CIONLABS

MODULE Datasheet

DS-BC101HZ-01-22P V1.3

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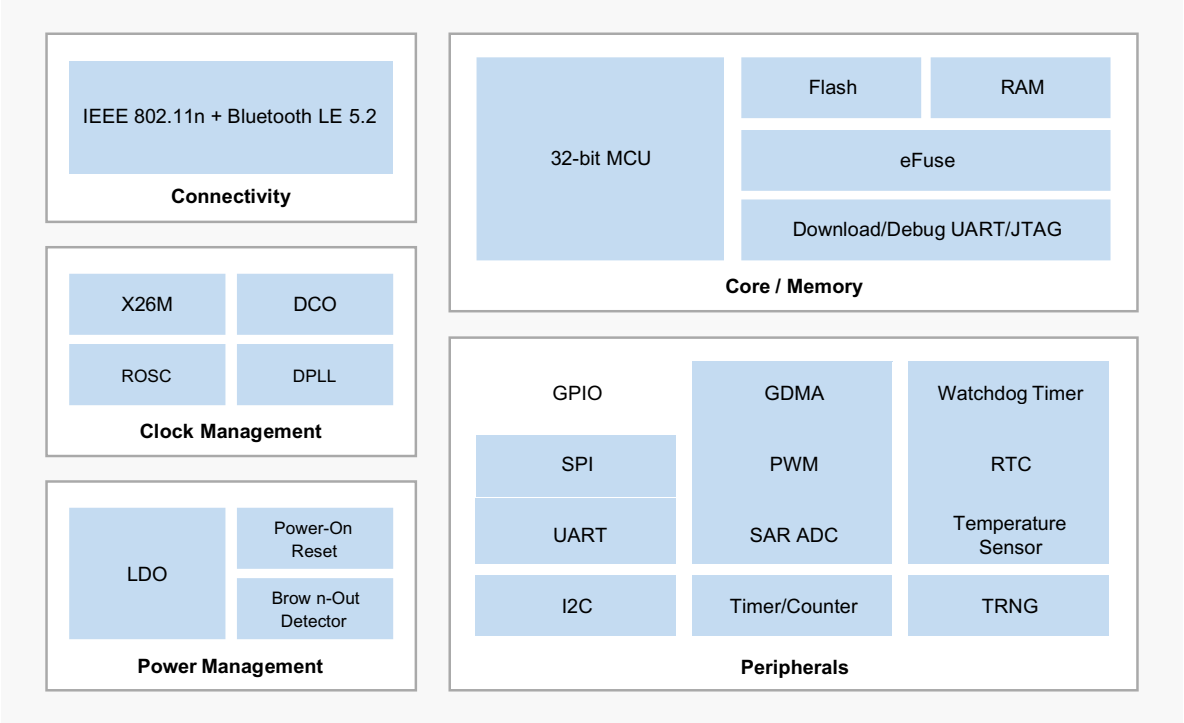
Overview

The module BC101HZ-01-22P is a highly-integrated Beken BK7238 single-chip Wi-Fi 802.11n and Bluetooth Low Energy (LE) 5.2 combo solution designedfor applications that require low power and compact size. Integrating a powerful 32-bit MCU and a comprehensive setof 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 BC101HZ-01-22P.

Block Diagram



The module BC101HZ-01-22P 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	BC101HZ-01-22P
Flash	2 MB
RAM	256KB

GPIO	19

Feature		BC101HZ-01-22P
SPI	Master/Slave	1
UART		2
I2C	Master/Slave	1
GDMA		Yes
PWM	PWM0 ~ 5	6
SAR ADC	10 bits	1
	Number of channels	6
Timer	General-purpose timer/counter	6
	Watchdog timer	1
	Low-power timer	1
Temperature sensor		1
TRNG		Yes
Package Size		16mm x 24mm
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

