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 gas sensor for measuring carbon dioxide (CO_2) levels.

The XENSIV™ PAS CO2 is a real CO_2 sensor that overcomes the size, performance and assembly challenges of existing CO_2 sensor solutions. Based on a unique photoacoustic spectroscopy (PAS) concept, the sensor comes in an exceptionally miniaturized module that is four times smaller and three times lighter than existing solutions, enabling more than 75 percent space-saving in customer systems.

In addition to its exceptionally compact design, XENSIV™ PAS CO2 delivers high data quality thanks to its superior accuracy, outperforming state-of-the-art CO_2 sensors. Capable of detecting CO_2 levels at ppm level (±30 ppm ±3% of reading), this sensor is particularly suited to HVAC applications and demand-controlled ventilation (DCV). Not only does it comply with major smart building standards (e.g. LEED, Well), it also leads to significant energy savings.

XENSIV™ PAS CO2 integrates a dedicated microcontroller for direct ppm readouts as well as advanced compensation algorithms. The available configuration options make the sensor one of the most versatile plug-and-play CO_2 sensors on the market. Customizable options include: dedicated ABOC (Automatic Baseline Offset Calibration), pressure compensation based on customer pressure input data, signal alarm, sample rate and early measurement notification, which are mainly useful for power consumption management. The SMD package, delivered in tape and reel, is compatible with high-volume automatic manufacturing and allows for cost-effective, easy assembly plus quick integration into customer systems.

All components of XENSIV™ PAS CO2 are developed in-house according to Infineon's high-quality standards. The sensor therefore benefits from Infineon's proven track record in MEMS design and acoustics.

A complete suite of evaluation boards (PAS CO2 Evaluation Board, Arduino based PAS CO2 Shield2Go, Adafruit based PAS CO2 Wing Board compatible with Cypress eco-system), libraries and application notes will be available to support customers in accelerating design-to-market.

The XENSIV™ PAS CO2 sensor is ideal for building automation and smart homes as well as various indoor air quality IoT devices such as air purifiers, thermostats, baby monitoring devices, wake-up alarms and smart speakers. Additional use cases include smart indoor lighting, traffic management and in-cabin air quality monitoring. By monitoring air quality, XENSIV™ PAS CO2 enables users to understand and improve the surrounding air in an easy and efficient manner.

www.infineon.com/CO2

Key features

› Unprecedentedly small form factor (14 x 13.8 x 7.5 mm³)
› Accurate and robust performance at ppm level (±30 ppm ±3% of reading)
› Compatibility with major assembly standards thanks to SMD package
› Advanced compensation and self-calibration algorithms
› Three interface options: UART, I²C, PWM
› Integrated microcontroller for algorithms and direct ppm readout

Key benefits

› High-quality data
› Space savings in customers' end products
› Cost-effective and easy assembly for high-volume applications
› Plug-and-play device
› Customer flexibility thanks to the varied configuration options
› Fast design-to-market

Key applications

› Ventilation control/building automation
› Smart appliances such as air purifiers, air conditioners
› Consumer devices for air quality monitoring such as thermostats and personal assistants
› Agriculture
› Smart indoor lighting

* XENSIV™ PAS CO2 sensor will be available via distributors mid of 2021.
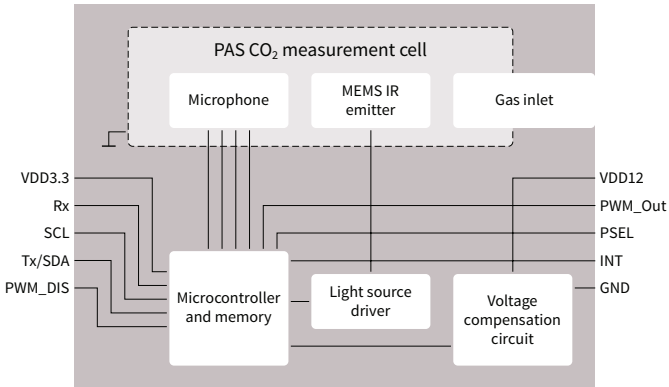
Photoacoustic principle: How does it work?

