GOC-RG450

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	2021/9/11	Initial draft
V1.1	2022/10/24	Update Bluetooth Standard

Contents

1. Introduction

GOC-RG450 is a highly integrated module that support 1-stream 802.11ac solutions with Multi-userMIMO (Multiple-Input, Multiple-Output) STA mode with integrated Bluetooth 5.3 controller, 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 GOC-RG450 provides a complete solution for a high-performance integrated wireless and Bluetooth device.

GOC-RG450 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-RG450 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 GOC-RG450 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-RG450 Bluetooth controller complies with Bluetooth core specification v4.2/5.3, and supports dual mode (BR/EDR + Low Energy Controllers). It is compatible with previous versions, including v2.1 +EDR. For BR/EDR, it supports scatterrnet 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.
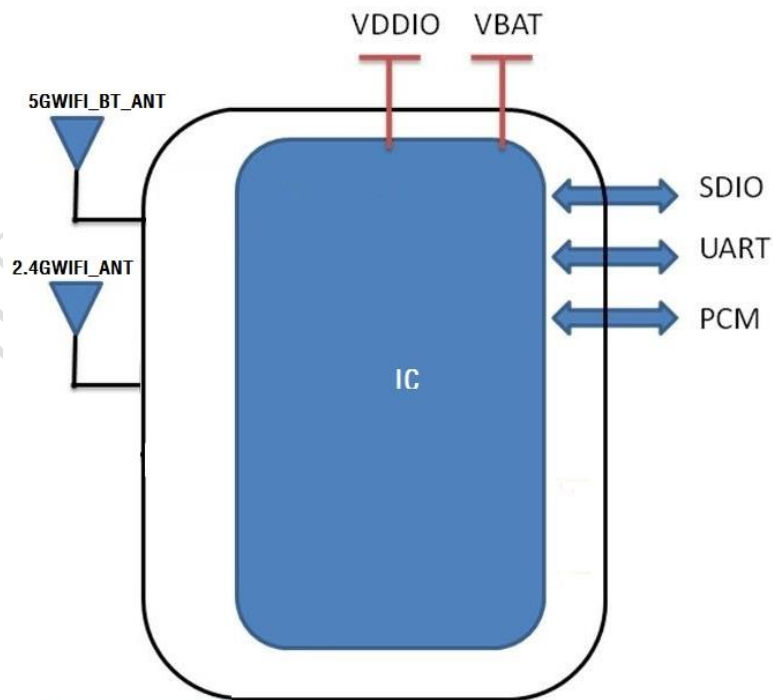
2. Block Diagram

Figure 1: 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-RG450
Bluetooth	
Bluetooth Standard	Bluetooth V4.2/5.3+LE + BR/EDR
Frequency Band	2402MHz~2480MHz
Interface	UART/PCM
WIFI	

Frequency Band	2.4GHz/5GHz
Interface	SDIO1.1/2.0/3.0
Size	12mm*12mm*2.4mm
Operating temperature	-40℃~+85℃
Storage Temperature	-55℃~+125℃
VBAT	3.3V
VDDIO	1.8V or 3.3V
Working current	250mA
Max current	<700mA
Humidity	Operating Humidity 60% to 85% Non-Condensing

