Bluetooth Low Energy Module Specification

HY-234004PC

Version：V1.0

Version	Revision Date	Reviser	Reviewer	Revised Contents
V1.0	2023/3/2	YDQ	LYC	1st issue (Translated by Joe)

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1. Brief Description

HY-234004PC Bluetooth low energy single-mode module is aimed at low-power sensors and nearby single-mode devices, providing Bluetooth low energy features: radio, Bluetooth protocol stack, configuration files and the required space for customer applications. The module provides a flexible hardware interface for connecting sensors.

HY-234004PC can be directly powered by a standard 3V button battery or a pair of AAA batteries. In the lowest power shutdown mode, it consumes only 0.15uA and wakes up within a few microseconds. The transmission distance of HY-234004PC will vary according to the structure of the whole product, parts material, layout, antenna type, placement location, and surrounding environment.

Bluetooth IC: CC2340R5 4X4 QFN24

1.1Application field

Medical

– Home healthcare – blood glucose/pressure monitor, CPAP machine, electronic thermometer

– Patient monitoring & diagnostics – medical sensor patches

– Personal care & Fitness – electric toothbrush, wearable fitness & activity monitor

Building automation

– Building security systems – motion detector, electronic smart lock, door and window sensor, garage door system, gateway

– HVAC – thermostat, wireless environmental sensor

– Fire safety system – smoke and heat detector

– Video surveillance – IP network camera

Lighting

– LED luminaire

– Lighting Control – daylight sensor, lighting sensor, wireless control

Factory automation and control

Retail automation & payment – Electronic point of sale

Communication equipment

– Wired networking – wireless LAN or Wi-Fi access points, edge router

Personal electronics

– Connected peripherals – consumer wireless module, pointing devices, keyboards and keypads

– Gaming – electronic and robotic toys

– Wearables (non-medical) – smart trackers, smart clothing

1.2 Key Feature

–Bluetooth 5.3, single-mode compatible

–Support Master mode, slave mode, master-slave mode

–Integrated Bluetooth Low Energy Stacking GAP, GATT, L2CAP, SMP Bluetooth Low Energy Profiles

–Ultra-low current consumption

1) Standby state: 0.7uA (RTC running and RAM/CPU holding, LFXT DCDC charging current setting: ipeak=7)

2) Off state: 150nA (no clock running, no storage)

Programmable ARM Cortex-M0+ processor for embedding complete applications

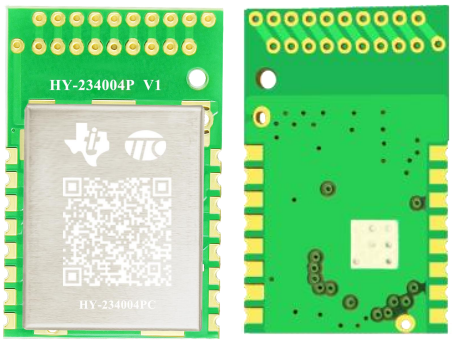
2. Product Model

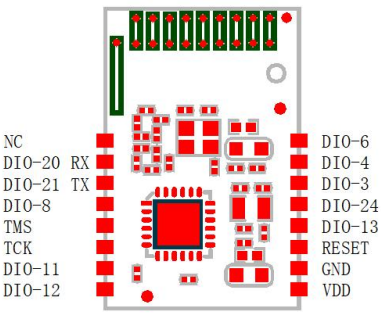
4 antenna types and shielding cover are optional

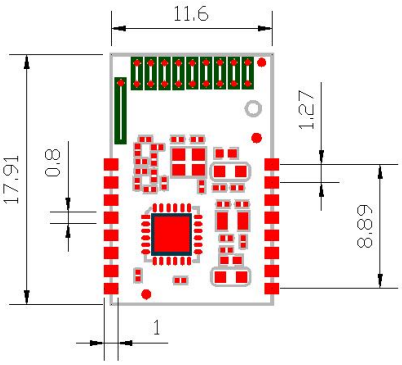
Hardware model	Mark
HY-234004PC	PCB helical antenna with shield

