LoRa-Kit Specification

Version V1.0.0

Document Revision History

Version	Date	Description of Changes	Authored by	Approved by
V1.0.0	2024-04-10	First edition	Shi Daoteng	Xu Hong

Contents

1 Product Overview

The LoRa-Kit is a development board designed by Ai-Thinker for LoRa modules. It is equipped with an STM32F103C8T6 chip and a TB-05 module, along with pin headers for LoRa adapter boards. It is compatible with adapter boards such as Ra-01 and Ra-03, and supports the full series of LoRa modules including Ra-01, Ra-01S, Ra-01SC, and Ra-03SCH, enabling the development and testing of LoRa communication and low-power performance. The onboard TB-05 module, used together with a mini program developed by our company, allows RF parameter configuration of LoRa modules and point-to-point range testing. In addition, the jumper pin headers reserved on the board serve as an interface for secondary development programming and low-power evaluation testing.

The TB-05 is a Bluetooth module based on the TLSR8250 chip, compliant with the BLE 5.0 low-power Tmall Genie Mesh standard. It supports direct control by Tmall Genie and features Bluetooth mesh networking capability. Devices communicate via peer-to-peer star-topology networks using Bluetooth broadcast, ensuring timely responses even in multi-device scenarios. It is primarily used in smart lighting control, meeting requirements for low power consumption, low latency, and short-range wireless data communication.

Application areas: Development and testing of LoRa communication and low-power performance.

1.1 Features

- Adopts DIP-30 package
- Supports Bluetooth configuration of LoRa node parameters
- Supports operation in the following frequency bands:
- Low frequency band range: 410–525 MHz, compatible with modules such as Ra-01, Ra-02, Ra-01S, Ra-01SC, etc.
- High frequency band range: 803–930 MHz, compatible with modules such as Ra-01H, Ra-01SH, Ra-01SCH, Ra-03SCH, etc.
- Development board operating voltage: 5 V
- Theoretical maximum transmit power:
  Modules such as Ra-01, Ra-02, Ra-01H: 20 dBm
  Modules such as Ra-01S, Ra-01SC, Ra-01SH, Ra-01SCH, Ra-03SCH: 22 dBm
- Supports point-to-point transparent data transmission
- Compatible with adapter boards such as Ra-01 and Ra-03
- Supports wireless wake-up
- LoRa module supports FSK, GFSK, and LoRa™ modulation modes

2 Main Parameters

Table 1 Main Parameter Specifications

Model	LoRa-Kit
Package	DIP-30
Dimensions	40.00*50.00 (±0.2 mm)
Antenna Type	Half-hole, IPEX connector
Frequency Range	LoRa low-frequency modules: 410–525 MHz, LoRa high-frequency modules: 803–930 MHz
Operating Temperature	-20–70 ℃
Storage Conditions	-40–125 ℃, < 90% RH
Power Supply Range	Supply voltage: 5 V (Type-C port), supply current: ≥ 500 mA
Supported Interfaces	Type-C
UART Baud Rate	Default 115200 bps

2.1 Static Electricity Requirements

LoRa-Kit is an electrostatic sensitive device (ESD) and requires special precautions during handling.

Figure 1 ESD Protection Diagram

2.2 Electrical Characteristics

Table 2 Electrical Characteristics

Parameter	Min	Typ	Max	Unit
Operating Temperature	-20	-	+70	℃
Storage Temperature	-40	-	+125	℃
Supply Voltage	4.75	5	5.25	V

