

AW-AM457MA-D

IEEE 802.11a/b/g/n Wireless LAN 1T1R and Bluetooth 5.1 Combo Module (M.2 2230)

Datasheet

Rev. C

DF

(For Standard)

Features

WLAN

- PCIe M.2 TYPE 2230: 30mm(L) x 22mm(W) x 2.85 mm(H)(Max)
- SDIO interface 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

- UART interface support for Bluetooth
- High speed PCM interfaces
- Audio Codec interface support
- Bluetooth 5.1 complaint with Bluetooth 2.1 + Enhanced Data Rate (EDR)

Revision History

Document NO: R2-2457MA-DST-01

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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-AM457MA-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-AM457MA-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-AM457MA-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.

For the video, voice and multimedia applications the AW-AM457MA-D 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.

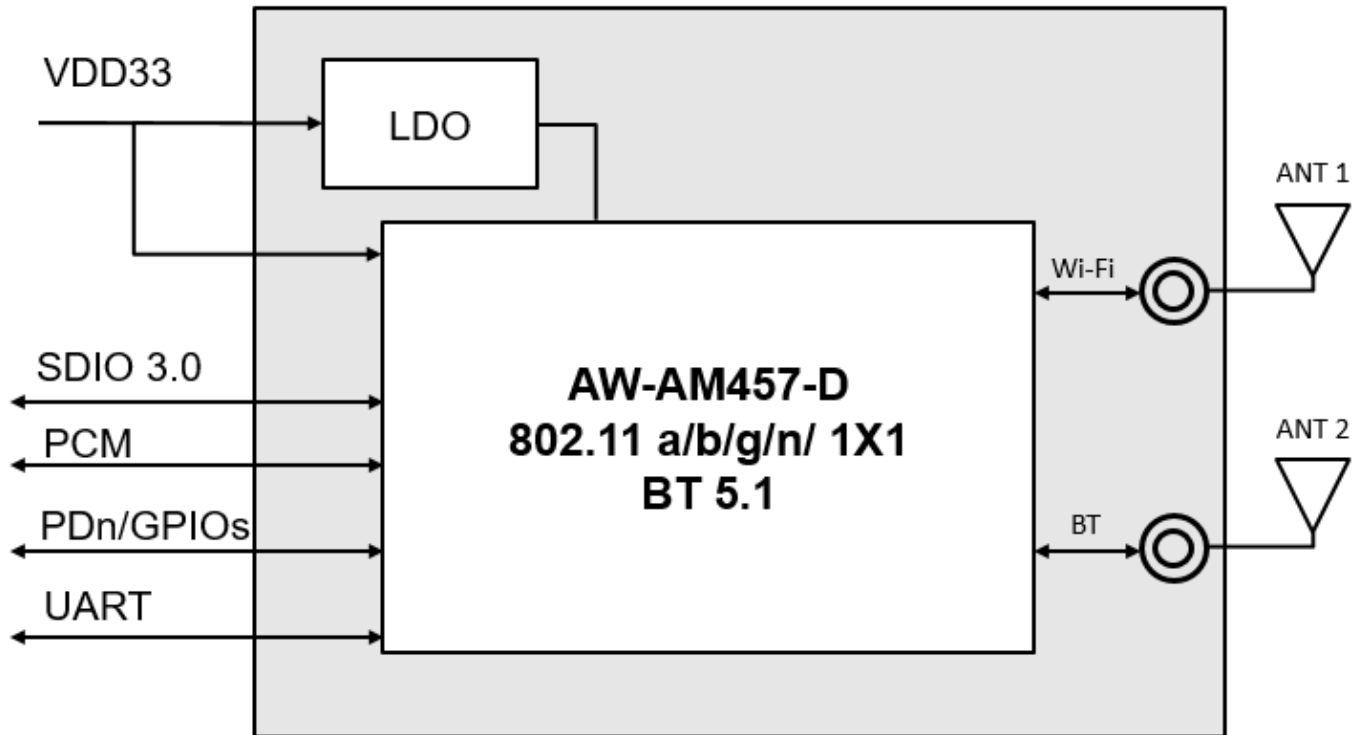
For Bluetooth operation, **AW-AM457MA-D** is Bluetooth 5.1 (supports Low Energy).

AW-AM457MA-D supports SDIO interface for WLAN and Bluetooth to the host processor.

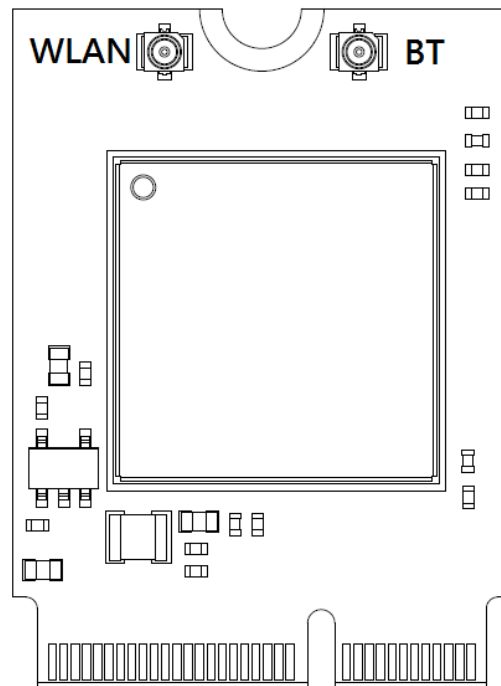
AW-AM457MA-D is suitable for multiple mobile processors for different applications with the support cellular phone co-existence.

AW-AM457MA-D module adopts NXP's latest highly-integrated dual-band WLAN & Bluetooth SoC--**IW416**. All the other components are implemented by all means to reach the mechanical specification required.

