AzureWave Technologies, Inc.

# AW-NM230NF-H

## IEEE 802.11 b/g/n Wireless LAN and Bluetooth Module

## Datasheet

**Rev. C**

**B2**

**(For Standard)**

## Features

- Integrates Infineon solutions of CYW43438 Wi-Fi /BT/FM RX SoC
- SDIO v2.0 interfaces support for WLAN
- High speed UART and PCM for Bluetooth
- Lead-free Design
- 16.0mm(L) x 12.0mm(W) x 1.53 mm(H) 108 pin LGA package

### Wi-Fi

- Single band 2.4 GHz 802.11 b/g/n
- SDIO v2.0, including DS and HS modes
- Security–WEP, WPA/WPA2 (personal), AES (HW), TKIP (HW), CKIP (SW), WMM/WMM-PS/WMM-SA
- Dara Rate up to 72.2Mbps

### Bluetooth

- Supports extended Synchronous Connections (eSCO), for enhanced voice quality by allowing for retransmission of dropped packets
- Adaptive Frequency Hopping (AFH) for reducing radio frequency interference
- Maximum UART baud rates up to 4 Mbps
- Supports 5.0's LE Secure Connections
- Supports Bluetooth Core Specification version 5.1 + (Enhanced Data Rate) EDR features:
  - Adaptive Frequency Hopping (AFH)
  - Quality of Service (QoS)
  - Extended Synchronous Connections (eSCO) — Voice Connections
  - Fast Connect (interlaced page and inquiry scans)
  - Secure Simple Pairing (SSP)
  - Sniff Subrating (SSR)
  - Encryption Pause Resume (EPR)
  - Extended Inquiry Response (EIR)
  - Link Supervision Timeout (LST)
- Interface support – Host Controller Interface (HCI) using a high-speed UART interface and PCM for audio data

# Revision History

Document NO: R2-2230NF-DST-01

| Version | Revision Date | DCN NO. | Description | Initials | Approved |
|---|---|---|---|---|---|
| 0.1 | 2015/4/17 | | ● Initial Version | Chao Lee | Amos Fu |
| 0.2 | 2015/4/24 | | ● Update Power Specifications Table | Chao Lee | Amos Fu |
| 0.3 | 2015/6/16 | | ● Update ME drawing | Chao Lee | Amos Fu |
| 0.4 | 2015/7/31 | | ● Update Block Diagram | Chao Lee | Amos Fu |
| 0.5 | 2015/8/17 | | ● Add power consumption | Chao Lee | Amos Fu |
| 0.6 | 2015/11/26 | | ● Update Electrical Characteristics | Chao Lee | Amos Fu |
| 0.7 | 2016/06/27 | | ● Added description for pin 11 & pin 12. | Steven Jian | Chihhao Liao |
| 0.8 | 2018/12/24 | | ● Updated Document Format<br>● BT support 4.2 | Steven Jian | Chihhao Liao |
| 0.9 | 2019/11/06 | | ● Updated 1.4 | Steven Jian | Chihhao Liao |
| A | 2020/03/14 | DCN016857 | ● Changed Document format<br>● Updated 3. Electrical Characteristics<br>● Updated 1.3.3 Bluetooth | Steven Jian | Chihhao Liao |
| B | 2020/06/08 | DCN017437 | ● Support Bluetooth Core Specification 5.1 | Steven Jian | Chihhao Liao |
| C | 2021/04/15 | DCN021182 | ● Changed document format<br>● Updated the chip vendor name | Steven Jian | Chihhao Liao |

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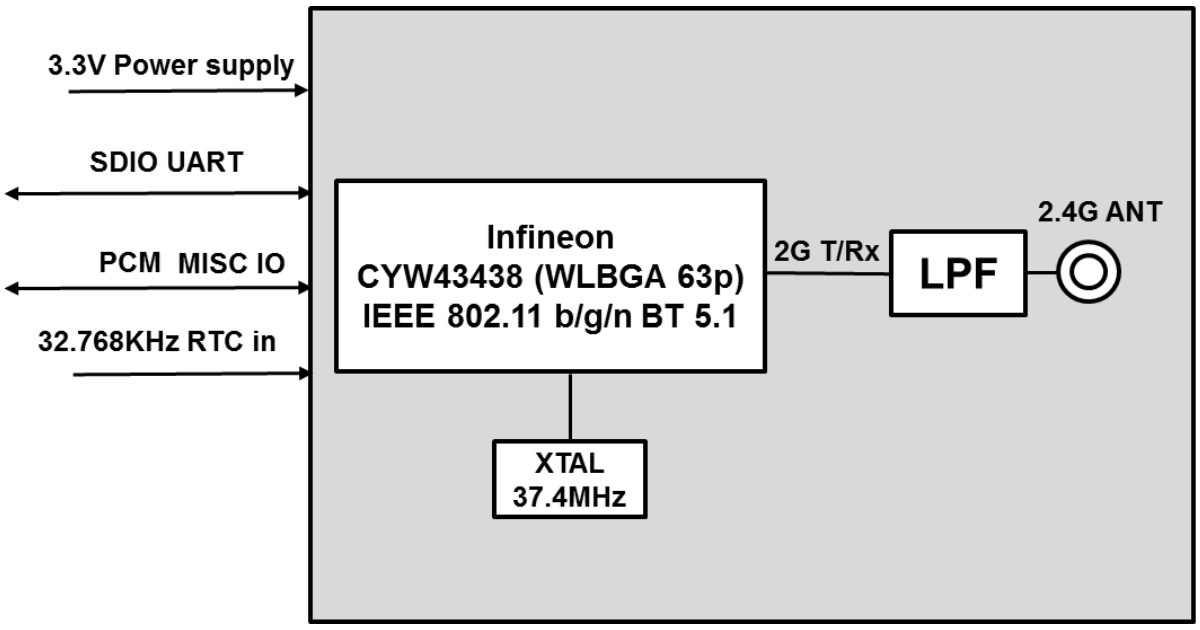
# 1. Introduction

## 1.1 Product Overview

AzureWave Technologies, Inc. introduces the advanced IEEE 802.11 b/g/n WLAN and Bluetooth combo module - AW-NM230NF-H. The module is targeted to mobile and embedded devices which need small footprint package, low power consumption, and multiple OS support. The module supports 2.4GHz IEEE 802.11n MAC/baseband/radio, and Bluetooth 5.1 functionality. It also features an integrated Power Management Unit (PMU), Power Amplifiers (PAs), and a Low Noise Amplifier (LNA) to address the needs of mobile devices that require minimal power consumption and compact size. By using AW-NM230NF-H, the customers can easily enable the Wi-Fi and BT embedded applications with the benefits of high design flexibility, short development cycle, and quick time-to-market. Specified in the IEEE 802.11 standard minimize the system power requirements by using AW-NM230NF-H. In addition to the support of WPA/WPA2 (personal) and WEP encryption, the AW-NM230NF-H also supports the IEEE 802.11i security standard through AES and TKIP acceleration hardware for faster data encryption. For the video, voice and multimedia applications the AW-NM230NF-H support 802.11e Quality of Service (QoS). The host interface is SDIO v2.0 interface.

For Bluetooth operation, the AW-NM230NF-H is Bluetooth Core Specification 5.1 compliant. The Bluetooth transmitter also features a Class 1 power amplifier. The AW-NM230NF-H supports extended Synchronous Connections (eSCO), for enhanced voice quality by allowing for retransmission of dropped packets, and Adaptive Frequency Hopping (AFH) for reducing radio frequency interference. It also incorporates all Bluetooth 5.1 compliance features including secure simple pairing, sniff subrating, and encryption pause and resume and supports Bluetooth 5.1 compliance LE. An independent, high-speed UART is provided for the Bluetooth host interface. The Bluetooth subsystem presents a standard Host Controller Interface (HCI) via a high speed UART and PCM for audio.

