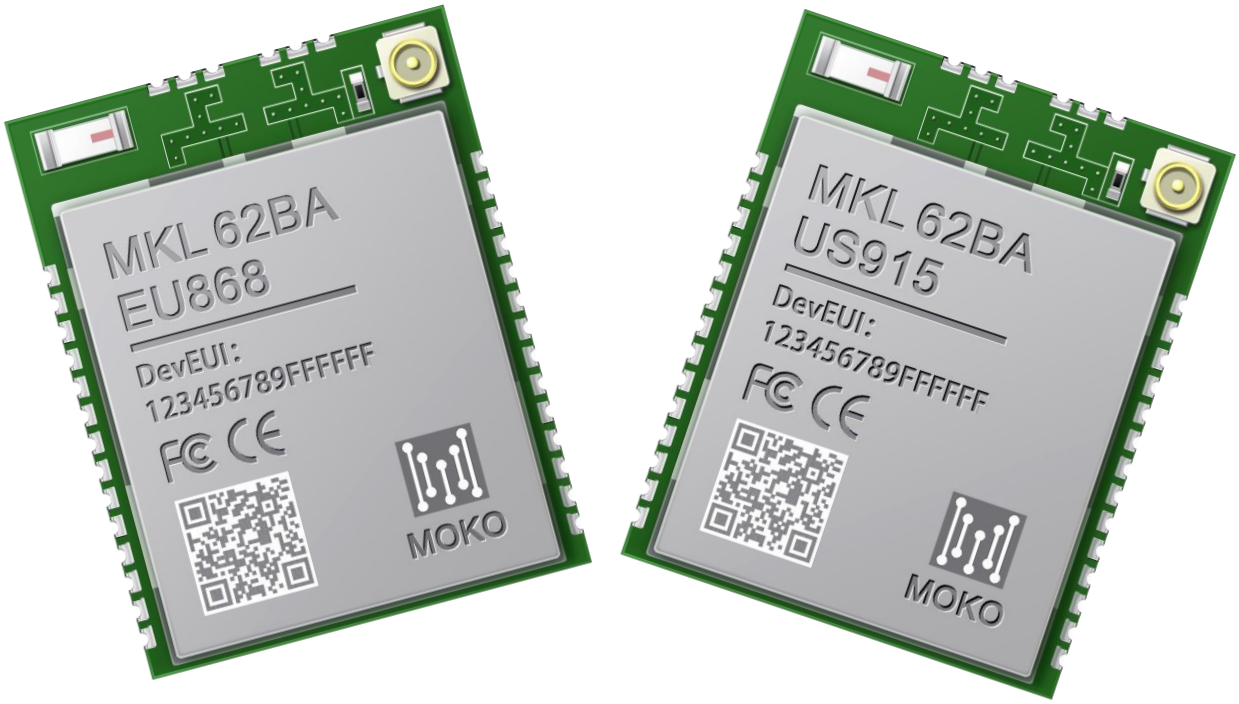
MKL62BA LoRaWAN Module Datasheet

Version V1.0



CONTENT

1 Overview and Key Features

1.1 Brief Introduction

MKL62BA is a standard LoRaWAN node module designed and manufactured by MOKO technology Ltd. The module integrates with the world-leading Nordic Semiconductor nRF52832 (BLE) and Semtech Sx1262 (LoRa) chipsets, providing ultra-low power consumption with outstanding wireless range using the LoRa radio link and local BLE connections.

Users can easily access the standard LoRaWAN network through AT commands, making it an excellent choice for IOT applications. MOKO will provide AT commands instruction and quick start development board kit.

