

## General Description

BDE-WF3135 dramatically simplifies the implementation of Internet connectivity. This dual-band Wi-Fi® network processor module can be added to any low-cost, low-power microcontroller unit (MCU); it integrates all protocols for Wi-Fi® and Internet, which greatly minimize host MCU software requirements.

This ROM-based subsystem includes an 802.11 a/b/g/n dual-band 2.4 GHz and 5 GHz radio, baseband, and MAC with powerful hardware cryptographic engine. With built-in security protocols, the BDE-WF3135 solution provides a robust and simple security experience. The BDE-WF3135 is available in an LGA package that is easy to lay out with all required components including serial Flash, RF filters, diplexer, crystal, and passive components that are fully integrated.

This generation introduces new capabilities that further simplify the connectivity of things to the Internet. The main new features of BDE-WF3135 include:

- 802.11 a/b/g/n: 2.4 GHz and 5 GHz support
- 2.4 GHz Coexistence with Bluetooth® low energy radio
- Antenna diversity
- More concurrent secure sockets, up to 16
- Unique device identifier with ability to generate certificate signing request (CSR)
- Online certificate status protocol (OCSP)
- Wi-Fi Alliance® certified for IoT low power capabilities
- Hostless mode for offloading template packet transmissions
- Improved fast scan.

## Key Features

- Fully integrated and green/RoHS module includes all required clocks, serial peripheral interface (SPI) flash, and passives
- Integrated Wi-Fi® and internet protocols
- 802.11a/b/g/n: 2.4 GHz and 5 GHz
- Rich set of IoT security features helps developers protect data
- Low-power modes for battery powered application
- Coexistence with 2.4 GHz radios
- Industrial temperature: -40°C to +85°C
- Wi-Fi network processor subsystem:
  - Wi-Fi core:
    - 802.11 a/b/g/n 2.4 GHz and 5 GHz
    - Modes:
      - Access Point (AP)
      - Station (STA)
      - Wi-Fi Direct® (only supported 2.4 GHz)
    - Security:
      - WEP
      - WPA™/ WPA2™ PSK
      - WPA2 Enterprise
      - WPA3™ Personal
  - Internet and application protocols:
    - HTTPs server, mDNS, DNS-SD, DHCP
    - IPv4 and IPv6 TCP/IP stack
    - 16 BSD sockets (fully secured TLS v1.2 and SSL 3.0)
  - Built-in power management
  - subsystem:
    - Configurable low-power profiles (always on, intermittently connected, tag)
    - Advanced low-power modes
    - Integrated DC/DC regulators
- Application throughput
  - UDP: 16 Mbps
  - TCP : 13 Mbps
- Multilayered Security Features:
  - Separate execution environments
  - Networking security

- Device identity and key
- Hardware accelerator cryptographic engines (AES, DES, SHA/MD5, CRC)
- File system security (encryption, authentication, access control)
- Initial secure programming
- Software tamper detection
- Secure boot
- Certificate signing request (CSR)
- Unique per device key pair
- Recovery mechanism – ability to recover to factory defaults
- Power-Management Subsystem:
  - Integrated DC/DC converters support a wide range of supply voltage:
    - Single wide-voltage supply, VBAT: 2.3 V to 3.6 V
  - Advanced low-power modes:
    - Shutdown: 1  $\mu$ A
    - hibernate: 5.5  $\mu$ A
    - Low-power deep sleep (LPDS): 115  $\mu$ A
- Idle connected (MCU in LPDS): 710  $\mu$ A
- RX traffic (MCU active): 53 mA
- TX traffic (MCU active): 223 mA
- Wi-Fi TX power
  - 2.4 GHz: 16 dBm at 1 DSSS
  - 5 GHz: 15.1 dBm at 6 OFDM
- Wi-Fi RX sensitivity
  - 2.4 GHz: -94.5 dBm at 1 DSSS
  - 5 GHz: -89 dBm at 6 OFDM
- Additional integrated components on module
  - 40.0 MHz crystal with internal oscillator
  - 32.768 kHz crystal (RTC)
  - 32 Mbit SPI Serial Flash
  - RF filters, diplexer, and passive components
- QFM package
  - 1.27-mm pitch, 63-pin, 20.5-mm  $\times$  25-mm QFM package for easy assembly and low-cost PCB design

## Applications

For Internet of Things applications, such as:

- Medical and Healthcare
  - Multiparameter Patient Monitor
  - Electrocardiogram (ECG)
  - Electronic Hospital Bed & Bed Control
  - Telehealth Systems
- Building and Home Automation:
  - HVAC Systems & Thermostat
  - Video Surveillance, Video Doorbells, and Low-Power Camera
  - Building Security Systems and E-locks
- Appliances
- Asset Tracking
- Factory Automation
- Grid Infrastructure

**Table 0-1. WF3135 Device Family**

Part Number	Chipset	Description	Size (mm)	Package
BDE-WF3135A	CC3135	With PCB antenna	20.5 × 23 × 2.4	SMD-63
BDE-WF3135AU	CC3135	With U.FL connector for external antenna, such as whip antenna	20.5 × 23 × 2.4	SMD-63
BDE-WF3135N	CC3135	RF pad out for external antenna, such as Ceramic Antenna	20.5 × 17.5 × 2.4	SMD-63

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## 1. References

- [1] CC3135 resources: <https://www.ti.com/product/CC3135>

## 2. Block Diagram

Confidential.

Figure 1 shows the functional block diagram of the BDE-WF3135 module.

Figure 2 shows the CC3135 hardware overview.

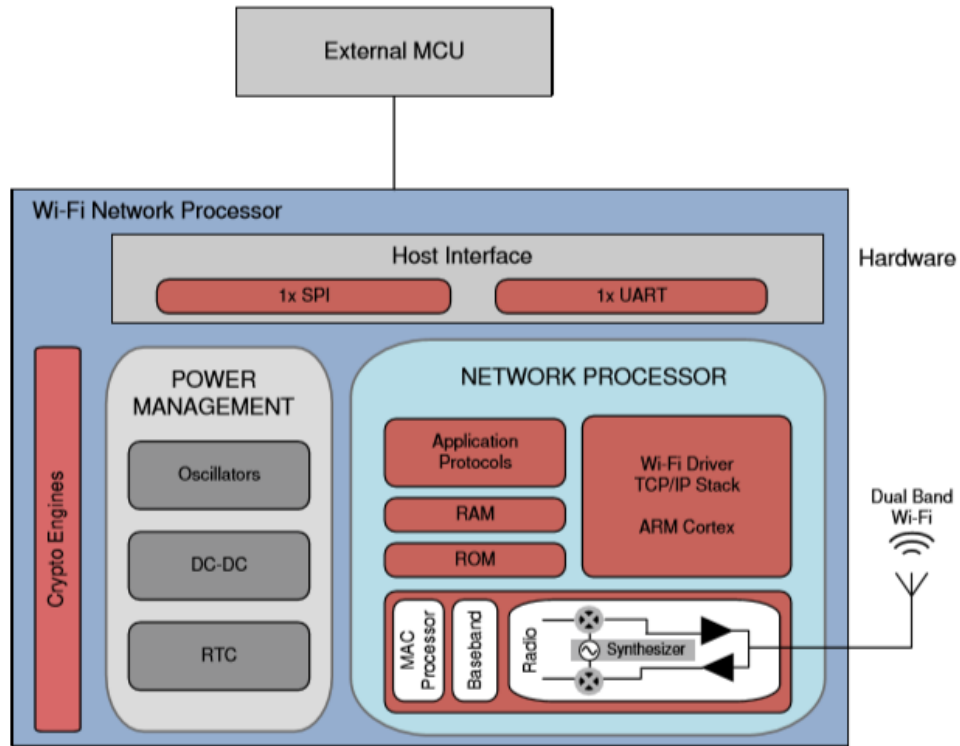


Figure 2. CC3135 Hardware Overview

Figure 3 shows an overview of the CC3135 embedded software.