Table 1: Specifications

6. Pin Diagram And Description

6.1 Pin Diagram
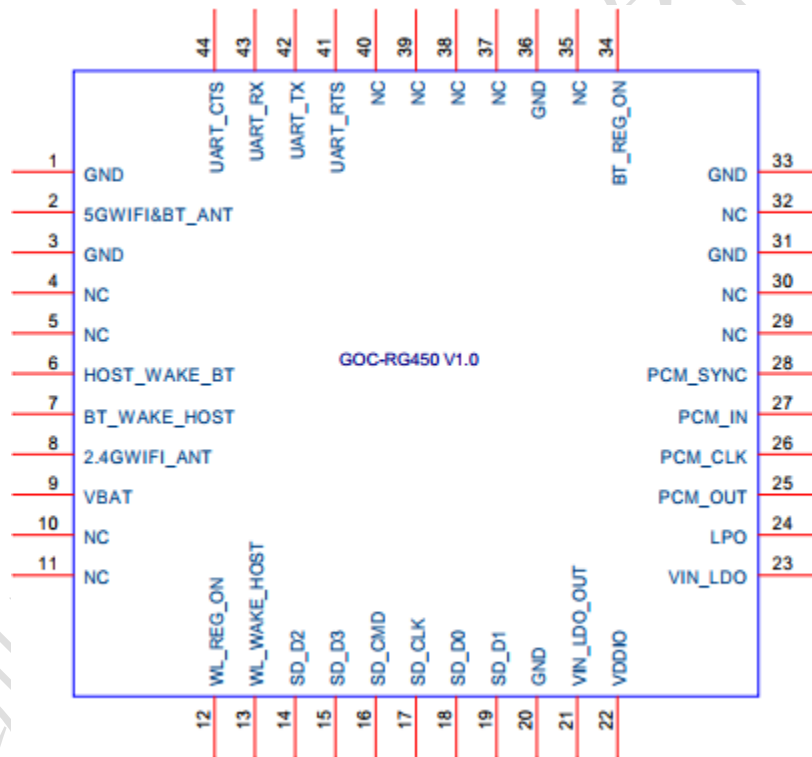

Figure 2: GOC-RG450 Pin

6.2 Pin Description

NO	Name	Type	Description
1	GND	Ground	Ground
2	5GWIFI_BT_ANT	RF	Bluetooth and WIFI(5GHz) Antenna
3	GND	Ground	Ground
4	NC	NC	NC

5	NC	NC	NC
6	HOST_WAKE_BT	Input/Output	HOST wake-up Bluetooth device
7	BT_WAKE_ HOST	Input/Output	Bluetooth device wake-up HOST
8	2.4GWIFI _ANT	RF	WIFI(2.4GHz) Antenna
9	VBAT	POWER	3.3V Supply Voltage
10	NC	NC	NC
11	NC	NC	NC
12	WL_REG_ON	Input	WIFI enable
13	WL_HOST_ WAKE	Input/Output	WLAN wake-up HOST
14	SD_D2	Input/Output	SDIO Data Line 2
15	SD_D3	Input/Output	SDIO Data Line 3
16	SD_CMD	Input/Output	SDIO Command Input
17	SD_CLK	Input	SDIO Clock Input
18	SD_D0	Input/Output	SDIO Data Line 0
19	SD_D1	Input/Output	SDIO Data Line 1
20	GND	Ground	Ground
21	VIN_LDO_OUT	POWER	Internal Buck voltage generation pin
22	VDDIO	POWER	1.8V~3.3V Supply Voltage
23	VIN_LDO	POWER	Internal Buck voltage generation pin
24	LPO	Output	External sleep clock input (32.768 kHz)(Reserved)
25	PCM_OUT	Output	PCM data Output
26	PCM_CLK	Input/Output	PCM clock
27	PCM_IN	Input	PCM data Input
28	PCM_SYNC	Input/Output	PCM sync signal
29	NC	NC	NC
30	NC	NC	NC
31	GND	Ground	Ground
32	NC	NC	NC
33	GND	Ground	Ground
34	BT_REG_ON	Input	Bluetooth enable
35	NC	NC	NC
36	GND	Ground	Ground
37	NC	NC	NC
38	NC	NC	NC
39	NC	NC	NC
40	NC	NC	NC
41	UART_RTS	Output	High-Speed UART RTS
42	UART_TX	Output	High-Speed UART Data Out
43	UART_RX	Input	High-Speed UART Data In
44	UART_CTS	Input	High-Speed UART CTS