2.3 Development Board Digital Port Characteristics

Table 3 Development Board Digital Ports

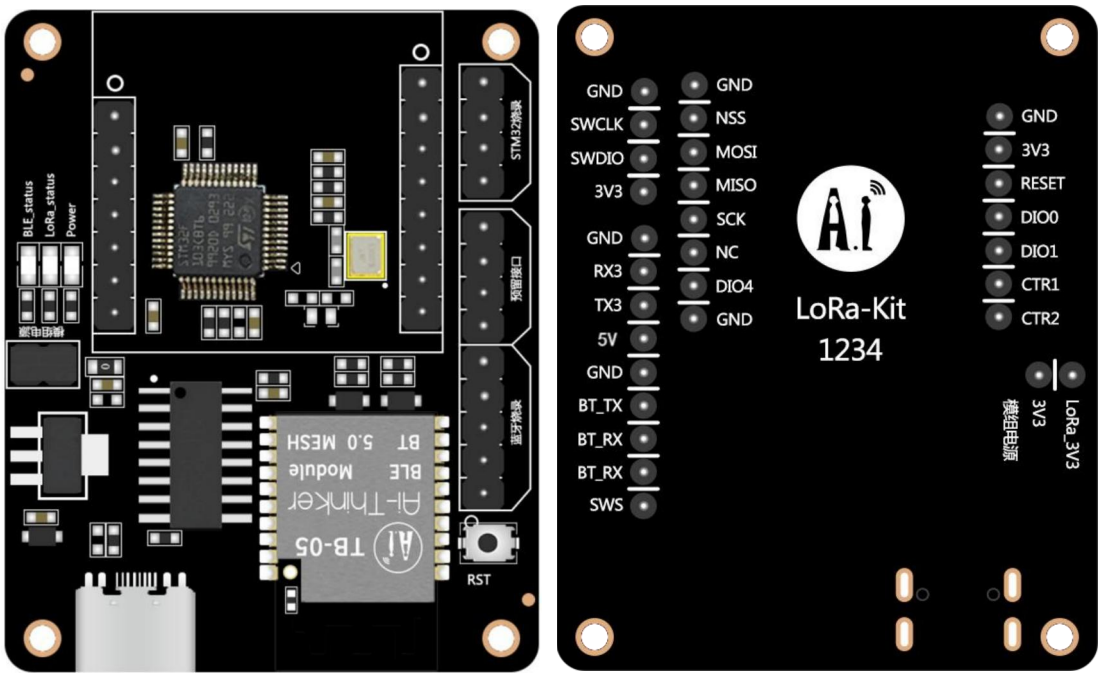
Description		Typ		Unit	
Maximum Operating Frequency		72		MHz	
Port	**Name**	**Min**	**Typ**	**Max**	**Unit**
MCU Supply Voltage	VDD	-	3.3	-	V
IO Level	VIO	-	3.3	-	V
Input Low Level	VIL	GND	-	0.35VDD	V
Input High Level	VIH	0.65VDD	-	VDD+0.5	V
Output Low Level	VOL	VSS	-	0.35VDD	V
Output High Level	VOH	0.65VDD	-	VDD	V

2.4 RF Parameters

Table 4 RF Parameters

Module Model	Description		Theoretical Value			Unit
	Mode	Frequency Band	Min	Typ	Max	
Ra-01	Transmit Power	410–525 MHz	-	-	20	dBm
Ra-02	Transmit Power	410–525 MHz	-	-	20	dBm
Ra-01H	Transmit Power	803–930 MHz	-	-	20	dBm
Ra-01S	Transmit Power	410–525 MHz	-	-	22	dBm
Ra-01SH	Transmit Power	803–930 MHz	-	-	22	dBm
Ra-01SC	Transmit Power	410–525 MHz	-	-	22	dBm
Ra-01SCH	Transmit Power	803–930 MHz	-	-	22	dBm
Ra-03SCH	Transmit Power	803–930 MHz	-	-	22	dBm

