

# **AW-CM358AN**

## **IEEE 802.11a/b/g/n/ac WLAN with Bluetooth 5.2 Combo LGA Module with Printed Antenna**

### **Datasheet**

**Rev. C**

**DF**

**(For Standard)**

## Features

### Wi-Fi

- 1 antennas to support 1(Transmit) × 1(Receive) technology and Bluetooth
- High speed wireless connection up to 433.3Mbps transmit/receive PHY rate using 80MHz bandwidth
- Backward compatibility with legacy 802.11 ac/n/a/g/b technology.
- 20MHz bandwidth/ channel, 40MHz bandwidth/ channel, upper/ lower 20MHz packets in 40MHz channel, 20MHz duplicate legacy packets in 40MHz channel mode operation.
- 80MHz bandwidth/ channel, 4 positions of 20MHz packets in 80MHz channel, upper/ lower 40MHz packets in 80MHz channel, 20MHz quadruplicate legacy packets in 80MHz channel mode operation.
- Dynamic frequency selection (radar detection)
- Enhanced radar detection for long and short pulse radar.
- Enhanced AGC scheme for DFS channel.
- 20/40/80Mhz coexistence with middle-packet detection (GI detection) for enhanced CCA.
- 1 spatial stream STBC reception.
- LDPC transmission and reception for both 802.11n and 802.11ac.
- 256 QAM (MCS 8, 9) modulation, optional support for 802.11ac MCS 9 in 20MHz using LDPC.
- Short guard interval.
- Temporal Key Integrity Protocol (TKIP)/ Wired Equivalent Privacy (WEP)/ Advanced Encryption Standard (AES)/ Counter-Mode/ CBC-MAC Protocol (CCMP).
- Cipher-Based Message Authentication Code (CMAC)/ WLAN Authentication and Privacy Infrastructure (WAPI).
- External Crystal frequency

### Bluetooth

- Baseband and radio BDR and EDR packet types – 1Mbps (GFSK), 2Mbps (π/4-DQPSK), and 3Mbps (8DPSK).
- Bluetooth 5.2 support.
- Enhanced Data Rate (EDR) compliant for both 2Mbps and 3Mbps supported.
- High speed UART and PCM for Bluetooth.
- Fully functional Bluetooth baseband-AFH, forward error correction, header error control, access code correlation, CRC, encryption bit stream generation, and whitening.
- Adaptive Frequency Hopping (AFH) using Packet Error Rate (PER).
- SCO/ eSCO links with hardware accelerated audio signal processing and hardware supported PPEC algorithm for speech quality improvement.
- Standard Bluetooth power saving mechanisms.
- Automatic ACL packet type selection.
- Full master and slave piconet support.
- Scatternet support.

- Enhanced Power Control (EPC).
- Channel Quality Driven Data Rate (CQDDR).
- Encryption (AES) support.
- Supports link layer topology to be master and slave (connects up to 16 links).
- LE Privacy 1.2
- LE Secure Connection.
- LE Data Length Extension.
- 2 Mbps LE
- Direction Finding – Connectionless Angle of Departure (AoD).
- Direction Finding – Connection – oriented Angle of Arrival (AoA).



AzureWave Technologies, Inc.

## Revision History

Document NO: R2-2358AN-DST-01

[illegible]

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## 1. Introduction

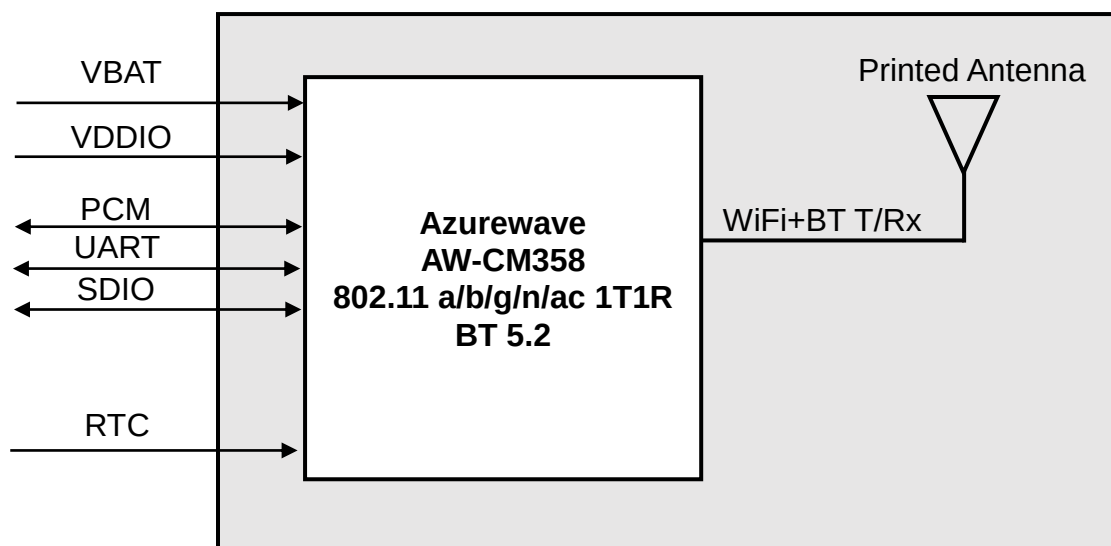
### 1.1 Product Overview

**AzureWave Technologies, Inc.** introduces the pioneer of the IEEE 802.11 a/b/g/n/ac WIFI with Bluetooth 5.2 combo SDIO and UART LGA Module --- **AW-CM358AN**. The AW-CM358AN IEEE 802.11 a/b/g/n/ac WIFI with Bluetooth 5.2 combo module is a highly integrated wireless local area network (WLAN) solution to let users enjoy the digital content through the latest wireless technology without using the extra cables and cords. It combines with Bluetooth 4.2 and provides a complete 2.4GHz Bluetooth system which is fully compliant to Bluetooth 4.2 and v2.1 that supports EDR of 2Mbps and 3Mbps for data and audio communications. It enables a high performance, cost effective, low power, compact solution that easily fits onto the SDIO and UART combo LGA module. Generic interfaces include SDIO 3.0 and high-speed UART interfaces for connecting WLAN and Bluetooth technologies to the host processor.

AW-CM358AN uses Direct Sequence Spread Spectrum (DSSS), Orthogonal Frequency Division Multiplexing (OFDM), BPSK, QPSK, 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-CM358AN. In addition to the support of **WPA/WPA2/WPA3** and **WEP** 64-bit and 128-bit encryption, It also supports the **IEEE 802.11i** security standard through the implementation of **Advanced Encryption Standard (AES)/Counter Mode CBC-MAC Protocol (CCMP)**, **AES/Galois/Counter Mode Protocol (GCMP)**, **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 video, voice, and multimedia applications, 802.11e Quality of Service (QoS) is supported. The device also supports 802.11h Dynamic Frequency Selection (DFS) for detecting radar pulses when operating in the 5 GHz range.

Wireless home audio and video entertainment systems including DVT, set-top boxes, blue-ray DVD players, media servers, and gaming consoles. Mobile routers and Internet of Things (IoT) gateways. AW-CM358AN module adopts NXP's latest highly-integrated WLAN & Bluetooth SoC---**88W8987**. All the other components are implemented by all means to reach the mechanical specification required.

