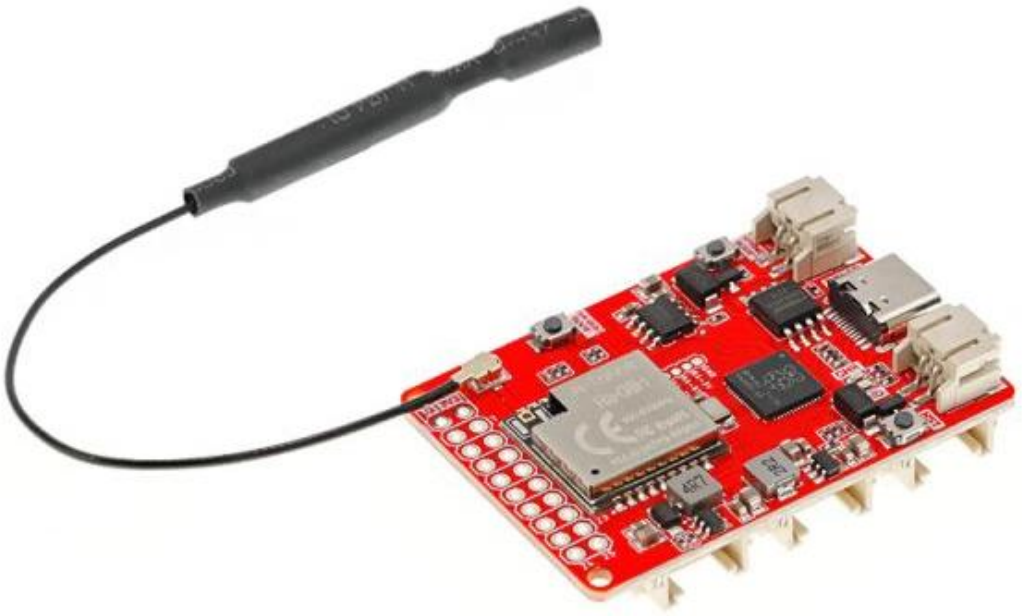
RA-08H LoRaWAN Node Board DataSheet



V1.0

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1 Overview

1.1 Product Description

The RA-08H Node Board is a high-performance IoT hardware platform based on the RP2040 dual-core ARM Cortex-M0+ microcontroller. It integrates the RA-08H module, supporting the 803-930MHz frequency band and the LoRaWAN protocol, with a transmit power of +22dBm and an ultra-high receive sensitivity of -138dBm@125kHz SF12. The hardware design includes 4MB Flash storage, 264KB SRAM, six 5V Crowtail interfaces (supporting analog/digital/UART/I2C), and a 20-pin GPIO expansion. It supports solar charging and lithium battery power supply, with an operational amplifier enabling high-precision analog signal acquisition, forming a complete chain from sensor data collection to LoRa wireless transmission.

The device features dual modes: LoRa point-to-point transparent transmission and LoRaWAN network compatibility. It supports Arduino/MicroPython development environments and can be quickly integrated with 150+ Crowtail ecosystem sensor modules.In its system architecture, the RP2040 microcontroller coordinates sensor data acquisition and communicates with the RA-08H module via LPUART for remote transmission, while status LEDs facilitate system monitoring. It is suitable for applications such as soil moisture monitoring in smart

agriculture, distributed sensor networks in industrial environments, and urban weather stations—particularly in outdoor IoT monitoring systems requiring low-power, wide-area transmission with multi-node, long-distance deployment.

1.2 Key Features

- **Powerful MCU Performance:** Equipped with the RP2040 microcontroller, featuring dual 32-bit ARM Cortex-M0+ cores, delivering robust processing power for device operations.
- **Wide Frequency Band Support:** Integrated RA-08H module supports the 803MHz–930MHz range, covering EU868 and US915 bands.
- **Rich Interface Resources:** Offers extensive external interfaces, compatible with 150+ Crowtail series modules for high expandability.
- **Flexible Transmission Modes:** Supports both LoRa point-to-point transparent transmission and LoRaWAN network connectivity, meeting diverse communication needs.
- **Multi-System Compatibility:** Works seamlessly with Arduino & MicroPython, enabling easy development across different projects.