3 Appearance and Dimensions



Top View Bottom View

Figure 2 LoRa-Kit Appearance Diagram

Note: *Rendering for reference only; actual product shall prevail.*

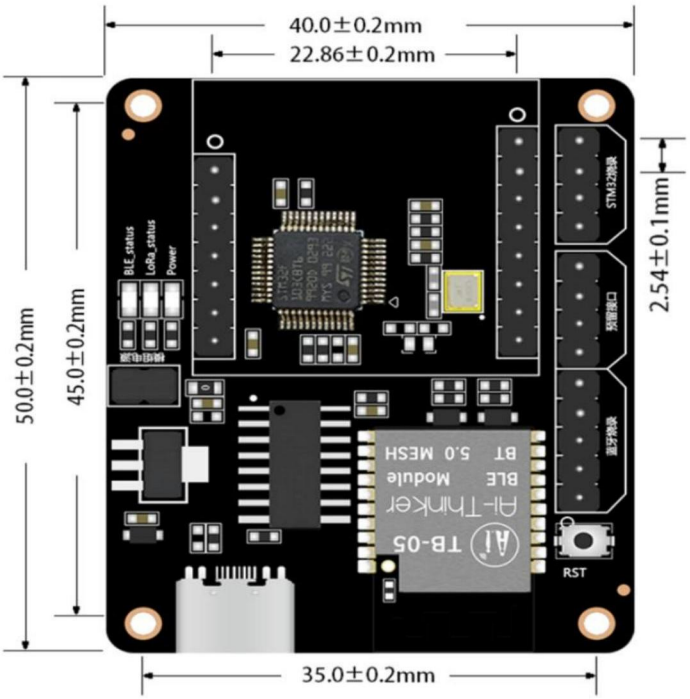
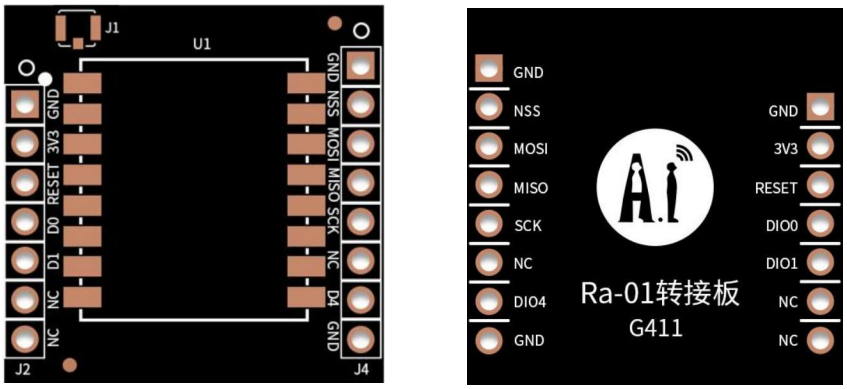


Figure 3 Dimension Diagram



Top View Bottom View

Figure 4 Ra-01 Appearance Diagram

Note: *Rendering for reference only; actual product shall prevail.*

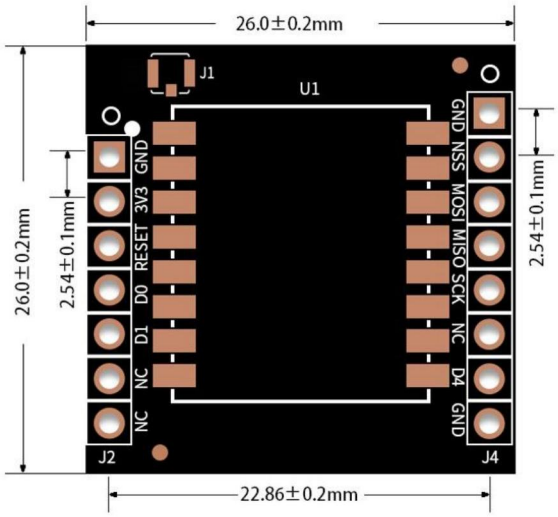
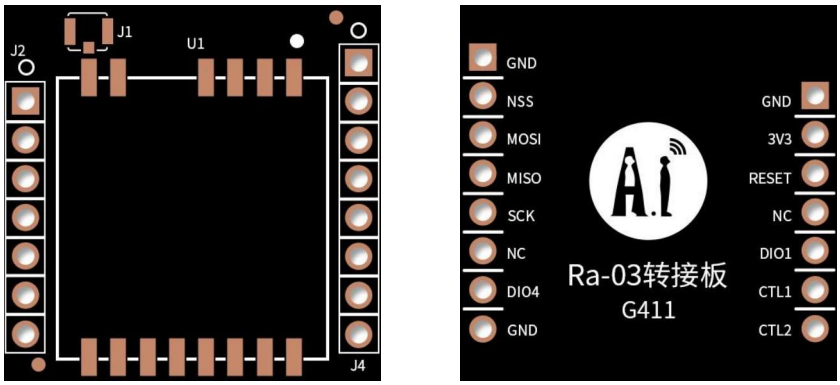