## 1.2 Block Diagram



AW-CM358AN BLOCK DIAGRAM

## 1.3 Specifications Table

### 1.3.1 General

| Features                   | Description                                                                           |
|----------------------------|---------------------------------------------------------------------------------------|
| <b>Product Description</b> | IEEE 802.11 a/b/g/n/ac Wi-Fi with Bluetooth 5.2 combo LGA module with Printed Antenna |
| <b>Major Chipset</b>       | NXP 88W8987                                                                           |
| <b>Host Interface</b>      | Wi-Fi + BT<br>● SDIO + UART                                                           |
| <b>Dimension</b>           | 28mm(L) x 18mm(W) x 2.65mm(T)                                                         |
| <b>Form Factor</b>         | LGA module, 110 pins                                                                  |
| <b>Antenna</b>             | 1T1R<br>ANT1(Printed Antenna) : Wi-Fi/Bluetooth → TX/RX                               |
| <b>Weight</b>              | TBD                                                                                   |

### 1.3.2 WLAN

| Features                  | Description                                                                                                                                                                               |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>WLAN Standard</b>      | IEEE 802.11a/b/g/n/ac 1T1R                                                                                                                                                                |
| <b>WLAN VID/PID</b>       | N/A                                                                                                                                                                                       |
| <b>WLAN SVID/SPID</b>     | N/A                                                                                                                                                                                       |
| <b>Frequency Range</b>    | WLAN: 2.4 GHz / 5GHz Band                                                                                                                                                                 |
| <b>Modulation</b>         | DSSS<br>DBPSK(1Mbps), DQPSK(2Mbps), CCK(11/5.5Mbps)<br>OFDM<br>BPSK(9/6Mbps/MCS0), QPSK(18/12Mbps/MCS1~2),<br>16-QAM(36/24Mbps/MCS3~4), 64-QAM(72.2/54/48Mbps/MCS5~7),<br>256-QAM(MCS8~9) |
| <b>Number of Channels</b> | 802.11b:<br>USA, Canada and Taiwan – 1 ~ 11<br>Most European Countries – 1 ~ 13<br>Japan – 1 ~ 13<br>802.11g:<br>USA and Canada – 1 ~ 11                                                  |

|                             |                                                                                                                                                                                                                                                 |     |     |     |      |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------|
|                             | Most European Countries – 1 ~ 13<br>802.11n:<br>USA and Canada – 1 ~ 11<br>Most European Countries – 1 ~ 13<br>802.11a:<br>USA – 36, 40, 44, 48, 52, 56, 60, 64, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140, 149, 153, 157, 161, 165 |     |     |     |      |
| <b>Output Power</b>         | <b>2.4G</b>                                                                                                                                                                                                                                     |     |     |     |      |
|                             |                                                                                                                                                                                                                                                 | Min | Typ | Max | Unit |
|                             | 11b (11Mbps)<br>@EVM<35%                                                                                                                                                                                                                        | 14  | 16  | 18  | dBm  |
|                             | 11g (54Mbps)<br>@EVM ≤ -25 dB                                                                                                                                                                                                                   | 12  | 14  | 16  | dBm  |
|                             | 11n (HT20 MCS7)<br>@EVM ≤ -27 dB                                                                                                                                                                                                                | 11  | 13  | 15  | dBm  |
|                             | 11n (HT40 MCS7)<br>@EVM ≤ -27 dB                                                                                                                                                                                                                | 10  | 12  | 14  | dBm  |
|                             | <b>5G</b>                                                                                                                                                                                                                                       |     |     |     |      |
|                             |                                                                                                                                                                                                                                                 | Min | Typ | Max | Unit |
|                             | 11a (54Mbps)<br>@EVM ≤ -25 dB                                                                                                                                                                                                                   | 11  | 13  | 15  | dBm  |
|                             | 11n (HT20 MCS7)<br>@EVM ≤ -27 dB                                                                                                                                                                                                                | 8   | 10  | 12  | dBm  |
|                             | 11n (HT40 MCS7)<br>@EVM ≤ -27 dB                                                                                                                                                                                                                | 8   | 10  | 12  | dBm  |
|                             | 11ac (VHT20 MCS8)<br>@EVM ≤ -30 dB                                                                                                                                                                                                              | 8   | 10  | 12  | dBm  |
|                             | 11ac (VHT40 MCS9)<br>@EVM ≤ -32 dB                                                                                                                                                                                                              | 7   | 9   | 11  | dBm  |
|                             | 11ac (VHT80 MCS9)<br>@EVM ≤ -32 dB                                                                                                                                                                                                              | 6   | 8   | 10  | dBm  |
| <b>Receiver Sensitivity</b> | <b>2.4G</b>                                                                                                                                                                                                                                     |     |     |     |      |
|                             |                                                                                                                                                                                                                                                 | Min | Typ | Max | Unit |
|                             | 11b (11Mbps)                                                                                                                                                                                                                                    |     | -87 | -84 | dBm  |
|                             | 11g (54Mbps)                                                                                                                                                                                                                                    |     | -73 | -70 | dBm  |
|                             | 11n (HT20 MCS7)                                                                                                                                                                                                                                 |     | -69 | -66 | dBm  |
|                             | 11n (HT40 MCS7)                                                                                                                                                                                                                                 |     | -67 | -64 | dBm  |
|                             | <b>5G(n/ac packets with LDPC)</b>                                                                                                                                                                                                               |     |     |     |      |
|                             |                                                                                                                                                                                                                                                 | Min | Typ | Max | Unit |
|                             | 11a (54Mbps)                                                                                                                                                                                                                                    |     | -71 | -68 | dBm  |
|                             | 11n (HT20 MCS7)                                                                                                                                                                                                                                 |     | -67 | -64 | dBm  |
|                             | 11n (HT40 MCS7)                                                                                                                                                                                                                                 |     | -63 | -60 | dBm  |

|                  |                                                                                                                                                                                                                                                                                                                                       |  |     |     |     |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|-----|-----|
|                  | 11ac (VHT20 MCS8)                                                                                                                                                                                                                                                                                                                     |  | -67 | -64 | dBm |
|                  | 11ac (VHT40 MCS9)                                                                                                                                                                                                                                                                                                                     |  | -59 | -56 | dBm |
|                  | 11ac (VHT80 MCS9)                                                                                                                                                                                                                                                                                                                     |  | -55 | -52 | dBm |
| <b>Data Rate</b> | 802.11b: 1, 2, 5.5, 11Mbps<br>802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps<br>802.11n: MCS0~7 HT20/HT40<br>802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps<br>802.11ac: MCS0~8 VHT20<br>802.11ac: MCS0~9 VHT40/VHT80                                                                                                                           |  |     |     |     |
| <b>Security</b>  | <ul style="list-style-type: none"> <li>● WPA™- and WPA2™- (Personal) support for powerful encryption and authentication</li> <li>● AES and TKIP acceleration hardware for faster data encryption and 802.11i compatibility</li> <li>● Wi-Fi Protected Setup (WPS)</li> <li>● WEP</li> <li>● CKIP(Software)</li> <li>● WPA3</li> </ul> |  |     |     |     |

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

### 1.3.3 Bluetooth

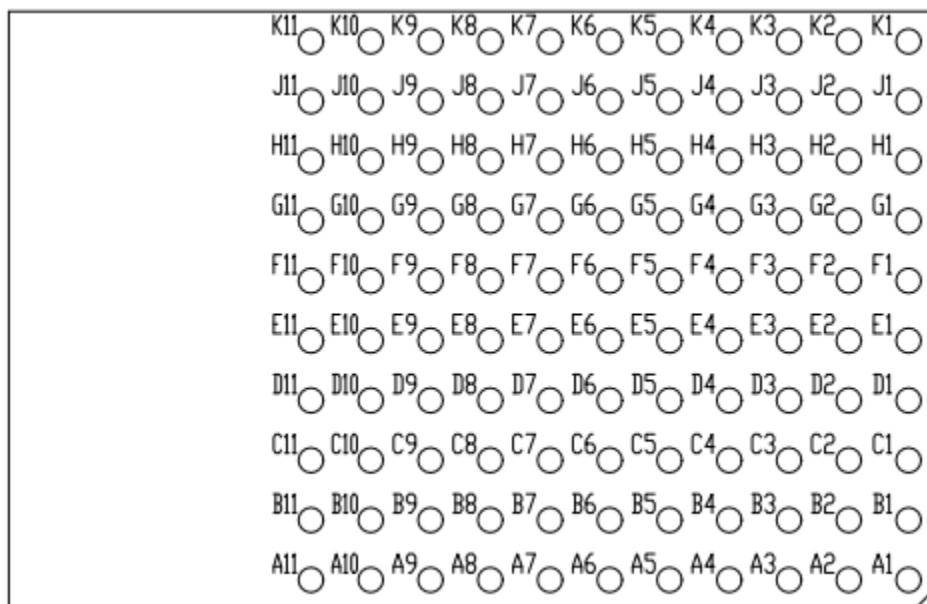
| Features                    | Description                                              |     |     |     |      |
|-----------------------------|----------------------------------------------------------|-----|-----|-----|------|
| <b>Bluetooth Standard</b>   | Bluetooth 2.1+Enhanced Data Rate (EDR)/BT3.0/BT4.2/BT5.0 |     |     |     |      |
| <b>Bluetooth VID/PID</b>    | N/A                                                      |     |     |     |      |
| <b>Frequency Range</b>      | 2400~2483.5MHz                                           |     |     |     |      |
| <b>Modulation</b>           | GFSK (1Mbps), $\pi/4$ DQPSK (2Mbps) and 8DPSK (3Mbps)    |     |     |     |      |
| <b>Output Power</b>         |                                                          | Min | Typ | Max | Unit |
|                             | BDR                                                      | 0   | 2   | 4   | dBm  |
|                             | EDR                                                      | 0   | 2   | 4   | dBm  |
|                             | LE                                                       | 0   | 2   | 4   | dBm  |
| <b>Receiver Sensitivity</b> |                                                          | Min | Typ | Max | Unit |
|                             | DH5                                                      |     | -88 | -84 | dBm  |
|                             | 2DH5                                                     |     | -88 | -84 | dBm  |
|                             | 3DH5                                                     |     | -80 | -76 | dBm  |
|                             | LE                                                       |     | -88 | -84 | dBm  |

