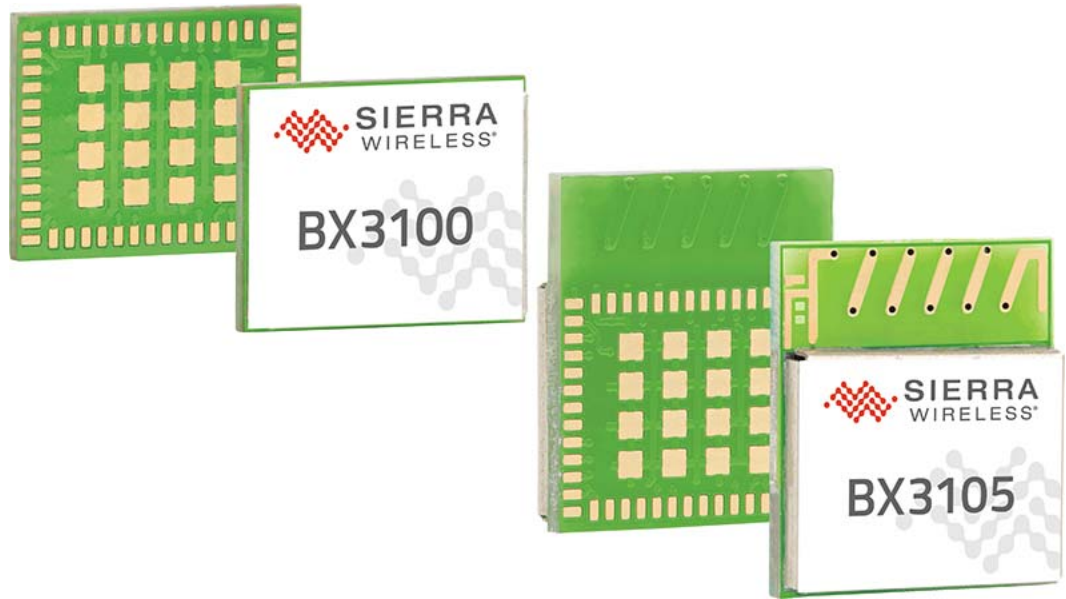




# AirPrime BX310x Wi-Fi/BT Module

## Product Technical Specification



**SIERRA**  
WIRELESS®

41111444  
Rev 6

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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 <a href="#">Table 2-1</a> (moved Data Transfer entry from Bluetooth to Wi-Fi section) Corrected pin types in Table 6-1 Pin Definitions (11–13, 24–27)

Revision number	Release date	Changes
5	July 2018	Added module weight Removed system clock outputs Updated schematics Updated mechanical drawings Updated Power Supply Ratings (voltage ranges) Added Analog Power Considerations section Updated Digital Power Considerations section Updated VGPIO Power Considerations section Updated Power Management description Updated Current Consumption section Updated Generic Radio section Updated Wi-Fi Radio section Updated Bluetooth Radio section Updated Antenna section Added Suggested Antennas section Updated UART section Added ADC/Voltage Measurement topic (replaced ADC topic and Voltage Measurement topic) Updated General Purpose Input/Output topic Updated SPI Bus topic Updated SDIO topic Updated Module Enable topic Added General Layout Recommendations chapter Added Firmware Upgrade chapter Removed United States and Canada Regulatory Information topics Updated Bluetooth Qualification Program topic Added References section
6	July 2018	Updated VDD_PADS_BB voltage range Updated Wi-Fi Radio Generic Radio Characteristics table values Updated Bluetooth Radio Generic Radio Characteristics table values

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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 and modes:

**Table 1-1: Supported RF Frequencies**

Technology	RF band	Notes
Wi-Fi	2.4GHz (2.400–2.485 GHz)	<ul style="list-style-type: none"> <li>• 802.11b/g/n/e/i</li> <li>• Max data rate—MCS7 HT40 150 Mbps</li> </ul>
Bluetooth		<ul style="list-style-type: none"> <li>• v4.2 BR/EDR and BLE compliant</li> </ul>

### 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 20 dBm (maximum)

For a list of additional supported Wi-Fi functionality, protocols, and features, see [Features on page 14](#).

### 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 14](#).

## 1.2.3 Interfaces

The AirPrime BX310x provides the following interfaces and peripheral connectivity:

- Power supply—See [Power Supply Ratings on page 17](#).
- RF—See [RF on page 21](#).
- UART serial link—See [UART on page 29](#).
- ADC/Voltage measurement—See [ADC/Voltage Measurement on page 30](#).
- I<sup>2</sup>C—See [I2C Interface on page 31](#).
- Digital audio (I<sup>2</sup>S)—See [I2S Interface \(Digital Audio\) on page 32](#).
- GPIOs—See [General Purpose Input/Output \(GPIO\) on page 32](#).
- SPI bus—See [SPI Bus on page 34](#).
- SDIO—See [Secure Digital IO \(SDIO\) Interface on page 35](#).
- Module enable—See [Module Enable on page 36](#).
- PWM—See [PWM on page 36](#).

## 1.2.4 Configuration Utility

The AirPrime BX310x includes a browser-based utility for device configuration. For usage details, refer to [1] AirPrime BX310x AT Command Reference available at [source.sierrawireless.com](http://source.sierrawireless.com).

## 1.3 General Hardware Features

### 1.3.1 Physical Dimensions and Connection Interface

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

**Table 1-2: AirPrime BX310x Dimensions<sup>a</sup>**

Parameter	Nominal		Tolerance	Units
	BX3100 <sup>b</sup>	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	0.56	0.65	±0.10	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 8-1 on page 43](#) 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



