

# **AW-CM299**

## **IEEE 802.11 1X1 ac/a/b/g/n Wireless LAN + Bluetooth Module**

### **Datasheet**

**Version 0.5**

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| Document release | Date       | Modification                                                                                                                                                                                                                                              | Initials  | Approved   |
|------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------|
| Version 0.1      | 2016/11/18 | Draft version                                                                                                                                                                                                                                             | Grace Liu | Daniel Lee |
| Version 0.2      | 2017/3/28  | 1-4. Specifications Table<br>5. Mechanical Information                                                                                                                                                                                                    | Grace Liu | Daniel Lee |
| Version 0.3      | 2017/4/24  | 5. Mechanical Information                                                                                                                                                                                                                                 | Grace Liu | Daniel Lee |
| Version 0.4      | 2017/5/16  | 1-2. Block Diagram<br>1-4. Specifications Table<br>4. Pin Definition                                                                                                                                                                                      | Grace Liu | Daniel Lee |
| Version 0.5      | 2018/1/30  | 1. Add 6. Shipping information<br>2. Modify input power information in 1-4. Specifications Table and 2.Electrical Characteristic<br>3. Modify ESD rating in 2.Electrical Characteristic<br>4. Add Federal Communication Commission Interference Statement | Grace Liu | Daniel Lee |

## 1. General Description

### 1-1. Product Overview and Functional Description

**AzureWave Technologies, Inc.** introduces the IEEE 802.11ac/a/b/g/n 1X1 WLAN & Bluetooth module -- **AW-CM299**. 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-CM299, 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**.

Compliance with the IEEE 802.11ac/a/b/g/n standard, the AW-CM299 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-CM286NF. In addition to the support of **WPA/WPA2** and **WEP** 64-bit and 128-bit encryption, the AW-CM299 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.

For the video, voice and multimedia applications the AW-CM286NF 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.

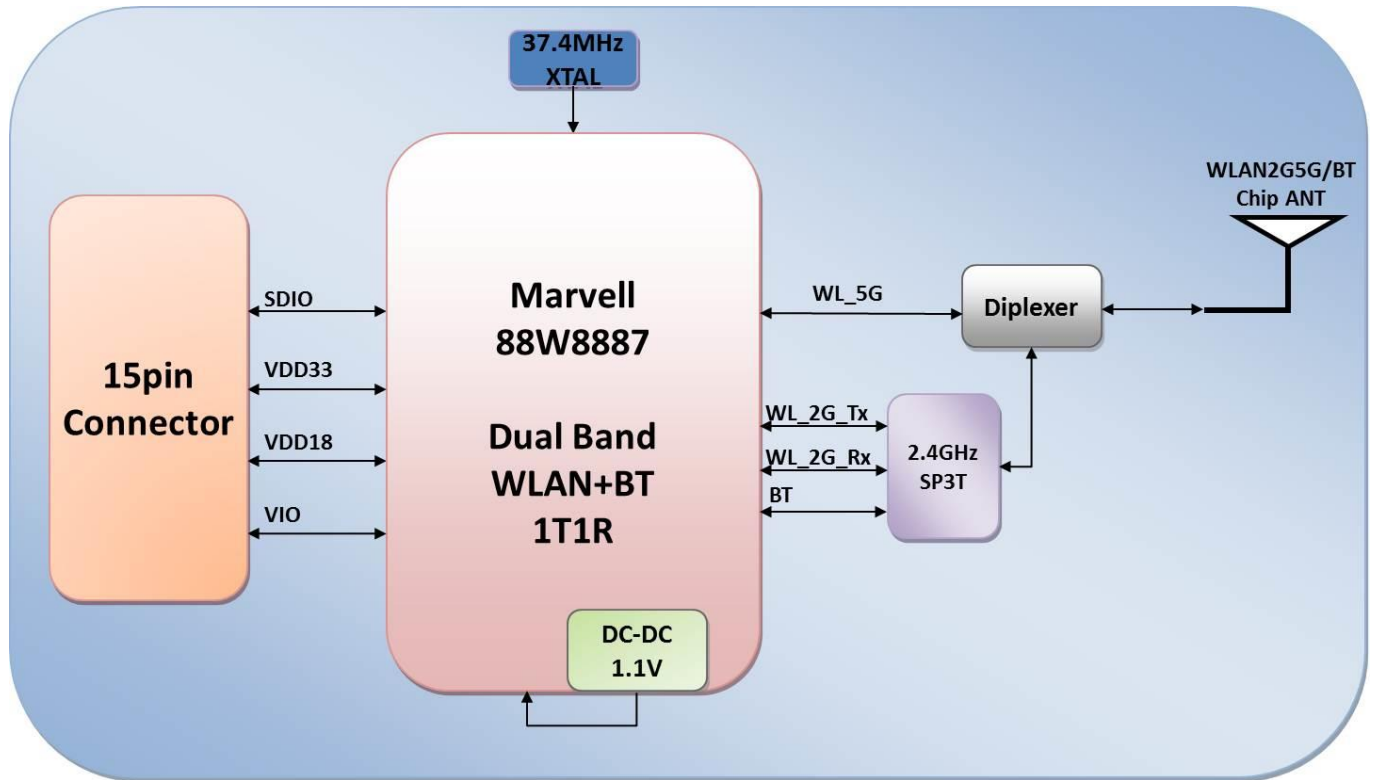
For Bluetooth operation, AW-CM299 is **Bluetooth 4.2 (supports Low Energy)**.

