a module solution provider

WQ3132-00

WLAN Dual-Band 2x2 802.11ac + Bluetooth 5.0

Wireless Module

Qualcomm WCN3990 Solution

Datasheet

Draft. 0.1

Prepared By	Reviewed By	Approved By

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1. OVERVIEW

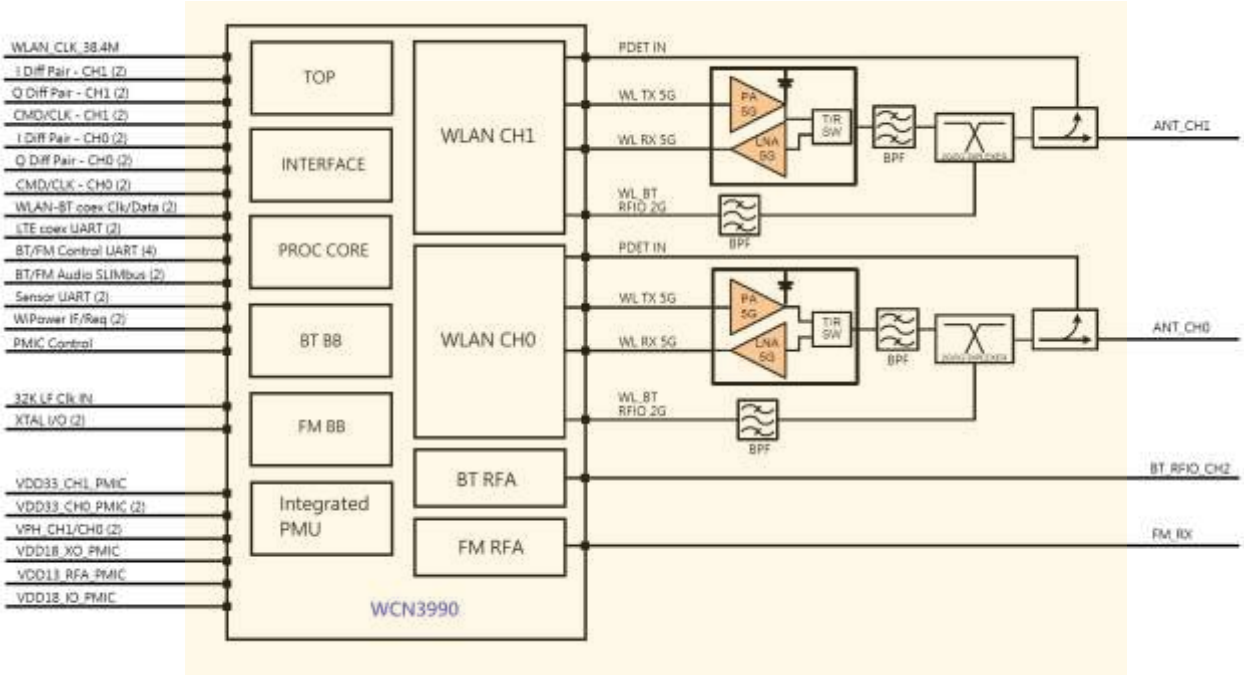
The WQ3132-00 is a wireless local area network (WLAN), Bluetooth (BT) and FM combination module to support 2 × 2 multiple input, multiple output (MIMO) with two spatial streams IEEE 802.11a/b/g/n/ac WLAN standards and Bluetooth + LE 5.X + HS enabling seamless integration of WLAN/Bluetooth and low-energy technology. This module is based on Qualcomm WCN3990 single-die chip.

1.1. General Features

- Full PMIC support including shared XO
- 6th Generation MIMO solution
- 2x2 802.11ac with MU-MIMO
- 160 MHz & DBS support
- Bluetooth 5.0 and FM RDS/RBDS
- Optional dedicated BT antenna support –concurrent operation for WLAN and BT with and without dedicated BT antenna
- RF performance meets all carrier requirements
  - Industry leading throughput (700+ Mbps TCP)
  - Low power island on MSM for lowest Wi-Fi power consumption (up to 61% improvement)
  - BT/BTLE integration within WCN3990 for lowest BT power consumption (up to 87% improvement)
- Compatible with Qualcomm WCN3990 RD2 non-antenna sharing reference design.
  - WCN3990 Internal RF power amplifier / Low noise amplifier for 2.4GHz band.
  - Built-in Qorvo QM45858 5.0GHz Wi-Fi RF Front-End Module
- Dimension 13.3mm(L) x 13.4mm(W) x 2.0mm(H)
- LGA-120 pins package
- RoHS Compliance