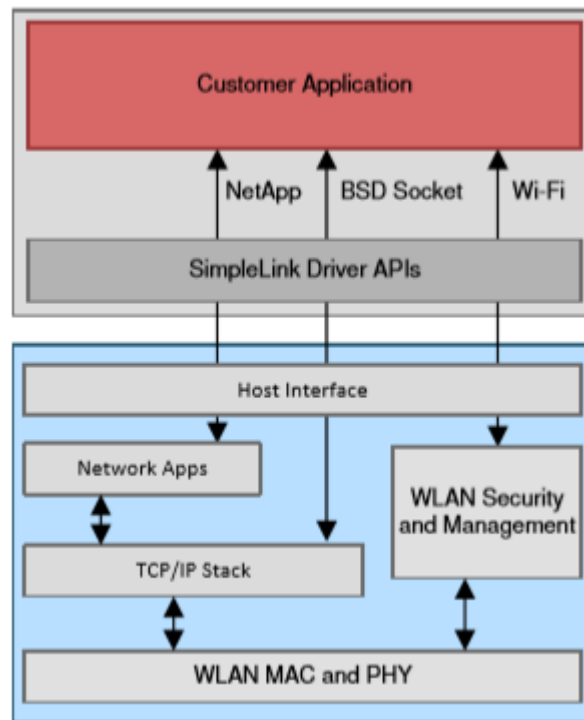


Figure 3. CC3135 Embedded Software

### 3. Pinout

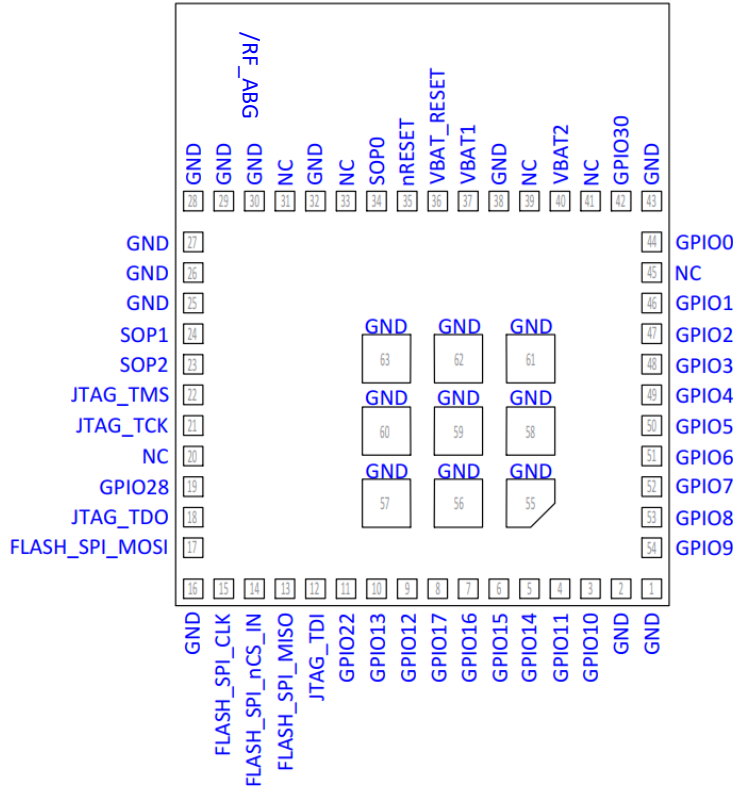


Figure 4. Pin Diagram Bottom View

#### 3.1 Pin Attributes

Table 3-1 describes the BDE-WF3135 pins.

Table 3-1. Pin Description

Pin #	DEFAULT FUNCTION	STATE AT RESET AND HIBERNATE	I/O TYPE <sup>(1)</sup>	DESCRIPTION
1	GND	–	Power	GND
2	GND	–	Power	GND
3	DIO10	–	I/O	Digital input or output
4	nHIB	Hi-Z	I	Hibernate signal input to the NWP subsystem (active low). This is connected to the MCU GPIO. If the GPIO from the MCU can float while the MCU enters low power, consider adding a pullup resistor on the board to avoid floating.
5	HOST_SPI_CLK	Hi-Z	I	Host interface SPI clock
6	HOST_SPI_MOSI	Hi-Z	I	Host interface SPI data input
7	HOST_SPI_MISO	Hi-Z	O	Host interface SPI data output
8	HOST_SPI_nCS	Hi-Z	I	Host interface SPI chip select (active low)
9	DIO12	–	O	Digital input or output



Pin #	DEFAULT FUNCTION	STATE AT RESET AND HIBERNATE	I/O TYPE <sup>(4)</sup>	DESCRIPTION
10	DIO13	–	–	Digital input or output
11	HOST_INTR	Hi-Z	O	Interrupt output (active high)
12	DIO23	Hi-Z		Digital input or output
13	FLASH_SPI_MISO	Hi-Z	I	External Serial Flash Programming: SPI data in
14	FLASH_SPI_CS	Hi-Z	O	External Serial Flash Programming: SPI chipselect (active low)
15	FLASH_SPI_CLK	Hi-Z	O	External Serial Flash Programming: SPI clock
16	GND	–	Power	Ground
17	FLASH_SPI_MOSI	Hi-Z	O	External Serial Flash Programming: SPI data out
18	DIO24	Hi-Z		Digital input or output
19	DIO28	–	–	Digital input or output
20	NC	–	–	No Connect or RF_ABG
21	Reserved	Hi-Z	–	No Connect
22	DIO29	Hi-Z		Digital input or output
23	SOP2	Hi-Z	O	A 100 kΩ pull down resistor is internally tied to this SOP pin.
24	SOP1	Hi-Z	–	A 100 kΩ pull down resistor is internally tied to this SOP pin. SOP[2:0] used for factory restore.
25	GND	–	Power	GND
26	GND	–	Power	GND
27	GND	–	Power	GND
28	GND	–	Power	GND
29	GND	–	Power	GND
30	GND	–	Power	GND
31	NC	–	–	No Connect or RF_ABG
32	GND	–	Power	GND
33	NC / RF_ABG	–	–	No Connect
34	SOP0	Hi-Z	–	A 100 kΩ pull down resistor is internally tied to this SOP pin. SOP[2:0] used for factory restore.
35	nRESET	Hi-Z	I	There is an internal 100 kΩ pull-up resistor option from the nRESET pin to VBAT_RESET. Note: VBAT_RESET is not connected to VBAT1 or VBAT2 within the module. The following connection schemes are recommended:
36	VBAT_RESET	Hi-Z	–	<ul style="list-style-type: none"> <li>Connect nRESET to a GPIO from the host only if nRESET will be in a defined state under all operating conditions. Leave VBAT_RESET unconnected to save power.</li> <li>If nRESET cannot be in a defined state under all operating conditions, connect VBAT_RESET to the main module power supply (VBAT1 and VBAT2). Due to the internal pull-up resistor, a leakage current of 3.3 V / 100 kΩ is expected.</li> </ul>
37	VBAT1	Hi-Z	-	Power supply for the module, must be connected to battery (2.3 V to 3.6 V)
38	GND	–	Power	GND
39	NC	–	–	No Connect
40	VBAT2	Hi-Z	-	Power supply for the module, must be connected to battery (2.3 V to 3.6 V)
41	NC	–	–	No Connect
42	DIO30	Hi-Z	–	Network Scriptor I/O
43	GND	–	Power	GND
44	UART1_nRTS	Hi-Z	O	UART interface to host (request to send)

Pin #	DEFAULT FUNCTION	STATE AT RESET AND HIBERNATE	I/O TYPE <sup>(1)</sup>	DESCRIPTION
45	NC	–	–	No Connect
46	UART1_TX	Hi-Z	O	UART interface to host (transmit)
47	UART1_RX	Hi-Z	I	UART interface to host (receive)
48	TEST_58	Hi-Z	O	Test signal; connect to an external test point.
49	TEST_59	Hi-Z	O	Test signal; connect to an external test point.
50	TEST_60	Hi-Z	O	Test signal; connect to an external test point.
51	UART1_nCTS	Hi-Z	I	UART interface to host (clear to send)
52	TEST_62	Hi-Z	O	Test signal; connect to an external test point.
53	DIO8	Hi-Z		Digital input or output
54	DIO9	Hi-Z	–	Digital input or output

(1) I = input, O = output, RF = radio frequency, I/O = bidirectional

## 3.2 Signal Descriptions

**Table 3-2: Signal Descriptions**

FUNCTION	SIGNAL NAME	PIN NO.	PIN TYPE	SIGNAL DIRECTION	DESCRIPTION
Antenna selection	DIO10	3	I/O	O	Antenna selection control
	DIO12	9	I/O	O	
	DIO13	10	I/O	O	
	DIO23	12	I/O	O	
	DIO24	18	I/O	O	
	DIO28	19 <a href="#">(1)</a>	I/O	O	
	DIO29	22	I/O	O	
	DIO25	23	O	O	
	DIO30	42 <a href="#">(1)</a>	I/O	O	
	DIO3	48	I/O	O	
	DIO4	49	I/O	O	
	DIO5	50	I/O	O	
	DIO8	53	I/O	O	
	DIO9	54	I/O	O	
BLE/2.4 GHz Radio coexistence <a href="#">(2)</a>	DIO10	3	I/O	I/O	Coexistence inputs and outputs
	DIO12	9	I/O	I/O	
	DIO13	10	I/O	I/O	
	DIO23	12	I/O	I/O	
	DIO24	18	I/O	I/O	
	DIO28	19 <a href="#">(1)</a>	I/O	I/O	
	DIO29	22	I/O	I/O	
	DIO30	42 <a href="#">(1)</a>	I/O	I/O	
	DIO3	48	I/O	I/O	
	DIO4	49	I/O	I/O	
	DIO5	50	I/O	I/O	
	DIO8	53	I/O	I/O	
	DIO9	54	I/O	I/O	
	Hostless Mode	DIO10	3	I/O	
DIO12		9	I/O	I/O	
DIO13		10	I/O	I/O	
DIO23		12	I/O	I/O	
DIO24		18	I/O	I/O	
DIO28		19 <a href="#">(1)</a>	I/O	I/O	
DIO29		22	I/O	I/O	
DIO25		23	O	O	
DIO30		42 <a href="#">(1)</a>	I/O	I/O	
DIO3		48	I/O	I/O	
DIO4		49	I/O	I/O	
DIO5		50	I/O	I/O	
DIO8		53	I/O	I/O	
DIO9		54	I/O	I/O	

