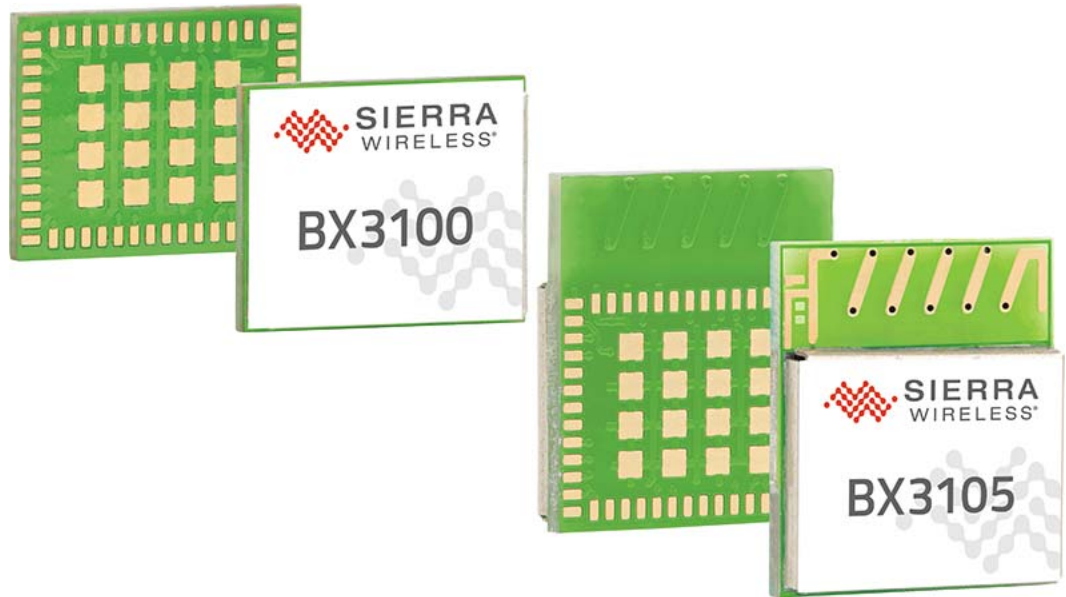




AirPrime BX310x Wi-Fi/BT Module

Product Technical Specification



SIERRA
WIRELESS®

41111444
Rev 4

Important Notice

Due to the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. Although significant delays or losses of data are rare when wireless devices such as the Sierra Wireless modem are used in a normal manner with a well-constructed network, the Sierra Wireless modem should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. Sierra Wireless accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the Sierra Wireless modem, or for failure of the Sierra Wireless modem to transmit or receive such data.

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Revision History

Revision number	Release date	Changes
1	August 2017	Creation (limited release)
2	October 2017	General release
3	February 2018	Updated application schematic Updated VDD_PADS_BB voltage Updated current consumption measurement power supply to 3.3V Updated Table 2-1 AirPrime BX310x Capabilities—noted Bluetooth features not yet supported Updated Table 3-5 RF Current Consumption Specifications Updated Table 3-7 Generic Radio Characteristics Updated Table 3-8 Generic Radio Characteristics Updated Table 3-9 Absolute Maximum Ratings Updated Table 3-10 Recommended Operating Conditions Updated Mechanical drawings Updated Table 6-1 Pin Definitions—VDD_PADS_BB min voltage
4	February 2018	Updated Table 2-1 (moved Data Transfer entry from Bluetooth to Wi-Fi section) Corrected pin types in Table 6-1 Pin Definitions (11–13, 24–27)

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>> 1: Introduction

This document defines and illustrates the AirPrime BX310x (BX3100, BX3105) Wi-Fi/BT Host-less module's high-level product features, interfaces, and hardware features (including electrical and mechanical performance criteria).

1.1 Module Variants

AirPrime BX310x module variants include:

- AirPrime BX3100—External antenna connection
- AirPrime BX3105—Embedded antenna

1.2 General RF/Software Features

The AirPrime BX310x is a low-power, small form-factor self-contained Wi-Fi/Bluetooth (Wi-Fi/BT) module.

With an embedded software suite, the BX310x is an ideal solution for developers who want to quickly and cost-effectively integrate Wi-Fi/BT functionality into their products.

The following table summarizes the module's supported wireless frequencies:

Table 1-1: Supported RF Frequencies

Technology	RF band	Notes
Wi-Fi	2.4GHz (2.400–2.485 GHz)	• 802.11b/g/n/e/i
		• Max data rate—MCS7 HT40 150 Mbps
Bluetooth		• v4.2 BR/EDR and BLE compliant

1.2.1 Wi-Fi

The AirPrime BX310x supports 2.4 GHz Wi-Fi operation. Key features include:

- TCP/IP
- 802.11 b/g/n/e/i
- Connection methods—BSS STA, SoftAP
- Transmit power—Adjustable, up to 21 dBm (maximum)

For a list of additional supported Wi-Fi functionality, protocols, and features, see [Features on page 12](#).

1.2.2 Bluetooth

The AirPrime BX310x supports 2.4 GHz Bluetooth classic and BLE operation. Key features include:

- Bluetooth v4.2 BR/EDR and BLE compliant
- SPP (Serial Port Profile)

For a list of additional supported Bluetooth functionality, protocols, and features, see [Features on page 12](#).

1.2.3 Interfaces

The AirPrime BX310x provides the following interfaces and peripheral connectivity:

- Power supply—See [Power Supply Ratings on page 15](#).
- RF—See [RF on page 18](#).
- UART serial link—See [UART on page 23](#).
- ADC—See [ADC on page 24](#).
- Voltage measurement—See [Voltage Measurement on page 24](#).
- I²C—See [I2C Interface on page 24](#).
- Digital audio (I²S)—See [I2S Interface \(Digital Audio\) on page 26](#).
- GPIOs—See [General Purpose Input/Output \(GPIO\) on page 26](#).
- SPI bus—See [SPI Bus on page 27](#).
- SDIO—See [Secure Digital IO \(SDIO\) Interface on page 28](#).
- Module enable—See [Module Enable on page 28](#).
- System clock outputs—See [Clock on page 29](#).
- PWM—See [PWM on page 29](#).

1.2.4 Configuration Utility

The AirPrime BX310x includes a browser-based utility for device configuration. For usage details, refer to the AirPrime BX Series Development Kit User Guide available at source.sierrawireless.com (forthcoming).

1.3 General Hardware Features

1.3.1 Physical Dimensions and Connection Interface

AirPrime BX310x modules are compact, robust, fully shielded and labeled modules with the dimensions noted in [Table 1-2](#).

Table 1-2: AirPrime BX310x Dimensions^a

Parameter	Nominal		Tolerance	Units
	BX3100 ^b	BX3105		
Length	11.5	13.5	±0.10	mm
Width	9.5	11.5	±0.10	mm
Thickness	2.4	2.4	±0.20	mm
Weight	TBD	TBD	TBD	g

a. Dimensions are accurate as of the release date of this document.

b. BX3100 is a CF3 xSmall module, which belongs to the Common Flexible Form Factor (CF3) family of WWAN modules

The AirPrime BX310x module is an LGA form factor device. All electrical and mechanical connections are made through the 70 Land Grid Array (LGA) pads on the bottom side of the PCB. (See [Figure 6-1 on page 33](#) for details.)

