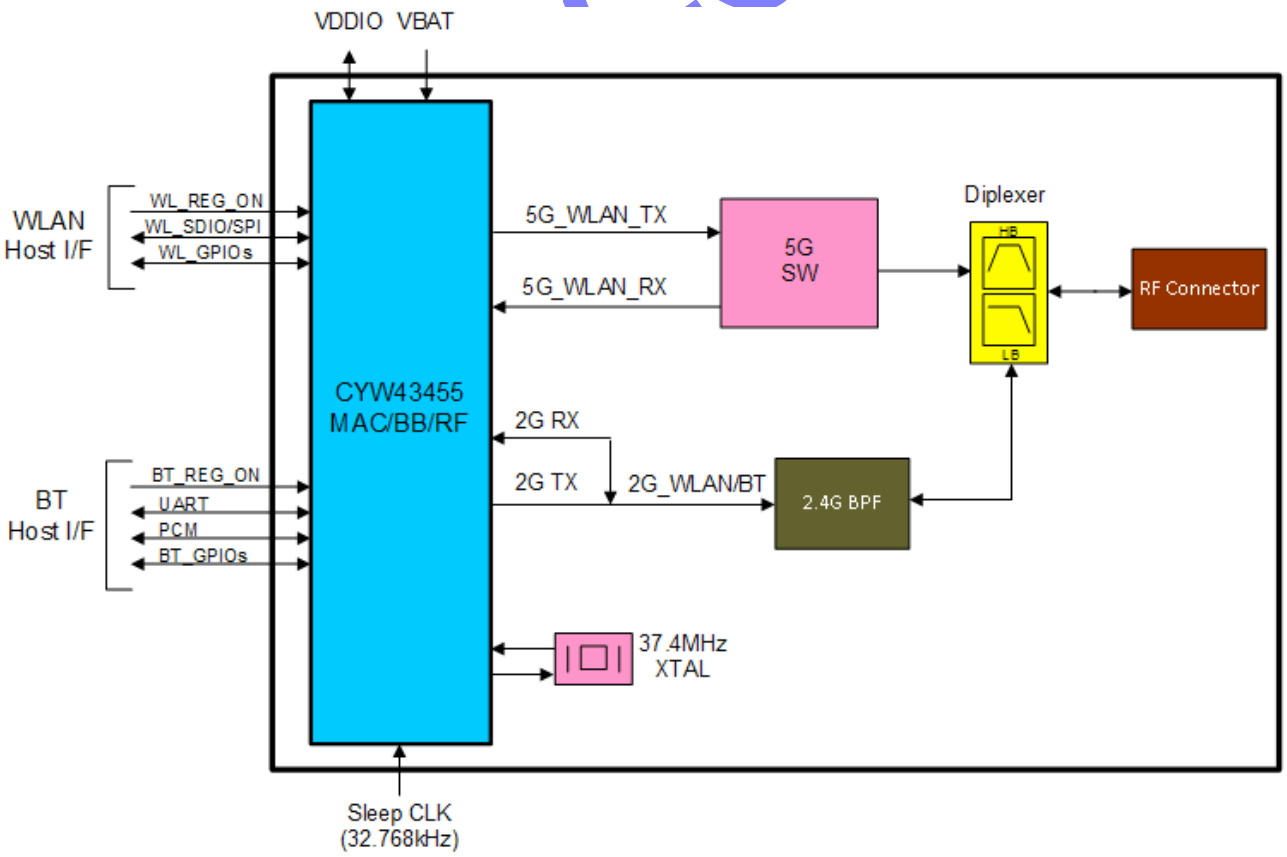
The purpose of this document is defined the product specification for 802.11a/b/g/n/ac Wi-Fi with BT4.2 SIP module WM-BAC-BM-25. All the data in this document is based on CYW43455 datasheet and other documents. The data will be updated after implementing the measurement of the module.

This product is designated for using in embedded applications, which required high integration and high data rate wireless connectivity. The application such as DSC, IPCAM, Media Adapter, Barcode scanner, mini-Printer, VoIP phone, Data storage device could be the potential application for wireless application.

1 BLOCK DIAGRAM

The module is designed based on CYW43455 chipset solution. For the WLAN section, the host interface is included: a SDIO v3.0 interface, which can operate in 4b, or 1b mode. An independent, high-speed UART is provided for the Bluetooth host interface.

A brief block diagram of the WM-BAC-BM-25 module is depicted as below figure.



2 DELIVERABLES

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

- WM-BAC-BM-25 Module with packaging
- Evaluation kits (with SDIO/SPI/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-BAC-BM-25 module.
- Unit Test / Qualification report
- Product Specifications.
- Agency certification pre-test report base on adapter boards

3 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. 2012.

4 TECHNICAL SPECIFICATION

4.1 ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Conditions	Min	Max	Unit
VBAT	Main input supply from battery to switcher		-0.5	6.0[a]	V
VDDIO	DC supply voltage for digital I/O		-0.5	3.9	V
ESD	Electro-static discharge voltage	HBM		2	KV
Ts	Storage temperature		-40	85	℃
VBAT	Operating temperature		-40	85	℃
VBAT	Voltage ripple[b]		-2	2	%

Notes: a. The maximum continuous voltage is 5.25V. Voltages up to 6.0V for up to 10 seconds, cumulative duration, over the lifetime of the device are allowed.
b. To achieve optimal RF performance, please keep ripple value under 20 mV as possible.

4.2 RECOMMENDABLE OPERATION CONDITION

4.2.1 TEMPERATURE, HUMIDITY

The WM-BAC-BM-25 module has to withstand the operational requirements as listed in the table below.

Operating Temperature	-40° to 85° Celsius	
Specification Temperature Range	-10° to 65° Celsius	
Relative Humidity range	Max 95%	Non condensing , relative humidity

Notes: All RF characteristic in this datasheet are defined by Specification Temperature Range.
RF performance may derating under over-temperature and over-voltage range condition.

4.2.2 VOLTAGE

Power supply for the WM-BAC-BM-25 module will be provided by the host via the power pins

Symbol	Parameter	Min	Typ.	Max	Unit
VBAT	Operation Voltage	3.0	3.6	5.25[*b]	V
	Specification Voltage[*a]	3.2	3.6	4.8	V
VDDIO	DC supply voltage for digital I/O	1.62	1.8	3.63	V
			3.3		

Notes: a. All RF characteristics in this datasheet are defined by Specification Voltage.
b. The maximum continuous voltage is 5.25V.

4.2.3 CURRENT CONSUMPTION

(VBAT = +3.0V to +5.25V, VDDIO = +3.3V, TA = -10C to +65°C, 50Ω nominal system impedance.
Typical values of VBAT+VDDIO shown below are at VBATT = +3.6V and TA = +25°C)

2.4GHz

Item		Condition	Typ.	Max	Unit
Tx	1Mbps	Continuous Tx @ 17 dBm	389	401	mA
	11Mbps	Continuous Tx @ 17 dBm	353	378	mA
	6Mbps	Continuous Tx @ 15 dBm	336	355	mA
	54Mbps	Continuous Tx @ 15 dBm	273	290	mA
	MCS0 (HT20)	Continuous Tx @ 15 dBm	340	353	mA
	MCS7 (HT20)	Continuous Tx @ 15 dBm	272	294	mA
	BT Class1	Continuous Tx @ 8 dBm	45	55	mA
	BT Class2	Continuous Tx @ 0 dBm	28	33	mA
Rx	1Mbps	Rx sensitivity @ -95 dBm	76.4	84	mA
	11Mbps	Rx sensitivity @ -88 dBm	77	88	mA
	6Mbps	Rx sensitivity @ -89 dBm	76	85	mA
	54Mbps	Rx sensitivity @ -74 dBm	77	86	mA
	MCS0 (HT20)	Rx sensitivity @ -89 dBm	76.1	88	mA
	MCS7 (HT20)	Rx sensitivity @-71 dBm	77	87	mA
	BT	Rx sensitivity @ -85 dbm	22	30	mA

Operating Mode/Condition	Typ.	Max	Unit
BT Sleep Mode	6	-	uA
WIFI Sleep Mode	25	-	uA
Power off Mode	6	10	uA

Note: The Current Consumption will be updated after samples reliability test

5GHz

Item		Condition	Typ.	Max	Unit
Tx	6Mbps	Continuous Tx @ 15 dBm	338	366	mA
	54Mbps	Continuous Tx @ 15 dBm	274	289	mA
	MCS0 (HT20)	Continuous Tx @ 15 dBm	334	357	mA
	MCS7 (HT20)	Continuous Tx @ 15 dBm	267	291	mA
	MCS9 (VHT80)	Continuous Tx @ 12 dBm	224	244	mA
Rx	6Mbps	Rx sensitivity @ -89 dBm	91.1	101	mA
	54Mbps	Rx sensitivity @ -74 dBm	92.1	102	mA
	MCS0 (HT20)	Rx sensitivity @ -89 dBm	91.1	100	mA
	MCS7 (HT20)	Rx sensitivity @ -71 dBm	92.2	102	mA
	MCS9 (VHT80)	Rx sensitivity @ -63 dBm	122	141	mA

Note: The Current Consumption will be updated after samples reliability test

4.3 WIRELESS SPECIFICATIONS

The WM-BAC-BM-25 module complies with the following features and standards;

Features	Description
WLAN Standards	IEEE 802 Part 11a/b/g/n/ac (802.11a/b/g/n/ac)
Bluetooth	Bluetooth ™ 4.2 compliance
Frequency Band	2.4 to 2.497GHz (1 to 14 channels)
	4.9 to 5.845GHz

4.4 RADIO SPECIFICATIONS 802.11A/B/G/N/AC

The RF performance of WM-BAC-BM-25 is given as follows.
Condition: VBAT= 3.6V、VDDIO=3.3V at room Temperature

4.4.1 802.11B TRANSMIT

Item	Condition	Min.	Typ.*c	Max. *d	Unit
Target Output Power Level*b	11Mbps	-	17	17.5	dBm
Target Output Power Level*b	1Mbps	-	17	17.5	dBm
Transmit center frequency tolerance*a		-25	-	25	ppm
Transmit spectral mask	@+/-11MHz	-	-	-30*a	dBr
	@+/-22MHz	-	-	-50*a	dBr

Notes: a. Refer to IEEE802.11 specification.
b. Output power tolerance is +/- 2dB.
c. Typical TX power
d. Max. allowed TX power
Notes: The Output Power Level will be updated after samples reliability test.

