# AW-NM191MA

## IEEE 802.11b/g/n Wireless LAN
## LGA Module
## With M.2 2230 Adaptor Board

## <u>Datasheet</u>

**Rev. C**

**DF**

**(SDIO)**

# Features

## WLAN

- PCIe M.2 TYPE 2230: 30mm(L) x 22mm(W) x 2.91 mm(H)(Max)
- SDIO 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

# Revision History

Document NO: R2-2191MA-DST-01

| Version | Revision Date | DCN NO. | Description | Initials | Approved |
|---|---|---|---|---|---|
| A | 2020/03/22 | DCN016978 | ● Initial Version | Renton Tao | NC Chen |
| B | 2020/05/25 | DCN017352 | ● Update SDIO interface condition | Renton Tao | NC Chen |
| C | 2021/04/12 | DCN021272 | ● Update datasheet form | Renton Tao | NC Chen |
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# 1. Introduction

## 1.1 Product Overview

**AzureWave Technologies, Inc.** introduces the IEEE 802.11b/g/n 1X1WLAN NGFF module --- **AW-NM191MA**. 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-NM191MA, 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-NM191MA. In addition to the support of **WPA/WPA2** and **WEP** 64-bit and 128-bit encryption, the AW-NM191MA 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-NM191MA** supports **SDIO interface** for WLAN to the host processor.

**AW-NM191MA** is suitable for multiple mobile processors for different applications with the support cellular phone co-existence.

