

CO₂ sensor



Overview

High performance in a small size – disruptive CO₂ sensor based on photoacoustic spectroscopy (PAS)

Use Infineon's XENSIV™ PAS CO₂ sensor to track the environment you are in – for improved health, productivity, and overall well-being.

Increasingly efficient building insulation can help to mitigate the effects of climate change, but heavily insulated buildings are not always good for human health. Poor ventilation can result in lower oxygen levels and a build-up of carbon dioxide (CO₂). Even moderate levels of CO₂ can have a negative impact on health and productivity. Already at 1000ppm, people begin to experience drowsiness and have difficulty concentrating. Consequently, CO₂ sensor module manufacturers are facing a growing demand for smart indoor air quality sensors that can “smell” rising levels of CO₂ and either alert the user or trigger a system response. Smart home CO₂ sensors enable real-time CO₂ monitoring for demand-controlled ventilation systems, air purifiers, and thermostats while allowing users to accurately measure and adjust indoor air quality.

Measure what matters with our XENSIV™ PAS CO₂ sensor

With the recent pandemic, awareness of indoor air quality is rising, making accurate, affordable monitoring solutions such as the XENSIV™ PAS CO₂ sensor more important than ever. It has been shown that a correlation exists between the concentration of CO₂ and aerosols, one of the transmission pathways of viruses (like COVID-19 or influenza). Therefore, if we can reliably measure the CO₂ level indoors using CO₂ sensing technology, we can actively manage the risk of virus transmission.

Widespread adoption of CO₂ sensors has so far been hampered by size, performance, and cost constraints. The XENSIV™ PAS CO₂ sensor from Infineon leverages photoacoustic spectroscopy (PAS) technology to provide an exceptionally small, real CO₂ sensor, overcoming the challenges of existing carbon dioxide gas detectors. Its unprecedentedly small form factor in SMD (Surface Mounted Device) package allows for smooth high-volume assembly and easy system integration. The unique CO₂ sensor intuitively understands its environment, using disruptive and highly accurate CO₂ sensor technology when measuring carbon dioxide detector levels.

CO₂ sensor product portfolio

As a global leader in sensor technology, Infineon has developed a CO₂ sensor chip that provides accurate, real-time CO₂ measurement thanks to superior MEMS technology. The MEMS-based CO₂

sensor uses Infineon's MEMS microphone which acts as a pressure sensor and is optimized for low frequency operation. The XENSIV™ PAS CO2 sensor module integrates a PAS transducer, a microcontroller, and a MOSFET on the PCB.

There are three CO₂ sensor types that are mainly used in the industry. These include PAS (photoacoustic spectroscopy) CO₂ sensors, NDIR (non-dispersive infrared) CO₂ sensors, and EC (electrochemical) CO₂ sensors. Infineon's XENSIV™ PAS CO2 sensor matches the performance of NDIR and EC CO₂ sensors, while being more affordable and compact, making it the ideal solution for smart home and building automation applications.

Along with size and cost advantages, the sensor delivers superior accuracy, providing a direct readout of the real CO₂ level, not simply a correlation. Infineon's leading position in MEMS technology is the foundation for this unique and accurate CO₂ detection approach. Reliable CO₂ sensor measurement enables smart CO₂ measurement and monitoring of indoor air quality, allowing users to take control of their environmental conditions and experience improvements in health, productivity, and overall well-being.

Get ready to measure what matters and register now!

Be one of the first informed when the new XENSIV™ PAS CO2 single sensor is in stock.

Contact us (<https://infineoncommunity.com/pas-co2-alert-me>)!

