AW-XM646x Series

IEEE 802.11 a/b/g/n/ac/ax Wireless LAN 1T1R and BLE/802.15.4 Solution Family 12 x 12 LGA Module

Datasheet

Rev. B

DF

For Standard

Features

WLAN

- 1x1 dual-band 2.4 GHz/5 GHz Wi-Fi 6 radio
- Integrated Wi-Fi PA, LNA, and T/R switch, up to +23 dBm TX power
- 20 MHz channel operation
- Wi-Fi 6 Target Wake Time (TWT) support
- Wi-Fi 6 Extended Range (ER) and Dual Carrier Modulation (DCM)
- Low-power Wi-Fi idle, standby, and sleep modes
- WPA2/WPA3 security
- Support for Matter over Wi-Fi

Bluetooth

- Bluetooth Low Energy 5.4
- Bluetooth LE 1 Mbps and 2 Mbps high-speed uncoded modes, and Long Range operation (125 kbps and 500 kbps coded data rates)
- IEEE 802.15.4-2015 compliant MAC
- Support for Matter over Thread

802.15.4

- IEEE 802.15.4-2015 compliant supporting Thread in 2.4 GHz band
- Shared transmitter and antenna pin with Bluetooth
- Simultaneous receive with Wi-Fi and Bluetooth
- MAC accelerator with packet formatting, CRCs, address check, auto-acks, timers

Revision History

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Version	Revision Date	DCN NO.	Description	Initials	Approved
A	2024/12/12	DCN033008	Initial version	Vigil Tsai	N.C. Chen
B	2025/03/18	DCN033820	● Update RF specification ● Update Specifications Table ● Update packing information	Roger Liu	N.C. Chen

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1. Introduction

1.1 Product Overview

AzureWave Technologies, Inc. introduces the IEEE 802.11a/b/g/n/ac/ax 1x1 dual band WLAN, BLE/802.15.4, module – **AW-XM646.** With full-feature Wi-Fi subsystem integrated into a module, **AW-XM646** provides the best and most convenient SMT process. The module is targeted to smart entertainment, gateways, hubs, bridges, smart home, industrial, point of sale (POS) terminal, smart appliances which need convenient SMT process.

By using **AW-XM646**, the customers can easily integrate the Wi-Fi, BLE, 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 802.11 a/b/g/n/ac/ax standard, the **AW-XM646** 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-XM646**.

The **AW-XM646** supports standard interface **USB 2.0 / SDIO3.0 for WLAN**, **USB 2.0 / UART for BLE, SPI for 802.15.4**. **AW-XM646** is suitable for multiple mobile processors for different applications. With the combo functions and the good performance, the **AW-XM646** is the best solution for the consumer electronics and smart applications.

1.2 Block Diagram

TBD

1.3 Specifications Table

1.3.1 General

Features	Description
Product Description	IEEE 802.11 a/b/g/n/ac/ax Wi-Fi 6 with BLE/802.15.4 Combo Solution
Major Chipset	NXP IW610B/CF/G WLCSP (114pins)
Host Interface	WiFi + BLE + 802.15.4 ● SDIO + UART + SPI (Optional) ● USB + USB + SPI (Optional)
Dimension	12 mm X 12 mm x 2 mm(Max)
Form Factor	LGA module, 48 pins
Antenna	ANT1(Main)：WiFi/BLE/802.15.4 → TX/RX
Weight	TBD

AW-XM646x variants

Product name	Features
AW-XM646B-USB	1x1 Single -band (2.4 GHz) Wi-Fi 6 + BLE
AW-XM646B-SUR	1x1 Single -band (2.4 GHz) Wi-Fi 6 + BLE
AW-XM646C-USB	1x1 Single -band (2.4 GHz) Wi-Fi 6 + BLE/802.15.4
AW-XM646C-SUR	1x1 Single -band (2.4 GHz) Wi-Fi 6 + BLE/802.15.4
AW-XM646F-USB	1x1 Dual-band (2.4 / 5 GHz) Wi-Fi 6 + BLE
AW-XM646F-SUR	1x1 Dual-band (2.4 / 5 GHz) Wi-Fi 6 + BLE
AW-XM646G-USB	1x1 Dual-band (2.4 / 5 GHz) Wi-Fi 6 + BLE/802.15.4
AW-XM646G-SUR	1x1 Dual-band (2.4 / 5 GHz) Wi-Fi 6 + BLE/802.15.4