1.2 Block Diagram



AW-AM457MA Block Diagram



1.3 Specifications Table

1.3.1 General

Features	Description
Product Description	IEEE 802.11a/b/g/n Wireless LAN 1T1R and Bluetooth 5.1 Combo Module (M.2 2230)
Major Chipset	NXP IW416
Host Interface	WiFi + BT ● SDIO + UART
Dimension	22mm(W) x 30mm(L) x 2.85mm(H) (Tolerance remarked in mechanical drawing)
Form factor	M.2 2230
Antenna	I-PEX MHF4 Connector Receptacle (20449) ANT1 : WiFi → TX/RX ANT2 : Bluetooth → TX/RX
Weight	2.7 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 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
Number of Channels	2.4GHz ■ USA, NORTH AMERICA, Canada and Taiwan – 1 ~ 11 ■ China, Australia, Most European Countries, Japan – 1 ~ 13 5GHz ■ 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

Output Power (Board Level Limit)*	2.4G				
		Min	Typ	Max	Unit
	11b (11Mbps) @EVM<35%	15.5	17	18.5	dBm
	11g (54Mbps) @EVM ≤ -27 dB	14.5	16	17.5	dBm
	11n (HT20 MCS7) @EVM ≤ -28 dB	12.5	14	15.5	dBm
	5GHz				
		Min	Typ	Max	Unit
	11a (54Mbps) @EVM ≤ -27 dB	14	16	18	dBm
	11n (HT20 MCS7) @EVM ≤ -28 dB	13	15	17	dBm
	11n (HT40 MCS7) @EVM ≤ -28 dB	12	14	16	dBm
Receiver Sensitivity	2.4GHz				
		Min	Typ	Max	Unit
	11b (11Mbps)	-	-86	-83	dBm
	11g (54Mbps)	-	-73	-70	dBm
	11n (HT20 MCS7)	-	-69	-66	dBm
	5GHz				
		Min	Typ	Max	Unit
	11a (54Mbps)	-	-71	-68	dBm
	11n (HT20 MCS7)	-	-68	-65	dBm
	11n (HT40 MCS7)	-	-66	-63	dBm
Data Rate	<ul style="list-style-type: none"> 802.11b: 1, 2, 5.5, 11Mbps 802.11a/g: 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11n: up to 150Mbps-single 				
Security	<ul style="list-style-type: none"> WAPI WEP 64-bit and 128-bit encryption with H/W TKIP processing WPA/WPA2 (Wi-Fi Protected Access) AES-CCMP hardware implementation as part of 802.11i security standard 				

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

1.3.3 Bluetooth

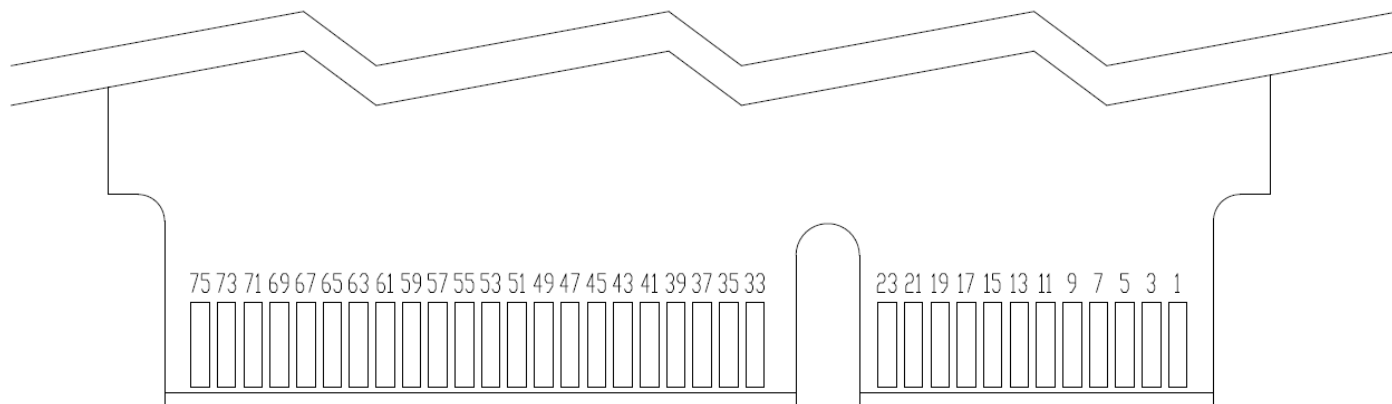
Features	Description				
Bluetooth Standard	Bluetooth 2.1 and 3.0+Enhanced Data Rate (EDR) + BT 5.1				
Bluetooth VID/PID	NA				
Frequency Range	2402~2480MHz				
Modulation	GFSK (1Mbps), $\pi/4$ DQPSK (2Mbps) and 8DPSK (3Mbps)				
Output Power		Min	Typ	Max	Unit
	BDR	0	2	4	dBm
	EDR	0	2	4	dBm
	BLE	0	2	4	dBm
Receiver Sensitivity		Min	Typ	Max	Unit
	BDR	-	-83	-80	dBm
	BER < 0.1%				

1.3.4 Operating Conditions

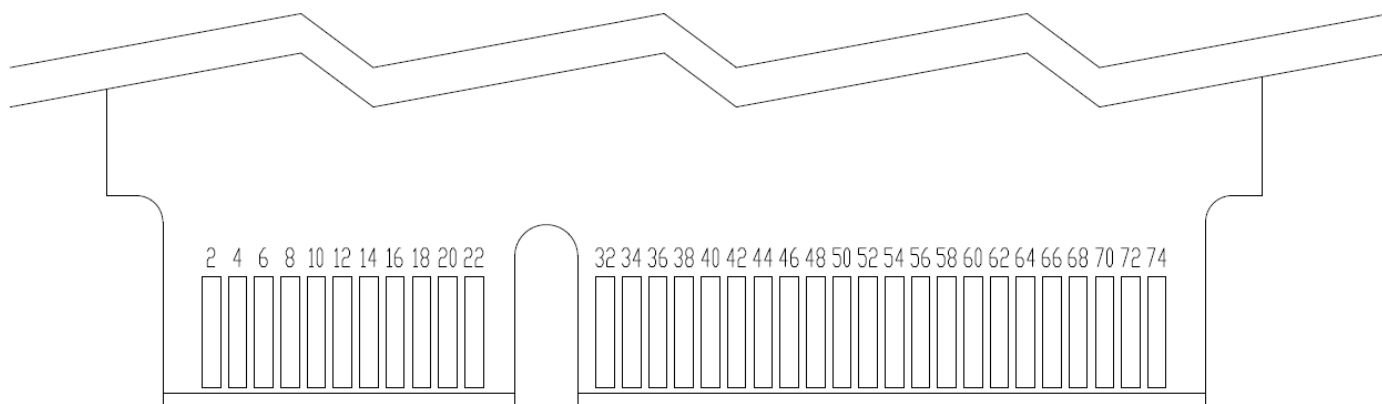
Features	Description
Operating Conditions	
Voltage	Power supply for host:3.3V
Operating Temperature	0°C to 70 °C
Operating Humidity	less than 85% R.H.
Storage Temperature	-40°C to 125 °C
Storage Humidity	less than 60% R.H.
ESD Protection	
Human Body Model	NA
Charged Device Model	NA

2. Pin Definition

2.1 Pin Map



AW-AM457MA-D Pin Map (Top View)



AW-AM457MA-D Pin Map (Bottom View)

