

General Description

BDE-BW3301N is a 2.4-GHz Wi-Fi 6 and Bluetooth Low Energy Combo wireless module based on TI's 10th generation connectivity combo chip CC3301 which is based upon proven technology and complements the TI integrated devices for connectivity portfolio. This module is ideal for use in cost sensitive embedded applications with a Linux or RTOS host running TCP/IP, where the peak throughput requirement is 50 Mbps maximum at the IP layer. BDE-BW3301N could be the best choice for bringing the efficiency of Wi-Fi 6 to embedded device applications with a small PCB footprint and highly optimized bill of materials with lower cost.



Key Features

- Highly optimized Wi-Fi 6 and Bluetooth Low Energy 5.2 system for low cost embedded IoT applications
- Seamless integration with TI Sitara MPU (Linux) / MCU+ (FreeRTOS) as well as other application processors
- 3-wire or 1-wire PTA for external coexistence with additional 2.4GHz radios (e.g. Thread or Zigbee)
- Multirole support e.g. STA and AP to connect directly with other Wi-Fi devices on different RF channels (Wi-Fi networks)
- Optional antenna diversity or selection
- Operating temperature: -40°C to +85°C
- Wi-Fi 6®
 - MAC, Baseband and RF Transceiver with support for IEEE 802.11 a/b/g/n/ax Wi-Fi6
 - Medium access controller (MAC)
- Hardware-based encryption and decryption using supporting WPA2 and WPA3
- TWT and OFDMA for optimal embedded performance
- Application throughput up to 50 Mbps
- Supports 4-bit SDIO and SPI host interfaces
- Bluetooth® Low Energy 5.2
 - Bluetooth 5.2 supporting long-range and highspeed PHYs (up to 2 Mbps)
 - Host controller interface (HCI) transport for Bluetooth with option for shared SDIO or UART
 - Bluetooth Low Energy certified stack
- Integrated 2.4G-Hz PA for complete wireless solution with up to +20dBm output power
- Security
 - Secured host interface
 - Firmware authentication
 - Anti-rollback protection
- Power Management
 - VDD_1V8: 1.62V - 1.98 V
 - VDD_3V3: 2.1 V - 4.2 V
- Clock Source:
 - 40 MHz XTAL fast clock
 - External 32.768-kHz slow clock by default
- Package
 - 65-QFM, 11-mm x 11-mm x 2-mm
- Regulatory (In Progress)
 - FCC
 - IC
 - CE-RED
 - Bluetooth SIG

Applications

- Grid Infrastructure
 - Electricity Meter
 - String Inverter
 - Micro Inverter
 - Energy Storage Power Conversion System (PCS)
- Building and Home Automation
 - HVAC Controller
 - HVAC Gateway
 - Thermostat
 - Building Security Gateway
 - Garage door system
 - IP network camera/ Video doorbell
 - Wireless security camera
- Appliances
 - Refrigerator & freezer
 - Oven
 - Washer & dryer
 - Residential water heater & heating system
- Air purifier & humidifier
- Coffee machine
- Air conditioner indoor unit
- Vacuum robot
- Robotic lawn mower
- Medical
 - Infusion pump
 - Electronic hospital bed & bed control
 - Multiparameter patient monitor
 - Blood glucose monitor
 - Blood pressure monitor
 - CPAP machine
 - Telehealth systems
 - MRI
 - Ultrasound scanner
 - Ultrasound smart probe
 - Electric toothbrush
- Retail Automation and Payment

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1. References

1. The latest datasheet can be found in this [link](#).
2. CC3301 resources: <https://www.ti.com/product/CC3301>

2. Block Diagram

BDE-BW3301N module is based on the TI's 10th generation connectivity combo chip CC3301.

The module, as seen in Figure 2-1, comprises of:

- 40-MHz XTAL
- Bandpass filter
- Decoupling capacitors

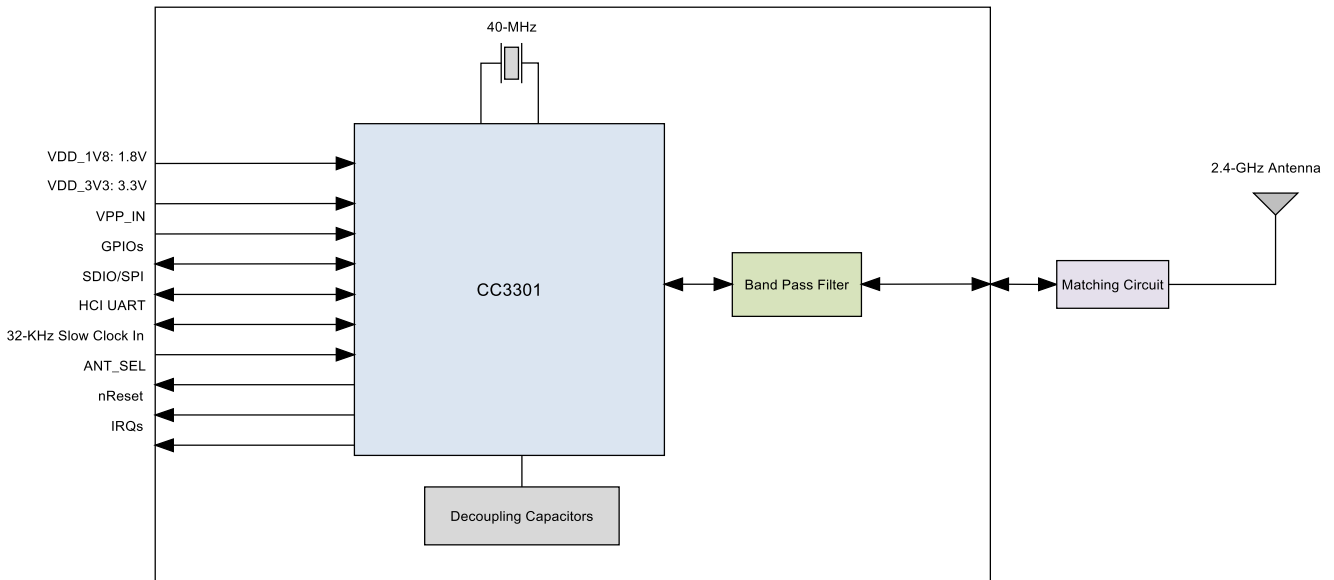


Figure 2-1. BDE-BW3301N Module Block Diagram

Module Pin #	Pin Name	Type	Description
19	IRQ_BLE	O	IRQ_BLE to Host (in shared SDIO mode)
20	IRQ_WL	O	IRQ_WL to Host
21	LOGGER	O	Tracer (UART TX Debug Logger)
22	SDIO_D0	I/O	SDIO_D0_WL (SPI_DOUT)
23	SDIO_D1	I/O	SDIO_D1_WL.
24	SDIO_D2	I/O	SDIO_D2_WL
25	SDIO_D3	I/O	SDIO_D3_WL (SPI_CSX)
26	SDIO_CMD	I	SDIO_CMD_WL (SPI_DIN)
27	SDIO_CLK	I	SDIO_CLK_WL (SPI_CLK). Must be driven by host.
28	GND	Ground	Power ground
29	GND	Ground	Power ground
30	GND	Ground	Power ground
31	GND	Ground	Power ground
32	VDD_1V8	Power	1.8V Power supply
33	VDD_1V8	Power	1.8V Power supply
34	ANT_SEL	O	Antenna select control for antenna diversity
35	UART_TX	O	UART TX for BLE HCI
36	UART_RX	I	UART RX for BLE HCI
37	UART_CTS	I	UART CTS for flow control for BLE HCI
38	UART_RTS	O	UART RTS for Flow Control for Bluetooth Low Energy HCI
39	COEX_GRA	O	External Coexistence Interface - Grant
40	COEX_REQ	I	External Coexistence Interface – Request
41	COEX_PRI	I	External Coexistence Interface – Priority
42	GND	Ground	Power ground
43	GND	Ground	Power ground
44	GND	Ground	Power ground
45	GND	Ground	Power ground
46	GND	Ground	Power ground
47	GND	Ground	Power ground
48	VDD_3V3	Power	3.3V Power supply
49	VDD_3V3	Power	3.3V Power supply
50	GND	Ground	Power ground
51	GND	Ground	Power ground
52	GND	Ground	Power ground
53	GND	Ground	Power ground
54	GND	Ground	Power ground
55	GND	Ground	Power ground
56	GND	Ground	Power ground
57 -65	GND	Ground	Thermal pads, connect to GND

4. Specifications

4.1 Absolute Maximum Ratings

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, so functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification are not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

PARAMETER	MIN	MAX	UNIT	Notes
V _{PA}	TBD	TBD	V	
V _{MAIN}	TBD	TBD	V	
V _{IO}	TBD	TBD	V	VDD IO Voltage
	TBD	TBD	V	Input Voltage to all digital pins
	TBD	TBD	V	HFXT_P Input Voltage
RF pin	TBD	TBD	dBm	
Storage Temperature	TBD	TBD	°C	

