GOC-RG440

Bluetooth+WIFI Module Hardware Specification

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NOTE:

1. The module must use ladder steel net, and recommend ladder steel net thickness 0.16--0.20mm. The adaptability of the products is adjusted accordingly.
2. Before the use of the module, bake at 60 degrees centigrade and bake for 12 hours.

Release Record

Version Number	Release Date	Comments
V1.0	2018/08/31	Initial draft
V1.1	2019/04/19	Update Module height
V1.2	2019/08/30	Increase packing methods and performance parameters, Cancel reference design
V1.3	2020/06/20	Update Pin Diagram and Electrical Characteristic
V1.4	2020/08/13	Update Bluetooth Standard
V1.5	2021/01/09	Update Pin Diagram And Description

Contents

1. Introduction

GOC-RG440 is a highly integrated module that support 1-stream 802.11ac solutions with Multi-user MIMO (Multiple-Input, Multiple-Output) STA mode with integrated Bluetooth 2.1/4.2controller, SDIO (SDIO 1.1/2.0/3.0) interface, and HS-UART mixed interface. It combines a WLAN MAC,a 1T1R capable WLAN baseband, and RF in s single chip. The RTL8821CS provides a complete solution for a high-performance integrated wireless and Bluetooth device.

GOC-RG440 baseband implements Multi-user Multiple Input, Multiple Output (MU MIMO) Orthogonal Frequency Division Multiplexing (OFDM) STA mode with one transmit and one receive path (1T1R). Features include one spatial stream transmission, short Guard Interval (GI) of 400ns, spatial spreading, and support for variant channel bandwidth. Moreover, GOC-RG440 provides one spatial stream space-time block code (STBC), Transmit Beamforming (TxBF) and Low Density Parity Check (LDPC) to extend the range of transmission. As the recipient, the RTL8821CS also supports explicit sounding packetfeedback that helps senders with beamforming capability.For legacy compatibility, Direct Sequence Spread Spectrum (DSSS), Complementary Code Keying (CCK) and OFDM baseband processing are included to support all IEEE 802.11b, 802.11g and 802.11a data rates. Differential phase shift keying modulation schemes, DBPSK and DQPSK with data scrambling capability are available, and CCK provides support for legacy data rates, with long or short preamble. The high speed FFT/IFFT paths, combined with BPSK, QPSK, 16QAM, 64QAM and 256QAM modulation of the individual subcarriers, and rate compatible coding rate of 1/2, 2/3, 3/4, and 5/6, provide up to 433.3Mbps for IEEE 802.11ac MIMO OFDM.

GOC-RG440 Bluetooth controller complies with Bluetooth core specification v4.2/5.1, and supports dual mode (BR/EDR + Low Energy Controllers). It is compatible with previous versions, including v2.1 +EDR. For BR/EDR, it supports scatternet topology and allows active links in slave mode, and active links in master mode. For Low Energy, it supports multiple states and allows active links in master mode. The links in BR/EDR and LE can be active simultaneously.

