MKL110BC Geolocation Module
Product Specification

Version 1.0

MOKO TECHNOLOGY LTD.

Version 1.0

www.mokosmart.com

Content

1 Instruction

1.1 Product Introduction

MKL110BC is a fusion positioning module based on LoRaWAN communication technology. The hardware mainly integrates Semtech's LR1110 Edge chip and Nordic's Nrf series Bluetooth chip, which can provide a variety of positioning technologies including Bluetooth positioning, LP-GPS and WIFI positioning, as well as low power consumption, long-range communication, and high anti-interference characteristics.

It is an ideal platform for developing various Indoor/outdoor tracking product solutions, which can help users reduce the development time and development costs.

1.2 Features and benefits

- Cost effective, ultra-low power and small size
- Multi-location technology (WIFI Only RX+Bluetooth+LP GPS)
- GNSS (GPS, BeiDou, geostationary) satellite signals ➢
Semtech's LoRa Cloud™ geolocation capabilities ➢ High LoRa
transmit power
    - Sensitivity: -137dBm@SF12 300bps
    - Max LoRa Tx power: 22dBm
- Long range – LoRa range up to 10 km
- Bluetooth v5.3 – Nordic nRF52840
- BLE RX sensitivity: -96dBm
- Built-in TCXO for improve high frequency stability
- Compact footprint and 50 pins with SMT package
- Standard shielding cover protection for increased interference immunity
- OTA via Bluetooth

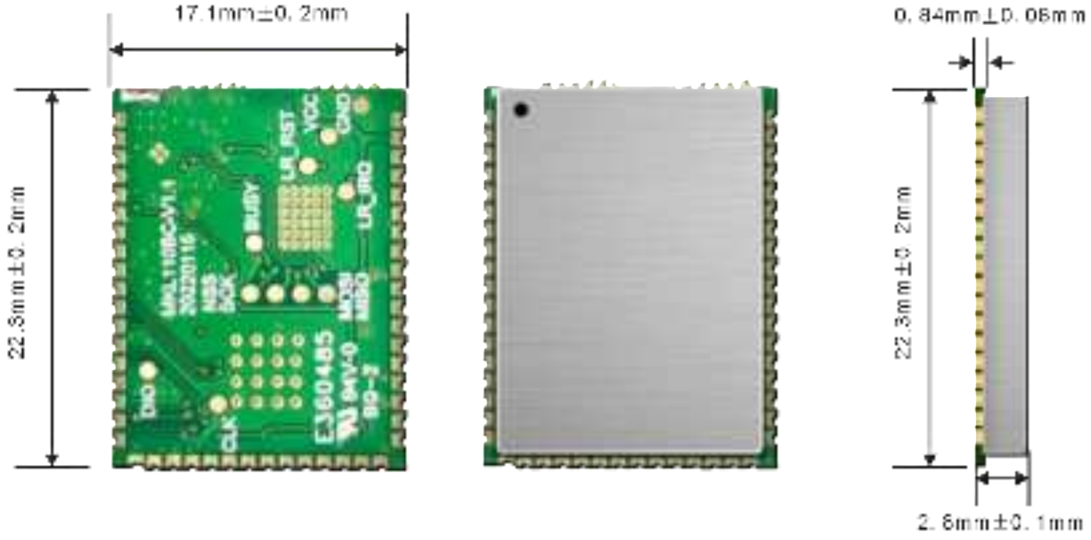
1.3 Application

- Shared scooters/bikes tracking
- Tools monitoring for construction site
- Cattle tracking
- Fleet Management
- Boats and Water Vehicles
- Smart agriculture
- Asset recovery
- Inventory management
- Asset loss and theft prevention

