

BTA-QC3031-3M

Preliminary Datasheet

(Version 01)

Issued date: October 27, 2020

This device is intended only for OEM integrators under the following conditions:

The use of the printed antenna with gain=-0.46dBi(2.4GHz)

IMPORTANT NOTE:

In the event that these conditions can't be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and FCC ID can't be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product(including the transmitter) and obtain a separate FCC authorization.

End Product Labeling

The final end product must be labeled in a visible area with the following:

“Contains FCC ID: 2AABGQ3031-3M”.The grantee's FCC ID can be used only when all FCC compliance requirements are met.

EnzyTek Bluetooth® Class II Module – BTA-QC3031-3M



Product Description

BTA-QC3031-3M is a highly integrated small form factor (25.25x13.5 mm²) Bluetooth class II module which adopts Qualcomm QCC3031 as core chip for Bluetooth operation.

QCC3031 QFN is a system on-chip (SoC) with on-chip Bluetooth, audio and programmable application processor. It includes high-performance, analog, and digital audio codecs, Class-AB speaker drivers, advanced power management, Li-ion battery charger, light-emitting diode (LED) drivers, and flexible interfaces including inter-integrated circuit sound (I²S), inter-integrated circuit interface (I²C), universal asynchronous receiver transmitter (UART), and programmable input/output (PIO).

FEATURES

- Highly integrated BT 5.0 module
QCC3031 (embedded Balun + Filter + Crystal + Flash + Ext. Antenna)
- 120 MHz Qualcomm® Kalimba™ audio DSPs
- 32 MHz Developer Processor for applications
- Firmware Processor for system
- Flexible QSPI flash programmable platform
- Advanced audio algorithms
- High-performance 24-bit stereo audio interface
- Digital and analog microphone interfaces
- Flexible PIO controller and LED pins with PWM support
- 1 mic Qualcomm® cVc™ speaker noise reduction and echo cancellation technology
- aptX, aptX HD, aptX Low Latency, SBC, and AAC audio codecs support
- Serial interfaces: UART, Bit Serializer (I²C/SPI), USB 2.0
- Integrated PMU: Dual SMPS for system/digital circuits, Integrated Li-ion battery charger
- Frequency: 2402 ~ 2480 GHz
- TX Output Power : 9 dBm/(Max)
- RX Sensitivity : -90 dBm (typ)
- Dimension : 25.25 mm x 13.5 mm x 2.8+/-0.1 mm (L x W x H)
- Temperature :-10~+70 °C

Applications

- Wireless speakers

Audio subsystem

- 32-bit Kalimba audio digital signal processor (DSP) core with flexible clocking from 2 MHz to 120 MHz to allow optimization and trade-off performance vs. power consumption
- DSP runs from ROM
- 80 KB program random access memory (RAM)
- 256 KB data RAM
- 5 Mb ROM

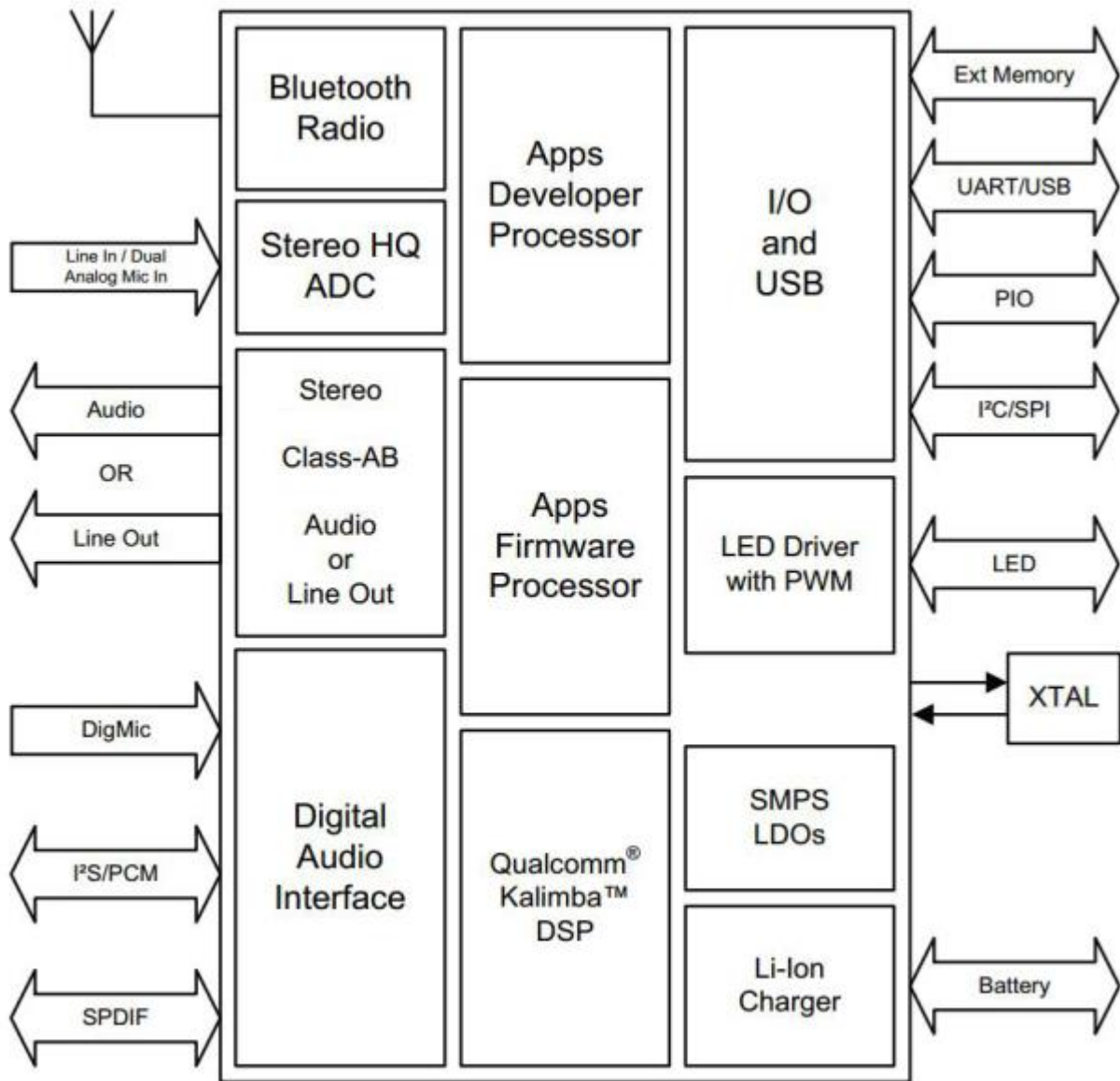
Application subsystem

- Dual core application subsystem 32 MHz operation
- 32-bit Firmware Processor:
 - Reserved for system use
 - Runs Bluetooth upper stack, profiles, house-keeping code
- 32-bit Developer Processor:
 - Runs developer applications
- Both cores execute code from external flash memory using QSPI clocked at 32 MHz
- On-chip caches per core allow for optimized performance and power consumption

