

MEMS Pressure Sensors Medical Solutions



Amphenol
Advanced Sensors

Medical MEMS

Pressure Sensors Market

The medical MEMS pressure sensors market is valued at ~\$220 MM and growing at a moderate rate. In 2015, the respiratory devices, including anesthesia delivery machines, oxygen concentrators, sleep apnea machines and ventilators held the largest share in the global market.

North America and Europe are the key consumption markets.

Players

1. Amphenol

Amphenol's pressure sensor product line includes highly cost effective families of surface mount, hybrid and media-isolated sensors that serve medical applications.

2. Honeywell

Sensors and switches that are stable and reliable to enhance patient safety and comfort.

3. OMRON

Advanced technology for wireless monitors, apps and wearables for heart health.

4. NXP

Global semiconductor manufacturer.

5. SMI

Developer and manufacturer of MEMS-based pressure sensors.

Market Characteristics

New application: Medical smart inhalers, pave the way for future medical IoT applications. Historically, respiratory devices and patient monitoring are the main applications.

NovaSensor Differentiators

NovaSensor is the market leader in the Medical industry. In addition to foundry capabilities, we have advanced prototyping centers to develop products 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.

Our foundries produce more than a million die weekly. Our facilities include clean room areas, along with controlled environment assembly and lab areas. We hold ISO 9001 and ISO/TS 16949 Quality Certifications.

Our mainstream MEMS solutions include pressure sensors in surface mount packages, fully calibrated and amplified or digital output versions, and media isolated technology for harsh environments. We can also deliver highly customized value-added solutions from custom designed pressure dies to pressure transducers.

Key Target Applications

- Catheter
- Smart inhaler
- Blood monitoring invasive
- Blood monitoring non-invasive
- Respiratory devices
- Diagnostic/Analytical equipment

Target Customers for Key Applications

Smart Inhalers



- Adherium
- AstraZeneca
- Cohero Health
- GSK (GlaxoSmithKline)
- Gecko Health
- Inspiro Medical
- Propeller Health

Spirometers



- CareFusion
- Philips Healthcare
- Schiller
- WelchAllyn
- SDI Diagnostics
- CardioTech
- MIR Medical Research
- Vitalograph
- NIHON KOHDEN

MEMS Catheter Solutions

Amphenol offers a line of products ideal for catheter applications. Our die offer small size, high accuracy and a range of pressure sensing capability. Die products are typically delivered as sawn wafers on tape, but other options are available. Sensor Die are 100% electrically- tested and visually inspected before delivery.

MEMS Catheter Die Products

- P162** – catheter pressure die
- P330** – catheter pressure die
- P330B** – catheter pressure die with solder bumps
- P330W** – catheter sub-assembly, including P330B sensor die with long wires (Prototypes available)
- P2490** – catheter pressure die, small size (In Development)

Target Customers

- B.Braun Medical (PA, USA)
- Becton Dickinson (BD) (NJ, USA)
- Boston Scientific Corporation (MA, USA)
- Teleflex Incorporated (PA, USA)
- Cook Medical (IN, USA)
- Medtronic plc (MN, USA)
- Johnson & Johnson Inc (NJ, USA)
- Abbot Laboratories (IL, USA)

Parameter	Units	P161-P162-P165	P330	P2490	P330B / P330F
Size (L x W x T)	µm	1150 x 725 x 180	900 x 330 x 180	800 x 240 x 90	900 x 330 x 120
Circuit		Two piezoresistors (half-bridge). Need to add two resistors to complete the bridge			
Excitation	V	1...6 DC, 10V DC maximum			
Pressure	mmHg	0-300 diff (P161-2) absolute (P165)	450-1050 absolute	450-1050 absolute	450-1050 absolute
Bridge resistance*	Ohm	800	3200	2000	2000
Sensitivity*	µV/V/mmHg	18	10	8	15 / 6
Nonlinearity*	mmHg	<1	<1	<1	<1
Offset at 1 bar*	mV/V	1 (P161-2)/ 12 (P165)	9	within ±3	within ±3
TC Offset	µV/V/C	±40	±30	±20	±20
TC Sensitivity*	%/C	-0.12	-0.2	-0.2	-0.2
TC Resistance*	%/C	0.12	0.10	0.13	0.13
Operating temp.	C	15...45 (die products may be used beyond this range with additional validation)			
Proof pressure	mmHg		2700	3000	3000 / 6000
Wire connection		Wire bonding (WB)		Soldering (solder bumps on die)	
Samples		Available	Available	Available	Available
Product status		Released	Released	In development	Released