AW-CM299 supports **SDIO** for WLAN and BT to the host processor.

AW-CM299 module adopts Marvell's latest highly-integrated dual-band WLAN & Bluetooth SoC--- **88W8887**. All the other components are implemented by all means to reach the mechanical specification required.

## 1-2. Block Diagram

A simplified block diagram of the AW-CM299 module is depicted in the figure below.



**AW-CM299 BLOCK DIAGRAM**

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### 1-3. Key feature:

- Small footprint: 22mm(L) x 11mm(W) x 2.3mm(H)Max
- IEEE 802.11ac compliant, 1x1 spatial stream with data rates up to MCS9 (433 Mbps)
- Bluetooth 4.2 (supports Low Energy (LE))
- SDIO 3.0 device interface may be used as host interface for WLAN/Bluetooth
- On board dual band chip antenna
- Multiple power saving modes for low power consumption
- Lead-free design

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## 1-4. Specifications Table

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model Name                       | AW-CM299                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Product Description              | Wireless LAN + Bluetooth Combo Module                                                                                                                                                                                                                                                                                                                                                                                                       |
| WLAN Standard                    | IEEE 802.11ac/a/b/g/n, Wi-Fi compliant                                                                                                                                                                                                                                                                                                                                                                                                      |
| Bluetooth Standard               | Bluetooth 4.2 complaint with Bluetooth 2.1+Enhanced Data Rate (EDR)                                                                                                                                                                                                                                                                                                                                                                         |
| Host Interface                   | ◆ SDIO 3.0 device interface (SPI, 1-bit SDIO, 4-bit SDIO transfer modes at full clock range up to 208 MHz)                                                                                                                                                                                                                                                                                                                                  |
| Major Chipset                    | Marvell 88W8887                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Dimension                        | 22mm x 11mm x 2.3mm(Max)                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Weight                           | TBD                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Antenna                          | On Board Chip Antenna                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Operating Conditions</b>      |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Voltage                          | 3.3V/1.8V+- 10%                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Temperature                      | Operating: -20 ~ 85°C ; Storage: -40 ~ 85°C                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Electrical Specifications</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Frequency Range                  | 2.4 GHz ISM radio band / 5 GHz Unlicensed National Information Infrastructure (U-NII) band                                                                                                                                                                                                                                                                                                                                                  |
| Number of Channels               | 802.11a: USA, Taiwan – 12/4<br>Most European Countries –19<br>Japan – 4<br>802.11b: USA, Canada and Taiwan – 11<br>Most European Countries – 13<br>France – 4<br>802.11g: USA, Canada and Taiwan – 11<br>Most European Countries – 13<br>Japan – 13<br>802.11n(HT20): Channel 1~13(2412~2472)<br>802.11n(HT40): Channel 1~7(2422~2472)                                                                                                      |
| Modulation                       | DSSS,OFDM,DBPSK,DQPSK,CCK, 16-QAM, 64-QAM 256-QAM for WLAN<br>GFSK (1Mbps), $\pi/4$ DQPSK (2Mbps) and 8DPSK (3Mbps) for Bluetooth                                                                                                                                                                                                                                                                                                           |
| Output Power                     | WLAN(conducted):<br>WLAN G band:<br>11b:16dBm +/- 2dB(11Mbps)<br>11g:14dBm +/- 2dB (54Mbps)<br>11n HT20:13dBm +/- 2dB(MCS7)<br>11n HT40:12dBm +/- 2dB(MCS7)<br>WLAN A band:<br>11a:13dBm +/- 2dB(54Mbps)<br>11n HT20:12dBm +/- 2dB(MCS7)<br>11n HT40:11dBm +/- 2dB(MCS7)<br>11ac VHT_20:11dBm +/- 2dB(MCS8)<br>11ac VHT_40:10dBm +/- 2dB(MCS9)<br>11ac VHT_80: 7dBm +/- 2dB(MCS9)<br><br>Bluetooth(conducted):<br>BDR/EDR:2dBm+-2dB(class2) |