1.2 Features and Advantages

▪ Built in LoRaWAN standard protocol and supports the whole world LoRaWAN frequency band
▪ Bluetooth v4.2 – Nordic nRF52832
▪ On-board BLE ceramic antenna
▪ U.FL for external LoRa antenna
▪ Built-in TCXO for improve high frequency stability
▪ Supports AT command for configuring
▪ Compact footprint and 33 pins with SMT package
▪ Long range – LoRa range up to 10 km
▪ BLE TX power default in 0 dBm
▪ BLE RX sensitivity: -96dBm
▪ Ultra-low power consumption
▪ BLE TX: 5.3mA peak (at 0 dBm @Vcc=3.3V)
▪ BLE RX: 5.4mA peak (@Vcc=3.3V)
▪ Deep Sleep:7 uA
▪ Fast time-to-market
▪ No external components required

1.3 Application Areas

▪ Public or private networks
▪ Smart meter recording
▪ Smart agriculture
▪ Smart parking

▪Smart city
▪ Asset tracking
▪ Any long range, battery powered sensor application

2 Specifications

Categories	Feature	Implementation
MCU	NRF52832	ARM® Cortex®-M4 32-bit processor
	Flash	512KB
	RAM	64KB
LoRa Wireless Specification	LoRa	LoRaWAN 1.0.2 (End Device)
	Frequency	MKL62BA-US915 support US915/AU915/AS923
		MKL62BA-EU868 support EU868/IN865
	Max Transmit Power	21dBm
	Receive Sensitivity	-137dBm@SF12
	Range	Up to 10 km(in free space 5dBi)
BLE Wireless Specification	Bluetooth® (BLE)	V4.2
	Frequency	2.402 - 2.480 GHz
	Transmit Power	0 dBm
	Range	Up to 50 m in free space
Interface	Total	34pins
BLE Services	Services supported	GATT client and capabilities
FW Upgrade	NRF52832	Over the air
Programmability	NRF52832	(1) Via UART (2) Via 2-Wire SWD Programming/Debug Interface
AT commands	See <MKL62BA AT Command>	See <MKL62BA AT Command>
Supply Voltage	Supply (VCC)	3.3V
Power Consumption	TX Current(LoRa+BLE)	Max 120mA
	RX Current(LoRa+BLE)	6.4mA
	Sleep current	7uA
Antenna Options	BLE (Internal) chip antenna	On-board ceramic chip monopole antenna-0.5 dBi
	LoRa (External)	U.FL (IPEX) connector for external antenna
Physical	Dimensions	24mm x 19mm x 2.8mm
Environmental	Operating	-40 ℃ to +85 ℃ (VCC 3.3 V)
	Storage	-40 ℃ to +85 ℃
Miscellaneous	Lead Free	Lead-free and RoHS compliant

Development Tools	Development Kit	Development Kit MKL62ST-DT and Free DEMO firmware
Approvals	Under Approval FCC/CE /LoRaWAN Alliance certification	

