AW-CM389MA

IEEE 802.11 2X2 MIMO ac/a/b/g/n Wireless LAN + Bluetooth Combo M.2 1216 Module with M.2 2230 Adaptor Board

Datasheet

Version 0.4
B1H
(PCIE+USB)

Revision History

Document release	Date	Modification	Initials	Approved
Version 0.1	2016/08/03	Initial Version	Grace Liu	Peter Chen
Version 0.2	2017/03/10	1. Modify Block Diagram 2. Update Pin Definition	Peter Chen	Daniel Lee
Version 0.3	2017/04/15	2-4. Power up Timing Sequence	Grace	Daniel Lee
Version 0.4	2018/08/09	Update 1-2. Key Features 1-4. Specifications Table 5 packing information	Grace	NC

1. General Description

1-1. Product Overview and Functional Description

AzureWave Technologies, Inc. introduces the advanced **IEEE 802.11 a/b/g/n/ac 2x2 MIMO WLAN and Bluetooth combo** module - **AW-CM389MA.** The module is targeted to mobile and embedded devices which need small footprint package, low power consumption, and multiple OS support. The module supports **2.4GHz/5GHz** IEEE 802.11a/b/g/n/ac MAC/baseband/radio, and Bluetooth 4.2 functionality. It also features an integrated Power Management Unit (PMU), Power Amplifiers (PAs), and a Low Noise Amplifier (LNA) to address the needs of mobile devices that require minimal power consumption and compact size. By using AW-CM389MA, the customers can easily enable the Wi-Fi and BT embedded applications with the benefits of **high design flexibility, short development cycle, and quick time-to-market.** Specified in the IEEE 802.11 standard minimize the system power requirements by using AW-CM389MA. In addition to the support of **WPA/WPA2 (personal)** and **WEP** encryption, the AW-CM389MA also supports the IEEE 802.11i security standard through **AES** and **TKIP** acceleration hardware for faster data encryption. For the video, voice and multimedia applications the AW-CM389MA support 802.11e Quality of Service (QoS). The host interface is **PCIe** interface.

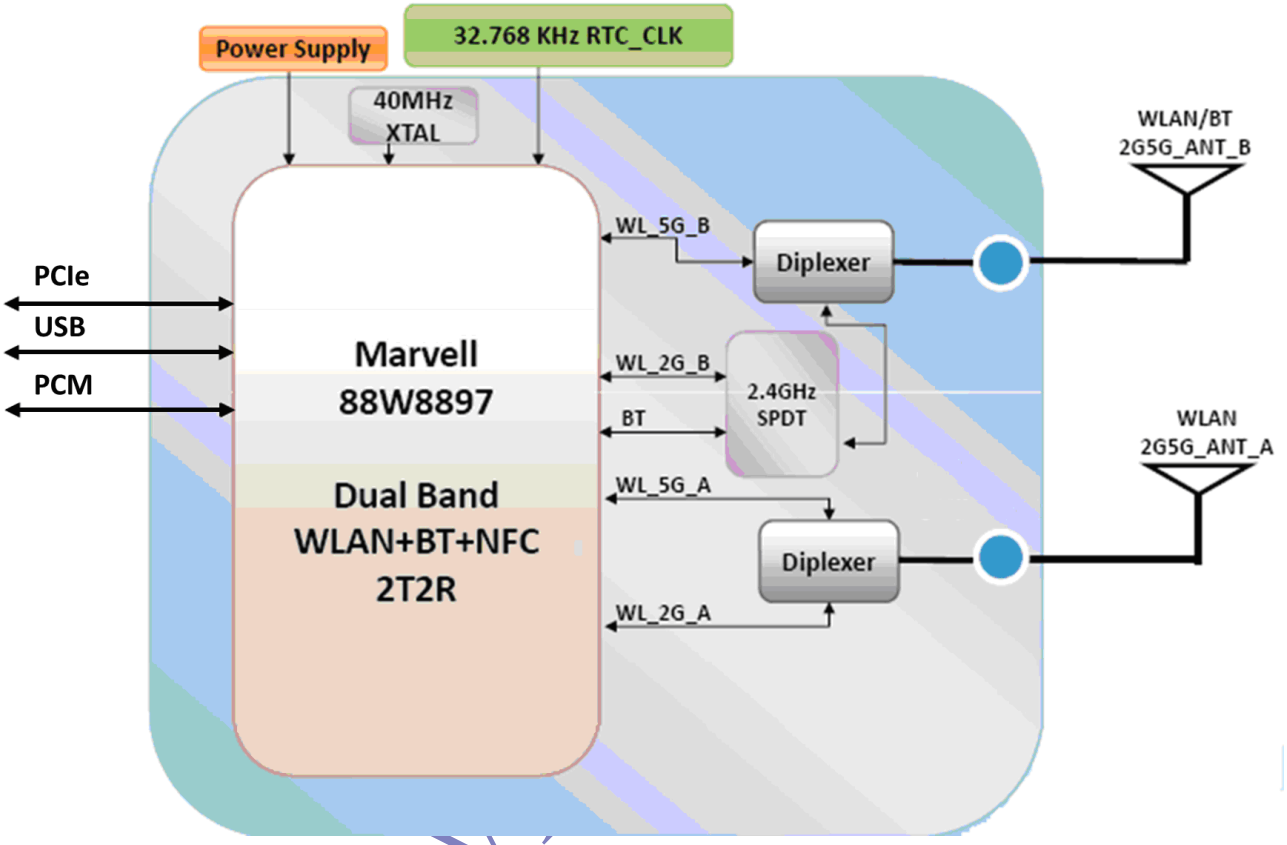
For Bluetooth operation, the AW-CM389MA is **Bluetooth 4.2** compliant. The Bluetooth transmitter also features a Class 2 power amplifier. The AW-CM389MA supports **extended Synchronous Connections (eSCO),** for enhanced voice quality by allowing for retransmission of dropped packets, and **Adaptive Frequency Hopping (AFH)** for reducing radio frequency interference. It also incorporates all Bluetooth 4.1 features including **Secure Simple Pairing**, **Sniff Substrating**, and **Encryption Pause and Resume**. An independent, **USB** is provided for the Bluetooth host interface. The Bluetooth subsystem presents a standard Host Controller Interface (HCI) via a **USB and PCM** for audio.