**AW-NM191MA** 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
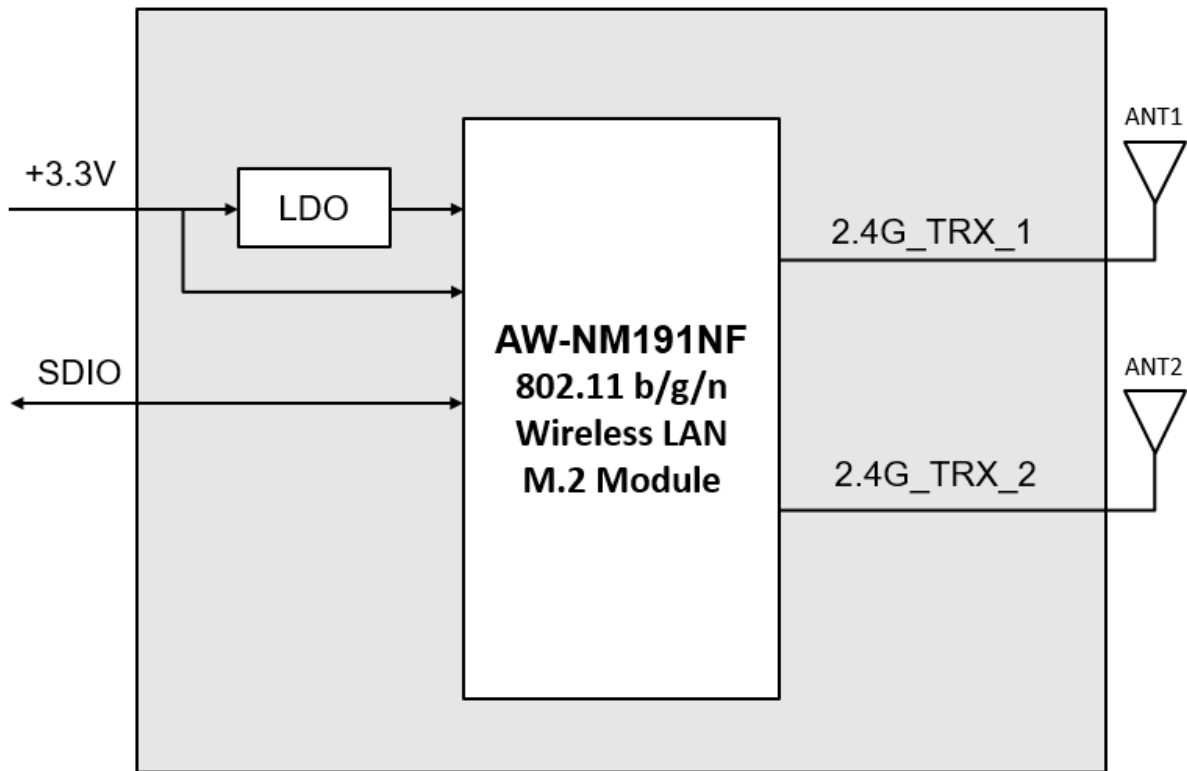


**AW-NM191MA Block Diagram**
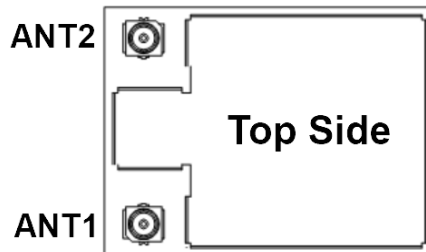


**Module antenna configuration**

## 1.3 Specifications Table

### 1.3.1 General

| Features | Description |
|---|---|
| **Product Description** | IEEE 802.11b/g/n Wireless LAN LGA Module With M.2 2230 Adaptor Board |
| **Major Chipset** | NXP 88W8801 |
| **Host Interface** | SDIO for WLAN |
| **Dimension** | 22mm(W) x 30mm(L) x 2.91mm(H) (Tolerance remarked in mechanical drawing) |
| **Form factor** | M.2 2230 (E key) |
| **Antenna** | I-PEX MHF4 Connector Receptacle (20449) ANT1：WiFi → TX/RX ANT2：WiFi → TX/RX |
| **Weight** | 2.1 g |

### 1.3.2 WLAN

| Features | Description |
|---|---|
| **WLAN Standard** | IEEE 802.11 b/g/n |
| **WLAN VID/PID** | N/A |
| **Frequency Rage** | 2.4 GHz：2.412 ~ 2.472 GHz |
| **Modulation** | DSSS, OFDM, DBPSK, DQPSK, CCK, 16-QAM, 64-QAM |
| **Number of Channels** | **2.4GHz**<br>■ USA, NORTH AMERICA, Canada and Taiwan – 1 ~ 11<br>■ 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 | ■ 802.11b: 1, 2, 5.5, 11Mbps<br>■ 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps<br>■ 802.11n: up to 72.2Mbps | | | | |
| Security | ■ WAPI<br>■ WEP 64-bit and 128-bit encryption with H/W TKIP processing<br>■ WPA/WPA2 (Wi-Fi Protected Access)<br>■ AES-CCMP hardware implementation as part of 802.11i security standard | | | | |

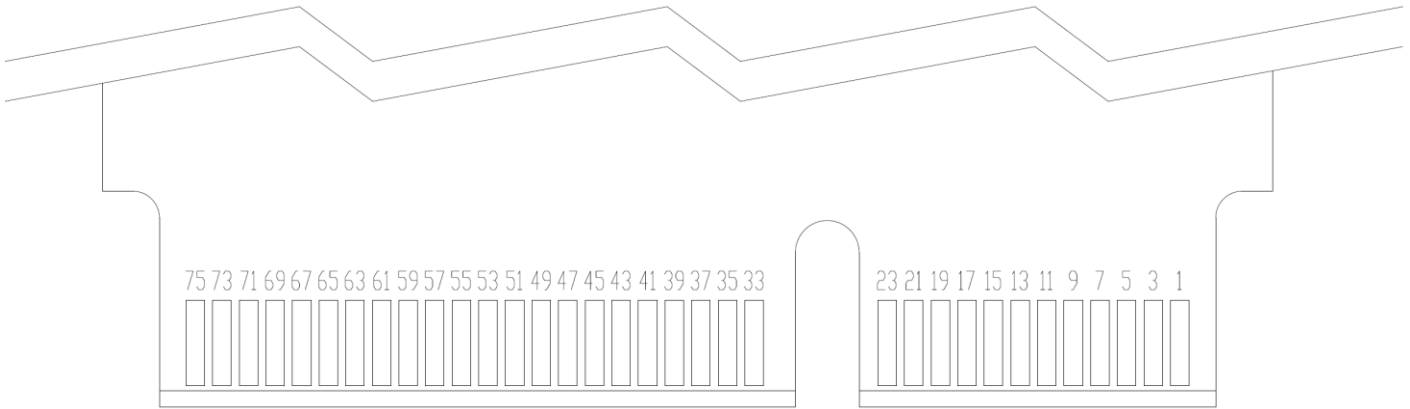\* If you have any certification questions about output power please contact FAE directly.

