RAK11720 WisDuo LPWAN Module Datasheet

Overview

Description

RAK11720 is a low-power long-range LoRaWAN module based on Ambiq Apollo3 Blue AMA3B1KK-KBR-B0 SoC MCU that supports Bluetooth 5.0 (Bluetooth Low Energy) and SX1262 LoRa transceiver from Semtech. This module complies with Class A, B, & C of LoRaWAN 1.0.3 specifications and also supports LoRa Point-to-Point (P2P) communication mode, which helps you implement your own customized LoRa network quickly. The two RF communication characteristic of the module (LoRa + BLE) makes it suitable for a variety of applications in the IoT field, such as home automation, sensor networks, building automation, and IoT network applications.

The default firmware of RAK11720 is based on RUI3 (RAKwireless Unified Interface). This allows you to easily use RAK11720 as a stand-alone module by developing your own custom firmware via Arduino compatible RUI3 APIs. You can directly interface sensors and other external peripherals to it without needing an additional MCU. In addition to that, RAK11720 can still be interfaced to an external host MCU using AT commands via UART or via BLE connection.

> 📝 **NOTE**
>
> There are two variants available for the RAK11720 Module:
> (1) With MHF4 IPEX connector to connect external antennas
> (2) No IPEX connector but with RF pinout to connect custom antenna

Features

- Based on **AMA3B1KK-KBR-B0** and **SX1262**
- ARM Cortex-M4F
- 1 MB Flash and 348 KB SRAM
- **LoRaWAN 1.0.3** specification compliant
- **Supported bands**: EU433, CN470, IN865, EU868, AU915, US915, KR920, RU864, and AS923-1/2/3/4
- LoRaWAN Activation by OTAA/ABP
- LoRa Point-to-Point (P2P) communication
- Custom firmware using Arduino via RUI3 API
- Easy-to-use AT Command set via UART interface
- I/O ports: UART/I2C/SPI/ADC/GPIO
- Long-range - greater than 10 km with optimized antenna
- Ultra-low-power consumption of 2.37 µA in sleep mode
- **Supply Voltage**: 1.8 V ~ 3.6 V
- **Temperature range**: -40° C ~ 85° C

Specifications

Overview

Block Diagram

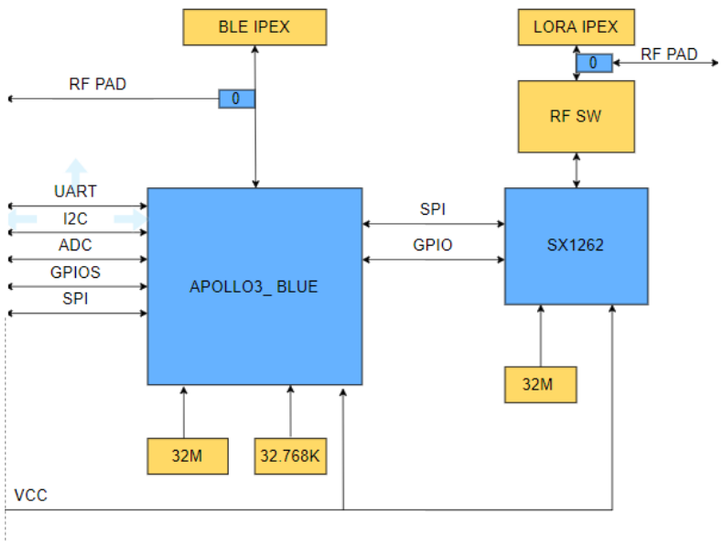

Figure 1: RAK11720 System Block Diagram

Hardware

The hardware specification is categorized into three parts. It covers the RF, electrical, and mechanical parameters that include the tabular data of the functionalities and standard values of the RAK11720 WisDuo LPWAN Module.