1.3 Functions & Application Scenarios

The RA-08H node board can build a multi-functional environmental monitoring system through seamless integration with Crowtail ecosystem sensors. It supports connection to DHT20 temperature and humidity sensors for climate data collection, can be paired with GPS modules for precise positioning, and integrates Air Quality Sensor 2.0 and Ultraviolet Sensor 2.0 to form a comprehensive environmental parameter monitoring network.

Leveraging the long-distance and low-power characteristics of LoRa technology, the system is particularly suitable for distributed deployment scenarios, such as field environment monitoring in smart agriculture (integrated analysis of temperature, humidity, ultraviolet rays, and air quality), wild ecological research (mobile monitoring stations with GPS positioning), and toxic gas diffusion tracking in industrial plants. All sensor data can be uploaded to the cloud via LoRa point-to-point transmission or LoRaWAN network, enabling wide-area real-time environmental monitoring and early warning.

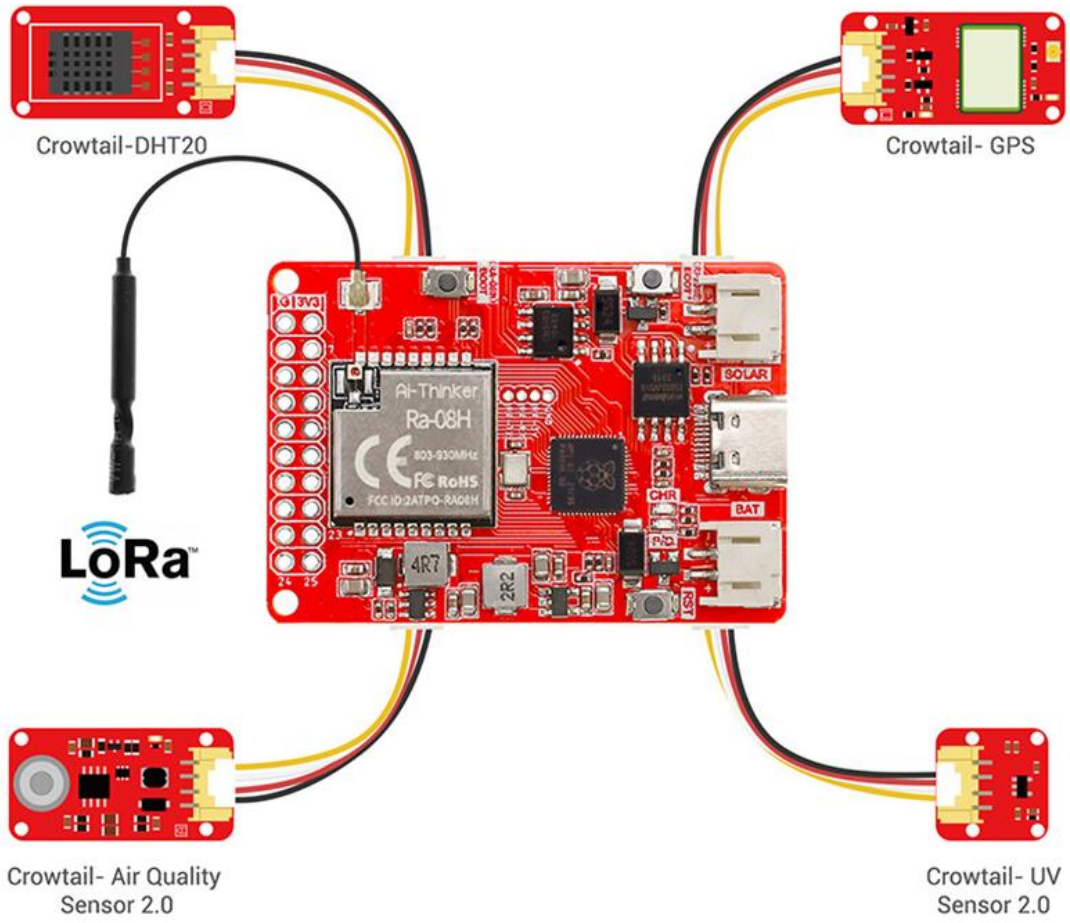

Figure 1:Function Application Diagram

2 Network Topology Diagram

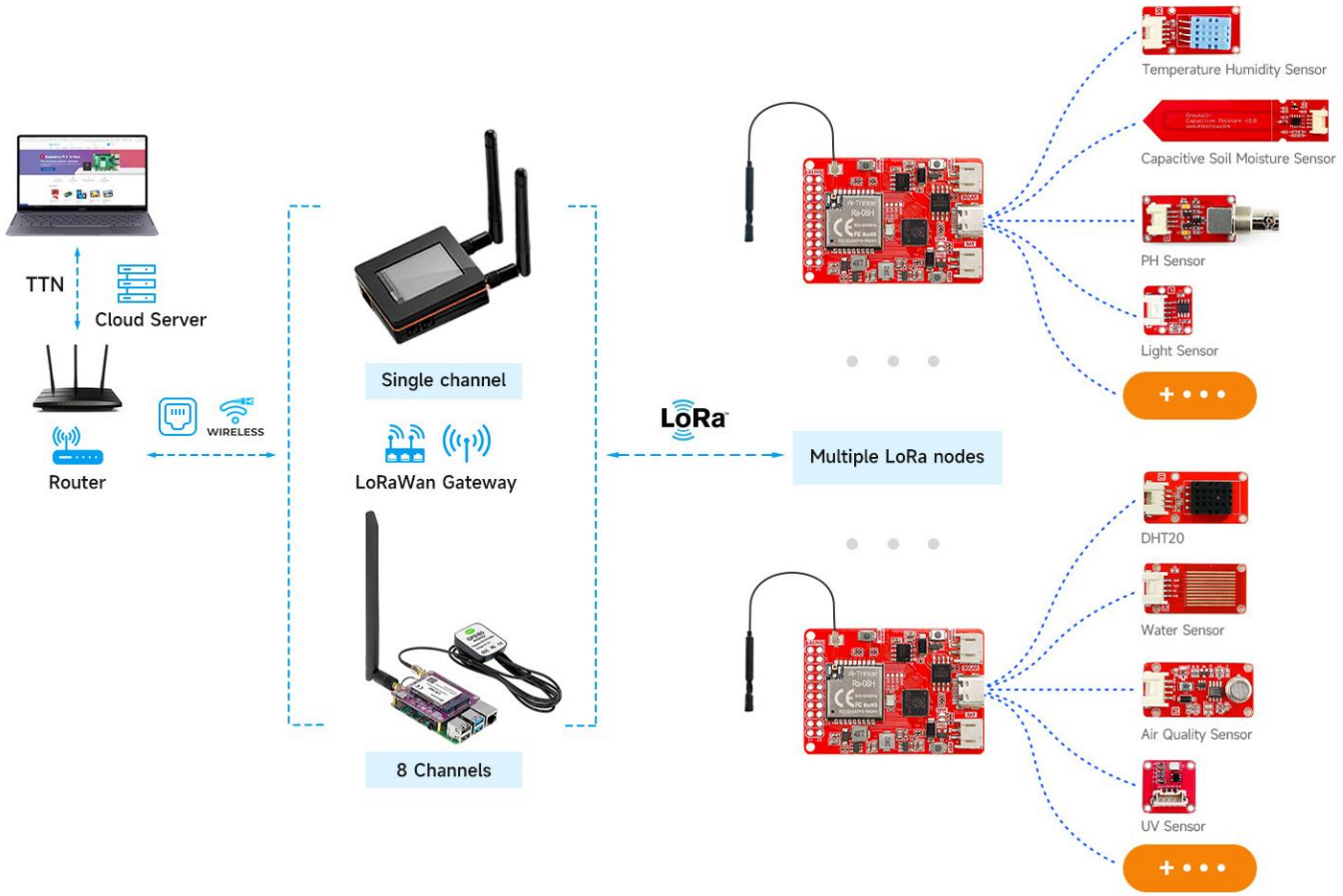

Figure 2:Network Topology Diagram

3 Product Appearance Diagrams

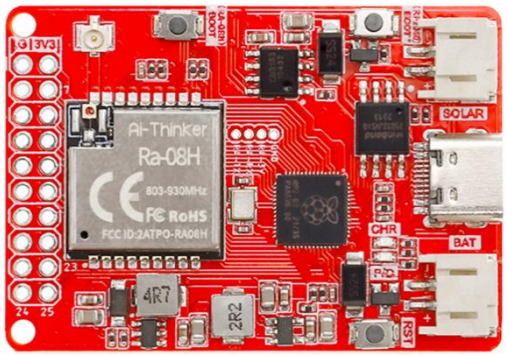

Figure 3:Front View

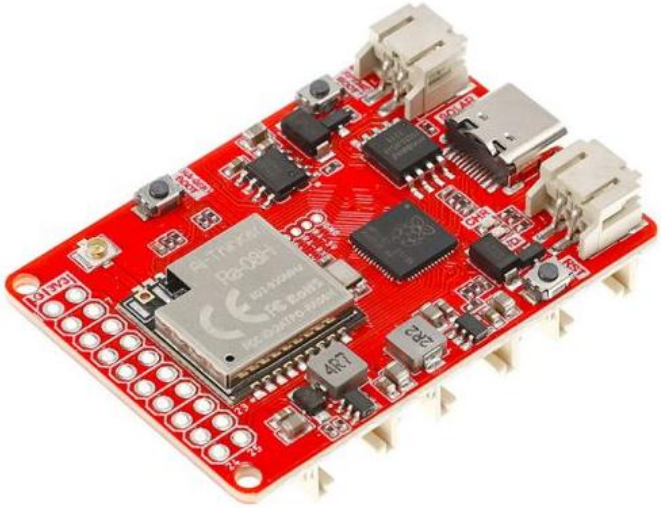

Figure 4:Side View

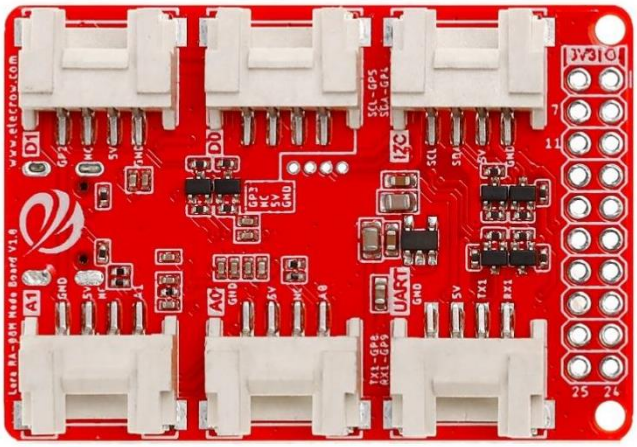