Table3-2. Signal Descriptions (continued)

FUNCTION	SIGNAL NAME	PIN NO.	PIN TYPE	SIGNAL DIRECTION	DESCRIPTION
HOST SPI	HOST_SPI_CLK	5	I/O	I	Host SPI clock input
	HOST_SPI_MOSI	6	I/O	I	Data from Host
	HOST_SPI_MISO	7	I/O	O	Data to Host
	HOST_SPI_nCS	8	I/O	I	Device select (active low)
FLASH SPI	FLASH_SPI_DIN	13	I	I	External serial Flash interface: SPI data in
	FLASH_SPI_CS	14	O	O	External serial Flash interface: SPI chip select (active low)
	FLASH_SPI_CLK	15	O	O	External serial Flash interface: SPI clock
	FLASH_SPI_MOSI	17	O	O	External serial Flash interface: SPI data out
UART	UART1_nRTS	44	I/O	O	UART1 request-to-send (active low)
	UART1_TX	46	I/O	I	UART TX data
	UART1_RX	47	I/O	O	UART RX data
	UART1_nCTS	51	I/O	I	UART1 clear-to-send (active low)
Sense-On-Power	SOP2	23 <sup>(3)</sup>	O	I	Sense-on-power 2
	SOP1	24	I	I	Configuration sense-on-power 1
	SOP0	34	I	I	Configuration sense-on-power 0
Power	VBAT1	37	-	-	Power supply for the module
	VBAT2	40	-	-	Power supply for the module
nHIB	nHIB	4	I	I	Hibernate signal input to the NWP subsystem (active low)
RF	RF_ABG	31	NC	NC	WLAN analog RF 802.11 a/b/g/n bands
Test Port	TEST_58	48	O	O	Test Signal
	TEST_59	49	I	I	Test Signal
	TEST_60	50	O	O	Test Signal
	TEST_62	52	O	O	Test Signal

(1) LPDS retention unavailable.

(2) The BDE-WF3135 are compatible with TI BLE modules using an external RF switch.

(3) This pin has dual functions: as a SOP[2] (device operation mode), and as an external TCXO enable. As a TCXO enable, the pin is an output on power up and driven logic high. During hibernate low-power mode, the pin is in a Hi-Z state but is pulled down for SOP mode to disable TCXO. Because of the SOP functionality, the pin must be used as an output only.

### 3.3 Connections for Unused Pins

All unused pins must be left as no connect (NC) pins. Table 3-3 provides a list of NC pins.

**Table3-3. Connections for Unused Pins**

FUNCTION	SIGNAL DESCRIPTION	PIN NUMBER	ACCEPTABLE PRACTICE
DIO	Digital input or output	3, 9, 10, 12, 18, 19, 22, 42, 53, 54	Wake up I/O source should not be floating during hibernate. All the I/O pins will float while in Hibernate and Reset states. Ensure pullup and pulldown resistors are available on board to maintain the state of the I/O. Leave unused GPIOs as NC
No Connect	NC	20, 21, 31, 33, 39, 41, 45	Unused pin, leave as NC.
SOP	Configuration sense-on-power	23, 24, 34	Leave as NC (Modules contain internal 100 kΩ pull down resistors on the SOP lines). An external 10 kΩ pull up resistor is required for factory restore.
Reset	RESET input for the device	35, 36	<p>There is an internal 100 kΩ pull-up resistor option from the nRESET pin to VBAT_RESET. Note: VBAT_RESET is not connected to VBAT1 or VBAT2 within the module. The following connection schemes are recommended:</p> <ul style="list-style-type: none"> <li>Connect nRESET to a GPIO from the host only if nRESET will be in a defined state under all operating conditions. Leave VBAT_RESET unconnected to save power.</li> <li>If nRESET cannot be in a defined state under all operating conditions, connect VBAT_RESET to the main module power supply (VBAT1 and VBAT2). Due to the internal pull-up resistor, a leakage current of 3.3 V / 100 kΩ is expected.</li> </ul>

## 4. Characteristics

All MIN/MAX specification limits are guaranteed by design, production testing and/or statistical characterization. Typical values are based on characterization results at default measurement conditions and are informative only.

Default measurement conditions (unless otherwise specified): VBAT= 3.0 V, TA = 25 °C. All radio measurements are performed with standard RF measurement equipment.

### 4.1. Absolute Maximum Ratings

These specifications indicate levels where permanent damage to the module can occur. Functional operation is not ensured under these conditions. Operation at absolute maximum conditions for extended periods can adversely affect long-term reliability of the module [\(1\)\(2\)](#).

**Table 4-1. Absolute Maximum Ratings**

Parameter	Min	Max	Unit
V <sub>BAT</sub>	-0.5	3.8	V
Digital I/O	-0.5	VBAT + 0.5	V
RF pin	-0.5	2.1	V
Analog pins	-0.5	2.1	V
Operating temperature, T <sub>A</sub>	-40	85	°C
Storage temperature, T <sub>stg</sub>	-40	85	°C
Junction temperature, T <sub>j</sub> <a href="#">(3)</a>		120	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) All voltage values are with respect to VSS, unless otherwise noted.

(3) Junction temperature is for the CC3135RNMARGK device that is contained within the module.

### 4.2. Recommended Operating Conditions

Function operation is not ensured outside this limit, and operation outside this limit for extended periods can adversely affect long-term reliability of the module [\(1\)\(2\)\(3\)](#).

**Table 4-2. Recommended Operating Conditions**

Parameter	Min	Typ	Max	Unit
V <sub>BAT</sub>	2.3	3.3	3.6	V
Operating temperature	-40	25	85	°C
Ambient thermal slew	-20		20	°C/minute

(1) When operating at an ambient temperature of over 75°C, the transmit duty cycle must remain below 50% to avoid the auto-protect feature of the power amplifier. If the auto-protect feature triggers, the device takes a maximum of 60 seconds to restart the transmission.

(2) To ensure WLAN performance, ripple on the 2.3-V to 3.6-V supply must be less than ±300 mV.

(3) The minimum voltage specified includes the ripple on the supply voltage and all other transient dips. The brownout condition is 2.1 V, and care must be taken when operating at the minimum specified voltage.

### 4.3. Current Consumption Summary: 2.4GHz GF Band

T<sub>A</sub> = 25°C, V<sub>BAT</sub> = 3.6 V

PARAMETER	TEST CONDITIONS <sup>(1)(2)</sup>	MIN	TYP	MAX	UNIT	
TX	1 DSSS	TX power level = 0		280	mA	
		TX power level = 4		205		
	6 OFDM	TX power level = 0		252		
		TX power level = 4		180		
	54 OFDM	TX power level = 0		220		
		TX power level = 4		160		
RX <sup>(3)</sup>	1 DSSS			55	mA	
	54 OFDM			54		
Idle connected <sup>(4)</sup>				685	μA	
LPDS				120	μA	
Hibernate				6	μA	
Shutdown				1	μA	
Peak calibration current <sup>(3)(5)</sup>	V <sub>BAT</sub> = 3.6 V				430	mA
	V <sub>BAT</sub> = 3.3 V				450	
	V <sub>BAT</sub> = 2.3 V				600	

- (1) TX power level = 0 implies maximum power. TX power level = 4 implies output power backed off approximately 4 dB.
- (2) The BDE-WF3135 system is a constant power-source system. The active current numbers scale based on the V<sub>BAT</sub> voltage supplied.
- (3) The RX current is measured with a 1-Mbps throughput rate.
- (4) DTIM = 1
- (5) The complete calibration can take up to 17 mJ of energy from the battery over a time of 24 ms. In default mode, calibration is performed sparingly, and typically occurs when re-enabling the NWP and when the temperature has changed by more than 20°C. There are two additional calibration modes that may be used to reduced or completely eliminate the calibration event.