Interfaces

Module	Interfaces
RAK11720	UART0 (Default for AT command and FW update)

Pin Definition

Pin No.	Name	Type	Description
1	GP43/UART1_RX	I/O	GPIO and UART2 Interface (RX)
2	GP42/UART1_TX	I/O	GPIO and UART2 Interface (TX)
3	GP12/ADC9	I/O	GPIO and ADC
4	GP39/UART0_TX	I/O	GPIO and UART0 Interface(TX) - AT Command and FW Update
5	GP40/UART0_RX	I/O	GPIO and UART0 Interface (RX) - AT Command and FW Update
6	GP45	I/O	GPIO only
7	GP21/SWDIO		GPIO and SWD debug pin (SWDIO)
8	GP20/SWDCK		GPIO and SWD debug pin (SWDCK)
9	GP27/I2C2_SCL	I/O	GPIO and I2C2 (SCL)
10	GP25/I2C2_SDA	I/O	GPIO and I2C2 (SDA)

Pin No.	Name	Type	Description
11	GND	POWER	Ground connections
12	LORA RF	RF	LORA RF Port (only available on **RAK11720 NO-IPEX connector variant**)
13	GP7/SPI0_MOSI	I/O	GPIO and SPI0 (MOSI)
14	GP6/SPI0_MISO	I/O	GPIO and SPI0 (MISO)
15	GP5/SPI0_CLK	I/O	GPIO and SPI0 (CLK)
16	GP1/SPI0_NSS	I/O	GPIO and SPI0 (NSS)
17	GND	POWER	Ground connections
18	GND	POWER	Ground connections
19	GP4	I/O	GPIO only
20	GP36	I/O	GPIO only
21	SWO	I/O	SBL log output
22	RST		MCU Reset (nRST)
23	GND	POWER	Ground connections
24	VDD	POWER	VDD - Voltage Supply
25	GP32/ADC4	I/O	GPIO and ADC
26	GP31/ADC3	I/O	GPIO and ADC
27	GP37	I/O	GPIO only
28	GND	POWER	Ground connections
29	GP44	I/O	GPIO only
30	GP38	I/O	GPIO only
31	GP33/ADC5	I/O	GPIO and ADC
32	GP13/ADC8	I/O	GPIO and ADC
33	BLE RF	RF	BLE RF Port (only available on **RAK11720 NO-IPEX connector variant**)

Pin No.	Name	Type	Description
34	GND	POWER	Ground connections

RF Characteristics

The RAK11720 module supports the LoRaWAN bands shown in the table below. When buying a RAK11720 module, pay attention to specifying the correct core module RAK11720 H/L for your region, in which H stands for high-frequency regions and L for low-frequency regions.

Module	Region	Frequency
RAK11720 (L)	Europe	EU433
	China	CN470
RAK11720 (H)	Europe	EU868
	North America	US915
	Australia	AU915
	Korea	KR920
	Asia	AS923-1/2/3/4
	India	IN865
	Russia	RU864

Electrical Characteristics

Operating Voltage

Feature	Minimum	Typical	Maximum	Unit
VCC	1.8	3.3	3.6	Volts (V)

Operating Current

Feature	Condition	Minimum	Typical	Maximum	Unit
Operating Current	BLE TX Mode	-	12.7 @4.0 dBm	-	mA
	LORA TX Mode	-	87 @ 20 dBm, 868 MHz	-	mA

Sleep Current

Feature	Condition	Minimum (2.1 V)	Typical (3.3 V)	Maximum	Unit

Feature	Condition	Minimum (2.1 V)	Typical (3.3 V)	Maximum	Unit
Current Consumption	EU868	-	2.37	-	μA
	US915	-	2.37	-	μA
	CN470	-	2.37	-	μA

