

# **AW- CM276NF**

## **IEEE 802.11a/b/g/n/ac Wireless LAN 2T2R and Bluetooth 5.0 Combo Module (M.2 1216)**

### **Datasheet**

**Rev. E**

**0B**

**(For Standard)**

## Features

### WiFi

- PCIe M.2 TYPE 1216: 16mm(L) x 12mm(W) x 1.85 mm(H)(Max)
- SDIO 3.0, PCIe, USB 3.0/2.0 interfaces support for WLAN
- Sub-meter accuracy WiFi indoor locationing(802.11mc)
- Multiple power saving modes for low power consumption
- IEEE 802.11i for advanced security
- Quality of Service (QoS) support for multimedia applications
- Support China WAPI
- Lead-free design

### Bluetooth

- USB 3.0/2.0, SDIO3.0, UART interfaces support for Bluetooth
- High speed UART,PCM interfaces
- Audio Codec interface support
- Bluetooth 5.0 compliant with Bluetooth 2.1 + Enhanced Data Rate (EDR)



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## 1. Introduction

### 1.1 Product Overview

**AzureWave Technologies, Inc.** introduces the IEEE 802.11ac/a/b/g/n 2X2 MU-MIMO WLAN & Bluetooth NGFF module --- **AW-CM276NF**. The module is targeted to mobile devices including **Notebook, TV, Tablet and Gaming Device** which need small package module, low power consumption, multiple interfaces and OS support. By using AW-CM276NF, 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**.

Compliance with the IEEE 802.11ac/a/b/g/n standard supporting 802.11ac Wave 2, the AW-CM276NF uses Direct Sequence Spread Spectrum (**DSSS**), Orthogonal Frequency Division Multiplexing (**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-CM276NF. In addition to the support of **WPA/WPA2/WPA3** and **WEP** 64-bit and 128-bit encryption, the AW-CM276NF also supports the **IEEE 802.11i** security standard through the implementation of **Advanced Encryption Standard (AES)/Counter Mode CBC-MAC Protocol (CCMP)**, Wired Equivalent Privacy (**WEP**) with Temporal Key Integrity Protocol (**TKIP**), Advanced Encryption Standard (**AES**)/Cipher-Based Message Authentication Code (**CMAC**), and WLAN Authentication and Privacy Infrastructure (**WAPI**) security mechanisms.

For the video, voice and multimedia applications the AW-CM276NF support **802.11e Quality of Service (QoS)**. The device also supports **802.11h Dynamic Frequency Selection (DFS)** for detecting radar pulses when operating in the 5GHz range.

For Bluetooth operation, AW-CM276NF is **Bluetooth 5.0 (supports Low Energy)**.

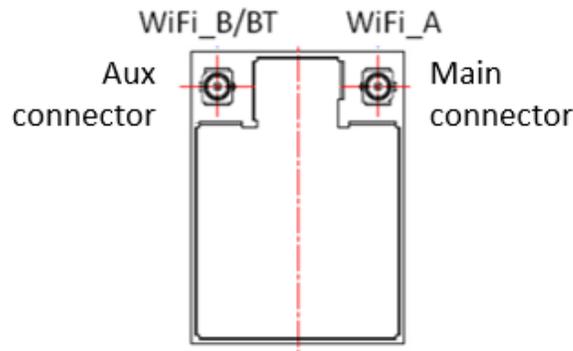
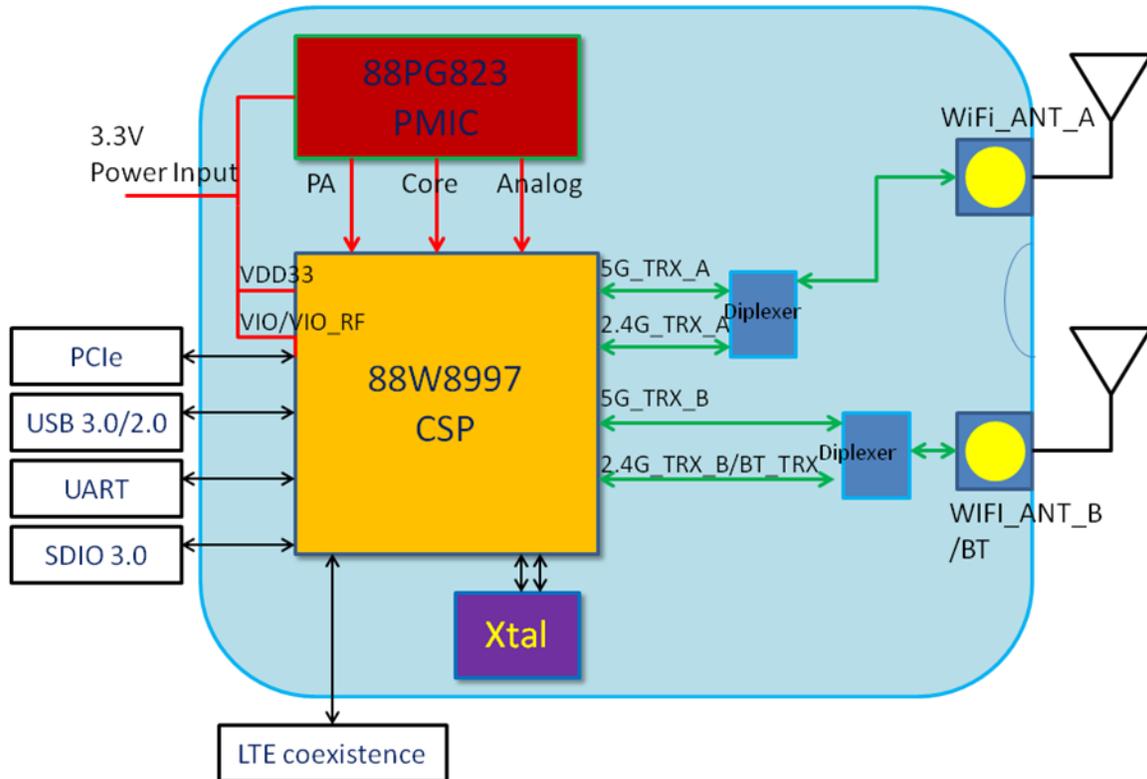
**AW-CM276NF** supports **PCIE, USB 3.0/2.0, SDIO3.0**, and high speed **UART interfaces** for WLAN and Bluetooth to the host processor.

**AW-CM276NF** is suitable for multiple mobile processors for different applications with the support cellular phone co-existence.

**AW-CM276NF** module adopts Marvell's latest highly-integrated dual-band WLAN & Bluetooth SoC---**88W8997**. All the other components are implemented by all means to reach the mechanical specification required.

## 1.2. Block Diagram

### AW-CM276NF NGFF Module



**Module antenna configuration**

## 1.3 Specifications Table

### 1.3.1 General

Features	Description
Product Description	Wireless LAN 2T2R & Bluetooth Combo M.2 Module
Major Chipset	Marvell 88W8997
Host Interface	PCIe/SDIO/USB for WLAN, USB/SDIO/UART for Bluetooth
Dimension	12mm(W) x 16mm(L) x 1.85mm(H) (Tolerance remarked in mechanical drawing)
Package	M.2 1216
Antenna	I-PEX MHF4 Connector Receptacle (20449) ANTA : WiFi → TX/RX ANTB : WiFi/Bluetooth → TX/RX
Weight	0.5 g

### 1.3.2 WLAN

Features	Description
WLAN Standard	IEEE 802.11 a/b/g/n/ac
WLAN VID/PID	1B4B/2B42
Frequency Range	2.4 GHz : 2.412 ~ 2.484 GHz 5 GHz : 4.915 ~5.925GHz
Modulation	DSSS, OFDM, DBPSK, DQPSK, CCK, 16-QAM, 64-QAM, 256-QAM
Number of Channels	<b>2.4GHz</b> <ul style="list-style-type: none"> <li>■ USA, NORTH AMERICA, Canada and Taiwan – 1 ~ 11</li> <li>■ China, Australia, Most European Countries, Japan – 1 ~ 13</li> </ul> <b>5GHz</b> <ul style="list-style-type: none"> <li>■ USA, EUROPE –36,40,44,48,52,56,60,64,100,104,108,112,116,120, 124,128,132,136,140,149,153,157,161,165</li> </ul>