### 4.4. Current Consumption Summary: 5 GHz RF Band

T<sub>A</sub> = 25°C, V<sub>BAT</sub> = 3.6 V

PARAMETER	TEST CONDITIONS <sup>(1)(2)</sup>	MIN	TYP	MAX	UNIT	
TX	6 OFDM			325	mA	
	54 OFDM			300		
RX <sup>(3)</sup>	54 OFDM			65	mA	
Idle connected <sup>(4)</sup>				700	μA	
LPDS				120	μA	
Hibernate				6	μA	
Shutdown				1	μA	
Peak calibration current <sup>(5)(3)</sup>	V <sub>BAT</sub> = 3.6 V				300	mA
	V <sub>BAT</sub> = 3.3 V				305	
	V <sub>BAT</sub> = 2.7 V				300	
	V <sub>BAT</sub> = 2.3 V				350	

- (1) TX power level = 0 implies maximum power. TX power level = 4 implies output power backed off approximately 4 dB.
- (2) The BDE-WF3135 system is a constant power-source system. The active current numbers scale based on the V<sub>BAT</sub> voltage supplied.
- (3) The RX current is measured with a 1-Mbps throughput rate.
- (4) DTIM = 1
- (5) The complete calibration can take up to 17 mJ of energy from the battery over a time of 24 ms. In default mode, calibration is performed sparingly, and typically occurs when re-enabling the NWP and when the temperature has changed by more than 20°C. There are two additional calibration modes that may be used to reduced or completely eliminate the calibration event.

## 4.5. Electrical Characteristics for DIO Pins

 $T_A = 25^\circ\text{C}$ ,  $V_{\text{BAT}} = 3.3\text{ V}$ 

PARAMETER		TEST CONDITIONS(1)	MIN	NOM	MAX	UNIT
$C_{\text{IN}}$	Pin capacitance			4		pF
$V_{\text{IH}}$	High-level input voltage		$0.65 \times V_{\text{DD}}$		$V_{\text{DD}} + 0.5\text{ V}$	V
$V_{\text{IL}}$	Low-level input voltage		-0.5		$0.35 \times V_{\text{DD}}$	V
$I_{\text{IH}}$	High-level input current			5		nA
$I_{\text{IL}}$	Low-level input current			5		nA
$V_{\text{OH}}$	High-level output voltage	IL = 2 mA; configured I/O drive strength = 2 mA; $2.4\text{ V} \leq V_{\text{DD}} < 3.6\text{ V}$			$V_{\text{DD}} \times 0.8$	V
		IL = 4 mA; configured I/O drive strength = 4 mA; $2.4\text{ V} \leq V_{\text{DD}} < 3.6\text{ V}$			$V_{\text{DD}} \times 0.7$	V
		IL = 8 mA; configured I/O drive strength = 8 mA; $2.4\text{ V} \leq V_{\text{DD}} < 3.6\text{ V}$			$V_{\text{DD}} \times 0.7$	V
		IL = 2 mA; configured I/O drive strength = 2 mA; $2.3\text{ V} \leq V_{\text{DD}} < 2.4\text{ V}$			$V_{\text{DD}} \times 0.75$	V
$V_{\text{OL}}$	Low-level output voltage	IL = 2 mA; configured I/O drive strength = 2 mA; $2.4\text{ V} \leq V_{\text{DD}} < 3.6\text{ V}$	$V_{\text{DD}} \times 0.2$			V
		IL = 4 mA; configured I/O drive strength = 4 mA; $2.4\text{ V} \leq V_{\text{DD}} < 3.6\text{ V}$	$V_{\text{DD}} \times 0.2$			V
		IL = 8 mA; configured I/O drive strength = 8 mA; $2.4\text{ V} \leq V_{\text{DD}} < 3.6\text{ V}$	$V_{\text{DD}} \times 0.2$			V
		IL = 2 mA; configured I/O drive strength = 2 mA; $2.3\text{ V} \leq V_{\text{DD}} < 2.4\text{ V}$	$V_{\text{DD}} \times 0.25$			V
$I_{\text{OH}}$	High-level source current	2-mA drive		2		mA
		4-mA drive		4		
		6-mA drive		6		
$I_{\text{OL}}$	Low-level sink current	2-mA drive		2		mA
		4-mA drive		4		
		6-mA drive		6		
$V_{\text{IL}}$	nRESET(2)		0.6			V

(1) We recommend using the lowest possible drive strength that is adequate for the applications. This recommendation minimizes the risk of interference to the WLAN radio and reduces any potential degradation of RF sensitivity and performance. The default drive strength setting is 6 mA.

(2) The nRESET pin must be held below 0.6 V for the device to register a reset.



### 4.6. BLE and WLAN Coexistence Requirements

For proper BLE and WLAN 2.4 GHz radio coexistence, the following requirements must be met.

**Table 4-3. BLE/WLAN Coex (1) Isolation Requirement**

PARAMETER	Band	MIN	TYP	MAX	UNIT
Port-to-port isolation	Dual antenna configuration(2)	20(3)			dB

(1) The BDE-WF3135 are compatible with TI BLE modules using an external RF switch.

(2) A single antenna configuration is possible using the CC3x35 devices.

(3) For dual antenna configuration antenna placement must be such that isolation between the BLE and WLAN ports is at least 20 dB.

### 4.7. Reset Requirement

PARAMETER	MIN	TYP	MAX	UNIT
V <sub>IH</sub> Operation mode level		0.65 × V <sub>BAT</sub>		V
V <sub>IL</sub> Shutdown mode level(1)	0	0.6		V
Minimum time for nReset low for resetting the module	5			ms
T <sub>r</sub> and T <sub>f</sub> Rise and fall times		20		μs

(1) The nRESET pin must be held below 0.6 V for the module to register a reset.

### 4.8. Thermal Resistance Characteristics for MOB Package

NO.	PARAMETER	DESCRIPTION	°C/W(1)(2)	AIR FLOW (m/s) (3)
T1	R <sub>θJC</sub>	Junction-to-case	11.5	N/A
T2	R <sub>θJB</sub>	Junction-to-board	8.0	N/A
T3	R <sub>θJA</sub>	Junction-to-free air	19.3	0
T4		Junction-to-moving air	14.5	1
T5		Junction-to-moving air	13.4	2
T6		Junction-to-moving air	12.2	3
T7	ψ <sub>JT</sub>	Junction-to-free air	5.5	0
T8		Junction-to-package top	5.2	1
T9		Junction-to-package top	6.3	2
T10		Junction-to-package top	6.5	3
T11	ψ <sub>JB</sub>	Junction-to-free air	6.5	0
T12		Junction-to-board	6.8	1
T13		Junction-to-board	6.8	2
T14		Junction-to-board	6.6	3

(1) °C/W = degrees Celsius per watt.

(2) These values are based on a JEDEC-defined 2S2P system (with the exception of the Theta JC [R<sub>θJC</sub>] value, which is based on a JEDEC-defined 1S0P system) and will change based on environment as well as application. For more information, see these EIA/JEDEC standards:

- JESD51-2, *Integrated Circuits Thermal Test Method Environmental Conditions - Natural Convection (Still Air)*
- JESD51-3, *Low Effective Thermal Conductivity Test Board for Leaded Surface Mount Packages*
- JESD51-7, *High Effective Thermal Conductivity Test Board for Leaded Surface Mount Packages*
- JESD51-9, *Test Boards for Area Array Surface Mount Package Thermal Measurements*

Power dissipation of 2 W and an ambient temperature of 70°C is assumed.

(3) m/s = meters per second.

## 5. Detailed Description

### 5.1 Overview

The BDE-WF3135 dual-band Wi-Fi module contains a dedicated Arm<sup>®</sup> MCU that offloads many of the networking activities from the host MCU. Including an 802.11 a/b/g/n radio, baseband, and MAC with a powerful crypto engine for a fast, secure WLAN and Internet connections with 256-bit encryption. The BDE-WF3135 module supports station, AP, and Wi-Fi Direct modes. The device also supports WPA2 personal and enterprise security, WPS 2.0, and WPA3 personal. The Wi-Fi network processor includes an embedded IPv6 and IPv4 TCP/IP stack.