Bluetooth subsystem

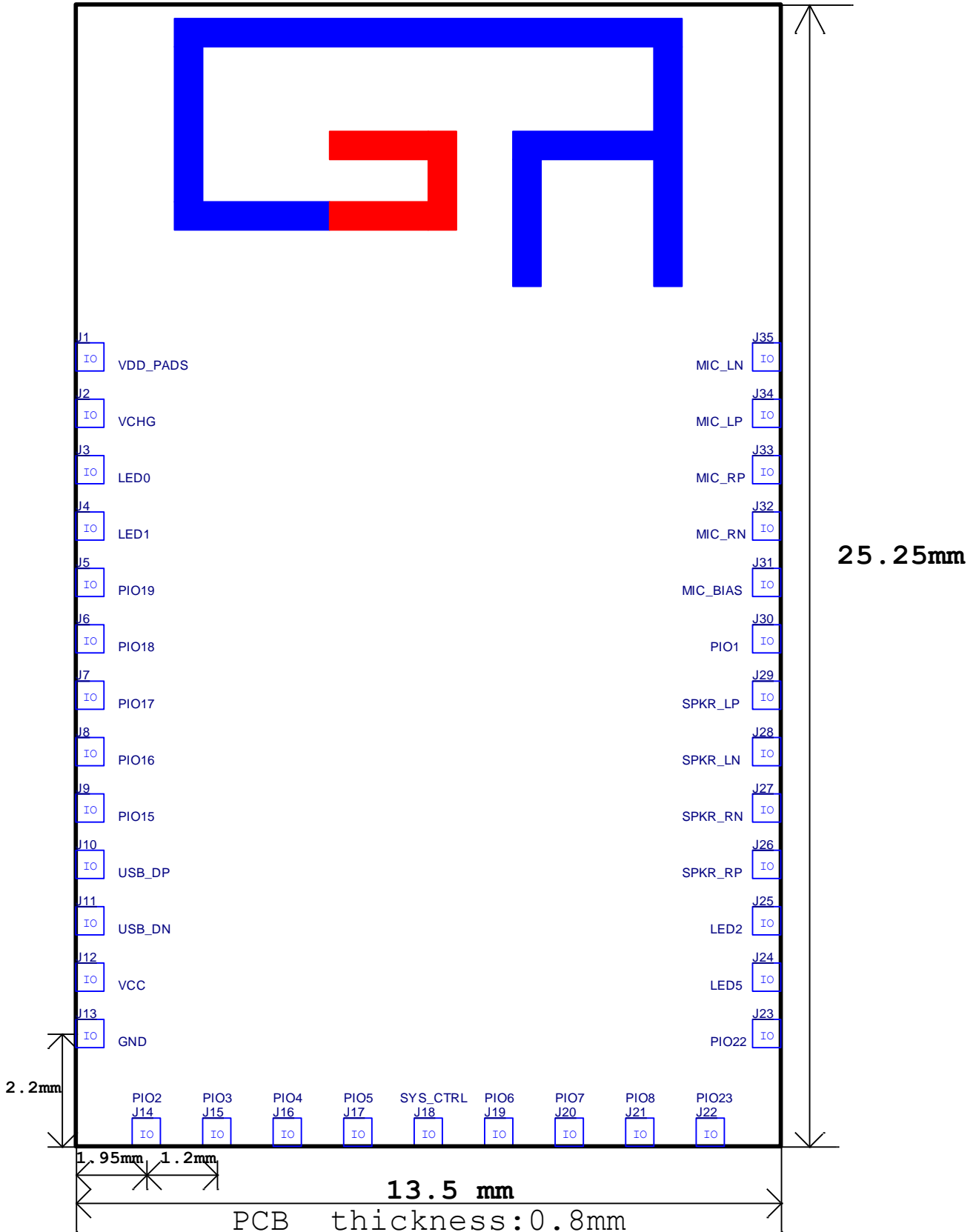
- Qualified to Bluetooth v5.0 specification including 2 Mbps Bluetooth low energy (Production parts)
- Single ended antenna connection with on-chip balun and Tx/Rx switch
- Bluetooth, Bluetooth low energy, and mixed topologies supported
- Class 1/2 support

Block Diagram



Pinout Diagram & Dimension

Unit : mm



I/O PIN LISTING

Pin No.	Pin Name	Type	Description
1	VDD_PADS	Power	1.8 V/3.3 V PIO supply
2	VCHG	Power	VCHG voltage input.
3	LED0	Analog or digital input/ open drain output.	General-purpose analog/digital input or open drain LED output.
4	LED1	Analog or digital input/ open drain output.	General-purpose analog/digital input or open drain LED output.
5	PIO19	Digital: Bidirectional with programmable strength internal pull- up/pull-down	Programmable I/O line 19. Alternative function: ■ PCM_DIN[0]
6	PIO18	Digital: Bidirectional with programmable strength internal pull- up/pull-down	Programmable I/O line 18. Alternative function: ■ PCM_DOUT[0]
7	PIO17	Digital: Bidirectional with programmable strength internal pull- up/pull-down	Programmable I/O line 17. Alternative function: ■ PCM_SYNC
8	PIO16	Digital: Bidirectional with programmable strength internal pull- up/pull-down	Programmable I/O line 16. Alternative function: ■ PCM_CLK
9	PIO15	Digital: Bidirectional with programmable strength internal pull- up/pull-down	Programmable I/O line 15. Alternative function: ■ MCLK_OUT
10	USB_DP	Digital	USB Full Speed device D- I/O. IEC-61000-4-2 (device level) ESD Protection
11	USB_DN	Digital	USB Full Speed device D+ I/O. IEC-61000-4-2 (device level) ESD Protection
12	VCC	Power	DC 3.3V input.
13	GND	Power	Ground
14	PIO2	Digital: Bidirectional with programmable strength internal pull- up/pull-down	Programmable I/O line 2. Alternative function: ■ TBR_MISO[3]
15	PIO3	Digital: Bidirectional with programmable strength internal pull- up/pull-down	Programmable I/O line 3. Alternative function: ■ TBR_MISO[2]
16	PIO4	Digital: Bidirectional with programmable strength internal pull- up/pull-down	Programmable I/O line 4. Alternative function: ■ TBR_MOSI[1]
17	PIO5	Digital: Bidirectional with programmable strength internal pull- up/pull-down	Programmable I/O line 5. Alternative function: ■ TBR_MISO[1]