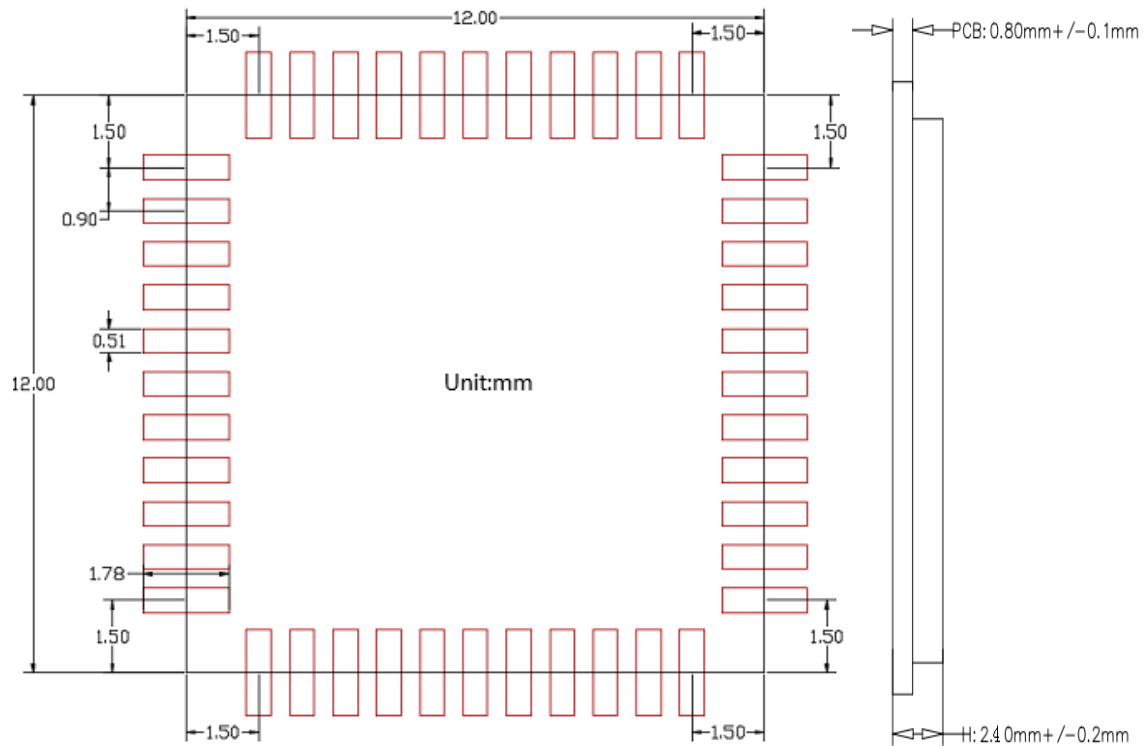Table 2: Pin Description

6.3 PCB Layout Footprint

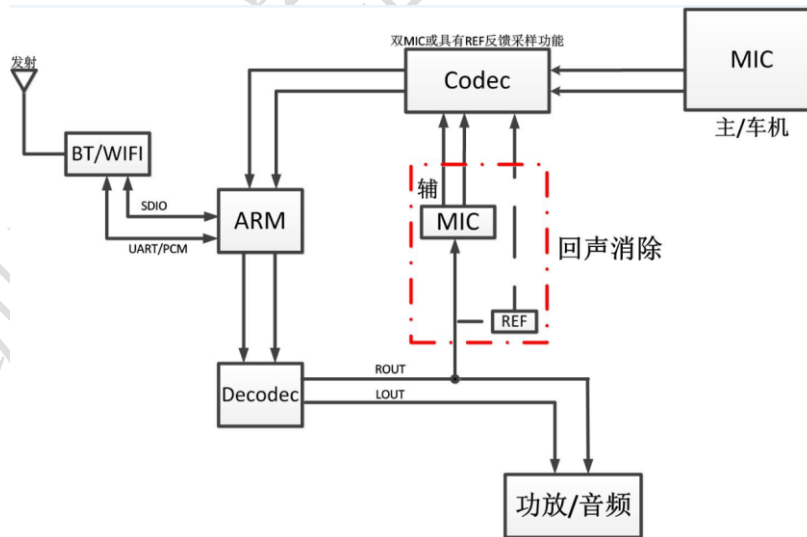Figure 3: PCB Layout Footprint

7. Echo Cancellation Principle

Figure 4: 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. UART Interface

GOC-RG450 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-RG450 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 2: UART Interface Power-On Timing Parameters