4.4.2 802.11G TRANSMIT

Item	Condition	Min.	Typ.*c	Max. *d	Unit
Target Output Power Level*b	54Mbps	-	15	16	dBm
Target Output Power Level*b	6Mbps	-	16	18	dBm
Transmit center frequency tolerance*a		-25	-	25	ppm
Transmit Modulation Accuracy (EVM)	54Mbps		-	-25*a	dB
	6Mbps		-	-5*a	dB
Transmit Spectral Mask	@ +/-11MHz		-	-20*a	dBr
	@ +/-20MHz		-	-28*a	dBr
	@ +/-30MHz		-	-40*a	dBr

Notes: a. Refer to IEEE802.11 specification.
b. Output power tolerance is +/- 2dB.
c. Typical TX power
d. Max. allowed TX power
Notes: The Output Power Level will be updated after samples reliability test.

4.4.3 802.11A TRANSMIT

Item	Condition	Min.	Typ.*c	Max. *d	Unit
Target Output Power Level*b	54Mbps	-	15	16	dBm
Target Output Power Level*b	6Mbps	-	16	18	dBm
Transmit Center Frequency Tolerance*a		-20	-	20	ppm
Transmit Modulation Accuracy (EVM)	54Mbps	-	-	-25*a	dB
	6Mbps	-	-	-5*a	dB
Transmit Spectral Mask	@ +/-11MHz	-	-	-20*a	dBr
	@ +/-20MHz	-	-	-28*a	dBr
	@ +/-30MHz	-	-	-40*a	dBr

Notes: a. Refer to IEEE802.11 specification.
b. Output power tolerance is +/- 2dB.
c. Typical TX power
d. Max. allowed TX power
Notes: The Output Power Level will be updated after samples reliability test.

4.4.4 2.4GHZ 802.11N TRANSMIT – HT20

Item	Condition	Min.	Typ.*c	Max. *d	Unit
Target Output Power Level*b	MCS7	-	15	16	dBm
Target Output Power Level*b	MCS0	-	16	18	dBm
Transmit Center Frequency Tolerance*a		-25	-	25	ppm
Transmit Modulation Accuracy (EVM)	MCS7	-	-	-27*a	dB
	MCS0	-	-	-5*a	dB
Transmit Spectral Mask	@ +/-11MHz	-	-	-20*a	dBr
	@ +/-20MHz	-	-	-28*a	dBr
	@ +/-30MHz	-	-	-45*a	dBr

Notes: a. Refer to IEEE802.11 specification.
b. Output power tolerance is +/- 2dB.
c. Typical TX power
d. Max. allowed TX power
Notes: The Output Power Level will be updated after samples reliability test.

4.4.5 5GHZ 802.11N TRANSMIT – HT20

Item	Condition	Min.	Typ.*c	Max. *d	Unit
Target Output Power Level*b	MCS7	-	15	16	dBm
Target Output Power Level*b	MCS0	-	16	18	dBm
Transmit Center Frequency Tolerance*a		-20	-	20	ppm
Transmit Modulation Accuracy (EVM)	MCS7	-	-	-27*a	dB
	MCS0	-	-	-5*a	dB
Transmit Spectral Mask	@ +/-11MHz	-	-	-20*a	dBr
	@ +/-20MHz	-	-	-28*a	dBr
	@ +/-30MHz	-	-	-40*a	dBr

Notes: a. Refer to IEEE802.11 specification.
b. Output power tolerance is +/- 2dB.
c. Typical TX power
d. Max. allowed TX power
Notes: The Output Power Level will be updated after samples reliability test.

4.4.6 802.11AC TRANSMIT – HT80

Item	Condition	Min.	Typ.*c	Max.*d	Unit
Target Output Power Level*b	MCS9	-	12	13	dBm
Target Output Power Level*b	MCS0	-	14	15	dBm
Transmit Center Frequency Tolerance*a		-20	-	20	ppm
Transmit Modulation Accuracy (EVM)	MCS0			-5*a	dB
	MCS9		-	-32*a	dB
Transmit Spectral Mask	@ +/-41MHz	-	-	-20*a	dBr
	@ +/-80MHz	-	-	-28*a	dBr
	@ +/-120MHz	-	-	-40*a	dBr

Notes: a. Refer to IEEE802.11 specification.
b. Output power tolerance is +/- 2dB.
c. Typical TX power
d. Max. allowed TX power
Notes: The Output Power Level will be updated after samples reliability test.

4.4.7 802.11B RECEIVER

Item	Condition	Min.	Typ.	Max.*b	Unit
Receiver Minimum Input Level Sensitivity (PER< 8 %)	11Mbps	-	-88	-79	dBm
	1Mbps	-	-95	-85	dBm
Receiver Maximum Input Level Sensitivity (PER< 8 %)	11Mbps	-10*a	-	-	dBm
	1Mbps	-10*a	-	-	dBm

Notes: a. Refer to IEEE802.11 specification.
b. 3dB better than IEEE802.11 specification
Notes: The Minimum Input Level Sensitivity will be updated after samples reliability test.

4.4.8 802.11G RECEIVER

Item	Condition	Min.	Typ.	Max.*b	Unit
Receiver Minimum Input Level Sensitivity (PER< 10%)	54Mbps	-	-76	-68	dBm
	6Mbps	-	-89	-85	dBm
Receiver Maximum Input Level (PER<10%)	54Mbps	-20*a	-	-	dBm
	6Mbps	-20*a	-	-	dBm

Notes: a. Refer to IEEE802.11 specification.
b. 3dB better than IEEE802.11 specification
Notes: The Minimum Input Level Sensitivity will be updated after samples reliability test.

4.4.9 802.11A RECEIVER

Item	Condition	Min.	Typ.	Max. *b	Unit
Receiver Input Level Sensitivity (PER<10%)	54Mbps	-	-76	-68	dBm
	6Mbps	-	-89	-85	dBm
Receiver Maximum Input Level (PER<10%)	54Mbps	-30*a	-	-	dBm
	6Mbps	-30*a	-	-	dBm

Notes: a. Refer to IEEE802.11 specification.
b. 3dB better than IEEE802.11 specification
Notes: The Minimum Input Level Sensitivity will be updated after samples reliability test.

4.4.10 802.11N RECEIVER

Item	Condition	Min.	Typ.	Max. *b	Unit
2.4GHz – HT20 Receiver Input Level Sensitivity (PER<10%)	MCS7	-	-73	-67	dBm
	MCS0	-	-89	-85	dBm
2.4GHz – HT20 Receiver Maximum Input Level (PER<10%)	MCS7	-20*a	-	-	dBm
	MCS0	-20*a	-	-	dBm
5GHz – HT20 Receiver Input Level Sensitivity (PER<10%)	MCS7	-	-71	-67	dBm
	MCS0	-	-89	-85	dBm
5GHz – HT20 Receiver Maximum Input Level (PER<10%)	MCS7	-30*a	-	-	dBm
	MCS0	-30*a	-	-	dBm

Notes: a. Refer to IEEE802.11 specification.
b. 3dB better than IEEE802.11 specification
Notes: The Minimum Input Level Sensitivity will be updated after samples reliability test

4.4.11 802.11AC RECEIVER

Item	Condition	Min.	Typ.	Max. *b	Unit
5GHz – VHT80 Receiver Input Level Sensitivity (PER<10%)	MCS9	-	-64	-54	dBm
	MCS0	-	-89	-79	dBm
5GHz – VHT80 Receiver Maximum Input Level (PER<10%)	MCS9	-30*a	-	-	dBm
	MCS0	-30*a	-	-	dBm

Notes: a. Refer to IEEE802.11 specification.
b. 3dB better than IEEE802.11 specification
Notes: The Minimum Input Level Sensitivity will be updated after samples reliability test

4.5 RADIO SPECIFICATIONS 802.15 BLUETOOTH

The Radio specification is compliant with the Bluetooth™ 4.2 + EDR specification

Features	Description
Frequency Band	2400 MHz ~ 2483.5 MHz
Number of Channels	79 channels
Modulation	FHSS (Frequency Hopping Spread Spectrum) , GFSK, DPSK

