AzureWave Technologies, Inc.

AW-AM457-D

IEEE 802.11 1X1 a/b/g/n Wireless LAN + Bluetooth 5.2 Combo LGA Module

Datasheet

Rev. E

DF

For Standard

Features

WLAN

- Support 802.11 a/b/g/n
- Dual bands: 2.4 GHz and 5 GHz
- Single stream 802.11n with 20/40 MHz channels for 5G and 20 MHz only for 2.4G
- Up to MCS7 data rates (150 Mbps)
- Support 802.11mc for location
- Dynamic Rapid Channel Switching (DRCS) for simultaneous and power efficient operation in 2.4 GHz and 5 GHz bands
- Interface to coexist with 802.15.4, LTE, or other radios.
- Security: WPA3 and WPA.

Bluetooth

- Full Bluetooth 5.2 features
- Long range - 4x coverage
- 2 Mbps data rate - 2x faster
- Connection/connectionless AoA
- Connection/connectionless AoD
- Improved advertisement capacity-enables more IoT services
- Audio interface: I2S and PCM
- Security: AES

Revision History

Document NO: R2-2457-DST-01

Version	Revision Date	DCN NO.	Description	Initials	Approved
A	2020/01/21	DCN016710	● Draft version	Renton Tao	N.C Chen
B	2020/12/10	DCN018928	● Modify model name ● Add specification table and operating temperature ● Add ESD information ● Modify pin table(Pin 19) ● Add power sequence ● Add Power Consumption ● Modify operating conditions	Roger Liu	N.C Chen
C	2021/02/18	DCN020661	● Modify datasheet form ● Modify Host Interface ● Modify Bluetooth specification ● Update box label information ● Modify 2.4G n mode bandwidth ● Update packing information	Roger Liu	N.C Chen
D	2021/09/26	DCN023395	● Modify pin table for GPIO and pin 59~68 to NC ● Remove USB interface	Roger Liu	N.C Chen
E	2021/12/24	DCN025025	● Update power consumption ● Update BT feature to 5.2	Roger Liu	N.C Chen

AzureWave Technologies, Inc.

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1. Introduction

1.1 Product Overview

AzureWave Technologies, Inc. introduces the IEEE 802.11a/b/g/n WLAN, BT, combo module – **AW-AM457-D.** With four advanced radio technologies integrated into a module, AW-AM457-D provides the best and most convenient SMT process. The module is targeted to mobile devices including**,** Tablet PC, Portable Media Players (PMPs), Portable Navigation Devices (PNDs), Personal Digital Assistants (PDAs), Tracking Devices, Gaming Devices which need convenient SMT process, low power consumption.

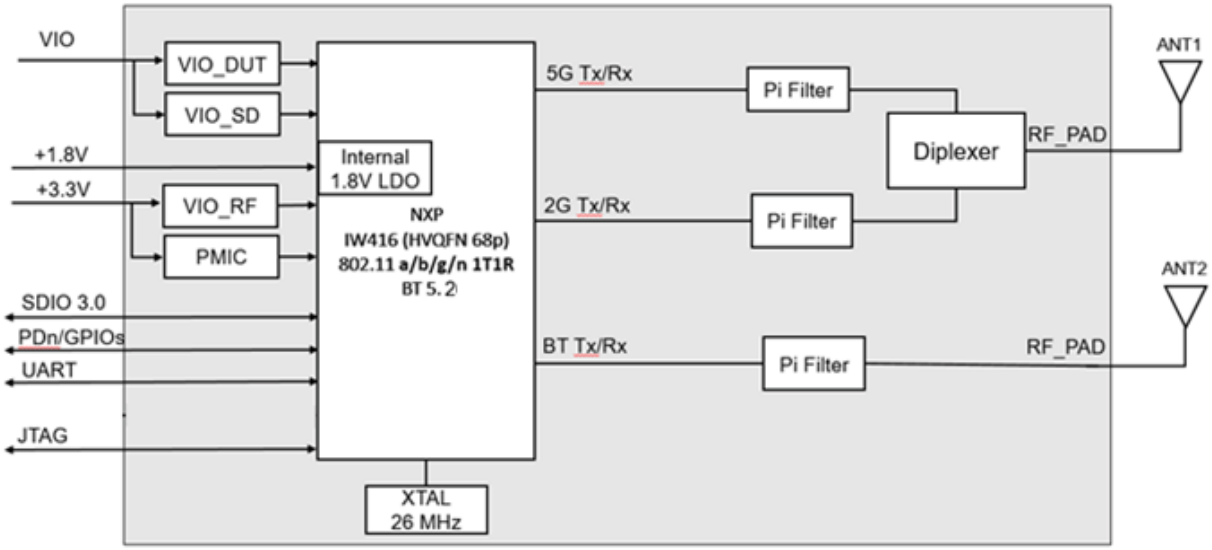
By using AW-AM457-D, the customers can easily integrate the Wi-Fi, BT, by a combo module with the benefits of **high design flexibility, high success rate on SMT process, short development cycle, and quick time-to-market.**

Compliance with the IEEE 802.11a/b/g/n standard, the AW-AM457-D uses **DSSS**, **OFDM**, **DBPSK**, **DQPSK**, **CCK** and **QAM** baseband modulation technologies. A high level of integration and full implementation of the power management functions specified in the IEEE 802.11 standard minimize the system power requirements by using AW-AM457-D.

The AW-AM457-D supports standard interface **SDIO3.0 for WLAN, UART for BT**. AW-AM457-D is suitable for multiple mobile processors for different applications. With the combo functions and the good performance, the AW-AM457-D is the best solution for the consumer electronics and the tablet PC.

1.2 Block Diagram

A simplified block diagram of the AW-AM457-D module is depicted in the figure below.



AW-AM457-D Block Diagram

1.3 Specifications Table

1.3.1 General

Features	Description
Product Description	IEEE 802.11 a/b/g/n Wi-Fi with Bluetooth 5.2 Combo Module
Major Chipset	NXP IW416 (68-pin HVQFN)
Host Interface	WiFi + BT ● SDIO + UART
Dimension	15 mm X 15 mm x 2.5 mm(Max)
Form factor	LGA module, 76 pins
Antenna	For LGA, “1T1R, external ANT1：WiFi → TX/RX ANT2：Bluetooth → TX/RX
Weight	0.5 g

1.3.2 WLAN

Features	Description
WLAN Standard	IEEE 802.11 a/b/g/n 1T1R
WLAN VID/PID	NA
WLAN SVID/SPID	NA
Frequency Rage	2.4 GHz ISM Bands 2.412-2.472 GHz 5.15-5.25 GHz (FCC UNII-low band) for US/Canada and Europe 5.25-5.35 GHz (FCC UNII-middle band) for US/Canada and Europe 5.47-5.725 GHz for Europe 5.725-5.825 GHz (FCC UNII-high band) for US/Canada
Modulation	DSSS, OFDM, DBPSK, DQPSK, CCK, 16-QAM, 64-QAM
Number of Channels	2.4GHz: ■ USA, NORTH AMERICA, Canada and Taiwan - 1 ~ 11 ■ China, Australia, Most European Countries - 1 ~ 13 ■ Japan, 1 ~ 13 5GHz: ■ USA, Canada, Most European Countries - 36,40,44,48,52,56,60,64,100,104,108,112,116,120,124,128,132,136,140,149,153,157,161,165 ■ Japan -