The LGA pads have the following distribution:

Table 1-3: LGA Pad Types

Pad Type/Quantity		Dimensions	Pitch
Signal Pads	54 outer pads	0.75x0.35 mm	0.65 mm
Ground Pads	16 inner pads	1.0x1.0 mm	1.83 mm/1.48 mm

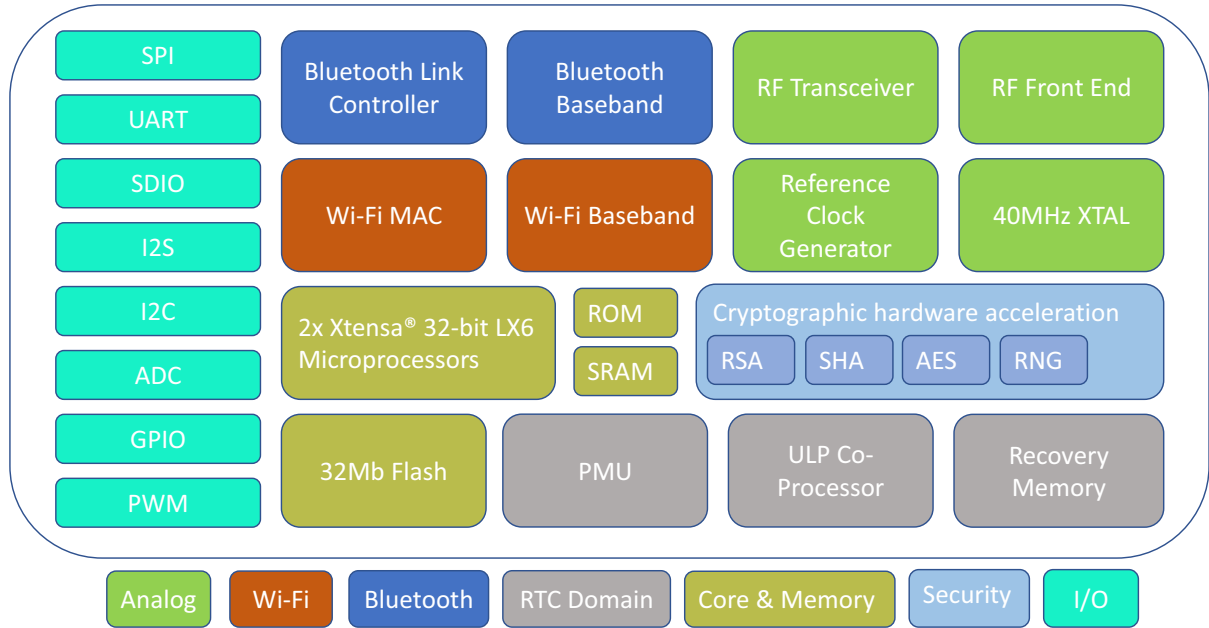


Figure 2-2: Block diagram

2.2 Features

Table 2-1 summarizes the AirPrime BX310x module’s RF (Wi-Fi and Bluetooth), Power, software, and hardware capabilities.

Note: Table contents are preliminary and subject to change.

Table 2-1: AirPrime BX310x Capabilities

Feature	Description
Module	<ul style="list-style-type: none"> Secure boot Secure update FOTA (Firmware update Over The Air) Sierra Wireless AirVantage support CF3-compliant footprint (BX3100)

Table 2-1: AirPrime BX310x Capabilities (Continued)

Feature	Description
Wi-Fi	<ul style="list-style-type: none"> • Protocols: <ul style="list-style-type: none"> • 802.11 b/g/n/e/i • 802.11 n (2.4 GHz), up to 150 Mbps; MCS0-7 in 20/40 MHz bandwidths • Receiving STBC (Space-time Block Code) 2x1 • 802.11 e: QoS for wireless multimedia technology • Additional 802.11i security features (pre-authentication, TSN, etc.) • WMM-PS, UAPSD • A-MPDU, A-MSDU aggregation • Block ACK (RTS/CTS/ACK/BA) • Fragmentation/defragmentation • CCMP (CBC-MAC, counter model), TKIP (MIC, RC4), WAPI (SMS4), WEP (RC4), CRC • Frame encapsulation (802.11h/RFC 1042) • Pre-authentication, TSN • Supported channels—1–14 • Data transfer (HTTP, HTTPS, MQTT, TCP/UDP) • Autoconnection—After device reset, automatically connects to available AP based on previous configuration • Infrastructure BSS Station mode/SoftAP mode: AP mode, STA mode, concurrent AP/STA mode • Up to 8^a simultaneous Wi-Fi clients • IP configuration—IP address in STA mode via DHCP or static assignment • Authentication (security) modes: WPA, WPA2, WPA/WPA2, WPA2 Enterprise • UMA-compliant and certified • Open interface for various upper layer authentication schemes over EAP (e.g. TLS, PEAP, LEAP, SIM, AKA, customer-specific) • Adaptive rate fallback algorithm • Automatic retransmission/response on slow hosts

Table 2-1: AirPrime BX310x Capabilities (Continued)

Feature	Description
Bluetooth	<ul style="list-style-type: none"> • Bluetooth v4.2 BR/EDR^b and BLE compliant • Supported channels: BT Classic^b—0–78; BLE—0–39 • Supported v4.2 modes: BR^b (Basic Rate); EDR^b (Enhanced Data Rate); LE (Low Energy) • BT^b classic mandatory features • BT low-energy mandatory features • Class 1/Class 2/Class 3 transmitter without external power amplifier • Class 1 operation without external PA • Enhanced power control (>30 dB dynamic control range) • +10 dBm transmitting power • NZIF receiver with -98 dBm sensitivity • Modulation—p/4 DQPSK^b, 8 DPSK^b • ACL^b, SCO^b, eSCO^b • Adaptive Frequency Hopping (AFH) • BT 4.2 controller and host stack^b • Service Discover Protocol (SDP)^b • General Access Profile (GAP) • Security Manage Protocol (SMP)^b • Bluetooth Low Energy (BLE) • ATT/GATT • BLE Beacon • SPP^b, RFCOMM • Profiles: Wi-Fi Autoconnection—After device reset, automatically connects to available AP based on previous configuration. • UART features: GATT profiles, Define personal services • Roles—Simultaneous Central (access point)/Peripheral (client) • Simultaneous connections: <ul style="list-style-type: none"> • Up to 7^a (total) simultaneous connections, including up to 3^a BLE connections • Simultaneous BT Classic^b and BLE connections • PCM^b/I2S^b
Configuration	Device configuration methods: <ul style="list-style-type: none"> • Built-in web-based configuration utility. See Configuration Utility on page 9. • AT commands available over UART, Wi-Fi, and BT links. Refer to AirPrime BX310x AT Command Reference at source.sierrawireless.com.
Security	<ul style="list-style-type: none"> • All standard IEEE802.11 security features, including WFA, WPA/WPA2, WAPI • Secure boot • Flash encryption • Cryptographic hardware acceleration: AES, HASH (SHA-2) library, RSA, ECC, Random Number Generator (RNG)
Power management	Multiple power modes ^b to reduce power consumption: Active, Radio off, Light sleep, Deep sleep, Hibernation Sleep Patterns: Association sleep pattern, ULP sensor-monitored pattern

a. Subject to firmware support and RAM limitations.
 b. Support pending firmware upgrade.

