

RF-2400 Series

High-performance low-power 2.4GHz RF Module Specifications

1、 Introduction

RF-2400 series is a highly integrated RF transmit/receive modules. The module package the Beken BK2421 chip and its peripheral circuit, makes the SPI port communicate with the MCU directly without any additional external circuit, and reduce product development costs. It has the excellent RF performance of other communication protocols in 2.4GHz frequency band, and significant anti-interference ability, low power consumption, small size. It can achieve high-speed wireless transmission (up to 2Mbps) with ultra-low power consumption. The receiver's normal operating current is 17mA, transmitter with output power of 0dBm current 17mA, power-down mode current 3uA. It integrates a jamming detection feature can be set by software, can switch to the channel to continue communication without interference.

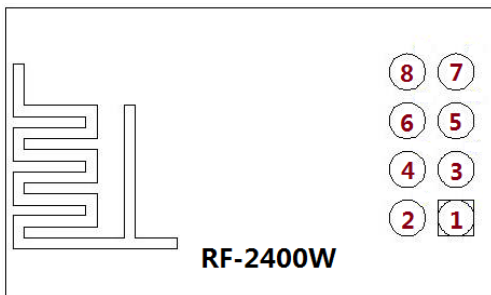
2、 Features

- RF-2400 series has three models: RF-2400W、 RF-2400P、 RF-2400-V03
- Operation band: 2400-2483.5 MHz ISM band
- Transfer Rate: 1Mbps or 2Mbps
- Programmable output power: (-10dBm, -5dBm, 0dBm, 5 dBm)
- valid data length of Receive/transmit: 1 to 32 bytes
- 6 data pipes for 1:6 star networks
- power supply 1.9V ~ 3.6V
- SPI interface with maximum 8MHz clock
- adopt GFSK modulation, significantly improves the sensitivity of the chip
- the transmission mode consumes 17mA at 0 dBm
- the receive mode consumes 17mA at 1Mbps data transfer rate
- current consumption of 3uA in POWERDOWN mode
- current consumption of 50uA in standby-I mode
- open transmission distance of about 20-50 meters (for reference only)
- We can use RF-2400-V03 for mass production after pass RF-2400P/W validation test.
- The module has many advantage like low cost, stable performance, portability, abundant supply and high cost performance.
- INHAOS will provide a full range of after-sales technical services to help customers to add 2.4GHz wireless communication to product.

4、Applications

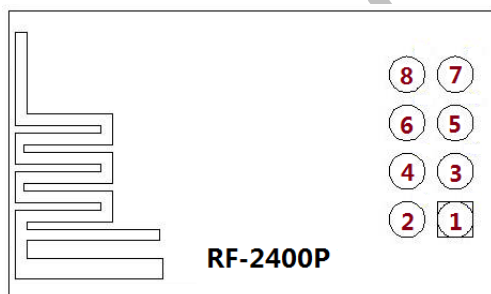
- Wireless Access System
- Fire & Security Systems
- Remote control
- Intelligent Toys
- Telemetry
- Car alarm
- Industrial Sensors
- Wireless Data Communication
- Intelligent sports equipment
- wireless mouse, keyboard, game joystick

5、RF-2400 Module Pin Information



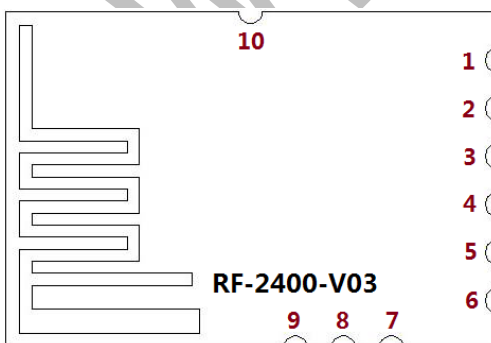
RF-2400P/W Pin Information

NO.	Name	Functional Description
1	GND	Ground (0V)
2	VCC	Power (1.9V~3.6V)
3	CE	Chip enable , active RX/TX mode ,low active
4	CSN	SPI Chip select
5	SCK	SPI Clock
6	MOSI	Master output, slave input
7	MISO	Master input, slave output
8	IRQ	Maskable interrupt pin, Active low