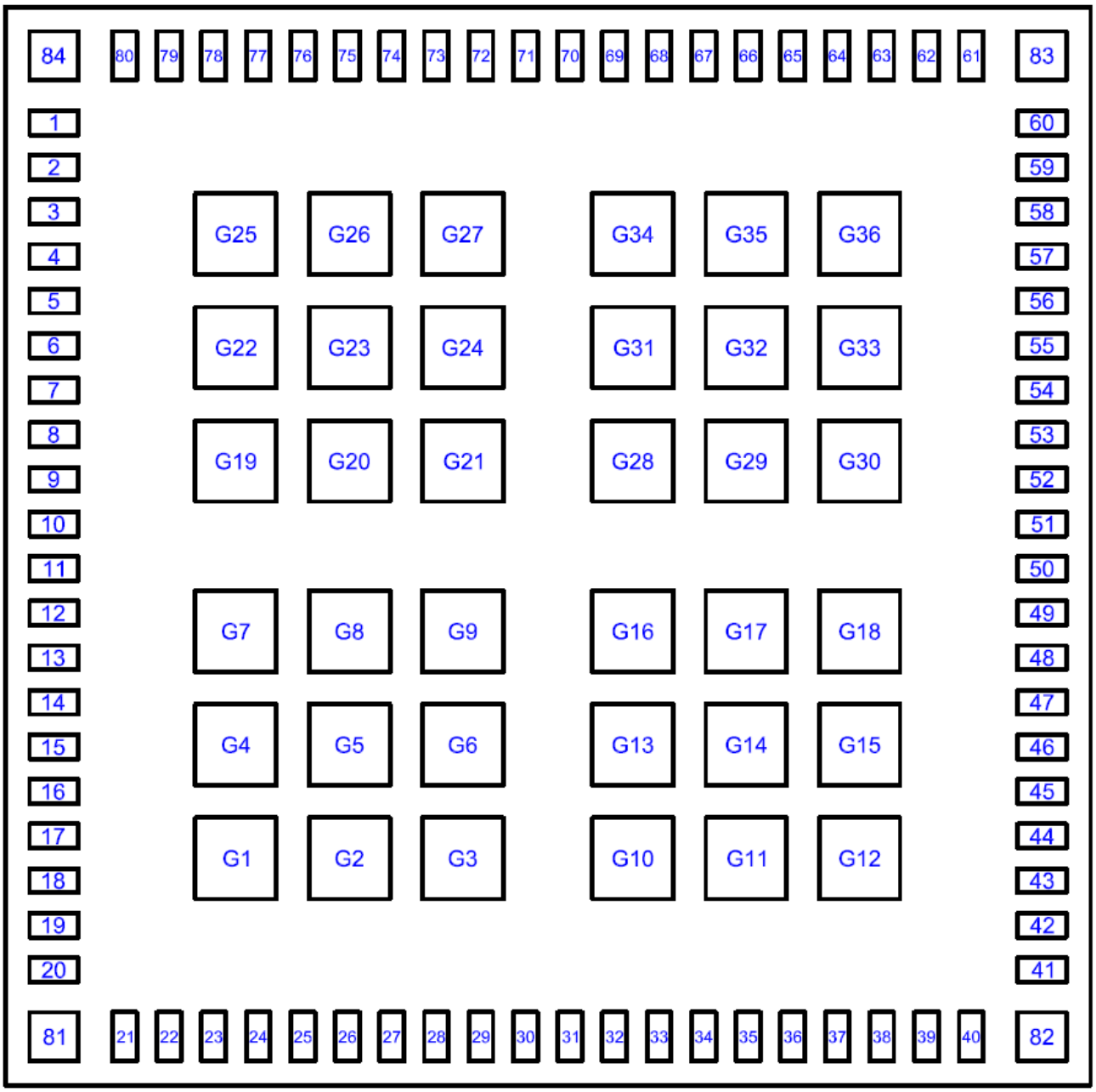
2. FUNCTIONAL FEATURES

2.1. Module Block Diagram



3. MODULE OUTLINE

3.1. Signal Layout (Top View)



3.2. Pin Description

Table 3-1. Pin Description

Pin No.	Pin Name	Type(1)	Description
1	GND	GND	Ground
2	ANT_CH0	RF	2.4G/5G dual band WIFI and BT RF input/output – Chain 0
3	GND	GND	Ground
4	GND	GND	Ground
5	GND	GND	Ground
6	GND	GND	Ground
7	GND	GND	Ground
8	GND	GND	Ground
9	VDD33_CH0	POWER	3.3V, Shared between 2G/5G WLAN and BT main supply chain 0
10	VDD33_CH0	POWER	
11	VDD18_XO	POWER	1.8V Crystal oscillator, chain 0 synth supply, and Chain 1 VCO supply
12	VDD13_RFA	POWER	1.3V, Power for WCN analog, digital, and RF core circuits
13	WP_IF	B / NP	Open Drain, single wire (half-duplex) UART between WiPower IC and BT subsystem to exchange WiPower related messages.
14	WIPWR_RECHG_REQ	DI / NP	WiPower recharge request to PMIC indicating if battery needs charging.
15	SW_CTRL	DO / NP	PMIC ball control and 38.4 MHz system clock request
16	GND	GND	Ground
17	BT_RFIO_CH2	RF	RF IO for dedicated BT Tx/Rx chain 2. If not used, terminate with 50 ohms.
18	GND	GND	Ground
19	LF_CLK_IN	DI / NP	32K sleep clock input
20	SENS_TXD	DO / NP	Sensor two-wire UART, connects to host (MSM/APQ) sensor core
21	SENS_RXD	DI / NP	
22	COEX_RXD	DI / NP	LTE coex using WCI2 (messaging) over UART (PHY)