Figure 5:Back View

4 Dimension Diagram

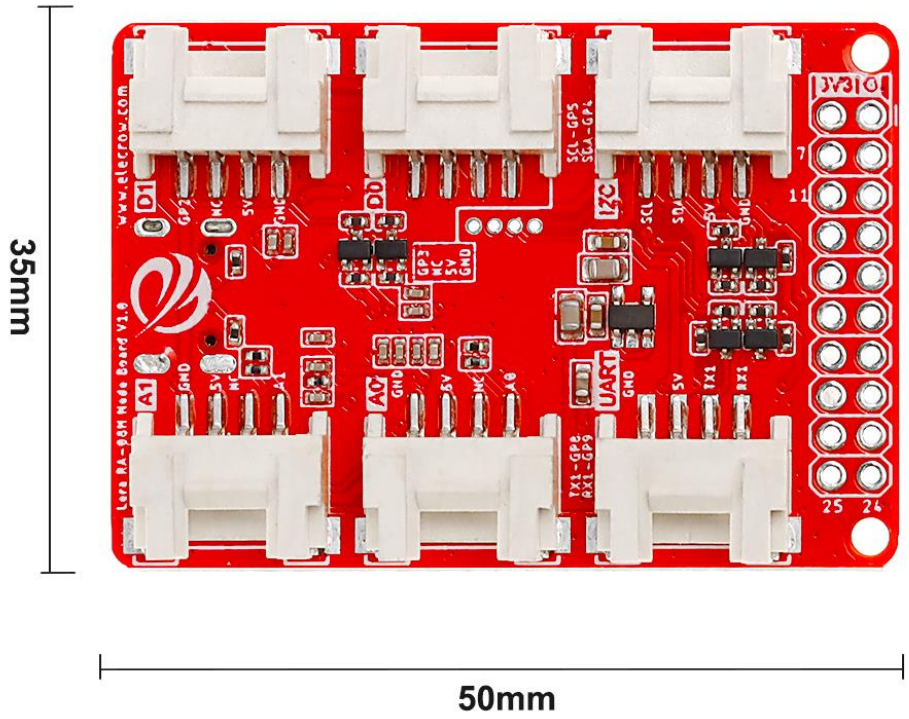

Figure 6:Dimension Diagram

5 System Block Diagram

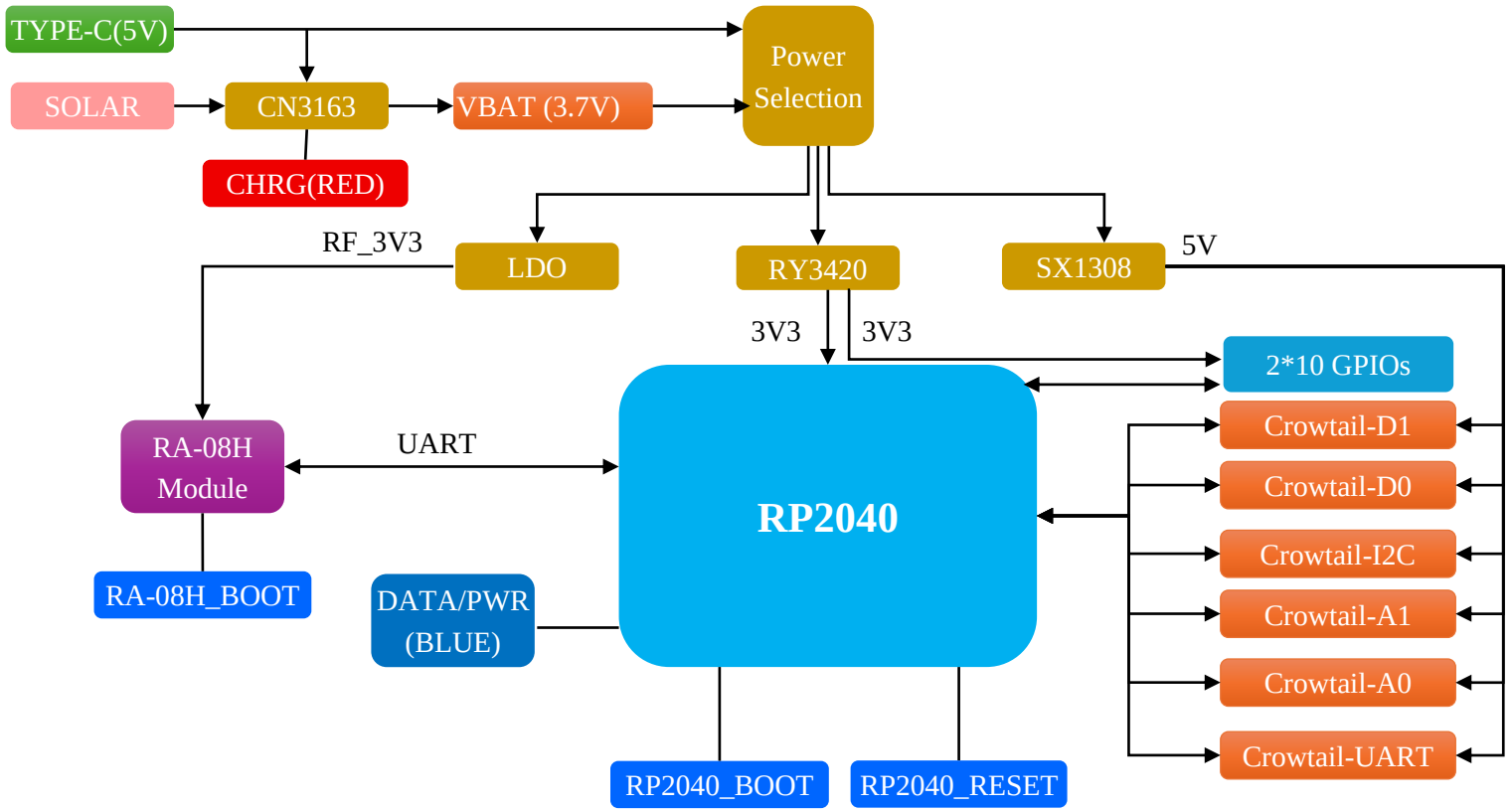

Figure 7:System Block Diagram of RA-08H Node Board

6 Hardware Overview

The hardware overview discusses the pin definitions and function descriptions of the RA-08H node board, covering the corresponding relationships and specific descriptions of pins for buttons/indicators and various interfaces.

