Technical Data sheet

NLN500a

Author: Kamesh Lakhwani

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Preface

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Revision history

Name	Description of Change	Date	Version
Kamesh Lakhwani	Initial version	07/08/2020	1.0
Kamesh Lakhwani	Added Temperature and Humidity data as per the test carried out in Environmental Chamber at SLS	11/11/2020	1.1
Sagar Mistry	Updated RF details	13/11/2020	1.2

Approval

Name	Position	Signature	Date
Himanshu Ankleshwaria	Manager	Email approval received (must be stored in document library with Approved version)	13/11/2020

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1. Introduction

The NebuLink Node NLN500a is First and Smallest STM32WL Based LoRa Module.

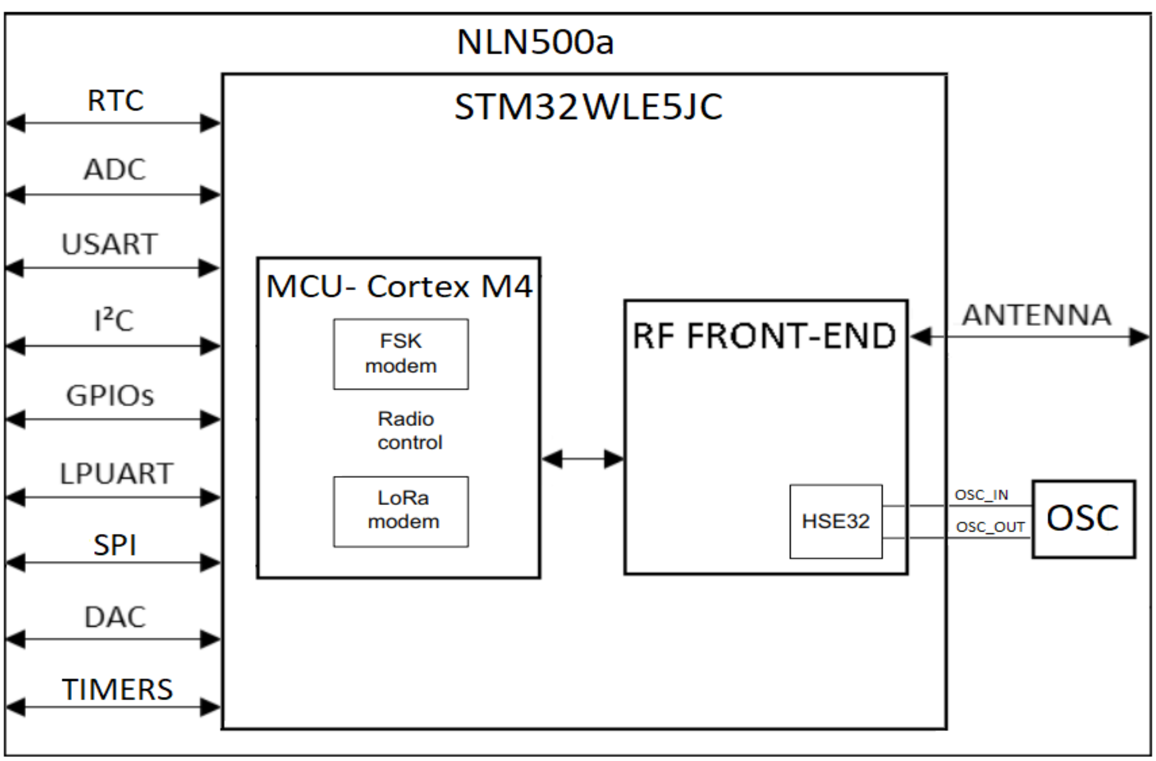
It is build on the STM32WL SoC which has Embedded LoRaWAN Transceiver for wide range of Smart Applications. It is useful when long range is required as it operates at 868 MHz & 915 MHz Band and uses Lo–Ra(Long-Range) and Sigfox Protocol for communication. It offers long range, low power and secure data transmission for M2M and IoT applications.