### 1.3.4 Operating Conditions

| Features                     | Description                         |
|------------------------------|-------------------------------------|
| <b>Operating Conditions</b>  |                                     |
| <b>Voltage</b>               | VBAT: 3.07~3.53V<br>VIO : 1.8V      |
| <b>Operating Temperature</b> | -30°C ~85°C                         |
| <b>Operating Humidity</b>    | less than 85% R.H.                  |
| <b>Storage Temperature</b>   | -40°C ~90°C                         |
| <b>Storage Humidity</b>      | less than 60% R.H.                  |
| <b>ESD Protection</b>        |                                     |
| <b>Human Body Model</b>      | ±2KV per MIL-STD-883H Method 3015.8 |
| <b>Changed Device Model</b>  | ±500V per JEDEC EIA/JESD22-C101E    |

## 2. Pin Definition

### 2.1 Pin Map



**AW-CM358AN Top View Pin Map**

## 2.2 Pin Table

| Pin No | Definition    | Basic Description                                                                                                          | Voltage | Type     |
|--------|---------------|----------------------------------------------------------------------------------------------------------------------------|---------|----------|
| A1     | GND           | Ground.                                                                                                                    |         | GND      |
| A2     | SDIO_DATA1    | SDIO Data Line 1.                                                                                                          | VDDIO   | I/O      |
| A3     | SDIO_DATA0    | SDIO Data Line 0.                                                                                                          | VDDIO   | I/O      |
| A4     | SDIO_DATA_CLK | SDIO Clock Input.                                                                                                          | VDDIO   | I        |
| A5     | SDIO_DATA_CMD | SDIO Command Input.                                                                                                        | VDDIO   | I/O      |
| A6     | SDIO_DATA3    | SDIO Data Line 3.                                                                                                          | VDDIO   | I/O      |
| A7     | SDIO_DATA2    | SDIO Data Line 2.                                                                                                          | VDDIO   | I/O      |
| A8     | WL_HOST_WAKE  | WLAN to wake-up HOST                                                                                                       |         | O        |
| A9     | PDn           | Power up/ down internal regulators.<br>0 = full power-down mode<br>1 = normal mode<br>Default pull high in module internal |         | I        |
| A10    | VBAT          | 3.3V power pin                                                                                                             | 3.3V    | VCC      |
| A11    | VBAT          | 3.3V power pin                                                                                                             | 3.3V    | VCC      |
| B1     | VIN_LDO_OUT   | Switch Node of Internal DC-DC convertor                                                                                    | 1.8V    | VCC      |
| B2     | VIN_LDO_OUT   | Switch Node of Internal DC-DC convertor                                                                                    | 1.8V    | VCC      |
| B3     | GND           | Ground.                                                                                                                    |         | GND      |
| B4     | GND           | Ground.                                                                                                                    |         | GND      |
| B5     | GND           | Ground.                                                                                                                    |         | GND      |
| B6     | GND           | Ground.                                                                                                                    |         | GND      |
| B7     | GND           | Ground.                                                                                                                    |         | GND      |
| B8     | GND           | Ground.                                                                                                                    |         | GND      |
| B9     | NC            | Floating Pin, No connect to anything                                                                                       |         | Floating |
| B10    | GND           | Ground.                                                                                                                    |         | GND      |
| B11    | GND           | Ground.                                                                                                                    |         | GND      |

|     |           |                                        |      |     |
|-----|-----------|----------------------------------------|------|-----|
| C1  | VIN_LDO   | DC-DC convertor to supply AVDD18 of IC | 1.8V | VCC |
| C2  | VIN_LDO   | DC-DC convertor to supply AVDD18 of IC | 1.8V | VCC |
| C3  | GND       | Ground.                                |      | GND |
| C4  | GND       | Ground.                                |      | GND |
| C5  | GND       | Ground.                                |      | GND |
| C6  | GND       | Ground.                                |      | GND |
| C7  | GND       | Ground.                                |      | GND |
| C8  | GND       | Ground.                                |      | GND |
| C9  | GND       | Ground.                                |      | GND |
| C10 | GND       | Ground.                                |      | GND |
| C11 | GND       | Ground.                                |      | GND |
| D1  | GND       | Ground.                                |      | GND |
| D2  | GND       | Ground.                                |      | GND |
| D3  | GND       | Ground.                                |      | GND |
| D4  | GND       | Ground.                                |      | GND |
| D5  | GND       | Ground.                                |      | GND |
| D6  | GND       | Ground.                                |      | GND |
| D7  | GND       | Ground.                                |      | GND |
| D8  | GND       | Ground.                                |      | GND |
| D9  | GND       | Ground.                                |      | GND |
| D10 | GND       | Ground.                                |      | GND |
| D11 | GND       | Ground.                                |      | GND |
| E1  | SUSCLK_IN | External 32K or RTC clock              |      | I   |
| E2  | GND       | Ground.                                |      | GND |
| E3  | GND       | Ground.                                |      | GND |
| E4  | GND       | Ground.                                |      | GND |

|     |            |                                      |  |          |
|-----|------------|--------------------------------------|--|----------|
| E5  | GND        | Ground.                              |  | GND      |
| E6  | GND        | Ground.                              |  | GND      |
| E7  | GND        | Ground.                              |  | GND      |
| E8  | GND        | Ground.                              |  | GND      |
| E9  | GND        | Ground.                              |  | GND      |
| E10 | GND        | Ground.                              |  | GND      |
| E11 | GND        | Ground.                              |  | GND      |
| F1  | BT_PCM_OUT | PCM data out                         |  | O        |
| F2  | NC         | Floating Pin, No connect to anything |  | Floating |
| F3  | GND        | Ground.                              |  | GND      |
| F4  | GND        | Ground.                              |  | GND      |
| F5  | GND        | Ground.                              |  | GND      |
| F6  | GND        | Ground.                              |  | GND      |
| F7  | GND        | Ground.                              |  | GND      |
| F8  | GND        | Ground.                              |  | GND      |
| F9  | GND        | Ground.                              |  | GND      |
| F10 | GND        | Ground.                              |  | GND      |
| F11 | GND        | Ground.                              |  | GND      |
| G1  | BT_PCM_CLK | PCM Clock                            |  | I/O      |
| G2  | NC         | Floating Pin, No connect to anything |  | Floating |
| G3  | GND        | Ground.                              |  | GND      |
| G4  | GND        | Ground.                              |  | GND      |
| G5  | GND        | Ground.                              |  | GND      |
| G6  | GND        | Ground.                              |  | GND      |
| G7  | GND        | Ground.                              |  | GND      |
| G8  | GND        | Ground.                              |  | GND      |