## 1.2 Block Diagram




**AW-NM230NF-H Block Diagram**

## 1.3 Specifications Table

### 1.3.1 General

| Features | Description |
|---|---|
| **Product Description** | IEEE 802.11 b/g/n Wireless LAN and Bluetooth Module |
| **Major Chipset** | Infineon CYW43438 (WLBGA 63p) |
| **Host Interface** | WLAN: SDIO v2.0<br>Bluetooth: UART |
| **Dimension** | 16.0mm(L) x 12.0mm(W) x 1.53mm(H) |
| **Form factor** | M.2 1216 |
| **Antenna** | 2.4G Ant: Wi-Fi/BT |
| **Weight** | 0.5g |

### 1.3.2 WLAN

| Features | Description |
|---|---|
| **WLAN Standard** | IEEE 802.11 b/g/n, Wi-Fi compliant |
| **WLAN VID/PID** | N/A |
| **WLAN SVID/SPID** | N/A |
| **Frequency Rage** | WLAN: 2.4 GHz |
| **Modulation** | DSSS, OFDM, BPSK(9/6Mbps), QPSK(18/12Mbps), DBPSK(1Mbps), DQPSK(2Mbps), CCK(11/5.5Mbps), 16-QAM(36/24Mbps), 64-QAM (72.2/54/48Mbps) |
| **Number of Channels** | 802.11b:<br>USA, Canada and Taiwan – 1 ~ 11<br>Most European Countries – 1 ~ 13<br>Japan – 1 ~ 14<br><br>802.11g:<br>USA and Canada – 1 ~ 11<br>Most European Countries – 1 ~ 13 |

<table>
<tr><td></td><td>802.11n:<br>USA and Canada – 1 ~ 11<br>Most European Countries – 1 ~ 13</td></tr>
<tr><td>Output Power</td><td>2.4G
<table>
<tr><td></td><td>Min</td><td>Typ</td><td>Max</td><td>Unit</td></tr>
<tr><td>11b (11Mbps)<br>@EVM<35%</td><td>15</td><td>17</td><td>19</td><td>dBm</td></tr>
<tr><td>11g (54Mbps)<br>@EVM≦-25 dB</td><td>13</td><td>15</td><td>17</td><td>dBm</td></tr>
<tr><td>11n (HT20 MCS7)<br>@EVM≦-27 dB</td><td>11</td><td>13</td><td>15</td><td>dBm</td></tr>
</table></td></tr>
<tr><td>Receiver Sensitivity</td><td>2.4G
<table>
<tr><td></td><td>Min</td><td>Typ</td><td>Max</td><td>Unit</td></tr>
<tr><td>11b (1Mbps)</td><td></td><td>-96</td><td>-91</td><td>dBm</td></tr>
<tr><td>11g (6Mbps)</td><td></td><td>-91</td><td>-84</td><td>dBm</td></tr>
<tr><td>11b (11Mbps)</td><td></td><td>-89</td><td>-82</td><td>dBm</td></tr>
<tr><td>11g (54Mbps)</td><td></td><td>-76</td><td>-68</td><td>dBm</td></tr>
<tr><td>11n (HT20 MCS0)</td><td></td><td>-91</td><td>-84</td><td>dBm</td></tr>
<tr><td>11n (HT20 MCS7)</td><td></td><td>-73</td><td>-66</td><td>dBm</td></tr>
</table></td></tr>
<tr><td>Data Rate</td><td>802.11b: 1, 2, 5.5, 11Mbps<br>802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps<br>802.11n:MCS 0~7 HT20</td></tr>
<tr><td>Security</td><td>◆ WPA™- and WPA2™- (Personal) support for powerful encryption and authentication<br>◆ AES and TKIP acceleration hardware for faster data encryption and 802.11i compatibility<br>◆ Cisco® Compatible Extension- (CCX, CCX 2.0, CCX 3.0, CCX 4.0, CCX5.0) certified<br>◆ Wi-Fi Protected Setup (WPS)<br>◆ WEP<br>◆ WMM / WMM-SA<br>◆ CKIP(Software)</td></tr>
</table>

### 1.3.3 Bluetooth

| Features | Description |
|---|---|
| **Bluetooth Standard** | Bluetooth 2.1+Enhanced Data Rate (EDR) /Core Specification 5.1 |
| **Bluetooth VID/PID** | N/A |

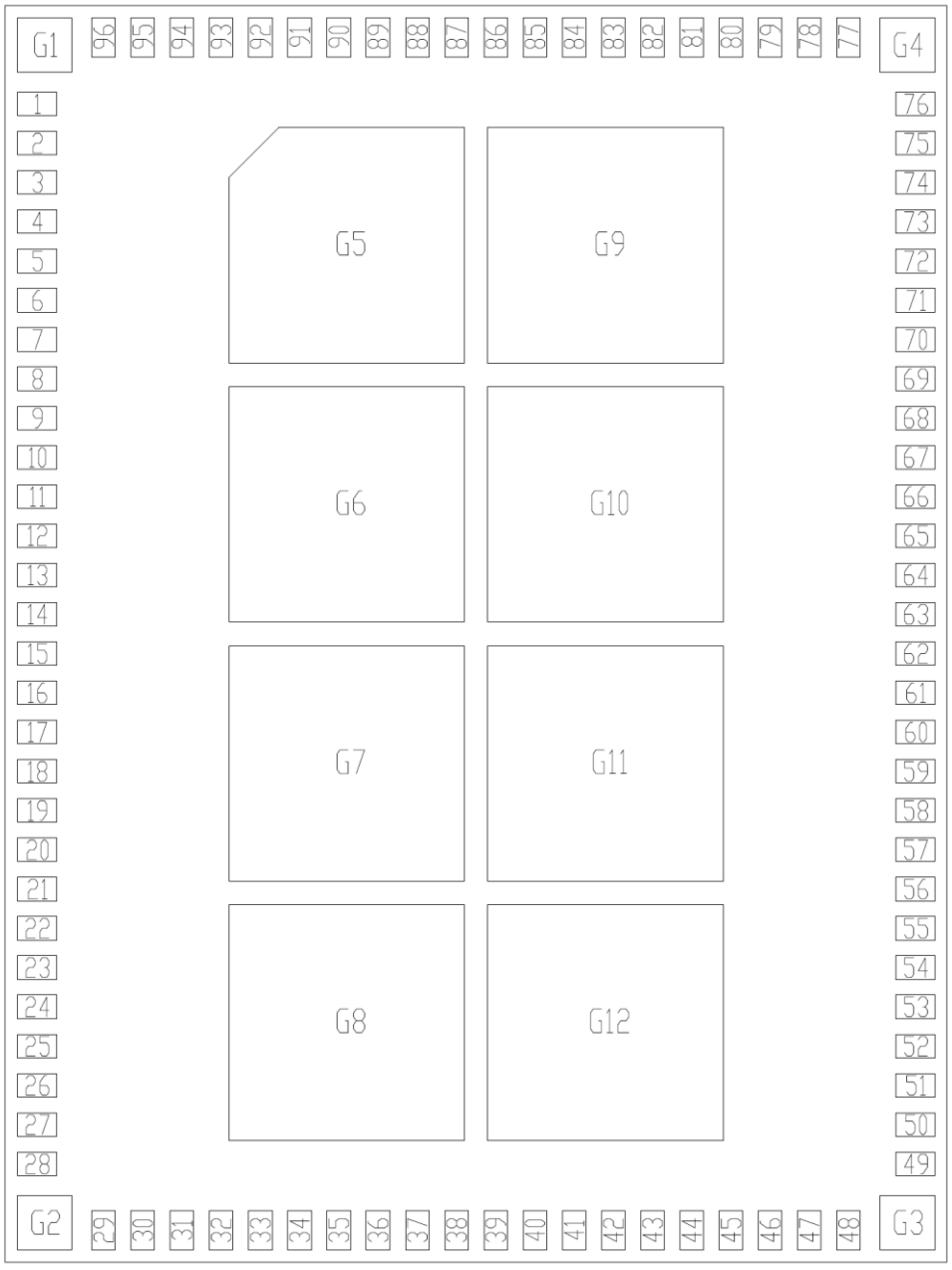
<table>
<tr><td>Frequency Rage</td><td>2400~2483.5MHz</td></tr>
<tr><td>Modulation</td><td>GFSK (1Mbps), Π/4DQPSK (2Mbps) and 8DPSK (3Mbps)</td></tr>
<tr><td>Output Power</td><td>Basic Rate : 7.5dBm +/- 2.5dBm (Max Settings)</td></tr>
<tr><td>Receiver Sensitivity</td><td>
<table>
<tr><td></td><td>Min</td><td>Typ</td><td>Max</td><td>Unit</td></tr>
<tr><td>DH5</td><td></td><td>-91</td><td>-82</td><td>dBm</td></tr>
<tr><td>2DH5</td><td></td><td>-93</td><td>-84</td><td>dBm</td></tr>
<tr><td>3DH5</td><td></td><td>-87</td><td>-76</td><td>dBm</td></tr>
</table>
</td></tr>
</table>

