

WNSQ-293BE(BT)

WiFi 7 2x2 MU-MIMO

802.11be Tri-band 2.4GHz/5GHz/6GHz

2T2R Wi-Fi+BT 5.4 M.2 LGA Type 1620 module



Wi-Fi +Bluetooth Combo Solution M.2 LGA Module

WNSQ-293BE(BT), Qualcomm based WiFi-7 (802.11be) module in M.2 1620 LGA formfactor, running PCIe (Wifi) and USB/UART (Bluetooth), with Tri-band capability (2.4GHz, 5GHz, and 6GHz). WNSQ-293BE(BT) supports simultaneous operation on 2.4 GHz +5 GHz, 2.4 GHz + 6 GHz and 5 GHz + 6 GHz.

WNSQ-293BE(BT) designed with 2 spatial streams (2T2R, or 2x2) in MU-MIMO mode. Adopting the latest 802.11be solution. It is ideal for next-generation high throughput

Software wise WNSQ-293BE(BT) support Linux in the near future. The module is capable to run on both x86 platform and ARM based platform, and supports STA mode and Soft AP Mode*, recommend to run on application includes: digital signage/POS, rugged computer / tablets, fanless automation PC and other industrial environment applications that requires high speed data transmission.

Embedded Application

Applications include IPC/ Advertising machine/ OTT/ IPTV/ DVB/ STB / DV/ Mini Driving Recorder/ Intelligent Projector Pico/ VR/ AR terminal/ POS machine/ Vehicle mounted front/ Rear Terminal UAV/ Robot/ Intelligent Gateway/ Smart city and other electronic products.

Key Feature

- Compliant with IEEE 802.11 be/ax/ac/a/b/g/n
- Support Multi-link Operation (MLO)
- Supports 2x2 Multi-User Multiple-Input Multiple-Output (MU-MIMO)
- Support up to 4096 QAM modulation at each band
- Support Dual band simultaneously (DBS)
- Support channel bandwidth for both 20 MHz, and 40 MHz at 2.4GHz, 20 MHz, 40MHz, 80 MHz and 160MHz at 5GHz and 6GHz band.
- Low-power PCIe (with L1 substate) interface

Specification

Standards	IEEE 802.11be/ax/ac/a/b/g/n (2T2R) Bluetooth V5.4, V5.3, V5.2, V5.1, V5.0, V4.2, V4.1, V4.0LE, V3.0, V2.1+EDR
Chipset	Qualcomm QCC2076
Data Rate	802.11b: 11Mbps 802.11a/g: 54Mbps 802.11n: MCS0~15 802.11ac: MCS0~9 802.11ax: MCS0~13 802.11be: MCS0~13 Bluetooth: 1 Mbps, 2Mbps and Up to 3Mbps
Operating Frequency	IEEE 802.11 be/ax/ac/a/b/g/n ISM Band, 2.412GHz~2.484GHz, 5.150GHz~5.850GHz ,5.925~7.125GHz *Subject to local regulations
Interface	WLAN: PCIe Bluetooth: USB or UART
Form Factor	M.2 LGA 1620
Antenna	2 x IPEX MHF4 connectors Main: WIFI/BT Aux: WIFI/BT
Modulation	Wi-Fi: 802.11b: DSSS (DBPSK, DQPSK, CCK) 802.11g: OFDM (BPSK, QPSK, 16-QAM, 64-QAM) 802.11n: OFDM (BPSK, QPSK, 16-QAM, 64-QAM) 802.11a: OFDM (BPSK, QPSK, 16-QAM, 64-QAM) 802.11ac: OFDM (BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM) 802.11ax: OFDMA (BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM, 1024-QAM, 4096-QAM) 802.11be: OFDMA (BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM, 1024-QAM, 4096-QAM) BT: Header: GFSK Payload 2M: $\pi/4$ -DQPSK Payload 3M: 8-DPSK

