



CIONLABS

MODULE Datasheet

DS-BC101VE-01-11P V1.4

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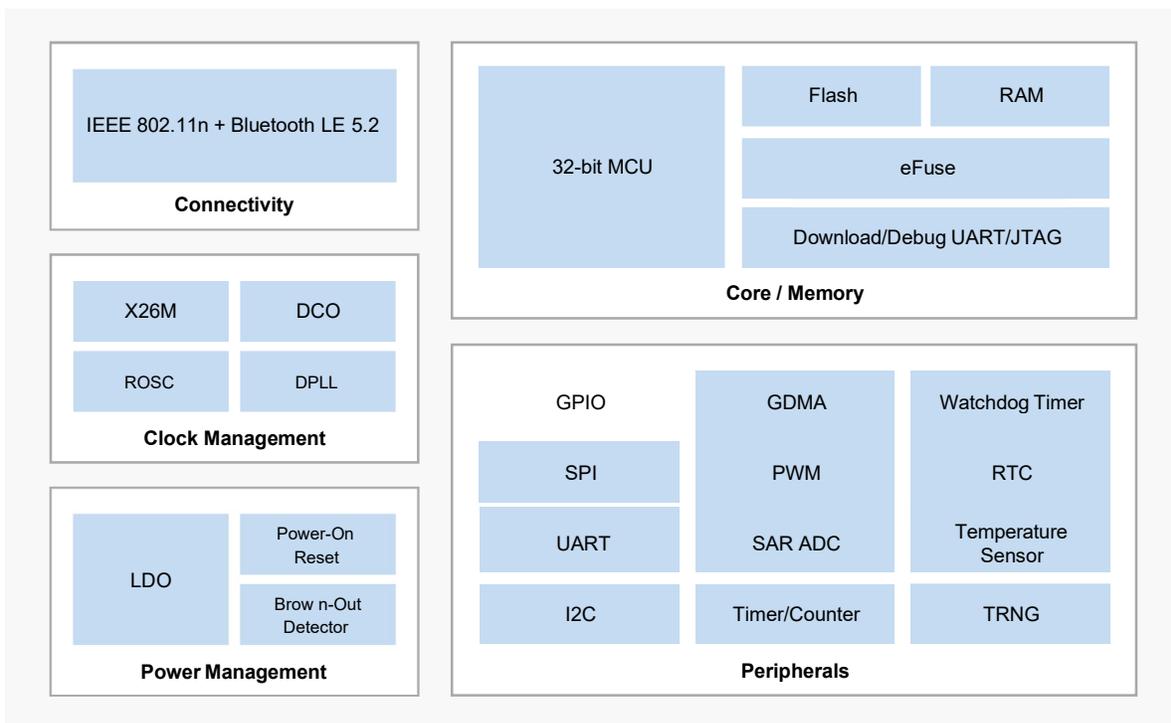
Overview

The module BC101VE-01-11P is a highly-integrated Beken BK7238 single-chip Wi-Fi 802.11n and Bluetooth Low Energy (LE) 5.2 combo solution designed for applications that require low power and compact size. Integrating a powerful 32-bit MCU and a comprehensive set of peripherals and interfaces makes the module ideal for advanced Internet of Things (IoT) applications.

Using advanced design techniques and process technology, the module delivers high integration and minimal power consumption in an extremely small package for smart lighting, smart home, indoor positioning, and other complex IoT applications.

The figure below shows the general block diagram of the BC101VE-01-11P.

Block Diagram



The module BC101VE-01-11P devices are offered in several packages. The set of included peripherals varies depending on the package. The below table shows the list of peripherals available on each part number.

Table Device Options and Features

Feature	BC101VE-01-11P
Flash	2 MB
RAM	256KB

GPIO	9
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Feature		BC101VE-01-11P
SPI	Master/Slave	0
UART		2
I2C	Master/Slave	1
GDMA		Yes
PWM	PWM0 ~ 5	5
SAR ADC	10 bits	1
	Number of channels	4
Timer	General-purpose timer/counter	6
	Watchdog timer	1
	Low-power timer	1
Temperature sensor		1
TRNG		Yes
Package Size		15mm x 18mm
Operating voltage		3.3V

