

# BM3301 – 1216 Module

---

Wi-Fi 6 and BLE 5.4 Wireless Module - Powered by TI CC3301

---

Datasheet

V0.9

## Content

|                                                        |    |
|--------------------------------------------------------|----|
| Content .....                                          | 2  |
| 1 Introduction .....                                   | 1  |
| Features .....                                         | 1  |
| Application .....                                      | 1  |
| 2 Description .....                                    | 5  |
| 2.1 Pin Diagram .....                                  | 5  |
| 2.2 Pin Attributes .....                               | 5  |
| 3 Electrical characteristics .....                     | 9  |
| 3.1 Absolute Maximum Ratings .....                     | 9  |
| 3.2 Normal working conditions .....                    | 9  |
| 3.3 Electrical Characteristics .....                   | 9  |
| 3.4 Module specifications .....                        | 9  |
| 4 Timing and Switching Characteristics .....           | 10 |
| 4.1 Power Supply Sequencing .....                      | 10 |
| 4.2 Clocking Specifications .....                      | 10 |
| 4.2.1 Slow Clock Generated Internally .....            | 10 |
| 4.2.2 Slow Clock Using an External Oscillator .....    | 10 |
| 5 Application information .....                        | 11 |
| 5.1 Package information .....                          | 11 |
| 5.1.1 BM3301-1216 Module Package information .....     | 11 |
| 5.2 Land Pattern .....                                 | 11 |
| 5.3 Reference design based on BM3301-1216 Module ..... | 12 |
| 5.3.1 BM3301-1216 Module Block Diagram .....           | 12 |
| 5.3.2 SDIO lines .....                                 | 12 |
| 6 Ordering information .....                           | 13 |
| 7 Reversion .....                                      | 13 |
| 8 FCC .....                                            | 14 |

# 1 Introduction

---

BM3301 – 1216 is a 2.4-GHz Wi-Fi6 and Bluetooth Low Energy wireless module based on TI's 10th-generation connectivity combo chip CC3301, which is based upon proven technology. This Module is ideal for use in cost-sensitive embedded application with a Linux or RTOS host running TCP/IP. This Module is an ideal platform for developing wireless communication product solutions.

## Features

- Wi-Fi 6
  - 2.4 GHz, 20 MHz, single spatial stream
  - MAC, baseband, and RF transceiver with support for IEEE 802.11 b/g/n/ax
  - Target wake time (TWT), OFDMA, MU-MIMO (Downlink), Basic Service Set Coloring, and trigger frame for improved efficiency
  - Hardware-based encryption and decryption using supporting WPA2 and WPA3
  - Excellent interoperability
  - Support for 4-bits SDIO or SPI host interfaces
- Bluetooth Low Energy 5.4
  - LE Coded PHYs (Long Range), LE 2M PHY (High Speed) and Advertising Extension
  - Host controller interface (HCI) transport with option for UART or shared SDIO
- Security
  - Secured host interface
  - Firmware authentication
  - Anti-rollback protection
- Application throughput up to 50 Mbps
- 3-wire or 1-wire PTA for external coexistence with additional 2.4-GHz radios (for example, Thread or Zigbee)
- Multirole support (for example, concurrent STA and AP) to connect with Wi-Fi devices on different RF channels (Wi-Fi networks)
- 1 integrated antenna port (supporting Wi-Fi and Bluetooth Low Energy coexistence)
- Compact footprint and pins with SMT package
- Integrated 2.4-GHz PA for complete wireless solution with up to +20dBm output power
- Using an IPEX Gen4 socket to connect an external antenna (ex: Rubber ducky antenna, PCB antenna, FPC antenna)
- Operation temperature: -40°C to 85°C
- Operation humidity: 10%~ 85%

## Application

- Internet of Things (IoT)
- Multimedia
- Home Electronics
- Home Application and White Goods

- Industrial and Home Automation
- Smart Gateway and Metering
- Video Conferencing
- Video Camera and Security

This product specification includes a detailed description of the BM3301 – 1216 Module's performance and functions. For the latest firmware, product updates or errata, please contact Seeed Studio.