RF-2400-V03 Pin Information




NO.	Name	Functional Description
1	IRQ	Maskable interrupt pin, Active low
2	MISO	Master input, slave output
3	MOSI	Master output, slave input
4	SCK	SPI Clock
5	CSN	SPI Chip select
6	CE	Chip enable , active RX/TX mode ,low active
7	GND	Ground (0V)
8	VCC	Power (1.9V~3.6V)
9	GND	Ground (0V)
10	GND	Ground (0V)



6、 Selection Guide

Before RF-2400 series wireless module was released, the best modules of 2.4G RF Transceivers are based on Nordic nRF24L01+. Now RF engineers have more choices by RF-2400 series modules. It was produced by Beken BK-2421 chip, with the same performance, lower cost, more stable supply and better service than nRF24L01+.

BK-2421 is a stable high-performance 2.4G wireless module. In China, over 10KK products use this chip monthly. To let more people know about this chip, we have released the RF-2400 series modules. We usually recommend customers to use RF-2400W or RF-2400P for products design verification. You can directly use RF-2400-V3 for formal product design after the verification. INHAOS has already done fully performance tests of the three modules to ensure no technical risks.

NO.	Model	Pack	Size(mm)	antenna	The Scope of Application	Picture
1	RF-2400W	DIP	15 x 26	Wiggle antenna	DIY, Performance verification	货号: RF-2400W 
2	RF-2400P	DIP	15 x 26	PIFA antenna	DIY, Performance verification	货号: RF-2400P 
3	RF-2400-V03	SMT	14 x 20	PIFA antenna	Product Design	货号: RF-2400-V03 

RF-2400W and RF-2400P has the same dimensions and electrical interfaces, and different antenna, Wiggle Antenna is about 1dB lower than PIFA with smaller volume. You can purchase RF-2400W and RF-2400P to measure to select the appropriate antenna design for mass production. RF-2400-V3 can use SMD reflow, and is available for quantity production with smaller size and lower cost. From cost and package, RF-2400-V3 is very suitable for mass production.

7、 Application Notes

INHAOS has done full RF match and debugging on the RF-2400 Series modules to ensure the best performance. Note in application:

7.1: About power supply

The nominal supply voltage of RF-2400 series is 1.9 ~ 3.6V, it is best to provide a stable supply

voltage. In order to compatible with 3.3V and 5V MCU system ,we recommend 3.3V power supply. If the power supply has large ripple , we suggest series 10 ohm resistor and 860nF RC filter circuit in the Vcc circuit.

7.2: About the interface level

The modules' IO is compatible with TTL and CMOS . We suggest series 100 ohm resistor to IO port for overload protect.

7.3: About the RF module's position in the machine

In the overall layout, make sure no metal objects 10mm around the antenna. It's better to right point to RF receiving or transmitting direction. Module should be placed horizontally in the machine.