Features

Wi-Fi

- IEEE 802.11 b/g/n 1x1 compliant
- Supports 20 MHz channel
- STBC supported
- Working mode STA, AP, Direct
- Concurrent AP + STA
- TX power up to +19 dBm
- RX sensitivity -99 dBm

Bluetooth Low Energy

- Bluetooth 5.2
- Bluetooth Low Energy (LE), 1 Mbps, 2 Mbps, and long-range (125 kbps and 500 kbps)
- Advertising extensions
- Bluetooth direction finding: Angle of Arrival (AoA) and Angle of Departure (AoD)
- Supports an antenna array with up to sixteen antennae for precise indoor positioning
- Integrated Bluetooth LE/WLAN coexistence (PTA)

Core and Memory

- 32-bit MCU at up to 160 MHz
- SiP Flash options: 1 MB, 2 MB, or none (depending on the package)
- 288 KB RAM
- 4-byte eFuse
- UART/JTAG for download and debugging

Clock Management

- External oscillator: 26 MHz crystal oscillator (X26M)
- Internal oscillator: 26 ~ 160 MHz digitally controlled oscillator (DCO), 32 kHz ring oscillator (ROSC)
- 480 MHz DPLL

Power Management

- 2.7 to 3.6 V VBAT supply
- On-chip power-on reset (POR) and brown-out detector (BOD)
- Embedded LDO regulators
- Low power consumption:
 - Active mode RX: 30 mA
 - Normal standby mode: 300 μ A
 - Low voltage standby mode: 75 μ A
 - Shutdown mode: 0.5 μ A

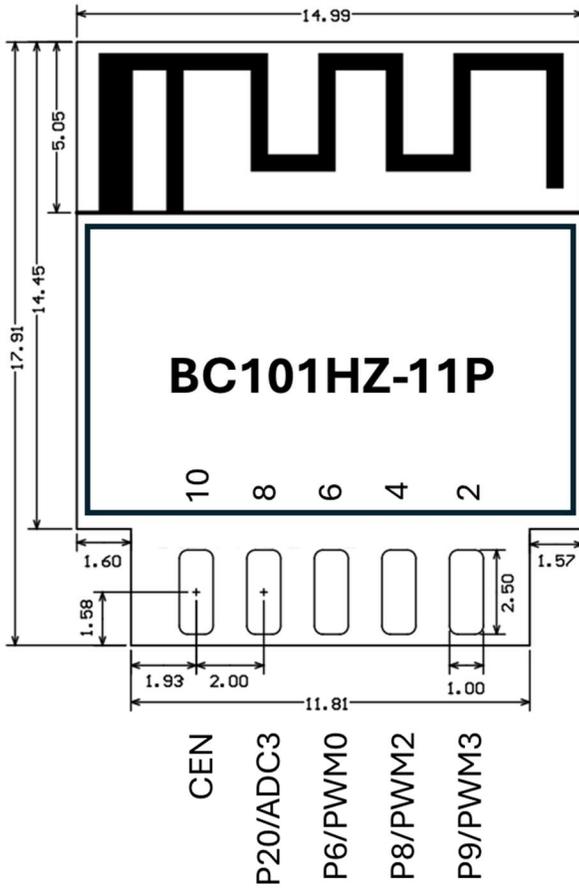
Peripherals

- GPIOs: 9
- 1x SPI
- 2x UART: 1 with Flash download support
- 1x I2C
- 1x general-purpose DMA controller (GDMA) with 6 channels
- 6x 32-bit PWM channel
- 10-bit SAR ADC, up to 6 channels
- 6x general-purpose 32-bit timer/counter
- 1x watchdog timer
- 1x real-time counter (RTC)
- 1x temperature sensor
- 1x true random number generator (TRNG)