1.3.2 WLAN

Features	Description
WLAN Standard	IEEE 802.11 a/b/g/n/ac/ax Wi-Fi 6
Frequency Range	2.4 GHz ISM Bands 2.412-2.462 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 US/Canada and Europe 5.725-5.895 GHz (FCC UNII-high band) for US/Canada
Modulation	DSSS, OFDM, DBPSK, DQPSK, CCK, 16-QAM, 64-QAM, 256-QAM, OFDMA

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 - 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

Output Power (Board Level Limit)*

2.4G

	Min	Typ	Max	Unit
11b (11Mbps) @EVM<35%	17.5	19	20.5	dBm
11g (54Mbps) @EVM≦-25 dB	15.5	17.	18.5	dBm
11n (HT20 MCS7) @EVM≦-27 dB	14.5	16	17.5	dBm
11ax(HE20 MCS9) @EVM≦-32 dB	13.5	15	16.5	dBm

5G

	Min	Typ	Max	Unit
11a (54Mbps) @EVM≦-25 dB	14	16	18	dBm
11n (HT20 MCS7) @EVM≦-27 dB	14	16	18	dBm
11ac(VHT20 MCS8) @EVM≦-30 dB	14	16	18	dBm
11ax(HE20 MCS9) @EVM≦-32 dB	13	15	17	dBm

Receiver Sensitivity	**2.4G**				
		Min	Typ	Max	Unit
	11b (11Mbps)	-	-89	-86	dBm
	11g (54Mbps)	-	-75	-72	dBm
	11n (HT20 MCS7)	-	-72	-69	dBm
	11ax (HE20 MCS9)	-	-65	-62	dBm
	5G				
		Min	Typ	Max	Unit
	11a (54Mbps)	-	-74	-71	dBm
	11n (HT20 MCS7)	-	-71	-68	dBm
	11ac(VHT20 MCS8)	-	-67	-64	dBm
	11ax(HE20 MCS9)	-	-64	-61	dBm
Data Rate	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 802.11ac: Maximum data rates up to 86 Mbps 802.11ax: Maximum data rates up to 115 Mbps				
Security	■ WiFi: WPA3, WPA2, WPA2 and WPA mixed mode, WEP ■ BT: AES				

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

1.3.3 Bluetooth

| Features	Description				
Bluetooth Standard	Bluetooth LE 5.4 certified				
Frequency Range	2402MHz~2480MHz				
Modulation	Header GFSK				
Output Power		Min	Typ	Max	Unit
	Low Energy 1M	0	2	4	dBm
Receiver Sensitivity	BT Sensitivity (PER<30.8%)				
		Min	Typ	Max	Unit
	Low Energy 1M		-96	-93	dBm

1.3.4 802.15.4

Features	Description				
Thread Standard	IEEE 802.15.4-2015 compliant supporting Matter over Thread in 2.4 GHz band				
Frequency Range	2400MHz~2480MHz				
Modulation	O-QPSK				
Output Power		Min	Typ	Max	Unit
	Thread	0	2	4	dBm

1.3.5 Operating Conditions

Features	Description
Operating Conditions	
Voltage	3.3V +-5%
Operating Temperature	-40 ºC to +85 ºC
Operating Humidity	Less than 85% R.H.
Storage Temperature	-40 ºC to +85 ºC
Storage Humidity	Less than 60% R.H.