4.2 ESD Ratings

		VALUE	UNIT
V (ESD) Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	TBD	V
	Charged device model (CDM), per ANSI/ESDA/JEDEC JS-002 ⁽²⁾	TBD	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

4.3 Recommended Operating Conditions

PARAMETER	MIN	TYP	MAX	UNIT	Notes
V _{DD_3V3}	2.1	3.3	4.2	V	
V _{DD_1V8}	1.62	1.8	1.98	V	
Storage Temperature	-40		85	°C	

5. Mechanical Specifications

5.1 Dimensions

Fig 5-1 shows the overall dimensions of BDE-BW3301N. The module measures 11mm long by 11mm wide by 2mm height with the shield.

Note: All dimensions are in mm.

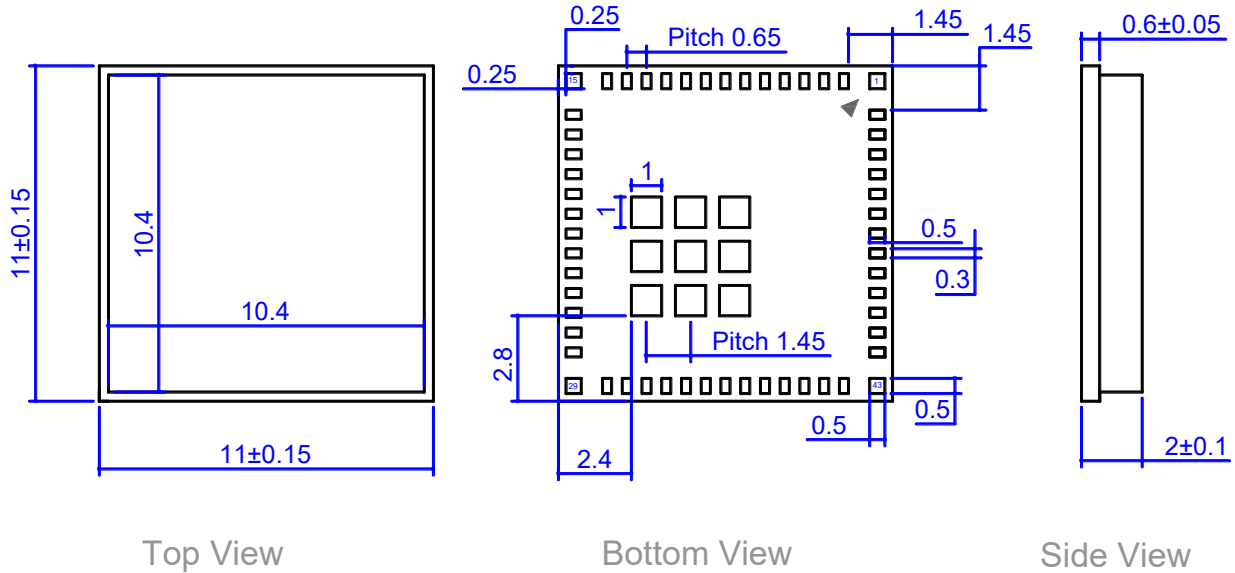


Figure 5-1. Mechanical Drawing

6. Reference Design

6.1. Block Diagram

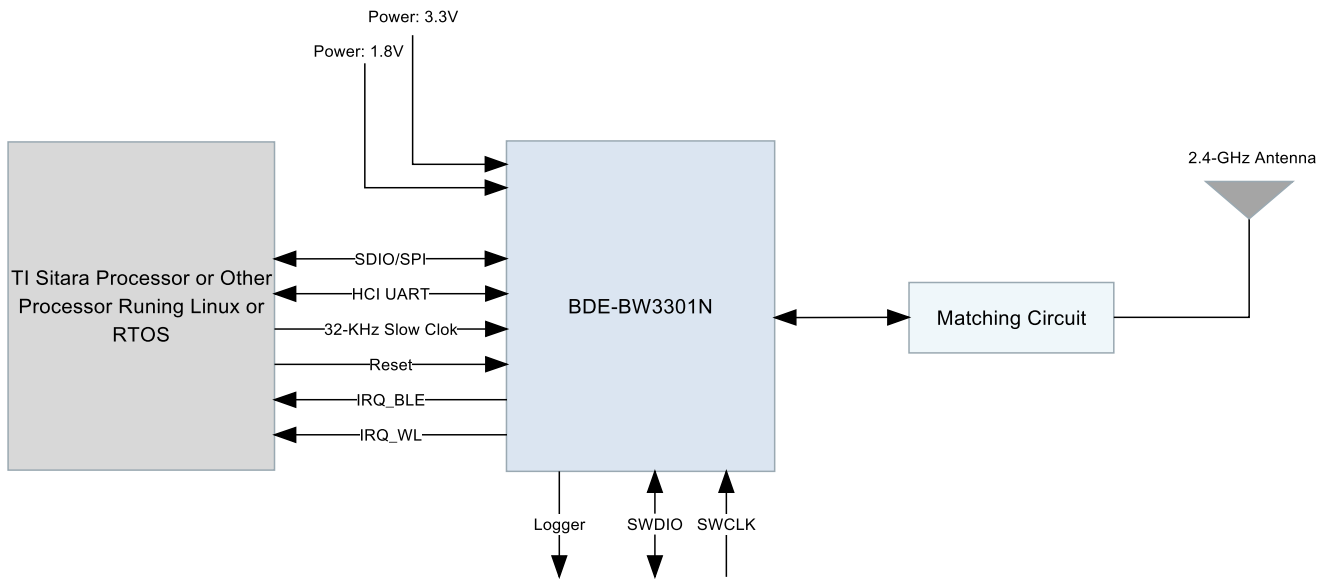


Figure 6-1. High-Level System Block Diagram

Note: Pin IRQ_BLE, IRQ_WL and Logger are assigned as the SoP mode pins, the default SoP mode is “001”, which is IRQ_BLE pin being pulled down, IRQ_WL pin being pulled down and Logger pin being pulled up by default.

6.2. Reference Schematic

For reference schematic, please refer to the design files of BDE-EVM-3301N.

6.3. Design Consideration

ITEM	DESCRIPTION
Thermal	
1	The proximity of ground vias must be close to the pad.
2	Signal traces must not be run underneath the module on the layer where the module is mounted.
3	Have a complete ground pour in layer 2 for thermal dissipation.
4	Have a solid ground plane and ground vias under the module for stable system and thermal dissipation.
5	Increase the ground pour in the first layer and have all of the traces from the first layer on the inner layers, if possible.
6	Signal traces can be run on a third layer under the solid ground layer, which is below the module mounting layer.
RF Trace and Antenna Routing	
7	The RF trace antenna feed must be as short as possible beyond the ground reference. At this point, the trace starts to radiate.
8	The RF trace bends must be gradual with an approximate maximum bend of 45° with trace mitered. RF traces must not have sharp corners.

9	RF traces must have via stitching on the ground plane beside the RF trace on both sides.