18	SYS_CTRL	Digital input	Typically connected to an ON/OFF push button. Boots device in response to a button press when power is still present from battery and/or charger but software has placed the device in the OFF or DORMANT state. Additionally useable as a digital input in normal operation. No pull. Additional function: ■ PIO[0] input only
19	PIO6	Digital: Bidirectional with programmable strength internal pull- up/pull-down	Programmable I/O line 6. Alternative function: ■ TBR_MOSI[0]
20	PIO7	Digital: Bidirectional with programmable strength internal pull- up/pull-down	Programmable I/O line 7. Alternative function: ■ TBR_MISO[0]
21	PIO8	Digital: Bidirectional with programmable strength internal pull- up/pull-down	Programmable I/O line 8. Alternative function: ■ TBR_CLK
22	PIO23	Digital: Bidirectional with programmable strength internal pull- up/pull-down	Programmable I/O line 23.
23	PIO22	Digital: Bidirectional with programmable strength internal pull- up/pull-down	Programmable I/O line 22.
24	LED5	Analog or digital input/ open drain output.	General-purpose analog/digital input or open drain LED output.
25	LED2	Analog or digital input/ open drain output.	General-purpose analog/digital input or open drain LED output.
26	SPK_RP	Analogue out	Headphone/speaker differential right output, positive. Alternative function : Differential right line output, positive
27	SPK_RN	Analogue out	Headphone/speaker differential left output, negative. Alternative function : Differential left line output, negative
28	SPK_LN	Analogue out	Headphone/speaker differential left output, negative. Alternative function : Differential left line output, negative
29	SPK_LP	Analogue out	Headphone/speaker differential left output, positive. Alternative function : Differential left line output, positive

30	PIO1	Digital: Bidirectional with programmable strength internal pull- up/pull-down	Automatically defaults to RESET# mode when the device is unpowered, or in off modes. Reconfigurable as a PIO after boot. Alternative function: <input type="checkbox"/> Programmable I/O line 1
31	MIC_BIAS	Analog	Mic bias output.
32	MIC_RN	Analog	Microphone differential 1 input, positive. Alternative function: <input type="checkbox"/> Differential audio line input left, negative
33	MIC_RP	Analog	Microphone differential 1 input, negative. Alternative function: <input type="checkbox"/> Differential audio line input left, positive
34	MIC_LP	Analog	Microphone differential 1 input, positive. Alternative function: <input type="checkbox"/> Differential audio line input left, positive
35	MIC_LN	Analog	Microphone differential 1 input, negative. Alternative function: <input type="checkbox"/> Differential audio line input left, negative
36	GND	Power	Ground
37	RF	BT_RF	Bluetooth transmit/receive.
38	GND	Power	Ground

PS:The PIO definition can be customize for the application, please contact with EnzyTek for detail FW specification.

Radio Characteristics

VCC = 3.3V and test under Non-EDR environment

	Min	Typ	Max	Bluetooth Spec.	Unit
Maximum RF transmit power	7	8	9	0 ~ +20	dBm
Sensitivity, 0.1% BER	2.402 GHz		-90	≤ -70	dBm
	2.411 GHz		-90		dBm
	2.480 GHz		-90		dBm
RF Power control range		20		≥ 16	dB
RF Power control resolution	3.5		5.5	$2\text{dB} \leq \text{step} \leq 8\text{dB}$	dBm
20dB bandwidth for modulated carrier		910		≤ 1000	kHz
$\Delta f_{1\text{avg}}$ Max. modulation	155	165	170	$140 < f_{1\text{avg}} < 175$	kHz
$\Delta f_{2\text{max}}$ Min.. modulation	135		185	≥ 115	kHz
$\Delta f_{1\text{avg}} / \Delta f_{2\text{avg}}$	0.9	1.15	1.25	≥ 0.80	
Initial Center Frequency	-15		+15	$\leq \pm 75$	kHz
Frequency Drift Rate	-340		340	$\leq \pm 400$	kHz/us
Frequency Drift (single slot packet)	-20	-10	20	$\leq \pm 25$	kHz
Frequency Drift (five slot packet)	-20	-12	20	$\leq \pm 40$	kHz

Battery input pin specification

VBAT	Min	Typ	Max	Unit
Operating voltage	2.8	3.7	4.6	V
Software power-off threshold	-	3	-	V
Under voltage lockout rising threshold	2.47	2.6	2.73	V
Under voltage lockout hysteresis	50	-	120	mV
USB dead/weak battery rising threshold	3.14	3.3	3.46	V
USB dead/weak battery hysteresis	50	-	120	mV

Charger input pin specification

VCHG	Min	Typ	Max	Unit
Operating voltage (full device specification)	4.75	5	6.5	V
Operating voltage (reduced charger specification)	4.0	5	6.5	V
VCHG_PRESENT rising threshold	3.4	3.6	4.0	V
VCHG_PRESENT hysteresis	70	-	150	mV
Full operating range	VCHG_PRESENT	-	6.5	V
On chip pull-down (disabled when VCHG_PRESENT = 1)	10	20	30	kΩ

Microphone Bias

Parameter	Conditions	Min	Typ	Max	Unit
Output voltage (Tunable, step = 0.1 V)	-	1.5	-	2.1	V
Output current capability	-	0.07	-	3.0	mA
Output noise	B/W = 20 Hz → 20 kHz Unweighted	4.5	5.1	7.3	μVrms
Crosstalk Between Microphones	Using recommended application circuit	-	80	-	dB
Load capacitance ^a	From parasitic PCB routing and package	-	-	0.1	nF