3. Module detail pictures

17.9*11.59*2.2/2.7 mm ±0.2mm







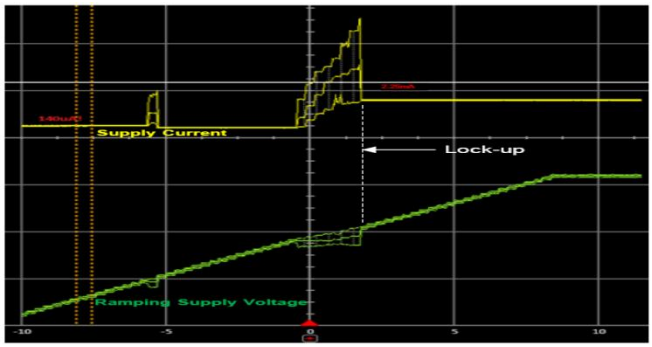
4. Precautions for use:

4.1-Pay attention to electrostatic protection: During the operation, ensure that the instrument and equipment are completely grounded. Prevent poor grounding of the soldering iron and various equipment; avoid static electricity generated by packaging materials and human body contact, which will damage the IC or the program will be blown away; when manually soldering the module, pay attention to the temperature of the soldering iron to avoid peeling off of the PCB copper skin; The power supply damages the module; the operator must install the anti-static ring and implement the static protection inspection to prevent human contact from damaging the IC and the program. Good contact to avoid oxidation and poor contact; the electrostatic voltage of the environment and personnel is within 0±100V. Anti-static signs should be made in the work area.

4.2-Pay attention to avoid program runaway or IC damage caused by abnormal voltage of the Bluetooth chip due to poor power supply circuit of the motherboard, soldering short circuit connection/open circuit.

4.3-When burning the program firmware in the module flash memory, the VDDS DC power supply voltage must be between 2.4~3.3V.

4.4-Avoid multiple occurrences of the power supply voltage falling within the range of the electrical detection threshold (1.76 V ~ 1.78 V) within the BOD Brown-Out Decect range,the below picture shows the power-off lock area, the firmware may be locked causing the boot code to pause and unable to connect to the JTAG protocol. In this state, the reset pin action can be used to eliminate this phenomenon below 1.0 V; the rechargeable battery is in the state of charging and discharging; while applying it, ensure the voltage setting of the protection system, and pay attention to the internal resistance and line impedance voltage drop caused by power supply; ensure The device operates from 2.0 V to 3.6 V with a guaranteed voltage slope greater than 0.5 V/ms (passing the BOD threshold).

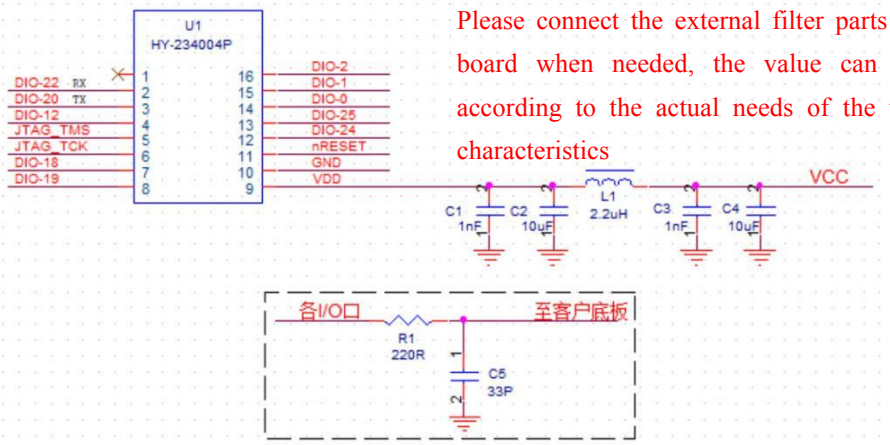


4.5-During the production and transportation process, please take good measures to protect the module parts to prevent the precision parts on the module from being damaged (reflow furnace outlet and assembly, testing, and transportation processes, it is recommended to use anti-collision materials for buffering, and do not collide with each other.