## 2 Description

BM3301 – 1216 Module is embedded with TI CC3301, which is very suitable for the design of various embedded devices. The module, as seen in below diagram, comprise of:

- 40Mhz XTAL
- Bandpass filter
- Decoupling capacitors
- IPEX Gen 4 connector (BM3301-1216)

### 2.1 Pin Diagram



Figure 2-4. BM3301-1216 Module Pin arrangement

### 2.2 Pin Attributes

Table 2-1. BM3301-1216 Module pinout

| Number | Name | Voltage Level | Type | Description   |
|--------|------|---------------|------|---------------|
| 1      | NC   |               | -    | Not connected |
| 2      | NC   |               | -    | Not connected |
| 3      | NC   |               | -    | Not connected |

|    |               |      |       |                                                            |
|----|---------------|------|-------|------------------------------------------------------------|
| 4  | VDD_3.3V      | 3.3V | Power | 3.3V Power Supply                                          |
| 5  | VDD_3.3V      | 3.3V | Power | 3.3V Power Supply                                          |
| 6  | GND           |      | -     | Ground                                                     |
| 7  | Logger        | 1.8V | O     | UART TX Debug Logger (Reuse as working mode configuration) |
| 8  | NC            |      | -     | Not connected                                              |
| 9  | NC            |      | -     | Not connected                                              |
| 10 | NC            |      | -     | Not connected                                              |
| 11 | COEX_GRANT    | 1.8V | O     | External Coexistence Interface -Grant                      |
| 12 | COEX_REQ      | 1.8V | I     | External Coexistence Interface -Request                    |
| 13 | COEX_PRIORITY | 1.8V | I     | External Coexistence Interface -Priority                   |
| 14 | NC            |      | -     | Not connected                                              |
| 15 | NC            |      | -     | Not connected                                              |
| 16 | NC            |      | -     | Not connected                                              |
| 17 | GND           |      | -     | Ground                                                     |
| 18 | NC            |      | -     | Not connected                                              |
| 19 | NC            |      | -     | Not connected                                              |
| 20 | GND           |      | -     | Ground                                                     |
| 21 | NC            |      | -     | Not connected                                              |
| 22 | NC            |      | -     | Not connected                                              |
| 23 | GND           |      | -     | Ground                                                     |
| 24 | NC            |      | -     | Not connected                                              |
| 25 | NC            |      | -     | Not connected                                              |
| 26 | GND           |      | -     | Ground                                                     |
| 27 | Slow_CLK      | 1.8V | I     | External Slow Clock Input                                  |
| 28 | NC            |      | -     | Not connected                                              |
| 29 | NC            |      | -     | Not connected                                              |
| 30 | NC            |      | -     | Not connected                                              |
| 31 | NC            |      | -     | Not connected                                              |
| 32 | GND           |      | -     | Ground                                                     |
| 33 | NC            |      | -     | Not connected                                              |
| 34 | NC            |      | -     | Not connected                                              |
| 35 | GND           |      | -     | Ground                                                     |
| 36 | NC            |      | -     | Not connected                                              |
| 37 | NC            |      | -     | Not connected                                              |
| 38 | GND           |      | -     | Ground                                                     |
| 39 | NC            |      | -     | Not connected                                              |