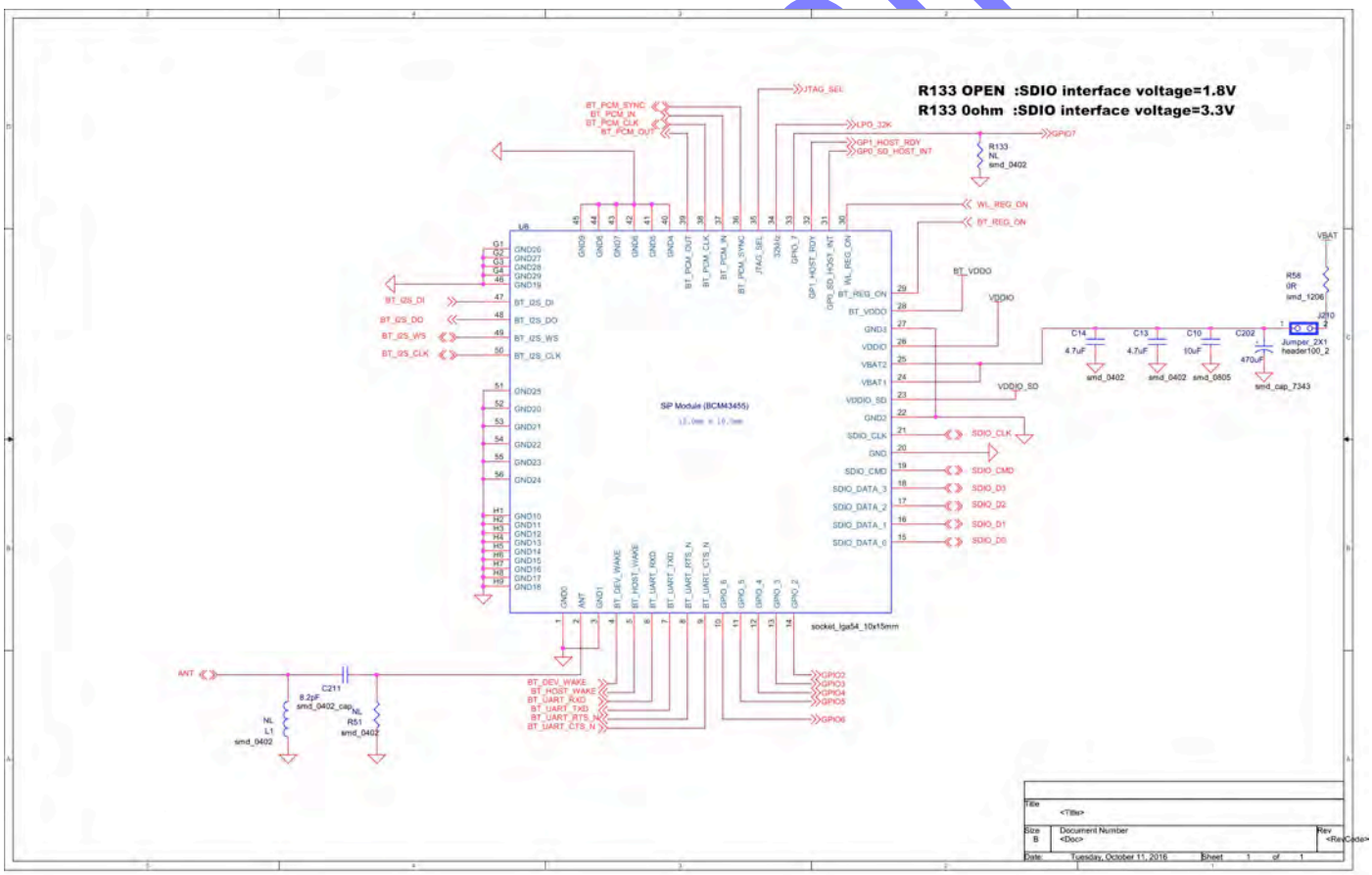
The RF performance of WM-BAC-BM-25 is given as follows.
Condition: VBAT= 3.6V 、 VDDIO=3.3V at room Temperature

4.6 BLUETOOTH RADIO CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max. *a	Unit
Basic Rate					
Output Power	Average Power	0	7	20	dBm
Frequency Range*a		2400	-	2483.5	MHz
Sensitivity (BER)	BER ≦0.1%	-	-90	-70	dBm
Maximum Input Level	BER ≦0.1%	-	-	-20	dBm
EDR					
Relative Power*a	π/4-DQPSK	-4.0	-1	1.0	dBm
	8DPSK	-4.0	-1	1.0	dBm
EDR Sensitivity(BER)	π/4-DQPSK BER ≦0.01%	-	-85	-70	dBm
	8DPSK BER ≦0.01%	-	-85	-70	dBm
EDR Maximum Input Level	π/4-DQPSK BER ≦0.1%	-	-	-20	dBm
	8DPSK BER ≦0.1%	-	-	-20	dBm
BLE					
BLE Output Power	Average Power	-20	7	10	dBm
BLE Sensitivity (PER)	PER ≦30.8%	-	-90	-70	dBm
BLE Maximum Input Level	PER ≦30.8%	-	-	-10	dBm

Notes: a. Refer to Bluetooth specification.
b. BT Performance will be updated after samples reliability test

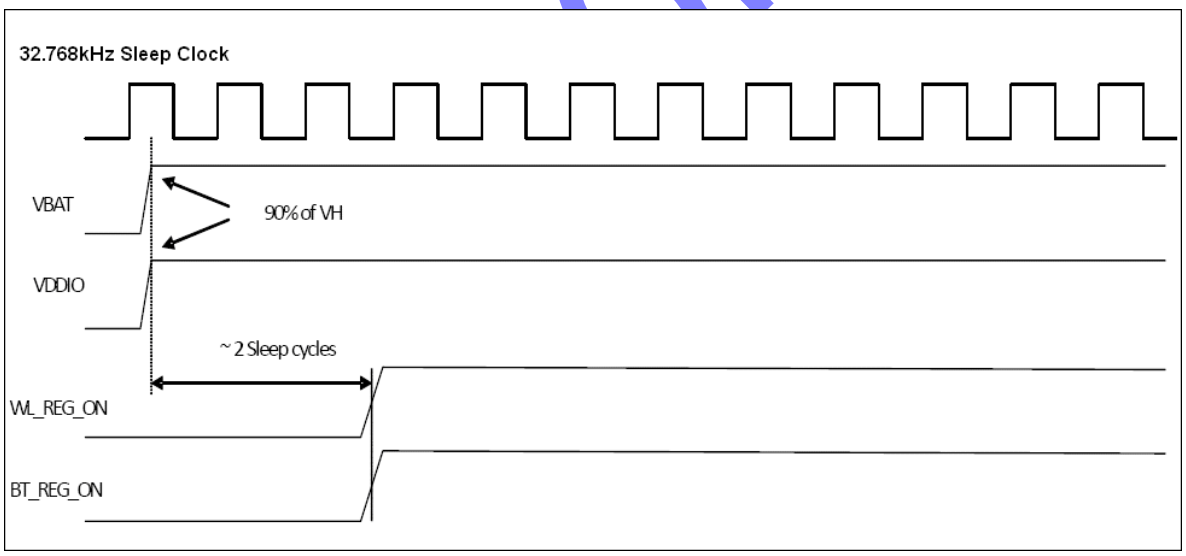
4.7 REFERENCE CIRCUIT



4.8 TIMING DIAGRAM OF INTERFACE

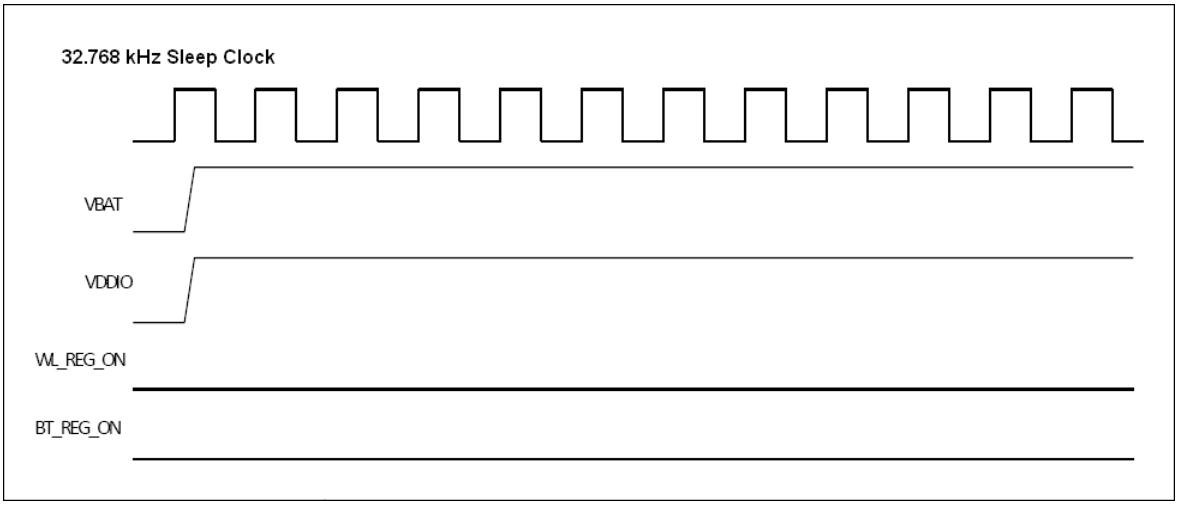
4.8.1 CONTROL SIGNAL TIMING DIAGRAMS

Power-up timing for WLAN ON, BT ON *



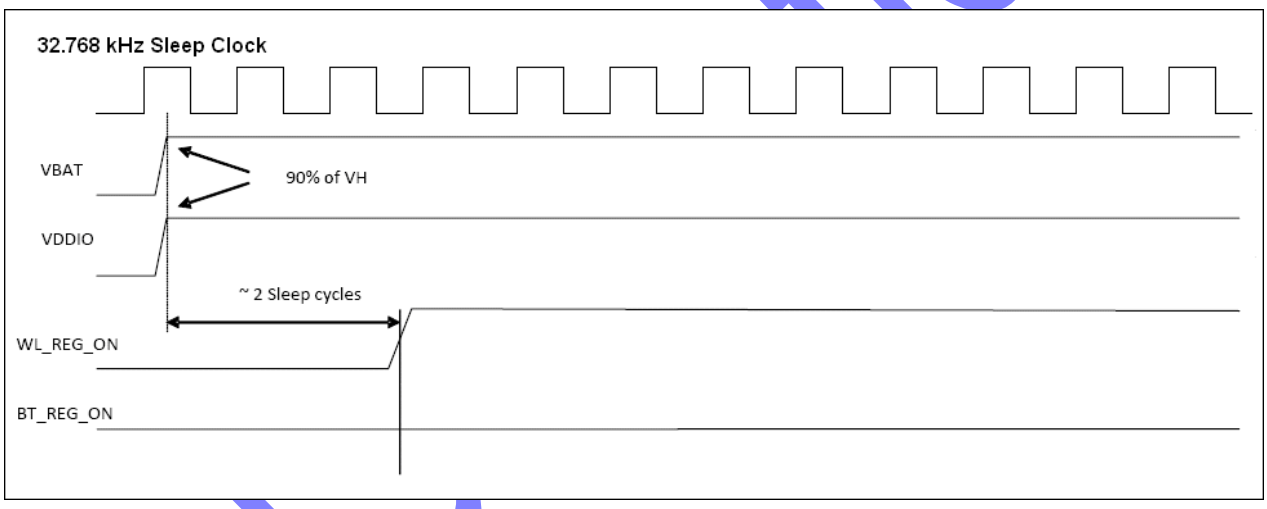
WM-BAC-BM-25 power-up timing for WLAN ON, BT ON