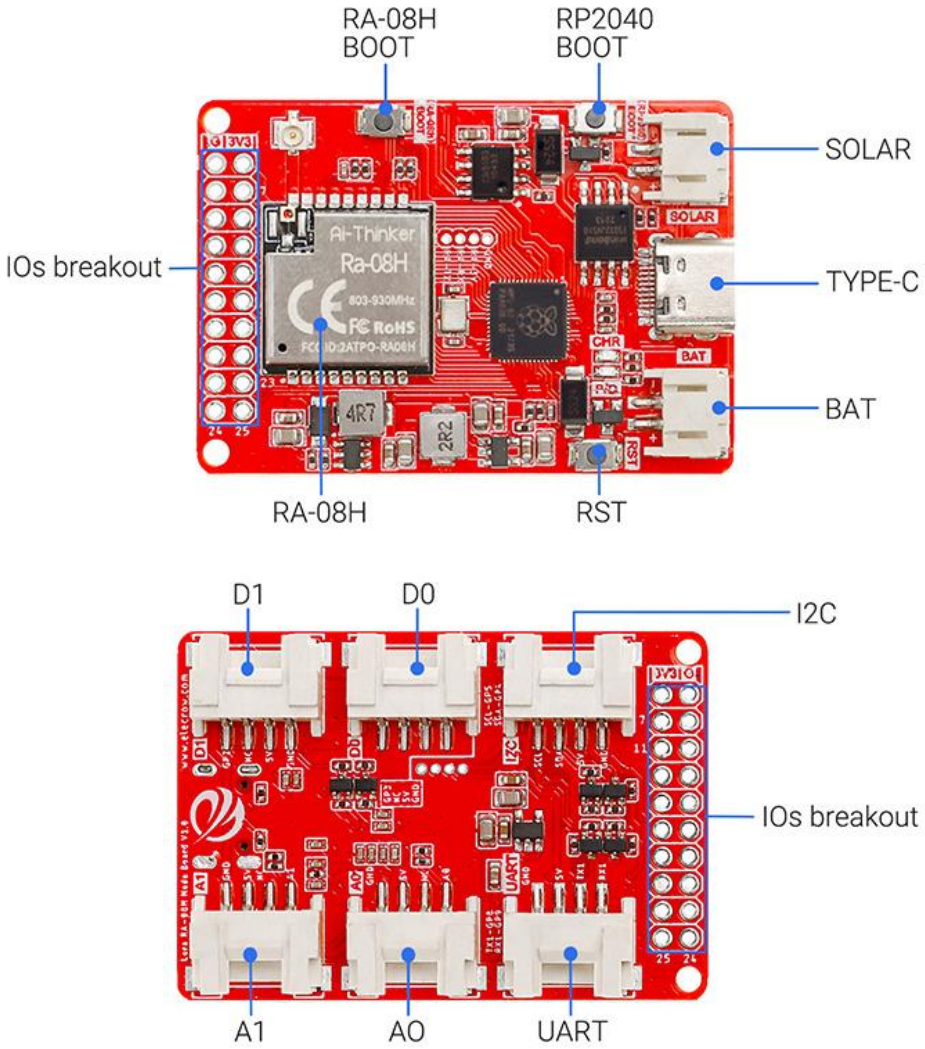

Figure 8:Schematic Diagram of RA-08H Node Board Interfaces

6.1 Pin Definitions and Functions of Buttons/Indicators

NO.	Button/Indicator Name	Silkscreen	State	Pin	RP2040 Pin	Description
1	RA-08H BOOT	RA-08H BOOT	Long press	IO2	/	For the RA-08H-BOOT button, press and hold it before powering on to put the RA-08H module into firmware burning mode.
2	RP2040 BOOT	RP2040 BOOT	Short press	BOOT	/	Download button. Press and hold the Boot button and press the RESET button to start the firmware download mode. Users can download firmware through the USB interface
3	RST	RST	Short press	RESET	RUN	When the RST button is pressed briefly, the RUN pin is pulled low, triggering RP2040 reset and quickly restoring the device to its initial operating state
4	DATA/PWR Indicator	P/D	BLUE	D25	GPIO25	Blue power indicator/RA-08H module data transceiver indicator, normally on by default, indicates when RA-08H communicates with the outside (needs to be set by the user)
5	CHR Indicator	CHR	RED	CHRG	/	Red indicator, used to indicate the charging status, stays on when charging, and turns off when fully charged. Indicates during charging. Can be charged by connecting a power cord through the USB interface or using a solar panel. The red light is on when the battery is charging and turns off when fully charged