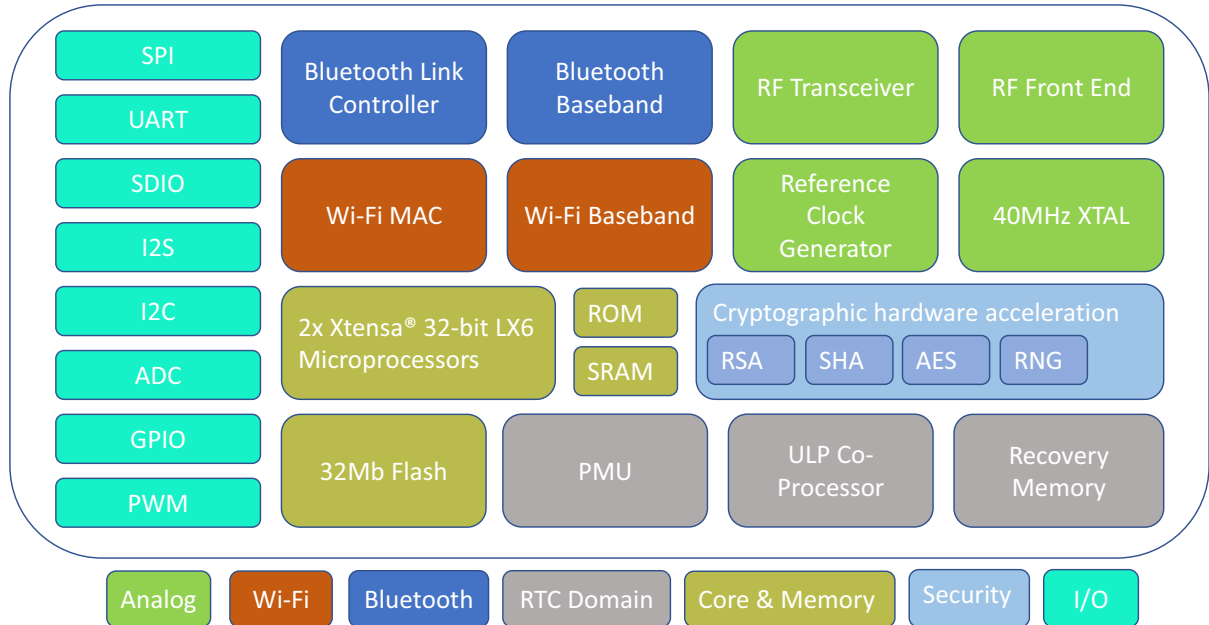


Figure 2-2: Block diagram

## 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"> <li>Secure boot</li> <li>Secure update</li> <li>FOTA (Firmware update Over The Air)</li> <li>Sierra Wireless AirVantage support</li> <li>CF3-compliant footprint (BX3100)</li> </ul>

**Table 2-1: AirPrime BX310x Capabilities (Continued)**

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

**Table 2-1: AirPrime BX310x Capabilities (Continued)**

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

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)

### 3.2 Power Supply Ratings

DC power is supplied via the pins described in [Table 3-2 on page 17](#).

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*Note: Operation above the maximum specified operating voltage (see [Table 3-9 on page 23](#)) 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	VGPIO	3.3V	Output	Supply voltage reference for secondary I2C interface (pins 53/54)
50	VDD_3V3_RF	2.3–3.6V	Input	RF/Analog signal power supply
51	VDD_3V3_PA	2.3–3.6V	Input	Internal Power Amplifier power supply
52	VDD_PADS_BB	2.7–3.6V	Input	Baseband/Digital I/O power supply

#### 3.2.1 Analog Power Considerations

Pin 51 (VDD\_3V3\_PA) supplies the power amplifiers, and pin 50 (VDD\_3V3\_RF) supplies the remaining analog domains. During radio operation, a transient increase in current supplied via pin 50 could cause power rail collapse if not appropriately decoupled with a reservoir capacitor. Therefore, as shown in [Figure 3-1](#), external 10  $\mu$ F and 22  $\mu$ F decoupling capacitors are required to be connected close to pin 50.

If the module is powered with a single 3.3V supply derived from an LDO or SMPS, ensure that the regulator’s peak current handling is at least 500 mA (600 mA preferred).

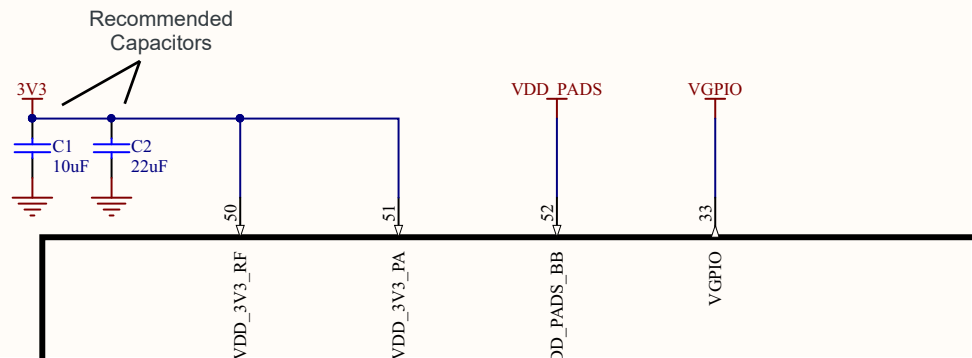


Figure 3-1: VDD\_3V3\_RF Capacitor Requirement

To avoid resistive losses affecting the power rail stability and level, ensure sufficient tracking width from the regulator output to the decoupling capacitors—a track width of 0.3 mm is recommended:

- Acceptable peak-to-peak voltage ripple on the analog voltage pins (50, 51) is 80 mV maximum.
- Typically, the analog and digital pins (50, 51, 52) are supplied by the same source. If this is the case (two or three pins with same source), connect the output of the external LDO or SMPS to those pins via both decoupling capacitors to form a star point for the supply inputs.

### 3.2.2 Digital Power Considerations

Pin 52 (VDD\_PADS\_BB) supplies the baseband digital parts of the design, including the CPU domains and the RTC domains. There are no specific requirements for decoupling of this pin.

As noted in [Analog Power Considerations](#), the analog and digital pins (50, 51, 52) typically are supplied by the same source. If this is the case (two or three pins with same source), connect the output of the external LDO or SMPS to those pins via both decoupling capacitors to form a star point for the supply inputs.

Pin 52 also connects to an internal LDO to generate the VGPIO voltage on pin 33.

### 3.2.3 VGPIO Power Considerations

VGPIO provides the voltage reference for the GPIO pins and, if required, is available to supply 3.3V to external circuitry.

VGPIO is generated internally from the VDD\_PADS\_BB input pin via a configurable LDO that provides either 1.8V or VDD\_PADS\_BB as its output.

No external pull-down is required.

**Important:** A limitation on the module's internal Flash voltage range requires VGPI0 to be set at 3.3V. If the voltage is switched to 1.8V, the module will not boot. Therefore do not include any external pull-up on pin 43 (GPIO(12)/MTDI/SD\_DATA2/HSPIQ), which if pulled high at boot time will cause VGPI0 to switch to 1.8V.

### 3.2.4 Power Management

The AirPrime BX310x switches between several power modes to minimize current consumption.

Light Sleep and Deep Sleep modes are enabled via AT commands from the host. Refer to [1] AirPrime BX310x AT Command Reference for details.

Table 3-3 describes the AirPrime BX310x's supported power modes.

