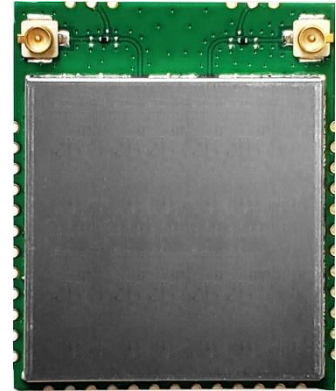


## BL-Q391

WIFI 6 & BT5.1 Module

### 特性 Features:

- **接收制式 Supported WLAN Standard**
  - IEEE Std. 802.11a
  - IEEE Std. 802.11b
  - IEEE Std. 802.11g
  - IEEE Std. 802.11n
  - IEEE Std. 802.11ac
  - IEEE Std. 802.11ax
- **芯片方案 Chip Solution**
  - Qualcomm QCA6391
- **结构大小 Size**
  - 28.0mm x23.0mm x 2.2mm



接口 Interface	安装方式 Assemble	频段 Band	天线 Antenna	供电 Power supply
PCIE	SMD	2.4G/5G	IPEX	3.3V

## 深圳市必联电子有限公司

Shenzhen Bilian Electronic Co., Ltd.

地址 Add: 深圳市光明区观光路华强创意公园 1A 座 10-11 楼  
10-11/F, Building 1A, Huaqiang idea park, Guangming district,  
Shenzhen.Guangdong, China

联系电话 : 0755-29807378

网 址 : [www.b-link.net.cn](http://www.b-link.net.cn)

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公司：深圳市必联电子有限公司

Factory: Shenzhen Bilian Electronic Co., Ltd.

<b>批准</b> Approved	<b>审核</b> Checked	<b>拟制</b> Designed	<b>产品</b> Product	<b>无线模块</b> WiFi Module
			<b>型号</b> Model	<b>BL-Q391</b>
			<b>日期</b> Date	<b>2020-06-15</b>



## 1. Introduction

BL-Q391 module is designed based on Qualcomm QCA6391 solution, The QCA6391 is a highly integrated system on chip( SOC ) supporting 802.11ax Wi-Fi, Bluetooth(BT) Milan. The QCA6391 supports simultaneous operation on 2.4GHz and 5GHz, also known as Dual Band Simultaneous (DBS).

### 1.1 RF module Overview

The general HW architecture for the module is shown in Figure 1. This WLAN Module is designed based on Qualcomm QCA6391. BL-Q391 module Compliant with IEEE 802.11a/b/g/n/ac/ax. Supports 2x2 Multi-User Multiple-Input Multiple-Output(MU-MIMO).Dual Band Simultaneous (DBS) with dual MAC, up to 1774.5 Mbps data rate (2x2+2x2 11ax DBS).Dynamic Frequency Selection (DFS, radar detection).Low power PCIe (w/L1 sub-state) interface. Compliant with Bluetooth v5.1 and ANT+, Bluetooth Milan ready. Supports 2 Mbps Bluetooth Low Energy (BLE), BLE long range. Flexible interface Slimbus PCM for BT audio.

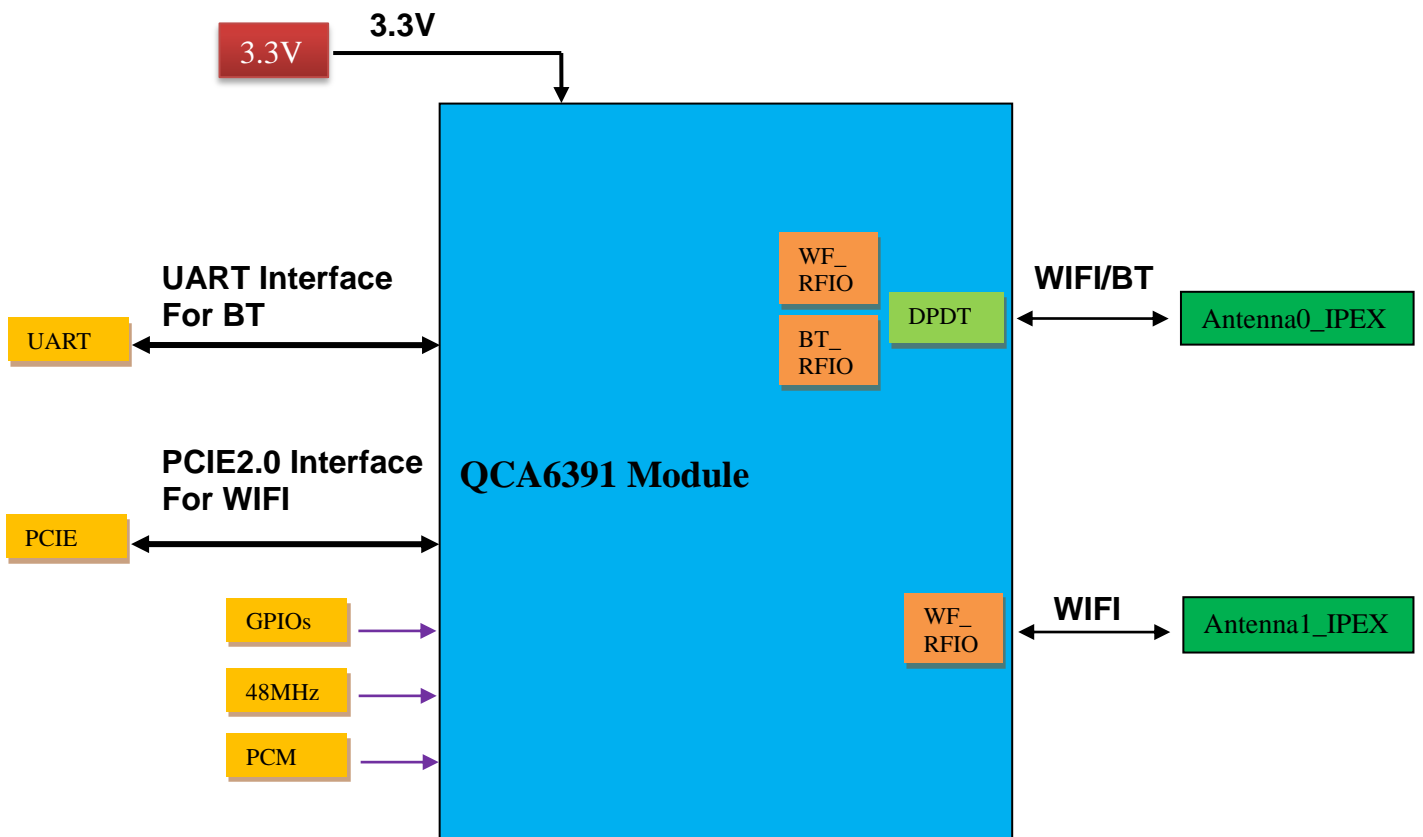


Figure 1 BL-Q391 Block Diagram

## 1.2 Specification reference

This specification is based on additional references listed below.