Figure 5 Ra-01 Dimension Diagram



Top View Bottom View

Figure 6 Ra-03 Adapter Board Appearance Diagram

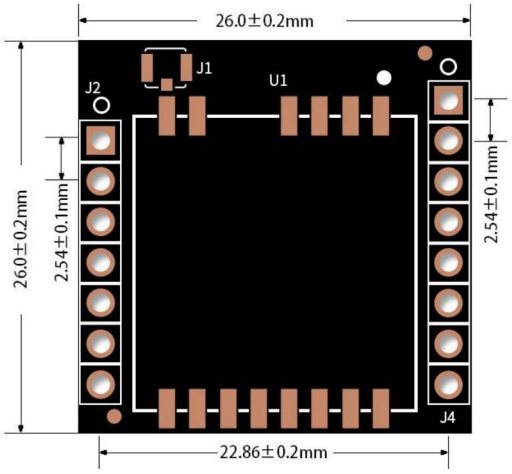


Figure 7 Ra-03 Adapter Board Dimension Diagram

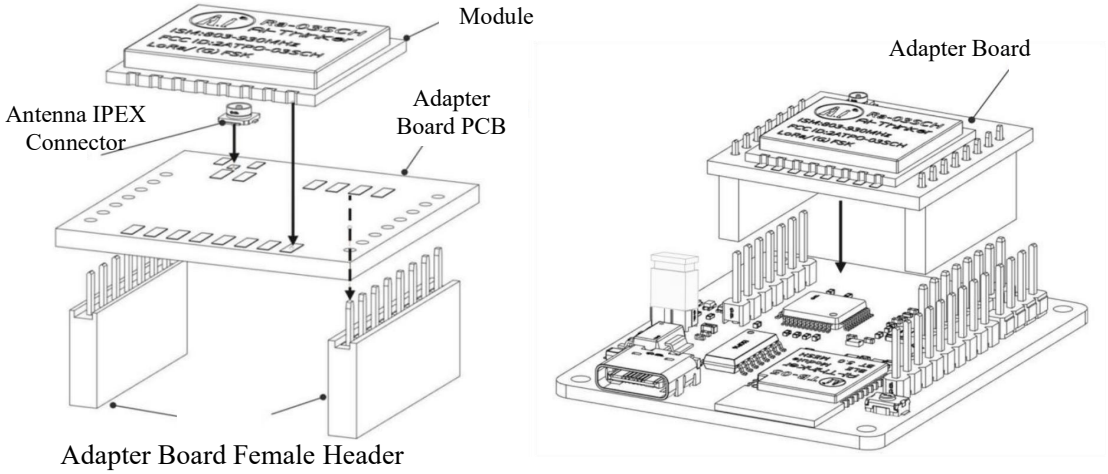


Figure 8 Installation Diagram

Table 5 Adapter Board and LoRa Module Correspondence Table

Adapter Board Model	LoRa Module Model
Ra-01 Adapter Board	Ra-01
	Ra-02
	Ra-01H
	Ra-01S
	Ra-01SH
	Ra-01SC
	Ra-01SCH
Ra-03 Adapter Board	Ra-03SCH

4 Pin Definition

4.1 LoRa-Kit Pin Definition

The LoRa-Kit exposes a total of 30 pins, as shown in the pin diagram. The pin function definition table provides the detailed interface specifications.

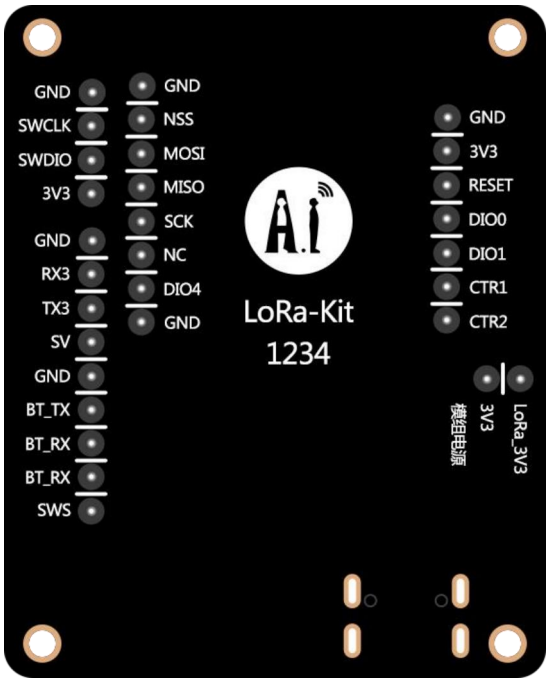


Figure 9 Pin Diagram

Table 6 LoRa-Kit Pin Function Definition

Pin No.	Name	Function Description
1	GND	Ground
2	3V3	3.3 V power supply; external power supply input current is recommended to be above 500 mA
3	RESET	LORA_RESET: Reset pin for LoRa module
4	DIO0	LORA_DIO0: Digital IO0 software configuration for LoRa module
5	DIO1	LORA_DIO1: Digital IO1 software configuration for LoRa module
6	CTR1	CTR1: Applied to the driving of Ra-03SCH RF switch
7	CTR2	CTR2: Applied to the driving of Ra-03SCH RF switch
8	GND	Ground
9	DIO4	LORA_DIO4: Digital IO4 software configuration for LoRa module
10	NC	NC
11	SCK	SPI_SCK: SPI clock input for LoRa module

