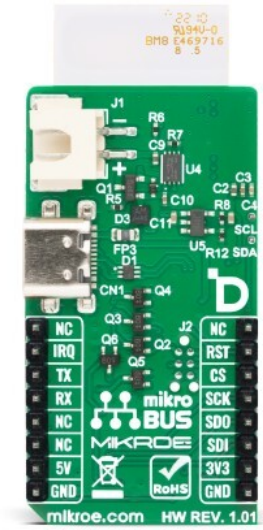
MIKROELEKTRONIKA D.O.O, Batajnički drum 23, 11000 Belgrade, Serbia
VAT: SR105917343 Registration No. 20490918
Phone: + 381 11 78 57 600 Fax: + 381 11 63 09 644 E-mail: office@mikroe.com
www.mikroe.com

# RTLS UWB Click


PID: MIKROE-6863

**RTLS UWB Click** is a compact add-on board designed for real-time location, distance measurement, and motion-aware tracking applications using ultra-wideband communication. This board is based on the DWM3001C, a two-way ranging (TWR) communication module with an integrated BLE SoC and motion sensor from Qorvo. It integrates a DW3110 UWB transceiver, nRF52833 Bluetooth Low Energy MCU, LIS2DH12 accelerometer, planar UWB antenna, power management circuitry, and crystal oscillator, supporting IEEE 802.15.4-2015 and IEEE 802.15.4z BPRF standards, UWB channels 5 and 9, data rates up to 6.8Mbps, AES 128/256 security, UART communication, motion-triggered ranging, battery charging, USB Type-C control, NFC connectivity, and onboard status indication. RTLS UWB Click is suitable for asset tracking, indoor positioning, personnel and equipment localization, smart logistics, industrial monitoring, and other low-power real-time location systems.

For more information about **RTLS UWB Click** visit the official product page.

## How does it work?

RTLS UWB Click is based on the DWM3001C, a two-way ranging (TWR) communication module with an integrated BLE SoC and motion sensor from Qorvo. The module combines the DW3110 low-power single-chip CMOS RF transceiver, Nordic nRF52833 microcontroller, planar UWB antenna, LIS2DH12 three-axis accelerometer, power management circuitry, and crystal oscillator into a fully integrated solution optimized for precise real-time location systems using two-way ranging or TDoA schemes, as well as location-aware wireless sensor networks. It is compliant with IEEE 802.15.4-2015 and IEEE 802.15.4z BPRF standards, and supports UWB channels 5 at 6.5GHz and 9 at 8GHz, data rates of 850kbps and 6.8Mbps, packet lengths up to 1023 bytes, integrated MAC support features, AES 128/256 security, and a fully coherent

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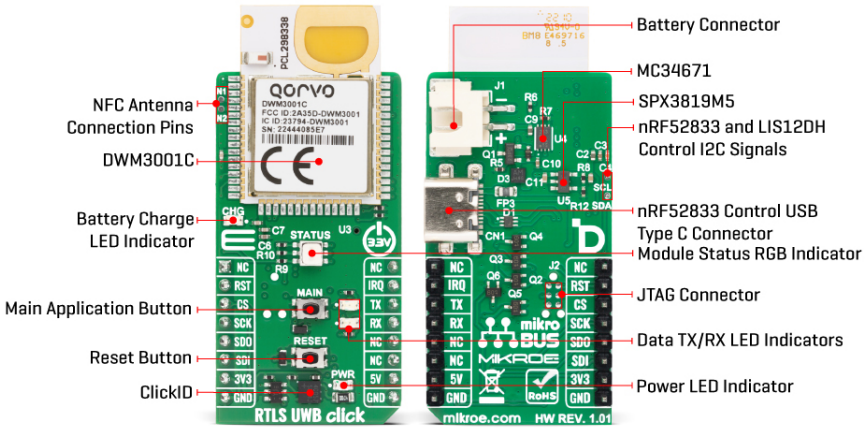
receiver for maximum range and positioning accuracy, while maintaining power consumption optimized for battery-operated applications.




The onboard nRF52833 processor is based on a 64MHz Arm® Cortex®-M4 core and provides Bluetooth Low Energy connectivity together with advanced interfaces such as USB 2.0 full-speed, high-speed SPI, and NFC-A support, while the integrated LIS2DH12 accelerometer enables motion-aware operation, allowing UWB ranging to be activated only when movement is detected to help extend battery life. RTLS UWB Click is suitable for asset tracking, indoor positioning, personnel and equipment localization, smart logistics, industrial monitoring, and other applications requiring accurate, secure, and low-power real-time location functionality.

RTLS UWB Click communicates with the host MCU through a UART interface, with TX and RX orange LED indicators for data activity monitoring, while additional SPI signals for the nRF52833 processor and I2C data and clock lines shared with the LIS2DH12 accelerometer are available through onboard test points. The board also provides an IRQ pin used to signal interrupt events from the module to the host MCU, while the RST pin and onboard RESET button both serve the same function of resetting the DWM3001C module. It also includes a MAIN application button and an RGB module status indicator for flexible control and system feedback.

For development and standalone use, it includes a USB Type-C connector for nRF52833 control, NFC pins for external antenna connection, a JTAG connector on the back side of the board for debugging and programming, and a battery connector with an onboard MC34671 battery charger and orange CHG LED indicator for charge status monitoring.

This Click board™ can operate with both 3.3V and 5V power supply rails, while the DWM3001C module itself uses low-voltage internal power domains. Therefore, appropriate logic voltage level conversion must be performed before interfacing the board with MCUs operating at different logic levels. It also comes equipped with a library containing functions and example code that can be used as a reference for further development.