- \_ IEEE Std. 802.11a
- \_ IEEE Std. 802.11b
- \_ IEEE Std. 802.11g
- \_ IEEE Std. 802.11n
- \_ IEEE Std. 802.11ac
- \_ IEEE Std. 802.11ax
- \_ Bluetooth 5.1

## 1.3 System Functions

Table1: General Specification as below:

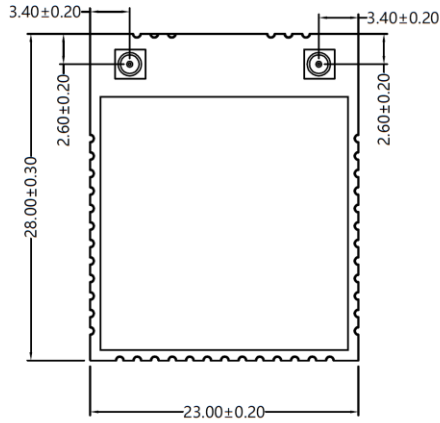
Main Chipset	Qualcomm QCA6391
Operating Frequency	2.4G/5G
WiFi Standard	802.11a/b/g/n/ac/ax (2x2+2x2 DBS)
Bluetooth	5.1
Modulation	WIFI: 11b: DBPSK, DQPSK and CCK and DSSS 11a/g: BPSK, QPSK, 16QAM, 64QAM and OFDM 11n: BPSK, QPSK, 16QAM, 64QAM and OFDM 11ac: BPSK, QPSK, 16QAM, 64QAM,256QAM and OFDM 11ax: BPSK, QPSK, 16QAM, 64QAM,256QAM,1024QAM and OFDMA BT: FHSS, GFSK, DPSK, DQPSK
Data rates	11b: 1, 2, 5.5 and 11Mbps 11a/g: 6, 9, 12, 18, 24, 36, 48 and 54 Mbps 11n: MCS0~15, up to 300Mbps 11ac: MCS0~9, Nss=2, BW=80MHz up to 866.7Mbps 11ax: MCS0~11, Nss=2, BW=40MHz up to 573.5Mbps 11ax: MCS0~11, Nss=2, BW=80MHz up to 1201Mbps Max data rate: 1774.5 Mbps(2x2+2x2 11ax DBS)
Form factor	43 pins
Host Interface	PCIE Gen2 for WIFI, UART for BT
PCB Stack	6-layers design
Dimension	Typical, 28mm x 23mm x 2.2mm
Antenna	External Antennas Design
Operation Temperature	-10°C to +70°C
Storage Temperature	-45°C to +125°C
Operation Voltage	3.3V +/-10%
Power Consumption (TX)	667Ma
Power Consumption (RX)	165Ma

## 2. Mechanical Specification

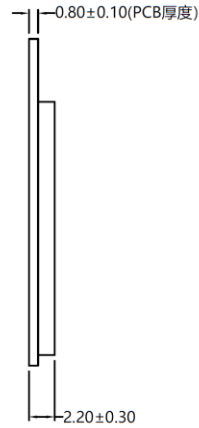
### 2.1 Mechanical Outline Drawing

Typical Dimension (W x L ): 28.0mmx 23.0mm x 2.2mm

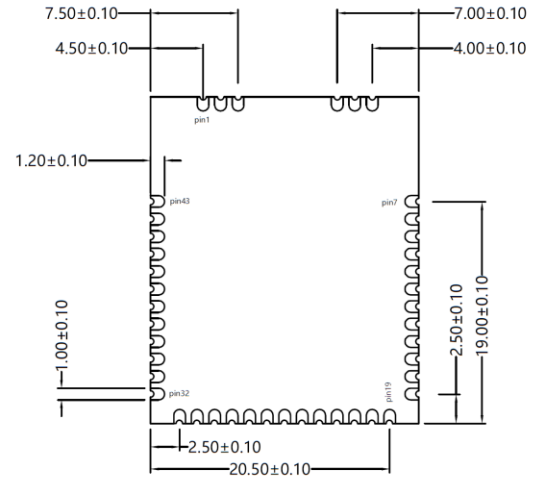
General tolerance:  $\pm 0.2\text{mm}$



主视图

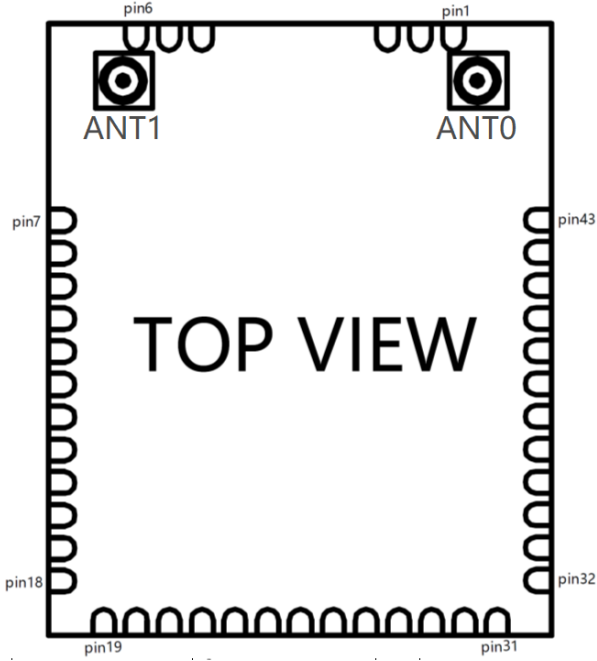


侧视图



背视图

**2.2 Pin define:**



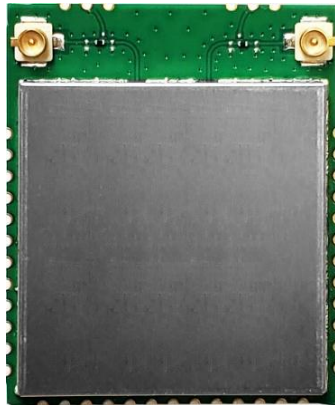
Note:

ANT0: WIFI+BT ANT

ANT1: WIFI ANT

Pin	Define	Description	Pin	Define	Description
1	GND	GND	23	HST_PCIE_RXN	PCIE_RXN
2	NC	Not connect	24	HST_PCIE_RXP	PCIE_RXP
3	GND	GND	25	GND	GND
4	GND	GND	26	HST_PCIE_TXN	PCIE_TXN
5	NC	Not connect	27	HST_PCIE_TXP	PCIE_TXP
6	GND	GND	28	GND	GND
7	GND	GND	29	PERST0_L	PCIE RESET (0/3.3V)
8	BT_UART_TX	BT_UART_TX (0/3.3V)	30	PEWAKE0_L	WIFI-WAKE-HOST (0/3.3V)
9	BT_UART_RX	BT_UART_RX (0/3.3V)	31	CLKREQ0_L	PCIE CLK request to enter L1SS (0/3.3V)
10	BT_UART_CTS	BT_UART_CTS (0/3.3V)	32	UART-WAKE-HOST	BT-WAKE-HOST (0/3.3V)
11	BT_UART_RTS	BT_UART_RTS (0/3.3V)	33	GND	GND
12	3.3V	POWER (请预留 2A)	34	SUSCLK	32K_CLK (0/1.8V) , Not connect if not use
13	3.3V	POWER (请预留 2A)	35	BT_PCM_IN	BT_PCM_IN (0/1.8V)
14	GND	GND	36	BT_PCM_OUT	BT_PCM_OUT (0/1.8V)
15	WL_DBG_UART_RXD	Debug, not connect (0/1.8V)	37	BT_PCM_SYNC	BT_PCM_SYNC (0/1.8V)
16	WL_DBG_UART_TXD	Debug, not connect (0/1.8V)	38	BT_PCM_CLK	BT_PCM_CLK (0/1.8V)
17	BT_DBG_UART_RXD	Debug, not connect (0/1.8V)	39	GND	GND
18	BT_DBG_UART_TXD	Debug, not connect (0/1.8V)	40	NC	Not connect
19	GND	GND	41	WL_DIS	WIFI enable (0/3.3V)
20	HST_PCIE_ERFCLKN	PCIE_CLKN	42	BT_DIS	BT enable (0/3.3V)
21	HST_PCIE_ERFCLKP	PCIE_CLKP	43	GND	GND
22	GND	GND			

### 2.3 Product Picture



**TOP VIEW**



**BOTTOM VIEW**

PCB 厂家管控字符

SMT 厂家管控字符

### 3. Electrical Specification

This Specification is based-on conductive DVT testing result. The extreme condition include overall temperature (0°C,+25°C,+40°C) and overall voltage (3.0V,3.3V,3.6V).

#### 3.1 IEEE 802.11b Section:

Items		Contents				
Specification	IEEE802.11b					
Mode	DBPSK, DQPSK and CCK and DSSS					
Channel	CH1 to CH13					
Data rate	1, 2, 5.5, 11Mbps					
TX Characteristics		Min.	Typ.	Max.	Unit	Remark
1. Power Levels(Calibrated)						
1) 17dBm Target (For Each antenna port) @1Mbps~11Mbps		15	17	19	dBm	
2. Spectrum Mask @ Target Power						
1) fc +/-11MHz to +/-22MHz		-	-	-30	dBr	
2) fc > +/-22MHz		-	-	-50	dBr	
3. Constellation Error(EVM) @ Target Power						
1) 1Mbps		-	-23	-13	Db	
2) 2Mbps		-	-	-13	Db	
3) 5.5Mbps		-	-	-13	Db	
4) 11Mbps		-	-23	-13	Db	
4. Frequency Error		-15	-	15	ppm	
RX Characteristics		Min.	Typ.	Max.	Unit	
5. Minimum Input Level Sensitivity(each chain)						
1) 1Mbps (FER ≤ 8%)		-	-95	-85	dBm	
2) 2Mbps (FER ≤ 8%)		-	-	-83	dBm	
3) 5.5Mbps (FER ≤ 8%)		-	-	-81	dBm	
4) 11Mbps (FER ≤ 8%)		-	-89	-79	dBm	
6. Maximum Input Level (FER ≤ 8%)		-10	10	-	dBm	



**3. 2 IEEE 802.11g/a Section:**

Items	Contents				
Specification	IEEE802.11g & IEEE802.11a				
Mode	BPSK, QPSK, 16QAM, 64QAM and OFDM				
Channel	CH1 to CH13 @ 11g CH36 to CH165 @ 11a				
Data rate	6, 9, 12, 18, 24, 36, 48, 54Mbps				
TX Characteristics	Min.	Typ.	Max.	Unit	Remark
<b>1. Power Levels</b>					
1) 15dBm Target (For Each antenna port) @ 11g/54Mbps	13	15	17	dBm	
2) 15dBm Target (For Each antenna port) @ 11a/54Mbps	13	15	17	dBm	
<b>2. Spectrum Mask @ Target Power</b>					
1) at fc +/-11MHz	-	-	-20	dBr	
2) at fc +/-20MHz	-	-	-28	dBr	
3) at fc > +/-30MHz	-	-	-40	dBr	
<b>3. Constellation Error(EVM) @ Target Power</b>					
1) 6Mbps	-	-30	-8	Db	
2) 9Mbps	-	-	-11	Db	
3) 12Mbps	-	-	-13	Db	
4) 18Mbps	-	-	-16	Db	
5) 24Mbps	-	-	-19	Db	
6) 36Mbps	-	-	-23	Db	
7) 48Mbps	-	-	-25	Db	
8) 54Mbps	-	-37	-28	Db	
<b>4. Frequency Error</b>					
1) IEEE802.11g	-15	-	15	ppm	
2) IEEE802.11a	-15	-	15	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
<b>5. Minimum Input Level Sensitivity(each chain)</b>					
1) 6Mbps (PER ≤ 10%)	-	-94	-85	dBm	
2) 9Mbps (PER ≤ 10%)	-	-	-84	dBm	
3) 12Mbps (PER ≤ 10%)	-	-	-82	dBm	
4) 18Mbps (PER ≤ 10%)	-	-	-80	dBm	
5) 24Mbps (PER ≤ 10%)	-	-	-77	dBm	
6) 36Mbps (PER ≤ 10%)	-	-	-73	dBm	
7) 48Mbps (PER ≤ 10%)	-	-	-69	dBm	
8) 54Mbps (PER ≤ 10%)	-	-76	-68	dBm	
<b>6. Maximum Input Level (PER ≤ 10%)</b>					
1) IEEE802.11g	-20	-2	-	dBm	
2) IEEE802.11a	-30	-2	-	dBm	