4.6-This module is a humidity-sensitive component. If it is used in SMD reflow soldering operations, please strictly follow the regulations of IPC/JEDECJ-STD-020, and do a good job of drying and dehumidification first, and because this module has been placed after 2 processing operations In the functional test environment,

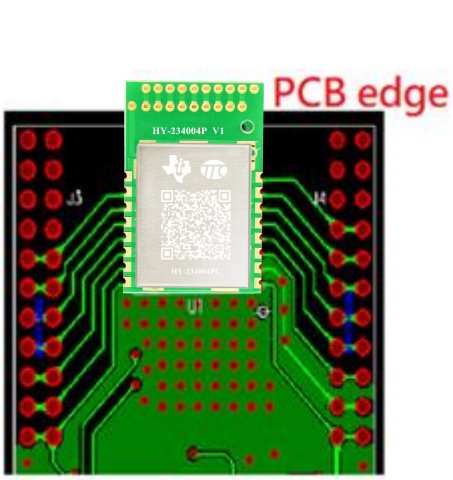
the humidity inside the chip cannot be guaranteed at a certain ratio, please understand;
The above precautions are as follows:

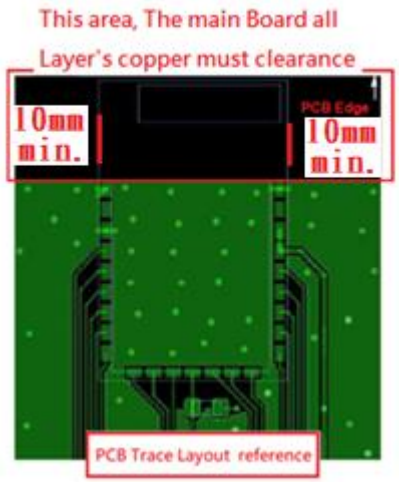
4.7-The external filter parts on the module application schematic diagram should be connected to the main board when needed, and the values can be changed according to the actual needs of the whole board characteristics;



Please connect the external filter parts to the main board when needed, the value can be changed according to the actual needs of the whole board characteristics

4.8-Installation Suggestion 1: The PCB copper skin around the module antenna and under the RF circuit must be clear, and the module must be placed on the edge of the motherboard. There should be no metal parts or substances that hinder electromagnetic radiation near the antenna, which will affect the control distance.
4.9- Installation suggestion 2: The layout of signal lines and power lines, do not cross the lines, avoid crosstalk, and affect the receiving sensitivity, as shown in the following schematic diagram:





If the PCB not ground isolation signals between different layers, Trace do not intersect between different layers layout, prevent crosstalk
若 PCB不同層間沒有接地面隔離信號, 不同層間的線路不要交叉布局,防止串擾.

5. Pin Function Description

Pin	Name	Type	Description
1	NC	NC	Not connect
2	DIO_20	Digital or Analog I/O	GPIO, analog capability
3	DIO_21	Digital or Analog I/O	GPIO, analog capability
4	DIO_8	Digital I/O	GPIO, high-drive capability
5	DIO16_SWDIO JTAG TMSC	Digital I/O	GPIO, SWD interface: mode select or SWDIO, high-drive capability
6	DIO17_SWDCK JTAG TCKC	Digital I/O	GPIO, SWD interface: clock, high-drive capability
7	DIO_11	Digital I/O	GPIO, high-drive capability
8	DIO_12	Digital I/O	GPIO, high-drive capability
9	VDD	Power supply	+1.8V to +3.8V (Recommended 2.7~3.3V)
10	GND	Power GND	Ground
11	RESET_N	Digital input	Reset, active-low. Module have pull up.
12	DIO_13	Digital I/O	GPIO, Analog capability, high-drive capability
13	DIO_24	Digital or Analog I/O	GPIO, analog capability
14	DIO_3	Digital or Analog I/O	GPIO, analog capability
15	DIO_4	Digital or Analog I/O	GPIO, analog capability
16	DIO_6	Digital or Analog I/O	GPIO, analog capability

6. Electrical Characteristics

Test conditions: Ta = 25 ℃, VDD =3.0V with internal DC-DC voltage regulator, test standard: 1Mbps GFSK modulation, FRF = 2440MHz Bluetooth low energy mode.