These Module designed to be extremely low-power and is based on the high-performance STM32WLE5JC Arm® Cortex®-M4 32-bit RISC core operating at a frequency of up to 48 MHz. This core implements a full set of DSP instructions and an independent memory protection unit (MPU) that enhances the application security.

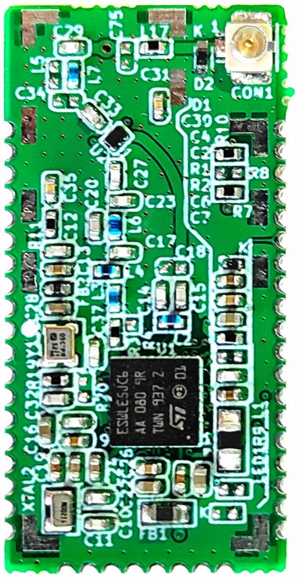
1.1. Brief Specifications

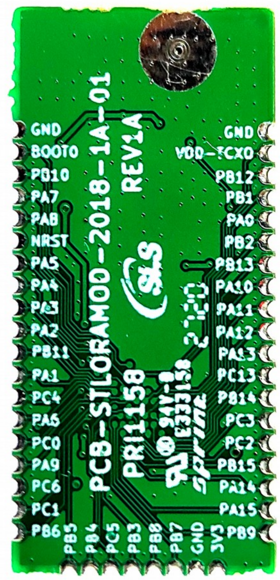
Module	Chip	Power(dBm)	Antenna	Dimension (mm) LxWxH
NLN500a	STM32WLE5JC	+21	External	16.0×32.6×3.5

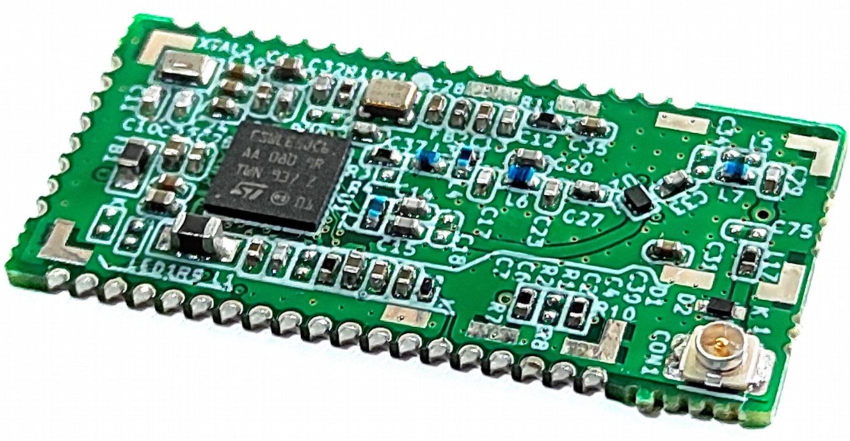
1.2. Block Diagram



2. Different Images of the Module







3. Key Features

- Frequency Band: Supports EU 863-870,US 902-928,IN865
- RX sensitivity: –122 dBm (125 kHz BW and spreading factor 7) and –136 dBm (125 kHz BW and spreading factor 12) for LoRa
- Transmitter high output power programmable up to +21 dBm
- Its support protocols such as LoRaWAN® and Sigfox™
- 1.8V to 3.6 V power supply
- -20°C to +75 °C operating temperature range
- Core: 32-bit Arm®Cortex®-M4 CPU
- Hardware encryption AES 256-bit
- OTA(over-the-air) firmware update capable
- Up to 256-Kbyte Flash memory
- Up to 64-Kbyte RAM
- Serial-wire debug (SWD), JTAG for the application processor
- Up to 43 I/Os, most 5 V-tolerant available on Edge Plated holes of the module
- The Module can be directly soldered on any device board
- RF shield on the module for preventing the module from external electromagnetic radiation and interference

4. Applications

The applications include, but are not limited to:

- Building automation & monitoring
- Lighting controls
- Inventory management
- Environmental monitoring
- Security
- Industrial monitoring

    - Machinery condition and performance monitoring
    - Monitoring of plant system parameters such as temperature, pressure, flow, tank level, humidity, vibration, etc.
- Smart Metering & Lighting Solutions
- Smart Flood Sensors
- Smart Street Lighting
- Smart City Network
- Smart Waste Management, etc.