23	COEX_TXD	DO / NP	
24	GND	GND	Ground
25	FM_RX_HEADSET	RF	FM headset antenna. If not used, connect to ground.
26	GND	GND	Ground
27	XTALO	AO	Reserved (crystal out)
28	XTALI	AI	Reference clock input (crystal in)
29	GND	GND	Ground
30	WL_CMD_CLK_CH0	DI / PD	Chain 0 using proprietary command interface over WSI 2.0 (PHY)
31	WL_CMD_DATA_CH0	B / PD	
32	GND	GND	Ground
33	COEX_DATA	B / PD	WLAN/BT coex using MCI (messaging) over WSI 1.0 (PHY)
34	COEX_CLK	DI / PD	
35	VDD18_IO	POWER	IO supply
36	SB_CLK	DI / NP	SLIMbus for BT/FM audio
37	SB_DATA	B / PD	
38	GND	GND	Ground
39	WL_CMD_DATA_CH1	B / PD	Chain 1 using proprietary command interface over WSI 2.0 (PHY)
40	WL_CMD_CLK_CH1	DI / PD	
41	CLK_OUT	DO / NP	38.4 MHz synchronization clock to MSM
42	GND	GND	Ground
43	WL_BB_QN_CH0	AI / AO	IQ analog interface chain 0
44	WL_BB_QP_CH0	AI / AO	
45	WL_BB_IP_CH0	AI / AO	
46	WL_BB_IN_CH0	AI / AO	
47	GND	GND	Ground
48	WL_BB_QN_CH1	AI / AO	IQ analog interface chain 0
49	WL_BB_QP_CH1	AI / AO	
50	WL_BB_IN_CH1	AI / AO	
51	WL_BB_IP_CH1	AI / AO	
52	GND	GND	Ground
53	VDD33_CH1	POWER	3.3V, Shared between 2G/5G WLAN PA main supply chain 1
54	CTS	DI / NP	CTS, BT using HCI (messaging) over UART (PHY)

55	RTS	DO / NP	RTS, BT using HCI (messaging) over UART (PHY)
56	TXD	DO / NP	TXD, BT using HCI (messaging) over UART (PHY)
57	RXD	DI / NP	RXD, BT using HCI (messaging) over UART (PHY)
58	GND	GND	Ground
59	GND	GND	Ground
60	GND	GND	Ground
61	GND	GND	Ground
62	GND	GND	Ground
63	ANT_CH1	RF	2.4G/5G dual band WIFI RF input/output – Chain 1
64	GND	GND	Ground
65	GND	GND	Ground
66	GND	GND	Ground
67	GND	GND	Ground
68	GND	GND	Ground
69	GND	GND	Ground
70	VPH_CH1	POWER	3.3V, Power for QM45858 5GHz Wi-Fi RF FEM – Chain 1
71	VPH_CH0	POWER	3.3V, Power for QM45858 5GHz Wi-Fi RF FEM – Chain 0
72	GND	GND	Ground
73	GND	GND	Ground
74	GND	GND	Ground
75	GND	GND	Ground
76	GND	GND	Ground
77	GND	GND	Ground
78	GND	GND	Ground
79	GND	GND	Ground
80	GND	GND	Ground
81	GND	GND	Ground
82	GND	GND	Ground
83	GND	GND	Ground
84	GND	GND	Ground
G1 – G36	GND	GND	Ground

(1) I/O description (pin type) parameters

Power: Voltage supply

GND: Ground

PU: Input signals with weak internal pull-up, to prevent signals from floating when left open

PD: Input signals with weak internal pull-down, to prevent signals from floating when left open

NP: No pull-up

B: Bidirectional digital with CMOS input

DI: Digital input (CMOS)

DO: Digital output signal

AI: Analog input (does not include pad circuitry)

AO: Analog output (does not include pad circuitry)

RF: Radio frequency signal

4. MODULE SPECIFICATIONS

We reserve the right to amend the design and/or specifications of our products without notice.

4.1. Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)

Symbol	Conditions	MIN	MAX	Unit
VDD13_RFA	Power for WCN analog, digital, and RF core circuits	-0.5	2	V
VDD18_XO	Power for WCN XO circuits	-0.5	2	V
VDD18_IO	Power for WCN digital I/O circuits	-0.5	2	V
VDD33_CH0, VDD33_CH1	Power for WLAN 5 GHz and 2.4 GHz PA driver amplifier circuits	-0.5	3.6	V
VPH_CH0, VPH_CH1	Power for QM45858 5GHz Wi-Fi RF FEM	-0.5	6.0	V
Input RF level	Maximum RF input	-	0	dBm
ESD	Human-Body Model (HBM) Rating	2000		V
	Charge Device Model (CDM) Rating	500		V
Storage temperature range		-40	+85	°C

4.2. Recommended Operating Conditions

Parameter	Conditions	MIN	Typ.	MAX	Unit
Ambient temperature range		-30	-	85	°C
VDD13_RFA	Power for WCN analog, digital, and RF core circuits	1.245	1.3	1.35	V
VDD18_XO	Power for WCN XO circuits	1.7	1.8	1.9	V
VDD18_IO	Power for WCN digital I/O circuits	1.7	1.8	1.9	V
VDD33_CH0, VDD33_CH1	Power for WLAN 5 GHz and 2.4 GHz PA driver amplifier circuits	3.2	3.3	3.4	V
VPH_CH0, VPH_CH1	Power for QM45858 5GHz Wi-Fi RF FEM	3.0	3.3	4.8	V