Stereo Codec: Analogue to Digital Converter :

High-quality (HQADC) differential audio input

Parameter	Conditions	Mi	Typ	Max	Uni
Output Sample Width	-	-	-	24	Bit
Output Sample Rate, F_{sample}	-	8	-	96	kHz
Input level	-	-	-	2.4	V pk-pk
Input impedance	0 dB to 24 dB analog gain	-	20	-	k
	27 dB to 39 dB analog gain	-	10	-	k
SNR	$f_{\text{in}} = 1 \text{ kHz}$ 48 kHz A-Weighted THD+N < 0.1%	-	100	-	dB
THD+N	$f_{\text{in}} = 1 \text{ kHz}$ 48 kHz	-	-91	-	dB
Digital gain	Digital gain resolution = 1/32	-24.0	-	21.5	dB
Analog gain	3 dB steps	0	-	39	dB
Stereo separation (crosstalk)	-	80	-	-	dB

Stereo Codec: Digital to Analog Converter :

Class-AB DAC audio output

Parameter	Conditions	Mi	Typ	Max	Uni
Input Sample Width	-	-	-	24	Bit
Input Sample Rate, F_{sample}	-	8	-	192	kHz
Output Power	0 dBFS, 32 Ω load	-	-	30	mW
	-3 dBFS, 16 Ω load	-	-	-	-
Load	-	1	32	30k	Ω

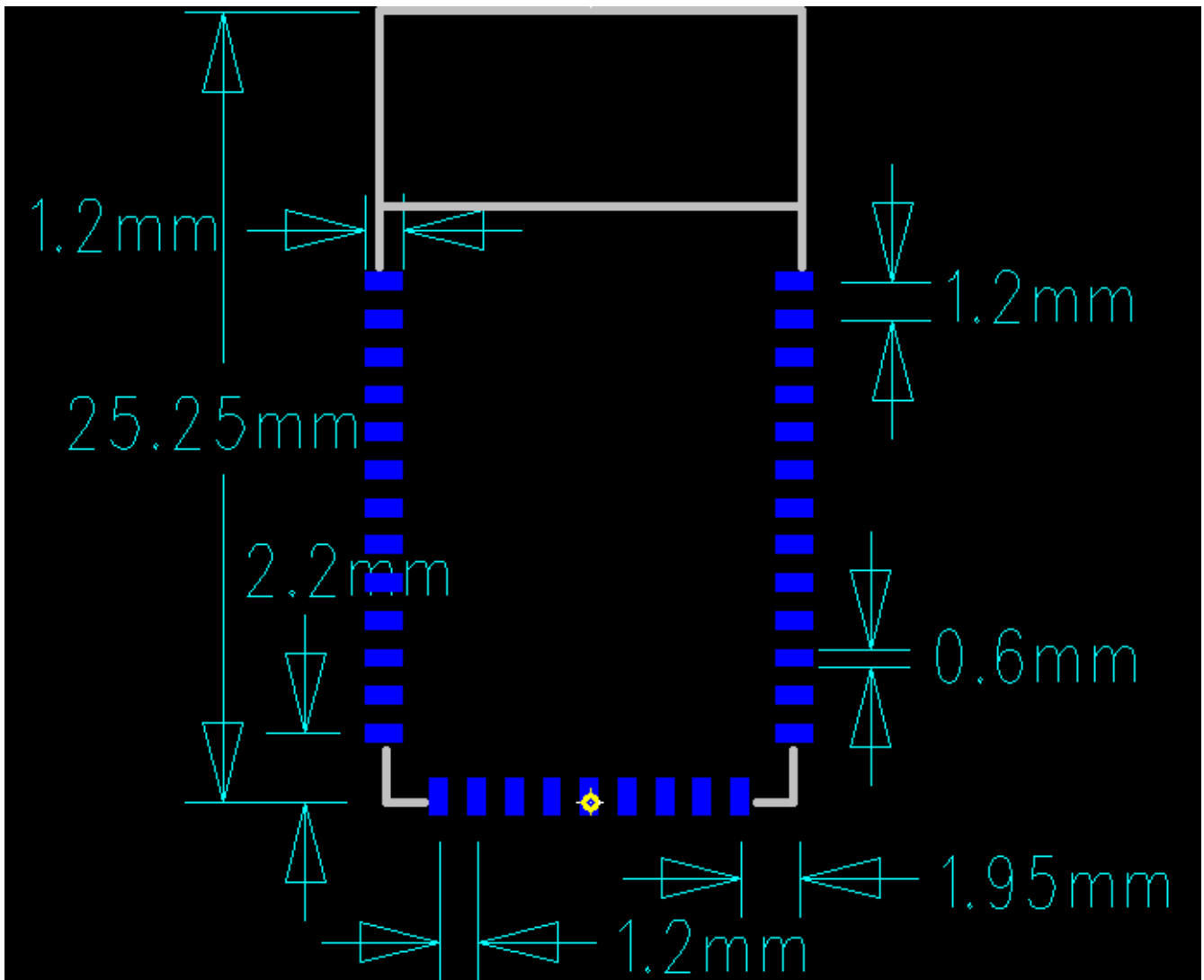
SNR	$f_{in} = 1 \text{ kHz}$ 48 kHz F_{sample} B/W = 20 Hz → 20 kHz A-Weighted 0 dBFS 32 Ω load	-	98.3	-	dBA
THD+N	$f_{in} = 1 \text{ kHz}$ 48 kHz B/W = 20 Hz → 20 kHz -1 dBFS 32 Ω load	-	-87.5	-	dB
Digital gain	Digital gain resolution = 1/32	-24.0	-	21.5	dB
Stereo separation (crosstalk)	-	80	-	-	dB
Max capacitive load	Per terminal to ground	-	-	100	pF