3 Hardware Specifications

3.1 Block Diagram and Pin-out

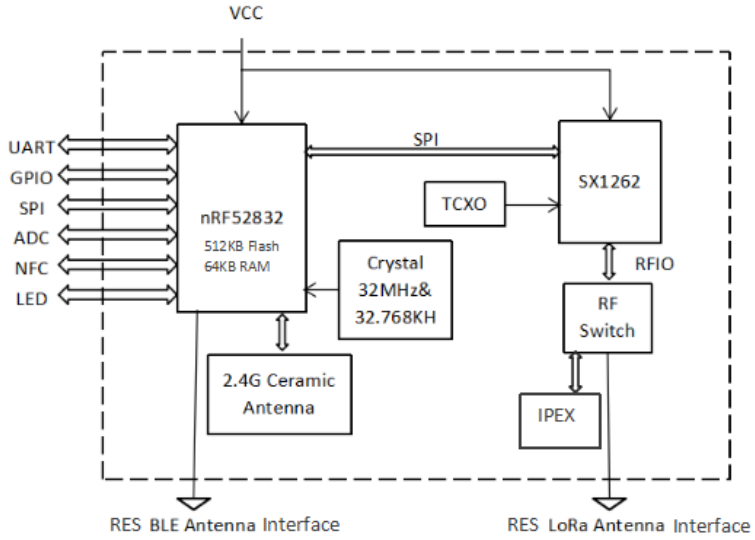


Figure 1: Functional block diagram for MKL62BA modules

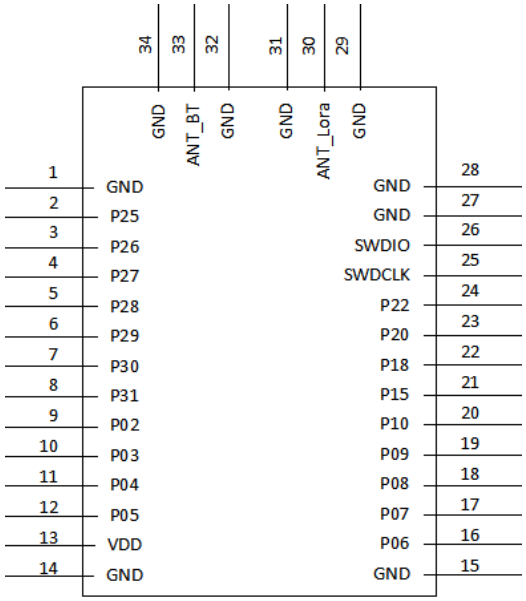


Figure 2: MKL62BA module pin-out (top view)

3.2 Pin Definitions

Pin	Pin Name	Type	Description
1	GND	Power	Ground
2	P25	Digital I/O	General purpose I/O
3	P26	Digital I/O	General purpose I/O
4	P27	Digital I/O	General purpose I/O
5	P28	Digital I/O Analog input	General purpose I/O
6	P29	Digital I/O Analog input	UART_CTS
7	P30	Digital I/O Analog input	UART_RTS
8	P31	Digital I/O Analog input	UART_TX
9	P02	Digital I/O Analog input	UART_RX
10	P03	Digital I/O Analog input	General purpose I/O
11	P04	Digital I/O Analog input	General purpose I/O
12	P05	Digital I/O Analog input	General purpose I/O, reserved for ADC port
13	VCC	Power	Power supply
14	GND	Power	Ground
15	GND	Power	Ground
16	P06	Digital I/O	MCU reset input
17	P07	Digital I/O	General purpose I/O, reserved for I2C_SDA
18	P08	Digital I/O	General purpose I/O, reserved for I2C_SCL
19	P09	NFC input Digital I/O	General purpose I/O, reserved for NFC
20	P10	NFC input Digital I/O	General purpose I/O, reserved for NFC
21	P15	Digital I/O	General purpose I/O, reserved for SPI_CS
22	P18	Digital I/O	General purpose I/O, reserved for SPI_MISO
23	P20	Digital I/O	General purpose I/O, reserved for SPI_MOSI
24	P22	Digital I/O	General purpose I/O, reserved for SPI_CLK
25	SWDIO	Digital I/O	SWD debug port data
26	SWDCLK	Digital input	SWD debug port clock

27	GND	Power	Ground
28	GND	Power	Ground
29	GND	Power	Ground
30	ANT_Lora	RF	Reserved for external LoRa antenna port
31	GND	Power	Ground
32	GND	Power	Ground
33	ANT_BT	RF	Reserved for external BLE antenna port
34	GND	Power	Ground

3.3 Electrical Specifications

3.3.1 Absolute Maximum Ratings

Absolute maximum ratings for supply voltage and voltages on digital and analogue pins of the module are listed below; exceeding these values causes permanent damage.

Parameter	Minimum	Maximum	Unit
Voltage at VCC	-0.3	+3.6	V
Storage temperature	-40	85	ºC

3.3.2 Recommended Operating Parameters

When the VCC is 3.3V, the performance will be the best. The operating voltage range is 1.9V-3.6V.

Parameter	Minimum	Type	Maximum	Unit
Voltage at VCC	3.27	3.3	3.33	V
Storage temperature	-40	25	85	ºC

3.4 RF Specifications

3.4.1 LoRa Frequency vs Tx Power

Test condition: VCC=3.3V, 25°C, SF10/BW125K

Frequency/MHz	Max Tx Power/dBm	Test Frequency/MHz	Frequency Offset/ppm
903.9	20.7	903.8992	-0.885053656
904.1	20.6	904.0991	-0.995465103

904.3	20.7	904.2991	-0.995244941
904.5	20.7	904.4992	-0.884466556
904.7	20.7	904.6992	-0.884271029
904.9	20.7	904.8991	-0.994585037
905.1	20.6	905.0992	-0.883880234
905.3	20.7	905.2991	-0.994145587