4.3. Typical Power Consumption

TBD

4.4. Digital Logic Characteristics

Tc = 25°C

Symbol	Parameter	Comments	Min	Typ	Max	Units
VIH	High-level input voltage		0.7 x VIO	-	VIO + 0.3	V
VIL	Low-level input voltage		-0.3		0.3 x VIO	V
IIH	Input high leakage current (pull resistor not enabled)	VIN = VIO max		-	5.0	µA
IIL	Input low leakage current (pull resistor not enabled)	VIN = 0 V, Supply = VIO max	-5.0	-		µA
RPU	Input pull-up resistor	Up	70.41	-	168.83	kΩ
RPD	Input pull-down resistor	Down	31.08	-	72.17	kΩ
VOH	High-level output voltage	0.7 * VIO with 10% variation	0.7 x 0.9 x VIO	-	0.7 x 1.2 x VIO	V
VOL	Low-level output voltage	0.3 * VIO with 10% variation	0.3 x 0.8 x VIO	-	0.3 x 1.1 x VIO	V
IOH	High-level output current		-	-	2.09	mA
IOL	Low-level output current		-	-	-1.09	mA
CIN	Input capacitance		-	-	5	pF

4.5. WLAN RF Characteristics

Transmit power with IEEE 802.11 EVM and spectral mask compliance at 25°C

Band	Mode	Data rates	Spatial Streams	BW	Tx Pout Typ (dBm)	Rx Sensitivity Typ (dBm)
2.4 GHz	1x1	CCK 1M	-	-	19	-96.5
2.4 GHz	1x1	CCK 11M			19	-88.5-
2.4 GHz	2x2	CCK 1M			22	-99.5
2.4 GHz	2x2	CCK 11M			22	-91.5
2.4 GHz	1x1	OFDM 6M		20M	17.5	-91
2.4 GHz	1x1	OFDM 54M		20M	16	-74.5
2.4 GHz	2x2	OFDM 6M		20M	17.5	-93
2.4 GHz	2x2	OFDM 54M		20M	16	-77.5
2.4 GHz	1x1	11n/ac MCS0	1SS	20M	17.5	-91
2.4 GHz	1x1	11n/ac MCS7	1SS	20M	15.5	-74
2.4 GHz	1x1	11n/ac MCS8	1SS	20M	14.5	-69.5
2.4 GHz	1x1	11ac MCS9[1]	1SS	20M	13.5	-68
2.4 GHz	2x2	11n/ac MCS0	1SS	20M	17.5	-93
2.4 GHz	2x2	11n/ac MCS7	1SS	20M	15.5	-77
2.4 GHz	2x2	11n/ac MCS8	1SS	20M	14.5	-72.5
2.4 GHz	2x2	11n/ac MCS8/0	2SS	20M	17.5	-93
2.4 GHz	2x2	11n/ac MCS15/7	2SS	20M	15.5	-73
2.4 GHz	2x2	11ac MCS8	2SS	20M	14.5	-68.5
2.4 GHz	2x2	11ac MCS9[1]	2SS	20M	13.5	-67
2.4 GHz	1x1	11n/ac MCS0	1SS	40M	17	-88
2.4 GHz	1x1	11n/ac MCS7	1SS	40M	15	-71
2.4 GHz	1x1	11ac MCS9	1SS	40M	13	-65
2.4 GHz	2x2	11n/ac MCS0	1SS	40M	17	-90
2.4 GHz	2x2	11n/ac MCS7	1SS	40M	15	-74
2.4 GHz	2x2	11ac MCS9	1SS	40M	13	-65
2.4 GHz	2x2	11n/ac MCS8/0	2SS	40M	17	-88.5