|     |              |                                      |  |          |
|-----|--------------|--------------------------------------|--|----------|
| G9  | GND          | Ground.                              |  | GND      |
| G10 | GND          | Ground.                              |  | GND      |
| G11 | GND          | Ground.                              |  | GND      |
| H1  | BT_PCM_IN    | PCM data Input                       |  | I        |
| H2  | GND          | Ground.                              |  | GND      |
| H3  | GND          | Ground.                              |  | GND      |
| H4  | GND          | Ground.                              |  | GND      |
| H5  | GND          | Ground.                              |  | GND      |
| H6  | GND          | Ground.                              |  | GND      |
| H7  | GND          | Ground.                              |  | GND      |
| H8  | GND          | Ground.                              |  | GND      |
| H9  | GND          | Ground.                              |  | GND      |
| H10 | GND          | Ground.                              |  | GND      |
| H11 | GND          | Ground.                              |  | GND      |
| J1  | BT_PCM_SYNC  | PCM Synchronization control          |  | O        |
| J2  | GND          | Ground.                              |  | GND      |
| J3  | HOST_WL_WAKE | Host wake-up WLAN device             |  | Floating |
| J4  | NC           | Floating Pin, No connect to anything |  | Floating |
| J5  | NC           | Floating Pin, No connect to anything |  | Floating |
| J6  | NC           | Floating Pin, No connect to anything |  | Floating |
| J7  | NC           | Floating Pin, No connect to anything |  | Floating |
| J8  | NC           | Floating Pin, No connect to anything |  | Floating |
| J9  | BT_WAKE_HOST | Bluetooth device to wake-up Host     |  | O        |
| J10 | GND          | Ground.                              |  | GND      |
| J11 | GND          | Ground.                              |  | GND      |
| K1  | GND          | Ground.                              |  | GND      |

|     |              |                                          |      |          |
|-----|--------------|------------------------------------------|------|----------|
| K2  | VDDIO        | 1.8V VDDIO supply for WLAN and Bluetooth | 1.8V | VCC      |
| K3  | NC           | Floating Pin, No connect to anything     |      | Floating |
| K4  | HOST_WAKE_BT | Host wake-up Bluetooth device            |      | I        |
| K5  | NC           | Floating Pin, No connect to anything     |      | Floating |
| K6  | UART_RTS_N   | High-Speed UART RTS                      |      | O        |
| K7  | UART_TXD     | High-Speed UART Data Out                 |      | O        |
| K8  | UART_RXD     | High-Speed UART Data In                  |      | I        |
| K9  | UART_CTS_N   | High-Speed UART CTS                      |      | I        |
| K10 | GND          | Ground.                                  |      | GND      |
| K11 | GND          | Ground.                                  |      | GND      |

### 3. Electrical Characteristics

#### 3.1 Absolute Maximum Ratings

| Symbol       | Parameter                         | Minimum | Typical | Maximum | Unit |
|--------------|-----------------------------------|---------|---------|---------|------|
| <b>VBAT</b>  | DC supply for the 3.3V input      | 2.5     | 3.3     | 4.0     | V    |
| <b>VDDIO</b> | DC supply voltage for digital I/O |         | 1.8     | 2.2     | V    |

#### 3.2 Recommended Operating Conditions

| Symbol       | Parameter                         | Minimum | Typical | Maximum | Unit |
|--------------|-----------------------------------|---------|---------|---------|------|
| <b>VBAT</b>  | DC supply for the 3.3V input      | 3.07    | 3.3     | 3.53    | V    |
| <b>VDDIO</b> | DC supply voltage for digital I/O | 1.67    | 1.8     | 1.98    | V    |

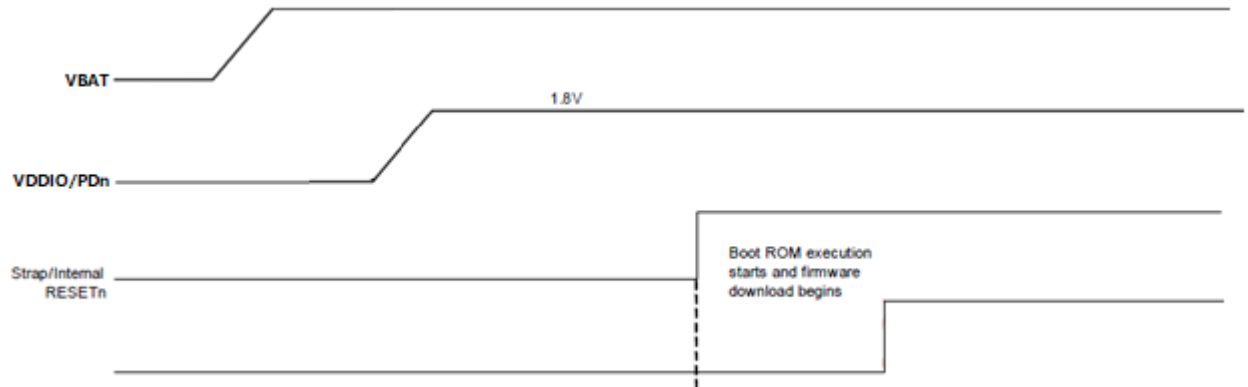
### 3.3 Digital IO Pin DC Characteristics

| Symbol                              | Parameter           | Minimum | Typical | Maximum | Unit |
|-------------------------------------|---------------------|---------|---------|---------|------|
| <b>Digital I/O pins, VDDIO=1.8V</b> |                     |         |         |         |      |
| <b>V<sub>IH</sub></b>               | Input high voltage  | 1.26    | -       | 2.2     | V    |
| <b>V<sub>IL</sub></b>               | Input low voltage   | -0.4    | -       | 0.54    | V    |
| <b>V<sub>OH</sub></b>               | Output high voltage | 1.4     | -       | -       | V    |
| <b>V<sub>OL</sub></b>               | Output Low Voltage  | -       | -       | 0.4     | V    |

### 3.4 Host Interface

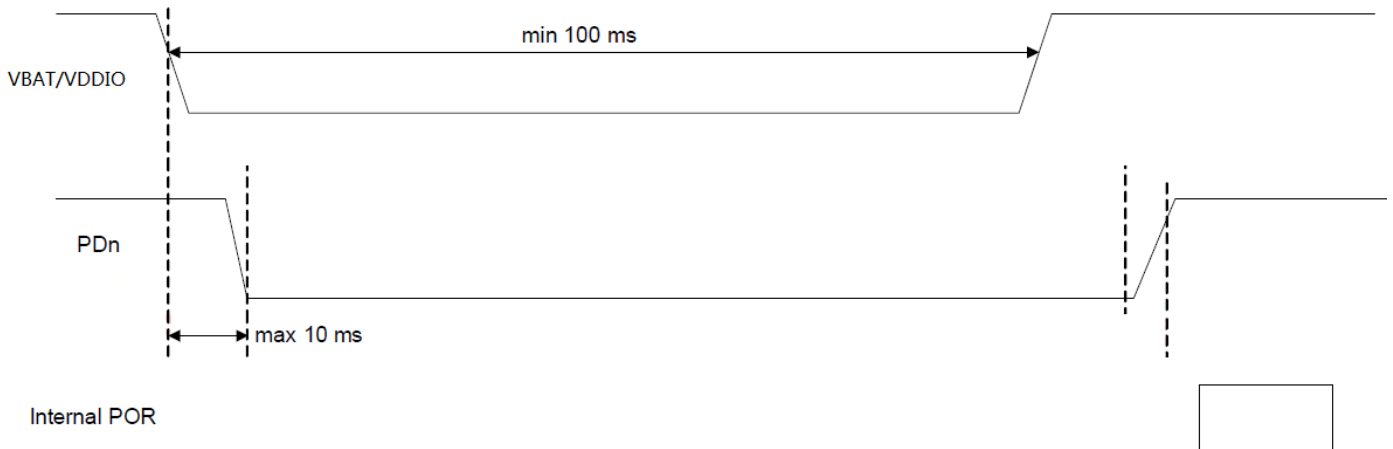
#### Power-up Sequence

VDDIO/PdN no specific time requirement, just need to follow up the power on sequence waveform.



#### Power-down Sequence

The table is AW-CM358AN module power down sequence, the maximum ramp-down time for PDn from VBAT assertion is 10ms. VBAT must be asserted a minimum of 100 ms to guarantee that PDn are discharged to less than 0.2V for the POR generate properly after VBAT is deasserted.



### 3.4.1 SDIO Interface

The AW-CM358AN 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-CM358AN 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.