Mechanical Characteristics

Module Dimensions

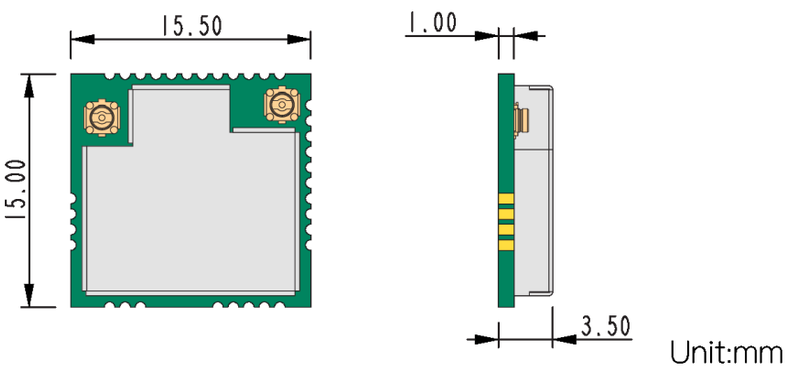

Figure 2: Board dimension

Layout Recommendation

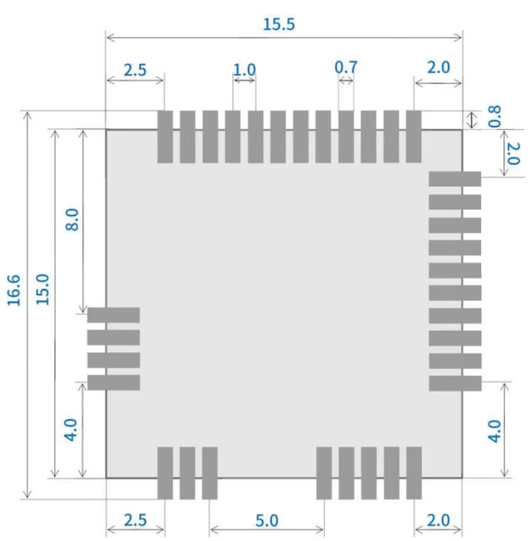

Figure 3: PCB footprint and recommendations

Environmental Characteristics

Operating Temperature

Feature	Minimum	Typical	Maximum	Unit
Operating Temperature	-40	25	85	°C

Storage Temperature

Feature	Minimum	Typical	Maximum	Unit
Storage Temperature	-40	-	85	°C

Recommended Reflow Profile

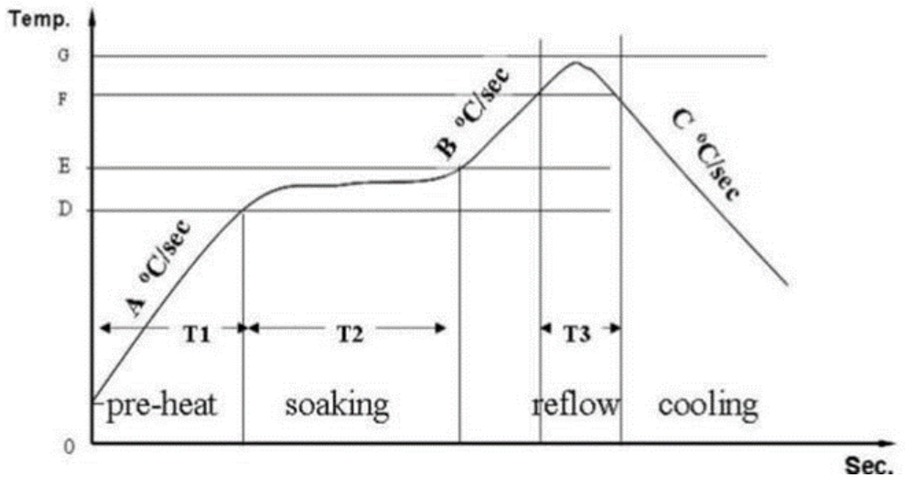

Figure 4: Reflow Profile for RAK11720

Standard conditions for reflow soldering:

- Pre-heating Ramp (A) (Initial temperature: 150° C): **1~2.5° C/sec**
- Soaking Time (T2) (150~180° C): **60~100 sec**
- Peak Temperature (G): **230~250° C**
- Reflow Time (T3) (>220° C): **30~60 sec**
- Ramp-up Rate (B): **0~2.5° C/sec**
- Ramp-down Rate (C): **1~3° C/sec**

Software

Download the latest RAK11720 WisDuo LPWAN Module firmware provided below. RAK11720 (L) and RAK11720 (H) use the same firmware and it will automatically detect the variant of the module being used.

Firmware

Model	Note	Source
RAK11720 (.bin via UART)	(default baudrate = 115200)	Download
RAK11720 (.bin via BLE)		Download
RAK11720 (.hex)		Download

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