Ra-09-DTU Specification

Version V1.2.0

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Document resume

Version	Date	Develop/revise content	Edition	Approve
V1.2.0	2023.12.01	First Edition	YingYing Chen	Hong Xu

Content

1. Product overview

Ra-09-DTU equipment is a LoRa related DTU equipment designed and developed by Shenzhen Ai-Thinker Technology Co., LTD., which is used for ultra-long distance extended frequency communication. Its chip STM32WLE5CCU6 is the universal LPWAN wireless communication SoC, which integrates RF transceiver, modem and 32-bit Arm® Cortex® -M4 MCU. The MCU uses an ARM kernel with an operating frequency of up to 48 MHz. The Ra-09-DTU device supports LoRa modulation and conventional (G) FSK modulation; the transmitter also supports BPSK modulation and (G) MSK modulation, and the receiver supports (G) MSK modulation.

STM32WLE5CCU6 Module provides ultra-long range and ultra-low power communication for LPWAN applications, which can be widely used in intelligent instrumentation, supply chain and logistics, home building automation, security systems, remote irrigation systems and other scenarios.

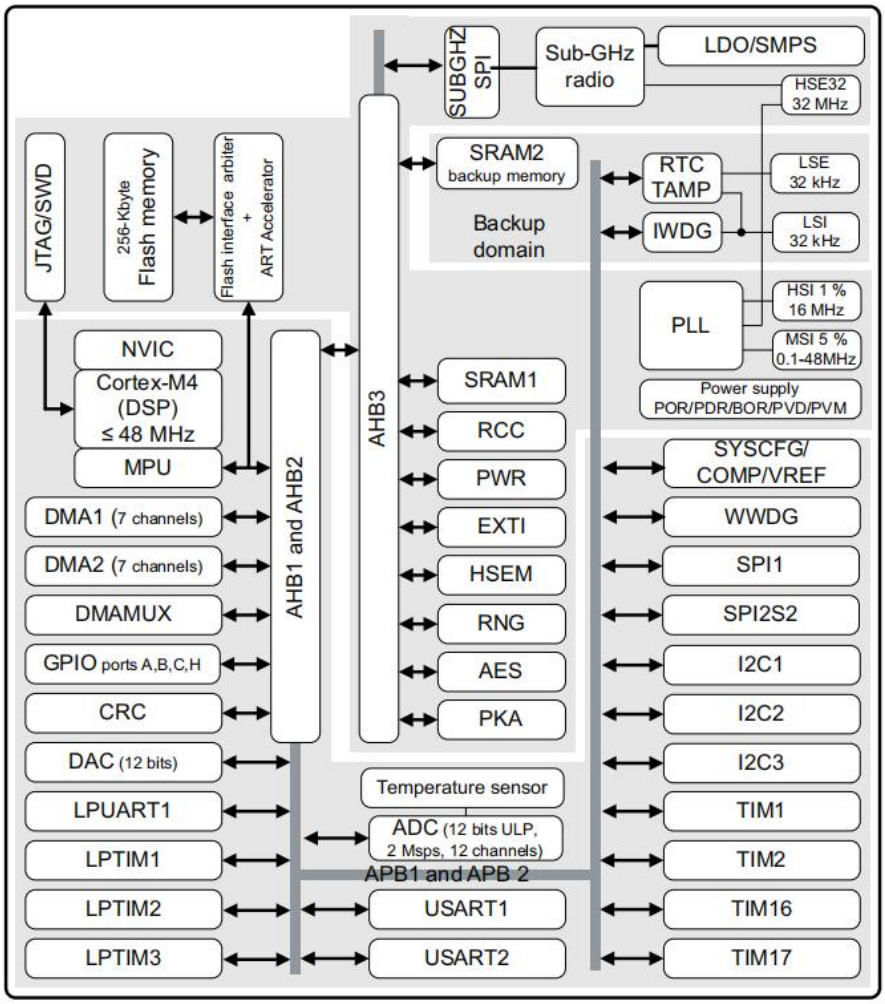


Figure 1 Main chip architecture diagram

1.1. Characteristic

- Supported frequency band: 410MHz-525MHz
- The operating voltage is 9~ 28 V, with the theoretical maximum transmitting power+ 22 dBm
- High sensitivity: -140dBm @125KHz SF12
- Support for the expansion factor SF5/SF6/SF7/SF8/SF9/SF10/SF11/SF12
- Embedded memory: 256KB FLASH, 64KB RAM
- Support LoRa / (G) FSK / BPSK / (G) MSK modulation
- The antenna interface is the SMA interface
- Support multiple dormancy modes: deep sleep current as low as 0.1 uA

1.2. Typical application scenarios

- ✓ Intelligent household electrical appliance
- ✓ Intelligent business
- ✓ Smart security
- ✓ Smart lighting
- ✓ Smart factory
- ✓ Smart storage
- ✓ Remote meter reading
- ✓ Agricultural irrigation