2. Pin Definition

2.1 Pin Map
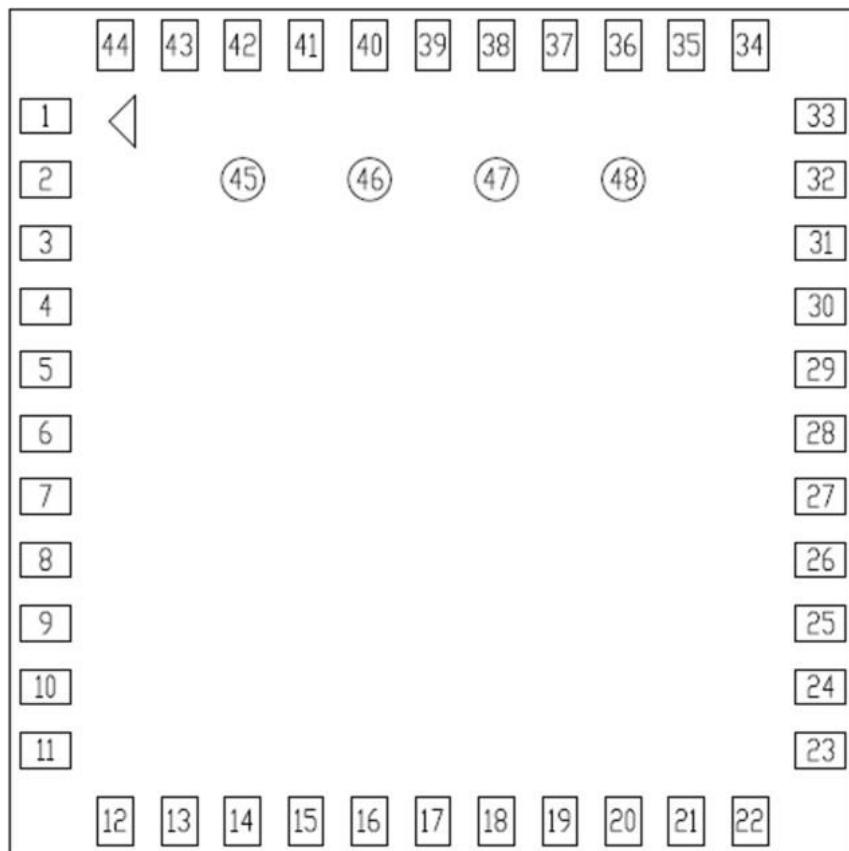
PIN DEFINED (TOP VIEW)

AW-XM646 Pin Map (top view)

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2.2 Pin Table

Pin No	Definition	Basic Description	Voltage	Type
1	GND1	Ground	---	---
2	RF_ANT	RF pin out	---	I/O
3	GND	Ground	---	---
4	SPI_TXD	SPI receive output signal. GPIO[6]	VDDIO	I/O
5	SPI_RXD	SPI receive input signal. GPIO[7]. PCM mode PCM sync signal	VDDIO	I/O
6	HOST_WAKE_ BT	GPIO Mode : GPIO[17]. Host wake BLE/802.15.4 device	VDDIO	I/O
7	BT_WAKE_Host	JTAG_TDO mode test data output signal. GPIO[5]. BLE/802.15.4 device wake Host	VDDIO	O
8	SPI_FRM	SPI_FRM - SPI frame signal. GPIO[8]	VDDIO	I/O
9	VBAT	3.3V power voltage source input	3.3V	P
10	JTAG_TMS	JTAG test mode select input signal. GPIO[3]	VDDIO	I/O
11	SPI_CLK	SPI_CLK - SPI clock signal. GPIO[9]	VDDIO	I/O
12	PDn	Full Power-down (input) (active low) 0 = full power-down mode 1 = normal mode (Has pull high 51k resistor to 3.3V internally)	3.3V	I
13	WL_WAKE_Host	JTAG_TDI Mode test data input signal. GPIO[4]. Wake up mode WIFI wake host output signal	VDDIO	I/O
14	SDIO_DATA2	SDIO Data line Bit[2]	VDDIO	I/O
15	SDIO_DATA3	SDIO Data line Bit[3]	VDDIO	I/O
16	SDIO_CMD	SDIO Command	VDDIO	I/O
17	SDIO_CLK	SDIO Clock input	VDDIO	I
18	SDIO_DATA0	SDIO Data line Bit[0]	VDDIO	I/O
19	SDIO_DATA1	SDIO Data line Bit[1]	VDDIO	I/O
20	GND	Ground	---	---
21	DCDC_1V8_OUT	Internal DC-DC output (Need external 1uH power inductor and 22μF capacitance)	1.8V	P
22	VDDIO	1.8V/3.3V Digital I/O Power Supply	1.8V/3.3V	P
23	DCDC_1V8_IN	1.8V power voltage source input	1.8V	P
24	NC	Floating Pin, No connect to anything.	---	Floating
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	NC	Floating Pin, No connect to anything.	---	Floating
30	NC	Floating Pin, No connect to anything.	---	Floating
31	GND	Ground	---	---
32	NC	Floating Pin, No connect to anything.	---	Floating
33	GND	Ground	---	---

