



Pressure sensors: Turning environmental signals into smart actions

Abstract

The evolving landscape of connected consumer electronics is reshaping the design and reliability requirements of modern pressure sensing solutions. Barometric absolute pressure sensors such as the Infineon XENSIV™ DPS368 significantly enhance environmental robustness but face new challenges due to exposure to particulate dust and moisture. As a result, protected MEMS architecture is becoming a critical system feature across vacuum cleaners, outdoor devices, and level sensing applications.

This article explains why gel-protected sensing is well suited for robust pressure measurement in harsh conditions. It outlines the real-world drivers behind environmental protection requirements, describes the physical benefits of the XENSIV™ DPS368, and compares this approach with conventional unprotected sensors. The discussion then highlights how Infineon's XENSIV™ DPS368 sensor ensures stability, predictable drift, and reliable operation, which is waterproof-certified and tested against Arizona dust A4.

1 Pressure sensing: A background intelligence signal

Pressure sensors convert physical phenomena—such as changes in ambient air pressure or airflow—into signals that electronic systems can process continuously and in real time. In modern consumer, industrial, and IoT devices, this information acts as a continuous feedback input, supporting closed-loop control, sensor fusion, and early detection of abnormal or degrading operating conditions. Rather than relying on fixed assumptions or open-loop behavior, systems increasingly use pressure data to validate their operating state and adapt dynamically to changing environments.

As devices evolve toward greater autonomy and contextual awareness, sensing has transferred from event-driven measurement to continuous background observation. In this shift, pressure sensing plays a subtle but important role. It provides a stable, real-world reference that software can use to refine decisions over time, even though it remains largely invisible to end users. This underpins pressure-sensing requirements across consumer, industrial, and automotive systems alike.

1.1 Infineon’s barometric air pressure sensing portfolio

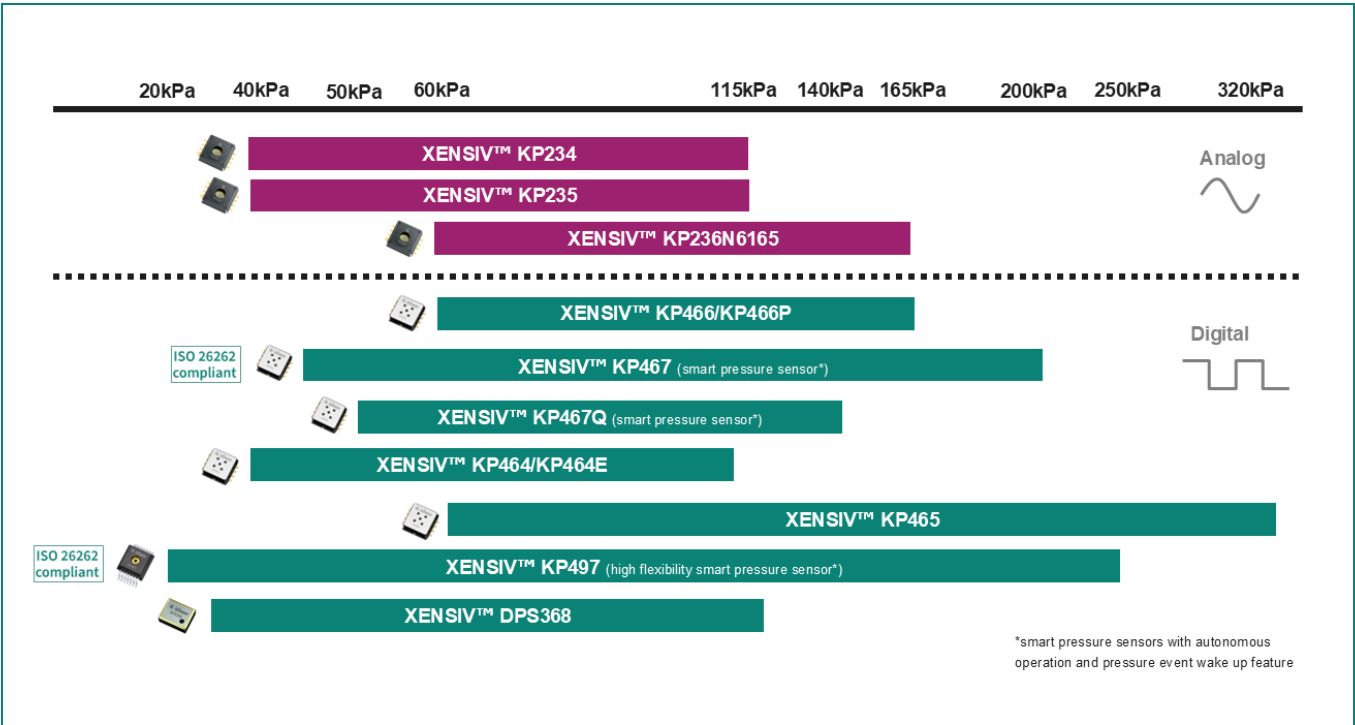


Figure 1 Overview of Infineon’s wide-range automotive, industrial and consumer BAP sensor portfolio across both analog and digital implementations