<table>
<tr><td></td><td>36,40,44,48,52,56,60,64,100,104,108,112,116,120,124,128,132,136,140
China - 36,40,44,48,52,56,60,64, 149,153,157,161,165</td></tr>
<tr><td>Output Power
(Board Level Limit)*</td><td>2.4G
<table><tr><th></th><th>Min</th><th>Typ</th><th>Max</th><th>Unit</th></tr><tr><td>11b (11Mbps)
@EVM<35%</td><td>15.5</td><td>17</td><td>18.5</td><td>dBm</td></tr><tr><td>11g (54Mbps)
@EVM≦-30 dB</td><td>14.5</td><td>16</td><td>17.5</td><td>dBm</td></tr><tr><td>11n (HT20 MCS7)
@EVM≦-30 dB</td><td>12.5</td><td>14</td><td>15.5</td><td>dBm</td></tr></table>5G
<table><tr><th></th><th>Min</th><th>Typ</th><th>Max</th><th>Unit</th></tr><tr><td>11a (54Mbps)
@EVM≦-27 dB</td><td>14</td><td>16</td><td>18</td><td>dBm</td></tr><tr><td>11n (HT20 MCS7)
@EVM≦-28 dB</td><td>13</td><td>15</td><td>17</td><td>dBm</td></tr><tr><td>11n (HT40 MCS7)
@EVM≦-28 dB</td><td>12</td><td>14</td><td>16</td><td>dBm</td></tr></table></td></tr>
<tr><td>Receiver Sensitivity</td><td>2.4G
<table><tr><th></th><th>Min</th><th>Typ</th><th>Max</th><th>Unit</th></tr><tr><td>11b (11Mbps)</td><td>-</td><td>-86</td><td>-83</td><td>dBm</td></tr><tr><td>11g (54Mbps)</td><td>-</td><td>-73</td><td>-70</td><td>dBm</td></tr><tr><td>11n (HT20 MCS7)</td><td>-</td><td>-69</td><td>-66</td><td>dBm</td></tr></table>5G
<table><tr><th></th><th>Min</th><th>Typ</th><th>Max</th><th>Unit</th></tr><tr><td>11a (54Mbps)</td><td>-</td><td>-71</td><td>-68</td><td>dBm</td></tr><tr><td>11n (HT20 MCS7)</td><td>-</td><td>-68</td><td>-65</td><td>dBm</td></tr><tr><td>11n (HT40 MCS7)</td><td>-</td><td>-66</td><td>-63</td><td>dBm</td></tr></table></td></tr>
<tr><td>Data Rate</td><td>WLAN:
802.11b : 1, 2, 5.5, 11Mbps
802.11a/g : 6, 9, 12, 18, 24, 36, 48, 54Mbps
802.11n : Maximum data rates up to 72 Mbps (20 MHz channel), 150 Mbps (40 MHz channel)</td></tr>
<tr><td>Security</td><td>■ WiFi: WPA/WPA3
■ BT: AES</td></tr>
</table>

*** If you have any certification questions about output power please contact FAE directly**

1.3.3 Bluetooth

<table>
<tr><th>Features</th><th>Description</th></tr>
<tr><td>Bluetooth Standard</td><td>Full Bluetooth 5.2 features</td></tr>
<tr><td>Bluetooth VID/PID</td><td>NA</td></tr>
<tr><td>Frequency Rage</td><td>2402MHz~2483MHz</td></tr>
<tr><td>Modulation</td><td>Header GFSK
Payload 2M: π/4-DQPSK
Payload 3M: 8DPSK</td></tr>
<tr><td>Output Power</td><td>
<table>
<tr><td></td><td>Min</td><td>Typ</td><td>Max</td><td>Unit</td></tr>
<tr><td>BDR</td><td>0</td><td>2</td><td>4</td><td>dBm</td></tr>
<tr><td>EDR</td><td>0</td><td>2</td><td>4</td><td>dBm</td></tr>
<tr><td>Low Energy</td><td>0</td><td>2</td><td>4</td><td>dBm</td></tr>
</table>
</td></tr>
<tr><td>Receiver Sensitivity</td><td>
<table>
<tr><td></td><td>Min</td><td>Typ</td><td>Max</td><td>Unit</td></tr>
<tr><td>BDR(DH1)</td><td>-</td><td>-83</td><td>-80</td><td>dBm</td></tr>
<tr><td>EDR(2DH5)</td><td>-</td><td>-88</td><td>-85</td><td>dBm</td></tr>
<tr><td>EDR(3DH5)</td><td>-</td><td>-83</td><td>-80</td><td>dBm</td></tr>
<tr><td>Low Energy</td><td>-</td><td>-96</td><td>-93</td><td>dBm</td></tr>
</table>
BT Sensitivity (BER<0.1%)
</td></tr>
</table>

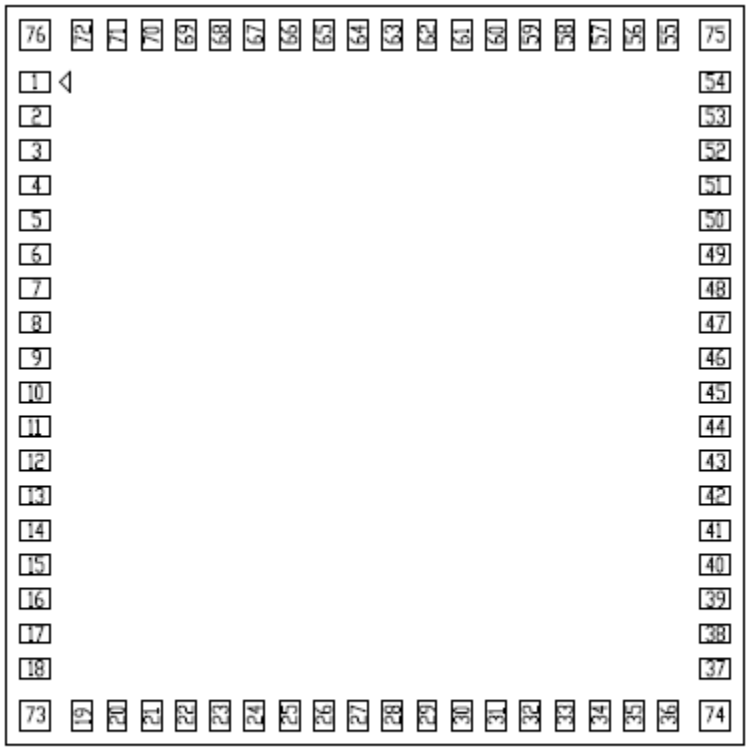
1.3.4 Operating Conditions

Features	Description
Operating Conditions	
Voltage	3.3V +-5%
Operating Temperature	0 ºC to +70 ºC
Operating Humidity	less than 85% R.H.
Storage Temperature	-40 ºC to +125 ºC
Storage Humidity	less than 60% R.H.
ESD Protection	
Human Body Model	+-2kV
Changed Device Model	+-500V

2. Pin Definition

2.1 Pin Map

AW-AM457-D pin out drawing (top view).



PIN DEFINED (TOP VIEW)

2.2 Pin Table

Pin No	Definition	Basic Description	Voltage	Type
1	NC	Floating Pin, No connect to anything.	---	Floating
2	NC	Floating Pin, No connect to anything.	---	Floating
3	WCI_SOUT	WCI interface serial output pin, for coexistence with LTE, 802.15.4 radio, or other external radios	1.8V	O
4	WCI_SIN	WCI interface serial input pin, for coexistence with LTE, 802.15.4 radio, or other external radios	1.8V	I
5	NC	Floating Pin, No connect to anything.	---	Floating
6	GND	Ground	---	---
7	SLP_CLK_IN	External Low Power Clock input (32.768KHz)	1.8V	I
8	GND	Ground	---	---
9	GPIO[1]	GPIO Mode : GPIO[1]/WiFi to Host Wake	VDDIO	I/O
10	GPIO[4]	GPIO Mode : GPIO[4]/PCM_DOUT	VDDIO	I/O
11	GPIO[5]	GPIO Mode : GPIO[5]/PCM_DIN	VDDIO	I/O
12	GPIO[6]	GPIO Mode : GPIO[6]/PCM_CLK	VDDIO	I/O
13	GPIO[7]	GPIO Mode : GPIO[7]/PCM_SYNC	VDDIO	I/O
14	GND	Ground	---	---
15	3V3	3.3V power voltage source input	3.3V	P
16	3V3	3.3V power voltage source input	3.3V	P
17	GND	Ground	---	---
18	Reserved	Reserved(Do not connect to anything)	---	Floating
19	Reserved	Reserved(Do not connect to anything)	---	Floating
20	NC	Floating Pin, No connect to anything.	---	Floating
21	1V8_IN	AVDD18 input	1.8V	P
22	VIO	1.8V/3.3V Digital I/O Power Supply	1.8V/3.3V	P
23	GND	Ground	---	---
24	GND	Ground	---	---
25	NC	Floating Pin, No connect to anything.	---	Floating
26	NC	Floating Pin, No connect to anything.	---	Floating
27	NC	Floating Pin, No connect to anything.	---	Floating
28	NC	Floating Pin, No connect to anything.	---	Floating
29	PDn	Full Power-down input pin (active low) 0 = full power-down mode 1 = normal mode	1.8V	I
30	SDIO_DATA_CMD	SDIO Command	VIO_SD	I/O
31	GND	Ground	---	---
32	SDIO_DATA_CLK	SDIO Clock input	VIO_SD	I
33	SDIO_DATA_0	SDIO Data line Bit[0]	VIO_SD	I/O
34	SDIO_DATA_1	SDIO Data line Bit[1]	VIO_SD	I/O
35	SDIO_DATA_2	SDIO Data line Bit[2]	VIO_SD	I/O
36	SDIO_DATA_3	SDIO Data line Bit[3]	VIO_SD	I/O
37	VIO_SD	1.8V/3.3V SDIO Power Supply	1.8V/3.3V	P