Power consumption

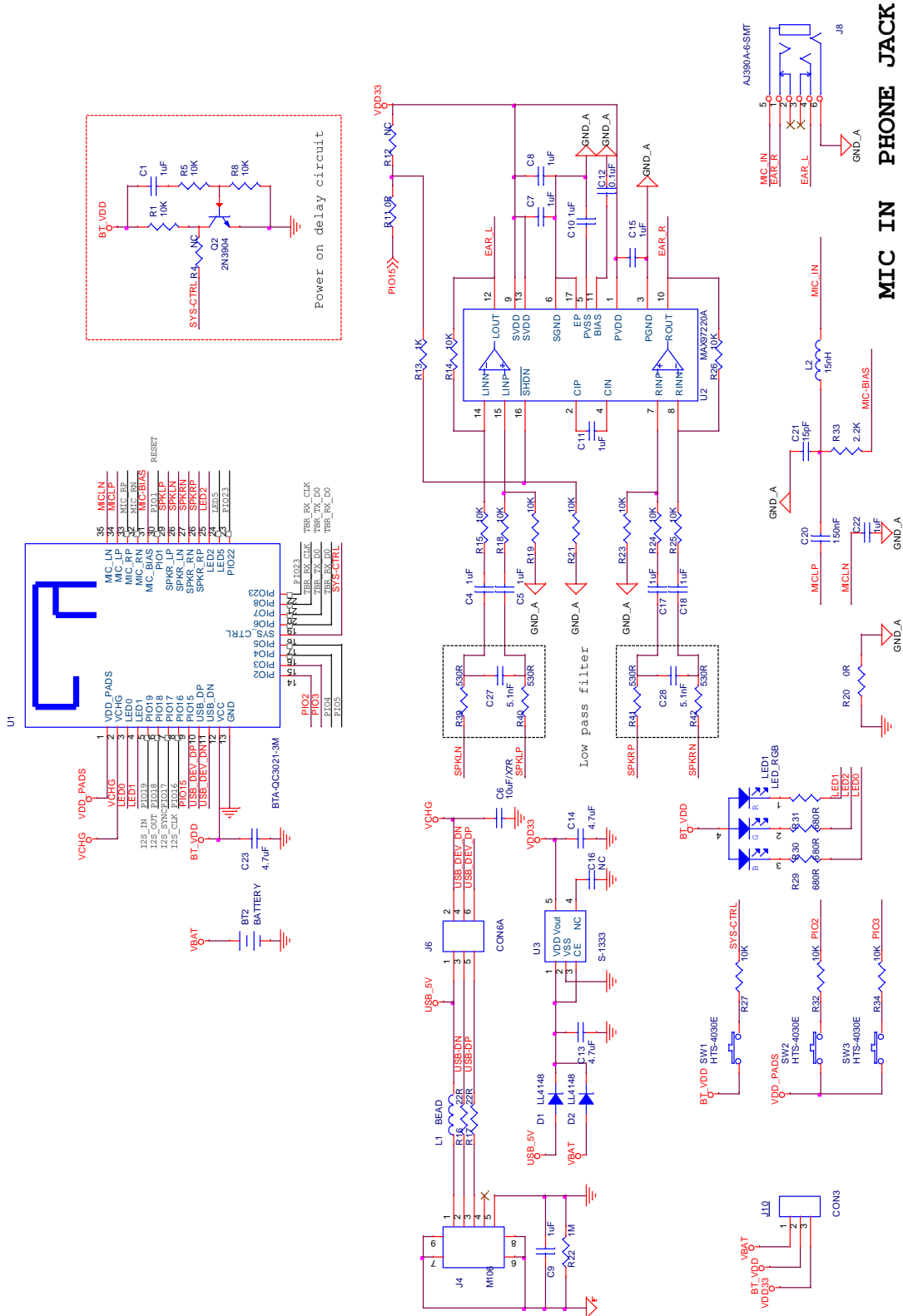
FW Version	DM3021-SPPA-020584			DM3021-SPPB-020594		
Role	TX			RX		
Profile	SPP			SPP		
Sniff mode	Disable			Disable		
Deep Sleep mode	Disable			Disable		
Baud rate(bits/sec)	115200			115200		
HW Platform	BTA-QC3021-DB+MB			BTA-QC3021-DB+MB		
Power source	DC_3.3V			DC_3.3V		
RF output power	Max.			Max.		
Test Status	Min.	Avg.(3min)	Max.	Min.	Avg.(3min)	Max.
Power on and unconnected	1.05mA	1.18mA	3.16mA	1.05mA	1.12mA	2.2mA
Inquiring(TX)/Pairing(RX)	1.05mA	6.8mA	7.35mA	1.05mA	1.18mA	3.2mA
Connected and no data Transfer	1.41mA	1.57mA	2.68mA	2.15mA	2.33mA	3.05mA
Connected TX/RX: 1 digit/sec	1.41mA	1.62mA	2.9mA	2.15mA	2.35mA	3.27mA
Connected TX/RX: 10 digits/sec	1.41mA	1.67mA	3.46mA	2.15mA	2.38mA	3.8mA
Connected TX: 1 set/sec 1 22 333 4444 55555 666666 7777777 88888888 999999999 0000000000	1.41mA	1.69mA	3.9mA	2.15mA	2.4mA	4.02mA

