RAK3400 LoRa Module

WisDuo Series

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1 Introduction

This document defines RAK3400 module and describes hardware interface which are connected with customers applications.

This document helps customers quickly understand the interface specifications, electrical and mechanical details, as well as other related information of RAK3400.

2 Overview

2.1 General description

RAK3400 is an BLE5.0 wireless communication module, it includes an nRF52840, Ultra-low power consumption of 2.0uA in sleep mode, and BLE output power up to 4dBm.

The module supports BLE 5.0. Its RF communication capabilities make it suitable for a variety of applications in the IoT field.

2.2 Main Features

- Compact Form Factor: 15 x 23 x 3 mm
- 44 Pin Stamp Pad for PCB SMT mounting
- I/O ports: UART/I2C/GPIO/USB/SPI (optional NFC interface)
- Temperature range: -40°C to +85°C
- Supply voltage: 2.0 ~ 3.6V
- Ultra-Low Power Consumption 2.0uA in sleep mode
- BLE5.0 (Tx power -20 to +4 dBm in 4dB steps)

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2.3 Block Diagram

The following figure shows a block diagram of RAK3400.

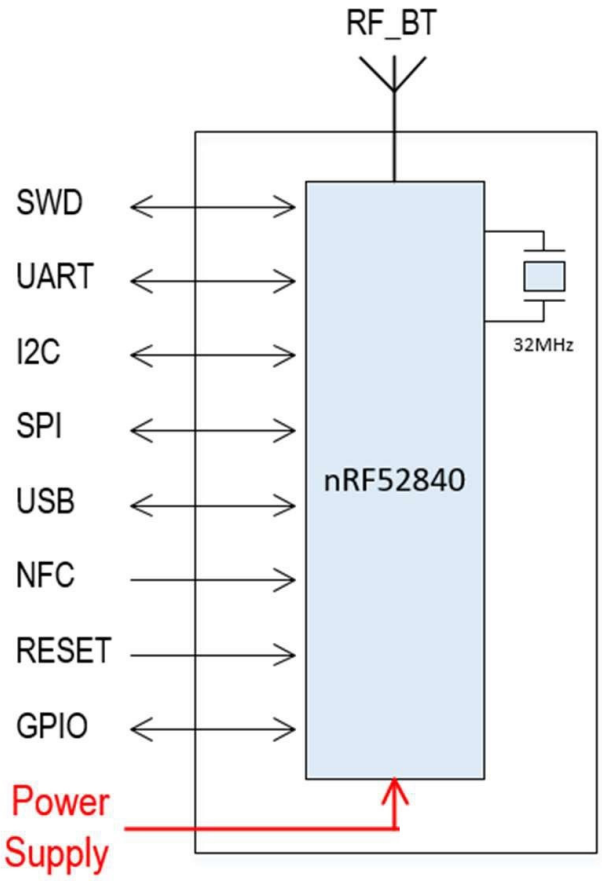

Figure 1: Block Diagram

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2.4 Pin Assignment

The following figure shows the pin assignment of RAK3400 module.