2.2 Pin Table

Pin No	Definition	Basic Description	Voltage	Type
1	GND	Ground		GND
2	3.3V	3.3V power supply.	3.3V	Power
3	USB_D+	USB 2.0 Serial Differential Data—Positive.	I/O	3.3V
4	3.3V	3.3V power supply	3.3V	Power
5	USB_D-	USB 2.0 Serial Differential Data—Negative	I/O	3.3V
6	NC	No connect to anything		Floating
7	GND	Ground		GND
8	PCM_CLK	PCM clock	1.8V	I/O
9	SDIO_DATA_CLK	SDIO CLK	1.8V	I
10	PCM_SYNC	PCM Synchronization control	1.8V	O
11	SDIO_DATA_CMD	SDIO CMD	1.8V	I/O
12	PCM_OUT	PCM data Out	1.8V	O
13	SDIO_DATA_0	SDIO Data [0]	1.8V	I/O
14	PCM_IN	PCM data Input	1.8V	I
15	SDIO_DATA_1	SDIO Data [1]	1.8V	I/O
16	NC	No connect to anything		Floating
17	SDIO_DATA_2	SDIO Data [2]	1.8V	I/O
18	GND	Ground.		GND
19	SDIO_DATA_3	SDIO Data [3]	1.8V	I/O
20	UART_WAKE	GPIO mode: GPIO[0] Out-of-band wake-up mode: BT to host wake-up	3.3V	O
21	SDIO_WAKE	GPIO mode: GPIO[1] Out-of-band wake-up mode: WIFI to host wake-up	1.8V	O
22	GPIO[10] / UART_SOUT	GPIO[10] / UART_SOUT (output)	1.8V	O
23	SDIO RESET	GPIO mode: GPIO[14] JTAG mode: JTAG_TCK Reset recovery mode: Host-to-Wi-Fi reset recovery	1.8V	I
32	GPIO[9] / UART_SIN	GPIO[9] / UART_SIN (input)	1.8V	I
33	GND	Ground.		GND
34	GPIO[11] / UART_RTSn	GPIO[11] / UART_RTSn (output)	1.8V	O
35	NC	No connect to anything		Floating
36	GPIO[8] / UART_CTSn	GPIO[8] / UART_CTSn (input)	1.8V	I
37	NC	No connect to anything		Floating
38	JTAG_TDO	JTAG test data (output).	1.8V	O
39	GND	Ground		GND
40	DEV_WLAN_WAKE	Host to Wi-Fi wake-up	1.8V	I
41	NC	No connect to anything		Floating
42	DEV_BT_WAKE	Host to BT wake-up	1.8V	I
43	NC	No connect to anything		Floating

44	JTAG_TDI	JTAG test data (input).	1.8V	I
45	GND	Ground		GND
46	JTAG_TCK	JTAG test clock (input).	1.8V	I
47	NC	No connect to anything		Floating
48	JTAG_TMS	JTAG test mode select (input)	1.8V	I
49	NC	No connect to anything		Floating
50	SUSCLK_32KHz	External sleep clock input (32.768 kHz).	3.3V	I
51	GND	Ground		GND
52	NC	No connect to anything		Floating
53	NC	No connect to anything		Floating
54	W_DISABLE#2	GPIO mode: GPIO[15] JTAG mode: JTAG_TMS Reset recovery mode: Host-to-Bluetooth reset recovery	3.3V	I
55	NC	No connect to anything		Floating
56	W_DISABLE#1	PDn Full Power-Down (input) (active low) The module internal pull-up 51kΩ on this pin.	3.3V	I
57	GND	Ground		GND
58	NC	No connect to anything		Floating
59	NC	No connect to anything		Floating
60	NC	No connect to anything		Floating
61	NC	No connect to anything		Floating
62	NC	No connect to anything		Floating
63	GND	Ground		GND
64	NC	No connect to anything		Floating
65	NC	No connect to anything		Floating
66	NC	No connect to anything		Floating
67	NC	No connect to anything		Floating
68	NC	No connect to anything		Floating
69	GND	Ground		GND
70	NC	No connect to anything		Floating
71	NC	No connect to anything		Floating
72	3.3V	3.3V power supply	3.3V	Power
73	NC	No connect to anything		Floating
74	3.3V	3.3V power supply	3.3V	Power
75	GND	Ground		GND

3. Electrical Characteristics

3.1 Absolute Maximum Ratings

Symbol	Parameter	Minimum	Typical	Maximum	Unit
3.3V	DC supply for the 3.3V input	-	3.3	3.96	V

3.2 Recommended Operating Conditions

Symbol	Parameter	Minimum	Typical	Maximum	Unit
1.8V	1.8V digital I/O power supply	--	1.62	1.8	1.98
3.3V	3.3V VBAT input	--	2.97	3.3	3.63
TA	Ambient operating temperature	--	-30		85

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
V _{HYS}	Input hysteresis	100	-	-	mV
VOL	Output low voltage	-	-	0.4	V
VOH	Output high voltage	V18-0.4	-	-	V
VOH	Output high voltage	V33-0.4	-	-	V

3.4 Host Interface

3.4.1 SDIO Interface

The AW-AM457MA-D 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-AM457MA-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 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

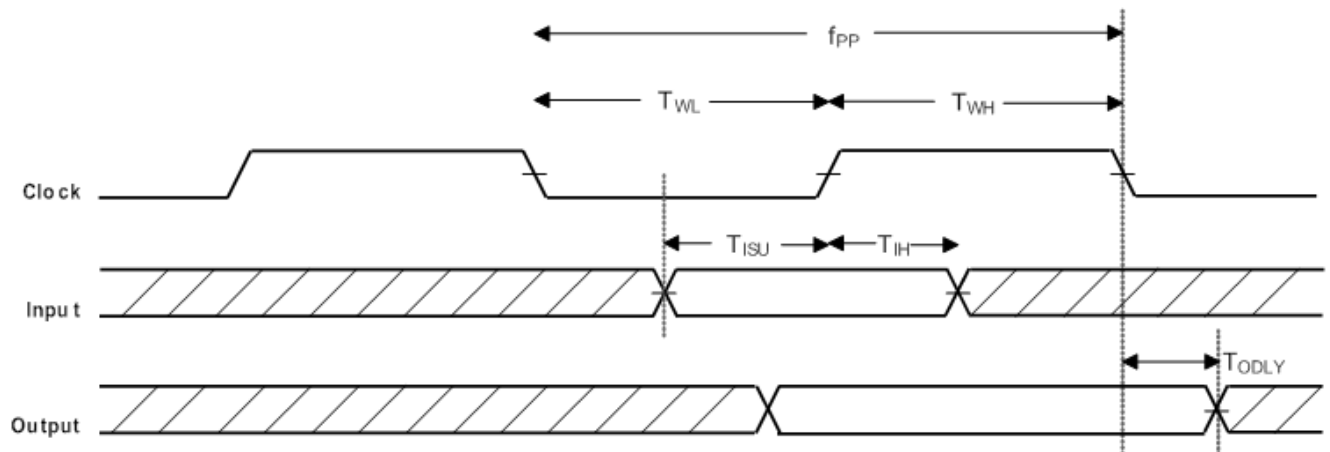
3.4.1.1. SDIO Interface Signal Description