**3.3 IEEE 802.11n HT20 Section:**

Items	Contents				
Specification	IEEE802.11n HT20 @ 2.4G IEEE802.11n HT20 @ 5G				
Mode	BPSK, QPSK, 16QAM, 64QAM and OFDM				
Channel	CH1 to CH13 @ 2.4G CH36 to CH165 @ 5G				
Data rate (MCS index)	MCS0/1/2/3/4/5/6/7/8/9/10/11/12/13/14/15				
TX Characteristics	Min.	Typ.	Max.	Unit	Remark
<b>1. Power Levels</b>					
1) 14dBm Target (For Each antenna port) @ 2.4G/MCS7	12	14	16	dBm	
2) 14dBm Target (For Each antenna port) @ 5G/MCS7	12	14	16	dBm	
<b>2. Spectrum Mask @ Target Power</b>					
1) at fc +/-11MHz	-	-	-20	dBr	
2) at fc +/-20MHz	-	-	-28	dBr	
3) at fc > +/-30MHz	-	-	-45	dBr	
<b>3. Constellation Error(EVM) @ Target Power</b>					
1) MCS0	-	-30	-8	Db	
2) MCS1	-	-	-13	Db	
3) MCS2	-	-	-16	Db	
4) MCS3	-	-	-19	Db	
5) MCS4	-	-	-22	Db	
6) MCS5	-	-	-25	Db	
7) MCS6	-	-	-28	Db	
8) MCS7	-	-38	-30	Db	
<b>4. Frequency Error</b>					
1) IEEE802.11n HT20 @ 2.4G	-15	-	15	ppm	
2) IEEE802.11n HT20 @ 5G	-15	-	15	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
<b>5. Minimum Input Level Sensitivity(each chain)</b>					
1) MCS0 (PER ≤ 10%)	-	-94	-85	dBm	
2) MCS1 (PER ≤ 10%)	-	-	-82	dBm	
3) MCS2 (PER ≤ 10%)	-	-	-80	dBm	
4) MCS3 (PER ≤ 10%)	-	-	-77	dBm	
5) MCS4 (PER ≤ 10%)	-	-	-73	dBm	
6) MCS5 (PER ≤ 10%)	-	-	-69	dBm	
7) MCS6 (PER ≤ 10%)	-	-	-68	dBm	
8) MCS7 (PER ≤ 10%)	-	-74	-67	dBm	
<b>6. Maximum Input Level (PER ≤ 10%)</b>					
1) IEEE802.11n HT20 @ 2.4G	-20	-2	-	dBm	
2) IEEE802.11n HT20 @ 5G	-30	-2	-	dBm	

**3.4 IEEE 802.11n HT40 Section:**

Items	Contents				
Specification	IEEE802.11n HT40 @ 2.4G IEEE802.11n HT40 @ 5G				
Mode	BPSK, QPSK, 16QAM, 64QAM and OFDM				
Channel	CH3 to CH11 @ 2.4G CH38 to CH163 @ 5G				
Data rate (MCS index)	MCS0/1/2/3/4/5/6/7/8/9/10/11/12/13/14/15				
TX Characteristics	Min.	Typ.	Max.	Unit	Remark
<b>1. Power Levels (Calibrated)</b>					
1) 14dBm Target (For Each antenna port) @ 2.4G/MCS7	12	14	16	dBm	
2) 14dBm Target (For Each antenna port) @ 5G/MCS7	12	14	16	dBm	
<b>2. Spectrum Mask @ Target Power</b>					
1) at fc +/-21MHz	-	-	-20	dBr	
2) at fc +/-40MHz	-	-	-28	dBr	
3) at fc > +/-60MHz	-	-	-45	dBr	
<b>3. Constellation Error(EVM) @ Target Power</b>					
1) MCS0	-	-30	-8	Db	
2) MCS1	-	-	-13	Db	
3) MCS2	-	-	-16	Db	
4) MCS3	-	-	-19	Db	
5) MCS4	-	-	-22	Db	
6) MCS5	-	-	-25	Db	
7) MCS6	-	-	-28	Db	
8) MCS7	-	-38	-30	Db	
<b>4. Frequency Error</b>					
1) IEEE802.11n HT20 @ 2.4G	-15	-	15	ppm	
2) IEEE802.11n HT20 @ 5G	-15	-	15	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
<b>5. Minimum Input Level Sensitivity(each chain)</b>					
1) MCS0 (PER $\leq$ 10%)	-	-90	-82	dBm	
2) MCS1 (PER $\leq$ 10%)	-	-	-79	dBm	
3) MCS2 (PER $\leq$ 10%)	-	-	-77	dBm	
4) MCS3 (PER $\leq$ 10%)	-	-	-74	dBm	
5) MCS4 (PER $\leq$ 10%)	-	-	-70	dBm	
6) MCS5 (PER $\leq$ 10%)	-	-	-66	dBm	
7) MCS6 (PER $\leq$ 10%)	-	-	-65	dBm	
8) MCS7 (PER $\leq$ 10%)	-	-71	-64	dBm	
<b>6. Maximum Input Level(PER <math>\leq</math> 10%)</b>					
1) IEEE802.11n HT20 @ 2.4G	-20	-2	-	dBm	
2) IEEE802.11n HT20 @ 5G	-30	-2	-	dBm	

