

AW-NM191NF

IEEE 802.11b/g/n Wireless LAN M.2 1216 LGA Module

Datasheet

Rev. B

B1

Standard

Features

WLAN

- M.2 TYPE 1216: 16mm(L) x 12mm(W) x 1.95 mm(H)(Max)
- SDIO/USB2.0 interface support for WLAN
- High speed wireless connection up to 72.2 Mbps for Wi-Fi
- Multiple power saving modes for low power consumption
- IEEE 802.11i for advanced security
- Support China WAPI
- Lead-free design

Table of Contents

Features	2
Revision History	3
Table of Contents	4
1. Introduction	5
1.1 Product Overview	5
1.2 Block Diagram	6
1.3 Specifications Table	7
1.3.1 General	7
1.3.2 WLAN	7
1.3.3 Operating Conditions	8
2. Pin Definition	10
2.1 Pin Table	10
3. Electrical Characteristics	15
3.1 Absolute Maximum Ratings	15
3.2 Recommended Operating Conditions	15
3.3 Digital IO Pin DC Characteristics	15
3.3.1 DC Electricals-1.8V Operation (VIO_SD)	15
3.4 Host Interface	16
3.4.1 SDIO Interface	16
3.5 Power up Sequence	18
3.5.1 Reset Configuration	18
4. Mechanical Information	19
4.1 Mechanical Drawing	19
4.2 Antenna connector drawing	20
4.3 Recommended Footprint Pattern	21
5. Shipping Information	22
5.1 Tape information	22
5.1 Reel information	23
5.2 Packing Information	24
6. Module Marking Information	28

1. Introduction

1.1 Product Overview

AzureWave Technologies, Inc. introduces the IEEE 802.11b/g/n 1X1WLAN M.2 1216 module --- **AW-NM191NF**. 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-NM191NF, the customers can easily enable the Wi-Fi applications with the benefits of **high design flexibility, short development cycle, and quick time-to-market**.

Compliance with the IEEE 802.11b/g/n standard, the AW-NM191MA 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-NM191NF. In addition to the support of **WPA/WPA2/WPA3** and **WEP** 64-bit and 128-bit encryption, the AW-NM191NF 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.

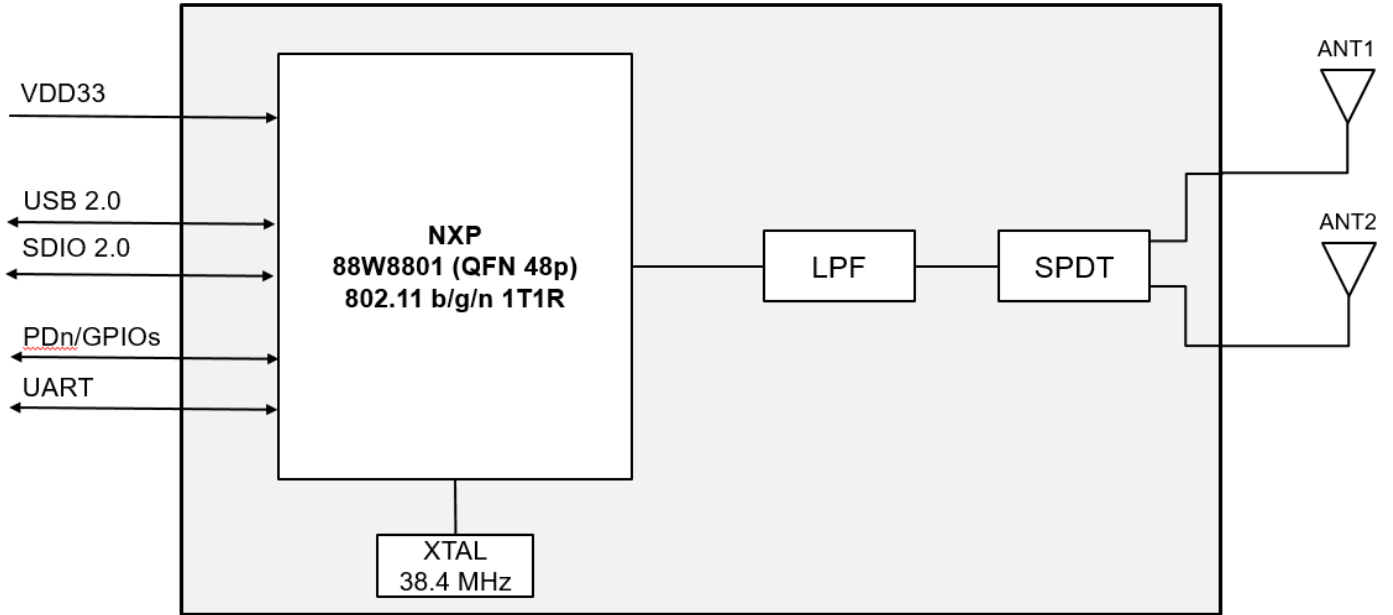
AW-NM191NF supports **SDIO or USB2.0 interface** for WLAN to the host processor.