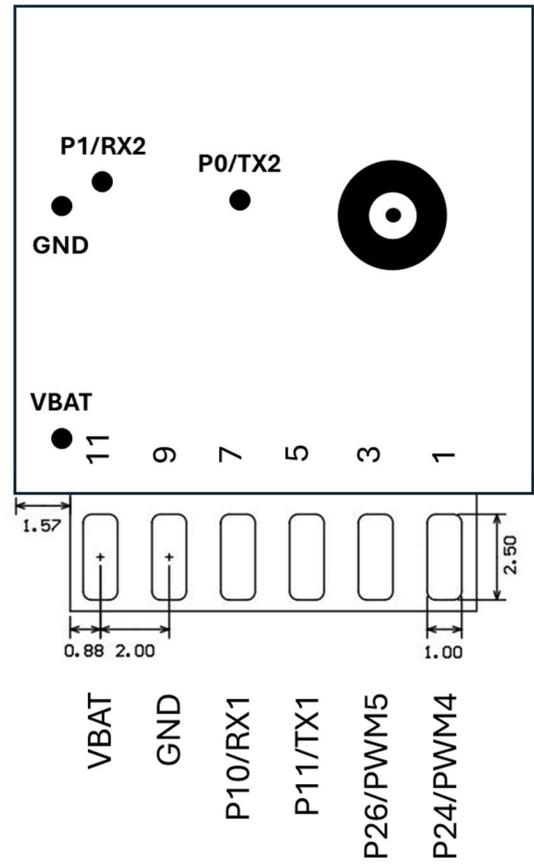
Pin Configuration

The pin configuration of the module is as below:

Front View



Back View



Electrical Characteristics

Note: Values currently listed in this section are preliminary measurements subject to change.

Absolute Maximum Ratings

Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device.

Exposure to absolute-maximum-rated conditions for prolonged periods may affect the device's reliability.

Parameter	Description	Min.	Max.	Unit
V _{BAT}	Battery regulator supply voltage	-0.3	3.6	V
P _{RX}	RX input power	-	10	dBm
T _{STR}	Storage temperature range	-55	150	°C

ESD Ratings

Parameter	Description	Value	Unit
ESD HBM	Human body model	±2000	V
ESD CDM	Charged device model	±500	V

Recommended Operating Conditions

Parameter	Description	Min.	Typ.	Max.	Unit
V _{BAT}	Battery/regulator supply voltage	2.7	-	3.6	V
V _{CCIF}	Supply voltage for IF	2.7	-	3.6	V
V _{CCRXFE}	Supply voltage for RX	2.7	-	3.6	V
V _{CCPA}	Supply voltage for PA	2.7	-	3.6	V
V _{CCTX}	Supply voltage for TX	2.7	-	3.6	V
V _{CCPLL}	Supply voltage for RF PLL	2.7	-	3.6	V
V _{DDAON}	Always-ON digital LDO output voltage	0.5	0.9	1.0	V
V _{DD_FLASH}	Supply voltage for external Flash	2.7	-	3.6	V

Parameter	Description	Min.	Typ.	Max.	Unit
T _{OPR}	Operating temperature range	-40	-	105	°C

Digital LDO

Parameter	Description	Min.	Typ.	Max.	Unit
VDDAON	Always ON LDO digital output voltage	0.5	0.9	1.0	V
Load Current	-	-	-	50	mA

Crystal and Reference Clock

Parameter	Description	Min.	Typ.	Max.	Unit
Frequency	Crystal and reference frequency	-	26	-	MHz
Tolerance	Crystal and reference frequency tolerance	-10	-	+10	ppm
XI Pin	Input voltage range for reference clock input	-0.3	-	1.05	V

Current Consumption

Measured with T = 25 °C, VBAT = 3.0 V unless otherwise stated.

Parameter	Condition	Min.	Typ.	Max.	Unit
Active Mode					
RX current	11 Mbps DSSS	-	30	-	mA
	54 Mbps OFDM	-	33	-	mA
	MCS7, HT20	-	33	-	mA
TX current	11 Mbps DSSS @ 17 dBm	-	265	-	mA
	54 Mbps OFDM @ 15 dBm	-	230	-	mA
	MCS7, HT20 @ 14 dBm	-	220	-	mA
Standby Mode					
Normal standby	-	-	300	-	μA

Low voltage standby	-	-	75	-	μA
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Parameter	Condition	Min.	Typ.	Max.	Unit
Deep Sleep Mode					
Deep sleep	-	-	10	-	μA
Shutdown Mode					
Shutdown	-	-	0.5	-	μA

WLAN RF Characteristics - Receiver

Measured with T = 25 °C, VBAT = 3.0 V unless otherwise stated.