Band	Mode	Data rates	Spatial Streams	BW	Tx Pout Typ (dBm)	Rx Sensitivity Typ (dBm)
2.4 GHz	2x2	11n/ac MCS15/7	2SS	40M	15	-70
2.4 GHz	2x2	11ac MCS9	2SS	40M	13	-64.5
5 GHz	1x1	OFDM 6M		20M	19	-92.5
5 GHz	1x1	OFDM 54M		20M	18	-76
5 GHz	2x2	OFDM 6M		20M	19	-94.5
5 GHz	2x2	OFDM 54M		20M	18	-79
5 GHz	1x1	11n/ac MCS0	1SS	20M	19	-92.5
5 GHz	1x1	11n/ac MCS7	1SS	20M	17	-75.5
5 GHz	1x1	11n/ac MCS8	1SS	20M	16	-72
5 GHz	1x1	11ac MCS9[1]	1SS	20M	15	-69.5
5 GHz	2x2	11n/ac MCS0	1SS	20M	19	-94.5
5 GHz	2x2	11n/ac MCS7	1SS	20M	17	-78.5
5 GHz	2x2	11n/ac MCS8	1SS	20M	16	-75
5 GHz	2x2	11n/ac MCS8/0	2SS	20M	19	-93
5 GHz	2x2	11n/ac MCS15/7	2SS	20M	17	-74.5
5 GHz	2x2	11ac MCS8	2SS	20M	16	-70.5
5 GHz	2x2	11ac MCS9[1]	2SS	20M	15	-68.5
5 GHz	1x1	11n/ac MCS0	1SS	40M	18.5	-90
5 GHz	1x1	11n/ac MCS7	1SS	40M	16.5	-73
5 GHz	1x1	11ac MCS9	1SS	40M	15.5	-67
5 GHz	2x2	11n/ac MCS0	1SS	40M	18.5	-92
5 GHz	2x2	11n/ac MCS7	1SS	40M	16.5	-76
5 GHz	2x2	11ac MCS9	1SS	40M	15.5	-70
5 GHz	2x2	11n/ac MCS8/0	2SS	40M	18.5	-90
5 GHz	2x2	11n/ac MCS15/7	2SS	40M	16.5	-72
5 GHz	2x2	11ac MCS9	2SS	40M	15.5	-66.5
5 GHz	1x1	11n/ac MCS0	1SS	80M	18	-87
5 GHz	1x1	11n/ac MCS7	1SS	80M	16	-70
5 GHz	1x1	11ac MCS9	1SS	80M	14	-64
5 GHz	2x2	11n/ac MCS0	1SS	80M	18	-89

Band	Mode	Data rates	Spatial Streams	BW	Tx Pout Typ (dBm)	Rx Sensitivity Typ (dBm)
5 GHz	2x2	11n/ac MCS7	1SS	80M	16	-73
5 GHz	2x2	11ac MCS9	1SS	80M	14	-67
5 GHz	2x2	11n/ac MCS8/0	2SS	80M	18	-87.5
5 GHz	2x2	11n/ac MCS15/7	2SS	80M	16	-69.5
5 GHz	2x2	11ac MCS9	2SS	80M	14	-63.5
5 GHz	1x1	11n/ac MCS0	1SS	160M	18	-87
5 GHz	1x1	11n/ac MCS7	1SS	160M	16	-69.5
5 GHz	1x1	11ac MCS9	1SS	160M	14	-63.5

1. The MCS9 VHT20 rates are not defined by IEEE.

4.6. BT RF Characteristics

- **Bluetooth RF TX**

Bluetooth basic rate transmitter performance at 25°C

Parameter		Min	Typ	Max	Units
RF frequency range		2402	-	2480	MHz
RF output power (GFSK)	Chain-0 maximum power setting		11		dBm
	Chain-0, High power mode (PL10)[1] Maximum power setting		17		dBm
	Chain-2 maximum power setting		11		dBm
Transmit power control range		40	-	-	dB
Transmit power control step size	Each control step of power change	2	-	8	dB

1. High power mode with one extra power control step (PL10) is available for designs with high RF front end loss or poor antenna gain

Bluetooth EDR rate transmitter performance at 25°C

Parameter		Min	Typ	Max	Units
RF frequency range[1]		2402	-	2480	MHz
RF output power (Pi/4-DQPSK, 8DQPSK)	Chain-0 maximum power setting		8		dBm
	Chain-0, High power mode (PL10)[2] Maximum power setting		12		dBm
	Chain-2 maximum power setting		8		dBm
Transmit power control range		40		-	dB
Transmit power control step size	Each control step of power change	2	-	8	dB

1. High power mode with one extra power control step (PL10) is available for designs with high RF front end loss or poor antenna gain

Bluetooth low energy mode transmitter performance at 25°C

Parameter		Min	Typ	Max	Units
RF frequency range		2402	-	2480	MHz
RF output power (GFSK)	Chain-0 maximum power setting		11		dBm
	Chain-0, High power mode (PL10)[2] Maximum power setting		17		dBm
	Chain-2 maximum power setting		11		dBm

1. High power mode with one extra power control step (PL10) is available for designs with high RF front end loss or poor antenna gain

● Bluetooth RF RX

Bluetooth basic rate receiver performance at 25°C

Parameter		Min	Typ	Max	Units
RF frequency range		2402	-	2480	MHz
Sensitivity (DH5)	Chain-0, BER ≤ 0.1%		-93.5		dBm
	Chain-2, BER ≤ 0.1%		-96		dBm
Maximum usable input	BER ≤ 0.1%	0	-	-	dBm

Bluetooth Enhanced data rate receiver performance at 25°C

Parameter		Min	Typ	Max	Units
RF frequency range		2402	-	2480	MHz
Sensitivity (pi/4-DQPSK, 2-DH5)	Chain-0, BER ≤ 0.01%		-93		dBm
	Chain-2, BER ≤ 0.01%		-95.5		dBm
Sensitivity (8DPSK, 3-DH5)	Chain-0, BER ≤ 0.01%		-86		dBm
	Chain-2, BER ≤ 0.01%		-88.5		dBm
Maximum usable input	BER ≤ 0.01%	-10	-	-	dBm

