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BL653 Click

PID: MIKROE-6433

BL653 Click is a compact add-on board for long-range Bluetooth Low Energy (LE) connectivity in next-generation industrial IoT applications. This board features the BL653 module from Ezurio and is powered by Nordic's nRF52833 silicon; it integrates a powerful Cortex-M4F microcontroller with 512kB flash memory and 128kB RAM. It supports Bluetooth v5.4 features such as direction finding (AoA and AoD), NFC capabilities, and multiple interfaces, including UART, I2C, SPI, and USB. It offers robust communication with data rates of 2Mbps, 1Mbps, and 125kbps coded PHY, alongside modular certifications for global compliance. BL653 Click is ideal for device control, data collection, proximity sensing, and industrial automation applications, even in harsh environments.

For more information about **BL653 Click** visit the official product page.

How does it work?

BL653 Click is based on the BL653, a longer-range Bluetooth LE module for next-generation industrial IoT from Ezurio. This module, powered by Nordic's nRF52833 silicon, integrates a powerful Cortex-M4F microcontroller, offering 512kB of flash memory and 128kB of RAM for hostless operation and efficient application processing. With its multi-wireless capabilities (Bluetooth v5.4 and NFC) and modular certifications for FCC, ISED, EU, RCM, MIC, KC, AS/NZS, and Bluetooth SIG, the BL653 Click ensures quick and hassle-free deployment in global markets. It represents the future of wireless Industrial Internet of Things (IIoT) connectivity to implement reliable wireless communication in even the harshest operating environments.

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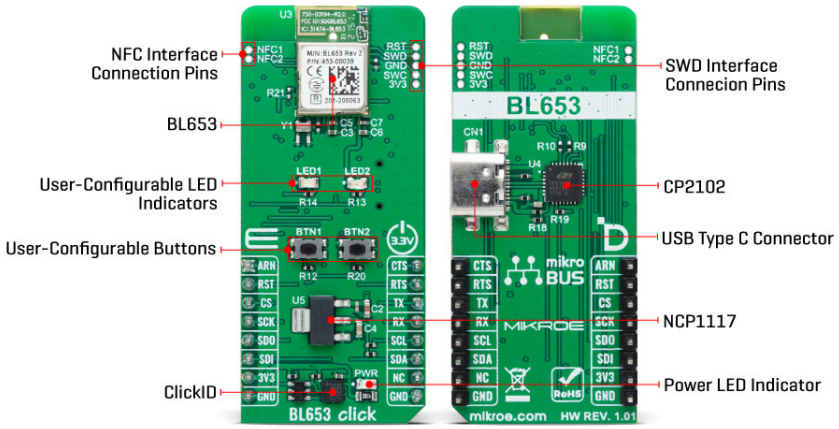

This Click board™ provides a wide range of configurable interfaces, including UART, I2C, SPI, USB, and NFC, allowing easy integration into diverse industrial systems. It supports peripheral and central Bluetooth LE roles, enabling data collection, device control, and proximity-sensing applications. Its support for Bluetooth 5.4 features like direction finding (AoA and AoD) and multiple data rates, including 2Mbps, 1Mbps, and 125kbps coded PHY, ensures high-performance communication over long distances. It can be easily programmed using a simple AT command set, Zephyr RTOS, or the Nordic SDK, allowing developers to create event-driven, automated applications or implement custom solutions.

This Click board™ establishes communication between the BL653 module and the host MCU through a UART interface, using standard UART RX and TX pins and hardware flow control via CTS and RTS pins. The default communication speed is set at 115200bps, ensuring efficient data exchange. The host MCU configures communication and other features using high-level AT commands, making it easy to manage without requiring in-depth knowledge of Bluetooth protocol. Additionally, the board includes an SPI interface with a maximum clock speed of 8MHz and an I2C interface with a maximum clock speed of 400kHz.