5. Specification

5.1. Functional Characteristics

5.1.1. CPU:

- High-performance STM32WLE5JC Arm® Cortex®-M4 32-bit RISC core operating at a frequency of up to 48 MHz.

5.1.2. Memory:

- Up to 256-Kbyte Flash memory
- Up to 64-Kbyte RAM

5.1.3. Clock sources:

- External HSE Clock 32 MHz TCXO
- External 32 kHz oscillator for RTC with calibration

5.2. RF Characteristics

Parameter	NLN500a
Transmit Power	+21 dBm
Receive Sensitivity (1% PER)	–122 dBm (125 kHz BW, spreading factor 7) and –136 dBm (125 kHz BW, spreading factor 12)
RF Range(Line-Of-Sight)	10KM*
Frequency Band	EU 863-870,US 902-928,IN865
RF Data Rate	0.013 to 17.4 Kbit/s

Note:

*Range figure estimates are based on ideal conditions with limited sources of interference. Actual range will vary based on transmitting power, type of transmitting antenna used, height of transmitting antenna, height of receiving antenna, orientation of transmitter and receiver, weather conditions, interference sources in the area, and terrain between receiver and transmitter.

5.3. Electrical Characteristic

5.3.1. Absolute Max. Rating

Symbol	Description	Min	Max	Unit
VDDX - VSS	External main supply voltage (including VDD, VDDA, VDDRF, VDDSMPS, VBAT, VREF+)	-0.3	+3.9	V

5.3.2. Recommended Operating Conditions

Symbol	Description	Min	Typ	Max	Units
VDD	Standard operating voltage	1.8	3.3	3.6	V

5.3.3. Current Consumption

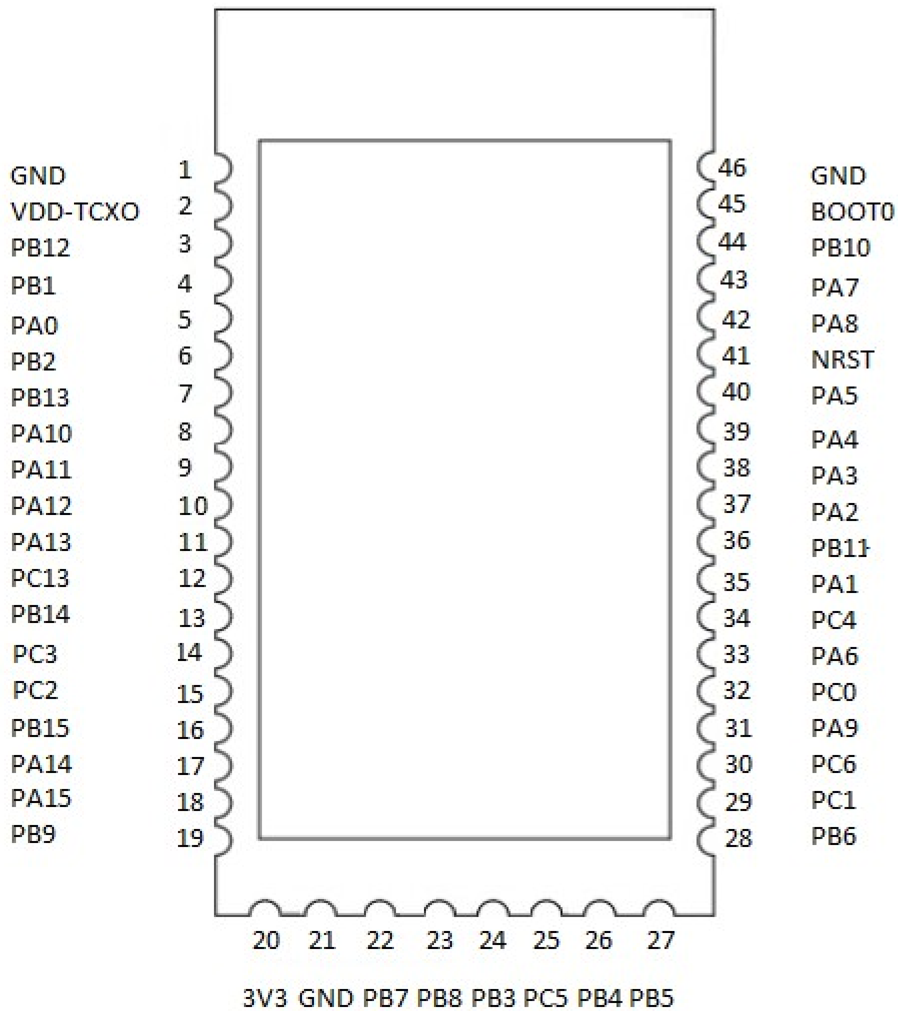
Mode	Current	Condition
Radio in transmit	132mA	868 MHz, +21 dBm, 3.3 V,SF7,125KHz
	130mA	868 MHz, +21 dBm, 3.3 V,SF12,125KHz
Radio in receive	10mA	Rx boosted, LoRa 125 kHz, SMPS ON
Standby (RTC enable)	1.6μA	VDD = 3 V
Deep-Sleep mode	1μA	Sleep with cold start (All blocks off)