Power Consumption	11be TX mode: 802 mA (MAX) RX mode: 407 mA (MAX)
Operating Voltage	DC 3.3V
Operating Temperature Range	-30°C ~+85°C (Operating)
Storage Temperature Range	-40°C~+85°C
Humidity (Non-Condensing)	5%~90% (Operating) 5%~90% (Storing)
Dimension L x W x H (in mm)	20mm(± 0.15mm) x 16 mm(± 0.15mm) x 1.8 mm(± 0.3mm)
Weight (g)	1.2g
Driver Support	Linux
Security	WPS2.0, WAPI, WPA, WPA2, WPA3

OUTPUT POWER & SENSITIVITY

802.11b

Data Rate	Tx ± 1.5 dBm	Rx Sensitivity
11Mbps	18 dBm	≤ -91 dBm

802.11g

Data Rate	Tx ± 1.5 dBm	Rx Sensitivity
54Mbps	16 dBm	≤ -77.5 dBm

802.11n / 2.4GHz

HT20	Data Rate	Tx ± 1.5 dBm (1TX)	Tx ± 1.5 dBm (2TX)	Rx Sensitivity
	MCS7	16.5 dBm	19.5 dBm	≤ -76.5 dBm
HT40	MCS7	14.5 dBm	17.5 dBm	≤ -74 dBm

802.11a

Data Rate	Tx ± 2 dBm	Rx Sensitivity
54Mbps	16 dBm	≤ -76.5 dBm

802.11n / 5GHz

HT20	Data Rate	Tx ± 2 dBm (1TX)	Tx ± 2 dBm (2TX)	Rx Sensitivity
	MCS7	15 dBm	18 dBm	≤ -76 dBm
HT40	MCS7	14.5 dBm	17.5 dBm	≤ -73.5 dBm

802.11ac

VHT80	Data Rate	Tx ± 2 dBm (1TX)	Tx ± 2 dBm (2TX)	Rx Sensitivity
	MCS9	13 dBm	16 dBm	≤ -64.5 dBm
VHT160	MCS9	13 dBm	16 dBm	≤ -62 dBm

802.11ax / 2.4 GHz

HE40	Data Rate	Tx ± 1.5 dBm (1TX)	Tx ± 1.5 dBm (2TX)	Rx Sensitivity
	MCS13	11.5 dBm	14.5 dBm	≤ -55.5 dBm

802.11ax / 5GHz

HE80	Data Rate	Tx ± 2 dBm (1TX)	Tx ± 2 dBm (2TX)	Rx Sensitivity
	MCS13	12 dBm	15 dBm	≤ -52 dBm
HE160	MCS13	12 dBm	15 dBm	≤ -49.5 dBm

802.11ax / 6GHz				
HE80	Data Rate	Tx $\pm$ 2 dBm (1TX)	Tx $\pm$ 2 dBm (2TX)	Rx Sensitivity
	MCS13	11 dBm	14 dBm	$\leq$ -51 dBm
HE160	MCS13	11 dBm	14 dBm	$\leq$ -48.5 dBm