1-2. Key Features

1 PCIe interfaces support for WLAN and USB interfaces support for Bluetooth
2 Bluetooth 4.2 complaint with Bluetooth 2.1 + Enhanced Data Rate (EDR)
3 Audio Codec interface support
4 Multiple power saving modes for low power consumption
5 IEEE 802.11i for advanced security
6 Quality of Service (QoS) support for multimedia applications
7 Drip-in WLAN Linux drivers
8 Support for Linux kernel versions up to 2.6.32.
9 Support for BlueZ v4.47 Bluetooth profiles stack used in Android Éclair
10 Simultaneous AP-STA
11 Support China WAPI
12 Lead-free design

1-3. Block Diagram

A simplified block diagram of the AW-CM389MA module is depicted in the figure below.



1-4. Specifications Table

Model Name	AW-CM389MA
Product Description	**IEEE 802.11 2X2 MIMO ac/a/b/g/n Wireless LAN + Bluetooth M.2 Combo Module with HMC Adaptor Board**
WLAN Standard	IEEE 802.11 a/b/g/n/ac, Wi-Fi compliant
Bluetooth Standard	Bluetooth 4.2 complaint with Bluetooth 2.1+Enhanced Data Rate (EDR)
Host Interface	WLAN/Bluetooth: PCIe/USB
Audio Interface	Digital PCM for Bluetooth
Major Chipset	Marvell 88W8897
Dimension	30mm(L) x 22mm(W) x 2.25mm(H) (with shielding)
Weight	0.0020kg
Form Factor	M.2 2230 E Key
Operating Conditions	
Voltage	Input supply : 3.3V+/- 10%
Temperature	Operating : -30 ℃~ 85 ℃ ; Storage : -40 ℃ ~ 85 ℃
Electrical Specifications	
Frequency Range	2.4 GHz ISM radio band / 5 GHz Unlicensed National Information Infrastructure (U-NII) band
Number of Channels	802.11ac: USA-4 802.11a: USA, Taiwan – 12/4 Most European Countries –19 Japan – 4 802.11b: USA, Canada and Taiwan – 11 Most European Countries – 13 France – 4 802.11g: USA, Canada and Taiwan – 11 Most European Countries – 13 Japan – 13 802.11n(HT20): Channel 1~13(2412~2472) 802.11n(HT40): Channel 1~7(2422~2452)
Modulation	DSSS,OFDM,DBPSK,DQPSK,CCK, 16-QAM, 64-QAM 256-QAM for WLAN GFSK (1Mbps), Π/4 DQPSK (2Mbps) and 8DPSK (3Mbps) for Bluetooth

