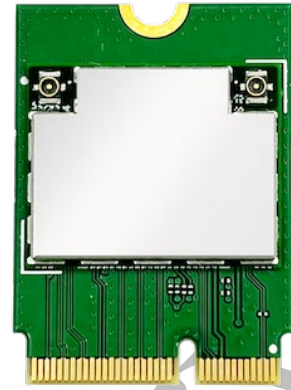


WNFQ-293BE(BT)

WiFi 7 2x2 MU-MIMO

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

2T2R Wi-Fi+Bluetooth 5.4 M.2 module



Wi-Fi +Bluetooth Combo Solution M.2 Module

WNFQ-293BE(BT), Qualcomm based WiFi-7 (802.11be) module in M.2 2230 E key formfactor, running PCIe (Wifi) and USB (Bluetooth), supports DBDC (Dual-band, Dual-concurrent) mode, but with Tri-band capability (2.4GHz, 5GHz, and 6GHz). WNFQ-293BE(BT) is able to concurrently run 2.4GHz with 5GHz, or 6GHz, and support full IEEE802.11 be/ax/ac/a/b/g/n protocol, up to 160MHz mode.

WNFQ-293BE(BT) designed with 2 spatial streams (2T2R, or 2x2) in MU-MIMO mode. With a standard M.2 E key 2230 formfactor, WNFQ-293BE(BT) can accommodate to all existing platform that has M.2 Adaptor pre-integrated, no extra work with platform design.

Software wise WNFQ-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 tri-band 2.4 GHz/5 GHz/6 GHz
- Support up to 4096 QAM modulation at each band
- 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, 2.400GHz~2.4835GHz, 5.150GHz~5.850GHz ,5.925~7.125GHz *Subject to local regulations
Interface	WLAN: PCIe Bluetooth: USB
Form Factor	M.2 2230 E Key
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, 4096QAM) 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: 407mA (MAX)
Operating Voltage	DC 3.3V
Operating Temperature Range	-30°~+85°C (Operating)(TBD)
Storage Temperature Range	-40°C~85°C
Humidity (Non-Condensing)	5%~90% (Operating) 5%~90% (Storing)
Dimension L x W x H (in mm)	30mm(± 0.15mm) x 22mm(± 0.15mm) x 3.4mm(± 0.3mm)
Weight (g)	3.1g
Driver Support	Linux
Security	WPS2.0, WAPI, WPA, WPA2, WPA3

OUTPUT POWER & SENSITIVITY
802.11b

Data Rate	Tx $\pm$ 1.5 dBm	Rx Sensitivity
11Mbps	18 dBm	$\leq$ -91 dBm

802.11g

Data Rate	Tx $\pm$ 1.5dBm	Rx Sensitivity
54Mbps	16 dBm	$\leq$ -77.5 dBm

802.11n / 2.4GHz

HT20	Data Rate	Tx $\pm$ 1.5 dBm (1TX)	Tx $\pm$ 1.5 dBm (2TX)	Rx Sensitivity
	MCS7	16.5 dBm	19.5 dBm	$\leq$ -76.5 dBm
HT40	MCS7	14.5 dBm	17.5 dBm	$\leq$ -74 dBm

802.11a

Data Rate	Tx $\pm$ 2dBm	Rx Sensitivity
54Mbps	16 dBm	$\leq$ -76.5 dBm

802.11n / 5GHz

HT20	Data Rate	Tx $\pm$ 2 dBm (1TX)	Tx $\pm$ 2 dBm (2TX)	Rx Sensitivity
	MCS7	15dBm	18 dBm	$\leq$ -76 dBm
HT40	MCS7	14.5 dBm	17.5 dBm	$\leq$ -73.5 dBm

802.11ac

VHT80	Data Rate	Tx $\pm$ 2 dBm (1TX)	Tx $\pm$ 2 dBm (2TX)	Rx Sensitivity
	MCS9	13 dBm	16 dBm	$\leq$ -64.5 dBm
VHT160	MCS9	13 dBm	16 dBm	$\leq$ -62 dBm