## 1.3.3 Operating Conditions

| Features | Description |
| --- | --- |
| **Operating Conditions** | |
| Voltage | Power supply for host:3.3V |
| Operating Temperature | 0℃ ～ 70 ℃ |
| Operating Humidity | less than 85% R.H. |
| Storage Temperature | -40℃ ～ 85 ℃ |
| Storage Humidity | less than 60% R.H. |
| **ESD Protection** | |
| Human Body Model | +-2kV |
| Changed Device Model | +-500V |

# 2. Pin Definition

## 2.1 Pin Map



75 73 71 69 67 65 63 61 59 57 55 53 51 49 47 45 43 41 39 37 35 33    23 21 19 17 15 13 11 9 7 5 3 1

**AW-NM191MA Pin Map (Top View)**



2 4 6 8 10 12 14 16 18 20 22    32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74
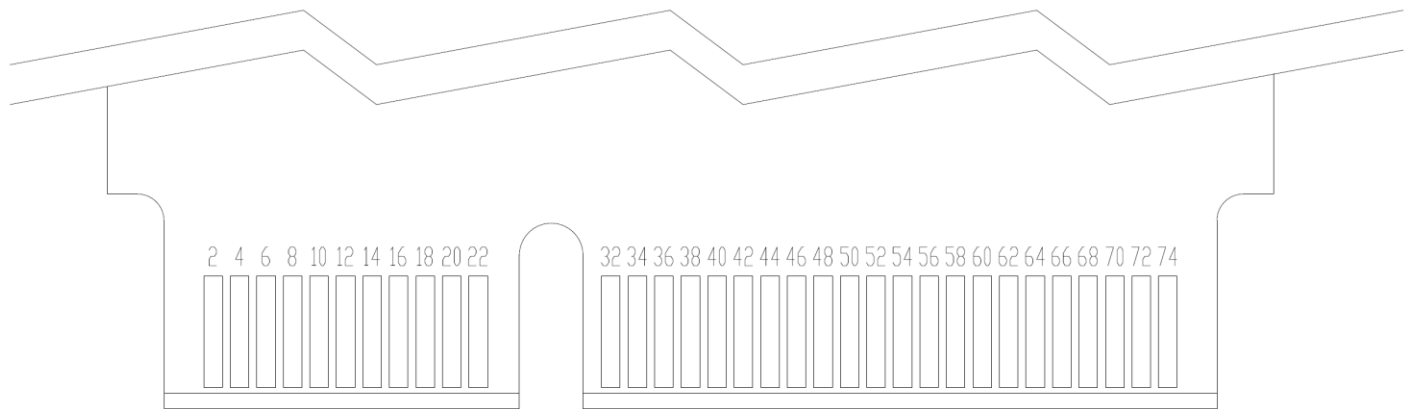
**AW-NM191MA Pin Map (Bottom View)**