Output Power

WLAN:

2.4G

	Min	Typ	Max	Unit
11b (11Mbps) @EVM<35%	14	16	18	dBm
11g (54Mbps) @EVM≦-27 dB	12	14	16	dBm
11n (HT20 MCS7) @EVM≦-28 dB	11	13	15	dBm
11n (HT40 MCS7) @EVM≦-28 dB	9	11	13	dBm

5G

	Min	Typ	Max	Unit
11a (54Mbps) @EVM ≦-27 dB	11	13	15	dBm
11n (HT20 MCS7) @EVM≦-28 dB	10	12	14	dBm
11n (HT40 MCS7) @EVM≦-28 dB	8	10	12	dBm
11ac (VHT20 MCS8) @EVM≦-30 dB	9	11	13	dBm
11ac (VHT40 MCS9) @EVM≦-32 dB	7	9	11	dBm
11ac (VHT80 MCS9) @EVM≦-32 dB	6	8	10	dBm

Bluetooth:

BR:0~4dBm

EDR:0~4dBm

Receive Sensitivity

WLAN :

2.4G

	Min	Typ	Max	Unit
11b (11Mbps)		-84	-83	dBm
11g (54Mbps)		-74	-72	dBm
11n (HT20 MCS7)		-72	-68	dBm
11n (HT40 MCS7)		-68	-65	dBm

5G

	Min	Typ	Max	Unit
11a (54Mbps)		-72	-67	dBm
11n (HT20 MCS7)		-71	-67	dBm
11n (HT40 MCS7)		-68	-64	dBm
11ac (VHT20 MCS8)		-65	-62	dBm
11ac (VHT40 MCS9)		-64	-61	dBm
11ac (VHT80 MCS9)		-58	-54	dBm

Bluetooth:

BR:-70dBm(Max.)

EDR:-70dBm(Max.)

Data Rates	WLAN 802.11b: 1, 2, 5.5, 11Mbps 802.11a/g: 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11n: up to 150Mbps-single 802.11n: up to 300Mbps-2x2 MIMO 802.11ac:up to 192.6Mbps (20MHz channel) 802.11ac:up to 400Mbps (40MHz channel) 802.11ac:up to 866.7Mbps (80MHz channel) Bluetooth Bluetooth 2.1+EDR data rates of 1,2, and 3Mbps
Security	◆ 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
Operating System Compatibility	Linux

2. Electrical Characteristics

2-1. Recommended Operating Conditions

Symbol	Parameter	Type	Min	Typ	Max	Units
3.3V	3.3V power supply	Input	2.97	3.3	3.63	V

2-2. DC Characteristics - 3.3V Operation

Symbol	Parameter	Condition	Min	Typ	Max	Units
V_{IH}	Input high voltage	VIO=3.3V	2.31	-	3.7	V
V_{IL}	Input low voltage	VIO =3.3V	-0.4	-	0.99	V
V_{HYS}	Input hysteresis	VIO=3.3V	100			mV
V_{OH}	Output high voltage	VIO =3.3V	2.9	-	-	V
V_{OL}	Output low voltage	VIO =3.3V	-	-	0.4	V