7.4: About PCB design

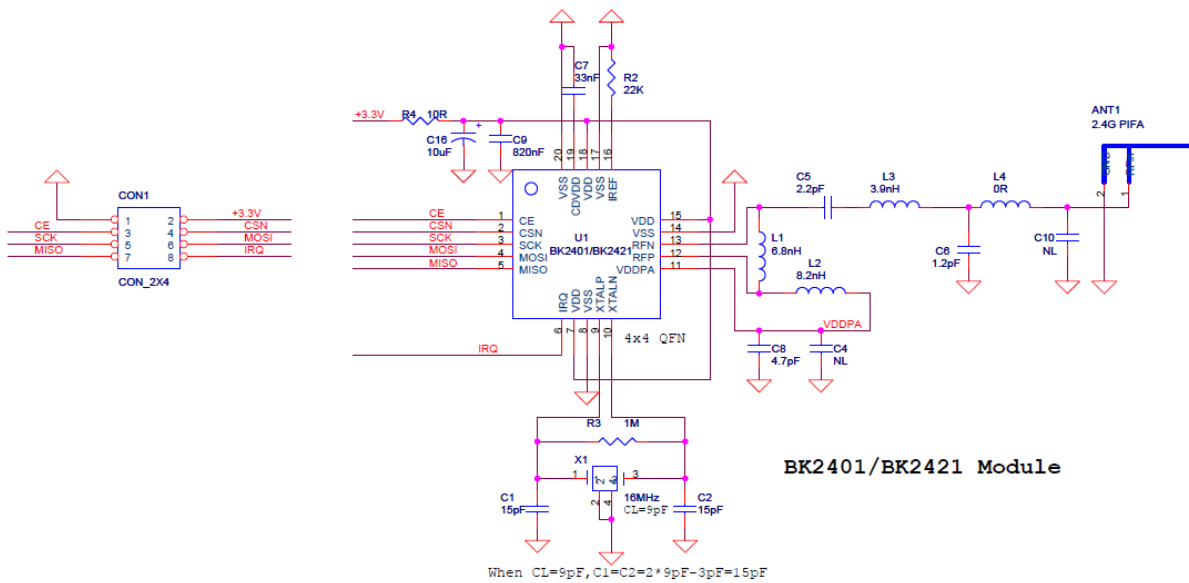
In the PCB design, no part or circuit can be placed under the antenna. It must be emptied with no copper.

8、 Electric parameter

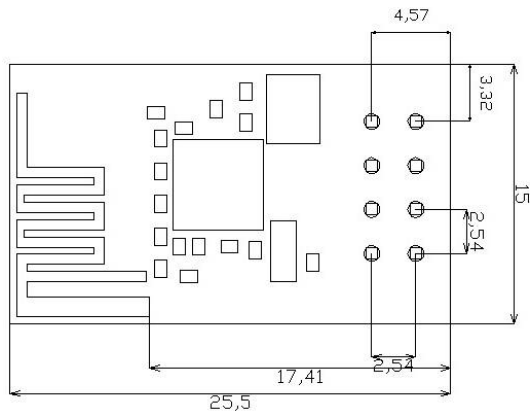
Name	Parameter	Min	Typical	Max	Unit	Comment
Operating Condition						
VDD	Voltage	1.9	3.0	3.6	V	
TEMP	Temperature	-40	+27	+86	°C	
Digital input Pin						
VIN	High level	0.7VDD		5.25	V	
VIL	Low level	VSS		0.3VDD	V	
Digital output Pin						
VOH	High level(I _{OH} =-0.25mA)	VDD-0.3		VDD	V	
VOL	Low level(I _{OL} =0.25mA)	0		0.3	V	
Normal Condition						
IVDD	Power Down current			3	uA	
IVDD	Standby-I current			50	uA	
IVDD	Standby-II current			400	uA	
Normal RF condition						
FOP	Operating frequency	2400		2527	MHz	
FXTAL	Crystal frequency		16		MHz	
RFSK	Air data rate	1		2	Mbps	
Transmitter						
PRF	Output power	-40	0	5	dBm	
PBW	Modulation 20dB bandwidth(2Mbps)		2.5		MHz	
PBW	Modulation 20dB bandwidth(1Mbps)		1.3		MHz	
PRF1	Out of band emission 2MHz		-20		dBm	

PRF2	Out of band emission 4MHz		-40		dBm	
IVDD	Current at -40dBm output power		11		mA	
IVDD	Current ata-30dBm output power		11		mA	
IVDD	Current ata-30dBm output power		12		mA	
IVDD	Current ata-25dBm output power		13		mA	
IVDD	Current ata-10dBm output power		15		mA	
IVDD	Current ata-0dBm output power		17		mA	
IVDD	Current ata-5dBm output power		23		mA	
Receiver						
IVDD	Current(2Mbps)		18			
IVDD	Current(1Mbps)		17			
Max_Input	1E-3 BER		10			
RXSSENS	1E-3 BER sensitivity(2Mbps)		-85			
RXSSENS	1E-3 BER sensitivity(1Mbps)		-88			
C/I _{CO}	Co-channel C/I (2Mbps)		4			
C/I _{1ST}	ACS C/I 2MHz(2Mbps)		-5			
C/I _{2ND}	ACS C/I 4MHz(2Mbps)		-20			
C/I _{3RD}	ACS C/I 6MHz(2Mbps)		-25			
C/I _{CO}	Co-channel C/I(1Mbps)		4			
C/I _{1ST}	ACS C/I1MHz(1Mbps)		4			
C/I _{2ND}	ACS C/I 2MHz(1Mbps)		-18			
C/I _{3RD}	ACS C/I 3MHz(1Mbps)		-19			

