

CIONLABS

MODULE Datasheet

DS-BC401HZ-01-73P

V1.0

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Features

1.1 Overview

The BC401HZ-01-73P module is based on the Beken BK7258M chip. The BK7258 is a highly integrated 1x1 single-band 2.4 GHz Wi-Fi 6 (802.11b/g/n/ax) and Bluetooth 5.4 Low Energy (LE) combo solution designed for applications that require high security and abundant resources. The integration of a 32-bit ARMv8-M Star MCU and a comprehensive set of peripherals makes the BK7258 ideal for advanced Internet of Things (IoT) applications.

The BK7258 provides state-of-the-art security based on a powerful security architecture. The BK7258 integrates a IoT Platform Security Suite (IPSS) for cryptograph and system security control. The IPSS embeds all-round and robust security features to set up a top-secret execution environment for IoT devices.

Using advanced design techniques and ultra-low power process technology, the BK7258 delivers high integration, efficient security, and minimal power consumption for IP cameras, HMI applications, smart locks, and other advanced IoT applications.

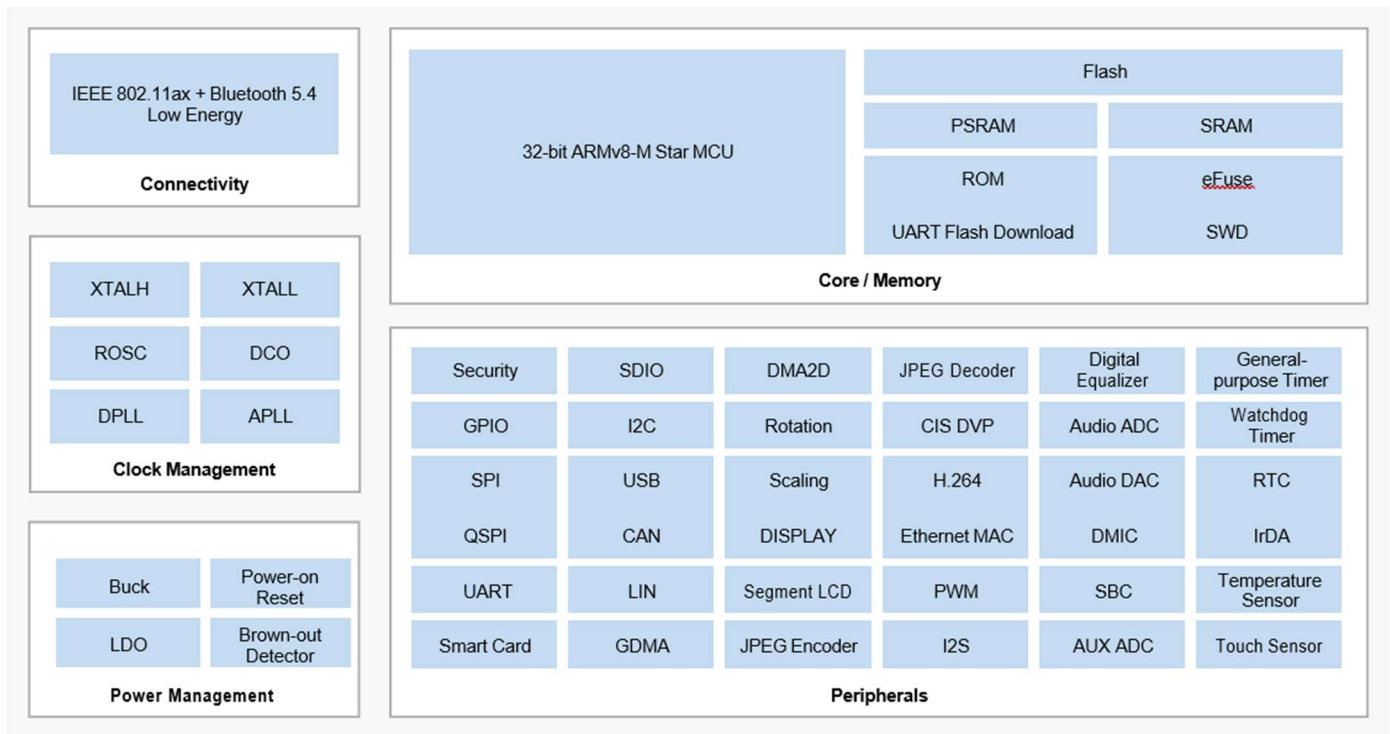


Figure 1 BK7236M Block Diagram

1.2 Features

Wi-Fi

- IEEE 802.11b/g/n/ax 1x1 compliant
- 20/40 MHz channel bandwidth for 2.4 GHz
- Supports downlink Multi-User Multiple-Input Multiple-Output (DL MU-MIMO)
- Supports Orthogonal Frequency Division Multiple Access (OFDMA)
- Supports Target Wake Time (TWT)
- TX and RX Low-Density Parity Check (LDPC) support for extended range
- WPA/WPA2/WPA3-Personal support for enhanced security
- Working modes: STA, soft AP, Direct
- Concurrent AP + STA
- Integrated Bluetooth/Wi-Fi coexistence (PTA)
- TX power up to +21 dBm
- RX sensitivity -99 dBm

Bluetooth Low Energy

- Bluetooth 5.4 Low Energy (LE)
- Supports Bluetooth Low Energy 1 Mbps, 2 Mbps, and long range (125 kbps and 500 kbps)
- Supported Bluetooth Low Energy features: LE audio, Angle of Arrival (AoA) and Angle of Departure (AoD) direction finding, 2 Mbps, advertising extensions, and long range
- Supports an antenna array with up to 16 antennas for precise positioning