10	RF traces must have constant impedance (Coplanar or microstrip transmission line).
11	For best results, the RF trace ground layer must be the ground layer immediately below the RF trace. The ground layer must be solid.
12	There must be no traces or ground under the antenna section.
13	RF traces must be as short as possible. The antenna, RF traces, and modules must be on the edge of the PCB product. The proximity of the antenna to the enclosure and the enclosure material must also be considered.
Supply and Interface	
14	The power trace for VBAT must be at least 40-mil wide.
15	The 1.8-V trace must be at least 18-mil wide.
16	Make VDD_3V3 and VDD_1V8 traces as wide as possible to ensure reduced inductance and trace resistance.
17	If possible, shield 3V3 and 1V8 traces with ground above, below, and beside the traces.
18	SDIO signals traces (CLK, CMD, D0, 01, 02, and 03) must be routed in parallel to each other and as short as possible (less than 12 cm). In addition, every trace length must be the same as the others. There should be enough space between traces- greater than 1.5 times the trace width or ground- to ensure signal quality, especially for the SDIO_CLK trace. Remember to keep these traces away from the other digital or analog signal traces. BDE recommends adding ground shielding around these buses.
19	SDIO and digital clock signals are a source of noise. Keep the traces of these signals as short as possible. If possible, maintain a clearance around them.

7. Ordering Information

Part Number	Size (mm)	Core Chip	Shipping Form	MOQ
BDE-BW3301N	11 x 11 x 2	CC3301	Tape & Reel	1K

8. Revision History

Revision	Date	Description
V0.1	17-Oct-2022	Preliminary, draft
V0.2	16-Nov-2022	Preliminary, changed part number, updated diagram, pinout, mechanical
V0.3	8-Dec-2022	Preliminary, updated product image, diagram, mechanical
V0.4	31-Mar-2023	Modified pinout and dimension, added more information including reference and design considerations

Important Notice and Disclaimer

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