34	RST_NB	Host-to-BT reset /IND_RST_BT – Independent. GPIO[11]	VDDIO	I
35	JTAG_TCK	JTAG test clock input signal. GPIO[2]	VDDIO	I
36	GND	Ground	---	---
37	USB_DM	USB Serial Differential Data Minus	3.3V	I/O
38	USB_DP	USB Serial Differential Data Plus	3.3V	I/O
39	GND	Ground	---	---
40	HOST_WAKE_WL	Host wake WLAN radio input signal. GPIO[16].	VDDIO	I
41	UART_RTS_N	UART_RTSn (active low)	VDDIO	O
42	UART_TXD	UART_SOUT	VDDIO	O
43	UART_RXD	UART_SIN	VDDIO	I
44	UART_CTS	UART_CTS(active low)	VDDIO	I
45	GND	Ground	---	---
46	RST_WL	Independent software reset for Wi-Fi. GPIO[10]	VDDIO	I/O
47	NC	Floating Pin, No connect to anything.	VDDIO	I/O
48	SPI_INT	SPI interrupt signal / BOOT3	VDDIO	I/O

3. Electrical Characteristics

3.1 Absolute Maximum Ratings

Symbol	Parameter	Minimum	Typical	Maximum	Unit
VBAT	DC supply for the 3.3V input	-	3.3	3.96	V
VDDIO	I/O power supply	-	3.3	3.96	V
		-	1.8	2.16	

3.2 Recommended Operating Conditions

Symbol	Parameter	Minimum	Typical	Maximum	Unit
VBAT	DC supply for the 3.3V input	3.14	3.3	3.46	V
VDDIO	1.8V/3.3V digital I/O power supply	3.14	3.3	3.46	V
		1.71	1.8	1.89	

3.3 Digital IO Pin DC Characteristics

3.3.1 1.8V Operation (VDDIO)

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 (VDDIO)

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

3.4 Host Interface

3.4.1 SDIO Interface

The AW-XM646 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-XM646 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.

◆ 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-XM646 SDIO Pin Name	Type	Description
SDIO_CLK	I	SDIO 4-bit mode: Clock SDIO 1-bit mode: Clock
SDIO_CMD	I/O	SDIO 4-bit mode: Command line SDIO 1-bit mode: Command line
SDIO_DATA3	I/O	SDIO 4-bit mode: Data line Bit[3] SDIO 1-bit mode: Not used
SDIO_DATA2	I/O	SDIO 4-bit mode: Data line Bit[2] or Read Wait (optional) SDIO 1-bit mode: Read Wait (optional)
SDIO_DATA1	I/O	SDIO 4-bit mode: Data line Bit[1] SDIO 1-bit mode: Interrupt
SDIO_DATA0	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)
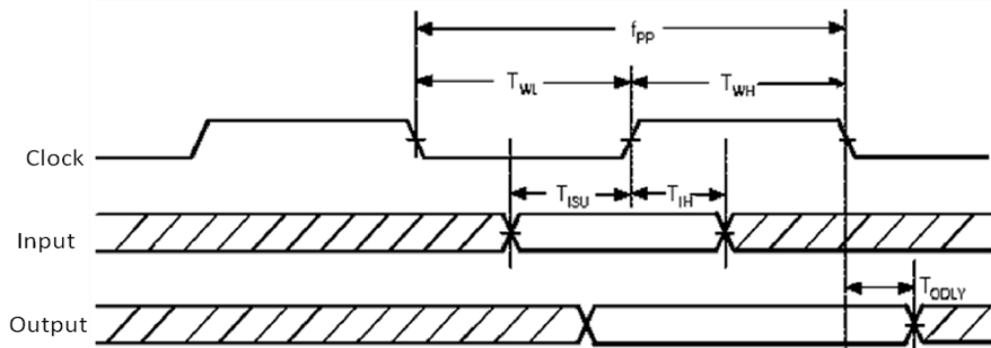