5.3.4. Environmental Characteristic

- Operating Temperature: -20 ºC to 75 ºC
- Humidity: 95%

6. Pin Diagram

6.1. Pin Diagram of Module



6.2.Pin Details of the module

Pin #	Pin Name	Pin Type	Pin Function/Alternate Functions
1	GND	S	Ground
2	PB0-VDD-TCXO	I/O	COMP1_OUT, CM4_EVENTOUT
3	PB12	I/O	TIM1_BKIN, I2C3_SMBA, SPI2_NSS/I2S2_WS, LPUART1_RTS, CM4_EVENTOUT
4	PB1	I/O	LPUART1_RTS_DE, LPTIM2_IN1, CM4_EVENTOUT
5	PA0	I/O	TIM2_CH1, I2C3_SMBA, I2S_CKIN, USART2_CTS, COMP1_OUT, TIM2_ETR, CM4_EVENTOUT
6	PB2	I/O	LPTIM1_OUT, I2C3_SMBA, SPI1_NSS, DEBUG_RF_SMPSRDY, CM4_EVENTOUT
7	PB13	I/O	TIM1_CH1N, I2C3_SCL, SPI2_SCK/I2S2_CK, LPUART1_CTS, CM4_EVENTOUT
8	PA10	I/O	RTC_REFIN, TIM1_CH3, I2C1_SDA, SPI2_MOSI/I2S2_SD, USART1_RX, DEBUG_RF_HSE32RDY, TIM17_BKIN, CM4_EVENTOUT
9	PA11	I/O	TIM1_CH4, TIM1_BKIN2, LPTIM3_ETR, I2C2_SDA, SPI1_MISO, USART1_CTS, DEBUG_RF_NRESET, CM4_EVENTOUT
10	PA12	I/O	TIM1_ETR, LPTIM3_IN1, I2C2_SCL, SPI1_MOSI, RF_BUSY, USART1_RTS, CM4_EVENTOUT
11	PA13	I/O	JTMS-SWDIO, I2C2_SMBA, IR_OUT, CM4_EVENTOUT
12	PC13	I/O	CM4_EVENTOUT
13	PB14	I/O	TIM1_CH2N, I2S2_MCK, I2C3_SDA, SPI2_MISO, CM4_EVENTOUT
14	PC3	I/O	LPTIM1_ETR, SPI2_MOSI/I2S2_SD, LPTIM2_ETR, CM4_EVENTOUT
15	PC2	I/O	LPTIM1_IN2, SPI2_MISO, CM4_EVENTOUT
16	PB15	I/O	TIM1_CH3N, I2C2_SCL, SPI2_MOSI/I2S2_SD, CM4_EVENTOUT
17	PA14	I/O	JTCK-SWCLK, LPTIM1_OUT, I2C1_SMBA, CM4_EVENTOUT