## 1.3.4 Operating Conditions

| Features | Description |
|---|---|
| **Operating Conditions** | |
| **Voltage** | Input supply for host I/O : 3.3V |
| **Operating Temperature** | -30°C to 70°C (Optimal RF performance guarantee -20°C to 70°C) |
| **Operating Humidity** | less than 85% R.H. |
| **Storage Temperature** | -20°C to 85°C |
| **Storage Humidity** | less than 60% R.H. |
| **ESD Protection** | |
| **Human Body Model** | ±1.25KV per MIL-STD-883H Method 3015.8 |
| **Charged Device Model** | ±175V per JEDEC EIA/JESD22-C101E |

# 2. Pin Definition

## 2.1 Pin Map




**AW-NM230-H Pin Map (Top View)**

## 2.2 Pin Table

| Pin No | Definition | Basic Description | Voltage | Type |
|---|---|---|---|---|
| 1 | NC | No Connect | | Floating |
| 2 | NC | No Connect | | Floating |
| 3 | NC | No Connect | | Floating |
| 4 | 3.3V | 3.3V power pin | 3.3V | VCC |
| 5 | 3.3V | 3.3V power pin | 3.3V | VCC |
| 6 | GND | Ground. | | GND |
| 7 | NC | No Connect | | Floating |
| 8 | NC | No Connect | | Floating |
| 9 | NC | No Connect | | Floating |
| 10 | NC | No Connect | | Floating |
| 11 | GPIO1 | Programmable. Can be configured as WLAN SECI Tx output to an LTE IC | 3.3V | I/O |
| 12 | GPIO2 | Programmable. Can be configured as WLAN SECI Rx input from an LTE IC | 3.3V | I/O |
| 13 | NC | No Connect | | Floating |
| 14 | NC | No Connect | | Floating |
| 15 | NC | No Connect | | Floating |
| 16 | NC | No Connect | | Floating |
| 17 | GND | Ground. | | GND |
| 18 | NC | No Connect | | Floating |
| 19 | NC | No Connect | | Floating |
| 20 | GND | Ground. | | GND |
| 21 | NC | No Connect | | Floating |
| 22 | NC | No Connect | | Floating |
| 23 | GND | Ground | | GND |

| | | | | |
|---|---|---|---|---|
| 24 | BT_HOST_WAKE_DEV | BT Device Wake | 3.3V | I |
| 25 | NC | No Connect | | Floating |
| 26 | GND | Ground | | GND |
| 27 | SUSCLK(32kHz) | External sleep clock input (32.768 kHz). | 3.3V | I |
| 28 | WL_DIS# | Used by PMU to power up or power down the internal regulators used by the WLAN section. Also, when deasserted, this pin holds the WLAN section in reset. This pin has an internal 200k ohm pull down resistor that is enabled by default. It can be disabled through programming. | 3.3V | I |
| 29 | NC | No Connect | | Floating |
| 30 | NC | No Connect | | Floating |
| 31 | NC | No Connect | | Floating |
| 32 | GND | Ground | | GND |
| 33 | NC | No Connect | | Floating |
| 34 | NC | No Connect | | Floating |
| 35 | GND | Ground | | GND |
| 36 | NC | No Connect | | Floating |
| 37 | NC | No Connect | | Floating |
| 38 | GND | Ground | | GND |
| 39 | NC | No Connect | | Floating |
| 40 | NC | No Connect | | Floating |
| 41 | GND | Ground | | GND |
| 42 | NC | No Connect | | Floating |
| 43 | NC | No Connect | | Floating |
| 44 | NC | No Connect | | Floating |
| 45 | WL_DIS# | Used by PMU to power up or power down the internal regulators used by the WLAN section. Also, when deasserted, this pin holds the WLAN section in reset. This pin has an internal 200k ohm pull down resistor that is enabled by default. It can be disabled through programming. | 3.3V | I |

| | | | | |
|---|---|---|---|---|
| 46 | WL_DEV_WAKE_HOST | WL Host Wake | 3.3V | O |
| 47 | SDIO_D3 | SDIO Data Line 3 | 3.3V | I/O |
| 48 | SDIO_D2 | SDIO Data Line 2 | 3.3V | I/O |
| 49 | SDIO_D1 | SDIO Data Line 1 | 3.3V | I/O |
| 50 | SDIO_D20 | SDIO Data Line 0 | 3.3V | I/O |
| 51 | SDIO_CMD | SDIO Command Input | 3.3V | I/O |
| 52 | SDIO_CLK | SDIO Clock Input | 3.3V | I |
| 53 | BT_DEV_WAKE_HOST | BT Host Wake | 3.3V | O |
| 54 | UART_CTS | High-Speed UART CTS | 3.3V | I |
| 55 | UART_OUT | High-Speed UART Data Out | 3.3V | O |
| 56 | UART_IN | High-Speed UART Data In | 3.3V | I |
| 57 | UART_RTS | High-Speed UART RTS | 3.3V | O |
| 58 | PCM_SYNC | PCM Synchronization control | 3.3V | O |
| 59 | PCM_IN | PCM data Input | 3.3V | I |
| 60 | PCM_OUT | PCM data Out | 3.3V | O |
| 61 | PCM_CLK | PCM Clock | 3.3V | I/O |
| 62 | GND | Ground | | GND |
| 63 | BT_DIS# | Used by PMU to power up or power down the internal regulators used by the Bluetooth section. Also, when deasserted, this pin holds the Bluetooth section in reset. This pin has an internal 200k ohm pull down resistor that is enabled by default. It can be disabled through programming. | 3.3V | I |
| 64 | NC | No Connect | | Floating |
| 65 | NC | No Connect | | Floating |
| 66 | NC | No Connect | | Floating |
| 67 | NC | No Connect | | Floating |
| 68 | GND | Ground | | GND |
| 69 | NC | No Connect | | Floating |

| | | | | |
|---|---|---|---|---|
| **70** | **NC** | **No Connect** | | **Floating** |
| **71** | **GND** | **Ground** | | **GND** |
| **72** | **3.3V** | **3.3V power pin** | **3.3V** | **VCC** |
| **73** | **3.3V** | **3.3V power pin** | **3.3V** | **VCC** |
| **74** | **GND** | **Ground** | | **GND** |
| **75** | **GND** | **Ground** | | **GND** |
| **76** | **GND** | **Ground** | | **GND** |
| **77** | **GND** | **Ground** | | **GND** |
| **78** | **GND** | **Ground** | | **GND** |
| **79** | **GND** | **Ground** | | **GND** |
| **80** | **GND** | **Ground** | | **GND** |
| **81** | **GND** | **Ground** | | **GND** |
| **82** | **GND** | **Ground** | | **GND** |
| **83** | **GND** | **Ground** | | **GND** |
| **84** | **GND** | **Ground** | | **GND** |
| **85** | **GND** | **Ground** | | **GND** |
| **86** | **GND** | **Ground** | | **GND** |
| **87** | **GND** | **Ground** | | **GND** |
| **88** | **GND** | **Ground** | | **GND** |
| **89** | **GND** | **Ground** | | **GND** |
| **90** | **GND** | **Ground** | | **GND** |
| **91** | **GND** | **Ground** | | **GND** |
| **92** | **GND** | **Ground** | | **GND** |
| **93** | **GND** | **Ground** | | **GND** |
| **94** | **GND** | **Ground** | | **GND** |
| **95** | **GND** | **Ground** | | **GND** |

| | | | | |
|---|---|---|---|---|
| **96** | **GND** | **Ground** | | **GND** |
| **G1** | **GND** | **Ground** | | **GND** |
| **G2** | **GND** | **Ground** | | **GND** |
| **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** |
| **G12** | **GND** | **Ground** | | **GND** |