Core

- ARMv8-M Star (M33F) MCU at up to 480 MHz:
 - Double-precision floating-point unit (FPU)
 - 16 KB ITCM + 16 KB DTCM
 - Embedded TrustZone
 - Supports DSP instructions with SIMD
 - 3.84 CoreMark/MHz
- UART Flash download
- Serial Wire Debug (SWD) interface

Memory

- Flash up to 16 MB
- PSRAM up to 16 MB
- 640 KB Share SRAM
- 64 KB ROM
- eFuse

Security

The BK7258 integrates the IoT Platform Security Suite (IPSS) for cryptograph and system security control. The key features of the IPSS include:

- Secure boot
- Secure debug
- Secure connection
- Firmware Over-The-Air (FOTA)
- Provisioning
- TEE_M
- TrustEngine, which includes the following features:
 - Symmetric schemes, AES-ECB/CBC/CTR/CBC-MAC/CMAC/CCM/GCM (key size 128-bit, 192-bit and 256-bit)
 - Symmetric schemes, SM4-ECB/CBC/CTR/CBC-MAC/CMAC/CCM/GCM
 - Digest schemes, SHA1/224/256
 - Digest scheme, SM3
 - Asymmetric schemes, RSA 1024/2048/3072/4096 and ECCP 192/224/256/384/512/521
 - Asymmetric scheme, SM2
 - Key ladder for key management
 - Lifecycle management
 - True random number generator

Clock Management

- External oscillator: 26 MHz crystal oscillator (XTALH), 32.768 kHz crystal oscillator (XTALL)
- Internal oscillator: 32 kHz ring oscillator (ROSC), 26–360 MHz digitally controlled oscillator (DCO)
- 320/480 MHz PLL (DPLL)
- Audio PLL (APLL)

Power Management

- 2.0 to 5.5 V VBAT supply
- On-chip Power-On Reset (POR) and Brown-Out Detector (BOD)
- Embedded buck (DC-DC) converters and LDO regulators
- Low power consumption:
 - Active mode RX: 10 mA
 - Sleep mode: TBD
 - Deep sleep mode: TBD
 - Shutdown mode: TBD

Peripherals

- 56 GPIOs
- 2x SPI
- 2x QSPI
- 3x UART: 1 with hardware flow control and Flash download support
- 1x Smart Card controller
- 1x SDIO
- 2x I2C
- 1x high-speed USB2.0 (HS)
- 1x CAN controller with CAN FD
- 1x LIN controller
- 2x general-purpose DMA controller (GDMA), each with 12 channels
- 1x DMA2D controller
- 1x rotation module
- 2x scaling module
- 1x display controller supporting RGB and 8080 interfaces
- 1x segment LCD controller for up to 4x32 segments
- 1x JPEG hardware encoder
- 1x JPEG hardware decoder
- 1x 8-bit CIS DVP interface
- 1x 720p H.264 video encoder

- 1x Ethernet MAC interface
- 12x 32-bit PWM channel
- 3x I2S
- 1x four-band digital hardware equalizer
- 2x audio ADC
- 1x audio DAC
- 1x DMIC
- 1x SBC accelerator
- 12-bit AUX ADC, up to 11 channels
- 6x 32-bit general-purpose timer
- 2x watchdog timer (WDT)
- 1x real-time counter (RTC)
- 1x IrDA
- 1x temperature sensor
- 1x touch sensor, up to 16 touch sensing I/Os

Packaging

- QFN88 package, 9 x 9 mm
- Operating temperature range: -40 up to +125 °C

Applications

- HMI (Human Machine Interface) applications
- Home appliance
 - Refrigerator
 - Air conditioner
 - Thermostat
 - Washing machine
 - Robot cleaner
- Smart plug
- Smart lighting
 - Light bulb
 - Light switch

- Ceiling light
 - Stand light
- Others
 - Remote controller
 - Toy
 - Drone
 - Industrial terminal
 - Factory automation sensor/switch
 - Smart meter
 - Payment terminal
 - Industrial computer
 - Medical devices
 - Kitchen appliances
 - Home automation switch/sensor
 - Door lock
 - Door camera

Electrical Specifications

2.1 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 reliability of the device.

Parameter	Description	Min.	Max.	Unit
VBAT	Battery regulator supply voltage	-0.3	5.5	V
VIO	IO LDO output voltage	-0.3	3.6	V
VCCPA	Supply voltage for PA	-0.3	3.6	V
VCCPAD	Supply voltage for PA driver	-0.3	3.6	V
VCCIF	Supply voltage for IF	-0.3	1.65	V
VCCRXFE	Supply voltage for RX	-0.3	1.65	V
VCCPLL	Supply voltage for RF PLL	-0.3	1.65	V
VCCPLL_BT	Supply voltage for Bluetooth RF PLL	-0.3	1.65	V
VDDPA_BT	Bluetooth RF PA LDO output voltage	-0.3	1.1	V
VDDA	Analog LDO output voltage	-0.3	1.65	V
VDDD	Digital LDO output voltage	-0.3	1.1	V
VDDDIG	Digital core LDO output voltage	-0.3	0.975	V
VDDGPIO	GPIO LDO output voltage	-0.3	3.6	V
VDDRAM	PSRAM LDO output voltage	-0.3	3.6	V
SWA	Analog buck switch output voltage	-0.3	5.5	V
SWD	Digital buck switch output voltage	-0.3	5.5	V
MICBIAS	Microphone bias output voltage	-0.3	3.6	V
P _{RX}	RX input power	-	10	dBm
T _{STR}	Storage temperature range	-55	150	°C