Bluetooth Low energy receiver performance at 25°C

Parameter		Min	Typ	Max	Units
RF frequency range		2402	-	2480	MHz
Sensitivity (1Mbps)	Chain-0, PER ≤ 30.8%		-96.5		dBm
	Chain-2, PER ≤ 30.8%		-99.5		dBm
Sensitivity (2Mbps)	Chain-0, PER ≤ 30.8%		-95		dBm
	Chain-2, PER ≤ 30.8%		-98		dBm

Maximum usable input	PER ≤ 30.8%	0	-	-	dBm

4.7. FM RF Characteristics

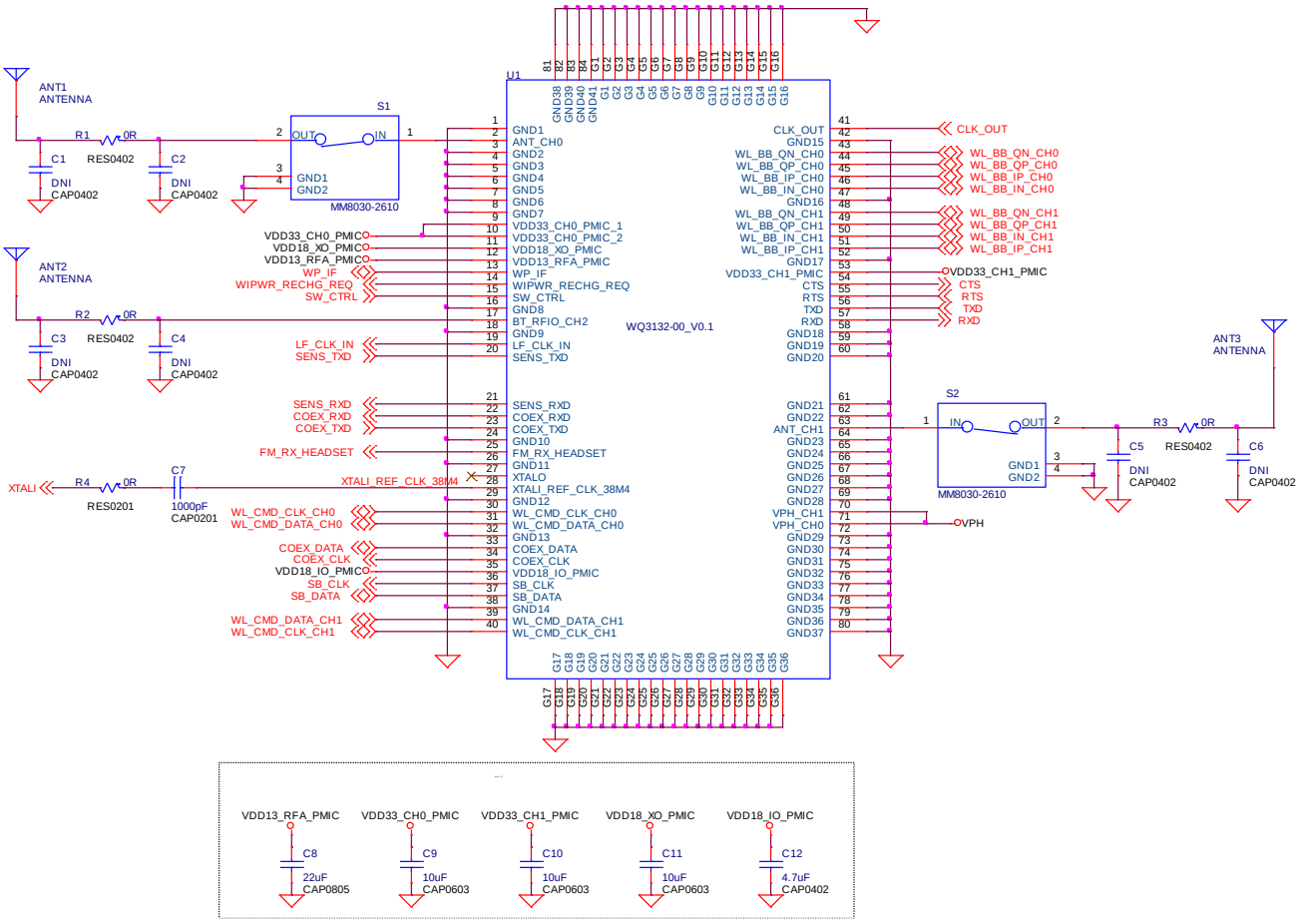
Parameter		Min	Typ	Max	Units
RF frequency range		70	-	108	MHz
Channel frequency step			50 100 200		kHz
RF input impedance	With external resonant tank		1700		Ω
Sensitivity	FM only, headset LNA pathfmod = 1 kHz, Δf = 22.5 kHz (S+N)/N = 26 dB, BAF = 300 Hz to 15 kHz, (A-weighted) de-emph = 50 µs, f_{IN} = 76 to 108 MHz		-1		dBµV EMF
RDS sensitivity	For an RDS deviation of 2 kHz. 95% of blocks decoded with no errors, taken over 5000 blocks		15		dBµV EMF
	For an RDS deviation of 1.2 kHz. 95% of blocks decoded with no errors, taken over 5000 blocks		19		dBµV EMF