Multiple RTLS UWB Click boards with the **LEAPS RTLS software stack** will provide an all-in-one demonstration setup. The setup provides a wide range of evaluation demonstrations of the Ultra-Wideband technology ranging from infrastructure-less proximity between the tags, advanced navigation and tracking RTLS (Real-Time Location System) demonstrations using DL-TDoA (Downlink TDoA), UL-TDoA (Uplink TDoA) and TWR (Two-Way Ranging) techniques. Uplink and Downlink data telemetry are also a part of the RTLS demo.

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## Specifications

| | |
|---|---|
| Type | UWB |
| Applications | Ideal for precise UWB-based positioning, tracking, access control, and presence-aware interaction across smart cities, buildings, industry, retail, homes, and consumer devices |
| On-board modules | DWM3001C - a two-way ranging (TWR) communication module with BLE SoC and motion sensor from Qorvo |
| Key Features | IEEE 802.15.4-2015 and IEEE 802.15.4z BPRF compliance, UWB channels 5 and 9 support, 850kbps and 6.8Mbps data rates, up to 1023-byte packet length, AES 128/256 security block, fully coherent receiver, integrated Nordic nRF52833 BLE SoC, integrated LIS2DH12 three-axis accelerometer, motion-aware UWB ranging, and more |
| Interface | I2C,SPI,UART,USB |
| Feature | ClickID |
| Compatibility | mikroBUS™ |
| Click board size | M (42.9 x 25.4 mm) |
| Input Voltage | 3.3V,5V |

## Pinout diagram

This table shows how the pinout on RTLS UWB Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

| Notes | Pin | mikroBUS | | | | Pin | Notes |
|---|---|---|---|---|---|---|---|
| | NC | 1 | AN | PWM | 16 | NC | |
| Reset / ID SEL | **RST** | 2 | RST | INT | 15 | **IRQ** | Interrupt |
| SPI Select / ID COMM | **CS** | 3 | CS | RX | 14 | **TX** | UART TX |
| SPI Clock | **SCK** | 4 | SCK | TX | 13 | **RX** | UART RX |
| SPI Data OUT | **SDO** | 5 | MISO | SCL | 12 | NC | |
| SPI Data IN | **SDI** | 6 | MOSI | SDA | 11 | NC | |
| Power Supply | **3.3V** | 7 | 3.3V | 5V | 10 | **5V** | Power Supply |
| Ground | **GND** | 8 | GND | GND | 9 | **GND** | Ground |

## Onboard settings and indicators

| Label | Name | Default | Description |
|---|---|---|---|
| LD1 | PWR | - | Power LED Indicator |
| LD2-LD3 | - | - | Data TX/RX LED Indicators |
| LD4 | CHG | - | Power LED Indicator |
| LD5 | STATUS | - | Module Status RGB Indicator |

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| | | | |
|---|---|---|---|
| T1 | RESET | - | Reset Button |
| T2 | MAIN | - | Main Application Button |

## RTLS UWB Click electrical specifications

| Description | Min | Typ | Max | Unit |
|---|---|---|---|---|
| Supply Voltage | 3.3 | - | 5 | V |
| UWB Operating Frequency | 6.5 | - | 8 | GHz |
| UWB Data Rate | 850 | - | 6800 | kbps |
| RX Power | - | 14 | - | dBm |

## Software Support

RTLS UWB Click demo application is developed using the NECTO Studio, ensuring compatibility with mikroSDK's open-source libraries and tools. Designed for plug-and-play implementation and testing, the demo is fully compatible with all development, starter, and mikromedia boards featuring a mikroBUS™ socket.

### Example Description

This example demonstrates the use of an RTLS UWB Click board by showing the two-way ranging (TWR) communication between two or three Click boards.

Key Functions

- rtlsuwb_cfg_setup This function initializes Click configuration structure to initial values.
- rtlsuwb_init This function initializes all necessary pins and peripherals used for this Click board.
- rtlsuwb_cmd_run This function sends a specified command to the Click module.
- rtlsuwb_cmd_set This function sets a value to a specified command of the Click module.
- rtlsuwb_generic_read This function reads a desired number of data bytes by using UART serial interface.

Application Init

Initializes the logger and RTLS UWB Click driver, resets the device, switches it to stop mode, and configures the selected application mode as initiator or responder.

Application Task

Reads and displays all incoming messages on the USB UART. One Click board should be configured to APP_INITIATOR and the others to APP_RESPONDER_1 and APP_RESPONDER_2. The initiator Click displays the address and distance of each responder nodes, while the responder Click boards displays the address and distance of the initiator Click board.

### Application Output

This Click board can be interfaced and monitored in two ways:

- Application Output - Use the "Application Output" window in Debug mode for real-time data monitoring. Set it up properly by following this tutorial.
- UART Terminal - Monitor data via the UART Terminal using a USB to UART converter.

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For detailed instructions, check out this tutorial.

### Additional Notes and Information

The complete application code and a ready-to-use project are available through the NECTO Studio Package Manager for direct installation in the NECTO Studio. The application code can also be found on the MIKROE GitHub account.

## Resources

mikroBUS™

mikroSDK

Click board™ Catalog

Click boards™

ClickID

## Downloads

RTLS UWB click example package

RTLS UWB click 2D and 3D files v101

RTLS UWB click schematic v101

DWM3001C datasheet

LEAPS RTLS Specification

LEAPS documentation

LEAPS Software Demos