2.2 ESD Ratings

Parameter	Description	Test Condition	Value	Unit
ESD HBM	Electrostatic discharge voltage (human body model), per ANSI/ESDA/JEDEC JS-001-2017	-	TBD	V
ESD CDM	Electrostatic discharge voltage (charge device model), per ANSI/ESDA/JEDEC JS-002-2018	-	TBD	V

2.3 Recommended Operating Conditions

Parameter	Description	Min.	Typ.	Max.	Unit
VBAT	Battery regulator supply voltage	2.0	-	5.5	V
VIO	IO LDO output voltage	2.0	-	3.6	V
VCCPA	Supply voltage for PA	2.0	-	3.6	V
VCCPAD	Supply voltage for PA driver	2.0	-	3.6	V
VCCIF	Supply voltage for IF	1.25	-	1.65	V
VCCRxFE	Supply voltage for RX	1.25	-	1.65	V
VCCPLL	Supply voltage for RF PLL	1.25	-	1.65	V
VCCPLL_BT	Supply voltage for Bluetooth RF PLL	1.25	-	1.65	V
VDDPA_BT	Bluetooth RF PA LDO output voltage	0.9	-	1.1	V
VDDA	Analog LDO output voltage	1.25	-	1.65	V
VDDD	Digital LDO output voltage	0.7	-	1.1	V
VDDDIG	Digital core LDO output voltage	0.45	-	0.975	V
VDDGPIO	GPIO LDO output voltage	1.8	-	3.6	V
VDDRAM	PSRAM LDO output voltage	-	1.8	-	V
MICBIAS	Microphone bias output voltage	1.8	-	2.4	V
T _{OPR}	Operating temperature range	-40	-	125	°C

2.4 Digital I/O Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _{IH}	High-level input voltage	-	0.7 V _{IO}	-	V _{IO} + 0.3	V
V _{IL}	Low-level input voltage	-	-0.3	-	0.3 V _{IO}	V
V _{OH}	High-level output voltage	-	0.9 V _{IO}	-	-	V
V _{OL}	Low-level output voltage	-	-	-	0.1 V _{IO}	V
I _{DRV}	I/O output drive strength	-	5	-	20	mA
R _{PU}	Weak pull-up resistor	-	-	40	-	kΩ
R _{PD}	Weak pull-down resistor	-	-	44	-	kΩ

2.5 Analog Buck

Parameter	Description	Min.	Typ.	Max.	Unit
V _{DDA}	Buck/LDO output voltage	1.25	1.4	1.65	V
Load current	-	-	-	150	mA
Switching frequency	Buck modulation frequency	0.5	1	2	MHz
Output filter capacitor capacitance	-	-	4.7	-	μF
Inductor inductance	-	-	4.7	-	μH
Inductor DC resistance	-	-	-	500	mΩ
Inductor saturation current	-	300	-	-	mA

2.6 Digital Buck

Parameter	Description	Min.	Typ.	Max.	Unit
V _{DDD}	Buck/LDO output voltage	0.75	1.05	1.1	V
Load current	-	-	-	100	mA
Switching frequency	Buck modulation frequency	0.5	1	2	MHz

Output filter capacitor capacitance	-	-	4.7	-	μF
Parameter	Description	Min.	Typ.	Max.	Unit
Inductor inductance	-	-	4.7	-	μH
Inductor DC resistance	-	-	-	500	mΩ
Inductor saturation current	-	200	-	-	mA

2.7 Analog LDO

Parameter	Description	Min.	Typ.	Max.	Unit
VDDA	Analog LDO output voltage	1.15	1.35	1.5	V
Load current	-	-	-	150	mA

2.8 Digital LDO

Parameter	Description	Min.	Typ.	Max.	Unit
VDDD	Digital LDO output voltage	0.7	1.0	1.05	V
Load current	-	-	-	100	mA

2.9 Core LDO

Parameter	Description	Min.	Typ.	Max.	Unit
VDDDIG	Digital core LDO output voltage	0.45	0.9	0.975	V
Load current	-	-	-	100	mA

2.10 26 MHz Crystal Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
F0	Nominal Frequency	-	-	26	-	MHz
ΔF/F0	Frequency tolerance	25 °C	-10	-	+10	ppm
		-40 to 105 °C crystal	-20	-	+20	ppm

TC	Frequency stability overoperating temperature	-30 to 85 °C crystal	-10	-	+10	ppm
CL	Load capacitance	-	7	7.3	9	pF
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
TS	Trim sensitivity	-40 to 105 °C crystal	-	32	-	ppm/pF
		-30 to 85 °C crystal	-	17	-	ppm/pF

2.11 Current Consumption

Measured with T = 25 °C, VBAT = 3.3 V unless otherwise stated.