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|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Receive Sensitivity            | <b>WLAN(conducted):</b><br><b>WLAN G band :</b><br>11b: -87dBm (11Mbps)<br>-95dBm(1Mbps)<br>11g: -73dBm (54Mbps)<br>-88dBm(6Mbps)<br>11n HT20: -70dBm (MCS7)<br>-84dBm(MCS0)<br>11n HT40: -68dBm (MCS7)<br>-82dBm(MCS0)<br><b>WLAN A band:</b><br>11a: -68dBm (54Mbps)<br>-85dBm(6Mbps)<br>11n HT20: -66dBm (MCS7)<br>-85dBm(MCS0)<br>11n HT40: -64dBm(MCS7)<br>-82dBm(MCS0)<br>11ac VHT_20: -61dBm(MCS8)<br>-85dBm(MCS0)<br>11ac VHT_40: -58dBm(MCS9)<br>-83dBm(MCS0)<br>11ac VHT_80: -52dBm(MCS9)<br>-80dBm(MCS0)<br><br><b>Bluetooth(conducted):</b><br>BDR : -80dBm(DH5)<br>EDR: -80dBm(2DH5) |
| Data Rates                     | <b>WLAN</b><br>802.11b: 1, 2, 5.5, 11Mbps<br>802.11a/g: 6, 9, 12, 18, 24, 36, 48, 54Mbps<br>802.11n: up to 150Mbps<br>802.11ac: up to 86.7Mbps (20MHz channel)<br>802.11ac: up to 200Mbps (40MHz channel)<br>802.11ac: up to 433Mbps (80MHz channel)<br><b>Bluetooth</b><br>Bluetooth 2.1+EDR data rates of 1,2, and 3Mbps                                                                                                                                                                                                                                                                        |
| ESD Rating                     | HCP/VCP discharge $\pm 4$ KV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Operating Range                | Open Space: ~300m ; Indoor: ~100m for WLAN<br>Minimum 10 m indoor for Bluetooth<br>The transmission speed may vary according to the environment)                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Security                       | <ul style="list-style-type: none"> <li>◆ WAPI</li> <li>◆ WEP 64-bit and 128-bit encryption with H/W TKIP processing</li> <li>◆ WPA/WPA2 (Wi-Fi Protected Access)</li> <li>◆ AES-CCMP hardware implementation as part of 802.11i security standard</li> </ul>                                                                                                                                                                                                                                                                                                                                      |
| Operating System Compatibility | Linux (Android, Meego), More information please contact Azurewave FAE.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## 2. Electrical Characteristic