12	MISO	SPI_MISO: SPI data output for LoRa module
13	MOSI	SPI_MOSI: SPI data input for LoRa module
14	NSS	SPI_NSS：SPI chip select input for LoRa module
15	GND	Ground
16	GND	Ground
17	SWCLK	SWCLK: Programming interface for the STM32F103CBT6 chip
18	SWDIO	SWDIO: Programming interface for the STM32F103CBT6 chip
19	3V3	3.3 V power supply; external power supply input current is recommended to be above 500 mA
20	GND	Ground
21	RX3	UART3_RX: Reserved UART interface
22	TX3	UART3_TX: Reserved UART interface
23	5V	5 V power supply; external power supply input current is recommended to be above 500 mA
24	GND	Ground
25	BT_TX	BLE_TX: STM32F103CBT6 and TB-05 communication port
26	BT_RX	BLE_RX: STM32F103CBT6 and TB-05 communication port
27	BT_RX	BLE_RX: TB-05 programming control pin
28	SWS	SWS: TB-05 programming control pin
29	LORA_3V3	3.3 V power supply; external power supply input current is recommended to be above 500 mA
30	3V3	3.3 V power supply; external power supply input current is recommended to be above 500 mA
Note: Short-circuit pins 29 and 30 with a jumper cap to supply power to the LoRa module.		

Table 7 Pin Correspondence Between LoRa Adapter Board and STM32F103C8T6 Chip

STM32F103C8T6 Chip Pin	LoRa Adapter Board
PB14	LORA_RESET
PB0	LORA_DIO0
PB1	LORA_DIO1
PA0/WKUP	LORA_DIO4
PA11	CTR1
PA12	CTR2
PA5	SPI_SCK
PA6	SPI_MISO
PA7	SPI_MOSI
PA4	SPI_NSS