38	GND	Ground	---	---
39	Reserved	Reserved(Do not connect to anything)	---	Floating
40	Reserved	Reserved(Do not connect to anything)	---	Floating
41	GND	Ground	---	---
42	UART_RX	UART SIN pin	VDDIO	I
43	UART_TX	UART SOUT.pin	VDDIO	O
44	UART_RTSn	UART Mode: UART_RTSn (output) (active low)	VDDIO	O
45	UART_CTSn	UART Mode: UART_CTSn input pin (active low)	VDDIO	I
46	GPIO[3]	GPIO Mode : GPIO[3]/JTAG_TDO	VDDIO	I/O
47	GPIO[2]	GPIO Mode : GPIO[2]/JTAG_TDI	VDDIO	I/O
48	GPIO[14]	GPIO Mode : GPIO[14]/JTAG_TCK	VDDIO	I/O
49	GPIO[15]	GPIO Mode : GPIO[15]/JTAG_TMS	VDDIO	I/O
50	GPIO[12]	GPIO Mode : GPIO[12]/Host to BT Wake	VDDIO	I/O
51	GPIO[0]	GPIO Mode : GPIO[0].	VDDIO	I/O
52	GPIO[13]	GPIO Mode : GPIO[13]/Host to WiFi Wake	VDDIO	I/O
53	CON[0]	Firmware Boot Options for Host interface. See below table*	3.3V	I
54	CON[1]	Firmware Boot Options for Host interface. See below table*	3.3V	I
55	GND	Ground	---	---
56	BT_ANT	BT RF pin	---	I/O
57	GND	Ground	---	---
58	GND	Ground	---	---
59	NC	Floating Pin, No connect to anything.	---	Floating
60	NC	Floating Pin, No connect to anything.	---	Floating
61	NC	Floating Pin, No connect to anything.	---	Floating
62	NC	Floating Pin, No connect to anything.	---	Floating
63	NC	Floating Pin, No connect to anything.	---	Floating
64	NC	Floating Pin, No connect to anything.	---	Floating
65	NC	Floating Pin, No connect to anything.	---	Floating
66	NC	Floating Pin, No connect to anything.	---	Floating
67	NC	Floating Pin, No connect to anything.	---	Floating
68	NC	Floating Pin, No connect to anything.	---	Floating
69	GND	Ground	---	---
70	GND	Ground	---	---
71	WL_ANT	WLAN RF pin	---	I/O
72	GND	Ground	---	---
73	GND	Ground	---	---
74	GND	Ground	---	---
75	GND	Ground	---	---
76	GND	Ground	---	---

*Firmware Boot options for Host Interface

Strap Value [1:0]	WLAN	Bluetooth/LE	Firmware Download	Firmware Download Mode	Number of SDIO Functions
10	SDIO	UART	SDIO+UART	Parallel	1(WLAN)

3. Electrical Characteristics

3.1 Absolute Maximum Ratings

Symbol	Parameter	Minimum	Typical	Maximum	Unit
3V3	DC supply for the 3.3V input	-	3.3	3.96	V
VIO	I/O power supply	-	3.3	4.0	V
		-	1.8	2.2	
VIO_SD	SDIO power supply	-	3.3	4.0	V
		-	1.8	2.2	

3.2 Recommended Operating Conditions

Symbol	Parameter	Minimum	Typical	Maximum	Unit
3.3V	DC supply for the 3.3V input	3.14	3.3	3.46	V
VIO	1.8V/3.3V digital I/O power supply	2.97	3.3	3.47	V
		1.62	1.8	1.98	
VIO_SD	1.8V/3.3V SDIO power supply	2.97	3.3	3.47	V
		1.62	1.8	1.98	

3.3 Digital IO Pin DC Characteristics

3.3.1 1.8V Operation (VIO)

Symbol	Parameter	Minimum	Typical	Maximum	Unit
V_{IH}	Input high voltage	0.7*VIO	-	VIO+0.4	V
V_{IL}	Input low voltage	-0.4	-	0.3*VIO	
V_{OH}	Output high voltage	VIO-0.4	-	-	
V_{OL}	Output low voltage	-	-	0.4	
V_{HYS}	Input Hysteresis	100			mV

3.3.2 3.3V Operation (VIO)

Symbol	Parameter	Minimum	Typical	Maximum	Unit
V_{IH}	Input high voltage	0.7*VIO	-	VIO+0.4	V
V_{IL}	Input low voltage	-0.4	-	0.3*VIO	
V_{OH}	Output High Voltage	VIO-0.4	-	-	
V_{OL}	Output Low Voltage	-	-	0.4	
V_{HYS}	Input Hysteresis	100			mV

3.3.3 1.8V Operation (VIO_SD)

Symbol	Parameter	Minimum	Typical	Maximum	Unit
V_{IH}	Input high voltage	0.7*VIO_SD	-	VIO_SD+0.4	V
V_{IL}	Input low voltage	-0.4	-	0.3*VIO_SD	
V_{OH}	Output High Voltage	VIO_SD-0.4	-	-	
V_{OL}	Output Low Voltage	-	-	0.4	
V_{HYS}	Input Hysteresis	100			mV

3.3.4 3.3V Operation (VIO_SD)

Symbol	Parameter	Minimum	Typical	Maximum	Unit
V_{IH}	Input high voltage	0.7*VIO_SD	-	VIO_SD+0.4	V
V_{IL}	Input low voltage	-0.4	-	0.3* VIO_SD	
V_{OH}	Output High Voltage	VIO_SD-0.4	-	-	
V_{OL}	Output Low Voltage	-	-	0.4	
V_{HYS}	Input Hysteresis	100			mV

3.4 Host Interface

3.4.1 SDIO Interface

The AW-AM457-D supports a SDIO device interface that conforms to the industry SDIO Full-Speed card specification and allows a host controller using the SDIO bus protocol to access the Wireless SoC device.

The AW-AM457-D acts as the device on the SDIO bus. The host unit can access registers of the SDIO interface directly and can access shared memory in the frvice through the use of BARs and a DMA engine.

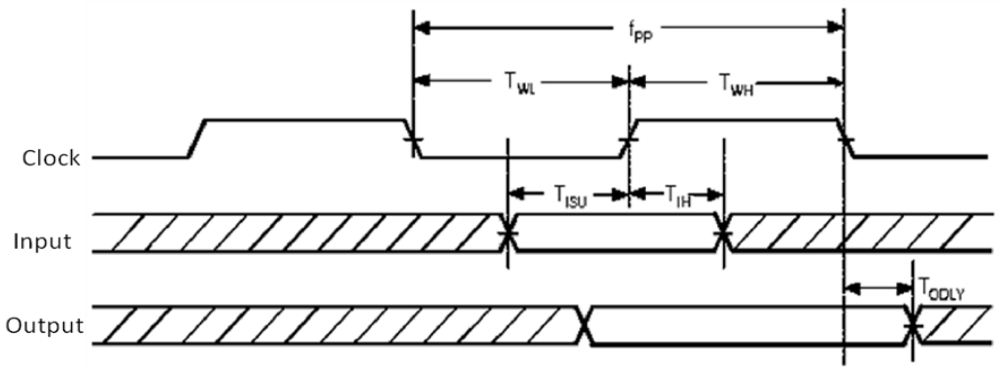
- Support SDIO 3.0 Standard.
- On-chip memory used for CIS.
- Supports 4-bit SDIO and 1-bit SDIO transfer modes.
- Special interrupt register for information exchange.
- Allows card to interrupt host.