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

SDIO Protocol Timing Diagram – Default Speed Mode



SDIO Protocol Timing Diagram – HighSpeed Mode

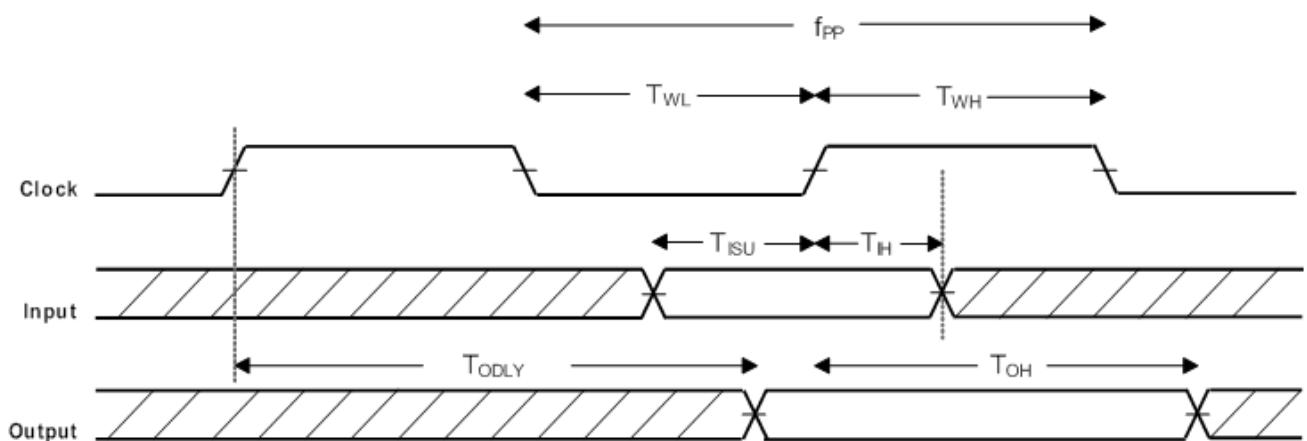


Table shows SDIO Timing Data—Default Speed, High Speed Modes

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

Symbol	Parameter	Condition	Min	Typ	Max	Units
f_{PP}	Clock Frequency	Default Speed	0	--	25	MHz
		High Speed	0	--	50	MHz
T_{WL}	Clock Low Time	Default Speed	10	--	--	ns
		High Speed	7	--	--	ns
T_{WH}	Clock High Time	Default Speed	10	--	--	ns
		High Speed	7	--	--	ns
T_{ISU}	Input Setup Time	Default Speed	5	--	--	ns
		High Speed	6	--	--	ns
T_{IH}	Input Hold Time	Default Speed	5	--	--	ns
		High Speed	2	--	--	ns
T_{ODLY}	Output Delay Time CL \leq 40 pF (1 card)	Default Speed	--	--	14	ns
		High Speed	---	-1	4	ns
T_{OH}	Output Hold Time	High Speed	2.5	--	--	ns

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

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

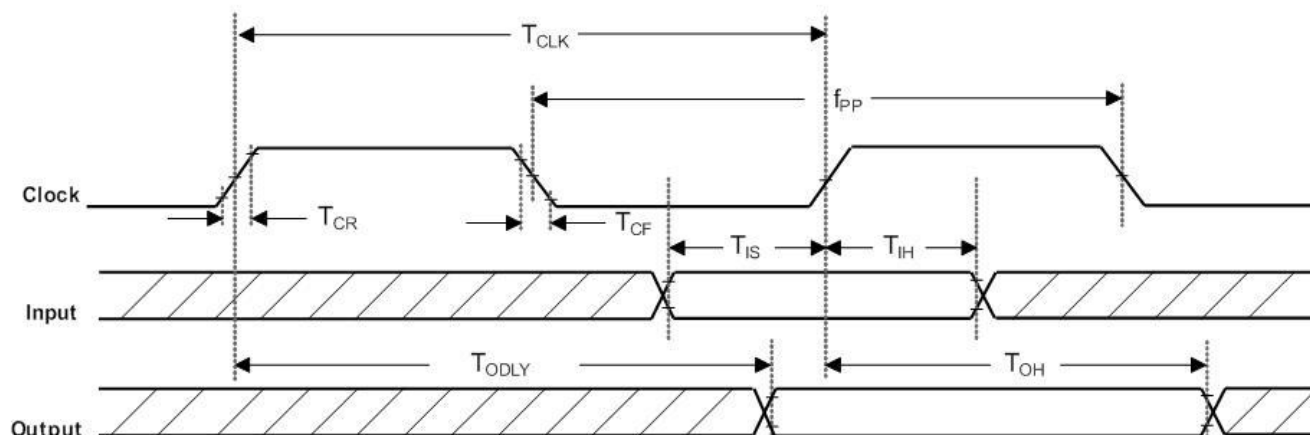
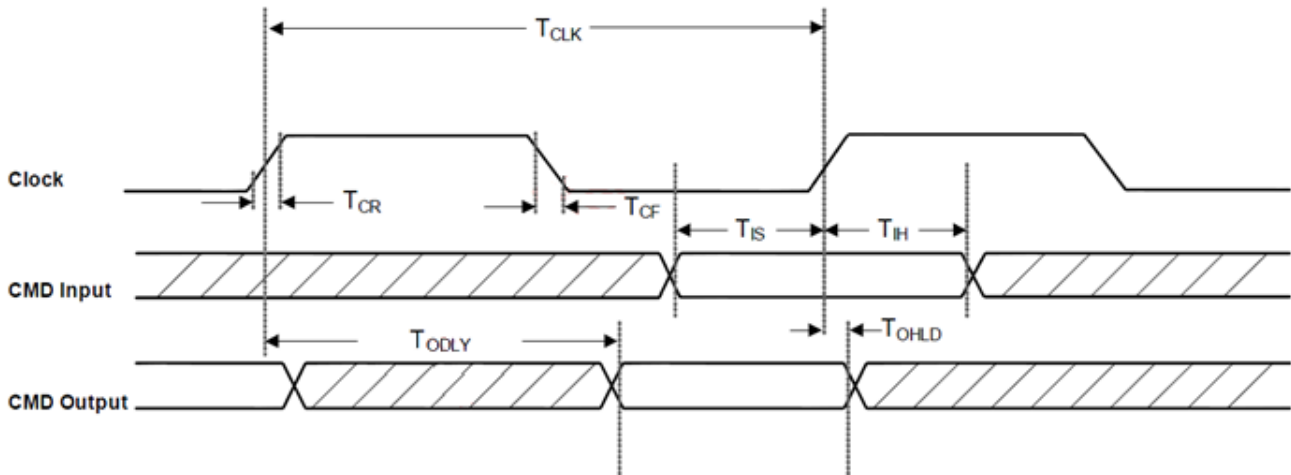


