



# BC188 Datasheet

## Key Specifications

- Low Power Wi-Fi module with Microcontroller and Antenna
- Cortex-M4F CPU with integrated 512KB SRAM, 320KB ROM, 8Mbit Flash
- Ultra Low Power modes (Deep Sleep, Standby)
- IEEE 802.11n/g/b, 1x1 SISO, 2.4 GHz and HT20
- Antenna Diversity
- Embedded Stack and TCP/IP, Simple UART interface
- 3xI2S, 3xSPI, 2xI2C, 3xUART, QSPI, Up to 35 GPIOs, 2 x Wake
- 2 Step ADC with PGA, 2 Channel or 1 Diff channel DAC
- Small form factor (22mm x 15.5mm x 1.5mm)

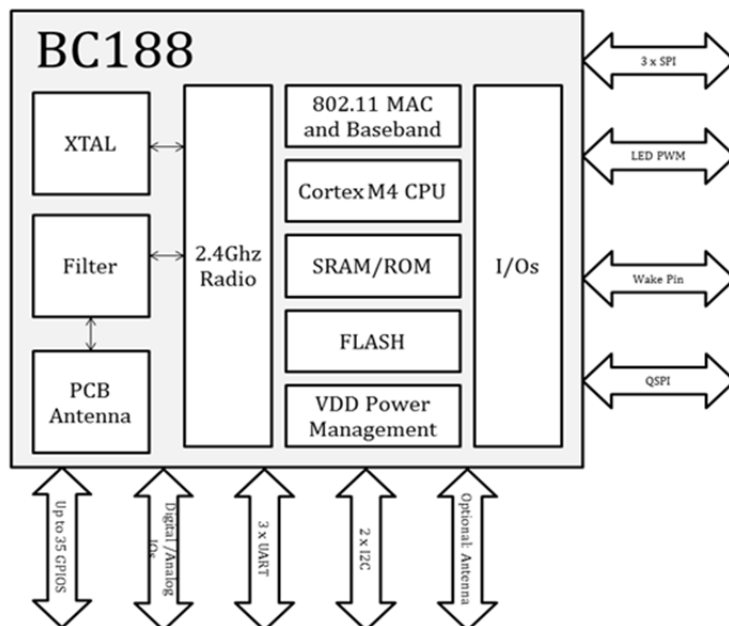


## Applications

- White Goods/Appliances
- Consumer Devices and Accessories
- Home Automation
- Personal Health Devices
- IoT and Wearables
- Commercial and Industrial

## Description

BC188 is a highly flexible, low power, small form factor self contained Wi-Fi module. It comes preloaded with BlueCreation Melody-Wi-Fi software, and is ideal for developers who want to quickly and cost effectively integrate Wi-Fi functionality into their products.





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## General Specifications

Specifications	Description
Wi-Fi	802.11 b.g.n.d.e.h.i.k.r.w
Interfaces	UART, AIO, GPIO, SPI, PCM, I2S, SPDIF, I2C
Size	22mm x 15.5mm x 1.5mm
Weight	0.9g

## Wi-Fi Specifications

Specifications	Description
Encryption	WEP 64 and 128 bit encryption (WPA), AES-CCMP, WAPI
Frequency Range	2400 to 2500 MHz
Maximum Data Rate	72.2Mbps, 20 MHz channels
Tx output saturation	26dBm
Rx input IP3	-15dBm
Phase Noise	-103dBc/Hz