Test condition: VCC=3.3V, 25°C, SF7/BW125K

Frequency/MHz	Max Tx Power/dBm	Test Frequency/MHz	Frequency Offset/ppm
903.9	21.07	903.8992	-0.885053656
904.1	21.04	904.0991	-0.995465103
904.3	21.08	904.2991	-0.995244941
904.5	21.1	904.4992	-0.884466556
904.7	21	904.6992	-0.884271029
904.9	21.1	904.8991	-0.994585037
905.1	21.2	905.0992	-0.883880234
905.3	21.2	905.2991	-0.994145587

Test condition: VCC=3.3V, 25°C, SF10/BW125K

Frequency/MHz	Max Tx Power/dBm	Test Frequency/MHz	Frequency Offset/ppm
902.7	20.75	902.6992	-0.886230198
903.3	20.73	903.2992	-0.885641536
905.9	20.77	905.8992	-0.88309968
906.5	20.74	906.4992	-0.882515168
907.5	20.74	907.4992	-0.8815427
908.1	20.74	908.0991	-0.991080278
909.1	20.73	909.0992	-0.8799912
909.7	20.71	909.6992	-0.879410795
910.7	20.71	910.6992	-0.878445152
911.3	20.71	911.2992	-0.877866784
912.3	20.68	912.2992	-0.876904527
912.9	20.63	912.8992	-0.876328185
913.9	20.6	913.8992	-0.875369296
914.5	20.6	914.4992	-0.87479497

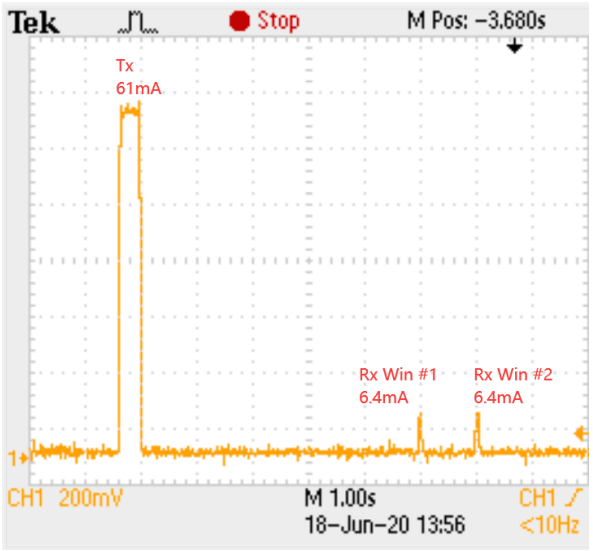
3.4.2 LoRa Frequency vs Receive Sensitivity

Test condition: VCC=3.3V, 25°C

Frequency	SF	Rx Sensitivity/dBm	Frequency	SF	Rx Sensitivity/dBm
923.3	SF7	-124	923.3	SF10	-132.2
923.9	SF7	-124.2	923.9	SF10	-132.2
924.5	SF7	-124.2	924.5	SF10	-132.1
925.1	SF7	-124.1	925.1	SF10	-132.2
925.7	SF7	-124.2	925.7	SF10	-132.2
926.3	SF7	-124.3	926.3	SF10	-132.2
926.9	SF7	-124.2	926.9	SF10	-132.2
927.5	SF7	-124.1	927.5	SF10	-132.3
868.1	SF7	-124.2	868.1	SF10	-132.1
868.3	SF7	-124.3	868.3	SF10	-132.1
868.5	SF7	-124.3	868.5	SF10	-132.2
869.525	SF7	-124.2	869.525	SF10	-132.1

3.4.3 LoRa Current Waveforms for Tx/Rx Cycle

Test condition: VCC=3.3V, 25°C, when sending a Join request to the gateway.