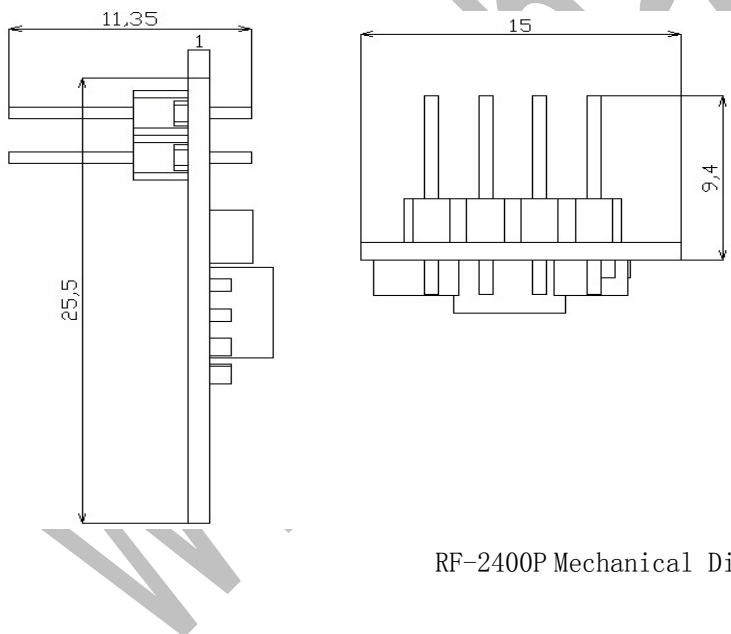
9、Schematic



10、RF-2400P Mechanical Dimensions (Unit: mm)