Infineon offers a broad and scalable portfolio of [barometric air pressure \(BAP\) sensors](#) designed to address distinct requirements across consumer, industrial, and automotive applications. The portfolio spans multiple product families, differentiated by pressure ranges, interface options, and operating conditions, enabling the designers to choose the right sensors for specific application environments and performance needs.

While wide-range BAP sensors form a foundational part of Infineon’s [pressure sensor portfolio](#), addressing automotive and industrial use cases, most consumer and IoT applications operate close to atmospheric pressure and impose different sensing priorities. In these scenarios, the ability to resolve small, repeatable pressure changes is more critical than measuring large absolute pressure ranges. This drives requirements for low noise, high repeatability, predictable temperature behavior, and compact form factors.

Within Infineon’s consumer BAP portfolio, devices optimized for near-atmospheric operation support applications such as airflow sensing, altitude detection, and system-state monitoring. The following sections use [XENSIV™ DPS368](#)

as a representative example, illustrating how these portfolio-level design principles are realized at the device level in consumer systems.

1.2 Where pressure sensor adds value in consumer applications

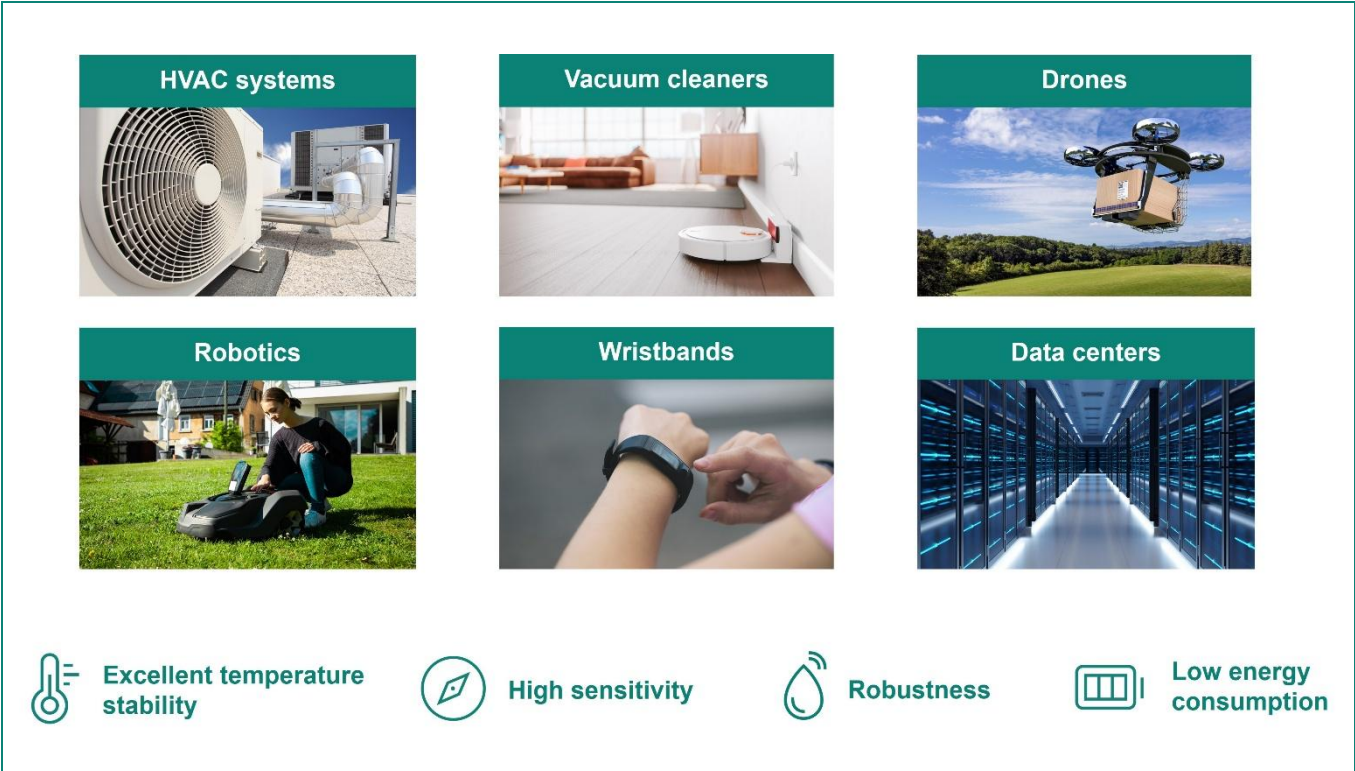


Figure2 Examples of system-level information enabled by barometric pressure sensing in consumer and industrial applications, where small pressure changes provide meaningful context

In these systems, such as HVAC systems, wristbands, robotics, and vacuum cleaners, the information derived from near-atmospheric pressure changes enables functions such as airflow detection, altitude awareness, and enclosure or system-state monitoring.