AW-NM191NF is suitable for multiple mobile processors for different applications with the support cellular phone co-existence.

AW-NM191NF module adopts NXP's latest highly-integrated WLAN SoC---**88W8801**. All the other components are implemented by all means to reach the mechanical specification required.

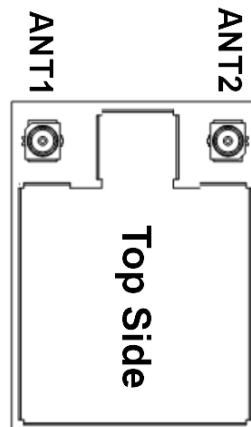
1.2 Block Diagram

AW-NM191NF M.2 1216 Module



AW-NM191NF Block Diagram

Module antenna configuration



1.3 Specifications Table

1.3.1 General

Features	Description
Product Description	IEEE 802.11 Wi-Fi b/g/n Wireless LAN M.2 Module
Major Chipset	NXP 88W8801
Host Interface	Wi-Fi <ul style="list-style-type: none"> ● SDIO2.0 ● USB2.0
Dimension	12mm(W) x 16mm(L) x 1.95mm(H) (Tolerance remarked in mechanical drawing)
Form factor	M.2 1216
Antenna	1T1R (w/ antenna diversity) I-PEX MHF4 Connector Receptacle (20449) ANT1 : WiFi → TX/RX ANT2 : WiFi → TX/RX
Weight	0.6g

1.3.2 WLAN

Features	Description
WLAN Standard	IEEE 802.11 b/g/n
WLAN VID/PID	N/A
Frequency Range	2.4 GHz : 2.412 ~ 2.472 GHz
Modulation	DSSS, OFDM, DBPSK, DQPSK, CCK, 16-QAM, 64-QAM
Number of Channels	2.4GHz <ul style="list-style-type: none"> ■ USA, NORTH AMERICA, Canada and Taiwan – 1 ~ 11 ■ China, Australia, Most European Countries, Japan – 1 ~ 13

Output Power (Board Level Limit)*	2.4GHz				
		Min	Typ	Max	Unit
	11b (11Mbps) @EVM<35%	15.5	17	18.5	dBm
	11g (54Mbps) @EVM ≤ -27 dB	12.5	14	15.5	dBm
	11n (HT20 MCS7) @EVM ≤ -28 dB	11.5	13	14.5	dBm
Receiver Sensitivity	2.4GHz				
		Min	Typ	Max	Unit
	11b (11Mbps)	-	-87	-84	dBm
	11g (54Mbps)	-	-73	-70	dBm
	11n (HT20 MCS7)	-	-70	-67	dBm
Data Rate	<ul style="list-style-type: none"> ■ 802.11b: 1, 2, 5.5, 11Mbps ■ 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps ■ 802.11n: up to 72.2Mbps 				
Security	<ul style="list-style-type: none"> ■ WAPI ■ WEP 64-bit and 128-bit encryption with H/W TKIP processing ■ WPA/WPA2/WPA3 (Wi-Fi Protected Access) ■ AES-CCMP hardware implementation as part of 802.11i security standard 				
Operating System Compatibility	<ul style="list-style-type: none"> ■ Linux 				
Regulatory	<ul style="list-style-type: none"> ■ CE, FCC and Japan 				

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

1.3.3 Operating Conditions

Features	Description
Operating Conditions	
Voltage	Power supply for host: 3.3V
Operating Temperature	0 °C ~ 70 °C
Operating Humidity	less than 95% R.H.
Storage Temperature	-40 °C ~ 85 °C
Storage Humidity	less than 95% R.H.
ESD Protection	

Human Body Model	+2kV per MIL-STD-883H Method 3015.8
Changed Device Model	+500V per JEDEC EIA/JESD22-C101E

2. Pin Definition

2.1 Pin Table

PIN No.	Definition	Description	Type	Level
1	TMS	JTAG controller select (input)	Input	VIO
2	TCK	JTAG test clock (input)	Input	VIO
3	TDI	JTAG test data (input)	Input	VIO
4	3.3V	3.3V Power supply.	VCC	-
5	3.3V	3.3V Power supply.	VCC	-
6	GND	Ground.	GND	-
7	TDO	JTAG test data (output)	Input	VIO
8	NC	No connect to gold fingers.	Floating	-
9	NC	No connect to gold fingers.	Floating	-
10	NC	No connect to gold fingers.	Floating	-
11	NC	No connect to gold fingers.	Floating	-
12	NC	No connect to gold fingers.	Floating	-
13	NC	No connect to gold fingers.	Floating	-
14	NC	No connect to gold fingers.	Floating	-
15	NC	No connect to gold fingers.	Floating	-
16	NC	No connect to gold fingers.	Floating	-
17	GND	Ground.	GND	-
18	NC	No connect to gold fingers.	Floating	-
19	NC	No connect to gold fingers.	Floating	-
20	GND	Ground.	GND	-
21	CON[0]	Boot Options and Host Interface Selection 00 = UART (debug) 01 = reserved 10 = SDIO (CON1=>HIGH ,CON0=>Low) 11 = USB (default)	Input	1.8V