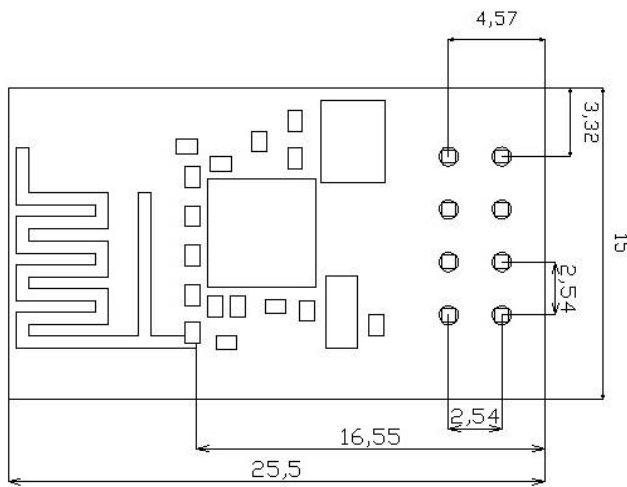


RF-2400P Mechanical Dimensions

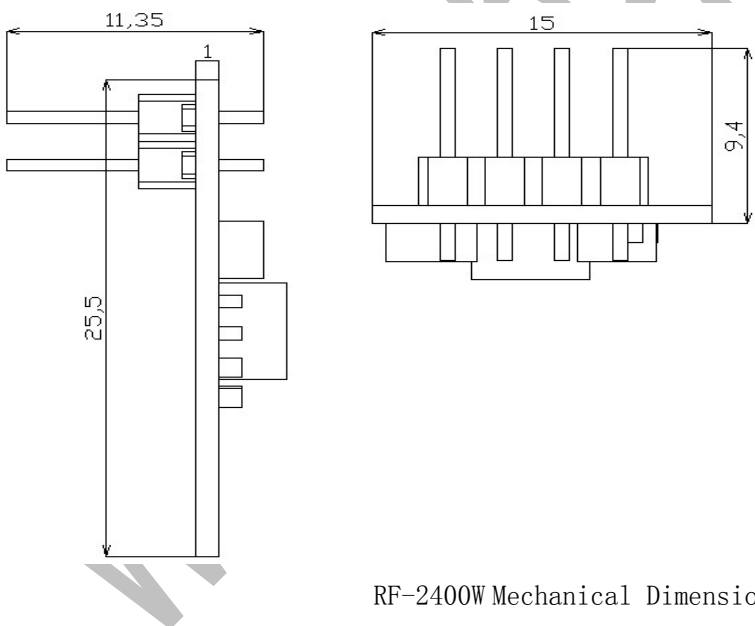


RF-2400P Mechanical Dimensions

11、 RF-2400W Mechanical Dimensions (Unit: mm)

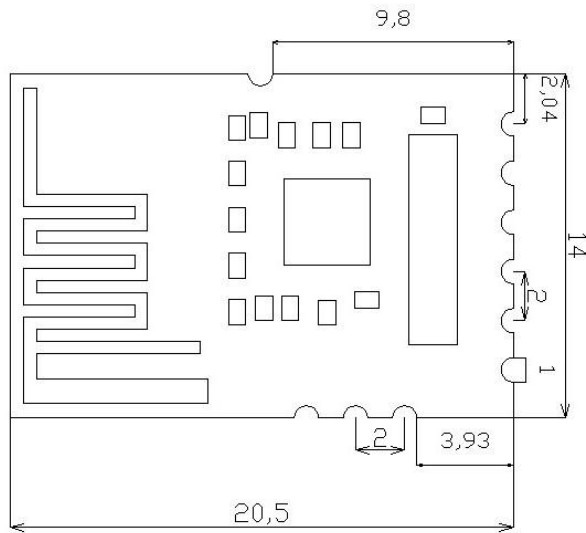


RF-2400W Mechanical Dimensions

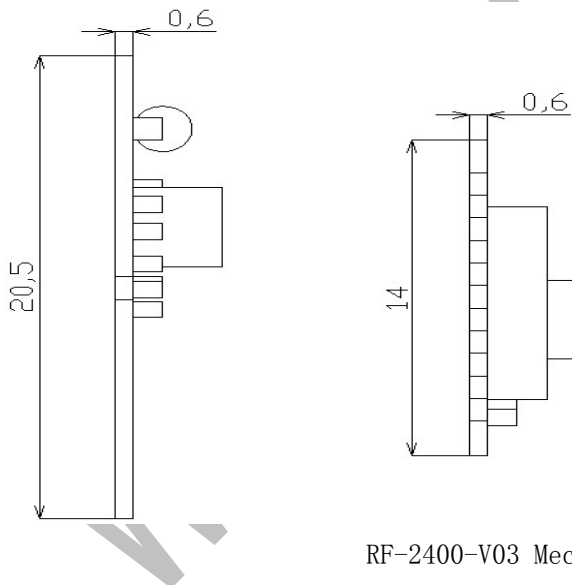


RF-2400W Mechanical Dimensions

12、 RF-2400-V03 Mechanical Dimensions (Unit: mm)