**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 <sup>a</sup>	On	Off	On	On	
Light sleep <sup>a</sup>	Pause	Off	On	On	Wake up events will wake the module.
Deep sleep <sup>a</sup>	Off	Off	On	On/Off	Connection data stored in RTC memory
Hibernate <sup>a</sup>	Off	Off	Off	Off	Only RTC timer or specific RTC GPIOs can wake the module.

a. Available in future firmware release.

### 3.2.5 Current Consumption

The following current consumption values are taken using a single 3.3 V supply input and measuring the current drawn in the various operational modes. RF power is referenced to the Antenna port into a 50 Ω load. The values provided are average current taken at 25°C ambient temperature.

All Wi-Fi transmitter measurements are based on 50% duty cycle and continuous transmit mode. All Bluetooth transmitter measurements are based on 11% (DH1) duty cycle.

**Table 3-4: RF Current Consumption Specifications**

Mode	Typ	Unit
50% Duty Cycle Transmit 802.11b, DSSS 1 Mbps, POUT=+18.0 dBm	192	mA
50% Duty Cycle Transmit 802.11b, CCK 11 Mbps, POUT=+18.0 dBm	194	mA

**Table 3-4: RF Current Consumption Specifications (Continued)**

Mode	Typ	Unit
50% Duty Cycle Transmit 802.11g, OFDM 54 Mbps, POUT = +14 dBm	155	mA
50% Duty Cycle Transmit 802.11n, MCS7 HT20, POUT=+11.5 dBm	152	mA
50% Duty Cycle Transmit 802.11n, MCS7 HT40, POUT=+11.5 dBm	152	mA
Receive 802.11b, packet length=1024 bytes, -80 dBm	57	mA
Receive 802.11g, packet length=1024 bytes, -70 dBm	57	mA
Receive 802.11n HT20, packet length=1024 bytes, -65 dBm	57	mA
Receive 802.11n HT40, packet length=1024 bytes, -65 dBm	57	mA
11% Duty Cycle, DH1 Transmit Bluetooth 1 Mbps, 0 dBm	64	mA
11% Duty Cycle, 2DH1 Continuous Transmit Bluetooth 2 Mbps, 0 dBm	64	mA
11% Duty Cycle, 3DH1 Continuous Transmit Bluetooth 3 Mbps, 0 dBm	64	mA
11% Duty Cycle Continuous Transmit Bluetooth 1 Mbps, 10 dBm	69.6	mA
11% Duty Cycle Continuous Transmit Bluetooth 2 Mbps, 4.0 dBm	67.4	mA
11% Duty Cycle Continuous Transmit Bluetooth 3 Mbps, 4.0 dBm	67.4	mA
84% Duty Cycle Transmit LE 1 Mbps, 10 dBm	137	mA
84% Duty Cycle Transmit LE 1 Mbps, 4.0 dBm	114	mA
84% Duty Cycle Transmit LE 1 Mbps, 0 dBm	95	mA
Continuous Bluetooth Receive	58	mA
Light Sleep	1.9	μA
Deep Sleep	1.4	μA

### 3.3 RF

#### 3.3.1 Generic Radio

Measurements conducted at 25°C ambient temperature.

**Table 3-5: 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		0		dBi

#### 3.3.2 Wi-Fi Radio

Measurements conducted at 25°C ambient temperature.

**Table 3-6: Generic Radio Characteristics**

Description	Typ	Unit
Transmit 802.11b, CCK 11 Mbps, Output Power, EVM and Mask Compliant	15.5	dBm
Transmit 802.11g, OFDM 54 Mbps, Output Power, EVM and Mask Compliant	13.5	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	-95	dBm
Receiver Sensitivity 11b CCK, 11 Mbps	-88	dBm
Receiver Sensitivity 11g OFDM, 6 Mbps	-91.5	dBm
Receiver Sensitivity 11g OFDM, 54 Mbps	-74.5	dBm
Receiver Sensitivity 11n HT20 OFDM, 72.2 Mbps	-71.5	dBm
Receiver Sensitivity 11n HT40 OFDM, 135 Mbps	-70	dBm
BX3100 Harmonics 2F0	-42	dBm
BX3100 Harmonics 3F0	-54	dBm

### 3.3.3 Bluetooth Radio

Measurements conducted at 25°C ambient temperature.

**Table 3-7: Generic Radio Characteristics**

Description	Min	Typ	Unit
Transmit Power BR 1 Mbps, ACR & Modulation Compliant	-	4 <sup>a</sup>	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	-	4 <sup>b</sup>	dBm
Receiver Sensitivity BR 1 Mbps	-	-87	dBm
Receiver Sensitivity EDR 2 Mbps	-	-88	dBm
Receiver Sensitivity EDR 3 Mbps	-	-81	dBm
Receiver Sensitivity LE 1 Mbps	-	-90	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

- a. For FCC Band edge compliance on channel 78
- b. For FCC Band edge compliance on channel 39

## 3.4 Electrical Specifications

### 3.4.1 Absolute Maximum Ratings

**Table 3-8: Absolute Maximum Ratings**

Parameter		Min	Max	Units
V <sub>IL</sub>	Input low voltage	-0.3	0.25×V <sub>IO</sub>	V
V <sub>IH</sub>	Input high voltage	0.75×V <sub>IO</sub>	3.6	V
I <sub>IL</sub>	Input leakage current	-	50	nA
V <sub>OL</sub>	Output low voltage	-	0.1×V <sub>IO</sub>	V
V <sub>OH</sub>	Output high voltage	0.8×V <sub>IO</sub>	-	V
C <sub>pad</sub>	Input pin capacitance	-	2	pF
V <sub>IO</sub>	VDD_PADS_BB	2.7	3.6	V
I <sub>MAX</sub>	GPIO maximum drive capability	-	12	mA
T <sub>STR</sub>	Storage temperature range	-40	150	°C

**Table 3-9: Recommended Operating Conditions**

Parameter		Min	Typ	Max	Units
V <sub>DD</sub>	Supply voltage (VDD_3V3_PA, VDD_3V3_RF)	2.3	3.3	3.6	V
V <sub>IO</sub>	I/O supply voltage (VDD_PADS_BB)	2.7	3.3	3.6	V
T <sub>OPR</sub>	Operating temperature range	-40	-	85	°C
V <sub>IL</sub>	CMOS low level input voltage	0	-	0.3×V <sub>IO</sub>	V
V <sub>IH</sub>	CMOS high level input voltage	0.7×V <sub>IO</sub>	-	V <sub>IO</sub>	V
V <sub>TH</sub>	CMOS threshold voltage	-	0.5×V <sub>IO</sub>	-	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 11](#)). The following drawings illustrate the device footprint and dimensions.