2. Block Diagram

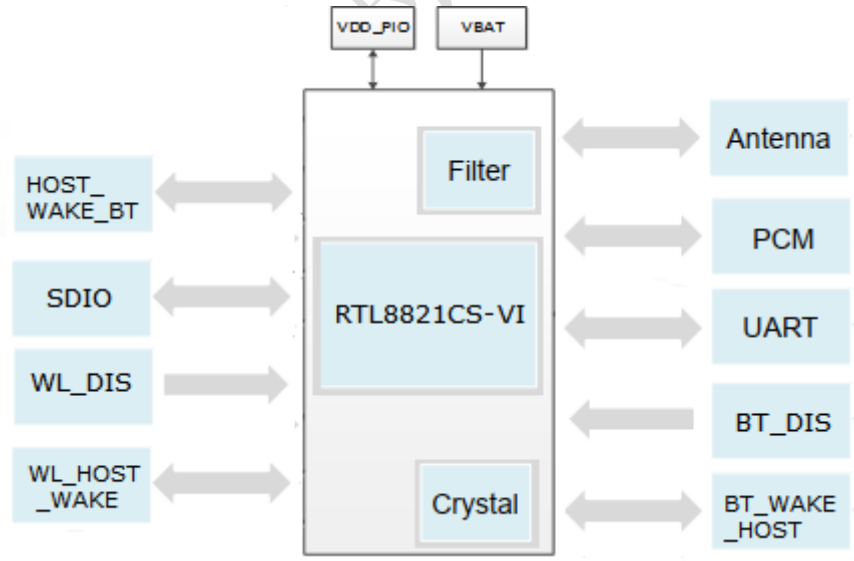

Figure 1: GOC-RG440 system Block Diagram

3. Bluetooth Features

- Compatible with Bluetooth v2.1+EDR
- Support Bluetooth 4.2 features
- HS-UART interface for Bluetooth data transmission compliant with H4 and H5 specification

- PCM interface for audio data transmission via Bluetooth controller
- Integrated MCU to execute Bluetooth protocol stack
- Supports all packet types in basic rate and enhanced data rate
- Supports SCO/eSCO link (allows one link for PCM interface and three links for HS-UART)
- Supports piconets in a scatternet
- Supports Secure Simple Pairing
- Supports Low Power Mode (Sniff/Sniff Sub-rating)
- Enhanced BT/WLAN Coexistence Control to improve transmission quality in different profiles
- Bluetooth 4.0 Dual Mode support: Simultaneous LE and BR/EDR
- Supports multiple Low Energy states Bluetooth Transceiver
- Fast AGC control to improve receiving dynamic range
- Supports AFH to dynamically detect channel quality to improve transmission quality
- Integrated internal Class 1, Class 2, and Class 3 PA
- Supports Enhanced Power Control
- Supports Bluetooth Low Energy

4. WIFI Features

- Support IEEE 802.11a/b/g/n/ac
- Support 802.11ac 1x1,Wave-2 compliant with MU-MIMO STA mode
- Complete 802.11n MIMO solution for 2.4GHz and 5Ghz band
- Maximum PHY data rate up to 86.7Mbps using 20MHz bandwidth, 200Mbps using
- 40MHz bandwidth, and 433.3Mbps using 80MHz bandwidth.
- Backward compatible with 802.11a/b/g devices while operating at 802.11n data rates
- Backward compatible with 802.11a/n devices while operating at 802.11ac data rates. Host Interface
- Complies with SDIO 1.1/2.0/3.0 for WLAN with clock rate up to 100MHz (SDR50 and DDR50)
- G-SPI interface for configurable endian for WLAN
- Complies with HS-UART with configurable baud rate for Bluetooth Standards Supported
- IEEE 802.11a/b/g/n/ac compatible WLAN
- IEEE 802.11e QoS Enhancement (WMM)
- IEEE 802.11i (WPA, WPA2). Open, shared key, and pair-wise key authentication services
- IEEE 802.11h DFS, TPC, SpectrumMeasurement
- IEEE 802.11k Radio Resource Measurement
- WAPI (Wireless Authentication Privacy Infrastructure) certified.
- Cisco Compatible Extensions (CCX) for WLAN devices MAC Features

5. Specification

Feature	Description
Model Name	GOC-RG440
Bluetooth	
Bluetooth Standard	Bluetooth V4.2/5.1+LE + BR/EDR
Frequency Band	2402MHz~2480MHz
Interface	UART/PCM
WIFI	
Frequency Band	2.4GHz/5GHz
Interface	SDIO1.1/2.0/3.0
Size	17mm*17mm*2.4mm
Operating temperature	-40℃~+85℃

Storage Temperature	-55℃~+125℃
VBAT	3.3V
VDD_PIO	1.8V or 3.3V
Working current	350mA
Max current	<700mA
Humidity	Operating Humidity 60% to 85% Non-Condensing