3: Technical Specifications

3.1 Environmental

The environmental specifications for operation and storage of the AirPrime BX310x are defined in Table 3-1.

Table 3-1: Environmental Specifications

Parameter	Range
Ambient Operating Temperature	-40°C to +85°C
Ambient Storage Temperature	-40°C to +105°C (Recommended)
Ambient Humidity	TBD

3.2 Power Supply Ratings

DC power is supplied via the pins described in [Table 3-2 on page 15](#).

Note: Operation above the maximum specified operating voltage (see [Table 3-10 on page 20](#)) is not recommended, and specified typical performance or functional operation of the device is neither implied nor guaranteed.

Table 3-2: Power Supply Pins

Pin	Name	Voltage	Direction	Function
33	VGPI0	3.3V	Output	Supply voltage reference for secondary I2C interface (pins 53/54)
50	VDD_3V3_RF	2.7–3.6V	Input	RF/Analog signal power supply
51	VDD_3V3_PA	2.7–3.6V	Input	Internal Power Amplifier power supply
52	VDD_PADS_BB	2.3–3.6V	Input	Baseband/Digital I/O power supply

3.2.1 Power Management

The AirPrime BX310x switches between several power modes to minimize current consumption. The following tables describe these modes and their typical current consumption:

Table 3-3: Power Modes—Descriptions

Power Mode	CPU	Wi-Fi/BT radio/baseband	RTC	ULP co-processor	Notes
Active	On	On	On	On	Fully functional
Radio off	On	Off	On	On	
Light sleep	Pause	Off	On	On	Wake up events will wake the module.
Deep sleep	Off	Off	On	On/Off	Connection data stored in RTC memory
Hibernate	Off	Off	Off	Off	Only RTC timer or specific RTC GPIOs can wake the module.

Table 3-4: Power Modes—Typical Current Consumption

Power Mode	Description	Current Consumption
Active (RF on)	Wi-Fi Tx packet 13 dB~21 dBm	160~260 mA
	Wi-Fi/BT Tx packet 0 dBm	120 mA
	Wi-Fi/BT Rx and listening	80~90 mA
	Association sleep patter (by Light-sleep)	0.9 mA@DTIM3, 1.2 mA@DTIM1
Modem-sleep	CPU is powered on.	Max speed: 20 mA
		Normal speed: 5~10 mA
		Slow speed: 3 mA
Light-sleep	-	0.8 mA
Deep-sleep	ULP processor powered on	0.15 mA
	ULP sensor-monitored pattern	25 μ A @ 1% duty
	RTC timer + RTC memory	10 μ A
Hibernation	RTC timer only	5 μ A

3.2.2 Current Consumption

Current consumption measurements are conducted at the module antenna port with 3.3 V supply at 25°C ambient temperature.

All transmitter measurements are based on 90% duty cycle and continuous transmit mode.

Table 3-5: RF Current Consumption Specifications

Mode	Min	Typ	Max	Unit
Transmit 802.11b, DSSS 1 Mbps, POUT=+18.0 dBm	-	208	-	mA
Transmit 802.11b, CCK 11 Mbps, POUT=+18.0 dBm	-	224	-	mA
Transmit 802.11g, OFDM 54 Mbps, POUT = +14 dBm	-	144	-	mA
Transmit 802.11n, MCS7 HT20, POUT=+11.5 dBm	-	116	-	mA
Transmit 802.11n, MCS7 HT40, POUT=+11.5 dBm	-	116	-	mA
Receive 802.11b, packet length=1024 bytes, -80 dBm	-	85	-	mA
Receive 802.11g, packet length=1024 bytes, -70 dBm	-	85	-	mA
Receive 802.11n HT20, packet length=1024 bytes, -65 dBm	-	80	-	mA
Receive 802.11n HT40, packet length=1024 bytes, -65 dBm	-	80	-	mA
Continuous Transmit Bluetooth 1 Mbps, 0 dBm	-	73	-	mA
Continuous Transmit Bluetooth 2 Mbps, 0 dBm	-	73	-	mA
Continuous Transmit Bluetooth 3 Mbps, 0 dBm	-	73	-	mA
Continuous Transmit Bluetooth 1 Mbps, 10 dBm	-	100	-	mA
Continuous Transmit Bluetooth 2 Mbps, 4.0 dBm	-	78	-	mA
Continuous Transmit Bluetooth 3 Mbps, 4.0 dBm	-	78	-	mA
Continuous Transmit LE 1 Mbps, 10 dBm	-	109	-	mA
Continuous Bluetooth Receive	-	70	-	mA
Power Save, DTIM 1	-	TBD	-	mA
Power Save, DTIM 3	-	TBD	-	mA
Power Save, DTIM 10	-	TBD	-	mA
1.28 sec page scan (non-interlaced)	-	TBD	-	mA
1.28 sec LE ADV	-	TBD	-	mA
1.28 sec Sniff as master	-	TBD	-	mA
1.28 sec Sniff as slave	-	TBD	-	mA
Modem Sleep	-	TBD	-	mA
Light Sleep	-	TBD	-	mA
Deep Sleep	-	TBD	-	μA
Hibernation	-	TBD	-	μA

3.3 RF

3.3.1 Generic Radio

Measurements conducted at 25°C ambient temperature.

Table 3-6: Generic Radio Characteristics

Description	Min	Typ	Max	Unit
BX3100 RF Port Impedance		50		Ω
Frequency Band	2.4	2.45	2.485	GHz
BX3105 Antenna Gain		TBD		dBi

3.3.2 Wi-Fi Radio

Measurements conducted at 25°C ambient temperature.

Table 3-7: Generic Radio Characteristics

Description	Min	Typ	Max	Unit
Transmit 802.11b, CCK 11 Mbps, Output Power, EVM and Mask Compliant		18.0		dBm
Transmit 802.11g, OFDM 54 Mbps, Output Power, EVM and Mask Compliant		14.0		dBm
Transmit 802.11n, MCS7 HT20 72.2 Mbps, Output Power, EVM and Mask Compliant		11.5		dBm
Transmit 802.11n, MCS7 HT40 135 Mbps, Output Power, EVM and Mask Compliant		11.5		dBm
Receiver Sensitivity 11b DSSS, 1 Mbps		-97.5		dBm
Receiver Sensitivity 11b CCK, 11 Mbps		-88		dBm
Receiver Sensitivity 11g OFDM, 6 Mbps		-92		dBm
Receiver Sensitivity 11g OFDM, 54 Mbps		-72.5		dBm
Receiver Sensitivity 11n HT20 OFDM, 72.2 Mbps		-71		dBm
Receiver Sensitivity 11n HT40 OFDM, 135 Mbps		-71		dBm
BX3100 Harmonics 2F0		-42		dBm
BX3100 Harmonics 3F0		-54		dBm

3.3.3 Bluetooth Radio

Measurements conducted at 25°C ambient temperature.