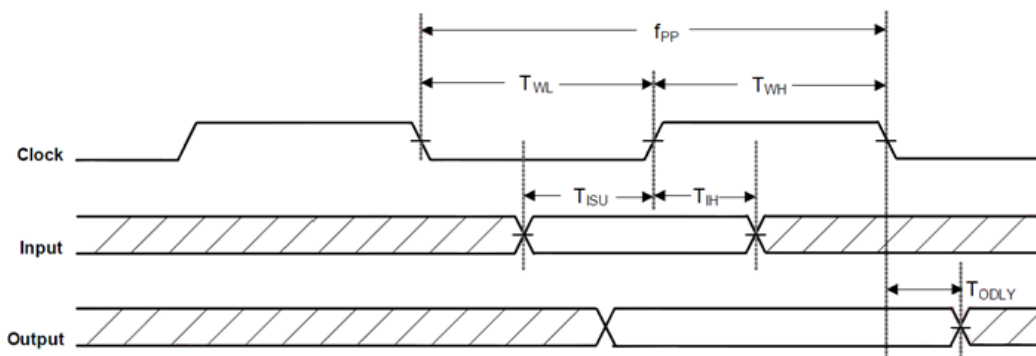
- ◆ Support SDIO 3.0 Standard.
- ◆ On-chip memory used for CIS.
- ◆ Supports 4-bit SDIO and 1-bit SDIO transfer modes.
- ◆ Special interrupt register for information exchange.

#### SDIO Interface Signals

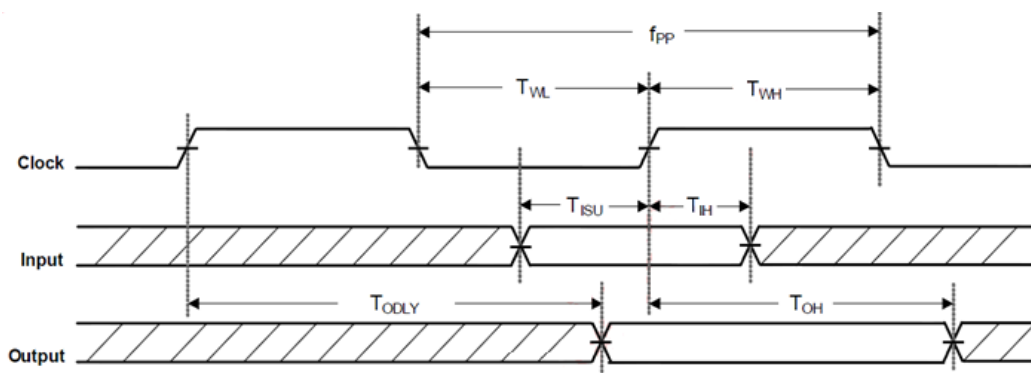
| AW-CM358AN<br>SDIO Pin Name | Type | Description                                                                                        |
|-----------------------------|------|----------------------------------------------------------------------------------------------------|
| SDIO_DATA_CLK               | I    | SDIO 4-bit mode: Clock<br>SDIO 1-bit mode: Clock                                                   |
| SDIO_DATA_CMD               | I/O  | SDIO 4-bit mode: Command line<br>SDIO 1-bit mode: Command line                                     |
| SDIO_DATA_3                 | I/O  | SDIO 4-bit mode: Data line Bit[3]<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>SDIO 1-bit mode: Read Wait (optional) |
| SDIO_DATA_1                 | I/O  | SDIO 4-bit mode: Data line Bit[1]<br>SDIO 1-bit mode: Interrupt                                    |
| SDIO_DATA_0                 | I/O  | SDIO 4-bit mode: Data line Bit[0]<br>SDIO 1-bit mode: Data line                                    |

## Default Speed, High-Speed Modes

### SDIO Protocol Timing Diagram – Default Speed Mode



### SDIO Protocol Timing Diagram – High Speed Mode

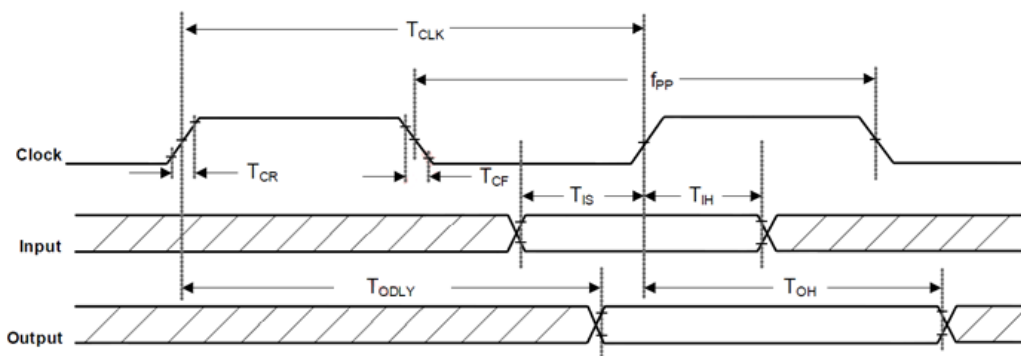


### SDIO Timing Data- Default Speed, High-Speed Modes

| Symbol     | Parameter         | Condition  | Min | Max | Units |
|------------|-------------------|------------|-----|-----|-------|
| $f_{PP}$   | CLK Frequency     | Normal     | 0   | 25  | MHz   |
|            |                   | High Speed | 0   | 50  |       |
| $t_{WL}$   | CLK low Time      | Normal     | 10  | -   |       |
|            |                   | High Speed | 7   | -   |       |
| $t_{WH}$   | CLK High Time     | Normal     | 10  | -   |       |
|            |                   | High Speed | 7   | -   |       |
| $t_{ISU}$  | Input Setup Time  | Normal     | 5   | -   |       |
|            |                   | High Speed | 6   | -   |       |
| $t_{IH}$   | Input Hold Time   | Normal     | 5   | -   |       |
|            |                   | High Speed | 2   | -   |       |
| $t_{ODLY}$ | Output Delay Time | Normal     | -   | 14  |       |
|            |                   | High Speed | -   | 14  |       |
| $T_{OH}$   | Output hold time  | High Speed | 2.5 |     |       |

1. For SDIO 2.0 running at 50MHz clock frequency, only 1.8V is supported.
2. For SDIO 2.0 running at 25MHz clock frequency, 1.8V is supported.

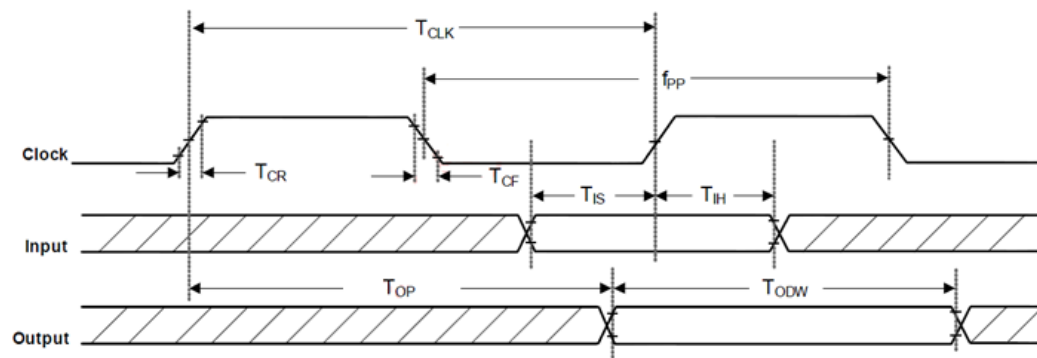
## SDIO Protocol Timing Diagram – SDR12, SDR25, SDR50 Modes (up to 100MHz) (1.8V)



## SDIO Timing Data- SDR12, SDR25, SDR50 Modes (up to 100MHz) (1.8V)

| Symbol           | Parameter            | Condition   | Min | Typ | Max                 | Units |
|------------------|----------------------|-------------|-----|-----|---------------------|-------|
| $f_{pp}$         | CLK Frequency        | SDR12/25/50 | 25  | -   | 100                 | MHz   |
| $T_{IS}$         | Input setup time     | SDR12/25/50 | 3   | -   | -                   | ns    |
| $T_{IH}$         | Input hold time      | SDR12/25/50 | 0.8 | -   | -                   | ns    |
| $T_{CLK}$        | Clock time           | SDR12/25/50 | 10  | -   | 40                  | ns    |
| $T_{CR}, T_{CF}$ | Rise time, fall time | SDR12/25/50 | -   | -   | $0.2 \cdot T_{CLK}$ | ns    |
| $T_{ODLY}$       | Output delay time    | SDR12/25/50 | -   | -   | 7.5                 | ns    |
| $T_{OH}$         | Output hold time     | SDR12/25/50 | 1.5 | -   | -                   | ns    |