Table 1: Specifications

6. Pin Diagram And Description

6.1 Pin Diagram

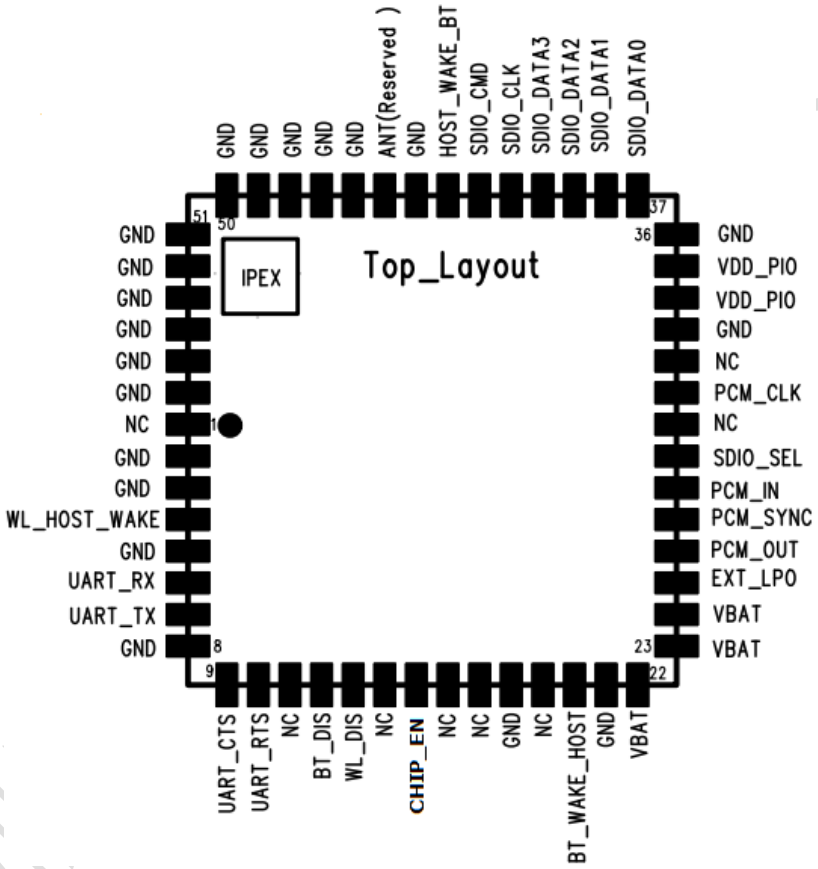

Figure 2: GOC-RG440 Pin

6.2 Pin Description

Pin	Pin Name	**Type**	Description
1	NC	NC	NC
2	GND	Ground	Ground
3	GND	Ground	Ground
4	WL_HOST_WAKE	Input/Output	WL_HOST_WAKE
5	GND	Ground	Ground
6	UART_RX	Input	High-Speed UART Data In