Highlights



XENSIV™ PAS CO2
sensor community


Learn more or ask questions

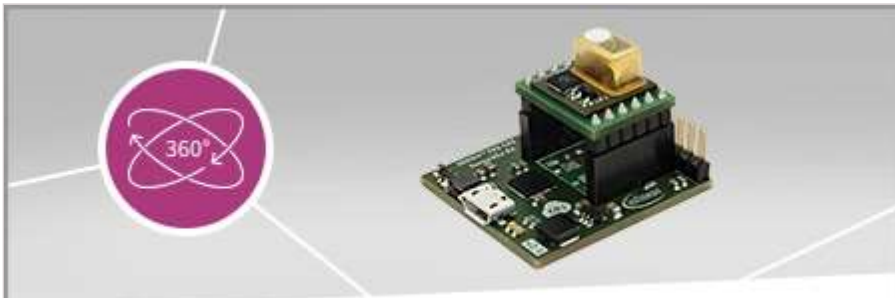
(<https://community.infineon.com/t5/CO2-Sensor/bd-p/CO2Sensors/?intc=PSS.RFS.P. EnvironSensing.Comm1>)

(<https://event.on24.com/wcc/r/3324212/9C628B550842F343665BA7EB6F7DB90B?partnerref=INF2>)



Webinar – accurate CO₂ measurement

 [see webinar](#)



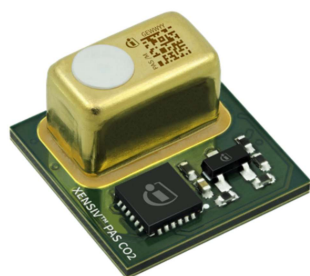
XENSIV™ PAS CO₂ Sensor2Go Evaluation Kit

 [Explore 3D model](#)

[\(/cms/media/pss-3dmodels/pas-co2-sensor-2go-kit/\)](/cms/media/pss-3dmodels/pas-co2-sensor-2go-kit/)

Details

Disruptive environmental sensor technology from Infineon



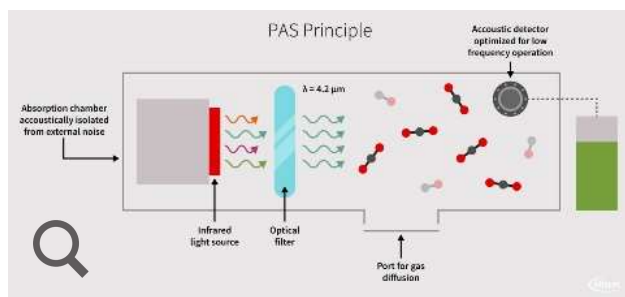
The XENSIV™ PAS CO₂ integrates on the PCB the photoacoustic (PAS) transducer, including a detector, infrared source and optical filter; a microcontroller for signal processing and algorithms; and a MOSFET chip to drive the infrared source. The integrated microcontroller runs ppm calculations as well as advanced compensation and configuration algorithms.

The sensor uses a MEMS acoustic detector. The exceptional sensitivity of this acoustic detector coupled with the integrated PCB design reduce space requirements by more than 75 percent compared to commercially available real CO₂ sensors. Therefore, the XENSIV™ PAS CO₂ sensor

outperforms state-of-the-art NDIR sensors in terms of size and cost, without compromising on performance.

Features	Benefits
<ul style="list-style-type: none"> • Exceptionally small form factor (14 x 13.8 x 7.5 mm³) • Accurate and robust performance at ppm level (± 30 ppm $\pm 3\%$ of reading) • SMD package delivered in tape and reel • Advanced compensation and self-calibration algorithms • Various configuration options (e.g. sampling rate, baseline calibration) and interfaces (UART, I2C, PWM) 	<ul style="list-style-type: none"> • Space savings in customers' end products • High-quality data and compliance with smart building standards • Cost-effective high-volume assembly and easy system integration • Plug & play for fast design-to-market • Customer flexibility thanks to variety of configuration options

The Photoacoustic Spectroscopy (PAS) Principle



The PAS principle works as follows. Pulses of light from an infrared source pass through an optical filter tuned specifically to the CO_2 absorption wavelength ($\lambda = 4.2 \mu\text{m}$). The CO_2 molecules inside the measurement chamber absorb the filtered light, causing the molecules to shake and generate a pressure wave with each pulse. This is called the photoacoustic effect. The highly sensitive MEMS

acoustic detector detects the pressure change generated by CO_2 molecules within the sensor cavity, and the microcontroller converts the output into a CO_2 concentration reading. In order to achieve a ppm reading as accurate as possible, the acoustic detector is optimized for low frequency operation, and the absorption chamber is acoustically isolated from external noise.