**Output Power  
(Board Level Limit)\***
**2.4GHz**

	Min	Typ	Max	Unit
11b (11Mbps) @EVM<35%	15.5	17	18.5	dBm
11g (54Mbps) @EVM $\leq$ -27 dB	14.5	16	17.5	dBm
11n (HT20 MCS7) @EVM $\leq$ -28 dB	14.5	16	17.5	dBm
11n (HT40 MCS7) @EVM $\leq$ -28 dB	12.5	14	15.5	dBm

**5GHz**

	Min	Typ	Max	Unit
11a (54Mbps) @EVM $\leq$ -27 dB	11	13	15	dBm
11n (HT20 MCS7) @EVM $\leq$ -28 dB	11	13	15	dBm
11n (HT40 MCS7) @EVM $\leq$ -28 dB	10	12	14	dBm
11ac (VHT20 MCS8) @EVM $\leq$ -30 dB	11	13	15	dBm
11ac (VHT40 MCS9) @EVM $\leq$ -32 dB	10	12	14	dBm
11ac (VHT80 MCS9) @EVM $\leq$ -32 dB	8	10	12	dBm

**Receiver Sensitivity**
**2.4GHz**

	Min	Typ	Max	Unit
11b (11Mbps)		-88	-85	dBm
11g (54Mbps)		-75	-72	dBm
11n (HT20 MCS7)		-72	-70	dBm
11n (HT40 MCS7)		-69	-67	dBm

**5GHz**

	Min	Typ	Max	Unit
11a (54Mbps)		-72	-68	dBm
11n (HT20 MCS7)		-70	-67	dBm
11n (HT40 MCS7)		-68	-65	dBm
11ac(VHT20 MCS8)		-65	-62	dBm
11ac(VHT40 MCS9)		-63	-60	dBm
11ac(VHT80 MCS9)		-60	-57	dBm

Data Rate	<ul style="list-style-type: none"> <li>■ 802.11b: 1, 2, 5.5, 11Mbps</li> <li>■ 802.11a/g: 6, 9, 12, 18, 24, 36, 48, 54Mbps</li> <li>■ 802.11n: up to 150Mbps-single</li> <li>■ 802.11n: up to 300Mbps-2x2 MIMO</li> <li>■ 802.11ac: up to 192.6Mbps (20MHz channel)</li> <li>■ 802.11ac: up to 400Mbps (40MHz channel)</li> <li>■ 802.11ac: up to 866.7Mbps (80MHz channel)</li> </ul>
Security	<ul style="list-style-type: none"> <li>■ WAPI</li> <li>■ WEP 64-bit and 128-bit encryption with H/W TKIP processing</li> <li>■ WPA/WPA2/WPA3 (Wi-Fi Protected Access)</li> <li>■ AES-CCMP hardware implementation as part of 802.11i security standard</li> </ul>

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

### 1.3.3 Bluetooth

Features	Description																				
Bluetooth Standard	Bluetooth 2.1 and 3.0+Enhanced Data Rate (EDR) + BT 5.0																				
Bluetooth VID/PID	1286/204E																				
Frequency Range	2402~2480MHz																				
Modulation	GFSK (1Mbps), $\pi/4$ DQPSK (2Mbps) and 8DPSK (3Mbps)																				
Output Power	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>Min</th> <th>Typ</th> <th>Max</th> <th>Unit</th> </tr> </thead> <tbody> <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>BLE</td> <td>0</td> <td>2</td> <td>4</td> <td>dBm</td> </tr> </tbody> </table>		Min	Typ	Max	Unit	BDR	0	2	4	dBm	EDR	0	2	4	dBm	BLE	0	2	4	dBm
	Min	Typ	Max	Unit																	
BDR	0	2	4	dBm																	
EDR	0	2	4	dBm																	
BLE	0	2	4	dBm																	
Receiver Sensitivity	BER < 0.1% <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>Min</th> <th>Typ</th> <th>Max</th> <th>Unit</th> </tr> </thead> <tbody> <tr> <td>BDR</td> <td></td> <td>-83</td> <td></td> <td>dBm</td> </tr> </tbody> </table>		Min	Typ	Max	Unit	BDR		-83		dBm										
	Min	Typ	Max	Unit																	
BDR		-83		dBm																	

### 1.3.4 Operating Conditions

Features	Description
Operating Conditions	
Voltage	Power supply for host:3.3V
Operating Temperature	-30~85 °C
Operating Humidity	less than 85% R.H.
Storage Temperature	-40~125 °C
Storage Humidity	less than 60% R.H.
ESD Protection	
Human Body Model	+/-2kV
Charged Device Model	+/-500V

## 2. Pin Definition

### 2.1. Pin map

	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77				
	GND(G1)	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND(G4)		
1	NC																					GND	76	
2	NC																						GND	75
3	NC																						GND	74
4	3.3V		GND(G5)		GND(G13)		GND(G21)		GND(G29)													VID	73	
5	3.3V																					3.3V	72	
6	GND																						GND	71
7	NC		GND(G6)		GND(G14)		GND(G22)		GND(G30)														USB_DP	70
8	CONFIG_HOST[0]																						USB_DM	69
9	CONFIG_HOST[1]																						GND	68
10	CONFIG_HOST[2]		GND(G7)		GND(G15)		GND(G23)		GND(G31)														NC	67
11	GPIO[17]UART_LTE_SOUT/TDO																						GPIO[15]TMS/Host Wake WLAN	66
12	GPIO[16]UART_LTE_SIN/TDI																						GPIO[3]BT_LED	65
13	CONFIG_HOST[3]		GND(G8)		GND(G16)		GND(G24)		GND(G32)														GPIO[2]WLAN_LED	64
14	NC																						GPIO[22]PCI_E_W_DISABLEn	63
15	GPIO[1]																						GND	62
16	NC																						GPIO[6]PCM_CLK	61
17	GND		GND(G9)																				GPIO[5]PCM_OUT	60
18	GPIO[25]																						GPIO[4]PCM_IN	59
19	NC																						GPIO[7]PCM_SYNC	58
20	GND		GND(G10)																				GPIO[11]UART_RTSn	57
21	GPIO[26]																						GPIO[9]UART_SIN	56
22	GPIO[27]																						GPIO[8]UART_SOUT	55
23	GND		GND(G11)		GND(G19)		GND(G27)		GND(G35)														GPIO[10]UART_CTSn	54
24	ATEST0																						GPIO[12]UARTHostWakeBT	53
25	NC																						SD_CLK	52
26	GND		GND(G12)		GND(G20)		GND(G28)		GND(G36)														SD_CMD	51
27	SLP_CLK																						SD_DAT[0]	50
28	GPIO[13]BT_IRQ[0]																						SD_DAT[1]	49
	GND(G2)	PCIE_WAKE <sub>n</sub>	PCIE_CLKREQ <sub>n</sub>	GPIO[21]/ PCIE_PERS <sub>Tn</sub>	GND	PCIE_RCLK_N	PCIE_RCLK_P	GND	PCIE_TX_N/ USB3.0_TX_N	PCIE_TX_P/ USB3.0_TX_P	GND	PCIE_RX_N/ USB3.0_RX_N	PCIE_RX_P/ USB3.0_RX_P	GND	GPIO[0]/ CLK_REQ	NC	VIO_SD	PD <sub>n</sub>	GPIO[14]TCK/ WLAN Wake Host	SD_DAT[3]	SD_DAT[2]	GND(G3)		
		29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48			