4 Mechanical Details

4.1 MKL62BA Mechanical Details

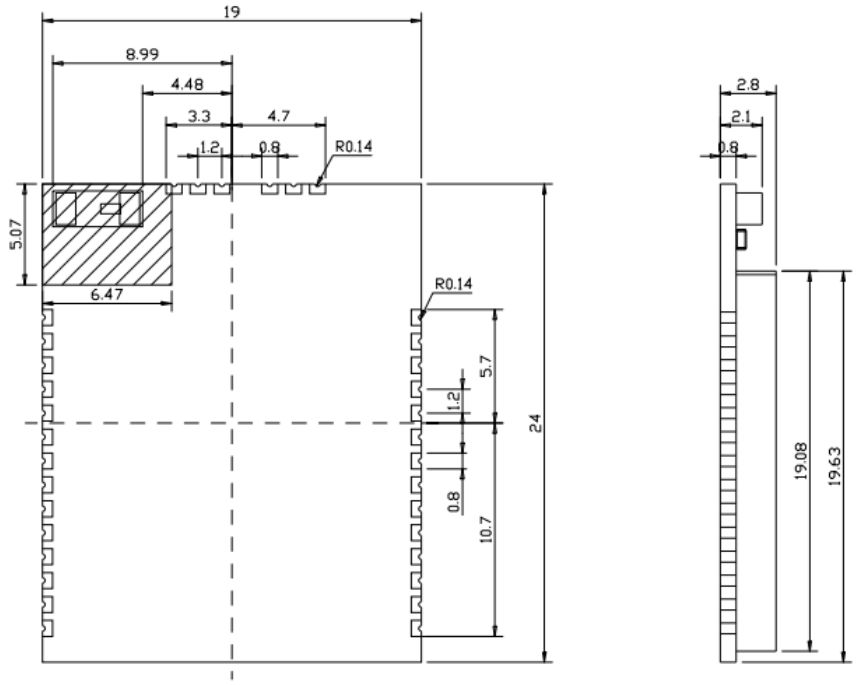


Figure 3: MKL62BA Module Mechanical drawing(unit:mm)

4.2 Main PCB Layout And Module Mounting

Recommended for main board layout:

- Avoid running any signal line below module whenever possible.
- No ground plane below antenna.
- If possible, cut-off the portion of main board below antenna.

Recommended module mounting:

You can refer to the following references for the mounting design of the module with on-board ceramic BLE antenna.
For external LoRa antenna to the u.FL connector, you need to refer to the external antenna design requirements.

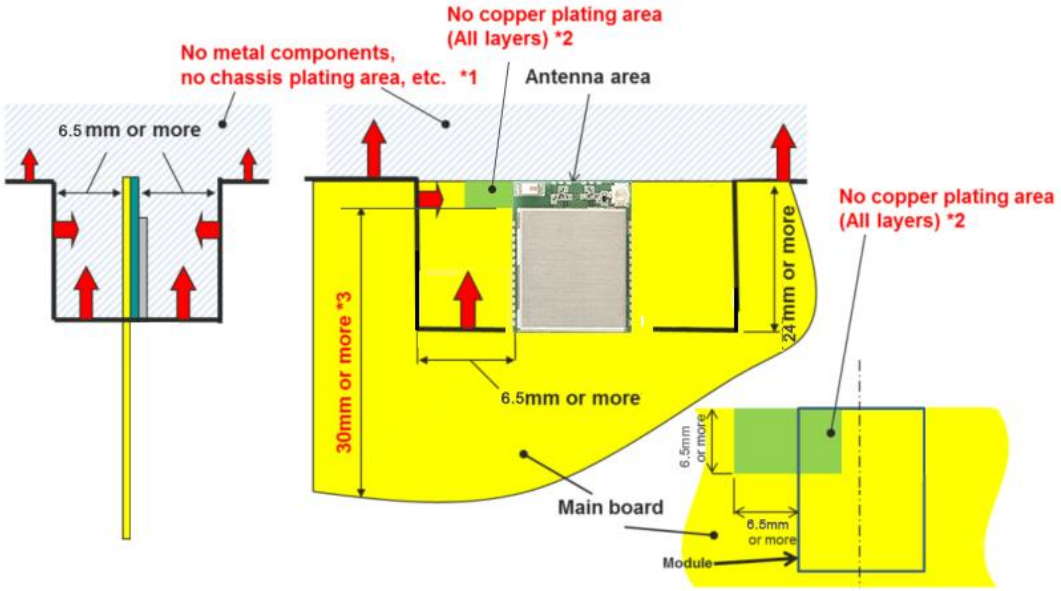


Figure 4: Module mounting example

- Please do not place any metal components in gray shaded space(*1), such as signal line and metal chassis as possible except for main board while mounting the components in *1 space on the main board is allowed except for no copper plating area(*2).

