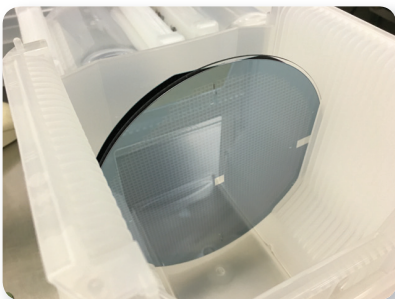
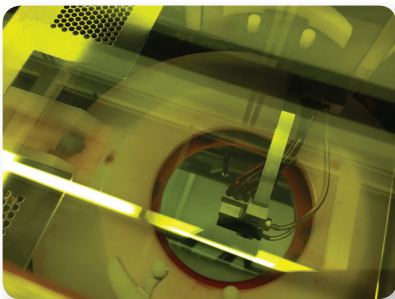
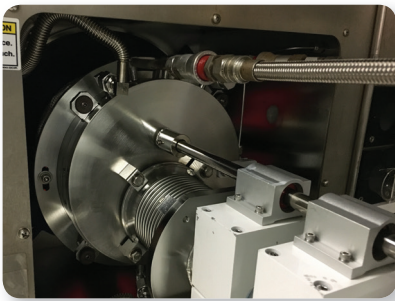


# MEMS Pressure Sensor Solutions



# MEMS

## Microelectromechanical Systems



Amphenol Advanced Sensors capitalizes on NovaSensor's heritage as a pioneer in micromachining process design for pressure sensing and MEMS technology for OEM customers in the medical, automotive, and industrial process industries.

This expertise spans three decades and shipment of more than 500 million MEMS-based sensors. This track record, combined with a library of intellectual property, range of technology, production capability and expertise, make NovaSensor® a logical choice to help bring your microsystem design to market.

NovaSensor has foundry capabilities beyond those of virtually any other MEMS partner. Advanced prototyping centers help develop your ideas and make them process ready. Dedicated production facilities located in the US and Asia offer redundant capacity to enhance productivity and meet global delivery requirements— giving you room to grow your business.

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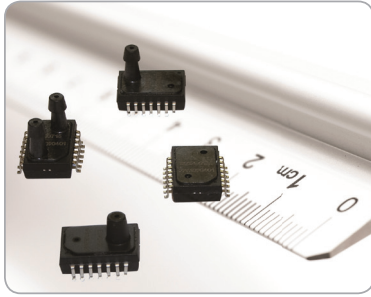
Our foundries produce more than a million dice weekly. Our facilities include thousands of square feet of clean room areas, along with controlled environment assembly and lab areas. We hold ISO 9001, QS 9000, TS 16949/ISO-9000-2000 quality certifications.

Equipped with the most advanced design tools and cutting edge laboratories, NovaSensor is a leader in the design, model and fabrication of a of Microelectromechanical systems (MEMS). NovaSensor's MEMS sensor line includes state-of-the-art, high-performance and cost effective sensor solutions known for their accuracy, reliability and size. Our MEMS solutions include pressure sensors in surface mount packages, fully calibrated and amplified or digital output versions, and media isolated technology for harsh environments. Our sensors offer best in class performance for applications in the healthcare, transportation and industrial markets.



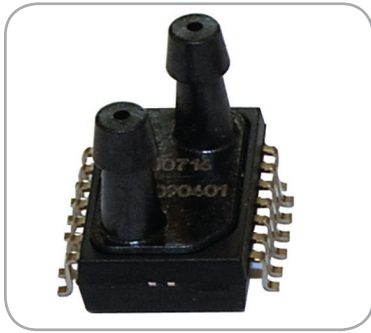
### Applications

- Disposable blood pressure
- Ventilation
- Anesthesia
- Sleep apnea
- Respiratory applications
- Catheter pressure
- Portable gauges and manometers
- Altimeters and barometers
- Pressure switches and controllers
- Pneumatic controls
- Automotive tire pressure



## NPA Surface-Mount Pressure Sensor Series

The NPA product series is provided in a miniature size as a cost effective solution for applications that require calibrated performance. Packaged in a SOIC14 pin surface mount, the NPA Series is available in Gauge, Absolute or Differential pressure ranges with either mV, amplified analog or digital outputs. The sensor is intended for printed circuit board mounting and delivered in tape and reel form to simplify manufacturing handling.