## 2.2. Pin Table

Pin No	Definition	Basic Description	Voltage	Type
1	NC	NC		
2	NC	NC		
3	NC	NC		
4	3.3V	3.3V Power Supply	3.3V	I
5	3.3V	3.3V Power Supply	3.3V	I
6	GND	System Ground Pin		GND
7	NC	NC		
8	CONFIG_HOST[0]	Configuration: CONFIG_HOST[0]		
9	CONFIG_HOST[1]	Configuration: CONFIG_HOST[1]		
10	CONFIG_HOST[2]	Configuration: CONFIG_HOST[2]		
11	GPIO[17] /UART_LTE_SOUT/ TDO	GPIO[17] / UART_LTE_SOUT/TDO (output)	VIO	O
12	GPIO[16]/ UART_LTE_SIN/TDI	GPIO[16] / UART_LTE_SIN/TDI (input)	VIO	I
13	CONFIG_HOST[3]	Configuration: CONFIG_HOST[3]		
14	NC	NC		
15	GPIO[1]	GPIO[1] (input/output)	VIO	I/O
16	NC	NC		I/O
17	GND	System Ground Pin		GND
18	GPIO[25]	GPIO[25] (input/output)	VIO	I/O
19	NC	NC		
20	GND	System Ground Pin		GND
21	GPIO[26]	GPIO[26] (input/output)	VIO	I/O
22	GPIO[27]	GPIO[27] (input/output)	VIO	I/O
23	GND	System Ground Pin		
24	ATEST0	NC, reserved for debug		I
25	NC	NC		I/O
26	GND	System Ground Pin		GND
27	SLP_CLK	Sleep Clock Input Used for WLAN and Bluetooth low-power modes. External sleep clock of 32.768 KHz must be used for auto reference clock calibration and for WLAN/Bluetooth low power operation.		I
28	GPIO[13]/BT IRQ(O)	GPIO[13]/ BT Wake Host(active low) (output)	VIO	O
29	PCIE_WAKE <sub>n</sub>	PCIe wake signal (input/output) (active low)	VIO	I/O
30	PCIE_CLKREQ <sub>n</sub>	PCIe clock request (input/output) (active low)	VIO	I/O
31	GPIO[21]/PCIE_PE RST <sub>n</sub>	PCIe host indication to reset the device (input) (active low)	VIO	I
32	GND	System Ground Pin		GND
33	PCIE_RCLK_N	PCI Express Differential Clock Input—Negative	1.8V(intern al)	I
34	PCIE_RCLK_P	PCI Express Differential Clock Input—Positive	1.8V(intern al)	I

35	GND	System Ground Pin		GND
36	PCIE_TX_N/USB3.0_TX_N	PCI Express Transmit Data—Negative / USB 3.0 TX negative	1.8V(internal)	O
37	PCIE_TX_P/USB3.0_TX_P	PCI Express Transmit Data—Positive / USB 3.0 TX positive	1.8V(internal)	O
38	GND	System Ground Pin		GND
39	PCIE_RX_N/USB3.0_RX_N	PCI Express Receive Data—Negative / USB 3.0 RX negative	1.8V(internal)	I
40	PCIE_RX_P/USB3.0_RX_P	PCI Express Receive Data—Positive / USB 3.0 RX positive	1.8V(internal)	I
41	GND	System Ground Pin		GND
42	GPIO[0]/CLK_REQ	GPIO[0] (input/output)	VIO	O
43	NC	NC		
44	VIO_SD	1.8V/3.3V Digital I/O SDIO Power Supply	VIO_SD	I
45	PDn	Full Power Down (input) (active low)	3.3V	I
46	GPIO[14] /TCK/WLAN Wake Host	GPIO[14]/TCK/WLAN Wake Host(active low) (output)	VIO	O
47	SD_DAT[3]	SDIO Data line Bit[3]	VIO_SD	I/O
48	SD_DAT[2]	SDIO Data line Bit[2]	VIO_SD	I/O
49	SD_DAT[1]	SDIO Data line Bit[1]	VIO_SD	I/O
50	SD_DAT[0]	SDIO Data line Bit[0]	VIO_SD	I/O
51	SD_CMD	SDIO Command/response (input/output)	VIO_SD	I/O
52	SD_CLK	SDIO Clock input	VIO_SD	I
53	GPIO[12] / UART Host Wake BT	GPIO[12]/ UART Host Wake BT(active low) (input)	VIO	I
54	GPIO[10] / UART_CTSn	GPIO[10] / UART_CTSn (input)	VIO	I
55	GPIO[8] / UART_SOUT	GPIO[8] / UART_SOUT (output)	VIO	O
56	GPIO[9] / UART_SIN	GPIO[9] / UART_SIN (input)	VIO	I
57	GPIO[11] / UART_RTSn	GPIO[11] / UART_RTSn (output)	VIO	O
58	GPIO[7] / PCM_SYNC	GPIO[7] / PCM_SYNC (input/output)	VIO	I/O
59	GPIO[4] / PCM_IN	GPIO[4] / PCM_IN (input)	I	VIO
60	GPIO[5] / PCM_OUT	GPIO[5] / PCM_OUT (output)	O	VIO
61	GPIO[6] / PCM_CLK	GPIO[6] / PCM_CLK (input)	I	VIO
62	GND	System Ground Pin		GND
63	GPIO[22] / PCIE_W_DISABLEn	GPIO[22] / PCIE_W_DISABLEn (input)	I	VIO
64	GPIO[2] / WLAN_LED	LED_OUT_WLAN (output)	O	VIO
65	GPIO[3] / BT_LED	LED_OUT_BT (output)	O	VIO
66	GPIO[15]	GPIO[15] / JTAG TMS/ Host Wake WLAN (input)	I	VIO

	/ TMS/ Host Wake WLAN			
67	NC	NC		
68	GND	System Ground Pin		GND
69	USB_DM	USB Serial Differential Data Minus	I/O	3.3V
70	USB_DP	USB Serial Differential Data Plus	I/O	3.3V
71	GND	System Ground Pin		GND
72	3.3V	3.3V Power Supply	I	3.3V
73	VIO	Digital I/O Power Supply	I	VIO
74	GND	System Ground Pin		
75	GND	System Ground Pin		
76	GND	System Ground Pin		
77	GND	System Ground Pin		
78	GND	System Ground Pin		
79	GND	System Ground Pin		
80	GND	System Ground Pin		
81	GND	System Ground Pin		
82	GND	System Ground Pin		
83	GND	System Ground Pin		
84	GND	System Ground Pin		
85	GND	System Ground Pin		
86	GND	System Ground Pin		
87	GND	System Ground Pin		
88	GND	System Ground Pin		
89	GND	System Ground Pin		
90	GND	System Ground Pin		
91	GND	System Ground Pin		
92	GND	System Ground Pin		
93	GND	System Ground Pin		

94	GND	System Ground Pin		
95	GND	System Ground Pin		
96	GND	System Ground Pin		
G1~G36	GND	System Ground Pin		

**Notes:**

1. PCIE Impedance targets: Single-ended Z of 60 ohms +- 15% . Differential Impedance of ~100 ohm +- 20%.
2. USB Impedance targets: D+/D- are differential and should have 90ohms impedance.
3. \* Implement by different hardware version.

**Note: Interface supports and combinations as shown below:**

Scenario	WLAN	BT	Strap value CON[2:0]
1	SDIO	UART	000
2	SDIO	SDIO	001
3	PCle	USB	010(default)
4	PCle	UART	011
5	USB3.0	UART	100
6	USB2.0	USB2.0	101
7	USB3/2.0	USB3/2.0	110
8	USB3.0	USB3.0	111

**\*Configuration pins:**

Pin No.	Configuration
10	CON[2]
9	CON[1]
8	CON[0]

### 3. Electrical Characteristics

#### 3.1 Absolute Maximum Ratings

Symbol	Parameter	Condition	Min	Typ	Max	Units
Pin73/ VIO	Host I/O power supply	--	--	1.8	2.2	V
		--	--	2.5	3.0	
		--	--	3.3	4.0	
Pin44/ VIO_SD	SDIO power supply	--	--	1.8	2.2	V
		--	--	3.3	4.0	
Pin4,5,72/ 3.3V	3.3V VBAT input	--	--	3.3	3.63	V
Tstorage	Storage Temperature		-40		125	°C

#### 3.2 Recommended Operating Conditions

Symbol	Parameter	Condition	Min	Typ	Max	Units
Pin73/ VIO	1.8V/2.5V/3.3V digital I/O power supply	--	1.62	1.8	1.98	V
		--	2.25	2.5	2.75	
		--	2.97	3.3	3.63	
Pin44/ VIO_SD	1.8V/3.3V digital I/O SDIO power supply	--	1.62	1.8	1.98	V
		--	2.97	3.3	3.63	
Pin4,5,72/ 3.3V	3.3V VBAT input	--	2.97	3.3	3.63	V
TA	Ambient operating temperature	--	-30		85	°C

#### 3.3 Digital IO Pin DC Characteristics

##### 3.3.1 DC Electricals-1.8V Operation(VIO)

Symbol	Parameter	Minimum	Typical	Maximum	Unit
VIL	Input low voltage	-0.4	-	0.3*V18	V
VIH	Input high voltage	0.7*V18	-	V18+0.4	V
VHYS	Input hysteresis	100	-	-	mV
VOL	Output low voltage	-	-	0.4	V
VOH	Output high voltage	V18-0.4	-	-	V