Table 3-8: Generic Radio Characteristics

Description	Min	Typ	Max	Unit
Transmit Power BR 1 Mbps, ACR & Modulation Compliant	-	10	-	dBm
Transmit Power BR 2 Mbps, ACR & Modulation Compliant	-	4	-	dBm
Transmit Power BR 3 Mbps, ACR & Modulation Compliant	-	4	-	dBm
Transmit Power LE 1 Mbps, ACR & Modulation Compliant	-	10	-	dBm
Receiver Sensitivity BR 1 Mbps	-	TBD	-	dBm
Receiver Sensitivity EDR 2 Mbps	-	TBD	-	dBm
Receiver Sensitivity EDR 3 Mbps	-	TBD	-	dBm
Receiver Sensitivity LE 1 Mbps	-	-92	-	dBm
Out-of-band blocking performance 30 MHz~2000 MHz	-10	-	-	dBm
Out-of-band blocking performance 2000 MHz~2400 MHz	-27	-	-	dBm
Out-of-band blocking performance 2500 MHz~3000 MHz	-27	-	-	dBm
Out-of-band blocking performance 3000 MHz~12.5 GHz	-10	-	-	dBm

3.4 Electrical Specifications

3.4.1 Absolute Maximum Ratings

Table 3-9: Absolute Maximum Ratings

Parameter		Min	Max	Units
V _{IL}	Input low voltage	-0.3	0.25×V _{IO}	V
V _{IH}	Input high voltage	0.75×V _{IO}	3.6	V
I _{IL}	Input leakage current	-	50	nA
V _{OL}	Output low voltage	-	0.1×V _{IO}	V
V _{OH}	Output high voltage	0.8×V _{IO}	-	V
C _{pad}	Input pin capacitance	-	2	pF
V _{IO}	VDD_PADS_BB	2.1	3.3	V
I _{MAX}	Maximum drive capability	-	12	mA
T _{STR}	Storage temperature range	-40	150	°C

Table 3-10: Recommended Operating Conditions

Parameter		Min	Typ	Max	Units
V _{DD}	Supply voltage (VDD_3V3_PA, VDD_3V3_RF)	2.8	3.3	3.6	V
V _{IO}	I/O supply voltage	2.3	3.3	3.3	V
T _{OPR}	Operating temperature range	-40	-	85	°C
V _{IL}	CMOS low level input voltage	0	-	0.3×V _{IO}	V
V _{IH}	CMOS high level input voltage	0.7×V _{IO}	-	V _{IO}	V
V _{TH}	CMOS threshold voltage	-	0.5×V _{IO}	-	V

3.5 Mechanical

3.6 Mechanical Drawings

The AirPrime BX310x module's LGA footprint is a 70-pad array of copper pads (see [Physical Dimensions and Connection Interface on page 9](#)). The following drawings illustrate the device footprint and dimensions.

Note: Dimensions in Figure 3-1 and Figure 3-2 are preliminary and subject to change.