### 2-1.Absolute Maximum Ratings

| Symbol | Parameter             | Condition | Min | Typ | Max | Units |
|--------|-----------------------|-----------|-----|-----|-----|-------|
| VCC33  | 3.3V input            | --        | --  | 3.3 | 4.0 | V     |
| VCC18  | 1.8V input            | --        | --  | 1.8 | 2.2 | V     |
| VIO    | Host I/O power supply | --        | --  | 3.3 | 4.0 | V     |
|        |                       |           |     | 2.5 | 3.0 |       |
|        |                       |           |     | 1.8 | 2.2 |       |

### 2-2.Recommanded Operating Conditions

| Symbol | Parameter                               | Condition | Min  | Typ | Max  | Units |
|--------|-----------------------------------------|-----------|------|-----|------|-------|
| VCC33  | LDO VBAT input                          | --        | 2.7  | 3.3 | 3.63 | V     |
| VCC18  | 1.8V power supply                       | --        | 1.71 | 1.8 | 1.89 | V     |
| VIO    | 1.8V/2.5V/3.3V digital I/O power supply | --        | 2.97 | 3.3 | 3.63 | V     |
|        |                                         |           | 2.25 | 2.5 | 2.75 |       |
|        |                                         |           | 1.62 | 1.8 | 1.98 |       |

## 2-3.Clock Specifications

### 2-3-1 External Sleep Clock Timing

**External Sleep Clock is necessary for two reasons:**

1. Auto frequency Detection.

This is where the internal logic will bin the Ref clock source to figure out what is the reference clock frequency is. This is done so no strapping is needed for telling 8887 what the ref clock input is.

2. Allow low current modes for BT to enter sleep modes such as sniff modes.

The AW-CM299 external sleep clock pin is powered from the 1.8V voltage supply.

| Symbol            | Parameter             | Min                 | Typ          | Max                 | Units |
|-------------------|-----------------------|---------------------|--------------|---------------------|-------|
| CLK               | Clock Frequency Range | 32 or 32.768 -50ppm | 32 or 32.768 | 32 or 32.768 +50ppm | KHz   |
| T <sub>HIGH</sub> | Clock high time       | 40                  | --           | --                  | ns    |
| T <sub>LOW</sub>  | Clock low time        | 40                  | --           | --                  | ns    |
| T <sub>RISE</sub> | Clock rise time       | --                  | --           | 5                   | ns    |
| T <sub>FALL</sub> | Clock fall time       | --                  | --           | 5                   | ns    |

## 2-4. Reset Configuration

The AW-CM299 is reset to its default operating state under the following conditions:

- Power-on reset (POR)
- Software/Firmware reset
- External pin reset (RESETn)

### 2-4-1. Internal Reset

The AW-CM299 device is reset, and the internal CPU begins the boot sequence when any of the following internal reset events occur:

- Device receives power and VDDL supplies rise (triggers internal POR circuit)
- External pin (PDn) assertion will generate POR

### 2-4-2. External Reset

The AW-CM299 is reset when PDn pin is asserted low and the internal CPU begins the boot sequence when the PDn pin transitions from low to high.

## 3. Host Interfaces

### 3-1. SDIO Interface

The AW-CM299 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-CM299 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