### 3.3.2 DC Electricals-3.3V Operation(VIO)

Symbol	Parameter	Minimum	Typical	Maximum	Unit
VIL	Input low voltage	-0.4	-	0.3*V33	V
VIH	Input high voltage	0.7*V33	-	V33+0.4	V
V <sub>HYS</sub>	Input hysteresis	100	-	-	mV
VOL	Output low voltage	-	-	0.4	V
VOH	Output high voltage	V33-0.4	-	-	V

### 3.3.3 DC Electricals-1.8V Operation(VIO\_SD)

Symbol	Parameter	Minimum	Typical	Maximum	Unit
VIL	Input low voltage	-0.4	-	0.3*V18	V
VIH	Input high voltage	0.7*V18	-	V33+0.4	V
V <sub>HYS</sub>	Input hysteresis	100	-	-	mV
VOL	Output low voltage	-	-	0.4	V
VOH	Output high voltage	V18-0.4	-	-	V

### 3.3.4 DC Electricals-3.3V Operation(VIO\_SD)

Symbol	Parameter	Minimum	Typical	Maximum	Unit
VIL	Input low voltage	-0.4	-	0.3*V33	V
VIH	Input high voltage	0.7*V33	-	V33+0.4	V
V <sub>HYS</sub>	Input hysteresis	100	-	-	mV
VOL	Output low voltage	-	-	0.4	V
VOH	Output high voltage	V33-0.4	-	-	V

## 3.4 Host Interface

### 3.4.1. SDIO Interface

The AW-CM276NF supports a SDIO device interface that conforms to the industry standard SDIO Full-Speed card specification and allows a host controller using the SDIO bus protocol to access the Wireless module device.

The AW-CM276NF 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 device through the use of BARs and a DMA engine.

The SDIO device interface main features include:

Supports SDIO 3.0 Standard

On-chip memory used for CIS

Supports SPI, 1-bit SDIO, and 4-bit SDIO transfer modes

Special interrupt register for information exchange

Allows card to interrupt host

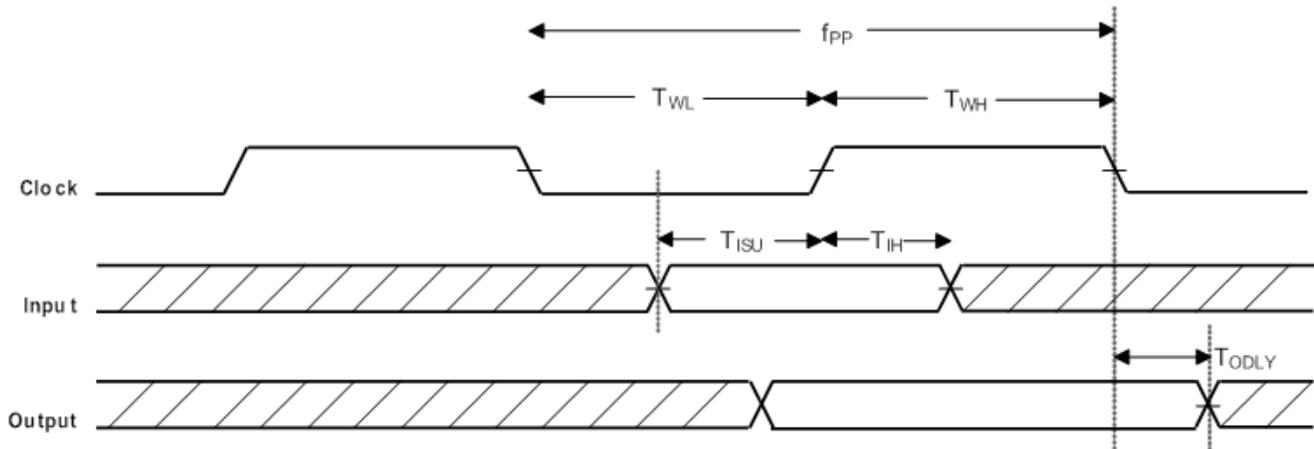
#### 3.4.1.1. SDIO Interface Signal Description

Pin Name	Signal Name	Type	Description
SD_CLK	CLK	I/O	SDIO 1-bit mode: Clock SDIO SPI mode: Clock
SD_CMD	CMD	I/O	SDIO 1-bit mode: Command line SDIO SPI mode: Data input
SD_DAT[3]	DAT3	I/O	SDIO 4-bit mode: Data line bit [3] SDIO 1-bit mode: Not used SDIO SPI mode: Chip select (active low)
SD_DAT[2]	DAT2	I/O	SDIO 4-bit mode: Data line bit [2] or Read Wait (optional) SDIO 1-bit mode: Read Wait (optional) SDIO SPI mode: Reserved
SD_DAT[1]	DAT1	I/O	SDIO 4-bit mode: Data line bit [1] SDIO 1-bit mode: Interrupt SDIO SPI mode: Interrupt

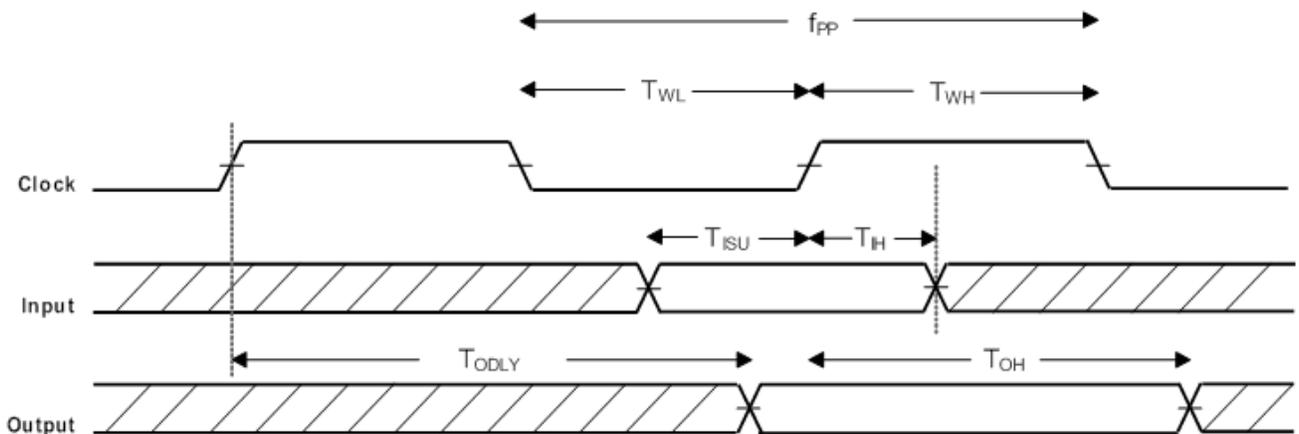
SD_DAT[0]	DAT0	I/O	SDIO 4-bit mode: Data line bit [0] SDIO 1-bit mode: Data line SDIO SPI mode: Data output
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### 3.4.1.2. Default Speed, High Speed Modes (3.3V)

SDIO Protocol Timing Diagram – Default Speed Mode (3.3V)



SDIO Protocol Timing Diagram – HighSpeed Mode (3.3V)



**Table shows SDIO Timing Data—Default Speed, High Speed Modes (3.3V)**

NOTE: Over full range of values specified in the Recommended Operating Conditions unless otherwise specified.

Symbol	Parameter	Condition	Min	Typ	Max	Units
f <sub>PP</sub>	Clock Frequency	Default Speed	0	--	25	MHz
		High Speed	0	--	50	MHz
T <sub>WL</sub>	Clock Low Time	Default Speed	10	--	--	ns
		High Speed	7	--	--	ns
T <sub>WH</sub>	Clock High Time	Default Speed	10	--	--	ns
		High Speed	7	--	--	ns
T <sub>ISU</sub>	Input Setup Time	Default Speed	5	--	--	ns
		High Speed	6	--	--	ns
T <sub>IH</sub>	Input Hold Time	Default Speed	5	--	--	ns
		High Speed	2	--	--	ns
T <sub>ODLY</sub>	Output Delay Time CL ≤ 40 pF (1 card)	Default Speed	--	--	14	ns
		High Speed	---	-1	4	ns
T <sub>OH</sub>	Output Hold Time	High Speed	2.5	--	--	ns