## 2.2 Pin Table

| Pin No | Definition | Basic Description | Voltage | Type |
|--------|-----------|-------------------|---------|------|
| 1 | GND | Ground | GND | |
| 2 | 3.3V | 3.3V power supply. | Power | 3.3V |
| 3 | NC | No connect to anything | Floating | |
| 4 | 3.3V | 3.3V power supply | Power | 3.3V |
| 5 | NC | No connect to anything | Floating | |
| 6 | NC | No connect to anything | Floating | |
| 7 | GND | Ground | GND | |
| 8 | NC | No connect to anything | Floating | |
| 9 | SDIO CLK | **SDIO 4-bit Mode**: Clock input<br>**SDIO 1-bit Mode**: Clock input<br>**SDIO SPI Mode**: Clock input | Input | 1.8V |
| 10 | NC | No connect to anything | Floating | |
| 11 | SDIO CMD | **SDIO 4-bit Mode**: Command/response (input/output)<br>**SDIO 1-bit Mode**: Command line<br>**SDIO SPI Mode**: Data input<br>**USB Mode**: USB_VBUS_ON (input) | Input/Output | 1.8V |
| 12 | NC | No connect to anything | Floating | |
| 13 | SDIO DAT0 | **SDIO 4-bit Mode**: Data line Bit[0]<br>**SDIO 1-bit Mode**: Data line<br>**SDIO SPI Mode**: Data output | Input/Output | 1.8V |
| 14 | NC | No connect to anything | Floating | |
| 15 | SDIO DAT1 | **SDIO 4-bit Mode**: Data line Bit[1]<br>**SDIO 1-bit Mode**: Interrupt<br>**SDIO SPI Mode**: Interrupt<br>SDO is tristate when SCSn is inactive.<br>Enables multiple devices driving SDO line. | Input/Output | 1.8V |
| 16 | NC | No connect to anything | Floating | |
| 17 | SDIO DAT2 | **SDIO 4-bit Mode**: Data line Bit[2] or read wait (optional)<br>**SDIO 1-bit Mode**: Read wait (optional)<br>**SDIO SPI Mode**: Reserved | Input/Output | 1.8V |
| 18 | GND | Ground. | GND | |
| 19 | SDIO DAT3 | **SDIO 4-bit Mode**: Data line Bit[3]<br>**SDIO 1-bit Mode**: Reserved<br>**SDIO SPI Mode**: Card select (active low) | Input/Output | 1.8V |
| 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 | NC | No connect to anything | Floating | |
| 36 | NC | No connect to anything | Floating | |
| 37 | NC | No connect to anything | Floating | |
| 38 | NC | No connect to anything | Floating | |
| 39 | GND | Ground | GND | |
| 40 | NC | No connect to anything | Floating | |
| 41 | NC | No connect to anything | Floating | |
| 42 | NC | No connect to anything | Floating | |
| 43 | NC | No connect to anything | Floating | |
| 44 | NC | No connect to anything | Floating | |
| 45 | GND | Ground | GND | |
| 46 | NC | No connect to anything | Floating | |
| 47 | NC | No connect to anything | Floating | |
| 48 | NC | No connect to anything | Floating | |
| 49 | NC | No connect to anything | Floating | |
| 50 | NC | No connect to anything | Floating | |
| 51 | GND | Ground | GND | |
| 52 | NC | No connect to anything | Floating | |
| 53 | NC | No connect to anything | Floating | |
| 54 | NC | No connect to anything | Floating | |
| 55 | NC | No connect to anything | Floating | |
| 56 | PDn | Full Power-Down (input) (active low)<br>The module internal pull-up 51k$\Omega$ on this pin. | 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 | Power | |
| 73 | NC | No connect to anything | Floating | |
| 74 | 3.3V | 3.3V power supply | Power | |
| 75 | 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 | ℃ |

## 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 |
| 3.3V | 3.3V VBAT input | -- | 2.97 | 3.3 | 3.63 | V |
| $T_A$ | Ambient operating temperature | -- | -30 | | 85 | ℃ |

## 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

The AW-NM191MA 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-NM191MA 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-NM191MA SDIO Pin Name | Type | Description |
|---|---|---|
| SDIO_DATA_CLK | I | SDIO 4-bit mode: Clock<br><br>SDIO 1-bit mode: Clock |
| SDIO_DATA_CMD | I/O | SDIO 4-bit mode: Command line<br><br>SDIO 1-bit mode: Command line |
| SDIO_DATA_3 | I/O | SDIO 4-bit mode: Data line Bit[3]<br><br>SDIO 1-bit mode: Not used |
| SDIO_DATA_2 | I/O | SDIO 4-bit mode: Data line Bit[2] or Read Wait (optional)<br><br>SDIO 1-bit mode: Read Wait (optional) |
| SDIO_DATA_1 | I/O | SDIO 4-bit mode: Data line Bit[1]<br><br>SDIO 1-bit mode: Interrupt |
| SDIO_DATA_0 | I/O | SDIO 4-bit mode: Data line Bit[0]<br><br>SDIO 1-bit mode: Data line |