22	CON[1]		Input	1.8V
23	GND	Ground.	GND	-
24	NC	No connect to gold fingers.	Floating	-
25	NC	No connect to gold fingers.	Floating	-
26	GND	Ground.	GND	-
27	NC	No connect to gold fingers.	output	-
28	NC	No connect to gold fingers.	Floating	-
29	NC	No connect to gold fingers.	Floating	-
30	NC	No connect to gold fingers.	Floating	-
31	NC	No connect to gold fingers.	Floating	-
32	GND	Ground.	GND	-
33	NC	No connect to gold fingers.	Floating	-
34	NC	No connect to gold fingers.	Floating	-
35	GND	Ground.	GND	-
36	NC	No connect to gold fingers.	Floating	-
37	NC	No connect to gold fingers.	Floating	-
38	GND	Ground.	GND	-
39	NC	No connect to gold fingers.	Floating	-
40	NC	No connect to gold fingers.	Floating	-
41	GND	Ground.	GND	-
42	GPIO0	GPIO	Input/Output	VIO
43	HOST_WAKE	Host-to-SoC Wakeup (input)	input	1.8V
44	SD_VIO	I/O SDIO Power Supply	VCC	-
45	PDN	Full Power-Down (active low) 0 = full power-down mode 1 = normal mode <ul style="list-style-type: none"> • Connect to power-down pin of host or 3.3V • External host required to drive this pin high for normal operation • No internal pull-up on this pin. 	VCC	3.3V/1.8V

46	GPIO1	GPIO	Input/Output	VIO
47	SDIO DAT3	SDIO 4-bit Mode: Data line Bit[3] SDIO 1-bit Mode: Reserved SDIO SPI Mode: Card select (active low)	Input/Output	SD_VIO
48	SDIO DAT2	SDIO 4-bit Mode: Data line Bit[2] or read wait (optional) SDIO 1-bit Mode: Read wait (optional) SDIO SPI Mode: Reserved	Input/Output	SD_VIO
49	SDIO DAT1	SDIO 4-bit Mode: Data line Bit[1] SDIO 1-bit Mode: Interrupt SDIO SPI Mode: Interrupt SDO is tristate when SCSn is inactive. Enables multiple devices driving SDO line.	Input/Output	SD_VIO
50	SDIO DAT0	SDIO 4-bit Mode: Data line Bit[0] SDIO 1-bit Mode: Data line SDIO SPI Mode: Data output	Input/Output	SD_VIO
51	SDIO CMD	SDIO 4-bit Mode: Command/response (input/output) SDIO 1-bit Mode: Command line SDIO SPI Mode: Data input USB Mode: USB_VBUS_ON (input)	Input/Output	SD_VIO
52	SDIO CLK	SDIO 4-bit Mode: Clock input SDIO 1-bit Mode: Clock input SDIO SPI Mode: Clock input	Input	SD_VIO
53	NC	No connect to gold fingers.	Floating	-
54	NC	No connect to gold fingers.	Floating	-
55	NC	No connect to gold fingers.	Floating	-
56	NC	No connect to gold fingers.	Floating	-
57	GND	Ground	GND	-
58	NC	No connect to gold fingers.	Floating	-
59	NC	No connect to gold fingers.	Floating	-
60	NC	No connect to gold fingers.	Floating	-
61	NC	No connect to gold fingers.	Floating	-
62	GND	Ground.	GND	-
63	NC	No connect to gold fingers.	Floating	-
64	NC	No connect to gold fingers.	Floating	-
65	NC	No connect to gold fingers.	Floating	-
66	GPIO3	GPIO	Input/Output	VIO

67	GPIO2	GPIO	Input/Output	VIO
68	GND	Ground.	GND	-
69	USB_D-	USB Serial Differential Data Negative	Input/Output	3.3V
70	USB_D+	USB Serial Differential Data Positive	Input/Output	3.3V
71	GND	Ground.	GND	-
72	3.3V	3.3V Power supply.	VCC	-
73	VIO	3.3V Power supply.	VCC	-
74	GND	Ground.	GND	-
75	GND	Ground.	GND	-
76	GND	Ground.	GND	-
77	GND	Ground.	GND	-
78	GND	Ground.	GND	-
79	GND	Ground.	GND	-
80	GND	Ground.	GND	-
81	GND	Ground.	GND	-
82	GND	Ground.	GND	-
83	GND	Ground.	GND	-
84	GND	Ground.	GND	-
85	GND	Ground.	GND	-
86	GND	Ground.	GND	-
87	GND	Ground.	GND	-
88	GND	Ground.	GND	-
89	GND	Ground.	GND	-
90	GND	Ground.	GND	-
91	GND	Ground.	GND	-
92	GND	Ground.	GND	-
93	GND	Ground.	GND	-