802.11ax / 2.4 GHz

HE40	Data Rate	Tx $\pm$ 1.5 dBm (1TX)	Tx $\pm$ 1.5 dBm (2TX)	Rx Sensitivity
	MCS13	11.5 dBm	14.5 dBm	$\leq$ -55.5 dBm

802.11ax / 5GHz

HE80	Data Rate	Tx $\pm$ 2 dBm (1TX)	Tx $\pm$ 2 dBm (2TX)	Rx Sensitivity
	MCS13	12 dBm	15 dBm	$\leq$ -52 dBm
HE160	MCS13	12 dBm	15 dBm	$\leq$ -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

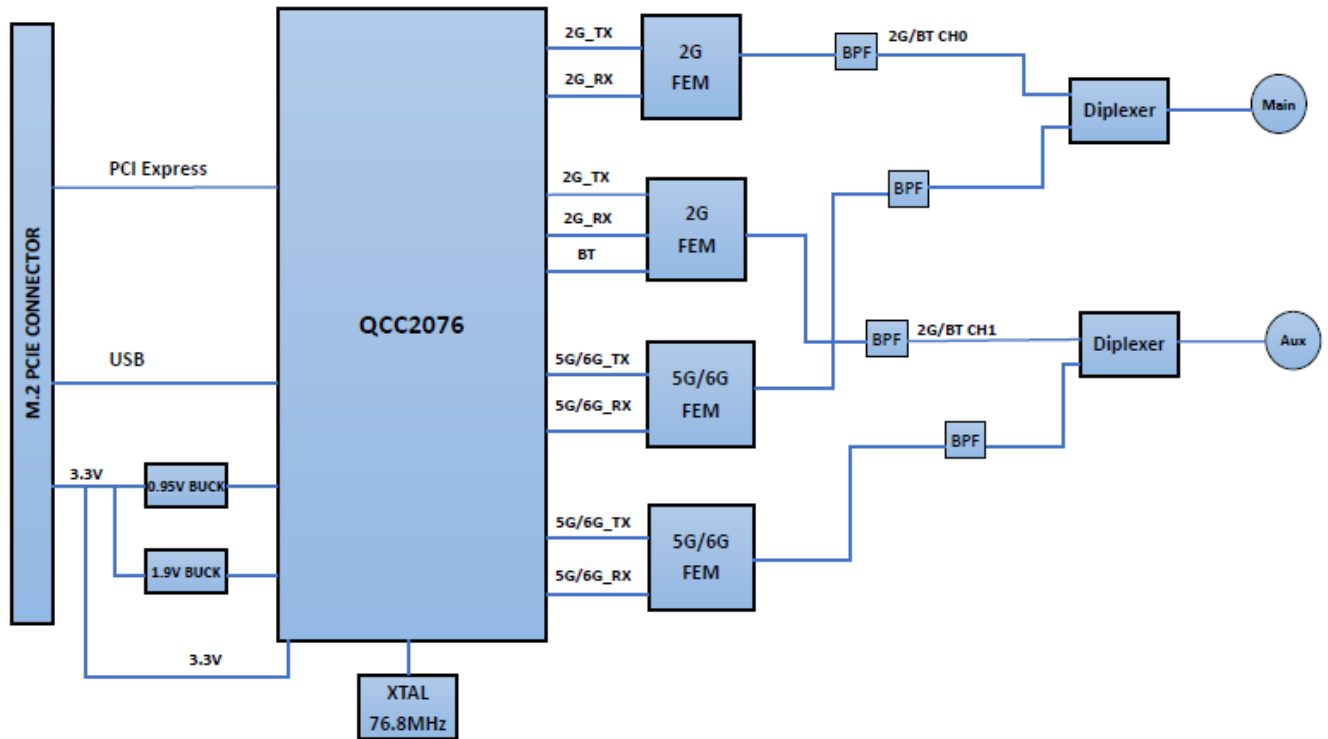
802.11be / 2.4 GHz				
EHT40	Data Rate	Tx $\pm$ 1.5 dBm (1TX)	Tx $\pm$ 1.5 dBm (2TX)	Rx Sensitivity
	MCS13	11.5 dBm	14.5 dBm	$\leq$ -56 dBm