9. PCM Interface

GOC-RG450 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

10. Electrical Characteristic

10.1 Absolute Maximum Ratings

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

Table 3: Absolute Maximum Ratings

10.2 Recommended Operating Conditions

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

Table 4: Recommended Operating Conditions

11. Recommended Reflow Profile

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

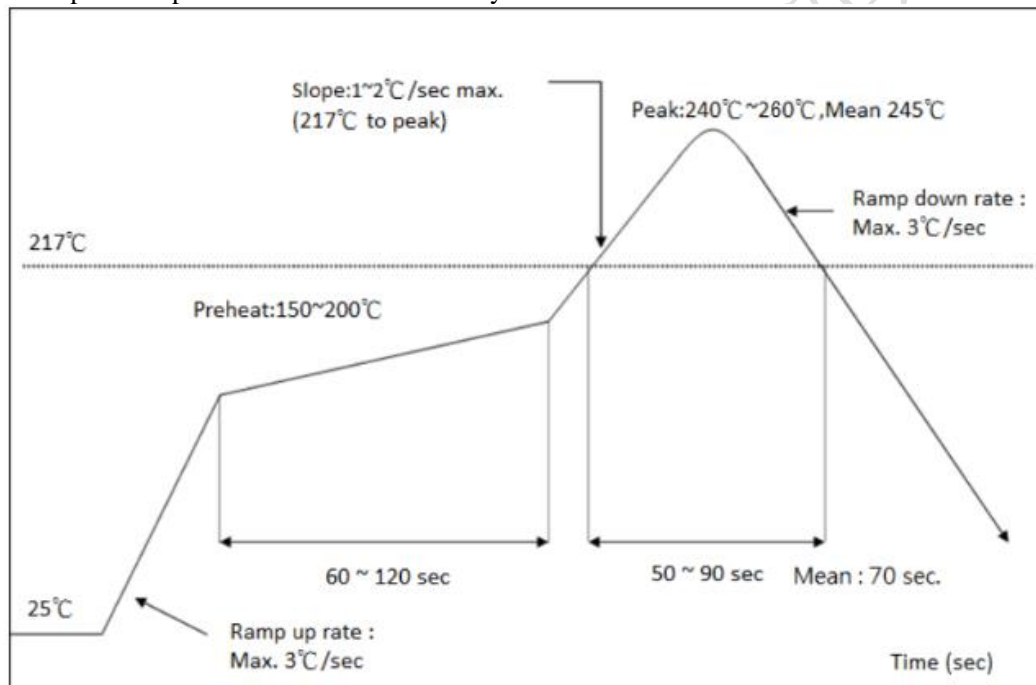
Figure 5 : Recommended Reflow Profile

12. Hardware Intteration Suggestions

12.1 Soldering Recommendations

It is compatible with industrial standard reflow profile for Pb-free solders. The reflow profile used is dependent on the thermal mass of the entire populated PCB, heat transfer efficiency of the oven and particular type of solder paste used. Consult the datasheet of particular solder paste for profile configurations.

Goodocom will give following recommendations for soldering the module to ensure reliable solder joint and operation of the module after soldering. Since the profile used is process and layout dependent, the optimum profile should be studied case by case. Thus following recommendation should be taken as a starting point guide.

12.2 Layout Guidelines(External Antenna)

Placement and PCB layout are critical to optimize the performances of a module without on-board antenna designs. The trace from the antenna port of the module to an external antenna should be 50 and must be as short as possible to avoid any interference into the transceiver of the module.

The location of the external antenna and RF-IN port of the module should be kept away from any noise sources and digital traces. A matching network might be needed in between the external antenna and RF-IN port to better match the impedance to minimize the return loss.

As indicated in below, RF critical circuits of the module should be clearly separated from any digital circuits on the system board. All RF circuits in the module are close to the antenna port. The module, then, should be placed in this way that module digital part towards your digital section of the system PCB.
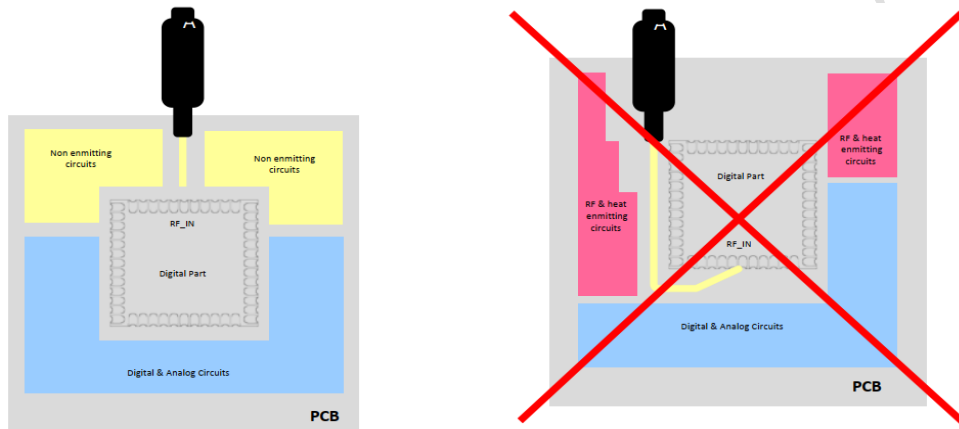
Figure 6: Placement the Module on a System Board