### 3.4.1.3. SDR12, SDR25, SDR50 Modes (up to 100MHz) (1.8V)

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

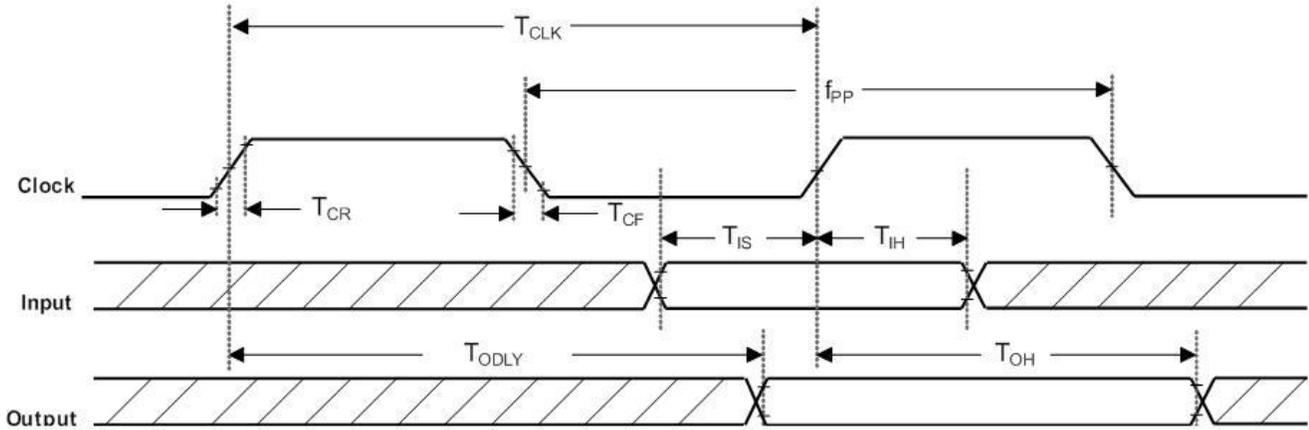


Table shows SDIO Timing Data—SDR12,SDR25,SDR50 Modes (up to 100MHz) (1.8V)

Symbol	Parameter	Condition	Min	Typ	Max	Units
$f_{PP}$	Clock frequency	SDR12/25/50	25	--	100	MHz
$T_{IS}$	Input setup time	SDR12/25/50	3	--	--	ns
$T_{IH}$	Input hold time	SDR12/25/50	0.8	--	--	ns
$T_{CLK}$	Clock time	SDR12/25/50	10	--	40	ns
$T_{CR}, T_{CF}$	Rise time, fall time $T_{CR}, T_{CF} < 2$ ns (max) at 100 MHz $C_{CARD} = 10$ pF	SDR12/25/50	--	--	$0.2 * T_{CLK}$	ns
$T_{ODLY}$	Output delay time $C_L \leq 30$ pF	SDR12/25/50	--	--	7.5	ns
$T_{OH}$	Output hold time $C_L = 15$ pF	SDR12/25/50	1.5	--	--	ns

### 3.4.1.4. SDR104 Modes (208MHz) (1.8V)

#### SDIO Protocol Timing Diagram –SDR104 Mode (208MHz)

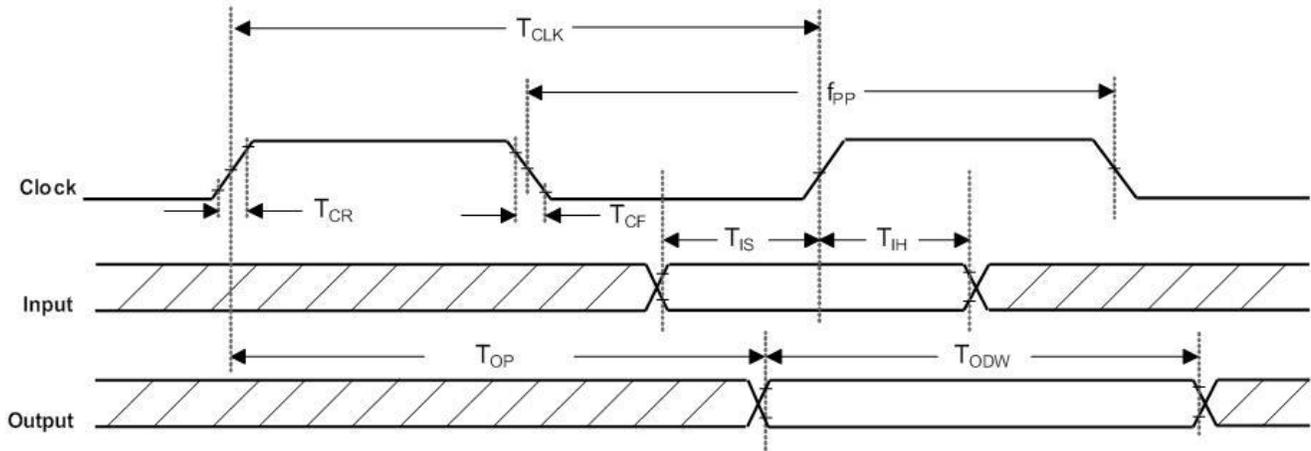


Table shows SDIO Timing Data—SDR104 Mode (208MHz)

Symbol	Parameter	Condition	Min	Typ	Max	Units
$f_{PP}$	Clock frequency	SDR104	0	--	208	MHz
$T_{IS}$	Input setup time	SDR104	1.4	--	--	ns
$T_{IH}$	Input hold time	SDR104	0.8	--	--	ns
$T_{CLK}$	Clock time	SDR104	4.8	--	--	ns
$T_{CR}, T_{CF}$	Rise time, fall time $T_{CR}, T_{CF} < 0.96$ ns (max) at 208 MHz $C_{CARD} = 10$ pF	SDR104	--	--	$0.2 * T_{CLK}$	ns
$T_{OP}$	Card output phase	SDR104	0	--	10	ns
$T_{ODW}$	Output timing of variable data window	SDR104	2.88	--	--	ns

### 3.4.2. PCI Express Interface

#### 3.4.2.1. Differential Tx Output Electricals

Symbol	Parameter	Min	Typ	Max	Units
UI	Unit interval Each UI is 400 ps $\pm$ 300 PPM. UI does not account for SSC dictated variations.	399.98	400	400.12	ps
$V_{Tx\_DIFFpp}$	Differential peak-to-peak output voltage $V_{Tx\_DIFFpp} = 2 *  V_{Tx\_D+} - V_{Tx\_D-} $	0.800	--	1.2	V
$V_{Tx\_DE\_RATIO}$	De-emphasized differential output voltage (ratio)	-3.0	-3.5	-4.0	db
$T_{Rx\_EYE}$	Minimum Tx eye width	0.75	--	--	UI
$T_{Rx\_EYE\_MEDIAN\_MAX\_JIT}$	Maximum time between jitter median and maximum deviation from median	--	--	0.125	UI
$T_{Tx\_RISE}$ , $T_{Tx\_FALL}$	D+/D- Tx output rise/fall time	0.125	--	--	UI
$V_{Tx\_CM\_DC\_ACTIVE\_IDLE\_DELTA}$	Absolute delta of DC common mode voltage during L0 and electrical idle	0-	-	100	mV
$V_{Tx\_CM\_DC\_LINE\_DELTA}$	Absolute delta of DC common mode voltage between D+ and D-	0-	-	25	mV
$V_{Tx\_IDLE\_DIFFp}$	Electrical idle differential peak output voltage	0	--	20	mV
$V_{Tx\_RCV\_DETECT}$	Voltage change allowed during receiver detection	--	--	600	mV
$V_{Tx\_DC\_CM}$	Tx DC common mode voltage	--	--	3.6	V
$I_{Tx\_SHORT}$	Tx short circuit current limit	--	--	90	mA
$T_{Tx\_IDLE\_MIN}$	Minimum time spent in electrical idle	50	--	--	UI
$T_{Tx\_IDLE\_SET\_TO\_IDLE}$	Maximum time to transition to a valid electrical idle after sending an electrical idle ordered set	--	--	20	UI
$T_{Tx\_IDLE\_TO\_DIFF\_DATA}$	Maximum time to transition to valid Tx specifications after leaving an electrical idle condition	--	--	20	UI
$RL_{Tx\_DIFF}$	Differential return loss	10	--	--	dB
$RL_{Tx\_CM}$	Common mode return loss	6	--	--	dB
$C_{Tx}$	AC coupling capacitor	75	--	200	nF
$T_{Crosstalk}$	Crosstalk random timeout	0	--	1	ms