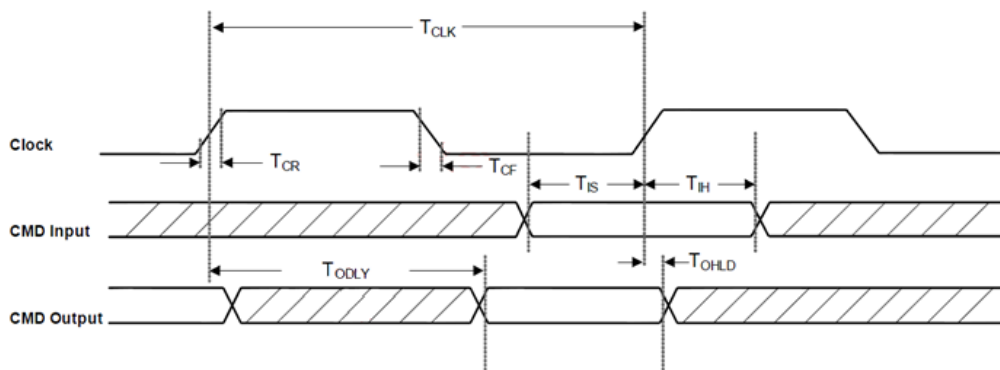
## SDIO Protocol Timing Diagram – SDR104 Mode (208MHz)



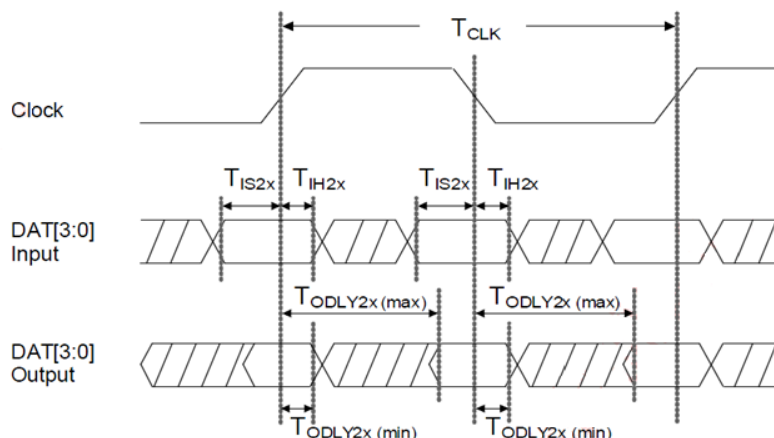
## SDIO Timing Data- SDR104 Mode (208MHz)

| Symbol           | Parameter            | Condition | Min  | Typ | Max                 | Units |
|------------------|----------------------|-----------|------|-----|---------------------|-------|
| $f_{pp}$         | CLK Frequency        | SDR104    | 0    | -   | 208                 | MHz   |
| $T_{IS}$         | Input setup time     | SDR104    | 1.4  | -   | -                   | ns    |
| $T_{IH}$         | Input hold time      | SDR104    | 0.8  | -   | -                   | ns    |
| $T_{CLK}$        | Clock time           | SDR104    | 4.8  | -   | -                   | ns    |
| $T_{CR}, T_{CF}$ | Rise time, fall time | SDR104    | -    | -   | $0.2 \cdot T_{CLK}$ | ns    |
| $T_{ODLY}$       | Output delay time    | SDR104    | 0    | -   | 10                  | ns    |
| $T_{OH}$         | Output hold time     | SDR104    | 2.88 | -   | -                   | ns    |

## SDIO CMD Timing Diagram – DDR50 Mode (50MHz)



## SDIO SAT [3:0] Timing Diagram – SDR50 Mode (50MHz)



## SDIO Timing Data- DDR50 Mode (50MHz)

| Symbol                  | Parameter                                   | Condition | Min | Typ | Max                 | Units |
|-------------------------|---------------------------------------------|-----------|-----|-----|---------------------|-------|
| <b>Clock</b>            |                                             |           |     |     |                     |       |
| $T_{CLK}$               | Clock time                                  | DDR50     | 20  | -   | -                   | ns    |
| $T_{CR}, T_{CF}$        | Rise time, fall time                        | DDR50     | -   | -   | $0.2 \cdot T_{CLK}$ | Ns    |
| <b>Clock Duty</b>       |                                             | DDR50     | 45  | -   | 55                  | %     |
| <b>CMD Input</b>        |                                             |           |     |     |                     |       |
| $T_{IS}$                | Input setup time                            | DDR50     | 6   | -   | -                   | ns    |
| $T_{IH}$                | Input hold time                             | DDR50     | 0.8 | -   | -                   | ns    |
| <b>CMD Output</b>       |                                             |           |     |     |                     |       |
| $T_{ODLY}$              | Output delay time during data transfer mode | DDR50     | -   | -   | 13.7                | ns    |
| $T_{OHLd}$              | Output hold time                            | DDR50     | 1.5 | -   | -                   | ns    |
| <b>DAT [3:0] Input</b>  |                                             |           |     |     |                     |       |
| $T_{IS2X}$              | Input hold time                             | DDR50     | 3   | -   | -                   | ns    |
| $T_{IH2X}$              | Input hold time                             | DDR50     | 0.8 | -   | -                   | ns    |
| <b>DAT [3:0] Output</b> |                                             |           |     |     |                     |       |
| $T_{ODLY2X(max)}$       | Output delay time during data transfer mode | DDR50     | -   | -   | 7                   | ns    |
| $T_{ODLY2X(min)}$       | Output hold time                            | DDR50     | 1.5 | -   | -                   | ns    |

### 3.4.2 UART Interface

#### High-Speed UART interface

The AW-CM358AN supports a high-speed Universal Asynchronous Receiver/ Transmitter (UART) interface, compliant to the industry standard 16550 specification.

- ◆ FIFO mode permanently selected for transmit and receive operations.
- ◆ 2 pins for transmit and receive operations.
- ◆ 2 flow control pins.
- ◆ Interrupt triggers for low-power, internal CPU (for debug purposes).
- ◆ Support diagnostic tests.
- ◆ Support data input/ output operations for peripheral devices connected through a standard UART interface.

#### UART Interface Signals

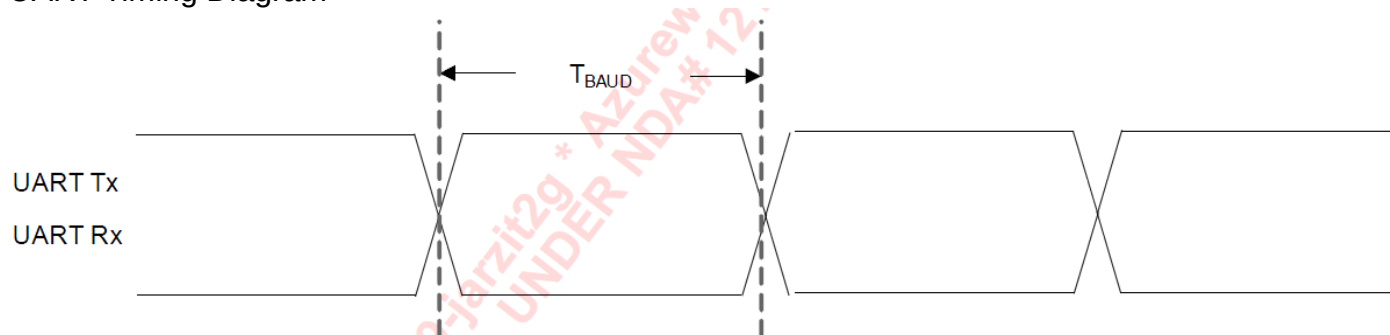
| Pin Number | Signal Name | 16550 Standard Name | Type | Description     |
|------------|-------------|---------------------|------|-----------------|
| <b>K7</b>  | UART_TXD    | SOUT                | O    | Serial data     |
| <b>K8</b>  | UART_RXD    | SIN                 | I    | Serial data     |
| <b>K9</b>  | UART_CTSn   | CTS <sub>n</sub>    | I    | Clear To Send   |
| <b>K6</b>  | UART_RTSn   | RTS <sub>n</sub>    | O    | Request To Send |

#### UART Baud Rates Supported

| Baud Rate |        |         |         |         |
|-----------|--------|---------|---------|---------|
| 1200      | 38400  | 460800  | 1500000 | 3000000 |
| 2400      | 57600  | 500000  | 1843200 | 3250000 |
| 4800      | 76800  | 921600  | 2000000 | 3692300 |
| 9600      | 115200 | 1000000 | 2100000 | 4000000 |
| 19200     | 230400 | 1382400 | 2764800 | -       |

The UART Tx and Rx pins are powered from the VDDIO voltage supply.