XENSIV™ PAS CO_2 sensor to detect carbon dioxide





Watch video [Share](#)

Watch the video to learn more about the PAS principle and how our XENSIV™ PAS CO2 sensor works.

Documents

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ret=https%3A%2F%2Fwww.infineon.com%2Fcms%2Fen%2Fproduct%2Fsensor%2Fco2-sensors%2F%23!documents)

to myInfineon to see all documents available

+ Expand all

+ Product Selection Guide



XENSIV™ – Sensing the World selection guide (/dgdl/Infineon-SensorSelectionGuide-ProductSelectionGuide-v01_00-EN.pdf?fileId=5546d462636cc8fb0164229c09f51bbe)

> EN/JA/CN (/dgdl/Infineon-SensorSelectionGuide-ProductSelectionGuide-v01_00-EN.pdf?fileId=5546d462636cc8fb0164229c09f51bbe)

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+ Product Brief



XENSIV™ PAS CO2 environmental sensor (/dgdl/Infineon-XENSIV_CO2_sensor-ProductBrief-v03_00-EN.pdf?fileId=5546d4626b2d8e69016b69ba27c958c1)

> EN (/dgdl/Infineon-XENSIV_CO2_sensor-ProductBrief-v03_00-EN.pdf?fileId=5546d4626b2d8e69016b69ba27c958c1)

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— Data Sheets



Preliminary datasheet for XENSIV™ PAS CO2 sensor (/dgd/Infineon-EVAL_PASCO2_SENSOR-DataSheet-v01_02-EN.pdf?

fileId=5546d462758f5bd10175934ec4215c6a)

> EN (/dgd/Infineon-EVAL_PASCO2_SENSOR-DataSheet-v01_02-EN.pdf?

fileId=5546d462758f5bd10175934ec4215c6a)

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Product Catalogue



XENSIV™ – sensing the world pocket guide (/dgd/Infineon-XENSIV_Pocket_Guide-ProductCatalogue-v03_00-EN.pdf?fileId=5546d462636cc8fb016422aea1671cc0)

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fileId=5546d462636cc8fb016422aea1671cc0)

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Application Notes

Whitepaper



The rise of the smart kitchen: connected living in the heart of the home (/dgd/Infineon-The_rise_of_the_smart_kitchen_connected_living_in_the_heart_of_the_home-

Whitepaper-v01_00-EN.pdf?fileId=5546d46278d64ffd0178fb4fbb1a7836)



> EN (/dgd/Infineon-The_rise_of_the_smart_kitchen_connected_living_in_the_heart_of_the_home-Whitepaper-v01_00-EN.pdf?fileId=5546d46278d64ffd0178fb4fbb1a7836)

>> EE Times, November 2020: Infineon PASCO2 sensor (/dgd/Infineon-EE Times, November 2020_PASCO2sensor-Article-Article-v01_00-EN.pdf?

> CN (/dgd/Infineon-The_rise_of_the_smart_kitchen_connected_living_in_the_heart_of_the_home-Whitepaper-v01_00-EN.pdf?fileId=5546d46275b79adb0175d1a459eb5b6c)

>>> EN (/dgd/Infineon-The_rise_of_the_smart_kitchen_connected_living_in_the_heart_of_the_home-Whitepaper-v01_00-EN.pdf?fileId=5546d46275b79adb0175d1a459eb5b6c)

>>>> EN (/dgd/Infineon-EE Times, November 2020_PASCO2sensor-Article-Article-v01_00-EN.pdf?

fileId=5546d46275b79adb0175d1a459eb5b6c)

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Elektronik Oktober2020: Sensorik zur Raumluftüberwachung (/dgd/Infineon-Elektronik_October2020_PASCO2sensor-Article-v01_00-DE.pdf?