2-3. PCIe Host Interface Specification

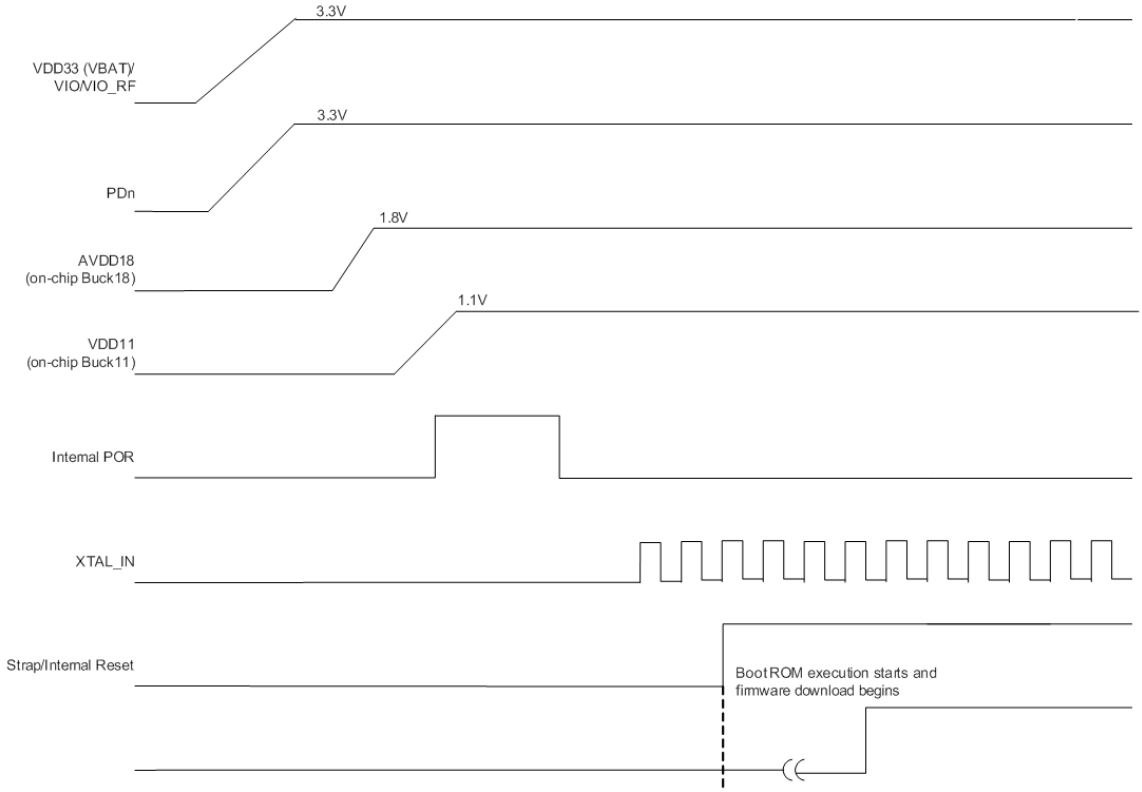
PCIe Express Tx Output Specification

Symbol	Parameter	Min	Typ	Max	Units
UI	Unit interval	399.98	400	400.12	Ps
V_{Tx_DIFFpp}	Differential peak-to-peak output voltage	0.8	-	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	
T_{Tx_RISE, TT_FALL}	D+/D- Tx output rise/fall time	0.125	-	-	
$V_{Tx\_CM\_DC\_ACTIVE\_IDLE\_DELTA}$	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	
$V_{Tx\_IDLE\_DIFFp}$	Electrical idle differential peak output voltage	0	-	20	
$V_{Tx\_RCV\_DETECT}$	Voltage change allowed during receiver detection	-	-	600	
$V_{Tx\_DC\_CM}$	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	
$T_{Tx\_IDLE\_TO\_DIFF\_DATA}$	Maximum time to transition to valid Tx specifications after leaving an electrical idle condition	-	-	20	
RL_{Tx_DIFF}	Differential return loss	10	-	-	dB
RL_{Tx_CM}	Common mode return loss	6	-	-	
C_{Tx}	AC coupling capacitor	75	-	200	nF
$T_{Crosstalk}$	Crosstalk random timeout	0	-	1	ms

PCIe Express Rx Input Specification

Symbol	Parameter	Min	Typ	Max	Units
UI	Unit interval	399.98	400	400.12	Ps
V_{Rx_DIFFpp}	Differential peak-to-peak voltage	0.175	-	1.2	V
T_{RX_EYE}	Minimum receiver eye width	0.4	-	-	UI
$T_{Rx\_EYE\_MEDIAN\_MAX\_JIT}$	Maximum time between jitter median and maximum deviation from median	-	-	0.3	
$V_{Rx\_CM\_ACp}$	AC peak common mode input return loss	-	-	150	mV
RL_{Rx_DIFF}	Differential return loss	10	-	-	dB
RL_{Rx_CM}	Common mode return loss	6	-	-	
$Z_{Rx\_DIFF\_DC}$	DC differential input impedance	80	100	120	Ω
Z_{Rx_DC}	DC input impedance	40	50	60	
$Z_{Rx\_HIGH\_IMP\_DC\_POS}$	Powered down DC input impedance positive	50	-	-	k
$Z_{Rx\_HIGH\_IMP\_DC\_NEG}$	Powered down DC input impedance negative	1	-	-	kΩ
$V_{Rx\_IDLE\_DET\_DIFFpp}$	Electrical idle detect threshold	65	-	175	mV
$T_{Rx\_IDLE\_DET\_DIFF\_ENTER\ TIME}$	Unexpected electrical idle enter detect threshold integration time	-	-	10	ms
L_{Rx_SKEW}	Total skew	-	-	20	ns