7	UART_TX	Output	High-Speed UART Data Out
8	GND	Ground	Ground
9	UART_CTS	Input	High-Speed UART CTS
10	UART_RTS	Output	High-Speed UART RTS
11	NC	NC	NC
12	BT_DIS	Input	Bluetooth enable
13	WL_DIS	Input	WIFI enable
14	NC	NC	NC
15	CHIP_EN	Input	can externally shut down the module including BT and WIFI
16	NC	NC	NC
17	NC	NC	NC
18	GND	Ground	Ground
19	NC	NC	NC
20	BT_WAKE_HOST	Input/Output	Bluetooth device to wake-up HOST
21	GND	Ground	Ground
22	VBAT	POWER	3.3V Supply Voltage
23	VBAT	POWER	3.3V Supply Voltage
24	VBAT	POWER	3.3V Supply Voltage
25	EXT_LPO	Output	External sleep clock input (32.768 kHz)(Reserved)
26	PCM_OUT	Output	PCM data Output
27	PCM_SYNC	Output	PCM Synchronization control
28	PCM_IN	Input	PCM data Input
29	SDIO_SEL	Input/Output	General Purpose Input/ Output Pin(Reserved)
30	NC	NC	NC
31	PCM_CLK	Input/Output	PCM clock
32	NC	NC	NC
33	GND	Ground	Ground
34	VDD_PIO	POWER	1.8V~3.3V Supply Voltage
35	VDD_PIO	POWER	1.8V~3.3V Supply Voltage
36	GND	Ground	Ground
37	SDIO_DATA0	Input/Output	SDIO Data Line 0
38	SDIO_DATA1	Input/Output	SDIO Data Line 1
39	SDIO_DATA2	Input/Output	SDIO Data Line 2
40	SDIO_DATA3	Input/Output	SDIO Data Line 3
41	SDIO_CLK	Input	SDIO Clock Input
42	SDIO_CMD	Input/Output	SDIO Command Input
43	HOST_WAKE_BT	Input/Output	HOST_WAKE_BT
44	GND	Ground	Ground
45	ANT	RF	Bluetooth and WIFI(2.4G+5G) Antenna(Reserved)
46	GND	Ground	Ground
47	GND	Ground	Ground
48	GND	Ground	Ground
49	GND	Ground	Ground
50	GND	Ground	Ground
51	GND	Ground	Ground
52	GND	Ground	Ground
53	GND	Ground	Ground
54	GND	Ground	Ground