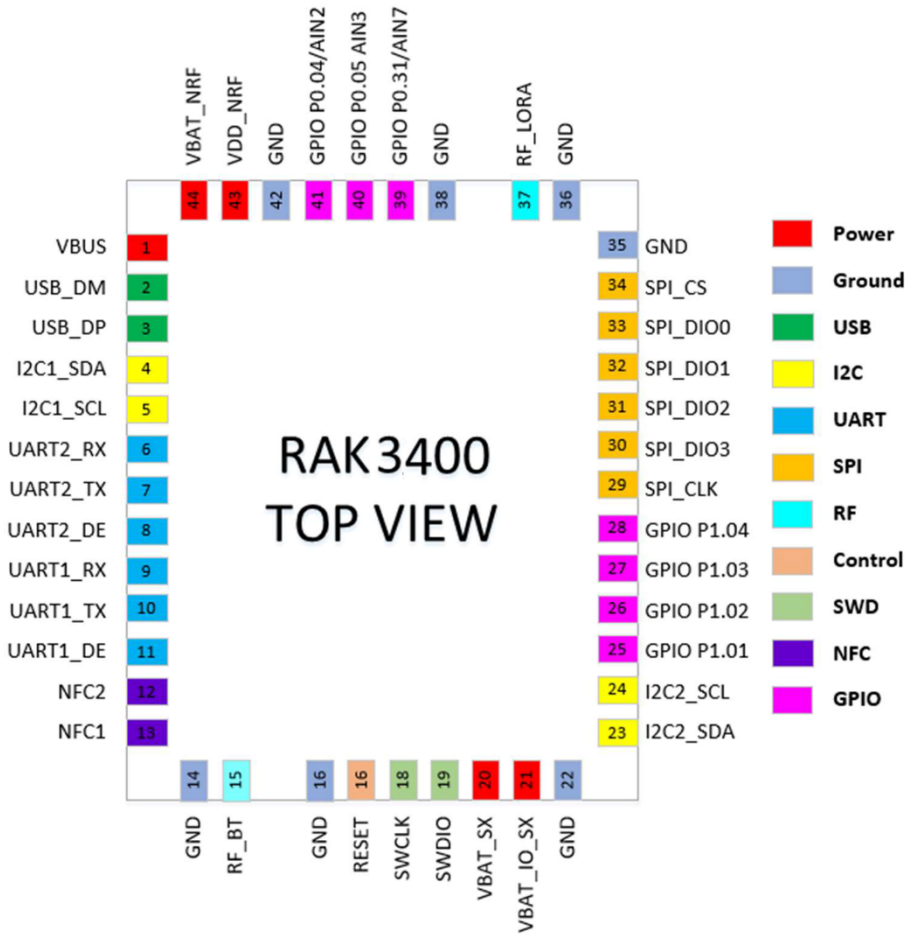

Figure 2: Pin Assignment

- NOTES

  - For single 3.3V power supply, connect VBAT_NRF, VDD_NRF, together with 3.3V power
  - For 3.6V li-SOCL2 battery or 4.2V li-MnO2 battery, connect VBAT_NRF with battery output, VDD_NRF can use to indicate IO voltage level. Please don't power any chip with VDD_NRF.
  - GND pins should be connected to ground in the design.
  - VBAT_SX, VBAT_SX_IO is reserved, they are not connected to any chips in RAK3400 module.

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2.5 Pin Description

The following tables show the pin definition and description of RAK3400.

Table 2: Definition of I/O Parameters

Type	Description
PI	Power Input
PO	Power Output
DI	Digital Input
DO	Digital Output
IO	Bidirectional
AI	Analog Input
AO	Analog Output

Table 3: Pin Description

Power Supply				
Pin Name	Pin No.	Type	Description	Comment
VDD_NRF	43	PI	Power supply	
VBAT_NRF	44	PI	High Power supply	
GND	14,16, 22,35, 36,38, 42	Ground		
I2C Interface				
Pin Name	Pin No.	Type	Description	Comment
I2C1_SDA	4	IO	I2C serial data	P0.13
I2C1_SCL	5	OD	I2C serial clock	P0.14
I2C2_SDA	23	IO	I2C serial data	P0.24
I2C2_SCL	24	OD	I2C serial clock	P0.25
USB Interface				
Pin Name	Pin No.	Type	Description	Comment
VBUS	1	PI	USB power	5V input for 3.3V regulator
USB_DP	3	IO	USB differential data(+)	
USB_DM	2	IO	USB differential data(-)	
UART Interface				
Pin Name	Pin No.	Type	Description	Comment
UART1_TX	10	DO	UART1 transmit	P0.20
UART1_RX	9	DI	UART1 receive	P0.19
UART1_DE	11	DI	UART1 detect	P0.21
UART2_TX	7	DO	UART2 transmit	P0.16
UART2_RX	6	DI	UART2 receive	P0.15
UART2_DE	8	DI	UART2 detect	P0.17
Quad SPI Interface				
Pin Name	Pin No.	Type	Description	Comment
SPI_CLK	29	DO	SPI clock	P0.03
SPI_CS	34	DO	SPI chip select	P0.26
SPI_DIO0	33	IO	SPI data input/output 0	P0.30
SPI_DIO1	32	IO	SPI data input/output 1	P0.29
SPI_DIO2	31	IO	SPI data input/output 2	P0.28
SPI_DIO3	30	IO	SPI data input/output 3	P0.02