Table 8 Pin Correspondence Between TB-05 Module and STM32F103C8T6 Chip

STM32F103C8T6 Chip Pin	TB-05 Module
PA3/UART2_RX	BLE_TX
PA2/UART2_TX	BLE_RX
PA1	TB-05_RST

4.2 Adapter Board Pin Definition

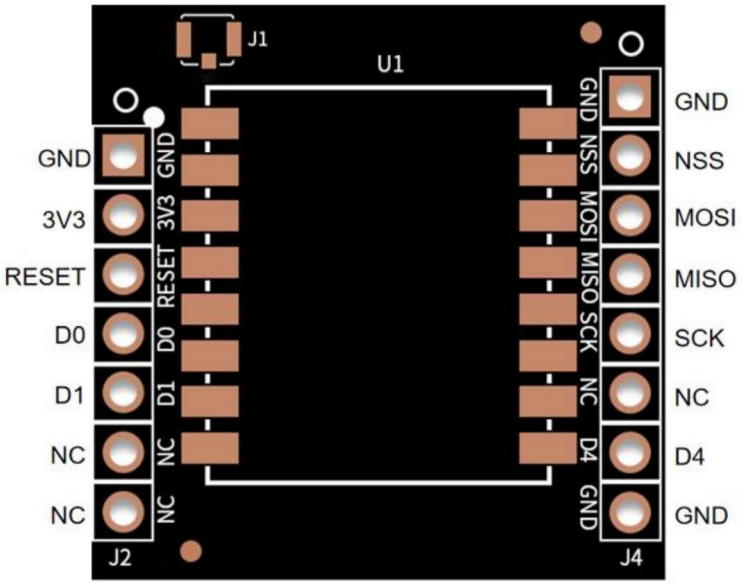


Figure 10 Ra-01 Adapter Board Pin Diagram

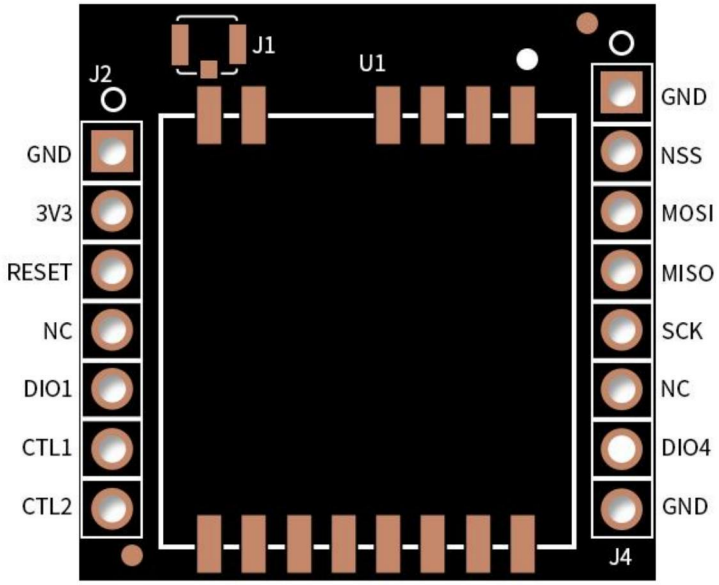


Figure 11 Ra-03 Adapter Board Pin Diagram

Table 9 Ra-01 Adapter Board Pin Function Definition

Pin No.	Name	Function Description
1	GND	Ground
2	3V3	Typical 3.3 V power supply, current above 200 mA
3	RESET	Reset pin for LoRa module
4	DIO0	Digital IO0 software configuration
5	DIO1	Digital IO1 software configuration
6	NC	NC
7	NC	NC
8	GND	Ground
9	DIO4	Digital IO4 software configuration
10	NC	NC
11	SCK	SPI clock input
12	MISO	SPI data output
13	MOSI	SPI data input
14	NSS	SPI chip select input
15	GND	Ground

Table 10 Ra-03 Adapter Board Pin Function Definition

Pin No.	Name	Function Description
1,8, 15	GND	Ground
2	3V3	Typical 3.3 V power supply, current above 200 mA
3	RESET	Reset pin for LoRa module
4	DIO0	NC
5	DIO1	Digital IO1 software configuration
6	NC	Applied to the driving of Ra-03SCH RF switch
7	NC	Applied to the driving of Ra-03SCH RF switch
9	DIO4	Digital IO4 software configuration
10	NC	NC
11	SCK	SPI clock input
12	MISO	SPI data output
13	MOSI	SPI data input
14	NSS	SPI chip select input