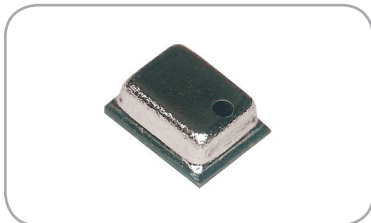


### Features

- Surface Mountable SOIC 14 pin
- Differential, Gauge, Absolute & Low Pressure
- 2" H<sub>2</sub>O (0 - 5 mbar) to 30 psi (0-2.07 bar) Full Scale
- Output Options:
  - Amplified Analog,
  - Digital Serial (14bit),
  - Digital I<sup>2</sup>C,
  - Uncalibrated mV
- On chip temperature sensor in digital mode
- Operating temperature range of -40 to 125°C
- Total Error Band < ±1.5% FSO
- Barbed, Manifold, or non ported available
- 60 psi proof pressure on all ranges 10" H<sub>2</sub>O and higher

### Applications

- Respiratory
- Anesthesia Monitors
- Sleep Apnea
- Critical Care Monitors
- HVAC - Ventilation
- Filter Monitoring
- Negative pressure wound therapy
- Compression therapy



## NPA 201 Digital Barometric Pressure Sensor

The NovaSensor NPA 201 is an absolute pressure sensor with digital output for low cost applications. Its low power consumption and compact size makes it ideal for battery powered and mobile applications or any application where size is a constraint. In today's growing market for portable electronics and wearables with multiple parameters being measured there are many applications that require an accurate measurement of barometric pressure to determine factors such as altitude.



### Features

- 260 to 1260 mbar absolute pressure range
- Temperature measurement included
- Sleep State current <250nA (25°C)
- Temperature resolution: <0.003K/LSB
- 16bit Pressure and Temperature resolution
- Operating temperature: -40°C to +85°C
- Absolute accuracy ± 0.2 mbar / Relative accuracy ± 0.1 mbar
- I2C interface
- Operating range 1.7 ~ 3.6V
- Small size package (2.0 x 2.5 x 1.0mm)
- 8-HCLGA package
- No External Components Required
- Fully Calibrated and Compensated

### Applications

- Pressure sensor for mobile devices (smart phones, smart watches, tablets)
- Indoor and outdoor navigation
- Enhancement of GPS navigation
- Altimeter and barometer for portable devices
- Weather station equipment
- Leisure and sports (wearables)
- Hard Disk Drive (HDD)
- Weather forecast



## NPI-19 Series Low and Medium Pressure Sensors

NPI media isolated sensors are designed to operate in hostile environments and yet give the outstanding sensitivity, linearity, and hysteresis of a silicon sensor. The piezoresistive sensor chip is housed in a fluid-filled cylindrical cavity and isolated from measured media by a stainless steel diaphragm and body. The NPI Series employs SenStable<sup>®</sup> processing technology, providing excellent output stability. The series is available in either a constant current or constant voltage version.

### Features

- Pressure ranges 0 - 2.5 psi (0 - 172 mBar) up to 0 - 300 psig (0 - 21 Bar)
- Solid state, high reliability
- 316L stainless steel, ISO sensor design
- $\pm 0.5\%$  static accuracy
- Temperature compensated 32°F to

158°F (0°C to 70°C)

- 125 mV typical FSO on current version
- 75  $\pm 1$  mV FSO on voltage version
- Thermal errors less than 2% FSO
- Standard configurations include: 0.74 in (19 mm) diameter x 0.28 in (7.1 mm) long cylinder with o-ring seals
- Custom configurations and other pressure ranges available. Please consult the factory.

### Applications

- Process control systems
- Hydraulic systems and valves
- Biomedical instruments
- Refrigeration and HVAC controls
- Appliances and consumer electronics
- Ship and marine systems
- Aircraft and avionic systems



## NPI-15 Series Media Isolated, High Pressure Sensors

The NovaSensor<sup>®</sup> NPI-15 Series incorporates state-of-the-art IsoSensor technology, which gives the OEM user the best in price and performance. They are designed to operate in hostile environments and yet give the outstanding sensitivity, linearity, and hysteresis of a silicon sensor.

