



Case Study: GORE® Protective Membrane for Cutting-Edge Gas Sensors

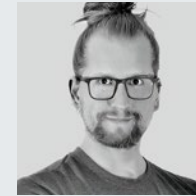
Gore and Infineon Take Gas Detection Sensors to a New Level

? CHALLENGE

In recent years, the heightened focus on health and well-being has emphasized the significance of indoor air quality. Infineon, one of the leading sensor solution manufacturers, seized this opportunity to further elevate their **innovative photoacoustic spectroscopy (PAS) sensors¹ for CO₂ detection**. As the demand for high-quality gas sensors was – and still is – on the rise, they aimed for **optimized performance** and a streamlined manufacturing process.

However, their state-of-the-art technology comes with a particularly compact design. To achieve their goals, Infineon turned to the industry leader, Gore, who had the same **innovative mindset and ambition**. Fortunately, they found their perfect match in Gore.

“Our MEMS team continuously praised Gore’s quality and customer support. It was the logical next step to approach them for this project, too.”



Dr. David Tumpold, Innovation Engineer MEMS at Infineon Technologies AG

1. Photoacoustic spectroscopy is an innovative technology used in gas detection. It measures the absorption of light and the subsequent emission of soundwaves, which are then analyzed to identify the concentration of gas in a sample.



Infineon PAS CO₂ sensor





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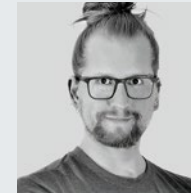
SOLUTION

Developing a suitable solution for our customer presented unique challenges. Infineon's cutting-edge PAS CO₂ sensors require **minimal background noise in the absorption chamber** for precise CO₂ measurement. We were asked to **design a membrane with maximum attenuation** – while also allowing target gases to diffuse and achieve the shortest possible response time. Finally, the solution had to withstand high temperature requirements of Infineon's defined packaging processes.

Fueled by the pursuit of innovation, the engineering teams on both sides collaborated with unparalleled speed and motivation. To find the perfect fit for Infineon, Gore developed an acoustic test method to identify the right membrane options, leveraging Gore capabilities and industry knowledge. Those were then tested (see figures 1 and 2) while Infineon evaluated their final performance.

To conduct the response time test as shown in figure 2, the Gore team placed the PAS CO₂ sensor in a closed box and injected a specific amount of CO₂ to reach a CO₂ concentration of about 2300 ppm. Once a stable state was achieved inside the box, our experts measured the response time T_{63} for the CO₂ decrease until room conditions were reached again.

“Sealing the port with acoustically suppressing properties while having the same port transparent for gases to diffuse is crucial in photoacoustic spectroscopy. It requires a special micromesh technology, and we knew Gore could provide it.”



Dr. David Tumpold, Innovation Engineer MEMS at Infineon Technologies AG

This entire project phase stood out with **transparent exchanges and seamless communication** between Gore and Infineon. Ultimately, Gore's combined expertise in acoustic performance, gas diffusion, and sensing applications led to a solution that is not only unique in its performance but also **reduces the number of components inside the sensor** to a single membrane.



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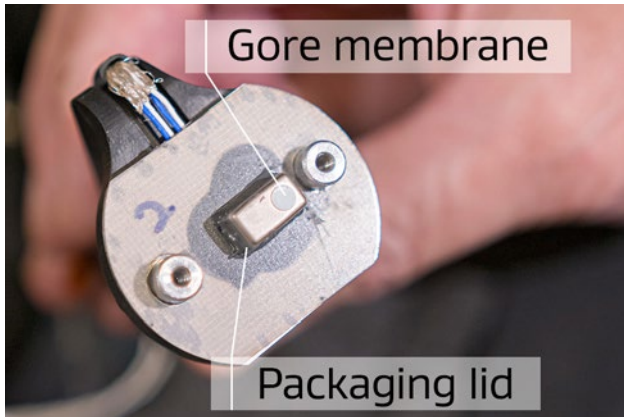


Figure 1a: PAS test fixture with an Infineon packaging lid and Gore membrane

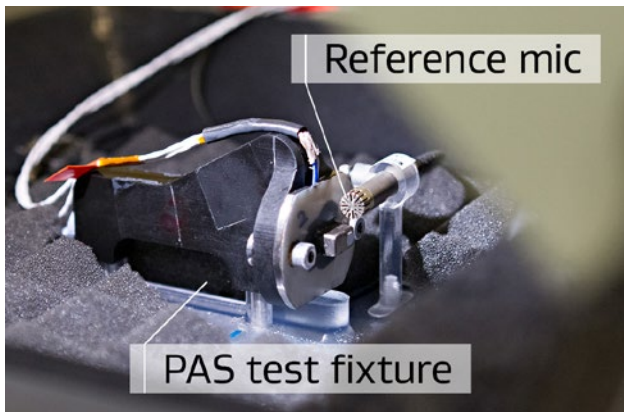


Figure 1b: PAS test fixture installed in an anechoic box with reference microphone