### 3.4.2.2. Differential Rx Output Electricals

Symbol	Parameter	Min	Typ	Max	Units
UI	Unit interval Each UI is 400 ps $\pm$ 300 ppm. UI does not account for SSC dictated variations.	399.98	400	400.12	ps
V <sub>Rx_DIFFpp</sub>	Differential peak-to-peak voltage $V_{Rx\_DIFFpp} = 2 *  V_{Rx-D+} - V_{Rx-D-} $	0.175	--	1.2	V
T <sub>Rx_EYE</sub>	Minimum receiver eye width	0.4	--	--	UI
T <sub>Rx_EYE_MEDIAN_MAX_JIT</sub>	Maximum time between jitter median and maximum deviation from median	--	--	0.3	UI
V <sub>Rx_CM_ACp</sub>	AC peak common mode input voltage	--	--	150	mV
RL <sub>Rx_DIFF</sub>	Differential return loss	10	--	--	dB
RL <sub>Rx_CM</sub>	Common mode return loss	6	--	--	dB
Z <sub>Rx_DIFF_DC</sub>	DC differential input impedance	80	100	120	$\Omega$
Z <sub>Rx_DC</sub>	DC input impedance	40	50	60	$\Omega$
Z <sub>Rx_HIGH_IMP_DC_POS</sub>	Powered down DC input impedance positive	50	--	--	k
Z <sub>Rx_HIGH_IMP_DC_NEG</sub>	Powered down DC input impedance negative	1	--	--	k $\Omega$
V <sub>Rx_IDLE_DET_DIFFpp</sub>	Electrical idle detect threshold	65	--	175	mV
T <sub>Rx_IDLE_DET_DIFF_ENTERTIME</sub>	Unexpected electrical idle enter detect threshold integration time	--	--	10	ms
L <sub>Rx_SKEW</sub>	Total skew	---	-2	0	ns

### 3.4.3. USB Interface

The USB device interface is compliant with the Universal Serial Bus Specification, Revision 2.0, April 27, 2000. A USB host uses the USB cable bus and the USB 2.0 device interface to communicate with the chip.

The main features of the USB device interface include:

High/full speed operation (480/12 Mbps)

Suspend/host resume/device resume (remote wake-up)

Built-in DMA engine that reduces interrupt loads on the embedded processor and reduces the system bus bandwidth requirement for serving the USB device operation

The USB 2.0 device interface is designed with 3.3V signal level pads.

### 3.4.3.1. USB 2.0 Device Interface Description

Table shows the signal mapping between the AW-CM276NF and the USB Specification, Revision 2.0.

Pin Name	USB 2.0 Specification Pin Name	Description
Pin72/ 3V3_USB	VBUS	USB Bus Power Supply On-board regulator regulates voltage from VBUS level to voltage levels used by USB PHY.
	GND	USB Bus Ground Common ground on SoC device.
Pin70/ USB_DP	D+	USB Bus Data Positive. One of the differential data pair.
Pin69/ USB_DN	D-	USB Bus Data Negative. One of the differential data pair.

### 3.4.3.2. USB 2.0 Device Functional Description

The device controller uses internal Scatter/Gather DMA engine to transfer the transmit packet from internal SRAM to USB and the receive packet from USB to internal SRAM. The Device IN Endpoint DMA (DIEPDMA<sub>n</sub>) and Device OUT Endpoint DMA (DOEPDMA<sub>n</sub>) registers are used by the DMA engine to access the base descriptor. The application is interrupted after the programmed transfer size extracted from the descriptors is transmitted or received. By using registers, interrupts, and special data structures, the device controller can communicate with the device controller driver (application/software) about bus states, host request, and data transfer status. The device controller driver also has all of the routines to respond to the device framework commands issued by a USB host, so it controls the attachment, configuration, operation, and detachment of the device.

### 3.4.4. High-Speed UART Interface

The AW-CM276NF 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. Table shows the rates supported.

The UART interface features include:

- FIFO mode permanently selected for transmit and receive operations

- Two pins for transmit and receive operations

Two flow control pins

Interrupt triggers for low-power, high throughput operation

The UART interface operation includes:

Upload boot code to the internal CPU (for debug purposes)

Support diagnostic tests

Support data input/output operations for peripheral devices connected through a standard UART interface

#### UART Baud Rates Supported

Baud Rate				
1200	38400	460800	1500000	3000000
2400	57600	500000	1843200	3250000
4800	76800	921600	2000000	3692300
9600	115200	1000000	2100000	4000000
19200	230400	1382400	2764800	--

### 3.4.4.1. UART Interface Signal Description

Table shows the standard UART signal names on the device.

Signal Name	16550 Standard Pin Name	Description
<b>Data Bus</b>		
UART_SIN	SIN	Serial data input from modem, data set, or peripheral device
UART_SOUT	SOUT	Serial data output from modem, data set, or peripheral device
<b>Modem Control</b>		
UART_RTSN	RTS	Request To Send output to modem, data set, or peripheral device (active low)
UART_CTSN	CTS	Clear To Send input from modem, data set, or peripheral device (active low)

### 3.4.4.2. UART Interface Functional Description

#### 3.4.4.2.1. Booting from UART

When booting from the UART, the AW-CM276NF device has the following requirements:

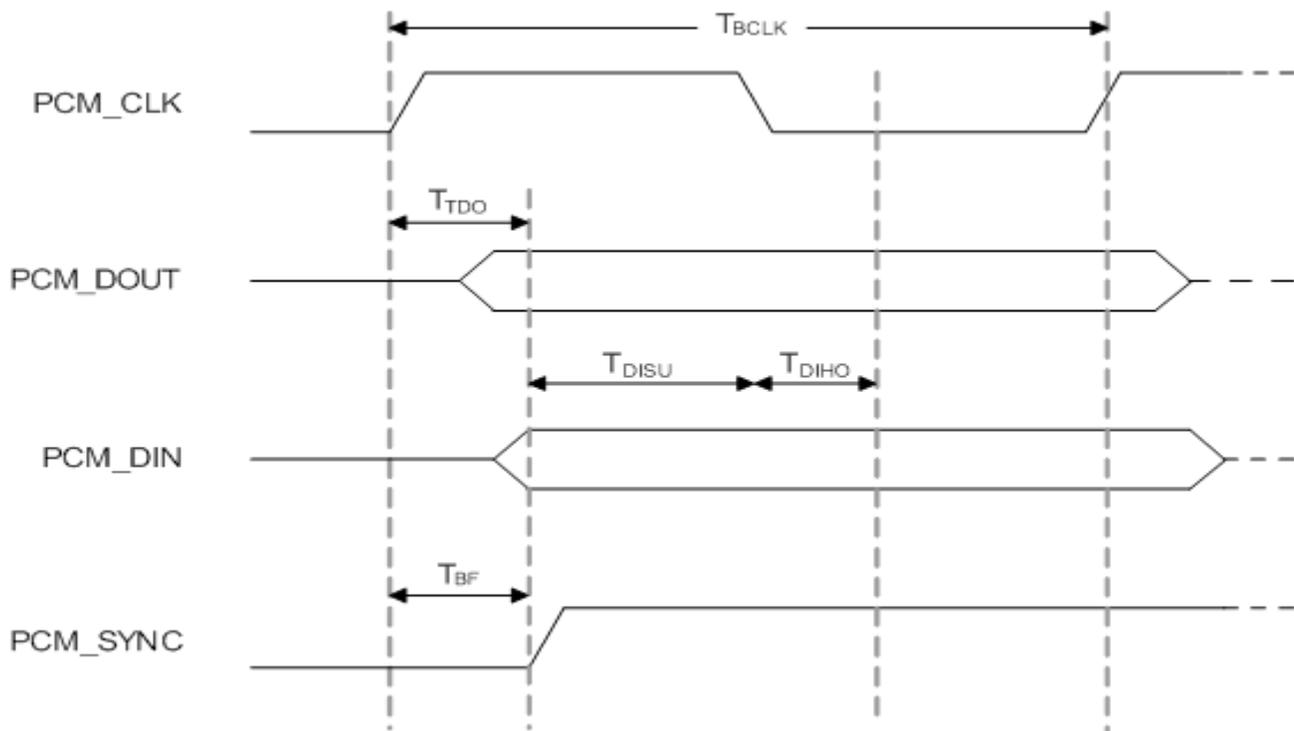
System Requirement	Description
Number of data bits	8 bits
Stop bits	1 bit
Parity	No parity
Baud Rate	115200

### 3.4.4.2.2. UART as Test Port

Test diagnostic programs may be uploaded to the CPU through the UART interface. During execution, the diagnostic program transmits performance and status information through the UART by performing a write to the PBU address space designated to the UART.