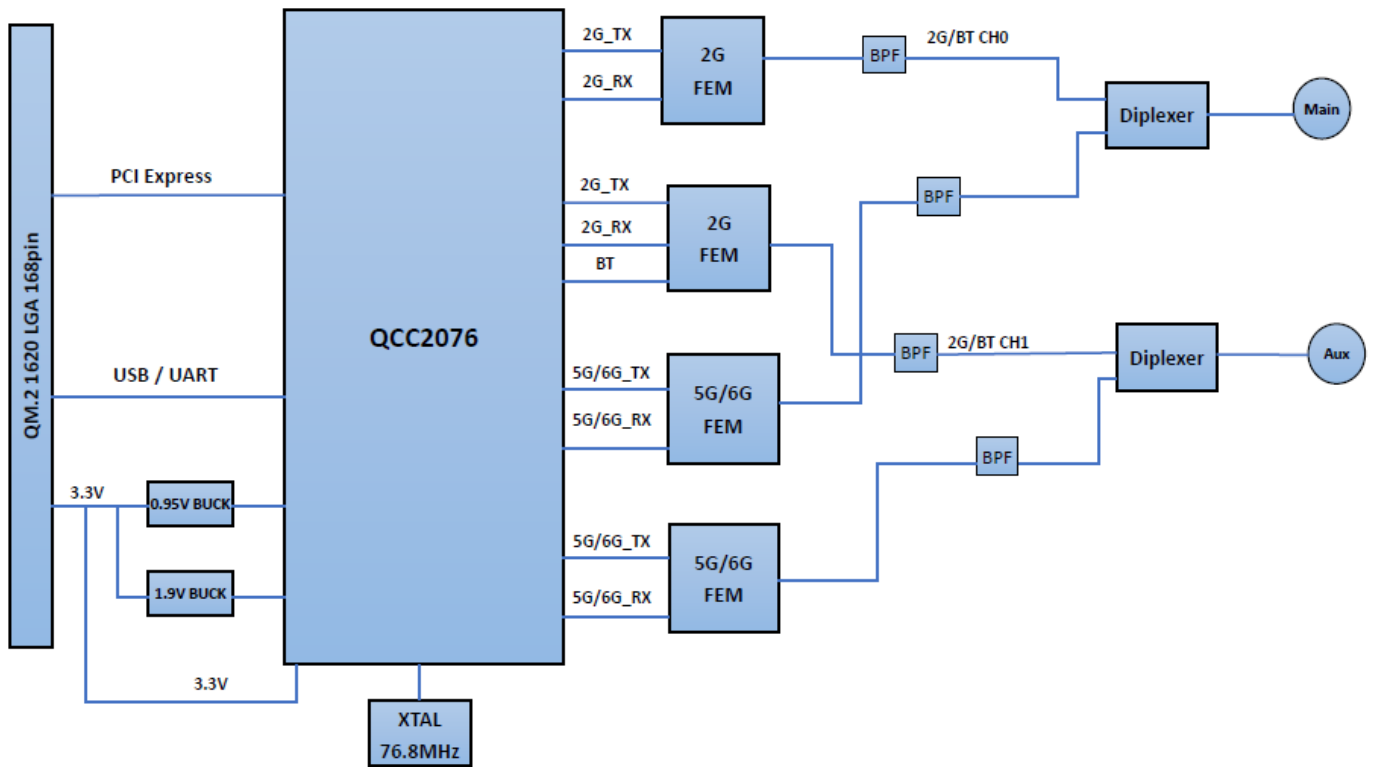
802.11be / 2.4 GHz				
EHT40	Data Rate	Tx $\pm$ 1.5 dBm (1TX)	Tx $\pm$ 1.5 dBm (2TX)	Rx Sensitivity
	MCS13	11.5 dBm	14.5 dBm	$\leq$ -56 dBm

802.11be / 5GHz				
EHT80	Data Rate	Tx $\pm$ 2 dBm (1TX)	Tx $\pm$ 2 dBm (2TX)	Rx Sensitivity
	MCS13	12 dBm	15 dBm	$\leq$ -52.5 dBm
EHT160	MCS13	12 dBm	15 dBm	$\leq$ -49.5 dBm