55	GND	Ground	Ground
56	GND	Ground	Ground

Table 2: Pin Description

6.3 PCB Layout Footprint

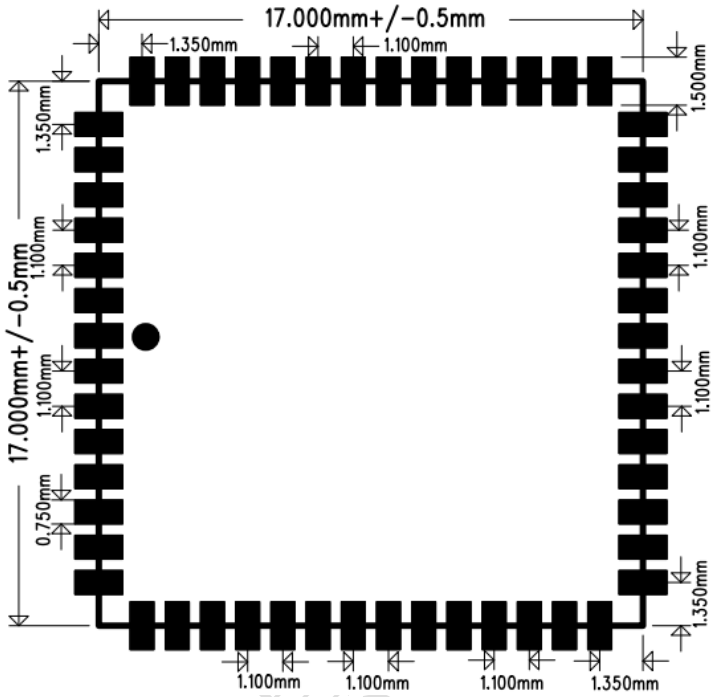

Figure 3: PCB Layout Footprint

6.4 Module Package

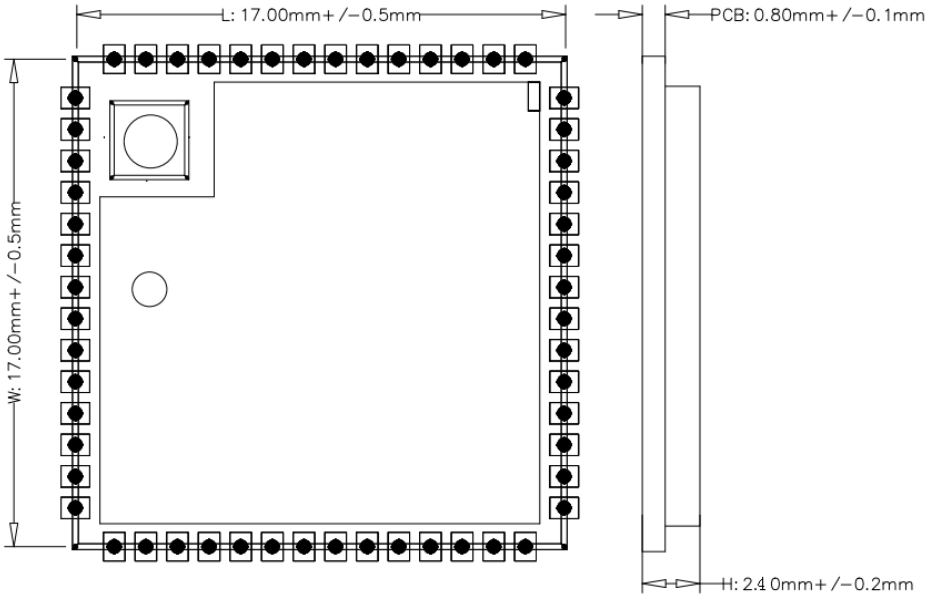

Figure 4: Module Package

7. Echo Cancellation Principle

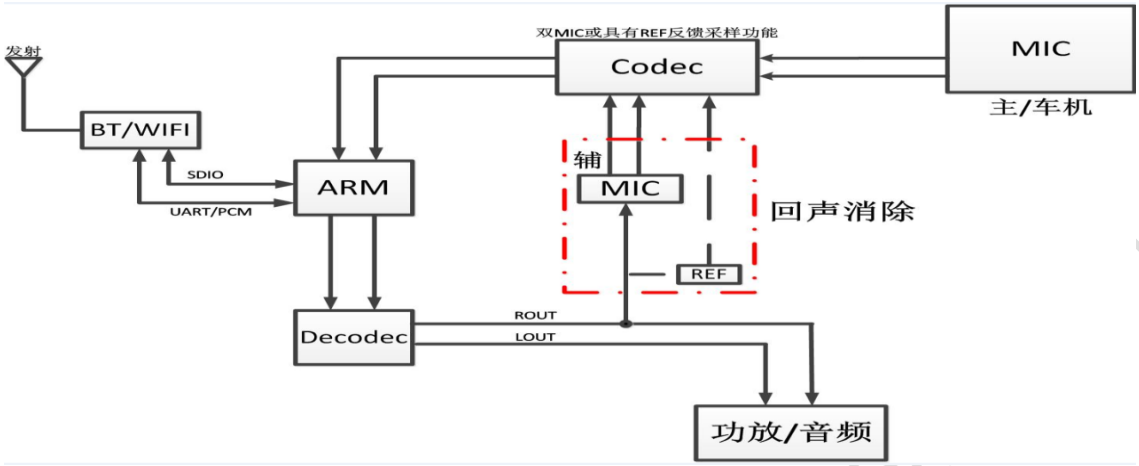

Figure 5: Echo Cancellation Principle

The left picture is a schematic diagram of the echo cancellation principle. After Decodec decoding of the leftand right channel sound, after data sampling and master MIC data comparison, echo cancellation can be processed. The right picture is a reference example, which can be designed according to the actual plan.

Flying echo cancellation design, priority to use the echo cancellation design of IFLYTEK.

8. Power Management Handshake Interface Signal Level

1) BT_DIS Signal Level

The BT_DIS signal level ranges from 1.8V to 3.3V. The host provides the power source with the targeted power level to the GOC-RG440 via the VDD_IO_1 pin.

2) WL_DIS_N Signal Level

The WL_DIS_N signal level ranges from 1.8V to 3.3V. The host provides the power source with the targeted power level to the RTL8821CS via the VDD_IO pin.