## Audio Specifications

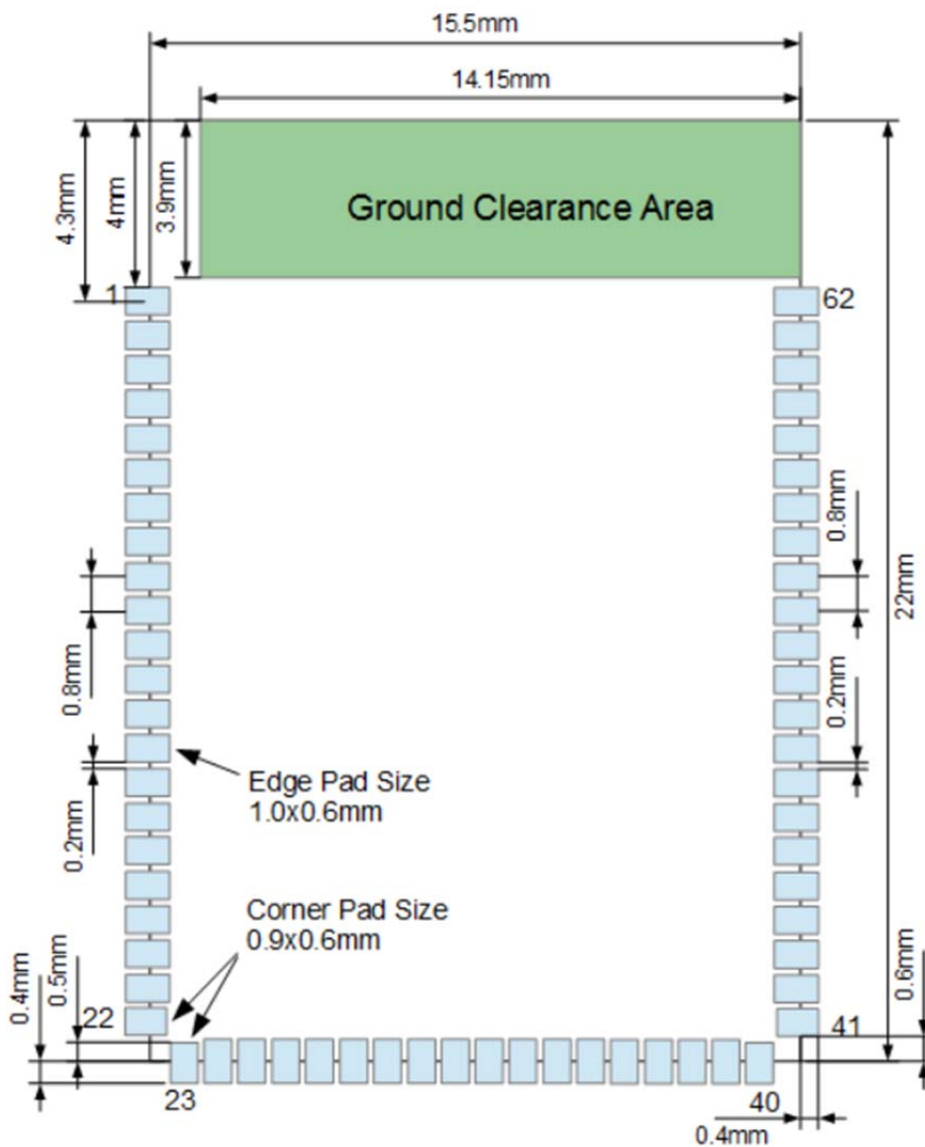
Specifications	Description
DAC output range	0.12V to 1.6V
Common ADC Input	0.9V (Typical)

## Electric Specifications

Specifications	Description
Supply Voltage	3.0V to 3.6 V DC (Supports Li Ion battery voltage range)
Typical Current (Sleep)	36 $\mu$ A
Typical Current (PowerSave)	0.4mA
Operating Temperature	-40°C to 85°C