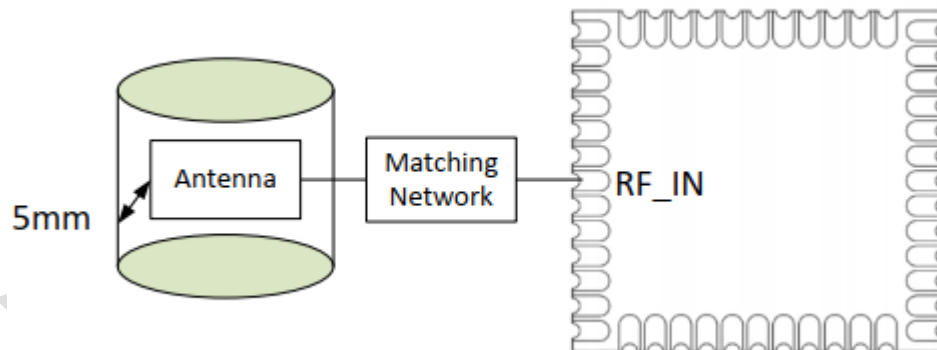## 12.3 Antenna Connection and Grounding Plane Design

Figure 7: Leave 5mm Clearance Space from the Antenna

General design recommendations are:

- The length of the trace or connection line should be kept as short as possible.
- Distance between connection and ground area on the top layer should at least be as large as the dielectric thickness. Routing the RF close to digital sections of the system board should be avoided.
- To reduce signal reflections, sharp angles in the routing of the micro strip line should be avoided. Chamfers or fillets are preferred for rectangular routing; 45-degree routing is preferred over Manhattan style 90-degree routing.
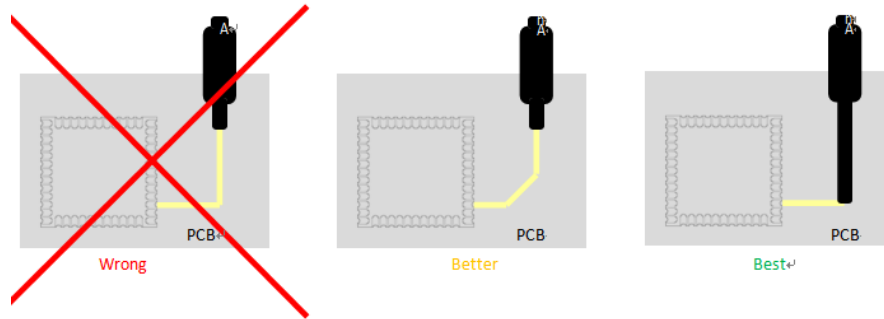
Figure 8: Recommended Trace Connects Antenna and the Module

Routing of the RF-connection underneath the module should be avoided. The distance of the micro strip line to the ground plane on the bottom side of the receiver is very small and has huge tolerances. Therefore, the impedance of this part of the trace cannot be controlled.

Use as many vias as possible to connect the ground planes.

12.4 SDIO Lines Layout Guideline

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

SDIO_CMD

SDIO_CLK

SD_D0 ~ SD_D3

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

12.5 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.

12.6 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.

12.7 Power Trace Lines Layout Guideline

VBAT Trace Width: 30mil

VDDIO Trace Width: 25mil

12.8 Ground Lines Layout Guideline

A Complete Ground in Ground Layer.

Add Ground Through Holes to GOC-RG450 Module Ground Pads.

Decoupling Capacitors close to GOC-RG450 Module Power and Ground Pads.

13. Module Part Number Description

GOC-RG 450

Company Name ⎯⎯⎯⎯⎯

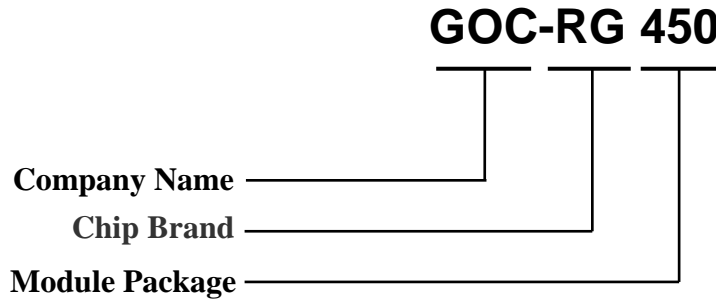**Chip Brand** ⎯⎯⎯⎯⎯

Module Package ⎯⎯⎯⎯⎯

Figure 9: 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.

14. Ordering Information

Part Number	Description	Remark
GOC-RG450 V1.0	2.4 GHz and 5 GHz WLAN+ BT5.3 module	

Table 5: Ordering Information

15. Packaging Information

15.1 Net Weight

The module net weight: TBD

15.2 Package

TBD

15.3 Storage Requirements

1）Temperature: 22~28 ℃;

2）Humidity: <70%（RH）;

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

15.4 Humidity Sensitive Characteristic

1）MSL: 3

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-022