### 5.2 Module Features

#### 5.2.1 WLAN

The WLAN features are as follows:

- 802.11 a/b/g/n integrated radio, modem, and MAC supporting WLAN communication as a BSS station, AP, and Wi-Fi Direct client and group owner with CCK and OFDM rates in the 2.4 GHz ISM band, channels 1 to 13, and 5 GHz U-NII band.
- Autocalibrated radio with a single-ended 50-Ω interface enables easy connection to the antenna without requiring expertise in radio circuit design.
- Advanced connection manager with multiple user-configurable profiles stored in a serial Flash allows automatic, fast connection to an access point without user or host intervention.
- Supports all common Wi-Fi security modes for personal and enterprise networks, with on-chip security accelerators, including WEP, WPA/WPA2 PSK, WPA2 Enterprise (802.1x), WPA3 Personal.
- Smart provisioning options deeply integrated within the device provide a comprehensive end-to-end solution. Elaborate events notification to the host enable the application to control the provisioning decision flow. The wide variety of Wi-Fi provisioning methods include:
  - Access Point using HTTPS
  - SmartConfig Technology: a 1-step, 1-time process to connect a BDE-WF3135MOD-enabled module to the home wireless network, removing dependency on the I/O capabilities of the host MCU; thus, the device is usable by deeply embedded applications.
- 802.11 transceiver mode transmits and receives proprietary data through a socket without adding MAC or PHY headers, and provides the option to select the working

- channel, rate, and transmitted power. The receiver mode works together with the filtering options.

### 5.2.2 Network Stack

The network stack features are as follows:

- Integrated IPv4, IPv6, and TCP/IP stack with BSD socket APIs for simple Internet connectivity with any MCU, microprocessor, or ASIC

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**Note**

Not all APIs are 100% BSD compliant. Not all BSD APIs are supported.

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- Support of 16 simultaneous TCP, UDP, RAW, SSL\TLS sockets
- Built-in network protocols:
  - Static IP, LLA, DHCPv4, DHCPv6 (Stateful) with DAD and Stateless auto configuration
  - ARP, ICMPv4, IGMP, ICMPv6, MLD, ND
  - DNS client for easy connection to the local network and the Internet
- Built-in network application and utilities:
  - HTTP/HTTPS
    - Web page content stored on serial Flash
    - RESTful APIs for setting\configuring application content
    - Dynamic user callbacks
- Service discovery: Multicast DNS service discovery allows a client to advertise its service without a centralized server. After connecting to the access point, the BDE-WF3135 device provides critical information, such as device name, IP, vendor, and port number.
- DHCP server
- Ping

Table 5-1 summarizes the NWP features.

**Table 5-1. NWP Features**

Feature	Description
Wi-Fi standards	802.11a/b/g/n station 802.11a/b/g AP supporting up to four stations Wi-Fi Direct client and group owner
Wi-Fi channels	2.4 GHz ISM and 5 GHz U-NII Channels
Channel Bandwidth	20 MHz
Wi-Fi security	WEP, WPA/WPA2 PSK, WPA2 enterprise (802.1x), WPA3 personal(1)
Wi-Fi provisioning	SmartConfig technology, Wi-Fi protected setup (WPS2), AP mode with internal HTTP web server
IP protocols	IPv4/IPv6
IP addressing	Static IP, LLA, DHCPv4, DHCPv6 with DAD
Cross layer	ARP, ICMPv4, IGMP, ICMPv6, MLD, NDP
Transport	UDP, TCP SSLv3.0/TLSv1.0/TLSv1.1/TLSv1.2 RAW

Table 5-1. NWP Features (continued)

Feature	Description
Network applications and utilities	Ping HTTP/HTTPS web server mDNS DNS-SD DHCP server
Host interface	UART/SPI
Security	Device identity Trusted root-certificate catalog TI root-of-trust public key
Power management	Enhanced power policy management uses 802.11 power save and deep-sleep power modes
Other	Transceiver Programmable RX filters with event-trigger mechanism Rx Metrics for tracking the surrounding RF environment

(1) Supported from Service Pack v4.5.0.11-3.1.0.5-3.1.0.25. Limited to STA mode only.

### 5.2.2.1 Security

The BDE-WF3135 internet-on-a chip module enhances the security capabilities available for development of IoT devices, while completely offloading these activities from the MCU to the networking subsystem. The security capabilities include the following key features:

#### Wi-Fi and Internet security

- Personal and enterprise Wi-Fi security
  - Personal standards
    - AES (WPA2-PSK)
    - TKIP (WPA-PSK)
    - WEP
- **Enterprise standards**
  - EAP Fast
  - EAP PEAPv0 MSCHAPv2
  - EAP PEAPv0 TLS
  - EAP PEAPv1 TLS EAP LS
  - EAP TTLS TLS
  - EAP TTLS MSCHAPv2
- **Secure sockets**
  - Protocol versions: SSL v3/TLS 1.0/TLS 1.1/TLS 1.2
  - On-chip powerful crypto engine for fast, secure Wi-Fi and internet connections with 256-bit AES encryption for TLS and SSL connections
  - Ciphers suites
    - SL\_SEC\_MASK\_SSL\_RSA\_WITH\_RC4\_128\_SHA
    - SL\_SEC\_MASK\_SSL\_RSA\_WITH\_RC4\_128\_MD5
    - SL\_SEC\_MASK\_TLS\_RSA\_WITH\_AES\_256\_CBC\_SHA
    - SL\_SEC\_MASK\_TLS\_DHE\_RSA\_WITH\_AES\_256\_CBC\_SHA
    - SL\_SEC\_MASK\_TLS\_ECDHE\_RSA\_WITH\_AES\_256\_CBC\_SHA
    - SL\_SEC\_MASK\_TLS\_ECDHE\_RSA\_WITH\_RC4\_128\_SHA
    - SL\_SEC\_MASK\_TLS\_RSA\_WITH\_AES\_128\_CBC\_SHA256

- SL\_SEC\_MASK\_TLS\_RSA\_WITH\_AES\_256\_CBC\_SHA256
- SL\_SEC\_MASK\_TLS\_ECDHE\_RSA\_WITH\_AES\_128\_CBC\_SHA256
- SL\_SEC\_MASK\_TLS\_ECDHE\_ECDSA\_WITH\_AES\_128\_CBC\_SHA256
- SL\_SEC\_MASK\_TLS\_ECDHE\_ECDSA\_WITH\_AES\_128\_CBC\_SHA
- SL\_SEC\_MASK\_TLS\_ECDHE\_ECDSA\_WITH\_AES\_256\_CBC\_SHA
- SL\_SEC\_MASK\_TLS\_RSA\_WITH\_AES\_128\_GCM\_SHA256
- SL\_SEC\_MASK\_TLS\_RSA\_WITH\_AES\_256\_GCM\_SHA384
- SL\_SEC\_MASK\_TLS\_DHE\_RSA\_WITH\_AES\_128\_GCM\_SHA256
- SL\_SEC\_MASK\_TLS\_DHE\_RSA\_WITH\_AES\_256\_GCM\_SHA384
- SL\_SEC\_MASK\_TLS\_ECDHE\_RSA\_WITH\_AES\_128\_GCM\_SHA256
- SL\_SEC\_MASK\_TLS\_ECDHE\_RSA\_WITH\_AES\_256\_GCM\_SHA384
- SL\_SEC\_MASK\_TLS\_ECDHE\_ECDSA\_WITH\_AES\_128\_GCM\_SHA256
- SL\_SEC\_MASK\_TLS\_ECDHE\_ECDSA\_WITH\_AES\_256\_GCM\_SHA384
- SL\_SEC\_MASK\_TLS\_ECDHE\_ECDSA\_WITH\_CHACHA20\_POLY1305\_SHA256
- SL\_SEC\_MASK\_TLS\_ECDHE\_RSA\_WITH\_CHACHA20\_POLY1305\_SHA256
- SL\_SEC\_MASK\_TLS\_DHE\_RSA\_WITH\_CHACHA20\_POLY1305\_SHA256
- Server authentication
- Client authentication
- Domain name verification
- Socket upgrade to secure socket – STARTTLS
- Secure HTTP server (HTTPS)
- The trusted root-certificate catalog verifies that the CA used by the application is trusted and known secure content delivery.
- The TI root-of-trust public key is a hardware-based mechanism that allows authenticating TI as the genuine origin of a given content using asymmetric keys.
- Secure content delivery allows file transfer to the system in a secure way on any unsecured tunnel.
- Code and data security
  - Secured network information: Network passwords and certificates are encrypted
  - Secured and authenticated service pack: SP is signed based on TI certificate

### 5.3 Restoring Factory Default Configuration

The device has an internal recovery mechanism that allows rolling back the file system to its predefined factory image or restoring the factory default parameters of the device. The factory image is kept in a separate sector on the sFLASH in a secure manner and cannot be accessed from the host processor. The following restore modes are supported:

- None—no factory restore settings
- Enable restore of factory default parameters
- Enable restore of factory image and factory default parameters

The restore process is performed by pulling or forcing SOP[2:0] = 011 pins and toggling the nRESET pin from low to high.

The process is fail-safe and resumes operation if a power failure occurs before the restore is finished. The restore process typically takes about 8 seconds, depending on the attributes of the serial Flash vendor.