# Module Footprint





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## PIN Description

No	Pin Name	Primary Function	Secondary Function
1	GND	GND	GND
2	ANT_CTRL1	Output ANT_CTRL1	General Purpose IO44
3	ANT_CTRL0	Output ANT_CTRL0	General Purpose IO 45
4	GND	GND	GND
5	RF_EXT	External RF Connection	NA
6	GND	GND	GND
7	UART_CTS/GPIO_0	UART Clear To Send via	GPIO_0
8	UART_RTS/GPIO_1	UART Ready To Send via	GPIO_1
9	UART_TX/GPIO_2	UART Transmit via	GPIO_2
10	UART_RX/GPIO_3	UART Receive via	GPIO_3
11	VDDIO_0	Supply input for GPIOs	NA
12	VDDIO_1	Supply input for GPIO16	NA
13	GND	GND	GND
14	GND	GND	GND
15	GND	GND	GND
16	GPIO_16	General Purpose IO 16	CON5 Configuration Pin 5
17	GND	GND	GND
18	GND	GND	GND
19	GPIO23	General Purpose IO 23	Wake Up 1
20	GPIO22	General Purpose IO 22	Wake Up 0
21	GPIO24	General Purpose IO 24	General Purpose Timer 1 Channel 5
22	GND	GND	GND
23	GND	GND	GND
24	GND	GND	GND
25	VBAT	Battery Supply Input	NA
26	RST#	Module Reset (Active Low)	NA
27	GPIO25	XTAL_32k CLK IN	GPIO25
28	GPIO26	XTAL_32k CLK OUT	GPIO26
29	GND	GND	GND
30	QSPI_D1/GPIO31	Flash SPI Data I/O 1	GPIO31
31	QSPI_CLK/GPIO29	Flash SPI Clock	GPIO29
32	VDDIO_2	Supply input for QSPI I/O	NA
33	GND	GND	GND
34	QSPI_D2/GPIO32	Flash SPI Data I/O 2	GPIO32
35	QSPI_D3/GPIO33	Flash SPI Data I/O 3	GPIO33
36	QSPI_D0/GPIO30	Flash SPI Data I/O 0	GPIO30
37	QSPI_SSN/GPIO28	Flash SPI Chip Select	GPIO28
38	GPIO27	General Purpose IO 27	CON4 Configuration Pin 4



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No	Pin Name	Pin Type	Pin Description
39	GND	GND	GND
40	GND	GND	GND
41	GND	GND	GND
42	GND	GND	GND
43	VDDIO_3	Supply input for GPIO	NA
44	GPIO40	General Purpose IO 40	NA
45	GPIO39	General Purpose IO 39	General Purpose Timer 3 Clock Input
46	GND	GND	GND
47	GPIO41	General Purpose IO 41	NA
48	GPIO42	General Purpose IO 42	NA
49	GPIO43	General Purpose IO 43	NA
50	GPIO46	General Purpose IO 46	NA
51	GPIO47	General Purpose IO 47	NA
52	GPIO48	General Purpose IO 48	NA
53	GPIO49	General Purpose IO 49	NA
54	GPIO7	General Purpose IO 7	JTAG Test Clock
55	GPIO6	General Purpose IO 6	JTAG Test Data Output
56	GPIO5	General Purpose IO 5	I2C0_SCL
57	GPIO4	General Purpose IO 4	I2C0_SDA
58	GPIO8	General Purpose IO 8	JTAG Test Mode State
59	GPIO9	General Purpose IO 9	JTAG Test Data Input
60	GPIO10	General Purpose IO 10	JTAG Test Reset (Active Low)
61	3V3	3V3 Supply Input	NA
62	GND	GND	GND