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> DE (/dgd/Infineon-Elektronik_October2020_PASCO2sensor-Article-v01_00-DE.pdf?

fileId=5546d46275b79adb0175d1a452d75b69)

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Boards

Image	Board	Family	Description	Status
	After-assembly calibration scheme for XENSIV™ PAS CO2 (/dgd/Infineon-AN_FCS_AB06-ApplicationNotes-v01_00-EN.pdf?fileId=5546d4627b830c27017b8f0a98ad6354)			
	EVAL_PASCO2_MINIBOARD (/dgd/Infineon-PASCO2_2-ApplicationNotes-v01_00-EN.pdf?fileId=5546d4627b830c27017b8f0a98ad6354) (7cms/en/product/evaluation-boards/eval_pasco2_miniboard/) 21-08-29 pdf 228 KB	CO2 sensors	CO2 evaluation board for CO2 measurement	active
	EVAL_PASCO2_SENSOR2GO (/dgd/Infineon-PASCO2_2-ApplicationNotes-v01_00-EN.pdf?fileId=5546d4627a0b0c7b017a5174394768a1) (7cms/en/product/evaluation-boards/eval_pasco2_sensor2go/) 21-06-28 pdf 759 KB	CO2 sensors	CO2 evaluation kit for CO2 measurement	active

> EN (/dgd/Infineon-programming_guide_PAS_CO2_evaluationkit-ApplicationNotes-v02_00-EN.pdf?fileId=5546d4627600a6bc0176041139e77780) ▶

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+ Reference Design



Recommendation for optimizing power consumption for battery driven applications with XENSIV™ PAS CO2 sensor (/dgd/Infineon-XENSIV_PAS_CO2_lowpower_applications-ReferenceDesign-v01_00-EN.pdf?fileId=5546d4627a0b0c7b017a427827253fe7) (7cms/en/product/development-kits/development-kit-gen-2.5-ReferenceDesign-v01_00-EN.zip?fileId=5546d4627a0b0c7b017a438ac97b4c11) (7cms/en/product/development-kits/development-kit-gen-2.5-ReferenceDesign-v01_00-EN.zip?fileId=5546d4627a0b0c7b017a427827253fe7) ▶

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Recommended performance evaluation methodology for XENSIV™ PAS CO2 sensor (/dgd/Infineon-PASCO2_recommended_performance_evaluation_methodology-ApplicationNotes-v01_00-EN.pdf?fileId=5546d4627a0b0c7b017a431d8acc4681) ▶

Tools & Software

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Where to download the libraries for XENSIV™ PAS CO2 01_00 | 2021-06-25 | pdf | 390 KB



Registermap description of XENSIV™ PAS CO2 sensor (/dgd/Infineon-Registermap_description_PASCO2_MA2-ApplicationNotes-v02_00-EN.pdf?fileId=5546d4627600a6bc017604238d967785) ▶

XFP library (<https://github.com/Infineon/pas-co2-sensor/releases/tag/v1.0.3>)