PCB Layout Guide

Footprint dimensions

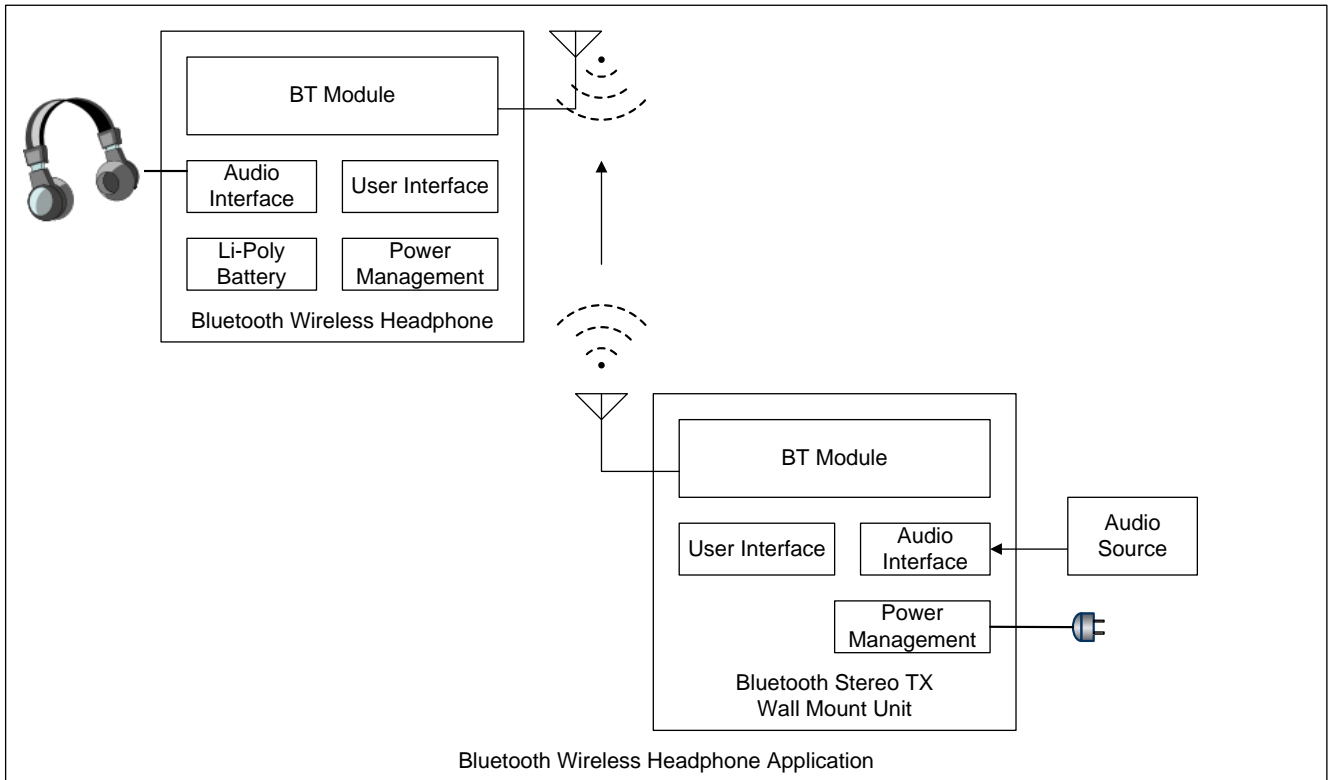


BT Stereo Headset Application Circuit

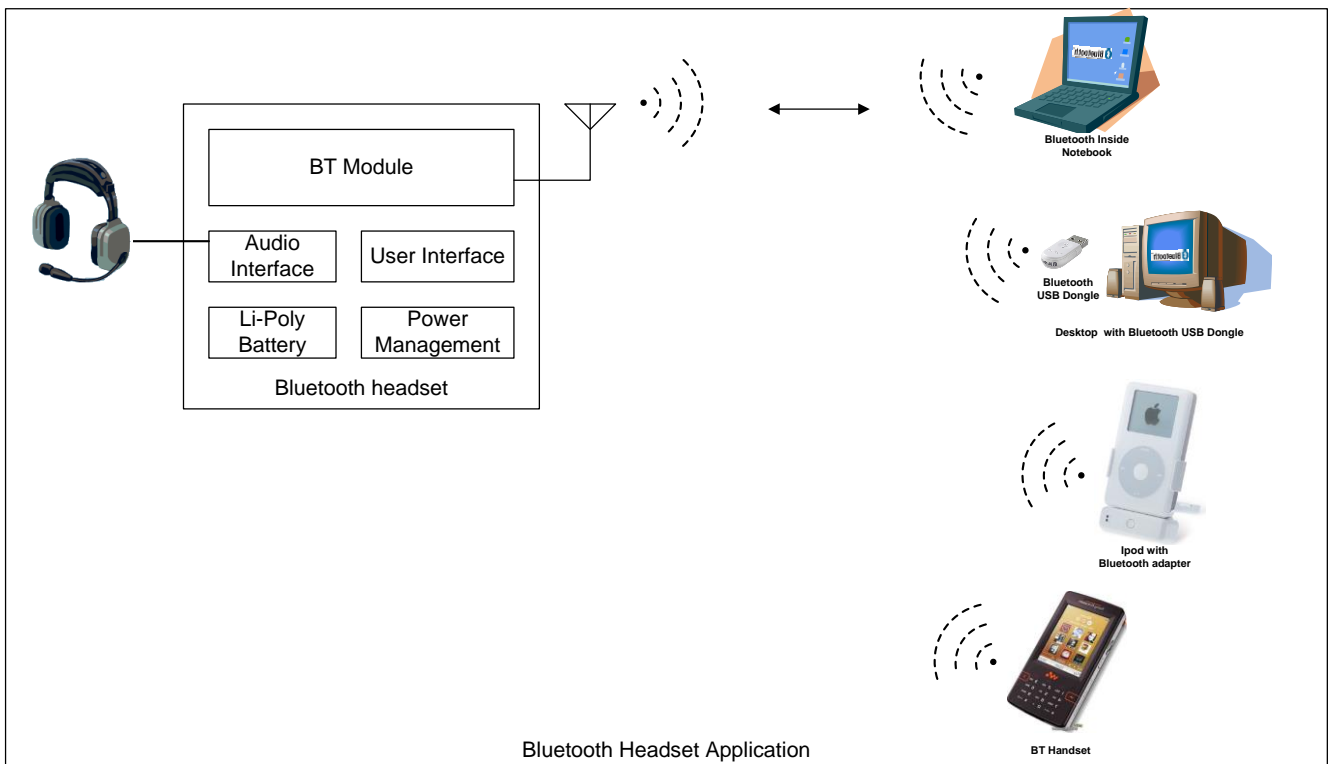


Application Block Diagram

Bluetooth Wireless Headphone Application