## 3.4.1.1 SDIO Protocol Timing

Default Speed, High-Speed Modes
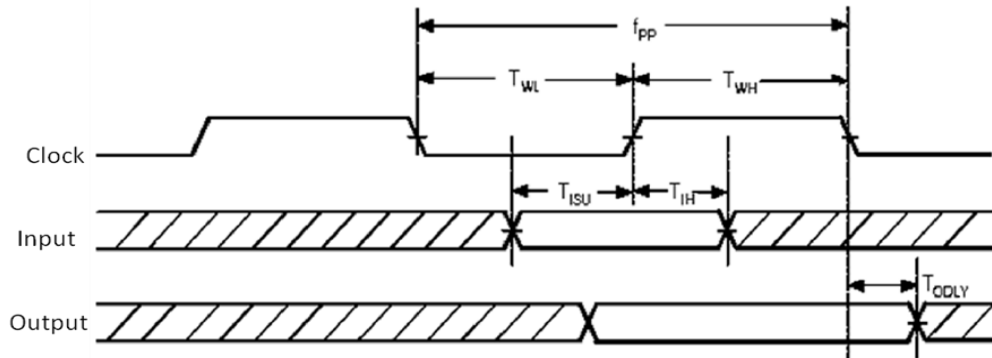


SDIO protocol timing Diagram - Default mode.
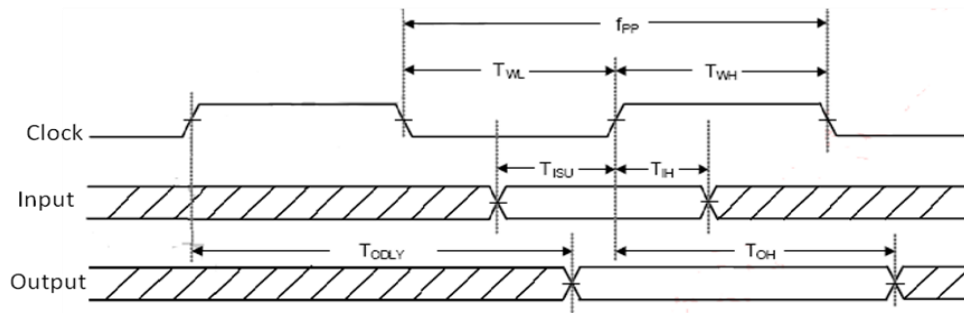


SDIO protocol timing Diagram - High Speed mode.

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|--------|-----------|-----------|-----|-----|-----|-------|
| fpp | 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.