# 3. Electrical Characteristics

## 3.1 Absolute Maximum Ratings

| Symbol | Parameter | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| **3.3V** | Power supply for Internal Regulators | -0.5 | | 3.9 | V |

## 3.2 Recommended Operating Conditions

| Symbol | Parameter | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| **3.3V** | Power supply for Internal Regulators | 3* | 3.3 | 3.46 | V |

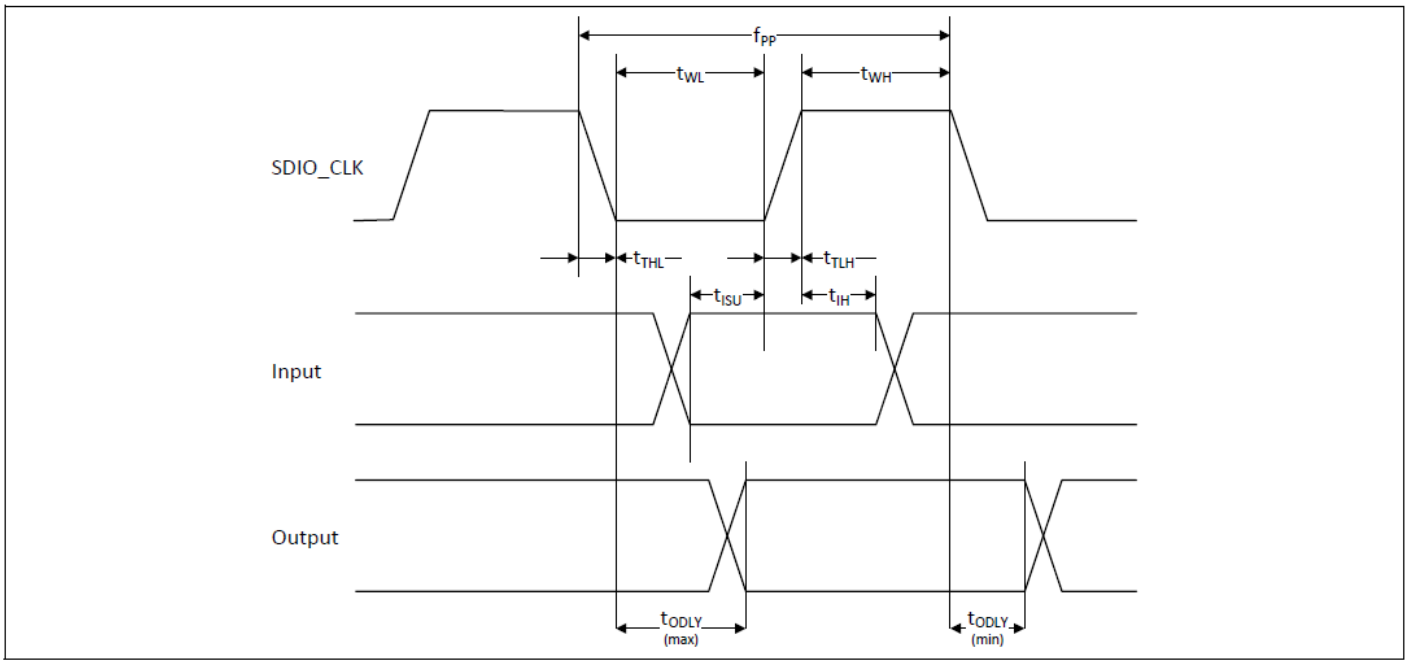
***Optimal RF performance is guaranteed only for 3.2V<VBAT<3.46V**

## 3.3 Digital IO Pin DC Characteristics

| Symbol | Parameter | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| **For SDIO Interface VDDIO =3.3V** | | | | | |
| **VIH** | Input high voltage | 2.06 | - | - | V |
| **VIL** | Input low voltage | - | - | 0.82 | V |
| **VOH** | Output High Voltage @ 2mA | 2.47 | - | - | V |
| **VOL** | Output Low Voltage @ 2mA | - | - | 0.41 | V |
| **Other Digital Interface VDDIO=3.3V** | | | | | |
| **VIH** | Input high voltage | 2 | - | - | V |
| **VIL** | Input low voltage | - | - | 0.8 | V |
| **VOH** | Output High Voltage @ 2mA | 2.9 | - | - | V |
| **VOL** | Output Low Voltage @ 2mA | - | - | 0.4 | V |