6.1 RF Characteristics and Current Consumption:

Modulation method: GFSK

Frequency range: 2400~2483.5MHz (2.4G ISM band)

IC transmit power range: -21~+8dBm typical (controlled by software programming)

Antenna feed end RF transmit power: +6 dBm typical. (RF TX is set at +8dBm maximum characteristic)

Antenna feed end RF receiving sensitivity: -93dBm typical (at PER <30.8% characteristic)

Frequency offset value: RF ± 60ppm , MCU clock 32.768KHz ± 350ppm (using crystal oscillator mode)

- Ultra-low current consumption:
  1. RF TX current: 5mA (0dBm)
  2. RF TX current: <12mA (8dBm)
  3. RF RX current: 5.3mA
  4. Idle state: 56uA (support system and RAM power supply)
  5. Standby state: 0.7uA (RTC running and RAM/CPU keeping)
  6. Off state: 150nA (no clock running, no storage)

6.2 Absolute Maximum Ratings

Note: These are absolute maximum ratings, beyond which the module may be permanently damaged, these are not maximum operating conditions, see 6-4 for maximum recommended operating conditions.

Rated Value	Min	Max	Unit
VDDS	-0.3	4.1	V
Other terminal voltage	VSS-0.3	VDDS+0.3	V
Storage temperature	-40	+150	°C

6.3 ESD Rated Value

			数值	单位
V_{ESD} electrostatic discharge	Human Body Model (HBM), according to ANSI / ESDA / JEDEC/JS001	all pins	±2000	V
	Charging device mode according to JESD22-C101	RF pins	±500	
		non-RF pin	±500	

6.4 Recommended working conditions

Power supply voltage noise should be less than 10mVpp, excessive power supply noise will degrade RF performance.

Rated Value	Min	Max	Unit
VDD(when Bluetooth is active)	2.2	3.8	V
VDD(when flash programming firmware)	2.4	3.6	V
Operating temperature	-40	+125	°C

Remark:

(1).Recommended DC power supply voltage: 2.7~3.3V DC.

(2). When the program firmware is burned in the module flash memory, the DC power supply voltage must

be between 2.4~3.6V to avoid incomplete or abnormal conditions during burning.

(3). For button batteries, in the worst case, the equivalent source resistance of the battery will cause a power supply voltage drop. At this time, VDDS must use a 22μF input capacitor to strengthen the power supply capacity to ensure compliance with the conversion rate (6-6 timing requirements).

6.5 GPIO DC Characteristics

Parameter	Test Conditions	Typical V	Unit
GPIO VOH at 10 mA load	high-drive GPIOs only, max drive setting	2.85	V
PIO VOL at 10 mA load	high-drive GPIOs only, max drive setting	0.15	V
GPIO VOH at 2 mA load	standard drive GPIOs	2.9	V
GPIO VOL at 2 mA load	standard drive GPIOs	0.1	V

6.6 Timing Requirements

Description	Min	Standard	Max	Unit
Features of input control				
RESET_N stay low duration	1			μs

(1) In the worst case, the equivalent source resistance of the battery will cause a power supply voltage drop. At this time, VDDS must use a 22μF input capacitor to strengthen the power supply capacity to ensure compliance with the conversion rate.

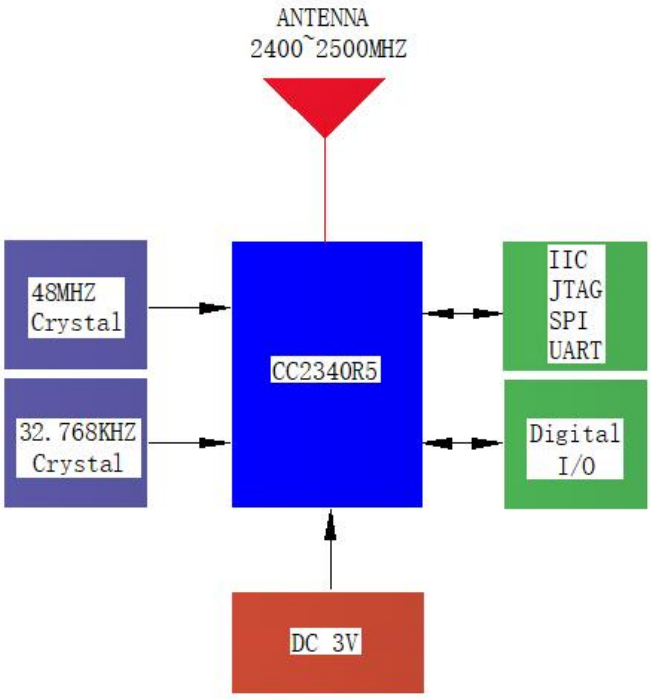
(2) When using RCOSC_LF as a sleep timer application, the frequency drift caused by temperature changes must be considered.