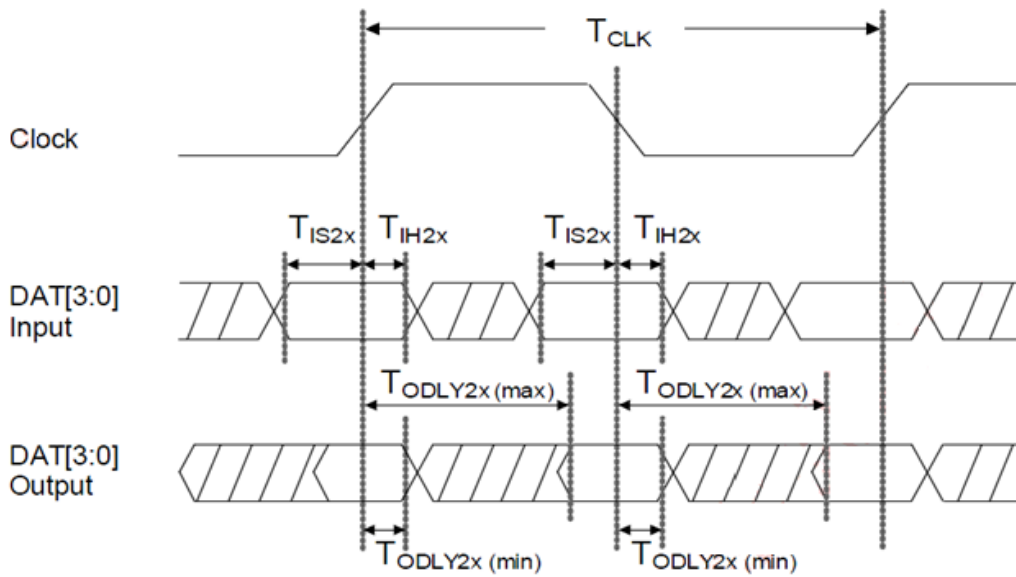
Table shows SDIO Timing Data—SDR12,SDR25,SDR50 Modes (up to 100MHz)

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	--	--	$0.2 \cdot T_{CLK}$	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 DDR50 Mode (50MHz) (1.8V)



SDIO CMD Timing Diagram - DDR50 Mode (50 MHz)



SDIO DAT[3:0] Timing Diagram - DDR50 Mode¹ (50 MHz)

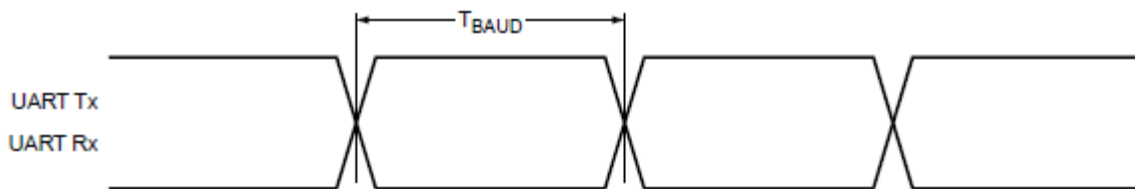
¹ In DDR50 mode, DAT[3:0] lines are sampled on both edges of the clock (not applicable for CMD line).

Symbol	Parameter	Condition	Min	Typ	Max	Units
Clock						
T_{CLK}	Clock time	DDR50	20	-	-	ns
T_{CR}, T_{CF}	Rise time, fall time	DDR50	-	-	$0.2 \cdot T_{CLK}$	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)

3.4.2.High-Speed UART Interface

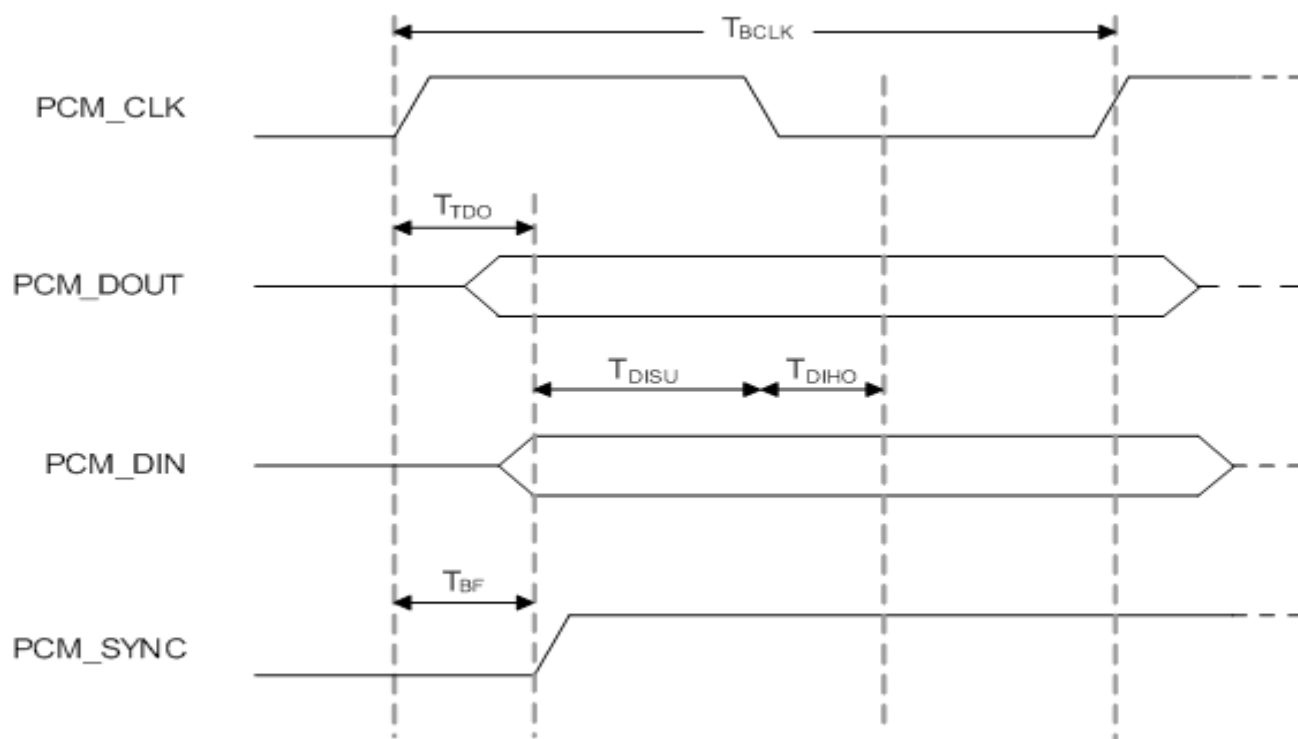
The AW-AM457-D supports a high-speed Universal Asynchronous Receiver/Transmitter (UART) interface, compliant to the industry standard 16550 specification. High-speed baud rates are supported to provide the physical transport between the device and the host for exchanging Bluetooth data.