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SWD Interface				
Pin Name	Pin No.	Type	Description	Comment
SWDIO	19	Debug	SWD I/O for debug and programming	
SWCLK	18	Debug	SWD clock input for debug and programming	
RESET				
Pin Name	Pin No.	Type	Description	Comment
RESET	17	DI	Reset the module	
NFC Interface				
Pin Name	Pin No.	Type	Description	Comment
NFC1	13	DI	NFC input 1	P0.09
NFC2	12	DI	NFC input 2	P0.10
Antenna Interface				
Pin Name	Pin No.	Type	Description	Comment
RF_BT	15	IO	Bluetooth antenna interface	50Ω Impedance If unused, keep this pin open
GPIO Interface				
Pin Name	Pin No.	Type	Description	Comment
GPIO P1.01	25	IO	General-purpose input/output	
GPIO P1.02	26	IO	General-purpose input/output	
GPIO P1.03	27	IO	General-purpose input/output	
GPIO P1.04	28	IO	General-purpose input/output	
ADC Interface				
Pin Name	Pin No.	Type	Description	Comment
GPIO P0.31 / AIN7	39	IO / AI	General-purpose IO / General purpose ADC interface	
GPIO P0.05 / AIN3	40	IO / AI	General-purpose IO / General purpose ADC interface	
GPIO P0.04 / AIN7	41	IO / AI	General-purpose IO / General purpose ADC interface	

2.6 Power Consumption

The following table show the power consumption.

Table 4: Power Consumption

Item	Power Consumption	Condition
Tx mode BT@4dBm	9mA	BT Tx mode
Rx mode BT@2Mbps	11.5mA	BT Rx mode
Sleep mode	2.0uA	BT sleep

2.7 Absolute Maximum Ratings

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The following table show the absolute maximum ratings of RAK3400

Table 5: Absolute Maximum Ratings

Symbol	Description	Min.	Nom.	Max.	Unit
VDD_NRF	MCU power supply	-0.3	-	3.9	V
VBUS	USB supply voltage	-0.3	-	5.8	V
VBAT_NRF	MCU high voltage power supply	-0.3	-	5.8	V
ESD HBM	Human Body Model	-	-	2000	V
ESD CDM	Charged Device Model	-	-	500	V

2.8 Recommended operating conditions

The following table shows the recommended operating conditions of RAK3400.

Table 6: Recommended operating conditions

Symbol	Description	Min.	Nom.	Max.	Unit
VDD_NRF	NRF52840 power supply	2.0	3.3	3.6	V
VBUS	VBUS USB supply voltage	4.35	5.0	5.5	V
VBAT_NRF	NRF52840 high voltage power supply	2.5	-	5.5	V

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3 Mechanical Dimensions

This chapter describes the mechanical dimensions of the module. All dimensions are measured in millimeter (mm), and the dimensions tolerances are ±0.05mm unless otherwise specified.

3.1 Top and Side Dimensions

The following figure shows the mechanical dimension of the RAK3400 module.

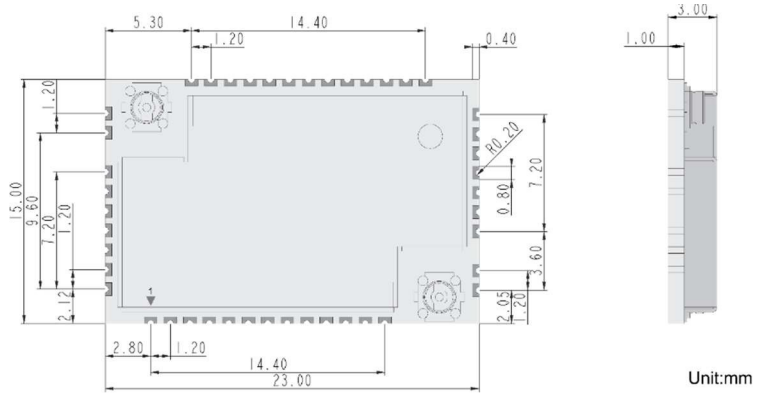

Figure 3: Top and Side Dimensions

3.2 Recommended Footprint

The following figure shows the recommended footprint of the RAK3400 module.