94	GND	Ground.	GND	-
95	GND	Ground.	GND	-
96	GND	Ground.	GND	-
G1~G1 32	GND	Ground.	GND	-

3. Electrical Characteristics

3.1 Absolute Maximum Ratings

Symbol	Parameter	Condition	Min	Typ	Max	Units
VIO_SD	Host I/O power supply	--	--	1.8	2.2	V
3.3V	3.3V VBAT input	--	--	3.3	3.63	V
T _{storage}	Storage Temperature		-40		125	°C

3.2 Recommended Operating Conditions

Symbol	Parameter	Condition	Min	Typ	Max	Units
VIO_SD	Host I/O power supply	--	1.62	1.8	1.98	V
			2.97	3.3	3.63	
3.3V	3.3V VBAT input	--	2.97	3.3	3.63	V
T _A	Ambient operating temperature	--	-30		85	°C

3.3 Digital IO Pin DC Characteristics

3.3.1 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	-	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

3.4 Host Interface

3.4.1 SDIO Interface

AW-NM191NF 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.

AW-NM191NF 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.

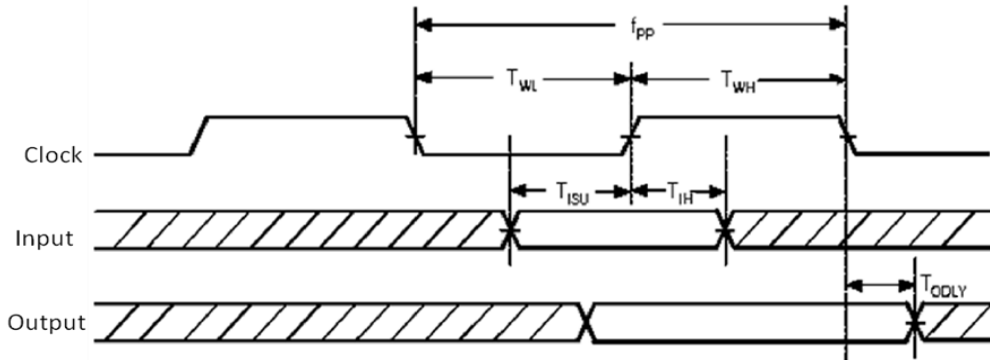
- On-chip memory used for CIS.
- Supports 4-bit SDIO and 1-bit SDIO transfer modes.
- Special interrupt register for information exchange.
- Allows card to interrupt host.

SDIO Interface Signals

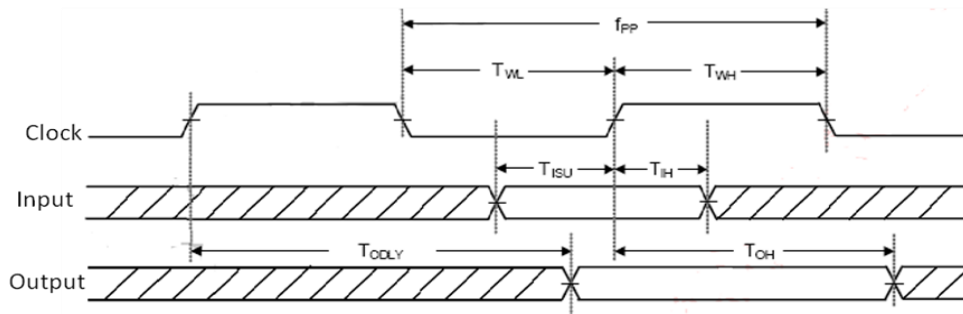
AW-NM191NF SDIO Pin Name	Type	Description
SDIO_DATA_CLK	I	SDIO 4-bit mode: Clock SDIO 1-bit mode: Clock
SDIO_DATA_CMD	I/O	SDIO 4-bit mode: Command line SDIO 1-bit mode: Command line
SDIO_DATA_3	I/O	SDIO 4-bit mode: Data line Bit[3] SDIO 1-bit mode: Not used
SDIO_DATA_2	I/O	SDIO 4-bit mode: Data line 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

SDIO Protocol Timing

Default Speed, High-Speed Modes



SDIO protocol timing Diagram - Default mode.



SDIO protocol timing Diagram - High Speed mode.

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 ≤ 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.

3.5 Power up Sequence

The AW-NM191NF is reset, and the internal CPU begins the boot sequence when the PDn input pin transitions from low to high following NXP's power up sequence.

PDn pin has internal 10k ohm resistor pull-up to 3.3V.