To reliably support these system-level functions in continuous operation, the pressure sensor must deliver stable, low-noise measurements and maintain predictable behavior across environmental conditions. Figure 3 summarizes the key electrical and environmental characteristics of XENSIV™ DPS368 that are essential for continuous background pressure sensing, including noise behavior and robustness under dust exposure.

2 Why capacitive pressure sensing fits consumer BAP applications

Capacitive pressure sensing is specifically well-suited for consumer BAP applications operating near atmospheric pressure. Its inherent high sensitivity and low intrinsic noise enable software to reliably resolve small, repeatable pressure changes that would otherwise be obscured by sensor noise or drift.

With an ultra-compact $2.0 \times 2.5 \times 1.1 \text{ mm}^3$ package, XENSIV™ DPS368 supports easy integration into space-constrained consumer applications. Its linear and predictable temperature behavior with negligible hysteresis supports effective digital compensation, ensuring a stable pressure output across operating conditions. Compact MEMS structures provide high sensitivity while maintaining mechanical robustness, supporting continuous operation in consumer environments.

Combined with ultra-low standby current and configurable operating modes, XENSIV™ DPS368 enables continuous background pressure sensing that supports closed-loop control, sensor fusion, and early detection of abnormal or degrading operating conditions—without compromising battery lifetime (see Figure 2).