SDIO protocol timing Diagram - Default mode. (3.3V)
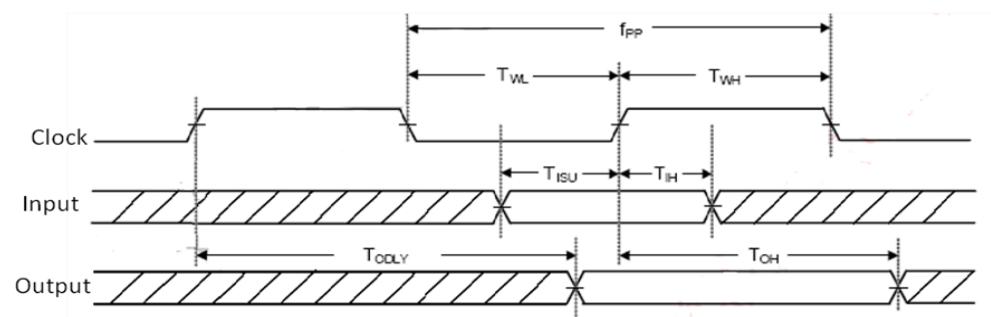
SDIO protocol timing Diagram - High Speed mode. (3.3V)

Symbol	Parameter	Condition	Min	Typ	Max	Units
f_{pp}	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
	$CL \leqq 40pF$ (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)
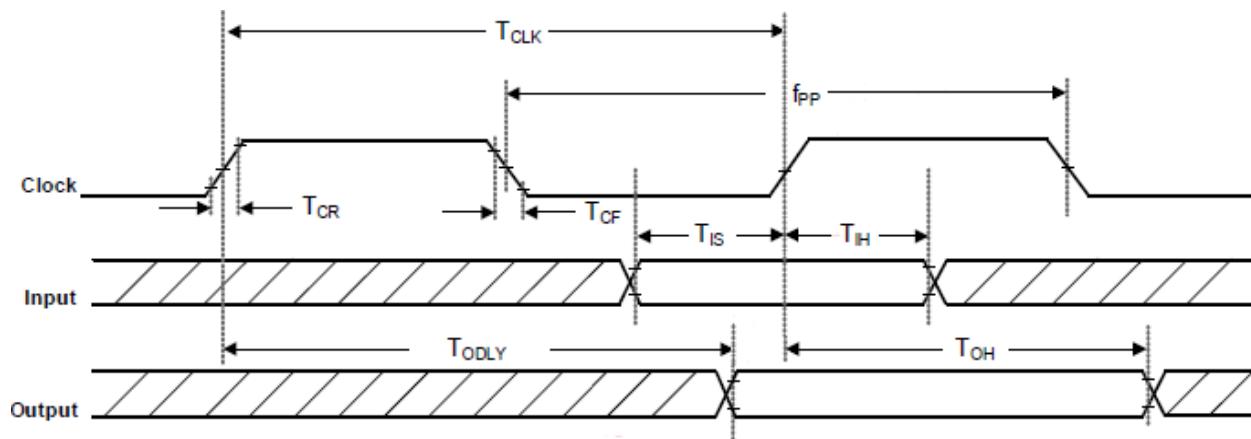
SDIO Protocol Timing Diagram - SDR12, SDR25, SDR50 Modes (up to 100 MHz)(1.8V)