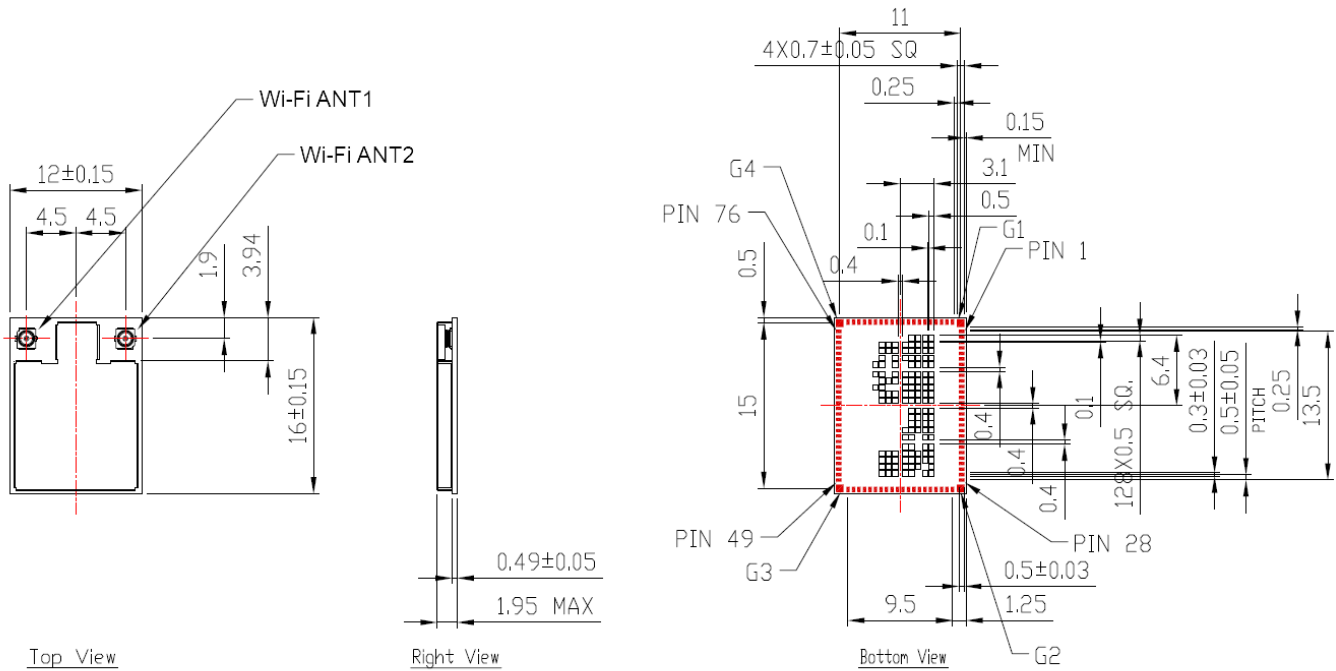
3.5.1 Reset Configuration

The AW-NM191NF is reset to its default operating state under the following conditions:

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

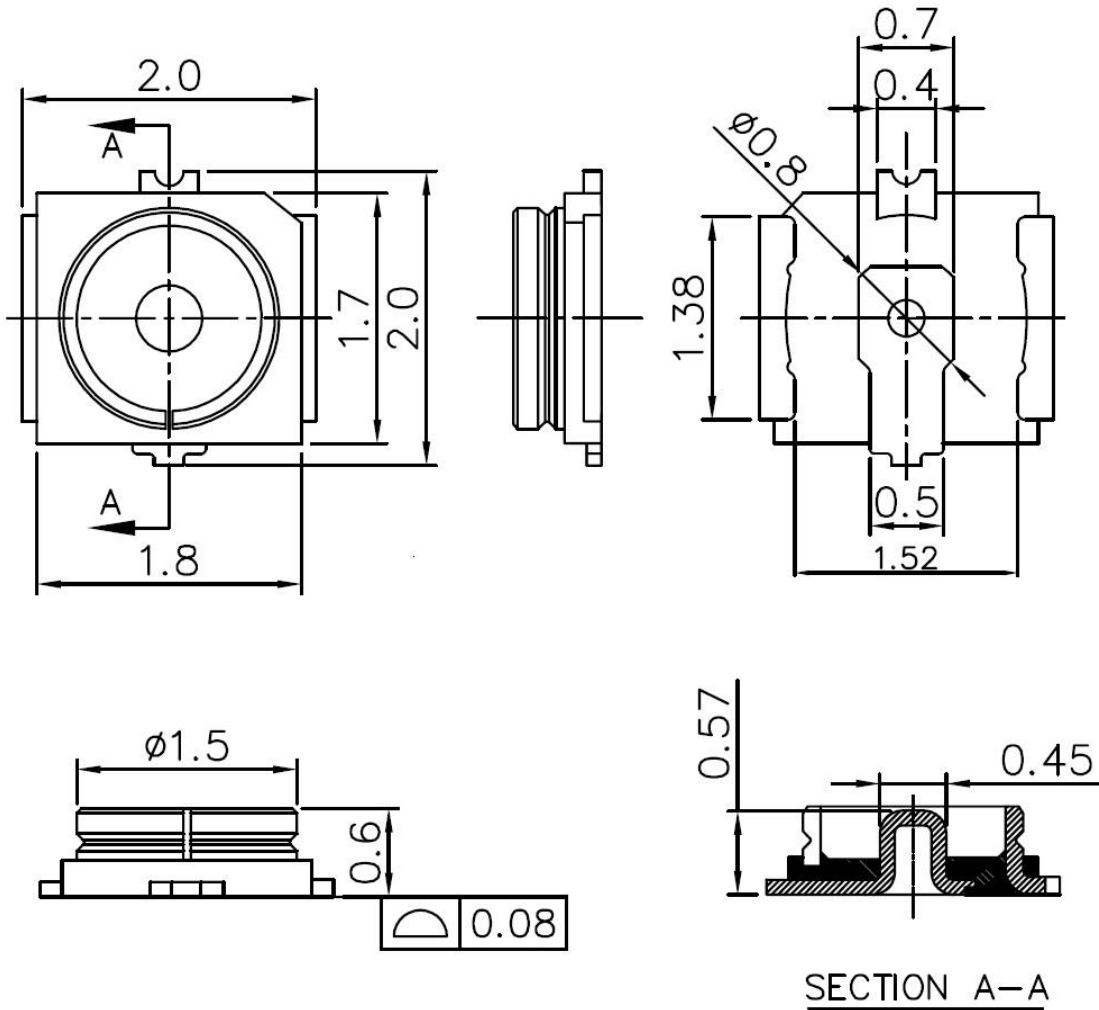
4. Mechanical Information

4.1 Mechanical Drawing



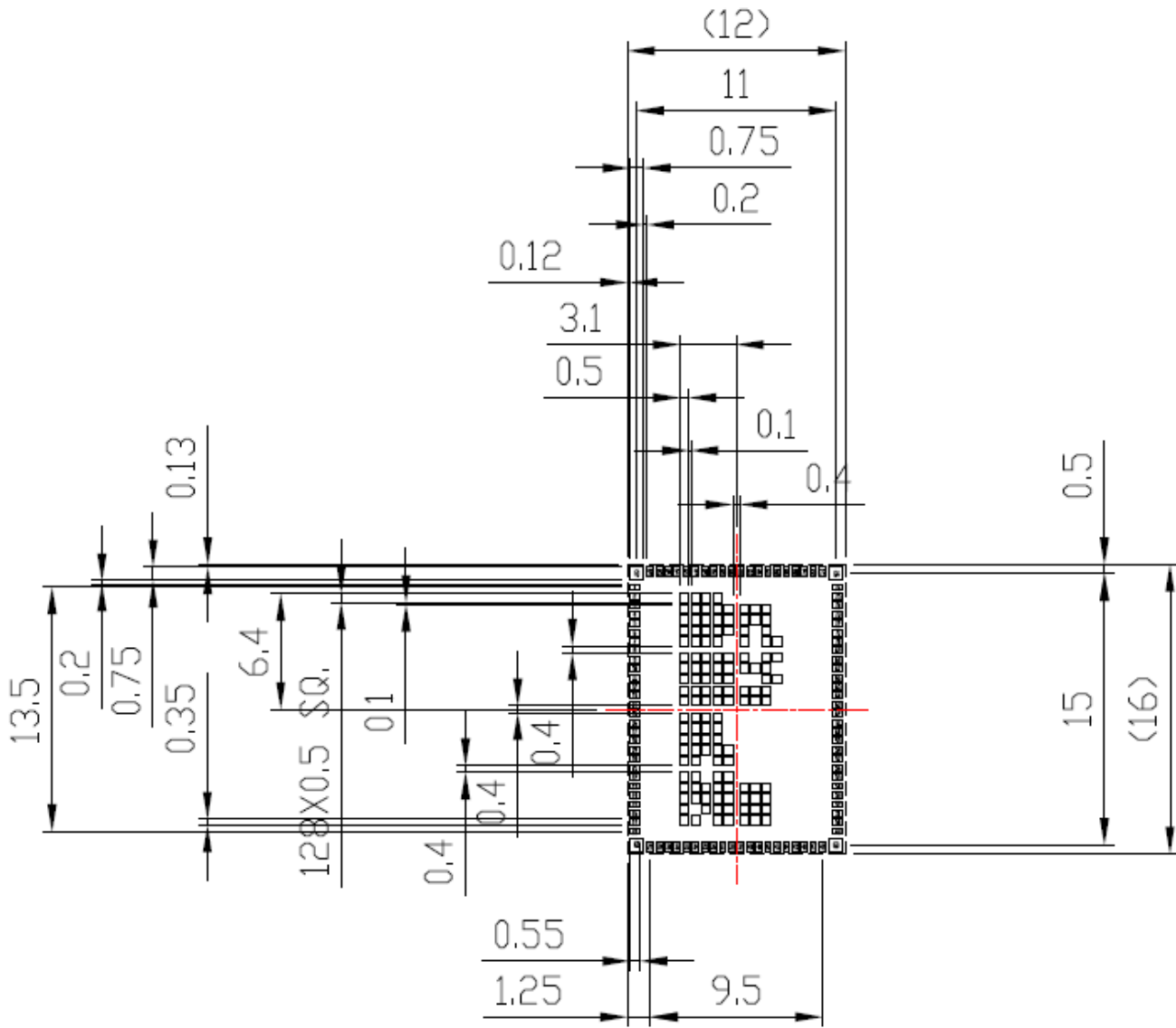
Tolerances unless otherwise specified : ± 0.15 mm