## 3.4 Host Interface

### 3.4.1 SDIO



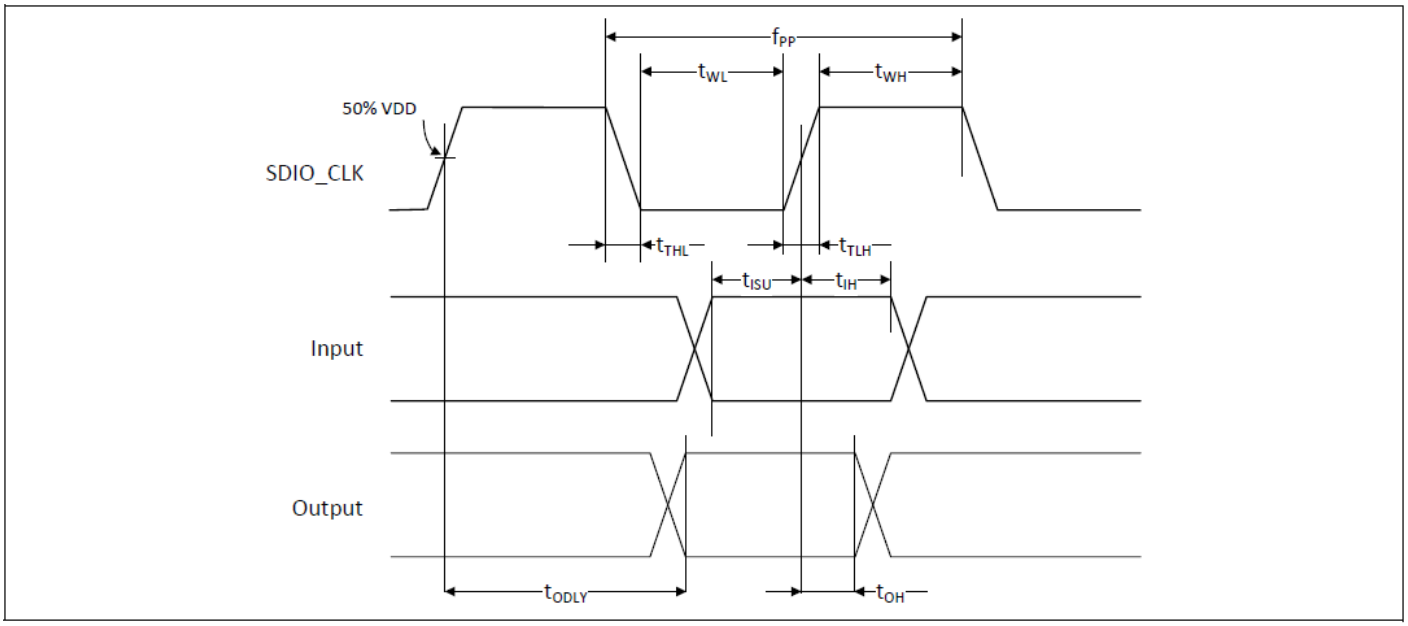

**SDIO Bus Timing (Default Mode)**

| Parameter | Symbol | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| **SDIO CLK (All values are referred to minimum VIH and maximum VIL*)** | | | | | |
| **Frequency – Data Transfer mode** | fPP | 0 | – | 25 | MHz |
| **Frequency – Identification mode** | fOD | 0 | – | 400 | kHz |
| **Clock low time** | tWL | 10 | – | – | ns |
| **Clock high time** | tWH | 10 | – | – | ns |
| **Clock rise time** | tTLH | – | – | 10 | ns |
| **Clock low time** | tTHL | – | – | 10 | ns |
| **Inputs: CMD, DAT (referenced to CLK)** | | | | | |
| **Input setup time** | tISU | 5 | – | – | ns |
| **Input hold time** | tIH | 5 | – | – | ns |

| | | | | | |
|---|---|---|---|---|---|
| **Outputs: CMD, DAT (referenced to CLK)** | | | | | |
| **Output delay time – Data Transfer mode** | tODLY | 0 | – | 14 | ns |
| **Output delay time – Identification mode** | tODLY | 0 | – | 50 | ns |

**SDIO Bus Timing Parameters (Default Mode)**

* min (VIH) = 0.7 × VDDIO and max (VIL) = 0.2 × VDDIO




**SDIO Bus Timing (High-Speed Mode)**

| Parameter | Symbol | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| **SDIO CLK (all values are referred to minimum VIH and maximum VIL*)** | | | | | |
| **Frequency – Data Transfer Mode** | fPP | 0 | – | 50 | MHz |
| **Frequency – Identification Mode** | fOD | 0 | – | 400 | kHz |
| **Clock low time** | tWL | 7 | – | – | ns |
| **Clock high time** | tWH | 7 | – | – | ns |
| **Clock rise time** | tTLH | – | – | 3 | ns |
| **Clock low time** | tTHL | – | – | 3 | ns |
| **Inputs: CMD, DAT (referenced to CLK)** | | | | | |
| **Input setup Time** | tISU | 6 | – | – | ns |

| | | | | | |
|---|---|---|---|---|---|
| **Input hold Time** | tIH | 2 | – | – | ns |
| **Outputs: CMD, DAT (referenced to CLK)** | | | | | |
| **Output delay time – Data Transfer Mode** | tODLY | – | – | 14 | ns |
| **Output hold time** | tOH | 2.5 | – | – | ns |
| **Total system capacitance (each line)** | CL | – | – | 40 | pF |

**SDIO Bus Timing a Parameters (High-Speed Mode)**

* min (VIH) = 0.7 × VDDIO and max (VIL) = 0.2 × VDDIO

## 3.4.2 UART Interface

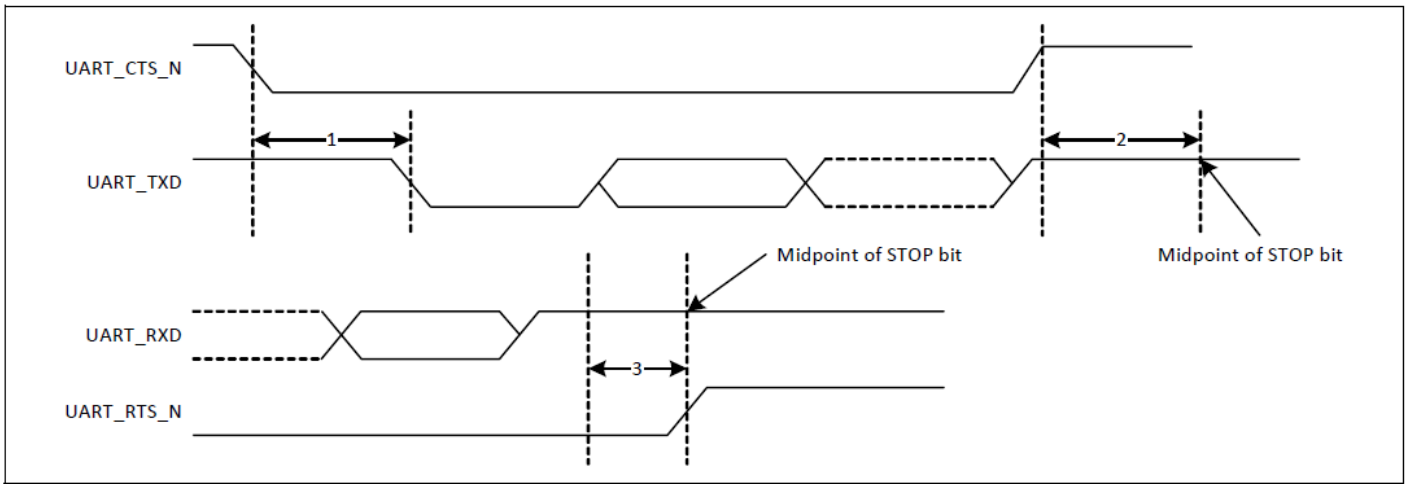
The AW-NM230NF-H includes a single UART for Bluetooth. The UART is a standard 4-wire interface (RX, TX, RTS, and CTS) with adjustable baud rates from 9600 bps to 4.0 Mbps. The interface features an automatic baud rate detection capability that returns a baud rate selection. Alternatively, the baud rate may be selected through a vendor-specific UART HCI command.

UART has a 1040-byte receive FIFO and a 1040-byte transmit FIFO to support EDR. Access to the FIFOs is conducted through the AHB interface through either DMA or the CPU. The UART supports the Bluetooth 5.1 UART HCI specification: H4, a custom Extended H4, and H5. The default baud rate is 115.2 Kbaud.

The UART supports the 3-wire H5 UART transport, as described in the Bluetooth specification (“Three-wire UART Transport Layer”).Compared to H4, the H5 UART transport reduces the number of signal lines required by eliminating the CTS and RTS signals.

The AW-NM230NF-H UART can perform XON/XOFF flow control and includes hardware support for the Serial Line Input Protocol (SLIP). It can also perform wake-on activity. For example, activity on the RX or CTS inputs can wake the chip from a sleep state.

Normally, the UART baud rate is set by a configuration record downloaded after device reset, or by automatic baud rate detection, and the host does not need to adjust the baud rate. Support for changing the baud rate during normal HCI UART operation is included through a vendor-specific command that allows the host to adjust the contents of the baud rate registers. The AW-NM230NF-H UARTs operate correctly with the host UART as long as the combined baud rate error of the two devices is within ±2%.