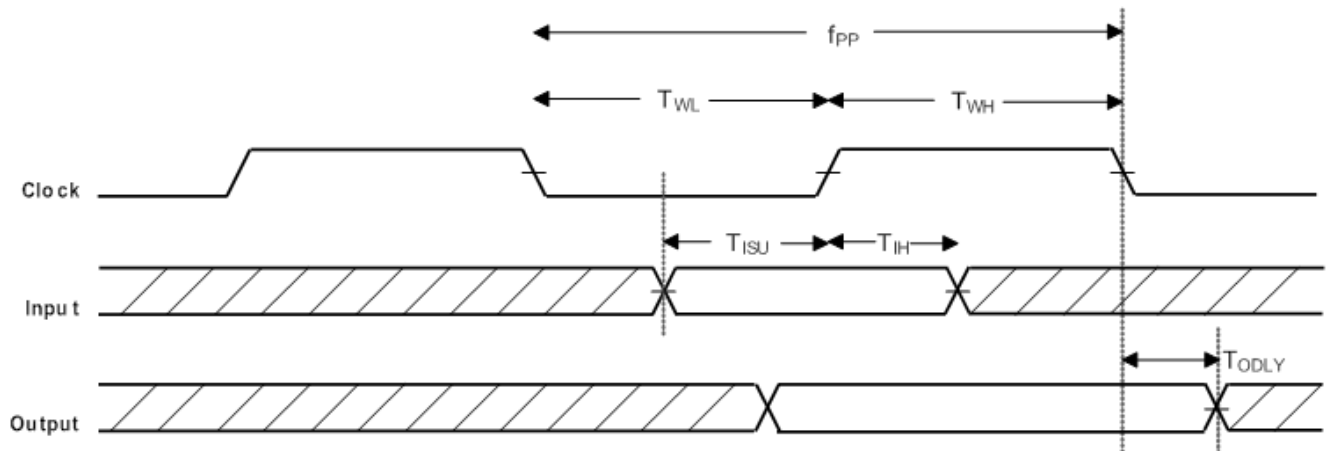
Allows card to interrupt host

#### 3-1-1. SDIO Interface Signal Description

| Pin Name  | Signal Name | Type | Description                                                                                                                    |
|-----------|-------------|------|--------------------------------------------------------------------------------------------------------------------------------|
| SD_CLK    | CLK         | I/O  | SDIO 1-bit mode: Clock<br>SDIO SPI mode: Clock                                                                                 |
| SD_CMD    | CMD         | I/O  | SDIO 1-bit mode: Command line<br>SDIO SPI mode: Data input                                                                     |
| SD_DAT[3] | DAT3        | I/O  | SDIO 4-bit mode: Data line bit [3]<br>SDIO 1-bit mode: Not used<br>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)<br>SDIO 1-bit mode: Read Wait (optional)<br>SDIO SPI mode: Reserved |
| SD_DAT[1] | DAT1        | I/O  | SDIO 4-bit mode: Data line bit [1]<br>SDIO 1-bit mode: Interrupt<br>SDIO SPI mode: Interrupt                                   |
| SD_DAT[0] | DAT0        | I/O  | SDIO 4-bit mode: Data line bit [0]<br>SDIO 1-bit mode: Data line<br>SDIO SPI mode: Data output                                 |

### 3-1-2. Default Speed, High Speed Modes (3.3V)

#### SDIO Protocol Timing Diagram – Default Speed Mode (3.3V)



#### SDIO Protocol Timing Diagram – HighSpeed Mode (3.3V)

Table shows SDIO Timing Data—Default Speed, High Speed Modes (3.3V)