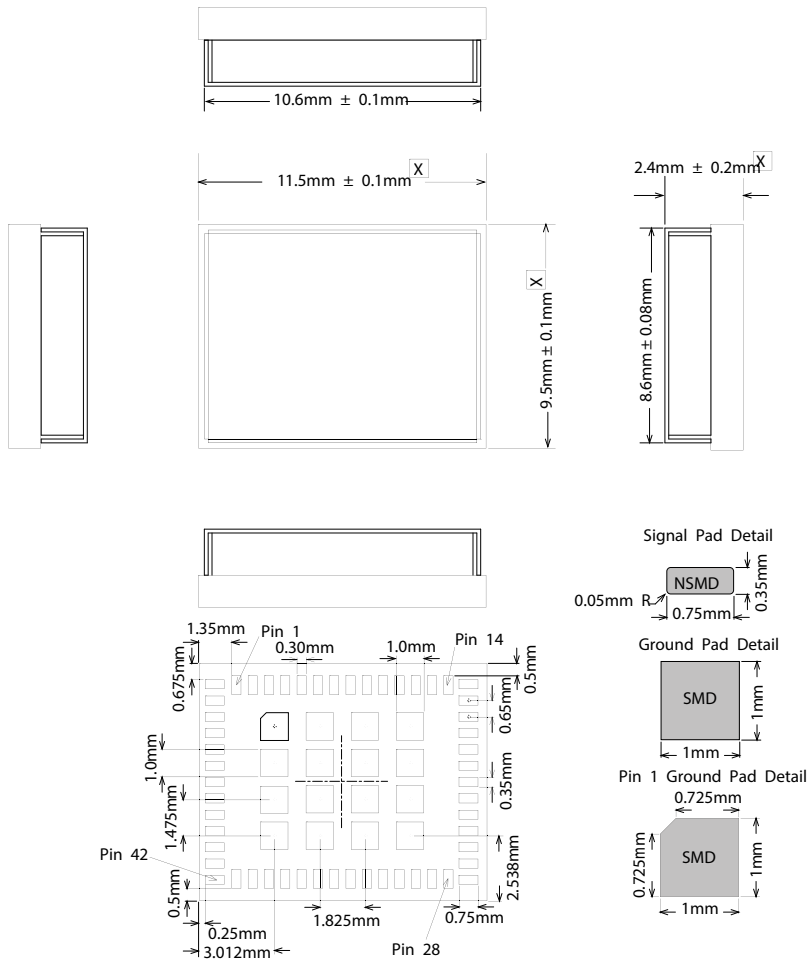


Figure 3-1: AirPrime BX3100 Mechanical Drawing

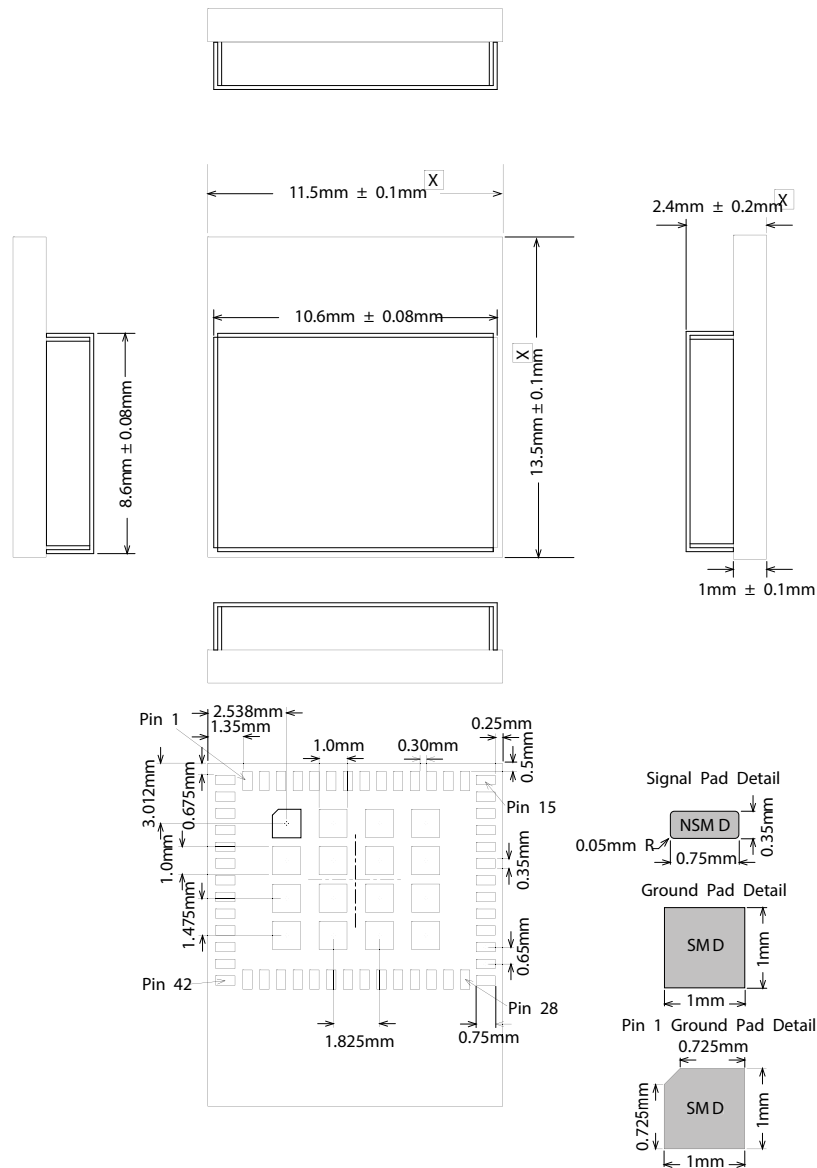


Figure 3-2: AirPrime BX3105 Mechanical Drawing

3.7 Antenna

The AirPrime BX3100 uses an LGA pad (pin 40—RF_MAIN), which the application must connect to an external antenna.

The AirPrime BX3105 includes an integrated PCB antenna. Leave the LGA pad (pin 40) unconnected.

>> 4: Interfaces Specification

4.1 Overview

This section describes the interfaces supported by the AirPrime BX310x embedded module and provides specific voltage, timing, and circuit recommendations for each interface.

4.2 UART

The AirPrime BX310x provides one UART interface for asynchronous communication between the AirPrime BX310x module and a host device (e.g. a PC or host processor):

- UART0—4-wire, RS-232-compliant interface

Note: Up to two additional UART interfaces can be added by configuring GPIOs using AT commands.

Flow control is managed using:

- RTS/CTS signals (This method is required for higher UART interface speeds.)
or
- Software XON/XOFF

[Table 4-1 on page 23](#) describes the signals used for UART0.

Note: UART signals are named with respect to the module, and directions are listed with respect to the module. For example, UART0_RXD is an output from the module to the host.

Table 4-1: UART0 Pins^a

Pin	Interface	Name	Direction	Function	Voltage Level
2	UART0	UART0_RTS	I	Ready To Send, flow control	VDD_PADS_BB
3		UART0_CTS	O	Clear To Send, flow control	
4		UART0_TXD	I	Transmit Data	
5		UART0_RXD	O	Receive Data	

a. If UART0 pins are not used, leave open.

4.3 ADC

The AirPrime BX310x provides two general purpose ADC (Analog to Digital Converter) inputs that are used to measure analog voltages.

Table 4-2: ADC Interface Pins^a

Pin	Signal name	Direction ^b	Function	Voltage Level
18	VDET_1	I	Analog to Digital Converter	VDD_PADS_BB
19	VDET_2	I		

- a. Leave open any pins that are not used.
b. Signal direction with respect to the module.

4.4 Voltage Measurement

The AirPrime BX310x supports the measurement of analog voltages using the following methods:

- ADCs—Two input pins that can be used for direct voltage measurements. See [ADC on page 24](#).
- Combination of four GPIOs and external capacitors—Small analog signals can be measured by configuring (using AT commands) the pins in [Table 4-3](#) below to support a low-noise programmable gain amplifier with the addition of external 270 pF capacitors between pins 31/32 and pins 34/36. The internal ULP-coprocessor is also designed to measure the voltages while operating in the sleep mode, to enable low power consumption; the CPU can be woken up by a threshold setting and/or via other triggers.

Table 4-3: Voltage-measurement GPIO Pins^a

Pin	Signal Name	Direction ^b	Voltage level
31	SENSOR_VP	I	VDD_PADS_BB
32	SENSOR_CAPP	I	
34	SENSOR_CAPN	I	
36	SENSOR_VN	I	

- a. Leave open any pins that are not used.
b. Signal direction with respect to the module.

4.5 I²C Interface

The AirPrime BX310x module provides two I²C (Inter-Integrated Circuit) dedicated serial ports (bus interface) based on [8] The I2C Bus Specification, Version 2.1, January 2000 (Phillips Semiconductor document number 9398 393 40011).

The interfaces use the pins indicated in [Table 4-4](#).

Table 4-4: I²C Interface Pins^a

Pin	Signal name	Direction	Function	Voltage Level
9	I2C1_SCL	I/O	Primary I2C interface	VDD_PADS_BB
17	I2C1_SDA	I/O	Primary I2C interface	
53	I2C2_SDA	I/O	Secondary I2C interface	VGPIO
54	I2C2_SCL	I/O	Secondary I2C interface	

a. Leave open any pins that are not used.

This implementation of the I²C interface includes the following characteristics:

- Supported voltage:
 - Primary I2C (1.8 V/3.3 V, configurable)
 - Secondary I2C (3.3 V)
- Standard-mode interface—Data transfer rates up to 100 kbit/s
- Fast-mode interface—Data transfer rates up to 400 kbit/s)
- Master mode operation
- Addressing modes—7-bit; 10-bit; Dual addressing mode

External 2.2 kΩ pull-up resistors must be applied to I²C signals (see [Figure 4-1 on page 25](#)).

For I²C bus details, including I2C bus waveform and timing details, refer to the I2C Bus Specification.

4.5.1 Application

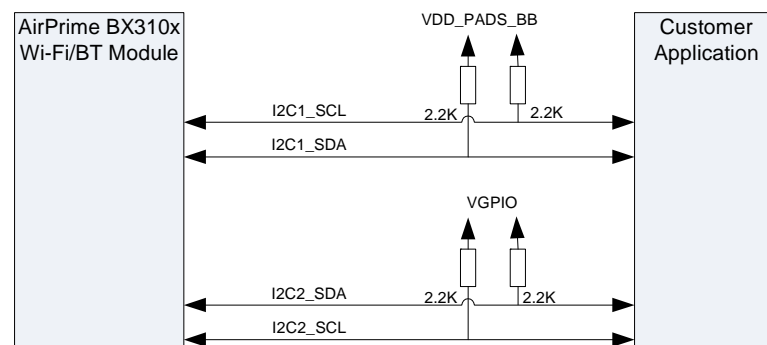


Figure 4-1: Example of I²C Bus Application

4.6 I2S Interface (Digital Audio)

Note: Interface support is forthcoming.