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

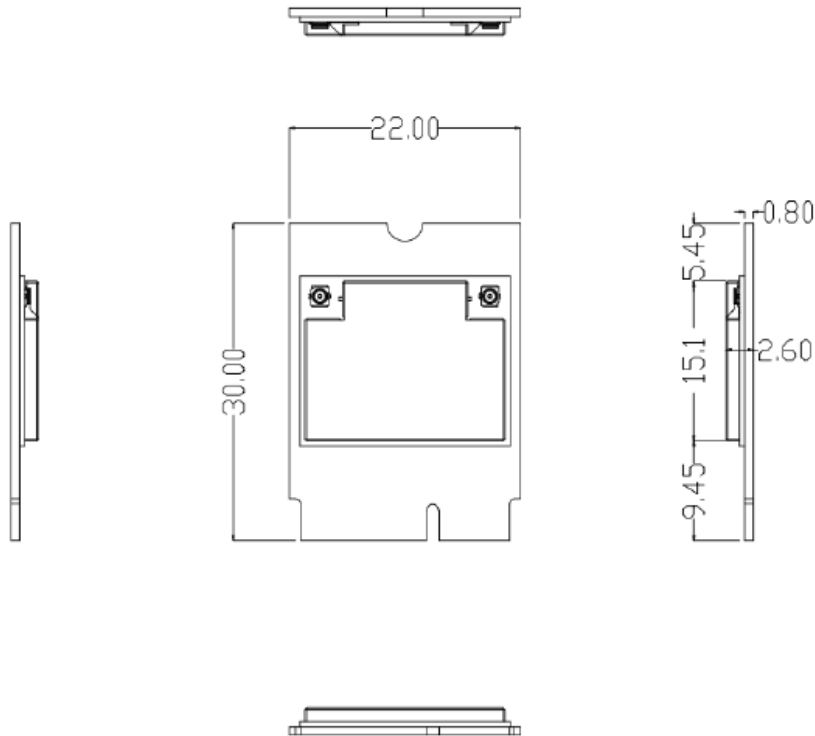
802.11be/ 6GHz				
EHT80	Data Rate	Tx $\pm$ 2 dBm (1TX)	Tx $\pm$ 2 dBm (2TX)	Rx Sensitivity
	MCS13	11 dBm	14 dBm	$\leq$ -51.5 dBm
EHT160	MCS13	11 dBm	14 dBm	$\leq$ -48.5 dBm