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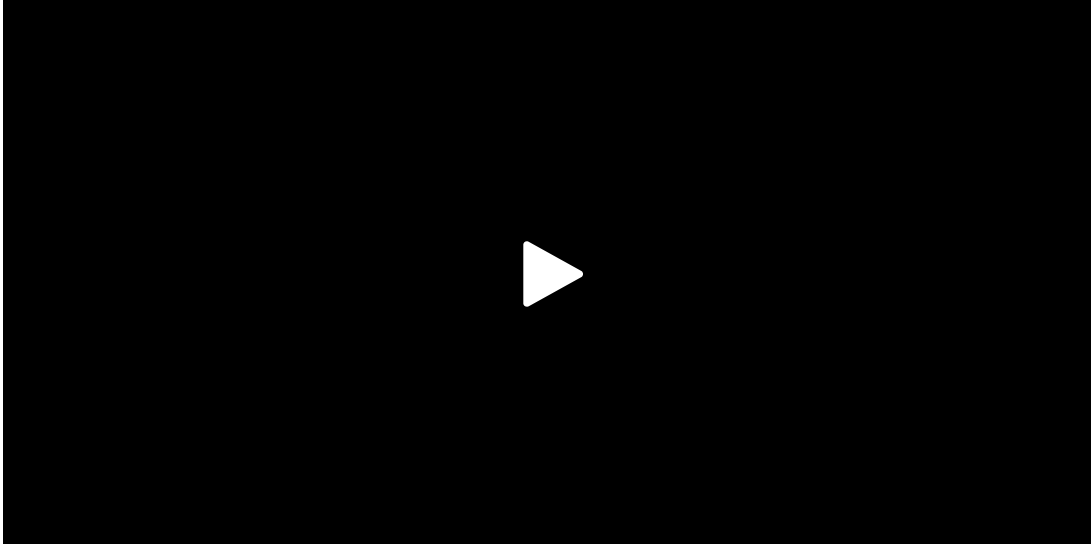
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Arduino library (<https://github.com/Infineon/arduino-pas-co2-sensor/releases/tag/v1.0.3>)

PSoC library ([https://github.com/Infineon/sensor-xensiv-pasco2#\\$\\$ASSET_REPO\\$\\$/sensor-xensiv-pasco2/latest-v0.X](https://github.com/Infineon/sensor-xensiv-pasco2#$$ASSET_REPO$$/sensor-xensiv-pasco2/latest-v0.X))

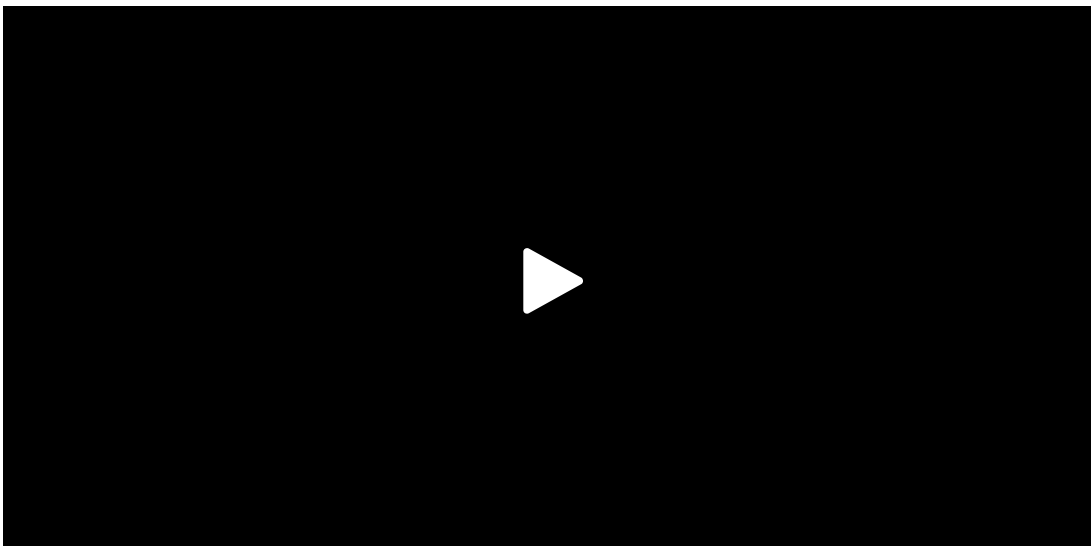
Videos

Infineon XENSIV™ PAS CO2 sensor - giving things a nose [Share](#)