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

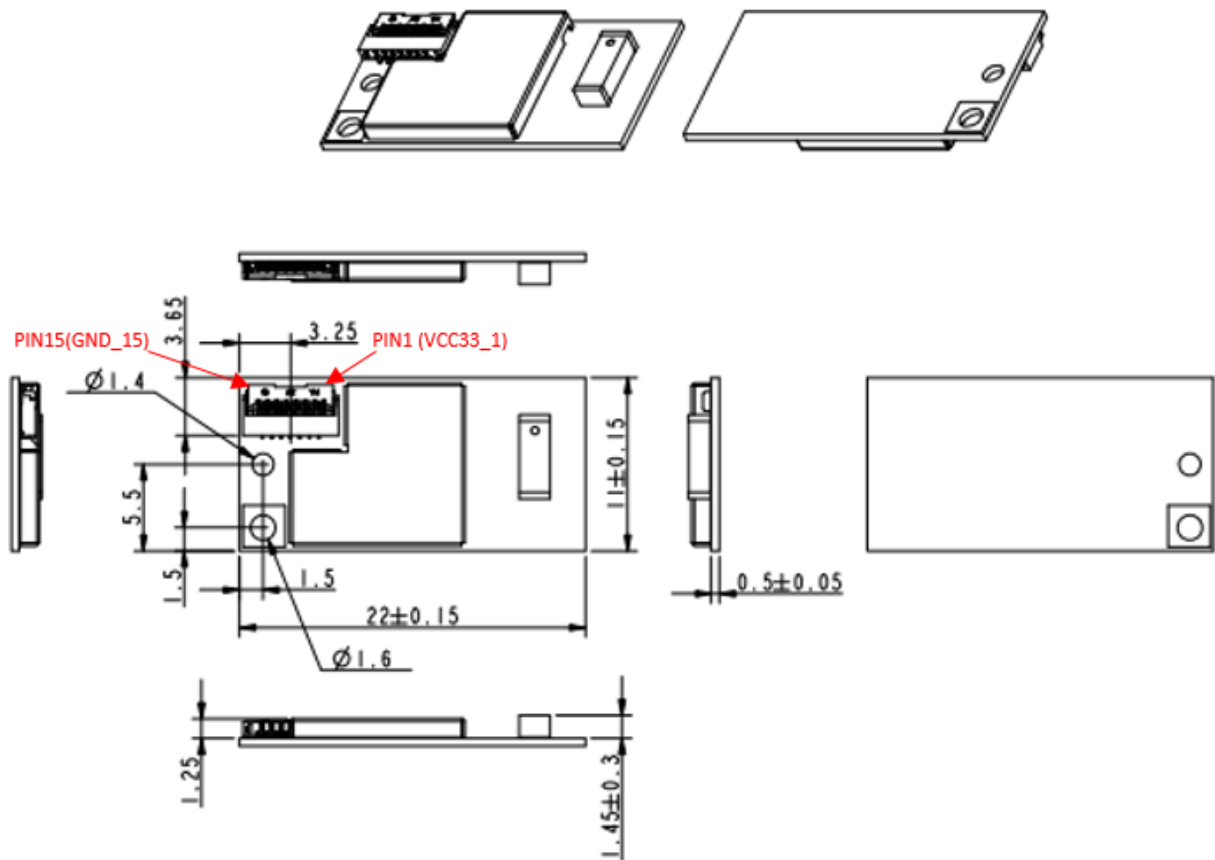
| Symbol     | Parameter                                | Condition     | Min | Typ | Max | Units |
|------------|------------------------------------------|---------------|-----|-----|-----|-------|
| $f_{PP}$   | Clock Frequency                          | Default Speed | 0   | --  | 25  | MHz   |
|            |                                          | 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<br>CL ≤ 40 pF (1 card) | Default Speed | --  | --  | 14  | ns    |
|            |                                          | High Speed    | --- | -1  | 4   | ns    |
| $T_{OH}$   | Output Hold Time                         | High Speed    | 2.5 | --  | --  | ns    |