Power-up timing for WLAN OFF, BT OFF *



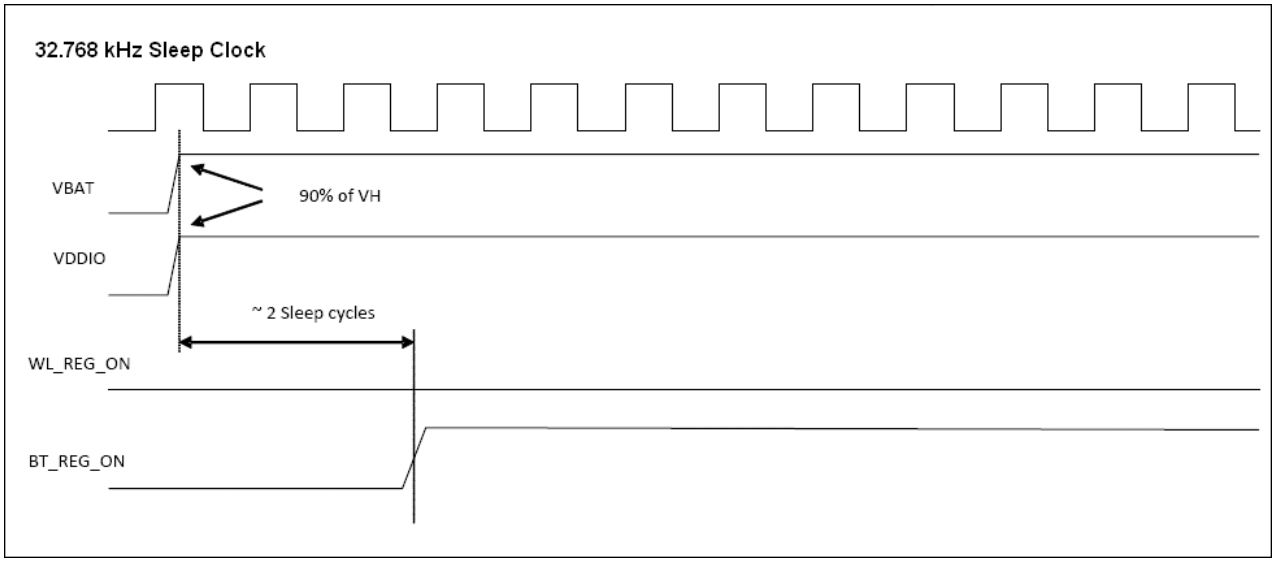
WM-BAC-BM-25 power-up timing for WLAN OFF, BT OFF

Power-up timing for WLAN ON, BT OFF *



WM-BAC-BM-25 power-up timing for WLAN ON, BT OFF

Power-up timing for WLAN OFF, BT ON *



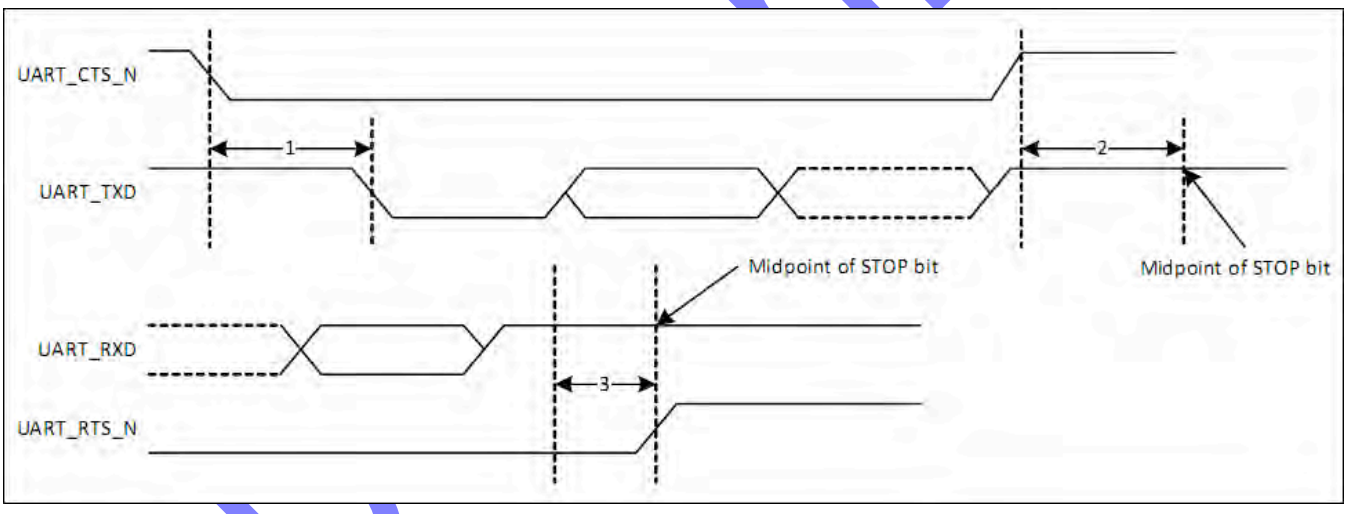
WM-BAC-BM-25 power-up timing for WLAN OFF, BT ON

***Note:**

- VBAT should not raise 10%–90% faster than 40 microseconds.
- VBAT should be up before or at the same time as VDDIO.
- VDDIO should NOT be present first or be held high before VBAT is high.

4.8.2 UART TIMING

The WM-BAC-BM-25 shares a single UART for Bluetooth. The UART is a standard 4-wire interface (RX, TX, RTS, and CTS) with adjustable baud rates from 9600 bps to 4.0 Mbps.



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

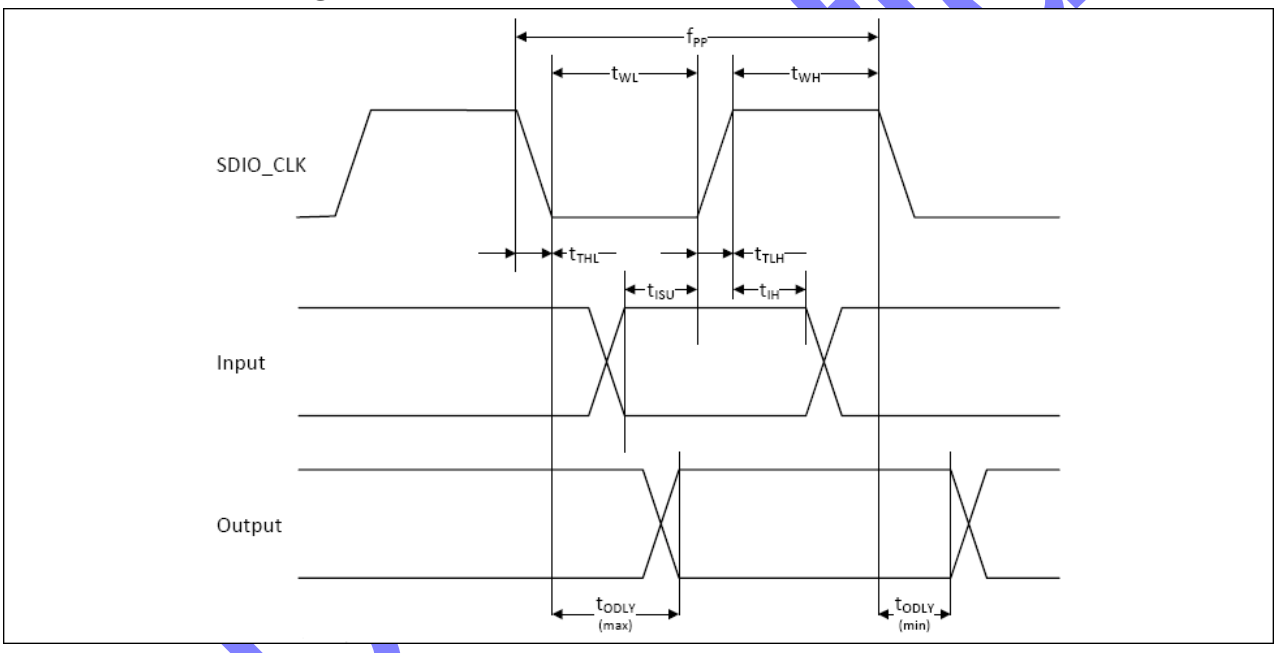
4.8.3 SDIO TIMING

WM-BAC-BM-25 WLAN section provide support for SDIO version 3.0.

