



NF-02-PA(Si24R1) Specification

Version V1.0

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Document Revision History

Version	Date	Created / Revised Content	Prepared by	Approved by
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1. Product Overview

The NF-02-PA (Si24R1) is a 2.4GHz wireless transceiver module. The module integrates an Si24R1 RF chip and a power amplifier chip, with transmit power up to 20dBm. It supports a maximum data rate of 2Mbps and adopts a standard SPI communication interface. The module provides high stability and high cost-performance. The module uses a standard 2.54mm pin header interface, making it easy to assemble and suitable for rapid integration into various end products.

The NF-02-PA (Si24R1) is suitable for a variety of IoT applications and is widely used in wireless mice, wireless remote controls, motion-sensing devices, active RFID, NFC, low-power ad hoc wireless sensor nodes, etc.

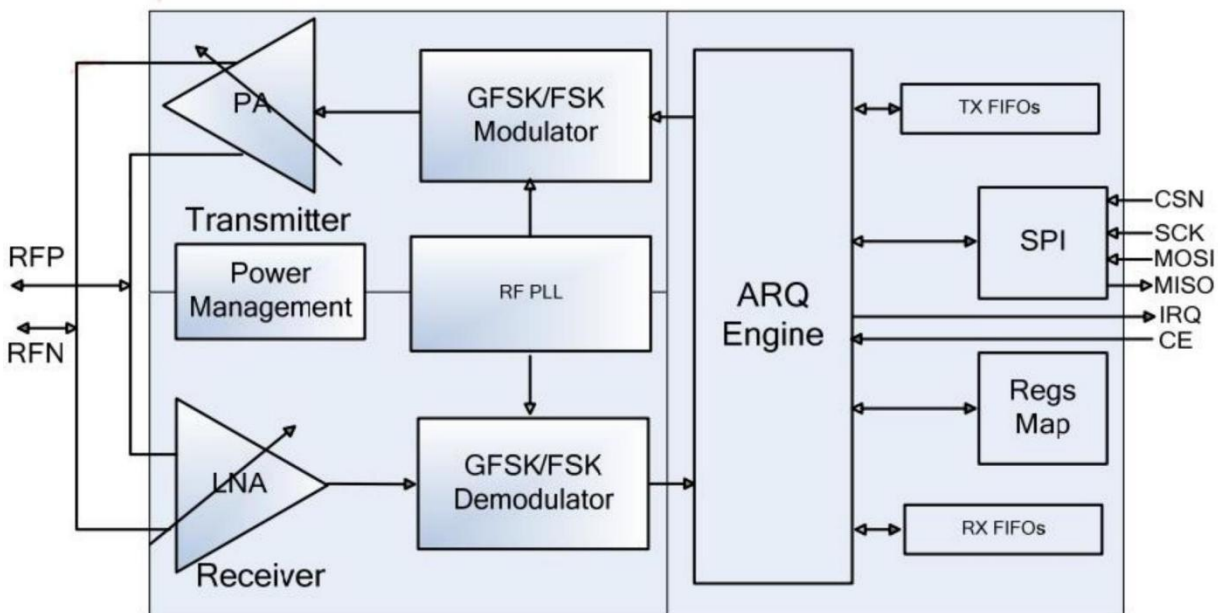


Figure 1 Chip Architecture Diagram

1.1. Features

- Ultra-small DIP-8 package, simple and easy to use
- Uses GFSK/FSK modulation
- Supports 2Mbps/1Mbps/250Kbps data rates
- Wide supply voltage range: 2.0 – 3.6V
- Channels: 126 RF channels

- Receiver sensitivity: -96dBm@250kbps
- Maximum transmit power: 20dBm
- Four-wire SPI interface, up to 10Mbps
- Integrated intelligent ARQ baseband protocol engine
- Hardware interrupt output for transceiver data
- Supports 1-bit RSSI output