Comparison Gore Membrane 1 vs Gore Membrane 2

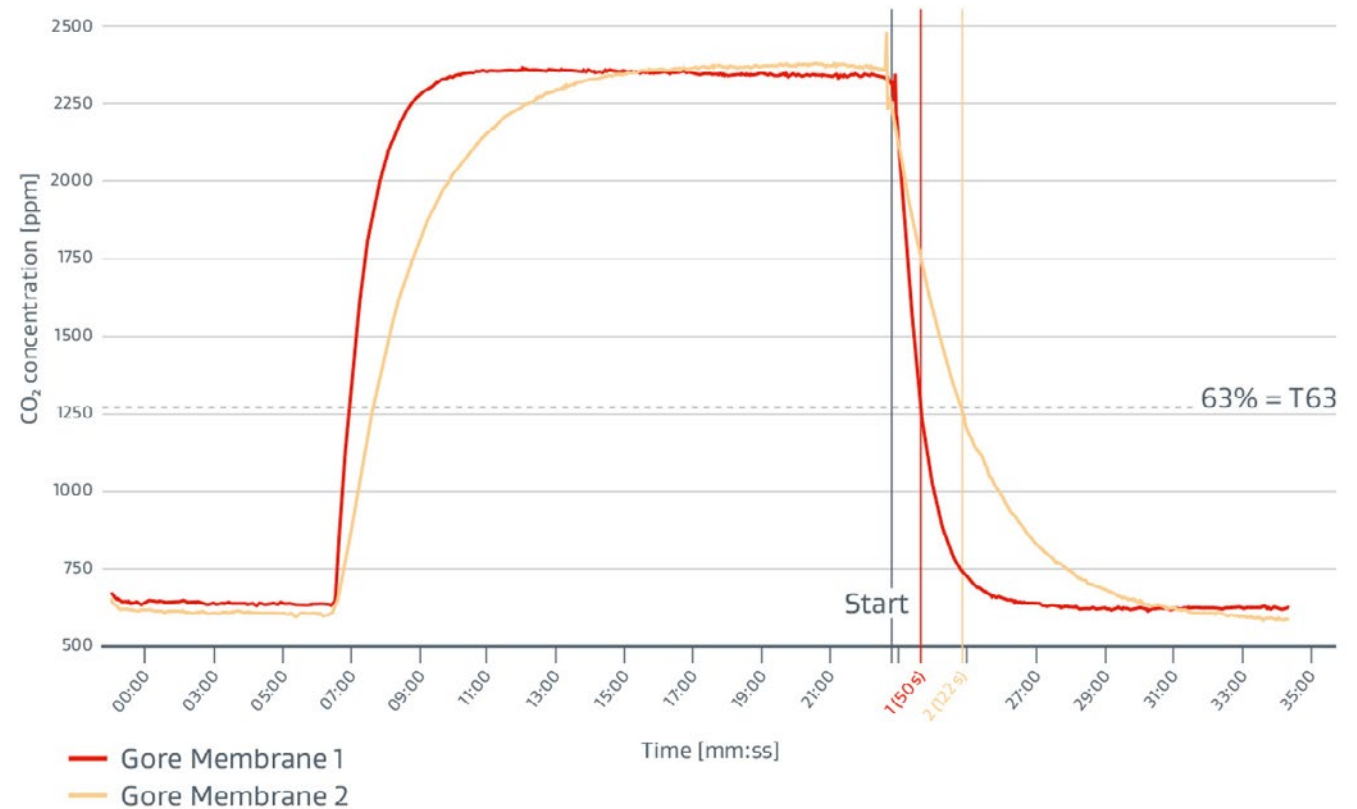


Figure 2: Investigation of two Gore membranes to find the perfect fit for the Infineon PAS CO₂ sensor.



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★ RESULTS

Excellent teamwork, transparent communication, and a shared innovative mindset between Infineon and Gore shaped the entire collaboration. This project marked the first time that Gore developed a membrane for photoacoustic sensing applications, surpassing all expectations with impressive results:

- **Improved sensor response time** by more than 40% compared to the first generation of Infineon's PAS CO₂ sensors while maintaining acoustic attenuation (see figures 3 and 4).
- Replacing two components with a **single high-performance membrane.**
- **Simplified assembly process** and enhanced cost efficiency.
- **Enabling further sensor applications** through the new design, e.g., Smart Lighting, Agriculture, Smart Speakers & Conference Systems, and In-Cabin Air Quality.
- **Strengthened relationship** between Gore and Infineon's global supply chain.

"The collaboration with Infineon was exceptionally transparent and uncomplicated. We are genuinely looking forward to the next project: Infineon and our engineers are already discussing the development of a third generation and further optimization of the sensor."



