

AW-NB197SM

**IEEE 802.11 b/g/n Wireless LAN ,
Bluetooth and FM Combo Stamp Module**

Datasheet

Version 0.4

0B

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Revision History

Document release	Date	Modification	Initials	Approved
Version 0.1	2014/08/26	Initial Version	Roger Lee	Amos Fu
Version 0.2	2015/11/30	Update Specifications Table	Chao Lee	Amos Fu
Version 0.3	2015/12/25	Add power consumption	Chao Lee	Amos Fu
Version 0.4	2016/01/25	Added PCM Interface Timing	Steven Jian	Chihhao Liao

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1. General Description

1-1. Product Overview and Functional Description

AzureWave Technologies, Inc. introduces the advanced **IEEE 802.11 b/g/n WLAN, Bluetooth and FM combo** module - **AW-NB197SM**. The module is targeted to mobile and embedded devices which need small footprint package, low power consumption, and multiple OS support. The module supports **2.4GHz** IEEE 802.11n MAC/baseband/radio, and Bluetooth 4.1 functionality. It also features an integrated Power Management Unit (PMU), Power Amplifiers (PAs), and a Low Noise Amplifier (LNA) to address the needs of mobile devices that require minimal power consumption and compact size. By using AW-NB197SM, the customers can easily enable the Wi-Fi and BT embedded applications with the benefits of **high design flexibility, short development cycle, and quick time-to-market**. Specified in the IEEE 802.11 standard minimize the system power requirements by using AW-NB197SM. In addition to the support of **WPA/WPA2 (personal)** and **WEP** encryption, the AW-NB197SM also supports the IEEE 802.11i security standard through **AES** and **TKIP** acceleration hardware for faster data encryption. For the video, voice and multimedia applications the AW-NB197SM support 802.11e Quality of Service (QoS). The host interface is **SDIO v2.0** interface.

For Bluetooth operation, the AW-NB197SM is **Bluetooth 4.1** compliant. The Bluetooth transmitter also features a Class 1 power amplifier. The AW-NB197SM supports **extended Synchronous Connections (eSCO)**, for enhanced voice quality by allowing for retransmission of dropped packets, and **Adaptive Frequency Hopping (AFH)** for reducing radio frequency interference. It also incorporates all Bluetooth 4.1 features including **Secure Simple Pairing, Sniff Subrating, and Encryption Pause and Resume**. An independent, high-speed UART is provided for the Bluetooth host interface. The Bluetooth subsystem presents a standard Host Controller Interface (HCI) via a high speed UART and PCM for audio.

For FM receiver, the **AW-NB197SM** is 76-MHz to 108-MHz FM bands supported and supports the European Radio Data Systems (RDS) and the North American Radio Broadcast Data System (RBDS) modulations. The FM subsystem supports the HCI control interface as well as I2S interfaces of the Bluetooth subsystem.

1-2. Key Features

1-2-1. General

- Integrates Broadcom solutions of BCM43438_A1 WiFi /BT/FM RX SoC
- SDIO v2.0 interfaces support for WLAN
- High speed UART and PCM for Bluetooth
- Lead-free Design
- 12.0mm(L) x 12.0mm(W) x 1.5 mm(H) 47 pin LGA package
- **Without Crystal(XTAL)**

1-2-2. WLAN Section

- Single band 2.4 GHz 802.11 b/g/n
- WLAN host interface options
 - SDIO v2.0, including DS and HS modes
- Security–WEP, WPA/WPA2 (personal), AES (HW), TKIP (HW), CKIP (SW), WMM/WMM-PS/WMM-SA

1-2-3. Bluetooth Section

- Supports extended Synchronous Connections (eSCO), for enhanced voice quality by allowing for retransmission of dropped packets
- Adaptive Frequency Hopping (AFH) for reducing radio frequency interference
- Maximum UART baud rates up to 4 Mbps
- Supports all Bluetooth 4.1 packet types
- Fully supports Bluetooth Core Specification version 4.1 + (Enhanced Data Rate) EDR features:
 - Adaptive Frequency Hopping (AFH)
 - Quality of Service (QoS)
 - Extended Synchronous Connections (eSCO) — Voice Connections
 - Fast Connect (interlaced page and inquiry scans)
 - Secure Simple Pairing (SSP)
 - Sniff Subrating (SSR)
 - Encryption Pause Resume (EPR)
 - Extended Inquiry Response (EIR)
 - Link Supervision Timeout (LST)
- Interface support – Host Controller Interface (HCI) using a high-speed UART interface and PCM for audio data