8.1 System Power On Sequence

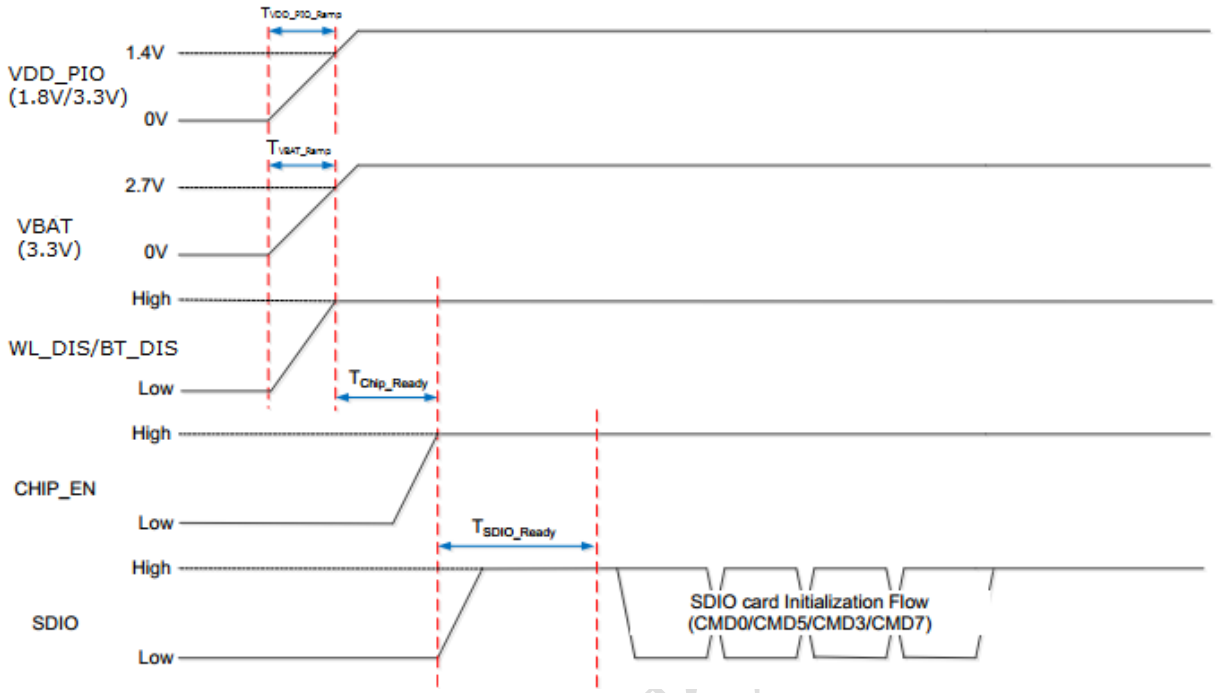

Figure 6: System Power-On Sequence

	Min	Typical	Max	Unit	Description
$T_{VDD\_PIO\_Ramp}$	0.1	0.5	2.5	ms	The VDD_PIO main power ramp up duration.
$T_{VBAT\_\_Ramp}$	0.1	0.5	2.5	ms	The VBAT main power ramp up duration.
T_{Chip_Ready}	0	10	X	ms	CHIP_EN pull high timing
T_{SDIO_Ready}	1	2	10	ms	SDIO Not Ready Duration. In this state, the GOC-RG440 may respond to commands without the ready bit being set. After the ready bit is set, the host will initiate complete card detection procedure.

Table 3: System Power On Timing Parameters

9. UART Interface

GOC-RG440 UART interface is a standard 4-wire interface with RX, TX, CTS, and RTS. The interface supports the Bluetooth UART HCI H4 and H5 specifications. The default baud rate is 115.2 kbaud. In order to support high and low speed baud rate, the GOC-RG440 provides multiple UART clocks.