Note:

- Per Section 6 of the SDIO specification, pull-ups in the 10 k to 100 k range are required on the four DATA lines and the CMD line. This requirement must be met during all operating states either through the use of external pull-up resistors or through proper programming of the SDIO host's internal pull-ups

SDIO timing in default mode

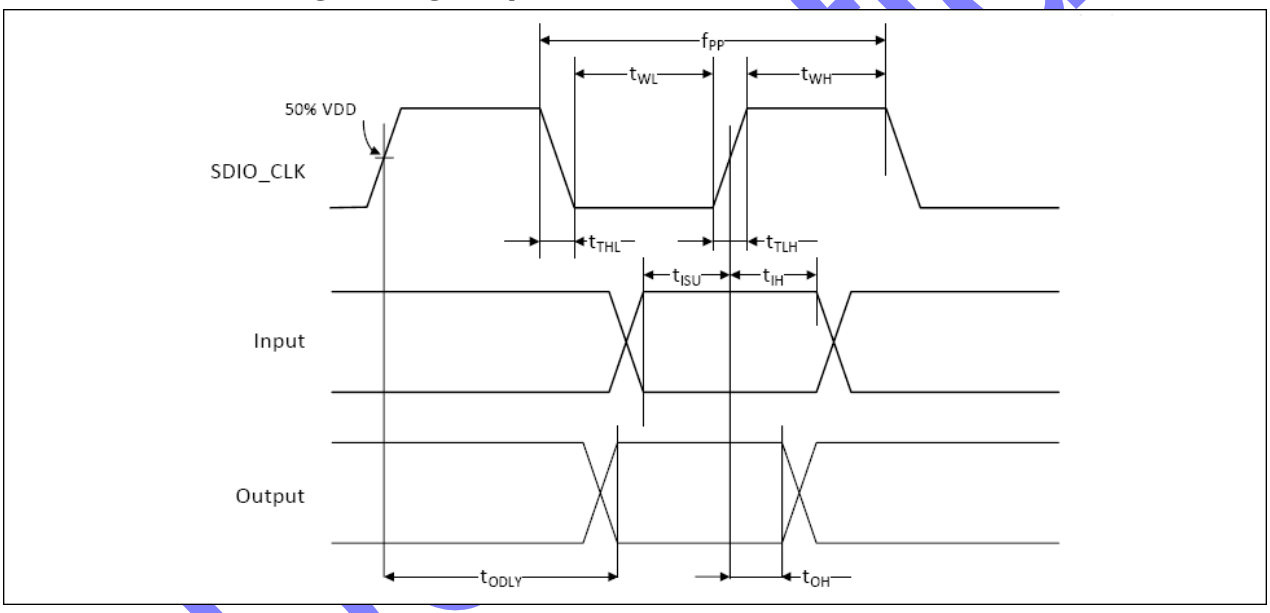


SDIO Bus Timing Parameters (Default Mode)

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	–	25	MHz
Frequency – Identification mode	fOD	0	–	400	kHz
Clock low time	tWL	10	–	–	ns
Clock high time	tWH	10	–	–	ns
Clock rise time	tTLH	–	–	10	ns
Clock low time	tTHL	–	–	10	ns
Inputs: CMD, DAT (referenced to CLK)					
Input setup time	tISU	5	–	–	ns
Input hold time	tIH	5	–	–	ns
Outputs: CMD, DAT (referenced to CLK)					
Output delay time – Data Transfer mode	tODLY	0	–	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.

SDIO timing in High-Speed Mode



SDIO Bus Timing Parameters (High-Speed Mode)

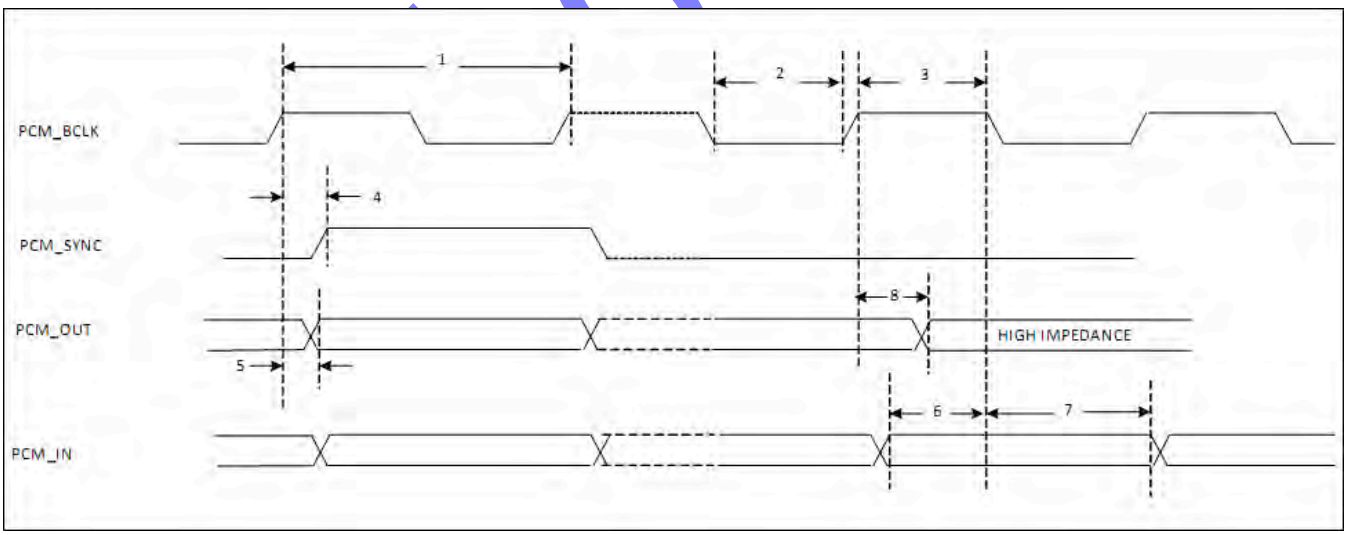
Parameter	*Symbol*	*Minimum*	*Typical*	*Maximum*	*Unit*
SDIO CLK (all values are referred to minimum VIH and maximum VIL[b])					
Frequency – Data Transfer Mode	fPP	0	–	50	MHz
Frequency – Identification Mode	fOD	0	–	400	kHz
Clock low time	tWL	7	–	–	ns
Clock high time	tWH	7	–	–	ns
Clock rise time	tTLH	–	–	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.

4.8.4 PCM TIMING

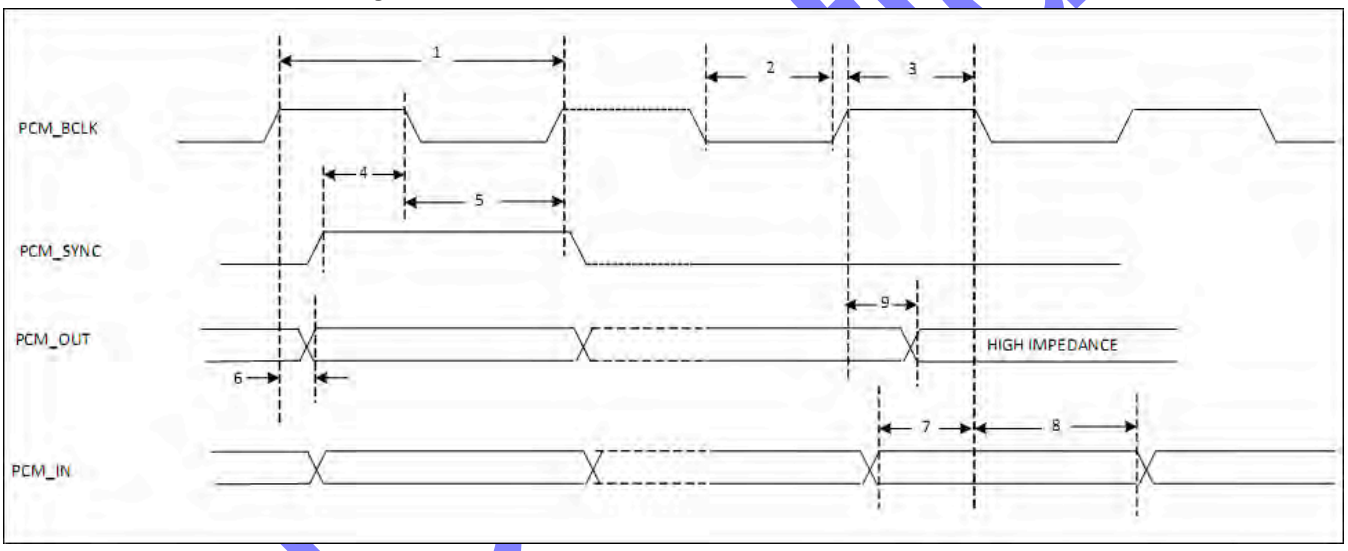
The PCM Interface on the WM-BAC-BM-25 can connect to linear PCM Codec devices in master or slave mode. In master mode, the WM-BAC-BM-25 generates the PCM_CLK and PCM_SYNC signals, and in slave mode, these signals are provided by another master on the PCM interface and are inputs to the WM-BAC-BM-25.

Short Frame Sync, Master Mode



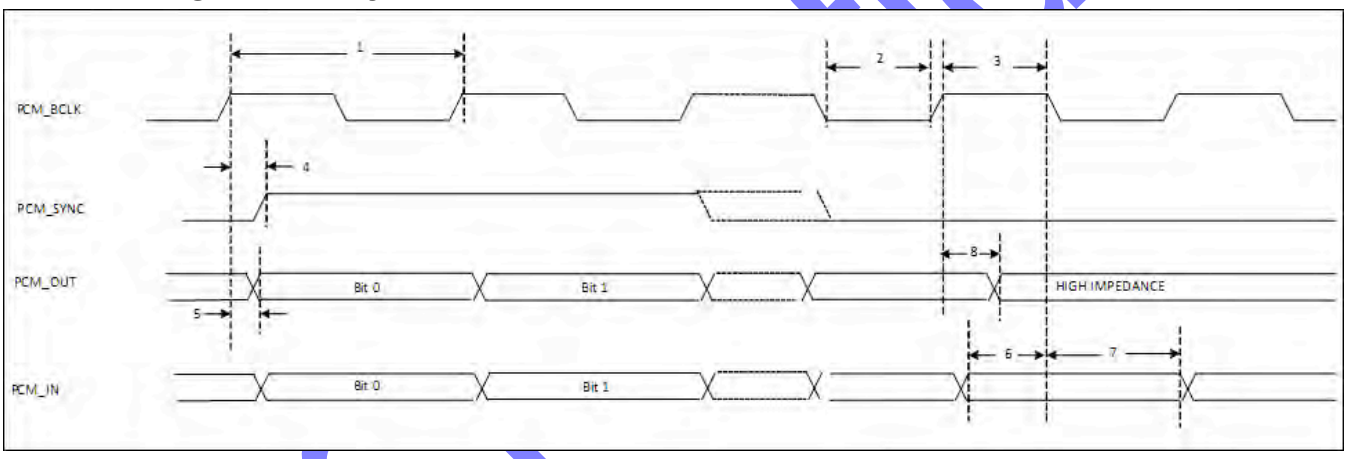
Ref No.	*Characteristics*	*Minimum*	*Typical*	*Maximum*	*Unit*
1	PCM bit clock frequency	–	–	12	MHz
2	PCM bit clock HIGH	41	–	–	ns
3	PCM bit clock LOW	41	–	–	ns
4	PCM_SYNC delay	0	–	25	ns
5	PCM_OUT delay	0	–	25	ns
6	PCM_IN setup	8	–	–	ns
7	PCM_IN hold	8	–	–	ns
8	Delay from rising edge of PCM_BCLK during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