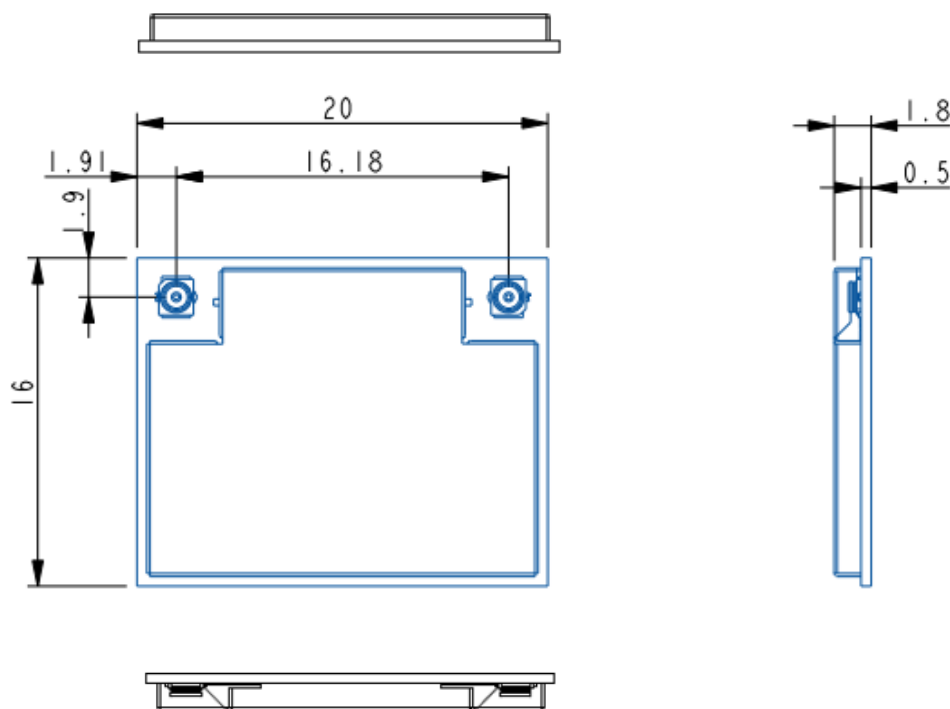
802.11be/ 6GHz				
EHT80	Data Rate	Tx $\pm$ 2 dBm (1TX)	Tx $\pm$ 2 dBm (2TX)	Rx Sensitivity
	MCS13	11 dBm	14 dBm	$\leq$ -51.5 dBm
EHT160	MCS13	11 dBm	14 dBm	$\leq$ -48.5 dBm

Bluetooth		
Data Rate	Tx $\pm$ 2dBm (Class I and Class II Device)	Rx Sensitivity
3M bps	11 $\leq$ Output Power $\leq$ 17 dBm	BER<0.1% Typical: -90dBm
1M bps	3 $\leq$ Output Power $\leq$ 7dBm	BLE 1Mbps (PER <30.8%) Typical: -93dBm
2M bps	3 $\leq$ Output Power $\leq$ 7dBm	BLE 2Mbps (PER <30.8%) Typical: -90dBm