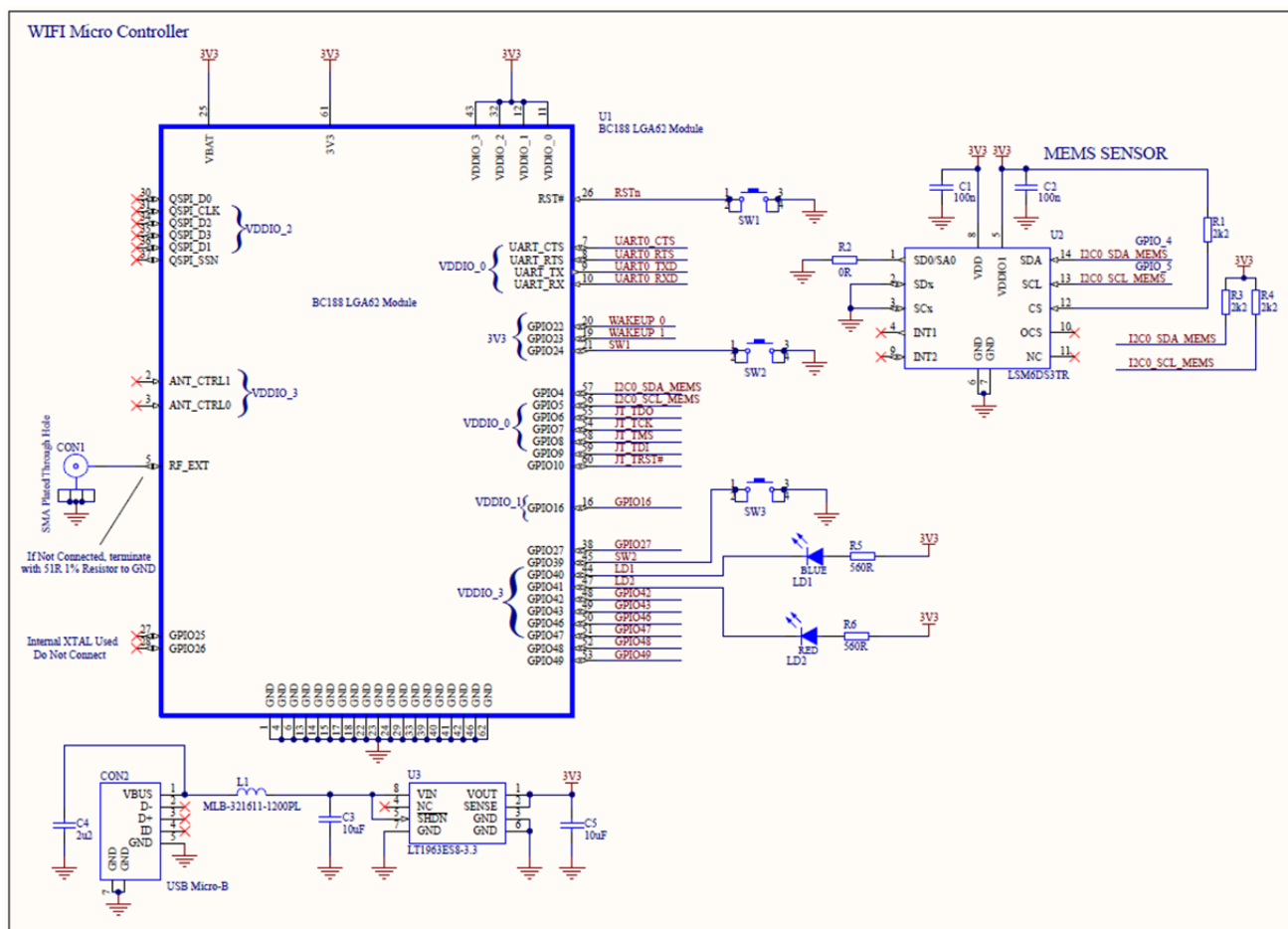
## Notes



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# Hardware Design Guideline

## Application Schematic



Net	Minimum	Typical	Maximum	Absolute Maximum**
VBAT	3.0V*	3.3V	3.60V	3.63V
3V3	2.97V	3.3V	3.63V	4.00V
VDDIO_0	2.97V	3.3V	3.60V	3.63V
VDDIO_1	2.97V	3.3V	3.60V	4.00V
VDDIO_2	2.97V	3.3V	3.60V	4.00V
VDDIO_3	2.97V	3.3V	3.60V	3.63V

\*This is the minimum voltage allowed to enable the module in the boot modes described below.