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

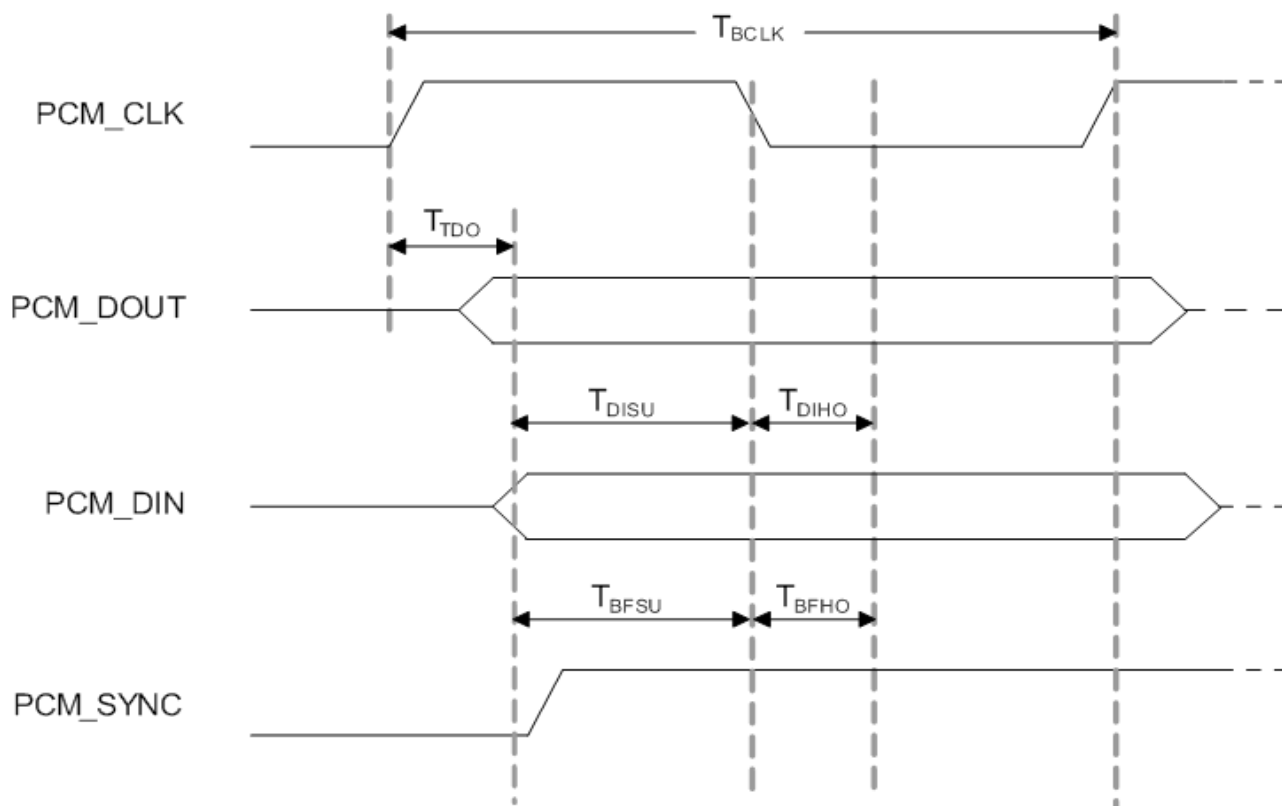
3.4.3. PCM Interface

3.4.3.1 PCM Timing Specification – Master Mode



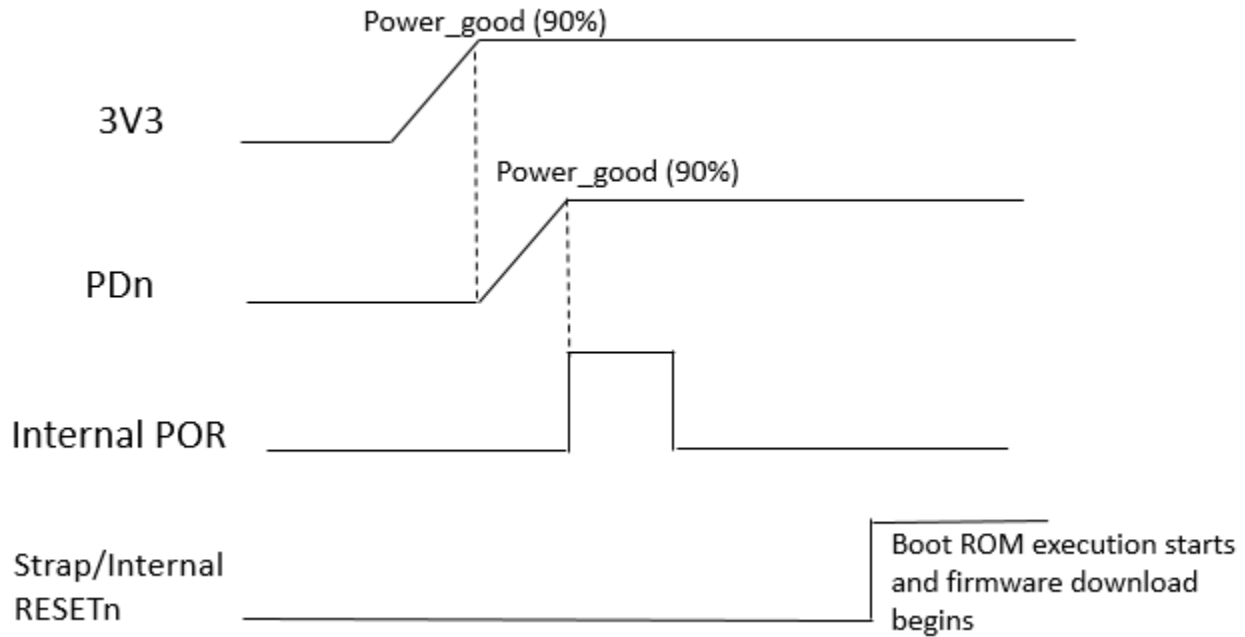
Symbol	Parameter	Condition	Min	Typ	Max	Unit
F_{BCLK}	--	--	--	2/2.048	--	MHz
Duty Cycle _{BCLK}	--	--	0.4	0.5	0.6	--
$T_{BCLK \text{ rise/fall}}$	--	--	--	3	--	ns
T_{DO}	--	--	--	--	15	ns
T_{DISU}	--	--	20	--	--	ns
T_{DIHO}	--	--	15	--	--	ns
T_{BF}	--	--	--	--	15	ns