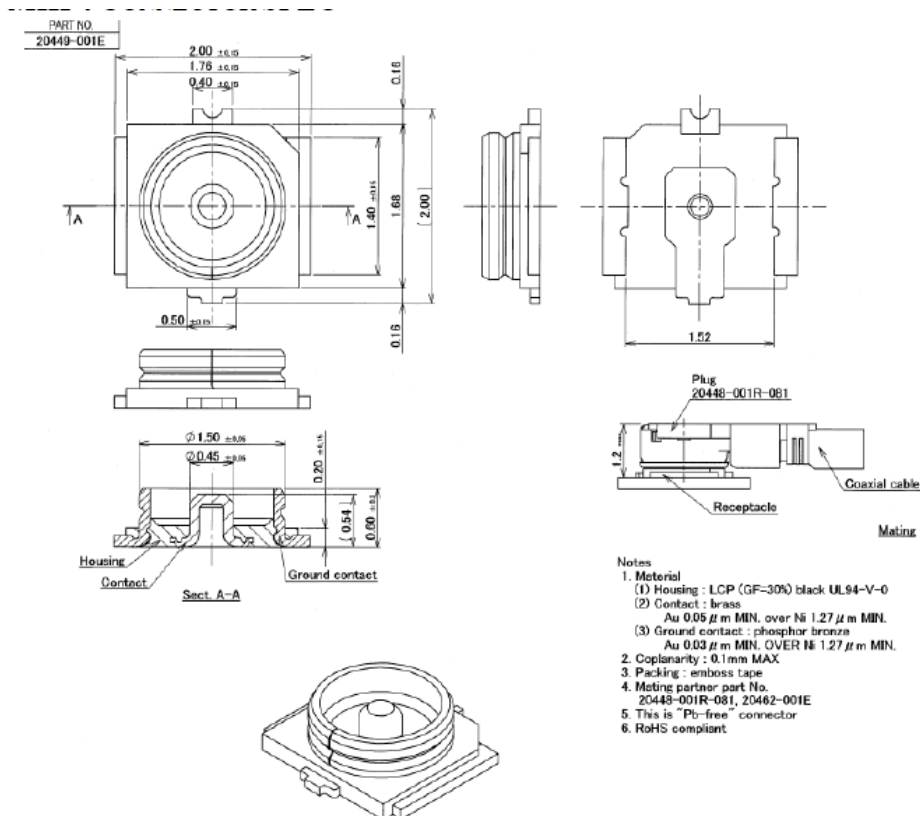
Block Diagram



Mechanical Dimension (mm)



MHF4 connector spec.



Module Land Pad

The formfactor of module is QM.2 LGA which totally has 168x land pads

Module pinout(Top view)

		GND																													
GND		105	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	108	GND							
		1	NC																	IO_1V8_SEL	76										
		2	NC																	JT_USB_UART_SEL	75										
		3	NC																	GND	74										
GND	GND	4	3.3V																	3V3	73			GND	GND						
		5	3.3V																	3V3	72										
GND	GND	6	GND							GND	97				GND	104				GND	71			GND	GND						
		7	WL_TX_EN																	BT_USB_DP	70										
GND	GND	8	LAA_TX_EN																	BT_USB_DM	69			GND	GND						
		9	NC																	GND	68										
GND	GND	10	NC																	WAKE_BT	67			GND	GND						
		11	LTE_COEX_RXD																	VIO_1V8	66										
GND	GND	12	LTE_COEX_TXD								GND	98				GND	103			LED1	65			GND	GND						
		13	WLAN_DEVICE_SOL																	LED2	64										
GND	GND	14	NC																	W_DISABLE2_L	63			GND	GND						
		15	NC																	GND	62										
GND	GND	16	WLAN_HOST_SOL																	BT_I2S_0_SCK_GPIO	61			GND	GND						
		17	GND																	BT_I2S_0_SDO_GPIO	60										
GND	GND	18	WL_DBG_UART_RXD																	BT_I2S_0_SDI_GPIO	59			GND	GND						
		19	WL_DBG_UART_TXD																	BT_I2S_0_WS_GPIO	58										
GND	GND	20	GND																	BT_UART_RT5	57			GND	GND						
		21	HMT_PCIE_TXN1																	BT_UART_RXD	56										
GND	GND	22	HMT_PCIE_TXP1																	BT_UART_TXD	55			GND	GND						
		23	GND																	BT_UART_CTS	54										
GND	GND	24	HMT_PCIE_RXN1																	JT_WAKEUP_HOST	53			GND	GND						
		25	HMT_PCIE_RXP1																	NC	52										
GND	GND	26	GND																	NC	51			GND	GND						
		27	32KHz_CLK																	TRST	50										
		28	W_DISABLE_L																	TDI	49										
		TOP View																													
GND		106	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	107	GND							
		GND	CLKREQD_L	PERSTO_L	GND	HMT_PCIE_REFCLKN	HMT_PCIE_REFCLKP	GND	HMT_PCIE_TXN0	HMT_PCIE_TXP0	GND	HMT_PCIE_RX_N0	HMT_PCIE_RX_P0	GND	N79_TX_EN	WL_TXEN_IO_N79	SENS_TXD	WL_EN	RMS	TDO	TCX	GND									
			PEWAKED_L																												

Pin Assignment

The following section illustrate signal pin-outs for the module connector.