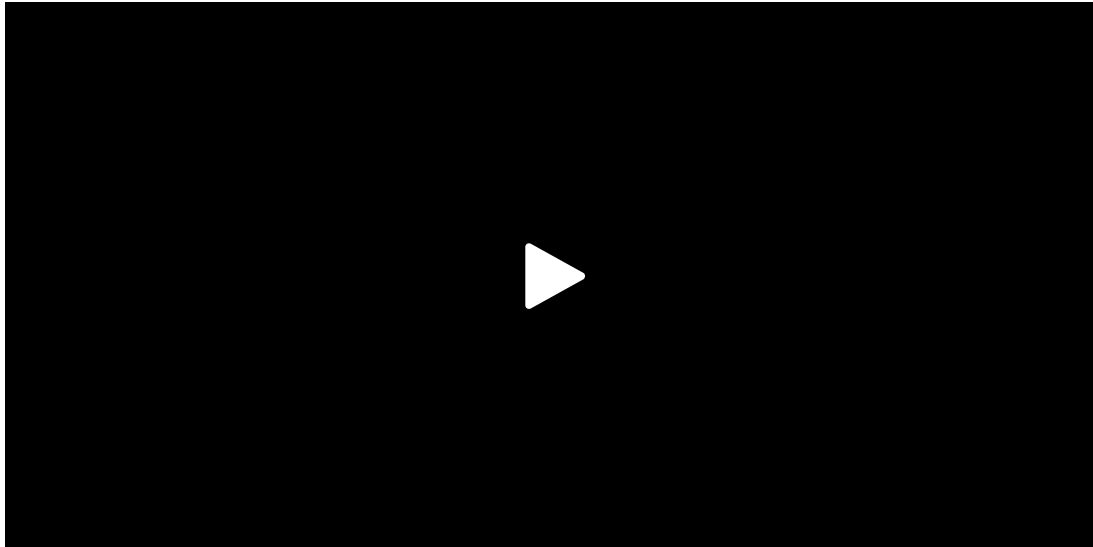


Our nose: 400 receptors distinguish more than 10,000 fragrances and odors. Inspired by the human senses - our XENSIV™ environmental sensor enables things to smell by detecting gas concentrations for indoor and outdoor air quality monitoring.

Time for technology that can “smell” [Share](#)



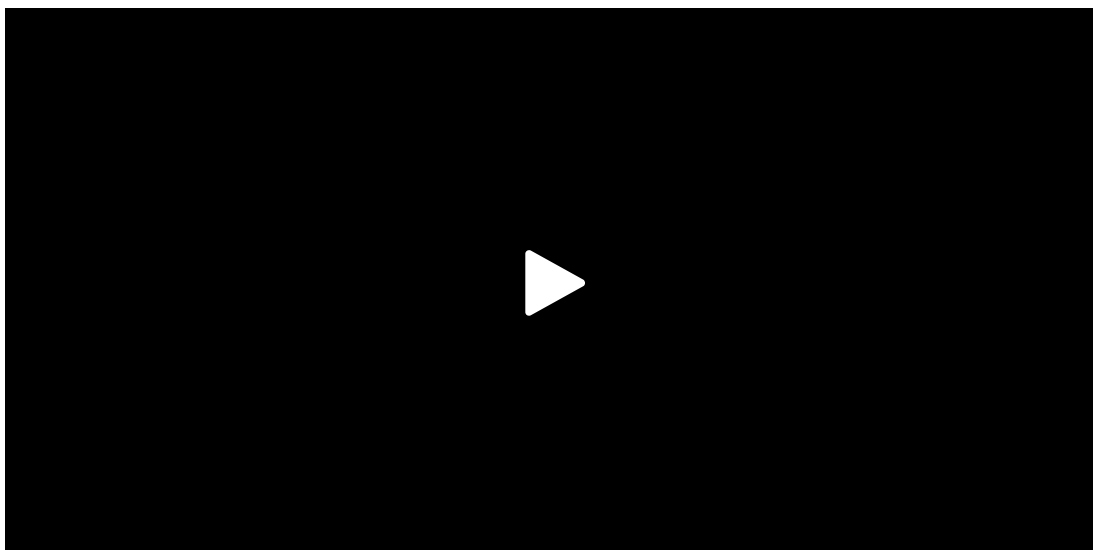
With our XENSIV™ PAS CO2 sensor Infineon is on the way to enable everyone to track the environment they are in everywhere and anytime in a smart, easy to use and affordable way – for a better and healthier life!