Short Frame Sync, Slave Mode



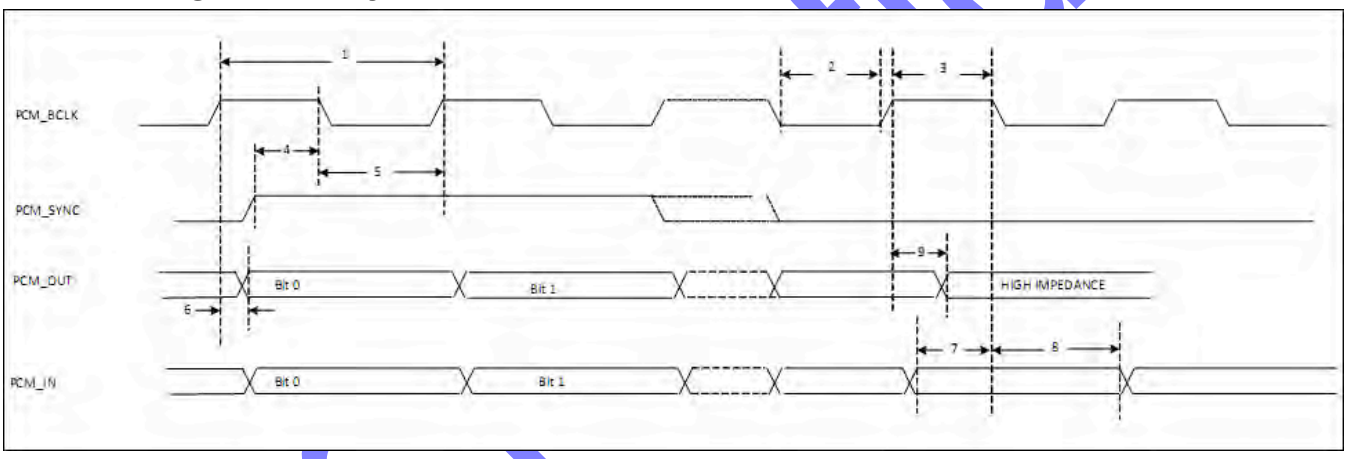
Ref No.	*Characteristics*	*Minimum*	*Typical*	*Maximum*	*Unit*
1	PCM bit clock frequency	–	–	12	MHz
2	PCM bit clock HIGH	41	–	–	ns
3	PCM bit clock LOW	41	–	–	ns
4	PCM_SYNC setup	8	–	–	ns
5	PCM_SYNC hold	8	–	–	ns
6	PCM_OUT delay	0	–	25	ns
7	PCM_IN setup	8	–	–	ns
8	PCM_IN hold	8	–	–	ns
9	Delay from rising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

Long Frame Sync, Master Mode



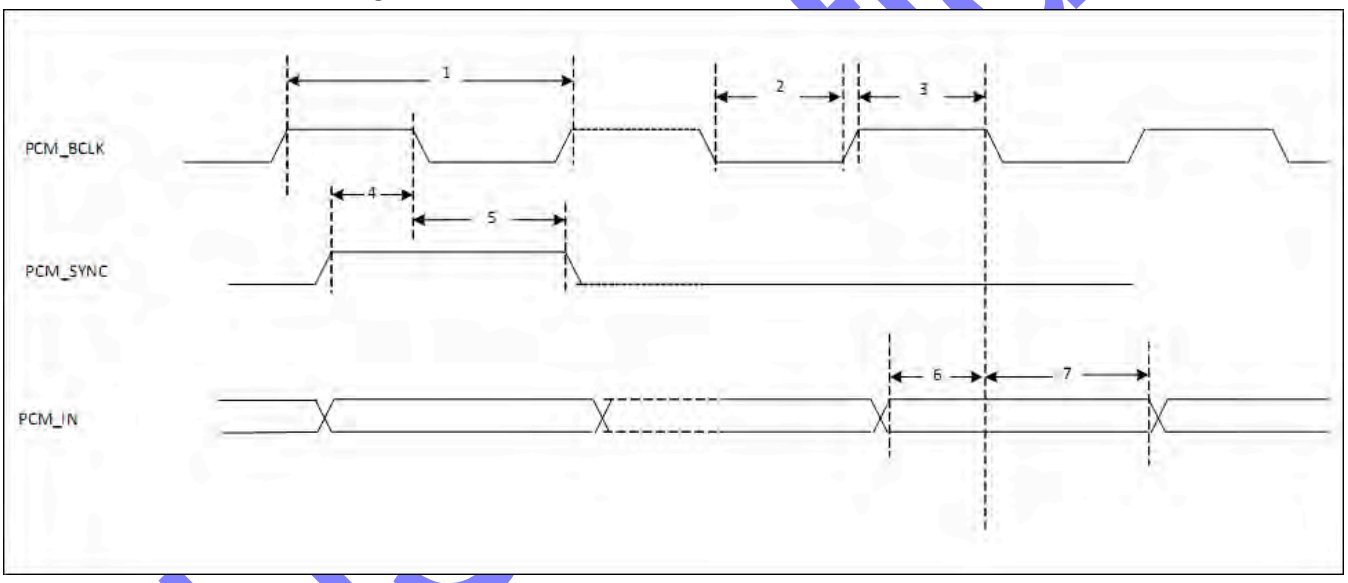
Ref No.	*Characteristics*	*Minimum*	*Typical*	*Maximum*	*Unit*
1	PCM bit clock frequency	–	–	12	MHz
2	PCM bit clock HIGH	41	–	–	ns
3	PCM bit clock LOW	41	–	–	ns
4	PCM_SYNC delay	0	–	25	ns
5	PCM_OUT delay	0	–	25	ns
6	PCM_IN setup	8	–	–	ns
7	PCM_IN hold	8	–	–	ns
8	Delay from rising edge of PCM_BCLK during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

Long Frame Sync, Slave Mode



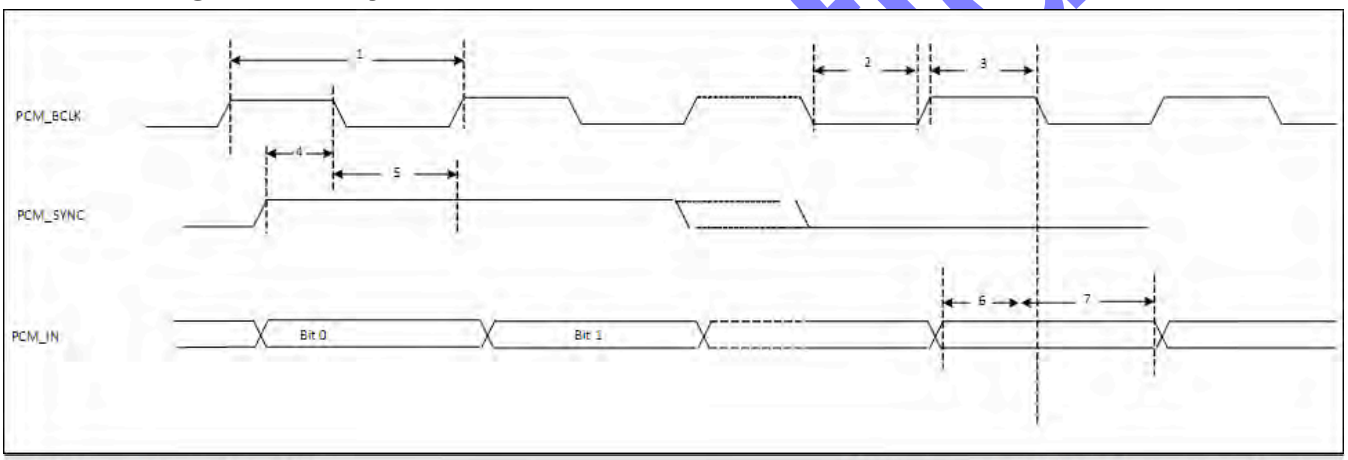
Ref No.	*Characteristics*	*Minimum*	*Typical*	*Maximum*	*Unit*
1	PCM bit clock frequency	–	–	12	MHz
2	PCM bit clock HIGH	41	–	–	ns
3	PCM bit clock LOW	41	–	–	ns
4	PCM_SYNC setup	8	–	–	ns
5	PCM_SYNC hold	8	–	–	ns
6	PCM_OUT delay	0	–	25	ns
7	PCM_IN setup	8	–	–	ns
8	PCM_IN hold	8	–	–	ns
9	Delay from rising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

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

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

4.9 FREQUENCY REFERENCES

4.9.1 EXTERNAL 32.768KHZ LOW-POWER OSCILLATOR

The WM-BAC-BM-25 uses a secondary low frequency clock for low-power-mode timing. Either the internal low-precision LPO or an external 32.768 kHz precision oscillator is required. The internal LPO frequency range is approximately 33 kHz ± 30% over process, voltage, and temperature, which is adequate for some applications. However, one trade-off caused by this wide LPO tolerance is a small current consumption increase during power save mode that is incurred by the wake up earlier to avoid missing beacons.

Whenever possible, the preferred approach is to use a precision external 32.768 kHz clock that meets the requirements listed below.