6.7 Action state switching timing characteristics

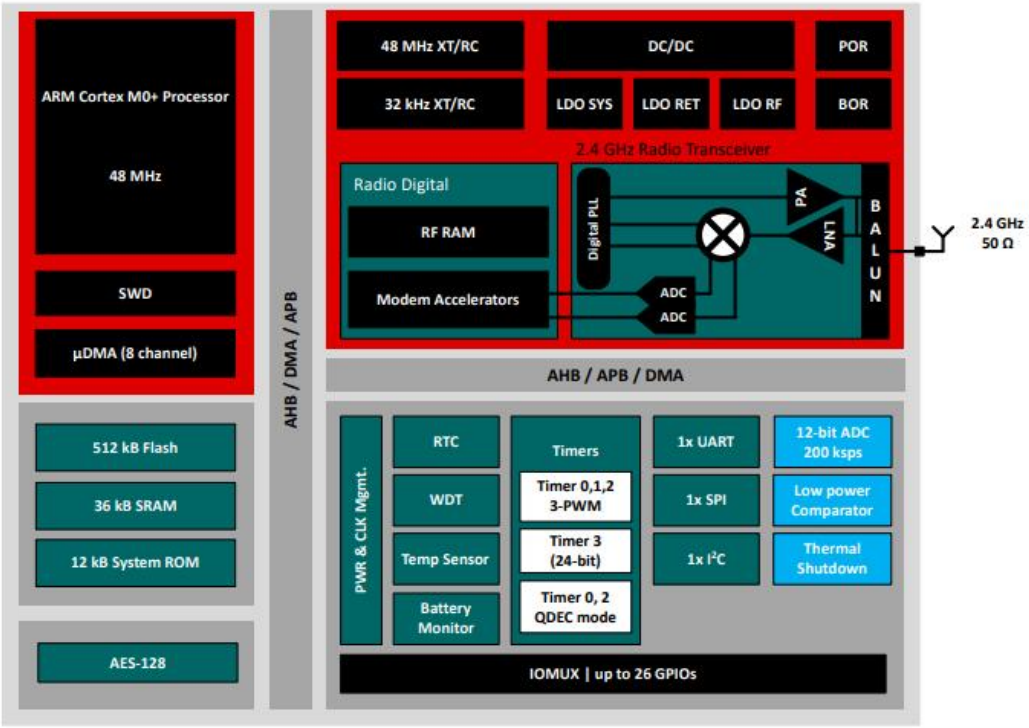
Measurement conditions: $T_c = 25°C$, $V_{DDS} = 3.0\ V$, unless otherwise noted

Parameter	Test Conditions	Min	Typical	Max	Unit
Wakeup and Timing					
Idle →Active	Flash disabled in idle mode		10		μs
Standby →Active	GLDO ON, min recharge current configuration		200		μs
Shutdown →Active	GLDO default charge current setting, VDDR capacitor fully discharged		2000		μs