2-4. **Power up Timing Sequence**

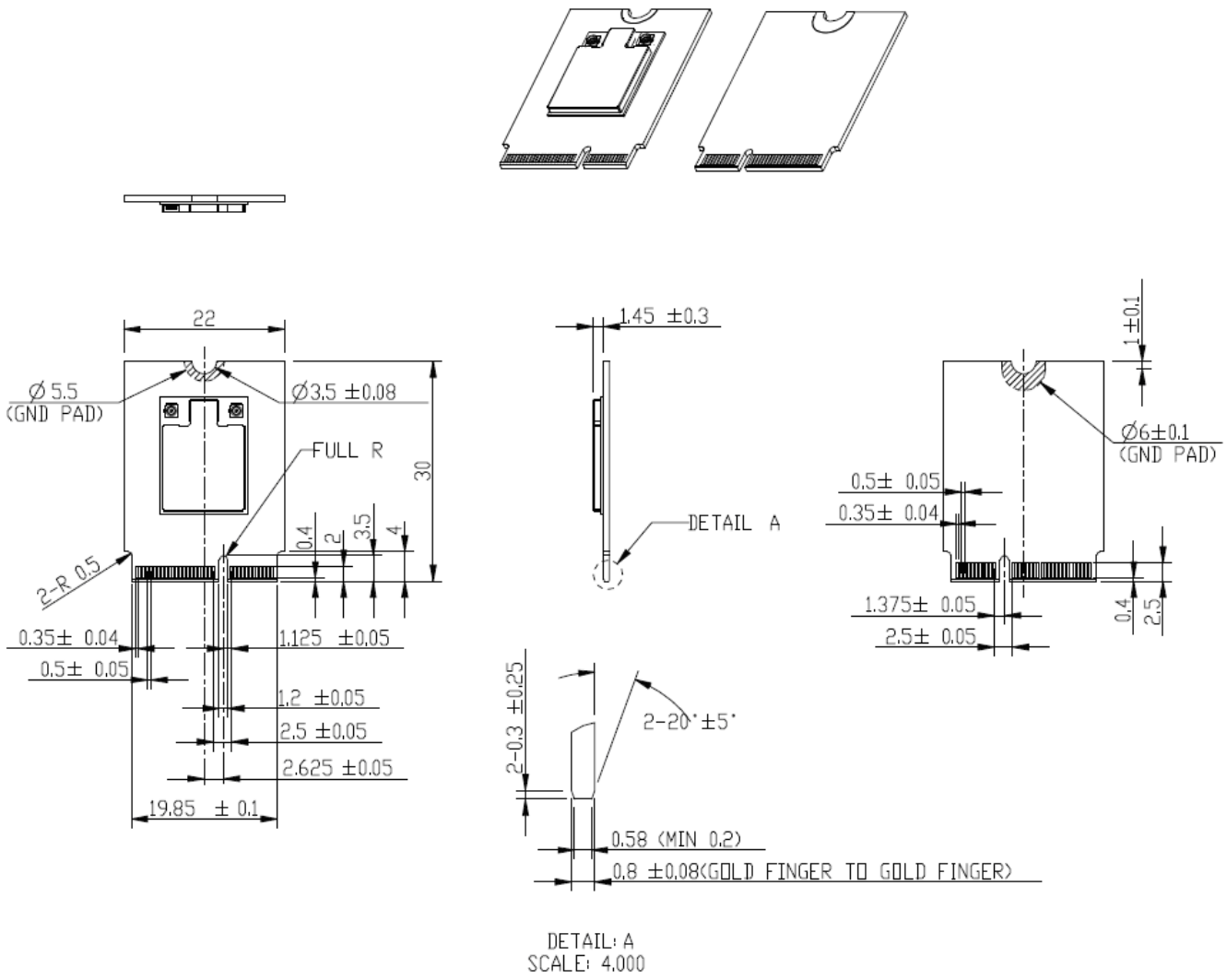


3. Pin Definition

Pin No.	Definition	Basic Description	Type	Supply
1	GND	Ground	GND	
2	3.3V	3.3V power supply.	VCC	3.3V
3	USB_D+	USB Bus Data Plus 1 of the differential data pair.	I/O	3.3V
4	3.3V	3.3V power supply	VCC	3.3V
5	USB_D-	USB Bus Data Minus 1 of the differential data pair.	I/O	3.3V
6	LED_WLAN_L	Active low signal. The signal is used to provide status indicators via LED. (in this project is not used, please let it open)	Output	3.3V
7	GND	Ground	GND	
8	PCM_CLK	PCM clock	I/O	3.3V
9	NC	No connect to anything	Floating	
10	PCM_SYNC	PCM Synchronization control	O	3.3V
11	NC	No connect to anything	Floating	
12	PCM_OUT	PCM data Out	O	3.3V
13	NC	No connect to anything	Floating	
14	PCM_IN	PCM data Input	I	3.3V
15	NC	No connect to anything	Floating	
16	LED_BT_L	Active low signal. The signal is used to provide status indicators via LED. (in this project is not used, please let it open)	Output	3.3V
17	NC	No connect to anything	Floating	
18	GND	Ground.	GND	
19	NC	No connect to anything	Floating	
20	NC	No connect to anything	Floating	
21	NC	No connect to anything	Floating	
22	NC	No connect to anything	Floating	
23	NC	No connect to anything	Floating	
32	NC	No connect to anything	Floating	
33	GND	Ground.	GND	
34	NC	No connect to anything	Floating	
35	PCIE_RXP	PCI Express Lane 0, Receive Pair, Positive Signal 2.5 GHz serial low-voltage interface	I	1.8V (Internal)
36	NC	No connect to anything	Floating	
37	PCIE_RXN	PCI Express Lane 0, Receive Pair, Negative Signal 2.5 GHz serial low-voltage interface	I	1.8V (Internal)
38	NC	No connect to anything	Floating	
39	GND	Ground	GND	
40	NC	No connect to anything	Floating	
41	PCIE_TXP	PCI Express Lane 0, Transmit Pair, Positive Signal 2.5 GHz serial low-voltage interface	O	1.8V

				(Internal)
42	NC	No connect to anything	Floating	