The AirPrime BX310x provides a 4-wire I²S (digital audio) interface that can be used to transfer serial digital audio to or from an external stereo DAC/ADC, and supports the following features:

- Modes—Master, Slave
- Transmission format—Full duplex, Half duplex
- Resolution (bits per frame)—8, 16, 32, 40, 48
- Channels—Input, Output
- Bit clock—10 kHz–40 MHz
- Supported audio interfaces (forthcoming)—PDM (Pulse Density Modulation), BT PCM (Pulse Code Modulation)

The interface uses the pins indicated in [Table 4-5](#).

Table 4-5: I2S Interface Pins^a

Pin	Signal name	Direction ^b	Function	Voltage Level
16	I2S_MCLK	O	I2S MasterClock	VDD_PADS_BB
24	I2S_DO	O	I2S Data Out	
25	I2S_DI	I	I2S Data In	
26	I2S_LRCLK	I/O	I2S Left-Right Clock (Word Select)	
27	I2S_BCLK	I/O	I2S Bit Clock	

- a. Leave open any pins that are not used.
 b. Signal direction with respect to the module.

4.7 General Purpose Input/Output (GPIO)

The AirPrime BX310x defines several GPIOs for customer use, as described in [Table 4-6](#) and [Table 4-7](#).

Note: The pins carrying the 'Alternate function' GPIOs are multi-function. The alternate interfaces (SDIO or SPI) can be selected via an AT command.

Table 4-6: GPIO Pins (Dedicated)^a

Pin	Signal Name	Direction	Default State	Function	Voltage Level
14	GPIO(5)	I/O	No pull ^b	General purpose I/O	VDD_PADS_BB
35	GPIO(27)	I/O			

- a. Leave open any pins that are not used.
 b. Internal configuration of all GPIOs—no internal pull-ups

Table 4-7: GPIO Pins (Alternate function)^a

Pin	Signal Name	Direction	Default State	Function	Voltage Level
42	GPIO(15)	I/O	No pull ^b	General purpose I/O	VDD_PADS_BB
43	GPIO(12)				
44	GPIO(14)				
45	GPIO(13)				
46	GPIO(2)				
47	GPIO(4)				

- a. Leave open any pins that are not used.
- b. Internal configuration of all GPIOs—no internal pull-ups

4.8 SPI Bus

Note: Interface support is forthcoming.

The AirPrime BX310x provides one 6-wire Serial Flash SPI-compatible interface.

Note: Traditional 4-wire (MOSI/MISO/SCLK/SS) SPI can also be implemented over using appropriate pins.

Table 4-8 on page 27 describes the SPI interface pins.

Note: The pins carrying the SPI interface are multi-function. The alternate interfaces (SDIO or GPIO) can be selected via an AT command.

Table 4-8: SPI Pin Descriptions^a

Pin	Signal Name	Direction ^b	Function	Voltage Level
42	HSPICS0	I/O	SPI Chip Select	VDD_PADS_BB
43	HSPIQ	I/O	SPI Data In	
44	HSPICK	I/O	SPI Clock	
45	HSPID	I/O	SPI Data Out	
46	HSPIWP	O	SPI Write Protect	
47	HSPIHD	O	SPI Hold	

- a. Leave open any pins that are not used.
- b. Signal direction with respect to the module.

4.9 Secure Digital IO (SDIO) Interface

Note: Interface support is forthcoming.

The AirPrime BX310x defines one SDIO slave-controller interface (SD 2.0-compliant), which allows a host controller to access the module (the slave device) on the SDIO bus.

The following features are supported:

- Data transfer rates—0–50 MHz
- Block size—Up to 512 bytes
- Interrupts—module-initiated and host-initiated
- Module-initiated data transfer via host interrupt
- Configurable features—Sampling, driving clock edge
- Registers for direct access by host

Table 4-9 describes the signals used for SDIO.

Note: The pins carrying the SDIO interface are multi-function. The alternate interfaces (GPIO or SPI) can be selected via an AT command.

Table 4-9: SDIO Pin Descriptions^a

Pin	Signal Name	Direction	Function	Voltage Level
42	SD_CMD	I/O	SDIO command	VDD_PADS_BB
43	SD_DATA2	I/O	SDIO data bit 2	
44	SD_CLK	I/O	SDIO clock	
45	SD_DATA3	I/O	SDIO data bit 3	
46	SD_DATA0	I/O	SDIO data bit 0	
47	SD_DATA1	I/O	SDIO data bit 1	

a. Leave open any pins that are not used.

4.10 Module Enable

The AirPrime BX310x uses the ENABLE (Module Enable) signal to turn the module on/off:

- Turn module on—Drive ENABLE high (to VDD_PADS_BB)
- Turn module off—Drive ENABLE low (to 0V)

Table 4-10: Enable Pin Description^a

Pin	Signal Name	Direction ^b	Function	Voltage Level
37	ENABLE	I	Start/stop module	VDD_PADS_BB

a. Leave open any pins that are not used.

b. Signal direction with respect to the module.

4.11 Clock

The AirPrime BX310x outputs the I2S Master Clock (pin 16, GPIO(0)_I2S_MCLK) and can output a configurable RTC on some GPIOs (details TBD).

4.12 PWM

The AirPrime BX310x supports the use of any signal in [Table 6-1 on page 33](#) that includes “(GPIOx)” in its name as a PWM, via AT command configuration.

>> 5: Regulatory Certifications

Caution: *Unauthorized modifications or changes not expressly approved by Sierra Wireless could void compliance with regulatory rules, and thereby your authority to use this equipment.*

The BX3100/BX3105 module is designed to meet, and upon commercial release, will meet the requirements of the following regulatory bodies and regulations, where applicable:

- Federal Communications Commission (FCC) of the United States
- The Certification and Engineering Bureau of Industry Canada (IC)
- Ministry of Internal Affairs and Communications (MIC) of Japan
- Radio Equipment Directive of the European Union

Upon commercial release, the following industry certification will have been obtained, where applicable:

- Bluetooth SIG

Additional certifications and details on specific country approvals may be obtained upon customer request — contact your Sierra Wireless account representative for details.

Additional testing and certification may be required for the end product with an embedded BX3100/BX3105 module and are the responsibility of the OEM. Sierra Wireless offers professional services-based assistance to OEMs with the testing and certification process, if required.

United States

The BX3100/BX3105 module, upon commercial release, will have been granted modular approval by the FCC. Integrators may use the BX3100/BX3105 module in their end products without additional FCC certification if the following conditions are met.

- At least 20 cm separation distance between the antenna and the user's body must be maintained at all times.
- The BX3100/BX3105 module must not be collocated with any other transmitter within a host device.
- The regulatory label on the end product must include the text “Contains FCC ID: TBD” and the following compliance statement:

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.

A user manual with the end product must clearly indicate the operating requirements and conditions to ensure compliance with current FCC RF exposure guidelines.

The end product with an embedded BX3100/BX3105 module may also need to meet the FCC Part 15 unintentional emission requirements and be properly authorized per FCC Part 15 Subpart B.

Canada

The BX3100/BX3105 module, upon commercial release, will have been granted modular approval by IC. Integrators may use the BX3100/BX3105 module in their end products without additional IC certification if the following conditions are met.

