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seeed studio BM3301 Wi-Fi 6 and BLE 5.4 Wireless Module Owner's Manual

BM3301–1216Module
Wi-Fi6andBLE5.4WirelessModule-PoweredbyTICC3301
Datasheet
V0.9

Contents

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 costsensitive 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℃ to 85℃

➢ Operation humidity: 10%~ 85%

Application

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

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

Number	Name	Voltage Level	Type	Description
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	VDD_1.8V	1.8V	Power	1.8V Power Supply (Not Required)
43	VDD_1.8V	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_{IO}.

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/DOUT
68	GND		–	Ground
69	NC		–	Not connected
70	NC		–	Not connected
71	GND		–	Ground
72	VDD_3.3V	3.3V	Power	3.3V Power Supply
73	VDD_3.3V	3.3V	Power	3.3V Power Supply

74 – 96	GND		–	Ground
S1 – S12	GND		–	Ground

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
Vdd_3.3v	1216-Module 3.3V Supply Voltage	-0.5	4.2	V
VIO/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
Vdd_3.3v	1216-Module 3.3V Supply Voltage	3.0	3.3	3.6	V
VIO	1216-Module IO voltage	1.62	1.8	1.98	V
Top	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
VIH	High level input voltage		$0.65 \times V_{IO}$		VIO	V
VIL	Low level input voltage		0		$0.35 \times V_{IO}$	V
VOH	High level output voltage	At 4mA	$V_{IO} - 0.45$		VIO	V
VOL	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	470	20.2dBm 6 OFDM	mA
				65	305	20dBm BLE 1M Channel 4	
	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
		Conditions	min	type	max	
		1 DSS	–		–	
		2 DSS	–		–	

ITEMs	Descriptions
Peripheral Interface	SDIO 3.0
	SPI
	UART
	Coexistence
	SWD

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 acurrate 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 clock should be fed into the BMCC3301-1313 pin Slow_CLK and should be stable before nReset is deasserted and device is enabled.
4.2.2.1 External SlowClock Requirement

Parameter	Description	min	TYP	max	Unit
Input slow clock frequency	Square wave		32768		Hz
Frequency accuracy	Inital + temperature + aging			±250	ppm
Input Duty cycle		30	50	70	%
Rise and fall time	10% to 90% (rise) and 90% to 10% (fall) of digital signal level			100	ns
VIL (Input low level)		0		0.35 x VI O	V
VIH (Input high level)		0.65 x VI O		1.95	V
Input impedence		1			MΩ
Input capacitance				5	pF

Application information

5.1 Package information
5.1.1 BM3301-1216 Module Package information
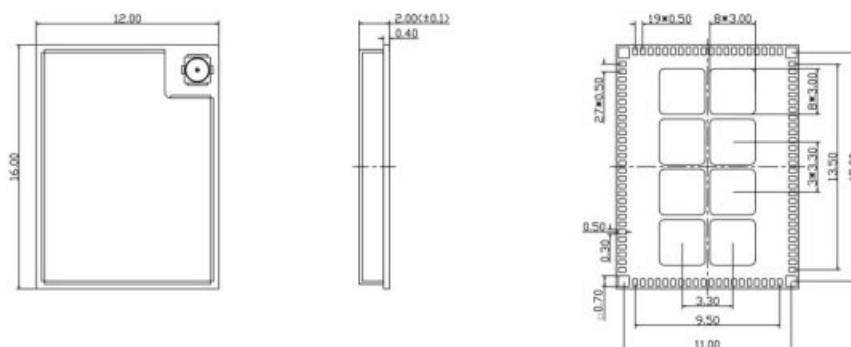
Figure 5-1-2. BM3301-1216 Module Package Outline Drawing

5.2 Land Pattern
The following figure shows the recommended pad dimensions.
5.3 Reference design based on BM3301-1216 Module
Considering different application scenarios, we provide two different reference designs.
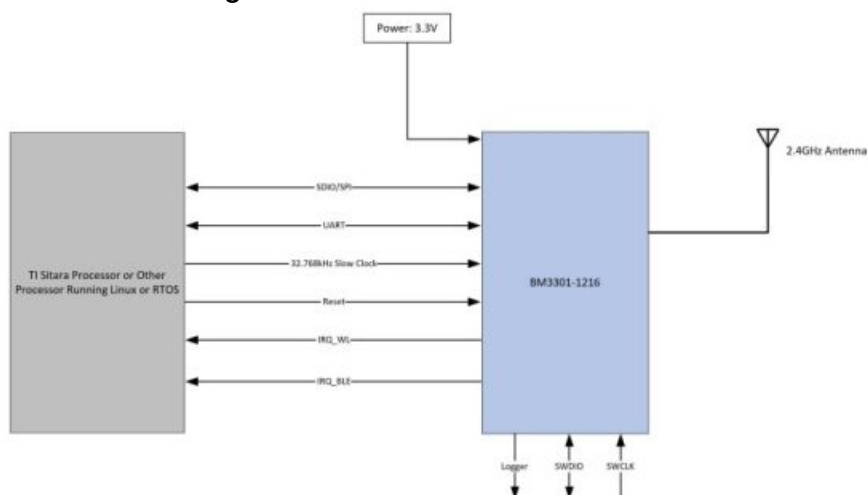### 5.3.1 BM3301-1216 Module Block Diagram

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.

● SDIO_CLK:	539.16 mil
● SDIO_CMD:	570.29 mil
●SDIO_Do:	481.10 mil
● SDIO D1:	502.99 mil
● SDIO D2:	506.48 mil
● SDIO_D3:	502.13 mil

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

Reversion

V0.9 2023-05-25 Draft release

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 hasno manual instructions to remove or install module

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.

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.

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.

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

Documents / **Resources**

	seeed studio BM3301 Wi-Fi 6 and BLE 5.4 Wireless Module [pdf] Owner's Manual Z4T-BM3301-1216, Z4TBM33011216, bm3301 1216, BM3301 Wi-Fi 6 and BLE 5.4 Wireless Module, BM3301, Wi-Fi 6 and BLE 5.4 Wireless Module, BLE 5.4 Wireless Module, Wireless Module, Module

References

- 🌐 **Seeed Studio Bazaar, The IoT Hardware enabler.**
- **User Manual**