* The following signal type is defined:

I: Input; O: Output; I/O: Input/Output; G: Ground; P: Voltage Supply

Pin#	Pin Name	Type	Description
1	NC	NC	No Connection
2	NC	NC	No Connection
3	NC	NC	No Connection
4	3.3V	P	VDD system power supply input
5	3.3V	P	VDD system power supply input
6	GND	G	Ground connections
7	WL_TX_EN(1.8V)	O	The QCC asserts this GPIO to high state, when either 5GHz chain0 or chain1 is set to transmit at power greater than certain power. When this GPIO is set high, the LAA receivers is placed in a protected state
8	LAA_TX_EN(1.8V)	I	This is an input from the SDR to QCC. The SDR sets GPIO high if LAA is transmitting above a prescribed RF power. GPIO is monitored by QCC. When it goes high, QCC places the 5GHz receiver in a protected state.
9	NC	NC	No Connection
10	NC	NC	No Connection
11	LTE_COEX_RXD(1.8V)	I	WSI interface for LTE co-existing interface with LTE modem to enable FW communication
12	LTE_COEX_TXD(1.8V)	O	WSI interface for LTE co-existing interface with LTE modem to enable FW communication
13	WLAN_DEVICE_SOL(1.8V)	O	Device sign of life
14	NC	NC	No Connection
15	NC	NC	No Connection
16	WLAN_HOST_SOL(1.8V)	I	HOST sign of life
17	GND	G	Ground connections
18	WL_DBG_UART_RXD(1.8V)	I	Debug interface (Host no need to connect)
19	WL_DBG_UART_TXD(1.8V)	O	Debug interface (Host no need to connect)
20	GND	G	Ground connections
21	HMT_PCIE_TXN1	O	PCIe TX differential signal lane 1 shall be connected to receiver differential pair on the system board
22	HMT_PCIE_TXP1	O	PCIe TX differential signal lane 1 shall be connected to

			receiver differential pair on the system board
23	GND	G	Ground connections
24	HMT_PCIE_RXN1	I	PCIe TX differential signal lane 1 shall be connected to transmitter differential pair on the system board
25	HMT_PCIE_RXP1	I	PCIe TX differential signal lane 1 shall be connected to transmitter differential pair on the system board
26	GND	G	Ground connections
27	32KHz_CLK	I	Suspend Clock is a 32.768KHz clock supply input that is provided by platform to enable WLAN to enter reduce power consumption mode. A pull-down resistor is required if this pin is not used.
28	W_DISABLE_L (1.8V)	I	It is an interrupt pin to WLAN. When WLAN detected interrupt, it turns off WLAN MAC/PHY/RF for power save application
29	PEWAKEO_L (1.8V)	O	WALN PCIe wake-up signal. It is an open-drain signal that requires an external pull-up
30	CLKREQO_L (1.8V)	I/O	WALN PCIe clock request signal. It is an open-drain signal that requires an external pull-up
31	PERSTO_L (1.8V)	I	WLAN PCIe reset
32	GND	G	Ground connections
33	HMT_PCIE_REFCLKN	I	WLAN PCIe reference clock input differential signals
34	HMT_PCIE_REFCLKP	I	WLAN PCIe reference clock input differential signals
35	GND	G	Ground connections
36	HMT_PCIE_TXN0	O	PCIe TX differential signal lane 0 shall be connected to receiver differential pair on the system board
37	HMT_PCIE_TXP0	O	PCIe TX differential signal lane 0 shall be connected to receiver differential pair on the system board
38	GND	G	Ground connections
39	HMT_PCIE_RXN0	I	PCIe RX differential signal lane 0 shall be connected to transmitter differential pair on the system board
40	HMT_PCIE_RXP0	I	PCIe RX differential signal lane 0 shall be connected to transmitter differential pair on the system board
41	GND	G	Ground connections
42	N79_TX_EN-	I	This is an input from the SDR to QCC. This GPIO is set high by the SDR when N79 transmits above a prescribed RF power. The QCC can be configured to respond to this GPIO when operating below a certain

