Product brief

XENSIV™ PAS CO2 Sensor
Measure what matters

Infineon has leveraged its state-of-the-art capabilities in sensors and MEMS to develop a disruptive carbon dioxide (CO_2) sensor. Measuring CO_2, a key indicator of indoor air quality, allows us to optimize what really matters: health, comfort, and energy efficiency.

By leveraging photoacoustic spectroscopy (PAS), XENSIV™ PAS CO2 overcomes the size, performance and assembly challenges of existing CO_2 sensor solutions. The sensor comes in an exceptionally miniaturized module (14 x 13.8 x 7.5 mm³) that is four times smaller and three times lighter than its NDIR counterparts. This enables more than 75 percent space-saving in customer systems. In addition to its compact design, XENSIV™ PAS CO2 delivers high data quality thanks to its superior accuracy (±30 ppm ±3% of reading). This makes XENSIV™ PAS CO2 the smallest real CO_2 sensor in the world that achieves this level of accuracy.

All major components of XENSIV™ PAS CO2 are developed in-house according to Infineon's high-quality standards. This includes a dedicated microcontroller, which runs advanced compensation algorithms to deliver direct and reliable ppm readouts of real CO_2 levels. The available configuration options make the sensor one of the most versatile plug-and-play CO_2 sensors on the market. These options include: dedicated ABOC (Automatic Baseline Offset Calibration), pressure compensation, signal alarm, sample rate and early measurement notification, which are mainly useful for power consumption management. The SMD package, delivered in tape and reel, facilitates ease of assembly, even in high-speed, high-volume manufacturing.

This ease of integration makes XENSIV™ PAS CO2 the right fit for a variety of applications in building automation, smart home and air quality monitoring. In HVAC (heating, ventilation and air conditioning) systems, the sensor ensures that optimal levels of indoor air quality are achieved. Furthermore, by facilitating DCV (demand-controlled ventilation), CO_2 sensing leads to an increase in the energy efficiency of these systems as well as significant savings on energy bills. With its small footprint, XENSIV™ PAS CO2 is also ideal for smart home appliances and IoT devices such as air purifiers, thermostats, smart lighting systems, air quality monitors, and smart speakers.

A complete suite of boards (Sensor2Go Kit, Mini Evaluation Board, Arduino-based Shield2Go, Adafruit-based Wing Board), libraries and application notes will be available to support customers in accelerating their design-to-market.

Key features...

› Small form factor (14 x 13.8 x 7.5 mm³)
› High accuracy (±30 ppm ±3% of reading) and robust performance
› SMD package delivered in tape and reel
› Advanced compensation and self-calibration algorithms
› Three interface options: UART, I²C, PWM
› Various configuration options

... result in key benefits

› Space savings in customers' end products
› High data quality
› Smooth high-volume assembly
› Plug-and-play solution
› Customer flexibility thanks to variety of interface & configuration options

Key applications

› HVAC (heating, ventilation and air conditioning) systems
› Smart home & building appliances like air purifiers and IoT devices
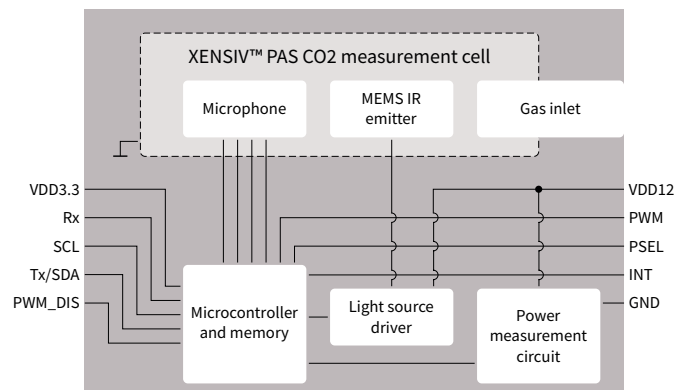› Air quality monitors

Photoacoustic principle: How does it work?

Pulses of light from an infrared source pass through an optical filter tuned specifically to the CO_2 absorption wavelength (= 4.2 µm). 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 sound is then detected by an acoustic detector optimized for low frequency operation, and the microcontroller converts the output into a CO_2 concentration reading. In order to provide accurate CO_2 sensing information, the absorption chamber is acoustically isolated from external noise.

PAS Principle

$\lambda = 4.2 \,\mu m$

Infrared light source — Optical filter — Absorption chamber accoustically isolated from external noise — Port for gas diffusion — Accoustic detector optimized for low frequency operation
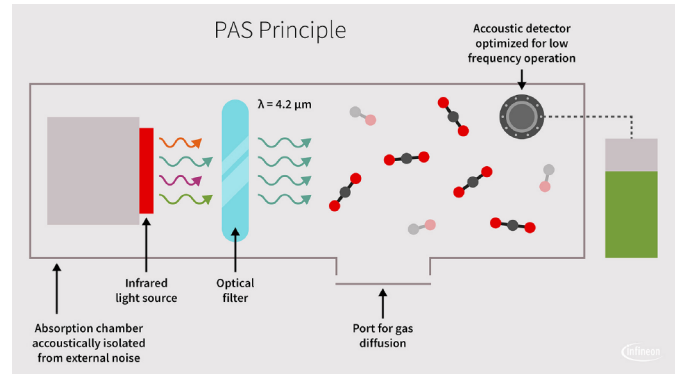
Block diagram

The XENSIV™ PAS CO2 sensor module PCB integrates a PAS transducer, a microcontroller, and a MOSFET. The PAS transducer includes a proprietary infrared emitter with blackbody radiation which is periodically chopped by the MOSFET, a narrow-band optical filter tuned to the CO_2 wavelength and Infineon's MEMS microphone, which acts as a pressure sensor and is optimized for low frequency operation.

XENSIV™ PAS CO2 measurement cell: Microphone, MEMS IR emitter, Gas inlet, VDD3.3, Rx, SCL, Tx/SDA, PWM_DIS, Microcontroller and memory, Light source driver, Power measurement circuit, VDD12, PWM, PSEL, INT, GND

Pin configuration

Pin	Symbol	Type	Description
1	VDD3.3	Power supply (3.3 V)	3.3 V digital power supply
2	Rx	Input	UART receiver pin
3	SCL	Input/Output	I²C clock pin (3.3 V domain)
4	Tx/SDA	Input/Output	UART transmitter pin (3.3 V domain)/ I²C data pin (3.3 V domain)
5	PWM_DIS	Input	PWM disable input pin (3.3 V domain)
6	GND	Ground	Ground
7	INT	Output	Interrupt output pin (3.3 V domain)
8	PSEL	Input	Communication interface select input pin (3.3 V domain)
9	PWM	Output	PWM output pin (3.3 V domain)
10	VDD12	Power supply (12 V)	12 V power supply for the IR emitter

VDD12 10 | PWM 9 | PSEL 8 | INT 7 | GND 6 | VDD3.3 1 | Rx 2 | SCL 3 | Tx/SDA 4 | PWM_DIS 5

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