## 3.5 Power up Sequence

The AW-NM191MA 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-NM191MA 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
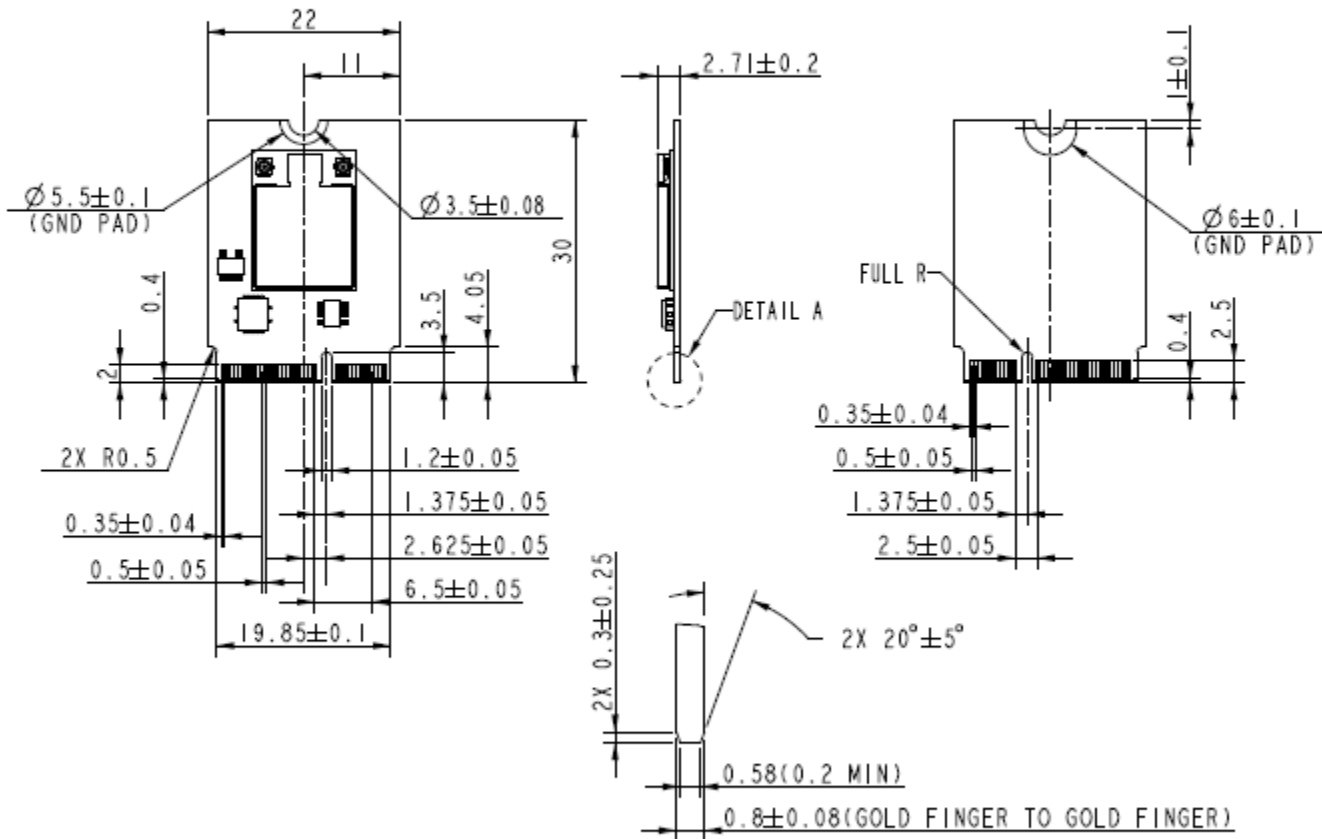


TOLERANCES UNLESS OTHERWISE SPECIFIED:±0.15mm

FORM NO.: FR2-015_ A          Responsible Department：WBU                    Expiry Date: Forever

![AzureWave Technologies, Inc. logo]