2. Key Specifications

Table 1 Key Specifications

Model	NF-02-PA (Si24R1)
Package	DIP-8
Dimensions	40.8*15.3*19.0(±0.2)mm
Antenna Type	External SMA antenna
Frequency Range	2400 – 2525MHz
Modulation Method	GFSK/FSK
Transmit Power	Max 20dBm
Data Rate	Supports 2Mbps/1Mbps/250Kbps
Channel	126 RF channels, 1MHz spacing between each channel
Test Distance	1000m (clear sky, no obstacles, at max. transmit power)
Operating Temperature	-40°C – 85°C
Storage Conditions	-40 – 125°C, < 90% RH
Receiver Sensitivity	-96dBm@250Kbps
Transmit Length	Single data packet 1 – 32 bytes, 3-level FIFO
Receive Length	Single data packet 1 – 32 bytes, 3-level FIFO
Supply Range	Supply voltage 2.0V – 3.6V, supply current >250mA
Standby Current	26μA
Receive Current	25mA (2Mbps)
Transmit Current	250mA (20dBm)
Supported Interface	SPI
Interface Rate	SPI maximum rate 10Mbps

2.1. Electrical Parameters

The NF-02-PA (Si24R1) module is an ESD-sensitive device and requires special precautions during handling.



Figure 2 ESD Protection Diagram

2.2. Electrical Characteristics

Table 2 Electrical Characteristics Parameter Description

Parameter		Condition	Min	Typ	Max	Unit
Supply Voltage		VDD	2.0	3.3	3.6	V
I/O	VIL/VIH	-	-0.3/0.75VDD	-	0.25VDD/VDD+0.3	V
	VOL/VOH	-	N/0.8VIO	-	0.1VIO/N	V

2.3. 2.4G RF Performance

Table 3 Electrical Characteristics Parameter Description

Description	Typ	Unit
Operating Frequency	2400 – 2525	MHz
Output Power		
Maximum Output Power	20±2	dBm
Receiver Sensitivity		
2Mbps	-83±2	dBm

1Mbps	-87±2	dBm
250kbps	-96±2	dBm

3. Appearance and Dimensions

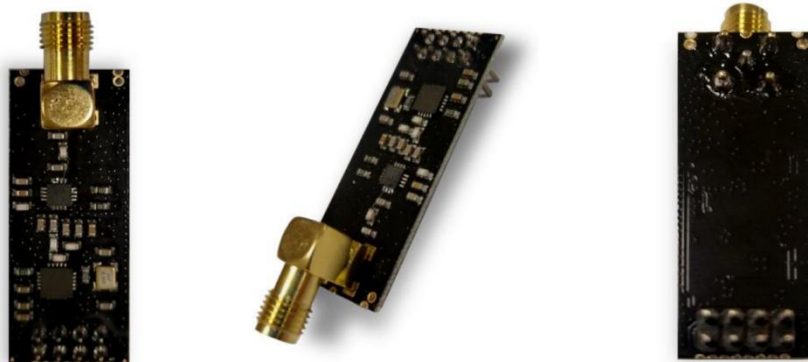


Figure 3 Module Appearance
(images are for reference only; actual product prevails)