\*\*Operation above this level of voltage may damage the device.



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### **Boot Modes**

All supplies (VBAT Pin 25, 3V3 Pin 61 and VDDIO Pins 11,12, 32 & 43) should be applied simultaneously. No digital pins (GPIO, UART, I2C etc.) should be powered externally without first applying VDDIO\_X.

The entire module is in a reset state during power on when, internal PMU detection circuit detects the voltage rising on VBAT.

### **RESET Mode**

The Module is reset by applying a minimum of a 80us active low pulse to RST# (Pin26). An internal PMU detection circuit detects when RST# is pulled low and powers on when RST# >1.25V. Pulling RST# low resets the entire module.

### **Power Down Modes**

Several power down modes are supported

### **GPIOs**

Unused PIOs should be left floating.

### **UART**

The BC188 is controlled by GPIOs. This can be configured. If GPIO control is not used, these GPIOs should be left floating. The UART by default does not use RTS/CTS flow control. If the users do not expect to use it, these lines should be left floating.

### **EXT RF**

If the External RF Port is not used terminate with a 510hm 1% resistor to ground.

The external RF port is internally DC Blocked and can be used as a external RF connection for test purposes or as an additional antenna where higher gain or range is required than that supported by the internal antenna on the module.

### **Digital Pin States on RESET or after Power Up**

The following table shows the Digital Pin States on RESET or after power up.

Pin Name / Group	I/O Type	State after Power Up or RESET
UART_RX	Digital bi-directional with PU	Strong PU
UART_TX	Digital bi-directional with PU	Weak PU
UART_CTS	Digital bi-directional with PD	Weak PD
UART_RTS	Digital bi-directional with PU	Weak PU
GPIOX	Digital bi-directional with PU	Weak PU
RST#	Digital input with PU	Strong PU