4.2 Antenna connector drawing



UNITS: mm

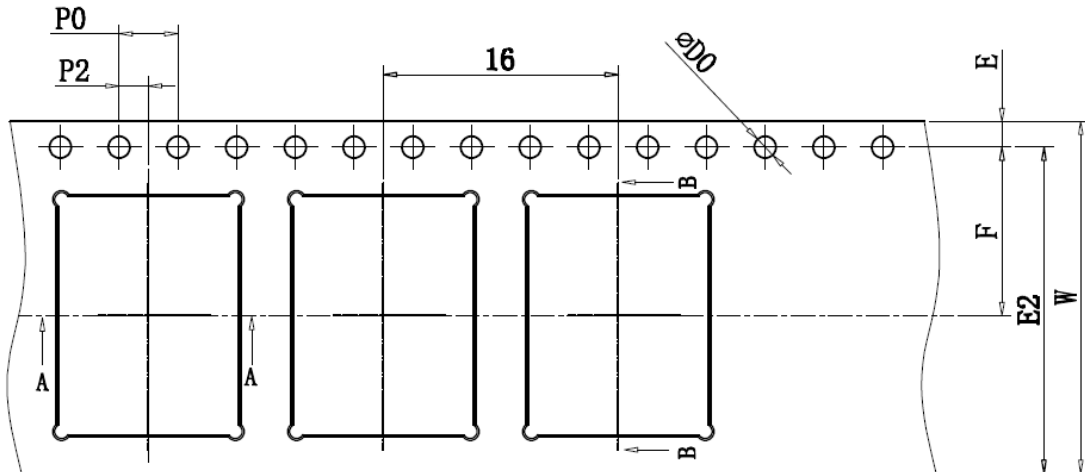
4.3 Recommended Footprint Pattern



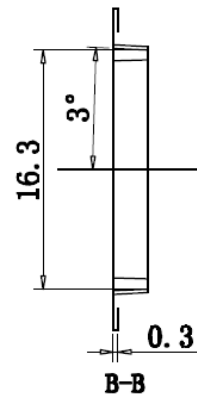
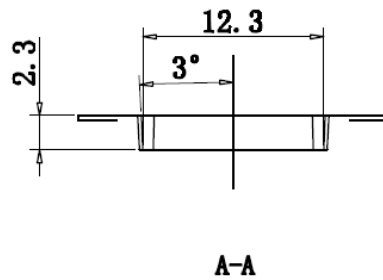
5. Shipping Information