2 Specifications

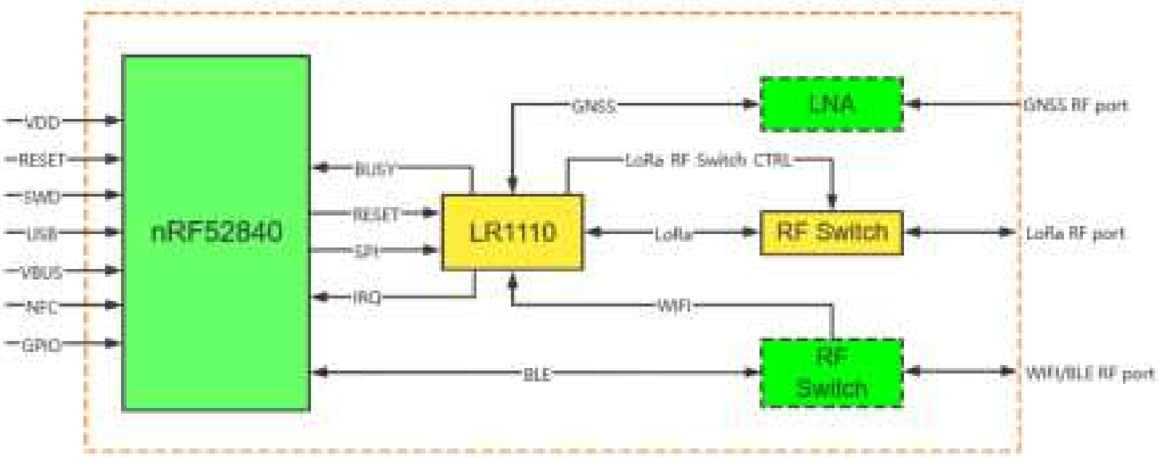
Categories	Parameter	Value
General	Dimension	22.3mm*17.1mm*2.8mm(With Shield)
	Package	SMT
	PIN	50 Pin Half-Hole
	Additional Feature	Geolocation (WIFI+Bluetooth+LP GPS)
MCU	NRF52840	ARM® Cortex™-M4 32-bit processor
	Flash	1MB
	RAM	256KB
LoRa Wireless Specification	LoRa Protocol	LoRaWAN V1.0.3
	Frequency Plan	EU868/AU915/US915/AS923/IN865/KR920/EU433/CN470/CN779/RU864
	Max Transmit Power	Max 22dBm
	Sensitivity	-137dBm@SF12 300bps
	Range	Up to 10 km (in free space 5dBi)
BLE Wireless Specification	Bluetooth® (BLE)	V 5.3
	Max Transmit Power	8 dBm
	Sensitivity	- 95 dBm
	Range	Up to 50 m in free space
Power Consumption	Supply Voltage	2.8V ~ 3.6V
	Sleep Current	<6uA
	Standby Current	<600uA
	Max Operation Current	<125mA
Antenna	LoRa Antenna	Stamp Hole
	BLE Antenna	Stamp Hole
Application Parameter	Operating Temperature	-40 to 85 °C
	Storage Temperature	-40 to 85 °C
	Certification	CE FCC certification in process
	Miscellaneous	Lead-free and RoHS compliant