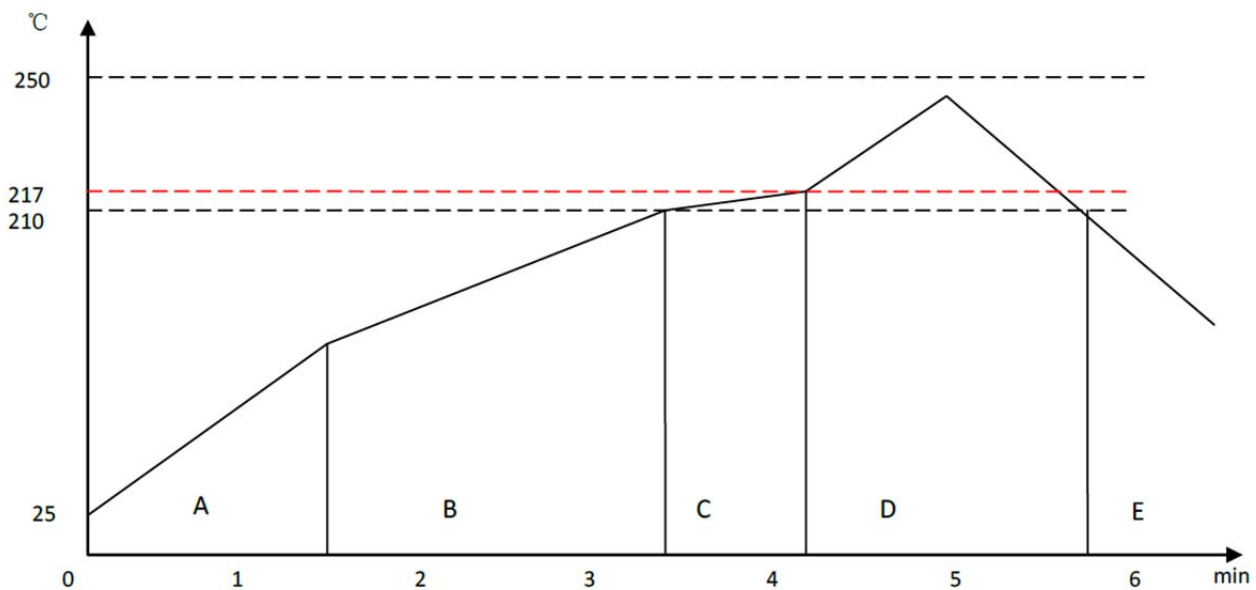
PD = Pull Down, PU = Pull Up





## Solder Reflow Profile

The solder profile is described below.



Zone A: Preheat: This raises the temperature at a controlled rate, typically 0.5 - 2C/s. This will preheat the component to 120°C to 150°C to distribute the heat uniformly to the PCB.

Zone B: Equilibrium1: In this zone, the flux becomes soft and uniformly spreads solder particles over the PCB board, preventing re-oxidisation. The recommended temperature for this zone is 150°C to 200°C for 60s to 120s.

Zone C: Equilibrium2: This is optional and in order to resolve the upright component issue. Temperature is 210°C to 217°C for 20s to 30s.

Zone D: Reflow zone: The temperature should be high enough to avoid wetting but low enough to avoid component deterioration. The recommended peak temperature is 230°C to 250°C. The soldering time should be 30s to 90s when the temperature is above 217°C.

Zone E: Cooling: The cooling rate should be fast to keep the solder grains small which will give a longer lasting joint. A typical cooling rate is 4°C/s.



# Regulatory Certifications

BC188 is delivered with FCC, CE and IC certifications. This allows to integrate the module in an end product without the need to obtain subsequent and separate approvals from these regulatory agencies. This is valid in the case no other intentional or un-intentional radiator components are incorporated into the product. Without these certification, an end product cannot be marketed in the relevant regions.

## United States - FCC

- In case no other intentional or un-intentional radiator is incorporated, the BC188's FCC certification allows users to integrate the module into products without the need to obtain subsequent and separate approval.
- The BC188 was approved as "intentional transmitter radio module" by the United States' Federal Communications Commission (FCC) with accordance to CFR47 Telecommunications Part 15, Subpart C, section 212. This certification is applicable in all the states in the United States.
- The certification allows products to be listed in the NRTL (National Recognized Test Laboratory) as appointed by OSHA (Occupational Safety and Health Administration).

### Labelling

- The BC188 has been labelled with its own FCC ID number. In order to extend the certification granted to the BC188, its FCC ID number must be displayed on the finished product in which the module is integrated. The following wording should be used "Contains Transmitter Module FCC ID: SSSBC188-X "or "Contains FCC ID: SSSBC188-X".
- The user-manual for any product in which the BC188 is integrated in must include the following statements:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Reorient or relocate the receiving antenna; Increase the separation between the equipment and receiver; Connect the equipment into an outlet on a circuit different from that to which the receiver is connected; Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this



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device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

To satisfy FCC RF Exposure requirements for mobile and base station transmission devices, a separation distance of 70mm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

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

Federal Communications Commission (FCC):  
<http://www.fcc.gov>

FCC Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB):  
<http://apps.fcc.gov/oetcf/kdb/index.cfm>



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### Europe - CE and RoHS Marking



- In case no other intentional or un-intentional radiator is incorporated, the BC188's CE marking certification allows users to integrate the module into products without the need to obtain subsequent and separate CE approval.
- The BC188 has been tested and granted approval as R&TTE Directive product under the 1999/5/EC Essential Requirements for Health and Safety (Article (3.1(a)), Electromagnetic Compatibility, (EMC) (Article 3.1(b)), and Radio (Article 3.2). A Notified Body Opinion has been issued.
- The BC188 has also been tested and granted approval under the directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment 2002/95/EC (commonly referred to as the Restriction of Hazardous Substances Directive or RoHS). This certification ensures the module is environmental safe and free from hazardous substances (including Lead).
- Both certifications are applicable in all the 27 countries of the European Economic Area.