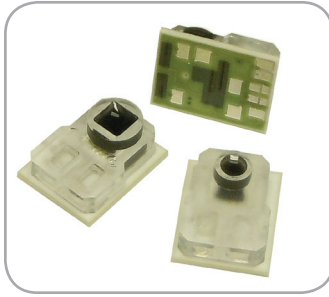
### Features

- Three standard ranges: 0 psi to 500 psi to 0 psi to 5,000 psi (0 bar to 34 bar to 0 bar to 345 bar) available, sealed gage or absolute
- Solid state, high reliability
- High sensitivity, 200 mV typical FSO with 1.0 mA excitation
- 316 L stainless steel, IsoSensor design
- Linearity 0.1% FSO typical
- Standard configurations include:
  - 1/2–20 UNF threaded male port with 1.0 in (25.40 mm) flange
- 0.59 in (15 mm) diameter x 0.87 in (22 mm) long cylinder with o-ring seals

- 1/4–18 NPT male port with 7/8 in flange
- 1/8–27 NPT male port with 7/8 in flange
- Thermal accuracy FSO 0.2% typical
- Custom configurations and other pressure ranges can be accommodated.

### Applications

- Process control systems
- Hydraulic systems and valves
- Automobiles and trucks
- Biomedical instruments
- Refrigeration and HVAC controls
- Appliances and consumer electronics
- Ship and marine systems
- Aircraft and avionic systems



## NPC-100/120 Series Disposable Medical Pressure Sensor

The NovaSensor® NPC-100 Series pressure sensor is specifically designed for use in disposable medical applications. The device is compensated and calibrated per the Association for the Advancement of Medical Instrumentation (AAMI) guidelines for industry acceptability. The sensor integrates a high-performance, pressure sensor die with temperature compensation circuitry and gel protection in a small, low-cost package.

### Features

- 300 mmHg Gage Pressure
- Solid state, high reliability
- Media compatibility
- High performance
- Factory filled with dielectric gel
- Small size
- Fully tested
- Temperature compensated
- Low cost disposable design
- Designed to AAMI specifications

### Applications

- Medical instrumentation
- Blood pressure measurement
- Infusion pumps
- Kidney dialysis machines



## NPH Series Solid State Low Pressure Sensors

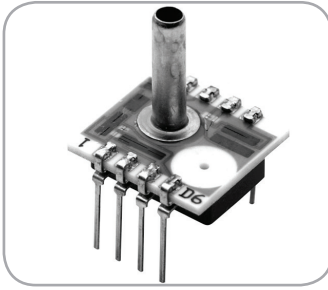
The NPH Series of sensors consists of an integrated circuit silicon sensor chip housed in a standard TO-8 electrical package that is printed circuit board mountable. Constant current excitation to the sensor produces a voltage output that is linearly proportional to the input pressure. The sensor is compatible with most non-corrosive gases and dry air. A laser-trimmed, thick-film resistor network on a hybrid ceramic substrate provides temperature compensation.

### Features

- Solid state, high reliability
- Standard TO-8 package suitable for PC board mount
- Low cost, small size
- Available in gauge, absolute, and differential pressure versions
- Media compatible with non-corrosive gases and dry air
- Thermal accuracy FSO 0.5% typical
- Overpressure capability to five times maximum rated pressure
- Three standard ranges: 0 to 10 in H<sub>2</sub>O (0 to 25 mbar), 0 to 1 psi (0 to 0.07 bar), and 0 to 5 psi (0 to 0.34 bar)
- Nonlinearity 0.05% FSO typical
- Standard 3/16 in OD pressure port
- Ceramic substrate with temperature compensation resistors

### Applications

- Process control, P-to-I converters
- Pneumatic control systems
- HVAC controls
- Biomedical: Infusion pumps, sphygmomanometers, respirators
- Aerospace: Altimeters, barometers, cabin pressure sensors
- Computer peripherals



## NPC-1210 Series Medium/Low Pressure Sensors

The NPC-1210 series of solid-state pressure sensors are designed to provide a cost effective solution for applications that require calibrated performance over a wide temperature range. Packaged in a dual-in-line configuration, the NPC-1210 Series is intended for printed circuit board mounting. Optional pressure port and lead configurations provide superior flexibility in low profile applications where pressure connection orientation is critical.