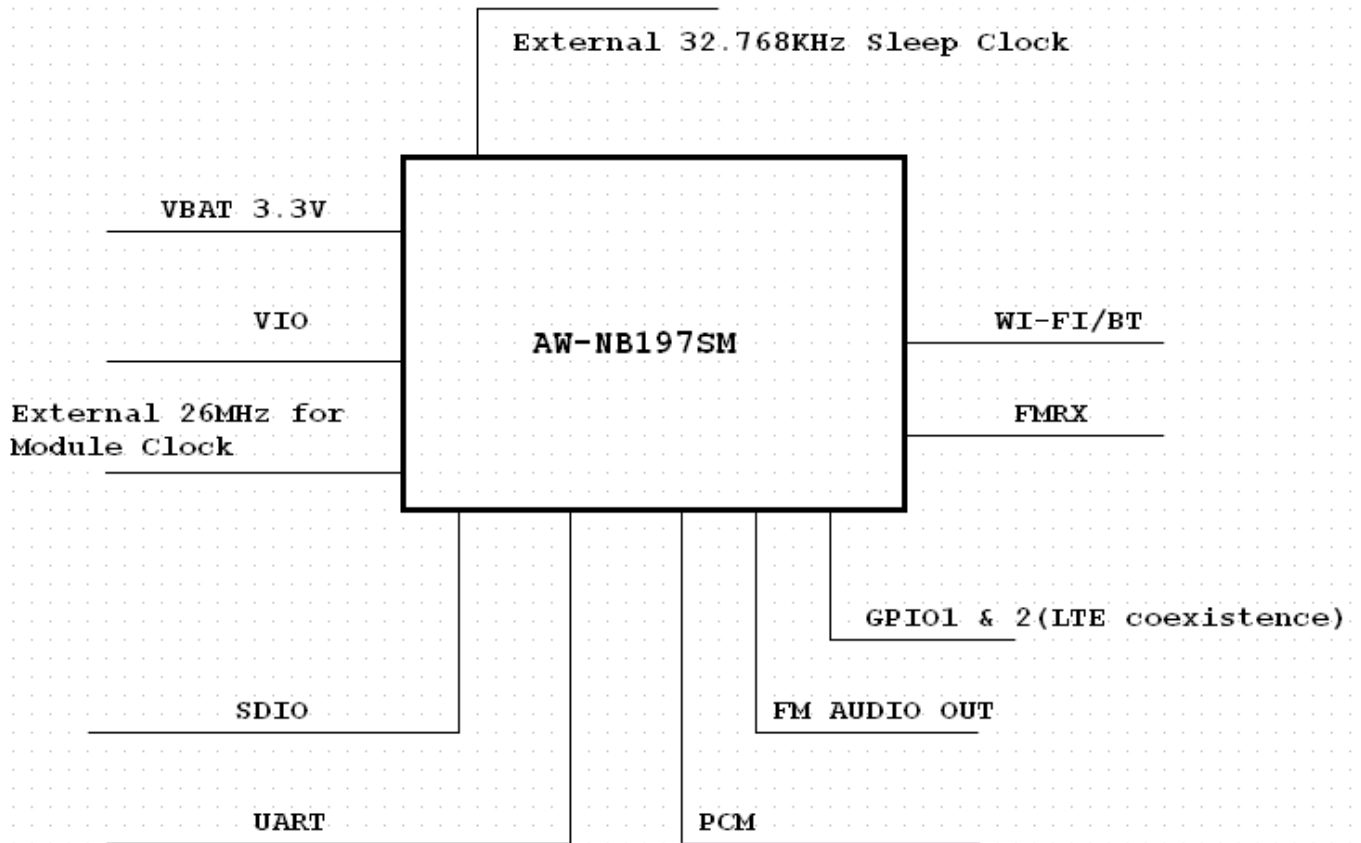
1-2-4. FM Section

- 76-MHz to 108-MHz FM bands supported (US, Europe, and Japan)
- RDS and RBDS demodulator and decoder with filter and buffering functions
- FM subsystem control using the Bluetooth HCI interface
- FM subsystem operates from reference clock inputs
- Improved audio interface capabilities with full-featured bidirectional PCM.
- Auto search and tuning functions

1-3. Block Diagram

A simplified block diagram of the AW-NB197SM module is depicted in the figure below.

AW-NB197SM Block Diagram



1-4. Specifications Table

Model Name	AW-NB197SM
Product Description	IEEE 802.11 b/g/n Wireless LAN and Bluetooth Combo Stamp Module
WLAN Standard	IEEE 802.11 b/g/n, Wi-Fi compliant
Bluetooth Standard	Bluetooth 4.1
Host Interface	WLAN: SDIO v2.0 Bluetooth: UART
Audio Interface	Digital PCM for Bluetooth
Major Chipset	Broadcom BCM43438_A1
Dimension	12.0mm(L) x 12.0mm(W) x 1.5 mm(H)
Weight	0.4g
Package	47 pin Stamp Module
Operating Conditions	
Voltage	Input supply for host I/O : 3.3V
Temperature	Operating: -20~70 °C ; Storage: -20~85 °C
Relative Humidity	< 60 % (storage) <85% (operation)
Electrical Specifications	
Frequency Range	WLAN: 2.4 GHz Band Bluetooth: 2400~2483.5MHz
Number of Channels	802.11b: USA, Canada and Taiwan – 1 ~ 11 Most European Countries – 1 ~ 13 Japan – 1 ~ 14 802.11g: USA and Canada – 1 ~ 11 Most European Countries – 1 ~ 13 802.11n: USA and Canada – 1 ~ 11 Most European Countries – 1 ~ 13
Modulation	WLAN: DSSS, OFDM, BPSK(9/6Mbps), QPSK(18/12Mbps), DBPSK(1Mbps), DQPSK(2Mbps), CCK(11/5.5Mbps), 16-QAM(36/24Mbps), 64-QAM (72.2/54/48Mbps) Bluetooth: GFSK (1Mbps), $\pi/4$ DQPSK (2Mbps) and 8DPSK (3Mbps)
Output Power	WLAN: 11b: 17 dBm (\pm 2dBm) 11g: 15 dBm (\pm 2dBm) 11n_HT20: 13 dBm (\pm 2dBm) Bluetooth: 0 ≤ Output Power ≤ +10 dBm (Conductive)

Receive Sensitivity	WLAN: 11b (11Mbps): -82 dBm (Typical) 11g (54Mbps): -68 dBm (Typical) 11n (HT20 MCS7): -66 dBm (Typical) Bluetooth: BT: BER < 0.1% (Anritsu 8852B Tx -70dBm)
Data Rates	WLAN: 802.11b: 1, 2, 5.5, 11Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11n:MCS 0~7 HT20 Bluetooth: Bluetooth 2.1+EDR data rates of 1, 2, and 3Mbps
Security	<ul style="list-style-type: none"> ◆ WPA™- and WPA2™- (Personal) support for powerful encryption and authentication ◆ AES and TKIP acceleration hardware for faster data encryption and 802.11i compatibility ◆ Cisco® Compatible Extension- (CCX, CCX 2.0, CCX 3.0, CCX 4.0, CCX5.0) certified ◆ Wi-Fi Protected Setup (WPS) ◆ WEP ◆ WMM / WMM-SA ◆ CKIP(Software)
ESD test condition	ESD:HBM +-1.25KV CDM+-175V
Operating System Compatibility	Android/Linux

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2. Electrical Characteristics