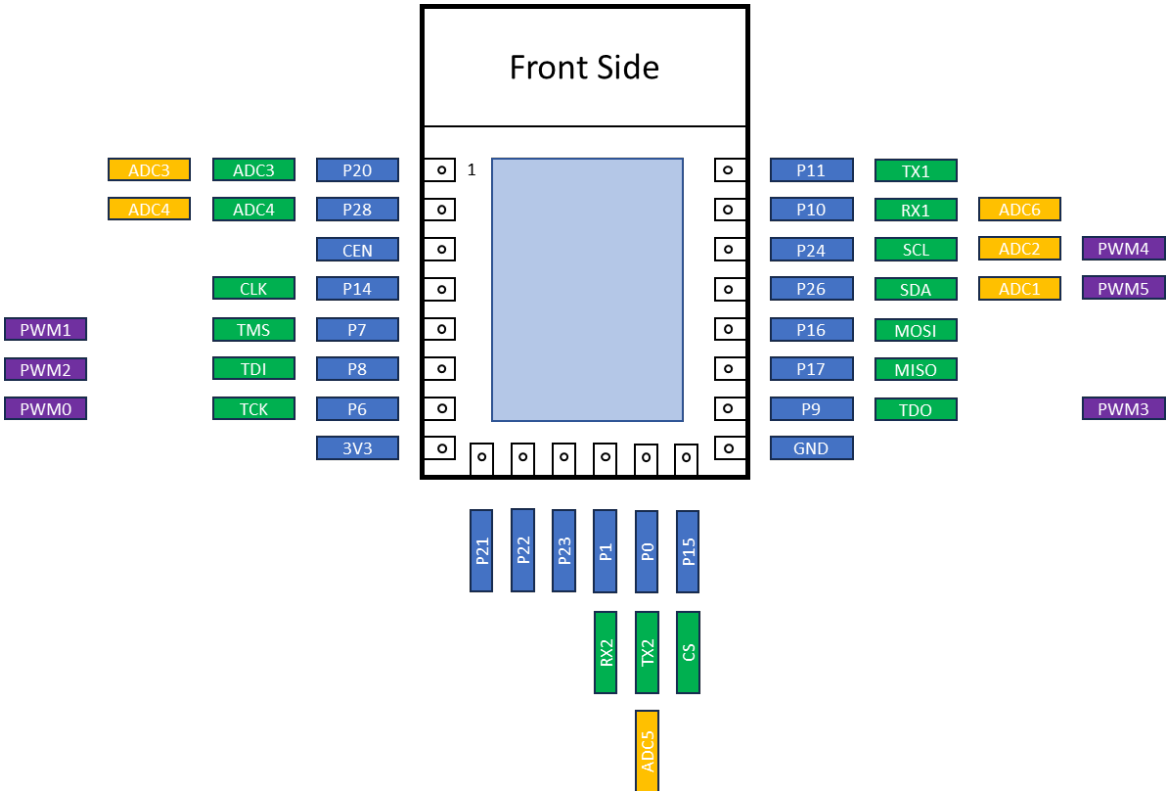
- 2.7 to 3.6 V VBAT supply
- On-chip power-on reset (POR) and brown-out detector (BOD)
- Embedded LDO regulators
- Low power consumption:
  - Active mode RX: 30 mA
  - Normal standby mode: 300 µA
  - Low voltage standby mode: 75 µA
  - Shutdown mode: 0.5 µA

Peripherals

- GPIOs: 19
- 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)