5.1 Tape information

- Material: PS
- Color: Black
- Thickness: 0.30 mm

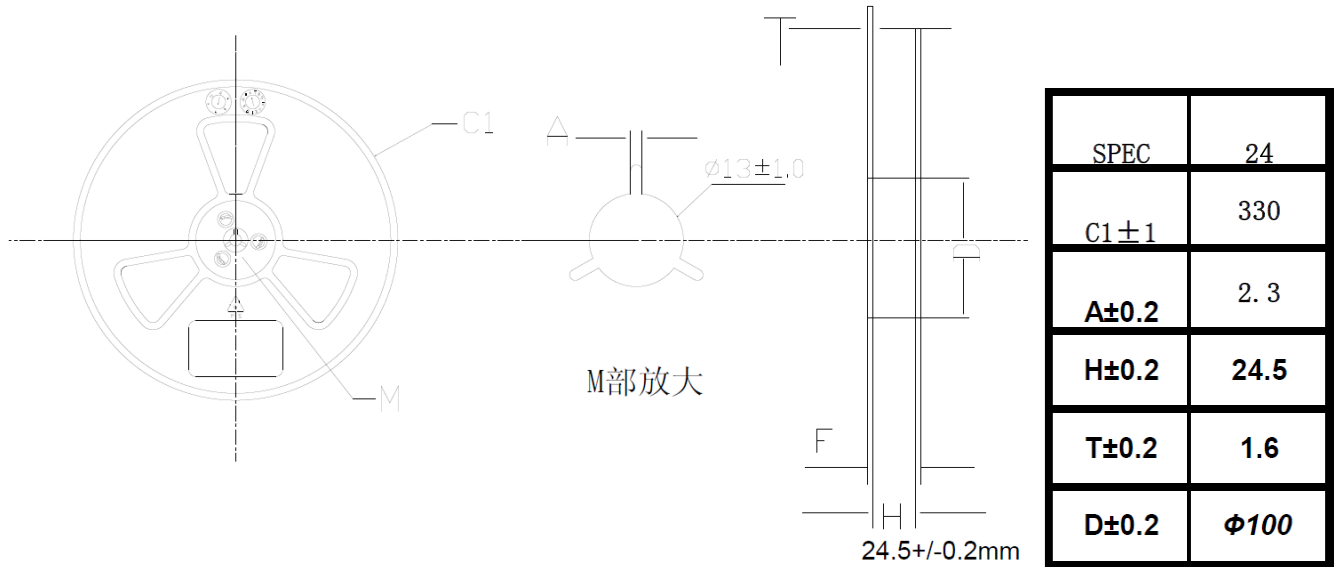


尺寸栏	
E	1.75±0.10
E2	22.25 MIN
F	11.50±0.10
P2	2.00±0.10
$\phi D0$	1.50 ± $\begin{matrix} 0.10 \\ 0.00 \end{matrix}$
$\phi D1$	
P0	4.00±0.10
10P0	40.00±0.20
W	24.00±0.30
P	16.00±0.10
A0	12.30±0.10
B0	16.30±0.10
K0	2.3±0.10
t	0.30±0.05



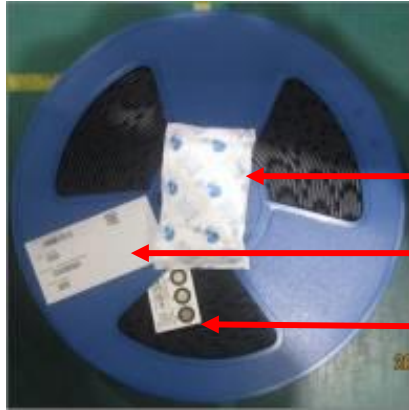
5.1 Reel information

- Material: PS
- Color: Blue
- Dimension: 13 inch



5.2 Packing Information

1. One reel can pack 1,500pcs M.2 1216 modules
2. One production label is pasted on the reel, one desiccant and one humidity indicator card are put on the reel



One desiccant

One production label

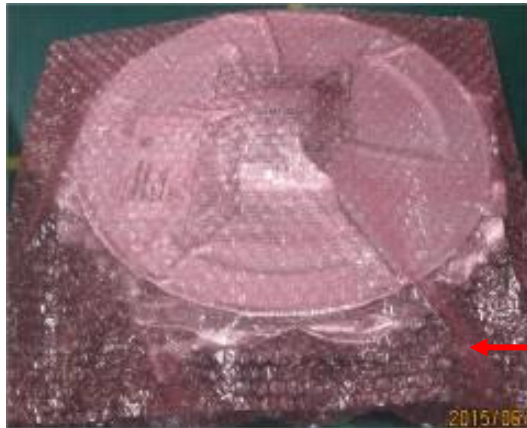
One humidity indicator card

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



One production label

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



One 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. **5 inner boxes** could be put into one carton

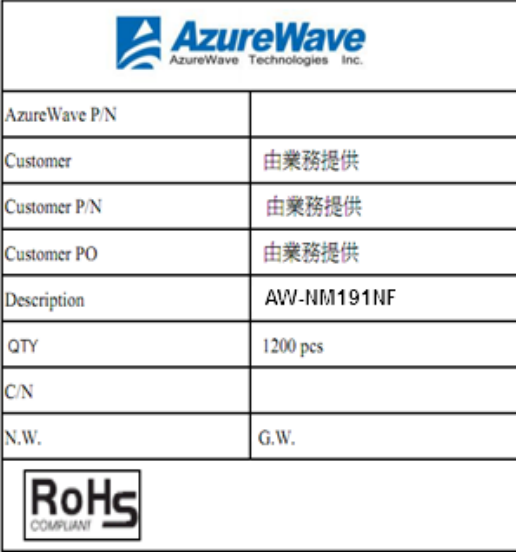











7. Sealing the carton by AzureWave tape



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




<p>Example of carton label</p>	 <table border="1"> <tr> <td colspan="2" style="text-align: center;"></td> </tr> <tr> <td>AzureWave P/N</td> <td></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-NM191NF</td> </tr> <tr> <td>QTY</td> <td>1200 pcs</td> </tr> <tr> <td>C/N</td> <td></td> </tr> <tr> <td>N.W.</td> <td>G.W.</td> </tr> <tr> <td colspan="2" style="text-align: center;"></td> </tr> </table>			AzureWave P/N		Customer	由業務提供	Customer P/N	由業務提供	Customer PO	由業務提供	Description	AW-NM191NF	QTY	1200 pcs	C/N		N.W.	G.W.		
																					
AzureWave P/N																					
Customer	由業務提供																				
Customer P/N	由業務提供																				
Customer PO	由業務提供																				
Description	AW-NM191NF																				
QTY	1200 pcs																				
C/N																					
N.W.	G.W.																				
																					
<p>Example of box label</p>																					
<p>Example of production label</p>																					
<p>Example of balance label (尾數標籤)</p>																					

Note:

- 1 tape reel = 1 inner box = 1,500pcs
- 1 carton = 5 inner boxes = 5 * 1,500pcs = 7,500pcs

6. Module Marking Information

Top side	Bottom side
 <p>2D Barcode</p> <ul style="list-style-type: none"> ● Shows MAC Address of WLAN ● Size: 4 x 4 mm ● Type: Data Matrix 	