3.4.3.2 PCM Timing Specification – Slave Mode



Symbol	Parameter	Condition	Min	Typ	Max	Unit s
F_{BCLK}	--	--	--	2/2.048	--	MHz
Duty Cycle _{BCLK}	--	--	0.4	0.5	0.6	--
$T_{BCLK \text{ rise/fall}}$	--	--	--	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



3.6 Power consumption

3.6.1 WLAN result

Item				VBAT=3.3V				
Band (GHz)	Mode	BW (MHz)	RF Power (dBm)	Transmit			Receive	
				Max.	Avg.	DUTY %	Max.	Avg.
TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

* The power consumption is based on Azurewave test environment, these data for reference only.

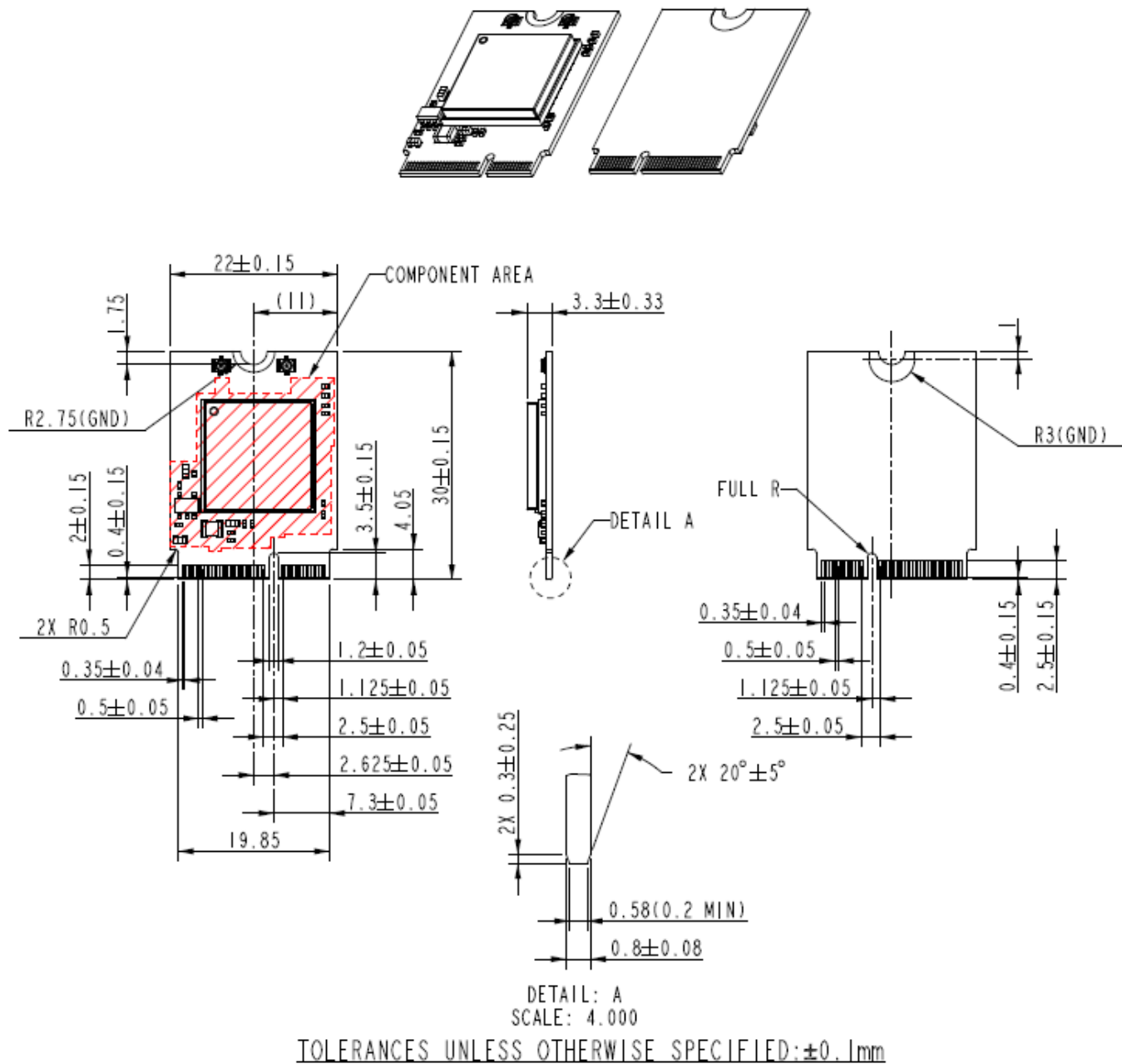
3.6.2 Bluetooth

No.	Mode	VBAT=3.3V			
		Transmit		Receive	
		Max.	Avg.	Max.	Avg.
TBD	TBD	TBD	TBD	TBD	TBD