2. Main parameter

Table 1 Main parameter description

Model	Ra-09-DTU
Package	Electrical cabinet fence
Size	37.0*88.0*59.2(±1)mm
Antenna	SMA interface
Frequency range	410-525MHz
Operation temperature	-40 ℃ ~ 85 ℃
Storage environment	-40 ℃ ~ 125 ℃ , < 90%RH
Power supply	Typical value 12V, Power supply range 9~28V, Power supply current > 500mA
Power supply	UART
IO	4
Series Rate	Support 110 to 4608000 bps, default is 9600 bps
Crystal frequency	32MHz
Flash	256KB
Transport Protocol	LoRaWAN
Transmission distance	The open field is equipped with a sucker antenna can reach 4.8km

2.1. Electrostatic requirements

Ra-09-DTU is electrostatic sensitive equipment that requires special precautions during handling.

Figure 2 ESD Anti-static diagram

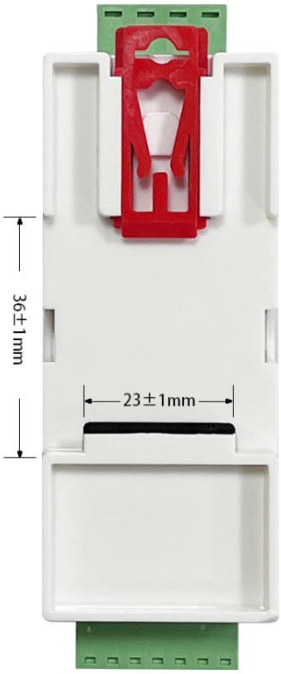
2.2. RF Parameters

Table 2 RF parameters

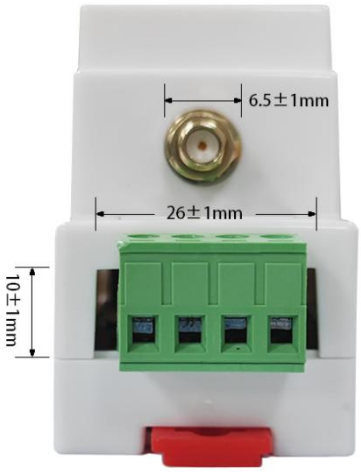
Output Power					
PA parameter	**Frequency band**	**Min.**	**Typical value**	**Max.**	**Unit**
Output Power	433MHz	-	21	22	dBm
Output Power	470MHz	-	21	22	dBm
Output Power	490MHz	-	21	22	dBm
Output Power	510MHz	-	21	22	dBm
Receiving sensitivity Modulation bandwidth 125kHz					
Model		**Min.**	**Typical value**	**Max.**	**Unit**
SF7		-	-123	-	dBm
SF8		-	-126	-	dBm
SF9		-	-128	-	dBm
SF10		-	-131	-	dBm
SF11		-	-135	-	dBm
SF12		-	-140	-	dBm

3. Appearance size

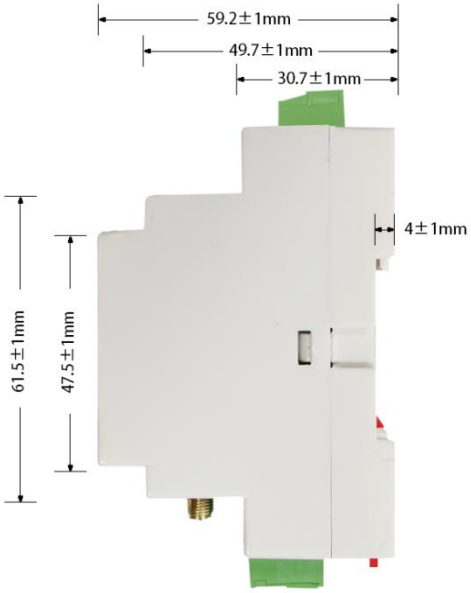
Top View



Bottom view



Front view



Left view

Figure 3 Module appearance and size

(The rendering is for reference only, subject to the actual object)

4. Pin definition

Ra-09-DTU device connects to a total of 11 pins and an SMA interface. For example, the pin diagram is shown in the pin function definition table.

Power supply port　　Serial port

Figure 4 Schematic diagram of module pins

Table 3 Pin function definition table

No.	Name	Function
1	DC+	Dc power supply positive
2	DC-	Negative DC power supply
3	IN-	External input signal positive
4	IN+	External input signal negative
5	A	A phase of the RS485
6	B	B phase of the RS4853
7	GND	Common ground pin
8	TX	TX pin of RS232(NC, if you need to use, please contact Ai-Thinker)
9	RX	RX pin of RS232NC, if you need to use, please contact Ai-Thinker)
10	OUT	Relay output
11	COM	Relay COM terminal
12	SMA	Antenna SMA interface