3 Mechanical Size

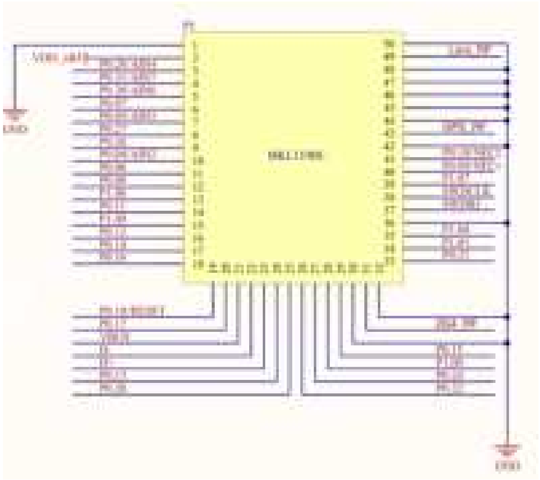


4 Circuit Design

4.1 Block Diagram



4.2 Pin Assignments



PIN No.	Name	Type	Function
1	GND	Power	Ground
2	VDD_nRF	Power	Power Supply
3	P0.28	Digital I/O	General Purpose I/O
	AIN4	Analog input 0	SAADC/COMP/LPCOMP input
4	P0.31	Digital I/O	General Purpose I/O
	AIN7	Analog input 0	SAADC/COMP/LPCOMP input
5	P0.30	Digital I/O	General Purpose I/O
	AIN6	Analog input 0	SAADC/COMP/LPCOMP input
6	P0.07	Digital I/O	General Purpose I/O
7	P0.05	Digital I/O	General Purpose I/O
	AIN3	Analog input 0	SAADC/COMP/LPCOMP input
8	P0.27	Digital I/O	General Purpose I/O
9	P0.26	Digital I/O	General Purpose I/O
10	P0.04	Digital I/O	General Purpose I/O
	AIN2	Analog input 0	SAADC/COMP/LPCOMP input
11	P0.06	Digital I/O	General Purpose I/O
12	P0.08	Digital I/O	General Purpose I/O
13	P1.08	Digital I/O	General Purpose I/O
14	P0.11	Digital I/O	General Purpose I/O
15	P1.09	Digital I/O	General Purpose I/O
16	P0.12	Digital I/O	General Purpose I/O
17	P0.14	Digital I/O	General Purpose I/O
18	P0.16	Digital I/O	General Purpose I/O
19	P0.18	Digital I/O	General Purpose I/O
	RESET	Reset	Reserved for reset
20	P0.17	Digital I/O	General Purpose I/O
21	VBUS	Power	5 V input for USB controller
22	D-	USB	USB D-
23	D+	USB	USB D+
24	P0.13	Digital I/O	General Purpose I/O
25	P0.20	Digital I/O	General Purpose I/O
26	P0.22	Digital I/O	General Purpose I/O
27	P0.24	Digital I/O	General Purpose I/O
28	P1.00	Digital I/O	General Purpose I/O

29	P0.15	Digital I/O	General Purpose I/O
30	GND	Power	Ground
31	2G4_RF	RF	Reserved for BLE antenna port
32	GND	Power	Ground
33	P0.21	Digital I/O	General Purpose I/O
34	P1.01	Digital I/O	General Purpose I/O
35	P1.04	Digital I/O	General Purpose I/O
36	GND	Power	Ground
37	SWDIO	Debug	Serial wire debug I/O for debug and programming
38	SWDLCK	Debug	Serial wire debug clock input for debug and programming
39	P1.07	Digital I/O	General Purpose I/O
40	P0.09	Digital I/O	General Purpose I/O
	NFC1	NFC	Reserved for NFC
41	P0.10	Digital I/O	General Purpose I/O
	NFC2	NFC	Reserved for NFC
42	GND	Power	Ground
43	GPS_RF	RF	Reserved for GPS antenna port
44	GND	Power	Ground
45	GND	Power	Ground
46	GND	Power	Ground
47	GND	Power	Ground
48	GND	Power	Ground
49	Lora_RF	RF	Reserved for LoRa antenna port
50	GND	Power	Ground

Note: Please refer to Nordic nRF52840 Product Specifications for detailed descriptions and features supported about the Pin assignments.