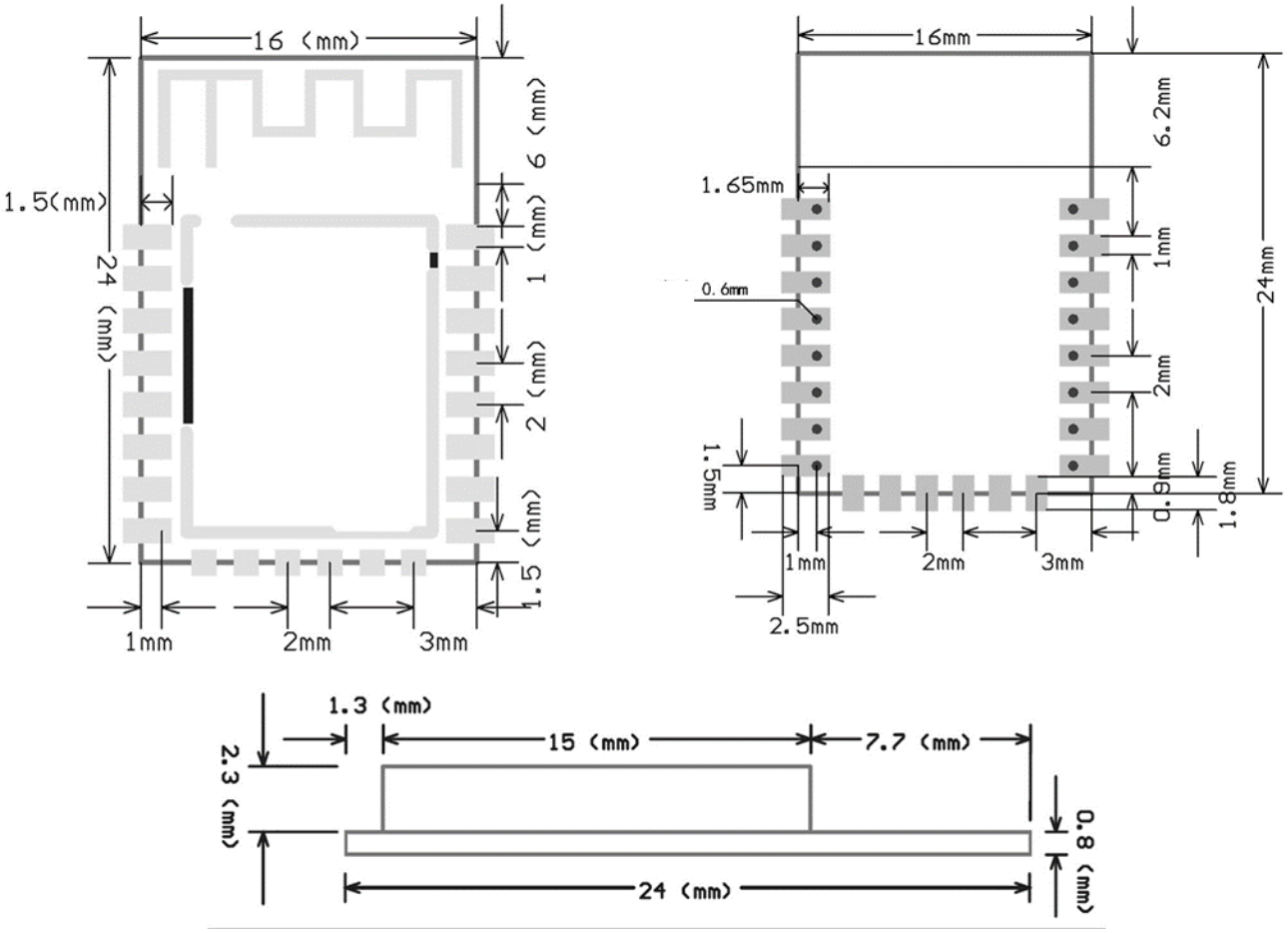
Pin Configuration

The pin configuration of the module are as below:



Appearance size

The dimensionas of the module are as below:



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 toabsolute-maximum-rated conditions for prolonged periods may affect the device's reliability.

Parameter	Description	Min.	Max.	Unit
VBAT	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
VBAT	Battery/regulator supply voltage	2.7	-	3.6	V
VCCIF	Supply voltage for IF	2.7	-	3.6	V
VCCRXFE	Supply voltage for RX	2.7	-	3.6	V
VCCPA	Supply voltage for PA	2.7	-	3.6	V
VCCTX	Supply voltage for TX	2.7	-	3.6	V
VCCPLL	Supply voltage for RF PLL	2.7	-	3.6	V
VDDAON	Always-ON digital LDO output voltage	0.5	0.9	1.0	V
VDD_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

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	-	-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

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.

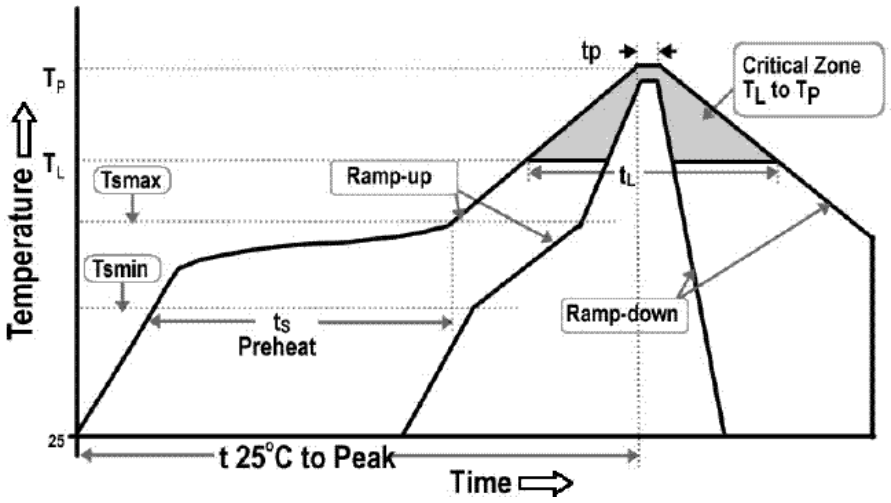
Parameter	Condition	Min.	Typ.	Max.	Unit
General					
Frequency range	-	2402	-	2480	MHz
TX Power					
TX power	-	6	8	10	dBm
Bluetooth LE 1 Mbps					
Modulation Characteristics					
Δf1avg	-	-	250	-	kHz
Δf2max	-	-	230	-	kHz
Δf2avg/Δf1avg	-	-	0.9	-	-
Carrier Frequency Offset and Drift					
Max $\lvert f_n \rvert$ $n = 0, 1, 2, 3 \ldots k$	-	-	2.0	-	kHz
Max $\lvert f_0 - f_n \rvert$ $n = 2, 3, 4 \ldots k$	-	-	1.5	-	kHz
$\lvert f_1 - f_0 \rvert$	-	-	0.5	-	kHz
Max $\lvert f_n - f_{n-5} \rvert$ $n = 6, 7, 8 \ldots k$	-	-	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 (Tsmin)	150 °C
	Temperature Max (Tsmax)	200 °C
	Time (ts)	60-180 seconds
Time Maintained above	Temperature (TL)	217 °C
	Time (tL)	60-150 seconds
Peak/Classification Temperature (Tp)		260 °C
Time within 5 °C of Actual Peak Temperature (tp)		20-40 seconds
Ramp-Down Rate		6 °C/second max.
Time 25 °C to Peak Temperature		8 minutes max.

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