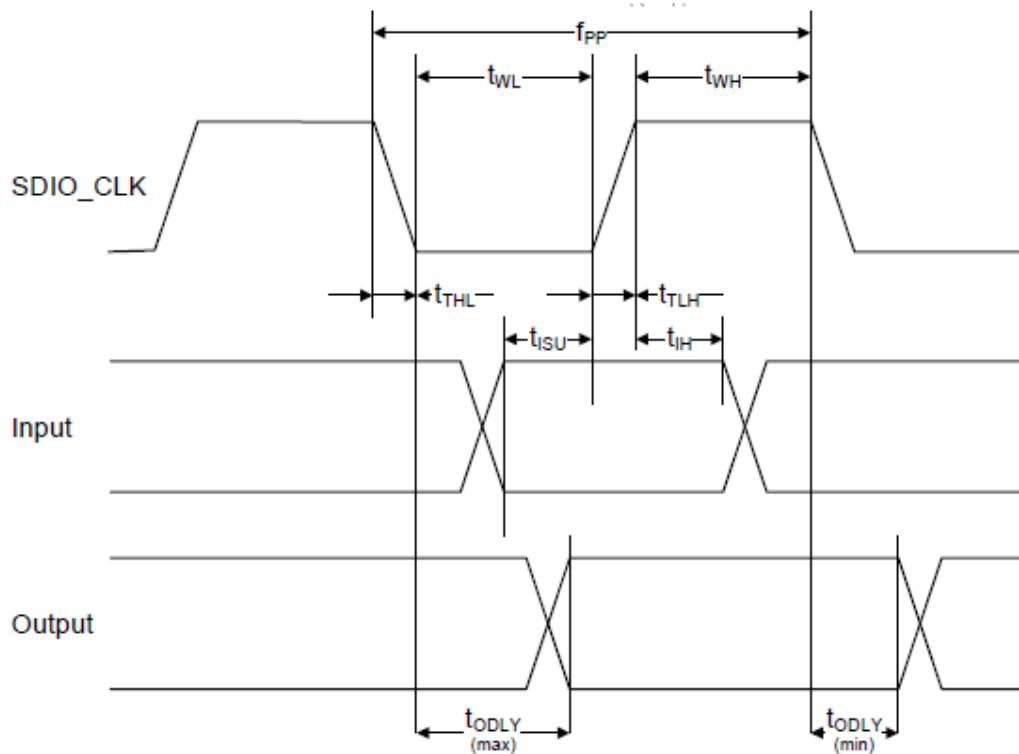
2-1. Recommended Operating Conditions

Symbol	Parameter	Type	Min	Typ	Max	Units
VBAT	Power supply for Internal Regulators and FEM	Input	3.0	3.3	3.6	V

2-2. DC Characteristics for Host I/O

Symbol	Parameter	Condition	Min	Typ	Max	Units
SDIO Interface I/O pins						
V_{IH}	Input high voltage (V_{DDIO})	VDDIO_SD=3.3V	2.06	-	-	
V_{IL}	Input low voltage (V_{DDIO})	VDDIO_SD=3.3V	-	-	0.82	
V_{OH}	Output High Voltage @ 2mA	VDDIO_SD=3.3V	2.47	-	-	
V_{OL}	Output Low Voltage @ 2mA	VDDIO_SD=3.3V	-	-	0.41	
Other Digital I/O pins						
V_{IH}	Input high voltage (V_{DDIO})	VDDIO=3.3V	2.0	-	-	
V_{IL}	Input low voltage (V_{DDIO})	VDDIO=3.3V	-	-	0.8	
V_{OH}	Output High Voltage @ 2mA	VDDIO=3.3V	2.9	-	-	
V_{OL}	Output Low Voltage @ 2mA	VDDIO=3.3V	-	-	0.4	

2-3. SDIO Host Interface Specification



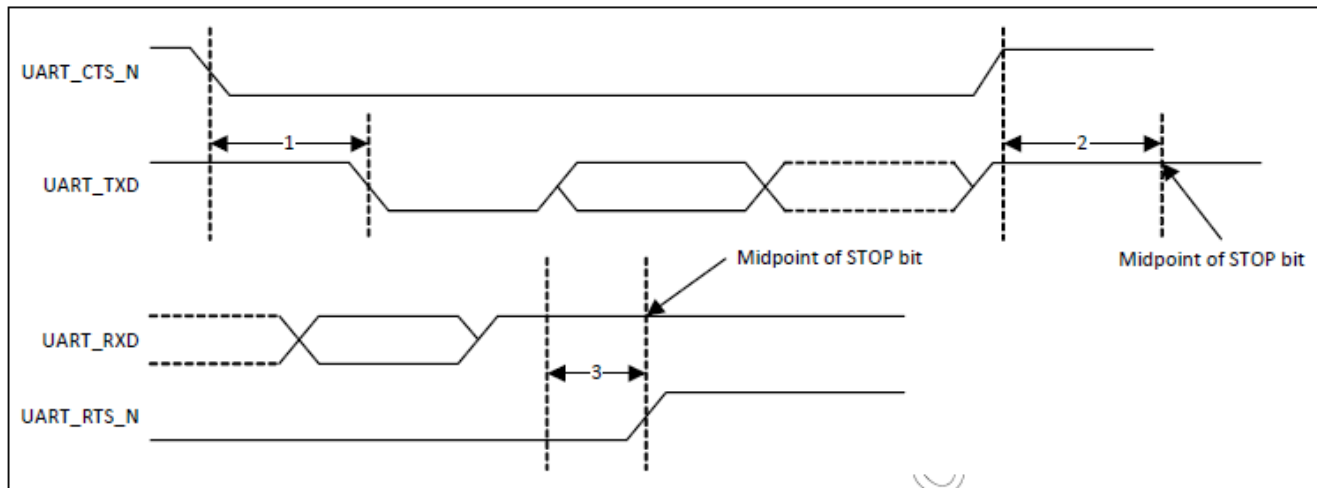
SDIO Timing Data

Symbol	Parameter	Condition	Min	Max	Units
f_{pp}	CLK Frequency	Normal	0	25	MHz
		High Speed	0	50	
t_{WH}	CLK High Time	Normal	10	-	ns
		High Speed	7	-	
t_{WL}	CLK Low Time	Normal	10	-	
		High Speed	7	-	
t_{TLH}	CLK rise Time	Normal	-	10	
		High Speed	-	3	
t_{THL}	CLK fall Time	Normal	-	10	
		High Speed	-	3	
t_{ISU}	Input Setup Time	Normal	5	-	
		High Speed	6	-	
t_{IH}	Input Hold Time	Normal	5	-	
		High Speed	2	-	