43	PCIE_TXN	PCI Express Lane 0, Transmit Pair, Negative Signal 2.5 GHz serial low-voltage interface	O	1.8V (Internal)
44	NC	No connect to anything	Floating	
45	GND	Ground	GND	
46	NC	No connect to anything	Floating	
47	PCIE_CLKP	PCI Express Differential Clock Input—Positive	I	1.8V (Internal)
48	NC	No connect to anything	Floating	
49	PCOE_CLKN	PCI Express Differential Clock Input—Negative	I	1.8V (Internal)
50	CLK_32KHz	External sleep clock input (32.768 kHz).	I	3.3V
51	GND	Ground	GND	
52	PERST0	PCI Express Reset	I	3.3V
53	PCIE_CLKREQ_N	PCI Express Clock Request	I/O	3.3V
54	PDn	Full Power-Down (input) (active low) The module internal pull-up 51kΩ on this pin.	I	3.3V
55	PCIE_WAKEUP_N	PCI Express Clock Request	O	3.3V
56	W_DISABLE#1	PCIE_W_DISABLE, PCIe host indication the WLAN function of the device	I	3.3V
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	VCC	3.3V
73	NC	No connect to anything	Floating	
74	3.3V	3.3V power supply	VCC	3.3V
75	GND	Ground	GND	

4. Mechanical Information



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

Remark： 160pcs/Tray，5 Tray/inner box， 2 inner box/carton. 1,600pcs/carton

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

Example:

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

<table>
<tr><td>Example of carton label</td><td>
<table>
<tr><td colspan="2">AzureWave Technologies Inc.</td></tr>
<tr><td>AzureWave P/N</td><td>2-1280MA-B1H</td></tr>
<tr><td>Customer</td><td>由業務提供</td></tr>
<tr><td>Customer P/N</td><td>由業務提供</td></tr>
<tr><td>Customer PO</td><td>由業務提供</td></tr>
<tr><td>Description</td><td>AW-CM389MA</td></tr>
<tr><td>QTY</td><td>1600pcs</td></tr>
<tr><td>C/N</td><td></td></tr>
<tr><td>N.W.</td><td>G.W.</td></tr>
<tr><td colspan="2">RoHS COMPLIANT</td></tr>
</table>
</td></tr>
<tr><td>Example of box label</td><td> 
</td></tr>
<tr><td>Example of balance label</td><td> 
</td></tr>
</table>