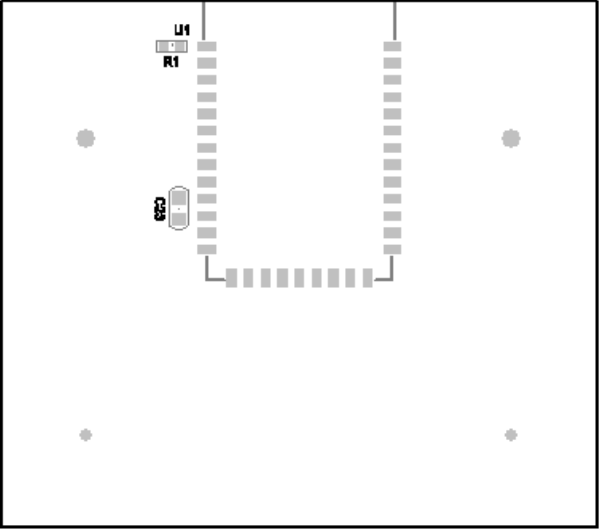
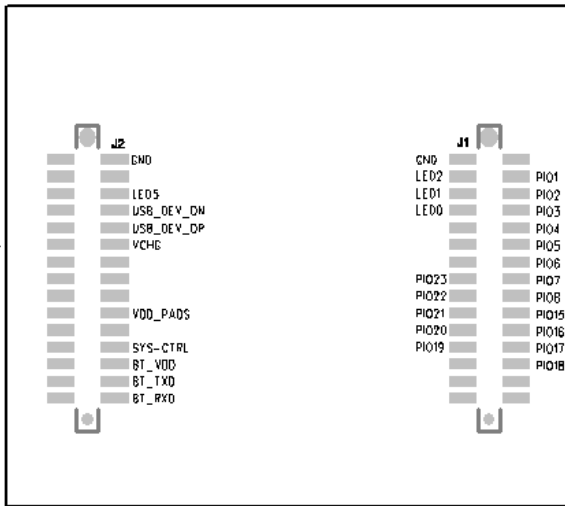

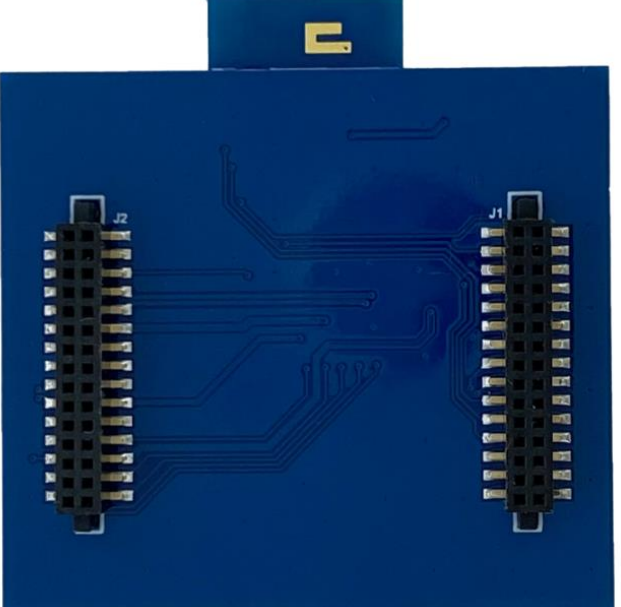


Bluetooth Wireless Headset Application

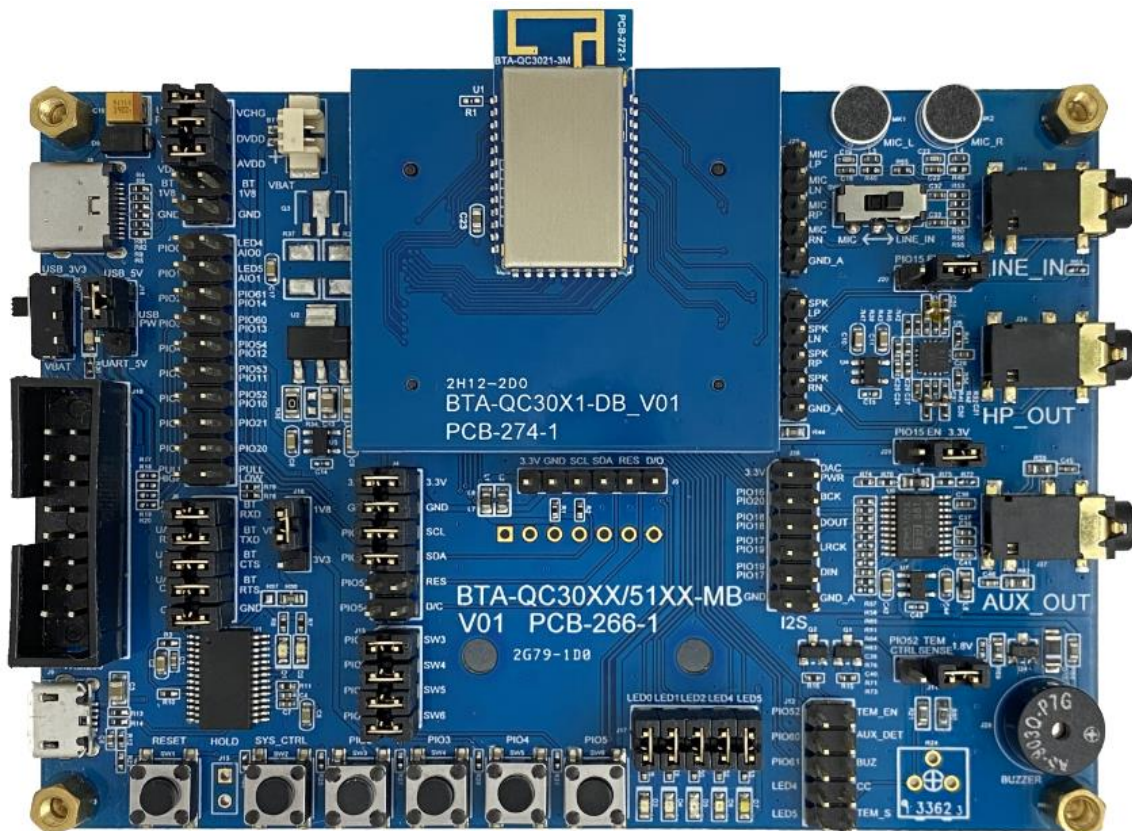
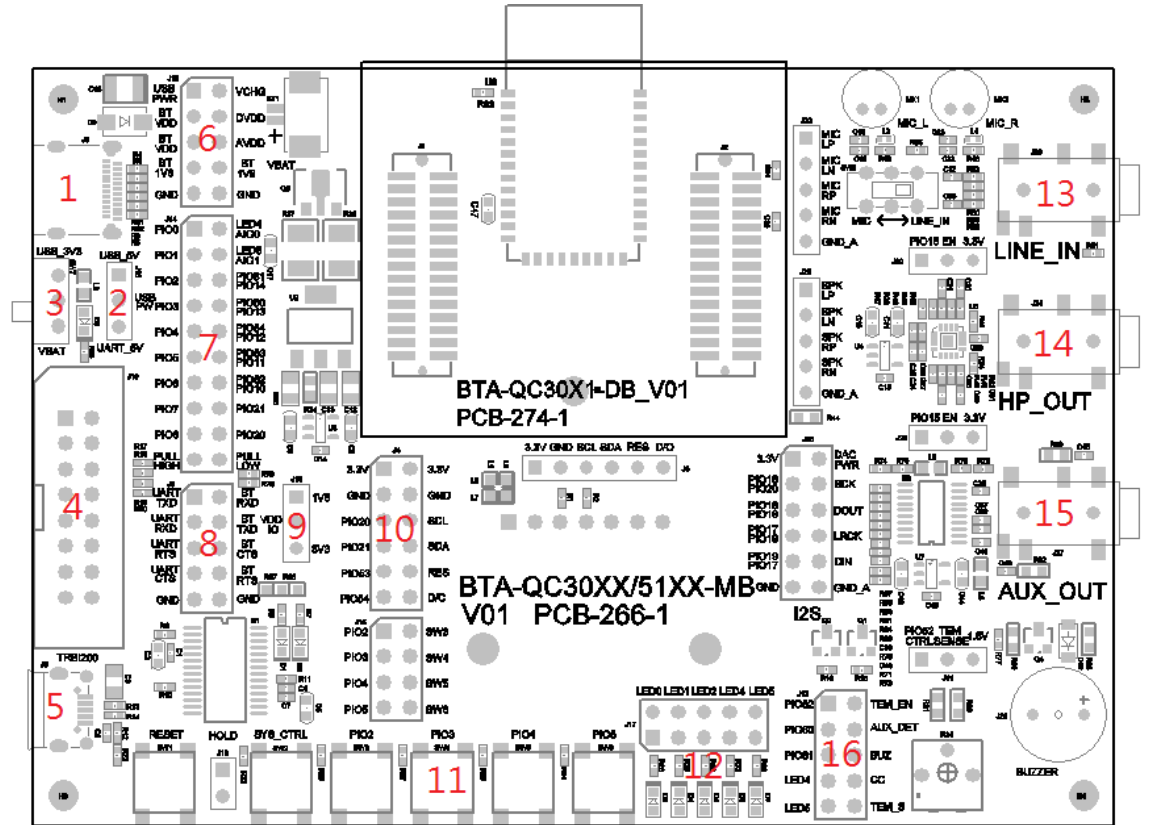