Desired BaudRate	Error	Desired Baud Rate	Error
1200	0%	1382400	-0.22%
9600	0%	1444400	-0.20%
14400	0%	1500000	-0.31%
19200	0.01%	1843200	-0.22%
28800	0.01%	2000000	0%
38400	0.04%	2100000	0.25%
57600	0.01%	2500000	0%

76800	0.04%	2764800	-0.22%
115200	-0.08%	3000000	-0.31%
128000	0%	3250000	0.47%
153600	-0.08%	3692300	-0.38%
230400	-0.08%	3710000	0.29%
460800	-0.08%	3750000	0.39%
500000	0%	3800000	0.25%
921600	-0.22%	4000000	0%
1000000	0%		

Table 4: UART Interface Power-On Timing Parameters

10. PCM Interface

GOC-RG440 supports a PCM digital audio interface that is used for transmitting digital audio/voice data to/from the Audio Codec. Features are supported as below:

- Supports Master and Slave mode
- Programmable long/short Frame Sync
- Supports 8-bit A-law/μ-law, and 13/16-bit linear PCM formats
- Supports sign-extension and zero-padding for 8-bit and 13-bit samples
- Supports padding of Audio Gain to 13-bit samples
- PCM Master Clock Output: 64, 128, 256, or 512kHz
- Supports SCO/ESCO link

11. Electrical Characteristic

11.1 Absolute Maximum Ratings

Maximum Ratings	Min	Typical	Max
VBAT	3.0V	3.3V	3.6V
VDD_PIO	1.71V	1.8V	1.89V
	3.16V	3.3V	3.46V

Table 5: Absolute Maximum Ratings

11.2 Recommended Operating Conditions

Operating Conditions	Min	Typical	Max
Operating Temperature	-40℃	/	+85℃
Storage Temperature	-55℃	/	+125℃
VBAT	3.16V	3.3V	3.46V
VDD_PIO	1.71V	1.8V	1.89V
	3.16V	3.3V	3.46V

Table 6: Recommended Operating Conditions

12. Recommended Reflow Profile

Referred to IPC/JEDEC standard.
Peak package body temperature :<260 ℃.
Time of peak temperature for Pb-free assembly : 5~10sec.