#### UART Timing Diagram



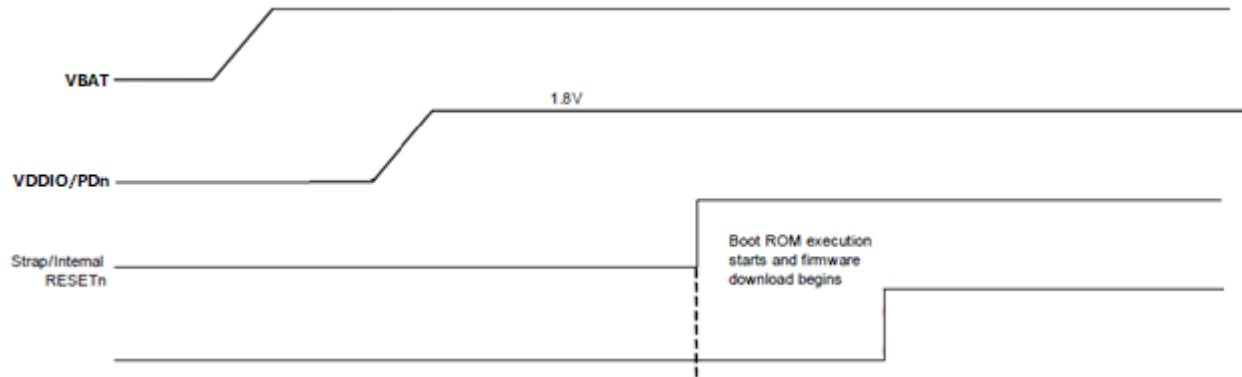
#### UART Timing Data

| Symbol | Parameter | Condition           | Min | Typ | Max | Units |
|--------|-----------|---------------------|-----|-----|-----|-------|
| TBAUD  | Baud rate | 38.4MHz input clock | 250 | -   | -   | ns    |

### 3.5 Power up Timing Sequence

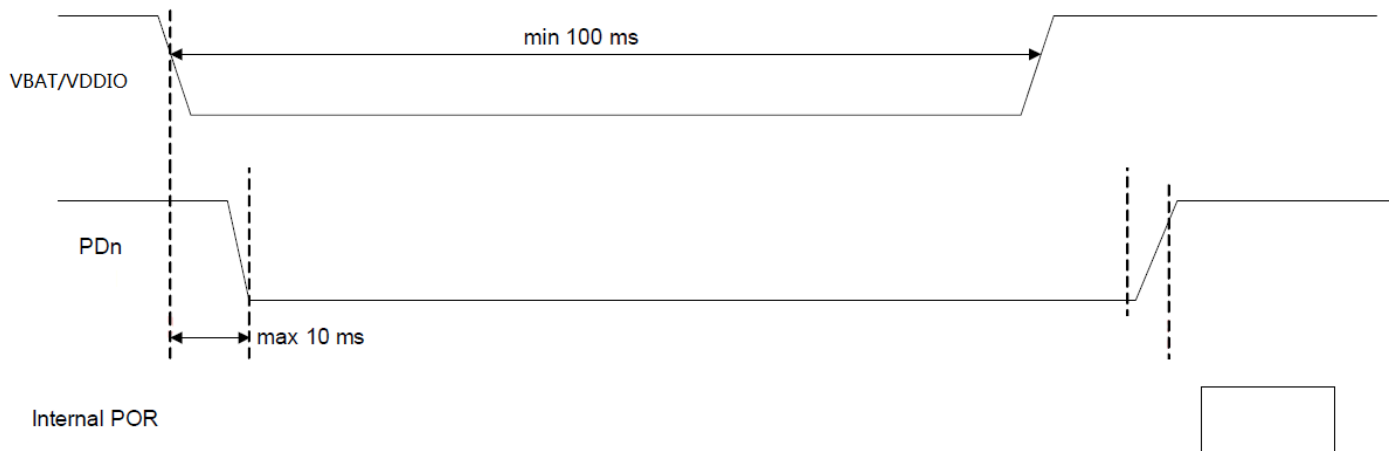
#### Power-up Sequence

VDDIO/PdN no specific time requirement, just need to follow up the power on sequence waveform.



#### Power-down Sequence

The table is AW-CM358AN module power down sequence, the maximum ramp-down time for PDn from VBAT assertion is 10ms. VBAT must be asserted a minimum of 100 ms to guarantee that PDn are discharged to less than 0.2V for the POR generate properly after VBAT is deasserted.



## **3.6 Power Consumption\***

### **3.6.1 WLAN**

TBD

\* The power consumption is based on Azurewave test environment, these data for reference only.

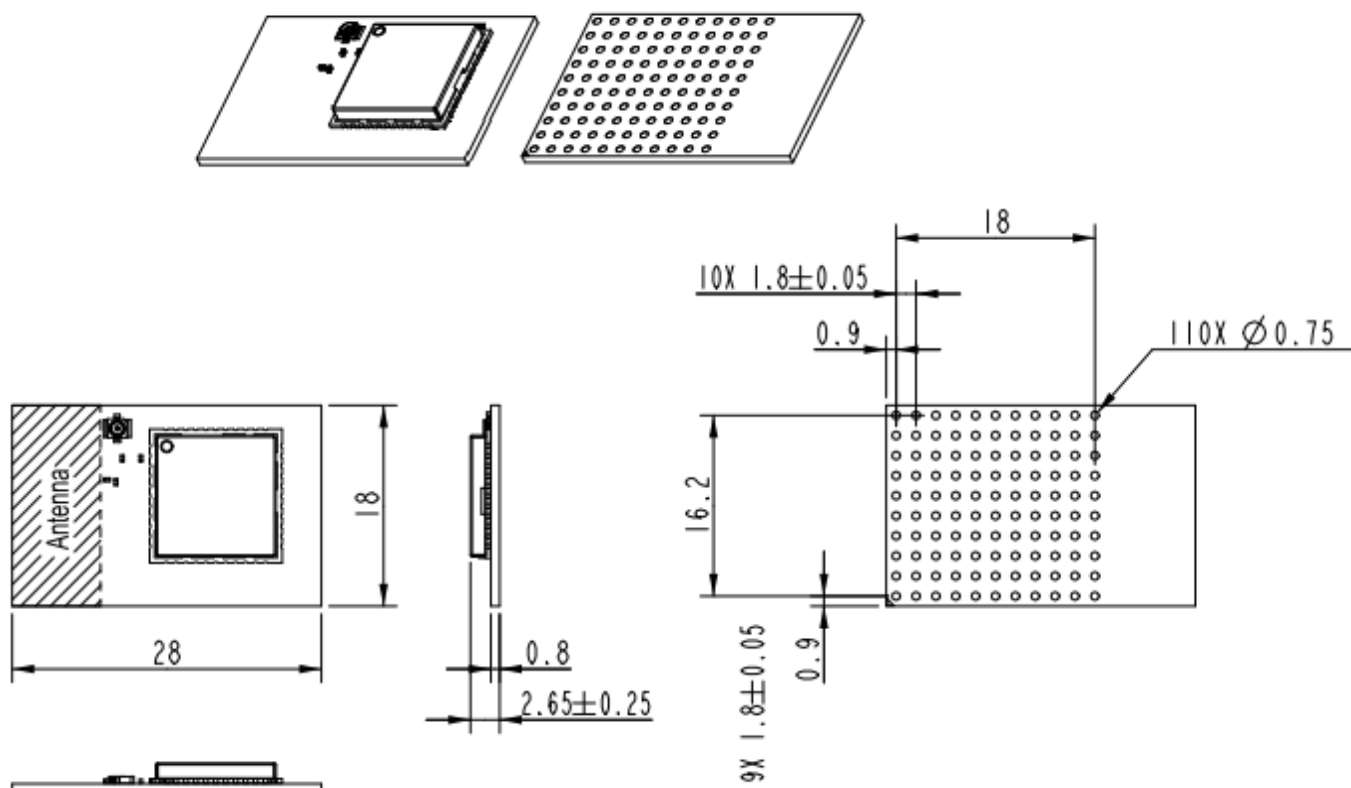
### **3.6.2 Bluetooth**

TBD

\* The power consumption is based on Azurewave test environment, these data for reference only.