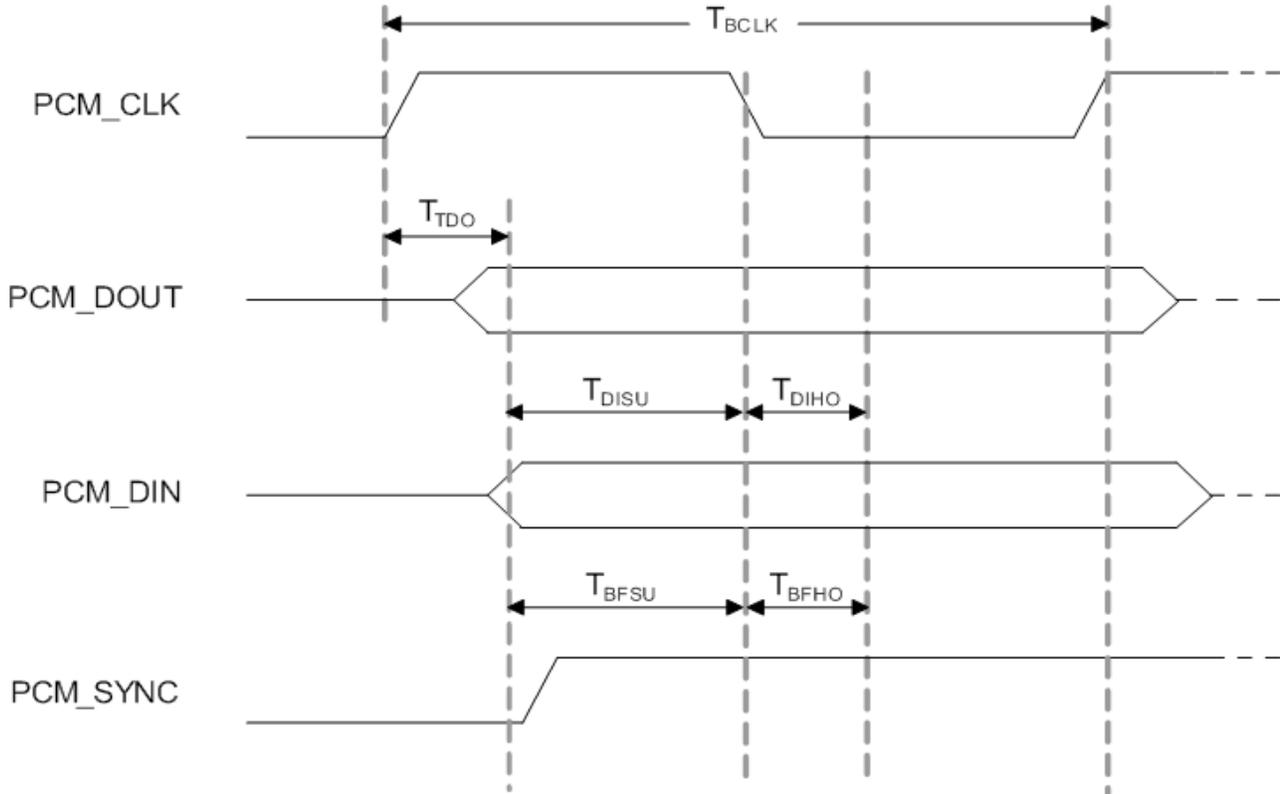
## 3.4.5. PCM Interface

### 3.4.5.1. PCM Timing Specification – Master Mode



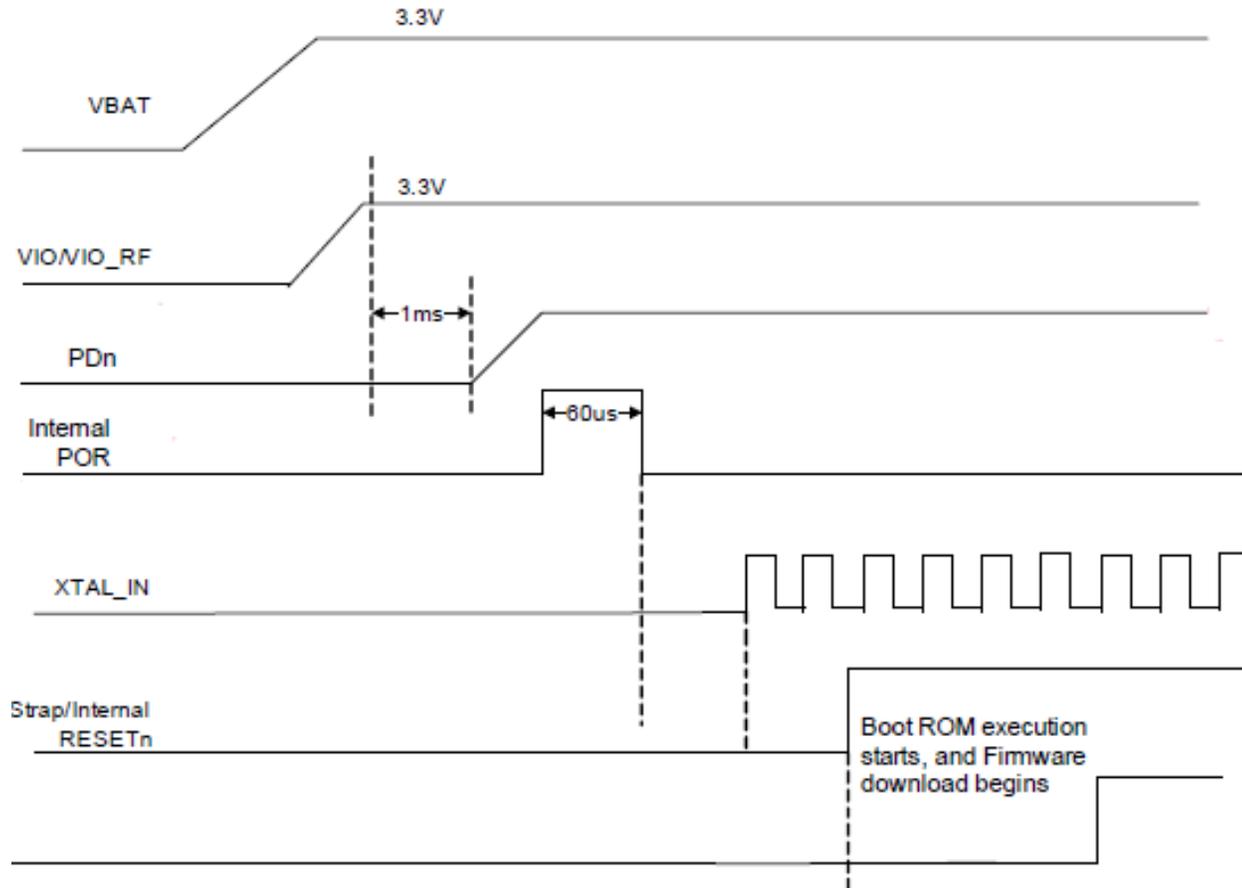
Symbol	Parameter	Condition	Min	Typ	Max	Units
$F_{BCLK}$	--	--	--	2/2.048	--	MHz
Duty Cycle $_{BCLK}$	--	--	0.4	0.5	0.6	--
$T_{BCLK\ rise/fall}$	--	--	--	3	--	ns
$T_{DO}$	--	--	--	--	15	ns
$T_{DISU}$	--	--	20	--	--	ns
$T_{DHO}$	--	--	15	--	--	ns
$T_{BF}$	--	--	--	--	15	ns

### 3.4.5.2. PCM Timing Specification – Slave Mode



Symbol	Parameter	Condition	Min	Typ	Max	Unit
$F_{BCLK}$	--	--	--	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. Power up Timing Sequence