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

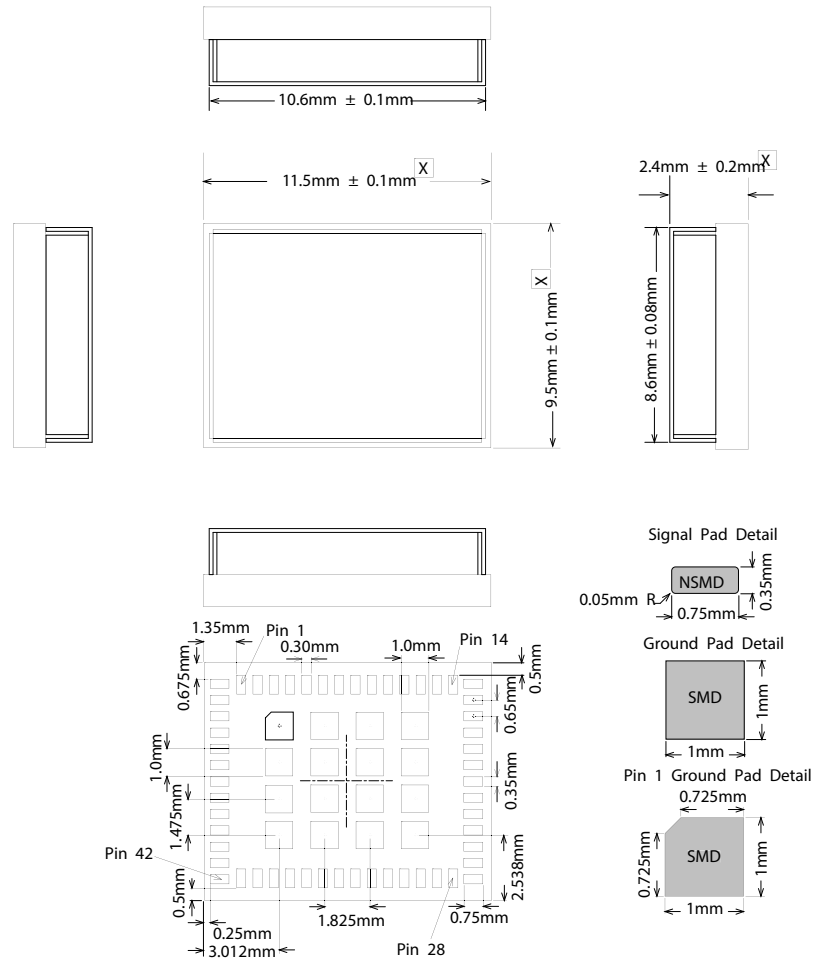


Figure 3-2: AirPrime BX3100 Mechanical Drawing



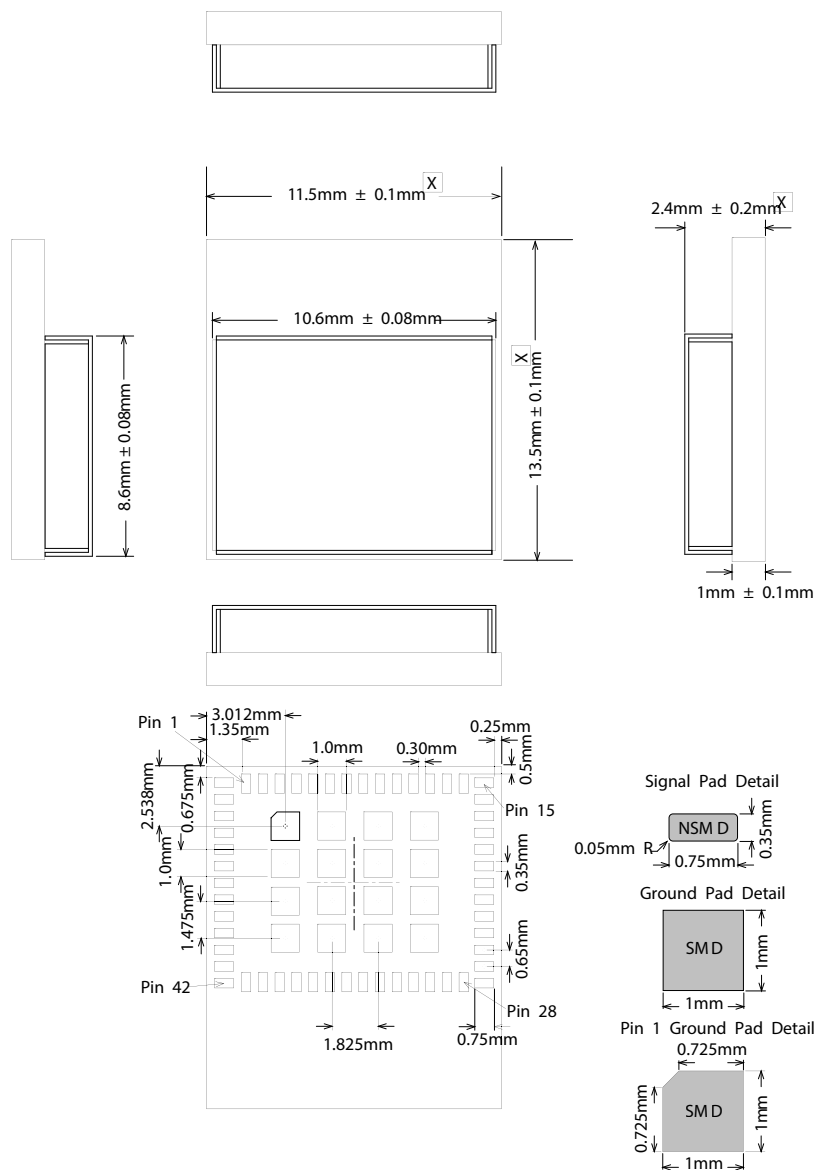


Figure 3-3: AirPrime BX3105 Mechanical Drawing

### 3.7 Antenna

The AirPrime BX3100 connects the RF I/O to the LGA pad (pin 40—RF\_MAIN). The port is nominally matched to  $50\ \Omega$ , which the application typically will connect to an external antenna. Tracking from the LGA pad to the antenna port should use a controlled  $50\ \Omega$  impedance transmission line technique. Provision for an antenna-matching circuit is recommended for conversion of the nominal  $50\ \Omega$  module port to the antenna impedance required for optimum transmission.

The AirPrime BX3105 includes an integrated PCB antenna. In this case, pin 40 is not connected internally to the RF port, however Sierra Wireless recommends leaving pin 40 unconnected on the application PCB.