5. DESIGN RECOMMENDATIONS

5.1. Module Layout Recommendations

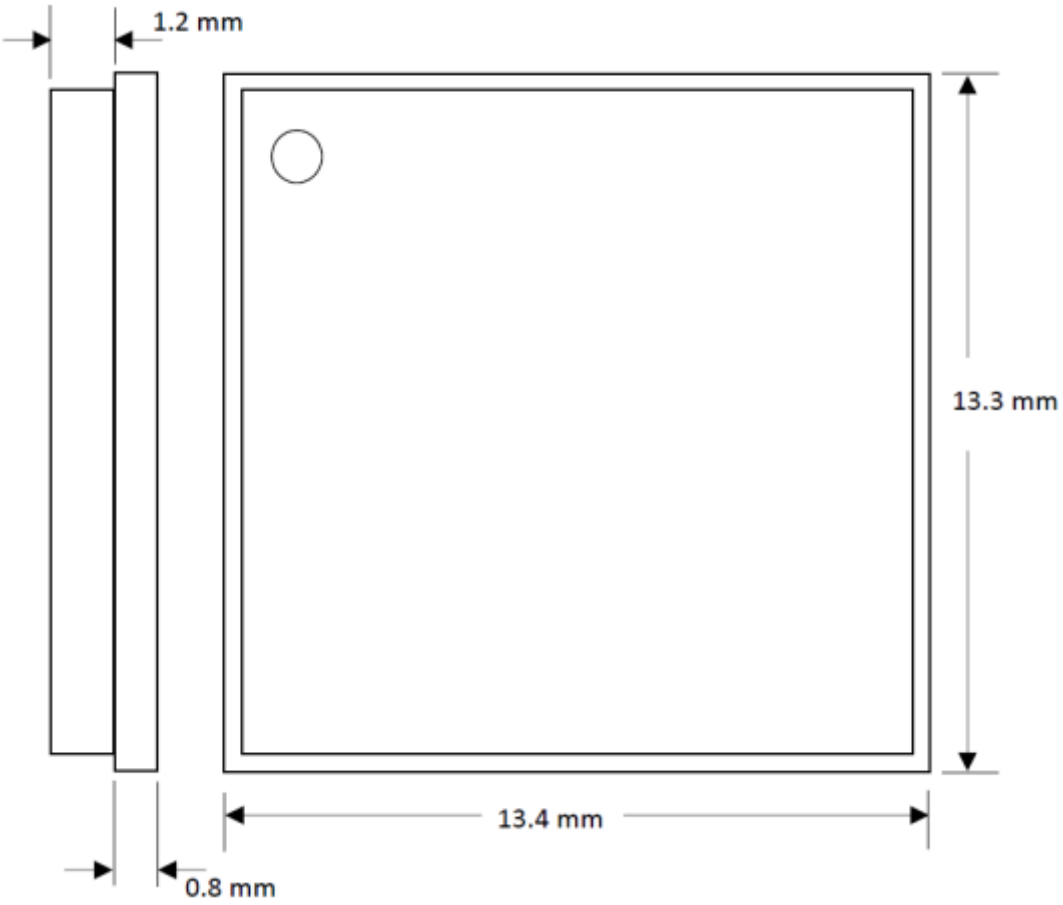
TBD

5.2. Reference Schematic



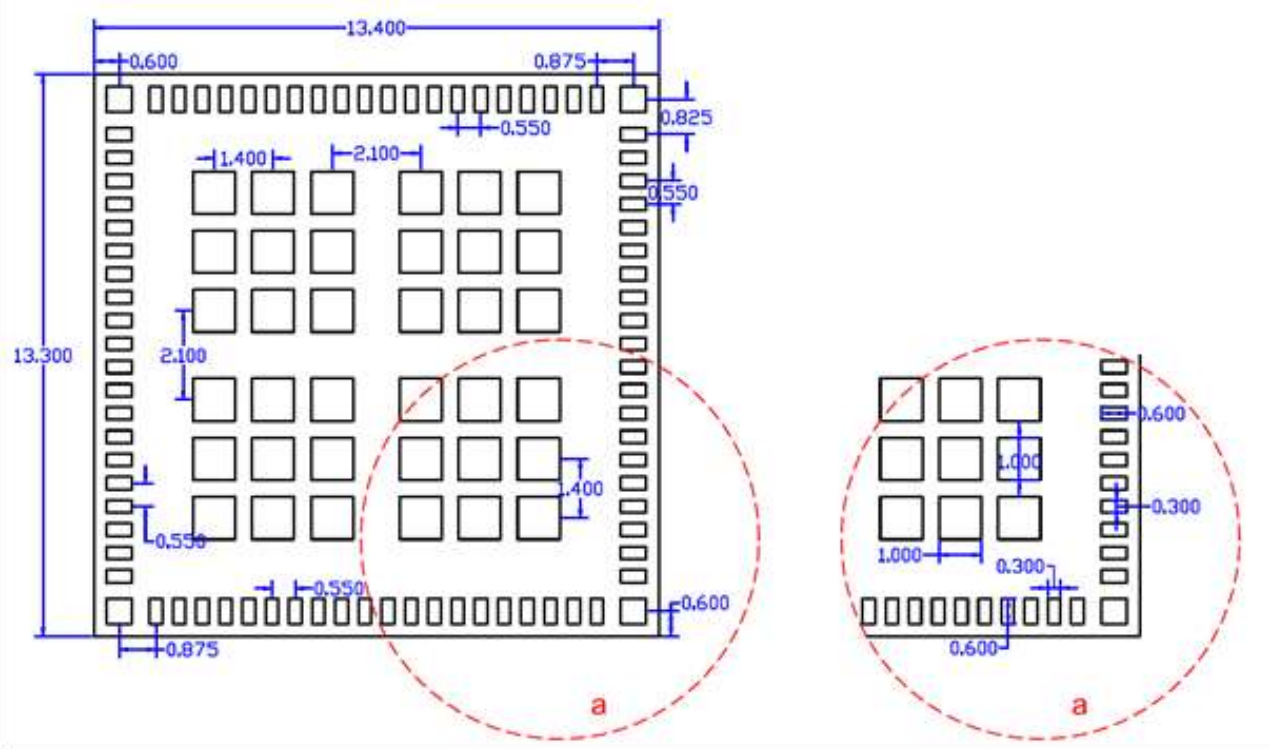
6. PACKAGE INFORMATION

6.1. Module Mechanical Outline



Top View

6.2. Recommended Land Pattern



6.3. Ordering Information

Order Number	Package
WQ3132-00	LGA-120

6.4. Package Marking

Marking	Description
JORJIN	Brand name
WQ3132-00	Model name
YYWWSSFX	Lot Trace Code: YYWWSSFX YY= Digit of the year, ex: 2017=17 WW= Week (01~52) SS= Serial number from 01~98 match to MFG's lot number, or 99 to repair control code F= Reverse for internal use X = A for Module version

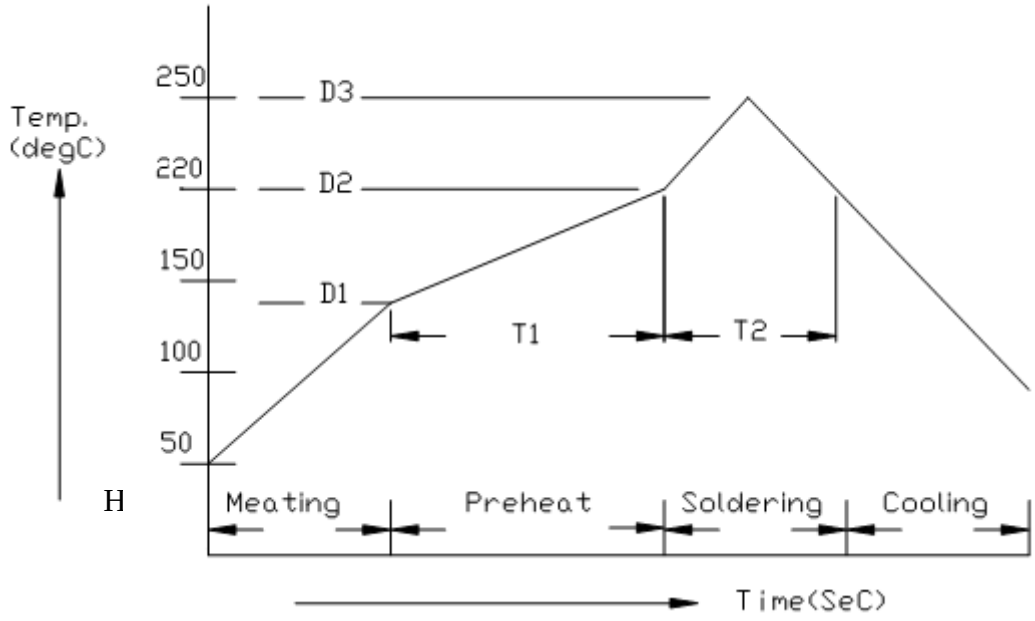
7. SMT AND BAKING RECOMMENDATION

7.1. Baking Recommendation

- Baking condition：
  - Follow MSL Level 4 to do baking process.
  - After bag is opened, devices that will be subjected to reflow solder or other high temperature process must be
    a) Mounted within 72 hours of factory conditions <30°C/60% RH, or
    b) Stored at <10% RH.
  - Devices require bake, before mounting, if Humidity Indicator Card reads >10%
  - If baking is required, Devices may be baked for 8 hrs. at 125 °C.

7.2. SMT Recommendation

- Recommended Reflow profile：



No.	Item	Temperature (°C)	Time (sec)
1	Pre-heat	D1: 140 ~ D2: 200	T1: 80 ~ 120
2	Soldering	D2: = 220	T2: 60 +/- 10
3	Peak-Temp.	D3: 250 °C max	

Note: (1) Reflow soldering is recommended two times maximum.

(2) Add Nitrogen while Reflow process： SMT solder ability will be better.

- **Stencil thickness**： 0.1~ 0.13 mm (Recommended)
- **Soldering paste (without Pb)**： Recommended SENJU N705-GRN3360-K2-V can get better soldering effects.

8. HISTORY CHANGE

Revision	Date	Description
D 0.1	2019/Oct/14	Initial Released.