

## CO2 3 Click



PID: MIKROE-5646

**CO2 3 Click** is a compact add-on board that allows for precise and reliable indoor air quality measurements. This board features XENSIV™ [PASCO2V01BUMA1](#), a highly accurate CO2 sensor module from [Infineon Technologies](#) that uses photoacoustic spectroscopy technology to measure indoor air quality. The module comprises a gas measuring cell, an IR emitter, a microphone, and a microcontroller for data processing. Its key components are developed in-house, ensuring the highest quality and performance. Other major characteristics include high accuracy, low power consumption, and versatile configuration options. This Click board™ is suitable for various applications in building automation, smart home appliances, and air quality monitoring, such as air purifiers, thermostats, and HVAC (heating, ventilation, and air conditioning) systems.

**NOTE:** The metal cover on the PAS module protects the inlet from dust, particles, and other contaminants. To ensure the module's proper functioning and longevity, keeping the metal cover in place and not removing it is essential.

### How does it work?

CO2 3 Click is based on the XENSIV™ PASCO2V01BUMA1, the smallest CO2 sensor module from Infineon Technologies that uses photoacoustic spectroscopy technology to measure indoor air quality. The module consists of a gas measuring cell with an infrared (IR) emitter, a high-SNR microphone as the acoustic detector, and an XMC™ microcontroller for data processing, delivering exceptional accuracy, boasting a rate of  $\pm 30\text{ppm} \pm 3\%$  of reading. Its diffuser port allows for efficient gas exchange while maintaining dust protection, and its acoustic isolation ensures highly accurate CO2 sensing information. Because of its superior features, this board makes an excellent choice for building automation, smart home

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appliances, and air quality monitoring, including air purifiers, thermostats, and HVAC systems. Its precise measurements can help optimize indoor air quality, improving human health, productivity, and comfort.



As mentioned, the PASCO2V01BUMA1 overcomes the size, performance, and assembly challenges of existing CO2 sensor solutions by using photoacoustic spectroscopy (PAS). It uses pulses of light from an infrared source that pass through an optical filter explicitly tuned to the CO2 absorption wavelength. The CO2 molecules inside the measurement chamber absorb the filtered light, causing the molecules to shake and generate a pressure wave with each pulse, known as the photoacoustic effect. The sound is then detected by an acoustic detector optimized for low-frequency operation, and the microcontroller converts the output into a CO2 concentration reading. This results in a highly accurate and reliable measurement of CO2 levels in real time.

All significant components of the XENSIV™ PASCO2V01BUMA1 CO2 module are developed in-house according to Infineon's high-quality standards, ensuring the highest quality and performance. The dedicated MCU runs advanced compensation algorithms to deliver direct and reliable ppm readouts of actual CO2 levels. The available configuration options, such as ABOC, pressure compensation, signal alarm, sample rate, and early measurement notification, make this board one of the most versatile plug-and-play CO2 solutions on the market.

This Click board™ comes with a configurable host interface that allows communication with MCU using the selected interface. The PASCO2V01BUMA1 can communicate with MCU using the UART interface with commonly used UART RX and TX pins as its default communication protocol operating at 115200bps to transmit and exchange data with the host MCU or using the optional I2C interface. The I2C interface is compatible with the Fast-Mode allowing a maximum frequency of 400kHz. Selection is made by positioning SMD jumpers marked COMM SEL to the appropriate position. All jumpers must be on the same side, or the Click board™ may become unresponsive.

As a third option for communication with the MCU, users have a PWM interface controlled via the PWS pin of the mikroBUS™ socket. The PWS pin is first asserted after the Power-On boot sequence (not after soft reset), and the level of the pin is checked. If a low level is detected, an internal interrupt routine configures the device into Continuous mode and starts a measurement sequence. At the end of each measurement sequence, the level of this pin is polled. If it is high, the device is configured back to Idle mode. The PWO pin, routed to the AN pin of the mikroBUS™ socket by default, offers the possibility to read out the CO2

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concentration by delivering a PWM signal whose timing information contains the CO2 concentration value. At the end of each measurement sequence, the device updates the PWM timing with the measured CO2 concentration. This board also possesses an additional interrupt alert signal, routed on the INT pin of the mikroBUS™ socket, to provide a notification of CO2 measurements that violate programmed thresholds.