For optimum antenna performance, the AirPrime BX3105 requires restrictions on metal, ground, and other tracking around the BX3105 antenna area. The module is designed to be placed in a corner area of the customer application, as shown in [Figure 3-4](#).



Figure 3-4: BX3105 Placement Examples

[Table 3-10](#) presents operating range information for the integrated antenna.

**Table 3-10: BX310x — Typical Range Performance**

Radio	Mode	Range (m)	Notes
BLE	Advertising	105	LOS (Line of Sight)
	Connection	105	
	Connection to Mobile	110	
Wi-Fi	Connection	> ~250	

When the BX3105 module is placed along a side of the PCB, ground, metal tracking, and metallic objects should not be placed in the area indicated by red arrows in [Figure 3-5](#). Also, when the application PCB is placed in a housing, do not use metallic coatings or structures in the area adjacent to the area indicated by red arrows.

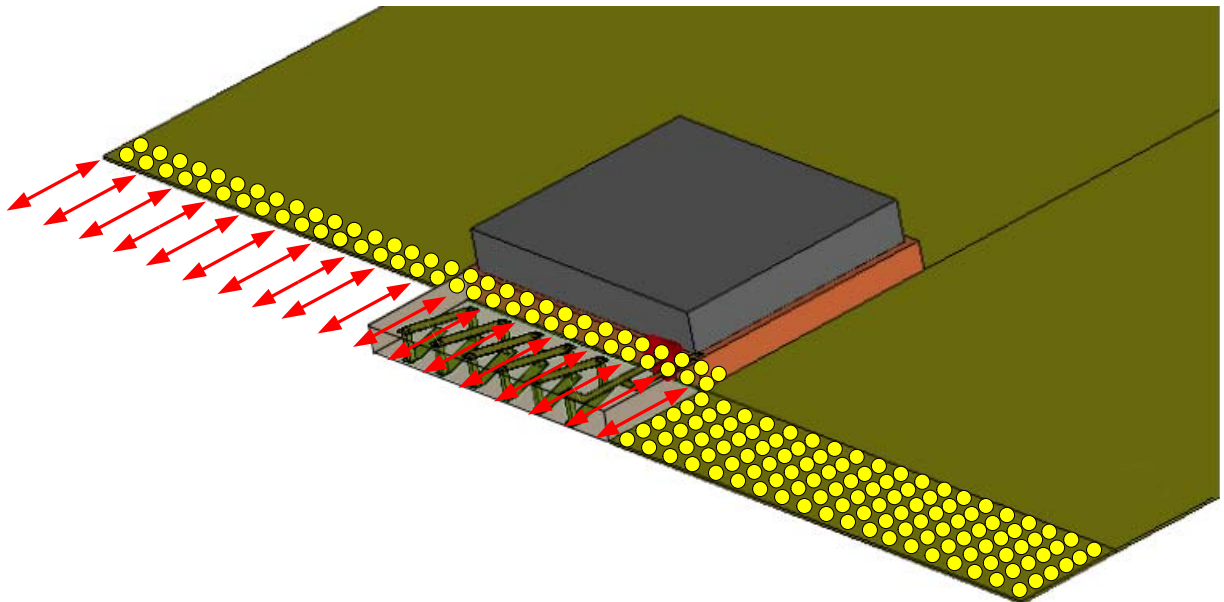
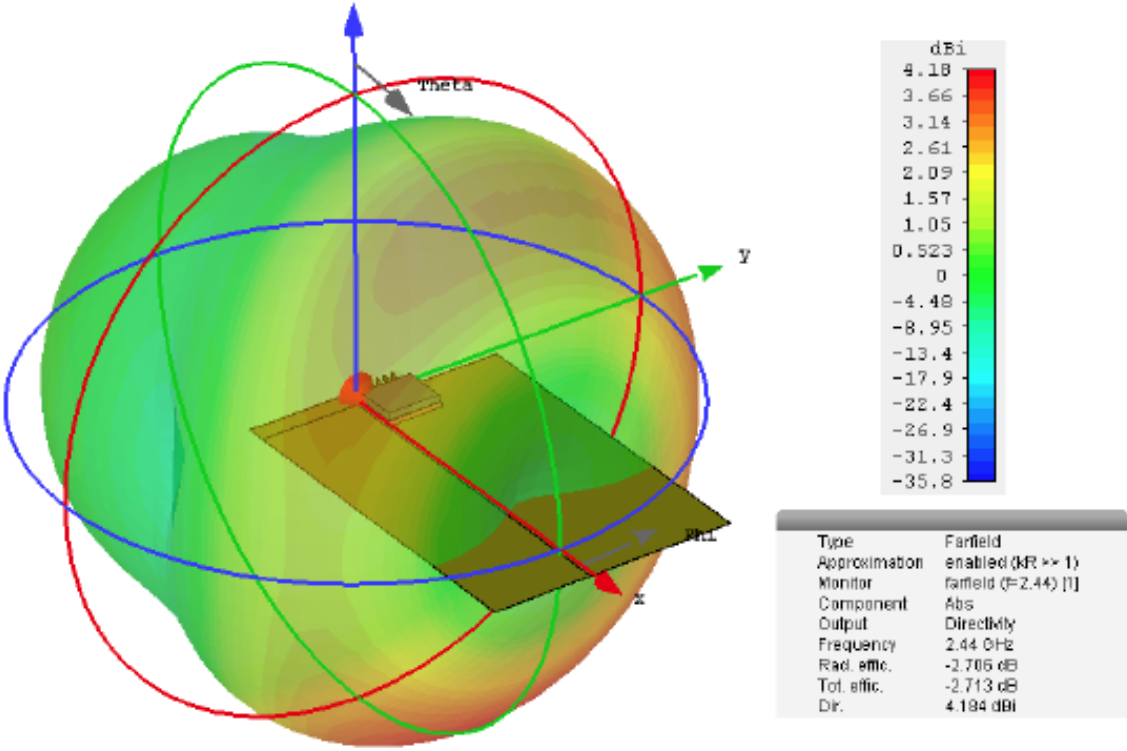


Figure 3-5: BX3105 Placement Restrictions

The integrated antenna in the BX3105 requires a solid ground plane on the application PCB. At the PCB edges (indicated in Figure 3-5 by yellow dots), place dense vias to connect internal and external ground planes together. Continue the via pattern throughout the application PCB where possible. An insufficient ground plane that is poorly connected throughout the application PCB may cause poor radiated performance of the module. Figure 3-6 shows the simulated radiated performance of the Antenna and module when placed on a 50 mm x 75 mm application PCB.