SDIO Interface Signals

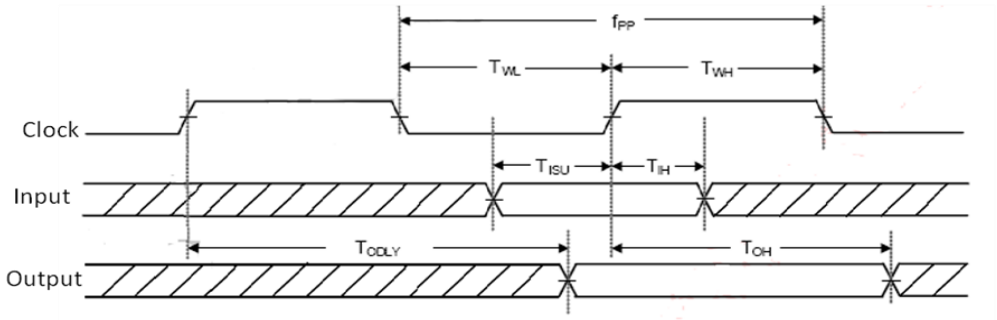
AW-AM457-D SDIO Pin Name	Type	Description
SDIO_DATA_CLK	I	SDIO 4-bit mode: Clock SDIO 1-bit mode: Clock
SDIO_DATA_CMD	I/O	SDIO 4-bit mode: Command line SDIO 1-bit mode: Command line
SDIO_DATA_3	I/O	SDIO 4-bit mode: Data line Bit[3] SDIO 1-bit mode: Not used
SDIO_DATA_2	I/O	SDIO 4-bit mode: Data line Bit[2] or Read Wait (optional) SDIO 1-bit mode: Read Wait (optional)
SDIO_DATA_1	I/O	SDIO 4-bit mode: Data line Bit[1] SDIO 1-bit mode: Interrupt
SDIO_DATA_0	I/O	SDIO 4-bit mode: Data line Bit[0] SDIO 1-bit mode: Data line

3.4.2 SDIO Protocol Timing

3.4.2.1 Default Speed, High-Speed Modes (3.3V)



SDIO protocol timing Diagram - Default mode. (3.3V)

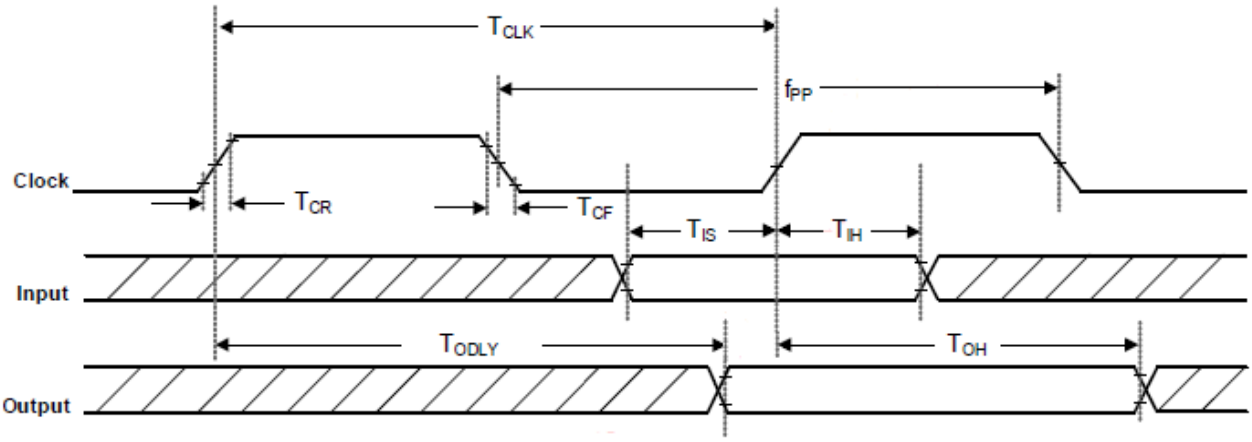


SDIO protocol timing Diagram - High Speed mode. (3.3V)

Symbol	Parameter	Condition	Min	Typ	Max	Units
fpp	CLK Frequency	Normal	0	--	25	MHz
		High Speed	0	--	50	MHz
T_{WH}	CLK High Time	Normal	10	--	--	ns
		High Speed	7	--	--	ns
T_{WL}	CLK Low Time	Normal	10	--	--	ns
		High Speed	7	--	--	ns
T_{ISU}	Input Setup Time	Normal	5	--	--	ns
		High Speed	6	--	--	ns
T_{IH}	Input Hold Time	Normal	5	--	--	ns
		High Speed	2	--	--	ns
T_{ODLY}	Output Delay Time	Normal	--	--	14	ns
	CL ≦ 40pF (1 card)	High Speed	--	--	14	ns
T_{OH}	Output Hold Time	High Speed	2.5	--	--	ns

SDIO Timing Data – Default Speed / High-Speed modes. (3.3V)

3.4.2.2 SDR12, SDR25, SDR50 Modes (up to 100MHz) (1.8V)

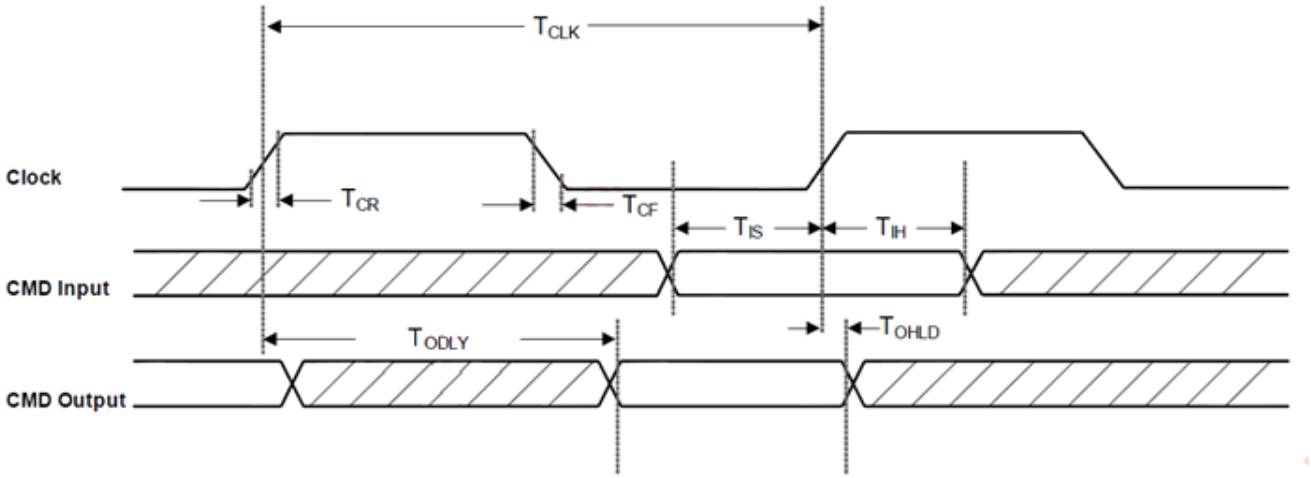


SDIO Protocol Timing Diagram - SDR12, SDR25, SDR50 Modes (up to 100 MHz)(1.8V)