18	PA15	I/O	JTDI, TIM2_CH1, TIM2_ETR, I2C2_SDA, SPI1_NSS, CM4_EVENTOUT
19	PB9	I/O	TIM1_CH3N, I2C1_SDA, SPI2_NSS/I2S2_WS, IR_OUT, TIM17_CH1, CM4_EVENTOUT
20	3V3	S	Module Supply
21	GND	S	Ground
22	PB7	I/O	LPTIM1_IN2, TIM1_BKIN, I2C1_SDA, USART1_RX, TIM17_CH1N, CM4_EVENTOUT
23	PB8	I/O	TIM1_CH2N, I2C1_SCL, RF_IRQ2, TIM16_CH1, CM4_EVENTOUT
24	PB3	I/O	JTDO/TRACESWO, TIM2_CH2, SPI1_SCK, RF_IRQ0, USART1_RTS, CM4_EVENTOUT
25	PC5	I/O	CM4_EVENTOUT
26	PB4	I/O	NJTRST, I2C3_SDA, SPI1_MISO, USART1_CTS, DEBUG_RF_LDORDY, TIM17_BKIN, CM4_EVENTOUT
27	PB5	I/O	LPTIM1_IN1, I2C1_SMBA, SPI1_MOSI, RF_IRQ1, USART1_CK, COMP2_OUT, TIM16_BKIN, CM4_EVENTOUT
28	PB6	I/O	LPTIM1_ETR, I2C1_SCL, USART1_TX, TIM16_CH1N, CM4_EVENTOUT
29	PC1	I/O	LPTIM1_OUT, SPI2_MOSI/I2S2_SD, I2C3_SDA, LPUART1_TX, CM4_EVENTOUT
30	PC6	I/O	I2S2_MCK, CM4_EVENTOUT
31	PA9	I/O	TIM1_CH2, SPI2_NSS/I2S2_WS, I2C1_SCL, SPI2_SCK/I2S2_CK, USART1_TX, CM4_EVENTOUT
32	PC0	I/O	LPTIM1_IN1, I2C3_SCL, LPUART1_RX, LPTIM2_IN1, CM4_EVENTOUT
33	PA6	I/O	TIM1_BKIN, I2C2_SMBA, SPI1_MISO, LPUART1_CTS, DEBUG_SUBGHZSPI_ MISOOUT, TIM16_CH1, CM4_EVENTOUT
34	PC4	I/O	CM4_EVENTOUT
35	PA1	I/O	TIM2_CH2, LPTIM3_OUT, I2C1_SMBA, SPI1_SCK, USART2_RTS, LPUART1_RTS, CM4_EVENTOUT
36	PB11	I/O	TIM2_CH4, I2C3_SDA, LPUART1_TX, COMP2_OUT, CM4_EVENTOUT
37	PA2	I/O	LSCO, TIM2_CH3, USART2_TX,