Simulated Performance—Measurements pending final tuning

Figure 3-6: Simulated Radiated Antenna Performance

### 3.7.1 Suggested Antennas

The following table describes several suggested antennas. Comparable antennas may also be used.

Table 3-11: Antennas

Module	Antenna	Description	Type	Maximum Gain
BX3105	3D PIFA Antenna	-	Integrated antenna	2 dBi

**Table 3-11: Antennas (Continued)**

<b>Module</b>	<b>Antenna</b>	<b>Description</b>	<b>Type</b>	<b>Maximum Gain</b>
BX3100	Gemwave Technologies, Ltd FSD_BL3404-50T	2.4 GHz; S-SMA (M/M); swivel antenna	Dipole	1.5 dBi
	RF Solutions ANT-24G-S21	2.4 GHz General purpose whip; straight RF antenna	Monopole	0 dBi
	RF Solutions ANT-24G-DPL-SMA	2.4 GHz Whip Wi-Fi antenna; SMA male	Dipole	2.1 dBi
	Molex 47950-0011	2.4 GHz/5 GHz; micro- coaxial RF connector	Dipole	2.27 dBi @ 2.4 GHz 4.9 dBi @ 5 GHz

## >> 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

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

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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 29](#) describes the signals used for UART0.

**Table 4-1: UART0 Pins<sup>a</sup>**

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.

---

*Note: UART signals are named with respect to the HOST, and directions are listed with respect to the module. For example, UART0\_RXD is an output from the module to the host.*

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The UART interface is configurable via AT commands:

- Default configuration—115200 (baudrate), 8 bit, no parity, no handshaking
- Baudrate considerations:
  - Maximum supported—5 Mbaud
  - Maximum tested—3 Mbaud. This is the maximum baudrate supported by the BX310x Dev Kit FTDI converter IC.
  - HW handshaking is recommended above rates of 1 Mbaud and can be enabled via AT command (AT&K3).

- Common baud rates are supported—any baud rate in the supported range can be selected via `AT+IPR=<uart_baud_rate>` command. The device automatically configures the clock dividers appropriately for the chosen baud rate.
- Baud rates are persistent post-reset.
- Recommendation—Add series termination resistors close to the module in the UART lines for management of clock harmonics. 499Ω resistors are recommended.

### 4.3 ADC/Voltage Measurement

The AirPrime BX310x provides a general purpose ADC (Analog to Digital Converter) input, which can sample multiple inputs configured using AT commands.

Pins `VDET_1`, `VDET_2`, `SENSOR_VP`, and `SENSOR_VN` are used to measure single-ended analog voltages referenced to ground. The voltage on these pins is read via an AT command.

Noise can have a large impact on sensitive voltage measurements. To improve the accuracy of small voltage level measurements, a 100 nF capacitor to ground is recommended on the input to the `VDET_1`, `VDET_2`, `SENSOR_VP`, and `SENSOR_VN` pins.

**Table 4-2: ADC Interface Pins<sup>a</sup>**

Pin	Signal name	Direction <sup>b</sup>	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.

**Table 4-3: Voltage-measurement GPIO Pins<sup>a</sup>**

Pin	Signal Name	Direction <sup>b</sup>	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.

Access to a Hall effect sensor is supported via firmware, and is selected using AT commands.

The sensor pins (`SENSOR_VP` or `SENSOR_VN`) will trigger an input perturbation (glitch) lasting for 80 ns when the ADC or Hall sensor is initialized.

## 4.4 I<sup>2</sup>C Interface

The AirPrime BX310x module provides two I<sup>2</sup>C (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: I<sup>2</sup>C Interface Pins<sup>a</sup>**

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	VGPI0
54	I2C2_SCL	I/O	Secondary I2C interface	

a. Leave open any pins that are not used.

This implementation of the I<sup>2</sup>C interface includes the following characteristics:

- Supported voltage:
  - Primary I2C (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 I<sup>2</sup>C signals (see [Figure 4-1 on page 31](#)).

For I<sup>2</sup>C bus details, including I2C bus waveform and timing details, refer to the I2C Bus Specification.

### 4.4.1 Application

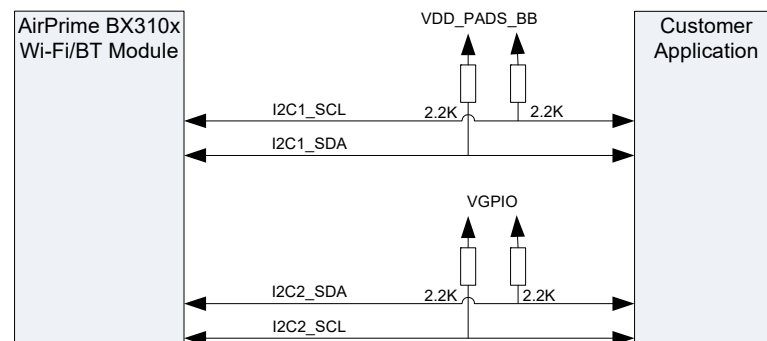


Figure 4-1: Example of I<sup>2</sup>C Bus Application

## 4.5 I2S Interface (Digital Audio)

*Note: Interface support is forthcoming.*

The AirPrime BX310x provides a 4-wire I<sup>2</sup>S (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<sup>a</sup>**

Pin	Signal name	Direction <sup>b</sup>	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.

## 4.6 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)<sup>a</sup>**

Pin	Signal Name	Direction	Default State	Function	Voltage Level
14	GPIO(5)	I/O	Pull high <sup>b</sup>	General purpose I/O	VDD_PADS_BB
35	GPIO(27)	I/O	No pull <sup>c</sup>		

- a. Leave open any pins that are not used.
- b. Pulled high internally
- c. Internal configuration—no internal pull-ups



**Table 4-7: GPIO Pins (Alternate function)<sup>a</sup>**

Pin	Signal Name	Direction	Default State	Function	Voltage Level
9	GPIO(23)	I/O	No pull <sup>b</sup>	General purpose I/O	VDD_PADS_BB
16	GPIO(0)		Pull high <sup>c</sup>		
17	GPIO(25)		No pull <sup>b</sup>		
18	GPIO(34)		No pull <sup>b</sup>		
19	GPIO(35)		No pull <sup>b</sup>		
24	GPIO(32)		No pull <sup>b</sup>		
25	GPIO(33)		No pull <sup>b</sup>		
26	GPIO(18)		No pull <sup>b</sup>		
27	GPIO(26)		No pull <sup>b</sup>		
31	GPIO(36)		No pull <sup>b</sup>		
32	GPIO(37)		No pull <sup>b</sup>		
34	GPIO(38)		No pull <sup>b</sup>		
36	GPIO(39)		No pull <sup>b</sup>		
42	GPIO(15)		Pull high <sup>c d</sup>		
43	GPIO(12)		Pull low <sup>e</sup>		
44	GPIO(14)		Pull high <sup>c</sup>		
45	GPIO(13)		Pull high <sup>c</sup>		
46	GPIO(2)		Pull low <sup>e</sup>		
47	GPIO(4)		Pull low <sup>e</sup>		
53	GPIO(16)		No pull <sup>b</sup>		
54	GPIO(17)	No pull <sup>b</sup>			