t_{ODLY}	Output Delay Time	Normal	-	14
		High Speed	-	14

2-4. UART Host Interface Specification

UART Timing



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

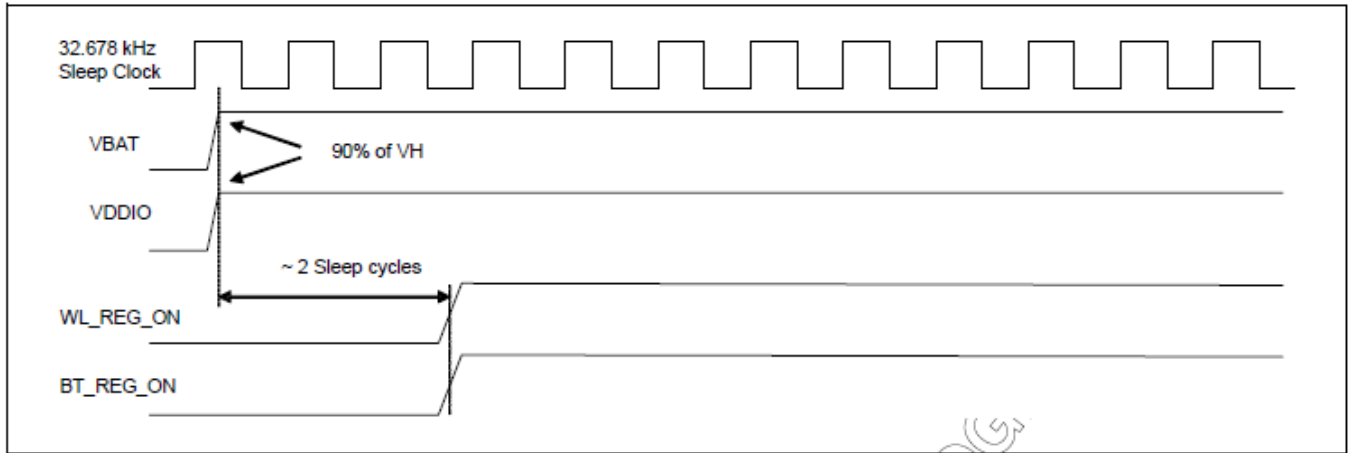
2-5. Power-Up Sequence and Timing

WLAN = ON, Bluetooth = ON

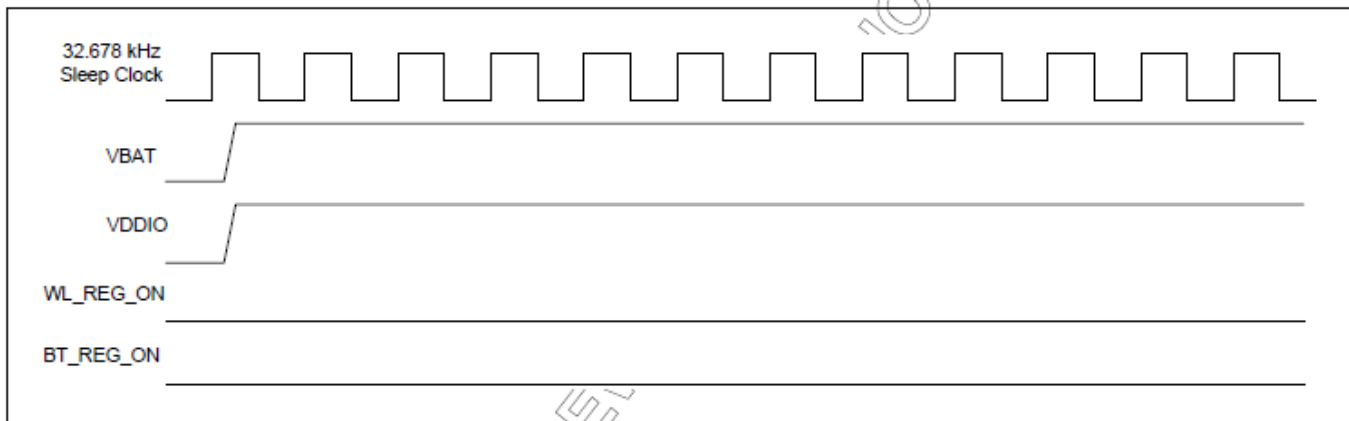
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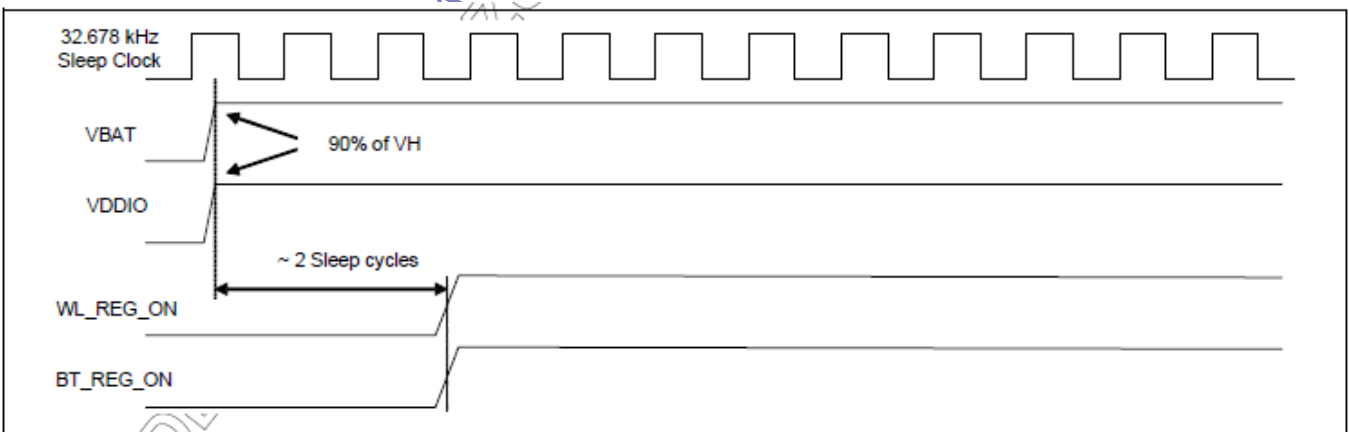
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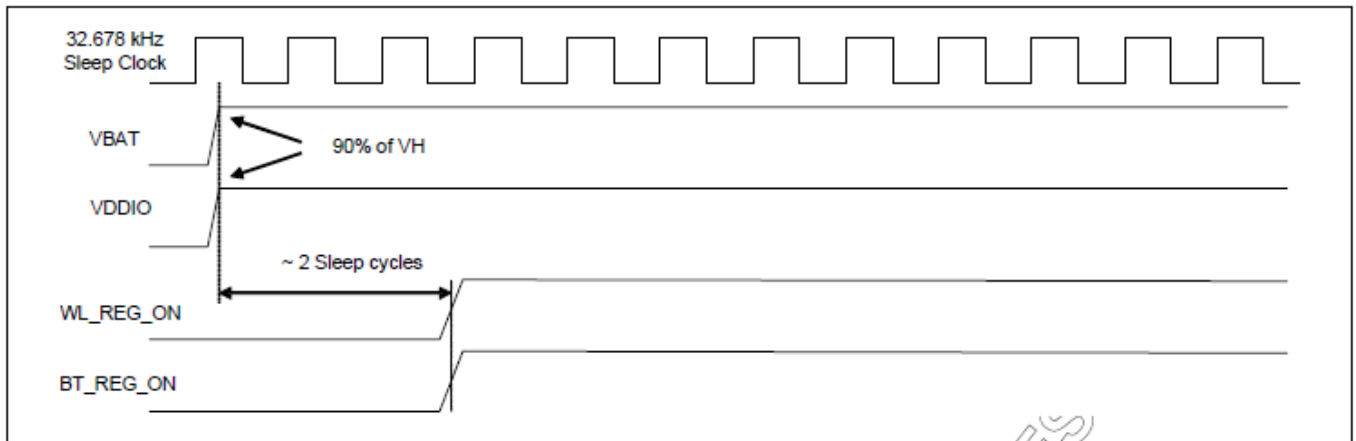
WLAN = OFF, Bluetooth = OFF