Jochen Elsesser, Key Account Manager at GORE



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Comparison Infineon Gen1 vs Infineon Gen2 (with Gore Membrane)

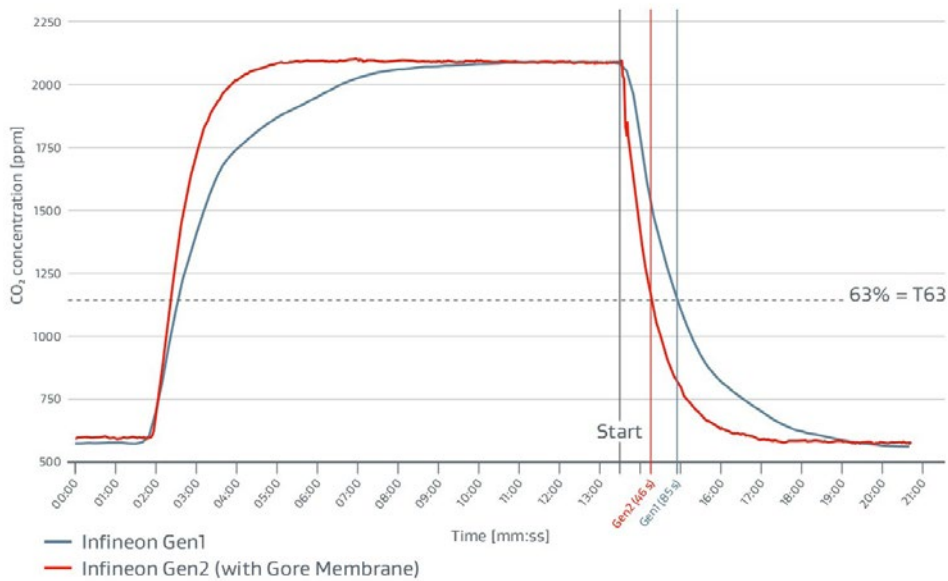


Figure 3: Response Time Curves of Gen1 (blue) vs Gen2 (red) leveraging a Gore membrane

Avg GORE® Vent Attenuation (dB) vs Frequency for Infineon Sensor

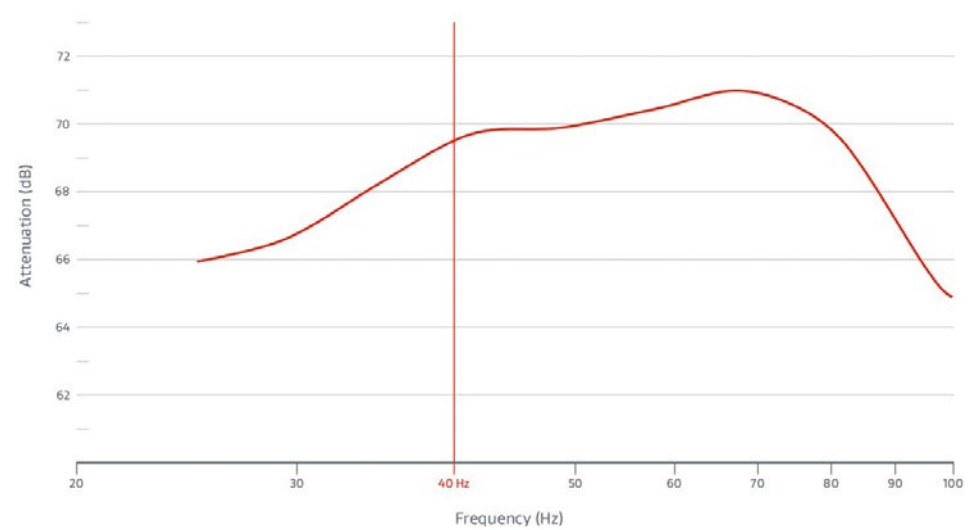


Figure 4: Vent attenuation as function of frequency with special emphasis at 40Hz

WANT TO KNOW MORE?

To read the full story, visit our website:

gore.com/infineon-pas



Interested in Testing Our Products or Talking to Our Experts?

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INTERNATIONAL CONTACTS

Australia +61 2 9473 6800

Brazil +55 11 5502 7800

China +86 21 5172 8299

EMEA +49 89 4612 2211

India +91 22 6768 7000

Japan +81 3 6746 2570

Korea +82 2 393 3411

Mexico +52 81 8288 1281

Singapore +65 6733 2882

Taiwan +886 2 2173 7799

United Kingdom +44 1506 460123

USA +1 410 506 7812

W. L. Gore & Associates GmbH

Hermann-Oberth-Str. 26, 85640 Putzbrunn, Germany

T +49 89 4612 2211 F +49 89 4612 2302

Contact Us: gore.com/gas-sensors

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