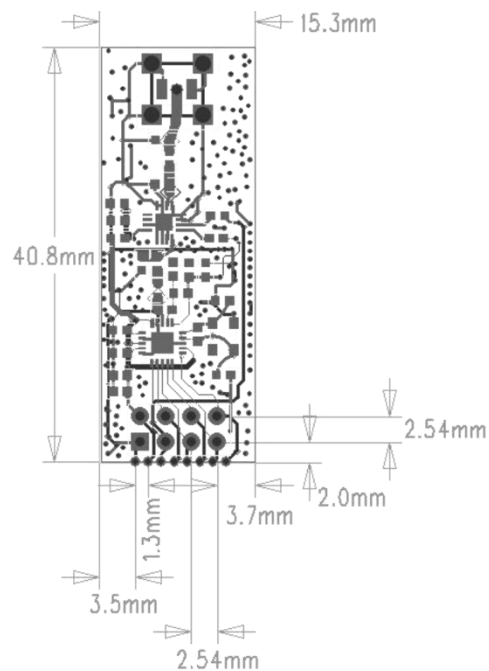


Figure 4 Module Dimensions

4. Pin Definition

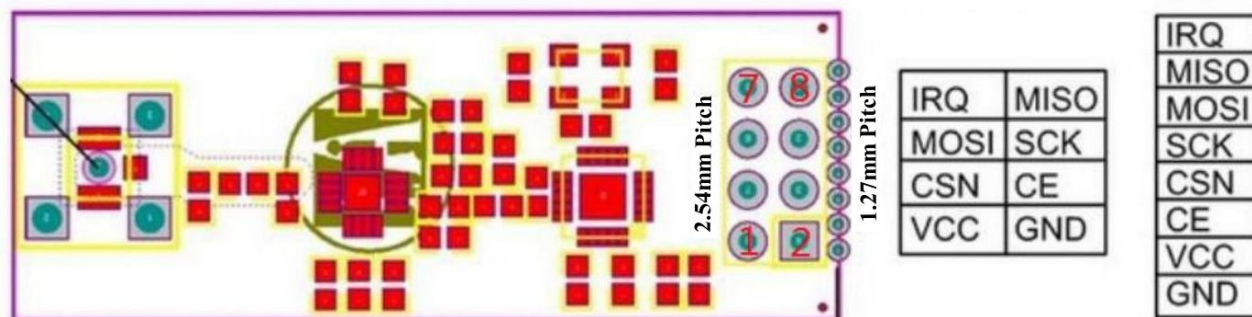


Figure 5 Pin Diagram

Table 4 Pin Function Definition

Pin No.	Name	Function Description
1	VCC	Power supply, must be between 2.0 – 3.6V
2	GND	Ground, connected to the power reference ground
3	CSN	Module chip select pin, used to initiate an SPI communication
4	CE	Module enable control pin; when CE is at a low level, the module is in standby mode
5	MOSI	Module SPI data input pin
6	SCK	Module SPI bus clock
7	IRQ	Module interrupt signal output, active low
8	MISO	Module SPI data output pin