Parameter	Condition	Min.	Typ.	Max.	Unit
Active Mode					
RX current	11b: 11 Mbps DSSS	-	10	-	mA
	11g: 54 Mbps OFDM	-	TBD	-	mA
	11n: MCS7, HT20	-	TBD	-	mA
	11n: MCS7, HT40	-	TBD	-	mA
	11ax: MCS7, HE20	-	TBD	-	mA
TX current	11b: 11 Mbps DSSS @ 17 dBm	-	TBD	-	mA
	11g: 54 Mbps OFDM @ 15 dBm	-	TBD	-	mA
	11n: MCS7, HT20 @ 14 dBm	-	TBD	-	mA
	11n: MCS7, HT40 @ 14 dBm	-	TBD	-	mA
	11ax: MCS7, HE20 @ 14 dBm	-	TBD	-	mA
Sleep Mode					
Sleep	-	-	TBD	-	μA
Deep sleep	-	-	TBD	-	μA
Shutdown Mode					
Shutdown	-	-	TBD	-	μA

2.12 WLAN RF Receiver Characteristics

Measured with T = 25 °C, VBAT = 3.3 V unless otherwise stated.

Parameter	Condition	Min.	Typ.	Max.	Unit
General					
Frequency range	-	2412	-	2484	MHz
Sensitivity					
Sensitivity - IEEE 802.11b (8% PER for 1024 octet PSDU)	1 Mbps DSSS	-	-99	-	dBm
	2 Mbps DSSS	-	-95	-	dBm
	5.5 Mbps DSSS	-	-93	-	dBm
	11 Mbps DSSS	-	-89	-	dBm
Sensitivity - IEEE 802.11g (10% PER for 1000 octet PSDU)	6 Mbps OFDM	-	-92	-	dBm
	9 Mbps OFDM	-	-91	-	dBm
	12 Mbps OFDM	-	-90	-	dBm
	18 Mbps OFDM	-	-87	-	dBm
	24 Mbps OFDM	-	-85	-	dBm
	36 Mbps OFDM	-	-81	-	dBm
	48 Mbps OFDM	-	-77	-	dBm
	54 Mbps OFDM	-	-76	-	dBm
Sensitivity - IEEE 802.11n, 20 MHz (10% PER for 4096 octet PSDU, LDPC)	HT20, MCS0	-	-93	-	dBm
	HT20, MCS1	-	-92	-	dBm
	HT20, MCS2	-	-89	-	dBm
	HT20, MCS3	-	-87	-	dBm
	HT20, MCS4	-	-83	-	dBm
	HT20, MCS5	-	-79	-	dBm
	HT20, MCS6	-	-77	-	dBm
	HT20, MCS7	-	-75	-	dBm
Sensitivity - IEEE 802.11n, 40 MHz	HT40, MCS0	-	TBD	-	dBm

(10% PER for 4096 octet PSDU, LDPC)	HT40, MCS1	-	TBD	-	dBm
	HT40, MCS2	-	TBD	-	dBm
	HT40, MCS3	-	TBD	-	dBm
	HT40, MCS4	-	TBD	-	dBm
	HT40, MCS5	-	TBD	-	dBm
	HT40, MCS6	-	TBD	-	dBm
	HT40, MCS7	-	TBD	-	dBm
Sensitivity - IEEE 802.11ax, 20 MHz (10% PER for 4096 octet PSDU,LDPC)	HE20, MCS0	-	-92	-	dBm
	HE20, MCS1	-	-91	-	dBm
	HE20, MCS2	-	-88	-	dBm
	HE20, MCS3	-	-86	-	dBm
	HE20, MCS4	-	-82	-	dBm
	HE20, MCS5	-	-78	-	dBm
	HE20, MCS6	-	-76	-	dBm
Sensitivity - IEEE 802.11ax, 40 MHz (10% PER for 4096 octet PSDU,LDPC)	HE40, MCS0	-	TBD	-	dBm
	HE40, MCS1	-	TBD	-	dBm
	HE40, MCS2	-	TBD	-	dBm
	HE40, MCS3	-	TBD	-	dBm
	HE40, MCS4	-	TBD	-	dBm
	HE40, MCS5	-	TBD	-	dBm
	HE40, MCS6	-	TBD	-	dBm
	HE40, MCS7	-	TBD	-	dBm
Maximum Receive Level					
Maximum receive level @ 2.4 GHz	11b: 1, 2 Mbps (8% PER, 1024 octets)	-	10	-	dBm
	11b: 5.5, 11 Mbps (8% PER, 1024 octets)	-	TBD	-	dBm
	11g: 6–54 Mbps (10% PER, 1000 octets)	-	10	-	dBm

	11n: MCS0–7 (10% PER, 4096 octets)	-	10	-	dBm
	11ax: MCS0–7 (10% PER, 4096 octets)	-	TBD	-	dBm
Adjacent Channel Rejection					
Adjacent channel (± 30 MHz)rejection - IEEE 802.11b (8% PER for 1024 octet PSDU with desired signal level as specified in Condition)	1 Mbps DSSS	-74 dBm	-	TBD	dB
	2 Mbps DSSS	-74 dBm	-	TBD	dB
Adjacent channel (± 25 MHz)rejection - IEEE 802.11b (8% PER for 1024 octet PSDU with desired signal level as specified in Condition)	5.5 Mbps DSSS	-70 dBm	-	TBD	dB
	11 Mbps DSSS	-70 dBm	-	40	dB
Adjacent channel (± 25 MHz)rejection - IEEE 802.11g (10% PER for 1000 octet PSDUwith desired signal level as specified in Condition)	6 Mbps OFDM	-79 dBm	-	TBD	dB
	54 Mbps OFDM	-62 dBm	-	26	dB
Adjacent channel (± 25 MHz)rejection - IEEE 802.11n (10% PER for 4096 octet PSDUwith desired signal level as specified in Condition)	HT20, MCS0	-79 dBm	-	TBD	dB
	HT20, MCS7	-61 dBm	-	25	dB
Adjacent channel (± 40 MHz)rejection - IEEE 802.11n (10% PER for 4096 octet PSDUwith desired signal level as specified in Condition)	HT40, MCS0	-76 dBm	-	TBD	dB
	HT40, MCS7	-58 dBm	-	TBD	dB
Adjacent channel (± 20 MHz)rejection - IEEE 802.11ax (10% PER for 4096 octet PSDUwith desired signal level as specified in Condition)	HE20, MCS0	-79 dBm	-	TBD	dB
	HE20, MCS7	-61 dBm	-	TBD	dB
Adjacent channel (± 40 MHz)rejection - IEEE	HE40, MCS0	-76 dBm	-	TBD	dB