## 4. Pin Definition

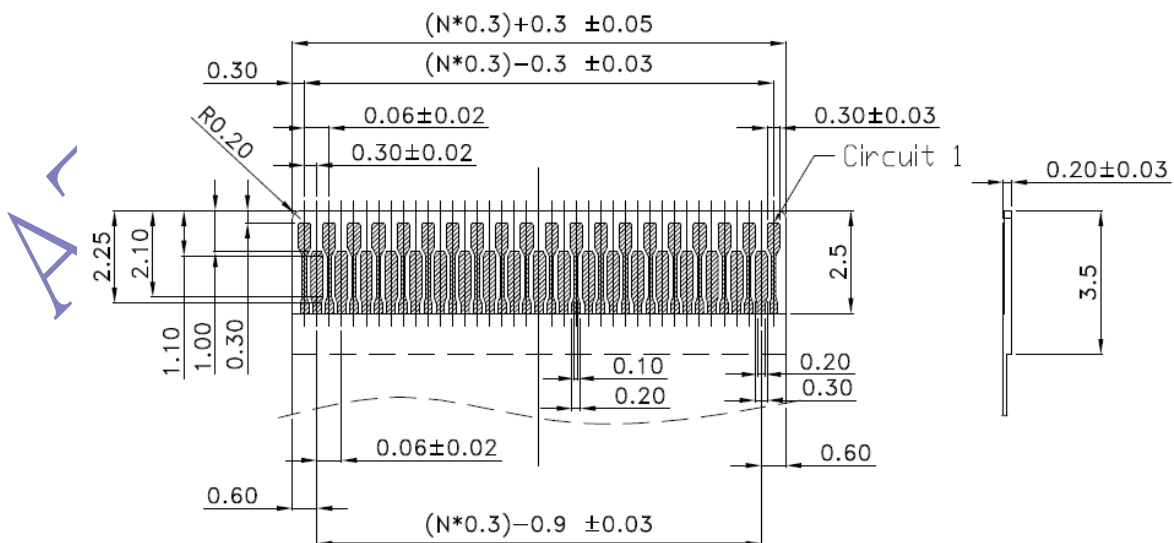
| Pin No | Definition     | Basic Description                                                     | Type |
|--------|----------------|-----------------------------------------------------------------------|------|
| 1      | VCC33_1        | Main Power Supply (3.3V)                                              | I    |
| 2      | VCC33_2        | Main Power Supply (3.3V)                                              | I    |
| 3      | VCC18          | 1.8V Power Supply                                                     | I    |
| 4      | VIO            | 1.8V/3.3V I/O Power Supply                                            | I    |
| 5      | GND_5          | GND                                                                   | -    |
| 6      | PDn            | Power Down (H : normal operation, L : power down)<br>Pulled up to VIO | I    |
| 7      | BT_wakeup_host | Bluetooth wakeup host                                                 | O    |
| 8      | SD_DATA0       | SDIO DATA0                                                            | I/O  |
| 9      | SD_DATA1       | SDIO DATA1                                                            | I/O  |
| 10     | SD_DATA2       | SDIO DATA2                                                            | I/O  |
| 11     | SD_DATA3       | SDIO DATA3                                                            | I/O  |
| 12     | SD_CMD         | SDIO Command                                                          | I/O  |
| 13     | GND_13         | GND                                                                   | -    |
| 14     | SD_CLK         | SDIO CLOCK                                                            | I    |
| 15     | GND_15         | GND                                                                   | -    |

## 5. Mechanical Information

### 5-1. Package Outline Drawing



### 5-2. Recommended FPC/FFC



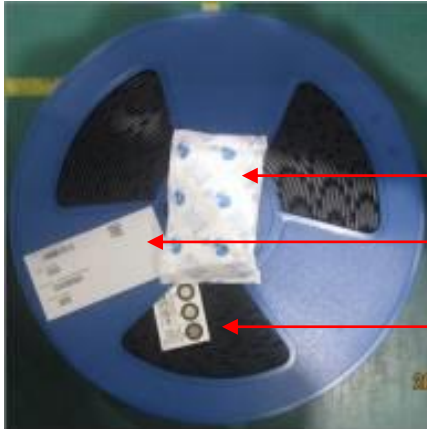
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## 6. Shipping Information

### 6-1



1 UNIT DESICCANT

AFFIX PACKING LABEL

HUMIDITY INDICATOR CARD

### 6-2



AFFIX PACKING LABEL

### 6-3



PINK BUBBLE WRAP

### 6-4

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AFFIX PACKING LABEL

## 6-5

1 Carton= 3 Boxes



## 6-6



**Note: 1 tape reel = 1 box = 1,100pcs**

**1 carton = 3 boxes = 3 \* 1,100pcs= 3,300pcs**

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## 7. 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:**

#### **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.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Country Code selection feature to be disabled for products marketed to the US/CANADA

**This device is intended only for OEM integrators under the following conditions:**

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna,
- 3) For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change.

As long as 3 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

**IMPORTANT NOTE**

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

**End Product Labeling**

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID: TLZ-CM299".

**Manual Information to the End User**

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.