### Features

- Pressure Ranges 0 to 10" H<sub>2</sub>O (0-25mbar) up to 0 to 100 psi (0-6.89 bar)
- 100mV full scale typical output (FSO) (For ranges >5 psi )
- 50mV full scale output (FSO) (For ranges 10" H<sub>2</sub>O, 1 psi)
- High sensitivity
- High accuracy
- Interchangeable
- Temperature compensated 0°C to 60°C (32°F to 140°F)
- PCB mountable package
- DIP package
- Solid-state reliability
- Individual device traceability

### Applications

- Industrial automation
- Air flow monitors
- Process control
- Medical equipment
- Underground cable leak detection
- Ventilation
- Respirator monitoring



## NPC-1220 Series Medium Pressure Sensors

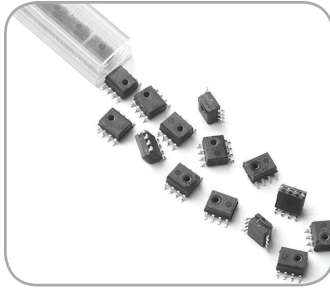
The NPC-1220 Series of solid state pressure sensors are designed to provide a cost effective solution for applications that require calibrated performance over a wide temperature range. Packaged in a dual-in-line configuration, the NPC-1220 Series is intended for printed circuit board mounting. Optional pressure port and lead configurations give superior flexibility in low profile applications where pressure connection orientation is critical.

### Features

- Pressure Ranges 0 to 10" H<sub>2</sub>O (0-25mbar) up to 0 to 100 psi (0-6.89 bar)
- 50 mV full scale output (FSO) with current-set resistor circuit
- ±0.1% accuracy
- Interchangeable
- Temperature compensated 32°F to 140°F (0°C to 60°C)
- Absolute, Gauge and Differential ranges
- PCB mountable package
- DIP package
- Solid state reliability
- Individual device traceability

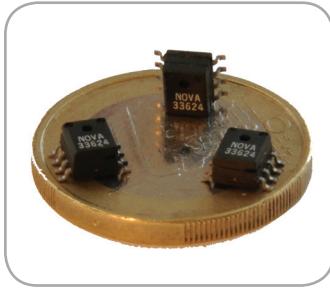
### Applications

- Industrial automation
- Air flow monitors
- Process control
- Medical equipment
- Underground cable leak detection



## NPP-301 Series Surface Mount Pressure Sensor

The NPP-301 Series features silicon pressure sensors in surface mount packages. An ultra-small Silicon Fusion Bonded (SFB), ultra-high stability SenStable® piezoresistive chip is placed in a plastic package that exploits high volume, leadframe package technology to bring forth a low-cost sensor alternative to the OEM user.

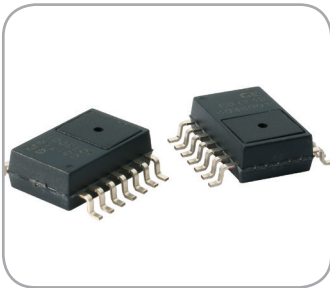


### Features

- Low-cost surface mount package: SO-8
- 100, 200 and 700 kPa (15, 30 & 100 psi) absolute pressure ranges available
- Wide operating temperature range: -40°F to 257°F (-40°C to 125°C)
- Static accuracy <0.20% FSO maximum
- Suitable for automated component assembly
- Four element Wheatstone bridge configuration for circuit design flexibility
- Solid-state reliability
- Available in ported version

### Applications

- Automotive tire pressure
- Pneumatic controls
- Pressure switches and controllers
- Altimeters and barometers
- Cable leak detection
- Consumer appliances
- Portable gauges and manometers



## NPX1 Remote Tire Pressure Monitoring (RTPM) Sensor

The NPX1 sensor adds a silicon pressure sensor, a 8-bit RISC processor, and a LF-input stage to meet market demands for flexible, customer specific behavior solutions and overall system cost reduction. This programmable version of the sensor is available for development purposes, allowing the customer to download the application code in an electrically programmable ROM version. This sensor is intended for developing the application specific program. In order to ensure high reliability, the NPX1 sensor has the measurement routines (pressure, temperature, and supply voltage) implemented in ROM.