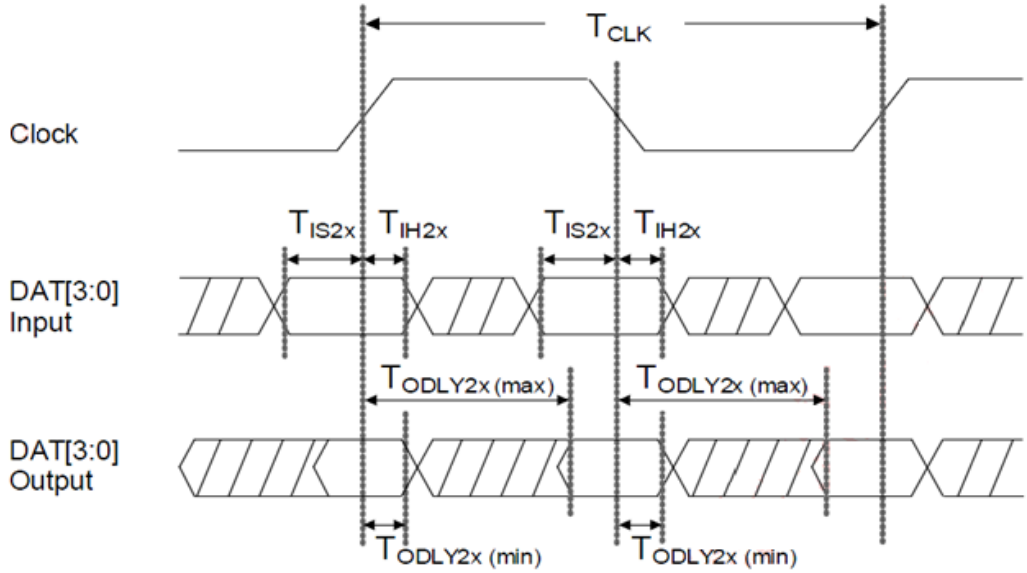
Symbol	Parameter	Condition	Min	Typ	Max	Units
F_{pp}	CLK Frequency	SDR12/25/50	25	-	100	MHz
T_{CLK}	Clock Time	SDR12/25/50	10	-	40	ns
T_{IS}	Input Setup Time	SDR12/25/50	3	-	-	ns
T_{IH}	Input Hold Time	SDR12/25/50	0.8	-	-	ns
T_{CR} ,T_{CF}	Rise time, fail time TCR ,TCF <2ns(max) at 100MHz CCARD =10pF	SDR12/25/50	-	-	0.2*T_{CLK}	ns
T_{ODLY}	Output Delay Time CL ≦ 30pF	SDR12/25/50	-	-	7.5	ns
T_{OH}	Output Hold Time CL =15pF	SDR12/25/50	1.5	-	-	ns

SDIO Timing Data - SDR12/25/50 modes. (1.8V)

3.4.2.3 DDR50 Mode (50MHz) (1.8V)



SDIO CMD Timing Diagram - DDR50 Mode (50 MHz)



SDIO DAT[3:0] Timing Diagram - DDR50 Mode[1] (50 MHz)

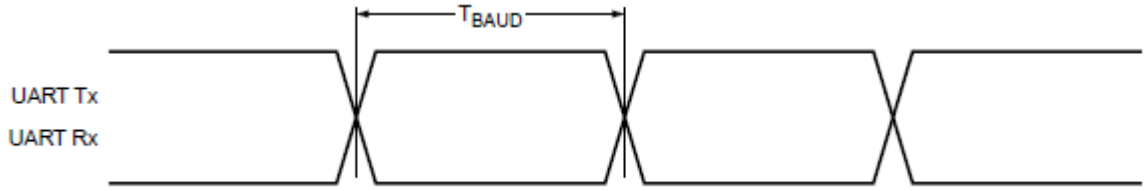
[1] In DDR50 mode, DAT[3:0] lines are sampled on both edges of the clock (not applicable for CMD line).

Symbol	Parameter	Condition	Min	Typ	Max	Units
Clock						
T_{CLK}	Clock time	DDR50	20	-	-	ns
T_{CR}, T_{CF}	Rise time, fall time	DDR50	-	-	0.2*T_{CLK}	Ns
Clock Duty		DDR50	45	-	55	%
CMD Input						
T_{IS}	Input setup time	DDR50	6	-	-	ns
T_{IH}	Input hold time	DDR50	0.8	-	-	ns
CMD Output						
T_{ODLY}	Output delay time during data transfer mode	DDR50	-	-	13.7	ns
T_{OHLD}	Output hold time	DDR50	1.5	-	-	ns
DAT [3:0] Input						
T_{IS2X}	Input setup time	DDR50	3	-	-	ns
T_{IH2X}	Input hold time	DDR50	0.8	-	-	ns
DAT [3:0] Output						
$T_{ODLY2X(max)}$	Output delay time during data transfer mode	DDR50	-	-	7	ns
$T_{ODLY2X(min)}$	Output hold time	DDR50	1.5	-	-	ns

SDIO Timing Data - DDR50 Mode (50MHz)

3.4.3.High-Speed UART Interface

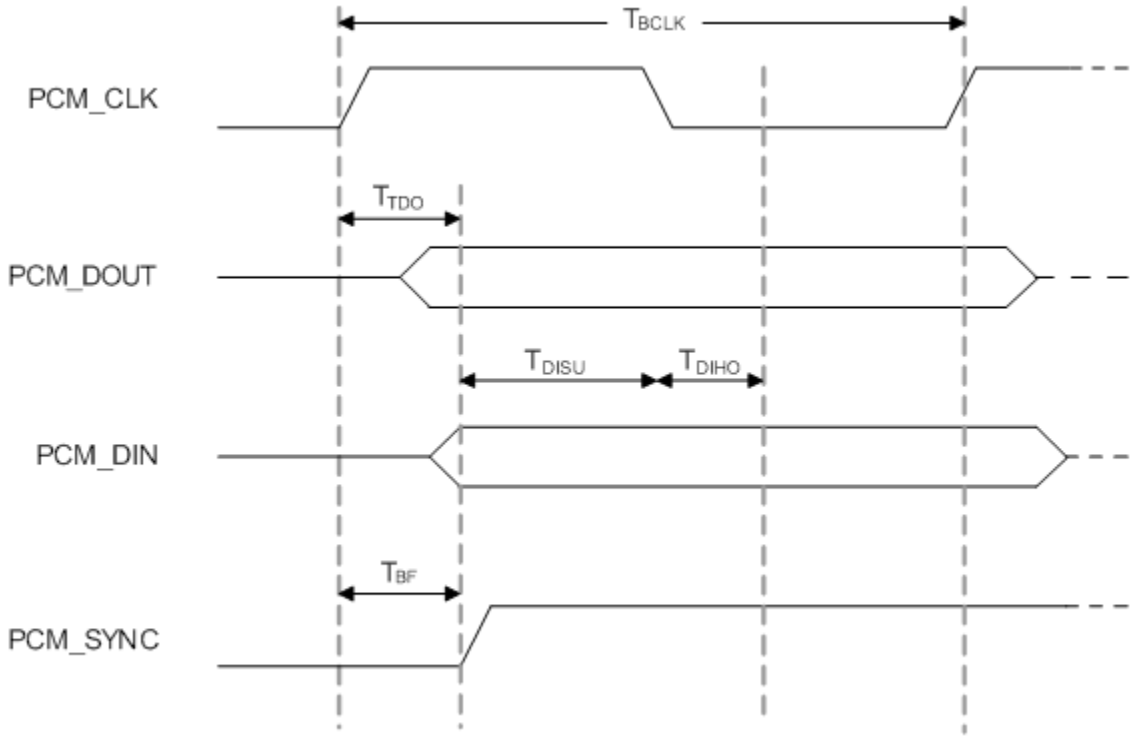
The AW-AM457-D supports a high-speed Universal Asynchronous Receiver/Transmitter (UART) interface, compliant to the industry standard 16550 specification. High-speed baud rates are supported to provide the physical transport between the device and the host for exchanging Bluetooth data.



Symbol	Parameter	Condition	Min	Typ	Max	Units
T_{BAUD}	Baud rate	26MHz input clock	250	-	-	ns