**3.5 IEEE 802.11ac Section:**

Items	Contents							
Specification	IEEE802.11ac							
Mode	BPSK, QPSK, 16QAM, 64QAM ,256QAM and OFDM							
Channel	CH36 to CH165 VHT20 CH38 to CH163 VHT40 CH42 to CH157 VHT80							
Data rate (MCS index)	MCS0/1/2/3/4/5/6/7/8/9							
TX Characteristics	Min.	Typ.			Max.		Unit	Remark
1. Power Levels (Calibrated)								
1) 13dBm Target (For Each antenna port) @VHT20/VHT40/VHT80 MCS9	11	13			15		dBm	
2. Spectrum Mask @ Target Power								
1) at fc +/-11MHz /20MHz/30MHz	-	-			-20		dBr	
2) at fc +/-21MHz /40MHz/60MHz	-	-			-28		dBr	
3) at fc +/-41MHz /80MHz/120MHz	-	-			-40		dBr	
3. Constellation Error(EVM) @ Target Power								
1) MCS0	-	-			-8		Db	
2) MCS1	-	-			-13		Db	
3) MCS2	-	-			-16		Db	
4) MCS3	-	-			-19		Db	
5) MCS4	-	-			-22		Db	
6) MCS5	-	-			-25		Db	
7) MCS6	-	-			-28		Db	
8) MCS7	-	-			-30		Db	
9) MCS8	-	-			-32		Db	
10) MCS9	-	-36			-33		Db	
4. Frequency Error	-15	-			15		ppm	
RX Characteristics	Min.	Typ.			Max.		Unit	
5. Minimum Input Level Sensitivity(each chain)		VHT 20	VHT 40	VHT 80	VHT 20	VHT 40	VHT 80	
1) MCS0 (PER ≦ 10%)	-	-94	-90	-87	-85	-82	-79	dBm
2) MCS1 (PER ≦ 10%)	-	-	-	-	-82	-79	-76	dBm
3) MCS2 (PER ≦ 10%)	-	-	-	-	-80	-77	-74	dBm
4) MCS3 (PER ≦ 10%)	-	-	-	-	-77	-74	-71	dBm
5) MCS4 (PER ≦ 10%)	-	-	-	-	-73	-70	-67	dBm
6) MCS5 (PER ≦ 10%)	-	-	-	-	-69	-67	-63	dBm
7) MCS6 (PER ≦ 10%)	-	-	-	-	-68	-65	-62	dBm
8) MCS7 (PER ≦ 10%)	-	-	-	-	-67	-64	-61	dBm
9) MCS8 (PER ≦ 10%)	-	-	-	-	-62	-59	-56	dBm
10) MCS9 (PER ≦ 10%)	-	-70	-65	-63	-60	-57	-54	dBm
6. Maximum Input Level(PER ≦ 10%)	-30	-2	-2	-2	-			dBm

**3.6 IEEE 802.11ax Section:**

Items	Contents							
Specification	IEEE802.11ax							
Mode	BPSK, QPSK, 16QAM, 64QAM ,256QAM, 1024QAM and OFDMA							
Channel	CH1 to CH13 @ 2.4G CH36 to CH165 @ 5G							
Data rate (MCS index)	MCS0/1/2/3/4/5/6/7/8/9/10/11							
TX Characteristics	Min.	Typ.			Max.		Unit	Remark
1. Power Levels (Calibrated)								
2) 13dBm Target (For Each antenna port) @HE20/HE40/HE80 MCS11 @2.4G&5G	11	13			15		dBm	
2. Spectrum Mask @ Target Power								
1) at fc +/-11MHz /20MHz/30MHz	-	-			-20		dBr	
2) at fc +/-21MHz /40MHz/60MHz	-	-			-28		dBr	
3) at fc +/-41MHz /80MHz/120MHz	-	-			-40		dBr	
3. Constellation Error(EVM) @ Target Power								
1) MCS0	-	-20			-8		Db	
2) MCS1	-	-			-13		Db	
3) MCS2	-	-			-16		Db	
4) MCS3	-	-			-19		Db	
5) MCS4	-	-			-22		Db	
6) MCS5	-	-			-25		Db	
7) MCS6	-	-			-28		Db	
8) MCS7	-	-			-30		Db	
9) MCS8	-	-			-32		Db	
10) MCS9	-	-			-33		Db	
11) MCS10	-	-			-34		Db	
12) MCS11	-	-38			-35		Db	
4. Frequency Error	-15	-			15		ppm	
RX Characteristics	Min.	Typ.			Max.		Unit	
5. Minimum Input Level Sensitivity(each chain)		HE 20	HE 40	HE 80	HE 20	HE 40	HE 80	
1) MCS0 (PER ≦ 10%)	-	-94	-90	-87	-85	-82	-79	dBm
2) MCS1 (PER ≦ 10%)	-	-	-	-	-82	-79	-76	dBm
3) MCS2 (PER ≦ 10%)	-	-	-	-	-80	-77	-74	dBm
4) MCS3 (PER ≦ 10%)	-	-	-	-	-77	-74	-71	dBm
5) MCS4 (PER ≦ 10%)	-	-	-	-	-73	-70	-67	dBm
6) MCS5 (PER ≦ 10%)	-	-	-	-	-69	-67	-63	dBm
7) MCS6 (PER ≦ 10%)	-	-	-	-	-68	-65	-62	dBm
8) MCS7 (PER ≦ 10%)	-	-	-	-	-67	-64	-61	dBm
9) MCS8 (PER ≦ 10%)	-	-	-	-	-62	-59	-56	dBm
10) MCS9 (PER ≦ 10%)	-	-	-	-	-60	-57	-54	dBm
11) MCS10 (PER ≦ 10%)	-	-	-	-	-58	-55	-52	dBm
12) MCS11 (PER ≦ 10%)	-	-63	-61	-58	-55	-53	-50	dBm
6. Maximum Input Level(PER ≦ 10%)	-30	-2	-2	-2	-			dBm