Parameter	Condition	Min.	Typ.	Max.	Unit
General					
Frequency range	-	2412	-	2484	MHz
Sensitivity					
Sensitivity - IEEE 802.11b	1 Mbps DSSS	-	-99	-	dBm
	2 Mbps DSSS	-	-96	-	dBm
	5.5 Mbps DSSS	-	-94	-	dBm
	11 Mbps DSSS	-	-90	-	dBm
Sensitivity - IEEE 802.11g (10% PER for 1024 octet PSDU)	6 Mbps OFDM	-	-92	-	dBm
	9 Mbps OFDM	-	-92	-	dBm
	12 Mbps OFDM	-	-91	-	dBm
	18 Mbps OFDM	-	-89	-	dBm
	24 Mbps OFDM	-	-86	-	dBm
	36 Mbps OFDM	-	-82	-	dBm
	48 Mbps OFDM	-	-78	-	dBm
	54 Mbps OFDM	-	-76	-	dBm
MCS0	MCS0	-	-92	-	dBm
	MCS1	-	-90	-	dBm

Sensitivity - IEEE 802.11n, 20 MHz (10% PER for 4096 octets PSDU)	MCS2	-	-87	-	dBm
	MCS3	-	-84	-	dBm

Parameter	Condition	Min.	Typ.	Max.	Unit
	MCS4	-	-81	-	dBm
	MCS5	-	-77	-	dBm
	MCS6	-	-75	-	dBm
	MCS7	-	-74	-	dBm
Maximum Receive Level					
Maximum receive level @ 2.4 GHz	1, 2 Mbps (8% PER, 1024 octets)	-	-	10	dBm
	5.5, 11 Mbps (8% PER, 1024 octets)	-	-	10	dBm
	6 ~54 Mbps (10% PER, 1024 octets)	-	-	5	dBm
	MCS0~7 (10% PER, 4096 octets)	-	-	2	dBm
Adjacent Channel Rejection					
Adjacent channel rejection - IEEE 802.11b	1 Mbps DSSS	-74 dBm	-	45	dB
	2 Mbps DSSS	-74 dBm	-	45	dB
	5.5 Mbps DSSS	-70 dBm	-	40	dB
	11 Mbps DSSS	-70 dBm	-	40	dB
Adjacent channel rejection - IEEE 802.11g	6 Mbps OFDM	-79 dBm	-	37	dB
	54 Mbps OFDM	-62 dBm	-	28	dB
	MCS0	-79 dBm	-	35	dB

Adjacent channel rejection - IEEE 802.11n	MCS7	-61 dBm	-	22	-	dB
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WLAN RF Characteristics - Transmitter

Measured with T = 25 °C, VBAT = 3.0 V unless otherwise stated.

Parameter	Condition	Min.	Typ.	Max.	Unit	
General						
Frequency range	-	2412	-	2484	MHz	
TX power						
TX power - IEEE 802.11b (EVM compliant)	1 Mbps DSSS	-	19	-	dBm	
	11 Mbps DSSS	-	19	-	dBm	
TX power - IEEE 802.11g (EVM compliant)	6 Mbps OFDM	-	20	-	dBm	
	54 Mbps OFDM	-	17	-	dBm	
TX power - IEEE 802.11n (EVM compliant)	MCS0	-	19	-	dBm	
	MCS7	-	16	-	dBm	
Harmonic Level						
Harmonic level (at maximum output power)	4.8~5.0 GHz	2nd harmonic	-	-	-45	dBm
	7.2~7.5 GHz	3rd harmonic	-	-	-50	dBm
General Spurs						
General spurs (at maximum output power)	1~18 GHz	-	-	-45	dBm	

Bluetooth LE RF Characteristics - Receiver

Measured with T = 25 °C, VBAT = 3.0 V unless otherwise stated.

Parameter	Condition	Min.	Typ.	Max.	Unit
General					
Frequency range	-	2402	-	2480	MHz
Data rate	Bluetooth LE 1 Mbps, 2 Mbps, 125 kbps and 500 kbps				
Bluetooth LE 1 Mbps					

Sensitivity	30.8% PER	-	-98	-	dBm
Maximum input level	30.8% PER	0	-	-	dBm

Out-of-band blocking	30-2000 MHz	-10	-	-	dBm
Out-of-band blocking	2003-2399 MHz	-20	-	-	dBm
Out-of-band blocking	2484-2997 MHz	-10	-	-	dBm
Out-of-band blocking	3000 MHz-12.75 GHz	-10	-	-	dBm

Bluetooth LE RF Characteristics - Transmitter

Measured with T = 25 °C, VBAT = 3.0 V unless otherwise stated.