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

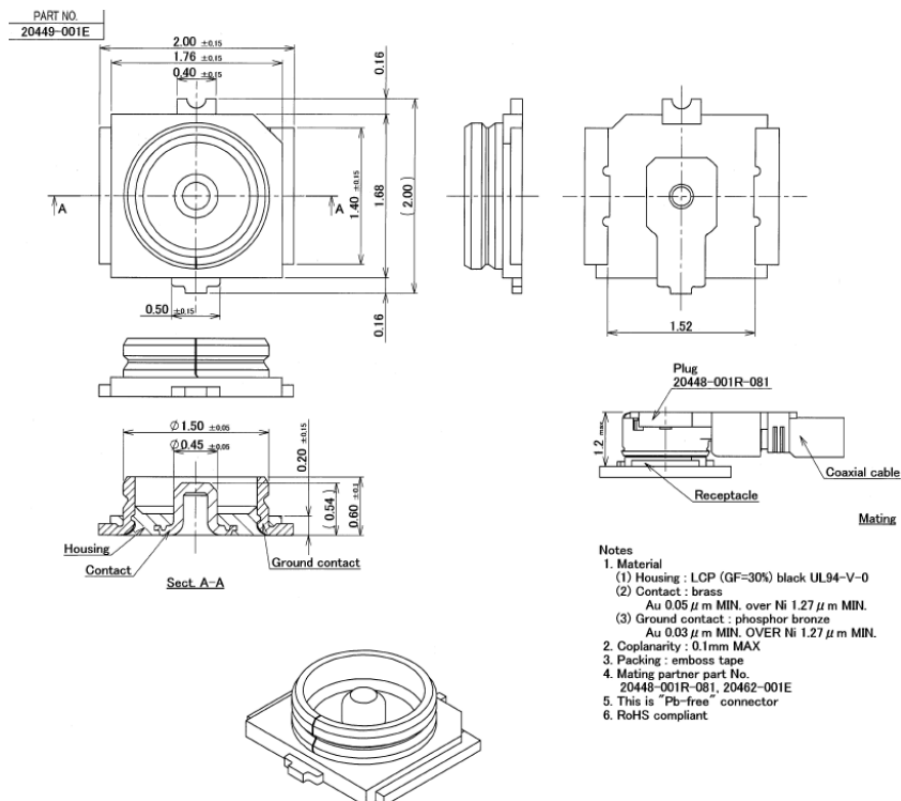
Block Diagram



Mechanical Dimension (mm)



MHF4 connector spec.



Pin Assignment

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

TOP			
Pin#	Pin Name	Type	Description
1	GND	G	Ground connections
3	USB_D+	I/O	USB serial differential data Positive
5	USB_D-	I/O	USB serial differential data Negative
7	GND	G	Ground connections
9	SDIO_CLK/SYSCLK	NC	No Connection
11	SDIO_CMD	NC	No Connection
13	SDIO_DATA0	NC	No Connection
15	SDIO_DATA1	NC	No Connection
17	SDIO_DATA2	NC	No Connection
19	SDIO_DATA3	NC	No Connection
21	SDIO_WAKE#	NC	No Connection
23	WL_EN	I	WLAN enable signal. It is an input, active high to enable WLAN operation.(Optional)
25	NOTCH FOR KEY E	NC	No Connection
27	NOTCH FOR KEY E	NC	No Connection
29	NOTCH FOR KEY E	NC	No Connection
31	NOTCH FOR KEY E	NC	No Connection
33	GND	G	Ground connections
35	PERp0	I	PCIe RX differential signal lane 0 shall be connected to transmitter differential pair on the system board
37	PERn0	I	PCIe RX differential signal lane 0 shall be connected to transmitter differential pair on the system board
39	GND	G	Ground connections
41	PETp0	O	PCIe TX differential signal lane 0 shall be connected to receiver differential pair on the system board
43	PETn0	O	PCIe TX differential signal lane 0 shall be connected to receiver differential pair on the system board
45	GND	G	Ground connections

TOP			
Pin#	Pin Name	Type	Description
47	REFCLKp0	I	WLAN PCIe reference clock input differential signals
49	REFCLKn0	I	WLAN PCIe reference clock input differential signals
51	GND	G	Ground connections
53	CLKREQ0# (1.8V)	I/O	WLAN PCIe clock request signal. It is an open-drain signal that requires an external pull-up
55	PEWAKE0# (1.8V)	O	WLAN PCIe wake-up signal. It is an open-drain signal that requires an external pull-up
57	GND	G	Ground connections
59	HMT_PCIE_RXP1	I	PCIe TX differential signal lane 1 shall be connected to transmitter differential pair on the system board
61	HMT_PCIE_RXN1	I	PCIe TX differential signal lane 1 shall be connected to transmitter differential pair on the system board
63	GND	G	Ground connections
65	HMT_PCIE_TXP1	O	PCIe TX differential signal lane 1 shall be connected to receiver differential pair on the system board
67	HMT_PCIE_TXN1	O	PCIe TX differential signal lane 1 shall be connected to receiver differential pair on the system board
69	GND	G	Ground connections
71	RESERVED/REFCLKp1	NC	No Connection
73	RESERVED/REFCLKn1	NC	No Connection
75	GND	G	Ground connections