**3.7 Bluetooth Section:**

**3.7.1 BR Specification**

Items	Contents				
Host Interface	UART				
Antenna Reference	Small antennas with 0~2 dBi peak gain				
Channel	CH0 to CH78				
Modulation	GFSK				
	Min.	Typ.	Max.	Unit	
TX Characteristics					
1.Output Average Power	0	10	20	dBm	
2.Modulation Characteristics					
1)Delta f1(Avg)		157		kHz	
2)Delta f2max(For at least 99.9% of all Delta f2max)		121		kHz	
3)Delta f2/ Delta f1		0.85		kHz	
3.Initial Carrier Frequency Tolerance		+/-20	-	kHz	
4. Carrier Frequency Drift					
1) One Slot packet drift (DH1)		+/-15		kHz	
2) Three Slot packet drift (DH3)		+/-15		kHz	
3) Five Slot packet drift (DH5)		+/-15		kHz	
4) Max Drift Rate		+/-15		kHz/50us	
RX Characteristics					
1. Receiver Sensitivity (BER<0.1%)		-92		dBm	
2. Maximum usable signal (BER<0.1%)		-5		dBm	

**3.7.2 EDR Specification**

Items	Contents				
Host Interface	UART				
Antenna Reference	Small antennas with 0~2 dBi peak gain				
Channel	CH0 to CH78				
Modulation	$\pi/4$ -DQPSK , 8PSK				
	Min.	Typ.	Max.	Unit	
TX Characteristics					
1.Output Power	0	10	20		
1) $\pi/4$ -DQPSK		8		dBm	
2) 8PSK		8		dBm	
2. Frequency Stability				kHz	
1) Omega-i		+/-4		kHz	
2) Omega-0		+/-4	-	kHz	
3) Omega-0 + Omega-i		+/-4			
3. Modulation Accuracy					
1) RMS DEVM					
$\pi/4$ -DQPSK		+/-9		%	
8PSK		+/-9		%	
2) Peak DEVM					
$\pi/4$ -DQPSK		+/-28		%	
8PSK		+/-21		%	
3) 99% DEVM					
$\pi/4$ -DQPSK		+/-15		%	
8PSK		+/-12		%	
RX Characteristics					
1. Receiver Sensitivity (BER<0.01%)					
1) $\pi/4$ -DQPSK		-91		dBm	
2) 8PSK		-85		dBm	
2. Maximum usable signal (BER<0.1%)					
1) $\pi/4$ -DQPSK		-5		dBm	
2) 8PSK		-5		dBm	

**3.7.3 LE Specification**

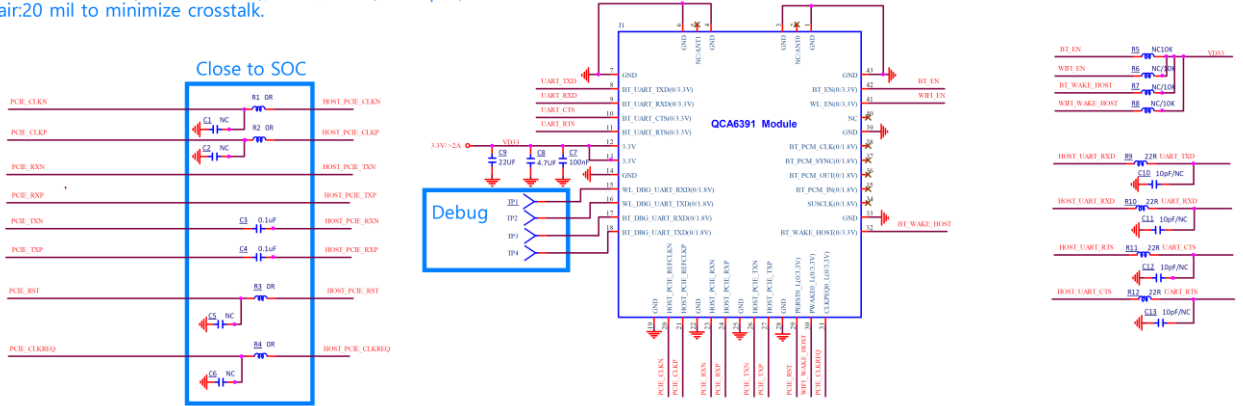
Items	Contents				
Host Interface	UART				
Antenna Reference	Small antennas with 0~2 dBi peak gain				
Channel	CH0 to CH39				
	Min.	Typ.	Max.	Unit	
TX Characteristics					
1. Output power at NOC	0	10	20	dBm	
2. Modulation Characteristics					
1)Delta f1(Avg)	225		275	kHz	
2)Delta f2max(For at least 99.9% of all Delta f2max)	185			kHz	
3)Delta f2/ Delta f1	0.8	0.94		Hz/Hz	
3. Carrier frequency offset and drift					
1) Frequency Offset	-150		150	kHz	
2) Frequency Drift	-50		50	kHz	
3) Max Drift Rate	-20		20	Hz/us	
4.In-band Spurious Emissions					
1)+/-2M offset			-20	dBm	
2)>+/-3MHz offset			-30	dBm	
RX Characteristics					
1. Receiver Sensitivity (BER<30.8%)		-95		dBm	
2. Maximum usable signal (BER<30.8%)		-5		dBm	