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 $\leqq$ 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 SDR104 mode (208MHz) (1.8V)
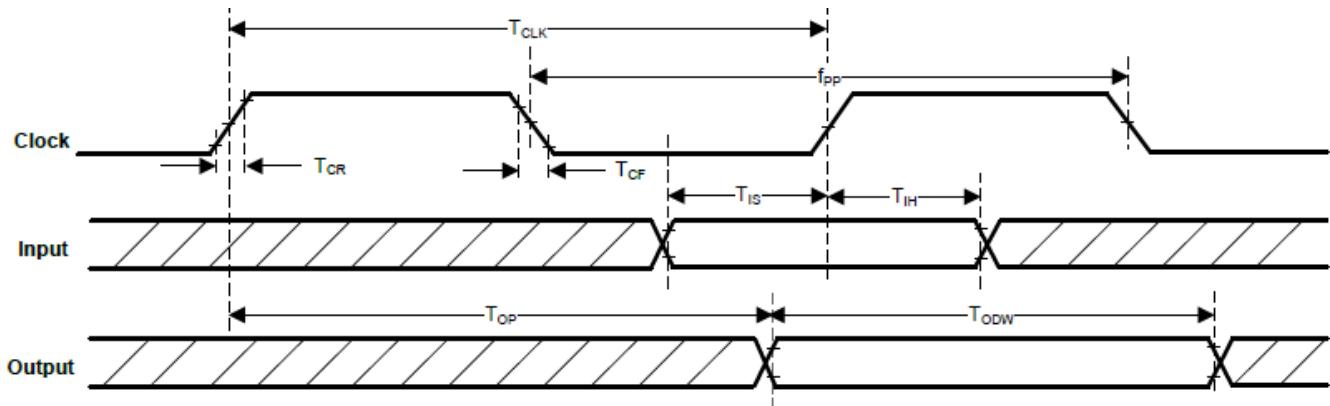
Symbol	Parameter	Condition	Min	Typ	Max	Units
F_{pp}	CLK Frequency	SDR104	0	-	208	MHz
T_{CLK}	Clock Time	SDR104	4.8	-		
T_{IS}	Input Setup Time	SDR104	1.4	-	-	ns
T_{IH}	Input Hold Time	SDR104	0.8	-	-	ns
T_{CR} , T_{CF}	Rise time, fail time TCR,TCF<0.96ns(max) at 208MHz CCARD =10pF	SDR104	-	-	$0.2*T_{CLK}$	ns
T_{OP}	Card output phase	SDR104	0	-	10	ns
T_{ODW}	Output timing of variable data window	SDR104	2.88	-	-	ns

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3.4.3 High-Speed UART Interface

The AW-XM646 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.
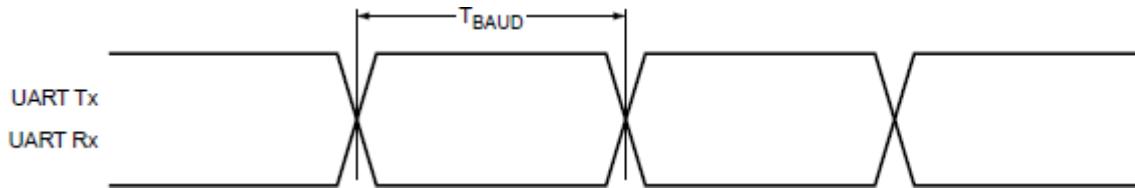
Symbol	Parameter	Condition	Min	Typ	Max	Units
T_{BAUD}	Baud rate	26MHz or 40MHz input clock	250			

3.4.4 USB Interface

3.4.4.1 USB LS driver and receiver parameters

Symbol	Parameter	Min	Typ	Max	Units
BR	Valid power to PDn deasserted	-	1.5	-	Mbit/s
BR_{PPM}	Input high voltage	-15000.0	-	15000.0	ppm
Driver specifications					
V_{OH}	Output single ended high Defined with 1.425 kΩ pull-up resistor to 3.6V	2.8	-	3.6	V
V_{OL}	Output single ended low Defined with 1.425 kΩ pull-down resistor to ground	0.0	-	0.3	V
V_{CRS}	Output single crossover voltage	1.3	-	2.0	V
T_{LR}	Data fall time Defined from 10% to 90% for rise time and 90% to 10% for fall time.	75.0	-	300.0	ns
T_{LF}	Data rise time Defined from 10% to 90% for rise time and 90% to 10% for fall time.	75.0	-	300.0	ns
T_{LRFM}	Rise and fall time matching	80.0	-	125.0	%
T_{UDJ1}	Source jitter total: to next transition • Including frequency tolerance. Timing difference between the differential data signals. • Defined at crossover point of	-95.0	-	95.0	ns

	differential data signals.		-		
T$_{UDJ2}$	Source jitter total: for paired transitions • Including frequency tolerance. Timing difference between the differential data signals. • Defined at crossover point of differential data signals.	-150.0	-	150.00	ns
Receiver specifications					
V$_{IH}$	Input single ended high	2.0	-	-	V
V$_{IL}$	Input single ended low	-	-	0.8	V
V$_{DI}$	Differential input sensitivity	0.2	-	-	V