WLAN = ON, Bluetooth = OFF



WLAN = OFF, Bluetooth = ON



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2-6. PCM Interface Timing

Short Frame Sync, Master Mode

PCM Timing Diagram (Short Frame Sync, Master Mode)

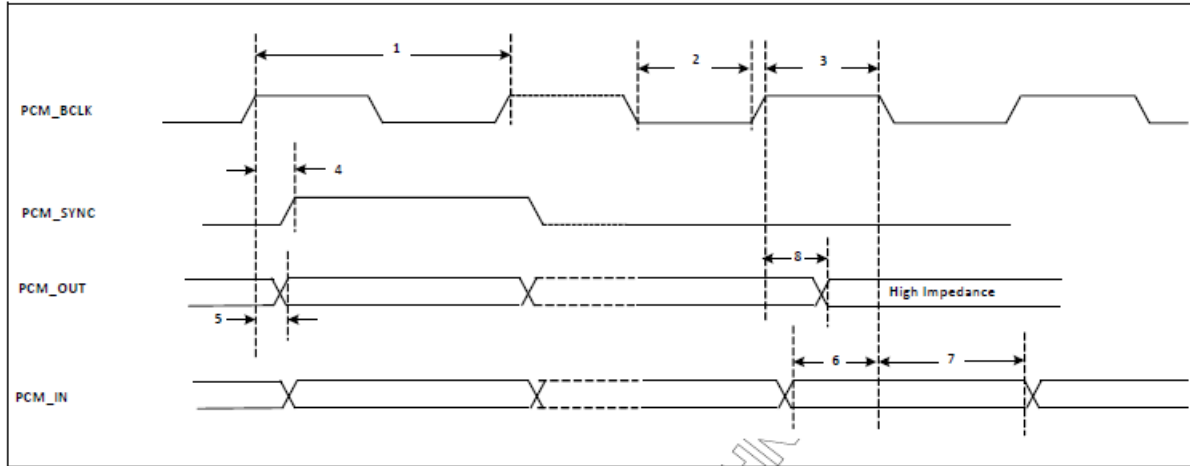


Table 8: PCM Interface Timing Specifications (Short Frame Sync, Master Mode)

Ref No.	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency	–	–	12	MHz
2	PCM bit clock low	41	–	–	ns
3	PCM bit clock high	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

PCM Timing Diagram (Short Frame Sync, Slave Mode)