### 5.4 Hostless Mode

The BDE-WF3135 device incorporates a scripting ability that enables offloading of simple tasks from the host processor. Using simple and conditional scripts, repetitive tasks can be handled internally, which allows the host processor to remain in a low-power state. In some cases where the scripter is being used to send packets, it reduces code footprint and memory consumption. The *if-this-then-that* style conditioning can include anything from GPIO toggling to transmitting packets.

The conditional scripting abilities can be divided into conditions and actions. The conditions define when to trigger actions. Only one action can be defined per condition, but multiple instances of the same condition may be used, so in effect multiple actions can be defined for a single condition. In total, 16 condition and action pairs can be defined. The conditions can be simple, or complex using sub-conditions (using a combinatorial AND condition between them). The actions are divided into two types, those that can occur during runtime and those that can occur only during the initialization phase.

The following actions can only be performed when triggered by the pre-initialization condition:

- Set roles AP, station, P2P, and Tag modes
- Delete all stored profiles
- Set connection policy
- Hardware GPIO indication allows an I/O to be driven directly from the WLAN core hardware to indicate internal signaling

The following actions may be activated during runtime:

- Send transceiver packet
- Send UDP packet

- Send TCP packet
- Increment counter increments one of the user counters by 1
- Set counter allows setting a specific value to a counter
- Timer control
- Set GPIO allows GPIO output from the device using the internal networking core
- Enter Hibernate state

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#### Note

Consider the following limitations:

- Timing cannot be ensured when using the network scripter because some variable latency will apply depending on the utilization of the networking core.
  - The scripter is limited to 16 pairs of conditions and reactions.
  - Both timers and counters are limited to 8 instances each. Timers are limited to a resolution of 1 second. Counters are 32 bits wide.
  - Packet length is limited to the size of one packet and the number of possible packet tokens is limited to 8.
-

## 6. Mechanical Specifications

### 6.1 Dimensions

The module dimensions are presented in the following figure 5(unit: mm).

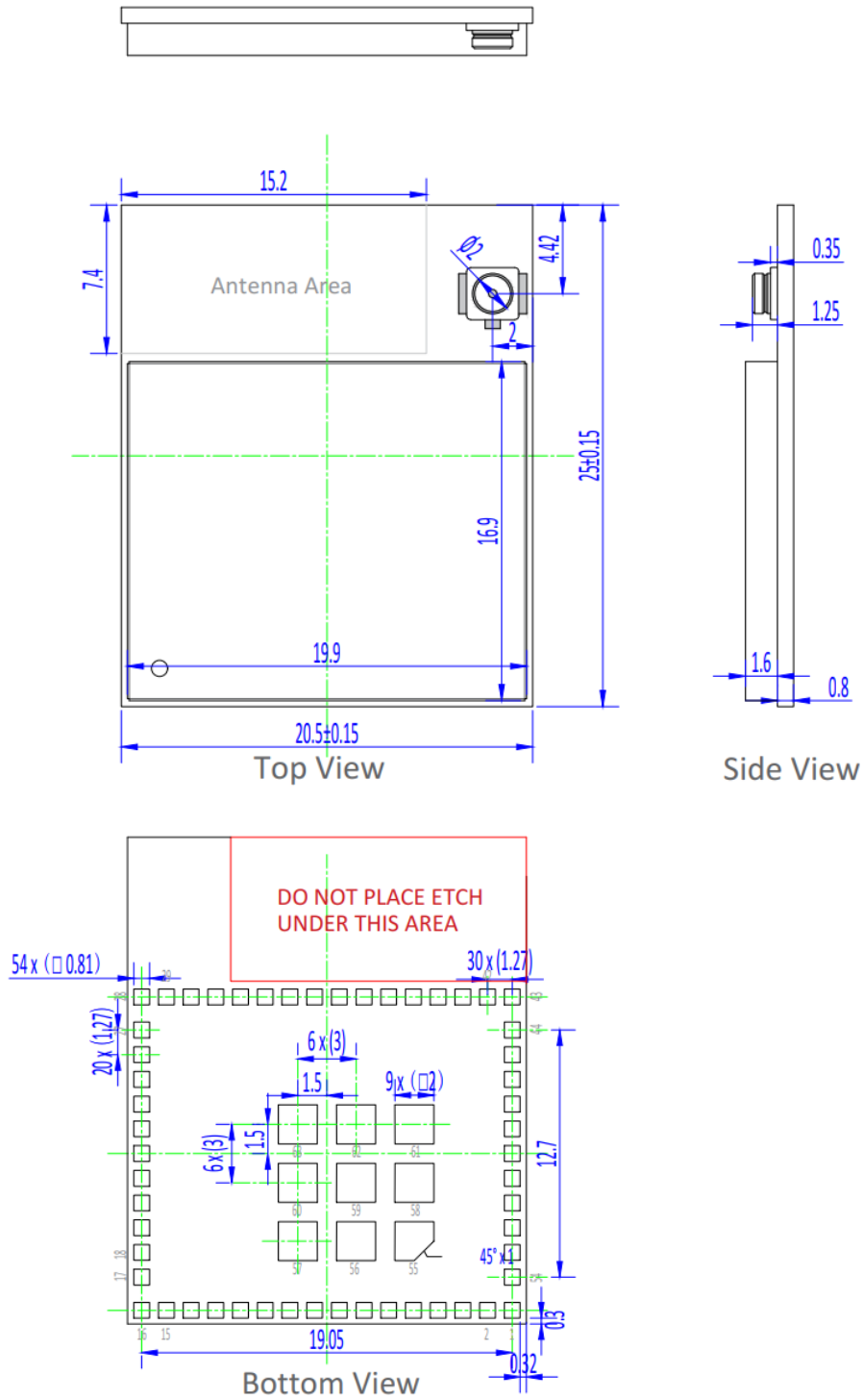
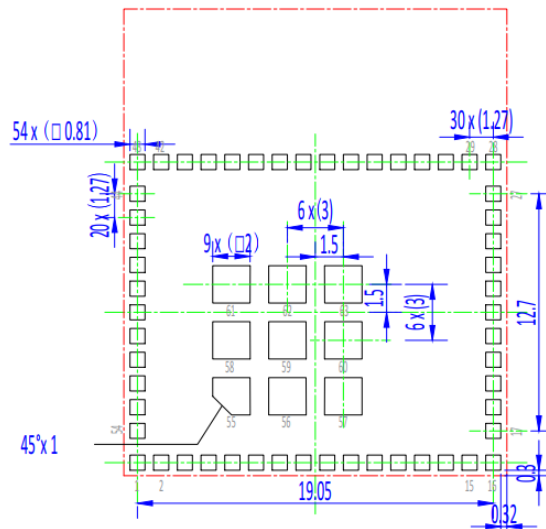


Figure 5. Mechanical Drawing



## 6.2 PCB Footprint

The footprint for the PCB is presented in the following figure (unit: mm).



**Figure 6. Module Footprint Top View**

## 7. Application Information

### 7.1 BLE/2.4 GHz Radio Coexistence

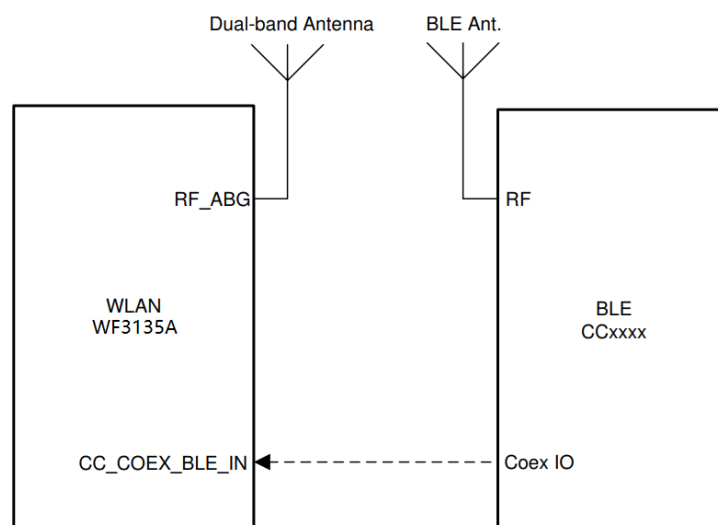
The BDE-WF3135 device is designed to support BLE/2.4 GHz radio coexistence. Because WLAN is inherently more tolerant to time-domain disturbances, the coexistence mechanism gives priority to the Bluetooth<sup>®</sup> low energy entity over the WLAN. Bluetooth<sup>®</sup> low energy operates in the 2.4 GHz band, therefore the coexistence mechanism does not affect the 5 GHz band. The BDE-WF3135 device can operate normally on the 5 GHz band, while the Bluetooth<sup>®</sup> low energy works on the 2.4 GHz band without mutual interference.