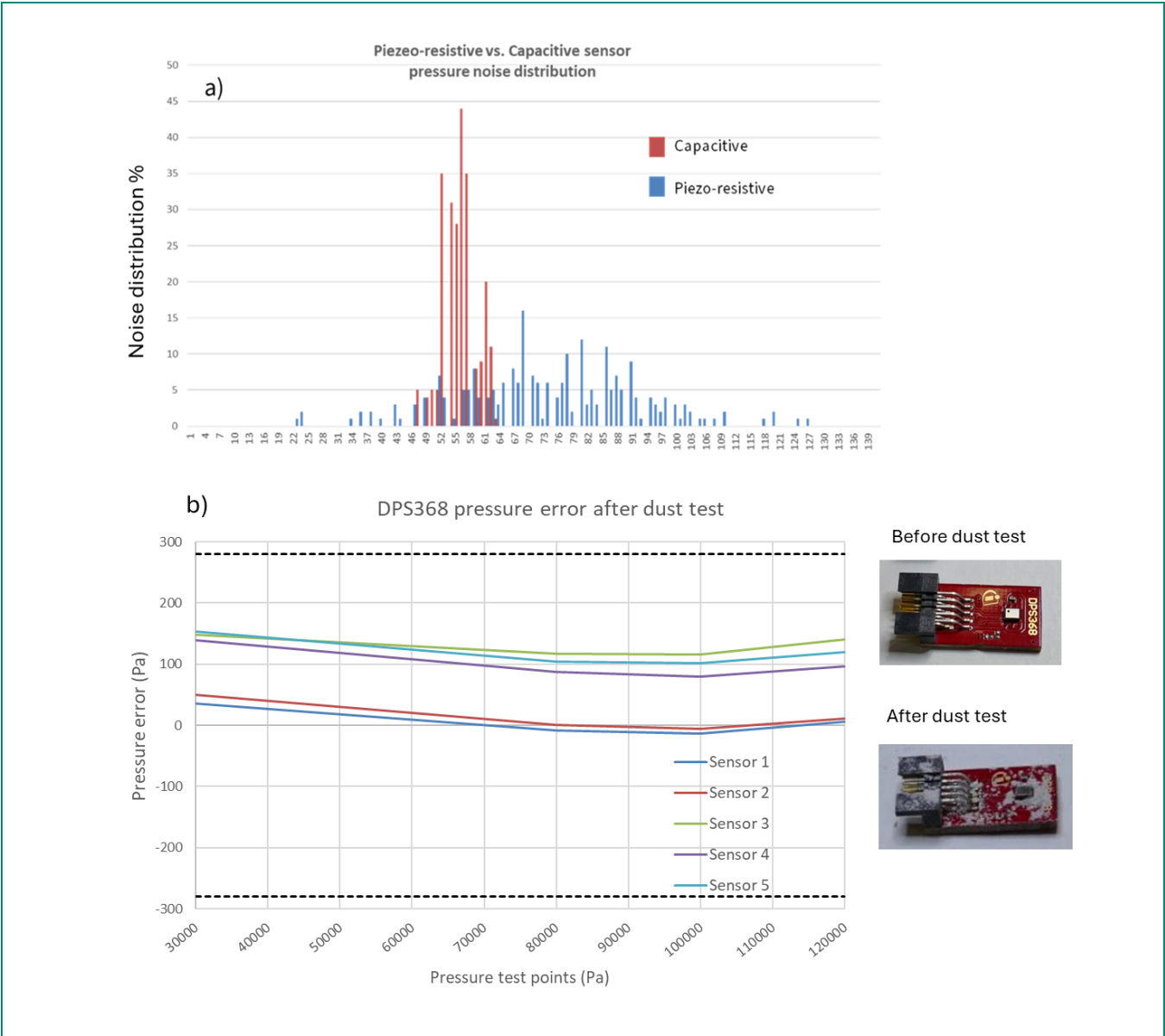


Figure3 a) Pressure noise distribution of XENSIV™ DPS368 capacitive vs. piezoresistive sensors, b) Dust-induced pressure error change (after – before) for DPS368 samples with photographic images

2.1 Resolution, stability, and robustness over raw accuracy

Although consumer applications do not always demand high absolute pressure accuracy, they consistently require stable, repeatable measurements with minimal noise and drift. Resolution and measurement consistency are therefore more critical than raw accuracy alone, as they determine how reliably software can detect trends, state changes, and subtle environmental variations over time.

The pressure noise distribution of Infineon's [XENSIV™ DPS368](#) highlights how repeatability and low measurement variance enable software to reliably resolve small pressure changes, supporting sensor fusion and adaptive control in consumer systems (see **Figure 3a**). Narrower noise distributions and predictable behavior over environmental conditions improve the system's ability to resolve small environmental changes, enabling more reliable interpretation by software.

2.2 Environmental robustness in real-world consumer conditions

Beyond electrical performance, consumer pressure sensors must continue to operate reliably when exposed to dust, particles, and other environmental contaminants. Many consumer devices are routinely used in conditions that are far from clean environments. In XENSIV™ DPS368, environmental robustness is achieved through a gel-protected MEMS and ASIC architecture, and is validated through standardized IP and dust testing to ensure predictable and repeatable behavior. This enables robust operation in the presence of water (IPx8), dust, and moisture, allowing pressure sensing to remain reliable even in harsh real-world environments.

Figure 3b shows the change in pressure error (post vs. pre-exposure) across multiple test points for XENSIV™ DPS368 samples subjected to Arizona dust A4 exposure. The results show stable and repeatable pressure-sensing behavior after dust exposure, with all samples remaining within the specified cumulative absolute accuracy limits. Although small offset shifts are observed, no abnormal deviations or loss of functionality occur, and the overall error profile remains smooth and predictable. All tested samples remain within the specified cumulative absolute accuracy limit of ± 280 Pa, which excludes soldering effects and includes solder-induced drift and long-term drift. This confirms that exposure to particulate dust does not degrade pressure-sensing performance beyond guaranteed specifications under representative real-world consumer conditions.

3 Conclusion

Many consumer devices are exposed to dust and moisture, where conventional pressure sensors may lose reliability. These real-world conditions make environmental robustness a critical requirement. Infineon's [XENSIV™ DPS368](#) is designed for such environments. As the successor to DPS310, it combines a proven chipset with a gel-protected MEMS and ASIC architecture, enabling reliable operation near atmospheric pressure even in harsh conditions. Validation through Arizona A4 dust testing and IPx8 certification confirms stable and predictable performance when exposed to particulate contamination and water—conditions commonly found in applications such as vacuum cleaners, outdoor devices, and level sensing.

The consumer grade XENSIV™ DPS368 belongs to Infineon's BAP sensor family optimized for near-atmospheric operation, while the broader portfolio also includes automotive-qualified pressure sensors that address applications such as engine, powertrain, and vehicle system monitoring. This breadth enables scalable pressure-sensing solutions across multiple markets, with devices tailored to the specific performance, robustness, and qualification requirements of each application domain.

For more information on Infineon's pressure sensor portfolio and barometric pressure sensing solutions, visit: [Infineon XENSIV™ pressure sensors](#).

References

- [1] Infineon Technologies AG: *XENSIV™ Pressure sensors page*; [Available online](#)
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