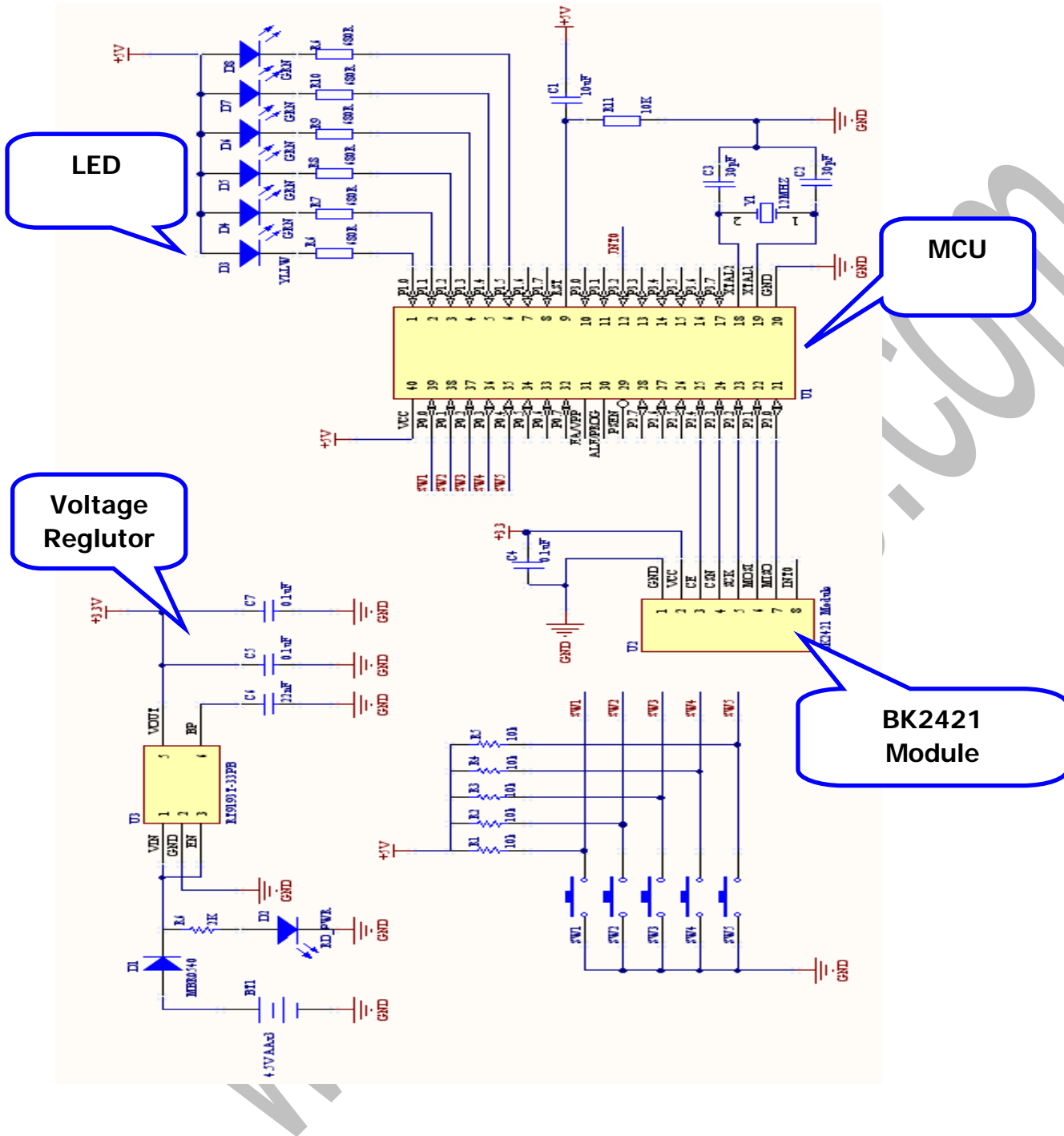


RF-2400-V03 Mechanical Dimensions



RF-2400-V03 Mechanical Dimensions

13、RF-2400 Module Application



14、 Reference Documents

- 1) RF-2400 Series Operations Guide -C51
- 2) RF-2400 Series Operations Guide -avr
- 3) nRF24L01_Product_Specification_v2_0
- 4) BK2401_BK2421Hardware Reference Designv3.0

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15、 Revision History

Version	Date	Page	Description
V10	2011-6-2		
V11	2011-6-16	P3	Modify RF-2400-V03 pinout & description

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We also can undertake the following services:

- Electronic product design
- Brand components acting
- Embedded development kit, Circuit module

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