6.2 Pin Definitions and Functions of Interfaces

NO.	Interface Name	Silkscreen	Pin	RP2040 Pin	Voltage	Description
1	Type-C Interface	/	DP DN USB_D- USB_D+	USB_D- USB_D+	5V	USB-C interface, which serves as the power supply for the node board, the communication interface between the PC and RP2040, and charges the lithium battery when an external lithium battery is connected.
2	SOLAR	SOLAR	SOLAR	/	5V	PH2.0-5V solar panel interface, which can be used to connect an external solar panel to charge the lithium battery.
3	BAT	BAT	VBAT	/	3.7V	PH2.0-3.7V lithium battery interface, which can be used to connect an external 3.7V lithium battery.
4	D1	D1	D2_H	GPIO2	5V	External Crowtail-5V - HY-4P-2.0 port. It can be used to connect 5V Crowtail sensors or modules with digital signals.
5	D0	D0	D3_H	GPIO3	5V	External Crowtail-5V - HY-4P-2.0 port. It can be used to connect 5V Crowtail sensors or modules with digital signals.
6	I2C	I2C	D4/SDA0_H D5/SCL0_H	GPIO4 GPIO5	5V	External Crowtail-5V - HY-4P-2.0 port. It can be used to connect 5V Crowtail sensors or modules with I2C interface