## 4.2 Antenna connector drawing
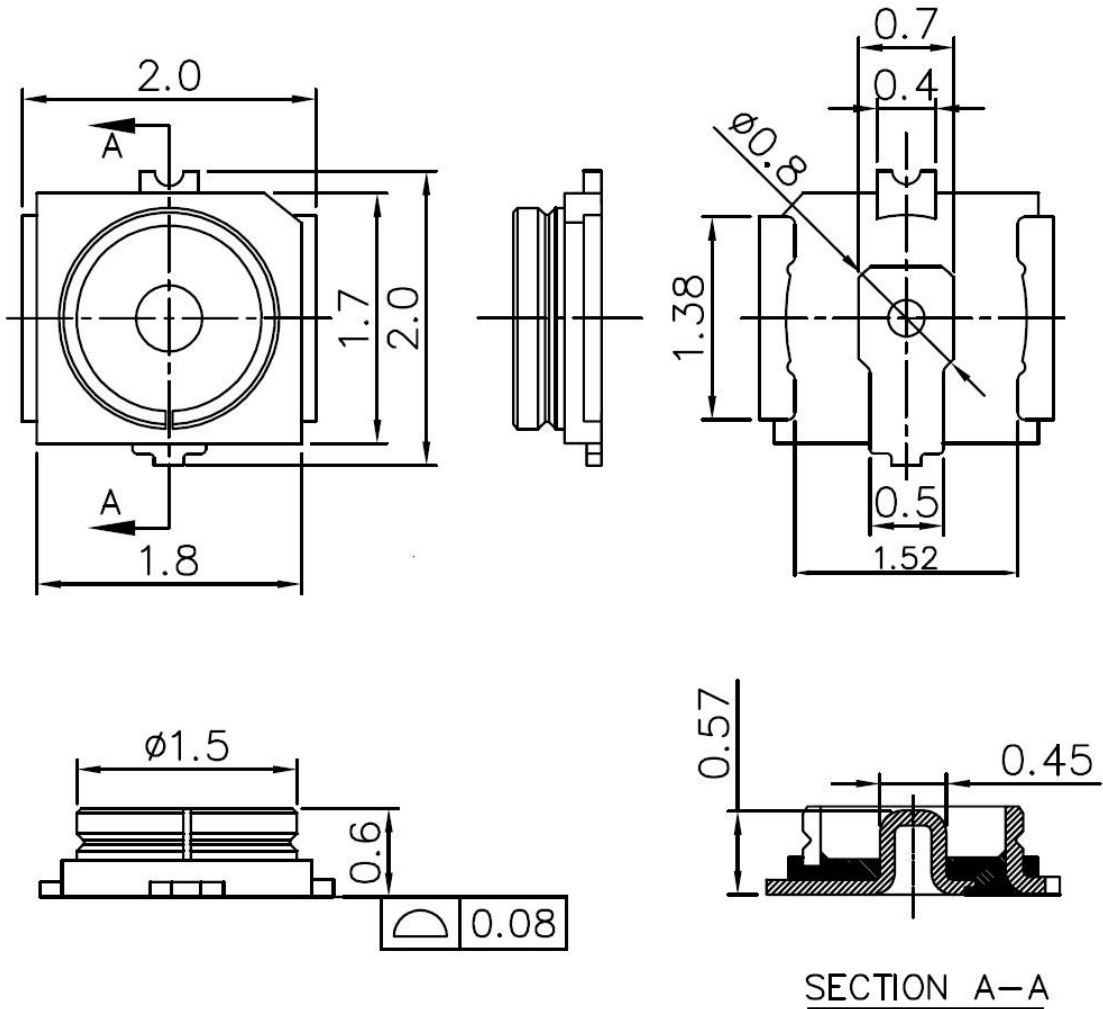


UNITS: mm

# 5. Packaging Information

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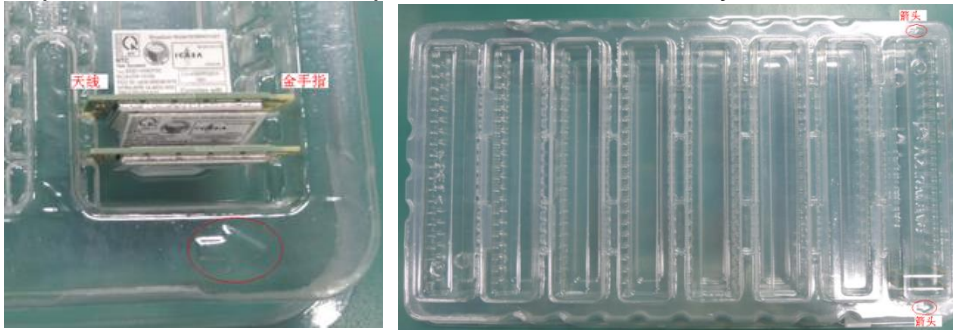


2. One cover tray put on bottom tray



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



Production

7. One package label pasted in side of inner box



Example:



2-40600-0B    400 PCS
盛達電業股份有限公司

PCKNO0447716

FORM NO.: FR2-015_ A                    Responsible Department：WBU                    Expiry Date: Forever

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



| Example of carton label |  |
|---|---|
| Example of box label |  |
| Example of production label |  |
| Example of balance label |  |

FORM NO.: FR2-015_ A　　　　　　　Responsible Department：WBU　　　　　　　Expiry Date: Forever