|    |                      |      |       |                                                                                                                  |
|----|----------------------|------|-------|------------------------------------------------------------------------------------------------------------------|
| 40 | NC                   |      | -     | Not connected                                                                                                    |
| 41 | GND                  |      | -     | Ground                                                                                                           |
| 42 | V <sub>DD_1.8V</sub> | 1.8V | Power | 1.8V Power Supply (Not Required)                                                                                 |
| 43 | V <sub>DD_1.8V</sub> | 1.8V | Power | 1.8V Power Supply (Not Required)                                                                                 |
| 44 | NC                   |      | -     | Not connected                                                                                                    |
| 45 | RESET                | 1.8V | I     | Disable or enable the Module (Active low). A 200kΩ pull-up resistor is internally connected to V <sub>IO</sub> . |
| 46 | IRQ_WL               | 1.8V | I/O   | IRQ_WL to Host (Reuse as working mode configuration)                                                             |
| 47 | SDIO_D3              | 1.8V | I/O   | SDIO_D3_WL (SPI_CS)                                                                                              |
| 48 | SDIO_D2              | 1.8V | I/O   | SDIO_D2_WL                                                                                                       |
| 49 | SDIO_D1              | 1.8V | I/O   | SDIO_D1_WL                                                                                                       |
| 50 | SDIO_D0              | 1.8V | I/O   | SDIO_D0_WL (SPI_DOUT)                                                                                            |
| 51 | SDIO_CMD             | 1.8V | I/O   | SDIO_CMD_WL (SPI_DIN)                                                                                            |
| 52 | SDIO_CLK             | 1.8V | I     | SDIO_CLK (SPI_CLK)                                                                                               |
| 53 | IRQ_BLE              | 1.8V | O     | IRQ_BLE to Host (in shared SDIO mode) (Reuse as working mode configuration)                                      |
| 54 | UART_CTS             | 1.8V | I     | Device CTS signal – flow control for BLE HCI                                                                     |
| 55 | UART_TX              | 1.8V | O     | UART TX for BLE HCI                                                                                              |
| 56 | UART_RX              | 1.8V | I     | UART RX for BLE HCI                                                                                              |
| 57 | UART_RTS             | 1.8V | O     | Device RTS signal – flow control for BLE HCI                                                                     |
| 58 | NC                   |      | -     | Not connected                                                                                                    |
| 59 | NC                   |      | -     | Not connected                                                                                                    |
| 60 | NC                   |      | -     | Not connected                                                                                                    |
| 61 | NC                   |      | -     | Not connected                                                                                                    |
| 62 | GND                  |      | -     | Ground                                                                                                           |
| 63 | NC                   |      | -     | Not connected                                                                                                    |
| 64 | Fast_CLK_REQ         | 1.8V | O     | Fast clock request from the device                                                                               |
| 65 | ANT_SEL              | 1.8V | I/O   | Default antenna select control line                                                                              |
| 66 | SWCLK                | 1.8V | I     | Serial Wire Debug CLK                                                                                            |
| 67 | SWDIO                | 1.8V | I/O   | Serial Wire Debug DIN/DOU                                                                                        |
| 68 | GND                  |      | -     | Ground                                                                                                           |
| 69 | NC                   |      | -     | Not connected                                                                                                    |
| 70 | NC                   |      | -     | Not connected                                                                                                    |
| 71 | GND                  |      | -     | Ground                                                                                                           |
| 72 | V <sub>DD_3.3V</sub> | 3.3V | Power | 3.3V Power Supply                                                                                                |
| 73 | V <sub>DD_3.3V</sub> | 3.3V | Power | 3.3V Power Supply                                                                                                |

|          |     |  |   |        |
|----------|-----|--|---|--------|
| 74 - 96  | GND |  | - | Ground |
| S1 - S12 | GND |  | - | Ground |

## 3 Electrical characteristics

### 3.1 Absolute Maximum Ratings

Reaching or exceeding the maximum ratings listed in the table below can cause equipment damage.

Table 3-1. Absolute Maximum Ratings

| Parameter            | Description                     | min  | max | unit |
|----------------------|---------------------------------|------|-----|------|
| V <sub>DD_3.3V</sub> | 1216-Module 3.3V Supply Voltage | -0.5 | 4.2 | V    |
| V <sub>IO</sub> /1V8 | 1216-Module IO Voltage          | -0.5 | 2.1 | V    |

### 3.2 Normal working conditions

Table 3-2. Recommended Operating Conditions

| Parameter            | Description                     | min  | TYP | max  | unit |
|----------------------|---------------------------------|------|-----|------|------|
| V <sub>DD_3.3V</sub> | 1216-Module 3.3V Supply Voltage | 3.0  | 3.3 | 3.6  | V    |
| V <sub>IO</sub>      | 1216-Module IO voltage          | 1.62 | 1.8 | 1.98 | V    |
| T <sub>op</sub>      | Operation temperature           | -40  |     | +85  | °C   |

### 3.3 Electrical Characteristics

Table 3-3. BM3301-1x1x Module Electrical Characteristics

| Parameter       | Description               | Test Condition | min                    | TYP | max                    | unit |
|-----------------|---------------------------|----------------|------------------------|-----|------------------------|------|
| V <sub>IH</sub> | High level input voltage  |                | 0.65 x V <sub>IO</sub> |     | V <sub>IO</sub>        | V    |
| V <sub>IL</sub> | Low level input voltage   |                | 0                      |     | 0.35 x V <sub>IO</sub> | V    |
| V <sub>OH</sub> | High level output voltage | At 4mA         | V <sub>IO</sub> – 0.45 |     | V <sub>IO</sub>        | V    |
| V <sub>OL</sub> | Low level output voltage  | At 4mA         | 0                      |     | 0.45                   | V    |