External 32.768 kHz Sleep Clock Specifications

Parameter	*LPO Clock*	*Units*
Nominal input frequency	32.768	kHz
Frequency accuracy	±200	ppm
Duty cycle	30–70	%
Input signal amplitude	200–3300	mV, p-p
Signal type	Square-wave or sine-wave	–
Input impedance[a]	>100k <5	Ω pF
Clock jitter (during initial start-up)	<10,000	ppm

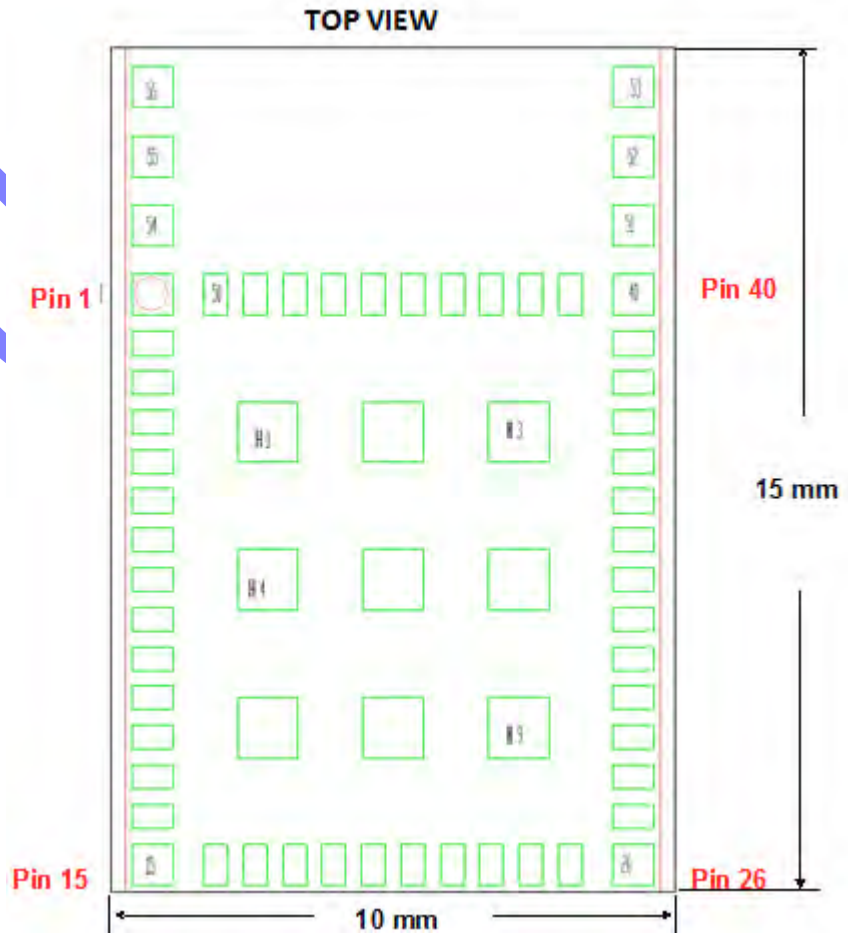
a. When power is applied or switched off.

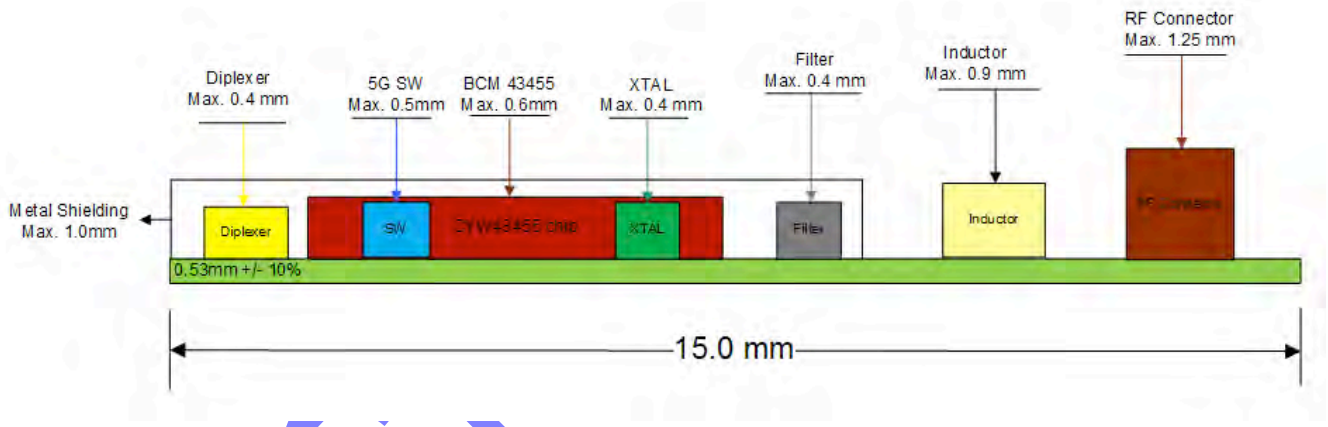
4.10 DIMENSIONS, WEIGHT AND MOUNTING

The following paragraphs provide the requirements for the size, weight and mounting of the WM-BAC-BM-25 SiP module.

4.10.1 DIMENSION & MODEL CODE

The size and thickness of the WM-BAC-BM-25 module is “15 mm ± 0.1"(L) x “10 mm ± 0.1”(W) x “1.78 mm” (Typ.)(H), with metal shielding package.





5 LEGAL, REGULATORY & OTHER TECHNICAL CONSTRAINTS

The WM-BAC-BM-25 module is pre-tested to ensure that all requirements compliant with FCC and CE. Customers could leverage U.FL connector for external antenna to do the final certification in flexible way.

6 PIN OUT AND PIN DESCRIPTION

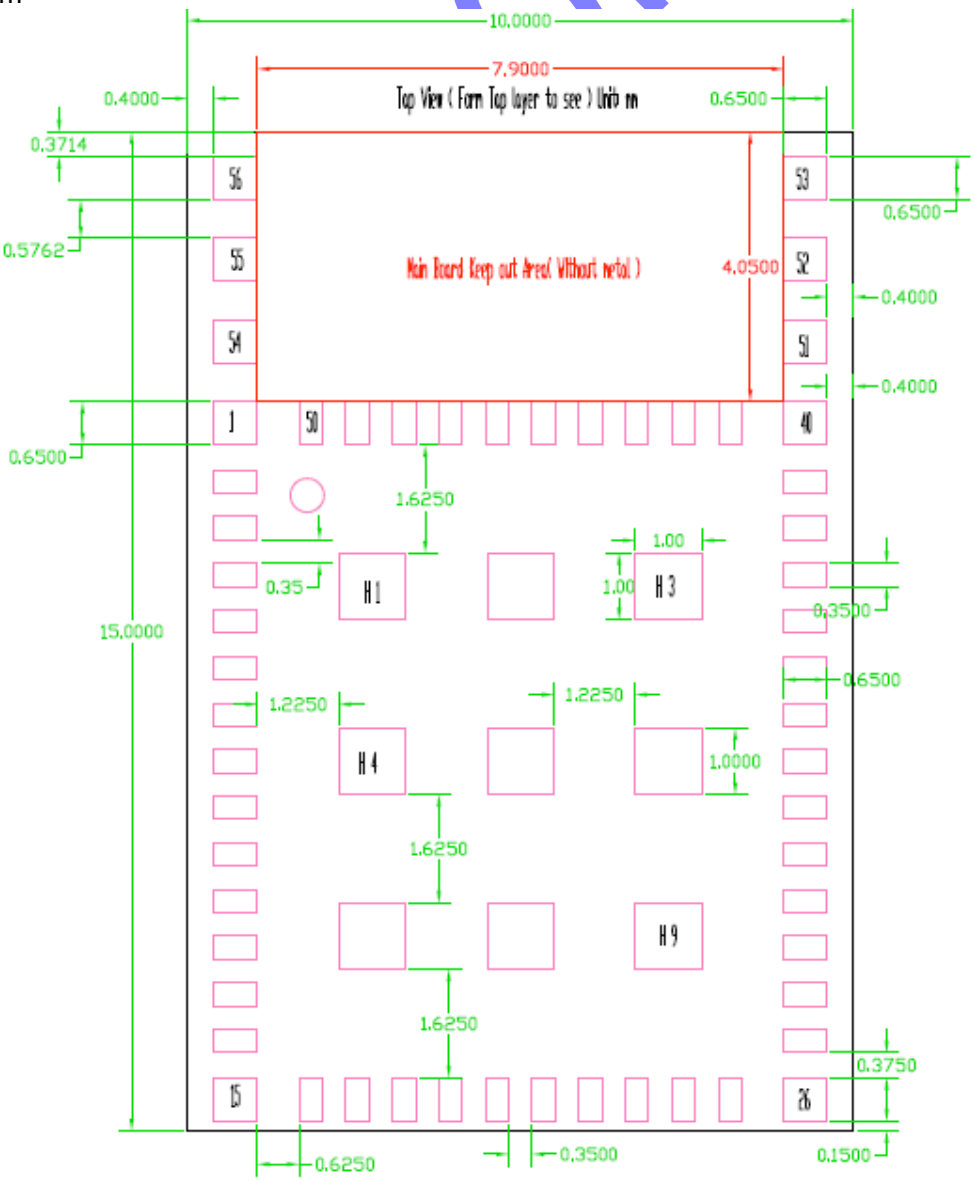
Pin#	Pin Name	Type	Description
RF Port			
2	ANT	I/O	WLAN/BT Transmit/Receive Antenna Port
WLAN SDIO Interface (level referred by VDDIO)			
15	SDIO_DATA_0	I	SDIO Bus data line 0
16	SDIO_DATA_1	I/O	SDIO Bus data line 1
17	SDIO_DATA_2	I/O	SDIO Bus data line 2
18	SDIO_DATA_3	I/O	SDIO Bus data line 3
19	SDIO_CMD	I/O	SDIO Bus command line
21	SDIO_CLK	I/O	SDIO Bus clock input
Bluetooth UART Interface (level referred by VDDIO)			
6	BT_UART_RXD	I	Bluetooth UART serial input. Serial data input for the HCI UART Interface.
7	BT_UART_TXD	O	Bluetooth UART serial output. Serial data output for the HCI UART Interface.
8	BT_UART_RTS_N	O	Bluetooth UART request-to-send. Active-low request-to-send signal for the HCI UART interface.
9	BT_UART_CTS_N	I	Bluetooth UART clear-to-send. Active-low clear-to-send signal for the HCI UART interface.
Bluetooth PCM Interface (level referred by VDDIO)			
36	BT_PCM_SYNC	I/O	PCM sync signal can be master (output) or slave (input).
37	BT_PCM_IN	I	PCM data input.
38	BT_PCM_CLK	I/O	PCM clock can be master (output) or slave (input).
39	BT_PCM_OUT	O	PCM data output.
Reference Clock			
34	32kHz	I	External sleep clock input (32.768 kHz)
GPIO and Control Signal (level referred by VDDIO)			
31	GP0_SD_HOST_INT	I/O	This pin can be programmed by software to be a GPIO or a WLAN_HOST_WAKE output indicating that host wake-up should be performed.
32	GP1_HOST_RDY	I/O	This pin can be programmed by software to be a GPIO
14	GPIO_2	I/O	This pin can be programmed by software to be a GPIO
13	GPIO_3	I/O	This pin can be programmed by software to be a GPIO
12	GPIO_4	I/O	This pin can be programmed by software to be a GPIO
11	GPIO_5	I/O	This pin can be programmed by software to be a GPIO
10	GPIO_6	I/O	This pin can be programmed by software to be a GPIO
33	GPIO_7	I/O	This pin can be programmed by software to be a GPIO
5	BT_HOST_WAKE	O	Bluetooth HOST_WAKE
4	BT_DEV_WAKE	I	Bluetooth DEV_WAKE