5 Schematic Diagram

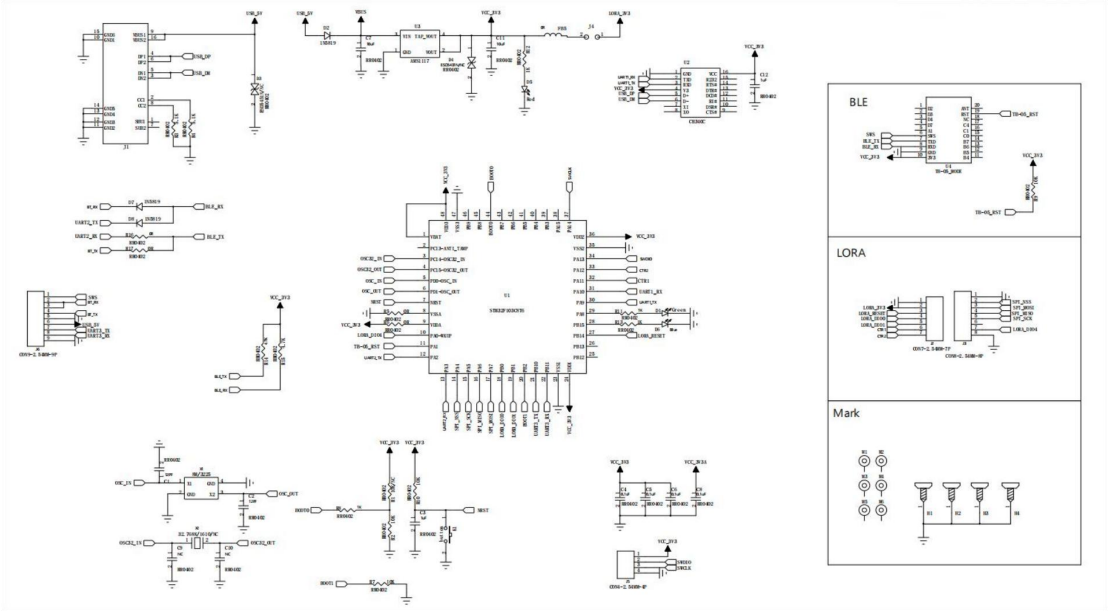


Figure 12 LoRa-Kit Development Board Schematic Diagram

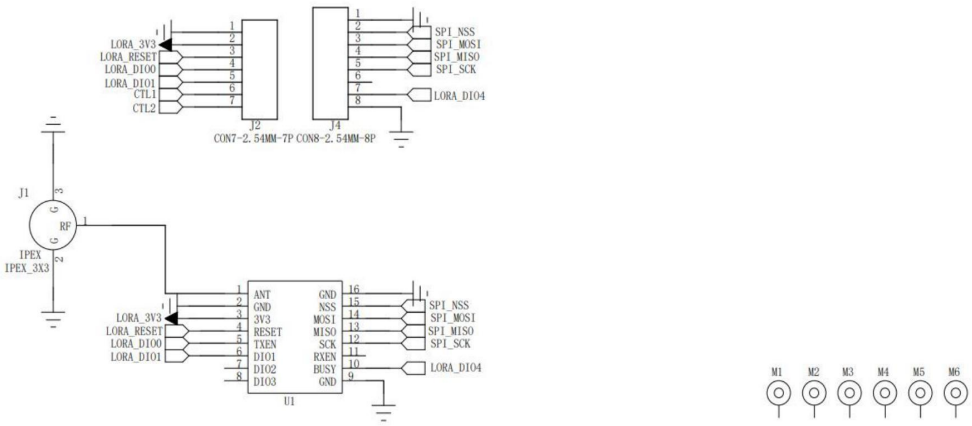


Figure 13 Ra-01 Adapter Board Schematic Diagram

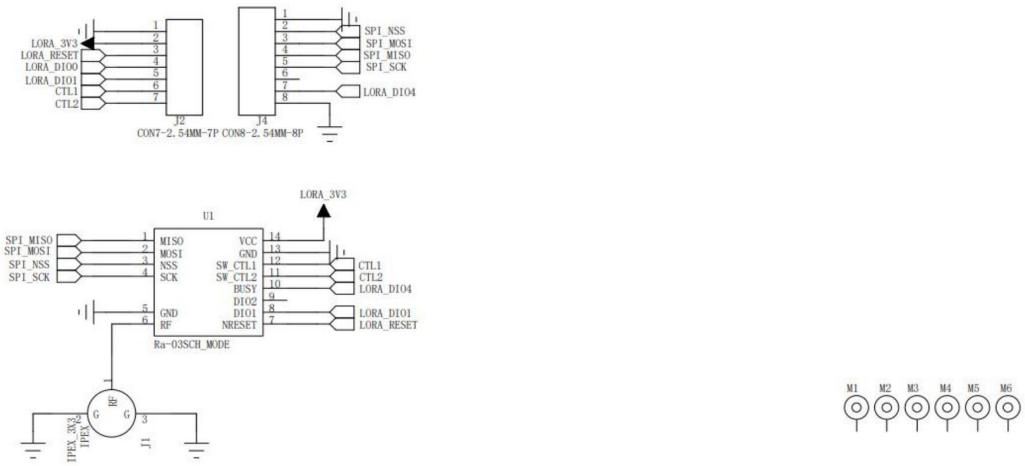


Figure 14 Ra-03 Adapter Board Schematic Diagram

6 Storage Conditions

The product sealed in a moisture barrier bag should be stored in a non-condensing ambient environment of <40 ℃/90% RH.

The moisture sensitivity level (MSL) of the module is Level 3.

After opening the vacuum bag, the module must be used up within 168 hours at 25±5 ℃/60% RH. Otherwise, it needs to be baked before being put back into production.

7 Packaging Information

Table 11 Packaging Information

Packaging Content	Packaging Method	Quantity Per Pack (ESD Bag)
LoRa-Kit	Foam + ESD bag	1 pcs

8 Contact Information

Official Website Official Forum Development DOCS LinkedIn
Tmall Store Taobao Store Alibaba Store

Technical Support: support@aithinker.com

Domestic Business Cooperation: sales@aithinker.com

Overseas Business Cooperation: overseas@aithinker.com

Company Address: Rooms 403–405, 408–410, Building C, Huafeng Smart Innovation Port, Gushu, Xixiang, Bao'an District, Shenzhen, Guangdong, China

Contact Hotline: 0755-29162996

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