- a. Leave open any pins that are not used.
- b. Internal configuration—no internal pull-ups
- c. Pulled high internally
- d. GPIO(15) default state (pull HIGH) enables UART boot messaging. To disable UART boot messages, drive GPIO(15) LOW prior to boot.
- e. Pulled low internally

## 4.7 Bootstrap Pins

The GPIOs listed in [Table 4-8](#) are used as Bootstrap pins during start-up.

**Table 4-8: GPIO Bootstrap Functions**

GPIO	Function	Default State	Default Function	Alternative
0	Boot Source	High, Internal pull 45 kΩ	Boot from Internal Flash	Download to Flash (Disabled)
2	Boot Source	High, Internal pull 45 kΩ		
5	SDIO Slave Timing	High, Internal pull 45 kΩ	Rising Edge Input & Output	See <a href="#">Table 4-9</a> .
15 (MTDO)		High, Internal pull 45 kΩ		
12 (MTDI)	SDIO Interface Voltage	Low, Internal pull 45 kΩ	3.3V	1.8V (Not supported)

**Table 4-9: SDIO Slave Timing Configuration**

GPIO(5)	GPIO(15)	Configuration
Low	Low	Falling Edge Input & Output
Low	High	Rising Edge Input, Falling Edge Output
High	Low	Falling Edge Input, Rising Edge Output
High	High	Rising Edge Input & Output

## 4.8 SPI Bus

*Note: Interface support is forthcoming.*

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

*Note: Traditional 5-wire (MOSI/MISO/SCLK/CS/SRDY) SPI Slave interface can also be implemented over this same interface.*

[Table 4-10](#) describes the SPI interface pins for both configurations (5- and 6-wire).

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

**Table 4-10: SPI Pin Descriptions<sup>a</sup>**

Pin	SPI Master	SPI Slave	Direction <sup>b</sup>		Function
	6-Wire Signal Name	5-Wire Signal Name	Master	Slave	
42	HSPICS0	CS	O	I	SPI Chip Select
43	HSPIQ	MISO	I	O	MISO
44	HSPICK	SCLK	O	I	SPI Clock

**Table 4-10: SPI Pin Descriptions<sup>a</sup> (Continued)**

Pin	SPI Master	SPI Slave	Direction <sup>b</sup>		Function
	6-Wire Signal Name	5-Wire Signal Name	Master	Slave	
45	HSPID	MOSI	O	I	MOSI
46	HSPiWP	-	O	-	Write Protect (M)
47	HSPiHD	SRDY	O	O	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 supports connections to SD memory and I/O cards.

The following features are supported:

- SPI/1-bit/4-bit modes
- 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 4-11 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 4-11: SDIO Pin Descriptions<sup>a</sup>**

Pin	Signal Name	Direction	Function
42	SD_CMD	I/O	SDIO command
43	SD_DATA2	I/O	SDIO data bit 2
44	SD_CLK	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.

SDIO is particularly susceptible to tracking impedance and length variations between the SDIO tracks. Ensure that controlled impedance tracking is used, and minimize tracking length between the module and SD slave device. Add series resistor footprints at the host end to decrease the drive current and reduce potential interference, and match the length of all the SD tracks to within 1 mm.

SDIO tracking can cause significant radiated interference at integer multiples of the SD clock frequency, which can be picked up by the BX310x antenna. Bury SDIO tracks between ground planes and ensure stitching ground vias are placed throughout the board surrounding the SDIO tracking.

SDIO timing during the boot process is provided by GPIO(5) and GPIO(15). See [Table 4-9 on page 34](#) for details.

## 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 4-12: Enable Pin Description**

Pin	Signal Name	Direction <sup>a</sup>	Function	Voltage Level
37 <sup>b</sup>	ENABLE	I	Start/stop module	VDD_PADS_BB

- a. Signal direction with respect to the module.  
 b. Do not leave this pin unconnected.

To avoid a possible implementation-dependent issue where enabling/disabling Wi-Fi functionality could cause a perturbation (glitch) on the power supply rails that impacts module operations, a short delay (1 ms recommended) is required for the power supply to stabilize before enabling the module.

If ENABLE is controlled by the Host, the host implements the delay (from the time the supply is present) before driving ENABLE high.

If ENABLE is hard-wired to the supply (VDD\_PADS\_BB), an RC circuit (10kΩ & 0.1uF) is required. The RC circuit will create the required delay, allowing the supply to stabilize before ENABLE is pulled high.

Do not leave this pin unconnected.

## 4.11 PWM

The AirPrime BX310x supports the use of PWM functionality on GPIOs (GPIO(5) and GPIO(27)) via AT command configuration. Refer to [1] AirPrime BX310x AT Command Reference for details.

## >> 5: General Layout Recommendations

In addition to specific requirements for the antenna implementation and clearance of the BX3105 detailed in this document, good mixed-signal layout practices should be followed:

- Avoid tracking of high frequency signals near the RF sections of the module.
- Ensure plenty of ground vias throughout the application board.
- Tightly tie ground planes together throughout the application board.
- BX3100 RF tracking to application board antenna or RF connector:
  - Use 50  $\Omega$  impedance controlled tracks.
  - Do not track near sources of digital interference.
  - Provide continuous unbroken ground plane reference.
  - Avoid multiple layer changes.
- Supply decoupling should be placed as close to the supply pins as possible.
- Avoid long digital tracks on surface layers—they may support significant RF harmonic content.

## >> 6: Firmware Upgrade

The BX310x is firmware-upgradeable via the following methods:

- AirVantage FOTA (Firmware Over The Air)

Once the BX310x is registered on AirVantage, the customer can select public firmware packages for the device and initiate the FOTA update. If connected to the cloud, the BX310x can respond to a service request for firmware update or can initiate the update via AT commands.

For AT commands and notification details, refer to [1] AirPrime BX310x AT Command Reference.

For AirVantage FOTA details, refer to [source.sierrawireless.com/airvantage/fota](http://source.sierrawireless.com/airvantage/fota).