Measure what matters with XENSIV™ PAS CO2 sensor [Share](#)


Learn more about the principle of our XENSIV™ PAS CO2 sensor and how it measures indoor air quality.

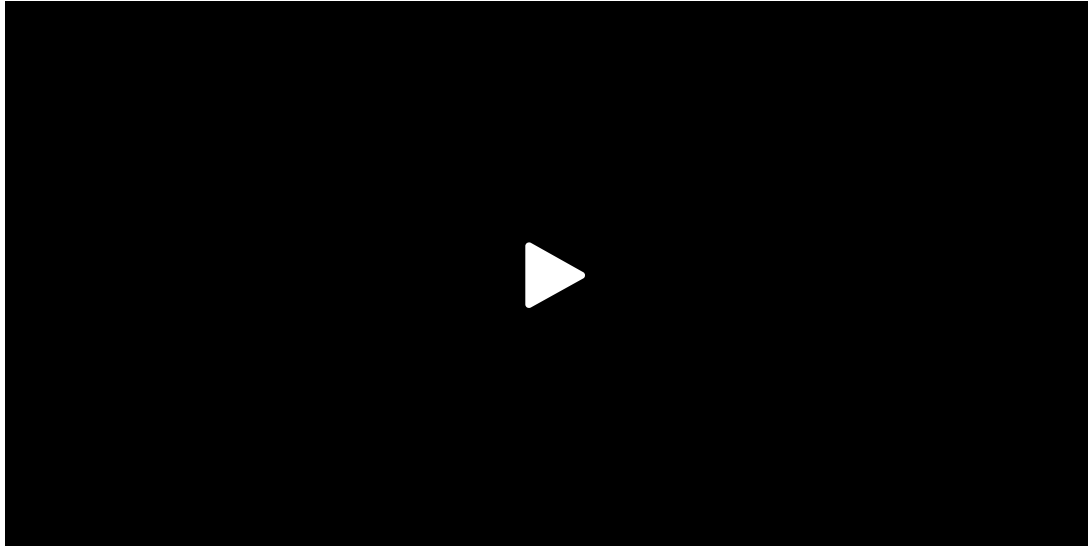
Measure what matters - get started with the XENSIV™ PAS CO2 Sensor2Go Evaluation Kit [Share](#)



In this video you will learn how to get started with the XENSIV™ PAS CO2 Sensor2Go Evaluation Kit. This video illustrates how fast and easy the sensor is to use. Plug & play CO₂ measurements in ppm readout for indoor air quality monitoring.

Measure what matters - get started with the XENSIV™ PAS CO2 Mini Evaluation Board

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In this video you will learn how to get started with the XENSIV™ PAS CO2 Mini Evaluation Board. This video illustrates how fast and easy the sensor is to use for prototyping and design of indoor air quality applications.

Applications

Improving air quality in smart homes and automated buildings

With its small footprint, XENSIV™ PAS CO₂ is ideal for smart home appliances and IoT CO₂ sensor devices such as demand-controlled ventilation systems, air purifiers, thermostats, smart lighting systems, air quality monitors, weather stations, and smart speakers. By integrating CO₂ gas sensor modules into these systems, significant amounts of energy can be saved, and indoor air quality can be greatly improved. This leads to a lower energy bill and a healthier indoor environment. Infineon is making a valuable contribution enabling everyone to track their environment in a smart, easy-to-use, and affordable way – for a better and healthier life!

Using CO₂ sensors in

HVAC (</cms/en/applications/industrial/smart-building/heating-ventilation-and-air-conditioning-hvac/>)

(heating, ventilation, and air conditioning) systems ensures that optimal levels of indoor air quality are achieved. Furthermore, by facilitating DCV (demand-controlled ventilation), carbon dioxide sensors

lead to an increase in the energy efficiency of HVAC systems as well as significant savings on energy bills.