- At least 20 cm separation distance between the antenna and the user's body must be maintained at all times.
- The BX3100/BX3105 module must not be collocated with any other transmitter within a host device.
- The regulatory label on the end product must include the text "Contains IC : TBD" and the following compliance statement:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie 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, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Bluetooth Qualification Program (BQP)

- In case no other non-certified Bluetooth components are incorporated, the BX3100/BX3105's BQP marking certification allows users to integrate the module into products without the need to obtain subsequent and separate approval.
- The BX3100/BX3105 has been approved by the Bluetooth Qualification Body (BQB) to use the Bluetooth trademark and to offer official Bluetooth functionality. The approval according to the V4.2 Bluetooth specification confirms that the module complies with the Bluetooth specification and will successfully operate with other products supporting the same profile. BQP certification also ensures that the module has gone through safety assessment. This certification was granted through a combination of product performance testing and interoperability testing. This certification applies globally.

Labelling

- Products complying with all relevant requirements are allowed to bear the official Bluetooth logo

For further information regarding the BQP certification requirements please review the following websites:

Bluetooth Special Interest Group:

<https://www.bluetooth.org/apps/content/>

>> 6: Pinout

The system interface of the AirPrime BX310x is through the LGA pattern on the bottom of the PCB.

AirPrime BX310x pins are divided into three functional categories:

- Core functions and associated pins—Cover all the mandatory features for M2M connectivity and will be available by default across all CF3 family of modules. These Core functions are always available and always at the same physical pin locations. A customer platform using only these functions and associated pins is guaranteed to be forward and/or backward compatible with the next generation of CF3 modules.
- Extension functions and associated pins—Bring additional capabilities to the customer. Whenever an Extension function is available on a module, it is always at the same pin location.
- Custom functions and associated pins—These are module-specific and make use of specific chipset functions and I/Os.

Warning: *Custom features should be used with caution as there is no guarantee that the custom functions available on a given module will be available on other CF3 modules.*

Pins marked as "Leave open" or "Reserved" should not be used or connected.

6.1 Pin Configuration

Figure 6-1 illustrates the pin configuration of the AirPrime BX310x module.

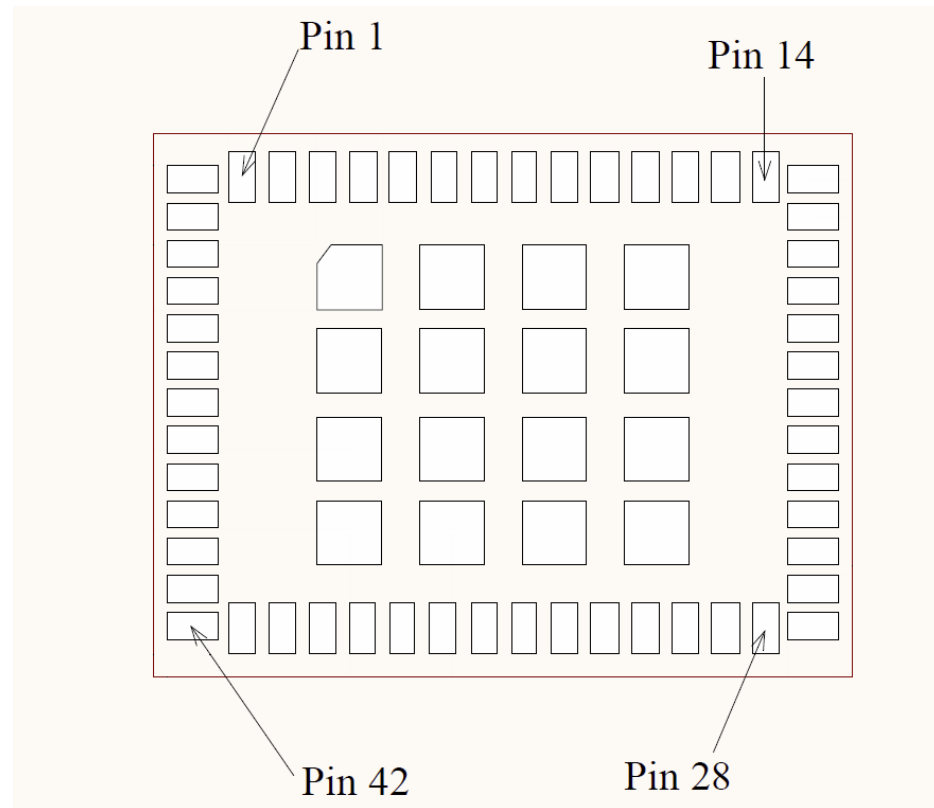


Figure 6-1: Pin Configuration (Bottom View)

6.2 Pin Description

Table 6-1 on page 33 lists detailed information for the LGA pins.

Important: Leave open all pins that are not used.

Table 6-1: Pin Definitions

Pin	Signal name	Group	I/O ^a	Voltage	PU/ PD ^b	Active ^c	Function	Type ^d
1	Reserved	NoConnect		-	-	-	-	E
2	UART0_RTS_GPIO(22)	UART0	I	VDD_PADS_BB	PU	L	UART0 Request To Send	C
3	UART0_CTS_GPIO(19)	UART0	O	VDD_PADS_BB	PU	L	UART0 Clear To Send	C
4	UART0_TXD	UART0	I	VDD_PADS_BB	PU	L	UART0 Transmit Data	C
5	UART0_RXD	UART0	O	VDD_PADS_BB	PU	L	UART0 Receive Data	C
6	Reserved	NoConnect	-	-	-	-	-	E

Table 6-1: Pin Definitions (Continued)

Pin	Signal name	Group	I/O ^a	Voltage	PU/ PD ^b	Active ^c	Function	Type ^d
7	Reserved	NoConnect	-	-	-	-	-	E
8	Reserved	NoConnect	-	-	-	-	-	E
9	GPIO(23)	GPIO	I/O	VDD_PADS_BB	NP	SW	General Purpose I/O	C
	I2C1_SCL	I2C1	I/O		PUE	L	Primary I2C interface—Clock	
10	Reserved	NoConnect	-	-	-	-	-	C
11	Reserved	NoConnect	-	-	-	-	-	C
12	Reserved	NoConnect	-	-	-	-	-	C
13	Reserved	NoConnect	-	-	-	-	-	C
14	GPIO(5)	GPIO	I/O	VDD_PADS_BB	NP	SW	General Purpose I/O	E
15	Reserved	NoConnect	-	-	-	-	-	E
16	I2S_MCLK	I2S	O	VDD_PADS_BB	NP	H	I2S Master Clock	E
	GPIO(0)	GPIO	I/O		NP	SW	General Purpose I/O	
17	GPIO(25)	GPIO	I/O	VDD_PADS_BB	NP	SW	General Purpose I/O	E
	I2C1_SDA	I2C1	I/O		PUE	L	Primary I2C interface—Data	
18	VDET_1	VoltMeasure	I	VDD_PADS_BB	NP	H	ADC input for voltage measurement	C
	GPIO(34)	GPIO	I/O		NP	SW	General Purpose I/O	
19	VDET_2	VoltMeasure	I	VDD_PADS_BB	NP	H	ADC input for voltage measurement	C
	GPIO(35)	GPIO	I/O		NP	SW	General Purpose I/O	
20	Reserved	NoConnect	-	-	-	-	-	C
21	Reserved	NoConnect	-	-	-	-	-	C
22	Reserved	NoConnect	-	-	-	-	-	C
23	Reserved	NoConnect	-	-	-	-	-	C
24	I2S_DO	I2S	O	VDD_PADS_BB	PD	H	I2S Data Out	C
	GPIO(32)	GPIO	I/O		NP	SW	General Purpose I/O	
25	I2S_DI	I2S	I	VDD_PADS_BB	PD	H	I2S Data In	C
	GPIO(33)	GPIO	I/O		NP	SW	General Purpose I/O	
26	I2S_LRCLK	I2S	I/O	VDD_PADS_BB	PD	L/H	I2S Left-Right Clock (Word Select)	C
	GPIO(18)	GPIO	I/O		NP	SW	General Purpose I/O	
27	I2S_BCLK	I2S	I/O	VDD_PADS_BB	PD	H	I2S Bit Clock	C
	GPIO(26)	GPIO	I/O		NP	SW	General Purpose I/O	
28	GND	Ground	0V	0V	-	-	Ground	C
29	Reserved	NoConnect	-	-	-	-	-	E