In addition to the interface pins, the board features a reset (RST) pin for hard resetting the module when necessary and an ARN pin as AutoRUN signal of the BL653 module that selects between the two BL653 operating modes at power-up: self-contained run mode or interactive/development mode. This board also includes a USB Type-C connector for USB 2.0 Full Speed 12Mbps hardware capability, allowing both power supply and configuration via a PC. This functionality is enabled by the CP2102N, a highly integrated USB-to-UART bridge, along with the NCP1117 LDO regulator, which converts the USB supply to the necessary 3.3V for the module.

BL653 Click also includes dedicated pins for NFC support, fully compliant with the NFC Forum specification. This feature operates at 13.56MHz with a data rate of 106kbps, supporting NFC Type 2 and Type 4 tag emulation. It offers multiple modes of operation, including disable, sense, and activated, providing flexibility for integrating advanced NFC functionalities into your applications. Additionally, the board features two user-configurable buttons (BTN1 and BTN2) and two user-configurable LED indicators (a blue LED1 and an orange LED2) for customizable user interaction and status indication. For development and debugging purposes, the Click board™ is equipped with unsoldered pins for an SWD interface, enabling easy access to programming and debugging functionalities.

This Click board™ can be operated only with a 3.3V logic voltage level. The board must

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perform appropriate logic voltage level conversion before using MCUs with 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.

Specifications

Type	BT/BLE
Applications	Ideal for device control, data collection, proximity sensing, and industrial automation applications, even in harsh environments
On-board modules	BL653 - Bluetooth LE module for next-generation industrial IoT from Ezurio
Key Features	Bluetooth LE v5.4 module powered by Nordic's nRF52833 Cortex-M4 silicon, features like AoA/AoD and up to 2Mbps coded PHY, compliant with NFC Forum specifications, several interfaces, user interaction, SWD interface for debugging, and more
Interface	I2C,SPI,UART,USB
Feature	ClickID
Compatibility	mikroBUS™
Click board size	L (57.15 x 25.4 mm)
Input Voltage	3.3V

Pinout diagram

This table shows how the pinout on BL653 Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin	mikroBUS				Pin	Notes
AutoRUN Control	**ARN**	1	AN	PWM	16	**CTS**	UART CTS
Reset	**RST**	2	RST	INT	15	**RTS**	UART RTS
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	**SCL**	I2C Clock
SPI Data IN	**SDI**	6	MOSI	SDA	11	**SDA**	I2C Data
Power Supply	**3.3V**	7	3.3V	5V	10	NC	
Ground	**GND**	8	GND	GND	9	**GND**	Ground

Onboard settings and indicators

Label	Name	Default	Description
LD1	PWR	-	Power LED Indicator
LD2-LD3	LED1-LED2	-	User-Configurable LED Indicators
T1-T2	BTN1-BTN2	-	User-Configurable Buttons

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BL653 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	-	3.3	-	V
Frequency	2.402	-	2.480	GHz
Transmit Output Power	-	-	+8	dBm
Receive Sensitivity	-96	-	-103	dBm
Raw Data rates (Air)	125	-	1000	kbps

Software Support

BL653 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 BL653 Click board by processing data from a connected BT device.

Key Functions

- bl653_cfg_setup Config Object Initialization function.
- bl653_init Initialization function.
- bl653_cmd_run This function sends a specified command with or without parameters to the Click module.
- bl653_cmd_set This function sets a value to a specified command parameter of the Click module.
- bl653_cmd_get This function is used to get the value of a given command parameter from the Click module.

Application Init

Initializes the driver and logger.

Application Task

Application task is split in few stages:

- BL653_POWER_UP:

  Powers up the device and reads the system information.

- BL653_CONFIG_EXAMPLE:

  Sets the BT device name.

- BL653_EXAMPLE:

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Performs a BT terminal example by processing all data from a connected BT device and sending back an adequate response messages.

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. 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

BL653 click 2D and 3D files v101

BL653 datasheet

BL653 click schematic v101

BL653 click example package