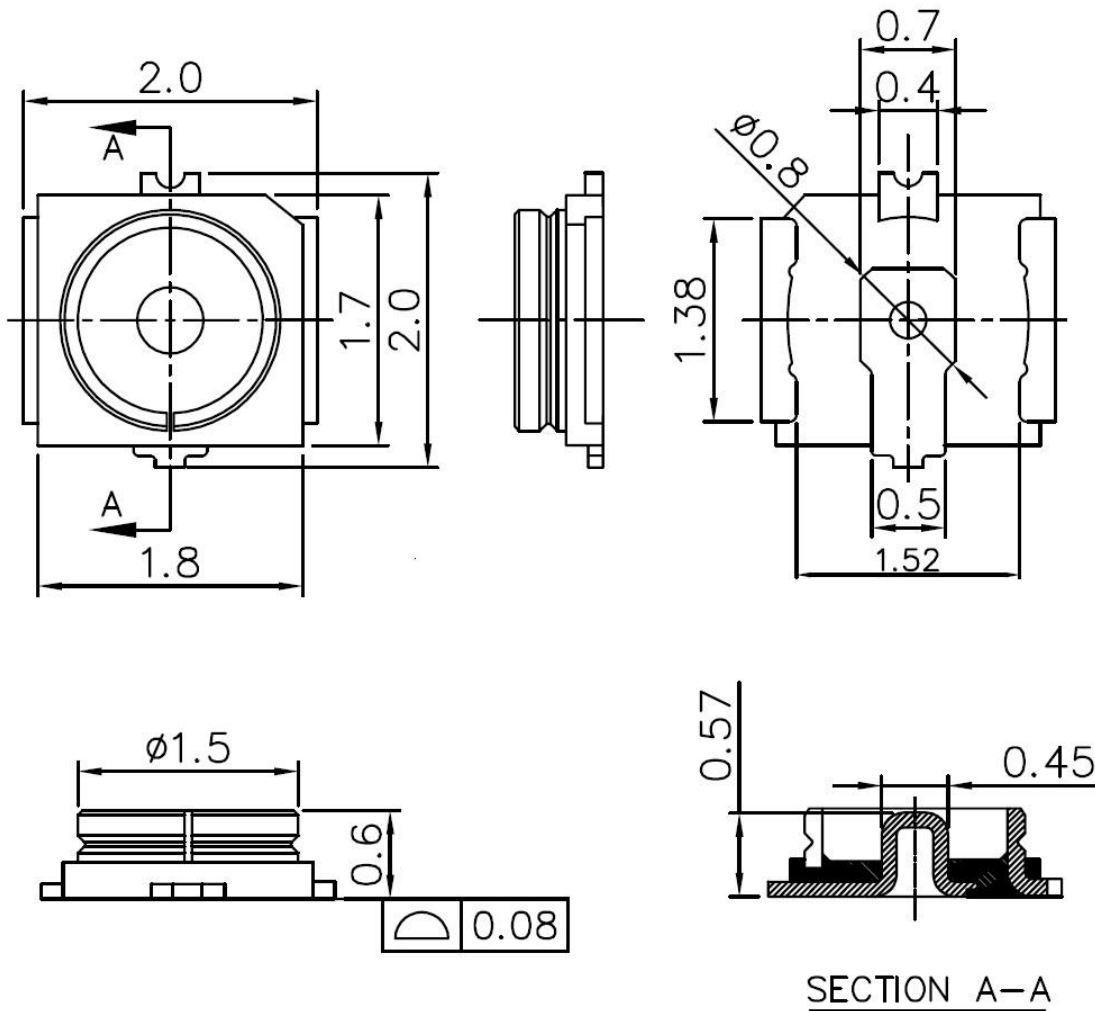
* The power consumption is based on Azurewave test environment, these data for reference only.

4. Mechanical Information

4.1 Mechanical Drawing



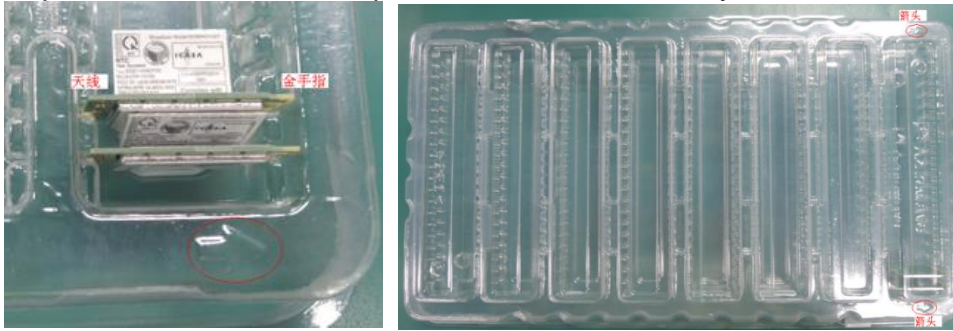
4.2 Antenna connector drawing



UNITS: mm

5. Packing Information

1. 160pcs M.2 2230 modules put in the one bottom tray



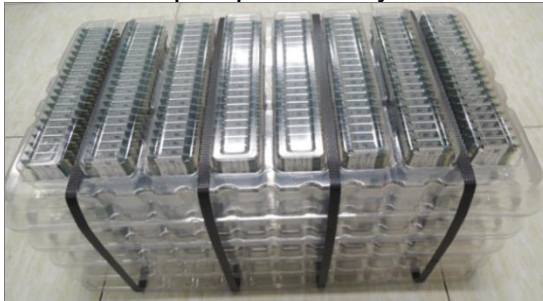
2. One cover tray put on bottom tray



3. 5pcs tray (cover + bottom) stacked together



4. Use P.P Strap to pack 5 trays



5. Put packed trays into inner box



6. Seal the inner box by AzureWave tape



7. One package label pasted in side of inner box



Example:



8. Two inner boxes put into one carton; If only one inner box has modules, “Empty” label pasted on the other one inner box

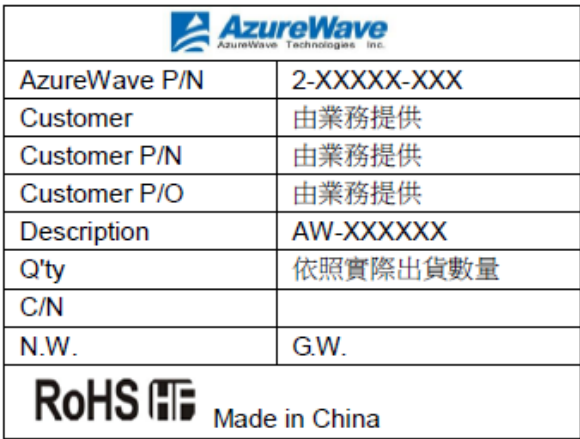
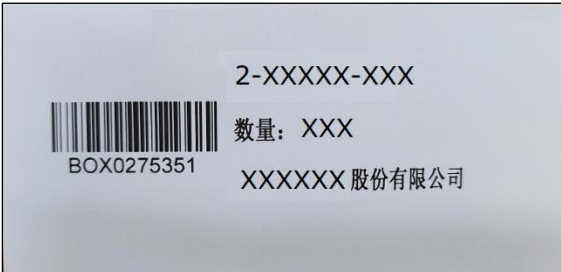


9. Seal the carton by AzureWave tape



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



Example of carton label	
Example of box label	

Example of production label	
Example of balance label	

Note:

- ◆ 1 tray = 160pcs
- ◆ 1 inner box = 5 tray = 5*160pcs
- ◆ 1 carton = 2 inner boxes = 2*800pcs = 1,600pcs