			channel number, and to ignore this GPIO when operating above a certain channel number. When QCC responds to this GPIO, it places the 5GHz receivers in a protected state
43	WL_TXEN_TO_N79	O	This is an output from the QCC to SDR. The QCC asserts this GPIO to high state when the 5GHz or 6GHz chains are transmitting above certain power, and below a configurable channel frequency. The intent of allowing the channel to be configured is to improve concurrency with N79, depending on the filter selected and used on the device
44	SENS_TXD(1.8V)	O	Bluetooth 2-wire UART interfaces connect to the sensor block in the host
45	WL_EN(1.8V)	I	WLAN enable signal. It is an input, active high to enable WLAN operation
46	TMS(1.8V)	NC	JTAG signal, no connect
47	TDO(1.8V)	NC	JTAG signal, no connect
48	TCK(1.8V)	NC	JTAG signal, no connect
49	TDI(1.8V)	NC	JTAG signal, no connect
50	TRST(1.8V)	NC	JTAG signal, no connect
51	NC	NC	No Connection
52	NC	NC	No Connection
53	BT_WAKEUP_HOST(1.8V)	O	Wakeup host via Bluetooth while receiving magic Packet frame
54	BT_UART_CTS(1.8V)	I	UART Clear to Send
55	BT_UART_TXD(1.8V)	O	UART Transmit Data The baud rate is 115200 as default and can be configured up to 3.125Mbps
56	BT_UART_RXD(1.8V)	I	UART Receive Data The baud rate is 115200 as default and can be configured up to 3.125Mbps
57	BT_UART_RTS(1.8V)	O	UART Ready to Send
58	BT_I2S_0_WS_GPIO(1.8V)	I	Bluetooth 4-wire I2S interface operated in slave mode. The clock rate is up to 2.048MHz. I2S word select
59	BT_I2S_0_SDI_GPIO(1.8V)	I	Bluetooth 4-wire I2S interface operated in slave mode. The clock rate is up to 2.048MHz.

			I2S data input
60	BT_I2S_0_SDO_GPIO(1.8V)	O	Bluetooth 4-wire I2S interface operated in slave mode. The clock rate is up to 2.048MHz. I2S data output
61	BT_I2S_0_SCK_GPIO(1.8V)	I	Bluetooth 4-wire I2S interface operated in slave mode. The clock rate is up to 2.048MHz. I2S continuous serial clock
62	GND	G	Ground connections
63	W_DISABLE2_L(1.8V)	I	It is an interrupt pin to BT. Active low to disable BT function
64	LED2(1.8V)	OD	BT status indicator
65	LED1(1.8V)	OD	Wi-Fi status indicator
66	VIO_1V8(1.8V)	P	Internal 1.8V source input for VDD_IO Platform no need to connect
67	WAKE_BT(1.8V)	I	Wakeup BT via HOST while sending an interrupt event
68	GND	G	Ground connections
69	BT_USB_DM	I/O	USB Data- differential serial data interface
70	BT_USB_DP	I/O	USB Data+ differential serial data interface
71	GND	G	Ground connections
72	3.3V	P	VDD system power supply input
73	3.3V	P	VDD system power supply input
74	GND	G	Ground connections
75	BT_USB_UART_SEL	O	Connect this pin to GND if platform is x86
76	IO_1V8_SEL	O	Connect this pin to GND if platform is x86
77~168	GND	G	Ground connections

Note:

BT interface can be selected through platform by following configuration.

BT Interface	BT_USB_UART_SEL(Pin75)	IO_1V8_SEL(Pin76)
USB Interface	GND	GND
UART Interface	Floating	Floating

Certification

☒ **FCC**☒ **IC**☐ **NCC**☒ **CE (RED EN 300 328 V2.2.2 / EN 301 893 V2.1.1)**☐ **MIC**☐ **ASNZS**

Ordering Information

Product Name	Part Number	Description
WNSQ-293BE(BT)	R9701B10007	802.11be Tri-band, 2T2R Wi-Fi+BT M.2 1620 LGA Module

Optional Accessory

Product Name	Part Number	Description
AD-510AX	R3410A10051	Dipole Antenna,2.27dBi/2.69dBi/3.52dBi/2.4G/5G/6GHz,RP SMA(M)connector
CBIRF-NE150	R3470300025	RF Cable, I-PEXMHF4 to RP-SMA(F); L150mm; Coaxial 0.81 Black
CBIRF-NE250	R3470300026	RF Cable, I-PEXMHF4 to RP-SMA(F); L250mm; Coaxial 0.81 Black