The following coexistence modes can be configured by the user:

- Off mode or intrinsic mode
  - No BLE/2.4 GHz radio coexistence, or no synchronization between WLAN and Bluetooth<sup>®</sup> low energy—in case Bluetooth<sup>®</sup> low energy exists in this mode, collisions can randomly occur.
- Time Division Multiplexing (TDM, Dual Antenna)
  - Dual-band Wi-Fi (see Figure 16)

In this mode, the WLAN can operate on either a 2.4 or 5 GHz band and Bluetooth<sup>®</sup> low energy operates on the 2.4 GHz band.

Figure 8 shows the dual antenna implementation of a complete Bluetooth<sup>®</sup> low energy and WLAN coexistence network with the WLAN operating on either a 2.4- or a 5 GHz band. Note in this implementation no Coex switch is required and only a single GPIO from the BLE device to the BDE-WF3135 device is required.



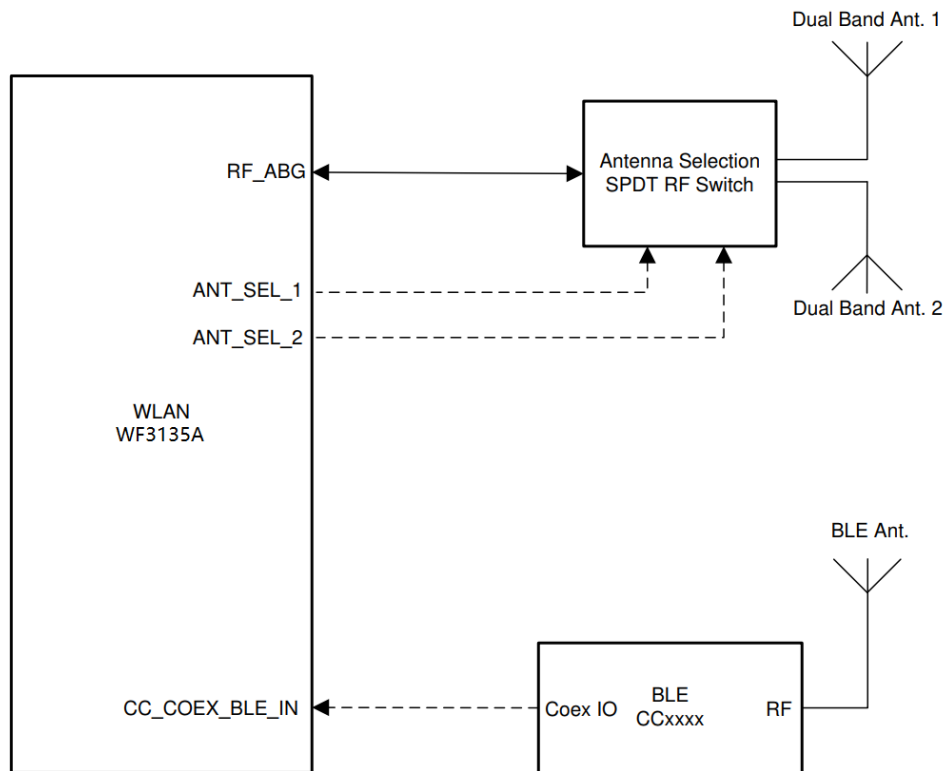
**Figure 8. Dual-Antenna Coexistence Mode Block Diagram**

## 7.2 Antenna Selection

The BDE-WF3135 device is designed to also support antenna selection and is controlled from Image Creator. When enabled, there are 3 options possible options:

- ANT 1: When selected, the GPIOs that are defined for antenna selection will set the RF path for antenna 1.
- ANT 2: When selected, the GPIOs that are defined for antenna selection will set the RF path for antenna 2.
- Auto select: When selected, during a scan and prior to connecting to an AP, BDE-WF3135 device will determine the best RF path and select the appropriate antenna. The result is the saved as port of the profile.

Figure 9 shows the antenna selection implementation for Wi-Fi, with BLE operating on it's own antenna. Note in this implementation, only a single GPIO from the BLE device to the BDE-WF3135 device is required. The Antenna switch is controlled by 2 GPIO lines from the BDE-WF3135 device.



**Figure 9. Coexistence Solution with Wi-Fi Antenna Selection and dedicated BLE antenna**

### 7.3 Typical Application

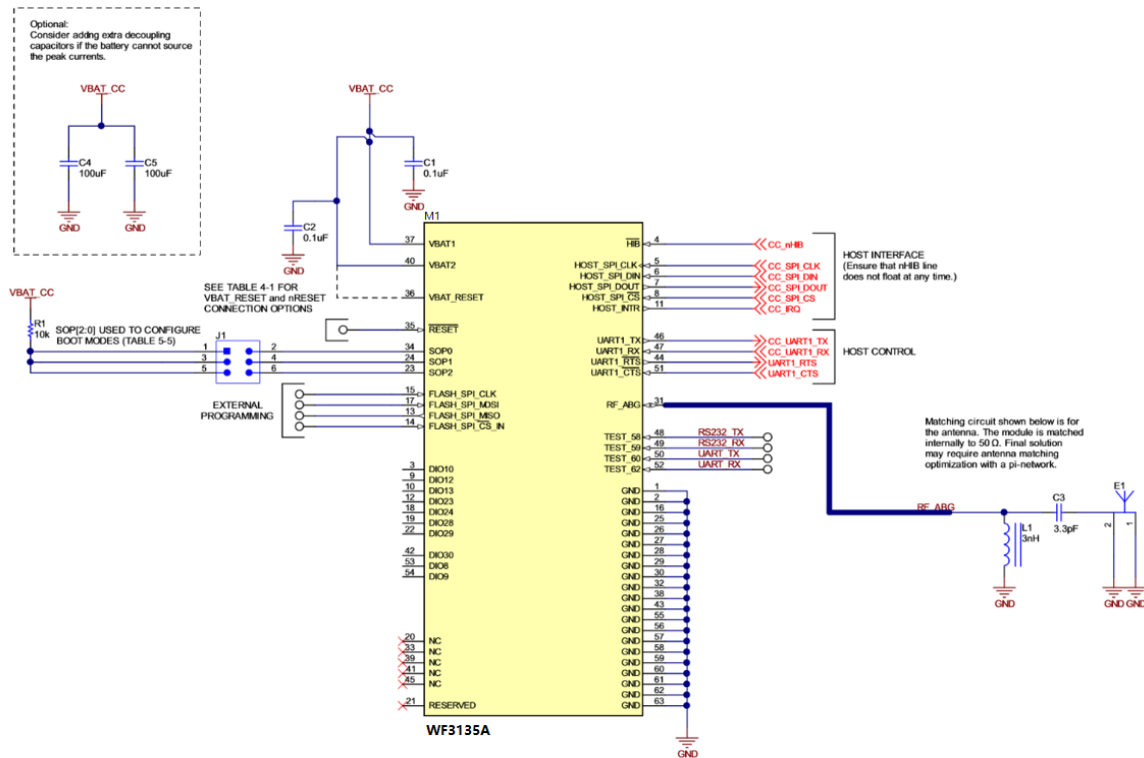


Figure 10. BDE-WF3135 Module Reference Schematic

#### Note

The following guidelines are recommended for implementation of the RF design:

- Ensure an RF path is designed with an impedance of 50 Ω
- Tuning of the antenna impedance π matching network is recommended after manufacturing of the PCB to account for PCB parasitics
- π or L matching and tuning may be required between cascaded passive components on the RF path

Table 7-1. Bill of Materials

QTY	PART REFERENCE	VALUE	MANUFACTURER	PART NUMBER	DESCRIPTION
2	C1, C2	0.1 uF	Murata	GRM155R61A104KA01D	Capacitor, ceramic, 0.1 uF, 10 V, ±10%, X5R, 0402
1	C3	3.3 pF	Murata	GJM1555C1H3R3BB01	Capacitor, ceramic, 3.3 pF, 50 V, ±0.1pF, C0G/NP0,0402
2	C4, C5	100 uF	Murata	LMK325ABJ107MMHT	Capacitor, ceramic, 100 uF, 10 V, ±20%, X5R, AEC-Q200 Grade 3, 1210
1	E1	2.4 GHz, 5 GHz Ant	Ethertronics	M830520	Antenna Bluetooth WLAN Zigbee®
1	L1	3 nH	Murata	LQG15HS3N0S02D	Inductor, Unshielded, Multilayer, 3nH, 0.8 A, 0.125Ω, SMD
1	R1	10k	Vishay-Dale	CRCW040210K0JNED	RES, 10 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402
1	M1	BDE-WF3135	BDE	BDE-WF3135	Wi-Fi® Dual-Band Network Processor Internet-of-Things Module Solution for MCU Applications, MOB0063A

## 7.4 Power Supply Decoupling and Bulk Capacitors

Depending upon routing resistors and battery type, TI recommends adding two 100- $\mu$ F ceramic capacitors to help provide the peak current drawn by the BDE-WF3135 module.