						communication (such as temperature and humidity, GPS, etc.), and realize digital signal acquisition through RP2040 control.
7	IOs breakout	3V3|G	D6 D7 D8 D9 D10 D11 D12 D13 D14 D15 D16 D17 D18 D19 D20 D21 D22 D23 D24 D25	GPIO6 GPIO7 GPIO8 GPIO9 GPIO10 GPIO11 GPIO12 GPIO13 GPIO14 GPIO15 GPIO16 GPIO17 GPIO18 GPIO19 GPIO20 GPIO21 GPIO22 GPIO23 GPIO24 GPIO25	3.3V	20-pin general-purpose GPIO interface, supporting the expansion of more peripherals.
8	A1	A1	A1_IN	ADC1	5V	External Crowtail-5V - HY-4P-2.0 port. It can be used to connect 5V Crowtail sensors or modules with analog signals (such as ultraviolet, air quality). The signals are amplified and conditioned by the SGM321YN5 operational amplifier, and then collected through the ADC pin of RP2040 to ensure data accuracy.
9	A0	A0	A0_IN	ADC0	5V	External Crowtail-5V - HY-4P-2.0 port. It can

						be used to connect 5V Crowtail sensors or modules with analog signals (such as ultraviolet, air quality). The signals are amplified and conditioned by the SGM321YN5 operational amplifier, and then collected through the ADC pin of RP2040 to ensure data accuracy.
10	UART	UART	D8/TX1_H D9/RX1_H	GPIO8 GPIO9	5V	External Crowtail-5V - HY-4P-2.0 port. It can be used to connect 5V Crowtail sensors or modules with UART serial communication (such as temperature and humidity, GPS, etc.), and realize digital signal acquisition through RP2040 control.
11	RA-08H Module	/	D0/TX0 D1/RX0	GPIO0 GPIO1	3.3V	RA-08H, controlled by sending AT commands through the serial port, communicates with RP2040 via the UART interface (TX0/RX0 pins), and wirelessly transmits the data collected by the sensors, forming a LoRa IoT link.

7 Technical Specifications

NO.	Item Group	Item	Parameter
1	Raspberry Pi Chip RP2040	Processor	Dual-core Arm Cortex-M0+ @ 133MHz
2		SRAM	264KB
3		Flash	4M
4	RA-08H Module	RF Module	RA-08H module (chip ASR6601)
5		Processor	Built-in 32-bit RISC MCU, based on ARM Cortex-M4 core, operating frequency 48MHz
6		RAM	16KB
7		Flash	128KB
8		TX Transmission Power	Theoretical maximum transmission power is +22dBm
9		RX Receiving Sensitivity	-138dBm@125kHz SF12
10		LoRaWAN Protocol	Supported
11		Supported Frequency Bands	EU868, US915
12		Frequency Range	803 MHz to 930 MHz
13		Signal Modulation Modes	LoRa®, (G)FSK, (G)MSK, BPSK
14		Power Supply Range	2.7~3.6V, supply current > 500mA
15		Antenna Type	Half-hole pad, through-hole pad or IPEX interface
16		Module Size	16mm×16mm×3.2mm (±0.2mm)
17	Mechanical Characteristics	Size	35*50mm
18	Electrical Characteristics	Standby Power Consumption	0.1W
19	Interfaces	Communication Interfaces	➢ 1*USB-C interface (DC 5V/1A) ➢ 6*5V Crowtail interfaces (2 analog interfaces, 2 digital interfaces, 1 UART interface, 1 I2C interface) ➢ 2x10 general-purpose GPIO interfaces ➢ 1*battery interface (3.7V-4.2V) ➢ 1*solar interface (4.4V-6V)
20		External Antenna	External LoRa spring antenna (868MHz/915MHz)

8 Environmental Characteristics

8.1 Extreme Operating Conditions

NO.	Item	Description	Minimum Value	Maximum Value	Unit
1	VCCmr	Supply Voltage	3.7	5.5	V
2	Tmr	Ambient Temperature	-40	+85	℃

8.2 Normal Working Conditions

NO.	Item	Description	Minimum Value	Typical Value	Maximum Value	Unit
1	VCCop	Supply Voltage	3.7	5	5.5	V

9 Related Documents

- **RA-08H Node Board Product Link**
- **RA-08H Module Datasheet**

10 Revision History

Date	Version	Release Notes
2025/8/31	V1.0	First release