3.4.4.2 USB FS driver and receiver parameters

| Symbol	Parameter	Min	Typ	Max	Units
BR	Baud rate	-	12.0	-	Mbit/s
BR$_{PPM}$	Baud rate tolerance	-2500.0	-	2500.0	ppm
Driver specifications					
V$_{OH}$	Output single ended high Defined with 1.425 kΩ pull-up resistor to 3.6V.	2.8	--	3.6	V
V$_{OL}$	Output single ended low Defined with 1.425 kΩ pull-down resistor to ground	0.0	--	0.3	V
V$_{CRS}$	Output single crossover voltage	1.3	-	2.0	V
T$_{FR}$	Data fall time Defined from 10% to 90% for rise time and 90% to 10% for fall time.	-4.0	-	20.0	ns
T$_{FL}$	Data rise time Defined from 10% to 90% for rise time and 90% to 10% for fall time.	-4.0	-	20.0	ns
T$_{DJ1}$	Source jitter total: to next transition • Including frequency tolerance. Timing difference between the differential data signals. • Defined at crossover point of differential data signals.	-3.5	-	3.5	ns
T$_{DJ2}$	Source jitter total: for paired transitions • Including frequency tolerance. Timing difference between the differential data signals. • Defined at crossover point of differential data signals.	-4.0	-	4.0	ns

T_{FDEOP}	Source jitter for differential transition to SE0 transition Defined at crossover point of differential data signals.	-2.0	-	5.0	ns
Receiver specifications					
V_{IH}	Input single ended high	2.0	-	-	V
V_{IL}	Input single ended low	-	-	0.8	V
V_{DI}	Differential input sensitivity	0.2	-	-	V
TJR1	Receiver jitter: to next transition Defined at crossover point of differential data signals.	-18.5	-	18.5	ns
TJR2	Receiver jitter: for paired transitions Defined at crossover point of differential data signals.	-9.0	-	9.0	ns

3.4.4.3 USB HS driver and receiver parameters

Symbol	Parameter	Min	Typ	Max	Units
BR	Baud rate	-	480.0	-	Mbit/s
BR_{PPM}	Baud rate tolerance	-500.0	-	500.0	ppm
Driver specifications					
V_{HSOH}	Data signaling high	360.0	-	440.0	mV
V_{HSOL}	Data signaling low	-10.0	-	10.0	mV
T_{HSR}	Data rise time Defined from 10% to 90% for rise time and 90% to 10% for fall time.	500.0	-	-	ns
T_{HSF}	Data fall time Defined from 10% to 90% for rise time and 90% to 10% for fall time.	-500.0	-	-	ns
Receiver specifications					
V_{HSCM}	Input single ended low	-50	-	500.00	mV

![AzureWave Technologies, Inc. logo]