## 7.5 Reset

The module features an internal RC circuit to reset the device during power ON. The nRESET pin must be held below 0.6 V for at least 5 ms for the device to successfully reset.

## 7.6 Unused Pins

All unused pins can be left unconnected without the concern of having leakage current.

## 8. Design Guidelines

Use the following guidelines to lay out the CC3135MODAx module with an integrated antenna, as shown in Figure 11.

- The module must have an overhang of 1 mm from the PCB edge.
- The module must have a 6-mm clearance on all layers (no copper) to the left and right of the module placement.
- There must be at least one ground-reference plane under the module on the main PCB.

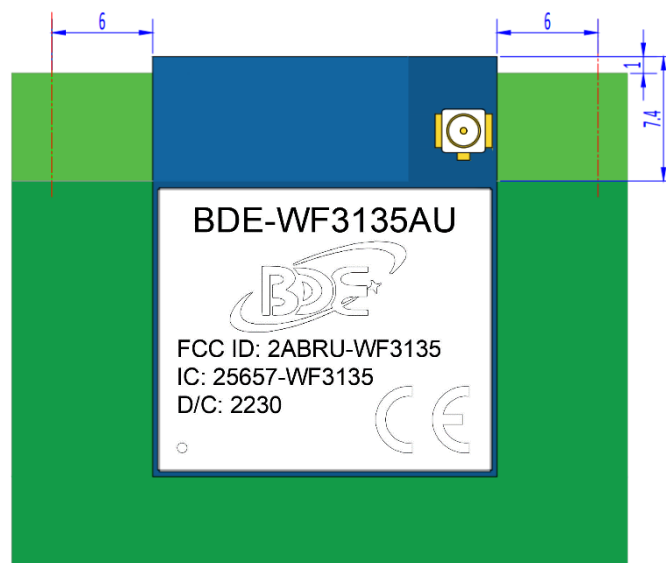


Figure 11. BDE-WF3135 Layout Guidelines

## 9. Soldering

To be defined

## 10. Ordering Information

**Table 10-1: Ordering Information**

Part Number	Size (mm)	Shipping Form	MOQ
BDE-WF3135A	25 x 20.5 x 2.4	Tape & Reel	1000
BDE-WF3135AU	25 x 20.5 x 2.4	Tape & Reel	1000
BDE-WF3135N	20.5 x 17.5 x 2.4	Tape & Reel	1000

### 10.1 Regulatory

#### 11.1 FCC Warning

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

1. List of applicable FCC rules  
FCC Part 15.247, 15.407

2. Specific operational use conditions  
This transmitter/module and its antenna(s) must not be co-located or operating in conjunction with any transmitter. This information also extends to the host manufacturer's instruction manual.

3. Limited module procedures  
Not applicable

4. Trace antenna designs  
It is "not applicable" as trace antenna which is not used on the module.

5. RF exposure considerations  
This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This compliance to FCC radiation exposure limits for an uncontrolled environment, and minimum of 20cm separation between antenna and body.  
The host product manufacturer would provide the above information to end users in their end-product manuals.

6. Antennas  
PCB Antenna: 2.5dBi@2.4G, 2.5dBi@5G, Manufacturer: BDE, MPN: BDE-ANT-2458-3135  
Ceramic Antenna: 1dBi@2.4G, 2.6dBi@5G, Manufacturer: Ethertronics, MPN: M830520  
Whip Antenna: 6dBi@2.4G, 7dBi@5G, Manufacturer: BDE, MPN: BDE-ANT-2458-01

7. Label and compliance information  
The end product must carry a physical label or shall use e-labeling followed KDB784748D01 and KDB 784748 stating "Contains Transmitter Module FCC ID: 2ABRU-WF3135".

#### 8. Information on test modes and additional testing requirements

For more information on testing, please contact the manufacturer.

#### 9. Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for the specific rule parts (FCC Part 15.247) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed when contains digital circuitry.

## 11.2 FCC Statements

(OEM) Integrator has to assure compliance of the entire end-product incl. the integrated RF Module. For 15 B (§15.107 and if applicable §15.109) compliance, the host manufacturer is required to show compliance with 15 while the module is installed and operating.

Furthermore the module should be transmitting and the evaluation should confirm that the module's intentional emissions (15C) are compliant (fundamental / out-of-band). Finally the integrator has to apply the appropriate equipment authorization (e.g. Verification) for the new host device per definition in §15.101.

Integrator is reminded to assure that these installation instructions will not be made available to the end-user of the final host device.

The final host device, into which this RF Module is integrated" has to be labeled with an auxiliary label stating the FCC ID of the RF Module, such as "Contains FCC ID: 2ABRU-WF3135".

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."

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

The Integrator will be responsible to satisfy SAR/ RF Exposure requirements, when the module integrated into the host device.

### 11.3 Module statement

The single-modular transmitter is a self-contained, physically delineated, component for which compliance can be demonstrated independent of the host operating conditions, and which complies with all eight requirements of § 15.212(a)(1) as summarized below.

- (1) The radio elements have the radio frequency circuitry shielded.
- (2) The module has buffered modulation/data inputs to ensure that the device will comply with Part 15 requirements with any type of input signal.
- (3) The module contains power supply regulation on the module.
- (4) The module contains a permanently attached antenna.
- (5) The module demonstrates compliance in a stand-alone configuration.
- (6) The module is labeled with its permanently affixed FCC ID label.
- (7) The module complies with all specific rules applicable to the transmitter, including all the conditions provided in the integration instructions by the grantee.
- (8) The module complies with RF exposure requirements.

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

### 11.4 IC Statements

The final host device, into which this RF Module is integrated" has to be labeled with an auxiliary label stating the IC of the RF Module, such as" Contains transmitter module IC: 25657-WF3135

Le périphérique hôte final, dans lequel ce module RF est intégré "doit être étiqueté avec une étiquette auxiliaire indiquant le CI du module RF, tel que" Contient le module émetteur IC: 25657-WF3135

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' compromettre le fonctionnement.

#### Radio Frequency Exposure Statement for IC:

The device has been evaluated to meet general RF exposure requirements. The device can be used in mobile exposure conditions. The min separation distance is 20cm.

#### Déclaration d'exposition aux radiofréquences pour IC:

L'appareil a été évalué pour répondre aux exigences générales en matière d'exposition aux RF. L'appareil peut être utilisé dans des conditions d'exposition mobiles. La distance de séparation minimale est de 20 cm.

This radio transmitter [IC: 25657-WF3135] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Cet émetteur radio [IC: 25657-WF3135] a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous, avec le gain maximal admissible indiqué. Les types d'antenne non inclus dans cette liste qui ont un gain supérieur au gain maximum indiqué pour tout type répertorié sont strictement interdits pour une utilisation avec cet appareil.

Operation of this device is restricted to indoor use only. (W52 band)

Le fonctionnement de cet appareil est limité à une utilisation en intérieur uniquement. (W52 band)

## 11.5 U-NII Bands

For USA: The frequency stability of all transmission frequencies of U-NII-1, U-NII 2A, U-NII 2C and U-NII-3 meets the requirements of 47 CFR FCC Part15.407(g), and the manufacturer declares that their transmission is maintained at Band U-NII-1, U-NII 2A, U-NII 2C and U-NII-3.

For Canada: The frequency stability of all transmission frequencies of U-NII-1, U-NII 2A, U-NII 2C and U-NII-3 meets the 47 CFR FCC Part15.407(g) requirements, and the manufacturer states that their transmissions remain within the U-NII-1, U-NII 2A, U-NII 2C and U-NII-3 bands.

Pour le Canada : La stabilité de fréquence de toutes les fréquences de transmission de U-NII-1, U-NII 2A, U-NII 2C et U-NII-3 est conforme aux exigences 47 CFR FCC Part15.407(g), et le fabricant déclare que leurs transmissions restent dans les bandes U-NII-1, U-NII 2A, U-NII 2C et U-NII-3.

U-NII-1: 5150MHz ~ 5250MHz

U-NII-2A: 5250MHz ~ 5350MHz

U-NII-2C: 5470MHz ~ 5725MHz

U-NII-3: 5725MHz ~ 5850MHz

## Revision History

Revision	Date	Description
V1.0	27 - Dec - 2020	Initial Released
V1.1	13 - Oct - 2021	Replace Ceramic Antenna with PCB antenna Module size adjustment Partial content modification
V2.0	27- Dec - 2021	Change Module's name

## Contacts

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