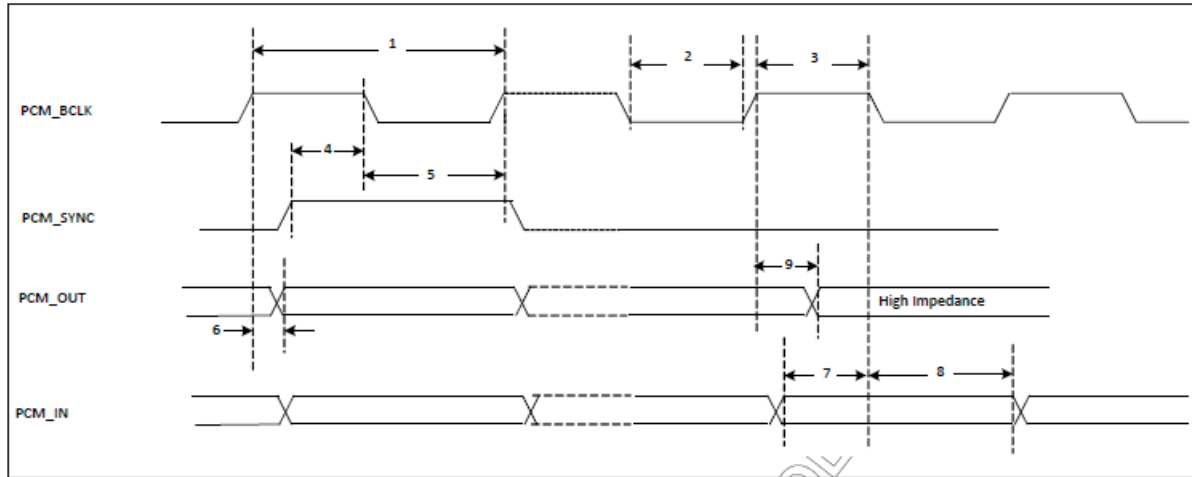


Table 9: PCM Interface Timing Specifications (Short Frame Sync, Slave Mode)

Ref No.	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency	–	–	12	MHz
2	PCM bit clock low	41	–	–	ns
3	PCM bit clock high	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

PCM Timing Diagram (Long Frame Sync, Master Mode)

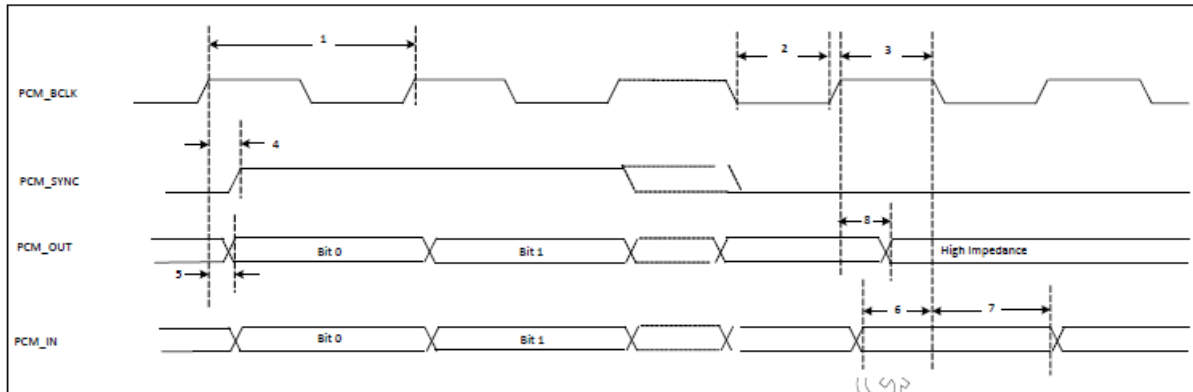


Table 10: PCM Interface Timing Specifications (Long Frame Sync, Master Mode)

Ref No.	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency	—	—	12	MHz
2	PCM bit clock low	41	—	—	ns
3	PCM bit clock high	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

PCM Timing Diagram (Long Frame Sync, Slave Mode)

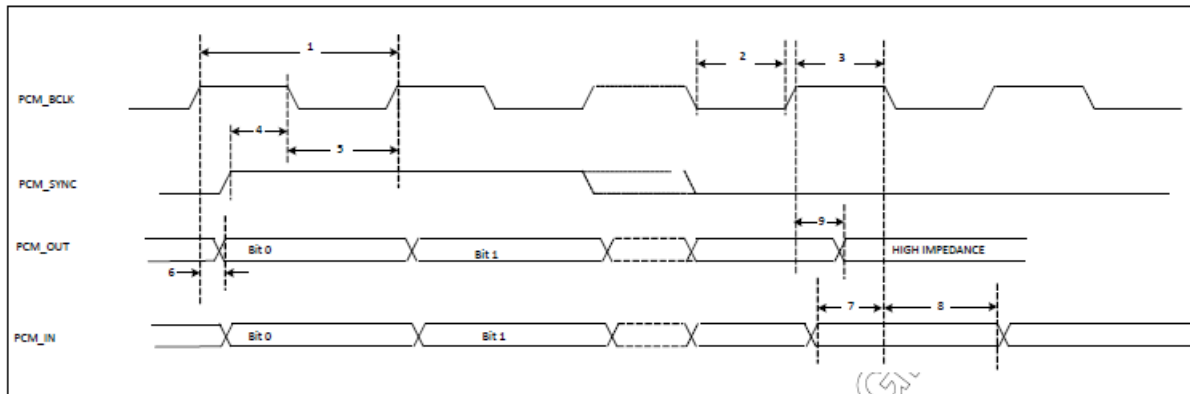


Table 11: PCM Interface Timing Specifications (Long Frame Sync, Slave Mode)

Ref No.	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency	—	—	12	MHz
2	PCM bit clock low	41	—	—	ns
3	PCM bit clock high	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