			LPUART1_TX, COMP2_OUT, DEBUG_PWR_LDORDY, CM4_EVENTOUT
38	PA3	I/O	TIM2_CH4, I2S2_MCK, USART2_RX, LPUART1_RX, CM4_EVENTOUT
39	PA4	I/O	RTC_OUT2, LPTIM1_OUT, SPI1_NSS, USART2_CK, DEBUG_SUBGHZSPI_ NSSOUT, LPTIM2_OUT, CM4_EVENTOUT
40	PA5	I/O	TIM2_CH1, TIM2_ETR, SPI2_MISO, SPI1_SCK, DEBUG_SUBGHZSPI_ SCKOUT, LPTIM2_ETR, CM4_EVENTOUT
41	NRST	I/O	Reset
42	PA8	I/O	MCO, TIM1_CH1, SPI2_SCK/I2S2_CK, USART1_CK, LPTIM2_OUT, CM4_EVENTOUT
43	PA7	I/O	TIM1_CH1N, I2C3_SCL, SPI1_MOSI, COMP2_OUT, DEBUG_SUBGHZSPI_ MOSIOUT, TIM17_CH1, CM4_EVENTOUT
44	PB10	I/O	TIM2_CH3, I2C3_SCL, SPI2_SCK/I2S2_CK, LPUART1_RX, COMP1_OUT, CM4_EVENTOUT
45	BOOT0	I/O	CM4_EVENTOUT
46	GND	S	Ground

7. Programming Information

It can be programmed using STLink or STM32F446 Nucleo-64 programmer board with below pin interface.

1. GND
2. 3V3
3. JTMS-SWDIO (PA13)
4. JTCK-SWCLK (PA14)
5. NRST

8. Reset Information

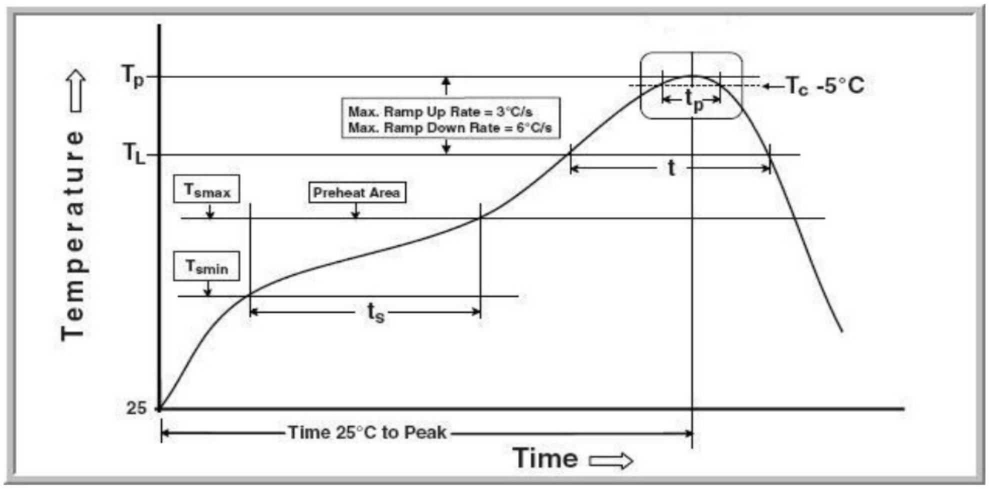
NRST is maintained HIGH in module itself. This pin is active low.

9. Recommended antenna

Any 50 ohm matched antenna with U.FL connection.