- (*2)This area is routing prohibited area on the main board and it includes on board antenna routing prohibited area the size can refer to mechanical drawing shaded space . Please do not place copper on any layer.

- (*3) Characteristics may deteriorate when GND pattern length is less than 30mm. It should be 30 mm or more as possible.

- Ground plane shall be at least 6.5 mm from the edge of the antenna area of module.

- All module GND pins MUST be connected to main board GND. Place GND vias close to module GND pads as possible. Unused PCB area on surface layer can flooded with copper but place GND via regularly to connect copper flood to inner GND plane. If GND flood copper underside the module then connects with GND vias to inner GND plane.

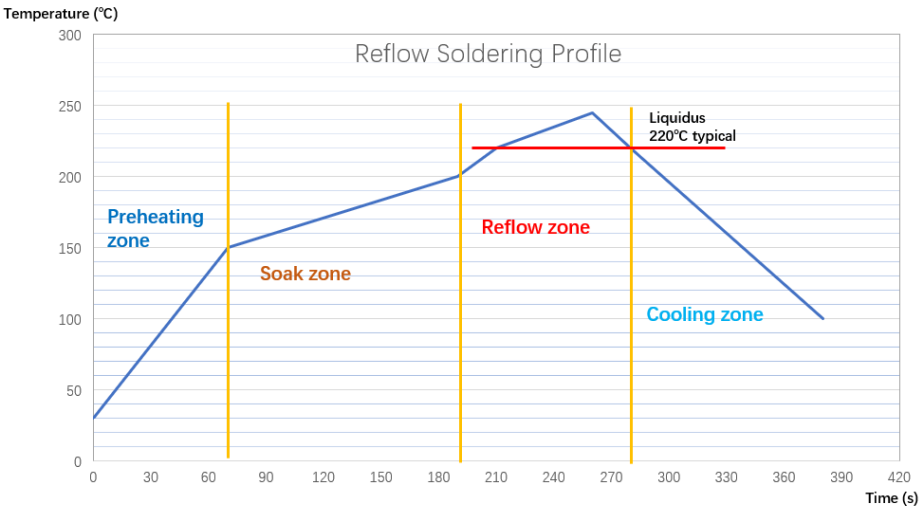
- Even when above mentioned condition is satisfied, communication performance may be significantly deteriorated depending on the structure of the product. Bluetooth range performance is degraded if a module is placed in the middle of the main board.

- For best BLE chip antenna performance, the module MUST be placed on the edge of the main PCB (preferably in the corner) with the antenna facing the corner. If the module is not placed in corner, but on edge of main PCB, the antenna routing prohibited area should be extended.

5 Reflow Soldering

Reflow soldering is a vitally important step in the SMT process. The temperature curve associated with the reflow is an essential parameter to control to ensure the correct connection of parts. The parameters of certain components will also directly impact the temperature curve selected for this step in the process.

Temperature-Time Profile for Reflow Soldering



- The standard reflow profile has four zones: ①preheat, ②soak, ③reflow and ④cooling. The profile describes the ideal temperature curve of the top layer of the PCB.

- During reflow, modules should not be above 260°C and not for more than 30 seconds.

Specification	Value	Unit
Temperature Increase Rate	<2.5	℃ / s
Temperature Decrease Rate	Free air cooling	-
Preheat Temperature	0 - 150	℃
Preheat Period (Typical)	40 - 90	s
Soak Temp Increase Rate	0.4 - 1	℃ / s
Soak Temperature	150 - 200	℃
Soak Period	60 - 120	s
Liquidus Temperature (SAC305)	220	℃
Time Above Liquidus	45 - 90	s
Reflow Temperature	230 - 250	℃
Absolute Peak Temperature	260	℃

6 Ordering Information

Part Number	Description	Remark
MKL62BA-EU868	Moko LoRaWAN module with SX1262 and BLE-Europe	IN865 is compatible
MKL62BA-US915	Moko LoRaWAN module with SX1262 and BLE-North America	AU915, AS923 are compatible

7 Additional Assistance

Please contact our sales team for further assistance:

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8 Revision

Version	Description	Editor	Date
1.0	Initial Version	Iris	2020/8/11