### Features

- 12 bit ADC
- 4k byte flash (E-ROM)
- 4k ROM for user application
- 128 byte RAM
- 128 byte EEPROM
- Battery management—minimizing power consumption.
- Measure and compensate pressure, temperature, and battery voltage
- Media compatibility with tire pressure media
- 450, 700, and 1400 kPa (65, 100 & 200 psi) absolute pressure ranges. Custom ranges are available.
- On chip temperature sensor
- On chip temperature shut down

# Amphenol Advanced Sensors Overview

Amphenol Advanced Sensors is a world leader in advanced measurement and sensor-based technology solutions. We design and manufacture precision instruments and systems that measure temperature, pressure, humidity and gas concentration for customers around the world in the Healthcare, Transportation and Industrial Markets. We create value by providing critical information for real time decisions.

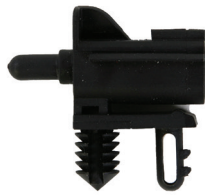
## Temperature - Thermometrics®

With more than 70 years of technology experience in the development, design and manufacture of high quality sensors, Thermometrics offers one of the most comprehensive ranges of temperature measurement and sensing products in the world today. Thermometrics' temperature technologies include high accuracy NTC thermistors, PTC heaters, non-contact IR and custom design capabilities globally. Thermometrics provides solutions to a wide range of temperature sensing challenges faced by the healthcare, automotive, industrial and consumer markets.



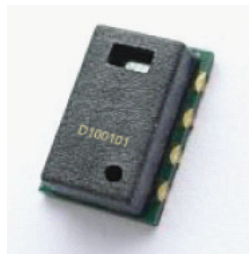
### Applications

- Intake air & Exhaust gas
- Coolant/transmission fluid
- Outside air & cabin temperature
- Catheter temperature
- Clinical Thermometers
- Neonatal
- Environmental control systems
- High voltage and short circuit protection
- Current limiting & surge suppression



## Humidity

Amphenol Advanced Sensors offers a range of elements and fully integrated relative humidity products from sensors and elements all the way up to industrial transmitters for HVAC and specialist applications such as harsh environments, automotive environmental control and medical devices.



### Applications

- HVACR
- Instrumentation
- Cargo storage
- Controls
- Weather telemetry

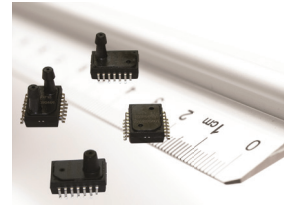
## Pressure (MEMS) - NovaSensor®

Equipped with the most advanced design tools and cutting edge laboratories, NovaSensor is a leader in the design, model and fabrication of a of Microelectromechanical systems (MEMS). NovaSensor's MEMS sensor line includes state-of-the-art, high-performance and cost effective sensor solutions known for their accuracy, reliability and size. Our sensors offer best in class performance for applications in the healthcare, transportation and industrial markets.



### Applications

- Automotive tire pressure
- Pneumatic controls
- Pressure switches and controllers
- Altimeters and barometers
- Portable gauges and manometers
- Catheter pressure
- Respiratory applications
- Sleep apnea
- Anesthesia
- Ventilation
- Disposable blood pressure
- Fuel pressure
- Transmission control



## CO<sub>2</sub> - Telaire®

Telaire's product line boasts over 30 patents related to the design and application of low-cost infrared gas sensing, including the Automatic Background Calibration (ABC Logic™) algorithm. We offer a range of OEM CO<sub>2</sub> modules with lifetime calibration warranty, CO<sub>2</sub> instruments and transmitters for various HVAC and ventilation control applications.



### Applications

- HVAC transmitters
- Handheld CO<sub>2</sub> and IAQ instruments
- Residential IAQ
- Indoor Growing (horticulture)
- Air to Air heat exchangers

# Amphenol

## Advanced Sensors

[www.amphenol-sensors.com](http://www.amphenol-sensors.com)

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