5. Schematic

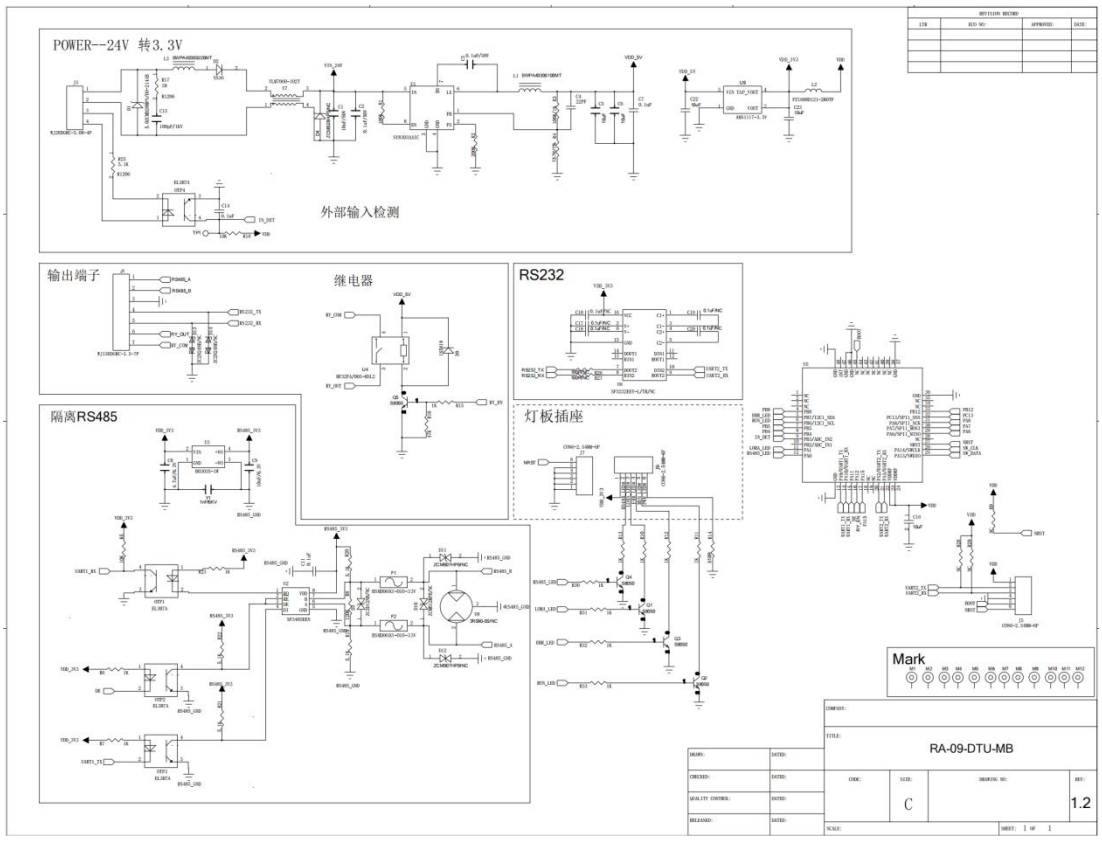


Figure 5 Schematic diagram

6. Design guidance

6.1. Power Supply

- Recommended 9~28V voltage, peak current above 500mA.

6.2. GPIO

- Ra-09-DTU peripherals lead to some IO, If necessary, it is recommended to use a 10-100 ohms series resistor on the IO port. This can suppresses overshoot and make the levels on both sides more stable. Helps with both EMI and ESD.

7. FAQ

7.1. Factors affecting transmission distance

(1) When there is a linear communication barrier, the communication distance will decay accordingly;

(2) Temperature, humidity, same frequency interference, will lead to increased communication packet loss rate;

(3) The ground absorbs and reflects radio waves, and the test effect near the ground is poor.

(4) Sea water has a strong ability to absorb radio waves, so the seaside test effect is poor;

(5) There are metal objects near the antenna, or placed in a metal shell, the signal attenuation will be very serious;

(6) The power register is set incorrectly, the air speed is set too high, the higher the air speed, the closer the distance;

(7) At room temperature, the low voltage of the power supply is lower than the recommended value, and the lower the voltage, the smaller the transmission power;

(8) The poor matching degree between the antenna and the module or the quality problem of the antenna itself.

7.2. Factors that cause interference to the device

(1) There's a cofrequency interference nearby, stay away from interference sources or modify the frequency and channel to avoid interference;

(2) The power supply is not ideal may also cause garbled codes, be sure to ensure the reliability of the power supply;

8. Storage conditions

Products sealed in moisture-proof bags should be stored in a non-condensing atmospheric environment of <40℃/90%RH.

The module has a moisture sensitivity level MSL of level 3.

After the vacuum bag is unsealed, it must be used within 168 hours at 25±5℃/60%RH, otherwise it needs to be baked before it can be put on line again.

9. Product packaging information

Table 4 Packaging Information Table

Packing list	Packing way	Quantity per package	Quantity per package
Ra-09-DTU	PE bag	1pcs	15pcs

10.Contact us

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