5. Application Reference Circuit

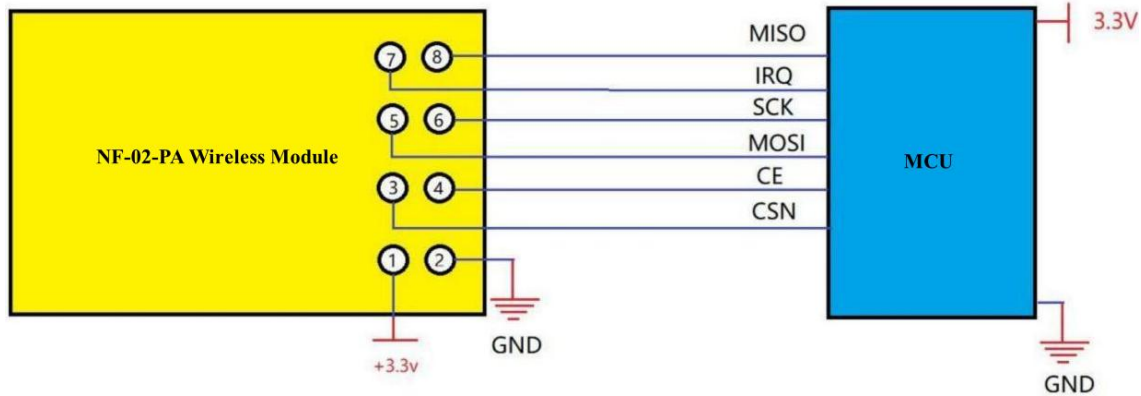


Figure 6 Application Reference Circuit

5.1. Application Description

- It is recommended to connect the CE pin to the MCU GPIO port.
- IRQ may be left unconnected; the SPI polling method can be used to obtain the interrupt status of the STATUS register. However, it is recommended to use the MCU hardware external interrupt and connect IRQ to the MCU external trigger pin to trigger the MCU interrupt.
- The RF chip used in NF-02-PA (Si24R1) is the Si24R1. The read/write method of the chip registers shall follow the timing described in the chip datasheet. For details, refer to the Si24R1 chip datasheet or download the driver examples for STM32 and 8051 MCU from the official website.
- Ensure good grounding with a large ground plane and low power ripple; add filtering capacitors as close as possible to the module's VCC and GND pins.
- For other 2.4G selection materials, please visit the website: <https://docs.ai-thinker.com/2.4g>.

6. Design Guide

6.1. Precautions

- High-frequency analog devices have electrostatic sensitivity; please avoid human body contact with the electronic components on the module as much as possible.
- Ensure the power supply has low ripple and avoid large fluctuations in the supply voltage. It is recommended to use a π -type filter (ceramic capacitor // tantalum capacitor + inductor).

- Use a single-point grounding method for the module ground; it is recommended to use a 0-ohm resistor or a 0mH inductor, and keep the reference ground of other circuit parts separate.
- Check whether the antenna is covered by a metal shell; some components (such as relays) can affect antenna performance. Also ensure the antenna is exposed, preferably oriented vertically upward.
- If other wireless modules of different frequency bands exist inside the same product, the frequency must be properly planned and shielding measures adopted to reduce the impact of harmonic interference and intermodulation interference.
- If a crystal oscillator is located near the module circuit board where this module is mounted, please increase the straight-line distance between the module and the crystal oscillator as much as possible.

6.2. Power Supply

- Recommended voltage 3.3V, with peak current above 250mA.
- It is recommended to use an LDO for power supply; if using DC-DC, keep the ripple within 30mV.
- For the DC-DC power supply circuit, it is recommended to reserve space for a dynamic response capacitor, which can optimize the output ripple when the load changes significantly.
- It is recommended to add ESD protection devices at the 3.3V power interface.

6.3. FAQ

Table 5 Short Communication Distance: Ideal Range Not Achieved

No.	Cause	Description
01	Obstacle	The 2.4G band has poor penetration due to its physical characteristics; when an obstacle exists during line-of-sight communication, the communication distance will be greatly shortened.
02	Interference Source	Temperature, humidity, and electromagnetic interference from the same frequency band will increase the packet loss rate of communication.
03	Antenna	The antenna uses a 50-ohm impedance trace; if there are metal objects near the antenna or the module is placed inside a shielding case, signal attenuation will occur.
04	CE Pin	In the program configuration, the transmitting device is not kept at high level, resulting in reduced sensitivity when receiving the acknowledgment signal.
05	Transmit Power	When configuring the register, the higher the transmit power is configured, the farther the transmission distance will be.
06	Transmit Rate	If the configured transmit rate is too high, the transmission distance will also be relatively reduced.
07	Low Voltage	The supply voltage is less than 3.3V, resulting in insufficient module power supply, which relatively affects the module's transmit power.

Table 6 Module Overheating and Damage

No.	Cause	Description
01	Supply Voltage	Check the power supply to ensure it is between 2.0 and 3.6V; exceeding 3.6V will cause module damage.
02	Stability	Check the stability of the power supply; the voltage must not fluctuate too much.
03	ESD Protection	Ensure proper ESD protection during power installation and use; high-frequency devices have electrostatic sensitivity.
04	Soldering	The module cannot undergo reflow soldering or wave soldering, otherwise it will be damaged.

7. Packaging Information

As shown in the figure below, the NF-02-PA (Si24R1) is packaged in an ESD bag.



Figure 7 Packaging Diagram

8. Contact Us

Official Website: <https://www.ai-thinker.com>

Development DOCS: <https://docs.ai-thinker.com>

Official Forum: <http://bbs.ai-thinker.com>

Sample Purchase: <https://anxinke.taobao.com>

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