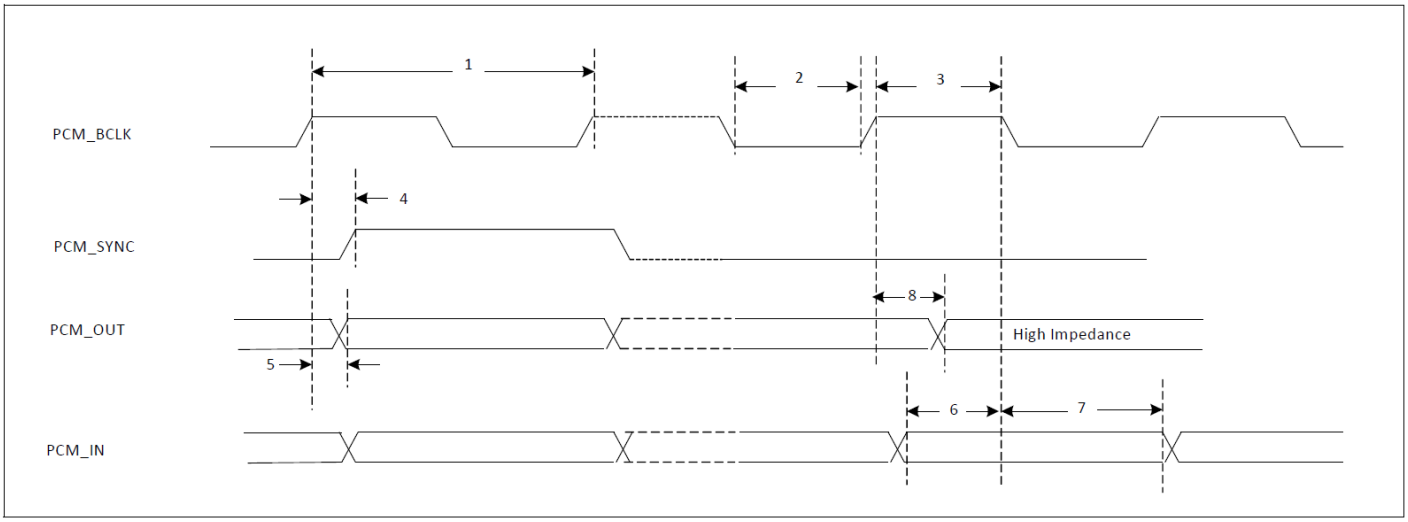



**UART Timing**

| Parameter | Reference Characteristics | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| **1** | Delay time, UART_CTS_N low to UART_TXD valid | – | – | 1.5 | Bit periods |
| **2** | Setup time, UART_CTS_N high before midpoint of stop bit | – | – | 0.5 | Bit periods |
| **3** | Delay time, midpoint of stop bit to UART_RTS_N high | – | – | 0.5 | Bit periods |

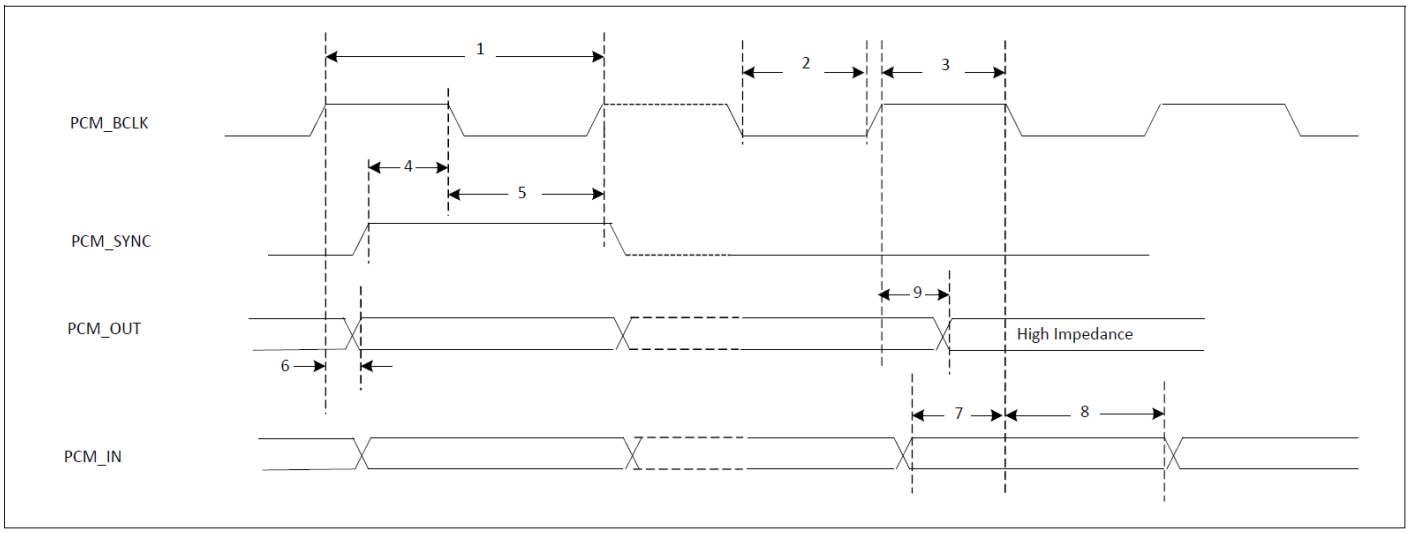
**UART Timing Specifications**

## 3.4.3 PCM Interface Timing




**PCM Timing Diagram (Short Frame Sync, Master Mode)**

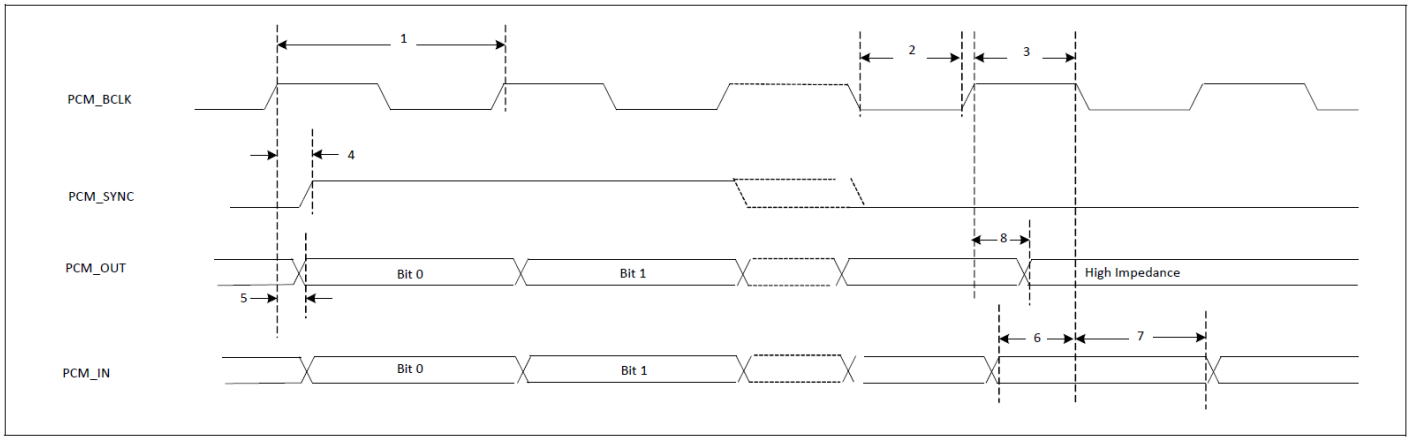
| Parameter | Reference Characteristics | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| 1 | PCM bit clock frequency | | | 12 | MHz |
| 2 | PCM bit clock low | 41 | | | ns |
| 3 | PCM bit clock high | 41 | | | ns |
| 4 | PCM_SYNC delay | 0 | | 25 | ns |
| 5 | PCM_OUT delay | 0 | | 25 | ns |
| 6 | PCM_IN setup | 8 | | | ns |
| 7 | PCM_IN hold | 8 | | | ns |
| 8 | Delay from rising edge of PCM_BCLK during last bit period to PCM_OUT becoming high impedance | 0 | | 25 | ns |




**PCM Timing Diagram (Short Frame Sync, Slave Mode)**

| Parameter | Reference Characteristics | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| 1 | PCM bit clock frequency | | | 12 | MHz |
| 2 | PCM bit clock low | 41 | | | ns |