### Labelling and Documentation

- Products complying with all relevant essential requirements shall bear the CE conformity marking accompanied by the identification number XXX-XXX
- The RoHS certification does not dictate any specific product labelling. However, we recommend marking the product with a "RoHS Compliant" statement.
- R&TTE Directive requires a manufacturer to establish technical documentation. It must be kept by the manufacturer or his authorised representative in the EU for at least 10 years after the last product has been manufactured. The documentation must cover:
  - a general description of the product,
  - conceptual design and manufacturing drawings and schemes of components, sub-assemblies, circuits and other design documentation,
  - descriptions and explanations necessary for the understanding of said drawings and schemes and the operation of the product,
  - a list of the standards referred to in Article 5, applied in full or in part, and descriptions and explanations of the solutions adopted to meet the essential requirements of the Directive where such standards
  - results of design calculations made, examinations carried out, etc.,
  - test reports.



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- Test reports must include the following table containing the BC188 tests:

Certification	Standards	Article	Laboratory	Report Number	Date
Safety	EN 60950-1:2006+A11:2009+A1:2010	(3.1(a))			
Health	EN 50371:2002-03				
EMC	EN 301 489-1 V1.8.1 (2008-04); EN 301 489-17 V2.1.1 (2009-05)	(3.1(b))			
Radio	EN 300 328 V1.7.1 (2006-10)	(3.2)			

- For further labelling and CE marking requirements please review the R&TTE Compliance Association Technical Guidance: <http://rtteca.com/>

For further information regarding the R&TTE certification requirements please review the following websites:

Radio and Telecommunications Terminal Equipment (R&TTE):  
[http://ec.europa.eu/enterprise/rtte/index\\_en.htm](http://ec.europa.eu/enterprise/rtte/index_en.htm)

European Conference of Postal and Telecommunications Administrations (CEPT):  
<http://www.cept.org>

European Telecommunications Standards Institute (ETSI):  
<http://www.etsi.org>

European Radio Communications Office (ERO):  
<http://www.ero.dk>



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### Canada - IC

- In case no other intentional or un-intentional radiator is incorporated, the BC188's IC certification allows users to integrate the module into products without the need to obtain subsequent and separate approval.
- The BC188 has been tested and granted approval under Industry Canada (IC) Radio Standards Specification (RSS) RSS-210, RSSGen and ICES-003. This certification is applicable in Canada.

#### Labelling and Documentation

- The BC188 has been labelled with its own IC ID number. In order to extend the certification granted to the BC188, its CE ID number must be displayed on the finished product in which the module is integrated. The following wording should be used "Contains Transmitter Module IC: XXX"
- The user-manual for any product in which the BC188 is integrated in must include the following statements:

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.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante

#### Radiation Exposure Statement:

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 45mm between the radiator & your body.

#### Déclaration d'exposition aux radiations:



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Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 45mm de distance entre la source de rayonnement et votre corps.

- For further labelling and IC marking requirements please review the Industry Canada website: <http://www.ic.gc.ca/>

### Notes:

- Changes or modifications that are made to the module circuitry can hinder the certification
- Installers must comply with all of the instructions provided by the certification agency, which indicate installation and/or operating conditions necessary for compliance
- It is important to note that the finished product is required to comply with all applicable authorizations regulations and requirement that is not associated with the BC188 module, including non-intentional transmitting modules and other intentionally transmitting modules.
- The previous section represents BlueCreation interpretation of the salient issues of the certifications. For full details of the certification please refer to the local agencies' websites. Where there is any difference between this document and the local agencies' website, the subsequent should be followed.
- At the time of writing this document FCC and CE certification were still processed by the relevant authorities.