This Click board™ can only be operated with a 3.3V logic voltage level. Since the sensor module for proper operation requires a voltage level of 12V, this Click board™ also features the [TLV61046A](#), a voltage boost converter to generate a stable 12V supply. The board must perform appropriate logic voltage level conversion before using MCUs with different logic levels. However, the Click board™ comes equipped with a library containing functions and an example code that can be used as a reference for further development.

## Specifications

Type	Gas
Applications	Can be used for air purifiers, thermostats, and HVAC (heating, ventilation, and air conditioning) systems
On-board modules	XENSIV™ PASCO2V01BUMA1 - CO2 sensor module from Infineon Technologies
Key Features	Based on the photoacoustic spectroscopy principle, high accuracy, compact size, direct ppm readout thanks via onboard MCU, operating range up to 32.000ppm, vast lifetime, selectable communication interface, and more
Interface	Analog,I2C,PWM,UART
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 CO2 3 Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin					Pin	Notes
PWM CO2 Concentration Signal	<b>PWO</b>	1	AN	PWM	16	<b>PWS</b>	PWM Interface Control
	NC	2	RST	INT	15	<b>INT</b>	Interrupt
ID COMM	<b>CS</b>	3	CS	RX	14	<b>TX</b>	UART TX
	NC	4	SCK	TX	13	<b>RX</b>	UART RX
	NC	5	MISO	SCL	12	<b>SCL</b>	I2C Clock
	NC	6	MOSI	SDA	11	<b>SDA</b>	I2C Data

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Power Supply	<b>3.3V</b>	7	3.3V	5V	10	<b>5V</b>	Power Supply
Ground	<b>GND</b>	8	GND	GND	9	<b>GND</b>	Ground

## Onboard settings and indicators

Label	Name	Default	Description
LD1	PWR	-	Power LED Indicator
JP1-JP2	COMM SEL	Right	Communication Interface Selection UART/I2C: Left position UART, Right position I2C

## CO2 3 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	3.3	-	5	V
Operating Range	0	-	32.000	ppm
Accuracy	-	±30	-	ppm

## Software Support

We provide a library for the CO2 3 Click as well as a demo application (example), developed using MIKROE [compilers](#). The demo can run on all the main MIKROE [development boards](#).

Package can be downloaded/installed directly from NECTO Studio Package Manager (recommended), downloaded from our [LibStock™](#) or found on [MIKROE github account](#).

### Library Description

This library contains API for CO2 3 Click driver.

Key functions

- `co23_get_co2_ppm` CO2 3 get CO2 concentration function.
- `co23_set_meas_cfg` CO2 3 set measurement configuration function.
- `co23_set_pressure_ref` CO2 3 set reference pressure function.

### Example Description

This library contains API for CO2 3 Click driver. This driver provides the functions for sensor configuration and reading the CO2 gas concentration in the air.

The full application code, and ready to use projects can be installed directly from NECTO Studio Package Manager (recommended), downloaded from our [LibStock™](#) or found on [MIKROE github account](#).

Other MIKROE Libraries used in the example:

- MikroSDK.Board

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- MikroSDK.Log
- Click.CO23

## Additional notes and informations

Depending on the development board you are using, you may need [USB UART click](#), [USB UART 2 Click](#) or [RS232 Click](#) to connect to your PC, for development systems with no UART to USB interface available on the board. UART terminal is available in all MIKROE [compilers](#).

## mikroSDK

This Click board™ is supported with [mikroSDK](#) - MIKROE Software Development Kit, that needs to be downloaded from the [LibStock](#) and installed for the compiler you are using to ensure proper operation of mikroSDK compliant Click board™ demo applications.

For more information about mikroSDK, visit the [official page](#).

## Resources

[mikroBUS™](#)

[mikroSDK](#)

[Click board™ Catalog](#)

[Click boards™](#)

[ClickID](#)

## Downloads

[CO2 3 click example on Libstock](#)

[CO2 3 click 2D and 3D files v101](#)

[TLV61046A datasheet](#)

[PASCO2V01BUMA1 datasheet](#)

[CO2 3 click schematic v101](#)

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