BB-STM23WL

User Manual

Rev.1.0 November 2021

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Overview

LoRa (short for long range) is a spread spectrum modulation technique derived from chirp spread spectrum (CSS) technology. LoRa devices and wireless radio frequency technology is a long range, low power wireless platform that has become very popular for Internet of Things (IoT) networks worldwide. LoRa devices and the open LoRaWAN® protocol enable smart IoT applications that solve some of the biggest challenges facing our planet: energy management, natural resource reduction, pollution control, infrastructure efficiency, disaster prevention, and more.

LoRa advantages are:

- Easy to install – wireless technology, no need to install wires, dig channels etc.
- Uses license free frequancy – no need to pay licensee fees like GSM frequencies.
- Low power – LoRa devices can work up to 10 years from small lithium battery (depend on how many messages per day device will send).
- Long Range – LoRa devices can communicate up to 15 km at rural and up to 1-2km in urban area.
- Secure communication – all messages are AES128 encrypted
- Low Cost – LoRa devices are under EUR 10
- No taxes for traffic like other technologies which require operator like GSM, LTE, NB-IoT, SigFox etc.

LoRa is not solution for any problem, some limitations are:

- small messages 51 up to 222 bytes
- slow speed of transmission 292 up to 550 bps

The long range is good but also bad as when one device start to transmit all other devices in it’s range can’t transmit. This creates some issues when for instance thousands of devices are installed in their transmission range reach. When we add to this that there is no moderation/operator who to set rules, if one participant do not follow the rules and start to transmit without pause this participant will jam/silence all others withing his transmission ranges.

General information

BB-STM32WL is based on ST Microelectronics Inc STM32WLE5CCU6 SOC.

STM32WLE5CCU6 is long-range wireless and ultra-low-power device and embed a powerful and ultra-low-power LPWAN-compliant radio solution, enabling LoRa® modulation.

STM32WLE5CCU6 features:

- 32-bit Arm® Cortex®-M4 CPU
- 256-Kbyte Flash memory
- 64-Kbyte RAM
- RF Frequency range: 150 MHz to 960 MHz
- Modulation: LoRa®
- RX sensitivity: –148 dBm (at 10.4 kHz, spreading factor 12)
- Transmitter high output power, programmable up to +22 dBm
- Transmitter low output power, programmable up to +15 dBm
- Compliant with the following radio frequency regulations such as ETSI EN 300 220, EN 300 113, EN 301 166, FCC CFR 47 Part 15, 24, 90, 101 and the Japanese ARIB STD-T30, T-67, T-108
- Compatible with LoRaWAN®
- 1.8 V to 3.6 V power supply
- -40 °C to +105 °C temperature range
- Shutdown mode: 31 nA (V_{DD} = 3 V)
- Standby (+ RTC) mode:360 nA (V_{DD} = 3 V)
- Stop2 (+ RTC) mode: 1.07 µA (V_{DD} = 3 V)
- Active-mode MCU: < 72 µA/MHz (CoreMark®)
- Active-mode RX: 4.82 mA
- Active-mode TX: 15 mA at 10 dBm and 87 mA at 20 dBm (LoRa® 125 kHz)
- Hardware encryption AES 256-bit
- True random number generator (RNG)
- Sector protection against read/write operations (PCROP, RDP, WRP)
- CRC calculation unit
- Unique device identifier (64-bit UID compliant with IEEE 802-2001 standard)
- 96-bit unique die identifier
- Hardware public key accelerator (PKA)
- High-efficiency embedded SMPS step-down converter
- SMPS to LDO smart switch
- Ultra-safe, low-power BOR (brownout reset) with 5 selectable thresholds
- Ultra-low-power POR/PDR
- Programmable voltage detector (PVD)
- VBAT mode with RTC and 20x32-byte backup registers
- 32 MHz crystal oscillator
- TCXO support: programmable supply voltage