## 4. Mechanical Information

### 4.1 Mechanical Drawing



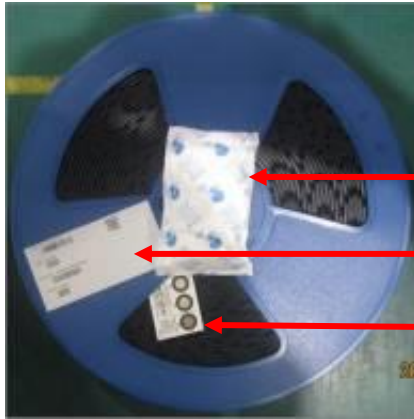
TOLERANCE UNLESS OTHERWISE SPECIFIED:  $\pm 0.1\text{mm}$

## 5. Packaging Information

1. One Tape reel = 1 Box = 750 pcs

Carton = 3 Boxes = 2,250 pcs

2. One production label is pasted on the reel, one desiccant and one humidity indicator card are put on the reel

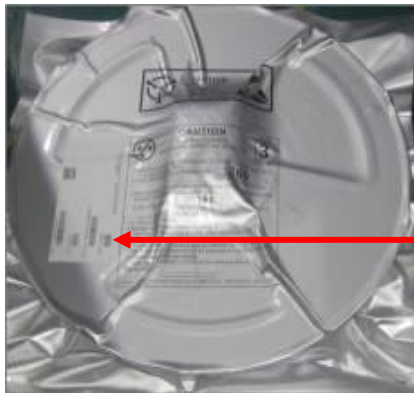


One desiccant

One production label

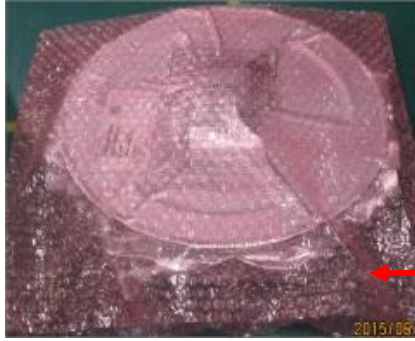
One humidity indicator card

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. **3 inner boxes** could be put into one carton



Production

7. Sealing the carton by tape



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



### **Federal Communication Commission Interference Statement**

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.

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

**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 20 cm between the radiator & your body.

**This module is intended for OEM integrators only. Per FCC KDB 996369 D03 OEM Manual v01 guidance, the following conditions must be strictly followed when using this certified module:**

**KDB 996369 D03 OEM Manual v01 rule sections:**

**2.2 List of applicable FCC rules**

This module has been tested for compliance to FCC Part 15

**2.3 Summarize the specific operational use conditions**

The module is tested for standalone mobile RF exposure use condition. Any other usage conditions such as co-location with other transmitter(s) or being used in a portable condition will need a separate reassessment through a class II permissive change application or new certification.

**2.4 Limited module procedures**

Not applicable.

**2.5 Trace antenna designs**

Not applicable.

**2.6 RF exposure considerations**

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.

**2.7 Antennas**

The following antennas have been certified for use with this module; antennas of the same type with equal or lower gain may also be used with this module. The antenna must be installed such that 20 cm can be maintained between the antenna and users.

| Brand      | Model             | Antenna Net Gain(dBi) | Frequency range | Antenna Type | Connector Type |
|------------|-------------------|-----------------------|-----------------|--------------|----------------|
| MAG.LAYERS | MSA-4008-25GC1-A2 | 2.98                  | 2.4~2.4835GHz   | PIFA         | i-pex(MHF)     |
|            |                   | 5.16                  | 5.15~5.85GHz    |              |                |
| AzureWave  | AW-CM358AN        | 3.4                   | 2.4~2.4835GHz   | PCB          | none           |
|            |                   | 3.4                   | 5.15~5.85GHz    |              |                |

**2.8 Label and compliance information**

The final end product must be labeled in a visible area with the following: "Contains FCC ID: **TLZ-CM358SM**". The grantee's FCC ID can be used only when all FCC compliance requirements are met.

**2.9 Information on test modes and additional testing requirements**

This transmitter is tested in a standalone mobile RF exposure condition and any co-located or simultaneous transmission with other transmitter(s) or portable use will require a separate class II permissive change re-evaluation or new certification.

#### 2.10 Additional testing, Part 15 Subpart B disclaimer

This transmitter module is tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B (unintentional radiator) rule requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rule requirements if applicable.

As long as all 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.

#### **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.

#### **OEM/Host manufacturer responsibilities**

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product must be reassessed against all the essential requirements of the FCC rule such as FCC Part 15 Subpart B before it can be placed on the US market. This includes reassessing the transmitter module for compliance with the Radio and EMF essential requirements of the FCC rules. This module must not be incorporated into any other device or system without retesting for compliance as multi-radio and combined equipment.

**Industry Canada statement:**

This device complies with ISED's licence-exempt RSSs. 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.

Le présent appareil est conforme aux CNR d'ISED applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

**Radiation Exposure Statement:**

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

**Déclaration d'exposition aux radiations:**

Cet équipement est conforme aux limites d'exposition aux rayonnements ISED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé à plus de 20 cm entre le radiateur et votre corps.

**This device is intended only for OEM integrators under the following conditions: (For module device use)**

- 1) The antenna must be installed and operated with greater than 20cm between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as **2** 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.

**Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: (Pour utilisation de dispositif module)**

- 1) L'antenne doit être installé et exploité avec plus de 20 cm entre l'antenne et les utilisateurs, et
- 2) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

Tant que les **2** conditions ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

**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 Canada authorization is no longer considered valid and the IC 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 Canada authorization.

**NOTE IMPORTANTE:**

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

**End Product Labeling**

This transmitter module is authorized only for use in device where the antenna may be installed and operated with greater than 20 cm between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains IC: **6100A-CM358SM**".

**Plaque signalétique du produit final**

Ce module émetteur est autorisé uniquement pour une utilisation dans un appareil où l'antenne peut être installée et utilisée à plus de 20 cm entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: **6100A-CM358SM**".

**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.

**Manuel d'information à l'utilisateur final**

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

**Caution :**

(i) the device for operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems;

(ii) for devices with detachable antenna(s), the maximum antenna gain permitted for devices in the bands 5250-5350 MHz and 5470-5725 MHz shall be such that the equipment still complies with the e.i.r.p. limit;

(iii) for devices with detachable antenna(s), the maximum antenna gain permitted for devices in the band 5725-5850 MHz shall be such that the equipment still complies with the e.i.r.p. limits as appropriate;

(iv) where applicable, antenna type(s), antenna models(s), and worst-case tilt angle(s) necessary to remain compliant with the e.i.r.p. elevation mask requirement set forth in section 6.2.2.3 shall be clearly indicated.

**Avertissement:**

Le guide d'utilisation des dispositifs pour réseaux locaux doit inclure des instructions précises sur les restrictions susmentionnées, notamment :

(i) les dispositifs fonctionnant dans la bande 5150-5250 MHz sont réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux;

(ii) pour les dispositifs munis d'antennes amovibles, le gain maximal d'antenne permis pour les dispositifs utilisant les bandes de 5 250 à 5 350 MHz et de 5 470 à 5 725 MHz doit être conforme à la limite de la p.i.r.e.;

(iii) pour les dispositifs munis d'antennes amovibles, le gain maximal d'antenne permis (pour les dispositifs utilisant la bande de 5 725 à 5 850 MHz) doit être conforme à la limite de la p.i.r.e. spécifiée, selon le cas;

(iv) lorsqu'il y a lieu, les types d'antennes (s'il y en a plusieurs), les numéros de modèle de l'antenne et les pires angles d'inclinaison nécessaires pour rester conforme à l'exigence de la p.i.r.e. applicable au masque d'élévation, énoncée à la section 6.2.2.3, doivent être clairement indiqués