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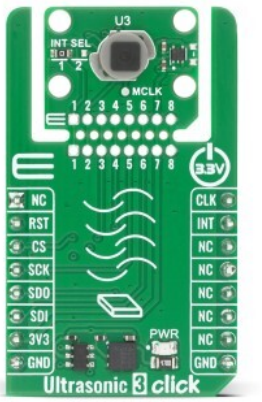
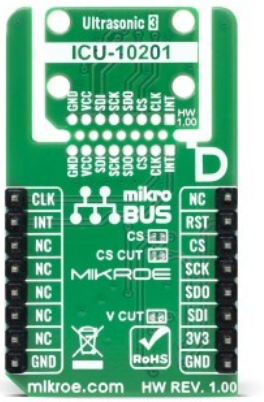
Ultrasonic 3 Click





PID: MIKROE-4870

Ultrasonic 3 Click is a compact add-on board designed for distance measurement, presence detection, and object tracking in short- to mid-range embedded applications. It is based on the ICU-10201, a high-performance ultrasonic Time-of-Flight (ToF) transceiver from TDK InvenSense built on Chirp's patented MEMS technology that integrates a 175kHz PMUT with a second-generation ultra-low-power SoC. This sensor supports an operating range from 10cm up to 1.2m, detects moving objects closer than 10cm, enables simultaneous ranging to multiple objects within a customizable field of view of up to 180°, and operates reliably in all lighting conditions while remaining insensitive to object color and capable of detecting transparent surfaces such as glass. It communicates with the host MCU over an SPI interface up to 13MHz, and supports the MIKROE Click Snap feature for flexible integration. It is ideal for robotic vacuum navigation, cliff and floor detection, sub-1m presence sensing, 3D tracking, and pitch-catch ranging between wireless nodes.

For more information about **Ultrasonic 3 Click** visit the official product page.

How does it work?

Ultrasonic 3 Click is based on the ICU-10201, an ultrasonic Time-of-Flight (ToF) transceiver from TDK InvenSense, built on Chirp's patented MEMS technology and designed for distance measurement, presence detection, and object tracking in short- to mid-range embedded applications. The ICU-10201 integrates a nominally 175kHz PMUT (Piezoelectric Micromachined Ultrasonic Transducer) with a second-generation ultra-low power System on Chip. The integrated SoC is optimized for low overall system power consumption and simplified integration with external host processors, using custom digital circuitry to process and buffer raw ultrasonic sensor data. It can convert raw measurements into high-level outputs such as

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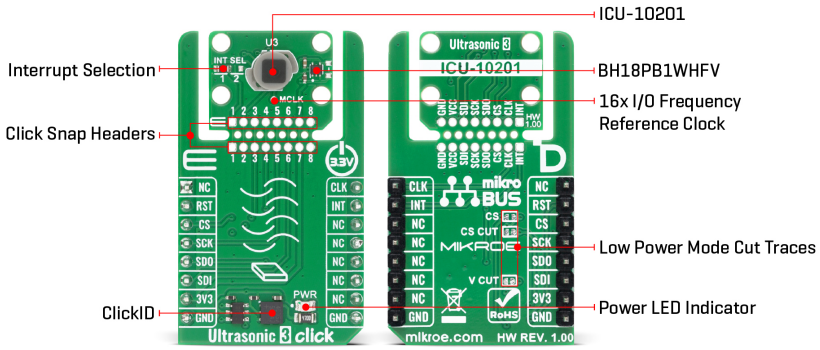
precise range to nearby targets or event-based detection such as presence, which can be directly accessed by the host MCU.



Ultrasonic 3 Click supports an operating range from 10cm up to 1.2m, detects moving objects closer than 10cm, and enables simultaneous range measurements to multiple objects within its customizable field of view of up to 180°. It operates reliably in all lighting conditions, from full sunlight to complete darkness, and is insensitive to object color while also detecting optically transparent surfaces such as glass and clear plastics. These characteristics make it suitable for applications including floor type detection and cliff detection in robotic vacuums, sub-1m presence sensing, 3D tracking, and pitch-catch ranging between wireless nodes.