Table 6-1: Pin Definitions (Continued)

Pin	Signal name	Group	I/O ^a	Voltage	PU/ PD ^b	Active ^c	Function	Type ^d
30	GND	Ground	0V	0V	-	-	Ground	C
31	GPIO(36)	GPIO	I/O	VDD_PADS_BB	NP	SW	General Purpose I/O	C
	SENSOR_VP	VoltMeasure	I		NP	H	ADC input for voltage measurement	
32	GPIO(37)	GPIO	I/O	VDD_PADS_BB	NP	SW	General Purpose I/O	C
	SENSOR_CAPP	VoldMeasure	I		NP	H	ADC input for voltage measurement	
33	VGPIO	Power	O	3.3V			Reference voltage output	C
34	GPIO(38)	GPIO	I/O	VDD_PADS_BB	NP	SW	General Purpose I/O	C
	SENSOR_CAPN	VoltMeasure	I		NP	H	ADC input for voltage measurement	
35	GPIO(27)	GPIO	I/O	VDD_PADS_BB	NP	L	General Purpose I/O	E
36	GPIO(39)	GPIO	I/O	VDD_PADS_BB	NP	SW	General Purpose I/O	C
	SENSOR_VN	VoltMeasure	I		NP	H	ADC input for voltage measurement	
37	ENABLE	Control	I	VDD_PADS_BB		L	Turn module on/off	C
38	Reserved	NoConnect	-	-	-	-	-	E
39	GND	Ground	0V	0V	-	-	Ground	C
40	RF_MAIN	RF	I/O		-	-	(BX3100) RF antenna, DC blocked (BX3105) Leave pin unconnected	C
41	GND	Ground	0V	0V	-	-	Ground	C
42	SD_CMD	SDIO	I/O	VDD_PADS_BB	NP	H	SDIO Command	E
	HSPICS0	SPI	I/O		NP	SW	SPI Chip Select	C
	GPIO(15)	GPIO	I/O		NP	SW	General Purpose I/O	E
43	SD_DATA2	SDIO	I/O	VDD_PADS_BB	NP	H	SDIO Data bit 2	E
	HSPIQ	SPI	I/O		NP	SW	SPI Data In	C
	GPIO(12)	GPIO	I/O		NP	SW	General Purpose I/O	E
44	SD_CLK	SDIO	I/O	VDD_PADS_BB	NP	H	SDIO Clock	E
	HSPICLK	SPI	I/O		NP	SW	SPI Clock (output from Master)	C
	GPIO(14)	GPIO	I/O		NP	SW	General Purpose I/O	E
45	SD_DATA3	SDIO	I/O	VDD_PADS_BB	NP	H	SDIO Data bit 3	E
	HSPID	SPI	I/O		NP	SW	SPI Data Out	C
	GPIO(13)	GPIO	I/O		NP	SW	General Purpose I/O	E
46	SD_DATA0	SDIO	I/O	VDD_PADS_BB	NP	H	SDIO Data bit 0	E
	HSPIWP	SPI	O		NP	SW	SPI Write Protect	E
	GPIO(2)	GPIO	I/O		NP	SW	General Purpose I/O	E

Table 6-1: Pin Definitions (Continued)

Pin	Signal name	Group	I/O ^a	Voltage	PU/ PD ^b	Active ^c	Function	Type ^d
47	SD_DATA1	SDIO	I/O	VDD_PADS_BB	NP	H	SDIO Data bit 1	E
	HSPIHD	SPI	O		NP	SW	SPI Hold	E
	GPIO(4)	GPIO	I/O		NP	SW	General Purpose I/O	E
48	Reserved	NoConnect	-	-	-	-	-	E
49	Reserved	NoConnect	-	-	-	-	-	E
50	VDD_3V3_RF	Power	I	2.8 (Min) 3.3V (Typ) 3.6 (Max)	-	-	3.3v nominal supply for Analog/RF	C
51	VDD_3V3_PA	Power	I	2.8 (Min) 3.3V (Typ) 3.6 (Max)	-	-	3.3v nominal supply for Internal Power Amplifier	C
52	VDD_PADS_BB	Power	I	2.3 (Min) 3.3V (Typ) 3.6 (Max)	-	-	3.3v nominal supply for Baseband and Digital I/O	C
53	GPIO(16)	GPIO	I/O	VGPIIO	NP	SW	General Purpose I/O	C
	I2C2_SDA	I2C2	I/O		PUE	L	Primary I2C interface—Data	
54	GPIO(17)	GPIO	I/O	VDD_PADS_BB	NP	SW	General Purpose I/O	C
	I2C2_SCL	I2C2	I/O		PUE	L	Primary I2C interface—Clock	
G1– G16	Ground	Ground	0V	0V	-	-	Ground	C

- a. I/O: Signal direction with respect to the module
- b. PU/PD: NP—No Pull; PD—Pull Down; PU—Pull Up; PUE—Pull Up External
- c. Active: H—High; L—Low; SW—Software defined
- d. Type: C—Core; E—Extended; K—Custom

7: Abbreviations

Table 7-1: Acronyms and Definitions

Acronym or term	Definition
AFH	Adaptive Frequency Rate Hopping
AP	Access Point
BLE	Bluetooth Low Energy
BR	Basic Rate
BSS	Basic Service Set
BT	Bluetooth (Classic)
EDR	Enhanced Data Rate
EDR	Enhanced Data Rate
GAP	Generic Access Profile
GAP	General Access Profile
GATT	General Attribute Profile
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
LE	Low Energy
MQTT	Message Queuing Telemetry Transport
PAN	Personal Area Network
RFCOMM	Radio Frequency Communication
SDP	Service Discover Protocol
SMP	Security Manage Protocol
SPP	Bluetooth Serial Port Profile
STA	Station (client)
UART	Universal Asynchronous Receiver-Transmitter
Wi-Fi	Wireless Networking
WPA	Wi-Fi Protected Access
WPA2	Wi-Fi Protected Access 2
WPS	Wi-Fi Protected Setup