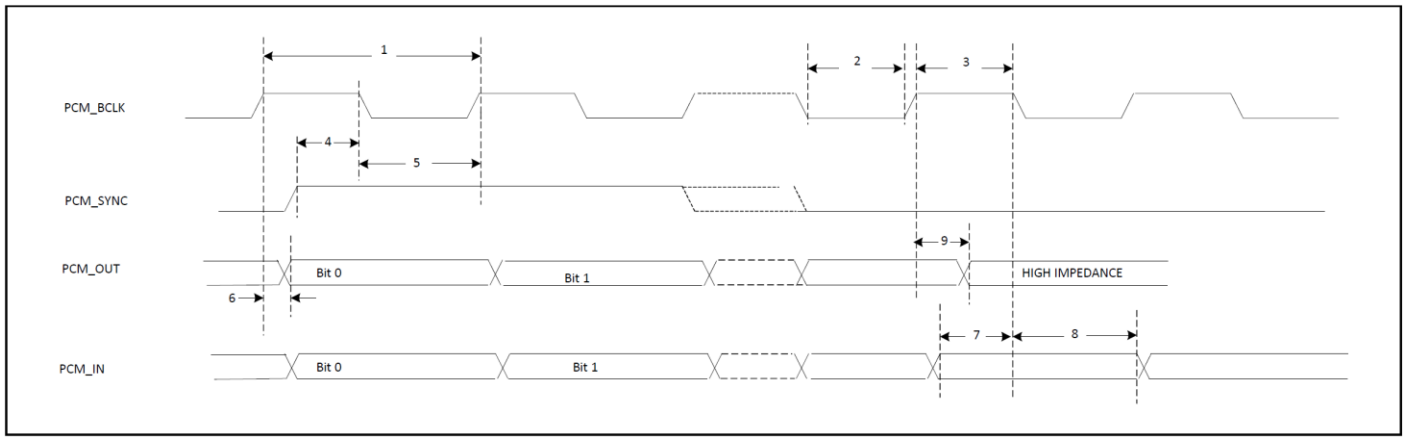
| | | | | | |
|---|---|---|---|---|---|
| **3** | PCM bit clock high | 41 | | | ns |
| **4** | PCM_SYNC setup | 8 | | | ns |
| **5** | PCM_SYNC hold | 8 | | | ns |
| **6** | PCM_OUT delay | 0 | | 25 | ns |
| **7** | PCM_IN setup | 8 | | | ns |
| **8** | PCM_IN hold | 8 | | | ns |
| **9** | Delay from rising edge of PCM_BCLK during last bit period to PCM_OUT becoming high impedance | 0 | | 25 | ns |




**PCM Timing Diagram (Long Frame Sync, Master Mode)**

| Parameter | Reference Characteristics | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| **1** | PCM bit clock frequency | | | 12 | MHz |
| **2** | PCM bit clock low | 41 | | | ns |
| **3** | PCM bit clock high | 41 | | | ns |
| **4** | PCM_SYNC delay | 0 | | 25 | ns |
| **5** | PCM_OUT delay | 0 | | 25 | ns |

| | | | | | |
|---|---|---|---|---|---|
| **6** | PCM_IN setup | 8 | | | ns |
| **7** | PCM_IN hold | 8 | | | ns |
| **8** | Delay from rising edge of PCM_BCLK during last bit period to PCM_OUT becoming high impedance | 0 | | 25 | ns |

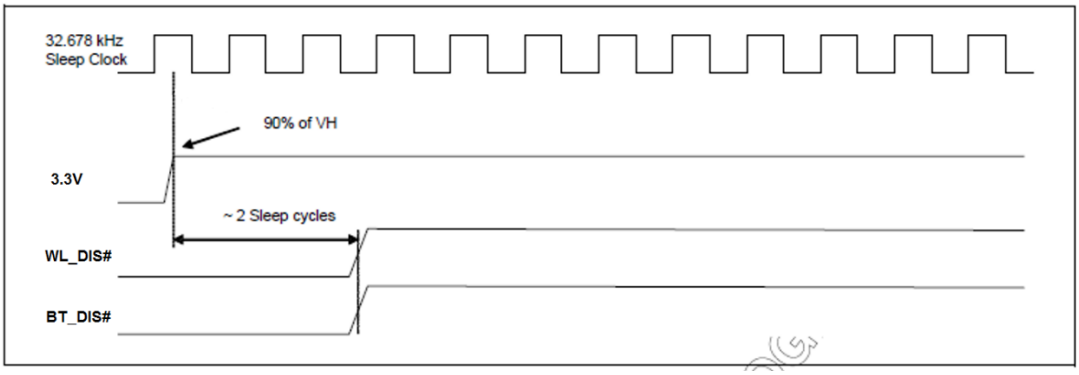



**PCM Timing Diagram (Long Frame Sync, Slave Mode)**

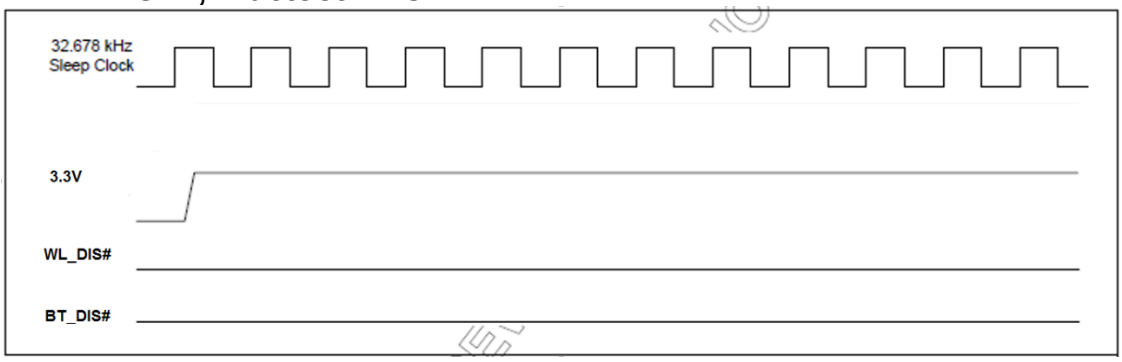
| Parameter | Reference Characteristics | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| **1** | PCM bit clock frequency | | | 12 | MHz |
| **2** | PCM bit clock low | 41 | | | ns |
| **3** | PCM bit clock high | 41 | | | ns |
| **4** | PCM_SYNC setup | 8 | | | ns |
| **5** | PCM_SYNC hold | 8 | | | ns |
| **6** | PCM_OUT delay | 0 | | 25 | ns |
| **7** | PCM_IN setup | 8 | | | ns |
| **8** | PCM_IN hold | 8 | | | ns |
| **9** | Delay from rising edge of PCM_BCLK during last bit period to PCM_OUT becoming high impedance | 0 | | 25 | ns |