3.1. Pin Definition

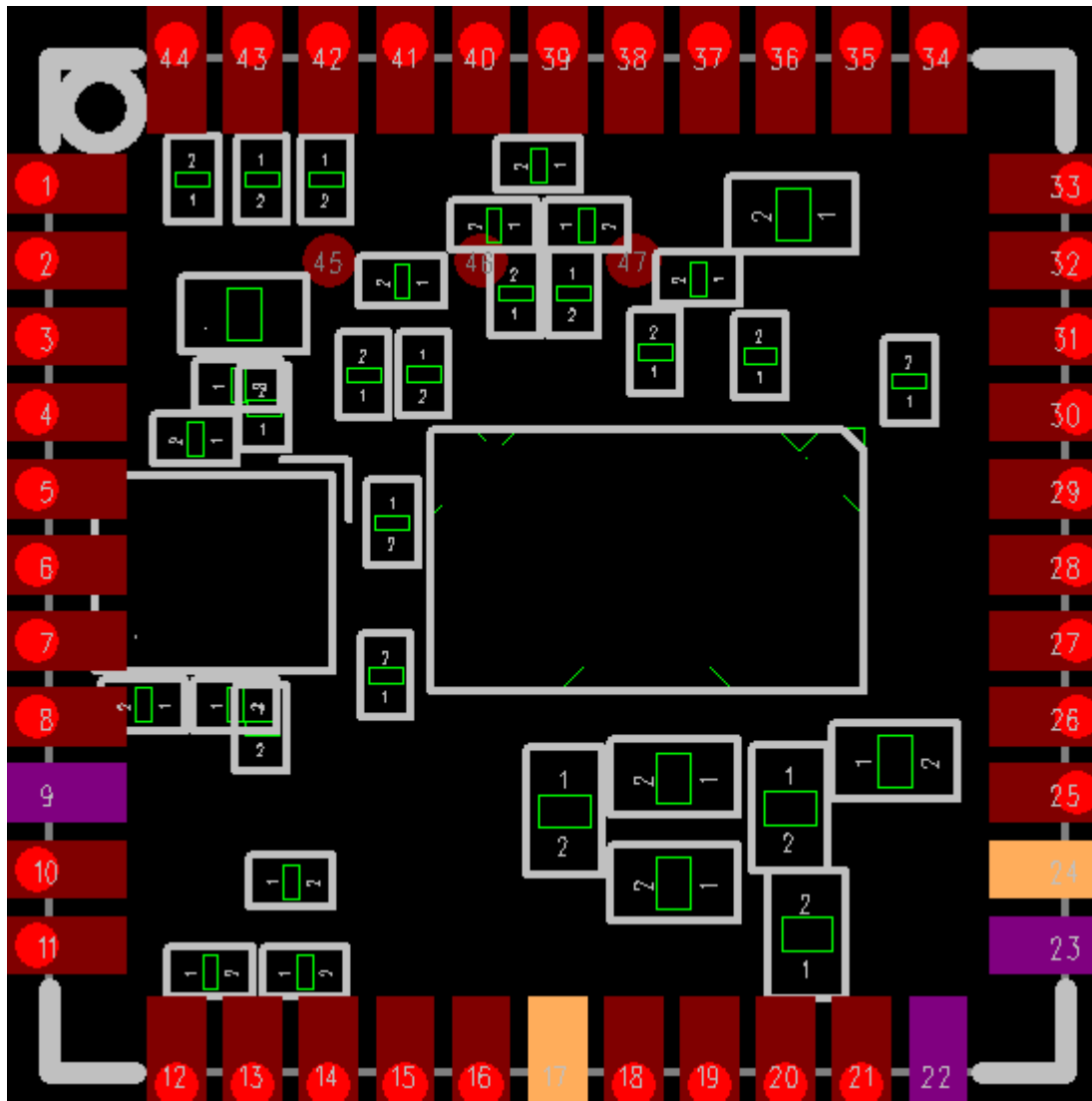
Note: The pin name and direction are defined on module side.

Pin No	Definition	Basic Description	Type
1	GND	Ground.	GND
2	WL_BT_ANT	WLAN/BT RF TX/RX path.	RF
3	GND	Ground.	GND
4	FM_RX	FM radio RF input.	RF
5	NC	Floating Pin, No connect to anything.	Floating
6	BT_HOST_WAKE_DEV	BT Device Wake	I
7	BT_DEV_WAKE_HOST	BT Host Wake	O
8	NC	Floating Pin, No connect to anything.	Floating
9	VBAT	3.3V power pin	VCC
10	XTAL_IN	Crystal Input	I
11	XTAL_OUT	Crystal Output	O
12	WL_DIS#	Used by PMU to power up or power down the internal regulators used by the WLAN section. Also, when deasserted, this pin holds the WLAN section in reset. This pin has an internal 200k ohm pull down resistor that is enabled by default. It can be disabled through programming.	I
13	WL_DEV_WAKE_HOST	WL Host Wake	O
14	SDIO_D2	SDIO Data Line 2	I/O
15	SDIO_D3	SDIO Data Line 3	I/O
16	SDIO_CMD	SDIO Command Input	I/O
17	SDIO_CLK	SDIO Clock Input	I
18	SDIO_D0	SDIO Data Line 0	I/O
19	SDIO_D1	SDIO Data Line 1	I/O
20	GND	Ground.	GND
21	VIN_LDO_OUT	Internal Buck 1.2V voltage generation pin	VCC

22	VDDIO	1.8V-3.3V VDDIO supply for WLAN and BT	VCC
23	VIN_LDO	Internal Buck 1.2V voltage generation pin	VCC
24	SUSCLK_IN	External 32K or RTC clock	I
25	PCM_OUT	PCM data Out	O
26	PCM_CLK	PCM Clock	I/O
27	PCM_IN	PCM data Input	I
28	PCM_SYNC	PCM Synchronization control	O
29	NC	Floating Pin, No connect to anything.	Floating
30	NC	Floating Pin, No connect to anything.	Floating
31	GND	Ground.	GND
32	NC	Floating Pin, No connect to anything.	Floating
33	GND	Ground.	GND
34	BT_DIS#	Used by PMU to power up or power down the internal regulators used by the Bluetooth section. Also, when deasserted, this pin holds the Bluetooth section in reset. This pin has an internal 200k ohm pull down resistor that is enabled by default. It can be disabled through programming.	I
35	NC	Floating Pin, No connect to anything.	Floating
36	GND	Ground.	GND
37	NC	Floating Pin, No connect to anything.	Floating
38	NC	Floating Pin, No connect to anything.	Floating
39	GPIO2	Wi-Fi Co-existence pin with LTE(WLAN_SECI_RX)	I
40	GPIO1	Wi-Fi Co-existence pin with LTE(WLAN_SECI_TX)	O
41	UART_RTS	High-Speed UART RTS	O
42	UART_OUT	High-Speed UART Data Out	O
43	UART_IN	High-Speed UART Data In	I
44	UART_CTS	High-Speed UART CTS	I
45	TP1	FM Analog AUDIO left output.	O
46	TP2	FM Analog AUDIO right output	O
47	TP3(NC)	Floating Pin, No connect to anything.	Floating