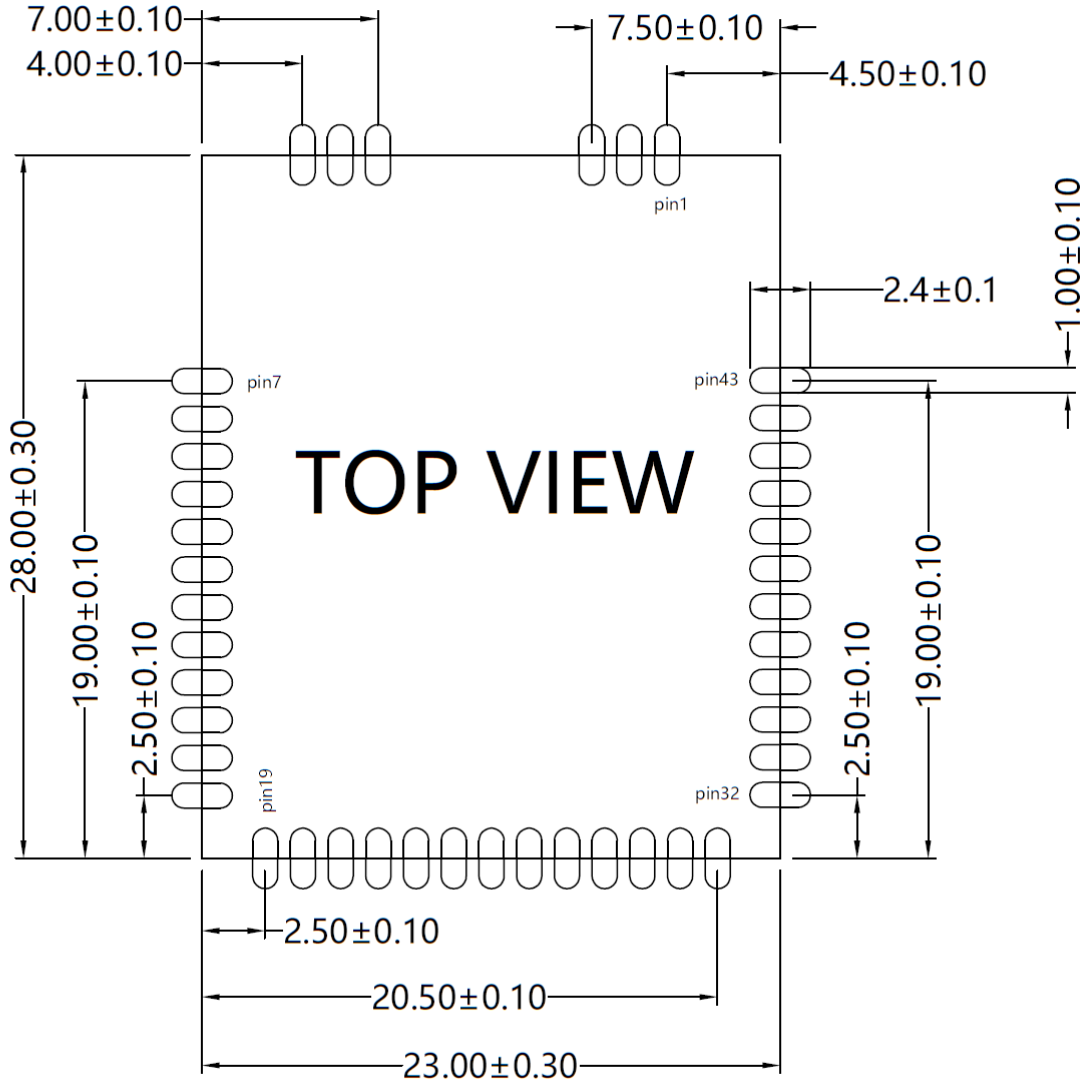
## 4. Reference Design

### 4.1 SCH

Note :  
 Differential impedance:100 +/-10%(recommended),100 +/-20%(PCIE spec).  
 Spacing of pair-to-pair:20 mil to minimize crosstalk.



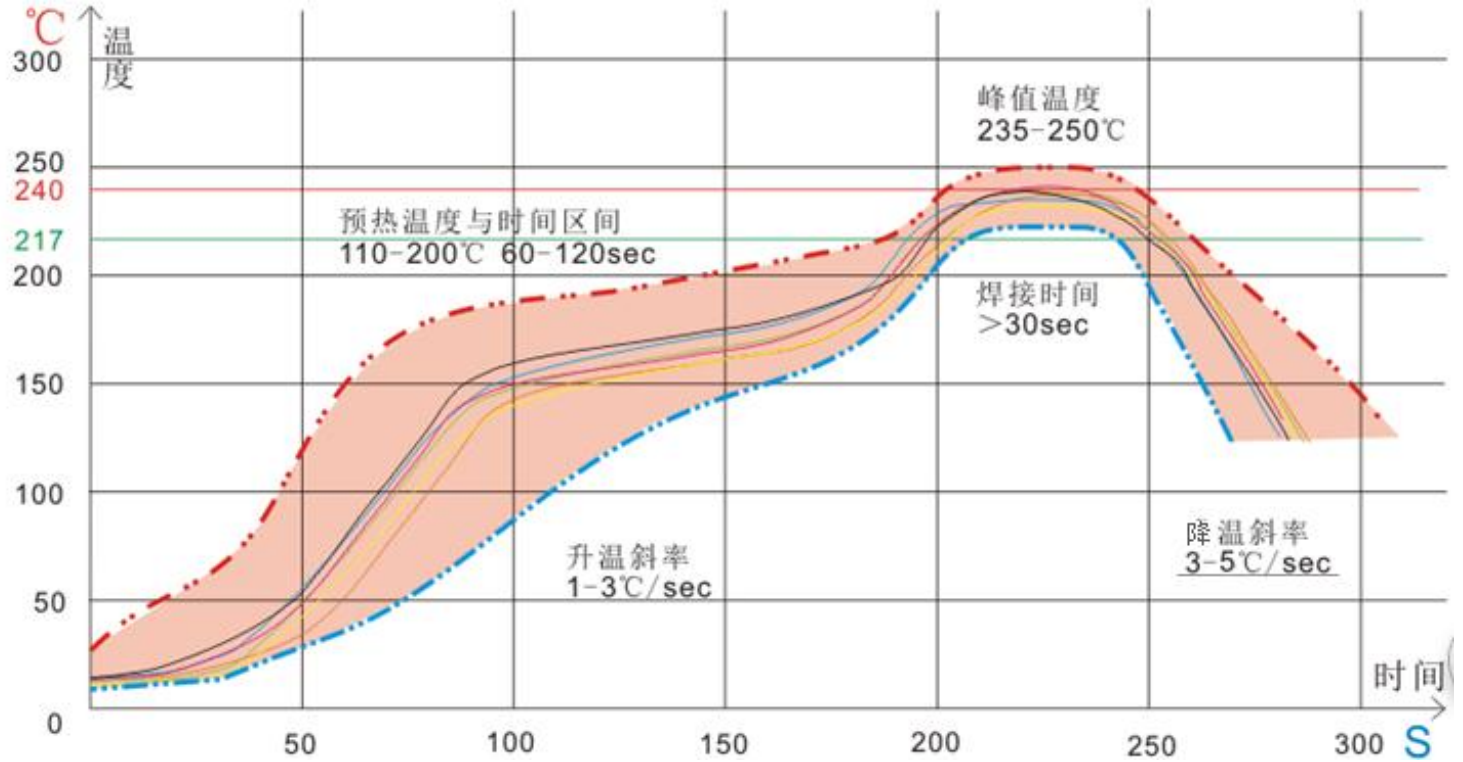
### 4.2 Recommend PCB Layout Decal



## 5. Software Requirements

The driver supports the following operating systems: Linux, Microsoft Windows Win7-Win10.  
 Mfg. software tool is QDART.