- Non-AirVantage OTA (Over The Air)

The BX310x supports non-AirVantage OTA via the AT+FOTA=<url> command. The BX310x connects to the specified <url> and downloads the firmware package using the MQTT protocol.

The firmware package will be posted on [source.sierrawireless.com](http://source.sierrawireless.com) for customers to use their own OTA service to update the firmware on the BX310x. For +FOTA details, refer to [1] AirPrime BX310x AT Command Reference. The customer is responsible for securing the communication between the BX310x and the MQTT server where the firmware package resides.

- UART from HOST

A firmware file can be downloaded to the module using the UART interface connected to a host device. A UART updater tool and source code is available on [source.sierrawireless.com](http://source.sierrawireless.com) for customers who wish to implement this functionality in their own application.

Currently, the BX310x is put into update mode by driving GPIO(27) high prior to boot. If the customer wishes to use UART mode, then GPIO(27) must be controlled by the HOST to enable this mode.

The firmware file is transferred and written encrypted into Flash over the UART interface prior to initiating the update process.

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*Note: Only authentic, signed Sierra firmware can be used in the update process.*

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Each of the upgrade methods follows the same process:

1. Firmware is written encrypted into an empty (or unused) Flash partition.

2. Firmware signature is verified by the bootloader prior to use.
  - If verification passes, then:
    - The boot process switches to the new partition and the device boots normally using the new firmware file.
    - The verification process is not retriggered on subsequent boots until another update process is initiated.
  - If verification fails, then:
    - The device reverts to the original partition.
    - If the upgrade was attempted OTA, the running firmware indicates a failure to update. If the upgrade was attempted over the UART, a verification failure message is reported.
    - The failed firmware file is not erased from Flash, but can be overwritten if another update process is initiated.

## >> 7: Regulatory Compliance

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**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.*

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

- Federal Communications Commission (FCC) of the United States
- Innovation, Science and Economic Development Canada (ISED)
- Ministry of Internal Affairs and Communications (MIC) of Japan
- Radio Equipment Directive of the European Union
- Ministry of Industry and Information Technology (People's Republic of China)
- The National Communications Commission (NCC) of Taiwan, Republic of China
- The National Telecommunications Agency (ANATEL)
- National Radio Research Agency (South Korea)

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*Note: To determine whether specific approvals have been received or to obtain the anticipated schedule for approvals, please contact your Sierra Wireless account representative.*

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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.

### 7.1 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 is undergoing approval (as of publication date of this document) 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 profiles. This certification applies globally.

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*Note: To determine whether specific approvals have been received or to obtain the anticipated schedule for approvals, please contact your Sierra Wireless account representative.*

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**Table 7-1: QDID (Qualified Design Identifications)**

<b>Module</b>	<b>QDID</b>
BX3100	TBD
BX3105	TBD

### 7.1.1 Labeling

- 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 website:

- Bluetooth Special Interest Group—<https://www.bluetooth.org/apps/content/>

## >> 8: 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.

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**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.*

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

## 8.1 Pin Configuration

Figure 8-1 illustrates the pin configuration of the AirPrime BX310x module.

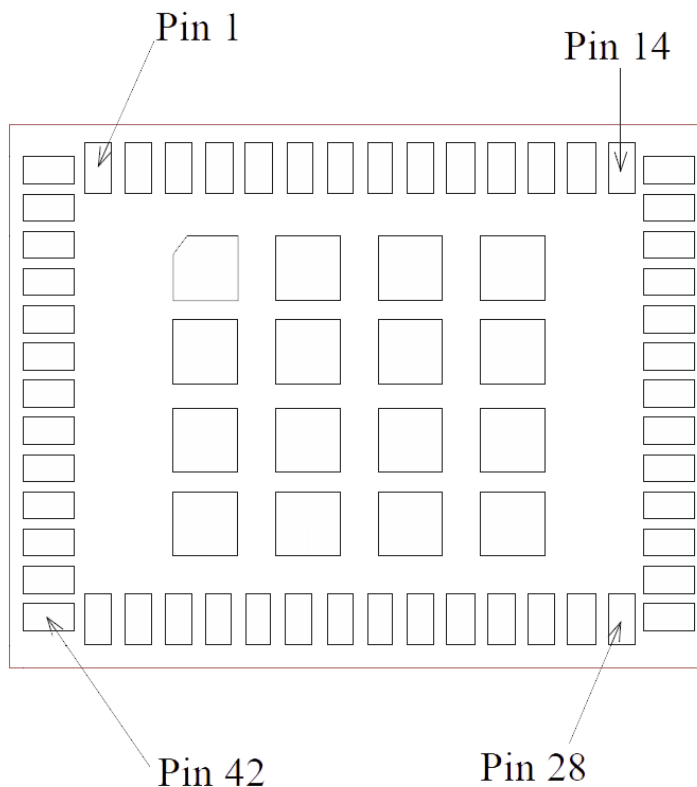


Figure 8-1: Pin Configuration (Bottom View)

## 8.2 Pin Description

Table 8-1 on page 43 lists detailed information for the LGA pins.

**Important:** Leave open all pins that are not used.

Table 8-1: Pin Definitions

Pin	Signal name	Group	I/O <sup>a</sup>	Voltage	PU/ PD <sup>b</sup>	Active <sup>c</sup>	Function	Type <sup>d</sup>
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 8-1: Pin Definitions (Continued)

Pin	Signal name	Group	I/O <sup>a</sup>	Voltage	PU/ PD <sup>b</sup>	Active <sup>c</sup>	Function	Type <sup>d</sup>
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 8-1: Pin Definitions (Continued)

Pin	Signal name	Group	I/O <sup>a</sup>	Voltage	PU/ PD <sup>b</sup>	Active <sup>c</sup>	Function	Type <sup>d</sup>
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 8-1: Pin Definitions (Continued)**

Pin	Signal name	Group	I/O <sup>a</sup>	Voltage	PU/ PD <sup>b</sup>	Active <sup>c</sup>	Function	Type <sup>d</sup>
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	2.7 (Min) 3.3V (Typ) 3.6 (Max)	-	-	3.3v nominal supply for Baseband and Digital I/O	C
53	GPIO(16)	GPIO	I/O	VGPIO	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

## >> 9: References

### 9.1 Web Site Support

Check <http://source.sierrawireless.com> for the latest documentation available for the AirPrime BX310x.

### 9.2 Reference Documents

- [1] AirPrime BX310x AT Command Reference  
Reference number: 41111445

## >> 10: Abbreviations

**Table 10-1: 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