## BC188 Datasheet

# WLAN

## Overview

The BC188 integrates a highly integrated, single-band (2.4 GHz) IEEE 802.11n 1x1 WLAN subsystem, specifically designed to support next generation, high throughput data rates.

The subsystem provides the combined functions of CPU, memory, Medium Access Controller (MAC), Direct Sequence Spread Spectrum (DSSS) and Orthogonal Frequency Division Multiplexing (OFDM) baseband modulation, direct conversion WLAN RF radio, and encryption. For security, the 802.11i security is supported through several protocols.

## Features

- 1x1 SISO, 2.4 GHz, HT20 operation
- Antenna diversity
- CMOS and low-swing sine wave input clock
- Low power with deep sleep and standby modes
- Pre-regulated supplies
- Integrated T/R switch, PA, and LNA
- Optional 802.11n features
- One Time Programmable (OTP) memory to eliminate need for external EEPROM

## WLAN MAC

- Simultaneous peer-to-peer and infrastructure Modes
- RTS/CTS for operation under DCF
- Hardware filtering of 32 multicast addresses
- On-chip Tx and Rx FIFO for maximum throughput
- Open System and Shared Key Authentication services
- A-MPDU Rx (de-aggregation) and Tx (aggregation)
- Reduced Inter-Frame Spacing (RIFS) receive
- Management information base counters
- Radio resource measurement counters
- Quality of service queues
- Block acknowledgment extension





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- Multiple-BSSID and Multiple-Station operation
- Transmit rate adaptation
- Transmit power control
- Long and short preamble generation on a frame-by-frame basis for 802.11b frames

## WLAN Baseband

- 802.11n 1x1 SISO
- Backward compatibility with legacy 802.11g/b technology
- PHY data rates up to 72.2 Mbps
- 20 MHz bandwidth/channel
- Modulation and Coding Scheme (MCS)-MCS 0~7
- Radio resource measurement
- Optional 802.11n SISO features
  - 1 spatial stream STBC reception and transmission
  - Short guard interval
  - RIFS on receive path 802.11n packets
  - 802.11n greenfield Tx/Rx
- Power save features

## WLAN Radio

The BC188 direct conversion WLAN RF radio integrates all the necessary functions for transmit and receive operation.

Features Include:

- Integrated direct-conversion radio
- 20 MHz channel bandwidth
- Integrated T/R switch, PA, and LNA.

## WLAN Rx Path



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- Direct conversion architecture eliminates need for external SAW filter
- On-chip gain selectable LNA with optimized noise figure and power consumption
- High dynamic range AGC function in receive mode

### WLAN Tx Path

- Integrated power amplifier with power control
- Optimized Tx gain distribution for linearity and noise performance

### WLAN Local Oscillator

- Fractional-N for multiple reference clock support
- Fine channel step

### Channel Frequencies Supported

<b>20 MHz Channels</b>	
<b>Channel</b>	<b>Frequency (GHz)</b>
1	2.412
2	2.417
3	2.422
4	2.427
5	2.432
6	2.437
7	2.442
8	2.447
9	2.452
10	2.457
11	2.462



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12	2.467
13	2.472

## WLAN Encryption

- WEP 64- and 128-bit encryption with hardware TKIP processing (WPA)
- AES-CCMP hardware implementation as part of 802.11i security standard (WPA2)
- Enhanced AES engine performance
- AES-Cipher-Based Message Authentication Code (CMAC) as part of the 802.11w security standard
- WLAN Authentication and Privacy Infrastructure (WAPI)

## Ordering Information

Part number BC188

Order number	Description
BC188	WiFi Module with integrated PCB Antenna
BC188-DISKIT-001	Development kit for the BC188 module

## General Notes



## BC188 Datasheet

- BlueCreation's products are not authorised for use in life-support or safety-critical applications. Use in such applications is done at the sole discretion of the customer. BlueCreation will not warrant the use of its devices in such applications.
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