### 6. Reflow Standard Condition

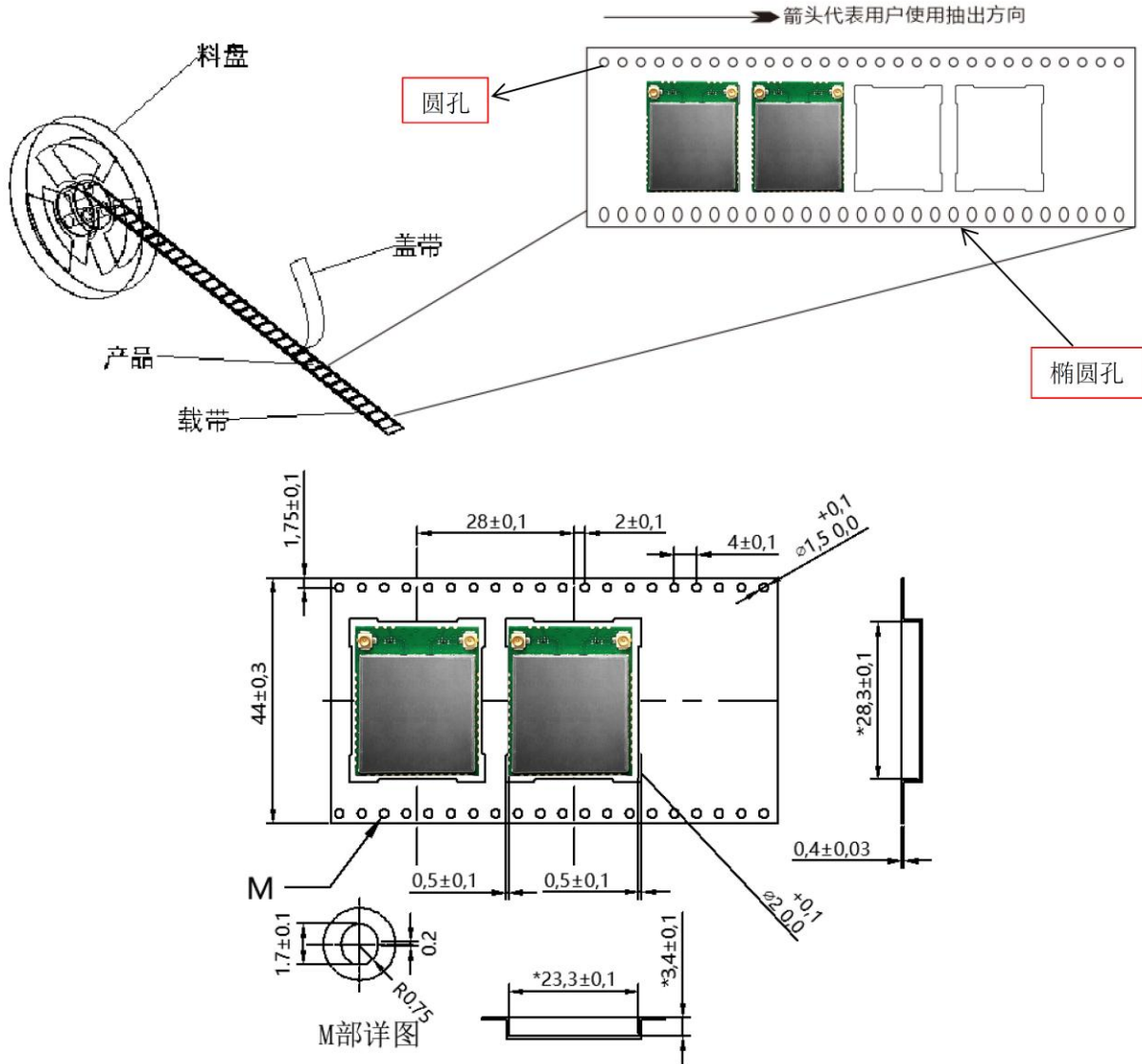


升温区：温度：<150℃，时间：60~90秒之间，斜率控制在1~3℃/S之间。  
 预热恒温区：温度：150℃~200℃，时间：60-120秒之间，斜率在0.3-0.8之间。  
 回流焊接区：峰值温度235℃~250℃(建议峰值温度<245℃=，时间30-70秒。  
 冷却区：温度：217℃~170℃，斜率在3~5℃/S之间。  
 焊料为锡银铜合金无铅焊料/ Sn&Ag&Cu Lead-free solder(SAC305)。

### 7. Key component List

序号	关键件名称	型号	规格/材料	生产者	备注
1	集成电路	QCA6391	BGA	Qualcomm	
2	PCB	JUI7.820.0640系列	FR-4,6LAY	顺络 信利 科翔	
3	晶体振荡器	SMD2016-48M	48M	Hosonic TXC 加高 泰晶 晶威特	

## 8. Package



- 1、产品放置方向、标签粘贴位置、包装按示意图进行;
- 2、每卷放600只产品, 每小盒放1卷, 大箱共5装个小盒, 产品数量共3000只/箱;
- 3、外箱尺寸: 370mm\*300mm\*370mm, 小盒尺寸: 355mm\*355mm\*55mm;
- 4、真空包内放置2g干燥剂2袋, 6色湿度卡1张;
- 5、其它未尽事宜按客户的包装要求执行。