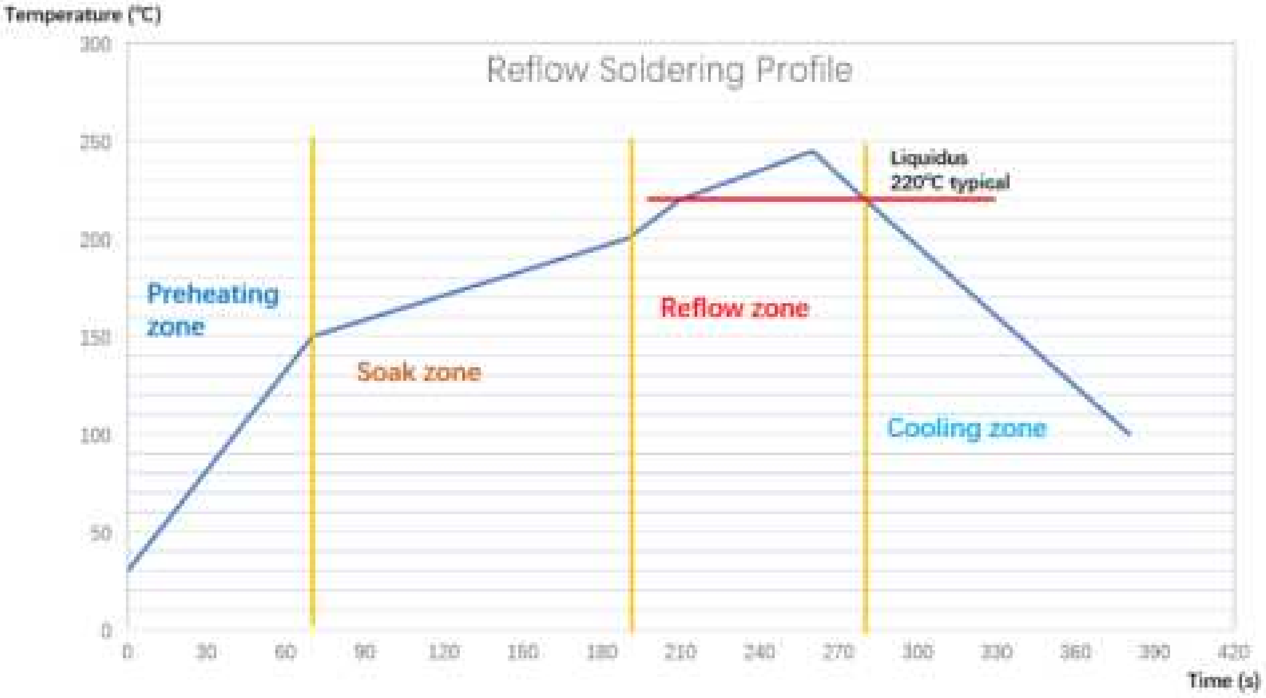
5 Cautions

5.1 Reflow soldering

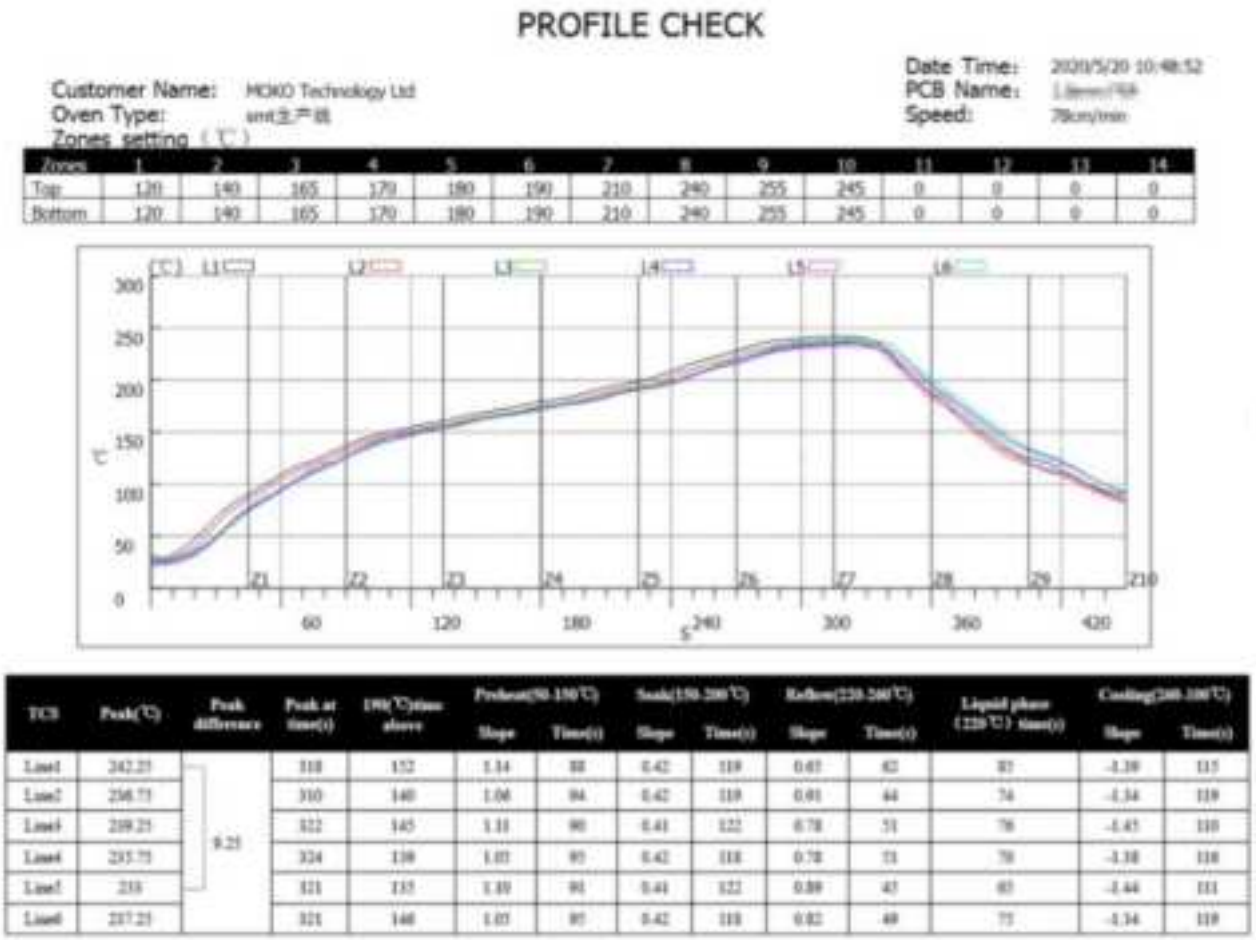
Reflow soldering is a vitally important step in the SMT process. The temperature curve associated with the reflow is an essential parameter to control to ensure the correct connection of parts. The parameters of certain components will also directly impact the temperature curve selected for this step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