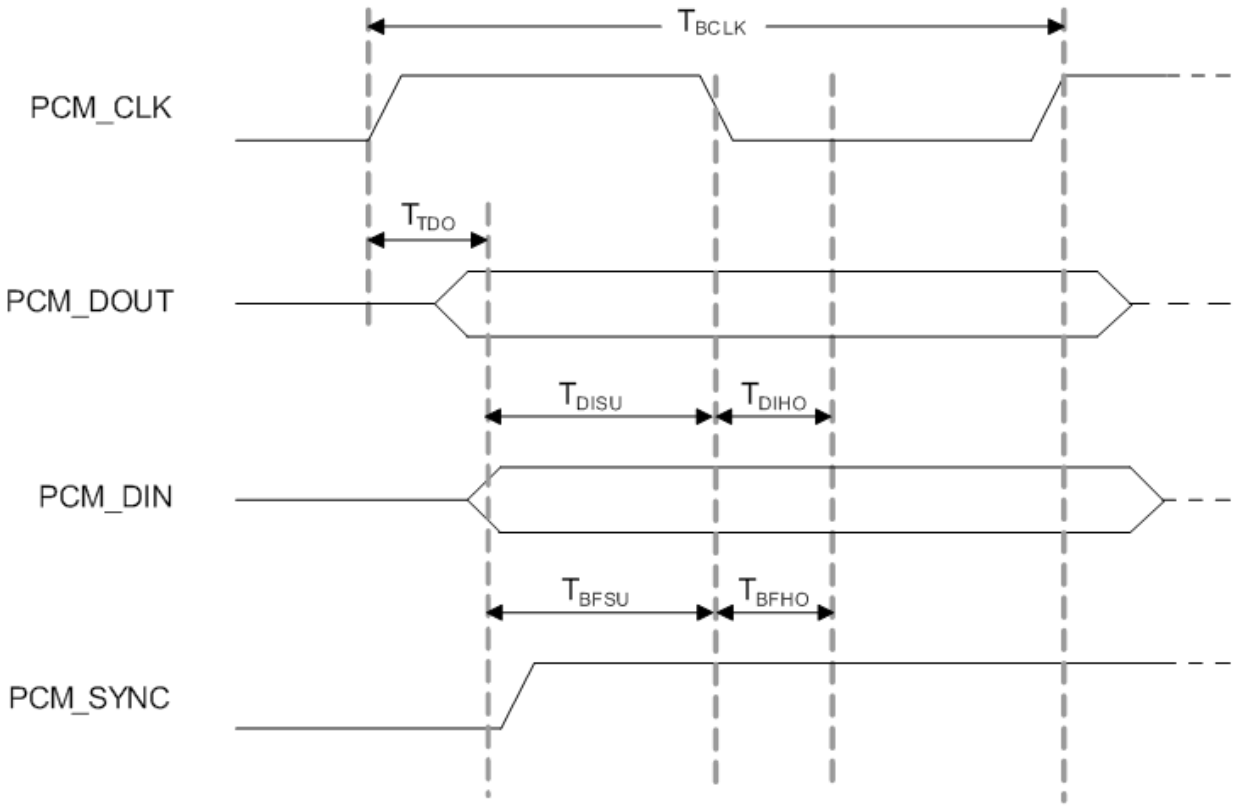
3.4.4 PCM Interface

3.4.4.1 PCM Timing Specification – Master Mode



Symbol	Parameter	Condition	Min	Typ	Max	Units
F_{BCLK}	--	--	--	2/2.048	--	MHz
Duty Cycle$_{BCLK}$	--	--	0.4	0.5	0.6	--
$T_{BCLK\ rise/fall}$	--	--	--	3	--	ns
T_{DO}	--	--	--	--	15	ns
T_{DISU}	--	--	20	--	--	ns
T_{DIHO}	--	--	15	--	--	ns
T_{BF}	--	--	--	--	15	ns

3.4.4.2 PCM Timing Specification – Slave Mode

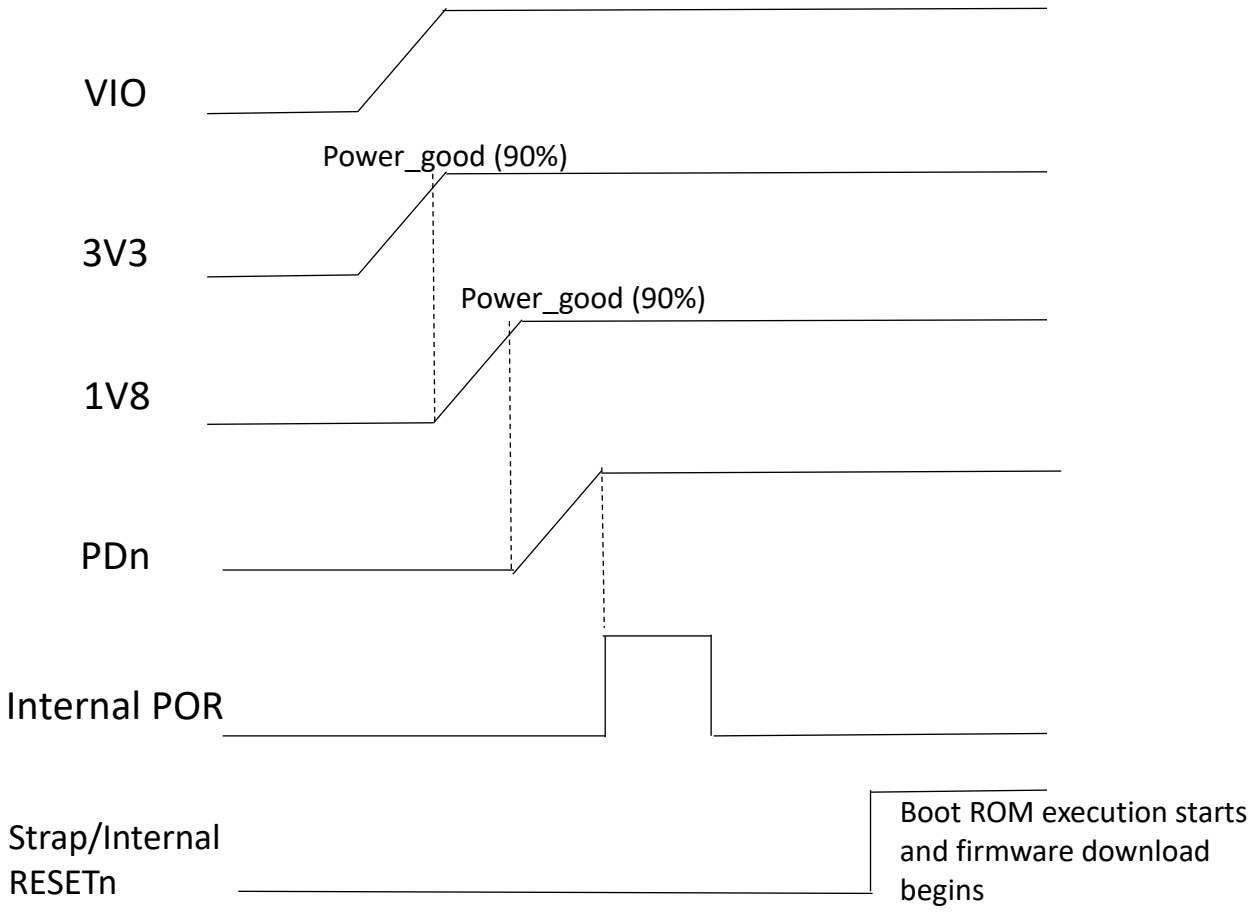


Symbol	Parameter	Condition	Min	Typ	Max	Units
F_{BCLK}	--	--	--	2/2.048	--	MHz
Duty $Cycle_{BCLK}$	--	--	0.4	0.5	0.6	--
$T_{BCLK\ rise/fall}$	--	--	--	3	--	ns
T_{DO}	--	--	--	--	30	ns
T_{DISU}	--	--	15	--	--	ns
T_{DIHO}	--	--	10	--	--	ns
T_{BFSU}	--	--	15	--	--	ns
T_{BFHO}			10		--	ns

3.5 Timing Sequence

AW-AM457-D power up timing sequence.

- VDD33 must be good (90%) before +1.8V starts ramping up.
- +1.8Vmust be good (90%) before PDn starts ramping up.



3.6 Power Consumption

3.6.1 WLAN

Test Condition

1. All results are with the **Bluetooth off** .(hciconfig hci0 down)
2. All results are run to **take 3 minutes** then record the test **average** and maximum value.