Evaluation board definition

BTA-QC3031-DB

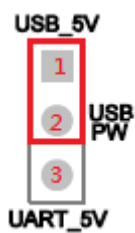
Top	Bottom
	
	

BTA-QC3031-MB+DB

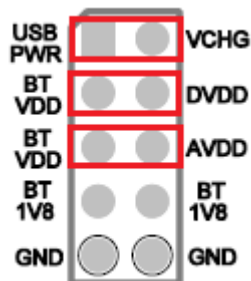


Jumper setting

1. USB-TYPE C
Main USB port
2. USB Power source
1-2 short : USB Type C
2-3 short : Micro-USB



3. Power Switch
UP: VDD_33 on or VBAT off.
Down: VBAT on or power VDD_33 off.
4. TRBI
Interface for TRBI2000 Tool kit
5. USB-Micro USB
It must be connected to this port as you use the UART function.
6. GPIO
Full PIO/AIO test pin.
7. Power source selector
Header default setting

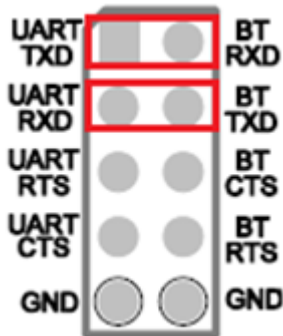


8. UART

Header default setting

BT_TX=PIO5, BT_RX=PIO4

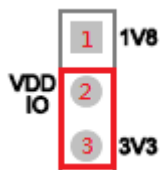
MB



9. VDD_IO

1-2 short: 1V8

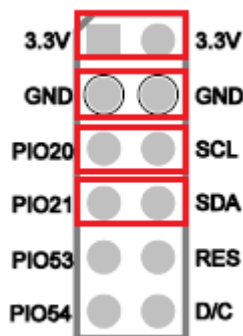
2-3 short: 3V3



10. I2C(Display)

Header default setting

SCL=PIO20, SDA=PIO21



11. Button

Header default setting:

Reset=PIO0, SYS_CTRL=PIO1, SW3=PIO2, SW4=PIO3, SW5=PIO4, SW6=PIO5

12. LED

Header default setting

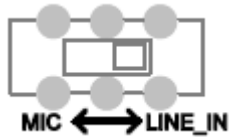
LED_G=LED0, LED_B=LED1, LED_R=LED2, LED_O=LED4, LED_W=LED5

13. MIC/LINE IN

Switch setting

Left: MIC In

Right: Line in



14. HP OUT

1-2 short: PIO15 enable

2-3 short: 3.3V enable



15. AUX OUT

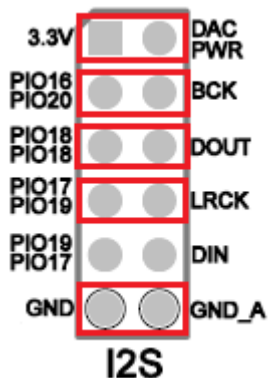
1-2 short: PIO15 enable

2-3 short: 3.3V enable



Header default setting

BCLK=PIO16, DOUT=PIO, DIN=PIO19, LRCK=PIO17



16. TEM EN/Buzzer/AUX_DET/CC/TEM_S

Header default setting

TEM EN=PIO52, LINE IN_DET=PIO60, Buzzer=PIO61, CC_Type C=LED4,

TEM S=LED5



FCC (U. S. Federal Communications Commission)

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may NOT cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

FEDERAL COMMUNICATIONS COMMISSION INTERFERENCE STATEMENT

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. The 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 of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between 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.

CAUTION:

Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment

The changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

RF exposure warning

This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provide with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.