This Click board™ is designed in a unique format supporting the newly introduced MIKROE feature called "Click Snap." Unlike the standardized version of Click boards, this feature allows the main sensor/IC/module area to become movable by breaking the PCB, opening many new possibilities for implementation. Thanks to the Snap feature, the ICU-10201 can operate autonomously by accessing its signals directly on the pins marked 1-8. Additionally, the Snap part includes a specified and fixed screw hole position, enabling users to secure the Snap board in their desired location.

The ICU-10201 communicates with the host processor via an SPI interface operating up to 13MHz with 3.3V power supply. The sensor can also operates with 1.8V, which is provided on the board by the BH18PB1WHFV LDO regulator generating 1.8V from the 3.3V mikroBUS™ power rail. In addition to standard interface signals, the board features an optional 32kHz reference clock input on the CLK pin, two programmable open-drain interrupt outputs routed through an onboard INT SEL jumper to the INT pin for flexible sensor triggering or host wake-up functionality, and an optional external 16x operating frequency reference clock available on the MCLK test point. Additionally, on the back side of the board, there is a designated section consisting of cuttable traces. By cutting these traces resulting in reduced power consumption and improved energy efficiency, making the board particularly suitable for battery-powered or energy-sensitive applications.

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

Click Snap

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Click Snap is an innovative feature of our standardized Click add-on boards, designed to bring greater flexibility and optimize your prototypes. By simply snapping the PCB along predefined lines, you can easily detach the main sensor/IC/module area, reducing the overall size, weight, and power consumption - ideal for the final phase of prototyping. For more details about Click Snap, visit the official page dedicated to this feature.

Specifications

Type	Proximity
Applications	Ideal for robotic vacuum navigation, cliff and floor detection, sub-1m presence sensing, 3D tracking, and pitch-catch ranging between wireless nodes
On-board modules	ICU-10201 - ultrasonic Time-of-Flight (ToF) sensor from TDK InvenSense
Key Features	Ultrasonic Time-of-Flight (ToF) sensing with integrated 175kHz PMUT and ultra-low-power SoC, operating range from 10cm to 1.2m, detection of moving objects closer than 10cm, simultaneous multi-object ranging within the field of view, customizable field of view up to 180°, reliable operation in all lighting conditions from full sunlight to complete darkness, insensitivity to object color with detection of optically transparent surfaces, Click Snap feature, and more
Interface	SPI
Feature	Click Snap,ClickID
Compatibility	mikroBUS™
Click board size	M (42.9 x 25.4 mm)
Input Voltage	3.3V

Pinout diagram

This table shows how the pinout on Ultrasonic 3 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	**CLK**	Low Frequency Reference Clock
ID SEL	**RST**	2	RST	INT	15	**INT**	Interrupt
SPI Select / ID COMM	**CS**	3	CS	RX	14	NC	
SPI Clock	**SCK**	4	SCK	TX	13	NC	
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	NC	
Ground	**GND**	8	GND	GND	9	**GND**	Ground

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Onboard settings and indicators

Label	Name	Default	Description
LD1	PWR	-	Power LED Indicator
JP1	INT SEL	Left	Interrupt Selection 1/2: Left position 1, Right position 2

Ultrasonic 3 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	-	1.8 / 3.3	-	V
Detection Range	0.10	-	1.20	m
Minimum Detectable Distance (moving object)	-	-	0.10	m

Software Support

Ultrasonic 3 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 ranging with Ultrasonic 3 Click (Chirp/TDK time-of-flight). The example periodically triggers a measurement and prints the measured distance to the USB UART.

Key Functions

- ultrasonic3_cfg_setup This function initializes Click configuration structure to initial values.
- ultrasonic3_init This function initializes all necessary pins and peripherals used for this Click board.
- ultrasonic3_default_cfg This function executes a default configuration of Ultrasonic 3 Click board.
- ultrasonic3_get_measurements This function triggers and reads the measurements and logs data.

Application Init

Initialize the USB UART logger and the Ultrasonic 3 driver, then apply the default configuration to start the sensor and prepare it for continuous single-shot ranging.

Application Task

Triggers a measurement and logs results (distance, sample number, and amplitude) every 100ms.

Application Output

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

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- 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

Ultrasonic 3 click example package

Ultrasonic 3 click 2D and 3D files v100

Ultrasonic 3 click schematic v100

ICU-10201 datasheet