### 3.4 Module specifications

Table 3-4. BM3301-1313 Module features

| ITEMs     | Parameter                       |             | Specifications                |           |            |                                          | Unit |
|-----------|---------------------------------|-------------|-------------------------------|-----------|------------|------------------------------------------|------|
| Structure | Size                            | 1216-Module | 12(W) x 16(L) x 2.1(H)Max     |           |            |                                          |      |
|           | Package                         | 1216-Module | 108 pins LGA Module           |           |            |                                          |      |
|           | Sleep current                   | 1216-Module | 215(TBD)                      |           |            |                                          |      |
|           | Operation current (Transmitter) | 1216-Moudle | 3.3V                          | 360<br>65 | 470<br>305 | 20.2dBm 6 OFDM<br>20dBm BLE 1M Channel 4 | mA   |
|           | Operation current               |             | TBD @ Wi-Fi Continous Receive |           |            |                                          | mA   |

|  |                      |                                           |     |      |     |     |
|--|----------------------|-------------------------------------------|-----|------|-----|-----|
|  | (Receiver)           | TBD @ Bluetooth Scan                      |     |      |     |     |
|  |                      | TBD @ Wi-Fi Scan                          |     |      |     |     |
|  | TX Output power(Max) | 20 @ 11ax SU ER MCS0                      |     |      |     | dBm |
|  |                      | 16 @ BLE 20dBm 1M Channel 4               |     |      |     |     |
|  | Sensitivity          | Wi-Fi@20-MHz bandwidth. At <10% PER limit |     |      |     | dBm |
|  |                      | Condi<br>ons                              | min | type | max |     |
|  |                      | 1 DSS                                     | -   |      | -   |     |
|  |                      | 2 DSS                                     | -   |      | -   |     |
|  |                      |                                           |     |      |     |     |

| ITEMs                | Descriptions |
|----------------------|--------------|
| Peripheral Interface | SDIO 3.0     |
|                      | SPI          |
|                      | UART         |
|                      | Coexistence  |
|                      | SWD          |

## 4 Timing and Switching Characteristics

### 4.1 Power Supply Sequencing

For proper operation of the device, perform the recommended power-up sequencing as follows:

1. All supplies (VBAT, VIO) must be available before Reset is released.
2. For an external slow clock, ensure that the clock is stable before Reset is deasserted (high).
3. The Reset pin should be held low for 10 us after stabilization of the external power supplies.

### 4.2 Clocking Specifications

A slow clock running at 32.768 kHz for low power modes

#### 4.2.1 Slow Clock Generated Internally

In order to minimize external components, the slow clock can be generated by an internal oscillator. However, this clock is less accurate and consumes more power than sourcing the slow clock externally. For this scenario the Slow\_CLK pin should be left not connected.

#### 4.2.2 Slow Clock Using an External Oscillator

For optimal power consumption, the slow clock can be generated externally by an oscillator or sourced from elsewhere in the system. The external source must meet the requirements listed below. This



## 5.3 Reference design based on BM3301-1216 Module

Considering different application scenarios, we provide two different reference designs.