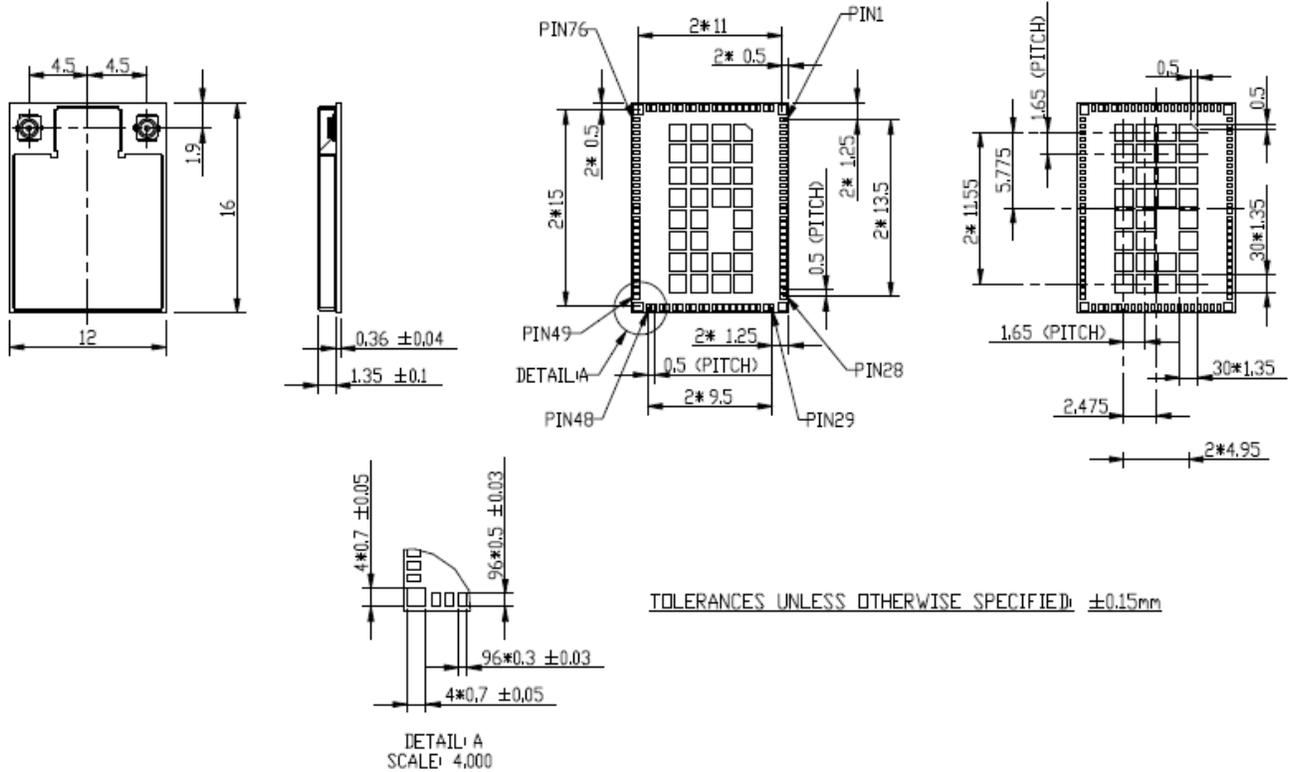
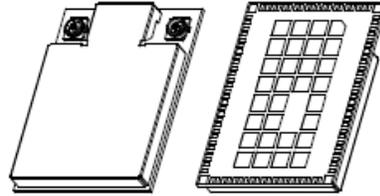
#### 3.5.1. Reset Configuration

The AW-CM276NF is reset to its default operating state under the following conditions:

- Power-on reset (POR)
- Software/Firmware reset
- External pin for power down (PDn)

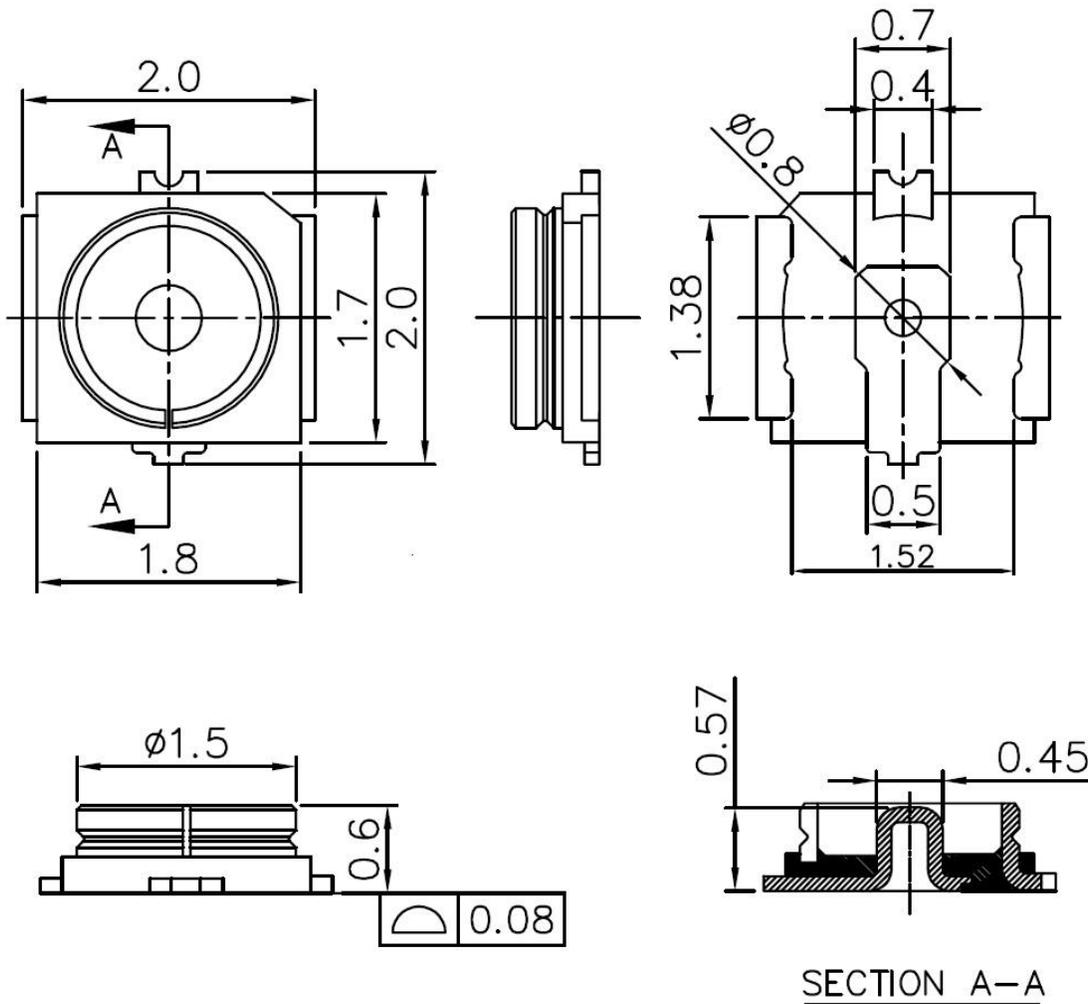
## 4. Mechanical Information

### 4.1 Mechanical Drawing





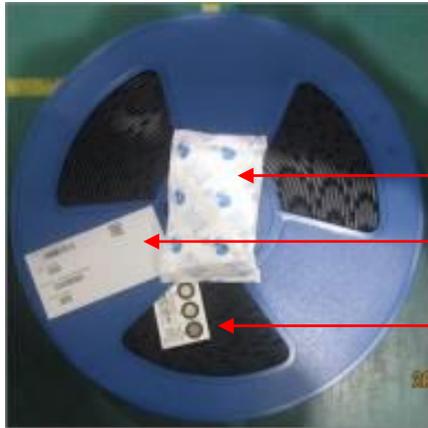
### 4.3. Antenna connector drawing



UNITS: mm

## 5. Packaging Information

### 5.1

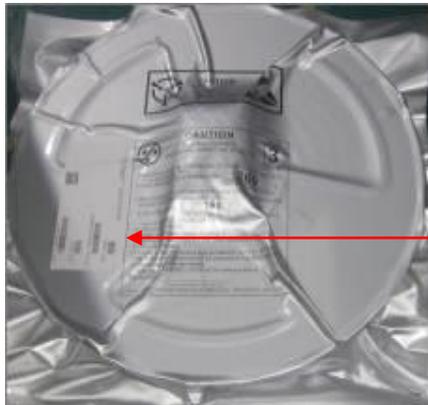


1 UNIT DESICCANT

AFFIX PACKING LABEL

HUMIDITY INDICATOR CARD

### 5.2



AFFIX PACKING LABEL

### 5.3



PINK BUBBLE WRAP

**5.4**



AFFIX PACKING LABEL

**5.5**

1 Carton= 5 Boxes



TRANSPARENT SEALING TAPE  
AFFIX PACKING LABEL

**5.6**



**Note:** 1 tape reel = 1 box = 1,500pcs

**1 carton = 5 boxes = 5 \* 1,500pcs=7,500pcs**