- 32 kHz oscillator for RTC with calibration
- High-speed internal 16 MHz factory trimmed RC (± 1 %)
- Internal low-power 32 kHz RC
- Internal multi-speed low-power 100 kHz to 48 MHz RC
- PLL for CPU, ADC and audio clocks
- 20x32-bit backup register
- Bootloader supporting USART and SPI interfaces
- OTA (over-the-air) firmware update capable
- Sector protection against read/write operations
- 12-bit ADC 2.5 Msps, up to 16 bits with hardware oversampling, conversion range up to 3.6 V
- 12-bit DAC, low-power sample-and-hold
- 2x ultra-low-power comparators
- 2x DMA controller (7 channels each) supporting ADC, DAC, SPI, I2C, LPUART, USART, AES and timers
- 2x USART (ISO 7816, IrDA, SPI)
- 1x LPUART (low-power)
- 2x SPI 16 Mbit/s (1 over 2 supporting I2S)
- 3x I2C (SMBus/PMBus™)
- 2x 16-bit 1-channel timer
- 1x 16-bit 4-channel timer (supporting motor control)
- 1x 32-bit 4-channel timer
- 3x 16-bit ultra-low-power timer
- 1x RTC with 32-bit sub-second wakeup counter
- 1x independent SysTick
- 1x independent watchdog
- 1x window watchdog
- 43 I/Os, most 5 V-tolerant
- Serial-wire debug (SWD), JTAG

BB-STM32WL module has no antenna but just U.FL connector for external antenna.

We offer BB-STM32WL-ANT with PCB antenna with +2dBi gain :

Order codes

LoRa in Europe operates at 868Mz and in North America operates at 915Mhz.

BB-STM32WL is produced by default for 868Mhz. Note that 915Mhz version can be produced on request.

BB-STM32WL	industrial grade -40+85°C, European frequency, no antenna, u.FL IPEX connector
BB-STM32WL-ANT	industrial grade -40+85°C, European frequency, includes cable and PCB antenna

Software

STM32WL have extensive software support from ST Microelectronics.

LoRa and LoRaWAN projects are available.

Power supply

BB-STM32WL supply voltage is 3.3V, but operates from 1.8 up to 3.6VDC, this allow full utilization of LiPo 3.7V battery (discharged 2.0V, charged 3.7V)

Make sure your power source can provide peak current at least 120mA.

Power consumption is:

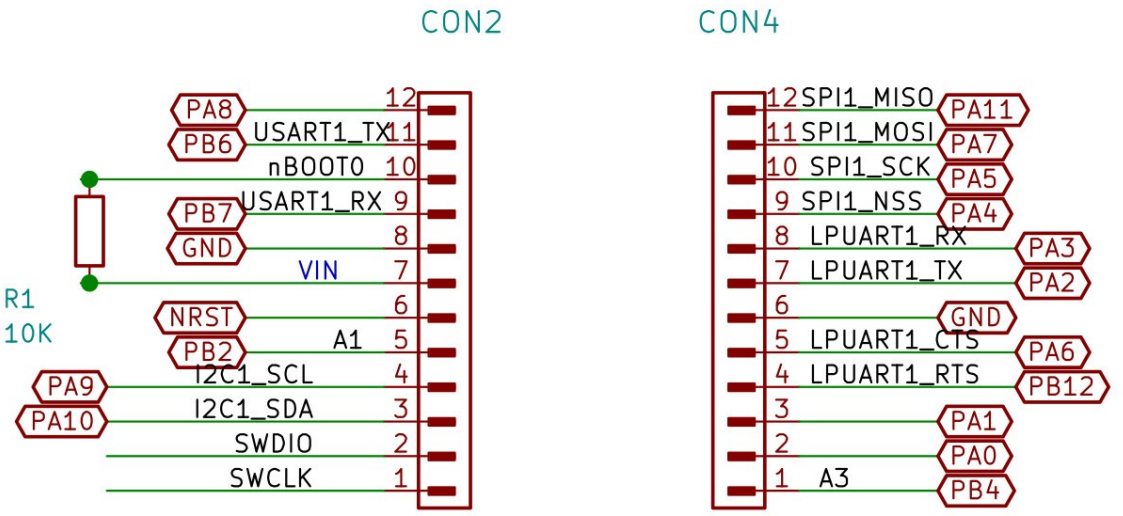
- Supply current in Sleep mode 0.2mA
- Supply current in Standby mode 1.6-1.8mA
- Supply current in Receive mode 10-12mA
- Supply current in Transmit mode +13 dBm 29 mA
- Supply current in Transmit mode +20 dBm 120 mA

Pinout

All available STM32WL signals are available on two 0.1 inch (2.54 mm) step row of 12 pads where headers can be soldered.

The distance between the rows is 1.0 inch (25.4mm)

Total board dimensions are 1.1 inch (28 mm) x 1.22 inch (31 mm)



Revision History

Revision 1.0 November 2021

Contact information

Headquarters and Factory address:

OLIMEX Ltd

ul. Pravda 2

Plovdiv 4000

BULGARIA

Sales: sales@olimex.com

Technical Support: support@olimex.com

Corporate Website: www.olimex.com

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