3.5 Timing Sequence

AW-XM646 power up timing sequence.
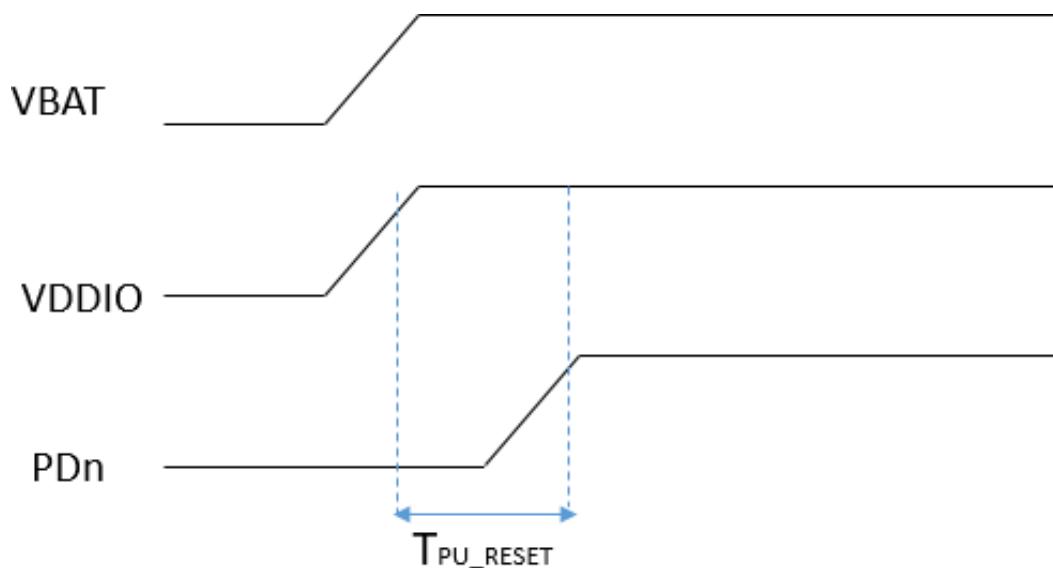
| Symbol	Parameter	Min	Typ	Max	Units
TPU_RESET	Valid power to PDn deasserted	0	-	-	ms
V_{IH}	Input high voltage	1.75	-	3.63	V
V_{IL}	Input low voltage	-0.4	-	0.2	V

4. Mechanical Information

4.1 Mechanical Drawing
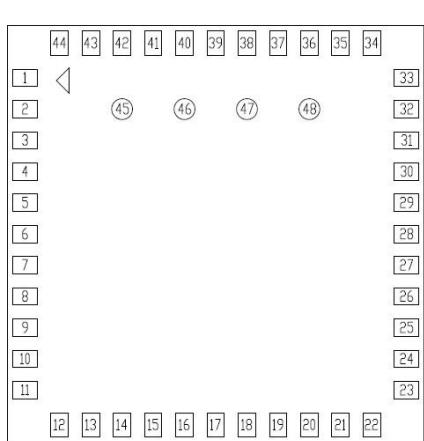
PIN DEFINED (TOP VIEW)
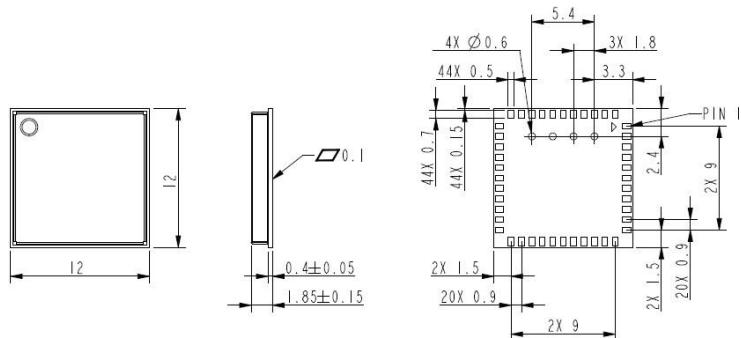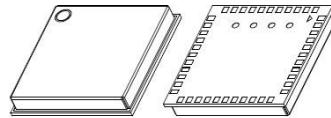
TOLERANCE UNLESS OTHERWISE SPECIFIED:±0.1mm

FCC:

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

IMPORTANT NOTE:

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

IMPORTANT NOTE:

This module is intended for OEM integrator. This module is only FCC authorized for the specific rule parts listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Additional testing and certification may be necessary when multiple modules are used.

OEM integrators that they must use the equivalent antennas or C2PC will be required.

The host manufacturer should reference KDB Publication 996369 D04 Module Integration Guide.

Make sure that the antenna used for host device must be an integral antenna, per the rules governing U-NII Band 4 operation.

USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied.

The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains TX FCC ID: TLZ-XM666".

This equipment complies with FCC mobile radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator & your body. If the module is installed in a portable host, a separate SAR evaluation is required to confirm compliance with relevant FCC portable RF exposure rules.

This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

Ant list

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	ARISTOTLE	RFA-27-JP326MHF4C198	PIFA Antenna	I-PEX	Note1

Note1:

Ant.	Gain (dBi)	
	WLAN 2.4GHz/Bluetooth/802.15.4	WLAN 5GHz/6GHz
1	3.5	5

This device is restricted for indoor use.
The antenna is limited as the antenna listed.