3.2. Pin Map

AW-NB197SM Top View Pin Map



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4. Power consumption

WiFi

No.	Item			VBAT_IN=3.3 V				
				Max.			Avg.	
1.	WLAN OFF ^{*(1)(2)(4)}			238.2μA			228.5μA	
2.	Deepsleep ^{*(2)(3)(4)(7)}			3.04mA			530.6μA	
3.	Power save ^{*(2)(3)(4)(8)}			249.1mA			5.9mA	
4.	Not Connect to AP ^{*(4)(5)}			8.9mA			1.67mA	
5.	Connect to AP (2.4G) ^{*(2)(3)(4)}			43.9mA			41.4mA	
Band (GHz)	Mode	BW (MHz)	RF Power (dBm)	Transmit			Receive	
				Max.	Avg.	Duty. (%)	Max.	Avg.
2.4 (5)(6)	11b@1Mbps	20	17	248.9	233.3	97.6	48.4	44.3
	11b@11Mbps	20	17	242.6	202.6	80	49.4	45.1
	11g@6Mbps	20	15	241.4	214.6	86.9	46.1	43.9
	11g@54Mbps	20	15	238.1	140.8	43.9	44.2	40.9
	11n@MCS0	20	13	229.4	137.5	43.9	44.6	41.3
	11n@MCS7	20	13	229.1	139.4	44	45.0	41.7

(1)WLAN off (WIFI (pin:T3)/ BT (pin:T7) =LOW)

(2)Using normal firmware on os: UBUNTU.

(3)Link AP use D-LINK 825, DTIM = 1, Beacon Interval = 100 ms.

(4)Measurement Instrument using Agilent 34411A Digit Multimeter.

(5)Using MFG firmware.

(6)Using LeCroy to measure Duty cycle's Max and recoard Measure->Mean , Mean= Avg.

(7)Deepsleep:connect to AP -> ./wl deepsleep 1.

(8)Power save:connect to AP -> ./wl PM 2.

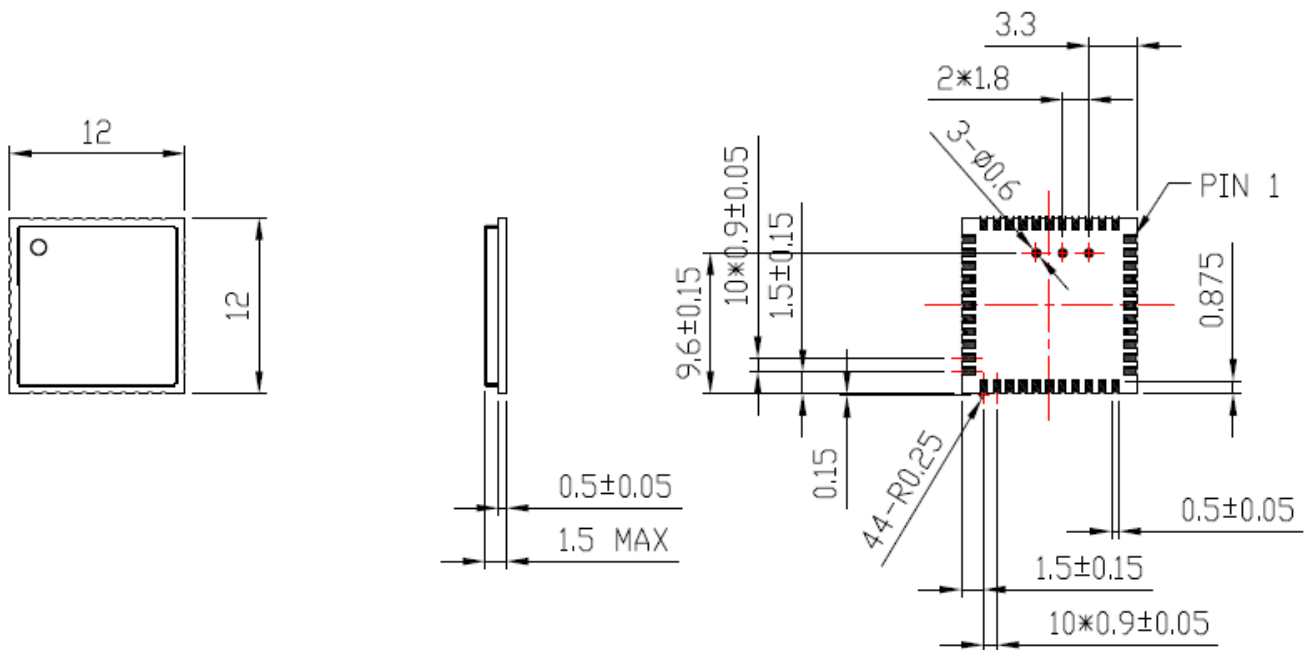
BT

No.	Mode	Packet Type	VBAT_IN=3.3 V	
			Max.	Avg.
1.	Deepsleep	N/A	3.92mA	3.06mA
2.	Transmit	DH5	43.5 mA	32.7 mA
3.	Receive	3-DH5	19.1 mA	14.8 mA

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- AW-NB197SM removed from the vacuum packaging must be within 168 hours do SMT process and had finished Reflow.
- If AW- NB197SM cannot reflow finished within the specified time, it must be according to the baking conditions 2 hours at temperature of 125 degrees C and then re-bake for vacuum packaging.
- Reflow (Reflow) temperature need to be based on the size of the motherboard (generally in accordance with the solder paste used by customers Reflow Profile may be).
- Need to pick up the WIFI module, operating in accordance with ESD protection norms.