No.	Item			VDD=3.3 V	
				Max.	Avg.
1	WLAN OFF *(1)			535.8uA	524.2uA
2	Sleep *(3)			590.8uA	576.0uA
3	Power Save DTIM1 (2.4GHz) *(4) (6)			580.5uA	529.3uA
4	Power Save DTIM3 (2.4GHz) *(5) (6)			581.4uA	529.2uA
5	Power Save DTIM1 (5GHz) *(4) (6)			563.7uA	530.8uA
6	Power Save DTIM3 (5GHz) *(5) (6)			614.2uA	529.0uA

No.	Item			VDD=3.3 V		
				Max.	Avg.	
Band (GHz)	Mode	BW (MHz)	RF Power (dBm)	Transmit		
				Max.	Avg.	Duty (%)
2.4	11b@1Mbps	20	17	181.3mA	179.5mA	99 %
	11g@54Mbps	20	16	142.6mA	142.4mA	81 %
	11n@MCS7	20	14	120.2mA	119.7mA	76 %
	11n@MCS7	40	14	111.6mA	111.2mA	64 %
5	11a@54Mbps	20	16	175.1mA	174.5mA	78 %
	11n@MCS7	20	15	158.7mA	158.6mA	79 %
	11n@MCS7	40	14	128.1mA	128.0mA	66%

Band (GHz)	Mode	BW(MHz)	Receive	
			Max.	Avg.
2.4	11b@1Mbps	20	898.9uA	679.8uA
	11n@MCS7	20	942.3uA	679.9uA
5	11a@54Mbps	20	967.1uA	679.8uA
	11n@MCS7	20	905.2uA	680.3uA
	11n@MCS7	40	920.4uA	680.3uA

No.	Item	VIO=3.3 V	
		Max.	Avg.
1	WLAN OFF *(1)	4.43uA	3.85uA
2	Sleep *(3)	43.1uA	42.4uA
3	Power Save DTIM1 (2.4GHz) *(4) (6)	84.1uA	49.6uA
4	Power Save DTIM3 (2.4GHz) *(5) (6)	96.3uA	42.3uA
5	Power Save DTIM1 (5GHz) *(4) (6)	84.6uA	44.8uA
6	Power Save DTIM3 (5GHz) *(5) (6)	97.9uA	41.2uA

No.	Item			VIO=3.3 V		
				Max.		Avg.
Band (GHz)	Mode	BW (MHz)	RF Power (dBm)	Transmit		
				Max.	Avg.	Duty (%)
2.4	11b@1Mbps	20	17	163.6uA	137.8uA	68 %
	11g@54Mbps	20	16	159.8uA	137.0uA	60 %
	11n@MCS7	20	14	164.9uA	135.7uA	68 %
	11n@MCS7	40	14	155.7A	135.6uA	64 %
5	11a@54Mbps	20	16	161.5uA	139.4uA	60 %
	11n@MCS7	20	15	161.0uA	139.3uA	67 %
	11n@MCS7	40	14	159.5uA	138.4uA	61 %
Band (GHz)	Mode	BW(MHz)		Receive		
				Max.		Avg.
2.4	11b@1Mbps	20		148.6uA		130.5uA
	11n@MCS7	20		157.9uA		131.0uA
5	11a@54Mbps	20		156.8uA		131.6uA
	11n@MCS7	20		162.2uA		131.4uA
	11n@MCS7	40		157.5uA		132.4uA

No.	Item	VIO SD=3.3 V	
		Max.	Avg.
1	PDN *(1)	4.23mA	4.20mA
2	Sleep *(2) (3)	4.33mA	4.20mA
3	Power Save DTIM 1 (2.4GHz)* (3) (4)	4.24mA	4.21mA
4	Power Save DTIM 3 (2.4GHz)* (3) (4)	4.25mA	4.21mA
5	Power Save DTIM 1 (5 GHz)* (3) (4)	4.26mA	4.21mA
6	Power Save DTIM 3 (5 GHz)* (3) (4)	4.28mA	4.21mA

No.	Item			VIO SD=3.3 V		
				Max.		Avg.
Band (GHz)	Mode	BW (MHz)	RF Power (dBm)	Transmit		
				Max.	Avg.	Duty (%)
2.4	11b@1Mbps	20	17	4.22mA	4.22mA	64 %
	11g@54Mbps	20	16	4.22mA	4.22mA	66 %
	11n@MCS7	20	14	4.22mA	4.22mA	63 %
	11n@MCS7	40	14	4.22mA	4.21mA	64 %
5	11a@54Mbps	20	16	4.22mA	4.22mA	66 %
	11n@MCS7	20	15	4.22mA	4.22mA	69 %
	11n@MCS7	40	14	4.22mA	4.22mA	51 %
Band	Mode	BW(MHz)		Receive		

(GHz)			Max.	Avg.
2.4	11b@1Mbps	20	4.21mA	4.21mA
	11n@MCS7	20	4.21mA	4.21mA
5	11a@54Mbps	20	4.22mA	4.21mA
	11n@MCS7	20	4.21mA	4.21mA
	11n@MCS7	40	4.21mA	4.21mA

No.	Item	VDD=1.8 V	
		Max.	Avg.
1	PDN *(1)	158.8uA	142.7uA
2	Sleep *(2) (3)	604.1uA	580.5uA
3	Power Save DTIM 1 (2.4GHz)* (3) (4)	75.4mA	3.4mA
4	Power Save DTIM 3 (2.4GHz)* (3) (4)	67.2mA	1.5mA
5	Power Save DTIM 1 (5 GHz)* (3) (4)	68.1mA	864.7uA
6	Power Save DTIM 3 (5 GHz)* (3) (4)	67.7mA	1.1mA

No.	Item			VDD=1.8 V		
				Max.	Avg.	
Band (GHz)	Mode	BW (MHz)	RF Power (dBm)	Transmit		
				Max.	Avg.	Duty (%)
2.4	11b@1Mbps	20	17	223.5 mA	215.5 mA	99%
	11g@54Mbps	20	16	221.5 mA	221.2 mA	88%
	11n@MCS7	20	14	219.5 mA	219.3 mA	85%
	11n@MCS7	40	14	221.1 mA	220.9 mA	80%
5	11a@54Mbps	20	16	282.5 mA	282.2 mA	88%
	11n@MCS7	20	15	281.2 mA	280.7 mA	87%
	11n@MCS7	40	14	278.2 mA	277.9 mA	80%

Band (GHz)	Mode	BW(MHz)	Receive	
			Max.	Avg.
2.4	11b@1Mbps	20	73.0 mA	72.9 mA
	11n@MCS7	20	72.6mA	72.5mA
5	11a@54Mbps	20	75.7 mA	75.6 mA
	11n@MCS7	20	97.8 mA	96.2mA
	11n@MCS7	40	95.6mA	95.4mA

3.6.2 Bluetooth

Test Condition

1. The Bluetooth is in **test mode** run transmit or receive with a specified output power measure current consumption.
2. All results are run to **take 3 minutes** then record the test **average** and maximum value.

Mode	Packet Type	RF Power (dBm)	VDD=3.3 V		VDD=1.8V		VIO=3.3V		VIO SD=3.3V	
			Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.
Sleep	N/A	N/A	641.1uA	630.5uA	12.9mA	12.6mA	125.4uA	115.uA	4.33mA	4.21mA
Transmit	DH5	1.1	691.9uA	681.6uA	38.9mA	31.8mA	149.0uA	141.1uA	4.19mA	4.18mA
Receive	3DH5	N/A	689.7uA	681.0uA	43.9mA	37.9mA	150.7uA	138.1uA	4.19mA	4.18mA