- The standard reflow profile has four zones: ①**preheat,** ②**soak,** ③**reflow,** ④**cooling**. 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
Temperature Increase Rate	<2.5°C/s
Temperature Decrease Rate	Free air cooling
Preheat Temperature	0-150°C
Preheat Period (Typical)	40-90s
Soak Temp Increase Rate	0.4-1°C/s
Soak Temperature	150-200°C
Soak Period	60-120s
Liquidus Temperature (SAC305)	220°C
Time Above Liquidous	45-90s
Reflow Temperature	230-250°C
Absolute Peak Temperature	260°C



PROFILE CHECK

Customer Name: MOKO Technology Ltd
Oven Type: smt生产线
Zones setting（℃）

Date Time: 2020/5/20 10:48:52
PCB Name: [illegible]
Speed: 70cm/min

Zones	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Top	120	140	165	170	180	190	210	240	255	245	0	0	0	0
Bottom	120	140	165	170	180	190	210	240	255	245	0	0	0	0

TCS	Peak(℃)	Peak difference	Peak at time(s)	190(℃)time above	Preheat(50-150℃)		Soak(150-200℃)		Reflow(220-240℃)		Liquid phase (220℃) time(s)	Cooling(240-100℃)	
					Slope	Time(s)	Slope	Time(s)	Slope	Time(s)		Slope	Time(s)
Line1	242.25	9.25	318	152	1.14	88	0.42	119	0.65	42	87	-1.39	115
Line2	236.75		310	140	1.06	84	0.42	119	0.81	44	74	-1.34	119
Line3	239.25		322	145	1.11	90	0.41	122	0.78	51	78	-1.45	110
Line4	235.75		324	138	1.03	95	0.42	118	0.78	51	78	-1.38	118
Line5	233		321	135	1.19	91	0.44	122	0.89	47	65	-1.44	111
Line6	237.25		321	148	1.05	95	0.42	118	0.82	49	75	-1.34	119

5.2 Usage Condition Notes

- Follow the conditions written in this specification, especially the recommended condition
- ratings about the power supply applied to this product.
- The supply voltage has to be free of AC ripple voltage (for example from a battery or a low
- noise regulator output). For noisy supply voltages, provide a decoupling circuit (for example a
- ferrite in series connection and a bypass capacitor to ground of at least 47Uf directly at the
- module).
- Take measures to protect the unit against static electricity. If pulses or other transient loads (a
- large load applied in a short time) are applied to the products, check and evaluate their
- operation before assembly on the final products.
- The supply voltage should not be exceedingly high or reversed. It should not carry noise and/or
- spikes.
- This product away from other high frequency circuits.
- Keep this product away from heat. Heat is the major cause of decreasing the life of these
- products.
- Avoid assembly and use of the target equipment in conditions where the products'

- temperature may exceed the maximum tolerance.
- This product should not be mechanically stressed when installed.
- Do not use dropped products.
- Do not touch, damage or soil the pins.
- Pressing on parts of the metal shield or fastening objects to the metal shield will cause
- damage.

5.3 Storage Notes

- The module should not be stressed mechanically during storage.
- Do not store these products in the following conditions or the performance characteristics of
- the product, such as RF performance will be adversely affected:
  - Storage in salty air or in an environment with a high concentration of corrosive gas.
  - Storage in direct sunlight
  - Storage in an environment where the temperature may be outside the range specified.
  - Storage of the products for more than one year after the date of delivery storage period.
- Keep this product away from water, poisonous gas and corrosive gas.
- This product should not be stressed or shocked when transported.

FCC 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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Radiation Exposure Statement
The modular can be installed or integrated in mobile or fix devices only. This modular cannot be installed in any portable device, for example, USB dongle like transmitters is forbidden.
This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter Module FCC ID: 2AO94-MKL110BC Or Contains FCC ID: 2AO94-MKL110BC”

When the module is installed inside another device, the user manual of this device must contain below warning statements:
1. 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.
2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

The host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.
The end user manual shall include all required regulatory information/warning as shown in this manual, include:
This product must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

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