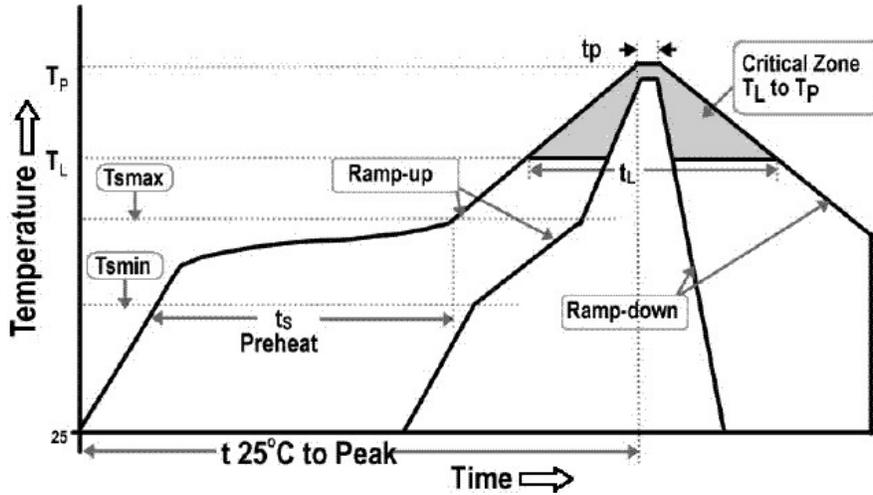
Parameter	Condition	Min.	Typ.	Max.	Unit
General					
Frequency range	-	2402	-	2480	MHz
TX Power					
TX power	-	6	8	10	dBm
Bluetooth LE 1 Mbps					
Modulation Characteristics					
$\Delta f_{1\text{ avg}}$	-	-	250	-	kHz
$\Delta f_{2\text{ max}}$	-	-	230	-	kHz
$\Delta f_{2\text{ avg}}/\Delta f_{1\text{ avg}}$	-	-	0.9	-	-
Carrier Frequency Offset and Drift					
$\text{Max } f_n _{n=0, 1, 2, 3\dots k}$	-	-	2.0	-	kHz
$\text{Max } f_0 - f_n _{n=2, 3, 4\dots k}$	-	-	1.5	-	kHz
$ f_1 - f_0 $	-	-	0.5	-	kHz
$\text{Max } f_n - f_{n-5} _{n=6, 7, 8\dots k}$	-	-	1.3	-	kHz/50 μs

SAR ADC Characteristics

Measured with T = 25 °C, VBAT = 3.0 V unless otherwise stated.

Parameter	Condition	Min.	Typ.	Max.	Unit
Conversion clock	-	-	-	26	MHz
Conversion time	-	-	16	-	Cycle
VREF	-	-	0.9	-	V
Resolution	-	-	10	-	Bits
Input voltage range	-	0	-	ADC_VREF*4	V
Input impedance	-	-	Infinite	-	kΩ
Input capacitance (Cs)	-	-	1	-	pF
DNL	-	-	1	-	Bits
SNDR	-	-	57.5	-	dB
T _{STARTUP}	-	-	32	-	Cycle
Current consumption	With buffer	-	200	-	μA

Solder Reflow Profile



Profile Feature		Specification
Average Ramp-Up Rate (tsmax to tp)		3 °C/second max.
Pre_heat	Temperature Min (T _{smin})	150 °C
	Temperature Max (T _{smax})	200 °C
	Time (t _s)	60-180 seconds
Time Maintained above	Temperature (T _L)	217 °C
	Time (t _L)	60-150 seconds
Peak/Classification Temperature (T _p)		260 °C
Time within 5 °C of Actual Peak Temperature (t _p)		20-40 seconds
Ramp-Down Rate		6 °C/second max.
Time 25 °C to Peak Temperature		8 minutes max.

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Cionlabs Private Limited

2nd Floor, Building 380,
9th Main, Sector 7, HSR Layout,
Bengaluru, Karnataka - 560102
<http://www.cionlabs.com>

Cionlabs Inc.

112 Capital Trail Suite A Newark DE 19711
United States