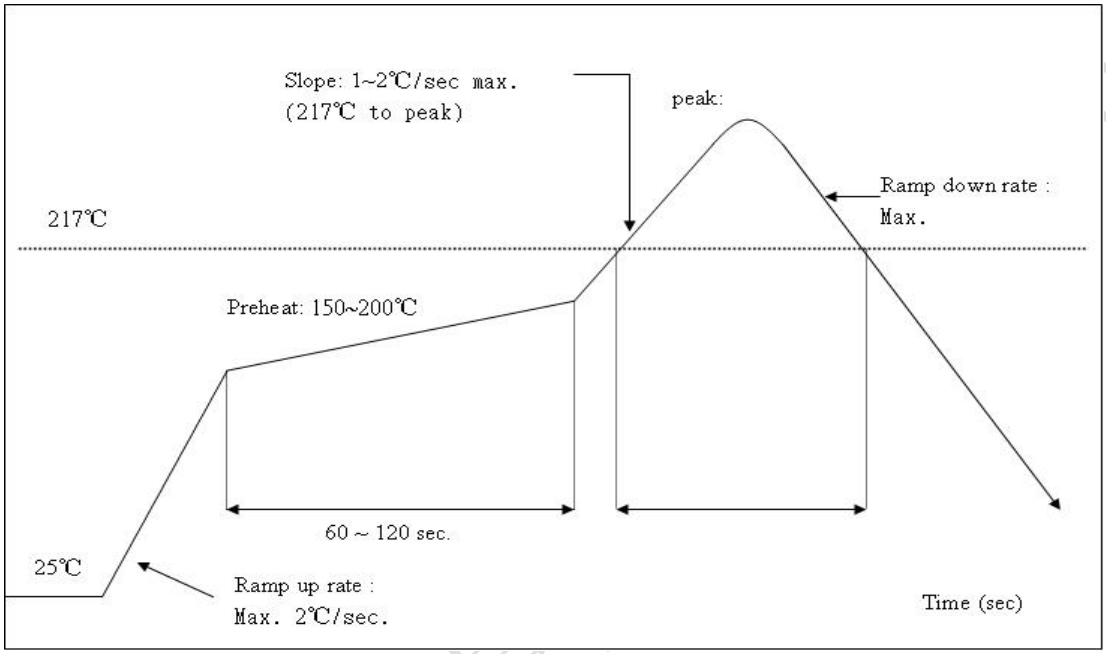

Figure 7 : Recommended Reflow Profile

13. PCB Layout Recommendation

13.1 Antenna

Antenna trace impedance should be adjusted to 50ohm.The area above (or under) the RF antenna trace should be free from other traces.

13.2 HCI UART Lines Layout Guideline

The following HCI line routing must obey the following rule to prevent overshoot/undershoot, as these lines drive 4 ~ 8mA.

UART_RX UART_TX UART_CTS UART_RTS

The route length of these signals be less than 15 cm and the line impedance be less than 50Ω.

13.3 PCM Lines Layout Guideline

The following HCI line routing must obey the following rule to prevent overshoot/undershoot, as these lines drive 4 mA.

PCM_SYNC PCM_CLK PCM_OUT PCM_IN

The route length of these signals be less than 15 cm and the line impedance be less than 50Ω.

13.4 Power Trace Lines Layout Guideline

VBAT Trace Width: 30mil
VDD_PIO Trace Width: 25mil

13.5 Ground Lines Layout Guideline

A Complete Ground in Ground Layer.
Add Ground Through Holes to GOC-RG440 Module Ground Pads.
Decoupling Capacitors close to GOC-RG440 Module Power and Ground Pads.

14. Module Part Number Description

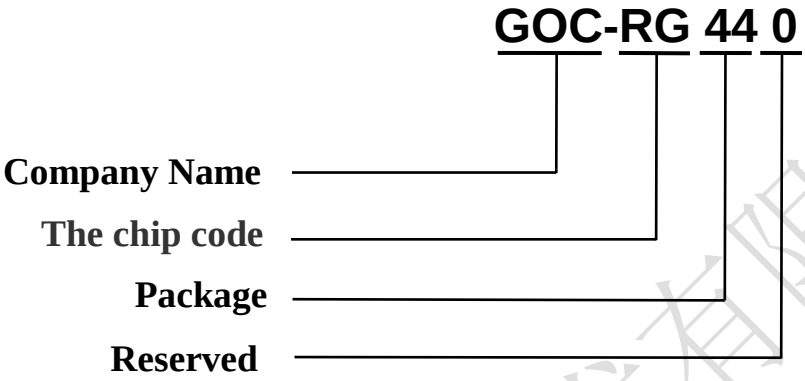

Figure 8: Module Part Number Description

For a list of available options (e.g. package, packing) and orderable part numbers or for further information on any aspect of this device, please go to *www.goodocom.com* or contact the GOODOCOM Sales Office nearest to you.

15. Ordering Information

Part Number	Description	Remark
GOC-RG440	2.4 GHz and 5 GHz WLAN+ BT 4.2/5.1 module	IPEX Antenna

Table 7: Ordering Information

16. Packaging Information

16.1 Net Weight

The module net weight: 1.3g±0.1g

16.2 Package

72pcs module in one tray 2000pcs modules into one pack 4000pcs Modules One Box
Carton size:270mm*275mm*220mm
Tray size:225mm*205mm*7mm

16.3 Storage Requirements

1）Temperature: 22~28℃;

2 ）Humidity: <70%（ RH）;

Vacuum packed and sealed in good condition to ensure 12 months of welding.

16.4 Humidity Sensitive Characteristic

1） MSL: 3 level

2） Once opened, SMT within 168 hours in the condition of temperature: 22~28℃ and humidity<60%(RH).

3） Handling, storage, and processing should follow IPC/JEDECJ-STD-033