### 5.3.1 BM3301-1216 Module Block Diagram

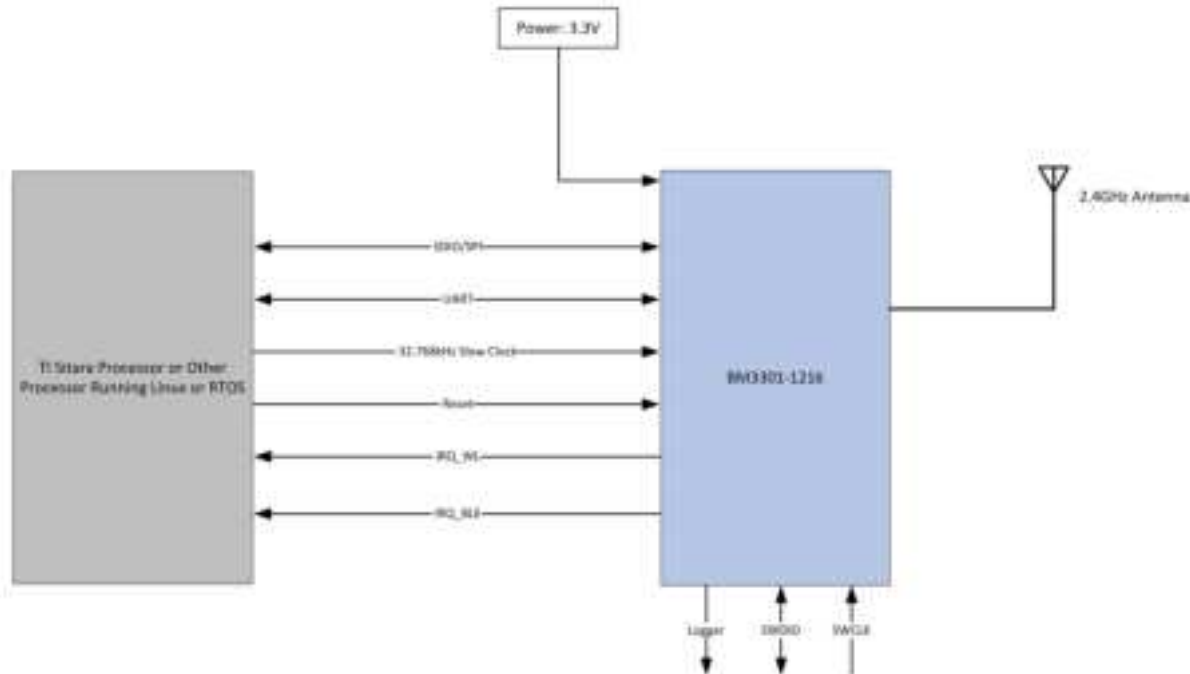


Figure 5-3-1. System Block Diagram

Notes:

1. IRQ\_WL, IRQ\_BLE, Logger are used to configure the working mode. IRQ\_WL, IRQ\_BLE need to be pulled down, Logger needs to be pulled up.
2. IRQ\_WL, IRQ\_BLE, Logger already have internal pull-up or pull-down resistors. External resistors are not required, but it is recommended to reserve positions for resistors.
3. SWDIO, do not add pull-down resistor.
4. SWCLK, do not add pull-up resistor.

### 5.3.2 SDIO lines

Due to the size of the module, the length of SDIO lines is not equal within the module, and it is necessary to compensate for the unequal length lines in your design.

The length of each SDIO lines of BM3301-1216 Module

- SDIO\_CLK: 539.16 mil
- SDIO\_CMD: 570.29 mil
- SDIO\_D0: 481.10 mil
- SDIO\_D1: 502.99 mil
- SDIO\_D2: 506.48 mil
- SDIO\_D3: 502.13 mil

## 6 Ordering information

---

Technical Support:

Sales:

Table 5 Ordering Information

| Part Number        | Package size (mm)          | IPEX GEN4 |
|--------------------|----------------------------|-----------|
| BM3301-1216 Module | 12(W) x 16(L) x 2.1(H) max | Yes       |

## 7 Reversion

---

V0.9    2023-05-25    Draft release

## 8 FCC

---

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.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: 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 or more 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.

This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following:

“Contains Transmitter Module FCC ID:Z4T-BM3301-1216”

The module is limited to OEM installation ONLY

The OEM integrators is responsible for ensuring that the end-user has no manual instructions to remove or install module

The module is limited to installation in mobile or fixed applications, according to Part 2.1091(b)

The separate approval is required for all other operating configurations, including portable configurations with respect to configurations

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

## IC

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

(1) This device may not cause interference.

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes :

(1) L'appareil ne doit pas produire de brouillage;

(2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. Cet émetteur ne doit pas être colocalisé ou fonctionner en conjonction avec une autre antenne ou un autre émetteur.

The device meets the exemption from the routine evaluation limits in section 2.5 of RSS-102 and compliance with RSS-102 RF exposure, users can obtain Canadian information on RF exposure and compliance. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

Le dispositif rencontre l'exemption des limites courantes d'évaluation dans la section 2.5 de RSS 102 et la conformité à l'exposition de RSS-102 rf, utilisateurs peut obtenir l'information canadienne sur l'exposition et la conformité de rf. Cet émetteur ne doit pas être Co-placé ou ne fonctionnant en même temps qu'aucune autre antenne ou émetteur. Cet équipement devrait être installé et actionné avec une distance minimum de 20 centimètres entre le radiateur et votre corps.

Please notice that if the ISED certification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains IC: 21046-BM33011216" any similar wording that expresses the same meaning may be used.

Veuillez noter que si le numéro de certification ISDE n'est pas visible lorsque le module est installé à l'intérieur d'un autre dispositif, alors l'extérieur du dispositif dans lequel le module est installé doit également afficher une étiquette se référant au module fermé. Cette étiquette extérieure peut utiliser des libellés tels que: «contient IC: 21046-BM33011216» toute formulation similaire qui exprime la même signification peut être utilisée.

### Antenna information

| Antenna Type | Antenna Gain |
|--------------|--------------|
| Rod antenna  | 2.81 dBi     |
| PCB antenna  | 2.87 dBi     |

Trace antenna designs: Not applicable.

| Type d'antenne | Max Gain d' antenne |
|----------------|---------------------|
| Rod antenna    | 2.81 dBi            |
| PCB antenna    | 2.87 dBi            |