802.11ax (10% PER for 4096 octet PSDU with desired signal level as specified in Condition)	HE40, MCS7	-58 dBm	-	TBD	-	dB
Spurious Emissions						
Spurious emissions	< 1 GHz		-	TBD	-	dBm
	> 1 GHz		-	TBD	-	dBm

2.13 WLAN RF Transmitter Characteristics

Measured with T = 25 °C, VBAT = 3.3 V unless otherwise stated.

Parameter	Condition	Min.	Typ.	Max.	Unit
General					
Frequency range	-	2412	-	2484	MHz
TX power					
TX power - IEEE 802.11b (SEM compliant)	1 Mbps DSSS	-	21	-	dBm
	11 Mbps DSSS	-	20	-	dBm
TX power - IEEE 802.11g (EVM compliant)	6 Mbps OFDM	-	19	-	dBm
	54 Mbps OFDM	-	18	-	dBm
TX power - IEEE 802.11n (EVM compliant)	HT20, MCS0	-	19	-	dBm
	HT20, MCS7	-	17	-	dBm
	HT40, MCS0	-	TBD	-	dBm
	HT40, MCS7	-	TBD	-	dBm
TX power - IEEE 802.11ax (EVM compliant)	HE20, MCS0	-	TBD	-	dBm
	HE20, MCS7	-	TBD	-	dBm
Spurious Emissions					
Spurious emissions (at maximumoutput power)	< 1 GHz	-	TBD	-	dBm
	> 1 GHz	-	TBD	-	dBm

2.14 Bluetooth LE RF Receiver Characteristics

Measured with T = 25 °C, VBAT = 3.3 V unless otherwise stated.

Parameter	Condition	Min.	Typ.	Max.	Unit
General					
Frequency range	-	2402	-	2480	MHz
Bluetooth LE 1 Mbps					
Sensitivity	30.8% PER	-	-97	-	dBm
Maximum input level	30.8% PER	-	TBD	-	dBm
C/I co-channel	-	-	TBD	-	dB
C/I 1 MHz adjacent channel	-	-	0	-	dB
C/I -1 MHz adjacent channel	-	-	TBD	-	dB
C/I 2 MHz adjacent channel	-	-	-20	-	dB
C/I -2 MHz adjacent channel	-	-	TBD	-	dB
C/I 3 MHz adjacent channel	-	-	TBD	-	dB
C/I -3 MHz adjacent channel	-	-	TBD	-	dB
C/I > 3 MHz adjacent channel	-	-	TBD	-	dB
C/I < -3 MHz adjacent channel	-	-	TBD	-	dB
Out-of-band blocking	30–2000 MHz	-10	-	-	dBm
	2003–2399 MHz	-20	-	-	dBm
	2484–2997 MHz	-10	-	-	dBm
	3000 MHz–12.75 GHz	-10	-	-	dBm
Intermodulation	-	-	-	-23	dBm
Bluetooth LE 2 Mbps					
Sensitivity	30.8% PER	-	TBD	-	dBm
Maximum input level	30.8% PER	-	TBD	-	dBm
C/I co-channel	-	-	TBD	-	dB
C/I 2 MHz adjacent channel	-	-	TBD	-	dB
C/I -2 MHz adjacent channel	-	-	TBD	-	dB
C/I 4 MHz adjacent channel	-	-	TBD	-	dB
C/I -4 MHz adjacent channel	-	-	TBD	-	dB

C/I 6 MHz adjacent channel	-	-	TBD	-	dB
C/I -6 MHz adjacent channel	-	-	TBD	-	dB
C/I > 6 MHz adjacent channel	-	-	TBD	-	dB
C/I < -6 MHz adjacent channel	-	-	TBD	-	dB
Out-of-band blocking	30–2000 MHz	-	TBD	-	dBm
	2003–2399 MHz	-	TBD	-	dBm
	2484–2997 MHz	-	TBD	-	dBm
	3000 MHz–12.75 GHz	-	TBD	-	dBm
Intermodulation	-	-	TBD	-	dBm
Bluetooth LE 125 kbps					
Sensitivity	30.8% PER	-	TBD	-	dBm
Maximum input level	30.8% PER	-	TBD	-	dBm
C/I co-channel	-	-	TBD	-	dB
C/I 1 MHz adjacent channel	-	-	TBD	-	dB
C/I -1 MHz adjacent channel	-	-	TBD	-	dB
C/I 2 MHz adjacent channel	-	-	TBD	-	dB
C/I -2 MHz adjacent channel	-	-	TBD	-	dB
C/I 3 MHz adjacent channel	-	-	TBD	-	dB
C/I -3 MHz adjacent channel	-	-	TBD	-	dB
C/I > 3 MHz adjacent channel	-	-	TBD	-	dB
C/I < -3 MHz adjacent channel	-	-	TBD	-	dB
Bluetooth LE 500 kbps					
Sensitivity	30.8% PER	-	TBD	-	dBm
Maximum input level	30.8% PER	-	TBD	-	dBm
C/I co-channel	-	-	TBD	-	dB
C/I 1 MHz adjacent channel	-	-	TBD	-	dB
C/I -1 MHz adjacent channel	-	-	TBD	-	dB
C/I 2 MHz adjacent channel	-	-	TBD	-	dB
C/I -2 MHz adjacent channel	-	-	TBD	-	dB