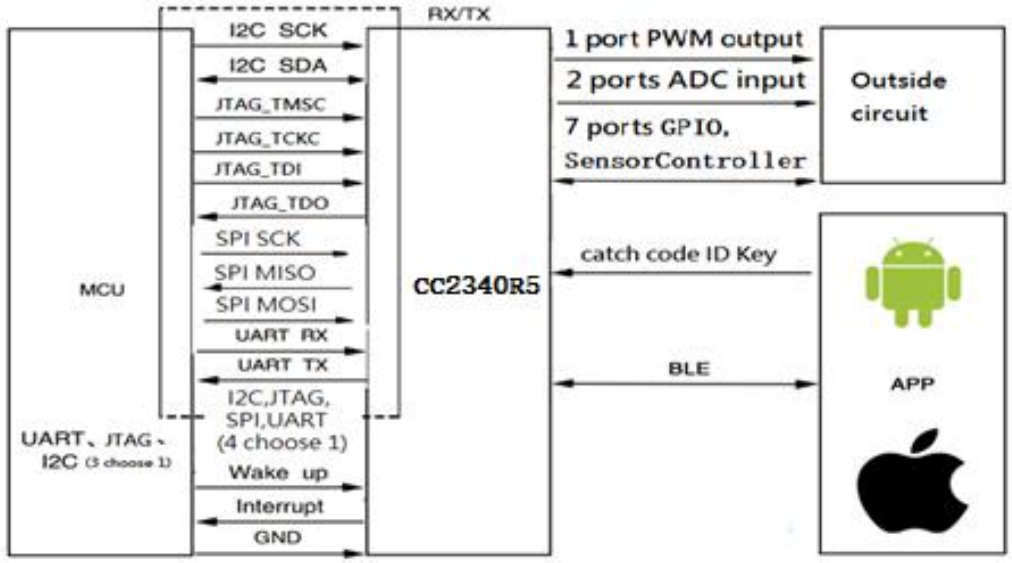
7. Module Block Diagram



8. IC Functional Block Diagram



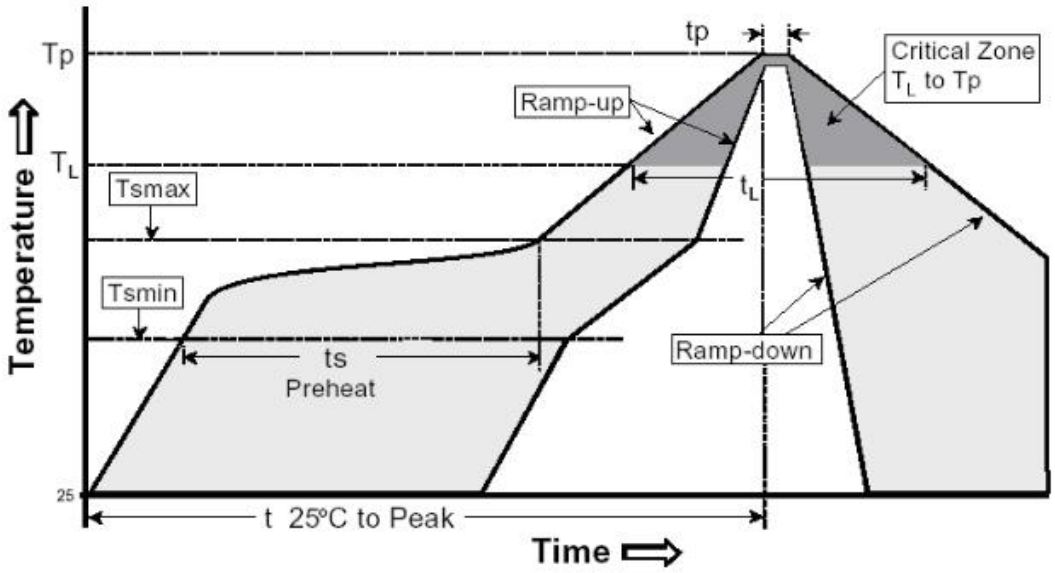
8. Working mode block diagram



9. Reflow Soldering Profile Recommendations

Profile Feature	Pb-Free Assembly	
	Large Body	Small Body
Average ramp-up rate(T_L to T_P)	3°C/second max	
Preheat -Temperature Min (Ts_{min}) -Temperature Max (Ts_{max}) -Time (min to max)(ts)	150°C 200°C 60-180 seconds	
$Ts_{max}$to T-$_L$ -Ramp-up Rate	3°C/second max	
Time maintained above -Temperature (T_L) -Time (t_L)	217°C 60-150 seconds	
Peak Temperature (T_P)	245 +0/-5°C	250 +0/-5°C
Time within 5°C of actualPeakTemperature (t_p)	10-30 seconds	20-40 seconds
Ramp-down Rate	6°C/second max	
Time 25°C to PeakTemperature	8 minutes max	

Reflow Profile Classification



10. Contact us

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