3.7 Sleep Clock

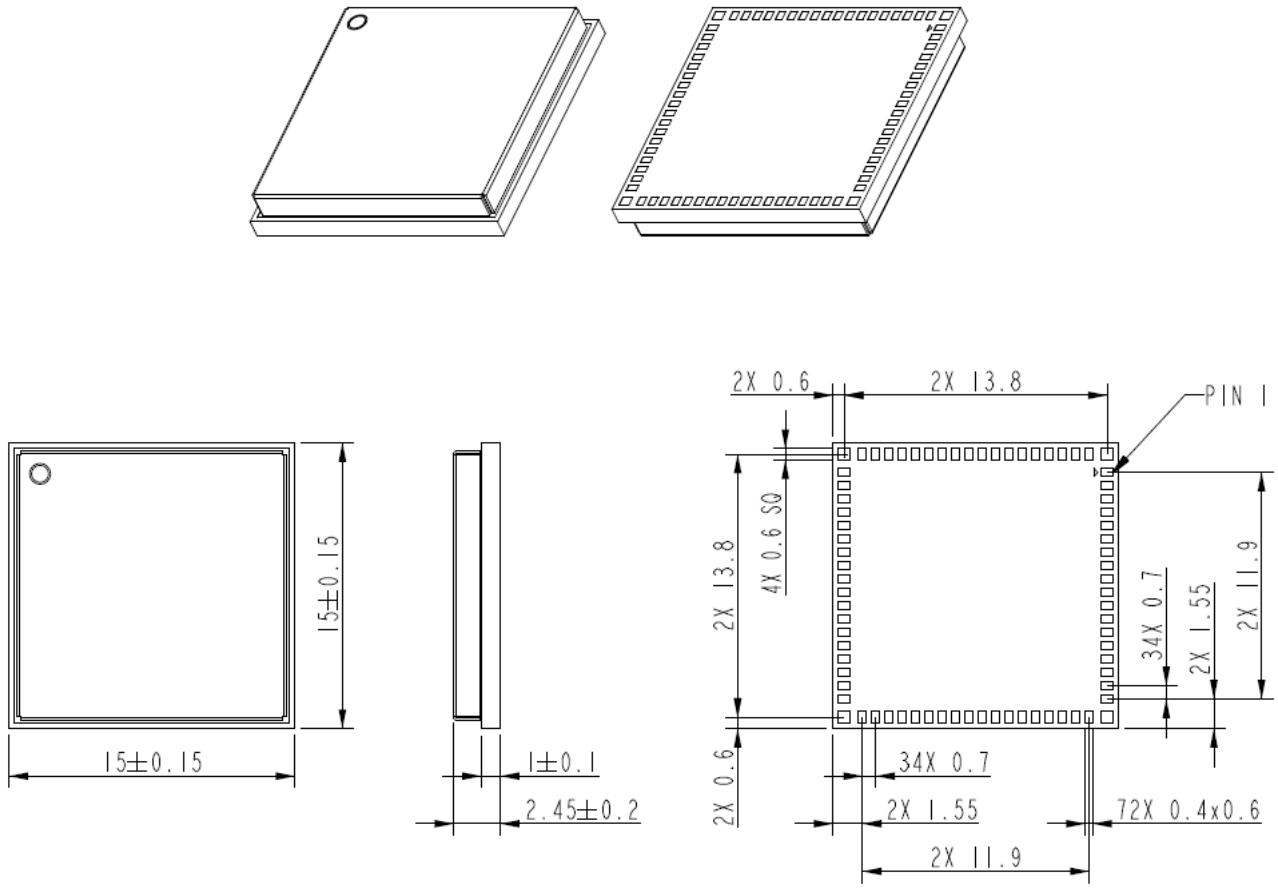
An external crystal is used for generating all radio frequencies and normal operation clocking. As an alternative, an external frequency reference driven by a temperature-compensated crystal oscillator (TCXO) signal may be used. No software settings are required to differentiate between the two. In addition, a low-power oscillator (LPO) is provided for lower power mode timing.

External 32.768KHz Low-Power Oscillator

Symbol	Parameter	Min	Typ	Max	Units
CLK	Clock frequency range/ accuracy ■ CMOS input clock signal type ■ ±250 ppm (initial, aging, temperature)	-	32.768	-	kHz
PN	Phase noise requirement (@ 100KHz)	-	-125	-	dBc/Hz
J_C	Cycle jitter	-	1.5	-	ns (RMS)
SR	Slew rate limit (10-90%)	-	-	100	ns
DC	Duty cycle tolerance	20	-	80	%

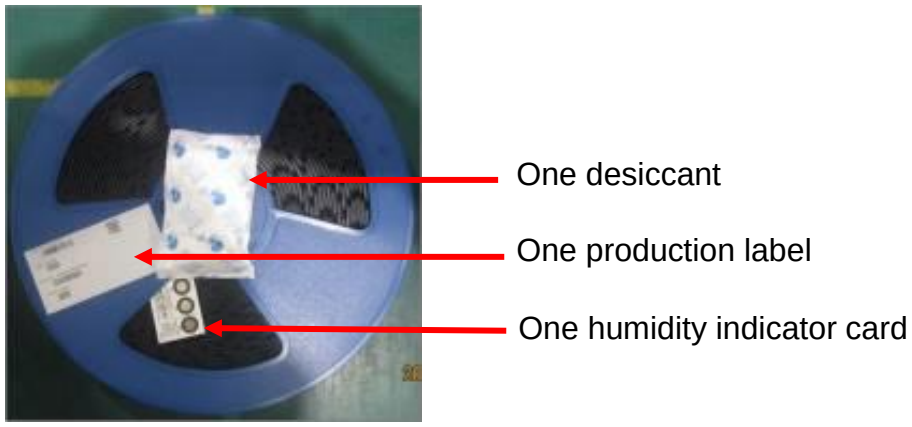
4. Mechanical Information

4.1 Mechanical Drawing

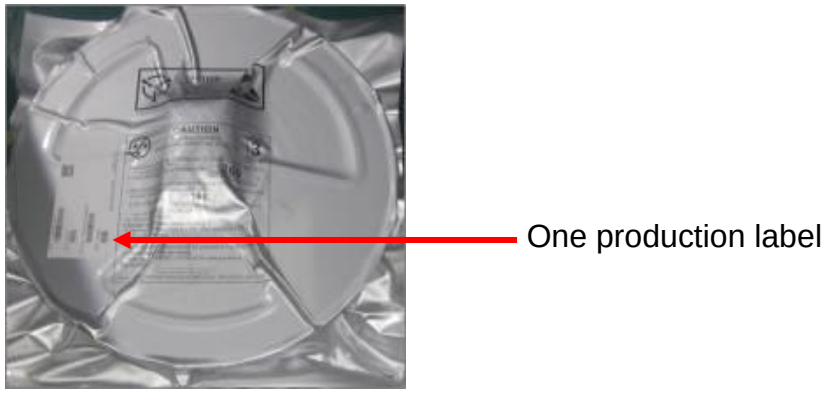


5. Packing Information

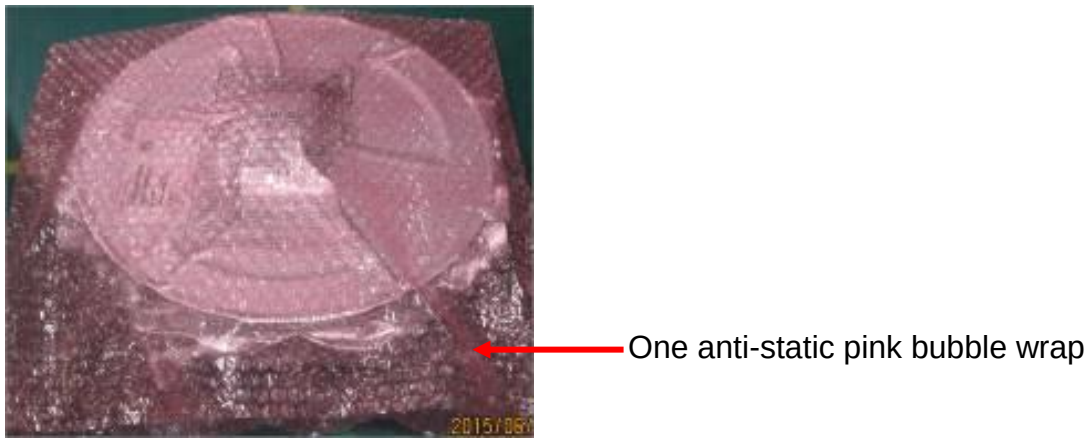
1. One reel can pack 750pcs modules
2. One production label is pasted on the reel, one desiccant and one humidity indicator card are put on the reel



3. One reel is put into the anti-static moisture barrier bag, and then one label is pasted on the bag



4. A bag is put into the anti-static pink bubble wrap



5. A bubble wrap is put into the inner box and then one label is pasted on the inner box

One production label

6. 4 inner boxes could be put into one carton

7. Sealing the carton by AzureWave tape

8. One carton label and one box label are pasted on the carton. If one carton is not full, one balance label pasted on the carton

One carton label

One box label

Example of carton label	AzureWave AzureWave P/N: 2-XXXXX-XXX Customer: 由業務提供 Customer P/N: 由業務提供 Customer P/O: 由業務提供 Description: AW-XXXXXX Q'ty: 依照實際出貨數量 C/N: N.W.: G.W. RoHS HF Made in China
Example of box label	2-XXXXX-XXX BOX0275351 数量：XXX XXXXXX 股份有限公司

Example of production label	
Example of balance label	

Note:

- **1 reel = 1 inner box = 750pcs**
- **1 carton = 4 inner boxes = 4 * 750pcs = 3,000pcs**