C/I 3 MHz adjacent channel	-	-	TBD	-	dB
C/I -3 MHz adjacent channel	-	-	TBD	-	dB
C/I > 3 MHz adjacent channel	-	-	TBD	-	dB
C/I < -3 MHz adjacent channel	-	-	TBD	-	dB

2.15 Bluetooth LE RF Transmitter Characteristics

Measured with T = 25 °C, VBAT = 3.3 V unless otherwise stated.

Parameter		Condition	Min.	Typ.	Max.	Unit
General						
Frequency range		-	2402	-	2480	MHz
TX power		-	-20	5	15	dBm
Bluetooth LE 1 Mbps						
In-band emissions	±2 MHz offset	-	-	TBD	-	dBm
	±3 MHz offset	-	-	TBD	-	dBm
	>±3 MHz offset	-	-	TBD	-	dBm
Modulation characteristics	Δf1avg	-	-	TBD	-	kHz
	Δf2max	-	-	TBD	-	kHz
	Δf2avg/Δf1avg	-	-	TBD	-	-
Carrier frequency offset and drift	Max f _n _{n = 0, 1, 2, 3...k}	-	-	TBD	-	kHz
	Max f ₀ - f _n _{n = 2, 3, 4...k}	-	-	TBD	-	kHz
	f ₁ - f ₀	-	-	TBD	-	kHz
	Max f _n - f _{n-5} _{n = 6, 7, 8...k}	-	-	TBD	-	kHz/50 μs
Bluetooth LE 2 Mbps						
In-band emissions	±4 MHz offset	-	-	TBD	-	dBm
	±5 MHz offset	-	-	TBD	-	dBm
	>±5 MHz offset	-	-	TBD	-	dBm
Modulation	Δf1avg	-	-	TBD	-	kHz
	Δf2max	-	-	TBD	-	kHz

characteristics	$\Delta f_{2avg}/\Delta f_{1avg}$	-	-	TBD	-	-
Carrier frequency offset and drift	$\text{Max } f_n _{n=0, 1, 2, 3...k}$	-	-	TBD	-	kHz
	$\text{Max } f_0 - f_n _{n=2, 3, 4...k}$	-	-	TBD	-	kHz
	$ f_1 - f_0 $	-	-	TBD	-	kHz
	$\text{Max } f_n - f_{n-5} _{n=6, 7, 8...k}$	-	-	TBD	-	kHz/50 μ s
Bluetooth LE 125 kbps						
In-band emissions	± 2 MHz offset	-	-	TBD	-	dBm
	± 3 MHz offset	-	-	TBD	-	dBm
	$> \pm 3$ MHz offset	-	-	TBD	-	dBm
Modulation characteristics	Δf_{1avg}	-	-	TBD	-	kHz
	Δf_{1max}	-	-	TBD	-	kHz
Carrier frequency offset and drift	$\text{Max } f_n _{n=0, 1, 2, 3...k}$	-	-	TBD	-	kHz
	$\text{Max } f_0 - f_n _{n=1, 2, 3...k}$	-	-	TBD	-	kHz
	$ f_0 - f_3 $	-	-	TBD	-	kHz
	$ f_n - f_{n-3} _{n=7, 8, 9...k}$	-	-	TBD	-	kHz/48 μ s
Bluetooth LE 500 kbps						
In-band emissions	± 2 MHz offset	-	-	TBD	-	dBm
	± 3 MHz offset	-	-	TBD	-	dBm
	$> \pm 3$ MHz offset	-	-	TBD	-	dBm

2.16 Audio Characteristics

Parameter	Condition	Min.	Typ.	Max.	Unit
DAC differential output	With 600 Ohm loading	-	1	-	Vrms
	With 16 Ohm loading	-	0.8	-	Vrms
DAC differential output THD	With 0.7 Vrms @ 600 Ohm loading	-	-	-80	dB
	With 0.65 Vrms @ 16 Ohm loading	-	-	-80	dB
DAC output SNR	1 kHz sine wave	-	104	-	dB
DAC sampling rate	-	8	-	48	kHz

ADC SNR	1 kHz sine wave	-	100	-	dB
ADC sampling rate	-	8	-	48	kHz

2.17 AUX ADC Characteristics

Parameter	Condition	Min.	Typ.	Max.	Unit
Conversion clock	-	-	-	13	MHz
Conversion time	-	-	16	-	Cycle
V_{REF}	Internal	-	1.2	-	V
	External	-	VIO/2	-	V
Input voltage range	-	0	-	$V_{REF} \times 2$	V
Input impedance	-	10	-	-	M Ω
Input capacitance (Cs)	-	-	1	-	pF
DNL	-	-1	-	3	LSB
INL	-	-5	-	5	LSB
ENOB	-	-	10	-	Bit
SNDR	-	-	62	-	dB
SFDR	-	-	77	-	dB
$T_{STARTUP}$	-	-	5	-	μ s
Current consumption	-	-	200	-	μ A

Pin Configuration

The pin configuration of the module is as below:

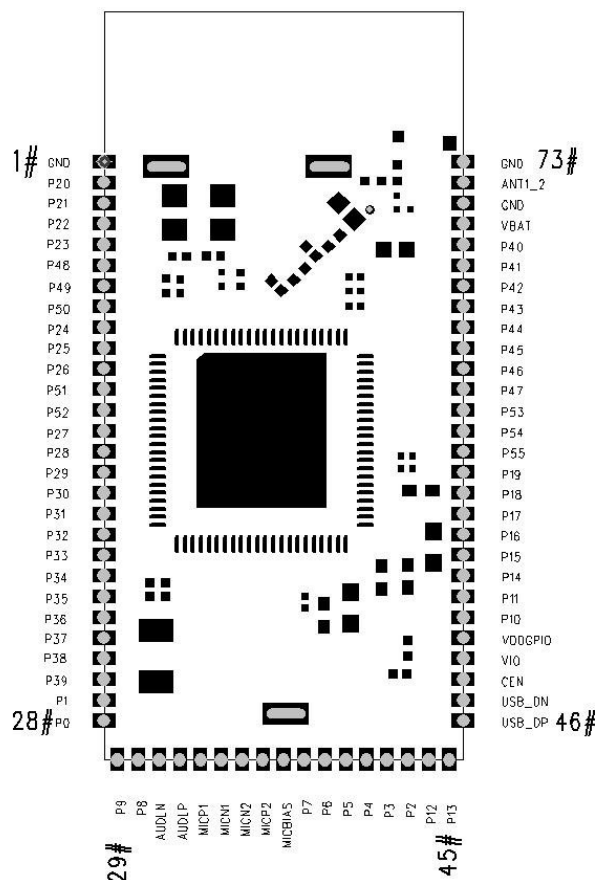


Figure 2 Pin Configuration

Pin	Name	Pin Type	Description
1	GND	G	Ground
2	P20	I/O	GPIO20/I2C0_SCL/SWCLK/RGB_R6/I8080_D9/SEG10
3	P21	I/O	GPIO21/I2C0_SDA/SWDIO/ADC6/RGB_R5/I8080_D8/SEG9
4	P22	I/O	GPIO22/CLK26M/PWMG0_PWM2/ADC5/QSPI0_SCK/RGB_R4/I8080_CSX/SEG8
5	P23	I/O	GPIO23/PWMG0_PWM3/ADC3/QSPI0_CS/RGB_R3/I8080_RESET/SEG7
6	P48	I/O	GPIO48/ENET_MDIO/RGB_R2/I8080_D16
7	P49	I/O	GPIO49/ENET_RXD0/RGB_R1/I8080_D17
8	P50	I/O	GPIO50/ENET_RXD1/RGB_R0
9	P24	I/O	GPIO24/LPO_CLK/PWMG0_PWM4/ADC2/QSPI0_IO0/RGB_G7/I8080_RSX/SEG6
10	P25	I/O	GPIO25/IRDA/PWMG0_PWM5/ADC1/QSPI0_IO1/RGB_G6/I8080_WRX/SEG5
11	P26	I/O	GPIO26/WIFI_TX_EN/QSPI0_IO2/RGB_G5/I8080_RDX/SEG4

12	P51	I/O	GPIO51/ENET_RXDV/RGB_G1
13	P52	I/O	GPIO52/ENET_TXD0/RGB_G0
14	P27	I/O	GPIO27/CIS_MCLK/CLK_AUXS_CIS/ENET_PHY_INT/QSPI0_IO3/SEG17
15	P28	I/O	GPIO28/WIFI_RX_EN/I2S_MCLK/ADC4/TOUCH2/CLK_AUXS_CIS/SEG18
16	P29	I/O	GPIO29/CIS_PCLK/ENET_MDC/TOUCH3/SEG19
17	P30	I/O	GPIO30/CIS_HSYNC/UART2_RX/LIN_RXD/TOUCH4/SC_CLK/SEG20
18	P31	I/O	GPIO31/CIS_VSYNC/UART2_TX/LIN_TXD/TOUCH5/SC_IO/SEG21
19	P32	I/O	GPIO32/CIS_PXD0/PWMG1_PWM0/ENET_MDIO/TOUCH6/SC_RSTN/SEG22
20	P33	I/O	GPIO33/CIS_PXD1/PWMG1_PWM1/ENET_RXD0/TOUCH7/SPI0_SCK/SEG23
21	P34	I/O	GPIO34/CIS_PXD2/PWMG1_PWM2/ENET_RXD1/TOUCH8/SPI0_CSN/SEG24
22	P35	I/O	GPIO35/CIS_PXD3/PWMG1_PWM3/ENET_RXDV/TOUCH9/SPI0_MOSI/SEG25
23	P36	I/O	GPIO36/CIS_PXD4/PWMG1_PWM4/ENET_TXD0/TOUCH10/SPI0_MISO/SEG26
24	P37	I/O	GPIO37/CIS_PXD5/PWMG1_PWM5/ENET_TXD1/TOUCH11/SEG27
25	P38	I/O	GPIO38/CIS_PXD6/I2C1_SCL/ENET_TXEN/TOUCH12/COM4/SEG28
26	P39	I/O	GPIO39/CIS_PXD7/I2C1_SDA/ENET_REF_CLK/TOUCH13/COM5/SEG29
27	P1	I/O	GPIO1/UART1_RX/I2C1_SDA/SWDIO/SC_CLK/ADC13/LIN_RXD
28	P0	I/O	GPIO0/UART1_TX/I2C1_SCL/SWCLK/SC_IO/ADC12/LIN_TXD
29	P9	I/O	GPIO9/BT_PRIORITY/PWMG0_PWM3/I2S0_DOUT/DMIC_DAT/32K_XI
30	P8	I/O	GPIO8/BT_ACTIVE/PWMG0_PWM2/I2S0_DIN/DMIC_CLK/ADC10/32K_XO
31	AUDLN	Or	Audio left channel negative output
32	AUDLP	Or	Audio left channel positive output
33	MICP1	I	Microphone 1 positive input
34	MICN1	I	Microphone 1 negative input
35	MICN2	I	Microphone 2 negative input
36	MICP2	I	Microphone 2 positive input
37	MICBIAS	Or	Microphone bias output
38	P7	I/O	GPIO7/WIFI_ACTIVE/PWMG0_PWM1/I2S0_SYNC/QSPI1_IO3
39	P6	I/O	GPIO6/CLK13M/PWMG0_PWM0/I2S0_SCK/QSPI1_IO2
40	P5	I/O	GPIO5/SPI1_MISO/SDIO_DATA1/COM7/QSPI1_IO1/SEG31
41	P4	I/O	GPIO4/SPI1_MOSI/SDIO_DATA0/COM6/QSPI1_IO0/SEG30
42	P3	I/O	GPIO3/SPI1_CSN/SDIO_CMD/SC_VCC/QSPI1_CS