Pin Assignment

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

BOTTOM			
Pin#	Pin Name	Type	Description
2	3.3 V	P	VDD system power supply input
4	3.3 V	P	VDD system power supply input
6	LED_1#	OD	Wi-Fi status indicator
8	I2S_SCK (1.8V)	I	Bluetooth 4-wire I2S interface operated in slave mode. The clock rate is up to 2.048MHz. I2S continuous serial clock
10	I2S_WS (1.8V)	I	Bluetooth 4-wire I2S interface operated in slave mode. The clock rate is up to 2.048MHz. I2S word select

BOTTOM			
Pin#	Pin Name	Type	Description
12	I2S_SD_OUT (1.8V)	O	Bluetooth 4-wire I2S interface operated in slave mode. The clock rate is up to 2.048MHz.I2S data output
14	I2S_SD_IN (1.8V)	I	Bluetooth 4-wire I2S interface operated in slave mode. The clock rate is up to 2.048MHz.I2S data input
16	LED_2#	OD	BT status indicator
18	GND	G	Ground connections
20	UART_WAKE# (SENSE-RXD)	O	Wakeup host via Bluetooth while receiving magic Packet frame (SENSE-RXD)
22	UART_TXD	O	UART Transmit Data The baud rate is 115200 as default and can be configured up to 3.125Mbps
24	NOTCH FOR KEY E	NC	No Connection
26	NOTCH FOR KEY E	NC	No Connection
28	NOTCH FOR KEY E	NC	No Connection
30	NOTCH FOR KEY E	NC	No Connection
32	UART_RXD	I	UART Receive Data The baud rate is 115200 as default and can be configured up to 3.125Mbps
34	UART_RTS	O	UART Ready to Send (1.8V)
36	UART_CTS	I	UART Clear to Send (1.8V)
38	VENDOR DEFINED (LAA_TX_EN)	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.
40	VENDOR DEFINED (WL_TX_EN)	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
42	RESERVED	DNC	RESERVED
44	RESERVED/COEX0	DNC	RESERVED
46	RESERVED/COEX1	DNC	RESERVED
48	RESERVED/COEX2	DNC	RESERVED
50	SUSCLK	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 pulldown resistor is required if this pin is not used.

BOTTOM			
Pin#	Pin Name	Type	Description
52	PERST0#	I	PCIe host indication to reset the device Active low.
54	W_DISABLE2# (1.8V)	I	It is an interrupt pin to BT. Active low to disable BT function
56	W_DISABLE1# (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
58	I2C_DATA	I/O	Debug interface (Host no need to connect)
60	I2C_CLK	I	Debug interface (Host no need to connect)
62	ALERT#(SENS_TXD)	O	SENS_TXD
64	RESERVED	DNC	RESERVED
66	UIM_SWP/PERST1#	I	Wakeup BT via HOST while sending an interrupt event
68	UIM_POWER_SNK/CLKREQ1#	NC	No Connection
70	UIM_POWER_SRC/GPIO_1/PEWAKE1#	NC	No Connection
72	3.3 V	P	VDD system power supply input
74	3.3 V	P	VDD system power supply input

Note: Power (P), Ground (G), Open-Drain (OD), Input (I), Output (O), Do Not Connect (DNC), No Connection (NC), Input/Output(I/O)

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
WNFQ-293BE(BT)	R9701B10008	11be/ax/ac/a/b/g/n 2T2R Wi-Fi+BT M.2 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