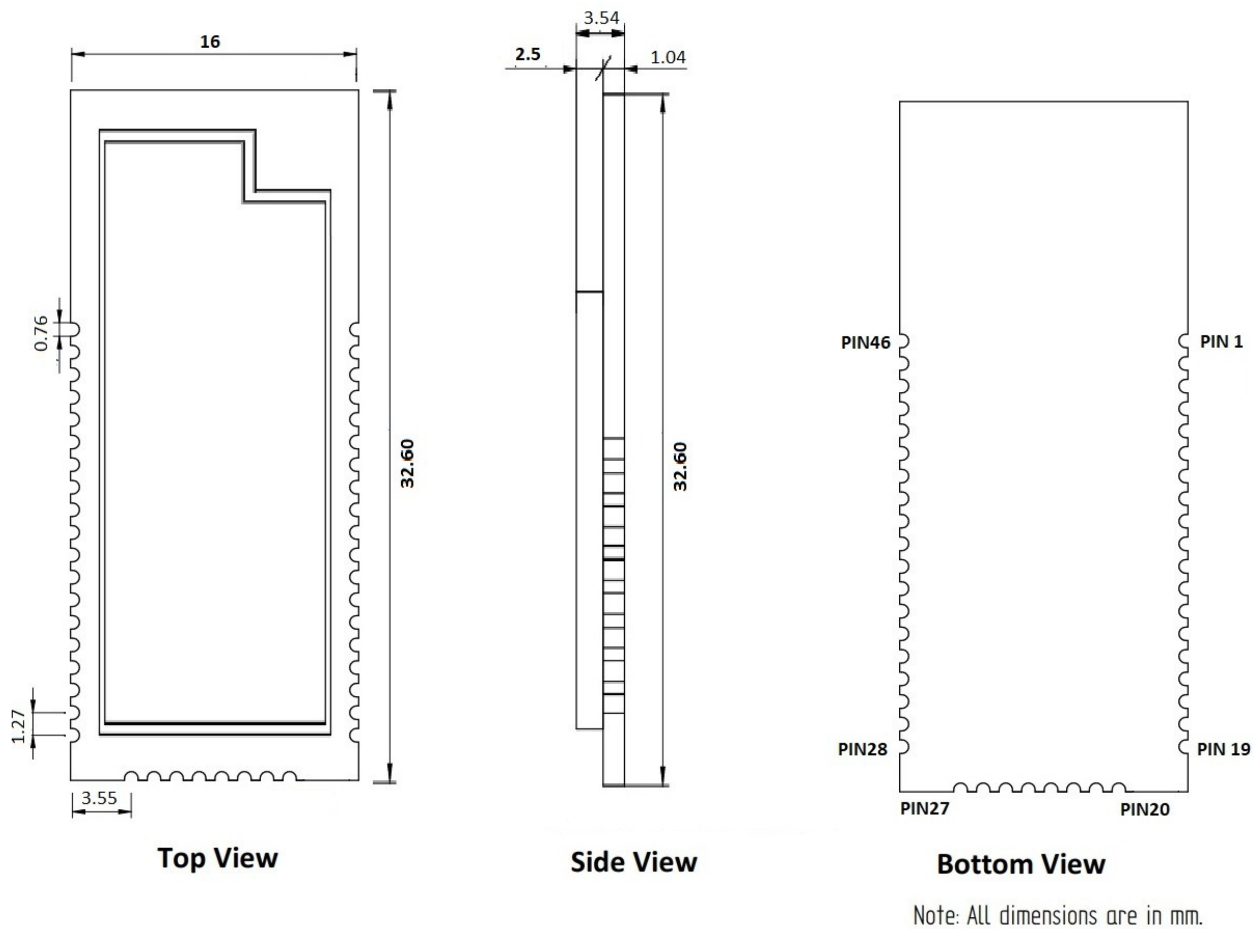
10. Soldering Information

For reflow soldering, it is recommended to follow the reflow profile in below figure as a guide, as well as the paste manufacturer's guidelines on peak flow temperature, soak times, time above liquid and ramp rates.



Profile Feature	Pb-Free Assembly
Average Ramp-Up Rate (TSmax to TP)	3°C / second max.
Preheat Temperature Min (Tsmin) Temperature Max (Tsmax) Time (tSmin to tSmax)	 150°C 200°C 60-180 seconds
Time maintained above Temperature (TL) Time (tL)	 217°C 60-150 seconds
Peak/Classification Temperature (TP)	245°C
Time within 5°C of the specified Peak Temperature (tP)	20-40 seconds
Ramp-Down Rate (TP to TL)	6°C / second max.
Time 25°C to Peak Temperature	8 minutes max.

11.Package Outline



12. Regulatory Approval

CE-RED	Under Process
FCC	Under Process
WEEE	Under Process
RoHS	Under Process
LoRa Certification	Under Process
WPC	Under Process