Appearance size

The dimensions of the module are as below:

Module dimensions: 32.50mm $\pm$ 0.2mm(L) x 15.60 $\pm$ 0.2mm(W) x 2.4 $\pm$ 0.2mm (H)

PCB Thickness: 0.8mm ($\pm$ 0.1mm)

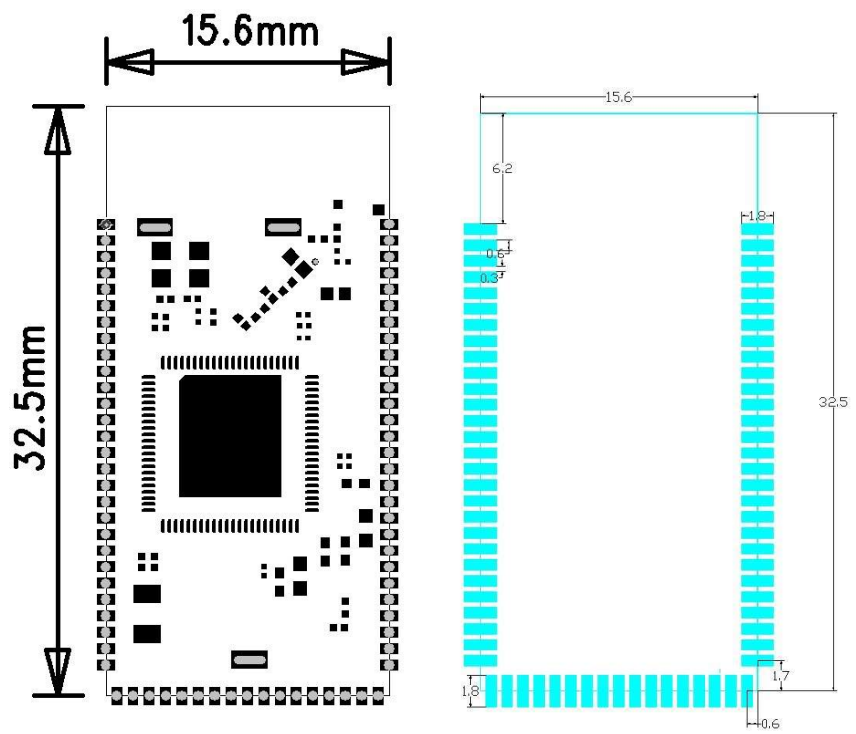
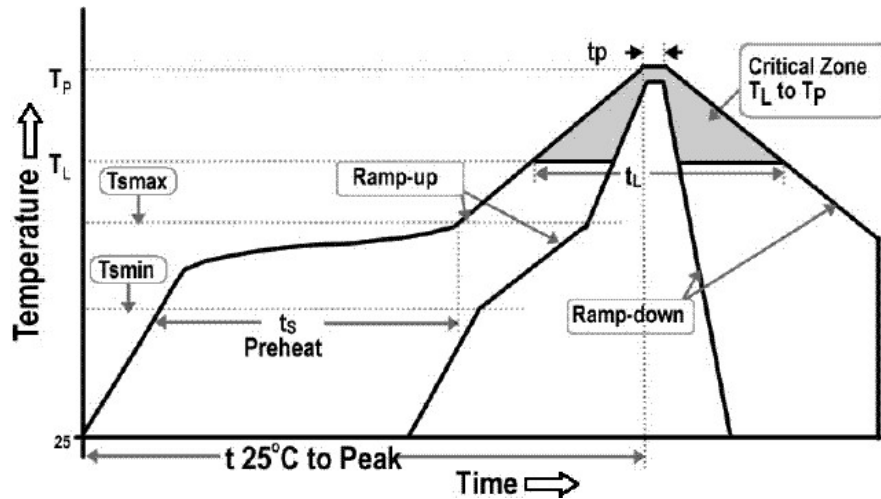


Figure 3 Module Dimensions

Solder Reflow Profile



Profile Feature		Specification
Average Ramp-Up Rate (t _{smax} to t _p)		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