* Typical value

Product Focus: P330 Series Absolute Pressure Sensor Die

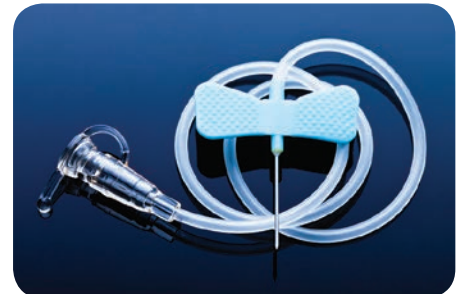
Excellent accuracy, ideal for medical catheters and IC packages.

Features

- Extremely small size: 330 x 180 µm cross section
- Stable, accurate pressure measurement
- Low power consumption using high impedance
- Absolute pressure sensing
- Standard pressure range of 450 to 1050 mmHgA
- 4500 mmHgA burst pressure
- Gold wire bond pads

Applications

- Medical Catheter
- Cardiovascular
- Respiratory
- Intracranial
- Urological/Rectal
- Ablation
- Body Cavity
- Research



Medical Applications

The NovaSensor Product Manager Promise:

- Quick Quote Turnaround
- Early Engineering Engagement to follow up on tech questions
- Support Commercial Engagement
- Timely Review of Contracts
- Prioritize Opportunities

MEMS Sensor Standard Product Overview

NovaSensor is a leader in the design and fabrication of MEMS Pressure Sensors and the inventor of SenStable® Processing Technology providing an excellent stability of its sensors. NovaSensor MEMS Pressure Sensors are known for their accuracy, reliability, and miniature size. Our sensors offer best-in-class performance for Industrial, Healthcare, and Transportation Applications.

NPI Series - Media Isolated Sensors

Designed to operate in hostile environments while providing outstanding sensitivity, high linearity, and low hysteresis.

Features

- Best in class stability
- Stainless steel media isolation
- Suitable for use with liquids or gases
- Pressure ranges from 5 to 10,000 psi (custom specs)
- Absolute, Gauge, or Differential



Applications

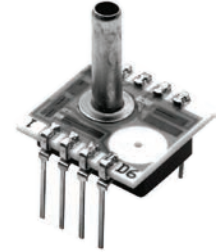
- Industrial automation
- Process control
- Level/Depth sensing
- Corrosive fluids and gas measurements

NPC Series - Low/Medium Pressure Sensors

Cost-effective solution for applications that require compensated performance.

Features

- Best in class stability
- PCB mountable DIP packaging
- Multiple tube & pin configurations
- Pressure ranges from 10" H2O to 100 psi
- Absolute, Gauge, or Differential



Applications

- Industrial automation
- Air flow monitors
- Process control
- Medical equipment

NPA Series - Pressure Sensors

Compact packaging and a cost-effective solution for applications that require calibrated performance and amplified output.

Features

- Best in class stability
- Surface mount SOIC-14 package
- Digital, Analog, or Amplified Analog output
- Multiple port configurations
- Pressure ranges from 2" H2O to 30 psi
- Burst pressure up to 10X for low pressure models
- Absolute, Gauge, or Differential



Applications

- Medical equipment
- Process control
- HVAC
- Consumer appliances

NPH Series - Medium Pressure Sensors

Reliability at a low cost and small size.

Features

- Best in class stability
- Standard PCB mountable TO-8 package
- Media compatible with non-corrosive gases and dry air
- Pressure ranges from 2" H2O to 100 psi
- Absolute, Gauge, or Differential



Applications

- Industrial automation
- Process control

NPC-100 Disposable Sensor

Low cost design.

Features

- Designed to AAMI BP-22 Specs
- Solid State high reliability
- 25 Years in volume production
- Media Compatible Dielectric Gel
- High Performance Small Size



Applications

- Blood Pressure Monitoring
- Infusion and Dialysis Pumps
- All Disposable Applications
- Medical Instrumentation

NPP-301 Pressure Sensors

Low cost board mount plastic packages.

Features

- Small SOIC-8 Package
- Low Power
- Wide temp range (-40°C to 125°C)
- Easy to automate

Applications

- TPMS
- Barometric Absolute Pressure
- In Line Pump Monitoring
- Medical Device Atmospheric Compensation
- Short Term Implantable Diagnostics