## 3.5 Power up Timing Sequence

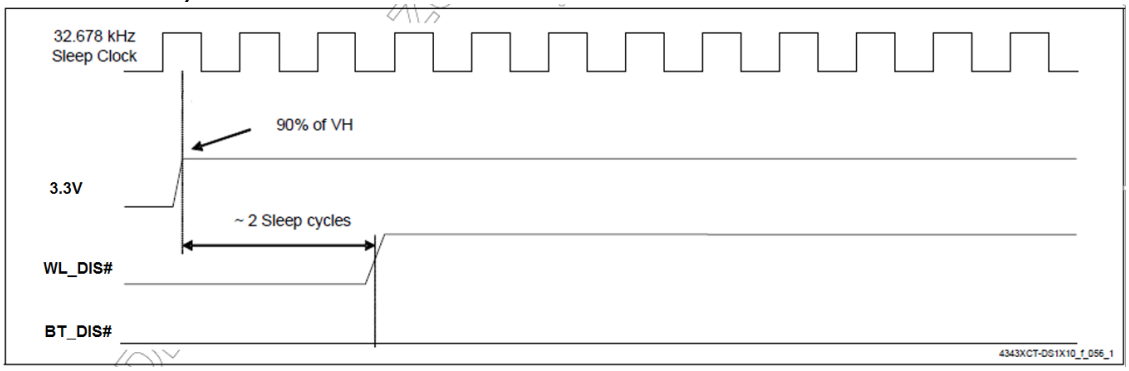
### WLAN = ON, Bluetooth = ON



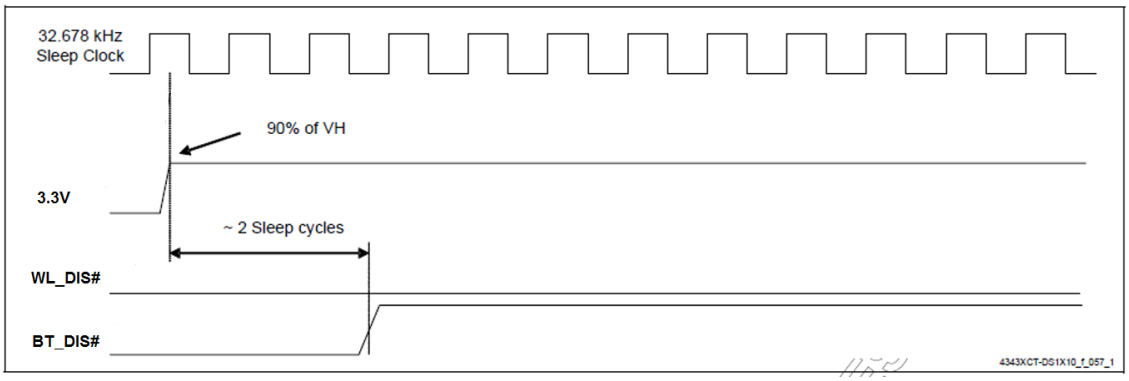

### WLAN = OFF, Bluetooth = OFF




### WLAN = ON, Bluetooth = OFF




### WLAN = OFF, Bluetooth = ON



## 3.6 Frequency References

The AW-NM230NF-H uses an internal 26MHz xtal for normal operation and an external secondary low frequency clock for low-power-mode timing. Either the internal low-precision LPO or an external 32.768 kHz precision oscillator is required. The internal LPO frequency range is approximately 33 kHz ± 30% over process, voltage, and temperature, which is adequate for some applications. However, a trade-off caused by this wide LPO tolerance is a small current consumption increase during WLAN power save mode that is incurred by the need to wake up earlier to avoid missing beacons.
The preferred approach for WLAN is to connect a precision external 32.768 kHz clock that meets the requirements listed in Table below.

| Parameter | LPO | Units |
|---|---|---|
| **Nominal input frequency** | 32.768 | kHz |
| **Frequency accuracy** | +-200 | ppm |
| **Duty cycle** | 30 - 70 | % |
| **Input signal amplitude** | 200 - 3300 | mV , p-p |
| **Input impedance** | >100 | kΩ |
| | <5 | pF |
| **Signal type** | Square-wave or sine-wave | - |
| **Clock jitter (during initial start-up)** | <10000 | ppm |

## 3.7 Power Consumption*

### 3.7.1 WLAN

| Test Bed | ThinkPad T60 |
|---|---|
| **Test OS** | Ubuntu 12.04 |
| **Test AP** | RT-AC66U |
| **Driver Version** | 1.201.34 |
| **Test Voltage** | 3.3V |

| Item | | Current value |
|---|---|---|
| No connect AP | AVG | 17.1 mA |
| | MAX | 19.8 mA |
| | MIN | 16.9 mA |
| Connect AP *(1) | AVG | 58.4 mA |
| | MAX | 255.2 mA |
| | MIN | 58.3 mA |
| WLAN RF OFF *(2) | | 13.5 mA |
| Transmit by HT20 | | 252.8 mA |
| Receiver by HT20 | | 101.7 mA |

(1) DTIM = 1, Beacon Interval = 100 ms.
(2) WL-DIS =LOW

### 3.7.2 Bluetooth

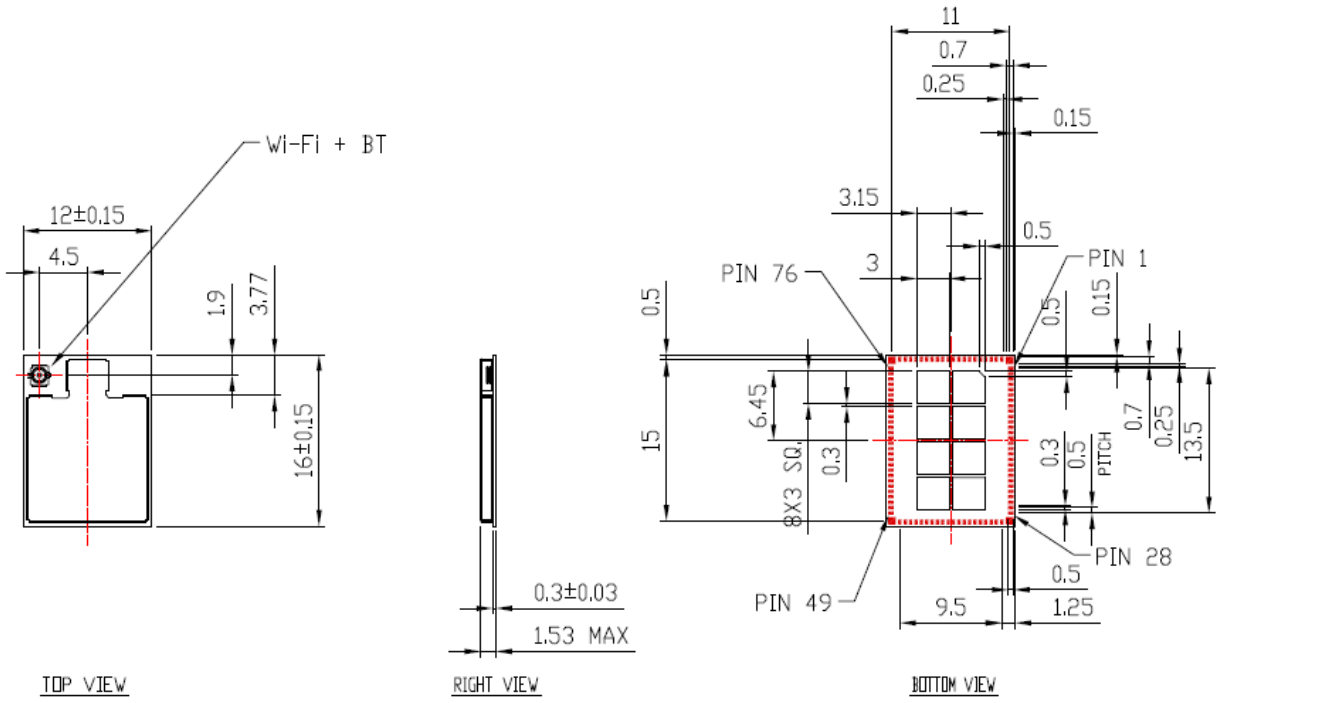
| Test Bed | | DELL E6500 |
|---|---|---|
| Test OS | | Windows XP |
| Driver Version | | BCM4343A1_001.002.009.0035.0102.hcd |
| Test Voltage | | 3.3V |
| Item | | Current value |
| No connect BT device *(2) | AVG | 18.3 mA |
| | MAX | 18.5 mA |
| | MIN | 18.3 mA |
| BT RF OFF *(3) | | 13.5 mA |
| Transmit @DH5 *(4) | | 44.7 mA |
| Receiver @DH5 | | 26.4 mA |

(1) Using Bluetooth tool to Measure TX/RX
(2) No connect BT device is download firmware then did not do anything.
(3) BT-DIS =LOW.
(4) DH5 Output power @ 6 dBm

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

# 4. Mechanical Information

## 4.1 Mechanical Drawing




**Unit: mm**

# 5. Packaging Information

## 5.1


## 5.2


## 5.3

PINK BUBBLE WRAP

## 5.4


AFFIX PACKING LABEL

## 5.5

1 Carton= 5 Boxes


## 5.6


AFFIX PACKING LABEL