Pin#	Pin Name	Type	Description
29	BT_REG_ON	I	Used by PMU to power up or power down the internal CYW43455 regulators used by the BT section. This pin has an internal 200kOhm pull-down resistor that is enabled by default. It can be disabled through programming.
30	WL_REG_ON	I	Used by PMU to power up or power down the internal CYW43455 regulators used by the WLAN section. This pin has an internal 200kOhm pull-down resistor that is enabled by default. It can be disabled through programming.
Bluetooth I2S			
47	BT_I2S_DI	I	I2S data input
48	BT_I2S_DO	O	I2S data output
49	BT_I2S_WS	I/O	I2S WS: can be master (output) or slave (input)
50	BT_I2S_CLK	I/O	PCM or SLIMbus clock; can be master (output) or slave (input)
JTAG Interface			
35	JTAG_SEL	I/O	JTAG select. This pin must be connected to ground if the JTAG interface is not used.
Power Supplies			
24	VBAT1	I	Battery supply input
25	VBAT2	I	Battery supply input
23	VDDIO_SD	I	1.8V-3.3V supply for the SDIO pads.
26	VDDIO	I	1.8V-3.3V VDDIO supply for the WLAN.
28	BT_VDDO	I	1.8V-3.3V VDDIO supply for the BT.
Ground			
1	GND	-	Ground
3	GND	-	Ground
20	GND	-	Ground
22	GND	-	Ground
27	GND	-	Ground
40-46	GND	-	Ground
51-56	GND	-	Ground
H1~H9	GND	-	Ground

7 GUIDELINE TO PERFORM SMT WITH MODULE

7.1 PCB FOOTPRINT RECOMMENDATION

Unit: mm



Top View

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.

1. Reflow equipment needed at least nine heater zones. Recommend forced air type reflow oven with Nitrogen.

2. 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.

3. It is recommended that time above 217°C for the solder joints is between 40-90s, and with a minimum of 40s.

4. Optimal cooling rate is <1℃/sec. from peak to 217 ℃

5. 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.

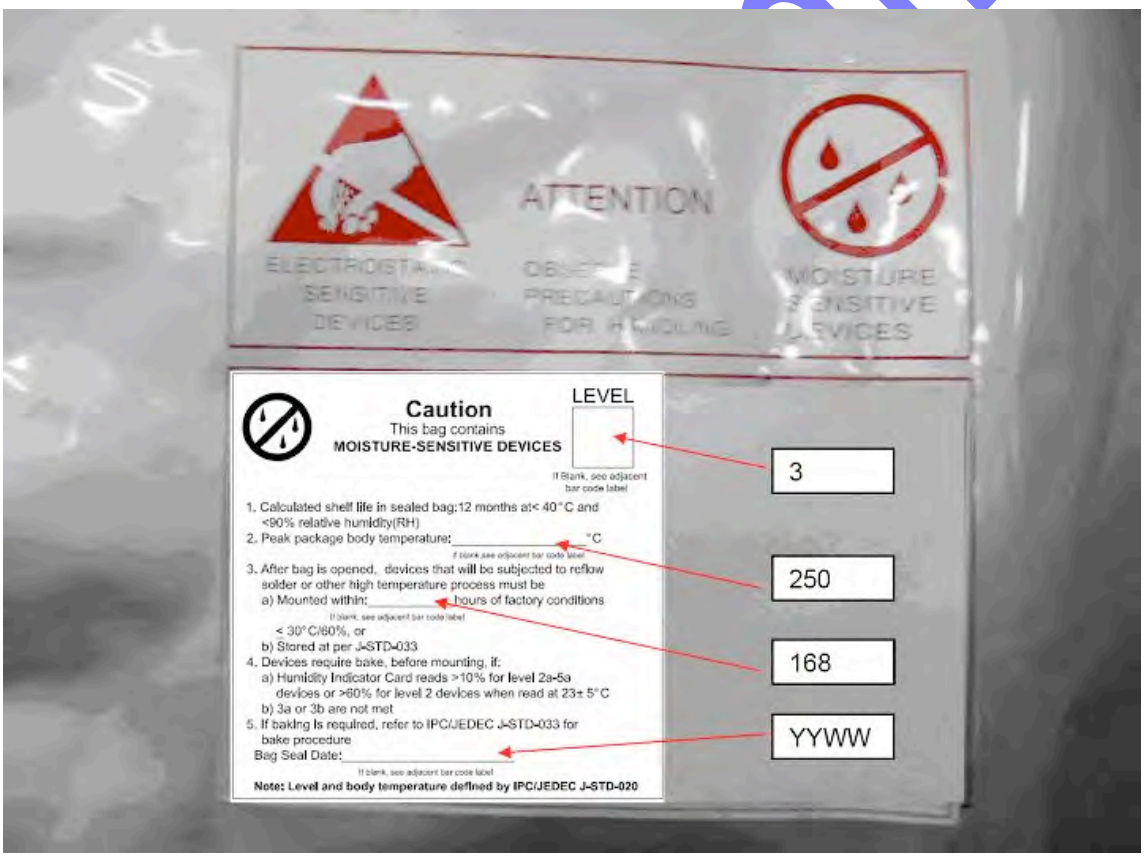
7.3 RECOMMENDED REFLOW PROFILE

(1) Solder paste alloy : SAC305 (Sn96.5/Ag3.0/Cu0.5) (Lead Free solder paste.)
(2) A-B. Temp.: 150~200℃; soak time:60~120sec.(Base on Flux type, reference only)
(3) C. Peak temp: <245℃
(4) D. Time above 217 ℃: 40~90sec.(Base on SAC305)
(5) Suggestion: Optimal cooling rate is <1℃/sec. from peak to 217 ℃.
(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.

8 PACKAGE AND STORAGE CONDITION

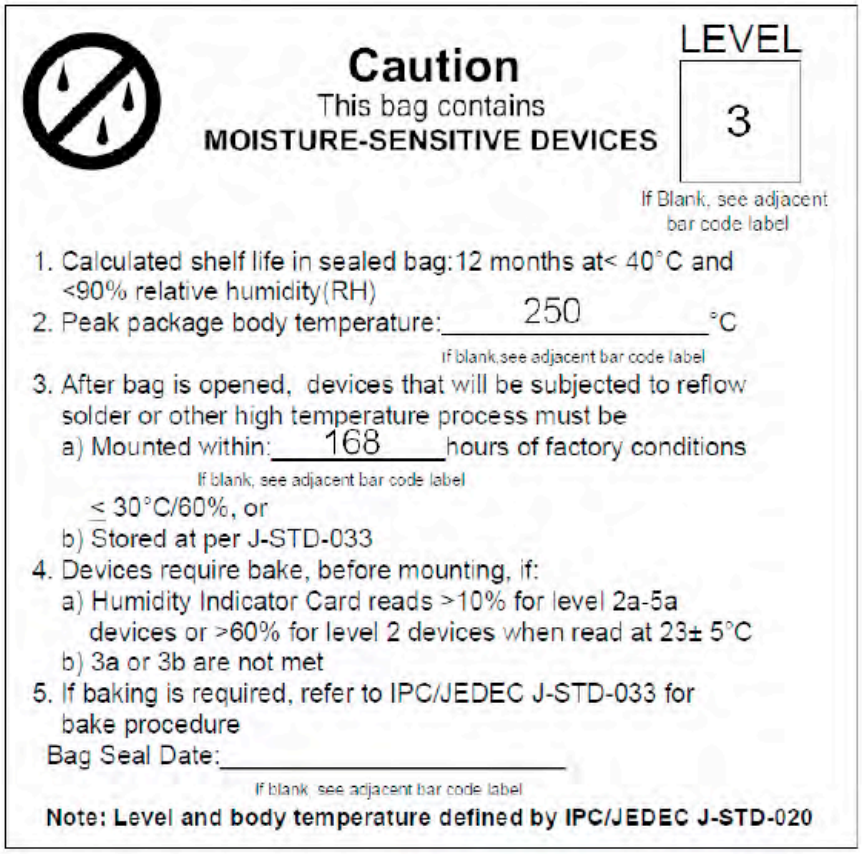
8.1 PACKAGE



8.2 EMC/ESD LEVEL

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

8.3 MSL LEVEL/STORAGE CONDITION (REFERENCE ONLY)



Half-Sine Shock
Sustained for Mechanical Shock under 2000G

Product Warranty: 1 year

For Additional information, please contact the following:
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