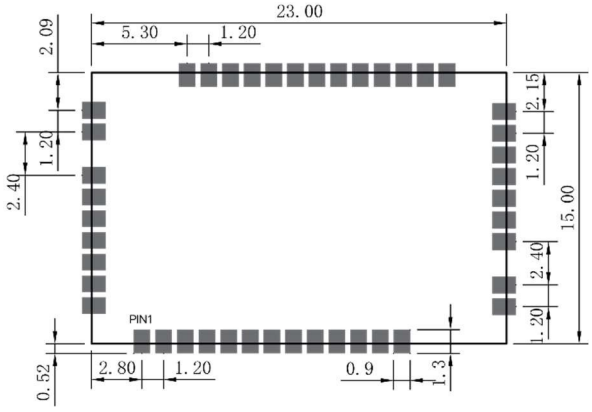

Figure 4: Recommended Footprint (Unit: mm)

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4 Recommended Reflow Profile

The following figure shows the Recommended Reflow Soldering Thermal Profile of RAK3400.

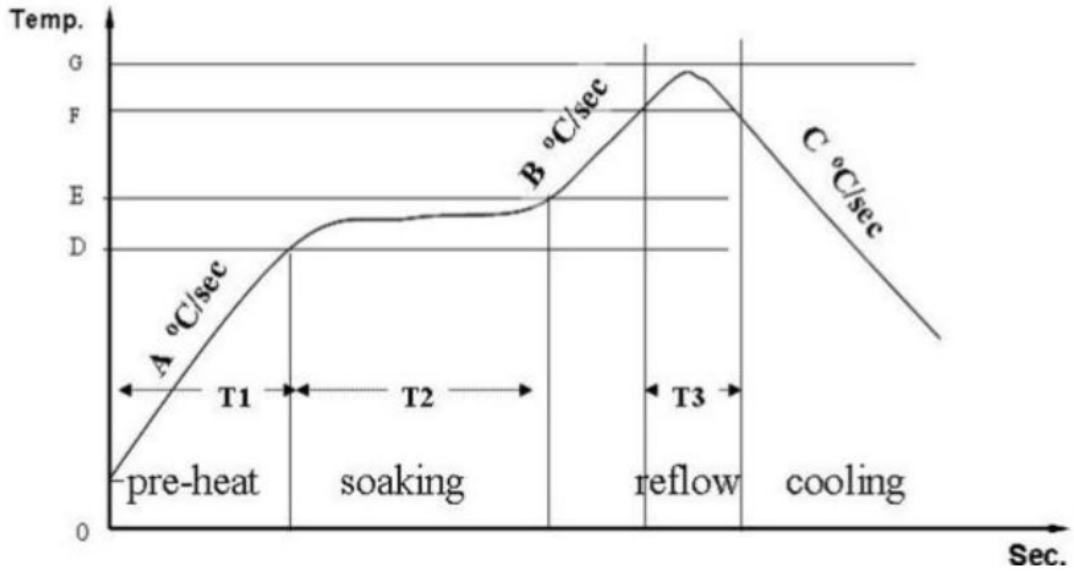

Figure 5: Recommended Reflow Soldering Thermal Profile

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Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Caution:
Changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

FCC Statement:
"This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
—Reorient or relocate the receiving antenna.
—Increase the separation between the equipment and receiver.
—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
—Consult the dealer or an experienced radio/TV technician for help."

IC statement:
This device complies with Industry Canada licence-exempt RSS standard(s).
Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.
Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.
:
This equipment complies with Industry Canada radiation exposure limits set forth for an uncontrolled environment.
Cet équipement est conforme à l'exposition aux rayonnements Industry Canada limites établies pour un environnement non contrôlé.

The proposed FCC IC label format is to be placed on the module. If it is not visible when the module is installed into the system, “Contains FCC ID: 2AF6B-RAK3400, Contains IC: 25908-RAK3400” shall be placed on the outside of final host system.

Labelling

— This radio transmitter [25908-RAK3400] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.
— Le présent émetteur radio [25908-RAK3400] a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés cidessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont trictement interdits pour l'exploitation de l'émetteur.

Antenna info

Antenna type: IPEX Antenna
Manufacturer: Shenzhen RAKwireless Technology Co., Ltd.
Model name: 501-0132-X1
Antenna gain: 1.68dBi

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