- [Smart building \(/cms/en/applications/industrial/smart-building/\)](/cms/en/applications/industrial/smart-building/)

Condition monitoring and predictive maintenance in HVAC systems

- [maintenance/?redirId=130529](/cms/en/applications/industrial/smart-building/condition-monitoring-and-predictive-maintenance/?redirId=130529)
- [Smart home \(/cms/en/applications/consumer/smart-home/\)](/cms/en/applications/consumer/smart-home/)
- [Wearables \(/cms/en/applications/consumer/wearables/\)](/cms/en/applications/consumer/wearables/)

Support

Search the FAQs! Enter your search terms...



Top 6 FAQs. Use the search bar above to show more!

How can I order a XENSIV™ PAS CO2 Sensor2Go Evaluation Kit?

To order a XENSIV™ PAS CO2 Sensor2Go Evaluation Kit, please contact the dedicated Infineon account/sales manager responsible for your company or buy directly via our board website [here \(https://www.infineon.com/cms/en/product/evaluation-boards/eval_pasco2_sensor2go/#\)](https://www.infineon.com/cms/en/product/evaluation-boards/eval_pasco2_sensor2go/#). Please note that due to very high interest in the XENSIV™ PAS CO2 Evaluation Kit, the process might require some additional time.

[+ Read more](#)

Getting started with the XENSIV™ PAS CO2 Sensor2Go Evaluation Kit

Please watch our “Get started with the XENSIV™ PAS CO2 Sensor2Go Evaluation Kit - Measure what matters” [video \(https://www.infineon.com/cms/en/product/evaluation-boards/eval_pasco2_sensor2go/#!videos\)](https://www.infineon.com/cms/en/product/evaluation-boards/eval_pasco2_sensor2go/#!videos) or download our “Quick start guide” to set-up the Evaluation Kit in only a few simple steps [here \(https://www.infineon.com/dgdl/Infineon-Quickstart_guide_PASCO2_Sensor2Go_evaluationkit-UserManual-v01_00-EN.pdf?...](https://www.infineon.com/dgdl/Infineon-Quickstart_guide_PASCO2_Sensor2Go_evaluationkit-UserManual-v01_00-EN.pdf?...)

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XENSIV™ PAS CO2: Technical Questions & Support

Please have look at our documentation section above. Here we cover multiple topics with regard

to the product as well as the Evaluation boards.

Still open questions...? Please try the “search tab” in the support section to find the most frequently asked questions (FAQ). If you would like to contact us and ensure your case is duly reported, we kindly ask you to submit your request via the following support form:...

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Using XENSIV™ PAS CO2 sensor for low power application

The XENSIV™ PAS CO2 offers several features for power optimization. For details, please, have a look into our application note tile as **XENSIV™ PAS CO2 for low power applications** (https://www.infineon.com/dgdl/Infineon-XENSIV_PAS_CO2_lowpower_applications-ApplicationNotes-v01_00-EN.pdf?fileId=5546d4627a0b0c7b017a427827253f07). Additionally, we are offering a power calculator to assist your application design for optimized power...

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Generating 12V supply effectively for the XENSIV™ PAS CO2 sensor

XENSIV™ PAS CO2 requires a stable 12V supply. If in your application 12V is not offered, then it can easily be generated from lower voltage using a boost converter. In our reference design we are providing an example of generating 12V from 5V using a typical cost-efficient boost converter. The reference design can be downloaded from the product page [here](#) (https://www.infineon.com/dgdl/Infineon-Development_Kit_Gen_2.5-ReferenceDesign-...

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How good is the XENSIV™ PAS CO2 sensor performance?

XENSIV™ PAS CO2 offers best in class performance based on patented Photo Acoustic Technology. The sensor is selective to only CO2, thanks to highly selective light source optimized for CO2 detection. However, for best practice sensor integration into your application, please have a look into our application note titled as **Design in guideline** (https://www.infineon.com/dgdl/Infineon-PAS_CO2_General_Design-In_Guideline.docx-...

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