With PAS, pulses of light from an infrared source pass through an optical filter tuned specifically to the CO_2 absorption wavelength ($\lambda = 4.2$ 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 a MEMS microphone or acoustic detector optimized for low frequency operation, and the microcontroller converts the microphone 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; otherwise the function of CO_2 detection would be significantly disrupted.

Absorption chamber acoustically isolated from external noise

$\lambda = 4.2$ µm

Infrared light source · Optical filter · Port for gas diffusion · Acoustic detector optimized for low frequency operation
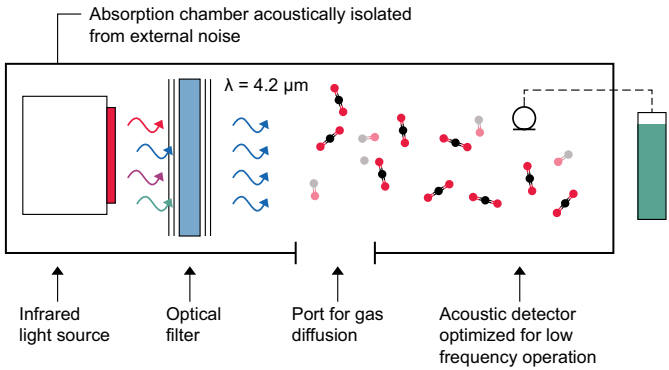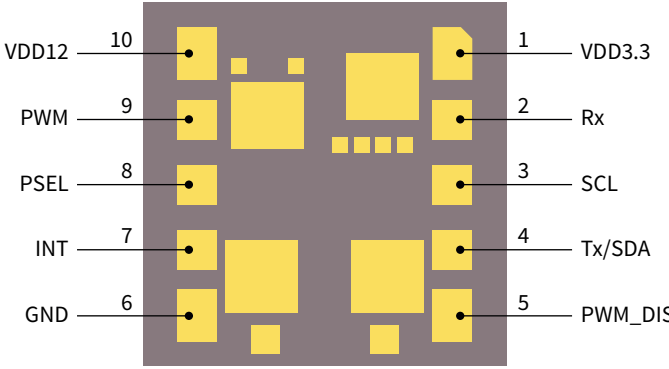
Block diagram

The XENSIV™ PAS CO2 sensor module PCB integrates a photoacoustic (PAS) transducer, a microcontroller for signal processing, algorithms 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.

PAS CO_2 measurement cell

Microphone · MEMS IR emitter · Gas inlet

VDD3.3 · Rx · SCL · Tx/SDA · PWM_DIS

VDD12 · PWM_Out · PSEL · INT · GND

Microcontroller and memory · Light source driver · Voltage compensation circuit

Pin configuration

Pin	Name	UART	I²C w/o interrupt	PWM
1	VDD 3.3 V	Digital supply voltage for digital blocks and I/O interface		
2	Rx	Rx data in		
3	SCL	Not used	Serial clock	
4	Tx/SDA	Rx data out	Serial data in/out	
5	PWM_DIS	Not used		Input
6	GND	Protocol select, left floating	Protocol select, active low	
7	INT	Data read out interrupt		
8	PSEL	Input		
9	PWN	Not used		Output
10	VDD 12 V	Supply voltage of the IR emitter		

VDD12 — 10
PWM — 9
PSEL — 8
INT — 7
GND — 6

1 — VDD3.3
2 — Rx
3 — SCL
4 — Tx/SDA
5 — PWM_DIS

Additional information
For further information on technologies, our products, the application of our products, delivery terms and conditions and/or prices, please contact your nearest Infineon Technologies office (www.infineon.com).

Warnings
Due to technical requirements, our products may contain dangerous substances. For information on the types in question, please contact your nearest Infineon Technologies office.

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